APPENDIX K: 25% ENGINEERING DESIGN REPORT HERRING RIVER TIDAL RESTORATION PROJECT

25% Engineering Design Report
Herring River Tidal Restoration Project

Friends of Herring River
Wellfleet, Massachusetts

July 2014

FUSS & O'NEILL

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MASSACHUSETTS ENVIRONMENTAL TRUST
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1 Introduction

1.1 Executive Summary

Structural, geotechnical and hydrologic/hydraulic analyses were performed to assess conditions and support development of 25% design drawings for the proposed replacement of an existing culvert structure at Chequessett Neck Road in Wellfleet, Massachusetts with a box beam bridge structure that will allow for controlled restoration of former tidal salt marsh areas upstream of this road. The Herring River Restoration Committee (HRRC), a multi-agency group appointed by the Cape Cod National Seashore and the Towns of Wellfleet and Truro, and the Friends of Herring River, a non-governmental organization, have recognized the benefits of restoring this tidally restricted and degraded wetland system, and are undertaking leading roles in developing and implementing this restoration project.

The Herring River was diked in 1909, resulting in reduction of tidal flushing and salt water intrusion, drastically reducing the salt marsh coastal ecosystem. In 1972 the current culvert structure under Chequessett Neck Road was constructed, comprising three bays fitted with two flap gates and an inoperable slide gate in a nearly closed position. The muted tidal range resulting from this structure's constriction has caused most formerly salt marshes to convert to deciduous forests and brackish or freshwater wetlands.

This structure is equipped with two flap gates and an inoperable slide gate fixed in a nearly closed position. The goal of this restoration project is to restore tidal flow to upstream areas of degraded tidal river and salt marsh, improving water quality and allowing affected vegetative and aquatic animal communities to revert to diverse compositions more closely resembling what existed prior to construction of the Chequessett Neck Road Dike, while avoiding/mitigating impacts to private properties and public infrastructure resulting from the increased tidal range.

To assess the severity of the restriction and the potential for ecological restoration, the anticipated effects of replacing the undersized culvert with a larger opening were evaluated in a draft Environmental Impact Statement/Environmental Impact Report completed in 2012 which is currently in the public comment phase. This study includes a detailed assessment of natural and cultural resources and the project's potential impacts to areas of concern, including potential impacts to private properties and public infrastructure. A number of alternative restoration approaches have been identified and evaluated in this report, to support development of the preferred alternative, which includes construction of the proposed structure at the Chequessett Neck Road dike, in addition to several other activities at upstream culverts, roads and properties to facilitate the restoration objectives and avoid/mitigate impacts.

A hydrodynamic modeling study completed by the Woods Hole Group (WHG) in 2012 evaluated alternative structure opening sizes to improve tidal exchange to the Herring River. Through this analysis, it was determined that a 165-foot long, 10-foot high structure would provide the maximum amount of tidal flushing allowable while limiting upstream tidal elevations in adjacent properties during the storm of record. This study also determined that control structures would be required at the proposed structure to allow tidal flushing to be gradually increased over a period of time to allow acclamation and monitoring of system responses/impacts to adjacent properties and infrastructure under an adaptive management program.

In 2013 Fuss & O'Neill (F&O) completed an alternatives analysis study to evaluate possible structural alternatives to replace the existing culvert structure with a 165-ft x 10-ft structure equipped with tidal controls. Three culvert replacement alternatives were evaluated to determine the option best suited to restore upstream water surface elevations and salinity concentrations:

- Three-sided pre-cast concrete box culvert
- Four-sided pre-cast concrete box culvert
- Pre-stressed box beam bridge

Based on this study, the box beam bridge structure selected as the preferred alternative. A concurrent study by WHG in 2013 evaluated alternative gate types/configurations and operating scenarios to determine the optimal number/type of gates to be constructed with the proposed structure. WHG has also completed wave generation and scour analyses to evaluate potential wave conditions at the structure and anticipated velocities under extreme storm/tidal conditions and gate operation configurations.

Subsurface conditions were investigated and assessed by F&O at the proposed location for the bridge construction in order to provide recommendations for foundation design and construction. Borings performed along the crest of the embankment indicated approximately 10 to 15 feet of sand fill above 35 to 40 feet of medium dense to dense fine sand. Dense silt was encountered approximately 74 feet below the embankment crest. Groundwater was encountered at the bottom of the sand fill material, approximately at the same elevation as the adjacent surface water, varying moderately with the tidal fluctuation. Due to proposed live and dead loads and subsurface conditions, a tapered steel tube pile foundation was selected to support the bridge and gate vertical and lateral loads. Sixteen-inch diameter tapered tube piles will be driven a minimum of 34 feet into the natural sand deposits below the bridge and gate structures to achieve the required vertical and lateral pile capacities.

A structural evaluation was completed by F&O to address applicable items in the LRFD report, including a type study to review existing data, assess alternative replacement structure configurations and identify the most appropriate structure type for the site conditions and required operations. Evaluations completed to date in support of the 25% complete design drawings are documented in this report.

1.2 Project Description

Figure 1 — Photograph of Existing Culvert Structure

The Project Site is located at the point where Chequessett Neck Road (CNR) crosses the Herring River in Wellfleet, Massachusetts.

The purpose of this project is to replace the three-bay culvert structure with a larger box beam bridge structure to allow controlled restoration of the upstream salt marsh by gradually increasing tidal flushing between the Herring River and Wellfleet

Harbor under monitoring and control procedures contained indicated in an adaptive management plan currently being developed.

1.3 Site Description

The Herring River (River) is located in Wellfleet, MA and runs from Herring Pond south through a series of channels, road crossings and former salt marsh embayments to Wellfleet Harbor. Historically, the nearly four-mile river supported extensive salt marsh and coastal wetland communities, including salt-water dependent flora and fauna, particularly river herring, eels and shellfish communities.

Figure 2 — Photograph of Herring River

The mouth of the River, located at Chequessett Neck, was diked in 1909 to create land for development and reduce mosquito populations for the local population and to support nearby tourism enterprises. The River was manipulated further by channelizing/straightening sections and through construction of culverted roadway crossings to further these goals and provide access for development of areas drained by the reduced tidal range.

Figure 3 — Photograph of Wellfleet Harbor

These changes had a drastic effect on this coastal ecosystem, resulting principally from subsidence of wetland areas, reduced tidal range into upstream marshes and a reduction of salinity. Several areas that were formerly salt marshes have converted to deciduous forests and brackish or freshwater wetlands.

Numerous studies have documented changes to these wetland communities and the accompanying decline in water quality upstream of the CNR dike, including most significantly alewife and eel fish kills in the 1980's and a decline in viable shellfish populations, all resulting from reduced tidal flushing. The Cape Cod National Seashore (CCNS) and the Town of Wellfleet have been studying approaches to restore the River's natural coastal ecosystem since the 1980s by removing or modifying the CNR dike, as documented by numerous investigations and modeling studies.

Detailed descriptions of site characteristics and areas of concern are contained in the October 2012 Draft Environmental Impact Statement/Environmental Impact Report included in *Attachment A* of this report.

1.4 Scope of Report

The primary scope of this report is to present findings of the geotechnical and scour analyses and present the 25% design of the Chequessett Neck Road bridge structure. The following attachments are referenced in subsequent sections of this report.

Attachment A – Project Background and Hydrodynamic Modeling Information

- Draft Environmental Impact Statement/Environmental Impact Report (October 2012)
- Hydrodynamic Modeling Final Comprehensive Report (June 2012)
- Final Dike Control Structure Hydrodynamic Modeling Report (December 2013)
- Construction Drawings: Proposed Relocation of Water Control Structure – Herring River Dike

Attachment B – Scour and Wave Analysis Information

- Sediment Laboratory Gradation Test Reports
- Scour Analysis Modeling and Design Report (July 2014)
- Wave Generation Modeling Report (June 2014)

Attachment C – Geotechnical Investigation and Evaluation Information

- Boring Logs
- Soil Laboratory Analytical Test Results
- In-Situ Hydraulic Conductivity Test Results
- Seepage Analysis Figures
- Pile Foundation Design Calculations

Attachment C – Structural Design Drawings and Supporting Information

- 25% Design Drawing Set
- Opinion of Construction Cost

2 Hydrodynamic Modeling and Scour/Wave Analyses

2.1 Project Description

A description of the project site and objectives is provided in *Sections 1.2 and 1.3* above.

2.2 Scope of Analysis

The following analyses are addressed in this report, in support of the developed design.

- Hydrodynamic modeling has been completed to evaluate alternative bridge opening sizes and determine the optimal configuration that achieves restoration objectives while avoiding/minimizing impacts to adjacent properties and infrastructure.
- A scour analysis has been completed to evaluate potential scour conditions following construction of the proposed structure and determine design requirements for scour countermeasures at/adjacent to the structure.
- A wave generation analysis has been completed to evaluate potential wave conditions from Wellfleet Harbor and determine the suitability of the proposed structure to withstand hydrodynamic loadings during a maximal event.

It was determined that an ice loading analysis was not required for the proposed structure based on the Town's record of observations at the site reflecting no significant ice dams/floes at the existing structure, due principally to limited ice formation in the harbor and alternating diurnal tidal flows through the culvert structure, which will continue subsequent to construction of the proposed structure.

2.3 Data Collection

To evaluate hydrologic conditions at the site and determine the most appropriate restoration approach, data on the salt marsh and estuarine habitat were collected from a number of previous studies and assessments of the site. Topographic mapping of the project site was developed from both photogrammetric and Light Detection and Ranging (LiDAR) surveys, bathymetric surveys and supplemented by a field topographic ground survey in 2012.

Tidal monitoring studies have been completed to assess tidal elevations and salinity ranges in respective portions of the Herring River's coves and embayments. Wetland assessments have also been completed to characterize existing salt marsh, estuarine and aquatic habitats throughout the site. The results of these assessments are documented in the Draft Environmental Impact Statement/Environmental Impact Report and June 2012 Hydrodynamic Modeling Final Comprehensive Report included in *Attachment A* of this report.

2.3.1 Sediment Investigation

Six sediment grab samples were collected at and adjacent to the existing culvert structure to characterize native sediment that could be mobilized by scour conditions following construction of the proposed structure. These samples were collected using a hand auger at locations depicted on *Figure 4* below.

Collected samples generally consisted of fine to medium sand with trace amounts of silt. Organic material was present in the samples, indicated by dark coloration and odor of the samples. This information, supplemented by subsurface borings conducted through the embankment (documented in *Section 3* below), was used in the scour analysis and development of requirements for scour countermeasures.

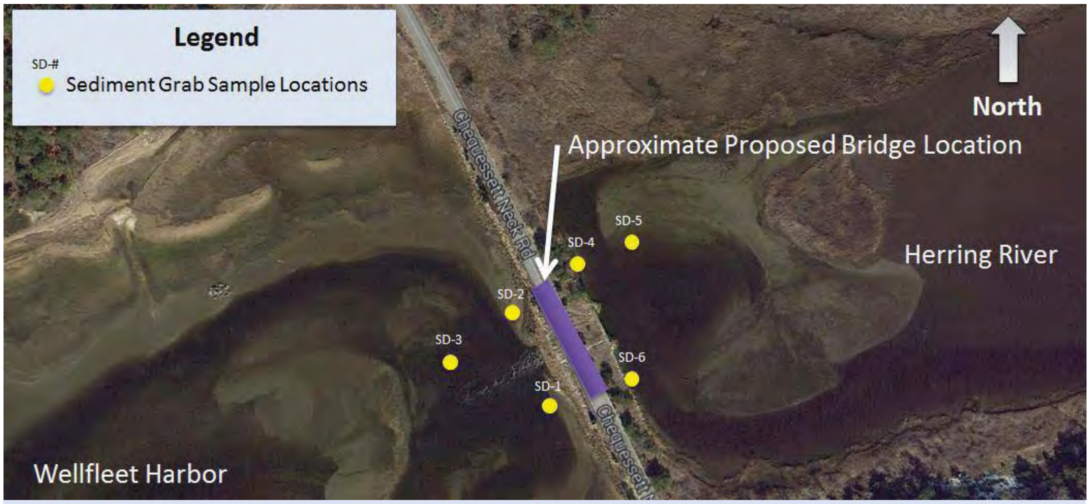


Figure 4 — Sediment Sample Locations

Laboratory gradation testing was performed on the sediment samples; results from this testing are provided in *Attachment B*. Sediment classifications for each of the samples, based on laboratory sieve analyses, are summarized in *Table 1* below.

Table 1
Sediment Sample Classifications

Sample ID	ASTM Classification	AASHTO Classification
SD-1	Poorly graded sand (SP)	Stone Fragments, Gravel and Sand (A-1-b(1))
SD-2	Poorly graded gravel (GM)	Silty Gravel and Sand (A-2-4(0))
SD-3	Poorly graded sand (SP)	Stone Fragments, Gravel and Sand (A-1-b(1))
SD-4	Poorly graded sand (SP)	Stone Fragments, Gravel and Sand (A-1-b(1))
SD-5	Poorly graded sand (SP)	Stone Fragments, Gravel and Sand (A-1-b(1))
SD-6	Well-graded sand (WG)	Stone Fragments, Gravel and Sand (A-1-b(1))

It is noted that sediment samples taken in deeper water both upstream and downstream of the existing dike consisted of poorly graded sands, whereas the sediment sample taken from the shallower area of sediment deposit (i.e., SD-2) consisted of silty gravel with sand.

2.4 Modeling Methodologies, Findings and Recommendations

As part of the restoration project's earlier study phases, alternative hydrodynamic models incorporating algorithms accurately representing determinant physics principles for changes to water surface elevation, current velocities, salinity, sediment transport, and water quality parameters associated with potential modifications to the system's hydrology were evaluated. Model requirements included being dynamic and capable of representing bi-directional tidal flows, having high resolution to accurately identify and represent important physical processes, and having adequate flexibility to link with other potential modeling tools (e.g., biological models) in an adaptive management setting.

After evaluating more than 10 capable hydrodynamic models in conjunction with the goals of the restoration project, the Environmental Fluid Dynamics Code (EFDC) model was selected to simulate the Herring River estuarine system. This model has been successfully used on other projects for studies of circulation, discharge dilution, water quality, Total Maximum Daily Load (TMDL), and sediment transport. It is capable of predicting hydrodynamics and water quality changes in multiple dimensions and is accepted as an approved model by the Environmental Protection Agency (EPA) and other state and federal agencies.

Further descriptions of the modeling methodology, results and conclusions/recommendations determining the proposed structures opening size and number/types of control gates are provided in the June 2012 Hydrodynamic Modeling Final Comprehensive Report and December 2013 Final Dike Control Structure Hydrodynamic Modeling Report, both included in *Attachment A*. It should be noted that the gates will be power-actuated with the use of a portable trailer-mounted generator transported to the site. The power/control panels for the gates will be located on the south end of the harbor-side platform.

Summaries of methodologies, conclusions and recommendations for scour and wave analyses are provided in *Attachment B* and analyzed below.

<u>Wave Analysis</u>

- The current configuration is capable of withstanding the wave action determined from the analysis. Any connections or details will be designed in the 75% submittal to address wave loadings as needed.
- Wave overtopping is expected to be minimal for the design storm event during the full sea level rise scenario predicted at the end of the75- year design life.
- Within the limits of the project, stone armor protection on the harbor-side of the embankment and vegetated soil-filled stone armor protection on the river-side of the embankment will provide wave/overtopping scour protection adjacent to the bridge structure.
- Wave/overtopping protection requirements for portions of the embankment outside the project limits will be addressed in the future when uncertainty associated with sea level rise predictions and modeling data/methodologies is reduced.

<u>Scour Analysis</u>

- Existing stone armor protection on the harbor-side and river-side of the embankment will be reinstalled within the limits of current placement within the limits of disturbance.
- The area immediately under the gates will be composed of a concrete base to provide adequate closure for the gates and minimize leaking. This will also resist scour expected from high velocities and transitional flow in and around the gate openings.
- The area under the bridge structure and in front of the panels will be protected with large rip-rap scour protection. Excess existing riprap from the embankment slopes can be used in these locations, and supplemented from suitable off-site sources.

- Channel areas below and upstream/downstream of the bridge structure will be protected by stone armor sized and placed in layer thicknesses as indicated by WHG's scour analysis and recommendations.

3 Geotechnical Evaluation

3.1 Description of Local Geology

The local geology of the site is characteristic of low-lying areas typical of Cape Cod, being formed as part of a terminal glacial moraine in recent geological history (approximately 18,000 years ago) with significant sand outwash deposits. As parts of this moraine eroded from the receding ice sheet, deposition within outwash plains created salt marshes that are present today, as found currently at the site of the Chequessett Neck dike.

According to the USGS's Geologic Map of Cape Cod and the Islands, Massachusetts, the site lies within an area mapped as Qwo, Wellfleet Plain Deposits. This map describes the Wellfleet Plain Deposits unit as "Mostly gravelly sand with scattered boulders." As noted in the description of the subsurface investigation program completed at the site in 2013, the majority of the soils underlying Chequessett Neck Road are sands.

3.2 Subsurface Exploration Program

Fuss & O'Neill subcontracted Soil Exploration Corp of Leominster, Massachusetts, to drill test borings at the site. These borings were performed on November 18, through 21, 2013. The locations of the four test borings are depicted on *Figure 5* below, as well as on Sheet CS-102 – Existing Conditions Plan in the drawing set included in *Attachment D*. Boring locations were selected based on the proposed locations of bridge abutments and piers, as reflected on Sheet CS-103 – Proposed Conditions Plan in *Attachment D*.

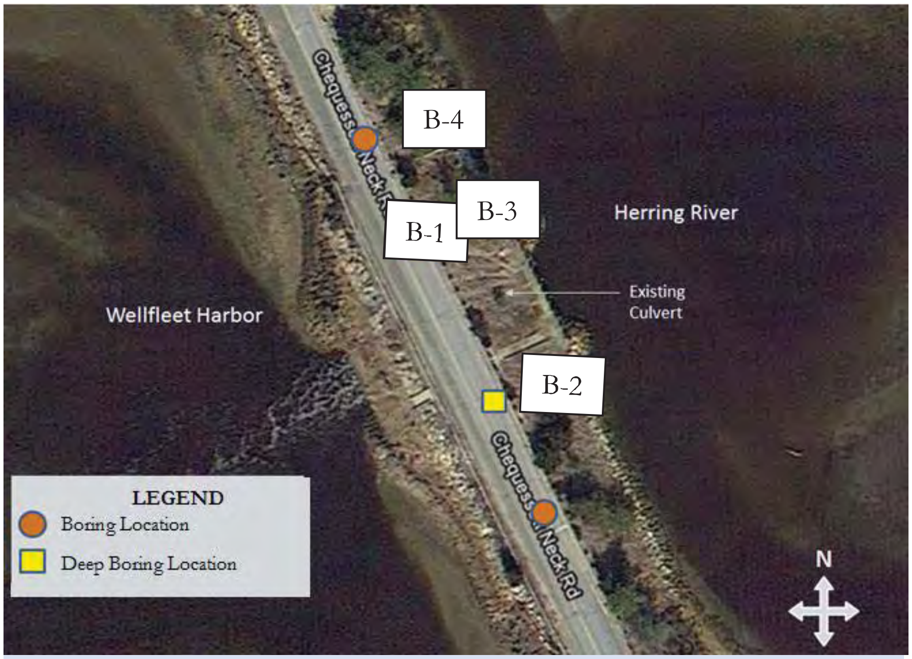


Figure 5 — Soil Boring Locations

Test borings B-1, B-2, B-3 and B-4 were advanced to depths of 41 feet, 78 feet, 42 feet, and 41 feet below the existing ground surface, respectively. Borings were completed using a truck-mounted drill rig and standard hollow stem auger techniques. Each boring was observed and logged by a Fuss & O'Neill engineer. Boring logs from the field program are provided in *Attachment C*.

Standard penetration tests (SPTs) were performed at maximum 5-foot intervals in the test borings. The SPT consists of advancing a 2-inch outside-diameter split spoon sampler a total of 24 inches into the bottom of a borehole with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler the second and third 6-inch interval is the Standard Penetration Resistance, also known as the SPT N-value, which is a relative indicator of the in-place soil's relative density.

Laboratory testing (ASTM D 422) was performed on soil samples selected from the drilling activities to confirm field identification and for use in subsequent foundation design. Representative soil samples were obtained from boring B-1 at depth interval 10 to 12 feet, from B-2 at depth intervals 5 to 7 feet and 19 to 21 feet, from B-3 at depth interval of 19 to 21 feet, and from B-4 at depth interval 74 to 76 feet. Sieve test results are provided in *Attachment C*.

A piezometer was installed in borehole B-2 and a single-well pumping test was conducted to estimate the horizontal soil permeability. The piezometer consists of a 2-inch diameter slotted PVC screen with solid riser. The screen was installed between 40 and 50 feet below the ground surface. Well development procedures consisted of purging groundwater with a peristaltic pump and periodically agitating the suction line to mobilize sediment from the bottom of the well. The well was developed for approximately 30 minutes, at which point agitating the suction line did not mobilize additional sediment.

Following well development, Fuss & O'Neill personnel allowed the well to return to equilibrium and then completed a single-well pumping test.

The hydraulic conductivity within the screened interval was calculated to be 10.8 feet per day (3.81×10^{-3} centimeters per second; cm/s). The literature notes that hydraulic conductivities for glacial outwash deposits are typically in the range of 10^{-3} to 10^{-1} cm/s, and therefore the calculated hydraulic conductivity was consistent with the soil materials identified at the site. A summary of the pump test is included in *Attachment C*.

3.3 Verification of Sample Descriptions of Boring Logs

Fuss & O'Neill's senior geotechnical engineer collected and reviewed jar samples collected during the drilling program. The field logs and data sheets were prepared by Fuss & O'Neill's field geotechnical engineer who observed the borings and obtained the samples. Based on the laboratory test results and the senior engineer's review with the field engineer, the boring logs were accepted as documented in the field.

3.4 Subsurface Profile

The soil observed in the borings generally consisted of approximately 11 to 14 feet of medium-dense, fine to coarse or fine to medium sand with trace amounts of silt (embankment fill) beneath the road surface. The fill was observed to be relatively loose in boring B-4. Below this layer of embankment fill, a layer of medium dense wet fine to medium sand, having an approximate thickness of 40 feet in boring B-2. Below this sand deposit, the soil to the bottom of borings B-1, B-3, and B-4 consisted of medium dense to very dense fine sand. A very dense layer of silt was encountered in boring B-2 at a depth of 74 feet.

The depth to saturated soil in boreholes B-2 and B-3 was approximately 15 feet below the existing ground surface at mid-tide (observed at approximately 0830 and 1030 hours for the two borings, with high tide at approximately 1200 hours). The ground water table was encountered at a depth of 13 feet and 12 feet in boreholes B-1 and B-2, respectively. The depth to groundwater within the embankment will fluctuate with the tide as well as with precipitation and other factors.

A graphical depiction of the inferred subsurface profile at the site, including approximate depths/elevations of observed soil layer transitions and Standard Penetration Resistance values is provided in *Attachment C.*

3.5 Seismic Design Parameters and Liquefaction Potential

Seismic design parameters are summarized in *Table 2* below.

Table 2
Seismic Parameters (from IBC2009 and Massachusetts Amendments)

Site Class	E
S_s	0.20
S_1	0.054

Liquefaction potential was considered using a design earthquake of magnitude 7.5 and a Peak Ground Acceleration of 0.054g (from Massachusetts Amendments to the IBC for Wellfleet). Using these parameters, the driving force Cyclic Stress Ratio for the design earthquake was calculated to be 0.04 for the saturated sand layer below the fill.

After correcting the average blow count data for overburden effects and rod and hammer efficiencies, a shear resistance Cyclic Stress Ratio for the same saturated sand using the soil parameters described previously was calculated to be 0.2. The factor of safety against liquefaction was estimated to be greater than 4.0. Based on this evaluation, liquefaction is not expected at this site.

3.6 Recommended Foundation System

The bridge structure will allow for the existing salt marsh subgrade to be the invert of the paneled openings, with support for the structure provided by a new foundation. This foundation will require support of the overlying box beam bridge superstructure, panel/gate structures, paved road features and live loads, as indicated below.

- The factored vertical live and dead loads required to be supported are 6 kips (live load), 1 kip (dead load wearing surface), 10 kips (dead load soil), and 28 kips (dead load structure) per linear foot of the foundations at the abutments.
- On the pier foundation a factored load of 34 kips (dead load structure), 6 kips (live load), and 1 kip (dead load wearing surface) needs to be supported.
- A factored vertical load of 10 kips (dead loads structure) per linear foot acts on the panel footing.
- The horizontal factored loads acting on per linear foot of the foundation under the abutment is 10 kips (horizontal earth pressure force, water load).
- Horizontal load of 2 kips per linear foot and 5 kips per linear foot act on the pier foundation and panel footings respectively.

Due to vertical and horizontal loads expected for this structure, and based on the soil types, densities, groundwater fluctuations, and tidal flows, a uniformly tapered steel pile was selected for use to support the proposed bridge and gates. Tapered steel piles can develop significant bearing capacity in sand at relatively shallow driving depths.

3.7 Embankment Considerations

3.7.1 Embankment Stability

Slope stability analysis was not performed as the existing embankment appears stable and has not exhibited evidence of instability or settlement since reconstruction in 1972-73 (slopes are armored or suitably vegetated with no slides/sloughs, runoff erosion, vertical/horizontal misalignment of slopes, road surface or poles/structures). Structural backfill material proposed for the project with excavated areas to be backfilled will be compacted to specified densities (i.e., 95% of maximum dry density) to ensure stability of portions of the embankment adjacent to the proposed bridge structure. No other portions of the dike structure will be modified by this project.

3.7.2 Seepage through Embankment

Seepage analysis was performed using the SEEP2D finite element analysis software with the GMS Version 8.3 Windows-based interface to estimate the potential for excessive seepage gradient under mean high water and tail water elevations. Seepage through the embankment was performed for mean high head water at elevation 12 on the Wellfleet harbor side and a low water elevation of -2.8 on the Herring river side.

The results of the analysis indicate a maximum exit gradient of 0.37, a gradient that should not present any issues with seepage or piping. It is noted that this analysis excluded any consideration of the timber sheeting that is noted to existing in the 1972 drawing set, and any further reduction of seepage from this structure, or remnants of this structure, would further reduce the maximum reported exist gradient..

3.7.3 Seepage under Gate Structure

Seepage analysis was performed to analyze the flow under the sheet pile cut off wall when the sluice gate under the bridge is closed. From the exit gradients computed it was determined that a sheet pile cutoff wall driven to EL -24 (NAVD88) will be required to reduce the exit gradient sufficiently below the critical gradient at which instability could occur. This cutoff wall depth reduces the estimated exit gradient to 0.38, avoiding the potential for piping or sand boils channel bottom material.

3.8 Shallow Foundation Design

Based on proposed vertical and horizontal loads expected for this bridge, as well as potential scour conditions, it was decided that a deep foundation system would be more appropriate for support of the structures than shallow spread footings. As such, a shallow foundation design was not evaluated further.

3.9 Deep Foundation Design

The following foundation design recommendations have been developed based on a review of subsurface data collected, the engineering evaluation completed as part of this assessment, and the requirements of the proposed replacement structure for this project.

As with any subsurface investigation program, the nature and extent of variations between the borings may not become evident until construction is underway. If variations appear evident at that time, it will be necessary to reevaluate these recommendations and implement revisions issued by a qualified geotechnical engineer, based on the new observations, test data and analyses undertaken at the time of construction.

The following design factors are noted for the proposed structure's deep foundation:

- Due to potential for scouring it is recommended that the proposed bridge be supported on tapered steel tube piles driven through the underlying natural sand deposit. Soil properties for this profile layer are summarized below in *Table 3*.

Table 3
Deep Foundation Soil Parameters (Saturated Sand Layer)

Unit Weight	57.6 pcf
Internal friction angle	33 degrees
Pile/sand interface friction angle	29 degrees
Active Earth Pressure Coefficient	0.21

- Tapered tube pile capacities were estimated using the Nordlund method with an Allowable Stress Design Factor of Safety of 3.5. Tapered tube piles driven to the design embedment depth should develop an allowable axial capacity of 108 kips per pile.
- Fuss & O' Neill used COM 624 as packaged by CivilTech Software's AllPile analysis program to estimate the horizontal deflection due to lateral loading. Using a maximum horizontal load of 9 kips per pile at the pile cap, a deflection of 0.1 inches was predicted, well within any deflection limits for the type of structure proposed for this project.
- Piles should have a minimum tip diameter of 8 inches and butt diameter of 16 inches, uniform taper length of 20 feet measured 14 feet from the butt. The piles should penetrate to a minimum embedment depth of 34 feet below the mud line.
- One full-scale static pile load test should be performed to verify predicted pile capacity. Increasing the number of piles to reduce the applied load on each pile may eliminate the need for a pile load test, which may be more cost effective depending on the difference in cost between the additional piles and the pile load test.
- Jetting and predrilling of piles will not be permitted unless approved in writing by a qualified geotechnical engineer responsible for oversight of the construction project, which would be

accepted with additional installation requirements and controls to ensure proper support for the proposed replacement structure.

Using the Nordlund analysis method to estimate the size and depth of pile required, Fuss & O'Neill's analysis results indicate 16-inch diameter (Butt) tapered steel piles shall be embedded 34 feet into the sand below the pile cap base elevations to adequately support the proposed structure. Pile group locations and configurations (i.e., vertical, inclined) are reflected on structural profiles, sections and details in the drawing set provided in *Attachment D*.

3.10 Construction Considerations

3.10.1 Water Table

The water table was observed close to the base of the sand fill layer while conducting the borings. This elevation is expected to fluctuate moderately with the varying tidal elevations during construction. Groundwater cutoff and dewatering systems will be required to establish and maintain suitable conditions for construction of the substructure elements, as discussed below.

3.10.2 Water Control

Water control will be required at the bottom of deep excavations during construction. The specific type and configuration of the dewatering system will be determined by the contractor, based on its proposed means and methods, such that performance requirements, principally to establish "dry" work areas, are achieved. Depending on the excavation depth in relation to actual tidal/storm elevations, actual soil conditions, and leakage through temporary cofferdams installed around excavation areas, the depth, size, spacing and type of sump drains (dewatered by suction or submerged pumps) will be determined.

Bypass of surface tidal flows will be required to maintain flood and ebb tides across the embankment and into/from the Herring River system. Similar to groundwater dewatering methods, the approach to bypassing surface waters around active construction areas will be determined by the contractor, based upon its means/methods and construction sequence. A "control of water" plan will be required to be submitted for review and acceptance by the project engineer, based on conformance to project specification requirements. A conceptual approach to controlling water during construction is described below and on Sheet CP-101 – Construction Sequence and Water Control Plan in the drawing set included in *Attachment D*. Potential scour conditions and required countermeasures for temporary cofferdams/sheeting will be determined as part of the 75% design analysis.

3.10.3 Excavations

Excavation of fill material around the existing culverts will be required to a depth that will allow construction access to both drive piles into the underlying sand layer and construct the proposed abutment and pier foundations. Temporary excavation slopes will be to a maximum of 2H:1V, unless otherwise reinforced or shored, to allow construction equipment to reach the work area on a stable surface. It is possible that the excavation will need to be benched or ramped to achieve this, depending on the type of equipment used to complete the work. Temporary steel sheeting is reflected on the drawings included in *Attachment D* for control of water, and due to this mobilization of materials and equipment, it will likely be cost effective to utilize steel sheeting to retain earth slopes adjacent to active work areas.

3.10.4 Obstructions

Obstructions will be removed if the depth of the obstruction is not beyond the reach of excavation equipment. Otherwise, if an obstruction is encountered during pile driving at an elevation too shallow to achieve design load capacity, but too deep to be removed, the pile will be relocated, and redesign provided, as directed by the on-site engineer. It is noted the timber cutoff sheeting is reflected on both sides of the existing culvert structure in the 1972 drawings, which will be removed as required within the limits of construction, such that the proposed structures and cutoff sheeting can be constructed to match portions remaining outside the project limits.

3.10.5 Protection of Adjacent Structures and Utilities

Adjacent structures include Chequessett Neck Road and its underlying embankment, guard rails along the edges of the road, and utility poles supporting overhead utilities. The road/embankment, guardrails and several utility poles will need to be removed for the construction work and replaced during the final stages of construction. Relocation of utility poles and overhead lines will need to be completed in consultation with the utility company owners. A preliminary alignment for the temporary relocation of overhead utilities is shown on Sheet CG-101 – Grading and Drainage Plan included in *Attachment D*, reflecting burial of respective utilities in belowground conduits immediately adjacent to, and below, the proposed bridge structure.

Guardrail systems will be removed from within the footprint of the proposed bridge structures construction area; portions of guardrails not removed will be protected throughout construction. Proposed guardrail systems extending from the proposed bridge abutments will tie into these existing guardrails to remain.

An alternate work items have been indicated on the drawings reflecting potential removal/replacement of remaining sections of guardrail systems and overhead utilities beyond the project limits, subject to ongoing coordination between the HRRC and the Town of Wellfleet.

Adjacent portions of the will need to be repaired following construction and prepared to satisfactorily match to the new pavement to be placed within the limits of excavation required to construct the bridge structure. The site contractor will be required to protect adjacent structures beyond the work limits during construction.

3.10.6 Sequence of Construction Activities

In order to replace the existing culverts that hydraulic connect Wellfleet Harbor with Herring River, an approximate 525-foot section of Chequessett Neck Road will be temporarily closed to traffic. This section of roadway is expected to be closed for approximately 7-9 months, subject to permitting windows and weather conditions. Refer to Sheet CP-101 – Construction Sequence & Water Control Plan in *Attachment D* for descriptions and depictions of the five general stages of construction, reflecting planned cofferdamming, water control and traffic bypass provisions in respective project phases.

3.10.7 Adjacent Properties and Infrastructure

In October 2012, the HRRC initiated an outreach effort with low-lying property owners in the Herring River estuary. There are approximately 376 parcels of low-lying private land adjacent to the restoration area. The HRRC compiled a database of all these properties and using the hydrodynamic modeling performed by the Woods Hole Group (WHG) was able to estimate physical impacts to these properties resulting from the maximum increased tidal/flood elevations associated with the structure's largest potential opening size (all panels/gates removed, resulting in a fully open bridge structure).

The HRRC developed a classification system to evaluate the types and severity of impacts under different tidal benchmarks (e.g. mean high water, mean high water spring, average annual high water, 100 year storm, etc.). The classification system evaluates a range of different types of potential impacts such as infrequent and frequent flooding of natural vegetation, cultivated vegetation (such as lawns and gardens), and structures (such as buildings, driveways, wells, etc.). While the majority of impacts would be changes to natural vegetation, there are approximately two-dozen parcels that could experience some kind of structural impact if no mitigation efforts are made. The classification system also evaluates potential changes in regulatory jurisdiction such as the boundary of the Riverfront Area under the Wetlands Protection Act.

The HRRC conducted a letter campaign to low-lying property owners after publication of the DEIS/EIR in October 2012. Each letter explained the types of impacts that could be expected for that property, and invited the landowners to contact the HRRC if they wished to get further information. Of the total number of letters sent out, approximately 40 landowners have responded to date, seeking more information. The HRRC established a landowner database system to track these contacts and manage communications and mitigation strategies at the respective properties. The HRRC is currently working directly with landowners that have contacted them to conduct site surveys and develop site-specific plans to mitigate impacts and address concerns.

The HRRC will continue to work with landowners to develop individual mitigation plans to prevent flooding impacts to properties, proceeding to development of legal agreements with each structurally-affected property owner to detail the agreed-upon mitigation approach.

Potential impacts to roadways and other public infrastructure is also addressed in the DEIS/EIR, where certain impacts roadways may be abandoned, raised or otherwise modified to address potential flood impacts.

3.10.8 Additional Earthwork Considerations

The following controls or methods should be employed during construction to ensure that the proposed bridge structures or adjacent structures to remain are not compromised by inadequate structural fill or improper construction approaches.

- Fill used to backfill should meet the gradation requirements of MassDOT Item No. M1.04.0 Type B and should be free of organic material, construction debris, ice, snow, and other deleterious material. Existing site soils in general may be suitable for reuse as bedding and backfill materials adjacent to the structure, subject to inspection and testing to verify gradation requirements are met in other excavation areas.

- Fill placed above footings should be placed in loose lifts not to exceed 12 inches in thickness and should be compacted to 95 percent of maximum dry density as determined by American Society of Testing and Materials Test 1557, Method C.
- Excavation, fill placement, and footing construction should be conducted under dry conditions. Excavation shoring and side slopes, where used, should be in accordance with Occupational Safety and Health Administration (OSHA) standards. This will require that methods be developed and implemented to bypass tidal and storm flows at the site through temporary structures while the bridge is being constructed.
- Subsurface cutoff walls and sumps will be required to draw down groundwater levels to below excavated areas until constructed features are in place and backfilled to a sufficiently high elevation that structures and materials are not potentially compromised by natural high surface water and/or groundwater conditions (e.g., floods, seasonal high tides, storm surges, etc.) once the cutoff structures are removed and dewatering systems cease operating.

  The size, spacing and depths of sumps in concert with positive cutoff methods (e.g., driven cofferdam/shoring sheets) will need to be determined by an engineering analysis as part of the contractor's submittal for control of water, demonstrating the ability to maintain water levels sufficiently below the bottom of excavations to allow placement of soil materials and structures under controlled conditions.

4 Structural Evaluation

4.1 Project Location

Available project location information for the structure is provided below.

Town:	Wellfleet
District:	MASSDOT District #5
Bridge Number:	N/A
BIN:	N/A
Structure Number:	N/A
Roadway on Bridge:	Chequessett Neck Road
Feature Intersected:	Herring River

4.2 Description of Existing Site Conditions

4.2.1 Description of Existing Bridge Structure

A description of the existing drainage structure at the project site is provided in *Sections 1.2 and 1.3*.

4.2.2 Description of Approach Roadway

The existing approach roadway is located on the crest of an earthen embankment with a base width of approximately 80 feet and a crest width of approximately 30 feet in the vicinity of the proposed bridge. The approach roadway carries two travel lanes, each measuring approximately ten feet wide with 12 inch wide asphalt berm curbs along both travel lanes. The approach roadway does not have formal shoulders or sidewalks. A guard rail is located behind the berm curbs, offset approximately 1-3 feet from the edge of pavement to each guard rail's face.

The approach roadway slopes up to the and north from the site of the existing culverts. The cross slopes of the travel lanes vary along the length of the embankment, between approximately 0.5% to 5.0%, due to localized settlement along the embankment crest.

4.2.3 Description of Features under the Bridge Structure

There is no bridge currently on the site. The existing drainage structure was constructed in 1972-73 and is described in Section 1.3 and graphically depicted on <u>Sheet CS-102 – Existing Conditions Plan</u> in the drawing set included in *Attachment D*. Design drawings from the 1972-73 reconstruction are provided as information in *Attachment A*.

This structure's flap/slide gates are in poor condition. Viewing platforms on the upstream and downstream side of the embankments are provided with steps from the roadway and guardrails, inviting members of the public to stop/park on the roadway where no shoulder exists for vehicles to move out of the travel lane; stopped vehicles this become an impediment to passing vehicles, pedestrians and bikers, generating a safety concern.

4.2.4 Description of Existing Hydraulics at the Bridge Site

The existing hydraulic opening under the causeway is comprised of three 6-foot wide box culverts with flow control structures. One culvert has an adjustable sluice gate (currently in a fixed position resulting in an approximately 2-foot high vertical opening). The other two culvers have tidal flap gates that only allow ebbing tide flows to Wellfleet Harbor. The culverts severely restrict tidal flow between the Herring River and Wellfleet Harbor.

4.2.5 Description of All Utilities within the Bridge Site

No underground utilities were located in the vicinity of the work areas associated with the proposed structure. Overhead utility wires are located along the western edge of the embankment's crest, with timber utility poles located to the north and south of the culvert structure, continuing in both directions along the embankment crest to adjacent land on each side of the river. The poles and the overhead lines will need to be temporarily relocated and reset as part of the project.

A pair of catch basins is located on either side of Chequessett Neck Road just north of the proposed bridge structure. These catch basins, as well as an adjacent small drainage culvert, will be removed during excavation of the bridge's northern abutment. As shown Sheet CG-101 – Grading and Drainage Plan in *Attachment D*, these catch basins are proposed to be replaced by new structures, and other drainage features proposed as part of the bridge structure. A catch basin further to the north, and outside the proposed limit of work, will remain.

4.2.6 Description of Environmentally Sensitive or Cultural Resource Areas

The Herring River is designated as an Outstanding Resource Water (ORW), being identified as the largest migratory fish run on the outer cape. In addition, Wellfleet Harbor is designated by Massachusetts Office of Coastal Zone Management as an Area of Critical Environmental Concern (ACEC), with its 2003 fact sheet noting the following:

> "the diverse and relatively unaltered habitats of this ACEC provide feeding, spawning, and nursery grounds for numerous shellfish, finfish, amphibians, reptiles, birds, and mammals. In 2002, the state's Natural Heritage and Endangered Species Program (NHESP) identified approximately 7,990 acres or 65% of the ACEC as core habitat through their BioMap project… Habitat for oysters, bay scallops, quahogs, blue mussels, and razor, soft shell, and surf clams can be found within the ACEC boundary according to draft maps made in 2003 by the Division of

Marine Fisheries and based on historical information and interviews with local shellfish officers."

Wetlands have been flagged and surveyed along the both sides of the embankment as shown on Sheet CS-102 – Existing Conditions Plan in *Attachment D*, and will be reflected on site plan drawings transmitted to respective regulatory review agencies as part of the project's permitting phase.

Portions of the ACEC have also been designated by the Massachusetts Department of Conservation and Recreation as containing visual landscapes and cultural resources that place it in the top 5% of all landscapes in the Commonwealth (1982 Massachusetts Scenic Landscape Inventory). An area of potential cultural resources has been identified on the upstream side of the northern end of the embankment, and is currently being evaluated by the Cape Cod National Seashore archaeologists to identify particular resources that might be affected by the project.

4.2.7 Hazardous Materials

There are no known or expected hazardous materials or contaminants in the approach roadways or otherwise in the embankment at the location of the proposed bridge.

4.3 Description of Project Parameters and Constraints

4.3.1 Description of Proposed Roadway Cross-Section

The roadway cross-section on the bridge will consist of two travel lanes, each measuring 11'-0" and will tie into existing lane widths at the limits of construction (refer to Roadway Transition Plan on Sheet CD-502 – Construction Details in *Attachment D*). The asphalt berm curbs on the roadway approaches will be transitioned to the CT-TL2 railing and will not be present within the footprint of the bridge itself. An 8'-0" wide parking lane and adjacent 5'-0" wide sidewalk will be constructed on the western side of the bridge structure, and a 5'-0" wide sidewalk will be constructed on the eastern side. Concrete ADA-accessible platforms will be provided on both sides of the bridge structure as well.

The curbing outside the bridge footprint will consist of modified Type A asphalt berm curbs measuring 12 inches wide. Guard rails will be set back from the gutter line approximately 3'-6" and will tie into the existing guardrail locations within the limits of construction.

The roadway approaches and the roadway on the bridge will be crowned with cross-slopes of ¼ inch per foot, with the center of the crown located along the centerline of the roadway. Approach slabs will be constructed adjacent to the abutments.

4.3.2 Proposed Traffic Management

The proposed traffic management plan during construction has been developed with as part of the staged construction approach described in *Section 3.10.6* above.

Based on a review of traffic count data obtained from Cape Cod Commission website for Chequessett Neck Road (just south of Duck Harbor Road), the estimated annual average daily traffic and peak hour volumes were relatively low with the highest volumes anticipated to occur during the summer months. The estimated annual average daily traffic volume was 811 vehicles, while the estimated summer average daily traffic was 1,067 vehicles. The estimated summer peak hour volume (between 4-5pm) was 97 vehicles with 37 vehicles per hour travelling in the northbound direction and 60 vehicles per hour traveling in the southbound direction. This translates to approximately one vehicle per minute travelling in the southbound direction during the peak hour.

Due to the relatively low traffic volumes, it was determined that a one-lane signalized alternating two-way traffic setup would be adequate to regulate traffic flow during construction. Since Chequessett Neck Road is a two lane roadway (with one lane in each direction), stop bars will be provided at the entrances to the bypass route from both directions along with pre-timed signals. Using Synchro 8 and SimTraffic capacity and signal timing software, it was determined that each of the signals would be fixed (pre-timed) with green, yellow, and all red times of 16 seconds, 3 seconds, and 22 seconds, respectively. This was based on an assumed design speed of 25 mph. The analysis also reveals that this signal will have minimal impact on capacity and roadway operating conditions with a 'B' level of service (LOS).

The temporary bypass route will be constructed on the eastern (Herring River) side of Chequessett Neck Road, as reflected on Sheet CT-101 – Conceptual Traffic Diversion and Sheeting Layout Plan in *Attachment D*. A bridge consisting of prefabricated modular steel components (e.g., fabricated by Acrow, or equal) will span approximately 190 feet across the Herring River in order to facilitate bypass of surface water around respective active work areas and avoid/minimize impacts to wetland resources. Temporary sheeting will be installed to form the embankments that will serve as the temporary bridge's abutments as well as northbound and southbound approaches from portions of the existing roadway to remain outside the construction area. The geometric layout of the bypass route was designed to accommodate the turning movements of a WB-62 vehicle.

A cantilevered walkway platform will be included with the temporary bridge to provide a separate bypass route for pedestrians and dismounted bikers. A separate lane will be provided for pedestrians/bikers on each of the northbound and southbound approaches. Guardrail systems will be provided on both sides of the bypass roadways on the approaches, to guard vehicles from the adjacent sheeting and to provide separation from the pedestrian/biker path. A handrail system will be provided on the upstream side of the approaches to protect pedestrians/bikers from the sheeting and associated fall hazard. As noted above, overhead utilities will be temporarily routed along this bypass route, supported by temporary poles set in the backfill material placed to form the two approaches to the bridge structure.

4.3.3 Proposed Stormwater Management

Stormwater runoff from the structure will be treated with deep sump catch basins with hoods and stormwater treatment planter/filter boxes adjacent to both bridge abutments. The deep sump/hooded catch basins will collect and separate debris and some sediment, oil and grease from the stormwater runoff being conveyed. Stormwater will be discharged from these structures to one of four planter/filter boxes that will provide treatment function similar to bioretention basins, further treating stormwater by filtering out additional sediment, nutrients and other pollutants. Runoff will be discharged from these structures by underdrains at the bottom of the planter/filter boxes.

The planter/filter boxes were sized in accordance with the Massachusetts Stormwater Handbook (Handbook) and cover approximately 270 square feet (5% of the area draining to the boxes, per the Handbook). The two planter/filter boxes at the south end of the bridge will have 30" of soil media as recommended by the Handbook for nitrogen removal, while the two planter/filter boxes at the north end of the bridge will have 24" of soil media due to roadway and tidal elevation constraints. It is noted that 24" of soil media is the minimum depth of media recognized by the Handbook to achieve 80%-90% of total suspended solids removal.

4.3.4 Proposed Clearances

Overhead Clearances:	Not Applicable	
Under Clearances:	Horizontal:	65'-11" min. clearance below the haunches of the center bay. 49'-8.5" min. clearance below the haunches of the two outer bays.
	Vertical:	9'-0" from the proposed channel bed (EL. -4.0) to the low chord of the arch openings (EL. 5.0). 10'-0" from the proposed channel bed (EL. -4.0) to the high chord at the center of the arch openings (EL. 6.0).

4.3.5 Hydraulic Data

The existing culverts are restrictive and mute the tidal regime upstream of Chequessett Neck Road. The tidal hydrographs generated through the project's hydraulic study have the signature curve of a restricted marsh and conclusively demonstrate that the upstream marsh system is tidally restricted. The following metrics were taken from Woods Hole Group's hydrologic/hydraulic study report included in *Attachment A*.

Drainage Area:	11.0 Square Miles
Design Discharge:	41,670 Cubic Feet per Second
Design Frequency:	100-year Recurrence
Design Velocity:	~20-30 Feet per Second
Design High Water Elevation:	7.5 Feet (NAVD88)

The peak discharge for the 100-year storm event is approximately 31,800 cubic feet per second (cfs). This is for the fully open case (165' wide and 10' high opening). Under normal conditions and adaptive management cases (gates closed) the flux is smaller. It should also be noted that the peak influx for the 100-year storm is actually higher than the discharge due to the tidal asymmetries (this is a flood dominated system). The peak influx is 41,670 cfs because the flooding tide is shorter than the ebbing tide. As a result, the bridge is actually designing for a peak influx, not discharge.

With regard to the Design High Water Elevation, the bridge structure's full open dimensions (i.e. when all panels are removed) has been sized to limit maximum water surface elevations in the lower Herring River basin to EL 7.5 NAVD88, and maximum water surface elevations in upgradient portions of the drainage system to respective elevations below this maximum.

4.3.6 Preliminary Geotechnical Data

A description of subsurface profiles observed during the boring investigation is provided in *Section 3.2* and *3.4* of this report. A detailed assessment of foundation requirements is also provided in *Section 3.9* above. A graphical profile of depths/elevations of observed soil layer transitions is provided in *Appendix C*.

4.3.7 Constraints Imposed by Approach Roadway Features

The width of the existing embankment's crest and base, and the configuration of the existing roadway upon the crest, dictate the layout of the proposed roadway approaches and travel lanes within the proposed bridge's footprint. The proposed travel lane widths are set at 11 feet while the existing travel lanes are 10 feet wide. The configurations and relative locations of the proposed replacement asphalt berm curbs and guard rails tie into the existing features.

4.3.8 Constraints Imposed by Utilities

Overhead wires will be temporarily relocated and protected during construction as reflected on Sheet CT-101 – Conceptual Traffic Diversion and Sheeting Layout Plan in the drawing set included in *Attachment D*. Two existing utility poles near the proposed structure will need to be removed and temporarily reset by two or more additional poles along the alignment of the temporary traffic bypass route. The design calls for these utilities to be routed belowground within the limit of construction, to junctions at adjacent poles to remain outside the work area. These activities will be coordinated with the utility service owner(s) as part of ongoing design, and prior to/during construction.

4.3.9 Constraints Imposed by Environmentally Sensitive Areas

Work will be conducted to protect wetland resources and water quality on both sides of the embankment. Appropriate controls and precautions to be employed will be reflected on Sheet CE-101 – Soil Erosion and Sediment Control Plan in the drawing set included in *Attachment D*. This plan and other pollution prevention plans (e.g., SWPPP) will be prepared for respective permit submissions to state and federal regulatory agencies.

4.3.10 Constraints Imposed by Cultural Resource Areas

An area of potentially sensitive archeological areas was provided by the National Park Service. This area is shown on the Sheet CS-102 – Existing Conditions Plan in the drawing set included in *Attachment D* and is currently being evaluated as part of the project's planning and coordination activities with the National Park Service's Cape Cod National Seashore staff. Potential impacts to cultural resources will be refined once the definitive limit of disturbance is determined in ongoing design.

If it is determined that the work could impact sensitive archeological resources, the site plan will the altered to avoid such areas if possible. If the project requires work within an area of concern, appropriate controls and monitoring procedures will be established, in consultation with NPS staff, the Massachusetts Historical Commission and tribal representatives, as appropriate.

4.3.11 Hazardous Material Disposition

There are no known hazardous or other contaminated materials at the site that would need to be managed during construction of the proposed structure.

4.3.12 Other Project Constraints

As noted above, the width of the embankment's base and crest and proximity immediately adjacent to adjacent tidal wetlands restrict the layout of the proposed roadway and bridge. In order to minimize impacts to these wetland resources, the width of the embankment's base will not be increased except where required by a 2H:1V slope (maximum proposed slope grade). The proposed roadway lane widths will be one-foot wider than existing lanes, transitioning to match existing widths at the limits of construction. Public safety will be improved by the provision of parking spaces along the bridge's southbound lane and a marked/signed crosswalk across both lanes.

Boater and rescue safety is an ongoing concern at this design phase, and will be addressed further in the 75% design phase. Specific considerations for the proposed bridge structure are discussed below in *Section 4.4*. It is noted that potential development of portage facilities is currently being considered/discussed by the HRRC and the Town of Wellfleet.

4.4 Appropriate Bridge Structure Types

A hydrologic and hydraulic study completed in December 2013 by Woods Hole Group determined the required hydraulic openings and gate configurations to meet the required opening to provide required tidal flushing upstream of the embankment.

In accordance with the MassDOT bridge design manual, the following bridge systems are acceptable alternatives for use on state highways.

- Structural Plate Pipes: Pre-engineered structures made of steel or aluminum, generally for spans less than 20 feet.
- Pre-cast Concrete Four-Sided Box Culvert: Reinforced concrete structures that are assembled away from the construction site before being delivered. Shipping considerations restrict the spans of these structures to less than 15 feet.
- Pre-cast Concrete-Three Sided Culvert: Reinforced concrete structures similar to the four-sided box culvert, except without a base slab. Three-sided culverts are supported on strip footings, allow for the use of native streambed materials, and are suitable for spans up to 40 feet.
- Slabs or Composite Deck/Stringer Designs: Pre-cast, reinforced concrete slabs or steel stringer beams with composite concrete decks. Concrete slabs can be quickly assembled and supported on abutments, though the span is generally limited to less than 25 feet. Steel stringer beams with a composite deck allow for spans greater than 25 feet but come at the disadvantage of increased construction schedule and decreased service life (due to steel in a marine environment).
- Adjacent Pre-stressed Concrete Beams: Pre-cast, reinforced concrete beams are assembled side-by-side and supported on abutments. The top surface of the beams may be used as a deck. This bridge type is suitable for spans up to 55 feet with Deck Beams and 110 feet with Box Beams.
- Spread Pre-stressed Concrete Beams: Similar to Adjacent Pre-stressed Concrete Beam bridges except that the beams are deeper and spaced apart, as opposed to sitting side-by-side.
- Steel Stringer and Pre-stressed Concrete NEBT Girders with a Composite Concrete Deck: Choice of steel beams or New England Bulb-Tee concrete beams, which are constructed with a composite deck. Making the deck a separate composite structure attached to the beams gives improved strength to the structure, allowing for spans up to 90 feet.

All of the above alternatives were considered and based on a meeting workshops with the HRRC, the following three structure alternatives were evaluated in a detailed alternatives analysis.

- Four Sided Pre-cast Concrete Box Culvert
- Three Sided Pre-cast Concrete Box Culvert
- Adjacent Pre-stressed Concrete Box Beams

While each of the alternatives would meet the project's functional requirements and conform to site constraints, selection of the preferred alternative was achieved by weighing the relative importance of a variety of considerations including effects on natural resources, physical processes including low tide drainage, sediment transport and scour, long-term maintenance requirements and costs, construction costs, aesthetics, site safety and security.

A comparative constraints analysis matrix was created to assimilate the respective advantages/ disadvantages of the alternative structures, and was reviewed and discussed with the HRRC in workshops through between September and November 2012, and subsequently with the Town of Wellfleet in a December 13, 2012 workshop. This matrix reflected numerical weighting of respective criteria to characterize relative importance in meeting project objectives, and scoring of the respective alternatives under each of these criteria. Weighted scores were then totaled for each alternative, such that an overall score for each alternative is provided. This approach determined that the adjacent pre-stressed concrete box beam bridge structure supported on piles was most advantageous to meet the project's respective objectives.

The selected structure is described in further detail in the following sections.

4.5 Proposed Substructure Arrangement, Span and Foundation Type

This proposed structure is comprised of two outer spans of approximately 49.5 feet and one center span of approximately 66 feet, for a total hydraulic opening potential of approximately 166 feet. The number of spans and their respective lengths were determined based on relative span length ratios required by the MassDOT LRFD Bridge Manual. A three span structure was determined to be most appropriate, as a two-span structure would lead to span lengths of 88 feet, exceeding the reasonable capacity of a pre-cast box beam, while a four-span structure would increase the overall length of the structure and increase construction costs beyond what would be required for a three-span structure (due to an additional pier and time to place the additional bridge beams).

Current design evaluations indicate that excavation to EL -9 (NAVD88) would likely be required to meet channel invert elevations and provide sufficient pile cap depths supporting abutments and piers. Pile cap foundations below piers are proposed to be 10-feet wide, and approximately 16-feet wide below abutments, to provide adequate clearance for the anticipated arrangement of vertical and battered tapered steel tube piles. Wingwalls are proposed to retain adjacent embankment soils and stone armor protection on upstream and downstream ends of the north and south abutments.

Piers are proposed to be 5-feet wide, and will support removable pre-cast concrete panels spanning each of the bays. These panels will be either equipped with tide control gates, or "dead" panels with no openings, as reflected on <u>Sheet SA-103 – Bridge Elevation and Longitudinal Section</u> in the drawing set included in *Attachment D*. A concrete base will be constructed below the pre-cast panels, at the proposed channel invert elevation, with a keyway to seat the bottom of the panels. The top of the pre-cast panels will be restrained horizontally by the bridge deck, and through interlocking keys between adjacent panels continuing to guides in sidewalls of the piers and abutments. Panels have been sized to accommodate the configuration of gate frames providing 6-foot wide by 10-foot high openings through the panels, and provide consistent/regular dimensions between the respective bays. The typical configuration of the panels is shown on Sheet SA-105 – Structural Details in the drawing set included in *Attachment D*.

A permanent steel sheeting cutoff wall will be constructed along the length of the concrete bases below the panels, extending continuously below the bridge piers and abutments, and continuing beyond the abutments to meet existing timber cutoff sheeting at the limits of excavation. As noted above, this sheeting will extend to at least 24-feet below the mudline to achieve adequate seepage cutoff below the panels under the maximum hydraulic loading. Vertical and battered piles will provide vertical and horizontal support below the pre-cast panels. Stone armor channel scour protection will extend from the piers and the concrete bases below the panels, as shown on the Sheet SA-103 – Bridge Elevation and Longitudinal Section and SA-104 – Structural Sections included in *Attachment D*.

4.6 Proposed Superstructure Type

The main bridge span will be comprised of adjacent pre-stressed, pre-cast concrete box beams. Nine adjacent B48-27 box beams will support the main bridge deck underlying the roadway and sidewalk areas. Two utility bay keeper blocks are proposed below the two sidewalks to house utility supports for separate conduits routing relocated utilities (electrical and communication) below the bridge deck. These utilities will continue in trenches with handholes to the nearest adjacent utility poles to remain. Type 1 approach slabs will be constructed at both south and north abutments.

Public access platforms offset from the main bridge deck over the center span will be supported by adjacent B-36-24 box beams (four (4) for the platform upstream of the main deck, and six (6) for the downstream platform). These platforms will be supported by the two piers supporting the main bridge decks

Bridge parapets (CT-TL2 barriers) will be constructed along the edges of the main bridge deck spanning all bays. Steel-backed timber guardrails will extend from the north and south abutments to existing guardrails to remain (noting these guardrails may be extended, as an alternate, to the ends of the embankment). A sloped safety barrier will be constructed along the westbound parking lane/sidewalk area to protect the gate frames and persons located in the access area immediately adjacent to the gate frames. Four openings will be provided in this barrier for movement of persons from the crosswalk and parking spaces to the platform areas (see Sheet SA-105 – Structural Details for an elevation view of the barrier). One of these openings (at the south end of the platform) will provide access for personnel operating the gate structures, which will be powered by a portable trailer-mounted generator brought to the site, with power/control cabinets located at the south end of the platform.

A railing system will be provided around openings in the bridge deck created to allow removable panels to be raised for removal or lowered into position. While the tops of the removable panels will be exposed within these openings and located less than one-foot below the bridge deck elevation, a space will exist within the footprint of the each gate frame mounted to the downstream face of the removable panel. These opening will be less than one-foot wide and less than 7-5-feet long at panels with gates, and less than two-feet wide at "dead" panels without gates. Secured grating will be provided at "dead" panel openings to avoid the hazard of persons falling in the opening. A similar railing system will be installed along perimeters of the platforms, to protect against falling hazards.

The proposed bridge structure type will provide the largest horizontal clearance within the channel structures of the considered alternatives, and result in a significant improvement of boater/rescue safety in comparison to the existing structure. The structure's vertical clearance from the roof of the platforms above the Mean High Water elevation is more than approximately 4.5-feet, and more than 4-feet below the roof of the main bridge deck.

Arched facia panels will extend down vertically from the top of the upstream and downstream faces of the bridge openings. These fascia panels, together with warning signage posted on the upstream and downstream bridge faces and/or signage posted on warning buoys immediately upstream and downstream of the bridge structure, would provide a visual warning to approaching boaters of the hazard present.

4.7 Preliminary Project Cost Estimate

The budgetary opinion of construction cost to construct the proposed bridge structure, appurtenances and other site improvements is approximately $13,100,000 including a 20% contingency and two years of inflation at 3% per annum. A budgetary opinion of cost is typically expected to be accurate within a range of -15% to +30%, resulting in an expected cost range of between $11,100,000 and $16,980,000. As the project design progresses to completion of construction and bidding documents the cost will be updated, with the contingency and cost range both reduced accordingly.

4.8 Proposed Bridge Structure Type

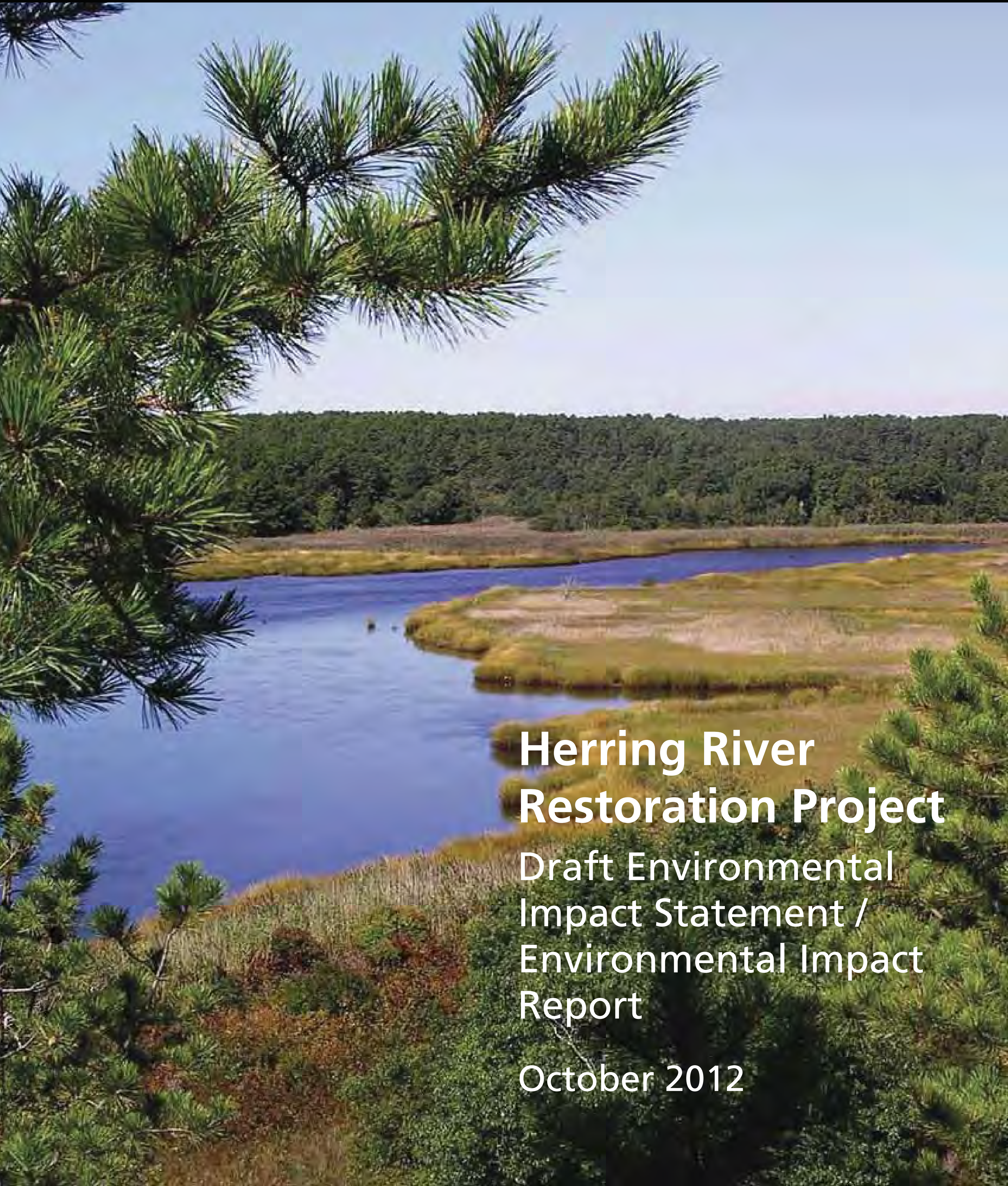
As noted above, the proposed bridge structure is an Adjacent Pre-Stressed Concrete Box Beam Bridge.

Attachment A

Project Background and Hydrodynamic Modeling Information

National Park Service
U.S. Department of the Interior
Cape Cod National Seashore

Town of Wellfleet
Town of Truro
Herring River Restoration Committee



Herring River Restoration Project

Draft Environmental Impact Statement / Environmental Impact Report

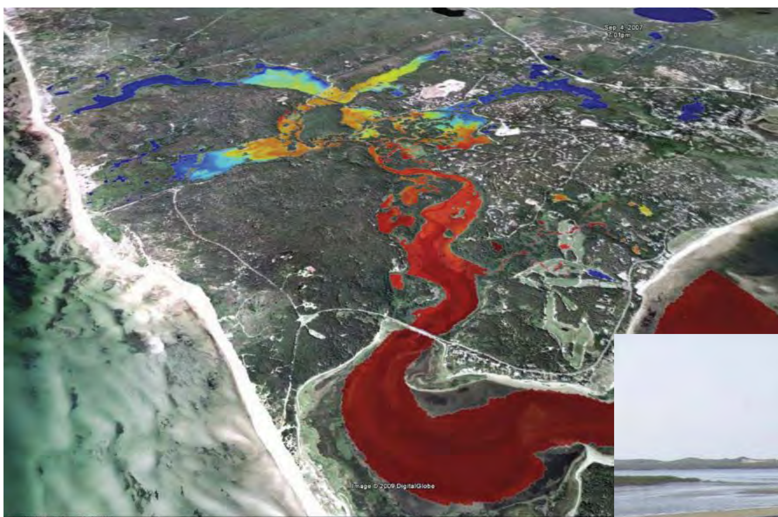
October 2012

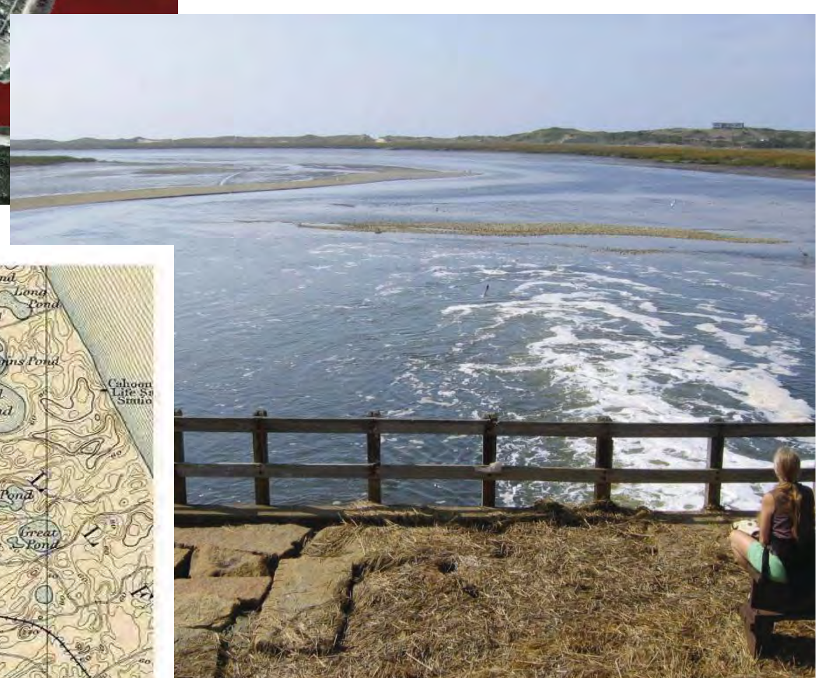
Appendices

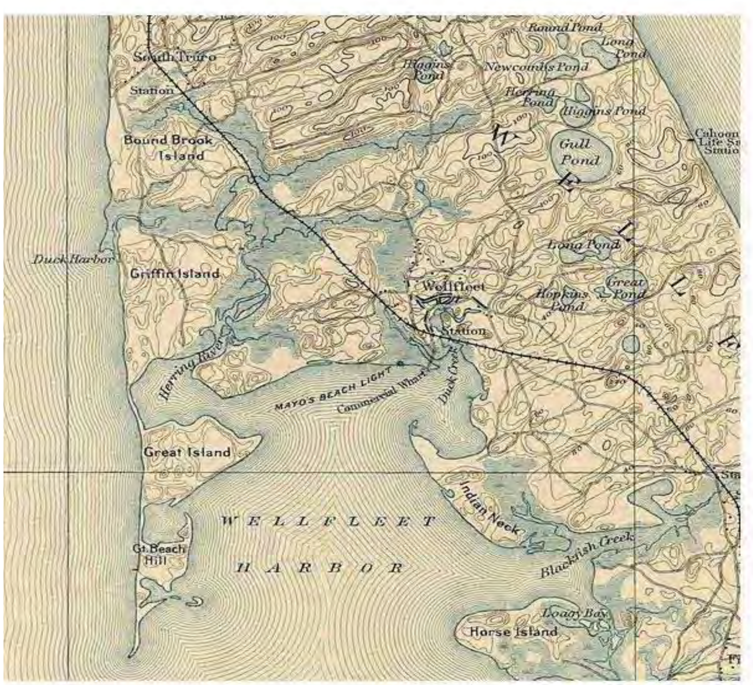
WOODS HOLE GROUP

Herring River Hydrodynamic Modeling

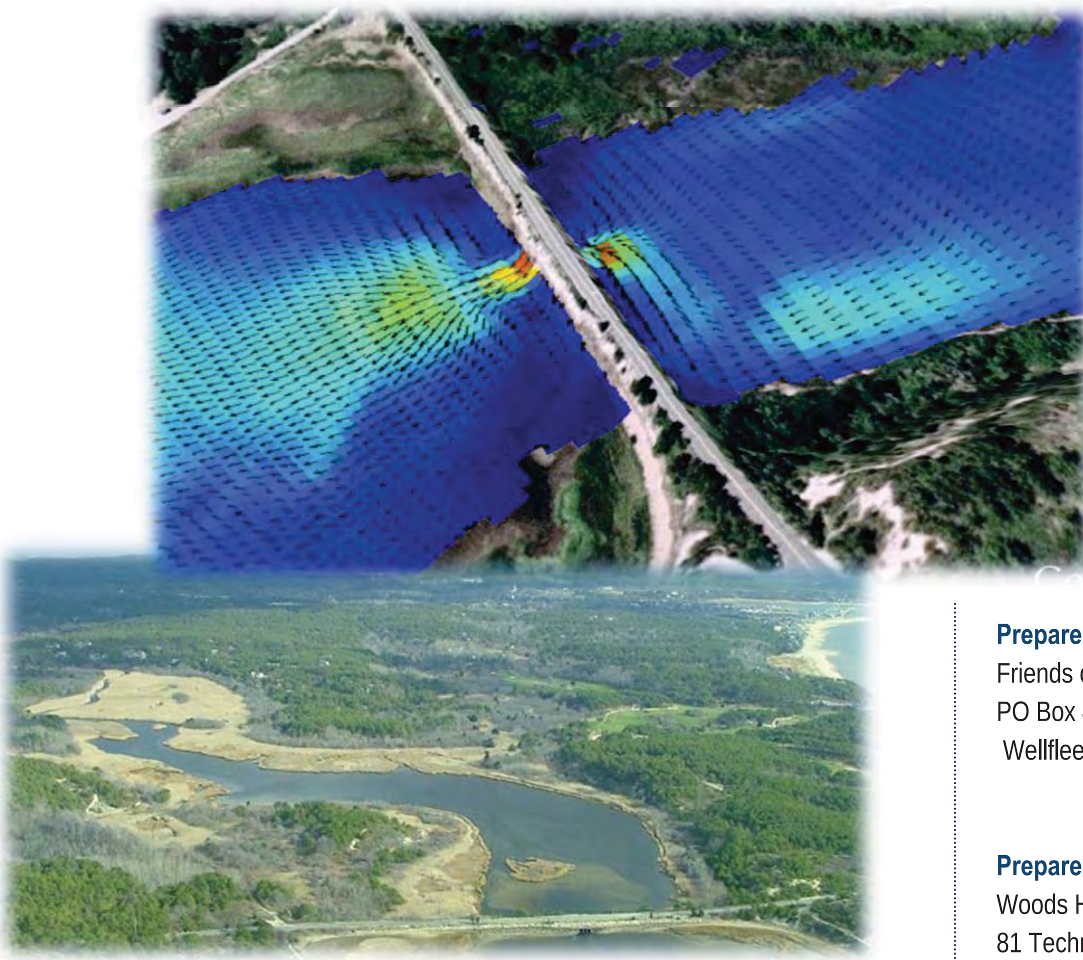
Final Comprehensive Report







Herring River Restoration Project: Final Dike Control Structure Hydrodynamic Modeling



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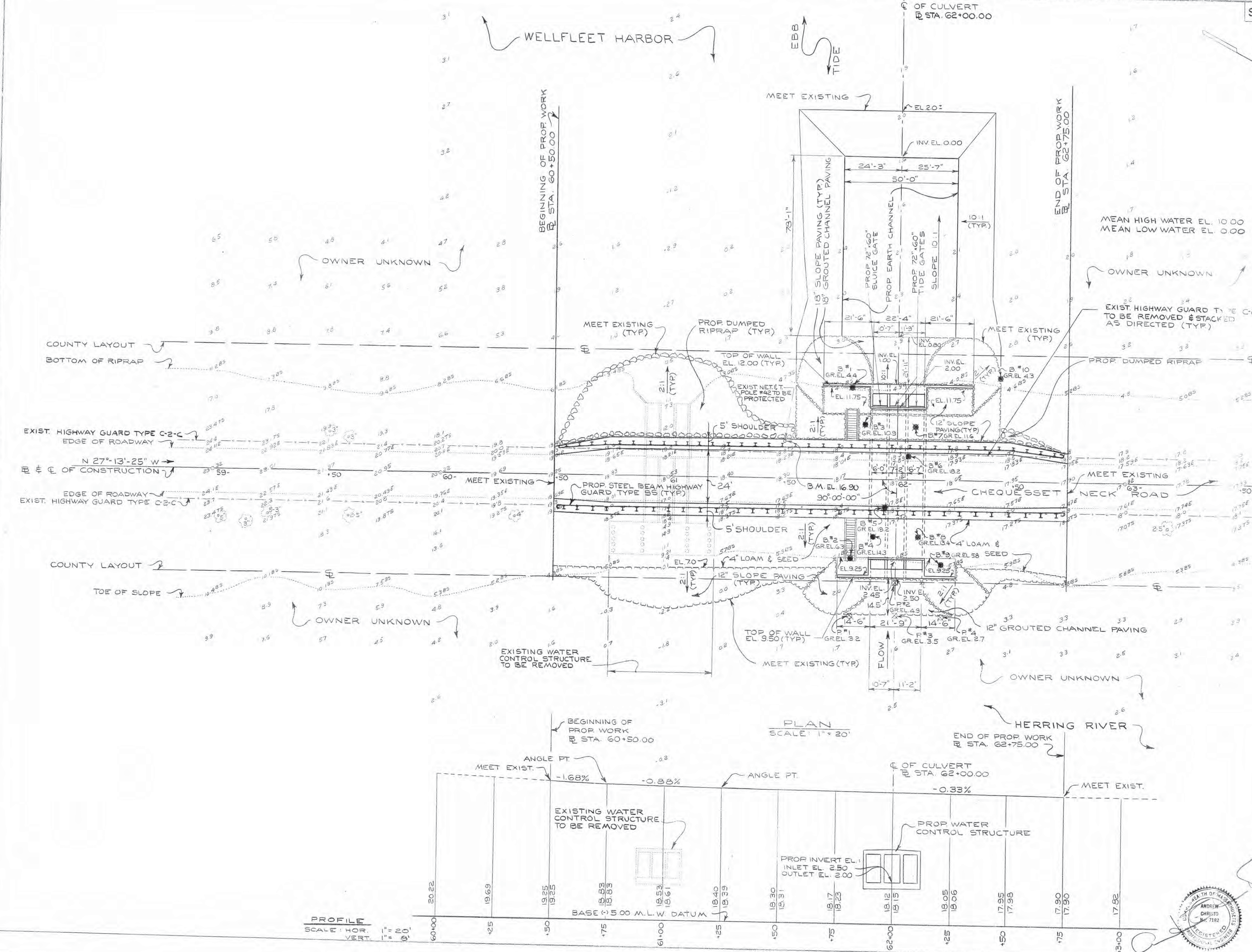
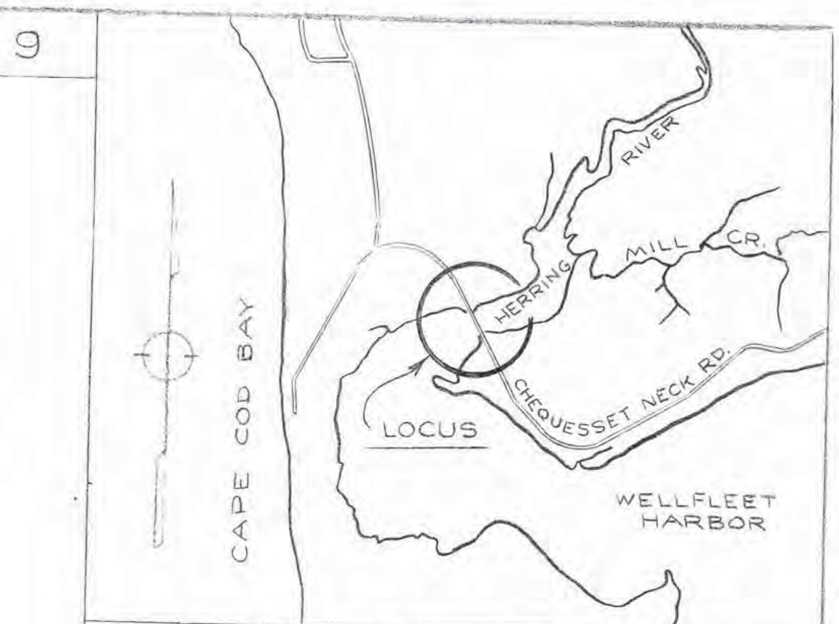
December 2013

SHEET NO. 1 OF 9





LOCATION PLAN

SCALE 1:24000 GRAPHIC SCALE: 1000 0 1000 2000 FT.

TRACED FROM U.S.G.S. MAP - WELLFLEET QUAD. - MASS.

LIST OF DRAWINGS

SHEET NO.	DESCRIPTION
1	PLAN & PROFILE
2	PLAN & ELEVATION
3	SECTIONS 1-1 & 2-2 AND TYPICAL RETAINING WALL SECTION
4	TYPICAL SECTIONS
5	DETAILS @ INLET & OUTLET AND MISCELLANEOUS SECTIONS
6	MISCELLANEOUS DETAILS
7	TIDE GATE DETAILS
8	SLUICE GATE DETAILS
9	BORING LOGS

1" = 8' 1" = 20'

GRAPHIC SCALES

GENERAL NOTES:

1. ELEVATION ARE IN FEET, TENTHS AND HUNDREDTHS AND REFER TO MEAN LOW WATER DATUM.
2. BENCH MARK: NAIL @ BASE OF N.E.T. & T. POLE #42, EL. 16.90 ABOVE MEAN LOW WATER.
3. SURVEY NOTE BOOK NOS.:
   HIGHWAY SURVEY BK. # 2168, 5949, 10929.
   WATERWAYS TRANSIT BK. # 1049, 1060.
4. HYDRAULIC DATA:
   DRAINAGE AREA: 8.60 SQUARE MILES
   DESIGN FLOOD: MAJOR FLOOD - 1295 C.F.S. (50 YEAR FREQUENCY)
   ESTIMATED DISCHARGE: 462 C.F.S.
   VELOCITY OF FLOOD FLOW: 9.10 FT./SEC.
5. ● INDICATES BORING LOCATIONS.
   ✕ INDICATES PUNCHING (PROBING) LOCATIONS.

PROPOSED RELOCATION OF WATER CONTROL STRUCTURE HERRING RIVER DIKE

CHEQUESSET NECK ROAD WELLFLEET

PLAN & PROFILE

DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS

ANDREW CHRISTO, ENGINEERS
230 BOYLSTON ST. BOSTON, MASS.

MAY, 1972
D.P.W. REVIEW BY ___ DATE ___
DESIGNED BY PR
TRACED BY PDB
APPROVED BY AC
DEPUTY CHIEF ENGINEER, WATERWAYS

CONTRACT NO. 2755 ACC. NO. 04938-A

NOTES:
1) FOR SECTIONS 1-1 & 2-2 SEE SHEET NO. 3.
2) FOR SECTION 3-3 SEE SHEET NO. 5.
3) FOR SECTION 4-4 SEE SHEET NO. 6.
4) FOR SECTION 5-5 SEE SHEET NO. 3.
5) FOR EXIST. GROUND ELEVATIONS SEE SHEET NO. 1.

PLAN & ELEVATION

DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS

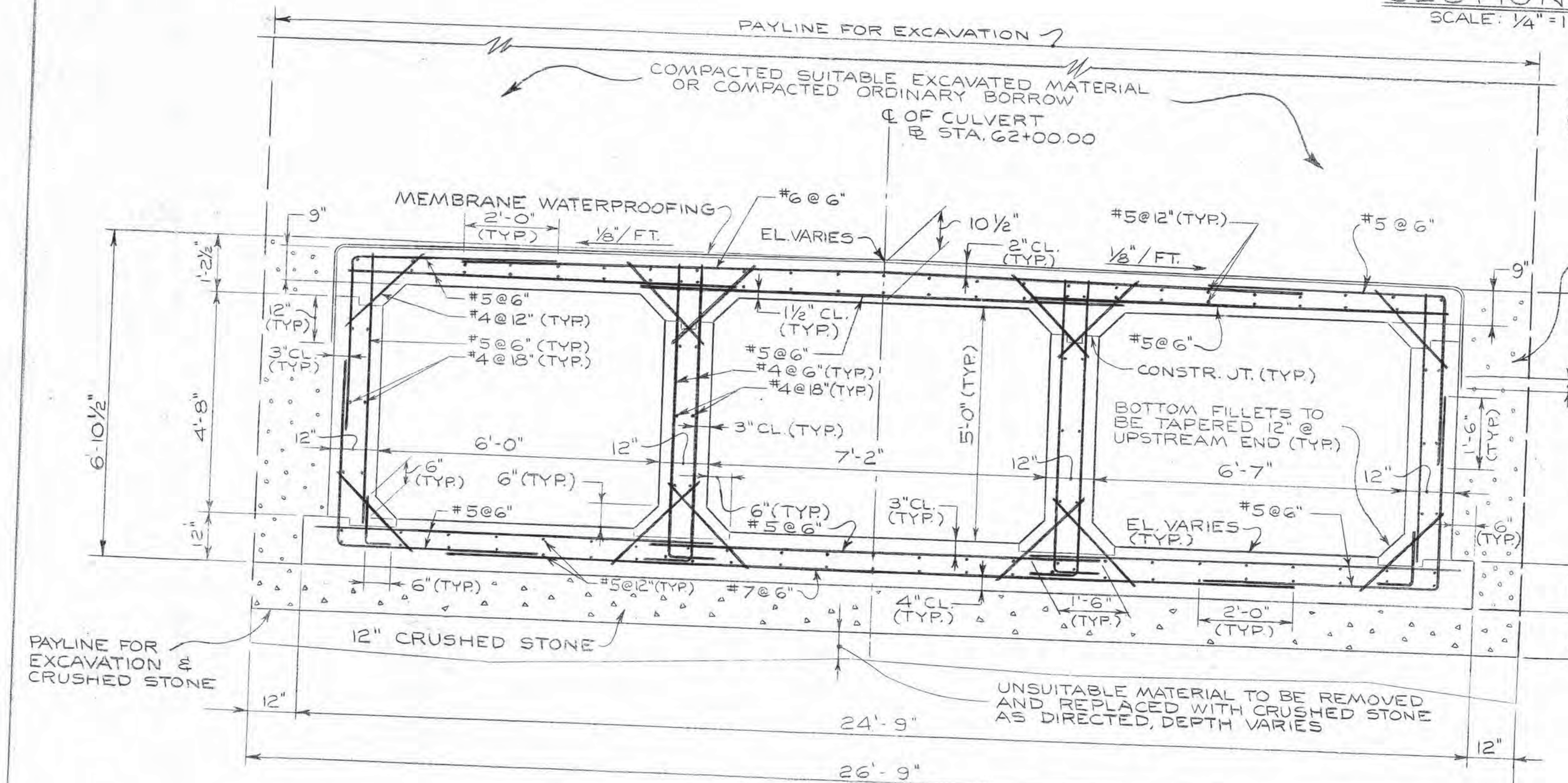
ANDREW CHRISTO, ENGINEERS
230 BOYLSTON ST. BOSTON, MASS.

D.P.W. REVIEW BY ___ DATE ___
DESIGNED BY PR
TRACED BY DFN
APPROVED BY AC

CONTRACT NO. 2755 | ACC. NO. 04938-B

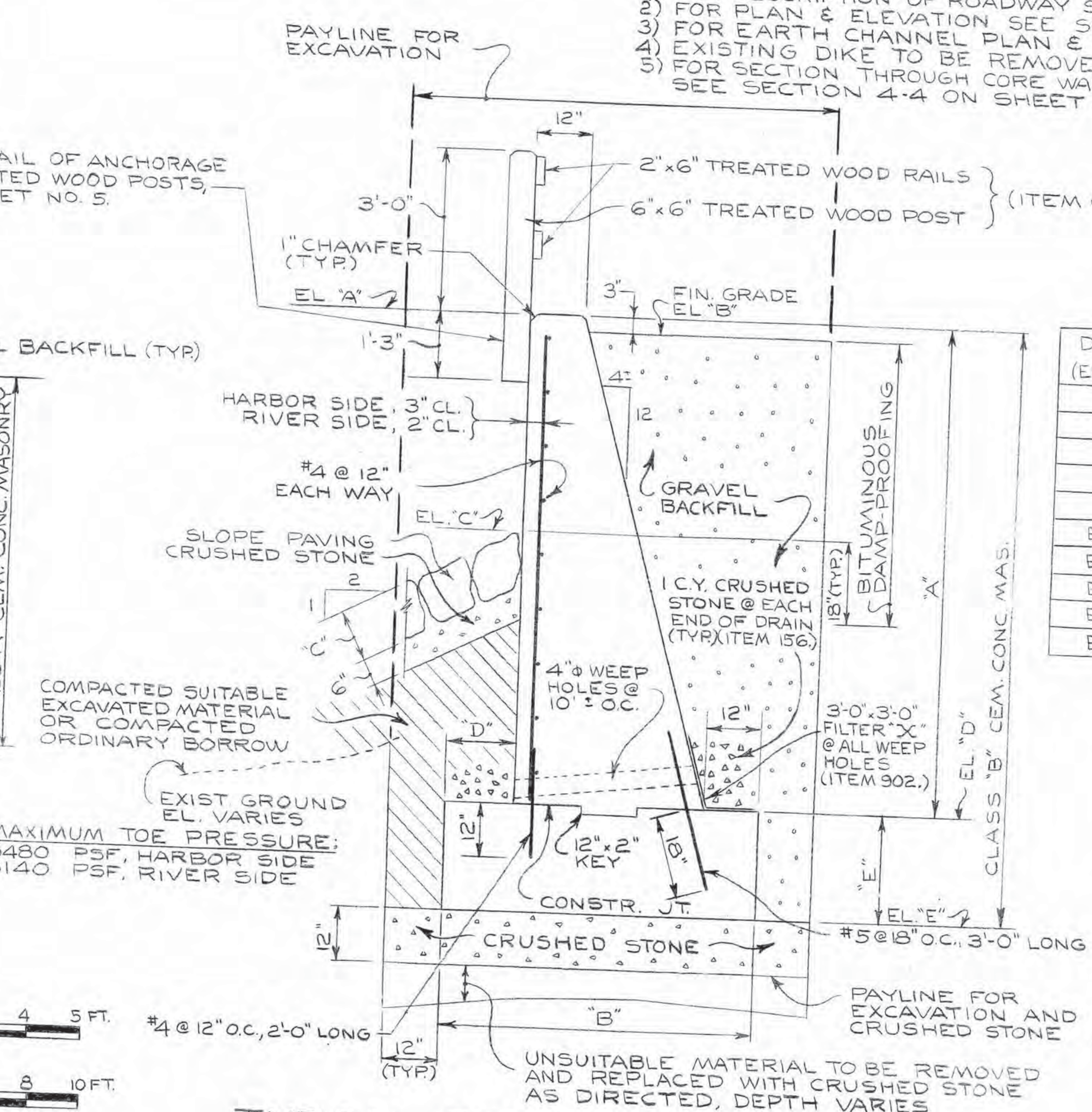
SECTION 1-1
SCALE: 1/4" = 1'-0"

NOTES:
1) FOR DESCRIPTION OF ROADWAY SURFACE & FOUNDATION SEE SHEET NO. 4.
2) FOR PLAN & ELEVATION SEE SHEET NO. 2.
3) FOR EARTH CHANNEL PLAN & SECTION SEE SHEET NOS. 1 & 5.
4) EXISTING DIKE TO BE REMOVED UNLESS OTHERWISE NOTED.
5) FOR SECTION THROUGH CORE WALL & IMPERVIOUS BORROW SEE SECTION 4-4 ON SHEET NO. 6.



SECTION 2-2
SCALE: 1/2" = 1'-0"

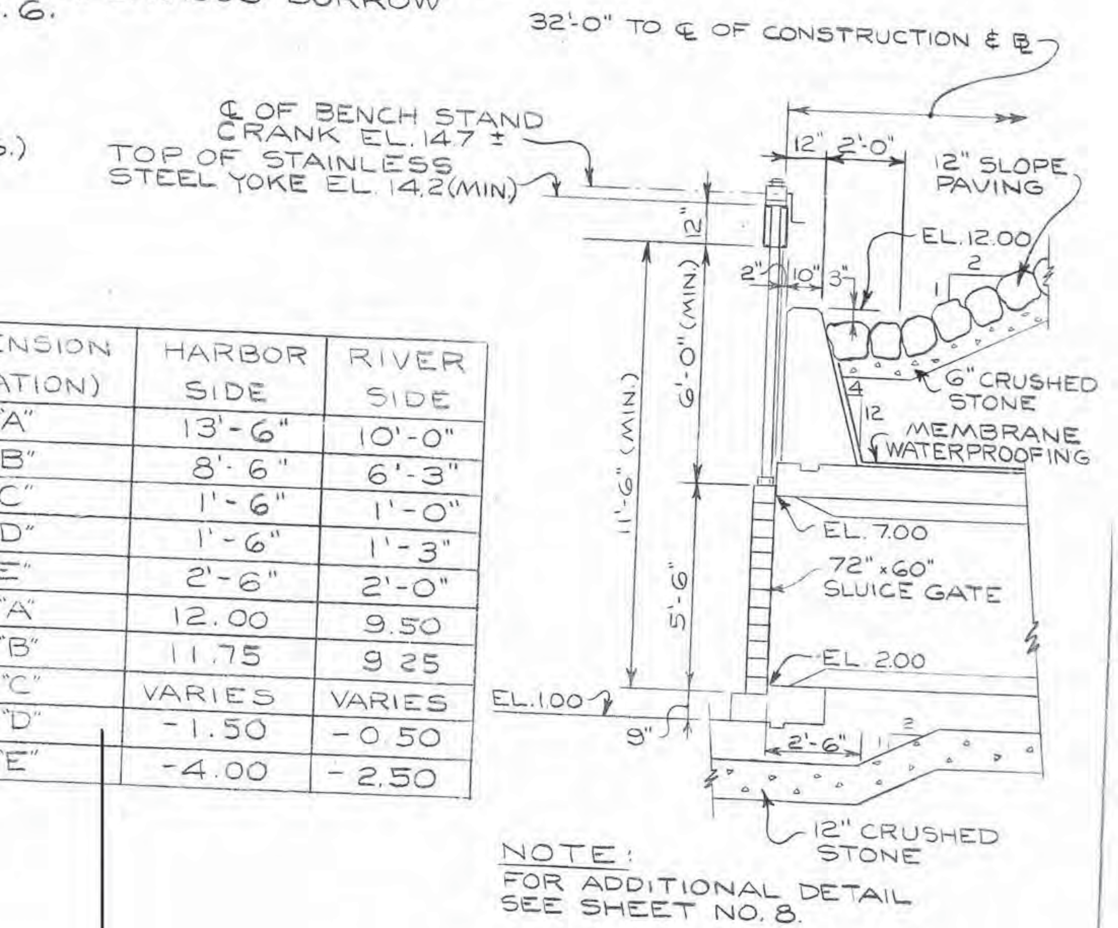
GRAPHIC SCALES
1/2" = 1'-0"
1/4" = 1'-0"



MAXIMUM TOE PRESSURE:
3480 PSF, HARBOR SIDE
3140 PSF, RIVER SIDE

TYPICAL RETAINING WALL SECTION
NO SCALE

DIMENSION (ELEVATION)	HARBOR SIDE	RIVER SIDE
"A"	13'-6"	10'-0"
"B"	8'-6"	6'-3"
"C"	1'-6"	1'-0"
"D"	1'-6"	1'-3"
"E"	2'-6"	2'-0"
EL. "A"	12.00	9.50
EL. "B"	11.75	9.25
EL. "C"	VARIES	VARIES
EL. "D"	-1.50	-0.50
EL. "E"	-4.00	-2.50



NOTE:
FOR ADDITIONAL DETAIL SEE SHEET NO. 8.

SECTION 5-5
SCALE: 1/4" = 1'-0"

SECTIONS 1-1, 2-2 & 5-5
AND TYPICAL RETAINING WALL SECTION

DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS

ANDREW CHRISTO, ENGINEERS
230 BOYLSTON ST. BOSTON, MASS.

D.P.W. REVIEW BY ___ DATE ___
DESIGNED BY PR
TRACED BY PDB
APPROVED BY AC

CONTRACT NO. 2755 ACC. NO. 04938-C

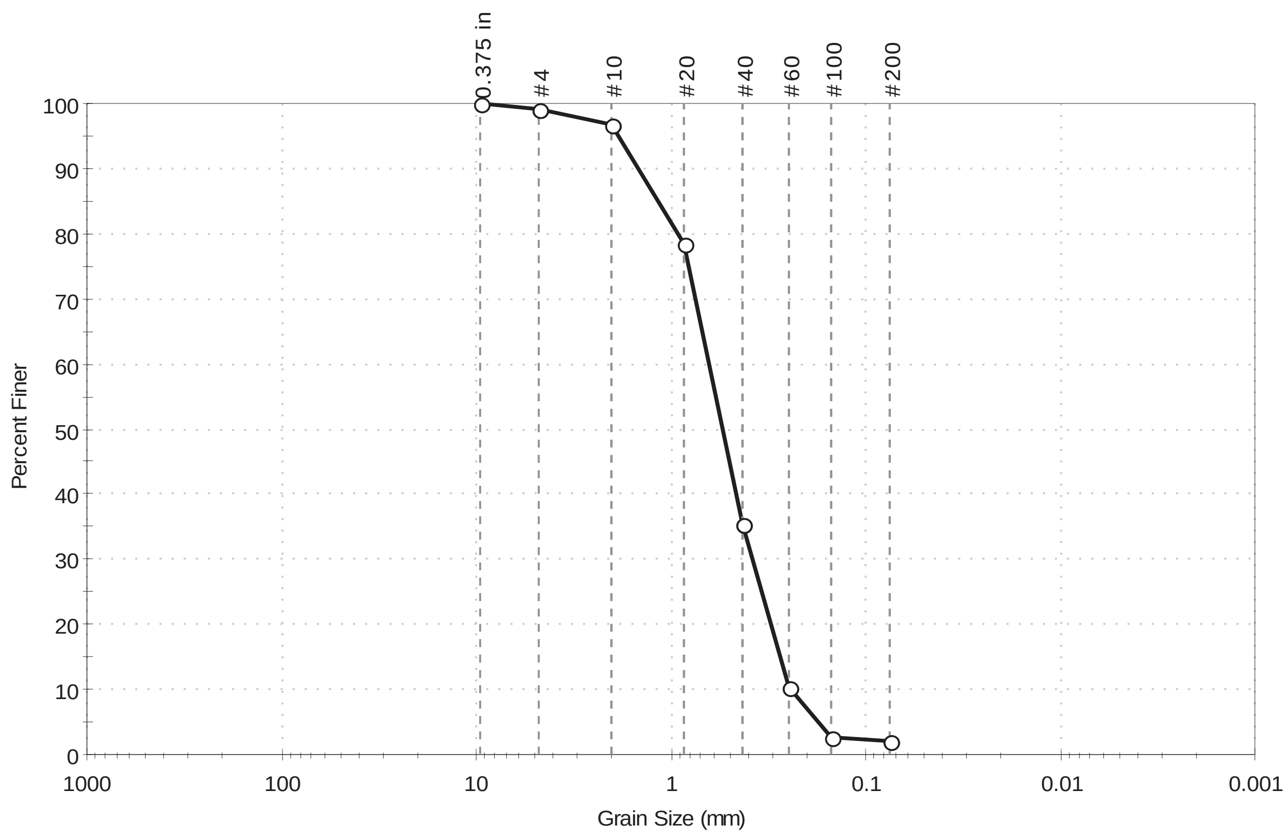
Attachment B

Scour and Wave Analysis Information

Client:	Fuss & O'Neill, Inc.			
Project:	Herring River Drilling			
Location:	Wellfleet, MA		Project No:	GTX-301245
Boring ID: SEDIMENT		Sample Type: bag	Tested By:	jbr
Sample ID: S-1		Test Date: 12/05/13	Checked By:	jdt
Depth : ---		Test Id: 284498		

Test Comment: ---
Sample Description: Moist, dark yellowish brown sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.7	97.3	2.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	97		
#20	0.85	78		
#40	0.42	35		
#60	0.25	10		
#100	0.15	3		
#200	0.075	2		

Coefficients

D_{85} = 1.1611 mm | D_{30} = 0.3799 mm
D_{60} = 0.6326 mm | D_{15} = 0.2766 mm
D_{50} = 0.5385 mm | D_{10} = 0.2463 mm
C_u = 2.568 | C_c = 0.926

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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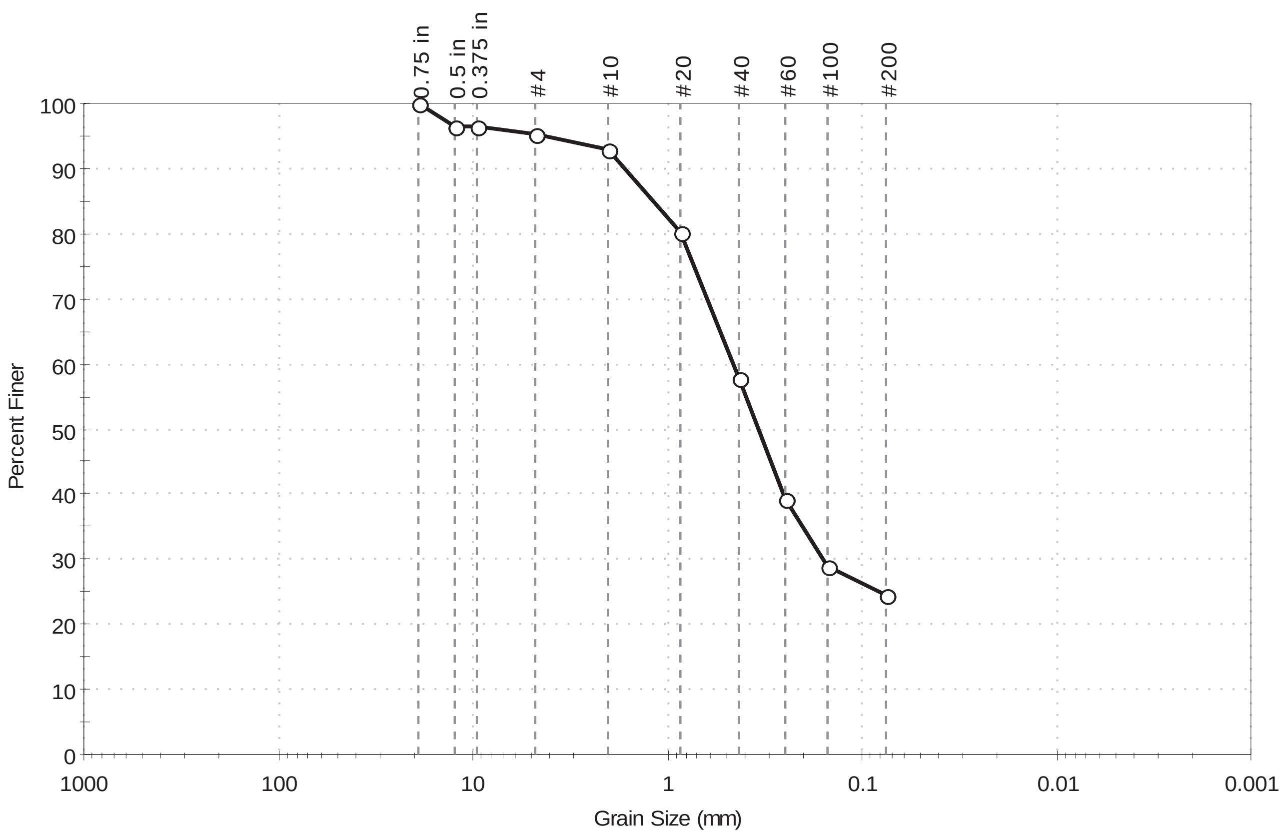
Client:	Fuss & O'Neill, Inc.				
Project:	Herring River Drilling				
Location:	Wellfleet, MA			Project No:	GTX-301245
Boring ID:	SEDIMENT	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-2	Test Date:	12/05/13	Checked By:	jdt
Depth :	---	Test Id:	284499		
Test Comment:	---				
Sample Description:	Moist, very dark gray silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	4.6	70.8	24.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	96		
#4	4.75	95		
#10	2.00	93		
#20	0.85	80		
#40	0.42	58		
#60	0.25	39		
#100	0.15	29		
#200	0.075	25		

Coefficients

D_{85} = 1.1717 mm | D_{30} = 0.1579 mm
D_{60} = 0.4550 mm | D_{15} = N/A
D_{50} = 0.3401 mm | D_{10} = N/A
C_u = N/A | C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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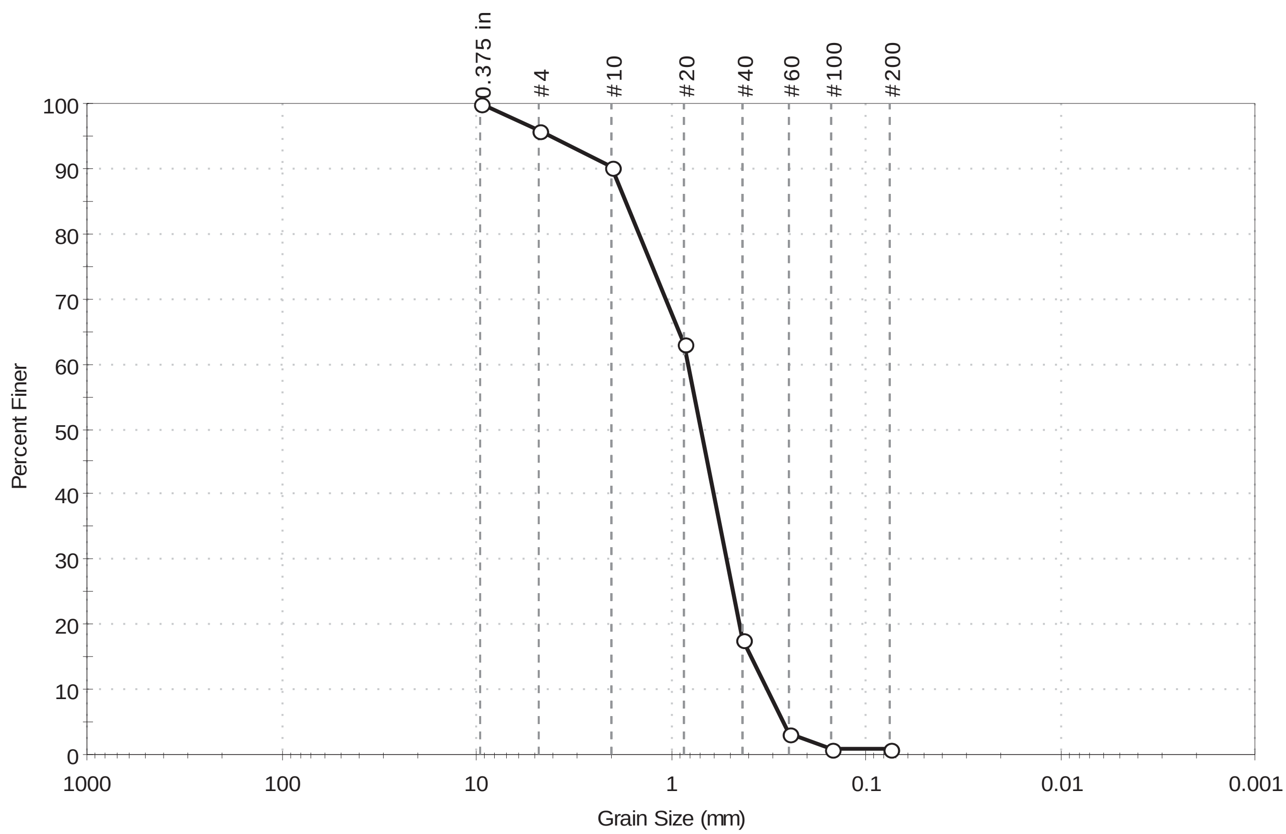
GeoTesting EXPRESS

Client:	Fuss & O'Neill, Inc.				
Project:	Herring River Drilling				
Location:	Wellfleet, MA			Project No:	GTX-301245
Boring ID:	SEDIMENT	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-3	Test Date:	12/05/13	Checked By:	jdt
Depth :	---	Test Id:	284500		
Test Comment:	---				
Sample Description:	Moist, light yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	4.1	95.0	0.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	96		
#10	2.00	90		
#20	0.85	63		
#40	0.42	18		
#60	0.25	3		
#100	0.15	1		
#200	0.075	1		

Coefficients

D_{85} = 1.6994 mm	D_{30} = 0.5127 mm
D_{60} = 0.8110 mm	D_{15} = 0.3847 mm
D_{50} = 0.6961 mm	D_{10} = 0.3206 mm
C_u = 2.530	C_c = 1.011

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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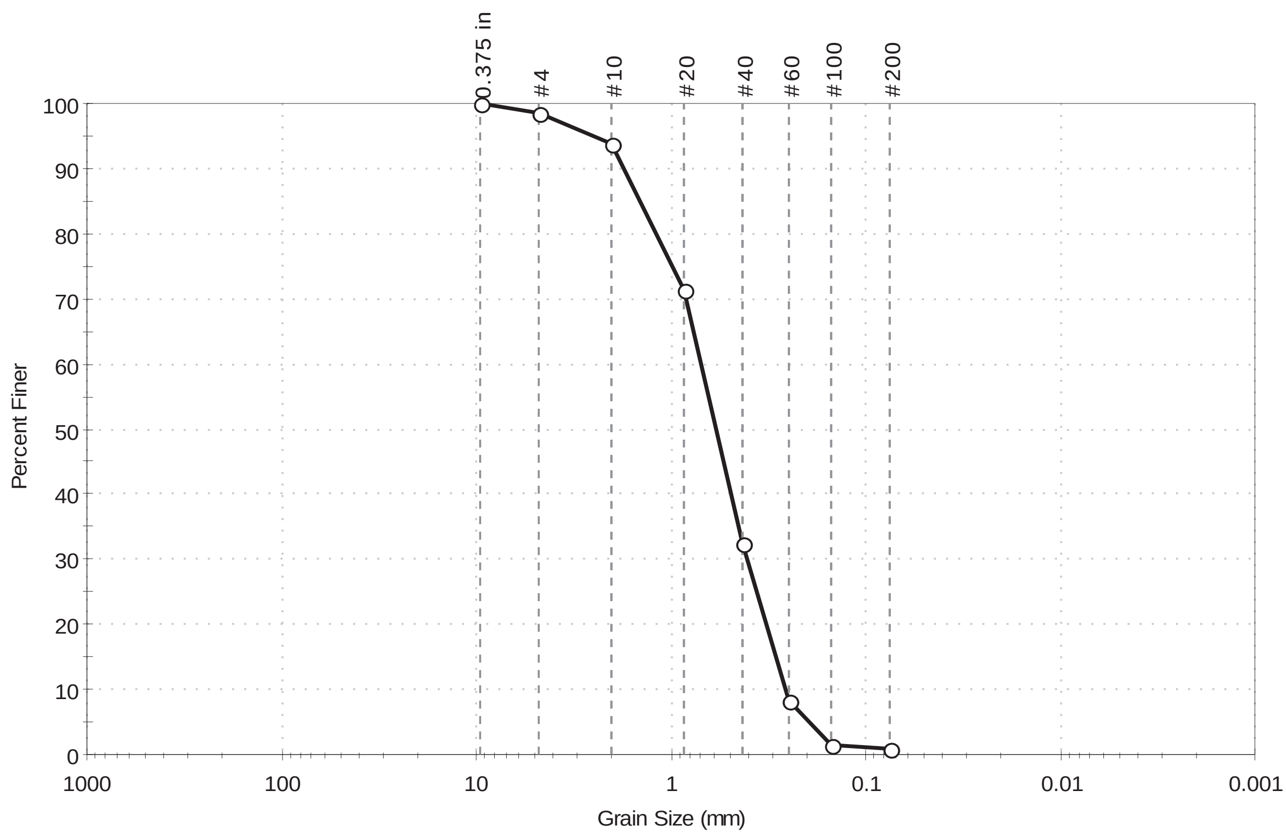
Client:	Fuss & O'Neill, Inc.				
Project:	Herring River Drilling				
Location:	Wellfleet, MA			Project No:	GTX-301245
Boring ID:	SEDIMENT	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-4	Test Date:	12/05/13	Checked By:	jdt
Depth :	---	Test Id:	284501		
Test Comment:	---				
Sample Description:	Wet, dark olive gray sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	1.3	97.8	0.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	94		
#20	0.85	71		
#40	0.42	32		
#60	0.25	8		
#100	0.15	1		
#200	0.075	1		

Coefficients

D_{85} = 1.4315 mm — D_{30} = 0.4032 mm

D_{60} = 0.6954 mm — D_{15} = 0.2894 mm

D_{50} = 0.5818 mm — D_{10} = 0.2591 mm

C_u = 2.684 — C_c = 0.902

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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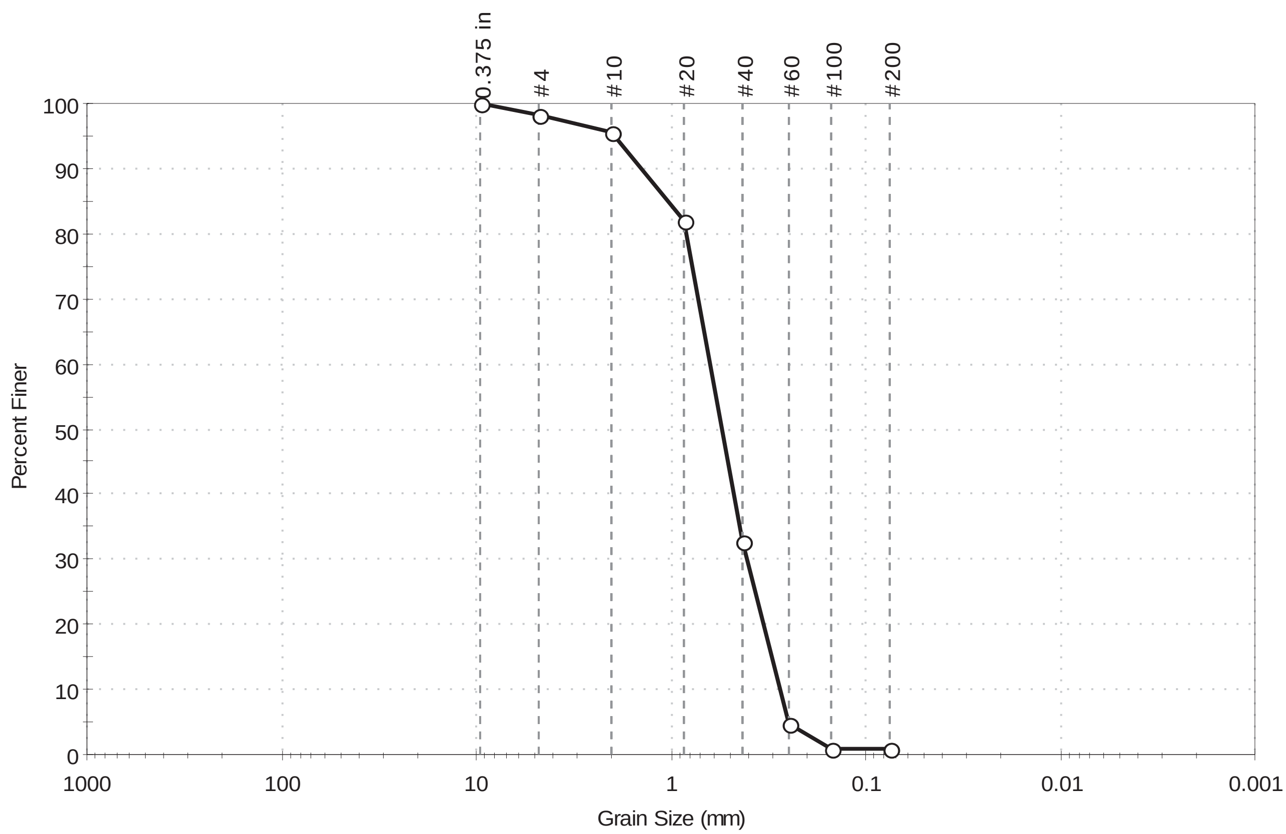
Client:	Fuss & O'Neill, Inc.				
Project:	Herring River Drilling				
Location:	Wellfleet, MA			Project No:	GTX-301245
Boring ID:	SEDIMENT	Sample Type:	bag	Tested By:	jbr
Sample ID:	S-5	Test Date:	12/05/13	Checked By:	jdt
Depth :	---	Test Id:	284502		
Test Comment:	---				
Sample Description:	Moist, light yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	1.8	97.2	1.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	96		
#20	0.85	82		
#40	0.42	33		
#60	0.25	5		
#100	0.15	1		
#200	0.075	1		

Coefficients

D_{85} = 1.0335 mm	D_{30} = 0.4032 mm
D_{60} = 0.6241 mm	D_{15} = 0.3040 mm
D_{50} = 0.5419 mm	D_{10} = 0.2767 mm
C_u = 2.256	C_c = 0.941

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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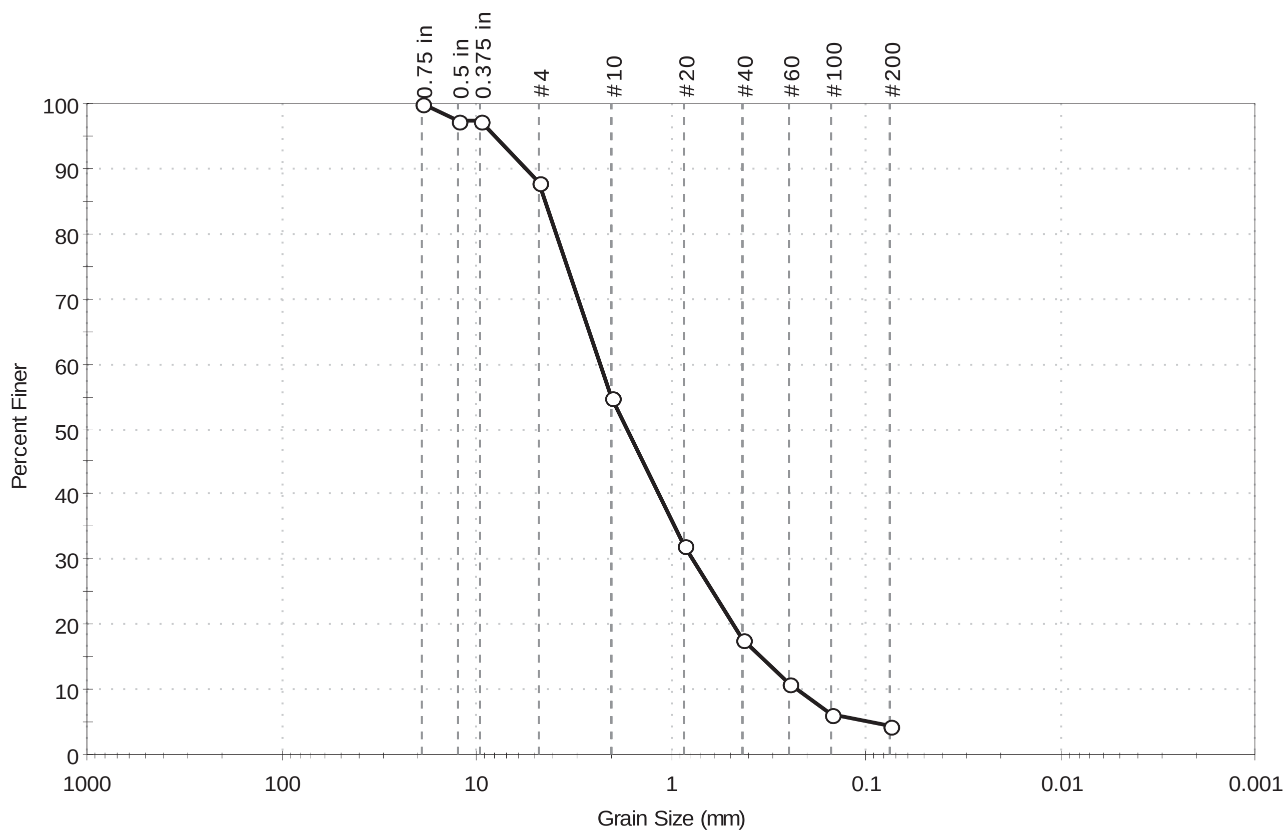
Client: Fuss & O'Neill, Inc.			
Project: Herring River Drilling			
Location: Wellfleet, MA		Project No:	GTX-301245
Boring ID: SEDIMENT	Sample Type: bag	Tested By:	jbr
Sample ID: S-6	Test Date: 12/05/13	Checked By:	jdt
Depth : ---	Test Id: 284503		
Test Comment: ---			
Sample Description: Wet, black sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	12.1	83.4	4.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	97		
0.375 in	9.50	97		
#4	4.75	88		
#10	2.00	55		
#20	0.85	32		
#40	0.42	18		
#60	0.25	11		
#100	0.15	6		
#200	0.075	5		

Coefficients

D_{85} = 4.3959 mm　　D_{30} = 0.7686 mm

D_{60} = 2.2907 mm　　D_{15} = 0.3443 mm

D_{50} = 1.6693 mm　　D_{10} = 0.2266 mm

C_u = 10.109　　C_c = 1.138

Classification

ASTM　Well-graded sand (SW)

AASHTO　Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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Attachment C

Geotechnical Investigation and Evaluation Information

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	BORING LOG Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-1 Sheet 1 of 1 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs   Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation: 12.1 (NAVD88)
Date Start: 11/20/13   Date Finish: 11/20/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1500- 11/20/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	12.1		0.0-0.5			Asphalt	Asphalt	AS	
0.5	11.6	S-1	0.5-2.5	6/24	12 20 12 10	Dense red brown fine to medium SAND,some Gravel	Sand/ Fill	FI/SP	
5	7.1	S-2	5-7	12/24	7 6 19 9	Medium dense red brown fine to medium, SAND, trace Gravel. Asphalt fragments in the recovery		FI/SP AS	
10	2.1	S-3	10-12	8/24	3 3 3 4	Loose red brown fine to medium SAND	Sandy Fill	SP	1
14	-1.9	S-4	14-16	7/24	3 5 5 7	Medium dense, yellowish brown fine to medium, SAND, little Gravel,wet	Sand	SP	
19	-6.9	S-5	19-21	9/24	6 6 7 7	Medium dense, greyish fine to medium SAND , trace Gravel, wet		SP	
24	-11.9	S-6	24-26	9/24	12 14 15 9	Medium dense, reddish brown fine to medium SAND , trace Gravel, wet		SP	
29	-16.9	S-7	29-31	5/24	5 7 7 8	Medium dense, yellowish fine to medium SAND , trace Gravel, wet		SP	
34	-21.9	S-8	34-36	14/24	3 5 7 7	Medium dense, greyish fine to medium SAND , trace Gravel, wet		SP	
39	-26.9	S-9	39-41	6/24	4 6 9 10	Medium dense, greyish fine to medium SAND, wet		SP	
						End of Boring 41'; No refusal			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
End of Boring 41'; No refusal
Auto hammer
1. Ground water table encounterd at 13' from the ground surface.

FUSS & O'NEILL, INC. **CONSULTING ENGINEERS** **MANCHESTER, CT**	**BORING LOG** **Project: Herring River Restoration** **Location: Wellfleet, MA**	**Boring ID: B-2** **Sheet 1 of 2** **Project No.: 20120636.A13**

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs   Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/18/13   Date Finish: 11/19/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1300- 11/19/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	12.3		0-0.5			Asphalt upto 3" and then Gravel	Asphalt	AS	
0.5	11.8	S-1	0.5-2.5	14/24	7 12 14 17	Medium dense brown moist fine to medium SAND, little Gravel	Sandy Fill	FI/SP	
5	7.3	S-2	5-7	12/24	14 10 4 4	Medium dense moist brown fine to medium SAND, little Gravel		FI/SP	
10	2.3	S-3	10-12	11/24	9 11 13 15	Medium dense moist brown fine to medium SAND		FI/SP	
14	-1.7	S-4	14-16	8/24	3 3 3 4	Loose moist brown fine to medium SAND		FI/SP	1
19	-6.7	S-5	19-21	8/24	8 8 7 8	Medium dense wet light grey fine to medium SAND, some Gravel	Sand	SP	
24	-11.7	S-6	24-26	8/24	9 11 12 15	Medium dense wet light grey fine to medium SAND, some Gravel		SP	
29	-16.7	S-7	29-31	0/24	14 16 14 9	No Recovery, Gravel in Spoon tip			
34	-21.7	S-8	34-36	16/24	7 8 9 8	Medium dense wet greyish brown fine to medium SAND, trace Gravel		SP	
39	-26.7	S-9	39-41	9/24	8 9 9 10	Medium dense wet greyish brown fine to medium SAND, trace Gravel		SP	
44	-31.7	S-10	44-46	9/24	6 8 8 10	Medium dense wet greyish brown fine to medium SAND, some Gravel		SP	
49	-36.7	S-11	49-51	11/24	4 5 6 12	Medium dense , wet, reddish brown fine to medium SAND, some Gravel		SP	

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
End of Boring 78'; No refusal
Auto hammer
1. Ground water table encounterd at 15' from the ground surface.

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-2 Sheet 2 of 2 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/18/13 Date Finish: 11/19/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1300- 11/19/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
54		S-12	54-56	12/24	22 26 25 25	Very dense wet reddish brown fine to medium SAND, little Gravel	Sand	SP	
59		S-13	59-61	18/24	7 14 11 22	Medium dense wet reddish brown fine to medium SAND, trace Gravel		SP	
64		S-14	64-66	13/24	5 9 13 15	Medium dense wet olive grey fine SAND		SP	
69		S-15	69-71	16/24	16 23 29 37	Very dense wet grey fine SAND, trace Silt		SP	
74		S-16	74-76	17/24	16 25 26 33	Very dense dark grey SILT, trace Sand.Moist	Silt	ML	
76		S-17	76-78	16/24	19 21 26 29	Dense dark grey SILT, trace Sand.Moist		ML	
78						End of boring @ 78 ft			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
End of Boring 78'; No refusal
Auto hammer

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-3 Sheet 1 of 1 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs　Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/21/13　Date Finish: 11/21/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1500- 11/21/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	12.1		0.0-0.3 0.3-0.5			Asphalt Gravel	Asphalt	AS	
0.5	11.6	S-1	0.5-2.5	15/24	8 16 18 14	Dense yellowish brown fine to medium SAND,trace Gravel	Sandy Fill	FI/SP	
5	7.1	S-2	5-7	14/24	7 6 7 9	Medium dense yellowish brown fine to medium SAND		FI/SP	
10	2.1	S-3	10-12	16/24	11 11 13 11	Medium dense yellowish brown moist fine to medium SAND, little Gravel		SP	
15	-2.9	S-4	15-17	11/24	2 2 2 2	Loose,wet, yellowish brown fine to mediumSAND, trace Gravel	Sand	SP	
19	-6.9	S-5	19-21	10/24	10 12 12 12	Medium dense,wet, light grey fine to medium SAND, trace Gravel		SP	
24	-11.9	S-6	24-26	8/24	10 14 13 12	Medium dense,wet, light grey fine to medium SAND, trace Gravel		SP	
29	-16.9	S-7	29-31	0	10 12 22 26	No Recovery, Rock in Spoon tip			
34	-21.9	S-8	34-36	11/24	14 14 16 11	Dense,wet reddish brown fine to medium SAND, some Gravel, trace Silt		SP	
39	-26.9	S-9	39-41	1/24	7 9 10 10	Poor recovery; reddish brown fine to medium SAND, little Gravel		SP	
						End of Boring @ 41 ft			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
End of Boring 41'; No refusal
Auto hammer
Ground water table encounterd at 15' from the ground surface.

