DRAINAGE REPORT

For

POND STREET ACQUISITIONS LLC

PROPOSED

"Mixed Use Development"

505 Pond Street & 1537 Main Street
City of Weymouth, Massachusetts
Norfolk County

Prepared by:

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TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

APPENDIX B: PROJECT LOCATION MAPS

- USGS MAP
- FEMA FIRMETTE

APPENDIX C: SOIL AND WETLAND INFORMATION

- NCRS CUSTOM SOIL RESOURCE REPORT
- GEOTECHNICAL ENGINEERING REPORT

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- EXISTING CONDITIONS DRAINAGE MAP
- EXISTING CONDITIONS HYDROCAD COMPUTATIONS

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- PROPOSED CONDITIONS DRAINAGE MAP
- PROPOSED CONDITIONS HYDROCAD CALCULATIONS

APPENDIX F: STORMWATER CALCULATIONS

- MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME
- MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL
- NOAA RAINFALL DATA
- MOUNDING ANALYSIS AND NARRATIVE [If Required]

APPENDIX G: OPERATION AND MAINTENANCE

- STORMWATER OPERATION AND MAINTENANCE PLAN
- INSPECTION REPORT
- INSPECTION AND MAINTENANCE LOG FORM
- LONG-TERM POLLUTION PREVENTION PLAN
- ILLICIT DISCHARGE STATEMENT
- SPILL PREVENTION
- PROPOSED OPERATION AND MAINTENANCE MAP
- MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS

APPENDIX H: CONSTRUCTION INSPECTION AND CONTROL

- STORMWATER INSPECTION REPORT
- STORMWATER SEDIMENTATION AND EROSION CONTROL PLANS
- STAGNATION PREVENTION AND MOSQUITO CONTROL PLAN

EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed mixed-use development located at the southwesterly corner of Pond Street and Main Street in the City of Weymouth, Massachusetts. The site, which contains approximately 2.10 acres, contains an existing retail paint store and a residential house. The majority of the site is developed, consisting of the two buildings and associated parking areas. The remaining areas of the site are landscaped and wooded.

The proposed project includes the construction of two freestanding mixed-use buildings with associated parking areas, landscaping, stormwater management, and associated utilities. The northernmost building is 9,710± sf and the southernmost building is 7,916± sf. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at two (2) "design points" where stormwater runoff currently drains to under existing conditions. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP-1	3.93	0.14	**-3.79**	7.74	0.51	**-7.23**	10.22	0.80	**-9.42**	14.06	1.29	**-12.77**
DP-2	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.01	0.00	**-0.01**

**Flows are represented in cubic feet per second (cfs)*

I. EXISTING SITE CONDITIONS

Existing Site Description

The site consists of approximately 2.10 acres of land along the western side of Main Street at the southwest corner of Main Street and Pond Street in the City of Weymouth, Massachusetts. The site also has frontage along Jessica Lane and Nelson Road. The southern portion of the site contains an existing residential house with an existing driveway, landscaping, and wooded areas. The northern portion of the site consists of an existing retail paint store with associated landscape and parking areas. There are portions of the site with ledge outcroppings and slopes range from approximately 1% to 20% generally running from west to east.

On-Site Soil Information

Soils within the analyzed area consist of the following as classified by the Natural Resource Conservation Service (NRCS):

Table 2.1: Existing Soil Information

Soil Unit Symbol	Soil Name / Description	Hydrologic Soil Group (HSG)
254B	Merrimac fine sandy loam	A
602	Urban Land	N/A

Onsite borings were witnessed by Northeast Geotechnical, Inc. on June 1, 2022. Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

A small western portion of the site drains towards the western abutter, and the remainder of the site drains overland west to east towards the rights-of-way and into the municipal drainage system. A portion of the existing retail parking area drains to catch basins with unknown outlets. On-site elevations range from 177 at the residential property to 168 along the southeast property corner at the intersection of Jessica Lane and Main Street.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at two (2) “design points” as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into two (2) separate sub

catchments, as described below, to analyze existing and proposed flow rates at each design point. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP-1) is the existing site. Under existing conditions, this design point receives flows from approximately is the existing roadway. Under existing conditions, this design point receives stormwater flows from approximately 2.25 acres of land, designated as watershed "E-1". Refer to Table 2.1 below for additional detail.

Design Point #2 (DP-2) is the western abutting property. Under existing conditions, this design point receives stormwater flows from approximately 0.01 acres of land, designated as watershed "E-2". Refer to Table 2.1 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
E1	2.25±	Rooftops, paved parking, grass, gravel surface, woods	80	6.0
E2	0.01±	Grass	39	6.0

Refer to **Table 1.1 and 5.1** for the existing conditions peak rates of runoff. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

II. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project includes the construction of two freestanding mixed-use buildings totaling 17,626± sf along with associated parking areas, landscaping, utilities, and a new stormwater management system. The site, including the proposed parking areas, has been designed to drain to deep-sump, hooded catch basins. The catch basins will capture and convey stormwater runoff, via an underground pipe system, to a proposed underground infiltration basin. Pretreatment of the stormwater runoff will be provided by a combination of the deep-sump, hooded catch basins and an isolator row of stormwater infiltration chambers prior to discharge into the proposed infiltration basin. Rooftop runoff has been designed to flow to the basin as well.

Proposed Development Collection and Conveyance

Deep sump hooded catch basins are proposed to collect and route runoff from the paved parking areas to the proposed underground infiltration basin. Pipes have been designed for the 25-year storm using the Rational Method.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meets, or exceeds, the standards set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards. Refer to **Section V** for additional information.

Proposed Watersheds and Design Point Information

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in **Section II** above. The site was subdivided into two (2) sub catchment for the proposed conditions as described below. The minimum time of concentration for the proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP-1 receives stormwater flows from approximately 2.27 acres of land, designated as watersheds “P-1” and “P-2”. Refer to Table 3.1 below for additional detail.

Under proposed conditions DP-2 does not receive stormwater flows from the development area. Refer to Table 3.1 below for additional detail.

Table 3.1: Proposed Sub-catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
P-1	1.93±	Rooftops, paved parking, landscaping	92	6.0	UGS-1 / DP-1
P-2	0.34±	Paved parking, landscaping	61	6.0	DP-1

Refer to **Table 1.1 and 6.1** for the calculated proposed conditions peak rates of runoff. For additional hydrologic information, refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

III. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in table 4.1 below for stormwater calculations is based on NOAA. Refer to **Appendix F** for more information.

Table 4.1: NOAA Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.36	5.11	6.21	7.89

*Values derived from NOAA ATLAS on 03/02/2023

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Additionally, the proposed project meets, or exceeds, the MADEP Stormwater Management standards. Compliance with these standards is described further below.

IV. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The project has been designed so that proposed impervious areas (including the building roof and paved parking/driveway areas) shall be collected and passed through the proposed drainage system for treatment prior to discharge.

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1** and **Table 6.1**, the development of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

Standard #3: Recharge

The stormwater runoff from the project will be collected and diverted to a proposed underground infiltration basin. The project as proposed will involve the creation of 14,919 square feet of new impervious area and is required to infiltrate 760 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed underground infiltration basin will provide 17,081 cubic feet of volume for groundwater recharge. Refer to **Appendix F** of this report for calculations documenting required and provided recharge volumes.

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing that the proposed underground infiltration basin will drain within 16.8 hours are included in **Appendix F** of this report.

A groundwater mounding analysis has been provided in **Appendix F** of this report. The analysis shows that the groundwater mound will have no effect on the proposed system.

Standard #4: Water Quality

Water quality treatment is provided via deep sump catch basins, an isolator row, and an underground infiltration basin. TSS removal calculations are included in **Appendix F** of this report. The project as proposed will involve the creation of 14,919 square feet of new impervious area and is required to treat 6,462 cubic feet of water quality volume as defined in Stormwater Standard 4. The proposed infiltration basin provides 17,081 cubic feet of water quality volume for water

quality treatment. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes.

Standard #5: Land Use with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

Not Applicable for this project.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets. Additionally, the project is required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period. The SWPPP will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the project's proponent. Refer to **Appendix H**.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix G** of this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties and an estimated budget for inspections and maintenance.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit

discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

V. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development stormwater discharge comparisons are contained in **Table 6.1** below:

Table 6.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP-1	3.93	0.14	**-3.79**	7.74	0.51	**-7.23**	10.22	0.80	**-9.42**	14.06	1.29	**-12.77**
DP-2	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.00	0.00	**0.00**	0.01	0.00	**-0.01**

**Flows are represented in cubic feet per second (cfs)*

As outlined in the table above, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year storm events. Additionally, the project meets or exceeds the MADEP Stormwater Management Standards as described further herein.

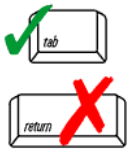
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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 8[2]
- 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.

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[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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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

April 5, 2023

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): Underground infiltration 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 Field[1]

☐ 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.

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[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

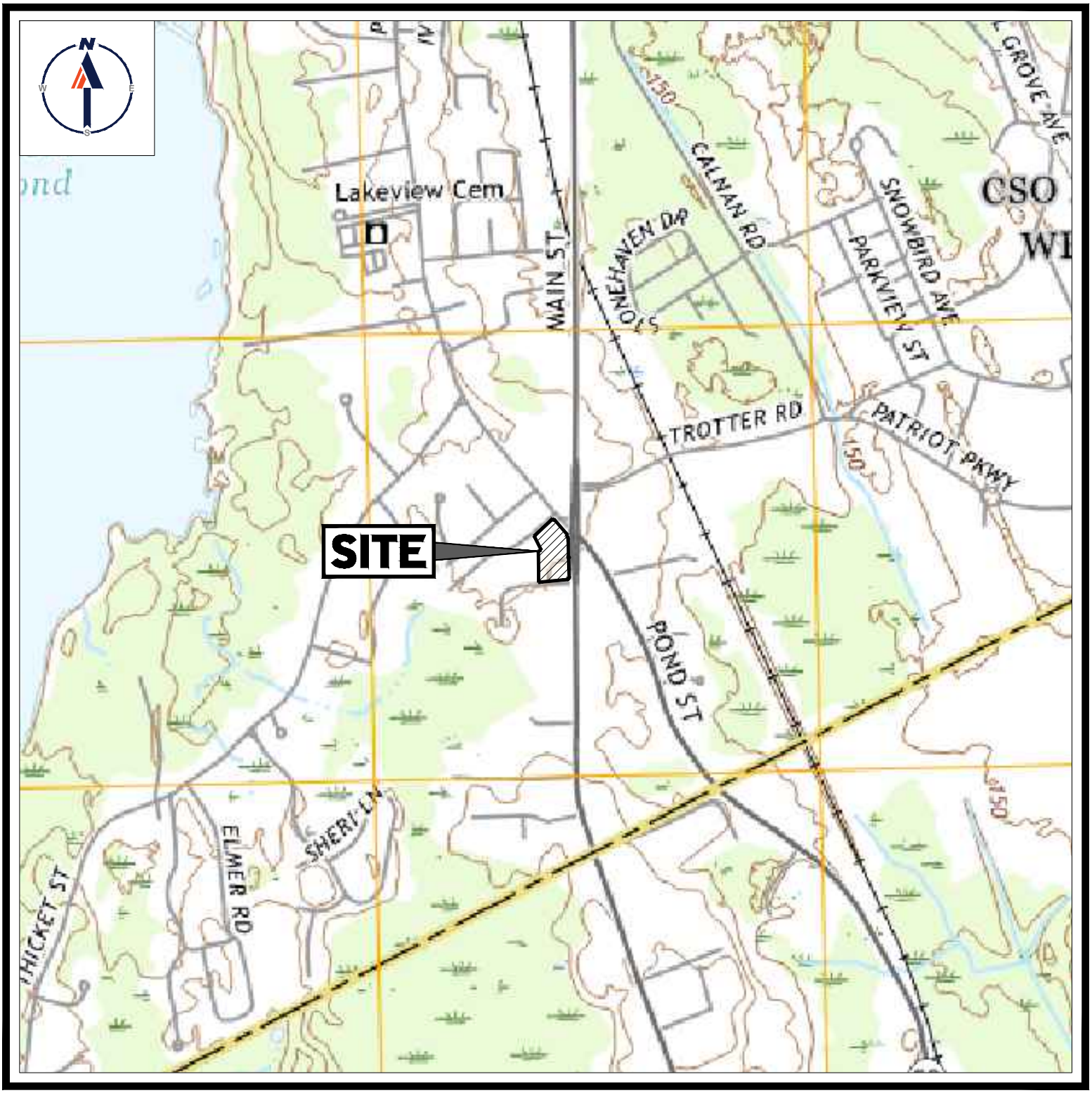
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ 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.

APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*



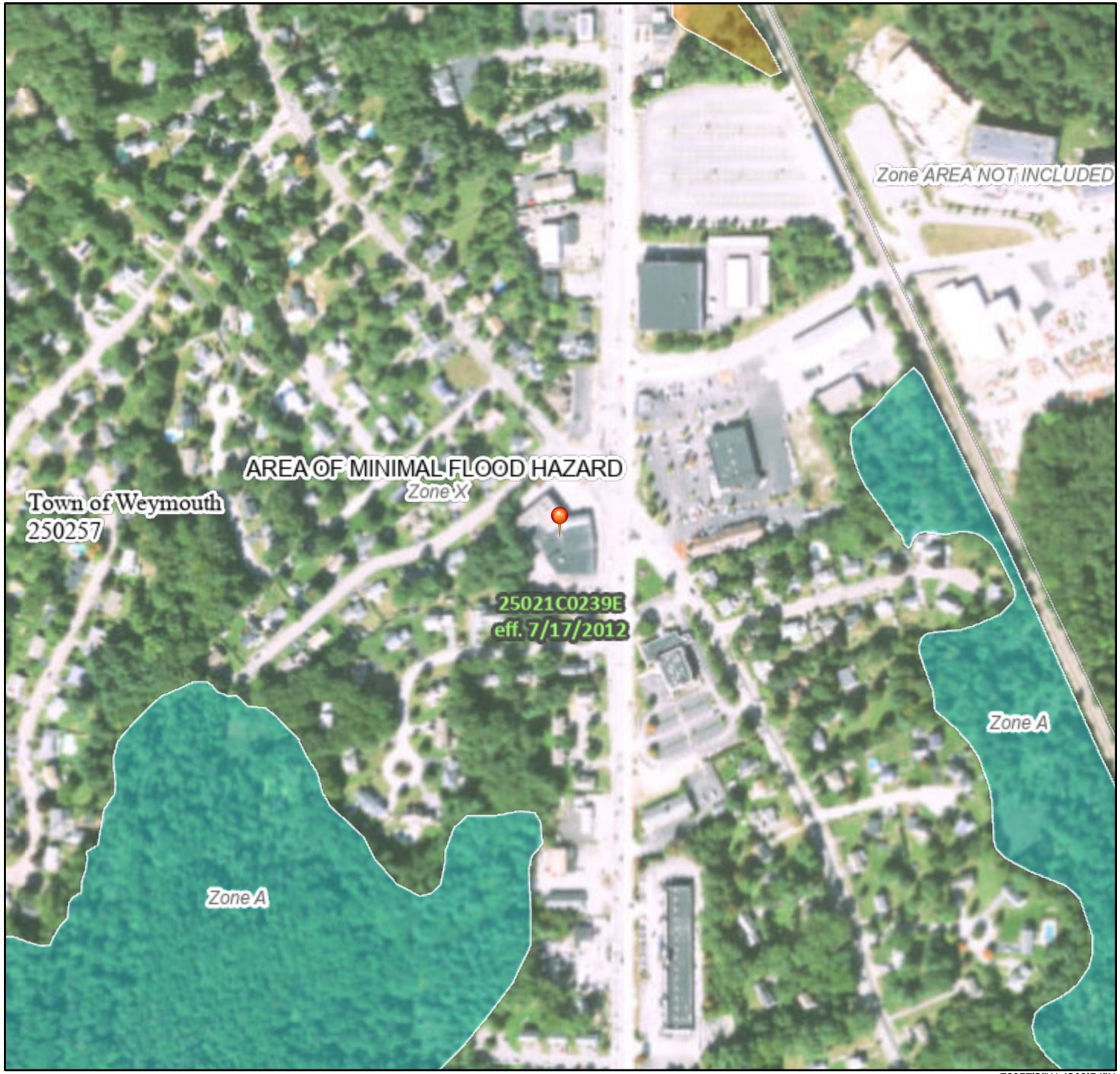
USGS MAP

SCALE: 1" = 1,000'
SOURCE: USGS

National Flood Hazard Layer FIRMette

FEMA

70°57'39"W 42°9'21"N



70°57'2"W 42°8'54"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

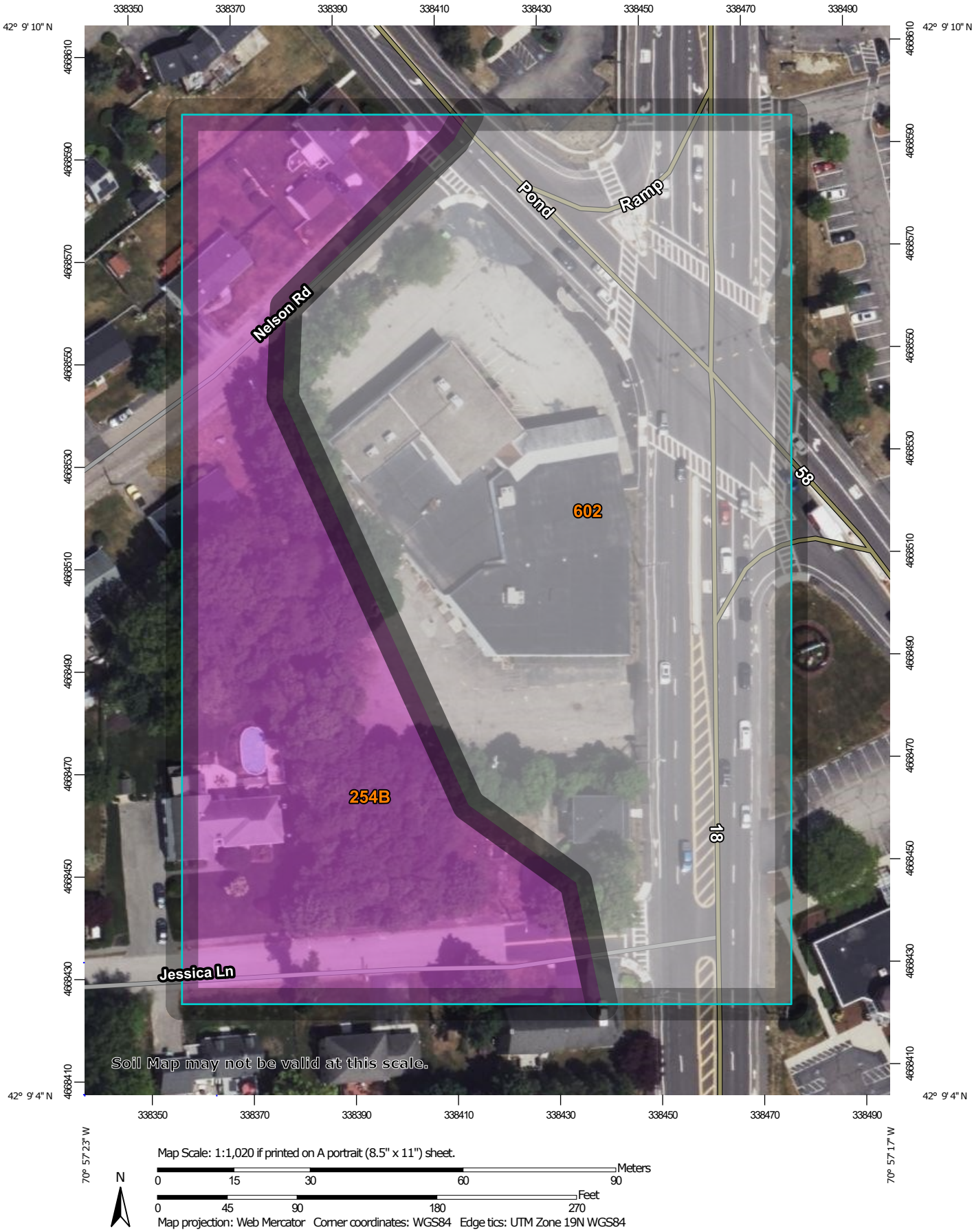
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/24/2023 at 2:48 PM 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.

