DRAINAGE REPORT

For

PROPOSED

Medical Clinic

15 Pleasant Valley Drive
Sutton, MA
Middlesex County

Prepared by:

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed medical office at the intersection of Route 146 & Pleasant Valley Road in the Town of Sutton, Massachusetts. The 1.25± acre site is partially developed, containing an unmaintained compacted gravel drive and a concrete slab from the previous use, with the remaining portion being undeveloped wooded land. The site contains no stormwater management systems.

The proposed project includes the construction of a new 5,253 square-foot (sf) freestanding medical clinic along with a new paved parking area, driveway, landscaping, storm water management components and associated utilities. 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 one (1) "design point" where stormwater runoff currently drains to under existing conditions. The design point is 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
DP1	0.01	0.00	**-0.01**	0.24	0.00	**-0.24**	0.85	0.08	**-0.77**	2.77	2.29	**-0.48**

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

II. EXISTING SITE CONDITIONS

Existing Site Description

The site consists of approximately 1.25± acres of land located at the intersection of Route 146 & Pleasant Valley Road in the Town of Sutton, Massachusetts. The acre site is partially developed, containing an unmaintained compacted gravel drive and a concrete slab from the previous use, with the remaining portion being undeveloped wooded land. The site contains no stormwater management systems. The surrounding properties are commercial developments.

On-Site Soil Information

A majority of the soils on the site are mapped as Udorthents smoothed, which is classified by the Natural Resource Conservation Service (NRCS) as Hydrologic Soil Group (HSG) "A". The eastern portion of the site is mapped as Pits, gravel, which is currently not rated by NRCS. Refer to **Appendix C** for additional information.

Soil testing was completed by Bohler in April 2022. Soils were classified as sandy loam and loamy sand. Groundwater was not observed within any of the text pits. Estimated seasonal high groundwater is at a depth greater than 132 inches. Based on these findings, an infiltration rate of 2.41 in/hr was used in the Hydrologic model. Refer to Test Pit Logs 1-5 in **Appendix C** for more information.

Existing Collection and Conveyance

The entire site flows overland to the north eastern corner of the site, to a natural low point. Currently, the site contains no stormwater management systems.

Slopes on the site range from 0%-50% slopes with on-site elevations ranging from 419 at the north eastern corner to 434 at the western portion of the site.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at one (1) "design point" where stormwater runoff currently drains to under existing conditions. The total area analyzed is approximately 1.25± acres. The site was subdivided into a single sub-catchment for the existing conditions as described below. The minimum time of concentration for

all proposed areas is calculated as 6 minutes (0.1 hr). Runoff generated onsite flows overland to the design point as described below.

Design Point #1 (DP1) is an existing topographical low point located at the north eastern corner of the site. Under existing conditions, this design point receives stormwater flows from approximately 1.25± acres of land designated as Watershed "E1". E1 consists of onsite areas consisting of undeveloped wooded areas, a gravel drive, and a concrete slab with a CN of 47 and a Tc of 6 minutes.

Refer to the Pre-Development Drainage Analysis Exhibit in **Appendix D** of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of the construction of a new 5,252 s.f. freestanding medical office building and associated paved parking area, driveway, landscaping, stormwater management system, and utilities. The site, including the proposed paved 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 an underground infiltration system for recharge. Pretreatment of stormwater runoff will be provided by a combination of the deep-sump, hooded catch basins and isolator rows associated with the underground system prior to discharge.

Proposed Development Collection and Conveyance

Deep sump hooded catch basins are proposed to collect and route runoff from all the paved areas to the underground infiltration system. Overflow from the underground system discharges to an outlet control structure equipped with a weir to ensure post-construction peak flows fall below the pre-construction peak flows. Overflow from the underground system will discharge at grade through an outlet pipe. Clean stormwater runoff from the new building roof is routed to an underground infiltration system to reduce post-construction peak flow & promote groundwater infiltration. All runoff generated from proposed hardscapes on-site is captured & treated prior to discharge.

Pipes have been designed for the 25-year storm using the Rational Method. Pipe sizing calculations are included in **Appendix F**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the local total suspended solid (TSS) & total phosphorus (TP) removal requirements as set forth in the local regulations & Massachusetts Department of Environmental Protection Stormwater Handbook standards. Refer to **Appendix F** for calculations. In addition, a Stormwater Operation and Maintenance (O&M) Plan, attached in **Appendix G**, has been developed which includes scheduled maintenance and periodic inspections of stormwater management structures.

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 point described in **Section II** above. The site was subdivided into two (2) separate sub catchments (all tributary to Design Point-1) for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP1) is the natural low point on the north eastern corner of the site. Under proposed conditions this Design Point receives stormwater flows from approximately 1.25± acres (matching existing) of land designated as Watersheds "P1" and "P2"

- P1 consists of pavement, roof, and tributary grassed areas and has a calculated curve number (CN) of 76 and a time of concentration (Tc) of 6 minutes. Stormwater flow is collected via deep sump catch basins & routed to an isolator row within the proposed underground infiltration area. An emergency overflow outlet discharges to the subject wetlands during larger storm events.

- P2 consists of all grass & wooded areas tributary to Design Point 1 that are within the proposed limits of disturbance but not collected by any proposed BMP. It has a has a calculated curve number (CN) of 37 and a time of concentration (Tc) of 6 minutes. No impervious surface is located within sub-catchment P2.

Refer to **Table 1.1** 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.

IV. 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 Cornell University. Refer to **Appendix F** for more information.

Table 4.1: Cornell University Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.09	4.65	5.87	8.36

*Values derived from Cornell University Atlas of Precipitation Extremes for the Northeastern United States and Southern Canada

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.

V. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The project has been designed so that proposed impervious areas shall be collected and passed through the proposed drainage systems for treatment prior to discharge.

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1**, 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

All proposed impervious area onsite will be directed to infiltration systems for groundwater recharge. Stormwater runoff generated from the paved/roof areas will be collected and diverted to an underground chamber system for pre-treatment and recharge.

The project as proposed will involve the creation of approximately 0.6 ± acres of new impervious area and is required to infiltrate 812 cubic feet of stormwater as defined in Stormwater Standard 3. All the proposed impervious area onsite will be directed to the new underground infiltration system (UG-1), which will provide 2,352 cubic feet of volume below the lowest outlet, 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 system will drain within 72 hours are included in **Appendix F** of this report.

Standard #4: Water Quality

Water quality treatment is provided for all of the new impervious area via deep sump catch basins, Stormtech Isolator Rows, and a new underground infiltration system. TSS removal calculations are included in **Appendix F** of this report. The project as proposed will involve the creation of 21,563 square feet of impervious area (excluding the proposed building) and is required to treat 2,236 cubic feet of water quality volume as defined in Stormwater Standard 4. Water quality

volume is equal to one (1) inch of runoff times the total impervious area of the post development site, refer to Standard #6 below. The proposed underground infiltration (UG 1) system provides 2,352 cubic feet of water quality volume below the lowest outlet for water quality treatment. Isolator rows have been sized to meet the one (1) inch water quality flow rate 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

Infiltration rates exceed 2.4 inches/hour due to sandy/gravelly soils classified onsite. The proposed stormwater management system has been designed to provide at least eighty percent (80%) removal of Total Suspended Solids (TSS) through the use of several Best Management Practices (BMPs), including deep-sump hooded catch basins, Stormtech Isolator Rows, and an underground infiltration system. The deep-sump hooded catch basins and Stormtech Isolator Rows will provide a minimum of 44% TSS removal prior to recharge within the underground infiltration basin. The infiltration basin has been sized to hold at least one (1) inch water quality volume below the lowest outlet for water quality treatment. Isolator rows have been sized to meet the one (1) inch water quality flow rate for water quality treatment prior to discharge. Refer to **Appendix F** for TSS removal and water quality volume and flow rate calculations.

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 stockpiles 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.

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 includes a list of responsible parties and outlines procedures and timetables for the long-term operation and maintenance of the proposed underground 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.

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.

VI. 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 annual pollutant loads from the post-development runoff.

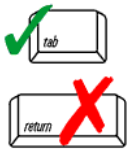
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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.

[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

John Kucich December 16, 2022
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): Below ground 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.

