

November 22, 2021

STORMWATER REPORT

For

**NORTHEASTERN UNIVERSITY
MARINE SCIENCE CENTER
SEAWATER INTAKE PROJECT**

430 Nahant Road
Nahant, Massachusetts

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Nitsch Project #12125.3

NOVEMBER 22, 2021

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1.0 INTRODUCTION

Nitsch Engineering has prepared this Stormwater Report to support the Notice of Intent (NOI) application for the Northeastern University Marine Science Center Seawater Intake Project in Nahant, Massachusetts. The Project site is located at 430 Nahant Rd., Nahant, Massachusetts (subsequently referred to as the "Site"). Northeastern University is proposing the construction of a building addition to the existing Marine Science Center, accessible walkways and underground utility modifications including drainage, water, sewer, and Seawater Effluent and Supply lines along with driveway resurfacing and associated grading improvements. The Project includes a stormwater management system, which has been designed to comply with the requirements of the Town of Nahant Stormwater Bylaw and the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

2.0 EXISTING CONDITIONS

The Site is located at 430 Nahant Road at East Point in Nahant, Massachusetts on approximately 25± acres of open land with over 3,500 feet of ocean frontage. The Atlantic Ocean is located to the south of the site. The Marine Science Center abuts Swallow Cave Road to the West and Nahant Road to the north, with access provided by an existing driveway located off Nahant Road.

2.1 Existing Drainage Infrastructure

There is minimal drainage infrastructure onsite. Stormwater runoff from some roof areas is collected below grade and piped to a small, closed drainage system that discharges offsite. There are limited catch basins onsite and the majority of site flows overland to either low points onsite or directly to the Atlantic Ocean. The existing drainage system provides minimal treatment and peak rate mitigation.

2.2 NRSC Soil Designations

The Soil Classification Summary (Table 1) outlines the Natural Resources Conservation Services (NRCS) designation of the soil series at the Site. The majority of soils are classified as Smoothed Udorthents with a hydrologic soil group (HSG) rating of A, indicating that the soils have a high infiltrative capacity.

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
651	Udorthents, Smoothed	---

2.3 On-Site Soil Investigations

Approximately 11 test pits were performed on the Site in 2017 by Haley & Aldrich. One of the test pits was in the general vicinity of the proposed work on the western portion of the Site. These test pit logs are provided in Appendix F.

The results of boring log HA17-B16 indicated olive brown well graded sand up to 10 feet below ground elevation.

Additional test pits were conducted by Nitsch Engineering on June 24, 2021 to determine groundwater elevation at the location of the proposed recharge system. Groundwater was estimated to be at elevation 8.33.

2.4 Wetland Resource Areas

The project is bordered by the Atlantic Ocean to the south. The site contains Coastal Bank, 100-foot buffer to Coastal Bank, Bordering Vegetated Wetlands (BVW), and 100-foot to BVW. LEC Environmental conducted multiple site visits to delineate these resource areas. Detailed information on these resources is provided in the Wetland Resource Area Analysis Report prepared by LEC Environmental provided in the Notice of Intent. Refer to the NOI for a description of the locations of each of the resource areas.

2.5 FEMA Flood Zone

There are two different types of FEMA Floodplain Zones located on the project site.

- There is a 100-year Zone AE Floodplain at Elevation 13 associated with the Atlantic Ocean along the southern part of the property.
- There is a 100-year Zone VE Floodplain associated with the Atlantic Ocean along the southern edge of the property.

The FEMA Flood Zones onsite are considered Land Subject to Coastal Flowage because they are subject to inundation caused by coastal storms up to and including the 100-year storm event. The FEMA Flood Zones onsite provide connectivity between Nahant Bay and the Atlantic Ocean during the 100-year storm event.

Refer to the NOI for specific information regarding the regulatory requirements and the impacts of the project on the Flood Hazard Zones.

3.0 PROPOSED CONDITIONS

3.1 Project Description

The Project includes the construction of a building adjacent to the existing Northeastern University Marine Science Center along with seawater effluent and intake lines and associated utility and landscape improvements. The majority of site improvements lay outside of the 100 ft Nahant Bylaw Buffer Zone. The limits of the two proposed impervious areas within the Buffer Zone will be treated with subsurface infiltration systems.

3.2 Stormwater Management System

The Project has been designed using environmentally sensitive site design and LID techniques. Stormwater systems have been designed to model natural hydrologic features, including promoting infiltration throughout the site.

The proposed stormwater management system for the project site includes subsurface infiltration systems. Overflow from the proposed BMPs will be discharged to the adjacent wetland.

Subsurface Infiltration Systems

Subsurface infiltration systems are proposed to collect and infiltrate runoff from proposed impervious areas within the 100 ft Nahant Bylaw Buffer Zone. There are two subsurface systems; one by the proposed handicap parking space and a second south of the proposed walkway running from the proposed building to the existing eastern sidewalk. The system adjacent to the parking space comprises of 15 linear feet of 12" perforated CPP (corrugated plastic pipe). The system adjacent to the walkway comprises of 40 linear feet of 12" perforated CPP (corrugated plastic pipe). The pipes will be enveloped within a crushed stone base that extends 9 inches above and 3 inches below the

pipe and 6 inches around the perimeter of the pipe and a filter fabric. Both infiltration systems were sized to meet Standard 3 of the Massachusetts Stormwater Handbook recharge requirements. The recharge volume calculations can be found in the Standard 3 section below.

3.3 Peak Flow Reduction

The limits of the two proposed impervious areas within the 100 ft Nahant Bylaw Buffer Zone were analyzed as watershed areas 1S and 2S in the pre-development and post-development conditions. The Pre-development and Post-development Watershed Plans can be found in the Figures appendix. In pre-development conditions, both watershed areas 1S and 2S are comprised of pervious surfaces and sheet flow to the southeast to the existing wetlands. In the post-development conditions, both watershed areas comprise of proposed impervious surfaces and will be graded to flow to a proposed subsurface infiltration system. Both proposed subsurface infiltration systems will provide peak flow attenuation in accordance with Standard 2 of MassDEP Stormwater Management Handbook.

