STORMWATER REPORT

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PREPARED FOR

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December 14, 2021

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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

Massachusetts Department of Environmental Protection
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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.

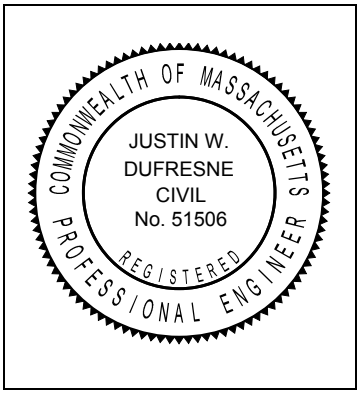
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



December 14, 2021

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): _____

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.

Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00). This report also demonstrates compliance with the Town of Leicester Stormwater Regulations for stormwater design and mitigation.

Project Description

The Applicant, JMC/TBG Leicester, LLC, is proposing the development of a warehouse/manufacturing facility (the Project). As proposed, the Project consists of 260,000 square feet of building space, ancillary landscape improvements, parking spaces, and utility improvements to support this use.

The Project will generate more than 1,000 vehicle trips per day and is considered a Land Use with Higher Potential Pollutant Loads (LUHPPL).

Site Description

The Project Site is a ±49.8-acre parcel of land (the Site) located at 0, 90 & 92 Huntoon Memorial Highway in Leicester, Massachusetts (see Figure 1). The Site lies within the French surface watershed and is bounded by a business and wetland system to the north, undeveloped, wooded land and wetlands to the south, Grindstone Brook to the east, and undeveloped, wooded land and wetlands to the west. See Figure 1, Site Locus Map.

There are wetland resource areas on the Site and the Project will include work within areas regulated by the Wetlands Protection Act. Refer to the Notice of Intent prepared by VHB for more information regarding wetland resource areas on the Site and work within areas regulated by the Wetlands Protection Act.

According to the National Resources Conservation Service (NRCS), surface soils on the Site include Montauk fine sandy loam, Freetown muck, and Canton fine sandy loam. On-site soils are classified as Hydrologic Soil Groups (HSG) B, C and D. Based on the soil evaluation included in Appendix C, the Site appears to be generally Hydrologic Soil Group C with shallow bedrock and is not considered to be within an area of rapid infiltration (soils with a saturated hydraulic conductivity greater than 2.4 inches per hour).

Existing Drainage Conditions

Under existing conditions, the Site is undeveloped woodlands with generally rolling topography. Figure 2 illustrates the existing drainage patterns on the Site. Currently, the Site is divided into 8 drainage areas as stormwater runoff flows to 4 Design Points. Table 2 below provides a summary of the existing conditions hydrologic data.

Table 1 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
EX1	Large Wetland	DP1	7.83	71	27.0
EX1-A	Property Line	DP1-A	4.96	70	15.4
EX2	Rochdale Pond	DP2	3.40	70	16.0
EX2-A	Reach R2-A Grindstone Brook (South)	DP2	3.11	70	13.5
EX2-B	Reach R2-B Grindstone Brook (Middle)	DP2	4.95	70	13.1
EX2-BB	Wetland attached to Grindstone Brook	DP2	4.96	70	22.8
EX2-C	Reach R2-C Grindstone Brook (North)	DP2	4.87	70	9.5
EX3	Small Wetland	DP3	4.00	70	10.9
		Total:	38.08		

Proposed Drainage Conditions

Figure 3 illustrates the proposed "post construction" drainage conditions for the project. As shown, the Site will be divided into 10 drainage areas that discharge treated stormwater to the 4 existing Design Points. Table 3 below provides a summary of the proposed conditions hydrologic data.

Table 2 Proposed Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
PR1	Subsurface Basin	DP1	6.83	91	5.0
PR1-A	Property Line	DP1-A	1.06	71	5.0
PR1-B	Large Wetland	DP1	3.05	72	5.0
PR2	Gravel Wetland	DP2	11.15	91	5.4

PR2-A	Rochdale Pond	DP2	1.94	70	7.5
PR2-AA	Reach R2-A Grindstone Brook (South)	DP2	2.73	70	12.2
PR2-B	Reach R2-B Grindstone Brook (Middle)	DP2	4.18	70	8.1
PR2-BB	Wetland attached to Grindstone Brook	DP2	1.61	71	10.6
PR2-C	Reach R2-C Grindstone Brook (North)	DP2	2.80	70	5.0
PR3	Small Wetland	DP3	2.73	70	6.3
		Total:	38.08		

The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook. Because the Project is considered a LUHPPL, the proposed stormwater management system has been designed to treat the one inch Water Quality Volume and provide 44% Total Suspended Solids (TSS) pretreatment prior to infiltration.

There area two treatment trains proposed for the stormwater management system and they are follows:

- Deep-sump, hooded catch basin→Proprietary Hydrodynamic Separator→Infiltration
- Deep-sump, hooded catch basin→ Gravel Wetland

Hydraulic Pipe Sizing

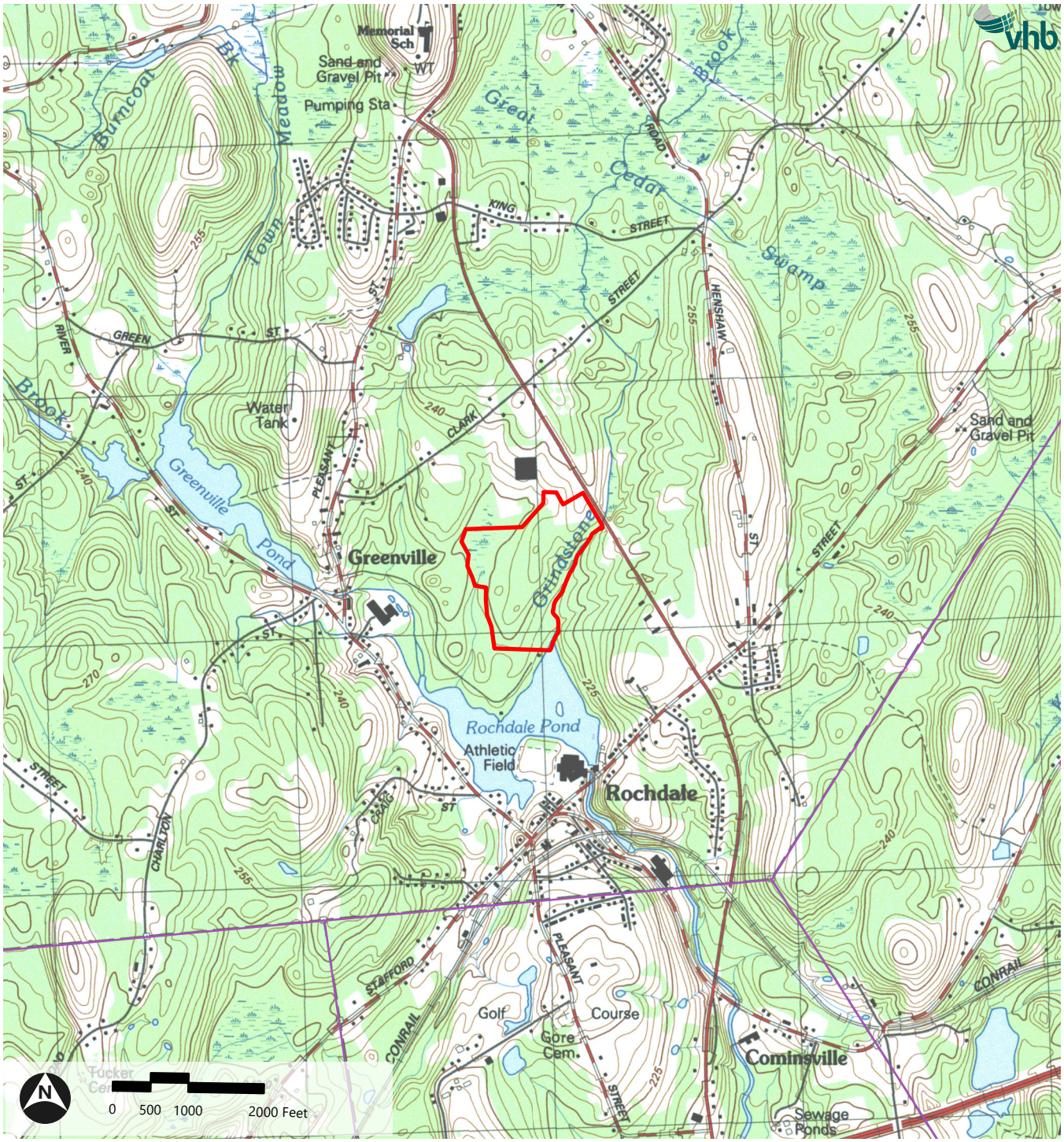
The closed drainage piping system was sized for the 10-year storm event. Drainage pipes were sized using Manning's equation for flowing-full capacity and the Rational Method to estimate runoff. The performance of the system was analyzed using StormCAD, a HEC-22 based program. A summary table of the closed-drainage system analysis is included in Appendix A.

Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the site design include a constructed wetland (gravel wetland). In general, stormwater from the proposed impervious surfaces is captured by deep-sump, hooded catch basins and treated by the gravel wetland.

Figure 1: USGS Locus Map

Leicester Central | Leicester, MA



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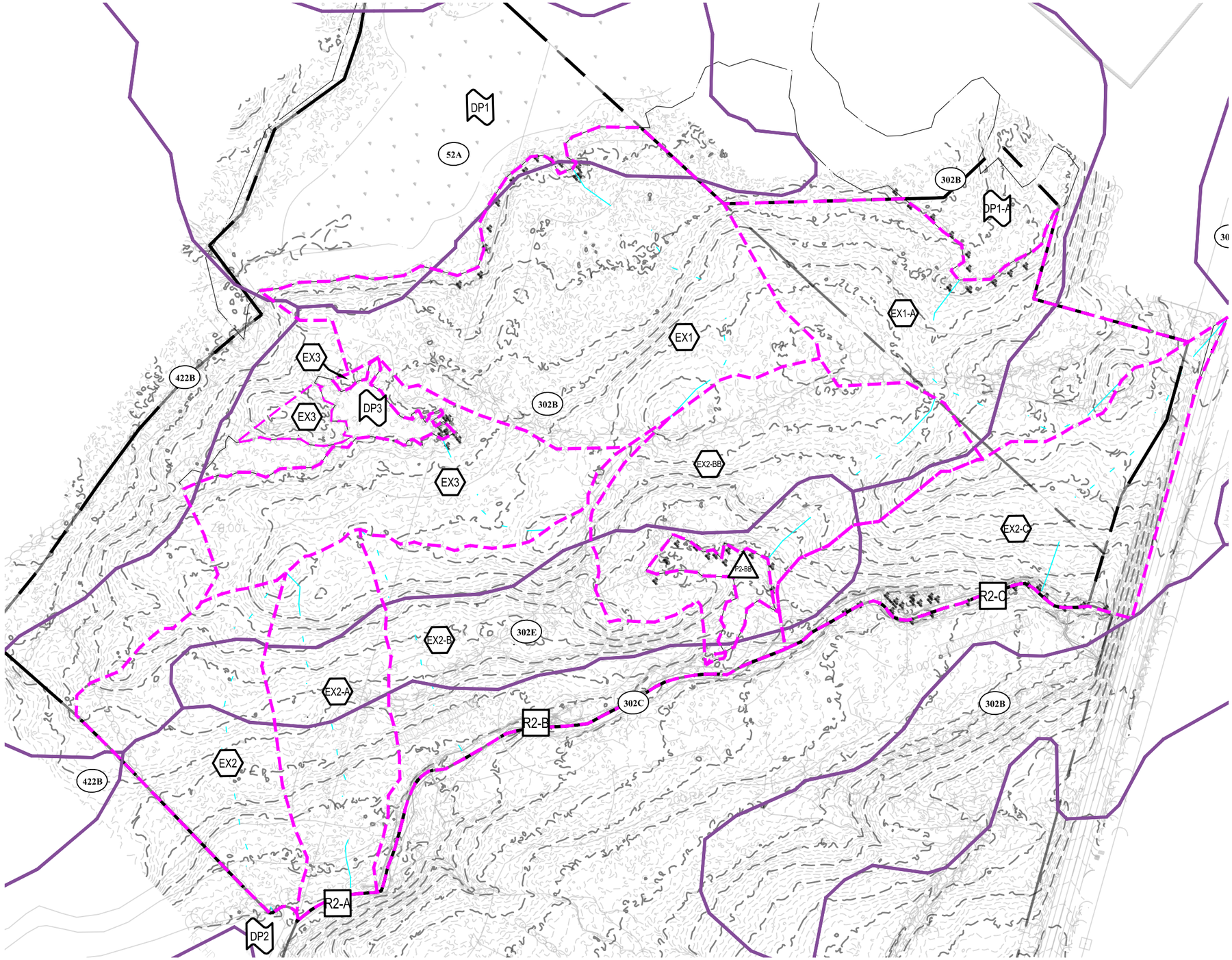

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SYMBOLS

- DESIGN POINT
- DRAINAGE AREA DESIGNATION
- POND
- REACH

LINETYPES

- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- SOIL TYPE BOUNDARY
- 100' BUFFER ZONE
- WETLAND BOUNDARY

SCS SOIL CLASSIFICATIONS

3A	SCARBORO AND WALPOLE SOILS, 0 TO 3 PERCENT SLOPES, HSG B/D
52A	FREETOWN MUCK, 0 TO 1 PERCENT SLOPES, HSG B/D
73A	WHITMAN FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES, EXTREMELY STONY, HSG D
302B	MONTAUK FINE SANDY LOAM, 0 TO 8 PERCENT SLOPES, EXTREMELY STONY, HSG C
302C	MONTAUK FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES, EXTREMELY STONY, HSG C
302E	MONTAUK FINE SANDY LOAM, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY, HSG C
422B	CANTON FINE SANDY LOAM, 0 TO 8 PERCENT SLOPES, EXTREMELY STONY, HSG B

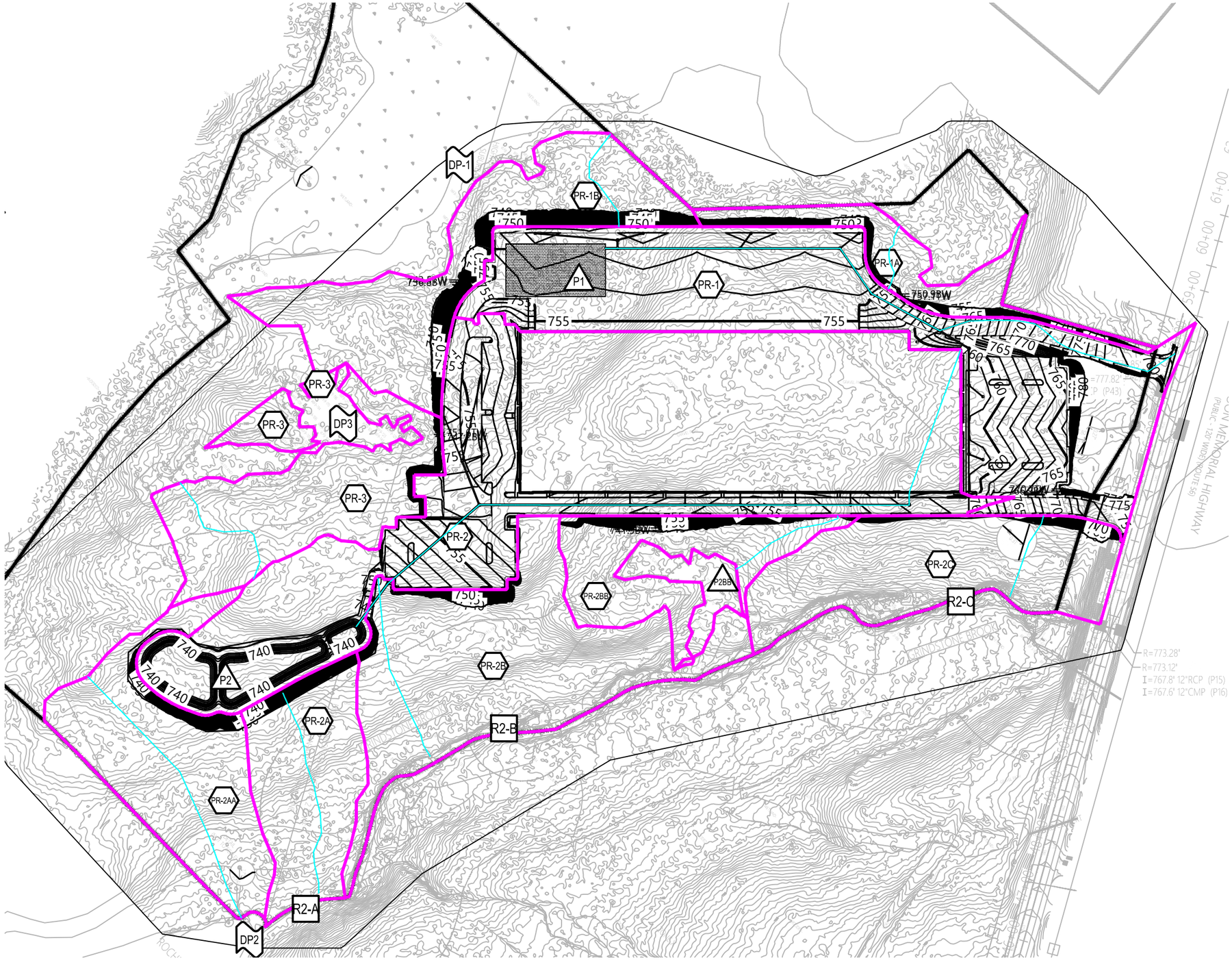
0 100 200 Feet

Existing Drainage Conditions

Figure 2

Leicester Central
Leicester, Massachusetts

December 2021



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SYMBOLS

- DESIGN POINT
- DRAINAGE AREA DESIGNATION
- POND
- REACH

LINETYPES

- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- SOIL TYPE BOUNDARY
- 100' BUFFER ZONE
- WETLAND BOUNDARY

4–220 4–219

0 100 200 Feet

vhb

Proposed Drainage Conditions

Leicester Central
Leicester, MA

Figure 3

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Regulatory Compliance

Massachusetts Department of Environmental Protection (DEP) – Stormwater Management Standards

As demonstrated below, the proposed Project fully complies with the DEP Stormwater Management Standards.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to comply with Standard 1.

The Best Management Practices (BMPs) included in the proposed stormwater management system have been designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges will result from the Project are presented through compliance with Standards 4 through 6.

All proposed Project stormwater outlets and conveyances have been designed to not cause erosion or scour to wetlands or receiving waters. Outlets from closed drainage systems have been designed with flared end sections and stone protection to dissipate discharge velocities. Overflows from BMP's that impound stormwater have been designed protect downgradient areas from erosion.

Computations and supporting information for the sizing and selection of materials used to protect from scour and erosion are included in Appendix A.

Standard 2: Peak Rate Attenuation

The Project has been designed to comply with Standard 2.

The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 25 and 100 years. The results of the analysis, as summarized in Table 3 below, indicate that there is no increase in peak discharge rates between the existing and proposed conditions for the analyzed storms.

Computations and supporting information regarding the hydrologic modeling are included in Appendix B.

Table 3 Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point: DP1				
Existing	6.74	17.82	25.69	38.59
Proposed	4.14	16.60	24.51	37.93
Design Point: DP1-A				
Existing	3.10	8.42	12.19	18.38
Proposed	0.98	2.54	3.64	5.42
Design Point: DP2				
Existing	11.51	32.61	47.79	72.94
Proposed	11.35	32.24	47.37	72.01
Design Point: DP3				
Existing	2.83	7.67	11.10	16.73
Proposed	2.26	6.06	8.76	13.17

Standard 3: Stormwater Recharge

The Project is seeking relief under Stormwater Management Standard 7 and as such complies with Standard 3 to the maximum extent practicable.

In accordance with the Stormwater Handbook, the Required Recharge Volume for the Project is therefore 11,905 cubic feet.

Recharge of stormwater has been provided through the use of a subsurface infiltration basin, which has been sized using the static method. Each infiltration BMP has been designed to drain completely within 72 hours. Table 5 below provides a summary of the proposed infiltration BMPs utilized for the Project.

Table 5 Summary of Recharge Calculations

Infiltration BMP	Provided Recharge Volume (cubic feet)
Basin P1	17,772
Total Provided Recharge	**17,772**
Total Required Recharge*	**11,905**

***The Adjusted Recharge Volume with the capture area adjust factor is 32,080 cubic feet. Due to high groundwater and C and D soils, we are recharging to the maximum extent practicable and exceeding the required recharge volume before applying the capture area adjustment.**

Soil evaluation (including Geotechnical Report), computations, and supporting information are included in Appendix C.

Standard 4: Water Quality

The Project has been designed to comply with Standard 4.

The proposed stormwater management system implements a treatment train of BMPs that has been designed to provide 80% TSS removal of stormwater runoff from all proposed impervious surfaces [as well as 44% pretreatment prior to infiltration BMPs] – engineer to include if pretreatment is required.

Computations and supporting information, including the Long-Term Pollution Prevention Plan, are included in Appendix D.

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

The Project is considered a LUHPPL and therefore has been designed with suitable BMPs sized to treat the 1 inch Water Quality Volume and provide the pretreatment requirement of 44% TSS removal prior to infiltration. Proposed source controls and pollution prevention measures have been identified in the Long-Term Pollution Prevention Plan included in Appendix D.

For computations and supporting information regarding the sizing of BMPs suitable for treatment of runoff from LUHPPLs, see Appendix D.

Standard 6: Critical Areas

The Project will not discharge stormwater near or to a critical area.

For computations and supporting information regarding the sizing of BMPs suitable for treatment of runoff near or to critical areas, see Appendix D.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

The Project site is comprised solely of C and D soils and bedrock therefore the Project has been designed to comply with Stormwater Management Standards 2-6 to the maximum extent practicable. Standards 8-10 have been met completely.

Refer directly to each Standard for applicable computations and supporting information demonstrating compliance with each.

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

The Project will disturb more than one acre of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance

begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are included in Appendix F.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project. The O&M Plan is included in Appendix D as part of the Long Term Pollution Prevention Plan.

Standard 10: Prohibition of Illicit Discharges

The site was previously undeveloped and no sanitary sewer or storm drainage infrastructure is known to exist on the site. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Appendix A: Standard 1 Computations and Supporting Information

- Precipitation Frequency Data
- Pipe Sizing Calculations

  The closed drainage system was designed for the 10-year storm event. Drainage pipes were sized using Manning's Equation for full-flow capacity and the Rational Method. Additionally, the performance of the system was analyzed using StormCAD, a HEC-22 based program.
- Stone outlet protection for pipe ends

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NOAA Atlas 14, Volume 10, Version 3
Location name: Rochdale, Massachusetts, USA*
Latitude: 42.2079°, Longitude: -71.9054°
Elevation: 790.82 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.08** (3.28-5.04)	**4.80** (3.84-5.93)	**5.98** (4.75-7.40)	**6.96** (5.51-8.69)	**8.30** (6.34-10.9)	**9.32** (6.94-12.5)	**10.4** (7.45-14.6)	**11.5** (7.82-16.7)	**13.1** (8.53-19.9)	**14.4** (9.12-22.3)
10-min	**2.89** (2.32-3.57)	**3.40** (2.72-4.20)	**4.24** (3.38-5.26)	**4.93** (3.91-6.16)	**5.89** (4.48-7.72)	**6.61** (4.92-8.89)	**7.36** (5.28-10.3)	**8.17** (5.55-11.8)	**9.29** (6.05-14.1)	**10.2** (6.46-15.8)
15-min	**2.27** (1.82-2.80)	**2.67** (2.14-3.30)	**3.32** (2.65-4.12)	**3.87** (3.06-4.83)	**4.62** (3.52-6.06)	**5.18** (3.85-6.97)	**5.77** (4.14-8.09)	**6.40** (4.35-9.29)	**7.29** (4.74-11.0)	**8.00** (5.06-12.4)
30-min	**1.55** (1.24-1.91)	**1.82** (1.46-2.25)	**2.27** (1.81-2.81)	**2.64** (2.09-3.30)	**3.15** (2.40-4.14)	**3.54** (2.64-4.76)	**3.94** (2.83-5.53)	**4.38** (2.97-6.35)	**4.99** (3.24-7.54)	**5.47** (3.47-8.49)
60-min	**0.981** (0.785-1.21)	**1.16** (0.924-1.43)	**1.44** (1.15-1.79)	**1.68** (1.33-2.09)	**2.00** (1.52-2.62)	**2.25** (1.67-3.02)	**2.50** (1.80-3.51)	**2.78** (1.89-4.03)	**3.16** (2.06-4.79)	**3.47** (2.20-5.39)
2-hr	**0.625** (0.504-0.765)	**0.739** (0.595-0.906)	**0.926** (0.742-1.14)	**1.08** (0.861-1.34)	**1.29** (0.994-1.69)	**1.45** (1.09-1.95)	**1.62** (1.18-2.28)	**1.82** (1.24-2.62)	**2.11** (1.37-3.17)	**2.35** (1.49-3.62)
3-hr	**0.476** (0.385-0.580)	**0.565** (0.457-0.691)	**0.712** (0.573-0.873)	**0.833** (0.667-1.03)	**1.00** (0.772-1.31)	**1.12** (0.848-1.51)	**1.26** (0.920-1.77)	**1.42** (0.967-2.04)	**1.66** (1.08-2.48)	**1.86** (1.18-2.85)
6-hr	**0.297** (0.242-0.360)	**0.357** (0.291-0.433)	**0.454** (0.368-0.553)	**0.535** (0.431-0.657)	**0.647** (0.503-0.840)	**0.729** (0.554-0.974)	**0.819** (0.604-1.15)	**0.928** (0.636-1.33)	**1.09** (0.717-1.63)	**1.24** (0.789-1.89)
12-hr	**0.181** (0.148-0.217)	**0.220** (0.180-0.265)	**0.284** (0.232-0.343)	**0.337** (0.273-0.410)	**0.410** (0.321-0.529)	**0.464** (0.355-0.616)	**0.522** (0.387-0.729)	**0.594** (0.408-0.843)	**0.703** (0.462-1.04)	**0.797** (0.510-1.21)
24-hr	**0.108** (0.089-0.129)	**0.132** (0.109-0.158)	**0.172** (0.142-0.207)	**0.206** (0.168-0.249)	**0.251** (0.198-0.323)	**0.285** (0.220-0.377)	**0.322** (0.240-0.447)	**0.367** (0.254-0.518)	**0.436** (0.288-0.641)	**0.496** (0.318-0.745)
2-day	**0.062** (0.052-0.073)	**0.076** (0.064-0.091)	**0.100** (0.083-0.119)	**0.120** (0.098-0.144)	**0.146** (0.116-0.187)	**0.166** (0.129-0.218)	**0.188** (0.141-0.260)	**0.215** (0.149-0.301)	**0.257** (0.170-0.375)	**0.293** (0.189-0.437)
3-day	**0.045** (0.038-0.053)	**0.055** (0.046-0.066)	**0.072** (0.060-0.086)	**0.087** (0.072-0.104)	**0.106** (0.084-0.135)	**0.120** (0.094-0.158)	**0.136** (0.103-0.187)	**0.156** (0.108-0.217)	**0.186** (0.123-0.271)	**0.213** (0.137-0.316)
4-day	**0.036** (0.030-0.043)	**0.044** (0.037-0.052)	**0.058** (0.048-0.069)	**0.069** (0.057-0.083)	**0.085** (0.068-0.107)	**0.096** (0.075-0.125)	**0.108** (0.082-0.149)	**0.124** (0.086-0.172)	**0.148** (0.098-0.215)	**0.169** (0.109-0.251)
7-day	**0.025** (0.021-0.029)	**0.030** (0.025-0.035)	**0.038** (0.032-0.045)	**0.045** (0.038-0.054)	**0.055** (0.044-0.069)	**0.062** (0.049-0.081)	**0.070** (0.053-0.095)	**0.080** (0.056-0.110)	**0.095** (0.063-0.136)	**0.107** (0.070-0.158)
10-day	**0.020** (0.017-0.023)	**0.024** (0.020-0.028)	**0.030** (0.025-0.035)	**0.035** (0.030-0.042)	**0.042** (0.034-0.053)	**0.048** (0.037-0.061)	**0.053** (0.040-0.072)	**0.060** (0.042-0.083)	**0.071** (0.047-0.102)	**0.080** (0.052-0.117)
20-day	**0.014** (0.012-0.017)	**0.016** (0.014-0.019)	**0.020** (0.017-0.023)	**0.022** (0.019-0.026)	**0.026** (0.021-0.032)	**0.029** (0.023-0.037)	**0.032** (0.024-0.042)	**0.035** (0.025-0.048)	**0.040** (0.027-0.057)	**0.044** (0.028-0.064)
30-day	**0.012** (0.010-0.014)	**0.013** (0.011-0.015)	**0.016** (0.013-0.018)	**0.017** (0.015-0.020)	**0.020** (0.016-0.025)	**0.022** (0.017-0.028)	**0.024** (0.018-0.031)	**0.026** (0.019-0.035)	**0.029** (0.019-0.041)	**0.031** (0.020-0.045)
45-day	**0.010** (0.009-0.011)	**0.011** (0.009-0.013)	**0.012** (0.011-0.014)	**0.014** (0.012-0.016)	**0.016** (0.013-0.019)	**0.017** (0.013-0.021)	**0.018** (0.014-0.024)	**0.020** (0.014-0.026)	**0.021** (0.014-0.030)	**0.022** (0.014-0.032)
60-day	**0.009** (0.008-0.010)	**0.009** (0.008-0.011)	**0.011** (0.009-0.012)	**0.012** (0.010-0.014)	**0.013** (0.011-0.016)	**0.014** (0.011-0.017)	**0.015** (0.011-0.019)	**0.016** (0.011-0.022)	**0.017** (0.012-0.024)	**0.018** (0.012-0.026)

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

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

Please refer to NOAA Atlas 14 document for more information.

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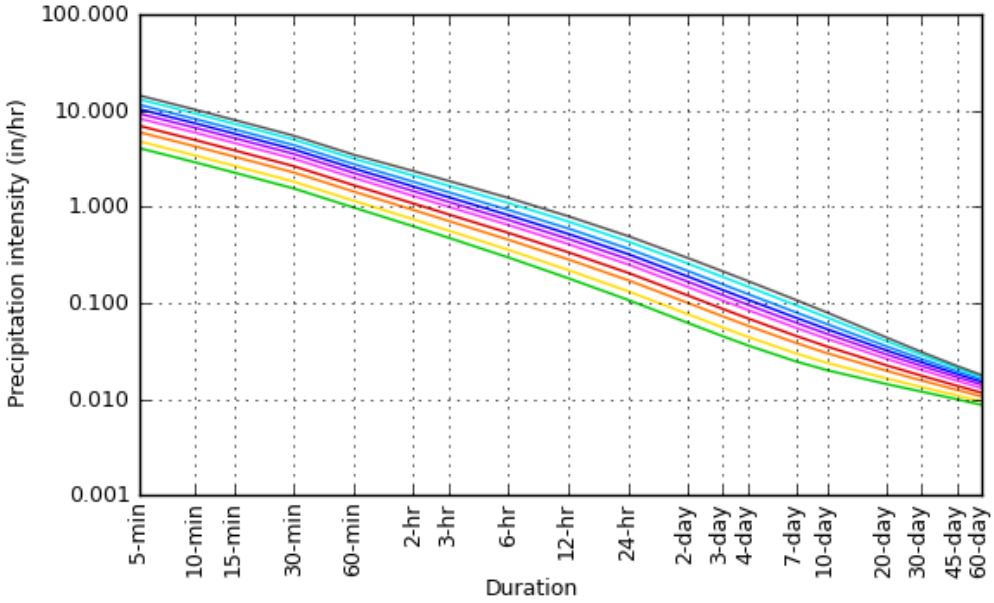
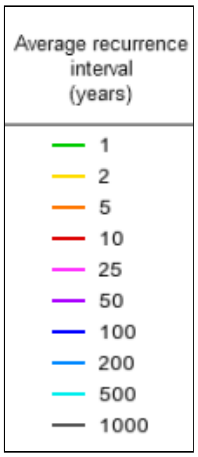
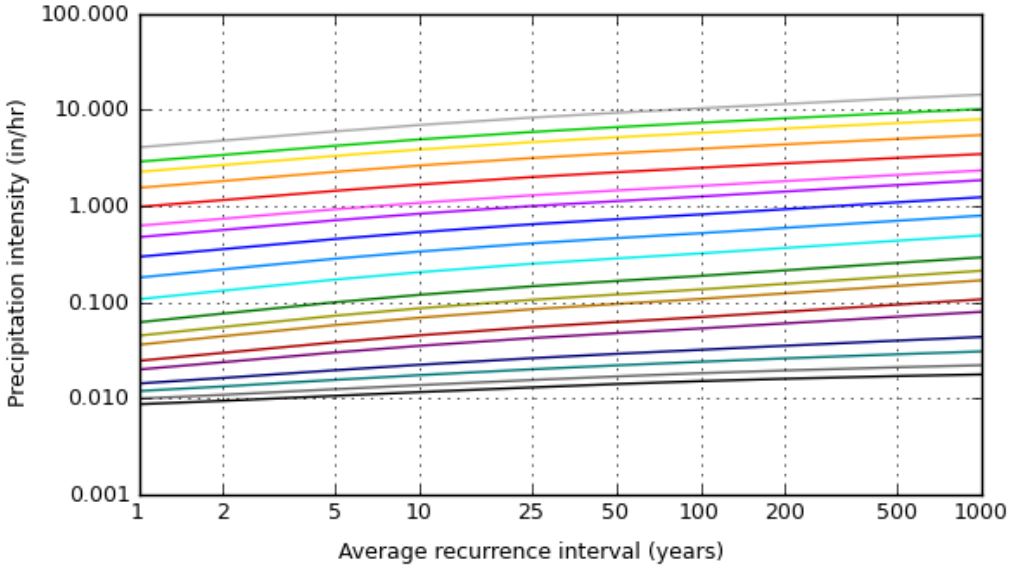
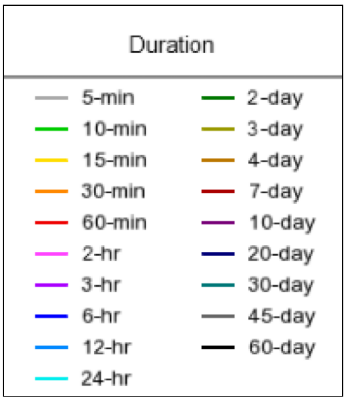
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 42.2079°, Longitude: -71.9054°









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Created (GMT): Tue Nov 9 18:35:01 2021

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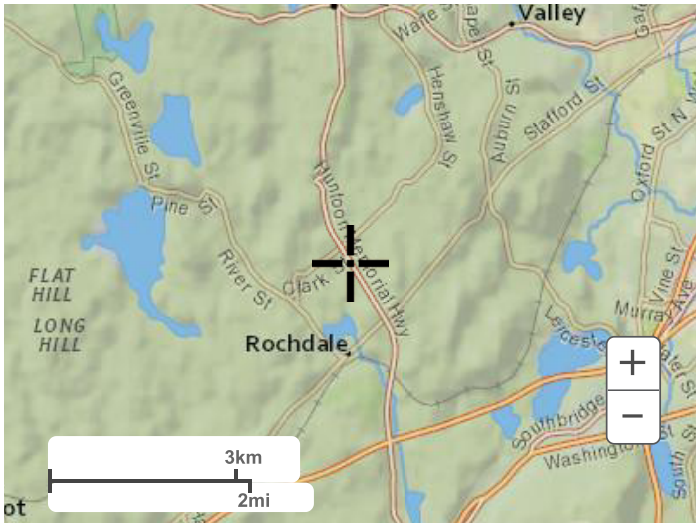
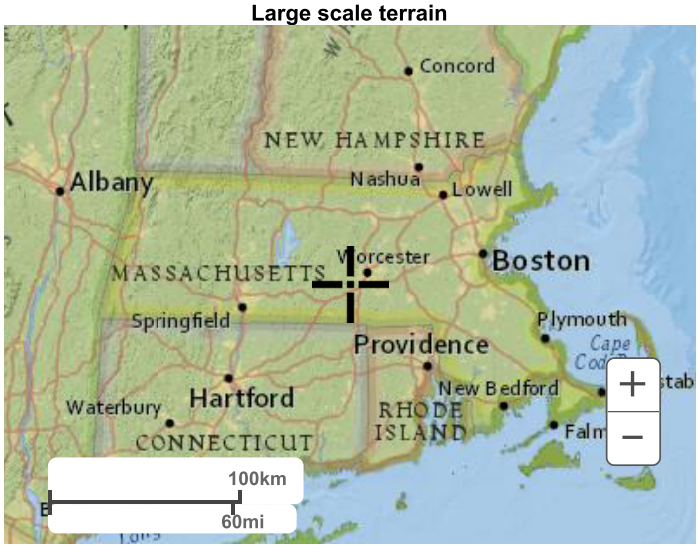
Maps & aerials

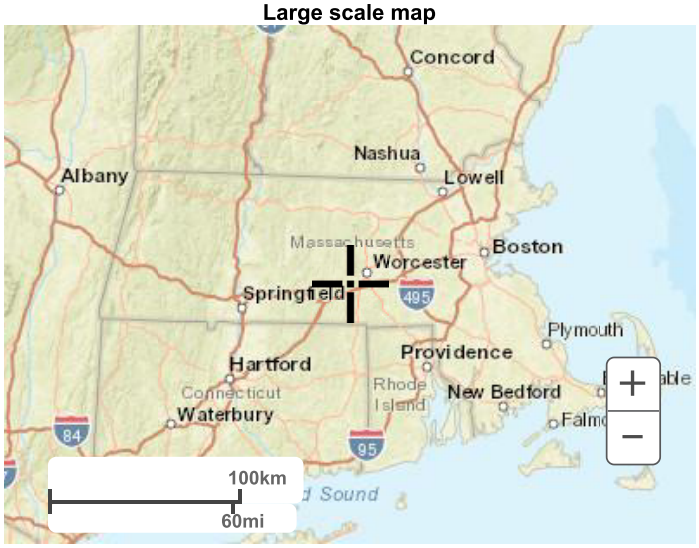
Small scale terrain



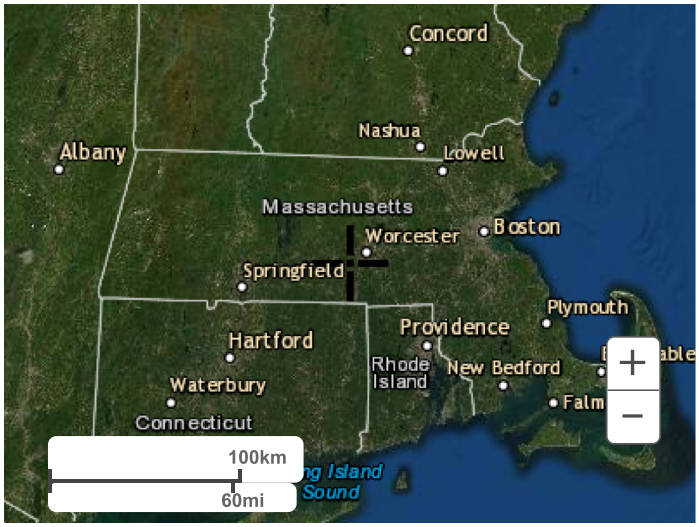
Large scale terrain



Large scale map



Large scale aerial



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

Stormcad Conduit Output Table - Hydraulic Pipe Analysis

Project	Leicester Central	**Project #**	15392
Calculated by	CSH	**Date**	12/7/2021
Checked by	REW	**Date**	12/7/2021

Start Node	Stop Node	Upstream Inlet Area	Upstream Inlet C	System CA	Time of Conc.	Intensity	Pipe Size	Material	Manning's "n"	Slope	Length	Capacity (Full Flow)	Capacity (Design)	Velocity (Average)	Rim (Upper)	Hydraulic Grade Line In	Rim (Lower)	Hydraulic Grade Line Out	Invert (Upper)	Invert (Lower)
-	-	(acres)	-	(acres)	(min)	(in/hr)	(in)	-	-	(ft/ft)	(ft)	(cfs)	(cfs)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
DMH 213	DMH 211	(N/A)	(N/A)	1.495	0.0	7.81	24.0	CHDPE	0.013	0.011	149.7	23.4	23.4	7.5	761.8	753.0	754.2	751.2	751.8	750.2
DMH 215	DMH 213	(N/A)	(N/A)	1.249	0.0	7.89	24.0	CHDPE	0.013	0.011	66.0	23.3	23.3	7.1	761.3	753.7	761.8	753.0	752.6	751.9
DMH 218	DMH 216	(N/A)	(N/A)	0.689	0.0	8.15	24.0	CHDPE	0.013	0.010	132.7	22.4	22.4	5.9	758.7	755.7	758.7	754.6	754.9	753.6
DMH 216	DMH 215	(N/A)	(N/A)	1.249	0.0	7.97	24.0	CHDPE	0.013	0.011	71.0	24.0	24.0	7.3	758.7	754.6	761.3	753.6	753.5	752.7
DMH 116	DMH 115	(N/A)	(N/A)	0.767	0.0	8.32	18.0	CHDPE	0.013	0.011	113.3	11.3	11.3	6.1	758.3	752.4	756.8	751.6	752.7	751.4
DMH 109	DMH 104	(N/A)	(N/A)	6.099	0.0	7.69	36.0	CHDPE	0.013	0.011	191.5	69.8	69.8	10.2	757.9	746.6	757.6	744.8	744.9	742.8
DMH 104	DMH 101	(N/A)	(N/A)	7.011	0.0	7.53	36.0	CHDPE	0.013	0.010	232.9	66.3	66.3	10.4	757.6	744.8	744.2	742.1	742.4	740.1
DMH 110	DMH 109	(N/A)	(N/A)	5.331	0.0	7.77	36.0	CHDPE	0.013	0.011	99.3	70.2	70.2	10.0	757.3	747.6	757.9	746.6	746.1	745.0
DMH 115	DMH 114	(N/A)	(N/A)	1.535	0.0	8.17	24.0	CHDPE	0.013	0.011	106.3	24.0	24.0	7.5	756.8	751.6	755.5	750.7	751.3	750.1
DMH 111	DMH 110	(N/A)	(N/A)	4.563	0.0	7.85	30.0	CHDPE	0.013	0.011	106.3	43.6	43.6	9.8	756.4	748.7	757.3	747.6	747.4	746.2
DMH 114	DMH 112	(N/A)	(N/A)	2.303	0.0	8.05	24.0	CHDPE	0.013	0.011	106.3	24.0	24.0	8.2	755.5	750.7	755.3	749.7	750.0	748.8
DMH 105	DMH 104	(N/A)	(N/A)	0.913	0.0	8.07	24.0	CHDPE	0.013	0.021	90.4	32.8	32.8	8.4	755.3	745.4	757.6	744.8	744.4	742.5
DMH 112	DMH 111	(N/A)	(N/A)	3.796	0.0	7.95	30.0	CHDPE	0.013	0.011	106.3	43.6	43.6	9.3	755.3	749.7	756.4	748.7	748.7	747.5
DMH 201	FES 200	(N/A)	(N/A)	0.000	0.0	10.71	24.0	CHDPE	0.013	0.145	34.5	86.2	86.2	20.4	754.3	744.4	740.3	738.6	743.0	738.0
DMH 211	DMH 210	(N/A)	(N/A)	1.628	0.0	7.65	24.0	CHDPE	0.013	0.013	105.8	26.0	26.0	8.2	754.2	751.4	752.5	750.1	750.1	748.7
DMH 202	DMH 201	(N/A)	(N/A)	0.000	0.0	10.74	24.0	CHDPE	0.013	0.042	49.3	46.2	46.2	13.0	752.9	746.5	754.3	743.9	745.2	743.1
WQU 203	BASIN IN	(N/A)	(N/A)	4.510	0.0	6.98	36.0	CHDPE	0.013	0.004	23.1	43.9	43.9	6.8	752.5	748.6	748.9	748.4	746.7	746.6
DMH 210	DMH 207	(N/A)	(N/A)	2.150	0.0	7.55	30.0	CHDPE	0.013	0.005	193.1	28.0	28.0	5.9	752.5	750.1	752.4	749.5	748.7	747.8
DMH 207	WQU 203	(N/A)	(N/A)	2.970	0.0	7.28	30.0	CHDPE	0.013	0.005	236.0	28.0	28.0	6.3	752.4	749.5	752.5	748.6	747.8	746.7
DMH 204	WQU 203	(N/A)	(N/A)	1.541	0.0	8.13	24.0	CHDPE	0.013	0.019	15.9	31.1	31.1	9.4	752.3	748.5	752.5	748.6	747.0	746.7
DMH 101	FES 100	(N/A)	(N/A)	7.658	0.0	7.35	36.0	CHDPE	0.013	0.010	102.1	66.0	66.0	10.5	744.2	742.4	740.7	741.2	740.0	739.0
CB 220	DMH 218	0.246	0.788	0.194	5.0	8.33	12.0	CHDPE	0.013	0.013	111.6	4.1	4.1	5.0	759.5	757.0	758.7	755.7	756.5	755.0
CB 219	DMH 218	0.671	0.739	0.496	5.0	8.33	18.0	CHDPE	0.013	0.010	29.0	10.7	10.7	5.7	759.3	756.1	758.7	755.7	755.3	755.0
CB 217	DMH 216	0.879	0.637	0.560	5.0	8.33	12.0	CHDPE	0.013	0.049	34.8	7.9	7.9	10.5	759.3	756.2	758.7	754.6	755.3	753.6
CB 214	DMH 213	0.266	0.900	0.239	5.0	8.33	12.0	CHDPE	0.013	0.090	59.9	10.7	10.7	10.5	764.5	758.8	761.8	753.1	758.2	752.8
CB 212	DMH 211	0.147	0.900	0.132	5.0	8.33	12.0	CHDPE	0.013	0.016	18.6	4.5	4.5	4.8	754.2	751.4	754.2	751.4	750.5	750.2
CB 209	DMH 210	0.678	0.771	0.523	5.0	8.33	12.0	CHDPE	0.013	0.026	46.3	5.7	5.7	5.6	751.6	750.8	752.5	750.1	749.3	748.1
CB 208	DMH 207	0.937	0.874	0.819	5.0	8.33	18.0	CHDPE	0.013	0.008	35.9	9.6	9.6	5.9	751.6	749.5	752.4	749.5	748.5	748.2
CB 206	DMH 204	0.959	0.858	0.822	5.0	8.33	18.0	CHDPE	0.013	0.008	50.9	9.3	9.3	5.8	751.6	749.0	752.3	748.6	748.0	747.6
CB 205	DMH 204	0.926	0.776	0.718	5.0	8.33	18.0	CHDPE	0.013	0.011	159.3	10.9	10.9	6.3	751.6	750.3	752.3	748.4	749.3	747.6
CB 107	DMH 105	0.822	0.614	0.504	5.0	8.33	12.0	CHDPE	0.013	0.021	90.7	5.2	5.2	7.3	752.6	747.3	755.3	745.4	746.4	744.5
CB 108	DMH 105	0.222	0.851	0.189	5.0	8.33	12.0	CHDPE	0.013	0.020	182.3	5.1	5.1	5.7	755.5	750.7	755.3	746.9	750.2	746.5

Stormcad Conduit Output Table - Hydraulic Pipe Analysis

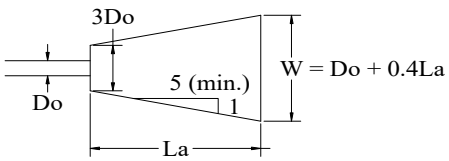
Project	Leicester Central	**Project #**	15392
Calculated by	CSH	**Date**	12/7/2021
Checked by	REW	**Date**	12/7/2021

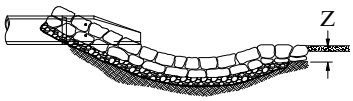
Start Node	Stop Node	Upstream Inlet Area	Upstream Inlet C	System CA	Time of Conc.	Intensity	Pipe Size	Material	Manning's "n"	Slope	Length	Capacity (Full Flow)	Capacity (Design)	Velocity (Average)	Rim (Upper)	Hydraulic Grade Line In	Rim (Lower)	Hydraulic Grade Line Out	Invert (Upper)	Invert (Lower)
-	-	(acres)	-	(acres)	(min)	(in/hr)	(in)	-	-	(ft/ft)	(ft)	(cfs)	(cfs)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
CB 106	DMH 105	0.266	0.827	0.220	5.0	8.33	12.0	CHDPE	0.013	0.022	41.5	5.3	5.3	6.1	755.5	746.0	755.3	745.4	745.4	744.5
RL 7	DMH 109	0.853	0.900	0.768	5.0	8.33	12.0	CHDPE	0.013	0.079	24.1	10.0	10.0	14.1	759.3	754.3	757.9	751.8	753.3	751.4
RL 6	DMH 110	0.853	0.900	0.768	5.0	8.33	12.0	CHDPE	0.013	0.079	24.1	10.0	10.0	14.1	759.3	754.3	757.3	751.8	753.3	751.4

Outfall Riprap Sizing and Velocity Calculations

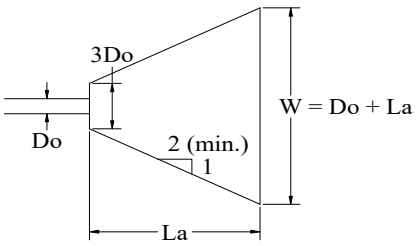
Project	Leicester Central	**Project #**	15392
Calculated by	CSH	**Date**	12/7/2021
Checked by	REW	**Date**	12/7/2021

Tw ≥ 0.5Do





Tw < 0.5Do



OUTLET DESCRIPTION:		**FES-100**	**FES-119**	**FES-200**	**FES-302**
Design Storm	(yr)	25	25	25	25
Flow / Discharge (Q)	(cfs)	56.2	56.2	14.4	8.0
Defined Channel ?	-	NO	NO	NO	NO
Defined Channel Width	(ft)	0	0	0	0
Outlet Pipe Diameter (D_O)	(in)	36	24	24	12
Tailwater Condition (T_W)	(ft)	TW ≥ 0.5D	TW ≥ 0.5D	TW ≥ 0.5D	TW ≥ 0.5D
Apron Length (L_A)	(ft)	20	13	16	20
Apron Width at Outlet ($3D_O$)	(ft)	9	6	6	3
Apron Width at End (W)	(ft)	11	7.2	8.4	9
Median Stone Diameter (d_{50})	(in)	8.4	9.4	6	6
Largest Stone Diameter	(in)	12.6	14.1	9	9
Apron Depth (Z)	(in)	18.9	21.15	13.5	13.5