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *GEOTECHNICAL ENGINEERING REPORT*


70° 57' 23" W
70° 57' 17" W
42° 9' 10" N
42° 9' 4" N
338350
338370
338390
338410
338430
338450
338470
338490
4668610
4668590
4668570
4668550
4668530
4668510
4668490
4668470
4668450
4668430
4668410
Pond
Ramp
Nelson Rd
58
602
254B
18
Jessica Ln
Soil Map may not be valid at this scale.
Map Scale: 1:1,020 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 15 30 60 90
Feet
0 45 90 180 270
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 1:25,000.

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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	1.9	37.4%
602	Urban land, 0 to 15 percent slopes		3.2	62.6%
Totals for Area of Interest			**5.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NORTHEAST GEOTECHNICAL, INC.
Delivering Practical Engineering Solutions

GEOTECHNICAL ENGINEERING REPORT
PROPOSED RETAIL DEVELOPMENT
505 POND STREET AND 1537 MAIN STREET
WEYMOUTH, MASSACHUSETTS

Prepared For:
Harborlight Advisors

Prepared By:
Northeast Geotechnical, Inc.
166 Raymond Hall Drive
North Attleborough, MA 02760

Project No. H477.00
June 17, 2022

NORTHEAST GEOTECHNICAL, INC.
Delivering Practical Engineering Solutions

June 17, 2022 Project No. H477.00

Michael A. d'Hemecourt
Principal
Harborlight Advisors

SUBJECT: Geotechnical Engineering Report
Proposed Retail Development
505 Pond Street and 1537 Main Street
Weymouth, MA

Dear Mike:

Northeast Geotechnical, Inc. is pleased to present this report summarizing the results of our geotechnical engineering studies for the retail development project proposed to be constructed at 505 Pond Street and 1537 Main Street in Weymouth, Massachusetts. Our services have been performed in accordance with our proposal to you dated April 19, 2022.

Our first objective was to assess the existing subsurface soil and groundwater conditions in the proposed building areas by observing and logging exploratory soil test borings. Then, based on the subsurface conditions encountered, we developed geotechnical engineering recommendations for use in foundation and ground floor slab design for the proposed buildings and for use in earthwork construction activities. We also developed a recommended seismic site class based on the subsurface soil conditions encountered.

BACKGROUND

A concept site plan provided to us shows two proposed retail buildings labeled Retail A and Retail B. Retail A is shown to have a footprint area of 7,200 square feet plus a 2,400 square foot drive thru area. Retail B is shown to have a footprint area of about 5,240 square feet plus a 2,246 square foot drive thru area.

Retail A is to be located on the 505 Pond Street portion of the development in an area currently occupied by an existing two-story masonry building formerly operated as a paint store. The existing building has a footprint area of about 23,847± square feet and a finish floor at roughly Elevation 171± to 172± feet based on an existing conditions plan provided to us.

Retail B is to be located on the 1537 Main Street portion of the development south of Retail A. This portion of the site is currently occupied by a two-story residential type of structure with a footprint area of about 947± square feet and a finish floor at about Elevation 172± feet based on the existing conditions plan.

The existing grading at the site generally varies between about Elevations 172± to about 168± feet. The west end of the 1537 Main Street parcel appears to slope up to about Elevation 174± and to 177± feet in a couple of localized areas that could be ledge outcroppings based on notes contained on the plans provided and field observations.

No proposed site grading was provided to us. However, we assume the proposed grading will roughly match the existing grading except that some cuts may be required at the west end of the 1537 Main Street parcel in the area of the localized high spots.

SUBSURFACE EXPLORATORY SOIL TEST BORINGS

Northeast Geotechnical, Inc. coordinated, observed and logged seven soil test borings (B-1 to B-7) on June 1 and 2, 2022 to assess the subsurface soil and groundwater conditions in the proposed building areas.

The test borings were performed by Drilex Environmental, Inc. of Auburn, Massachusetts using a truck-mounted drill rig. The test borings were advanced using 4.25± inch inside diameter hollow stem augers to depths of about 7.5± to 20± feet below existing ground surface. The test borings were terminated in apparent natural granular soil deposits. Auger refusal was encountered in each test boring except boring B-2.

Standard Penetration Testing was performed in the test borings at about 5± foot intervals or less. This testing consisted of driving a standard 2 inch outside diameter split spoon sampler up to 24 inches at each sampling depth by repeated blows of a 140 pound automatic trip safety hammer falling 30 inches. The sum of the hammer blows from the 6 to 18 inch interval is the Standard Penetration Resistance of the soil sampled.

The test borings were located in the field by Northeast Geotechnical, Inc. using taping, pacing and/or line of sight from existing site features. The test borings were performed outside of the existing buildings at the site. The test boring locations are approximately shown on the attached Subsurface Exploration Location Plan (Figure No. 1). The locations shown on the plan should be considered accurate only to the degree implied by the location methods used in the field.

Our logs of the conditions encountered in the test borings are attached. The logs include the Standard Penetration Test results, our visual field sample descriptions using Burmister's descriptions, and other observations and information.

Note that the soil descriptions of the split spoon samples are generally representative of the minus 1.4± inch size fraction of the overall soil deposits sampled. This is the approximate inside diameter of the split spoon sampler.

LABORATORY SOIL TESTING

Select soil samples from the test borings were submitted to Thielsch Engineering's soils testing laboratory in Cranston, Rhode Island for sieve analysis to assess basic engineering properties and reuse potential of the materials sampled. The test results are attached and are representative of the 1.4± inch minus fraction of the overall soil deposits sampled.

GENERAL SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

The test borings we observed and logged generally indicated an approximate 3 inch thick existing asphalt layer or a thin topsoil fill layer about 2 inches thick at the existing ground surface in areas outside of the existing buildings. These surficial layers appeared to be underlain by up to about 5± feet of existing granular fill materials. The existing granular fill then appeared to be underlain by an apparent natural deposit of silty sand and gravel with apparent cobbles and boulders to the depths explored.

The existing fill encountered appeared to typically consist of a mixture of sand, gravel and silt in various proportions as indicated on the attached test boring logs. The fill also appeared to typically contain trace amounts of brick, asphalt, ash, slag, wood and/or roots. The fill appeared loose to dense based on the Standard Penetration testing performed during the test borings.

The natural silty sand and gravel deposit encountered below the existing fill appeared to generally consist of fine to coarse sand with variable gravel and silt content as indicated on the test boring logs. Based on our observations during drilling, this deposit also appeared to contain cobbles and boulders. The Standard Penetration testing indicated the deposit to be medium dense to very dense.

Refer to the attached test boring logs for more information regarding the thickness, description and density of the soils sampled. Also refer to the attached laboratory test results for gradation distribution of the 1.4± inch minus fraction of the tested soil samples.

Groundwater was encountered in each test boring at depths of about 7± to 13± feet below existing ground surface at the time the borings were performed. Note that groundwater levels will fluctuate due to variations in temperature, precipitation and other factors. Therefore, groundwater levels at any time could be different than those reported herein.

CONCLUSIONS AND RECOMMENDATIONS

It is our opinion that the natural granular soil deposit (i.e., the natural silty sand and gravel deposit) is suitable to support the proposed buildings using normal spread footings and slab-on-grade construction. The existing fill may also be suitable for slab support only provided it can be successfully densified in-place using a heavy, self-propelled, ride-on vibratory drum compactor as recommended herein.

Existing fill encountered during footing excavation is not considered suitable for foundation support and should be over-excavated below all footings and be replaced with controlled compacted lifts of structural fill as recommended herein. The existing fill should be removed within the 1 horizontal to 1 vertical footing stress zone. Building area earthwork should be performed under the full-time observation of a qualified geotechnical engineer.

Our geotechnical engineering conclusions and recommendations for preparation of the proposed building area subgrades, re-use of on-site materials, foundation and slab design and seismic site class are presented based on the test borings we observed and logged, the laboratory test results and our geotechnical engineering analysis and evaluation of this information. Our conclusions and recommendations are subject to the attached Limitations and Service Constraints.

Building Area Subgrade Preparation

The existing surface vegetation/topsoil and existing pavement should be stripped from the proposed building areas and to a distance of at least 5 feet outside the proposed building foundation limits. Existing slabs, foundations, underground utility pipes and other below grade structures should also be excavated and removed from the proposed building areas and to at least 5 feet outside the proposed building foundation limits.

The excavations made to remove existing foundations, underground utility pipes and other below grade structures should be backfilled with controlled, compacted lifts of structural fill. We recommend structural fill be placed up to slab subgrade elevation in 6 inch maximum thick lifts in confined areas where lighter compaction equipment is usually used and 12 inch maximum thick lifts in open areas where heavier compaction equipment is typically used.

Each lift of structural fill placed within the building areas should be compacted using suitable vibratory compaction equipment to at least 95 percent of the fill material's maximum dry density as determined by ASTM D-1557. In addition to achieving the minimum degree of compaction, each lift of fill should be compacted to a firm and stable condition as assessed by a qualified, on-site geotechnical engineer.

Structural fill from off-site sources should be free from ice and snow, roots, sod, rubbish, and other deleterious or organic material, and meet the following gradation criteria:

Structural Fill Gradation Recommendation

Sieve Size	Percent Finer by Weight
6 inches	100
No. 10	30-95
No. 40	10-70
No. 200	0-12

Structural fill should not be placed over frozen ground and should be protected from becoming frozen. Frozen ground should be removed prior to placing structural fill for compaction. Placement and compaction of structural fill within the proposed building areas should be observed and tested by a qualified geotechnical engineer.

Following removal and backfilling of the existing foundations, underground utilities and structures from the proposed building areas, the existing fill should then be densified in-place by making at least 15 passes over the proposed building areas and at least 5 feet beyond with a 15-ton minimum, self-propelled, ride-on vibratory drum compactor. If weak or unstable areas are identified, these areas should be removed and be replaced with compacted structural fill.

Densification of existing fill and fill placement and compaction within the proposed building areas should be observed by a qualified geotechnical engineer.

Re-use of On-Site Materials as Structural Fill

The existing fill and the natural silty sand and gravel should generally be suitable for re-use as structural fill provided they are protected from becoming too wet and/or frozen during construction and meet the below recommended criteria. Excavated on-site granular fill and the natural silty sand and gravel could be reused as compacted structural fill under the following conditions:

- The materials are essentially free of wood, roots and other organic matter;
- Boulders and construction debris greater than 6 inches in size are screened out of the material;
- The material is not frozen; and
- The material is at a suitable moisture content to allow it to be placed and compacted to the required density and to a firm and stable condition on the day it is placed.

Building Foundations

Provided the building areas are prepared as recommended above, spread footings may be used to support the proposed buildings. Footings should bear directly on undisturbed natural soils or properly placed and compacted structural fill as recommended herein placed directly on the undisturbed natural soils where removal of existing fill soils extends below proposed bottom of footing elevations. Existing fill should not be left in-place below proposed footings. The maximum allowable bearing pressure on the soil should not exceed 4,000 pounds per square foot under these conditions.

Regardless of the recommended allowable bearing pressure, continuous wall footings should be at least 24 inches wide and column footings should be at least 36 inches in the least lateral dimension. Exterior footings should be located a minimum of four feet below adjacent ground surface for frost protection.

During wet weather or anytime pouring of the concrete is delayed, the footing subgrades should be overexcavated for the immediate placement and compaction of a 6 inch minimum thick layer of ¾ inch crushed stone.

Footings should not be poured over frozen ground and frost should not be allowed to penetrate beneath footings. Footings should be adequately backfilled before frost can penetrate below them or they should otherwise be protected from frost penetration using a combination of heat and insulation blankets until they can be adequately backfilled.

Utilities should not be located within the one horizontal to one vertical theoretical stress zone of the foundations. Where applicable, exterior foundations should be lowered to allow pipe penetrations to be installed through the foundation walls above the top of foundations.

Footings and foundation walls should generally be backfilled with controlled 6 to 8 inch maximum thick lifts of structural fill. Each lift of backfill above bottom of footing elevation to slab subgrade elevation should be compacted to at least 92 percent of the fill material's maximum dry density as determined by ASTM D-1557 and to a firm and stable condition.

Backfill should not be placed over frozen ground. All frozen ground should be removed prior to placing backfill for compaction.

Floor Slab

The ground floor slab for the proposed buildings can be supported on-grade provided the preceding recommendations are satisfactorily implemented. The slabs should bear directly on a 6 inch minimum thick base course layer of sand and gravel compacted to at least 95 percent of the material's maximum dry density as determined by ASTM D-1557. The base course sand and gravel should be free from ice and snow, roots, sod, rubbish, and other deleterious or organic material, and meet the following gradation criteria:

Base Course Sand and Gravel

Sieve Size	Percent Finer by Weight
4 inch	100
½ inch	50-85
No. 4	40-75
No. 10	30-60
No. 40	10-35
No. 100	5-20
No. 200	2-8

Seismic Site Class

We recommend a seismic site class D be used for seismic design of the proposed buildings in accordance with the ninth edition of the Massachusetts State Building Code provided the recommendations presented in this reported are followed under appropriate geotechnical engineering observation during construction.

Design Review and Construction Observation

Northeast Geotechnical should be retained to review the foundation plans and earthwork specifications prior to bidding for construction to see that our recommendations have been properly interpreted and included.

Northeast Geotechnical should also be retained to provide construction observation and soil testing services during the earthwork phase of the project. The purpose of our participation is to observe that the contractors perform earthwork in general compliance with the recommendations presented in this report and to verify our design assumptions in the field. In addition, we can provide engineering input in a timely manner if subsurface conditions are found to vary from those anticipated prior to construction and warrant a design change or a change in earthwork procedures.

We have enjoyed working with you on this project and look forward to continuing our involvement during the upcoming construction phase. If you have any questions or require additional information, please do not hesitate to call.

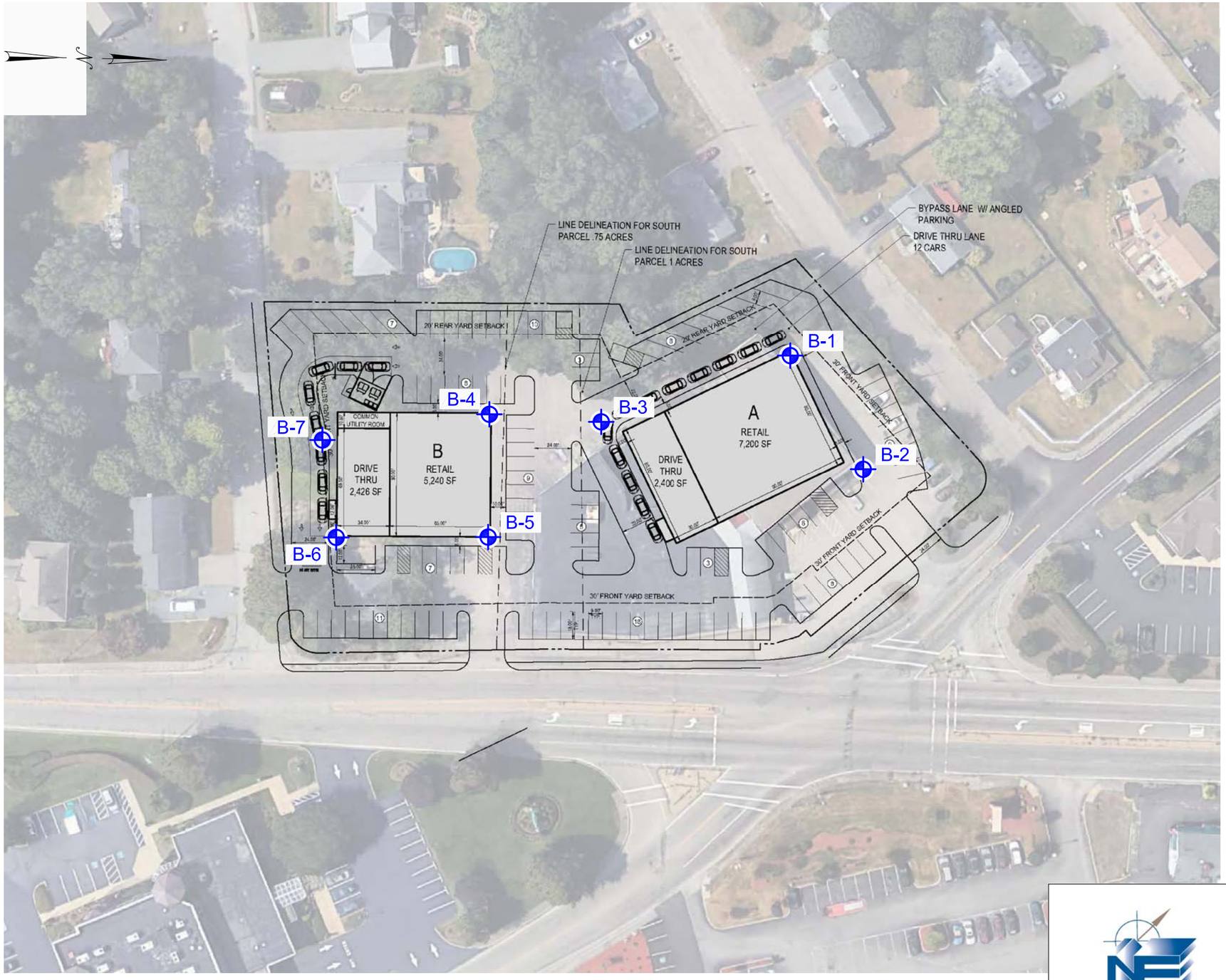
Sincerely,

Northeast Geotechnical, Inc.