[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

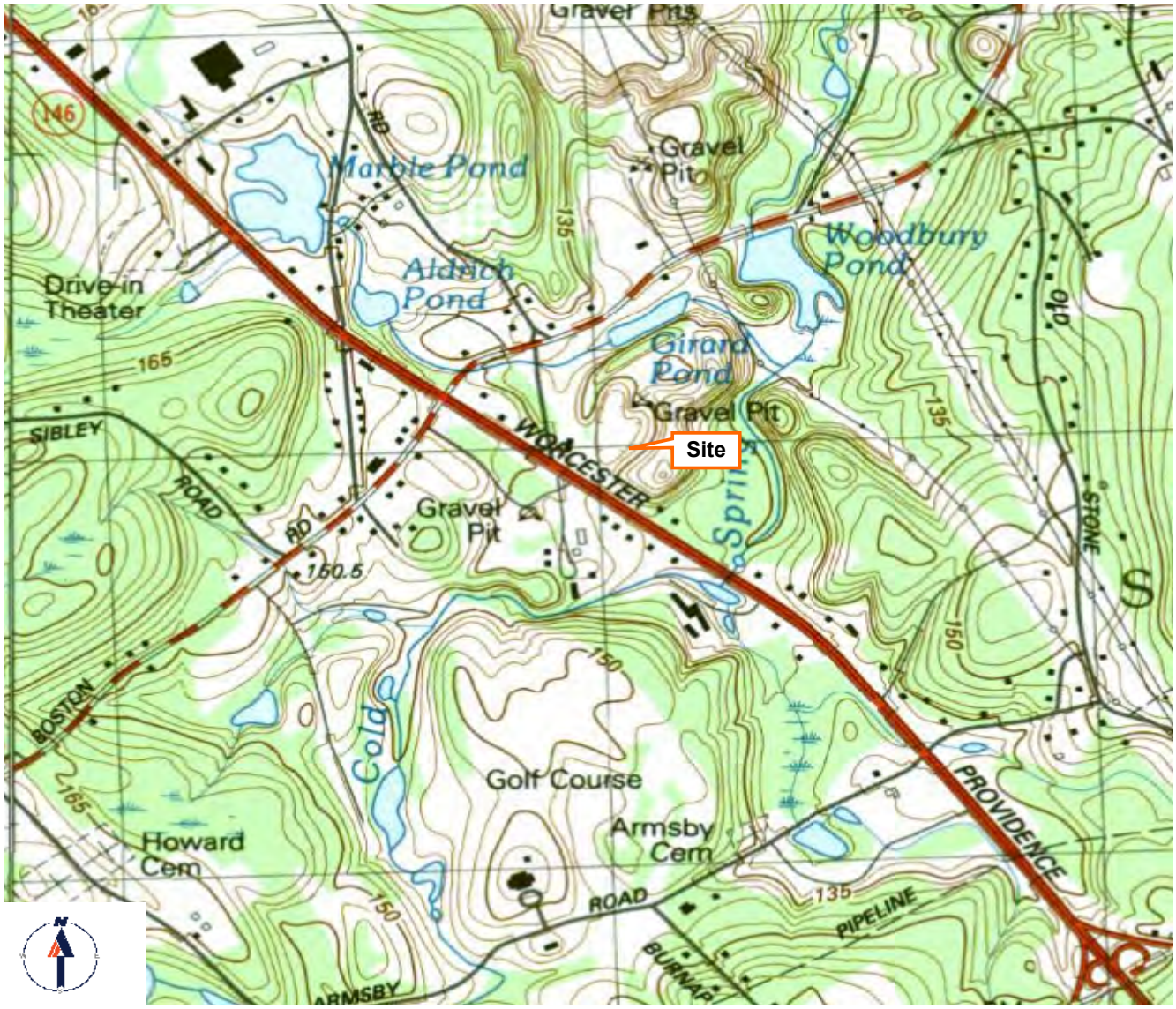
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ 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
42° 9' 37.188" N, 71° 44' 8.052" W

Source: USGS, 2019

Date Access: 03/25/2022

Torrington Properties, Inc.	
15 Pleasant Valley Drive **Map 10, Parcel 93**	**Town of Sutton** **Worcester County, MA**
BENH #W221017	
Prepared by: RPV / Date: 2/23/2022	BOHLER
Checked by: GD / Scale: NTS	

FEMA Flood Map

Source:FEMA FIRM Map #25027C0836E dated 1/20/2010

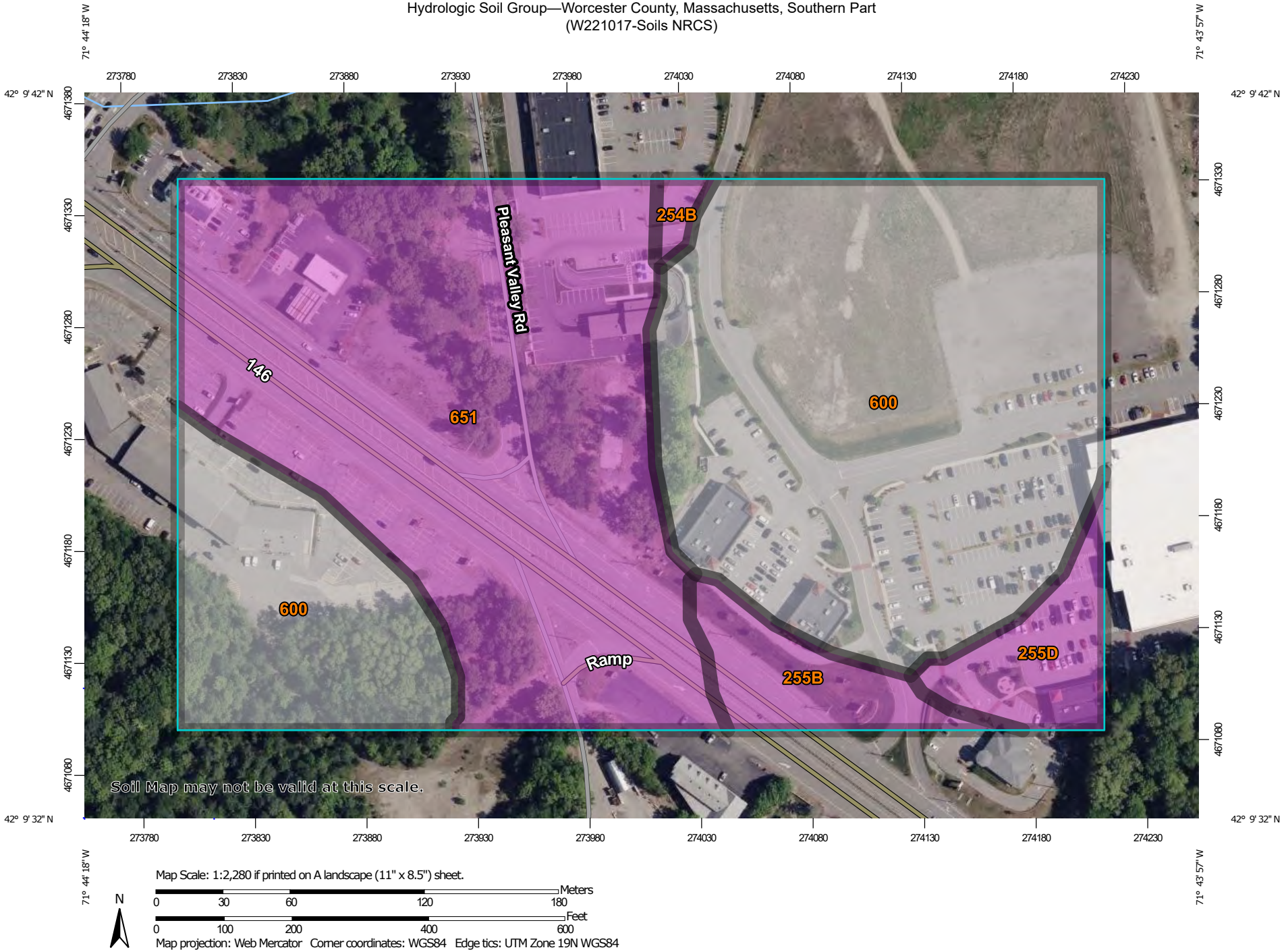
Date Access: 03/25/2022

Torrington Properties, Inc.	
15 Pleasant Valley Drive **Map 10, Parcel 93**	**Town of Sutton** **Worcester County, MA**
BENH #W221017	
Prepared by: RPV / Date: 2/23/2022	BOHLER
Checked by: GD / Scale: NTS	

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *REPORT OF GEOTECHNICAL INVESTIGATION*
- *SOIL TESTING*
- *WETLAND/WATERCOURSES REPORT*

Hydrologic Soil Group—Worcester County, Massachusetts, Southern Part
(W221017-Soils NRCS)



Map Scale: 1:2,280 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 15, 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	0.2	0.6%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	1.1	4.3%
255D	Windsor loamy sand, 15 to 25 percent slopes	A	1.1	4.2%
600	Pits, gravel		12.6	49.8%
651	Udorthents, smoothed	A	10.4	41.1%
Totals for Area of Interest			**25.4**	**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.