4.0 MassDEP Stormwater Management Standards

The Project is considered a **new development** under the DEP Stormwater Management System. However, the majority of the project is outside of the 100 ft Nahant Buffer Zone. The portions of the Site within the Buffer Zone will be designed to meet the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

The Project will not discharge any untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards and stormwater outfalls will be stabilized to prevent erosion.

Standard 2: Peak Rate Attenuation

The proposed stormwater management system will be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, 25- and 100-year, 24-hour storm events.

Standard 3: Groundwater Recharge

The Site was designed using environmentally sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. The annual recharge from the subsurface systems by the parking space and by the walkway will approximate the annual recharge from pre-development conditions based on soil type using the guidelines provided in the MassDEP Stormwater Management Handbook.

Subsurface Infiltration System #1 (Parking Space)

Impervious Area	= 60 sf
Rv (Recharge Volume)	= 60 sf x 0.35 in. / (12 inches/ft)
	= 2 cubic feet

The subsurface infiltration system #1 has a total volume of 60 cubic feet and exceeds the recharge volume required under the MassDEP Stormwater Management Standards.

Subsurface Infiltration System #2 (Walkway)

Impervious Area = 238 sf
Rv (Recharge Volume) = 238 sf x 0.35 in. / (12 inches/ft)
= 7 cubic feet

The subsurface infiltration system #2 has a total volume of 160 cubic feet and exceeds the recharge volume required under the MassDEP Stormwater Management Standards.

The drawdown calculations provided in Appendix A indicate that the proposed infiltration BMPs will drain within 72 hours, meeting the MassDEP drawdown requirement.

Standard 4: Water Quality Treatment

The proposed stormwater management system will be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). Structural stormwater BMPs including a subsurface infiltration system to capture the required water quality volume (1 inch over the project site) and remove a minimum of 80% of total suspended solids.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, are included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan (Appendix D).

Standard 5: Land Uses with Higher Potential Pollutant Loads

The Project is not considered a LUHPPL and therefore, this standard is not applicable.

Standard 6: Critical Areas

The Project is not located within any critical areas. Therefore, this standard is not applicable.

Standard 7: Redevelopments

The Project is not considered a redevelopment under the MassDEP Stormwater Management Standards. Therefore, this standard is not applicable.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) will be developed and implemented during the Notice of Intent permitting process.

Standard 9: Operation and Maintenance Plan

A post-construction operation and maintenance plan has been prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater BMP operation requirements for the academic campus are summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan provided in Appendix D.

Standard 10: Prohibition of Illicit Discharges

There will be no illicit discharges to the stormwater management system associated with the Project. An Illicit Discharge Compliance Statement is provided in Appendix A.

5.0 CONCLUSION

In conclusion, the Project's stormwater management system will reduce peak runoff rates and volumes through the use of infiltration BMPs and improve the water quality of stormwater being discharged from the Site. Environmentally sensitive site design and low impact development techniques will be implemented throughout the Site. The Project is being designed to meet the MassDEP Stormwater Management Standards and the Town of Nahant Stormwater Bylaw to the maximum extent practicable.

FIGURES

Figure 1	USGS Locus Map
Figure 2	Aerial Locus Map
Figure 3	Wetlands Map
Figure 4	FEMA Map
DA-EX	Pre-development Watershed Plan
DA-PR	Post-development Watershed Plan
RE	Recharge Exhibit