James M. Handanyan, P.E.
Principal Engineer

Glenn A. Olson, P.E.
Principal Engineer

Attachments: Figure No. 1 – Subsurface Exploration Location Plan
Limitations and Service Constraints
Test Boring Logs
Laboratory Soil Test Results



NOTES:

1. BASE MAP DEVELOPED FROM PLAN TITLED "CONCEPT PLAN A", ORIGINAL SCALE: 1"=30', DATED 04/11/2022, PROVIDED BY BOHLER.
2. TEST BORINGS LOCATED BY NORTHEAST GEOTECHNICAL, INC. PERSONNEL USING LINE OF SIGHT, TAPING AND/OR PACING FROM EXISTING SITE AND BUILDING FEATURES. THE LOCATIONS SHOWN ON THIS PLAN SHOULD BE CONSIDERED APPROXIMATE TO THE DEGREE IMPLIED BY THE METHODS USED.
3. TEST BORINGS OBSERVED AND LOGGED BY NORTHEAST GEOTECHNICAL, INC. PERSONNEL.

LEGEND:

⊕ TEST BORINGS PERFORMED BY DRILEX ENVIRONMENTAL OF AUBURN, MA ON JUNE 1 AND JUNE 2, 2022.

NORTHEAST GEOTECHNICAL

NORTHEAST GEOTECHNICAL, INC.

PROPOSED RETAIL DEVELOPMENT

505 POND ST. & 1537 MAIN ST. WEYMOUTH, MA

SUBSURFACE EXPLORATION LOCATION PLAN

Project No.: H477.00	Drawn By: JJP	Reviewed By: J. HANDANYAN, P.E.
Date: 6/4/2022	Scale: 1"=70'	Figure No.: 1

LIMITATIONS AND SERVICE CONSTRAINTS
Geotechnical Engineering Consulting Services

The opinions, conclusions and recommendations presented in this report are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by Northeast Geotechnical, Inc. and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the geotechnical consulting industry. No representation, warranty, or guarantee, express or implied, is intended or given. To the extent that Northeast Geotechnical, Inc. relied upon any information prepared by other parties not under contract to Northeast Geotechnical, Inc. , Northeast Geotechnical, Inc. makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Furthermore, nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

Subsurface Explorations and Testing

Results of any observations, subsurface exploration or testing, and any findings presented in this report apply solely to conditions existing at the time when Northeast Geotechnical, Inc.'s exploratory work was performed. It must be recognized that any such observations and exploratory or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site may vary from those at the locations where data were collected and conditions can change with time. Northeast Geotechnical, Inc.'s ability to interpret exploratory and test results is related to the availability of the data and the extent of the exploratory and testing activities.

The findings, conclusions and recommendations submitted in this report are based, in part, on data obtained from subsurface borings, test pits, and specific, discrete sampling locations. The nature and extent of variation between these test locations, which may be widely spaced, may not become evident until construction. If variations are subsequently encountered, it will be necessary to re-evaluate the conclusions and recommendations of this report.

Correlations and descriptions of subsurface conditions presented in boring logs, test pit logs, subsurface profiles, and other materials are approximate only. Subsurface conditions may vary significantly from those encountered in borings and sampling locations and transitions between subsurface materials may be gradual or highly variable.

Conditions at the time water level measurements and other subsurface observations were made are presented in the boring logs or other sampling forms. These field data have been reviewed and interpretations provided in this report. However, groundwater levels may be variable and may fluctuate due to variation in precipitation, temperature, and other factors. Therefore, groundwater levels at the site at any time may be different than stated in this report.

Review

In the event that any change in the nature, design, or location of the proposed structure(s) is planned, the conclusions and recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or verified in writing.

Northeast Geotechnical, Inc. should be provided the opportunity for a general review of final design plans and specifications to assess that our recommendations have been properly interpreted and included in the design and construction documents.

Construction

To verify conditions presented in this report and modify recommendations based on field conditions encountered in the field, Northeast Geotechnical, Inc. should be retained to provide geotechnical engineering services during the construction phase of the project. This is to observe compliance with design concepts, specifications, and recommendations contained in this report, and to verify and refine our recommendations as necessary in the event that subsurface conditions differ from those anticipated prior to the start of construction.

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-1
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-1-2022 / Overcast w/ Rain, 50s to 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 172± feet
Depth to Water: 13± feet

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Pavement, 0.3'±	3± inches BITUMINOUS CONCRETE
	S-1	0.5-2.5'	24"	19"	15-24-21-13		Existing Fill	Dense, gray-tan-brown, F/C GRAVEL and F/C SAND, some Silt, trace (-) Brick/Asphalt, moist
	S-2A	2.5-3'	6"	6"	13		3'±	Gray-brown, F/C SAND, some F/C Gravel, some (-) Silt, trace Asphalt, moist
	S-2B	3-4.5'	18"	8"	16-27-43			Dense, gray-tan-brown, F/C GRAVEL, some (+) F/C Sand, some Silt, contains pulverized rock, moist
5'						2,3		
	S-3	5-7'	24"	16"	16-25-38-32			Very dense, gray-tan, F/C GRAVEL and F/C SAND, trace Silt, moist
						4		
							Natural Silty Sand and Gravel with Cobbles and Boulders	
10'								
	S-4	10-12'	24"	11"	22-30-23-32			Very dense, gray-tan, F/C SAND, some F/C Gravel, some (-) Silt, moist
						4,5		
15'								
	S-5	15-17'	24"	12"	13-11-10-10			
								Medium dense, gray-brown, F/C SAND, some Silt, some F/C Gravel, wet
						6,7	19'±	
20'								Bottom of boring at 19± feet (Auger Refusal)
25'								

Notes:
1) Augered to approximately 0.5± feet below ground surface (bgs) through existing pavement.
2) Heavy auger grinding on probable boulder observed from approximately 4± to 5± feet bgs. Auger refusal at 5± feet bgs.
3) Following initial auger refusal, offset boring 4± feet northeast then continued
4) Heavy auger grinding on probable cobbles and/or boulders observed from approximately 7± to 9± feet bgs and 13.5± to 15± feet bgs.
5) Groundwater encountered at 13± feet bgs while drilling.
6) Auger refusal at 19± feet bgs.
7) Boring terminated at 19± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-2
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-1-2022 / Overcast w/ Rain, 50s to 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 171± feet
Depth to Water: 11± feet

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Pavement, 0.3'±	3± inches BITUMINOUS CONCRETE
	S-1A	0.5-2'	18"	7"	7-29-14		Existing Fill	Dense, brown, F/C GRAVEL and F/C SAND, some Silt, trace Brick/Asphalt, moist
	S-1B	2-2.5'	6"	5"	4			Tan, F/C SAND, some Silt, little F. Gravel, moist
	S-2	2.5-3.5'	12"	6"	4-3-50/0"	2,3	4'±	Loose, brown, Clayey SILT, little (+) F. Gravel, little F/M Sand, trace Ash
5'	S-3	4-6'	24"	16"	13-57-49-45			Very dense, gray-tan-brown, F/C GRAVEL, some (+) F/C Sand, trace Silt, contains pulverized rock, moist
	S-4	6-6.1'	1"	0"	50/1"	4,5		No recovery
10'								
	S-5	10-12'	24"	16"	18-25-23-25	6	Natural Silty Sand and Gravel with Cobbles and Boulders	Dense, tan-brown, F/C SAND, some Silt, little F/C Gravel, moist to wet
15'								
	S-6	15-17'	24"	10"	72-25-21-23			Dense, gray-brown, F/C SAND and F/C GRAVEL, some Silt, wet
20'								
	S-7	20-21'	12"	12"	19-100/6"	7	21'±	Very dense, gray-brown, F/C SAND, some Silt, some F/C Gravel, wet
								Bottom of boring at 21± feet
25'								

Notes:

1) Augered to approximately 0.5± feet below ground surface (bgs) through existing pavement.
2) Sampler refusal at 3.5± feet bgs.
3) Auger refusal at 3.5± feet bgs on probable boulder. Offset boring 4± feet northeast then continued.
4) Sampler refusal at 6.1± feet bgs.
5) Frequent heavy auger grinding on probable cobbles and/or boulders observed from approximately 4± to 20± feet bgs. Cobbles observed in auger cuttings.
6) Groundwater encountered at 11± feet bgs while sampling.
7) Boring terminated at 21± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-3
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-1-2022 / Overcast w/ Rain, 50s to 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 171± feet
Depth to Water: 10± feet

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Pavement, 0.3'±	3± inches BITUMINOUS CONCRETE
	S-1	0.5-1.8'	15"	12"	12-14-50/3"	2	Existing Fill, 2'±	M. dense, gray-tan-brown, F/C GRAVEL, some (+) F/C Sand, trace Silt, moist
	S-2	2-3.3'	15"	8"	28-22-50/3"	3		Very dense, gray-tan-brown, F/C GRAVEL, some (+) F/C Sand, some Silt, moist
						4		
5'								
	S-3	5-7'	24"	17"	14-31-23-21		Natural Silty Sand and Gravel with Cobbles and Boulders	Very dense, gray-tan-brown, F/C SAND and F/C GRAVEL, some Silt, trace (-) Fine Roots, moist
						5		
	S-4	7-9'	24"	21"	33-26-27-22			Very dense, gray-tan, F/C SAND, some F/C Gravel, some (-) Silt, moist
10'								
	S-5	10-12'	24"	10"	8-20-21-17	6		Dense, gray-brown, F/C SAND, some (-) Silt, little (+) F/C Gravel, wet
						7,8	14'±	
15'								Bottom of boring at 14± feet (Auger Refusal)
20'								
25'								

Notes:
1) Augered to approximately 0.5± feet below ground surface (bgs) through existing pavement.
2) Sampler and auger refusal on probable boulder at 1.8± feet bgs. Offset boring 4± feet southeast then continue.
3) Sampler refusal at 3.3± feet bgs.
4) Heavy auger grinding through probable boulder(s) from 3.3± to 5± feet bgs.
5) Frequent heavy auger grinding on probable cobbles and/or boulders observed from approximately 6± to 14± feet bgs.
6) Groundwater encountered at 10± feet bgs while sampling.
7) Auger refusal at 14± feet bgs.
8) Boring terminated at 14± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-4
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-1-2022 / Overcast w/ Rain, 50s to 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 170± feet
Depth to Water: None Observed

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Pavement, 0.3'±	3± inches BITUMINOUS CONCRETE
	S-1	0.5-2.5'	24"	3"	13-11-6-4	2	Existing Fill	M. dense, gray-brown, F/C SAND and F/C GRAVEL, little Silt, little Ashpalt, moist
	S-2A	2.5-3'	6"	6"	6		3'±	Gray-brown, F/C SAND, some F/C Gravel, some (-) Silt, trace Slag
	S-2B	3-4.5'	18"	14"	14-25-25		Natural Silty Sand and Gravel with Cobbles and Boulders	Dense, gray-tan, F/C SAND, some F/C Gravel, some Silt, moist
5'								
	S-3	5-6.5'	18"	18"	25-54-50/6"	3,4		Very dense, gray-tan, F/C SAND and F/C GRAVEL, some (-) Silt, trace (-) Fine Roots, contains pulverized rock, moist
						5,6	9'±	
10'								Bottom of boring at 9± feet (Auger Refusal)
15'								
20'								
25'								

Notes:
1) Augered to approximately 0.5± feet below ground surface (bgs) through existing pavement.
2) Sample S-1 had minimal recovery--rock blocking sampler tip.
3) Frequent heavy auger grinding on probable cobbles and/or boulders observed from approximately 5± to 9± feet bgs. Cobbles observed in auger cuttings.
4) Sampler refusal at 6.5± feet bgs.
5) Auger refusal at 9± feet bgs.
6) Boring terminated at 9± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-5
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-2-2022 / Overcast, 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 170± feet
Depth to Water: 10.5± feet

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
						1	Pavement, 0.3'±	3± inches BITUMINOUS CONCRETE
	S-1	0.5-2.5'	24"	13"	7-6-3-3		Existing Fill	Loose, tan, F/C SAND, little F/C Gravel, trace Silt, moist
	S-2A	2.5-3'	6"	5"	2		3'±	Gray-tan-brown, F/C SAND, some F/C Gravel, little Silt, little Wood, moist
	S-2B	3-3.8'	9"	6"	20-50/3"	2		Very dense, gray-tan-brown, F/C GRAVEL and F/C SAND, little (+) Silt, moist
5'						3		
	S-3	5-7'	24"	17"	32-42-47-48		Natural Silty Sand and Gravel with Cobbles and Boulders	Very dense, gray-tan-brown, F/C SAND and F/C GRAVEL, little (+) Silt, moist
	S-4	7-7.5'	6"	5"	100/6"			Very dense, gray-tan-brown, F/C SAND and F/C GRAVEL, little (+) Silt, moist
10'								
	S-5	10-12'	24"	16"	12-13-14-14	4		Medium dense, gray-brown, F/M SAND, some (-) Silt, little (-) fine Gravel, wet
						5,6	12.5'±	
								Bottom of boring at 12.5± feet (Auger Refusal)
15'								
20'								
25'								

Notes:

1) Augered to approximately 0.5± feet below ground surface (bgs) through existing pavement.
2) Sampler refusal at 3.8± feet bgs.
3) Frequent heavy auger grinding on probable cobbles and/or boulders observed from approximately 3.8± to 12.5± feet bgs. Cobbles observed in auger cuttings.
4) Groundwater encountered at 10.5± feet bgs while sampling.
5) Auger refusal at 12.5± feet bgs.
6) Boring terminated at 12.5± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-6
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-2-2022 / Overcast, 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 169± feet
Depth to Water: 7± feet

	Sample Data						Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
	S-1A	0-0.2'	2"	2"	4		Topsoil Fill, 0.2'±	Brown, ROOTS and SILT, little F. Gravel, moist
	S-1B	0.2-2'	22"	8"	4-10-12		Existing Fill	Medium dense, light brown, SILT, little F/C Sand, trace F/C Gravel, trace Roots, moist
						1		
5'	S-2A	4-5'	12"	10"	7-12		5'±	Brown, F/C SAND, some Silt, some fine Gravel, trace Roots, moist
	S-2B	5-6'	12"	5"	27-43	2	Natural Silty Sand and Gravel, 7.5'±	Gray-tan, F/C SAND and F/C GRAVEL, some Silt, moist
	S-3	6-7.3'	15"	9"	29-60-50/3"	3,4		Very dense, gray-tan, F/C SAND, some (+) F/C Gravel, some Silt, moist to wet
						5,6		
10'								Bottom of boring at 7.5± feet (Auger Refusal)
15'								
20'								
25'								

Notes:
1) Augered through cobbles and boulders from 2± to 4± feet below ground surface (bgs).
2) Frequent heavy auger grinding on probable cobbles and/or boulders observed from approximately 5± to 7.5± feet bgs.
3) Groundwater encountered at 7± feet bgs while sampling.
4) Sampler refusal at 7.3± feet bgs.
5) Auger refusal at 7.5± feet bgs.
6) Boring terminated at 7.5± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse
Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

NORTHEAST GEOTECHNICAL, INC.

TEST BORING LOG

Project: Proposed Retail Development
505 Pond Street & 1537 Main Street
Weymouth, MA

Test Boring No.: B-7
Page: 1 of 1
File No.: H477.00
Reviewed By: J. Handanyan, P.E.

Boring Co.: Drilex Environmental, Inc.
Foreman: Chris Hogan
Boring Equipment: Mobile B-57 Truck-Mounted Drill Rig
4¼-inch I.D. Hollow-Stem Augers
2" O.D. Split Spoon, 140 lb. Auto Hammer

Date/Weather: 6-2-2022 / Overcast, 60s °F
Northeast Geotechnical Observer: Christian Rice, P.E.
Test Boring Location: See Subsurface Exploration Location Plan
Ground Surface Elevation: 169± feet
Depth to Water: 7± feet

Sample Data							Strata Change	Sample Description
	No.	Depth	Pen.	Rec.	Blows per 6 in.	Rem.		
	S-1A	0-0.2'	2"	2"	3		Topsoil Fill, 0.2'±	Brown, ROOTS and SILT, trace F. Sand, trace F. Gravel, moist
	S-1B	0.2-2'	22"	16"	4-6-10		Existing Fill, 2'±	Med. dense, light brown, SILT and F/C SAND, little F. Gravel, trace Roots, moist
	S-2	2-4'	24"	20"	16-16-29-43		Natural Silty Sand and Gravel with Cobbles and Boulders	Dense, gray-tan-rust, F/C SAND, some Silt, some F/C Gravel, moist
5'	S-3	5-7'	24"	17"	15-23-21-20			Dense, tan-brown-rust, F/C SAND, some Silt, some F/C Gravel, moist
	S-4	7-9'	24"	22"	24-20-26-27	1		Dense, gray-brown-tan-rust, F/C SAND, some Silt, some F/C Gravel, wet
10'	S-5	10-11.5'	18"	11"	6-8-19-50/0"	2 3,4	11.5'±	Medium dense, gray-tan, F/C SAND, some Silt, little F/C Gravel, wet
15'								Bottom of boring at 11.5± feet (Auger Refusal)
20'								
25'								

Notes:
1) Groundwater encountered at 7± feet below ground surface (bgs) while sampling.
2) Frequent heavy auger grinding on probable cobbles and/or boulders observed from approximately 7± to 11.5± feet bgs.
3) Sampler and auger refusal at 11.5± feet bgs.
4) Boring terminated at 11.5± feet bgs.