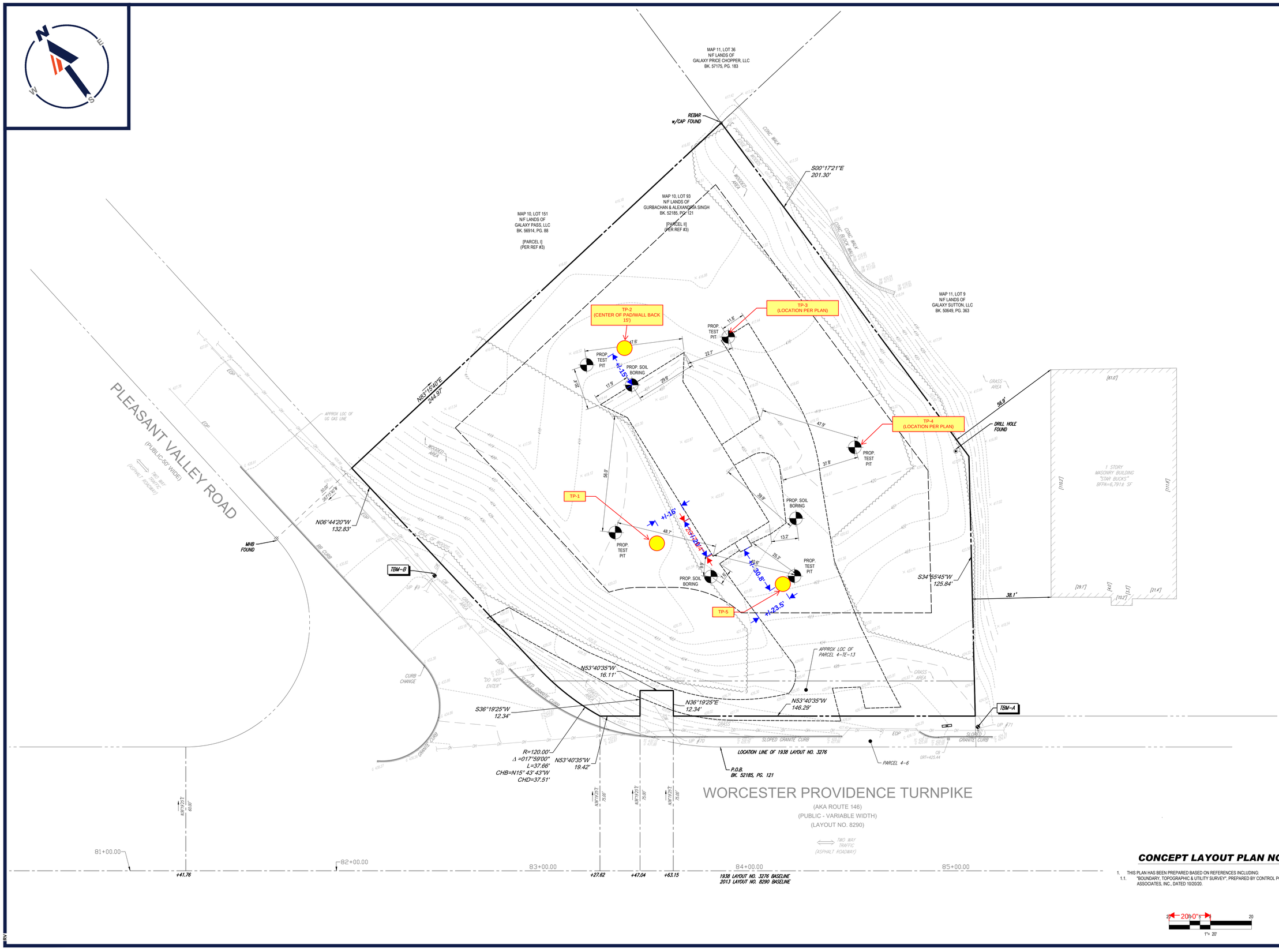
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



CONCEPT LAYOUT PLAN NOTES

1. THIS PLAN HAS BEEN PREPARED BASED ON REFERENCES INCLUDING:
   1.1. "BOUNDARY, TOPOGRAPHIC & UTILITY SURVEY", PREPARED BY CONTROL POINT ASSOCIATES, INC., DATED 10/20/20.

1" = 20'

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

Know what's below. Call before you dig.
ALWAYS CALL 811
It's fast. It's free. It's the law.

FOR CONCEPT PURPOSES ONLY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	W221017
DRAWN BY:	CFD
CHECKED BY:	GB
DATE:	01/21/2022
CAD I.D.:	W221017-THSK-041322

PROJECT:

PROPOSED CONCEPT PLAN

FOR

TORRINGTON PROPERTIES INC.

PROPOSED DEVELOPMENT

MAP: #10 LOT: #93
15 PLEASANT VALLEY ROAD,
TOWN OF SUTTON ,
WORCESTER COUNTY,
MASSACHUSETTS

BOHLER
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone: (508) 480-9900
www.BohlerEngineering.com

J.A. KUCICH
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 41930
NEW HAMPSHIRE LICENSE No. 15416
CONNECTICUT LICENSE No. 29127
RHODE ISLAND LICENSE No. 20016
MAINE LICENSE No. 22553

SHEET TITLE:
SOIL BORING & TEST PIT LOCATION SKETCH

SHEET NUMBER:
SK-01

ORG. DATE - 01/21/2022

P:\2022\W221017\CAD\TRANSFERS\SENT\DESIGN TEAM\GROUP\W221017-THSK-041322---LAYOUT CA-02-CONCEPT

RV

Site Location or lot #	15 Pleasant Valley Road, Sutton, MA				DEEP HOLE # TP-1
Applicant/owner:	Torrington Properties, Inc.				
DATE:	04/13/2022	WEATHER:	Sunny	TEMP: 50 º	
LOCATION: (Refer to sketch attached)	Refer to sketch				
PERFORMED BY:	Andrew Steiner (SE# 14373)				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant Lot		Landform:	Outwash Moraine	
Vegetation:	Wooded/Overgrown Area		Slope:	0%-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 50 ft.	Possible Wet Area:	> 50 ft.
Drinking Water Well:	Unknown ft.	Drainageway:	>100 ft.
Property Line:	>70 ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-22"	FILL	Fill	Fill	-
22"-25"	A	Sandy Loam	10YR 3/3	buried (roots) - fine, Grav: 0%-5%, C&S: 0-5%, massive, friable
25"-36"	B	Sandy Loam	10YR 4/6	fine, Grav: 0%-5%, C&S: 0-5%, massive, friable (stable cast, staining)
36"-66"	C	Sandy Loam	10YR 5/5	Grav: 10-15%, C&S: 10-15%, massive, friable
66"-132" (+)	2C	Loamy Sand	10YR 6/2	Grav: 0-5%, C&S: 0-5%, single grain, loose (very weak cast,some staining)

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	None
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		> 132"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:			None		
		Depth to weeping from side of obs. hole:			None		
		Depth to soil mottles, description:			None		
		Groundwater adjustment:			NA		
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	

Site Location or lot #	15 Pleasant Valley Road, Sutton, MA				DEEP HOLE # TP-2
Applicant/owner:	Torrington Properties, Inc.				
DATE:	04/13/2022	WEATHER:	Sunny	TEMP: 50 º	
LOCATION: (Refer to sketch attached)	Refer to sketch				
PERFORMED BY:	Andrew Steiner (SE# 14373)				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant Lot		Landform:	Outwash Moraine	
Vegetation:	Loam		Slope:	0%-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 50 ft.	Possible Wet Area:	> 40 ft.
Drinking Water Well:	Unknown ft.	Drainageway:	>30 ft.
Property Line:	>40 ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-22"	FILL	Fill	Fill	-
22"-24"	A	Sandy Loam	10YR 2/2	buried (roots) - fine, Grav: 0%-5%, C&S: 0-5%, massive, friable
24"-30"	B	Sandy Loam	10YR 4/6	fine, Grav: 0%-5%, C&S: 0-5%, massive, friable (stable cast, staining)
30"-72"	C	Sandy Loam	10YR 5/3	Grav: 0-5%, C&S: 0-5%, massive, friable
72"-132" (+)	2C	Loamy Sand	10YR 5/4	Grav: 10-15%, C&S: 10-15%, single grain, loose (very weak cast,some staining)

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	None
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		> 132"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:			None		
		Depth to weeping from side of obs. hole:			None		
		Depth to soil mottles, description:			None		
		Groundwater adjustment:			NA		
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	close proximity to drainage pipe from abutting property - samples felt wet

Site Location or lot #	15 Pleasant Valley Road, Sutton, MA				DEEP HOLE # TP-3
Applicant/owner:	Torrington Properties, Inc.				
DATE:	04/13/2022	WEATHER:	Sunny	TEMP: 50 º	
LOCATION: (Refer to sketch attached)	Refer to sketch				
PERFORMED BY:	Andrew Steiner (SE# 14373)				
WITNESSED BY:	N/A (for drainage only)				

Land Use:	Vacant Lot	Landform:	Outwash Moraine
Vegetation:	pave/loam	Slope:	0%-3%
Stone Walls:	☐ Y ☒ N	Surface Stones:	☐ Y ☒ N

Distance From:			
Open Water Bodies:	> 50 ft.	Possible Wet Area:	> 50 ft.
Drinking Water Well:	Unknown ft.	Drainageway:	>50 ft.
Property Line:	>50 ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-12"	FILL	Fill	Fill	mix of pave/loam
12"-28"	B/C	Sandy Losm	7.5 YR 5/6 10YR 5/3	B/C horizon, fine, Grav: 0%-5%, C&S: 0-5%, massive, friable
28"-60"	C1	Loamy Sand	10YR 5/4	Grav: 10%-15%, C&S: 10-15%, single grain, loose (weak cast, some staining, very gritty feel)
60"-120" (+)	C2	Loamy Sand	10YR 5/4	Grav: 0-5%, C&S: 0-5%, single grain, loose

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	None
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		> 120"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:			None		
		Depth to weeping from side of obs. hole:			None		
		Depth to soil mottles, description:			None		
		Groundwater adjustment:			NA		
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	3' wide sections of Variegated Mottles at 22" (7.5 YR 5/8) - not consistent thought the test site and not considered to indicate seasonal high groundwater.