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-4 Sheet 1 of 1 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs   Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/20/13   Date Finish: 11/20/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

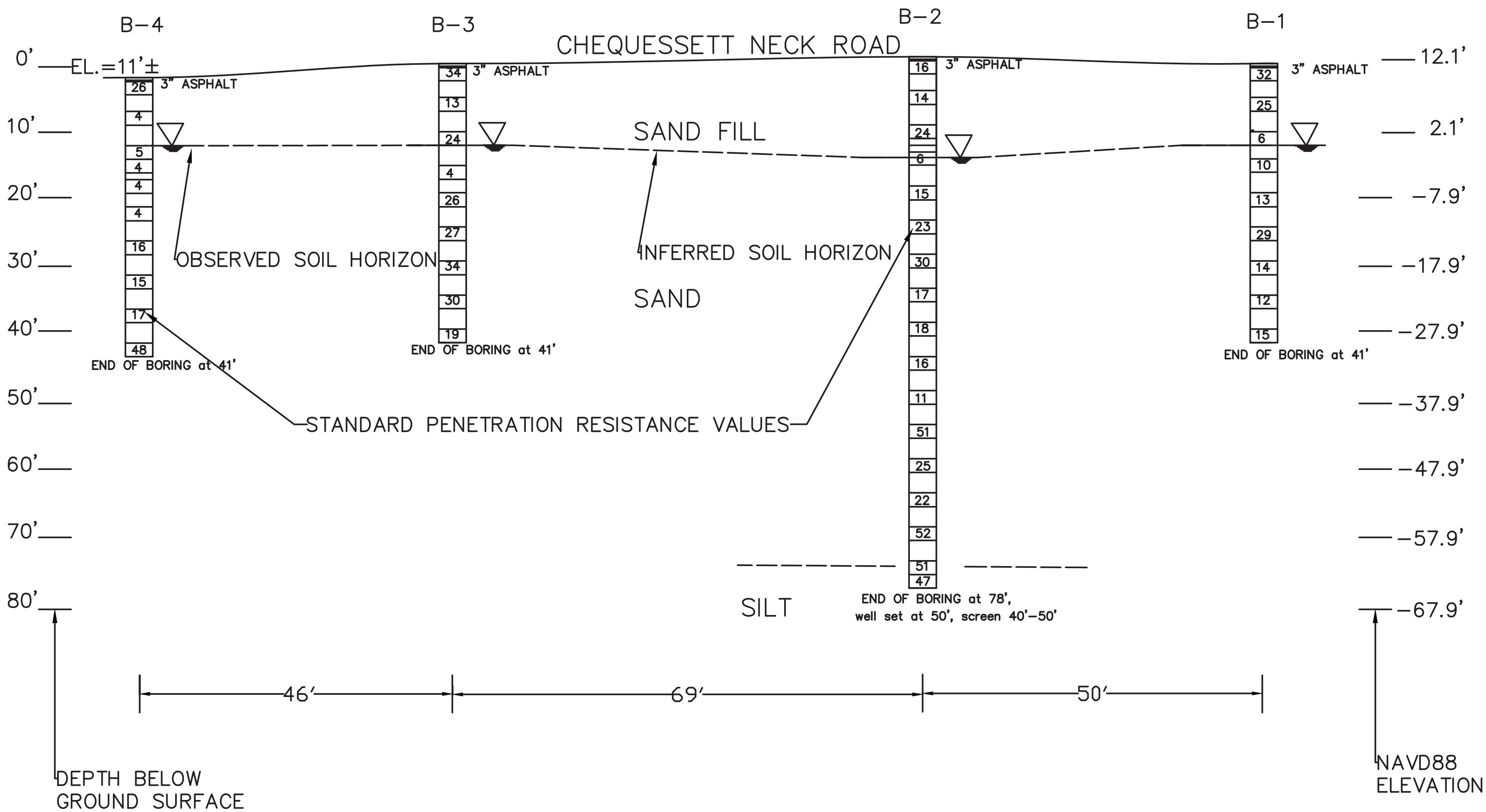
Time & Date of Completion: 1100- 11/20/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	11		0.0-0.25 0.25-0.5			Asphalt Gravel	Asphalt	AS	
0.5	10.5	S-1	0.5-2.5	14/24	8 14 12 11	Medium dense reddish brown fine to medium SAND, some Gravel	Sandy Fill	FI/SP	
5	6	S-2	5-7	15/24	3 2 2 2	Loose moist reddish brown fine to medium SAND trace Gravel		FI/SP	
10	1		10-12	0	2 2 3 2	No Recovery		FI/SP	
12	-1	S-3	12-14	14/24	3 2 2 3	Loose, wet reddish brown fine to medium SAND,trace Gravel	Sand	SP	
15	-4	S-4	15-17	16/24	2 2 2 4	Loose,wet, yellowish brown fine to medium SAND, trace Gravel		SP	
19	-8	S-5	19-21	6/24	3 2 2 3	Loose, wet, yellowish brown fine to medium SAND, trace Gravel		SP	
24	-13	S-6	24-26	13/24	3 7 9 12	Medium dense, wet, light grey fine to medium SAND, little Gravel		SP	
29	-18	S-7	29-31	11/24	7 7 8 12	Medium dense, wet, light brown fine to medium SAND, little Gravel		SP	
34	-23	S-8	34-36	14/24	5 8 9 11	Medium dense,wet, light brown fine to medium SAND		SP	
39	-28	S-9	39-41	17/24	13 21 27 35	Dense,wet, reddish brown fine to medium SAND, little Gravel		SP	
						End of Boring 41'; No refusal		SP	

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
End of Boring 41'; No refusal
Auto hammer
Ground water table encounterd at 12' from the ground surface.



Notes:

1. Borings performed by Soil Exploration Corp on Nov 18 through Nov 21, 2013. Borings logged by a Fuss & O'Neill engineer.

2. Numbers indicated in the boring profile represent Standard Penetration Test N– values (uncorrected).

SCALE:	
HORZ.:	
VERT.:	
DATUM:	
HORZ.:	
VERT.: NAVD88	

0 10' 20'
GRAPHIC SCALE

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

HERRING RIVER RESTORATION COMMITTEE

SUBSURFACE SOIL PROFILE
CHEQUESSETT NECK ROAD BRIDGE REPLACEMENT

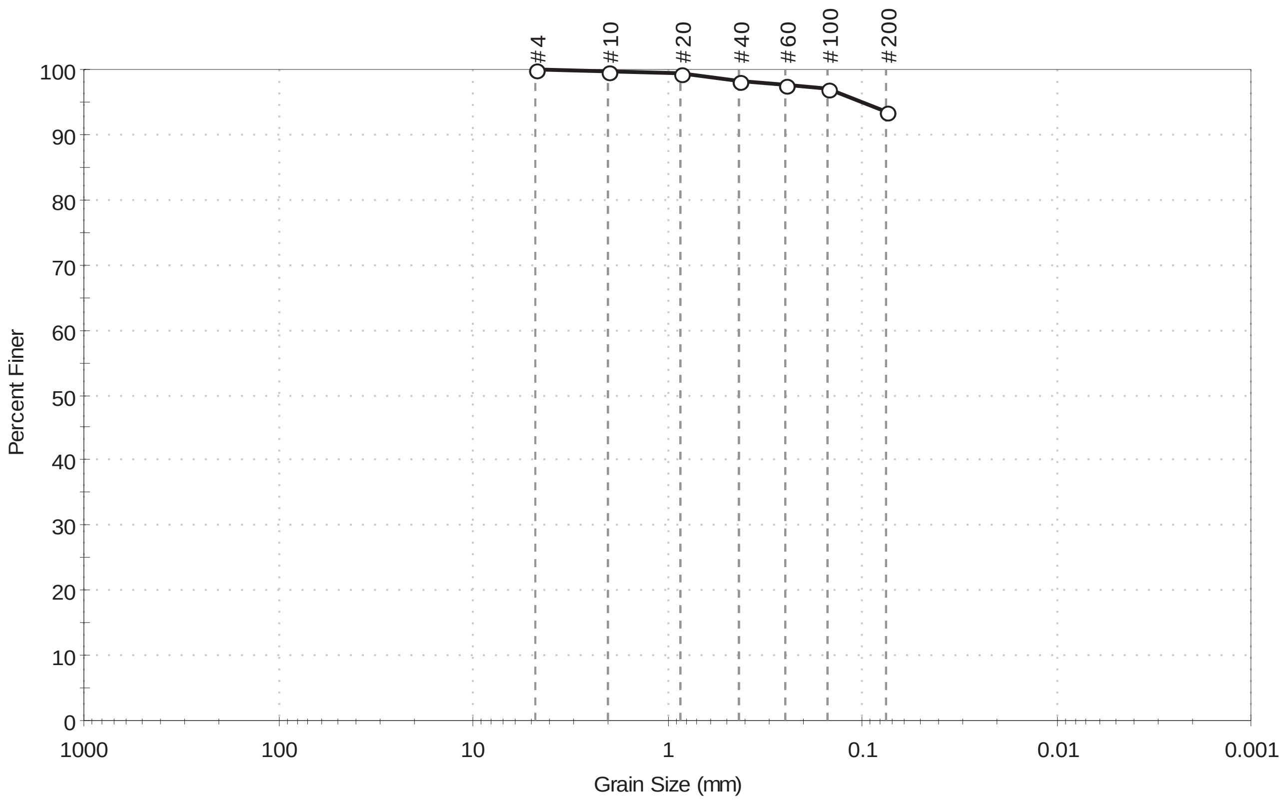
HERRING RIVER TIDAL RESTORATION PROJECT

WELLFLEET MASSACHUSSETTS

PROJ. No.: 20120636.A13
DATE: DEC. 2013

Client:	Fuss & O'Neill, Inc.			
Project:	Herring River Drilling			
Location:	Wellfleet, MA		Project No:	GTX-301245
Boring ID:	B-2	Sample Type: jar	Tested By:	jbr
Sample ID:	S-16	Test Date: 12/05/13	Checked By:	jdt
Depth :	74-76 ft.	Test Id: 284504		
Test Comment:	---			
Sample Description:	Moist, dark gray silt			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	6.5	93.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	98		
#100	0.15	97		
#200	0.075	93		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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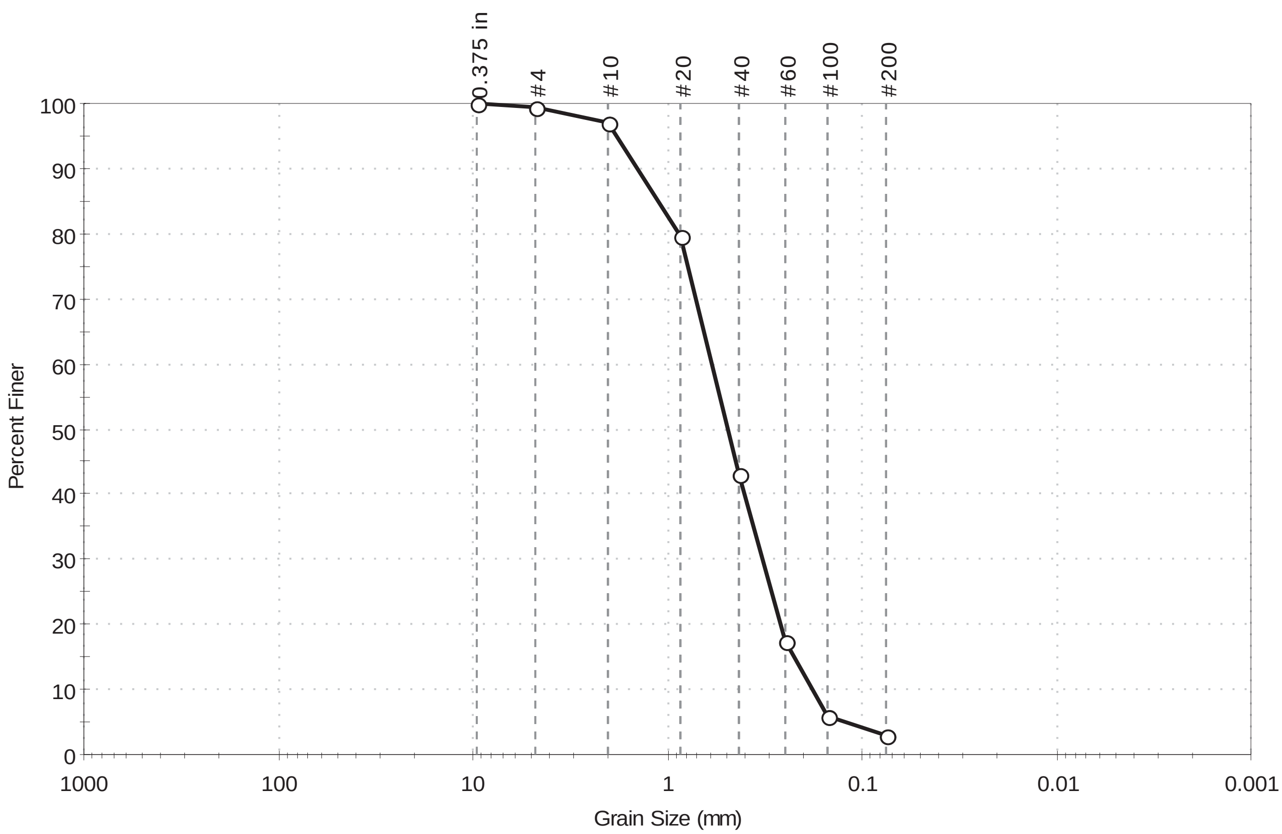
Client: Fuss & O'Neill, Inc.			
Project: Herring River Drilling			
Location: Wellfleet, MA		Project No:	GTX-301245
Boring ID: B-4	Sample Type: jar	Tested By:	jbr
Sample ID: S-2	Test Date: 12/05/13	Checked By:	jdt
Depth : 5-7 ft.	Test Id: 284505		
Test Comment: ---			
Sample Description: Moist, yellowish brown sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.7	96.3	3.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	97		
#20	0.85	80		
#40	0.42	43		
#60	0.25	17		
#100	0.15	6		
#200	0.075	3		

Coefficients

D_{85} = 1.1043 mm D_{30} = 0.3252 mm
D_{60} = 0.5859 mm D_{15} = 0.2260 mm
D_{50} = 0.4852 mm D_{10} = 0.1809 mm
C_u = 3.239 C_c = 0.998

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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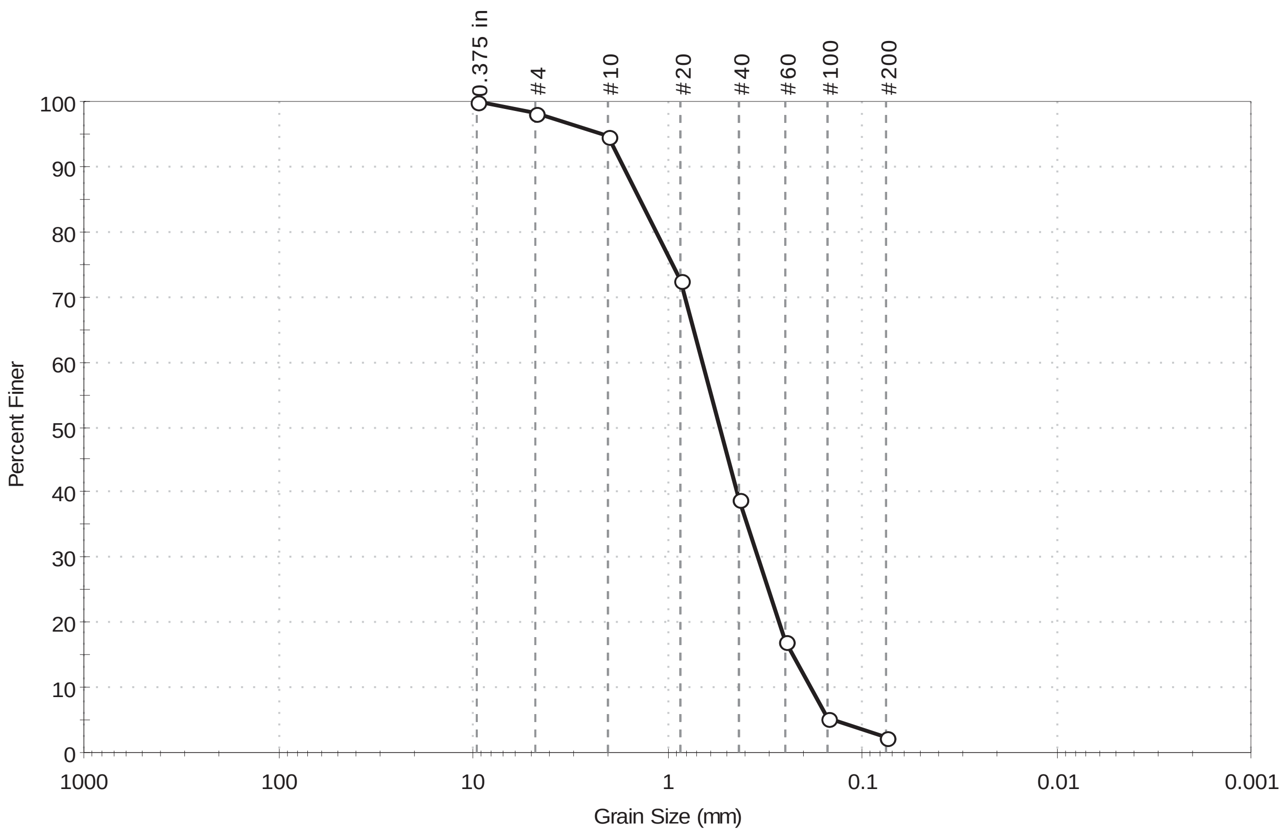
Client:	Fuss & O'Neill, Inc.			
Project:	Herring River Drilling			
Location:	Wellfleet, MA		Project No:	GTX-301245
Boring ID: B-1		Sample Type: jar	Tested By:	jbr
Sample ID: S-3		Test Date: 02/06/14	Checked By:	jdt
Depth : 10-12 ft		Test Id: 287962		
Test Comment:	---			
Sample Description:	Moist, brown sand			
Sample Comment:	---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	1.7	96.0	2.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	95		
#20	0.85	73		
#40	0.42	39		
#60	0.25	17		
#100	0.15	5		
#200	0.075	2		

Coefficients

D_{85} = 1.3703 mm D_{30} = 0.3422 mm

D_{60} = 0.6556 mm D_{15} = 0.2274 mm

D_{50} = 0.5341 mm D_{10} = 0.1831 mm

C_u = 3.581 C_c = 0.976

Classification

ASTM   Poorly graded sand (SP)

AASHTO   Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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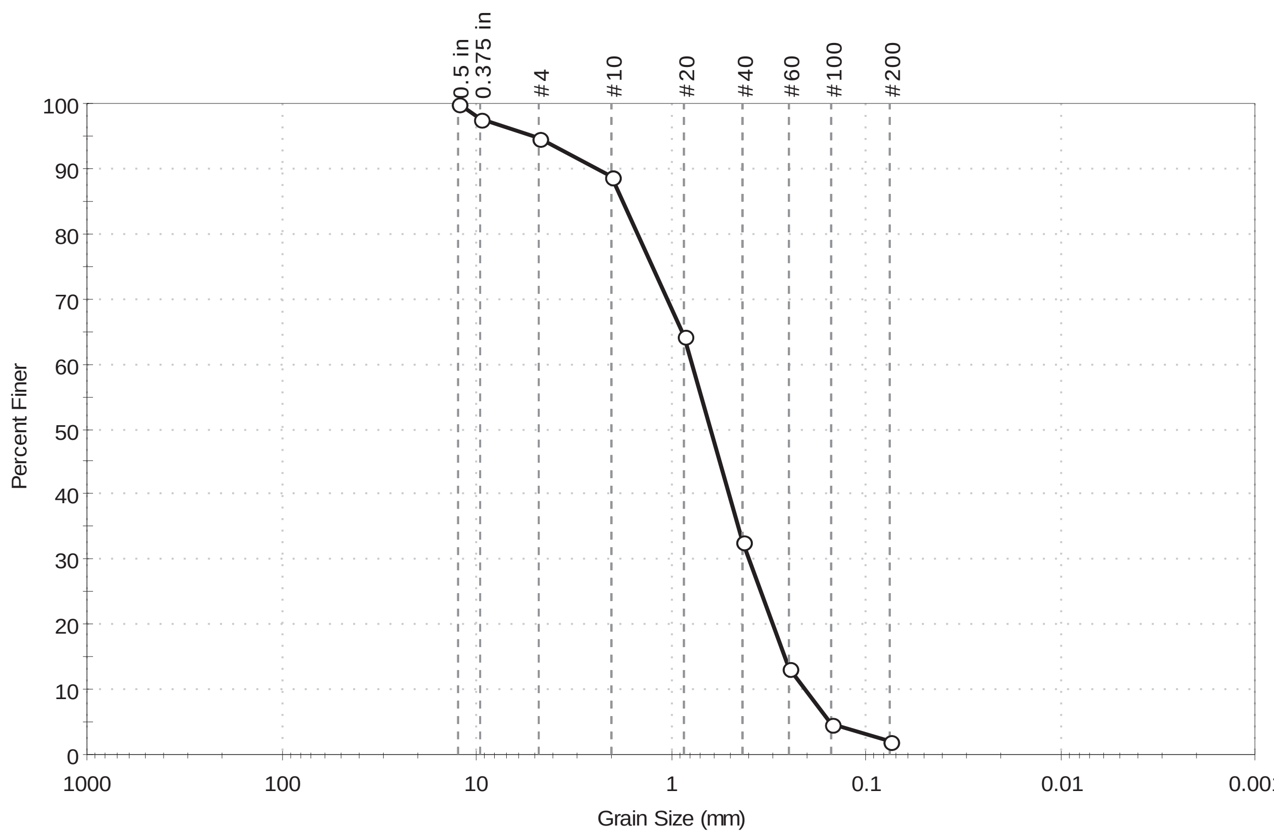
Client: Fuss & O'Neill, Inc.			
Project: Herring River Drilling			
Location: Wellfleet, MA		Project No:	GTX-301245
Boring ID: B-2	Sample Type: bag	Tested By:	jbr
Sample ID: S-5	Test Date: 02/06/14	Checked By:	jdt
Depth : 19-21 ft	Test Id: 287963		
Test Comment: ---			
Sample Description: Moist, pale brown sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	5.3	92.7	2.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	98		
#4	4.75	95		
#10	2.00	89		
#20	0.85	64		
#40	0.42	33		
#60	0.25	13		
#100	0.15	5		
#200	0.075	2		

Coefficients

D_{85} = 1.7522 mm D_{30} = 0.3955 mm

D_{60} = 0.7726 mm D_{15} = 0.2615 mm

D_{50} = 0.6211 mm D_{10} = 0.2049 mm

C_u = 3.771 C_c = 0.988

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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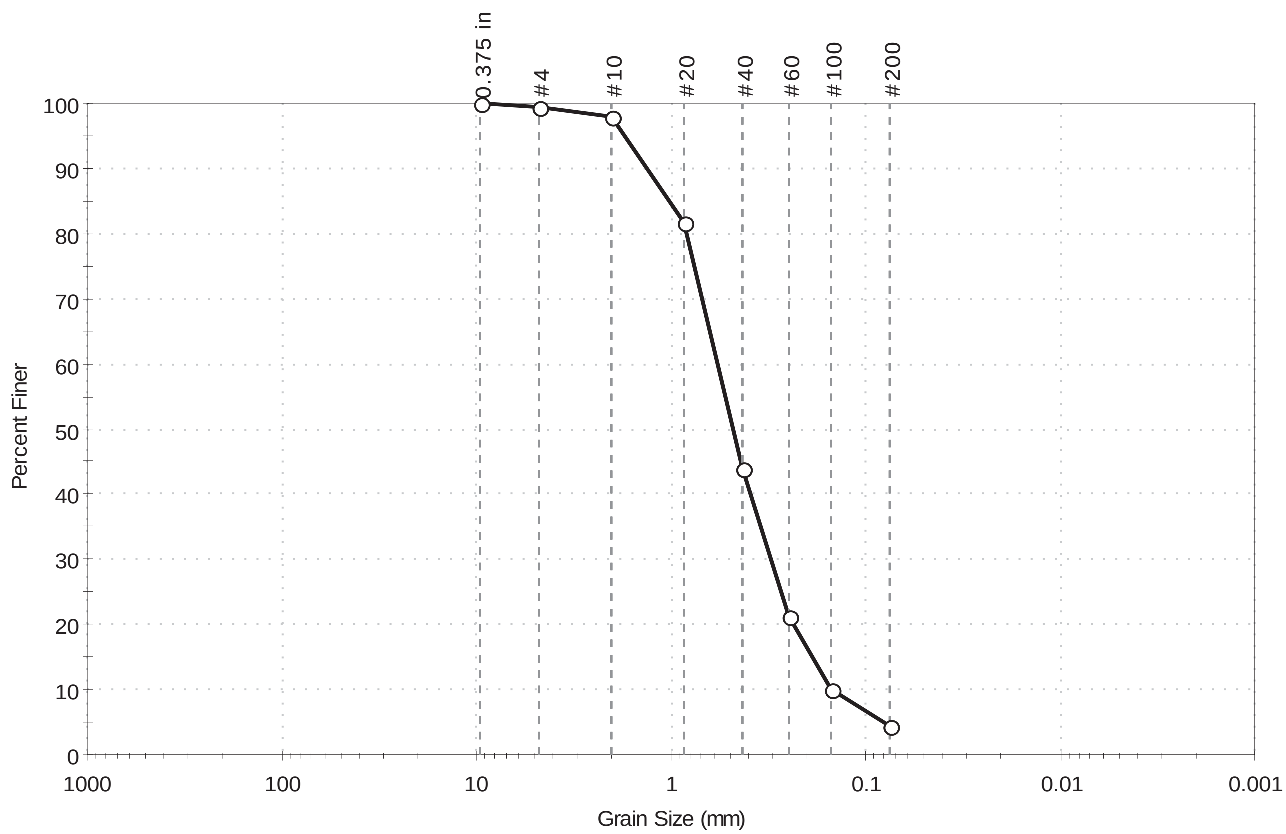
GeoTesting EXPRESS

Client:	Fuss & O'Neill, Inc.		
Project:	Herring River Drilling		
Location:	Wellfleet, MA	Project No:	GTX-301245
Boring ID: B-3	Sample Type: jar	Tested By:	jbr
Sample ID: S-5	Test Date: 02/06/14	Checked By:	jdt
Depth : 19-21 ft	Test Id: 287964		
Test Comment:	---		
Sample Description:	Moist, pale brown sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.5	95.1	4.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	98		
#20	0.85	82		
#40	0.42	44		
#60	0.25	21		
#100	0.15	10		
#200	0.075	4		

Coefficients

D_{85} = 1.0044 mm | D_{30} = 0.3070 mm
D_{60} = 0.5708 mm | D_{15} = 0.1886 mm
D_{50} = 0.4756 mm | D_{10} = 0.1507 mm
C_u = 3.788 | C_c = 1.096

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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Single Well Steady State Pumping Test--Radial Flow

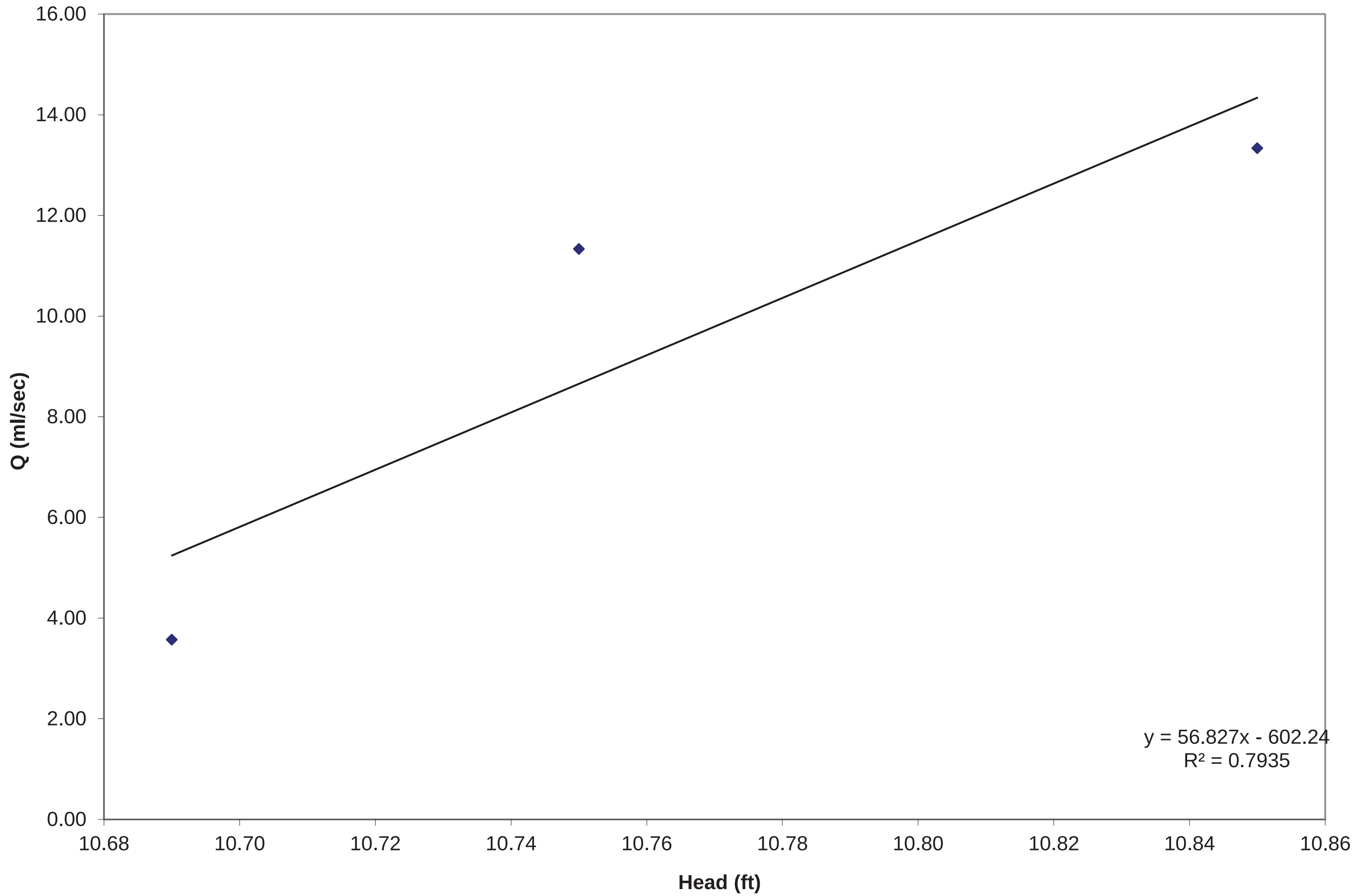
Sampler Info		Site Info	
P-transducer reading at start (ft):	10.69	Site	Herring River
Saturated Screen Length [**L**] (ft):	10.00	Sampler	WRFS-22
Well Intake Radius[**R**] (ft):	0.083	Date	11/20/13
Radius of Influence [**Ri**](assume 50* R) (ft)	4.17	Personnel	D. Hollibaugh-Baker

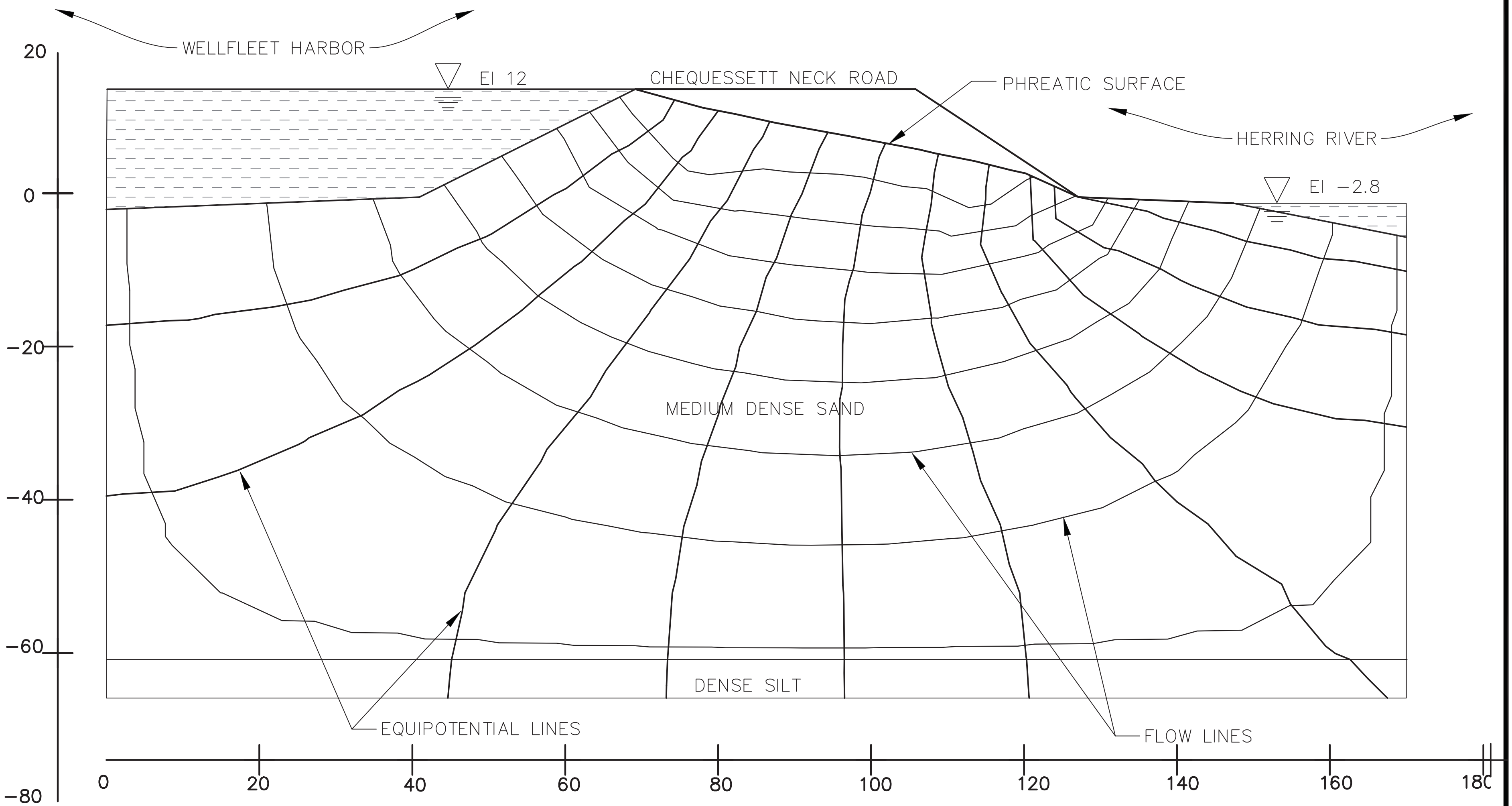
Test 1		**Test 2**		**Test 3**	
Steady State head (ft)	10.69	Steady State head (ft)	10.75	Steady State head (ft)	10.85
Volume (ml)	500.0	Volume (ml)	1020.0	Volume (ml)	2000.0
Time (sec)	140	Time (sec)	90	Time (sec)	150
Flow Rate Q (ml/sec)	3.57	Flow Rate Q (ml/sec)	11.33	Flow Rate Q (ml/sec)	13.33

slope (Q/h)=	56.82701652	ml/sec/ft
k=	1.08E+01	ft/day
k=	3.81E-03	cm/s

K (cm/s)	**Description**
< 10^{-7}	cyrstalline rocks, clays
10^{-6} - 10^{-4}	clay-->silty sand--> fine sand (till)
10^{-3} - 10^{-1}	med sand to gravel
>10^{-1}	coarse gravels, cobbles

Comments:


16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Q (ml/sec)
10.68
10.70
10.72
10.74
10.76
10.78
10.80
10.82
10.84
10.86
Head (ft)
y = 56.827x - 602.24
R² = 0.7935



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Plotter: DWG TO PDF.PC3 CTB File: FO 2008 MONO (HALF).CTB

MS VIEW:

LAYER STATE:

SCALE:	
HORZ.: 1" = 20'	
VERT.: -	
DATUM:	
HORZ.: -	
VERT.: -	
0 10' 20' GRAPHIC SCALE	

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

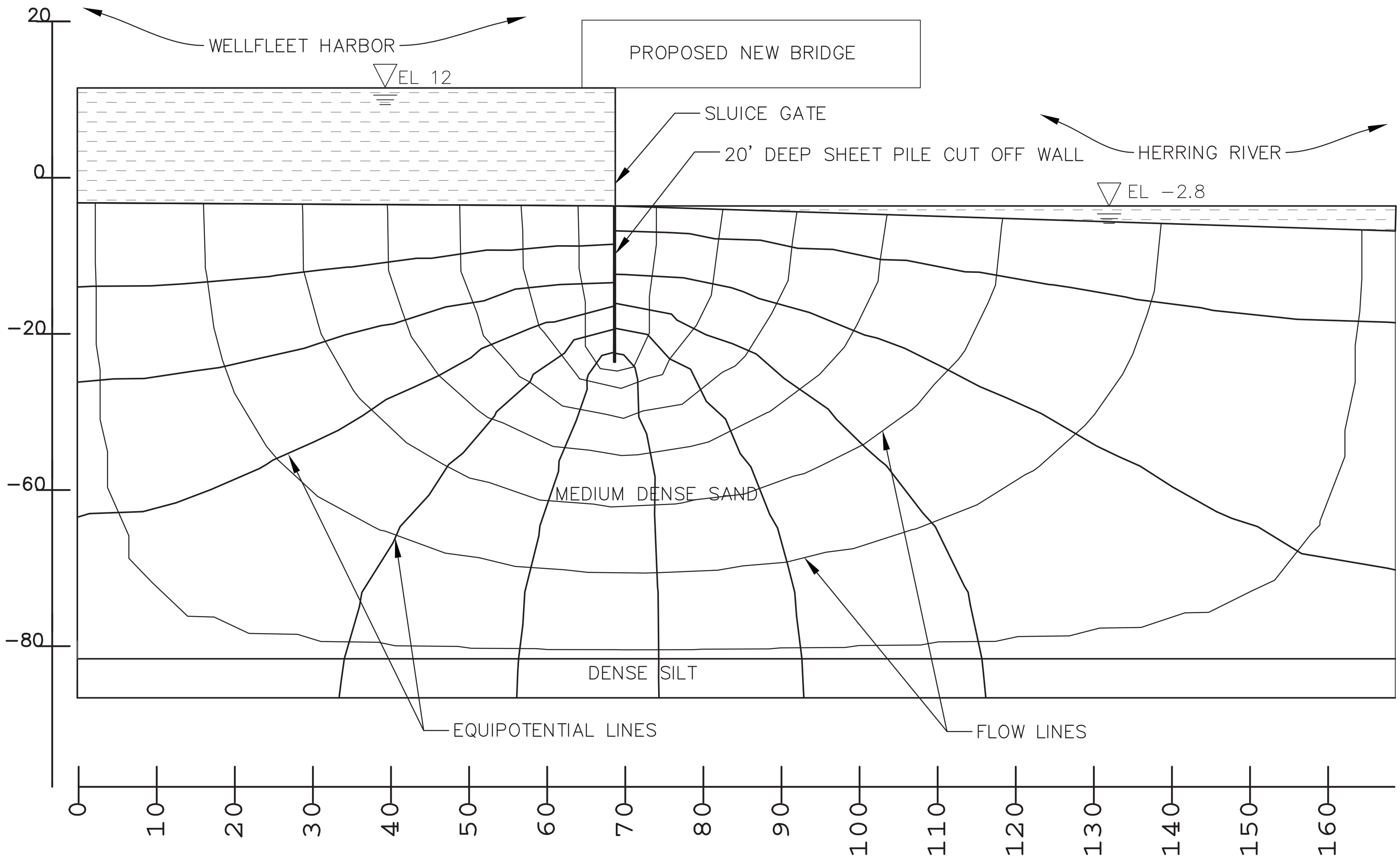
FRIENDS OF HERRING RIVER

EMBANKMENT SEEPAGE ANALYSIS

HERRING RIVER TIDAL RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A13
DATE: April 2014



File Path: Y:\P2012\0636\A13\Deliverables\Report\Back up files\Seepage\Seepage_Results\CNR dike seepage (20' deep sheet pile).dwg Layout: 08.5X11-L_DWG TO PDF Plotted: Thu, June 05, 2014 - 2:40 PM User: ccullen

Plotter: DWG TO PDF.PC3 CTB File: FO 2008 MONO (HALF).CTB

MS VIEW:

LAYER STATE:

SCALE:	
HORZ.: 1" = 20'	
VERT.: -	
DATUM:	
HORZ.: -	
VERT.: -	

0 10' 20'

GRAPHIC SCALE

FUSS & O'NEILL

317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
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FRIENDS OF HERRING RIVER

SEEPAGE ANALYSIS - SLUICE GATE AND 20' DEEP SHEET PILE WALL

HERRING RIVER TIDAL RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A13

DATE: April 2014

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\8X16X20.DVN
Project Name: 8x16x20   Project Date: 04/22/2014
Project Client:
Computed By:
Project Manager:

PILE INFORMATION

Pile Type: Monotube Pile
Top of Pile: 0.00 ft
Diameter of Pile: 16.00 in
Diameter of Tip: 8.00 in
Length of Taper: 20.00 ft

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	10.00 ft	0.00%	120.00 pcf	31.9/31.9	Nordlund
2	Cohesionless	9.00 ft	0.00%	120.00 pcf	36.8/36.8	Nordlund
3	Cohesionless	15.00 ft	0.00%	120.00 pcf	32.4/32.4	Nordlund
4	Cohesionless	15.00 ft	0.00%	120.00 pcf	35.1/35.1	Nordlund
5	Cohesionless	15.00 ft	0.00%	120.00 pcf	36.1/36.1	Nordlund
6	Cohesionless	2.00 ft	0.00%	125.00 pcf	38.4/38.4	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.29 psf	21.32	N/A	0.00 Kips
9.01 ft	Cohesionless	259.49 psf	24.17	N/A	16.05 Kips
9.99 ft	Cohesionless	287.71 psf	24.47	N/A	20.48 Kips
10.01 ft	Cohesionless	576.29 psf	24.62	N/A	20.60 Kips
18.99 ft	Cohesionless	834.91 psf	27.91	N/A	137.89 Kips
19.01 ft	Cohesionless	1094.69 psf	21.67	N/A	138.25 Kips
28.01 ft	Cohesionless	1353.89 psf	24.57	N/A	292.19 Kips
33.99 ft	Cohesionless	1526.11 psf	26.31	N/A	365.61 Kips
34.01 ft	Cohesionless	1958.69 psf	23.47	N/A	365.77 Kips
43.01 ft	Cohesionless	2217.89 psf	26.61	N/A	500.91 Kips
48.99 ft	Cohesionless	2390.11 psf	28.50	N/A	678.55 Kips
49.01 ft	Cohesionless	2822.69 psf	24.13	N/A	679.21 Kips
58.01 ft	Cohesionless	3081.89 psf	27.36	N/A	990.34 Kips
63.99 ft	Cohesionless	3254.11 psf	29.29	N/A	1202.59 Kips
64.01 ft	Cohesionless	3686.71 psf	25.70	N/A	1203.41 Kips
65.99 ft	Cohesionless	3748.69 psf	26.42	N/A	1298.81 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.58 psf	39.70	10.86 Kips	0.00 Kips
9.01 ft	Cohesionless	518.98 psf	39.70	10.86 Kips	4.48 Kips
9.99 ft	Cohesionless	575.42 psf	39.70	10.86 Kips	4.96 Kips
10.01 ft	Cohesionless	576.58 psf	88.46	67.85 Kips	12.54 Kips
18.99 ft	Cohesionless	1093.82 psf	88.46	67.85 Kips	23.79 Kips
19.01 ft	Cohesionless	1094.98 psf	42.43	13.42 Kips	9.83 Kips
28.01 ft	Cohesionless	1613.38 psf	42.43	13.42 Kips	13.42 Kips
33.99 ft	Cohesionless	1957.82 psf	42.43	13.42 Kips	13.42 Kips
34.01 ft	Cohesionless	1958.98 psf	65.14	38.85 Kips	29.50 Kips
43.01 ft	Cohesionless	2477.38 psf	65.14	38.85 Kips	37.30 Kips
48.99 ft	Cohesionless	2821.82 psf	65.14	38.85 Kips	38.85 Kips
49.01 ft	Cohesionless	2822.98 psf	78.46	53.89 Kips	53.22 Kips
58.01 ft	Cohesionless	3341.38 psf	78.46	53.89 Kips	53.89 Kips
63.99 ft	Cohesionless	3685.82 psf	78.46	53.89 Kips	53.89 Kips
64.01 ft	Cohesionless	3687.03 psf	120.41	103.23 Kips	103.23 Kips
65.99 ft	Cohesionless	3810.97 psf	120.41	103.23 Kips	103.23 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	16.05 Kips	4.48 Kips	20.52 Kips
9.99 ft	20.48 Kips	4.96 Kips	25.45 Kips
10.01 ft	20.60 Kips	12.54 Kips	33.14 Kips
18.99 ft	137.89 Kips	23.79 Kips	161.68 Kips
19.01 ft	138.25 Kips	9.83 Kips	148.08 Kips
28.01 ft	292.19 Kips	13.42 Kips	305.62 Kips
33.99 ft	365.61 Kips	13.42 Kips	379.03 Kips
34.01 ft	365.77 Kips	29.50 Kips	395.27 Kips
43.01 ft	500.91 Kips	37.30 Kips	538.21 Kips
48.99 ft	678.55 Kips	38.85 Kips	717.40 Kips
49.01 ft	679.21 Kips	53.22 Kips	732.43 Kips
58.01 ft	990.34 Kips	53.89 Kips	1044.23 Kips
63.99 ft	1202.59 Kips	53.89 Kips	1256.48 Kips
64.01 ft	1203.41 Kips	103.23 Kips	1306.64 Kips
65.99 ft	1298.81 Kips	103.23 Kips	1402.03 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.29 psf	21.32	N/A	0.00 Kips
9.01 ft	Cohesionless	259.49 psf	24.17	N/A	16.05 Kips
9.99 ft	Cohesionless	287.71 psf	24.47	N/A	20.48 Kips
10.01 ft	Cohesionless	576.29 psf	24.62	N/A	20.60 Kips
18.99 ft	Cohesionless	834.91 psf	27.91	N/A	137.89 Kips
19.01 ft	Cohesionless	1094.69 psf	21.67	N/A	138.25 Kips
28.01 ft	Cohesionless	1353.89 psf	24.57	N/A	292.19 Kips
33.99 ft	Cohesionless	1526.11 psf	26.31	N/A	365.61 Kips
34.01 ft	Cohesionless	1958.69 psf	23.47	N/A	365.77 Kips
43.01 ft	Cohesionless	2217.89 psf	26.61	N/A	500.91 Kips
48.99 ft	Cohesionless	2390.11 psf	28.50	N/A	678.55 Kips
49.01 ft	Cohesionless	2822.69 psf	24.13	N/A	679.21 Kips
58.01 ft	Cohesionless	3081.89 psf	27.36	N/A	990.34 Kips
63.99 ft	Cohesionless	3254.11 psf	29.29	N/A	1202.59 Kips
64.01 ft	Cohesionless	3686.71 psf	25.70	N/A	1203.41 Kips
65.99 ft	Cohesionless	3748.69 psf	26.42	N/A	1298.81 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.58 psf	39.70	10.86 Kips	0.00 Kips
9.01 ft	Cohesionless	518.98 psf	39.70	10.86 Kips	4.48 Kips
9.99 ft	Cohesionless	575.42 psf	39.70	10.86 Kips	4.96 Kips
10.01 ft	Cohesionless	576.58 psf	88.46	67.85 Kips	12.54 Kips
18.99 ft	Cohesionless	1093.82 psf	88.46	67.85 Kips	23.79 Kips
19.01 ft	Cohesionless	1094.98 psf	42.43	13.42 Kips	9.83 Kips
28.01 ft	Cohesionless	1613.38 psf	42.43	13.42 Kips	13.42 Kips
33.99 ft	Cohesionless	1957.82 psf	42.43	13.42 Kips	13.42 Kips
34.01 ft	Cohesionless	1958.98 psf	65.14	38.85 Kips	29.50 Kips
43.01 ft	Cohesionless	2477.38 psf	65.14	38.85 Kips	37.30 Kips
48.99 ft	Cohesionless	2821.82 psf	65.14	38.85 Kips	38.85 Kips
49.01 ft	Cohesionless	2822.98 psf	78.46	53.89 Kips	53.22 Kips
58.01 ft	Cohesionless	3341.38 psf	78.46	53.89 Kips	53.89 Kips
63.99 ft	Cohesionless	3685.82 psf	78.46	53.89 Kips	53.89 Kips
64.01 ft	Cohesionless	3687.03 psf	120.41	103.23 Kips	103.23 Kips
65.99 ft	Cohesionless	3810.97 psf	120.41	103.23 Kips	103.23 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	16.05 Kips	4.48 Kips	20.52 Kips
9.99 ft	20.48 Kips	4.96 Kips	25.45 Kips
10.01 ft	20.60 Kips	12.54 Kips	33.14 Kips
18.99 ft	137.89 Kips	23.79 Kips	161.68 Kips
19.01 ft	138.25 Kips	9.83 Kips	148.08 Kips
28.01 ft	292.19 Kips	13.42 Kips	305.62 Kips
33.99 ft	365.61 Kips	13.42 Kips	379.03 Kips
34.01 ft	365.77 Kips	29.50 Kips	395.27 Kips
43.01 ft	500.91 Kips	37.30 Kips	538.21 Kips
48.99 ft	678.55 Kips	38.85 Kips	717.40 Kips
49.01 ft	679.21 Kips	53.22 Kips	732.43 Kips
58.01 ft	990.34 Kips	53.89 Kips	1044.23 Kips
63.99 ft	1202.59 Kips	53.89 Kips	1256.48 Kips
64.01 ft	1203.41 Kips	103.23 Kips	1306.64 Kips
65.99 ft	1298.81 Kips	103.23 Kips	1402.03 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.29 psf	21.32	N/A	0.00 Kips
9.01 ft	Cohesionless	259.49 psf	24.17	N/A	16.05 Kips
9.99 ft	Cohesionless	287.71 psf	24.47	N/A	20.48 Kips
10.01 ft	Cohesionless	576.29 psf	24.62	N/A	20.60 Kips
18.99 ft	Cohesionless	834.91 psf	27.91	N/A	137.89 Kips
19.01 ft	Cohesionless	1094.69 psf	21.67	N/A	138.25 Kips
28.01 ft	Cohesionless	1353.89 psf	24.57	N/A	292.19 Kips
33.99 ft	Cohesionless	1526.11 psf	26.31	N/A	365.61 Kips
34.01 ft	Cohesionless	1958.69 psf	23.47	N/A	365.77 Kips
43.01 ft	Cohesionless	2217.89 psf	26.61	N/A	500.91 Kips
48.99 ft	Cohesionless	2390.11 psf	28.50	N/A	678.55 Kips
49.01 ft	Cohesionless	2822.69 psf	24.13	N/A	679.21 Kips
58.01 ft	Cohesionless	3081.89 psf	27.36	N/A	990.34 Kips
63.99 ft	Cohesionless	3254.11 psf	29.29	N/A	1202.59 Kips
64.01 ft	Cohesionless	3686.71 psf	25.70	N/A	1203.41 Kips
65.99 ft	Cohesionless	3748.69 psf	26.42	N/A	1298.81 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.58 psf	39.70	10.86 Kips	0.00 Kips
9.01 ft	Cohesionless	518.98 psf	39.70	10.86 Kips	4.48 Kips
9.99 ft	Cohesionless	575.42 psf	39.70	10.86 Kips	4.96 Kips
10.01 ft	Cohesionless	576.58 psf	88.46	67.85 Kips	12.54 Kips
18.99 ft	Cohesionless	1093.82 psf	88.46	67.85 Kips	23.79 Kips
19.01 ft	Cohesionless	1094.98 psf	42.43	13.42 Kips	9.83 Kips
28.01 ft	Cohesionless	1613.38 psf	42.43	13.42 Kips	13.42 Kips
33.99 ft	Cohesionless	1957.82 psf	42.43	13.42 Kips	13.42 Kips
34.01 ft	Cohesionless	1958.98 psf	65.14	38.85 Kips	29.50 Kips
43.01 ft	Cohesionless	2477.38 psf	65.14	38.85 Kips	37.30 Kips
48.99 ft	Cohesionless	2821.82 psf	65.14	38.85 Kips	38.85 Kips
49.01 ft	Cohesionless	2822.98 psf	78.46	53.89 Kips	53.22 Kips
58.01 ft	Cohesionless	3341.38 psf	78.46	53.89 Kips	53.89 Kips
63.99 ft	Cohesionless	3685.82 psf	78.46	53.89 Kips	53.89 Kips
64.01 ft	Cohesionless	3687.03 psf	120.41	103.23 Kips	103.23 Kips
65.99 ft	Cohesionless	3810.97 psf	120.41	103.23 Kips	103.23 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity	FS=3.5
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips	
9.01 ft	16.05 Kips	4.48 Kips	20.52 Kips	
9.99 ft	20.48 Kips	4.96 Kips	25.45 Kips	
10.01 ft	20.60 Kips	12.54 Kips	33.14 Kips	
18.99 ft	137.89 Kips	23.79 Kips	161.68 Kips	
19.01 ft	138.25 Kips	9.83 Kips	148.08 Kips	
28.01 ft	292.19 Kips	13.42 Kips	305.62 Kips	87 K
33.99 ft	365.61 Kips	13.42 Kips	379.03 Kips	108 K
34.01 ft	365.77 Kips	29.50 Kips	395.27 Kips	
43.01 ft	500.91 Kips	37.30 Kips	538.21 Kips	
48.99 ft	678.55 Kips	38.85 Kips	717.40 Kips	
49.01 ft	679.21 Kips	53.22 Kips	732.43 Kips	
58.01 ft	990.34 Kips	53.89 Kips	1044.23 Kips	
63.99 ft	1202.59 Kips	53.89 Kips	1256.48 Kips	
64.01 ft	1203.41 Kips	103.23 Kips	1306.64 Kips	
65.99 ft	1298.81 Kips	103.23 Kips	1402.03 Kips	

Attachment D

25% Design Drawings (Rolled Separately) and Opinion of Construction Cost

HERRING RIVER TIDAL RESTORATION PROJECT

CHEQUESSETT NECK ROAD · WELLFLEET · MASSACHUSETTS

BRIDGE CONSTRUCTION PROJECT

25% DESIGN DRAWING SET

JULY 2014

PREPARED FOR

FRIENDS OF HERRING RIVER
P.O. BOX 496
WELLFLEET, MA 02667

TOWN OF WELLFLEET
300 MAIN STREET
WELLFLEET, MA 02667

PREPARED BY

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

LOCATION MAP
SCALE: 1" = 1000'

SHEET INDEX

PROJECT TEAM

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FUSS & O'NEILL, INC.
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
P: 401-861-3070

COASTAL MODELING
WOODS HOLE GROUP, INC.
81 TECHNOLOGY PARK DRIVE
EAST FALMOUTH, MA 02536
P: 508-540-8080

SURVEY
BAXTER NYE ENGINEERING & SURVEYING
78 NORTH STREET, 3RD FLOOR
HYANNIS, MA 02601
P: 508-771-7502

MASSACHUSETTS ENVIRONMENTAL TRUST
THIS PROJECT IS FUNDED IN PART BY THE MASSACHUSETTS ENVIRONMENTAL TRUST

NOT FOR CONSTRUCTION

PROJ. No.: 20120636.A13
DATE: JULY 2014

GI-001

LEGEND

Symbol	Description
	PROPERTY BOUNDARY
	CAPE COD NATIONAL SEASHORE BOUNDARY
	EDGE OF CHANNEL/BANK
	APPROX. MEAN HIGHER HIGH WATER BOUNDARY
	APPROX. MEAN HIGH WATER BOUNDARY
	APPROX. MEAN LOW WATER BOUNDARY
F	100-YEAR FLOODPLAIN BOUNDARY
WF/HT-10 WF/HT-11	HIGH TIDE LINE
WF/CW-4 WF/CW-5	WETLAND FLAG/COASTAL WETLAND
	CONTOUR (AERIAL)
	CONTOUR (GROUND SURVEY)
× 2.50	SPOT ELEVATION (GROUND SURVEY)
+ 2.50	SPOT ELEVATION (LIDAR)
EOP	EDGE OF PAVEMENT
CCB	CAPE COD PAVEMENT BERM
	GUARDRAIL
OHW	OVERHEAD UTILITY
CB R=8.3 I=5.8 S=2.3	CATCH BASIN RIM ELEVATION= INVERT= SUMP=
	UTILITY POLE
	SIGN
B-1	BORING LOCATION
	EXISTING STONE ARMOR
LOD	LIMIT OF DISTURBANCE
10	PROPOSED CONTOUR
	TEMPORARY COFFERDAM/SHEETING
	PROPOSED GUARDRAIL
	COIR ROLL BARRIER
	APPROXIMATE BOUNDARY OF WETLAND VEGETATIVE COMMUNITY
	NON-TIDAL BORDERING VEGETATED WETLAND
	SALT MARSH
	LAND UNDER WATER
	EXISTING STONE ARMOR WAVE/SCOUR PROTECTION REMOVED AND REINSTALLED AS SLOPE PROTECTION
	SOIL-FILLED STONE ARMOR SCOUR AND SLOPE PROTECTION SIZED TO WITHSTAND INTERMEDIATE TO HIGH FLOW VELOCITIES AND/OR WAVE ACTION; SLOPE PROTECTION ON HERRING RIVER SIDE OF ROADWAY SHALL BE VEGETATED
	SOIL-FILLED STONE ARMOR SCOUR PROTECTION SIZED TO WITHSTAND LOW FLOW VELOCITIES

MAP NOTES AND REFERENCES:

1. PROJECT LOCATION AREA:
   CHEQUESSETT NECK ROAD AT THE LOCATION OF
   THE HERRING RIVER CULVERT
   ASSESSOR MAP NOs. 18 AND 19
   WELLFLEET, MASSACHUSETTS
2. EXISTING SITE CONDITIONS INCLUDING SITE FEATURES, WETLAND FLAGGING, AND TOPOGRAPHICAL INFORMATION WITHIN THE IMMEDIATE PROJECT AREA ARE BASED UPON AN ON-GROUND SURVEY PERFORMED BY BAXTER NYE ENGINEERING & SURVEYING BETWEEN AUGUST 14 THROUGH 27, 2012.
3. ALL SURVEY ELEVATIONS DEPICTED HEREON ARE IN ENGLISH UNITS (FEET) AND REFERENCED TO NAVD88, UNLESS OTHERWISE NOTED.
4. SURVEY BENCHMARKS:
   - ROD AND CAP (EL. 11.61-NAVD88) ESTABLISHED SOUTH OF CULVERT STRUCTURE ADJACENT TO ROADWAY SHOULDER AS SHOWN HEREIN. THE BENCHMARK WAS ESTABLISHED BY LEICA RX 1250 TC GPS RTK.
4. PROPERTY BOUNDARIES SHOWN HEREON WERE OBTAINED FROM MASSGIS PROPERTY LINE DATABASES, ARE NOT TO BE CONSTRUED AS AN ACCURATE BOUNDARY SURVEY, AND ARE SUBJECT TO SUCH CHANGES AS AN ACCURATE BOUNDARY SURVEY MAY DISCLOSE.
5. FLOOD ZONE INFORMATION:
   THE PROJECT SITE IS LOCATED IN SPECIAL FLOOD HAZARD AREAS (SFHAs) ZONE 'AH' UPSTREAM/RIVERSIDE (EL 2.14') OF THE CHEQUESSETT NECK ROAD CULVERT AND ZONE 'A3' DOWNSTREAM/HARBORSIDE (EL 11.14') OF THE CULVERT AS REFLECTED ON FIRM 2500140011C FOR THE TOWN OF WELLFLEET, MASSACHUSETTS IN BARNSTABLE COUNTY (DATED JULY 2, 1992).
6. ENVIRONMENTAL INFORMATION:
   - TIDAL ELEVATIONS WERE OBTAINED FROM A REPORT ENTITLED "HERRING RIVER HYDRODYNAMIC MODELING, FINAL COMPREHENSIVE REPORT," PREPARED BY THE WOODS HOLE GROUP, AND DATED JUNE 2012.
   - THE SITE IS LOCATED WITHIN THE WELLFLEET HARBOR AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC).
   - THE SITE IS WITHIN AN AREA OF ESTIMATED HABITAT OF RARE WILDLIFE PER NHESP MAP OCTOBER 1, 2010 "ESTIMATED HABITATS OF RARE WILDLIFE" FOR USE WITH THE MA WETLANDS PROTECTION ACT REGULATIONS (310 CMR 10).
   - SITE DOES NOT CONTAIN CERTIFIED VERNAL POOLS PER NHESP MAP OCTOBER 1, 2010 "CERTIFIED VERNAL POOLS."
   - THE SITE IS WITHIN A PRIORITY HABITAT PER NHESP MAP OCTOBER 1, 2010 "PRIORITY HABITATS OF RARE SPECIES" FOR SPECIES UNDER THE MASSACHUSETTS ENDANGERED SPECIES ACT, REGULATIONS (321 CMR 10).
   - THE SITE IS NOT WITHIN A GROUND WATER PROTECTION AREA.
   - WETLAND FLAG SERIES NOs. SMH 1 THROUGH 16 AND SMH 20 THROUGH 36 WERE DELINEATED BY THE NATIONAL PARK SERVICE ON JULY 5 AND AUGUST 9, 2012 AND FIELD LOCATED BY BAXTER NYE ENGINEERING & SURVEYING.
7. UTILITY INFORMATION:
   - OVERHEAD ELECTRIC/COMMUNICATION LINES AND UTILITY POLES (UP NOs. 15/40 THROUGH 46), REFLECTED HEREIN, WERE FIELD LOCATED BY BAXTER NYE ENGINEERING & SURVEYING.
   - AS CONFIRMED THROUGH CORRESPONDENCE WITH DIG-SAFE BETWEEN JULY 12 AND 17, 2012 AND NATIONAL GRID; NO GAS MAINS/FACILITIES, WATER MAINS, OR UNDERGROUND ELECTRIC/COMMUNICATION CONDUITS WERE LOCATED WITHIN THE PROJECT AREA.
   - STORM DRAINS AND FEATURES REFLECTED HEREIN WERE OBTAINED SOLELY FROM SURVEY. NO OTHER AS-BUILT OR CONSTRUCTION PLANS ARE AVAILABLE AS WELLFLEET DPW CONFIRMED THAT ALL WITHIN THE PROJECT AREA ARE LEACHING BASINS.

GENERAL CONSTRUCTION AND COORDINATION REQUIREMENTS

1. VERIFY THE LOCATIONS OF EXISTING STRUCTURES AND THE PROPOSED LAYOUT OF THE REPLACEMENT BRIDGE IN ITS RELATIONSHIP TO THE EXISTING SITE SURVEY. THE CONTRACTOR SHALL ALSO VERIFY ALL DIMENSIONS, SITE CONDITIONS, AND MATERIAL SPECIFICATIONS AND SHALL NOTIFY THE OWNER AND ENGINEER OF ANY DISCREPANCIES BEFORE COMMENCING OR PROCEEDING WITH THE WORK.
2. OBTAIN FIELD MEASUREMENTS AS REQUIRED TO FIT THE WORK PROPERLY. RECHECK MEASUREMENTS BEFORE CONSTRUCTING EACH WORK ITEM. WHERE PORTIONS OF THE WORK ARE INDICATED TO FIT TO OTHER CONSTRUCTION, VERIFY DIMENSIONS OF OTHER CONSTRUCTION BY FIELD MEASUREMENTS BEFORE FABRICATION. COORDINATE FABRICATION SCHEDULE WITH CONSTRUCTION PROGRESS TO AVOID DELAYING THE WORK.
3. VERIFY SPACE REQUIREMENTS AND DIMENSIONS OF ITEMS SHOWN ON DRAWINGS. CHECK THE LOCATION, LEVEL AND GRADE, OF EVERY MAJOR ELEMENT AS THE WORK PROGRESSES.
4. ESTABLISH BENCHMARKS AND CONTROL POINTS IN ADDITION TO THOSE INDICATED TO SET LINES, GRADES, AND LEVELS AT EACH STAGE OF CONSTRUCTION. LOCATE THE WORK AND COMPONENTS OF THE WORK ACCURATELY, IN CORRECT ALIGNMENT AND ELEVATION, AS INDICATED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACING, WITH MATCHING MATERIALS, ANY PAVEMENT, WALKS, SIGNS, CURBS, ETC., THAT MUST BE CUT OR THAT ARE DAMAGED DURING CONSTRUCTION.
6. COMPLY WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND RECOMMENDATIONS FOR INSTALLING MATERIALS AND PRODUCTS.
7. INSTALL PRODUCTS AT THE TIME AND UNDER CONDITIONS THAT WILL ENSURE THE BEST POSSIBLE RESULTS. MAINTAIN CONDITIONS REQUIRED FOR PRODUCT PERFORMANCE UNTIL SUBSTANTIAL COMPLETION.
8. CONDUCT CONSTRUCTION OPERATIONS SO NO PART OF THE WORK IS SUBJECTED TO DAMAGING OPERATIONS OR LOADING IN EXCESS OF THAT EXPECTED DURING NORMAL POST-CONSTRUCTION CONDITIONS.
9. PROVIDE ANCHORS AND FASTENERS AS REQUIRED TO ANCHOR EACH COMPONENT SECURELY IN PLACE, ACCURATELY LOCATED AND ALIGNED WITH OTHER PORTIONS OF THE WORK.
10. USE PRODUCTS, CLEANERS, AND INSTALLATION MATERIALS THAT ARE NOT CONSIDERED HAZARDOUS.
11. CONTRACTOR AGREES THAT IT ASSUMES SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE CONTRACT OWNER, PROPERTY OWNERS AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL AND ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM "THE SOLE NEGLIGENCE OF THE CONTRACT OWNER, PROPERTY OWNER OR THE ENGINEER."
12. PRIOR TO CONSTRUCTION, ACCESS AND CONSTRUCTION EASEMENTS MUST BE GRANTED BY PROPERTY OWNERS WHERE ACCESS AND CONSTRUCTION (INCLUDING STORAGE/STAGING) WILL BE REQUIRED.

EXISTING UTILITY COORDINATION REQUIREMENTS

1. BEFORE BEGINNING SITE WORK, THE CONTRACTOR SHALL INVESTIGATE AND VERIFY THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES AND OTHER CONSTRUCTION AFFECTING THE WORK. THE CONTRACTOR SHALL MAKE EXPLORATORY EXCAVATIONS AND LOCATE ANY EXISTING UTILITIES SUFFICIENTLY AHEAD OF CONSTRUCTION TO PERMIT REVISIONS TO PLANS IF NECESSARY. THE EXISTENCE AND/OR LOCATION OF UTILITIES SHOWN ON THESE PLANS MAY BE ONLY APPROXIMATELY CORRECT AND THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN HEREON AND ANY OTHER EXISTING UTILITIES NOT OF RECORD OR NOT SHOWN ON THESE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING, AT ITS OWN EXPENSE, ANY EXISTING UTILITIES DAMAGED DURING CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT DIG SAFE (811) AND UTILITY COMPANIES TO LOCATE ALL EXISTING UTILITIES, AT LEAST 72 HOURS PRIOR TO THE START OF CONSTRUCTION. THE LOCATION OF EXISTING UNDERGROUND INFRASTRUCTURE, UTILITIES, CONDUITS AND LINES ARE SHOWN IN AN APPROXIMATE WAY ONLY, MAY NOT BE LIMITED TO THOSE SHOWN HEREIN AND HAVE BEEN RESEARCHED BASED ON THE AVAILABLE UTILITY RECORDS NOTED HEREON. THE CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT RESULT FROM THE CONTRACTOR'S FAILURE TO LOCATE SAID INFRASTRUCTURE AND UTILITIES EXACTLY. IF FIELD CONDITIONS DIFFERS FROM PLAN INFORMATION, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY FOR POSSIBLE REDESIGN.
3. PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

CONTROL OF WATER AND PROTECTION OF WORK REQUIREMENTS

1. THE WORK AND SITE SHALL BE PROTECTED AT ALL TIMES UNTIL FINAL ACCEPTANCE BY THE OWNER. CARE SHALL BE EXERCISED WHILE OPERATING EQUIPMENT ON AND ADJACENT TO THE WORK AREA. THE CONTRACTOR SHALL BE RESPONSIBLE TO ASSURE THE UTILIZED EQUIPMENT DOES NOT CAUSE DAMAGE TO THE BRIDGE STRUCTURE, HEADWALLS OR OTHER CONSTRUCTED OR EXISTING FEATURES.
2. ACCESS TO VARIOUS PORTIONS OF THE SITE SHALL BE UNDERTAKEN IN SUCH A MANNER THAT THE WORK AND SITE ARE PROTECTED AT ALL TIMES. ACCESS WAYS SHALL BE CONSTRUCTED, MAINTAINED, AND PROTECTED WITH TEMPORARY COFFERDAM(S), WATER BYPASS CONVEYANCES AND EROSION AND SEDIMENT CONTROLS TO PREVENT DAMAGE FROM EROSION DURING MAJOR STORM EVENTS.
3. PLACEMENT AND COMPACTION OF FILL MATERIALS SHALL BE COMPLETED IN SUCH A MANNER THAT THE WORK AND ADJACENT ROADWAYS ARE PROTECTED FROM DAMAGE AT ALL TIMES.
4. BACKFILL OPERATIONS SHALL PROCEED TO RAISE THE GROUND SURFACE UNIFORMLY AND SHAPED TO PROVIDE POSITIVE DRAINAGE AT ALL TIMES. CONSTRUCT AND MAINTAIN ON THE SITE, ALL DITCHES AND CHANNELS NECESSARY TO KEEP THE SITE IN A DRY AND WORKABLE CONDITION. WHERE WATER IS FLOWING OR OTHERWISE INFILTRATING INTO AN EXCAVATION, PROVIDE FOR PUMPING AND OTHER DRAINAGE FACILITIES, INCLUDING EROSION AND SEDIMENT CONTROLS, TO DIVERT WATER FROM SUCH EXCAVATION.
5. TEMPORARY COFFERDAM AND WATER BYPASS CONVEYANCE SYSTEMS AND MEASURES TO DISCHARGE CHANNEL FLOW THROUGH THE SITE SHALL BE INSTALLED, OPERATED, MAINTAINED AND REMOVED IN SUCH MANNERS TO PROTECT THE WORK AND EXISTING FEATURES FROM DAMAGE AT ALL TIMES UNTIL FINAL ACCEPTANCE BY THE OWNER.
6. DO NOT ALLOW WATER TO ACCUMULATE IN EXCAVATIONS. REMOVE WATER TO PREVENT SOFTENING OF FOUNDATION BOTTOMS, UNDERCUTTING OF FOOTINGS AND SOIL CHANGES DETRIMENTAL TO STABILITY OF SUBGRADES, FOUNDATIONS AND STRUCTURES.
7. THE TEMPORARY WATER CONTROL SYSTEM (INCLUDING COFFERDAMMING AND BY-PASS STRUCTURES) MUST BE MAINTAINED TO ALLOW A DRY WORKING CONDITION (NO SEDIMENT PLUME) IN THE WATERCOURSE. PROVIDE AND MAINTAIN PUMPS, WELL POINTS, SUMPS, SUCTION AND DISCHARGE LINES, AND OTHER DEWATERING SYSTEM COMPONENTS NECESSARY TO CONVEY WATER AWAY FROM EXCAVATIONS. UTILIZE COFFERDAMS, TEMPORARY PIPE CULVERTS WITH OTHER EROSION AND SEDIMENT CONTROLS AS NECESSARY TO MINIMIZE THE POTENTIAL FOR EROSION IN WORK AREAS. SOIL DISTURBANCE WITHIN THE WATERCOURSE MUST TEMPORARILY CEASE IN THE EVENT OF ANY ABNORMALLY HIGH STORMWATER RUNOFF OR TIDAL SURCHARGE EVENT IF A DRY WORKING CONDITION CANNOT BE MAINTAINED BY USE OF WATER PUMPS OR OTHER MEANS.
8. PUMP DISCHARGES FROM LOCALIZED TRENCH/FOOTING EXCAVATIONS SHALL BE MANAGED SUCH THAT THESE DO NOT CAUSE EROSION OF SOILS. FOR EXAMPLE, PUMP INTAKES SHALL BE FLOATED TO MINIMIZE SEDIMENTATION. ADDITIONALLY, PUMPED WATER SHALL BE DISCHARGED INTO CONSTRUCTED DEWATERING AREAS (AS REFLECTED HEREIN), CONSISTING OF FILTER BAGS SURROUNDED BY A TIGHT ENCLOSURE OF CRUSHED STONE AND PORTABLE CONCRETE BARRIERS, IN ORDER TO PROPERLY FILTER TURBID WATER PRIOR TO ITS RETURN TO THE WATERCOURSE. STONE ARMOR PROTECTION SHALL BE INSTALLED AS REQUIRED AT THE DISCHARGE OF THE DEWATERING AREA TO AVOID SCOUR OR SUSPENSION OF SOIL AT THE DISCHARGE. WATER SHALL NOT BE DISCHARGED ONTO FILL OR BACKFILL AREAS OR FOUNDATIONS. WATER SHALL ONLY BE ALLOWED TO DISCHARGE DIRECTLY INTO THE WATERCOURSE AFTER EMERGING CLEAR WITHOUT ANY SUSPENDED SEDIMENT OR SILT.
9. PROTECT CONSTRUCTED WORK ON THE SITE DURING FLOOD CONDITIONS.
10. CONSTRUCT TEMPORARY COFFERDAM(S) AND WATER DIVERSION STRUCTURE(S) OF MATERIALS THAT CAN BE COMPLETELY REMOVED FROM THE RIVER UPON COMPLETION OF CONSTRUCTION. REMOVAL OF THE TEMPORARY COFFERDAM(S) SHALL BE CONDUCTED IN A CONTROLLED MANNER.

EROSION CONTROL NOTES

1. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES, INSTALL ALL EROSION AND SEDIMENT CONTROL DEVICES AS SHOWN ON THE PLAN OR AS REQUIRED BY SITE CONDITIONS. ALL EROSION CONTROL DEVICES WILL BE MAINTAINED THROUGHOUT CONSTRUCTION.
2. DISTURBANCE OF SOIL SURFACES IS REGULATED BY STATE LAW AND LOCAL ORDINANCE. ALL WORK SHALL COMPLY WITH THE FOLLOWING CRITERIA AND OTHER PERMIT CONDITIONS TO PREVENT OR MINIMIZE SOIL EROSION AND SEDIMENTATION TO OFF-SITE AREAS.
3. THE CONTRACTOR SHALL COMPLY WITH THE LATEST EDITION OF THE "MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS" IN CONSTRUCTING THE EROSION AND SEDIMENT CONTROLS INDICATED ON THE PLANS. ALL EROSION AND SEDIMENT CONTROL MEASURES OR WORKS AND REHABILITATION MEASURES MUST CONFORM TO OR EXCEED THE SPECIFICATIONS OR STANDARDS SET OUT IN THIS HANDBOOK.
4. THE CONTRACTOR IS RESPONSIBLE FOR THE TIMELY INSTALLATION, INSPECTION, MAINTENANCE, AND/OR REPLACEMENT OF ALL TEMPORARY AND PERMANENT EROSION CONTROL DEVICES SHOWN ON THESE PLANS TO ENSURE PROPER OPERATION THROUGHOUT THE LIFE OF THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR MAINTENANCE OF PERMANENT MEASURES UNTIL CONSTRUCTION OF THE PROJECT IS COMPLETED OR UNTIL IT IS ACCEPTED BY THE OWNER. REMOVE EROSION AND SEDIMENTATION CONTROLS AFTER STABLE VEGETATIVE GROWTH IS ESTABLISHED.
5. THE CONTRACTOR SHALL INSPECT EROSION AND SEDIMENT CONTROL DEVICES AT THE END OF EACH WORKING DAY, AFTER EACH STORM EVENT, AND AT LEAST DAILY DURING PROLONGED RAINFALL. CLEAN OUT ACCUMULATED SEDIMENT BEHIND CONTROLS. REPAIR OR REPLACE PROMPTLY. REPAIR OR REPLACE CONTROLS PROMPTLY AS NEEDED. REMOVE ACCUMULATED SEDIMENT FROM BEHIND PERIMETER CONTROLS WHEN ONE-HALF OF THE ORIGINAL HEIGHT OF THE COIR ROLLS BECOME FILLED WITH SEDIMENT. REMOVE SEDIMENT FROM CATCH BASIN INSERTS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS. DISPOSE OF REMOVED SEDIMENT IN ON-SITE FILL AREAS OR LAWFULLY OFF-SITE.
6. TREES AND OTHER EXISTING VEGETATION NOT WITHIN THE LIMITS OF DISTURBANCE SHALL BE PROTECTED FROM DAMAGE. RESTORE DISTURBED AREAS AS CLOSELY AS POSSIBLE. AREAS DAMAGED DURING CONSTRUCTION SHALL BE RE-SEEDED OR OTHERWISE RESTORED TO THEIR ORIGINAL CONDITION.
7. TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED FOR ANY DISTURBED AREAS THAT HAVE NOT YET REACHED FINISHED GRADE AS SOON AS POSSIBLE, BUT NOT MORE THAN FOURTEEN (14) DAYS AFTER CONSTRUCTION ACTIVITY IN THAT AREA HAS TEMPORARILY CEASED, UNLESS THE ACTIVITY IS TO RESUME WITHIN TWENTY-ONE (21) DAYS. TEMPORARY VEGETATIVE COVER SHALL CONSIST OF 40% ANNUAL RYEGRASS AND 60% PERENNIAL RYEGRASS FROM APRIL 1 TO NOVEMBER 15 AND WINTER RYEGRASS BETWEEN NOVEMBER 15 AND MARCH 31. SEED AT A RATE OF 75 LBS/ACRE BY HAND.
8. PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED TO ALL DISTURBED AREAS THAT HAVE REACHED FINISHED GRADE AS SOON AS POSSIBLE, BUT NOT MORE THAN FOURTEEN (14) DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT AREA HAS PERMANENTLY CEASED. RECOMMENDED PERMANENT SEEDING DATES ARE APRIL 15 TO JUNE 15 AND AUGUST 15 TO OCTOBER 15. PERMANENT VEGETATIVE COVER SEED MIXTURES AND APPLICATION RATES FOR ROADWAY SHOULDER AND EMBANKMENT SLOPE RESTORATION AREA SHALL BE IN ACCORDANCE WITH THE SITE RESTORATION PLAN. PLUG PLANTINGS FOR MARSH AND EMBANKMENT SLOPE RESTORATION AREAS SHALL BE IN ACCORDANCE WITH THE SITE RESTORATION PLAN AND SHALL BE INSTALLED BASED ON SEASONAL AVAILABILITY AND VIABILITY, AS RECOMMENDED BY THE NURSERY PROVIDING PLANT STOCK. ALL PLANTINGS AND SEED SHALL BE COVERED BY A ONE-YEAR WARRANTY PERIOD; RESEEDING/RE-PLANTING SHALL BE COMPLETED TO ENSURE STABLE VEGETATIVE COVER IS ESTABLISHED OVER ALL DISTURBED AREA.
9. IF PERMANENT SEEDING CANNOT BE COMPLETED IMMEDIATELY OR WITHIN THE RECOMMENDED SEEDING DATES, TEMPORARY BIODEGRADABLE EROSION CONTROL BLANKETING (CONTAINING NO PLASTIC COMPONENTS) SHALL BE SPREAD/INSTALLED OVER ALL DISTURBED AREAS TO PROTECT THE SITE UNTIL ARRIVAL OF THE NEXT RECOMMENDED SEEDING PERIOD. MULCHING /BLANKETING SHOULD BE PERFORMED AS SOON AS POSSIBLE, BUT NOT MORE THAN FOURTEEN (14) DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT AREA HAS TEMPORARILY CEASED UNLESS THE ACTIVITY IS TO RESUME WITHIN TWENTY-ONE (21) DAYS.
10. BLANKETING MUST BE INSPECTED PERIODICALLY, IN PARTICULAR AFTER RAINSTORMS, TO CHECK FOR RILL EROSION. WHERE EROSION IS OBSERVED, ADDITIONAL MULCH MUST BE APPLIED OR BLANKETING REPAIRED OR REPLACED. INSPECTIONS SHALL TAKE PLACE UNTIL VEGETATION IS THOROUGHLY ESTABLISHED.
11. GOOD HOUSEKEEPING: THE PROJECT SITE SHALL PROVIDE FOR THE MINIMIZATION OF EXPOSURE OF CONSTRUCTION DEBRIS (INCLUDING, BUT NOT LIMITED TO, INSULATION, WIRING, PAINTS AND PAINT CANS, SOLVENTS, WALL BOARD, ETC.) TO PRECIPITATION BY MEANS OF DISPOSAL AND/OR PROPER SHELTER OR COVER. CONSTRUCTION WASTE MUST BE PROPERLY DISPOSED OF IN ORDER TO AVOID EXPOSURE TO PRECIPITATION AT THE END OF EACH WORKING DAY.
12. STORAGE AND DISPOSAL: MATERIALS WHICH COULD BE A POTENTIAL SOURCE OF STORMWATER POLLUTION SUCH AS GASOLINE, DIESEL FUEL, HYDRAULIC OIL, ETC., WILL BE STORED AT THE END OF EACH DAY IN A LOCKED STORAGE TRAILER OR COVERED LOCATION AND TAKEN OFF-SITE AND PROPERLY DISPOSED OF. ALL TYPES OF WASTE GENERATED AT THIS SITE WILL BE DISPOSED OF IN A MANNER CONSISTENT WITH STATE LAW AND/OR REGULATIONS.
13. SPILL/LEAK PROTECTION AND RESPONSE: FUEL VEHICLES AND EQUIPMENT AWAY FROM THE WETLAND AND DRAINAGE SYSTEM AND PREVENT CONTAMINATION OF SOIL, GROUNDWATER OR SURFACE WATER FROM SPILLS OR LEAKS.. DEPLOY BOOMS AND OTHER CONTAINMENT/CLEANUP MEASURES IN THE EVENT OF A SPILL OR LEAK. NOTIFY LOCAL FIRE DEPT. AND DEP IMMEDIATELY OF ANY SPILLS.
14. DEWATERING: DEWATERING SHALL BE IN ACCORDANCE WITH THE "MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS." ALL TEMPORARY COFFERDAM AND WATER BYPASS CONVEYANCE PRODUCTS AND MATERIALS SHALL BE COMPLETELY REMOVED FROM THE SITE.
15. TRACKING AND DUST CONTROL: IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CLEAN ADJACENT ROADS WHERE CONSTRUCTION VEHICLES HAVE TRACKED SEDIMENT FROM THE PROJECT, CONTROL DUST, AND TAKE ALL NECESSARY MEASURES TO ENSURE THAT THE SITE AND ALL ADJACENT ROADS BE MAINTAINED IN A MUD- AND DUST-FREE CONDITION AT ALL TIMES THROUGHOUT THE LIFE OF THE CONTRACT. ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO THE SURROUNDING ROADWAYS MUST BE REMOVED IMMEDIATELY. DUST CONTROL MAY INCLUDE APPLICATION OF CONTROLLED AMOUNTS OF WATER ONTO AFFECTED AREAS OR OTHER CONTROL MEASURES APPROVED BY THE ENGINEER.

PROGRESS CLEANING REQUIREMENTS

1. CLEAN PROJECT SITE AND WORK AREAS DAILY, INCLUDING COMMON AREAS. MAINTAIN PROJECT SITE FREE OF WASTE MATERIALS AND DEBRIS. DISPOSE OF MATERIALS LAWFULLY OFF-SITE.
2. CLEAN AREAS WHERE WORK IS IN PROGRESS TO THE LEVEL OF CLEANLINESS NECESSARY FOR PROPER EXECUTION OF THE WORK.
   A. REMOVE LIQUID SPILLS PROMPTLY.
   B. APPLY WATER AS NEEDED TO CONTROL DUST.
3. BURYING OR BURNING WASTE MATERIALS ON-SITE WILL NOT BE PERMITTED. WASHING WASTE MATERIALS INTO STORM DRAINS AND WATERWAYS WILL NOT BE PERMITTED.
4. DURING HANDLING AND INSTALLATION, CLEAN AND PROTECT CONSTRUCTION IN PROGRESS AND ADJOINING MATERIALS ALREADY IN PLACE. APPLY PROTECTIVE COVERING WHERE REQUIRED TO ENSURE PROTECTION FROM DAMAGE OR DETERIORATION AT SUBSTANTIAL COMPLETION.
5. LIMITING EXPOSURES: SUPERVISE CONSTRUCTION OPERATIONS TO ASSURE THAT NO PART OF THE CONSTRUCTION, COMPLETED OR IN PROGRESS, IS SUBJECT TO HARMFUL, DANGEROUS, DAMAGING, OR OTHERWISE DELETERIOUS EXPOSURE DURING THE CONSTRUCTION PERIOD.

ROADWAY/TRAFFIC DIVERSION REQUIREMENTS

1. TRAFFIC ALONG CHEQUESSETT NECK ROAD WILL BE IMPACTED THROUGHOUT CONSTRUCTION.
2. IN ORDER TO REPLACE THE EXISTING CULVERTS THAT HYDRAULIC CONNECT WELLFLEET HARBOR WITH HERRING RIVER, AN APPROXIMATE 525-FOOT SECTION OF CHEQUESSETT NECK ROAD WILL BE TEMPORARILY CLOSED TO TRAFFIC. THIS SECTION OF ROADWAY IS EXPECTED TO BE CLOSED FOR MOST OF THE DURATION OF CONSTRUCTION WHICH IS ANTICIPATED TO LAST APPROXIMATELY FORTY-TWO (42) TO FIFTY-TWO (52) WEEKS.
3. A TEMPORARY SINGLE-LANE BYPASS ROUTE AND BRIDGE WILL BE CONSTRUCTED TO DIVERT TRAFFIC AROUND THE WORK AREA/ZONE. THIS TEMPORARY BYPASS ROUTE WILL BE CONSTRUCTED ON THE EASTERN (HERRING RIVER) SIDE OF CHEQUESSETT NECK ROAD. THE BRIDGE WILL CONSIST OF PREFABRICATED MODULAR STEEL COMPONENTS THAT WILL SPAN APPROXIMATELY 190 FEET ACROSS THE HERRING RIVER IN ORDER TO MINIMIZE CONSTRUCTION IMPACTS. TEMPORARY SHEETING WILL BE INSTALLED TO FORM THE EMBANKMENTS THAT WILL SERVE AS THE BRIDGE'S NORTHBOUND AND SOUTHBOUND APPROACHES AND ABUTMENTS. THE LAYOUT OF THE BYPASS ROUTE WAS DESIGNED TO ACCOMMODATE THE TURNING MOVEMENTS OF A WB-62 VEHICLE. THE TEMPORARY BRIDGE AND ROADWAY WILL BE DESIGNED AND CONSTRUCTED TO SUPPORT A HS-25 LOAD RATING.
4. DUE TO THE RELATIVELY LOW TRAFFIC VOLUMES, IT WAS DETERMINED THAT A ONE-LANE SIGNALIZED ALTERNATING TWO-WAY TRAFFIC SETUP WOULD BE ADEQUATE IN REGULATING TRAFFIC FLOW DURING CONSTRUCTION. SINCE CHEQUESSETT NECK ROAD IS A TWO LANE ROADWAY (WITH ONE LANE IN EACH DIRECTION), STOP BARS WILL BE PROVIDED AT THE ENTRANCES TO THE BYPASS ROUTE FROM BOTH DIRECTIONS ALONG WITH PRE-TIMED SIGNALS. USING SYNCHRO 8 AND SIMTRAFFIC, CAPACITY AND SIGNAL TIMING SOFTWARE, IT WAS DETERMINED THAT EACH OF THE SIGNALS WOULD BE FIXED (PRE-TIMED) WITH GREEN, YELLOW, AND ALL RED TIMES OF 16 SECONDS, 3 SECONDS, AND 22 SECONDS, RESPECTIVELY. THIS WAS BASED ON AN ASSUMED DESIGN SPEED OF 25 MPH. THE ANALYSIS ALSO REVEALS THAT THIS SIGNAL WILL HAVE MINIMAL IMPACT ON CAPACITY AND ROADWAY OPERATING CONDITIONS WITH A 'B' LEVEL OF SERVICE (LOS).
5. ALL REQUIRED BARRICADES, SIGNAGE, AND OTHER TEMPORARY TRAFFIC CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED THROUGHOUT CONSTRUCTION AS DEPICTED ON SHEET CT-101, CONCEPTUAL TRAFFIC DIVERSION & SHEETING LAYOUT PLAN.

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
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FRIENDS OF HERRING RIVER

GENERAL NOTES & LEGEND

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CN-001

RECREATIONAL BOATING HAZARD COMMUNICATION/PORTAGE NOTE:

RECREATIONAL BOATING HAZARD COMMUNICATION SIGNAGE/BARRIERS AND FORMAL/INFORMAL PORTAGE PROVISIONS WILL BE INCORPORATED BASED ON THE OUTCOME OF ON-GOING REVIEW AND COORDINATION BETWEEN THE NATIONAL PARK SERVICE AND THE TOWN OF WELLFLEET. WARNING SIGNAGE/BARRIERS, PORTAGE SIGNAGE, AND POTENTIAL PARKING/DESIGNATED PORTAGE IMPROVEMENTS AT THE NORTH END OF THE DIKE STRUCTURE SHALL BE REFLECTED ON THE 75% DESIGN DRAWINGS.

STAGING AREA NOTES:

1. STAGING AREAS SHOWN HEREON ARE PROVISIONAL AS OF THE DATE OF THIS DRAWING SET, AND SUBJECT TO REVISION OR EXCLUSION, PENDING INITIATION AND COMPLETION OF DISCUSSIONS WITH RESPECTIVE PROPERTY OWNERS AS TO THE EXTENT, TYPE AND SEASONALITY OF POTENTIAL STAGING/STORAGE ACTIVITIES ASSOCIATED WITH THE PROJECT.
2. IN ADDITION TO THE SPECIFIC LOCATIONS SHOWN HEREON, ADDITIONAL OFF-SITE STAGING AREAS MAY BE UTILIZED, SUBJECT TO DISCUSSION AND AGREEMENT WITH RESPECTIVE PROPERTY OWNERS, THE TOWN OF WELLFLEET, AND THE NATIONAL PARK SERVICE. THESE INCLUDE A PUBLIC PARKING AREA AT THE END OF DUCK HARBOR ROAD, A FORMER BORROW PIT ON POLE DIKE ROAD (CURRENTLY OWNED BY THE TOWN OF WELLFLEET), AND A PARKING AREA ON GRIFFIN ISLAND ROAD (ALSO OWNED BY THE TOWN OF WELLFLEET).
3. BARGES WILL BE MOBILIZED TO THE SITE FOR ADDITIONAL STAGING OF MATERIALS (E.G., STEEL SHEETING, PIPE PILES) AND TO PROVIDE OPERATING PLATFORMS FOR CRANE EQUIPMENT AT VARIOUS STAGES OF CONSTRUCTION. IT IS EXPECTED THAT THE MAJORITY OF BARGES, IF NOT ALL BARGES, WILL BE LOCATED ON THE HARBOR-SIDE OF THE EMBANKMENT, HOWEVER ONE OR MORE BARGES MAY BE DEPLOYED ON THE RIVER-SIDE OF THE EMBANKMENT, SUBJECT TO THE ENGINEER'S REVIEW AND ACCEPTANCE OF THE CONTRACTOR'S PROPOSED ACCESS PLAN SUBMITTAL PRIOR TO CONSTRUCTION,

   ANY BARGES MOBILIZED TO THE SITE WILL BE REQUIRED TO BE CLEANED IMMEDIATELY PRIOR TO TRANSPORT, BE EQUIPPED WITH SPUDS TO SECURE THE BARGE FROM WAVES, CURRENTS, AND TIDAL FLUCTUATIONS, AND BE PROVIDED WITH A SITE-SPECIFIC FUELING PROTOCOL, SPILL CONTROL AND COUNTERMEASURE PLAN AND APPROPRIATE SPILL CONTAINMENT/CLEANUP MATERIALS.

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
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FRIENDS OF HERRING RIVER

INDEX & OFF-SITE STAGING PLAN

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD — WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CS-101

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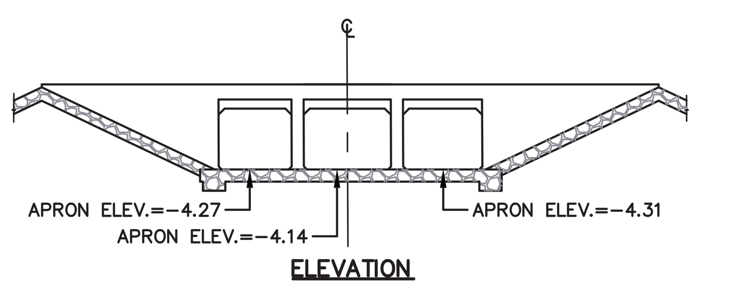
MS VIEW:
LAYER STATE:

TIDE TABLE FOR THE WELLFLEET HARBOR AND DIKED HERRING RIVER:

MHHW EL.= 5.2± (WELLFLEET HARBOR) / 0.3± (HERRING RIVER)
MHW EL.=4.84 (WELLFLEET HARBOR) / 0.24 (HERRING RIVER)
MTL EL.=-0.32 (WELLFLEET HARBOR) / -0.98 (HERRING RIVER)
MLW EL=-5.47 (WELLFLEET HARBOR) / -2.2 (HERRING RIVER)
MLLW EL.= -5.8± (WELLFLEET HARBOR) / -2.4± (HERRING RIVER)



RIVER SIDE
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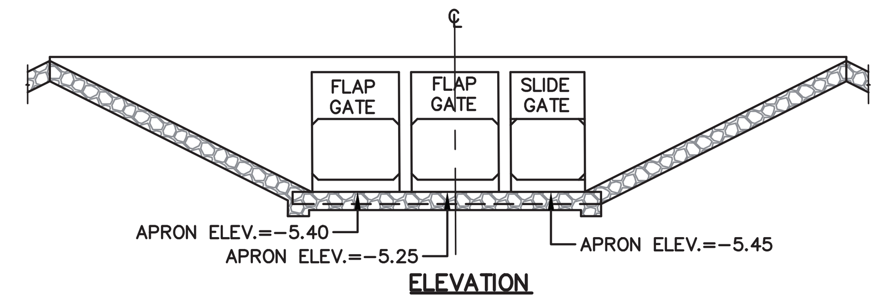

HARBOR SIDE
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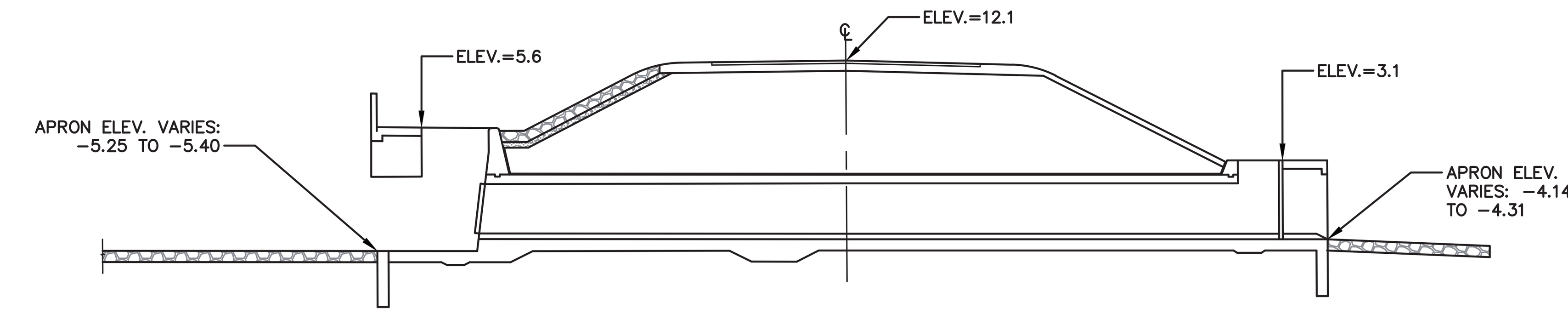

HARBOR SIDE
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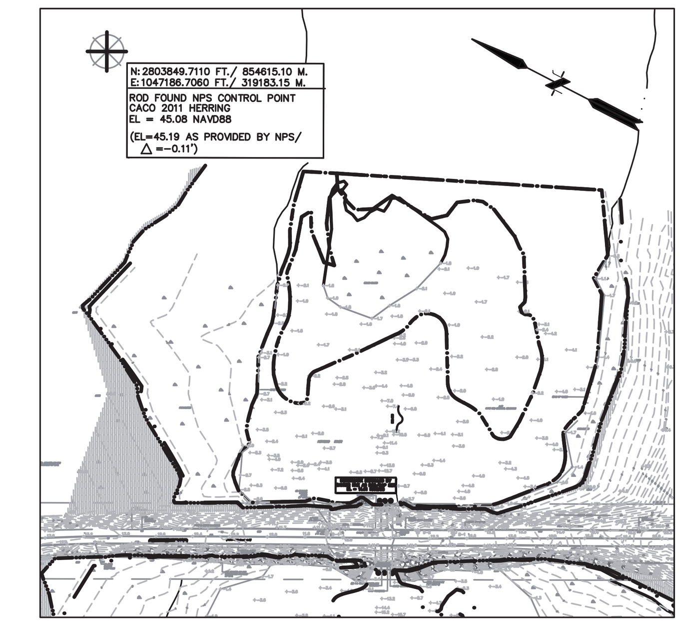
RIVER SIDE



KEY PLAN OF NPS CONTROL POINT
SCALE: 1"=2,000'

200-FOOT RIVERFRONT WETLAND NOTE:
THE ENTIRE PROJECT SITE IS LOCATED WITHIN THE 200-FOOT RIVERFRONT WETLAND

DOWNSTREAM		
CULVERT 1	CULVERT 2	CULVERT 3
CULVERT APRON EL= -5.40	CULVERT APRON EL= -5.25	CULVERT APRON EL= -5.45

UPSTREAM		
CULVERT 1	CULVERT 2	CULVERT 3
CULVERT APRON EL= -4.31	CULVERT APRON EL= -4.14	CULVERT APRON EL= -4.27

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FRIENDS OF HERRING RIVER

EXISTING CONDITIONS PLAN

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT
CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CS-102

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
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FRIENDS OF HERRING RIVER

PROPOSED CONDITIONS PLAN

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

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FRIENDS OF HERRING RIVER

GRADING AND DRAINAGE PLAN

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CG-101

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EROSION CONTROL NOTES

1. REFER TO THE CONSTRUCTION SEQUENCE & WATER CONTROL PLAN, SHEET CP–101, FOR ADDITIONAL DETAILS AND NOTES PERTAINING TO THE STAGED INSTALLATION OF THE EROSION CONTROL MEASURES REFLECTED ON THIS SHEET.
2. SIZE/LOCATION OF DEWATERING BASINS ARE APPROXIMATE AND SHALL BE DETERMINED BY CONTRACTOR'S ACCEPTED WATER CONTROL PLAN, DEVELOPED IN ACCORDANCE WITH THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS

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FRIENDS OF HERRING RIVER

SOIL EROSION & SEDIMENTATION CONTROL PLAN
HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CE-101

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MS VIEW:
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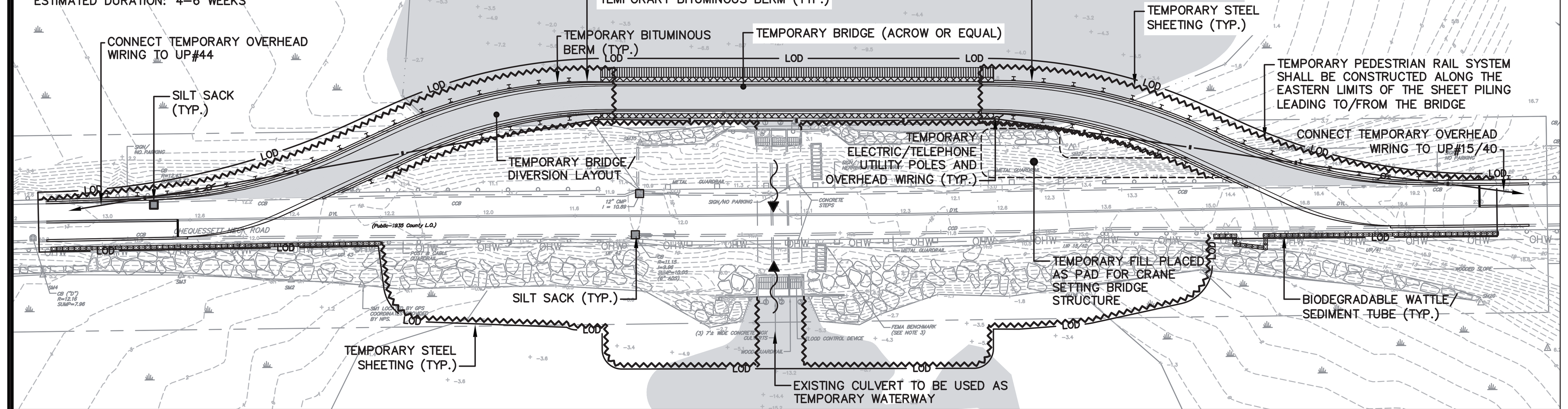
STAGE 1

1. SET UP MAINTENANCE AND PROTECTION OF TRAFFIC DEVICES ACCORDINGLY FOR TYPICAL SHOULDER AND LANE CLOSURES AS APPLICABLE AND AS REFLECTED ON SHEET CT-101.
2. DRIVE TEMPORARY STEEL SHEETING ASSOCIATED WITH CONSTRUCTION OF TEMPORARY BRIDGE APPROACHES AND ALONG HARBORSIDE OF ROADWAY. EXISTING CULVERTS SHALL REMAIN IN PLACE TO CONVEY TIDAL FLOW DURING THIS STAGE OF CONSTRUCTION.
3. PLACE COMPACTED FILL BETWEEN THE SHEETING TO CONSTRUCT TEMPORARY BRIDGE APPROACH EMBANKMENTS.
4. CONSTRUCT STUB ABUTMENTS FOR TEMPORARY BRIDGE, TEMPORARY SETTING AREA FOR BRIDGE CRANE, AND ASSEMBLE/CONSTRUCT TEMPORARY BRIDGE.
5. RESTORE AND STORE EXISTING GUARDRAILS WITHIN LIMITS OF TEMPORARY ROADWAY APPROACHES. CONSTRUCT TEMPORARY ROADWAY IMPROVEMENTS (INCLUDING PAVEMENT, STRIPING, GUARDRAILS, PEDESTRIAN RAIL SYSTEM, AND BITUMINOUS BERM), INSTALL TEMPORARY ELECTRIC/TELEPHONE OVERHEAD WIRING AND POLES, AND PERFORM TEMPORARY LANE SHIFT WITH TRAFFIC CONTROLS.

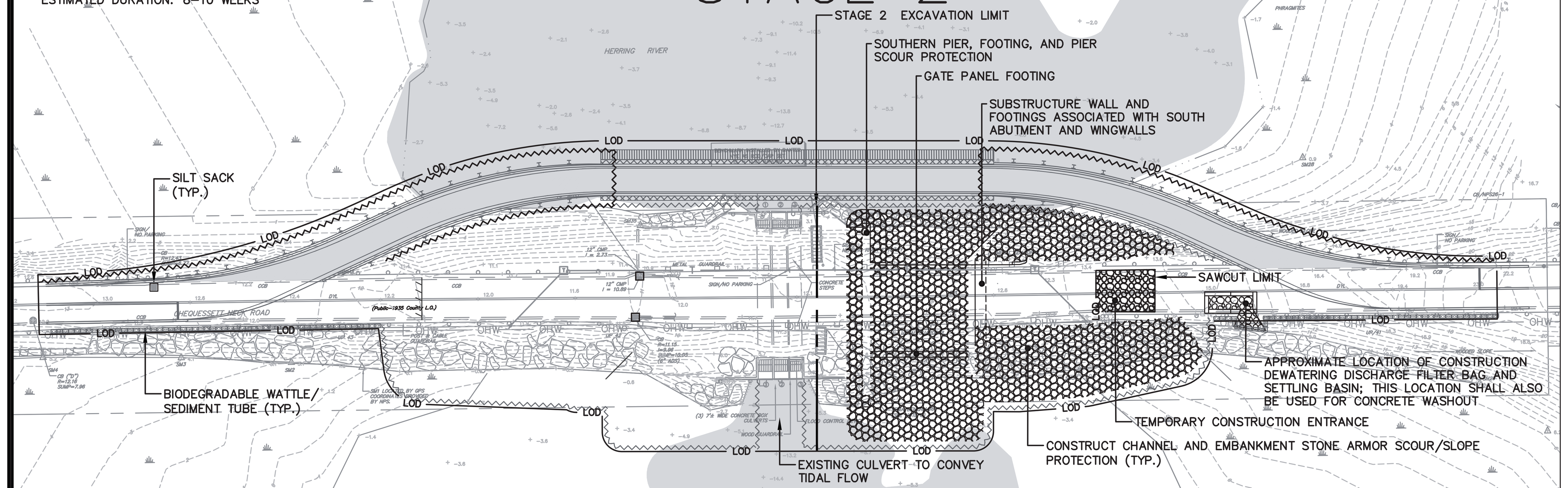
ESTIMATED DURATION: 4-6 WEEKS



STAGE 2

1. EXCAVATE TO THE STAGE 2 EXCAVATION LIMIT AND DEMOLISH EXISTING STRUCTURES WITHIN THE WORK AREA. SAWCUT PAVEMENT, STOCKPILE EXISTING STONE ARMOR SLOPE PROTECTION FOR RE-USE.
2. CONSTRUCT EXCAVATION SUPPORT SYSTEM AND SUBSTRUCTURE ELEMENTS INCLUDING ABUTMENTS, PIERS, PANEL FOOTINGS, AND TEMPORARY GATE STRUCTURES WITHIN SOUTHERN SPAN.
3. PLACE COMPACTED BACKFILL MATERIALS AND PIER ABUTMENT AND CHANNEL SCOUR PROTECTION TO CHANNEL INVERT ELEVATION WITHIN SOUTHERN SPAN.

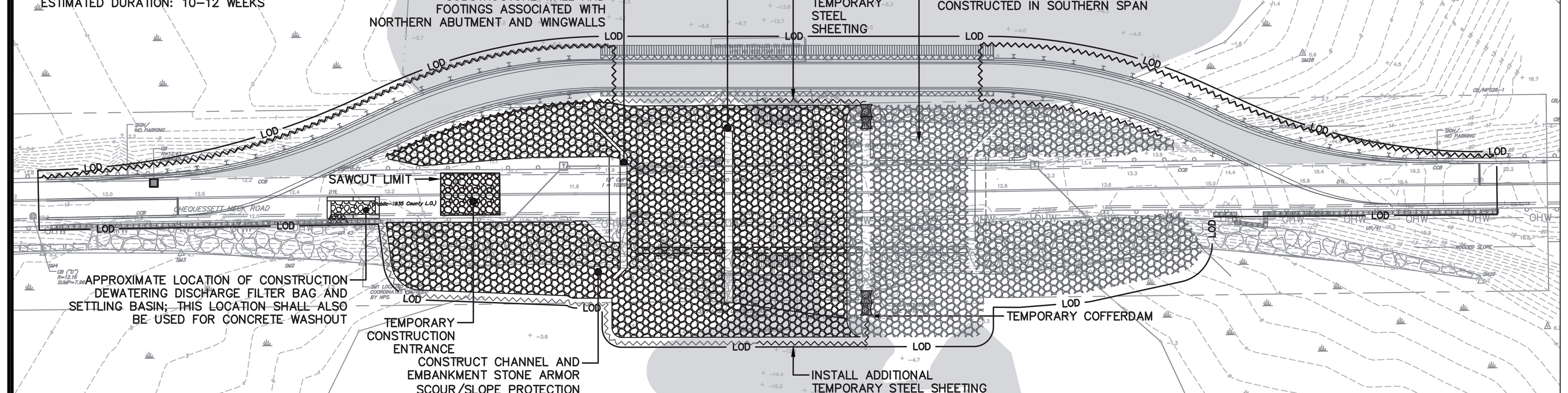
ESTIMATED DURATION: 8-10 WEEKS



STAGE 3

1. REDIRECT TIDAL FLOW THROUGH TEMPORARILY-BRACED PANELS CONFIGURED WITH TEMPORARY GATE/FLAP CONFIGURATION TO MATCH TIDAL FLOW CONDITIONS OF EXISTING CULVERT. OPEN GATE STRUCTURES ABOVE FOOTING PANELS IN SOUTHERN SPAN.
2. REMOVE SHEETING ON SOUTHERN SIDE TO LIMITS SHOWN AND INSTALL ADDITIONAL SHEETING/COFFERDAMMING AS NECESSARY TO ENDS OF THE SOUTHERN PIER.
3. INSTALL BULK BAGS (OR EQUIVALENT) AS SHOWN TO FORM AN IMPERMEABLE BARRIER BETWEEN THE ENDS OF THE PIER AND THE NEWLY INSTALLED SHEET PILE ENDS TO PREVENT WATER FLOW INTO WORK AREA.
4. SAWCUT PAVEMENT AND EXCAVATE NORTHERN WORK AREA AND DEMOLISH/REMOVE EXISTING STRUCTURES INCLUDING CULVERTS AND ASSOCIATED WALLS.
5. CONSTRUCT SUBSTRUCTURE ELEMENTS INCLUDING ABUTMENT AND PIER IN ADDITION TO PANEL FOOTINGS AND TEMPORARY GATE STRUCTURES WITHIN NORTHERN AND CENTER BRIDGE SPANS.
6. PLACE COMPACTED BACKFILL MATERIAL AND CONSTRUCT PIER/ABUTMENT AND CHANNEL SCOUR PROTECTION TO CHANNEL INVERT ELEVATION WITHIN NORTHERN AND CENTER BRIDGE SPANS.

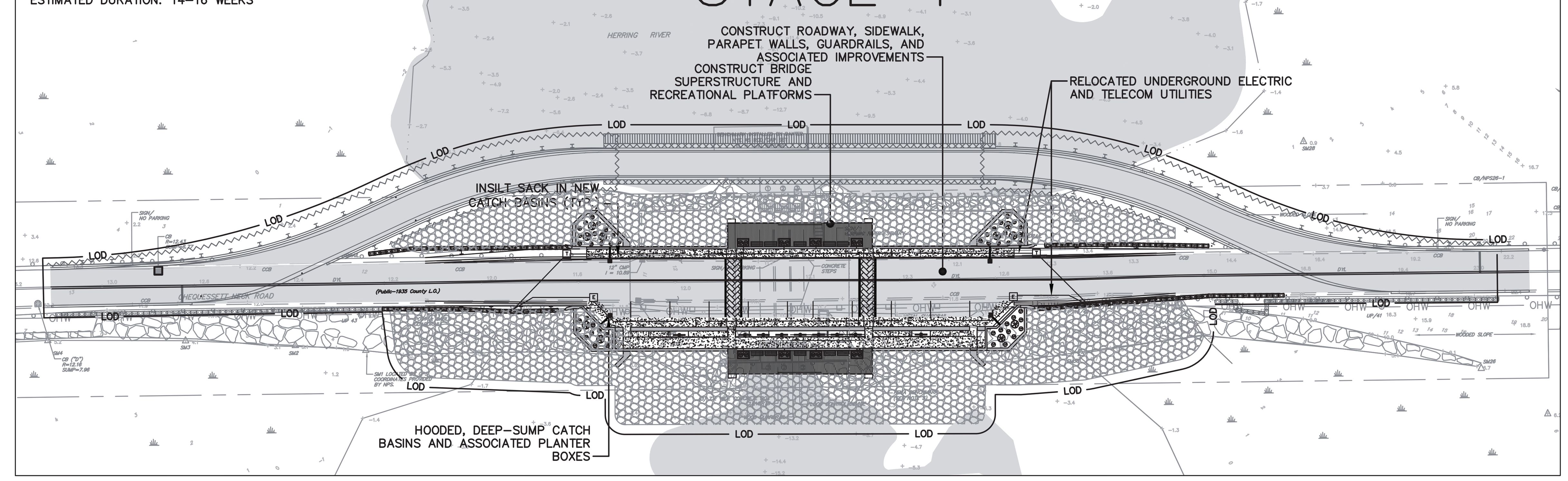
ESTIMATED DURATION: 10-12 WEEKS



STAGE 4

1. INSTALL BRIDGE SUPERSTRUCTURE, ROADWAY, STRIPING/SIGNAGE, RELOCATED UTILITIES, GATES/PANELS AND ASSOCIATED ROADWAY APPURTENANCES. GATES ON PANELS TO BE CONFIGURED TO MATCH TIDAL FLOW CONSTRAINTS OF EXISTING CULVERT.
2. REMOVE TEMPORARY SHEETING AND BULKBAGS ON HARBOR-SIDE OF BRIDGE STRUCTURE AS INDICATED IN ADDITION TO SECTION OF SHEETING ON RIVERSIDE OF BRIDGE BETWEEN THE NORTHERN ABUTMENT AND SOUTHERN PIER.
3. RESTORE DISTURBED AREAS ON HARBOR-SIDE OF STRUCTURE WITH TOPSOIL, SEEDING, PLANTINGS AND EROSION CONTROLS.

ESTIMATED DURATION: 14-16 WEEKS

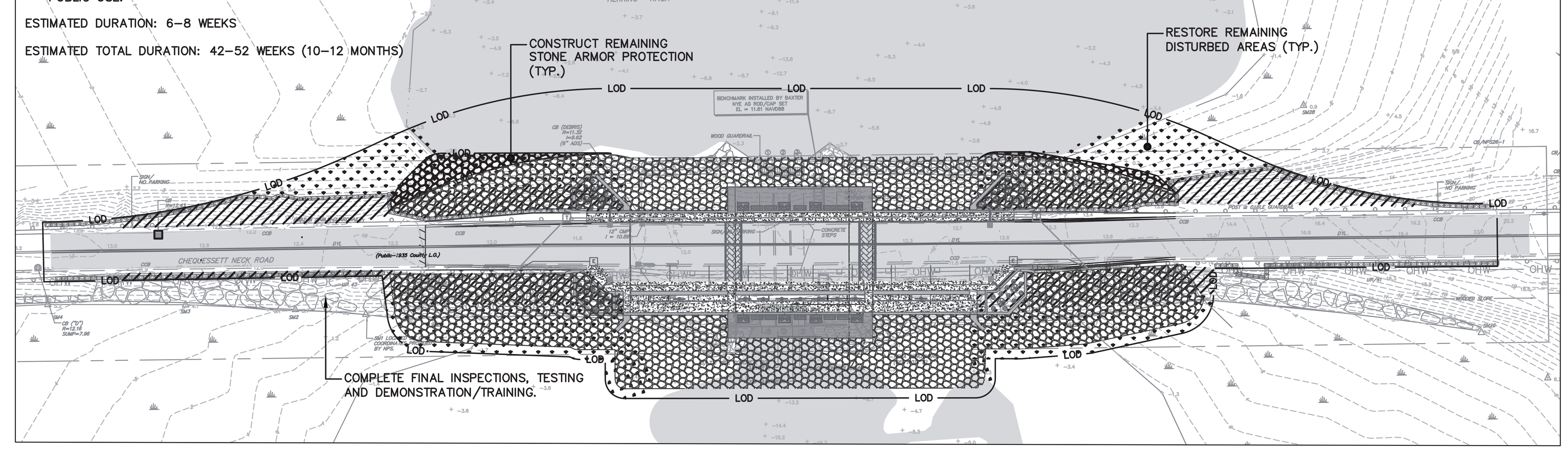


STAGE 5

1. SET UP MAINTENANCE AND PROTECTION OF TRAFFIC DEVICES ACCORDINGLY FOR TYPICAL SHOULDER AND LANE CLOSURES AS APPLICABLE AND AS REFLECTED ON SHEET CT-101.
2. REINSTALL GUARDRAIL WITHIN LIMITS OF TEMPORARY ROADWAY APPROACHES.
3. REMOVE TEMPORARY TRAFFIC CONTROLS, SHEETING, TEMPORARY BRIDGE AND FILL MATERIAL COMPRISING TRAFFIC BYPASS ROUTE.
4. REGRADE REMAINING EMBANKMENT SLOPE AREAS AND CONSTRUCT STONE ARMOR PROTECTION MEASURES AS NECESSARY.
5. RESTORE DISTURBED AREAS ON RIVER-SIDE OF STRUCTURE WITH TOPSOIL, SEEDING, PLANTINGS AND EROSION CONTROLS.
6. COMPLETE CONSTRUCTION OF REMAINING MISCELLANEOUS ITEMS.
7. REMOVE REMAINING TEMPORARY TRAFFIC CONTROLS AND OPEN BRIDGE FULLY FOR PUBLIC USE.

ESTIMATED DURATION: 6-8 WEEKS

ESTIMATED TOTAL DURATION: 42-52 WEEKS (10-12 MONTHS)



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FRIENDS OF HERRING RIVER

CONSTRUCTION SEQUENCE & WATER CONTROL PLAN

HERRING RIVER TIDAL RESTORATION PROJECT

BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CP-101

RESTORATION LEGEND

MARSH AREA RESTORATION

ROADWAY SHOULDER RESTORATION

EMBANKMENT AREA RESTORATION

RESTORATION NOTES

1. DISTURBED ROADWAY SHOULDER AREAS AND/OR AREAS DISTURBED UPGRADIENT OF WETLANDS TO BE COVERED WITH TOPSOIL PRIOR TO SEEDING (WHERE PROPOSED STRUCTURES ARE NOT LOCATED). NOT ALL POTENTIALLY DISTURBED AREAS REQUIRING RESTORATION ARE SHOWN HEREON.

2. ALL SEED MIXES SHALL BE FREE OF INVASIVE NON-NATIVE PLANT SPECIES.

3. DISTURBED MARSH AREAS TO BE VEGETATED WITH PLUG PLANTINGS SHALL BE GRADED TO ORIGINAL CONDITIONS PRIOR TO PLANTING. PLANTING SHALL BE CONDUCTED DURING LOW TIDE CONDITIONS.

4. ALL DISTURBED AREAS TO BE RESTORED SHALL BE TEMPORARILY STABILIZED WITH BIODEGRADABLE EROSION CONTROL BLANKETING (NO PLASTIC COMPONENTS, JUTE MESH OR EQUIVALENT).

RESTORATION REQUIREMENTS

ROADWAY SHOULDER RESTORATION

MIXTURE: NEW ENGLAND EROSION CONTROL/RESTORATION MIX

APPLICATION RATE: 35 LBS/ACRE

BOTANICAL NAME	COMMON NAME	IND.
FESTUCA RUBRA	CREEPING RED FESCUE	FACU
ELYMUS CANADENSIS	CANADA WILD RYE	FACU+
LOLIUM MULTIFLORUM	ANNUAL RYEGRASS	NI
LOLIUM PERENNE	PERRENIAL RYEGRASS	NI
BOUTELOUA GRACILIS	BLUE GRAMA	NI
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	FACU
SORGHASTRUM NUTANS	INDIAN GRASS	UPL
AGROSTIS SCABRA	ROUGH BENTGRASS/TICKLEGRASS	FAC
AGROSTIS PERENNANS	UPLAND BENTGRASS	FACU

MARSH AREA RESTORATION

PLANTING TYPE: SALTMARSH CORDGRASS (SPARTINA ALTERNIFLORA)

PLANTING SPACING: 12" O.C.

EMBANKMENT SLOPE RESTORATION

AREA TO BE RESTORED WITH STONE SLOPE PROTECTION. EXISTING STONE SLOPE PROTECTION ON HARBOR SIDE OF EMBANKMENT SHALL BE RE-USED ASSUMING IT MEETS MINIMUM SIZE REQUIREMENTS SPECIFIED. SLOPE PROTECTION ON THE RIVER SIDE OF THE EMBANKMENT SHALL BE SOIL-FILLED AND VEGETATED WITH PLUG PLANTINGS.

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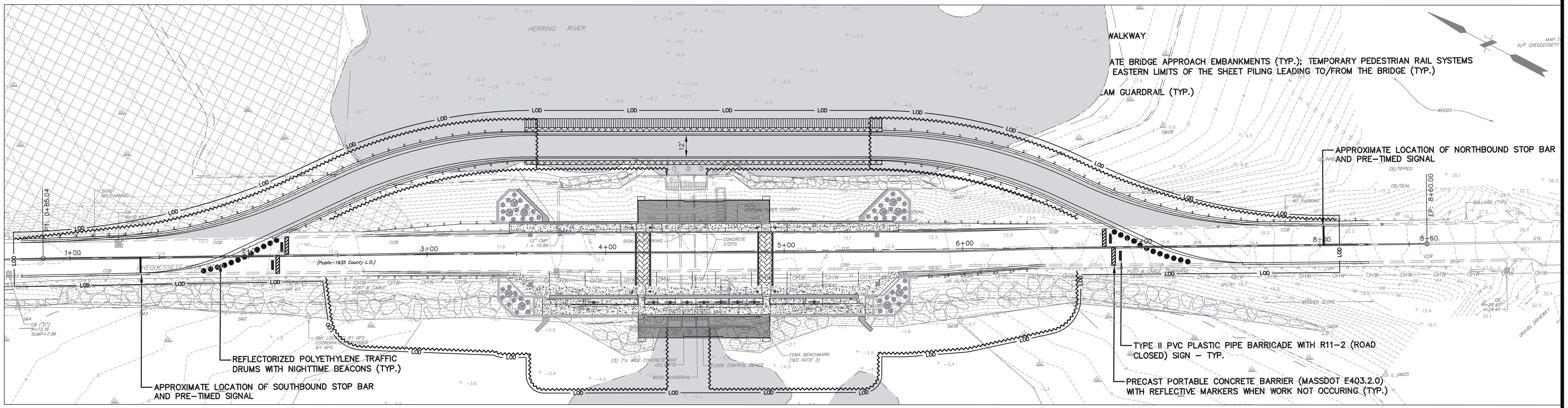
SITE RESTORATION PLAN

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

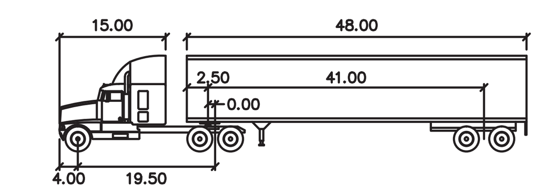
PROJ. No.: 20120636A13
DATE: JULY 2014

LA-101



TEMPORARY DIVERSION BRIDGE/ LANE CONFIGURATION LAYOUT:

1. THE TEMPORARY DIVERSION BRIDGE/LANE CONFIGURATION LAYOUT WAS DESIGNED TO ACCOMMODATE THE TURNING MOVEMENTS OF A WB-62 DESIGN VEHICLE.
2. THE DIMENSIONS FOR THE WB-62 VEHICLE ARE AS FOLLOWS:

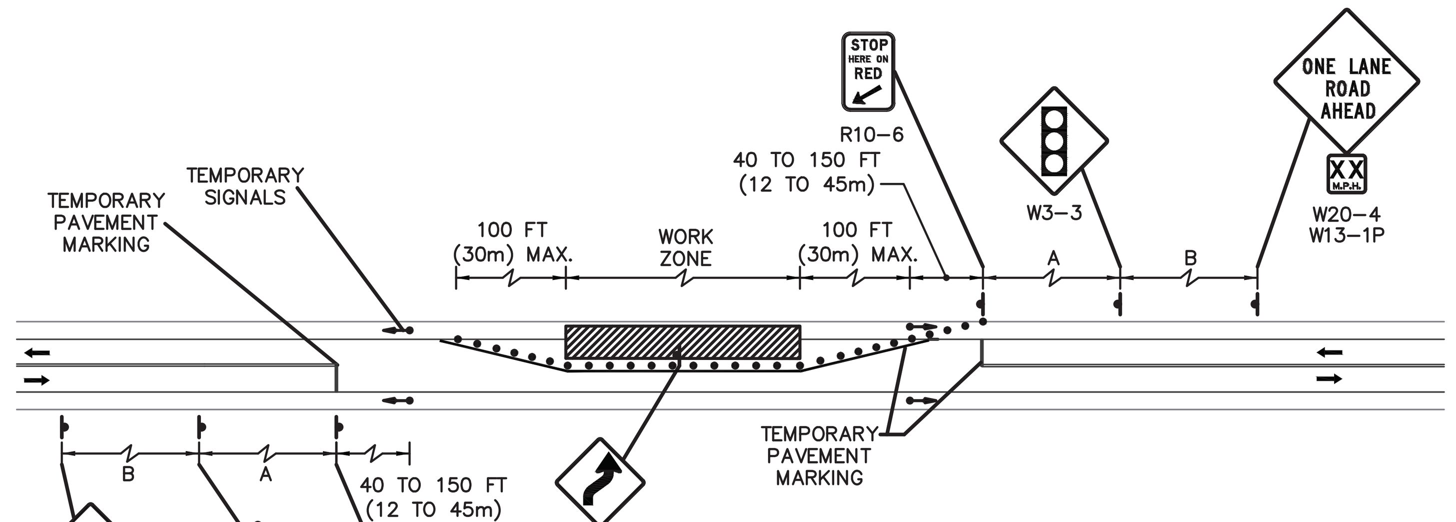


WB-62 feet

Tractor Width	: 8.00	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 28.4
Tractor Track	: 8.00	Articulating Angle	: 70.0
Trailer Track	: 8.50		

NOTES:

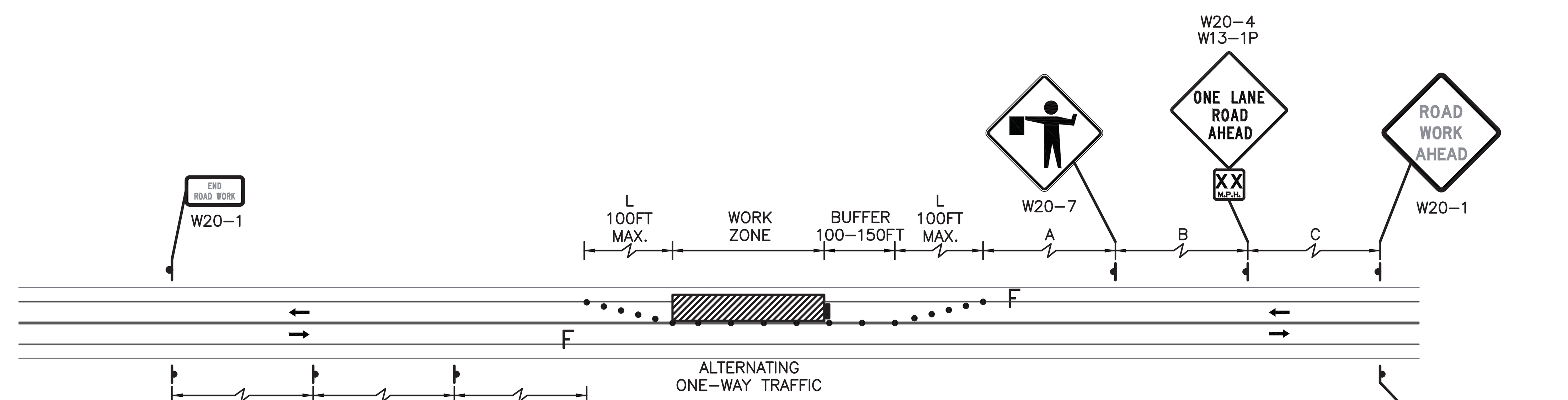
1. ALL TEMPORARY TRAFFIC CONTROL WORK SHALL CONFORM TO THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD) AND ALL REVISIONS.
2. ALL WORK TO MASSDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
3. ALL SIGN LEGENDS, BORDERS AND MOUNTING SHALL BE IN ACCORDANCE WITH THE MUTCD.
4. TEMPORARY CONSTRUCTION SIGNING AND ALL OTHER TRAFFIC CONTROL DEVICES SHALL BE IN PLACE PRIOR TO THE START OF ANY WORK.
5. TEMPORARY CONSTRUCTION SIGNING, BARRICADES AND ALL OTHER NECESSARY WORK ZONE TRAFFIC CONTROL DEVICES SHALL BE REMOVED FROM THE ROADWAY OR COVERED WHEN THEY ARE NOT REQUIRED FOR CONTROL OF TRAFFIC.
6. SIGNS AND SIGN SUPPORTS LOCATED ON OR NEAR THE TRAVELED WAY, AND REFLECTORIZED PLASTIC DRUMS WITH LIGHTING DEVICES MOUNTED ON THEM, MUST PASS THE CRITERIA SET FORTH IN NCHRP REPORT 350, "RECOMMENDED PROCEDURES FOR THE SAFETY PERFORMANCE EVALUATION OF HIGHWAY FEATURES."
7. THE FIRST THREE PLASTIC DRUMS OF A TAPER MAY BE MOUNTED WITH TYPE A LIGHTS.
8. AN ADVISORY SPEED LIMIT, IF REQUIRED, SHALL BE DETERMINED BY THE ENGINEER.
9. DISTANCES ARE A GUIDE AND MAY BE ADJUSTED IN THE FIELD BY THE ENGINEER.
10. MAXIMUM SPACING OF TRAFFIC DEVICES IN A TAPER (DRUMS OR CONES) IS EQUAL IN FEET TO THE SPEED LIMIT IN MPH.
11. MINIMUM LANE WIDTH IS TO BE 11 FEET DURING LANE CLOSURE. MINIMUM LANE WIDTH TO BE MEASURED FROM THE EDGE OF DRUMS.
12. ALL SIGNS SHALL BE MOUNTED ON THEIR OWN STANDARD SIGN SUPPORTS.
13. CHANNELIZING DEVICES AND ADVANCE WARNING SIGNS SHOULD BE PLACED BEYOND THE MINIMUM DISTANCES SHOWN, IF NEEDED TO MAINTAIN THEIR VISIBILITY TO MOTORISTS WHERE SIGHT DISTANCE IS RESTRICTED.
14. A BUFFER SPACE IS RECOMMENDED FOR ALL WORK ZONES.
15. PEDESTRIAN SIGNAGE SHALL BE INSTALLED AS REQUIRED BY THE TOWN AND MASSDOT TO DIRECT PEDESTRIANS (DURING THE OFF-HOURS) TO THE WALKWAY ALONG THE EASTERN SIDE OF THE TEMPORARY BRIDGE AND DIVERSION ROUTE. OPENINGS IN THE TEMPORARY GUARDRAIL SYSTEM SHALL BE CONSTRUCTED TO FACILITATE PEDESTRIAN ACCESS.