Figure 1: USGS Locus Map
NU Seawater Intake
Nahant, MA



Figure 2: Aerial Locus Map
NU Seawater Intake
Nahant, MA

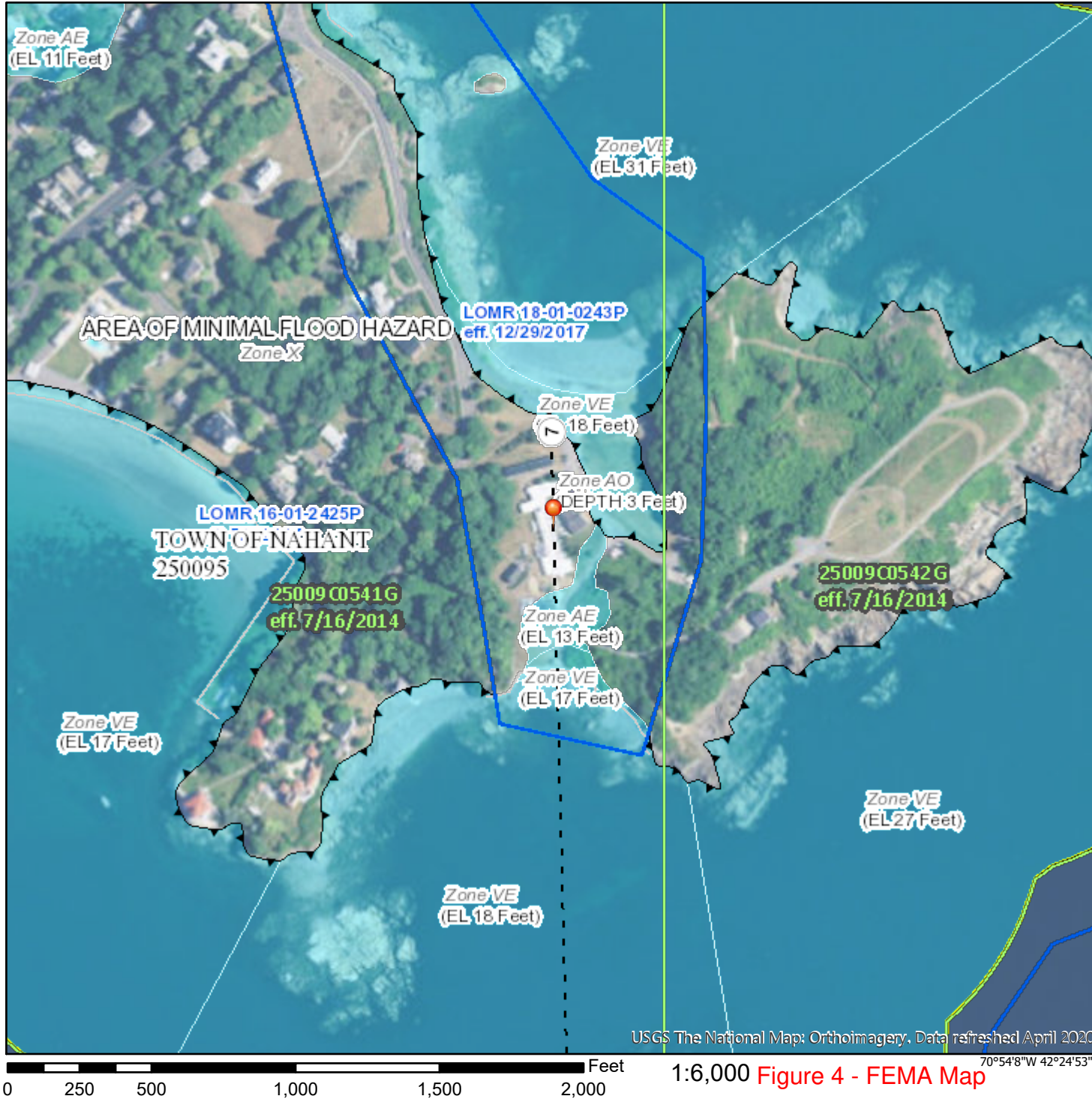


Figure 3: Wetlands Map
 NU Seawater Intake
 Nahant, MA

National Flood Hazard Layer FIRMMette



70°54'45"W 42°25'20"N



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped
		The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.



This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/14/2020 at 10:49 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

USGS The National Map: Orthoimagery. Data refreshed April 2020

1:6,000 Figure 4 - FEMA Map



NAHANT SEAWATER
PUMPHOUSE
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NAHANT MA 01908

NEU PROJECT#	160276
MOB#	

NOTICE OF INTENT
SUBMISSION

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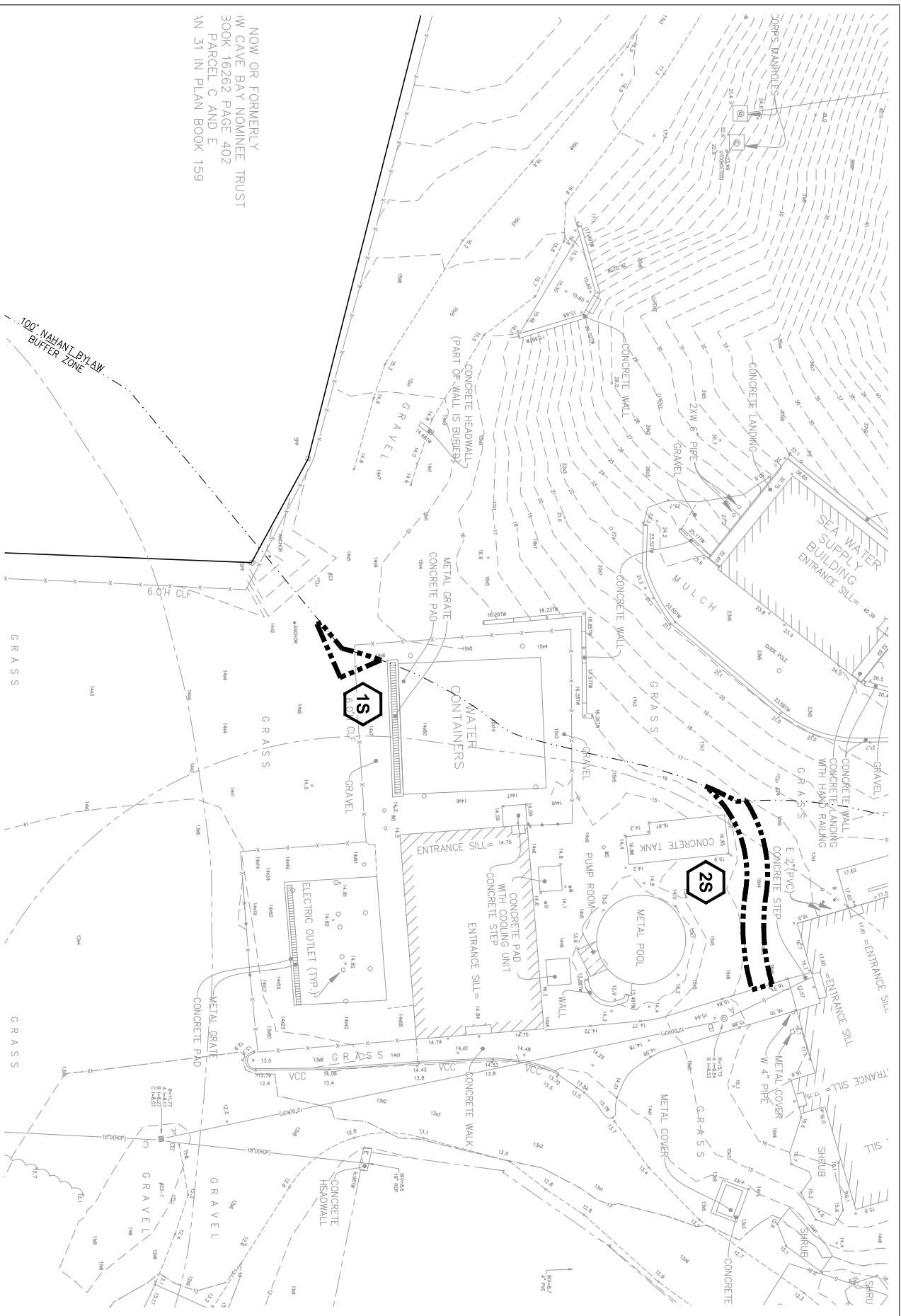
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DATE

PROJECT NUMBER 2004	SCALE AS NOTED
DRAWING TITLE PRE-DEVELOPMENT WATERSHED PLAN	

DR-EX



APPENDIX A

Stormwater Management Standards Documentation

MassDEP Checklist for Stormwater Report

Standard 3: Drawdown Calculations

Standard 4: TSS Removal

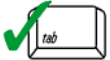
Standard 10: Illicit Discharge Compliance Statement