Standard Penetration Resistance (Blows/Foot)	Density
0 -4	Very Loose
4 - 10	Loose
10 - 30	Med. Dense
30 - 50	Dense
50+	Very Dense

Abbreviations
F = Fine
M = Medium
C = Coarse
F/M = Fine to Medium
F/C = Fine to Coarse

Proportions Used
Trace (T) = 0 - 10%
Little (Li) = 10 - 20%
Some (So) = 20 - 35%
AND = 35-50%

THIELSCH ENGINEERING

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Cranston RI, 02910
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Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
Northeast Geotechnical, Inc.
Foster, RI
PM: James Handanyan
Assigned By: James Handanyan
Collected By: James Handanyan

Project Information:
Proposed Retail Development
Weymouth, MA
TEI Project Number: 74-22-0002.101
Summary Page: 1 of 1
Report Date: 06.14.22

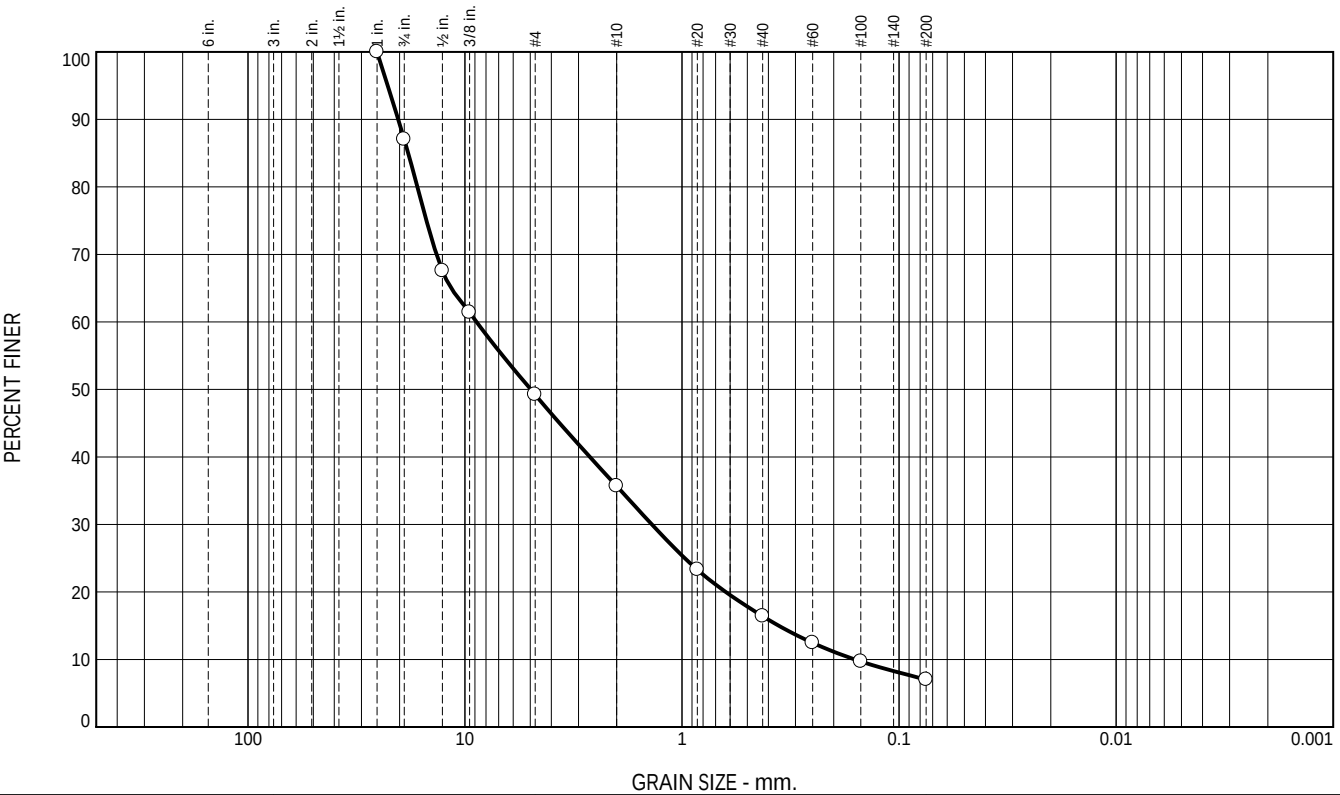
LABORATORY TESTING DATA SHEET, Report No.: 7422-F-124

Boring No.	Sample No.	Depth (ft)	Laboratory No.	Identification Tests								Proctor / Thermal Resistivity							Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	Thermal Resistivity Optimum (°C*cm/W)	Thermal Resistivity Oven Dried (°C*cm/W)	
				D2216	D4318		D6913			D2974	D854			D1557			D5334		
B-1	S-3	5-7	22-S-2102				50.8	42.2	7.0										Light Olive well-graded gravel with silt and sand
B-2	S-3	4-6	22-S-2103				58.7	34.0	7.3										Light Olive well-graded gravel with silt and sand
B-3	S-1	0.5-1.8	22-S-2104				60.7	33.3	6.0										Light Olive well-graded gravel with silt and sand
B-4	S-2B	3-4.5	22-S-2105				29.3	40.8	29.9										Light Olive silty sand with gravel
B-5	S-5	10-12	22-S-2106				10.8	68.5	20.7										Olive silty sand
B-6	S-2A	4-5	22-S-2107				24.4	49.8	25.8										Olive silty sand with gravel
B-7	S-3	5-7	22-S-2108				24.5	48.8	26.7										Olive silty sand with gravel

Date Received: *06.07.22* Reviewed By: Date Reviewed: *06.15.22*

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.0	37.8	13.5	19.3	9.4	7.0	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	87.0			
1/2"	67.6			
3/8"	61.4			
#4	49.2			
#10	35.7			
#20	23.3			
#40	16.4			
#60	12.5			
#100	9.7			
#200	7.0			

* (no specification provided)

Material Description

Light Olive well-graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 20.3192 D_{85}= 18.2597 D_{60}= 8.8471
D_{50}= 4.9774 D_{30}= 1.3769 D_{15}= 0.3588
D_{10}= 0.1598 C_u= 55.35 C_c= 1.34

Classification

USCS= GW-GM AASHTO= A-1-a

Test Remarks

Source of Sample: Boring Depth: 5-7'
Sample Number: B-1 / S-3 Sample Date: 06.10.22

Thielsch Engineering Inc.

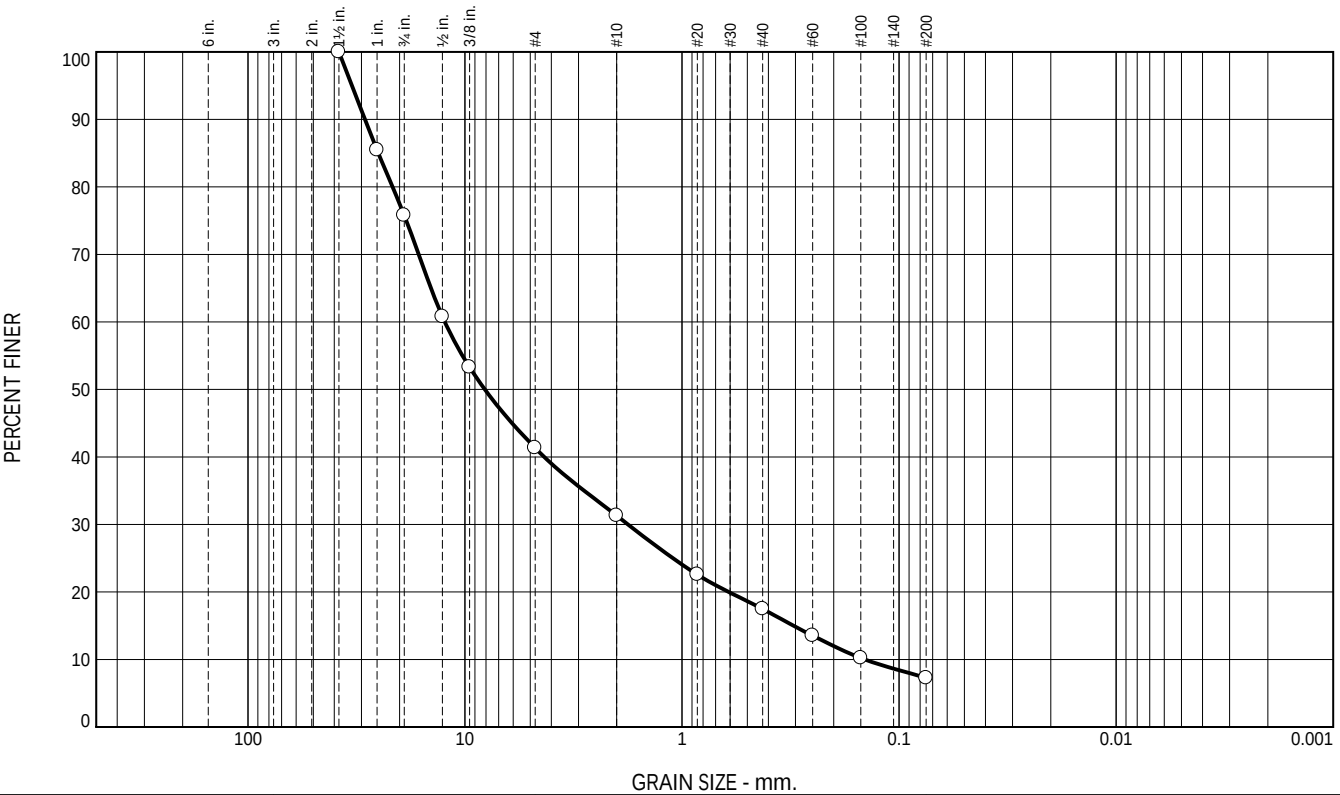
Cranston, RI

Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101 Figure 22-S-2102

Tested By: SL / FR Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.2	34.5	10.0	13.8	10.2	7.3	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1 1/2"	100.0			
1"	85.5			
3/4"	75.8			
1/2"	60.8			
3/8"	53.3			
#4	41.3			
#10	31.3			
#20	22.6			
#40	17.5			
#60	13.5			
#100	10.2			
#200	7.3			

* (no specification provided)

Material Description

Light Olive well-graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 28.8799 D_{85}= 25.0620 D_{60}= 12.3831
D_{50}= 8.1023 D_{30}= 1.7739 D_{15}= 0.3064
D_{10}= 0.1439 C_u= 86.04 C_c= 1.77

Classification

USCS= GW-GM AASHTO= A-1-a

Test Remarks

Source of Sample: Boring Depth: 4-6'
Sample Number: B-2 / S-3

Sample Date: 06.10.22

Thielsch Engineering Inc.

Cranston, RI

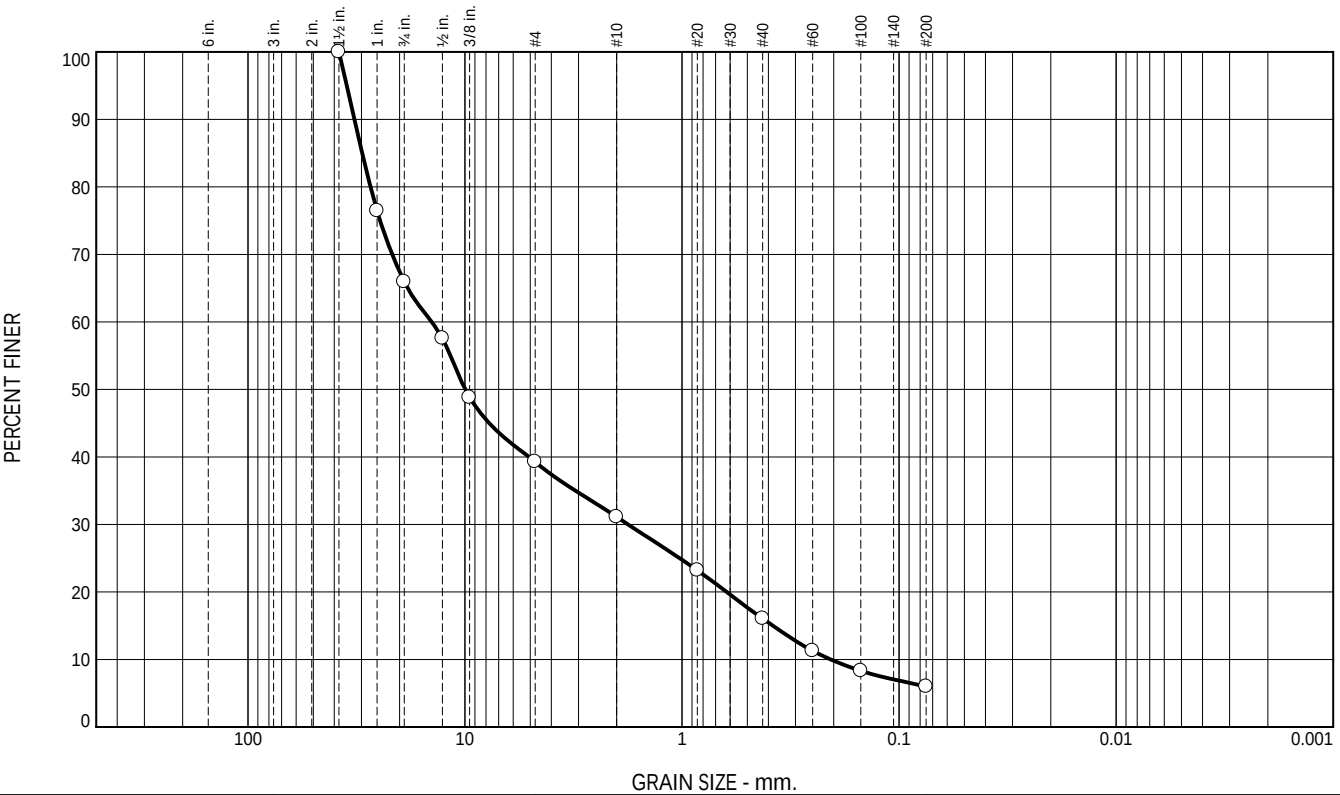
Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101

Figure 22-S-2103

Tested By: SL / FR Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	34.0	26.7	8.2	15.0	10.1	6.0	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1 1/2"	100.0			
1"	76.5			
3/4"	66.0			
1/2"	57.6			
3/8"	48.8			
#4	39.3			
#10	31.1			
#20	23.2			
#40	16.1			
#60	11.3			
#100	8.3			
#200	6.0			

* (no specification provided)

Material Description

Light Olive well-graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 32.3074 D_{85}= 29.7457 D_{60}= 14.2183
D_{50}= 9.9884 D_{30}= 1.7725 D_{15}= 0.3812
D_{10}= 0.2067 C_u= 68.78 C_c= 1.07

Classification

USCS= GW-GM AASHTO= A-1-a

Test Remarks

Source of Sample: Boring Depth: 0.5-1.8'
Sample Number: B-3 / S-1 Sample Date: 06.09.22

Thielsch Engineering Inc.

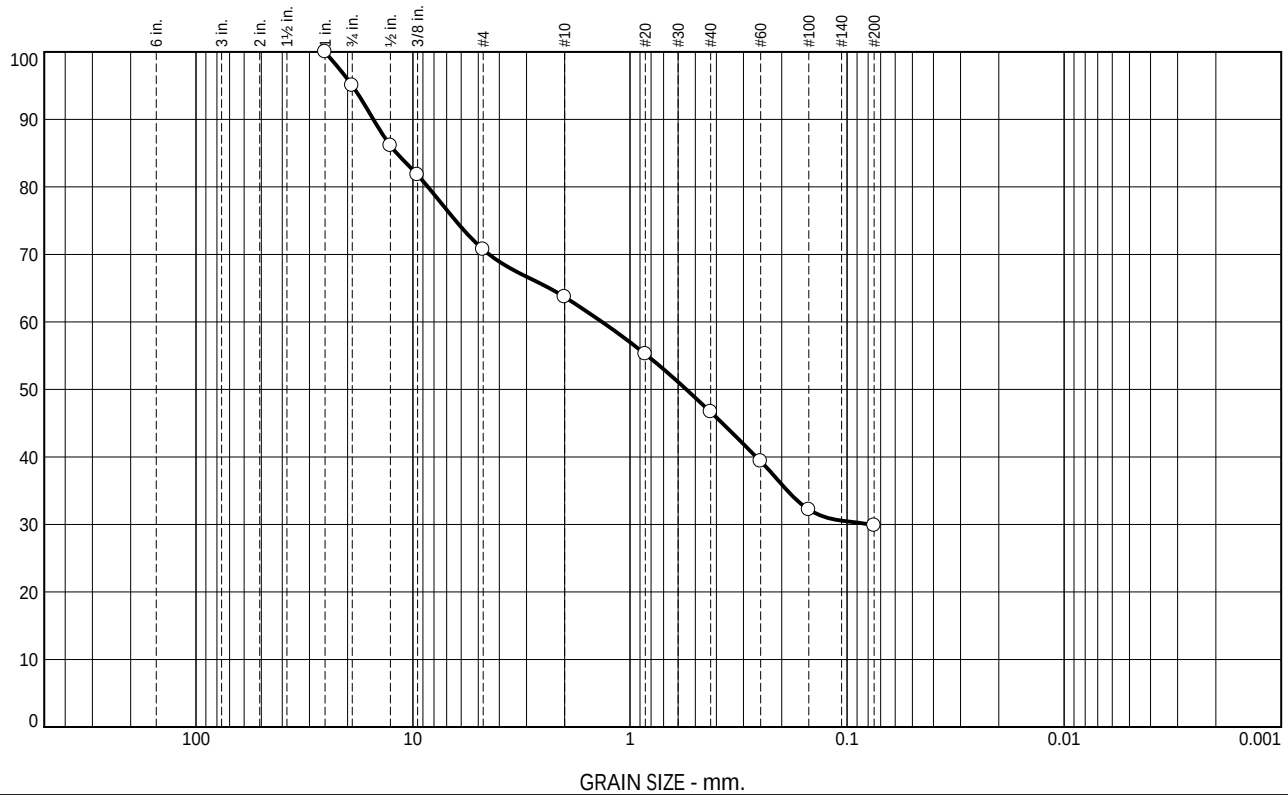
Cranston, RI

Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101 Figure 22-S-2104

Tested By: SL / FR Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.0	24.3	7.0	17.0	16.8	29.9	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	95.0			
1/2"	86.1			
3/8"	81.8			
#4	70.7			
#10	63.7			
#20	55.2			
#40	46.7			
#60	39.3			
#100	32.2			
#200	29.9			

* (no specification provided)

Material Description

Light Olive silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 15.2203 D_{85}= 11.9011 D_{60}= 1.3463
D_{50}= 0.5505 D_{30}= 0.0787 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: Boring Depth: 3-4.5'
Sample Number: B-4 / S-2B Sample Date: 06.09.22