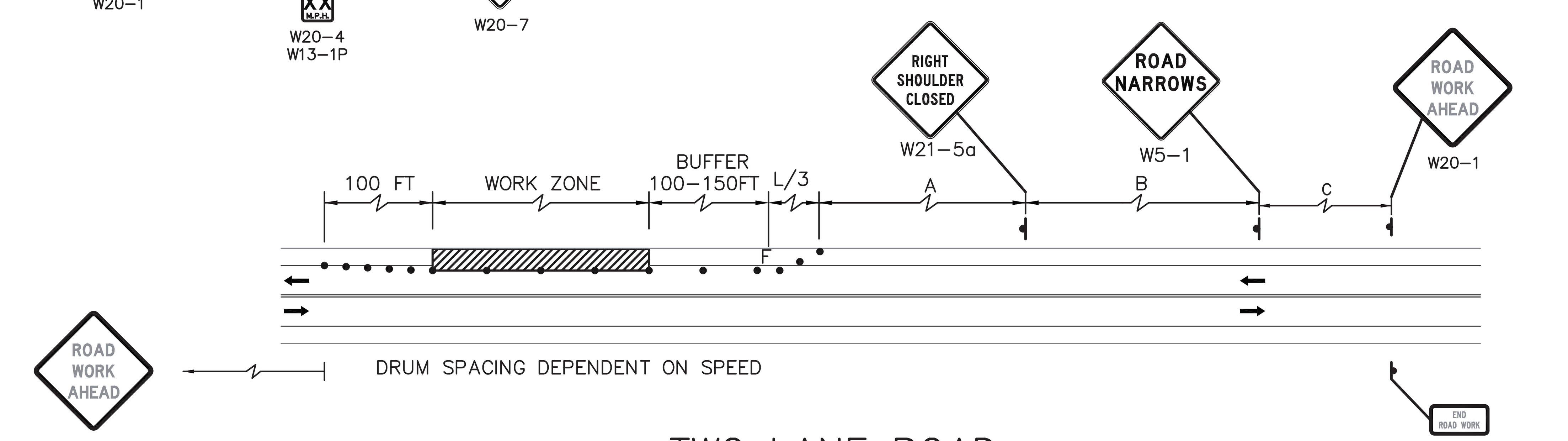
TWO LANE ROAD
ONE LANE ALTERNATING TRAFFIC
WITH TEMPORARY SIGNAL
NOT TO SCALE

TYPICAL CONSTRUCTION SIGNING

IDENTIFICATION NUMBER	SIZE OF SHEET WIDTH (IN)	SIZE OF SHEET HEIGHT (IN)	TEXT	AREA IN SQUARE FEET
G20-2A	48	24	END ROAD WORK	8.00
W20-1 (AHEAD)	36	36	ROAD WORK AHEAD	9.00
W5-1	36	36	ROAD NARROWS	9.00
R4-7	24	30		5.00
W20-8	36	36	POLICE OFFICER AHEAD	9.00
W20-7a	36	36		9.00
W20-4	36	36	ONE LANE ROAD AHEAD	9.00
W1-4R	30	30		6.25
W1-4L	30	30		6.25
W13-1	24	30	XX M.P.H.	5.00
W8-3	30	30	RAISED STRUCTURE	6.25
W8-1	30	30	BUMP	6.25
W8-14	30	30	GROOVED PAVEMENT AHEAD	6.25
W8-15	30	30	MOTORCYCLES USE CAUTION	6.25



TWO LANE ROAD
TYPICAL LANE CLOSURE
NOT TO SCALE



TWO LANE ROAD
TYPICAL CLOSED SHOULDER
NOT TO SCALE

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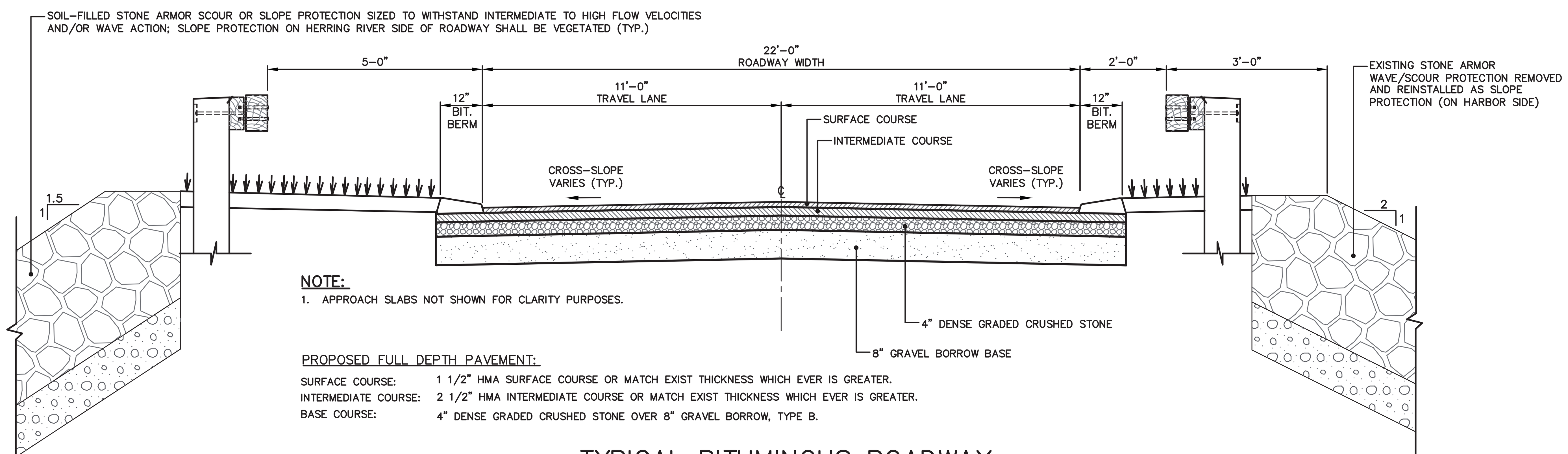
CONCEPTUAL TRAFFIC DIVERSION & SHEETING LAYOUT PLAN
HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT
CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CT-101

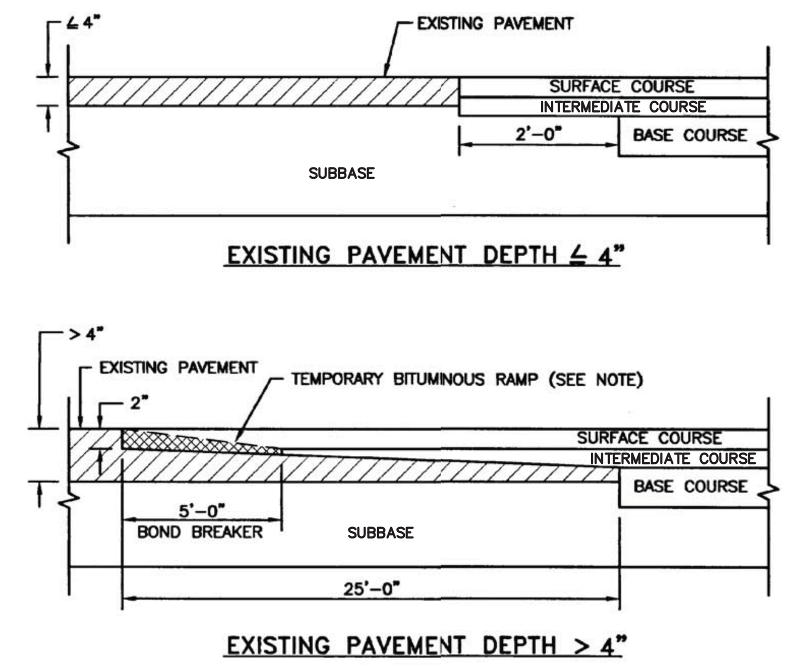


NOTE:
1. APPROACH SLABS NOT SHOWN FOR CLARITY PURPOSES.

PROPOSED FULL DEPTH PAVEMENT:

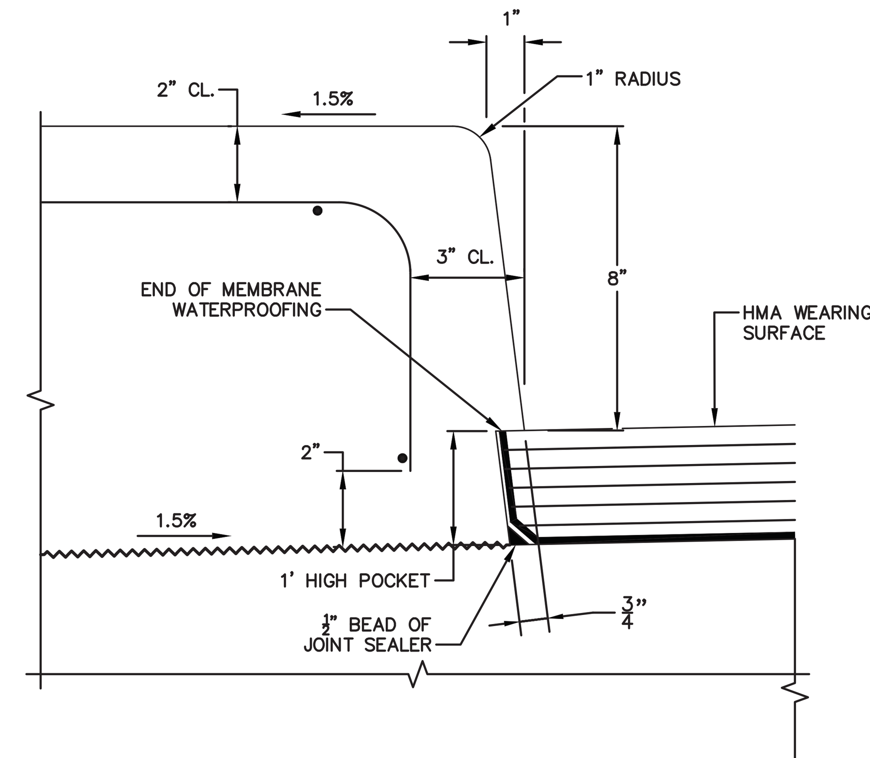
SURFACE COURSE: 1 1/2" HMA SURFACE COURSE OR MATCH EXIST THICKNESS WHICH EVER IS GREATER.
INTERMEDIATE COURSE: 2 1/2" HMA INTERMEDIATE COURSE OR MATCH EXIST THICKNESS WHICH EVER IS GREATER.
BASE COURSE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B.

TYPICAL BITUMINOUS ROADWAY CROSS-SECTION AT BRIDGE APPROACHES
NOT TO SCALE



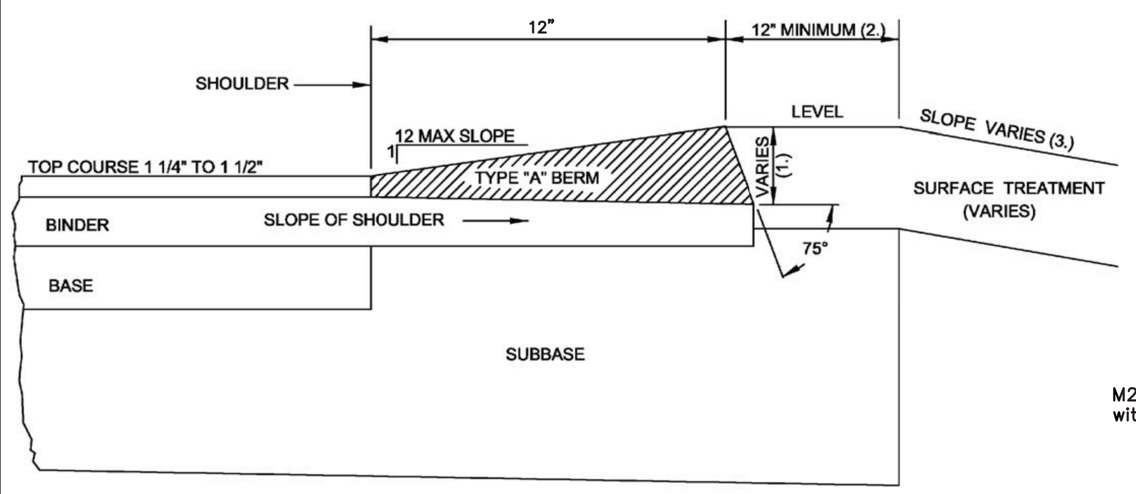
NOTE:
A BOND BREAKER (TAPERED OR EQUIVALENT) WILL BE PLACED 5'-0" FROM THE JOINT AND COVERED WITH THE BINDER COURSE AS THE TEMPORARY RAMP, PRIOR TO PLACING THE SURFACE COURSE, THE BINDER COURSE AND BOND BREAKER WILL BE REMOVED.

TRANSVERSE PAVEMENT CUT AND MATCH
NOT TO SCALE



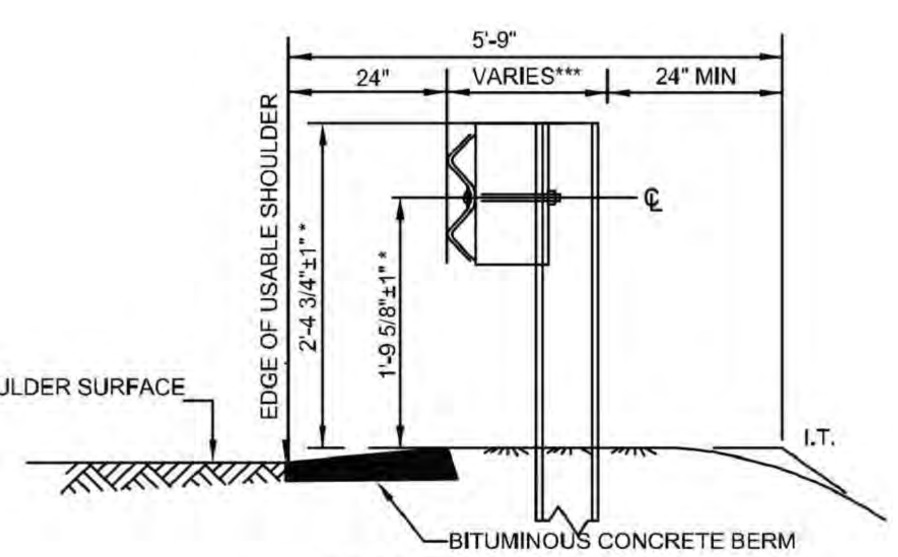
NOTES:
1. TURN MEMBRANE UP INTO 3" HIGH POCKET.
2. DIMENSIONS AT THE FACE OF CURB ARE THE SAME FOR THE SAFETY CURB.

FACE OF SIDEWALK CURB DETAILS
NOT TO SCALE



NOTE:
FOR MODIFIED BERM THE SLOPE REMAINS CONSTANT AT 1 (V) TO 12 (H)
1. THIS DIMENSION VARIES WITH THE THICKNESS OF THE TOP COURSE AND SLOPE OF BINDER
2. SEE E 401.1.1 FOR TYPICAL SECTION AT GUARDRAIL LOCATIONS

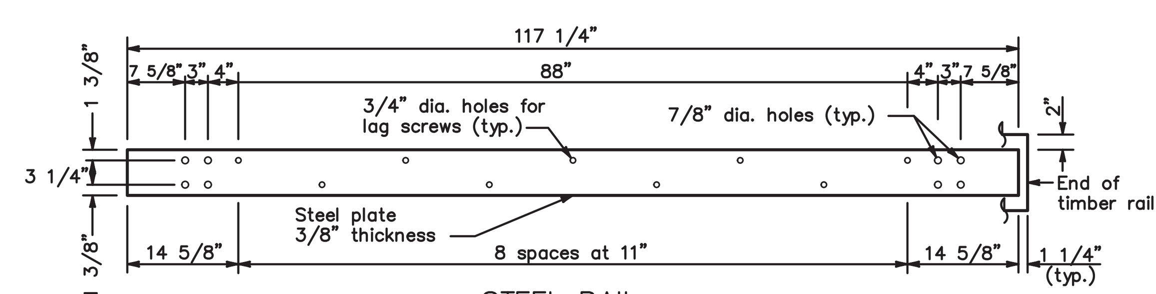
BITUMINOUS BERM
NOT TO SCALE



SECTION Z-Z**

TYPE "A" BERM ALONG EDGE OF SHOULDER

TEMPORARY STEEL 2 BEAM HIGHWAY GUARDRAIL FOR TRAFFIC DIVERSION (MASSDOT E.401.1.0)
NOT TO SCALE



STEEL RAIL

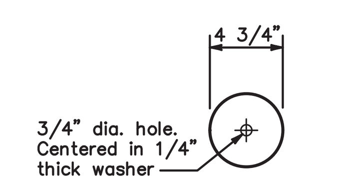
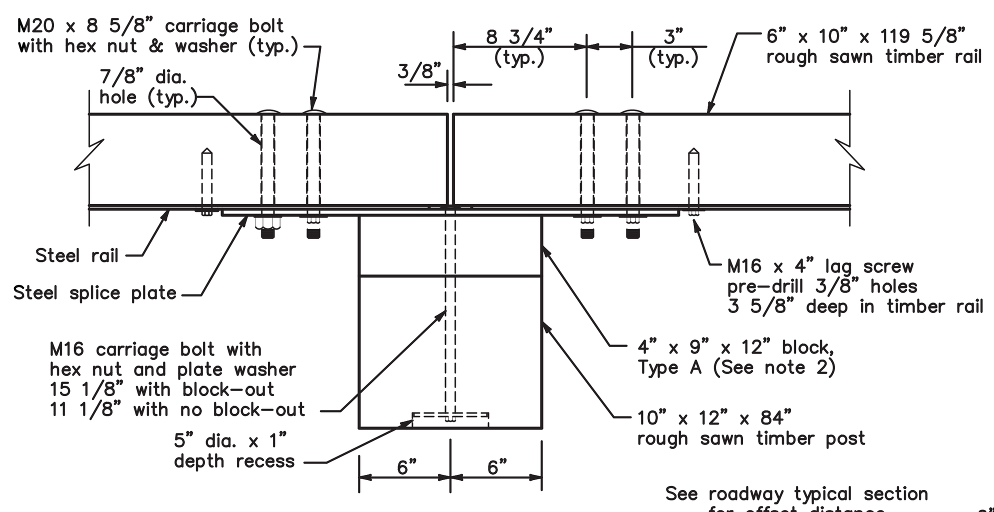


PLATE WASHER



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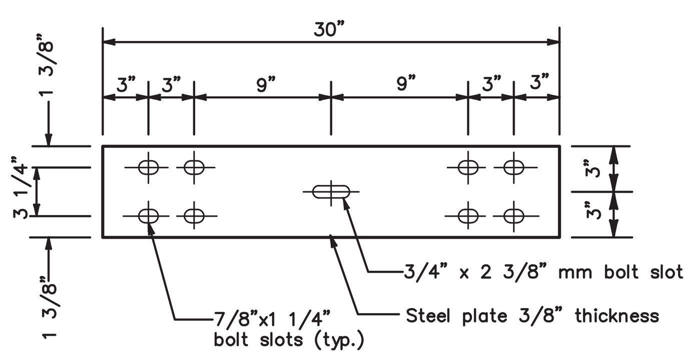
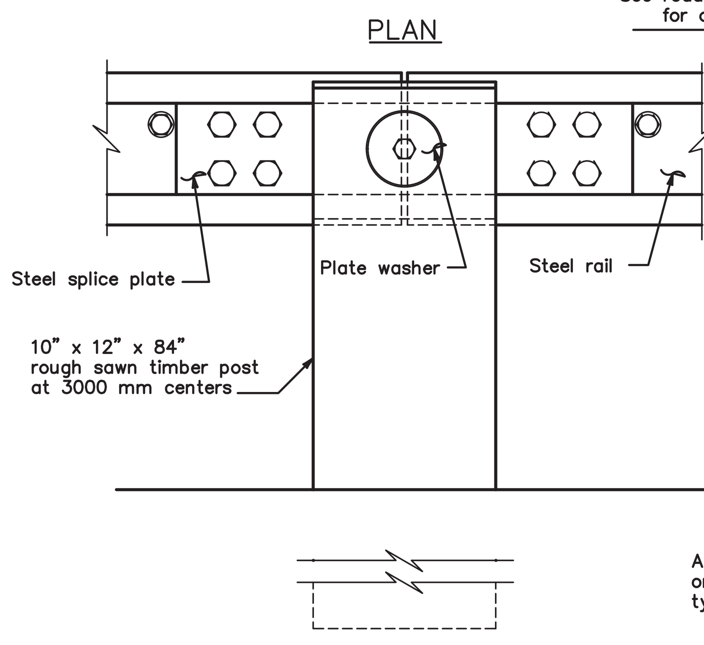
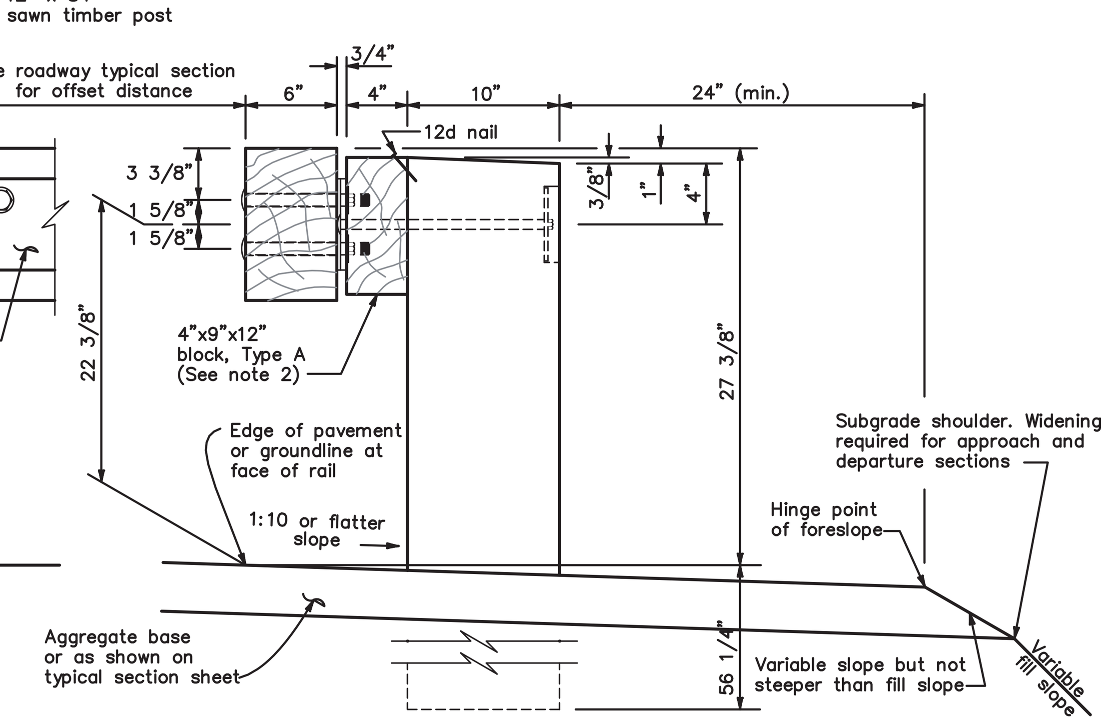


STEEL SPLICE PLATE



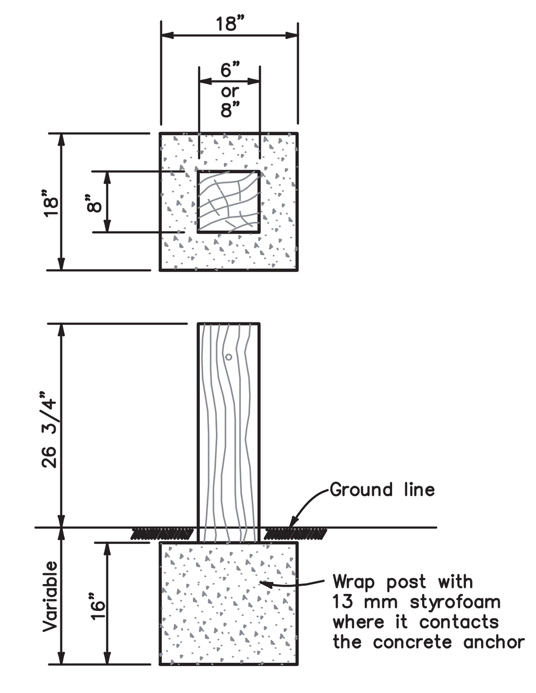
ELEVATION POST CONNECTION



TYPICAL GUARDRAIL CROSS SECTION

NOTE:
1. Dimensions not labeled are in millimeters.
2. Use the Type A, blocked-out, system or the Type B, non-blocked-out, system as specified.
3. Use weathering steel for all structural steel and fastener hardware as specified.
4. Place a terminal section (See Standards M617-61 and M617-62) on both approach and trailing ends of barrier installations.
5. Furnish hardware in the metric sizes shown. Equivalent imperial sizes may be used when metric sizes are not available.

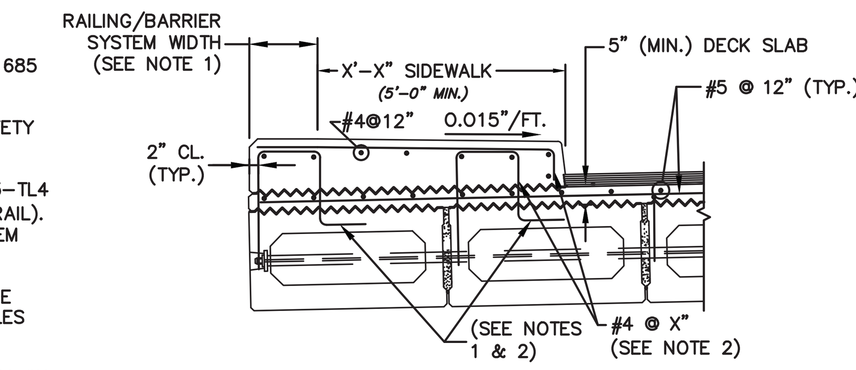
STEEL-BACKED PERMANENT TIMBER GUARDRAIL, TYPE A & TYPE B
NOT TO SCALE



Use 22" diameter round anchor or 20" square anchor. Reduced size acceptable in solid rock.

CONCRETE ANCHOR FOR SHORT GUARDRAIL POST

NOTES:
1. DECK SLAB SHALL BE 4000 PSI, 3/4 IN, 585 HP CEMENT CONCRETE.
2. SIDEWALK AND SAFETY CURB CONCRETE SHALL BE 5000 PSI, 3/4 IN, 685 HP CEMENT CONCRETE.
3. SEE CHAPTER 9, RAILING/BARRIER SYSTEM FOR SIDEWALK AND SAFETY CURB DIMENSIONS, REINFORCEMENT AND EMBEDMENT LENGTHS NOT SHOWN. MODIFY THE SECTIONS IN CHAPTER 9 TO SHOW THE BEAM ARRANGEMENT AND DETAILS SHOWN ABOVE. SAFETY CURB FOR S3-TL4 RAIL SHOWN (WIDTH SHALL NOT BE LESS THAN 19 1/2" FOR S3-TL4 RAIL). ACTUAL SAFETY CURB WIDTH DEPENDS ON RAILING/BARRIER SYSTEM CHOSEN.
4. SPACING OF SIDEWALK AND SAFETY CURB DOWELS AND TRANSVERSE SIDEWALK AND SAFETY CURB REINFORCEMENT SHALL BE IN MULTIPLES OF THE BOX BEAM STIRRUP REINFORCEMENT.
5. SIDEWALK SLAB MAY OVERHANG THE EXTERIOR BEAM BY A MAXIMUM OF 3" WITHOUT ALTERING THE REINFORCEMENT SHOWN. FOR OVERHANGS GREATER THAN 3" USE THE DETAILS SHOWN ON DWG. NO.'S 4.3.6 AND 9.3.5 AND 9.3.6. SAFETY CURB CANNOT OVERHANG BEAM.
6. PROVIDE PARAFFIN JOINTS IN THE SIDEWALK AND SAFETY CURB.



SIDEWALK SECTION
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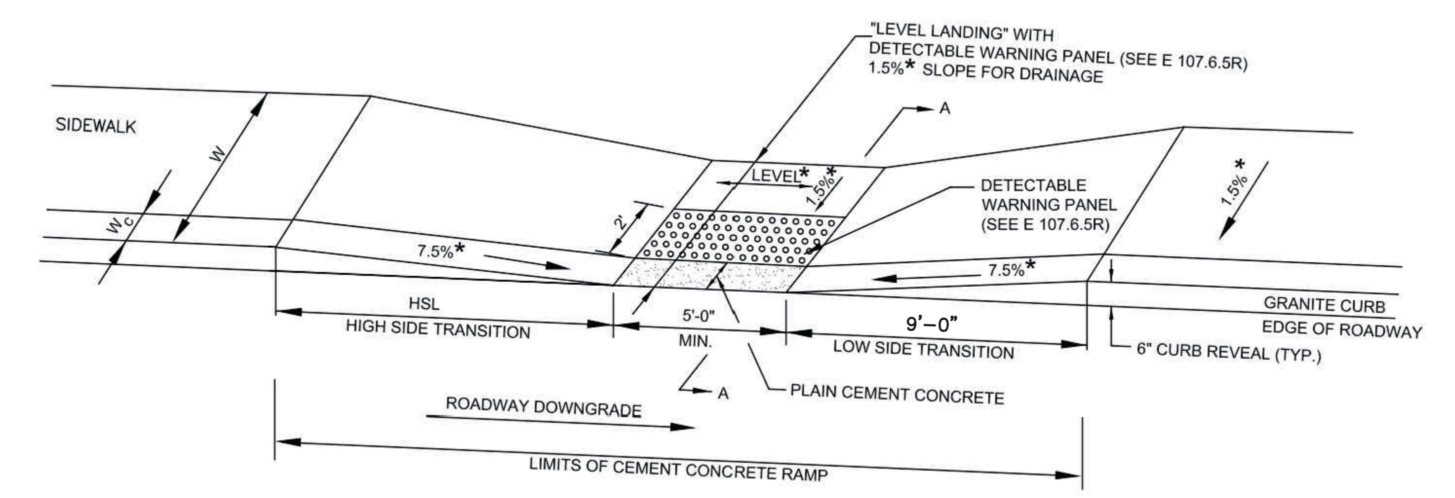
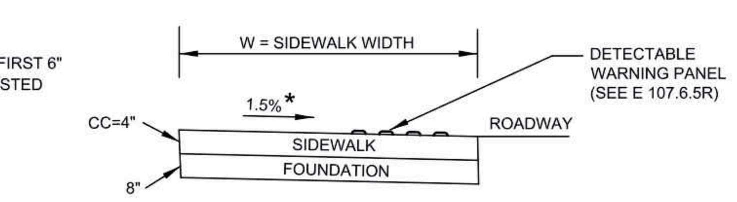


LEGEND
HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0R)
W = SIDEWALK WIDTH
W_C = CURB WIDTH
CC = CEMENT CONCRETE
★ = TOLERANCE FOR CONSTRUCTION ±0.5%
USABLE SIDEWALK WIDTH PER AAB = W-Wc
USABLE SIDEWALK WIDTH PER AAB IS NOT TO BE LESS THAN 4'0"
SEE E 107.6.5R FOR DETAILS OF DETECTABLE WARNING PANEL

NOTE:
ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO BE ADJUSTED FOR FIELD CONDITIONS



SECTION A-A

WHEELCHAIR RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL (MASSDOT E107.2.1R)
NOT TO SCALE

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CONSTRUCTION DETAILS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CD-501

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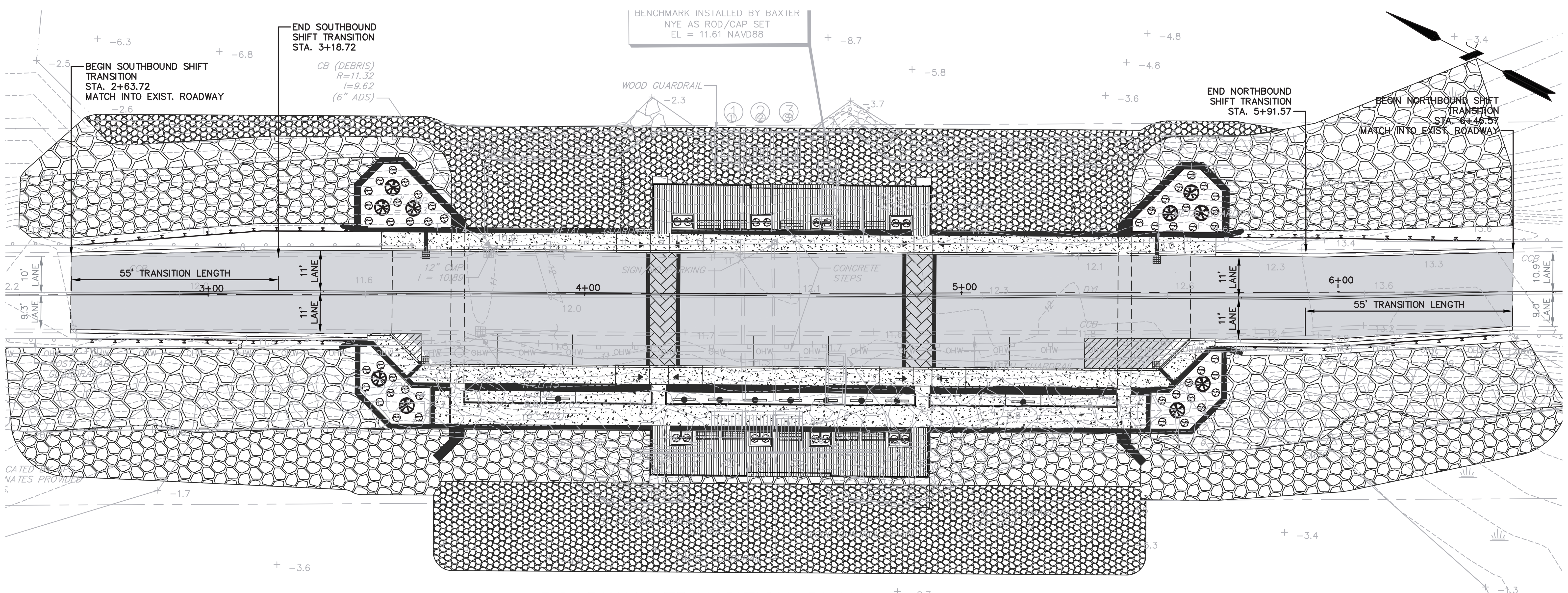
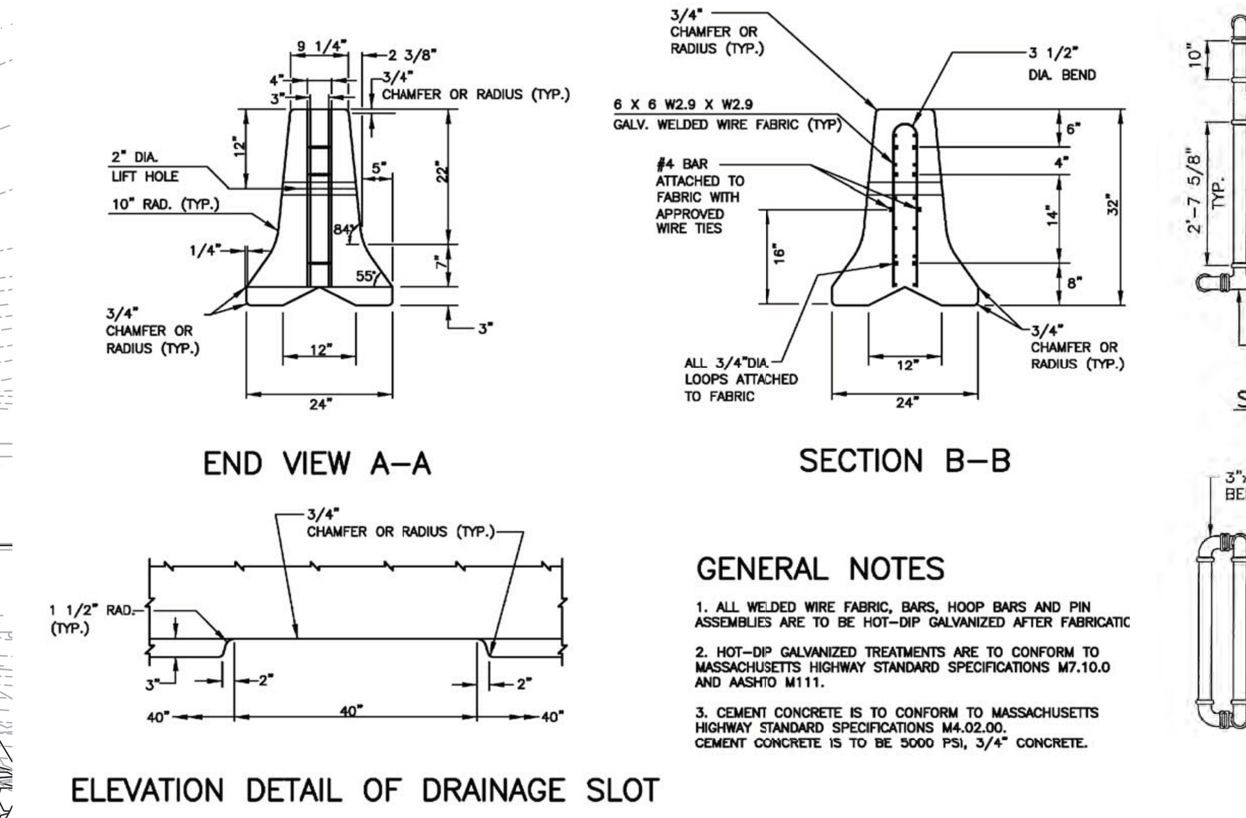


ROADWAY TRANSITION PLAN

SCALE: 1"=20'



GENERAL NOTES

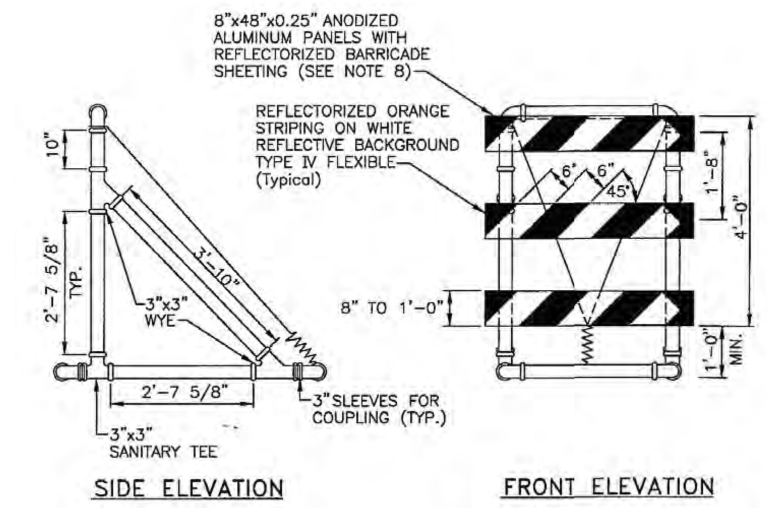
1. ALL WELDED WIRE FABRIC, BARS, HOOP BARS AND PIN ASSEMBLIES ARE TO BE HOT-DIP GALVANIZED AFTER FABRICATIO

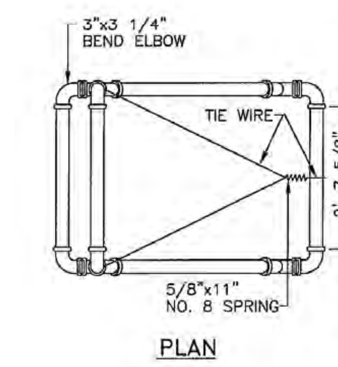
2. HOT-DIP GALVANIZED TREATMENTS ARE TO CONFORM TO MASSACHUSETTS HIGHWAY STANDARD SPECIFICATIONS M7.10.0 AND AASHTO M111.

3. CEMENT CONCRETE IS TO CONFORM TO MASSACHUSETTS HIGHWAY STANDARD SPECIFICATIONS M4.02.00. CEMENT CONCRETE IS TO BE 5000 PSI, 3/4" CONCRETE.

PRECAST PORTABLE CONCRETE BARRIER
(MASSDOT E403.2.0)

NOT TO SCALE

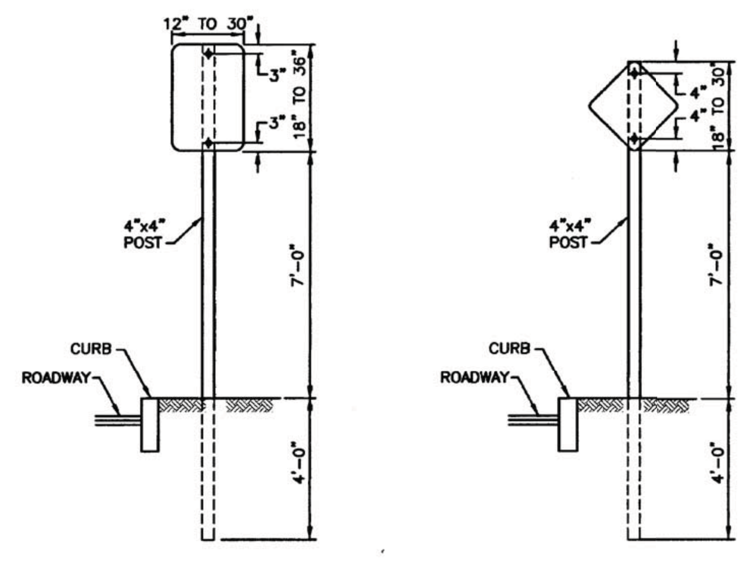




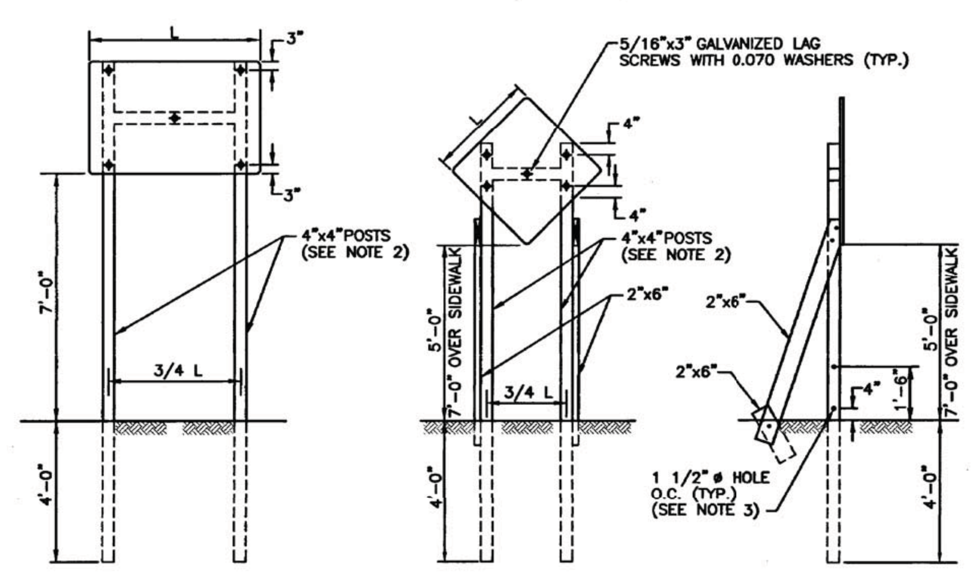
NOTES:
1. SHALL BE IN ACCORDANCE WITH SECTION 923 OF THE R.I. STANDARD SPECIFICATIONS.
2. ALL PIPE SHALL BE POLYVINYL CHLORIDE (PVC) PRESSURE RATED CLASS SDR 21 OR SDR 26 CONFORMING TO ASTM D2241 OR ASTM D2729.
3. JOINT FILLINGS MAY BE PVC–ASTM D 2665 OR ACRYLONITILE BUTADIENE STYRENE (ABS) ASTM D 2661 (DRAINAGE WASTE AND VENT).
4. ALL PIPES SHALL BE WHITE. WHITE FITTINGS ARE PREFERRED, BLACK MAY BE USED.
5. ALL JOINTS SHALL BE FREE TO SEPARATE UPON VEHICLE IMPACT.
6. A FIXED FRANGIBLE PAVEMENT CONNECTION PREFERRED. SAND BAGS MAY BE SUBSTITUTED.
7. STRIPES SHALL BE SLOPED DOWNWARD IN DIRECTION OF TRAFFIC TO PASS.
8. PVC PIPE SHALL BE ULTRAVIOLET LIGHT STABILIZED.
9. ATTACH PANELS WITH 1" NO. 14 PAN HEAD METAL SCREWS.

PVC PLASTIC PIPE
TYPE III BARRICADE

NOT TO SCALE



SIGNS UP TO 10 SQ. FT.

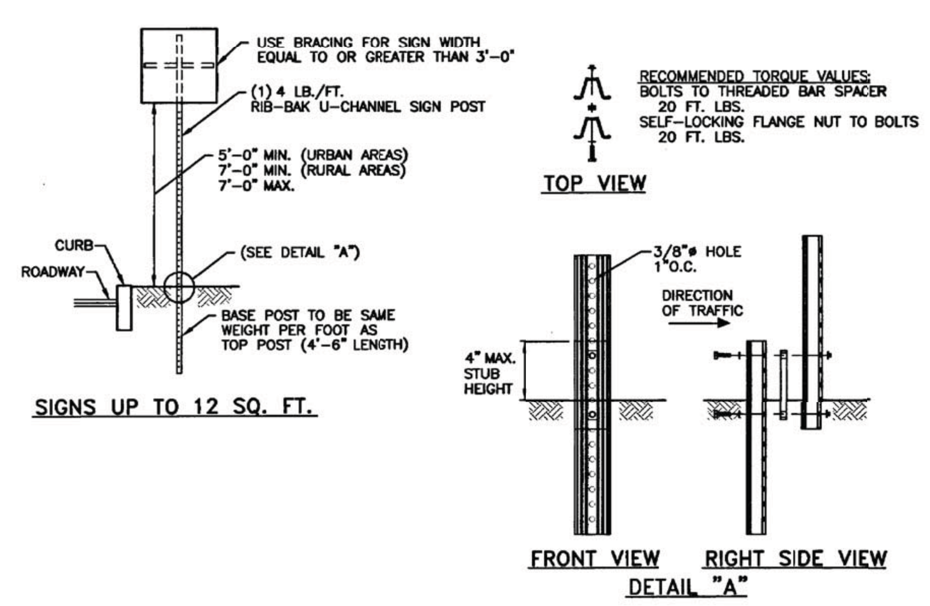


SIGNS UP TO 60 SQ. FT.

NOTES:
1. SHALL BE IN ACCORDANCE WITH SECTION 840 OF THE MASSACHUSETTS DOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, 1988 EDITION INCLUDING THE LATEST SUPPLEMENTAL AND INTERIM SPECIFICATIONS.
2. USE (2) 4"x6" POSTS FOR SIGNS GREATER THAN 20 SQ. FT.
3. DRILL 1-1/2"ø HOLES FOR 4"x6" POSTS ONLY.
4. FOR SIGNS 5'-0"x5'-0" AND LARGER USE DIAGONAL BRACING ON EACH VERTICAL POST AND 4 LAG SCREWS
5. CONSTRUCTION AND TEMPORARY SIGN LABELS SHALL BE 3/4" THICK EXTERIOR GRADE PLYWOOD OR ALUMINUM.
6. ALL SIGN SUPPORTS (INCLUDING TEMPORARY) MUST BE SUCCESSFULLY CRASH TESTED.

CONSTRUCTION AND TEMPORARY SIGN
MOUNTINGS (SIGNS UP TO 60 SQ. FT.)

NOT TO SCALE

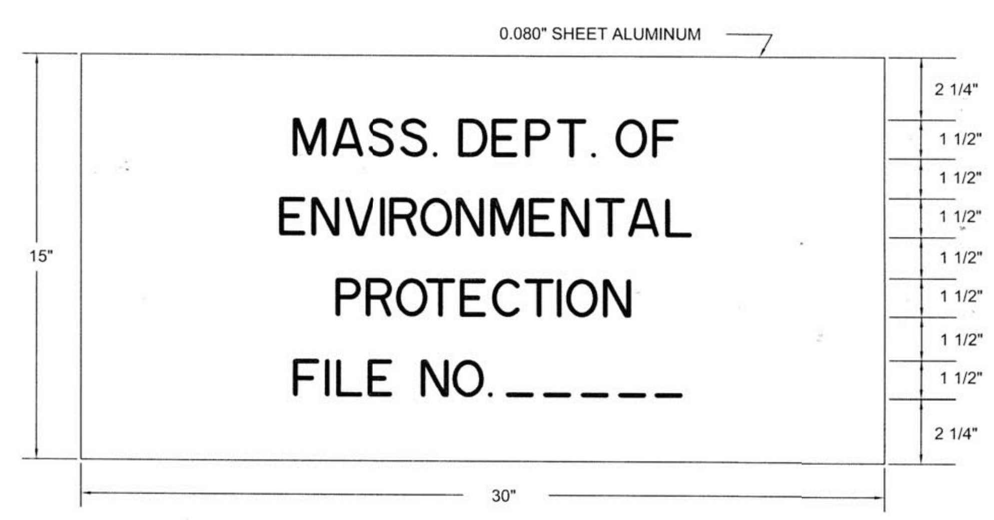


INSTALLATION PROCEDURE:
1. REMOVE A SPADE FULL OF SOIL (APPROXIMATELY 2" DEEP) FROM WHERE THE BASE POST WILL BE LOCATED.
2. DRIVE THE BASE POST IN THE CENTER OF THE HOLE JUST CREATED, TO WITHIN 4" OF GRADE LEVEL.
3. PLACE ONE BOLT AND FLAT WASHER IN THE TOP HOLE OF THE BASE POST. (IF THE TOP HOLE ON THE BASE POST, OR THE BOTTOM HOLE ON THE TOP POST IS LESS THAN 3/4" FROM END OF THE POST USE THE SECOND AND SIXTH HOLES.) WITH THE THREADED BAR SPACER ALIGNED WITH TOP HOLE ON THE BACK SIDE OF THE BASE POST, SECURELY TIGHTEN THE BOLT TO 20 FT. LBS. OF TORQUE. REPEAT THIS PROCESS FOR THE LOWER BOLT.
4. NEST THE TOP POST OVER THE PROTRUDING BOLTS ON THE BASE POST. PLACE A SELF-LOCKING FLANGE NUT ON EACH BOLT AND TIGHTEN SECURELY TO 20 FT. LBS. OF TORQUE.
5. REPLACE SOIL REMOVED IN STEP 1.
6. IN TRIPLE POST INSTALLATIONS USING 4 LB./FT. POSTS IN WEAK SOIL, A 1'-0"W x 6"H SOIL PLATE IS REQUIRED.

NOTES:
1. SHALL BE IN ACCORDANCE WITH SECTION T.15 OF THE R.I. STANDARD SPECIFICATIONS.
2. THE SIVER ANODIZED BAR SPACER IS FOR USE WITH 2, 2.5 AND 2.75 LB./FT. RIB-BAK POST GRADE SP-80 ONLY.
3. THE GOLD ANODIZED BAR SPACER IS FOR USE WITH 3 AND 4 LB./FT. RIB-BAK POST GRADE SP-80 ONLY.
4. INSTALLATION PROCEDURES SHALL BE IN ACCORDANCE WITH THE MANUFACTURE'S RECOMMENDATIONS.

SIGN POST INSTALLATION DETAIL FOR
U-CHANNEL POST

NOT TO SCALE



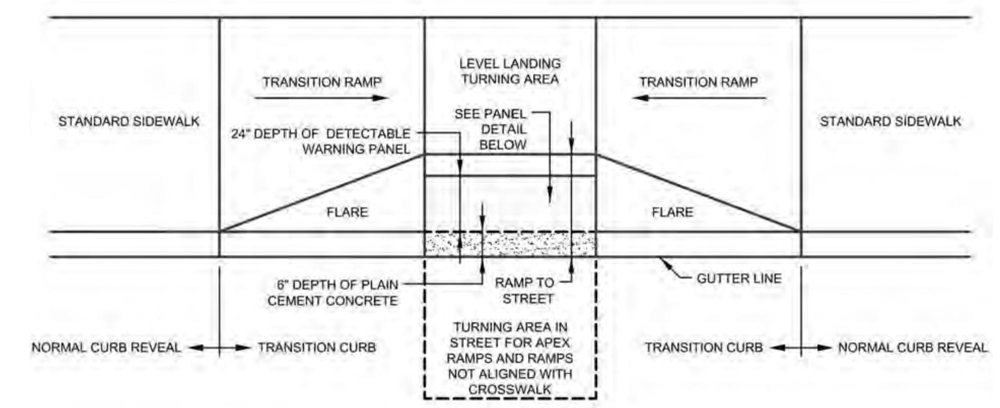
COLORS — LEGEND - BLACK (NON-REFLECTORIZED)
BACKGROUND - WHITE (REFLECTORIZED)

THE SIGN IS TO BE MOUNTED ON A MASSDOT HIGHWAY DIVISION STANDARD "P-5" POST

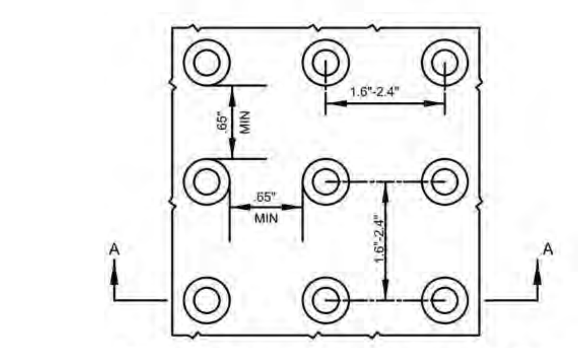
NOTES:
1. THE SIGN IS PLACED ON ALL PROJECTS SUBJECT TO THE PROVISIONS OF THE MASSACHUSETTS WETLANDS PROTECTION ACT.
2. THE LOCATION OF THE SIGN IS TO BE DETERMINED BY THE ENGINEER.
3. SEE SPECIAL PROVISIONS FOR THE MANUFACTURE, MAINTENANCE, ERECTION AND REMOVAL RESPONSIBILITIES.
4. USE SERIES "D" FOR LETTERING.

WETLANDS PROTECTION ACT SIGN
(MASSDOT E501.1.0)

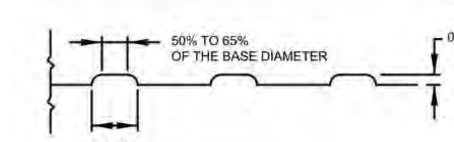
NOT TO SCALE



TYPICAL INSTALLATION



DETAIL OF DETECTABLE WARNING PANEL



SECTION A-A

NOTE:

PANELS MAY BE CONCRETE PRECAST OR CAST IN PLACE OR OTHER SUITABLE MATERIAL PERMANENTLY APPLIED TO THE RAMP. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT.

DETECTABLE WARNING PANEL FOR WHEELCHAIR
RAMPS AND STANDARD RAMP TERMINOLOGY
(MASSDOT E107.6.5R)

NOT TO SCALE

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
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DATUM:
HORZ.: NAD83
VERT.: NAVD88
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FRIENDS OF HERRING RIVER

CONSTRUCTION DETAILS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT
CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CD-502

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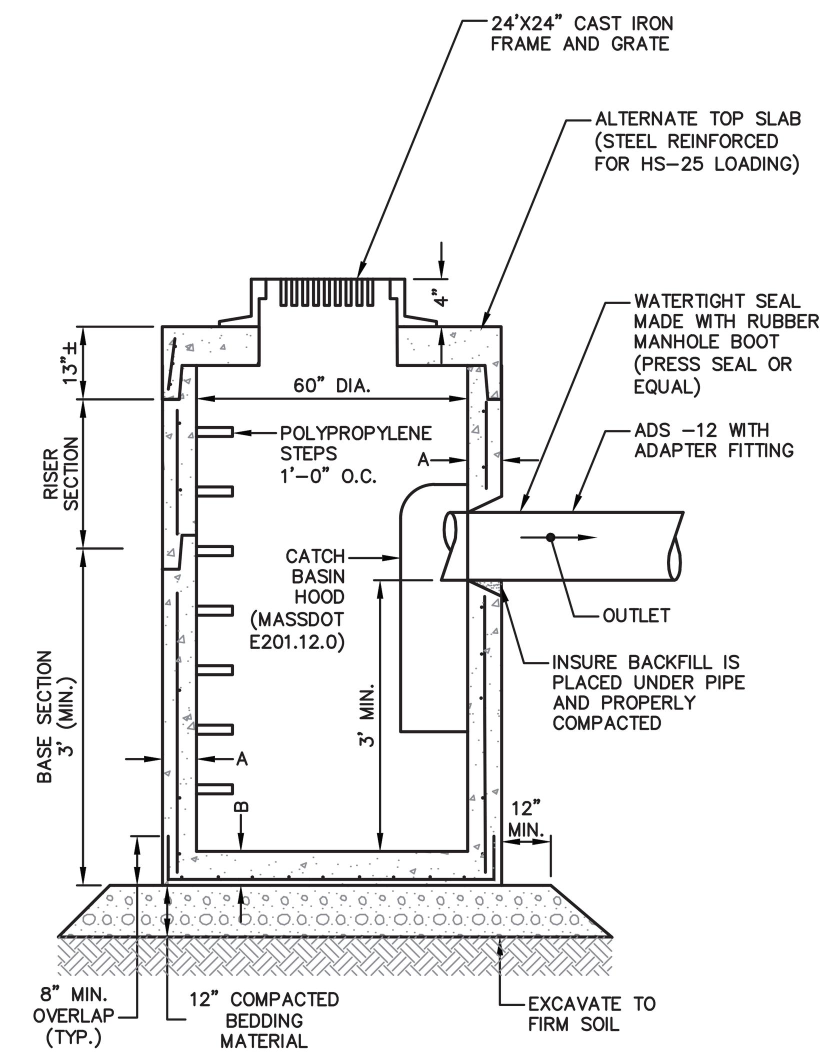


SECTION

HOODED, PRECAST CONCRETE CATCH BASIN
(5' DIAMETER)

NOT TO SCALE

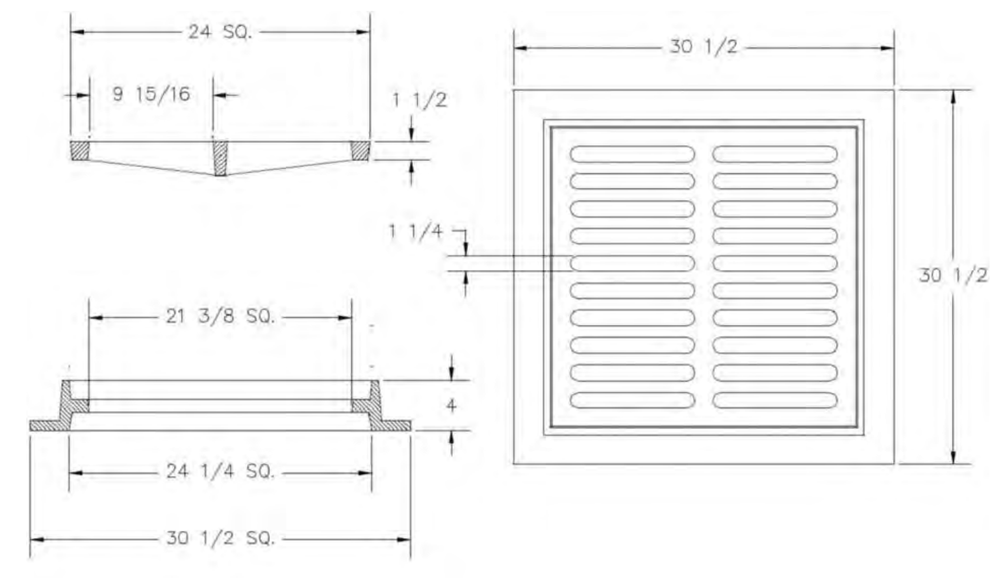
GENERAL NOTES:

1. FRAME & GRATE TO BE FOUR FLANGE USF 4132 & 6230, RESPECTIVELY, AS MANUFACTURED BY US FOUNDRY OR APPROVED EQUAL. FRAME HEIGHT SHALL NOT EXCEED 4-INCHES.
2. FRAME & GRATE SHALL BE ASTM-A48 CLASS 35B GRAY IRON, HEAVY DUTY.
3. SEE TABLE 1 FOR STEEL REINFORCEMENT REQUIREMENTS.
4. STEEL REINFORCEMENT FOR BASE SECTION BOTTOM SHALL BE A MINIMUM OF 0.15 SQ.IN./LIN.FT. (BOTH WAYS) FOR 5' DIA. BASINS.
5. CONCRETE SHALL BE COMPRESSIVE STRENGTH 4000 PSI TYPE II CEMENT PER ASTM C-478.
6. CATCH BASIN DESIGN SHALL CONFORM TO ASTM C-478 FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS."
7. ONE POUR MONOLITHIC BASE SECTION.
8. JOINTS SHALL BE SEALED USING BUTYL RUBBER JOINT SEALANT PER ASTM C-990 & AASHTO M-198.
9. STEPS SHALL BE CONSTRUCTED OF POLYPROPYLENE COATED GRADE 60 REINFORCING BARS PER ASTM C-478 AND OSHA STD. 1-1.9.

TABLE 1

CATCH BASIN DIAMETER (D)	A	B	CIRCUMFERENTIAL STEEL REINFORCEMENT REQUIRED*
5'-0"	6"	8"	.15 SQ.IN. / LIN.FT.

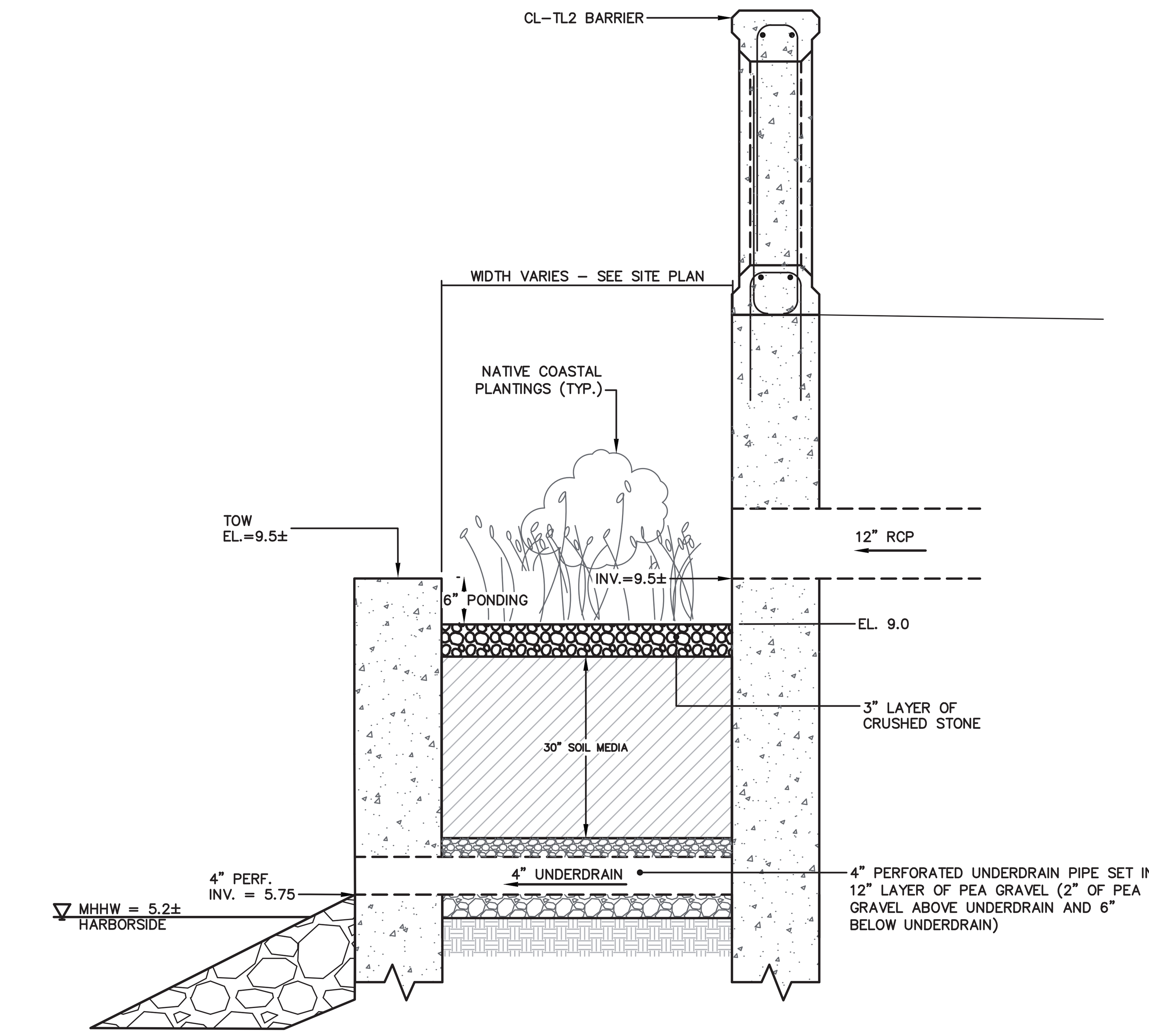
* FOR LONGITUDINAL (VERTICAL STANDING) REINFORCEMENT REFER TO ASTM C478, ITEM 8.1.2



NOTES:
1- MATERIAL: ASTM-A48 CLASS 35B GRAY IRON
2- FRAME WT: 160 LBS APP.
3- GRATE WT: 150 LBS. APP.

TYPICAL CATCH BASIN FRAME & GRATE

NOT TO SCALE



STORMWATER FILTER SECTION – PLANTER NOs. 1&2

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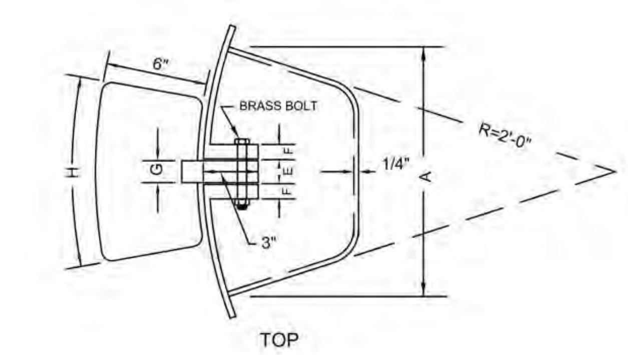
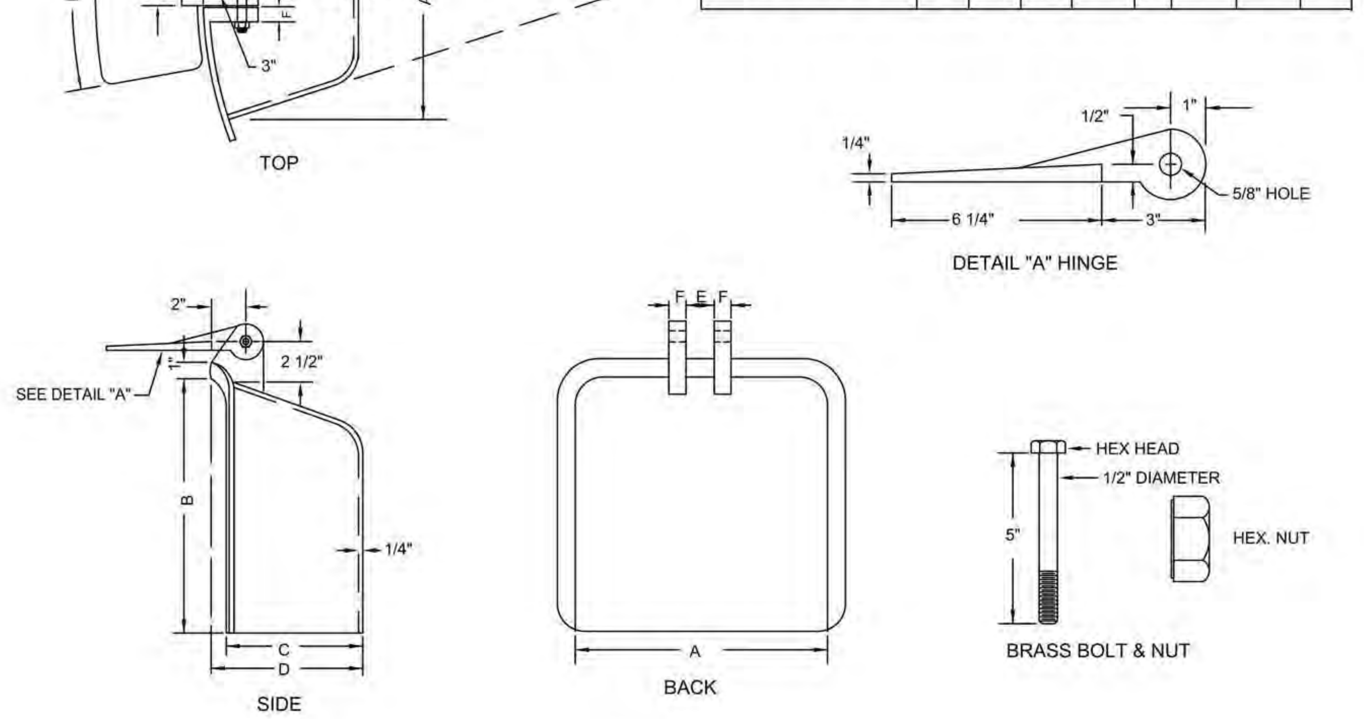


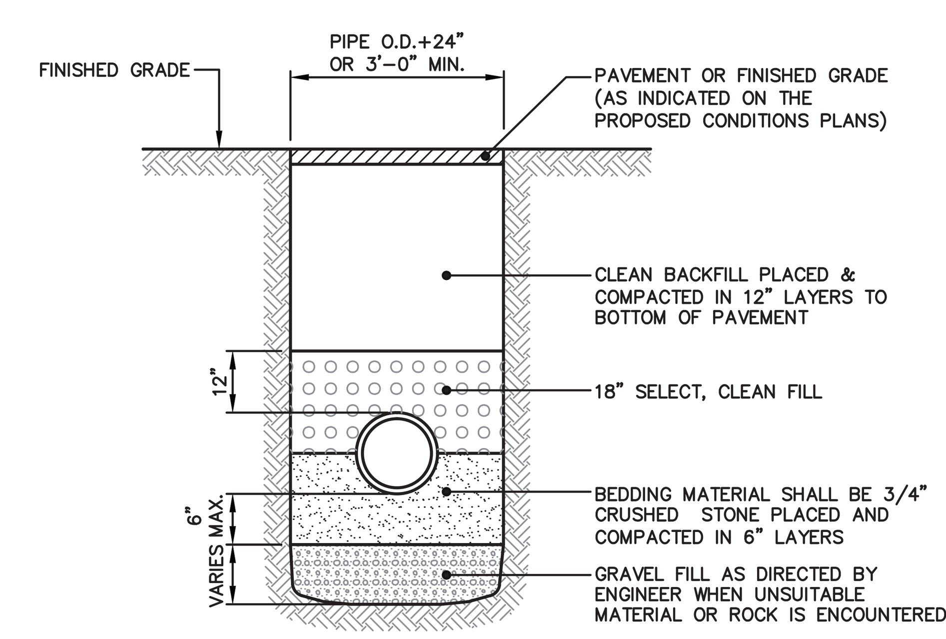
DIMENSIONS (in.)	A	B	C	D	E	F	G	H
8" and 10" PIPE	15	15	8	9	2	7/8	1 7/8	14
12" and 15" PIPE	18	18	10	11 1/4	2	1	1 7/8	14



NOTE:
1. HOODS TO BE GRAY CAST IRON AASHTO CLASS #30

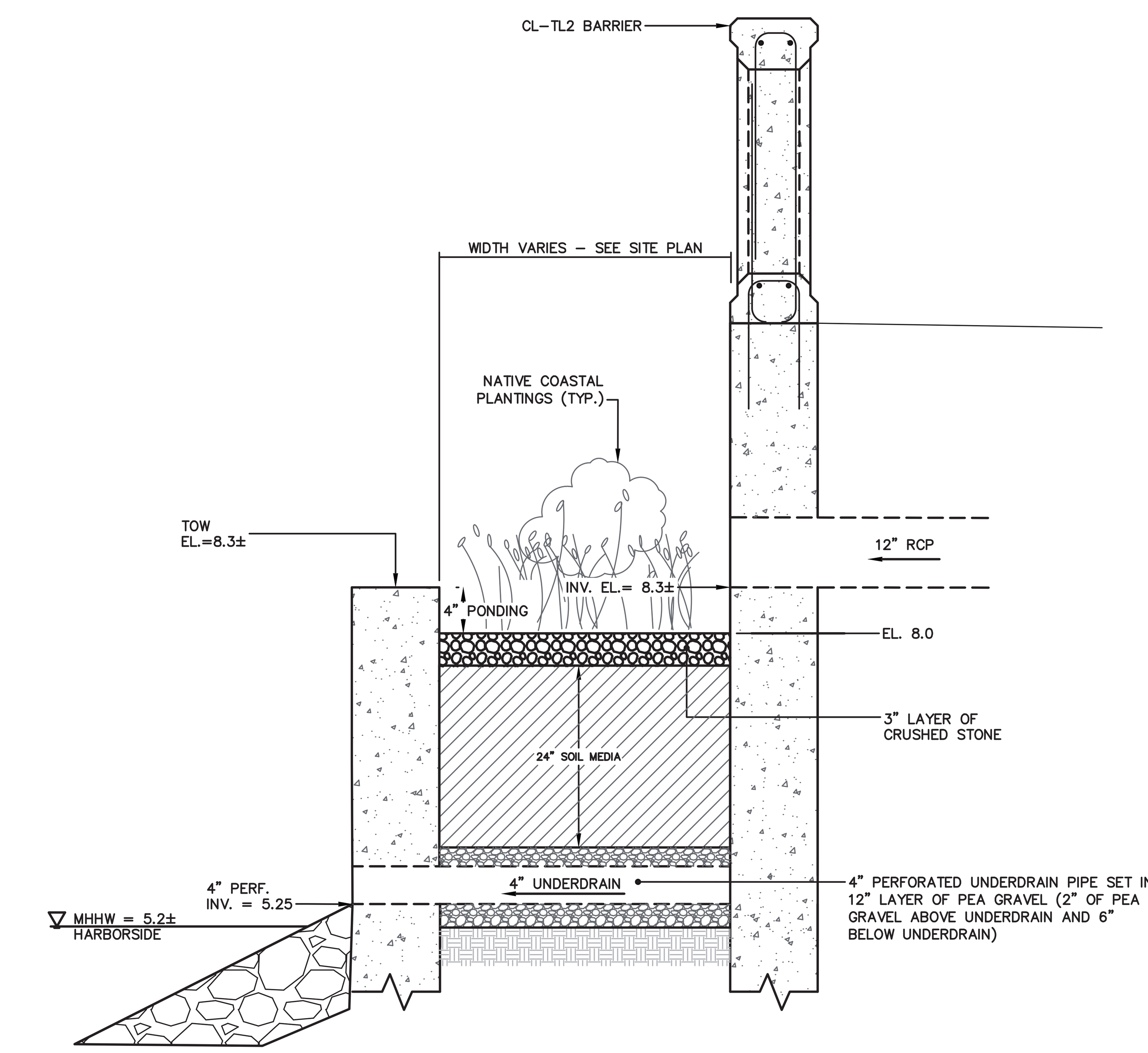
CATCH BASIN HOOD
(MASSDOT E201.12.0)

NOT TO SCALE



TYPICAL STORM DRAIN
TRENCH DETAIL

NOT TO SCALE



STORMWATER FILTER SECTION – PLANTER NOs. 3&4

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FRIENDS OF HERRING RIVER

CONSTRUCTION DETAILS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CD-503

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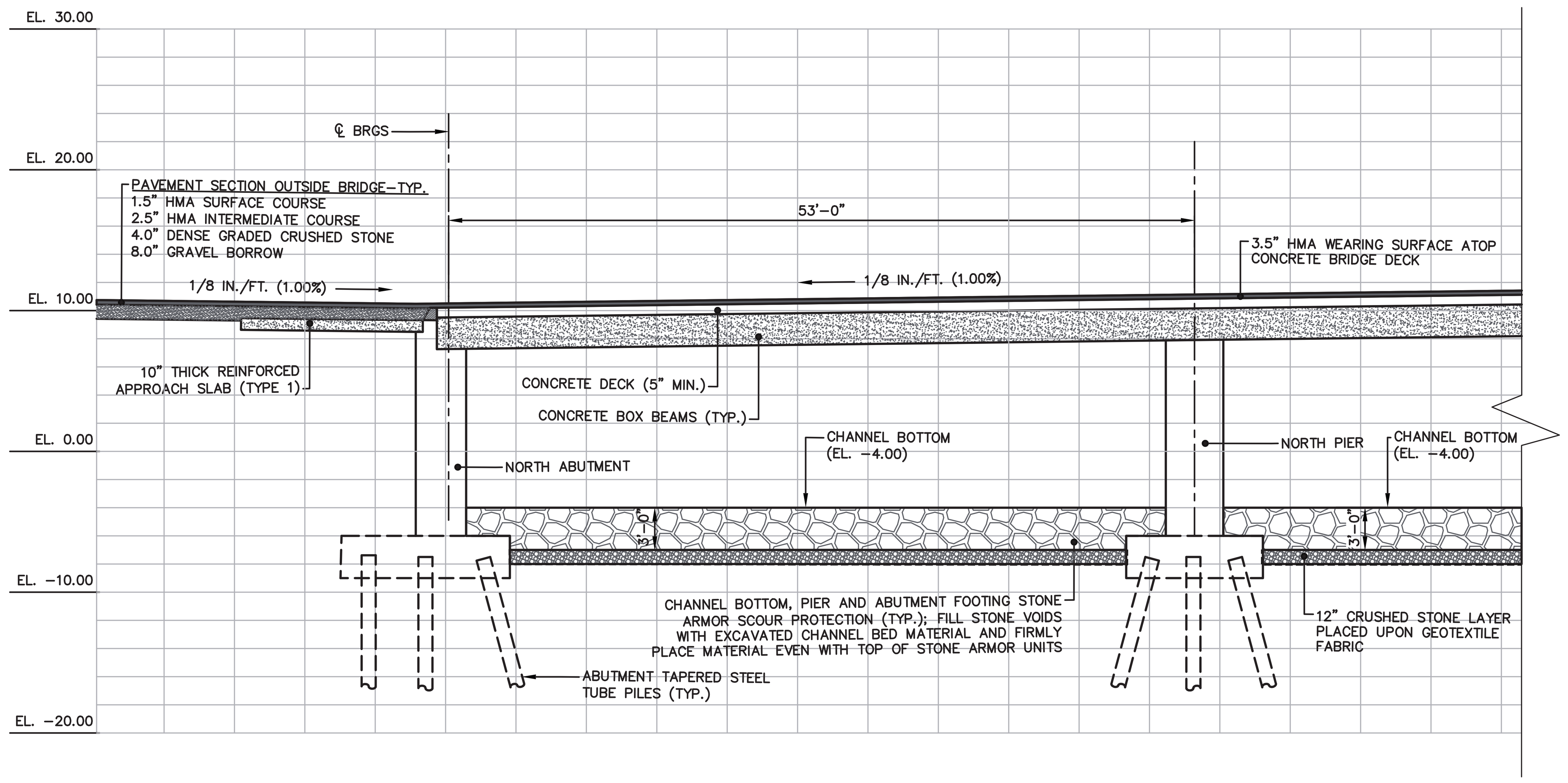
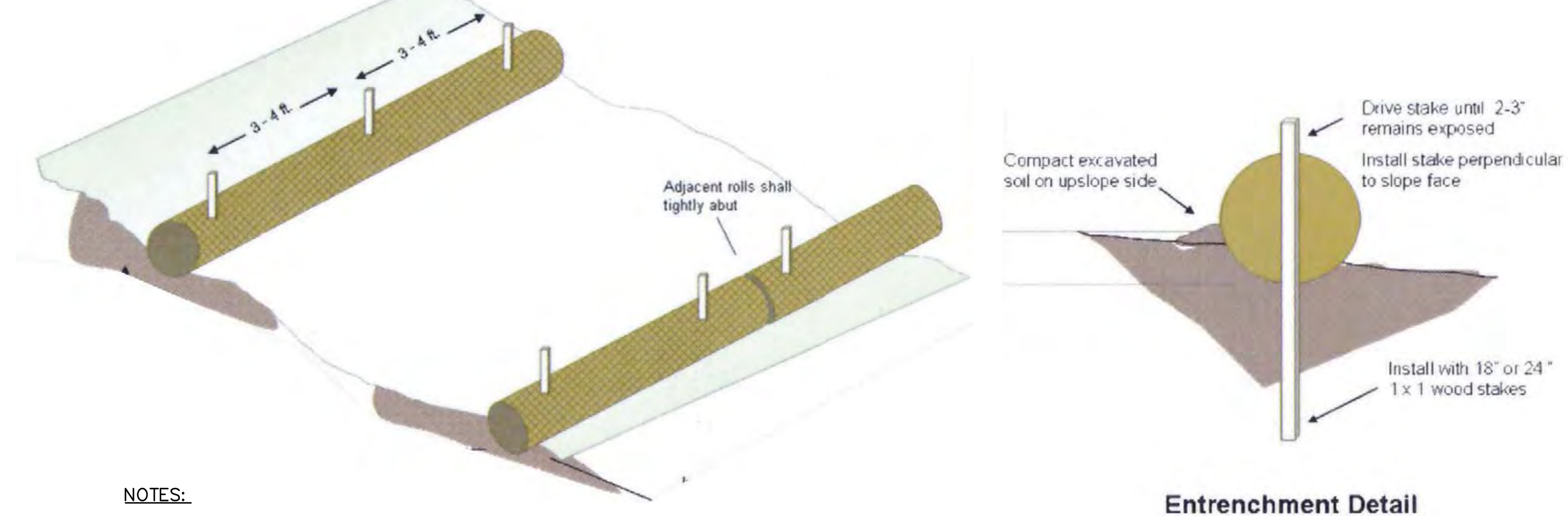


TYPICAL BRIDGE ABUTMENT AND PIER FOOTING SCOUR PROTECTION

SCALE: 1/8"= 1'-0"

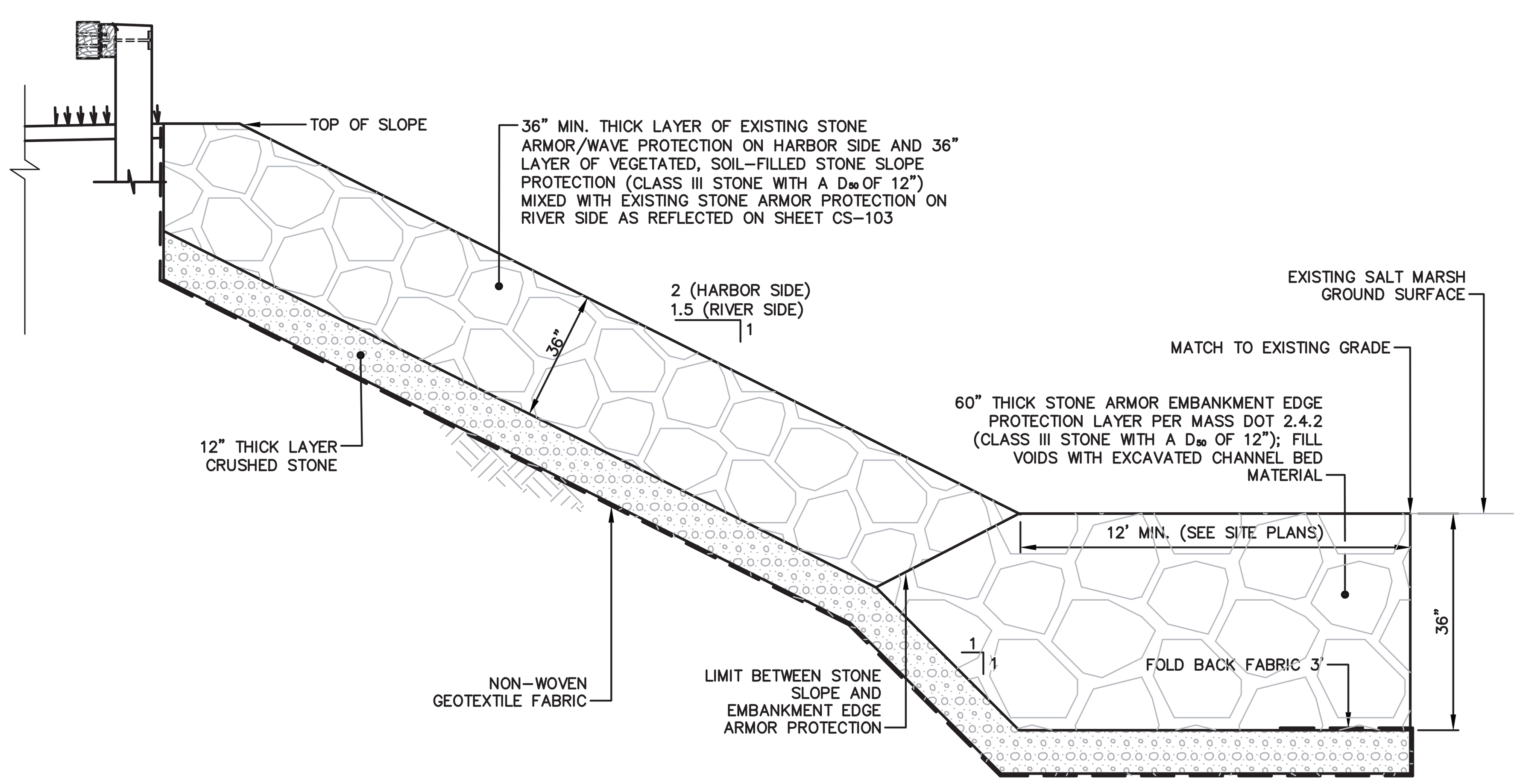


NOTES:

1. 12-INCH DIAMETER COIR ROLLS SHALL BE INSTALLED WHERE INDICATED ON THE CONTRACT DRAWINGS AND BE CONSTRUCTED OF 100% BIODEGRADABLE MATERIAL. A ROW OF COIR ROLLS (WEIGHTED DOWN AND NOT STAKED) SHALL ALSO BE INSTALLED AROUND ANY SOIL STOCKPILE AREAS UTILIZED BY THE CONTRACTOR DURING CONSTRUCTION IN PAVED AREAS.
2. COIR ROLLS SHALL BE TRENCHED APPROXIMATELY 2-3 INCHES AND STAKED SUCH THAT COIR ROLLS DIRECTLY CONTACT SOIL AND PRECLUDE UNDERMINING OR BLOWOUTS. THE TRENCH SHALL BE APPROXIMATELY 9 INCHES WIDE. STAKES SHALL BE DRIVEN THROUGH THE CENTER OF THE COIR ROLL AT A SPACING OF 3-4 FEET ON CENTER AND NO GREATER THAN 6" FROM THE EACH END OF THE COIR ROLL. STAKES SHALL BE 1-INCH BY 1-INCH WOODEN STAKES WITH A LENGTH OF 18-24 INCHES. COMPACT SOIL EXCAVATED TO CREATE TRENCH ON UPHILL SIDE SIDE.
3. ENDS OF ADJACENT COIR ROLLS SHALL BE TIGHTLY BUTTED OR OVERLAPPED SO THAT NO OPENING EXISTS FOR WATER TO PASS THROUGH. COIR ROLLS SHALL BE FREE OF DAMAGE OR DEFECTS WHEN DELIVERED TO THE SHIPPER. NO VEHICLES SHALL BE DRIVEN OVER COIR ROLLS.

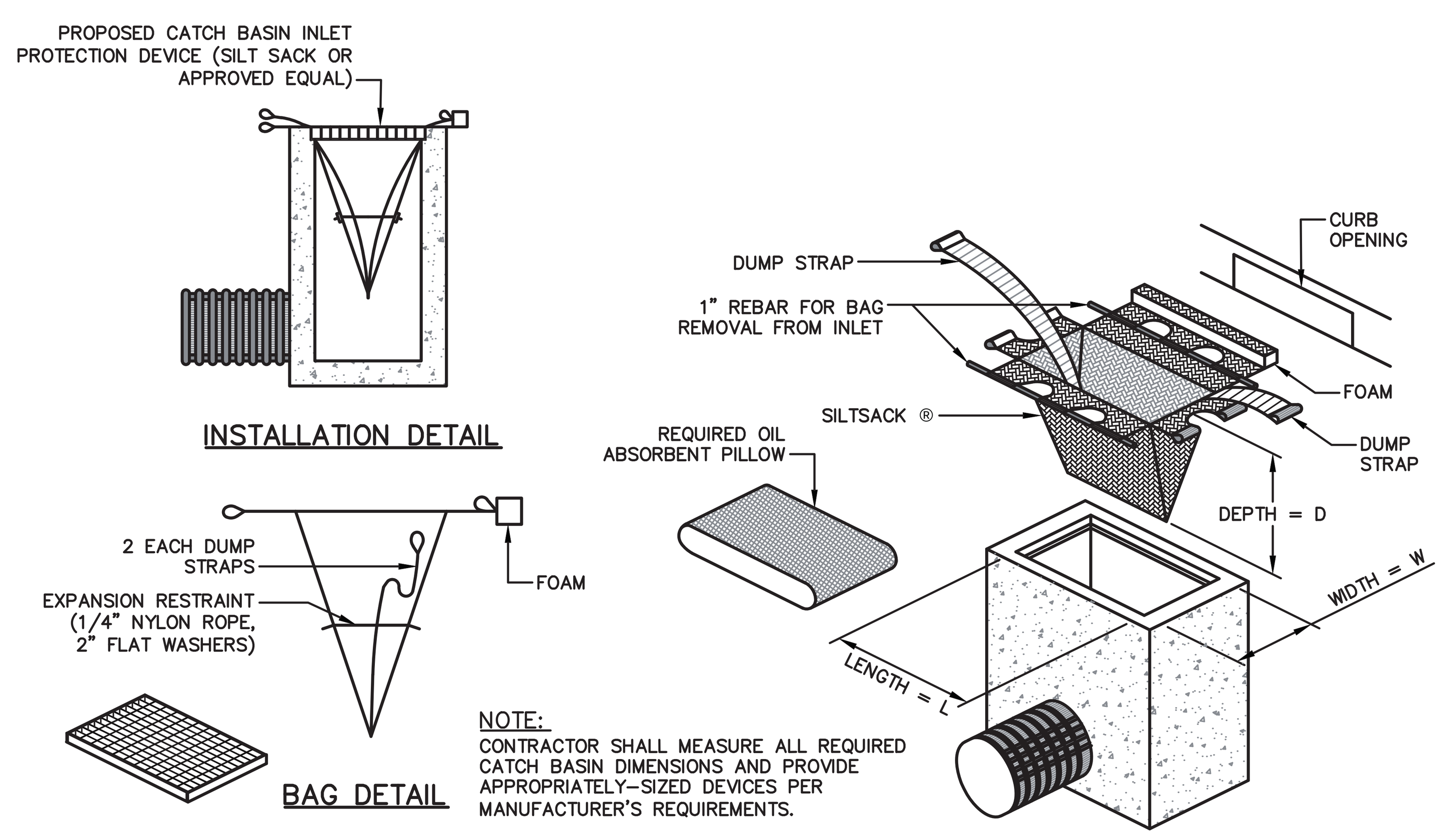
BIODEGRADABLE WATTLE/SEDIMENT TUBE

NOT TO SCALE



SOIL-FILLED STONE EMBANKMENT SLOPE AND TOE PROTECTION

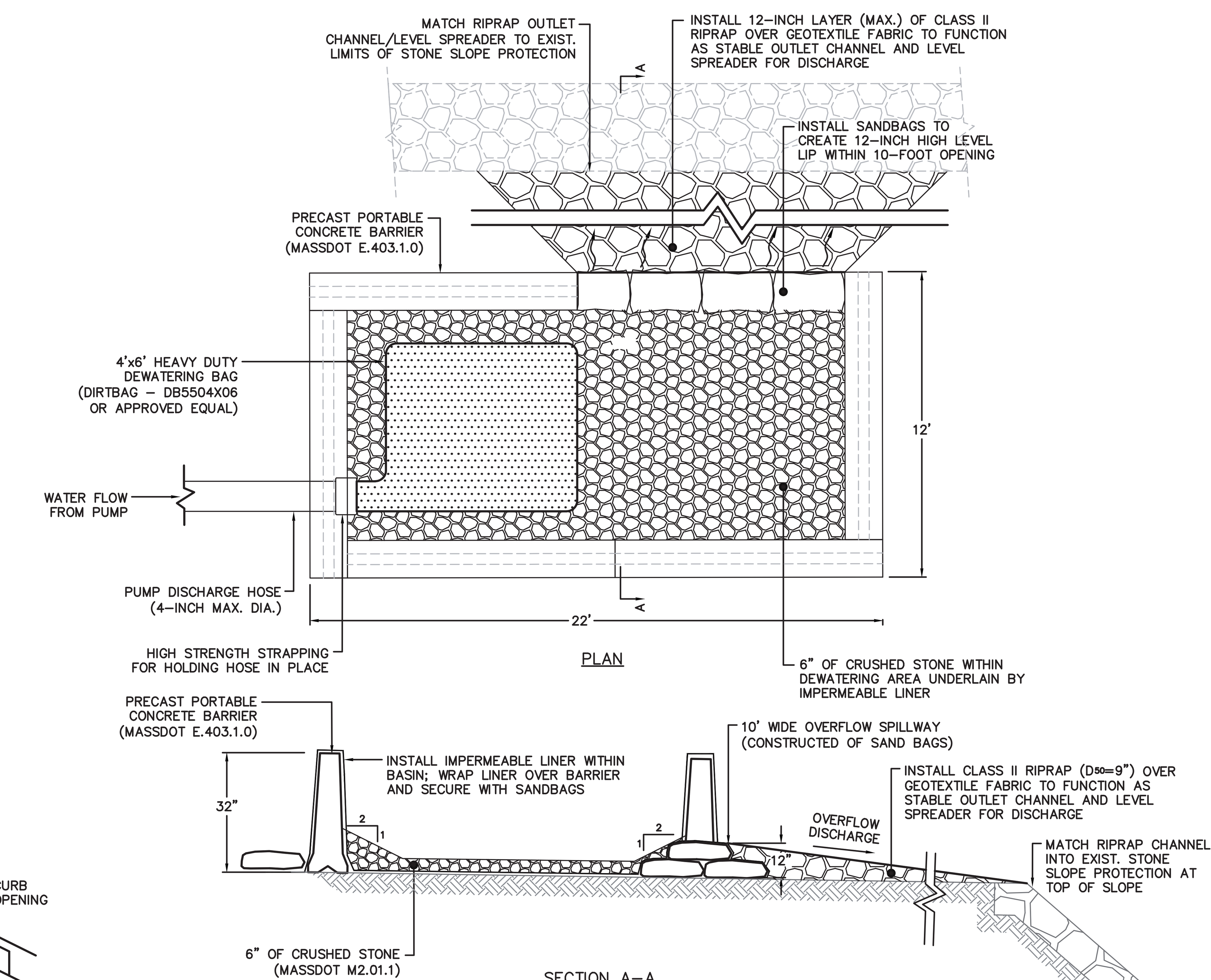
NOT TO SCALE



NOTE:
CONTRACTOR SHALL MEASURE ALL REQUIRED CATCH BASIN DIMENSIONS AND PROVIDE APPROPRIATELY-SIZED DEVICES PER MANUFACTURER'S REQUIREMENTS.

CATCH BASIN INLET PROTECTION

NOT TO SCALE



NOTES:

1. THE DEWATERING BAG, DIRTBAG DB 55 OR APPROVED EQUAL, SHALL BE HEAVY DUTY AND CONSIST OF A NONWOVEN BAG SEWN WITH A DOUBLE NEEDLE MATCHING USING A HIGH STRENGTH THREAD.
2. EACH DEWATERING BAG SHALL HAVE A FILL SPOUT LARGE ENOUGH TO ACCOMMODATE A 4-INCH DISCHARGE HOSE. THE BAG SHALL BE PROVIDED WITH STRAPS TO SECURE THE HOSE AND PREVENT PUMPED WATER FROM ESCAPING WITHOUT BEING FILTERED.
3. MAINTAIN DEWATERING BAG(S) AS NECESSARY TO EFFICIENTLY FILTER SEDIMENT OR PASS WATER AT A REASONABLE RATE. USE OF EXCESSIVE FLOW RATES OR OVERFILLING DIRTBAG OF THE HOSE ATTACHMENT STRAPS WITH SEDIMENT WILL CAUSE RUPTURES OF THE BAGS OR FAILURE.
4. DISPOSE OF DEWATERING BAG AND CONTENTS AT OFF-SITE DISPOSAL FACILITY IN ACCORDANCE WITH LOCAL, STATE, AND/OR FEDERAL REGULATIONS.
5. INSTALL DEWATERING BAG AND CRUSHED STONE BEDDING WITH A SLOPE SO INCOMING WATER FLOWS DOWNHILL THROUGH THE BAG WITHOUT CREATING MORE EROSION. STRAP THE NECK OF DEWATERING BAG TIGHTLY TO THE DISCHARGE HOSE.
6. GEOTEXTILE FILTER FABRIC SHALL CONSIST OF A NONWOVEN GEOTEXTILE FABRIC CONFORMING TO TYPE III FABRIC IN ACCORDANCE WITH TABLE III, SECTION M.9.50.0 OF THE MASSDOT STANDARD SPECIFICATIONS.
7. THE IMPERMEABLE LINER SHALL CONSIST OF A 30-MIL THICK PVC LINER.

CONSTRUCTION DEWATERING DISCHARGE
FILTER BAG AND SETTLING BASIN

NOT TO SCALE

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FRIENDS OF HERRING RIVER

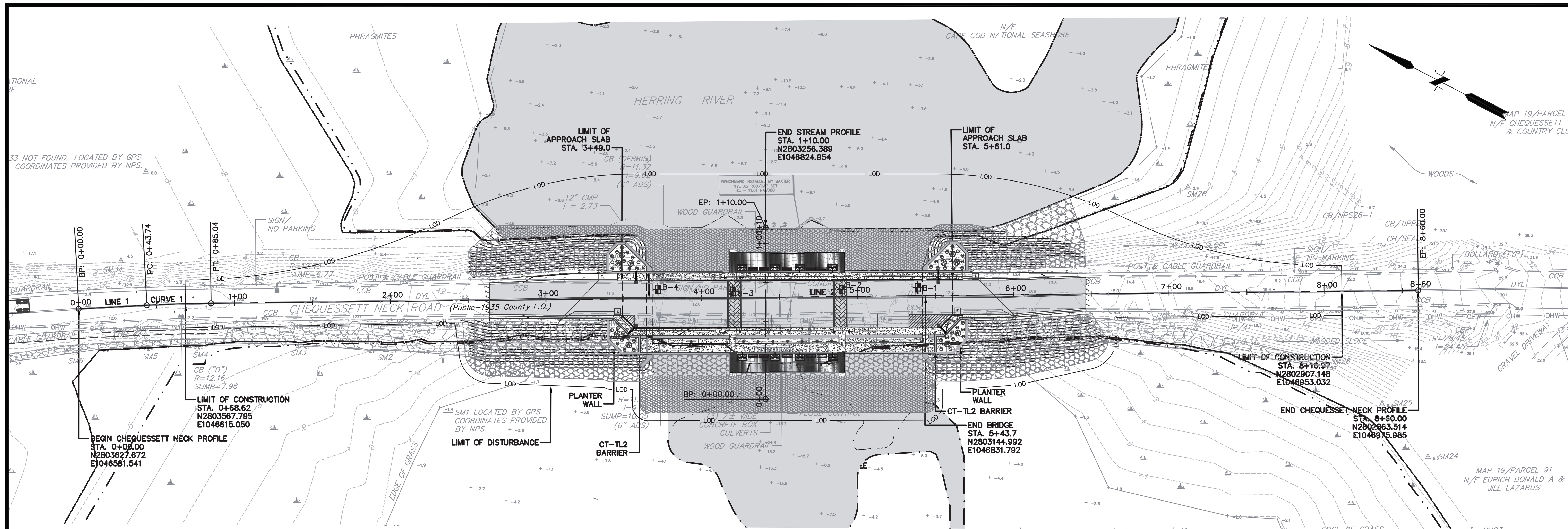
CONSTRUCTION DETAILS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

CD-504



KEY PLAN
SCALE: 1"= 40'

LINE TABLE		
LINE	LENGTH	BEARING
1	43.74	S29°29'28"E
2	774.96'	S27°07'29"E

CURVE TABLE					
CURVE	DELTA	RADIUS	ARC LENGTH	TANGENT	CHORD
1	2°21'58"	1000.00	41.30'	20.65'	41.29'

LOCATION MAP
SCALE: 1"= 2000'

TYPE OF PROJECT: NEW BRIDGE		
BRIDGE DESIGN LOADING: HL93		
SURVEY NOTE BOOKS: SURVEY BY BAXTER NYE, INC.		
SURVEY REFERENCE: NAVD OF 1988		
TRAFFIC DATA[1]		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2020	
AVERAGE DAILY TRAFFIC – PRESENT	1078	
AVERAGE DAILY TRAFFIC – DESIGN YEAR	1180	
DESIGN HOURLY VOLUME	115	
DIRECTIONAL DISTRIBUTION	0.62	
TRUCK PERCENTAGE – AVERAGE DAY[2]	3.9%	
TRUCK PERCENTAGE – PEAK HOUR[2]	3.9%	
DESIGN SPEED	35	
DIRECTIONAL DESIGN HOURLY VOLUME	76	

NOTES:
1. TRAFFIC DATA TAKEN INCLUDED IN TABLE WAS OBTAINED FROM THE CAPE COD COMMISSION'S TRAFFIC COUNT DATA PUBLISHED FOR THE TOWN OF WELLFLEET (2013) AT WWW.CAPECODCOMMISSION.ORG. THE PRESENT ADT IS BASED ON READINGS OBTAINED 8/7/12–8/9/12 DURING THE PEAK SUMMER SEASON.
2. TRUCK PERCENTAGE BASED ON VALUE PROVIDED WITHIN CAPE COD COMMISSION'S 2013 TRAFFIC COUNTING REPORT AT CHEQUESSETT NECK ROAD (SOUTH OF DUCK HARBOR ROAD).
3. A 2020 DESIGN YEAR WAS SELECTED SELECTED SINCE MASSDOT REQUIRES THAT ALL PROJECTS BE EVALUATED USING FUTURE TRAFFIC VOLUMES. AT MINIMUM, THE FUTURE YEAR IS DEFINED AS 7 YEARS FROM THE BASE YEAR. AN ANNUAL TRAFFIC GROWTH RATE OF 1.3% WAS UTILIZED BASED ON RECOMMENDATIONS PROVIDED BY THE CAPE COD COMMISSION.
4. BENCH MARK: ROD/CAP SET AT TOP OF CONCRETE STEPS LOCATED ON EASTERN SIDE OF CHEQUESSETT NECK ROAD AT FOLLOWING CONSTRUCTION BASELINE LOCATION:
   STA. 4+68.05, 15.48' LT.
   ELEV. 11.61 (NAVD88)

DESIGN:

IN ACCORDANCE WITH THE 2012 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS 6TH EDITION WITH INTERIM SPECIFICATIONS THROUGH 2013 FOR HL–93 LOADING.

NOTES:
1. APPROVAL DOES NOT INCLUDE THE PROFILE GRADES WHICH ARE PRELIMINARY ONLY.
2. APPROVAL DOES NOT INCLUDE STRUCTURAL ANALYSIS.
3. DIMENSIONS OF STRUCTURAL MEMBERS ARE APPROXIMATE, AND WILL BE FINALIZED DURING THE FINAL DESIGN PHASE.
4. SEE 2014 GEOTECHNICAL, REPORT BY FUSS & O'NEILL INC.
5. SEISMIC GROUND SHAKING HAZARD
   DESIGN SPECTRA: A_S = 0.126
   S_{DS} = 0.271
   S_{D1} = 0.110
   SITE CLASS = E
   SEISMIC DESIGN CATEGORY (SDC) = A
6. REFER TO HERRING RIVER HYDRODYNAMIC MODELING REPORT PREPARED BY THE WOODS HOLE GROUP, INC., DATED JUNE 2012.
7. NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

HYDRAULIC DATA:

DRAINAGE AREA: 11.0 SQUARE MILES
DESIGN DISCHARGE: 41,670 CUBIC FEET PER SECOND (SEE NOTE 1)
DESIGN FREQUENCY: 100 YEARS
DESIGN VELOCITY: ≈20 TO 30 FEET PER SECOND
DESIGN HIGH WATER ELEVATION: 7.5 FEET (NAVD88) – SEE NOTE 2

NOTES:
1. THE PEAK DISCHARGE FOR THE 100–YEAR STORM EVENT IS APPROXIMATELY 31,800 CFS. THIS IS FOR THE FULLY OPEN CASE (165' WIDE AND 10' HIGH OPENING). UNDER NORMAL CONDITIONS AND ADAPTIVE MANAGEMENT CASES (GATES CLOSED) THE FLUX IS SMALLER. IT SHOULD ALSO BE NOTED THAT THE PEAK INFLUX FOR THE 100–YEAR STORM IS ACTUALLY HIGHER THAN THE DISCHARGE DUE TO THE TIDAL ASYMMETRIES (THIS IS A FLOOD DOMINATED SYSTEM). THE PEAK INFLUX IS 41,670 CFS BECAUSE THE FLOODING TIDE IS SHORTER THAN THE EBBING TIDE. AS A RESULT, THE BRIDGE IS ACTUALLY DESIGNING FOR A PEAK INFLUX, NOT DISCHARGE.
2. THE BRIDGE STRUCTURE'S FULL OPEN DIMENSIONS (I.E. WHEN ALL PANELS ARE REMOVED) HAS BEEN SIZED TO LIMIT MAXIMUM WATER SURFACE ELEVATIONS IN THE LOWER HERRING RIVER BASIN TO EL 7.5 NAVD88, AND MAXIMUM WATER SURFACE ELEVATIONS IN UPGRADIENT PORTIONS OF THE DRAINAGE SYSTEM TO RESPECTIVE ELEVATIONS BELOW THIS MAXIMUM.

BASIC FLOOD DATA:

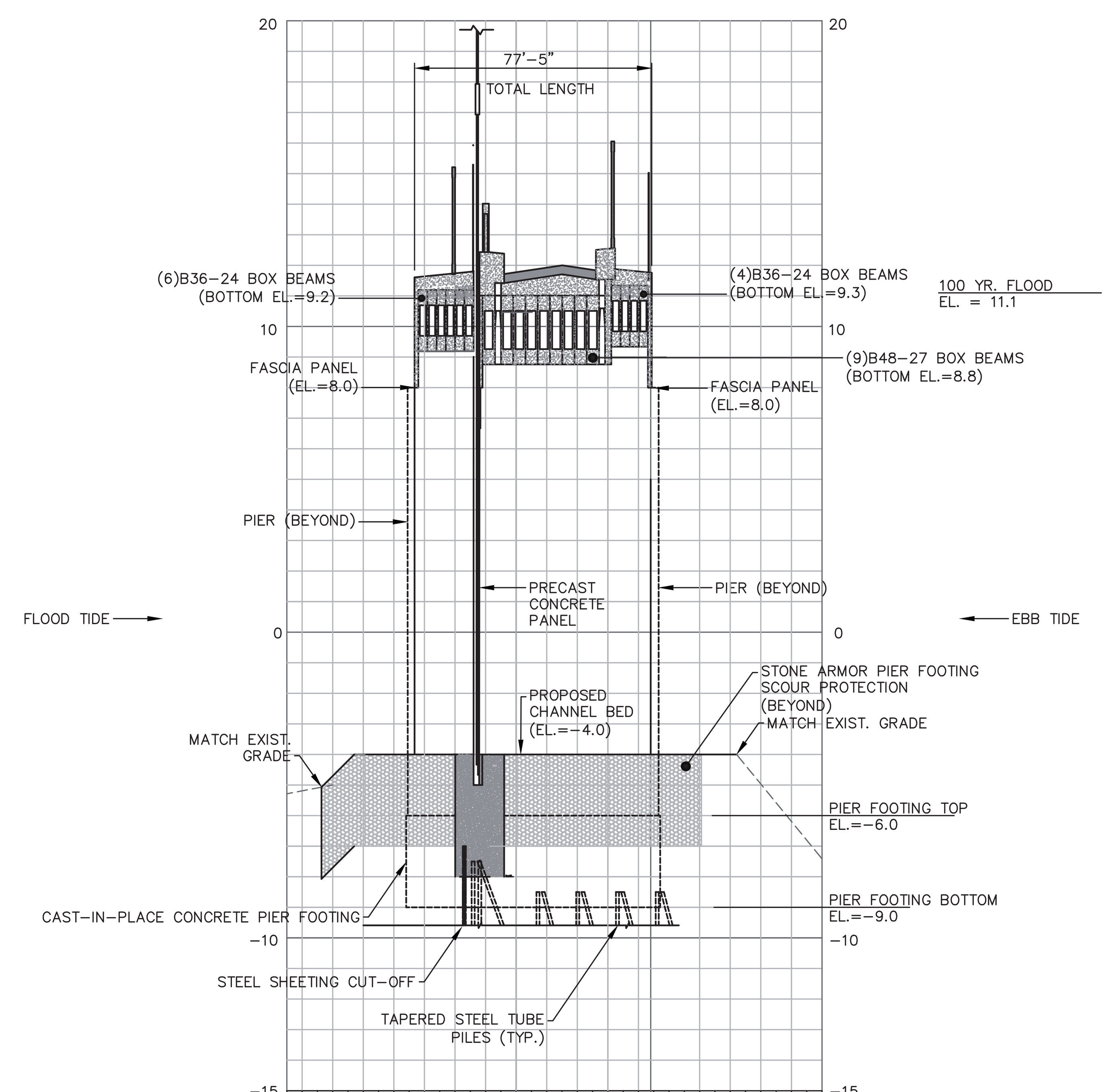
Q (100 YEAR) = NOT APPLICABLE (HERRING RIVER IS TIDALLY IMPACTED AND BFE IN FIRM WAS DETERMINED BY FEMA ACCOUNTING FOR STORM SURGE, WAVE RUNUP, AND WAVE HEIGHTS)
WATER SURFACE ELEVATION: 11.1 FEET (NAVD88)

FLOOD OF RECORD:

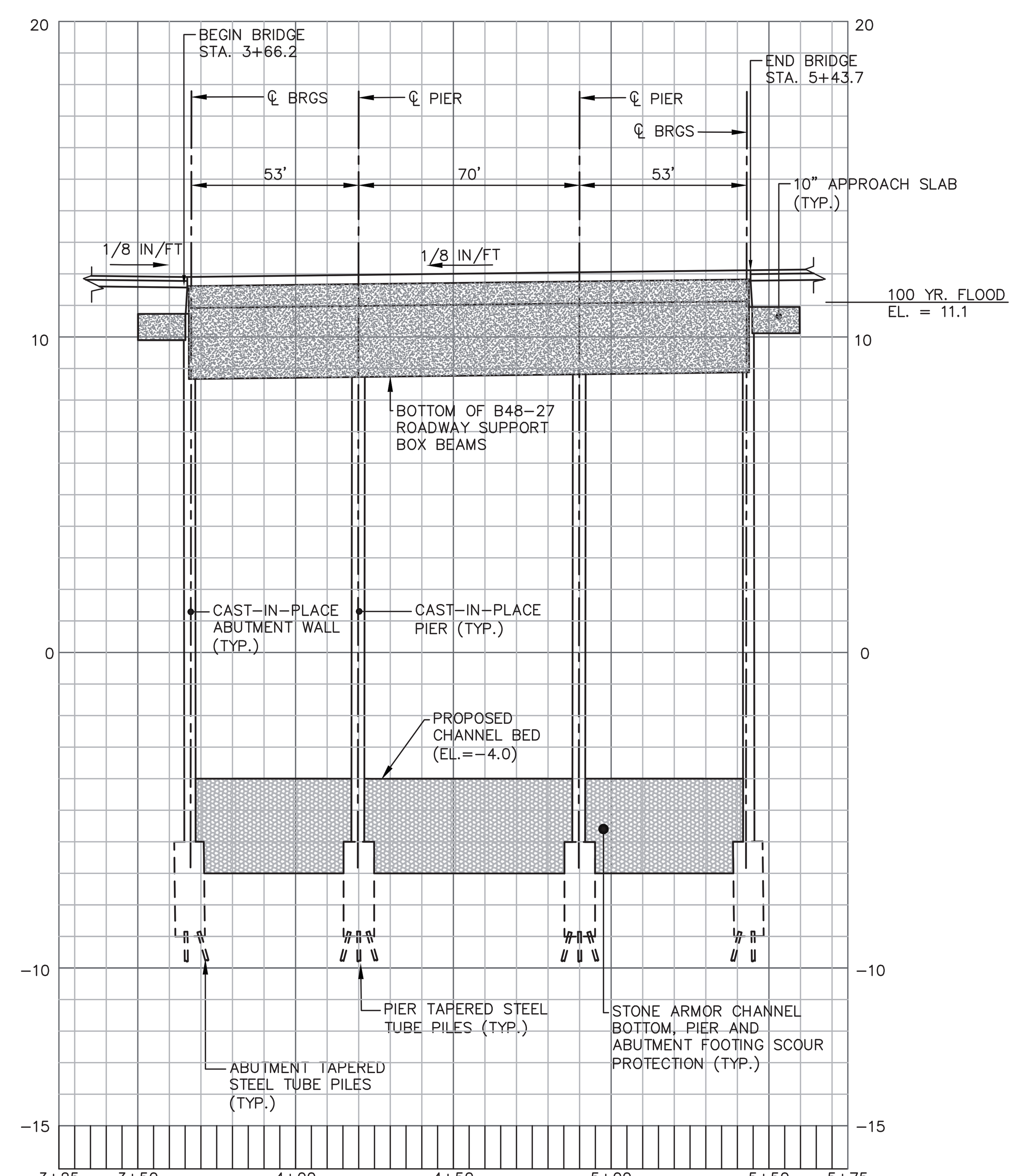
Q=UNKNOWN
FREQUENCY: 100 YEARS
DATE: FEBRUARY 1978

HISTORY OF ICE FLOWS: NONE RECORDED

EVIDENCE OF SCOUR AND EROSION: THERE ARE SCOUR HOLES AT THE UPSTREAM (HARBORSIDE) AND DOWNSTREAM (RIVERSIDE) ENDS OF THE CULVERTS WITH MAXIMUM DEPTHS OF 10.5 FEET AND 9.7 FEET, RESPECTIVELY. THE SCOUR HOLE AT THE UPSTREAM (HARBORSIDE) END IS LIKELY DUE TO INCREASED/ACCELERATED VELOCITIES THROUGH THE EXISTING UNDERSIZED CULVERTS AT EROSIVE VELOCITIES DURING THE HIGH TIDE CYCLE AND DURING STORM SURGES. THE SCOUR HOLE AT THE DOWNSTREAM (RIVERSIDE) END, IS LIKELY DUE TO TURBULENCE AND EROSIVE EDDIES FORMING AS THE FLOW EXITS THE CULVERTS AND EXPANDS TO CONFORM TO THE NATURAL CHANNEL WIDTH.



STREAM – PROFILE STA. 0+00 – 1+10
SCALE: H: 1"= 40'
V: 1"=4'



CHEQUESSETT NECK ROAD
PROFILE STA. 0+00 – 9+60
SCALE: H: 1"= 40'
V: 1"=4'

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

NOT FOR CONSTRUCTION

SCALE:
HORZ.: 1" = 40'
VERT.: 1"=4'
DATUM:
HORZ.: NAD83
VERT.: NAVD88
GRAPHIC SCALE

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FRIENDS OF HERRING RIVER

STRUCTURAL PLAN

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

SA-101

File Path: J:\DWG\P2012\0636\A13\Structural\Plan\20120636A13_STR01.dwg, Layout: SA-101, Plotted: Tue, Jul 15, 2014 - 2:44 PM User: saruda
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MS VIEW:
LAYER STATE:

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-4 Sheet 1 of 1 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/20/13 Date Finish: 11/20/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1100- 11/20/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	11		0.0-0.25 0.25-0.5			Asphalt Gravel	Asphalt	AS	
0.5	10.5	S-1	0.5-2.5	14/24	8 14 12 11	Medium dense reddish brown fine to medium SAND, some Gravel	Sandy Fill	FI/SP	
5	6	S-2	5-7	15/24	3 2 2 2	Loose moist reddish brown fine to medium SAND trace Gravel		FI/SP	
10	1		10-12	0	2 2 3 2	No Recovery		FI/SP	
12	-1	S-3	12-14	14/24	3 2 2 3	Loose, wet reddish brown fine to medium SAND,trace Gravel	Sand	SP	
15	-4	S-4	15-17	16/24	2 2 2 4	Loose,wet, yellowish brown fine to medium SAND, trace Gravel		SP	
19	-8	S-5	19-21	6/24	3 2 2 3	Loose, wet, yellowish brown fine to medium SAND, trace Gravel		SP	
24	-13	S-6	24-26	13/24	3 7 9 12	Medium dense, wet, light grey fine to medium SAND, little Gravel		SP	
29	-18	S-7	29-31	11/24	7 7 8 12	Medium dense, wet, light brown fine to medium SAND, little Gravel		SP	
34	-23	S-8	34-36	14/24	5 8 9 11	Medium dense,wet, light brown fine to medium SAND		SP	
39	-28	S-9	39-41	17/24	13 21 27 35	Dense,wet, reddish brown fine to medium SAND, little Gravel		SP	
						End of Boring 41'; No refusal		SP	

MINOR CONSTITUENT PROPORTIONS:
Trace 0 to 10% Some 20 to 35%
Little 10 to 20% And 35 to 50%

REMARKS:
End of Boring 41'; No refusal
Auto hammer
Ground water table encounterd at 12' from the ground surface.

BORING B-4

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-3 Sheet 1 of 1 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/21/13 Date Finish: 11/21/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1500- 11/21/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	12.1		0.0-0.3 0.3-0.5			Asphalt Gravel	Asphalt	AS	
0.5	11.6	S-1	0.5-2.5	15/24	8 16 18 14	Dense yellowish brown fine to medium SAND,trace Gravel	Sandy Fill	FI/SP	
5	7.1	S-2	5-7	14/24	7 6 7 9	Medium dense yellowish brown fine to medium SAND		FI/SP	
10	2.1	S-3	10-12	16/24	11 11 13 11	Medium dense yellowish brown moist fine to medium SAND, little Gravel		SP	
15	-2.9	S-4	15-17	11/24	2 2 2 2	Loose,wet, yellowish brown fine to mediumSAND, trace Gravel	Sand	SP	
19	-6.9	S-5	19-21	10/24	10 12 12 12	Medium dense,wet, light grey fine to medium SAND, trace Gravel		SP	
24	-11.9	S-6	24-26	8/24	10 14 13 12	Medium dense,wet, light grey fine to medium SAND, trace Gravel		SP	
29	-16.9	S-7	29-31	0	10 12 22 26	No Recovery, Rock in Spoon tip			
34	-21.9	S-8	34-36	11/24	14 14 16 11	Dense,wet reddish brown fine to medium SAND, some Gravel, trace Silt		SP	
39	-26.9	S-9	39-41	1/24	7 9 10 10	Poor recovery; reddish brown fine to medium SAND, little Gravel		SP	
						End of Boring @ 41 ft			

MINOR CONSTITUENT PROPORTIONS:
Trace 0 to 10% Some 20 to 35%
Little 10 to 20% And 35 to 50%

REMARKS:
End of Boring 41'; No refusal
Auto hammer
Ground water table encounterd at 15' from the ground surface.

BORING B-3

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-2 Sheet 1 of 2 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation:
Date Start: 11/18/13 Date Finish: 11/19/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1300- 11/19/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	12.3		0-0.5			Asphalt upto 3" and then Gravel	Asphalt	AS	
0.5	11.8	S-1	0.5-2.5	14/24	7 12 14 17	Medium dense brown moist fine to medium SAND, little Gravel	Sandy Fill	FI/SP	
5	7.3	S-2	5-7	12/24	14 10 4 4	Medium dense moist brown fine to medium SAND, little Gravel		FI/SP	
10	2.3	S-3	10-12	11/24	9 11 13 15	Medium dense moist brown fine to medium SAND		FI/SP	
14	-1.7	S-4	14-16	8/24	3 3 3 4	Loose moist brown fine to medium SAND		FI/SP	1
19	-6.7	S-5	19-21	8/24	8 8 7 8	Medium dense wet light grey fine to medium SAND, some Gravel	Sand	SP	
24	-11.7	S-6	24-26	8/24	9 11 12 15	Medium dense wet light grey fine to medium SAND, some Gravel		SP	
29	-16.7	S-7	29-31	0/24	14 16 14 9	No Recovery, Gravel in Spoon tip			
34	-21.7	S-8	34-36	16/24	7 8 9 8	Medium dense wet greyish brown fine to medium SAND, trace Gravel		SP	
39	-26.7	S-9	39-41	9/24	8 9 9 10	Medium dense wet greyish brown fine to medium SAND, trace Gravel		SP	
44	-31.7	S-10	44-46	9/24	6 8 8 10	Medium dense wet greyish brown fine to medium SAND, some Gravel		SP	
49	-36.7	S-11	49-51	11/24	4 5 6 12	Medium dense , wet, reddish brown fine to medium SAND, some Gravel		SP	
54		S-12	54-56	12/24	22 26 25 25	Very dense wet reddish brown fine to medium SAND, little Gravel	Sand	SP	
59		S-13	59-61	18/24	7 14 11 22	Medium dense wet reddish brown fine to medium SAND, trace Gravel		SP	
64		S-14	64-66	13/24	5 9 13 15	Medium dense wet olive grey fine SAND		SP	
69		S-15	69-71	16/24	16 23 29 37	Very dense wet grey fine SAND, trace Silt		SP	
74		S-16	74-76	17/24	16 25 26 33	Very dense dark grey SILT, trace Sand.Moist	Silt	ML	
76		S-17	76-78	16/24	19 21 26 29	Dense dark grey SILT, trace Sand.Moist		ML	
78						End of boring @ 78 ft			

MINOR CONSTITUENT PROPORTIONS:
Trace 0 to 10% Some 20 to 35%
Little 10 to 20% And 35 to 50%

REMARKS:
End of Boring 78'; No refusal
Auto hammer
1. Ground water table encounterd at 15' from the ground surface.

BORING B-2

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Herring River Restoration Location: Wellfleet, MA	Boring ID: B-1 Sheet 1 of 1 Project No.: 20120636.A13

Contractor: Soil Exploration Corp
Operator: Tim Flores
F&O Rep.: Dan La France
Drilling Method: HSA/Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: North Pier
Ground Elevation: 12.1 (NAVD88)
Date Start: 11/20/13 Date Finish: 11/20/13

Water Level Measurements

Date	Ref. Pt.	Depth	Time

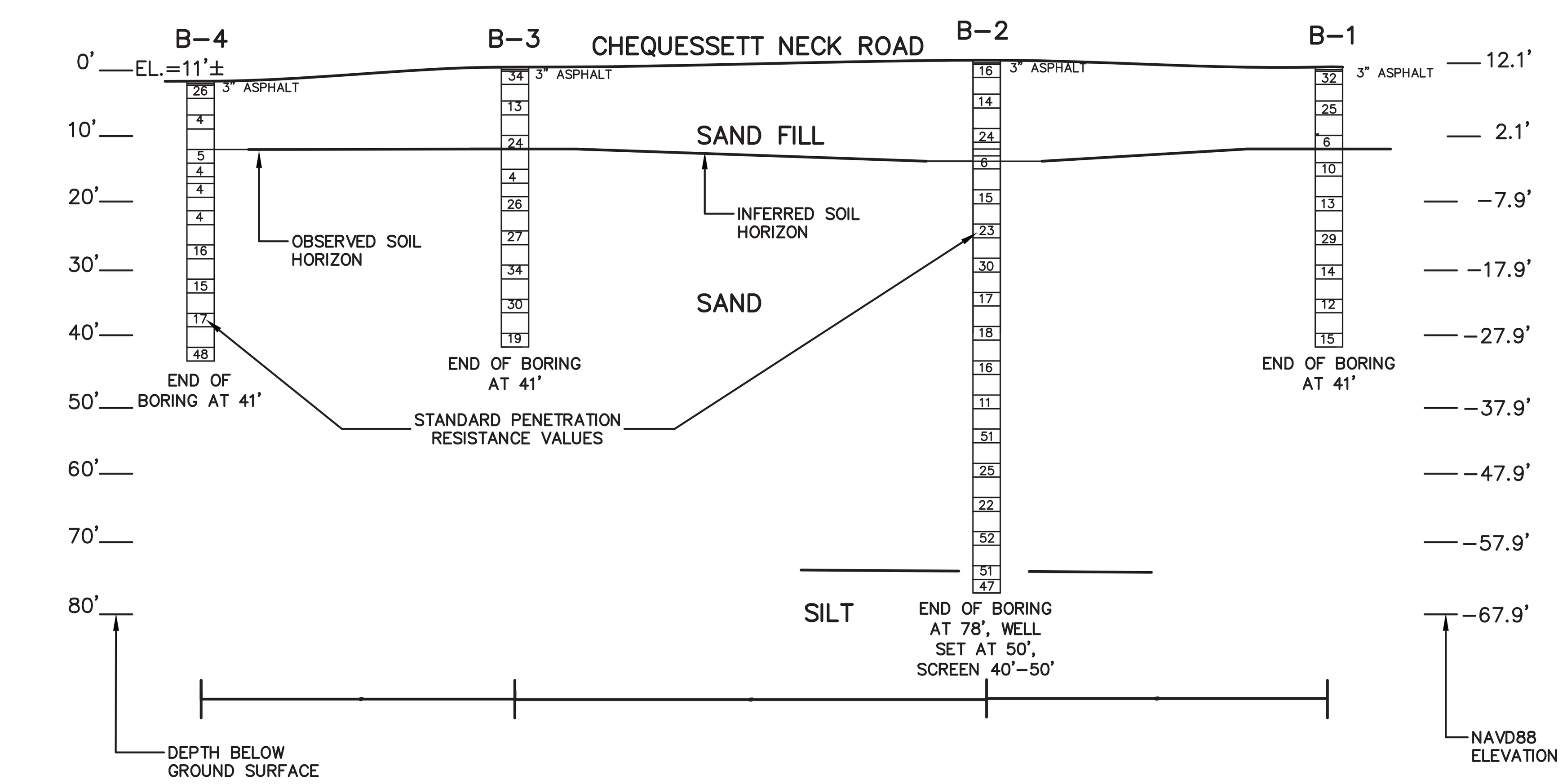
Time & Date of Completion: 1500- 11/20/2013

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	12.1		0.0-0.5			Asphalt	Asphalt	AS	
0.5	11.6	S-1	0.5-2.5	6/24	12 20 12 10	Dense red brown fine to medium SAND,some Gravel	Sand/ Fill	FI/SP	
5	7.1	S-2	5-7	12/24	7 6 19 9	Medium dense red brown fine to medium, SAND, trace Gravel. Asphalt fragments in the recovery		FI/SP AS	
10	2.1	S-3	10-12	8/24	3 3 3 4	Loose red brown fine to medium SAND	Sandy Fill	SP	1
14	-1.9	S-4	14-16	7/24	3 5 5 7	Medium dense, yellowish brown fine to medium, SAND, little Gravel,wet	Sand	SP	
19	-6.9	S-5	19-21	9/24	6 6 7 7	Medium dense, greyish fine to medium SAND , trace Gravel, wet		SP	
24	-11.9	S-6	24-26	9/24	12 14 15 9	Medium dense, reddish brown fine to medium SAND , trace Gravel, wet		SP	
29	-16.9	S-7	29-31	5/24	5 7 7 8	Medium dense, yellowish fine to medium SAND , trace Gravel, wet		SP	
34	-21.9	S-8	34-36	14/24	3 5 7 7	Medium dense, greyish fine to medium SAND , trace Gravel, wet		SP	
39	-26.9	S-9	39-41	6/24	4 6 9 10	Medium dense, greyish fine to medium SAND, wet		SP	
						End of Boring 41'; No refusal			

MINOR CONSTITUENT PROPORTIONS:
Trace 0 to 10% Some 20 to 35%
Little 10 to 20% And 35 to 50%

REMARKS:
End of Boring 41'; No refusal
Auto hammer
1. Ground water table encounterd at 13' from the ground surface.