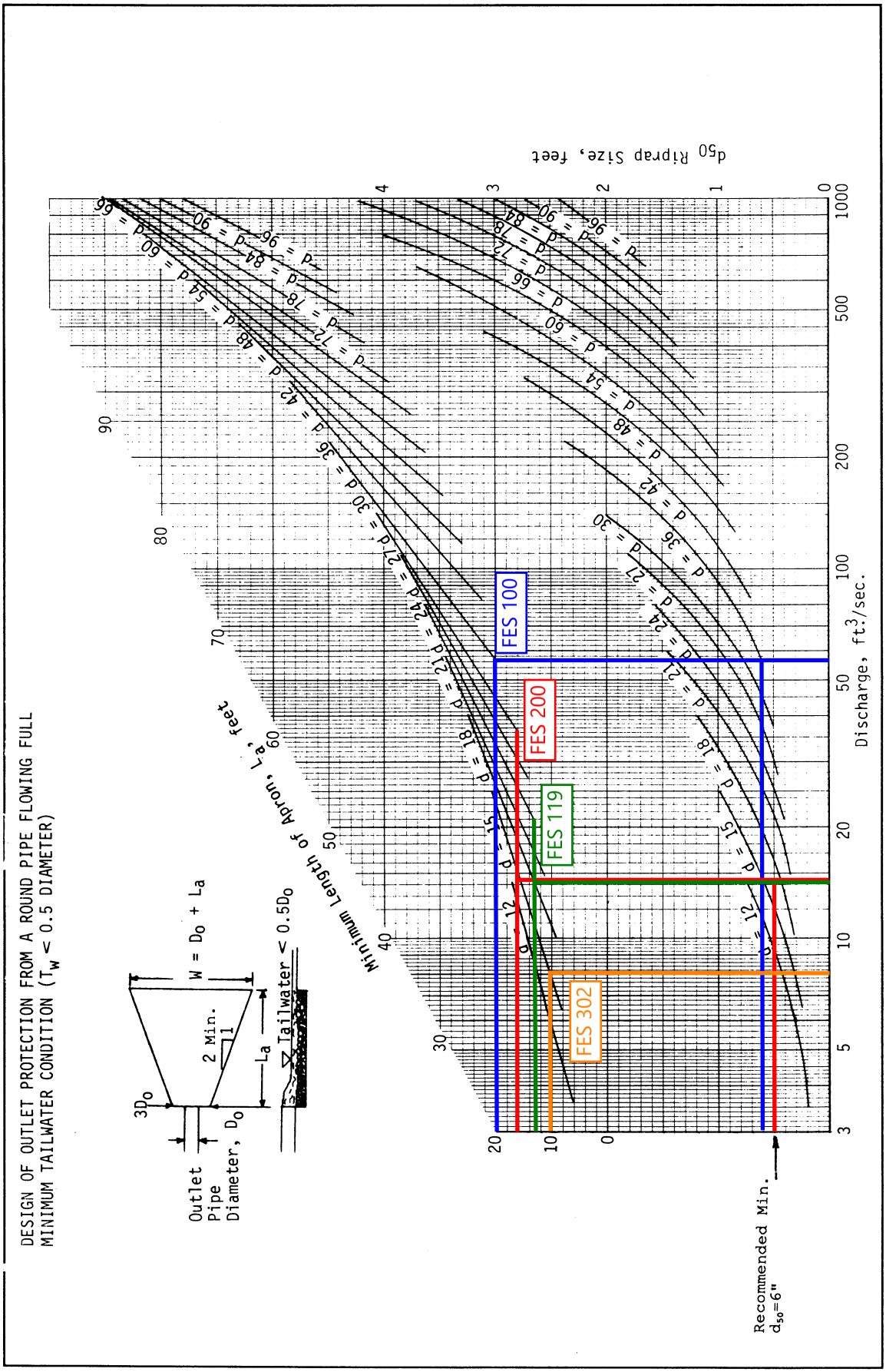
Apron Length (L_A):
Length = From Virginia DCR Handbook - Plate 3.18-3 *if T_W < 0.5D*
Length = From Virginia DCR Handbook - Plate 3.18-4 *if T_W ≥ 0.5D*

Apron Width at Outlet ($3D_O$):
Width = 3 x pipe dia. (or width of channel)

Apron Width at End (W):
Width = dia. + apron length *if T_W < 0.5D*
Width = dia. + 0.4 x apron length *if T_W ≥ 0.5D*
or apron width = channel width if a well defined channel exists

Rock Riprap:
Median Diameter (d_{50}) = From Virginia DCR Handbook - Plate 3.18-3 or 4
Largest stone dia = 1.5 x d_{50}

Apron Depth (Z):
6" or 1.5 x largest stone dia



Source: USDA-SCS Plate 3.18-3

Appendix B: Standard 2 Computations and Supporting Information

The rainfall-runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of 2, 10, 25 and 100-years. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm and NOAA Atlas 14 precipitation depths for the site: 3.17, 4.93, 6.03, and 7.73 inches, respectively. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 2 and 3 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. Drainage areas used in the analyses were described in previous sections and shown on Figures 2 and 3. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

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NOAA Atlas 14, Volume 10, Version 3
Location name: Rochdale, Massachusetts, USA*
Latitude: 42.2079°, Longitude: -71.9054°
Elevation: 790.82 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.340** (0.273-0.420)	**0.400** (0.320-0.494)	**0.498** (0.396-0.617)	**0.580** (0.459-0.724)	**0.692** (0.528-0.908)	**0.777** (0.578-1.05)	**0.865** (0.621-1.21)	**0.960** (0.652-1.39)	**1.09** (0.711-1.66)	**1.20** (0.760-1.86)
10-min	**0.482** (0.386-0.595)	**0.567** (0.454-0.700)	**0.706** (0.563-0.876)	**0.822** (0.651-1.03)	**0.981** (0.747-1.29)	**1.10** (0.820-1.48)	**1.23** (0.880-1.72)	**1.36** (0.925-1.97)	**1.55** (1.01-2.35)	**1.70** (1.08-2.64)
15-min	**0.567** (0.454-0.699)	**0.667** (0.534-0.824)	**0.831** (0.662-1.03)	**0.967** (0.765-1.21)	**1.15** (0.879-1.51)	**1.30** (0.963-1.74)	**1.44** (1.03-2.02)	**1.60** (1.09-2.32)	**1.82** (1.19-2.76)	**2.00** (1.27-3.10)
30-min	**0.774** (0.620-0.954)	**0.911** (0.729-1.13)	**1.14** (0.904-1.41)	**1.32** (1.05-1.65)	**1.58** (1.20-2.07)	**1.77** (1.32-2.38)	**1.97** (1.42-2.76)	**2.19** (1.49-3.18)	**2.49** (1.62-3.77)	**2.74** (1.73-4.25)
60-min	**0.981** (0.785-1.21)	**1.16** (0.924-1.43)	**1.44** (1.15-1.79)	**1.68** (1.33-2.09)	**2.00** (1.52-2.62)	**2.25** (1.67-3.02)	**2.50** (1.80-3.51)	**2.78** (1.89-4.03)	**3.16** (2.06-4.79)	**3.47** (2.20-5.39)
2-hr	**1.25** (1.01-1.53)	**1.48** (1.19-1.81)	**1.85** (1.49-2.28)	**2.16** (1.72-2.68)	**2.59** (1.99-3.38)	**2.90** (2.18-3.90)	**3.24** (2.36-4.56)	**3.63** (2.48-5.24)	**4.21** (2.75-6.34)	**4.70** (2.98-7.23)
3-hr	**1.43** (1.16-1.74)	**1.70** (1.37-2.07)	**2.14** (1.72-2.62)	**2.50** (2.00-3.09)	**3.00** (2.32-3.92)	**3.38** (2.55-4.53)	**3.78** (2.76-5.31)	**4.25** (2.90-6.12)	**4.97** (3.25-7.45)	**5.58** (3.55-8.56)
6-hr	**1.78** (1.45-2.15)	**2.14** (1.74-2.59)	**2.72** (2.21-3.31)	**3.21** (2.58-3.93)	**3.87** (3.01-5.03)	**4.37** (3.32-5.83)	**4.90** (3.61-6.88)	**5.55** (3.81-7.94)	**6.55** (4.29-9.76)	**7.41** (4.72-11.3)
12-hr	**2.18** (1.79-2.62)	**2.65** (2.17-3.19)	**3.42** (2.79-4.14)	**4.06** (3.29-4.94)	**4.94** (3.86-6.38)	**5.59** (4.27-7.42)	**6.29** (4.67-8.78)	**7.15** (4.92-10.2)	**8.47** (5.57-12.5)	**9.60** (6.14-14.5)
24-hr	**2.58** (2.14-3.09)	**3.17** (2.62-3.79)	**4.13** (3.40-4.97)	**4.93** (4.03-5.97)	**6.03** (4.75-7.74)	**6.85** (5.27-9.04)	**7.73** (5.76-10.7)	**8.81** (6.08-12.4)	**10.5** (6.90-15.4)	**11.9** (7.63-17.9)
2-day	**2.97** (2.48-3.53)	**3.67** (3.05-4.36)	**4.80** (3.98-5.73)	**5.74** (4.72-6.90)	**7.03** (5.58-8.97)	**7.98** (6.19-10.5)	**9.03** (6.78-12.5)	**10.3** (7.15-14.5)	**12.3** (8.15-18.0)	**14.1** (9.05-21.0)
3-day	**3.24** (2.71-3.83)	**3.99** (3.34-4.72)	**5.22** (4.34-6.20)	**6.24** (5.15-7.46)	**7.64** (6.08-9.71)	**8.67** (6.74-11.3)	**9.80** (7.39-13.5)	**11.2** (7.79-15.6)	**13.4** (8.89-19.5)	**15.3** (9.88-22.8)
4-day	**3.48** (2.92-4.10)	**4.27** (3.58-5.04)	**5.56** (4.64-6.59)	**6.64** (5.50-7.92)	**8.12** (6.48-10.3)	**9.21** (7.18-12.0)	**10.4** (7.86-14.3)	**11.9** (8.28-16.5)	**14.2** (9.44-20.6)	**16.2** (10.5-24.1)
7-day	**4.14** (3.50-4.85)	**5.01** (4.23-5.88)	**6.44** (5.41-7.59)	**7.63** (6.36-9.05)	**9.26** (7.42-11.6)	**10.5** (8.19-13.5)	**11.8** (8.91-16.0)	**13.4** (9.36-18.5)	**15.9** (10.6-22.9)	**18.0** (11.7-26.6)
10-day	**4.80** (4.07-5.61)	**5.72** (4.84-6.69)	**7.22** (6.09-8.48)	**8.47** (7.09-10.0)	**10.2** (8.18-12.7)	**11.5** (8.98-14.7)	**12.8** (9.70-17.3)	**14.5** (10.1-19.9)	**17.0** (11.3-24.4)	**19.1** (12.4-28.1)
20-day	**6.87** (5.87-7.97)	**7.85** (6.70-9.11)	**9.44** (8.02-11.0)	**10.8** (9.07-12.6)	**12.6** (10.2-15.5)	**14.0** (11.0-17.7)	**15.4** (11.6-20.3)	**17.0** (12.0-23.1)	**19.2** (12.9-27.3)	**20.9** (13.6-30.6)
30-day	**8.61** (7.39-9.94)	**9.61** (8.24-11.1)	**11.3** (9.60-13.1)	**12.6** (10.7-14.7)	**14.5** (11.7-17.7)	**15.9** (12.5-19.9)	**17.4** (13.0-22.6)	**18.8** (13.3-25.5)	**20.8** (14.0-29.4)	**22.2** (14.5-32.3)
45-day	**10.8** (9.28-12.4)	**11.8** (10.2-13.6)	**13.5** (11.6-15.6)	**14.9** (12.7-17.3)	**16.8** (13.6-20.4)	**18.3** (14.4-22.7)	**19.8** (14.8-25.4)	**21.1** (15.0-28.5)	**22.8** (15.4-32.1)	**24.0** (15.6-34.7)
60-day	**12.6** (10.9-14.4)	**13.6** (11.8-15.6)	**15.3** (13.2-17.7)	**16.8** (14.3-19.5)	**18.8** (15.3-22.6)	**20.3** (16.0-25.1)	**21.8** (16.3-27.8)	**23.1** (16.5-31.1)	**24.6** (16.7-34.6)	**25.6** (16.8-36.9)

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

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

Please refer to NOAA Atlas 14 document for more information.

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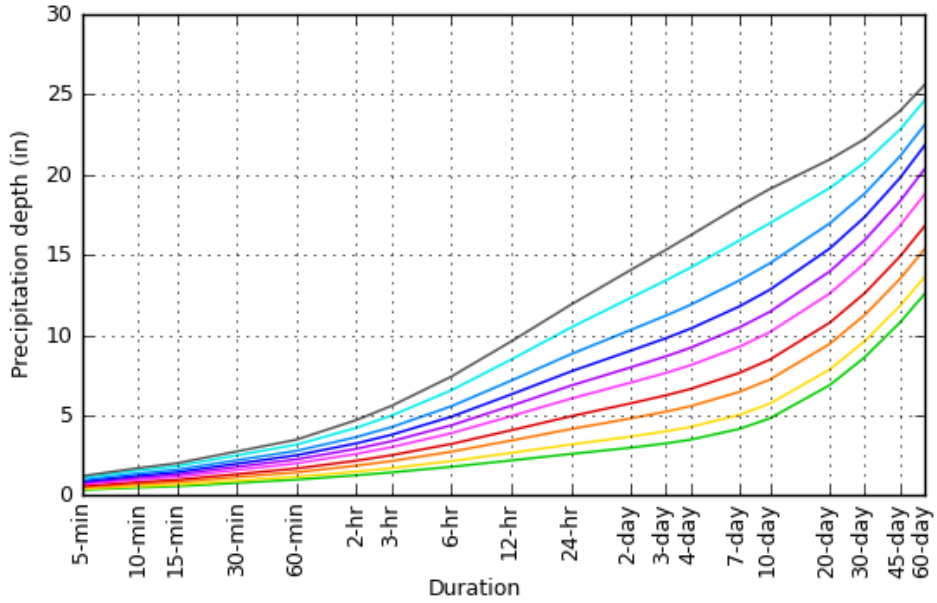
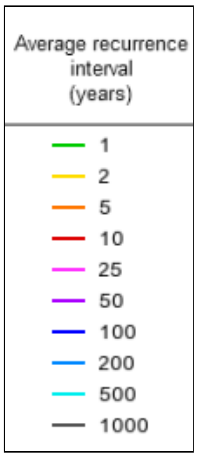
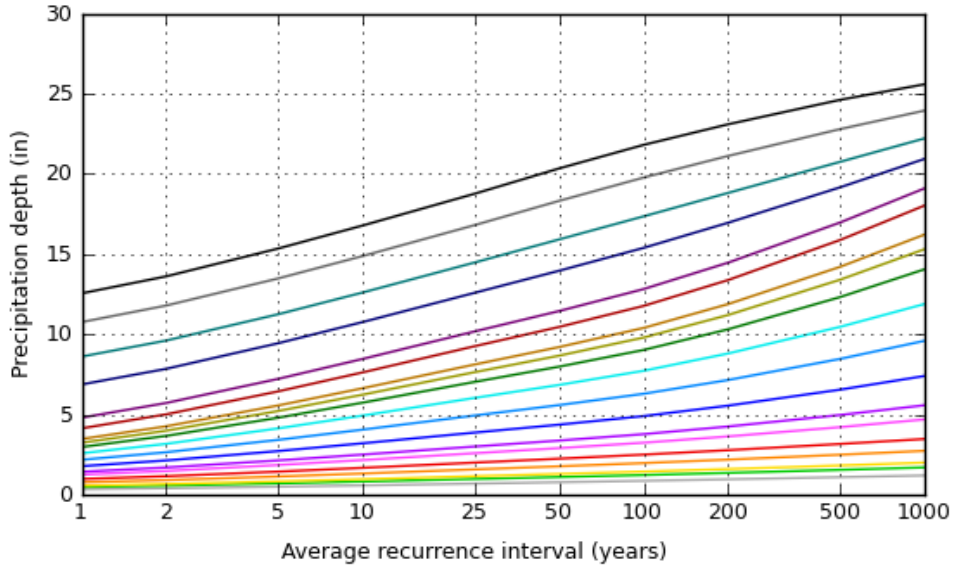
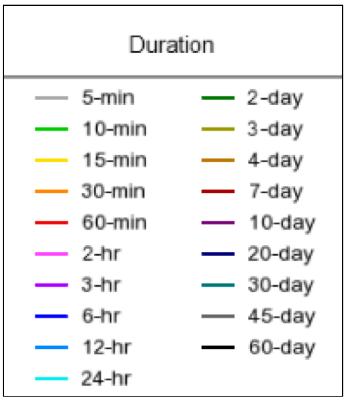
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.2079°, Longitude: -71.9054°









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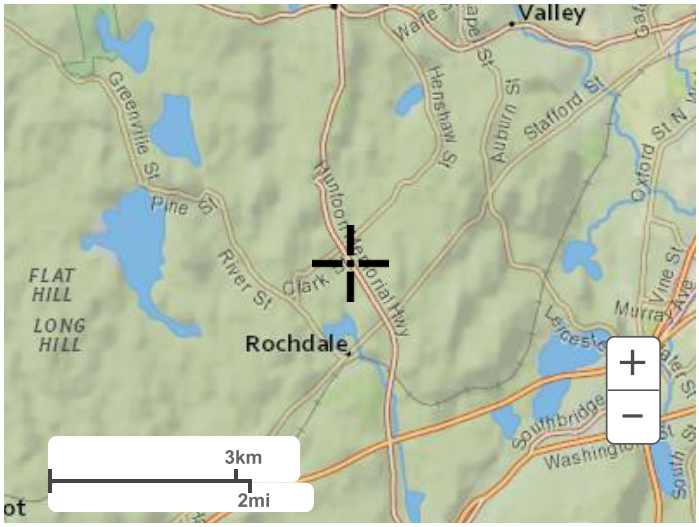
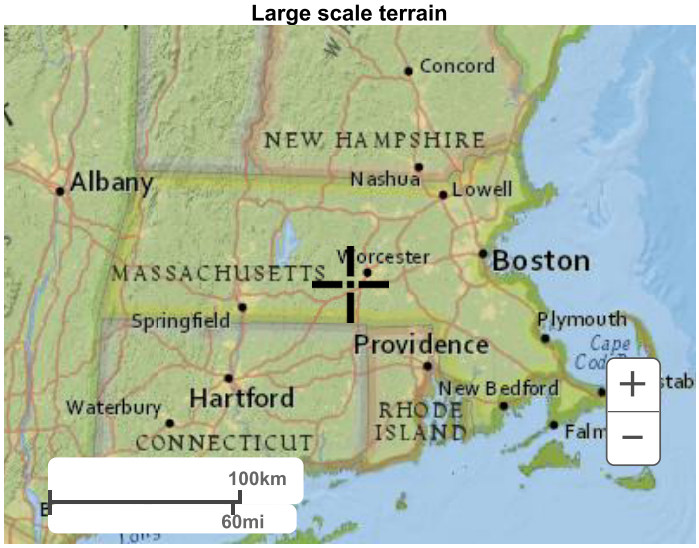
Maps & aerials

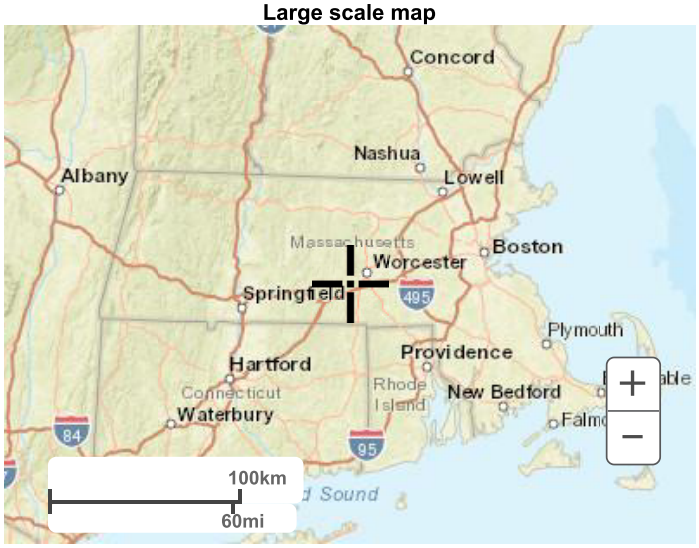
Small scale terrain



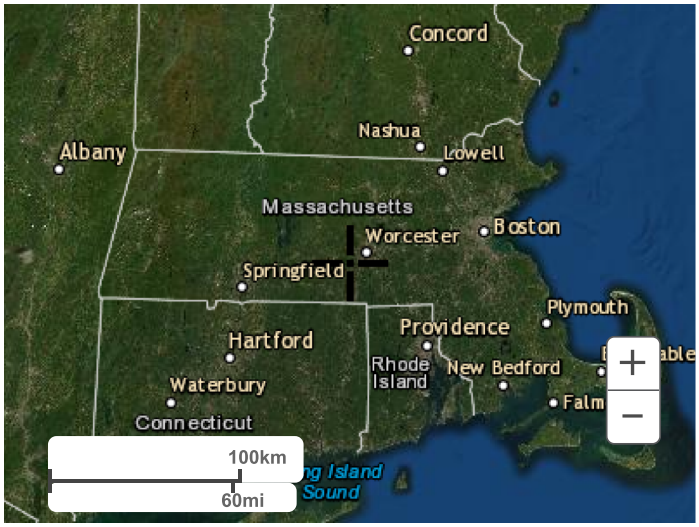
Large scale terrain



Large scale map



Large scale aerial



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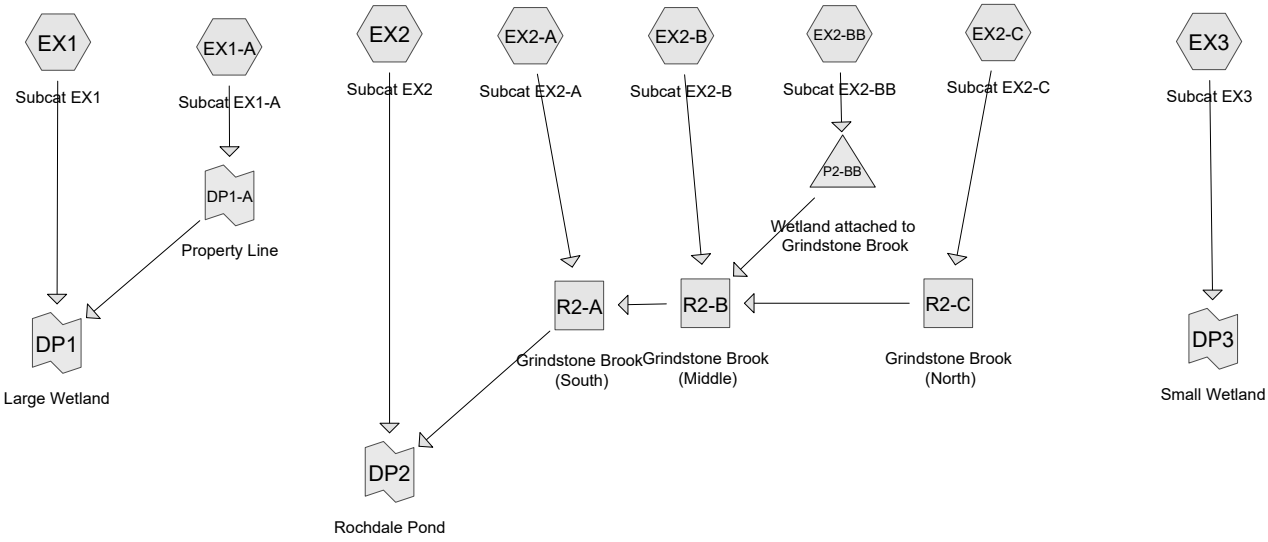
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov



Subcat Reach Pond Link

Routing Diagram for 15392.00 - EX
Prepared by VHB, Printed 12/14/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.00	65	Brush, Good, HSG C (EX2-C)
0.03	92	Paved roads w/open ditches, 50% imp, HSG C (EX2-C)
0.03	55	Woods, Good, HSG B (EX1, EX2, EX3)
37.27	70	Woods, Good, HSG C (EX1, EX1-A, EX2, EX2-A, EX2-B, EX2-BB, EX2-C, EX3)
0.74	77	Woods, Good, HSG D (EX1)
38.08	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.00	HSG A	
0.03	HSG B	EX1, EX2, EX3
37.30	HSG C	EX1, EX1-A, EX2, EX2-A, EX2-B, EX2-BB, EX2-C, EX3
0.74	HSG D	EX1
0.00	Other	
38.08		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.00	0.00	0.00	0.00	0.00	0.00	Brush, Good	EX 2-C
0.00	0.00	0.03	0.00	0.00	0.03	Paved roads w/open ditches, 50% imp	EX 2-C
0.00	0.03	37.27	0.74	0.00	38.05	Woods, Good	EX 1, EX 1-A, EX 2, EX 2-A, EX 2-B, EX 2-BB, EX 2-C, EX 3
0.00	**0.03**	**37.30**	**0.74**	**0.00**	**38.08**	**TOTAL AREA**	

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX1: Subcat EX1 Runoff Area=7.83 ac 0.00% Impervious Runoff Depth>0.77"
Flow Length=663' Tc=27.0 min CN=71 Runoff=4.24 cfs 0.503 af

Subcatchment EX1-A: Subcat EX1-A Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=636' Tc=15.4 min CN=70 Runoff=3.10 cfs 0.301 af

Subcatchment EX2: Subcat EX2 Runoff Area=3.40 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=703' Tc=16.0 min CN=70 Runoff=2.09 cfs 0.206 af

Subcatchment EX2-A: Subcat EX2-A Runoff Area=3.11 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=636' Tc=13.5 min CN=70 Runoff=2.04 cfs 0.189 af

Subcatchment EX2-B: Subcat EX2-B Runoff Area=4.95 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=476' Tc=13.1 min CN=70 Runoff=3.29 cfs 0.301 af

Subcatchment EX2-BB: Subcat EX2-BB Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=452' Tc=22.8 min CN=70 Runoff=2.66 cfs 0.300 af

Subcatchment EX2-C: Subcat EX2-C Runoff Area=4.87 ac 0.30% Impervious Runoff Depth>0.73"
Flow Length=651' Tc=9.5 min CN=70 Runoff=3.60 cfs 0.296 af

Subcatchment EX3: Subcat EX3 Runoff Area=4.00 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=295' Tc=10.9 min CN=70 Runoff=2.83 cfs 0.243 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.49' Max Vel=3.53 fps Inflow=9.87 cfs 1.076 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=110.72 cfs Outflow=9.78 cfs 1.074 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.42' Max Vel=4.62 fps Inflow=8.79 cfs 0.895 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=8.29 cfs 0.888 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.31' Max Vel=3.69 fps Inflow=3.60 cfs 0.296 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=3.44 cfs 0.295 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=2.66 cfs 0.300 af
Primary=2.66 cfs 0.300 af

Link DP1: Large Wetland Inflow=6.74 cfs 0.804 af
Primary=6.74 cfs 0.804 af

Link DP1-A: Property Line Inflow=3.10 cfs 0.301 af
Primary=3.10 cfs 0.301 af

Link DP2: Rochdale Pond Inflow=11.51 cfs 1.280 af
Primary=11.51 cfs 1.280 af

Link DP3: Small Wetland Inflow=2.83 cfs 0.243 af
Primary=2.83 cfs 0.243 af

Total Runoff Area = 38.08 ac Runoff Volume = 2.339 af Average Runoff Depth = 0.74"
99.96% Pervious = 38.06 ac 0.04% Impervious = 0.01 ac

Summary for Subcatchment EX1: Subcat EX1

Runoff = 4.24 cfs @ 12.42 hrs, Volume= 0.503 af, Depth> 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.02	55	Woods, Good, HSG B
7.08	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
7.83	71	Weighted Average
7.83		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0340	0.05		**Sheet Flow, First 50 feet** Woods: Dense underbrush n= 0.800 P2= 3.17"
3.6	235	0.0464	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	81	0.1519	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	297	0.0350	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.0	663	Total			

Summary for Subcatchment EX1-A: Subcat EX1-A

Runoff = 3.10 cfs @ 12.24 hrs, Volume= 0.301 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	38	0.0789	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	195	0.0359	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	190	0.0526	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.4	163	0.0534	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.4	636	Total			

Summary for Subcatchment EX2: Subcat EX2

Runoff = 2.09 cfs @ 12.25 hrs, Volume= 0.206 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.00	55	Woods, Good, HSG B
3.39	70	Woods, Good, HSG C
3.40	70	Weighted Average
3.40		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0580	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	60	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	368	0.0842	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	40	0.1750	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	185	0.0454	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.0	703	Total			

Summary for Subcatchment EX2-A: Subcat EX2-A

Runoff = 2.04 cfs @ 12.21 hrs, Volume= 0.189 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
3.11	70	Woods, Good, HSG C
3.11		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.6	74	0.1514	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	254	0.0937	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	48	0.1354	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	210	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.5	636	Total			

Summary for Subcatchment EX2-B: Subcat EX2-B

Runoff = 3.29 cfs @ 12.21 hrs, Volume= 0.301 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
4.95	70	Woods, Good, HSG C
4.95		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0540	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
1.1	76	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	58	0.1724	2.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	144	0.0764	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	148	0.1101	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	476	Total			

Summary for Subcatchment EX2-BB: Subcat EX2-BB

Runoff = 2.66 cfs @ 12.36 hrs, Volume= 0.300 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	263	0.0354	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	139	0.0784	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.8	452	Total			

Summary for Subcatchment EX2-C: Subcat EX2-C

Runoff = 3.60 cfs @ 12.15 hrs, Volume= 0.296 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.00	65	Brush, Good, HSG C
0.03	92	Paved roads w/open ditches, 50% imp, HSG C
4.84	70	Woods, Good, HSG C
4.87	70	Weighted Average
4.85		99.70% Pervious Area
0.01		0.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0220	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.6	115	0.0591	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.1	207	0.0290	0.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	131	0.0687	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.4	148	0.1243	1.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.5	651	Total			

Summary for Subcatchment EX3: Subcat EX3

Runoff = 2.83 cfs @ 12.17 hrs, Volume= 0.243 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.01	55	Woods, Good, HSG B
3.98	70	Woods, Good, HSG C
4.00	70	Weighted Average
4.00		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0740	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.6	245	0.0518	1.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	295	Total			

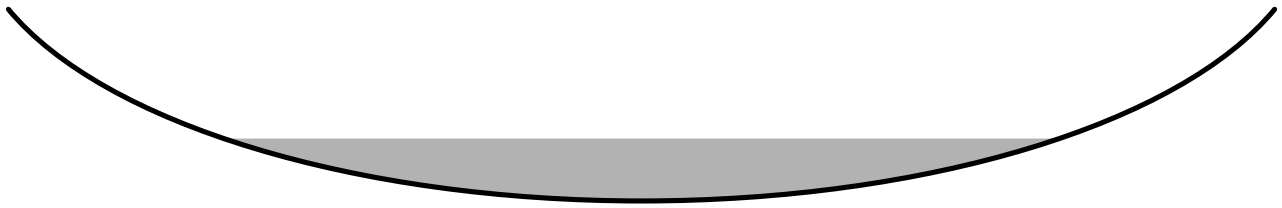
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 17.88 ac, 0.08% Impervious, Inflow Depth > 0.72" for 2-year event
Inflow = 9.87 cfs @ 12.37 hrs, Volume= 1.076 af
Outflow = 9.78 cfs @ 12.40 hrs, Volume= 1.074 af, Atten= 1%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.53 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.77 fps, Avg. Travel Time= 1.7 min

Peak Storage= 495 cf @ 12.38 hrs
Average Depth at Peak Storage= 0.49' , Surface Width= 8.55'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 110.72 cfs

15.00' x 1.50' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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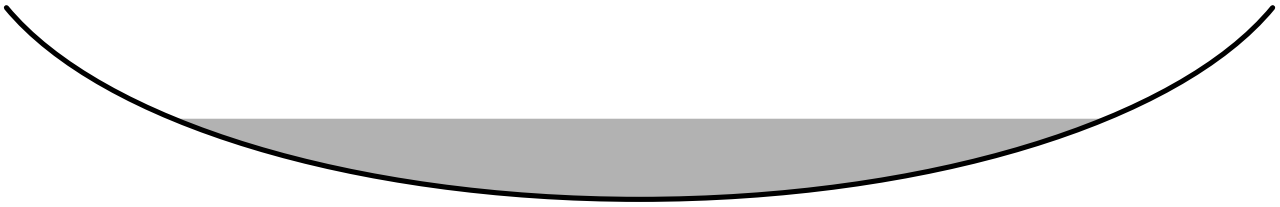
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 14.78 ac, 0.10% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 8.79 cfs @ 12.24 hrs, Volume= 0.895 af
Outflow = 8.29 cfs @ 12.39 hrs, Volume= 0.888 af, Atten= 6%, Lag= 8.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.62 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 2.30 fps, Avg. Travel Time= 8.7 min

Peak Storage= 2,187 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.42' , Surface Width= 6.48'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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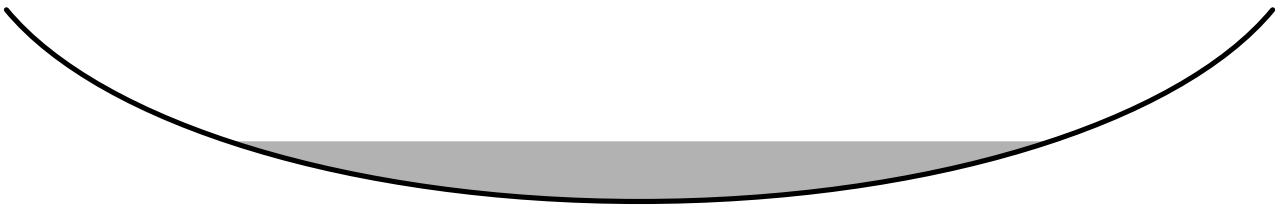
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 4.87 ac, 0.30% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 3.60 cfs @ 12.15 hrs, Volume= 0.296 af
Outflow = 3.44 cfs @ 12.22 hrs, Volume= 0.295 af, Atten= 4%, Lag= 4.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.69 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 4.8 min

Peak Storage= 467 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.31' , Surface Width= 4.48'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 2.66 cfs @ 12.36 hrs, Volume= 0.300 af
Primary = 2.66 cfs @ 12.36 hrs, Volume= 0.300 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 12.80 ac, 0.00% Impervious, Inflow Depth > 0.75" for 2-year event
Inflow = 6.74 cfs @ 12.36 hrs, Volume= 0.804 af
Primary = 6.74 cfs @ 12.36 hrs, Volume= 0.804 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 3.10 cfs @ 12.24 hrs, Volume= 0.301 af
Primary = 3.10 cfs @ 12.24 hrs, Volume= 0.301 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 21.28 ac, 0.07% Impervious, Inflow Depth > 0.72" for 2-year event
Inflow = 11.51 cfs @ 12.39 hrs, Volume= 1.280 af
Primary = 11.51 cfs @ 12.39 hrs, Volume= 1.280 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 4.00 ac, 0.00% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 2.83 cfs @ 12.17 hrs, Volume= 0.243 af
Primary = 2.83 cfs @ 12.17 hrs, Volume= 0.243 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX1: Subcat EX1 Runoff Area=7.83 ac 0.00% Impervious Runoff Depth>1.89"
Flow Length=663' Tc=27.0 min CN=71 Runoff=11.01 cfs 1.232 af

Subcatchment EX1-A: Subcat EX1-A Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>1.82"
Flow Length=636' Tc=15.4 min CN=70 Runoff=8.42 cfs 0.753 af

Subcatchment EX2: Subcat EX2 Runoff Area=3.40 ac 0.00% Impervious Runoff Depth>1.82"
Flow Length=703' Tc=16.0 min CN=70 Runoff=5.65 cfs 0.515 af

Subcatchment EX2-A: Subcat EX2-A Runoff Area=3.11 ac 0.00% Impervious Runoff Depth>1.82"
Flow Length=636' Tc=13.5 min CN=70 Runoff=5.52 cfs 0.471 af

Subcatchment EX2-B: Subcat EX2-B Runoff Area=4.95 ac 0.00% Impervious Runoff Depth>1.82"
Flow Length=476' Tc=13.1 min CN=70 Runoff=8.88 cfs 0.751 af

Subcatchment EX2-BB: Subcat EX2-BB Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>1.81"
Flow Length=452' Tc=22.8 min CN=70 Runoff=7.17 cfs 0.750 af

Subcatchment EX2-C: Subcat EX2-C Runoff Area=4.87 ac 0.30% Impervious Runoff Depth>1.82"
Flow Length=651' Tc=9.5 min CN=70 Runoff=9.71 cfs 0.740 af

Subcatchment EX3: Subcat EX3 Runoff Area=4.00 ac 0.00% Impervious Runoff Depth>1.82"
Flow Length=295' Tc=10.9 min CN=70 Runoff=7.67 cfs 0.607 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.79' Max Vel=4.84 fps Inflow=27.66 cfs 2.698 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=110.72 cfs Outflow=27.49 cfs 2.695 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.67' Max Vel=6.30 fps Inflow=24.01 cfs 2.239 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=23.18 cfs 2.227 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.50' Max Vel=5.02 fps Inflow=9.71 cfs 0.740 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=9.32 cfs 0.738 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=7.17 cfs 0.750 af
Primary=7.17 cfs 0.750 af

Link DP1: Large Wetland Inflow=17.82 cfs 1.985 af
Primary=17.82 cfs 1.985 af

Link DP1-A: Property Line Inflow=8.42 cfs 0.753 af
Primary=8.42 cfs 0.753 af

Link DP2: Rochdale Pond Inflow=32.61 cfs 3.210 af
Primary=32.61 cfs 3.210 af

Link DP3: Small Wetland Inflow=7.67 cfs 0.607 af
Primary=7.67 cfs 0.607 af

Total Runoff Area = 38.08 ac Runoff Volume = 5.819 af Average Runoff Depth = 1.83"
99.96% Pervious = 38.06 ac 0.04% Impervious = 0.01 ac

Summary for Subcatchment EX1: Subcat EX1

Runoff = 11.01 cfs @ 12.39 hrs, Volume= 1.232 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.02	55	Woods, Good, HSG B
7.08	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
7.83	71	Weighted Average
7.83		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0340	0.05		**Sheet Flow, First 50 feet** Woods: Dense underbrush n= 0.800 P2= 3.17"
3.6	235	0.0464	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	81	0.1519	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	297	0.0350	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.0	663	Total			

Summary for Subcatchment EX1-A: Subcat EX1-A

Runoff = 8.42 cfs @ 12.22 hrs, Volume= 0.753 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	38	0.0789	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	195	0.0359	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	190	0.0526	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.4	163	0.0534	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.4	636	Total			

Summary for Subcatchment EX2: Subcat EX2

Runoff = 5.65 cfs @ 12.23 hrs, Volume= 0.515 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.00	55	Woods, Good, HSG B
3.39	70	Woods, Good, HSG C
3.40	70	Weighted Average
3.40		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0580	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	60	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	368	0.0842	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	40	0.1750	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	185	0.0454	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.0	703	Total			

Summary for Subcatchment EX2-A: Subcat EX2-A

Runoff = 5.52 cfs @ 12.20 hrs, Volume= 0.471 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
3.11	70	Woods, Good, HSG C
3.11		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.6	74	0.1514	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	254	0.0937	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	48	0.1354	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	210	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.5	636	Total			

Summary for Subcatchment EX2-B: Subcat EX2-B

Runoff = 8.88 cfs @ 12.19 hrs, Volume= 0.751 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
4.95	70	Woods, Good, HSG C
4.95		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0540	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
1.1	76	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	58	0.1724	2.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	144	0.0764	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	148	0.1101	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	476	Total			

Summary for Subcatchment EX2-BB: Subcat EX2-BB

Runoff = 7.17 cfs @ 12.33 hrs, Volume= 0.750 af, Depth> 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	263	0.0354	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	139	0.0784	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.8	452	Total			

Summary for Subcatchment EX2-C: Subcat EX2-C

Runoff = 9.71 cfs @ 12.14 hrs, Volume= 0.740 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.00	65	Brush, Good, HSG C
0.03	92	Paved roads w/open ditches, 50% imp, HSG C
4.84	70	Woods, Good, HSG C
4.87	70	Weighted Average
4.85		99.70% Pervious Area
0.01		0.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0220	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.6	115	0.0591	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.1	207	0.0290	0.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	131	0.0687	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.4	148	0.1243	1.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.5	651	Total			

Summary for Subcatchment EX3: Subcat EX3

Runoff = 7.67 cfs @ 12.16 hrs, Volume= 0.607 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.01	55	Woods, Good, HSG B
3.98	70	Woods, Good, HSG C
4.00	70	Weighted Average
4.00		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0740	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.6	245	0.0518	1.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	295	Total			

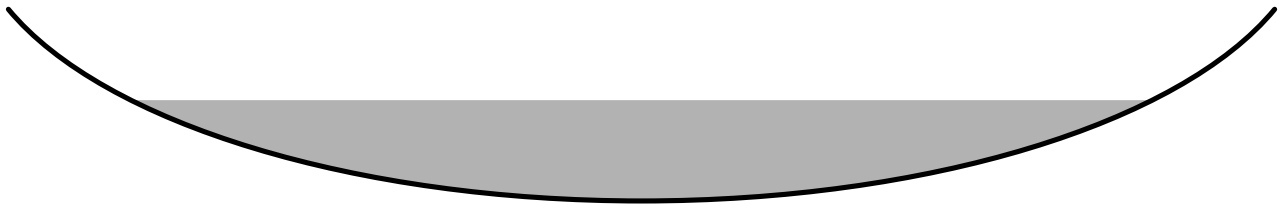
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 17.88 ac, 0.08% Impervious, Inflow Depth > 1.81" for 10-year event
Inflow = 27.66 cfs @ 12.30 hrs, Volume= 2.698 af
Outflow = 27.49 cfs @ 12.32 hrs, Volume= 2.695 af, Atten= 1%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.14 fps, Avg. Travel Time= 1.4 min

Peak Storage= 1,017 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.79' , Surface Width= 10.87'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 110.72 cfs

15.00' x 1.50' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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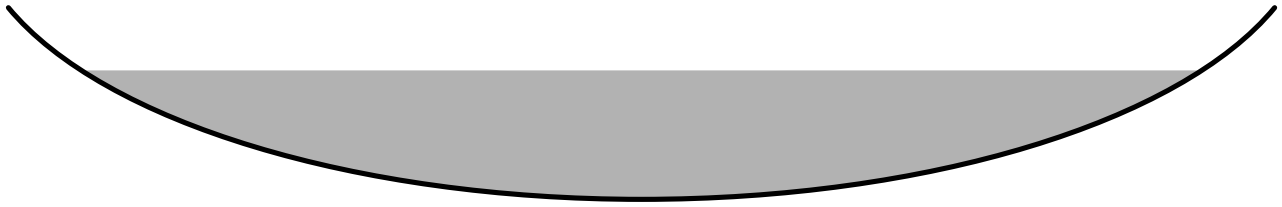
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 14.78 ac, 0.10% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 24.01 cfs @ 12.21 hrs, Volume= 2.239 af
Outflow = 23.18 cfs @ 12.31 hrs, Volume= 2.227 af, Atten= 3%, Lag= 6.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.30 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 2.79 fps, Avg. Travel Time= 7.2 min

Peak Storage= 4,444 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 8.21'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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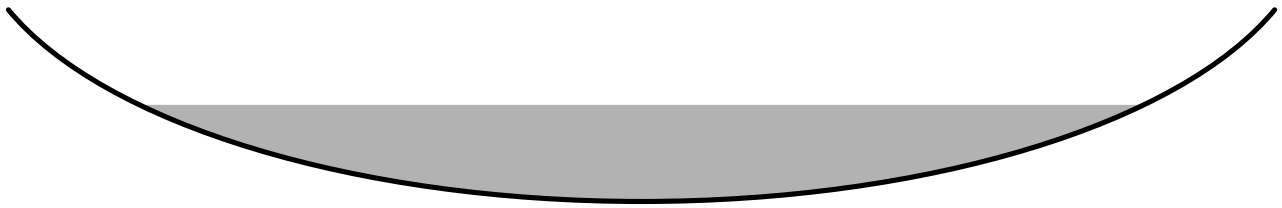
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 4.87 ac, 0.30% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 9.71 cfs @ 12.14 hrs, Volume= 0.740 af
Outflow = 9.32 cfs @ 12.20 hrs, Volume= 0.738 af, Atten= 4%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.02 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 4.0 min

Peak Storage= 949 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.50' , Surface Width= 5.68'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 1.81" for 10-year event
Inflow = 7.17 cfs @ 12.33 hrs, Volume= 0.750 af
Primary = 7.17 cfs @ 12.33 hrs, Volume= 0.750 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 12.80 ac, 0.00% Impervious, Inflow Depth > 1.86" for 10-year event
Inflow = 17.82 cfs @ 12.31 hrs, Volume= 1.985 af
Primary = 17.82 cfs @ 12.31 hrs, Volume= 1.985 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 8.42 cfs @ 12.22 hrs, Volume= 0.753 af
Primary = 8.42 cfs @ 12.22 hrs, Volume= 0.753 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 21.28 ac, 0.07% Impervious, Inflow Depth > 1.81" for 10-year event
Inflow = 32.61 cfs @ 12.31 hrs, Volume= 3.210 af
Primary = 32.61 cfs @ 12.31 hrs, Volume= 3.210 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 4.00 ac, 0.00% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 7.67 cfs @ 12.16 hrs, Volume= 0.607 af
Primary = 7.67 cfs @ 12.16 hrs, Volume= 0.607 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX1: Subcat EX1 Runoff Area=7.83 ac 0.00% Impervious Runoff Depth>2.69"
Flow Length=663' Tc=27.0 min CN=71 Runoff=15.80 cfs 1.756 af

Subcatchment EX1-A: Subcat EX1-A Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>2.61"
Flow Length=636' Tc=15.4 min CN=70 Runoff=12.19 cfs 1.080 af

Subcatchment EX2: Subcat EX2 Runoff Area=3.40 ac 0.00% Impervious Runoff Depth>2.61"
Flow Length=703' Tc=16.0 min CN=70 Runoff=8.18 cfs 0.739 af

Subcatchment EX2-A: Subcat EX2-A Runoff Area=3.11 ac 0.00% Impervious Runoff Depth>2.61"
Flow Length=636' Tc=13.5 min CN=70 Runoff=7.99 cfs 0.676 af

Subcatchment EX2-B: Subcat EX2-B Runoff Area=4.95 ac 0.00% Impervious Runoff Depth>2.61"
Flow Length=476' Tc=13.1 min CN=70 Runoff=12.85 cfs 1.078 af

Subcatchment EX2-BB: Subcat EX2-BB Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>2.60"
Flow Length=452' Tc=22.8 min CN=70 Runoff=10.40 cfs 1.076 af

Subcatchment EX2-C: Subcat EX2-C Runoff Area=4.87 ac 0.30% Impervious Runoff Depth>2.62"
Flow Length=651' Tc=9.5 min CN=70 Runoff=14.04 cfs 1.062 af

Subcatchment EX3: Subcat EX3 Runoff Area=4.00 ac 0.00% Impervious Runoff Depth>2.62"
Flow Length=295' Tc=10.9 min CN=70 Runoff=11.10 cfs 0.871 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.94' Max Vel=5.43 fps Inflow=40.41 cfs 3.875 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=110.72 cfs Outflow=40.21 cfs 3.871 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.80' Max Vel=7.07 fps Inflow=34.76 cfs 3.213 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=33.72 cfs 3.199 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.60' Max Vel=5.63 fps Inflow=14.04 cfs 1.062 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=13.47 cfs 1.059 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=10.40 cfs 1.076 af
Primary=10.40 cfs 1.076 af

Link DP1: Large Wetland Inflow=25.69 cfs 2.837 af
Primary=25.69 cfs 2.837 af

Link DP1-A: Property Line Inflow=12.19 cfs 1.080 af
Primary=12.19 cfs 1.080 af

Link DP2: Rochdale Pond Inflow=47.79 cfs 4.610 af
Primary=47.79 cfs 4.610 af

Link DP3: Small Wetland Inflow=11.10 cfs 0.871 af
Primary=11.10 cfs 0.871 af

Total Runoff Area = 38.08 ac Runoff Volume = 8.339 af Average Runoff Depth = 2.63"
99.96% Pervious = 38.06 ac 0.04% Impervious = 0.01 ac

Summary for Subcatchment EX1: Subcat EX1

Runoff = 15.80 cfs @ 12.39 hrs, Volume= 1.756 af, Depth> 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.02	55	Woods, Good, HSG B
7.08	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
7.83	71	Weighted Average
7.83		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0340	0.05		**Sheet Flow, First 50 feet** Woods: Dense underbrush n= 0.800 P2= 3.17"
3.6	235	0.0464	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	81	0.1519	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	297	0.0350	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.0	663	Total			

Summary for Subcatchment EX1-A: Subcat EX1-A

Runoff = 12.19 cfs @ 12.22 hrs, Volume= 1.080 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	38	0.0789	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	195	0.0359	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	190	0.0526	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.4	163	0.0534	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.4	636	Total			

Summary for Subcatchment EX2: Subcat EX2

Runoff = 8.18 cfs @ 12.23 hrs, Volume= 0.739 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.00	55	Woods, Good, HSG B
3.39	70	Woods, Good, HSG C
3.40	70	Weighted Average
3.40		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0580	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	60	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	368	0.0842	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	40	0.1750	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	185	0.0454	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.0	703	Total			

Summary for Subcatchment EX2-A: Subcat EX2-A

Runoff = 7.99 cfs @ 12.19 hrs, Volume= 0.676 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
3.11	70	Woods, Good, HSG C
3.11		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.6	74	0.1514	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	254	0.0937	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	48	0.1354	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	210	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.5	636	Total			

Summary for Subcatchment EX2-B: Subcat EX2-B

Runoff = 12.85 cfs @ 12.19 hrs, Volume= 1.078 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
4.95	70	Woods, Good, HSG C
4.95		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0540	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
1.1	76	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	58	0.1724	2.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	144	0.0764	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	148	0.1101	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	476	Total			

Summary for Subcatchment EX2-BB: Subcat EX2-BB

Runoff = 10.40 cfs @ 12.32 hrs, Volume= 1.076 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	263	0.0354	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	139	0.0784	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.8	452	Total			

Summary for Subcatchment EX2-C: Subcat EX2-C

Runoff = 14.04 cfs @ 12.14 hrs, Volume= 1.062 af, Depth> 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.00	65	Brush, Good, HSG C
0.03	92	Paved roads w/open ditches, 50% imp, HSG C
4.84	70	Woods, Good, HSG C
4.87	70	Weighted Average
4.85		99.70% Pervious Area
0.01		0.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0220	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.6	115	0.0591	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.1	207	0.0290	0.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	131	0.0687	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.4	148	0.1243	1.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.5	651	Total			

Summary for Subcatchment EX3: Subcat EX3

Runoff = 11.10 cfs @ 12.16 hrs, Volume= 0.871 af, Depth> 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.01	55	Woods, Good, HSG B
3.98	70	Woods, Good, HSG C
4.00	70	Weighted Average
4.00		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0740	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.6	245	0.0518	1.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	295	Total			

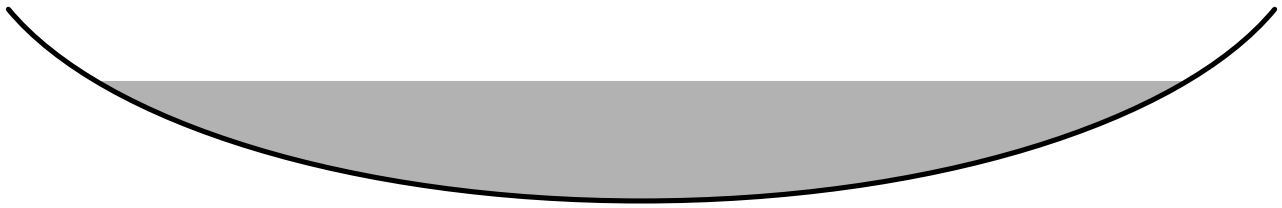
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 17.88 ac, 0.08% Impervious, Inflow Depth > 2.60" for 25-year event
Inflow = 40.41 cfs @ 12.28 hrs, Volume= 3.875 af
Outflow = 40.21 cfs @ 12.30 hrs, Volume= 3.871 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.43 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.32 fps, Avg. Travel Time= 1.3 min

Peak Storage= 1,324 cf @ 12.29 hrs
Average Depth at Peak Storage= 0.94' , Surface Width= 11.87'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 110.72 cfs

15.00' x 1.50' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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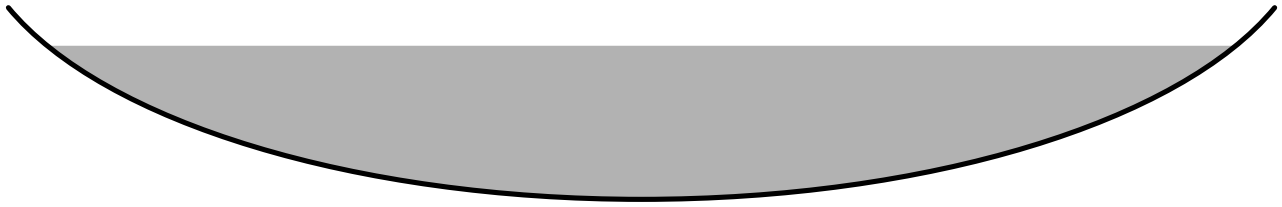
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 14.78 ac, 0.10% Impervious, Inflow Depth > 2.61" for 25-year event
Inflow = 34.76 cfs @ 12.21 hrs, Volume= 3.213 af
Outflow = 33.72 cfs @ 12.30 hrs, Volume= 3.199 af, Atten= 3%, Lag= 5.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.07 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 3.01 fps, Avg. Travel Time= 6.7 min