Site Location or lot #	15 Pleasant Valley Road, Sutton, MA				DEEP HOLE # TP-4
Applicant/owner:	Torrington Properties, Inc.				
DATE:	04/13/2022	WEATHER:	Sunny	TEMP: 50 º	
LOCATION: (Refer to sketch attached)	Refer to sketch				
PERFORMED BY:	Andrew Steiner (SE# 14373)				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant Lot		Landform:	Outwash Moraine	
Vegetation:	loam		Slope:	0%-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 50 ft.	Possible Wet Area:	> 50 ft.
Drinking Water Well:	Unknown ft.	Drainageway:	>50 ft.
Property Line:	>50 ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	A	Sandy Loam	10YR 2/2	fine, Grav: 0%-5%, C&S: 0-5%, massive, friable
3"-14"	Bw	Sandy Loam	7.5 YR 5/6	fine, Grav: 0%-5%, C&S: 0-5%, massive, friable
14"-42"	C1	Loamy Sand	10YR 5/4	Grav: 10%-15%, C&S: 10-15%, single grain, loose
42"-132" (+)	C2	Loamy Sand	10YR 6/2	Grav: 0-5%, C&S: 0-5%, single grain, loose

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	None
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		> 132"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:		None			
		Depth to weeping from side of obs. hole:		None			
		Depth to soil mottles, description:		None			
		Groundwater adjustment:		NA			
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	

Site Location or lot #	15 Pleasant Valley Road, Sutton, MA				DEEP HOLE # TP-5
Applicant/owner:	Torrington Properties, Inc.				
DATE:	04/13/2022	WEATHER:	Sunny	TEMP: 50 º	
LOCATION: (Refer to sketch attached)	Refer to sketch				
PERFORMED BY:	Andrew Steiner (SE# 14373)				
WITNESSED BY:	N/A (for drainage only)				

Land Use:	Vacant Lot	Landform:	Outwash Moraine
Vegetation:	pavement	Slope:	0%-3%
Stone Walls:	☐ Y ☒ N	Surface Stones:	☐ Y ☒ N

Distance From:			
Open Water Bodies:	> 50 ft.	Possible Wet Area:	> 50 ft.
Drinking Water Well:	Unknown ft.	Drainageway:	>50 ft.
Property Line:	>50 ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-12"	FILL	Fill	-	Pavement & Gravel Base
12"-20"	Bw	Sandy Loam	7.5 YR 5/6	fine, Grav: 0%-5%, C&S: 0-5%, massive, friable
20"-48"	C1	Loamy Sand	10YR 5/4	Grav: 10%-15%, C&S: 10-15%, single grain, loose
48"-132" (+)	C2	Loamy Sand	10YR 6/2	Grav: 0-5%, C&S: 0-5%, single grain, loose

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	None
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		> 132"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:			None		
		Depth to weeping from side of obs. hole:			None		
		Depth to soil mottles, description:			None		
		Groundwater adjustment:			NA		
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

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

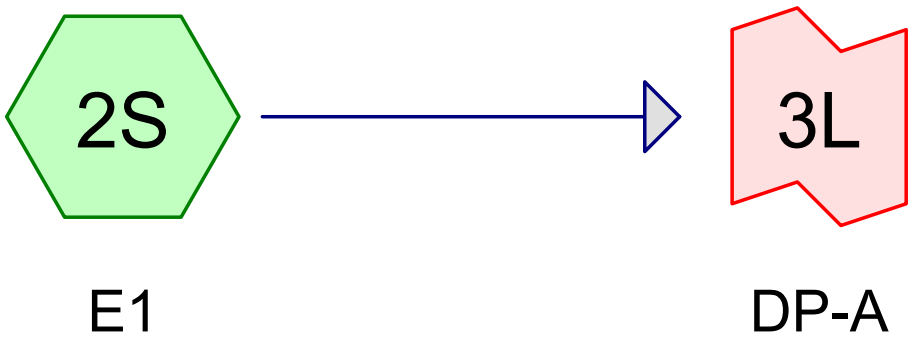
KEY

- SOIL BOUNDARY
- TIME OF CONCENTRATION
- P1 WATERSHED
- DP1 DESIGN POINT

PRE-DEVELOPMENT DRAINAGE ANALYSIS EXHIBIT

15 PLEASANT VALLEY DRIVE
SUTTON, MA

SCALE:1"=20'
DATE: 11/02/2022



Subcat Reach Pond Link

Routing Diagram for PRE-DEVELOPED
Prepared by {enter your company name here}, Printed 11/2/2022

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: E1 Runoff Area=54,465 sf 19.41% Impervious Runoff Depth=0.06"
Tc=6.0 min CN=47 Runoff=0.01 cfs 0.006 af

Link 3L: DP-A Inflow=0.01 cfs 0.006 af
Primary=0.01 cfs 0.006 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.006 af Average Runoff Depth = 0.06"
80.59% Pervious = 1.008 ac 19.41% Impervious = 0.243 ac

Summary for Subcatchment 2S: E1

Runoff = 0.01 cfs @ 15.02 hrs, Volume= 0.006 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
24,391	30	Woods, Good, HSG A
7,554	98	Paved parking, HSG A
3,016	98	Roofs, HSG A
19,248	39	>75% Grass cover, Good, HSG A
256	96	Gravel surface, HSG A
54,465	47	Weighted Average
43,895		80.59% Pervious Area
10,570		19.41% Impervious Area

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

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 19.41% Impervious, Inflow Depth = 0.06" for 2-YR event
Inflow = 0.01 cfs @ 15.02 hrs, Volume= 0.006 af
Primary = 0.01 cfs @ 15.02 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: E1 Runoff Area=54,465 sf 19.41% Impervious Runoff Depth=0.42"
Tc=6.0 min CN=47 Runoff=0.24 cfs 0.044 af

Link 3L: DP-A Inflow=0.24 cfs 0.044 af
Primary=0.24 cfs 0.044 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.044 af Average Runoff Depth = 0.42"
80.59% Pervious = 1.008 ac 19.41% Impervious = 0.243 ac

Summary for Subcatchment 2S: E1

Runoff = 0.24 cfs @ 12.30 hrs, Volume= 0.044 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.65"

Area (sf)	CN	Description
24,391	30	Woods, Good, HSG A
7,554	98	Paved parking, HSG A
3,016	98	Roofs, HSG A
19,248	39	>75% Grass cover, Good, HSG A
256	96	Gravel surface, HSG A
54,465	47	Weighted Average
43,895		80.59% Pervious Area
10,570		19.41% Impervious Area

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

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 19.41% Impervious, Inflow Depth = 0.42" for 10-YR event
Inflow = 0.24 cfs @ 12.30 hrs, Volume= 0.044 af
Primary = 0.24 cfs @ 12.30 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: E1 Runoff Area=54,465 sf 19.41% Impervious Runoff Depth=0.88"
Tc=6.0 min CN=47 Runoff=0.85 cfs 0.091 af

Link 3L: DP-A Inflow=0.85 cfs 0.091 af
Primary=0.85 cfs 0.091 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.091 af Average Runoff Depth = 0.88"
80.59% Pervious = 1.008 ac 19.41% Impervious = 0.243 ac

Summary for Subcatchment 2S: E1

Runoff = 0.85 cfs @ 12.12 hrs, Volume= 0.091 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.87"

Area (sf)	CN	Description
24,391	30	Woods, Good, HSG A
7,554	98	Paved parking, HSG A
3,016	98	Roofs, HSG A
19,248	39	>75% Grass cover, Good, HSG A
256	96	Gravel surface, HSG A
54,465	47	Weighted Average
43,895		80.59% Pervious Area
10,570		19.41% Impervious Area

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

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 19.41% Impervious, Inflow Depth = 0.88" for 25-YR event
Inflow = 0.85 cfs @ 12.12 hrs, Volume= 0.091 af
Primary = 0.85 cfs @ 12.12 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: E1 Runoff Area=54,465 sf 19.41% Impervious Runoff Depth=2.14"
Tc=6.0 min CN=47 Runoff=2.77 cfs 0.223 af

Link 3L: DP-A Inflow=2.77 cfs 0.223 af
Primary=2.77 cfs 0.223 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.223 af Average Runoff Depth = 2.14"
80.59% Pervious = 1.008 ac 19.41% Impervious = 0.243 ac

Summary for Subcatchment 2S: E1

Runoff = 2.77 cfs @ 12.10 hrs, Volume= 0.223 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.36"

Area (sf)	CN	Description
24,391	30	Woods, Good, HSG A
7,554	98	Paved parking, HSG A
3,016	98	Roofs, HSG A
19,248	39	>75% Grass cover, Good, HSG A
256	96	Gravel surface, HSG A
54,465	47	Weighted Average
43,895		80.59% Pervious Area
10,570		19.41% Impervious Area