BORING B-1



NOTES:

1. NUMBERS INDICATED IN THE BORING PROFILE REPRESENT STANDARD PENETRATION TEST N- VALUES (UNCORRECTED).

SUBSURFACE SOIL PROFILE

NOT TO SCALE

BORING NOTES:

1. LOCATION OF BORINGS ARE SHOWN ON THE PLANS.
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT THE BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION. SOILS ENCOUNTERED DURING EXCAVATION SHOULD BE REVIEWED BY A QUALIFIED PROFESSIONAL ENGINEER FOR INTERPRETATION AND ASSESSMENT OF MODIFIED CONSTRUCTION METHODS OR MATERIALS THAT MAY BE REQUIRED.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1-3/8" I.D. SPLIT SPOON SAMPLER 6" WITH A 140 POUND WEIGHT FALLING 30".
5. BORINGS PERFORMED BY SOIL EXPLORATION CORP., 148 PIONEER DRIVE, LEOMINSTER, MA. 01453 ON NOV 18 THROUGH NOV 21, 2013. BORINGS LOGGED BY A FUSS & O'NEILL ENGINEER.
6. NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

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LAYER STATE:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

NOT FOR CONSTRUCTION

SCALE:
HORZ.: NOT TO SCALE
VERT.: NOT TO SCALE
DATUM:
HORZ.: NAD83
VERT.: NAVD88
1 0 1
GRAPHIC SCALE

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FRIENDS OF HERRING RIVER

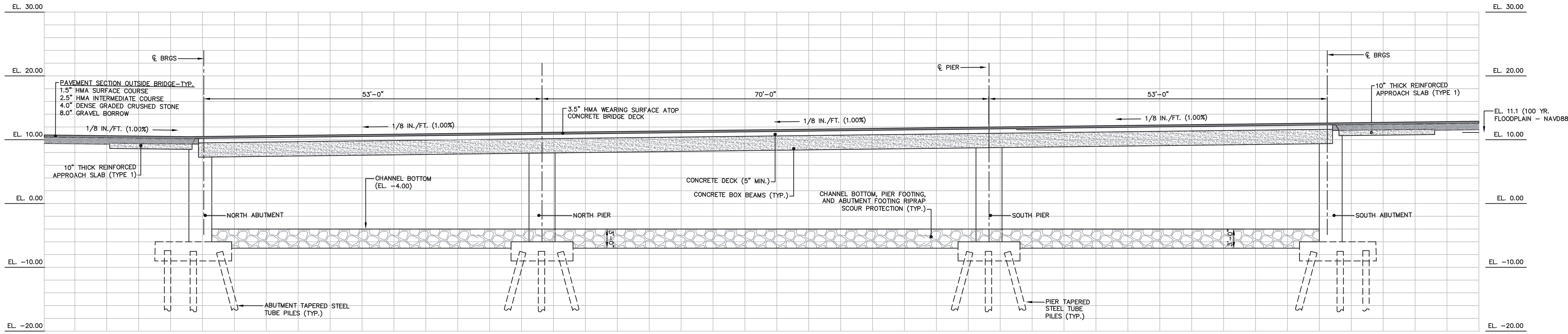
BORING LOGS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

SA-102



BRIDGE LONGITUDINAL SECTION
SCALE: 1/8"= 1'-0"

BRIDGE WEST ELEVATION
SCALE: 1/8"= 1'-0"

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

NOT FOR CONSTRUCTION

SCALE:
HORZ.: AS NOTED
VERT.: AS NOTED
DATUM:
HORZ.: NAD83
VERT.: NAVD88
8 0 8
GRAPHIC SCALE

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FRIENDS OF HERRING RIVER

BRIDGE ELEVATION AND LONGITUDINAL SECTION
HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

SA-103

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File Path: J:\DWG\P2012\0636\A13\Structural\Plan\20120636A13_STR02.dwg, Layout: SA-103, Plotted: Tue, Jul 15, 2014 - 2:45 PM User: sarruda
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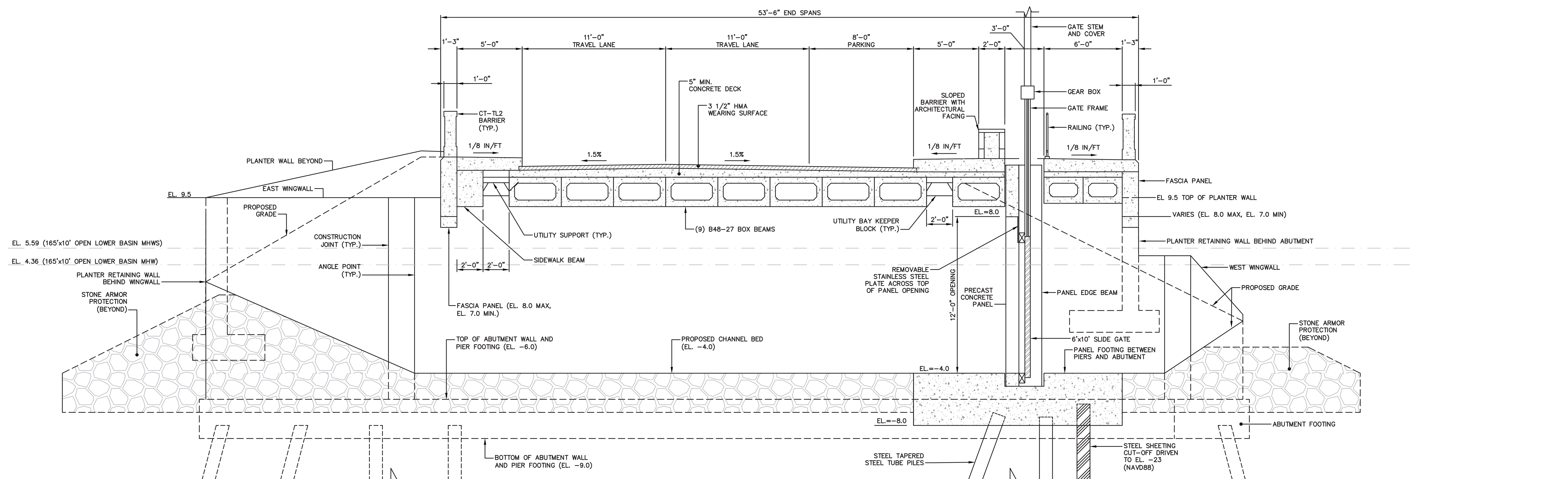
MS VIEW:

BRIDGE CENTER SPAN SECTION AND PIER ELEVATION

SCALE: 1/4"= 1'-0"



BRIDGE END SPAN SECTION AND ABUTMENT ELEVATION

SCALE: 1/4"= 1'-0"

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

NOT FOR CONSTRUCTION

SCALE:
HORZ.: 1/4"=1'
VERT.: 1/4"=1'
DATUM:
HORZ.: NAD83
VERT.: NAVD88
4 0 4
GRAPHIC SCALE

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FRIENDS OF HERRING RIVER

STRUCTURAL SECTIONS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

SA-104

18 OF 19

File Path: J:\DWG\P2012\0636\A13\Structural\Plan\20120636A13_STR02.dwg, Layout: SA-104, Plotted: Tue, Jul 15, 2014 - 2:45 PM User: sarruda
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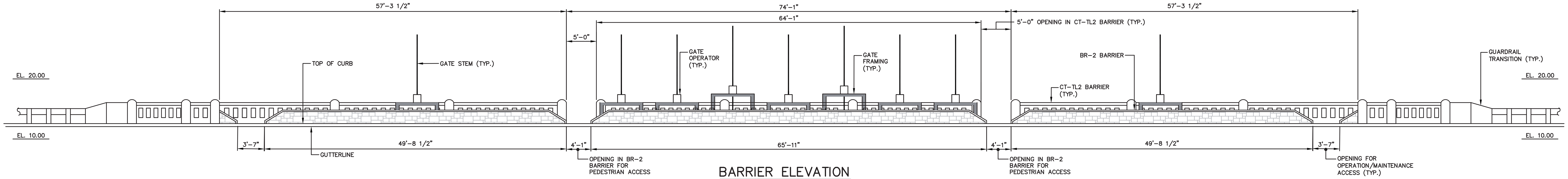
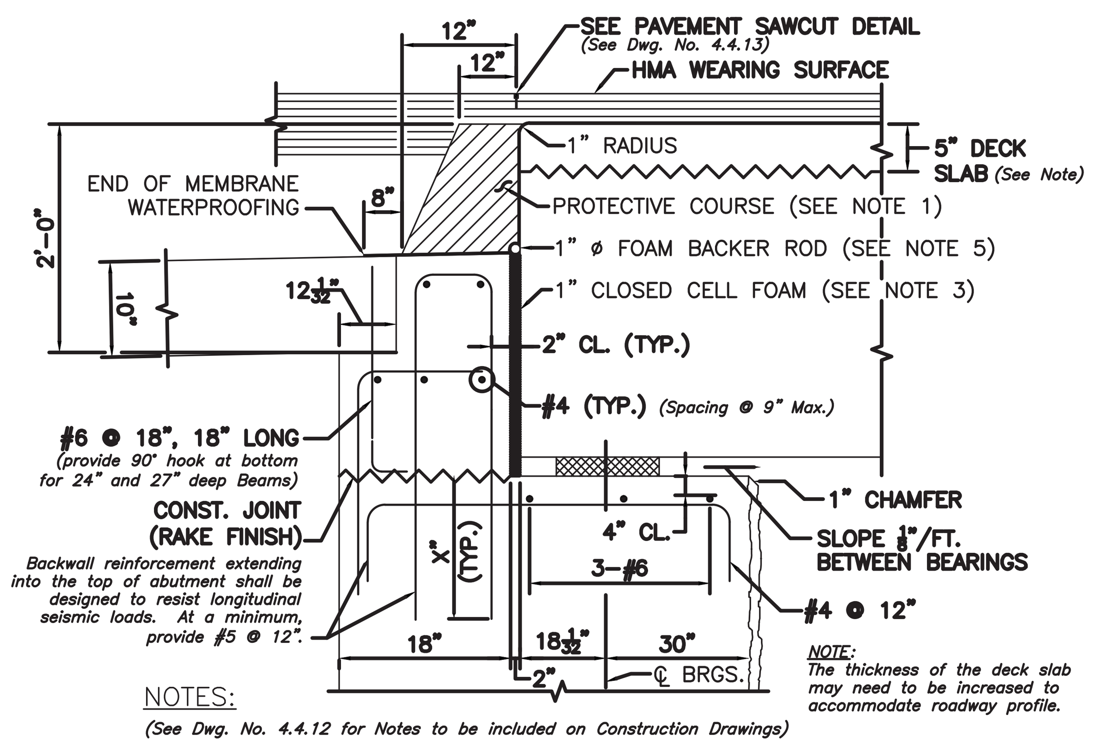


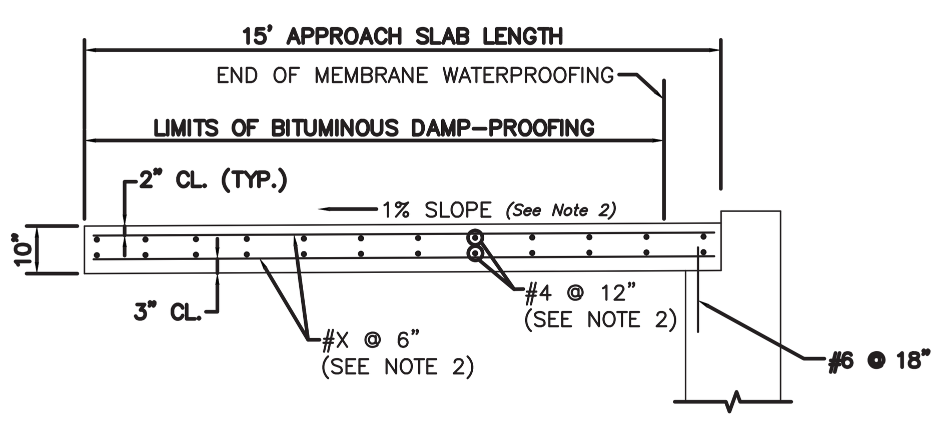
BARRIER ELEVATION

SCALE: SCALE: 1/8"= 1'-0"



DETAILS AT ABUTMENT – ROADWAY SECTION

SCALE: NOT TO SCALE



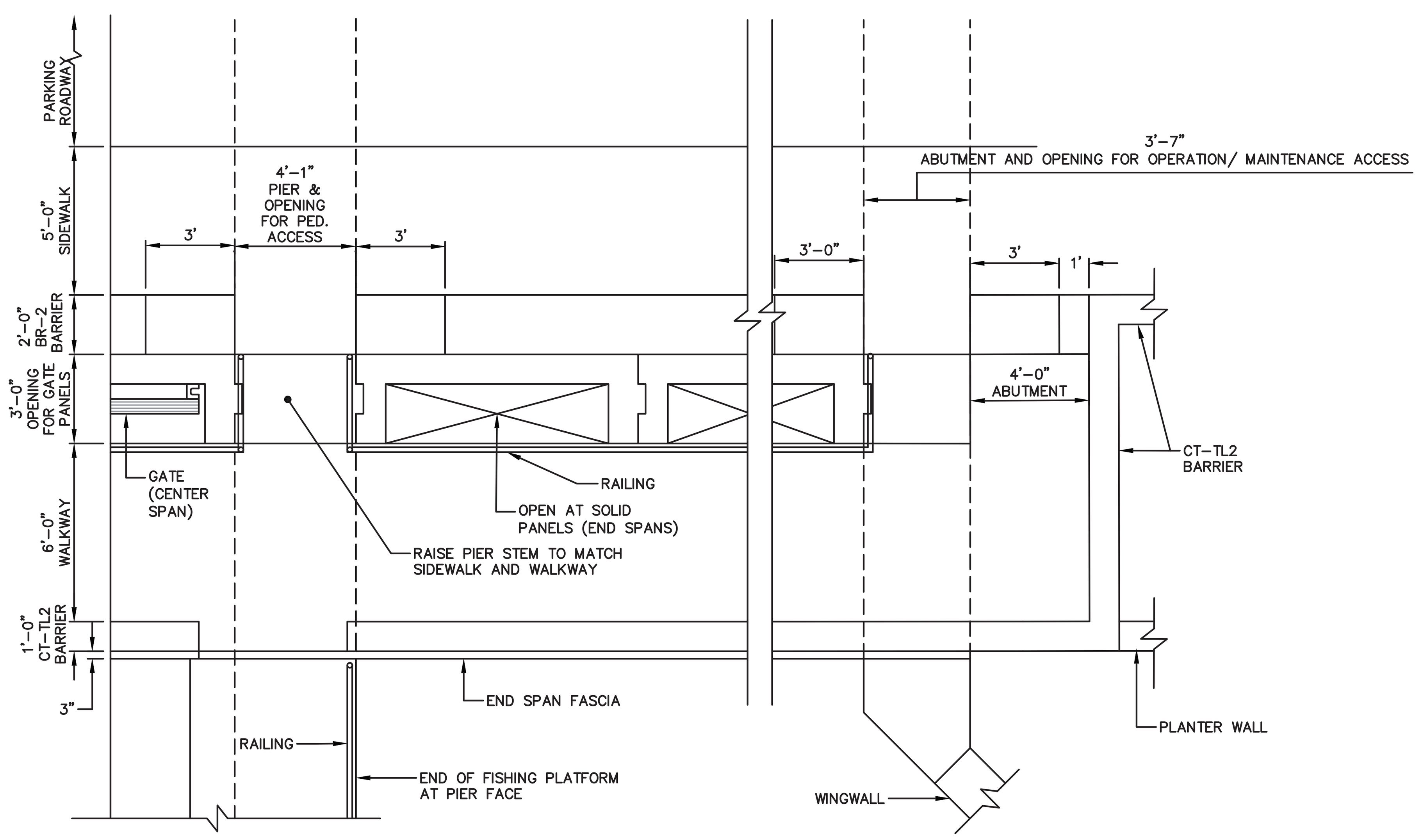
NOTES:

1. APPROACH SLAB TO BE 4000 PSI, 1½ IN, 565 CEMENT CONCRETE.
2. PLACE LONGITUDINAL REINFORCEMENT (Specify orientation per Dwg. No. 3.1.12). PLACE TRANSVERSE REINFORCEMENT PARALLEL TO ABUTMENT.

APPROACH SLAB (TYPE 1)

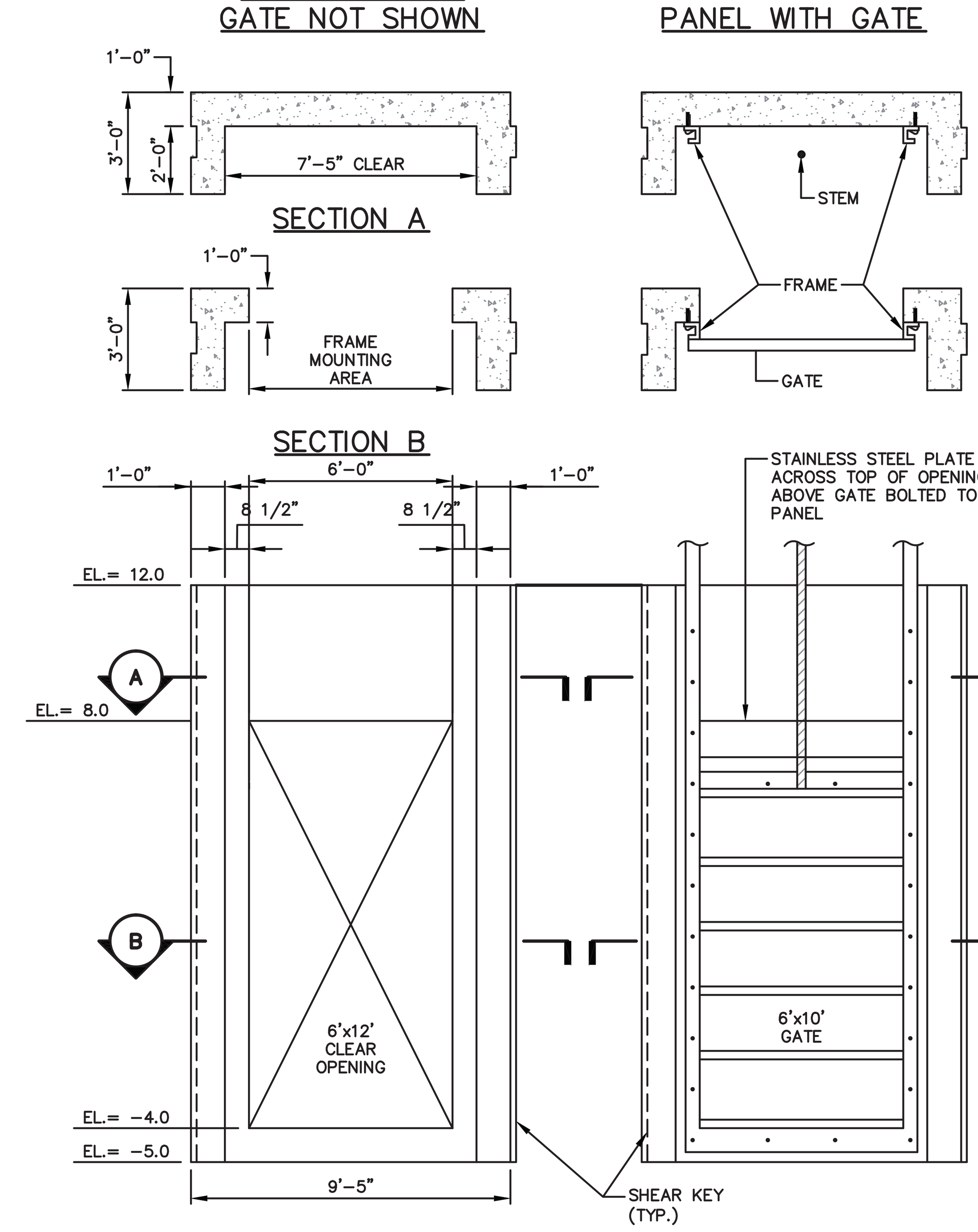
SCALE: NOT TO SCALE

NOTES:
1. See Roadway Section drawings for abutment details and dimensions not shown here.
2. If approach roadway slopes down and away from the abutment at greater than 2%, change slope of approach slab to approach roadway grade plus 1%, rounded up to the nearest 1%. Otherwise set slope at 2%.



PANEL PLAN AT PIERS AND ABUTMENT

SCALE: 1/4"= 1'-0"



PRECAST CONCRETE PANELS

SCALE: 1/4"= 1'-0"

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MS VIEW:
LAYER STATE:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

NOT FOR CONSTRUCTION

SCALE:
HORZ.: AS NOTED
VERT.: AS NOTED
DATUM:
HORZ.: NAD83
VERT.: NAVD88
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GRAPHIC SCALE

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FRIENDS OF HERRING RIVER

STRUCTURAL DETAILS

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636A13
DATE: JULY 2014

SA-105

19 OF 19

FUSS & O'NEILL, INC.
317 Iron Horse Way
Providence, RI 02908

BUDGETARY OPINION OF COST		DATE PREPARED : 7/6/14	SHEET 1 OF 1
PROJECT :	**Herring River Restoration**	BASIS :	2013 Mass Highway Weighted Average Bid Prices, 2013 Connecticutt DOT Bid Item List, 2012 RS Means Site and Landscaping Construction Cost, Previous Construction Projects.
LOCATION :	**Wellfleet, MA**		
DESCRIPTION:	**Pre-stressed Box-Beam Bridge - Single Elevation**		
DRAWING NO. :	**July 2014 Drawing Set**	ESTIMATOR : MKF/SDA	NSW

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
1	**Site Construction**				
	Site Clearing and Preparation	LS	1	$5,000	$5,000
	Sawcut Asphalt Pavement	LF	45	$5.00	$230
	Remove and Dispose Existing Pavement	SY	1,100	$10.00	$11,000
	Excavate Existing Embankment Soils to be Hauled 1/2 Mile	CY	6,200	$45.00	$279,000
	Excavate/Stockpile Existing Embankment Soils to be Reused	CY	3,700	$50.00	$185,000
	Excavate/Stockpile Existing Stone Armor to be Reused	CY	880	$55.00	$48,400
	Demolish, Remove and Dispose Existing Culvert Structure	LS	1	$125,000	$125,000
	Asphalt (Outside Bridge Footprint)	TONS	175	$80.00	$14,000
	Bituminous Berm	FT	350	$5.00	$1,750
	Drainage Structure Removed	EA	2	$500.00	$1,000
	New Deep Sump Catch Basin with Hood	EA	4	$5,000.00	$20,000
	12" CMP	LF	32	$40.00	$1,280
	12" Flared End Section	EA	0	$750.00	$0
	Crushed Stone Bedding	CY	630	$75.00	$47,250
	Soil-Filled Stone Armor Apron Scour and Slope Protection (Imported)	CY	2,525	$95.00	$239,880
	Stone Armor Slope Protection (Existing Armor Placed from Stockpiles)	CY	760	$25.00	$19,000
	Filter Fabric	SY	3,900	$5.00	$19,500
	Pavement Tack Coat/Joint Sealants	LS	1	$5,000	$5,000
	Remove and Dispose Existing Guardrails	FT	770	$3.00	$2,310
	Roadway Guardrails and Bridge Transition Rails	LS	1	$42,000	$42,000
	Painted Centerlines and Parking Lines	LF	800	$2.50	$2,000
	Painted Crosswalk	LS	1	$1,000.00	$1,000
	Grade, Topsoil and Seed Shoulder and Upstream Embankment Slope Areas	LS	1	$17,500	$17,500
	Restoration Plantings in Marsh and Slope Areas	LS	1	$15,000	$15,000
	Permanent Signage	LS	1	$2,500	$2,500
	Underground Utility Trenches, Conduit, Handholes, Utility Coordination	LS	1	$75,000	$75,000
	Site Construction Subtotal				**$1,179,600**
2	**Erosion and Sedimentation Control**				
	Wattles	LF	4,000	$5	$20,000
	Construction Entrances	CY	25	$75	$1,880
	Pump Discharge Treatment Controls	LS	1	$45,000	$45,000
	Catch Basin Inlet Protection Devices	EA	3	$500	$1,500
	Maintenance and Removal	LS	1	$40,000	$40,000
	Erosion and Sedimental Control Subtotal				**$108,380**
3	**Cofferdamming, Traffic Control and Control of Water**				
	Temporary Steel Sheeting Cofferdamming and Shoring (Includes Barges for Crane and Staging)	SF	54,000	$36	$1,944,000
	Temporary Pumps and Groundwater Dewatering	LS	1	$275,000	$275,000
	Temporary 200' Bridge with Walkway Rental, Installation and Removal	LS	1	$350,000	$350,000
	Temporary Bridge Approach Bracing, Compacted Fill, Paving, Guards, Striping and Abutments	LS	1	$185,000	$185,000
	Temporary Traffic Control Signals and Signage and Flaggers	LS	1	$125,000	$125,000
	Temporary Relocation of Overhead Utilities	LS	1	$50,000	$50,000
	Cofferdamming and Control of Water Subtotal				**$2,929,000**
4	**Bridge Construction**				
	Compacted Structural Backfill	CY	680	$41.00	$27,880
	Superpave Bridge Pavement	TON	112	$150.00	$16,800
	Metal Pipe Rail	FT	380	$190.00	$72,200
	4000 PSI, 1.5 in, 565 Cement Concrete (Abutments/Wingwalls/Piers/Footings)	CY	1,300	$940.00	$1,222,000
	5000 PSI, 3/4 in, 685 HP Cement Concrete (Sidewalks and Fascias)	CY	200	$1,400.00	$280,000
	4000 PSI, 3/4 in, 585 HP Cement Concrete (Deck and Approach Slabs)	CY	170	$990.00	$168,300
	5000 PSI, 3/8 in, 710 HP Cement Concrete (CT-TL2 Barrier)	CY	43	$4,500.00	$193,500
	Cement Concrete Form Liner	SY	450	$225.00	$101,250
	Steel Reinforcement for Structures - Epoxy Coated	LB	175,000	$2.60	$455,000
	Prestressed Concrete Box Beams (B36-24)	FT	740	$250.00	$185,000
	Prestressed Concrete Box Beams (B48-27)	FT	1,760	$300.00	$528,000
	Precast Concrete Gate Panels - Open	CY	68	$1,000.00	$68,000
	Precast Concrete Gate Panels - Solid	CY	57	$1,000.00	$57,000
	Elastomeric Bridge Bearing Pad	EA	88	$300.00	$26,400
	Steel Pipe Pile 16 Inch Outside Diameter	FT	7,100	$125.00	$887,500
	Steel Sheeting (Cutoff)	LB	200,000	$1.20	$240,000
	Membrane Waterproofing for Bridge Decks	SY	590	$25.00	$14,750
	Bituminous Damp-proofing	SY	290	$23.00	$6,670
	Utility Hangers and Conduits	LS	1	$5,000.00	$5,000
	Stormwater Treatment Planters	EA	4	$4,500.00	$18,000
	Planters, Benches and Appurtenances	LS	1	$7,500.00	$7,500
	Replacement Bridge Construction Subtotal				**$4,580,750**
5	**Gates and Operators**				
	6'Wx10'H Single-Leaf Rising Stem Slide Gates	EA	7	$46,000.00	$322,000
	6'Wx10'H Combination Slide/Flap Gates	EA	2	$69,000.00	$138,000
	Electric Actuators and Controls	EA	9	$16,000.00	$144,000
	Trailer Mounted 60kW Portable Generator and Disconnect Cabinet	LS	1	$70,000.00	$70,000
	Adjustments and Commissioning	LS	1	$20,000.00	$20,000
	Gates and Operators Subtotal				**$694,000**
	CONSTRUCTION SUBTOTAL				**$9,491,730**
	Miscellaneous Construction Items				
	Mobilization & Demobilization (2%)	LS	1	$190,000	$190,000
	Establish and Restore Staging Areas	LS	1	$20,000	$20,000
	Construction Survey Layout and As-Built Mapping	LS	1	$30,000	$30,000
	Field and Laboratory Testing	LS	1	$45,000	$45,000
	Insurance and Bonds (5%)	LS	1	$480,000	$480,000
	CONSTRUCTION ADMINISTRATION SUBTOTAL				**$765,000**
	OVERALL SUBTOTAL				**$10,256,730**
	CONTINGENCY (20%)				$2,051,346
	OVERALL TOTAL INCLUDING INFLATION AND CONTINGENCY (2016)				**$13,057,637.83**
	SUBTOTAL -15% TO +30% (ROUNDED TO NEAREST $1,000)		**$11,099,000**	**TO**	**$16,975,000**

APPENDIX L: TECHNICAL MEMORANDUM, MILL CREEK DIKE STRUCTURAL ALTERNATIVE ANALYSIS

Technical Memorandum
Mill Creek Dike
Structural Alternatives Analysis

Herring River Restoration Committee

Wellfleet, MA

June 2014

FUSS & O'NEILL

317 Iron Horse Way, Suite 204
Providence, RI 02908

Project No. 20120636.A12

FUSS & O'NEILL

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FUSS & O'NEILL

1 Introduction

1.1 Background and Project Purpose

The Mill Creek is a coastal subbasin of the Herring River (River), with its confluence approximately 1,500 feet upstream of Chequessett Neck Road. This coastal basin historically supported extensive salt marsh and coastal wetland communities, including salt-water dependent flora and fauna such as river herring, eels and shellfish communities. The Chequessett Neck Road Dike, constructed in 1909, restricts tidal range and salinity of the Herring River and Mill Creek, resulting in ecological transformation to freshwater and brackish wetland communities. The reduced tidal range allowed development of low-lying land within and adjacent to areas that were formerly tidally inundated, including portions of what is now the Chequessett Yacht and Country Club golf course on the cove's southern boundary.

Figure 1 — Mill Creek Site Photographs

The coastal restoration program currently being planned for the Herring River includes future replacement of the earthen Chequessett Neck Road dike structure with a gated bridge structure which will be operated under an adaptive management plan. This plan will gradually increase the size of the Chequessett Neck Road control structure's hydraulic opening, resulting in increased tidal range and flushing volumes into the upper Herring River system, including the Mill Creek subbasin. The ecological response to the increased tidal range and salinities will be monitored under the adaptive management plan to target restoration goals, while avoiding, minimizing or mitigating impacts to infrastructure and developed areas in adjacent low-lying areas that will become more influenced as tidal ranges increase to levels supporting the restoration goals.

Ongoing hydrodynamic modeling studies by the Woods Hole Group for the Herring River Restoration Committee (HRRC) provide information on design/operational requirements for the overall restoration program, particularly the evaluation, selection and design of alternative structural dike and gate configurations at the Chequessett Neck Road and other upstream structures, including the proposed Mill Creek dike. These evaluations are intended to identify the structure types that most successfully address evaluation criteria including meeting ecological and hydraulic restoration goals, protecting properties and infrastructure, and minimizing wetland impacts, construction costs and operation/ maintenance requirements at each location.

The design and operation of the Chequessett Neck Road control structure is being developed to allow adjustments to the size and configuration of gated hydraulic openings, such that maximum water surface elevations in upstream areas are limited to specific elevations in respective portions of the Herring River system. A preferred structural alternative was selected by the HRRC and the Town of Wellfleet, and Fuss & O'Neill is proceeding to develop a 25% design for this structure. Woods Hole Group completed a supplemental modeling study in December 2013 to evaluate potential gate numbers and opening/position combinations for this structure, in order to determine the optimal number of gates, gate types and locations that would provide sufficient controls over the range of tidal/storm conditions and restoration objectives.

In the course of these previous modeling studies, the maximum allowable opening size of the proposed Chequessett Neck Dike structure's (i.e., all gate structures removed) was determined, through modeling scenarios of the storm of record and sea level rise projections, to minimize flooding impacts to private properties and infrastructure while maximize achievement of targeted restoration objective. Through this analysis it was determined that the maximum opening size of the proposed structure (165-ft long, 10-ft high) would limit water surface elevations upstream of the dike to below EL 7.5 (NAVD88). Because low-lying, developed areas within the Mill Creek subasin, most significantly the Chequessett Yacht and Country Club immediately adjacent to the Mill Creek salt marsh, would be significantly affected by tidal/flood conditions at this elevation, an additional dike with a gated control structure is being proposed at the location of a former earthen dike approximately 1,200 feet upstream from Mill Creek's outlet to the Herring River.

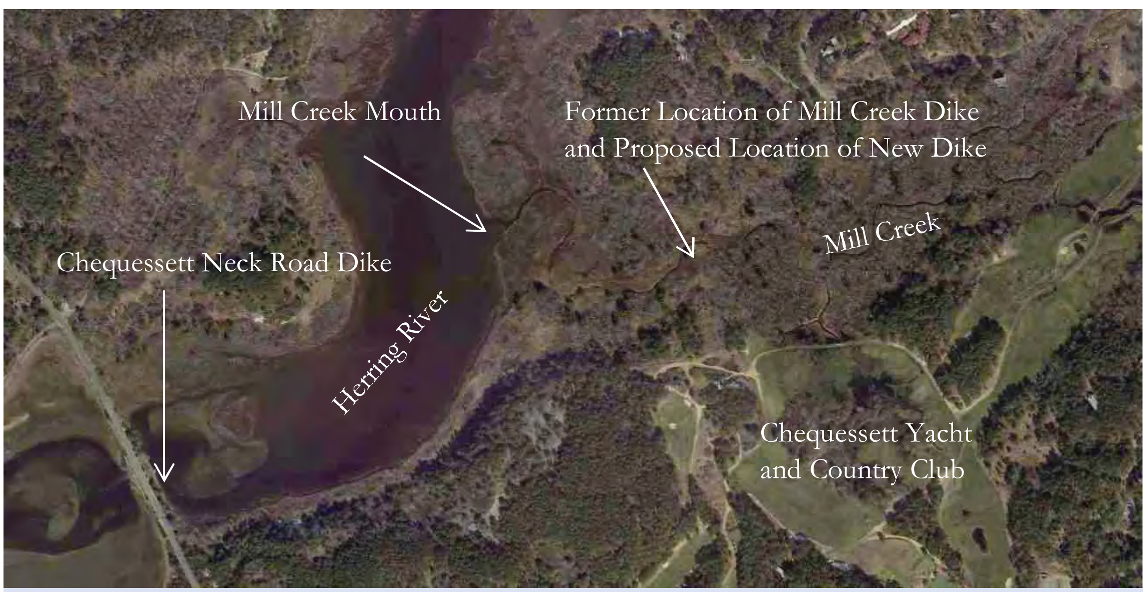

Figure 2 — Mill Creek Location Map

An initial engineering study of dike configuration alternatives completed in 2010 evaluated an earthen embankment structure constructed within the general footprint of the former dike, with alternative crest elevations that would provide protection against potential maximum tidal elevations being considered at that time in the restoration program's development. Current evaluations of Mill Creek dike alternatives are to be based on the identified maximum water surface elevation (7.5 NAVD88) as the basis for conceptual design and development of comparative costs for the alternatives bring considered.

1.2 Study Scope and Objectives

This engineering study has been requested by the HRRC to complete the following tasks to undertake a detailed alternatives analysis and develop a conceptual design for the Mill Creek dike and control structure. In general the scope of this current effort is to complete a layout evaluation and design study of conceptual dike and control structure alternatives at the former location of the Mill Creek Dike. The purpose of this study is to continue the evaluation of a previous study of structural layouts that was completed in September of 2010 to include consideration of additional design and project criteria in assessing structural alternatives and selecting an approach for future design.

- Base Mapping (*Section 2.1*): A base map was created in with data layers provided by the HRRC including National Park Service parcel boundary mapping, and contour data generated from MassGIS 2010 LiDAR point files. MassGIS vegetative and wetland community mapping was also incorporated into the developed base map. This mapping was used in the current study to develop layouts for the alternative dike configurations at the site, as well as to evaluate potential access routes from the northern side of Mill Creek (opposite the CYCC golf course). A copy of a 100-scale base map reflecting the Chequessett Neck Road dike and the location of the former Mill Creek dike is provided in *Attachment A*.

- Geotechnical Investigation (*Section 2.2*): Initial evaluation of conceptual alternatives included a review and assessment of data from a previous subsurface investigation soils in the vicinity of the proposed dike structure. This assessment determined that actual soil properties at the site would have a significant impact on the feasibility and cost of structural alternatives being considered. As a result, it was decided that a field exploration program should be conducted to confirm the type and structural properties of soils at the site to exclude uncertainty associated with this issues from consideration and selection of a preferred structural alternative under the current study, as well as enable an accurate opinion of construction cost to be developed. Support mapping for the field investigation's permit application, field data and findings/ conclusions from this investigation are presented in this section and *Attachment C*.

- Dike Culvert Structure Alternatives Evaluation (*Section 3.4*): Four potential replacement structure configurations were reviewed with the HRRC and representatives from the CYCC in a review workshops in Fall 2013 and Spring 2014. Two alternatives were selected for further design development and evaluation, considering criteria such as restoration function requirements, costs, aesthetics, operation and management burden and potential short- and long-term impacts to wetland/wildlife resources. A preferred structural configuration has been identified, based on input received from the HRRC and the CYCC through these project workshops. This evaluation is provided in *Section 3.4* and *Section 4*.

- Dike Gate Control Structure Alternatives Evaluation (*Sections 3.5*): Design layouts developed for each of the above-noted alternatives have been developed to accommodate gate structures having differing functional characteristics and operating mechanisms. A range of current gate technologies were reviewed, each of which may be coupled with alternative operator types allowing respective gate panel positions to be adjusted either manually or automatically. Through this analysis it was determined that any gate alternative could be coupled with any structural alternative. A review and selection of the preferred gate and operator types is provided in *Section 3.5*.

2 Mill Creek Dike Base Mapping and Subsurface Data

Updated base mapping of Herring River and Mill Creek in the area of the proposed dike was developed in support of the current layout and alternatives analysis, as described below.

2.1 Base Mapping

Base mapping of the proposed site for the new dike structure, as well as the area immediately adjacent to the creek and associated wetland resources was developed for the HRRC's initial review in May 2013. This initial mapping included comparative drawings incorporating 2007 topographic mapping developed from aerial photogrammetry (provided by the HRRC) and topographic contours developed from 2010 LiDAR point data (obtained from MassGIS). A final base map was prepared using the LiDAR data to depict contours and the 2007 aerial mapping to depict other mapping elements (roadways, vegetative boundaries).

Parcel data from MassGIS was also evaluated in comparison to property boundary mapping provided by NPS. Upon reviewing and discussion respective data sources for these, it was agreed that MassGIS boundaries would be incorporated in the final map, with the southern boundary NPS boundary along the Mill Creek and the Herring River adjusted to coincide with the EL 19 contour mapped by the LiDAR data, as this elevation is reportedly referenced in that parcel's boundary description.

A 100-scale drawing including the Chequessett Neck Dike and the downstream portion of Mill Creek, and a 50-scale drawing of Mill Creek in the area of the proposed dike, are provided in *Attachment A*.

2.2 Geotechnical Investigation and Evaluation

2.2.1 Existing Subsurface Data

A dike crossing formerly existed at the location of the proposed Mill Creek dike. Remnants of this structure remain at the site, principally in forested areas bordering both sides of the salt marsh vegetative community. There are no known records of the construction or removal of this dike, or other soil borings at the site.

An initial assessment of site conditions considered information from ten soil borings performed at the site of the Chequessett Neck Road Culvert by the Massachusetts Department of Public Works (DPW) between February 22 and March 1, 1972 as part of design efforts of the current culvert structure at the Chequessett Neck Road dike. These borings are located approximately 700 feet southwest of the former Mill Creek dike, and were advanced to a maximum depth of approximately 44 feet below the embankment crest elevation at the time of construction. The material within the embankment (i.e., above the elevation of the adjacent marsh) consisted primarily of loose sand with little gravel. Below the embankment fill, similar gradations were observed with recorded blow counts indicating a significant increase in the material's density reflecting its undisturbed condition. No organic, peat or clay layers were identified in these borings. Blow counts indicated dense to moderately dense soils that would be suitable for support of a rigid structure such as a bridge.

Confirmatory borings were conducted at the Chequessett Neck Road dike in 2012 as part of the design investigation for a planned replacement bridge structure. These borings extended deeper below the ground to support design evaluations for pile support foundations associated with this structure. A total of four borings were conducted over a span of approximately 175 feet, all of which confirmed previous observations of sand with little gravel at the site.

A separate subsurface investigation was conducted in 2009 within/near the Mill Creek marsh, in support of evaluations for planned grading activities in portions of the Chequessett Yacht and Country Club. The closest boring from this program was approximately 800 feet east of the former Mill Creek dike, and observed organic silt, sand and clay, and peat. Each of the strata in this boring exhibited extremely low blow counts, indicating weak soils that are not suitable for support of structures without significant mitigative/strengthening measures.

2.2.2 Subsurface Field Investigation

In order to confirm actual soil conditions at the Mill Creek dike, reduce uncertainty in evaluating structural alternatives and costs, and provide soil data that will be required for detailed geotechnical evaluations required to design structure foundation systems, a subsurface geotechnical investigation was conducted to confirm the character and properties of soils below the footprint of the former/proposed dike.

The objectives and elements of this investigatory program are outlined below:

- Conduct pre-mobilization coordination with the National Park Service and Chequessett Neck Yacht and Country Club representatives, in order to review access preparations and coordination procedures for the field activities. Drawings were prepared in support of permit application materials prepared by the Town of Wellfleet (included in *Attachment B*), and trees were cleared by AmeriCorps crews.
- Mobilize a contractor to place temporary "swamp mats" on the salt marsh ground surface where conditions were not suitable to support drilling equipment. These mats were removed upon completion of the program.
- Complete a subsurface boring program consisting of four test borings.
- Perform laboratory testing of representative soil samples collected from the four borings.
- Install one piezometer and conduct an in-situ borehole permeability test to estimate permeability of the subsurface soils.

Fuss & O'Neill subcontracted with SumCo Eco Contracting, LLC of Salem, MA to furnish, place and remove the temporary swamp mats in the salt marsh. New Hampshire Boring of Derry, New Hampshire, was contracted to drill the test borings at the site. The borings were completed on March 17 through 20, 2014. The approximate locations of the four test borings are depicted on *Figure 3* below.

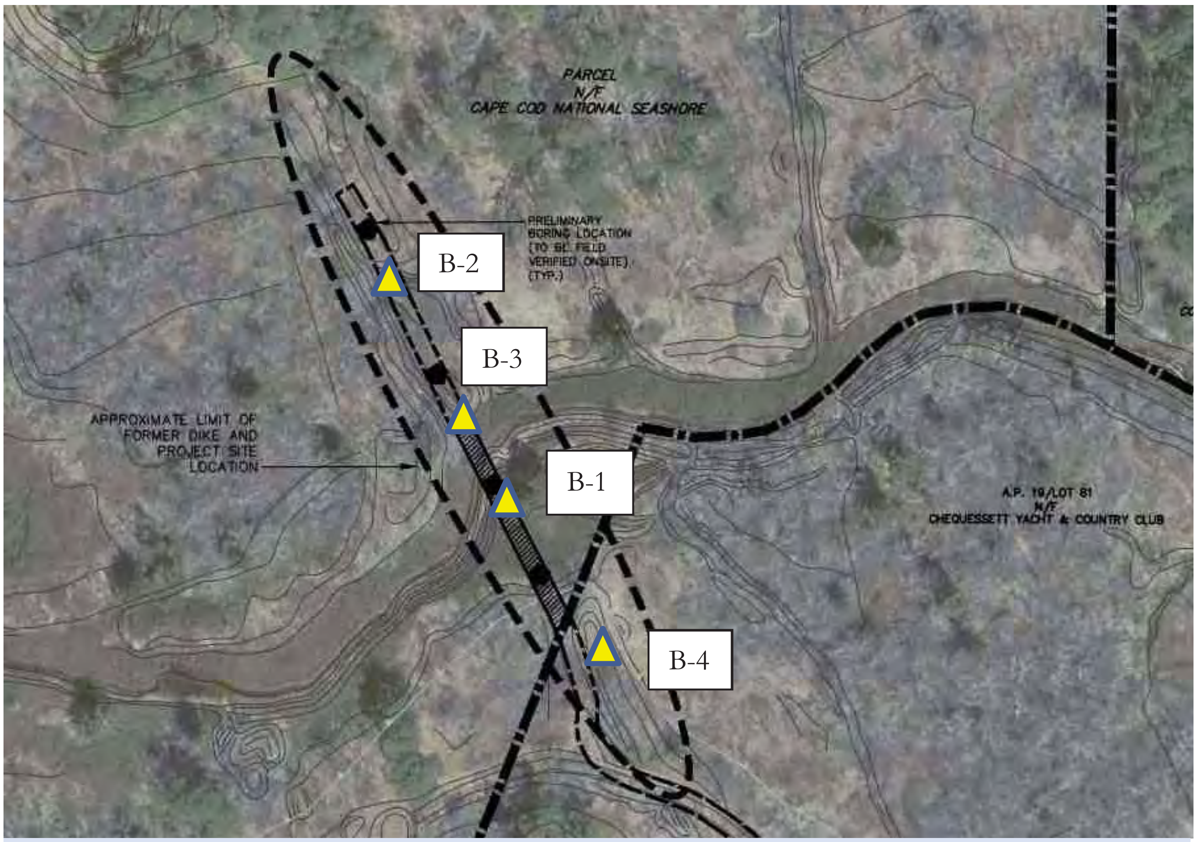

Figure 3 — Soil Boring Location Map

The test borings were advanced to depths below the existing ground surface of 41 feet in borings B-2 and B-3, 46 feet in boring B-4, and 71 feet in boring B-1 using a low-ground-pressure tracked drill rill. Drilling of soil borings were performed using drive and wash methodology. The boreholes were continuously cased with 4-inch diameter flush-joint casing. Each test boring was observed and logged by a Fuss & O'Neill geotechnical engineer. Boring logs prepared by the field engineer and reviewed by Fuss & O'Neill's senior geotechnical engineer are included in *Attachment B*.

Standard penetration tests (SPTs) were performed at maximum 5 foot intervals in the test borings. The SPT consists of advancing a 2-inch outside-diameter split spoon sampler a total of 24 inches into the bottom of a borehole with a 140-pound hammer free-falling 30 inches. The total number of blows required to drive the sampler the second and third 6-inch intervals is the Standard Penetration Resistance, also known as the SPT N-value, which is a relative indicator of the in-place soil density. SPT values at respective intervals are recorded on the boring logs.

A piezometer consisting of a 2-inch diameter slotted PVC screen with solid riser was installed in boring B-1 and a borehole permeability (slug) test was conducted to estimate the horizontal soil permeability.

The hydraulic conductivity at B-1 was estimated to be 2.1×10^{-3} cm per second. The literature notes that hydraulic conductivities for glacial outwash deposits are typically in the range of 10^{-3} to 10^{-1} cm per second, and therefore the calculated hydraulic conductivity is consistent with the soil materials identified at the site. Output data from these field measurements are included in *Attachment B*.

Laboratory Testing

Representative soil samples were obtained from boring B-1 at a depth interval of 19 to 21 feet, from boring B-2 at a depth interval of 19 to 21 feet, from boring B-3 at a depth interval of 19 to 19.9 feet, and from boring B-4 at a depth interval 9.5 to 11.5 feet. Laboratory gradation testing (ASTM D 422) was performed on two soil samples and Atterberg Limits testing (ASTM D 4318) was performed on two soil samples that exhibited plasticity characteristics; these test reports are included in *Attachment B*.

Soil Profile

The soil encountered at the site consisted predominantly of fine to medium sand interspersed with thin layers and lenses of stiff low plasticity silty and sandy clay. The thickness of the clay with sand/silt layers varied from approximately less than 1 foot to 4 feet. Samples with a clay constituent were encountered at depths below 10 feet in boreholes B-2, B-3 and B-4. In the deepest borehole, B-1, silt was encountered at 18 feet deep. Clayey soil was not encountered in borehole B-1 until a depth of 34 feet below ground surface.

The density of the sand layers in the upper 15 feet ranged from loose to dense. The lower densities in the sand were usually observed near clayey soil lenses. Below 15 feet, the density of the sand tends to increase with depth, becoming very dense below 40 feet.

Groundwater was encountered at a depth of 0.2 feet, 4 feet, 4 feet and 6.8 feet in boreholes B-1, B-2, B-3 and B-4, respectively. The depth to groundwater within the soil is expected to fluctuate with precipitation, tidal elevations and other factors.

A graphical depiction of the inferred subsurface profile at the site, including approximate depths/elevations of observed soil layer transitions and Standard Penetration Resistance values, is included in *Attachment B*.

2.2.3 Evaluation of Field Investigation Data

Soil conditions observed at the site during this field investigation are generally favorable for construction and support of structures. Specifically for the structural alternatives being evaluated for this dike structure, either shallow foundation systems with spread footings or deep foundation systems (i.e., sheeting or pile supported systems) would be suitable to support proposed concrete structural components.

Depending on the results of a detailed scour assessment, and the extent and type of scour countermeasures employed as part of the design, a deep foundation consisting of timber or steel piles would be appropriate to mitigate settlement or undermining of the structure. If there is no technicallybased need for one foundation type versus another, other considerations relating to cost, construction efficiency, and design factors of safety provided by alternative systems (i.e., design and construction risk reduction) would be considered in subsequent phases of design as part of a refined design analysis.

Preliminary analyses were also performed to assess the feasibility of using steel sheet pile walls for temporary water control along the boundaries of anticipated construction areas within the salt marsh, as well as for permanent seepage cutoff below the structural alternatives. These analyses used the soil data collected during the field investigation, and assumed a typical sheet pile section to estimate the required depth of embedment for the sheet piles. The analyses indicate water control during construction can be accomplished by driving sheet pile cutoff walls to reasonable moderate depths, generally less than 20 feet as cantilevered sheet piles with less than 1 inch of deflection at the pile tops under hydrostatic conditions corresponding to the 100-year storm event on the harbor side of the proposed dike and mean high water conditions on the Mill Creek side of the dike. .

3 Structural Alternatives Evaluation

3.1 Introduction

This section identifies and evaluates alternative structure types for the dike. Many structure types were initially reviewed based on project applicability and design criteria. After reviewing the initial alternatives with the project partners in July 2013, two structure types were selected for further evaluation. This section addresses the site and project constraints, identifies alternatives for water control structures and operators, discusses the two selected structural alternatives and presents a possible configuration of components (e.g., gates) for each.

3.2 Site and Construction Considerations

Several design criteria that are vital to the success of the project must be considered in order to maximize the end value of the project in terms of property protection and operation. The following paragraphs describe some of the site challenges that will impact design and construction of any proposed improvements on this site.

3.2.1 Existing Tidal and Flood Elevations

In June 2012 the Woods Hole Group completed a modeling study for the HRRC entitled *Herring River Hydrodynamic Modeling Final Comprehensive Report*. This report evaluated tidal elevations within the Mill Creek Subbasin under a scenario where the proposed Mill Creek Dike has a 3 foot sluice opening and Chequessett Neck Road has a ten sluice foot opening, as summarized below (referenced to NAVD88).

- Mean Low Water -0.47 feet
- Mean Tide Level 1.68 feet
- Mean High Water 3.83 feet

- Tide Range 4.30 feet
- Mean High Water Spring 4.77 feet
- Annual High Water 5.11 feet
- 100-year Storm Event 6.36 feet

During construction, cofferdam and dewatering systems are typically established to withstand the maximum anticipated water surface elevation associated with a two-year or five-year return frequency storm event, with freeboard of between one and two feet. Given the existing subsurface conditions and the anticipated hydrostatic pressure the use of steel sheeting is a viable and economic cofferdam system.

For purposes of this comparative study, it is assumed that the top of the cofferdam system will be set at an elevation two feet higher than the maximum design water surface elevation allowed upstream of the proposed Chequessett Neck Road dike structure (i.e., EL 9.5, two feet higher than EL 7.5, NAVD88).

3.2.2 Sea Level Rise

The Center for Operational Oceanographic Products and Services has predicted sea level rise over the next century based on measurements taken over the past 15 years at 128 stations. Based on these predictions the National Oceanic and Atmospheric Administration (NOAA) predicts between zero and three feet of sea level rise along the majority of the New England coast.

The Center for Operational Oceanographic Products and Services has monitoring stations in Boston Harbor (expected sea level rise of 0.86 feet in 100 years at 2.63 mm/yr), on Nantucket (expected sea level rise of 0.97 feet in 100 years at 2.95 mm/yr), in Falmouth, Massachusetts (expected sea level rise of 0.86 feet in 100 years at 2.61 mm/yr) and in Newport, Rhode Island (expected sea level rise of 0.85 feet in 100 years at 2.58 mm/yr). Although there is no monitoring station in Cape Cod Bay, it is expected that the rise will be comparable to those predicted in nearby locations.

For the purpose of this project, it is assumed that the sea level rise over the next 50 years will be approximately 2.1 feet at the Wellfleet Harbor in accordance with Woods Hole Group's previous assessments. The same assessment predicted sea level rise under existing conditions, and with the current Chequessett Neck Road culvert in place, to be approximately 0.26 feet at the site of the Mill Creek dike. It is expected that when the Chequessett Neck Road structure is replaced, and tidal flows are increased, the potential for sea level rise at the Mill Creek dike site will also increase, however the planned freeboard will be sufficient to avoid overtopping over the design life of the structure. It is noted that Woods Hole Group is currently reviewing current information and methodologies to assess sea level rise, which may affect result in updates (revisions) to the projections noted above.

Additional consideration will be given to freeboard and the structures top elevation in subsequent phases of design, once a preferred alternative is identified.

3.2.3 Tidal/River Flow Bypass

During construction of the structure, tidal flushing into Mill Creek and drainage out to Herring River will need to be maintained to match existing conditions as closely as possible in order to avoid excessive tidal and flood elevations in upstream properties and to continue to support the aquatic environments upstream of the dike structure. One or more bypass channels and/or conduits will need to be installed and maintained by the contractor to adequately match existing upstream tidal conditions. Several options exist to maintain bypass flows by installing one or more temporary conduits through the temporary cofferdamming and construction site. The final configuration and requirements for the flow bypass are to be detailed further in future design and permitting phases, depending on the selected structural alternative. It is anticipated that phased construction, in combination with bypass conduits and pumps if necessary, will be employed to maintain tidal/storm conveyance across the construction site.

In addition to providing adequate hydraulic capacity to maintain the existing tidal regime, requirements for fish passage during construction will also need to be considered. Although fish migration will be affected over the course of construction, it is anticipated that providing an opening or bypass capable of allowing fish passage will be acceptable for the period of construction. Once construction is complete, fish passage will be limited by the structure, but design efforts will be made to ensure that fish passage will still be possible.

3.2.4 Scour Analysis and Protection Design

A scour analysis and the design of scour countermeasures required to protect the dike will conducted in future design phases. The proposed location of the dike is within a FEMA AH zone. This is a designated area of 100-year shallow flooding where depths are between 1 and 3 feet. This correlates with the anticipated 100-year flood elevation of 6.36 feet as defined by The Woods Hole Group, Inc. in *Herring River Hydrodynamic Modeling: Final Comprehensive Report*. The creek banks adjacent to the dike are designated as FEMA C zones, areas of minimal flooding. While scour along the riverside toe of the dike is potentially of little concern, the potential for scour in the vicinity of the flow control devices, and along the landside toe of the dike under overtopping conditions should be mitigated.

While the top elevation of the proposed structure is preliminary and expected to prevent overtopping during the anticipated design storm event, overtopping could at least theoretically occur for larger events. As a result, it may be necessary to construct overtopping scour protection, to prevent loss of soils resulting from water cascading over the structure.

These considerations would be evaluated under formal hydrologic/hydraulic and scour analysis with design of the selected structure.

3.2.5 Utilities

There are no known underground or aboveground utilities in the vicinity of the proposed dike. The project's contractor will have to coordinate with DIG-SAFE to ensure the absence of onsite utilities. If onsite utilities are encountered, it will be the contractor's responsibility to work with the utility owners to protect any such utilities.

It is expected that power lines will not be brought to the site for construction. Portable generator power may be needed onsite for construction to operate portable dewatering or bypass pumps. While pumps are not anticipated to be required post-construction for low-tide drainage, that if they are determined to be required, a package standby power system would likely be a suitable alternative to address this potential need. It is noted that a portable power system (trailered generator) is being considered to operate tide gates at planned Chequessett Neck Road dike, and could also be used to power gates at the planned Mill Creek Dike. It may be possible to use this power system to operate any pumps required for low tide drainage.

3.2.6 Construction Access, Staging and Minimization of Site Impacts

A review of access requirements for equipment to mobilized for the drilling program conducted at the site entailed discussions and site walkovers with National Park Service and Chequessett Yacht and Country Club staff to evaluate alternative, potential impacts and approaches that could avoid or suitably address identified concerns (e.g., disruption of historic/cultural resources, golf course areas, disturbance to golf course users, etc.).

Through these discussions, it was determined that the route from Chequessett Neck Road, through the golf course and to the Mill Creek site shown in drawings included in *Attachment B* effectively avoided such impacts to the site in the winter season.

It is noted below, that construction associated with this project is expected to require between 4 to 10 months, depending on the selected alternative. If construction were to begin in mid-October, it would continue through the winter, ending by late winter at the earliest, or mid-summer at the latest. It is expected that continuing discussions with the Chequessett Yacht and Country Club will enable a project phasing/sequencing approach and access/staging plan to minimize impacts to the extent possible, recognizing the magnitude of the project.

Conceptual construction access routes are shown in Figure 4, reflecting previous discussions with the HRRC and Chequessett Yacht and Country Club staff. It is noted that the eastern-most route (in red) along the periphery of the golf course, could impact cultural resources noted as potentially being present in this area, and thus may not be feasible.

Figure 4 — Conceptual Alternative Construction Access Routes and Staging Area

3.2.7 Public Safety

The new structure at Mill Creek could potentially be a safety hazard for the public and recreational users. Although the structure will not be accessed by the public and a high number of users are not anticipated, there is a potential that boaters or swimmers could become inducted into the structure and impinged or struck by an interior structural member. It should be noted that the earthen dike will have the longest tunnel while the structural wall will have the shortest.

The proposed structure will need to incorporate appropriate safety hazard communication and protective measures such as warning signs/placards, structural guards or other measures. In addition, a thorough assessment should be completed as part of subsequent phases of design to ensure the roof elevation of proposed culvert openings are as high as allowed within the hydraulic models allowable envelope, to maximize boater and rescue safety at and near the culvert structures.

3.3 Design Requirements and Considerations

The proposed structure will be required to satisfy several specific criteria during construction as well as for final design. These design and construction criteria are described in the following sections. The criteria listed herein are not selection criteria but are the minimum standards for design and construction of the selected alternative.

3.3.1 Design Requirements

For the purpose of this report, the following design criteria have been identified for the dike structure:

- Provide a 75 year design life with proper maintenance
- Minimize temporary and long term environmental impacts
- Allow for the reconfiguration of the structure to provide a maximum hydraulic opening measuring 5 feet in height by 25 feet in width with an invert EL -1.5 NAVD88.
    - This proposed invert elevation will be evaluated once a field survey of the channel and marsh is completed by a licensed surveyor, and an evaluation of sediment below the channel can be completed to assess potential future subsidence.
    - Provision of low-head pumps could be possible for either alternative, provided that a power source is available, as discussed below in consideration of gate operator alternatives.
- Provide a structure that can accommodate a potential sea level rise without damage from overtopping Provide a structure requiring minimal future maintenance costs.
- Top of crest elevation shall be set at approximately EL 9.5 NAVD88 to provide adequate freeboard.

In order to meet the project goals, the selected configuration must be capable of supporting multiple water control structures (referred to as "gates"). Design criteria for these gates include:

- Provide a 75 year design life with proper maintenance

- Provide a safe and secure mechanism for adjusting and controlling flow into and out of the Mill Creek
- Provide gates requiring minimal future maintenance costs
- Provide gates that can be easily operated, requiring minimal labor due to uncertainty of who will be operating the gates (i.e., public works/facilities professionals or volunteers/laypersons).

Due to the project site's location in a marine environment, the selected configuration must be able to withstand significant lateral loads and withstand a salt water environment (corrosion resistant materials or protective coatings/systems).

3.4 Structural Alternatives

Fuss & O'Neill considered a wide variety of alternatives for comparison and determined that four final alternatives would be applicable for this project's site and operational constraints. These four primary alternative structures were considered presented at a workshop meeting with the HHRC in July 2013. These four alternatives are described below.

- **Earthen Dike:** A dike composed of compacted structural fill and topsoil. This structure would be the widest of all the structures with an approximate bottom width of 69 feet. This allows for vehicle and equipment maintenance access atop the structure itself, but also requires the longest culvert length.

- **Hybrid Wall/Earthen Dike:** A dike composed of a retaining wall (composed of concrete or steel sheeting) on the downstream side of an earthen embankment. This structure has an approximate bottom width of 39 feet, and reduces the overall foot print as well as the culvert length in comparison to the earthen dike, while still providing vehicle and equipment access for maintenance.

- **Double Wall Dike:** A dike composed of two retaining walls (composed of concrete or steel sheeting) backfilled with structural fill. This structure has the second smallest overall footprint and an estimated width of 20 feet and provides vehicle and equipment maintenance access. The use of concrete walls would require the construction of a cut off-wall to minimize seepage. Whereas the use of steel sheet pile walls could potentially reduce the need for cut off walls as they extend deeper into the subsurface stratum.

- **Single Wall Dike:** A dike composed of a single structural wall (composed of concrete or steel.) This structure has the smallest structural footprint with a wall stem approximately 2 feet in width, and a buried footing measuring approximately 12 feet in width. The slender width of the wall stem would eliminate the need for a culvert structure, and only require a penetration through the wall for flow control. The use of this alternative would require that vehicle access be provided via reinforced/stabilized access routes at marsh grade and an elevated, cantilevered catwalk to be attached to the wall for gate operation and maintenance/minor repair access along the length of the structure.

After the July 2013 workshop meeting with the HRRC, it was decided that the following two structural alternatives would be evaluated in further detail, as described in the following sections.

- Earthen Dike
- Single Wall Dike

These two alternatives were selected with the use of a decision matrix presented at the meeting (included in *Attachment C*). A decision matrix for the three different types of gate operators as also presented at this meeting. It was determined through Woods Hole Group's modeling analyses that the preferred gate structure is the combination slide flap gate. Example layouts pairing the two selected alternative structures with the combination slide flap gate have been developed and are provided in *Attachment D*.

Detailed order of magnitude opinions of construction cost for an earthen dike and single wall dike alternatives are included for reference in *Attachment E*.

3.4.1 Earthen Dike

An earthen dike (similar to the one depicted below in *Figure* 5) used to control water may be designed as a levee dike if the purpose is to provide protection from seasonal high water and which is therefore subject to water loading for relatively few short periods over a 12 month period. If they are to subject to frequent water loading, or for prolonged periods (longer than normal flood protection requirements) they should be designed in accordance with earth dam criteria rather than levee criteria. These requirements include configuration of the structure, material requirements, and other requirements determined by detailed modeling evaluations.

The proposed earthen dike must be designed to resist constant contact with water, and will be constructed using material meeting identified specification requirements (i.e., impermeability and structural properties). For this project, it is expected that construction of the Mill Creek dike would occur concurrently or immediately following construction of the Chequessett Neck Road dike structure, which would result in the generation of approximately 6,000 CY of excess fill material to be exported from the site. For purposes of opinions of cost prepared in this report, it is assumed that material will be used shared between the sites to save the costs of importing material from a borrow source.

Design criteria must be established to meet the specific needs of this project, including construction requirements such as compaction of imported material and preparation of subgrade areas. Earthen dikes built with smaller sections and steeper slopes generally require more comprehensive investigation and analysis than do dikes with broad sections and flatter slopes, the design of which is more empirical. The Mill Creek dike is likely to be constructed with conventional 3H:1V side slopes, in order to provide stability and facilitate safe access to maintain (i.e., mow) vegetation.

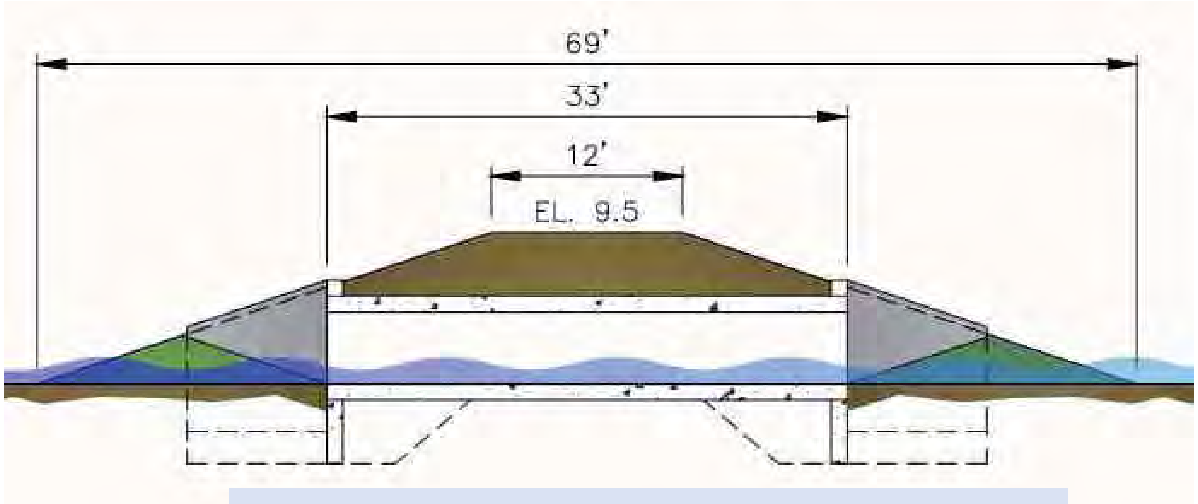

Figure 5 — Example Cross Section of Earth Dike with Culvert

3.4.1.1 Geometry and Access

The elevation of the existing channel is at approximately EL -1.5, meaning the maximum exposed height of the earthen dike will be approximately 10.9 feet. The earthen dike would be approximately 570 feet in length from end to end, and would be linear between both ends.

In general, the final geometry of an earthen dike is determined through a detailed analysis of the embankments stability and the underlying strata. Practical considerations such as construction methods, maintenance, seepage and slope protection criteria will often control the geometry of the dike. As noted above, while an embankment slope of 2H:1V is generally accepted as the steepest slope that can be easily construction and ensure the stability of slope protection measures, 3H:1V slopes are typically the steepest that can be mowed and maintained with conventional equipment. For the purpose of this study, a 3H:1V slope was used for the conceptual layout and order of magnitude opinion of cost estimate.

The width of the dike crown is also an item that must be given consideration. From a constructability standpoint, a 12 foot wide crown is typically the minimum acceptable width. The crown width is also typically set at a minimum of 12 feet for accessibility and safety reasons. While an analysis of the dike may show that the crown has to be wider in order to prevent seepage issues or provide adequate stability, for this study, a 12 foot wide crown will be used to allow access by maintenance and inspection vehicles, to allow workers easy access to the water control structures. A turn around will be provided at the north end of the dike.

3.4.1.2 Seepage

Seepage is a significant concern with earthen dike structures, requiring materials and constructed configuration that safety allow seepage to be conveyed without carrying soil particles. Areas of concern with seepage include underseepage, both shallow and deep, through seepage, piping, pore water pressures, and drainage.

3.4.1.2.1 Underseepage

Without control, underseepage in pervious foundations beneath levees may result in excessive hydrostatic pressures on the landside, sand boils, and piping beneath the levee itself. Underseepage problems are most severe when a pervious layer of soil underlies a dike and extends both landward and riverward from the dike, and when a relatively thin top stratum exists landward of the levee. There are several methods which can be used to minimize foundation underseepage including: cutoff trenches or walls, riverside impervious blankets, landside seepage berms, pervious toe trenches, and pressure relief wells.

A cutoff beneath the dike to block seepage through pervious foundation soils is the most positive means of eliminating seepage. Positive cutoffs may consist of steel sheet pile walls, excavated trenches backfilled with compacted earth or slurry trenches. Cutoffs will rarely be economical where they must penetrate more than 40 ft. While steel sheet piling may be used as a cutoff, and can significantly reduce the possibility of piping of pervious strata in the foundation. A flow net analysis is required to determine the effectiveness of a sheet pile cutoff wall and the need to seal sheet pile joints if one is used.

Open trench excavations can be readily made above the water table, but if they must be made below the water table, well point systems will be required. Cutoffs made by the slurry trench method can be made without a dewatering system, and the cost of this type of cutoff should be favorable in many cases when compared to the cost of a compacted earth cutoff. Ultimately, a flow net analysis will need to be conducted to determine the best method of providing eliminating seepage issues. This will be performed in future design phases once the geotechnical investigation has been completed.

Landside berms are constructed along the landside toe of an embankment and extend out from the toe. They prevent sand boils due to the additional weight they provide and the additional length they add to the seepage flow net. They also offer protection against sloughing of the embankment along the landside by buttressing the toe of the embankment.

Pervious toe trenches are often used when a dike is situated on deposits of pervious material overlain by little or no impervious material. Toe trenches are typically located along the landside toe of a dike. The geometry of the trench will be dictated by the anticipated volume of underseepage, the needed reduction in uplift pressure, construction limitations, and the stability of the material in which the trench is being installed. A toe trench which only partially penetrates a pervious layer can only improve seepage conditions at or near the toe of a dike as they are only effective in controlling shallow underseepage. Typical trench widths range from two (2) to six (6) feet. The required penetration depth of a toe trench is determined through a stability and flow net analysis. The addition of relief wells have been used effectively to in conjunction with toe trenches to collect deeper seepage. The use and effectiveness of a toe drain system is subject to a review of the existing topography and subsurface soil conditions.

Pressure relief wells may be used along the landside toe of a dike in order to reduce the uplift pressure which can cause sand boils, piping, and failure of the foundation material. Relief wells capture seepage and provide controlled outlets for the seepage that would penetrate the dike on the landward side of the dike. Relief wells are typically used when the underlying soil layers are deep and pervious, making the used of other seepage control methods impractical. One benefit of a pressure relief well system is that the system can be expanded if the initial installation does not adequately control seepage. Unfortunately, wells require periodic maintenance and often experience losses in efficiency over time due to clogging of well screens. They also increase seepage discharge volumes and a means of collection and discharge of the water must be provided.

A preliminary geotechnical analysis has determined that cutoff sheeting driven to 20 feet below the ground surface is likely to be sufficient to prevent seepage concerns at any of the structural alternatives being considered.

3.4.1.2.2 Through-seepage

Seepage through a dike is a concern as it may soften the fill at the landside toe and result in sloughing of the embankment or piping of fine materials. It may also decrease the stability of the embankment. In order to control through seepage in an earth dike, a design which incorporates pervious zones to capture and control the emergence of seepage may be practical. These zones can include a pervious toe drain, horizontal drainage layer and /or an inclined drainage layer. A toe drain is located along the toe of the embankment, while horizontal and inclined drainage layers are located within the embankment itself.

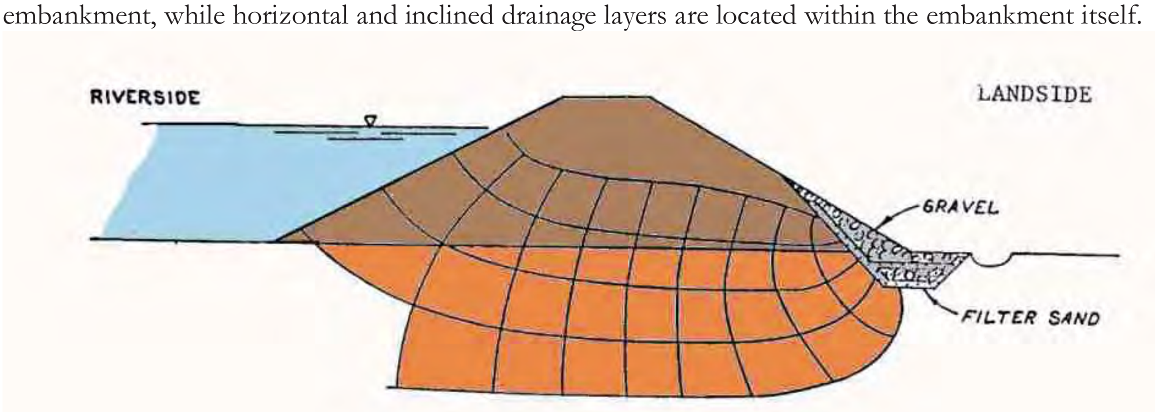

Figure 6 — Typical Toe Drain

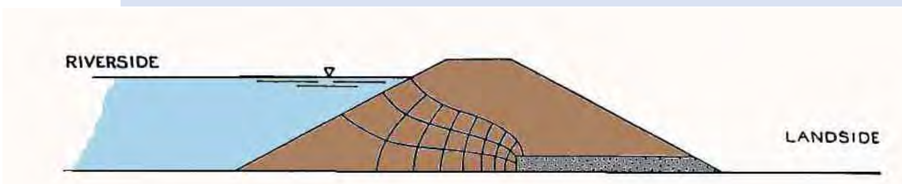

Figure 7 — Typical Horizontal Drainage Layer

Given the relatively low hydrostatic pressure head anticipated at this site, and need to minimize the impacts during construction, construction costs, and long term maintenance and operating costs and expenses, the use of a steel sheet pile cutoff wall will and pervious toe drain has been incorporated into the design of the earthen dike structure alternative.

3.4.1.3 Settlement

The construction of an earth dike must take the consolidation of the underlying soil strata and dike itself into consideration. A settlement analysis may be required during future design phases to adequately estimate the potential for, and anticipated amount of, settlement along the dike. Settlement can be expected when there are significant embankment loads, embankments constructed of compressible soils, embankments founded on compressible foundation soils, and below concrete structures founded on compressible soils.

Where foundation and embankment soils are pervious or semipervious, and the embankment loads are relatively high, most of the settlement will occur during construction. Due to the relatively low height of the proposed dike, full consolidation of underlying soil strata will likely not be possible without a period of preloading surcharge material within the dike's footprint, which could theoretically be achieve by stockpiling soil from the Chequessett Neck Road dike construction project at the site for a period of time before the start of construction. Such an approach would entail permitting approvals and require erosion and sedimentation controls for the period until construction starts at the site.

When the settlement analysis indicates that the anticipated settlement is greater than tolerable limits, the partial or complete removal of compressible foundation material may be necessary from both stability and settlement viewpoints. If the depth of compressible material requiring removal is too great for economical construction, other methods of control such as stage construction or vertical sand drains may be needed. Vertical sand drains allow the underlying soil layer to drain and consolidate quicker than they would otherwise.

For purposes of the current design analysis, it has been assumed that excavation of five (5) feet of soil within the footprint of the proposed dike will be sufficient to address any settlement concerns with shallow strata soils; this assumption will be further evaluated in subsequent phases of design.

3.4.1.4 Culvert Installation/ Flow Control

The control of tidal fluctuations, estuary drainage and flood waters through the dike will be controlled with the use of five parallel precast concrete culverts that will have tidal flow control devices installed at each culvert. The installation of the culverts will require careful design, analysis and construction oversight to ensure the proper construction of the culvert and seepage countermeasure.

3.4.1.5 Future Modifications:

If there is a need to increase the height of an earthen dike in the future to address changes in sea level, required freeboard and /or changes in nearby flood control structures it can be accomplished using one or more of the following methods:

- Riverside enlargement
  - Adding fill to the river side of the dike to increase base width and height
- Straddle enlargement
  - Adding fill to both the river side and land side of the dike to increase base width and height
- Landside enlargement
  - Adding fill to the land side of the dike to increase base width and height
- Increasing the steepness of the slopes (straddle enlargement)

- Adding fill to both sides of the dike at a slope steeper than the original to increase the height of the dike without increasing the width of the base
- Installation of a barrier/structure along the crown of the dike to serve as a floodwall

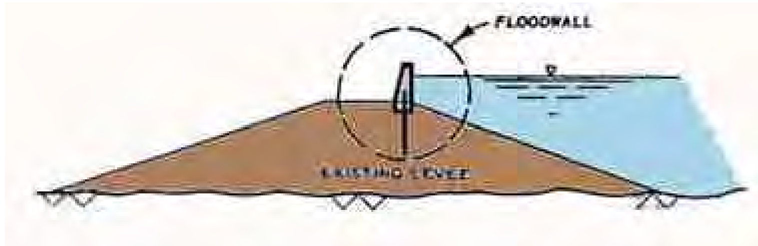

Figure 8 — Flood Wall Added to Dike

Each method has both advantages and disadvantages and will need to be evaluated to determine the most practical solution. The use of a riverside and straddle enlargement will likely not be advantageous in this case due to the tidal nature of the area and the need for extensive and expensive cofferdamming. The installation of a flood wall typically will be more expensive and time consuming than the installation of a landside enlargement. A landside enlargement which uses steeper slopes than the existing to minimize land impacts, or slopes that match the existing, are likely the most practical methods for increasing the height of the dike in the future. While the costs associated with future modification of the dike have not been included in this study, the potential need to increase the crest elevation should be taken into consideration during the initial design phases to reduce the potential of significant future construction costs.

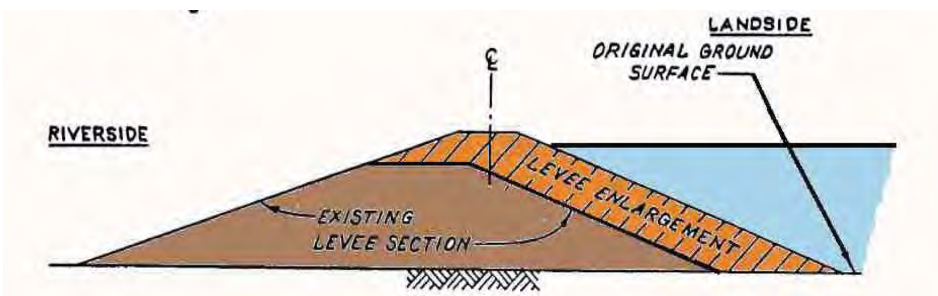

Figure 9 —Landside Dike Enlargement

3.4.1.6 Construction Sequence

The following are two possible construction sequences for the earthen dike. The first sequence is utilizes a bypass pipe to control flow through the site. The second utilizes a phased construction approach which will allow flow around the initial cofferdam setup for the first construction phase. Once the culvert system is completed the flow can be diverted through the culvert system while the second phase of construction is completed.

Bypass Pipe Construction Sequence

1. Mobilization
2. Clear and Grub
3. Construct temporary access road
4. Install cofferdam and construct bypass channel
5. Install bypass pipe to control flow
6. Excavate and dewater
7. Install partial fill for dike
8. Construct culvert system and flow control devices
9. Divert flow through culvert and remove bypass pipe
10. Install fill and construct remaining portion of dike
11. Remove cofferdam system

Phase Construction Sequence

1. Mobilization
2. Clear and Grub
3. Construct Temporary access road
4. Install cofferdam for Phase 1, construct bypass channel / divert water around end of cofferdam
5. Excavate and dewater
6. Construct portion of single wall dike and flow control structures
7. Remove portion of Phase 1 cofferdam to allow flow through flow control structures
8. Install cofferdam for Phase 2
9. Excavate and dewater
10. Construct remaining portion of single wall dike
11. Remove cofferdam system

3.4.1.7 Construction Schedule

It is estimated that the construction schedule for an earthen dike of the size required for this project, incorporating a precast concrete culvert system, and constructed with a bypass pipe for flow control will be on the order of 10 to 12 months. It is anticipated that the use of a phased construction approach will require approximately 12 and 13 months.

The additional time required for the phased construction is due to multiple mobilizations for sheet pile driving equipment, reconfiguration of the cofferdam system, and multiple stages required for fill and compaction operations. It should be noted that embankment fill imported from the Chequessett Neck Road project assuming project construction schedules align accordingly, and could affect these anticipated schedules.

3.4.2 Single Wall Dike

A single wall dike can be designed using cast-in-place concrete, precast concrete, steel sheet piling, plastic sheet piling or a combination of these materials. This type of wall should be designed in substantial accordance with the USACE Engineering Manual: Retaining and Flood Walls (EM 1110-2-2502) for this project. Certain single wall dikes can represent a significant cost savings when compared to the construction of an earth dike under suitable conditions. This study reviewed several single wall dike alternatives including the following:

- T-wall
- Gravity Wall
- Steel Sheet Pile Wall
- I-Wall

Each of these alternatives is discussed in the flowing sections.

3.4.2.1 Cast-In-Place Concrete Walls

Concrete dike walls are typically configured using one of the following wall types: cantilever wall, buttress wall, counterfort wall, inverted T-wall and gravity wall. Cantilever, buttress, counterfort and T-walls are very similar in configuration. They each consist of reinforced concrete and are designed on principles of leverage. The cross sectional area of the concrete is minimized through the use of steel reinforcement, relying primarily on the weight of the fill placed over the heel of the footing for stability. A cantilever wall requires the greatest amount of steel reinforcement of the wall configurations mentioned. The reinforcement attaches the wall stem to the footing.

Both the buttress and counterfort walls are similar to a cantilever retaining wall except that they can be used where the height of the stem is significant or when very high pressures are exerted on the walls stem. Counterforts and buttresses, or intermediate traverse support bracing, are designed and built at intervals along the wall and reduce the design forces. Generally these types of walls become more economical than a cantilever wall then the height of the wall exceeds 20 feet. The only difference between the two wall types is the location of the transverse support walls.

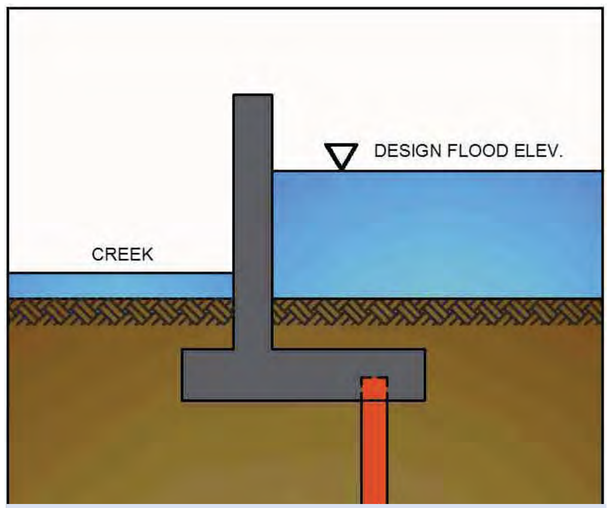

Figure 10 — Cantilever Wall

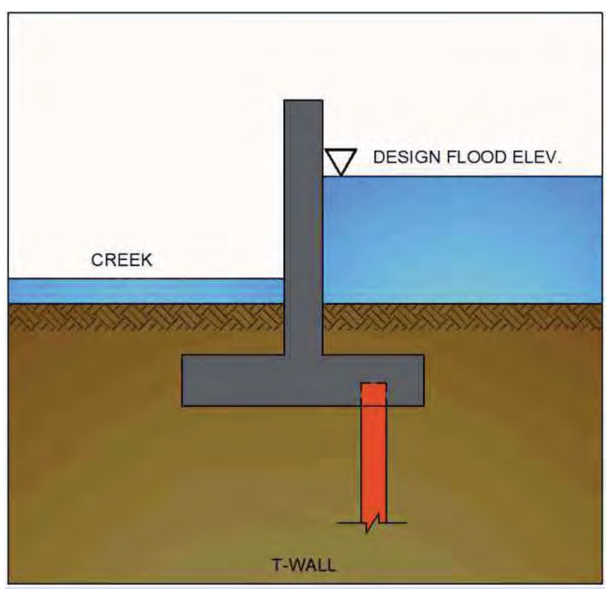

Figure 11 — T-Wall

Counterforts are located over the heel of the footing; buttresses are located over the toe of the footing.

Given that the cantilever, buttress and counterfort wall designs rely on the fill over the footing for stability, the footing thickness and size will need to be significantly greater than that of a typical retaining wall as the grades on both side of the wall will be the same. Due to the lack of fill over the heel of the footing, the use of a T-wall configuration often proves to be beneficial in an application where the grade on each side of the wall is at the same elevations. The wider toe aids the design by increasing the leverage arm of the footing, increasing the walls resistance to the forces acting against the wall.

A gravity wall, unlike a cantilever type of wall, relies primarily upon its own weight for stability. The gravity wall's structural stability is attained by effective positioning of the mass of the wall, rather than the weight of the retained materials. A gravity wall resists overturning primarily by the dead weight of the concrete construction. It is simply too heavy to be overturned by the lateral flood load. Frictional forces between the concrete base and the soil foundation resist sliding of the gravity wall. Gravity walls are appropriate for low walls or lightly loaded walls. They are relatively easy to design and construct. The primary disadvantage of a gravity floodwall is that a large volume of concrete required. As the required height of a gravity floodwall increases, it becomes more cost-effective to use a cantilever wall.

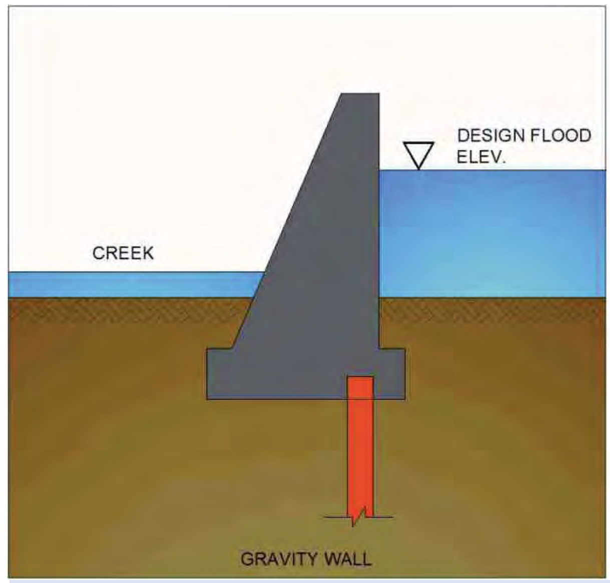

Figure 12 — Gravity Wall

No matter the type of concrete flood wall configuration, the use of a steel sheet pile or concrete cut off wall below the footing will likely be required to prevent seepage of water. The porosity of the in-situ soils and the hydrostatic head differential are two of the primary elements that control seepage rates. A flow net analysis will be required to determine the depth and appropriate type of cutoff wall.

The aesthetics of a concrete flood wall can be altered with the use of stone facing or concrete form liners to impart a pattern on the face of the concrete. The cost associated with facing the concrete with natural stone is significant when compared to the cost associated with the use of a form liner. Form liners are available in a wide variety of patterns and can be specified to meet the needs of the project.

The pattern shown in Figure No. 13 is only one of many available simulated stone patterns available; this particular pattern simulates the appearance of a cut granite block wall. The concrete can also be stained to match the look of natural stone wall. The cost of concrete form liners depends greatly on the pattern and if staining will be

Figure 13 — Concrete with Formliner Surface Treatment

incorporated. A cost of approximately $15 per square foot of surface area can be used for preliminary estimating purposes. Given that the aesthetics of the wall is not a primary concern due to its relative distance from persons who might view it; the use of form liners was not given further consideration in this study and not included in the cost comparisons.

3.4.2.2 Steel Sheet Pile Wall

Steel sheet pile flood walls may prove to be a suitable alternative depending on the findings of the geotechnical investigation which will be conducted in future design phases. Heavy-gauge steel is the most common material used for sheet pile flood walls due to its inherent strength, relative light weight, and long service life. These piles consist of interlocking sheets manufactured by either a hot-rolled or cold-formed process, and meet applicable standards for marine applications. While a number of sections are available, Z-type piling is predominantly used in retaining and floodwall applications where bending strength governs the design, as is the case for this site.

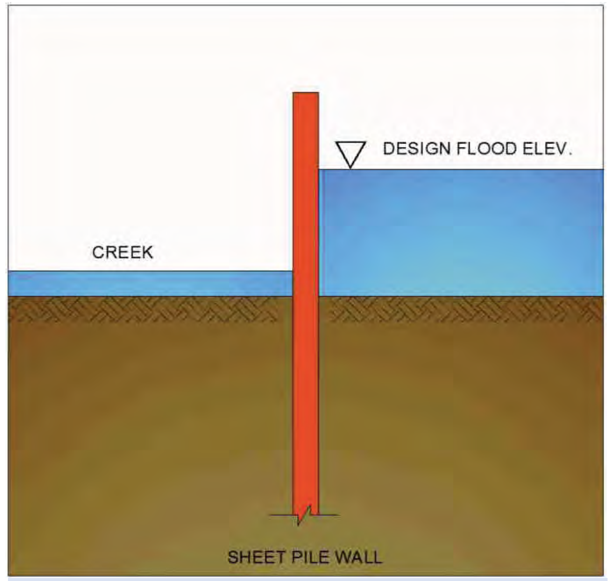

Figure 14 — Sheet Pile Wall

A sheet pile wall relies on passive soil pressures which are developed when loads, such as active earth pressures, are applied to the wall. For preliminary investigations, it is often assumed that the depth of sheet pile embedment required for stability is twice the height of the applied earth pressures.

3.4.2.2.1 Corrosion Protection

The life expectancy of the structure will be limited in marine environments due to corrosion, especially in the splash zone between the normal tidal surface elevations and the upper limit of wave action. Many references indicate average corrosion rates of 2 to 10 mils per year for the first several years depending on the environment the sheeting is exposed to. After the first several years the rate of corrosion typically decreases due to the overlying scale formed by corrosion. The sheeting at this site will be exposed to brackish water and tidal fluctuations.

For this project, both faces of a sheet pile wall would be exposed, meaning that corrosion will take place along both sides of the wall. It is anticipated that the loss of material over the service life of the wall will be on the order of ½ to ¾ inches. This is a significant amount of material loss and countermeasures will need to be used to ensure the longevity of the wall. A number of measures discussed in detail below are available to mitigate corrosion. These include cathodic protection systems, protective coatings, thicker steel sheet piles which can tolerate a loss of material on a sacrificial basis, and marine grade steel and composite materials which are formulated to resist corrosion. .

- Cathodic protection systems protect steel through an electrochemical means of corrosion control in which the oxidation reaction in a galvanic cell is concentrated at the anode and suppresses corrosion of the cathode in the same cell. Cathodic protection systems can be designed with either sacrificial metal or chemical anodes, and if needed can be externally charged to increase the effectiveness of the system. Due to the significant cost associated with the electric utilities required for the operation of an externally charged cathodic protection system, it has been eliminated from consideration as a viable alternative for this project. Sacrificial anode cathodic protection systems are considered a viable alternative due to their relatively low costs and low maintenance requirements. Additional investigation and cost benefit analysis is warranted in future design phases depending on the wall system selected for the dike.

- Marine grade steel alloy compositions have little to no effect on the corrosion rates of immersed or embedded steel sheet piles. The rate is approximately the same for all grades. However in the splash zone where the rate of corrosion is the most aggressive, ASTM A690 steel has been shown to significantly reduce the rate of corrosion and material loss. A690 steel offers approximately two to three times greater resistance to seawater "splash zone" corrosion than ordinary carbon steel.

- Sheet pile fabricated from composite materials, such as vinyl, are often considered due to its resistance to corrosion. However, due to limitations with driving it through dense subsurface soils such as those anticipated at this site it will likely be eliminated from consideration once adequate subsurface soil information is obtained. An additional limitation is the material's low Modulus of Elasticity (380,000 psi vs. steel at 29,000,000 psi) and material strength. The low property values result in excessive deflections under the applied loads when compared to steel sheeting, often requiring the use of significantly heavier sections and or the use of additional structures such as whalers and tiebacks and resist the applied loads.

  An evaluation of plastic sheeting (e.g., PVC or HDPE sheeting) as an alternative to steel sheeting was also performed. While these sheets could be driven to required depths in the soils, under the unbalanced loading conditions anticipated for this project they exhibit "long term creep," which is gradual, and increasing, deformation of the sheets over time due to imposed lateral loads, due to the weaker stiffness of the sheets as compared to steel sheets. Deflections of these sheets over their lifetime are much higher than steel sheets, and when considered for applications where clearance tolerances or alignments important (e.g., for structures supporting slide gates), or where concrete structures are incorporated which are susceptible to cracking and premature deterioration when subjected to deformation loads, the risks associated with these sheets generally outweigh any advantages they may provide (e.g., aesthetics).

  Lastly, because plastic sheets are not typically installed in the New England region, due to the predominance of gravel/rock/boulder subsurface conditions that are not conducive to driving these weaker sheets, contractors are not as familiar with the installation equipment and procedures required to successfully drive them in suitable sites. This general infamiliarity in this region typically results in increased costs due to increased equipment costs, time, and risks associated with this alternative.

- Galvanization of the steel sheeting is an effective method of long term protection. The galvanization process applies a thin coat of molten zinc which bonds to the surface of the steel. This zinc coating is acts sacrificial anode and cathodically protects exposed steel. While the coating can be applied with either an electrochemical or electrodeposition process, the most common method in use is hot-dip galvanization which applies a thicker more durable zinc coating.

- Non-metallic coatings are by far the most popular method for protecting steel in hostile environments and have been used in combination with a cathodic protection system to increase the system's effectiveness. Coal-tar epoxy is widely accepted coating system for protection for sheet pile walls in a corrosive environment. Two-part epoxy coatings have also been successfully used to protect sheet piling in marine environments. When applied over poorly prepared surfaces however, the service-life of protective coatings and their ultimate value were minimal, often less than five years. Due to this, inspection of the coating application is crucial to ensure their effectiveness. The surface preparation require for the application of coating systems is often time consuming and costly. Typically the surface of the steel needs to be prepared by blast cleaning the steel to a white metal finish and then primed prior to the application of the coating.

Considering that a sheep pile wall at this location would be subject to a severe environment increasing the potential for corrosion, and that the cosmetic appearance of the wall is not a primary consideration, the conceptual design of the sheet pile wall has been developed using a ASTM A-690 steel with a sacrificial thickness. The sacrificial thickness will allow the wall to be subject to corrosive action over the life of the wall and not result in a structural failure of the sheet pile dike. This was option was selected for the Mill Creek dike structural alternatives evaluation to minimize future maintenance, operating efforts and costs.

3.4.2.3 I-Wall

The configuration of an I-Wall is similar to that of a steel sheet pile wall with the exception that the exposed portion of the wall consists of reinforced concrete. A benefit of using this wall configuration is that the steel sheeting is not exposed and protected from corrosion. However, the cost of the reinforced concrete will likely exceed the cost of coatings, heavier sections or marine grade steel sheet piles that would be needed to counteract the effects of corrosion. This type of wall has seen extensive use by the US Army Corps of Engineers. In recent years, the failure of I-Walls has brought their construction and serviceability into question. Subsequent research by the USACE has

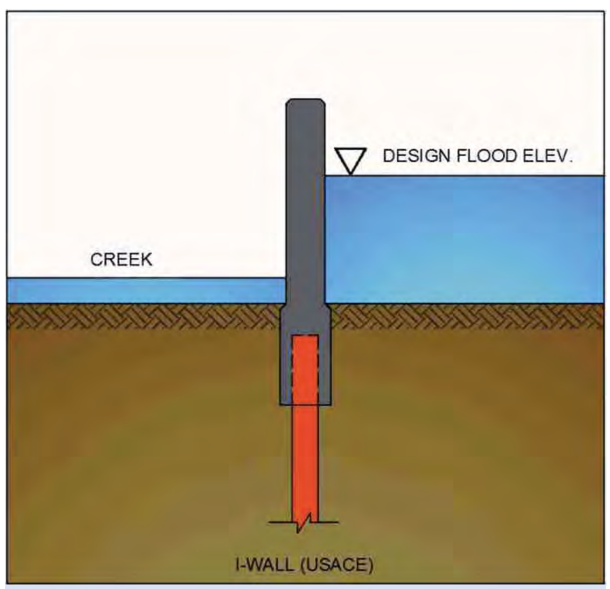

Figure 15 — I-Wall

shown that the I-Wall is still a valid design when all appropriate factors are taken into account.

3.4.2.4 Geometry / Access

The elevation of the existing channel is at approximately EL -1.5, meaning the maximum exposed height of the single wall dike will be approximately 10.9 feet. The single wall dike would be approximately 570 feet in length from end to end, and would be linear between both ends.

A steel sheet pile wall, concrete cantilever wall, T- Wall and I-Wall would all be similar in size above grade. The width of the wall stems would be approximately 2 feet in width for each alternative. The width of the stem for a gravity wall varies from approximately 2 feet at the top to 50% of the stem height at the base.

The footing for the concrete cantilever wall, T-Wall and gravity wall would be buried several feet below grade and vary in width depending on the exposed height of the dike. Typically the overall footing width is 50% to 70% of the walls overall height.

Access to the flood control devices for a single wall dike may be provided with either a full length elevated walkway attached to the land side face of the dike, or an at-grade access path with a ladder or stairway to leading to access an elevated operator platform mounted to the land side of the dike at the flow control structures. For the purpose of this study, a full length elevated platform will be assumed as the method of access to the flow control devices.

Access for maintenance and inspection of the dike will be provided by a foot path along the eastern face, and an improved road along the western face of the dike, south of Mill Creek. The improved access road, 12 feet in width, will allow maintenance vehicle access to the flow control structures. This road will terminate at the crest of the channels slope southern embankment, and will be subject to tidal conditions; as a result armoring or improvement of the road base will be required to support larger vehicles and equipment. During future design phases, the layout and configuration of the access should be reviewed to ensure adequate access is provided for inspection, maintenance and repairs.

3.4.2.5 Seepage

Water-retaining structures such as single wall dikes and floodwalls are subject to through-seepage, subsurface seepage, and seepage around their sides or ends. Seepage control is a primary consideration in the design of a single wall dike. Uncontrolled seepage may result in water pressures and uplift forces on the wall and consequent structural instability. Excessive pore water pressures in foundation soils near the landside toe of a wall may create boils, heaving, and the erosion of foundation soils through piping. For the purpose of this study steel sheet piles have been incorporated into each alternative to control seepage under the wall.

Through Seepage

In single wall dikes and flood walls, through-seepage in the wall joints is controlled with waterstops. The type of waterstop required is dependent on the function of the joints where they are located. Joints such as contraction or construction joints typically exhibit little to no movement. A ribbed Polyvinyl chloride water stop is usually sufficient. Where movement across the joint is anticipated, such as is the case with expansion joints, the use of a center bulb ribbed PVC waterstop is needed. The center bulb allows the waterstop of be move with the joint without damage. The addition of hydrophilic material along the joints in structures can be used as an additional measure of ensuring the joint are water tight.

End Seepage

The termination of a single wall dike within the adjacent embankments should not be an abrupt transition, and deserves special consideration to prevent excessive seepage around the ends of the wall. Seepage around the ends of the wall is controlled with the use of specially designed and constructed levee wrap-around sections and by embedding the dike wall into the adjacent embankments far enough to provide adequate seepage control. The configuration of the levee wrap around sections, and the needed embedment length, is dependent on the results of a seepage analysis. A full analysis will completed in future design phases. For the purpose of this study a minimum embedment length of the single wall dike alternative is being set at five feet, and will be evaluated and adjusted as required in subsequent design phases.

Under Seepage

Single wall dikes and floodwalls are usually provided with a toe drain to control local shallow seepage along the base of the wall on the landside. If the foundation soil stratum has a deep pervious layer additional control measures will be required to prevent subsurface seepage. These measures may include a cutoff wall that penetrates the underlying pervious soil stratum, trench drains, relief wells, and impervious blankets/berms. General descriptions of these items were provided earlier in this report.

For the purpose of this study, the use of steel sheet pile cutoff wall will be used for comparison and estimating purposes. A cutoff wall is typically provided under the footing of a reinforced concrete wall along the river side of the dike. For the steel sheet pile wall and I-wall alternatives, a cutoff wall will not be required as the wall itself provides a seepage cutoff. For purposes of this comparative evaluation, and based on the preliminary geotechnical seepage analysis, seepage cutoffs would need to extend to 20 feet below grade.

3.4.2.6 Settlement

The amount of settlement experience by of a rigid single wall dike is more critical than that experienced by an earthen dike. Where an earthen dike is a flexible structure, a single wall dike cannot tolerate a significant amount of differential settlement. Therefore, measures need to be taken to insure settlement of the single wall dike is limited.

A settlement analysis conducted as part of the geotechnical investigation will provide anticipated settlements along the wall. This analysis will also indicate appropriate measures for reducing or preventing settlement to acceptable limits. These measures may include the over excavation to remove unsuitable material, pre-consolidation of underlying soil stratum or timber piles. For the purpose of this study however, it appears that removal and replacement and/or surcharging soil strata would be adequate to avoid excessive settlement of concrete structures.

A significant amount of settlement of the steel sheet pile wall and I-wall alternatives is not anticipated, as these walls penetrate into deeper soils layers. The depth of the sheet piles can be configured during the design process to ensure the piles are stable, and prevent excessive settlement.

3.4.2.7 Culvert Installation and Flow Control

The installation of a culvert system to allow for, and control, flow through the dike is not needed for a single wall dike alternative. The flow control structures will be mounted directly to the wall, on the river side face. It is anticipated that a total of five penetrations through the dike will be required, each measuring 5 feet in width by 6 feet in height. These penetrations will be detailed in future design phases. It is anticipated that each penetration will be separated by an 18 inch wide column of concrete which will allow for the installation of the flow control devices. For the sheet pile wall alternative, a concrete facing or separate concrete structure inset into the wall will be required for mounting the flow control devices.

While a culvert system will not be needed for a single wall dike, and wing walls will not be needed to retain fill, a hydraulic analysis may show that a method of channeling the flow is needed to prevent vortexes and localized scour. The addition of walls that project upstream and downstream from the wall for this purpose may be warranted. However, for the purpose of this study, a method or structure for the purpose of channeling flow is not required.

3.4.2.8 Future Modifications

The modification of a single wall dike for changes in sea level and/or required freeboard can be accomplished by either increasing the physical height of the structure, or increasing the existing crest elevation with a newly constructed supplemental structure. In order to increase the physical height of the dike, an analysis must be conducted to determine if the existing wall can support the additional weight of the associated with the higher wall stem and the higher water surface elevations. Alternatively, a specified additional wall height can be accounted for during the initial design process. This would in effect overdesign the proposed wall to facilitate a potential future increase in crest elevation. The benefit to doing this is an initial structure that has higher factors of safety and a cost savings in the future if the crest elevation is increased.

The work required to increase the walls height can be performed by casting a cap along the top of reinforced concrete structures, or mounting an extension to the face of a sheet pile wall. This work can be performed from the landside of the dike and can potentially be completed using prefabricated components to expedite construction.

The construction of a supplemental structure, such as a new taller stem cast behind the original wall stem, is also possible. A supplemental structure would change the physical configuration of the base structure. While the base structure would be subject to greater loads than originally intended, the supplemental structure would add stability and strength to the base structure. The design of a supplemental structure can be done in the future as the capacity of the base structure will change when the supplemental structure is added. The work required to construct a supplemental structure can be performed along the upstream side of the existing wall and could potentially be accomplished with prefabricated components.

3.4.2.9 Construction Sequence

Two possible construction sequences for a single wall dike are provided below. The first sequence is utilizes a bypass pipe to control flow through the site, while the second utilizes a phased construction approach which will allow flow around the initial cofferdam setup for the first construction phase. Once the flow control structures are completed the flow can be diverted through the flow control structures system while the second phase of construction is completed.

<u>Bypass Pipe Construction Sequence</u>

1. Mobilization
2. Clear and Grub
3. Construct temporary access road
4. Install cofferdam and construct bypass channel
5. Install bypass pipe to control flow
6. Excavate and dewater
7. Construct single wall dike
8. Construct culvert system and flow control devices
9. Divert flow through culvert and remove bypass pipe
10. Construct remaining portion of single wall dike
11. Final grading and site work
12. Remove cofferdam system

<u>Phase Construction Sequence</u>

1. Mobilization
2. Clear and Grub
3. Construct Temporary access road
4. Install cofferdam for Phase 1, construct bypass channel and divert water
5. Excavate and dewater
6. Construct portion of dike, and flow control devices
7. Remove portion of cofferdam and divert flow through flow control devices
8. Install cofferdam for Phase 2
9. Excavate and dewater
10. Construction remaining portion of single wall dike
11. Remove cofferdam system (Phase 1 and Phase 2)

3.4.2.10 Construction Schedule

It is estimated that the construction schedule for a single wall dike of the size required for this project, utilizing steel sheet piles, incorporating a cast-in-place concrete facing for attachment of flow control devices, and constructed with a bypass pipe for flow control will be on the order of 3 to 5 months.

For single wall alternatives which require cofferdamming, a bypass pile for flow control, and cast in place concrete footings and/or wall stems, the anticipated construction schedule is on the order of 7 to 9 months.

It is anticipated that the use of a phased construction approach will require an additional 1 to 2 months for any alternative. This additional time is required due to multiple mobilizations for sheet pile driving equipment, reconfiguration of the cofferdam system, multiple stages for fill and compaction operations, etc.

3.5 Gate Structure Alternatives

Numerous gate configurations are available from several manufacturers, each offering varied features and functionality. Innovative custom designs are also available that allow the configuration and construction of flow controls suited for a specific need or site/structural constraint. During the initial investigation of flow control devices, research was conducted on alternatives that are readily available and would suit the project's critical functional requirements.

Through this research and evaluation it was determined that weir gates and the sole use of flap gates were not suitable alternatives because they would not offer the functionality and hydraulic control required for this site. As a result, the alternatives described below have been deemed suitable for use in the proposed structure. It is noted that the service life of any gate system is significantly affected by the degree that recommended maintenance practices are followed.

It was noted in the July 2013 workshop meeting with HRRC that aesthetic appearance of the structure at Mill Creek is not a priority because the structure will not likely be visible to the public. As a result it was determined that structures with rising stems could be used at this location without objection.

The following sections discuss the alternative gate structures that are in consideration for the structure at the Mill Creek dike. It should be noted that all gate types and operator types could be used for either structural alternative.

3.5.1.1 Slide Gates with Separate Flap Gates

Slide gates consist of panels that are lifted from above by a rotating screw, allowing water to pass below the lifted panels. These gates are typically fabricated using either aluminum or stainless steel and can be configured with either a rising stem or non-rising stem. The operators for slide gates may be either manual, electric with manual controls, or fully automated.

Flap gates could supplement a primary flow control gate such as a slide gate. These gates could be mounted on a concrete facing and placed in combination with an adjacent slide gate. These gates can be manufactured in a number of sizes to fit with a variety of sizes of culvert openings. However, flap gates require additional design consideration as the weight and head differential required to open the flap must be incorporated into the design and placement of the gates.

A slide gate could be paired with a flap gate in a configuration where the bottom portion of the slide gate could flap. The whole gate could rise as a single structure. The gate will be able to be locked closed or opened for security.

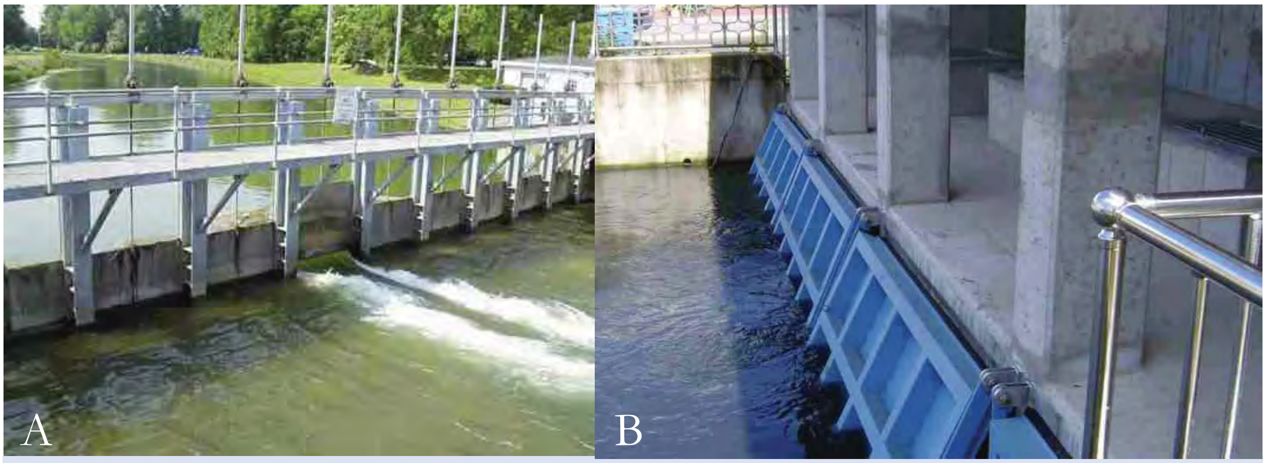

Figure 16 — (A) Rising Stem Slide Gates with Portable Drill Operated Controls, (B) Flap Gates

3.5.1.2 Combination Slide-Flap Gates

Slide-flap gates are structures that combine all of the features of a slide gate but also incorporate the functionality of flap gate by allowing the sliding leaf to rotate about a horizontal transverse axis at the top of the gate opening.

This functionality is typically provided to allow storm flow drainage from a tidal estuary, while limiting tidal surge or high tides into an estuary that would otherwise result in flood damage. For example, when the gate is partially open, the open area below the gate leaf allows for bi-directional flow, while the upper portion of the gate opening (where the leaf is located) restricts flow in one direction to a greater degree. As the gate moves to a more fully closed position, the open area (and bi-directional flow) decreases, resulting in the flow becoming predominately or entirely one-directional due to the function of the flap gate. The gate will be able to be locked closed or opened for security.

Figure 17 — Combination Slide-Flap Gate

3.5.1.3 Inverted Weir Stop Logs

Inverted weir stop logs operate in the same manner as a slide gate, however the actual gate is composed of several individual "stop logs" or sections that can be removed as the system is raised and re-installed if the system is lowered.

This system may be able to be configured to function with a cable lift, reducing the visual impacts associated with the use of a stem and operator. In addition, the ability to remove portions of the gate as it is opened will reduce the overall visual impact of the system. This system has marginally increased mechanical complexity in comparison to the other gate structures, but requires more labor to operate. The gate could be locked closed or opened for security.

Figure 18 — Typical Inverted Weir Stop Log

3.5.1.4 Gate Operator Alternatives

Alternative gate operator types include manual operators (e.g., hand-operated crank or wheel type) or powered operators (e.g., electrically or hydraulically actuated from a power source). Recent discussions completed with the HRRC and the Town of Wellfleet for the Chequessett Neck Road dike structure indicated that the preference/need for subsequent design was that a hydraulic actuator system with portable electric power generator is preferred, given the lack of 3-Phase power on this section of Chequessett Neck Road.

As a result, for purposes of this evaluation, it has been assumed that the portable generator system procured for the Chequessett Neck Road dike structure would be available to operate gates at the Mill Creek dike, when needed. The cost for the actuators, control and power panels/cabinets, and conduits has been included in the costs included in *Attachment E,* summarized below.

4 Recommended Structural Alternative

4.1 Comparative Cost Considerations

It has been determined through this study, as supported by the field geotechnical explorations that the alternatives considered in this report meet the project's overall functional requirements and can be constructed and operated within the site constraints as reflected in the conceptual layouts. Selection of a the recommended alternative in this report was based on an evaluation of relative criteria reflected in the comparative constraints evaluation matrix in Attachment D, including term impacts on natural resources, physical processes including low tide drainage, long-term operation/maintenance requirements and costs, construction costs, site safety and security.

The estimated order of magnitude opinions of construction cost (rounded to the nearest $10,000, adjusted for inflation to 2016) of each dike alternative are provided in *Attachment E*. and summarized in *Table 1* below. These costs include assumed combination slide flap gates with electric operators and a 35 percent contingency. Order of magnitude costs for conceptual level designs are typically expected to be accurate to within -15% to +30%, resulting in a construction cost range provided. As shown, the steel sheet pile single wall was determined to be the least expensive alternative, followed by the earthen dike alternative.

Table 1
Order-of-Magnitude Cost Comparison of Dike Alternatives

	Earthen Dike	Sheet Pile Wall	I-Wall	T-Wall	Gravity Wall
Construction Cost	$4,260,000	$2,860,000	$4,610,000	$5,120,00	$5,400,000
-15%	$3,810,000	$2,560,000	$4,120,000	$4,590,000	$4,830,000
+30%	$5,150,000	$3,460,000	$5,570,000	$6,200,000	$6,530,000

4.2 Operation and Maintenance Considerations

Both dike alternatives pose different maintenance requirements. The earthen dike is the easiest structure to access for routine maintenance, due to the access road being located on the embankment crest, above high tide and flood elevations, however will require routine maintenance to remove vegetation (e.g., mowing 4 times per year, or bush-hogging 2 times per year) and minor repairs associated with erosion and burrowing animals.

While the single wall dike will be accessible for inspection and maintenance, the at-grade access routes mean that during high tides or floods, vehicles/equipment could not access the channel to remove debris or repair gates, if needed. Manned access to the operators using the walkway would be equivalent for both structures, given that are both near the crest/top elevation of the structure, above high tide/flood elevations. It may be possible to place fill in the marsh to raise grades of the access routes to near/above the high tide elevations, or near/above the flood elevations, to reduce the severity/frequency of inundation, however doing this would entail additional wetland impacts and construction costs.

For the single wall dike alternative, vehicle/equipment access to marsh areas on the north side of the marsh channel would require a portable bridge (e.g., timber mats or steel plates set on beams supported by concrete waste blocks abutments, similar to what was placed for the drilling equipment access). This access would only be required for major repairs to the structure. Maintenance requirements for the single wall dike will be dependent on the chosen composition of the wall: steel or concrete. While each material has maintenance requirements, weathering steel is likely to require less maintenance over the long term, as opposed to concrete which may chip, crack or spall, depending on weather/site conditions.

It is noted that coating systems for steel sheeting would require routine maintenance, and thus are not recommended in favor of a weathering steel alternative.

4.3 Permitting Requirements

Permitting requirements that may need to be addressed prior to construction are listed below.

- Wellfleet Conservation Commission
- Massachusetts Environmental Policy Act Certification
- Massachusetts Wetlands Protection Act
- 401 Water Quality Certification
- Public Waterfront Act (Chapter 91)
- CZM Federal Consistency Review
- U.S. Army Corps of Engineers Category II General Permit
- NPDES Dewatering Discharge General Permit for Construction (Notice of Intent)
- Massachusetts Endangered Species Act
- Massachusetts Historical Commission (Project Notification Form likely required only)
- Cape Cod Commission (Development of Regional Impact, if necessary)
- U.S. Coast Guard Bridge Permit

It is noted that the sheet pile wall alternative has a significantly smaller footprint, resulting in reduced construction and post-construction phase direct impacts to wetland resources.

4.4 Recommended Alternative

Based on consideration of the above, it is recommended that the HRRC and the Chequessett Yacht and Country Club consider proceeding with a sheet pile wall alternative, due principally to the significantly lower construction costs, reduced construction footprint/wetland impact, shorter construction duration affecting golf course operations, reduced maintenance requirements, and previous feedback from the HRRC that aesthetics were not a heavily-weighted consideration.

It is understood that the HRRC, National Park Service staff, Chequessett Neck Country Club and Town of Wellfleet, will continue reviewing/considering this recommendation and the alternatives such that a final selection can be made by the HRRC, providing a basis for continued field investigations (e.g., wetland resource flagging, survey, etc.) and preliminary design of the preferred alternative incorporating any other design criteria/requirements identified by the reviewing parties.

Attachment A

Existing Conditions Base Map

MAP NOTES AND REFERENCES:

1. TOPOGRAPHY REFLECTED ON THIS PLAN WAS OBTAINED FROM LIDAR TERRAIN DATA PROVIDED BY MASSGIS. TERRAIN DATA FOR THIS AREA WAS OBTAINED IN WINTER–SPRING 2011. TOPOGRAPHICAL INFORMATION WAS PROCESSED TO MEET A BARE EARTH FUNDAMENTAL VERTICAL ACCURACY (FVA) OF 18.13 CM AT A 95% CONFIDENCE LEVEL, DERIVED ACCORDING TO NSSDA (I.E., BASED ON VRMSE OF 9.25 CM IN THE "OPEN TERRAIN" LAND COVER CATEGORY).

2. PROPERTY AND STATE HIGHWAY/PUBLIC ROADWAY LINES SHOWN HEREIN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM A COMBINATION OF DATA PROVIDED BY THE TOWN OF WELLFLEET, THE NATIONAL PARK SERVICE (NPS), AND LEVEL 3 ASSESSOR'S PARCEL MAPPING/DATA PROVIDED BY MASSGIS. THIS PLAN IS NOT TO BE CONSTRUED AS AN ACCURATE BOUNDARY SURVEY AND IS SUBJECT TO SUCH CHANGES AS AN ACCURATE BOUNDARY SURVEY OR DEED RESEARCH MAY DISCLOSE.

3. AERIAL IMAGERY REFLECTED ON THIS PLAN WAS OBTAINED FROM ORTHO IMAGERY (AERIAL PHOTOGRAPHY) PROVIDED BY MASSGIS. THE AERIAL PHOTOGRAPHY WAS ACQUIRED BY FUGRO EARTHDATA, INC. BETWEEN MARCH 24 TO APRIL 26, 2009. THE ORTHOPHOTOGRAPHY WAS CREATED FOR USE BY THE USGS, THE NATIONAL GEOSPATIAL–INTELLIGENCE AGENCY, AND MASSGIS. DEWBERRY AND DAVIS LLC WAS CONTRACTED BY THE USGS TO ACQUIRE PHOTO IDENTIFIABLE GROUND CONTROL POINTS DURING THE ACQUISITION OF AERIAL IMAGERY. THE GROUND CONTROL POINTS WERE ESTABLISHED USING GPS FOR VERTICAL (NAVD 88 METERS) AND HORIZONTAL (NAD83(NSRS2007) COORDINATE VALUES (UTM ZONE 19N IN 2008, MASSACHUSETTS STATEPLANE MAINLAND US SURVEY METERS IN 2009). THE 30CM ORTHOPHOTOS WERE CREATED TO BE FULLY COMPLIANT WITH A HORIZONTAL POSITIONAL ACCURACY NOT TO EXCEED 3 METERS ROOT MEAN SQUARED ERROR (RMSE).

4. WETLANDS REFLECTED ON THIS PLAN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM MASSGIS AND WERE INTERPRETED FROM 1:12,000 SCALE, STEREO COLOR–INFRARED (CIR) PHOTOGRAPHY BY STAFF AT UMASS AMHERST. THE PHOTOGRAPHY WITHIN THIS AREA WAS CAPTURED IN 1993. THE VARIOUS TYPES OF WETLANDS REFLECTED ON THIS PLAN ARE AS FOLLOWS:

   SALT MARSH — COASTAL BEACH — COASTAL BANK BLUFF — TIDAL FLAT
   SHALLOW MARSH MEADOW OR FEN — WOODED SWAMP (DECIDUOUS) — WOODED SWAMP (MIXED TREES)

5. FLOOD ZONE WATER SURFACE ELEVATIONS (AND FLOOD PLAIN BOUNDARIES) WITHIN THE PROJECT LIMITS WERE OBTAINED FROM FLOOD INSURANCE RATE MAP (FIRM) PANEL NO. 2500140011C FOR THE TOWN OF WELLFLEET, MASSACHUSETTS, DATED JULY 2, 1992.

6. PROPERTIES OWNED BY THE CAPE COD NATIONAL SEASHORE AS REFLECTED ON THIS PLAN ARE LOCATED WITHIN A FEMA RECOGNIZED UNDEVELOPED COASTAL BARRIER ZONE (REFERRED TO AS AN OTHERWISE PROTECTED AREA).

LEGEND

- FEMA FLOOD ZONE
- WETLANDS
- PROPOSED CONTOUR
- PROPERTY LINE/RIGHT–OF–WAY
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

SCALE:
HORZ.: 1" = 100'
VERT.: N/A

DATUM:
HORZ.: NAD83
VERT.: NAVD88

100 50 0 100
GRAPHIC SCALE

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317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

HERRING RIVER RESTORATION COMMITTEE

EXISTING CONDITIONS PLAN

HERRING RIVER AND MILL CREEK

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JUNE 2014

CS-101

MS VIEW:
LAYER STATE:

File Path: J:\DWG\P2012\0636\A12\Civil\Plan\20120636A20_EXC01.dwg Layout: 24X36-L_100 SCALE (LIDAR) Plotted: Thu, June 12, 2014 - 4:45 AM User: nwiberg
Plotter: DWG TO PDF.PC3 CTB File: FO.STB

MAP NOTES AND REFERENCES:

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2. PROPERTY AND STATE HIGHWAY/PUBLIC ROADWAY LINES SHOWN HEREIN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM A COMBINATION OF DATA PROVIDED BY THE TOWN OF WELLFLEET, THE NATIONAL PARK SERVICE (NPS), AND LEVEL 3 ASSESSOR'S PARCEL MAPPING/DATA PROVIDED BY MASSGIS. THIS PLAN IS NOT TO BE CONSTRUED AS AN ACCURATE BOUNDARY SURVEY AND IS SUBJECT TO SUCH CHANGES AS AN ACCURATE BOUNDARY SURVEY OR DEED RESEARCH MAY DISCLOSE.

3. AERIAL IMAGERY REFLECTED ON THIS PLAN WAS OBTAINED FROM ORTHO IMAGERY (AERIAL PHOTOGRAPHY) PROVIDED BY MASSGIS. THE AERIAL PHOTOGRAPHY WAS ACQUIRED BY FUGRO EARTHDATA, INC. BETWEEN MARCH 24 TO APRIL 26, 2009. THE ORTHOPHOTOGRAPHY WAS CREATED FOR USE BY THE USGS, THE NATIONAL GEOSPATIAL–INTELLIGENCE AGENCY, AND MASSGIS. DEWBERRY AND DAVIS LLC WAS CONTRACTED BY THE USGS TO ACQUIRE PHOTO IDENTIFIABLE GROUND CONTROL POINTS DURING THE ACQUISITION OF AERIAL IMAGERY. THE GROUND CONTROL POINTS WERE ESTABLISHED USING GPS FOR VERTICAL (NAVD 88 METERS) AND HORIZONTAL (NAD83(NSRS2007) COORDINATE VALUES (UTM ZONE 19N IN 2008, MASSACHUSETTS STATEPLANE MAINLAND US SURVEY METERS IN 2009). THE 30CM ORTHOPHOTOS WERE CREATED TO BE FULLY COMPLIANT WITH A HORIZONTAL POSITIONAL ACCURACY NOT TO EXCEED 3 METERS ROOT MEAN SQUARED ERROR (RMSE).

4. WETLANDS REFLECTED ON THIS PLAN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM MASSGIS AND WERE INTERPRETED FROM 1:12,000 SCALE, STEREO COLOR–INFRARED (CIR) PHOTOGRAPHY BY STAFF AT UMASS AMHERST. THE PHOTOGRAPHY WITHIN THIS AREA WAS CAPTURED IN 1993. THE VARIOUS TYPES OF WETLANDS REFLECTED ON THIS PLAN ARE AS FOLLOWS:

SALT MARSH	COASTAL BEACH	COASTAL BANK BLUFF	TIDAL FLAT
SHALLOW MARSH MEADOW OR FEN	WOODED SWAMP (DECIDUOUS)		WOODED SWAMP (MIXED TREES)

5. FLOOD ZONE WATER SURFACE ELEVATIONS (AND FLOOD PLAIN BOUNDARIES) WITHIN THE PROJECT LIMITS WERE OBTAINED FROM FLOOD INSURANCE RATE MAP (FIRM) PANEL NO. 2500140011C FOR THE TOWN OF WELLFLEET, MASSACHUSETTS, DATED JULY 2, 1992.

6. PROPERTIES OWNED BY THE CAPE COD NATIONAL SEASHORE AS REFLECTED ON THIS PLAN ARE LOCATED WITHIN A FEMA RECOGNIZED UNDEVELOPED COASTAL BARRIER ZONE (REFERRED TO AS AN OTHERWISE PROTECTED AREA).

File Path: J:\DWG\P2012\0636\A12\Civil\Plan\20120636A20_EXC01.dwg Layout: 24X36-L_50 SCALE (LIDAR) Plotted: Thu, June 12, 2014 - 5:04 AM User: nwiberg
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
MS VIEW:
LAYER STATE:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

SCALE:
HORZ.: 1" = 50'
VERT.: N/A
DATUM:
HORZ.: NAD83
VERT.: NAVD88

50 25 0 50
GRAPHIC SCALE

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

HERRING RIVER RESTORATION COMMITTEE

EXISTING CONDITIONS PLAN

MILL CREEK DIKE AND RESTORATION

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A20
DATE: JUNE 2014

CS-104

Attachment B

Geotechnical Field Investigation Data

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	BORING LOG Project: Mill Creek Dike Location: Wellfleet, MA	Boring ID: B-1 Sheet 1 of 2 Project No.: 20120636.A14

Contractor: New Hampshire Boring
Operator: Walter Hoeckele
F&O Rep.: Manju Sharma
Drilling Method: Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs   Hammer Fall (in.): 30
Boring Location: Station 4+10
Ground Elevation: 0.5 (NAVD88)
Date Start: 03/17/2014   Date Finish: 03/17/2014

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1630- 03/17/2014

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	1	S-1	0-2	1/24	1 1 0 0	Very loose dark brown organic SILT,roots present. Wet	Organic Soil	OL	1
4	-3	S-2	4-6	6/24	3 5 5 5	Medium dense grey fine to medium, SAND, trace Silt.	Sand	SP	
9	-8	S-3	9-11	5/24	1 2 2 1	Loose grey fine to medium SAND, little Silt.		SP	
14	-13	S-4	14-16	17/24	5 4 6 8	Medium dense grey fine SAND, some Silt.		SP	2
19	-18	S-5	19-21	20/24	10 16 18 27	Dense, grey fine SILT, some Clay, low plastciity	Clayey Silt	ML-CL	
24	-23	S-6	24-26	18/24	10 12 17 22	Medium dense, grey fine SAND ,little Silt.	Sand	SP	
29	-28	S-7	29-31	22/24	9 12 14 20	Medium dense, light brown fine SAND, little Silt.		SP	
34	-33	S-8	34-34.8 34.8-35.6	20/24	12 20 24 30	Very Stiff, dark grey CLAY, some Sand Dense, grey fine to medium SAND, some Silt.	Clayey Sand Sand	CL SP	
39	-38	S-9	39-41	15/24	15 20 29 43	Dense, light grey fine SAND, some Silt.		SP	
44	-43	S-10	44-46	12/24	29 45 57 57	Very dense light grey fine SAND, little Silt.		SP	
49	-48	S-11	49-51	12/24	21 47 59 57	Very dense yellow brown fine SAND, trace Silt.		SP	

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
Auto hammer
1. Groundwater encountere d at 0.2' .
2. Piezometer installed, screened between 18' and 8'.

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** Project: Mill Creek Dike Location: Wellfleet, MA	Boring ID: B-1 Sheet 2 of 2 Project No.: 20120636.A14

Contractor: New Hampshire Boring
Operator: Walter Hoeckele
F&O Rep.: Manju Sharma
Drilling Method: Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs   Hammer Fall (in.): 30
Boring Location: Station 4+10
Ground Elevation: 0.5 (NAVD88)
Date Start: 03/17/2014   Date Finish: 03/17/2014

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1630- 03/17/2014

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
54	-53	S-12	54-56	11/11	60 100/5"	Very dense yellow brown fine SAND, trace Silt.	Sand	SP	
59	-58	S-13	59-61	14/24	21 28 30 30	Very dense yellow brown fine SAND, trace Silt.		SP	
69	-68	S-14	69-71	15/24	26 26 30 33	Very dense yellow brown fine to medium SAND, trace Silt.		SP	
						End of boring @ 71'			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCLESTER, CT	**BORING LOG** Project: Mill Creek Dike Location: Wellfleet, MA	Boring ID: B-2 Sheet 1 of 1 Project No.: 20120636.A14

Contractor: New Hampshire Boring
Operator: Walter Hoeckele
F&O Rep.: Manju Sharma
Drilling Method: Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: Station 1+50
Ground Elevation:
Date Start: 03/20/2014 Date Finish: 03/20/2014

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 10:00- 03/20/2014

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	4.5	S-1	0-2	8/24	2	5" Top Soil	Top Soil	SP	
					2 4 4	Medium dense yellow brown fine to medium SAND, little Silt. Moist	Sand		
4	0.5	S-2	4-4.5	19/24	9 16	Medium stiff dark grey CLAY, trace Sand	Clay	CL	1
			4.5-5		18 17	Loose dark grey fine to medium SAND,some Silt, little Clay	Sand	SP	
9	-4.5	S-3	9.0-9.7 9.7-10.1	13/24	8 5 4 5	Loose dark grey fine to medium SAND,some Silt, little Clay		SP	
14	-9.5	S-4	14.0-14.75 14.75-15.67	20/24	2 2 2 4	Loose light grey fine to coarse SAND,some Silt.		SC	
19	-14.5	S-5	19-19.84 19.84-20.67		0 8 4 8	Medium dense yellow brown fine to medium SAND,some Silt.		SP	
24	-19.5	S-6	24-26	11/24	18 33 57 60	Very dense yellow brown fine to medium SAND, some Silt.		SP	
29	-24.5	S-7	29-31	13/24	17 23 29 49	Very dense yellow brown fine to medium SAND, some Silt.		SM	
34	-29.5	S-8	34-36	7/24	13 13 13 26	Medium dense yellow brown fine SILT, little Clay, low plasticity.	Silt	ML	
39	-34.5	S-9	39-39.5	23/24	8 7	Medium dense light grey fine to medium SAND, some Silt.	Sand	SM	
			39.5-40.5		15 16	Very stiff medium grey CLAY, some Sand.	Sandy clay	CL	
						End of boring at 41'			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
Auto hammer
1. Groundwater encountered at ~ 4 ft.