Peak Storage= 5,768 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.80' , Surface Width= 8.95'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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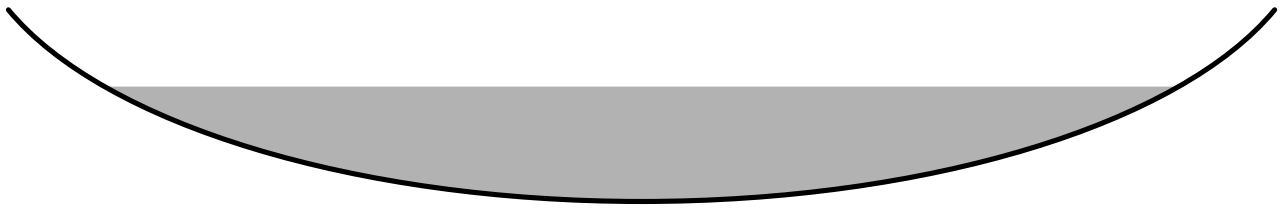
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 4.87 ac, 0.30% Impervious, Inflow Depth > 2.62" for 25-year event
Inflow = 14.04 cfs @ 12.14 hrs, Volume= 1.062 af
Outflow = 13.47 cfs @ 12.19 hrs, Volume= 1.059 af, Atten= 4%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.63 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 2.25 fps, Avg. Travel Time= 3.7 min

Peak Storage= 1,230 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 6.19'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 2.60" for 25-year event
Inflow = 10.40 cfs @ 12.32 hrs, Volume= 1.076 af
Primary = 10.40 cfs @ 12.32 hrs, Volume= 1.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 12.80 ac, 0.00% Impervious, Inflow Depth > 2.66" for 25-year event
Inflow = 25.69 cfs @ 12.30 hrs, Volume= 2.837 af
Primary = 25.69 cfs @ 12.30 hrs, Volume= 2.837 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 2.61" for 25-year event
Inflow = 12.19 cfs @ 12.22 hrs, Volume= 1.080 af
Primary = 12.19 cfs @ 12.22 hrs, Volume= 1.080 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 21.28 ac, 0.07% Impervious, Inflow Depth > 2.60" for 25-year event
Inflow = 47.79 cfs @ 12.29 hrs, Volume= 4.610 af
Primary = 47.79 cfs @ 12.29 hrs, Volume= 4.610 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 4.00 ac, 0.00% Impervious, Inflow Depth > 2.62" for 25-year event
Inflow = 11.10 cfs @ 12.16 hrs, Volume= 0.871 af
Primary = 11.10 cfs @ 12.16 hrs, Volume= 0.871 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX1: Subcat EX1 Runoff Area=7.83 ac 0.00% Impervious Runoff Depth>4.03"
Flow Length=663' Tc=27.0 min CN=71 Runoff=23.61 cfs 2.629 af

Subcatchment EX1-A: Subcat EX1-A Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>3.93"
Flow Length=636' Tc=15.4 min CN=70 Runoff=18.38 cfs 1.627 af

Subcatchment EX2: Subcat EX2 Runoff Area=3.40 ac 0.00% Impervious Runoff Depth>3.93"
Flow Length=703' Tc=16.0 min CN=70 Runoff=12.40 cfs 1.113 af

Subcatchment EX2-A: Subcat EX2-A Runoff Area=3.11 ac 0.00% Impervious Runoff Depth>3.94"
Flow Length=636' Tc=13.5 min CN=70 Runoff=12.03 cfs 1.018 af

Subcatchment EX2-B: Subcat EX2-B Runoff Area=4.95 ac 0.00% Impervious Runoff Depth>3.94"
Flow Length=476' Tc=13.1 min CN=70 Runoff=19.36 cfs 1.624 af

Subcatchment EX2-BB: Subcat EX2-BB Runoff Area=4.96 ac 0.00% Impervious Runoff Depth>3.92"
Flow Length=452' Tc=22.8 min CN=70 Runoff=15.67 cfs 1.621 af

Subcatchment EX2-C: Subcat EX2-C Runoff Area=4.87 ac 0.30% Impervious Runoff Depth>3.94"
Flow Length=651' Tc=9.5 min CN=70 Runoff=21.13 cfs 1.599 af

Subcatchment EX3: Subcat EX3 Runoff Area=4.00 ac 0.00% Impervious Runoff Depth>3.94"
Flow Length=295' Tc=10.9 min CN=70 Runoff=16.73 cfs 1.312 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=1.14' Max Vel=6.16 fps Inflow=61.59 cfs 5.841 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=110.72 cfs Outflow=60.88 cfs 5.837 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.97' Max Vel=8.00 fps Inflow=52.36 cfs 4.841 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=50.80 cfs 4.822 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.73' Max Vel=6.39 fps Inflow=21.13 cfs 1.599 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=20.29 cfs 1.596 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=15.67 cfs 1.621 af
Primary=15.67 cfs 1.621 af

Link DP1: Large Wetland Inflow=38.59 cfs 4.256 af
Primary=38.59 cfs 4.256 af

Link DP1-A: Property Line Inflow=18.38 cfs 1.627 af
Primary=18.38 cfs 1.627 af

Link DP2: Rochdale Pond Inflow=72.94 cfs 6.950 af
Primary=72.94 cfs 6.950 af

Link DP3: Small Wetland Inflow=16.73 cfs 1.312 af
Primary=16.73 cfs 1.312 af

Total Runoff Area = 38.08 ac Runoff Volume = 12.543 af Average Runoff Depth = 3.95"
99.96% Pervious = 38.06 ac 0.04% Impervious = 0.01 ac

Summary for Subcatchment EX1: Subcat EX1

Runoff = 23.61 cfs @ 12.38 hrs, Volume= 2.629 af, Depth> 4.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.02	55	Woods, Good, HSG B
7.08	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
7.83	71	Weighted Average
7.83		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	50	0.0340	0.05		**Sheet Flow, First 50 feet** Woods: Dense underbrush n= 0.800 P2= 3.17"
3.6	235	0.0464	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	81	0.1519	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	297	0.0350	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.0	663	Total			

Summary for Subcatchment EX1-A: Subcat EX1-A

Runoff = 18.38 cfs @ 12.21 hrs, Volume= 1.627 af, Depth> 3.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	38	0.0789	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	195	0.0359	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	190	0.0526	1.15		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.4	163	0.0534	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.4	636	Total			

Summary for Subcatchment EX2: Subcat EX2

Runoff = 12.40 cfs @ 12.22 hrs, Volume= 1.113 af, Depth> 3.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.00	55	Woods, Good, HSG B
3.39	70	Woods, Good, HSG C
3.40	70	Weighted Average
3.40		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0580	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.5	60	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	368	0.0842	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	40	0.1750	2.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	185	0.0454	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.0	703	Total			

Summary for Subcatchment EX2-A: Subcat EX2-A

Runoff = 12.03 cfs @ 12.19 hrs, Volume= 1.018 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
3.11	70	Woods, Good, HSG C
3.11		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
0.6	74	0.1514	1.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	254	0.0937	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	48	0.1354	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.9	210	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.5	636	Total			

Summary for Subcatchment EX2-B: Subcat EX2-B

Runoff = 19.36 cfs @ 12.18 hrs, Volume= 1.624 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
4.95	70	Woods, Good, HSG C
4.95		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0540	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
1.1	76	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	58	0.1724	2.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	144	0.0764	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	148	0.1101	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.1	476	Total			

Summary for Subcatchment EX2-BB: Subcat EX2-BB

Runoff = 15.67 cfs @ 12.32 hrs, Volume= 1.621 af, Depth> 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
4.96	70	Woods, Good, HSG C
4.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	263	0.0354	0.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	139	0.0784	1.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.8	452	Total			

Summary for Subcatchment EX2-C: Subcat EX2-C

Runoff = 21.13 cfs @ 12.14 hrs, Volume= 1.599 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.00	65	Brush, Good, HSG C
0.03	92	Paved roads w/open ditches, 50% imp, HSG C
4.84	70	Woods, Good, HSG C
4.87	70	Weighted Average
4.85		99.70% Pervious Area
0.01		0.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0220	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.6	115	0.0591	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.1	207	0.0290	0.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	131	0.0687	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.4	148	0.1243	1.76		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.5	651	Total			

Summary for Subcatchment EX3: Subcat EX3

Runoff = 16.73 cfs @ 12.16 hrs, Volume= 1.312 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.01	55	Woods, Good, HSG B
3.98	70	Woods, Good, HSG C
4.00	70	Weighted Average
4.00		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0740	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.6	245	0.0518	1.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.9	295	Total			

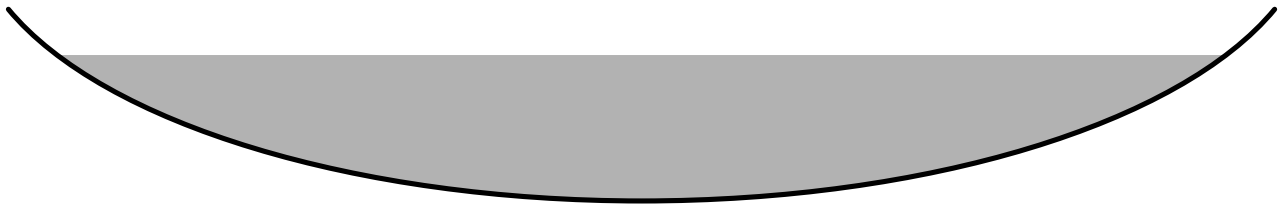
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 17.88 ac, 0.08% Impervious, Inflow Depth > 3.92" for 100-year event
Inflow = 61.59 cfs @ 12.26 hrs, Volume= 5.841 af
Outflow = 60.88 cfs @ 12.28 hrs, Volume= 5.837 af, Atten= 1%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.16 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.52 fps, Avg. Travel Time= 1.2 min

Peak Storage= 1,774 cf @ 12.27 hrs
Average Depth at Peak Storage= 1.14' , Surface Width= 13.09'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 110.72 cfs

15.00' x 1.50' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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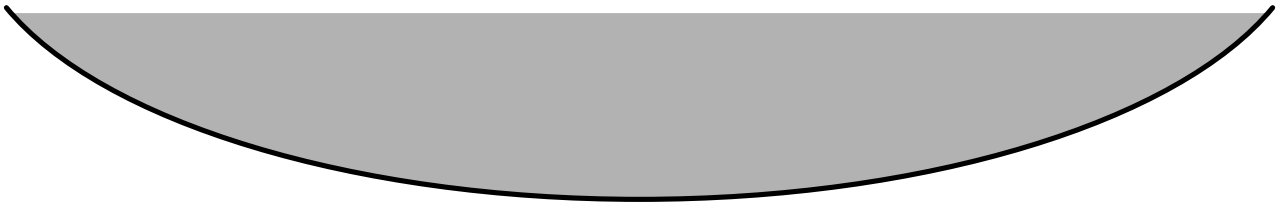
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 14.78 ac, 0.10% Impervious, Inflow Depth > 3.93" for 100-year event
Inflow = 52.36 cfs @ 12.20 hrs, Volume= 4.841 af
Outflow = 50.80 cfs @ 12.28 hrs, Volume= 4.822 af, Atten= 3%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.00 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 3.28 fps, Avg. Travel Time= 6.1 min

Peak Storage= 7,698 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.97' , Surface Width= 9.86'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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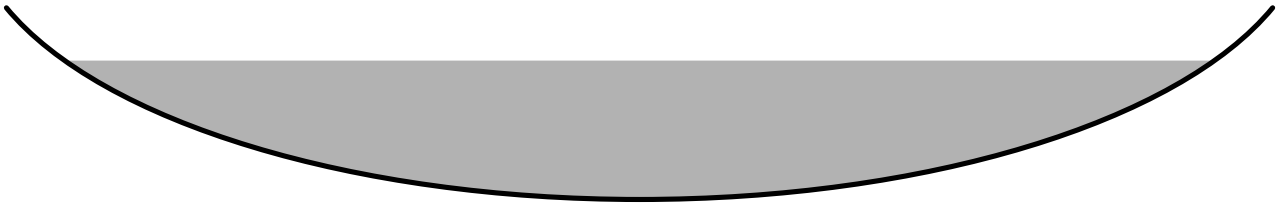
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 4.87 ac, 0.30% Impervious, Inflow Depth > 3.94" for 100-year event
Inflow = 21.13 cfs @ 12.14 hrs, Volume= 1.599 af
Outflow = 20.29 cfs @ 12.18 hrs, Volume= 1.596 af, Atten= 4%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.39 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.46 fps, Avg. Travel Time= 3.4 min

Peak Storage= 1,640 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.73' , Surface Width= 6.81'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 3.92" for 100-year event
Inflow = 15.67 cfs @ 12.32 hrs, Volume= 1.621 af
Primary = 15.67 cfs @ 12.32 hrs, Volume= 1.621 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 12.80 ac, 0.00% Impervious, Inflow Depth > 3.99" for 100-year event
Inflow = 38.59 cfs @ 12.29 hrs, Volume= 4.256 af
Primary = 38.59 cfs @ 12.29 hrs, Volume= 4.256 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 4.96 ac, 0.00% Impervious, Inflow Depth > 3.93" for 100-year event
Inflow = 18.38 cfs @ 12.21 hrs, Volume= 1.627 af
Primary = 18.38 cfs @ 12.21 hrs, Volume= 1.627 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

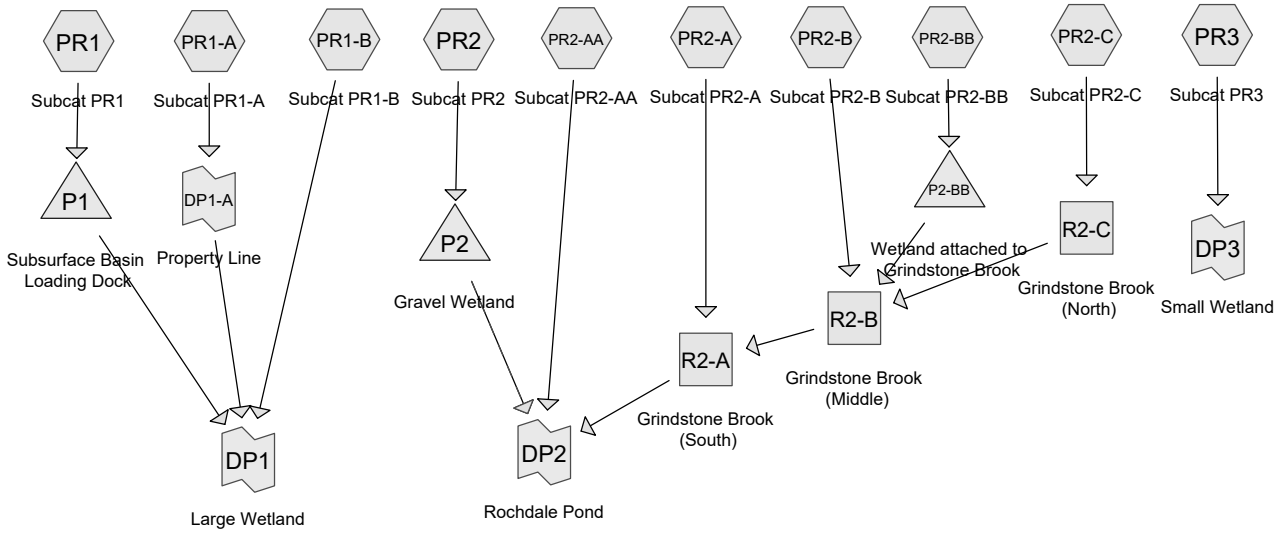
Inflow Area = 21.28 ac, 0.07% Impervious, Inflow Depth > 3.92" for 100-year event
Inflow = 72.94 cfs @ 12.27 hrs, Volume= 6.950 af
Primary = 72.94 cfs @ 12.27 hrs, Volume= 6.950 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 4.00 ac, 0.00% Impervious, Inflow Depth > 3.94" for 100-year event
Inflow = 16.73 cfs @ 12.16 hrs, Volume= 1.312 af
Primary = 16.73 cfs @ 12.16 hrs, Volume= 1.312 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for 15392.00 - PR
Prepared by VHB, Printed 12/14/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.85	74	>75% Grass cover, Good, HSG C (PR1, PR1-A, PR1-B, PR2, PR2-A, PR2-AA, PR2-B, PR2-BB, PR2-C, PR3)
7.16	98	Paved parking, HSG C (PR1, PR1-B, PR2, PR2-B, PR2-BB, PR3)
5.97	98	Roofs, HSG C (PR2)
0.03	55	Woods, Good, HSG B (PR1-B, PR2-AA, PR3)
19.32	70	Woods, Good, HSG C (PR1, PR1-A, PR1-B, PR2, PR2-A, PR2-AA, PR2-B, PR2-BB, PR2-C, PR3)
0.74	77	Woods, Good, HSG D (PR1-B)
38.08	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.00	HSG A	
0.03	HSG B	PR1-B, PR2-AA, PR3
37.30	HSG C	PR1, PR1-A, PR1-B, PR2, PR2-A, PR2-AA, PR2-B, PR2-BB, PR2-C, PR3
0.74	HSG D	PR1-B
0.00	Other	
38.08		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.00	0.00	4.85	0.00	0.00	4.85	>75% Grass cover, Good	PR1, PR1-A, PR1-B, PR2, PR2-A, PR2-AA, PR2-B, PR2-BB, PR2-C, PR3
0.00	0.00	7.16	0.00	0.00	7.16	Paved parking	PR1, PR1-B, PR2, PR2-B, PR2-BB, PR3
0.00	0.00	5.97	0.00	0.00	5.97	Roofs	PR2
0.00	0.03	19.32	0.74	0.00	20.10	Woods, Good	PR1, PR1-A, PR1-B, PR2, PR2-A, PR2-AA, PR2-B, PR2-BB, PR2-C, PR3
0.00	**0.03**	**37.30**	**0.74**	**0.00**	**38.08**	**TOTAL AREA**	

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: Subcat PR1 Runoff Area=6.83 ac 71.25% Impervious Runoff Depth>2.10"
Flow Length=1,099' Tc=5.0 min CN=91 Runoff=17.68 cfs 1.196 af

Subcatchment PR1-A: Subcat PR1-A Runoff Area=1.06 ac 0.00% Impervious Runoff Depth>0.78"
Flow Length=131' Tc=5.0 min CN=71 Runoff=0.98 cfs 0.069 af

Subcatchment PR1-B: Subcat PR1-B Runoff Area=3.05 ac 0.10% Impervious Runoff Depth>0.83"
Flow Length=213' Tc=5.0 min CN=72 Runoff=3.03 cfs 0.210 af

Subcatchment PR2: Subcat PR2 Runoff Area=11.15 ac 73.99% Impervious Runoff Depth>2.10"
Flow Length=1,482' Slope=0.0100 '/' Tc=5.4 min CN=91 Runoff=28.41 cfs 1.951 af

Subcatchment PR2-A: Subcat PR2-A Runoff Area=1.94 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=400' Tc=7.5 min CN=70 Runoff=1.54 cfs 0.118 af

Subcatchment PR2-AA: Subcat PR2-AA Runoff Area=2.73 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=561' Tc=12.2 min CN=70 Runoff=1.85 cfs 0.166 af

Subcatchment PR2-B: Subcat PR2-B Runoff Area=4.18 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=362' Tc=8.1 min CN=70 Runoff=3.20 cfs 0.254 af

Subcatchment PR2-BB: Subcat PR2-BB Runoff Area=1.61 ac 0.16% Impervious Runoff Depth>0.78"
Flow Length=230' Tc=10.6 min CN=71 Runoff=1.24 cfs 0.104 af

Subcatchment PR2-C: Subcat PR2-C Runoff Area=2.80 ac 0.00% Impervious Runoff Depth>0.73"
Flow Length=169' Tc=5.0 min CN=70 Runoff=2.40 cfs 0.171 af

Subcatchment PR3: Subcat PR3 Runoff Area=2.73 ac 0.14% Impervious Runoff Depth>0.73"
Flow Length=287' Tc=6.3 min CN=70 Runoff=2.26 cfs 0.166 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.37' Max Vel=2.95 fps Inflow=6.68 cfs 0.641 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=56.86 cfs Outflow=6.59 cfs 0.640 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.36' Max Vel=4.13 fps Inflow=6.59 cfs 0.528 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=5.75 cfs 0.523 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.26' Max Vel=3.21 fps Inflow=2.40 cfs 0.171 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=2.23 cfs 0.170 af

Pond P1: Subsurface Basin Loading Dock Peak Elev=746.62' Storage=0.655 af Inflow=17.68 cfs 1.196 af
Discarded=0.12 cfs 0.126 af Primary=2.59 cfs 0.605 af Outflow=2.71 cfs 0.731 af

Pond P2: Gravel Wetland Peak Elev=739.53' Storage=49,770 cf Inflow=28.41 cfs 1.951 af
Primary=3.95 cfs 1.166 af Secondary=0.00 cfs 0.000 af Outflow=3.95 cfs 1.166 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=1.24 cfs 0.104 af
Primary=1.24 cfs 0.104 af

Link DP1: Large Wetland Inflow=4.14 cfs 0.884 af
Primary=4.14 cfs 0.884 af

Link DP1-A: Property Line Inflow=0.98 cfs 0.069 af
Primary=0.98 cfs 0.069 af

Link DP2: Rochdale Pond Inflow=11.35 cfs 1.972 af
Primary=11.35 cfs 1.972 af

Link DP3: Small Wetland Inflow=2.26 cfs 0.166 af
Primary=2.26 cfs 0.166 af

Total Runoff Area = 38.08 ac Runoff Volume = 4.406 af Average Runoff Depth = 1.39"
65.53% Pervious = 24.95 ac 34.47% Impervious = 13.13 ac

Summary for Subcatchment PR1: Subcat PR1

Runoff = 17.68 cfs @ 12.07 hrs, Volume= 1.196 af, Depth> 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
1.10	74	>75% Grass cover, Good, HSG C
4.87	98	Paved parking, HSG C
0.87	70	Woods, Good, HSG C
6.83	91	Weighted Average
1.96		28.75% Pervious Area
4.87		71.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0280	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	380	0.0408	4.10		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.4	669	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
3.5	1,099	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-A: Subcat PR1-A

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 0.069 af, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.30	74	>75% Grass cover, Good, HSG C
0.76	70	Woods, Good, HSG C
1.06	71	Weighted Average
1.06		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.4545	0.38		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
1.0	120	0.0750	1.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	131	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-B: Subcat PR1-B

Runoff = 3.03 cfs @ 12.09 hrs, Volume= 0.210 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.56	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.02	55	Woods, Good, HSG B
1.73	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
3.05	72	Weighted Average
3.05		99.90% Pervious Area
0.00		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	27	0.4815	0.47		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
3.2	186	0.0376	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: Subcat PR2

Runoff = 28.41 cfs @ 12.08 hrs, Volume= 1.951 af, Depth> 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
1.92	74	>75% Grass cover, Good, HSG C
2.28	98	Paved parking, HSG C
5.97	98	Roofs, HSG C
0.98	70	Woods, Good, HSG C
11.15	91	Weighted Average
2.90		26.01% Pervious Area
8.25		73.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
2.0	242	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	1,190	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior

5.4 1,482 Total

Summary for Subcatchment PR2-A: Subcat PR2-A

Runoff = 1.54 cfs @ 12.12 hrs, Volume= 0.118 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
1.79	70	Woods, Good, HSG C
1.94	70	Weighted Average
1.94		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.3000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	370	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	400	Total			

Summary for Subcatchment PR2-AA: Subcat PR2-AA

Runoff = 1.85 cfs @ 12.19 hrs, Volume= 0.166 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	55	Woods, Good, HSG B
2.55	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.73		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
6.5	511	0.0685	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	561	Total			

Summary for Subcatchment PR2-B: Subcat PR2-B

Runoff = 3.20 cfs @ 12.13 hrs, Volume= 0.254 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
4.00	70	Woods, Good, HSG C
4.18	70	Weighted Average
4.18		100.00% Pervious Area
0.00		0.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.2360	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.5	312	0.0860	1.47		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.1	362	Total			

Summary for Subcatchment PR2-BB: Subcat PR2-BB

Runoff = 1.24 cfs @ 12.17 hrs, Volume= 0.104 af, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.24	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
1.37	70	Woods, Good, HSG C
1.61	71	Weighted Average
1.60		99.84% Pervious Area
0.00		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
2.0	180	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	230	Total			

Summary for Subcatchment PR2-C: Subcat PR2-C

Runoff = 2.40 cfs @ 12.09 hrs, Volume= 0.171 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
2.65	70	Woods, Good, HSG C
2.80	70	Weighted Average
2.80		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	16	0.5000	3.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	153	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	169	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: Subcat PR3

Runoff = 2.26 cfs @ 12.11 hrs, Volume= 0.166 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.17"

Area (ac)	CN	Description
0.08	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.01	55	Woods, Good, HSG B
2.63	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.72		99.86% Pervious Area
0.00		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0600	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.17"
3.1	237	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	287	Total			

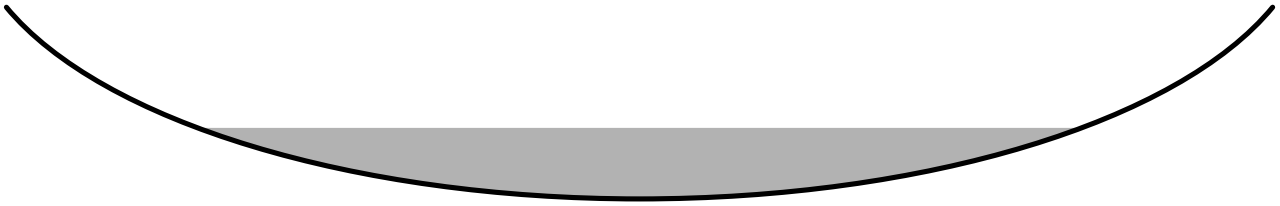
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 10.53 ac, 0.02% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 6.68 cfs @ 12.30 hrs, Volume= 0.641 af
Outflow = 6.59 cfs @ 12.32 hrs, Volume= 0.640 af, Atten= 1%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.95 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.42 fps, Avg. Travel Time= 2.1 min

Peak Storage= 403 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.37' , Surface Width= 9.14'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 56.86 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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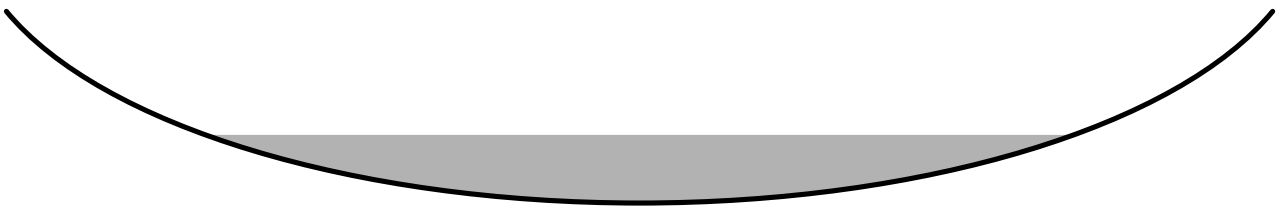
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 8.58 ac, 0.03% Impervious, Inflow Depth > 0.74" for 2-year event
Inflow = 6.59 cfs @ 12.15 hrs, Volume= 0.528 af
Outflow = 5.75 cfs @ 12.30 hrs, Volume= 0.523 af, Atten= 13%, Lag= 8.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.13 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 1.93 fps, Avg. Travel Time= 10.4 min

Peak Storage= 1,705 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.36' , Surface Width= 5.96'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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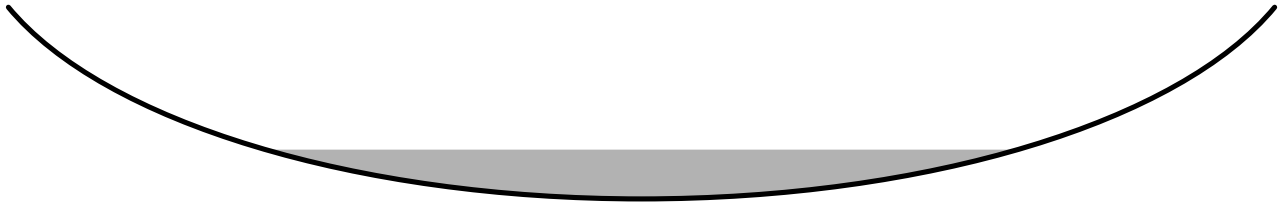
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 2.80 ac, 0.00% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 2.40 cfs @ 12.09 hrs, Volume= 0.171 af
Outflow = 2.23 cfs @ 12.17 hrs, Volume= 0.170 af, Atten= 7%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.21 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 5.7 min

Peak Storage= 347 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.26' , Surface Width= 4.06'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P1: Subsurface Basin Loading Dock

Inflow Area = 6.83 ac, 71.25% Impervious, Inflow Depth > 2.10" for 2-year event
Inflow = 17.68 cfs @ 12.07 hrs, Volume= 1.196 af
Outflow = 2.71 cfs @ 12.57 hrs, Volume= 0.731 af, Atten= 85%, Lag= 29.7 min
Discarded = 0.12 cfs @ 8.55 hrs, Volume= 0.126 af
Primary = 2.59 cfs @ 12.57 hrs, Volume= 0.605 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 746.62' @ 12.57 hrs Surf.Area= 0.45 ac Storage= 0.655 af

Plug-Flow detention time= 170.2 min calculated for 0.729 af (61% of inflow)
Center-of-Mass det. time= 96.6 min (866.9 - 770.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	744.50'	0.614 af	**101.58'W x 192.12'L x 5.50'H Field A** 2.464 af Overall - 0.928 af Embedded = 1.536 af x 40.0% Voids
#2A	745.25'	0.928 af	**ADS_StormTech MC-3500 d +Cap**x 364 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 364 Chambers in 14 Rows Cap Storage= +14.9 cf x 2 x 14 rows = 417.2 cf
		1.543 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	744.50'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	745.25'	**30.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 745.25' / 744.00' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Device 2	745.90'	**20.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	748.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 8.55 hrs HW=744.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=2.58 cfs @ 12.57 hrs HW=746.62' (Free Discharge)
└**2=Culvert** (Passes 2.58 cfs of 10.92 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 2.58 cfs @ 2.88 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2: Gravel Wetland

Inflow Area = 11.15 ac, 73.99% Impervious, Inflow Depth > 2.10" for 2-year event
Inflow = 28.41 cfs @ 12.08 hrs, Volume= 1.951 af
Outflow = 3.95 cfs @ 12.61 hrs, Volume= 1.166 af, Atten= 86%, Lag= 32.0 min
Primary = 3.95 cfs @ 12.61 hrs, Volume= 1.166 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 739.53' @ 12.61 hrs Surf.Area= 23,740 sf Storage= 49,770 cf

Plug-Flow detention time= 191.3 min calculated for 1.166 af (60% of inflow)
Center-of-Mass det. time= 116.3 min (886.9 - 770.6)

Volume	Invert	Avail.Storage	Storage Description
#1	737.00'	152,559 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
737.00	15,330	0	0
738.00	18,945	17,138	17,138
739.00	22,018	20,482	37,619
740.00	25,261	23,640	61,259
741.00	28,806	27,034	88,292
742.00	32,209	30,508	118,800
743.00	35,309	33,759	152,559

Device	Routing	Invert	Outlet Devices
#1	Primary	736.60'	**24.0" Round Culvert** L= 100.0' Ke= 0.050 Inlet / Outlet Invert= 736.60' / 735.70' S= 0.0090 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	738.60'	**18.0" W x 9.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	740.10'	**24.0" W x 7.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads

#4	Device 1	741.70'	**2.0" x 2.0" Horiz. Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#5	Secondary	742.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=3.95 cfs @ 12.61 hrs HW=739.53' (Free Discharge)
└─**1=Culvert** (Passes 3.95 cfs of 23.47 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 3.95 cfs @ 3.51 fps)
  ├─**3=Orifice** (Controls 0.00 cfs)
  └─**4=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=737.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 1.61 ac, 0.16% Impervious, Inflow Depth > 0.78" for 2-year event
Inflow = 1.24 cfs @ 12.17 hrs, Volume= 0.104 af
Primary = 1.24 cfs @ 12.17 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 10.94 ac, 44.51% Impervious, Inflow Depth > 0.97" for 2-year event
Inflow = 4.14 cfs @ 12.10 hrs, Volume= 0.884 af
Primary = 4.14 cfs @ 12.10 hrs, Volume= 0.884 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 1.06 ac, 0.00% Impervious, Inflow Depth > 0.78" for 2-year event
Inflow = 0.98 cfs @ 12.09 hrs, Volume= 0.069 af
Primary = 0.98 cfs @ 12.09 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 24.41 ac, 33.81% Impervious, Inflow Depth > 0.97" for 2-year event
Inflow = 11.35 cfs @ 12.34 hrs, Volume= 1.972 af
Primary = 11.35 cfs @ 12.34 hrs, Volume= 1.972 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 2.73 ac, 0.14% Impervious, Inflow Depth > 0.73" for 2-year event
Inflow = 2.26 cfs @ 12.11 hrs, Volume= 0.166 af
Primary = 2.26 cfs @ 12.11 hrs, Volume= 0.166 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: Subcat PR1 Runoff Area=6.83 ac 71.25% Impervious Runoff Depth>3.71"
Flow Length=1,099' Tc=5.0 min CN=91 Runoff=30.22 cfs 2.110 af

Subcatchment PR1-A: Subcat PR1-A Runoff Area=1.06 ac 0.00% Impervious Runoff Depth>1.90"
Flow Length=131' Tc=5.0 min CN=71 Runoff=2.54 cfs 0.168 af

Subcatchment PR1-B: Subcat PR1-B Runoff Area=3.05 ac 0.10% Impervious Runoff Depth>1.98"
Flow Length=213' Tc=5.0 min CN=72 Runoff=7.60 cfs 0.503 af

Subcatchment PR2: Subcat PR2 Runoff Area=11.15 ac 73.99% Impervious Runoff Depth>3.71"
Flow Length=1,482' Slope=0.0100 '/' Tc=5.4 min CN=91 Runoff=48.50 cfs 3.442 af

Subcatchment PR2-A: Subcat PR2-A Runoff Area=1.94 ac 0.00% Impervious Runoff Depth>1.83"
Flow Length=400' Tc=7.5 min CN=70 Runoff=4.15 cfs 0.296 af

Subcatchment PR2-AA: Subcat PR2-AA Runoff Area=2.73 ac 0.00% Impervious Runoff Depth>1.82"
Flow Length=561' Tc=12.2 min CN=70 Runoff=5.01 cfs 0.415 af

Subcatchment PR2-B: Subcat PR2-B Runoff Area=4.18 ac 0.00% Impervious Runoff Depth>1.83"
Flow Length=362' Tc=8.1 min CN=70 Runoff=8.73 cfs 0.635 af

Subcatchment PR2-BB: Subcat PR2-BB Runoff Area=1.61 ac 0.16% Impervious Runoff Depth>1.90"
Flow Length=230' Tc=10.6 min CN=71 Runoff=3.25 cfs 0.254 af

Subcatchment PR2-C: Subcat PR2-C Runoff Area=2.80 ac 0.00% Impervious Runoff Depth>1.83"
Flow Length=169' Tc=5.0 min CN=70 Runoff=6.42 cfs 0.427 af

Subcatchment PR3: Subcat PR3 Runoff Area=2.73 ac 0.14% Impervious Runoff Depth>1.83"
Flow Length=287' Tc=6.3 min CN=70 Runoff=6.06 cfs 0.415 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.60' Max Vel=4.06 fps Inflow=18.94 cfs 1.602 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=56.86 cfs Outflow=18.74 cfs 1.600 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.57' Max Vel=5.65 fps Inflow=17.73 cfs 1.314 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=16.25 cfs 1.306 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.41' Max Vel=4.42 fps Inflow=6.42 cfs 0.427 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=5.99 cfs 0.425 af

Pond P1: Subsurface Basin Loading Dock Peak Elev=747.57' Storage=0.987 af Inflow=30.22 cfs 2.110 af
Discarded=0.12 cfs 0.145 af Primary=9.63 cfs 1.474 af Outflow=9.75 cfs 1.620 af

Pond P2: Gravel Wetland Peak Elev=740.77' Storage=81,861 cf Inflow=48.50 cfs 3.442 af
Primary=10.62 cfs 2.613 af Secondary=0.00 cfs 0.000 af Outflow=10.62 cfs 2.613 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=3.25 cfs 0.254 af
Primary=3.25 cfs 0.254 af

Link DP1: Large Wetland Inflow=16.60 cfs 2.146 af
Primary=16.60 cfs 2.146 af

Link DP1-A: Property Line Inflow=2.54 cfs 0.168 af
Primary=2.54 cfs 0.168 af

Link DP2: Rochdale Pond Inflow=32.24 cfs 4.628 af
Primary=32.24 cfs 4.628 af

Link DP3: Small Wetland Inflow=6.06 cfs 0.415 af
Primary=6.06 cfs 0.415 af

Total Runoff Area = 38.08 ac Runoff Volume = 8.665 af Average Runoff Depth = 2.73"
65.53% Pervious = 24.95 ac 34.47% Impervious = 13.13 ac

Summary for Subcatchment PR1: Subcat PR1

Runoff = 30.22 cfs @ 12.07 hrs, Volume= 2.110 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
1.10	74	>75% Grass cover, Good, HSG C
4.87	98	Paved parking, HSG C
0.87	70	Woods, Good, HSG C
6.83	91	Weighted Average
1.96		28.75% Pervious Area
4.87		71.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0280	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	380	0.0408	4.10		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.4	669	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
3.5	1,099	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-A: Subcat PR1-A

Runoff = 2.54 cfs @ 12.08 hrs, Volume= 0.168 af, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.30	74	>75% Grass cover, Good, HSG C
0.76	70	Woods, Good, HSG C
1.06	71	Weighted Average
1.06		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.4545	0.38		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
1.0	120	0.0750	1.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	131	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-B: Subcat PR1-B

Runoff = 7.60 cfs @ 12.08 hrs, Volume= 0.503 af, Depth> 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.56	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.02	55	Woods, Good, HSG B
1.73	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
3.05	72	Weighted Average
3.05		99.90% Pervious Area
0.00		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	27	0.4815	0.47		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
3.2	186	0.0376	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: Subcat PR2

Runoff = 48.50 cfs @ 12.08 hrs, Volume= 3.442 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
1.92	74	>75% Grass cover, Good, HSG C
2.28	98	Paved parking, HSG C
5.97	98	Roofs, HSG C
0.98	70	Woods, Good, HSG C
11.15	91	Weighted Average
2.90		26.01% Pervious Area
8.25		73.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
2.0	242	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	1,190	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior

5.4 1,482 Total

Summary for Subcatchment PR2-A: Subcat PR2-A

Runoff = 4.15 cfs @ 12.11 hrs, Volume= 0.296 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
1.79	70	Woods, Good, HSG C
1.94	70	Weighted Average
1.94		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.3000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	370	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	400	Total			

Summary for Subcatchment PR2-AA: Subcat PR2-AA

Runoff = 5.01 cfs @ 12.18 hrs, Volume= 0.415 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	55	Woods, Good, HSG B
2.55	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.73		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
6.5	511	0.0685	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	561	Total			

Summary for Subcatchment PR2-B: Subcat PR2-B

Runoff = 8.73 cfs @ 12.12 hrs, Volume= 0.635 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
4.00	70	Woods, Good, HSG C
4.18	70	Weighted Average
4.18		100.00% Pervious Area
0.00		0.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.2360	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.5	312	0.0860	1.47		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.1	362	Total			

Summary for Subcatchment PR2-BB: Subcat PR2-BB

Runoff = 3.25 cfs @ 12.16 hrs, Volume= 0.254 af, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.24	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
1.37	70	Woods, Good, HSG C
1.61	71	Weighted Average
1.60		99.84% Pervious Area
0.00		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
2.0	180	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	230	Total			

Summary for Subcatchment PR2-C: Subcat PR2-C

Runoff = 6.42 cfs @ 12.08 hrs, Volume= 0.427 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
2.65	70	Woods, Good, HSG C
2.80	70	Weighted Average
2.80		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	16	0.5000	3.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	153	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	169	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: Subcat PR3

Runoff = 6.06 cfs @ 12.10 hrs, Volume= 0.415 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (ac)	CN	Description
0.08	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.01	55	Woods, Good, HSG B
2.63	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.72		99.86% Pervious Area
0.00		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0600	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.17"
3.1	237	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	287	Total			

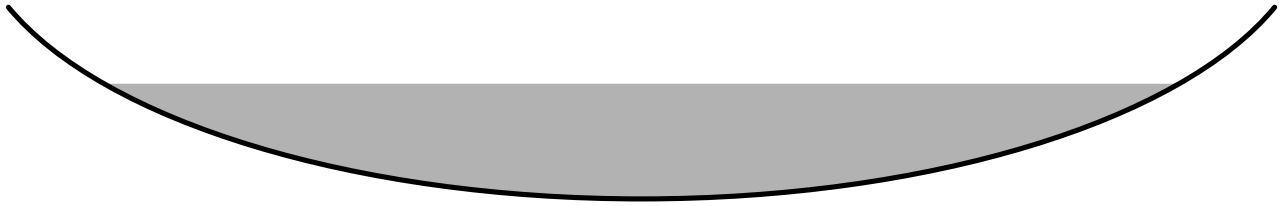
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 10.53 ac, 0.02% Impervious, Inflow Depth > 1.83" for 10-year event
Inflow = 18.94 cfs @ 12.23 hrs, Volume= 1.602 af
Outflow = 18.74 cfs @ 12.25 hrs, Volume= 1.600 af, Atten= 1%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.06 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 1.7 min

Peak Storage= 830 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 11.63'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 56.86 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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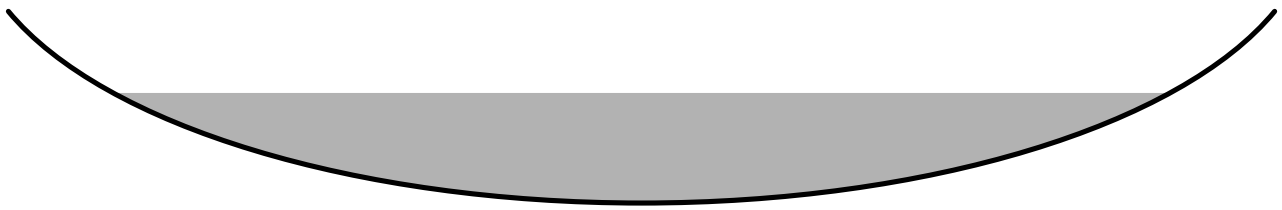
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 8.58 ac, 0.03% Impervious, Inflow Depth > 1.84" for 10-year event
Inflow = 17.73 cfs @ 12.14 hrs, Volume= 1.314 af
Outflow = 16.25 cfs @ 12.24 hrs, Volume= 1.306 af, Atten= 8%, Lag= 6.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.65 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 8.6 min

Peak Storage= 3,492 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.57' , Surface Width= 7.57'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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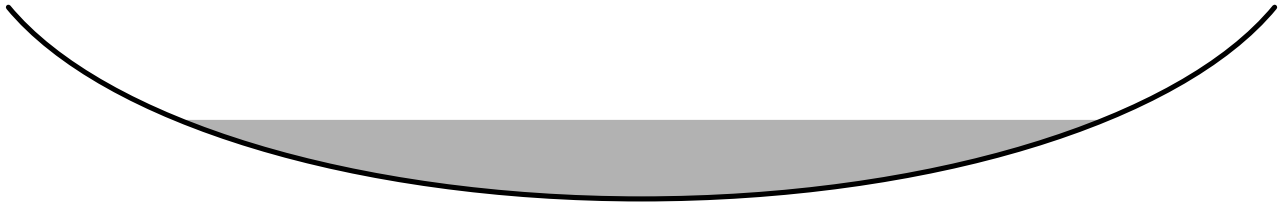
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 2.80 ac, 0.00% Impervious, Inflow Depth > 1.83" for 10-year event
Inflow = 6.42 cfs @ 12.08 hrs, Volume= 0.427 af
Outflow = 5.99 cfs @ 12.14 hrs, Volume= 0.425 af, Atten= 7%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.42 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 4.7 min

Peak Storage= 705 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.41' , Surface Width= 5.14'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P1: Subsurface Basin Loading Dock

Inflow Area = 6.83 ac, 71.25% Impervious, Inflow Depth > 3.71" for 10-year event
Inflow = 30.22 cfs @ 12.07 hrs, Volume= 2.110 af
Outflow = 9.75 cfs @ 12.37 hrs, Volume= 1.620 af, Atten= 68%, Lag= 17.6 min
Discarded = 0.12 cfs @ 6.65 hrs, Volume= 0.145 af
Primary = 9.63 cfs @ 12.37 hrs, Volume= 1.474 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 747.57' @ 12.37 hrs Surf.Area= 0.45 ac Storage= 0.987 af

Plug-Flow detention time= 130.7 min calculated for 1.616 af (77% of inflow)
Center-of-Mass det. time= 72.9 min (829.5 - 756.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	744.50'	0.614 af	**101.58'W x 192.12'L x 5.50'H Field A** 2.464 af Overall - 0.928 af Embedded = 1.536 af x 40.0% Voids
#2A	745.25'	0.928 af	**ADS_StormTech MC-3500 d +Cap**x 364 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 364 Chambers in 14 Rows Cap Storage= +14.9 cf x 2 x 14 rows = 417.2 cf
		1.543 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	744.50'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	745.25'	**30.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 745.25' / 744.00' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Device 2	745.90'	**20.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	748.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 6.65 hrs HW=744.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=9.61 cfs @ 12.37 hrs HW=747.57' (Free Discharge)
└**2=Culvert** (Passes 9.61 cfs of 24.64 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 9.61 cfs @ 4.40 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2: Gravel Wetland

Inflow Area = 11.15 ac, 73.99% Impervious, Inflow Depth > 3.71" for 10-year event
Inflow = 48.50 cfs @ 12.08 hrs, Volume= 3.442 af
Outflow = 10.62 cfs @ 12.49 hrs, Volume= 2.613 af, Atten= 78%, Lag= 24.6 min
Primary = 10.62 cfs @ 12.49 hrs, Volume= 2.613 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 740.77' @ 12.49 hrs Surf.Area= 28,003 sf Storage= 81,861 cf

Plug-Flow detention time= 167.9 min calculated for 2.613 af (76% of inflow)
Center-of-Mass det. time= 108.8 min (865.7 - 757.0)

Volume	Invert	Avail.Storage	Storage Description
#1	737.00'	152,559 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
737.00	15,330	0	0
738.00	18,945	17,138	17,138
739.00	22,018	20,482	37,619
740.00	25,261	23,640	61,259
741.00	28,806	27,034	88,292
742.00	32,209	30,508	118,800
743.00	35,309	33,759	152,559

Device	Routing	Invert	Outlet Devices
#1	Primary	736.60'	**24.0" Round Culvert** L= 100.0' Ke= 0.050 Inlet / Outlet Invert= 736.60' / 735.70' S= 0.0090 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	738.60'	**18.0" W x 9.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	740.10'	**24.0" W x 7.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads

#4	Device 1	741.70'	**2.0" x 2.0" Horiz. Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#5	Secondary	742.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=10.62 cfs @ 12.49 hrs HW=740.77' (Free Discharge)
└─**1=Culvert** (Passes 10.62 cfs of 30.41 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 7.25 cfs @ 6.44 fps)
  ├─**3=Orifice** (Orifice Controls 3.37 cfs @ 2.89 fps)
  └─**4=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=737.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 1.61 ac, 0.16% Impervious, Inflow Depth > 1.90" for 10-year event
Inflow = 3.25 cfs @ 12.16 hrs, Volume= 0.254 af
Primary = 3.25 cfs @ 12.16 hrs, Volume= 0.254 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 10.94 ac, 44.51% Impervious, Inflow Depth > 2.35" for 10-year event
Inflow = 16.60 cfs @ 12.11 hrs, Volume= 2.146 af
Primary = 16.60 cfs @ 12.11 hrs, Volume= 2.146 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 1.06 ac, 0.00% Impervious, Inflow Depth > 1.90" for 10-year event
Inflow = 2.54 cfs @ 12.08 hrs, Volume= 0.168 af
Primary = 2.54 cfs @ 12.08 hrs, Volume= 0.168 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 24.41 ac, 33.81% Impervious, Inflow Depth > 2.28" for 10-year event
Inflow = 32.24 cfs @ 12.26 hrs, Volume= 4.628 af
Primary = 32.24 cfs @ 12.26 hrs, Volume= 4.628 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 2.73 ac, 0.14% Impervious, Inflow Depth > 1.83" for 10-year event
Inflow = 6.06 cfs @ 12.10 hrs, Volume= 0.415 af
Primary = 6.06 cfs @ 12.10 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: Subcat PR1 Runoff Area=6.83 ac 71.25% Impervious Runoff Depth>4.73"
Flow Length=1,099' Tc=5.0 min CN=91 Runoff=37.99 cfs 2.692 af

Subcatchment PR1-A: Subcat PR1-A Runoff Area=1.06 ac 0.00% Impervious Runoff Depth>2.71"
Flow Length=131' Tc=5.0 min CN=71 Runoff=3.64 cfs 0.240 af

Subcatchment PR1-B: Subcat PR1-B Runoff Area=3.05 ac 0.10% Impervious Runoff Depth>2.80"
Flow Length=213' Tc=5.0 min CN=72 Runoff=10.79 cfs 0.713 af

Subcatchment PR2: Subcat PR2 Runoff Area=11.15 ac 73.99% Impervious Runoff Depth>4.73"
Flow Length=1,482' Slope=0.0100 '/' Tc=5.4 min CN=91 Runoff=60.95 cfs 4.393 af

Subcatchment PR2-A: Subcat PR2-A Runoff Area=1.94 ac 0.00% Impervious Runoff Depth>2.62"
Flow Length=400' Tc=7.5 min CN=70 Runoff=6.01 cfs 0.424 af

Subcatchment PR2-AA: Subcat PR2-AA Runoff Area=2.73 ac 0.00% Impervious Runoff Depth>2.61"
Flow Length=561' Tc=12.2 min CN=70 Runoff=7.30 cfs 0.595 af

Subcatchment PR2-B: Subcat PR2-B Runoff Area=4.18 ac 0.00% Impervious Runoff Depth>2.62"
Flow Length=362' Tc=8.1 min CN=70 Runoff=12.63 cfs 0.911 af

Subcatchment PR2-BB: Subcat PR2-BB Runoff Area=1.61 ac 0.16% Impervious Runoff Depth>2.71"
Flow Length=230' Tc=10.6 min CN=71 Runoff=4.66 cfs 0.362 af

Subcatchment PR2-C: Subcat PR2-C Runoff Area=2.80 ac 0.00% Impervious Runoff Depth>2.62"
Flow Length=169' Tc=5.0 min CN=70 Runoff=9.26 cfs 0.612 af

Subcatchment PR3: Subcat PR3 Runoff Area=2.73 ac 0.14% Impervious Runoff Depth>2.62"
Flow Length=287' Tc=6.3 min CN=70 Runoff=8.76 cfs 0.595 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.72' Max Vel=4.57 fps Inflow=28.24 cfs 2.298 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=56.86 cfs Outflow=27.71 cfs 2.295 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.69' Max Vel=6.37 fps Inflow=25.61 cfs 1.884 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=24.14 cfs 1.874 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.49' Max Vel=4.96 fps Inflow=9.26 cfs 0.612 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=8.65 cfs 0.610 af

Pond P1: Subsurface Basin Loading Dock Peak Elev=748.25' Storage=1.195 af Inflow=37.99 cfs 2.692 af
Discarded=0.12 cfs 0.154 af Primary=12.95 cfs 2.036 af Outflow=13.08 cfs 2.190 af