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

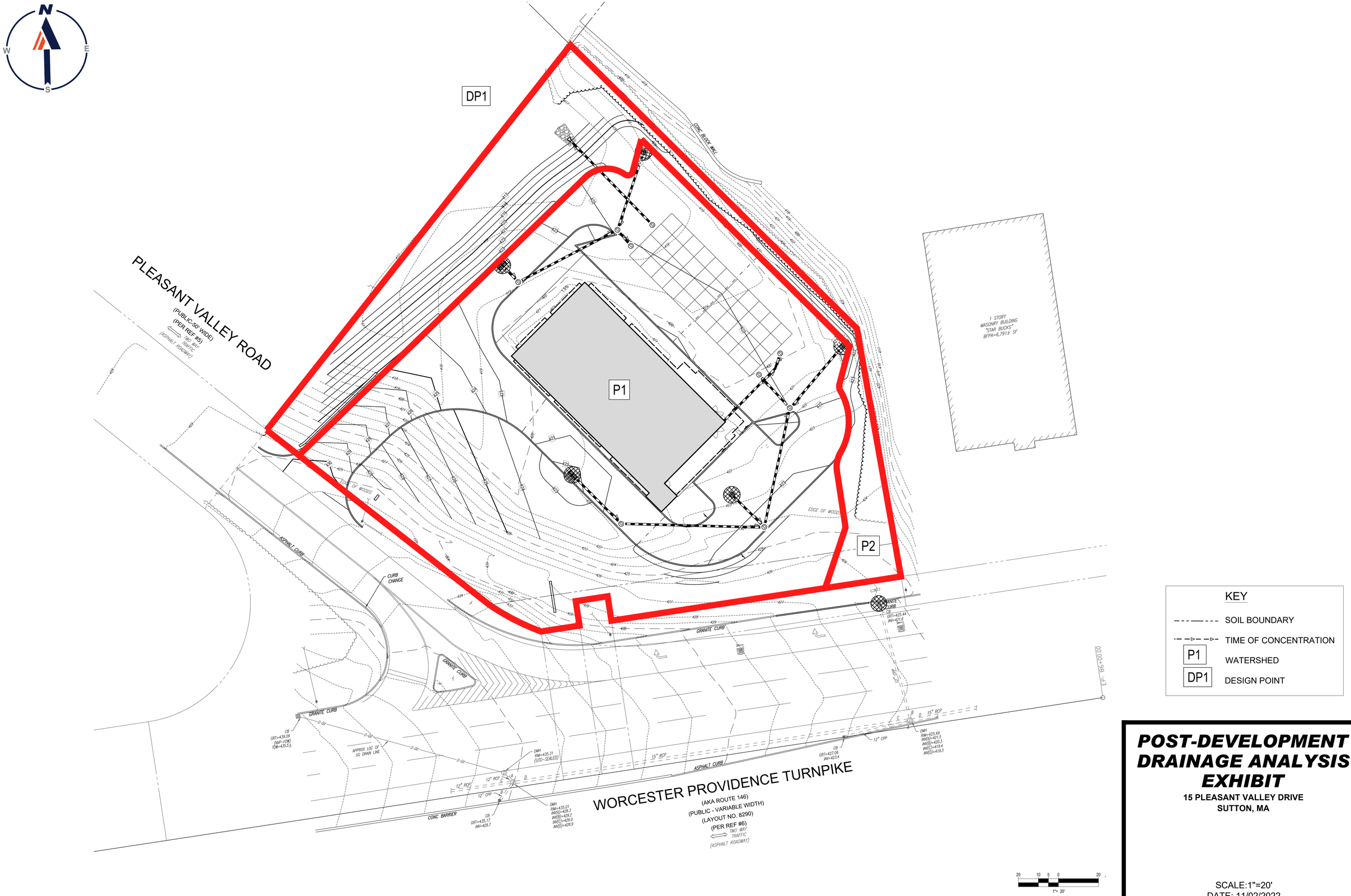
Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 19.41% Impervious, Inflow Depth = 2.14" for 100-YR event
Inflow = 2.77 cfs @ 12.10 hrs, Volume= 0.223 af
Primary = 2.77 cfs @ 12.10 hrs, Volume= 0.223 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

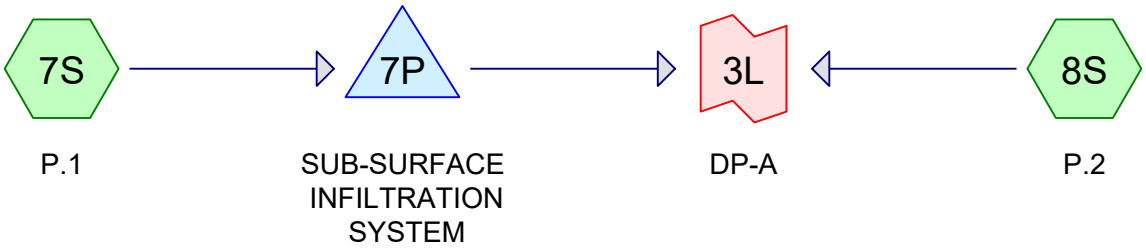
- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*



POST-DEVELOPMENT DRAINAGE ANALYSIS EXHIBIT

15 PLEASANT VALLEY DRIVE
SUTTON, MA

SCALE:1"=20'
DATE: 11/02/2022



Subcat Reach Pond Link

Routing Diagram for POST-DEVELOPED
Prepared by {enter your company name here}, Printed 11/2/2022

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment7S: P.1 Runoff Area=42,920 sf 62.49% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=76 Runoff=1.17 cfs 0.088 af

Subcatchment8S: P.2 Runoff Area=11,525 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.000 af

Pond 7P: SUB-SURFACEINFILTRATION Peak Elev=415.48' Storage=0.029 af Inflow=1.17 cfs 0.088 af
Discarded=0.16 cfs 0.088 af Primary=0.00 cfs 0.000 af Outflow=0.16 cfs 0.088 af

Link 3L: DP-A Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.088 af Average Runoff Depth = 0.85"
50.74% Pervious = 0.634 ac 49.26% Impervious = 0.616 ac

Summary for Subcatchment 7S: P.1

Runoff = 1.17 cfs @ 12.10 hrs, Volume= 0.088 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
5,253	98	Roofs, HSG A
19,294	98	Paved parking, HSG A
2,273	98	Unconnected pavement, HSG A
16,100	39	>75% Grass cover, Good, HSG A
42,920	76	Weighted Average
16,100		37.51% Pervious Area
26,820		62.49% Impervious Area
2,273		8.48% Unconnected

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

Summary for Subcatchment 8S: P.2

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.09"

Area (sf)	CN	Description
8,604	39	>75% Grass cover, Good, HSG A
2,921	30	Woods, Good, HSG A
11,525	37	Weighted Average
11,525		100.00% Pervious Area

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

Summary for Pond 7P: SUB-SURFACE INFILTRATION SYSTEM

Inflow Area = 0.985 ac, 62.49% Impervious, Inflow Depth = 1.08" for 2-YR event
Inflow = 1.17 cfs @ 12.10 hrs, Volume= 0.088 af
Outflow = 0.16 cfs @ 12.86 hrs, Volume= 0.088 af, Atten= 86%, Lag= 45.4 min
Discarded = 0.16 cfs @ 12.86 hrs, Volume= 0.088 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 415.48' @ 12.86 hrs Surf.Area= 0.058 ac Storage= 0.029 af

Plug-Flow detention time= 64.6 min calculated for 0.088 af (100% of inflow)

Center-of-Mass det. time= 64.6 min (922.2 - 857.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	414.50'	0.082 af	**29.92'W x 84.57'L x 5.50'H Field A** 0.319 af Overall - 0.114 af Embedded = 0.206 af x 40.0% Voids
#2A	415.25'	0.114 af	**ADS_StormTech MC-3500 d +Cap**x 44 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 4 Rows of 11 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.196 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	414.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 408.50'
#2	Primary	417.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 417.50' / 417.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	418.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	416.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.16 cfs @ 12.86 hrs HW=415.48' (Free Discharge)
└**1=Exfiltration** (Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=414.50' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
  ├**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 49.26% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment7S: P.1 Runoff Area=42,920 sf 62.49% Impervious Runoff Depth=2.25"
Tc=6.0 min CN=76 Runoff=2.54 cfs 0.185 af

Subcatchment8S: P.2 Runoff Area=11,525 sf 0.00% Impervious Runoff Depth=0.08"
Tc=6.0 min CN=37 Runoff=0.00 cfs 0.002 af

Pond 7P: SUB-SURFACEINFILTRATION Peak Elev=416.58' Storage=0.081 af Inflow=2.54 cfs 0.185 af
Discarded=0.19 cfs 0.185 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.185 af

Link 3L: DP-A Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.187 af Average Runoff Depth = 1.79"
50.74% Pervious = 0.634 ac 49.26% Impervious = 0.616 ac

Summary for Subcatchment 7S: P.1

Runoff = 2.54 cfs @ 12.09 hrs, Volume= 0.185 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.65"

Area (sf)	CN	Description
5,253	98	Roofs, HSG A
19,294	98	Paved parking, HSG A
2,273	98	Unconnected pavement, HSG A
16,100	39	>75% Grass cover, Good, HSG A
42,920	76	Weighted Average
16,100		37.51% Pervious Area
26,820		62.49% Impervious Area
2,273		8.48% Unconnected

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

Summary for Subcatchment 8S: P.2

Runoff = 0.00 cfs @ 15.04 hrs, Volume= 0.002 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.65"

Area (sf)	CN	Description
8,604	39	>75% Grass cover, Good, HSG A
2,921	30	Woods, Good, HSG A
11,525	37	Weighted Average
11,525		100.00% Pervious Area

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

Summary for Pond 7P: SUB-SURFACE INFILTRATION SYSTEM

Inflow Area = 0.985 ac, 62.49% Impervious, Inflow Depth = 2.25" for 10-YR event
Inflow = 2.54 cfs @ 12.09 hrs, Volume= 0.185 af
Outflow = 0.19 cfs @ 13.83 hrs, Volume= 0.185 af, Atten= 93%, Lag= 104.0 min
Discarded = 0.19 cfs @ 13.83 hrs, Volume= 0.185 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 416.58' @ 13.83 hrs Surf.Area= 0.058 ac Storage= 0.081 af

