DRAINAGE REPORT

Burtt Road Development

Andover & Tewksbury, MA

Prepared for:

MCP/Howland Burtt Owner, LLC
260 Franklin St.
Boston, MA 02110

Prepared by:

TEC, Inc.
282 Merrimack St, Floor 2
Lawrence MA, 01843

August 30, 2022
Revised September 27, 2022

Table of Contents

Appendix

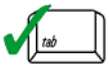
MassDEP Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

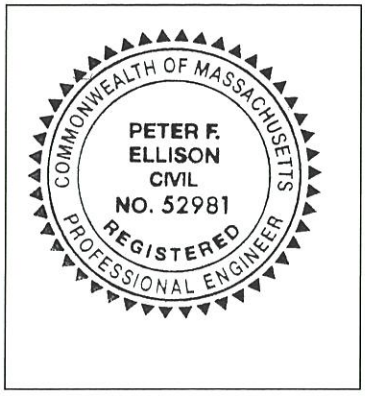
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date 8/30/2022

Checklist

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

- [X] 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:

- [X] No disturbance to any Wetland Resource Areas
- [ ] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [X] Minimizing disturbance to existing trees and shrubs
- [ ] LID Site Design Credit Requested:
  - [ ] Credit 1
  - [ ] Credit 2
  - [ ] Credit 3
- [X] 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
- [X] Water Quality Swale
- [X] Grass Channel
- [ ] Green Roof
- [X] Other (describe): **sediment forebay, infiltration basin**

Standard 1: No New Untreated Discharges

- [X] No new untreated discharges
- [X] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [X] 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.

List of Tables

1

Narrative

Introduction

The Applicant, MCP/Howland Burtt Owner, LLC, is proposing to develop a 50-acre parcel located in Andover and Tewksbury, Massachusetts. This location is identified on the Town of Andover's Assessors map as Map 163, Lots 8-#4, 9-#3 & 9A-#3, and Map 115, Lots 4, 5, 6, 7 & 8 within the Town of Tewksbury (the "Site"). The land is currently undeveloped and will be accessed via the extension of Burtt Road in the Town of Andover. The project area is abutted by the I-93 to the west; a utility substation to the northwest; railroad right of way to the east, commercial properties, and wetlands to the south and east.

The Applicant is proposing to develop the site by constructing a single building with an approximate total footprint of 167,610 square feet. The proposed site will include associated parking, landscaping, utility and stormwater management infrastructure (the "Project"). In Andover, the property is located within the Industrial Zoning District A and Medical Marijuana Overlay District. Within Tewksbury the property is located within the Industrial 1 Zoning District and the Wireless Communication Facility Overlay District.

This drainage study was performed in order to assess the potential impact of the Project. The Site is currently undeveloped and consists of no impervious surface. Runoff from the existing site primarily sheet flows across the site and discharges untreated to the nearby wetlands. The Project will provide a stormwater management system incorporating traditional and Low Impact Design (LID) Best Management Practices (BMPs) elements to fully comply with the Massachusetts Stormwater Management Handbook. This analysis has been prepared to verify that the Project will have a positive effect on the stormwater conditions both on-site and off-site.

The proposed Stormwater Management Plan has been designed to meet the Stormwater Standards identified in the Massachusetts Department of Environmental Protection (DEP) Stormwater Handbook and the Towns of Andover and Tewksbury Stormwater Regulations. The Stormwater Management Design reduces peak runoff rates and volumes, reduces the risk of erosion and sedimentation migration, and improves stormwater runoff quality.

Existing Conditions

The existing site is approximately 50 acres and consists of undeveloped lands and wetlands. Runoff from the site sheet flows to the nearby wetlands untreated. There are no drainage structures such as catch basins and underground pipes on site.

The site is comprised entirely of natural lying soils. These natural lying soils are mostly identified as Windsor Loamy Sand, hydrologic soil group A, and Freetown Muck, hydrologic soil group, hydrologic soil group B/D. Refer to Appendix C to review the full NRCS Soil Report for which depicts the various soils present at the site.

According to the FEMA Flood Insurance Rate Maps (FIRM), map number 25009C0356F, dated July 3, 2012, the property is not within the flood Hazard and outside of the flood plain. Refer to the attached FIRM Figure at the end of this section (Figure 3) and to the attached Site Plans to see the location of the existing and proposed elevation contours, and the 100-year flood plain.

Proposed Conditions

The proposed plan involves construction of a 167,610 square foot building to be used as warehouse space. The development will also include trees and grassed landscaped areas along with multiple paved parking areas that contains 294 standard parking spaces (including 22 banked parking spaces to be constructed as grass panel), and 40 trailer parking spaces for full size tractor trailers. Proposed development will create impervious coverage on site which will generate stormwater runoff.

The proposed stormwater management has been designed in accordance with the MassDEP Stormwater Management Policy and includes traditional and LID BMPs. BMPs proposed for the site include deep sump catch basins with hoods and sediment forebays prior to the discharge of stormwater into infiltration basins for recharge and treatment. Clean roof runoff will be directed into the infiltration basins for recharge.

The stormwater management system has been designed to provide water quality treatment and water quality control for 0.5" of runoff. This project is not considered a land use with higher potential pollutant load (LUHPPL).

Methodology

The Stormwater Management Plan, which will be implemented as part of this project, will provide adequate collection, management, and treatment of the stormwater runoff.

Existing and proposed hydrologic conditions were analyzed using HydroCAD, an SCS TR-20 based program, to calculate existing and proposed peak discharge rates. This method takes into account existing and proposed pervious and impervious areas including soil types and hydrologic classifications. The 2-, 10-, 25-, and 100-year, 24-hour storm frequencies were used in the

analysis in accordance with the MassDEP and the town of Andover requirements. Rainfall depths are taken from the Northeast Regional Climate Center.

The "Regulatory Compliance" portion of this report addresses the MassDEP Stormwater Management Performance Standards under the Wetlands Protection Act.

Pre-Development Runoff

The existing site contains approximately 50 acres of pervious area consisting of grass land, vegetation, wetlands and wooded area. Currently, all stormwater runoff travels to one of the three design points. Design Point 1 (DP-1) is the wetland to the north of the site which water from Subcatchment EX-101 flows to via sheet flow. Design Point 2 (DP-2) is also a wetland to the north of the site which water from Subcatchment EX-201 flows to via sheet flow. Design Point 3 (DP-3) is a wetland network on the southern and eastern boundary of the site which water from Subcatchments EX-301, EX-302, and EX-303 flow to via sheet flow.

The *Pre-Development Drainage Areas* are depicted in Figure D-1 of this report. This figure presents the delineation of the existing subcatchment areas and the Design Point. There are 5 existing subcatchment areas which are outlined below:

Existing Subcatchment Area 101 (EX-101) is comprised of 52,055 SF of pervious land area consisting of grass lands, wooded forest, and dirt roads with a weighted curve number (CN) of 62 draining to Discharge Point 2(DP-1).

Existing Subcatchment Area 201 (EX-201) is comprised of 68,794 SF of pervious land area consisting of grass lands, wooded forest, dirt road, and wetlands with a weighted CN of 39 draining to Discharge Point 2(DP-2).

Existing Subcatchment Area 301 (EX-301) is comprised of 14,767 SF of pervious land area consisting of grass lands, wooded forest, and wetlands with a weighted CN of 49 draining to Discharge Point 3(DP-3).

Existing Subcatchment Area 302 (EX-302) is comprised of 336,370 SF of pervious land area consisting of grass lands, dirt road, and wooded forest with a weighted CN of 57 draining to Discharge Point 3(DP-3).

Existing Subcatchment Area 303 (EX-303) is comprised of 286,929 SF of pervious land area consisting of grass lands, dirt road, paved road, and wooded forest with a weighted CN of 54 draining to Discharge Point 3(DP-3).

Post-Development Runoff

The proposed stormwater management system is designed to mitigate the effects of the proposed development by reducing the peak rates of runoff as compared to the existing conditions. In the proposed conditions analysis, the same design points identified and analyzed under the existing conditions were analyzed. The post-development subcatchment areas are identified in Figure D-2, *Post Development Drainage Areas.*

Proposed Subcatchment Area 101 (PR-101) is comprised of a 51,021 SF portion of EX-101 that remains undisturbed and has a weighed CN of 62. Stormwater from this area will continue to run overland to the existing wetland at the northern edge of the site (DP-1).

Proposed Subcatchment Area 201 (PR-201) is comprised of 68,794 SF of undisturbed pervious land area that remains unchanged from the existing Subcatchment EX-201. In earlier revisions, this area was bisected by the entrance road to the site. The current proposal has relocated this access roadway so no alterations to landcover will occur in this subcatchment. This area is still included in the analysis for consistency. Stormwater from PR-201 will continue to sheet flow over land and discharges into the existing wetland in the northeast corner of the site (DP-2).

Proposed Subcatchment Area 301 (PR-301) is comprised of 53,071 SF of open space at the edge of the proposed development area that will flow undetained to the adjacent wetland network on the south and east edge of the project (DP-3). This area mainly consists of grassed daylighting slopes along the perimeter with a weighted CN of 69.

Proposed Subcatchment Area 302 (PR-302) is a 30,756 SF area in the rear of the warehouse that includes the grass banked parking area and a pervious pavement system with a weighted CN of 92. Stormwater from this area will flow over land into the pervious pavement and infiltrate into the groundwater. The depth of the pervious pavement area was increased to over 2-feet of pervious stone material. Even during a 100-year storm event, the pervious pavement is able to hold and infiltrate the stormwater runoff without overflow.

Proposed Subcatchment Area 303 (PR-303) is comprised of 107,680 SF of building rooftop area. Stormwater runoff from the rooftop will be caught with internal roof drains and directed into infiltration basin P2 for recharge and treatment. During large storm events, stormwater from basin P2 will overflow into the wetland network on the south and east edge of the project (DP-3).

Proposed Subcatchment Area 304 (PR-304) is comprised of 215,213 SF of building rooftop, paved parking, and open space with a weighted CN of 91. Stormwater from this area will be directed into basin P2 for recharge and treatment. During large storm events, stormwater from basin P2 will overflow into the wetland network on the south and east edge of the project (DP-3).

Proposed Subcatchment Area 305 (PR-305) is a 142,335 SF area comprised of impervious pavement, grassed open space, and undisturbed areas with a weighted CN of 83. Stormwater from this area will be directed into basin P4 for recharge and treatment. During large storm

events, stormwater from basin P4 will overflow into the wetland network on the south and east edge of the project (DP-3).

Proposed Subcatchment Area 306 (PR-306) is a 90,071 SF area comprised of impervious pavement, grassed open space, and undisturbed wooded area with a weighted CN of 83. Stormwater from this area will be directed into basin P3 for recharge and treatment. During large storm events, stormwater from basin P3 will overflow into the wetland network on the south and east edge of the project (DP-3).

Table 1 (Peak Flow Summary)

Design Point	2-Yr Storm		10-Yr Storm		25-Yr Storm		100-Yr Storm	
	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)	Exist (cfs)	Prop (cfs)
DP-1	0.36	0.35	1.42	1.40	2.48	2.43	4.99	4.90
DP-2	0.00	0.00	0.04	0.04	0.29	0.29	1.69	1.69
DP-3	1.22	0.65	7.27	1.83	14.30	5.68	32.64	24.18

For all Design Points, the proposed project matches or decreases peak runoff rates from the existing conditions for the 2-, 10-, 25-, and 100-Year storm events, meeting state and local regulations.

TSS Removal

MassDEP Performance Standard 4 requires a TSS removal of at least 80%. DP-1 and DP-2 are retaining existing conditions, no stormwater treatment is proposed for these untouched areas of woods and open space. All impervious areas are being directed to infiltration basins to receive a minimum of 80% treatment. The large pavement and loading areas in the central portion of the site also includes deep sump and hooded catch basins as well as sediment forebays.

Treatment Train #1, consists of:
1 Sediment Forebay
2 Infiltration basin

Treatment Train #2, consists of:
1 Deep sump catch basins with hoods
2 Sediment Forebay
3 Infiltration basin

Treatment Train #3, consists of:
1. Pervious Pavement (sized for ½" WQV)

The project will achieve a minimum TSS removal rate of 80% for all Design Points, meeting the requirements in Standard 4.

Refer to *Appendix B-Water Quality Data* for TSS Removal Spreadsheet.

Regulatory Compliance

The DEP/CZM Stormwater Management Policy prescribes ten performance standards for site redevelopment projects. The proposed project has been designed in accordance with these standards. Compliance with the standards is outlined below.

1. *No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth*.

This project proposes no new untreated stormwater discharges or will cause erosion in the wetlands or waters of the Commonwealth.

2. *Stormwater management systems must be designed so that post- development peak discharge rates do not exceed pre-development peak discharge rates*.

As summarized in Table 1 Peak Flow Summary, the project decreases peak discharge rates for the 2, 10, 25 and 100-Year storm events for all discharge points. The HydroCAD analysis and output can be found in Appendix A, Hydrology Calculations.

3. *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures where feasible*.

The proposed stormwater management uses three infiltration basins and a pervious pavement infiltration system to provide groundwater recharge. The required recharge volume is determined based on the total proposed impervious area and the classification of the soils on site (Hydrologic Soil Type A).

Calculation Method 1 (Mass DEP Stormwater Handbook)
Rv = F x Impervious Area

Rv = Required Recharge Volume, expressed in cubic feet

F= Target Depth Factor associated with each Hydrologic Soil Group

Impervious Area= Pavement and rooftop area on site

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	**sand**	**0.6-inch**
B	loam	0.35-inch
C	silty loam	0.25-inch
D	clay	0.1-inch

Recharge Target Depth by Hydrologic Soil Group

Impervious Area Draining to Infiltration BMP = 435,264 SF
Total Imperious Area = 435,264 SF
Percent of Imperious Area Draining to Infiltration BMP = 100%

Rv = (0.60-inch) x 435,264 SF of Total Impervious Area

Rv = 21,763 cubic feet of Required Recharge Volume
Volume below lowest outlet (From HydroCAD):
P1 = 16,200 cubic feet
P2 = 9,711 cubic feet
P3 = 5,002 cubic feet
P4 = 7,375 cubic feet
Total Proposed Rv = 38,288 cubic feet (volume below lowest outlet)

Therefore, storage volume of the basins and volume of stormwater infiltrated exceed the requirements of Standard 3.

Calculation Method 2 (Town of Andover Stormwater Regulations Section IX.A.1)
$Re_v = [(S)(R_v)(A)]/12$, where
Re_v = Recharge volume (acre*feet)
$R_v = 0.05 + 0.009(I)$ where I is the percent impervious cover
A = site area in acres
S = Soil specific recharge factor

Hydrologic Group	Soil Specific Recharge Factor
A	0.60
B	0.35
C	0.25
D	0.10

For A Soils
I=59.5, R_v = 0.577, A=16.81, S=0.60
Re_v = [(0.60)(0.554)(16.81)]/12 = 0.492 acre*feet
Re_v = 21,432 CF
Total Proposed Re_v = 38,288 CF (below lowest outlets)

Confirm that P1 will empty within 72 hours:
Volume of Storage Below Outlet = 16,200 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P1 bottom = 18,000 SF
Time to Drain = 16,200 CF / (2.4"/hr) x (18,000 SF) = **4.5 hr < 72 hr**

Confirm that P2 will empty within 72 hours:
Volume of Storage Below Outlet = 9,711 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P2 = 19,632 SF
Time to Drain = 9,711 CF / (2.4"/hr) x (19,632 SF) = **2.5 hr < 72 hr**

Confirm that P3 will empty within 72 hours:
Volume of Storage Below Outlet = 5,002 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P3 = 5,500 SF
Time to Drain = 5,002 CF / (2.4"/hr) x (5,500 SF) = **4.5 hr < 72 hr**

Confirm that P4 will empty within 72 hours:
Volume of Storage Below Outlet = 7,375 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P4 = 6,733 SF
Time to Drain = 7,375 CF / (2.4"/hr) x (6,733 SF) = **5.4 hr < 72 hr**

4. *For new development, stormwater management systems must be designed to remove 80 percent of Total Suspended Solids*.

The proposed stormwater management design will implement BMP's including deep sump catch basins with hoods, sediment forebays, infiltration ponds, and pervious pavement to meet the 80% TSS removal rate. Refer to *Appendix B – Water Quality Data* for the TSS Removal Spreadsheet.

Water Quality Volumes

The proposed infiltration basins have been sized using the static method to provide a minimum 0.5" WQV below the lowest outlet. Infiltration basins P1, P3, and P4 are all sized for the 0.5" WQV for all impervious area, including rooftop area. Infiltration basin P2 is sized for the 0.5" WQV for impervious pavement area only. Rooftop area is considered "clean" runoff and therefore is not required to be included in the WQV calculation. See below calculations:

Infiltration Basin P1:
0.5" WQV = 24,753 SF impervious * 0.5" = 1,031CF
Volume of Storage Below Outlet = 16,200 CF

Infiltration Basin P2:
0.5" WQV = 157,576 SF impervious * 0.5" = 6,566 CF
Volume of Storage Below Outlet = 9,711 CF

Infiltration Basin P3:
0.5" WQV = 29,750 SF impervious * 0.5" = 2,351 CF
Volume of Storage Below Outlet = 5,002 CF

Infiltration Basin P4:
0.5" WQV = 88,827 SF impervious * 0.5" = 3,701 CF
Volume of Storage Below Outlet = 7,375 CF

The proposed infiltration basins, with the exception of the porous pavement basin P1 include sediment forebays sized to accommodate 1-year worth of sediment as required by Town of Andover Stormwater Regulations. Please see below calculations:

Sediment volume = Area to be sanded (acres) x 750 (lb/acre-storm) / 90 (pounds/cf) x 10 (storms/year) = (cf of sediment/year)

Infiltration Basin P2
South Forebay (SF21)
Sediment volume (P1) = 0.28 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (P1) = 23 cf of sediment/year
Volume Provided = 517 cf

North Forebay (SF22)
Sediment volume (P1) = 3.34 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (P1) = 278 cf of sediment/year
Volume Provided = 431 cf

Infiltration Basin P3
Sediment Forebay (SF31)
Sediment volume (P2) = 0.68 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (P2) = 57 cf of sediment/year
Volume Provided = 619 cf

Infiltration Basin P4
Sediment Forebay (SF41)
Sediment volume (P4) = 1.40 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (P4) = 170 cf of sediment/year
Volume Provided = 638 cf

All sediment forebays have been sized to accommodate at least one year's worth of sediment loading. Additionally, the forebays are also sized to handle the 0.1" minimum WQV per the MA Stormwater Handbook.

5. *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs.*

This project is not considered to be a land use with higher potential pollutant loading.

6. Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shell fish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies.

The project site is not located within any critical areas.

7. Redevelopment of previously developed areas must meet the Stormwater Management Standards to the maximum extent practicable.

The project is not considered a redevelopment project.

8. Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities.

The project has been designed to include erosion and sedimentation controls to prevent impacts to the resource areas. Construction activities will be isolated from downgradient areas by installing erosion control measures including a construction entrance/exit, and compost filter socks, and inlet protection devices. A Construction Period Pollution Prevention and Erosion and Sedimentation Plan has been prepared for the Project. Prior to construction, the Contractor will prepare a SWPPP and file an e-NOI with the Environmental Protection Agency.

9. All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed.

The project will include a long-term Operation and Maintenance Plan, see attached document, to provide efficient operation of the features of the proposed drainage system.

10. Illicit Discharges

Only stormwater will be conveyed to the stormwater management system. No illicit materials or connections are permitted. An Illicit Discharge Compliance Statement is included with the Drainage Report.

Conclusion

This proposed project is a new development and will introduce new impervious area. However, it provides equal or improved water quality treatment. The stormwater management plan controls the flow of stormwater, mitigates overall post peak runoff rates, and provides water quality treatment. The stormwater management plan provides erosion and sediment control resulting in clean stormwater runoff and a Long-Term Operation and Maintenance plan to ensure the proper functioning of the system over time. The project has been designed in accordance with the Stormwater Management Policy and Town of Andover Regulations.

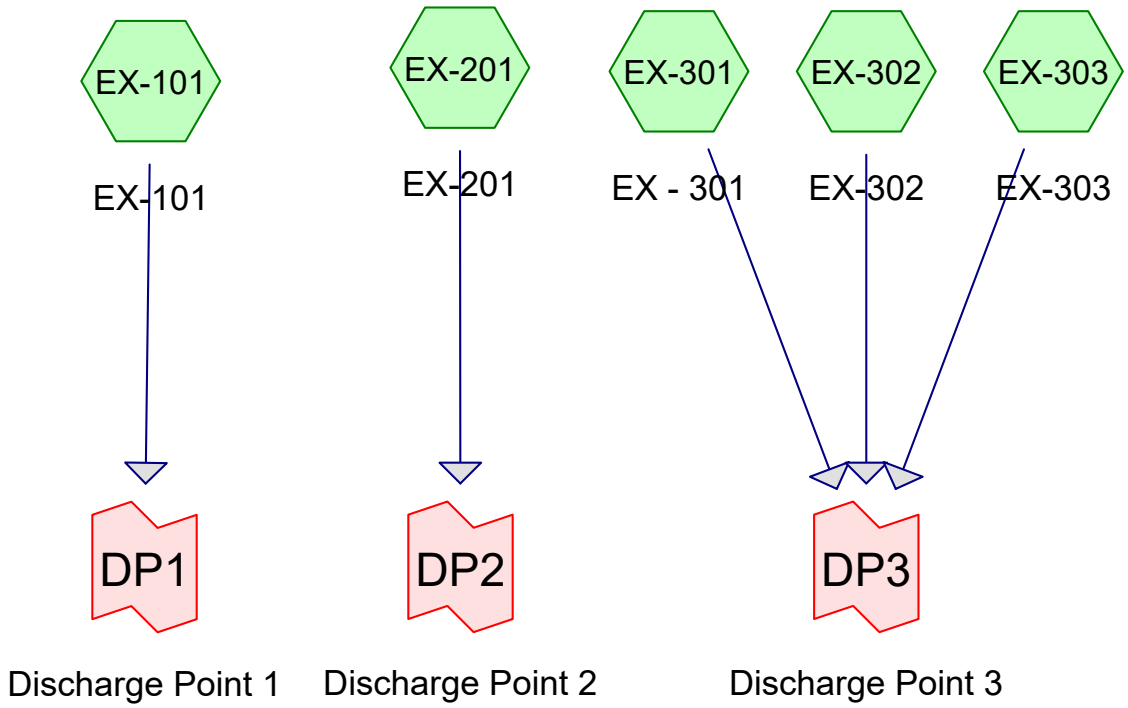
2

Appendix

A

Hydrologic Calculations

Hydraulic Calculations



Subcat Reach Pond Link

Routing Diagram for T1126_PRE
Prepared by IO, Printed 8/25/2022

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
14,680	72	Compacted Dirt Road - Windsor (EX-101)
1,307	82	Dirt Road - Sudbury (EX-302)
80,847	72	Dirt Road - Windsor (EX-201, EX-302, EX-303)
353,097	68	Open Space - Windsor (EX-101, EX-301, EX-302, EX-303)
13,983	68	Open space - Windsor (EX-201)
1,960	98	Paved Road - Deerfield (EX-303)
34,238	30	Woods and Forest - Deerfield (EX-201, EX-303)
261	77	Woods and Forest - Freetown (EX-303)
17,250	55	Woods and Forest - Sudbury (EX-302, EX-303)
241,291	30	Woods and Forest - Windsor (EX-101, EX-201, EX-301, EX-302, EX-303)

Summary for Subcatchment EX-101: EX-101

Runoff = 0.36 cfs @ 12.19 hrs, Volume= 1,994 cf, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (ac)	CN	Description
*	0.635	68	Open Space - Windsor
*	0.223	30	Woods and Forest - Windsor
*	0.337	72	Compacted Dirt Road - Windsor
	1.195	62	Weighted Average
	1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment EX-201: EX-201

Runoff = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	13,983	68	Open space - Windsor
*	24,319	30	Woods and Forest - Windsor
*	2,265	72	Dirt Road - Windsor
*	28,227	30	Woods and Forest - Deerfield
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.00 cfs @ 13.82 hrs, Volume= 122 cf, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (ac)	CN	Description
*	0.169	68	Open Space - Windsor
*	0.170	30	Woods and Forest - Windsor
	0.339	49	Weighted Average
	0.339		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.1	24	0.0350	3.01		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.9	74	Total			

Summary for Subcatchment EX-302: EX-302

Runoff = 0.81 cfs @ 12.62 hrs, Volume= 8,220 cf, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (ac)	CN	Description
*	2.381	30	Woods and Forest - Windsor
*	3.752	68	Open Space - Windsor
*	1.549	72	Dirt Road - Windsor
*	0.010	55	Woods and Forest - Sudbury
*	0.030	82	Dirt Road - Sudbury
	7.722	57	Weighted Average
	7.722		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0062	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
8.3	840	0.0110	1.69		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
27.9	890	Total			

Summary for Subcatchment EX-303: EX-303

Runoff = 0.47 cfs @ 12.47 hrs, Volume= 5,019 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (ac)	CN	Description
*	3.550	68	Open Space - Windsor
*	2.207	30	Woods and Forest - Windsor
*	0.255	72	Dirt Road - Windsor
*	0.386	55	Woods and Forest - Sudbury
*	0.006	77	Woods and Forest - Freetown
*	0.138	30	Woods and Forest - Deerfield
*	0.045	98	Paved Road - Deerfield
	6.587	54	Weighted Average
	6.542		99.32% Pervious Area
	0.045		0.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0510	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
3.9	394	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.3	444	Total			

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 0.46" for 2-YEAR event
Inflow = 0.36 cfs @ 12.19 hrs, Volume= 1,994 cf
Primary = 0.36 cfs @ 12.19 hrs, Volume= 1,994 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-YEAR event
Inflow = 0.00 cfs @ 24.05 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 0.25" for 2-YEAR event
Inflow = 1.22 cfs @ 12.55 hrs, Volume= 13,362 cf
Primary = 1.22 cfs @ 12.55 hrs, Volume= 13,362 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-101: EX-101

Runoff = 1.42 cfs @ 12.16 hrs, Volume= 5,685 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (ac)	CN	Description
*	0.635	68	Open Space - Windsor
*	0.223	30	Woods and Forest - Windsor
*	0.337	72	Compacted Dirt Road - Windsor
	1.195	62	Weighted Average
	1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment EX-201: EX-201

Runoff = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	13,983	68	Open space - Windsor
*	24,319	30	Woods and Forest - Windsor
*	2,265	72	Dirt Road - Windsor
*	28,227	30	Woods and Forest - Deerfield
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.10 cfs @ 12.28 hrs, Volume= 688 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (ac)	CN	Description
*	0.169	68	Open Space - Windsor
*	0.170	30	Woods and Forest - Windsor
	0.339	49	Weighted Average
	0.339		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.1	24	0.0350	3.01		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.9	74	Total			

Summary for Subcatchment EX-302: EX-302

Runoff = 4.36 cfs @ 12.46 hrs, Volume= 27,879 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (ac)	CN	Description
*	2.381	30	Woods and Forest - Windsor
*	3.752	68	Open Space - Windsor
*	1.549	72	Dirt Road - Windsor
*	0.010	55	Woods and Forest - Sudbury
*	0.030	82	Dirt Road - Sudbury
	7.722	57	Weighted Average
	7.722		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0062	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
8.3	840	0.0110	1.69		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
27.9	890	Total			

Summary for Subcatchment EX-303: EX-303

Runoff = 3.75 cfs @ 12.21 hrs, Volume= 19,626 cf, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (ac)	CN	Description
*	3.550	68	Open Space - Windsor
*	2.207	30	Woods and Forest - Windsor
*	0.255	72	Dirt Road - Windsor
*	0.386	55	Woods and Forest - Sudbury
*	0.006	77	Woods and Forest - Freetown
*	0.138	30	Woods and Forest - Deerfield
*	0.045	98	Paved Road - Deerfield
	6.587	54	Weighted Average
	6.542		99.32% Pervious Area
	0.045		0.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0510	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
3.9	394	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.3	444	Total			

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 1.31" for 10-YEAR event
Inflow = 1.42 cfs @ 12.16 hrs, Volume= 5,685 cf
Primary = 1.42 cfs @ 12.16 hrs, Volume= 5,685 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.16" for 10-YEAR event
Inflow = 0.04 cfs @ 13.75 hrs, Volume= 915 cf
Primary = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 0.91" for 10-YEAR event
Inflow = 7.27 cfs @ 12.40 hrs, Volume= 48,193 cf
Primary = 7.27 cfs @ 12.40 hrs, Volume= 48,193 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-101: EX-101

Runoff = 2.48 cfs @ 12.15 hrs, Volume= 9,336 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (ac)	CN	Description
*	0.635	68	Open Space - Windsor
*	0.223	30	Woods and Forest - Windsor
*	0.337	72	Compacted Dirt Road - Windsor
	1.195	62	Weighted Average
	1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment EX-201: EX-201

Runoff = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	13,983	68	Open space - Windsor
*	24,319	30	Woods and Forest - Windsor
*	2,265	72	Dirt Road - Windsor
*	28,227	30	Woods and Forest - Deerfield
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.28 cfs @ 12.20 hrs, Volume= 1,371 cf, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (ac)	CN	Description
*	0.169	68	Open Space - Windsor
*	0.170	30	Woods and Forest - Windsor
	0.339	49	Weighted Average
	0.339		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.1	24	0.0350	3.01		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.9	74	Total			

Summary for Subcatchment EX-302: EX-302

Runoff = 8.40 cfs @ 12.43 hrs, Volume= 48,519 cf, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (ac)	CN	Description
*	2.381	30	Woods and Forest - Windsor
*	3.752	68	Open Space - Windsor
*	1.549	72	Dirt Road - Windsor
*	0.010	55	Woods and Forest - Sudbury
*	0.030	82	Dirt Road - Sudbury
	7.722	57	Weighted Average
	7.722		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0062	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
8.3	840	0.0110	1.69		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
27.9	890	Total			

Summary for Subcatchment EX-303: EX-303

Runoff = 8.14 cfs @ 12.19 hrs, Volume= 35,648 cf, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (ac)	CN	Description
*	3.550	68	Open Space - Windsor
*	2.207	30	Woods and Forest - Windsor
*	0.255	72	Dirt Road - Windsor
*	0.386	55	Woods and Forest - Sudbury
*	0.006	77	Woods and Forest - Freetown
*	0.138	30	Woods and Forest - Deerfield
*	0.045	98	Paved Road - Deerfield
	6.587	54	Weighted Average
	6.542		99.32% Pervious Area
	0.045		0.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0510	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
3.9	394	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.3	444	Total			

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 2.15" for 25-YEAR event
Inflow = 2.48 cfs @ 12.15 hrs, Volume= 9,336 cf
Primary = 2.48 cfs @ 12.15 hrs, Volume= 9,336 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.47" for 25-YEAR event
Inflow = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf
Primary = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 1.61" for 25-YEAR event
Inflow = 14.30 cfs @ 12.34 hrs, Volume= 85,539 cf
Primary = 14.30 cfs @ 12.34 hrs, Volume= 85,539 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-101: EX-101

Runoff = 4.99 cfs @ 12.15 hrs, Volume= 18,091 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (ac)	CN	Description
*	0.635	68	Open Space - Windsor
*	0.223	30	Woods and Forest - Windsor
*	0.337	72	Compacted Dirt Road - Windsor
	1.195	62	Weighted Average
	1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment EX-201: EX-201

Runoff = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	13,983	68	Open space - Windsor
*	24,319	30	Woods and Forest - Windsor
*	2,265	72	Dirt Road - Windsor
*	28,227	30	Woods and Forest - Deerfield
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.79 cfs @ 12.18 hrs, Volume= 3,228 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (ac)	CN	Description
*	0.169	68	Open Space - Windsor
*	0.170	30	Woods and Forest - Windsor
	0.339	49	Weighted Average
	0.339		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.1	24	0.0350	3.01		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.9	74	Total			

Summary for Subcatchment EX-302: EX-302

Runoff = 18.46 cfs @ 12.40 hrs, Volume= 100,034 cf, Depth= 3.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (ac)	CN	Description
*	2.381	30	Woods and Forest - Windsor
*	3.752	68	Open Space - Windsor
*	1.549	72	Dirt Road - Windsor
*	0.010	55	Woods and Forest - Sudbury
*	0.030	82	Dirt Road - Sudbury
	7.722	57	Weighted Average
	7.722		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0062	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
8.3	840	0.0110	1.69		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
27.9	890	Total			

Summary for Subcatchment EX-303: EX-303

Runoff = 19.45 cfs @ 12.18 hrs, Volume= 76,776 cf, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (ac)	CN	Description
*	3.550	68	Open Space - Windsor
*	2.207	30	Woods and Forest - Windsor
*	0.255	72	Dirt Road - Windsor
*	0.386	55	Woods and Forest - Sudbury
*	0.006	77	Woods and Forest - Freetown
*	0.138	30	Woods and Forest - Deerfield
*	0.045	98	Paved Road - Deerfield
	6.587	54	Weighted Average
	6.542		99.32% Pervious Area
	0.045		0.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0510	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
3.9	394	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.3	444	Total			

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 4.17" for 100-YEAR event
Inflow = 4.99 cfs @ 12.15 hrs, Volume= 18,091 cf
Primary = 4.99 cfs @ 12.15 hrs, Volume= 18,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

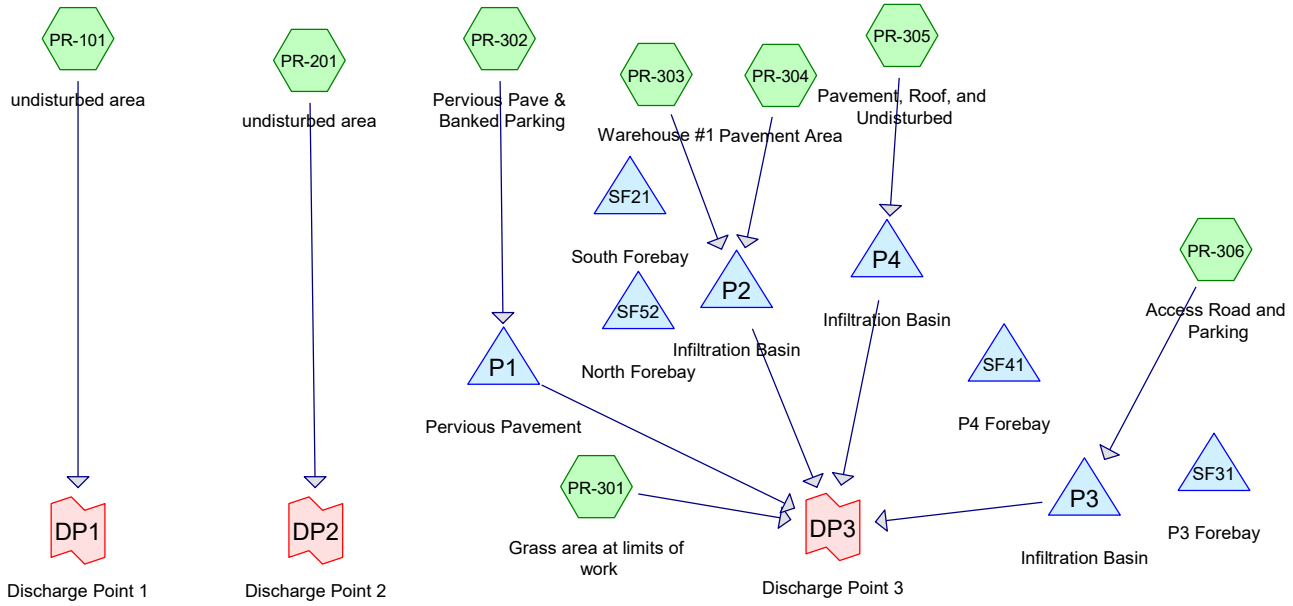
Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 1.50" for 100-YEAR event
Inflow = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf
Primary = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 3.39" for 100-YEAR event
Inflow = 32.64 cfs @ 12.25 hrs, Volume= 180,038 cf
Primary = 32.64 cfs @ 12.25 hrs, Volume= 180,038 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Subcat Reach Pond Link

Routing Diagram for T1126_POST
Prepared by IO, Printed 9/27/2022

Summary for Subcatchment PR-101: undisturbed area

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
*	27,051	68	Open Space - undisturbed
*	9,290	30	Woods and Forest - undisturbed
*	14,680	72	Dirt Road - undisturbed
	51,021	62	Weighted Average
	51,021		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
*	13,983	68	Open space - HSG A
*	52,546	30	Woods and Forest - HSG A
*	2,265	72	Dirt Road - HSG A
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
*	46,391	68	Open Space, HSG A
*	6,462	79	Open Space - HSG B
*	218	89	Open Space - HSG D
	53,071	69	Weighted Average
	53,071		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	36	0.0200	1.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.23"
2.7	14	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.23"
15.3	676	0.0110	0.73		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.9	936	Total			