Pond P2: Gravel Wetland Peak Elev=741.40' Storage=100,160 cf Inflow=60.95 cfs 4.393 af
Primary=14.06 cfs 3.540 af Secondary=0.00 cfs 0.000 af Outflow=14.06 cfs 3.540 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=4.66 cfs 0.362 af
Primary=4.66 cfs 0.362 af

Link DP1: Large Wetland Inflow=24.51 cfs 2.988 af
Primary=24.51 cfs 2.988 af

Link DP1-A: Property Line Inflow=3.64 cfs 0.240 af
Primary=3.64 cfs 0.240 af

Link DP2: Rochdale Pond Inflow=47.37 cfs 6.430 af
Primary=47.37 cfs 6.430 af

Link DP3: Small Wetland Inflow=8.76 cfs 0.595 af
Primary=8.76 cfs 0.595 af

Total Runoff Area = 38.08 ac Runoff Volume = 11.538 af Average Runoff Depth = 3.64"
65.53% Pervious = 24.95 ac 34.47% Impervious = 13.13 ac

Summary for Subcatchment PR1: Subcat PR1

Runoff = 37.99 cfs @ 12.07 hrs, Volume= 2.692 af, Depth> 4.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
1.10	74	>75% Grass cover, Good, HSG C
4.87	98	Paved parking, HSG C
0.87	70	Woods, Good, HSG C
6.83	91	Weighted Average
1.96		28.75% Pervious Area
4.87		71.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0280	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	380	0.0408	4.10		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.4	669	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
3.5	1,099	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-A: Subcat PR1-A

Runoff = 3.64 cfs @ 12.08 hrs, Volume= 0.240 af, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.30	74	>75% Grass cover, Good, HSG C
0.76	70	Woods, Good, HSG C
1.06	71	Weighted Average
1.06		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.4545	0.38		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
1.0	120	0.0750	1.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	131	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-B: Subcat PR1-B

Runoff = 10.79 cfs @ 12.08 hrs, Volume= 0.713 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.56	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.02	55	Woods, Good, HSG B
1.73	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
3.05	72	Weighted Average
3.05		99.90% Pervious Area
0.00		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	27	0.4815	0.47		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
3.2	186	0.0376	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: Subcat PR2

Runoff = 60.95 cfs @ 12.08 hrs, Volume= 4.393 af, Depth> 4.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
1.92	74	>75% Grass cover, Good, HSG C
2.28	98	Paved parking, HSG C
5.97	98	Roofs, HSG C
0.98	70	Woods, Good, HSG C
11.15	91	Weighted Average
2.90		26.01% Pervious Area
8.25		73.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
2.0	242	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	1,190	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior

5.4 1,482 Total

Summary for Subcatchment PR2-A: Subcat PR2-A

Runoff = 6.01 cfs @ 12.11 hrs, Volume= 0.424 af, Depth> 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
1.79	70	Woods, Good, HSG C
1.94	70	Weighted Average
1.94		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.3000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	370	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	400	Total			

Summary for Subcatchment PR2-AA: Subcat PR2-AA

Runoff = 7.30 cfs @ 12.17 hrs, Volume= 0.595 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	55	Woods, Good, HSG B
2.55	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.73		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
6.5	511	0.0685	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	561	Total			

Summary for Subcatchment PR2-B: Subcat PR2-B

Runoff = 12.63 cfs @ 12.12 hrs, Volume= 0.911 af, Depth> 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
4.00	70	Woods, Good, HSG C
4.18	70	Weighted Average
4.18		100.00% Pervious Area
0.00		0.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.2360	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.5	312	0.0860	1.47		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.1	362	Total			

Summary for Subcatchment PR2-BB: Subcat PR2-BB

Runoff = 4.66 cfs @ 12.15 hrs, Volume= 0.362 af, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.24	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
1.37	70	Woods, Good, HSG C
1.61	71	Weighted Average
1.60		99.84% Pervious Area
0.00		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
2.0	180	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	230	Total			

Summary for Subcatchment PR2-C: Subcat PR2-C

Runoff = 9.26 cfs @ 12.08 hrs, Volume= 0.612 af, Depth> 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
2.65	70	Woods, Good, HSG C
2.80	70	Weighted Average
2.80		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	16	0.5000	3.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	153	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	169	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: Subcat PR3

Runoff = 8.76 cfs @ 12.10 hrs, Volume= 0.595 af, Depth> 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.03"

Area (ac)	CN	Description
0.08	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.01	55	Woods, Good, HSG B
2.63	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.72		99.86% Pervious Area
0.00		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0600	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.17"
3.1	237	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	287	Total			

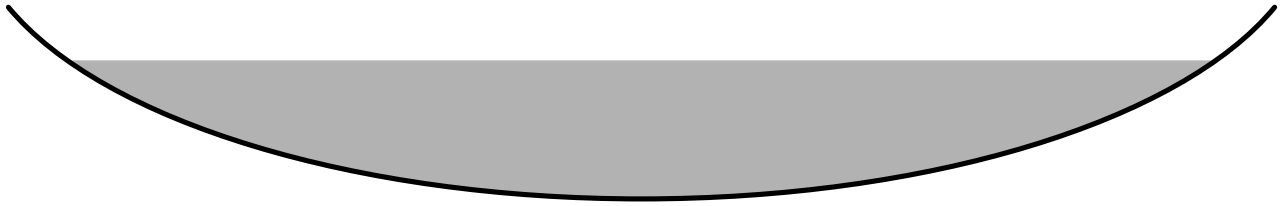
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 10.53 ac, 0.02% Impervious, Inflow Depth > 2.62" for 25-year event
Inflow = 28.24 cfs @ 12.21 hrs, Volume= 2.298 af
Outflow = 27.71 cfs @ 12.23 hrs, Volume= 2.295 af, Atten= 2%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.57 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 1.6 min

Peak Storage= 1,093 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.72' , Surface Width= 12.75'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 56.86 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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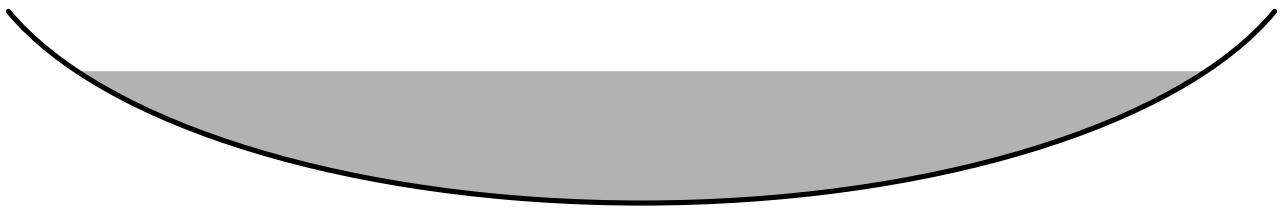
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 8.58 ac, 0.03% Impervious, Inflow Depth > 2.63" for 25-year event
Inflow = 25.61 cfs @ 12.13 hrs, Volume= 1.884 af
Outflow = 24.14 cfs @ 12.22 hrs, Volume= 1.874 af, Atten= 6%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.37 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 2.53 fps, Avg. Travel Time= 7.9 min

Peak Storage= 4,583 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.69' , Surface Width= 8.29'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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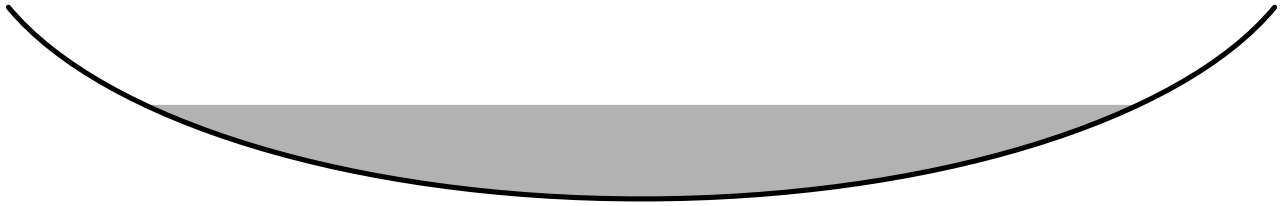
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 2.80 ac, 0.00% Impervious, Inflow Depth > 2.62" for 25-year event
Inflow = 9.26 cfs @ 12.08 hrs, Volume= 0.612 af
Outflow = 8.65 cfs @ 12.13 hrs, Volume= 0.610 af, Atten= 7%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.96 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.91 fps, Avg. Travel Time= 4.4 min

Peak Storage= 915 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.49' , Surface Width= 5.61'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P1: Subsurface Basin Loading Dock

Inflow Area = 6.83 ac, 71.25% Impervious, Inflow Depth > 4.73" for 25-year event
Inflow = 37.99 cfs @ 12.07 hrs, Volume= 2.692 af
Outflow = 13.08 cfs @ 12.34 hrs, Volume= 2.190 af, Atten= 66%, Lag= 16.1 min
Discarded = 0.12 cfs @ 5.70 hrs, Volume= 0.154 af
Primary = 12.95 cfs @ 12.34 hrs, Volume= 2.036 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 748.25' @ 12.34 hrs Surf.Area= 0.45 ac Storage= 1.195 af

Plug-Flow detention time= 120.6 min calculated for 2.184 af (81% of inflow)
Center-of-Mass det. time= 69.5 min (820.3 - 750.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	744.50'	0.614 af	**101.58'W x 192.12'L x 5.50'H Field A** 2.464 af Overall - 0.928 af Embedded = 1.536 af x 40.0% Voids
#2A	745.25'	0.928 af	**ADS_StormTech MC-3500 d +Cap**x 364 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 364 Chambers in 14 Rows Cap Storage= +14.9 cf x 2 x 14 rows = 417.2 cf
		1.543 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	744.50'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	745.25'	**30.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 745.25' / 744.00' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Device 2	745.90'	**20.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	748.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 5.70 hrs HW=744.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=12.95 cfs @ 12.34 hrs HW=748.25' (Free Discharge)
└**2=Culvert** (Passes 12.95 cfs of 31.28 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 12.95 cfs @ 5.93 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2: Gravel Wetland

Inflow Area = 11.15 ac, 73.99% Impervious, Inflow Depth > 4.73" for 25-year event
Inflow = 60.95 cfs @ 12.08 hrs, Volume= 4.393 af
Outflow = 14.06 cfs @ 12.47 hrs, Volume= 3.540 af, Atten= 77%, Lag= 23.7 min
Primary = 14.06 cfs @ 12.47 hrs, Volume= 3.540 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 741.40' @ 12.47 hrs Surf.Area= 30,175 sf Storage= 100,160 cf

Plug-Flow detention time= 158.1 min calculated for 3.540 af (81% of inflow)
Center-of-Mass det. time= 105.6 min (856.8 - 751.2)

Volume	Invert	Avail.Storage	Storage Description
#1	737.00'	152,559 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
737.00	15,330	0	0
738.00	18,945	17,138	17,138
739.00	22,018	20,482	37,619
740.00	25,261	23,640	61,259
741.00	28,806	27,034	88,292
742.00	32,209	30,508	118,800
743.00	35,309	33,759	152,559

Device	Routing	Invert	Outlet Devices
#1	Primary	736.60'	**24.0" Round Culvert** L= 100.0' Ke= 0.050 Inlet / Outlet Invert= 736.60' / 735.70' S= 0.0090 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	738.60'	**18.0" W x 9.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	740.10'	**24.0" W x 7.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads

#4	Device 1	741.70'	**2.0" x 2.0" Horiz. Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#5	Secondary	742.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=14.05 cfs @ 12.47 hrs HW=741.40' (Free Discharge)
└─**1=Culvert** (Passes 14.05 cfs of 33.37 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 8.43 cfs @ 7.49 fps)
  ├─**3=Orifice** (Orifice Controls 5.62 cfs @ 4.82 fps)
  └─**4=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=737.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 1.61 ac, 0.16% Impervious, Inflow Depth > 2.71" for 25-year event
Inflow = 4.66 cfs @ 12.15 hrs, Volume= 0.362 af
Primary = 4.66 cfs @ 12.15 hrs, Volume= 0.362 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 10.94 ac, 44.51% Impervious, Inflow Depth > 3.28" for 25-year event
Inflow = 24.51 cfs @ 12.10 hrs, Volume= 2.988 af
Primary = 24.51 cfs @ 12.10 hrs, Volume= 2.988 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 1.06 ac, 0.00% Impervious, Inflow Depth > 2.71" for 25-year event
Inflow = 3.64 cfs @ 12.08 hrs, Volume= 0.240 af
Primary = 3.64 cfs @ 12.08 hrs, Volume= 0.240 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 24.41 ac, 33.81% Impervious, Inflow Depth > 3.16" for 25-year event
Inflow = 47.37 cfs @ 12.23 hrs, Volume= 6.430 af
Primary = 47.37 cfs @ 12.23 hrs, Volume= 6.430 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 2.73 ac, 0.14% Impervious, Inflow Depth > 2.62" for 25-year event
Inflow = 8.76 cfs @ 12.10 hrs, Volume= 0.595 af
Primary = 8.76 cfs @ 12.10 hrs, Volume= 0.595 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: Subcat PR1 Runoff Area=6.83 ac 71.25% Impervious Runoff Depth>6.33"
Flow Length=1,099' Tc=5.0 min CN=91 Runoff=49.90 cfs 3.601 af

Subcatchment PR1-A: Subcat PR1-A Runoff Area=1.06 ac 0.00% Impervious Runoff Depth>4.06"
Flow Length=131' Tc=5.0 min CN=71 Runoff=5.42 cfs 0.359 af

Subcatchment PR1-B: Subcat PR1-B Runoff Area=3.05 ac 0.10% Impervious Runoff Depth>4.17"
Flow Length=213' Tc=5.0 min CN=72 Runoff=15.94 cfs 1.059 af

Subcatchment PR2: Subcat PR2 Runoff Area=11.15 ac 73.99% Impervious Runoff Depth>6.32"
Flow Length=1,482' Slope=0.0100 '/' Tc=5.4 min CN=91 Runoff=80.02 cfs 5.876 af

Subcatchment PR2-A: Subcat PR2-A Runoff Area=1.94 ac 0.00% Impervious Runoff Depth>3.94"
Flow Length=400' Tc=7.5 min CN=70 Runoff=9.04 cfs 0.638 af

Subcatchment PR2-AA: Subcat PR2-AA Runoff Area=2.73 ac 0.00% Impervious Runoff Depth>3.94"
Flow Length=561' Tc=12.2 min CN=70 Runoff=11.01 cfs 0.896 af

Subcatchment PR2-B: Subcat PR2-B Runoff Area=4.18 ac 0.00% Impervious Runoff Depth>3.94"
Flow Length=362' Tc=8.1 min CN=70 Runoff=19.03 cfs 1.372 af

Subcatchment PR2-BB: Subcat PR2-BB Runoff Area=1.61 ac 0.16% Impervious Runoff Depth>4.05"
Flow Length=230' Tc=10.6 min CN=71 Runoff=6.96 cfs 0.542 af

Subcatchment PR2-C: Subcat PR2-C Runoff Area=2.80 ac 0.00% Impervious Runoff Depth>3.95"
Flow Length=169' Tc=5.0 min CN=70 Runoff=13.91 cfs 0.921 af

Subcatchment PR3: Subcat PR3 Runoff Area=2.73 ac 0.14% Impervious Runoff Depth>3.95"
Flow Length=287' Tc=6.3 min CN=70 Runoff=13.17 cfs 0.896 af

Reach R2-A: Grindstone Brook (South) Avg. Flow Depth=0.88' Max Vel=5.23 fps Inflow=43.19 cfs 3.459 af
n=0.022 L=178.0' S=0.0124 '/' Capacity=56.86 cfs Outflow=42.58 cfs 3.456 af

Reach R2-B: Grindstone Brook (Middle) Avg. Flow Depth=0.84' Max Vel=7.25 fps Inflow=38.79 cfs 2.833 af
n=0.022 L=1,206.0' S=0.0260 '/' Capacity=54.42 cfs Outflow=36.76 cfs 2.821 af

Reach R2-C: Grindstone Brook (North) Avg. Flow Depth=0.60' Max Vel=5.62 fps Inflow=13.91 cfs 0.921 af
n=0.022 L=498.0' S=0.0245 '/' Capacity=41.91 cfs Outflow=13.09 cfs 0.919 af

Pond P1: Subsurface Basin Loading Dock Peak Elev=749.19' Storage=1.397 af Inflow=49.90 cfs 3.601 af
Discarded=0.12 cfs 0.163 af Primary=25.23 cfs 2.918 af Outflow=25.36 cfs 3.081 af

Pond P2: Gravel Wetland Peak Elev=742.20' Storage=125,317 cf Inflow=80.02 cfs 5.876 af
Primary=20.67 cfs 4.987 af Secondary=0.00 cfs 0.000 af Outflow=20.67 cfs 4.987 af

Pond P2-BB: Wetland attached to Grindstone Brook Inflow=6.96 cfs 0.542 af
Primary=6.96 cfs 0.542 af

Link DP1: Large Wetland Inflow=37.93 cfs 4.336 af
Primary=37.93 cfs 4.336 af

Link DP1-A: Property Line Inflow=5.42 cfs 0.359 af
Primary=5.42 cfs 0.359 af

Link DP2: Rochdale Pond Inflow=72.01 cfs 9.340 af
Primary=72.01 cfs 9.340 af

Link DP3: Small Wetland Inflow=13.17 cfs 0.896 af
Primary=13.17 cfs 0.896 af

Total Runoff Area = 38.08 ac Runoff Volume = 16.161 af Average Runoff Depth = 5.09"
65.53% Pervious = 24.95 ac 34.47% Impervious = 13.13 ac

Summary for Subcatchment PR1: Subcat PR1

Runoff = 49.90 cfs @ 12.07 hrs, Volume= 3.601 af, Depth> 6.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
1.10	74	>75% Grass cover, Good, HSG C
4.87	98	Paved parking, HSG C
0.87	70	Woods, Good, HSG C
6.83	91	Weighted Average
1.96		28.75% Pervious Area
4.87		71.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0280	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	380	0.0408	4.10		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.4	669	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
3.5	1,099	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-A: Subcat PR1-A

Runoff = 5.42 cfs @ 12.08 hrs, Volume= 0.359 af, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.30	74	>75% Grass cover, Good, HSG C
0.76	70	Woods, Good, HSG C
1.06	71	Weighted Average
1.06		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.4545	0.38		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
1.0	120	0.0750	1.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	131	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR1-B: Subcat PR1-B

Runoff = 15.94 cfs @ 12.08 hrs, Volume= 1.059 af, Depth> 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.56	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.02	55	Woods, Good, HSG B
1.73	70	Woods, Good, HSG C
0.74	77	Woods, Good, HSG D
3.05	72	Weighted Average
3.05		99.90% Pervious Area
0.00		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	27	0.4815	0.47		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.17"
3.2	186	0.0376	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	213	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: Subcat PR2

Runoff = 80.02 cfs @ 12.08 hrs, Volume= 5.876 af, Depth> 6.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
1.92	74	>75% Grass cover, Good, HSG C
2.28	98	Paved parking, HSG C
5.97	98	Roofs, HSG C
0.98	70	Woods, Good, HSG C
11.15	91	Weighted Average
2.90		26.01% Pervious Area
8.25		73.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
2.0	242	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	1,190	0.0100	7.80	24.51	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior

5.4 1,482 Total

Summary for Subcatchment PR2-A: Subcat PR2-A

Runoff = 9.04 cfs @ 12.11 hrs, Volume= 0.638 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
1.79	70	Woods, Good, HSG C
1.94	70	Weighted Average
1.94		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	30	0.3000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
4.7	370	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	400	Total			

Summary for Subcatchment PR2-AA: Subcat PR2-AA

Runoff = 11.01 cfs @ 12.17 hrs, Volume= 0.896 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	55	Woods, Good, HSG B
2.55	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.73		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
6.5	511	0.0685	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	561	Total			

Summary for Subcatchment PR2-B: Subcat PR2-B

Runoff = 19.03 cfs @ 12.12 hrs, Volume= 1.372 af, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.18	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
4.00	70	Woods, Good, HSG C
4.18	70	Weighted Average
4.18		100.00% Pervious Area
0.00		0.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.2360	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
3.5	312	0.0860	1.47		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.1	362	Total			

Summary for Subcatchment PR2-BB: Subcat PR2-BB

Runoff = 6.96 cfs @ 12.15 hrs, Volume= 0.542 af, Depth> 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.24	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
1.37	70	Woods, Good, HSG C
1.61	71	Weighted Average
1.60		99.84% Pervious Area
0.00		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0500	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.17"
2.0	180	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	230	Total			

Summary for Subcatchment PR2-C: Subcat PR2-C

Runoff = 13.91 cfs @ 12.08 hrs, Volume= 0.921 af, Depth> 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.15	74	>75% Grass cover, Good, HSG C
2.65	70	Woods, Good, HSG C
2.80	70	Weighted Average
2.80		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	16	0.5000	3.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.17"
1.5	153	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	169	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: Subcat PR3

Runoff = 13.17 cfs @ 12.10 hrs, Volume= 0.896 af, Depth> 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.73"

Area (ac)	CN	Description
0.08	74	>75% Grass cover, Good, HSG C
0.00	98	Paved parking, HSG C
0.01	55	Woods, Good, HSG B
2.63	70	Woods, Good, HSG C
2.73	70	Weighted Average
2.72		99.86% Pervious Area
0.00		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	50	0.0600	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.17"
3.1	237	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	287	Total			

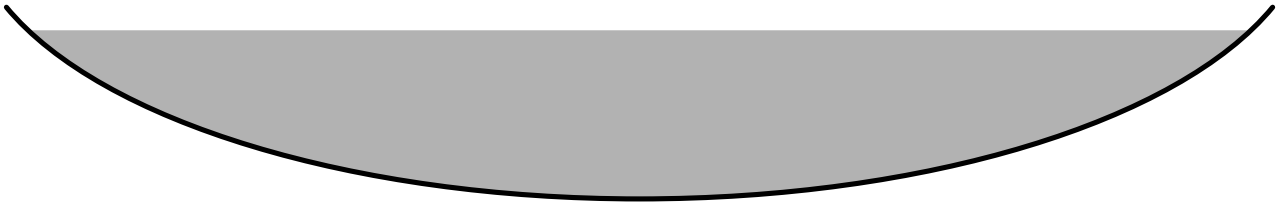
Summary for Reach R2-A: Grindstone Brook (South)

Inflow Area = 10.53 ac, 0.02% Impervious, Inflow Depth > 3.94" for 100-year event
Inflow = 43.19 cfs @ 12.20 hrs, Volume= 3.459 af
Outflow = 42.58 cfs @ 12.21 hrs, Volume= 3.456 af, Atten= 1%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.23 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.01 fps, Avg. Travel Time= 1.5 min

Peak Storage= 1,469 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.88' , Surface Width= 14.07'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 56.86 cfs

15.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 178.0' Slope= 0.0124 '/'
Inlet Invert= 701.90', Outlet Invert= 699.70'



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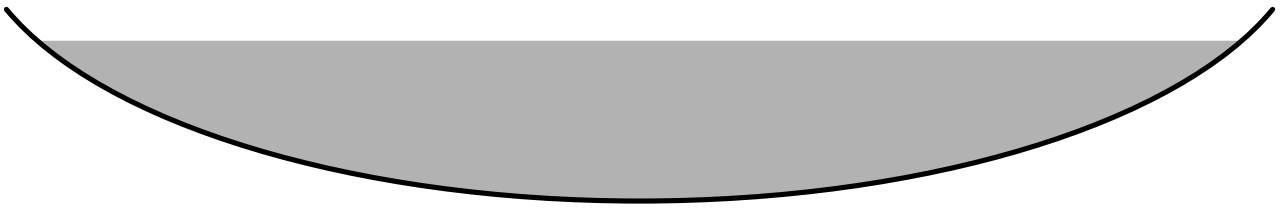
Summary for Reach R2-B: Grindstone Brook (Middle)

Inflow Area = 8.58 ac, 0.03% Impervious, Inflow Depth > 3.96" for 100-year event
Inflow = 38.79 cfs @ 12.12 hrs, Volume= 2.833 af
Outflow = 36.76 cfs @ 12.21 hrs, Volume= 2.821 af, Atten= 5%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.25 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 2.75 fps, Avg. Travel Time= 7.3 min

Peak Storage= 6,144 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.84' , Surface Width= 9.14'
Bank-Full Depth= 1.00' Flow Area= 6.7 sf, Capacity= 54.42 cfs

10.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 1,206.0' Slope= 0.0260 '/'
Inlet Invert= 733.20', Outlet Invert= 701.90'



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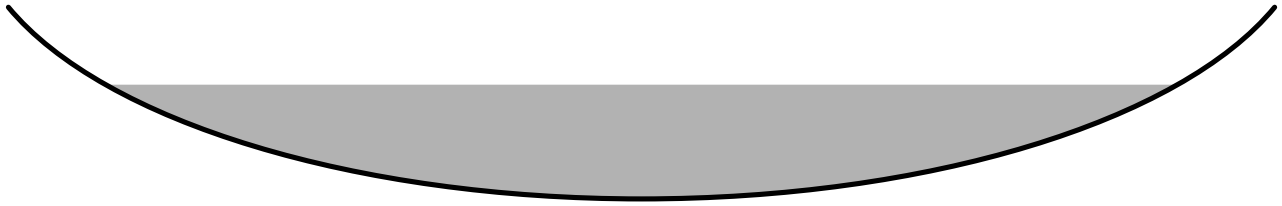
Summary for Reach R2-C: Grindstone Brook (North)

Inflow Area = 2.80 ac, 0.00% Impervious, Inflow Depth > 3.95" for 100-year event
Inflow = 13.91 cfs @ 12.08 hrs, Volume= 0.921 af
Outflow = 13.09 cfs @ 12.12 hrs, Volume= 0.919 af, Atten= 6%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.62 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 4.0 min

Peak Storage= 1,220 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 6.17'
Bank-Full Depth= 1.00' Flow Area= 5.3 sf, Capacity= 41.91 cfs

8.00' x 1.00' deep Parabolic Channel, n= 0.022 Earth, clean & straight
Length= 498.0' Slope= 0.0245 '/'
Inlet Invert= 745.40', Outlet Invert= 733.20'



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Summary for Pond P1: Subsurface Basin Loading Dock

Inflow Area = 6.83 ac, 71.25% Impervious, Inflow Depth > 6.33" for 100-year event
Inflow = 49.90 cfs @ 12.07 hrs, Volume= 3.601 af
Outflow = 25.36 cfs @ 12.22 hrs, Volume= 3.081 af, Atten= 49%, Lag= 8.7 min
Discarded = 0.12 cfs @ 4.65 hrs, Volume= 0.163 af
Primary = 25.23 cfs @ 12.22 hrs, Volume= 2.918 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 749.19' @ 12.22 hrs Surf.Area= 0.45 ac Storage= 1.397 af

Plug-Flow detention time= 108.1 min calculated for 3.073 af (85% of inflow)
Center-of-Mass det. time= 64.4 min (808.5 - 744.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	744.50'	0.614 af	**101.58'W x 192.12'L x 5.50'H Field A** 2.464 af Overall - 0.928 af Embedded = 1.536 af x 40.0% Voids
#2A	745.25'	0.928 af	**ADS_StormTech MC-3500 d +Cap**x 364 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 364 Chambers in 14 Rows Cap Storage= +14.9 cf x 2 x 14 rows = 417.2 cf
		1.543 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	744.50'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	745.25'	**30.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 745.25' / 744.00' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf
#3	Device 2	745.90'	**20.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	748.40'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 4.65 hrs HW=744.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=24.87 cfs @ 12.22 hrs HW=749.17' (Free Discharge)
└**2=Culvert** (Passes 24.87 cfs of 38.61 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 16.39 cfs @ 7.51 fps)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 8.48 cfs @ 2.87 fps)

Summary for Pond P2: Gravel Wetland

Inflow Area = 11.15 ac, 73.99% Impervious, Inflow Depth > 6.32" for 100-year event
Inflow = 80.02 cfs @ 12.08 hrs, Volume= 5.876 af
Outflow = 20.67 cfs @ 12.44 hrs, Volume= 4.987 af, Atten= 74%, Lag= 21.8 min
Primary = 20.67 cfs @ 12.44 hrs, Volume= 4.987 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 742.20' @ 12.44 hrs Surf.Area= 32,830 sf Storage= 125,317 cf

Plug-Flow detention time= 146.8 min calculated for 4.987 af (85% of inflow)
Center-of-Mass det. time= 101.7 min (846.1 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	737.00'	152,559 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
737.00	15,330	0	0
738.00	18,945	17,138	17,138
739.00	22,018	20,482	37,619
740.00	25,261	23,640	61,259
741.00	28,806	27,034	88,292
742.00	32,209	30,508	118,800
743.00	35,309	33,759	152,559

Device	Routing	Invert	Outlet Devices
#1	Primary	736.60'	**24.0" Round Culvert** L= 100.0' Ke= 0.050 Inlet / Outlet Invert= 736.60' / 735.70' S= 0.0090 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf
#2	Device 1	738.60'	**18.0" W x 9.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	740.10'	**24.0" W x 7.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads

#4	Device 1	741.70'	**2.0" x 2.0" Horiz. Grate X 6.00 columns** X 6 rows C= 0.600 in 24.0" x 24.0" Grate (25% open area) Limited to weir flow at low heads
#5	Secondary	742.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=20.67 cfs @ 12.44 hrs HW=742.20' (Free Discharge)
└─**1=Culvert** (Passes 20.67 cfs of 36.80 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 9.72 cfs @ 8.64 fps)
  ├─**3=Orifice** (Orifice Controls 7.54 cfs @ 6.47 fps)
  └─**4=Grate** (Orifice Controls 3.40 cfs @ 3.40 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=737.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P2-BB: Wetland attached to Grindstone Brook

Inflow Area = 1.61 ac, 0.16% Impervious, Inflow Depth > 4.05" for 100-year event
Inflow = 6.96 cfs @ 12.15 hrs, Volume= 0.542 af
Primary = 6.96 cfs @ 12.15 hrs, Volume= 0.542 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Large Wetland

Inflow Area = 10.94 ac, 44.51% Impervious, Inflow Depth > 4.75" for 100-year event
Inflow = 37.93 cfs @ 12.16 hrs, Volume= 4.336 af
Primary = 37.93 cfs @ 12.16 hrs, Volume= 4.336 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP1-A: Property Line

Inflow Area = 1.06 ac, 0.00% Impervious, Inflow Depth > 4.06" for 100-year event
Inflow = 5.42 cfs @ 12.08 hrs, Volume= 0.359 af
Primary = 5.42 cfs @ 12.08 hrs, Volume= 0.359 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Rochdale Pond

Inflow Area = 24.41 ac, 33.81% Impervious, Inflow Depth > 4.59" for 100-year event
Inflow = 72.01 cfs @ 12.21 hrs, Volume= 9.340 af
Primary = 72.01 cfs @ 12.21 hrs, Volume= 9.340 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Small Wetland

Inflow Area = 2.73 ac, 0.14% Impervious, Inflow Depth > 3.95" for 100-year event
Inflow = 13.17 cfs @ 12.10 hrs, Volume= 0.896 af
Primary = 13.17 cfs @ 12.10 hrs, Volume= 0.896 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Appendix C: Standard 3 Computations and Supporting Documentation

- Recharge Volume Calculations
- Soil Evaluation in accordance with Volume 3, Chapter 1 of the Handbook
- Geotechnical Report: *Geotechnical Investigation Report for 92 Huntoon Memorial Highway, Leicester, MA* prepared by Yankee Engineering & Testing, Inc. dated August 5, 2021

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Recharge Calculations

Project	Leicester Central	**Project #**	15392
Calculated by	ALG	**Date**	12/13/2021
Checked by	JWD	**Date**	12/13/2021

REQUIRED RECHARGE VOLUME

Hydrologic Soil Group (HSG)	Area (ft^2)	Inches of Runoff (in)	Volume (ft^3)
A	0	0.60	0
B	0	0.35	0
C	571,420	0.25	11,905
D	0	0.10	0
TOTAL			**11,905**

CAPTURE AREA ADJUSTMENT

Required Recharge Volume (ft^3)	11,905
Total Site Net Impervious Area (ft^2)	571,420
Total Site Impervious Area Draining to Recharge Facilities (ft^2)	212,050
Capture Area Adjustment Factor	2.69
Adjusted Recharge Volume (ft^3)*	**32,080**

*Due to high groundwater and C and D soils, we are recharging to the maximum extent practicable and exceeding the required recharge volume before applying the capture area adjustment.

PROVIDED RECHARGE VOLUME

BASIN P1:

Subsurface System under loading dock

Volumes provided below the lowest outlet at elevation: 745.9

Provided Volume:	Bottom Area (ft^2)	Volume (ft^3)
	20,604	**17,772**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**0.27**	(in/hr)
Drawdown Time:	**38.34**	(hours)

RECHARGE VOLUME SUMMARY

Required Recharge Volume:	**11,905**	(ft^3)
Adjusted Recharge Volume:	**32,080**	(ft^3)
Total Recharge Volume Provided:	**17,772**	(ft^3)

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.

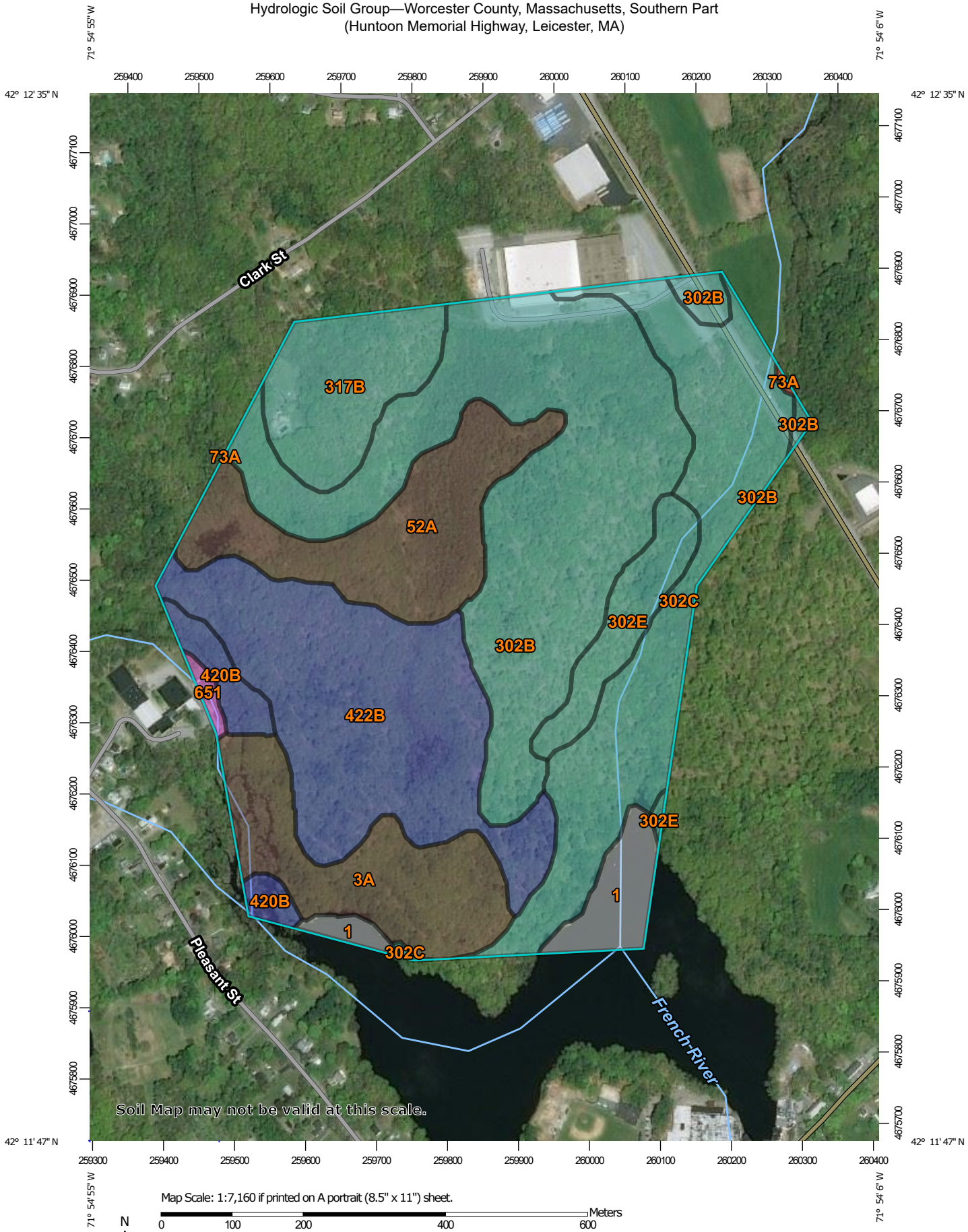
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group—Worcester County, Massachusetts, Southern Part
(Huntoon Memorial Highway, Leicester, MA)



Map Scale: 1:7,160 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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 14, Sep 3, 2021

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

Date(s) aerial images were photographed: May 18, 2019—Jul 9, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		5.2	3.3%
3A	Scarboro and Walpole soils, 0 to 3 percent slopes	B/D	14.2	9.1%
52A	Freetown muck, 0 to 1 percent slopes	B/D	16.3	10.4%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	0.1	0.1%
302B	Montauk fine sandy loam, 0 to 8 percent slopes, extremely stony	C	44.4	28.4%
302C	Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony	C	25.1	16.0%
302E	Montauk fine sandy loam, 15 to 35 percent slopes, extremely stony	C	6.1	3.9%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	C	10.8	6.9%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	3.5	2.2%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	30.1	19.2%
651	Udorthents, smoothed	A	0.6	0.4%
Totals for Area of Interest			**156.4**	**100.0%**

Yankee Engineering & Testing, Inc.

GEOTECHNICAL INVESTIGATION
REPORT

FOR

92-94 HUNTOON HWY FACILITY
92 HUNTOON MEMORIAL HIGHWAY, LEICESTER, MA

PREPARED
FOR:

THE BRENNAN GROUP, INC.
ONE WALNUT STREET, SUITE 3, BOSTON, MA 02108

PREPARED
BY:

YANKEE ENGINEERING & TESTING, INC.
WORCESTER, MASSACHUSETTS

PROJECT #2021-53

AUGUST 5, 2021

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Tel (508) 831-7404 Fax (508) 831-7388
CONSTRUCTION INSPECTION & MATERIALS TESTING
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Yankee Engineering & Testing, Inc.

August 5, 2021

Mr. Jack Brennan
The Brennan Group, Inc.
One Walnut Street, Suite 3
Boston, MA 02108

RE: Preliminary Geotechnical Investigation Summary
Proposed 92 – 94 Huntoon Memorial Highway Facility **Project #2021-53**
92 Huntoon Memorial Highway - Leicester, Massachusetts

Dear Mr. Brennan:

The purpose of this report, as agreed, is to formally present our field results, observations, and professional engineering recommendations/conclusions from the limited subsurface soil investigation, completed on July 30th and August 2nd 2021 at the above referenced site. Please refer to our proposal #2021-127 for the contracted scope of services.

This soil boring program, as requested, was intended to address the structural implications of the subsurface soils and groundwater conditions relative to the proposed building. The field and laboratory data were utilized to draw the geotechnical conclusions and to formulate the professional engineering recommendations presented herein.

EXISTING PROPERTY CONDITIONS:

The 50± acre property is located along the western side of Huntoon Memorial Highway (MA Route 56) in Rochdale/Leicester, Massachusetts. In general, the site is abutted by a large industrial complex to the north, woodlands to the south and west, and Huntoon Memorial Highway to the east. The site has rolling slopes that ranged from elev. 750'± on the southern side to elev. 770'± towards the northeast corner. Elevations were estimated from Google Earth.

During the initial site review Mr. Joel Morin explored the site and found the property to have been partially cleared and logged at some point in the past. As such, much of the property was largely accessible to the soil boring rig, although some sections were still densely wooded and, as such, not accessible to the rig. It should be noted that no site contours (elevations) were provided to Yankee, as such, all depths referenced in this report were relative to the existing ground elevation(s).

PROPOSED CONSTRUCTION:

The provided conceptual plans indicate that the development would consist of a warehouse/distribution facility constructed on the eastern side of Parcel #2 (44± acres) and extending into Parcel #1 (6± acres) The proposed building will have a footprint of roughly 202,800± s.f. with 50± loading docks/trailer parking spaces along the west side of the structure, and a 200± space parking lot on the east side of the site near the Huntoon Highway entrance. In addition, several stormwater management areas are proposed in the northern and eastern portions of the property. It is believed that the development will be serviced by municipal water, sewer, electric, and gas entering off Huntoon Highway. Further, there is an environmental resource buffer to the south with a 50' setback.

GEOLOGIC SITE CONDITIONS:

Based upon the 2018 USGS Surficial Materials Map of the Leicester Massachusetts Quadrangle, the property is mapped as generally having "thin till deposits" as well as localized "swamp deposits". These thin till deposits coarse deposits consist of diamicts with no sorting or stratification throughout the deposit. Any swamp deposits normally consist of organic muck and peat that contain minor amounts of sand, silt, and clay; they are stratified as well as poorly sorted.

These surficial deposits are typically underlain by crystalline metamorphic rocks of the Silurian age Paxton Formation. This Formation consists of undifferentiated biotite granofels, calc-silicate granofels, and sulfidic schist. It should be noted that there were no observed onsite surficial bedrock outcroppings, however. the boring exploration refusals indicated bedrock at depths varying from 5' to 18' throughout the property. Thus, shallow bedrock should be expected but typically at a depth of 5'-15'.

KNOWN SITE HISTORY:

According to our Google Earth historical image review, the site has remained relatively unchanged, since 03/1995, from the listed existing property conditions.

SUBSURFACE EXPLORATION SERVICES:

The subsurface sampling program consisted of nine (9) soil borings (B-1 to B-9), performed by Soil X Corp, under the supervision of Mr. Joel Morin, a *Yankee* Staff Geologist. The borings were advanced using 4" I.D. hollow stem augers, driven by an Acker ADII mounted on an ATV drill rig. The approximate boring locations are shown in Figure 1, the Boring Location Plan. It should be noted that the general boring locations were marked out by *Yankee*, prior to drilling, and approved by the client, in order to provide a cross section of the subsurface soils underlying the proposed construction area.

The subsurface soil penetration resistance (SPN), was typically measured using continuous sampling from 0'–7' and standard sampling (at 5' increments) to the boring termination depths. The soil penetration resistance was measured using a 24" long by 2" O.D. "split-spoon" sampler, driven by an automatic hammer delivering a force equal to the specified 140 lb. weight falling 30". The recorded values, commonly referred to as "blow counts", are listed on the attached boring logs. Also, the recovered soil samples, visually classified and labeled in the field, shall be stored at this office for 90 days in the event that additional future review is warranted. The boring termination depths were 16'6", 15', 5', 12', 14'6", 18', 12'6", 8', 9'6" for borings B-1, B-2, B-3, B-4, B-5, B-6, B-7, B-8, and B-9 respectively. A single bedrock probe (BP-1) was conducted near B-3 had a termination depth of 8'6".

BORING OBSERVATIONS:

All of the borings revealed similar subsurface soil conditions consisting of roughly 3" to 6" of topsoil overlying subsoil/roots to a depth of 18". Below the subsoils was a light brown/brown, damp to wet, medium dense to very dense, silty sand with varying amounts of gravel (commonly called "silty glacial till"). This material was found throughout the site and during drilling several large boulders were encountered. Below this silty till was light brown/brown, moist to wet, sand and gravel with varying amounts of silt that extended to the boring refusals on suspected bedrock. Signs of groundwater were observed at depths of 5' to 13' except at boring except B-9 (in highest northeast site corner).

LABORATORY TEST RESULTS:

Laboratory gradation analyses were completed, per ASTM D-422 washed sieve test methods, on seven (7) soil samples recovered from the expected footing subgrade elevation. The gradation results (copies attached) classified the soils as light brown SM/SM-SP: silty sands with gravel. The soil composition results (gravel/sand/silt percentages), as shown on the attached curves, can be summarized as follows:

Boring ID	Sample No#	Depth	Gravel (%>#4)	Sand (#4 to #200)	Silt/Clay (%<#200)
B-1	S-3	5' – 6'	15%	69%	17%
B-2	S-3	5' – 7'	41%	48%	11%
B-3	S-2	2' – 4'	34%	41%	25%
B-4	S-3	5' – 7'	8%	63%	29%
B-5	S-2	2' – 4'	11%	63%	26%
B-6	S-3	5' – 7'	10%	59%	31%
B-9	S-2	5' – 7'	24%	50%	26%

As can be seen on the Table, the soil gradations showed "fair/low" gravel contents of 8% to 40%, however, the soils also had slightly "high/poor" fines (% passing #200 sieve) contents ranging from 11% to 31%. Based on these test results, the soil(s) would be considered moderately susceptible to moisture and/or vibration, as well as, exhibiting poor/limited drainage characteristics and moderate "frost heave" potential. Thus, the reuse of onsite soils beneath structures or roadways would be considered challenging as they are moisture/vibration susceptible and can easily destabilize and become structurally unsuitable.

These soil grain size distributions would generally fall within SBC Soil Class #8, of SBC Table 1804.3 material classification, and were applied in determining the maximum allowable soil bearing capacity presented later in this report.

MASSACHUSETTS STATE BUILDING CODE:

The SBC sec. 9.4.1.2.1 applies site classes A/B/C/D/E based on boring standard penetration numbers (SPN's or blow counts) for soil below the proposed footing grade. Our evaluation, based on the consistent 30^{+} blows/foot correlated to Site Class "D" as they did not meet the 50^{+} blows per foot required to achieve Site Class "C". However, the subsurface soils were considered to be <u>not</u> susceptible to "liquefaction" (rapid settlement via vibration), according to SBC section 1805.3, due to their measured moderate relative density and because they were not classified as "clean sands".

Judging from the blow counts and soil type(s) it is our opinion that, in accordance with SBC section 1804.3, the maximum allowable net soil bearing capacity of the dense, silty sand with varying amounts of gravel (Class #8) at footing grade, could be up to 3.0 TSF. However, due to their moderately elevated fines content and likelihood that some building areas will bear in prepared structural fill, we recommend that the actual design soil bearing capacity not exceed a slightly conservative value of <u>2.0 TSF</u> (4000 psf).

SBC SEISMIC PARAMETERS:

Per Massachusetts SBC 9th Edition (2017), the design engineer should note that, based on Table 1604.1 (Leicester) Mapped Earthquake Design Factors S_S=0.178 and S_1=0.066 would apply to the site. Further, based on State Code Table 9.4.1.2.4a (using Site Class D and S_S=0.178) the short period spectral coefficient factor (F_a) is 1.6.

Thus, the maximum short period acceleration (S_{M1}) is F_a x S_S (1.6 x 0.178) = 0.2848

From Table 9.4.1.2.4b, the 1 second spectral coefficient factor (F_v) is 2.4 for Site Class D.

Thus, the maximum 1 second acceleration (S_{m1}) is F_v x S_1 (2.4 x 0.066) = 0.1584

LATERAL EARTH PRESSURES:

We recommended that the static lateral earth pressure (at rest = K_o) for any restrained walls, which will effectively serve as retaining walls with greater than 6' exposed, should be calculated using an equivalent fluid pressure of 60 pcf (pounds per cubic foot). This value is based on the backfill consisting of granular (less than 10% passing #200 sieve) soils, being compacted to greater than 95%. It is calculated as Ko = 1-sin Ø where Ø is the soil shear angle (assumed to be 30º± for "granular" sand/gravel with a unit weight of 120± pcf). Thus, the at rest (no wall movement) soil "fluid" pressure is Ko x soil unit weight = 0.5± x 120± pcf = 60 pcf.

The static lateral earth pressure (outward wall movement allowed "active" pressure = K_a) for "unrestrained" retaining walls, is calculated as Ka = $\tan^2$ (45º -sin Ø/2) where Ø is the soil shear angle (assumed 30º± for granular soil). Thus the "active" soil pressure is Ka x soil unit weight (0.33± x 120± pcf) yields an active equivalent fluid pressure of 40 pcf. Additional pressure(s) exerted from surcharge loads (acting within 1.5 times the wall height) should be considered as a uniform pressure equal to 0.5*q*, where *q* (psf) is the surcharge load. Further, granular backfill, should have less than 12% silt (% < #200 sieve) and be compacted to a minimum of 95%. Also, for cast-in-place concrete footings bearing on native soil or compacted structural fill, we recommend a design "sliding friction" coefficient not exceeding 0.40

SEISMIC LOADS ON FOUNDATION WALLS

Exterior foundation walls and retaining walls shall be designed to resist an earthquake force, F_w, for horizontal backfill surface, equal to:

$F_w = 0.100\ (S_s)\ (F_a)\ (\gamma)\ (H)^2$ where:

S_s listed above
F_a listed above
γ is total unit weight of the soil
H is the height of the wall measured as the difference in elevation of finished ground surface or floor in front of and behind the wall

The earthquake force from the backfill shall be distributed as an inverted triangle over the height of the wall. The minimum safety factor for retaining walls shall be 1.5 for sliding and 2.0 for overturning.

FOUNDATION CONSTRUCTION:

FOUNDATION FOOTINGS

The soil bearing capacity is based on a minimum footing width of 3' and must be reduced proportionately for narrower footings. Footings should be designed in accordance with SBC section 1806. For footings smaller than 3 feet in least lateral dimension, the allowable bearing pressure should be reduced to one-third of the above value multiplied by the least lateral footing dimension in feet. Also, we recommend that continuous wall footings be at least 18 inches wide and isolated footings at least 24" wide. Further, all exterior, and interior footings in unheated areas should bear a minimum of 4' below finished grade, to provide protection from frost. Also, interior footings in heated areas should bear at least 18" below the underside of the slab. In addition, as the subsurface soils were found to be at least dense, it is our professional engineering opinion that long-term post-construction settlement should not exceed 3/8" with insignificant differential settlement. However, depending on the designed slab grade and associated thickness of any required structural fill, this value may need to be reevaluated.

SLABS ON GRADE

The undisturbed silty gravelly sands appear suitable to remain as subgrade (up to 1'± below finish floor) for the expected concrete slab(s) on grade. However, due to the fine grained ("silty") nature of the soil, we recommend preparation of a minimum 12" thick layer "slab gravel", meeting the Dense Grade Specifications, presented hereinafter. It should be noted that it is unlikely that the onsite/existing soils will meet the gradation criteria. Further, due to their slightly elevated silt content, onsite blending with processed/crushed bedrock may not yield a suitable Gravel Base blend.

Unsuitable materials, including any topsoil silty subsoil, and/or organic materials should be stripped down to the underlying native silty gravelly sands, prior to commencing construction, in order to avoid possible contamination of suitable subgrade soil. Any unsuitable materials should be removed to a distance of 5 feet beyond the proposed building or pavement limits. The contractor should carefully proof roll the exposed soil subgrade with a minimum of ten (10) passes of a vibratory roller having a minimum static weight of 10,000 pounds. Over excavate any weak or soft spots, where necessary.

Place and compact granular fill material up to the required subgrade elevation(s). The recommended compaction, based on the percentage of the soil's maximum dry density according to ASTM D-1557 methods, is specified below:

General Fill Areas	Minimum Compaction
Beneath Footings, Slab, and for Pavement Gravel Base	95%
Below Pavement Base Course Material	95%
Beneath Landscaped Areas	90%

The following gradation specifications are recommended for granular fill, gravel base, and dense graded crushed stone materials:

Sieve Size	Granular Fill	Gravel Base	Dense Grade
6”	100	100	100
3”	95-100	100	100
1/2”	60-95	50-85	50-80
#4	50-80	40-75	30-55
#10	30-70	30-60	n/a
#40	10-70	10-35	10-25
#100	0-25	0-8	n/a
#200	0-10	0-8	3-10

All backfill soils shall be free from snow, ice, roots, topsoil, and/or other deleterious materials.