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	BORING LOG	Boring ID: B-3
	Project: Mill Creek Dike	Sheet 1 of 1
	Location: Wellfleet, MA	Project No.: 20120636.A14

Contractor: New Hampshire Boring
Operator: Walter Hoeckele
F&O Rep.: Manju Sharma
Drilling Method: Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs Hammer Fall (in.): 30
Boring Location: Station 3+30
Ground Elevation:
Date Start: 03/19/2014 Date Finish: 03/19/2014

Water Level Measurements

Date	Ref. Pt.	Depth	Time

Time & Date of Completion: 1430- 03/19/2014

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	3	S-1	0-2	8/24	2 2 4 4	3" Top Soil	Top Soil		
						Loose light grey fine to medium SAND, little Silt. Moist	Sand	SP	
4	-1	S-2	4-6	19/24	9 16 18 17	Dense dark gey fine to medium SAND, little Silt. Wet		SP	1
9	-6	S-3	9.0-9.7	13/24	8 5	Loose dark grey fine to medium SAND, little Silt.		SP	
			9.7-10.1		4 5	Stiff dark grey CLAY, some Sand	Sandy Clay	CL	
14	-11	S-4	14.0-14.7	20/24	2 2	Loose dark grey fine to medium SAND, little Clay, low plasticity.	Sand	SP	
			14.75-16		2 4	Stiff dark grey CLAY, some Silt	Silty Clay	ML	
19	-16	S-5	19-19.8		0 8	Stiff dark grey CLAY, some Silt		ML	
			19.8-21		4 8	Medium dense, dark grey fine to medium SAND ,little Silt, little Clay.	Sand	SP	
24	-21	S-6	24-26	11/24	18 33 57 60	Very dense, dark grey medium to coarse SAND, little Silt		SP	
29	-26	S-7	29-31	13/24	17 23 29 49	Very dense,yellow brown fine SAND, trace Silt		SP	
34	-31	S-8	34-36	7/24	13 13 13 26	Medium dense, light grey fine SAND, little Silt		SP	
39	-36	S-9	39-40.1	23/24	8 7	Stiff dark grey CLAY, some San	Sandy clay	CL	
			40.1-41		15 16	Medium dense,dark grey fine to medium SAND, little Silt	Sand	SP	
						End of boring at 41'			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
Auto hammer
1. Groundwater encountered at 4'.

FUSS & O'NEILL, INC. CONSULTING ENGINEERS MANCHESTER, CT	**BORING LOG** **Project: Mill Creek Dike** **Location: Wellfleet, MA**	**Boring ID: B-4** **Sheet 1 of 1** **Project No.: 20120636.A14**

Contractor: New Hampshire Boring
Operator: Walter Hoeckele
F&O Rep.: Manju Sharma
Drilling Method: Drive & Wash
Sampling Method: Split Spoon (2" OD)
Hammer Wt.: 140 lbs   Hammer Fall (in.): 30
Boring Location: Station 5+10
Ground Elevation:
Date Start: 03/18/2014   Date Finish: 03/18/2014

Water Level Measurements

Date	Ref. Pt.	Depth	Time

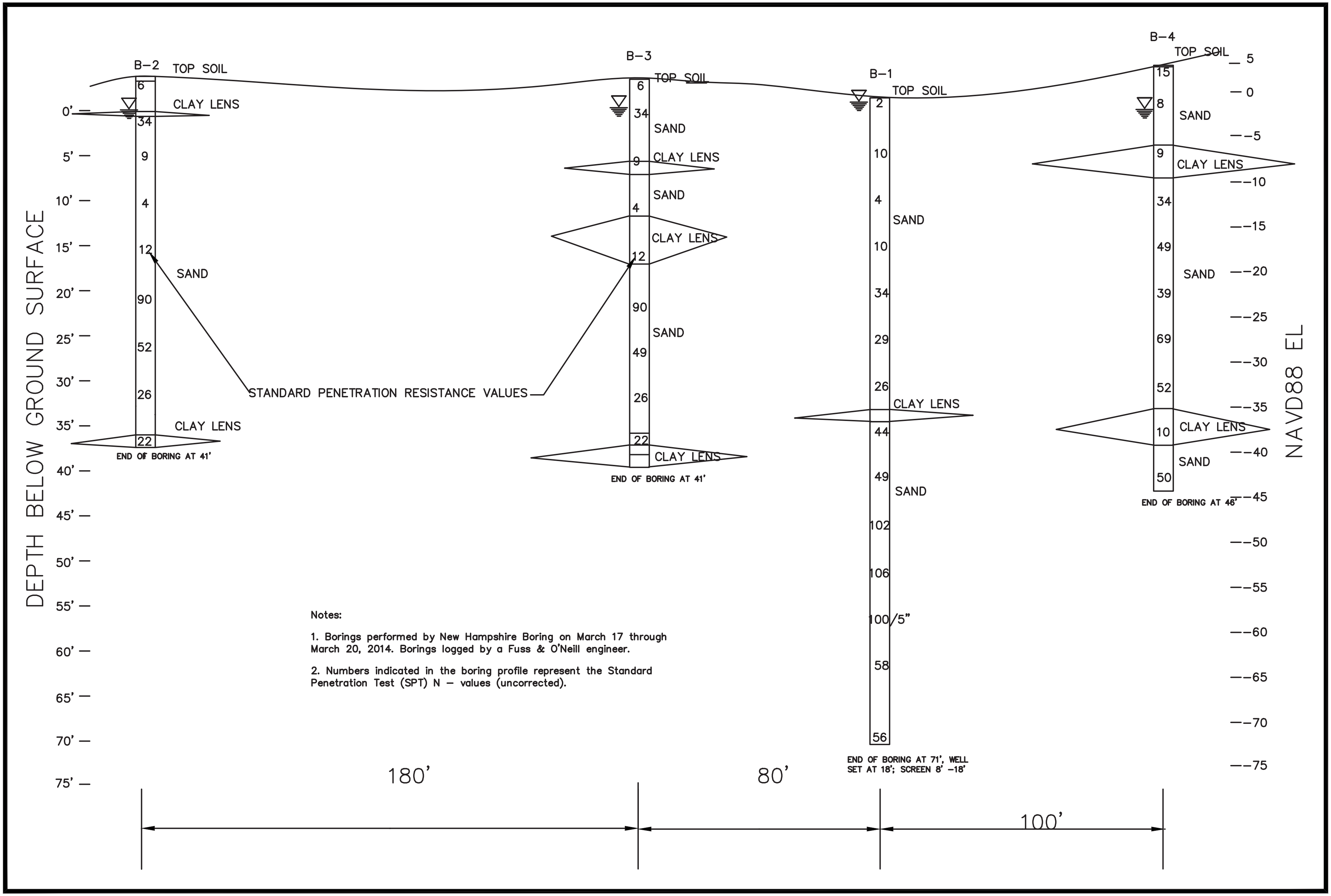
Time & Date of Completion: 1400- 03/18/2014

Depth (ft)	Elevation (NAVD88)	Sample No.	Sample Depth (ft)	Rec/ Pen	Blows/ 6"	Sample Description	Strata Change	USCS Class.	Remarks
0	4.5	S-1	0-2	14/24	1 7 8 10	Top Soil 4 inches Medium dense yellow brown fine to medium, SAND, trace Silt. Moist	Topsoil Sand	SP	
4	0.5	S-2	4-6	12/24	7 3 5 9	Loose yellow brown fine SAND, little Silt. Wet		SP	1
9	-4.5	S-3	9-11	24/24	2 4 5 11	Stiff medium grey CLAY, some Sand	Sandy Clay	CL	
14	-9.5	S-4	14-16	19/24	12 15 19 38	Dense light grey fine SAND, some Clay, medium overall plasticity.		SP	
19	-14.5	S-5	19-21	16/24	12 20 29 35	Dense light grey fine SAND, little Silt.		SP	
24	-19.5	S-6	24-26	14/24	14 17 22 34	Dense light grey fine SAND, little Silt.	Sand	SP	
29	-24.5	S-7	29-31	16/24	19 33 36 54	Very dense yellow brown fine SAND, little Silt.		SP	
34	-29.5	S-8	34-36	15/24	17 26 26 39	Very dense yellow brown fine SAND, little Silt.		SP	
39	-34.5	S-9	39-41	24/24	4 4 6 10	Stiff dark grey CLAY, some Sand, trace Silt	Sandy Clay	CL	
44	-39.5	S-10	44-46	17/24	13 24 26 35	Very dense dark grey fine SAND, little Silt.	Sand	SP	
						End of Boring at 46'			

MINOR CONSTITUENT PROPORTIONS:

Trace	**0 to 10%**	**Some**	**20 to 35%**
Little	**10 to 20%**	**And**	**35 to 50%**

REMARKS:
Auto hammer
1. Groundwater encountered at 6.8'.



Notes:

1. Borings performed by New Hampshire Boring on March 17 through March 20, 2014. Borings logged by a Fuss & O'Neill engineer.

2. Numbers indicated in the boring profile represent the Standard Penetration Test (SPT) N – values (uncorrected).

SCALE:	
HORZ.: NTS	
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0

GRAPHIC SCALE

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

FRIENDS OF HERRING RIVER

SOIL PROFILE AT THE PROPOSED MILL CREEK DIKE SITE

MILL CREEK DIKE

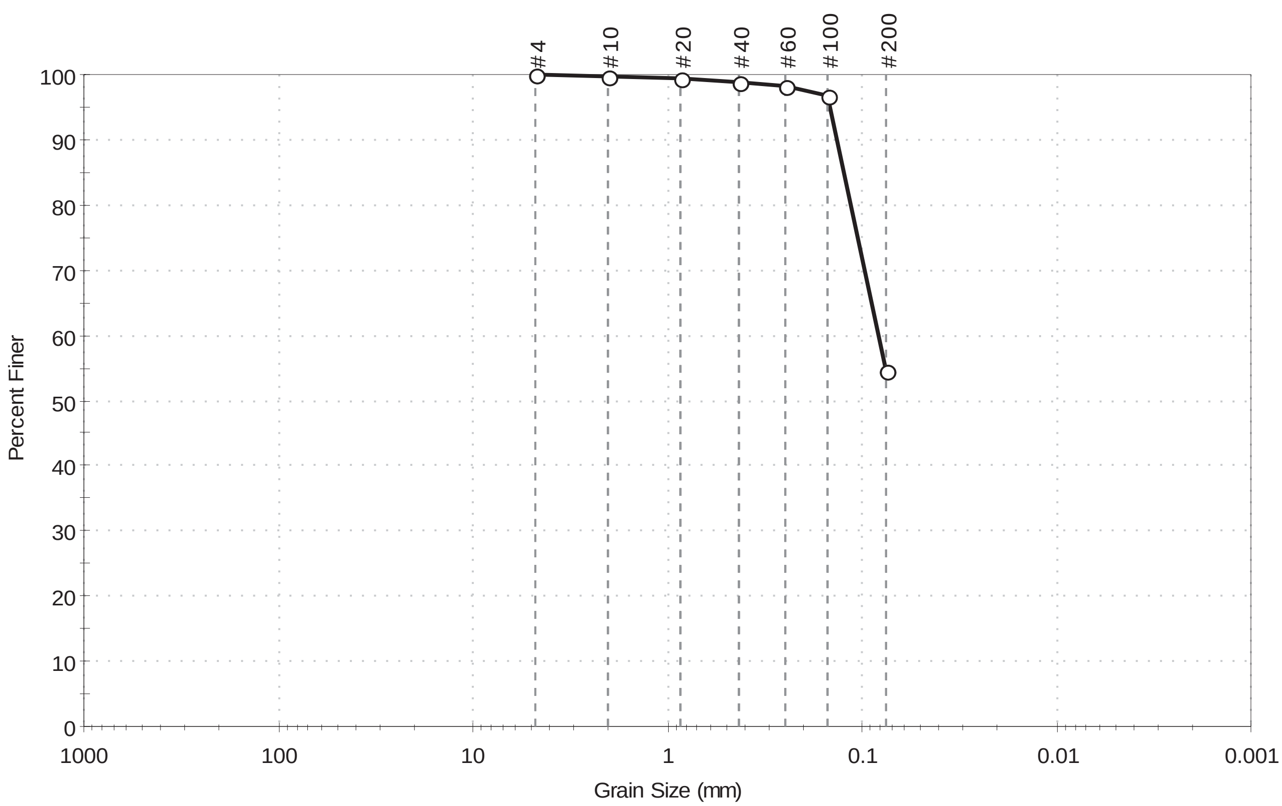
WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A14
DATE: 03/25/2014

Fig 1

Client:	Fuss & O'Neill, Inc.		
Project:	Mill Creek Dike		
Location:	Wellfleet, MA	Project No:	GTX-301591
Boring ID: B-1	Sample Type: jar	Tested By:	jbr
Sample ID: S-5	Test Date: 04/02/14	Checked By:	jdt
Depth : 19'-21'	Test Id: 291751		
Test Comment:	---		
Sample Description:	Moist, dark yellowish brown sandy silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	45.4	54.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	98		
#100	0.15	97		
#200	0.075	55		

Coefficients

D_{85} = 0.1235 mm	D_{30} = N/A
D_{60} = 0.0820 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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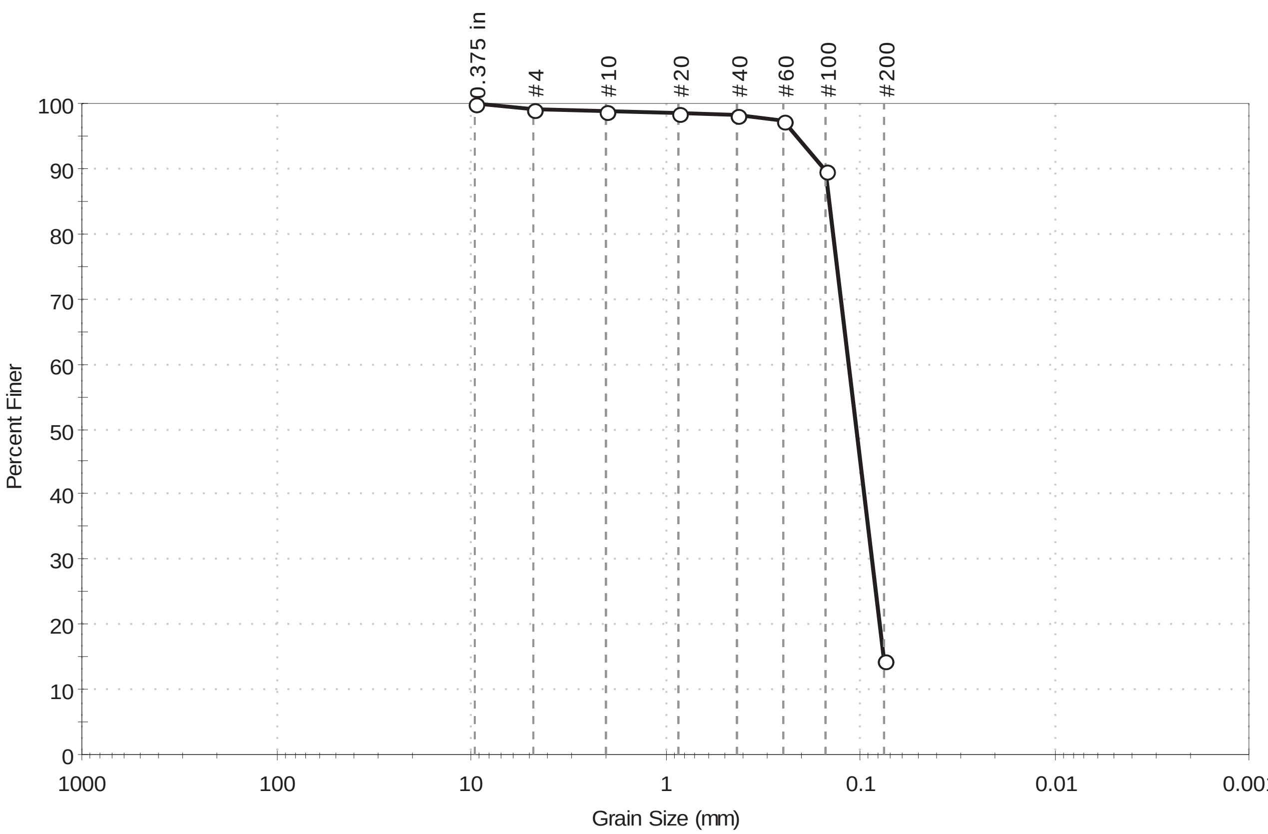
Client:	Fuss & O'Neill, Inc.		
Project:	Mill Creek Dike		
Location:	Wellfleet, MA	Project No:	GTX-301591
Boring ID: B-2	Sample Type: jar	Tested By:	jbr
Sample ID: S-5	Test Date: 04/02/14	Checked By:	jdt
Depth : 19'-21'	Test Id: 291752		
Test Comment:	---		
Sample Description:	Moist, light olive brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.8	84.6	14.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#60	0.25	97		
#100	0.15	90		
#200	0.075	15		

Coefficients

D_{85} = 0.1437 mm D_{30} = 0.0865 mm

D_{60} = 0.1141 mm D_{15} = 0.0753 mm

D_{50} = 0.1040 mm D_{10} = 0.0719 mm

C_u = 1.587 C_c = 0.912

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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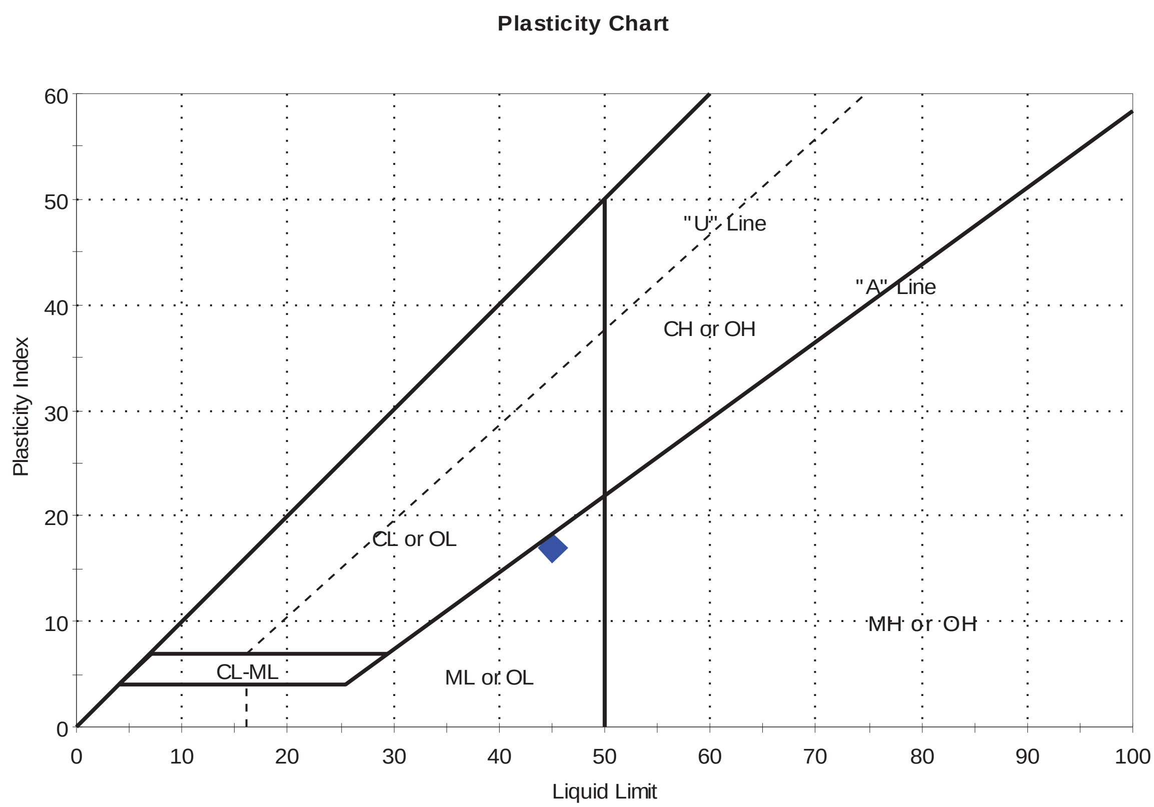
Client:	Fuss & O'Neill, Inc.				
Project:	Mill Creek Dike				
Location:	Wellfleet, MA			Project No:	GTX-301591
Boring ID:	B-3	Sample Type:	jar	Tested By:	cam
Sample ID:	S-5	Test Date:	04/03/14	Checked By:	jdt
Depth :	19'-19'10"	Test Id:	291753		

Test Comment: ---
Sample Description: Moist, very dark gray silt
Sample Comment: ---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-5	B-3	19'-19'10'	43	45	28	17	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

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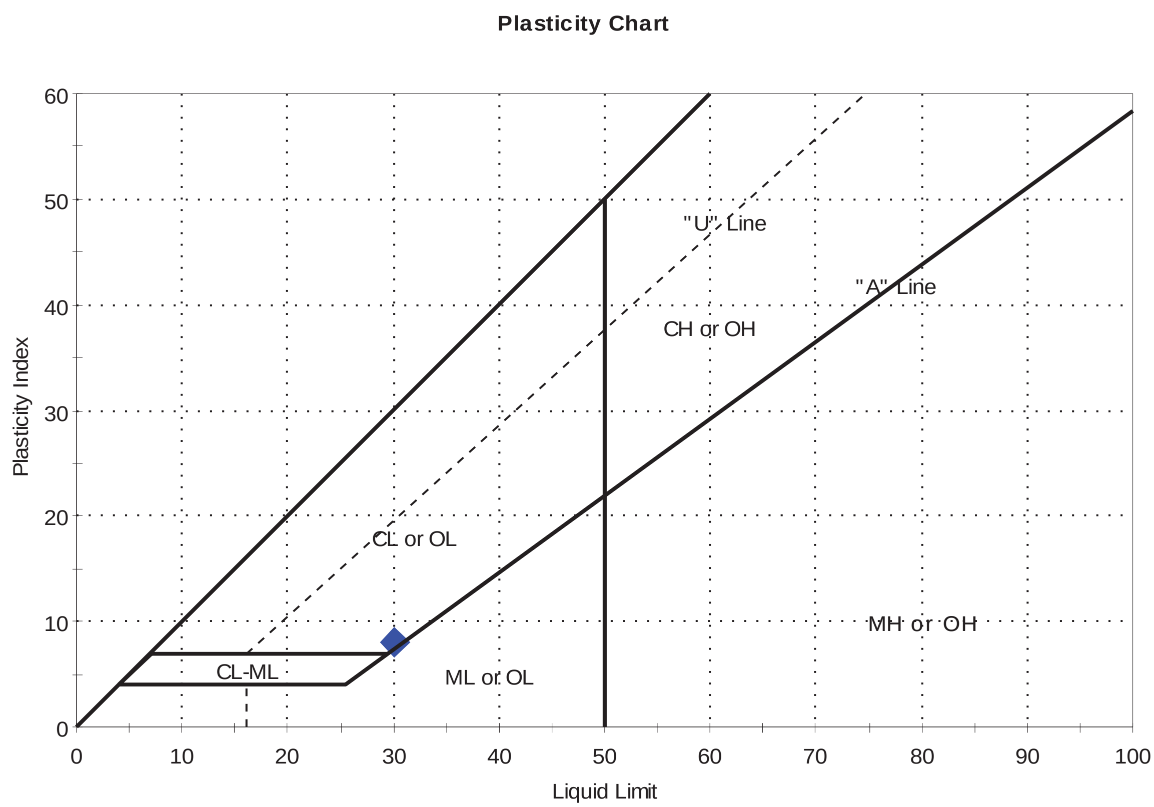
Client: Fuss & O'Neill, Inc.			
Project: Mill Creek Dike			
Location: Wellfleet, MA		Project No:	GTX-301591
Boring ID: B-4	Sample Type: jar	Tested By:	cam
Sample ID: S-3	Test Date: 04/03/14	Checked By:	jdt
Depth : 9.5'-11.5'	Test Id: 291754		
Test Comment: ---			
Sample Description: Moist, dark yellowish brown clay			
Sample Comment: ---			

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-3	B-4	9.5'-11.5'	37	30	22	8	2	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

Dilatancy: SLOW

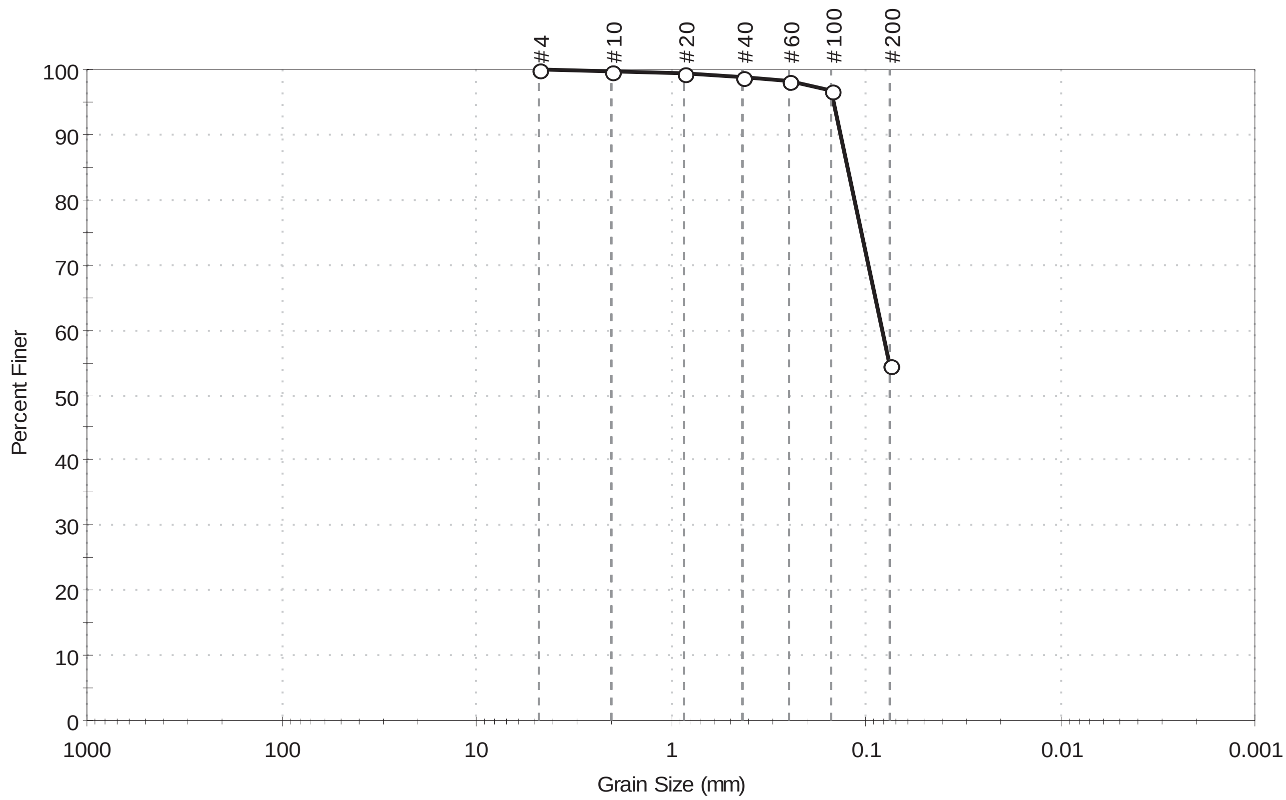
Toughness: LOW

printed 4/3/2014 11:16:01 AM

Client:	Fuss & O'Neill, Inc.		
Project:	Mill Creek Dike		
Location:	Wellfleet, MA	Project No:	GTX-301591
Boring ID: B-1	Sample Type: jar	Tested By:	jbr
Sample ID: S-5	Test Date: 04/02/14	Checked By:	jdt
Depth : 19'-21'	Test Id: 291751		

Test Comment: ---
Sample Description: Moist, dark yellowish brown sandy silt
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	45.4	54.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	98		
#100	0.15	97		
#200	0.075	55		

Coefficients

D_{85} = 0.1235 mm	D_{30} = N/A
D_{60} = 0.0820 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

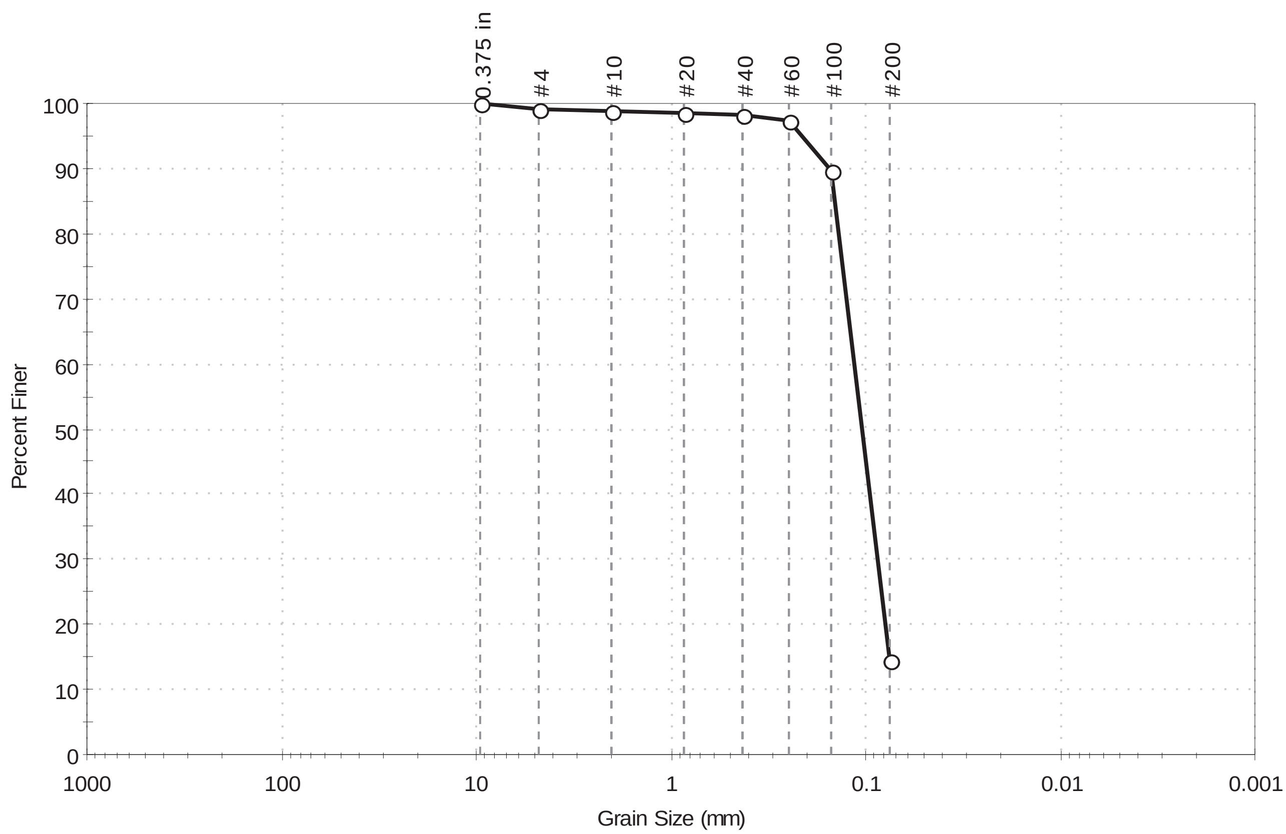
printed 4/3/2014 11:16:22 AM

Client:	Fuss & O'Neill, Inc.		
Project:	Mill Creek Dike		
Location:	Wellfleet, MA	Project No:	GTX-301591

Boring ID:	B-2	Sample Type:	jar	Tested By:	jbr
Sample ID:	S-5	Test Date:	04/02/14	Checked By:	jdt
Depth :	19'-21'	Test Id:	291752		

Test Comment: ---
Sample Description: Moist, light olive brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.8	84.6	14.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#60	0.25	97		
#100	0.15	90		
#200	0.075	15		

Coefficients

D_{85} = 0.1437 mm D_{30} = 0.0865 mm
D_{60} = 0.1141 mm D_{15} = 0.0753 mm
D_{50} = 0.1040 mm D_{10} = 0.0719 mm
C_u = 1.587 C_c = 0.912

Classification

ASTM   N/A

AASHTO   Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

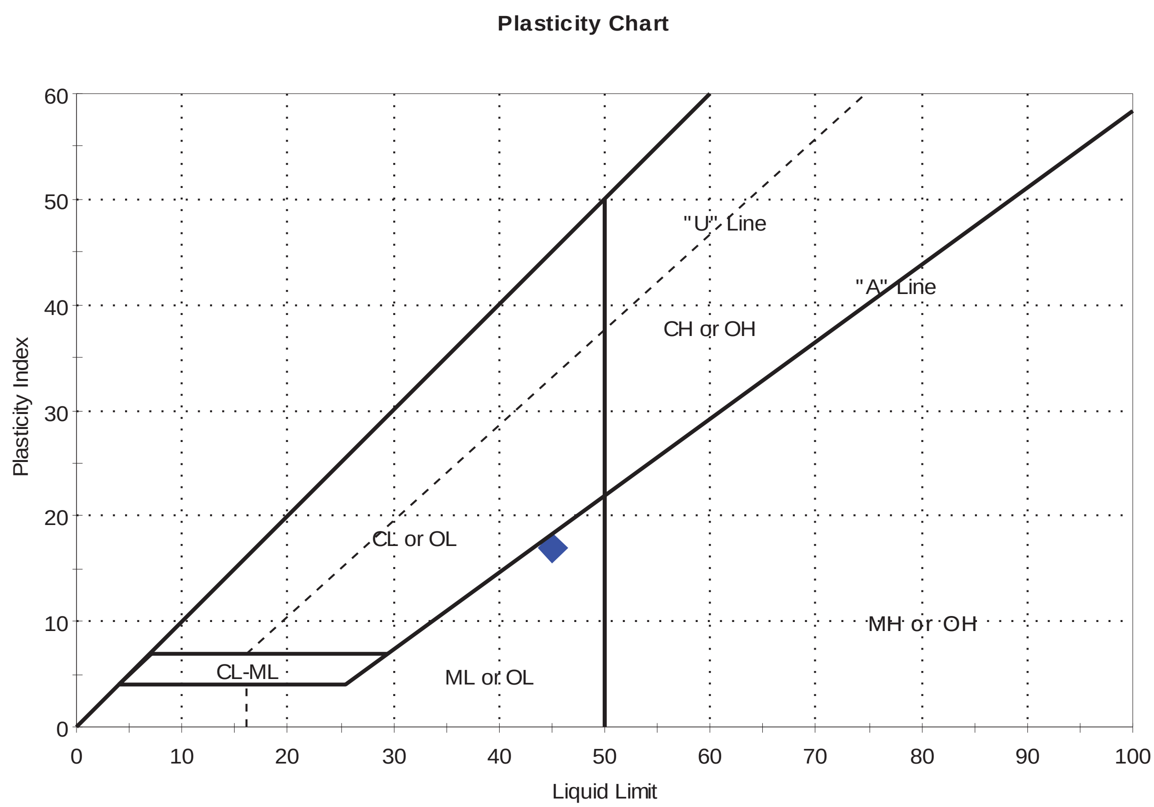
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

printed 4/3/2014 11:16:23 AM

Client:	Fuss & O'Neill, Inc.				
Project:	Mill Creek Dike				
Location:	Wellfleet, MA			Project No:	GTX-301591
Boring ID:	B-3	Sample Type:	jar	Tested By:	cam
Sample ID:	S-5	Test Date:	04/03/14	Checked By:	jdt
Depth :	19'-19'10"	Test Id:	291753		
Test Comment:	---				
Sample Description:	Moist, very dark gray silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-5	B-3	19'-19'10"	43	45	28	17	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

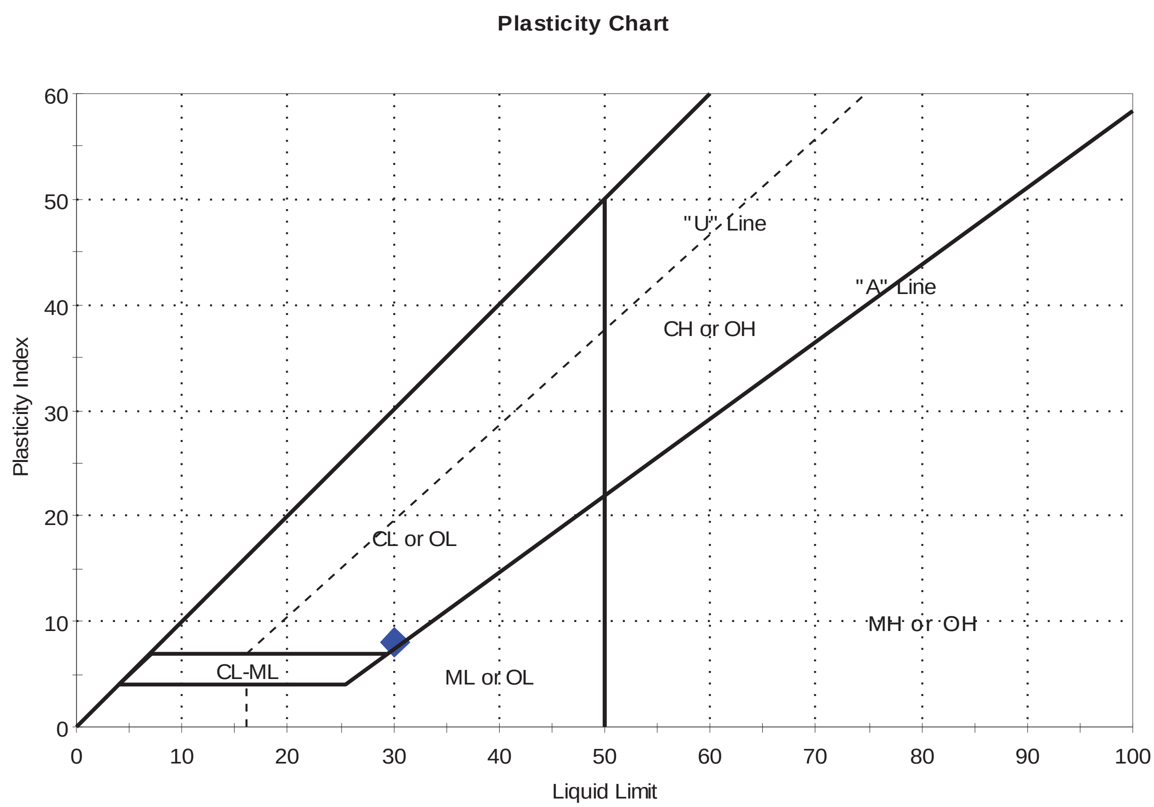
Dilatancy: SLOW

Toughness: LOW

printed 4/3/2014 11:16:01 AM

Client:	Fuss & O'Neill, Inc.				
Project:	Mill Creek Dike				
Location:	Wellfleet, MA			Project No:	GTX-301591
Boring ID:	B-4	Sample Type:	jar	Tested By:	cam
Sample ID:	S-3	Test Date:	04/03/14	Checked By:	jdt
Depth :	9.5'-11.5'	Test Id:	291754		
Test Comment:	---				
Sample Description:	Moist, dark yellowish brown clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-3	B-4	9.5'-11.5'	37	30	22	8	2	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

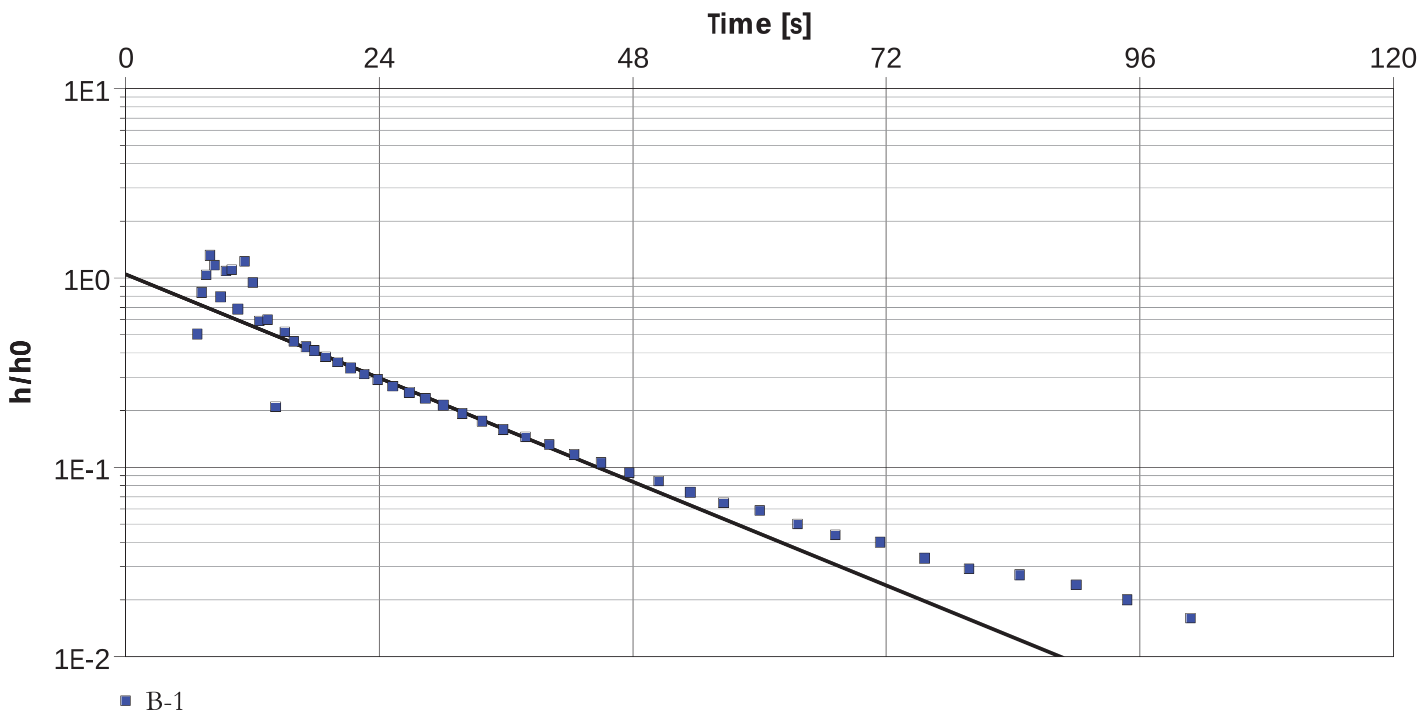
Dilatancy: SLOW

Toughness: LOW

printed 4/3/2014 11:16:01 AM

Fuss & O'Neill, Inc. 146 Hartford Road Manchester, CT 06040	**Slug Test Analysis Report**
	Project: Mill Creek
	Number: 20120636.A14
	Client: Friends of Herring River

Location: Wellfleet, MA	Slug Test: Falling Head Test 1	Test Well: B-1
Test Conducted by: MRS		Test Date: 3/20/2014
Analysis Performed by: DCL	Falling Head Test 1	Analysis Date: 3/21/2014
Aquifer Thickness: 20.00 ft		



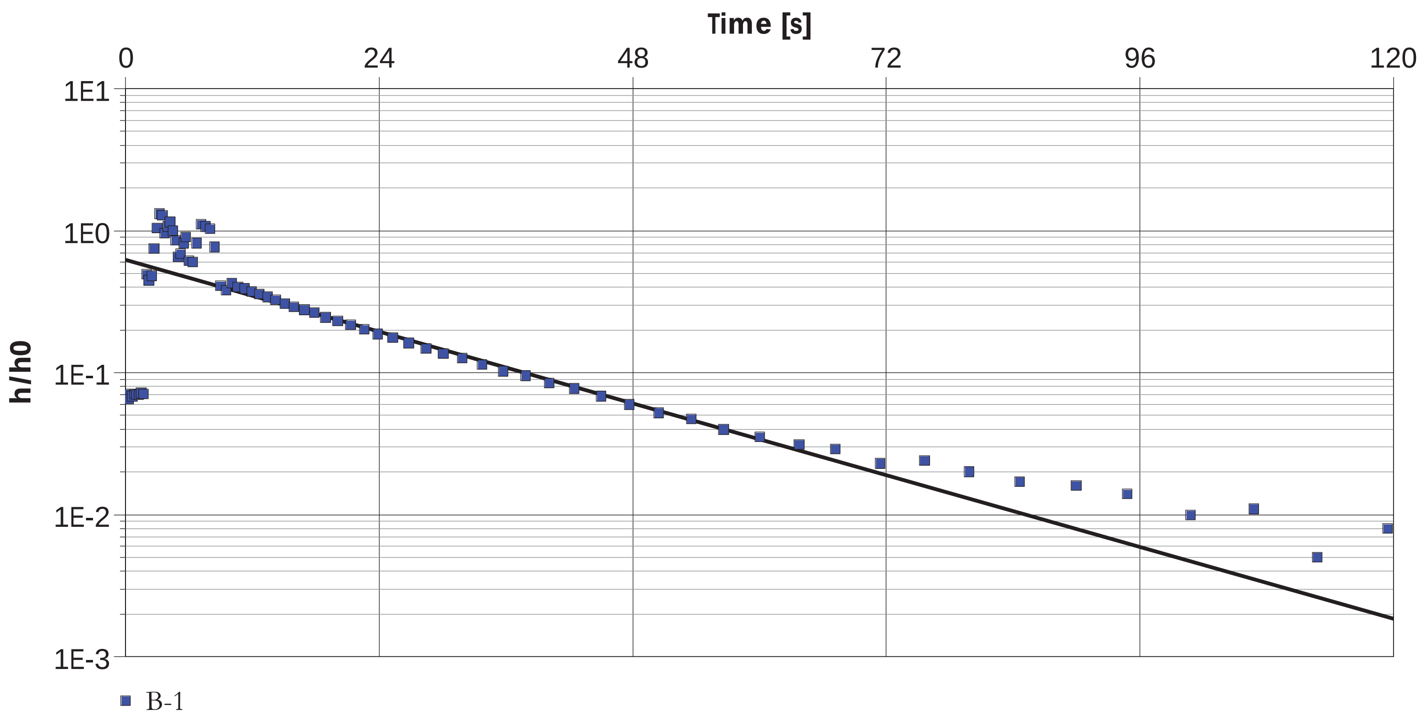
Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]	
B-1	5.88×10^{0}	

Time >60s excluded from analysis.
Time <10s (prior to slug insertion) excluded from analysis.

Fuss & O'Neill, Inc. 146 Hartford Road Manchester, CT 06040	**Slug Test Analysis Report** Project: Mill Creek Number: 20120636.A14 Client: Friends of Herring River

Location: Wellfleet, MA	Slug Test: Falling Head Test 2	Test Well: B-1
Test Conducted by: MRS		Test Date: 3/20/2014
Analysis Performed by: MRS	Falling Head Test 2	Analysis Date: 3/21/2014
Aquifer Thickness: 20.00 ft		



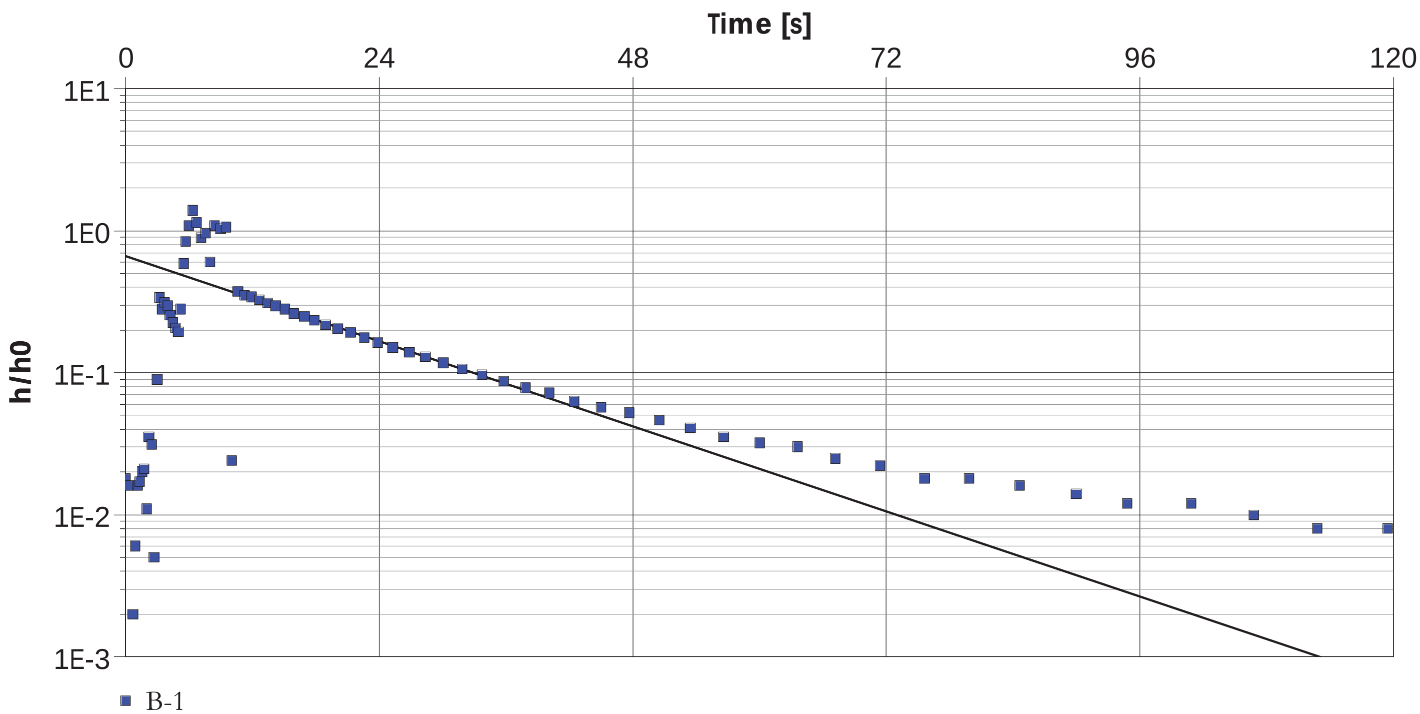
Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]	
B-1	5.42×10^{0}	

Time >60s excluded from analysis.
Time <10s (prior to slug insertion) excluded from analysis.

Fuss & O'Neill, Inc. 146 Hartford Road Manchester, CT 06040	**Slug Test Analysis Report** Project: Mill Creek Number: 20120636.A14 Client: Friends of Herring River

Location: Wellfleet, MA	Slug Test: Falling Head Test 3	Test Well: B-1
Test Conducted by: MRS		Test Date: 3/20/2014
Analysis Performed by: DCL	Falling Head Test 3	Analysis Date: 3/21/2014
Aquifer Thickness: 20.00 ft		



Calculation using Bouwer & Rice

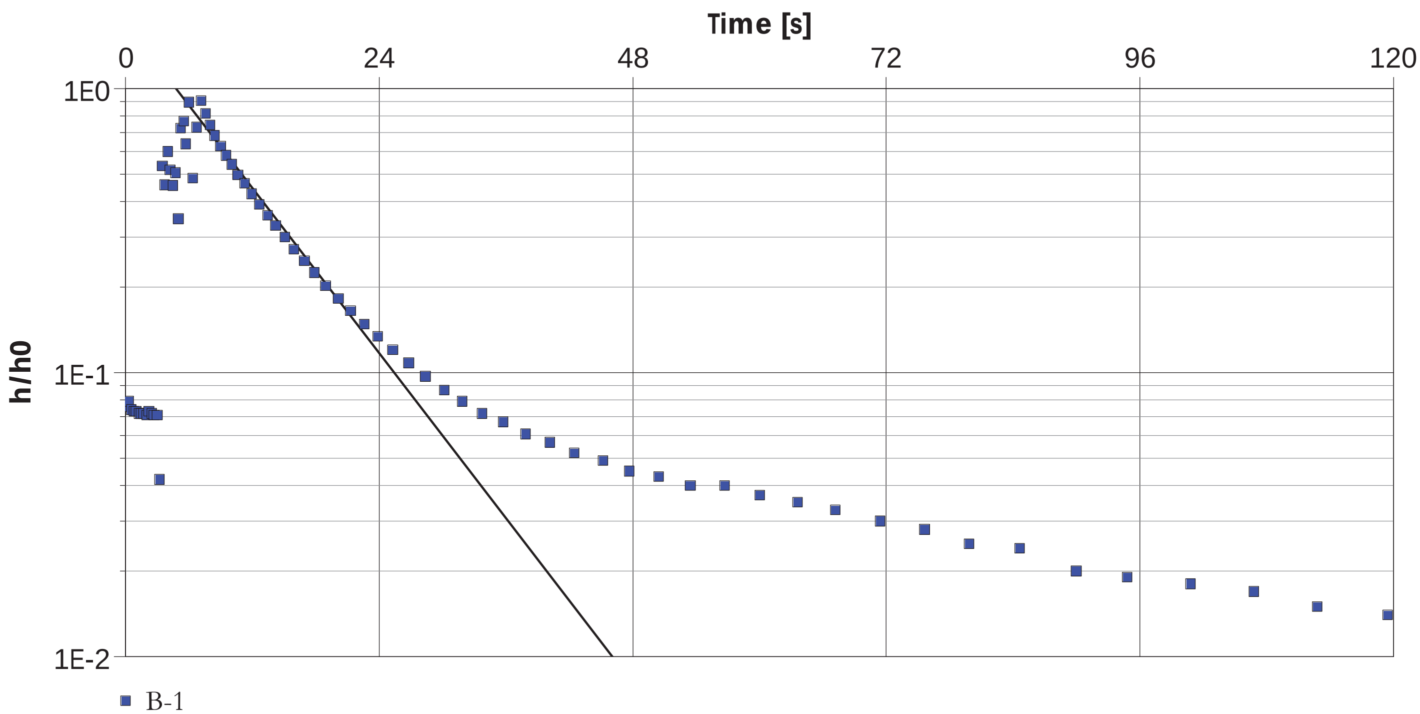
Observation Well	Hydraulic Conductivity [ft/d]	
B-1	6.42×10^{0}	

Time >45s excluded from anaylsis.
Time < 10.5s (before slug insertion) excluded from analysis.

Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040

Slug Test Analysis Report
Project: Mill Creek
Number: 20120636.A14
Client: Friends of Herring River

Location: Wellfleet, MA	Slug Test: Rising Head Test 1	Test Well: B-1
Test Conducted by: MRS		Test Date: 3/20/2014
Analysis Performed by: DCL	Rising Head Test 1	Analysis Date: 3/21/2014
Aquifer Thickness: 20.00 ft		



Calculation using Bouwer & Rice

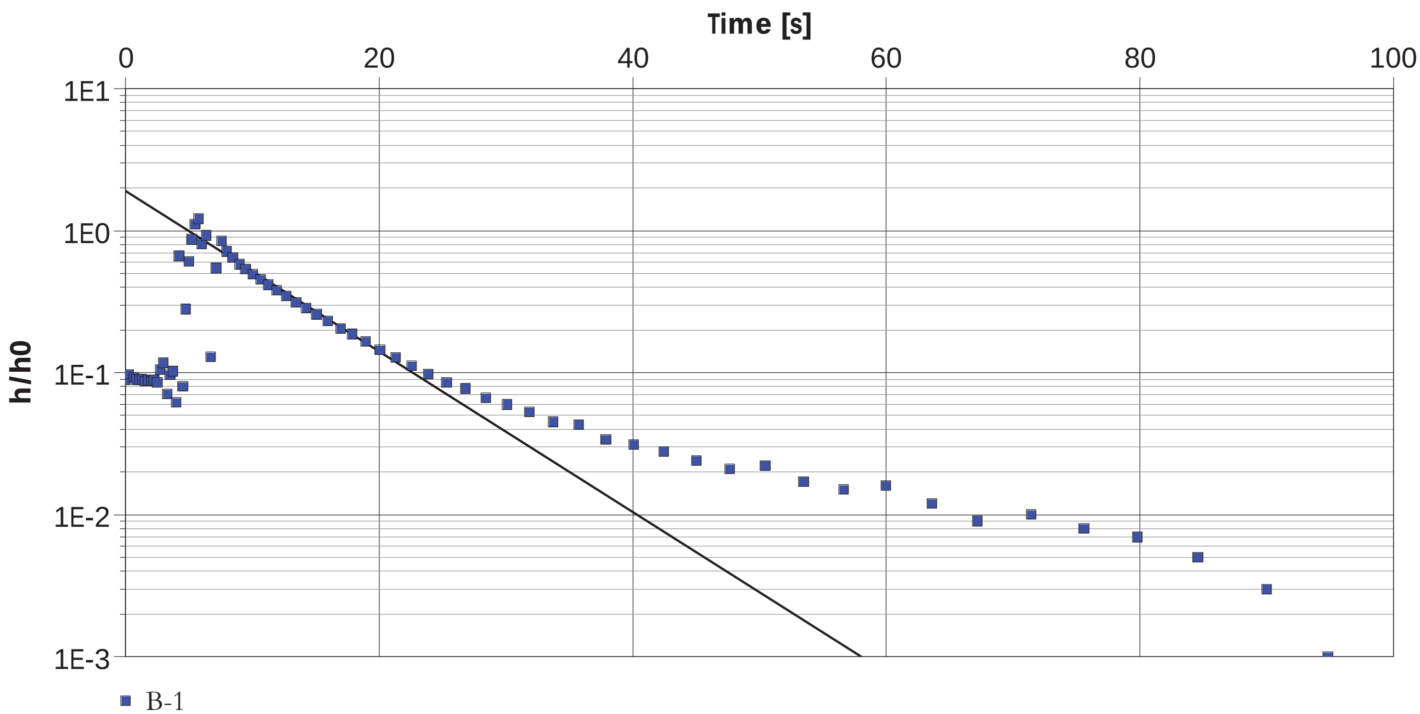
Observation Well	Hydraulic Conductivity [ft/d]	
B-1	1.25×10^{1}	

Time >25s excluded from analysis.
Time <7s (prior to slug removal) excluded from analysis.

Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040

Slug Test Analysis Report
Project: Mill Creek
Number: 20120636.A14
Client: Friends of Herring River

Location: Wellfleet, MA	Slug Test: Rising Head Test 2	Test Well: B-1
Test Conducted by: MRS		Test Date: 3/20/2014
Analysis Performed by: DCL	Rising Head Test 2	Analysis Date: 3/21/2014
Aquifer Thickness: 20.00 ft		



Calculation using Bouwer & Rice

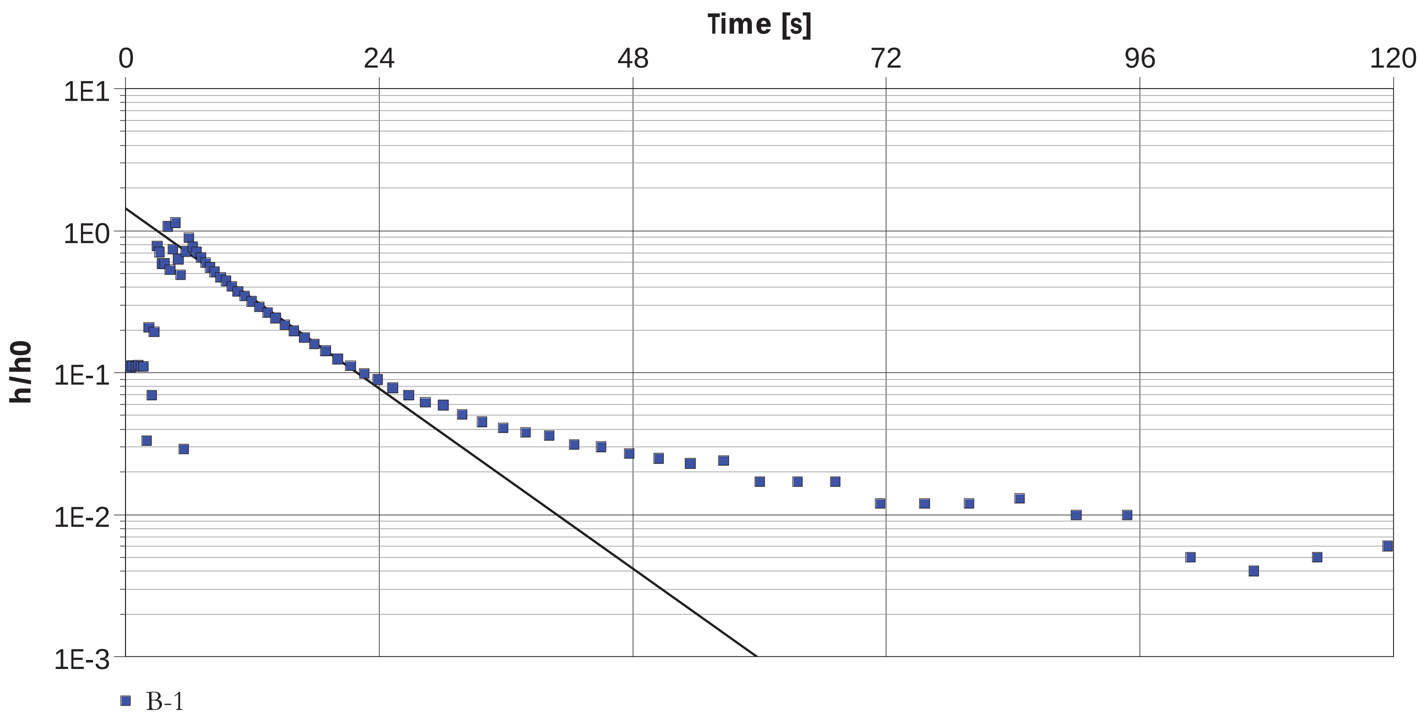
Observation Well	Hydraulic Conductivity [ft/d]
B-1	1.45×10^{1}

Time >24s excluded from analysis.
Time <7.5s (prior to slug insertion) excluded from analysis.

Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040

Slug Test Analysis Report
Project: Mill Creek
Number: 20120636.A14
Client: Friends of Herring River

Location: Wellfleet, MA	Slug Test: Rising Head Test 3	Test Well: B-1
Test Conducted by: MRS		Test Date: 3/20/2014
Analysis Performed by: DCL	Rising Head Test 3	Analysis Date: 3/21/2014
Aquifer Thickness: 20.00 ft		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]	
B-1	1.36×10^{1}	

Time >25s excluded from analysis.
Time <6s (prior to slug insertion) excluded from analysis.

MAP NOTES AND REFERENCES:

1. EXISTING FEATURES AND TOPOGRAPHICAL INFORMATION REFLECTED ON THIS PLAN WERE OBTAINED FROM CONCEPTUAL LAYOUT PLANS FOR MILL CREEK DIKE (SHEET NOs. C-1 THROUGH C-3) WHICH WERE PREPARED BY THE LOUIS BERGER GROUP, INC., AND ARE DATED SEPTEMBER 2010. EXISTING FEATURES AND TOPOGRAPHICAL INFORMATION SHOWN WITHIN THE PROJECT LIMITS ARE IN REFERENCE TO THE NAVD88 VERTICAL DATUM AND THE STATE OF MASSACHUSETTS NAD83 HORIZONTAL DATUM.

2. PROPERTY AND STATE HIGHWAY/PUBLIC ROADWAY LINES SHOWN HEREIN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM A COMBINATION OF DATA PROVIDED BY THE TOWN OF WELLFLEET, THE NATIONAL PARK SERVICE (NPS), AND LEVEL 3 ASSESSOR'S PARCEL MAPPING/DATA PROVIDED BY MASSGIS. THIS PLAN IS NOT TO BE CONSTRUED AS AN ACCURATE BOUNDARY SURVEY AND IS SUBJECT TO SUCH CHANGES AS AN ACCURATE BOUNDARY SURVEY OR DEED RESEARCH MAY DISCLOSE.

3. AERIAL IMAGERY REFLECTED ON THIS PLAN WAS OBTAINED FROM ORTHO IMAGERY (AERIAL PHOTOGRAPHY) PROVIDED BY MASSGIS. THE AERIAL PHOTOGRAPHY WAS ACQUIRED BY FUGRO EARTHDATA, INC. BETWEEN MARCH 24 TO APRIL 26, 2009. THE ORTHOPHOTOGRAPHY WAS CREATED FOR USE BY THE USGS, THE NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY, AND MASSGIS. DEWBERRY AND DAVIS LLC WAS CONTRACTED BY THE USGS TO ACQUIRE PHOTO IDENTIFIABLE GROUND CONTROL POINTS DURING THE ACQUISITION OF AERIAL IMAGERY. THE GROUND CONTROL POINTS WERE ESTABLISHED USING GPS FOR VERTICAL (NAVD 88 METERS) AND HORIZONTAL (NAD83(NSRS2007) COORDINATE VALUES (UTM ZONE 19N IN 2008, MASSACHUSETTS STATEPLANE MAINLAND US SURVEY METERS IN 2009). THE 30CM ORTHOPHOTOS WERE CREATED TO BE FULLY COMPLIANT WITH A HORIZONTAL POSITIONAL ACCURACY NOT TO EXCEED 3 METERS ROOT MEAN SQUARED ERROR (RMSE).

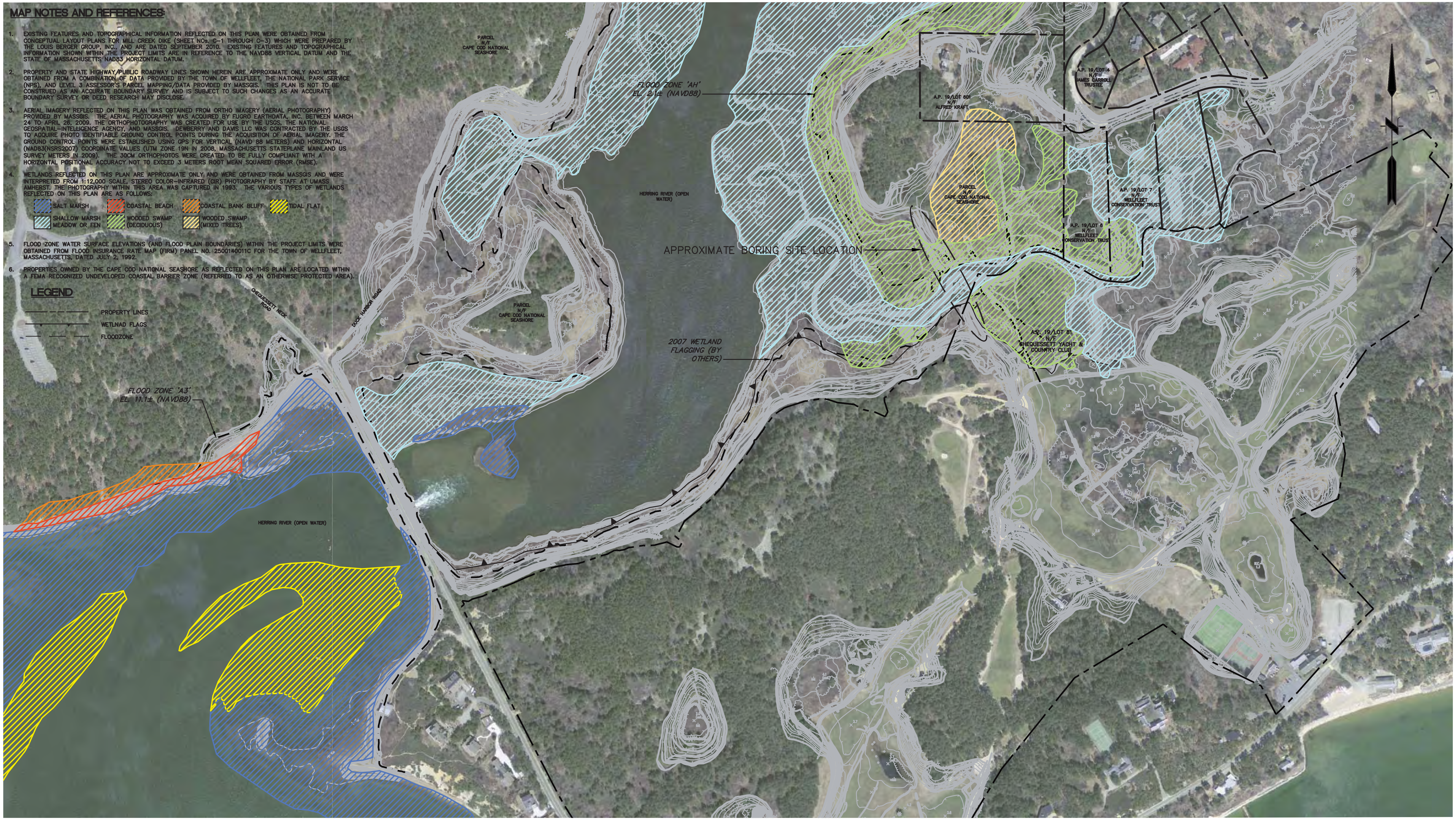
4. WETLANDS REFLECTED ON THIS PLAN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM MASSGIS AND WERE INTERPRETED FROM 1:12,000 SCALE, STEREO COLOR-INFRARED (CIR) PHOTOGRAPHY BY STAFF AT UMASS AMHERST. THE PHOTOGRAPHY WITHIN THIS AREA WAS CAPTURED IN 1993. THE VARIOUS TYPES OF WETLANDS REFLECTED ON THIS PLAN ARE AS FOLLOWS:
   - SALT MARSH
   - COASTAL BEACH
   - COASTAL BANK BLUFF
   - TIDAL FLAT
   - SHALLOW MARSH MEADOW OR FEN
   - WOODED SWAMP (DECIDUOUS)
   - WOODED SWAMP (MIXED TREES)

5. FLOOD ZONE WATER SURFACE ELEVATIONS (AND FLOOD PLAIN BOUNDARIES) WITHIN THE PROJECT LIMITS WERE OBTAINED FROM FLOOD INSURANCE RATE MAP (FIRM) PANEL NO. 2500140011C FOR THE TOWN OF WELLFLEET, MASSACHUSETTS, DATED JULY 2, 1992.

6. PROPERTIES OWNED BY THE CAPE COD NATIONAL SEASHORE AS REFLECTED ON THIS PLAN ARE LOCATED WITHIN A FEMA RECOGNIZED UNDEVELOPED COASTAL BARRIER ZONE (REFERRED TO AS AN OTHERWISE PROTECTED AREA).

LEGEND

- PROPERTY LINES
- WETLNAD FLAGS
- FLOODZONE



No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SCALE:
HORZ.: APPROX.1"=300'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
0 150 300
GRAPHIC SCALE

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www.fando.com

HERRING RIVER RESTORATION COMMITTEE

SITE LOCATION PLAN
MILL CREEK DIKE SUBSURFACE INVESTIGATION

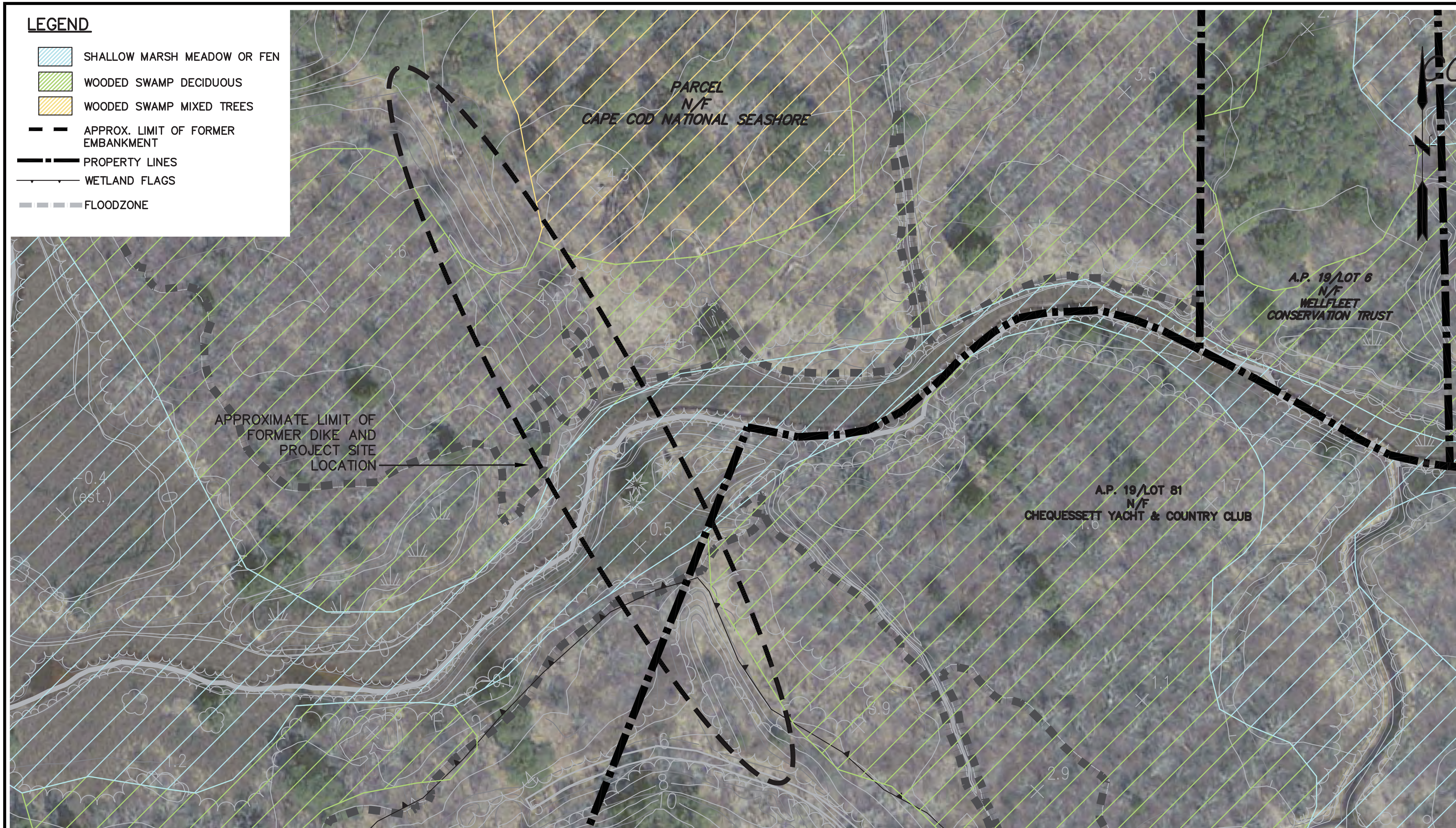
HERRING RIVER RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JANUARY 2014

FIG. 1

File Path: J:\DWG\P2012\0636\A12\Civil\Plan\MKF_FIGURES_20140109.dwg Layout: FIG.1-SITE LOCATION Plotted: Thu, February 06, 2014 - 12:02 PM User: mfisell
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
MS VIEW:
LAYER STATE:



File Path: J:\DWG\P2012\0636\A12\Civil\Plan\MKF_FIGURES_20140109.dwg Layout: FIG.2-EXISTING CONDITIONS Plotted: Thu, February 06, 2014 - 11:51 AM User: mfrisell

Plotter: DWG TO PDF.PC3 CTB File: FO.STB

MS VIEW:

LAYER STATE:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SCALE:
HORZ.: 1" = 60'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
0 30 60
GRAPHIC SCALE

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HERRING RIVER RESTORATION COMMITTEE

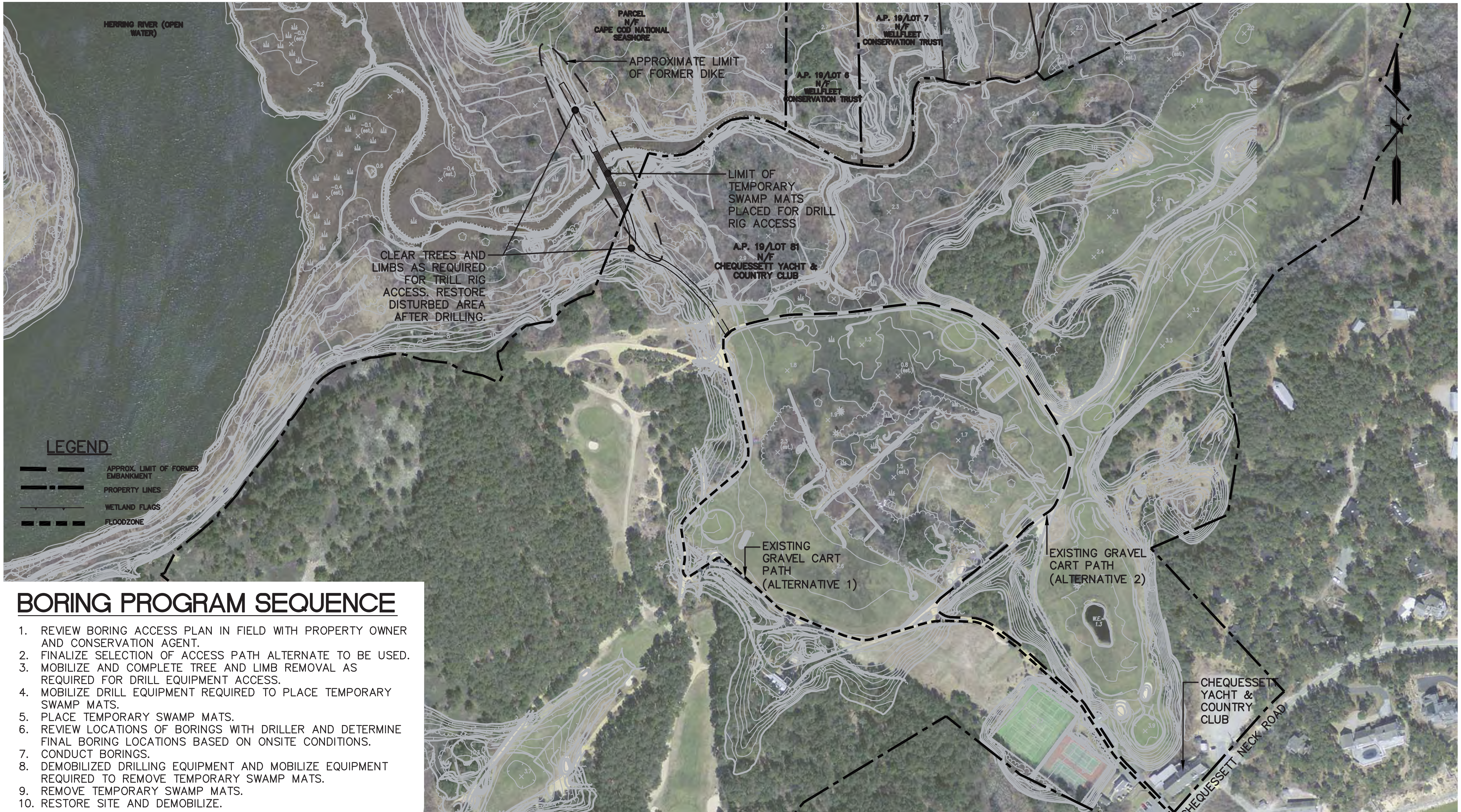
EXISTING CONDITIONS PLAN
MILL CREEK DIKE SUBSURFACE INVESTIGATION

HERRING RIVER RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JANUARY 2014

FIG. 2



BORING PROGRAM SEQUENCE

1. REVIEW BORING ACCESS PLAN IN FIELD WITH PROPERTY OWNER AND CONSERVATION AGENT.
2. FINALIZE SELECTION OF ACCESS PATH ALTERNATE TO BE USED.
3. MOBILIZE AND COMPLETE TREE AND LIMB REMOVAL AS REQUIRED FOR DRILL EQUIPMENT ACCESS.
4. MOBILIZE DRILL EQUIPMENT REQUIRED TO PLACE TEMPORARY SWAMP MATS.
5. PLACE TEMPORARY SWAMP MATS.
6. REVIEW LOCATIONS OF BORINGS WITH DRILLER AND DETERMINE FINAL BORING LOCATIONS BASED ON ONSITE CONDITIONS.
7. CONDUCT BORINGS.
8. DEMOBILIZED DRILLING EQUIPMENT AND MOBILIZE EQUIPMENT REQUIRED TO REMOVE TEMPORARY SWAMP MATS.
9. REMOVE TEMPORARY SWAMP MATS.
10. RESTORE SITE AND DEMOBILIZE.

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SCALE:
HORZ.: 1" = 200'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
0 100 200
GRAPHIC SCALE

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HERRING RIVER RESTORATION COMMITTEE

DRILLING ACCESS PLAN
MILL CREEK DIKE SUBSURFACE INVESTIGATION

HERRING RIVER RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JANUARY 2014

FIG. 3

File Path: J:\DWG\P2012\0636\A12\Civil\Plan\MKF_FIGURES_20140109.dwg Layout: FIG.3-DRILLING ACCESS Plotted: Thu, February 06, 2014 - 12:02 PM User: mfrisell
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
MS VIEW: LAYER STATE:

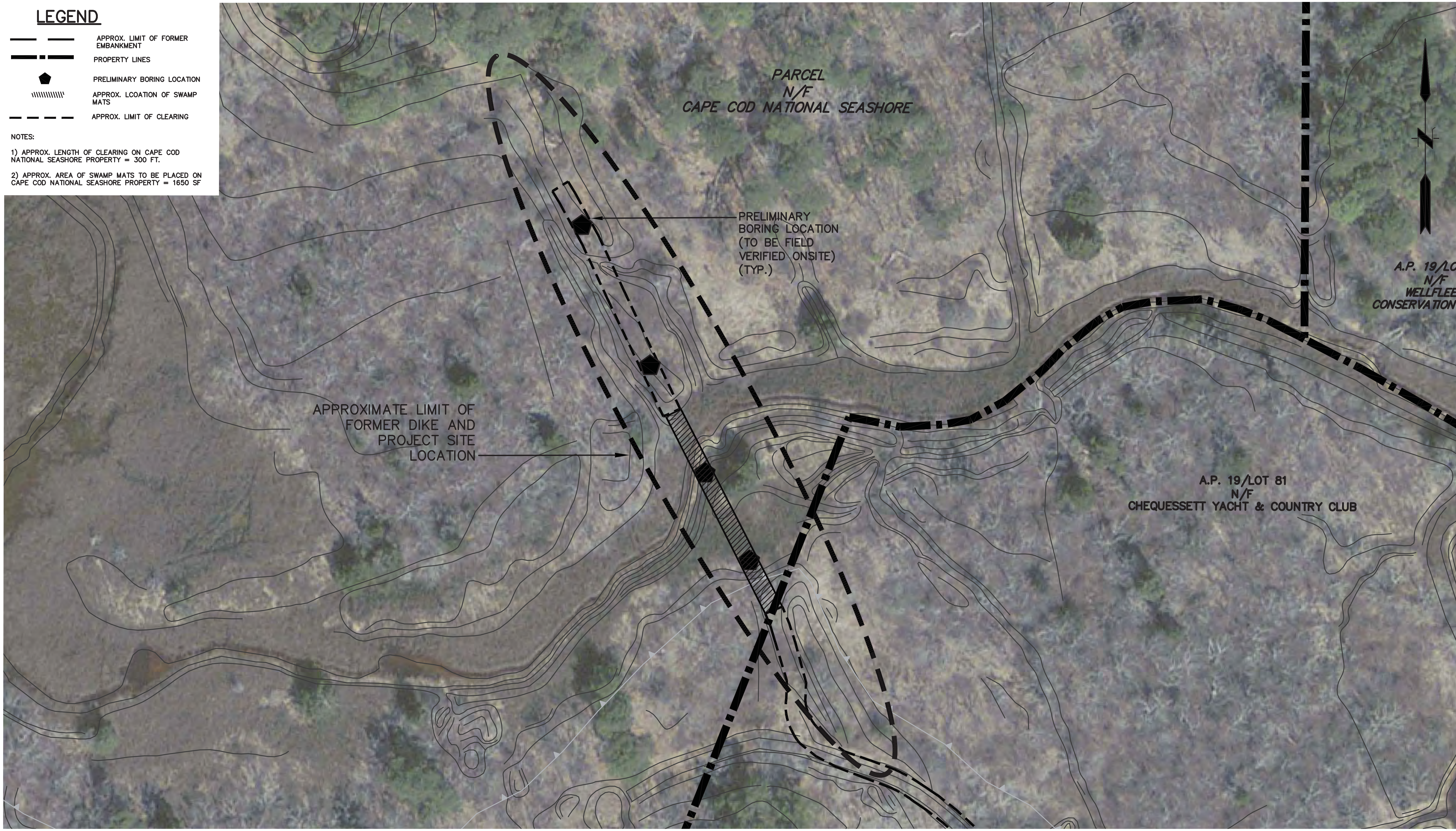
LEGEND

— —	APPROX. LIMIT OF FORMER EMBANKMENT
—·—	PROPERTY LINES
⬟	PRELIMINARY BORING LOCATION
\\\\\\\\\\\\\\	APPROX. LCOATION OF SWAMP MATS
— — —	APPROX. LIMIT OF CLEARING

NOTES:

1) APPROX. LENGTH OF CLEARING ON CAPE COD NATIONAL SEASHORE PROPERTY = 300 FT.

2) APPROX. AREA OF SWAMP MATS TO BE PLACED ON CAPE COD NATIONAL SEASHORE PROPERTY = 1650 SF



File Path: J:\DWG\P2012\0636\A12\Civil\Plan\MKF_FIGURES_20140109.dwg Layout: FIG.4-BORING PLAN Plotted: Thu, February 06, 2014 - 11:51 AM User: mfrisell
Plotter: DWG TO PDF.PC3 CTB File: FO.STB

MS VIEW:
LAYER STATE:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SCALE:
HORZ.: 1" = 60'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88

0 30 60
GRAPHIC SCALE

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HERRING RIVER RESTORATION COMMITTEE

BORING LAYOUT PLAN
MILL CREEK DIKE SUBSURFACE INVESTIGATION

HERRING RIVER RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JANUARY 2014

FIG. 4

File Path: J:\DWG\P2012\0636\A12\Civil\Plan\MKF_FIGURES_20140109.dwg Layout: FIG.5-PHOTO Plotted: Thu, February 06, 2014 - 12:02 PM User: mfrisell
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
MS VIEW:
LAYER STATE:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SCALE:
HORZ.: 1" = 60'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
0 30 60
GRAPHIC SCALE

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HERRING RIVER RESTORATION COMMITTEE

PHOTOGRAPH LOCATION PLAN
MILL CREEK DIKE SUBSURFACE INVESTIGATION

HERRING RIVER RESTORATION PROJECT

WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JANUARY 2014

FIG. 5


Photo 4822 -


Photo 164

Photo 4853

Photo 165

Photo 4845

Photo 4849

Photo 4827

Photo 4830

Photo 4840

Photo 4825

Photo 4828

Photo 4836

Photo 4834

Photo 4831

Photo 4833

Photo 4860

Photo 4859

Example of Temporary Mats Used for Equipment Access to Salt Marsh
(Medouie Creek Salt Marsh, Nantucket)

Example of Temporary Mats Used for Equipment Access to Salt Marsh
(Medouie Creek Salt Marsh, Nantucket)

Example of Temporary Mats Used for Equipment Access to Salt Marsh
(Medouie Creek Salt Marsh, Nantucket)

Salt Marsh Following Removal of Temporary Mats
(Medouie Creek Salt Marsh, Nantucket)

FUSS & O'NEILL

Attachment C

Comparative Constraints Analysis Summary Matrix

Comparative Constraints Analysis Summary Table for Alternative Mill Creek Dike Configurations
Herring River Restoration Project
June 2014

Dike Structure Alternative	Natural Resources and Environmental Criteria			Physical Process Criteria	Construction Phase Criteria			Post-Construction Phase Criteria				OVERALL SCORE
	Minimize Vegetative and Shellfish Community and Migratory Fisheries Passage Impacts at Dike During Construction	Minimize Long-Term Natural Resource Impacts at Dike (Vegetation, Shellfish, Fisheries)	Wildlife / Rare Species Impacts/ Benefits	Drainage and Scour/ Sedimentation	Minimize Construction Costs	Ease of Operation	Minimize Construction Duration	Minimize Operation and Maintenance Cost	Aesthetics - Compatibility to Site's Natural Environment and Impacts to Neighboring Properties	Security/Safety	Adaptability to Sea Rise Conditions / Capability to Meet FEMA Certification Criteria for Flood Protection	
Criteria Weighting	5	3	3	5	5	4	5	5	2	3	4	
Earthen Dike **(3H:1V slopes)**	○ Width of dike at its base will represent the largest required construction area and result in the greatest amount of disturbance. ○ Due to the width of the dike (69 feet) the temporary cofferdam will affect largest area compared to other three alternatives; impact to shellfish resources will be the greatest.	○ Largest overall required footprint. ○ Length of culvert will limit amount of interior light which is not conducive to fish passage. ○ Earthen slopes facilitate terrestrial wildlife passage across dike.	○ No known rare species or habitat impacted by site construction. ○ Equivalent long-term impacts/benefits to species/habitat in upstream resource areas as other alternatives. ○ Earthen slopes facilitate wildlife passage across dike.	o Culverts:3-sided culvert would provide a natural stream bottom, however increases potential for shifting natural bed and scour ; 4-sided culvert reduces the potential for scour however does not provide a natural stream bed. o All alternatives measure equally in ability to drain at low tide; drainage and scour depends on culvert type and gate structure type. o Flared wingwalls help reduce potential for scour at inlet.	o Intermediate construction cost ($3.8M - $5.2M)	o Structure type can be configured to provide the adequate crown width for full site access and gate operation.	o Simplest and most predictable construction schedule compared to other alternatives. o Significant earthwork will entail largest amount of erosion and sedimentation controls compared to single and double wall dike alternatives other alternatives. o Longest construction schedule.	○ Least amount of routine inspection and maintenance of the structural components ○ Requires regular ongoing maintenance of vegetation along slopes of the dike ○ Equivalent maintenance related to the gate compared to other alternatives	o Earthen slopes and crest can be vegetated to match adjacent natural vegetative communities. o Would blend into the site's existing aesthetic and have least impact/change to views from neighboring properties.	o Earthen slopes present smallest potential hazard to persons visiting the site. o Access to structure could be gained from all sides, would potentially require additional barricades/security measures for gate operators.	o Fill: Additional fill may be placed on top of the dike to meet FEMA requirements; contingent upon having adequate width at the top of the dike and/or available space at the base to achieve acceptable side-slopes for stability. ○ Bulkhead: A structural bulkhead can be installed along the top of the crest to increase the overall height of the dike if there is adequate crest width to accommodate the structure and the access path. ○ Equivalent maintenance related to the gate compared to other alternatives.	
Criteria Score	2	3	4	4	4	4	2	3	5	4	3	**3.32**
Single Wall Dike Structure Concrete Cantilever Wall / T-Wall / Gravity Wall / I-Wall	○ Culvert length of comparable to Steel Sheet Pile Wall alternative. ○ Temporary cofferdam will affect the larger area compared to Steel Sheet Pile Wall, but a smaller area compared to the Earthen Dike, three alternatives; moderate impact to shellfish resources.	○ Intermediate footprint when compared to other alternatives. ○ Shorter culvert width will provide more light within the passage corridor relative to earthen dike alternative, which is conducive to long-term fish passage. o Structure type does not support vegetation (exposed steel or concrete). ○ Vertical walls present barrier to wildlife attempting to cross dike. ○ Vertical walls present barrier to wildlife attempting to cross dike.	○ No known rare species or habitat would be impacted by site construction. ○ Equivalent long-term impacts/benefits to species/habitat in upstream resource areas as other alternatives. ○ Vertical wall creates a physical barrier to wildlife.	o Orifice through wall instead of channel through structure reduces potential for sedimentation and scour within channel structures. o All alternatives measure equally in ability to drain at low tide; drainage and scour depends on culvert type and gate structure type. o Vertical wall face does not readily accommodate flared ends to reduce scour at inlet.	o Construction cost for I Wall relatively similar to Earth Dike. ($4.6M - $5.6M) o Cantilever Wall / T-Wall / Gravity Wall construction costs higher than Earthen Dike. ($5.1M - $6.5M)	o Elevated walkway provided at crest for foot access to operate/inspect gates. o Lack of elevated equipment access surface at crest of structure limits accessibility; access routes only provided from each side of structure at/above marsh elevation. Equipment could be inhibited during higher flood tides and precluded during storm events. ○ Would require access from both sides of embankment unless bridge structure provided to cross channel from one side.	o Cofferdamming will be required to prevent inundation of excavation for footing. Cofferdamming and dewatering costs similar to Earthen Dike. ○ Construction access only at marsh grade would require measures to address max. tide and storm flood levels during construction (e.g., elevated access route) or temporary cofferdam to limit/remove tidal fluctuations within work site. ○ Intermediate construction schedule	○ Concrete wall structures will required moderate level of routine inspections compared to other alternatives to ensure construction is in conformance with the plans. ○ No vegetation to maintain on structure. ○ Equivalent maintenance related to the gate structures compared to other alternatives. ○ At-grade equipment access from both sides required, or temporary bridge needed if access from golf course. Normal tides could impede equipment access unless gates are closed/blocked or equipment access paths are raised above high tide EL.	o Structural wall potentially conflicts with site's natural aesthetic character, particularly if plain concrete is exposed to view. o Formlined concrete could be used to provide appearance of stone masonry.	o Vertical wall faces present higher potential hazard to persons visiting the site. o Access to structure limited to two ends of dike.	o Can be designed to accommodate a vertical extension of the concrete stem. ○ Would more readily accommodate a future change in invert elevation(s) as control is dictated by orifice(s) through wall, vs. outlet channel through wider dike in other alternatives. Modification would entail modifying orifice as opposed to replacing/modifying longer channel for other alternatives.	
Criteria Score	3	4	2	3	3	2	4	3	3	3	3	**3.02**
Single Wall Dike Structure Steel Sheeting	○ Shortest culvert length of alternatives considered. ○ Temporary cofferdam will affect the smallest area compared to the other three alternatives; smallest impact to shellfish resources.	○ Smallest footprint of alternatives considered. ○ Shorter culvert width will provide more light within the passage corridor relative to earthen dike alternative, which is conducive to long-term fish passage. o Structure type does not support vegetation (exposed steel or concrete). ○ Vertical walls present barrier to wildlife attempting to cross dike.	○ No known rare species or habitat would be impacted by site construction. ○ Equivalent long-term impacts/benefits to species/habitat in upstream resource areas as other alternatives. ○ Vertical wall creates a physical barrier to wildlife.	o Orifice through wall instead of channel through structure reduces potential for sedimentation and scour within channel structures. o All alternatives measure equally in ability to drain at low tide; drainage and scour depends on culvert type and gate structure type. o Vertical wall face does not readily accommodate flared ends to reduce scour at inlet.	o Lowest construction cost ($2.6M - $3.5M)	o Elevated walkway provided at crest for foot access to operate/inspect gates. o Lack of elevated equipment access surface at crest of structure limits accessibility; access routes only provided from each side of structure at/above marsh elevation. Equipment could be inhibited during higher flood tides and precluded during storm events. ○ Would require access from both sides of embankment unless portable bridge structure provided to cross channel from one side.	o Steel Sheet Pile Wall represents the shortest construction duration. (no excavation / compaction of earth / formwork / rebar placement / concrete placement / concrete curing) ○ Construction access only at marsh grade would require measures to address max. tide and storm flood levels during construction (e.g., elevated access route) or temporary cofferdam to limit/remove tidal fluctuations within work site. ○ Only one line of sheeting required. ○ Shortest construction schedule	○ Driven steel sheet piles likely require the most thorough, routine inspections in order to ensure joints are water-tight. ○ No vegetation to maintain on structure. ○ Equivalent maintenance related to the gate structures compared to other alternatives. ○ At-grade equipment access from both sides required, or temporary bridge needed if no access from golf course. Normal tides could impede equipment access unless gates are closed/blocked or equipment access paths are raised above high tide EL.	o Structural walls on both sides of dike potentially conflicts with site's natural aesthetic character, particularly if steel sheeting is employed.	o Vertical wall faces present higher potential hazard to persons visiting the site. o Access to structure limited to two ends of dike.	o Would likely require new set of adjacent higher sheets if raising is required, significant cost to replace structure. ○ Would more readily accommodate a future change in invert elevation(s) as control is dictated by orifice(s) through wall, vs. outlet channel through wider dike in other alternatives. Modification would entail modifying orifice as opposed to replacing/modifying longer channel for other alternatives.	
Criteria Score	4	5	2	3	5	2	5	3	2	3	2	**3.41**

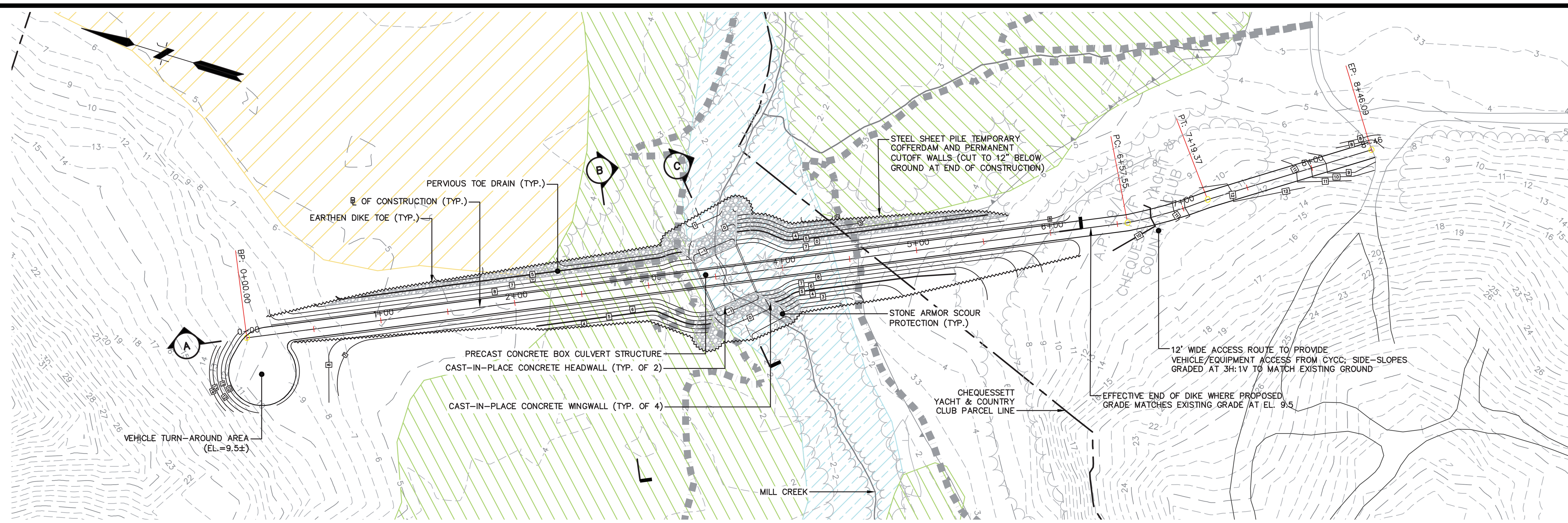
NOTE: ALL CRITERIAL WEIGHTING RATINGS AND SCORES ARE BASED ON A SCALE OF 1 - 5.

Attachment D

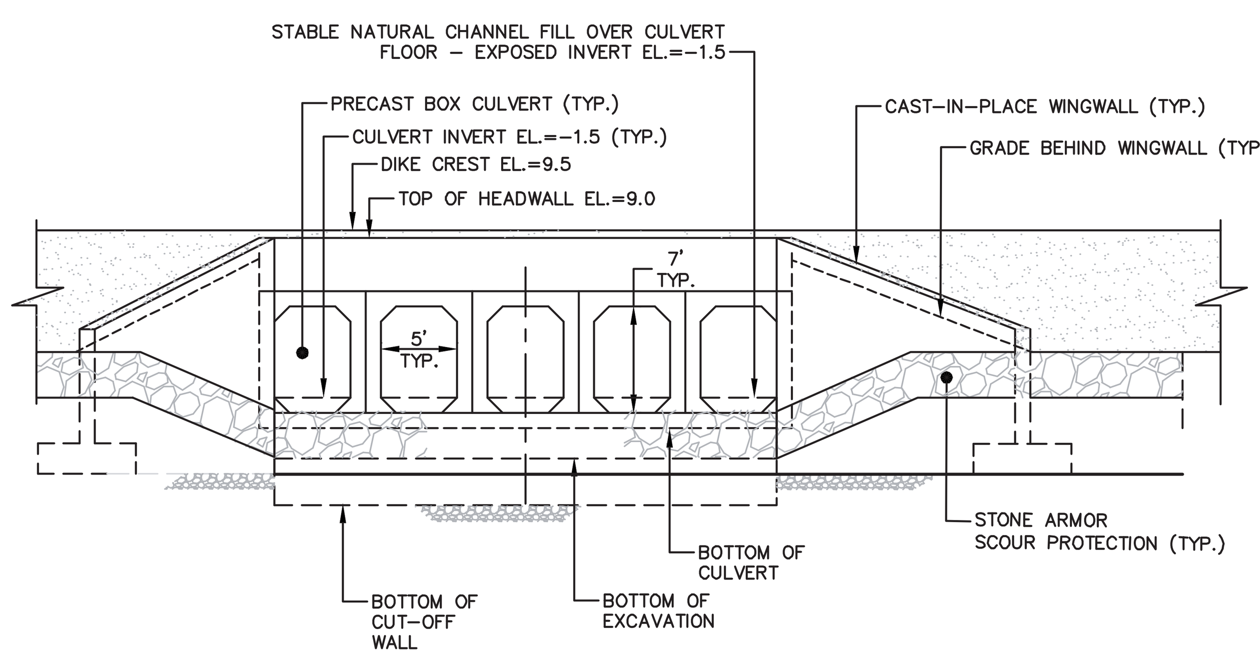
Alternate Structure Conceptual Layout Drawings

MAP NOTES AND REFERENCES:

1. TOPOGRAPHY REFLECTED ON THIS PLAN WAS OBTAINED FROM LIDAR TERRAIN DATA PROVIDED BY MASSGIS. TERRAIN DATA FOR THIS AREA WAS OBTAINED IN WINTER–SPRING 2011. TOPOGRAPHICAL INFORMATION WAS PROCESSED TO MEET A BARE EARTH FUNDAMENTAL VERTICAL ACCURACY (FVA) OF 18.13 CM AT A 95% CONFIDENCE LEVEL, DERIVED ACCORDING TO NSSDA (I.E., BASED ON VRMSE OF 9.25 CM IN THE "OPEN TERRAIN" LAND COVER CATEGORY).
2. PROPERTY AND STATE HIGHWAY/PUBLIC ROADWAY LINES SHOWN HEREIN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM A COMBINATION OF DATA PROVIDED BY THE TOWN OF WELLFLEET, THE NATIONAL PARK SERVICE (NPS), AND LEVEL 3 ASSESSOR'S PARCEL MAPPING/DATA PROVIDED BY MASSGIS. THIS PLAN IS NOT TO BE CONSTRUED AS AN ACCURATE BOUNDARY SURVEY AND IS SUBJECT TO SUCH CHANGES AS AN ACCURATE BOUNDARY SURVEY OR DEED RESEARCH MAY DISCLOSE.
3. AERIAL IMAGERY REFLECTED ON THIS PLAN WAS OBTAINED FROM ORTHO IMAGERY (AERIAL PHOTOGRAPHY) PROVIDED BY MASSGIS. THE AERIAL PHOTOGRAPHY WAS ACQUIRED BY FUGRO EARTHDATA, INC. BETWEEN MARCH 24 TO APRIL 26, 2009. THE ORTHOPHOTOGRAPHY WAS CREATED FOR USE BY THE USGS, THE NATIONAL GEOSPATIAL–INTELLIGENCE AGENCY, AND MASSGIS. DEWBERRY AND DAVIS LLC WAS CONTRACTED BY THE USGS TO ACQUIRE PHOTO IDENTIFIABLE GROUND CONTROL POINTS DURING THE ACQUISITION OF AERIAL IMAGERY. THE GROUND CONTROL POINTS WERE ESTABLISHED USING GPS FOR VERTICAL (NAVD 88 METERS) AND HORIZONTAL (NAD83(NSRS2007) COORDINATE VALUES (UTM ZONE 19N IN 2008, MASSACHUSETTS STATEPLANE MAINLAND US SURVEY METERS IN 2009). THE 30CM ORTHOPHOTOS WERE CREATED TO BE FULLY COMPLIANT WITH A HORIZONTAL POSITIONAL ACCURACY NOT TO EXCEED 3 METERS ROOT MEAN SQUARED ERROR (RMSE).
4. WETLANDS REFLECTED ON THIS PLAN ARE APPROXIMATE ONLY AND WERE OBTAINED FROM MASSGIS AND WERE INTERPRETED FROM 1:12,000 SCALE, STEREO COLOR–INFRARED (CIR) PHOTOGRAPHY BY STAFF AT UMASS AMHERST. THE PHOTOGRAPHY WITHIN THIS AREA WAS CAPTURED IN 1993. THE VARIOUS TYPES OF WETLANDS REFLECTED ON THIS PLAN ARE AS FOLLOWS:
   - SALT MARSH
   - COASTAL BEACH
   - COASTAL BANK BLUFF
   - TIDAL FLAT
   - SHALLOW MARSH MEADOW OR FEN
   - WOODED SWAMP (DECIDUOUS)
   - WOODED SWAMP (MIXED TREES)
5. FLOOD ZONE WATER SURFACE ELEVATIONS (AND FLOOD PLAIN BOUNDARIES) WITHIN THE PROJECT LIMITS WERE OBTAINED FROM FLOOD INSURANCE RATE MAP (FIRM) PANEL NO. 2500140011C FOR THE TOWN OF WELLFLEET, MASSACHUSETTS, DATED JULY 2, 1992.
6. PROPERTIES OWNED BY THE CAPE COD NATIONAL SEASHORE AS REFLECTED ON THIS PLAN ARE LOCATED WITHIN A FEMA RECOGNIZED UNDEVELOPED COASTAL BARRIER ZONE (REFERRED TO AS AN OTHERWISE PROTECTED AREA).



EARTHEN DIKE ALTERNATIVE PLAN
SCALE: 1" = 50'-0"



WESTERN INLET ELEVATION
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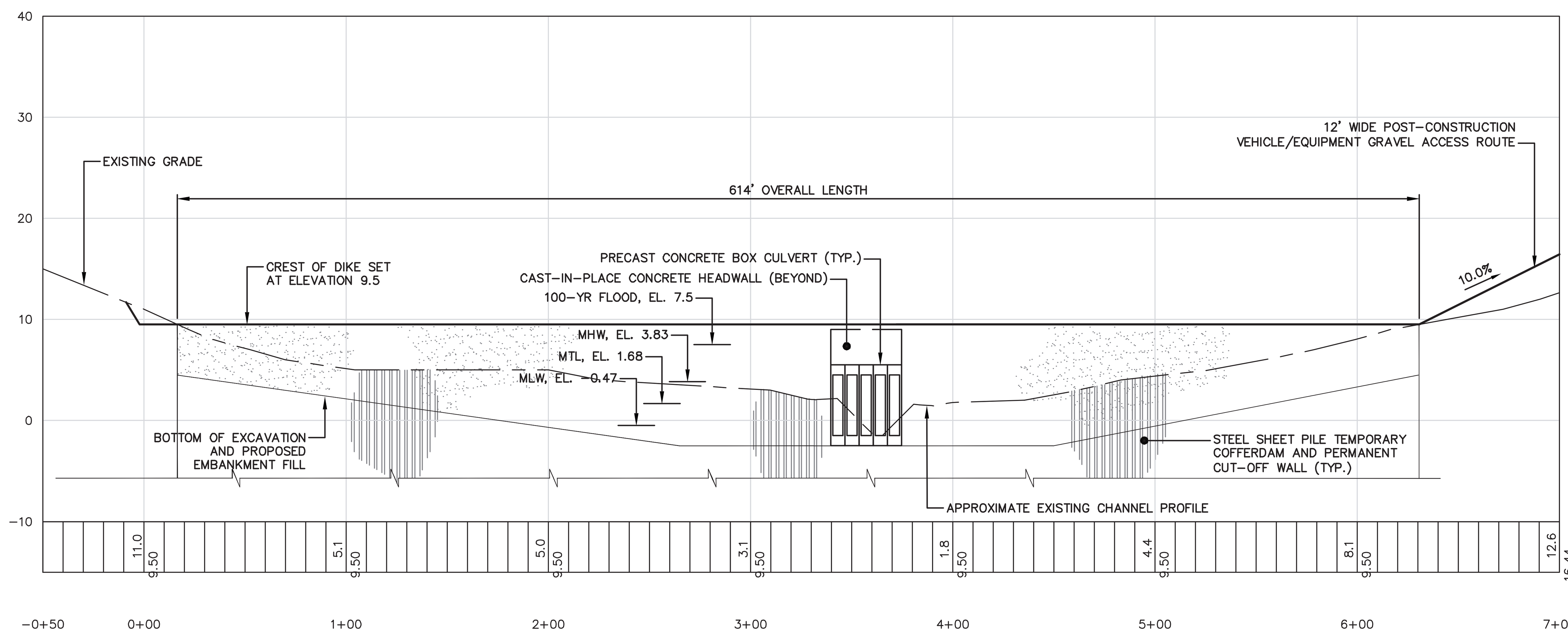
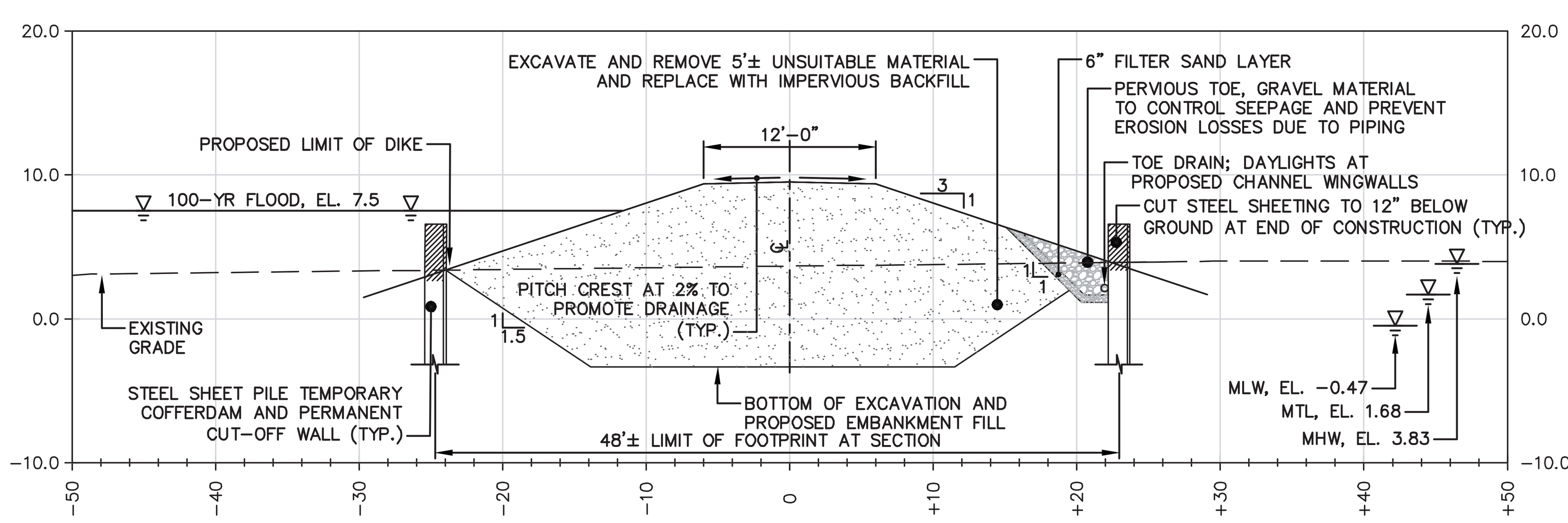
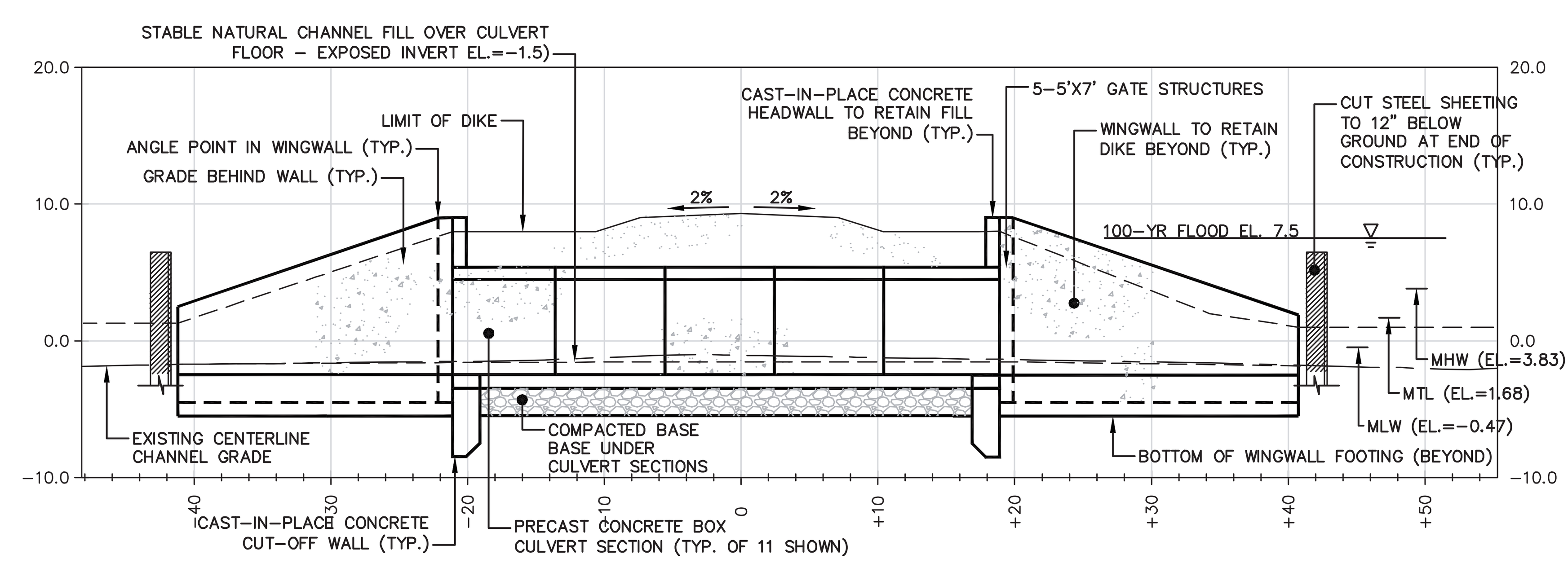


A LONGITUDINAL SECTION THROUGH EARTHEN DIKE
SCALE: H: 1" = 50'-0" / V: 1" = 10'-0"



B TYPICAL SECTION THROUGH EARTHEN DIKE AT STA. 2+75
SCALE: 1" = 10'-0"



C TYPICAL SECTION THROUGH CULVERT AT STA. 3+57
SCALE: 1" = 10'-0"

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

SCALE:
HORZ.: AS NOTED
VERT.: N/A
DATUM:
HORZ.: NAD83
VERT.: NAVD88
GRAPHIC SCALE

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PROVIDENCE, RI 02908
401.861.3070
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HERRING RIVER RESTORATION COMMITTEE
EARTHEN DIKE ALTERNATIVE
MILL CREEK DIKE SALT MARSH RESTORATION
WELLFLEET MASSACHUSETTS

PROJ. No.: 20120636.A12
DATE: JUNE 2014

CS-101

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Plotter: DWG TO PDF.PC3 CTB File: FO.STB
MS VIEW:
LAYER STATE:

MAP NOTES AND REFERENCES:

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   - TIDAL FLAT
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   - WOODED SWAMP (MIXED TREES)
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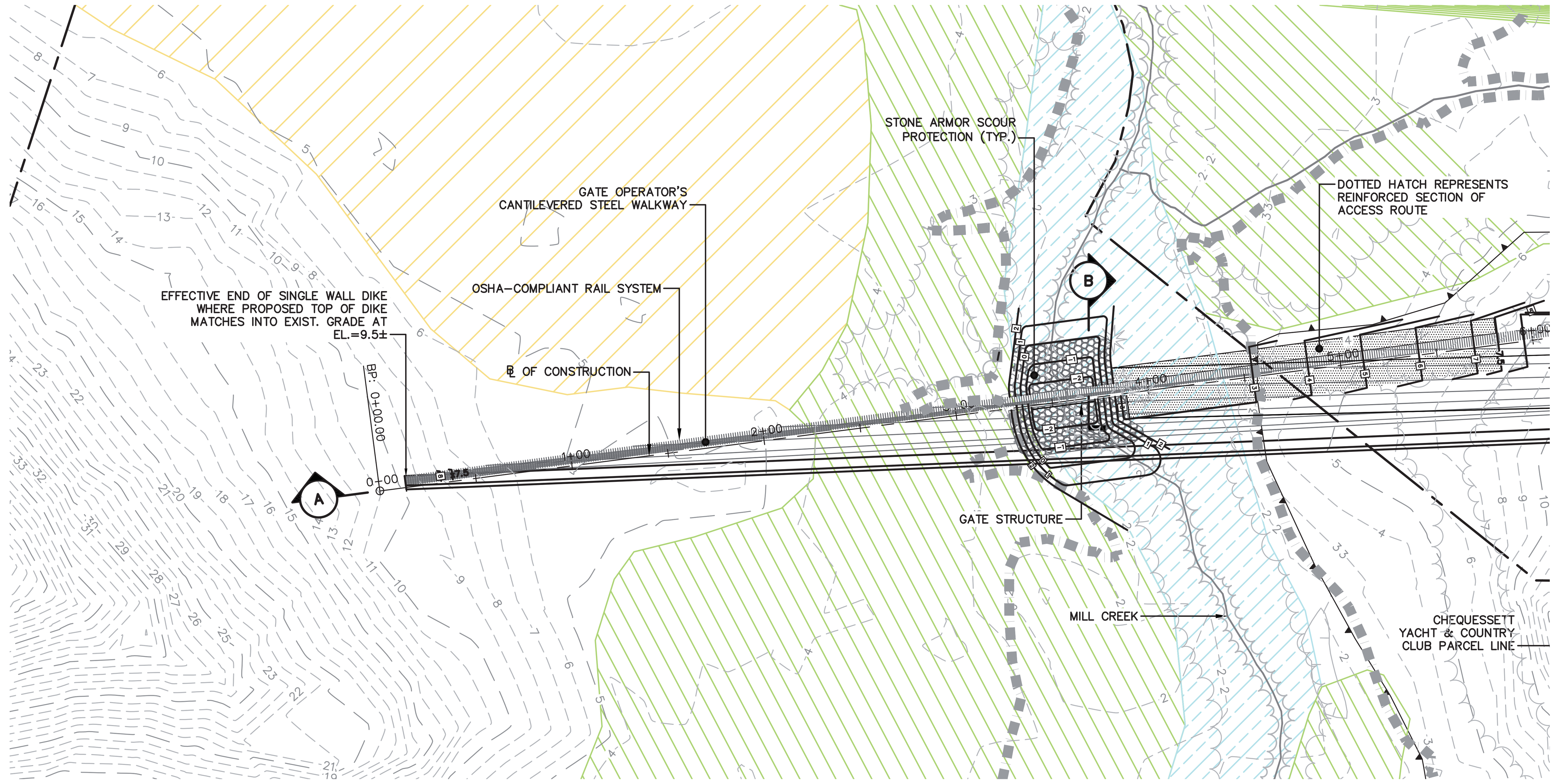

SHEET PILE WALL DIKE ALTERNATIVE PLAN
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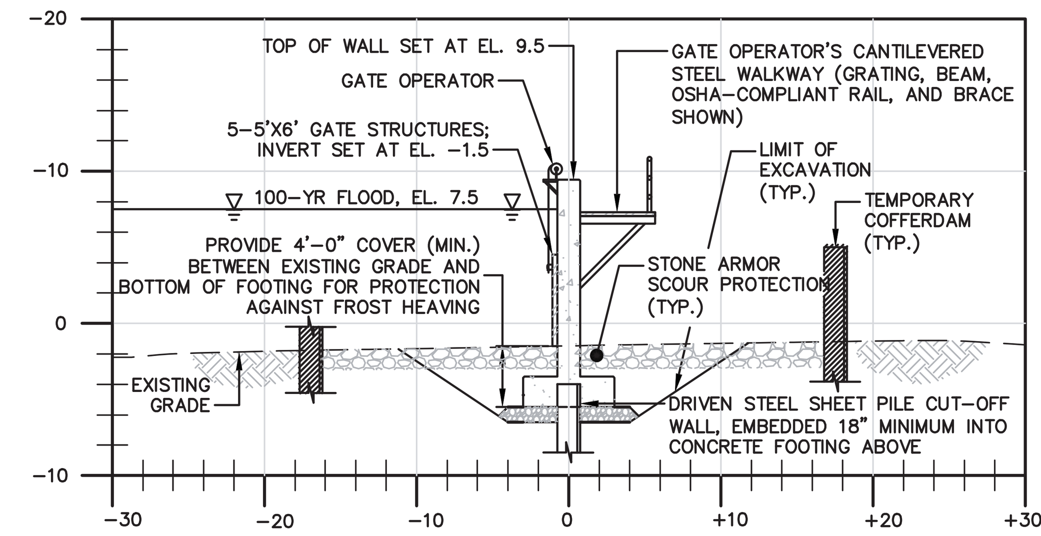
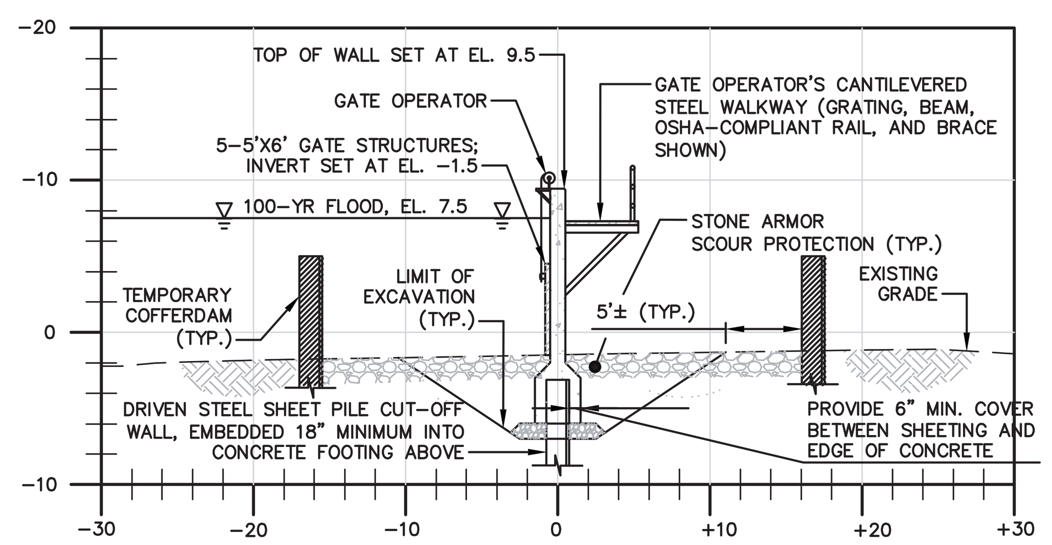
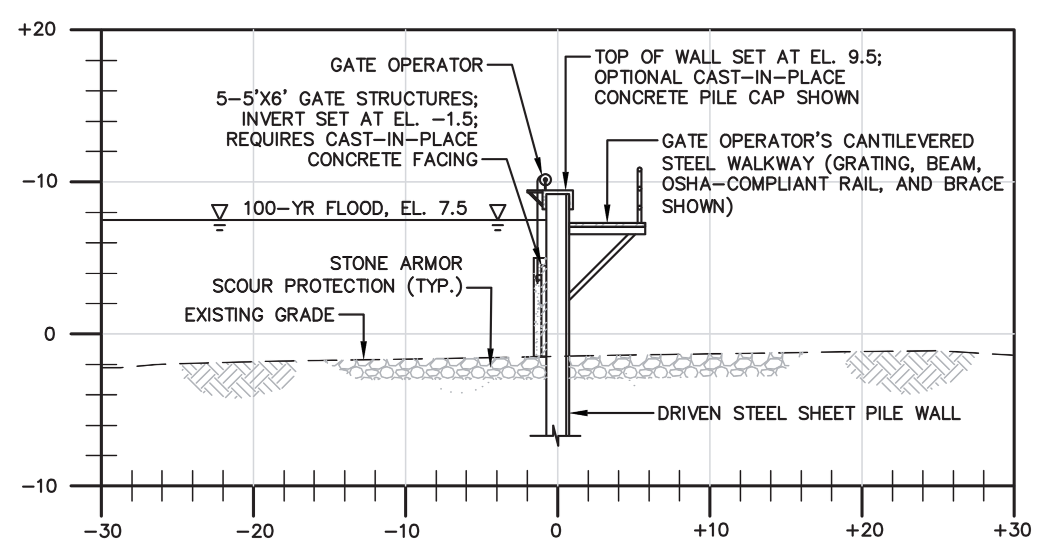


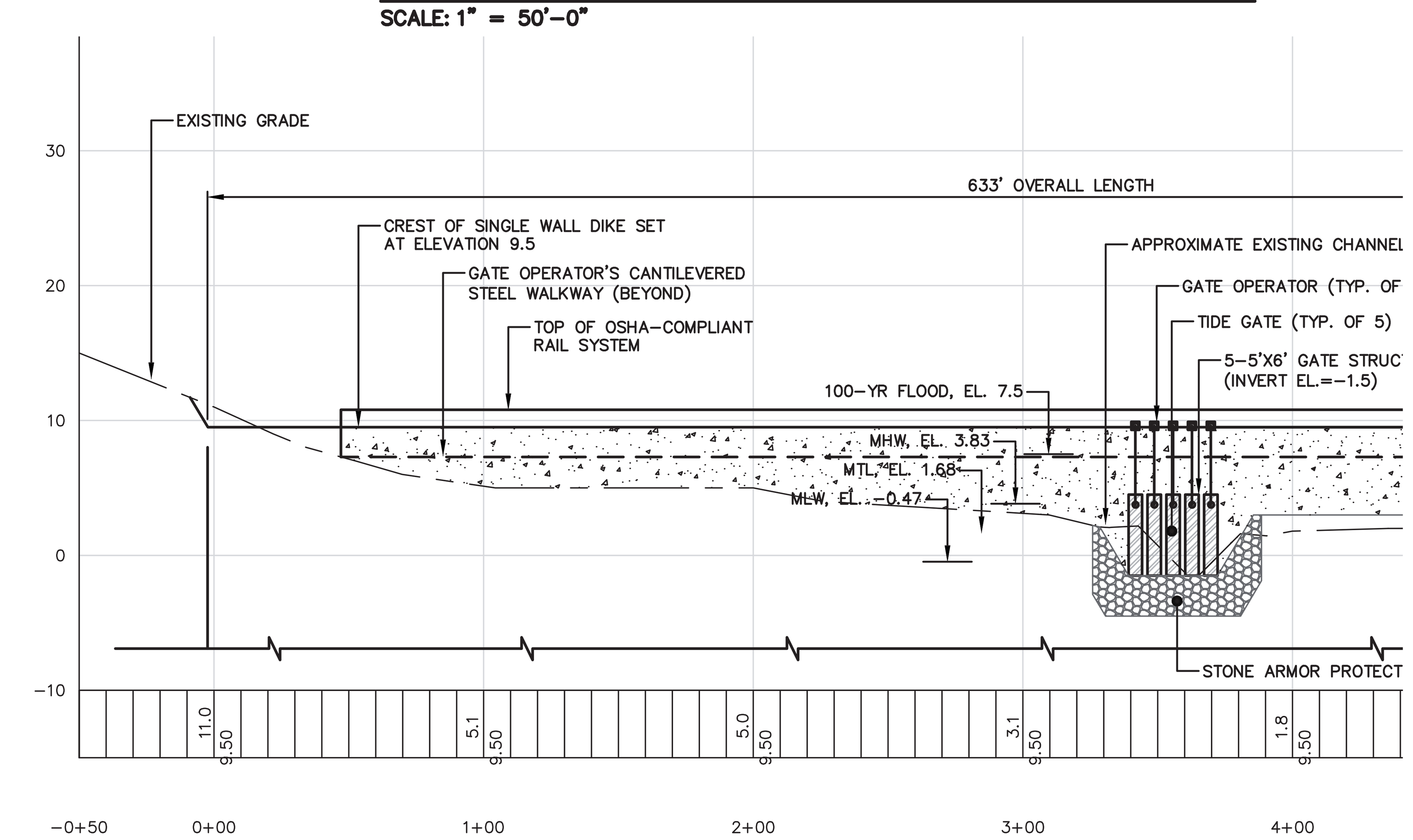
ALTERNATE WALL CONFIGURATION: T–WALL
SCALE: 1" = 10'-0"



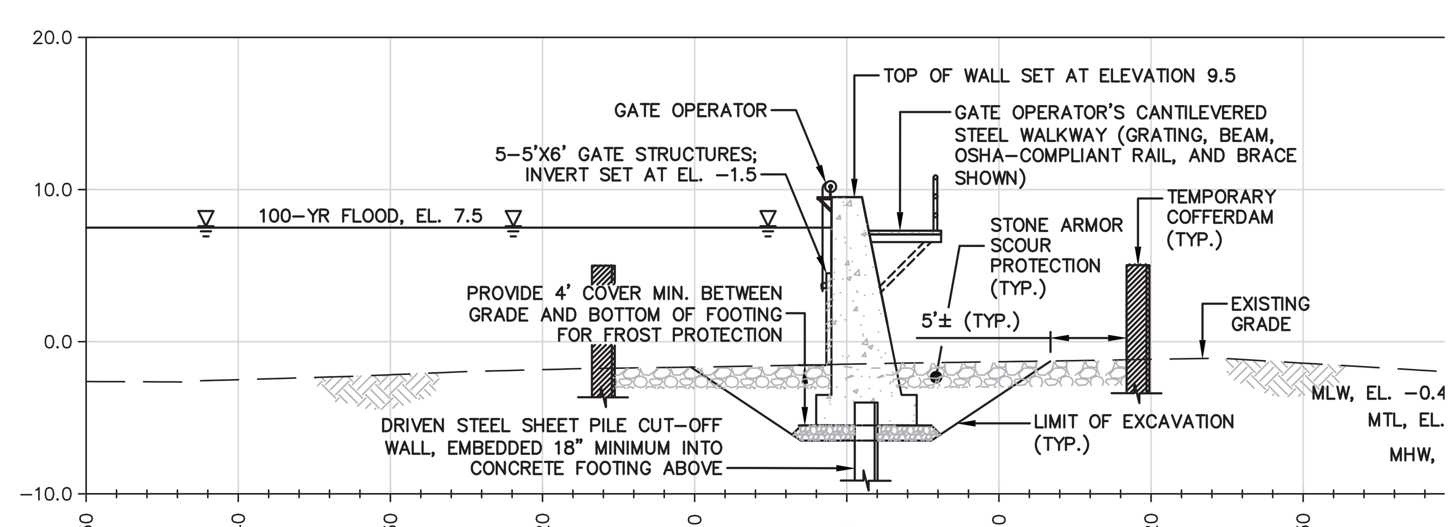
ALTERNATE WALL CONFIGURATION: I–WALL
SCALE: 1" = 10'-0"



ALTERNATE WALL CONFIGURATION: SHEET PILE WALL
SCALE: 1" = 10'-0"



A LONGITUDINAL SECTION THROUGH SINGLE SHEET PIL
SCALE: H: 1" = 50'-0" / V: 1" = 10'-0"



ALTERNATE WALL CONFIGURATION: CONCRETE GRAVITY WALL
SCALE: 1" = 10'-0"

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

SCALE:
HORZ.: AS NOTED
VERT.: N/A
DATUM:
HORZ.: NAD83
VERT.: NAVD88

GRAPHIC SCALE

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PROVIDENCE, RI 02908
401.861.3070
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WELLFLEET

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MS VIEW:
LAYER STATE:

Attachment E

Opinions of Construction Cost

FUSS & O'NEILL, INC.
317 Iron Horse Way
Providence, RI 02908

ORDER OF MAGNITUDE OPINION OF COST		DATE PREPARED : 06/11/14	SHEET 1 OF 5
PROJECT :	**Mill Creek Dike Alternatives Analysis**	BASIS :	2013 Mass Highway Weighted Average Bid Prices, 2013 Connecticut DOT Bid Item List, 2012 RS Means Site and Landscaping Construction Cost, Previous Construction Projects.
LOCATION :	**Wellfleet, MA**		
DESCRIPTION:	**Earthen Dike Alternative**		
DRAWING NO. :	**CS-101 Earthen Dike Alternative**	ESTIMATOR : MLG	CHECKED BY : PDB/NSW

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
1	**Site Construction**				
	Site Clearing	LS	1	$15,000.00	$15,000
	Excavation of Unsuitable Existing Material	CY	6,550	$26.00	$170,300
	Place Fill Material Imported and Placed from CNR Dike Construction	CY	6,200	$20.00	$124,000
	Import and Place Fill Material Suitable for Off-Site Borrow	CY	2,700	$40.00	$108,000
	4000 PSI Concrete for Cast-in-Place Headwalls	CY	45	$800.00	$36,000
	4000 PSI Concrete for Cast-in-Place Wingwalls	CY	110	$800.00	$88,000
	4000 PSI Concrete for Cast-in-Place Culvert Aprons	CY	35	$800.00	$28,000
	Filter Stone Material for Pervious Toe Drain	CY	210	$40.00	$8,400
	Sand Material for Pervious Toe Drain	CY	140	$40.00	$5,600
	Stone Armor Scour Protection	CY	330	$75.00	$24,750
	Place On-site Soil as Topsoil	CY	500	$20.00	$10,000
	Seeding, Planting and Restoration	LS	1	$12,000.00	$12,000
	Crushed Gravel Access Route	CY	360	$45.00	$16,200
	Furnish and Install Steel Sheeting for Cut-Off Walls	SF	24,000	$35.00	$840,000
	Site Construction Subtotal				**$1,486,250**
2	**Culvert and Tide Control Structures**				
	Compacted Base Material Below Culvert Units	CY	80	$50.00	$4,000
	Box Culvert Units with 5'-0" x 7'-0" Hydraulic Opening	LF	40	$6,500.00	$260,000
	Bituminous Damp-proofing	SY	200	$23.00	$4,600
	Stable Native Channel Material Over Culvert Inverts (Inc. Structural Anchors)	CY	60	$250.00	$15,000
	Combination Slide/Flap Tide Gate with Electric Operators	EA	5	$68,000.00	$340,000
	Generator Power and Control Panels and Conduits	LS	1	$45,000.00	$45,000
	Adjustments and Commissioning	LS	1	$20,000.00	$20,000
	Tide Control Structures Subtotal				**$688,600**
3	**Cofferdamming and Dewatering**				
	Additional Steel Sheeting Above Ground (Cut Off at 12" Below Ground at End of Construction)	SF	7,200	$40.00	$288,000
	Dewatering	LS	1	$125,000.00	$125,000
	Cofferdamming and Dewatering Subtotal				**$413,000**
	CONSTRUCTION SUBTOTAL				**$2,587,850**
	Construction Administration				
	Mobilization & Demobilization (2%)	LS	1	$60,000	$60,000
	Access Route and Staging Area Preparation, Maintenance and Restoration	LS	1	$45,000.00	$45,000
	Traffic Control	LS	1	$20,000	$20,000
	Erosion and Sedimentation Control Installation, Maintenance and Removal	LS	1	$75,000	$75,000
	Construction Survey Layout and As-Built Mapping	LS	1	$25,000	$25,000
	Field and Laboratory Testing	LS	1	$30,000	$30,000
	Insurance and Bonds (5%)	LS	1	$130,000	$130,000
	CONSTRUCTION ADMINISTRATION SUBTOTAL				**$385,000**
	OVERALL SUBTOTAL				**$2,972,850**
	CONTINGENCY (35%)				$1,040,498
	OVERALL TOTAL INCLUDING CONTINGENCY (2016)				**$4,257,760.36**
	SUBTOTAL -15% TO +30% (ROUNDED TO NEAREST $1,000)		**$3,812,000**	**TO**	**$5,150,000**

FUSS & O'NEILL, INC.
317 Iron Horse Way
Providence, RI 02908

ORDER OF MAGNITUDE OPINION OF COST		DATE PREPARED :	05/16/14	SHEET 2 OF 5	
PROJECT :	**Mill Creek Dike Alternatives Analysis**	BASIS :	2013 Mass Highway Weighted Average Bid Prices, 2013 Connecticut DOT Bid Item List, 2012 RS Means Site and Landscaping Construction Cost, Previous Construction Projects.		
LOCATION :	**Wellfleet, MA**				
DESCRIPTION:	**Single Wall T-Wall Alternative**				
DRAWING NO. :	**CS-102 Structural Wall Dike Alternative**	ESTIMATOR :	MLG	CHECKED BY :	PDB/NSW

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
1	**Site Construction**				
	Site Clearing	LS	1	$15,000.00	$15,000
	Excavation to Required Depth for Wall Construction	CY	1700	$26.00	$44,200
	4000 PSI Concrete for Wall Stem	CY	250	$800.00	$200,000
	4000 PSI Concrete for Wall Footing	CY	260	$800.00	$208,000
	Rebar for Wall Construction	LB	16,000	$3.00	$48,000
	Crushed Stone for Structure Bedding	TON	380	$40.00	$15,200
	Gravel Borrow for Backfilling Structures	CY	1,100	$40.00	$44,000
	Riprap for Scour Protection	TON	950	$50.00	$47,500
	Furnish and Install Steel Sheeting for Permanent Cut-Off Wall	LB	325,000	$2.00	$650,000
	Furnish and Install Battered Piles	LF	4,800	$50.00	$240,000
	Stone Armor Scour Protection	CY	80	$75.00	$6,000
	Crushed Gravel Access Route	CY	200	$45.00	$9,000
	Seeding, Planting and Restoration	LS	1	$7,500.00	$7,500
	Site Construction Subtotal				**$1,534,400**
2	**Tide Control Structures**				
	Combination Slide/Flap Tide Gate with Electric Operators	EA	5	$68,000.00	$340,000
	Gate Operator's Cantilevered Steel Walkway	LF	575	$200.00	$115,000
	Generator Power and Control Panels and Conduits	LS	1	$45,000.00	$45,000
	Adjustments and Commissioning	LS	1	$20,000.00	$20,000
	Tide Control Structures Subtotal				**$520,000**
3	**Cofferdamming and Dewatering**				
	Furnish and Install Temporary Steel Sheeting Cofferdam	SF	31,200	$35.00	$1,092,000
	Dewatering	LS	1	$50,000.00	$50,000
	Cofferdamming and Dewatering Subtotal				**$1,142,000**
	CONSTRUCTION SUBTOTAL				**$3,196,400**
	Construction Administration				
	Mobilization & Demobilization (2%)	LS	1	$70,000	$70,000
	Access Route and Staging Area Preparation, Maintenance and Restoration	LS	1	$45,000.00	$45,000
	Traffic Control	LS	1	$15,000	$15,000
	Erosion and Sedimentation Control Installation, Maintenance and Removal	LS	1	$60,000	$60,000
	Construction Survey Layout and As-Built Mapping	LS	1	$15,000	$15,000
	Field and Laboratory Testing	LS	1	$15,000	$15,000
	Insurance and Bonds (5%)	LS	1	$160,000	$160,000
	CONSTRUCTION ADMINISTRATION SUBTOTAL				**$380,000**
	OVERALL SUBTOTAL				**$3,576,400**
	CONTINGENCY (35%)				$1,251,740
	OVERALL TOTAL INCLUDING CONTINGENCY (2016)				**$5,122,173.73**
	SUBTOTAL -15% TO +30% (ROUNDED TO NEAREST $1,000)		**$4,586,000**	**TO**	**$6,195,000**

FUSS & O'NEILL, INC.