Plug-Flow detention time= 191.2 min calculated for 0.185 af (100% of inflow)

Center-of-Mass det. time= 191.2 min (1,026.9 - 835.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	414.50'	0.082 af	**29.92'W x 84.57'L x 5.50'H Field A** 0.319 af Overall - 0.114 af Embedded = 0.206 af x 40.0% Voids
#2A	415.25'	0.114 af	**ADS_StormTech MC-3500 d +Cap**x 44 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 4 Rows of 11 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.196 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	414.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 408.50'
#2	Primary	417.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 417.50' / 417.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	418.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	416.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.19 cfs @ 13.83 hrs HW=416.58' (Free Discharge)
└**1=Exfiltration** (Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=414.50' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
  ├**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 49.26% Impervious, Inflow Depth = 0.02" for 10-YR event
Inflow = 0.00 cfs @ 15.04 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 15.04 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment7S: P.1 Runoff Area=42,920 sf 62.49% Impervious Runoff Depth=3.27"
Tc=6.0 min CN=76 Runoff=3.70 cfs 0.268 af

Subcatchment8S: P.2 Runoff Area=11,525 sf 0.00% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=37 Runoff=0.02 cfs 0.007 af

Pond 7P: SUB-SURFACEINFILTRATION Peak Elev=417.64' Storage=0.128 af Inflow=3.70 cfs 0.268 af
Discarded=0.21 cfs 0.261 af Primary=0.07 cfs 0.008 af Outflow=0.28 cfs 0.268 af

Link 3L: DP-A Inflow=0.08 cfs 0.014 af
Primary=0.08 cfs 0.014 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.275 af Average Runoff Depth = 2.64"
50.74% Pervious = 0.634 ac 49.26% Impervious = 0.616 ac

Summary for Subcatchment 7S: P.1

Runoff = 3.70 cfs @ 12.09 hrs, Volume= 0.268 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.87"

Area (sf)	CN	Description
5,253	98	Roofs, HSG A
19,294	98	Paved parking, HSG A
2,273	98	Unconnected pavement, HSG A
16,100	39	>75% Grass cover, Good, HSG A
42,920	76	Weighted Average
16,100		37.51% Pervious Area
26,820		62.49% Impervious Area
2,273		8.48% Unconnected

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

Summary for Subcatchment 8S: P.2

Runoff = 0.02 cfs @ 12.41 hrs, Volume= 0.007 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.87"

Area (sf)	CN	Description
8,604	39	>75% Grass cover, Good, HSG A
2,921	30	Woods, Good, HSG A
11,525	37	Weighted Average
11,525		100.00% Pervious Area

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

Summary for Pond 7P: SUB-SURFACE INFILTRATION SYSTEM

Inflow Area = 0.985 ac, 62.49% Impervious, Inflow Depth = 3.27" for 25-YR event
Inflow = 3.70 cfs @ 12.09 hrs, Volume= 0.268 af
Outflow = 0.28 cfs @ 13.65 hrs, Volume= 0.268 af, Atten= 92%, Lag= 93.1 min
Discarded = 0.21 cfs @ 13.65 hrs, Volume= 0.261 af
Primary = 0.07 cfs @ 13.65 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 417.64' @ 13.65 hrs Surf.Area= 0.058 ac Storage= 0.128 af

Plug-Flow detention time= 268.9 min calculated for 0.268 af (100% of inflow)

Center-of-Mass det. time= 268.8 min (1,093.8 - 825.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	414.50'	0.082 af	**29.92'W x 84.57'L x 5.50'H Field A** 0.319 af Overall - 0.114 af Embedded = 0.206 af x 40.0% Voids
#2A	415.25'	0.114 af	**ADS_StormTech MC-3500 d +Cap**x 44 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 4 Rows of 11 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.196 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	414.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 408.50'
#2	Primary	417.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 417.50' / 417.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	418.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	416.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.21 cfs @ 13.65 hrs HW=417.64' (Free Discharge)
└**1=Exfiltration** (Controls 0.21 cfs)

Primary OutFlow Max=0.07 cfs @ 13.65 hrs HW=417.64' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.07 cfs @ 1.00 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)
  └**4=Orifice/Grate** (Passes 0.07 cfs of 0.16 cfs potential flow)

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 49.26% Impervious, Inflow Depth = 0.14" for 25-YR event
Inflow = 0.08 cfs @ 13.64 hrs, Volume= 0.014 af
Primary = 0.08 cfs @ 13.64 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment7S: P.1 Runoff Area=42,920 sf 62.49% Impervious Runoff Depth=5.49"
Tc=6.0 min CN=76 Runoff=6.16 cfs 0.450 af

Subcatchment8S: P.2 Runoff Area=11,525 sf 0.00% Impervious Runoff Depth=1.12"
Tc=6.0 min CN=37 Runoff=0.20 cfs 0.025 af

Pond 7P: SUB-SURFACEINFILTRATION Peak Elev=418.52' Storage=0.160 af Inflow=6.16 cfs 0.450 af
Discarded=0.24 cfs 0.311 af Primary=2.15 cfs 0.140 af Outflow=2.38 cfs 0.450 af

Link 3L: DP-A Inflow=2.29 cfs 0.164 af
Primary=2.29 cfs 0.164 af

Total Runoff Area = 1.250 ac Runoff Volume = 0.475 af Average Runoff Depth = 4.56"
50.74% Pervious = 0.634 ac 49.26% Impervious = 0.616 ac

Summary for Subcatchment 7S: P.1

Runoff = 6.16 cfs @ 12.09 hrs, Volume= 0.450 af, Depth= 5.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.36"

Area (sf)	CN	Description
5,253	98	Roofs, HSG A
19,294	98	Paved parking, HSG A
2,273	98	Unconnected pavement, HSG A
16,100	39	>75% Grass cover, Good, HSG A
42,920	76	Weighted Average
16,100		37.51% Pervious Area
26,820		62.49% Impervious Area
2,273		8.48% Unconnected

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

Summary for Subcatchment 8S: P.2

Runoff = 0.20 cfs @ 12.13 hrs, Volume= 0.025 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.36"

Area (sf)	CN	Description
8,604	39	>75% Grass cover, Good, HSG A
2,921	30	Woods, Good, HSG A
11,525	37	Weighted Average
11,525		100.00% Pervious Area

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

Summary for Pond 7P: SUB-SURFACE INFILTRATION SYSTEM

Inflow Area = 0.985 ac, 62.49% Impervious, Inflow Depth = 5.49" for 100-YR event
Inflow = 6.16 cfs @ 12.09 hrs, Volume= 0.450 af
Outflow = 2.38 cfs @ 12.35 hrs, Volume= 0.450 af, Atten= 61%, Lag= 15.4 min
Discarded = 0.24 cfs @ 12.35 hrs, Volume= 0.311 af
Primary = 2.15 cfs @ 12.35 hrs, Volume= 0.140 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 418.52' @ 12.35 hrs Surf.Area= 0.058 ac Storage= 0.160 af

Plug-Flow detention time= 202.9 min calculated for 0.450 af (100% of inflow)

Center-of-Mass det. time= 202.8 min (1,013.0 - 810.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	414.50'	0.082 af	**29.92'W x 84.57'L x 5.50'H Field A** 0.319 af Overall - 0.114 af Embedded = 0.206 af x 40.0% Voids
#2A	415.25'	0.114 af	**ADS_StormTech MC-3500 d +Cap**x 44 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 4 Rows of 11 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		0.196 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	414.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 408.50'
#2	Primary	417.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 417.50' / 417.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	418.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	416.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.24 cfs @ 12.35 hrs HW=418.52' (Free Discharge)
└**1=Exfiltration** (Controls 0.24 cfs)

Primary OutFlow Max=2.14 cfs @ 12.35 hrs HW=418.52' (Free Discharge)
└**2=Culvert** (Inlet Controls 2.14 cfs @ 2.73 fps)
  ├**3=Sharp-Crested Rectangular Weir**(Passes < 4.72 cfs potential flow)
  └**4=Orifice/Grate** (Passes < 0.42 cfs potential flow)

Summary for Link 3L: DP-A

Inflow Area = 1.250 ac, 49.26% Impervious, Inflow Depth = 1.58" for 100-YR event
Inflow = 2.29 cfs @ 12.34 hrs, Volume= 0.164 af
Primary = 2.29 cfs @ 12.34 hrs, Volume= 0.164 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *CORNELL RAINFALL DATA*
- *PIPE AND INLET SIZING*
- *OUTLET PROTECTION SIZING*

Medical Clinic
15 Pleasant Valley Drive
Southborough, MA
Bohler Job Number: W221017
November 3, 2022

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	0.243
Proposed Site Impervious Area (ac)	0.616
Proposed Increase in Site Impervious Area (ac)	0.373
Recharge Volume Required (cf)	**812**

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - C Soils (0.25 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - D Soils (0.10 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Total Recharge Volume Required (cf)	**812**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**0.616**
%Impervious Directed to Infiltration BMP	100%
Adjustment Factor	1.00
Adjusted Total Recharge Volume Required (cf)	**812**

Provided Recharge Volume*	
Underground Infiltration System #1	2,352
Total Recharge Volume Provided (cf)	**2,352**

Provided greater than or Equal to Required

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

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

Medical Clinic
15 Pleasant Valley Drive
Southborough, MA
Bohler Job Number: W221017
November 3, 2022

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - Underground Infiltration System #1	
Volume below outlet pipe (Rv) (cf)	2,352
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	2,530
Drawdown time (Hours)*	4.6

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

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Southborough, MA
Bohler Job Number: W221017
November 3, 2022

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)	26,833
Required Water Quality Volume (cf)	2,236

*Water Quality volume runoff is equal to 0.5 or 1.0 inches of runoff times the total impervious area of the post development project site.