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 0.06 cfs @ 12.11 hrs, Volume= 228 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
	24,753	98	Paved parking, HSG A
*	6,003	68	Open Space, HSG A
	30,756	92	Weighted Average
	6,003		19.52% Pervious Area
	24,753		80.48% Impervious Area

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 0.92 cfs @ 12.09 hrs, Volume= 2,853 cf, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

Area (sf)	CN	Description
107,680	98	Roofs, HSG A
107,680		100.00% Impervious Area

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 0.26 cfs @ 12.12 hrs, Volume= 1,268 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
*	45,292	68	Open Space - HSG A
*	157,576	98	Paved parking - HSG A
*	12,345	79	Open Space - HSG B
	215,213	91	Weighted Average
	57,637		26.78% Pervious Area
	157,576		73.22% Impervious Area

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 0.00 cfs @ 17.02 hrs, Volume= 45 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
*	88,827	98	Impervious - HSG A
*	33,775	68	Open Space - HSG A
*	13,112	30	Woods and Forest - HSG A - undisturbed
*	6,447	68	Open Space - HSG A - undisturbed
*	174	72	Dirt Road - HSG A - undisturbed
	142,335	83	Weighted Average
	53,508		37.59% Pervious Area
	88,827		62.41% Impervious Area

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 0.00 cfs @ 17.02 hrs, Volume= 29 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 0.5 inch wqv Rainfall=0.50"

	Area (sf)	CN	Description
*	56,428	98	Impervious - HSG A
*	19,094	77	Open Space - HSG A
*	14,549	30	Woods and Forest - HSG A - undisturbed
	90,071	83	Weighted Average
	33,643		37.35% Pervious Area
	56,428		62.65% Impervious Area

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 0.09" for 0.5 inch wqv event
Inflow = 0.06 cfs @ 12.11 hrs, Volume= 228 cf
Outflow = 0.06 cfs @ 12.11 hrs, Volume= 228 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.06 cfs @ 12.11 hrs, Volume= 228 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.75' @ 0.00 hrs Surf.Area= 18,000 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (898.7 - 898.7)

Volume	Invert	Avail.Storage	Storage Description
#1	95.75'	16,200 cf	**24.00'W x 750.00'L x 2.25'H Prismatoid** 40,500 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**750.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#2	Discarded	95.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 12.11 hrs HW=95.75' (Free Discharge)
↑—**2=Exfiltration** (Passes 0.00 cfs of 1.00 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 0.15" for 0.5 inch wqv event
Inflow = 1.16 cfs @ 12.10 hrs, Volume= 4,121 cf
Outflow = 1.10 cfs @ 12.12 hrs, Volume= 4,122 cf, Atten= 6%, Lag= 1.7 min
Discarded = 1.10 cfs @ 12.12 hrs, Volume= 4,122 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 92.67' @ 12.12 hrs Surf.Area= 19,633 sf Storage= 10 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (844.2 - 844.1)

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	108,964 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	19,632	822.0	0	0	19,632
93.00	20,458	829.0	6,614	6,614	20,591
94.00	22,973	847.0	21,703	28,318	23,134
95.00	25,545	866.0	24,248	52,565	25,862
96.00	28,174	885.0	26,849	79,414	28,650
97.00	30,947	904.0	29,550	108,964	31,499

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	93.15'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	96.40'	**30.0' 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
#5	Discarded	92.67'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.10 cfs @ 12.12 hrs HW=92.67' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 1.10 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.67' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
Inflow = 0.00 cfs @ 17.02 hrs, Volume= 29 cf
Outflow = 0.00 cfs @ 17.02 hrs, Volume= 29 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 17.02 hrs, Volume= 29 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 96.90' @ 0.00 hrs Surf.Area= 4,600 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (1,160.1 - 1,160.1)

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	34,920 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
96.90	4,600	0	0	4,600
97.00	4,680	464	464	4,684
98.00	5,499	5,084	5,548	5,541
99.00	6,374	5,931	11,479	6,457
100.00	7,306	6,835	18,314	7,434
101.00	8,294	7,795	26,109	8,471
102.00	9,339	8,811	34,920	9,567

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**12.0" Round RCP_Round 12"** L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	101.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	96.90'	**2.410 in/hr Exfiltration over Surface area**
#4	Primary	97.90'	**2.0" Vert. Low Flow Orifice** C= 0.600
#5	Primary	101.50'	**30.0' 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

Discarded OutFlow Max=0.00 cfs @ 17.02 hrs HW=96.90' (Free Discharge)
└**3=Exfiltration** (Passes 0.00 cfs of 0.26 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=96.90' TW=0.00' (Dynamic Tailwater)
├**1=RCP_Round 12"** (Controls 0.00 cfs)
│ └**2=Orifice/Grate** (Controls 0.00 cfs)
├**4=Low Flow Orifice** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
Inflow = 0.00 cfs @ 17.02 hrs, Volume= 45 cf
Outflow = 0.00 cfs @ 17.02 hrs, Volume= 45 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 17.02 hrs, Volume= 45 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 93.50' @ 0.00 hrs Surf.Area= 6,773 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (1,160.1 - 1,160.1)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	43,368 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	6,773	396.0	0	0	6,773
94.00	7,375	406.0	3,536	3,536	7,442
95.00	8,621	425.0	7,990	11,526	8,765
96.00	9,923	443.0	9,264	20,790	10,082
97.00	11,282	462.0	10,595	31,385	11,523
98.00	12,697	481.0	11,983	43,368	13,025

Device	Routing	Invert	Outlet Devices
#1	Primary	94.50'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	94.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	95.50'	**36.0" W x 21.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	97.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	97.50'	**30.0' 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
#6	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 17.02 hrs HW=93.50' (Free Discharge)
└**6=Exfiltration** (Passes 0.00 cfs of 0.38 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.50' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF21: South Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	517 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	385	80.0	0	0	385
93.67	661	102.0	517	517	716

Summary for Pond SF31: P3 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	619 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.90	416	0	0
97.90	822	619	619

Summary for Pond SF41: P4 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	638 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	363	78.0	0	0	363
94.80	631	100.0	638	638	695

Summary for Pond SF52: North Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	431 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	318	68.0	0	0	318
93.67	554	89.0	431	431	592

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-101: undisturbed area

Runoff = 0.35 cfs @ 12.19 hrs, Volume= 1,955 cf, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	27,051	68	Open Space - undisturbed
*	9,290	30	Woods and Forest - undisturbed
*	14,680	72	Dirt Road - undisturbed
	51,021	62	Weighted Average
	51,021		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	13,983	68	Open space - HSG A
*	52,546	30	Woods and Forest - HSG A
*	2,265	72	Dirt Road - HSG A
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 0.57 cfs @ 12.40 hrs, Volume= 3,324 cf, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	46,391	68	Open Space, HSG A
*	6,462	79	Open Space - HSG B
*	218	89	Open Space - HSG D
	53,071	69	Weighted Average
	53,071		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	36	0.0200	1.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.23"
2.7	14	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.23"
15.3	676	0.0110	0.73		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.9	936	Total			

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 1.86 cfs @ 12.09 hrs, Volume= 5,903 cf, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
	24,753	98	Paved parking, HSG A
*	6,003	68	Open Space, HSG A
	30,756	92	Weighted Average
	6,003		19.52% Pervious Area
	24,753		80.48% Impervious Area

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 7.56 cfs @ 12.08 hrs, Volume= 26,181 cf, Depth= 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

Area (sf)	CN	Description
107,680	98	Roofs, HSG A
107,680		100.00% Impervious Area

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 12.61 cfs @ 12.09 hrs, Volume= 39,660 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	45,292	68	Open Space - HSG A
*	157,576	98	Paved parking - HSG A
*	12,345	79	Open Space - HSG B
	215,213	91	Weighted Average
	57,637		26.78% Pervious Area
	157,576		73.22% Impervious Area

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 6.00 cfs @ 12.09 hrs, Volume= 18,601 cf, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	88,827	98	Impervious - HSG A
*	33,775	68	Open Space - HSG A
*	13,112	30	Woods and Forest - HSG A - undisturbed
*	6,447	68	Open Space - HSG A - undisturbed
*	174	72	Dirt Road - HSG A - undisturbed
	142,335	83	Weighted Average
	53,508		37.59% Pervious Area
	88,827		62.41% Impervious Area

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 3.80 cfs @ 12.09 hrs, Volume= 11,771 cf, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	56,428	98	Impervious - HSG A
*	19,094	77	Open Space - HSG A
*	14,549	30	Woods and Forest - HSG A - undisturbed
	90,071	83	Weighted Average
	33,643		37.35% Pervious Area
	56,428		62.65% Impervious Area

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 2.30" for 2-YEAR event
Inflow = 1.86 cfs @ 12.09 hrs, Volume= 5,903 cf
Outflow = 1.00 cfs @ 12.09 hrs, Volume= 5,911 cf, Atten= 46%, Lag= 0.3 min
Discarded = 1.00 cfs @ 12.09 hrs, Volume= 5,911 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.80' @ 12.21 hrs Surf.Area= 18,000 sf Storage= 384 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.3 min (799.6 - 798.3)

Volume	Invert	Avail.Storage	Storage Description
#1	95.75'	16,200 cf	**24.00'W x 750.00'L x 2.25'H Prismatoid** 40,500 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**750.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#2	Discarded	95.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.00 cfs @ 12.09 hrs HW=95.78' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 2.45" for 2-YEAR event
Inflow = 20.16 cfs @ 12.09 hrs, Volume= 65,841 cf
Outflow = 1.37 cfs @ 13.54 hrs, Volume= 65,842 cf, Atten= 93%, Lag= 87.5 min
Discarded = 1.28 cfs @ 13.54 hrs, Volume= 63,813 cf
Primary = 0.09 cfs @ 13.54 hrs, Volume= 2,030 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 93.99' @ 13.54 hrs Surf.Area= 22,938 sf Storage= 28,006 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 181.9 min (966.6 - 784.6)

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	108,964 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	19,632	822.0	0	0	19,632
93.00	20,458	829.0	6,614	6,614	20,591
94.00	22,973	847.0	21,703	28,318	23,134
95.00	25,545	866.0	24,248	52,565	25,862
96.00	28,174	885.0	26,849	79,414	28,650
97.00	30,947	904.0	29,550	108,964	31,499

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	93.15'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	96.40'	**30.0' 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
#5	Discarded	92.67'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.28 cfs @ 13.54 hrs HW=93.99' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 1.28 cfs)

Primary OutFlow Max=0.09 cfs @ 13.54 hrs HW=93.99' TW=0.00' (Dynamic Tailwater)
├**1=Culvert** (Passes 0.09 cfs of 2.65 cfs potential flow)
│ ├**2=Orifice/Grate** (Orifice Controls 0.09 cfs @ 4.18 fps)
│ └**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 1.57" for 2-YEAR event
Inflow = 3.80 cfs @ 12.09 hrs, Volume= 11,771 cf
Outflow = 0.30 cfs @ 13.59 hrs, Volume= 11,773 cf, Atten= 92%, Lag= 90.2 min
Discarded = 0.30 cfs @ 13.59 hrs, Volume= 11,773 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 97.87' @ 13.59 hrs Surf.Area= 5,392 sf Storage= 4,860 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 154.9 min (988.6 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	34,920 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
96.90	4,600	0	0	4,600
97.00	4,680	464	464	4,684
98.00	5,499	5,084	5,548	5,541
99.00	6,374	5,931	11,479	6,457
100.00	7,306	6,835	18,314	7,434
101.00	8,294	7,795	26,109	8,471
102.00	9,339	8,811	34,920	9,567

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**12.0" Round RCP_Round 12"** L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	101.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	96.90'	**2.410 in/hr Exfiltration over Surface area**
#4	Primary	97.90'	**2.0" Vert. Low Flow Orifice** C= 0.600
#5	Primary	101.50'	**30.0' 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

Discarded OutFlow Max=0.30 cfs @ 13.59 hrs HW=97.87' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=96.90' TW=0.00' (Dynamic Tailwater)
├**1=RCP_Round 12"** (Controls 0.00 cfs)
│ └**2=Orifice/Grate** (Controls 0.00 cfs)
├**4=Low Flow Orifice** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 1.57" for 2-YEAR event
Inflow = 6.00 cfs @ 12.09 hrs, Volume= 18,601 cf
Outflow = 0.46 cfs @ 13.71 hrs, Volume= 18,606 cf, Atten= 92%, Lag= 96.9 min
Discarded = 0.45 cfs @ 13.71 hrs, Volume= 18,574 cf
Primary = 0.01 cfs @ 13.71 hrs, Volume= 32 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 94.56' @ 13.71 hrs Surf.Area= 8,063 sf Storage= 7,873 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 170.8 min (1,004.5 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	43,368 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	6,773	396.0	0	0	6,773
94.00	7,375	406.0	3,536	3,536	7,442
95.00	8,621	425.0	7,990	11,526	8,765
96.00	9,923	443.0	9,264	20,790	10,082
97.00	11,282	462.0	10,595	31,385	11,523
98.00	12,697	481.0	11,983	43,368	13,025

Device	Routing	Invert	Outlet Devices
#1	Primary	94.50'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	94.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	95.50'	**36.0" W x 21.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	97.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	97.50'	**30.0' 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
#6	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.45 cfs @ 13.71 hrs HW=94.56' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.45 cfs)

Primary OutFlow Max=0.01 cfs @ 13.71 hrs HW=94.56' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.01 cfs of 0.01 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.85 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF21: South Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	517 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	385	80.0	0	0	385
93.67	661	102.0	517	517	716

Summary for Pond SF31: P3 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	619 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.90	416	0	0
97.90	822	619	619

Summary for Pond SF41: P4 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	638 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	363	78.0	0	0	363
94.80	631	100.0	638	638	695

Summary for Pond SF52: North Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	431 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	318	68.0	0	0	318
93.67	554	89.0	431	431	592

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 0.46" for 2-YEAR event
Inflow = 0.35 cfs @ 12.19 hrs, Volume= 1,955 cf
Primary = 0.35 cfs @ 12.19 hrs, Volume= 1,955 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-YEAR event
Inflow = 0.00 cfs @ 24.05 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.10" for 2-YEAR event
Inflow = 0.65 cfs @ 12.42 hrs, Volume= 5,385 cf
Primary = 0.65 cfs @ 12.42 hrs, Volume= 5,385 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-101: undisturbed area

Runoff = 1.40 cfs @ 12.16 hrs, Volume= 5,572 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	27,051	68	Open Space - undisturbed
*	9,290	30	Woods and Forest - undisturbed
*	14,680	72	Dirt Road - undisturbed
	51,021	62	Weighted Average
	51,021		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	13,983	68	Open space - HSG A
*	52,546	30	Woods and Forest - HSG A
*	2,265	72	Dirt Road - HSG A
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 1.54 cfs @ 12.37 hrs, Volume= 7,988 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	46,391	68	Open Space, HSG A
*	6,462	79	Open Space - HSG B
*	218	89	Open Space - HSG D
	53,071	69	Weighted Average
	53,071		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	36	0.0200	1.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.23"
2.7	14	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.23"
15.3	676	0.0110	0.73		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.9	936	Total			

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 3.06 cfs @ 12.08 hrs, Volume= 9,956 cf, Depth= 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
	24,753	98	Paved parking, HSG A
*	6,003	68	Open Space, HSG A
	30,756	92	Weighted Average
	6,003		19.52% Pervious Area
	24,753		80.48% Impervious Area

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 11.58 cfs @ 12.08 hrs, Volume= 40,860 cf, Depth= 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

Area (sf)	CN	Description
107,680	98	Roofs, HSG A
107,680		100.00% Impervious Area

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 21.01 cfs @ 12.08 hrs, Volume= 67,764 cf, Depth= 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	45,292	68	Open Space - HSG A
*	157,576	98	Paved parking - HSG A
*	12,345	79	Open Space - HSG B
	215,213	91	Weighted Average
	57,637		26.78% Pervious Area
	157,576		73.22% Impervious Area

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 11.40 cfs @ 12.09 hrs, Volume= 35,403 cf, Depth= 2.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	88,827	98	Impervious - HSG A
*	33,775	68	Open Space - HSG A
*	13,112	30	Woods and Forest - HSG A - undisturbed
*	6,447	68	Open Space - HSG A - undisturbed
*	174	72	Dirt Road - HSG A - undisturbed
	142,335	83	Weighted Average
	53,508		37.59% Pervious Area
	88,827		62.41% Impervious Area

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 7.21 cfs @ 12.09 hrs, Volume= 22,403 cf, Depth= 2.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

	Area (sf)	CN	Description
*	56,428	98	Impervious - HSG A
*	19,094	77	Open Space - HSG A
*	14,549	30	Woods and Forest - HSG A - undisturbed
	90,071	83	Weighted Average
	33,643		37.35% Pervious Area
	56,428		62.65% Impervious Area

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 3.88" for 10-YEAR event
Inflow = 3.06 cfs @ 12.08 hrs, Volume= 9,956 cf
Outflow = 1.00 cfs @ 12.00 hrs, Volume= 9,966 cf, Atten= 67%, Lag= 0.0 min
Discarded = 1.00 cfs @ 12.00 hrs, Volume= 9,966 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.95' @ 12.38 hrs Surf.Area= 18,000 sf Storage= 1,437 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 6.1 min (790.1 - 784.1)

Volume	Invert	Avail.Storage	Storage Description
#1	95.75'	16,200 cf	**24.00'W x 750.00'L x 2.25'H Prismatoid** 40,500 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**750.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#2	Discarded	95.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.00 cfs @ 12.00 hrs HW=95.77' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 4.04" for 10-YEAR event
Inflow = 32.59 cfs @ 12.08 hrs, Volume= 108,624 cf
Outflow = 1.58 cfs @ 14.40 hrs, Volume= 108,630 cf, Atten= 95%, Lag= 139.2 min
Discarded = 1.44 cfs @ 14.40 hrs, Volume= 102,717 cf
Primary = 0.14 cfs @ 14.40 hrs, Volume= 5,913 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.07' @ 14.40 hrs Surf.Area= 25,723 sf Storage= 54,344 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 330.2 min (1,103.6 - 773.4)

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	108,964 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	19,632	822.0	0	0	19,632
93.00	20,458	829.0	6,614	6,614	20,591
94.00	22,973	847.0	21,703	28,318	23,134
95.00	25,545	866.0	24,248	52,565	25,862
96.00	28,174	885.0	26,849	79,414	28,650
97.00	30,947	904.0	29,550	108,964	31,499

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	93.15'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	96.40'	**30.0' 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
#5	Discarded	92.67'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.44 cfs @ 14.40 hrs HW=95.07' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 1.44 cfs)