317 Iron Horse Way
Providence, RI 02908

ORDER OF MAGNITUDE OPINION OF COST		DATE PREPARED : 07/10/14	SHEET 3 OF 5
PROJECT :	**Mill Creek Dike Alternatives Analysis**	BASIS : 2013 Mass Highway Weighted Average Bid Prices, 2013 Connecticut DOT Bid Item List, 2012 RS Means Site and Landscaping Construction Cost, Previous Construction Projects.	
LOCATION :	**Wellfleet, MA**		
DESCRIPTION:	**Single Wall Sheet Pile Wall Alternative**		
DRAWING NO. :	**CS-102 Structural Wall Dike Alternative**	ESTIMATOR : MLG	CHECKED BY : PDB/NSW

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
1	**Site Construction**				
	Site Clearing	LS	1	$15,000.00	$15,000
	Furnish and Install Steel Sheeting	LB	510,000	$2.00	$1,020,000
	Stone Armor Scour Protection (Overtopping and Channel)	TON	950	$50.00	$47,500
	Crushed Gravel Access Route	CY	500	$65.00	$32,500
	Portable Bridge and Supports	LS	1	$20,000.00	$20,000
	Seeding, Planting and Restoration	LS	1	$7,500.00	$7,500
	Site Construction Subtotal				**$1,142,500**
2	**Tide Control Structures**				
	Combination Slide/Flap Tide Gate with Electric Operators	EA	5	$68,000.00	$340,000
	Gate Operator's Cantilevered Steel Walkway	LF	575	$200.00	$115,000
	4000 PSI Concrete for Concrete Facing	CY	5	$1,400.00	$7,000
	Generator Power and Control Panels and Conduits	LS	1	$45,000.00	$45,000
	Adjustments and Commissioning	LS	1	$20,000.00	$20,000
	Tide Control Structures Subtotal				**$527,000**
3	**Cofferdamming and Dewatering**				
	Control of Water	LS	1	$50,000.00	$50,000
	Cofferdamming and Dewatering Subtotal				**$50,000**
	CONSTRUCTION SUBTOTAL				**$1,719,500**
	Construction Administration				
	Mobilization & Demobilization (2%)	LS	1	$40,000	$40,000
	Access Route and Staging Area Preparation, Maintenance and Restoration	LS	1	$45,000.00	$45,000
	Traffic Control	LS	1	$15,000	$15,000
	Erosion and Sedimentation Control Installation, Maintenance and Removal	LS	1	$60,000	$60,000
	Construction Survey Layout and As-Built Mapping	LS	1	$15,000	$15,000
	Field and Laboratory Testing	LS	1	$15,000	$15,000
	Insurance and Bonds (5%)	LS	1	$90,000	$90,000
	CONSTRUCTION ADMINISTRATION SUBTOTAL				**$280,000**
	OVERALL SUBTOTAL				**$1,999,500**
	CONTINGENCY (35%)				$699,825
	OVERALL TOTAL INCLUDING CONTINGENCY (2016)				**$2,863,713.89**
	SUBTOTAL -15% TO +30% (ROUNDED TO NEAREST $1,000)		**$2,564,000**	**TO**	**$3,464,000**

FUSS & O'NEILL, INC.

317 Iron Horse Way
Providence, RI 02908

ORDER OF MAGNITUDE OPINION OF COST		DATE PREPARED :	05/16/14	SHEET 4	OF 5
PROJECT :	**Mill Creek Dike Alternatives Analysis**	BASIS :	2013 Mass Highway Weighted Average Bid Prices, 2013 Connecticut DOT Bid Item List, 2012 RS Means Site and Landscaping Construction Cost, Previous Construction Projects.		
LOCATION :	**Wellfleet, MA**				
DESCRIPTION:	**Single Wall I-Wall Alternative**				
DRAWING NO. :	**CS-102 Structural Wall Dike Alternative**	ESTIMATOR :	MLG	CHECKED BY :	PDB/NSW

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
1	**Site Construction**				
	Site Clearing	LS	1	$15,000.00	$15,000
	Excavation to Required Depth for Wall Construction	CY	1600	$26.00	$41,600
	4000 PSI Concrete for Wall Stem	CY	160	$800.00	$128,000
	4000 PSI Concrete for Wall Footing	CY	240	$800.00	$192,000
	Rebar for Wall Construction	LB	12,500	$3.00	$37,500
	Crushed Stone for Structure Bedding	TON	250	$40.00	$10,000
	Gravel Borrow for Backfilling Structures	CY	1,150	$40.00	$46,000
	Furnish and Install Steel Sheeting for Cut-Off Wall	LB	325,000	$2.00	$650,000
	Stone Armor Scour Protection (Overtopping and Channel)	TON	950	$50.00	$47,500
	Crushed Gravel Access Route	CY	300	$65.00	$19,500
	Seeding, Planting and Restoration	LS	1	$7,500.00	$7,500
	Site Construction Subtotal				**$1,194,600**
2	**Tide Control Structures**				
	Combination Slide/Flap Tide Gate with Electric Operators	EA	5	$68,000.00	$340,000
	Gate Operator's Cantilevered Steel Walkway	LF	575	$200.00	$115,000
	Generator Power and Control Panels and Conduits	LS	1	$45,000.00	$45,000
	Adjustments and Commissioning	LS	1	$20,000.00	$20,000
	Tide Control Structures Subtotal				**$520,000**
3	**Cofferdamming and Dewatering**				
	Furnish and Install Temporary Steel Sheeting Cofferdam	SF	31,200	$35.00	$1,092,000
	Dewatering	LS	1	$50,000.00	$50,000
	Cofferdamming and Dewatering Subtotal				**$1,142,000**
	CONSTRUCTION SUBTOTAL				**$2,856,600**
	Construction Administration				
	Mobilization & Demobilization (2%)	LS	1	$60,000	$60,000
	Access Route and Staging Area Preparation, Maintenance and Restoration	LS	1	$45,000.00	$45,000
	Traffic Control	LS	1	$15,000	$15,000
	Erosion and Sedimentation Control Installation, Maintenance and Removal	LS	1	$60,000	$60,000
	Construction Survey Layout and As-Built Mapping	LS	1	$15,000	$15,000
	Field and Laboratory Testing	LS	1	$15,000	$15,000
	Insurance and Bonds (5%)	LS	1	$150,000	$150,000
	CONSTRUCTION ADMINISTRATION SUBTOTAL				**$360,000**
	OVERALL SUBTOTAL				**$3,216,600**
	CONTINGENCY (35%)				$1,125,810
	OVERALL TOTAL INCLUDING CONTINGENCY (2016)				**$4,606,862.77**
	SUBTOTAL -15% TO +30% (ROUNDED TO NEAREST $1,000)		**$4,124,000**	**TO**	**$5,572,000**

FUSS & O'NEILL, INC.

317 Iron Horse Way
Providence, RI 02908

ORDER OF MAGNITUDE OPINION OF COST		DATE PREPARED :	05/16/14	SHEET 5 OF 5
PROJECT :	**Mill Creek Dike Alternatives Analysis**	BASIS :	2013 Mass Highway Weighted Average Bid Prices, 2013 Connecticut DOT Bid Item List, 2012 RS Means Site and Landscaping Construction Cost, Previous Construction Projects.	
LOCATION :	**Wellfleet, MA**			
DESCRIPTION:	**Single Wall Gravity Wall Alternative**			
DRAWING NO. :	**CS-102 Structural Wall Dike Alternative**	ESTIMATOR :	MLG	CHECKED BY : PDB/NSW

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
1	**Site Construction**				
	Site Clearing	LS	1	$15,000.00	$15,000
	Excavation to Required Depth for Wall Construction	CY	1800	$26.00	$46,800
	4000 PSI Concrete for Wall Stem	CY	480	$800.00	$384,000
	4000 PSI Concrete for Wall Footing	CY	240	$800.00	$192,000
	Rebar for Wall Construction	LB	17,000	$3.00	$51,000
	Crushed Stone for Structure Bedding	TON	400	$40.00	$16,000
	Gravel Borrow for Backfilling Structures	CY	1,000	$40.00	$40,000
	Furnish and Install Steel Sheeting for Cut-Off Wall	LB	325,000	$2.00	$650,000
	Furnish and Install Battered Piles	LF	4,800	$50.00	$240,000
	Compacted Fill Material for Truck Access Route	CY	200	$40.00	$8,000
	Stone Armor Scour Protection (Overtopping and Channel)	TON	950	$50.00	$47,500
	Crushed Gravel Access Route	CY	300	$65.00	$19,500
	Seeding, Planting and Restoration	LS	1	$7,500.00	$7,500
	Site Construction Subtotal				**$1,717,300**
2	**Tide Control Structures**				
	Combination Slide/Flap Tide Gate with Electric Operators	EA	5	$68,000.00	$340,000
	Gate Operator's Cantilevered Steel Walkway	LF	575	$200.00	$115,000
	Generator Power and Control Panels and Conduits	LS	1	$45,000.00	$45,000
	Adjustments and Commissioning	LS	1	$20,000.00	$20,000
	Tide Control Structures Subtotal				**$520,000**
3	**Cofferdamming and Dewatering**				
	Furnish and Install Temporary Steel Sheeting Cofferdam	SF	31,200	$35.00	$1,092,000
	Dewatering	LS	1	$50,000.00	$50,000
	Cofferdamming and Dewatering Subtotal				**$1,142,000**
	CONSTRUCTION SUBTOTAL				**$3,379,300**
	Construction Administration				
	Mobilization & Demobilization (2%)	LS	1	$70,000	$70,000
	Access Route and Staging Area Preparation, Maintenance and Restoration	LS	1	$45,000.00	$45,000
	Traffic Control	LS	1	$15,000	$15,000
	Erosion and Sedimentation Control Installation, Maintenance and Removal	LS	1	$60,000	$60,000
	Construction Survey Layout and As-Built Mapping	LS	1	$15,000	$15,000
	Field and Laboratory Testing	LS	1	$15,000	$15,000
	Insurance and Bonds (5%)	LS	1	$170,000	$170,000
	CONSTRUCTION ADMINISTRATION SUBTOTAL				**$390,000**
	OVERALL SUBTOTAL				**$3,769,300**
	CONTINGENCY (35%)				$1,319,255
	OVERALL TOTAL INCLUDING CONTINGENCY (2016)				**$5,398,448.00**
	SUBTOTAL -15% TO +30% (ROUNDED TO NEAREST $1,000)	**$4,833,000**	**TO**		**$6,529,000**

APPENDIX M: FINAL CONCERN RESPONSE REPORT AND DRAFT EIS/EIR COMMENT LETTERS

National Park Service
U.S. Department of the Interior

Cape Cod National Seashore
Massachusetts

Herring River Restoration Project Environmental Impact Statement/Environmental Impact Report

Cape Cod National Seashore

Final Concern Response Report

March 2016

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Contents

INTRODUCTION

Pursuant to the National Environmental Policy Act (NEPA), its implementing regulations, and the National Park Service (NPS) guidance on meeting the Service's NEPA obligations, Cape Cod National Seashore (the Seashore) in cooperation and coordination with other members of the HRRC considered public and agency comments submitted on the Herring River Restoration Project Draft Environmental Impact Statement (DEIS) / Draft Environmental Impact Report (DEIR). This report describes how the National Park Service considered all of the comments received and provides responses to substantive comments.

The DEIS/DEIR was available for public and agency review from October 12, 2012 through December 12, 2012. The availability of the DEIS/DEIR was announced on the park website (www.nps.gov/caco), through mailings sent to interested parties, elected officials, and appropriate local and state agencies, and through press releases and newspapers. The DEIS/DEIR was made available for review through several outlets, including the NPS Planning, Environment, and Public Comment (PEPC) website at http://parkplanning.nps.gov/herring_river_DEIS, several local libraries, CD or hardcopy requests from the Seashore, and specific distribution to several government agencies, stakeholder groups, and regulators. After reviewing the DEIS/DEIR, the public was encouraged to submit comments regarding the DEIS/DEIR electronically through the NPS PEPC website, and in hard copy delivered by the U.S. Postal Service or other mail delivery service or hand-delivered to CACO and the Herring River Restoration Committee (HRRC). Oral statements and written comments were also accepted during the public meeting on the DEIS/DEIR.

PUBLIC COMMENT MEETING

The NPS, with the assistance of HRRC, and the Cape Cod Commission (CCC), held a public hearing for the Herring River Restoration Project DEIS/DEIR. The hearing was held during the public comment period on November 8, 2012, beginning at 6:30 p.m. at the Wellfleet Senior Center/Council on Aging, in Wellfleet, MA. This hearing met the dual purposes of fulfilling the NPS's NEPA public involvement requirement and the formal public hearing for the CCC, as required by Section 5 of the Cape Cod Commission Act and MEPA regulations. The public hearing was held to continue the public involvement process and to obtain community feedback on DEIS/DEIR for tidal restoration of the Herring River.

Over 100 meeting attendees signed in during the public comment hearing. The meeting was a formal public hearing format where attendees had the opportunity to ask questions and comment about the study area; the purpose, need, and objectives of the plan; summaries of the proposed alternatives; potential impacts, and information on the history of Herring River. The public was given an opportunity to comment on the record during the meeting. They were also provided information on how to submit comments by other methods such as mail, email, or online through the PEPC database where they could post their comments directly. Public comments received are detailed in the following sections of this report.

COMMENT ANALYSIS METHODOLOGY

During the comment period, 43 pieces of correspondence were received by one of the following methods: email, hard copy letter via mail, the internet-based PEPC system, comment sheet at the public meeting, or verbal comment at the public meeting. Letters received by email or through the postal mail, as well as the verbal comments made at the public meeting, were entered into the PEPC system for analysis. Each of these letters or submissions is referred to as correspondence.

Three pieces of correspondence were received after the comment period had closed. Typically, within the NEPA process, correspondences received after the close of the comment period would not appear in this report. However, these late correspondences were all received by State agencies in Massachusetts, which under the Massachusetts Environmental Policy Act (MEPA), are allowed to accept comments after the comment period has ended.

Once all the correspondences were entered into PEPC, each was read, and specific comments within each correspondence were identified. A total of 161 comments were identified. When identifying comments, every attempt was made to capture the full breadth of comments submitted.

During coding, comments were classified as substantive or non-substantive. As explained in section 4.6A of the DO-12 Handbook, a substantive comment does one or more of the following:

- Question, with a reasonable basis, the accuracy of information in the EIS;
- Question, with a reasonable basis, the adequacy of the environmental analysis;
- Present reasonable alternatives other than those presented in the EIS; and/or
- Cause changes or revisions in the proposal.

Substantive comments raise, debate, or question a point of fact or policy. Comments in favor of or against the proposed action or alternatives, or comments that only agree or disagree with NPS policy, are not considered substantive. While all comments were read and were considered in shaping the Final Environmental Impact Statement (FEIS) / Environmental Impact Report (FEIR), only those determined to be substantive are explicitly addressed by the NPS responses in this report.

Each substantive comment was given a code to identify the general content of a comment and to group similar comments together. A total of 19 codes were used to categorize all of the comments received. An example of a code developed for this project is PP4000 – Private Property/Adjacent Lands: Impact of Proposal and Alternatives

Under each code, comments were summarized by writing a “concern statement” that represents the meaning of a group of similar comments. For example under the code *PP4000 – Private Property/Adjacent Lands: Impact of Proposal and Alternatives*, one concern statement is “The FEIS/FEIR should explain which specific properties would be impacted by the proposed project and the subsequent compensation in the event of adverse impacts ...” This single concern statement captures the meaning of multiple comments that make the same suggestion. Following each concern statement are one or more “representative quotes” which are comments taken directly from the correspondence to illustrate the issue, concern, or idea expressed by the comments grouped under that concern statement. While coding was used as a means of grouping similar comments together initially, in this report the concern statements are now organized under a set of simplified EIS-topics. These are intended to improve readability and allow for easier reference to the FEIS. For example, the concern statement mentioned above is placed under the heading Private Property/Adjacent Lands.

GUIDE TO THIS DOCUMENT

This report is organized as follows:

Content Analysis Report: This is the basic report produced from PEPC that provides information on the numbers and types of correspondences and comments received, organized by code and by various demographics. The first section is a summary of the number of correspondences that contain comments for each code and the percentage of correspondences that contain comments under those codes. For example, if the report states that code PP4000: Private Property/Adjacent Lands: Impact of Proposal and Alternatives appears in 17 correspondences, this means that 17 correspondences addressed impacts on private property or adjacent lands. Those correspondences also likely addressed other issues, and those comments were categorized under different codes; for this reason, the total number of correspondences in this table is not the same as the number of correspondences received.

Data are then presented about the correspondence by type (i.e., number of emails, letters, etc.); number received by organization type (i.e., organizations, governments, individuals, etc.); and number received by state.

Concerns and Comment Report: This report summarizes the substantive comments received during the DEIS/DEIR comment period. As explained in “Comment Analysis Methodology” above, these comments were initially sorted by code; however to develop a report that was more reader friendly, the codes where the organized by EIS-based topics and then further organized into concern statements. Representative quotes are then provided for each concern statement. A specific response is provided for each statement.

CONTENT ANALYSIS REPORT

TABLE 1: CORRESPONDENCE DISTRIBUTION BY TYPE

Type	# of Correspondences	% of Correspondence
Letter	20	46.51%
Web Form	19	44.19%
E-mail	3	6.98%
Transcript	1	2.33%
Total	43	100.00%

TABLE 2: CORRESPONDENCE DISTRIBUTION BY ORGANIZATION TYPE

Organization Type	# of Correspondences	% of Correspondences
Business	1	2.33%
Conservation/Preservation	4	9.30%
County Government	1	2.33%
Federal Government	4	9.30%
State Government	7	16.28%
Town or City Government	2	4.65%
Unaffiliated Individual	24	55.81%
Total	**43**	**100.00%**

TABLE 3: CORRESPONDENCE DISTRIBUTION BY STATE

State	# of Correspondences	% of Correspondences
MA	41	95.35%
CT	1	2.33%
VA	1	2.33%
Total	**43**	**100.00%**

CONCERNS AND COMMENT REPORT

1. GENERAL/PURPOSE AND NEED

CONCERN STATEMENT: The goal for the proposed project should include restoring links to as many tributaries as feasible.

Organization: Atlantic States Marine Fisheries Commission
Organization Type: Interstate Commission
Representative Quote: "The ultimate goal for any alternative selected should be to have as free and open a system as possible, given the human dimension constraints. Many of the design alternatives still require some tidal gate design, which is understandable given the need to slowly reintroduce tidal flow in the system. Eventual functions should include as many open links to river tributaries as feasible."

Response: Section 1.2 of the FEIS/FEIR explains that while the ecological goal is to restore the full natural tidal range in as much of the Herring River flood plain as practicable, tidal flooding in certain areas must be controlled to protect existing land uses. Where these considerations are relevant, the goal is to balance tidal restoration objectives with flood control by allowing the highest tide range practicable while also ensuring flood proofing and protection of vulnerable properties.

2. Alternatives

CONCERN STATEMENT: An option should be considered that utilizes a one way flapper valve as a tide control mitigation tool as opposed to beams, walls and other potentially damaging mitigation measures to protect the Upper Pole Dike Creek and its wildlife from saltwater intrusion.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "I feel that the best and fairest mitigation for the UPDC is a one way flapper valve protecting the whole UPDC and its wildlife and owners from saltwater intrusion. There are many unknowns about the length and breadth of this project. While restoration of federal marsh lands and the intended benefits can and should be accomplished, there needs to be a fair and reasonable approach to mitigation decisions. Berms, walls and other proposed mitigation options are risky, damaging and have unknown consequences, Thus the one way flapper valve protecting the UPDC is the best option. Please consider Alternative C with the addition of a flapper valve protecting Pole Dyke Creek from tidal restoration."

Response: Section 2.6.5 of the FEIS/FEIR states that any substantial flood impacts in Upper Pole Dike Creek would be addressed on a property-specific basis and by controlling flow at Pole Dike Road with a tide gate. The Preferred Alternative (D) outlined in Chapter 2 (see Sections 2.3.1 and 2.5.3) of the FEIS/FEIR includes provisions for tide control at Pole Dike Creek Road. The road will be raised above flood elevation and a tide gate will be installed to control water levels in the Upper Pole Dike Creek basin. The HRRC is working with property owners to develop impact prevention measures for specific properties. Through the adaptive management process, the Pole Dike Creek tide gate will be opened incrementally and water levels will be carefully monitored. While the goal is to reach full restoration of this basin, this will not occur unless and until provisions are in place to prevent any structural impacts to private properties.

CONCERN STATEMENT: The FEIS/FEIR should consider a phased approach with regards to modification or manipulation of the existing dike; taking different restorative steps over time in the near future to allow for a greater review of the effectiveness and impacts stemming from the implementation of these steps.

Organization: Herring River, annual herring count
Organization Type: Unaffiliated Individual
Representative Quote: "In essence I suggest a renewed look at a phased opening/removal of tidal gates as a 'Phase One' of the larger restoration of the estuary. As the gates are manipulated, leading to full flow thorough the opening over3-5 years, there will be opportunities to test and study, on a small scale, the environmental changes so well discussed in the draft EIS. Federal review and the congressional appropriation process on the larger restoration can occur simultaneously with this Phase One undertaking.

Accordingly, I recommend that the draft EIS be amended by adding a supplemental chapter further identifying and evaluating environmental concerns associated with a Phase One-all possible manipulation of existing tidal gate apparatus option over 3-5 years. Upon completion of such "mini-restoration", we can evaluate where we are, what expected (and unexpected) changes have occurred, and how what we've learned should affect the next steps in the ultimate restoration."

Response: The option of modifying the existing dike structure to initiate restoration has been considered but dismissed in the FEIS/FEIR, (Chapter 2, Section 2.7.2). This option was dismissed because the current configuration of the tide gates allows more water to flow into the system than is allowed to flow out into the harbor. Opening all of the existing gates would only increase the inflowing volume of water and would not increase the volume flowing out. Modeling shows that this configuration would increase the elevation of both high tides and low tides without increasing the overall tidal range. Because the intertidal area would not be substantially increased, the ecological benefits would be minimal, while the risks of damaging flood impacts would increase. It therefore fails to meet the project objectives.

CONCERN STATEMENT: A plan should be considered which keeps the river restoration within the bounds of Cape Cod National Seashore.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "I strongly urge you to consider a plan that keeps the river restoration within the Cape Cod National Seashore bounds. Doing so will allow full restoration of the Herring River and will give the herring full access to their traditional spawning grounds."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "… there should be an Alternative E, which confines the restoration efforts within the National Seashore boundary. She noted the project would bring the 200-foot buffer of the state Rivers Protection Act into play."

Response: The Herring River Restoration Project is being co-sponsored by the Towns of Wellfleet and Truro and Cape Cod National Seashore because the estuary is a shared resource. The wetland system does not conform to political boundaries. Portions of the Mill Creek, Upper Pole Dike Creek and Upper Bound Brook basins lie outside the boundary of Cape Cod National Seashore. There are more than 250 acres of degraded wetlands in these basins that have experienced the same loss of estuarine habitat and degradation of water quality as the rest of the estuary. While full restoration might not be possible in all these basins, restoring tidal flow is critical to improving water quality throughout the entire system, and achieving a gradual transition in salinity from seawater to freshwater for migrating fish. Section 4.6.3 of the FEIS/FEIR indicates that aquatic species would benefit from increased flow, water levels and water quality in the upper sub-basins. Restoring tidal flow will also promote the natural control of nuisance mosquitoes. Diking, wetland drainage and poor water quality presently block fish which eat mosquito larvae from the Mill Creek, Pole Dike Creek and Bound Brood basins. These upper basins are an important part of the overall restoration project, and restoration can be achieved in these areas while still protecting the private properties that abut them.

3. SALINITY OF SURFACE WATERS

CONCERN STATEMENT: The FEIS/FEIR should explain how salinity can be higher on the marsh surface than in adjacent creek channel (Table 4-13, page 217).

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "p. 217 ¶ line 2 and Table 4-13. How can salinity be higher on the marsh surface than in adjacent creek channels?"

Response: Development of the two-dimensional hydrodynamic model for the Herring River identified several anomalies within the flood plain based on the current altered state of its topography and bathymetry (i.e. subsided marsh surfaces, presence of anthropogenic fill) and complicated flow dynamics. The model identified areas where, during some tidal regimes, salt water would become impounded on marsh surfaces that are prone to poor drainage. Meanwhile, fresh surface water and groundwater would be discharged into adjacent channels, creating higher modeled salinity levels on certain marsh surfaces than in the channels. While the model suggests these conditions may occur at some point during the incremental restoration process, marsh drainage is expected to improve over time as the project is implemented.

4. WATER AND SEDIMENT QUALITY

CONCERN STATEMENT: The FEIS/FEIR should be corrected to reflect that the likely source of nitrogen is organic decomposition and retention of nitrogen as sorbed ammonium, and the likely source of phosphorus is decomposed organic matter (per DEIS page ii).

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "p. ii, ¶ 3. There is a problem with the contention that nitrogen and phosphorus are 'excessive' and the suggestion that they could be from fertilized lawns, agriculture (both very limited), golf course, landfill, etc. The most likely source of N is from organic decomposition and retention of N as sorbed ammonium, protected from oxidation (to nitrate) and dissolution by low pH. Similarly, the most likely source for high phosphorus is decomposed organic matter, i.e. drained peat; the phosphorus is retained in the low-organic-content soil in combination with oxidized iron minerals (Portnoy & Giblin, Biogeochemistry 36:275-303, 1997)."

Response: The text of the FEIS/FEIR has been changed to: "In addition, concentrations of nitrogen and phosphorus in the sediments of Herring River have remained high. Although there is no documentation of specific anthropogenic or natural inputs, potential sources of excessive nutrients in the watershed include animal waste and atmospheric deposition, exacerbated by the lack of tidal flushing has allowed nutrients to accumulate in the Herring River."

CONCERN STATEMENT: The FEIS/FEIR should clarify whether the Herring River is on the 303(d) list for pathogens, or for pH and metals only (per DEIS p. 189 paragraph 3).

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote:" p.189 ¶ 3. Is the river on the 303(d) list for pathogens, or just pH and metals?"

Response: The Herring River is listed for pathogens, pH, and metals in two different segments of the river. Segment MA96-07 (Herring Pond to south of High Toss Road) is impaired for metals and pH. Segment MA96-33 (from south of High Toss Road to Wellfleet Harbor) is impaired for pathogens (i.e., fecal coliform bacteria). The current discussion of the Alternative A: No Action, appearing on pages 197-198 of the FEIS, is clear about listing for pathogens, pH, and metals.

CONCERN STATEMENT: The FEIS/FEIR should address concerns about vegetation removal and the effect on nitrates and fecal coliform filtration.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "If you destroy all the fresh water vegetation, what is going to take its place to filter out nitrates and fecal coliform? Look at Duck Creek and Pamet River- they are closed for 6 months of the year. That would be devastating if it happens to Wellfleet Harbor."

Response: Regular tidal flushing is expected to substantially decrease concentrations of bacteria and nutrients in the Herring River. The tidally-influenced area within the estuary would increase significantly compared to existing conditions. Flushing rates would be increased (i.e., residence time would be decreased) at least 24-fold (see table 4-4 of the FEIS/FEIR). In addition, the survival time of fecal coliform bacteria would be reduced by higher salinity (see Bordalo et al. 2002), as well as by higher dissolved oxygen and lower water temperature. Nutrients would also be diluted and removed from the system with each tide cycle. In addition, tidal restoration will occur slowly, no sudden die-off of vegetation is expected, and large expanses of freshwater vegetation will remain in the upper reaches of the flood plain.

5. WETLAND HABITAT AND VEGETATION

CONCERN STATEMENT: The FEIS/FEIR should consider that the proposed action will cause blueberry bushes to die and decay, resulting in decreased food for animals and humans.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "All the blueberry bushes that lined Mill Pond Road died and never have come back creating a dead decaying landscape. The Herring River Estuary flooding will result in the same broad impact of the loss of beneficial vegetation, such as, blueberry bushes that lined Mill Pond and Old County Roads and have never returned, eliminating food for birds, animals and people."

Response: Chapter 4, Section 4.8 of the FEIS/FEIR analyzes project impacts to terrestrial species, including birds, mammals, and reptiles/amphibians. It is true that vegetation intolerant of salt water like blueberries may not survive in some parts of the project area as tides are restored to the Herring River estuary. One of the objectives of the project is to initiate a gradual shift from habitats that are dominated by freshwater and upland vegetation to those dominated by salt marsh vegetation. Nonetheless, when the restoration is complete, there will still be parts of the project area where saltwater will not reach and the existing vegetation will persist. In other areas it is likely that shrubs like blueberry will be replaced by salt-tolerant herbaceous vegetation such as salt marsh cordgrass and/or wetland shrubs such as arrowwood and winterberry that provide food, breeding areas, and cover for wildlife. The project anticipates that changes in vegetation will be monitored as the restoration project progresses. As the transition in vegetation occurs, it is possible that some of the existing vegetation will be removed in order to enhance the new growth. Wildlife that is dependent on salt marsh habitats, that is rare or currently does not occur in the project area, such as sharp-tailed sparrows, will benefit from restoration. Wildlife species that currently occur in the Herring River area will likely continue to exist but are expected to change their distribution as the shifts in habitat types occur. Ample upland and transitional habitat will remain available for upland and generalist species in areas adjacent to the project.

CONCERN STATEMENT: The implementation of project actions at High Toss Road must ensure that impacts to wetlands are the minimum necessary to achieve the project objectives.

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: MPS WET1.1, 1.2: "These standards protect wetlands and their buffers from alteration. This project element involves potential wetland alteration in the form of wetland fill and construction activities that might impact 13,000 sq. ft. of wetland resource areas. However, some action at High Toss Road is necessary to achieve the project objective of ecological restoration. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided.

As the HRRC refines the project, selecting a preferred alternative for High Toss Road and proceeding with the engineering required to execute this project element, they should keep in mind minimizing direct impacts to wetland resources (such as construction impacts, footprint of fill, rip rap or bulkheads associated with elevating the road, etc.)."

Response*:* The preferred plan for High Toss Road is to remove the existing causeway, which would improve tidal flow and drainage and restore approximately 10,000 square feet of historic filled wetlands. Activities at High Toss Road and elsewhere would not only minimize direct impacts to wetlands, they would result in a net increase in wetland acreage and restore wetland function.

CONCERN STATEMENT: The FEIS/FEIR should state whether the vegetation that dies will be removed.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Will the vegetation that will die off as a result of the increase of salt water be removed from our view. We would not like to have the Herring River look like the Pamet with all the dead trees after the dike was breached there some years ago."

Response: Specific vegetation management actions will be determined as part of the Adaptive Management Plan, contingent on landowners' approval. Vegetation removal is discussed in Sections 2.6.2 and 4.5 of the FEIS/FEIR. Because tidal influence will be reestablished slowly and in a controlled manner, massive die-offs of trees and shrubs, such as occurred when the Pamet River was suddenly and inadvertently flooded, are not expected.

CONCERN STATEMENT: The FEIS/FEIR should provide an estimate of the amount of salt marsh expansion and Phragmites loss or colonization, and provide a graphic depiction of this change.

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "The DEIR has identified approximately 9 acres of wetland that will be lost to fill for road elevation and relocation, construction of dikes and 8.3 acres of the 9 acres for fill associated with golf course relocation and elevation. Additionally, an unidentified amount of salt marsh will be lost to submerging when the increase in tidal elevation exceeds the lower growth elevation of the salt marsh. More temporary work area wetland impacts are expected (i.e. 2.4 acres for the Mill Creek dike work area). Some loss of wetland is deemed by MassDEP to be acceptable for restoration projects that show an overall improvement to the areas ability to protect the interest of the Act, however it will be necessary to quantify the predicted increase in wetlands expansion to offset wetland losses, or a significant improvement in wetland habitat by expansion of wetland, particularly salt marsh, through control of invasive species in order to obtain the necessary permits. However, the DEIR has identified a degree of uncertainty about salinity modeling in the basins beyond the lower Herring River. Significant acres in the upper Pole Dike Creek, upper Herring River and upper Bound Brook sub basins, are anticipated to have freshwater wetlands converted to brackish marsh and a potential spreading of Phragmites, particularly Bound Brook where salinity is expected to increase to just 15 PPT well within the salinity range for Phragmites. Salinity levels would vary throughout the system and with salinity levels in the upper reaches of the estuary not high enough to support salt marsh vegetation, a degree of uncertainty in determining future species composition exists. The DEIR clearly states the acreage to be covered by salt water with mid to high levels of salinity. It is unclear if this is inferred to mean those areas will be likely to be salt marsh. MassDEP is seeking further clarification in the FEIR for future permitting purposes, as to the amount of salt marsh expected to expand and how much of the area of Phragmites will be converted/lost to this expansion. It was also unclear in the DEIR how much of the project locus contains Phragmites under existing conditions."

Response: Currently, *Phragmites* primarily occupies about 70 acres within the Lower Herring River and Mill Creek sub-basins, with scattered small stands in Middle Herring River and Upper Pole Dike Creek. It's expected that the very high salinities (greater than 24 ppt) that will occur immediately following initial changes in tidal range will effectively and extensively reduce the coverage of *Phragmites* in the lower reaches of the system, where it presently is most abundant. However, there are concerns about how *Phragmites* may migrate, and potentially expand, in the mid to upper portions, where salinities will, at least temporarily, occur within the brackish range. To limit any expansion of *Phragmites*, NPS plans to treat stands with herbicide above High Toss Road within the National Seashore boundary prior to increasing tide range. NPS will also work with the town and other project partners to treat significant stands of *Phragmites* on private lands, with the goal of controlling the species in the project area before tides are restored. Targeted methods will be used in order to assure that there is little to no damage to non-target native plants that are interspersed with *Phragmites*. Dense *Phragmites* areas will be foliar sprayed using backpack sprayers. The herbicide glyphosate shall be used for all herbicide applications (2-5% volume/volume) mixed with wetland surfactant and drift control agent. For areas of *Phragmites* which are less dense and interspersed with desirable native vegetation targeted herbicide application the following methods will be used:

The “cut and drip” method - Each stem is cut below a node on the stem. One drop of a solution of herbicide with water, and indicator dye is dripped into each stem. This technique will be used around a three foot perimeter where *Phragmites* is growing directly adjacent to native shrubs.

The “glove” technique - To conduct the “glove” technique each herbicide applicator will wear a chemical resistant glove underneath an absorbent cotton glove. The applicator will also carry a hand pumped low volume backpack sprayer equipped with specialized ultra-low volume nozzles. The applicator moistens the glove from the backpack sprayer into the glove and proceeds to wipe each stem and leaf of the individual *Phragmites* plants. Although this technique is labor intensive, it limits herbicide exposure to non-target plants.

As part of the overall adaptive management program for the project, regrowth and potential expansion of *Phragmites* throughout the most vulnerable portions of the system (e.g. mid to lower salinity levels) will be extensively monitored and follow-up actions implemented as necessary. At that time, more detailed plans regarding *Phragmites* treatments and vegetation management will be prepared and presented to a regulatory oversight group for review and approval.

Also see the refined vegetation and habitat change analysis in Section 4.5.7 of the FEIS/FEIR for an estimate of the amount of salt marsh expansion and *Phragmites* loss or colonization, and a graphic depiction of current *Phragmites* stands.

6. AQUATIC SPECIES

CONCERN STATEMENT: The FEIS/FEIR should evaluate impacts to sensitive species and habitats as a result of Adaptive Management Plan actions, including the removal of upstream culverts, the dredging of sediments, and the removal of soil berms, and should implement the recommendations of the Atlantic States Marine Fisheries Commission.

Organization: Atlantic States Marine Fisheries Commission
Organization Type: Interstate Commission
Representative Quote: "Restoring the tidal flow of the Herring River will likely increase the available nursery area and spawning grounds for winter flounder, scup, alewife, river herring, as well as many other species. However, the Commission has some concern about the impact to sensitive habitats that could result from a few of the measures identified in the Adaptive Management Plan, such as the removal of several upstream culverts, dredging sediment to restore natural bottom habitat, and removing soil berms."

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: MPS WET1.1, 1.2: "These standards protect wetlands and their buffers from alteration. This element involves wetland alteration by way of the placement of fill. However, this action would be taken to achieve the project objective of ecological restoration, according to protocols in the Adaptive Management Plan. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided. As the HRRC refines the project, they should provide protocols within the Adaptive Management Plan to ensure that alterations to wetlands are the minimum necessary to achieve the project objectives."

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: MPS CR3.7: "This standard prohibits improvement dredging, except where necessary to accomplish a substantial public benefit. As part of the adaptive management plan, the project may need to dredge portions of the river/wetlands system in order to restore channel sinuosity, improve drainage, and improve habitat. The HRRC will have to demonstrate that the adaptive management plan has appropriate checks and balances to ensure that any improvement dredging resulting from the project will result in net gains to habitat, and/or other public benefit."

Response: Some of the actions envisioned as part of secondary management of the Herring River flood plain have the potential for short-term impacts to sensitive species and habitats. Among these impacts is erosion and sedimentation caused by vegetation clearing, tidal stream restoration, and removal of anthropogenic fill from the flood plain. Though measures such as use of hay bales and erosion control materials will be employed to avoid and minimize the harmful effects of sedimentation, some degree of short-term impact is likely unavoidable. Because secondary management activities and locations are uncertain, specific details about these impacts and mitigation measures are currently unknown. As part of the adaptive management program, the decisions to conduct secondary management activities will be integrated into a trade-off analysis, where the consequences of potential short-term impacts are weighed against the long-term management objectives. Results of these analyses will be reviewed and discussed by a regulatory oversight group before approvals are granted for any proposed work.

CONCERN STATEMENT: Because the current dike design may not provide for effective fish passage, the Adaptive Management Plan should include monitoring of fish passage at all tide control structures, and identify actions to improve fish passage if problems are detected.

Organization: USGS S.O. Conte Anadromous Fish Research Center
Organization Type: Federal Government
Representative Quote: "The proposed alternatives all retain some form of tidal control, which it seems will necessarily include generation of some or all of the factors known to create barriers to fish passage. I recognize that the proposed changes represent an attempt to balance various interests; however, it will be important to recognize at the outset that a key objective--provision of effective fish passage--may not be met by these designs. The solution to this will be to include post-construction monitoring of fish passage (preferably with acquisition of pre-construction baseline data) as part of the adaptive management framework, with an explicit plan to modify and improve fish passage if and when problems are identified. This must be performed at all flow control structures."

Response: Fish passage is discussed in Sections 4.6.2, 4.6.3, and 4.6.6 of the FEIS/FEIR. The new bridge and tide gates at Chequessett Neck Road would provide better fish passage for all fish including anadromous and catadromous species. Even at the outset of the phased tide gate opening, current velocities will decrease throughout much of the tidal cycle, tending toward more natural channel hydrodynamics. The Massachusetts Division of Marine Fisheries (DMF) is currently developing a guidance document containing specific criteria that fish passage projects should target, including water depth and velocity through culverts and bridges. The Herring River restoration project will be designed and managed to meet the DMF fish passage criteria to the extent practicable. Extensive baseline monitoring of river herring movement near water control structures is currently underway and is expected to continue as the project is implemented.

CONCERN STATEMENT: The FEIS/FEIR should explain why restoration of the Herring River is being considered, in light of offshore harvests that are causing the extinction of the river herring population.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Why restore the Herring River when the government, including NOAA, is not stopping the extinction of river herring? When they stop all harvest of herring from the shore out 50 miles, where 99% of the river herring live, a reasonable restoration should take place, but not until then."

Response: The purpose of the Herring River Restoration Project is to restore self-sustaining coastal habitats on a large portion of the 1,100-acre Herring River estuary, including the need to address the loss of estuarine habitat and degradation of water quality that has led to fish kills and to remove physical impediments to River Herring migration (see Chapter 1, pages 1-6). The National Marine Fisheries Service (NMFS) was recently petitioned to list river herring as a threatened or endangered species. In August 2013, after conducting an extensive review, NMFS ultimately determined not to list alewife and blueback herring as threatened or endangered. According to the NMFS listing determination (Federal Register, August 12, 2013), "historical and commercial and recreational fisheries for river herring likely contributed to the decline in abundance of both alewife and blueback herring populations. Current directed commercial and recreational alewife and blueback herring fisheries, as well as commercial fishery incidental catch, may continue to pose a threat to these species." However, that same report found that the decline in the abundance of river herring throughout the northeast United States is due to many factors, including loss of, and lack of safe access to, spawning habitat; commercial and recreational fishing, including incidental catch; predation; disease; and other factors. In fact, the NMFS study identified "dams and barriers as the most important threat to alewife and blueback herring populations both range-wide and across all stock complexes”. Removing the barriers to river herring migration in the Herring River estuary will enhance migratory fish access to approximately 156 acres of spawning habitat. Such barrier removal projects have been shown to substantially increase the size of herring runs (Sheppard and Block, 2013). While the Herring River restoration project alone will not solve the population issues being experienced across the region by river herring today, habitat restoration projects like this one are an indispensable part of the solution.

CONCERN STATEMENT: The FEIS/FEIR should identify impacts and consider a commitment to limit impacts to marine fisheries resources through mitigation measures including adoption of EFH conservation recommendations made by NOAA, minimizing sediment mobilization during construction by using cofferdams and in-water timing limits, and consultation with DMF to establish TOY and other restrictions to permit fish passage and minimize siltation during shellfish and winter flounder spawning and to review final dike designs related to passage.

Organization: National Oceanic and Atmospheric Administration
Organization Type: Federal Government
Representative Quote: “However, EFH may be adversely impacted by construction activities such as the installation and removal of cofferdams, and by potential measures identified in the Adaptive Management Plan, such as enlargement or removal of several upstream culverts, dredging of sediments to restore natural bottom habitat, and removing soil berms. We are concerned that the associated noise, obstruction, and turbidity and sedimentation impacts could impact EFH and other trust resources during sensitive life stages.

In-water construction including fill and excavation may result in mortality of benthic species through direct removal or through burial by excavated material. Crustaceans and egg and larval stages of fish may be most susceptible to such impacts. Excavation and other unconfined work such as the installation and removal of cofferdams also have the potential to increase levels of suspended sediment in the surrounding waters, which has been shown to restrict or inhibit habitat use and function, including fish reproduction (Newcombe and MacDonald 1991). High turbidity can impact fish species through greater expenditure of energy, gill tissue damage and mortality (Newcombe and Jensen 1996, Johnson et al. 2008). Furthermore, sub-lethal effects to estuarine fish can include decreased feeding, impacts from lowered oxygen levels, as well as impacts on gills and associated respiratory impacts (Wilber and Clarke 2001). Particularly, egg and larval life stages may be more sensitive to turbidity impacts (Newcombe and Jensen 1996).”

Organization: Massachusetts Division of Marine Fisheries
Organization Type: State Government
Representative Quote: “The proposed restoration project should enhance habitat for a variety of marine fisheries resources. However, a variety of shellfish and finfish species currently exist within the Herring River/Wellfleet Harbor complex, and construction methods and timing should be designed to minimize impacts to these existing marine fisheries resources.”

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: “The FEIR should include a commitment as part of the project's construction and design plans to adopt the Essential Fish Habitat (EFH) conservation recommendations made by NOAA. The FEIR should include a commitment by the Towns to work proactively with the DMF to develop construction activity specific TOY staging to minimize impacts to marine resources. The updated construction period impact assessment should commit to maintaining a channel of free-flowing water of sufficient width and depth to permit fish passage during both spring adult migration as well as fall juvenile emigration of diadromous fishes and a minimization of siltation effects during shellfish and

winter flounder spawning. The Towns should commit, as part of the FEIR, to consult with DMF as part of the dike design process with regards to diadromous fish passage and construction period BMPs.

Finally, the FEIR should include additional discussion regarding the potential impacts to fisheries habitat within the Herring River estuary directly associated with secondary management actions such as: the removal of upstream culverts, dredging of sediment, and removal of soil berms. Specifically, the FEIR should confirm how the project will seek to meet recommendations outlined in the Atlantic States Marine Fisheries Commission comment letter on the draft EIS/EIR."

Organization: Mass Division of Marine Fisheries
Organization Type: State Government
Representative Quote: "Recommended time-of-year (TOY) restrictions outlined in a previous Marine Fisheries comment letter on the ENF filing for this project and summarized in the Marine Fisheries TOY technical report for the Herring River [1] represent the most conservative suite of TOY restrictions based on all existing marine resources. These TOY restrictions are designed to protect marine resources during vulnerable periods, but all construction activities will not necessarily pose threats during these periods. A full set of potential TOY restrictions is listed below (Table 1), but all TOYs will not likely be applicable to any single construction activity. Marine Fisheries concurs with the National Marine Fisheries Service's comment letter dated December 3, 2012. Specifically, TOY restrictions will not be necessary in cases in which work is buffered by cofferdams and silt curtains, but installation and removal of these structures should be performed outside of relevant TOY windows. As noted in the FEIS/FEIR, Marine Fisheries should be consulted with to develop construction activity specific TOY staging to minimize impacts to marine resources. Staging should maintain a channel of free-flowing water of sufficient width and depth to permit fish passage during both the spring adult migration as well as the fall juvenile emigration of diadromous fishes. Staging should also minimize siltation effects during shellfish and winter flounder spawning. Marine Fisheries should also be consulted with to review final dike designs with regards to diadromous fish passage."

Table 1. TOY Restrictions for the Herring River Species
TOY Period
Alewife: April 1 to June 15; Sept. 1 to Nov. 15
Blueback Herring: April 1 to June 30; Sept. 1 to Nov. 15
American eel: March 15 to June 30; Sept. 15 to Oct. 31
White perch: April 1 to June 15
Winter flounder: Feb. 1 to June 30
Shellfish: May 1 to Nov. 15
Combined Resources: Feb. 1 to Nov. 15

Response: In their comments on the DEIS/DEIR, the Massachusetts Division of Marine Fisheries (Marine Fisheries) concurred with recommendations made by NOAA Fisheries as part of the Essential Fish Habitat (EFH) consultation process that stated (1) cofferdams be used to isolate in-water work and that their installation and removal be conducted using BMPs such as sediment curtains to minimize adverse impacts on marine species, and (2) no in-water construction occur between the dates of March 1 and June 30, while noting that once cofferdams are in place, work may occur behind them any time of year as long as adequate fish passage is provided. Marine Fisheries also provided additional recommended time-of-year (TOY), in-water construction, restrictions beyond the March 1 to June 30 timeframe.

Project proponents are committed to adopt the EFH conservation recommendations made by NOAA Fisheries in order to minimize impacts on marine species in the project area. FEIS/FEIR section 5.3.4, Compliance with the Magnuson-Stevens Fishery Conservation and Management Act, has been revised accordingly to reflect these recommendations.

Further, as noted in the DEIS/DEIR in Section 4.11, in addition to adherence to the recommendations made by Marine Fisheries, the project proponents will consult with both Marine Fisheries and NOAA Fisheries to develop all appropriate in-water construction related TOY restrictions to facilitate fish passage and minimize siltation during shellfish and winter flounder spawning as well as final dike design review.

7. State-listed Rare, Threatened, and Endangered Species

CONCERN STATEMENT: The analysis in the FEIS/FEIR should be refined to clarify effects on state-listed rare, threatened, and endangered species, such that NHESP can complete its review of these effects and submit recommendations to avoid, minimize, and mitigate impacts to state-listed species.

Organization: MA Natural Heritage and Endangered Species Program
Organization Type: State Government
Representative Quote: "The project site is located within Priority and Estimated Habitat as indicated in the 13th Edition of the MA Natural Heritage Atlas and therefore requires review by the NHESP for compliance with the Massachusetts Endangered Species Act (MESA 321 CMR 10.00).

The NHESP has been actively involved in the review of the proposed restoration plan through participation in the Herring River Restoration Technical Working Group. While the NHESP strongly supports habitat restoration, care must be taken to reduce impacts to state-listed species and their habitats. It appears that the proposed project may qualify for a MESA Habitat Management Exemption (321 CMR 10.14 (11)), however, in order for the NHESP to make a final determination, additional information must be submitted for review. Specifically, habitat impacts to certain state-listed species, such as the Eastern Box Turtle (*Terrapene carolina*), remain unclear and should be further refined. The NHESP is working with the proponent to address how the different alternatives might avoid, minimize, and mitigate impacts to state-listed species."

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "The DEIR has identified both short and long term adverse impacts to state listed rare, threatened and endangered species specifically, the Northern Harrier, Diamondback Terrapin, Eastern Box Turtle, Water Willow Stem Borer, American Bittern and Least Bittern. Project compliance with the Act requires no short or long term adverse impacts to state listed rare, threatened and endangered species. In some instances compliance is obtained through the implementation of a Comprehensive Management Plan (CMP) issued by the Massachusetts Natural Heritage and Endangered Species Program (MNHESP). MassDEP seeks clarification in the FEIR and on MNHESP's requirements and the effect they may have on project design. MassDEP will require the submittal of detailed information on how the project will comply with MNHESP's requirements to be submitted with any permit application and request for variance."

Response: See the refined vegetation and habitat change analysis in Section 4.5.7 of the FEIS/FEIR for a discussion of effects on state-listed rare, threatened, and endangered species. This analysis has been restructured in accordance with NHESP comments to allow for NHESP review and recommendations.

CONCERN STATEMENT: The FEIS/FEIR should consider that several state listed rare, threatened, and endangered animals will die as a result of the proposed project.

Organization: BB&N
Organization Type: Unaffiliated Individual
Representative Quote: "I have several issues with the Herring River Restoration that have not been adequately addressed. 1. Many animals and plants will die, including five animals on the state-listed Rare, Threatened, and Endangered Species including American Bittern, Least Bittern, Northern Harrier, Eastern Box Turtle, Water-Willow Stem Borer, and Diamondback Terrapin."

Response: Chapter 4, Section 4.8 of the FEIS/FEIR analyzes project impacts to terrestrial species, including birds, mammals, and reptiles/amphibians. The result of the analysis is that a gradual shift in species distribution would occur as habitat types changed in the estuary, but ample upland and transitional habitat would remain regionally available for upland and generalist species. The slow pace of change will allow mobile species to move to these areas that retain suitable habitat.

Also, see the refined vegetation and habitat change analysis in Section 4.5.7 of the FEIS/FEIR.

CONCERN STATEMENT: The FEIS/FEIR should provide additional information on rare species habitat impacts and mitigation efforts to evaluate how the project will avoid, minimize and mitigate impact to state listed species and inform the DEP wetlands variance process.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: MPS WPH1.4: "This standard requires the protection of rare species habitat. The project will result in indirect impacts to habitat of the Northern Harrier, Diamondback Terrapin, Eastern Box Turtle, American Bittern, Least Bittern, and Water Willow Stem Borer, all state-listed species. The actions contemplated under this project element may result in positive habitat changes for some of these species (e.g. increased estuarine habitat for Diamondback Terrapin), and in the loss of habitat for others (loss of freshwater marsh habitat for American and Least Bitterns). The Commission will seek guidance from the Natural Heritage and Endangered Species Program in determining whether the project complies with this standard, and whether impacts to rare species should be mitigated by means other than those planned for the restoration project generally (e.g. creation or preservation of specialized habitat within the project area, or elsewhere within the seashore)."

Representative Quote: "To the extent practicable, additional information on rare species habitat impacts and mitigation efforts should be presented in the FEIR to' assist in the evaluation of how the project will avoid, minimize and mitigate impacts to State-listed species and to inform MassDEP's wetlands variance process."

Response: See the refined vegetation and habitat change analysis in Section 4.5.7 of the FEIS/FEIR for an updated analysis of project effects on rare species habitat and state-listed species..

CONCERN STATEMENT: The Adaptive Management Plan should include expanded monitoring of rare species.

Organization: MA Natural Heritage and Endangered Species Program
Organization Type: State Government
Representative Quote: "The proposed Adaptive Management Plan (Appendix C of the DEIR/DEIS) should include expanded rare species monitoring (both pre- and post-restoration efforts) to better track and understand their responses to habitat management decisions and actions."

Response: Monitoring of rare species is discussed in the refined vegetation and habitat change analysis in Section 4.5.7 of the FEIS/FEIR.

8. Terrestrial Species

CONCERN STATEMENT: The FEIS/FEIR should explain why species that currently inhabit low lying land in the area are of less importance than the herring, since herring inhabit other areas on Cape Cod.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "And why do the fox and the other lowly animals who now inhabit those areas count less than the herring. You have other herring areas on Cape Cod."

Response: Chapter 4, Section 4.8 of the FEIS/FEIR analyzes project impacts to terrestrial species, including birds, mammals, and reptiles/amphibians. The result of the analysis is that a gradual shift in species distribution would occur as habitat types changed in the estuary, but ample upland and transitional habitat would remain regionally available for upland and generalist species. The slow pace of change will allow mobile species to move to these areas that retain suitable habitat

9. Cultural Resources

CONCERN STATEMENT: The FEIS/FEIR should reference MHC archaeological site inventory numbers from the 2011 technical report in the summary and tables in sections 3.9 and 4.9, and include an updated ancient and historic period archaeological context for the impact area of the preferred alternative.

Organization: MA Historic Commission
Organization Type: State Government
Representative Quote: "The FEIR should include an updated ancient and historic period archaeological context for the preferred alternative project impact area that incorporates current data from the :MHC's archaeological inventory, and from recent archaeological survey reports conducted on federal land that are not yet reported to the MHC for incorporation in the state archaeological inventory."

Organization: MA Historic Commission
Organization Type: State Government
Representative Quote: "Cultural Resources, including historical and archaeological resources, are described in DEIS Section 3.9 (pg. 144) and 4.9 (pg. 244). Ancient Native American and historical period archaeological sites within and adjacent to the project area of potential effect are also listed in Tables 3-15 (pg. 147) and 3-16 (pg. 149). The MHC notes that this summary description is based in part on data from a 2011 technical archaeological reconnaissance report prepared for the NPS by the PAL, Inc. The MHC's archaeological site inventory numbers should be referenced in the summary and the tables in the FEIR."

Response: For comparison purposes, summary table information and text in section 3.9 of the DEIS/DEIR has been revised to correspond directly with MHC site inventory numbers as described in the Phase 1A report, where possible. Recent technical reports and ongoing archaeological studies have been used to update the impact discussion on ancient and historic period archaeological context for the preferred alternative presented in the FEIS/FEIR.

CONCERN STATEMENT: Prior to implementation, the HRRC should provide existing conditions plans and proposed project plans to the MHC for the Preferred Alternative plan and the FEIS/FEIR should include an update on and summary of ongoing consultation with the MHC in regards to Section 106 of the NHPA and the development of a Programmatic Agreement.

Organization: MA Historic Commission
Organization Type: State Government
Representative Quote: "Section 5.3 (pp. 287, 288) provides a preliminary summary of consultation with the: MHC pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800) and states that a draft Programmatic Agreement (PA) is currently under review by this office. However, the MHC provided comments on the draft PA on July 16, 2012. The MHC looks forward to reviewing a revised PA that considers those comments. The FEIR should include a copy of the final executed PA and a summary of consultations with consulting parties."

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The MHC has also requested that, once developed, scaled existing and proposed conditions project plans and a draft scope for identification efforts for the Preferred Alternative be provided to all the consulting parties for review and comment."

Response: The National Park Service has developed completed a Programmatic Agreement (PA) with the Massachusetts Historical Commission to guide the identification, evaluation, and protection processes for archaeological resources within the Herring River Estuary. This PA defines the measures that must be carried out as the Project is implemented to comply with the requirements of the NEPA and NHPA processes and Massachusetts state regulations. As the project design process continues, NPS will provide plans and other documentation and consult with MHC under the terms of the PA (See Appendix I to the FEIS/FEIR).

CONCERN STATEMENT: The FEIS/FEIR should include a figure that depicts the APE for the Preferred Alternative (D) in relation to identified historic resources and sensitive archaeological areas.

Organization: MA Historic Commission
Organization Type: State Government
Representative Quote: “The FEIR should include a figure as an appendix that shows the project area of potential effect for the preferred alternative in relation to identified historic resources and to portions of the project area identified as archaeologically sensitive. This figure should not contain sensitive archaeological site locational information. A similar figure that shows identified archaeological sites should be provided to the Corps, MHC, THPOs, MBUAR and the archaeological consultant.”

Response: The FEIS/FEIR has been revised to include a figure depicting the Area of Potential Effect (APE) for the Preferred Alternative that clarifies the relationship to historic and archeological resources. Please refer to figure 3-24 and the Programmatic Agreement in Appendix I of the FEIS/FEIR.

10. NUISANCE MOSQUITOES

CONCERN STATEMENT: The proposed project should be re-evaluated due to concerns about disease transmission by nuisance mosquitoes.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "If the dikes at Herring River were put there to control mosquitos in 1909 I believe you said, why would you even try to change that in time when mosquitos are infected with diseases that are incurable."

Response: Chapter 4, Section 4.10.2 of the FEIS/FEIR evaluates the effects of each alternative on nuisance mosquito populations. The conclusion is that salt marsh restoration would result in a species replacement of freshwater breeding mosquitos (*O. cantator* and *O. canadensis*) by saltwater breeding mosquitoes (*O. solicitans*) with an overall reduction in mosquito frequency. Moreover, there is no evidence that the mosquito species common on outer Cape Cod pose a significant human disease risk.

11. SHELLFISH

CONCERN STATEMENT: The FEIS/FEIR should consider that mapped shellfish habitat extends to the region downstream of the Chequessett Neck Road Dike for oysters and quahogs and upstream of the Dike for oysters; land containing shellfish is deemed significant to the interest of the Wetlands Protection Act.

Organization: Massachusetts Division of Marine Fisheries
Organization Type: State Government
Representative Quote: "Wellfleet Harbor contains a variety of shellfish species, many of which support commercial and recreational fisheries. Wellfleet Harbor contains mapped shellfish habitat for American oyster (*Crassostrea virginica*), bay scallop (*Argopecten irradians*), quahog (*Mercenaria mercenaria*), razor clam (*Ensis directus*), and soft shelled clam (*Mya arenaria*). Mapped shellfish habitat extends to the region downstream of the Chequessett Neck Road Dike for oysters and quahogs and upstream of the Dike for oysters. Mapped land containing shellfish is deemed significant to the interest of the Wetlands Protection Act and the protection of marine fisheries."

Response: Any issues regarding mapped shellfish habitat will be addressed in the permitting process. Section 4.10.3 and the EFH Assessment in Appendix F of the DEIS/DEIR adequately describe the extent of shellfish habitat within the project area.

CONCERN STATEMENT: The FEIS/FEIR should address concerns about the proliferation of green crab and Japanese shore crab, which would adversely impact the shellfishing industry.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "What is going to be done about green crab and Japanese shore crab? Giving these invasive species more habitat to proliferate will definitely not help out the shellfish industry."

Response: Based on information provided by the Barnstable County Marine Extension Service, an increase in the population of green crab and Japanese shore crab due to the restoration will not have an important impact on the shellfish industry. Although green crabs are found in salt marshes, they are also found throughout the whole intertidal area. There will probably be some population increase in the restored marsh, but not so much as to increase predation outside the marsh, where shellfishing occurs. This is not considered an issue warranting analysis in the FEIS.

CONCERN STATEMENT: The FEIS/FEIR should provide monitoring protocols and management responses to address potential Wellfleet Harbor shellfishing impacts from sediment transport or poor water quality.

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "The DEIR has identified poor water quality within the Herring River particularly as it relates to the low dissolved oxygen, low pH, high metals, excess nutrients, pesticides, organic particulates, and fecal coliform and states discharges of these constituents is likely especially during the first few months of increasing the tidal range and salinity. Productive shellfish habitat exists immediately down river in Wellfleet Harbor and MassDEP is concerned about impacts to these shellfish beds from the mobilizing of these constituents. Although the DEIR only states that the discharges will be monitored and no additional information is provided. MassDEP believes that the FEIR should provide further clarification and additional information on what "management actions" the project proponent would undertake should the monitoring show impacts to downstream shellfish areas. MassDEP seeks this information to determine compliance with 310 CMR 10.34(4) of the Wetland Protection Act regulations

(regulations) that requires no adverse impacts to said beds from changes in water quality that would impact productivity."

Response: Detailed information about monitoring and management responses with respect to shellfishing in Wellfleet Harbor will be developed in close collaboration with the Town of Wellfleet and the shellfishing community as part of the adaptive management planning process. An expanded overview of the adaptive management approach proposed for the Herring River project is provided in Appendix C of the FEIS/FEIR.

CONCERN STATEMENT: The FEIS/FEIR should contain sufficient information to definitively gauge the impacts to the shellfishing industry, and should include mitigation measures for potential reduction or loss of livelihood.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "I have concerns about the impact of the HRR project on the shellfishing industry based in Wellfleet harbor. The EIR draft does not contain sufficient information to definitively gauge the danger to this vital and fragile Wellfleet commerce. The impact is discussed in terms of hydrodynamic and sediment models, which project that sediment would not be moved into the Harbor and into the shellfish beds. Are there no precedents for comparisons? Earlier restoration projects might offer more relevant and tangible information. Projections for such models are not sufficient to discount risks. In addition, the EIR draft lacks mitigation and compensation details for all negative impacts, and does not define liable person/agencies. No restoration should be undertaken until more definitive data are added to the EIR and funding for loss of livelihood etc. are defined."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Firstly, having a shellfish grant on Indian neck beach, I consider myself an abutter by water as well as by land. Wellfleet harbor has over 160 shellfish grants, many in the inner harbor. Tens of millions of pieces of shellfish are harvested each year from these waters. I have on my grant alone over four million clams and oysters. Shellfish, especially oysters, are very sensitive animals. An adult oyster will pump up to 50 gallons of water each day. A small amount of contaminate will shut down the harbor for harvesting, a larger amount could kill the oyster. Closure of shellfish beds will lead to financial hardship and ruin for many and the bad press harms our reputation in the market place that has taken years to establish. I have yet to see any plan that has been proposed that would deal with the potential loss of livelihood for hundreds of grant holders as well as ail the wild fishermen."

Response: Data and historical documentation (unpublished NPS data 2004 and 2009; Dougherty 2004) show that aquaculture areas on the flats and shoals of Egg Island and areas along Mayo Beach are currently, and were historically (prior to construction of the Chequessett Neck Dike), comprised of relatively coarse-grained sediment. Additionally, sediment particle size analyses and modeling of sediment transport dynamics (Harvey 2010; WHG 2012), show that the particle size of mobilized sediment and predicted flow velocities are inadequate to deposit sediment within the aquaculture areas. Sediment transport processes are far more dependent on tidal forces from Cape Cod Bay than the much lower force exerted by a new, larger tidal opening for the Herring River.

During the early stages of tidal restoration, the incremental opening of the tide gates at the Chequessett Neck Road Dike could transport some fine-grain material downstream into Wellfleet Harbor. The amount of this mobilized sediment is expected to be small and the predicted ebb-tide velocities too great for deposition of fine-grain particles to occur and a measurable impact in the harbor is not expected. Most suspended fine-grain particles would move through the system over several tidal cycles and eventually be transported through the harbor and into Cape Cod Bay (WHG 2012).

Monitoring for potential sediment transport and deposition downstream of the dike, including within the aquaculture areas, will be a component of the project's long-term adaptive management and monitoring program. Monitoring will be designed to detect changes in volume of suspended particles, particle size, and rate of deposition at key areas. As part of the adaptive approach to restoring tide range, alternate management actions will be considered in response to detections of change beyond pre-established threshold values (an expanded overview of the adaptive management approach proposed for the Herring River project is provided in Appendix C). Detailed information about monitoring and management/mitigation responses with respect to shellfishing in Wellfleet Harbor will be developed in close collaboration with the Town of Wellfleet and the shellfishing community throughout the adaptive management and permitting processes.

CONCERN STATEMENT: The FEIS/FEIR should consider impacts to the quahog industry that would result from higher salinity in the harbor.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "What will the effects of higher salinity in the harbor have on the quahog industry? QPX thrives in higher salinity."

Response: The FEIS/FEIR analyzes impacts to salinity in Section 4.2, shellfish in Section 4.6.2, and shellfishing in Section 4.10.3. There is no indication that restoration of tidal flow to the Herring River would increase salinity levels in Wellfleet Harbor. Salinity of the harbor is far more dependent on Cape Cod Bay and the Atlantic Ocean than the comparatively minor volume of water flowing into and out of the river. In addition, water quality improvements will enhance shellfish habitat in the estuary and harbor, and would likely result in the reopening of currently closed shellfishing areas and larger shellfish yields.

12. PRIVATE PROPERTY/ADJACENT LANDS

CONCERN STATEMENT: The FEIS/FEIR and Adaptive Management Plan should identify private wells and include monitoring to consider the potential for changes to the aquifer and saltwater interface.

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: "Furthermore the issue of private wells should be explicitly identified in the Adaptive Management Plan as an item for monitoring, potentially making use of the Chequessett Yacht and Country Club Golf Course Irrigation well and USGS monitoring wells and that were installed to characterize groundwater conditions in the Herring River watershed."

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: "Restoring tidal flow to the Herring River will result in improvements to water and sediment quality within the river and provide benefits to its ecology. The Commission indicated in its 2008 comment letter on the ENF that the project should identify potential private wells and provide information about how the restoration of tidal flow might affect their water. The DEIR/DEIS provides information identifying well sites could potentially be affected (Martin 2007) and reference to a report that evaluated the potential for changes to the aquifer and saltwater interface (Martin 2004). Although the DEIR/DEIS considered this item, it dismissed it from further consideration. It was not apparent how the DEIR/DEIS considered this issue in Chapter 4; Environmental Consequences."

Response: Recent studies by the NPS (Martin 2007; Martin 2004) have shown that tidal restoration will deepen the layer in the groundwater that is influenced by saltwater, and therefore would not adversely affect the majority of wells in the project area (see FEIS/FEIR, Section 1.11.3). However, a few domestic wells currently located within or very near the Herring River floodplain could be affected. As described in Section 4.10.5 of the FEIS/FEIR, a detailed evaluation of susceptible wells, including monitoring of well water quality, will be conducted to confirm and identify wells requiring relocation. Any domestic wells which are located within the Herring River flood plain and would be impacted by restored tidal exchange would be relocated to a more suitable location as part of the restoration project.

CONCERN STATEMENT: The FEIS/FEIR should consider how the expansion of jurisdictional areas under the Rivers Protection Act will be affected by the proposed project.

Organization: *Not specified*
Organization Type: Unaffiliated Individual
Representative Quote: "…few of the affected private property owners have a complete understanding of the project's full impact, noting that she was unaware of the impact of the Rivers Protection Act and its required setbacks."

Response: For some private properties adjacent to the Herring River estuary, restoring natural tidal flow could change the jurisdictional limits of one state statute which regulates activity in the Riverfront Area. Under the Rivers Protection Act, no one may remove, fill, dredge or alter the Riverfront Area without a permit from the local Conservation Commission. The Riverfront Area includes land within 200 feet of annual mean high water line of any perennial stream. The Herring River is proposed to be restored incrementally. This means that the jurisdictional boundary will change over time as the restoration proceeds. To adequately determine the Riverfront Area on a lot, a land survey would need to be done at the time of a project proposal. The submission of a land survey is not a new requirement and is part of all applications made to the Conservation Commission.

Specifically for proposed activities within the 200-foot Riverfront Area, an Order of Conditions is required from the town Conservation Commission. Work in the Riverfront area is not prohibited, but all applicants must demonstrate that their projects have no practicable alternatives or substantially equivalent economic alternatives with less adverse effects on the interests protected under the Wetlands Protection Act.

As part of its outreach program to low-lying property owners, the HRRC has provided affected landowners with information about how regulatory jurisdictions might change on individual properties. The Town of Wellfleet Conservation Commission prepared a summary of the Rivers Protection Act provisions, and town staff has met with interested landowners to discuss the effect of changes in regulatory jurisdiction on individual properties.

The discussion in Section 4.10.5 Low-Lying Properties sufficiently addresses both the physical and regulatory effects of the alternatives.

CONCERN STATEMENT: The FEIS/FEIR should provide a graphic showing predicted flooding in Mill Creek basin (under Alt D), the location of fairways to be filled, and the location of borrow area and practice range (in order to better define impacts to archaeological, rare species and wetland resources).

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "A major component of the Preferred Alternative includes the filling of the fairways and relocation of the practice range to an adjacent upland area. While I acknowledge that this project element will occur on private property with the owner's consent, additional clarification is required in the FEIR to fully understand the impacts of this project component to archaeological, rare species and wetland resources. The FEIR should include a graphic (at a legible scale) that identifies the anticipated areas of flooding under the Preferred Alternative within the Mill Creek sub-basin, the location of the fairways slated for filling, and the conceptual location of the proposed borrow area and future practice range at CYCC."

Response: The concept plan for regrading low portions of the CYCC golf course are presented in a new graphic inserted in Section 4.10.5 of the FEIS/FEIR. As actions are implemented, impacts to sensitive resources (i.e., areas of cultural resource sensitivity, rare species, and wetlands) will be updated and refined through technical studies, design plans, and permitting processes.

CONCERN STATEMENT: Mitigation measures in the FEIS/FEIR should be designed to account for the effects of climate change and sea level rise.

Organization: MA Coastal Zone Management
Organization Type: State Government
Representative Quote: "One of the most challenging aspects of this project involves the protection and mitigation to existing private properties within the Herring River flood plain. All of the proposed alternatives involve both direct physical impacts to existing private properties, as well as indirect impacts including visual, regulatory, and jurisdictional impacts. The DEIR includes a comprehensive analysis of properties affected under the various proposed alternatives, characterizes these impacts and identifies potential mitigation measures. The DEIR proposes to develop a formal process for creating agreements between affected property owners and the NPS and towns. CZM supports this approach and recommends that mitigation measures be designed to account for the effects of climate change and sea level rise."

[All land surface and tidal elevation values cited here are in NAVD88]

Response: Effects of sea-level rise on tidal impact prevention measures for low roads and private properties are addressed in Section 4.10.5 of the FEIS/FEIR.

CONCERN STATEMENT: The FEIS/FEIR should explain which specific properties would be impacted by the proposed project and the subsequent compensation in the event of adverse impacts as well as if the project would proceed if the NPS/HRRC does not have the money to compensate home owners.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "… and even if you bought the homes of those people who are affected who are afraid of flooding of their homes or basements cracking, you would never be able to give them enough to purchase another home in the area."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "What are the names of the 30 abutters who will have their property impacted? Disclose the areas of greatest impact! This seems like a very low estimate as I will no longer be able to get from my home in South Truro to Wellfleet on Old County Road if you flood that road (as in your assessment of flooded roads). How are you going to compensate them Fair market value - by eminent domain? This really should be explicitly addressed soon."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Will you go ahead if you don't have money to compensate home owners?"

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Some of the concerns we have are higher property evaluations when we have water views, our current conservation setback of 100 feet will increase to 200 feet and the greenhead flies that will come with restoring the salt marsh, which will make it impossible to keep our horses on our property for a couple of months in the summer. The bottom line is this will cost upwards to $5,000 dollars a year to live next to the marsh."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "If the Upper Pole Dike Creek is restored I would like our property to be grandfathered for the current conservation setback that we have now and for our property to be revalued for tax assessment purposes based on the current criteria used. I would also like there to be a fund set up so that I can be reimbursed for boarding my horses off site in the summer months for each year that I have them."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "A closely related issue concerns the absence of a "mitigation" fund and the fact that property owners have no written guarantee that mitigation will be prompt, painless, and sufficient. (Who really wants to deal with the thought of losing their well, for example? And who has the time to haggle about how fast it is fixed?) From the beginning, when this project was first being discussed by Gordon Peabody and others, I felt that the shellfish grant holders on Egg Island needed to know that if they lost a year or more of product (and all the work that went into planting and protecting that product) as a result of the changes to the dike, they would be fully, fairly, and quickly compensated. ...as no shellfisherman can afford to lose his/her yearly income."

Response: Concerns raised by property owners are a top priority for the Herring River Restoration Committee. The FEIS/FEIR does not include information regarding property-specific impacts or potential mitigation options because that level of detail is not appropriate to evaluate under the NEPA/MEPA review processes. Including information in a public document regarding specific private properties and discussions with landowners would raise privacy concerns.

The HRRC is working individually with affected landowners. The purpose of these interactions is to further explain and refine property-specific project effects and develop mitigation plans that address substantial adverse impacts. The most effective (and only practical) way to do this is to consult one-on-one with affected landowners to review information specific to their properties. Road access to private properties will be protected. Low-lying sections of public roads (such as Old County Road) will be raised to prevent flooding as part of the Project (see Section 4.10.6 of the FEIS/FEIR).

The restoration project partners are committed to addressing and mitigating any structural impacts resulting from the restoration of natural tidal flow. Some of the options available include raising or relocating affected buildings, driveways or wells, building berms to protect such structures, and/or limiting water levels across entire sub-basins. The cost of these impact mitigation measures will be borne by the Project. Water surface elevations within any sub-basin will not be increased until the necessary impact mitigation is in place.

CONCERN STATEMENT: The FEIS/FEIR should consider the use of updated modeling by the WHG (2007) as the basis for evaluating the groundwater response to tidal exchanges.

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: "The study by Masterson (2004) used the USGS groundwater model of the Chequessett lens to evaluate a number of scenarios of tidal exchanges based upon initial modeling by Spaulding (2001) of tidal response to dike openings. There were several scenarios in which tidal restoration resulted in a decrease of the fresh water lens thickness. The DEIR/DEIS has presented hydrologic modeling of tidal response from the Woods Hole Group and should consider the use of updated modeling by the WHG (2007) as the basis for evaluating the groundwater response."

Response*:* The response of groundwater to tidal exchange presented in the DEIS/DEIR is based on NPS studies (Martin 2004; Martin 2007) which in turn were based on an USGS groundwater studies (Masterson 2004; Masterson and Garabedian 2007). These USGS studies assumed an average water surface elevation in the Herring River of 1.5 feet NGVD29, based on output from an earlier hydrodynamic model developed at the University of Rhode Island (Spaulding and Grilli 2001). The USGS and NPS reports concluded that tidal exchange would not significantly impact the vertical location of the freshwater-saltwater interface or domestic water supplies located outside the Herring River flood plain.

Results from the more recent and more detailed hydrodynamic model (Woods Hole Group 2013) indicate an average Herring River water level of 0.97 feet NAVD88. After converting this value to NGVD29 (NGVD29 = NAVD88 + 0.86; [VERTCON, U.S. Geodetic Survey]), the resulting value of 1.83 feet is close to the value used in the USGS groundwater studies. These two completely independent investigations, using different analytical methods, arrived at nearly the same result for the predicted mean tide level in the lower Herring River. The close agreement of the two model predictions increases the confidence that the final result will be something close to those numbers and would not change the results of the groundwater analysis.

In addition to prior groundwater studies aimed at changes to the fresh-saltwater interface, additional groundwater modeling has been conducted since the draft EIS/EIR to investigate potential changes to the elevation of the water table in the Mill Creek sub-basin. This work evaluates potential impacts to groundwater under selected restoration alternatives for the proposed Herring River tidal restoration project, as well as a likely sea level rise condition expected under the changing climate. Overall, the analysis reveals that there are potential restoration scenarios, given the ability to control the long-term water levels at both CNR and the Mill Creek Dike, that result in minimal impact to the groundwater levels in the vicinity of the Mill Creek sub-basin. There are also potential restoration scenarios that are projected to lower groundwater elevations, primarily due to inclusion of a Mill Creek dike. Since it is expected to take some time before the full restoration is achieved, this allows the ability to monitor the groundwater levels throughout the adaptive management process and adjust restoration targets as necessary, prior to significant impact to groundwater levels (WHG 2016).

CONCERN STATEMENT: The FEIS/FEIR should contain specific information regarding mitigation measures that would be taken in the event of unanticipated adverse impacts to private property and personal incomes.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "… an affected private property owner… said the project's natural resources impacts had been studied in depth, but not so the impacts to private property. She questioned those, and the proposed mitigation for impacts to private property. She said the Final EIR/Final EIS should include significantly more detail on these impacts, such as a map of impacted properties, and suggested the main goal of the project could be achieved without impacts to Pole Dike Creek."

Response: Chapter 4, Section 4.10.5 of the FEIS/FEIR analyzes impacts to affected properties and identifies several general methods to mitigate those impacts. As noted in the response to MA Executive Office of Energy and Environment's similar comment below, FHR and HRRC are working individually with affected landowners. The purpose of these interactions is to further explain and refine property-specific project effects and develop mitigation plans that address substantial adverse impacts to structures. The most effective (and only practical) way to do this is to consult one-on-one with affected landowners to review information specific to their properties.

Most of the structurally affected private properties are located within either the Mill Creek or the Upper Pole Dike Creek basins of the Herring River flood plain. Structures within these sub-basins will receive four levels of overlapping and redundant protection from the impacts of restored tidal flow:

- First, the tidal control structure installed as part of the new Chequessett Neck Road Bridge will be carefully opened to increase tide range and water levels throughout the project area monitored to ensure that the system is performing as expected and no adverse impacts occur.
- Second, additional tide control structures will be constructed specifically across Mill Creek and Upper Pole Dike Creek to provide an additional layer of control and a tide regime specifically limited for these sub-basins. These structures will be opened and monitored similarly to the Chequessett Neck tide gates.
- Third, site-specific measures will be employed for individual properties to prevent tidal flows from impacting structures; these may include, but are not limited to, berms, elevation of land or structures, relocation of structures, and other practices.
- Fourth, in addition to monitoring of water surface elevations, the effectiveness of all individual impact mitigation practices will be specifically monitored to ensure they are working properly,

maintained, and in good condition; the exact nature and duration of this monitoring will vary based on site-specific circumstances, but will be specified as a component of each landowner agreement.

CONCERN STATEMENT: The present 100-foot setback for all abutting properties should be retained.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Two other concerns I have with this project include the potential property tax increase as well as the extended land use restrictions. The later will extend my present 100ft. wetland restriction to 200 hundred feet. Essentially encompassing my entire property. For a project that will clear cut 1,200 hundred acres in total, displace (most likely kill) all the creatures present. I find this unacceptable would like to propose that the present 100 feet set back remain for all abutters."

Response: The Wellfleet Environmental Protection Regulations state that all land within 100' of any freshwater wetland, inland bank, coastal wetland, coastal beach, beach, dune, flat, marsh, wet meadow, bog or swamp, any estuary, creek, river, stream, pond, lake and lands under these bodies of water, and land under the oceans shall be considered a buffer zone. This differs from setback and also differs from the Riverfront area. A setback is a function of zoning and is defined as the distance a structure must be from the edge of a lot. The riverfront area is neither a buffer zone nor a setback. It is a 200-foot wide corridor on each side of a perennial river or stream, measured from the mean annual high-water line of the river. A river is any natural flowing body of water that empties into any ocean, lake, or other river and that flows throughout the year. Riverfront areas may contain wetlands and floodplains, as well as what have traditionally been considered upland areas.

CONCERN STATEMENT: The HRRC should consider how the Restoration Project could affect public access to private properties.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "Another worrisome problem raised by the Draft, by what it says and by what it does not say, concerns the possibility that private property owners may find that parts of their property are no longer private because their backyard became tidal, and therefore open and exposed to recreational fishing or birding (and, possibly even boating) by the general public. I am particularly concerned about the private properties abutting the wetlands in the Upper Pole Dyke sub-basin area, where to my knowledge there is presently no public access or recreational activity. It is my opinion that something should be done to assure homeowners in that area that their expectation of privacy will be acknowledged and protected (by some form of legally enforceable restriction) before the proposed project is approved. No one should suddenly find that they are not able to use their own yard without encountering strangers."

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: "She was concerned about this, and impacts to her property, some 8 acres. She expressed concern that her private property would become 'public' by the act of inundation."

Response: Public access to private tidelands is governed by Massachusetts property law, in particular the Public Trust Doctrine. "Tideland" is the legal term for all land beneath the waters of the ocean, including lands that are always submerged as well as those in the intertidal area (i.e., between the high and low tide marks). In every coastal state, the use of tidelands is governed by a concept in property law known as the Public Trust Doctrine, which dates back centuries to ancient Roman law. The doctrine states that all rights in tidelands and the water itself are held by the state "in trust" for the benefit of the public. In Massachusetts, the intertidal area is based on the historic mean high tide line and is presumed to belong to the upland property owner, unless legal documentation proves otherwise for a given parcel. However, the law specifically reserves for the public the right to continue to use private tidelands for three purposes: fishing, fowling, and navigation. Those public rights exist today throughout the Herring River basin. The Restoration Project will not change the historic mean high water mark in the Herring River, thus will not change legal access to private tidelands.

CONCERN STATEMENT: The FEIS/FEIR should provide an update and outlined process regarding discussions or negotiations with low-lying property owners and the project's potential impacts to these properties under the Preferred Alternative.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: “The FEIR should not identify specific properties or individual property owners to preserve privacy. However, the FEIR should provide an update regarding discussions or negotiations with low-lying property owners and the project's potential impacts to these properties under the Preferred Alternative. The FEIR should provide an outline of an anticipated process for formal agreements with substantially affected landowners.”

Response: As described in Section 4.10.5 of the FEIS/FEIR, there are 378 parcels of potentially affected private land, owned by 325 individuals and trusts. The HRRC estimated potential effects to all of these properties using the computer model simulation of restored tidal regimes. Impacts were classified according to the types and severity of effects under different tidal conditions. Potential physical impacts were characterized as infrequent or frequent tidal flow affecting natural vegetation, cultivated vegetation (such as lawns and gardens), or structures (such as buildings, driveways, wells, etc.). While the majority of physical impacts involve only natural vegetation, there are about two-dozen parcels that – without flood prevention measures – could experience some kind of structural impact. Potential changes in regulatory jurisdictional under the Rivers Protection Act were also identified.
In October 2012, the Herring River Restoration Committee (HRRC) initiated an outreach effort with affected property owners in the Herring River project area. All 325 property owners were contacted by mail prior to the release of the DEIS/DEIR. Each letter explained the types of potential impacts that may be expected for each particular property and invited landowners to contact the HRRC to get further information. To date, the HRRC and Friends of Herring River (FHR) have followed up with more than 50 landowners and have conducted site visits and provided information about the specific impacts and potential measures that could be employed to prevent impacts to structures.
Further on-site investigations are underway for properties with potential structural impacts. FHR hired survey and engineering contractors to collect property-specific data, prepare detailed survey plans and develop preliminary impact mitigation plans for selected private properties. The FHR and HRRC will continue to work with landowners to further develop individual mitigation plans to prevent tidal flow impacts to structures and, where possible, to develop legal agreements with each structurally affected property owner to establish mutually agreed-upon mitigation approaches.
In addition to the work with individual property owners, the Restoration Project’s partner agencies have provided public funds for surveying, land planning, engineering and related studies in order to develop an impact prevention plan for the Chequessett Yacht and Country Club (CYCC).

In the fall of 2014, the HRRC and the Friends of Herring River (FHR) contracted with the Consensus Building Institute (CBI) to facilitate development of a conceptual agreement between HRRC and CYCC to permit, fund, and implement impact prevention work on CYCC property. As part of this effort, FHR hired a team of golf course designers to prepare plans to reconstruct the fairways, tees, greens, and other modifications needed to prevent impacts from the restoration of tidal flow in Mill Creek. The facilitation team conferred regularly throughout 2015 and early 2016, by phone, email and with a series of meetings between CYCC and HRRC representatives. The group agreed upon a detailed design plan for the golf course, and continues to negotiate on a conceptual framework for how the work would be funded and carried out.

Under that framework, the overall funding request for implementation of the restoration project would include money to reconstruct the golf course and to offset CYCC business losses during the construction period when the golf course is closed. CYCC and the project proponents have yet to agree on a final conceptual framework. If agreement on the framework by CYCC and the HRRC is achieved prior to preparation of the Project's permit applications, the golf course work would be proposed as part of initial phase of design, permitting and funding for the Restoration Project.

If agreement cannot be reached prior to preparation of permit applications: 1) tidal restoration would not be proposed in the Mill Creek sub-basin until a later Project phase after mitigation agreements are finalized with the CYCC and other affected Mill Creek landowners; 2) the Project proponents would continue to advance permitting and other elements of the Project that support tidal restoration in the main Herring River basin; and 3) the Project proponents would in good faith continue to seek mitigation agreements with CYCC and other affected landowners in the Mill Creek sub-basin.

Similar to Mill Creek, work is ongoing to evaluate impact mitigation options with landowners in the Upper Pole Dike Creek sub-basin, which contains most of the other properties with affected structures outside of Mill Creek. The HRRC and FHR are completing assessments for the Upper Pole Dike Creek sub-basin to determine if partial restoration of tidal flow is possible within that sub-basin. Restoration of tidal flow to Upper Pole Dike Creek will not be initiated until those assessments are complete and/or until the necessary mitigation agreements and actions are have been implemented, along with associated regulatory approvals and funding required to implement the mitigation measures.

CONCERN STATEMENT: The FEIS/FEIR should consider adopting requirements and measures to minimize potential wetland impacts particularly in Areas of Critical Environmental Concern.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The Towns should consider the requirements at 310 CMR 10.24(5)(6) regarding potential wetland impacts within an ACEC when establishing this process."

Response: Given the magnitude of certain unavoidable impacts and alterations to wetland resource areas, the DEIS/DEIR stated that a variance would likely be needed from certain provisions of the Wetlands Protection Act (WPA). However, since the release of the DEIS/DEIR, the MA Department of Environmental Protection has drafted new regulations which include provisions for Limited Project status for eligible ecological restoration projects. Under these new regulations, the Herring River Project may not require a WPA variance. Section 10.24(8) of the new regulations allows approval of an Ecological Restoration Limited Project that "may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals." There are no thresholds for the amount of alteration/loss allowed if the issuing authority determines that the project complies with the other applicable Ecological Restoration Limited Project provisions. In addition, 10.24(8)(a)4 states that dredging of up to 100 cubic yards of sediment may be permitted under the Ecological Restoration Limited Project in an ACEC or Outstanding Resource Water and more than 100 cubic yards may be permitted with an approved Sediment Management Plan. Removal of sediment from filled in tidal creeks and channels is expected as part of the adaptive approach to restoration of the Herring River flood plain, although exact volumes of sediment and other details will not be known before tidal influence is reestablished and the response of the system can be assessed. At that time, more detailed plans regarding sediment management will be prepared and presented to regulatory agencies for review and approval.

CONCERN STATEMENT: The FEIS/FEIR should present a more detailed plan and information regarding monitoring of potential adverse impacts particularly in regards to private property and steps will be taken in the event that adverse impacts are felt and should consider the elimination of the Upper Pole Dike sub-basin as many potential private properties could be adversely impacted.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: [We] “own about 3.5 acres and a cottage … which will be affected by the opening of the dike for the restoration of the Herring River. We have several concerns about the effect the increased tidal height will have on our property.
1. Will our well be adversely affected?
2. Will our access to our home be limited by seasonal or storm driven high tides?
3. We are planning to retire to that property, and we would like to expand the structure as permitted by town zoning requirements. We are concerned that we may have further limitations imposed on our use of the property as the river moves closer to our property line.”

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: “My primary concern about the Draft in its present form has to do with the fact that it does not set out a specific or adequate procedure for what will be done when things go wrong, and when an individual property(s) is damaged. There is nothing set out in the Draft that guarantees something will be done immediately to make things right, so that an affected family or businessman can get back to normal as quickly as possible. Although the plan makes several references to the fact that the project will be monitored, it fails to state in a specific or reassuring way what will be done when the monitoring reveals a serious unanticipated problem. As one of the 300+ affected residents, I want to know, for example, what specific circumstances will cause the monitoring entity (as yet unknown) to reduce saltwater flow. (How many property owners must be affected before action to reduce water levels is taken, exactly how much loss must a single property sustain before things are turned back, will one or more properties be sacrificed before the monitoring results in a prompt and permanent corrective action?) At present there are no adequate guidelines or criteria set out. Without specific criteria and guidelines, "monitor" is just an empty word. Affected property owners need to know now, not three years from now, exactly what will happen if the unexpected does occur (we all know from our own life experience that: "stuff happens"). Affected owners need to know now, not only for our own immediate peace of mind, but also, in the event that one of us finds, for example, that we need to sell our house in the next year, or so. If that were to happen, we would want to be able to point to a specific ironclad writing that would guarantee a potential buyer that things would be taken care of promptly and fully in the event that the project does become a reality. No family wants to risk purchasing an ongoing headache.”

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: “At present I question whether there is sufficient need to include the Upper Pole Dyke sub-basin in this project, since so many low lying private properties in that area will be adversely affected. I suspect that the environmental benefits gained there would not justify the personal costs. While I do not have sufficient information to speak definitely on the matter at the present time, I plan to try to inform myself in the future about the particular issues confronting owners there. Because my property lies beyond the main Upper Pole Dyke sub-basin, I do not share the same concerns as those whose properties will experience more flooding.”

Response: Chapter 4, Section 4.10.5 of the FEIS/FEIR analyzes impacts to affected properties and identifies several general methods to mitigate those impacts. As noted in the response to MA Executive Office of Energy and Environment's similar comment above, FHR and HRRC are working individually with affected landowners. The purpose of these interactions is to further explain and refine property-specific project effects and develop mitigation plans that address substantial adverse impacts to structures. The most effective (and only practical) way to do this is to consult one-on-one with affected landowners to review information specific to their properties.

Most of the structurally affected private properties are located within either the Mill Creek or the Upper Pole Dike Creek basins of the Herring River flood plain. Structures within these sub-basins will receive four levels of overlapping and redundant protection from the impacts of restored tidal flow:

- First, the tidal control structure installed as part of the new Chequessett Neck Road Bridge will be carefully opened to increase tide range and water levels throughout the project area monitored to ensure that the system is performing as expected and no adverse impacts occur.
- Second, additional tide control structures will be constructed specifically across Mill Creek and Upper Pole Dike Creek to provide an additional layer of control and a tide regime specifically limited for these sub-basins. These structures will be opened and monitored similarly to the Chequessett Neck tide gates.
- Third, site-specific measures will be employed for individual properties to prevent tidal flows from impacting structures; these may include, but are not limited to, berms, elevation of land or structures, relocation of structures, and other practices.
- Fourth, in addition to monitoring of water surface elevations, the effectiveness of all individual impact mitigation practices will be specifically monitored to ensure they are working properly, maintained, and in good condition; the exact nature and duration of this monitoring will vary based on site-specific circumstances, but will be specified as a component of each landowner agreement.

13. ROADS

CONCERN STATEMENT: The FEIS/FEIR should describe impacts of the High Toss Road/Duck Harbor Road bypass, if the bypass is needed.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The draft EIS/EIR noted that preliminary engineering analyses indicate that complete closure of Chequessett Neck Road would substantially reduce construction time and costs for rebuilding the dike. If Chequessett Neck Road is closed for a portion of the construction period, High Toss Road and Duck Harbor Road are proposed as detour routes. To accommodate this traffic, these two roadways will require temporary improvements (surface grading, vegetation clearing) …..The FEIR should describe potential impacts associated with the use of High Toss Road and Duck Harbor Road as detour routes if Chequessett Neck Road Dike is closed in its entirety during the dike construction period."

Response: It is not anticipated that a bypass at High Toss Road/Duck Harbor Road will be needed. Current design plans call for a construction staging plan that provides for continued traffic on the Chequessett Neck Bridge during reconstruction. In order to replace the existing culverts with the proposed bridge structure at the Chequessett Neck Road crossing over the Herring River, a temporary bridge would be installed adjacent to the construction area on the upstream side of the dike. The bridge would be inside the dewatered area and would not incur any additional wetland or resource area impacts. One-way traffic would be maintained at all times and traffic flow would be regulated by an automated signal system. A cantilevered walkway will be mounted onto the temporary bridge to allow safe pedestrian and bicycle passage across the dike during the construction period. This temporary bypass route is expected to be in place for approximately 7-8 months, after which traffic will be returned to the dike to travel over the new bridge structure and all temporary structures will be removed as part of site restoration. Details and drawings of the traffic bypass plan can be found in Appendix K.

CONCERN STATEMENT: The FEIR should explain the temporal relationship of the incremental tide gate openings to the need for raising low-lying roads.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "If possible, the FEIR should discuss the temporal relationship of the incremental tidal-control gate opening to necessary mitigation actions for low-lying roadways."

Response: Chapter 4, Section 4.10.6 of the FEIS/FEIR analyzes impacts to affected portions of the road network and proposes methods to mitigate those impacts. The Chequessett Neck Road tide gate openings will be managed so as to ensure that needed road improvements have been completed before changes in water surface elevations would affect low-lying roads.

CONCERN STATEMENT: The FEIS/FEIR should provide conceptual design plans to clarify wetlands and habitat disturbance for road and culvert work under Alt D, including preferred mitigation alternatives (i.e. raise, relocate, or abandon) for each road segment.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The FEIR should include conceptual design plans, engineering studies or traffic analyses, as appropriate, to clarify potential wetlands, habitat or other relevant environmental impacts associated with the elevation, relocation, culverting, or abandonment of low-lying roads under the

Preferred Alternative. The FEIR should provide additional discussion of preferred mitigation alternatives for each potentially impacted low-lying roadway segment."

Response*:* Alternatives for low lying roadway mitigation were developed and studied by Coast Line Engineering in 2011, including identification of potential wetland impacts. This report is included in Appendix H of the FEIS/FEIR. Additional roadwork design is currently underway. Further details concerning impacts, traffic management, and mitigation will be presented as part of the local, state, and federal permitting processes.

14. RECREATION ACCESS

CONCERN STATEMENT: The project alternatives should provide access points and parking for shellfish harvesters and recreational users, including a provision to relocate access points in case of unforeseen project impacts

Organization: Wellfleet Shellfish Advisory Board
Organization Type: Unaffiliated Individual
Representative Quote: "Shellfish harvesters will require new and continuing access to shellfish beds when they are deemed "open" for shellfishing. Access points must provide for nearby vehicle parking as well as safe entrance to the area, and include a provision to guarantee any necessary relocation of access points should unforeseen circumstances arise. Such access will not only be necessary for the shellfish harvesters, but will also be a requirement for continued recreational use of the River."

Organization: Cape Cod Commission
Organization Type: Town or City Government
Representative Quote: "She said the Town was concerned that it retains the right to manage the fisheries, and recommended additional public access points with vehicle parking and safe access."

Organization: Friends of Herring River Wellfleet/Truro MA
Organization Type: Unaffiliated Individual
Representative Quote: "We also strongly recommend that public access and recreational opportunities be integral to the planning, engineering and design processes and ultimate construction with proper consideration for respect of private property and the protection of natural resources."

Response: Chapter 4, Section 4.10.8 of the FEIS/FEIR analyzes the project impacts on public access points. Based on this analysis, the majority of existing access points will be unaffected by higher tide ranges in the estuary. Affected access points would be relocated to ensure that there is no net loss in public access points. Specific provisions for parking and other recreation infrastructure will be integrated into the design process for the various construction components of the project, such as the rebuilding of Chequessett Neck Dike, the removal of High Toss Road, and the elevation of other low lying roads.

15. SOCIOECONOMICS

CONCERN STATEMENT: The FEIS/FEIR should address concerns with the potential for tax increases on private property, and the current tax structure should be retained.

Organization: *Not Specified*
Organization Type: Unaffiliated Individuals
Representative Quote: “And lastly, I must comment on the matter of real estate taxes, even though that issue does not concern the Draft per se. I believe that no affected property owner should have to pay higher real estate taxes as a result of this project. I have heard HRRC committee members state that our properties will become more valuable (the implication, I assume, being that therefore we should be grateful and supportive). Perhaps that may prove to be true for some people, but in my case the difference between fresh water and salt water would not be noticeable (so I was assured by HRRC), and I will not have an improved view. (The wetland part of my property resembles a swamp, and I am not permitted to alter it. It should not look much different when it becomes 3% salt water.) I am mostly concerned therefore, for other neighbors. I think that, generally speaking, people tend to buy as much house/property as they can afford, and property taxes are a part of any decision to buy. If a homeowner could afford waterfront property they probably would have bought it at the outset. Because of this, any increase in taxes should be experienced by the citizens of the town as a whole, because we all stand to gain if we attain a healthy ecosystem in a place where there had been toxicity. (And, if a handful of owners actually do experience an exceptional increase in the value of their property, I think that their real estate taxes should not be raised until they sell. Increased potential [unrealized] value does not put money in your pocket.)”

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: “Higher property assessments for properties that will have increased water views is unfair. It is doubtful that we will get any tax break for the years of construction and transition. I propose that the tax structure remain as it is.”

Response: Ecological restoration projects can have a positive impact on site aesthetics and other characteristics that influence landscape appeal and property value. Hundreds of acres of viewscapes can be improved by restoring natural hydrology (see DEIS Section 3.10.6).

As discussed in DEIS Section 3.10.6, studies have shown that restoring degraded wetland habitats, removing invasive species and creating the open vistas of salt marsh, emergent wetlands, and tidal creeks can increase the value of adjacent lands (Bin et al. 2003; NOAA 2012; MA Dept. of Fish and Game 2014). While the Herring River Restoration Project will likely have a positive effect on property values, the Project has no bearing on tax assessments or rates, which are set according to state and town laws. Massachusetts municipalities value and assess all types of property for taxes based on fair market value and are required to assess all types of property at 100% of fair market value. Massachusetts allows taxpayers to appeal assessments directly to the town assessors.

CONCERN STATEMENT: The FEIS/FEIR should disclose impacts to taxpayers (nationally and locally).

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: “I would like to know what the impact to the taxpayers will be for each alternative. The costs to the Nation, Towns, local landowners and local economy must be significant. How can alternative approaches to solving a problem be considered without the financial component?”

Response: There are several reasons why the FEIS/FEIR does not provide an analysis of taxpayer impact. First, detailed project implementation costs will not be known until construction documents, including cost estimates, are completed. At that time, the final cost estimates for project implementation will be publicly available. Second, the project has no direct effect on tax policy. While it may use funds generated by taxes at various levels, no proposed tax policy changes accompany this proposal. Third, the purpose of NEPA and MEPA documents are to analyze environmental effects so that these environmental analyses can be considered in concert with economic and other factors. The EIS/EIR is an environmental document, not a budget analysis.

CONCERN STATEMENT: The FEIS/FEIR should consider how flooding and visual impacts on Old County Road will be perceived by tourists and townspeople.

Organization: BB&N
Organization Type: Unaffiliated Individual
Representative Quote: “Old County Road between Truro and Wellfleet, mentioned in several guide books for bicycle riders as one of the most beautiful rides in Massachusetts, will be flooded and destroyed by the Herring River restoration and will turn into the same ugly, stinking landscape for years as seen on the sites mentioned above. How will that be perceived by tourists and townspeople?”

Response: Chapter 4, Section 4.10.6 of the FEIS/FEIR analyzes impacts to affected portions of the road network and proposes methods to mitigate those impacts. This analysis concludes that Old County Road will only be closed and/or bypassed temporarily during raising/reconstruction. Chapter 4, Section 4.10.7 analyzes impacts to the viewscape during and after project implementation. It concludes that despite the potential for temporary adverse impacts from standing dead vegetation, the long-term consequence if restoration is enhanced viewscapes.

CONCERN STATEMENT: The FEIS/FEIR should explain how the project will be funded.

Organization: *Not Specified*
Organization Type: Unaffiliated Individual
Representative Quote: “Where is the money going to come from? "unfunded" now”

Response: Funding strategies for the implementation of the Herring River Restoration Project will be addressed after a Record of Decision and MEPA Certificate have been issued. However, it is anticipated that a mix of public and private sources would contribute to project implementation. Funding will be sought from federal and state agencies and appropriations. The Towns of Wellfleet and Truro are not expected to appropriate funds for the Project, but will likely contribute in-kind services.

16. Construction Period Impacts

CONCERN STATEMENT: The FEIS/FEIR should provide an updated construction phasing and management plan including modified BMPs.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "Based upon comments received or additional analysis conducted by the Towns, the FEIR should include an updated construction phasing and management plan. This updated plan should also include modifications to proposed construction period BMPs as recommended by federal or State Agencies."

Response: The phasing of construction has not yet been determined because that level of detail cannot be developed until a Record of Decision has been issued, selecting an alternative for implementation. However, once an alternative has been selected and as the Adaptive Management Plan and design elements are developed and finalized, information concerning the phasing of construction and a construction management plan, including specific BMPs, will be included as part of the permitting process for implementing the project.

CONCERN STATEMENT: The FEIS/FEIR should consider impacts of the project on the road network, particularly on emergency vehicle access, and this should be detailed in subsequent engineering studies and traffic analyses.

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: As detailed in the DEIR/DEIS, the increase in tidal flow from the Action Alternatives would result in the flooding of a number of local paved and unpaved roads. The impacted roads, including High Toss Road, Pole Dike Road, Bound Brook Road, Old County Road, and numerous fire roads, would need to be elevated, relocated, closed during high tides, or abandoned. The impacts of these alternatives on the roadway network, particularly on emergency vehicle access, should be detailed in subsequent engineering studies and traffic analyses.

Response: Chapter 4, Section 4.10.6 of the FEIS/FEIR analyzes impacts to affected portions of the road network and proposes methods to mitigate those impacts. In the long-term, no paved roads would be permanently closed as a result of the project. During construction on affected road segments, both normal and emergency traffic would be managed according to a traffic control plan that will be developed as part of the final construction documents.

17. CONSULTATION/COORDINATION/PERMITTING

CONCERN STATEMENT: The FEIS/FEIR should discuss how the HRRC proposes to proceed with obtaining permits and variances for the proposed action, especially clarifying issues raised in DEP letter.

Organization: Army Corps of Engineers
Organization Type: Federal Government
Representative Quote: "Clarify which agencies may require additional permits and identify those permits or permit modifications. The Standing Regulatory Oversight Committee should evaluate the need for additional permits or permit modifications during the adaptive management phase of the project."

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The FEIR should provide an update to the proposed comprehensive permitting methodology with State and federal Agencies based upon ongoing collaborative efforts with permitting authorities. The FEIR should provide additional clarification of the proposed permitting review process as requested in the MassDEP comment letter."

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "MassDEP believes the FEIR should discuss how they propose to proceed with permitting the action items proposed in the DEIR in terms of whether they contemplate a comprehensive permit application or a sequenced permit process, how they anticipate integrating activities on private property as part of this overall public project in the permitting process and how they envision the permitting process to deal with unanticipated impacts."

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "The DEIR states that the proposed increases in tidal elevation and range will result in the flooding of low lying properties to various degrees, and in particular to private land and structures (82% of the 309 non-federal propertied within the floodplain are private). In accordance with 310 CMR 10.24(5)(6), projects within ACEC's shall not have an adverse impacts on the interests of the Act, including the storm damage prevention and flood control interests. MassDEP will need further information on mitigation to impacted properties as part of an FEIR, if one is required, and the permit applications and request for variance. MassDEP seeks clarification in the FEIR as to how and if landowner permission will be obtained. Historically, in granting variances and permits to projects that increased flooding on properties, the variance allowed the flooding on land within the ownership of the project proponent or had other legal permission to flood."

Response: Given the magnitude of certain unavoidable impacts and alterations to wetland resource areas the DEIS/DEIR stated that a variance would likely be needed from certain provisions of the Wetlands Protection Act (WPA). However, since the release of the DEIS/DEIR, the MA Department of Environmental Protection has drafted new regulations which include provisions for Limited Project status for eligible ecological restoration projects. Under these new regulations, the Herring River Project may not require a WPA variance.

Section 10.24(8) of the new regulations allows approval of an Ecological Restoration Limited Project that "may result in the temporary or permanent loss of Resource Areas and/or the conversion of one Resource Area to another when such loss is necessary to the achievement of the project's ecological restoration goals." There are no thresholds for the amount of alteration/loss allowed if the issuing authority determines that the project complies with the other applicable Ecological Restoration Limited Project provisions.

Section 10.24(8)(e)1 of the new regulations states that “A project that will restore tidal flow and that does not meet all the eligibility criteria set forth in 310 CMR 10.13 may be permitted as an Ecological Restoration Limited Project provided that in addition to the criteria set forth in 310 CMR 10.24(8)(a) through (d), the project including any proposed flood mitigation measures will not significantly increase flooding or storm damage impacts to the built environment, including without limitation, buildings, wells, septic systems, roads or other man-made structures or infrastructure.”

HRRC anticipates seeking initial Orders of Conditions from the Wellfleet and Truro Conservation Commissions under DEP’s proposed new ecological restoration regulations, encompassing all the potential effects of the Project. This initial Notice of Intent (NOI) would address all possible project elements grouped into two classes associated with project implementation phases:

Class 1 covers all elements that are required to implement the initial phase of the project, including but not limited to:

- reconstruction of the Chequessett Neck Road dike,
- construction of the dike at Mill Creek,
- installation of a new tide gate at Pole Dike Creek Road, and
- hydraulic improvements and public access modifications at High Toss Road

Class 1 elements also cover the following measures located in areas that lie below targeted water elevations of the project’s initial implementation phase, including:

- mitigation measures designed to prevent flooding impacts to private structures,
- elevation of low-lying portions of public roads,
- channel and marsh surface modifications, and
- vegetation management.

Tide gates and water levels would be managed to prevent structural impacts in the Mill Creek and Upper Pole Dike Creek sub-basins and other potentially affected locations until associated Class 1 impact mitigation measures have been implemented.

Class 2 covers elements that would be implemented in subsequent phases of the project. Prior to approval and implementation of Class 1 elements and adaptive management analysis, Class 2 elements have unavoidable and varying degrees of uncertainty about whether, where, when, and/or how they would be implemented. These elements include, but are not limited to:

- additional private property impact mitigation measures,
- additional channel and marsh surface modifications,
- modifications to minor roads and replacement of small culverts in upstream areas, and
- vegetation management activities beyond the Lower Herring River.

Class 2 impact mitigation measures for structures and other infrastructure would be determined by future agreements with landowners, monitoring, and adaptive management decisions based on system response to incremental increases in tidal exchange.

This approach provides for efficient and comprehensive regulatory review of a complex and atypical public-benefit project. It effectively accommodates inherent project uncertainties while avoiding project segmentation and maintaining full regulatory review authority and public/abutter/landowner rights and opportunities for input**.**

Distinctions between how Class 1 and Class 2 elements would be reviewed and permitted/approved by regulatory authorities is covered in revised sections 5.3.3 and 5.3.5 of the FEIS/FEIR.

CONCERN STATEMENT: The HRRC should consider that the actions and anticipated results from the proposed project may be in conflict with minimum performance standards in the 2009 Regional Policy Plan, and that the large scale ecological restoration project does not fit neatly into the Cape Cod Commission's regulatory framework.

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: "This large-scale ecological restoration project does not fit neatly into the Cape Cod Commission's regulatory framework. Because the project is required to prepare an Environmental Impact Report through MEPA, it is a mandatory DRI. The project's anticipated outcomes will bring broad ecological benefits to the Herring River system in Wellfleet and Truro, and as a result will likely benefit human health and economy. However, the proposed changes to the existing man-made structures within the estuary, including the Chequessett Neck Road dike, and upstream dikes, culverts and roadways, are not without impacts that may be in conflict with minimum performance standards in the 2009 Regional Policy Plan (RPP) (as amended)."

Response: This issue will be addressed in the permitting process. Following issuance of a final Certificate by the MA Secretary of Energy and Environmental Affairs, the Herring River Restoration Project will submit a Development of Regional Impact application to the Cape Cod Commission. The Project will be proposed as a Project of Community Benefit under the Cape Cod Commission Enabling Regulations, Section 9, Hardship Exemptions. Under this section, the Commission may waive or modify application of one or more of the Minimum Performance Standards of the Regional Policy Plan where full compliance with the Minimum Performance Standards would constitute a hardship by diminishing the community benefit conferred by the Project.

CONCERN STATEMENT: The project must demonstrate that measures have been taken to minimize adverse impacts to Land Subject to Coastal Storm Flowage (LSCSF).

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: "MPS CR2.1, 2.3, 2.4, 2.8: These standards restrict development within land subject to coastal storm flowage (LSCSF) to ensure that development does not impede the storm damage control functions of LSCSF or impede the migration or function of other coastal resources. The project impacts resources protected by these standards, but CR2.10 (see below) provides an exception for ecological restoration projects."

Response: Cape Cod Commission (CCC) Minimum Performance Standards (MSP) CR 2.1, 2.3, 2.4, and 2.8 restrict development within land subject to coastal storm flowage (LSCSF) to ensure that development does not impede the storm damage control functions of LSCSF or impede the migration or function of other coastal resources. In its staff report, the CCC stated that the Herring River project impacts resources protected by these standards, but CR 2.10 provides an exception for ecological restoration projects. MPS CR 2.10 provides an exception from compliance with several coastal MPSs for projects that restore salt marsh, fish runs, and shellfish beds. In addition, adverse impacts to LSCSF will be minimal and will be limited to very small areas of fill intended to protect several specific low-lying properties in the flood plain from the impacts of restored tidal flow. Most of these areas currently do not provide any LSCSF functions. Overall, the project will vastly improve the function of LSCSF for the entire flood plain, as restrictive barriers to drainage will be removed and site specific measures will improve flood protection for several vulnerable roads and properties. These adverse and positive impacts will be presented in greater detail in the CCC DRI application and subsequent permitting documents.

CONCERN STATEMENT: The FEIS/FEIR should explain the schedule for development of MOU III, anticipated project components and actions to be addressed within the MOU (O&M of tide control structures, public access, etc.) and if feasible, provide a draft copy of the MOU.

Organization: Environmental Protection Agency, Region 1
Organization Type: Federal Government
Representative Quote: "We are also encouraged by the NPS and HRRC promise to coordinate with potentially affected private property owners to mitigate flooding impacts to private property and potential impacts to private water supplies. The development of a Memorandum of Understanding (MOU) between the towns and the CCNS is noted in the DEIS/EIR as an important component of the work necessary to advance the project. The FEIS should explain the schedule for development of the MOU and whether it will address potential impacts to private property owners."

Response: The Herring River Restoration Project is a partnership between the Towns of Wellfleet and Truro and Cape Cod National Seashore (CCNS). Pursuant to an August 2005 Memorandum of Understanding (MOU I) the Town of Wellfleet and CCNS worked together to complete a conceptual restoration plan for the estuary, which was accepted by both Towns and CCNS in a second MOU (MOU II) executed in November of 2007. MOU II created the Herring River Restoration Committee (HRRC) and directed the HRRC to develop a detailed restoration plan for the estuary and prepare an Environmental Impact Statement/Report (EIS/EIR) to address the requirements of the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA).
A third MOU (MOU III) between the Towns of Wellfleet and Truro and CCNS is being developed to document the agreement between the entities for project implementation. MOU III will address partner relationships, roles and responsibilities, decision authority, financial obligations and governing structure for the design, permitting, construction and operation and management activities. In January 2013, a MOU Working Group was formed to oversee the development of MOU III. The Working Group includes representatives of the HRRC, the Towns of Wellfleet and Truro, the Massachusetts Division of Ecological Restoration (DER) and the Friends of Herring River. The Working Group met regularly between 2013 and 2015 to review and evaluate management options for the Restoration Project. The Group engaged an outside consultant to help research organizational models for a third-party restoration management entity and produced a draft MOU III.
The draft MOU III proposes establishment of an intergovernmental team to provide policy oversight, assume decision-making authority, and – through a contractual arrangement – direct the activities of an independent organization that would undertake specified activities during project permitting, construction and implementation, including the adaptive management process. The structure of the intergovernmental team would generally include the following elements:
a. A Herring River Executive Council (HREC) comprised of:

- Two members of Town of Wellfleet Board of Selectmen and the Town Administrator
- Two members of Town of Truro Board of Selectmen and the Town Administrator
- The Superintendent of CCNS or his/her designee.

b. A continued interdisciplinary management team (Herring River Restoration Committee), which shall serve as an advisory group to the HREC with representation from:

- Town of Wellfleet
- Town of Truro
- CCNS
- Commonwealth of MA Division of Ecological Restoration (DER)
- U.S. Fish and Wildlife Service (USFWS)

- U.S. Natural Resources Conservation Service (NRCS)
- National Oceanic and Atmospheric Administration (NOAA)

The HREC and the HRRC will work with a proposed regulatory oversight group to facilitate compliance with federal, state, regional and local permitting requirements. The HREC also may consult other individuals or organizations, as needed, such as stakeholder groups and/or science advisors.
Through contracts for services and/or Cooperative Agreements, the Towns and/or CCNS may engage the services of an independent organization to undertake some or all of the responsibilities and functions outlined below in coordination with the HRRC:

- Provide and manage professional level technical and administrative staff necessary for the completion of all project elements;
- Compete for, receive, and administer project funding from state, federal, and private sector sources;
- Prepare and submit permit applications, ensure compliance with all permit conditions, noticing requirements, and other environmental compliance obligations;
- Prepare and advertise bid solicitation packages, manage and oversee competitive bidding processes, select and manage contractors, oversee construction activities, pay invoices, and comply with funder and contractor stipulations;
- Facilitate agreements with affected landowners;
- Conduct operations and maintenance of infrastructure in cooperation with the towns and CCNS as stipulated by any contract agreement(s);
- Implement the adaptive management plan under the technical direction of HRRC;
- Perform public outreach and education activities.

A copy of the draft MOU III is included in Appendix J of the FEIS/FEIR. The Project Partners intend to execute the Final MOU III in 2016.

CONCERN STATEMENT: The FEIS/FEIR should identify areas subject to a Coastal Restriction Order and discuss how the project complies with the order's requirements.

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "MassDEP has determined that portions of the Herring River estuary are under a Coastal Restriction Order pursuant to MGL Chapter 120, section 105. The FEIR should determine those areas subject to the restriction order and how the project does or does not comply with the requirement of said order."

Response: Coastal Restriction Order maps and other documents on file at the Wellfleet Health and Conservation Office have been examined. It was found that no portions of the Herring River project area are within restricted areas.

CONCERN STATEMENT: The project must demonstrate that CCC MPSs have been met; this standard provides for the proposed development activities that address the ecological restoration objectives of the project.

Organization: Cape Cod Commission
Organization Type: County Government
Representative Quote: "MPS CR2.10: This coastal standard provides an exception from compliance with several coastal MPSs for projects that restore salt marsh, fish runs, and shellfish beds. Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that

other MPSs have been met, this standard provides for the proposed development activities that address the ecological restoration objectives of the project."

Response: This issue will be addressed in the permitting process. Following issuance of a final Certificate by the MA Secretary of Energy and Environmental Affairs, the Herring River Restoration Project will submit a Development of Regional Impact application to the Cape Cod Commission. The Project will be proposed as a Project of Community Benefit under the Cape Cod Commission Enabling Regulations, Section 9, Hardship Exemptions. Under this section, the Commission may waive or modify application of one or more of the Minimum Performance Standards of the Regional Policy Plan where full compliance with the Minimum Performance Standards would constitute a hardship by diminishing the community benefit conferred by the Project.

CONCERN STATEMENT: The FEIS/FEIR should provide an update on stakeholder outreach, meetings with permitting agencies, and additional studies.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The FEIR should include an update on additional stakeholder outreach, meetings with permitting agencies, and additional studies undertaken to inform the project's design and advancement towards construction."

Response: Stakeholder Outreach: The Herring River Restoration Committee (HRRC) has worked with the Friends of Herring River to provide information to stakeholders and the general public. This includes the development of a website (friendsofherringriver.org) and a Facebook page with project updates, publication of regular newsletter updates for interested subscribers, press releases about project activities and an annual meeting each year with presentations on different aspects of the Restoration Project. In addition, the HRRC has undertaken direct outreach to affected property owners.

Meetings with Permitting Agencies: Since the issuance of the DEIS/DEIR, the HRRC has continued to meet with the Technical Working Group (TWG) set up under the November 2008 MEPA Certificate. The TWG has provided feedback and counsel on the overall permitting strategy, alternatives development, impact analysis, and approach to implementation of the project. The HRRC has also had a series of consultative meetings with representatives of key federal, state and regional agencies, including the U.S. Army Corps of Engineers, Massachusetts Historical Commission, the MA Department of Environmental Protection (DEP), the MA Natural Heritage and Endangered Species Program (NHESP) and the Cape Cod Commission. These consultations were intended to clarify the permitting path under each of the agencies. See responses to individual agency concern statements for more details.

Additional Studies: The HRRC has worked closely with the Friends of Herring River (FHR) to seek grant funding for Project design and engineering. In 2013, FHR received a Massachusetts Environmental Trust (MET) grant to conduct geotechnical investigations and prepare 25% design plans for the new bridge and tide gates at Chequessett Neck Road. FHR also received two Massachusetts Bays Program (MBP) grants: One to fund hydrodynamic modeling of incremental tide gate openings at Chequessett Neck, and another to develop conceptual plans to replace upstream culverts that currently obstruct fish passage. FHR also received a three year grant from the National Oceanic and Atmospheric Administration (NOAA) to fund engineering and design for other key elements of Project infrastructure, including designing the Mill Creek dike and tide gates, installing tide control at Pole Dike Road, raising low-lying road segments, raising the lower fairways of the Chequessett Yacht and Country Club (CYCC) golf course, and conceptual design of flood prevention measures for low-lying private structures, such as buildings, wells, and driveways. This engineering and design work is ongoing.

Updates concerning the design of structures, consultation with permitting agencies, and stakeholder outreach have been incorporated in the appropriate sections of the FEIS.