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

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

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

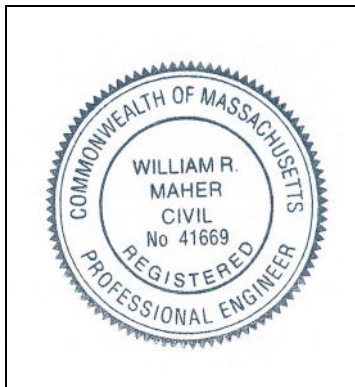
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
 - ☐ Credit 1
 - ☐ Credit 2
 - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Subsurface Recharge System

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☐ Static
 - ☒ Simple Dynamic
 - ☐ Dynamic Field¹
- ☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
 - ☐ Redevelopment Project
 - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☐ Description and delineation of public safety features;
 - ☐ Estimated operation and maintenance budget; and
 - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation – Subsurface Recharge System 1

Project Name: Nahant Seawater Intake	Nitsch Project #: 12125.3
Location: Nahant, MA	Checked by: WRM
Prepared by: SB	Sheet No. 1 of 2
Date: 11/22/2021	

INSTRUCTIONS:

1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	2	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	30		
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate	Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
		1.02	0.51	
4b	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	Hours
	Sandy Loam	B	1.02	
			Time _{drawdown} =	0.78
	72-Hour Drawdown Requirement Check:			OK

Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation – Subsurface Recharge System 2

Project Name: Nahant Seawater Intake	Nitsch Project #: 12125.3
Location: Nahant, MA	Checked by: WRM
Prepared by: SB	Sheet No. 2 of 2
Date: 11/22/2021	

INSTRUCTIONS:

1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	7	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	80		
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate	Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
		1.02	0.51	
4b	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	Hours
	Sandy Loam	B	1.02	
			Time _{drawdown} =	1.03
	72-Hour Drawdown Requirement Check:			OK

Northeastern University – Marine Science Center Seawater Project
WATER QUALITY TREATMENT SUMMARY (11/22/2021)

Nitsch Engineering has prepared this Water Quality Treatment Summary for the proposed Marine Science Seawater Project. In compliance with MassDEP Stormwater Management Standard #4, the proposed stormwater management systems are designed to remove at least 80% of the average annual post-construction load of TSS prior to discharge. The stormwater management system is designed to remove at least 44% of the average annual post-construction TSS load prior to discharge to the infiltration systems because the infiltration systems are located within areas where soils with rapid infiltration rates were observed.

A summary of treatment trains proposed to provide water quantity control and water quality improvement at the proposed project site is provided below.

Treatment Train A
Catchment Areas: 1S, 2S
Drain → Subsurface Recharge System → Discharge

Treatment Train A:

Drain → Subsurface Infiltration System → Discharge

Treatment Spreadsheet

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Subsurface Recharge System	0.80	1.00	0.80	0.20

Total TSS Removal =

80%

**Meets 80% TSS
removal requirement**

STANDARD 10: Illicit Discharge Compliance Statement

Project Name: Nahant Seawater Intake	Nitsch Project #: 12125.3
Location: Nahant, MA	Checked by: WRM
Prepared by: SB	Sheet No. 1 of 1
Date: 11/22/2021	

Standard 10 states: All illicit discharges to the stormwater management system are prohibited.

This is to verify:

1. Based on the information available there are no known or suspected illicit discharges to the stormwater management system at the Northeastern University Marine Science Center Seawater Intake Project site as defined in the MassDEP Stormwater Handbook.
2. The design of the stormwater system includes no proposed illicit discharges.



William Maher, PE

11/22/2021

Date

APPENDIX B

Long-Term Pollution Prevention and Stormwater Operation and Maintenance Plan

LONG-TERM POLLUTION PREVENTION PLAN AND STORMWATER OPERATION AND MAINTENANCE PLAN

Northeastern University Marine Science Center Seawater Intake Project

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1.0 INTRODUCTION

The purpose of this document is to specify the pollution prevention measures and stormwater management system operation and maintenance for the Northeastern Marine Science Center Seawater Intake site. The Responsible Party indicated below shall implement the management practices outlined in this document and proactively conduct operations at the project site in an environmentally responsible manner. Compliance with this Manual does not in any way dismiss the responsible party, owner, property manager, or occupants from compliance with other applicable federal, state, or local laws.

Responsible Party: Robert Lambert
Senior Project Manager
360 Huntington Avenue, Boston, MA 02115
(617)-373-6000

This Document has been prepared in compliance with Standards 4 and 9 of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards, which state:

Standard 4:

The Long-Term Pollution Prevention Plan shall include the proper procedures for the following:

- Good housekeeping
- Storing materials and waste products inside or under cover
- Vehicle washing
- Routine inspections of stormwater best management practices
- Spill prevention and response
- Maintenance of lawns, gardens, and other landscaped areas
- Pet waste management
- Proper management of deicing chemicals and snow

Standard 9:

The Long-Term Operation and Maintenance Plan shall at a minimum include:

- Stormwater management system(s) owner(s)
- The party or parties responsible for operation and maintenance, including how future property owners shall be notified of the presence of the stormwater management system and the requirement for operation and maintenance
- The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks
- A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point
- A description of public safety features

2.0 LONG-TERM POLLUTION PREVENTION PLAN

The Responsible Party shall implement the following good housekeeping procedures at the project site to reduce the possibility of accidental releases and to reduce safety hazards.

2.1 Storage of Hazardous Materials

To prevent leaks and spills, keep hazardous materials and waste products under cover or inside. Use drip pans or spill containment systems to prevent chemicals from entering the drainage system. Inspect storage areas for materials and waste products at least once per year to determine amount and type of the material on site, and if the material requires disposal.

Securely store liquid petroleum products and other liquid chemicals in federally- and state-approved containers. Restrict access to maintenance personnel and administrators.