Water Quality Volume Provided*	
Underground Infiltration System #1	2,352
Total Provided Water Quality Volume (cf)	2,352

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

Provided greater than or Equal to Required

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
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TSS Removal Calculation Worksheet

Location: (Pretreatment) CB --> Isolater Row

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Stormtech Isolator Row	**0.25**	**0.75**	**0.19**	**0.56**

Total TSS Removal = **44%**

Project: **Medical Clinic**

Prepared By: **Bohler Engineering**

Date: **11/3/2022**

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

Prepared By:
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TSS Removal Calculation Worksheet

Location: (Treatment) CB --> Underground Infiltration Chambers

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Underground Infiltration Chambers (with Isolator Row Pretreatment)	**0.80**	**0.75**	**0.60**	**0.15**

Total TSS Removal = **85%**

Project: **Medical Clinic**
Prepared By: **Bohler Engineering**
Date: **11/3/2022**

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

Prepared By:
Bohler Engineering
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Southborough, MA 01772
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OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

	OUTLET PIPE DIAMETER OR SPAN (in)									
DISCHARGE (cfs)	12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		***USE***						
6	12	11								
7		13	***12***							
8		14	13	***12***		***MINIMUM***				
9			14	13						
10			15	13						
11			16	14				***LENGTH***		
12				14						
14				16	***14***					
16				17	15	***14***			***OUTLINED***	
18				18	16	15				
20					17	15	***14***			
22		***USE***			18	16	15			
24						17	15	***14***		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	***16***	
40			***PREFORMED***				20	18	17	***16***
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					***SCOUR***			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							***HOLE***			29
130										30

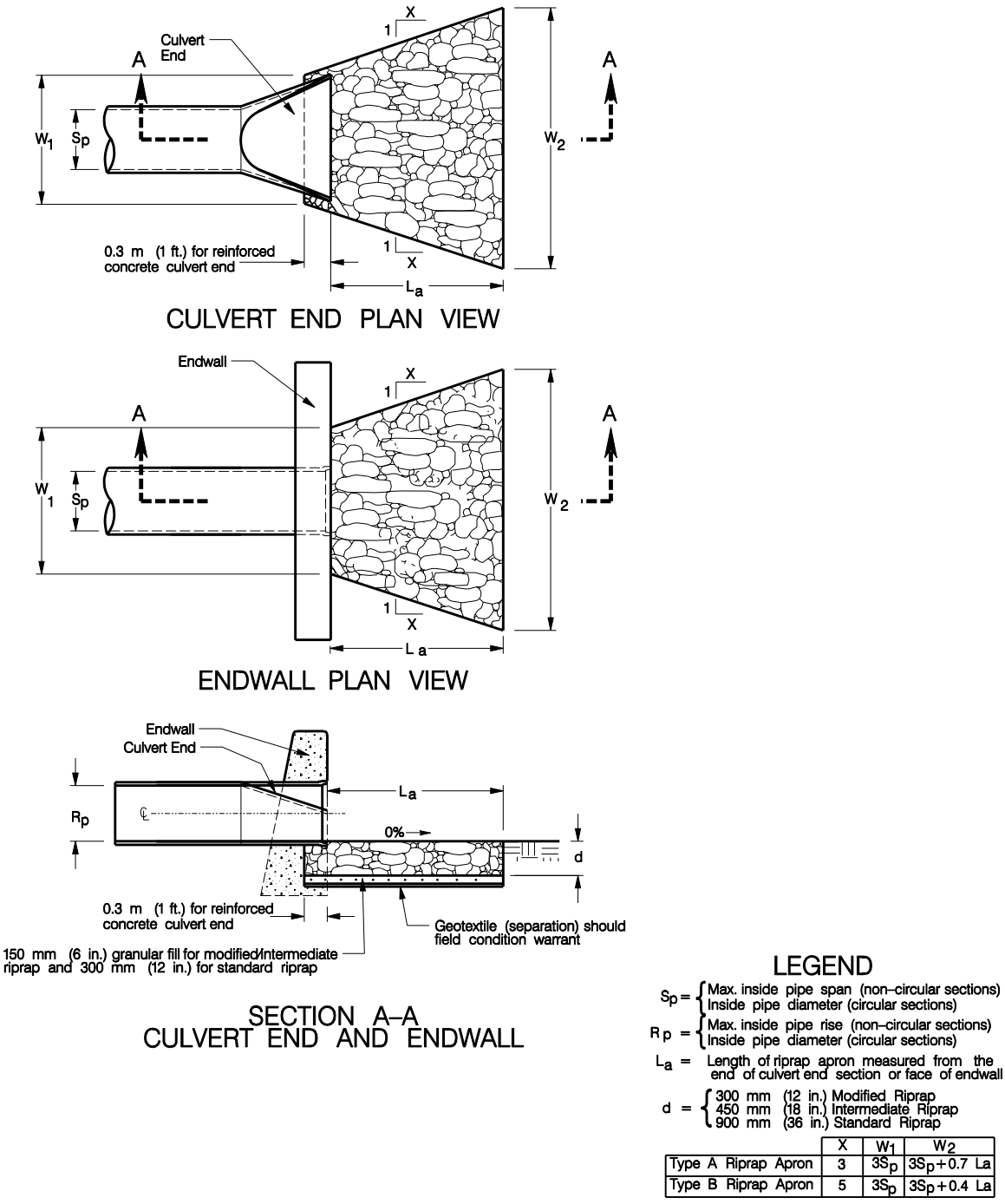
Table 11-12.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

OUTLET PROTECTION
OUTLET VELOCITY > 14 feet/sec or Length of Apron exceeds limits shown on Tables 11-12.1 and 11-13.1

Preformed Scour Hole										
(See Figure 11-15)	PIPE DIAMETER OR SPAN (in)									
	12	15	18	24	30	36	42	48	54	60
Type 1										
B	5	6	8	10	13	15	18	20	23	25
C	6	8	9	12	15	18	21	24	27	30
d	Depends on riprap type(see Figure 11-15)									
$2S_p$	2.0	2.6	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
$3S_p$	3.0	3.9	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
$F = 0.5\ S_p$	0.5	0.625	0.75	1	1.25	1.5	1.75	2	2.25	2.5
Type 2										
B	8	10	12	16	20	24	28	32	36	40
C	9	11	14	18	23	27	32	36	41	45
d	Depends on riprap size (see Figure 11-15)									
$2S_p$	2.0	2.6	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
$3S_p$	3.0	3.9	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
$F = S_p$	1.0	1.3	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Table 11-14.1 - Dimensions of Preformed Scour Hole (Feet)



	X	W1	W2
Type A Riprap Apron	3	$3S_p$	$3S_p+0.7$ La
Type B Riprap Apron	5	$3S_p$	$3S_p+0.4$ La

Figure 11-13 Type A and B Riprap Apron
(to be used where there is no defined channel downstream of the outlet)