18. SECTION 61

CONCERN STATEMENT: The FEIS/FEIR should include a separate chapter summarizing proposed mitigation measures, including draft Section 61 findings for each state agency that will issue permits for the project.

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: “The ‘Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report’ may indicate that this project requires further MEPA review and the preparation of a Final Environmental Impact Report. Pursuant to MEPA Regulations 301 CMR 11.12(5)(d), the Proponent will prepare Proposed Section 61 Findings to be included in the EIR in a separate chapter updating and summarizing proposed mitigation measures. In accordance with 301 CMR 11.07(6)(k), this chapter should also include separate updated draft Section 61 Findings for each State agency that will issue permits for the project. The draft Section 61 Findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.”

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: “The FEIR should include a separate chapter summarizing proposed mitigation measures. This chapter should also include draft Section 61 Findings for each State Agency that will issue permits for the project. The FEIR should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation. Given the phasing of build-out, the FEIR should identify development milestones upon which certain mitigation measures will be required to be implemented. I anticipate that the role of adaptive management as part of the project will be incorporated into these draft Section 61 findings with an amount of detail sufficient to satisfy State Agency requirements.”

Response*:* The required Draft Section 61 Findings are included as Appendix O to the FESI/FEIR.

19. Adaptive Management

CONCERN STATEMENT: The FEIS/FEIR should provide a refined Adaptive Management Plan.

Organization: MA Executive Office of Energy and Environment
Organization Type: State Government
Representative Quote: "The FEIR should include a refined proposed Adaptive Management Plan to provide additional information on the plan's elements and potential action items in light of relevant comments received."

Response: Additional detail concerning the Herring River Adaptive Management Program is presented in Appendix C of the FEIS/FEIR.

CONCERN STATEMENT: The FEIS/FEIR should provide alternative approaches to acquiring sediments for marsh accretion, because there are other competing entities for those limited dredge sediments for other uses (such as beach nourishment).

Organization: MA DEP, SERO
Organization Type: State Government
Representative Quote: "The DEIR states that in areas where subsidence has already happened and in areas where it has the potential to occur, it may be necessary to bring in additional sediment to augment that sedimentation anticipated to occur naturally. One source of supply depending on several factors includes sediment from dredging projects. While MassDEP recognizes the need for this augmentation, we also acknowledge that there are many competing entities for those limited dredge sediments for other uses such as beach nourishment. The FEIR should provide alternatives to acquiring sediments for marsh accretion."

Response: Table 4-1 of the DEIS/DEIR states that dredging has occurred 4 times since 1971, with the last dredging in 2007. Dredged materials are taken to the designated Cape Cod Bay disposal site 8 miles off shore. This past experience shows that dredged material from Wellfleet Harbor is generally fine organic material that is not suitable for beach nourishment, so competition for this material will be limited. Nonetheless, if augmentation of the sediment supply within the Herring River system is determined to be necessary, the Project will seek to evaluate sources based on compatibility of the material and sediment needs for other projects in the region.

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December 21, 2012

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Herring River Restoration Project
PROJECT MUNICIPALITY	: Wellfleet and Truro
PROJECT WATERSHED	: Cape Cod
EEA NUMBER	: 14272
PROJECT PROPONENT	: Towns of Wellfleet and Truro
DATE NOTICED IN MONITOR	: October 22, 2012

As Secretary of Energy and Environmental Affairs, I hereby determine that the Draft Environmental Impact Report (DEIR)[1] submitted on this project adequately and properly complies with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00). The Towns of Wellfleet and Truro (the Towns) must prepare and submit for review a Final Environmental Impact Report (FEIR) in response to the Scope provided below. The project is undergoing a coordinated review process under the National Environmental Policy Act (NEPA) and the Cape Cod Commission Act as a Development of Regional Impact (DRI).

Project Description

The project consists of the proposed restoration of native tidal wetland habitat to large portions of the Herring River floodplain in and adjacent to the Cape Cod National Seashore (the Seashore) by re-establishing tidal exchange in the river basin and connected sub-basins. Tidal exchange modifications will be facilitated through changes to the existing dike and tidal control

[1] In accordance with the Special Review Procedure established by Secretary Bowles, the DEIR is a joint document filed to meet the requirements of both MEPA and the National Environmental Policy Act (NEPA). For the purposes of this Certificate the DEIR will be referred to as the draft Environmental Impact Statement (EIS)/Environmental Impact Report (draft EIS/EIR) to reflect the joint nature of the filing.

structure at Chequessett Neck Road, establishment or alteration of other tidal control structures within the project area, and adaptive management techniques to incrementally achieve improved native estuarine habitat. The project seeks to balance an ecological goal of restoring the full natural tidal range in as much of the Herring River floodplain as practicable with controlling tidal range in certain areas to protect existing land uses. This project represents the single largest salt marsh restoration project in New England to date. I have received numerous comments from various State and federal environmental agencies supporting the project and its anticipated ecological benefits. However, several project components require additional review and consideration, most notably, the anticipated on-going process between the Towns, the Seashore and low-lying property owners that may incur varying degrees of impact associated with increased tidal flow within the Herring River estuary.

The geographic study area (the project area) examined in the draft EIS/EIR consists of the approximately 1,100-acre Herring River estuary[2] in the Towns of Wellfleet and Truro. The Herring River (along with its floodplain, tributary streams, and associated estuarine habitats within Wellfleet Harbor) was the largest tidal river and estuary complex on the Outer Cape prior to its historic alteration. Approximately 80 percent of the River's floodplain is located within Seashore boundaries, with the river itself extending from Wellfleet Harbor northeast for nearly four miles to Herring Pond in North Wellfleet. Bound Brook, a major tributary, extends northwest to Ryder Beach in South Truro. The Herring River basin is separated from Wellfleet Harbor by the Chequessett Neck Road Dike. The dike has three six-foot wide box culverts, each with an attached flow control structure. One culvert has an adjustable sluice gate that is currently set open at 24 inches and allows limited bi-directional tidal flow. The remaining two culverts have tidal flap gates designed to permit flow only during outgoing (ebb) tides. The project area includes the Herring River's Upper, Lower and Middle basins as well as a series of additional sub-basins which are physically, chemically, and biologically distinct from the Herring River itself. These stream sub-basins include: Duck Harbor, Mill Creek, Lower and Upper Bound Brook, and Lower and Upper Pole Dike Creek. Below is a brief description of each distinct sub-component of the project area:

Lower Herring River – Approximately 166 acres in area, Lower Herring River is located immediately upstream of the Chequessett Neck Road Dike and extends northerly to the High Toss Road crossing;

Middle Herring River – Approximately 74 acres in area, Middle Herring River extends from the High Toss Road crossing north to Bound Brook Island Road;

Upper Herring River – Approximately 156 acres in area, Upper Herring River extends northeast from Bound Brook Island Road and east of Route 6 to Herring Pond;

Mill Creek –Approximately 80 acres in area, Mill Creek extends easterly from its confluence with the Herring River (located about 1,600 feet east of the Chequessett Neck Road Dike) between the Chequessett Yacht and Country Club (CYCC) and Old Chequessett Neck Road;

Lower Pole Dike Creek – Approximately 114 acres in area, Lower Pole Dike Creek extends northeast from High Toss Road to Pole Dike Road;

[2] Approximately defined by the landward limit of the floodplain of the river and its tributaries.

Upper Pole Dike Creek – an area of about 174 areas of freshwater marsh, Upper Pole Dike Creek extends east of Pole Dike Road and includes an area of wetland and floodplain north of Wellfleet Center and east of Route 6;
Duck Harbor – Approximately 131 acres in area, Duck Harbor extends from the mainstem of the Herring River west to the Duck Harbor barrier beach;
Lower Bound Brook –Approximately 86 acres in area, Lower Bound Brook extends to the north and west of the Herring River north of Old County Road; and
Upper Bound Brook – Approximately 148 acres in area, Upper Bound Brook is located northwest of Lower Bound Brook and extends into the Ryder Hollow area of Truro.

According to the draft EIS/EIR, in 1909 the Town of Wellfleet diked the mouth of the Herring River in an effort to drain the breeding area for salt marsh mosquitoes (the Chequessett Neck Road Dike). As a further attempt to control mosquitoes, the Town of Wellfleet dug drainage ditches in the marsh upstream of the dike structure. By the mid-1930s, the Herring River mainstem, now flowing with freshwater, was channelized and straightened, cutting off many creek meanders between High Toss Road and Route 6, substantially reducing the length of the river. Subsequent to the diking of the Herring River, development occurred within the historic reaches of the estuary, in some cases at low elevations within the floodplain. Notable construction within the floodplain includes a portion of the CYCC 9-hole golf course and private residences. Over the decades the Chequessett Neck Road Dike has deteriorated, been repaired, and efforts have been made to modify control structures to increase tidal flow to the Herring River. Despite these efforts, estuary conditions continued to degrade after the tide gates were repaired. Concerns about tidal flooding of private properties and increased mosquito production prevented the Town of Wellfleet from opening the existing tide gate further than 24 inches, where it has remained since 1984.

The draft EIS/EIR identified key adverse ecological impacts resulting from the over 100 years of tidal restriction and salt marsh drainage. These include:

- Tidal restriction (lack of tidal inflow and outflow);
- Plant community changes (including loss of salt marsh vegetation and increase in non-native, invasive species);
- Loss of estuarine habitat and degradation of water quality;
- Alteration of natural sediment processes and increased salt marsh surface subsidence;
- Nuisance mosquito production; and
- Impediments to river herring migration.

A set of project objectives were created by the National Park Service (NPS) and the Herring River Restoration Committee (HRRC) to guide the project's design and review of potential project alternatives. These project objectives include:

- To the extent practicable, given adjacent infrastructure and other social constraints, re-establish the natural tidal range, salinity distribution, and sedimentation patterns of the 1,100-acre estuary;
- Improve estuarine water quality for resident estuarine and migratory animals including fish, shellfish, and waterbirds;

- Protect and enhance harvestable shellfish resources both within the estuary and in receiving waters of Wellfleet Bay;
- Restore the connection between the estuary and the larger marine environment to recover the estuary's functions as (1) a nursery for marine animals and (2) a source of organic matter for export to near-shore waters;
- Remove physical impediments to migratory fish passage to restore once-abundant river herring and eel runs;
- Re-establish the estuarine gradient of native salt, brackish, and freshwater marsh habitats in place of the invasive non-native and upland plants that have colonized most parts of the degraded flood plain;
- Restore normal sediment accumulation on the wetland surface to counter subsidence and to allow the Herring River marshes to accrete in the face of sea-level rise;
- Re-establish the natural control of nuisance mosquitoes by restoring tidal range and flushing, water quality, and predatory fish access;
- Restore the expansive marshes and tidal waters that were once a principal maritime focus of both Native Americans and European settlers of outer Cape Cod in a manner that preserves the area's important cultural resources;
- Minimize adverse impacts to cultural resources during project construction and adaptive management phases;
- Minimize adverse impacts to surrounding land uses, such as domestic residences, low-lying roads, wells, septic systems, commercial properties, and private property, including the CYCC;
- Educate visitors and the general public by demonstrating the connection between productive estuaries and salt marshes and a natural tidal regime;
- Improve finfishing and shellfishing opportunities; and
- Enhance opportunities for canoeing, kayaking, and wildlife viewing over a diversity of restored wetland and open-water habitats.

Project impacts were evaluated in the draft EIS/EIR for a variety of project alternatives using the aforementioned objectives as a framework for assessment of how each project alternative is consistent with or advances project goals.

<u>Project Review History and Background</u>

The Towns committed as part of a Special Review Procedure (SRP) established by Secretary Bowles to file one set of environmental review documents that fulfill the requirements of NEPA, MEPA and the Cape Cod Commission (CCC). A Certificate Establishing a Special Review Procedure was issued on June 20, 2008 to provide for coordination of MEPA review with other environmental and developmental review and permitting processes. It was determined that coordinated review allows for maximum public and agency understanding of the project to ensure that review by regulatory agencies is as efficient as possible.

Given the coordinated nature of the draft EIS/EIR, the document was provided with an extended review period under the MEPA regulations (301 CMR 11.00) to coincide with the review period required by NEPA. The draft EIS/EIR was published in the October 22, 2012 issue of the Environmental Monitor, with a comment period that concluded on December 12, 2012. A joint CCC/MEPA hearing was held on November 8, 2012 in conformance with joint review requirements between the CCC and MEPA.

The project has a lengthy history of coordination between local, State and federal officials and agencies given the complex nature and scope of the proposed project. Subsequent to an August 2005 Memorandum of Understanding (MOU) between the Town of Wellfleet and the Seashore, the Herring River Technical Committee (HRTC) was established to review scientific and technical data and consider community concerns regarding the feasibility of restoring the wetland system. In January 2006 the HRTC produced a "Full Report of the Herring River Technical Committee" which recommended the tidal restoration of the Herring River estuary. The HRTC worked to develop a Conceptual Restoration Plan (CRP) for the Herring River estuary which described possible ways to restore the Herring River. A second MOU was created on November 13, 2007 between the Seashore and the Towns accepting the CRP, agreeing to move forward with a detailed restoration plan, and establishing a new committee, the HRRC. This detailed restoration plan is the subject of this draft EIS/EIR. In addition, as directed in the Certificate on the EENF, a Technical Working Group (TWG) was established to identify and address environmental management and permitting issues associated with the project. The TWG met quarterly throughout the preparation of the draft EIS/EIR to assist in the development of study methodologies and protocols to ensure that these data meet the requirements anticipated as part of the permitting and approval processes. The TWG included members of various State, federal and local environmental and permitting agencies, as well as members of the HRRC.

Jurisdiction and Permitting

This project is subject to MEPA review and requires the preparation of a mandatory EIR because it requires State Agency Actions and exceeds several EIR thresholds, including but not limited to:

- Alteration of one or more acres of salt marsh or bordering vegetated wetlands (301 CMR 11.03(3)(a)(a));
- Alteration of ten or more acres of any other wetlands (301 CMR 11.03(3)(a)(b)); and
- Alteration requiring a variance in accordance with the Wetlands Protection Act (301 CMR 11.03(3)(a)(2));

The project will require a variance in accordance with the Wetlands Protection Act, an Individual Section 401 Water Quality Certification variance, and a Chapter 91 (c.91) License from the Massachusetts Department of Environmental Protection (MassDEP). A Conservation and Management Permit may be required in conformance with the Massachusetts Endangered Species Act (MESA) (M.G.L. c.131A and 321 CMR 10.00); however the Towns intend to prepare a Habitat Management Plan, which if approved, will exempt the project from MESA review. Federal Consistency Review will be required in accordance with the Coastal Zone Management Act of 1972. The project will require an Individual Permit from the United States Army Corps of Engineers (USACE) in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Review and approval in compliance with the National Historic

Preservation Act (NHPA) and the Massachusetts Historical Commission pursuant to Section 106 requirements and M.G.L. c.9, ss. 26-27C will also be required. Finally, the project will require review under the Wellfleet Environmental Protection Bylaw and the Truro Conservation Bylaw. The project site is located in the Wellfleet Harbor Area of Critical Environmental Concern (ACEC).

The project will receive Financial Assistance, in part, from State Agencies. Therefore, MEPA jurisdiction for this project is broad and extends to all aspects of the project that are likely, directly or indirectly, to cause Damage to the Environment as defined in the MEPA regulations.

Review of the DEIR

General

The draft EIS/EIR addressed the issues noted in the Certificate on the EENF and included additional information to respond to the Scope and to comments received on the EENF. As this is a joint document, the report included additional data and discussion as necessary to meet the requirements of the NEPA process, in addition to those outlined by MEPA and the CCC. The draft EIS/EIR followed the general guidance for outline and content in compliance with Section 11.07 of the MEPA regulations.

The draft EIS/EIR included a lengthy narrative with supporting graphics, data and appendices describing the existing conditions in the project area, including background on historic conditions, as appropriate. This existing conditions (referred to as Affected Environment in the report) assessment serves as the baseline against which potential impacts associated with each proposed alternative were measured. The existing conditions summary illustrated the environmental impacts of the tidal restriction and anthropogenic alteration within the Herring River estuary with regard to overall estuary health and functionality as an ecosystem. The draft EIS/EIR also described potential environmental impacts for all project alternatives, included proposed conditions plans illustrating estimated areas of impact associated with each alternative, and proposed mitigation measures to offset certain types of impacts (i.e., low-lying property flooding, etc.). The significance of potential impacts were assessed with consideration for both context and intensity. Finally, the draft EIS/EIR considered the cumulative impacts of the project by combining the impacts of the considered alternative with other past, present and reasonably forseeable future actions.

The draft EIS/EIR included a summary of the expected changes from tidal restoration within the estuary, including but not limited to: higher average water levels, lower low tides, reduced mosquito production, reversal of chemical processes that have caused high acidity and mobilized toxic metals, increased sediment transport and deposition, increased dissolved oxygen concentrations, dilution of fecal coliform counts, re-establishment of wetland plant communities, enhanced canoe and kayak access, and increase in diverse marine and estuarine resources.

A key component of the project included hydrodynamic modeling of the estuary to simulate potential changes to the project area under a variety of restoration scenarios. This model allowed for the evaluation of specific questions about potential change to surface water elevations, flow velocities, salinity changes, and sediment processes within the estuary. These data were essential to the completion of the alternatives analysis, facilitating the evaluation of potential environmental impacts associated with each contemplated restoration scenario.

Project Permitting

The draft EIS/EIR identified applicable federal, State and local environmental policies and permitting requirements. Specifically, the draft EIS/EIR identified each anticipated State permitting requirement, how the project intends to comply with permitting standards and requirements, or if these requirements cannot be met, how the project will use a variance process to permit the project's environmental impacts. I note that given the restorative nature of the proposed project, the applicability of performance standards or mitigation requirements remains unclear in certain instances. The draft EIS/EIR included a discussion outlining the Town's position on how the project meets the MassDEP wetlands variance criteria.

Components of the project will require c.91 Licenses in accordance with 310 CMR 9.00. Within the Herring River project area, c.91 jurisdiction potentially extends to the placement of fill and the new construction, substantial alteration, or expansion of existing structures below the historic (pre-Chequessett Neck Road Dike) mean high water line. No structures or fill in the Herring River floodplain (with the exception of the Bound Brook Road culvert) currently have c.91 Licenses. Therefore, new license applications will need to be submitted for all fill and structures below historic mean high water.

The draft EIS/EIR included a proposed regulatory permitting strategy, developed in consultation with the TWG, that acknowledges the need for a coordinated and comprehensive permitting strategy that facilitates efficient review, accommodates a long-term and dynamic implementation program, and ensures proper environmental protection and public input throughout the process. Restoration activities will proceed in an incremental and phased approach that will be guided by, and adjusted in response to, the adaptive management plan.

This permitting strategy includes the Towns applying for one set of comprehensive permits and approvals from all federal, State, and local regulatory authorities. Permits and approvals will be requested for the longest allowable timeframe. Permit applications will be grouped into two classes:

- **Class 1:** Elements that are required for initial project implementation and are certain to occur (e.g., construction of the main dike, construction of the dike at Mill Creek under Alternative D, and elevation of low-lying roads); and flood-proofing or other mitigation to impacted structures. Detailed plans, data and narratives will be provided in the initial permit applications;
- **Class 2:** Elements that may or may not be implemented, or have an uncertain extent of implementation (e.g., channel modifications, grading, and vegetation management), and that would be determined by future monitoring and adaptive management decisions. Details on Class 2-type projects will be provided in a broad fashion in the initial permit

applications, with further detail provided if and/or when they are proposed for implementation based upon adaptive management analysis.

The Towns have proposed the formation of a standing Regulatory Oversight Committee (ROC) as a successor to the TWG, comprised of representatives of regulatory authorities having jurisdiction over project activities. After the initial dike construction is complete and the project begins the adaptive management phase, the ROC will have the authority to review and approve substantial project design changes to Class 1 elements and more detailed design plans, methodologies, and specific restoration management actions related to Class 2 elements.

As proposed, ROC members will meet at least annually to review the monitoring results associated with the adaptive management plan and consider proposed changes and/or refinements to project designs and management activities. ROC meetings will be open to the public and will be noticed in advance through the Environmental Monitor and Town websites, with written public comment opportunities for consideration by the ROC. Deliberations, decisions, and official meeting minutes from ROC meetings will also be made publicly available.

Each representative of the ROC will determine for their respective jurisdictional authority whether the implementation of proposed Class 1 changes and/or Class 2 refinements may proceed under the original comprehensive permit authorization or require a formal proposal for amendment or modification of said permit. If formal review is required, the Towns will submit an application for permit amendment in compliance with the applicable regulations and procedures.

Adaptive Management Plan

The Herring River project will follow an adaptive approach to achieve restored tidal conditions though the management of adjustable tide-control gates and the implementation of other restoration actions over a period of years. The proposed adaptive management approach is designed to minimize risk to property and the environment given current uncertainties about the response of the Herring River system to the proposed restoration efforts. Despite extensive modeling efforts and data gathering, uncertainties remain about how specific ecological processes will respond to the proposed actions over the short-term and long-term.

An Adaptive Management Plan (AMP) is proposed in conjunction with the project to facilitate the achievement of project objectives and goals given the long-term, phased restoration process and project complexity. According to the draft EIS/EIR, adaptive management is a formal, iterative process where 1) a problem is assessed, 2) potential management actions are designed and implemented, 3) actions and resource responses are monitored over time, 4) data are evaluated, and 5) actions are adjusted as necessary to better achieve desired management outcomes. Succinctly, adaptive management is an approach for simultaneously managing and learning about the dynamics of resources under management to aid in the decision-making process when uncertainties exist.

The draft EIS/EIR provided an overview of the proposed AMP process for the project. This overview included a discussion of the general steps for adaptive management planning. Implementation of adaptive management requires careful planning, which the draft EIS/EIR described as a two-step process: a deliberative or set-up phase in which key components are formalized and an iterative process consisting of decision making, implementation, monitoring and feedback. The set-up phase will have several sub-components including:

- soliciting stakeholder involvement;
- creation of clear, measureable and fundamental objectives for desired resource conditions;
- establishment and description of a complete set of available management actions, or combination of actions;
- use of predictive modeling and hypotheses; and
- design of a careful monitoring plan to track system response after implementation of a management decision.

The set-up phase will provide the necessary framework for selecting the most appropriate actions for each step to achieve multiple management objectives - given the status of the current system - and predict outcomes of each possible management alternative. Predictions will consider uncertainty in the system through the use of multiple hypotheses using the current state of system knowledge. The information established during the set-up phase will inform the decision making process within the iterative phase. Selecting the best alternative will involve balancing the anticipated costs and benefits of any action when compared to project management objectives and accounting for tradeoffs in the future. Confidence in decision making will improve over time as the understanding of the system evolves with new information gathered as part of the monitoring process and as models (hypotheses) are supported or refuted by data and observations.

The draft EIS/EIR described adaptive management principles and processes as they will apply to the restoration of the Herring River estuary. Using the project's fundamental ecological goals of restoring natural hydrological conditions and ecosystem functions in the watershed, a series of means objectives will be identified to collectively describe the inter-related physical, chemical, and biological processes that need to be established to achieve project goals. These means objectives may include targeted water surface elevations, salinity levels, sediment transport and other estuarine processes. The draft EIS/EIR also highlighted potential areas of uncertainty for each topic explored as part of this document (i.e., salinity, aquatic species, etc.). Potential management actions will include both primary management actions (i.e., incremental tide gate opening, etc.) and secondary management actions (i.e., removal of woody vegetation, creation of tidal channels, etc.). Predictive models will be developed linking actions to outcomes to facilitate the identification of key ecological relationships or uncertainties. These models will be critical to provide an enhanced understanding of changes in vegetation, water quality, sediment distribution, and other processes as a function of modified hydrodynamics. Monitoring variables identified as part of the adaptive management process will provide the needed information to compare predictions to observations in order to properly assess alternative hypotheses of system functioning. Potential monitoring categories include: water surface elevations, water column salinity, vegetation and wetland habitat, sediment spatial distribution, marsh accretion, abundance and distribution of State-listed rare species and obligate habitat, and water quality. Monitoring protocols will be established to ensure that the monitoring plan is designed to provide appropriate information within the spatial and temporal scales required by the adaptive management decision making process.

A central component of the AMP will be a strategy for how management decision for the project will be made and who will make them. The draft EIS/EIR envisions that several integrated groups will be established to oversee and manage the implementation of the Herring River project and the AMP. The core of these groups will be an Executive Committee that includes representatives from the Towns and the Seashore. A Management Committee will be established to meet regularly to review and discuss day-to-day project details and make management recommendations to the Towns and the Seashore. The Management Committee will develop a science team to be responsible for monitoring and data reporting and to work closely with Seashore natural resource staff and other collaborators. A Technical Oversight Committee, analogous to the current TWG, will be established to review monitoring reports and results of predictive models, as well as Management Committee recommendations. It will authorize propsoed management actions requiring regulatory review according to guidelines set forth by individual permitting agencies. At each decision point to alter tidal control gate openings or to implement any of the secondary management actions, the Management Committee will review monitoring data and reports and revisit the predictive models to assess system responses to previous decisions. New data will be integrated into the models to update the credibility of each hypothesis. Throughout the process, the Management Committee will continue to receive feedback from stakeholders, revisit the adaptive management plan objectives, and refine management actions, models, and the monitoring plan as new information becomes available.

Alternatives Analysis

I commend the Towns for evaluating a thorough set of potential restoration alternatives for the Herring River estuary. The alternatives analyzed were screened by the Towns for their ability to meet the project purpose and objectives for technical, logistical, and financial feasibility, and for their ability to avoid significant adverse impacts. Using the MEPA and NEPA alternatives analyses requirements (either from applicable regulations or the EENF Certificate), the HRRC conducted public scoping sessions and workshops to refine the many possible restoration alternatives for the Herring River. The HRRC considered various types of tidal control structures, a number of control points, and widths of openings at Chequessett Neck Road Dike to narrow down potential alternatives.

In 2010, additional hydrodynamic modeling was conducted to develop an understanding of the range of tidal influences, salinities, and sediment transport that could be expected under the range of the three selected restoration scenarios. These initial modeling results were used to establish the range of tidal influences that could be expected and a lower and upper point of restoration potential. This type of analysis was critical to allow for an assessment of the potential environmental impacts associated with each alternative under a maximum restoration outcome. To assist in the determination of the Preferred Alternative (Alternative D), the HRRC conducted a three-day Value Analysis/Choosing by Advantages workshop in June 2011 to compare and rank the benefits, impacts, and costs of the action alternatives.

According to the draft EIS/EIR the action alternatives represent "bookends" of the minimum and maximum tidal exchange restoration necessary to meet project objectives, where Alternative B achieves the minimally acceptable tidal restoration with the least impacts, and Alternative D achieves the maximum practicable tidal restoration possible with more impacts, given the limitations of present day land use in the Herring River floodplain. Each alternative describes the possible endpoints of incremental tidal restoration. The final degree of tidal exchange may fall somewhere between the "bookends" pending the results of the proposed adaptive management program. The draft EIS/EIR included a discussion of how each alternative did or did not meet the project's established objectives.

Alternative A – No Action: this alternative maintains the existing 18-foot-wide Chequessett Neck Road Dike with two flap gates and one adjustable tide gate. No tidal restoration will occur. As part of the current process by the Federal Emergency Management Agency (FEMA) to redraw National Flood Insurance Program Flood Maps and Risk Mapping Assessments in Barnstable County, FEMA will be considering existing flood control structures and whether they meet specific standards. According to the draft EIS/EIR, structures that do not meet these specific standards will be decertified and therefore areas landward will be mapped as floodplains under the assumption that the dike does not provide any flood protection. Early indications subsequent to informal consultation between the Town of Wellfleet and FEMA are that the existing Chequessett Neck Road Dike will not meet these standards and therefore low-lying areas which are currently not in a mapped flood zone may be remapped as floodplain areas. In this scenario certain properties will be required to obtain flood insurance if the Town of Wellfleet does not upgrade the dike to meet FEMA design guidelines.

Alternative B – New Tidal Control Structure at Chequessett Neck – No Dike at Mill Creek: this alternative includes a 165-foot-wide series of culverts with adjustable tide gates installed in the Chequessett Neck Road Dike. The Mill Creek sub-basin will be left open to the Herring River, thereby subjecting the sub-basin to a limited tidal regime controlled at the Chequessett Neck Road Dike. Tide gates will be opened incrementally to a maximum of three feet with an objective of obtaining a mean high spring tide of 4.8 feet and a 100-year storm driven tide of 6.0 feet in the Lower Herring River. These tidal elevations represent the maximum restoration possible without the need to install a secondary tidal control structure at Mill Creek. Tides in upstream basins will be lower because of natural tide attenuation. Proposed flood proofing actions will be designed to accommodate 100-year storm driven tidal flooding up to 5.9 feet within the Mill Creek sub-basin and 5.3 feet in the Upper Pole Dike Creek sub-basin. Hydrodynamic modeling shows that several areas of the CYCC golf course will be affected by the tidal inundation levels proposed under this alternative. Options to address these impacts are discussed later in this Certificate.

Alternative C – New Tidal Control Structure at Chequessett Neck – Dike at Mill Creek that Excludes Tidal Flow: this alternative includes a 165-foot-wide series of culverts with adjustable tide gates installed in the Chequessett Neck Road Dike. Tide gates at the Chequessett Neck Road Dike will be fully opened (incrementally) to allow mean high water spring tides up to 5.6 feet and 100-year storm driven tides up to 7.5 feet in the Lower Herring River. This alternative provides the highest practicable high tide water surface elevations possible given the constraints of current land uses in the flood plain. To avoid flood impacts to low-lying private properties within the Mill Creek sub-basin, and thereby eliminate the need for additional flood protection measures for CYCC and other Mill Creek properties, this alternative includes the construction of a tidal exclusion dike at the mouth of Mill Creek. This Mill Creek Dike will eliminate tidal influence to the sub-basin and be designed to the minimum recommended crest height of two feet above the projected 100-year storm surge elevation (i.e., 9.5 feet). A one-way, flapper-style tide gate, possibly along with a mechanical pump, will be installed in the dike to allow freshwater to drain from the Mill Creek sub-basin toward the Herring River. Construction of this dike will require approximately 2,900 cy of fill and will permanently impact 12,500 sf of wetland. A construction work area encompassing approximately 2.4 acres of vegetated wetlands will also be temporarily impacted for construction dewatering purposes. Tides in upstream basins will be lower because of natural tide attenuation. Mitigation actions proposed throughout the remainder of the estuary will be designed to accommodate flooding up to the anticipated maximum tidal elevations.

Alternative D – New Tidal Control Structure at Chequessett Neck Dike – Dike at Mill Creek that Partially Restores Tidal Flow: this alternative includes a 165-foot-wide series of culverts with adjustable tide gates installed in the Chequessett Neck Road Dike. Tide gates at the Chequessett Neck Road Dike will be fully opened (incrementally) to allow mean high water spring tides up to 5.6 feet and 100-year storm driven tides up to 7.5 feet in the Lower Herring River. Tides in upstream basins will be lower because of natural tide attenuation. With the exception of Mill Creek, mitigation actions proposed throughout the remainder of the estuary will be designed to accommodate flooding up to the anticipated maximum tidal elevations. This alternative includes the construction of a dike at the mouth of Mill Creek with an adjustable, two-way tide gate which would be managed to partially restore tidal flow to the sub-basin. Mean spring high tides will be limited to 4.7 feet and 100-year storm driven events to a maximum of 5.9 feet in Mill Creek. The impacts of the dike's construction will be similar to Alternative C, while flood proofing described in Alternative B will be required for Mill Creek (e.g., CYCC mitigation and low-lying private properties).

As noted previously, under Alternatives B and D two options for mitigating potential flood impacts to the CYCC golf course were evaluated.

Option 1: Relocate the affected portions of the facility to upland locations currently owned by the CYCC. This will involve clearing, grading, and planting of new golf holes and a practice area. Approximately 30 acres of long-term upland disturbance will be generated under this option. One fairway will not be able to be relocated because of its proximity to the clubhouse and would require filling and regrading to raise elevations above the floodplain.

Option 2: Elevate the affected portions of the facility by providing necessary quantities of fill, regrading, and replanting the areas. Fill quantities are estimated at approximately 150,000 cubic yards (cy) along with 32 acres of disturbance for grading and site preparation. Portions of five low-lying golf holes will be reconstructed to a minimum elevation of 6.7 feet, which is two feet above the mean spring tide in Mill Creek.

As noted in the draft EIS/EIR, the comparative habitat restoration potential for each alternative are summarized below:

Alternative	Total Acres of Habitat Restored
Alternative A	0
Alternative B w/ Option 1	898.7
Alternative B w/ Option 2	881.1
Alternative C	912.7
Alternative D w/ Option 1	964.3
Alternative D w/ Option 2	956.0

Furthermore, the draft EIS/EIR identified a series of project elements common to all action alternatives. These include:

Incremental Tidal Restoration and Adaptive Management – Incremental tidal restoration will be used to allow monitoring of the system so that unexpected and/or undesirable outcomes can be detected and appropriate response actions taken. The Herring River estuary is a complex and dynamic wetland system and restoration efforts will occur in a long-term, phased manner over many years.

Monitoring – Field monitoring will be closely tied to the adaptive management process and designed to measure progress towards project objectives and assumptions built into the conceptual models. In addition to traditional ecological monitoring, these data will be used to support management decision making and assessment.

Vegetation Management – Upon restoration of tides to the estuary, the composition of plant communities are expected to change due to changes in tidal range, frequency and duration of tidal flooding, soil saturation, and salinity. Management of flood plain vegetation (mostly the removal of shrubs and trees before salt water reaches them and invasive vegetation contorl) will facilitate re-establishment of tidal marsh, reduce impediments to fish passage, and reduce mosquito breeding habitat. Potential techniques to manage woody vegetation include cutting, chipping, burning and targeted herbicide application. Vegetation management actions will be similar in type and implemented in an identical manner for each action alternative; however, the spatial extent and timing of when actions would be taken may vary.

Low-Lying Road Crossings and Culverts – Several segments of Pole Dike, Bound Brook Island, and Old County Roads will be vulnerable to high tide flooding subsequent to the proposed restoration. Mitigation for these impacts includes either the elevation or relocation of road surfaces and culverts. The draft EIS/EIR estimates that approximately 8,000 linear feet of road could be elevated to a minimum grade of 5.5 feet, which will require widening road bases and increasing culvert sizes. Elevating the roads above the 100-year storm elevation will require filling approximately 4,000 sf of adjacent wetlands, while only protecting against annual high water (AHW) will minimize wetland loss to 2,300 sf. Relocation options include altering road alignments onto a nearby former railroad right-of-way, which will further reduce potential wetland loss.

High Toss Road – Complete removal of the existing tidal restriction at High Toss road is a major component of the project under all action alternatives. The Herring River presently passes under High Toss Road (the second road that crosses the river) approximately one mile upstream from Chequessett Neck Road. High Toss Road is an infrequently traveled, unpaved earthen berm capable of accommodating emergency vehicle access to Griffin Island. The Herring River passes under the road at the western end though a five-foot diameter concrete culvert. Under all restoration scenarios High Toss Road will be overtopped daily by seawater and ebb tide drainage will be impeded by the causeway without modifications to the roadway.

To enhance tidal exchange and eliminate the restriction at High Toss Road the Towns will replace the existing five-foot culvert with either a properly designed box culvert or an open channel. An open channel may include a small bridge spanning the river if pedestrian and/or vehicle access is continued. According to the draft EIS/EIR, under either option, a tidal channel approximately 30-feet wide will be needed for adequate tidal conveyance. An open channel scenario will require the construction of a bridge designed for suitable vehicle loading.

Additional measures will also be implemented under all action alternatives to mitigate the anticipated flooding of High Toss Road at high tides greater than approximately three feet. Mitigation options explored include elevation of the roadway, abandonment and removal of the roadway, or periodic closure of the roadway during certain tidal events. Elevation or periodic closure of the roadway will still require that side slopes of the existing roadway be stabilized, while elevation of the roadway will likely also require widening of the roadway base, resulting in approximately 13,000 sf of impact to adjacent wetlands. If abandonment and removal of the roadway is pursued (contingent upon further public comment and consultation between the Town of Wellfleet and the Seashore), the length of roadway between Rainbow Lane and the parking area at Duck Harbor Road (approximately 1,000 feet) will be decommissioned. An additional 12,000 sf of wetland will be restored if this roadway segment is removed. If continued pedestrian and/or bicycle access is desired in this area, a boardwalk could be constructed across the floodplain and river.

Restoration of Tidal Channel and Marsh Surface Elevation – To achieve full tidal restoration, actions will be necessary to reverse previous direct and indirect alteration of the system's topography, bathymetry, and drainage capacity. Supplemental habitat management actions will be implemented to counteract the limitations created by these historic alterations (e.g., mosquito ditching, channelization, and marsh subsidence). These potential actions include, but are not limited to:

- Dredging of accumulated sediment to establish a natural bottom of the Herring River channel at the appropriate depth and maximize ebb tide drainage;
- Creation of small channels and ditches to improve tidal circulation;
- Restoring natural channel sinuosity;
- Removing lateral ditch dredge spoil berms and other anthropogenic material on the marsh surface to facilitate drainage of ponded water; and
- Applying a thin layer of dredged material to build up subsided marsh surfaces.

Upper Pole Dike Creek – The Upper Pole Dike Creek sub-basin contains approximately 130 private parcels located at least in part within the historic floodplain. According to the draft EIS/EIR, modeling shows that portions of these low-lying properties will potentially be affected by restored tides. Flood impacts will be addressed on a property-specific basis or by restricting tidal flow at Pole Dike Road with either the existing road culvert or a tide control gate.

Public Access and Recreation Opportunities – Given that the Herring River is located in the Seashore's "natural zone" which is managed to protect natural processes with limited infrastructure, development of public access points or visitor facilities are likely to occur at the discretion of adjacent landowners or stakeholders (e.g., the Towns, Wellfleet Conservation Trust, Friends of Herring River). Chequessett Neck Road Dike will be designed to include safe fishing access sites. Other opportunities that warrant further investigation include canoe or kayak launches, walking trails, and access to recreational shellfishing areas.

The draft EIS/EIR also included a brief description of alternatives that were considered but dismissed from consideration during the evaluation process. These alternatives include:

- Replace the dike with a bridge and fully restore the entire estuary (i.e., no control structures);
- Fully open the existing tide gates;
- Rebuild the dike with tidal openings less than 165 feet;
- Tidal power generation at the new Chequessett Neck Road Dike; and
- Unrestricted tide flow at Chequessett Neck

Selected Preferred Alternative

The Preferred Alternative (of Environmentally Preferable Alternative as defined by NEPA) is Alternative D with Option 2 (elevated fairways and practice areas at CYCC). The Preferred Alternative was evaluated based on its ability to meet the plan objectives and potential impacts on the environment. This alternative was considered the best to protect, preserve, and enhance historic, cultural and natural resources while maximizing tidal restoration potential. Impacts associated with the Preferred Alternative, and described in greater detail later in this Certificate, are based on end-point conditions (i.e., the final tide gate configuration) after the adaptive management process is completed and the project is fully implemented. It is anticipated that some impacts, such as improvements to water quality and sub-tidal habitat, will begin relatively soon after tidal exchange is restored. Other changes, especially those involving vegetation/wetland habitat change and marsh surface accretion, will continue for decades, until the system reaches a state of self-sustainable equilibrium.

Salinity of Surface Waters

The project is strongly influenced by the geographic extent of tidal inundation with saline water, the variable salinities of that water, the frequency and depth of inundation (both during daily cycles and infrequent storm events), and the volume of tidal water (i.e., tidal prism) moving in and out of the estuary. Existing conditions within Wellfleet Harbor include salinity ranges between 30 and 32 part per thousand (ppt). Construction of the Chequessett Neck Road Dike has limited upstream mean tide range to only 2.2 feet compared to 10.3 feet downstream of the dike. Because of this altered hydrology, saline waters during high tide currently extend 1.2 miles upstream of the dike. Monitoring data between 2006 and 2010 conducted by the Seashore confirm that waters within the upper estuary are consistently fresh, with other data documenting that saline waters never reach High Toss Road during normal tides.

Under the Preferred Alternative, the predicted mean high spring tide water surface elevation of approximately 5.6 feet in the Lower Herring River will restore tidal influence to approximately 890 acres of the former Herring River floodplain. High salinity water will consistently reach the Lower Herring River, Middle Herring River, Lower Pole Dike Creek, and Mill Creek sub-basins, and the eastern half of the Duck Harbor sub-basin, while salinity levels will remain low (generally below 5 ppt) in the upper portions of the Herring River, Bound Brook, and Upper Pole Dike Creek sub-basins. These salinity changes will result in permanent, estuary-wide changes in the penetration of high salinity water into lower and mid-floodplain sub-basins, critical to achieving the desired transition from a degraded freshwater wetland to a functioning estuarine wetland.

Water and Sediment Quality

The Herring River is designated a Class SA water (the highest coastal and marine class) under the Massachusetts Surface Water Quality Standards (314 CMR 4.00) requiring excellent habitat for fish, other aquatic life and wildlife, and primary and secondary recreation. The Herring River is also designated by the Commonwealth as an Outstanding Resource Water (ORW) (314 CMR 4.06(3)). The Herring River estuary does not meet its targeted designations under Massachusetts' regulations due to its degraded water quality conditions. These degraded water quality conditions have resulted in the Herring River being listed on the 303(d) list of impaired waters under the federal Clean Water Act (CWA). The Herring River segment between Herring Pond and High Toss Road is impaired for metals and pH, while the segment from south of High Toss Road to Wellfleet Harbor is impaired for pathogens.

The results of various research efforts, data gathering and monitoring were presented to characterize existing water and sediment quality within the project area. The draft EIS/EIR indicates that the Herring River currently suffers from low dissolved oxygen concentrations, highly acidic water resulting from the oxidation of organic matter and iron-sulfide minerals in salt marsh soils, increased dissolved iron concentrations in locations with the lowest rates of flushing, and dissolved aluminum concentrations above levels of concern within some portions of the estuary all resulting in degraded water quality. The draft EIS/EIR also notes the accumulation of nutrients within the Herring River due to a lack of tidal flushing. While pesticides were used historically within the system for mosquito control, samples analyzed did not exceed NOAA guideline values. Finally, high fecal coliform concentrations (likely from wildlife in the estuary and watershed) have kept the Herring River downstream of the dike permanently closed for shellfishing in some parts and only conditionally approved in other parts.

Under the Preferred Alternative, the project is expected to reduce system residence times upstream of High Toss Road by a factor of 33 (4801 hours vs. 144 hours), resulting in regular tidal flushing of the Herring River estuary with well-oxygenated water from Wellfleet Harbor. This is expected to maintain dissolved oxygen concentrations above State water quality standards at all times. However, summertime dissolved oxygen levels could remain low in ponded areas and obstructed ditches that are not regularly flushed by tidal waters. Tidal flushing is also expected to reduce acidification within the mid-portion of the Herring River estuary where saline water will again saturate drained peat. Restored salinities will reduce the leaching of aluminum and iron from the soils to receiving waters in concentrations that stress aquatic life. Decreased decomposition and increased saturation of soil pore spaces with water will also prevent further subsidence of the marsh surface. Improved tidal flushing will dilute and remove nutrients from the system with each tide cycle and the gradual reintroduction of tidal exchange is expected to allow ammonium-nitrogen to be slowly released, avoiding nitrogen loading that could contribute to algal blooms in receiving waters. Fecal coliform concentrations are also expected to substantially decrease with regular tidal flushing and will likely allow for the removal of the Herring River from the 303(d) list for pathogens.

Sediment Transport and Soils

When the Herring River was diked, sediment transport processes were interrupted and both the salt marsh and the underlying peat began to subside. Opening the dike and increasing tidal exchange will mobilize sediment that has accumulated within the existing channels as a natural tidal channel system begins to re-establish itself. Restoration of sediment transport processes will enhance accretion of sediment on subsided marsh plains, restore the dimension and pattern of tidal channels, and potentially influence ecological processes and resources. Changes in the tidal water surface elevation in the estuary, along with the subsidence of the marsh surface during the last 100 years, will be monitored to ensure a successful transition back to a salt marsh within healthy vegetation. The draft EIS/EIR identified the various types of soils within the project area, as determined and classified by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS). Approximately 80 percent of the Herring River floodplain is comprised of hydric soils.

Sediment transport analyses of the existing system found that normal tidal flow velocities are sufficient to initiate sediment movement, but only in the vicinity of the Chequessett Neck Road Dike. The study also confirmed that the system is flood-dominant; meaning that net transport of the sediment is into the Herring River. The dike has also caused a substantial reduction in flow velocity during flood tides in the area immediately downstream of the dike (as compared to pre-dike conditions), which likely has resulted in settling and deposition of suspended sediment during the slack flood tide in this area. Tidal restrictions have adversely affected the process of sediment deposition on salt marshes within the estuary. The construction of the Chequessett Neck Road Dike in 1909 reduced the upstream transport of inorganic sediment from reaching the salt marshes within the basin and marsh drainage has increased the rate of organic peat decomposition by aerating and drying the sediment, causing soil pore spaces to collapse and marsh elevations to subside. Much of the former salt marsh surface is approximately one to three feet lower than the mean high water elevation of 4.8 feet in Wellfleet Harbor.

The Preferred Alternative will enhance sediment transport throughout the Herring River estuary. Three classes of sediment transport are anticipated to occur: bedload, suspended load, and suspended fines. In response to increased tidal flow, the fine sediments that have accumulated in the tidal channels upstream and downstream of the dike will be temporarily mobilized as suspended load and suspended fines. Over a longer period, bank and bed erosion will increase the dimensions of the restored tidal conditions. Finally, the increased tide gate opening will alter the long-term sediment transport patterns in the marsh, providing a source of marine sediment to the marsh surface.

The draft EIS/EIR describes the potential project impacts of sediment transport on changes to tidal channels and marsh elevations and identifies the three sources of sediment as inorganic matter from Wellfleet Harbor, upland sediment sources, and organic matter. While the rate and depth of sediment accretion cannot be quantified with certainty, the Preferred Alternative will increase the areas of potential sediment mobilization upstream of the Chequessett Neck Road Dike during normal tidal conditions to 58 acres and to approximately 217 acres under 100-year storm conditions. This is substantially greater than the 0.1-acre of potential sediment mobilization under existing conditions. Areas of increased erosion upstream of the dike will be mostly confined to the future location of a more defined Herring River Channel. Areas of potential sediment mobilization downstream of the dike during normal tidal conditions will increase by 75 percent (98 vs. 56 acres) over existing conditions and by 50 percent (230 vs. 153 acres) during 100-year storm events. Sediment mobilization may also pose potential adverse impacts in the form of sedimentation of shellfish beds downstream of the dike.

The project will result in estuary-wide, beneficial changes to hydric soil types within the floodplain by increasing pore space, soil pH, and organic content as the soils are subjected to tidal inundation. Local changes in soil texture are also possible dependent upon the different erosional and/or depositional forces placed upon varying soil types. Widespread change to existing soils from freshwater non-tidal soils to estuarine sub-tidal and inter-tidal soil types will occur over the adaptive management period.

Wetland Habitats and Vegetation

The draft EIS/EIR included a summary of current wetland habitats and vegetation within the Herring River floodplain based upon vegetation mapping conducted by the Seashore. Typical vegetation within six separate vegetation classes were identified and mapped as part of the draft EIS/EIR. Vegetation cover type categories include: salt marsh, brackish marsh, freshwater marsh/meadow, shrublands, woodlands, and dune/heathlands. Sub-tidal/open water and developed areas were also identified as part of the existing conditions analysis. The project's potential impacts to wetland resource areas regulated in accordance with the Massachusetts Wetlands Protection Act and Section 401 of the CWA were also provided. The draft EIS/EIR included a detailed discussion of wetland resource areas present within the project area, applicable performance standards, the types of activities proposed in each wetland resource areas, and how the proposed activities meet these performance standards or criteria. As noted previously, a variance will be required from MassDEP for certain components of the work, as the project cannot meet all of the applicable performance standards or approval criteria as defined by the Wetlands Protection Act or Section 401 of the CWA and the Massachusetts Surface Water Quality Standards. The draft EIS/EIR discussed how the project intends to meet the criteria established by MassDEP for each variance process. While general estimates were provided regarding project impacts to wetland resource areas (detailed throughout this Certificate), wetland impact estimates related to secondary restoration activities and floodproofing have not yet been determined. These impacts will be assessed upon further project design, AMP implementation, and land owner consultations.

Re-introduction of tidal flows within the Herring River estuary will result in the widespread restoration of degraded coastal wetlands to estuarine sub-tidal and inter-tidal habitats. The draft EIS/EIR provided a thorough analysis and discussion of the predicted changes in vegetation cover type for each sub-basin. Under the Preferred Alternative, approximately 873 acres of existing vegetated area will be affected by the mean high water spring tide. Many changes in wetland habitat and vegetation will occur in conjunction with the project, notably the extensive restoration of salt marsh vegetative communities, primarily in the Lower Herring and Middle Herring River, and Lower Pole Dike Creek sub-basins. Due to the low salinity levels expected in the upper reaches of the system, little if any salt marsh vegetation will colonize the Upper Herring River, Upper Bound Brook, and Upper Pole Dike Creek sub-basins. Wetter conditions driven by tidal forcing with periodic influxes of brackish water may cause some degree of vegetation change, favoring certain types of wetland species over upland species. Within the Duck Harbor and Lower Bound Brook sub-basins salt marsh species are expected to colonize marsh areas adjacent to tidal channels and in some areas extend landward across the marsh surface. A wetland-to-upland transition zone (between the mean high water spring tide and the AHW tide elevations) is anticipated along the landward periphery of most of the upstream sub-basins. Subsided, former salt marsh areas within the Middle and Upper Herring River, Lower and Upper Pole Dike Creek, Duck Harbor and Lower Bound Brook sub-basins will be subject to sediment accretion and thus support a mix of salt marsh, brackish, and tidal freshwater plant communities. The draft EIS/EIR discussed the project's impacts on existing stands of common reed (*Phragmites australis*), a non-native invasive plant, and the potential for areas of common reed to shift within the estuary as tidal restrictions are removed. Invasive species management is a key component of the adaptive management plan proposed for the project.

Aquatic Species/Fisheries

The draft EIS/EIR summarizes inventories and wildlife observations describing the aquatic fauna existing within the Herring River estuary, and where appropriate, the receiving waters of Wellfleet Harbor. According to the draft EIS/EIR, the estuary downstream of the Chequessett Neck Road Dike is characterized by estuarine species that are dependent on marine conditions, while the abrupt change in salinity and tidal flushing in the Lower Herring River basin between the dike and High Toss Road results in a dramatic change in species richness and abundance, with species more tolerant of lower salinities becoming most dominant. Upstream of High Toss Road only freshwater or anadromous/catadromous species are found. The draft EIS/EIR lists the types and abundance of estuarine finfish, macroinvertebrate, and anadromous and catadromous fish species, and shellfish within the Herring River estuary.

The project is expected to have positive long-term benefit on finfishing and shellfishing within the estuary. The draft EIS/EIR described the existing conditions of the shellfishing industry, limitations on commercial and recreation harvesting, and aquaculture. Four commercially important species were identified: northern quahog (*Mercenaria mercenaria*), eastern oyster (*Crassostrea virginica*), bay scallop (*Argopecten irradians*), and softshell clam

(*Mya arenaria*). Currently, shellfishing is prohibited in a 90-acre area immediately downstream of the Chequessett Neck Road Dike and within the Herring River due to poor water quality caused by fecal coliform bacteria. Finfishing is an important commercial industry and recreational activity, with bluefish (*Pomatomus saltatrix*) and striped bass (*Morone saxatilis*) as the two predominately fished species in Wellfleet Harbor. Estuaries provide habitats for finfish to spawn and grow, with many species dependent upon estuarine conditions for at least some stage of their lifecycle.

The Preferred Alternative will change the Herring River estuary from a largely freshwater system to a largely tide-influenced system with saline waters extending much farther upstream than existing conditions. Total estimated estuarine habitat under the Preferred Alternative will be approximately 878 acres. Areas upstream of the dike where salinity penetrates are expected to experience an increase in diversity and population of resident estuarine fish species. More habitat will be available for spawning of certain species, with the exact amount of habitat available dependent upon accessibility within the system. Freshwater fish species habitat will be reduced in the lower sub-basins; however, in the upper basins improved water quality and levels are expected to benefit these species. The new dike will benefit all species of anadramous and catadramous fish, including river herring, hickory shad, white perch and American eel through better fish passage, while improved water quality and salinity levels will increase the amount of nursery habitat for juvenile fish. The project will also directly and indirectly benefit commercial and recreational finfishing improvements to habitat and water quality.

The increased salinity levels will improve conditions for shellfish to recolonize the area. Softshell and hard clams will likely be able to colonize areas upstream of the dike within their preferred salinity ranges. It is unlikely that oysters will establish themselves naturally upstream of the dike, unless the bottom substrate of the river hardens naturally with restoration. The mobilization of sediment during tidal restoration erosion processes is not expected to negatively impact softshell and hard clams; however, oysters may be temporarily impacted by fine grain sediments flushed out of the Herring River. The draft EIS/EIR indicated that sediment transport processes in Wellfleet Harbor are far more dependent on tidally-driven forces in Cape Cod Bay then whatever forces may be exerted by a new, larger tidal opening at the Herring River. Therefore, there are no long-term negative impacts to aquaculture resources in Wellfleet Harbor expected in association with the project.

Rare Species

The draft EIS/EIR identified six State-listed wildlife species within the project area that are currently listed as rare, threatened or endangered by the Natural Heritage and Endangered Species Program (NHESP) and regulated in accordance with the MESA. These wildlife species include: three birds, American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), and northern harrier (*Circus cyaneus*); two reptiles, diamondback terrapin (*Malaclemys terrapin*) and eastern box turtle (*Terrapene c. Carolina*); and one invertebrate, water-willow stem borer (*Papaipema sulphurata*). The draft EIS/EIR described each of the aforementioned protected species as well as their current status within the Herring River estuary.

According to the draft EIS/EIR, restoration of the Herring River estuary will likely affect State-listed species and their habitats, although not all impacts will be adverse:

- **Northern Harrier**: while small habitat changes may occur in the Bound Brook sub-basin where nesting pairs have been recorded, these changes are not expected to hinder future nesting activities. Areas suitable for harrier nesting will remain unchanged or may increase. The project will provide improved habitat for foraging.
- **American Bittern and Least Bittern**: while these species primarily use freshwater marsh habitats, they both also use brackish marsh habitats. Existing foraging, resting, or migratory habitat for these species will be affected or shifted by project.
- **Diamondback Terrapin**: while these species may be temporarily affected during the dike construction process, over the long-term the project is expected to restore hundreds of acres of nesting, nursery, wintering and foraging habitat in the Lower Herring River, Mill Creek, Middle Herring River, Lower Pole Dike Creek sub-basins and portions of the Duck Harbor sub-basin (up to 30 times more habitat than existing conditions).
- **Eastern Box Turtle**: the project will restore more saline and/or wetter conditions in areas that have dried out subsequent to construction of the dike. As conditions gradually change through incremental restoration of tides, turtles are expected to move to adjacent uplands. Turtles may be restricted in movement throughout the estuary in comparison to existing conditions, and will likely move to the periphery of the project area into upland areas. Turtles may be displaced from up to 890 acres influenced during mean high spring tide.
- **Water-Willow Stem-Borer**: this nocturnal moth feeds almost exclusively on water-willow (*Decodon verticillatus*), a plant species with a low tolerance to frequent inundation by salt water. The project will affect the distribution of water-willow within the estuary's ecosystem, and may die off in certain sub-basins and increase in others. The project is not expected to have a negative impact on the regional population of the Stem-Borer.

Terrestrial Wildlife

According to the draft EIS/EIR, over 450 species of amphibians, reptiles, fish, birds, and mammals depend on the diversity of upland, wetland, and coastal ecosystems found in the Seashore and nearby environs. Depending on the species, the Seashore may provide habitat all year round, or only during nesting season, migration, or winter. The draft EIS/EIR identified known species and described suitable habitat for freshwater marsh birds and upland birds, salt marsh birds, mammals, reptiles and amphibians. Much of these data were derived from ongoing Seashore monitoring and surveying efforts.

The project will result in habitat changes that will affect the distribution of terrestrial wildlife. Mammals, reptiles, and amphibians will gradually relocate to suitable habitat as the estuary undergoes the expected transition from degraded freshwater wetland to functioning estuarine wetland. No significant adverse impacts on regional populations are anticipated. There will be a substantial change in the composition of birds species that use the area for nesting, foraging, migration, etc. based upon the corresponding changes to vegetation associated within the floodplain. Changes in avian community structure include an overall increase in species abundance and a shift from a community of generalist species to one dominated by waterfowl, shorebirds, and wading birds.

Archaeological and Historic Resources

Archaeological resources in the project area were assessed through a combination of archival research, site file research, and walkover surveys. The draft EIS/EIR included a summary and characterization of pre-contact Native American, contact, and post-contact Euro-American archaeological sites. These resources were used to document known archaeological resources within the Herring River restoration areas and to identify areas where unknown archaeological resources may exist. This information, in combination with predictive models developed for archaeological resources elsewhere in the region, were then used to plot areas of archaeological sensitivity within the area of potential effect (APE). The APE is the geographic area in which an undertaking may cause changes in the character or use of historic properties, as defined under Section 106 of the NHPA. For this project the APE is defined as areas in the estuary below the 10-foot contour elevation, and certain upland areas where project impacts may occur, such as areas around CYCC, the Chequessett Neck Road Dike, and several low-lying roads including High Toss, Bound Brook Island and Pole Dike Roads. Potential impacts to archaeological resources will be primarily associated with the footprints of construction activities, as well as any other ground-disturbing activities, including borrow or construction staging areas.

According to the draft EIS/EIR, the APE was investigated by the Public Archaeology Laboratory in 2011; however, significant archaeological resources have yet to be identified pending final project design, and steps to identify, evaluate, and mitigate any adverse effects to significant properties are currently being developed in a Programmatic Agreement (PA) among consulting parties.

No structures located in the Herring River estuary are listed in the National Register of Historic Places. However, according to the draft EIS/EIR, a former tidal gristmill once spanned an historic dike at Mill Creek. Additionally, the Atwood-Higgins House, listed on the National Register in 1976, and other buildings associated with the house lie within 100 meters of the APE in the area associated with the restoration project near the confluence of Bound Brook and the Herring River on the eastern tip of Bound Brook Island. Other historic structures may be identified and evaluated as the extent of the project impacts are finalized; steps necessary to identify and evaluate historic structures in the APE will be defined in the PA currently under development.

Low-Lying Properties and Roads

According to the draft EIS/EIR, approximately 390 non-federally owned properties lie partially or fully within the Herring River floodplain that existed prior to the construction of the Chequessett Neck Road Dike. These properties include residential land, parcels owned by non-profit organizations, non-federal conservation land, commercial parcels, municipal lands, and undeveloped land. In total, these parcels cover approximately 354 acres within the Herring River floodplain. Residential properties are primarily located in the Upper Pole Dike Creek, Mill Creek, and Bound Brook sub-basins. As noted previously, the CYCC nine-hole golf course is located on approximately 106 acres, with approximately 37 acres of this land located within the historic floodplain of the Mill Creek sub-basin.

In the Preferred Alternative, all or portions of CYCC golf holes 1, 6, 7, 8, and 9 and the practice areas will be impacted by tidal waters and require modifications to avoid flooding. The Preferred Alternative includes implementing Option 2 at the CYCC, which includes retaining the current layout of the course, but elevating the low-lying golf holes, and relocating the practice area to an upland site that will also serve as the borrow area for the fill needed to elevate the low fairways. The current practice areas and the area between fairways 7 and 8 will be restored to a tidal wetland. The Preferred Alternative is expected to result in approximately 360,000 sf (8.3 acres) of direct wetland loss by filling the low areas.

The Preferred Alternative will also impact low-lying residential properties with varying degrees and frequencies. The draft EIS/EIR noted that hydrodynamic modeling results, aerial photography, topographic and ground survey data, and property records from the Town's assessor's databases were used to compile a preliminary list of privately owned properties potentially affected by the proposed increased tidal exchange. Properties were categorized based on the frequency of tidal water reaching the property and the nature of the land or structures impacted. The draft EIS/EIR included a description of each of these categories. These categories include:

- No physical impact;
- Infrequent Impact to Natural Vegetation;
- Frequent Impact to Natural Vegetation;
- Infrequent Impact to Cultivated Vegetation;
- Frequent Impact to Cultivated Vegetation;
- Infrequent Impact to Structures; and
- Frequent Flooding to Structures.

The draft EIS/EIR also identified potential jurisdictional changes to low-lying land uses due to physical changes within the Herring River estuary. These laws and regulations include the Wellfleet Zoning Bylaw, the Massachusetts Wetlands Protection Act and local wetland bylaws, and the Massachusetts Rivers Protection Act. Such jurisdictional changes may result in a reduction in lot sizes, new requirements for wetlands permitting, or the applicability of new wetlands regulations and performance standards. The draft EIS/EIR includes a summary table of potentially affected parcels based upon the various alternatives and impact categories. The Preferred Alternative will physically affect 179 parcels, with 11 of those parcels subjected to frequent impacts to structures, and nine parcels with infrequent impacts to structures.[3] Additionally, 169 parcels will not be physically impacted by water, but will be affected by a change in the location of the jurisdictional Riverfront Area.

Properties with predicted substantial impacts will require additional site-specific analysis to confirm and refine potential impacts and to develop cost-effective flood mitigation measures. According to the draft EIS/EIR, these measures generally could include: elevating or relocating driveways and landscaping, moving wells, building small berms or flood walls, moving or elevating structures, and compensation for lost value or voluntary sale of easements or other interests in land. The HRRC contacted potentially affected landowners prior to the release of the

[3] The total of physically affected parcels include physically affected driveways, wells, and buildings; several parcels include multiple affected structures; a total of approximately 29 structures could potentially be affected, of which six are residences.

draft EIS/EIR and offered to meet with owners individually to discuss the project and its potential impacts. A process for formal agreements between substantially affected landowners and the Towns will be developed as part of the third MOU between the Towns and the Seashore outlining the project's path towards implementation.

The project area also includes several segments of low-lying roads within the historic Herring River floodplain that will be susceptible to flooding after tidal exchange is restored. The draft EIS/EIR included the approximate lowest elevation and approximate length within the floodplain for each potentially affected roadway segment. The draft EIS/EIR also identified and characterized each roadway. Affected roadways include: High Toss, Pole Dike, Bound Brook Island, Old Country, Old Chequessett Neck, Duck Harbor and Ryder Beach Roads, and Rainbow Lane.

Output from the hydrodynamic model was used to compare the potential high tide elevations resulting from each of the action alternatives to determine the extent of possible flood impacts. These comparisons were used to develop conceptual plans for road surface elevation and realignment options for several high road segments. The draft EIS/EIR summarizes low-lying road impacts for two categories of roads, paved and sand and fire roads. The Preferred Alternative will impact approximately 9,397 feet of paved roads and approximately 10,727 feet of sand and fire roads. Options to mitigate impacts to these roadway segments include elevation, relocation, culvert replacement or construction, and acceptance of minimal risk. The draft EIS/EIR includes a conceptual discussion of improvements or modifications to Bound Brook Island, Pole Dike Creek and High Toss Roads to mitigate potential impacts from increased tidal inundation and flooding.

Greenhouse Gas Emissions

The Towns considered the contribution of predicted sea-level rise throughout the preparation of the hydrodynamic modeling process that was used to inform the selection of the Preferred Alternative. The project itself is also expected to function as a buffer to climate change, by increasing available wetlands to diffuse storm surges and stormwater runoff.

Construction Period

The Preferred Alternative includes the construction of at least two dikes, relocation or elevation of several roadway segments, installation of new culverts at road crossings in upstream project areas, and filling and relocating portions of the CYCC golf course. Secondary management actions, such as channel dredging and vegetation clearing will also incur construction-related impacts. While the project will be implemented over a long period of time, construction related impacts will be relatively short in duration with short-term impacts to soils, vegetation, water quality, and habitat. Permanent impacts to wetland resource areas are also anticipated in conjunction with the construction of the tide control structures, CYCC improvements, and roadway modifications.

According to the draft EIS/EIR previously disturbed areas will be used to stage equipment and materials to the extent possible. For dike construction, the sites will be dewatered using coffer dams and pumps, or other common methods for dike construction. These short-term disturbances associated with construction (dewatering and staging) may occur on approximately eight acres and will be restored when construction is complete. Individual construction elements are not anticipated to occur concurrently and are likely to be phased in over time. All low-lying roads do not need to be elevated at the start of the incremental tidal restoration and could be delayed or phased throughout the construction period. All construction impacts will be mitigated through the use of best management practices (BMPs). Activities related to residential flood proofing may have direct localized impact, but will be limited in scale compared to the size of the overall project. The exact length of secondary management action construction activities are unknown at this time and will be determined as part of the AMP process.

The Towns will implement time-of-year (TOY) restrictions as necessary to limit potential impacts to certain types of species during various construction phases contingent upon the type of work proposed, the location of the work, and the timing and duration of the activity. The comment letter from the Massachusetts Division of Marine Fisheries (DMF) noted that TOY restrictions will not be necessary in cases in which work is buffered by cofferdams and silt curtains, but installation and removal of these structures should be performed outside the relevant TOY windows. BMPs will also be implemented to reduce impacts to anadramous and catadramous fish passage, shellfisheries, and wildlife.

As the preliminary designs for the new Chequessett Neck Road Dike have not been completed, the draft EIS/EIR provided a broad estimate of construction impacts associated with dike construction. The potential area of construction-related impact is estimated at 103,000 sf (2.4 acres) currently comprised of the dike itself and adjacent inter- and sub-tidal wetland areas. Dike reconstruction and associated dewatering, sub-grade preparation, slope protection, and other work will be confined to this footprint. Impacts will be limited to temporary loss of wetland habitat and short-term increases in sedimentation within waters adjacent to the dike. However, if the Towns decide to increase the elevation of the dike beyond the 11.3-foot crest elevation presently in place, permanent wetland impacts will be incurred to allow for widening of the base of the dike. The draft EIS/EIR noted that preliminary engineering analyses indicate that complete closure of Chequessett Neck Road would substantially reduce construction time and costs for rebuilding the dike. If Chequessett Neck Road is closed for a portion of the construction period, High Toss Road and Duck Harbor Road are proposed as detour routes. To accommodate this traffic, these two roadways will require temporary improvements (surface grading, vegetation clearing).

SCOPE

The FEIR should follow Section 11.07 of the MEPA regulations for outline and content, as modified by this scope. In accordance with the joint MEPA/CCC review of the project, I hereby incorporate the CCC comment letter on the draft EIS/EIR into the Scope by reference. It is my understanding that upon conclusion of the MEPA process, the CCC's Development of Regional Impact (DRI) process will begin.

The FEIR should include an update on additional stakeholder outreach, meetings with permitting agencies, and additional studies undertaken to inform the project's design and advancement towards construction. The FEIR should include a refined proposed Adaptive

Management Plan to provide additional information on the plan's elements and potential action items in light of relevant comments received. The FEIR should identify any changes to the proposed Preferred Alternative since the filing and review of the draft EIS/EIR.

Permitting

The FEIR should provide an update to the proposed comprehensive permitting methodology with State and federal Agencies based upon ongoing collaborative efforts with permitting authorities. The FEIR should provide additional clarification of the proposed permitting review process as requested in the MassDEP comment letter.

Wetland Habitat and Vegetation

As requested by MassDEP, the FEIR should include an estimate as to the amount of salt marsh, based upon the current modeling, expected to expand and how much of the area of *Phragmites* will be converted/lost to this expansion. The FEIR should estimate the amount of *Phragmites* currently present within the Herring River estuary, and graphically identify those areas that under the Preferred Alternative may be susceptible to *Phragmites* colonization due to anticipated salinity levels and other relevant ecological factors.

According to the MassDEP comment letter, portions of the Herring River estuary are under a Coastal Restriction Order pursuant to M.G.L. c.120, s.105. The FEIR should identify those areas subject to the restriction order and discuss how the project will or will not comply with the order's requirements.

CYCC Impacts

A major component of the Preferred Alternative includes the filling of the fairways and relocation of the practice range to an adjacent upland area. While I acknowledge that this project element will occur on private property with the owner's consent, additional clarification is required in the FEIR to fully understand the impacts of this project component to archaeological, rare species and wetland resources. The FEIR should include a graphic (at a legible scale) that identifies the anticipated areas of flooding under the Preferred Alternative within the Mill Creek sub-basin, the location of the fairways slated for filling, and the conceptual location of the proposed borrow area and future practice range at CYCC.

Low-Lying Roads

The FEIR should include conceptual design plans, engineering studies or traffic analyses, as appropriate, to clarify potential wetlands, habitat or other relevant environmental impacts associated with the elevation, relocation, culverting, or abandonment of low-lying roads under the Preferred Alternative. The FEIR should provide additional discussion of preferred mitigation alternatives for each potentially impacted low-lying roadway segment. If possible, the FEIR should discuss the temporal relationship of the incremental tidal-control gate opening to necessary mitigation actions for low-lying roadways. The FEIR should describe potential impacts associated with the use of High Toss Road and Duck Harbor Road as detour routes if Chequessett Neck Road Dike is closed in its entirety during the dike construction period.

Low-Lying Properties

The FEIR should not identify specific properties or individual property owners to preserve privacy. However, the FEIR should provide an update regarding discussions or negotiations with low-lying property owners and the project's potential impacts to these properties under the Preferred Alternative. The FEIR should provide an outline of an anticipated process for formal agreements with substantially affected landowners. This process should consider how mitigation measures may be implemented on-site (i.e., construction of berms, etc.), potential monetary compensation, the potential impacts of sea-level rise, and how unintended property impacts may be assessed. The Towns should consider the requirements at 310 CMR 10.24(5)(6) regarding potential wetland impacts within an ACEC when establishing this process. The FEIR should clarify how the construction of a flapper-gate tide-control structure at Upper Pole Dike Creek may reduce potential impacts to low-lying properties within this sub-basin.

Aquatic Species / Fisheries

Several comment letters were received that focused on the potential project benefits associated with aquatic species and fisheries habitat and populations. These comments also included additional recommendations and guidance to limit potential harmful impacts to these resources, most notably during the construction period. Comments also were provided requesting clarity on potential mitigation measures proposed in conjunction with the project.

The FEIR should include a commitment as part of the project's construction and design plans to adopt the Essential Fish Habitat (EFH) conservation recommendations made by NOAA. The FEIR should identify potential management actions that may be undertaken with regard to potential impacts to shellfisheries if monitoring efforts indicate a negative impact to downstream shellfish beds.

The FEIR should include a commitment by the Towns to work proactively with the DMF to develop construction activity specific TOY staging to minimize impacts to marine resources. The updated construction period impact assessment should commit to maintaining a channel of free-flowing water of sufficient width and depth to permit fish passage during both spring adult migration as well as fall juvenile emigration of diadramous fishes and a minimization of siltation effects during shellfish and winter flounder spawning. The Towns should commit, as part of the FEIR, to consult with DMF as part of the dike design process with regards to diadramous fish passage and construction period BMPs.

Finally, the FEIR should include additional discussion regarding the potential impacts to fisheries habitat within the Herring River estuary directly associated with secondary management actions such as: the removal of upstream culverts, dredging of sediment, and removal of soil berms. Specifically, the FEIR should confirm how the project will seek to meet recommendations outlined in the Atlantic States Marine Fisheries Commission comment letter on the draft EIS/EIR.

Rare Species

The NHESP comment letter indicates that the project may qualify for a MESA Habitat Management Exemption (321 CMR 10.14(11)). However, in order for the NHESP to make a final determination, additional information must be submitted for review. I encourage the Towns to work with the NHESP prior to the preparation of the FEIR to determine the level of additional information necessary to satisfactorily demonstrate that the project will qualify for a MESA Habitat Management Exemption. To the extent practicable, additional information on rare species habitat impacts and mitigation efforts should be presented in the FEIR to assist in the evaluation of how the project will avoid, minimize and mitigate impacts to State-listed species and to inform MassDEP's wetlands variance process.

Archaeological and Historic Resources

As requested by the MHC, the FEIR should include a figure that depicts the APE for the Preferred Alternative in relation to identified historic resources and to portions of the project area identified as archaeologically sensitive. *This figure should not contain sensitive archaeological site locational information.* The MHC has also requested that, once developed, scaled existing and proposed conditions project plans and a draft scope for identification efforts for the Preferred Alternative be provided to all the consulting parties for review and comment. The FEIR should include an updated ancient and historic period archaeological context for the Preferred Alternative impact area that incorporates current data from the MHC's archaeological inventory and from recent archaeological survey reports conducted on federal land that have not been reported to the MHC for incorporation into the State archaeological inventory. Finally, the FEIR should include the Programmatic Agreement and a summary of consultations with consulting parties pursuant to Section 106 of the NHPA.

Construction Period Impacts

Based upon comments received or additional analysis conducted by the Towns, the FEIR should include an updated construction phasing and management plan. This updated plan should also include modifications to proposed construction period BMPs as recommended by federal or State Agencies.

Mitigation/Section 61 Findings

The draft EIS/EIR indicated that an MOU will be developed between the Towns and the Seashore to address advancement of the project up to, and through the construction phases. The FEIR should explain the schedule for development of the MOU, anticipated project components and actions that will be addressed within the agreement (i.e., operations and management of the tidal-control structures, public recreational access, etc.), and if feasible, a draft copy of the MOU.

The FEIR should include a separate chapter summarizing proposed mitigation measures. This chapter should also include draft Section 61 Findings for each State Agency that will issue permits for the project. The FEIR should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation. Given the phasing of build-out, the FEIR should identify development milestones upon which certain mitigation measures will be required to be implemented. I anticipate that the role of adaptive management as part of the project will be incorporated into these draft Section 61 findings with an amount of detail sufficient to satisfy State Agency requirements.

Responses to Comments/Circulation

The FEIR should contain a copy of this Certificate and a copy of each comment letter received. In order to ensure that the issues raised by commenters are addressed, the FEIR should include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended to, and shall not be construed to, enlarge the scope of the FEIR beyond what has been expressly identified in this certificate.

The Towns should circulate the FEIR to those parties who commented on the ENF, to any State Agencies from which the Proponent will seek permits or approvals, and to any parties specified in section 11.16 of the MEPA regulations. A copy of the FEIR should be made available for review at the Wellfleet and Truro public libraries. The Towns should provide a hard copy of the FEIR to each State Agency and Town department from which the Towns will seek permits and approvals. Copies of the FEIR may be provided on CD-ROM, posted on a project website, or through other similar media for review by others on the project distribution list. The Town should discuss distribution and the anticipated comment period for the FEIR with the MEPA office prior to the filing of the document, as per MEPA regulations, the standard comment period on the FEIR (30 days) may not be extended.

December 21, 2012
Date

Richard K. Sullivan Jr.

Comments received:

10/30/2012	Donald H. Thimas
11/01/2012	Massachusetts Historical Commission
11/09/2012	Chequssett Yacht and Country Club
11/09/2012	Kate L. Rensky
11/10/2012	John W. Portnoy
11/11/2012	Barbara A. Brennessel
11/11/2012	Wellfleet Shellfish Advisory Board
11/12/2012	Charles A. Rheault
11/14/2012	Lisbeth W. Chapman
11/29/2012	United States Army Corps of Engineers
12/03/2012	National Oceanic and Atmospheric Administration
12/03/2012	Cape Cod Commission
12/05/2012	Laura Runkel

12/06/2012	Association to Preserve Cape Cod
12/07/2012	Commonwealth of Massachusetts Division of Fisheries and Wildlife – Natural Heritage and Endangered Species Program
12/07/2012	Thomas O'Connell
12/08/2012	Pamela S. Bauder
12/10/2012	Douglas E. Franklin
12/10/2012	Michael Parlante
12/10/2012	Martin Nieski
12/10/2012	Pamela S. Bauder (2nd letter)
12/10/2012	Ashely Fawkes-Sylver
12/10/2012	Robert LaPointe
12/11/2012	Candida P. Monteith
12/11/2012	Friends of the Herring River
12/11/2012	Town of Wellfleet Comprehensive Wastewater Management Planning Committee
12/11/2012	The Compact of Cape Cod Conservation Trusts, Inc.
12/11/2012	United States Environmental Protection Agency, Region 1
12/12/2012	Alfred L. Kraft
12/12/2012	Wellfleet Conservation Trust
12/12/2012	Atlantic States Marine Fisheries Commission
12/12/2012	Laura A. Runkel (2nd letter)
12/12/2012	Gail Ferguson
12/12/2012	Mass Audubon
12/12/2012	USGS S.O. Conte Anadromous Fish Research Center
12/12/2012	Susan Hannah
12/12/2012	Sea Run Brook Trout Coalition
12/12/2012	Commonwealth of Massachusetts – Division of Marine Fisheries
12/12/2012	Massachusetts Department of Environmental Protection –SERO
12/14/2012	Massachusetts Office of Coastal Zone Management

RKS/HSJ/hsj

Correspondence: 1

Author Information

Keep Private: No
Name: Donald H. Thimas
Organization:
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 10/30/2012
Date Received: 10/30/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes:

Correspondence Text

The DEIS/DEIR report on the Herring River Restoration is extensive in its analysis of the alternative approaches to restoring the properties; and the impacts on everything possibly touched by it. I would like to know what the impact to the taxpayers will be for each alternative. The costs to the Nation, Towns, local landowners and local economy must be significant. How can alternative approaches to solving a problem be considered without the financial component?

I may have missed the financial analysis in the many pages of the report, and if so I would appreciate it being identified and highlighted.

In the current economy it is imperative that major, publicly funded projects be sound financially; and that the taxpayers get the best results for their investment.

Thank you.

Correspondence: 2

Author Information

Keep Private:	No
Name:	Kate L. Rensky
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/09/2012	Date Received: 11/09/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

If the dikes at Herring River were put there to control mosquitos in 1909 I believe you said, why would you even try to change that in time when mosquitos are infected with diseases that are incurable. and even if you bought the homes of those people who are affected who are afraid of flooding of their homes or basements cracking, you would never be able to give them enough to purchase another home in the area. Do we really have to save the entire world. Wouldn't this money be better spent fixing what you already have such as buildings, roadways. And why do the fox and the other lowly animals who now inhabit those areas count less than the herring. You have other herring areas on Cape Cod. Go Spend the money on Stoneybrook in S Dennis or the one that dried up in the early 70's in W. Dennis just past Lighthouse beach. People were allowed to build there, you shouldn't mess with their lives to save this area.

Correspondence: 3

Author Information

Keep Private:	No
Name:	John W. Portnoy
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/10/2012	Date Received: 11/10/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

First, I congratulate the HRRC for their monumental work , the excellent summary of environmental issues, and the creative approach to addressing social constraints and concerns.
p. ii, 3. There is a problem with the contention that nitrogen and phosphorus are "excessive" and the suggestion that they could be from fertilized lawns, agriculture (both very limited), golf course, landfill, etc. The most likely source of N is from organic decomposition and retention of N as sorbed ammonium, protected from oxidation (to nitrate) and dissolution by low pH. Similarly, the most likely source for high phosphorus is decomposed organic matter, i.e. drained peat; the phosphorus is retained in the low-organic-content soil in combination with oxidized iron minerals (Portnoy & Giblin, Biogeochemistry 36:275-303, 1997).
p. 43 3rd line from bottom. Should be "Culverts under these low-lying roads would need to enlarged".
p.131 Fig. 3-19, p. 6 3 (Impediments to river herring migration), P. 130 1: Herring spawn in Williams Pond also.
Pp 122, 123 Table 3-9. Why does the word "absent" appear before the common name of some species , i.e. in the first column?
p. 172 Table 3-22. What does "D" designate?
p.189 3. Is the river on the 303(d) list for pathogens, or just pH and metals?
p. 191 2 line 7. Too many "bathymetries".
p. 217 line 2 and Table 4-13. How can salinity be higher on the marsh surface than in adjacent creek channels?
p. 201. 3. The high sulfide concentrations observed in microcosm experiments (Portnoy & Giblin 1997b, Portnoy 1999) were in waterlogged peat from a marsh, not Herring River, that had been diked for many decades and was vegetated with freshwater wetland vegetation and not cordgrass.

Correspondence: 4

Author Information

Keep Private:	No
Name:	Barbara A. Brennessel
Organization:	Wheaton College
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/11/2012	Date Received: 11/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

To: HRRC
From: Barbara Brennessel, Wheaton College
Re: Draft EIS

I am a scientist from Wheaton College in Norton, MA who has worked with Massachusetts Audubon Society (Wellfleet Bay Wildlife Sanctuary) and the Cape Cod National Seashore on research, conservation and management of the diamondback terrapin (Malaclemys terrapin), listed as a threatened species in Massachusetts. My students and I have systematically monitored the Herring River Estuary in the spring and summer of 2011 and 2012 in order to assess the utilization of the Estuary by terrapins.

I have submitted reports to the CCNS as well as the NPS which detail terrapin encounters, terrapin captures and terrapin nesting activity. In short, terrapins are extensively utilizing the area west of the present dike. Female terrapins have also been captured on Chequessett Neck Road, above, and on both sides of the dike. We have seen road mortality each year. In addition, we have confirmed the presence of a few terrapin nests east of the dike. It would thus appear that as the restoration unfolds, there would be increased nesting habitat for terrapins and less road mortality, as terrapins would not need to cross Chequessett Neck Road to find areas to lay their eggs.

Because the salt marsh is an important nursery for hatchling and juvenile terrapins, the addition of salt marsh to the estuary will provide habitat for this critical period in the life of a terrapin.

The restoration will be important for the terrapins of the Herring River Estuary. On behalf of this threatened species, I speak in support of the project.

Correspondence: 5

Author Information

Keep Private:	No
Name:	Barbara Brennessel
Organization:	Wellfleet Shellfish Advisory Board
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/11/2012	Date Received: 11/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

To: HRRC
From: Shellfish Advisory Board, Town of Wellfleet
RE: Comments on Draft EIS

The Wellfleet Shellfish Advisory Board supports the Herring River Restoration Project.
The proposed restoration is important for the health of Wellfleet Harbor and its potential to contribute to the long-term economic sustainability of the commercial shellfishing industry in Wellfleet. There is optimism that the restoration will eventually improve water quality, create more opportunities for shellfishing and expand shellfish habitat east of the current dike on Chequessett Neck Road. In addition, the restoration should result in a better functioning Harbor, which will benefit, in the long-term, aquaculture operations in the waters between the Herring River and the Town pier.

With increased opportunities for shellfish to be harvested in the estuary, the Shellfish Advisory Board has 2 concerns:
1. Management of the fishery: As part of the 1961 Act to create the Cape Cod National Seashore, the Town retained the right to manage the shellfish industry in the Harbor. This right must be retained within any new shellfish habitat that is created by the project. Any new shellfish habitat or harvest areas must remain under the management of the Wellfleet Board of Selectmen, Shellfish Constable and Wellfleet Shellfish Department.

2. Public Access: Shellfish harvesters will require new and continuing access to shellfish beds when they are deemed "open" for shellfishing. Access points must provide for nearby vehicle parking as well as safe entrance to the area, and include a provision to guarantee any necessary relocation of access points should unforeseen circumstances arise. Such access will not only be necessary for the shellfish harvesters, but will also be a requirement for continued recreational use of the River.

Correspondence: 6

Author Information

Keep Private:	No
Name:	Lisbeth W. Chapman
Organization:	Friends of Herring River
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/14/2012	Date Received: 11/14/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

I am on the Board of the Friends of Herring River. Our organization has already submitted a comment. I am writing as an abutter to the Lower Bound Brook section of the restoration. My property is on a hill facing West across the estuary toward Bound Brook Island.

My family built our cottage in (b) (5) [redacted] in 1949. I sold it in 2010. I bought and moved next door to (b) (5) [redacted], to property formerly owned by my Godparents since 1952. Both properties are abutters with low road issues.

My long tenure on the estuary in this location convinces me that the restoration option D is the correct option on which to proceed. I am heartily in favor of the project. As a young teen I was able to watch the wind blow the salt grass in the estuary. Since that time, however, the invasive plants have dramatically reduced the salt marsh as well as my view of the grass. Although we always fall in love with what we have, my memory is long enough to know what the estuary looked like in the late 40s. I will miss the Spring blooming trees and shrubs when the salinization of a restored tidal flow makes our section of the estuary partially inhospitable to some species. Despite this, I want to see a healthy salt marsh restored as far into the Lower Bound Brook Basin as possible. Wellfleet deserves a healthy harbor. Cape Cod deserves a healthy Cape Cod Bay. Not restoring the Herring River in Wellfeet and Truro is not an option. We need to protect and preserve what we have for the greater good of our community and our future.

Correspondence: 7

Author Information

Keep Private:	No
Name:	Ed DeWitt
Organization:	Association to Preserve Cape Cod
Organization Type:	P - Conservation/Preservation

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/06/2012	Date Received: 12/06/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

December 6, 2012

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEPA Office
Holly Johnson, EEA No. 14272
100 Cambridge Street, Suite 900
Boston, MA 02114

Superintendent George Price
Cape Cod National Seashore
Attn: Cape Cod National Seashore and the Herring River Restoration Committee
Herring River Restoration Project, Draft EIS/EIR
99 Marconi Site Road
Wellfleet, MA 02667

RE: Herring River Restoration Project Draft EIS/EIR

Dear Secretary Sullivan and Superintendent Price:

The Association to Preserve Cape Cod (APCC), Cape Cod's nonprofit environmental advocacy and education organization, submits the following comments for the Herring River Restoration Project Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR).

APCC strongly supports the Herring River restoration effort proposed in the Draft EIS/EIR, and was one of the first to call for restoration of this major wetland system in the 1970s. Since then, APCC has actively followed the comprehensive public process that has resulted in the Draft EIS/EIR.

The proposed restoration would substantially reverse 100 years of wetland degradation and adverse ecological impacts that occurred as a consequence of diking the Herring River and the subsequent drainage of a large expanse of the salt marsh. According to the Draft EIS/EIR, the made-made alterations to the Herring River have resulted in:

* Restriction of natural tidal flow to the wetland system.
* The loss of native salt marsh vegetation and an increase in non-native, invasive species.
* The loss of estuarine habitat and degradation of water quality.
* Alteration of natural sediment processes and increased salt marsh surface subsidence.
* Nuisance mosquito production.
* Impediments to river herring migration.

According to the Draft EIS/EIR, restoration of the Herring River will, among other things, accomplish the following desirable benefits:

* Reestablish natural tidal flow, increase salinity and reestablish natural sedimentation patterns within the estuary, to the extent practicable.
* Improve water quality within the estuary and wetland system.
* Improve shellfish and finfish habitat.
* Restore the estuary's ability to function as a nursery for marine animals and to serve as a source of organic matter.
* Remove physical obstructions for migratory fish, including river herring and American eel.
* Reestablish salt, brackish, and freshwater marsh habitats and native plant species in place of invasive non-native and upland plant species.
* Reestablish a more natural control of nuisance mosquitoes through increased tidal flow and improved water quality.
* Create new recreational opportunities.

The Draft EIS/EIR reflects years of exhaustive and thorough study of past and current ecological conditions within the Herring River system, as well as a careful analysis of possible alternatives for the proposed restoration. The identified preferred alternative appears to produce the greatest possible environmental, cultural and recreational benefits while still being attentive to potential impacts to private property and public infrastructure.

While the document provides a highly detailed analysis of the proposed restoration project, there are still unresolved issues relating to likely infrastructure and private property impacts and the identification of appropriate mitigation for those impacts. APCC looks to the Final EIS/EIR for more substantive information on how these outstanding issues will be addressed.

Both the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA) focus on the need and, as stated in the NEPA legislation, the "critical importance of restoring and maintaining" the natural environment. The Herring River Restoration Project emulates the very core of both NEPA and MEPA as the environmental policy of both the nation and the state. Congress specifically found that we, as a society, must restore the natural environment from the impacts of population growth, high-density urbanization, industrial expansion and resource exploitation. The challenge for regulators is to recognize that the Herring River Restoration Project is not the type of project to address as development or even redevelopment, but rather, it is the practical means and measure to restore conditions under which humans and nature "can exist in productive harmony and fulfill the social, economic and other requirements of present and future generations of Americans," again, according to NEPA. The Herring River Restoration Project and similar environmental restoration projects are the very purpose of both NEPA and MEPA. The Herring River project restores and maintains the natural environment.

Thank you for the opportunity to comment.

Sincerely,

Ed DeWitt
Executive Director

cc: Cape Cod Commission

Correspondence: 8

Author Information

Keep Private:	No
Name:	Douglas E. Franklin
Organization:	Herring River, annual herring count
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/10/2012	Date Received: 12/10/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

December 7, 2012

Cape Cod National Seashore
Herring River Restoration Project, Draft EIS/EIR
99 Marconi Site Road
Wellfleet, MA 02667

Re: Comments, Draft Herring River Environmental Impact Statement

Sir,

I support the restoration of tidal flow to the Herring River estuary.

In 2005, as a member of the Natural Resources Advisory Committee of the Town of Wellfleet, we dedicated a separate chapter of the Harbor Management Plan to a discussion of the importance of restoring tidal flow to the Herring River. Seven years later, I am pleased to see more verbiage supporting the same objective. I assume this means progress (although if I were a herring returning to my native Wellfleet grounds, I would not find that my journey up the Herring River has become any easier).

In general, after reviewing the HR Restoration Draft EIS, I am concerned that continued weakness in our national economy, political stalemate in Washington, DC, and the inability of state or local resources alone to fund the restoration may render the options proposed as "dead on arrival".

Realistically, I believe that we must step back and look more closely at what positive restoration objectives can be achieved through manipulation of the existing dike and tidal gate structure. I certainly understand that research indicates that full restoration cannot be achieved utilizing the current opening, but I do believe a concentration on the structure presently existing offers the best opportunity, right now, to achieve some positive changes in the river while the federal government works to restore its fiscal health and the national economy, perhaps, rebounds. In essence I suggest a renewed look at a phased opening/removal of tidal gates as a "Phase One"of the larger restoration of the estuary. As the gates are manipulated, leading to full flow thorough the opening over3-5 years, there will be opportunities to test and study, on a small scale, the environmental changes so well discussed in the draft EIS. Federal review and the congressional appropriation process on the larger restoration can occur simultaneously with this Phase One undertaking.

Accordingly, I recommend that the draft EIS be amended by adding a supplemental chapter further identifying and evaluating environmental concerns associated with a Phase One-all possible manipulation of existing tidal gate apparatus option over 3-5 years. Upon completion of such "mini-restoration", we can evaluate where we are, what expected (and unexpected) changes have occurred, and how what we've learned should affect the next steps in the ultimate restoration.

I have two last concerns:-

What permanent or temporary modifications can be made to the current dike to assist the migration of herring in the Spring of 2013? The population of river herring in New England has dramatically decreased and it is important that all steps be taken to enlarge each year's class in the Herring River while we are discussing restoration options, lest we find, upon completion of the restoration, there are no herring to return.

As evidence of a community commitment to the ultimate restoration of the HR estuary, I think a major removal/adjustment/construction aspect of the dike apparatus should be undertaken in CY 2013. The longest journey starts with a single step - we need to take that step soon. I am concerned that the length of time associated with the design of a restoration strategy has reduced the community's awareness of the benefits of restoration, and a new comprehensive public education program will be necessary.

Thank you for the opportunity to respond to the draft EIS.

Sincerely,

Douglas E. Franklin

Natural Resources Advisory Board, Wellfleet, 2002-2005, former member and chair.
Herring River herring counter, 2008-present.

Correspondence: 9

Author Information

Keep Private:	No
Name:	Candida P. Monteith
Organization:	BB&N
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/11/2012	Date Received: 12/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

I am a concerned part time resident of Truro and have seen the effects of salt water killing a fresh water marsh in my immediate neighborhood, on Mill Pond Road and nearby on Old County at Phat's Vally where the Railroad dike broke through. I have several issues with the Herring River Restoration that have not been adequately addressed.
1. Many animals and plants will die, including five animals on the state-listed Rare, Threatened, and Endangered Species including American Bittern, Least Bittern, Northern Harrier, Eastern Box Turtle, Water-Willow Stem Borer, and Diamondback Terrapin.
2. The smell from this death lasted four years at least.
3. The visually ugly, dead trees are still there ten years later.

4. All the blueberry bushes that lined Mill Pond Road died and never have come back creating a dead decaying landscape. The Herring River Estuary flooding will result in the same broad impact of the loss of beneficial vegetation, such as, blueberry bushes that lined Mill Pond and Old county Roads and have never returned, eliminating food for birds, animals and people.

5. Old County Road between Truro and Wellfleet, mentioned in several guide books for bicycle riders as one of the most beautiful rides in Massachusetts, will be flooded and destroyed by the Herring River restoration and will turn into the same ugly, stinking landscape for years as seen on the sites mentioned above. How will that be perceived by tourists and townspeople?

6. AND MOST TROUBLING - The Herring River Estuary Project will open up Wellfleet making it more vulnerable to ocean flooding. We have seen in NY and NJ the devastating effects of the rising sea levels resulting from global warming.

Questions
1. What are the names of the endangered species effected see above.
2. What are the names of the 30 abutters who will have their property impacted? Disclose the

areas of greatest impact! This seems like a very low estimate as I will no longer be able to get from my home in South Truro to Wellfleet on Old County Road if you flood that road (as in your assessment of flooded roads)
4 How are you going to compensate them. Fair market value - by eminent domain? This really should be explicitly addressed soon.
5 Where is the money going to come from? "unfunded" now ? how long will the project threaten the saleability, accessability and safety of private homes before addressing these concerns?
6 Will you go ahead if you don't have money to compensate home owners?
7 Will you be able to defend yourself from the inevitable lawsuits? Indeed, if not, why not reduce the proposed scale of the restoration to a level that will take the majority of private properties out of contention. See alter. D modification (described above*)
8. The seas are rising and the Pamet marsh has changed to a salt marsh in several locations in recent years.

Correspondence: 10

Author Information

Keep Private:	No
Name:	C P. Monteith
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/11/2012	Date Received: 12/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

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Questions
1. What are the names of the endangered species effected see above.
2. What are the names of the 30 abutters who will have their property impacted? Disclose the

areas of greatest impact! This seems like a very low estimate as I will no longer be able to get from my home in South Truro to Wellfleet on Old County Road if you flood that road (as in your assessment of flooded roads)
4 How are you going to compensate them. Fair market value - by eminent domain? This really should be explicitly addressed soon.
5 Where is the money going to come from? "unfunded" now ? how long will the project threaten the saleability, accessability and safety of private homes before addressing these concerns?
6 Will you go ahead if you don't have money to compensate home owners?
7 Will you be able to defend yourself from the inevitable lawsuits? Indeed, if not, why not reduce the proposed scale of the restoration to a level that will take the majority of private properties out of contention. See alter. D modification (described above*)
8. The seas are rising and the Pamet marsh has changed to a salt marsh in several locations in recent years.

Correspondence: 11

Author Information

Keep Private:	No
Name:	Donald J. Palladino
Organization:	Friends of Herring River Wellfleet/Truro MA
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/11/2012	Date Received: 12/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

Publication of the draft EIS/EIR represents a major milestone leading to the restoration of tidal flow to the Herring River Estuary. Friends of Herring River commends the Herring River Restoration Committee for its work and thanks the Towns of Wellfleet and Truro, the Cape Cod National Seashore and cooperating federal and state agencies for their work that resulted in the needed environmental research,
evaluation of impacts and development of alternatives to achieve project objectives.

Friends of Herring River supports the alternative to achieve the maximum practical environmental restoration of tidal marsh while protecting private properties. Specifically we support Alternative D that provides for a new tidal control structure at Chequessett Neck and a dike at Mill Creek that partially restores flow in the Mill Creek Basin.

We also strongly recommend that public access and recreational opportunities be integral to the planning, engineering and design processes and ultimate construction with proper consideration for respect of private property and the protection of natural resources.

Correspondence: 12

Author Information

Keep Private: No
Name: Alfred L. Kraft
Organization:
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/12/2012
Date Received: 12/12/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes:

Correspondence Text

My wife and I own about 3.5 acres and a cottage at (b) (5) [redacted] which will be affected by the opening of the dike for the restoration of the Herring River. We have several concerns about the effect the increased tidal height will have on our property.
1. Will our well be adversly affected.
2. Will our access to our home be limited by seasonal or storm driven high tides.
3. We are planning to retire to that property, and we would like to expand the structure as permitted by town zoning requirements. We are concerned that we may have further limitiations imposed on our use of the propery as the river moves closer to our property line.
4. Will the vegitation that will die off as a result of the increase of salt water be removed from our view. We would not like to have the Herring River look like the Pamet with all the dead trees after the dike was breached there some years ago.
5. Will our real estate taxes increase.
6. We would like to have some signage at the beginning of our driveway which says that this is private property, as there will be increased interest by the public to get access to the Herring River and we want to protect our privacy.

Beyond these concerns, we are and have been for many years, in favor of the restoration of the Herring River.

Thank you,

Alfred Kraft
Madalon Meany

Correspondence: 13

Author Information

Keep Private: No
Name: Robert E. Beal
Organization: Atlantic States Marine Fisheries Commission
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/12/2012
Date Received: 12/12/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Web Form
Notes:

Correspondence Text

December 12, 2012

George E. Price, Jr.
Superintendent, Cape Cod National Seashore
Herring River Restoration Plan
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, Massachusetts 02667

Dear Mr. Price,

This letter provides the Atlantic States Marine Fisheries Commission's (Commission) comment on the Draft Environmental Impact Statement (DEIS) for the Herring River Restoration Project in Cape Cod National Seashore, Massachusetts. The Commission supports the efforts to restore the Herring River estuary to a more productive and natural condition. Specifically, the Commission believes several of the alternatives could have a positive impact on restoring historically productive habitat for several Commission managed species (e.g., winter flounder, scup, river herring, and alewife), as well as several other important species. While the Commission does not have a preference for a specific alternative, we would like to submit the following information for consideration should the preferred alternative be approved.

Restoring the tidal flow of the Herring River will likely increase the available nursery area and spawning grounds for winter flounder, scup, alewife, river herring, as well as many other species. However, the Commission has some concern about the impact to sensitive habitats that could result from a few of the measures identified in the Adaptive Management Plan, such as the removal of several upstream culverts, dredging sediment to restore natural bottom habitat,

and removing soil berms.
Amendment 1 to the Interstate Fishery Management Plan for Winter Flounder and Amendment 2 to the Interstate Fishery Management Plan for Shad and River Herring provide recommendations to avoid threats to habitats of concern. The recommendations apply to dredging projects that may increase suspended sediments in areas that are particularly critical to the survival of the species. Specifically, the Winter Flounder Amendment 1 and Shad and River Herring Amendment 2 recommend:

? Establish seasonal windows of compatibility for activities known or suspected to adversely affect river herring and winter flounder life stages and their habitats (e.g., dredging, filling, aquatic construction) as well as notify the appropriate construction or regulatory agencies in writing.

? Conduct studies to determine the effects of dredging on alosine habitat and migration; appropriate best management practices, including environmental windows, should be considered whenever navigation dredging or dredged material disposal operations would occur in a given waterway occupied by alosine species.

? Utilizing all state authorities under the Clean Water Act to minimize impairments to winter flounder and their habitats by issuing 401 water quality certifications that minimize sediment resuspension, especially in winter flounder spawning habitats.

? States should strive to maintain water quality in all suitable habitats for all life stages of river herring in all rivers with existing or potential spawning, juvenile rearing and production habitat.

? Successful upstream and downstream fish passage (safe, timely and effective) past anthropogenic barriers (e.g., physical such as dams, weirs, and culverts; and water quality such as thermal and chemical discharges, and in-stream flow alterations such as flow regulation and water withdrawal) is essential for adequate access to and utilization of critical freshwater spawning and larval rearing habitat.

? In rivers with flow regulation (e.g., storage and peak hydroelectric power generation dams), and consumptive water withdrawals (e.g., irrigation, domestic water supply, industrial use) states should strive to maintain in-stream flows at levels that ensure adequate fish passage, water quality and habitat protection for river herring.

? Protection and enhancement of freshwater habitat and adjacent riparian interfaces and buffers is important to ensuring the long-term health and viability of river herring spawning and larval habitat, and migratory corridors.

? Monitor and report on the amount of freshwater habitat opened through upstream passage projects and any associated changes in emigrating river herring abundance associated with improved habitat access.

The ultimate goal for any alternative selected should be to have as free and open a system as possible, given the human dimension constraints. Many of the design alternatives still require some tidal gate design, which is understandable given the need to slowly reintroduce tidal flow in the system. Eventual functions should include as many open links to river tributaries as feasible.

Each of the restoration alternatives will greatly benefit diadromous and estuarine fish habitat, and the system will be far more productive and linked to the marine environment of Cape Cod Bay through Wellfleet Harbor. Thank you for the opportunity to comment on this restoration project.

Sincerely,

Robert E. Beal
Executive Director
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200A-N
Arlington, VA 22201
703.842.0740 ? 703.842.0741 (fax) ? www.asmfc.org

cc: ISFMP Policy Board
ASMFC Habitat Committee
L12-218

Healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015.

Correspondence: 14

Author Information

Keep Private:	No		
Name:	Mark H. Robinson		
Organization:	The Compact of Cape Cod Conservation Trusts	☒	Official Rep.
Organization Type:	P - Conservation/Preservation		

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent:	Date Received: 12/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

THE COMPACT
OF CAPE COD CONSERVATION TRUSTS, INC.
11 December 2012

Herring River Restoration Committee
220 West Main Street
Wellfleet MA 02667

Dear Chairman:
RE: October 2012 Draft EIS
On behalf of The Compact of Cape Cod Conservation Trusts, Inc., I am writing to strongly support the goals and preferred alternatives of the Herring River Restoration Plan. I have worked on land protection and water quality issues in Wellfleet and Truro since 1984. In 1987 I designed the Pamet River Greenway Management Plan for the Truro Conservation Trust.

The Compact strongly endorses the goal of natural habitat restoration in general and the tidal restoration of a salt marsh here at Herring River in particular. Our communities should be proud to be partners in the largest salt marsh restoration effort ever attempted in New England.

The gradual inundation of the Herring River to increased natural tidal flow should enable officials to measure effects in a deliberate manner, both on habitat and private properties. Adaptive management should be pursued as flow increases.

The Compact was founded in 1986 to provide technical assistance to the region's non-profit land trusts and interested watershed organizations. We now provide advice to 22 Cape Cod environmental organizations.

Thank you for the opportunity to comment on this important proposal.

//signed//
Mark H. Robinson
Executive Director

cc: WCT; TCT; CCNS; FHR:To W;ToT; MEPA; CC

Correspondence: 15

Author Information

Keep Private:	No		
Name:	H. Curtis Spalding		
Organization:	Environmental Protection Agency, Region 1	◉	Official Rep.
Organization Type:	F - Federal Government		

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent:	Date Received: 12/11/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
December 11, 2012
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MA 02109-3912

George Price, Superintendent
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, Massachusetts 02667

OFFICE OF THE
REGIONAL ADMINISTRATOR

RE: EPA Comments on the Department of the Interior National Park Service Herring River Restoration Project Draft Environmental Impact Statement/Environmental Impact Report, Wellfleet and Truro, Massachusetts (CEQ# 20120319)

Dear Mr. Price:
In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, we have reviewed the October, 2012 Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for the Herring River Restoration Project in WeiiOeet and Truro, Massachusetts. The DEIS/EIR was prepared by the Department of the Interior National Park Service (NPS) and Herring
River Restoration Committee to evaluate the impacts of tidal restoration in the Herring River flood plain within the Cape Cod National Seashore (CCNS). EPA offered seeping comments to support preparation of the EIS and has served as a cooperating agency and member of the

technical working group on the project since 2009. Our involvement in the project, however, dates back as far as 1994 with our support for the project as a Coastal America Northeast Regional Implementation Team (NERIT) priority when we supported the Coastal America "Resolution to Restore Massachusetts Wetlands." EPA recognizes this project as an exciting opportunity for ecological restoration in New England and as a high priority for the region.
In general we found the DEIS/EIR comprehensive, well organized and informative, and because we had the opportunity as a cooperating agency to review and comment on prepublication drafts of the DEIS/EIR, we have no objections to the project or specific technical comments to offer. Instead, this letter contains recommendations for ongoing public coordination by the NPS and a request for continued involvement in the development of the adaptive management plan protocols for the project.

Over the past 18 years EPA has worked with a number of state and federal agencies to support efforts to restore tidal flows to coastal wetlands across New England. The Herring River project builds upon the success of numerous other ecological restoration projects involving the removal of tidal restrictions including work at the 99-acre Galilee Bird Sanctuary marsh in Narragansett, Rhode Island; the 90-acre Hatches Harbor salt marsh restoration in Provincetown Massachusetts; the 50-acre Sagamore Marsh restoration project in Bourne, Massachusetts; the 193-acre Little River salt marsh restoration in North Hampton and Hampton, New Hampshire; and the Sachuest Point National Wildlife Refuge restoration in Charlestown, Rhode Island. Numerous other salt marsh restoration projects have occurred in New England with many in Massachusetts guided principally by the efforts of the Massachusetts Division of Ecological Restoration, or the NOAA Restoration Center. The Herring River restoration project, however, represents the single largest salt marsh restoration project in New England to date. EPA is pleased to support each of these ecological restoration efforts as they are consistent with broad goals of the Clean Water Act to restore and maintain the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." Clean Water Act Section 101,33 U.S.C. 1251.

Background
The DEIS/EIR describes environmental degradation that followed the 1909 construction of the Chequessett Neck Road dike at the mouth of the Herring River in Wellfleet, Massachusetts. The dike (installed with tide gates) was designed to drain the upstream marsh and reduce salt marsh mosquito populations. The resulting 100 years of tidal restriction and salt marsh drainage did not solve the nuisance mosquito problem and led to severe impacts to the 11 00-acre Herring River estuary. The DEIS/EIR does a good job describing these impacts. They include the loss of salt marsh vegetation, degraded estuarine habitat and water quality (resulting in periodic fish kills), and changes to sedimentation processes (that led to salt marsh surface subsidence). Over time the lack of tidal exchange led to listing the Herring River as an "impaired" water under Section 303
(d) of the Clean Water Act due to low pH and high metal concentrations. The dike also created a significant barrier to the migration of river herring within the estuary. The adverse effects of restricted tidal flow in the Herring River estuary has been extensively studied and documented in scientific literature for more than 30 years. The DEIS also documents how existing roads, residences and other land uses (such as the Chequessett Yacht and Country Club (CYCC))

within the project area might be affected under different restoration scenarios.

As part of the EIS/EIR development the NPS and Herring River Restoration Committee established objectives that would meet the purpose of the project " ... to restore selfsustaining coastal habitats on a large portion of the 1,1 00-acre Herring River estuary in Wellfleet and Truro, Massachusetts." (DEIS/EIR Page 1) The objectives range from reestablishing a natural tidal regime, salinity and sedimentation patterns in the estuary while improving water quality to enhancements of recreational opportunities. All of the alternative scenarios considered in the DEIS/EIR were developed with consideration of these objectives. In all cases the reconnection of the estuary to the influence of the tide, within the limits of existing infrastructure and social constraints, remains the primary objective of the project.

Alternatives

The NPS facilitated a series of interagency discussions to help develop a range of reasonable action alternatives for the EIS. As a result of that process three action alternatives were advanced for consideration. All of the action alternatives would result in improvements to water quality in the Herring River estuary and they target varying levels of ecosystem restoration driven largely by differences in the amount of tidal flow allowed. Alternative A is the no action alternative (retention of the existing dike and tidal restrictions at Chequessett Neck Road). Alternative B includes a new tidal control structure at Chequessett Neck with no dike at the Mill Creek sub-basin (where the CYCC is located). Under this alternative the new flood control structure at Chequessett Neck would be used to limit tidal flooding and flood mitigation measures would be needed in the Mill Creek sub-basin. Alternative C would include the new tidal control structure at Chequessett Neck and a dike at Mill Creek that excludes tidal flow. The dike at Mill Creek would avoid flood impacts within the Mill Creek sub-basin. Alternative D is a slight modification of Alternative C with tide gates at Mill Creek to partially restore tidal flow to the Mill Creek sub-basin. Alternatives B and D include two options to mitigate flood impacts to the CYCC- relocation of portions of multiple low-lying golf holes to upland areas or elevation of affected areas in place.

The NPS and Herring River Restoration Committee identified Alternative D (with elevation of the CYCC golf course) as the preferred alternative. EPA supports selection of this alternative as it would restore tidal exchange to approximately 890-acres of former salt marsh and tidally influenced freshwater and brackish wetland habitats in the Herring River estuary. The project would also dramatically improve water quality conditions in the estuary over time.

Project Design and Adaptive Management

All of the project alternatives incorporate flood mitigation measures to address impacts from increased tidal exchange. The proposed work described in the DEIS/EIR includes raising approximately 8000 linear feet of low-lying roads including several segments of Pole Dike, Bound Brook Island, and Old County roads where they cross the Herring River and its tributaries. Additional engineering studies and traffic analyses are planned to help evaluate these actions and the potential for relocating some of the roads if necessary. The analysis also explains that potential significant adverse flood impacts to private property will be addressed on a property-specific basis and may include restricting the tidal flow at Pole Dike Road with a tide control gate if needed.

We are also encouraged by the NPS and HRRC promise to coordinate with potentially affected private property owners to mitigate flooding impacts to private property and potential impacts to private water supplies. The development of a Memorandum of Understanding (MOU) between the towns and the CCNS is noted in the DEIS/EIR as an important component of the work necessary to advance the project. The FEIS should explain the schedule for development of the MOU and whether it will address potential impacts to private property owners.

Restoration of tidal flows through the construction of a new structure at Chequessett Neck Road is the key component of the project design. The new dike will feature an adjustable tide gate that will allow for an incremental/gradual reintroduction of tidal flow to upper reaches of the estuary. The gradual opening of the tide gates will be part of an adaptive management plan proposed by the NPS and Herring River Restoration Committee to monitor how well the project is meeting established goals.

We found the discussion contained in the opening paragraphs of Appendix C of the DEIS/EIR particularly effective at conveying the underlying concepts of adaptive management as they will relate to this project.
" ... the Herring River project will be implemented by following an adaptive approach to achieve restored tidal conditions through the management of adjustable tidal control gates and the implementation other restoration actions over a period of years. This adaptive approach is designed to minimize risk to property and the environment given current uncertainties about the response of the Herring River system to the restored tidal conditions that have not been experienced in the last I00 years. Such risks necessitate a cautious start, when uncertainty is greatest; monitoring the outcomes of initial (and subsequent) tidal influx will reduce uncertainties regarding how the Herring River system responds to new conditions and allow the restoration project to proceed at a faster rate with greater confidence and less risk of unintended outcomes.

Adaptive management (AM), in the context of natural resources, is an approach for simultaneously managing and learning about the dynamics of resources under management. It is a formal process intended to aid decision making in situations where the outcomes are uncertain and learning is achieved by monitoring the system after management actions are implemented. Learning is targeted specifically at those uncertainties that impede decision-making and, thus, serves to improve our ability to predict outcomes and make better future decisions. "

We support the NPS use of adaptive management as an important tool to foster project success and to promote learning to address uncertainties. We also endorse the use of the adaptive management process as a tool to better inform and engage the public and stakeholders in the restoration process. EPA looks forward to working with the NPS and the Herring River Restoration Committee during the development and implementation of the adaptive management plan and we expect that our involvement will help us address our responsibilities related Clean Water Act permitting for the project in conjunction with the U.S. Army Corps of Engineers.

Conclusion/Rating
Based on our review of the DEIS we have no objections to the project as described and we rate

this EIS "LO-l - Lack of Objections-Adequate" in accordance with EPA's national rating system, a description of which is attached to this letter. We support the NPS focus on the long term and broad environmental goals of the Herring River restoration project and believe the project outlined in the DEIS/EIR will greatly benefit the natural National Seashore and surrounding region. We encourage the NPS to consider our recommendations as it works to develop the FEIS and we look forward to continued work with you as you refine and implement the adaptive management plan for the project.

We appreciate the opportunity to comment on this DEIS/EIR. Please feel free to contact me or Timothy Timmermann, Associate Director of the Office of Environmental Review at 617/918-1025 if you wish to discuss these comments further.

H. Curtis Spalding
Regional Administrator
Attachment
cc:
Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEP A Office
Holly Johnson, EEA No. 14272
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Summary of Rating Definitions and Follow-up Action
Environmental Impact of the Action
LO--Lack of Objections
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred a~ternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.
EO--Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental

quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not
corrcted at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-lnadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have fu ll public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

Correspondence: 16

Author Information

Keep Private:	No
Name:	Laura A. Runkel
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/12/2012	Date Received: 12/12/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

Dear Sir or Madam,

I have concerns about the impact of the HRR project on the shellfishing industry based in Wellfleet harbor. The EIR draft does not contain sufficient information to definitively gauge the danger to this vital and fragile Wellfleet commerce. The impact is discussed in terms of hydrodynamic and sediment models, which project that sediment would not be moved into the Harbor and into the shellfish beds. Are there no precedents for comparisons? Earlier restoration projects might offer more relevant and tangible information. Projections for such models are not sufficient to discount risks. In addition, the EIR draft lacks mitigation and compensation details for all negative impacts, and does not define liable person/agencies. No restoration should be undertaken until more definitive data are added to the EIR and funding for loss of livelihood etc. are defined.

The final EIR needs to more fully describe these details and the process should not proceed until they are in place.
Sincerely yours,

Laura Runkel

Correspondence: 17

Author Information

Keep Private:	No
Name:	Gail Ferguson
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/12/2012	Date Received: 12/12/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
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Correspondence Text

Comments regarding the Draft Environmental Impact Statement/Environmental Impact Report (dated October 2012) submitted by Gail Ferguson on 12/12/12:

When I first began to prepare my comments I realized that I did not really know what sort of comments were appropriate regarding the Draft Environmental Impact Statement (hereafter referred to as: "the Draft"). I am not an environmental scientist, and I am not really in a position to evaluate the relevant science and data. (I will have to accept that the science is adequate as a matter of blind faith in those people who put it all together.) I am, however, a full time resident of Wellfleet, and a person whose property will be affected by the project (if it obtains funding and approvals), and it is from that perspective that I would like to share the following comments and observations:

At the outset I want to particularly mention that my comments reflect my concerns not only for my own property (and my own pocketbook), but they also reflect my concerns for my neighbors' as well. I think that it is important for us all to recognize and admit that this project is not a project that the 300+ affected property owners have themselves requested, or which they necessarily want. The project is not being undertaken to specifically benefit those who will be directly impacted. If we support the project, it is because we appreciate that if the changes which were made to the dike at the Gut since the early 1900's are now reversed and /or corrected, the Herring River estuaries will become a healthier natural environment, primarily benefitting our harbor and its marine life, and thereby benefitting the region as a whole. If it were not for these general benefits to the community, I suspect that many of the potentially affected owners would not care whether the wetland abutting their property contained fresh water or salt water. I suspect also that on some level, many of us would probably prefer that things stay the same, rather than take on the unknown possible risks and stresses that could result from changes to the status quo. (Many of us are year 'round residents who cannot afford additional demands on our time or money. Like others, we are already stretched by rising costs. We don't want to have our taxes go up, and we don't have the time to have to negotiate with some unknown entity to repair the damage to our homes/wells/septic systems. Moreover, we particularly don't want to lose control of our property, in whole or in part ?we purchased our homes for our own comfort and security. That is not to say that we don't expect to be regulated with respect to, as a hypothetical example, doing environmental damage to wetlands?the main issue for most of us, I believe, is that we don't want our peace of mind, our privacy, our budget, or our precious spare time to be put at risk.)

My primary concern about the Draft in its present form has to do with the fact that it does not set out a specific or adequate procedure for what will be done when things go wrong, and when an individual property(s) is damaged. There is nothing set out in the Draft that guarantees something will be done immediately to make things right, so that an affected family or businessman can get back to normal as quickly as possible. Although the plan makes several references to the fact that the project will be monitored, it fails to state in a specific or reassuring way what will be done when the monitoring reveals a serious unanticipated problem. As one of the 300+ affected residents, I want to know, for example, what specific circumstances will cause the monitoring entity (as yet unknown) to reduce saltwater flow. (How many property owners must be affected before action to reduce water levels is taken, exactly how much loss must a single property sustain before things are turned back, will one or more properties be sacrificed before the monitoring results in a prompt and permanent corrective action?) At present there are no adequate guidelines or criteria set out. Without specific criteria and guidelines, "monitor" is just an empty word. Affected property owners need to know now, not three years from now, exactly what will happen if the unexpected does occur (we all know from our own life experience that: "stuff happens"). Affected owners need to know now, not only for our own immediate peace of mind, but also, in the event that one of us finds, for example, that we need to sell our house in the next year, or so. If that were to happen, we would want to be able to point to a specific ironclad writing that would guarantee a potential buyer that things would be taken care of promptly and fully in the event that the project does become a reality. No family wants to risk purchasing an ongoing headache.

A closely related issue concerns the absence of a "mitigation" fund and the fact that property owners have no written guarantee that mitigation will be prompt, painless, and sufficient. (Who really wants to deal with the thought of losing their well, for example? And who has the time to haggle about how fast it is fixed?) From the beginning, when this project was first being discussed by Gordon Peabody and others, I felt that the shellfish grant holders on Egg Island needed to know that if they lost a year or more of product (and all the work that went into planting and protecting that product) as a result of the changes to the dike, they would be fully, fairly, and quickly compensated. ...as no shellfisherman can afford to lose his/her yearly income.

The matter of shellfish loss is, of course, an obvious possibility, and one that has been acknowledged and discussed by the HRRC. There are other kinds of possible losses, however, that are not so obvious, which I have not heard mentioned. For example, I, myself, have different concerns: I make my yearly income by renting cottages on the property that will be affected. If something were to occur that caused my cottages to be not rentable for a summer (the possibility of obnoxious smelly rotting trees because of die-off, or dampness and mold, or worse, came to mind), I would probably be without tenants. I would not even be able to return rental deposits that I had received, because that money is always immediately spent on property taxes and insurance. (I should say that I have recently walked around my property with members of the HRRC committee, and I have been assured that I will be minimally affected since I am at the farthest end of an estuary?and so, I am not as worried as I had been initially about my own situation.) I mention my cottages because they have made me keenly aware that there are probably other not very obvious situations unique to my neighbors that would warrant quick action and financial reimbursement. No individual property owner, in my opinion, should be financially harmed or stressed by this project. Everyone who is ultimately affected deserves the peace of mind (today) that a thoughtful and detailed mitigation plan would provide.

Another worrisome problem raised by the Draft, by what it says and by what it does not say, concerns the possibility that private property owners may find that parts of their property are no longer private because their backyard has became tidal, and therefore open and exposed to recreational fishing or birding (and, possibly even boating) by the general public. I am particularly concerned about the private properties abutting the wetlands in the Upper Pole Dyke sub-basin area, where to my knowledge there is presently no public access or recreational activity. It is my opinion that something should be done to assure homeowners in that area that their expectation of privacy will be acknowledged and protected (by some form of legally enforceable restriction) before the proposed project is approved. No one should suddenly find that they are not able to use their own yard without encountering strangers. * (Please see, footnote below.)

And lastly, I must comment on the matter of real estate taxes, even though that issue does not concern the Draft per se. I believe that no affected property owner should have to pay higher real estate taxes as a result of this project. I have heard HRRC committee members state that our properties will become more valuable (the implication, I assume, being that therefore we should be grateful and supportive). Perhaps that may prove to be true for some people, but in my case the difference between fresh water and salt water would not be noticeable (so I was assured by HRRC), and I will not have an improved view. (The wetland part of my property resembles a swamp, and I am not permitted to alter it. It should not look much different when it becomes 3% salt water.) I am mostly concerned therefore, for other neighbors. I think that, generally speaking, people tend to buy as much house/property as they can afford, and property taxes are a part of any decision to buy. If a homeowner could afford waterfront property they probably would have bought it at the outset. Because of this, any increase in taxes should be experienced by the citizens of the town as a whole, because we all stand to gain if we attain a healthy ecosystem in a place where there had been toxicity. (And, if a handful of owners actually do experience an exceptional increase in the value of their property, I think that their real estate taxes should not be raised until they sell. Increased potential [unrealized] value does not put money in your pocket.)

I would be remiss if I did not finally comment on how impressed I am by the obvious time and talent and expertise that went into preparation of the Draft. I am truly in awe of the people who have brought us all to this point, and those who will continue to work to make this project become a reality. I am pleased to be able to share my comments with them, and I hope that in my own way I have done one small thing to contribute to making this project work out to everyone' s satisfaction.

I thank you for your time and attention to my comments.

Respectfully submitted,

Gail Ferguson

*At present I question whether there is sufficient need to include the Upper Pole Dyke sub-basin in this project, since so many low lying private properties in that area will be adversely affected. I suspect that the environmental benefits gained there would not justify the personal costs. While I do not have sufficient information to speak definitely on the matter at the present time, I plan to try to inform myself in the future about the particular issues confronting owners there. Because my property lies beyond the main Upper Pole Dyke sub-basin, I do not share the same concerns as those whose properties will experience more flooding.

Correspondence: 18

Author Information

Keep Private: No
Name: Heidi Ricci
Organization: Mass Audubon
Organization Type: P - Conservation/Preservation

Correspondence Information

Status: New
Park Correspondence Log:
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Contains Request(s): No
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Correspondence Text

December 12, 2012

Tim Smith
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667

Submitted electronically through the NPS Planning, Environment and Public Comment website followed by hard copy.

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and Environmental Affairs
Attention: MEPA Office
Holly Johnson, EEA #14272
100 Cambridge St., Suite 900
Boston MA, 02114

Via Email: holly.s.johnson@state.ma.us

Re: Herring River Restoration Project Draft Environmental Impact Statement/Draft Environmental Impact Report (DEIS/DEIR)

Dear Secretary Sullivan and Mr. Smith:

On behalf of Mass Audubon, I submit the following comments on the DEIS/DEIR for the Herring River restoration project. Mass Audubon strongly supports the restoration of tidal flow to the Herring River and adjoining wetlands. We are pleased to see the project moving forward through federal, state, regional, and local planning and environmental review processes. Mass Audubon has been following plans for this project with interest for many years and participated in pre-restoration monitoring by carrying out surveys of the avian resources in the Herring River estuary.

We thank the many agencies and individuals who have cooperated with the Herring River Restoration Committee including the Towns of Wellfleet and Truro, the Cape Cod National Seashore, and federal and state agencies who provided assistance with research, analysis, and evaluation of alternatives.

Mass Audubon supports Alternative D, which will maximize restoration of the tidal marsh while protecting private properties. We also support the use of new adjustable tide gates and application of an adaptive management approach with gradual introduction of increased tidal flows, monitoring, and appropriate adjustments based on results.

This is the largest wetlands restoration program proposed to date in Massachusetts. The project's ecological and public benefits include:
? Restoration of up to 900 acres of coastal wetlands and associated functions and values
? Restoration of fisheries, shellfisheries, and wildlife habitat
? Increased habitat for the Diamondback Terrapin, listed by the state as a threatened species
? Improved water quality
? Restoration of native plant communities and reduction in invasive species
? Reversal of ongoing subsidence of peat soils
? Increased resiliency of the wetlands to adapt to sea level rise and provide storm surge protection for surrounding areas
? Reduction in mosquito populations
? Increased recreational access to channels presently filled with vegetation
? Economic values including construction related work, improved fisheries, and increased property values
? Improved aesthetics

Thank you for the opportunity to comment on this important project.

Sincerely,

E. Heidi Ricci
Senior Policy Analyst

cc: Cape Cod Commission
Friends of Herring River

Correspondence: 19

Author Information

Keep Private:	No
Name:	Theodore Castro-Santos
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Organization Type:	F - Federal Government

Correspondence Information

Status: New	Park Correspondence Log:
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Notes:	

Correspondence Text

Although the document recognizes that an important benefit of the restoration project is to enhance fish passage, no details are provided as to why we expect this to work. Culverts and flow control structures are likely to create barriers to movement, either because they generate turbulence, noise, shadows, velocity gradients, or simply zones of high velocity that fish have difficulty passing. The proposed designs appear likely to continue to create barriers to movement of anadromous species like alewife and blueback herring, and also to killifish, sea-run brook trout, and perhaps invertebrates. The threatened diamondback terrapin might also be reluctant to pass these structures. When barriers to movement are present they can become attractive places for predators (including humans), which can further exacerbate the problems for fish passage.

The proposed alternatives all retain some form of tidal control, which it seems will necessarily include generation of some or all of the factors known to create barriers to fish passage. I recognize that the proposed changes represent an attempt to balance various interests, however, it will be important to recognize at the outset that a key objective--provision of effective fish passage--may not be met by these designs. The solution to this will be to include post-construction monitoring of fish passage (preferrably with acquisition of pre-construction baseline data) as part of the adaptive management framework, with an explicit plan to modify and improve fish passage if and when problems are identified. This must be performed at all flow control structures

Correspondence: 20

Author Information

Keep Private:	No
Name:	Susan Hannah
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

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Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Web Form
Notes:	

Correspondence Text

Herring River Restoration Project

I believe: We are in an age of global warming

that will rapidly alter the lives of every person on this

over populated and in many cases over built planet.

There will be a rise in the sea level.

There will be extreme climate changes to deal with.

No doubt there will be many unexpected and unpleasant

surprises that will have a negative impact on much of the population

of this planet earth. I cannot endorse a project such as this during

a time of such uncertainty and flux.

If the human race were to disappear tomorrow the planet would immediately

begin taking back, altering, and reclaiming our footprint.

Nature and climate change are all ready working on the Herring River.

With the sea level rising, storms, and all the other natural events occurring, increasing road heights, new dikes and flood gates seem too speculative.

Once again it is "controlling" nature, redirecting what people all ready redirected.

This seems very myopic.

A huge change is coming without mankind spending millions to imagine they are in

control and repairing anything.

I think the time for this project should have been when the original diking was done, 1909.

All of this is just more tinkering with nature which is readjusting this planet and the Herring River as I write this.

Sincerely,

Susan Hannah
(b) (5) [redacted]

Correspondence: 21

Author Information

Keep Private:	No
Name:	Geoffrey P. Day
Organization:	Sea Run Brook Trout Coalition
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
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Correspondence Text

I strongly support the Wellfleet Herring River Restoration project.

As a fisherman and ecologist, I strongly support Alternative D, the maximum practicable tidal restoration possible. If this restoration is complete, the fish and shellfish, the herring and oysters for which the area is named for and renowned, will benefit. Surely generations of other wildlife, visitors and natives of Wellfleet will also benefit.

As one of the founders of the Sea Run Brook Trout Coalition, I am pleased to think that if and when tidal restoration happens, that sea-run brook trout might be able to take advantage of the increased habitat.

Any restoration of the Herring River will also benefit science by showing what can be done, and studying the impact over time. SRBTC hopes that we can benefit as well, by applying what is learned at the Herring River and applying it in our plans for removing culverts and restoring Fresh Brook, (aka Trout Brook in South Wellfleet) which is a brook known once to hold a population of sea-run brook trout.

Thank you for this opportunity to comment and support the Herring River Restoration.

Sincerely,
Geoffrey Day
Clerk / Treasurer
Sea Run Brook Trout Coalition Corp

Correspondence: 22

Author Information

Keep Private:	No	
Name:	Louis A. Chiarella	
Organization:	National Oceanic and Atmospheric Administration	Official Rep.
Organization Type:	F - Federal Government	

Correspondence Information

Status: New	Park Correspondence Log:
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Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

Mr. George Price
Superintendent
National Park Service
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, Massachusetts 02667

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

DEC 3- 2012

Re: Herring River Restoration Project DEISIEIR

Dear Mr. Price:
We have reviewed the Draft Environmental Impact Statement Environmental Impact Report (DEIS/EIR), dated October 2012, for the Herring River Restoration Project in Wellfleet and Truro,
Massachusetts. The Herring River Restoration Committee (HRRC) and the National Park Service
(NPS) seek to restore coastal habitats by increasing tidal flow in much of the 1,100 acre Herring River estuary. Tidal flow has been restricted in the Herring River since 1909 with the construction

of a dike at Chequessett Neck Road, near the mouth of the river. Other portions of the river have been channelized, eliminating natural river meanders. Anthropogenic impacts and reduced tidal exchange has altered the natural estuarine system and decreased habitat and water quality.