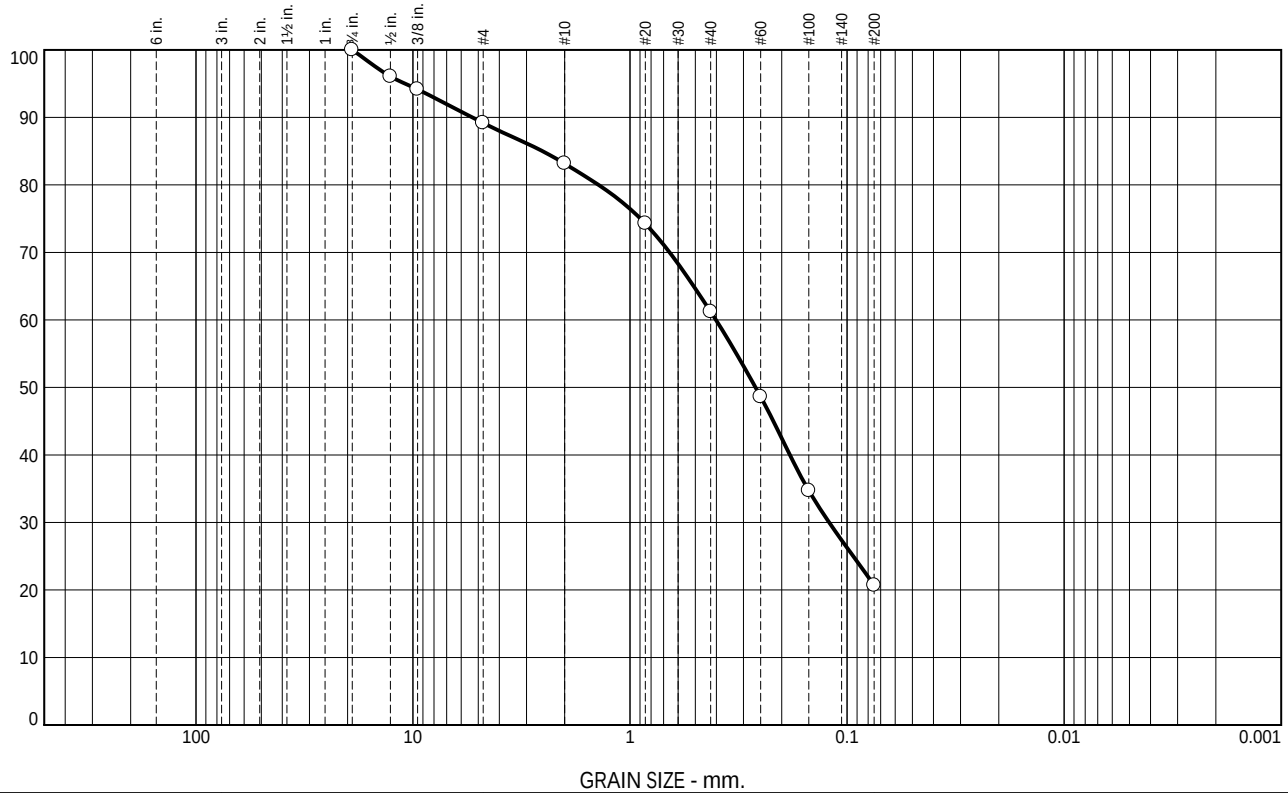
Thielsch Engineering Inc.
Cranston, RI

Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101 Figure 22-S-2105

Tested By: SL / FR Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.8	6.1	21.9	40.5	20.7	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
1/2"	96.1			
3/8"	94.2			
#4	89.2			
#10	83.1			
#20	74.3			
#40	61.2			
#60	48.6			
#100	34.7			
#200	20.7			

* (no specification provided)

Material Description

Olive silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 5.3367 D_{85}= 2.5327 D_{60}= 0.4020
D_{50}= 0.2641 D_{30}= 0.1210 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: Boring Depth: 10-12'
Sample Number: B-5 / S-5 Sample Date: 06.09.22

Thielsch Engineering Inc.

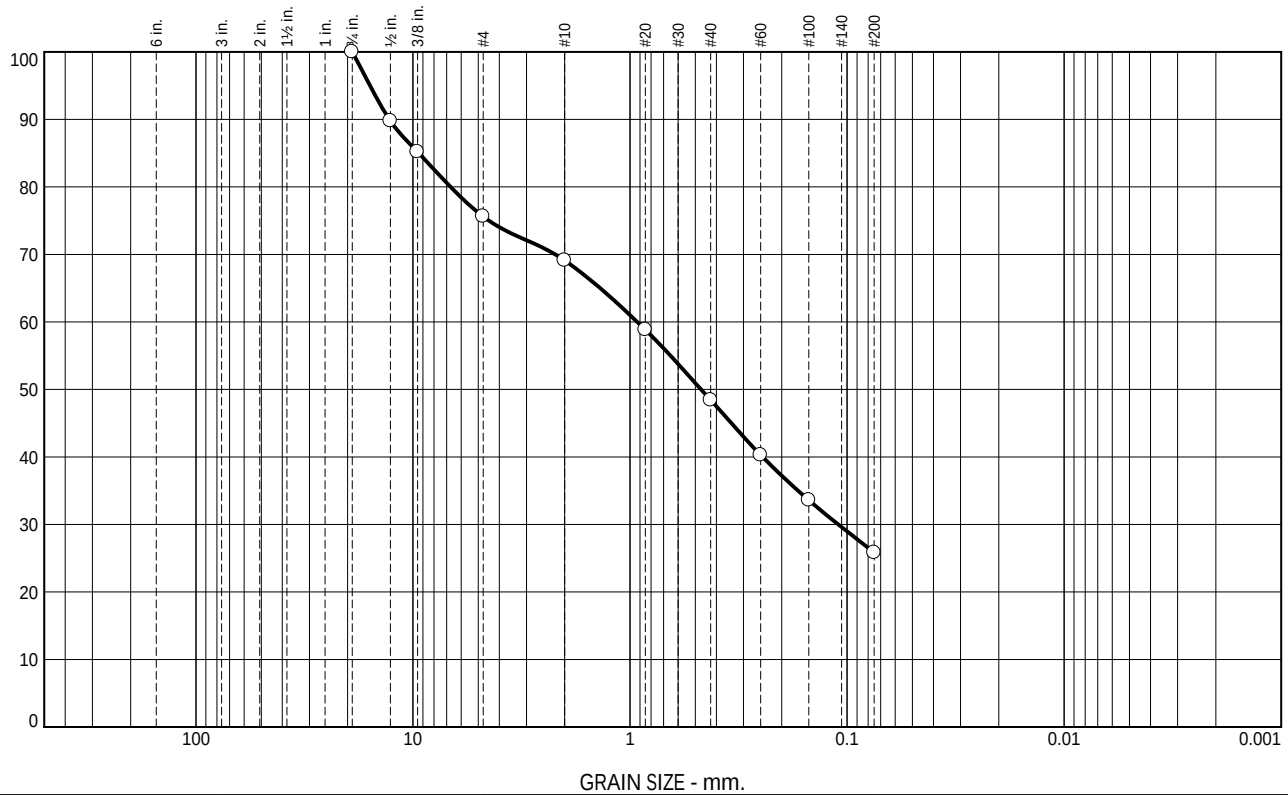
Cranston, RI

Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101 Figure 22-S-2106

Tested By: SL / FR Checked By:

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	24.4	6.5	20.7	22.6	25.8	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
1/2"	89.8			
3/8"	85.2			
#4	75.6			
#10	69.1			
#20	58.8			
#40	48.4			
#60	40.3			
#100	33.6			
#200	25.8			

* (no specification provided)

Material Description

Olive silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 12.8519 D_{85}= 9.4032 D_{60}= 0.9266
D_{50}= 0.4711 D_{30}= 0.1098 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: Boring Depth: 4-5'
Sample Number: B-6 / S-2A Sample Date: 06.09.22

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101 Figure 22-S-2107

Tested By: SL / FR Checked By:

Particle Size Distribution Report

ASTM D6913

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.5	19.0	7.0	17.9	23.9	26.7	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	94.5			
1/2"	82.1			
3/8"	80.6			
#4	75.5			
#10	68.5			
#20	59.1			
#40	50.6			
#60	43.3			
#100	35.3			
#200	26.7			

* (no specification provided)

Material Description

Olive silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 16.5179 D_{85}= 14.3041 D_{60}= 0.9190
D_{50}= 0.4053 D_{30}= 0.0984 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: Boring Depth: 5-7'
Sample Number: B-7 / S-3 Sample Date: 06.09.22

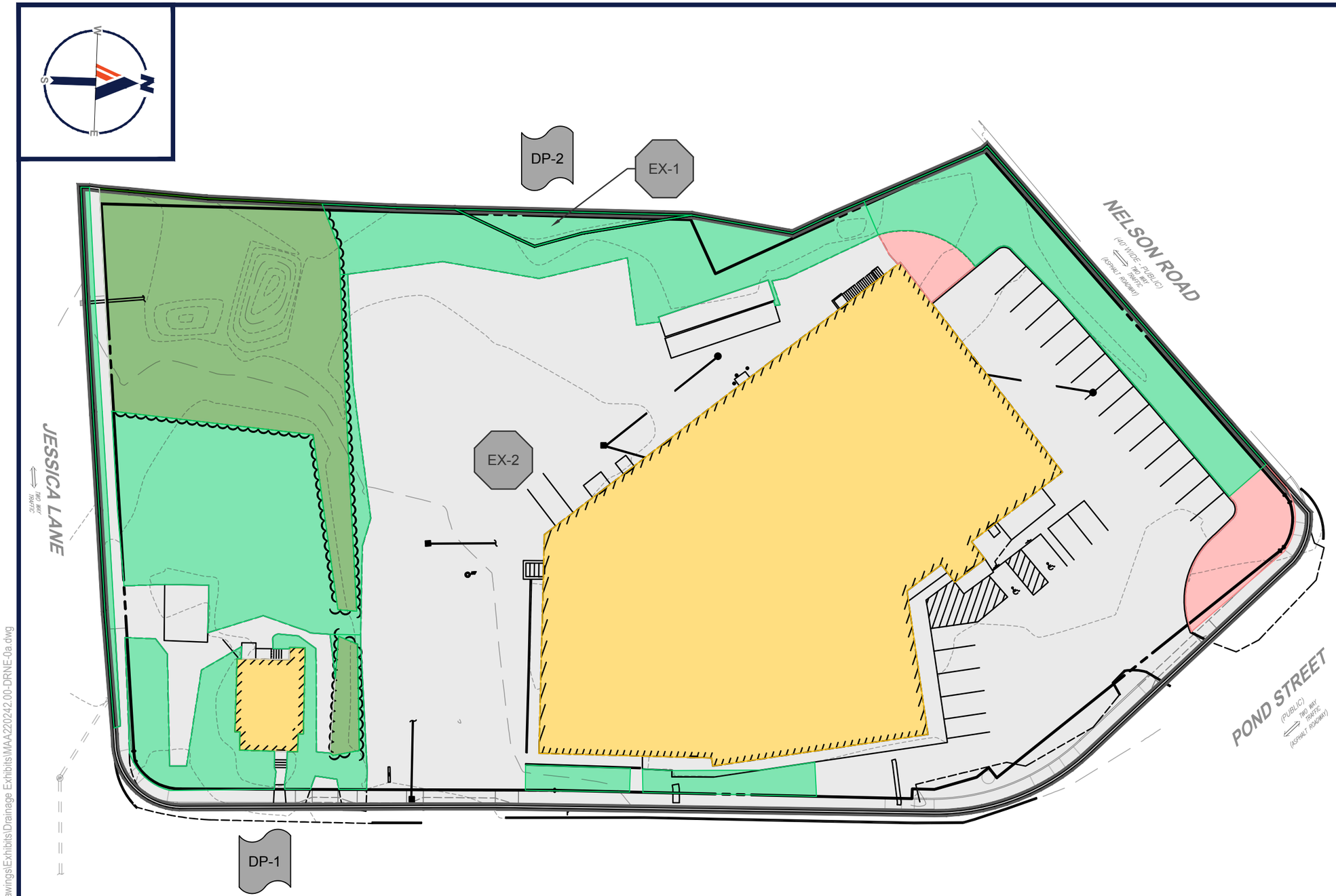
Thielsch Engineering Inc.
Cranston, RI

Client: Northeast Geotechnical, Inc.
Project: Proposed Retail Development
Weymouth, MA
Project No: 74-22-0002.101 Figure 22-S-2108

Tested By: SL / FR Checked By:

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- *EXISTING CONDITIONS DRAINAGE MAP*
- *EXISTING CONDITIONS HYDROCAD COMPUTATIONS*



LEGEND

- DP# — DESIGN POINT
- X-# — EXISTING SUBCATCHMENT
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY
- CONCRETE OR PAVEMENT
- ROOF
- GRASS OR LANDSCAPED AREA
- GRAVEL
- WOODS OR UNDEVELOPED AREA

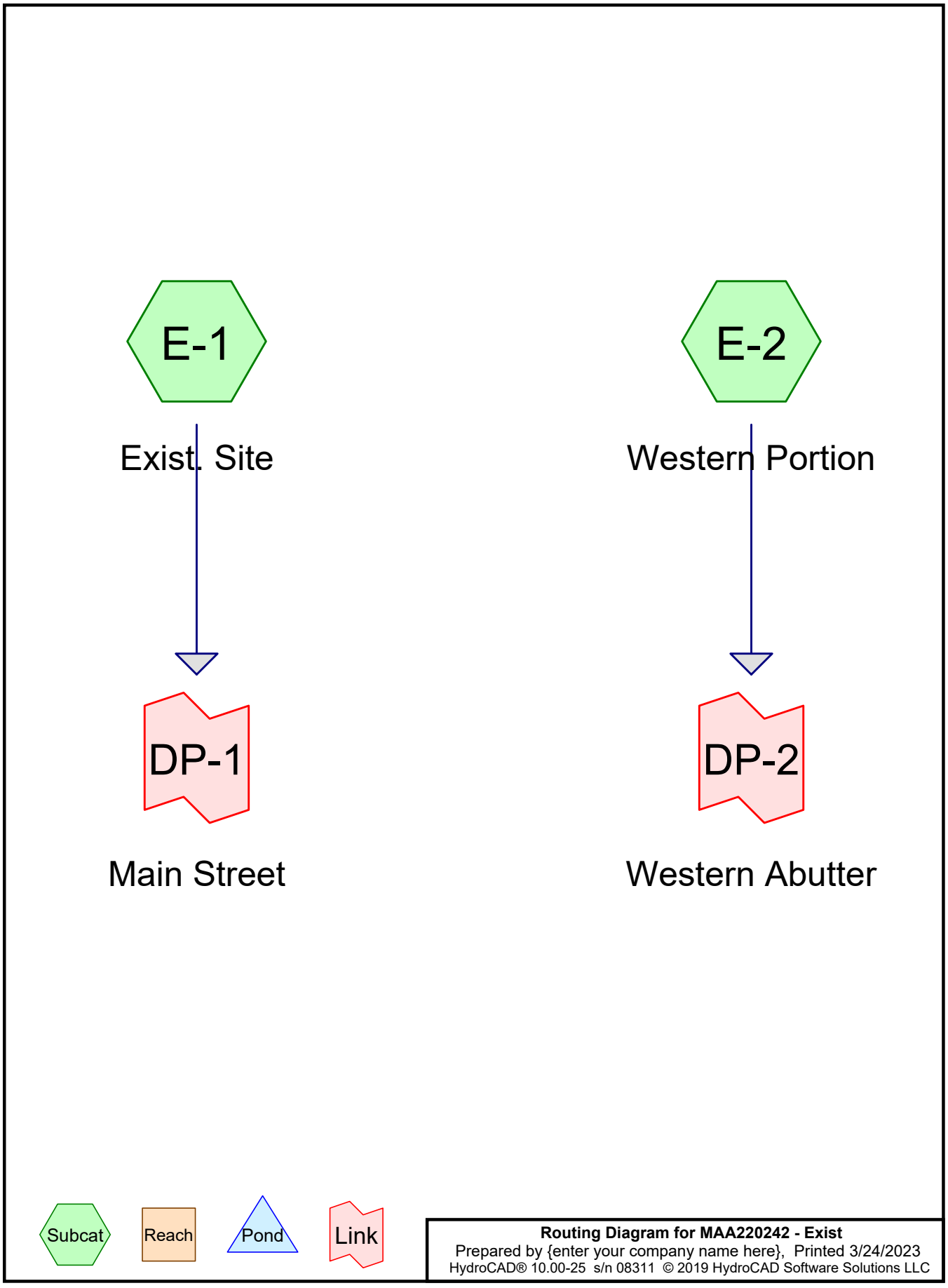
EXISTING CONDITIONS DRAINAGE AREA MAP

505 POND STREET
WEYMOUTH, MASSACHUSETTS

PREPARED BY
BOHLER

SCALE:1"=40' DATE: 03/24/2023

P:\2022\MAA220242.00\CAD\Drawings\Exhibits\Drainage Exhibits\MAA220242.00-DRNE-0a.dwg



Routing Diagram for MAA220242 - Exist
Prepared by {enter your company name here}, Printed 3/24/2023

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Exist. Site Runoff Area=98,189 sf 68.77% Impervious Runoff Depth=1.53"
Tc=6.0 min CN=80 Runoff=3.93 cfs 0.287 af

Subcatchment E-2: Western Portion Runoff Area=589 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Link DP-1: Main Street Inflow=3.93 cfs 0.287 af
Primary=3.93 cfs 0.287 af

Link DP-2: Western Abutter Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 2.268 ac Runoff Volume = 0.287 af Average Runoff Depth = 1.52"
31.64% Pervious = 0.718 ac 68.36% Impervious = 1.550 ac

Summary for Subcatchment E-1: Exist. Site

Runoff = 3.93 cfs @ 12.10 hrs, Volume= 0.287 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
42,727	98	Paved parking, HSG A
9,160	30	Woods, Good, HSG A
19,629	39	>75% Grass cover, Good, HSG A
1,878	96	Gravel surface, HSG A
24,795	98	Roofs, HSG A
98,189	80	Weighted Average
30,667		31.23% Pervious Area
67,522		68.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Western Portion

Runoff = 0.00 cfs @ 23.84 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
589	39	>75% Grass cover, Good, HSG A
589		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP-1: Main Street

Inflow Area = 2.254 ac, 68.77% Impervious, Inflow Depth = 1.53" for 2-Year event
Inflow = 3.93 cfs @ 12.10 hrs, Volume= 0.287 af
Primary = 3.93 cfs @ 12.10 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Inflow Area = 0.014 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 23.84 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.84 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Exist. Site Runoff Area=98,189 sf 68.77% Impervious Runoff Depth=2.99"
Tc=6.0 min CN=80 Runoff=7.74 cfs 0.561 af

Subcatchment E-2: Western Portion Runoff Area=589 sf 0.00% Impervious Runoff Depth=0.22"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Link DP-1: Main Street Inflow=7.74 cfs 0.561 af
Primary=7.74 cfs 0.561 af

Link DP-2: Western Abutter Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 2.268 ac Runoff Volume = 0.562 af Average Runoff Depth = 2.97"
31.64% Pervious = 0.718 ac 68.36% Impervious = 1.550 ac

Summary for Subcatchment E-1: Exist. Site

Runoff = 7.74 cfs @ 12.09 hrs, Volume= 0.561 af, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.11"

Area (sf)	CN	Description
42,727	98	Paved parking, HSG A
9,160	30	Woods, Good, HSG A
19,629	39	>75% Grass cover, Good, HSG A
1,878	96	Gravel surface, HSG A
24,795	98	Roofs, HSG A
98,189	80	Weighted Average
30,667		31.23% Pervious Area
67,522		68.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Western Portion