Primary OutFlow Max=0.14 cfs @ 14.40 hrs HW=95.07' TW=0.00' (Dynamic Tailwater)
├**1=Culvert** (Passes 0.14 cfs of 4.74 cfs potential flow)
│ ├**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.52 fps)
│ └**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 2.98" for 10-YEAR event
Inflow = 7.21 cfs @ 12.09 hrs, Volume= 22,403 cf
Outflow = 0.45 cfs @ 13.95 hrs, Volume= 22,406 cf, Atten= 94%, Lag= 112.0 min
Discarded = 0.35 cfs @ 13.95 hrs, Volume= 19,899 cf
Primary = 0.10 cfs @ 13.95 hrs, Volume= 2,507 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 98.89' @ 13.95 hrs Surf.Area= 6,272 sf Storage= 10,769 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 266.7 min (1,081.9 - 815.2)

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	34,920 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
96.90	4,600	0	0	4,600
97.00	4,680	464	464	4,684
98.00	5,499	5,084	5,548	5,541
99.00	6,374	5,931	11,479	6,457
100.00	7,306	6,835	18,314	7,434
101.00	8,294	7,795	26,109	8,471
102.00	9,339	8,811	34,920	9,567

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**12.0" Round RCP_Round 12"** L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	101.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	96.90'	**2.410 in/hr Exfiltration over Surface area**
#4	Primary	97.90'	**2.0" Vert. Low Flow Orifice** C= 0.600
#5	Primary	101.50'	**30.0' 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

Discarded OutFlow Max=0.35 cfs @ 13.95 hrs HW=98.89' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=0.10 cfs @ 13.95 hrs HW=98.89' TW=0.00' (Dynamic Tailwater)
├**1=RCP_Round 12"** (Passes 0.00 cfs of 2.06 cfs potential flow)
│└**2=Orifice/Grate** (Controls 0.00 cfs)
├**4=Low Flow Orifice** (Orifice Controls 0.10 cfs @ 4.58 fps)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 2.98" for 10-YEAR event
Inflow = 11.40 cfs @ 12.09 hrs, Volume= 35,403 cf
Outflow = 0.89 cfs @ 13.39 hrs, Volume= 35,407 cf, Atten= 92%, Lag= 78.0 min
Discarded = 0.52 cfs @ 13.39 hrs, Volume= 31,060 cf
Primary = 0.36 cfs @ 13.39 hrs, Volume= 4,348 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.59' @ 13.39 hrs Surf.Area= 9,378 sf Storage= 16,830 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 279.4 min (1,094.6 - 815.2)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	43,368 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	6,773	396.0	0	0	6,773
94.00	7,375	406.0	3,536	3,536	7,442
95.00	8,621	425.0	7,990	11,526	8,765
96.00	9,923	443.0	9,264	20,790	10,082
97.00	11,282	462.0	10,595	31,385	11,523
98.00	12,697	481.0	11,983	43,368	13,025

Device	Routing	Invert	Outlet Devices
#1	Primary	94.50'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	94.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	95.50'	**36.0" W x 21.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	97.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	97.50'	**30.0' 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
#6	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.52 cfs @ 13.39 hrs HW=95.59' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.52 cfs)

Primary OutFlow Max=0.36 cfs @ 13.39 hrs HW=95.59' TW=0.00' (Dynamic Tailwater)
├**1=Culvert** (Passes 0.36 cfs of 2.44 cfs potential flow)
│ ├**2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 4.83 fps)
│ ├**3=Orifice/Grate** (Orifice Controls 0.26 cfs @ 0.96 fps)
│ └**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF21: South Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	517 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	385	80.0	0	0	385
93.67	661	102.0	517	517	716

Summary for Pond SF31: P3 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	619 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.90	416	0	0
97.90	822	619	619

Summary for Pond SF41: P4 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	638 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	363	78.0	0	0	363
94.80	631	100.0	638	638	695

Summary for Pond SF52: North Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	431 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	318	68.0	0	0	318
93.67	554	89.0	431	431	592

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 1.31" for 10-YEAR event
Inflow = 1.40 cfs @ 12.16 hrs, Volume= 5,572 cf
Primary = 1.40 cfs @ 12.16 hrs, Volume= 5,572 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.16" for 10-YEAR event
Inflow = 0.04 cfs @ 13.75 hrs, Volume= 915 cf
Primary = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.39" for 10-YEAR event
Inflow = 1.83 cfs @ 12.37 hrs, Volume= 20,756 cf
Primary = 1.83 cfs @ 12.37 hrs, Volume= 20,756 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-101: undisturbed area

Runoff = 2.43 cfs @ 12.15 hrs, Volume= 9,151 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	27,051	68	Open Space - undisturbed
*	9,290	30	Woods and Forest - undisturbed
*	14,680	72	Dirt Road - undisturbed
	51,021	62	Weighted Average
	51,021		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	13,983	68	Open space - HSG A
*	52,546	30	Woods and Forest - HSG A
*	2,265	72	Dirt Road - HSG A
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 2.42 cfs @ 12.36 hrs, Volume= 12,308 cf, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	46,391	68	Open Space, HSG A
*	6,462	79	Open Space - HSG B
*	218	89	Open Space - HSG D
	53,071	69	Weighted Average
	53,071		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	36	0.0200	1.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.23"
2.7	14	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.23"
15.3	676	0.0110	0.73		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.9	936	Total			

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 4.00 cfs @ 12.08 hrs, Volume= 13,220 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
	24,753	98	Paved parking, HSG A
*	6,003	68	Open Space, HSG A
	30,756	92	Weighted Average
	6,003		19.52% Pervious Area
	24,753		80.48% Impervious Area

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 14.76 cfs @ 12.08 hrs, Volume= 52,510 cf, Depth= 5.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

Area (sf)	CN	Description
107,680	98	Roofs, HSG A
107,680		100.00% Impervious Area

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 27.61 cfs @ 12.08 hrs, Volume= 90,485 cf, Depth= 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	45,292	68	Open Space - HSG A
*	157,576	98	Paved parking - HSG A
*	12,345	79	Open Space - HSG B
	215,213	91	Weighted Average
	57,637		26.78% Pervious Area
	157,576		73.22% Impervious Area

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 15.80 cfs @ 12.09 hrs, Volume= 49,520 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	88,827	98	Impervious - HSG A
*	33,775	68	Open Space - HSG A
*	13,112	30	Woods and Forest - HSG A - undisturbed
*	6,447	68	Open Space - HSG A - undisturbed
*	174	72	Dirt Road - HSG A - undisturbed
	142,335	83	Weighted Average
	53,508		37.59% Pervious Area
	88,827		62.41% Impervious Area

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 10.00 cfs @ 12.09 hrs, Volume= 31,337 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

	Area (sf)	CN	Description
*	56,428	98	Impervious - HSG A
*	19,094	77	Open Space - HSG A
*	14,549	30	Woods and Forest - HSG A - undisturbed
	90,071	83	Weighted Average
	33,643		37.35% Pervious Area
	56,428		62.65% Impervious Area

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 5.16" for 25-YEAR event
Inflow = 4.00 cfs @ 12.08 hrs, Volume= 13,220 cf
Outflow = 1.00 cfs @ 11.91 hrs, Volume= 13,229 cf, Atten= 75%, Lag= 0.0 min
Discarded = 1.00 cfs @ 11.91 hrs, Volume= 13,229 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 96.11' @ 12.46 hrs Surf.Area= 18,000 sf Storage= 2,567 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 11.9 min (788.6 - 776.7)

Volume	Invert	Avail.Storage	Storage Description
#1	95.75'	16,200 cf	**24.00'W x 750.00'L x 2.25'H Prismatoid** 40,500 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**750.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#2	Discarded	95.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.00 cfs @ 11.91 hrs HW=95.77' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 5.31" for 25-YEAR event
Inflow = 42.36 cfs @ 12.08 hrs, Volume= 142,995 cf
Outflow = 1.74 cfs @ 14.98 hrs, Volume= 143,007 cf, Atten= 96%, Lag= 173.5 min
Discarded = 1.56 cfs @ 14.98 hrs, Volume= 133,716 cf
Primary = 0.17 cfs @ 14.98 hrs, Volume= 9,290 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.94' @ 14.98 hrs Surf.Area= 28,006 sf Storage= 77,656 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 439.9 min (1,207.4 - 767.5)

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	108,964 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	19,632	822.0	0	0	19,632
93.00	20,458	829.0	6,614	6,614	20,591
94.00	22,973	847.0	21,703	28,318	23,134
95.00	25,545	866.0	24,248	52,565	25,862
96.00	28,174	885.0	26,849	79,414	28,650
97.00	30,947	904.0	29,550	108,964	31,499

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	93.15'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	96.40'	**30.0' 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
#5	Discarded	92.67'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.56 cfs @ 14.98 hrs HW=95.94' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 1.56 cfs)

Primary OutFlow Max=0.17 cfs @ 14.98 hrs HW=95.94' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.17 cfs of 5.90 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 0.17 cfs @ 7.92 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 4.17" for 25-YEAR event
Inflow = 10.00 cfs @ 12.09 hrs, Volume= 31,337 cf
Outflow = 0.53 cfs @ 14.33 hrs, Volume= 31,340 cf, Atten= 95%, Lag= 134.8 min
Discarded = 0.39 cfs @ 14.33 hrs, Volume= 26,230 cf
Primary = 0.14 cfs @ 14.33 hrs, Volume= 5,111 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 99.72' @ 14.33 hrs Surf.Area= 7,042 sf Storage= 16,330 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 344.0 min (1,149.7 - 805.7)

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	34,920 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
96.90	4,600	0	0	4,600
97.00	4,680	464	464	4,684
98.00	5,499	5,084	5,548	5,541
99.00	6,374	5,931	11,479	6,457
100.00	7,306	6,835	18,314	7,434
101.00	8,294	7,795	26,109	8,471
102.00	9,339	8,811	34,920	9,567

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**12.0" Round RCP_Round 12"** L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	101.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	96.90'	**2.410 in/hr Exfiltration over Surface area**
#4	Primary	97.90'	**2.0" Vert. Low Flow Orifice** C= 0.600
#5	Primary	101.50'	**30.0' 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

Discarded OutFlow Max=0.39 cfs @ 14.33 hrs HW=99.72' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.39 cfs)

Primary OutFlow Max=0.14 cfs @ 14.33 hrs HW=99.72' TW=0.00' (Dynamic Tailwater)
├**1=RCP_Round 12"** (Passes 0.00 cfs of 4.09 cfs potential flow)
│└**2=Orifice/Grate** (Controls 0.00 cfs)
├**4=Low Flow Orifice** (Orifice Controls 0.14 cfs @ 6.35 fps)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 4.17" for 25-YEAR event
Inflow = 15.80 cfs @ 12.09 hrs, Volume= 49,520 cf
Outflow = 3.73 cfs @ 12.49 hrs, Volume= 49,521 cf, Atten= 76%, Lag= 24.0 min
Discarded = 0.55 cfs @ 12.49 hrs, Volume= 34,530 cf
Primary = 3.18 cfs @ 12.49 hrs, Volume= 14,992 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 95.97' @ 12.49 hrs Surf.Area= 9,876 sf Storage= 20,448 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 232.3 min (1,038.0 - 805.7)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	43,368 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	6,773	396.0	0	0	6,773
94.00	7,375	406.0	3,536	3,536	7,442
95.00	8,621	425.0	7,990	11,526	8,765
96.00	9,923	443.0	9,264	20,790	10,082
97.00	11,282	462.0	10,595	31,385	11,523
98.00	12,697	481.0	11,983	43,368	13,025

Device	Routing	Invert	Outlet Devices
#1	Primary	94.50'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	94.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	95.50'	**36.0" W x 21.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	97.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	97.50'	**30.0' 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
#6	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.55 cfs @ 12.49 hrs HW=95.97' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.55 cfs)

Primary OutFlow Max=3.18 cfs @ 12.49 hrs HW=95.97' TW=0.00' (Dynamic Tailwater)
├**1=Culvert** (Passes 3.18 cfs of 3.23 cfs potential flow)
│ ├**2=Orifice/Grate** (Orifice Controls 0.12 cfs @ 5.66 fps)
│ ├**3=Orifice/Grate** (Orifice Controls 3.06 cfs @ 2.19 fps)
│ └**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF21: South Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	517 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	385	80.0	0	0	385
93.67	661	102.0	517	517	716

Summary for Pond SF31: P3 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	619 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.90	416	0	0
97.90	822	619	619

Summary for Pond SF41: P4 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	638 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	363	78.0	0	0	363
94.80	631	100.0	638	638	695

Summary for Pond SF52: North Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	431 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	318	68.0	0	0	318
93.67	554	89.0	431	431	592

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 2.15" for 25-YEAR event
Inflow = 2.43 cfs @ 12.15 hrs, Volume= 9,151 cf
Primary = 2.43 cfs @ 12.15 hrs, Volume= 9,151 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.47" for 25-YEAR event
Inflow = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf
Primary = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.78" for 25-YEAR event
Inflow = 5.68 cfs @ 12.44 hrs, Volume= 41,701 cf
Primary = 5.68 cfs @ 12.44 hrs, Volume= 41,701 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Subcatchment PR-101: undisturbed area

Runoff = 4.90 cfs @ 12.15 hrs, Volume= 17,732 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	27,051	68	Open Space - undisturbed
*	9,290	30	Woods and Forest - undisturbed
*	14,680	72	Dirt Road - undisturbed
	51,021	62	Weighted Average
	51,021		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
0.7	141	0.0455	3.43		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.5	191	Total			

Summary for Subcatchment PR-201: undisturbed area

Runoff = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	13,983	68	Open space - HSG A
*	52,546	30	Woods and Forest - HSG A
*	2,265	72	Dirt Road - HSG A
	68,794	39	Weighted Average
	68,794		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0358	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
1.6	156	0.0108	1.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	206	Total			

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 4.40 cfs @ 12.34 hrs, Volume= 22,201 cf, Depth= 5.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	46,391	68	Open Space, HSG A
*	6,462	79	Open Space - HSG B
*	218	89	Open Space - HSG D
	53,071	69	Weighted Average
	53,071		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	36	0.0200	1.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.23"
2.7	14	0.0100	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.23"
15.3	676	0.0110	0.73		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	210	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.9	936	Total			

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 5.92 cfs @ 12.08 hrs, Volume= 20,033 cf, Depth= 7.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
	24,753	98	Paved parking, HSG A
*	6,003	68	Open Space, HSG A
	30,756	92	Weighted Average
	6,003		19.52% Pervious Area
	24,753		80.48% Impervious Area

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 21.32 cfs @ 12.08 hrs, Volume= 76,630 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

Area (sf)	CN	Description
107,680	98	Roofs, HSG A
107,680		100.00% Impervious Area

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 41.11 cfs @ 12.08 hrs, Volume= 138,012 cf, Depth= 7.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	45,292	68	Open Space - HSG A
*	157,576	98	Paved parking - HSG A
*	12,345	79	Open Space - HSG B
	215,213	91	Weighted Average
	57,637		26.78% Pervious Area
	157,576		73.22% Impervious Area

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 24.93 cfs @ 12.09 hrs, Volume= 79,765 cf, Depth= 6.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	88,827	98	Impervious - HSG A
*	33,775	68	Open Space - HSG A
*	13,112	30	Woods and Forest - HSG A - undisturbed
*	6,447	68	Open Space - HSG A - undisturbed
*	174	72	Dirt Road - HSG A - undisturbed
	142,335	83	Weighted Average
	53,508		37.59% Pervious Area
	88,827		62.41% Impervious Area

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 15.78 cfs @ 12.09 hrs, Volume= 50,476 cf, Depth= 6.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

	Area (sf)	CN	Description
*	56,428	98	Impervious - HSG A
*	19,094	77	Open Space - HSG A
*	14,549	30	Woods and Forest - HSG A - undisturbed
	90,071	83	Weighted Average
	33,643		37.35% Pervious Area
	56,428		62.65% Impervious Area

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 7.82" for 100-YEAR event
Inflow = 5.92 cfs @ 12.08 hrs, Volume= 20,033 cf
Outflow = 1.00 cfs @ 11.79 hrs, Volume= 20,036 cf, Atten= 83%, Lag= 0.0 min
Discarded = 1.00 cfs @ 11.79 hrs, Volume= 20,036 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 96.47' @ 12.54 hrs Surf.Area= 18,000 sf Storage= 5,198 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 27.9 min (794.5 - 766.7)

Volume	Invert	Avail.Storage	Storage Description
#1	95.75'	16,200 cf	**24.00'W x 750.00'L x 2.25'H Prismatoid** 40,500 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**750.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)
#2	Discarded	95.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.00 cfs @ 11.79 hrs HW=95.78' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
└**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 7.98" for 100-YEAR event
Inflow = 62.42 cfs @ 12.08 hrs, Volume= 214,642 cf
Outflow = 16.16 cfs @ 12.44 hrs, Volume= 214,658 cf, Atten= 74%, Lag= 21.6 min
Discarded = 1.67 cfs @ 12.44 hrs, Volume= 158,659 cf
Primary = 14.49 cfs @ 12.44 hrs, Volume= 55,998 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 96.62' @ 12.44 hrs Surf.Area= 29,882 sf Storage= 97,451 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 394.7 min (1,154.1 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	108,964 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	19,632	822.0	0	0	19,632
93.00	20,458	829.0	6,614	6,614	20,591
94.00	22,973	847.0	21,703	28,318	23,134
95.00	25,545	866.0	24,248	52,565	25,862
96.00	28,174	885.0	26,849	79,414	28,650
97.00	30,947	904.0	29,550	108,964	31,499

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	93.15'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	96.40'	**30.0' 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
#5	Discarded	92.67'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.67 cfs @ 12.44 hrs HW=96.62' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 1.67 cfs)

Primary OutFlow Max=14.49 cfs @ 12.44 hrs HW=96.62' TW=0.00' (Dynamic Tailwater)
├**1=Culvert** (Inlet Controls 6.68 cfs @ 8.51 fps)
│ ├**2=Orifice/Grate** (Passes < 0.19 cfs potential flow)
│ └**3=Orifice/Grate** (Passes < 11.84 cfs potential flow)
└**4=Broad-Crested Rectangular Weir** (Weir Controls 7.80 cfs @ 1.18 fps)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 6.72" for 100-YEAR event
Inflow = 15.78 cfs @ 12.09 hrs, Volume= 50,476 cf
Outflow = 0.68 cfs @ 14.97 hrs, Volume= 50,476 cf, Atten= 96%, Lag= 172.8 min
Discarded = 0.48 cfs @ 14.97 hrs, Volume= 39,965 cf
Primary = 0.19 cfs @ 14.97 hrs, Volume= 10,511 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 101.37' @ 14.97 hrs Surf.Area= 8,672 sf Storage= 29,233 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 489.1 min (1,281.4 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	34,920 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
96.90	4,600	0	0	4,600
97.00	4,680	464	464	4,684
98.00	5,499	5,084	5,548	5,541
99.00	6,374	5,931	11,479	6,457
100.00	7,306	6,835	18,314	7,434
101.00	8,294	7,795	26,109	8,471
102.00	9,339	8,811	34,920	9,567