2.2 Storage of Waste Products

Collect and store all waste materials in securely lidded dumpster(s) or other secure containers as applicable to the material. Keep dumpster lids closed and the areas around them clean. Do not fill the dumpsters with liquid waste or hose them out. Sweep areas around the dumpster regularly and put the debris in the garbage, instead of sweeping or hosing it into the parking lot. Legally dispose of collected waste on a regular basis.

Segregate liquid wastes, including motor oil, antifreeze, solvents, and lubricants, from solid waste and recycle through hazardous waste disposal companies, whenever possible. Separate oil filters, batteries, tires, and metal filings from grinding and polishing metal parts from common trash items and recycle. These items are not trash and are illegal to dump. Contact a hazardous waste hauler for proper disposal to a hazardous waste collection center.

2.3 Spill Prevention and Response

Implement spill response procedures for releases of significant materials such as fuels, oils, or chemical materials onto the ground or other area that could reasonably be expected to discharge to surface or groundwater.

- For minor spills, keep fifty (50) gallon spill control kits and Speedy Dry at all shop and work areas.
- Immediately contact applicable Federal, State, and local agencies for reportable quantities as required by law.
- Immediately perform applicable containment and cleanup procedures following a spill release.
- Promptly remove and dispose of all material collected during the response in accordance with Federal, State, and local requirements. A licensed emergency response contractor may be required to assist in cleanup of releases depending on the amount of the release, and the ability of the Contractor to perform the required response.
- Reportable quantities of chemicals, fuels, or oils are established under the Clean Water Act and enforced through Massachusetts Department of Environmental Protection (DEP).

2.4 Minimize Soil Erosion

Soil erosion facilitates mechanical transport of nutrients, pathogens, and organic matter to surface water bodies. Repair all areas where erosion is occurring throughout the project site. Stabilize bare soil with riprap, seed, mulch, or vegetation.

2.5 Vehicle Washing

No vehicle washing will occur onsite.

2.6 Maintenance of Lawns, Gardens, and other Landscaped Areas

Pesticides and fertilizers shall not be used in the landscaped areas associated with the project site and shall not be stored on-site. Dumping of lawn wastes, brush or leaves or other materials or debris is not permitted in any Resource Area. Grass clippings pruned branches and any other landscaped waste should be disposed of or composted in an appropriate location.

2.7 Management of Deicing Chemicals and Snow

The qualified contractor selected for snow plowing and deicing shall be made fully aware of the requirements of this section.

No road salt (sodium chloride) shall be stored on-site. The use of magnesium chloride de-icing product with a 0.5 to 1.0 percent sodium chloride mix for snow and ice treatment is permitted. The product shall be stored in a locked room inside the building and shall be used at exterior stairs and walkways. The snowplow contractor shall adhere to magnesium chloride use and storage requirements.

During typical snow plowing operations, snow shall be pushed to the designated snow removal areas. Snow shall not be stockpiled in wetland resource areas or within the 50-ft buffers to BVW or 200-ft Riverfront Area. In severe conditions where snow cannot be stockpiled on site, the snow shall be removed from the site and properly disposed of in accordance with the Massachusetts Department of Environmental Protection Bureau of Water Resources Snow Disposal Guidance dated December 23, 2019.

Use of sand is permitted only for impervious roadways and parking areas.

Before winter begins, the property owner and the contractor shall review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris. Street and parking lot sweeping should be followed in accordance with the Operation and Maintenance Plan.

2.8 Coordination with other Permits and Requirements

Certain conditions of other approvals affecting the long-term management of the property shall be considered part of this Long-Term Pollution Prevention Plan. The Owner shall become familiar with those documents and comply with the guidelines set forth in those documents.

3.0 STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN

3.1 Introduction

This Operation and Maintenance Plan (O&M Plan) for the NU Marine Center Seawater Intake project is required under Standard 9 of the 2008 MassDEP Stormwater Handbook to provide best management practices for implementing maintenance activities for the stormwater management system in a manner that minimizes impacts to wetland resource areas.

The Owner shall implement this O&M Plan and proactively conduct operations at the site in an environmentally responsible manner. Compliance with this O&M Plan does not in any way dismiss the Owner from compliance with other applicable Federal, State, or local laws.

Routine maintenance during construction and post-development phases of the project, as defined in the Operation and Maintenance Plan, shall be permitted without amendment to the Order of Conditions. A continuing condition in the Certificate of Compliance shall ensure that maintenance can be performed without triggering further filings under the Wetlands Protection Act.

All stormwater best management practices (BMPs) shall be operated and maintained in accordance with the design plans and the Operation and Maintenance Plan approved by the issuing authority. The Owner shall:

- a. Maintain an operation and maintenance log for the last three years, including inspections, repairs, replacement, and disposal (for disposal the log shall indicate the type of material and the disposal location). This is a rolling log in which the responsible party records all operation and maintenance activities for the past three years.
- b. Make this log available to MassDEP and the Conservation Commission upon request; and
- c. Allow members and agents of the MassDEP and the Conservation Commission to enter and inspect the premises to evaluate and ensure that the Owner complies with the Operation and Maintenance requirements for each BMP.

3.2 Stormwater Operation and Maintenance Requirements

Inspect and maintain the stormwater management system as directed below. Repairs to any component of the system shall be made as soon as possible to prevent any potential pollutants (including silt) from entering the resource areas.

Subsurface Recharge Structures

- Inspect subsurface detention/infiltration structures twice per year. Remove all debris and accumulated sediment that may clog the system.

3.3 Street Sweeping

Perform street sweeping at least twice per year, whenever there is significant debris present on roads and parking lots. Street sweeping shall occur in the spring and fall. Sweepings must be handled and disposed of properly according to the Nahant Conservation Commission.

3.4 Repair of the Stormwater Management System

The stormwater management system shall be maintained. The repair of any component of the system shall be made as soon as possible to prevent any potential pollutants including silt from entering the resource areas or the existing closed drainage system.

3.5 Reporting

The Owner shall maintain a record of drainage system inspections and maintenance (per this Plan) and submit a yearly report to the Nahant Conservation Commission.