The DEISIEIR describes several proposed alternatives to restore the Herring River system, including the No-Build Alternative, as well as three other build alternatives. All three build alternatives would include the replacement of the inadequate tide control structure at the dike with
two-way adjustable tide gates, but will have different upstream components, depending on the varying levels of tidal flow achieved at the dike. The restoration would be guided by the Adaptive
Management Plan, and would occur incrementally as the adjustable tide gates are gradually opened
through a phased approach. The extent to which the gates are opened must also take into consideration the private properties which have been constructed in low-lying areas of the Herring
River floodplain. Total estuarine habitat is currently limited to 70 acres within the lower Herring River and the proposed restoration alternatives would increase estuarine habitats to a total of 790 to
885 acres. We have participated in the interagency Herring River Technical Working Group and previously provided informal comments on the development of the essential fish habitat (EFH) assessment for the proposed restoration project.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Fish and Wildlife Coordination Act (FWCA) require federal agencies to consult with one another on projects
such as this. Insofar as a project involves EFH, as this project does, this process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation ofEFH assessments and generally outlines each agency's obligations in this consultation procedure. We offer the following comments and recommendations on this project pursuant to the above referenced regulatory process,

General Comments

Herring River downstream of the Chequessett Neck Road dike and the surrounding waters of Wellfleet Harbor are productive habitats that support numerous important living estuarine resources
including federally managed finfish and shellfish, including winter flounder, Atlantic mackerel, bluefish and scup. In addition, a numbe'r of our trust resources utilize the habitats in these areas, including anadromous fish such as alewife, blueback herring and white perch, and shellfish such as
northern quahog, eastern oyster and soft-shell clam.

Restored tidal flow within this area will likely result in benefits to the aquatic ecosystem, in particular, increases in the area of saltmarsh within Herring River. In addition, increased passage
and salinity within Herring River may result in increased use of the area by a variety of federally

managed species. Furthermore, increased tidal flushing will likely help rectify the water quality issues that have resulted in fish kills. Each of the build alternatives will allow for the restoration of salt marsh habitat upstream of the Chequessett Neck Road dike, providing feeding, spawning, and nursery habitats for fish such as winter flounder and scup, and river herring will likely benefit from improved water quality and enhanced upstream access to headwater spawning ponds. However, EFH may be adversely impacted by construction activities such as the installation and removal of cofferdams, and by potential measures identified in the Adaptive Management Plan, such as enlargement or removal of several upstream culverts, dredging of sediments to restore natural bottom habitat, and removing soil berms. We are concerned that the associated noise, obstruction, and turbidity and sedimentation impacts could impact EFH and other trust resources during sensitive life stages.

In-water construction including fill and excavation may result in mortality of benthic species through direct removal or through burial by excavated material. Crustaceans and egg and larval stages of fish may be most susceptible to such impacts. Excavation and other unconfined work such as the installation and removal of cofferdams also have the potential to increase levels of suspended sediment in the surrounding waters, which has been shown to restrict or inhibit habitat use and function, including fish reproduction (Newcombe and MacDonald 1991). High turbidity can impact fish species through greater expenditure of energy, gill tissue damage and mortality (Newcombe and Jensen 1996, Johnson et al. 2008). Furthermore, sub-lethal effects to estuarine fish can include decreased feeding, impacts from lowered oxygen levels, as well as impacts on gills and associated respiratory impacts (Wilber and Clarke 2001). Particularly, egg and larval life stages may be more sensitive to turbidity impacts (Newcombe and Jensen 1996).

Winter flounder eggs and larvae, once present on the substrate, could be directly impacted by elevated suspended sediment deposition (Berry et al. 2004; Johnson et al. 2008). Winter flounder spawning occurs in estuaries and rivers over fine sand, mud, and silty-clay bottom (Collette and Klein-MacPhee 2002). Eggs are demersal, adhesive and stick together in clusters (Pereira et al. 1999). Confining sediment producing work may minimize some of these impacts, particularly for early life stages.

Anadromous fish such as river herring may also be adversely affected by noise, turbidity and physical obstructions which can disrupt passage, particularly during spring and fall migrations. Suspended sediments can clog and hann the gills of fish, degrade or eliminate spawning and rearing habitats and impede feeding which negatively affects the growth and survival of anadromous species (US EPA 2003; Johnson et al. 2008). Elevated suspended sediments have also been shown to disrupt the schooling behavior of migratory fish (Wildish and Power 1985; Chiasson

1993) and should be avoided during periods of seasonal spawning runs.

Adverse impacts to shellfish resources may result from elevated levels of suspended sediment that
can interfere with spawning success, feeding and growth (Wilber and Clark 2001). Anthropogenic
disturbances have been recognized as a contributor to the reduction in oyster stocks (reviewed in Coen et al. 1999). Shellfish provide an important ecological role through water column filtration,
sediment stabilization as well as supplying habitat for estuarine species (Zimmennan et al. 1989, Newell 2004). Shellfish are also known to provide a food source for federally managed species, including winter flounder and scup (Steimle et al. 2000), two species with EFH designation in the
project area.

Essential Fish Habitat Conservation Recommendations
Herring River and Wellfleet Harbor are designated as EFH under the MSA for a variety of species
including winter flounder, windowpane flounder, white hake, pollock, bluefish, Atlantic butterfish,
Atlantic mackerel, scup, spiny dogfish and summer flounder. As described above, the proposed project would adversely affect EFH by increasing suspended sediments and potential fill and excavation within intertidal and subtidal habitats.

We recommend pursuant to Section 305(b)(4)(A) of the MSA that you adopt the following EFH conservation recommendations:
1) Cofferdams should be used to isolate in-water work; however, the installation and removal of cofferdams should be conducted using best management practices (BMPs), such as silt curtains. Once cofferdams are installed, work may occur behind them at any time of year.
2) No in-water work, including the installation or removal of cofferdams, should be conducted from March 1 through June 30 of any year, to minimize impacts to anadromous fish migrating toward their spawning grounds. Once cofferdams are installed, work may occur behind them at any time of year, provided adequate passage is maintained.

Please note that Section 305(b)(4)(B) of the MSA requires you to provide us with a detailed written
response to the above EFH conservation recommendations, including a description of measures you
adopt for avoiding, mitigating or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with our recommendations, Section 305(b)(4)(B) of the MSA also indicates that you must explain your reasons for not following the recommendations. Included in
such reasoning would be the scientific justification for any disagreements with us over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate or
offset such effects pursuant to 50 CFR 600.920(k).

Please also note that a distinct and further EFH consultation must be reinitiated pursuant to 50 CFR
600.920(1) if new infonnation becomes available or the project is revised in such a manner that affects the basis for the above EFH conservation recommendations.

Fish and Wildlife Coordination Act

As mentioned above, Herring River and Wellfleet Harbor serve as habitat for anadromous fish and
shellfish. These resources serve as prey for a number of federally managed species and are considered a component of EFH pursuant to the MSA. In addition, anadromous fish and shellfish
are considered trust resources, which are covered under the FWCA. Our concerns regarding impacts to trust resources would be resolved through the implementation of the above conservation
recommendations.

Conclusions

In summary, we recommend that the final EIS/EIR contain special restrictive conditions to avoid or
minimize impacts to EFH and our trust resources. Specifically, cofferdams should be used to isolate in-water work and BMPs should be used during cofferdam installation and removal. In addition, no in-water work, including the installation or removal of cofferdams, should be conducted from March 1 through June 30 of any year to protect anadromous fish. Once cofferdams
are installed, work may occur behind them at any time, provided adequate passage is maintained.

We look forward to your response to our EFH conservation recommendations as well as our other
recommendations on this project. Should you have any questions on these comments, please contact Jenna Pirrotta at (978) 675-2176 or Jenna.Pirrotta@noaa.gov.

cc: Steve Block, NOAA RC
Eileen Feeney, MA DMF
Holly Johnson, EEA MEP A
Ed Reiner, US EPA
John Sargent, US ACOE

~ Louis A. Chiarella
Assistant Regional Administrator
for Habitat Conservation

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Correspondence Text

December 12, 2012

Richard K. Sullivan, Jr.
Secretary, Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114
ATTN: Holly Johnson
Re: EEA# 14272

Dear Secretary Sullivan:
The Division of Marine Fisheries (MarineFisheries) has reviewed the draft EIS/EIR by the Cape Cod National Seashore and Herring River Restoration Committee, which evaluates the tidal restoration alternatives and associated impacts for the Herring River in the Towns of Wellfleet and Truro. Alternatives consists of a) retaining the existing tidal control structure at Chequessett Neck and b-d) various modifications to further restore tidal flow through the installation of a new tidal control structure at Chequessett Neck. Alternative C would include a dike at Mill Creek that excludes tidal flow in addition to the Chequessett Neck tidal control structure. Alternative D, the listed preferred alternative, would include a dike at Mill Creek that partially restores tidal flow in addition to the new tidal control structure at Chequessett Neck. Existing marine fisheries resources and habitat and potential project impacts to these resources are outlined in the following paragraphs.

The Herring River currently provides habitat for a variety of diadromous fishes including alewife (Alosa pseudoharengus), blueback herring (Alosa aestivalis), white perch (Morone americana), and American eel (Anguilla rostrata) [1]. MarineFisheries has placed a ban on river herring (alewife and blueback herring) harvest due to population declines [2]. Habitat impacts should be minimized to aid recovery of these species.

The Herring River/Wellfleet Harbor complex provides foraging and spawning habitat for winter flounder (Pseudopleuronectes americanus). Winter flounder spawn in this embayment from January through May. The Atlantic States Marine Fisheries Commission has designated winter flounder spawning habitat as "Habitat Areas of Particular Concern" (HAPC).

Wellfleet Harbor contains a variety of shellfish species, many of which support commercial and recreational fisheries. Wellfleet Harbor contains mapped shellfish habitat for American oyster (Crassostrea virginica), bay scallop (Argopecten irradians), quahog (Mercenaria mercenaria), razor clam (Ensis directus), and soft shelled clam (Mya arenaria). Mapped shellfish habitat extends to the region downstream of the Chequessett Neck Road Dike for oysters and quahogs and upstream of the Dike for oysters. Mapped land containing shellfish is deemed significant to the interest of the Wetlands Protection Act and the protection of marine fisheries.

The Herring River also contains salt marsh vegetation. Salt marsh provides a variety of ecosystem services, including habitat and energy sources for many fish and invertebrate species [4,5,6]. The proposed tidal restoration should expand and improve habitat for all of the above listed species. The new control structure at Chequessett Neck should enhance diadromous fish passage. Increased salinity associated with increased tidal flow may also remove or reduce existing watercress, which would further promote fish passage. Expansion of estuarine habitat following tidal restoration should also result in additional foraging habitat for these species as well as a variety of estuarine fishes and invertebrates. Increased tidal exchange should also improve water quality, including increases in pH and dissolved oxygen. Increased salinity should also expand shellfish habitat for several mapped species.
MarineFisheries offers the following comments for your consideration:

? The proposed restoration project should enhance habitat for a variety of marine fisheries resources. However, a variety of shellfish and finfish species currently exist within the Herring River/Wellfleet Harbor complex, and construction methods and timing should be designed to minimize impacts to these existing marine fisheries resources. Recommended time-of-year (TOY) restrictions outlined in a previous MarineFisheries comment letter on the ENF filing for this project and summarized in the MarineFisheries TOY technical report for the Herring River [1] represent the most conservative suite of TOY restrictions based on all existing marine resources. These TOY restrictions are designed to protect marine resources during vulnerable periods, but all construction activities will not necessarily pose threats during these periods. A full set of potential TOY restrictions is listed below (Table 1), but all TOYs will not likely be applicable to any single construction activity. MarineFisheries concurs with the National Marine Fisheries Service's comment letter dated December 3, 2012. Specifically, TOY restrictions will not be necessary in cases in which work is buffered by cofferdams and silt curtains, but installation and removal of these structures should be performed outside of relevant TOY windows. As noted in the EIS/EIR, MarineFisheries should be consulted with to develop construction activity specific TOY staging to minimize impacts to marine resources. Staging should maintain a channel of free-flowing water of sufficient width and depth to permit fish passage during both the spring adult migration as well as the fall juvenile emigration of diadromous fishes. Staging should also minimize siltation effects during shellfish and winter flounder spawning. MarineFisheries should also be consulted with to review final dike designs with regards to diadromous fish passage.

Table 1. TOY Restrictions for the Herring River Species

	TOY Period
Alewife	April 1 to June 15; Sept. 1 to Nov. 15
Blueback Herring	April 1 to June 30; Sept. 1 to Nov. 15
American eel	March 15 to June 30; Sept. 15 to Oct. 31
White perch	April 1 to June 15
Winter flounder	Feb. 1 to June 30
Shellfish	May 1 to Nov. 15
Combined Resources	Feb. 1 to Nov. 15

Questions regarding this review may be directed to John Logan in our New Bedford office at (508) 990-2860 ext. 141.

Sincerely,
Paul J. Diodati
Director

cc: Wellfleet Conservation Commission
Truro Conservation Commission
Lou Chiarella, NMFS
Robert Boeri, CZM
Ed Reiner, EPA
Ken Chin, DEP
Kathryn Ford, DMF
Richard Lehan, DFG
Kathryn Ford, Jerry Moles, John Sheppard, Brad Chase, Mark Rousseau, Christian Petitpas, DMF

References

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PD/JL/sd

Correspondence: 24

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Status: New	Park Correspondence Log:
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Number of Signatures: 1	Form Letter: No
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Correspondence Text

December 7, 2012

Secretary Richard K. Sullivan, Jr.
Executive Office of Environmental Affairs
Attention: MEPA Office
Holly Johnson, EOEA No. 14272
100 Cambridge St, Suite 900
Boston, MA 02114

Project Name: Herring River Restoration Project

Proponent: Cape Cod National Seashore and the Herring River Restoration Committee

Project Location: Truro & Wellfleet

Project Description: Tidal restoration of large portions of the Herring River flood plain

Document Reviewed: Draft Environmental Impact Report/ Draft Environmental Impact Statement

EOEA File Number: 14272

NHESP Tracking No: 04-15126

Dear Secretary Sullivan:
The Natural Heritage & Endangered Species Program (NHESP) of the Massachusetts Division of

Fisheries & Wildlife has reviewed the Draft Environmental Impact Report (DEIR) / Draft Environmental Impact Statement (DEIS) for the Herring River Restoration Project. At this time, the NHESP would like to offer the following comments regarding state-listed species and their habitats.

The project site is located within Priority and Estimated Habitat as indicated in the 13th Edition of the MA Natural Heritage Atlas and therefore requires review by the NHESP for compliance with the Massachusetts Endangered Species Act (MESA 321 CMR 10.00).

The NHESP has been actively involved in the review of the proposed restoration plan through participation in the Herring River Restoration Technical Working Group. While the NHESP strongly supports habitat restoration, care must be taken to reduce impacts to state-listed species and their habitats. It appears that the proposed project may qualify for a MESA Habitat Management Exemption (321 CMR 10.14 (11)), however, in order for the NHESP to make a final determination, additional information must be submitted for review. Specifically, habitat impacts to certain state-listed species, such as the Eastern Box Turtle (Terrapene carolina), remain unclear and should be further refined. The NHESP is working with the proponent to address how the different alternatives might avoid, minimize, and mitigate impacts to state-listed species. The proposed Adaptive Management Plan (Appendix C of the DEIR/DEIS) should include expanded rare species monitoring (both pre- and post-restoration efforts) to better track and understand their responses to habitat management decisions and actions. Please note that the NESP believes that possible grant opportunities and collaborations with academic institutions could provide assistance for conducting state-listed species surveys both on- and off-site.

The NHESP looks forward to continued careful coordination with the proponent on the proposed project.
We appreciate the opportunity to comment on this project. Please contact Eve Schlter, Ph.D., Senior Endangered Species Review Biologist, of our office with any questions about this letter at (508) 389-6346 or eve.schluter@state.ma.us

Sincerely,
Thomas W. French, Ph.D.
Assistant Director

cc: Margo Fenn, Herring River Restoration Committee
George Price, Cape Cod National Seashore
Truro Board of Selectmen
Truro Conservation Commission
Truro Planning Board
Wellfleet Board of Selectmen
Wellfleet Conservation Commission
Wellfleet Planning Board
Heather McElroy, Cape Cod Commission
DEP Southeastern Regional Office, MEPA Coordinator

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Correspondence Text

MEMORANDUM

TO: Holly Johnson, Environmental Reviewer, MEPA Unit

THROUGH: Jonathan Hobill, Regional Engineer, Bureau of Resource Protection
Phil Weinberg, Regional Director
David Johnston, Deputy Regional Director,
Bureau of Resource Protection
Maria Pinaud, Deputy Regional Director, BWP
Millie Garcia-Serrano, Deputy Regional Director, BWSC
Brenda Chabot, Deputy Regional Director, ADMIN

CC: Elizabeth Kouloheras, Chief, Wetlands and Waterways and
Team Leader, Cape Cod Watershed
Patti Kellogg, Wetlands Program
David Hill, Waterways Program
Jim Sprague, DEP/Boston, DWM-WW
Brian Dudley, Nutrient Management, Cape Cod Watershed
Richard Keith, Chief, Municipal Services
Pamela Truesdale, Municipal Services
Leonard Pinaud, Chief, Site Management
Allen Hemberger, Site Management
Lealdon Langley, BRP/DWM/WW

FROM: Sharon Stone, SERO MEPA Coordinator

DATE: December 12, 2012

RE: DEIR EOEEA #14272 ? WELLFLEET/TRURO ? Herring River
Restoration Project
****
"For Use in Intra-Agency Policy Deliberations"

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the Draft Environmental Impact Report for the Herring River Restoration Project submitted by the Cape Cod National Seashore (CCNS) and the Herring River Restoration Committee (HRRC). MassDEP offers the following comments for the Secretary of Energy and Environmental Affairs to consider in developing the scope for the Final Environmental Impact Report.

MassDEP undertakes extensive work in support of environmental restoration projects. This project represents the largest single restoration project proposed to date in Massachusetts. Given the project location within the Herring River ACEC, the project's goals and objectives, and the potential environmental benefits afforded by the restoration of the Herring River estuary by increasing the tidal range, MassDEP is highly supportive of the project and will continue to work with the CCNS and the HRRC throughout all phased of the project to assist in reaching those goals and benefits.

The 1,100-acre Herring River estuary, for over 100 years, has been subject to: 1) tidal restrictions that reduced salinity, sediment deposition and tidal water volume; 2) poor water quality including low dissolved oxygen, low pH and excess metals: 3) fish mortalities: 4) residential, commercial and agricultural runoff that discharged pesticides, fecal coliform, excess nutrients such as nitrogen and phosphorous, and PCB's; and 5) increased mosquito populations. In 2003 MassDEP listed the Herring River as "impaired" under Section 303(d) of the Clean Water Act for low pH and high metal concentrations. The tidal restriction has resulted in the severe loss of the once expansive natural salt marsh community, the subsidence of the organic peat that once supported it, and the expansion of the invasive, non-native, Phragmites australis.

The restoration of the Herring River estuary that includes its marshes (salt, brackish and fresh), floodplains, and wildlife habitat is extremely complex given its location and setting with the Towns of Wellfleet, Truro and the Cape Cod National Seashore. Many factors including salinity, water quality, sediment transport, soil chemistry, wetland habitat and vegetation, aquatic species, rare, threatened and endangered species, terrestrial wildlife, cultural resources, existing developed community and socioeconomics are under consideration, with analysis and mitigation options factored into achieving the restoration objectives while minimizing adverse impacts.

MassDEP believes that the CCNS and the HRRC has clearly and adequately identified in the DEIR the project alternatives that range from minimally meeting project objectives to the alternative that maximally meets project objectives given the aforementioned factors and limitations. All alternatives have clearly identified benefits (except the no action alternative) as well as detriments.

MassDEP in providing the following comments is seeking clarity and additional information necessary to permit the project under the Massachusetts Wetland Protection Act (Act), Section 401 of the Clean Water Act and Chapter 91, the Public Waterfront Act. The DEIR has already identified the need for a variance from several sections of the Massachusetts Wetlands Protection Act Regulations, 310 CMR 10.00.

1) The DEIR has identified poor water quality within the Herring River particularly as it relates to the low dissolved oxygen, low pH, high metals, excess nutrients, pesticides, organic particulates, and fecal coliform and states discharges of these constituents is likely especially during the first few months of increasing the tidal range and salinity. Productive shellfish habitat exists immediately down river in Wellfleet Harbor and MassDEP is concerned about impacts to these shellfish beds from the mobilizing of these constituents. Although the DEIR only states that the discharges will be monitored and no additional information is provided. MassDEP believes that the FEIR should provide further clarification and additional information on what "management actions" the project proponent would undertake should the monitoring show impacts to downstream shellfish areas. MassDEP seeks this information to determine compliance with 310 CMR 10.34(4) of the Wetland Protection Act regulations (regulations) that requires no adverse impacts to said beds from changes in water quality that would impact productivity.

2) The DEIR states that the proposed increases in tidal elevation and range will result in the flooding of low lying properties to various degrees, and in particular to private land and structures (82% of the 309 non-federal propertied within the floodplain are private). In accordance with 310 CMR 10.24(5)(6), projects within ACEC's shall not have an adverse impacts on the interests of the Act, including the storm damage prevention and flood control interests. MassDEP will need further information on mitigation to impacted properties as part of an FEIR, if one is required, and the permit applications and request for variance. MassDEP seeks clarification in the FEIR as to how and if landowner permission will be obtained. Historically, in granting variances and permits to projects that increased flooding on properties, the variance allowed the flooding on land within the ownership of the project proponent or had other legal permission to flood.

3) The DEIR has identified both short and long term adverse impacts to state listed rare, threatened and endangered species specifically, the Northern Harrier, Diamondback Terrapin, Eastern Box Turtle, Water Willow Stem Borer, American Bittern and Least Bittern. Project compliance with the Act requires no short or long term adverse impacts to state listed rare, threatened and endangered species. In some instances compliance is obtained through the implementation of a Comprehensive Management Plan (CMP) issued by the Massachusetts Natural Heritage and Endangered Species Program (MNHESP). MassDEP seeks clarification in the FEIR and on MNHESP's requirements and the effect they may have on project design. MassDEP will require the submittal of detailed information on how the project will comply with MNHESP's requirements to be submitted with any permit application and request for variance.

4) The DEIR has identified approximately 9 acres of wetland that will be lost to fill for road elevation and relocation, construction of dikes and 8.3 acres of the 9 acres for fill associated with golf course relocation and elevation. Additionally, an unidentified amount of salt marsh

will be lost to submerging when the increase in tidal elevation exceeds the lower growth elevation of the salt marsh. More temporary work area wetland impacts are expected (i.e. 2.4 acres for the Mill Creek dike work area). Some loss of wetland is deemed by MassDEP to be acceptable for restoration projects that show an overall improvement to the areas ability to protect the interest of the Act, however it will be necessary to quantify the predicted increase in wetlands expansion to offset wetland losses, or a significant improvement in wetland habitat by expansion of wetland, particularly salt marsh, through control of invasive species in order to obtain the necessary permits. However, the DEIR has identified a degree of uncertainty about salinity modeling in the basins beyond the lower Herring River. Significant acres in the upper Pole Dike Creek, upper Herring River and upper Bound Brook sub basins, are anticipated to have freshwater wetlands converted to brackish marsh and a potential spreading of Phragmites, particularly Bound Brook where salinity is expected to increase to just 15 PPT well within the salinity range for Phragmites. Salinity levels would vary throughout the system and with salinity levels in the upper reaches of the estuary not high enough to support salt marsh vegetation, a degree of uncertainty in determining future species composition exists. The DEIR clearly states the acreage to be covered by salt water with mid to high levels of salinity. It is unclear if this is inferred to mean those areas will be likely to be salt marsh. MassDEP is seeking further clarification in the FEIR for future permitting purposes, as to the amount of salt marsh expected to expand and how much of the area of Phragmites will be converted/lost to this expansion. It was also unclear in the DEIR how much of the project locus contains Phragmites under existing conditions.

5) The DEIR states that in areas where subsidence has already happened and in areas where it has the potential to occur, it may be necessary to bring in additional sediment to augment that sedimentation anticipated to occur naturally. One source of supply depending on several factors includes sediment from dredging projects. While MassDEP recognizes the need for this augmentation, we also acknowledge that there are many competing entities for those limited dredge sediments for other uses such as beach nourishment. The FEIR should provide alternatives to acquiring sediments for marsh accretion.

6) The DEIR states that many actions such as dike construction, road relocation/elevation, culvert replacement/removal , golf course relocation and elevation, tree and brush removal, sediment introduction, structure relocation, berm construction, side cast removal, etc, will occur over many years as the tide r駩me is slowly reintroduced. It is clear the actual full impact from the opening of the dike/sluice gate is unknown at this time and stated improvements are best professional judgments based upon the experience of other restoration projects. The need for the proposed adaptive management approach is important as the actual maximum benefits stated may not be observed for decades, and the degree of impact from performing or not performing an action is clearly unknown. MassDEP believes the FEIR should discuss how they propose to proceed with permitting the action items proposed in the DEIR in terms of whether they contemplate a comprehensive permit application or a sequenced permit process, how they anticipate integrating activities on private property as part of this overall public project in the permitting process and how they envision the permitting process to deal with unanticipated impacts.

7) MassDEP has determined that portions of the Herring River estuary are under a Coastal

Restriction Order pursuant to MGL Chapter 120, section 105. The FEIR should determine those areas subject to the restriction order and how the project does or does not comply with the requirement of said order.

Waterways

The Public Waterfront Act, M.G.L. c.91 and its Regulations at 310 CMR 9.00 regulates activities within waterways, including both present and formerly submerged tidelands and filled land located seaward of the historic high water mark. As indicated in the DEIR, Chapter 91 License applications will be required for the placement of fill, new construction, substantial alteration or expansion of existing structures below the historic mean high water shoreline. Also, any dredging of a waterway associated with the restoration project would require authorization under Chapter 91.

Depending on the final project design, the Proponent may choose to file a comprehensive Chapter 91 Application for the various components of the project, which may include the new tidal control structure at Chequessett Neck Road Dike, improvements to the low lying roads and culverts, and the construction of a dike at Mill Creek. Since much of the restoration area is located within the Wellfleet Harbor ACEC, the Proponent will need to demonstrate in the submittal of the Chapter 91 License Application that the project complies with the Waterways Regulations at 310 CMR 9.32(1)(e), categorical restrictions on fill and structures within an ACEC. The Department may approve Chapter 91 Licenses within an ACEC provided that the structures are "publicly-owned" and for water-dependent use below the high water mark and are designed to minimize encroachment in the water.

In conclusion, MassDEP Wetlands?Waterways Program finds that the Draft Environmental Impact Report prepared by the CCNS and the HRRC clearly and adequately identifies the project alternatives that range from minimally meeting project objectives to the alternative that maximally meets project objectives given the complex matrix of environmental and socioeconomic factors and limitations. All alternatives have clearly identified benefits (except the no action alternative) as well as detriments. MassDEP will continue to work with the CCNS and the HRRC to assist in reaching those goals and benefits.

Proposed s.61 Findings

The "Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report" may indicate that this project requires further MEPA review and the preparation of a Final Environmental Impact Report. Pursuant to MEPA Regulations 301 CMR 11.12(5)(d), the Proponent will prepare Proposed Section 61 Findings to be included in the EIR in a separate chapter updating and summarizing proposed mitigation measures. In accordance with 301 CMR 11.07(6)(k), this chapter should also include separate updated draft Section 61 Findings for each State agency that will issue permits for the project. The draft Section 61 Findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.

Bureau of Waste Site Cleanup

Based upon the information provided in the DEIR, the Bureau of Waste Site Cleanup (BWSC) searched its databases for disposal sites and release notifications. (A disposal site is a location where there has been a release to the environment of oil and/or hazardous material that is regulated under M.G. L. c. 21E and the Massachusetts Contingency Plan [MCP ? 310 CMR 40.0000]). There are five MCP disposal sites within one mile of the immediate vicinity of the proposed project. Three of the MCP sites are closed (A2 RAO), and two are under long-term monitoring (C1 RAO). See table below for a summary of these MCP sites.

Release Tracking Number (RTN) Site Address Type of Contaminant(s) Site Status and Date
4-0013690
1.0-miles northeast Jacks Gas
100 Route 6
Truro Gasoline Class C1 RAO
September 2, 2010
4-0021403
0.7-miles northeast Residential Property
117 Slough Pond Road
Truro Trimethylbenzene Class A2 RAO
June 21, 2011
4-0000847
0.6-miles south-southeast Mobil Station
2665 Route 6
Wellfleet Gasoline Class C1 RAO
August 23, 2005
4-0013692
0.6-miles south-southeast No Location Aid
Route 6
Wellfleet Benzo[A]pyrene Class A1 RAO
March 6, 1998
4-0000895
0.7-miles southeast Texaco Station
Route 6
Wellfleet Chlorinated solvents;
Waste oil Class A2 RAO
December 16, 2004

The files for these sites may be viewed at
http://public.dep.state.ma.us/SearchableSites/Search.asp

The Project Proponent is advised that the discovery of oil and/or hazardous material during the implementation of this project may require notification to the Massachusetts Department of Environmental Protection pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000). A Licensed Site Professional (LSP) should be retained to determine if notification is required and, if contamination is encountered, to determine the necessary response actions. The BWSC may be contacted for guidance if questions regarding cleanup arise.

The MassDEP Southeast Regional Office appreciates the opportunity to comment on this proposed project. If you have any questions regarding these comments, please contact Sharon Stone at (508) 946-2846.

Correspondence: 26

Author Information

Keep Private:	No
Name:	Brona Simon
Organization:	MA Historic Commission ◉ Official Rep.
Organization Type:	S - State Government

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 10/29/2012	Date Received: 11/01/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

October 29,2012

George Price, Jr.
Superintendant
National Park Service
Cape Cod National Seashore
99 Marconi Site Road .
Wellfleet, MA 02667
Attn: William Burke

RE: Herring River Tidal Restoration Project, Wellfleet, and Truro, MA. MHC # RC.44488.

Dear Mr. Price:
Staff of the Massachusetts Historical Commission (MHC), office ofthe State Historic Preservation Officer,
have reviewed the Draft Environmental Impact StatementlEnvironmental Impact Report (DEISIEIR),
received October 15,2012, for the project referenced above.

The MHC looks forward to reviewing the Final EIR (FEIR) that incorporates information responsive to the
following comments.

The MHC understands that the NPS preferred project alternative is Alternative D (Section 2.12, pg.
73), including reconstruction of the Chequessett Neck Dike with a 165 foot by 10 foot opening, construction of a new Mill Creek dike with two-way tide gate, and elevation of Chequessett Yacht &
Country Club (CYCC) golf course fairways. This project alternative may also include elevation and/or modification of existing roadways and excavation of a borrow pit to obtain fill for CYCC golf
course elevation.

The FEIR should include a figure as an appendix that shows the project area of potential effect for the
preferred alternative in relation to identified historic resources and to portions of the project area identified as archaeologically sensitive. This figure should not contain sensitive archaeological site
locational information. A similar figure that shows identified archaeological sites should be provided
to the Corps, MHC, THPOs, MBUAR and the archaeological consultant.

When they are developed, scaled existing and proposed conditions project plans and a draft scope for
identification efforts for the preferred alternative should also be provided to all the conSUlting parties
for review and comment.

Cultural Resources, including historical and archaeological resources, are described in DEIS Section 3.9 (pg. 144) and 4.9 (pg. 244). Ancient Native American and historical period archaeological sites within and
adjacent to the project area of potential effect are also listed in Tables 3-15 (pg. 147) and 3-16 (pg. 149). The MHC notes that this summary description is based in part on data from a 2011 technical archaeological reconnaissance report prepared for the NPS by the PAL, Inc. The MHC's archaeological site inventory numbers should be referenced in the summary and the tables in the FEIR.

The FEIR should include an updated ancient and historic period archaeological context for the preferred
alternative project impact area that incorporates current data from the :MHC's archaeological inventory, and from recent archaeological survey reports conducted on federal land that are not yet reported to the MHC for incorporation in the state archaeological inventory.

Section 5.3 (pp. 287, 288) provides a preliminary summary of consultation with the:MHC pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800) and states that a draft Programmatic Agreement (PA) is currently under review by this office. However, the:MHC provided
comments on the draft PA on July 16, 2012. The MHC looks forward to reviewing a revised PA that

considers those comments. The FEIR should include a copy of the final executed P A and a summary of
consultations with conSUlting parties.

These comments are offered to assist in compliance with Sections 106 the National Historic Preservation Act of 1966, as amended (36 CFR 800). If you have any questions, please contact Jonathan K. Patton at this office.
~~~
Brona Simon
State Historic Preservation Officer
Executive Director
State Archaeologist
Massachusetts Historical Commission

cc: Margo L. Fenn, Herring River Restoration Committee
Karen Kirk Adams, USACOE-NED, Regulatory
Kate Atwood, USACOE-NED
Katry Harris, ACHP
Ramona Peters, THPO, Mashpee Wampanoag Tribe
Bettina Washington, THPO, Wampanoag Tribe of Gay Head (Aquinnah)
Secretary Richard K, Sullivan, EEA, Attn: Holly Johnson, MEPA Unit
DEP-SERO, Wetlands & Waterways
Victor Mastone, Massachusetts Board of Underwater Archaeological Resources
John Felix, DEP-BRP
Sara Korjeff, Cape Cod Commission
Wellfleet Historical Commission
Deborah C. Cox, PAL, Attn: Holly Herbster
. Barbara Boone, Chequessett Yacht & Country Club
~~~

Correspondence: 27

Author Information

Keep Private:	No		
Name:	Andrea Adams		
Organization:	Cape Cod Commission		Official Rep.
Organization Type:	C - County Government		

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/05/2012	Date Received: 12/12/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: E-mail

Notes: Cover email sent by CCC to MEPA with attached letter and staff report

Correspondence Text

Dear Holly:

This is a follow up to a 12/3/12 letter that was sent to you by US Post by me on behalf of the Cape Cod Commission Subcommittee who is reviewing the Herring River Restoration project.

Please note that the project reference in the block below Mr. Sullivan's address is incorrect. The project referred to is the Yarmouth CWMP. It should be the Herring River Restoration Project DEIR/DEIS. The MEPA project number, is, however, correct: #14272.

My error notwithstanding, kindly accept the Subcommittee's comments for the record. Please contact me if you have any questions, and my apologies for any confusion this may have caused.

Andrea Adams
Senior Regulatory Planner
Cape Cod Commission

December 3, 2012
Regular Mail

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
RE: Yarmouth CWMP
MEPA Project Number - #14272
Attn: MEPA Analyst Holly Johnson

Dear Secretary Sullivan:
On November 8, 2012, a joint Cape Cod Commission (Commission)/MEPA public hearing was held and the Commission received comments on the Draft Environmental Impact Report/Draft Environmental Impact Statement (DEIR/ DEIS) for tbe proposed Herring River Restoration Project.

Prior to this hearing, tbe Commission Subcommittee received a copy of the DEIR/ DEIS. During tbe hearing, the Herring River Restoration Committee members, including representatives of the Towns of Truro and Wellfleet made a presentation on the proposed project and DEIR/DEIS. Commission staff provided an analysis of the DEIR/DEIS in a staff report. After consideration of tbis information, the Subcommittee met and voted to adopt tbe Commission staff report as their comments to MEPA.

The attached staff report provides comments for inclusion in Final EIR/ Final EIS scope concerning the 2009 Regional Policy Plan (revised August 2012) issue areas of Coastal Resources, Natural Resources, Water Resources, Heritage Preservation/ Community Character, Transportation and Hazardous/ Solid Waste Management. Thank you for considering our comments as you develop the scope for the Final EIR/Final EIS.

Please con Commission staff if you have any questions or concerns about tbe content of this letter or the
attaed taff report.
~------
Enclosure

Cc: Margo Fenn, Project Coordinator, Herring River Restoration Committee
Gary Joseph, Chair, Herring River Restoration Committee (c/o Wellfleet Health Agent)
Tim P. Smith, National Park Service/Cape Cod National Seashore
Timothy King, Wellfleet Interim Town Manager and DRI Liaison
Hillmy Greenberg-Lemos, Wellfleet Health Agent
Rex Peterson, Truro Town Administrator
Charleen Greenhalgh, Truro Assistant Town Administrator/ DRI Liaison

STAFF REPORT

HERRING RIVER RESTORATION
(EOEA # 14272)

COMMISSION SUBCOMMITTEE
Leonard Short (Orleans) (Chair)
Peter Graham (Truro)
John D. Harris (Minority Representative)
Roger Putnam (Wellfleet)
Elizabeth Taylor (Brewster)
Austin Knight (Provincetown) (Alternate)

COMMISSION STAFF
Andrea Adams (Senior Regulatory Planner/Project Manager)
Glenn Cannon (Director of Technical Services/Traffic Engineer, PE)
Tom Cambareri (Water Resources Program Manager)
Sarah Korjeff (Planner II/Historic Preservation Specialist)
Heather McElroy (Natural Resources Specialist)
Steven Tupper (Technical Services Planner)

DATE
October 29, 2012

INTRODUCTION
The Cape Cod Commission (Commission) has received a Draft Environmental Impact Report (DEIR)/Draft Environmental Impact Statement (DEIS), for the proposed Herring River Restoration Project from the Herring River Restoration Committee (Applicant). The Herring River Restoration Committee includes representatives from the Towns of Wellfleet and Truro, the National Park Service, and other state and Federal agencies.

A public hearing will be held on Thursday, November 8, 2012 at the Wellfleet Senior Center/Council on Aging, 715 Old Kings Highway, Wellfleet, MA, beginning at 6:30 PM for the purposes of providing hearing comments on the DEIR/DEIS and to gather information on the proposed project for the Joint Massachusetts Environmental Policy Act (MEPA)/Cape Cod Commission review process.

The DEIR/DEIS was published in the Environmental Monitor on October 22, 2012. Comments on the DEIR/DEIS are due to the Massachusetts Environmental Policy Act (MEPA) Unit by December 12, 2012.

PROJECT DESCRIPTION
As described in the Purpose section of the DEIR/DEIS, "the project is to restore self-sustaining coastal habitats on a large portion of the 1,100-acre Herring River estuary in Wellfleet and Truro." The DEIR/DEIS further describes a Preferred Alternative (Alternative D), the primary component of which is construction and installation of a new tidal control structure at Chequessett Neck Road, together with a new dike at the mouth of Mill Creek. Other project components include:
? Adaptive Management approach to long-term management of the new structure,
? Replacement of culverts at road crossings upstream of Chequessett Neck Road,
? Raising or relocating approximately 8,000 square feet of low lying roadway located within the Herring River floodplain,
? Management of woody vegetation within the Herring River floodplain to promote recolonization of salt marsh vegetation,
? Restoration of channel sinuosity, and
? Management and/or mitigation of flooding impacts to private properties.
A more detailed description and analysis of the proposed Project Alternatives is also discussed in the Coastal/Natural Resources comments, below.

JURISDICTION
As noted in the Certificate on the Environmental Notification Form issued by the Secretary of the Executive Office of Energy and Environmental Affairs, the proposed project requires the preparation of an Environmental Impact Report (EIR) pursuant to 301 CMR 11.00(3)(a) of the MEPA regulations at a minimum because it alters one or more acres of bordering vegetated wetlands. The proposed project may also alter more than 50 acres of land, require a variance according to the Wetlands Protection Act, and require both Chapter 91 Licenses and a 401 Water Quality Certification from the Department of Environmental Protection. As development requiring an EIR, the project is categorically deemed to be a Development of Regional Impact (DRI) under the Cape Cod Commission Act (Act), Section 12(i), and Section 2(d)(i) of the Commission's Enabling Regulations (revised March 2011; New Fee Schedule Effective July 1, 2012), and is subject to DRI review by the Commission.

PROCEDURAL HISTORY
On June 20, 2008, the Secretary of the Executive Office of Energy and Environmental Affairs (Secretary) issued a Certificate which established a Special Review Procedure to help coordinate review of the project, which involves a Citizen's Advisory Committee, designated as the Herring River Restoration Committee (HRRC). The HRRC includes representatives from the Towns of Wellfleet and Truro, the National Park Service, the Cape Cod National Seashore, and representatives from several other groups and state and federal agencies, including Office of Coastal Zone Management, Wetlands Restoration Center, US Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration.
The Commission and MEPA held a joint hearing on the Environmental Notification Form (ENF) on August 14, 2008, where a Commission Subcommittee formulated comments for inclusion into the MEPA scope for the Draft EIR. On November 7, 2008, the Secretary issued a Certificate on the ENF that set out the Draft EIR scope.

STAFF COMMENTS
Commission staff reviewed the DEIR/DEIS for the project's compliance with the Regional Policy Plan (as amended August 2012) and offers the following comments on the project for consideration by MEPA and other agencies.

COASTAL/NATURAL RESOURCES: WILDLIFE/PLANT HABITAT & WETLANDS
This large-scale ecological restoration project does not fit neatly into the Cape Cod Commission's regulatory framework. Because the project is required to prepare an Environmental Impact Report through MEPA, it is a mandatory DRI. The project's anticipated outcomes will bring broad ecological benefits to the Herring River system in Wellfleet and Truro, and as a result will likely benefit human health and economy. However, the proposed changes to the existing man-made structures within the estuary, including the Chequessett Neck Road dike, and upstream dikes, culverts and roadways, are not without impacts that may be in conflict with minimum performance standards in the 2009 Regional Policy Plan (RPP) (as amended).

The purpose of these staff comments on the Herring River Restoration Project is to inform the Cape Cod Commission of the instances where proposed actions in the DEIR/DEIS may be inconsistent with the RPP, and to offer some perspective as to how those inconsistencies may be balanced against the anticipated gains, or benefits, of the project. Under a typical DRI review, inconsistencies with MPSs may be addressed through mitigation; in the context of this ecological restoration project, "mitigation" may take several forms, depending on the nature of the impact.

The National Park Service, together with the Towns of Wellfleet and Truro, have invested years of research and analysis, engaging technical experts and concerned residents, and consulting regulatory agencies, into the development of this project and the parameters of possible alternatives. One of the roles the Commission may serve through the review of this project is to receive and filter public comments on the various options presented in the DEIR/DEIS, and make recommendations on options that will best serve the residents of Wellfleet, Truro, and the region.

Project Purpose and Potential Outcomes

The National Park Service (NPS) and the Herring River Restoration Committee (HRRC) have identified several objectives in pursuing this project. Observation and analysis of resources, and research and modeling of potential actions support the NPS and HRRC's anticipation of many positive ecological and social benefits from the project. The following summarizes potential outcomes:

1. Reestablishment, to extent practical, the natural tidal range within the 1,100 acre Herring River estuary,
2. Improve estuarine water quality for resident and migratory animals,
3. Protect and enhance harvestable shellfish resources,
4. Restore the estuary's functions as a nursery and source of organic matter,
5. Improve migratory fish and eel runs,
6. Re-establish the salinity gradient within the floodplain to improve estuarine habitats,
7. Restore normal sedimentation processes within the floodplain to counter marsh subsidence,
8. Restore ecological balance to improve mosquito control,
9. Cultural and socio-economic benefits, including restoration of expansive salt marshes within the floodplain for esthetic and recreational benefits.

The following staff comments are structured around the impacts to resources protected under the Cape Cod Commission Act, as specified in the RPP, due to the proposed restoration project as presented in the DEIR/DEIS:

1. Incremental Tidal Restoration and Adaptive Management
2. Vegetation Management
3. Low-lying Road Crossings and Culverts
a. High Toss Road
b. Pole Dike, Bound Brook, and Old County Roads
4. Restoration of Tidal Channel and Marsh Surface Elevation
5. Upper Pole Dike Creek
6. Public Access and Recreation Opportunities
7. Project Alternatives
a. Alternative B
b. Alternative C
c. Alternative D

1. Incremental Tidal Restoration and Adaptive Management
The project will involve the removal of the dike structure at Chequessett Neck Road, and replacement with a structure which will allow for the gradual re-introduction of tidal exchange to the Herring River system over a period of several years. This project element addresses the need to monitor the progress of the restoration effort over time, and to make management decisions that respond to the conditions-of-the-moment consistent with the objectives and limitations of the project (adaptive management). Actions contemplated in the draft framework for the Adaptive Management Plan, found in Appendix C of the DEIR/DEIS, include:
d. invasive species management,
e. planting and seeding native estuarine plants,
f. removal of woody vegetation within the restoration area,
g. reestablishment or creation of tidal channels,
h. creation of salt pannes and pools to promote fish habitat, and
i. applying layers of sediment to subsided areas to promote reestablishment of inter-tidal habitats.

Direct/Indirect Impacts:
These actions will require development activity (as defined by the Commission Act and Regional Policy Plan) within resource areas protected by the RPP. Direct impacts include: the 2.4 acres of alteration within wetlands, wetland buffers, coastal banks, land subject to coastal storm flowage, and rare species habitat to replace the dike and culverts at Chequessett Neck Road; vegetation removal within the 900+ acre restoration area; dredging to create channels and salt pannes; and application of sediment to the marsh surface. Indirect impacts will result due to changes within the restoration area that result from the change in salinity, tidal exchange, and flood levels including: changes from freshwater and brackish wetlands to salt and estuarine habitats, impacts to dunes, impacts to rare species habitat (Northern Harrier, Diamondback Terrapin, Eastern Box Turtle, American Bittern, Least Bittern, and Water Willow Stem Borer), changes in aquatic species, impacts to terrestrial species, and impacts to low-lying properties, including the Chequessett Yacht & Country Club (CYCC).

The following comments address the consistency of the removal of the dike and Adaptive Management project elements with the Minimum Performance Standards (MPS) and Best Development Practices (BDP) in the RPP:
MPS/BDP
Comment
MPS CR2.1, 2.3, 2.4, 2.8
These standards restrict development within land subject to coastal storm flowage (LSCSF) to ensure that development does not impede the storm damage control functions of LSCSF or impede the migration or function of other coastal resources. The project impacts resources protected by these standards, but CR2.10 (see below) provides an exception for ecological restoration projects.
MPS CR2.10
This coastal standard provides an exception from compliance with several coastal MPSs for projects that restore salt marsh, fish runs, and shellfish beds. Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that other MPSs have been met, this standard provides for the proposed development activities that address the

ecological restoration objectives of the project.
BDP CR2.13
This Best Development Practice encourages the removal of development from the coastal floodplain, which the project proposes.
BDP CR2.14
This Best Development Practice encourages the use of the 1988 datum of NAVD88, which the project does.
MPS CR3.7
This standard prohibits improvement dredging, except where necessary to accomplish a substantial public benefit. As part of the adaptive management plan, the project may need to dredge portions of the river/wetlands system in order to restore channel sinuosity, improve drainage, and improve habitat. The HRRC will have to demonstrate that the adaptive management plan has appropriate checks and balances to ensure that any improvement dredging resulting from the project will result in net gains to habitat, and/or other public benefit.
MPS CR3.9
This standard requires the beneficial reuse of clean dredged materials. The project will utilize dredged materials on the marsh surface in order to elevate the marsh surface, counter the effects of subsidence, and promote salt marsh growth.
MPS CR3.11
This standard protects fish, shellfish, and crustaceans from the impacts of development. The project will result in improvements to habitat for these animals.
MPS WET1.1, 1.2
These standards protect wetlands and their buffers from alteration. The project involves significant wetland alteration in the form of direct and indirect impacts (see above, Direct/Indirect impacts). However, these actions are taken to achieve the project
Herring River Restoration Project objective of ecological restoration. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided.

As the HRRC refines the project, selecting a preferred alternative and proceeding with the engineering required to execute the various project elements, they should keep in mind minimizing direct impacts to wetland resources (such as construction impacts, footprint of fill for dikes and road elevations, rip rap or bulkheads associated with protecting roads and low-lying properties, etc.). At the same time, Commission staff notes that over time, if objectives are met, the project will result in measurable improvements to salinity, estuarine wetland vegetation, water chemistry and dissolved oxygen, estuarine animal habitat, and reduced mosquito production, to 800 ? 900 acres of presently degraded estuarine habitat.
BDP WET1.5
This Best Development Practice encourages wetland restoration, including revegetation and restoration of tidal flushing.
MPS WPH1.1
This standard requires the preparation of a natural resources inventory for DRIs. The EIS/EIR provides adequate evaluation of the resources within the project area for the purposes of this standard.
MPS WPH1.2, 1.3
These standards require the minimization of clearing, grading, and fragmentation of wildlife

habitat. The project will require clearing of woody vegetation, either by mechanical means or through the natural process of increased salinity resulting from the restoration effort. However, as the HRRC refines the project, selecting a preferred alternative and proceeding with the engineering required to execute the various project elements, they should keep in mind minimizing clearing and grading (such as construction-related impacts).

MPS WPH1.4

This standard requires the protection of rare species habitat. The project will result in indirect impacts to habitat of the Northern Harrier, Diamondback Terrapin, Eastern Box Turtle, American Bittern, Least Bittern, and Water Willow Stem Borer, all state-listed species. The project will likely result in some positive habitat changes for some of these species (e.g. increased estuarine habitat for Diamondback Terrapin), and in the loss of habitat for others (loss of freshwater marsh habitat for American and Least Bitterns). The Commission will seek guidance from the Natural Heritage and Endangered Species Program in determining whether the project complies with this standard, and whether impacts to rare species should be mitigated by means other than those planned for the restoration project generally (e.g. creation or preservation of specialized habitat within the project area, or elsewhere within the seashore).

MPS WPH1.6

This standard addresses the management of invasive species within a project site. Invasive species management is an integral part of the proposed project.

BDP WPH1.7

This Best Development Practice encourages ecological restoration.

BDP WPH1.8

This Best Development Practice encourages un-development. The project includes elements that would potentially remove development from the floodplain.

2. Vegetation Management

The project anticipates the need to remove existing vegetation within the restoration area prior to, and/or during the course of the restoration. The removal of vegetation would be governed by protocols within the Adaptive Management Plan. As detailed in the discussion of performance standards, above, the removal of vegetation from wetlands and/or their buffers is inconsistent with MPS WET1.1 and 1.2, and WPH 1.2 and 1.3 but is supported by MPS CR2.10, MPS WPH1.6, BDP WET1.5, and BDP WPH1.7. As a change in wetland type and vegetation is an objective of the project and contributes toward the many anticipated benefits of the project, staff suggests that vegetation management is a necessary and appropriate project element.

3. Low-Lying Road Crossings and Culverts

j. High Toss Road

High Toss Road forms the next upstream barrier to tidal restoration within the Herring River system in the form of an earthen berm and culvert. According to the draft EIS/EIR, this restriction would need to be widened to 30 ft in order to restore tidal flow upstream. In addition, the restoration effort will result in flooding High Toss Road. The draft EIS/EIR outlines three potential options to address the flooding of the road and the tidal-flow barrier it presents: elevate the road, abandon and remove the road, or close the road during flood events. Each of these alternatives will result in impacts to wetlands and potential loss of use of the road. Staff recommends that public opinion may inform the best option for continued use of High Toss Road. Barring any clear consensus, staff suggests that the option which meets the project objectives while minimizing harm to the environment may be the best alternative.

The following comments address the consistency of the High Toss Road project elements with

the Minimum Performance Standards and BDPs in the RPP:
MPS/BDP
Comments
MPS CR1.1
This standard requires the protection of existing legal access to the coast. The draft EIS/EIR indicates that the HRRC is aware of the need to address the continued use of these public ways.
MPS CR2.10
This coastal standard provides an exception from compliance with several coastal MPSs (CR2.1, 2.3, 2.4, and 2.8) for projects that restore salt marsh, fish runs, and shellfish beds, and for the maintenance of public infrastructure (roads). Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that other MPSs have been met, this standard provides for the proposed development activities that address the ecological restoration objectives of the project.
BDP CR2.13
This Best Development Practice encourages the removal of development from the coastal floodplain, which the project proposes.
MPS WET1.1, 1.2
These standards protect wetlands and their buffers from alteration. This project element involves potential wetland alteration in the form of wetland fill and construction activities that might impact 13,000 sq ft of wetland resource areas. However, some action at High Toss Road is necessary to achieve the project objective of ecological restoration. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided.
As the HRRC refines the project, selecting a preferred alternative for High Toss Road and proceeding with the engineering required to execute this project element, they should keep in mind minimizing direct impacts to wetland resources (such as construction impacts, footprint of fill, rip rap or bulkheads associated with elevating the road, etc.). At the same time, Commission staff notes that over time, if objectives are met, the project will result in measurable improvements to salinity, estuarine wetland vegetation, water chemistry and dissolved oxygen, estuarine animal habitat, and reduced mosquito production, to 800 ? 900 acres of presently degraded estuarine habitat.
BDP WET1.5
This Best Development Practice encourages wetland restoration, including revegetation and restoration of tidal flushing.
MPS WPH1.2, 1.3
These standards require the minimization of clearing, grading, and fragmentation of wildlife habitat. This project element may require clearing of vegetation. However, as the HRRC refines the project, selecting a preferred alternative and proceeding with the engineering required to execute changes to High Toss Road, they should keep in mind minimizing clearing and grading (such as construction-related impacts).
MPS WPH1.4
This standard requires the protection of rare species habitat. Depending on the option for High Toss Road selected, this project element may result in impacts to rare species habitat. The Commission will seek guidance from the Natural Heritage and Endangered Species Program in determining whether this project element complies with this standard.
BDP WPH1.7

This Best Development Practice encourages ecological restoration.
BDP WPH1.8
This Best Development Practice encourages un-development. This element would potentially remove Pole Dike, Bound Brook, and Old County Roads
Segments of these roads, totaling approximately 6,200 linear ft, would be subject to flooding following restoration. The DEIR/DEIS suggests that these segments would need to be elevated or relocated to mitigate the effects of flooding, and that there is the possibility that culverts within these road segments would have to be replaced. As mitigating the effects of flooding on these roads is necessary to achieve the objectives of the project, staff suggests that the proposed alterations are necessary and appropriate project elements. Barring strong public opinion regarding elevating or relocating these road segments, staff suggests that the option which meets the project objectives while minimizing harm to the environment may be the best alternative.
The following comments address the consistency of the Pole Dike, Bound Brook, and Old County Roads project elements with the MPS and BPDs in the RPP:
MPS/BDP
Comments
MPS CR1.1
This standard requires the protection of existing legal access to the coast. The draft EIS/EIR indicates that the HRRC is aware of the need to address the continued use of these public ways.
MPS CR2.10
This coastal standard provides an exception from compliance with several coastal MPSs (CR2.1, 2.3, 2.4, and 2.8) for projects that restore salt marsh, fish runs, and shellfish beds, and for the maintenance of public infrastructure (roads). Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that other MPSs have been met, this standard provides for the proposed development activities that address the ecological restoration objectives of the project.
BDP CR2.13
This Best Management Practice encourages the removal of development from the coastal floodplain, which the project proposes.
MPS WET1.1, 1.2
These standards protect wetlands and their buffers from alteration. This project element involves potential wetland alteration in the form of wetland fill and construction activities that might impact 6,000 sq ft of wetland resource areas. However, some action at Pole Dike, Bound Brook, and Old County Roads is necessary to achieve the project objective of ecological restoration. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided.
As the HRRC refines the project, selecting a preferred alternative for Pole Dike, Bound Brook, and Old County Roads and proceeding with the engineering required to execute this project element, they should keep in mind minimizing direct impacts to wetland resources (such as construction impacts, footprint of fill, rip rap or bulkheads associated with elevating the roads, etc.). At the same time, Commission staff notes that over time, if objectives are met, the project will result in measurable improvements to salinity,
estuarine wetland vegetation, water chemistry and dissolved oxygen, estuarine animal habitat, and reduced mosquito production, to 800 ? 900 acres of presently degraded estuarine habitat.
BDP WET1.5
This Best Management Practice encourages wetland restoration, including revegetation and

restoration of tidal flushing.
MPS WPH1.2, 1.3
These standards require the minimization of clearing, grading, and fragmentation of wildlife habitat. This project element may require clearing of vegetation. However, as the HRRC refines the project, selecting a preferred alternative and proceeding with the engineering required to execute changes to Pole Dike, Bound Brook, and Old County Roads, they should keep in mind minimizing clearing and grading (such as construction-related impacts).
MPS WPH1.4
This standard requires the protection of rare species habitat. Depending on the options selected for these road segments, this project element may result in impacts to rare species habitat. The Commission will seek guidance from the Natural Heritage and Endangered Species Program in determining whether this project element complies with this standard.
BDP WPH1.7
This Best Management Practice encourages ecological restoration.
BDP WPH1.8
This Best Management Practice encourages un-development. This element would potentially remove development from the floodplain.

4. Restoration of Tidal Channel and Marsh Surface Elevation
This project element involves several potential actions to reverse the effects of diking, drainage, and subsidence of the marsh surface. These actions could include dredging of sediment within the Herring River channel, creation of small channels and ditches, restoring stream sinuosity, removing berms, and applying dredged materials to the marsh surface. As discussed above, these actions are regulated by Minimum Performance Standards in the RPP.
The following comments address the consistency of the Restoration of Tidal Channel and Marsh Surface project elements with the MPS and BDPs in the RPP:
MPS/BDP
Comment
MPS CR2.4
This standard restricts the placement of fill within land subject to coastal storm flowage (LSCSF) to ensure that development does not impede the storm damage control functions of LSCSF. This project element impacts resources protected by this standards, but CR2.10 (see below) provides an exception for ecological restoration projects.
MPS CR2.10
This coastal standard provides an exception from compliance with CR2.4 for projects that restore salt marsh, fish runs, and shellfish beds. Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that other MPSs have been met, this standard provides for the proposed activities that address the ecological restoration objectives of the project.
BDP CR2.13
This Best Development Practice encourages the removal of development from the coastal floodplain, which this element proposes.
MPS CR3.7
This standard prohibits improvement dredging, except where necessary to accomplish a substantial public benefit. The HRRC will have to demonstrate that the adaptive management plan has appropriate checks and balances to ensure that any improvement dredging resulting

from the project will result in net gains to habitat, or other public benefit.
MPS CR3.9
This standard requires the beneficial reuse of clean dredged materials. The project will utilize dredged materials on the marsh surface in order to elevate the marsh surface, counter the effects of subsidence, and promote salt marsh growth.
MPS CR3.11
This standard protects fish, shellfish, and crustaceans from the impacts of development. The project will result in improvements to habitat for these animals, however, dredging should be designed and timed to avoid adverse impacts to these animals.
MPS WET1.1, 1.2
These standards protect wetlands and their buffers from alteration. This element involves wetland alteration by way of the placement of fill. However, this action would be taken to achieve the project objective of ecological restoration, according to protocols in the Adaptive Management Plan. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided. As the HRRC refines the project, they should provide protocols within the Adaptive Management Plan to ensure that alterations to wetlands are the minimum necessary to achieve the project objectives. Commission staff notes that over time, if objectives are met, the project will result in measurable improvements to salinity, estuarine wetland vegetation, water chemistry and dissolved oxygen, estuarine animal habitat, and reduced mosquito production, to 800 ? 900 acres of presently degraded estuarine habitat.
BDP WET1.5
This Best Development Practice encourages wetland restoration.
MPS WPH1.4
This standard requires the protection of rare species habitat. The project will result in indirect impacts to habitat of the Northern Harrier, Diamondback Terrapin, Eastern Box Turtle, American Bittern, Least Bittern, and Water Willow Stem Borer, all state-listed species. The actions contemplated under this project element may result in positive habitat changes for some of these species (e.g. increased estuarine habitat for Diamondback Terrapin), and in the loss of habitat for others (loss of freshwater marsh habitat for American and Least Bitterns). The Commission will seek guidance from the Natural Heritage and Endangered Species Program in determining whether the project complies with this standard, and whether impacts to rare species should be mitigated by means other than those planned for the restoration project generally (e.g. creation or preservation of specialized habitat within the project area, or elsewhere within the seashore).
BDP WPH1.7
This Best Development Practice encourages ecological restoration.
BDP WPH1.8
This Best Development Practice encourages un-development. This element would potentially remove development from the floodplain.

5. Upper Pole Dike Creek This project element is located mostly outside of the Seashore boundary, and contains approximately 130 privately owned parcels within the historic floodplain. Approximately 100 acres of degraded wetlands could be restored with the reintroduction of tidal flow within this sub-basin. The HRRC would mitigate impacts to low-lying properties within this area on a site-by-site basis. Flood protection measures could include

elevating driveways, relocating structures, constructing berms or rip-rap walls, and/or moving wells.
The following comments address the consistency of mitigation of flooding to low-lying private properties within Upper Pole Dike Creek with the MPS and BDPs in the RPP:
MPS/BDP
Comment
MPS CR2.1, 2.3, 2.4, 2.8
These standards restrict development within land subject to coastal storm flowage (LSCSF) to ensure that development does not impede the storm damage control functions of LSCSF or impede the migration or function of other coastal resources. Mitigating low-lying properties could impact resources protected by these standards, but CR2.10 (see below) provides an exception for ecological restoration projects.
MPS CR2.10
This coastal standard provides an exception from compliance with several coastal MPSs for projects that restore salt marsh, fish runs, and shellfish beds. Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that other MPSs have been met, this standard provides for the proposed development activities that address the ecological restoration objectives of the project.
MPS WET1.1, 1.2
These standards protect wetlands and their buffers from alteration. Mitigating low-lying properties could result in impacts to wetlands and their buffers. However, these potential actions would be taken to achieve the project objective of ecological restoration. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided.
As the HRRC works through the details of mitigating low-lying properties, they should keep in mind minimizing direct impacts to wetland resources (such as construction impacts, footprint of fill for dikes and road elevations, rip rap or bulkheads associated with protecting roads and low-lying properties, etc.). Commission staff notes that over time, if objectives are met, the project will result in measurable improvements to salinity, estuarine wetland vegetation, water chemistry and dissolved oxygen, estuarine animal habitat, and reduced mosquito production, to 800 ? 900 acres of presently degraded estuarine habitat.
MPS WPH1.2, 1.3
These standards require the minimization of clearing, grading, and fragmentation of wildlife habitat. As the HRRC works through the details of mitigating flooding of low-lying properties, they should keep in mind minimizing clearing and grading (such as construction-related impacts).
MPS WPH1.4
This standard requires the protection of rare species habitat. Mitigating flooding of low-lying properties may result in impacts to habitat of state-listed species. The HRRC should work with the NHESP to avoid, minimize, and appropriately mitigate impacts to individual private properties.
BDP WPH1.7
This Best Development Practice encourages ecological restoration.
BDP WPH1.8
This Best Development Practice encourages un-development. The project includes elements that would potentially remove development from the floodplain.

6. Public Access and Recreation Opportunities
The HRRC intends to improve public recreational access opportunities as part of the restoration project, and through the design of specific project elements (such as the new Chequessett Neck Road tide-control structure). The RPP supports improved public access to the coast through MPS CR1.1, BDP CR1.5, and 1.6. In addition, the HRRC should note that MPS CR2.6 requires that redevelopment of water-dependent marine infrastructure that would impact a coastal bank should be set as far landward as feasible to minimize adverse impacts to the natural beneficial functions of the bank.
7. Project Alternatives The previous sections address the elements which are common to all of the potential alternatives. The following comments address only those elements which are unique to a project alternative.
1. Alternative B This alternative would achieve the lowest high tide elevation to achieve the project objectives through the construction of a tide control structure at Chequessett Neck Road. This alternative would not include a new dike structure at Mill Creek, and thus some action would be necessary to mitigate flooding to the CYCC. Options include 1. relocating or 2. elevating the flooded portions of the course.
2. Alternative C This alternative would achieve the highest possible high tide elevation given the current constraints within the floodplain, while excluding tidal restoration to the Mill Creek sub-basin through the construction of a dike. This second dike would allow for out-flow of fresh water, but would eliminate any tidal influence into this portion of the floodplain. The CYCC and other low-lying properties in the Mill Creek sub-basin would be unaffected by the restoration project.
3. Alternative D This alternative would achieve the highest possible high tide elevation given the current constraints within the floodplain, and would include a dike at Mill Creek with a tidal control structure to allow for management of tidal influence within the Mill Creek sub-basin. Because flooding would be re-introduced to this portion of the floodplain, some action would be necessary to mitigate flooding to the CYCC, and other low-lying properties. Options include 1. relocating or 2. elevating the flooded portions of the course. Each of these alternatives will result in impacts to coastal resources, freshwater wetlands, wildlife and plant habitat, and rare species habitat, as previously discussed. Through an alternatives analysis workshop, the HRRC identified the "full build" Alternative D as the preferred alternative for the project. Staff recommends that public opinion may also inform selection of the best alternative, as there are many resources of public and private value that will be significantly affected by the project. Alternative D will result in impacts not previously discussed. These impacts would result from the construction of a new dike at Mill Creek, and the flooding of CYCC. The construction of the dike will result in 2.4 acres of temporary impacts to wetlands and 12,500 sq ft of permanent wetland fill. Option 1, relocating the affected portions of the CYCC course, would result in 12 acres of course reverting to salt marsh, and 30 acres of upland (presently providing box turtle habitat) being converted to new fairways. Option 2, elevating the affected portions of the CYCC course, would result in 10 acres of fill within low-lying, wet areas of the course, and the clearing and excavation of 5 acres of upland (presently providing box turtle habitat) to supply the fill.
If the HRRC carries Alternative D forward as the preferred alternative in the final EIS/EIR, they will have to show that the impacts from Option 1 or 2 are consistent with the MPS. The following issues should be addressed:
MPS/BDP
Comment

MPS CR2.1, 2.3, 2.4, 2.8
These standards restrict development within land subject to coastal storm flowage (LSCSF) to ensure that development does not impede the storm damage control functions of LSCSF or impede the migration or function of other coastal resources. The project impacts resources protected by these standards, but CR2.10 (see below) provides an exception for ecological restoration projects.
MPS CR2.10
This coastal standard provides an exception from compliance with several coastal MPSs for projects that restore salt marsh, fish runs, and shellfish beds. Provided the HRRC demonstrates that measures have been taken to minimize adverse impacts to LSCSF, and that other MPSs have been met, this standard provides for the proposed development activities that address the ecological restoration objectives of the project.
BDP CR2.13
This Best Development Practice encourages the removal of development from the coastal floodplain, which the project proposes under Option 1.
MPS WET1.1, 1.2
These standards protect wetlands and their buffers from alteration. Changes to the CYCC fairways will involve some wetland alteration. However, these actions are taken to achieve the project objective of ecological restoration. This standard allows for alteration, provided it is the minimum necessary and there are no feasible alternatives, and that mitigation is provided.
As the HRRC refines the project, selecting a preferred alternative and option for the CYCC, they should keep in mind minimizing impacts to wetland resources (such as construction impacts, footprint of fill, etc.). At the same time, Commission staff notes that over time, if objectives are met, the project will result in measurable improvements to salinity, estuarine wetland vegetation, water chemistry and dissolved oxygen, estuarine animal habitat, and reduced mosquito production, to 800 ? 900 acres of presently degraded estuarine habitat.
MPS WPH1.2, 1.3
These standards require the minimization of clearing, grading, and fragmentation of wildlife habitat. Changes to the fairways will require clearing of vegetation. As the HRRC refines the project, selecting a preferred alternative and option for the CYCC, they should keep in mind minimizing clearing and grading.
MPS WPH1.4
This standard requires the protection of rare species habitat. Of either option selected, the impacts to rare species habitat should be avoided, minimized and mitigated. The Commission will seek guidance from the Natural Heritage and Endangered Species Program in determining consistency with this standard.
MPS WPH1.6
This standard addresses the management of invasive species within a project site. Invasive species management is an integral part of the project.

WATER RESOURCES
Restoring tidal flow to the Herring River will result in improvements to water and sediment quality within the river and provide benefits to its ecology. The Commission indicated in its 2008 comment letter on the ENF that the project should identify potential private wells and provide information about how the restoration of tidal flow might affect their water. The DEIR/DEIS provides information identifying well sites could potentially be affected (Martin

2007) and reference to a report that evaluated the potential for changes to the aquifer and saltwater interface (Martin 2004). Although the DEIR/DEIS considered this item, it dismissed it from further consideration. It was not apparent how the DEIR/DEIS considered this issue in Chapter 4; Environmental Consequences.

The study by Masterson (2004) used the USGS groundwater model of the Chequessett lens to evaluate a number of scenarios of tidal exchanges based upon initial modeling by Spaulding (2001) of tidal response to dike openings. There were several scenarios in which tidal restoration resulted in a decrease of the fresh water lens thickness. The DEIR/DEIS has presented hydrologic modeling of tidal response from the Woods Hole Group and should consider the use of updated modeling by the WHG (2007) as the basis for evaluating the groundwater response. Furthermore the issue of private wells should be explicitly identified in the Adaptive Management Plan as an item for monitoring, potentially making use of the Chequessett Yacht and Country Club Golf Course Irrigation well and USGS monitoring wells and that were installed to characterize groundwater conditions in the Herring River watershed.

HERITAGE PRESERVATION AND COMMUNITY CHARACTER

Historic, Cultural and Archeological Resources

The Regional Policy Plan requires protection of historic and archaeological resources under MPS HPCC1.1 and MPS HPCC1.3. As currently proposed in the Preferred Alternative (Alternative D), the Herring River Restoration Project involves the construction of a new dike structure that would raise the tidal level in portions of the Herring River estuary. The project has the potential to impact historic and archaeological sites in primarily three ways: from construction/ground disturbance in low-lying areas where new dikes and tidal control structures are proposed; from erosion due to increased tidal flow through sensitive areas; and from ground disturbance in archaeologically sensitive upland areas where an existing golf course may be relocated.

Commission staff notes that Alternative C, which would include construction of a tidal exclusion dike at Mill Creek, would have less impact on archaeological resources due to the fact that the golf course would not need to be relocated to archaeologically sensitive uplands.

The Cape Cod National Seashore maintains an inventory of cultural properties. While no known above ground historic resources have been identified in the project area, some early industrial properties such as dikes and bridges related to construction of the Cape Cod railroad in the 1870s may need further evaluation to determine their significance.

The project area is known to be archaeologically sensitive. An initial archaeological survey was conducted by PAL in 2011 (Phase 1A Archaeological Background Research and Sensitivity Assessment) and identified 25 known pre-contact archaeological sites in the area. This information was used to develop a predictive model to identify areas of high and moderate archaeological sensitivity in the project area. A full archaeological survey of the area has not been conducted due to the long-term and adaptive nature of the project. Further archaeological survey is proposed only for those areas that are proposed to be impacted by ground disturbance or increased tidal flow and erosion as the project develops. The process for determining when additional survey is warranted and how to proceed is to be addressed in a Programmatic Agreement that is currently being developed with consulting parties.

It appears that the proposed project may be able to avoid impacts to archaeological resources if it proceeds carefully and can adapt to avoid significant sites if they are found. The DEIR/DEIS outlines the goals of avoiding impacts to archaeological resources, first by avoiding archaeologically sensitive areas when possible and, if avoidance is not possible, then performing additional archaeological survey work to determine if archaeological resources are present. If resources are found, specific actions to mitigate impacts would be developed on a site by site basis. To be consistent with RPP standard MPS HPCC1.3 regarding protection of archaeological resources, any significant archaeological sites that are identified need to be preserved, and mitigation would be limited to means that protect those significant archaeological sites from destruction or negative impacts. The Programmatic Agreement should reflect the Commission's standard for protection of archaeological resources, and describe how impacts to significant archaeological sites will be mitigated consistent with this standard.

Exterior Lighting
The DEIR/DEIS did not address impacts from exterior lighting. However, based on a review of the Alternatives, Commission staff suggests exterior lighting impacts would likely be limited to work lights to illuminate construction or maintenance activities. At the same time, it is likely that the majority if not all construction or maintenance activities (such as vegetation trimming/removal within the floodplain) would occur during daylight hours. Given this, staff suggests the proposed Herring River Restoration Project will likely not result in a significant exterior lighting impact.

TRANSPORTATION
As detailed in the DEIR/DEIS, the increase in tidal flow from the Action Alternatives would result in the flooding of a number of local paved and unpaved roads. The impacted roads, including High Toss Road, Pole Dike Road, Bound Brook Road, Old County Road, and numerous fire roads, would need to be elevated, relocated, closed during high tides, or abandoned. The impacts of these alternatives on the roadway network, particularly on emergency vehicle access, should be detailed in subsequent engineering studies and traffic analyses.

In addition to permanent impacts, temporary construction impacts on the roadway network should be addressed in subsequent analyses. Chequessett Neck Road dike reconstruction will result in disruption to vehicles travelling on Chequessett Neck Road. If the road is to be closed for an extended period, care must be taken in providing a safe, well-signed detour route. If the road is to remain open during construction, efforts should be taken to ensure the safety of workers and the traveling public.

HAZARDOUS AND SOLID WASTE MANAGEMENT
Based on the overall project as described by the Executive Summary and Chapters 1 and 2 of the DEIR/DEIS, Commission staff suggests that generation of Hazardous and Solid Waste is likely to result from construction and long-term maintenance activities that involve construction equipment (such as backhoes, cranes, chain saws, etc.). Examples of project elements that appear likely to involve construction equipment include reconfiguration of the Chequessett Neck Road dike and tide gates, culvert replacement, raising or relocating low lying roadways, possible reconfiguration of the CYCC, and removing trees and woody vegetation within the floodplain.

The DEIR/DEIS did not provide sufficient information on the Hazardous or Solid Wastes associated with these and other project components for Commission staff to determine what types and quantities of Hazardous or Solid Wastes may be generated from the overall project. Commission staff suggests subsequent project documents provide more detail on what project elements would generate Hazardous or Solid Wastes, and include information on types and amounts of Hazardous and Solid Waste, and describe how these wastes would be handled and disposed of.

AFFORDABLE HOUSING
Given the nature of the project, Commission staff suggests that the Regional Policy Plan's Affordable Housing section does not apply to the proposed project.

ECONOMIC DEVELOPMENT
Given the nature of the project, and because the Towns of Truro and Wellfleet do not yet have a Land Use Vision Map, Commission staff suggests that the Regional Policy Plan's Economic Development section does not apply to the proposed project.

ENERGY RESOURCES
Given the nature of the project, Commission staff suggests that the Regional Policy Plan's Energy section does not apply to the proposed project.

LAND USE
Given the nature of the project, and because the Towns of Truro and Wellfleet do not yet have a Land Use Vision Map, Commission staff suggests that the Regional Policy Plan's Land Use section does not apply to the proposed project.

OPEN SPACE
Commission staff suggests that the Regional Policy Plan's Open Space section does not apply to the proposed project because the project proponents are the National Park Service together with the municipalities of Wellfleet and Truro.

Correspondence: 28

Author Information

Keep Private:	No
Name:	Charles R. Edmunson
Organization:	Chequessett Yacht and Country Club ◉ Official Rep.
Organization Type:	B - Business

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/08/2012	Date Received: 11/09/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

Mr. Tim Smith
Restoration Ecologist
Cape Cod National Seashore
Wellfleet, MA 02667

November 8, 2012

Dear Tim,
As you know, CVCC has been a participant in the Herring River Restoration project for many years, probably from the beginning. Not only has CVCC been a participant, but an avid supporter as well. While we have always been a supporter a major concern has been just what impact the restoration will have on our golf course.

After our committee at CVCC reviewed the four alternatives as outlined in the HRR Project DEIS/DEIR we agree whole heartedly with the NPS and HRRC decision that alternative 0 is the preferred alternative.
CVCC strongly urges the selection of alternative 0 so that we can continue to be an avid advocate of the Herring River Restoration Project.
Thank you for your interest and consideration of our position of this issue.

Charles R. Edmondson, President
Chequessett Vacht and Country Club

Correspondence: 29

Author Information

Keep Private: No
Name: Charles A. Rheault
Organization:
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 11/09/2012
Date Received: 11/12/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Letter
Notes:

Correspondence Text

Herring River Restoration Plan
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet Mass. 02667

November 9, 2012

Dear Sirs:

We regret very much that my wife and I were unable to attend the hearing last night, and would like to make some comments.

For some forty-odd years (1968) we have been abuttors to the Chequessett Yacht & Country Club and its 106 acres of land. We have been aware for a long time of the many and various problems which you and your committees have been interested in; we can recall John Portnoy's first raising the problem around 1970 or so.
We earnestly hope that those who have become so deeply interested, have put in so many, many hours of time on this worthy project, may agree that Alternative D is the best answer.

I would be glad to discuss further with anyone of similar concerns.
Yours sincerely,
Charles A. Rheault

Correspondence: 30

Author Information

Keep Private:	No		
Name:	William C. Scully		
Organization:	Army Corps of Engineers	☉	Official Rep.
Organization Type:	F - Federal Government		

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/19/2012	Date Received: 11/29/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: E-mail
Notes:	

Correspondence Text

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF
Regulatory Division
CENAE-R-2008-759

George Price
Superintendent
National Park Service
Herring River Draft EIS/EIR
Cape Cod National Seashore
99 Marconi Site Road .
Wellfleet, Massachusetts 02667

November 19,2012

Dear Mr. Price:
We have received your request for the Corps of Engineers to review and provide comment to the Herring River Restoration Project Joint Draft EIS/EIR. We are responding to your request in this letter as a cooperating agency to ensure that the final EIS contains information that we would need to adopt the EIS and to evaluate a permit application for the proj ect (33 CFR 325, Appendix B).

The organization, readability, and use of diagrams, graphs, and tables have made this document a pleasure to review. Our specific commems reJative to our authority are as follows:

Chapter 5: Consultation, Coordination, and ReguhitOl~v Compliance

Part 5.3 : Clarify which agencies may require ndditiollal p (~tmj ts and identif), those permits or permit modifications. The Standing Regulatmy Oversight Committee should evaluate the need for additional pennits or permit modifications during the adaptive management phase of the project.

Page 285, Erst paragraph: replace annual hig.h water (AJiW) \v;~ h mean high water (iv1HW).
Page 286, Mitigation: The statement "functions and values" should be replaced witb "functions". Cite the New England District Compensatory Mitigation Guidance, dated July 20, 2010, and explain how the project is consistent with our compensatory mitigation guidance.

Our mitigation guidance document can be found at our website at w\yw.nac. _u;~aC~-
,mTlly.rll~l/
regulatory/mitigation! guidance.htm.

Appendix F: Essential Fish Habitat Assessment
Ensure that the National Marine Fisheries Service has reviewed the Essential Fish Habitat (EFH)
assessment as required by the Magnuson-Stevens Fishery Conservation and Management Act as amended in 1996, Any pelTnit special conditions required by the NMFS should be coordinated with the Corps of Engineers to make sure the conditions meet our regulatory needs.
If you have any questions please contact me at (978) 318-8220 or John Sargent of my regulatory staff at (978) 318-8026.
Sincerely,
L~W'II." ." S ~l E': 1 am "CU Y .-.
Acting District 19i~_er

Copied
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' i

Correspondence: 31

Author Information

Keep Private:	No
Name:	Thomas O'Connell
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/06/2012	Date Received: 12/07/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

December 6, 2012
RE: Herring River Restoration Project: draft EIRIEIS commentary
Project # Project #14272 (MEPA attention Holly Johnson)

To whom it may concern,
Having spent considerable time living in close proximity to the upper pole dyke creek marsh in Wellfleet, I have grown to love it more every year. It's vast freshwater cattail meadow is an incredible ecosystem that is home to many creatures great and small, starting with the nesting redwing blackbirds in the spring, the summer chorus of American bullfrogs, the fall migratory feeding on winter berry bushes by Robins and Bluebirds,as well as many other species of birds, mammals and reptiles. We have a number of old swamp maples that provide much needed shade
in the summer. We also enjoy yearlong vistas of healthy, rolling marsh views, and our finger on the pulse of this beautiful, healthy ecosystem.

Our home, purchased ten years ago, was built in the late fifties at an elevation and proximity to the marsh that would put its existence in jeopardy if the current recommendation of the HRRC is
put in place. This marsh already holds and manages an incredible amount of water, mainly due to
runoff of storm water and natural lens emissions. Increased water in the Upper Pole Dyke Creek marsh will cause undue angst and hardship to homeowners due to all the projects unknowns, financial hardship to owners unable to sell because of unknowns, flooding to private property likely but when and where unknown, increased water table levels around home, jeopardizing trees and the house structure itself.

I feel that the best and fairest mitigation for the UPDC is a one way flapper valve protecting the whole UPDC and its wildlife and owners from saltwater intrusion. There are many unknowns about the length and breadth of this project. While restoration of federal marsh lands and the intended benefits can and should be accomplished, there needs to be a fair and reasonable approach to mitigation decisions. Berms, walls and other proposed mitigation options are risky, damaging and have unknown consequences, Thus the one way flapper valve protecting the UPDC is the best option. Please consider Alternative C with the addition of a flapper valve protecting ~. Pole Dyke Creek from tidal restoration.

J \

. . ,

Sincerely, \J ,/

Thomas O'Connell

Correspondence: 32

Author Information

Keep Private: No
Name: Michael Parlante
Organization:
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/08/2012
Date Received: 12/10/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Letter
Notes:

Correspondence Text

December 8, 2012
RE: Herring River Restoration Project (MEPA Project #14272)

To whom it may concern,

I have the following concerns about this project:
? Why restore the Herring River when the government, including NOAA, is not stopping the extinction of river herring? When they stop all harvest of herring from the shore out 50 miles, where 99% of the river herring live, a reasonable restoration should take place, but not until then.
? What is going to be done about green crab and Japanese shore crab? Giving these invasive species more habitat to proliferate will definitely not help out the shellfish industry.
? What will the effects of higher salinity in the harbor have on the quahog industry? QPX thrives
in higher salinity.
? Who is liable (property, livelihoods, etc) for damage and costs?
? The report is very vague on how restoration is going to proceed. What is going to happen to trees, mud, roads, other vegetation, displaced animals, septic systems? One page description just does not cut it.
? If you destroy all the fresh water vegetation, what is going to take its place to filter out nitrates and fecal coliform? Look at Duck Creek and Pamet River- they are closed for 6 months of the year. That would be devastating if it happens to Wellfleet Harbor.

Thank you for looking into my concerns.

Sincerely yours,
Michael Parlante

Correspondence: 33

Author Information

Keep Private: No
Name: Alex Hay
Organization: Wellfleet Wastewater Planning Comm. Official Rep.
Organization Type: T - Town or City Government

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/11/2012
Date Received: 12/12/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Letter
Notes:

Correspondence Text

TOWN OF WELLFLEET
Comprehensive Wastewater Management Planning Committee
220 West Main Street
Wellfleet, MA 02667
508-349-0308
fax 508-349-0327

December 11, 2012

Cape Cod National Seashore
Herring River Restoration Project, Draft EISIEIR
99 Marconi Site Road
Wellfleet, MA 02667

RE: Herring River Restoration Em Public Comments

As reflected in our minutes and approved 5-0 at our meeting today, the Wellfleet Comprehensive Wastewater Management Planning Committee would like to express support for this project in the strongest possible terms. As part of our ongoing review of options to meet the Town's TMDL requirements under State and Federal law, the proposed restoration of approximately 890 acres of salt marsh will provide benefits not only to the Herring River Watershed, but \Vellfleet Harbor and Cape Cod Bay.
Based on an extensive literature survey, the recovered salt marsh is likely to remove approximately 125,000 pounds of nitrogen per year which amounts to almost 15,000 people equivalents per year, obviously a sizable impact for a Town whose year round population is 2,750 and summer population is estimated at 18,000.
An equivalent removal of nitrogen from the watershed using traditional landside

treatment options would cost in the range of $80-$125 million dollars, while the restoration has an additional benefit of little or no on-going operating or maintenance costs.

Restoration not only provides direct water quality benefits, but will create new habitat for a host of other filter feeders such as shellfish and herring which were once abundant, and provide additional water quality and ecosystem services. According to NOAA research, approximately 80-90% of recreationally and commercially important fin fish are critically dependent on this type of habitat for about a year, in the early spawning stages.
While some of these marine benefits are compelling, they are but a small part of other restoration benefits to flora and fauna and overall function of the ecosystem. Clearly this project is of extraordinary importance to the town, the general public and the environment and we hope the application is expeditiously approved.

Yours truly,
Alex Hay Ned Hitchcock
Curt Felix Patrick Winslow
Lezli Rowell

cc: Board of Selectmen
Public Comment re: Herring River Restoration
Town Hall
Wellfleet, MA 02667

Cape Cod Commission
Public Comment re: Herring River Restoration
P.O. Box 226, 3225 Main Street,
Barnstable, MA 02630
Secretary Richard K. Sullivan, Jf.,
Executive Oflicc of Energy and Environmental Affairs,
Attn: MEP A Oflice, Holly Johnson, EEA No. 14272,
100 Cambridge Street, Suite 900
Boston, MA 02114

Correspondence: 34

Author Information

Keep Private: No
Name: Dennis O'Connell
Organization: Wellfleet Conservation Trust ⦿ Official Rep.
Organization Type: P - Conservation/Preservation

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/12/2012
Date Received: 12/12/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Letter
Notes:

Correspondence Text

WELLFLEET CONSERVATION TRUST
PO Box 84 WeIIfleet MA 02667

Herring River Restoration Committee
220 West Main Street (hand delivered)
Wellfleet, MA 02667 '

To the Committee:

Re: Comments on the Draft EIS of October 2012

December 12, 2012

The Wellfleet Conservation Trust is the owner of23 individual properties that could be impacted by restoration of the Herring River according to your documentation. We have been keenly aware and supportive of your progress over the past few years. In fact we helped fund your early outreach program by sponsoring the printing costs of some early brochures. At the October 15, 2012 Public Hearing, our Vice President, William Iacuessa, spoke in support of your process and goals.

We have reviewed our potentially-impacted properties and understand the possible effects on vegetation, soil conditions, added regulatory issues and access. There are no structures on these properties. All of these properties were donated to us over the past 28 years. We understood the low-lying nature of them at the time we took ownership. From your Draft EIS Report, we understand that there will be an adaptive implementation of the flood plain. We support that approach and hope that our properties will be beneficial to the process. We do not plan on seeking compensation for any impacts as we are very supportive of your goals for restoration and feel that your efforts are complementary to our activities. We do ask that we, and the public, be kept informed as the project goes forward and the adaptive process proceeds.

We support your project and its goals and wish the best on proceeding from here. Thank you for the opportunity to comment on the Draft EIS. Should you have any questions, please contact the undersigned.

On behalf of the Board of Trustees;

R. Dennis O'Connell, Trustee, President

cc: Cape Cod National Seashore
The Cape Cod Commission
Massachusetts Environmental Affairs
The Wellfleet Conservation Commission

Correspondence: 35

Author Information

Keep Private: No
Name: Martin Nieski
Organization:
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/07/2012
Date Received: 12/10/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Letter
Notes:

Correspondence Text

Draft EIR critiques;

Having recently met with the CCC it seems to me that the only reasonable alternative to the problem
with my property at (b) (5) [redacted] is option C which would put a dike of
some sort on Mill Creek.

It is clear that cost the per acre is greatest because of the situation with the golf course and my house. '
Not only would you still have the main river for the herring run, which I believe was the original intent of
the project, you would eliminate all the other issues in Mill Creek with the least impact on the project as
a whole.

Although I am not against the project as a whole, I can see where streamlining it at Mill Creek and Pole
Dike seem to make sense.

I am eagerly awaiting the assignment of a contact person so I discuss these problems face to face.

Martin Nieski
..

Correspondence: 36

Author Information

Keep Private:	No
Name:	Pamela S. Bauder
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/10/2012	Date Received: 12/12/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

December 10, 2012

Re: The Herring River Restoration project

The Herring River Restoration Project is a noble idea worthy of an incremental, fully pre-funded trial on federal land. The environmental movement has always decried drastic, sudden alterations of the existing landscape. This proposed project D, is too abrupt speculative a change to the ecosystem. I am not favor of this gamble being imposed on private land.and tne species which inhabit it. If the goal is to have the largest wetland restoration project:-it's for the wrong reasons.

Sincerely,
Pamela S. Bauder

Correspondence: 37

Author Information

Keep Private:	No
Name:	Pamela S. Bauder
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 11/08/2012	Date Received: 12/12/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

November 8, 2012

Herring River Restoration Committee
220 Main Street
Wellfleet, MA 02667

To Whom it May Concern:
When I first heard of th Herring River Restoration Project I was thrilled .. The word restoration alone is heavily freighted with positive connotations .. l had fanciful images that included swimming in my backyard as well as honoring the past.

AS I've increasingly informed. myself over the years, I see how simplistic that was.

However deep ones' fondness for herring, in the meetings I've attend, the loss of habitat for all creatures contributing to the chain of life which populate those 1000 acre are given short shrift. I've been told that they will move elswhere, as if that was feasible.. The measured gradual flooding in increments, which is the projected plan, maKes me wonder if the result will mirror that of frogs which, if dropped into hot water, immediately jump out;--but if placed in water which gradually comes to a boil die.

If any studies have been done on endangered species or loss of species (plant, animal, ana. insect) to the chain of life on this 1000 plus acres, how impartial and independent were they? If tied in
with the project in any way, I would think that those findings would naturally reflect a conflict of interest, and be invalidated ..

I also.worry that the flooding of land I've known and loved all my life would not only, by necessity. as described, killl off all the vegitation whose cnanging colors and textures have enriched my life; but the intrusion of salt water mignt also compromise the water table and effect my well---determined by the testing lab in Hyannis as already posessing "dangerously high levels of salt." This is a well limited by the numerous strictures imposed by the town to one spot on my property. It cannot be moved from its location--a location very close to the storm drain on Briar Lane, which the town insists on continuing to salt . I was also told at the DPW that Wellfleet accomodates and accepts what the Hyannis Labs deem "dangerously high levels of salt" in the well water to, and this is a quote "to benefit the construction industry."

Despite the assurances of those who have gotten grants and built careers promoting this project, however well intentioned, who is to say a rising sea encroaching on all sides of the Cape, (and we Know that it is)--willnot impinge disadvantageously inland? LOOK at what has happened this passed week in New York,
and New Jersey. with Hurricane sandy? Did the powers that be in those great metropolitan areas predict that?

It's easy and sometimes a seductive "feel good", to get swept up with causes. It sounds lovely to restore the herring run. How about restoring Wellfleet's whaling industry? I say this not to suggest another "cause du jour", but to provide perspective. Thereis a line I love in the poem "Another Time," D.W Auden: "Another time has other lives to live."

I overlook many acres of meadow protecting habitats for rabbits, foxes, possums, honeysuckle, birds, etc, unthreateded by people;-- land I have been paying taxes on, as did my parents before me-land which is private. This is land which, once flooded, I'm told by you, would be open to the public, hence, no longer mine, nor, after Killing off or driving off to their probable demise, would it belong to the rabbits, foxes, plants, birds, etc, which inhabit it. When I checked out the results of this having been done in Truro, I saw a depressing wasteland of blacK dead vegetation stuck in water. When I asked at the last meeting I attended here, if that is what would happen in Wellfleet, I was told that one solution woula be "to have a burn" to dispose of it. So I ask you, I'm told that I can be heavily fined for touching a shrub that may have only recently taken root on the property my family has been paying taxes on for generations, if you
deem it marsh, and therefore protected ?? But you may burn it, flood it, and allow the public on it?

Are herring the species ju jour, as whales were once, or people?

In deciding who lives and who dies, different species go in and out of fashion, but, to me, the impulse of those who assume the power to do so, is always alarming, however it may be framed. One, of many
succient ways of framing what you propose to do with my land is, you just may be, on top of all of the concerns I've mentioned,-- putting a smiley face on a land grab.

Sincerely,
Pamela S. Bauder

Correspondence: 38

Author Information

Keep Private:	No
Name:	Public Testimony Excerpt from Minutes, Joint Hearing with MEPA
Organization:	Cape Cod Commission Official Rep.
Organization Type:	T - Town or City Government

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent:	Date Received: 11/08/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Transcript

Notes: This is an excerpt of public testimony from the complete meeting minutes for the Cape Cod Commission Joint Hearing with MEPA for the Herring River Draft EIR/Draft EIS held at the Truro Council on Aging/Senior Center, 715 Old Kings Highway, Truro, MA, on November 8, 2012. This Joint Meeting also functioned as the NEPA DEIS public meeting.

Correspondence Text

Public Testimony
Mr. Short asked for public testimony but noted it would be subject to a three minute limit. He also asked those testifying to summarize their points if another speaker had already touched on that issue.

Mr. Bob Hubby, Chair, Wellfleet Open Space Committee, spoke in favor of the project.

Mr. Alex Hay, Chair, Wellfleet Wastewater Committee, spoke in favor of the project, noting that increased flows to the Harbor were important.

Mr. Ned Hitchcock, Wellfleet Natural Resources Advisory Board, said the Board supported Alternative D. He said the Shellfish Advisory Board also supports the project, but that both Boards wanted to emphasize the need to create public access points.

Ms. Barbara Bennesal, Wellfleet Shellfish Advisory Board, said the Board was in support of the project. She said it would expand shellfish habitat, and allow for a better functioning Harbor. She said the Town was concerned that it retain the right to manage the fisheries, and recommended additional public access points with vehicle parking and safe access.

Mr. Short described the Cape Cod Commission Subcommittee's role, that it would take comments and testimony, assemble the record and ultimately make a recommendation to the full Cape Cod Commission.

Ms. Adams clarified the Subcommittee's role, noting it was similar to that of a Planning Board. She said it was important that interested parties communicate with the Commission members in public hearings, or by mail through the Commission staff, so that all of the members could be made aware of the comments and concerns.

Mr. Short said the joint hearing would be in recess for 10-15 minutes for a comfort break for the Subcommittee members. Tape stopped at approximately 8:oo PM.

The tape was resumed at approximately 8:15 PM when the Subcommittee members reconvened the hearing after the comfort break.

Ms. Fenn clarified that comments received by the National Park Service or by the MEPA office would be shared between the two agencies.

Mr. Palladino, Friends of Herring River, commended the Towns for conducting the needed research. He said the Friends supported Alternative D. He said it was important to include public access opportunities in the project design.

Mr. Ed DeWitt, Executive Director of the Association for the Preservation of Cape Cod, spoke in favor of the project. He noted APCC had some 5,500 members. He said restoration of the Herring River was a top priority for APCC as far back as the 196o's. He said the marsh was critical to nutrient attenuation and addressing global warming. He said the marsh and estuary were a key public and fisheries resource.

Mr. Donald Thimus, Wellfleet, spoke in favor of the project, and agreed with Alternative D as the preferred alternative. He said the Applicants had done an outstanding job analyzing the alternatives, and the project would be good for the Town.

Mr. Jack Whalen said the Draft EIR/Draft EIS was comprehensive. He said Alternative D is key to restoring the marsh, and that the increased tidal flow would help kill off Phragmities.

Ms. Laura Runkle, said she was an affected private property owner. She said the project's natural resources impacts had been studied in depth, but not so the impacts to private property. She questioned those, and the proposed mitigation for impacts to private property. She said the Final EIR/Final EIS should include significantly more detail on these impacts, such as a map of impacted properties, and suggested the main goal of the project could be achieved without impacts to Pole Dike Creek

Mr. Michael Parlante questioned whether his property would become "public" based on the level of inundation. He said the Draft EIR/Draft EIS was vague on the impacts to roads. He questioned whether the project would include dredging? He questioned whether there would be impacts to shellfish grants in the Harbor?

Mr. Chuck Edmonson, President of the Chequessett Yacht and Country Club (CYCC), said the Draft EIR/Draft EIS was professionally prepared. He said the CYCC had been a participant in the restoration effort. He expressed concern over impacts to the golf course. At the same time, he said the CYCC had also selected Alternative D as the preferred alternative.

Mr. Bill Iacuessa, President, Wellfleet Conservation Trust, said the Trust was generally supportive of the project. He said the Trust as a group had not formally voted on the issue, but would do so at their next meeting, which was before December 12, 2012.

Ms. Ashley Faukes-Silver, said the impacts to private property owners need to be considered. She suggested this might include higher taxes because of increased marsh or water views. She expressed concern over impacts to her horses, and whether or not they would have to be relocated because of increased green head flies.

Ms. Pamela Bauder said she was an impacted private property owner. She said she was first thrilled about the project, but that was based on an overly simplistic view of it. She said the incremental flooding will negatively impact species presently resident in the marsh. She was concerned about this, and impacts to her property, some 8 acres. She expressed concern that her private property would become "public" by the act of inundation. She said the time for restoration of the marsh to the state that it was before the dike was first built had passed, and consideration should be given to species currently living there, and private property owners.

Mr. Martin Nieski, said he expects his property to be severely negatively impacted by the project. He acknowledged that perhaps he was given a building permit in error in 1990, when he constructed his house, given the nearness to the marsh edge. He said he had a report commissioned by Massachusetts Coastal Zone Management using a private consulting firm which described potential significant negative impacts to his property and his house. He read a paragraph from the report which indicated direct flooding of the basement, utilities and decking. He questioned why the Applicants had not released this report. He said that his house was effectively unsaleable, and the project raised eminent domain and takings questions. He said he was very frustrated with the entire process.

Mr. Short swore in Mr. Mark Flaherty, Massachusetts Audubon Society, who arrived late to the hearing.

Mr. Mark Flaherty, Massachusetts Audubon Society, said the Society supports the project. He thanked the Herring River Restoration Committee for their efforts. He said Audubon supports Alternative D and the use of an Adaptive Management Plan as the project moves forward.

Mr. Short asked for any further public comments. Mr. Nieski asked if the Applicants had submitted a copy of the report on his house for the record? He suggested either the Subcommittee or Applicants had a copy of the report. Ms. Adams suggested that Mr. Nieski could submit a copy of the report for the record and it can be mailed to the Commission office. She said it would then be distributed to the Subcommittee members.

Ms. Faukes-Silver suggested there should be an Alternative E, which confines the restoration efforts within the National Seashore boundary. She noted the project would bring the 200 foot buffer of the state Rivers Protection Act into play.

Ms. Bauder said few of the affected private property owners have a complete understanding of the project's full impact, noting that she was unaware of the impact of the Rivers Protection Act and its required setbacks.

Correspondence: 39

Author Information

Keep Private:	No
Name:	Ashley Fawkes-Sylver
Organization:	
Organization Type:	I - Unaffiliated Individual

Correspondence Information

Status: New	Park Correspondence Log:
Date Sent: 12/10/2012	Date Received: 12/12/2012
Number of Signatures: 1	Form Letter: No
Contains Request(s): No	Type: Letter
Notes:	

Correspondence Text

December 10, 2012

Cape Cod National Seashore/ Herring Rivet Restoration Committee
Herring River Restoration Project, Draft EIS/ElR
99 Marconi Site Road
Wellfleet, Mil 02667

To Whom It May Concern:

My husband and I have owned our property that abuts the Pole Dike Creek since 1999. We have been following the Herring River Restoration Project for years and are very concerned about the lack of information in the El R draft regarding the impact that restoring the river is going to have on
private property. It is of further concern that the Herring River Committee is recommending a full
restoration without fully studying all that is involved with the restoration.

Some of the concerns we have are higher property evaluations when we have waterviews, our current0 conservation setback of 100 feet will increase to 200 feet and the greenhead flies that will
come with restoring the salt marsh, which will make it impossible to keep our horses on our property for a couple of months in the summer. The bottom line is this will cost upwards to $5,000
dollars a year to live next to the marsh.

If the Upper Pole Dike Creek is restored I would like our property to be grandfathered for the current conservation setback that we have now and for our property to be revalued for tax assessment purposes based on the current criteria used. I would also like there to be a fund set

up
so that I can be reimbursed for boarding my horses off site in the summer months for each year that I have them.

I strongly urge you to consider a plan that keeps the river restoration within the Cape Cod National
Seashore bounds. Doing so will allow full restoration of the Herring River and will give the herring
full access to their traditional spawning grounds.

Sincerely,

Correspondence: 40

Author Information

Keep Private: No
Name: Robert LaPointe
Organization:
Organization Type: I - Unaffiliated Individual

Correspondence Information

Status: New
Park Correspondence Log:
Date Sent: 12/10/2012
Date Received: 12/12/2012
Number of Signatures: 1
Form Letter: No
Contains Request(s): No
Type: Letter
Notes:

Correspondence Text

December 10,2012
Re: Herring River Restoration Project

My name is Robert LaPointe, my family lives in the subdivision. My daughter
age II, attends the Nauset School District. I have been a aquaculturalist in Wellfleet for the past twenty
five years

I have several concerns regarding the Herring River Restoration project. Firstly, having a shellfish
grant on lndian neck beach, I consider myself an abutter by water as well as by land. Wellfleet harbor
has over 160 shellfish grants, many in the inner harbor. Tens of millions of pieces of shellfish are
harvested each year from these waters. I have on my grant alone over four million clams and oysters.
Shellfish, especially oysters, are very sensitive animals. An adult oyster will pump up to 50 gallons of
water each day. A small amount of contaminate will shut down the harbor for harvesting, a larger
amount could kill the oyster. Closure of shellfish beds will lead to financial hardship and ruin for many
and the bad press harms our reputation in the market place that has taken years to establish. I have yet
to see any plan that has been proposed that would deal with the potential loss of livelihood for hundreds
of grant holders as well as ail the wild fishermen.

Two other concerns I have with this project include the potencial property tax increase as well as the
extended land use restrictions. The later will extend my present 100ft. wetland restriction to 200 hundred feet. Essentially encompassing my entire property. For a project that will clear cut 1,200
hundred acres in total, displace (most likely kill) all the creatures pressent. I find this unacceptable.
would like to propose that the pressent 100 feet set back remain for all abutters.

Higher property assessments for properties that will have increased waterviews is unfair. It is doubtful
that we will get any tax break for the years of construction and transition. I propose that the tax structure remain as it is. I do not ever plan to sell my property. (To me it is only a potential tax increase in the years when I am hoping to slow down an retire.)

I understand the potential benefit of the restoration project, I also see a small group of people paying a
disproportionate amount for its success. And an even smaller number of abutters a huge amount. Tune
consuming projects like this have a tendency to change and evolve as they are implemented. Often
times, they run out of funds potentially leaving a unfinished mess. I have been assured over the years
that the vegetation will all be removed before the actual flooding of salt water. I hope that this promise
in particular remains true or I will be looking at a mess for the rest of my life.

Sincerely,
Robert La Pointe & family

APPENDIX N: MASSACHUSETTS ENVIRONMENTAL POLICY ACT DRAFT SECTION 61 FINDINGS AND PROPOSED MITIGATION MEASURES

Table of Contents

1.0 INTRODUCTION

Massachusetts General Law (M.G.L) Chapter 30, Section 61 authorizes state agencies with permitting responsibilities to make an official determination regarding potential impacts from a proposed project and whether impacts have been avoided, minimized, and/or mitigated for appropriately. The Law requires agencies/authorities to issue a determination that includes a finding describing the environmental impact, if any, of the project and whether all feasible measures have been taken to avoid or minimize said impact. The purpose of this document is to identify and present the mitigation measures and draft Section 61 Findings as part of the final *Herring River Restoration Project Environmental Impact Statement/Environmental Impact Report* (EIS/EIR).

Draft Section 61 Findings are outlined in the Massachusetts Environmental Policy Act (MEPA) Regulations 301 CMR 11.07, in accordance with M.G.L. c. 30, Section 61 for all state agency actions. These regulations require that each agency, department, board, commission, and authority of the Commonwealth “review, evaluate, and determine the impact on the natural environment of all works, project or activities conducted by them and shall use all practicable means and measures to minimize damage to the environment.” The regulation also states that, “Any determination made by an agency of the Commonwealth shall include a finding describing the environmental impact, if any, of the project and a finding that all feasible measures have been taken to avoid or minimize said impact.”

The Certificate of the Secretary of Energy and Environmental Affairs requires the final EIS/EIR to include a draft Section 61 Findings for state agency actions. The draft Section 61 Findings should clearly disclose impacts on the natural environment, commit to mitigation measures that will minimize environmental damage, and identify the parties responsible for implementing mitigation measures.

The Secretary’s Certificate on the Environmental Notification Form (November 7, 2008) identified the critical general issues to be addressed in the EIS/EIR, as well as specific requirements for the scope of the document. The brief overview of the project provided below explains the purpose of the proposed Herring River Restoration Project, outlines required state and federal permits and their authorities, summarizes mitigation commitments for permanent and construction-related impacts, and provides draft Section 61 determination language for state agencies.

2.0 PROJECT DESCRIPTION

2.1 PROJECT PURPOSE AND NEED

The Herring River estuary in Wellfleet and Truro on Cape Cod, Massachusetts (along with its flood plain, tributary streams, and associated estuarine habitats within Wellfleet Harbor) was the largest tidal river and estuary complex on the Outer Cape. Most of the river’s flood plain (approximately 80 percent) is within the boundary of the Cape Cod National Seashore (the Seashore). The river itself extends from Wellfleet Harbor northeast for nearly 4 miles to Herring Pond in north Wellfleet. Bound Brook, a major tributary, stretches northwest to Ryder Beach in South Truro. The river system, approximately defined by the landward limit of the flood plain of the river and its tributaries, encompasses about 1,100 acres. In addition to the Herring River’s upper, middle, and lower basins, the project area is composed of important stream sub-basins including Duck Harbor, Mill Creek, Lower and Upper Bound Brook, and Lower and Upper Pole Dike Creek.

The purpose of the Herring River Restoration Project is to restore self-sustaining coastal habitats on a large portion of the 1,100-acre Herring River estuary. The Herring River flood plain is a large and complex area that has been impacted by more than 150 years of human manipulation, the most substantial being the construction of the Chequessett Neck Road dike at the mouth of the river in 1909. The Herring River's wetland resources and natural ecosystem functions have been severely damaged by over 100 years of tidal restriction and salt marsh drainage.

2.2 HISTORY OF MASSACHUSETTS ENVIRONMENTAL POLICY ACT REVIEW

The Herring River Restoration Committee (HRRC) and the National Park Service (NPS) jointly propose to restore native tidal wetland habitat to large portions of the Herring River flood plain in and adjacent to the Seashore by re-establishing tidal exchange in the river basin and its connected sub-basins. While the ecological goal is to restore the full natural tidal range in as much of the Herring River flood plain as practicable, tidal flooding in certain areas must be controlled to protect existing land uses. Where these considerations are relevant, the goal is to balance tidal restoration objectives with flood control by allowing the highest tide range practicable while also ensuring flood proofing and protection of vulnerable properties. Just as the current degraded state of the river is the combined effect of many alterations occurring over many years, restoration of the river will also require multiple, combined actions to return it to a more fully functioning natural system.

Over the past several years, local, state, and federal partners and non-governmental organizations have expressed growing support for restoring the Herring River estuary. The process has not only encompassed many years of scientific and engineering investigations, but also has included a public review process to ensure that all concerns and interests are recognized and considered. The HRRC and NPS have prepared the EIS/EIR for the Herring River Restoration Project to assist the public, the Seashore, and the Towns of Wellfleet and Truro, MA, in developing a tidal restoration project for the Herring River.

The EIS/EIR was been prepared in accordance with the 1969 National Environmental Policy Act, the MEPA, and the Cape Cod Regional Policy Plan. For this project, the Towns of Wellfleet and Truro are the lead agencies for MEPA and the Cape Cod Commission; the NPS is the lead agency for National Environmental Policy Act compliance, with the participation of other cooperating agencies, namely the U.S. Fish and Wildlife Service, Natural Resources Conservation Service, National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency (USEPA), and the U.S. Army Corps of Engineers.

2.3 ALTERNATIVES DEVELOPED

Three action alternatives were developed for the restoration of the Herring River. These three alternatives are intended to represent a range of desirable endpoints to be achieved through incremental restoration of tidal exchange and adaptive management. The alternatives are distinguished primarily by the long-term configuration of a new dike and tide control structure at Chequessett Neck Road and the resulting degree of tidal exchange. Tidal exchange would be increased incrementally, over time, using an adaptive management approach, to achieve desired conditions for native estuarine habitats. The EIS/EIR assesses the impacts that could result from continuing current management (the no action alternative) or implementing any of the three action alternatives. The preferred alternative, with its various restoration components, serves to guide the process and timing of tidal restoration and will provide a strategy for long-term, systematic monitoring, management, and restoration of the Herring River estuary.

3.0 DRAFT SECTION 61 FINDINGS FOR STATE AGENCY ACTIONS

The purpose of this chapter is to identify and present the mitigation measures and draft Section 61 Findings as part of the EIS/EIR. Draft Section 61 Findings are outlined in the MEPA Regulations 301 CMR 11.07, in accordance with M.G.L. c. 30, Section 61 for all state agency actions. These regulations require that each agency, department, board, commission, and authority of the Commonwealth "review, evaluate, and determine the impact on the natural environment of all works, project or activities conducted by them and shall use all practicable means and measures to minimize damage to the environment." The regulation also states that, "Any determination made by an agency of the Commonwealth shall include a finding describing the environmental impact, if any, of the Project and a finding that all feasible measures have been taken to avoid or minimize said impact."

3.1 PERMITS AND APPROVALS

The final EIS/EIR is required as part of the Certificate of the Secretary of Energy and Environmental Affairs to include a separate chapter on mitigation measures associated with the Herring River Restoration Project and that this chapter also includes draft Section 61 Findings for all state agency actions. The draft Section 61 Findings need to contain a clear commitment to implement mitigation, identification of the parties responsible for implementing the mitigation, and a schedule for the implementation of mitigation.

The anticipated state agency actions are listed below. These actions summarize permits and approvals that will likely be required for implementation of the Herring River Restoration Project.

- Massachusetts Executive Office of Energy and Environmental Affairs approval of the final EIS/EIR.
- Massachusetts Department of Environmental Protection (MassDEP), Wetland Protection Act (WPA) and Wellfleet and Truro Conservation Commission approvals (applicable bylaws) for work within the 100-foot buffer to a wetland, per the wetlands regulations at 310 CMR 10.00. The Massachusetts Rivers Protection Act likewise regulates activity within 200 feet of perennial rivers (Riverfront Area). Any proposed alteration to a wetland resource area (defined as a change in vegetation, hydrology, or water quality) is reviewed for compliance with performance standards established for each resource area. The WPA also requires compliance with the MassDEP Stormwater Management Standards. Town-appointed Conservation Commissions have delegated statutory authority to administer the WPA and to issue Orders of Conditions for most alterations to wetland resource areas.

  New regulations, promulgated by MassDEP in October 2014, resulted in important changes to how the Herring River Restoration Project may be permitted, compared to information presented in the draft EIS/EIR. Most notable among these changes is the provision for Ecological Restoration Limited Projects (Section 10.24(8)(a) and Section 10.24(8)(e)1), which would allow the Herring River Restoration Project to proceed without a variance to the WPA or Section 401 Water Quality Certification (WQC) regulations, as had been noted in the draft EIS/EIR.

  The Herring River Restoration Project may be permitted by the Wellfleet and Truro Conservation Commissions as an Ecological Restoration Limited Project, as set forth in the WPA regulatory provisions governing review and approval of ecological restoration projects.

In addition, although the Herring River Restoration Project will involve dredging more than 100 cubic yards in an areas of critical environmental concern and Outstanding Resource Water, this may be permitted with a Section 401 WQC, per 310 CMR 10.12(1)(l). There are no thresholds for the amount of alteration/loss allowed if the issuing authority determines that the Herring River Restoration Project complies with the other applicable Ecological Restoration Limited Project provisions. This regulatory change eliminates the need for a WPA variance to permit the Herring River Restoration Project. "Chapter 5: Consultation, Coordination, and Regulatory Compliance," of the final EIS/EIR, contains a more detailed discussion of the proposed approach to WPA permitting.

HRRC anticipates seeking initial Orders of Conditions from the Wellfleet and Truro Conservation Commissions under MassDEP's proposed new ecological restoration regulations, encompassing all the potential effects of the Herring River Restoration Project. The Notice of Intent (NOI) would address all possible project elements grouped into two classes:

- Class 1-Elements that are required for initial project implementation and are certain to occur (including but not limited to, reconstruction of the main dike, construction of the dike at Mill Creek under the preferred alternative, and elevation of low-lying roads); and tidal flow impact prevention or other mitigation to impacted structures.
- Class 2-Elements that may or may not be implemented, or have an uncertain extent of implementation (including but not limited to, channel modifications, grading, and vegetation management), and that would be determined by future monitoring and adaptive management decisions based on system response to incremental increases in tidal exchange.

Primary construction elements and other activities that fall into Class 1 would be addressed with detailed plans, data, and narratives in the initial NOIs. Other Herring River Restoration Project elements that fall into Class 2 would be covered more broadly with lesser detail in the initial NOIs, and would be further considered in greater detail if and/or when they are proposed for implementation based on adaptive management analysis as tidal restoration progresses over time.

The approach is to submit one set of "umbrella" NOIs that covers all the primary Herring River Restoration Project elements that will definitely be required to achieve tidal restoration within the main Herring River basin, including all the dike/bridge/tide gate work, road work, and flood protection measures for private properties. Secondary activities that may or may not be necessary, depending on adaptive management and private landowner negotiations, (such as vegetation management, channel dredging, and other flood protection actions) would be approved as "potential work" and handled with subsequent amendments to the Orders of Conditions for specific locations and properties.

- MassDep, 401 WQC. MassDEP is required to issue water quality certificates for projects that result in discharge or fill, pursuant to the Massachusetts Clean Water Act (MGL c. 21 §§ 26-53) and Section 404 of the federal Clean Water Act. WQC regulations at 314 CMR 9.00 were revised in coordination with WPA regulation updates in October 2014. In a manner similar to the justifications cited above which would allow the Herring River Restoration Project to be permitted under the Massachusetts WPA as an Ecological Restoration Limited Project, approval under 401 WQC standards is expected. "Chapter 5: Consultation, Coordination, and Regulatory Compliance," of the final EIS/EIR contains a more detailed discussion of the proposed approach to compliance with the Massachusetts 401 WQC.

- MassDEP, Massachusetts Public Waterfront Act, Chapter 91 License (as applicable), pursuant to M.G.L. c. 91, the waterways licensing program. Chapter 91 is a collection of early ordinances and subsequent statutes designed to preserve and protect the public's rights in tidelands by ensuring that such lands are only used for water-dependent uses or otherwise serve a proper public purpose. Compliance with Chapter 91 is administered by MassDEP through the Waterways Regulations at 310 CMR 9.00. These regulations establish procedures for the issuance of licenses for activities and structures located within jurisdictional areas. Maintenance, repair and minor modifications to existing structures within jurisdictional area may be permitted without a new license or license amendment under the procedures at 310 CMR 9.22.

  Within the Herring River project area, Chapter 91 jurisdiction potentially extends to the placement of fill and the new construction, substantial alteration, or expansion of existing structures below the historic (pre-Chequessett Neck Dike) mean high water line. No structures or fill in the Herring River flood plain (with the exception of the Bound Brook Road culvert) currently have Chapter 91 licenses, thus new license applications would need to be submitted for all fill and structures below historic mean high water. These will include:

  – the new Chequessett Neck Road Dike;
  – a new dike and tide control structure at Mill Creek;
  – fill placed to elevate portions of the Chequessett Yacht and County Club golf course;
  – a new culvert and access improvements along High Toss Road;
  – several new culverts and fill placed along reaches of Pole Dike Creek, Bound Brook Island, and Old County Roads; and
  – other small culverts and related fill along roads in upstream reaches of the project area.

  It is expected that the Herring River Restoration Project will seek a Combined Permit, as allowed by 314 CMR 9.0.9(4), to cover both Section 401 Water Quality Certification and Chapter 91 Waterways licensing.

- MassDEP, Air Quality Permit BWP AQ 14, 15, 16, 17 Operating Permits. These are mandated for major sources of air pollution by the Clean Air Act Amendments of 1990. Massachusetts has incorporated this program in 310 CMR 7.00 Appendix D of its Air Pollution Control Regulations. In some cases, emissions from construction activities trigger this requirement.

- Office of Coastal Zone Management Federal Consistency Review, pre-consultation to determine applicability.

- Massachusetts Department of Transportation (MassDOT). Under Chapter 85 Section 35 of the Massachusetts General Laws, any structure (culvert, bridge or other) measured 10 feet or over along the roadway centerline (or 8 feet measured square to the abutments) is considered a "bridge" for the purpose of review by the MassDOT. By this law, MassDOT has been charged the task of reviewing all bridges along a public way (state maintained or otherwise).

- Massachusetts Division of Fisheries and Wildlife, The Natural Heritage and Endangered Species Program, Massachusetts Endangered Species Act (321 CMR 10.00) and/or the WPA (310 CMR 10.00) for work below mean high water line, in a fish run, or in priority or estimated habitats.

- Massachusetts Division of Marine Fisheries as appropriate. Massachusetts Division of Marine Fisheries will include consultation on potential impacts to diadromous fish species and mitigation measures, as appropriate.

- Massachusetts Historical Commission Section 106 consultation/reviews for any collection system components and pump stations to be constructed outside of road right-of-ways.
- Cape Cod Commission approval of the final EIS/EIR as part of the Development of Regional Impact approval process.
- Towns of Wellfleet and Truro building permits for the construction of structures as part of the Herring River Restoration Project.

The assessment of impacts to the environment as they pertain to the Herring River Restoration Project are discussed in chapter 4 of the final EIS/EIR. The following section summarizes mitigation measures and commitments, and may be used as the basis of development of Section 61 Findings for state permits necessary for construction and operation of the Herring River Restoration Project.

3.2 POTENTIAL DAMAGE TO THE ENVIRONMENT RESULTING FROM THE HERRING RIVER RESTORATION PROJECT

The Herring River Restoration Project would result in primarily beneficial effects on the environment. Salinity levels, water and sediment quality, sediment transport processes, and salt marsh vegetation would be restored to conditions approximating pre-dike conditions. In turn, habitat conditions would be improved for many aquatic species and wetland species, including state listed species such as diamondback terrapin, northern harrier, and American and least bittern.

However, the restoration does involve the potential for some adverse effects, primarily from direct construction impacts. There would also be some habitat loss for species using upland habitat types, but these are not predicted to have significant direct effects because these species are mobile (and the restoration gradual) and these habitat types abundant nearby and elsewhere on Cape Cod. Adverse effects are disclosed in table 1.

Table 1: Adverse Environmental Effects of the Herring River Restoration Project

Resource	Selected Alternative: New Tide Control Structure at Chequessett Neck and Mill Creek
State-listed Rare, Threatened, and Endangered Species	**Eastern Box Turtle** Within project area: • Reduce principal habitat (dry and wet deciduous forest, dry shrubland, dry dunes) from 88 acres to 0 acres • Reduce occasional habitat(miscellaneous non-tidal*, pine woodland, wet shrubland) by 488 acres to 123 acres • Increase unsuitable habitat from 307 to 883 acres • 3,870 acres of suitable habitat remain immediately adjacent to project area within Cape Cod National Seashore
	Water-Willow Stem Borer Within project area: • Reduce potential Decodon habitat (wet shrubland and wet deciduous forest) from 386 acres to 131 acres • Increase unsuitable habitat from 620 acres to 875 acres • 265 acres of suitable habitat would remain adjacent to project area

Resource	Selected Alternative: New Tide Control Structure at Chequessett Neck and Mill Creek
Terrestrial Wildlife	**Birds** For upland and other bird species, woodland, shrubland, and heathland habitat would be limited to the estuary periphery and the uppermost sub-basin, but these species would utilize adjacent upland habitats.
	Mammals Most species would relocate to the estuary periphery and to the upper extents of the 890-acre area affected by mean high spring tide.
	Reptiles and Amphibians Most species would relocate to the estuary periphery and to the upper extents of the 890-acre area affected by mean high spring tide.
Cultural Resources	There is a potential for adverse effects to archeological resources in the APE from construction or other ground-disturbance. Additional archeological assessment would occur prior to construction. Higher tides would not impact archeological resources because any inundation would be gradual. Erosion from increased tidal flows could impact transportation corridors across river channels, but these impacts would be mitigated by culvert replacement and other erosion control measures. For golf course flood proofing option implemented, 5 acres (approximately) of sensitive uplands could be disturbed.
Low-lying Properties	Increased tidal exchange could result in adverse impacts to low-lying properties and cultivated vegetation unless mitigation measures are undertaken to protect them from floodwater. However, flood proofing measures such as walls, berms, fill, or relocation would mitigate flood impacts.
Low-lying Roads	A number of paved and unpaved road segments would be subject to periodic flooding. These road segments could be raised or realigned to be protected from flooding. The maximum length of affected roads would be • Paved: 9,397 feet • Sand/fire roads: 10,727 feet
Viewscapes	Despite primarily beneficial long-term effects on the viewscape, in the short term, some dead or dying vegetation could reduce the quality of the viewscape until the transition is complete.
Recreational Experience and Public Access	Some low-lying access points could be impacted in the short term, but in the long term these could be replaced with better access points. After restoration, there would be improvements to recreational shellfishing, finfishing, wildlife viewing, boating, and visual aesthetics. There would be no net loss in public access.
Mill Creek Dike	Same as alternative C This structure would require approximately 2,900 cubic yards of fill and would permanently impact 12,500 square feet of wetland. In addition, a work area of approximately 105,000 square feet (2.4 acres) of wetlands would be impacted temporarily for dewatering and other associated work.
High Toss Road	If the road is reconstructed above high tide line, there would be a permanent loss of approximately 13,000 square feet of vegetated wetland. Alternatively, if High Toss Road were removed, approximately 12,000 square feet of additional salt marsh area would be restored.
Pole Dike/ Bound Brook Island Roads	Elevating the roads above the maximum coastal storm driven tidal elevation would fill approximately 4,000 square feet of adjacent wetlands. Elevating the roads above annual high water would fill approximately 2,300 square feet.

Resource	Selected Alternative: New Tide Control Structure at Chequessett Neck and Mill Creek
Chequessett Yacht and Country Club Golf Course Flood Proofing	To protect low-lying portions of the golf course, approximately 360,000 square feet (8.3 acres) of wetland would be filled and elevated above the high tide line. Most of this wetland is now a developed part of the golf course. Fill may be generated from an approximately 5-acre borrow area on adjacent uplands for both options. The upland area is highly sensitive for pre-contact archeological resources.
Residential Flood Proofing	Several low-lying residential properties could be impacted by restored tides, requiring actions such as constructing a small berm or wall to protect a residential parcel, adding fill to a low driveway or lawn, or relocating a well. Some of these actions may have limited wetland impacts.
Secondary Restoration Actions / Minor Road Improvements	These actions may include direct vegetation management, sediment management, channel improvements, and planting of vegetation. Impacts are expected to include work within wetland areas to remove trees and shrubs, dredge and/or deposit of sediment, excavation or fill of channels, and other actions to improve tidal circulation. Some actions may include access for heavy equipment.

3.3 CONSTRUCTION, MITIGATION AND MANAGEMENT MEASURES

As part of the EIS/EIR process outlined in 301 CMR 11.07, the following environmental measures were identified. These measures were outlined and identified to limit negative environmental impacts and/or create positive environmental impacts during development and operation of the Herring River Restoration Project. The schedule for the implementation of mitigation are also discussed where appropriate.

3.3.1 GENERAL CONSTRUCTION MEASURES

During construction, the site(s) will be secured to prevent unauthorized entry to the construction site, and to protect existing and adjacent facilities and properties. Supplemental lighting, signs, railings, and construction barriers will be used as necessary to provide safety to employees, construction workers, visitors, and the general public during the construction process in accordance with Occupational Safety and Health Administration and other applicable regulations.

Water used during the construction process, and that generated from runoff on the site, will be controlled by proper site grading, and by providing temporary berms, drains, and other means to prevent soil erosion. These means will also be used to reduce pooling and runoff on the site. Existing and new catch basins will be protected from siltation using hay bales, siltation fence, and catch basin inserts. At no time will the pumping of silt-laden water to surface waters, stream corridors, or wetlands be allowed. Pollution controls will also be provided to prevent the contamination of soils, water, and the atmosphere from the discharge of noxious, toxic substances, and pollutants during the construction process.

Erosion control measures including hay bales, siltation fencing, and erosion control fabric will be used to provide sedimentation barriers where required. Temporary seeding and mulching may also be used to minimize soil erosion and provide soil stabilization on slopes. Diversion trenches may also be used on the uphill side of disturbed areas to divert surface runoff. Land disturbances will be kept to a minimum to reduce erosion and impacts to resources. All erosion and stormwater control methods will be in accordance with the USEPA National Pollution Discharge Elimination System (NPDES) General Permit requirements, Commonwealth of Massachusetts regulations, and the Towns of Wellfleet and Truro regulations. A Stormwater Pollution Prevention Plan will be required as part of the NPDES General Permit.

The site will be maintained free of waste materials, debris, and trash following each day of work. Waste and other debris will be collected and disposed of off-site periodically. At no time during construction will the dumping of spoil material, waste, trees, brush, or other debris be allowed into any stream corridor, any wetland, any surface waters, or any unspecified location. The permanent or unspecified alteration of stream flow lines is not allowed during construction. Recycling of waste and construction debris will likely be mandated as well and should always be considered during construction.

Construction noise from heavy equipment will normally be limited to within normal operating hours of 7:00 a.m. to 5:00 p.m. and not during evenings, holidays, or weekends. Dust controls, including the possible use of street sweepers and/or watering trucks, will be used to minimize air-borne dust as necessary.

In addition to the measures identified in the general construction section, police details and other traffic controls will be necessary to minimize traffic problems during construction. Detours and trucking routes will need to be identified prior to construction and these routes will need to be designed to minimize impacts to surrounding residential areas not accustomed to heavy construction and increased vehicle traffic. Construction will have to allow for safe travel of both pedestrians and vehicle traffic.

Construction is planned to avoid impacts to animal habitats, wetlands, historic areas or potential archaeological sites, and the public. Construction in these areas will impact traffic (vehicle, pedestrian, and bicycle) in the roadways during construction. Construction procedures for traffic control, erosion protection, dust control, noise prevention, and wetland protection will be implemented as appropriate. Use of trench boxes, bracing, and other shoring methods will be utilized to provide the necessary safety for workers and others at the construction site. To the extent practicable, any private property, including trees and vegetation, that is damaged during construction is to be repaired or replaced. All roads, both publicly and privately owned, impacted by construction associated with the Herring River Restoration Project will be restored to condition safe and appropriate for vehicular traffic. Wetland regulations and permitting will be followed to minimize impacts to any adjacent wetlands.

Stormwater and construction runoff will be managed through the implementation of construction Stormwater Pollution Prevention Plans established prior to construction and regulated under USEPA NPDES General Permits for Construction.

Odor and noise mitigation measures will also be considered as part of the final design to minimize the impacts to adjacent properties during construction and operation.

Previous discussions held with Massachusetts Coastal Zone Management, the agency that upholds Executive Order 181, have identified that the water quality benefits provided by the Herring River Restoration Project will greatly outweigh the slight risk that a catastrophic coastal hazard could damage some of the infrastructure.

Temporary, short-term impacts from construction activities would be mitigated to the extent practicable. Appropriate construction mitigation measures would be incorporated into the contract documents and specifications governing the activities of contractors and subcontractors constructing elements of the proposed Herring River Restoration Project. Specific mitigation measures for construction impacts would be developed during the final design phase of the Herring River Restoration Project and would be reviewed by the appropriate regulatory agencies as part of the permit applications. Construction-period mitigation requirements would be incorporated into the final plans and specifications that would serve as the basis for the construction contract(s).

The following additional mitigation measures will be observed to avoid or minimize adverse environmental impacts:

- The restoration, for the most part, will take place on a previously developed parcels and along existing roadways and infrastructure.
- Any new structures will have exterior façades which will compliment and be consistent with local aesthetics.
- Vegetative screens will be employed if it is determined that they are necessary for aesthetic reasons.
- Consultation with expert agencies during the design phase and continued contact during construction if there is a resource that may be affected.
- Work will be halted if archaeological resources are uncovered during construction.
- The contractor will be required to thoroughly clean up the site before the contract is considered complete.
- Proper handling and storage of possible contaminants and hazardous substances will be required of the contractor, in addition to proper notifications.
- Access roads will be dampened to minimize construction dust if required.
- Debris will not be burned or buried on site as a means of disposal.
- No construction work will normally be performed during evening, holiday, or weekend hours.

3.2.2 ADAPTIVE MANAGEMENT MEASURES

Following construction, impacts that may result from the restoration of tidal flow to the Herring River estuary will be minimized and/or mitigated through the use of an Adaptive Management Plan. The EIS/EIR includes the implementation of an Adaptive Management Plan to consider the operational performance of the Herring River Restoration Project and to incorporate cost-effective non-traditional methods into the plan once they demonstrate feasibility. The Adaptive Management process will monitor resource parameters within the estuary during construction and, upon initiation of tidal flow. Tidal exchange would be increased incrementally, over time, to achieve desired conditions for native estuarine habitats. An Adaptive Management approach will enable the Herring River Restoration Project's operations to be adjusted and potential impacts to be mitigated based on the monitoring results of the environmental and economic impacts associated with the Restoration Project (see appendix C of the final EIS/EIR).

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

(2016)

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National Park Service
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U.S. Fish & Wildlife Service
U.S. Department of the Interior

Town of Wellfleet,
Massachusetts

Town of Truro,
Massachusetts

National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Commonwealth of Massachusetts
Division of Ecological Restoration

Natural Resources Conservation Service
U.S. Department of Agriculture