Device	Routing	Invert	Outlet Devices
#1	Primary	97.90'	**12.0" Round RCP_Round 12"** L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	101.80'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	96.90'	**2.410 in/hr Exfiltration over Surface area**
#4	Primary	97.90'	**2.0" Vert. Low Flow Orifice** C= 0.600
#5	Primary	101.50'	**30.0' 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

Discarded OutFlow Max=0.48 cfs @ 14.97 hrs HW=101.37' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.48 cfs)

Primary OutFlow Max=0.19 cfs @ 14.97 hrs HW=101.37' TW=0.00' (Dynamic Tailwater)
├**1=RCP_Round 12"** (Passes 0.00 cfs of 6.52 cfs potential flow)
│└**2=Orifice/Grate** (Controls 0.00 cfs)
├**4=Low Flow Orifice** (Orifice Controls 0.19 cfs @ 8.86 fps)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 6.72" for 100-YEAR event
Inflow = 24.93 cfs @ 12.09 hrs, Volume= 79,765 cf
Outflow = 6.04 cfs @ 12.47 hrs, Volume= 79,768 cf, Atten= 76%, Lag= 23.2 min
Discarded = 0.64 cfs @ 12.47 hrs, Volume= 40,241 cf
Primary = 5.41 cfs @ 12.47 hrs, Volume= 39,526 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 97.08' @ 12.47 hrs Surf.Area= 11,390 sf Storage= 32,278 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 185.2 min (977.6 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	43,368 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	6,773	396.0	0	0	6,773
94.00	7,375	406.0	3,536	3,536	7,442
95.00	8,621	425.0	7,990	11,526	8,765
96.00	9,923	443.0	9,264	20,790	10,082
97.00	11,282	462.0	10,595	31,385	11,523
98.00	12,697	481.0	11,983	43,368	13,025

Device	Routing	Invert	Outlet Devices
#1	Primary	94.50'	**12.0" Round Culvert** L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	94.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	95.50'	**36.0" W x 21.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	97.25'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	97.50'	**30.0' 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
#6	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.64 cfs @ 12.47 hrs HW=97.08' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=5.41 cfs @ 12.47 hrs HW=97.08' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 5.41 cfs @ 6.89 fps)
  └**2=Orifice/Grate** (Passes < 0.17 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 19.10 cfs potential flow)
  └**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF21: South Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	517 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	385	80.0	0	0	385
93.67	661	102.0	517	517	716

Summary for Pond SF31: P3 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	96.90'	619 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.90	416	0	0
97.90	822	619	619

Summary for Pond SF41: P4 Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	93.50'	638 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
93.50	363	78.0	0	0	363
94.80	631	100.0	638	638	695

Summary for Pond SF52: North Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	92.67'	431 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
92.67	318	68.0	0	0	318
93.67	554	89.0	431	431	592

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 4.17" for 100-YEAR event
Inflow = 4.90 cfs @ 12.15 hrs, Volume= 17,732 cf
Primary = 4.90 cfs @ 12.15 hrs, Volume= 17,732 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 1.50" for 100-YEAR event
Inflow = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf
Primary = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 2.41" for 100-YEAR event
Inflow = 24.18 cfs @ 12.43 hrs, Volume= 128,236 cf
Primary = 24.18 cfs @ 12.43 hrs, Volume= 128,236 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

TEC, Inc.
The Engineering Corp
282 Merrimack Street, 2nd Floor
Lawrence, MA 01843
t-978.794.1792

Storm Drainage Computations

Name Burtt Road Development
Client MCP/Howland Burtt Owner, LLC
Subject Proposed Conditions

Proj. No. T1126
Date 8/24/2022
Comp. Definitive
Check

Design Parameters
10 Year Storm
12 "Min. Pipe Size
Project File:

Location in Massachusetts: 1 (1-Boston, 2-Barnstable, 3-Worcester, 4-Springfield, 5-Pittsfield)
Manning's roughness coefficient: 0.013

(NOTE ENTER CELLS AS HIGHLIGHTED IN FIRST ROW)

ENGLISH

Rainfall Data is For Boston

LOCATION FROM DRAINAGE NO.	LOCATION TO DRAINAGE NO.	RAINFALL CONCENTRATION PERIOD IN MINUTES PIPE	RAINFALL CONCENTRATION PERIOD IN MINUTES TOTAL	COMBINED RUNOFF COEFF. C	TRIBUTARY AREA IN ACRES INC	TRIBUTARY AREA IN ACRES TOTAL	C x A INC	C x A TOTAL	RAINFALL INTENSITY (i) IN/HR	PEAK FLOW CFS	PIPE SIZE IN	PIPE n VALUE	PIPE SLOPE FT/FT	PIPE LENGTH FT	PIPE FULL CAPACITY CFS	PIPE FULL VELOCITY FT/S	PIPE PEAK FLOW CONDITIONS VELOCITY FT/S	PIPE PEAK FLOW CONDITIONS d/D	PROFILE INVERT ELEVATION UPPER END	PROFILE INVERT ELEVATION LOWER END	PROFILE RIM ELEVATION & DEPTH OF COVER UPPER RIM	PROFILE RIM ELEVATION & DEPTH OF COVER DEPTH	Qf/Qd
DCB 1	DMH 3		5.00	0.90	0.500	0.500	0.45	0.45	5.40	2.43	12	0.013	0.005	200	2.52	3.2	3.6	0.78	96.42	95.42	100.25	2.83	0.964902947
RD 1	DMH 3		5.00	0.90	1.580	1.580	1.42	1.42	5.40	7.68	18	0.013	0.014	44	12.26	6.9	7.3	0.57	98.00	97.40	102.00	2.50	0.626224046
CB 2	DMH 3		5.00	0.90	0.310	0.310	0.28	0.28	5.40	1.51	12	0.013	0.010	18	3.61	4.6	4.4	0.45	95.60	95.42	100.32	3.72	0.417102791
DMH 3	DMH 5	0.07	5.91			2.390	0.00	2.15	5.40	11.62	24	0.013	0.005	194	16.01	5.1	5.5	0.63	95.32	94.35	100.66	3.34	0.725632433
CB 4	DMH 5		5.00	0.90	0.480	0.480	0.43	0.43	5.40	2.33	12	0.013	0.005	28	2.54	3.2	3.7	0.75	94.49	94.35	98.00	2.51	0.917998977
DMH 5	DMH 8		6.50			2.870	0.00	2.58	5.20	13.43	24	0.013	0.005	187	16.02	5.1	5.7	0.70	94.25	93.31	98.62	2.37	0.838416875
TD-1	DMH 8		5.00	0.90	0.320	0.320	0.29	0.29	5.40	1.56	12	0.013	0.005	97	2.61	3.3	3.5	0.55	93.83	93.31	98.00	3.17	0.595624322
DCB 7	DMH 8		5.00	0.90	0.480	0.480	0.43	0.43	5.40	2.33	12	0.013	0.005	54	2.52	3.2	3.6	0.76	93.58	93.31	97.15	2.57	0.926306829
DMH 8	FES	0.25	7.04			3.670	0.00	3.30	5.00	16.52	30	0.013	0.005	108	29.02	5.9	6.1	0.54	93.21	92.67	98.70	2.99	0.569088859
RD 2	FES		5.00	0.90	2.250	2.250	2.03	2.03	5.40	10.94	18	0.013	0.053	82	24.09	13.6	13.3	0.47	97.00	92.67	101.50	3.00	0.453977199
CB 9	DMH 11		5.00	0.90	0.200	0.200	0.18	0.18	5.40	0.97	12	0.013	0.005	90	2.52	3.2	3.0	0.43	96.29	95.84	100.42	3.13	0.385102532
CB 10	DMH 11		5.00	0.90	0.380	0.380	0.34	0.34	5.40	1.85	12	0.013	0.005	110	2.51	3.2	3.5	0.63	96.39	95.84	101.00	3.61	0.73465835
DMH 11	DMH 14	0.53	5.53			0.580	0.00	0.52	5.40	2.82	18	0.013	0.005	165	7.44	4.2	3.9	0.42	95.74	94.91	101.94	4.70	0.378947145
DCB 12	DMH 14		5.00	0.90	0.600	0.600	0.54	0.54	5.40	2.92	12	0.013	0.005	52	2.51	3.2	3.7	1.00	95.17	94.91	98.30	2.13	1.160663573
DCB 13	DMH 14		5.00	0.90	0.470	0.470	0.42	0.42	5.40	2.28	12	0.013	0.005	88	2.50	3.2	3.6	0.75	95.34	94.91	99.74	3.40	0.914884537
DMH 14	DMH 17	0.40	6.24			1.650	0.00	1.49	5.20	7.72	24	0.013	0.005	215	16.02	5.1	5.0	0.48	94.81	93.73	98.90	2.09	0.482008569
CB 15	DMH 17		5.00	0.90	0.330	0.330	0.30	0.30	5.40	1.60	12	0.013	0.010	46	3.58	4.6	4.4	0.46	93.19	92.73	98.30	4.11	0.448127587
CB 16	DMH 17		5.00	0.90	0.280	0.280	0.25	0.25	5.40	1.36	12	0.013	0.010	43	3.55	4.5	4.2	0.42	94.16	93.73	98.99	3.83	0.3835454
DMH 17	FES		6.96			2.260	0.00	2.03	5.20	10.58	24	0.013	0.005	25	16.23	5.2	5.5	0.58	93.63	93.50	98.99	3.36	0.6515638
DCB 20	FES		5.00	0.90	0.580	0.580	0.52	0.52	5.40	2.82	12	0.013	0.005	132	2.52	3.2	3.6	1.00	97.56	96.90	100.85	2.29	1.119287418
DMH 40	DMH 19		5.00	0.90	0.330	0.330	0.30	0.30	5.40	1.60	12	0.013	0.011	146	3.67	4.7	4.5	0.46	99.15	97.60	102.93	2.78	0.437041974
CB 18	DMH 19		5.00	0.90	0.230	0.230	0.21	0.21	5.40	1.12	12	0.013	0.005	21	2.49	3.2	3.1	0.46	97.70	97.60	101.14	2.44	0.449369298
DMH 19	FES	0.11	5.54			0.560	0.00	0.50	5.40	2.72	12	0.013	0.010	61	3.53	4.5	4.9	0.65	97.50	96.90	101.58	3.08	0.770379544

B

Water Quality Data

TSS Removal Calculation Worksheet

Location: Treatment Train #1

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Infiltration Basin (w/ Sediment Forebay)	**0.80**	**0.75**	**0.60**	**0.15**

Total TSS Removal = **85%**

Project: **Burtt Road**
Prepared By: **TEC, Inc.**
Date: **2/27/2020**

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

TSS Removal Calculation Worksheet

Location: Treatment Train #2

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Infiltration Basin (w/ Sediment Forebay)	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = **80%**

Project: **Burtt Road**
Prepared By: **TEC, Inc.**
Date: **2/27/2020**

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

TSS Removal Calculation Worksheet

Location: Treatment Train #3

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Pervious Pavement	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = **80%**

Project: **Burtt Road**
Prepared By: **TEC, Inc.**
Date: **2/27/2020**

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

Stage-Area-Storage for Pond P1: Pervious Pavement

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
95.75	**18,000**	0	96.33	18,000	4,176
95.76	18,000	72	96.34	18,000	4,248
95.77	18,000	144	96.35	18,000	4,320
95.78	18,000	216	96.36	18,000	4,392
95.79	18,000	288	96.37	18,000	4,464
95.80	18,000	360	96.38	18,000	4,536
95.81	18,000	432	96.39	18,000	4,608
95.82	18,000	504	96.40	18,000	4,680
95.83	18,000	576	96.41	18,000	4,752
95.84	18,000	648	96.42	18,000	4,824
95.85	18,000	720	96.43	18,000	4,896
95.86	18,000	792	96.44	18,000	4,968
95.87	18,000	864	96.45	18,000	5,040
95.88	18,000	936	96.46	18,000	5,112
95.89	18,000	1,008	96.47	18,000	5,184
95.90	18,000	1,080	96.48	18,000	5,256
95.91	18,000	1,152	96.49	18,000	5,328
95.92	18,000	1,224	96.50	18,000	5,400
95.93	18,000	1,296	96.51	18,000	5,472
95.94	18,000	1,368	96.52	18,000	5,544
95.95	18,000	1,440	96.53	18,000	5,616
95.96	18,000	1,512	96.54	18,000	5,688
95.97	18,000	1,584	96.55	18,000	5,760
95.98	18,000	1,656	96.56	18,000	5,832
95.99	18,000	1,728	96.57	18,000	5,904
96.00	18,000	1,800	96.58	18,000	5,976
96.01	18,000	1,872	96.59	18,000	6,048
96.02	18,000	1,944	96.60	18,000	6,120
96.03	18,000	2,016	96.61	18,000	6,192
96.04	18,000	2,088	96.62	18,000	6,264
96.05	18,000	2,160	96.63	18,000	6,336
96.06	18,000	2,232	96.64	18,000	6,408
96.07	18,000	2,304	96.65	18,000	6,480
96.08	18,000	2,376	96.66	18,000	6,552
96.09	18,000	2,448	96.67	18,000	6,624
96.10	18,000	2,520	96.68	18,000	6,696
96.11	18,000	2,592	96.69	18,000	6,768
96.12	18,000	2,664	96.70	18,000	6,840
96.13	18,000	2,736	96.71	18,000	6,912
96.14	18,000	2,808	96.72	18,000	6,984
96.15	18,000	2,880	96.73	18,000	7,056
96.16	18,000	2,952	96.74	18,000	7,128
96.17	18,000	3,024	96.75	18,000	7,200
96.18	18,000	3,096	96.76	18,000	7,272
96.19	18,000	3,168	96.77	18,000	7,344
96.20	18,000	3,240	96.78	18,000	7,416
96.21	18,000	3,312	96.79	18,000	7,488
96.22	18,000	3,384	96.80	18,000	7,560
96.23	18,000	3,456	96.81	18,000	7,632
96.24	18,000	3,528	96.82	18,000	7,704
96.25	18,000	3,600	96.83	18,000	7,776
96.26	18,000	3,672	96.84	18,000	7,848
96.27	18,000	3,744	96.85	18,000	7,920
96.28	18,000	3,816	96.86	18,000	7,992
96.29	18,000	3,888	96.87	18,000	8,064
96.30	18,000	3,960	96.88	18,000	8,136
96.31	18,000	4,032	96.89	18,000	8,208
96.32	18,000	4,104	96.90	18,000	8,280

Stage-Area-Storage for Pond P1: Pervious Pavement (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
96.91	18,000	8,352
96.92	18,000	8,424
96.93	18,000	8,496
96.94	18,000	8,568
96.95	18,000	8,640
96.96	18,000	8,712
96.97	18,000	8,784
96.98	18,000	8,856
96.99	18,000	8,928
97.00	18,000	9,000
97.01	18,000	9,072
97.02	18,000	9,144
97.03	18,000	9,216
97.04	18,000	9,288
97.05	18,000	9,360
97.06	18,000	9,432
97.07	18,000	9,504
97.08	18,000	9,576
97.09	18,000	9,648
97.10	18,000	9,720
97.11	18,000	9,792
97.12	18,000	9,864
97.13	18,000	9,936
97.14	18,000	10,008
97.15	18,000	10,080
97.16	18,000	10,152
97.17	18,000	10,224
97.18	18,000	10,296
97.19	18,000	10,368
97.20	18,000	10,440
97.21	18,000	10,512
97.22	18,000	10,584
97.23	18,000	10,656
97.24	18,000	10,728
97.25	18,000	10,800
97.26	18,000	10,872
97.27	18,000	10,944
97.28	18,000	11,016
97.29	18,000	11,088
97.30	18,000	11,160
97.31	18,000	11,232
97.32	18,000	11,304
97.33	18,000	11,376
97.34	18,000	11,448
97.35	18,000	11,520
97.36	18,000	11,592
97.37	18,000	11,664
97.38	18,000	11,736
97.39	18,000	11,808
97.40	18,000	11,880
97.41	18,000	11,952
97.42	18,000	12,024
97.43	18,000	12,096
97.44	18,000	12,168
97.45	18,000	12,240
97.46	18,000	12,312
97.47	18,000	12,384
97.48	18,000	12,456
97.49	18,000	12,528
97.50	18,000	12,600
97.51	18,000	12,672
97.52	18,000	12,744
97.53	18,000	12,816
97.54	18,000	12,888
97.55	18,000	12,960
97.56	18,000	13,032
97.57	18,000	13,104
97.58	18,000	13,176
97.59	18,000	13,248
97.60	18,000	13,320
97.61	18,000	13,392
97.62	18,000	13,464
97.63	18,000	13,536
97.64	18,000	13,608
97.65	18,000	13,680
97.66	18,000	13,752
97.67	18,000	13,824
97.68	18,000	13,896
97.69	18,000	13,968
97.70	18,000	14,040
97.71	18,000	14,112
97.72	18,000	14,184
97.73	18,000	14,256
97.74	18,000	14,328
97.75	18,000	14,400
97.76	18,000	14,472
97.77	18,000	14,544
97.78	18,000	14,616
97.79	18,000	14,688
97.80	18,000	14,760
97.81	18,000	14,832
97.82	18,000	14,904
97.83	18,000	14,976
97.84	18,000	15,048
97.85	18,000	15,120
97.86	18,000	15,192
97.87	18,000	15,264
97.88	18,000	15,336
97.89	18,000	15,408
97.90	18,000	15,480
97.91	18,000	15,552
97.92	18,000	15,624
97.93	18,000	15,696
97.94	18,000	15,768
97.95	18,000	15,840
97.96	18,000	15,912
97.97	18,000	15,984
97.98	18,000	16,056
97.99	18,000	16,128
98.00	18,000	**16,200**