STORMWATER MANAGEMENT SYSTEM INSPECTION FORM

NU Marine Science Center Seawater Intake Project 430 Nahant Road Nahant, MA			Inspected by: _____ Date: _____
Component	Status/Inspection	Action Taken	
Drain Manholes			
Subsurface Recharge System			
Catch Basins			
Headwalls			
General site conditions – evidence of erosion, etc.			

SUBMIT COPIES OF STORMWATER MANAGEMENT SYSTEM INSPECTION FORM TO THE NAHANT CONSERVATION COMMISSIONS WITH THE YEARLY REPORT.

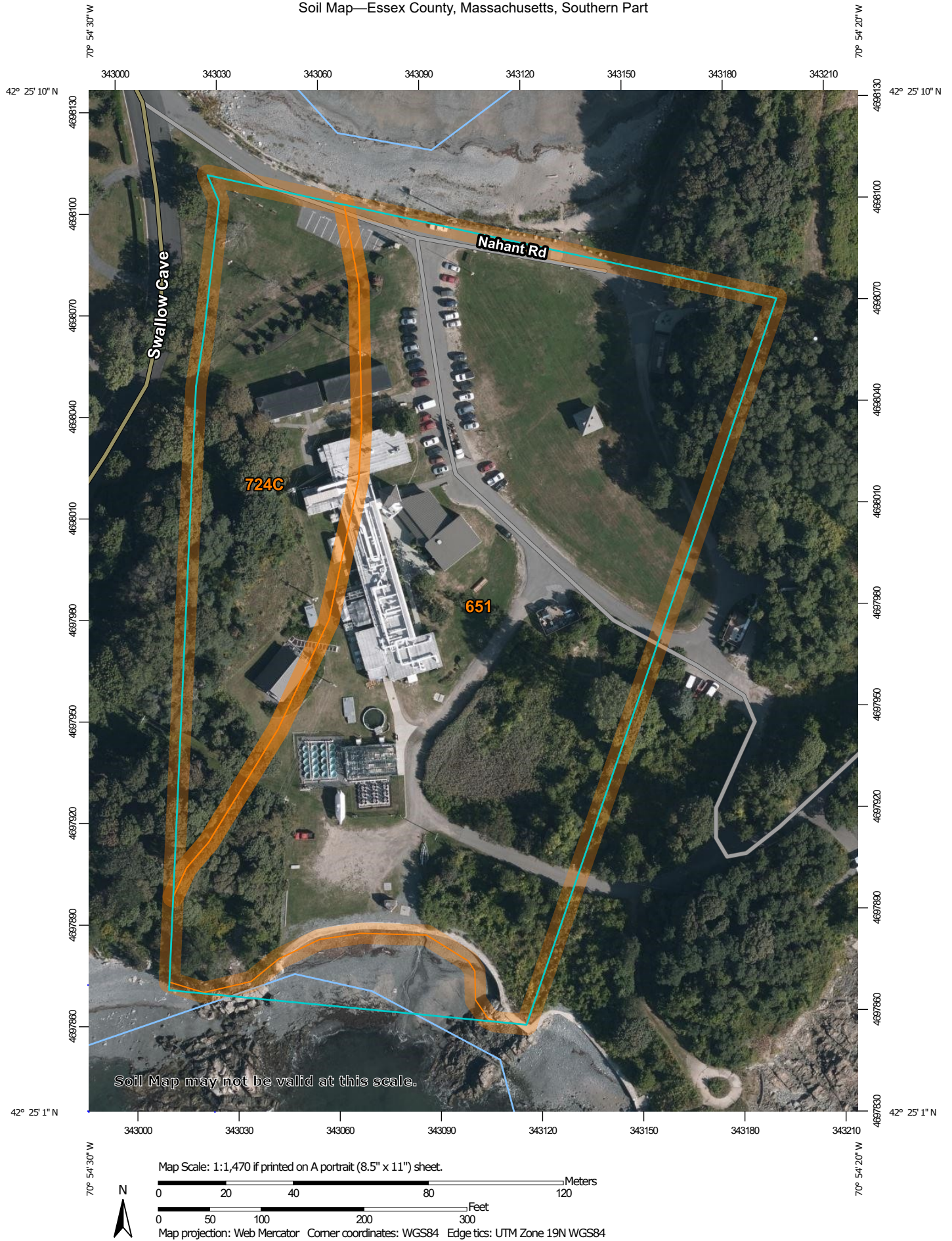
APPENDIX C

Soil Investigations

NRCS Soil Maps and Descriptions

Soil Test Pit Logs

Soil Map—Essex County, Massachusetts, Southern Part




**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

7/20/2020
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Essex County, Massachusetts, Southern Part

Survey Area Data: Version 17, Jun 9, 2020

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

Date(s) aerial images were photographed: Sep 11, 2019—Oct 5, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
651	Udorthents, smoothed	5.8	72.2%
724C	Hollis-Urban land-Rock outcrop complex, sloping	1.9	23.8%
Totals for Area of Interest		8.0	100.0%