Runoff = 0.00 cfs @ 12.46 hrs, Volume= 0.000 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.11"

Area (sf)	CN	Description
589	39	>75% Grass cover, Good, HSG A
589		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP-1: Main Street

Inflow Area = 2.254 ac, 68.77% Impervious, Inflow Depth = 2.99" for 10-Year event
Inflow = 7.74 cfs @ 12.09 hrs, Volume= 0.561 af
Primary = 7.74 cfs @ 12.09 hrs, Volume= 0.561 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Inflow Area = 0.014 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-Year event
Inflow = 0.00 cfs @ 12.46 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 12.46 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Exist. Site Runoff Area=98,189 sf 68.77% Impervious Runoff Depth=3.97"
Tc=6.0 min CN=80 Runoff=10.22 cfs 0.746 af

Subcatchment E-2: Western Portion Runoff Area=589 sf 0.00% Impervious Runoff Depth=0.51"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.001 af

Link DP-1: Main Street Inflow=10.22 cfs 0.746 af
Primary=10.22 cfs 0.746 af

Link DP-2: Western Abutter Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Total Runoff Area = 2.268 ac Runoff Volume = 0.747 af Average Runoff Depth = 3.95"
31.64% Pervious = 0.718 ac 68.36% Impervious = 1.550 ac

Summary for Subcatchment E-1: Exist. Site

Runoff = 10.22 cfs @ 12.09 hrs, Volume= 0.746 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.21"

Area (sf)	CN	Description
42,727	98	Paved parking, HSG A
9,160	30	Woods, Good, HSG A
19,629	39	>75% Grass cover, Good, HSG A
1,878	96	Gravel surface, HSG A
24,795	98	Roofs, HSG A
98,189	80	Weighted Average
30,667		31.23% Pervious Area
67,522		68.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Western Portion

Runoff = 0.00 cfs @ 12.32 hrs, Volume= 0.001 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.21"

Area (sf)	CN	Description
589	39	>75% Grass cover, Good, HSG A
589		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP-1: Main Street

Inflow Area = 2.254 ac, 68.77% Impervious, Inflow Depth = 3.97" for 25-Year event
Inflow = 10.22 cfs @ 12.09 hrs, Volume= 0.746 af
Primary = 10.22 cfs @ 12.09 hrs, Volume= 0.746 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Inflow Area = 0.014 ac, 0.00% Impervious, Inflow Depth = 0.51" for 25-Year event
Inflow = 0.00 cfs @ 12.32 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 12.32 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Exist. Site Runoff Area=98,189 sf 68.77% Impervious Runoff Depth=5.52"
Tc=6.0 min CN=80 Runoff=14.06 cfs 1.037 af

Subcatchment E-2: Western Portion Runoff Area=589 sf 0.00% Impervious Runoff Depth=1.11"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Link DP-1: Main Street Inflow=14.06 cfs 1.037 af
Primary=14.06 cfs 1.037 af

Link DP-2: Western Abutter Inflow=0.01 cfs 0.001 af
Primary=0.01 cfs 0.001 af

Total Runoff Area = 2.268 ac Runoff Volume = 1.039 af Average Runoff Depth = 5.50"
31.64% Pervious = 0.718 ac 68.36% Impervious = 1.550 ac

Summary for Subcatchment E-1: Exist. Site

Runoff = 14.06 cfs @ 12.09 hrs, Volume= 1.037 af, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
42,727	98	Paved parking, HSG A
9,160	30	Woods, Good, HSG A
19,629	39	>75% Grass cover, Good, HSG A
1,878	96	Gravel surface, HSG A
24,795	98	Roofs, HSG A
98,189	80	Weighted Average
30,667		31.23% Pervious Area
67,522		68.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Western Portion

Runoff = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
589	39	>75% Grass cover, Good, HSG A
589		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Link DP-1: Main Street

Inflow Area = 2.254 ac, 68.77% Impervious, Inflow Depth = 5.52" for 100-Year event
Inflow = 14.06 cfs @ 12.09 hrs, Volume= 1.037 af
Primary = 14.06 cfs @ 12.09 hrs, Volume= 1.037 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

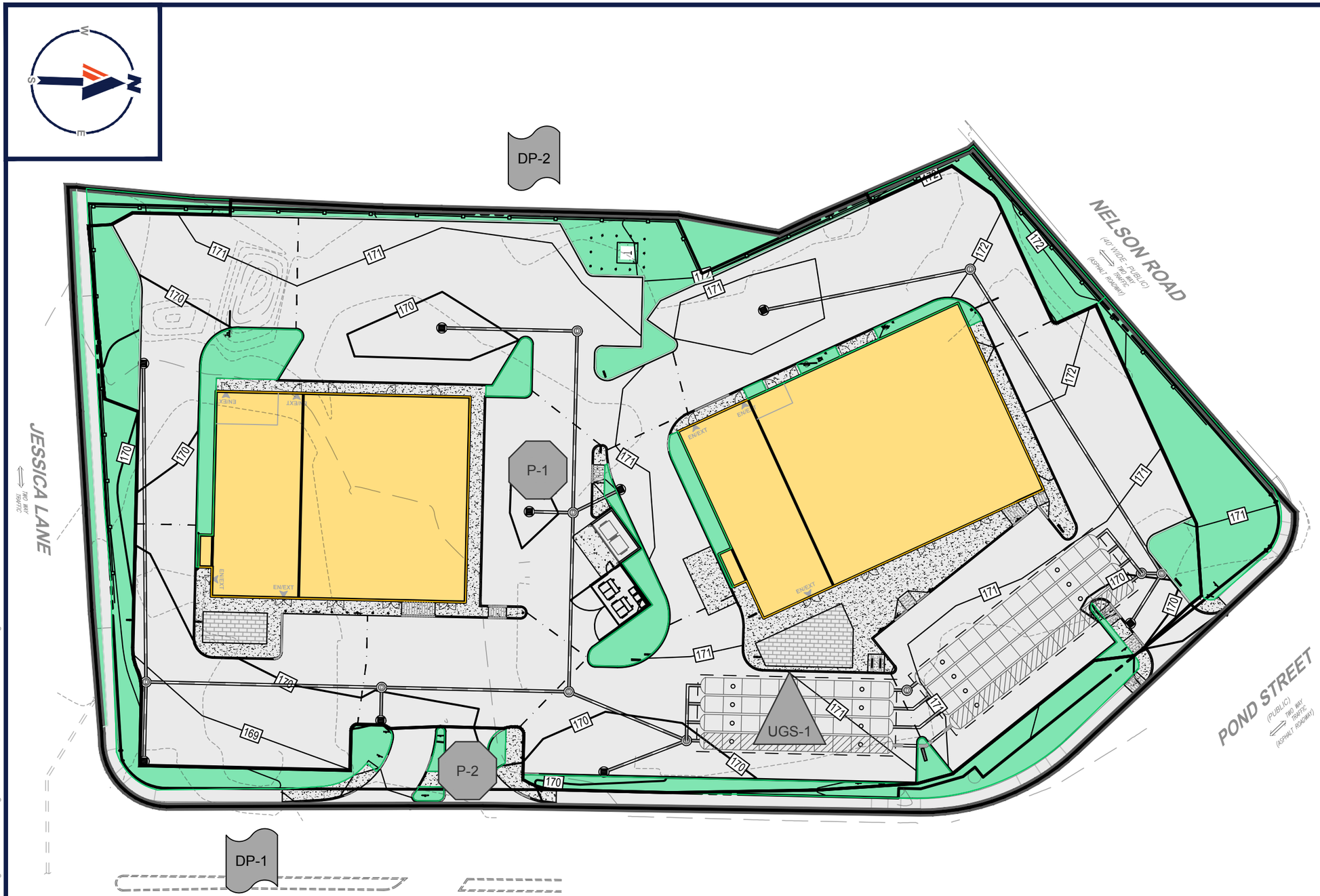
Summary for Link DP-2: Western Abutter

Inflow Area = 0.014 ac, 0.00% Impervious, Inflow Depth = 1.11" for 100-Year event
Inflow = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af
Primary = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*



LEGEND

- DP# — DESIGN POINT
- P-# — PROPOSED SUBCATCHMENT
- XX# — BASIN OR MODELED DRAINAGE STRUCTURE
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY
- CONCRETE OR PAVEMENT
- ROOF
- GRASS OR LANDSCAPED AREA

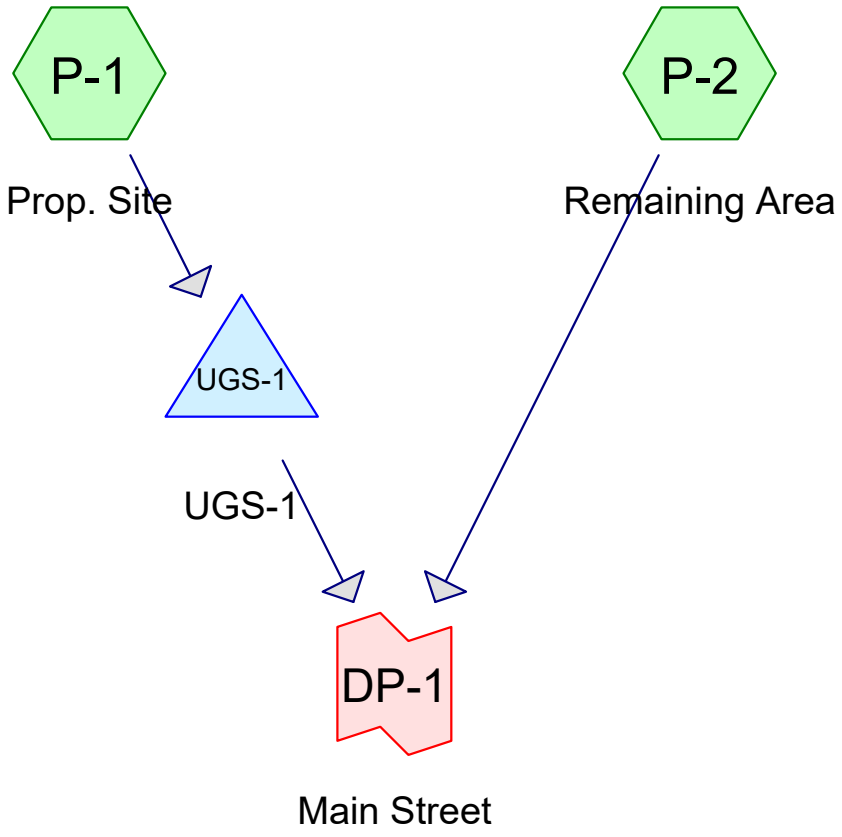
PROPOSED CONDITIONS DRAINAGE AREA MAP

505 POND STREET
WEYMOUTH, MASSACHUSETTS

PREPARED BY
BOHLER

SCALE:1"=40' DATE: 03/24/2023

P:\2022\MAA220242.00\CAD\Drawings\Exhibits\Drainage Exhibits\MAA220242.00-DRNE-0a.dwg



Subcat Reach Pond Link

Routing Diagram for MAA220242 - Prop

Prepared by {enter your company name here}, Printed 3/24/2023

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Prop. Site Runoff Area=84,064 sf 90.55% Impervious Runoff Depth=2.50"
Tc=6.0 min CN=92 Runoff=5.39 cfs 0.403 af

Subcatchment P-2: Remaining Area Runoff Area=14,714 sf 36.96% Impervious Runoff Depth=0.51"
Tc=6.0 min CN=61 Runoff=0.14 cfs 0.014 af

Pond UGS-1: UGS-1 Peak Elev=163.29' Storage=0.038 af Inflow=5.39 cfs 0.403 af
Outflow=2.41 cfs 0.405 af

Link DP-1: Main Street Inflow=0.14 cfs 0.014 af
Primary=0.14 cfs 0.014 af

Link DP-2: Western Abutter
Primary=0.00 cfs 0.000 af

Total Runoff Area = 2.268 ac Runoff Volume = 0.417 af Average Runoff Depth = 2.21"
17.44% Pervious = 0.395 ac 82.56% Impervious = 1.872 ac

Summary for Subcatchment P-1: Prop. Site

Runoff = 5.39 cfs @ 12.09 hrs, Volume= 0.403 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
58,455	98	Paved parking, HSG A
7,947	39	>75% Grass cover, Good, HSG A
17,662	98	Roofs, HSG A
84,064	92	Weighted Average
7,947		9.45% Pervious Area
76,117		90.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Remaining Area

Runoff = 0.14 cfs @ 12.12 hrs, Volume= 0.014 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
5,438	98	Paved parking, HSG A
9,276	39	>75% Grass cover, Good, HSG A
14,714	61	Weighted Average
9,276		63.04% Pervious Area
5,438		36.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond UGS-1: UGS-1

Inflow Area = 1.930 ac, 90.55% Impervious, Inflow Depth = 2.50" for 2-Year event
Inflow = 5.39 cfs @ 12.09 hrs, Volume= 0.403 af
Outflow = 2.41 cfs @ 12.05 hrs, Volume= 0.405 af, Atten= 55%, Lag= 0.0 min
Discarded = 2.41 cfs @ 12.05 hrs, Volume= 0.405 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 163.29' @ 12.28 hrs Surf.Area= 0.116 ac Storage= 0.038 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.9 min (798.9 - 796.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	162.50'	0.075 af	**29.92'W x 77.40'L x 5.50'H Field A** 0.292 af Overall - 0.104 af Embedded = 0.189 af x 40.0% Voids
#2A	163.25'	0.104 af	**ADS_StormTech MC-3500 d +Cap**x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 40 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
#3B	162.50'	0.089 af	**29.92'W x 91.74'L x 5.50'H Field B** 0.347 af Overall - 0.124 af Embedded = 0.223 af x 40.0% Voids
#4B	163.25'	0.124 af	**ADS_StormTech MC-3500 d +Cap**x 48 Inside #3 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 48 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.392 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.50'	**2.41 cfs Exfiltration at all elevations**

Discarded OutFlow Max=2.41 cfs @ 12.05 hrs HW=162.71' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.41 cfs)

Summary for Link DP-1: Main Street

Inflow Area = 2.268 ac, 82.56% Impervious, Inflow Depth = 0.08" for 2-Year event
Inflow = 0.14 cfs @ 12.12 hrs, Volume= 0.014 af
Primary = 0.14 cfs @ 12.12 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Prop. Site Runoff Area=84,064 sf 90.55% Impervious Runoff Depth=4.20"
Tc=6.0 min CN=92 Runoff=8.79 cfs 0.675 af

Subcatchment P-2: Remaining Area Runoff Area=14,714 sf 36.96% Impervious Runoff Depth=1.44"
Tc=6.0 min CN=61 Runoff=0.51 cfs 0.040 af

Pond UGS-1: UGS-1 Peak Elev=164.17' Storage=0.124 af Inflow=8.79 cfs 0.675 af
Outflow=2.41 cfs 0.675 af

Link DP-1: Main Street Inflow=0.51 cfs 0.040 af
Primary=0.51 cfs 0.040 af

Link DP-2: Western Abutter
Primary=0.00 cfs 0.000 af

Total Runoff Area = 2.268 ac Runoff Volume = 0.715 af Average Runoff Depth = 3.79"
17.44% Pervious = 0.395 ac 82.56% Impervious = 1.872 ac

Summary for Subcatchment P-1: Prop. Site

Runoff = 8.79 cfs @ 12.09 hrs, Volume= 0.675 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.11"

Area (sf)	CN	Description
58,455	98	Paved parking, HSG A
7,947	39	>75% Grass cover, Good, HSG A
17,662	98	Roofs, HSG A
84,064	92	Weighted Average
7,947		9.45% Pervious Area
76,117		90.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Remaining Area

Runoff = 0.51 cfs @ 12.10 hrs, Volume= 0.040 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.11"

Area (sf)	CN	Description
5,438	98	Paved parking, HSG A
9,276	39	>75% Grass cover, Good, HSG A
14,714	61	Weighted Average
9,276		63.04% Pervious Area
5,438		36.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond UGS-1: UGS-1

Inflow Area = 1.930 ac, 90.55% Impervious, Inflow Depth = 4.20" for 10-Year event
Inflow = 8.79 cfs @ 12.09 hrs, Volume= 0.675 af
Outflow = 2.41 cfs @ 11.90 hrs, Volume= 0.675 af, Atten= 73%, Lag= 0.0 min
Discarded = 2.41 cfs @ 11.90 hrs, Volume= 0.675 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 164.17' @ 12.44 hrs Surf.Area= 0.116 ac Storage= 0.124 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 10.5 min (792.6 - 782.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	162.50'	0.075 af	**29.92'W x 77.40'L x 5.50'H Field A** 0.292 af Overall - 0.104 af Embedded = 0.189 af x 40.0% Voids
#2A	163.25'	0.104 af	**ADS_StormTech MC-3500 d +Cap**x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 40 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
#3B	162.50'	0.089 af	**29.92'W x 91.74'L x 5.50'H Field B** 0.347 af Overall - 0.124 af Embedded = 0.223 af x 40.0% Voids
#4B	163.25'	0.124 af	**ADS_StormTech MC-3500 d +Cap**x 48 Inside #3 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 48 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.392 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.50'	**2.41 cfs Exfiltration at all elevations**

Discarded OutFlow Max=2.41 cfs @ 11.90 hrs HW=162.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 2.41 cfs)

Summary for Link DP-1: Main Street

Inflow Area = 2.268 ac, 82.56% Impervious, Inflow Depth = 0.21" for 10-Year event
Inflow = 0.51 cfs @ 12.10 hrs, Volume= 0.040 af
Primary = 0.51 cfs @ 12.10 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Prop. Site Runoff Area=84,064 sf 90.55% Impervious Runoff Depth=5.28"
Tc=6.0 min CN=92 Runoff=10.91 cfs 0.848 af

Subcatchment P-2: Remaining Area Runoff Area=14,714 sf 36.96% Impervious Runoff Depth=2.15"
Tc=6.0 min CN=61 Runoff=0.80 cfs 0.060 af

Pond UGS-1: UGS-1 Peak Elev=164.87' Storage=0.188 af Inflow=10.91 cfs 0.848 af
Outflow=2.41 cfs 0.851 af

Link DP-1: Main Street Inflow=0.80 cfs 0.060 af
Primary=0.80 cfs 0.060 af

Link DP-2: Western Abutter
Primary=0.00 cfs 0.000 af

Total Runoff Area = 2.268 ac Runoff Volume = 0.909 af Average Runoff Depth = 4.81"
17.44% Pervious = 0.395 ac 82.56% Impervious = 1.872 ac

Summary for Subcatchment P-1: Prop. Site

Runoff = 10.91 cfs @ 12.09 hrs, Volume= 0.848 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.21"

Area (sf)	CN	Description
58,455	98	Paved parking, HSG A
7,947	39	>75% Grass cover, Good, HSG A
17,662	98	Roofs, HSG A
84,064	92	Weighted Average
7,947		9.45% Pervious Area
76,117		90.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Remaining Area