FOUNDATIONS

The bearing soil, at the bottom of footing trenches, should be recompacted/proof rolled using vibratory equipment of sufficient weight to obtain the specified 95% minimum compaction. Backfilling of the foundation walls should occur on both sides to avoid unbalanced loading. Due to the observed soil type, silty glacial till, the contractors should be aware that OSHA safety standards, for excavations exceeding 4 feet in depth, may require significant widening to maintain the required slope(s). This report does not attempt to address any safety issues, which are the responsibility of the contractors and others.

PAVEMENTS

The subsurface soils appear suitable, in either their nature state or as backfill, for use as subgrade material beneath the bituminous pavement. However, we generally recommend a layer of “base” gravel, topped by a minimum of 4 inches of dense graded, crushed stone for directly beneath pavement. The dense mix is generally warranted as the onsite silty gravelly sands (“till”) are fine grained and can become destabilized when exposed to excess moisture and/or vibration. The increasing strength of the proposed layers should provide adequate support for the bituminous asphalt. Our typically recommended pavement cross sections are shown on the Table below:

Suggested Pavement Courses	Heavy Duty Traffic	Light Duty Traffic
Bituminous Top Mix MHD M3.11.03 Table A	1½”	1”
Bituminous Binder Mix M3.11.03 Table A	2½”	2”
Dense Graded Crushed Stone MHD M2.01.7	6”	4”
Gravel Borrow Subbase MHD M1.03.0	16”	12”

Given the expected “heavy truck” traffic loading, we believe that the heavy duty cross section could be satisfactory for the new bituminous concrete pavement. However, the project civil engineers who are intimately familiar with the expected traffic loading, should make the final judgement as to the pavement design(s) for the site.

Further, it should be noted that groundwater signs were observed in the boreholes at depths ranging from 5’ to 13’. Thus, we do not expect shallow foundation construction operations to experience significant groundwater problems, however, the native till is relatively impervious and, as such, controlling surface runoff water will present a challenge to the site contractor.

We do recommend that all soil bearing surface be carefully proof-rolled in order to verify the soil stability and achieve the State Code required minimum 95% degree of compaction. Further, should the construction excavation/progress reveal subsurface soil conditions that vary, from those presented herein, our firm should be immediately contacted for additional geotechnical engineering review.

We recommend that field compaction tests be completed on all prepared footing areas to ensure that the above geotechnical guidelines have been achieved. In addition, we recommend that Yankee Engineering & Testing, Inc. be retained to monitor the various geotechnical aspects of the foundation and pavement construction operations which are summarized below:

- Monitor the removal of unsuitable materials from footing and floor slab areas, and to confirm that the type of soil encountered at subgrade elevation is satisfactory.
- Review the proposed bearing surfaces to confirm that they have been properly prepared, and that they are satisfactory for the recommended bearing pressures.
- Monitor the placement and compaction of any structural ("controlled") backfill within the building and pavement areas, as required by the SBC.
- Check the suitability, via project specifications of soils proposed for use as backfill.

By monitoring these construction aspects, *we* will be able to check compliance with the design concepts, assumptions, and specifications, and to facilitate geotechnical changes in the event that the subsurface conditions differ from those anticipated. In addition, Yankee would be pleased to provide the concrete, masonry, and/or steel field testing services, during construction, as required by the SER and/or SBC.

GEOTECHNICAL CONCLUSIONS:

In summary, the site should be considered SBC Site Class D as it is underlain by a native dense silty sands/gravels (SBC Soil Class #7) having a recommended maximum design soil bearing capacity not exceeding 2.0 TSF (4000 psf). However, it should be noted that the soils were relatively silty ("fine") and, as such, the contractor may have to implement protective measures, depending on the construction season, to maintain the subgrade stability and suitability.

We believe that you will find the aforementioned information and engineering opinions to be clear and concise. However, should you have any questions or require additional geotechnical services please do not hesitate to contact me at our Worcester office.

We appreciate this opportunity this opportunity to be of service to your firm and look forward to working with you through completion of the project.

Prepared by:

Joel C. Morin, GIT
Staff Geologist/ICC Special Inspector

Reviewed by:

Scott M. Mensen, P.E., P.G.
Director of Engineering Services

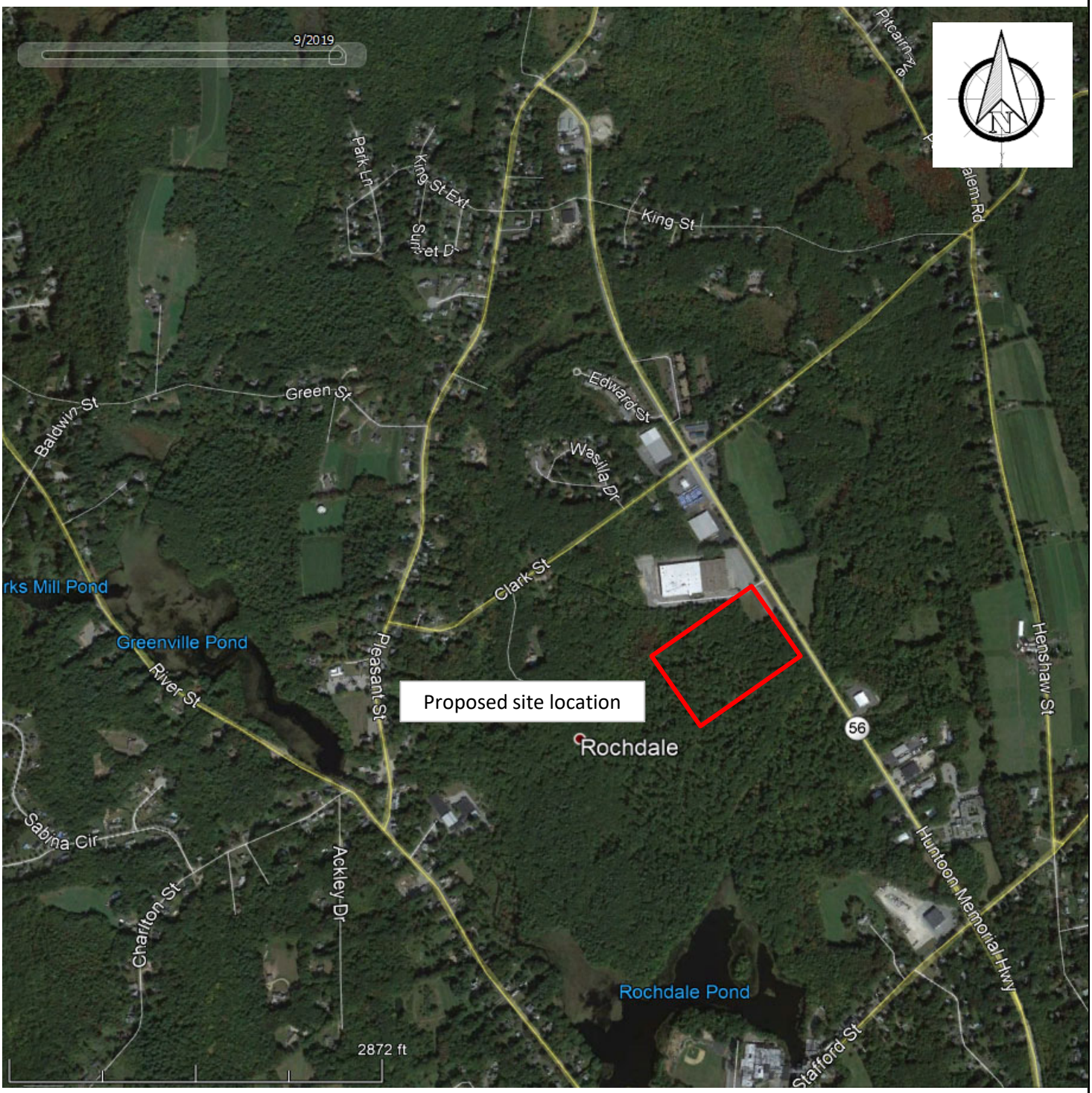
COMMONWEALTH OF MASSACHUSETTS
SCOTT M. MENSEN
CIVIL
No. 54870
REGISTERED PROFESSIONAL ENGINEER

enc.

Yankee Engineering & Testing, Inc.

APPENDIX A

Yankee Engineering & Testing, Inc.



Yankee Engineering & Testing, Inc.
10 Mason Street
Worcester, MA 10609
Phone: (508) 831-7404 • Fax: (508) 831-7388

Project:	92 - 94 Huntoon
Location:	92 Huntoon Memorial Hwy, Leicester, MA
Project #:	2021-53
Date:	August 2, 2021
Client:	The Brennan Group, Inc.

FROM: Google Earth Aerial photo dated 9/20/19	**SITE LOCUS PLAN** **FIGURE 1**	**Approx. Scale** See Map Scale

Yankee Engineering & Testing, Inc. 10 Mason Street Worcester, MA 01609 Phone: (508) 831-7404 Fax: (508) 831-7388	**Project:**	92 - 94 Huntoon
	Location:	92 Huntoon Memorial Hwy, Leicester, MA
	Project #:	2021-53
	Date:	August 2, 2021
	Client:	The Brennan Group, Inc.

FROM: Google Earth Image Google Earth Aerial dated 9/20/19	**BORING LOCATION PLAN** **FIGURE 2**	**Approx. Scale:** See map scale

SOIL TEST BORING LOG

Boring #	B - 1
Sheet #	1 of 1
Location:	S middle
Elevation:	≈ 761'
Drill Date:	7/30/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
13'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	15	3 - **4**		8" Orange, damp, **LOOSE**, silty sand	3" Topsoil
2					**6** - 6		4" Light brown, damp, medium dense, silty sand	Subsoil
3	S-2	2 - 4	24	2	3 - **9**		Light brown, damp, medium dense, silty sand some gravel	Native
4					**15** - 14			
5								
6	S-3	5 - 6'4"	16	12	6 - **34**		Light brown, damp, very dense, silty sand little gravel	Broken rock
7					**50+/4"**		Boulder to ~7'	
8								
9								
10								
11	S-4	10 - 12	24	20	13 - **18**		Light brown, damp, dense, silty sand some gravel	Native
12					**21** - 18			
13						▽		
14						13'		≈ 748'
15								
16	S-5	15 - 16' 6"	18	12	9 - **11**		Same as S-3 but medium dense and wet	Native
17					**8** - 50+/2"			
18						16'6"	Boring terminated by auger refusal on suspected bedrock at 16'6"	≈ 745'
19							in native silty sand some gravel	
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2040496, -71.9065740

SOIL TEST BORING LOG

Boring #	B - 2
Sheet #	1 of 1
Location:	SW
Elevation:	≈ 754'
Drill Date:	7/30/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
9'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	12	1 - **1**		Orange, damp, **VERY LOOSE**, silty sand	3" Topsoil
2					**1** - 1			Subsoil
3	S-2	2 - 3'6"	18	10	1 - **5**		3" same as S-1	Native
4					**50+/6"**		Light brown, damp, very dense, silty sand some gravel	
5								
6	S-3	5 - 7	24	8	14 - **29**		Brown, damp, very dense, silty f/m sand and gravel	Native
7					**27**- 24			
8								
9						▽		
10						9'		≈ 745'
11	S-4	10 - 12	24	10	6 - **8**		Light brown, wet, medium dense, silty sand and gravel	Native
12					**10** - 10			
13								
14								
15								
16						15'	Boring terminated by auger refusal on suspected bedrock at 15'	≈ 739'
17							in native silty sand and gravel	
18								
19								
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2041291, -71.9071755

SOIL TEST BORING LOG

Boring #	**B - 3**
Sheet #	1 of 1
Location:	SE
Elevation:	≈ 743'
Drill Date:	7/30/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
1'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	10	1 - **1**	▽	Brown/gray, moist/wet, **LOOSE**, silty sand trace gravel	3" Topsoil
2					**3** - 4	1'		≈ 742'
3	S-2	2 - 4	24	14	1 - **21**		Brown, wet, dense, silty sand some gravel	Native
4					**21** - 33			
5								
6						5'	Boring terminated by auger refusal on suspected bedrock at 5'	≈ 738'
7							in native silty sand some gravel	
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2041221, -71.9057184

SOIL TEST BORING LOG

Boring #	**B - 4**
Sheet #	1 of 1
Location:	SE Middle
Elevation:	≈ 758'
Drill Date:	7/30/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
10'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 9"	9	3	2 - **50+/3"**		Topsoil	
2								
3	S-2	2 - 4	24	10	4 - **6**		Brown, damp, medium dense, silty sand	Native
4					**7** - 9			
5								
6	S-3	5 - 7	24	16	10 - **13**		Tan, moist, medium dense, silty sand trace gravel	Native
7					**14** - 20			
8								
9								
10						▽		
11	S-4	10 - 10'9"	9	4	10 - **50+/3"**	10'	Brown, wet, very dense, silty sand some gravel	≈ 744'
12								
13						12'	Boring terminated by auger refusal on suspected bedrock at 12'	≈ 746'
14							in native silty sand some gravel	
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2045702, -71.9059900

SOIL TEST BORING LOG

Boring #	**B - 5**
Sheet #	1 of 1
Location:	SW middle
Elevation:	≈ 762'
Drill Date:	7/30/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
11'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	8	1 - **1**		Orange, damp, **LOOSE**, silty sand	2" Topsoil
2					**3** - 2			Subsoil
3	S-2	2 - 4	24	18	2 - **5**		4" same as S-1	
4					**12** - 23		Light brown, damp, medium dense, silty sand little gravel	Native
5								
6	S-3	5 - 7	24	20	10 - **10**		Same as S-2	
7					**18** - 43			
8							Boulder 8'-9'	
9								
10								
11	S-4	10 - 12	24	2	13 - **19**	▽	Brown, wet, dense, broken rock and silty sand	
12					**21** - 27	11'		≈ 751'
13								
14								
15						14'6"	Boring terminated by auger refusal on suspected bedrock at 14'6"	≈ 747'
16							in native silty sand	
17								
18								
19								
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2050716, -71.9065512

SOIL TEST BORING LOG

Boring #	**B - 6**
Sheet #	1 of 1
Location:	NW middle
Elevation:	≈ 757'
Drill Date:	8/2/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
11'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	10	2 - **3**		Orange, damp, **LOOSE**, silty sand	3" Topsoil
2					**3** - 9			
3	S-2	2 - 4	24	20	13 - **21**		Brown, damp, dense, silty sand little gravel	
4					**24** - 16			Native
5								
6	S-3	5 - 7	24	16	7 - **18**		Same as S-2	
7					**16** - 17			
8								
9								
10								
11	S-4	10 - 12	24	14	5 - **16**	▽	Light brown, moist to wet, dense, silty sand and gravel	
12					**20** - 24	11'		≈ 746'
13								
14								
15								
16	S-5	15 - 17	24	12	18 - **47**		Same as S-4 but very dense	
17					**54** - 48			
18								
19						18'	Boring terminated by auger refusal on suspected bedrock at 18'	≈ 739'
20							in native silty sand	
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2054471, -71.9065616

SOIL TEST BORING LOG

Boring #	**B - 7**
Sheet #	1 of 1
Location:	NE middle
Elevation:	≈ 759'
Drill Date:	8/2/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
5'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	14	2 - **4**		9" Orange/brown, damp, **LOOSE**, silty sand	5" Topsoil
2					**4** - 9			Subsoil
3	S-2	2 - 4	24	7	5 - **10**		Same as S-1	
4					**12** - 9			Native
5						▽		
6	S-3	5 - 7	24	16	16 - **23**	5'	Dark brown/brown, wet, dense, silty sand and gravel	≈ 754'
7					**24** - 22			
8								
9								
10								
11	S-4	10 - 12	24	18	16 - **17**		Brown, wet, dense, silty sand	Native
12					**27** - 36			
13						12'6"	Boring terminated by auger refusal on suspected bedrock at 12'6"	≈ 746'
14							in native silty sand	
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2050182, -71.9052021

SOIL TEST BORING LOG

Boring #	B - 8
Sheet #	1 of 1
Location:	NW
Elevation:	≈ 761'
Drill Date:	8/2/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
5'	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	12	4 - **3**		Orange, damp, **LOOSE**, silty sand	3" Topsoil
2					**4** - 6			Subsoil
3	S-2	2 - 3'10"	22	10	11 - **13**		Light brown, damp, medium dense, silty sand some gravel	Native
4					**16** - 50+/4"			
5						▽		
6	S-3	5 - 5'11"	11	15	42 - **50+/5"**	5'	Brown, wet, very dense, silty sand and gravel	≈ 754'
7								
8								
9						8'	Boring terminated by auger refusal on suspected bedrock at 8'	≈ 753'
10							in native silty sand and gravel	
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2055293, -71.9054442

SOIL TEST BORING LOG

Boring #	B - 9
Sheet #	1 of 1
Location:	North
Elevation:	≈ 773'
Drill Date:	8/2/2021

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon
Project Address: 92-94 Huntoon Hwy, Leicester, MA
Project No.: 2021-53

Drilling Type		
	Type	SPT
	Size	2" I.D.
	Hammer	140 lbs
	Fall	30"

Groundwater Observations		
Depth (ft)	Casing at	Stabilization Period
No GW	n/a	Upon boring completion

Depth (ft)	Boring Sampling Data No.	Depth (ft)	Pen. (in)	Rec. (in)	Blows/6"	Strata Change	Sample Descriptions & Geotechnical Observations	Remarks
1	S-1	0 - 2	24	10	1 - **3**		8" Orange, damp, **LOOSE**, silty sand and gravel	2" Topsoil
2					**5** - 16			
3	S-2	2 - 2'3"	3	0	**50+/3"**		No Recovery	Native
4								
5								
6	S-3	5 - 7	24	14	7 - **28**		Brown, damp, very dense, silty sand some gravel	
7					**38** - 36			
8								
9								
10						9'6"	Boring terminated by auger refusal on suspected bedrock at 9'6"	≈ 763'
11							in native silty sand some gravel	
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

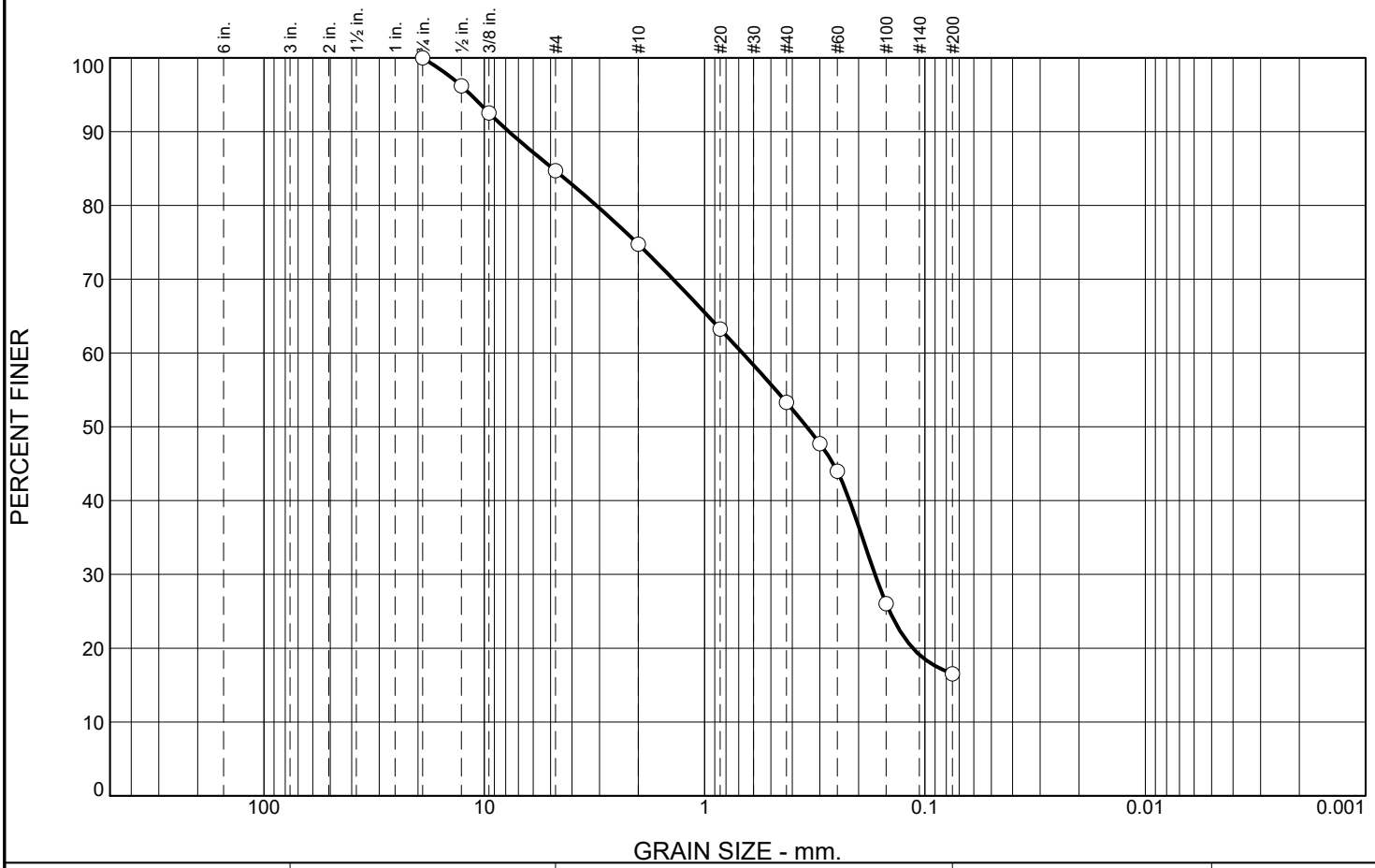
Drilling Co.:	Soil X Corp
Rig Type:	Acker AD II ATV
Driller:	Mr. George Guinto
Helper:	Mr. Mike Houde
Inspector:	Mr. Joel Morin
Client Rep.:	

Cohesive (blows/ft)	
0 - 2	Very Soft
2 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Hard

Cohesionless (blows/ft)	
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50+/ft	Very Dense

- Refer to geotechnical report dated 8/5/21 for additional information
- Ground elevation based on Google Earth
- Coordinates: 42.2056163, -71.9043227

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	15.3	68.2	16.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	96.2		
3/8"	92.5		
#4	84.7		
#10	74.7		
#20	63.2		
#40	53.3		
#50	47.7		
#60	44.0		
#100	26.0		
#200	16.5		

* (no specification provided)

Material Description

Brown silty sand little gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 4.8817 D_{60}= 0.6736 D_{50}= 0.3440
D_{30}= 0.1686 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

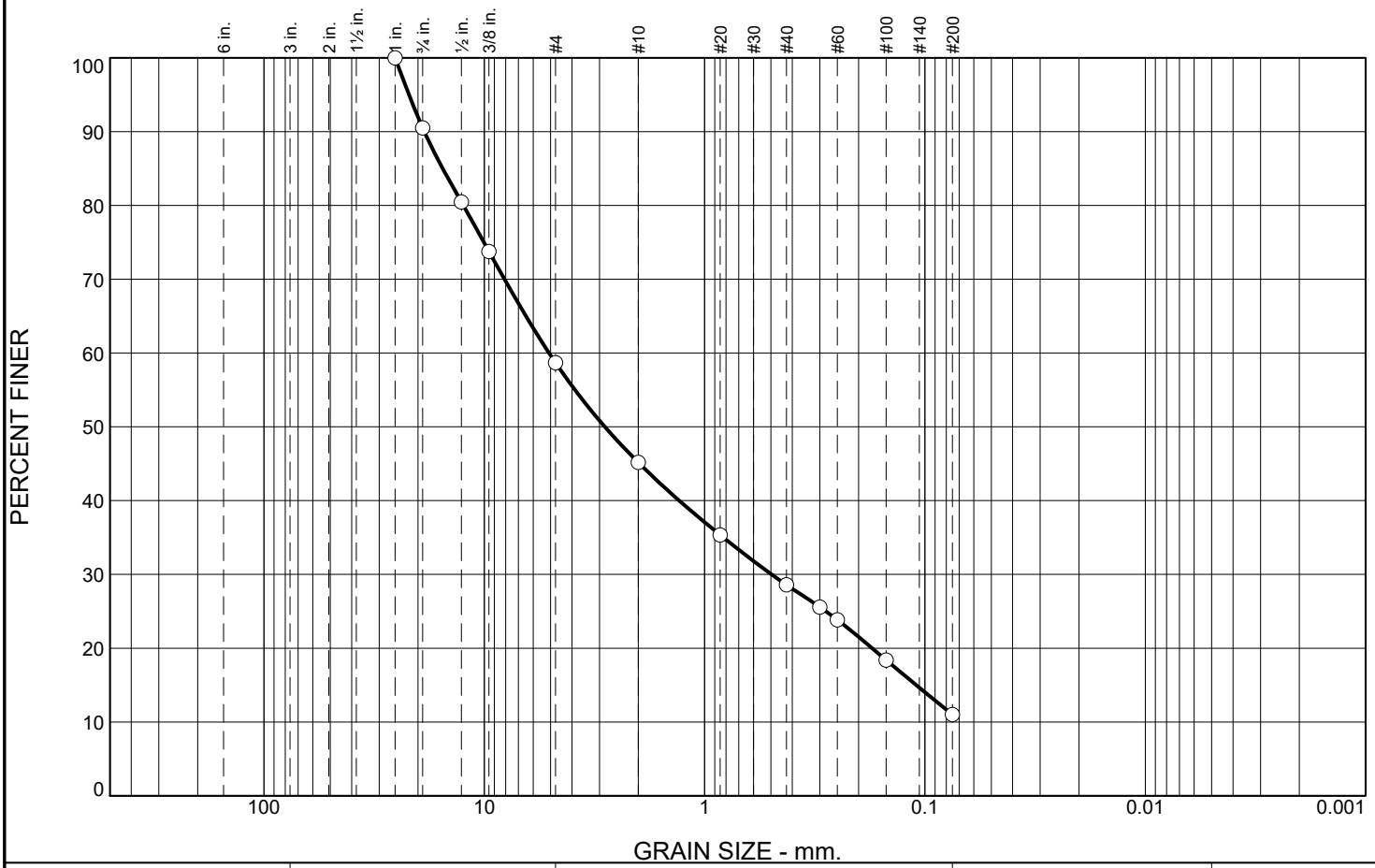
Sample No.: S-3 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-1 **Elev./Depth:** 5'- 6'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	41.3	47.7	11.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	90.5		
1/2"	80.5		
3/8"	73.8		
#4	58.7		
#10	45.2		
#20	35.3		
#40	28.6		
#50	25.6		
#60	23.8		
#100	18.4		
#200	11.0		

* (no specification provided)

Material Description

Brown silty f/m sand and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 15.4456 D_{60}= 5.0814 D_{50}= 2.8352
D_{30}= 0.4966 D_{15}= 0.1095 D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

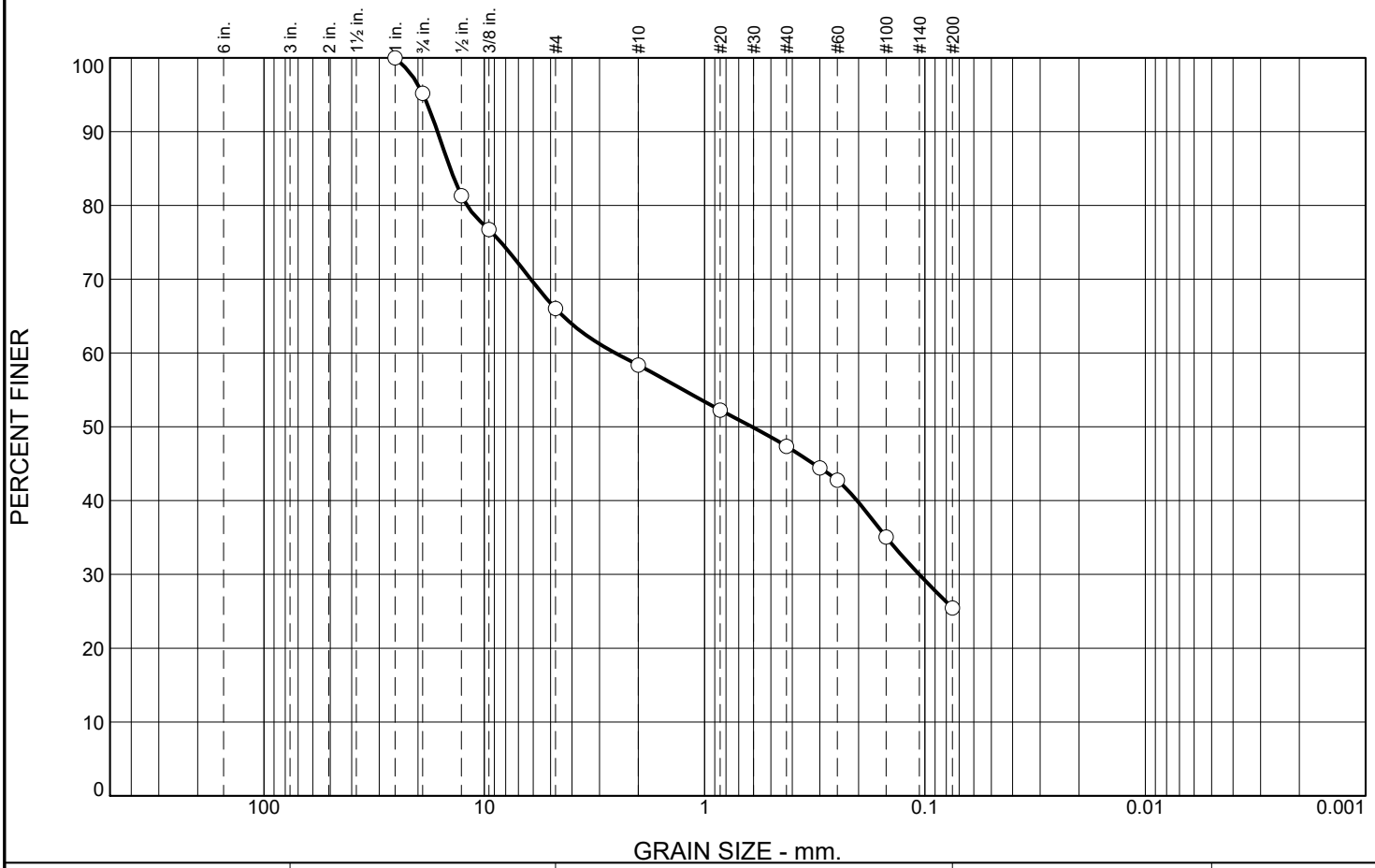
Sample No.: S-3 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-2 **Elev./Depth:** 5'- 7'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	34.0	40.5	25.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	95.2		
1/2"	81.3		
3/8"	76.7		
#4	66.0		
#10	58.4		
#20	52.3		
#40	47.4		
#50	44.4		
#60	42.8		
#100	35.1		
#200	25.5		

* (no specification provided)

Material Description

Brown silty sand some gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 14.2707 D_{60}= 2.5411 D_{50}= 0.6093
D_{30}= 0.1062 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

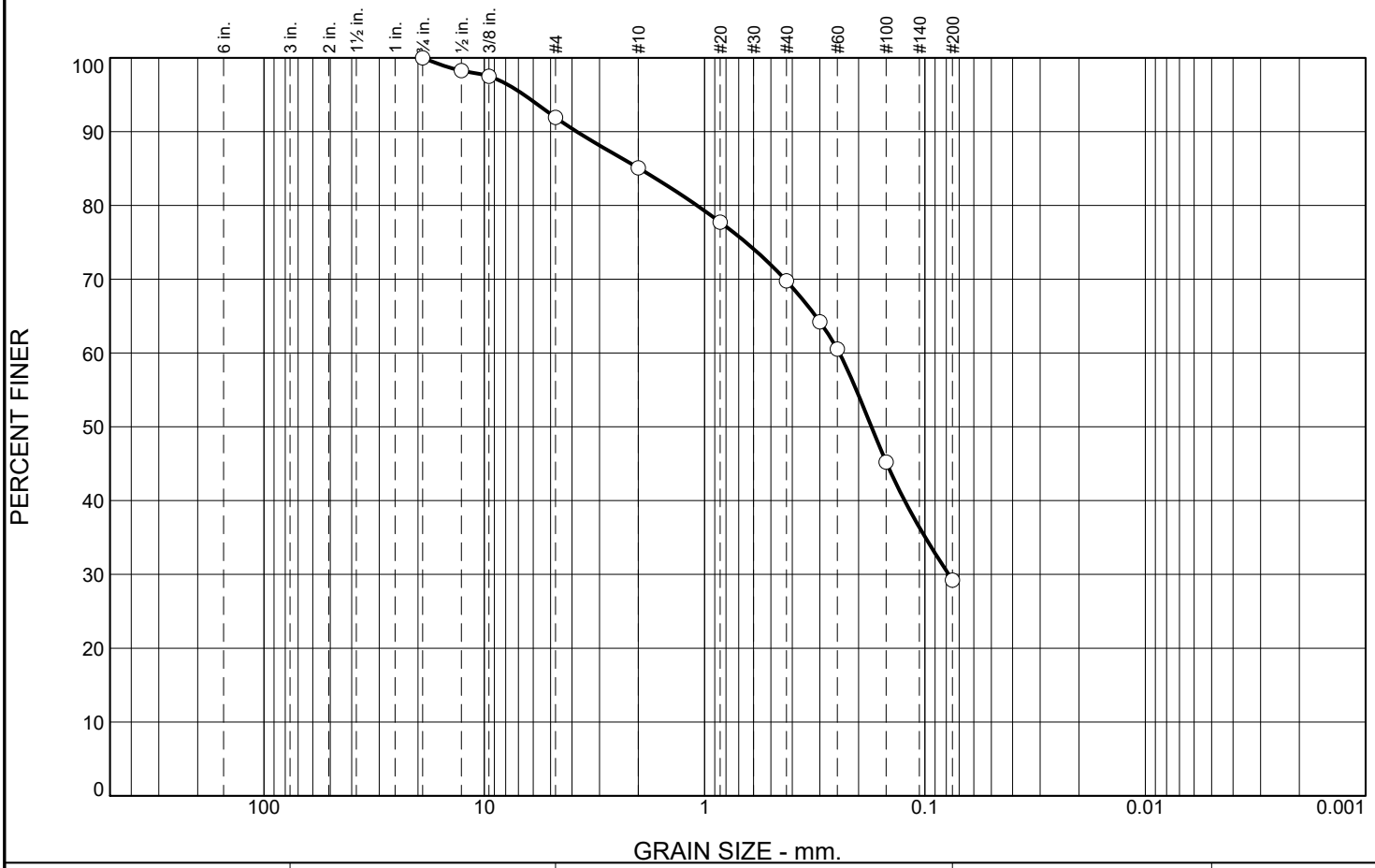
Sample No.: S-2 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-3 **Elev./Depth:** 2'- 4'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	8.1	62.7	29.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	98.3		
3/8"	97.5		
#4	91.9		
#10	85.1		
#20	77.7		
#40	69.8		
#50	64.2		
#60	60.5		
#100	45.2		
#200	29.2		

* (no specification provided)

Material Description

Tan silty sand trace gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 1.9771 D_{60}= 0.2446 D_{50}= 0.1750
D_{30}= 0.0780 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

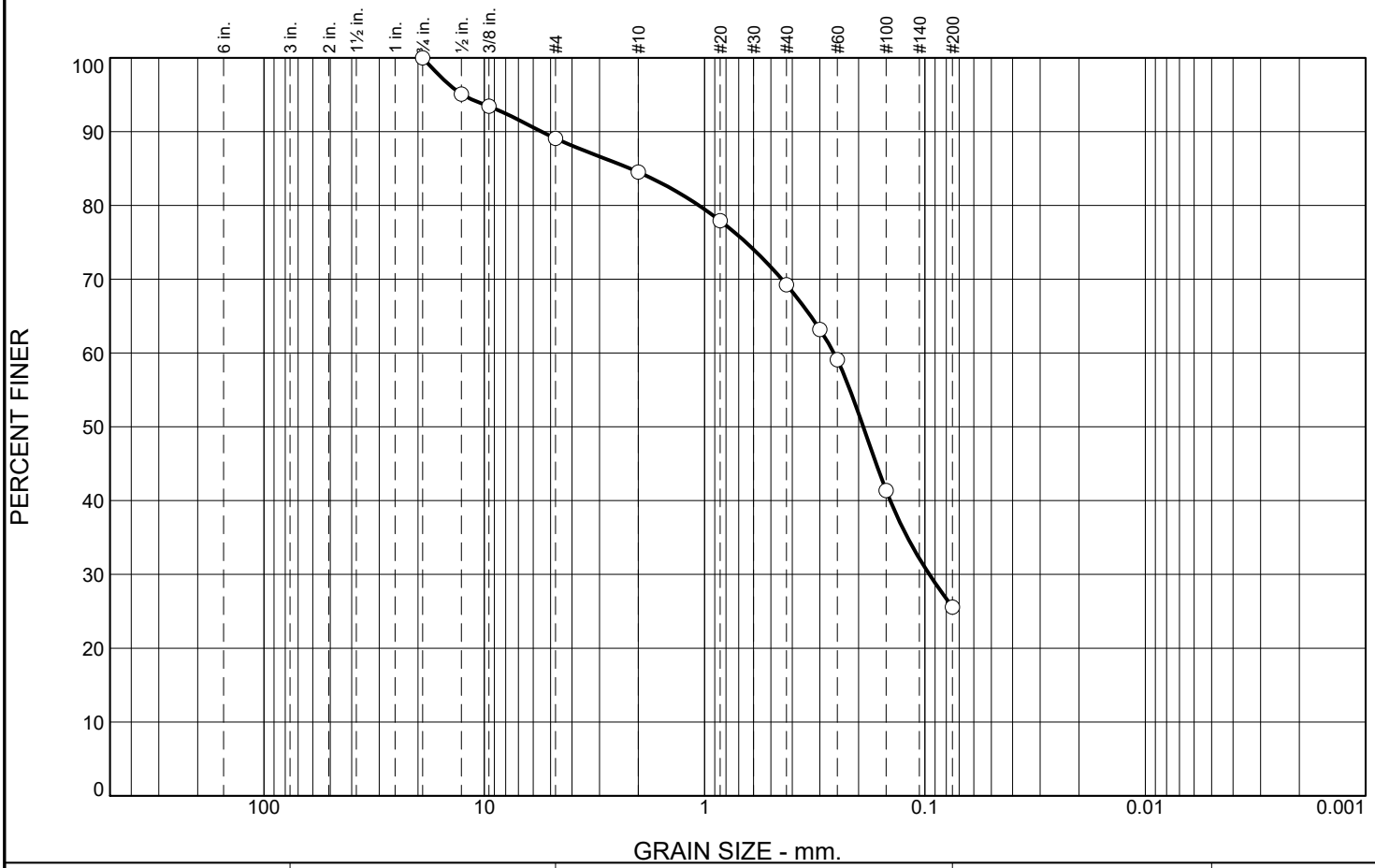
Sample No.: S-3 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-4 **Elev./Depth:** 5'- 7'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	10.9	63.5	25.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	95.1		
3/8"	93.4		
#4	89.1		
#10	84.5		
#20	77.9		
#40	69.3		
#50	63.2		
#60	59.1		
#100	41.4		
#200	25.6		

* (no specification provided)

Material Description

Light brown silty sand little gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 2.1786 D_{60}= 0.2590 D_{50}= 0.1905
D_{30}= 0.0955 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

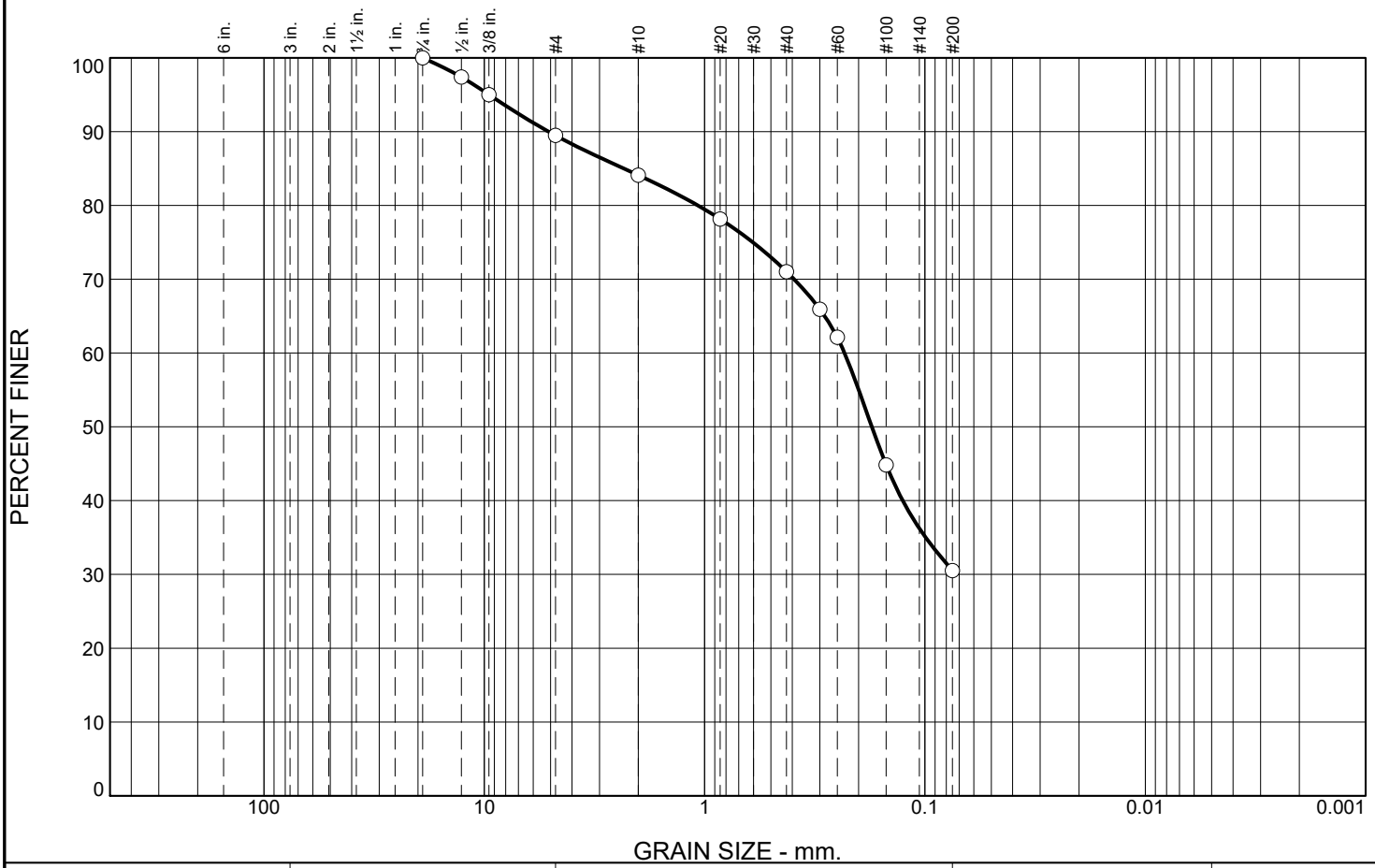
Sample No.: S-2 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-5 **Elev./Depth:** 2'- 4'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	10.5	59.0	30.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	97.4		
3/8"	95.0		
#4	89.5		
#10	84.1		
#20	78.2		
#40	71.0		
#50	65.9		
#60	62.1		
#100	44.8		
#200	30.5		

* (no specification provided)

Material Description

Brown silty sand little gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 2.3228 D_{60}= 0.2318 D_{50}= 0.1743
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

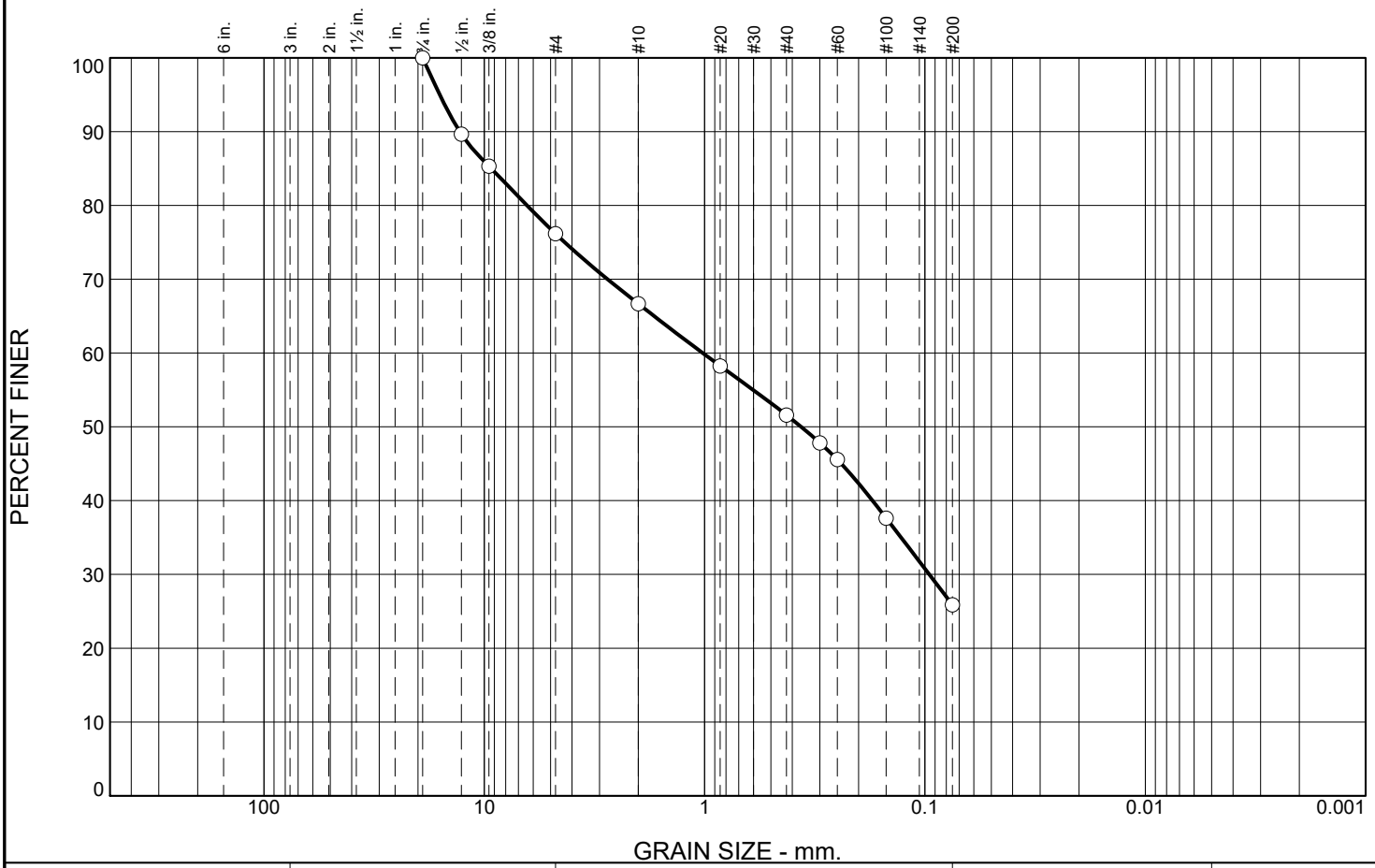
Sample No.: S-3 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-6 **Elev./Depth:** 5'- 7'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	23.8	50.3	25.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	89.7		
3/8"	85.3		
#4	76.2		
#10	66.7		
#20	58.3		
#40	51.6		
#50	47.8		
#60	45.6		
#100	37.6		
#200	25.9		

* (no specification provided)

Material Description

Brown silty sand some gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 9.2999 D_{60}= 1.0202 D_{50}= 0.3645
D_{30}= 0.0956 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Boring jar sampled by Joel Morin (Yankee) on 07/30/21
See geotechnical report for additional information

Sample No.: S-3 **Source of Sample:** Geotechnical Borings 2021 **Date:** 08/03/21
Location: B-9 **Elev./Depth:** 5'- 7'

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

IIGER03135.0MRP

APPENDIX B

Yankee Engineering & Testing, Inc.

GEOTECHNICAL LIMITATIONS

- The analyses and recommendations submitted in this report are based upon the data obtained from the subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the geotechnical engineering recommendations contained in this report.

- The generalized soil profile(s) is intended to show trends in the subsurface soil conditions. The boundaries between strata are approximated and have been developed by interpretation of the widely spaced explorations and samples. The actual soil transitions are probably more erratic.

- Water level readings have been made in the explorations at the times, and under the conditions, stated on the boring logs. However, it must be noted that fluctuations in the level of the groundwater will occur due to variations in rainfall, season, temperature and other factors.

- In the event that changes in the nature, design, or location of the proposed buildings are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by the preparer.

- It is recommended that this firm be provided the opportunity for a review of the final construction design and specifications, in order to confirm that the earthwork and foundation recommendations are properly implemented.

- It is recommended that this firm be retained to provide the geotechnical engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design concepts, material specifications and engineering recommendations, and to allow for changes in the event that conditions differ from those anticipated.

- This report has been prepared for the exclusive use of The Brennan Group, Inc. for specific applications to the 92-94 Huntoon Hwy project, located in Leicester, Massachusetts, in accordance with accepted foundation engineering practices. No other warranty, expressed or implied, is made.

- This report should be considered for foundation design purposes only, and is not sufficient to prepare an accurate or complete bid. Contractors wishing a copy of the report may secure it with the understanding that the reports scope is limited to general design considerations only.

SECTION 1: RESPONSIBILITIES

1.1 *Yankee Engineering & Testing, Inc., ("Yankee"), has the responsibility for providing the services described under the Scope of Services section. The work is to be performed according to accepted standards of care and is to be completed in a timely manner. The term "Yankee" as used herein includes all of Yankee Engineering & Testing, Inc's agents, employees, professional staff, and subcontractors.*

1.2 The Client or a duly authorized representative is responsible for providing Yankee with a clear understanding of the project nature and scope. The Client shall supply Yankee with sufficient and adequate information, including, but not limited to, maps, site plans, reports, surveys and designs, to allow Yankee to properly complete the specified services. The Client shall also communicate changes in the nature and scope of the project as soon as possible during performance of the work so that the changes can be incorporated into the work product.

1.3 The Client acknowledges that Yankee's responsibilities in providing the services described under the Scope of Services section is limited to those services described therein, and the Client hereby assumes any collateral or affiliated duties necessitated by or for those services. Such duties may include, but are not limited to, reporting requirements imposed by any third party such as federal, state, or local entities, the provision of any required notices to any third party, or the securing of necessary permits or permissions from any third parties required for Yankee's provision of the services so described, unless otherwise agreed upon by both parties.

1.4 Universal will not be responsible for scheduling our services and will not be responsible for tests or inspections that are not performed due to a failure to schedule our services on the project or any resulting damages.

SECTION 2: STANDARD OF CARE

2.1 Services performed by Yankee under this Agreement will be conducted in a manner consistent with the level of care and skill ordinarily exercised by members of Yankee's profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty, express or implied, is made.

2.2 The Client recognizes that subsurface conditions may vary from those observed at locations where borings, surveys, or other explorations are made, and that site conditions may change with time. Data, interpretations, and recommendations by Yankee will be based solely on information available to Yankee at the time of service. Yankee is responsible for those data, interpretations, and recommendations, but will not be responsible for other parties' interpretations or use of the information developed.

2.3 Execution of this document by Yankee is not a representation that Yankee has visited the site, become generally familiar with local conditions under which the services are to be performed, or correlated personal observations with the requirements of the Scope of Services. It is the Client's responsibility to provide Yankee with all information necessary for Yankee to provide the services described under the Scope of Services, and the Client assumes all liability for information not provided to Yankee that may affect the quality or sufficiency of the services so described.

2.4 Should Yankee be retained to provide threshold inspection services, Client acknowledges that Yankee's services thereunder do not constitute a guarantee that the construction in question has been properly designed or constructed, and Yankee's services do not replace any of the obligations or liabilities associated with any architect, contractor, or structural engineer. Therefore it is explicitly agreed that the Client will not hold Yankee responsible for the proper performance of service by any architect, contractor, structural engineer or any other entity associated with the project.