Lowest Outlet

Stage-Area-Storage for Pond P2: Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
92.67	19,632	0	93.25	21,073	11,806
92.68	19,657	196	93.26	21,098	12,016
92.69	19,682	393	93.27	21,123	12,228
92.70	19,706	590	93.28	21,148	12,439
92.71	19,731	787	93.29	21,172	12,650
92.72	19,756	985	93.30	21,197	12,862
92.73	19,781	1,182	93.31	21,222	13,074
92.74	19,806	1,380	93.32	21,247	13,287
92.75	19,831	1,579	93.33	21,272	13,499
92.76	19,856	1,777	93.34	21,297	13,712
92.77	19,881	1,976	93.35	21,322	13,925
92.78	19,905	2,175	93.36	21,347	14,139
92.79	19,930	2,374	93.37	21,372	14,352
92.80	19,955	2,573	93.38	21,397	14,566
92.81	19,980	2,773	93.39	21,422	14,780
92.82	20,005	2,973	93.40	21,447	14,995
92.83	20,030	3,173	93.41	21,472	15,209
92.84	20,055	3,373	93.42	21,497	15,424
92.85	20,080	3,574	93.43	21,522	15,639
92.86	20,105	3,775	93.44	21,547	15,854
92.87	20,131	3,976	93.45	21,572	16,070
92.88	20,156	4,178	93.46	21,597	16,286
92.89	20,181	4,379	93.47	21,622	16,502
92.90	20,206	4,581	93.48	21,647	16,718
92.91	20,231	4,783	93.49	21,672	16,935
92.92	20,256	4,986	93.50	21,697	17,152
92.93	20,281	5,189	93.51	21,722	17,369
92.94	20,307	5,391	93.52	21,748	17,586
92.95	20,332	5,595	93.53	21,773	17,804
92.96	20,357	5,798	93.54	21,798	18,022
92.97	20,382	6,002	93.55	21,823	18,240
92.98	20,407	6,206	93.56	21,848	18,458
92.99	20,433	6,410	93.57	21,874	18,677
93.00	20,458	6,614	93.58	21,899	18,896
93.01	20,482	6,819	93.59	21,924	19,115
93.02	20,507	7,024	93.60	21,950	19,334
93.03	20,531	7,229	93.61	21,975	19,554
93.04	20,556	7,435	93.62	22,000	19,774
93.05	20,580	7,640	93.63	22,025	19,994
93.06	20,605	7,846	93.64	22,051	20,214
93.07	20,629	8,052	93.65	22,076	20,435
93.08	20,654	8,259	93.66	22,102	20,656
93.09	20,678	8,466	93.67	22,127	20,877
93.10	20,703	8,672	93.68	22,152	21,098
93.11	20,728	8,880	93.69	22,178	21,320
93.12	20,752	9,087	93.70	22,203	21,542
93.13	20,777	9,295	93.71	22,229	21,764
93.14	20,801	9,503	93.72	22,254	21,986
Lowest Outlet 93.15	20,826	9,711	93.73	22,280	22,209
93.16	20,851	9,919	93.74	22,305	22,432
93.17	20,875	10,128	93.75	22,331	22,655
93.18	20,900	10,337	93.76	22,356	22,878
93.19	20,925	10,546	93.77	22,382	23,102
93.20	20,949	10,755	93.78	22,407	23,326
93.21	20,974	10,965	93.79	22,433	23,550
93.22	20,999	11,174	93.80	22,458	23,775
93.23	21,024	11,385	93.81	22,484	23,999
93.24	21,048	11,595	93.82	22,510	24,224

Stage-Area-Storage for Pond P2: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
93.83	22,535	24,450	94.41	24,011	37,949
93.84	22,561	24,675	94.42	24,037	38,189
93.85	22,586	24,901	94.43	24,062	38,429
93.86	22,612	25,127	94.44	24,088	38,670
93.87	22,638	25,353	94.45	24,114	38,911
93.88	22,664	25,580	94.46	24,139	39,152
93.89	22,689	25,806	94.47	24,165	39,394
93.90	22,715	26,033	94.48	24,191	39,636
93.91	22,741	26,261	94.49	24,216	39,878
93.92	22,766	26,488	94.50	24,242	40,120
93.93	22,792	26,716	94.51	24,268	40,363
93.94	22,818	26,944	94.52	24,293	40,605
93.95	22,844	27,172	94.53	24,319	40,848
93.96	22,870	27,401	94.54	24,345	41,092
93.97	22,895	27,630	94.55	24,371	41,335
93.98	22,921	27,859	94.56	24,397	41,579
93.99	22,947	28,088	94.57	24,422	41,823
94.00	22,973	28,318	94.58	24,448	42,068
94.01	22,998	28,548	94.59	24,474	42,312
94.02	23,023	28,778	94.60	24,500	42,557
94.03	23,048	29,008	94.61	24,526	42,802
94.04	23,073	29,239	94.62	24,552	43,048
94.05	23,098	29,470	94.63	24,577	43,293
94.06	23,123	29,701	94.64	24,603	43,539
94.07	23,149	29,932	94.65	24,629	43,785
94.08	23,174	30,164	94.66	24,655	44,032
94.09	23,199	30,395	94.67	24,681	44,278
94.10	23,224	30,628	94.68	24,707	44,525
94.11	23,249	30,860	94.69	24,733	44,773
94.12	23,274	31,093	94.70	24,759	45,020
94.13	23,300	31,325	94.71	24,785	45,268
94.14	23,325	31,559	94.72	24,811	45,516
94.15	23,350	31,792	94.73	24,837	45,764
94.16	23,375	32,026	94.74	24,863	46,013
94.17	23,401	32,259	94.75	24,889	46,261
94.18	23,426	32,494	94.76	24,915	46,510
94.19	23,451	32,728	94.77	24,941	46,760
94.20	23,476	32,963	94.78	24,967	47,009
94.21	23,502	33,197	94.79	24,994	47,259
94.22	23,527	33,433	94.80	25,020	47,509
94.23	23,552	33,668	94.81	25,046	47,759
94.24	23,578	33,904	94.82	25,072	48,010
94.25	23,603	34,140	94.83	25,098	48,261
94.26	23,629	34,376	94.84	25,124	48,512
94.27	23,654	34,612	94.85	25,151	48,763
94.28	23,679	34,849	94.86	25,177	49,015
94.29	23,705	35,086	94.87	25,203	49,267
94.30	23,730	35,323	94.88	25,229	49,519
94.31	23,756	35,560	94.89	25,255	49,771
94.32	23,781	35,798	94.90	25,282	50,024
94.33	23,807	36,036	94.91	25,308	50,277
94.34	23,832	36,274	94.92	25,334	50,530
94.35	23,858	36,513	94.93	25,361	50,784
94.36	23,883	36,751	94.94	25,387	51,037
94.37	23,909	36,990	94.95	25,413	51,291
94.38	23,934	37,229	94.96	25,440	51,546
94.39	23,960	37,469	94.97	25,466	51,800
94.40	23,985	37,709	94.98	25,492	52,055

Stage-Area-Storage for Pond P2: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
94.99	25,519	52,310	95.57	27,028	67,547
95.00	25,545	52,565	95.58	27,054	67,817
95.01	25,571	52,821	95.59	27,081	68,088
95.02	25,596	53,077	95.60	27,107	68,359
95.03	25,622	53,333	95.61	27,133	68,630
95.04	25,648	53,589	95.62	27,160	68,901
95.05	25,673	53,846	95.63	27,186	69,173
95.06	25,699	54,103	95.64	27,213	69,445
95.07	25,725	54,360	95.65	27,239	69,717
95.08	25,751	54,617	95.66	27,266	69,990
95.09	25,776	54,875	95.67	27,292	70,263
95.10	25,802	55,133	95.68	27,319	70,536
95.11	25,828	55,391	95.69	27,345	70,809
95.12	25,854	55,649	95.70	27,372	71,083
95.13	25,879	55,908	95.71	27,398	71,356
95.14	25,905	56,167	95.72	27,425	71,631
95.15	25,931	56,426	95.73	27,451	71,905
95.16	25,957	56,685	95.74	27,478	72,180
95.17	25,983	56,945	95.75	27,505	72,454
95.18	26,009	57,205	95.76	27,531	72,730
95.19	26,035	57,465	95.77	27,558	73,005
95.20	26,061	57,726	95.78	27,585	73,281
95.21	26,086	57,987	95.79	27,611	73,557
95.22	26,112	58,248	95.80	27,638	73,833
95.23	26,138	58,509	95.81	27,665	74,110
95.24	26,164	58,770	95.82	27,691	74,386
95.25	26,190	59,032	95.83	27,718	74,663
95.26	26,216	59,294	95.84	27,745	74,941
95.27	26,242	59,556	95.85	27,771	75,218
95.28	26,268	59,819	95.86	27,798	75,496
95.29	26,294	60,082	95.87	27,825	75,774
95.30	26,320	60,345	95.88	27,852	76,053
95.31	26,346	60,608	95.89	27,879	76,331
95.32	26,372	60,872	95.90	27,905	76,610
95.33	26,398	61,136	95.91	27,932	76,889
95.34	26,424	61,400	95.92	27,959	77,169
95.35	26,451	61,664	95.93	27,986	77,449
95.36	26,477	61,929	95.94	28,013	77,729
95.37	26,503	62,194	95.95	28,039	78,009
95.38	26,529	62,459	95.96	28,066	78,289
95.39	26,555	62,724	95.97	28,093	78,570
95.40	26,581	62,990	95.98	28,120	78,851
95.41	26,607	63,256	95.99	28,147	79,133
95.42	26,633	63,522	96.00	28,174	79,414
95.43	26,660	63,789	96.01	28,201	79,696
95.44	26,686	64,055	96.02	28,228	79,978
95.45	26,712	64,322	96.03	28,255	80,261
95.46	26,738	64,589	96.04	28,282	80,543
95.47	26,765	64,857	96.05	28,310	80,826
95.48	26,791	65,125	96.06	28,337	81,109
95.49	26,817	65,393	96.07	28,364	81,393
95.50	26,843	65,661	96.08	28,391	81,677
95.51	26,870	65,930	96.09	28,418	81,961
95.52	26,896	66,199	96.10	28,445	82,245
95.53	26,922	66,468	96.11	28,473	82,530
95.54	26,949	66,737	96.12	28,500	82,815
95.55	26,975	67,007	96.13	28,527	83,100
95.56	27,001	67,276	96.14	28,554	83,385

Stage-Area-Storage for Pond P2: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
96.15	28,582	83,671
96.16	28,609	83,957
96.17	28,636	84,243
96.18	28,664	84,529
96.19	28,691	84,816
96.20	28,718	85,103
96.21	28,746	85,391
96.22	28,773	85,678
96.23	28,800	85,966
96.24	28,828	86,254
96.25	28,855	86,543
96.26	28,882	86,831
96.27	28,910	87,120
96.28	28,937	87,409
96.29	28,965	87,699
96.30	28,992	87,989
96.31	29,020	88,279
96.32	29,047	88,569
96.33	29,075	88,860
96.34	29,102	89,151
96.35	29,130	89,442
96.36	29,157	89,733
96.37	29,185	90,025
96.38	29,212	90,317
96.39	29,240	90,609
96.40	29,268	90,902
96.41	29,295	91,195
96.42	29,323	91,488
96.43	29,350	91,781
96.44	29,378	92,075
96.45	29,406	92,369
96.46	29,433	92,663
96.47	29,461	92,957
96.48	29,489	93,252
96.49	29,517	93,547
96.50	29,544	93,842
96.51	29,572	94,138
96.52	29,600	94,434
96.53	29,627	94,730
96.54	29,655	95,026
96.55	29,683	95,323
96.56	29,711	95,620
96.57	29,739	95,917
96.58	29,766	96,215
96.59	29,794	96,513
96.60	29,822	96,811
96.61	29,850	97,109
96.62	29,878	97,408
96.63	29,906	97,707
96.64	29,934	98,006
96.65	29,962	98,305
96.66	29,990	98,605
96.67	30,018	98,905
96.68	30,045	99,205
96.69	30,073	99,506
96.70	30,101	99,807
96.71	30,129	100,108
96.72	30,157	100,409
96.73	30,185	100,711
96.74	30,214	101,013
96.75	30,242	101,315
96.76	30,270	101,618
96.77	30,298	101,921
96.78	30,326	102,224
96.79	30,354	102,527
96.80	30,382	102,831
96.81	30,410	103,135
96.82	30,438	103,439
96.83	30,466	103,744
96.84	30,495	104,049
96.85	30,523	104,354
96.86	30,551	104,659
96.87	30,579	104,965
96.88	30,607	105,271
96.89	30,636	105,577
96.90	30,664	105,883
96.91	30,692	106,190
96.92	30,720	106,497
96.93	30,749	106,804
96.94	30,777	107,112
96.95	30,805	107,420
96.96	30,834	107,728
96.97	30,862	108,037
96.98	30,890	108,345
96.99	30,919	108,654
97.00	**30,947**	**108,964**

Stage-Area-Storage for Pond P3: Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
96.90	4,600	0	98.06	5,550	5,879
96.92	4,616	92	98.08	5,567	5,991
96.94	4,632	185	98.10	5,584	6,102
96.96	4,648	277	98.12	5,601	6,214
96.98	4,664	371	98.14	5,618	6,326
97.00	4,680	464	98.16	5,635	6,439
97.02	4,696	558	98.18	5,652	6,552
97.04	4,711	652	98.20	5,669	6,665
97.06	4,727	746	98.22	5,686	6,778
97.08	4,743	841	98.24	5,703	6,892
97.10	4,759	936	98.26	5,720	7,006
97.12	4,775	1,031	98.28	5,737	7,121
97.14	4,791	1,127	98.30	5,755	7,236
97.16	4,807	1,223	98.32	5,772	7,351
97.18	4,823	1,319	98.34	5,789	7,467
97.20	4,839	1,416	98.36	5,807	7,583
97.22	4,855	1,513	98.38	5,824	7,699
97.24	4,871	1,610	98.40	5,841	7,816
97.26	4,887	1,708	98.42	5,859	7,933
97.28	4,903	1,805	98.44	5,876	8,050
97.30	4,919	1,904	98.46	5,893	8,168
97.32	4,935	2,002	98.48	5,911	8,286
97.34	4,951	2,101	98.50	5,928	8,404
97.36	4,967	2,200	98.52	5,946	8,523
97.38	4,983	2,300	98.54	5,963	8,642
97.40	5,000	2,400	98.56	5,981	8,761
97.42	5,016	2,500	98.58	5,999	8,881
97.44	5,032	2,600	98.60	6,016	9,001
97.46	5,049	2,701	98.62	6,034	9,122
97.48	5,065	2,802	98.64	6,052	9,243
97.50	5,081	2,904	98.66	6,069	9,364
97.52	5,098	3,005	98.68	6,087	9,486
97.54	5,114	3,108	98.70	6,105	9,607
97.56	5,131	3,210	98.72	6,122	9,730
97.58	5,147	3,313	98.74	6,140	9,852
97.60	5,163	3,416	98.76	6,158	9,975
97.62	5,180	3,519	98.78	6,176	10,099
97.64	5,197	3,623	98.80	6,194	10,222
97.66	5,213	3,727	98.82	6,212	10,346
97.68	5,230	3,832	98.84	6,230	10,471
97.70	5,246	3,936	98.86	6,248	10,596
97.72	5,263	4,041	98.88	6,266	10,721
97.74	5,280	4,147	98.90	6,284	10,846
97.76	5,296	4,253	98.92	6,302	10,972
97.78	5,313	4,359	98.94	6,320	11,098
97.80	5,330	4,465	98.96	6,338	11,225
97.82	5,347	4,572	98.98	6,356	11,352
97.84	5,364	4,679	99.00	6,374	11,479
97.86	5,380	4,786	99.02	6,392	11,607
97.88	5,397	4,894	99.04	6,410	11,735
Lowest Outlet 97.90	5,414	5,002	99.06	6,428	11,863
97.92	5,431	5,111	99.08	6,446	11,992
97.94	5,448	5,220	99.10	6,464	12,121
97.96	5,465	5,329	99.12	6,482	12,250
97.98	5,482	5,438	99.14	6,501	12,380
98.00	5,499	5,548	99.16	6,519	12,511
98.02	5,516	5,658	99.18	6,537	12,641
98.04	5,533	5,769	99.20	6,555	12,772

Stage-Area-Storage for Pond P4: Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	
93.50	6,773	0	94.08	7,471	4,130	
93.51	6,785	68	94.09	7,483	4,205	
93.52	6,797	136	94.10	7,495	4,279	
93.53	6,808	204	94.11	7,507	4,354	
93.54	6,820	272	94.12	7,519	4,430	
93.55	6,832	340	94.13	7,531	4,505	
93.56	6,844	409	94.14	7,544	4,580	
93.57	6,856	477	94.15	7,556	4,656	
93.58	6,868	546	94.16	7,568	4,731	
93.59	6,879	614	94.17	7,580	4,807	
93.60	6,891	683	94.18	7,592	4,883	
93.61	6,903	752	94.19	7,604	4,959	
93.62	6,915	821	94.20	7,616	5,035	
93.63	6,927	890	94.21	7,629	5,111	
93.64	6,939	960	94.22	7,641	5,188	
93.65	6,951	1,029	94.23	7,653	5,264	
93.66	6,963	1,099	94.24	7,665	5,341	
93.67	6,975	1,169	94.25	7,677	5,417	
93.68	6,987	1,238	94.26	7,690	5,494	
93.69	6,999	1,308	94.27	7,702	5,571	
93.70	7,011	1,378	94.28	7,714	5,648	
93.71	7,023	1,448	94.29	7,726	5,725	
93.72	7,035	1,519	94.30	7,739	5,803	
93.73	7,047	1,589	94.31	7,751	5,880	
93.74	7,059	1,660	94.32	7,763	5,958	
93.75	7,071	1,730	94.33	7,775	6,035	
93.76	7,083	1,801	94.34	7,788	6,113	
93.77	7,095	1,872	94.35	7,800	6,191	
93.78	7,107	1,943	94.36	7,812	6,269	
93.79	7,119	2,014	94.37	7,825	6,347	
93.80	7,131	2,085	94.38	7,837	6,426	
93.81	7,143	2,157	94.39	7,849	6,504	
93.82	7,155	2,228	94.40	7,862	6,583	
93.83	7,167	2,300	94.41	7,874	6,661	
93.84	7,180	2,372	94.42	7,886	6,740	
93.85	7,192	2,443	94.43	7,899	6,819	
93.86	7,204	2,515	94.44	7,911	6,898	
93.87	7,216	2,588	94.45	7,924	6,977	
93.88	7,228	2,660	94.46	7,936	7,057	
93.89	7,240	2,732	94.47	7,949	7,136	
93.90	7,253	2,805	94.48	7,961	7,216	
93.91	7,265	2,877	94.49	7,973	7,295	
93.92	7,277	2,950	94.50	7,986	7,375	Lowest Outlet
93.93	7,289	3,023	94.51	7,998	7,455	
93.94	7,301	3,096	94.52	8,011	7,535	
93.95	7,314	3,169	94.53	8,023	7,615	
93.96	7,326	3,242	94.54	8,036	7,696	
93.97	7,338	3,315	94.55	8,048	7,776	
93.98	7,350	3,389	94.56	8,061	7,857	
93.99	7,363	3,462	94.57	8,073	7,937	
94.00	7,375	3,536	94.58	8,086	8,018	
94.01	7,387	3,610	94.59	8,098	8,099	
94.02	7,399	3,684	94.60	8,111	8,180	
94.03	7,411	3,758	94.61	8,123	8,261	
94.04	7,423	3,832	94.62	8,136	8,342	
94.05	7,435	3,906	94.63	8,149	8,424	
94.06	7,447	3,981	94.64	8,161	8,505	
94.07	7,459	4,055	94.65	8,174	8,587	