TABLE 1
SUMMARY OF SUBSURFACE DATA
COASTAL SUSTAINABILITY INSTITUTE
MA-MAT, MASSACHUSETTS
FILE NO. 130798-002

TEST INFORMATION (CITY, STATE)	GROUND ELEVATION (FT, MSL)	DEPTH OF EXPOSURE (FT)	TILL		LOSS	MAKING DEPOSITS (SAND)		MAKING DEPOSITS (CLAY)		GLACIOFLUVIAL DEPOSITS		GLACIAL TILL		CONCRETE BINDER		REMARKS
			DEPTH TO TOP (FT)	6.5 EL. 10" (FT)		DEPTH TO TOP EL. OF TOP (FT)	THICKNESS (FT)	DEPTH TO TOP EL. OF TOP (FT)	THICKNESS (FT)	DEPTH TO TOP EL. OF TOP (FT)	THICKNESS (FT)	DEPTH TO TOP EL. OF TOP (FT)	THICKNESS (FT)	DEPTH TO TOP EL. OF TOP (FT)	THICKNESS (FT)	
ORIGINAL BORING PROGRAM (JULY 2011)	6.1	23.0	32.3	0.1	7.10	4.0	8.5	4.0	18.0	9.0	13.0	5.0	10.5	4.2	10.3	5.5
TEST BORING PROGRAM (SEPTEMBER 2017 - OCTOBER 2017)	6.2	11.0	28	0.0	5.10	8.5	8.5	4.0	22.5	14.0	14.0	13.0	10.5	4.2	10.3	5.5
HA17-341	23.3	29.0	0.0	23.5	4.2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	18.0
HA17-342	58.1	14.0	0.0	58.2	7.1	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-343	26.7	14.0	0.0	26.7	8.5	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-344	21.9	63.2	0.0	15.9	13.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-345	21.1	11.2	0.0	21.1	7.4	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-346	5.7	7.4	0.0	5.7	4.8	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-347	51.1	50.5	0.134	51.2	5.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-348	41.7	19.0	0.0	41.7	7.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-349	63.6	12.5	0.0	63.6	12.5	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-350	59.6	7.8	0.0	59.6	7.8	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-351	45.7	30.0	0.0	45.7	18.8	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-352	25.2	15.0	0.0	25.2	7.5	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-353	27.3	12.0	0.0	27.3	10.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-354	17.1	4.8	0.0	17.1	2.1	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-355	35.3	10.2	0.0	35.3	12.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-356	16.0	11.0	0.0	16.0	8.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-357	14.8	4.0	0.0	14.8	4.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-358	40.1	11.0	0.0	40.1	11.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
TEST BORING PROGRAM (AUGUST 2017 - SEPTEMBER 2017)	58.5	8.0	0.0	58.5	8.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-359	20.2	11.0	0.0	20.2	11.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-360	56.9	5.0	0.0	56.9	5.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-361	24.5	3.0	0.0	24.5	3.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-362	39.5	16.5	0.0	39.5	15.5	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-363	5.0	5.0	0.0	5.0	5.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-364	27.4	12.0	0.0	27.4	7.4	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-365	15.3	8.5	0.0	15.3	15.3	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-366	11.7	13.4	0.0	11.7	13.4	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-367	11.0	10.0	0.0	11.0	10.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0
HA17-368	25.5	11.0	0.0	25.5	11.0	NE	NE	NE	11.2	2.2	NE	NE	NE	NE	NE	15.0

NOTE:
1. DEPTH TO GLACIAL TILL AND BLINDING WERE REQUIRED. DEPTH IS AVERAGE AS CORRECT DISTANCE FROM GROUND SURFACE TO SO. STRATUM.
2. ELEVATION AND IN FEET AND REFERENCE TO NORTH AVERAGE VERTICAL DATUM OF 1988 IN AVERAGE.
3. ELEVATION AND IN FEET AND REFERENCE TO NORTH AVERAGE VERTICAL DATUM OF 1988 IN AVERAGE.
4. HA17-367 SHOWS TWO DEPTHS FOR FILL DUE TO THE FACT THAT THE BORING WAS PILED TO THROUGH THE PROTECTIVE COVER.

ABSECTIONS:
NE INDICATES NOT ENCOUNTERED
EL. ELEVATION
-- INDICATES NOT DETERMINED. INDICATES IMPROVED BOREHOLE PRESENCE OF DEPOSIT VERIFIED ON STRATUM NOT SHOWN.