SECTION 3: SITE ACCESS AND SITE CONDITIONS

3.1 Client will grant or obtain free access to the site for all equipment and personnel necessary for Yankee to perform the work set forth in this Agreement. The Client will notify any and all possessors of the project site that Client has granted Yankee free access to the site. Yankee will take reasonable precautions to minimize damage to the site, but it is understood by Client that, in the normal course of work, some damage may occur, and the correction of such damage is not part of this Agreement unless so specified in the Proposal.

3.2 The Client is responsible for the accuracy of locations for all subterranean structures and utilities. Yankee will take reasonable precautions to avoid known subterranean structures, and the Client waives any claim against Yankee, and agrees to defend, indemnify, and hold Yankee harmless from any claim or liability for injury or loss, including costs of defense, arising from damage done to subterranean structures and utilities not identified or accurately located. In addition, Client agrees to compensate Yankee for any time spent or expenses incurred by Yankee in defense of any such claim with compensation to be based upon Yankee's prevailing fee schedule and expense reimbursement policy.

SECTION 4: SAMPLE OWNERSHIP AND DISPOSAL

4.1 Soil or water samples obtained from the project during performance of the work shall remain the property of the Client.

4.2 Yankee will dispose of or return to Client all remaining soils and rock samples 60 days after submission of report covering those samples. Further storage or transfer of samples can to be made at Client's expense upon Client's prior written request.

4.3 Samples which are contaminated by petroleum products or other chemical waste will to be returned to Client for treatment or disposal, consistent with all appropriate federal, state, or local regulations.

SECTION 5: BILLING AND PAYMENT

5.1 Yankee will submit invoices to Client monthly or upon completion of services. Invoices will show charges for different personnel and expense classifications.

5.2 Payment is due 30 days after presentation of invoice and is past due 31 days from invoice date. Client agrees to pay a finance charge of one and one-half percent (1 ½ %) per month, or the maximum rate allowed by law, on past due accounts.

5.3 If Yankee incurs any expenses to collect overdue billings on invoices, the sums paid by Yankee for reasonable attorneys' fees, court costs, Yankee's time, Yankee's expenses, and interest will be due and owing by the Client.

SECTION 6: OWNERSHIP OF DOCUMENTS

6.1 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by Yankee, as instruments of service, shall remain the property of Yankee.

6.2 Client agrees that all reports and other work furnished to the Client or his agents, which are not paid for, will be returned upon demand and will not be used by the Client for any purpose.

6.3 Yankee will retain all pertinent records relating to the services performed for a period of five (5) years following submission of the report, during which period the records will be made available to the Client at all reasonable times.

6.4 All reports, boring logs, field data, field notes, laboratory test data, general calculations, estimates, and/or other documents presented by Yankee, are prepared for the sole and exclusive use of our Client, and may not be given to any other party or used or relied upon by any such party without the express written consent of Yankee.

SECTION 7: DISCOVERY OF UNANTICIPATED HAZARDOUS MATERIALS

7.1 Client warrants that a reasonable effort has been made to inform Consultant of known or suspected hazardous materials on or near the project site.

7.2 Under this agreement, the term hazardous materials include hazardous materials (40 CFR 172.01), hazardous wastes (40 CFR 261.2), hazardous substances (40 CFR 300.6), petroleum products, polychlorinated biphenyls, and asbestos.

7.3 Hazardous materials may exist at a site where there is no reason to believe they could or should be present. Yankee and Client agree that the discovery of unanticipated hazardous materials constitutes a changed condition mandating a renegotiation of the scope of work. Yankee and Client also agree that the discovery of unanticipated hazardous materials may make it necessary for Yankee to take immediate measures to protect health and safety. Client agrees to compensate Yankee for any equipment decontamination or other costs incident to the discovery of unanticipated hazardous waste.

7.4 Yankee agrees to notify Client when unanticipated hazardous materials or suspected hazardous materials are encountered. Client agrees to make any disclosures required by law to the appropriate governing agencies. Client also agrees to hold Yankee harmless for any and all consequences of disclosures made by Yankee which are required by governing law. In the event the project site is not owned by Client, Client recognizes that it is the Client's responsibility to inform the property owner of the discovery of unanticipated hazardous materials or suspected hazardous materials.

7.5 Notwithstanding any other provision of the Agreement, Client waives any claim against Yankee, and to the maximum extent permitted by law, agrees to defend, indemnify, and save Yankee harmless from any claim, liability, and/or defense costs for injury or loss arising from Yankee's discovery of unanticipated hazardous or suspected hazardous materials including any costs created by delay of the project and any cost associated with possible reduction of the property's value. Client will be responsible for ultimate disposal of any samples secured by Yankee which are found to be contaminated.

SECTION 8: RISK ALLOCATION

8.1 Client agrees that Yankee's liability for any damage on account of any breach of contract, error, omission or other professional negligence will be limited to a sum not to exceed $10,000 or Yankee's fee, whichever is greater.

SECTION 9: INSURANCE

9.1 Yankee represents and warrants that it and its agents, staff and consultants employed by it, is and are protected by worker's compensation insurance and that Yankee has such coverage under public liability and property damage insurance policies which Yankee deems to be adequate. Certificates for all such policies of insurance shall be provided to Client upon request in writing. Within the limits and conditions of such insurance, Yankee agrees to indemnify and save Client harmless from and against loss, damage, or liability arising from negligent acts by Yankee, its agents, staff, and consultants employed by it. Yankee shall not be responsible for any loss, damage or liability beyond the amounts, limits, and conditions of such insurance or the limits described in Section 8, whichever is less. The Client agrees to defend, indemnify and save Yankee harmless for loss, damage or liability arising from acts by Client, Client's agent, staff, and other Yankees employed by Client.

SECTION 10: DISPUTE RESOLUTION

10.1 All claims, disputes, and other matters in controversy between Yankee and Client arising out of or in any way related to this Agreement will be submitted to alternative dispute resolution (ADR) such as mediation or arbitration, before and as a condition precedent to other remedies provided by law, including the commencement of litigation.

10.2 If a dispute arises related to the services provided under this Agreement and that dispute requires litigation instead of ADR as provided above, then:

(a) the claim will be brought and tried in judicial jurisdiction of the court of the county where Yankee's principal place of business is located and Client waives the right to remove the action to any other county or judicial jurisdiction, and

(b) The prevailing party will be entitled to recovery of all reasonable costs incurred, including staff time, court costs, attorneys' fees, and other claim related expenses.

SECTION 11: TERMINATION

11.1 This agreement may be terminated by either party upon seven (7) days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof. Such termination shall not be effective if that substantial failure has been remedied before expiration of the period specified in the written notice. In the event of termination, Yankee shall be paid for services performed to the termination notice date plus reasonable termination expenses.

11.2 In the event of termination, or suspension for more than three (3) months prior to completion of all reports contemplated by the Agreement, Yankee may complete such analyses and records as are necessary to complete its files and may also complete a report on the services performed to the date of notice of termination or suspension. The expense of termination or suspension shall include all direct costs of Yankee in completing such analyses, records and reports.

SECTION 12: ASSIGNS

12.1 Neither the Client nor Yankee may delegate, assign, sublet or transfer their duties or interest in this Agreement without the written consent of the other party.

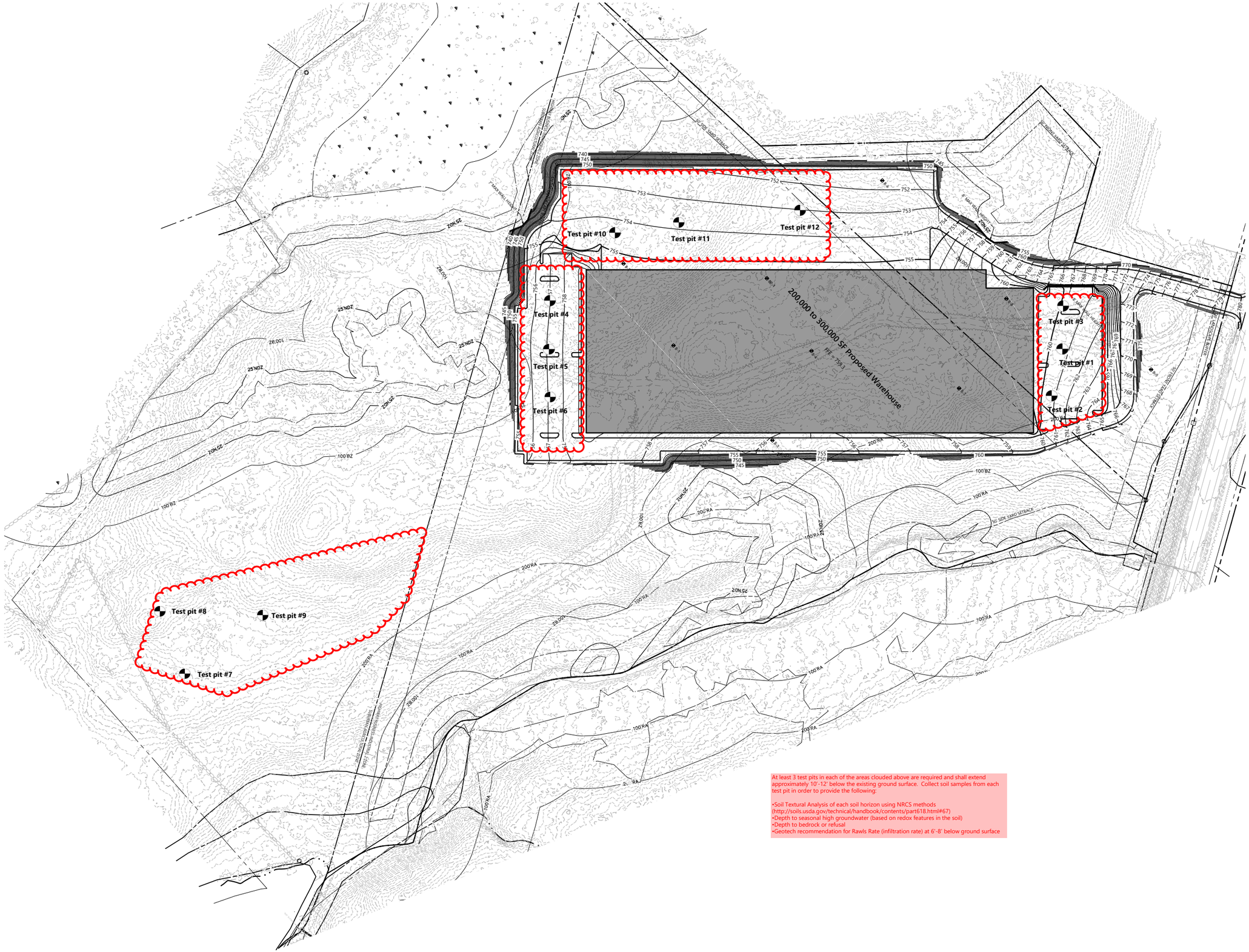
SECTION 13. GOVERNING LAW AND SURVIVAL

13.1 The laws of the Commonwealth of Massachusetts will govern the validity of these Terms, their interpretation and performance.

13.2 If any of the provisions contained in this Agreement are held illegal, invalid, or unenforceable, the enforceability of the remaining provisions will not be impaired. Limitations of liability and indemnities will survive termination of this Agreement for any cause.

SECTION 14. INTEGRATION CLAUSE

14.1 This Agreement represents and contains the entire and only agreement and understanding among the parties with respect to the subject matter of this Agreement, and supersedes any and all prior and contemporaneous oral and written agreements, understandings, representations, inducements, promises, warranties, and conditions among the parties. No agreement, understanding, representation, inducement, promise, warranty, or condition of any kind with respect to the subject matter of this Agreement shall be relied upon by the parties unless expressly incorporated herein.



At least 3 test pits in each of the areas clouded above are required and shall extend approximately 10'-12' below the existing ground surface. Collect soil samples from each test pit in order to provide the following:

- Soil Textural Analysis of each soil horizon using NRCS methods (http://soils.usda.gov/technical/handbook/contents/part618.html#67)
- Depth to seasonal high groundwater (based on redox features in the soil)
- Depth to bedrock or refusal
- Geotech recommendation for Rawls Rate (infiltration rate) at 6'-8' below ground surface

vhb.com

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120 Front Street
Suite 500
Worcester, MA 01608
508.752.1001

0 40 80 160 Feet

Leicester Warehouse

94/102 Huntoon Memorial Highway
Leicester, MA 01524

No.	Revision	Date	Appvd.

Designed by XXX | Checked by XXX

Issued for: Coordination | Date: Oct. 15, 2021

Not Approved for Construction

Drawing Title

Subsurface Investigation Sketch

Drawing Number

Sheet of

Project Number
15392.00

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 1**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 770'
Job No:	2021-53	Location:	Front mid
Date:	November 1, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 38° - 53°
Make:	Doosan	Model:	Dx235 LCR
Capacity:	1cy	Reach:	22'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam	n/a	18"
1.5				
2				
2 1/2	B Horizon	Brown sandy loam	n/a	30"
3'				
3 1/2'	36"	Test pit terminated at 36" on suspected bedrock		≈ 767'
4				
4 1/2				
5				
5 1/2				
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/01/21	8:00AM	No GW	Upon Completion

Test Pit Dimensions (ft)

Length:	15
Width:	8
Depth:	3

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc 10 Mason Street Worcester, MA 01609 phone 508-831-7404 fax 508-831-7388	Project:	92-94 Huntoon 92-94 Huntoon Hwy - I	Test Pit No# **TP - 2** Current Elev. ≈ 774'
	Job No:	2021-53	Location: SE front
	Date:	November 1, 2021	

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 38° - 53°
Make:	Doosan	Model:	Dx235 LCR
Capacity:	1cy	Reach:	22'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam		6"
1.5	B Horizon	Light brown/light orange loamy sand		12"
2				
2 1/2	C Horizon	Light brown loamy sand	3'//2 2'-3'//4 1'-2'//5 - 7	60"
3'				
3 1/2'				
4				
4 1/2				
5				
5 1/2		Mottling observed at 60"		Suspected seasonal high groundwater level
6				
6 1/2				
7				
7 1/2'	84"	Test pit terminated at 84" on suspected bedrock		≈ 767'
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/01/21	8:30AM	No GW	Upon Completion

Test Pit Dimensions (ft)

Length:	12
Width:	6
Depth:	7

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 3**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 769'
Job No:	2021-53	Location:	NW front
Date:	November 1, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 38° - 53°
Make:	Doosan	Model:	Dx235 LCR
Capacity:	1cy	Reach:	22'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam	n/a	18"
1.5				
2				
2 1/2		Light brown/light orange loamy sand		18"
3'	B Horizon	Mottling observed		Suspected seasonal
3 1/2'				high groundwater
4	42"	Test pit terminated at 42" on suspected bedrock		≈ 765'
4 1/2				
5				
5 1/2				
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/01/21	9:00AM	No GW	Upon Completion

Test Pit Dimensions (ft)

Length:	6
Width:	4
Depth:	3 1/2

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 4**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 740'
Job No:	2021-53	Location:	NW rear
Date:	November 1, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 38° - 53°
Make:	Doosan	Model:	Dx235 LCR
Capacity:	1cy	Reach:	22'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam		12"
1.5				
2	B Horizon	Light orange/light brown sandy loam		18"
2 1/2				
3'				
3 1/2'	C Horizon	Light brown loamy sand	2'//3 1'-2'//5	60"
4				
4 1/2				
5				
5 1/2				
6				
6 1/2		Mottling observed		Suspected seasonal high groundwater
7				
7 1/2		Groundwater observed at 84"		
8				
8 1/2	96"	Test pit terminated at 96" on suspected bedrock		≈ 732'
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/01/21	9:30AM	84"	Upon Completion

Test Pit Dimensions (ft)

Length:	10
Width:	5
Depth:	8

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 5**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 748'
Job No:	2021-53	Location:	
Date:	November 1, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 38° - 53°
Make:	Doosan	Model:	Dx235 LCR
Capacity:	1cy	Reach:	22'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam	n/a	12"
1.5				
2	B Horizon	Light orange/light brown sandy loam	n/a	18"
2 1/2				
3'				
3 1/2'	C Horizon	Groundwater observed at 36"	1'-2'//2-4	60"
4				
4 1/2				
5		Light gray/gray loamy sand		
5 1/2				
6				
6 1/2				
7				
7 1/2'	84"	Test pit terminated at 84" on suspected bedrock		≈ 741'
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/01/21	10:00AM	36"	Upon Completion

Test Pit Dimensions (ft)

Length:	11
Width:	4
Depth:	7

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 6**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 747'
Job No:	2021-53	Location:	
Date:	November 1, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 38° - 53°
Make:	Doosan	Model:	Dx235 LCR
Capacity:	1cy	Reach:	22'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Groundwater observed at 12"	n/a	18"
1.5		Brown sandy loam		
2				
2 1/2	B Horizon	Light brown/light orange sandy loam	n/a	36"
3'				
3 1/2'				
4				
4 1/2				
5				
5 1/2	60"	Test pit terminated at 60" on suspected bedrock		≈ 742'
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/01/21	10:30AM	12"	Upon Completion

Test Pit Dimensions (ft)

Length:	15
Width:	8
Depth:	3 1/2

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 7**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 730'
Job No:	2021-53	Location:	SE drainage
Date:	November 2, 2021		

Equipment:	Excavator	YET Rep	Mr. Scott Mensen
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 39° - 52°
Make:	CAT	Model:	302.5C
Capacity:	1/2 cy	Reach:	10'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Brown sandy loam	n/a	18"
1.5				
2				
2 1/2				
3'				
3 1/2'	B Horizon	Brown sandy loam	n/a	30"
4				
4 1/2				
5	54"	Test pit terminated at 54" on suspected bedrock		≈ 725'
5 1/2				
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/02/21	8:00AM	No GW	Upon Completion

Test Pit Dimensions (ft)

Length:	
Width:	
Depth:	4 1/2

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 8**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 731'
Job No:	2021-53	Location:	SW drainage
Date:	November 2, 2021		

Equipment:	Excavator	YET Rep	Mr. Scott Mensen
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 39° - 52°
Make:	CAT	Model:	302.5C
Capacity:	1/2 cy	Reach:	10'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam	n/a	6"
1.5	B Horizon	Light brown sandy loam	n/a	36"
2				
2 1/2				
3'				
3 1/2'				
4				
4 1/2	48"	Test pit terminated at 48" on suspected bedrock		≈ 727'
5				
5 1/2				
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/02/21	8:30AM	No GW	Upon Completion

Test Pit Dimensions (ft)

Length:	8
Width:	3
Depth:	4

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 9**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 736'
Job No:	2021-53	Location:	Mid drainage
Date:	November 2, 2021		

Equipment:	Excavator	YET Rep	Mr. Scott Mensen
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 39° - 52°
Make:	CAT	Model:	302.5C
Capacity:	1/2 cy	Reach:	10'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Brown sandy loam	n/a	6"
1.5	B Horizon	Brown sandy loam	n/a	30"
2				
2 1/2				
3'				
3 1/2'	36"			Seaonal High Groundwater
4	42"	Test pit terminated at 42" on suspected bedrock		≈ 732'
4 1/2				
5				
5 1/2				
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/02/21	9:00AM	36"	Upon Completion

Test Pit Dimensions (ft)

Length:	6
Width:	3
Depth:	3.5

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 10**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 741'
Job No:	2021-53	Location:	
Date:	November 2, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 39° - 52°
Make:	CAT	Model:	302.5C
Capacity:	1/2 cy	Reach:	10'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	12"
1				SHGW at 12"
1.5	A Horizon	Orange sandy loam	n/a	12"
2				
2 1/2				
3'				
3 1/2'	B Horizon	Brown loamy sand	n/a	36"
4				
4 1/2				
5				
5 1/2	60"	Test pit terminated at 60" in native loamy sand		≈ 736'
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/02/21	9:30AM	12"	Upon Completion

Test Pit Dimensions (ft)

Length:	6
Width:	2
Depth:	5

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 11**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 742'
Job No:	2021-53	Location:	
Date:	November 2, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 39° - 52°
Make:	CAT	Model:	302.5C
Capacity:	1/2 cy	Reach:	10'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	12"
1				SHGW at 24"
1.5	A Horizon	Orange sandy loam	n/a	12"
2		Groundwater observed at 24"		
2 1/2	B Horizon	Brown/gray sandy loam	n/a	6"
3'				
3 1/2'	C Horizon	Light brown sandy laom	n/a	18"
4				
4 1/2	48"	Test pit terminated at 48" in native loamy sand		≈ 738'
5				
5 1/2				
6				
6 1/2				
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/02/21	10:00AM	24"	Upon Completion

Test Pit Dimensions (ft)

Length:
Width:
Depth:

Soil Description Terminology

and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

SOIL TEST PIT LOG

Yankee Engineering & Testing, Inc
10 Mason Street
Worcester, MA 01609
phone 508-831-7404 fax 508-831-7388

Project:	92-94 Huntoon	Test Pit No#	**TP - 12**
	92-94 Huntoon Hwy - I	Current Elev.	≈ 757'
Job No:	2021-53	Location:	Side north
Date:	November 2, 2021		

Equipment:	Excavator	YET Rep	Mr. Joel Morin
Contractor:	Nicks Landscaping & Construction LLC	Client:	
Operator:	Nick Mauch	Weather:	Sunny, 39° - 52°
Make:	CAT	Model:	302.5C
Capacity:	1/2 cy	Reach:	10'

DEPTH (ft.)	STRATA CHANGE	SOIL VISUAL DESCRIPTION (estimate of soil composition)	BOULDER size//count	OTHER TEST PIT OBSERVATIONS
1/2	O Horizon	Topsoil	n/a	6"
1	A Horizon	Orange sandy loam		12"
1.5				
2	B Horizon	Light brown/light orange, moist, medium dense	n/a	12"
2 1/2		silty sand some gravel		
3'				
3 1/2'		Gray sandy loam		
4				
4 1/2	C Horizon	Groundwater observed at 4'	n/a	42"
5				
5 1/2				
6				
6 1/2	84"	Test pit terminated at 84" in native sandy loam		≈ 751'
7				
7 1/2'				
8				
8 1/2				
9				
9 1/2				

Field Groundwater Observations & Data

Date	Time	Depth	Comments
11/02/21	10:30AM	4'	Upon Completion

Test Pit Dimensions (ft)

Length:	5
Width:	2
Depth:	6

Soil Description Terminology

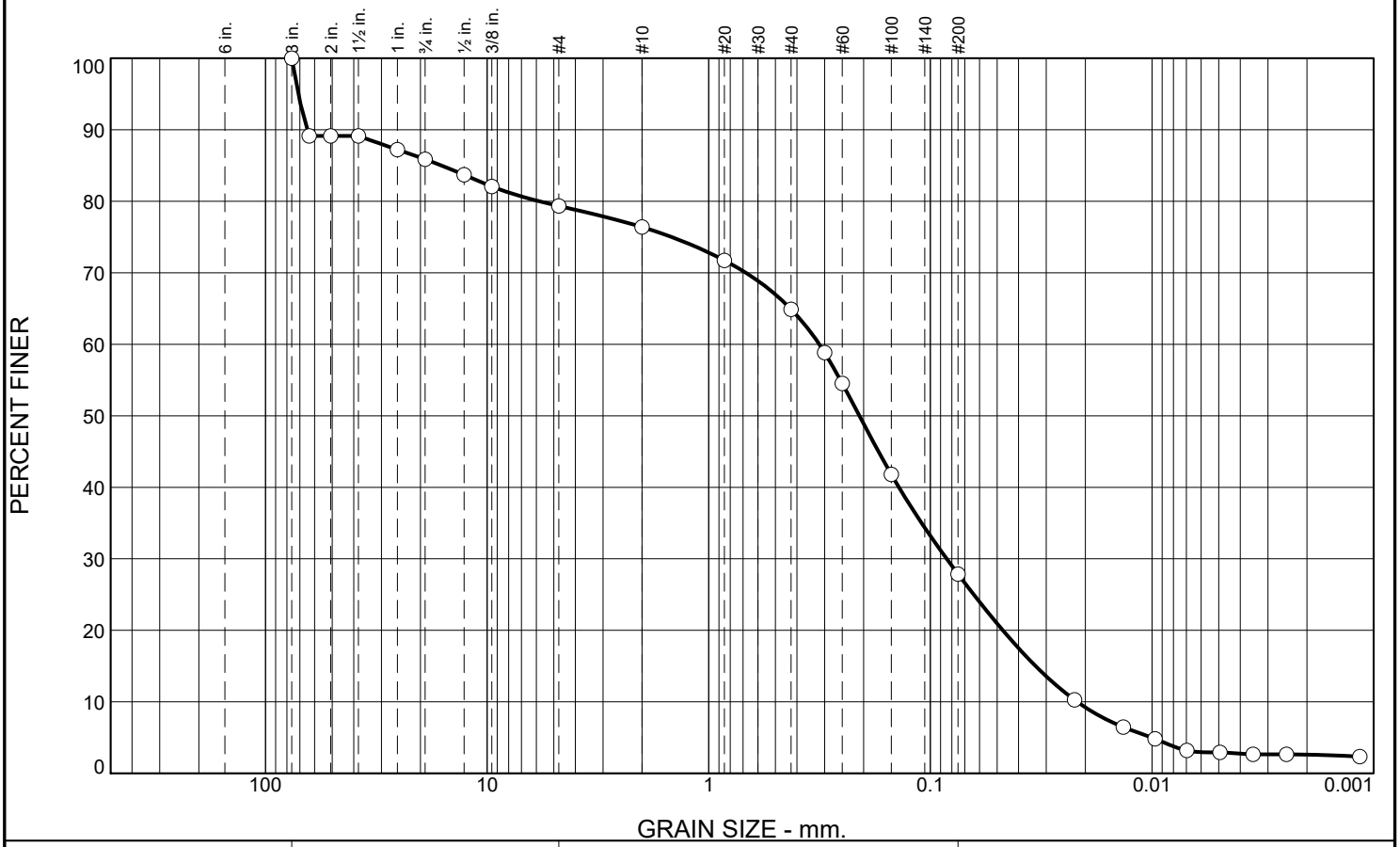
and = 35%+
some = 20% to 35%
little = 10% to 20%
trace = <10%

Information * - ground elevation based on Subsurface Investigation Sketch by VHB dated 10/15/21.

APPENDIX A

Yankee Engineering & Testing, Inc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.1	6.6	2.9	11.5	37.0	25.3	2.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2-1/2"	89.1		
2"	89.1		
1-1/2"	89.1		
1"	87.2		
3/4"	85.9		
1/2"	83.7		
3/8"	82.1		
#4	79.3		
#10	76.4		
#20	71.7		
#40	64.9		
#50	58.8		
#60	54.5		
#100	41.8		
#200	27.9		

* (no specification provided)

Material Description

Orange silty sand some gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 16.0753 D_{60}= 0.3172 D_{50}= 0.2091
D_{30}= 0.0844 D_{15}= 0.0335 D_{10}= 0.0218
C_u= 14.58 C_c= 1.03

Classification

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

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information

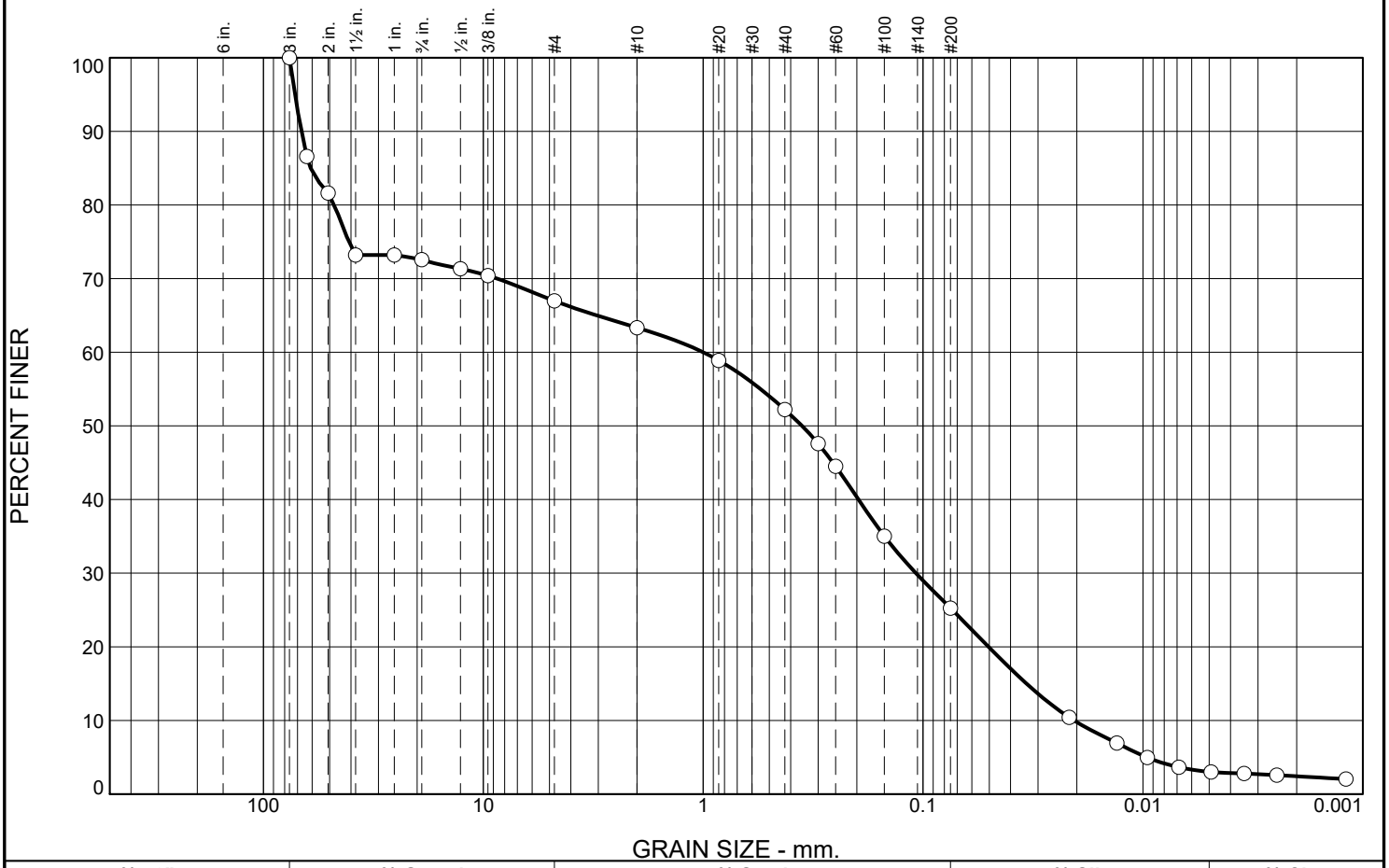
Sample No.: L30706 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-1 **Elev./Depth:** A Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	33.0	41.8	22.2	3.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2-1/2"	86.6		
2"	81.6		
1-1/2"	73.2		
1"	73.2		
3/4"	72.6		
1/2"	71.3		
3/8"	70.4		
#4	67.0		
#10	63.3		
#20	58.9		
#40	52.2		
#50	47.6		
#60	44.5		
#100	35.0		
#200	25.2		

* (no specification provided)

Material Description

Brown silty sand some gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 60.9647 D_{60}= 1.0004 D_{50}= 0.3551
D_{30}= 0.1078 D_{15}= 0.0338 D_{10}= 0.0206
C_u= 48.60 C_c= 0.56

Classification

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

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information

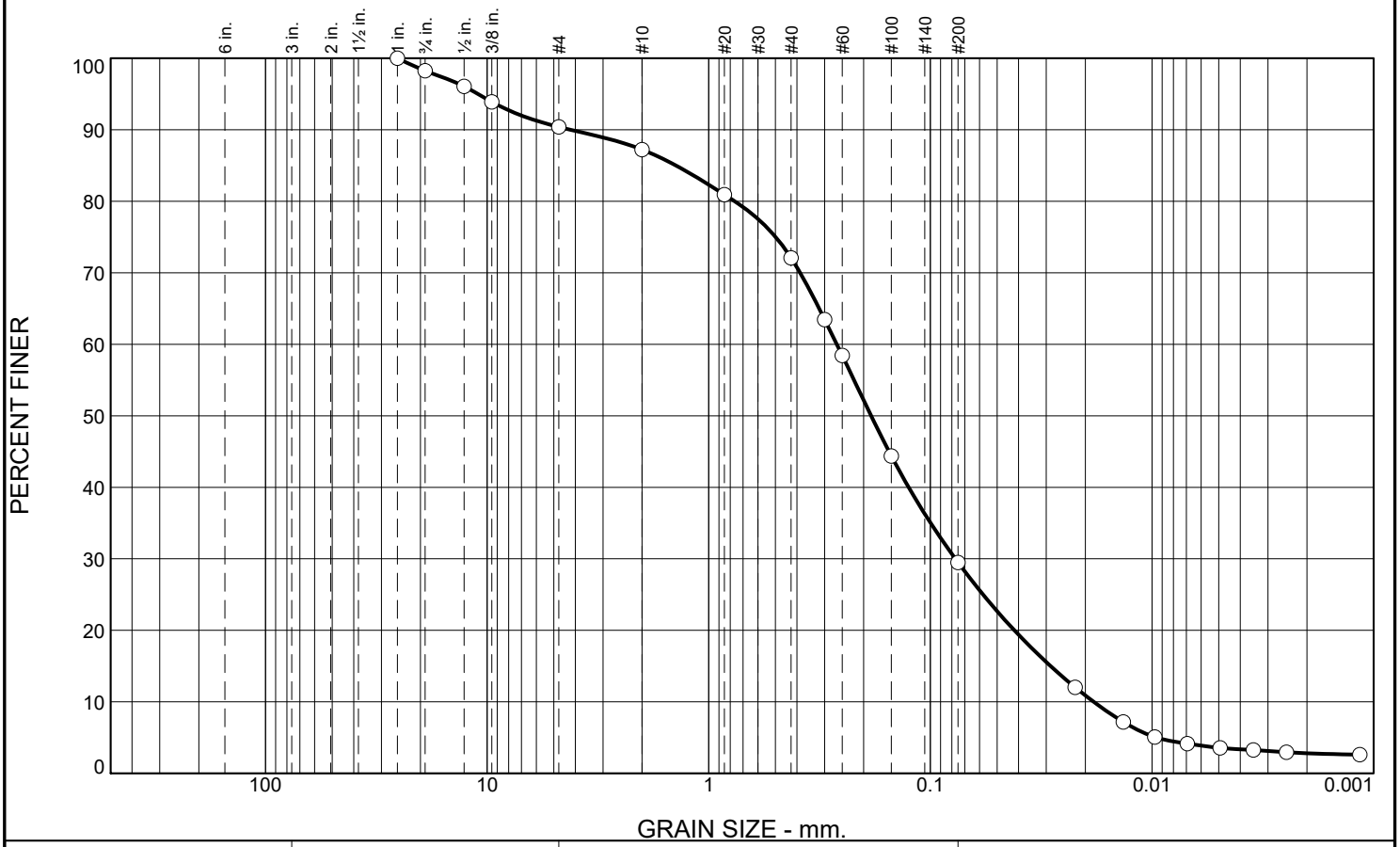
Sample No.: L30707 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-1 (2'-5') **Elev./Depth:** B Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.7	7.9	3.2	15.1	42.6	26.7	2.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	98.3		
1/2"	96.1		
3/8"	93.9		
#4	90.4		
#10	87.2		
#20	80.9		
#40	72.1		
#50	63.4		
#60	58.4		
#100	44.4		
#200	29.5		

* (no specification provided)

Material Description

Orange silty sand trace gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 1.4065 D_{60}= 0.2645 D_{50}= 0.1851
D_{30}= 0.0771 D_{15}= 0.0287 D_{10}= 0.0183
C_u= 14.42 C_c= 1.23

Classification

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

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information

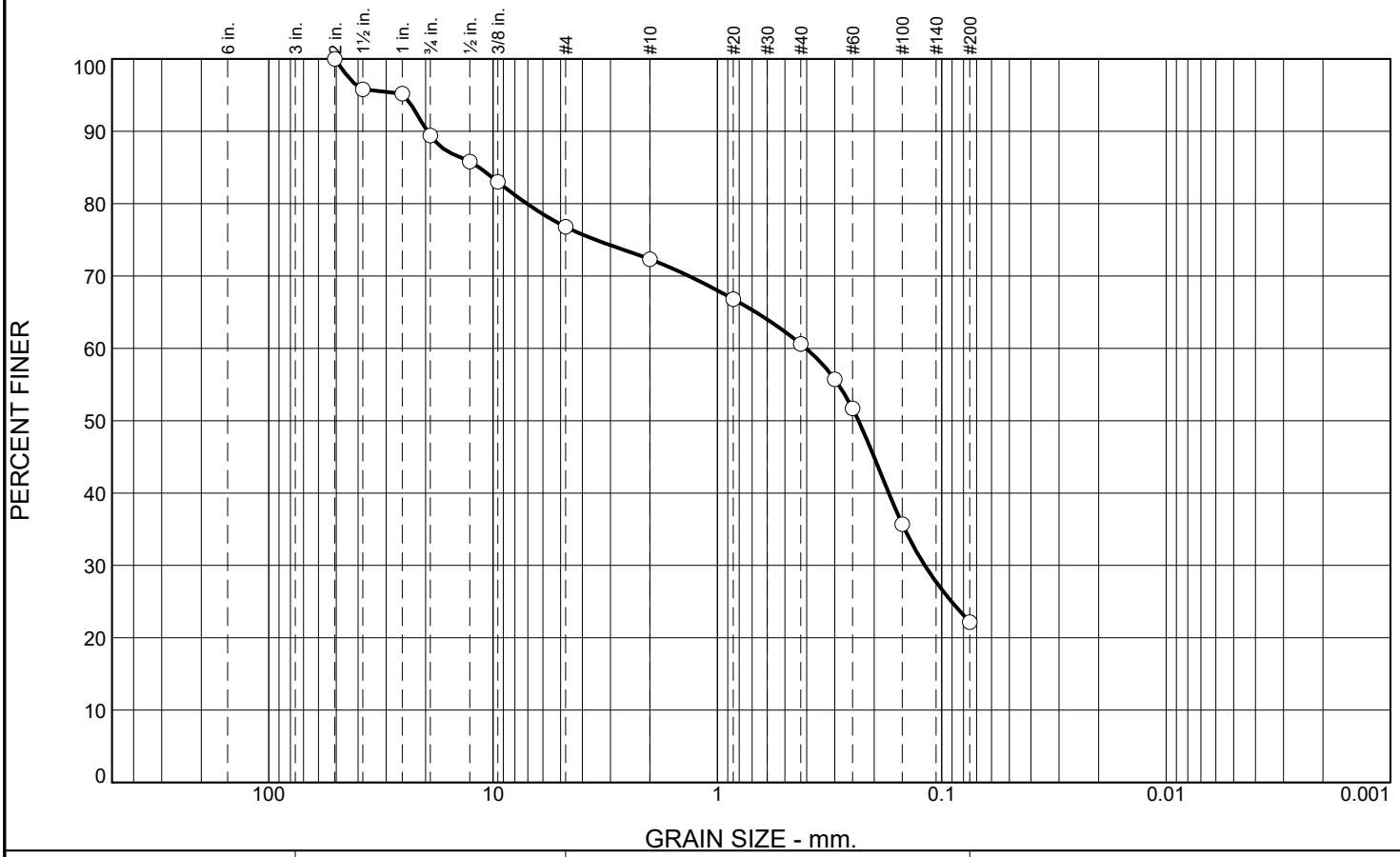
Sample No.: L30708 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-2 **Elev./Depth:** A Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.6	12.6	4.5	11.7	38.5	22.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	95.8		
1"	95.2		
3/4"	89.4		
1/2"	85.8		
3/8"	83.0		
#4	76.8		
#10	72.3		
#20	66.8		
#40	60.6		
#50	55.7		
#60	51.7		
#100	35.7		
#200	22.1		

* (no specification provided)

Material Description

Light brown/orange
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 11.5419 D_{60}= 0.4032 D_{50}= 0.2351
D_{30}= 0.1190 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information
Not enough fines for Hydrometer test

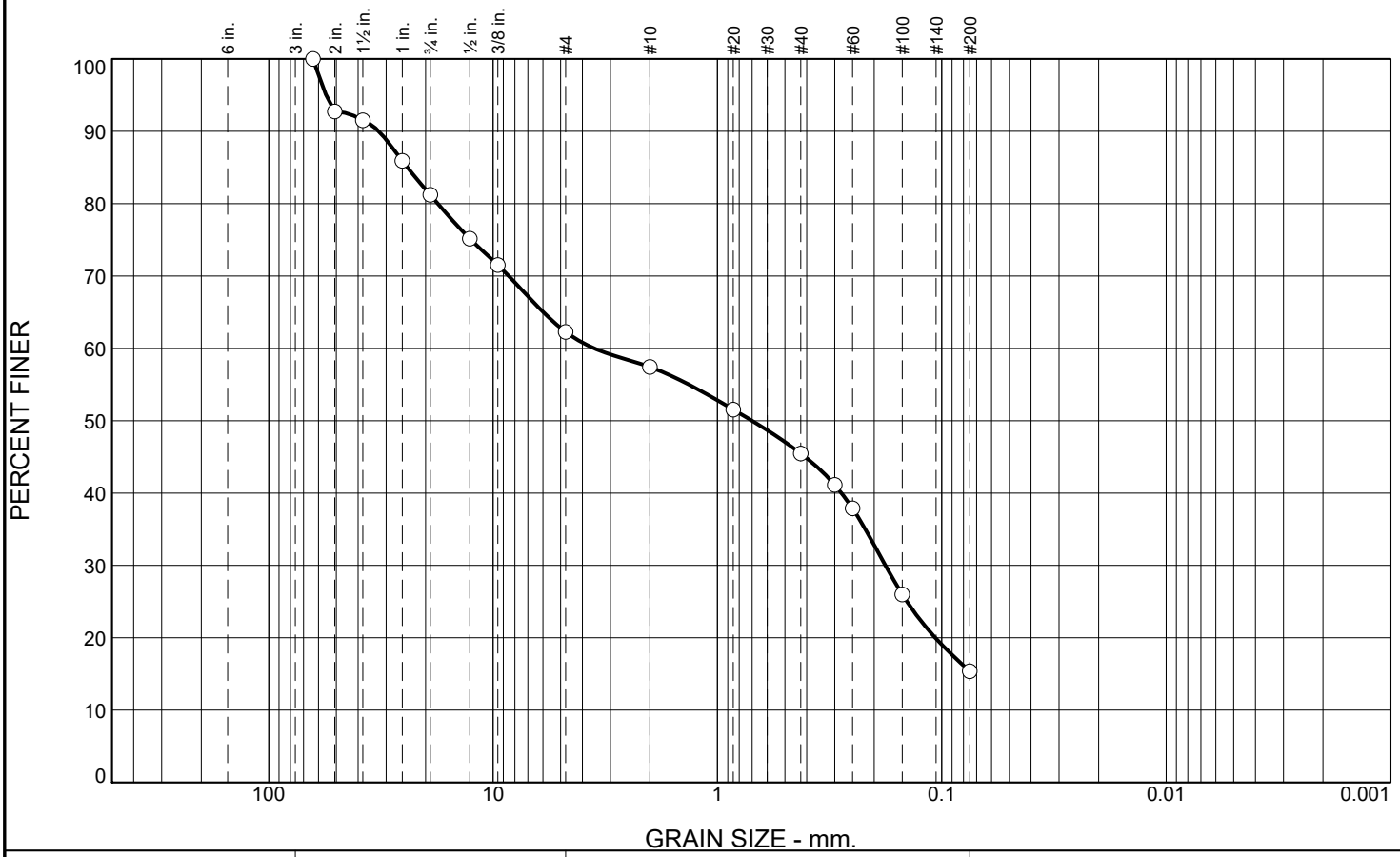
Sample No.: L30709 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-2 **Elev./Depth:** B Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.8	18.9	4.9	11.9	30.1	15.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2-1/2"	100.0		
2"	92.7		
1-1/2"	91.5		
1"	85.9		
3/4"	81.2		
1/2"	75.2		
3/8"	71.5		
#4	62.3		
#10	57.4		
#20	51.5		
#40	45.5		
#50	41.1		
#60	37.9		
#100	26.0		
#200	15.4		

* (no specification provided)

Material Description

Light brown silty sand and gravel
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 24.1009 D_{60}= 3.5395 D_{50}= 0.7019
D_{30}= 0.1784 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information
Not enough fines for Hydrometer test

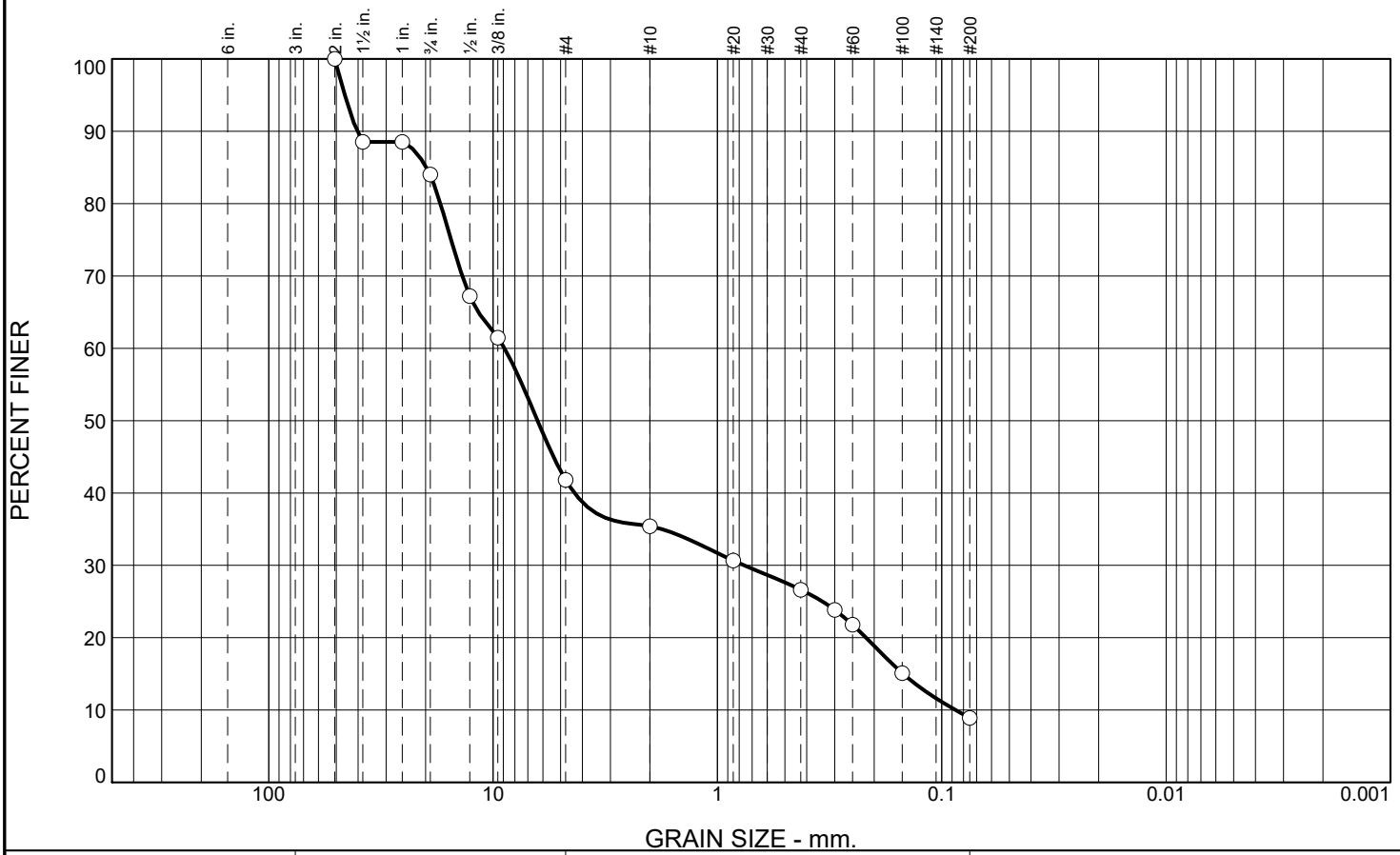
Sample No.: L30710 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-2 **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.0	42.2	6.4	8.8	17.7	8.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	88.5		
1"	88.5		
3/4"	84.0		
1/2"	67.2		
3/8"	61.5		
#4	41.8		
#10	35.4		
#20	30.7		
#40	26.6		
#50	23.8		
#60	21.8		
#100	15.1		
#200	8.9		

* (no specification provided)

Material Description

Orange/brown gravel some f/m sand trace silt
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 19.8176 D_{60}= 8.8955 D_{50}= 6.3364
D_{30}= 0.7607 D_{15}= 0.1487 D_{10}= 0.0867
C_u= 102.59 C_c= 0.75

Classification

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

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information
Not enough fines for Hydrometer test

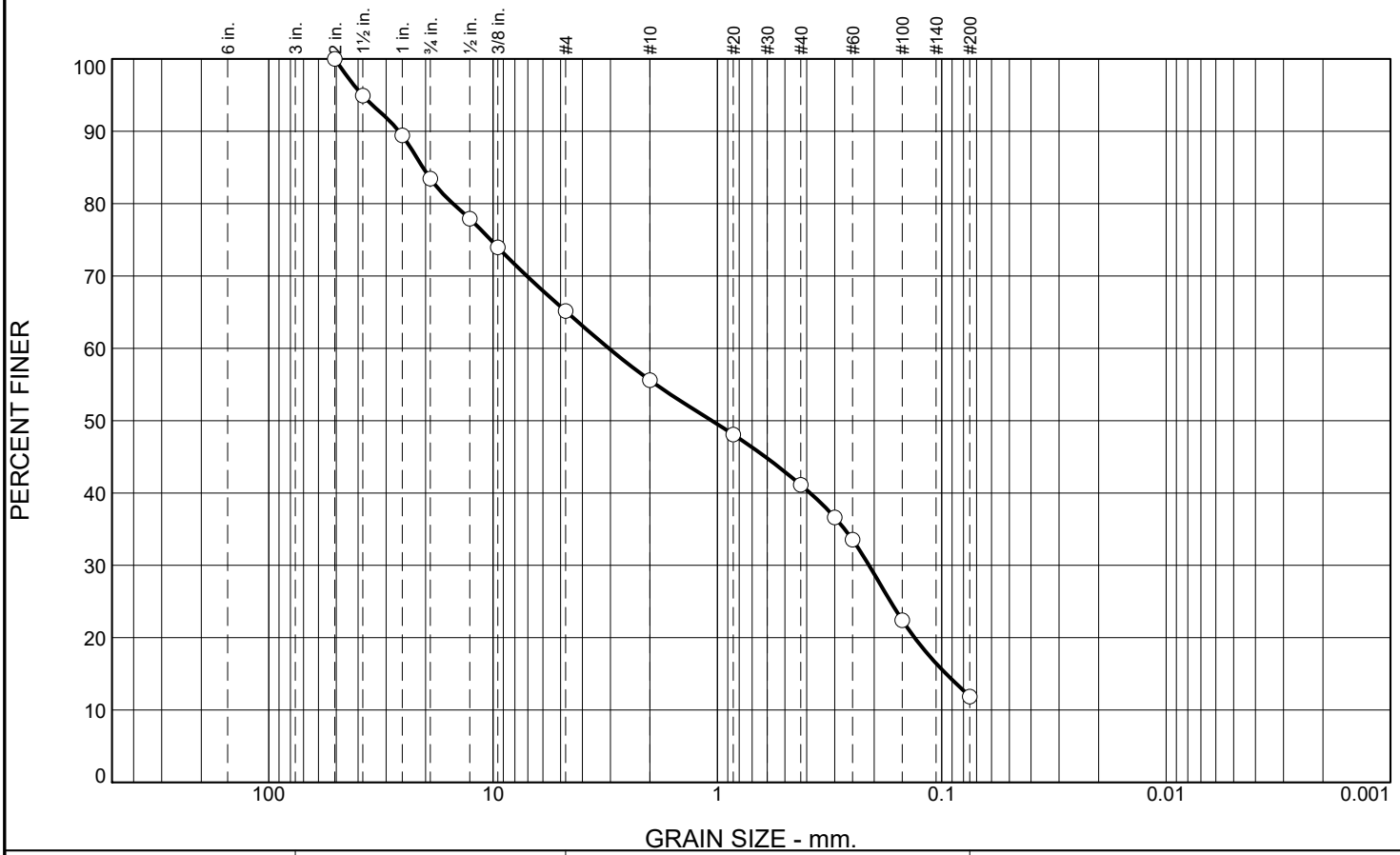
Sample No.: L30711 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-3 **Elev./Depth:** A/B Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.5	18.4	9.5	14.5	29.2	11.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	94.9		
1"	89.4		
3/4"	83.5		
1/2"	77.9		
3/8"	74.0		
#4	65.1		
#10	55.6		
#20	48.1		
#40	41.1		
#50	36.6		
#60	33.5		
#100	22.4		
#200	11.9		