Runoff = 0.80 cfs @ 12.10 hrs, Volume= 0.060 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.21"

Area (sf)	CN	Description
5,438	98	Paved parking, HSG A
9,276	39	>75% Grass cover, Good, HSG A
14,714	61	Weighted Average
9,276		63.04% Pervious Area
5,438		36.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond UGS-1: UGS-1

Inflow Area = 1.930 ac, 90.55% Impervious, Inflow Depth = 5.28" for 25-Year event
Inflow = 10.91 cfs @ 12.09 hrs, Volume= 0.848 af
Outflow = 2.41 cfs @ 11.80 hrs, Volume= 0.851 af, Atten= 78%, Lag= 0.0 min
Discarded = 2.41 cfs @ 11.80 hrs, Volume= 0.851 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 164.87' @ 12.49 hrs Surf.Area= 0.116 ac Storage= 0.188 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 17.3 min (793.5 - 776.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	162.50'	0.075 af	**29.92'W x 77.40'L x 5.50'H Field A** 0.292 af Overall - 0.104 af Embedded = 0.189 af x 40.0% Voids
#2A	163.25'	0.104 af	**ADS_StormTech MC-3500 d +Cap**x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 40 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
#3B	162.50'	0.089 af	**29.92'W x 91.74'L x 5.50'H Field B** 0.347 af Overall - 0.124 af Embedded = 0.223 af x 40.0% Voids
#4B	163.25'	0.124 af	**ADS_StormTech MC-3500 d +Cap**x 48 Inside #3 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 48 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.392 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.50'	**2.41 cfs Exfiltration at all elevations**

Discarded OutFlow Max=2.41 cfs @ 11.80 hrs HW=162.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 2.41 cfs)

Summary for Link DP-1: Main Street

Inflow Area = 2.268 ac, 82.56% Impervious, Inflow Depth = 0.32" for 25-Year event
Inflow = 0.80 cfs @ 12.10 hrs, Volume= 0.060 af
Primary = 0.80 cfs @ 12.10 hrs, Volume= 0.060 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P-1: Prop. Site Runoff Area=84,064 sf 90.55% Impervious Runoff Depth=6.93"
Tc=6.0 min CN=92 Runoff=14.11 cfs 1.115 af

Subcatchment P-2: Remaining Area Runoff Area=14,714 sf 36.96% Impervious Runoff Depth=3.36"
Tc=6.0 min CN=61 Runoff=1.29 cfs 0.095 af

Pond UGS-1: UGS-1 Peak Elev=166.13' Storage=0.294 af Inflow=14.11 cfs 1.115 af
Outflow=2.41 cfs 1.119 af

Link DP-1: Main Street Inflow=1.29 cfs 0.095 af
Primary=1.29 cfs 0.095 af

Link DP-2: Western Abutter
Primary=0.00 cfs 0.000 af

Total Runoff Area = 2.268 ac Runoff Volume = 1.210 af Average Runoff Depth = 6.40"
17.44% Pervious = 0.395 ac 82.56% Impervious = 1.872 ac

Summary for Subcatchment P-1: Prop. Site

Runoff = 14.11 cfs @ 12.09 hrs, Volume= 1.115 af, Depth= 6.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
58,455	98	Paved parking, HSG A
7,947	39	>75% Grass cover, Good, HSG A
17,662	98	Roofs, HSG A
84,064	92	Weighted Average
7,947		9.45% Pervious Area
76,117		90.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Remaining Area

Runoff = 1.29 cfs @ 12.10 hrs, Volume= 0.095 af, Depth= 3.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
5,438	98	Paved parking, HSG A
9,276	39	>75% Grass cover, Good, HSG A
14,714	61	Weighted Average
9,276		63.04% Pervious Area
5,438		36.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond UGS-1: UGS-1

Inflow Area = 1.930 ac, 90.55% Impervious, Inflow Depth = 6.93" for 100-Year event
Inflow = 14.11 cfs @ 12.09 hrs, Volume= 1.115 af
Outflow = 2.41 cfs @ 11.75 hrs, Volume= 1.119 af, Atten= 83%, Lag= 0.0 min
Discarded = 2.41 cfs @ 11.75 hrs, Volume= 1.119 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 166.13' @ 12.55 hrs Surf.Area= 0.116 ac Storage= 0.294 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 29.6 min (799.0 - 769.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	162.50'	0.075 af	**29.92'W x 77.40'L x 5.50'H Field A** 0.292 af Overall - 0.104 af Embedded = 0.189 af x 40.0% Voids
#2A	163.25'	0.104 af	**ADS_StormTech MC-3500 d +Cap**x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 40 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
#3B	162.50'	0.089 af	**29.92'W x 91.74'L x 5.50'H Field B** 0.347 af Overall - 0.124 af Embedded = 0.223 af x 40.0% Voids
#4B	163.25'	0.124 af	**ADS_StormTech MC-3500 d +Cap**x 48 Inside #3 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 48 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.392 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.50'	**2.41 cfs Exfiltration at all elevations**

Discarded OutFlow Max=2.41 cfs @ 11.75 hrs HW=162.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 2.41 cfs)

Summary for Link DP-1: Main Street

Inflow Area = 2.268 ac, 82.56% Impervious, Inflow Depth = 0.50" for 100-Year event
Inflow = 1.29 cfs @ 12.10 hrs, Volume= 0.095 af
Primary = 1.29 cfs @ 12.10 hrs, Volume= 0.095 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Western Abutter

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *NOAA RAINFALL DATA*
- *MOUNDING ANALYSIS AND NARRATIVE*

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA
Bohler Job Number: MAA220242.00
March 24, 2023

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	1.438
Proposed Site Impervious Area (ac)	1.780
Proposed Increase in Site Impervious Area (ac)	0.342
Recharge Volume Required (cf)	**746**

Total Recharge Volume Required (cf)	**746**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**1.747**
%Impervious Directed to Infiltration BMP	98%
Adjustment Factor	1.02
Adjusted Total Recharge Volume Required (cf)	**760**

Provided Recharge Volume*	
UGS-1	17,081
Total Recharge Volume Provided (cf)	**17,081**

Provided greater than or Equal to Required

*Volume provided below lowest outlet in cubic feet (cf)

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA
Bohler Job Number: MAA220242.00
March 24, 2023

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - UGS-1	
Volume below outlet pipe (Rv) (cf)	17,081
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	5,061
Drawdown time (Hours)*	**16.8**

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

Prepared By:
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352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA
Bohler Job Number: MAA220242.00
March 24, 2023

MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	77,549
Required Water Quality Volume (cf)	**6,462**
*Water Quality volume runoff is equal to 1.0 inches of runoff times the total impervious area of the post development project site.	

Water Quality Volume Provided*	
UGS-1	17,081
Total Provided Water Quality Volume (cf)	**17,081**

Required Recharge Provided

*Volume provided below lowest outlet pipe in cubic feet (cf)

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Proposed Storage Development
362 Turnpike Street
Canton, MA
Bohler Job Number: MAA220151.00
March 24, 2023

1" Water Quality Volume to Flow Rate Calculation Sheet

Compute Water Quality Flow with the following Equation

WQF = (qu)(A)(WQV)

Site Plan Callout		qu (from 1" - qu Table)	Impervious Area (SF)	Ai (sq/mi)	WQV (inches)		**WQF (cfs)**
UGS-1 Isolator Row	=	774	81555	0.002925	1	=	**2.26**

Water Quality Flow Rate = WQF
Water Quality Volume = WQV*
Unit peak discharge (csm/in) = qu**
Impervious Area in watershed (square miles) = Ai

*WQV is expressed in watershed inches (you must use 1.0-inches in all cases with this method and not 0.5-inches)
** calculate the qu based on the time of concentration (see 1" - qu Table)

UGS-2 Isolator row sizing

Maximum treatment flow rate - MC3500 Chamber*	0.395 cfs
Number of chambers in Isolator Row	22
WQF provided by isolator row =	8.69

*Per NJCAT Technology Verifaction, Isolator Row Plus, StormTech, LLC, July 2020

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Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA
Bohler Job Number: MAA220242.00
March 24, 2023

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Catch Basin to Underground Infiltration Basin with Isolator Row

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep-sump, Hooded Catch Basins	**0.25**	**1.00**	**0.25**	**0.75**
Underground Infiltration Basin with Isolator Row	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

*Equals remaining load from previous BMP (E) which enters BMP

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NOAA Atlas 14, Volume 10, Version 3
Location name: South Weymouth, Massachusetts, USA*
Latitude: 42.1521°, Longitude: -70.9557°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.303 (0.235-0.387)	0.377 (0.292-0.482)	0.498 (0.384-0.637)	0.597 (0.459-0.769)	0.735 (0.549-0.992)	0.837 (0.614-1.15)	0.948 (0.679-1.36)	1.08 (0.726-1.56)	1.28 (0.830-1.91)	1.46 (0.921-2.21)
10-min	0.429 (0.333-0.548)	0.534 (0.413-0.682)	0.705 (0.544-0.904)	0.847 (0.650-1.09)	1.04 (0.777-1.41)	1.19 (0.870-1.64)	1.34 (0.961-1.92)	1.53 (1.03-2.21)	1.82 (1.18-2.71)	2.06 (1.31-3.12)
15-min	0.505 (0.391-0.645)	0.628 (0.486-0.803)	0.829 (0.640-1.06)	0.996 (0.764-1.28)	1.23 (0.914-1.65)	1.40 (1.02-1.92)	1.58 (1.13-2.26)	1.80 (1.21-2.60)	2.14 (1.38-3.18)	2.42 (1.54-3.68)
30-min	0.701 (0.543-0.895)	0.872 (0.675-1.12)	1.15 (0.889-1.48)	1.39 (1.06-1.79)	1.71 (1.27-2.30)	1.94 (1.42-2.68)	2.20 (1.57-3.15)	2.51 (1.69-3.62)	2.98 (1.93-4.43)	3.38 (2.14-5.12)
60-min	0.896 (0.694-1.14)	1.12 (0.864-1.43)	1.48 (1.14-1.89)	1.78 (1.36-2.29)	2.19 (1.63-2.95)	2.49 (1.83-3.43)	2.82 (2.02-4.04)	3.22 (2.16-4.64)	3.82 (2.47-5.68)	4.33 (2.74-6.56)
2-hr	1.14 (0.884-1.44)	1.43 (1.12-1.82)	1.92 (1.49-2.45)	2.33 (1.79-2.98)	2.88 (2.16-3.87)	3.30 (2.43-4.52)	3.74 (2.70-5.34)	4.30 (2.89-6.14)	5.14 (3.34-7.59)	5.88 (3.73-8.82)
3-hr	1.32 (1.03-1.66)	1.66 (1.30-2.10)	2.23 (1.73-2.83)	2.70 (2.09-3.44)	3.34 (2.52-4.47)	3.82 (2.83-5.21)	4.34 (3.14-6.16)	4.98 (3.36-7.09)	5.98 (3.89-8.76)	6.84 (4.35-10.2)
6-hr	1.73 (1.35-2.17)	2.15 (1.68-2.70)	2.84 (2.22-3.57)	3.41 (2.65-4.31)	4.20 (3.17-5.55)	4.78 (3.55-6.46)	5.41 (3.92-7.60)	6.18 (4.19-8.71)	7.38 (4.82-10.7)	8.40 (5.37-12.4)
12-hr	2.26 (1.78-2.82)	2.75 (2.17-3.43)	3.55 (2.79-4.44)	4.21 (3.29-5.30)	5.12 (3.89-6.71)	5.80 (4.32-7.75)	6.53 (4.74-9.04)	7.41 (5.05-10.3)	8.73 (5.73-12.5)	9.85 (6.32-14.4)
24-hr	2.77 (2.19-3.43)	3.36 (2.66-4.16)	4.32 (3.40-5.36)	5.11 (4.01-6.38)	6.21 (4.73-8.06)	7.02 (5.25-9.30)	7.89 (5.75-10.8)	8.94 (6.12-12.3)	10.5 (6.92-14.9)	11.8 (7.63-17.1)
2-day	3.16 (2.51-3.88)	3.88 (3.09-4.78)	5.07 (4.02-6.26)	6.06 (4.78-7.51)	7.42 (5.68-9.58)	8.42 (6.33-11.1)	9.51 (6.98-13.0)	10.8 (7.44-14.8)	12.8 (8.49-18.1)	14.6 (9.42-20.8)
3-day	3.45 (2.76-4.23)	4.24 (3.38-5.19)	5.51 (4.39-6.78)	6.57 (5.20-8.12)	8.03 (6.17-10.3)	9.11 (6.87-11.9)	10.3 (7.57-14.0)	11.7 (8.06-15.9)	13.9 (9.20-19.4)	15.8 (10.2-22.4)
4-day	3.73 (2.99-4.56)	4.54 (3.63-5.55)	5.85 (4.67-7.18)	6.95 (5.51-8.55)	8.45 (6.50-10.8)	9.56 (7.22-12.5)	10.8 (7.94-14.5)	12.2 (8.44-16.6)	14.5 (9.61-20.1)	16.4 (10.6-23.2)
7-day	4.50 (3.61-5.46)	5.33 (4.28-6.48)	6.70 (5.36-8.16)	7.83 (6.23-9.58)	9.39 (7.25-11.9)	10.5 (7.98-13.6)	11.8 (8.70-15.8)	13.3 (9.20-17.8)	15.6 (10.4-21.4)	17.5 (11.4-24.5)
10-day	5.21 (4.20-6.30)	6.06 (4.88-7.35)	7.46 (5.99-9.06)	8.63 (6.88-10.5)	10.2 (7.91-12.9)	11.4 (8.66-14.7)	12.7 (9.36-16.8)	14.2 (9.86-18.9)	16.4 (11.0-22.5)	18.3 (11.9-25.4)
20-day	7.28 (5.90-8.75)	8.22 (6.65-9.89)	9.76 (7.87-11.8)	11.0 (8.84-13.4)	12.8 (9.91-15.9)	14.1 (10.7-17.8)	15.5 (11.4-20.0)	16.9 (11.8-22.4)	19.0 (12.7-25.7)	20.6 (13.5-28.3)
30-day	9.00 (7.32-10.8)	10.0 (8.12-12.0)	11.7 (9.43-14.0)	13.0 (10.5-15.7)	14.9 (11.6-18.4)	16.4 (12.4-20.5)	17.8 (13.0-22.7)	19.2 (13.5-25.2)	21.1 (14.2-28.4)	22.5 (14.8-30.7)
45-day	11.2 (9.10-13.3)	12.2 (9.97-14.6)	14.0 (11.4-16.8)	15.5 (12.5-18.6)	17.5 (13.6-21.5)	19.1 (14.5-23.7)	20.6 (15.1-26.1)	22.0 (15.5-28.7)	23.8 (16.1-31.8)	25.0 (16.4-33.9)
60-day	13.0 (10.6-15.4)	14.1 (11.5-16.8)	16.0 (13.0-19.1)	17.5 (14.2-21.0)	19.7 (15.3-24.0)	21.4 (16.2-26.4)	22.9 (16.8-28.8)	24.4 (17.2-31.6)	26.0 (17.6-34.6)	27.1 (17.9-36.6)

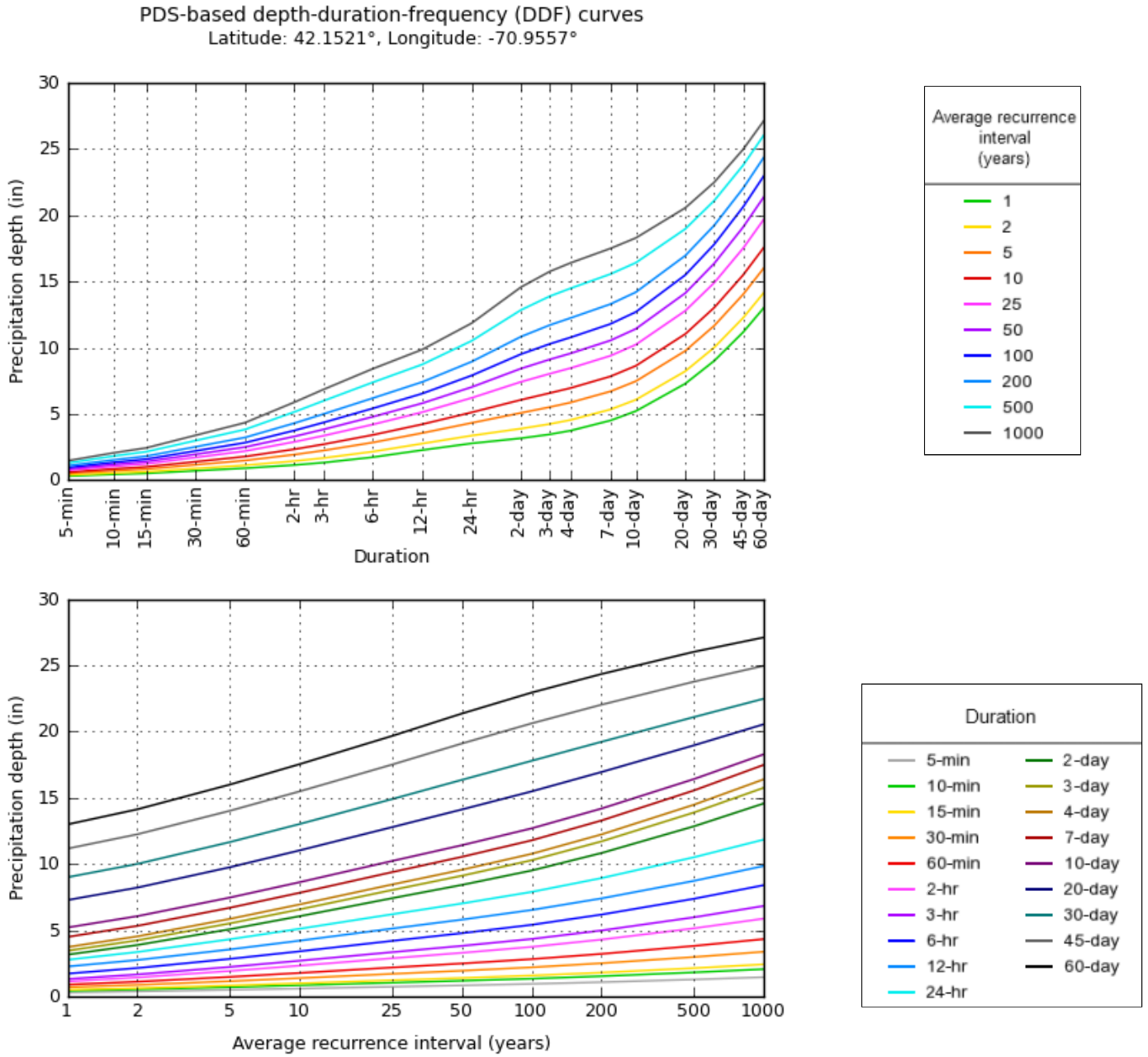
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