Stage-Area-Storage for Pond P4: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
94.66	8,186	8,669	95.24	8,925	13,631
94.67	8,199	8,751	95.25	8,938	13,721
94.68	8,212	8,833	95.26	8,951	13,810
94.69	8,224	8,915	95.27	8,964	13,900
94.70	8,237	8,997	95.28	8,976	13,989
94.71	8,250	9,080	95.29	8,989	14,079
94.72	8,262	9,162	95.30	9,002	14,169
94.73	8,275	9,245	95.31	9,015	14,259
94.74	8,288	9,328	95.32	9,028	14,349
94.75	8,300	9,411	95.33	9,041	14,440
94.76	8,313	9,494	95.34	9,053	14,530
94.77	8,326	9,577	95.35	9,066	14,621
94.78	8,339	9,660	95.36	9,079	14,712
94.79	8,351	9,744	95.37	9,092	14,802
94.80	8,364	9,827	95.38	9,105	14,893
94.81	8,377	9,911	95.39	9,118	14,984
94.82	8,390	9,995	95.40	9,131	15,076
94.83	8,402	10,079	95.41	9,144	15,167
94.84	8,415	10,163	95.42	9,157	15,259
94.85	8,428	10,247	95.43	9,170	15,350
94.86	8,441	10,332	95.44	9,183	15,442
94.87	8,454	10,416	95.45	9,196	15,534
94.88	8,466	10,501	95.46	9,209	15,626
94.89	8,479	10,585	95.47	9,222	15,718
94.90	8,492	10,670	95.48	9,235	15,810
94.91	8,505	10,755	95.49	9,248	15,903
94.92	8,518	10,840	95.50	9,261	15,995
94.93	8,531	10,926	95.51	9,274	16,088
94.94	8,543	11,011	95.52	9,287	16,181
94.95	8,556	11,096	95.53	9,300	16,274
94.96	8,569	11,182	95.54	9,313	16,367
94.97	8,582	11,268	95.55	9,326	16,460
94.98	8,595	11,354	95.56	9,339	16,553
94.99	8,608	11,440	95.57	9,352	16,647
95.00	8,621	11,526	95.58	9,365	16,740
95.01	8,634	11,612	95.59	9,378	16,834
95.02	8,646	11,699	95.60	9,391	16,928
95.03	8,659	11,785	95.61	9,404	17,022
95.04	8,671	11,872	95.62	9,417	17,116
95.05	8,684	11,958	95.63	9,431	17,210
95.06	8,697	12,045	95.64	9,444	17,305
95.07	8,709	12,132	95.65	9,457	17,399
95.08	8,722	12,220	95.66	9,470	17,494
95.09	8,734	12,307	95.67	9,483	17,588
95.10	8,747	12,394	95.68	9,496	17,683
95.11	8,760	12,482	95.69	9,510	17,778
95.12	8,772	12,569	95.70	9,523	17,874
95.13	8,785	12,657	95.71	9,536	17,969
95.14	8,798	12,745	95.72	9,549	18,064
95.15	8,810	12,833	95.73	9,562	18,160
95.16	8,823	12,921	95.74	9,576	18,256
95.17	8,836	13,010	95.75	9,589	18,351
95.18	8,849	13,098	95.76	9,602	18,447
95.19	8,861	13,187	95.77	9,615	18,543
95.20	8,874	13,275	95.78	9,629	18,640
95.21	8,887	13,364	95.79	9,642	18,736
95.22	8,900	13,453	95.80	9,655	18,832
95.23	8,912	13,542	95.81	9,669	18,929

Stage-Area-Storage for Pond P4: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
95.82	9,682	19,026	96.40	10,456	24,866
95.83	9,695	19,123	96.41	10,470	24,970
95.84	9,709	19,220	96.42	10,483	25,075
95.85	9,722	19,317	96.43	10,497	25,180
95.86	9,735	19,414	96.44	10,510	25,285
95.87	9,749	19,512	96.45	10,524	25,390
95.88	9,762	19,609	96.46	10,537	25,495
95.89	9,775	19,707	96.47	10,551	25,601
95.90	9,789	19,805	96.48	10,564	25,706
95.91	9,802	19,903	96.49	10,578	25,812
95.92	9,815	20,001	96.50	10,592	25,918
95.93	9,829	20,099	96.51	10,605	26,024
95.94	9,842	20,197	96.52	10,619	26,130
95.95	9,856	20,296	96.53	10,632	26,236
95.96	9,869	20,394	96.54	10,646	26,343
95.97	9,883	20,493	96.55	10,660	26,449
95.98	9,896	20,592	96.56	10,673	26,556
95.99	9,910	20,691	96.57	10,687	26,663
96.00	9,923	20,790	96.58	10,701	26,770
96.01	9,936	20,890	96.59	10,714	26,877
96.02	9,949	20,989	96.60	10,728	26,984
96.03	9,963	21,088	96.61	10,742	27,091
96.04	9,976	21,188	96.62	10,755	27,199
96.05	9,989	21,288	96.63	10,769	27,306
96.06	10,002	21,388	96.64	10,783	27,414
96.07	10,015	21,488	96.65	10,796	27,522
96.08	10,029	21,588	96.66	10,810	27,630
96.09	10,042	21,689	96.67	10,824	27,738
96.10	10,055	21,789	96.68	10,838	27,847
96.11	10,068	21,890	96.69	10,851	27,955
96.12	10,081	21,990	96.70	10,865	28,064
96.13	10,095	22,091	96.71	10,879	28,172
96.14	10,108	22,192	96.72	10,893	28,281
96.15	10,121	22,294	96.73	10,906	28,390
96.16	10,135	22,395	96.74	10,920	28,499
96.17	10,148	22,496	96.75	10,934	28,609
96.18	10,161	22,598	96.76	10,948	28,718
96.19	10,175	22,699	96.77	10,962	28,828
96.20	10,188	22,801	96.78	10,976	28,937
96.21	10,201	22,903	96.79	10,989	29,047
96.22	10,214	23,005	96.80	11,003	29,157
96.23	10,228	23,107	96.81	11,017	29,267
96.24	10,241	23,210	96.82	11,031	29,377
96.25	10,255	23,312	96.83	11,045	29,488
96.26	10,268	23,415	96.84	11,059	29,598
96.27	10,281	23,518	96.85	11,073	29,709
96.28	10,295	23,621	96.86	11,086	29,820
96.29	10,308	23,724	96.87	11,100	29,931
96.30	10,322	23,827	96.88	11,114	30,042
96.31	10,335	23,930	96.89	11,128	30,153
96.32	10,348	24,033	96.90	11,142	30,264
96.33	10,362	24,137	96.91	11,156	30,376
96.34	10,375	24,241	96.92	11,170	30,487
96.35	10,389	24,344	96.93	11,184	30,599
96.36	10,402	24,448	96.94	11,198	30,711
96.37	10,416	24,552	96.95	11,212	30,823
96.38	10,429	24,657	96.96	11,226	30,935
96.39	10,443	24,761	96.97	11,240	31,048

Stage-Area-Storage for Pond P4: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
96.98	11,254	31,160
96.99	11,268	31,273
97.00	11,282	31,385
97.01	11,296	31,498
97.02	11,309	31,611
97.03	11,323	31,725
97.04	11,337	31,838
97.05	11,351	31,951
97.06	11,365	32,065
97.07	11,378	32,179
97.08	11,392	32,292
97.09	11,406	32,406
97.10	11,420	32,521
97.11	11,434	32,635
97.12	11,447	32,749
97.13	11,461	32,864
97.14	11,475	32,978
97.15	11,489	33,093
97.16	11,503	33,208
97.17	11,517	33,323
97.18	11,531	33,439
97.19	11,544	33,554
97.20	11,558	33,669
97.21	11,572	33,785
97.22	11,586	33,901
97.23	11,600	34,017
97.24	11,614	34,133
97.25	11,628	34,249
97.26	11,642	34,365
97.27	11,656	34,482
97.28	11,670	34,599
97.29	11,684	34,715
97.30	11,698	34,832
97.31	11,712	34,949
97.32	11,726	35,066
97.33	11,740	35,184
97.34	11,754	35,301
97.35	11,768	35,419
97.36	11,782	35,537
97.37	11,796	35,654
97.38	11,810	35,773
97.39	11,824	35,891
97.40	11,838	36,009
97.41	11,852	36,127
97.42	11,866	36,246
97.43	11,880	36,365
97.44	11,894	36,484
97.45	11,908	36,603
97.46	11,923	36,722
97.47	11,937	36,841
97.48	11,951	36,961
97.49	11,965	37,080
97.50	11,979	37,200
97.51	11,993	37,320
97.52	12,007	37,440
97.53	12,022	37,560
97.54	12,036	37,680
97.55	12,050	37,801
97.56	12,064	37,921
97.57	12,078	38,042
97.58	12,093	38,163
97.59	12,107	38,284
97.60	12,121	38,405
97.61	12,135	38,526
97.62	12,149	38,648
97.63	12,164	38,769
97.64	12,178	38,891
97.65	12,192	39,013
97.66	12,207	39,135
97.67	12,221	39,257
97.68	12,235	39,379
97.69	12,249	39,501
97.70	12,264	39,624
97.71	12,278	39,747
97.72	12,292	39,870
97.73	12,307	39,993
97.74	12,321	40,116
97.75	12,335	40,239
97.76	12,350	40,362
97.77	12,364	40,486
97.78	12,379	40,610
97.79	12,393	40,734
97.80	12,407	40,858
97.81	12,422	40,982
97.82	12,436	41,106
97.83	12,451	41,230
97.84	12,465	41,355
97.85	12,479	41,480
97.86	12,494	41,605
97.87	12,508	41,730
97.88	12,523	41,855
97.89	12,537	41,980
97.90	12,552	42,106
97.91	12,566	42,231
97.92	12,581	42,357
97.93	12,595	42,483
97.94	12,610	42,609
97.95	12,624	42,735
97.96	12,639	42,861
97.97	12,653	42,988
97.98	12,668	43,114
97.99	12,682	43,241
98.00	**12,697**	**43,368**

Stage-Area-Storage for Pond P3: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
99.22	6,574	12,903	100.38	7,674	21,160
99.24	6,592	13,035	100.40	7,694	21,313
99.26	6,610	13,167	100.42	7,713	21,467
99.28	6,629	13,299	100.44	7,733	21,622
99.30	6,647	13,432	100.46	7,753	21,777
99.32	6,665	13,565	100.48	7,772	21,932
99.34	6,684	13,699	100.50	7,792	22,088
99.36	6,702	13,833	100.52	7,812	22,244
99.38	6,721	13,967	100.54	7,832	22,400
99.40	6,739	14,101	100.56	7,852	22,557
99.42	6,758	14,236	100.58	7,871	22,714
99.44	6,776	14,372	100.60	7,891	22,872
99.46	6,795	14,507	100.62	7,911	23,030
99.48	6,813	14,644	100.64	7,931	23,188
99.50	6,832	14,780	100.66	7,951	23,347
99.52	6,851	14,917	100.68	7,971	23,506
99.54	6,869	15,054	100.70	7,991	23,666
99.56	6,888	15,192	100.72	8,011	23,826
99.58	6,907	15,330	100.74	8,031	23,986
99.60	6,926	15,468	100.76	8,051	24,147
99.62	6,944	15,607	100.78	8,071	24,308
99.64	6,963	15,746	100.80	8,091	24,470
99.66	6,982	15,885	100.82	8,112	24,632
99.68	7,001	16,025	100.84	8,132	24,795
99.70	7,020	16,165	100.86	8,152	24,957
99.72	7,039	16,306	100.88	8,172	25,121
99.74	7,058	16,447	100.90	8,192	25,284
99.76	7,077	16,588	100.92	8,213	25,448
99.78	7,096	16,730	100.94	8,233	25,613
99.80	7,115	16,872	100.96	8,253	25,778
99.82	7,134	17,014	100.98	8,274	25,943
99.84	7,153	17,157	101.00	8,294	26,109
99.86	7,172	17,300	101.02	8,314	26,275
99.88	7,191	17,444	101.04	8,335	26,441
99.90	7,210	17,588	101.06	8,355	26,608
99.92	7,229	17,732	101.08	8,375	26,775
99.94	7,248	17,877	101.10	8,396	26,943
99.96	7,267	18,022	101.12	8,416	27,111
99.98	7,287	18,168	101.14	8,437	27,280
100.00	7,306	18,314	101.16	8,457	27,449
100.02	7,325	18,460	101.18	8,478	27,618
100.04	7,344	18,607	101.20	8,498	27,788
100.06	7,364	18,754	101.22	8,519	27,958
100.08	7,383	18,901	101.24	8,539	28,129
100.10	7,402	19,049	101.26	8,560	28,299
100.12	7,421	19,197	101.28	8,580	28,471
100.14	7,441	19,346	101.30	8,601	28,643
100.16	7,460	19,495	101.32	8,622	28,815
100.18	7,479	19,644	101.34	8,642	28,988
100.20	7,499	19,794	101.36	8,663	29,161
100.22	7,518	19,944	101.38	8,684	29,334
100.24	7,537	20,095	101.40	8,705	29,508
100.26	7,557	20,246	101.42	8,725	29,682
100.28	7,576	20,397	101.44	8,746	29,857
100.30	7,596	20,549	101.46	8,767	30,032
100.32	7,615	20,701	101.48	8,788	30,208
100.34	7,635	20,854	101.50	8,809	30,384
100.36	7,654	21,006	101.52	8,830	30,560

Stage-Area-Storage for Pond P3: Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
101.54	8,851	30,737
101.56	8,872	30,914
101.58	8,893	31,092
101.60	8,914	31,270
101.62	8,935	31,448
101.64	8,956	31,627
101.66	8,977	31,806
101.68	8,998	31,986
101.70	9,019	32,166
101.72	9,040	32,347
101.74	9,061	32,528
101.76	9,083	32,709
101.78	9,104	32,891
101.80	9,125	33,074
101.82	9,146	33,256
101.84	9,168	33,439
101.86	9,189	33,623
101.88	9,210	33,807
101.90	9,232	33,991
101.92	9,253	34,176
101.94	9,275	34,362
101.96	9,296	34,547
101.98	9,317	34,733
102.00	**9,339**	**34,920**

T0778.01 Riprap Sizing Computation for South Hunt Drainage Outlet

Taken from FHWA Hydraulic Design of Energy Dissipators for Culverts and Channels (Chapter 10) FHWA-NHI-06-086 July 2006

By: J. McIntire - TEC, Inc. 8/24/2022

$$D_{50} = 0.2D\left(\frac{Q}{\sqrt{gD^{2.5}}}\right)^{4/3}\left(\frac{D}{TW}\right)$$

$$D_{50} = riprap\ size\ (ft)$$

$$Q = design\ discharge\ \left(\frac{ft^3}{s}\right)$$

Used 10 year storm peak flow from drainage calculations

$$D = culvert\ diameter\ (ft)$$

$$TW = tailwater\ depth\ (ft)$$

Use 0.4D as minimum

$$g = acceleration\ due\ to\ gravity\ \left(32.2\ \frac{ft}{s^2}\right)$$

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Proposed Outfall – Pond 2

$$D_{50} = 0.2(1.0\ ft)\left(\frac{0.14\ \frac{ft^3}{s}}{\sqrt{(32.2\ \frac{ft}{s^2})(1.0ft)^{2.5}}}\right)^{4/3}\left(\frac{1.0ft}{0.4ft}\right) =$$

$0.04 inches = Class\ 1\ (Table\ 10.1)$ *-> Class 1 min. = 5”*

$Length = 4D = 4(1.0\ ft) = 4.0\ ft$

$Depth = 3.5(D_{50}) = 3.5(5\ in) = 17.5\ inches$

TEC recommends an upsize to 8’ long x 2’ deep.

Proposed Outfall – Pond 3

$$D_{50} = 0.2(1.0ft)\left(\frac{0.0\ \frac{ft^3}{s}}{\sqrt{(32.2\ \frac{ft}{s^2})(1.0ft)^{2.5}}}\right)^{4/3}\left(\frac{1.0ft}{0.4ft}\right) =$$

$0.0\ inches = Class\ 1\ (Table\ 10.1) \rightarrow\ Class\ 1\ min. =\ 5"$

$Length = 4D = 4(1.0\ ft) = 4.0\ ft$

$Depth = 3.5(D_{50}) = 3.5(5\ in) = 17.5\ inches$

TEC recommends an upsize to 8' long x 2' deep.