* (no specification provided)

Material Description

Brown f/m sand some gravel little silt
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 20.5598 D_{60}= 3.0470 D_{50}= 1.0602
D_{30}= 0.2110 D_{15}= 0.0955 D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information
Not enough fines for Hydrometer test

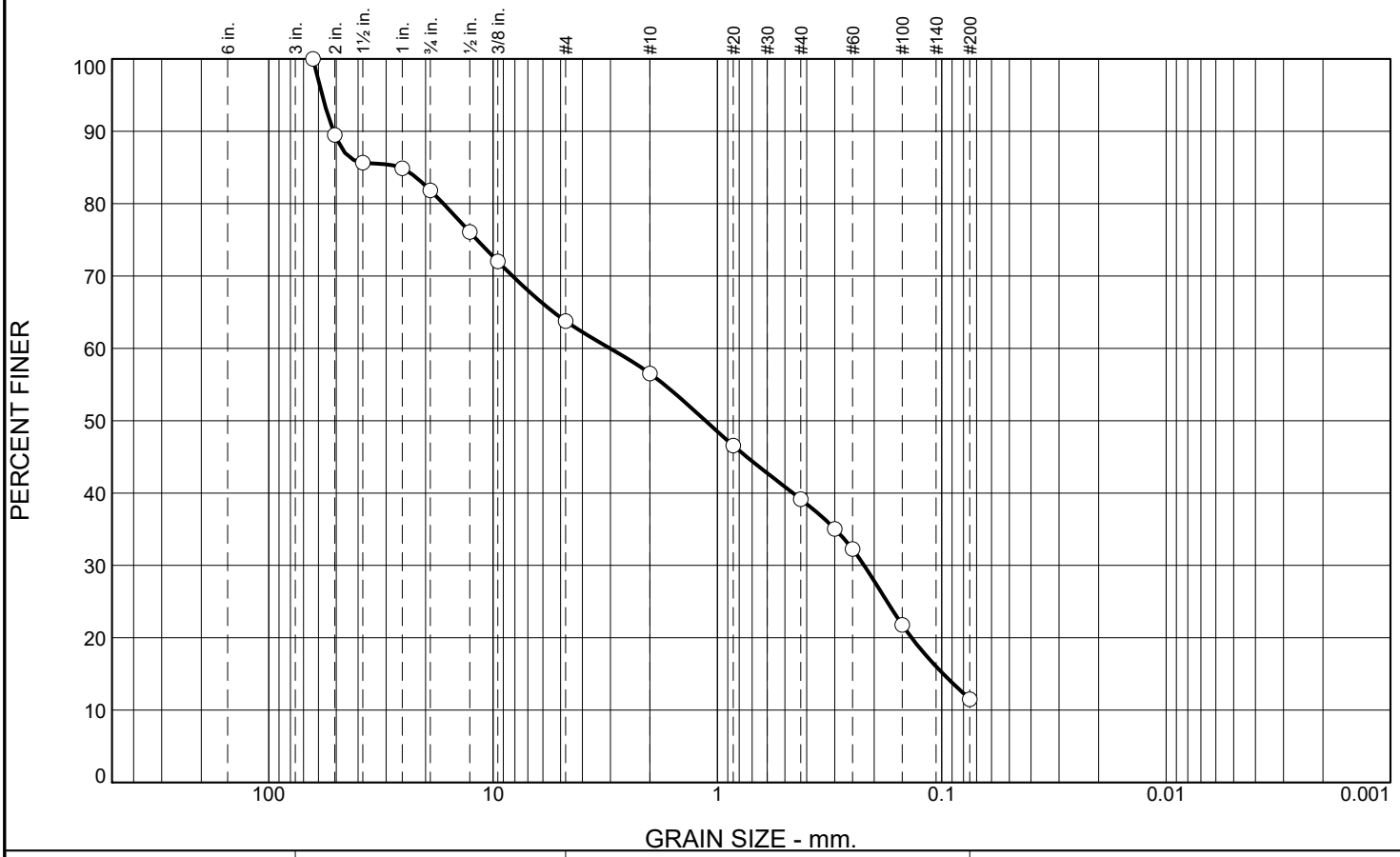
Sample No.: L30712 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-4 **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.2	18.0	7.3	17.4	27.6	11.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2-1/2"	100.0		
2"	89.5		
1-1/2"	85.7		
1"	84.9		
3/4"	81.8		
1/2"	76.1		
3/8"	72.0		
#4	63.8		
#10	56.5		
#20	46.6		
#40	39.1		
#50	35.1		
#60	32.3		
#100	21.8		
#200	11.5		

* (no specification provided)

Material Description

Brown f/m sand and gravel little silt
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 25.9552 D_{60}= 3.0120 D_{50}= 1.1312
D_{30}= 0.2219 D_{15}= 0.0984 D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information
Not enough fines for Hydrometer test

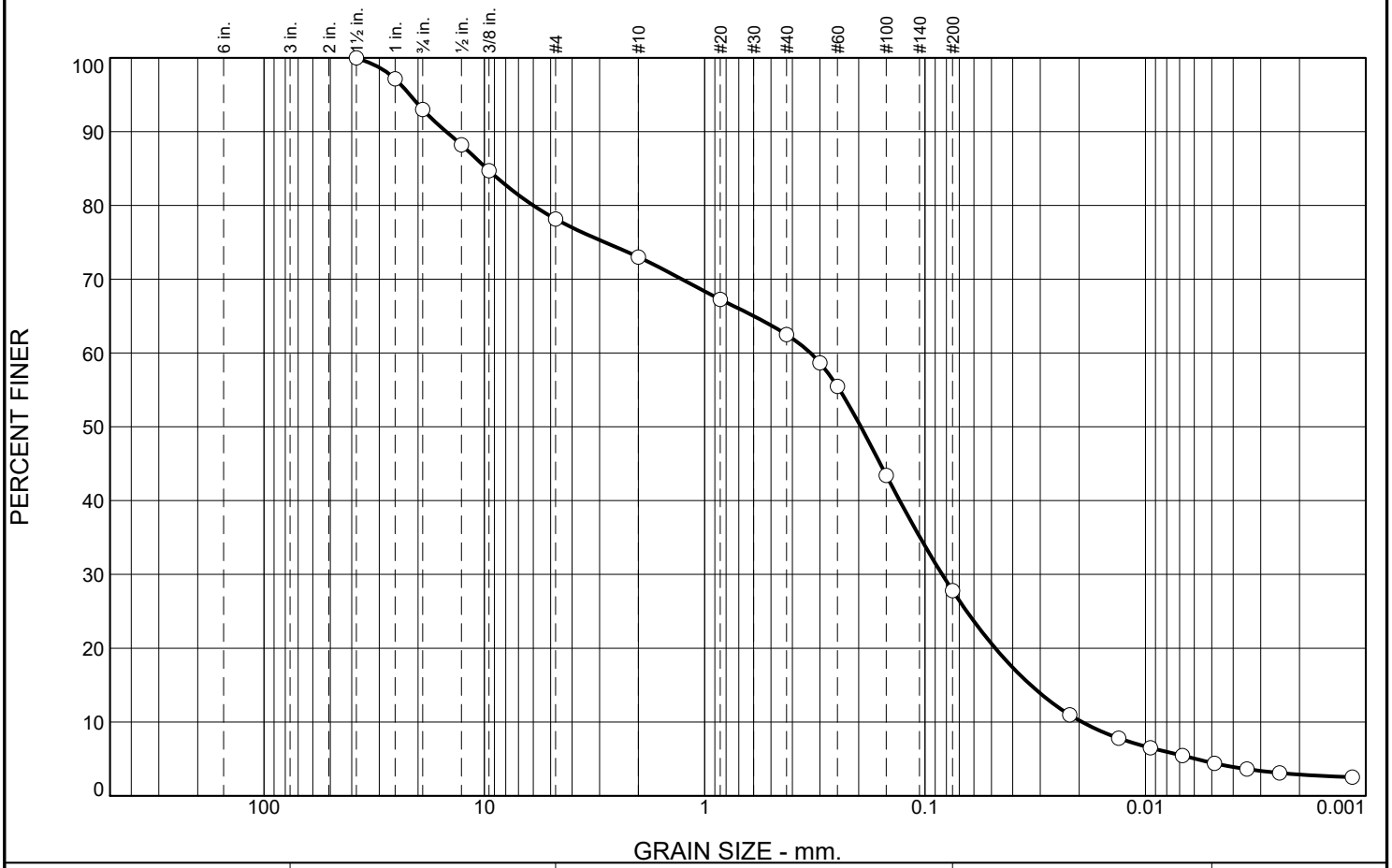
Sample No.: L30713 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-5 **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	21.8	50.4	23.3	4.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2"	100.0		
1"	97.2		
3/4"	93.0		
1/2"	88.2		
3/8"	84.7		
#4	78.2		
#10	73.0		
#20	67.3		
#40	62.5		
#50	58.7		
#60	55.5		
#100	43.4		
#200	27.8		

* (no specification provided)

Material Description

Orange/Brown silty sand some gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 9.7542 D_{60}= 0.3308 D_{50}= 0.1956
D_{30}= 0.0837 D_{15}= 0.0332 D_{10}= 0.0194
C_u= 17.04 C_c= 1.09

Classification

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

Remarks

Sampled by Joel Morin 11/1/21
See summary letter for additional information

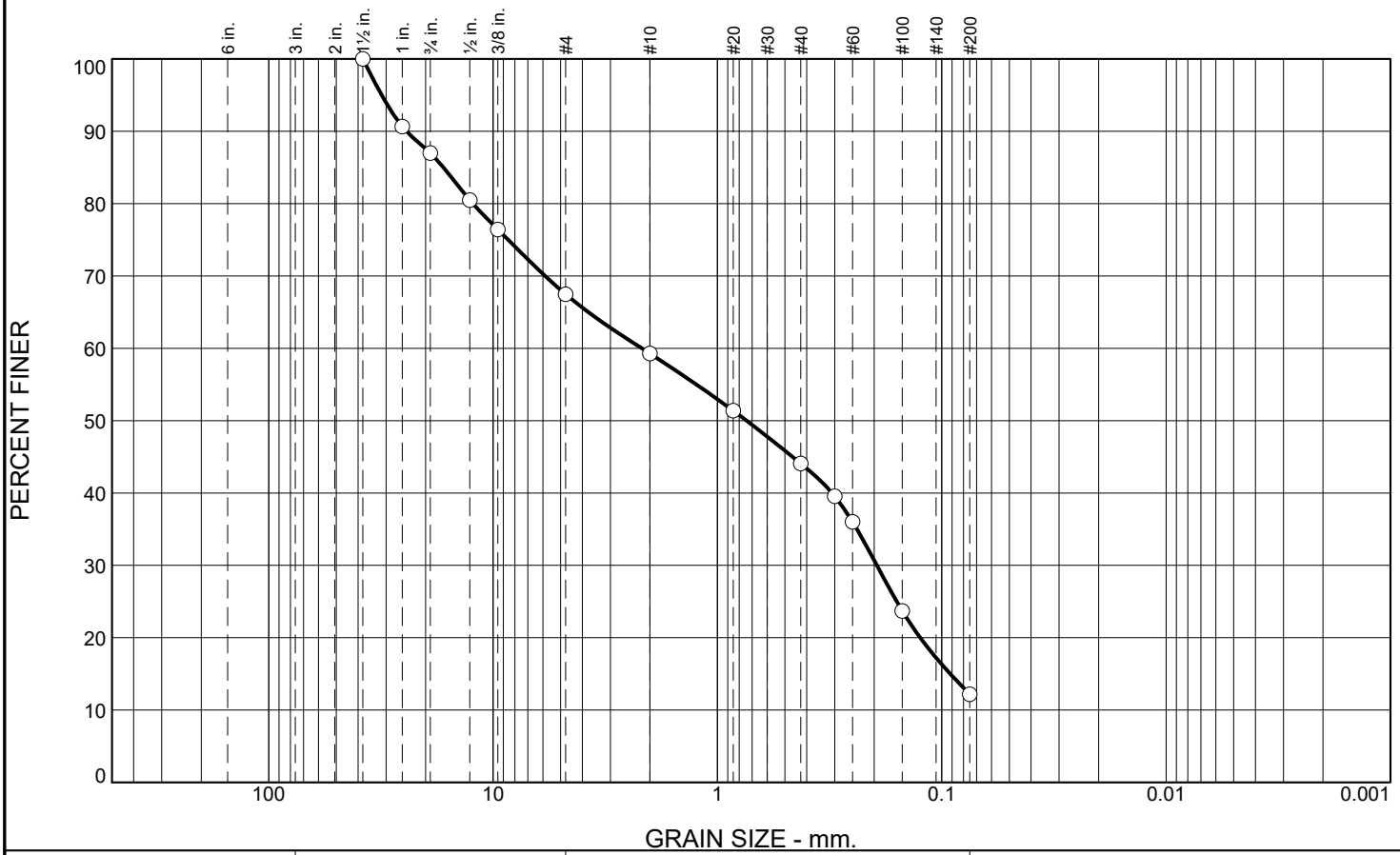
Sample No.: L30714 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-6 **Elev./Depth:** B Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.0	19.5	8.2	15.2	31.9	12.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2"	100.0		
1"	90.7		
3/4"	87.0		
1/2"	80.5		
3/8"	76.4		
#4	67.5		
#10	59.3		
#20	51.4		
#40	44.1		
#50	39.5		
#60	36.0		
#100	23.7		
#200	12.2		

* (no specification provided)

Material Description

Light brown silty sand some gravel
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 16.6538 D_{60}= 2.1742 D_{50}= 0.7417
D_{30}= 0.1947 D_{15}= 0.0916 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sampled by Scott Mensen 11/2/21
See summary letter for additional information
Not enough fines for Hydrometer test

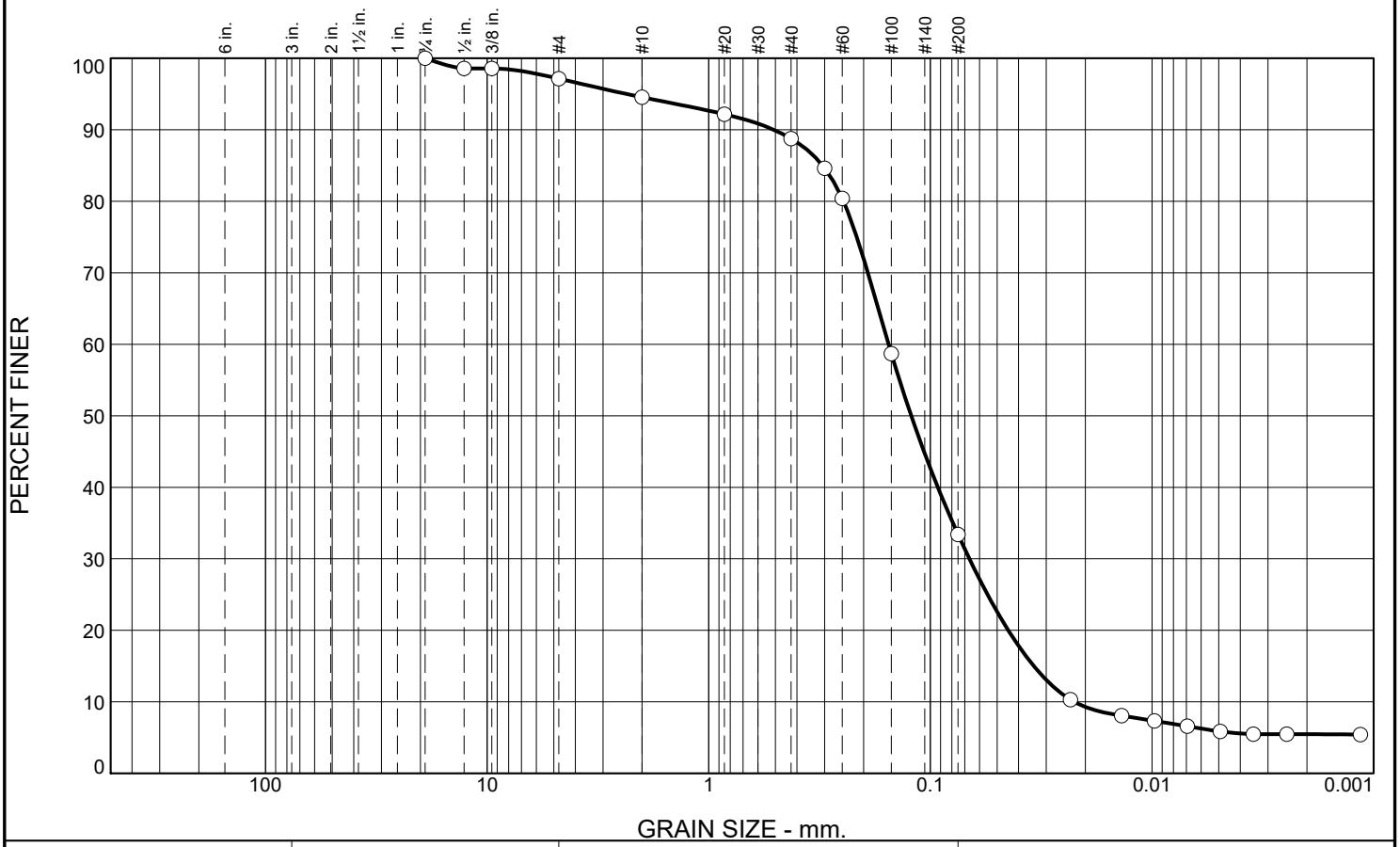
Sample No.: L30722 **Source of Sample:** Test Pits 2021 **Date:** 11/5/21
Location: TP-7 (2'-4') **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.9	2.6	5.8	55.3	27.9	5.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	98.6		
3/8"	98.6		
#4	97.1		
#10	94.5		
#20	92.2		
#40	88.7		
#50	84.6		
#60	80.4		
#100	58.7		
#200	33.4		

* (no specification provided)

Material Description

Light brown silty sand trace gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.3067 D_{60}= 0.1544 D_{50}= 0.1220
D_{30}= 0.0667 D_{15}= 0.0341 D_{10}= 0.0224
C_u= 6.88 C_c= 1.28

Classification

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

Remarks

Sampled by Scott Mensen 11/2/21
See summary letter for additional information

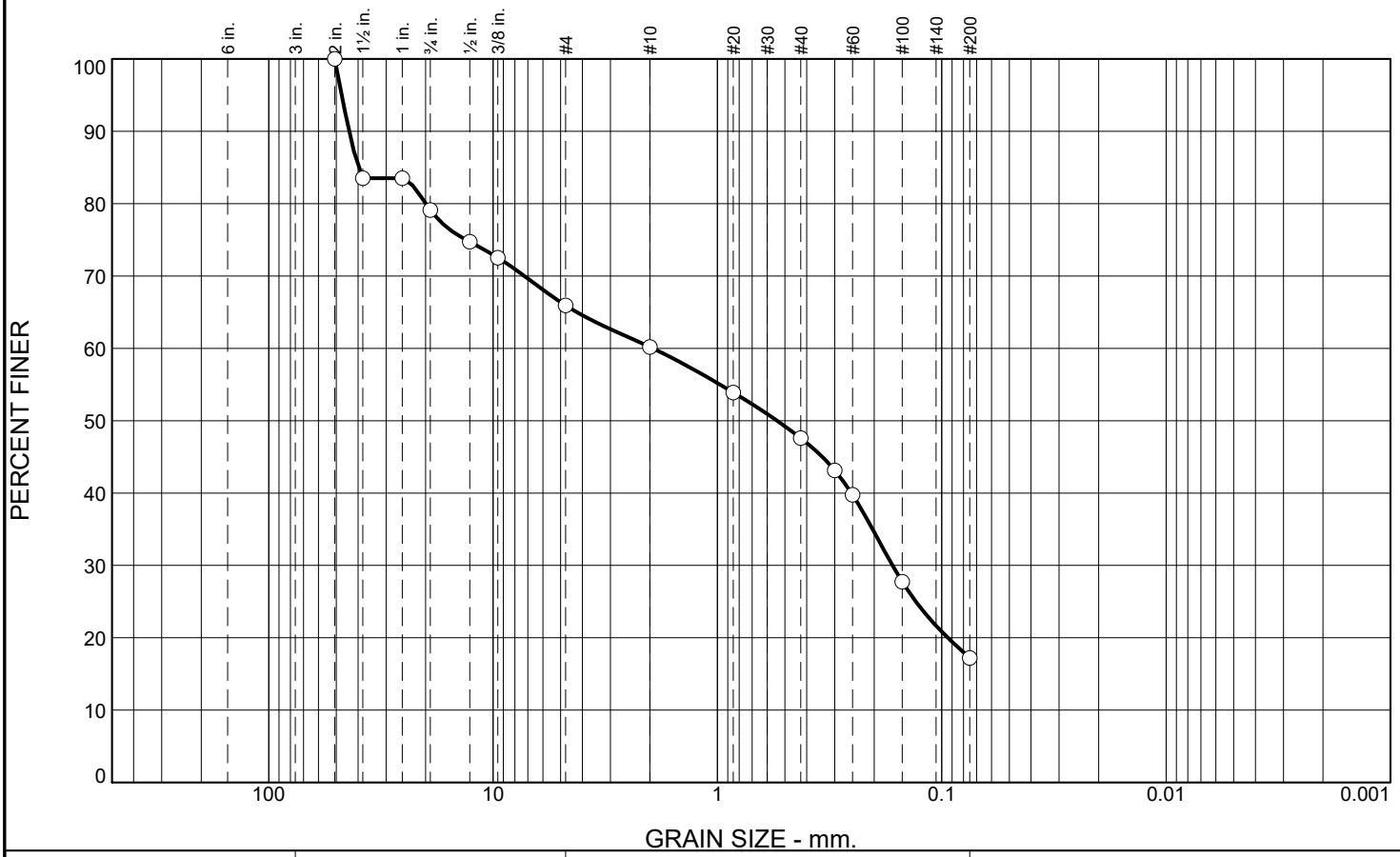
Sample No.: L30723 **Source of Sample:** Test Pits 2021 **Date:** 11/6/21
Location: TP-8 (1'-4') **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.9	13.2	5.7	12.6	30.4	17.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	83.5		
1"	83.5		
3/4"	79.1		
1/2"	74.7		
3/8"	72.5		
#4	65.9		
#10	60.2		
#20	53.9		
#40	47.6		
#50	43.1		
#60	39.8		
#100	27.7		
#200	17.2		

* (no specification provided)

Material Description

Light brown silty sand some gravel
USDA Textural Classification = Loamy Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 39.7543 D_{60}= 1.9410 D_{50}= 0.5421
D_{30}= 0.1658 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sampled by Scott Mensen 11/2/21
See summary letter for additional information
Not enough fines for Hydrometer test

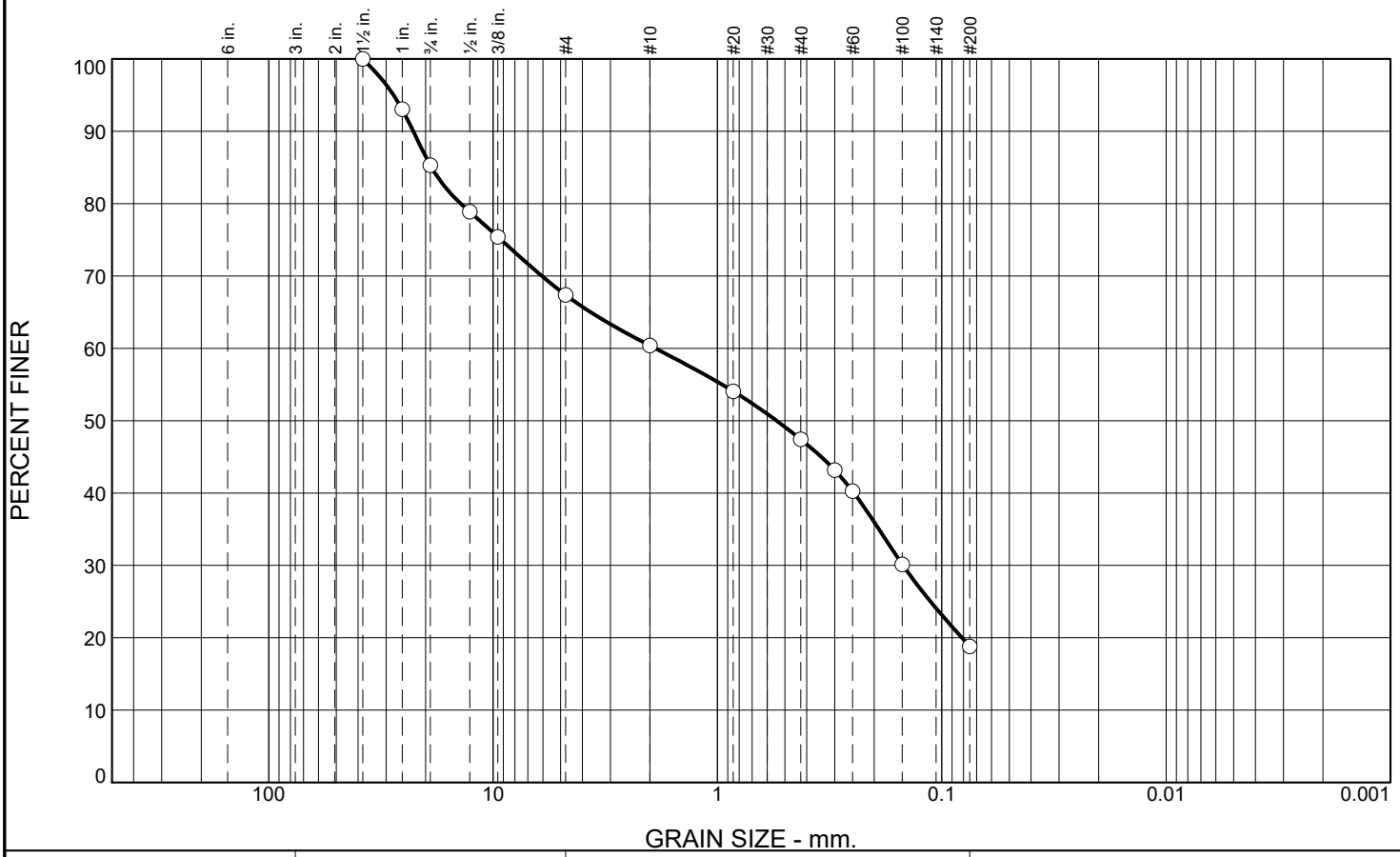
Sample No.: L30724 **Source of Sample:** Test Pits 2021 **Date:** 11/6/21
Location: TP-9 (1'-3') **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.7	17.9	7.0	13.0	28.6	18.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2"	100.0		
1"	93.0		
3/4"	85.3		
1/2"	78.9		
3/8"	75.4		
#4	67.4		
#10	60.4		
#20	54.1		
#40	47.4		
#50	43.2		
#60	40.3		
#100	30.1		
#200	18.8		

* (no specification provided)

Material Description

Brown silty sand some gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 18.8128 D_{60}= 1.8920 D_{50}= 0.5446
D_{30}= 0.1489 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sampled by Joel Morin 11/2/21
See summary letter for additional information
Not enough fines for Hydrometer test

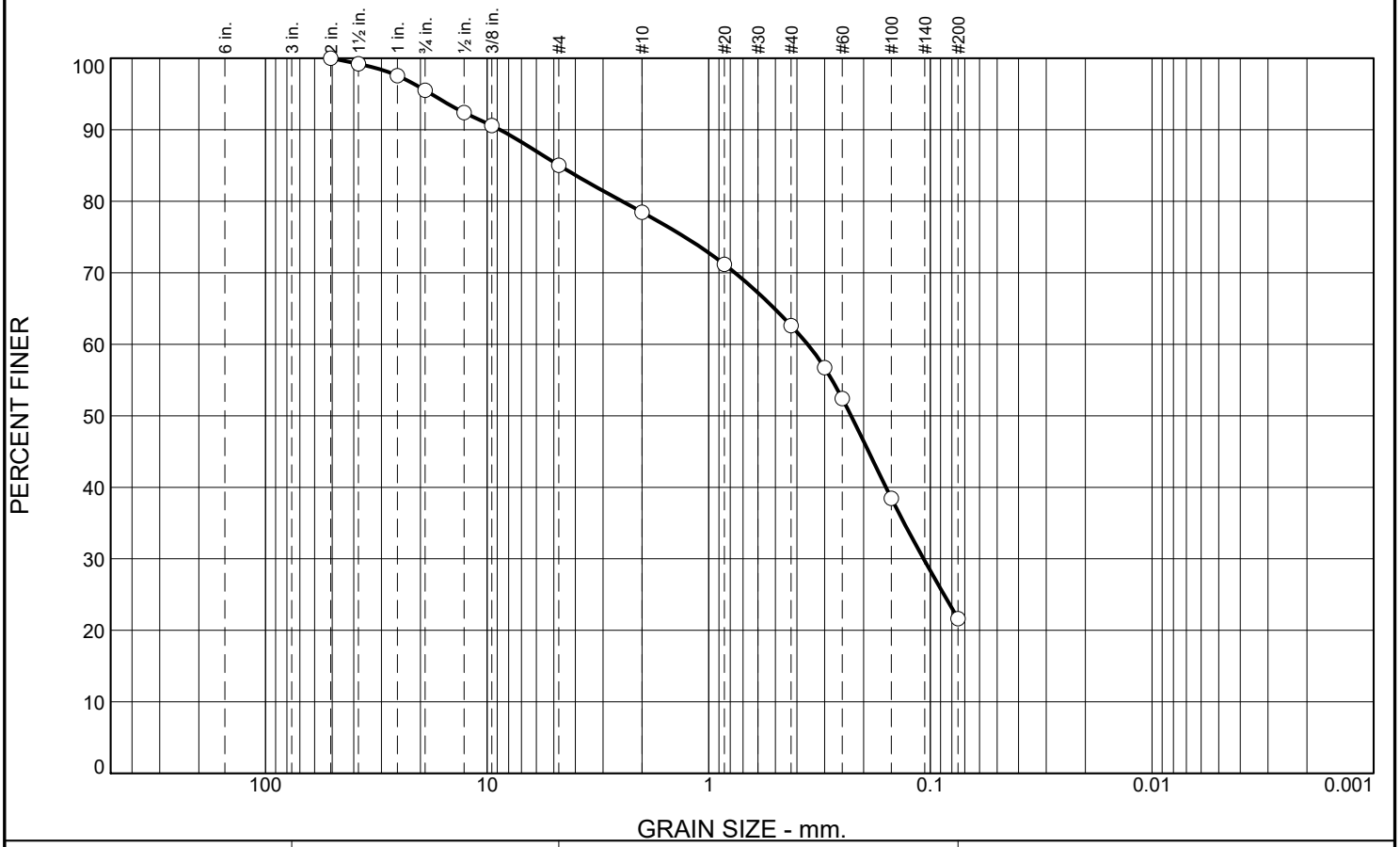
Sample No.: L30730 **Source of Sample:** Test Pits 2021 **Date:** 11/6/21
Location: TP-10 **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.5	10.5	6.5	15.9	41.0	21.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	99.2		
1"	97.6		
3/4"	95.5		
1/2"	92.4		
3/8"	90.6		
#4	85.0		
#10	78.5		
#20	71.2		
#40	62.6		
#50	56.7		
#60	52.4		
#100	38.5		
#200	21.6		

* (no specification provided)

Material Description

Brown 2" max silty sand little gravel
D-1557 proctor = 124.1 pcf @ 7.7% optimum moisture

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 4.7284 D_{60}= 0.3579 D_{50}= 0.2280
D_{30}= 0.1073 D_{15}= D_{10}=
C_u= C_c=

Classification

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

Remarks

Sampled by Joel Morin (Yankee) on 11/02/21

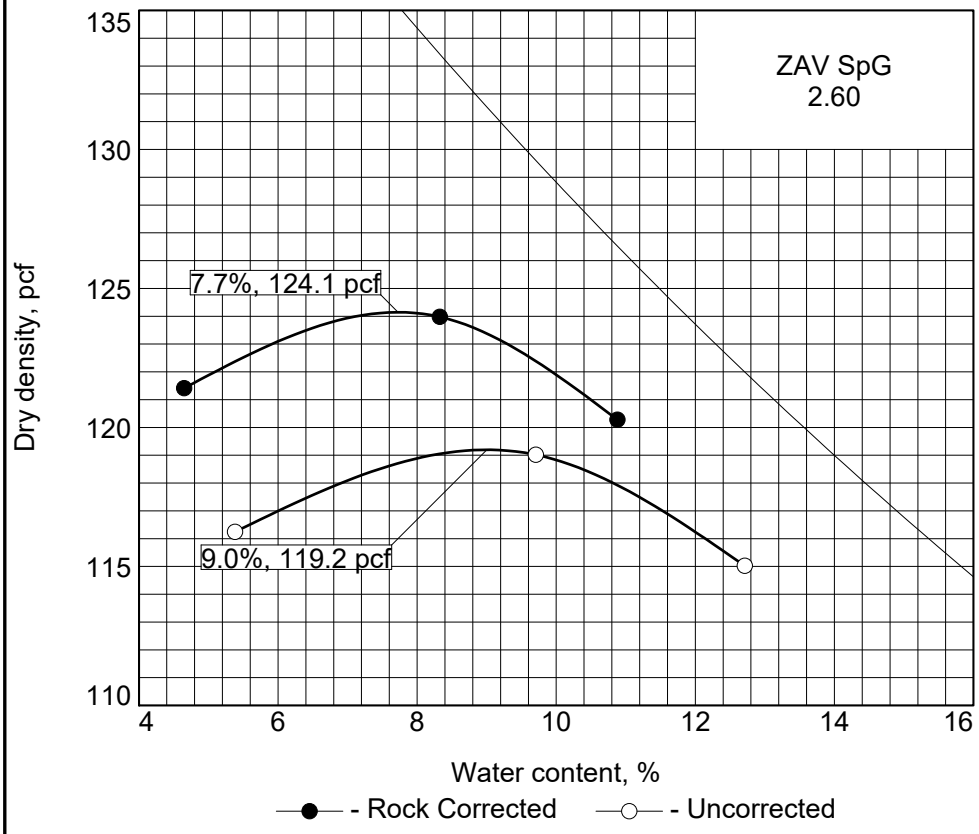
Sample No.: L-30732 **Source of Sample:** Test Pits 2021 **Date:** 11/09/21
Location: TP-10 **Elev./Depth:**

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

COMPACTION TEST REPORT



Curve No.
L-30732

Test Specification:
ASTM D 1557-12 Method A Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method Dry
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM **LL** NP **PI** NP
Sp.G. (ASTM D 854)
%>#4 15.0 **%<No.200** 21.6
USCS SM **AASHTO** A-2-4(0)
Date Sampled 11/02/21
Date Tested 11/09/21
Tested By AK

TESTING DATA

	1	2	3	4	5	6
WM + WS	6141.0	6263.0	6249.0			
WM	4289.0	4289.0	4289.0			
WW + T #1	70.9	73.8	67.8			
WD + T #1	68.3	67.9	61.6			
TARE #1	13.5	11.0	13.6			
WW + T #2	71.6	71.3	79.3			
WD + T #2	68.3	66.4	71.7			
TARE #2	13.5	12.2	10.9			
MOISTURE	4.6	8.3	10.9			
DRY DENSITY	121.4	124.0	120.3			

ROCK CORRECTED TEST RESULTS

Maximum dry density = 124.1 pcf

Optimum moisture = 7.7 %

Material Description

Brown 2" max silty sand little gravel
D-1557 proctor = 124.1 pcf @ 7.7% optimum moisture

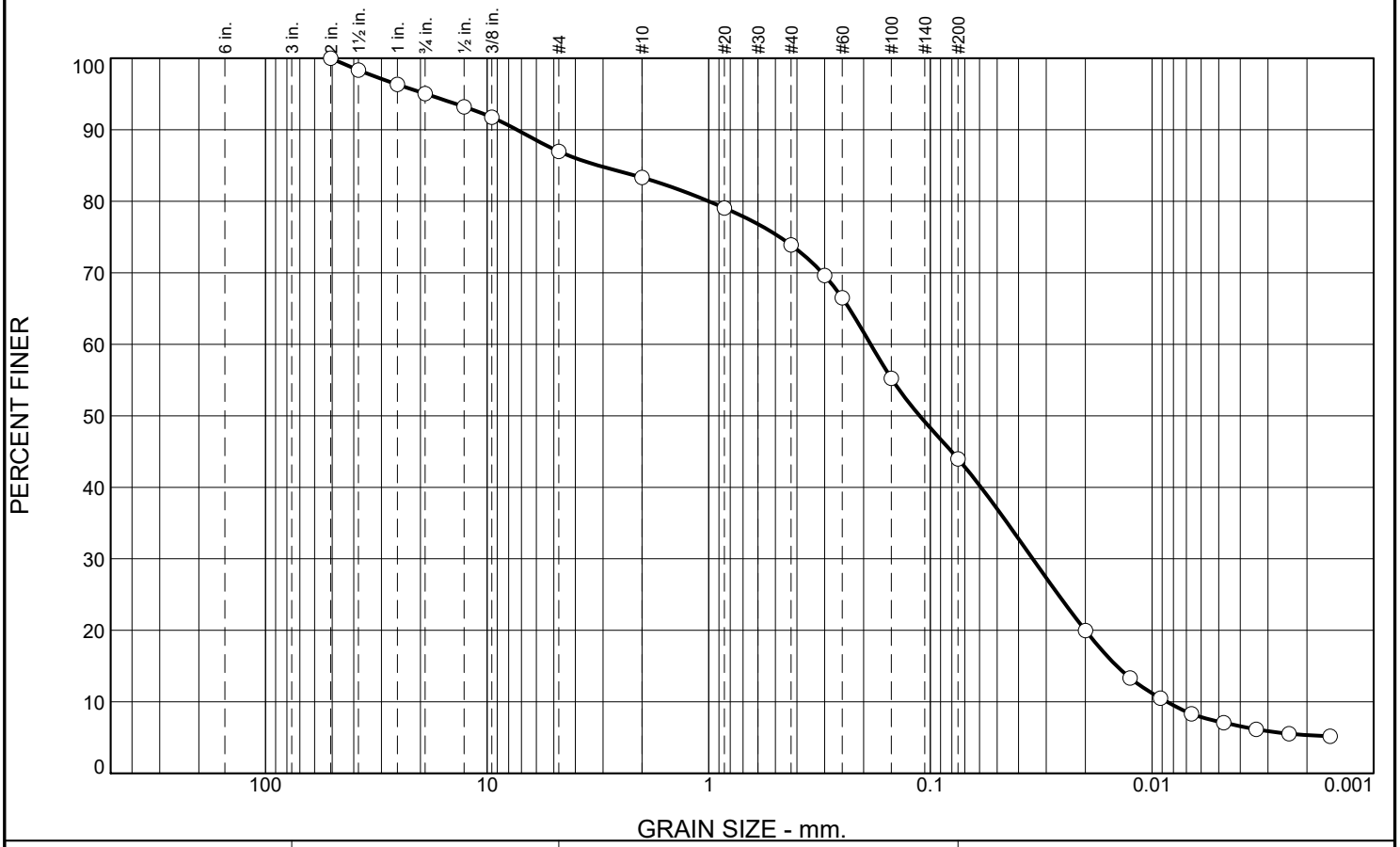
Remarks:
Test pits 2021

Project No. 2021-53 **Client:** The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
○ **Location:** TP-10 **Sample Number:** L-30732

Checked by: SMM
Title:

YANKEE ENGINEERING & TESTING, INC.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.0	8.0	3.7	9.4	29.9	38.6	5.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	98.3		
1"	96.3		
3/4"	95.0		
1/2"	93.2		
3/8"	91.7		
#4	87.0		
#10	83.3		
#20	79.1		
#40	73.9		
#50	69.6		
#60	66.5		
#100	55.2		
#200	44.0		

* (no specification provided)

Material Description

Brown silty sand little gravel
USDA Textural Classification = Sandy Loam

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 3.1463 D_{60}= 0.1861 D_{50}= 0.1118
D_{30}= 0.0345 D_{15}= 0.0144 D_{10}= 0.0086
C_u= 21.73 C_c= 0.75

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sampled by Joel Morin 11/2/21
See summary letter for additional information

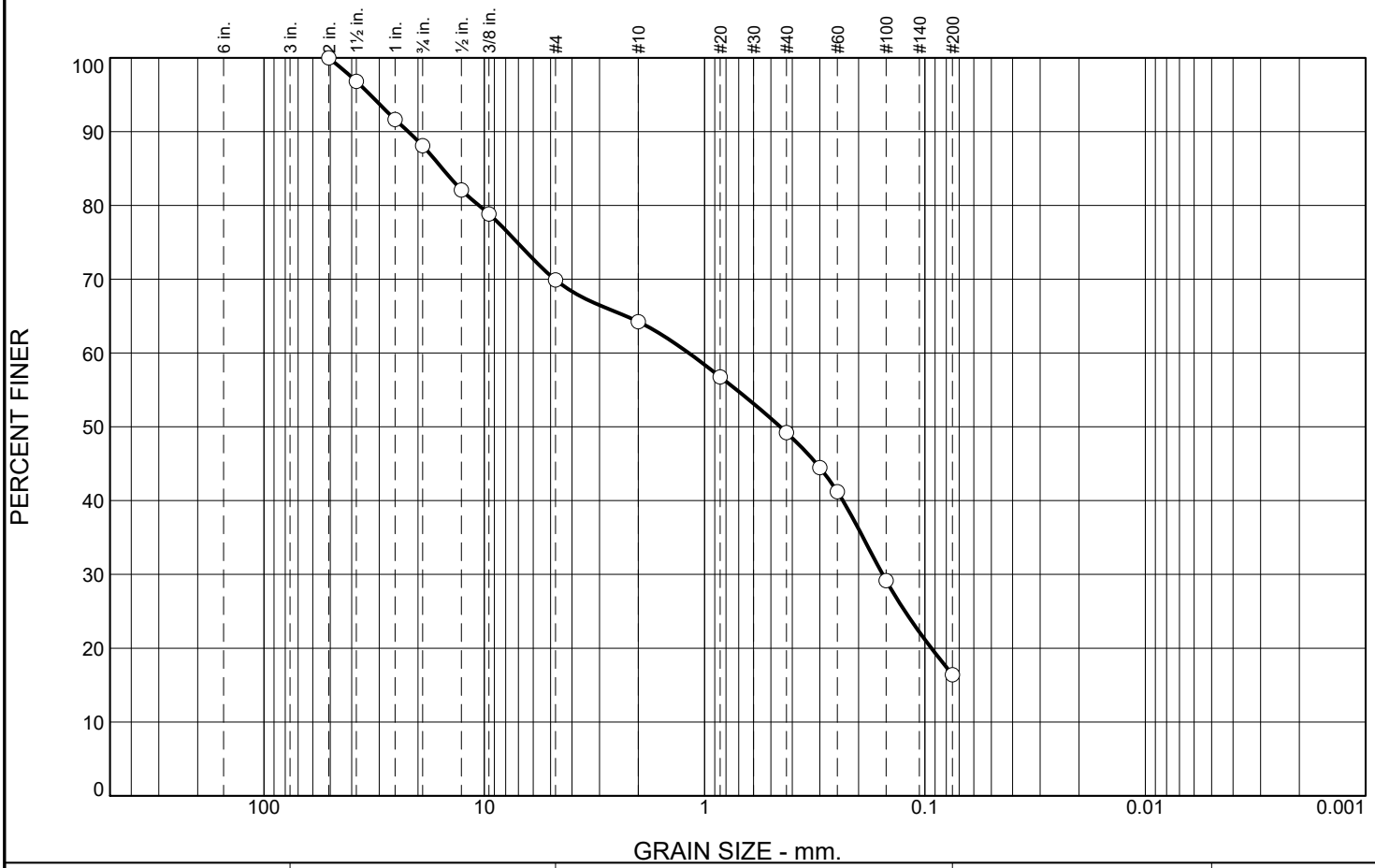
Sample No.: L30731 **Source of Sample:** Test Pits 2021 **Date:** 11/9/21
Location: TP-11 **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	30.1	53.5	16.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	96.8		
1"	91.7		
3/4"	88.1		
1/2"	82.1		
3/8"	78.8		
#4	69.9		
#10	64.2		
#20	56.8		
#40	49.2		
#50	44.5		
#60	41.2		
#100	29.2		
#200	16.4		

* (no specification provided)

Material Description

Brown 2" max silty sand some gravel
D-1557 proctor = 127.1 pcf @ 8.7% optimum moisture

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 15.4957 D_{60}= 1.1804 D_{50}= 0.4537
D_{30}= 0.1556 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sampled by Joel Morin (Yankee) on 11/02/21
USDA Textural Classification = Loamy Sand

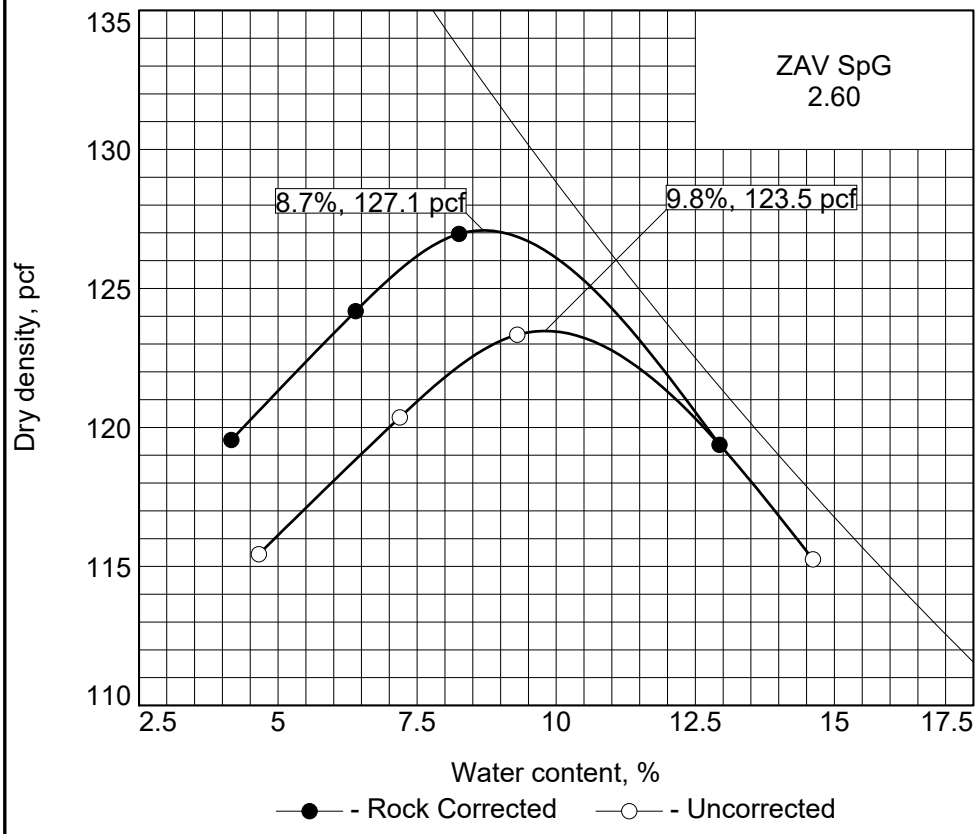
Sample No.: L-30733 **Source of Sample:** Test Pits 2021 **Date:** 11/09/21
Location: TP-12 **Elev./Depth:** C Horizon

YANKEE ENGINEERING & TESTING, INC.

Client: The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
Project No: 2021-53

Tested By: AK **Checked By:** SMM

COMPACTION TEST REPORT



Curve No.
L-30733

Test Specification:
ASTM D 1557-12 Method C Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method Dry
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 56
Mold Size 0.075 cu. ft.

Test Performed on Material Passing 3/4 in. **Sieve**

NM **LL** NP **PI** NP
Sp.G. (ASTM D 854)
%>3/4 in. 11.9 **%<No.200** 16.4
USCS SM **AASHTO** A-1-b
Date Sampled 11/02/21
Date Tested 11/09/21
Tested By AK

TESTING DATA

	1	2	3	4	5	6
WM + WS	9820.0	10099.0	10296.0	10204.0		
WM	5710.0	5710.0	5710.0	5710.0		
WW + T #1	82.0	69.8	83.1	85.2		
WD + T #1	79.2	65.8	77.9	76.4		
TARE #1	14.3	14.3	14.9	14.4		
WW + T #2	69.7	73.8	85.1	98.2		
WD + T #2	67.0	70.1	78.5	87.3		
TARE #2	12.8	14.3	14.4	14.5		
MOISTURE	4.2	6.4	8.3	12.9		
DRY DENSITY	119.5	124.2	127.0	119.4		

ROCK CORRECTED TEST RESULTS

Maximum dry density = 127.1 pcf

Optimum moisture = 8.7 %

Material Description

Brown 2" max silty sand some gravel
D-1557 proctor = 127.1 pcf @ 8.7% optimum moisture

Remarks:
Test pits 2021

Project No. 2021-53 **Client:** The Brennan Group, Inc.
Project: 92-94 Huntoon Hwy
Leicester, MA
○ **Loc.:** TP-12 **Depth:** C Horizon **Sample No.:** L-30733

Checked by: SMM
Title:

YANKEE ENGINEERING & TESTING, INC.

Yankee Engineering & Testing, Inc.

HYDRAULIC CONDUCTIVITY BY GUELPH PERMEAMETER

Project No.:	2021-53	Date:	November 15, 2021
Project Name:	92-94 Huntoon	Project Address:	92-94 Huntoon Highway, Leicester, MA
Client Name:	The Brennan Group, Inc.	Client Address:	One Walnut Street, Suite 3, Boston, MA 02108

Purpose: To conduct infiltration testing by Guelph Permeameter per ASTM D5126-10

Date Tested	Location	Depth Below Surface Grade (in)	Approx. Test Elevation (ft)	K_{fsat} (cm/sec)	K_{fsat} (in/hr)
11/2/21	TP-12	30	754	$5.37x10^{-4}$	$7.62x10^{-1}$

Data/worksheets available upon request.