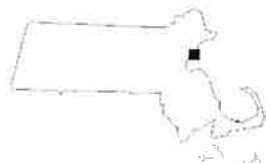


MAP SOURCE: ESRI

SITE COORDINATES: 42°25'7"N, 70°54'21"W

**HALEY
ALDRICH**

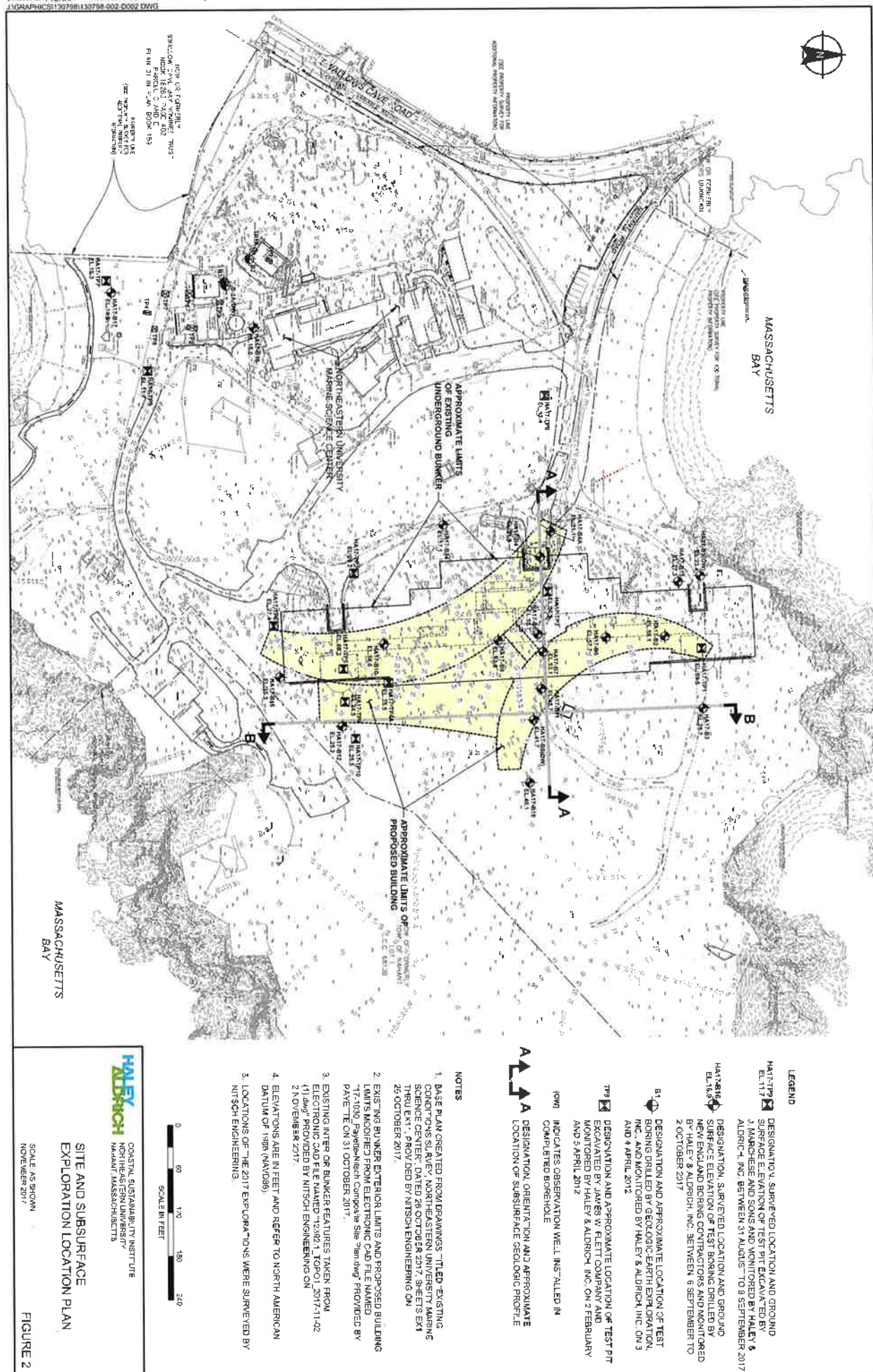
COASTAL SUSTAINABILITY INSTITUTE
NORTHEASTERN UNIVERSITY
NAHANT, MASSACHUSETTS



PROJECT LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT
NOVEMBER 2017

FIGURE 1





TEST BORING REPORT

Boring No. HA17- B16

Project COASTAL INVESTIGATION INSTITUTE, NAHANT, MA
Client NORTHEASTERN UNIVERSITY
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 130798-002
Sheet No. 1 of 2
Start 18 September 2017
Finish 18 September 2017
Driller M. Soucy
H&A Rep. S. Shay

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: Diedrich D-50
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Drive to 29.0 ft
				Hoist/Hammer: Cat-Head Safety Hammer
				PID Make & Model: NA

Elevation 16.0
Datum NAVD 88
Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size [†] , structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Test			
							% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0						Note: Borehole vacuum-excavated to 8.0 ft on 9/6/17.									
					SP-SM	0.0 - 4.0 ft: Light brown medium dense poorly graded SAND with silt and gravel (SP-SM), 2% oversize, mps 8.0 in., no structure, no odor, dry -FILL-	5	10	10	25	40	10			
					SW	4.0 - 8.0 ft: Olive brown well graded SAND with gravel (SW), 4% oversize, mps 6.0 in., no structure, no odor, dry	10	15	20	25	30				
5															
	16 23 21 32	S1 12	8.0 10.0	8.0 8.0	SW	Dense olive brown well graded SAND with gravel (SW), mps 2.5 cm, no structure, no odor, wet	10	15	25	25	20	5			
10	33 37 34 29	S2 16	10.0 12.0		SW	Very dense olive brown well graded SAND with gravel (SW), mps 2.5 cm, 4-in. medium sand layer interbedded at top of sample, no odor, wet -MARINE DEPOSITS-	10	15	20	30	25				
	13 23 24 23	S3 3	12.0 14.0	4.0 12.0	GP	Dense olive brown poorly graded GRAVEL (GP), mps 2.2 cm, no structure, no odor, wet. Poor recovery.	15	30	20	10	5				
	18 24 22 28	S4 18	14.0 16.0	2.0 14.0	SP/SC	Dense brown poorly graded SAND and clayey SAND (SP/SC), mps 2.0 cm., interbedded, stratified, no odor, wet -MARINE DEPOSITS-	5	5		20 30	65 40	5 30			
	37 48 100/4"	S5 8	16.0 17.3		SC	Very dense olive brown clayey SAND (SC), mps 1.5 cm as trace embedded gravel pieces, weakly stratified, no odor, wet Note: Possible cobble at 17.3 ft.			10	10	40	40			
				2.5 18.3											
20	19 15	S6 19	19.0 21.0		CL	Hard gray lean CLAY grading to lean CLAY with sand (CL), mps < 0.5mm, no structure, no odor, moist					15	85			

Water Level Data						Sample ID	Well Diagram	Summary	
Date	Time	Elapsed Time (hr.)	Depth (ft) to:			O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample		Overburden (ft)	31.0
			Bottom of Casing	Bottom of Hole	Water			Rock Cored (ft)	-
9/18/17	1230	0.5	29.0	31.0	12.3			Samples	S8
Boring No. HA17- B16									
Field Tests: Dilatancy: R - Rapid S - Slow N - None Toughness: L - Low M - Medium H - High Plasticity: N - Nonplastic L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High V - Very High									
†Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.									
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.									



Commonwealth of Massachusetts
Town of Nahant

Form 11 - Soil Suitability Assessment for On-Site Stormwater System(s)

Surface Elevation: 14.0±

Date: June 24, 2021 – Sunny - 62°
Location: Northeastern University
430 Nahant Road, Nahant, MA
William R. Maher, PE, SE#1458

Deep Observation Hole Number: **TP-201**

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-5"	A	10YR 3/2	---	---	---	LS	---	---			
5"-72"	FILL	---	---	---	---	---	---	---			

Additional Notes: GROUNDWATER WAS OBSERVED AT 5'-8" BELOW THE SURFACE; NO MOTTLING WAS OBSERVED.



Commonwealth of Massachusetts
Town of Nahant

Form 11 - Soil Suitability Assessment for On-Site Stormwater System(s)

Surface Elevation: 19.5±

Date: June 24, 2021 – Sunny - 62°
Location: Northeastern University
430 Nahant Road, Nahant, MA
William R. Maher, PE, SE#1458

Deep Observation Hole Number: TP-202

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-19"	A	10YR 2/2	---	---	---	LS	---	---			
19"-87"	FILL	---	---	---	---	---	---	---			
87"-124"	C	2.5Y 6/3	---	---	---	SL	<10%	---			

Additional Notes: GROUNDWATER WAS OBSERVED AT 10'-4" BELOW THE SURFACE. NO MOTTILING WAS OBSERVED.