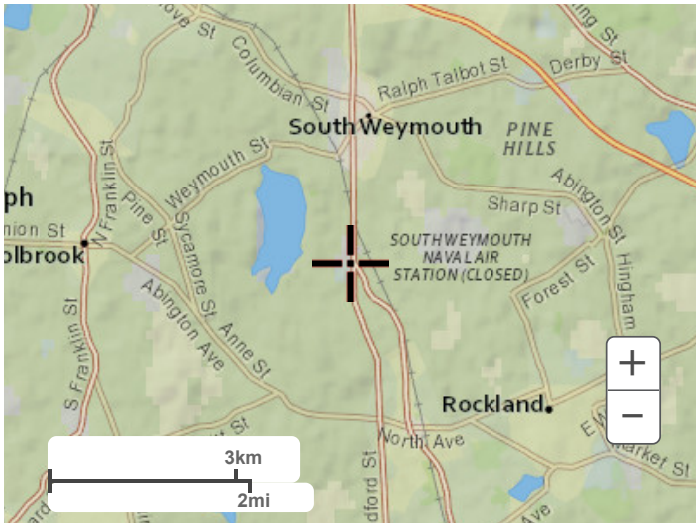
NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Thu Mar 2 14:56:13 2023

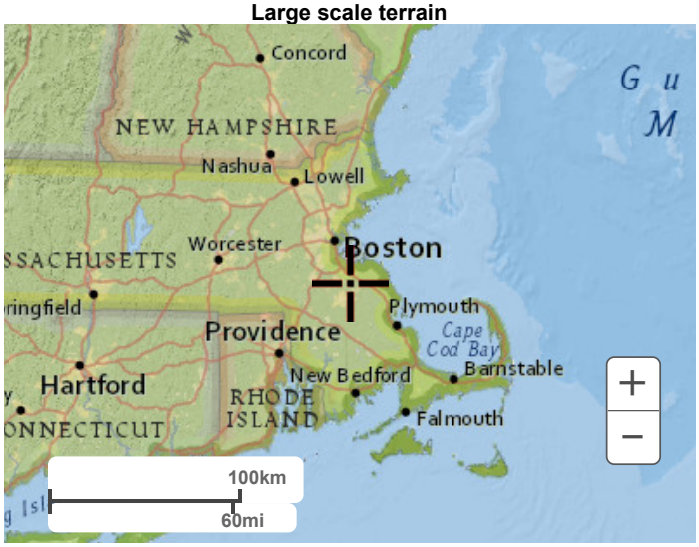
Back to Top

Maps & aerials

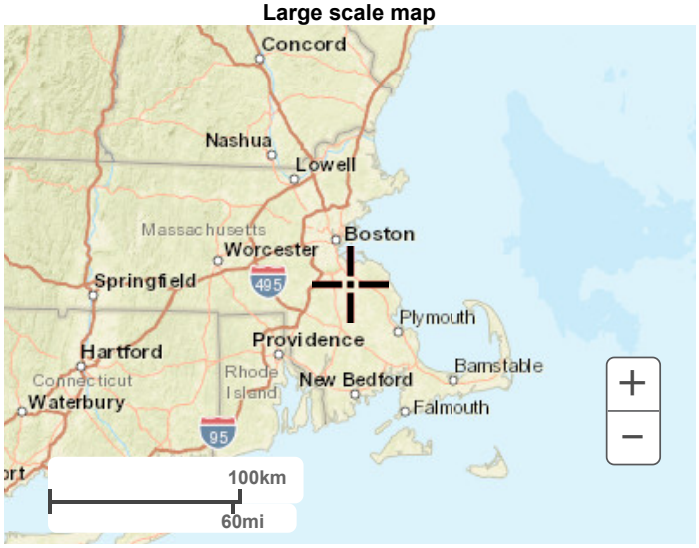
Small scale terrain



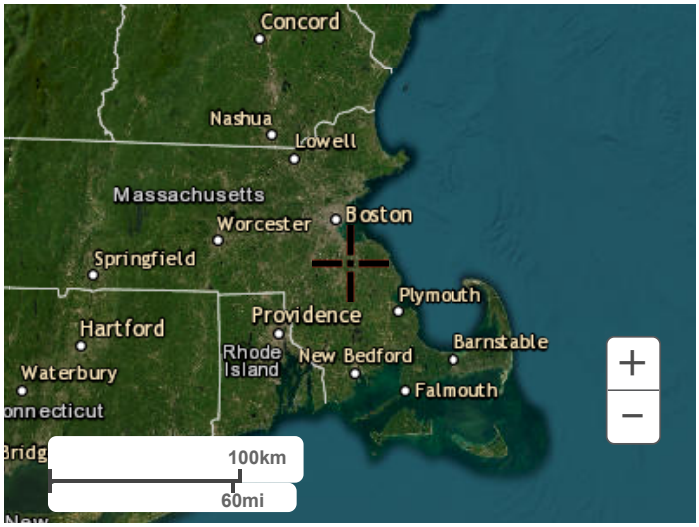
Large scale terrain



Large scale map



Large scale aerial



Back to Top

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

Disclaimer

GROUNDWATER MOUNDING CALCULATIONS

Proposed Mixed-Use Development
505 Pond Street, Weymouth, MA
BE Project No.: MAA220242.00

Methodology

UGS-1 for this project are designed with less than 4 feet of groundwater separation. It is also designed to attenuate the 10-year storm event or larger. Therefore, groundwater mounding calculations are required according to MA DEP Stormwater Management Guidelines. The purpose of the calculations is to ensure that the mound will not prevent the full draining of the basin. The mounding analysis must show that the recharge volume will exfiltrate within seventy-two (72) hours. Additionally, it should be verified that the mounding effect will not cause stormwater to surge above the lowest discharge point out of a basin (during the 72-hour period) or raise the water elevation in a nearby resource area.

The groundwater mounding analysis was performed by a proprietary program using the Hantush Method with Glover's Solution. Input parameters are site specific and determined based on existing and proposed conditions. The required input parameters are the following: application rate; duration of application; fillable porosity; hydraulic conductivity; initial saturated thickness; length of application area; width of application area; and distance to closest resource area (constant head boundary).

Calculations using the Hantush Method are considered conservative due to the fact that the unsaturated soil zone is not incorporated. In practice, this zone will have a significant positive effect on reducing the groundwater mounding under an infiltration basin by allowing horizontal migration. A minimum of a 2-foot unsaturated zone has been provided in the basin and the mounding in the basin (Δh) falls below the lowest outlet in the basin ensuring that stormwater will not bypass the basin floor and discharge though the outlet device. Please refer to the table below:

Stormwater Basin	Unsaturated Zone (FT)	Depth Below Lowest Outlet (FT)	Mounding Storage Provided (FT)	Groundwater Mounding - Δh (FT)
UGS-1	**2.0**	**3.75**	**5.75**	**2.77**

Additionally, given that the Groundwater Mounding (Δh) does not exceed the stone base of the proposed basin, it is assumed that the basin can still exfiltrate within 72 hours.

The application rate used is converted from the Rawls value selected for an exfiltration rate in HydroCAD. The duration of application used for the analysis is the 24-hour based duration of the storm event. The fillable porosity, hydraulic conductivity, and initial saturated thickness used for the analysis are based on the existing soil conditions.

Results

Based on the criteria mentioned above, the analysis (see attached) indicates the mound in the stormwater basin falls below the mounding storage provided. Additionally, the mounding effect at the end of Day 3 does not exceed the stone base of the proposed basin. Given these results, we feel as though the basins recharge the stormwater volume within 72 hours as required.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
4.8200	*R*	**Recharge (infiltration) rate (feet/day)**
0.280	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
410.10	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
84.570	x	**1/2 length of basin (x direction, in feet)**
14.960	y	**1/2 width of basin (y direction, in feet)**
0.700	t	**duration of infiltration period (days)**
2.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

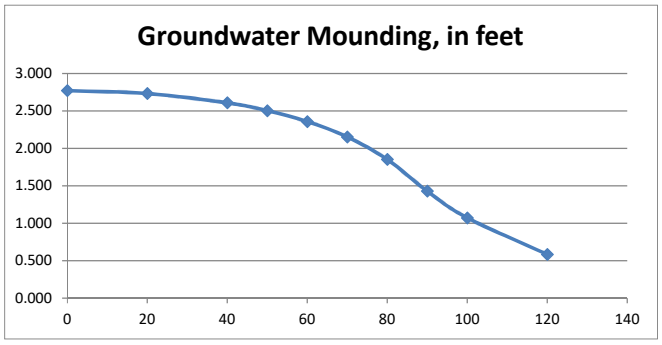
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

4.772	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.772	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.772	0
2.734	20
2.610	40
2.505	50
2.359	60
2.154	70
1.852	80
1.429	90
1.074	100
0.584	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Sensitivity Analysis

- Determine most sensitive parameters in Hantush method and Modflow
- Hydraulic conductivity, and specific yield

Rock Type	Grain size (mm)	Hydraulic Conductivity K (m/d)
Clay	0.0005-0.002	10^{-8}-10^{-2}
Silt	0.002-0.06	10^{-2} - 1
Fine Sand	0.06 -0.25	1 - 5
Medium Sand	0.25-0.50	5 - 20
Coarse Sand	0.50-2	20 - 100
Gravel	2-64	100 - 1000
Shale	small	$5x10^{-8}$ - $5x10^{-6}$
Sandstone	medium	10^{-3} - 1
Limestone	variable	10^{-5} - 1
Basalt	small	0.0003 - 3
Granite	large	0.0003 - 0.03
Slate	small	10^{-8} - 10^{-5}
Schist	medium	10^{-7} - 10^{-4}

16.40-65.62 (ft/day)

Source: Brassington, 1988

Material	Specific Yield (%)
Gravel, coarse	23
Gravel, medium	24
Gravel, fine	25
Sand, coarse	27
Sand, medium	28
Sand, fine	23
Silt	8
Clay	3
Sandstone, fine-grained	21
Sandstone, medium-grained	27
Limestone	14
Dune sand	38
Loess	18
Peat	44
Schist	26
Siltstone	12
Till, predomintly silt	6
Till, predominantly sand	16
Till, predominantly gravel	16
Tuff	21

Source: Johnson, 1967

APPENDIX G: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*
- *PROPOSED OPERATION AND MAINTENANCE MAP*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Pond Street Acquisitions LLC
P.O. Box 963
Portland, ME

RESPONSIBLE PARTY POST CONSTRUCTION:

Pond Street Acquisitions LLC
P.O. Box 963
Portland, ME

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots: Sweep at least four (4) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

   Approximate Maintenance Budget: $1,000/year

2. Catch basins, yard drains, trench drains, manholes and piping: Inspect four (4) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned four (4) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.

Approximate Maintenance Budget: $500/year per structure.

3. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).

   Approximate Maintenance Budget: $1,000/year per unit.

4. Underground Infiltration Basins: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. The outlet of the basin, if any, shall be inspected for erosion and sedimentation, and rip-rap shall be promptly repaired in the case of erosion. Sediment collecting in the bottom of the basin shall be inspected twice annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the basin. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

   Approximate Maintenance Budget: Cleaning - $1,000/year, Inspection - $200/year

All components of the stormwater system will be accessible by the owner or their assignee.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA

RESPONSIBLE PARTY:

Pond Street Acquisitions LLC
P.O. Box 963
Portland, ME

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Underground Infiltration Basin:	
Water Quality Units:	
Other:	

Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):
Catch Basins:
Infiltration Basin:
Water Quality Units:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Proposed Mixed-Use Development
505 Pond Street, Weymouth, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Pond Street Acquisitions LLC
P.O. Box 963
Portland, ME

RESPONSIBLE PARTY POST CONSTRUCTION:

Pond Street Acquisitions LLC
P.O. Box 963
Portland, ME

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.
- No outdoor maintenance or washing of vehicles allowed.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.
- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.

- Grass shall be maintained at a minimum blade height of two to three inches and only 1/3 of the plant height shall be removed at a time. Clippings shall not be disposed of within stormwater management areas or adjacent resource areas.

- Plants shall be pruned as necessary.

- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter into the soil, leaving behind sand and debris which can be removed in the springtime.

- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams, or other water bodies).

- In no case shall snow be disposed of or stored in the detention basins, infiltration basins or bioretention areas.

- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.

- The amount of sand and deicing chemicals shall be kept at the minimum amount required to provide safe pedestrian and vehicle travel.

- Deicing chemicals are recommended as a pretreatment to storm events to minimize the amount of applied sand.

- Sand and deicing chemicals should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials. Stockpile areas shall be located outside resource areas.

- The primary agents used for deicing at parking lots, sidewalks and the access roads shall consist of salt alternatives such as calcium carbonate (CaCO3) or potassium chloride (KCl) or sodium chloride.

- Deliveries shall be monitored by owner or owner's representative to ensure proper delivery and in the event that a spillage occurs it shall be contained and cleaned up immediately in accordance with the spill prevention program for the project.

- Recycle materials whenever possible. Provide separate containers for recycle materials. Recycling products will be removed by a certified waste hauler.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

_____

Name & Title Date

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

Proposed Mixed-Use Development
505 Pond Street
Weymouth, MA

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Weymouth Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Weymouth Health Department at (781) 340-5008 and the Weymouth Conservation Commission at (781) 340-5007.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Weymouth Health Department and Conservation Commission.

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

_____

_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCY PHONE: (888) 372-7341

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Detention • Retention • Water Quality

A division of ADS

Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

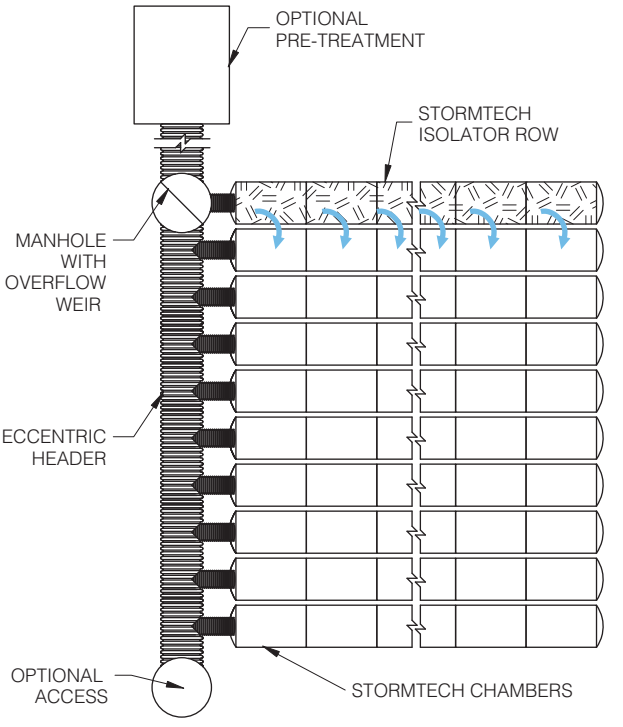
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

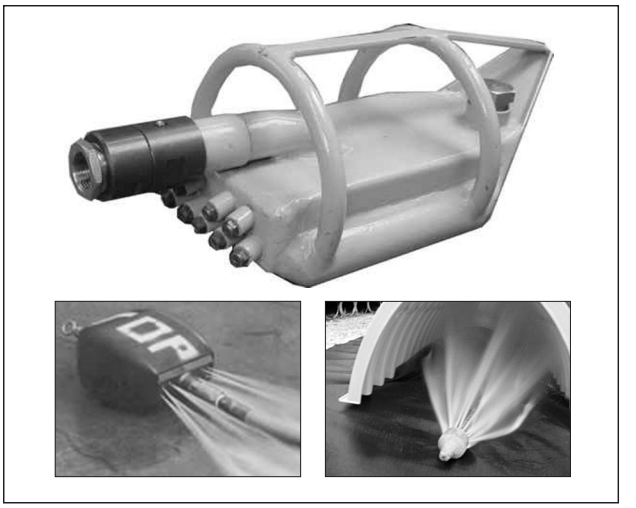
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

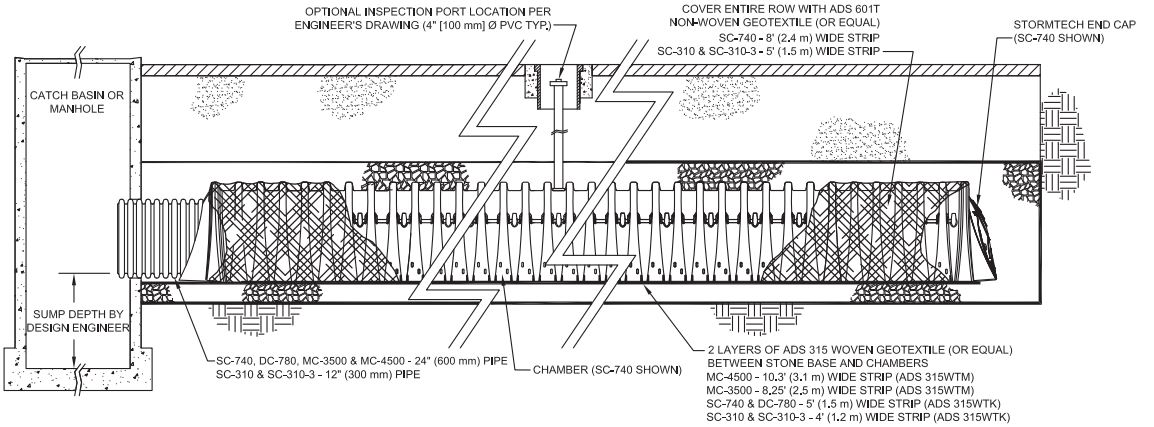
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

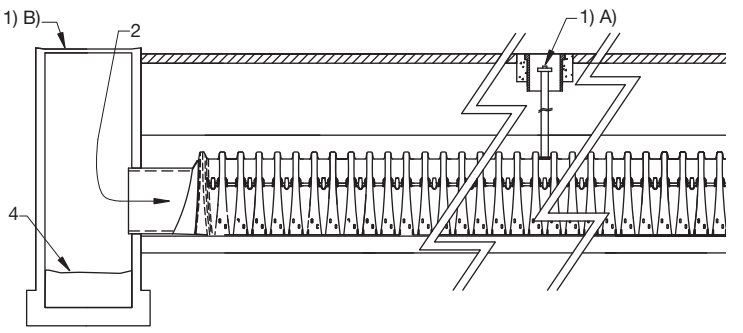
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry

2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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APPENDIX H: CONSTRUCTION INSPECTION AND CONTROL

- *STORMWATER INSPECTION REPORT*
- *STORMWATER SEDIMENTATION AND EROSION CONTROL PLANS*
- *STAGNATION PREVENTION AND MOSQUITO CONTROL PLAN*