Report by: Mr. Joel Morin

10 Mason Street Worcester Massachusetts 01609
Tel (508) 831-7404 Fax (508) 831-7388
CONSTRUCTION INSPECTION & MATERIALS TESTING
www.yankeeengineering.com

Appendix D: Standard 4 Computations and Supporting Information

- Water Quality Volume Calculations
- TSS Removal Worksheets
- Proprietary Water Quality Unit Sizing
- Proprietary Water Quality Unit Certification
- Operation and Maintenance Plan

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Water Quality Volume Calculations

Project	Leicester Central	**Project #**	15392
	Leicester, MA		
Calculated by	ALG	**Date**	12/13/2021
Checked by	JWD	**Date**	12/13/2021

Subsurface Infiltration Basin P1

Runoff from subcatchment areas PR1

Water Quality Storm Runoff Depth	(in)	**1.0**
Total Impervious Area	(ft^2)	**212,050**

BASIN WQV:

Required Volume:

Runoff Depth to be Treated (in)	Required Volume (ft^3)
1.0	**17,671**

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
745.6	20,604	**17,772**

Gravel Wetland P2

Runoff from subcatchment areas PR2

Water Quality Storm Runoff Depth	(in)	**1.0**
Total Impervious Area	(ft^2)	**359,370**

SEDIMENT FOREBAY WQV:

Required Volume*:

Runoff Depth to be Treated (in)	Required Volume (ft^3)
0.1	**2,995**

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
738.0	1,095	0
739.0	1,535	1,315
740.0	2,032	**3,099**

Water Quality Volume Calculations

Project	Leicester Central Leicester, MA	**Project #**	15392
Calculated by	ALG	**Date**	12/13/2021
Checked by	JWD	**Date**	12/13/2021

Cell WQV*:

Required Volume:

Runoff Depth to be Treated (in)	Required Volume (ft^3)
0.45	**13,476**

Provided Volume:

Cell 1:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
737.0	7,545	0
738.0	8,987	8,266
738.6	9,880	**13,926**

Cell 2:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
737.0	7,786	0
738.0	8,863	8,325
738.6	9,537	**13,845**

FREEBOARD CHECK:

100-YR Peak Elevation:	742.2
Maximum Basin Elevation:	743.2
Basin Freeboard:	**1.0**

** Per MassDEP Treatment Requirement*

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Leicester Central**	Sheet:	**1 of 2**
Project Number:	**15392.00**	Date:	**13-Dec-2021**
Location:	**Leicester, MA**	Computed by:	**ALG**
Discharge Point:	**DP2 - Rochdale Pond**	Checked by:	**JWD**
Drainage Area(s):	**PR2**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D E)
Deep Sump and Hooded Catch Basin	**25%**	**1.00**	**0.25**	**0.75**
Gravel Wetland	**80%**	**0.75**	**0.60**	**0.15**
	0%	**0.15**	**0.00**	**0.15**
	0%	**0.15**	**0.00**	**0.15**
	0%	**0.15**	**0.00**	**0.15**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **85%**

TSS Removal Calculation Worksheet

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Leicester Central**	Sheet:	**2 of 2**
Project Number:	**15392.00**	Date:	**13-Dec-2021**
Location:	**Leicester, MA**	Computed by:	**ALG**
Discharge Point:	**DP1 - Large Wetland**	Checked by:	**JWD**
Drainage Area(s):	**PR1**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Proprietary Water Quality Unit	**50%**	**75%**	**38%**	**38%**
	0%	**38%**	**0%**	**38%**
			Pre-Treatment TSS Removal =	**63%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Subsurface Infiltration Structure	**80%**	**100%**	**80%**	**20%**
	0%	**20%**	**0%**	**20%**
	0%	**20%**	**0%**	**20%**
	0%	**20%**	**0%**	**20%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **80%**

Project: Leicester Central
Location: Leicester, MA
Prepared For: VHB

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

$$Q = (qu)\ (A)\ (WQV)$$

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
WQU 203	4.86	0.0075950	6.0	0.100	1.00	774.00	5.88

The WQf sizing calculation selects the minimum size CDS/Cascade/StormCeptor model capable of operating at the computed WQf peak flowrate prior to bypassing. It assumes free discharge of the WQf through the unit and ignores the routing effect of any upstream storm drain piping. As with all hydrodynamic separators, there will be some impact to the Hydraulic Gradient of the corresponding drainage system, and evaluation of this impact should be considered in the design.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

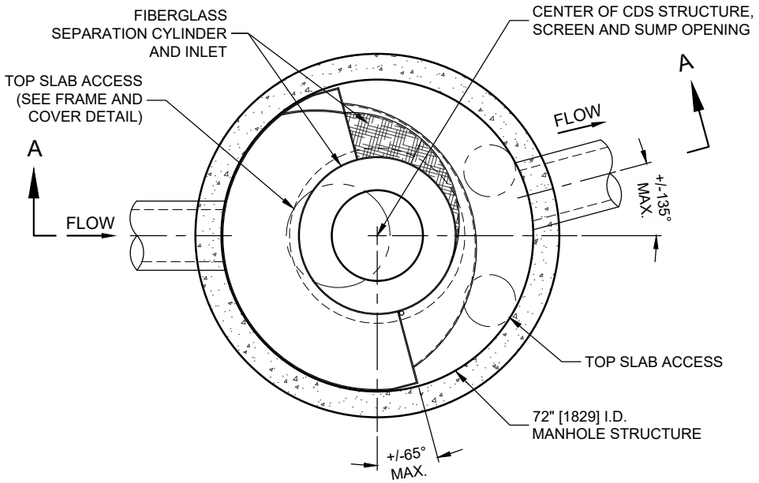
CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

LEICESTER CENTRAL
LEICESTER, MA

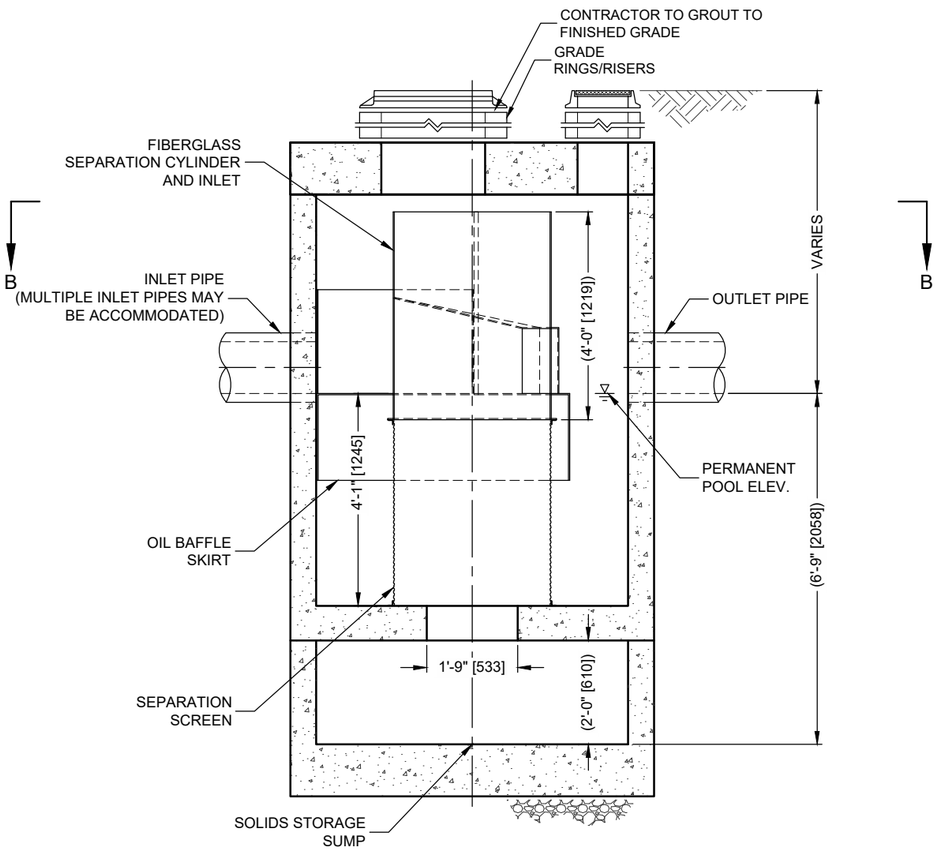
Area	4.86 ac	Unit Site Designation	WQU 203
Weighted C	0.9	Rainfall Station #	70
t_c	6 min		
CDS Model	3035-6	CDS Treatment Capacity	**6.5 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.04	15.1%	15.1%	0.17	0.17	14.5
0.08	24.6%	39.7%	0.35	0.35	23.1
0.12	13.7%	53.4%	0.52	0.52	12.7
0.16	9.4%	62.8%	0.70	0.70	8.6
0.20	6.6%	69.5%	0.87	0.87	5.9
0.24	5.2%	74.7%	1.05	1.05	4.6
0.28	4.8%	79.5%	1.22	1.22	4.1
0.32	3.1%	82.6%	1.40	1.40	2.7
0.36	2.7%	85.3%	1.57	1.57	2.2
0.40	2.1%	87.4%	1.75	1.75	1.7
0.48	2.5%	89.9%	2.10	2.10	1.9
0.56	2.0%	91.9%	2.45	2.45	1.5
0.64	1.4%	93.3%	2.80	2.80	1.0
0.72	1.0%	94.3%	3.15	3.15	0.7
0.80	1.1%	95.4%	3.50	3.50	0.7
1.00	1.6%	97.1%	4.37	4.37	1.0
1.20	0.9%	98.0%	5.25	5.25	0.5
1.40	0.6%	98.6%	6.12	6.12	0.3
1.60	0.5%	99.1%	7.00	6.50	0.2
1.80	0.5%	99.6%	7.87	6.50	0.2
0.00	0.0%	99.6%	0.00	0.00	0.0
					88.0
				Removal Efficiency Adjustment[2] =	0.0%
				Predicted % Annual Rainfall Treated =	99.4%
				Predicted Net Annual Load Removal Efficiency =	**88.0%**

1 - Based on 14 years of 15-minute rainfall data from NCDC Station 2107, East Brimfield Lake, Worcester County, M
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



PLAN VIEW B-B
N.T.S.



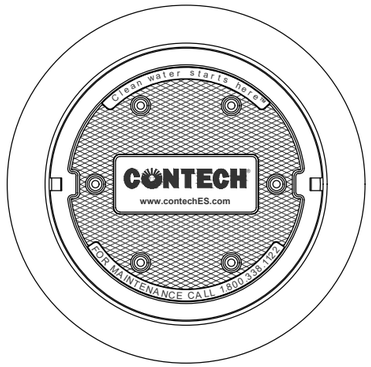
ELEVATION A-A
N.T.S.

CDS3035-6-C DESIGN NOTES

CDS3035-6-C RATED TREATMENT CAPACITY IS 6.5 CFS, OR PER LOCAL REGULATIONS.

THE STANDARD CDS3035-6-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS3035-6-C
ONLINE CDS
STANDARD DETAIL

KIM GUADAGNO

CHRIS CHRISTIE
Governor

Lt. Governor

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

BOB MARTIN
Commissioner

September 18, 2017

Daniel J. Figola, P.E.
General Manager
BaySaver Technologies, LLC
1030 Deer Hollow Drive
Mt. Airy, MD 21771

Re: MTD Lab Certification
BaySaver Barracuda™ Hydrodynamic Separator by BaySaver Technologies, LLC
Online Installation

TSS Removal Rate 50%

Dear Mr. Figola:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). BaySaver Technologies, LLC has requested an MTD Laboratory Certification for the BaySaver Barracuda™ Hydrodynamic Separator (BaySaver Barracuda).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated September 2017) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the BaySaver Barracuda by BaySaver Technologies, LLC at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The BaySaver Barracuda shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This BaySaver Barracuda cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the BaySaver Barracuda. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.ads-pipe.com/pdf/en/Barracuda_Maintenance_07_17.pdf for any changes to the maintenance requirements.

6. Sizing Requirement:

   The example below demonstrates the sizing procedure for the BaySaver Barracuda:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a BaySaver Barracuda. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c = 0.99 (curve number for impervious)
   Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the Barracuda Model S4 with a MTFR of 1.25 cfs could be used for this site to remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1.

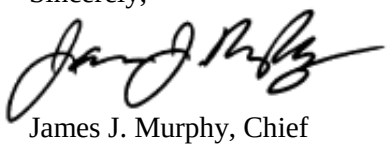
Table 1 BaySaver Barracuda Sizing Information

Barracuda Model	NJDEP 50% TSS Maximum Treatment Flow Rate (cfs)	Treatment Area (ft^2)	Hydraulic Loading Rate (gpm/ft^2)	50% Maximum Sediment Storage (ft^3)
S3	0.70	7.07	44.6	5.89
S4	1.25	12.57	44.6	10.47
S5	1.95	19.63	44.6	16.36
S6	2.80	28.27	44.6	23.56
S8	5.00	50.27	44.6	41.89
S10	7.80	78.54	44.6	65.45

A detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Mr. Shashi Nayak of my office at (609) 633-7021.

Sincerely,



James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

Maintenance Guide

BaySaver Barracuda

July 2017

One of the advantages of the BaySaver Barracuda is the ease of maintenance. Like any system that collects pollutants, the BaySaver Barracuda must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The systems were designed to minimize the volume of water removed during routine maintenance, reducing disposal costs.

Contractors can access the pollutants stored in the manhole through the manhole cover. This allows them to gain vacuum hose access to the bottom of the manhole to remove sediment and trash. There is no confined space entry necessary for inspection or maintenance.

The entire maintenance procedure typically takes from 2 to 4 hours, depending on the size of the system, the captured material, and the capacity of the vacuum truck.

Local regulations may apply to the maintenance procedure. Safe and legal disposal of pollutants is the responsibility of the maintenance contractor. Maintenance should be performed only by a qualified contractor.

Inspection and Cleaning Cycle

Periodic inspection is needed to determine the need for and frequency of maintenance. You should begin inspecting as soon as construction is complete and thereafter on an annual basis. Typically, the system needs to be cleaned every 1-3 years.

Excessive oils, fuels or sediments may reduce the maintenance cycle. Periodic inspection is important.

Determining When to Clean

To determine the sediment depth, the maintenance contractor should lower a stadia rod into the manhole until it contacts the top of the captured sediment and mark that spot on the rod. Then push the probe through to the bottom of the sump and mark that spot to determine sediment depth.

Maintenance should occur when the sediment has reached the levels indicated in the Storage Capacity Chart.

BaySaver Barracuda Storage Capacities

Model	Manhole Diameter	Treatment Chamber Capacity	Standard Sediment Capacity (20" depth)	NJDEP Sediment Capacity (50% of standard depth)
S3	36"	212 gallons	0.44 cubic yards	0.22 cubic yards
S4	48"	564 gallons	0.78 cubic yards	0.39 cubic yards
S5	60"	881 gallons	1.21 cubic yards	0.61 cubic yards
S6	72"	1269 gallons	1.75 cubic yards	0.88 cubic yards
S8	96"	3835 gallons	3.10 cubic yards	1.55 cubic yards
S10	120"	7496 gallons	4.85 cubic yards	2.43 cubic yards

Maintenance Instructions

1. Remove the manhole cover to provide access to the pollutant storage. Pollutants are stored in the sump, below the bowl assembly visible from the surface. You'll access this area through the 10" diameter access cylinder.

2. Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment. See figure 1.
3. Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
4. Fill the cleaned manhole with water until the level reaches the invert of the outlet pipe.
5. Replace the manhole cover.
6. Dispose of the polluted water, oils, sediment and trash at an approved facility.
   - Local regulations prohibit the discharge of solid material into the sanitary system. Check with the local sewer authority for authority to discharge the liquid.
   - Some localities treat the pollutants as leachate. Check with local regulators about disposal requirements.
   - Additional local regulations may apply to the maintenance procedure.

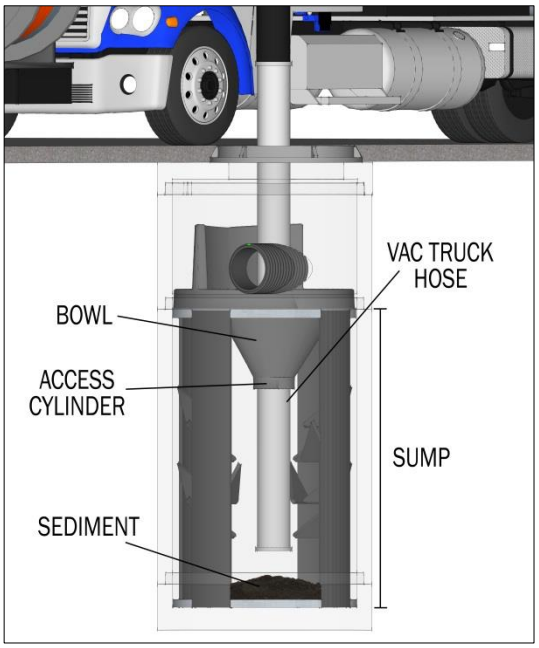


Figure 1

Stormwater Management Operations and Maintenance

Leicester Central

0, 90 & 92 Huntoon Memorial Highway

December 2021

The Project proposes a new stormwater management system that will require long term operations and maintenance as generally outlined herein.

Project Information

Site
Leicester Central
0, 90 & 92 Huntoon Highway
Leicester, MA

Developer
JMC/TBG Leicester, LLC
One Walnut Street Suite 3
Boston, MA 02108
617.305.4120

Site Contact Responsible for Operations and Maintenance at the Site, including Financing Maintenance and Repairs.

Name: _____

Address: _____

Telephone: _____

Email: _____

Signature: _____

1. Source Control

A comprehensive source control program will be implemented at the site, which includes the following components:

- Regular pavement sweeping
- Catch basin cleaning
- Clearing litter from the parking area, islands, and perimeter landscape areas
- Regular maintenance
- Spill Prevention training

2. Spill Prevention

The following practices will be followed for spill control, notification, and cleanup:

- At least three site personnel will receive spill prevention and cleanup training. These individuals will each become responsible for spill prevention and cleanup. The names of the responsible spill personnel will be posted in the material storage area and in the on-site office trailer.
- Spills of toxic or hazardous material in excess of reportable quantities will be reported to the following agencies as soon as possible:

Massachusetts Department of Environmental Protection Division of Hazardous Waste	(617) 292-5851 or (978) 661-7679
National Response Center	(800) 424-8802

- All spills will be cleaned up immediately after discovery;
- The spill area will be kept well ventilated and personnel will wear protective clothing to prevent injury from contact with a hazardous substance; and
- Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be informed of the procedures and the location of the information and cleanup supplies;
- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include, but will not be limited to the emergency response equipment listed herein;

A comprehensive Spill Prevention Control and Countermeasure (SPCC) plan will be developed and implemented by the General Contractor and other Operators. At a minimum the SPCC, will discuss:

- Spill prevention equipment;
- Spill prevention supplies provided on-site; and

› Spill prevention training to be provided by the Owner and/or Tenant to designated employees.

Initial Notification

In the event of a spill, site personnel will notify the 24-hour Emergency Contact immediately.

The 24-hour Emergency Contact or their chosen delegate will immediately notify emergency response services and notify the local boards and commissions at the first possible opportunity: Fire Department (immediately); the Police Department (immediately); the Board of Health (at first opportunity); and, the Conservation Commission (at first opportunity).

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Assessment – Initial Contamination

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following pages.

Reporting

The following Spill Report Template shall be completed.

Hazardous Waste / Oil Spill Report

Date: ____/____/_____ **Time:** _____ AM / PM

Exact location: _____

Type of equipment:_____ **Make:**_____ **Size:**_____

License or S/N:_____**Weather Conditions:**_____

On or near water
- Yes If yes, name of body of water:_____
- No

Type of chemical / oil spilled: _____

Amount of chemical / oil spilled: _____

Cause of spill: _____

_____

Measures taken to contain or clean up spill: _____

_____

Amount of chemical / oil recovered: _____ **Method:**_____

Material collected as a result of clean up _____

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal:_____

Name and address of any person, firm, or corporation suffering damages:

_____

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

_____

Spill reported to General Office by:_____**Time:** _____AM / PM

Spill reported to DEP / National Response Center by:_____

DEP Date: ____/_____/_____ **Time**:_____AM / PM **Inspector:**_____

NRC Date: ____/_____/_____ **Time:**_____AM / PM **Inspector:** _____

Additional comments: _____

EMERGENCY NOTIFICATION PHONE NUMBERS

1A	**Facility Manager**	T(P): T(S): T(T):	
1B	**Alternate Contact**	T(P): T(S): T(T):	
2	**Fire and Police**		911
3	**Cleanup Contractor**	T:	
4	**MassDEP**	T(P):	(800) 340-1133
5A	**National Response Center**	T:	(800) 424-8802
5B	**USEPA**	T(E): T(B):	(800) 424-8802 (800) 424-8802
6	**Leicester Board of Health**	B:	(508) 892-7008
7	**Leicester Conservation Commission**	B:	(508) 892-7070

(P) = Primary, (S) = Secondary, (T) = Tertiary, (E) = Emergency, (B) = Business

Post this list of emergency contact numbers in the main construction/facility office in a location that is readily accessible to all employees.

Emergency Response Equipment

The following is an example of an equipment and materials list that must be prepared by the Owner and Tenant. Equipment and supplies on this list shall be maintained at all times and stored in a secure area for long-term emergency response need.

Emergency Response Equipment

Supply	Quantity	Supplier
Sorbent Pillows (Pigs)	2	http://www.newpig.com
Sorbent Boom/Sock	25 feet	Item # KIT276 — mobile container with two pigs, 26 feet of sock, 50 pads, and five pounds of absorbent (or equivalent)
Sorbent Pads	50	
Lite-Dri® Absorbent	5 pounds	http://www.forestry-suppliers.com
Shovel	1	Item # 33934 — Shovel (or equivalent)
Pry Bar	1	Item # 43210 — Manhole cover pick (or equivalent)
Goggles	1 pair	Item # 23334 — Goggles (or equivalent)
Heavy Gloves	1 pair	Item # 90926 — Gloves (or equivalent)

3. Snow Management

- Snow storage areas will be managed to prevent blockage of storm drain catch basins and stormwater drainage swales. Snow combined with sand and debris may block a storm drainage system, diminishing the inlet capacity of the system and causing localized flooding.
- Sand and debris deposited on vegetated or paved areas shall be cleared from the site and properly disposed of at the end of the snow season, no later than May 15.
- Snow shall not be dumped into any waterbody, pond, or wetland resource area.

4. Maintenance of Stormwater Management Systems

Asphalt Pavement

- Sweep asphalt pavement areas at least two times per year with a rotary brush sweeper and properly dispose of removed material.
- Recommended sweeping schedule:
  - Oct/Nov
  - Apr/May

- More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.
- Check loading docks and dumpster areas frequently for spillage and/or pavement staining and clean as necessary.

Catch Basins

The proper removal of sediments and associated pollutants and trash occurs only when catch basin inlets and sumps are cleaned out regularly. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future deposition and enhances the overall performance. As noted in the pavement section, more frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.

Catch basins are constructed with sumps (minimum 4 feet) and hooded outlets to trap debris, sediments, and floating contaminants. Disposal of all sediments must be in accordance with applicable local, state, and federal guidelines.

Inspections and Cleaning

- All catch basins shall be inspected at least four times per year and cleaned a minimum of at least once per year.
- Sediment (if more than six inches deep) and/or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary
- During colder periods, the catch basin grates must be kept free of snow and ice.
- During warmer periods, the catch basin grates must be kept free of leaves, litter, sand, and debris.

Structural Water Quality Devices

The stormwater management system includes structural water quality devices. These are Contech Water Quality Units, which efficiently remove sediment and hydrocarbons from stormwater runoff.

- Inspect devices monthly for the first three months after construction.
- After initial three-month period, all water quality units are to be inspected at least four times per year and cleaned a minimum of at least once per year (when sediment reaches 8" in depth).
- Remove oil through 6" inspection/oil port.
- Remove sediment through 24" outlet riser pipe.
- Follow manufacturer instructions and contact manufacturer if system is malfunctioning.

Subsurface Infiltration Basin

The subsurface infiltration basin is used to detain and infiltrate roadway and rooftop runoff.

Inspections and Cleaning

- The subsurface infiltration systems will be inspected at least once each year by removing the manhole/access port covers and determining the thickness of sediment that has accumulated.
- If sediment is more than six inches deep, it must be suspended via flushing with clean water and removed using a vactor truck.
- Follow manufacturer's specifications and instructions for cleaning the sediment removal.
- Emergency overflow pipes will be examined at least once each year and verified that no blockage has occurred.
- System will be observed after rainfalls to see if it is properly draining.

Stormwater Outfalls

The stormwater drainage system has several stormwater outfalls throughout the Site where treated stormwater is discharged to the adjacent wetland areas.

- Inspect outfall locations monthly for the first three months after construction to ensure proper functioning and correct any observed issues.
- Inspect outfalls annually after initial three-month period.
- Annual inspections should be supplemented after large storms.
- Remove and dispose of any trash or debris found at the outfall location.

Roof Drain Leader

Roof runoff from the building is directed to the stormwater management system.

- Perform routine roof inspections quarterly.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.
- Clean inlets twice per year or as necessary.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of the stormwater management system. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings and proper aeration of soils.

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.

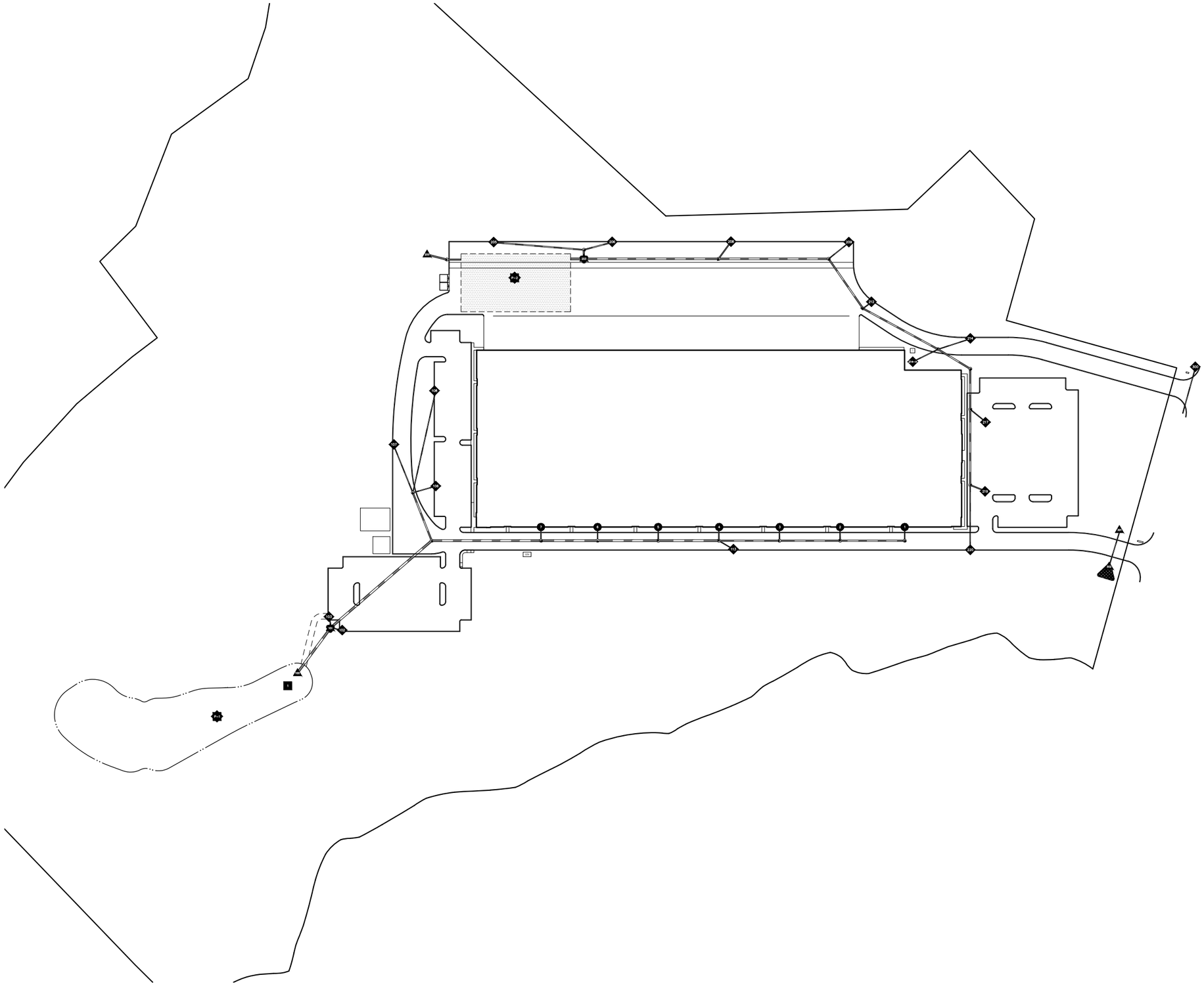
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.
- Annual application of compost amendments and aeration are recommended.

5. Reporting and Documentation

Routine required maintenance for the proposed stormwater management system is described herein. Following the completion of construction, device location maps, maintenance logs, and checklists shall be prepared to support the long-term operations and maintenance of the proposed stormwater management system, including:

- Identify each component of the final stormwater management system;
- Identify regular inspections and maintenance requirements;
- Date of each inspection or maintenance task;
- Identify the person responsible for the completion of tasks;
- Identify any outstanding problems, malfunctions or inconsistencies; and,
- Document and specific cleaning or repairs completed.

Requirements should be adjusted by the site manager as necessary to ensure successful functioning of system components. Accurate records of all inspections, routine maintenance and repairs shall be documented and records shall be maintained on site.



LEGEND

- # Standard Catch Basin
- # Subsurface Infiltration System/Extended Dry Detention Basin
- # Sediment Forebay
- # Outfall
- # Water Quality Unit
- # Roof Leader Inlet

vhb

Device Location Map
90-102 Huntoon Memorial Highway
Leicester, MA

December 2021

Appendix E: Standard 7 Supporting Information

› Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

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Construction Period Pollution Prevention and Erosion and Sedimentation Controls

Distribution & Light Manufacturing Project

0, 90 & 92 Huntoon Memorial Highway, Leicester, MA

December 2021

The Project will disturb more than 1 acre of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are summarized below.

1. Pollution Prevention

There are various pollutant generating activities that are likely to occur on the Site as part of construction of the Project. Pollution prevention procedures that may be used during the construction phase of the Project are listed below.

Fueling and Maintenance of Equipment or Vehicles

When fueling or maintaining equipment or vehicles, the contractor will adhere to the following requirements, including, but not limited to: provide an effective means of eliminating the discharge of spilled or leaked chemicals, including fuels and oils, from these activities; if applicable, comply with the Spill Prevention Control and Countermeasures (SPCC) requirements in 40 CFR 112 and Section 311 of the CWA; ensure adequate supplies are available at all times to handle spills, leaks, and disposal of used liquids; use drip pans and absorbents under or around leaky vehicles; dispose of or recycle oil and oily wastes in accordance with other federal, state, tribal, or local requirements; and, clean up spills or contaminated surfaces immediately, using dry clean up measures where possible, and eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge. Do not clean surfaces by hosing the area down.

Washing of Equipment and Vehicles

When washing equipment and/or vehicles, the contractor will adhere to the following requirements: provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of washing; ensure that there is no discharge of soaps, solvents, or detergents in equipment and vehicle wash water; and, for storage of soaps, detergents, or solvents, the contractor must provide either cover (e.g., plastic sheeting or temporary roofs) to prevent these detergents from coming into contact with rainwater, or a similarly effective means designed to prevent the discharge of pollutants from these areas. Effective controls may include, but are not restricted to, locating activities away from surface waters and stormwater inlets or conveyances and directing wash

waters to a sediment basin or sediments trap, using filtration devices, such as filter bags or sand filters, or using other similarly effective controls.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

When storing, handling, and disposing of construction products, materials, and wastes, the contractor will adhere to the following good-housekeeping practices: an effort will be made to store only enough product required to do the job; all materials stored on-site will be stored in a neat, orderly manner in their appropriate containers, and (if possible) under a roof or other enclosure; products will be kept in their original containers with the original manufacturer's label; substances will not be mixed with one another unless recommended by the manufacturer; whenever possible, all of a product will be used before disposing of the container; manufacturer's recommendations for proper use and disposal will be followed; and, the site superintendent will inspect the storage area daily to ensure proper use and disposal of materials on-site.

The following practices will reduce the risks associated with hazardous materials (e.g., petroleum products, solvents): a copy of all Material Safety Data Sheets (MSDS) for materials or products used during construction will be kept in the office trailer; products will be kept in original containers unless they are not re-sealable; original labels and material safety data (MSD sheets) will be retained; they contain important product information; and, if surplus product must be disposed, manufacturer's or local- and state-recommended methods for proper disposal will be followed.

Building Products

All containers will be tightly sealed and covered with plastic sheeting or a temporary roof when not required for use. Excess materials will be properly disposed of according to manufacturer's instructions or state and local regulations and shall not be discharged to the storm sewer system. No storage will occur within 100 feet of a wetland or waterway.

Pesticides, Herbicides, Insecticides

Pesticides, herbicides, and insecticides will not be used at the Project Site.

Deisel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

Products stored on site will be contained in water-tight containers with either a cover to minimize the exposure of the container to precipitation and to stormwater or a similarly effective means detained to minimize the discharge of pollutants from these areas such as secondary containment.

All on-site vehicles will be monitored for leaks and will receive regular preventive maintenance to reduce the chance of leakage. Spills will be cleaned up immediately, using dry clean-up methods where possible. The source of the spill will be eliminated to prevent continuation of an on-going discharge.

No vehicle maintenance or handling of petroleum products will occur within 100 feet of a wetland or waterway.

Any asphalt substances used on-site will be applied according to manufacturer's recommendations. No petroleum-based or asphalt substances will be stored within 100 feet of a wetland or waterway.

Hazardous or Toxic Waste

The contractor will: separate hazardous or toxic waste from construction and domestic waste; store waste in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, tribal, or local requirements; store all containers that will be stored outside within appropriately sized secondary containment (e.g., spill berms, decks, spill containment pallets) to prevent spills from being discharged, or provide a similarly effective means designed to prevent the discharge of pollutants from these areas (e.g., storing chemicals in covered area or having a spill kit available on site); clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly; not utilize hosing as a method to clean surfaces or spills; and, eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.

All hazardous waste materials (e.g., petroleum products, solvents) will be disposed in the manner specified by local and state regulation, or by the manufacturer. Site personnel will be instructed in these practices, and the site construction supervisor will be responsible for seeing that these procedures are followed.

Construction and Domestic Waste

The contractor will provide waste containers (e.g., dumpster or trash receptacle) of sufficient size and number to contain construction and domestic wastes. Waste containers will be covered to prevent precipitation from entering the container and becoming a source of pollution. Alternatively, the waste container will be kept in secondary containment to prevent discharges of contaminated stormwater.

Daily loose trash removal will prevent litter, construction debris, and construction chemicals exposed to stormwater from becoming a pollutant source for stormwater discharges. All loose trash will be placed in appropriate storage containers and will be disposed of properly.

Sanitary Waste

Portable toilets will be placed away from waters of the U.S., stormwater inlets and/or conveyances and will be secured in place so that they will not tip or be knocked over. All sanitary waste will be collected from the portable units by a licensed contractor as required, and disposed in compliance with state and local regulations.

Washing of Applicators and Containers used for Paint, Concrete or Other Materials

The contractor must provide an effective means of eliminating the discharge of water from the washout and cleanout of stucco, paint, concrete, form release oils, curing compounds, and other construction materials. To comply with this requirement, the contractor must: direct all washwater into a leak-proof container or leak-proof pit. The container or pit must

be designed so that no overflows can occur due to inadequate sizing or precipitation; do not dump liquid wastes in storm sewers; locate any washout or cleanout activities as far away as possible from surface waters, wetlands, and stormwater inlets or conveyances, and, to the extent practicable, designate areas to be used for these activities and conduct such activities only in these areas.

Fertilizers

Only slow-release organic fertilizers will be used in landscaped areas. This protocol will limit the amount of potential nutrients that could enter the stormwater and wetland systems. Fertilizer use will be reduced once the vegetated stabilization measures are established. The Contractor will adhere to the following requirements when applying fertilizer products: apply at a rate and in amounts consistent with manufacturer's specifications; apply at the appropriate time of year for the project location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth; avoid applying before heavy rains that could cause excess nutrients to be discharged; never apply to frozen ground; never apply to stormwater conveyance channels with flowing water; and follow all other federal, state, tribal, and local requirements regarding fertilizer application.

Pavement Sweeping

Pavement sweeping may be performed daily or as needed, when track-out has occurred. The sweeping program will remove sediments and contaminants directly from paved surfaces before their release into stormwater runoff. Pavement sweeping has been demonstrated to be an effective initial treatment for reducing pollutant loading into stormwater.

Spill Prevention and Response

The following practices will be followed for spill control, notification, and cleanup:

- The General Contractor is responsible for the daily operations and is also responsible for coordinating spill prevention and cleanup coordination. The General Contractor will designate at least three other site personnel to receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of the responsible spill personnel will be posted in the material storage area and in the on-site office trailer.
- Spills of toxic or hazardous material in excess of reportable quantities will be reported to the following agencies as soon as the General Contractor has knowledge of the release:

Massachusetts Department of Environmental Protection Division of Hazardous Waste	(617) 292-5851 or (978) 661-7679
National Response Center	(800) 424-8802

- All spills will be cleaned up immediately after discovery;

- The spill area will be kept well ventilated and personnel will wear protective clothing to prevent injury from contact with a hazardous substance; and
- Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be informed of the procedures and the location of the information and cleanup supplies;
- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include, but will not be limited to the emergency response equipment listed herein;

A comprehensive Spill Prevention Control and Countermeasure (SPCC) plan will be developed and implemented by the General Contractor and other Operators. At a minimum the SPCC, will discuss:

- Spill prevention equipment;
- Spill prevention supplies provided on-site; and
- Spill prevention training to be provided by the Owner and/or Tenant to designated employees.

Initial Notification

In the event of a spill, site personnel will notify the 24-hour Emergency Contact immediately.

The 24-hour Emergency Contact or their chosen delegate will immediately notify emergency response services and notify the local boards and commissions at the first possible opportunity: Fire Department (immediately); the Police Department (immediately); the Board of Health (at first opportunity); and, the Conservation Commission (at first opportunity).

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Assessment – Initial Contamination

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following pages.

Reporting

The following Spill Report Template (on the next page) shall be completed.

Hazardous Waste / Oil Spill Report

Date: ____/____/_____ **Time:** _____ AM / PM

Exact location: _____

Type of equipment:_____ **Make:**_____ **Size:**_____

License or S/N:_____**Weather Conditions:**_____

On or near water
- Yes If yes, name of body of water:_____
- No

Type of chemical / oil spilled: _____

Amount of chemical / oil spilled: _____

Cause of spill: _____

_____

Measures taken to contain or clean up spill: _____

_____

Amount of chemical / oil recovered: _____ **Method:**_____

Material collected as a result of clean up _____

drums containing: _____

drums containing: _____

drums containing: _____

Location and method of debris disposal:_____

Name and address of any person, firm, or corporation suffering damages:

_____

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

_____

Spill reported to General Office by:_____**Time:** _____AM / PM

Spill reported to DEP / National Response Center by:_____

DEP Date: ____/_____/_____ **Time**:_____AM / PM **Inspector:**_____

NRC Date: ____/_____/_____ **Time:**_____AM / PM **Inspector:** _____

Additional comments: _____

EMERGENCY NOTIFICATION PHONE NUMBERS

1A	**Facility Manager**	T(P): T(S): T(T):	
1B	**Alternate Contact**	T(P): T(S): T(T):	
2	**Fire and Police**		911
3	**Cleanup Contractor**	T:	
4	**MassDEP**	T(P):	(800) 340-1133
5A	**National Response Center**	T:	(800) 424-8802
5B	**USEPA**	T(E): T(B):	(800) 424-8802 (800) 424-8802
6	**Boylston Board of Health**	B:	(508) 869-6828
7	**Boylston Conservation Commission**	B:	(508) 869-6127

(P) = Primary, (S) = Secondary, (T) = Tertiary, (E) = Emergency, (B) = Business

Post this list of emergency contact numbers in the main construction/facility office in a location that is readily accessible to all employees.

Emergency Response Equipment

The following is an example of an equipment and materials list that must be prepared by the Owner and Tenant. Equipment and supplies on this list shall be maintained at all times and stored in a secure area for long-term emergency response need.

Emergency Response Equipment

Supply	Quantity	Supplier
Sorbent Pillows (Pigs)	2	http://www.newpig.com
Sorbent Boom/Sock	25 feet	Item # KIT276 — mobile container with two pigs, 26 feet of sock, 50 pads, and five pounds of absorbent (or equivalent)
Sorbent Pads	50	
Lite-Dri® Absorbent	5 pounds	http://www.forestry-suppliers.com
Shovel	1	Item # 33934 — Shovel (or equivalent)
Pry Bar	1	Item # 43210 — Manhole cover pick (or equivalent)
Goggles	1 pair	Item # 23334 — Goggles (or equivalent)
Heavy Gloves	1 pair	Item # 90926 — Gloves (or equivalent)

2. Erosion and Sedimentation Controls

Stormwater controls will be designed, installed, and maintained throughout construction in compliance with the EPA NPDES CGP and SWPPP prepared for the Project and maintained throughout construction. The purpose of erosion and sedimentation controls will be to minimize the discharge of pollutants from earth-disturbing activities during the construction phase of the Project. The program described herein, which will be documented in the SWPPP, incorporates BMPs specified in guidelines developed by MassDEP and the U.S. EPA, and complies with the requirements of the NPDES General Permit for Storm Water Discharges from construction activities.

Proper implementation of the erosion and sedimentation control program will:

- Minimize exposed soil areas through temporary stabilization and construction sequencing;
- Minimize sediment track-out from the Site;
- Minimize the generation of dust;
- Minimize soil compaction;
- Place structures to manage stormwater runoff and erosion; and
- Establish permanent vegetative cover or other forms of stabilization.

Stormwater controls will be installed prior to the commencement of each phase of earth-disturbing activities. All manufactured control measures will be installed and maintained in accordance with the manufacturer's specifications. The site contractor will inspect all erosion and sediment controls regularly and will perform corrective actions as required.

Erosion and sedimentation controls that may be used during the construction phase of the Project are listed below. The contractor will implement, modify, and amend the stormwater controls as necessary.

Perimeter Controls

Installation of perimeter controls will be completed prior to the commencement of earth-disturbing activities. The contractor will maintain project logs of installation, inspection, maintenance, and removal of all perimeter controls. Specific perimeter controls that are likely to be used will be either straw wattles and/or straw bale and silt-fence.

Sediment Track-out

Sediment track-out controls may be structural or non-structural. Non-structural controls include restricting vehicle use to properly designated exit points, and sweeping, shoveling, or vacuuming to manually remove sediment from public rights-of-way (hosing or sweeping sediment directly into a stormwater conveyance, storm drain inlet, or surface water is prohibited). In the event that sediment is tracked out of the site and onto the surface of off-site streets, other paved areas, and sidewalks, the contractor will remove the deposited sediment by the end of the same workday. If track-out occurs on a non-workday, the contractor will remove the sediment by the end of the next workday. The contractor will maintain project logs of installation, inspection, maintenance, and removal of all sediment track-out controls. Specific sediment track-out controls that are likely to be used are stabilized construction entrance/exits.

Stockpiled Sediment or Soil

Cover or appropriate temporary stabilization will be provided to stockpiles that will remain inactive/unused for more than 14 days. Temporary stabilization may be performed using vegetative or non-vegetative stabilization practices. Stockpiles will be physically separated from other stormwater conveyances, drain inlets, and areas where stormwater flows are concentrated. Stockpiles will also be protected from contact with stormwater (including run-on) by using a temporary perimeter sediment barrier, provided cover, and/or other appropriate temporary stabilization measures to avoid direct contact with precipitation or wind. Stockpiles will not be hosed down, and soil will not be swept into any stormwater conveyance storm drain inlet. Additionally, sediment will not be accumulated on pavement or other impervious surfaces. The contractor will maintain project logs of installation, inspection, maintenance, and removal of all stockpiled soil. Specific stockpile controls that are likely to be used include vegetative stabilization and non-vegetative stabilization.

Minimize Dust

When airborne dust is generated on-site, soil wetting will be performed to minimize the movement of dust and fine-grained sediment. The contractor shall apply water as a fine spray to wet the upper 0.5 inches of soil. The contractor will maintain project logs of installation, inspection, maintenance, and removal of all dust control activities.

Minimize the Disturbance of Steep Slopes

During the design phase of the Project, the design engineers minimized construction impacts on steep slopes to the maximum extent practicable. Where disturbances to steep slopes are still required, the contractor will minimize disturbances through the implementation of erosion and sediment control practices designed for use on steep slopes. Stabilization practices on steep slopes will occur within 14 days after grading or construction activities have temporarily or permanently ceased. Specific steep slope controls that are likely to be used include vegetative controls and/or erosion control blankets.

Topsoil

Topsoil is minimal on the site but will be preserved to the maximum extent practicable. Where it is infeasible to preserve topsoil in place, it will be repurposed throughout the Site, or stockpiled and disposed of in accordance with local, state, and federal regulations, as necessary. The contractor will maintain project logs of stockpiling and disposal of topsoil.

Soil Compaction

To avoid soil compaction, the contractor will limit vehicle and equipment use in areas where final vegetative stabilization will occur or where infiltration practices will be installed. Prior to seeding or planting of these areas, the soil will be inspected to determine if compaction will hinder vegetative growth. If compaction has occurred, techniques that condition soil to support vegetative growth will be implemented. Soil conditioning techniques shall be specified, as needed by the contractor.

Storm Drain Inlets

Prior to any earth-disturbing activities, inlet protection measures will be installed. Inlet protection measures are required to remove sediment from discharges prior to entry into any storm drain inlet that carries stormwater flow from the Site to a nearby waterbody. The contractor will maintain project logs of installation, inspection, maintenance, and removal of all storm drain inlet controls. Specific storm drain inlet controls that are likely to be used will be either silt sack sediment traps or straw bale and non-woven filter fabric. The storm drain inlet controls will be inspected and maintained regularly to prevent sediment accumulation and clogging and to ensure continuity.

Constructed Stormwater Conveyance Channels

Constructed stormwater conveyance channels may be used to collect runoff from construction areas and discharge to either sedimentation basins or protected catch basin inlets. The contractor may use erosion controls and velocity dissipation devices within and

along the length of any stormwater conveyance channel and at any outlet to slow runoff down and to minimize erosion. The contractor will maintain project logs of installation, inspection, maintenance, and removal of constructed stormwater conveyance channels.

Sediment Basins

Sediment basins may be used to collect runoff from construction areas to allow for suspended sediments to settle out of stormwater prior to discharge to points downstream. Sediment basins will be designed and constructed to avoid collecting water from wetlands and waterbodies, and to provide storage for either the volume of runoff generated from a 2-year, 24-hour design storm or a 3,600 cubic feet per acre of contributing area. Outlet structures will be designed to withdraw water from the surface of the basin, and inlets and outlets will be constructed to dissipate velocity and prevent erosion. The contractor will maintain project logs of installation, inspection, maintenance, and removal of sediment basins.

Chemical Treatment

Chemical treatment may only be applied during the situations detailed herein. Chemicals may only be applied where the treated stormwater is directed to a sediment control (e.g., a sediment basin, perimeter control) prior to discharge. Chemicals must be appropriately suited to the types of soils likely to be exposed during construction, and present in the discharges being treated. Safety Data Sheets must be provided to the project manager prior to bringing chemicals on site. If chemicals will be stored on the Site, chemicals must be stored in leak-proof containers that are kept under storm-resistant cover and surrounded by secondary containment structures. The volume of chemicals stored on site must be kept to a minimum. Use of chemicals must comply with applicable state and local requirements. Use of the chemicals must be in accordance with good engineering practices and specifications of the chemical provider/supplier. The contractor will be responsible for removal and disposal of unused chemicals. All personnel who handle and/or use treatment chemicals must be undergo appropriate product-specific training. No polyfluoroalkyl chemicals (PFAS) should not be used.

Site Stabilization

Site stabilization measures will be initiated immediately in any areas of exposed soil where construction activities have ceased and will not resume for 14 or more calendar days. Site stabilization practices may be temporary or permanent, and vegetative or non-vegetative. Specific site stabilization controls are likely to include the following: temporary vegetative stabilization which will be completed using annual grasses, such as annual rye; and non-vegetative stabilization, such as mulch application or erosion control blanket.

Dewatering Practices

If Project activities require dewatering, the contractor will implement dewatering practices to comply with the following requirements:

- Treat dewatering discharges with controls to minimize discharges of pollutants;

- Will not discharge visible floating solids or foam;
- Use an oil-water separator or suitable filtration device that is designed to remove oil, grease, or other products if dewatering water is found to contain these materials;
- Discharge water to vegetated, upland areas of the site to promote infiltration;
- Comply with velocity dissipation requirements;
- Handle backwash water by either hauling it away or returning it to the beginning of the treatment process; and
- Replace and clean the filter media used in the dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.

The contractor will maintain project logs to document regular installation, inspection, maintenance, and removal or dewatering controls. Specific dewatering practices may include straw bale basin or dewatering filter bag.

Appendix F: FEMA Flood Map

› FEMA Flood Insurance Rate Map

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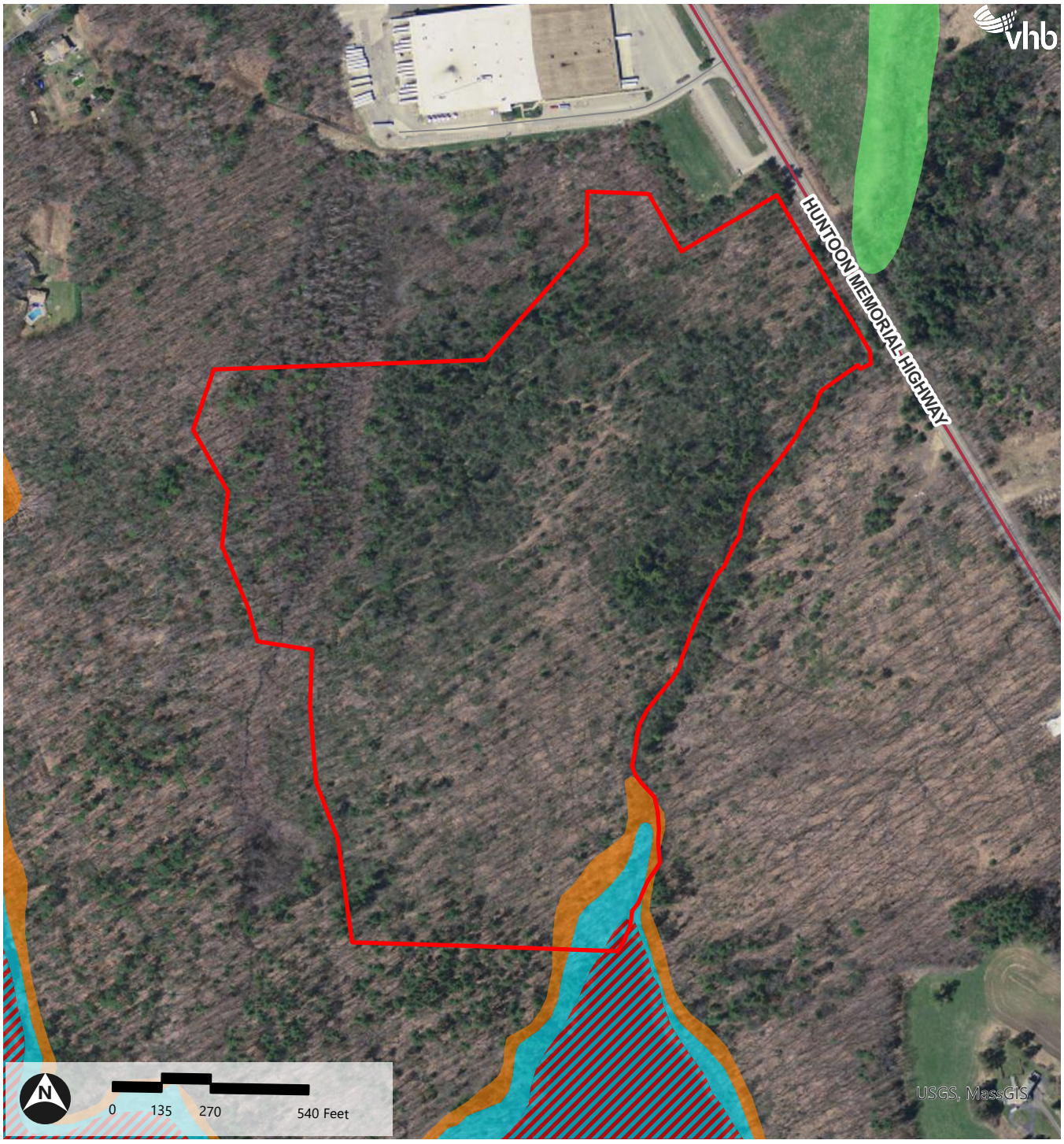
Figure 4: FEMA Flood Zones

Warehouse Development | Leicester, MA



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Project_Area

FEMA Flood Zone Designations

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- X: 0.2% Annual Chance of Flooding

Source: Source list here...can be 2 lines if needed with sources separated by commas or semi-colons.