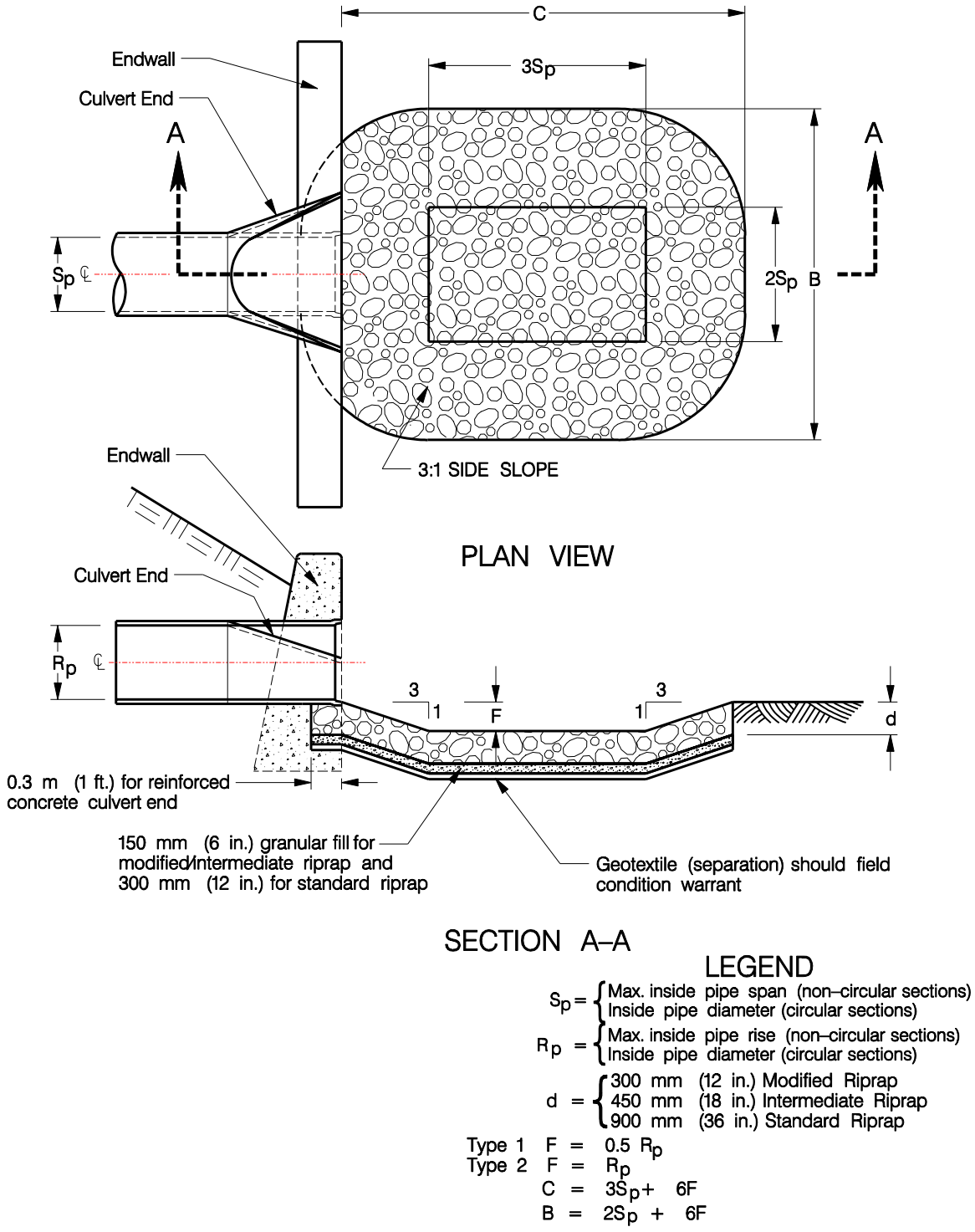


Figure 11-15 Preformed Scour Hole Type 1 and Type 2

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*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

Medical Clinic
15 Pleasant Valley Road
Sutton, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Torrington Properties
60 K Street
Boston, MA 02127

RESPONSIBLE PARTY POST CONSTRUCTION:

Torrington Properties
60 K Street
Boston, MA 02127

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 and on-site driveways: Sweep at least two (2) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off site in accordance with MADEP and other applicable requirements.

2. Catch basins, yard drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) 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.

3. Underground Infiltration Chambers: 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.

4. Headwalls, Rip rap, Scour Hole and Level Spreader: Inspect one (1) time per year. These areas shall be inspected to ensure there is no erosion or loss of material and shall be cleared of trash and debris as necessary. Any debris removed shall be deposited off-site in accordance with MADEP and other applicable requirements.

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

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Medical Clinic
15 Pleasant Valley Road
Sutton, MA

RESPONSIBLE PARTY:

Torrington Properties
60 K Street
Boston, MA 02127

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins/Area Drains:	
Discharge Points/Headwalls/Rip Rap/Sour Hole/Level Spreader:	
Underground Infiltration Chambers:	
Other:	

Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):
Catch Basins/Area Drains:
Discharge Points/Headwalls/Rip Rap/Sour Hole/Level Spreader:
Underground Infiltration Chambers:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Medical Clinic
15 Pleasant Valley Road – Sutton, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Medical Clinic
15 Pleasant Valley Road
Sutton, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Torrington Properties
60 K Street
Boston, MA 02127

RESPONSIBLE PARTY POST CONSTRUCTION:

Torrington Properties
60 K Street
Boston, MA 02127

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

- The property owner, or their tenants, shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc. In addition to "good housekeeping" of the interior of the site, the property owner, or their tenants, shall be responsible for regular inspection and cleaning of trash, debris, and other items along the frontage of the property.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots and driveways 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.
- Storage of fertilizers and/or pesticides shall be provided within a structure designed to prevent the generation and escape of contaminated runoff or leachate.

- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter in to 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).

- 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.

- 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.

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.

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

Medical Clinic
15 Pleasant Valley Road
Sutton, 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 Bellingham 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 Bellingham Board of Health at (508) 966-5820 and the Bellingham Conservation Commission at (508) 657-2858.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town of Bellingham Board of Health 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 AGENCYPHONE: (888) 372-7341

StormTech®

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.

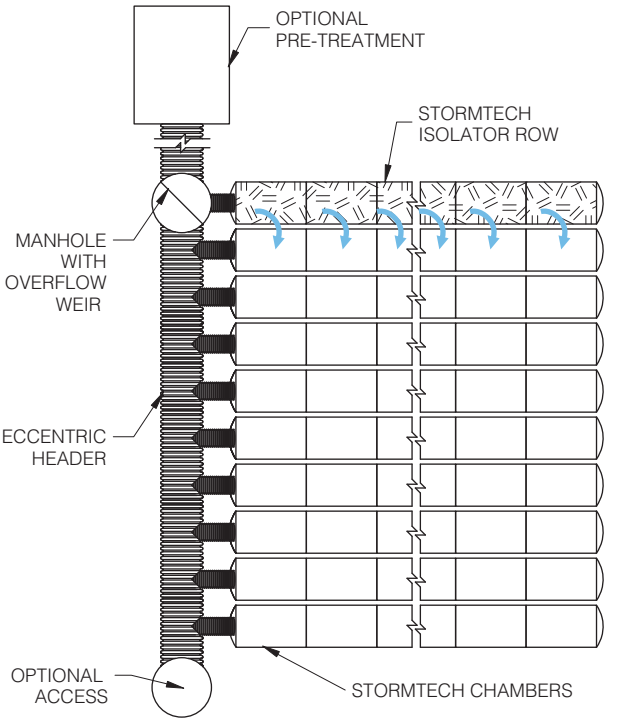
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of 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.

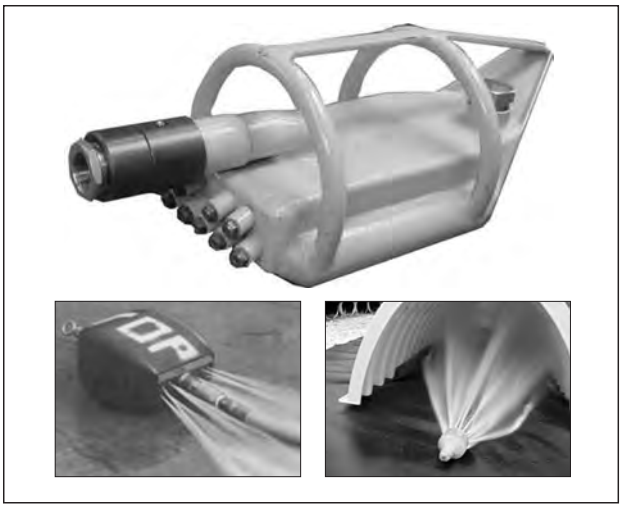
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

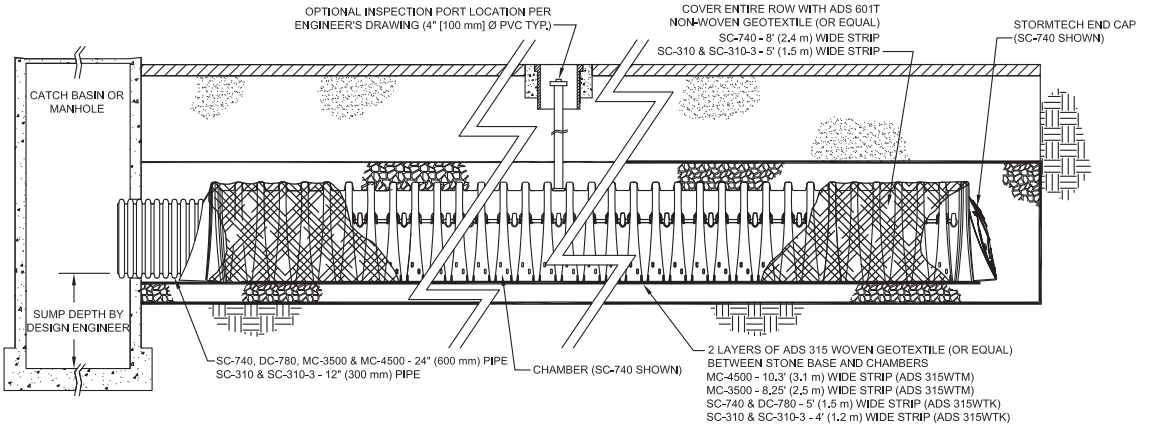
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via 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

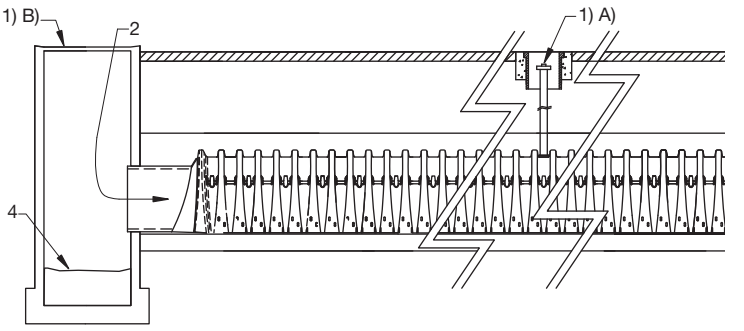
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

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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