Proposed Outfall – Pond 4

$$D_{50} = 0.2(1.0\ ft)\left(\frac{0.36\ \frac{ft^3}{s}}{\sqrt{(32.2\ \frac{ft}{s^2})(1.0ft)^{2.5}}}\right)^{4/3}\left(\frac{1.0ft}{0.4ft}\right) =$$

$0.2\ inches = Class\ 1\ (Table\ 10.1) \rightarrow\ Class\ 1\ min. =\ 5"$

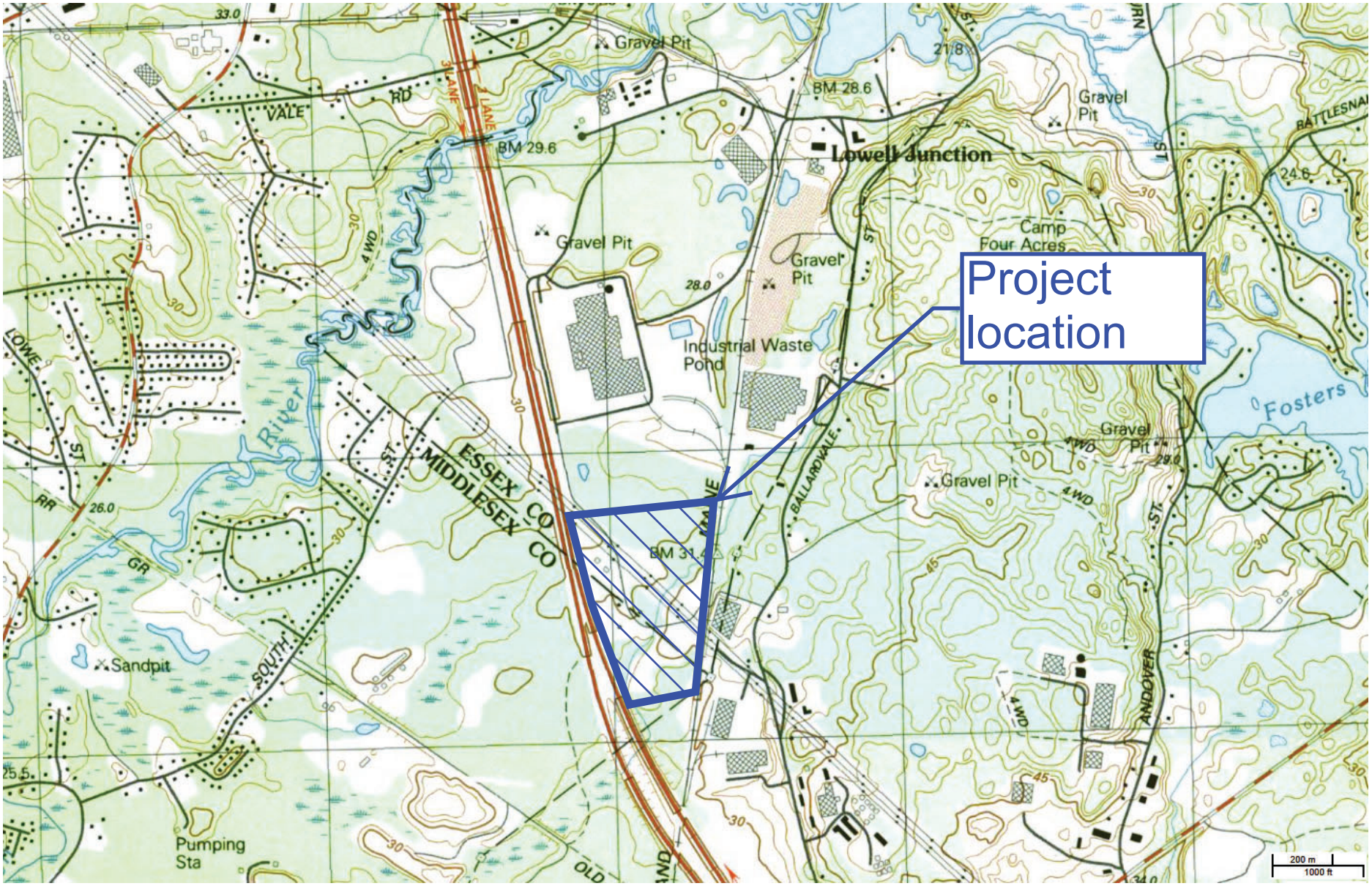
$Length = 4D = 4(1.0\ ft) = 4.0\ ft$

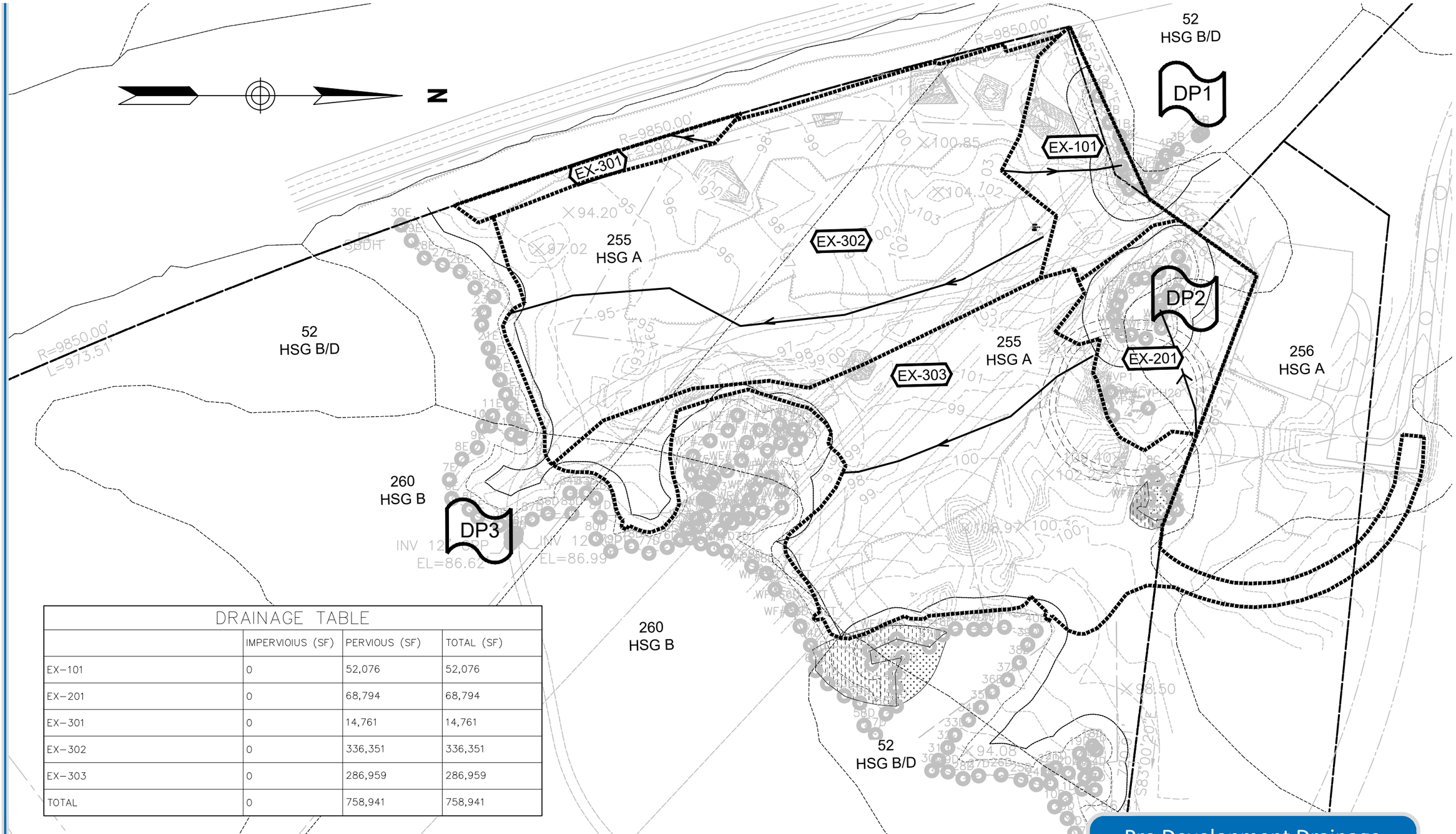
$Depth = 3.5(D_{50}) = 3.5(5\ in) = 17.5\ inches$

TEC recommends an upsize to 8' long x 2' deep.

C

Supporting Figures


Project location
Gravel Pit
BM 29.6
BM 28.6
Lowell Junction
Camp Four Acres
Industrial Waste Pond
Fosters
Sandpit
Pumping Sta
ESSEX CO
MIDDLESEX CO
River
BALLARDVALE
ANDOVER
SOUTH
OLD
200 m
1000 ft



DRAINAGE TABLE			
	IMPERVIOUS (SF)	PERVIOUS (SF)	TOTAL (SF)
EX-101	0	52,076	52,076
EX-201	0	68,794	68,794
EX-301	0	14,761	14,761
EX-302	0	336,351	336,351
EX-303	0	286,959	286,959
TOTAL	0	758,941	758,941

TEC
The Engineering Corp
TEC, Inc.
282 Merrimack St
Lawrence, MA 01843

LEGEND

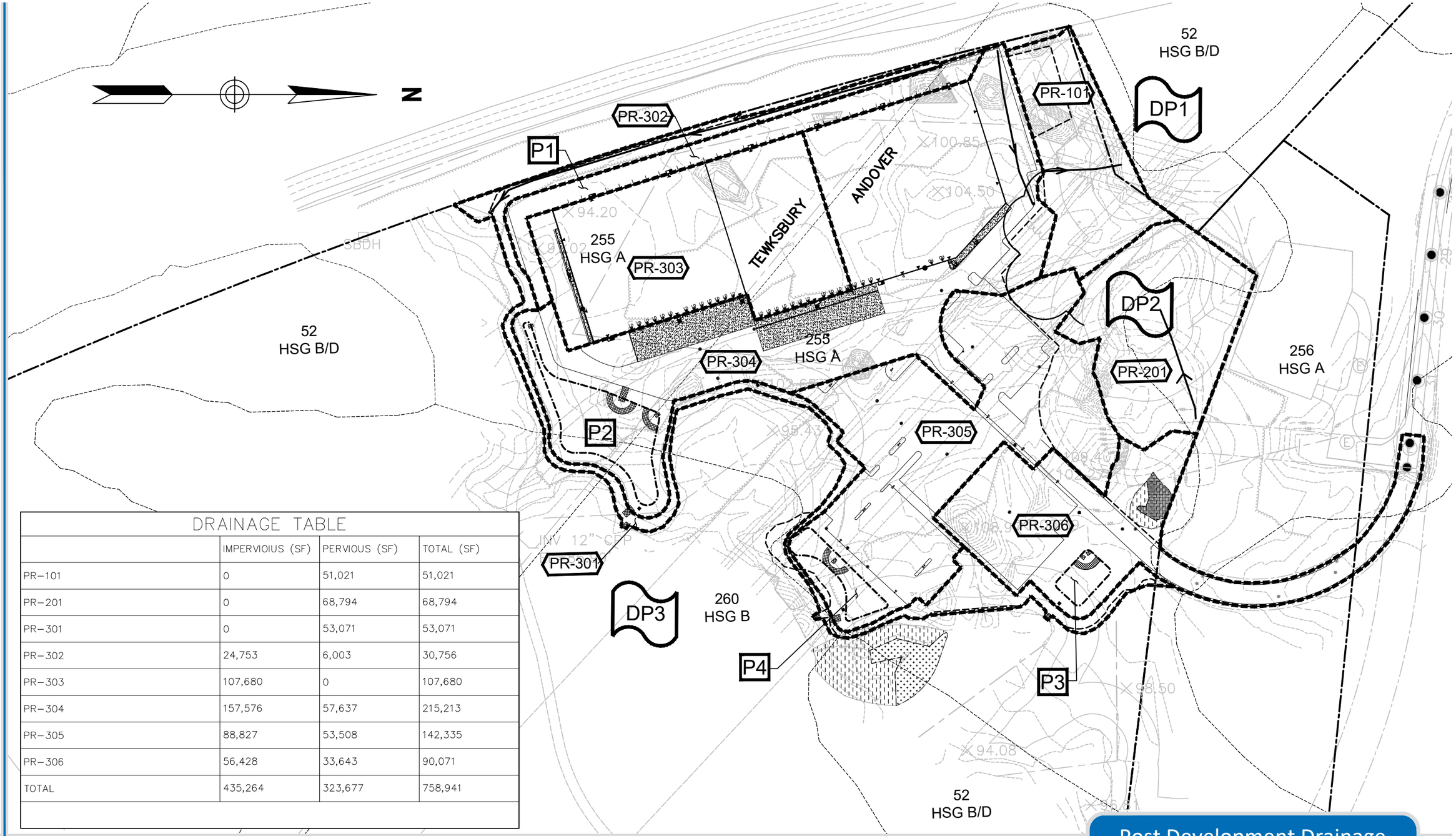
EX-1 SUBCATCHMENT AREA

DP1 DESIGN POINT

DRAINAGE AREA BOUNDARY

Pre Development Drainage

3, 3R, 4 Executive Place
Andover, Massachusetts
Scale: 1" = 100'



DRAINAGE TABLE

	IMPERVIOUS (SF)	PERVIOUS (SF)	TOTAL (SF)
PR-101	0	51,021	51,021
PR-201	0	68,794	68,794
PR-301	0	53,071	53,071
PR-302	24,753	6,003	30,756
PR-303	107,680	0	107,680
PR-304	157,576	57,637	215,213
PR-305	88,827	53,508	142,335
PR-306	56,428	33,643	90,071
TOTAL	435,264	323,677	758,941

TEC
The Engineering Corp
TEC, Inc.
282 Merrimack St
Lawrence, MA 01843

LEGEND

EX-1 SUBCATCHMENT AREA

DP1 DESIGN POINT

DRAINAGE AREA BOUNDARY

Post Development Drainage

3, 3R, 4 Executive Place
Andover, Massachusetts
Scale: 1" = 100'

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part; and Middlesex County, Massachusetts

Burtt Road Extension Site Development project

August 14, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


71° 10' 23" W
71° 9' 46" W
42° 36' 22" N
42° 35' 46" N
321800
321900
322000
322100
322200
322300
322400
322500
4719300
4719200
4719100
4719000
4718900
4718800
4718700
4718600
4718500
4718400
4718300
602
602
255B
255A
602
256A
255B
52A
52A
52A
255B
256A
51A
255B
93
255B
602
260A
255B
602
656
260B
256A
255A
52A
Soil Map may not be valid at this scale.
321700
Map Scale: 1:5,440 if printed on A portrait (8.5" x 11") sheet.
Meters
0
50
100
200
300
N
Feet
0
250
500
1000
1500
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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 14, Sep 7, 2018

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 18, Sep 7, 2018

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
52A	Freetown muck, 0 to 1 percent slopes	11.9	7.5%
255A	Windsor loamy sand, 0 to 3 percent slopes	20.4	12.9%
255B	Windsor loamy sand, 3 to 8 percent slopes	26.2	16.6%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	9.9	6.3%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	14.9	9.4%
602	Urban land	13.7	8.7%
Subtotals for Soil Survey Area		**97.0**	**61.3%**
Totals for Area of Interest		**158.3**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	1.8	1.1%
52A	Freetown muck, 0 to 1 percent slopes	10.7	6.7%
255A	Windsor loamy sand, 0 to 3 percent slopes	0.7	0.5%
255B	Windsor loamy sand, 3 to 8 percent slopes	14.0	8.8%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	10.0	6.3%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	7.3	4.6%
602	Urban land	5.9	3.8%
656	Udorthents-Urban land complex	10.9	6.9%
Subtotals for Soil Survey Area		**61.3**	**38.7%**
Totals for Area of Interest		**158.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic

class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, bogs, marshes, kettles, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Depressions, depressions, marshes, swamps, bogs, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkg
Elevation: 0 to 990 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Outwash terraces, outwash plains, dunes, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material

A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Deerfield, loamy sand

Percent of map unit: 10 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hinckley, loamy sand

Percent of map unit: 5 percent
Landform: Deltas, outwash plains, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Deltas, outwash plains, dunes, outwash terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Kames, deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deerfield

Setting

Landform: Kame terraces, outwash plains, outwash deltas, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand
Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 11.0
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor
Percent of map unit: 7 percent
Landform: Kame terraces, outwash terraces, outwash plains, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Wareham
Percent of map unit: 5 percent
Landform: Depressions, drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sudbury
Percent of map unit: 2 percent
Landform: Outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Ninigret
Percent of map unit: 1 percent
Landform: Kame terraces, outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

260A—Sudbury fine sandy loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: vjsk
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

O - 0 to 1 inches: muck
H2 - 1 to 5 inches: fine sandy loam
H3 - 5 to 21 inches: sandy loam
H4 - 21 to 27 inches: loamy sand
H5 - 27 to 60 inches: Error

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 15 percent
Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

602—Urban land

Map Unit Setting

National map unit symbol: vjx3
Frost-free period: 125 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: No

Charlton

Percent of map unit: 2 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 2 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 2 percent
Hydric soil rating: No

Paxton

Percent of map unit: 2 percent
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Hydric soil rating: No

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Swamps, depressions, depressions, bogs, marshes, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, kettles, depressions, depressions, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkg
Elevation: 0 to 990 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Dunes, deltas, outwash terraces, outwash plains
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Deerfield, loamy sand

Percent of map unit: 10 percent
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hinckley, loamy sand

Percent of map unit: 5 percent
Landform: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Outwash terraces, deltas, outwash plains, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand

Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deerfield

Setting

Landform: Outwash terraces, outwash deltas, outwash plains, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand
Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 11.0
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent
Landform: Outwash terraces, kame terraces, outwash deltas, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Wareham

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent
Landform: Kame terraces, outwash deltas, outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent
Landform: Kame terraces, outwash plains, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 27 inches: loamy sand
H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Depressions, terraces, deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Terraces, deltas, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 40 percent
Urban land: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

NOTES TO USERS

is for use in administering the National Flood Insurance Program. It does ssarily identify all areas subject to flooding, particularly from local drainage f small size. The **community map repository** should be consulted for pdated or additional flood hazard information.

more detailed information in areas where **Base Flood Elevations** (BFEs) **odways** have been determined, users are encouraged to consult the Flood nd Floodway Data and/or Summary of Stillwater Elevations tables contained Flood Insurance Study (FIS) Report that accompanies this FIRM. Users e aware that BFEs shown on the FIRM represent rounded whole-foot . These BFEs are intended for flood insurance rating purposes only and t be used as the sole source of flood elevation information. Accordingly, ation data presented in the FIS Report should be utilized in conjunction with for purposes of construction and/or floodplain management.

Base Flood Elevations shown on this map apply only landward of 0.0' erican Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be t coastal flood elevations are also provided in the Summary of Stillwater s table in the Flood Insurance Study Report for this jurisdiction. Elevations the Summary of Stillwater Elevations table should be used for construction odplain management purposes when they are higher than the elevations this FIRM.

es of the **floodways** were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with requirements of the National Flood Insurance Program. Floodway widths pertinent floodway data are provided in the Flood Insurance Study Report isdiction.

eas not in Special Flood Hazard Areas may be protected by **flood control s**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance ort for information on flood control structures for this jurisdiction.

ction used in the preparation of this map was Massachusetts State Plane Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 Differences in datum, spheroid, projection or UTM zones used in the n of FIRMs for adjacent jurisdictions may result in slight positional s in map features across jurisdiction boundaries. These differences do not accuracy of this FIRM.

vations on this map are referenced to the North American Vertical Datum of ese flood elevations must be compared to structure and ground elevations d to the same **vertical datum**. For information regarding conversion the National Geodetic Vertical Datum of 1929 and the North American Datum of 1988, visit the National Geodetic Survey website at w.ngs.noaa.gov or contact the National Geodetic Survey at the following

rmation Services
NGS12
Geodetic Survey
#9202
-West Highway
ing, Maryland 20910-3282
-3242

current elevation, description, and/or location information for **bench marks** this map, please contact the Information Services Branch of the National Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

information shown on this FIRM was derived from digital orthophotography by the Massachusetts Geographic Information System. This information was om photography dated 2005.

e baselines depicted on this map represent the hydraulic modeling baselines n the flood profiles in the FIS report. As a result of improved topographic data, **e baseline**, in some cases, may deviate significantly from the channel or appear outside the SFHA.

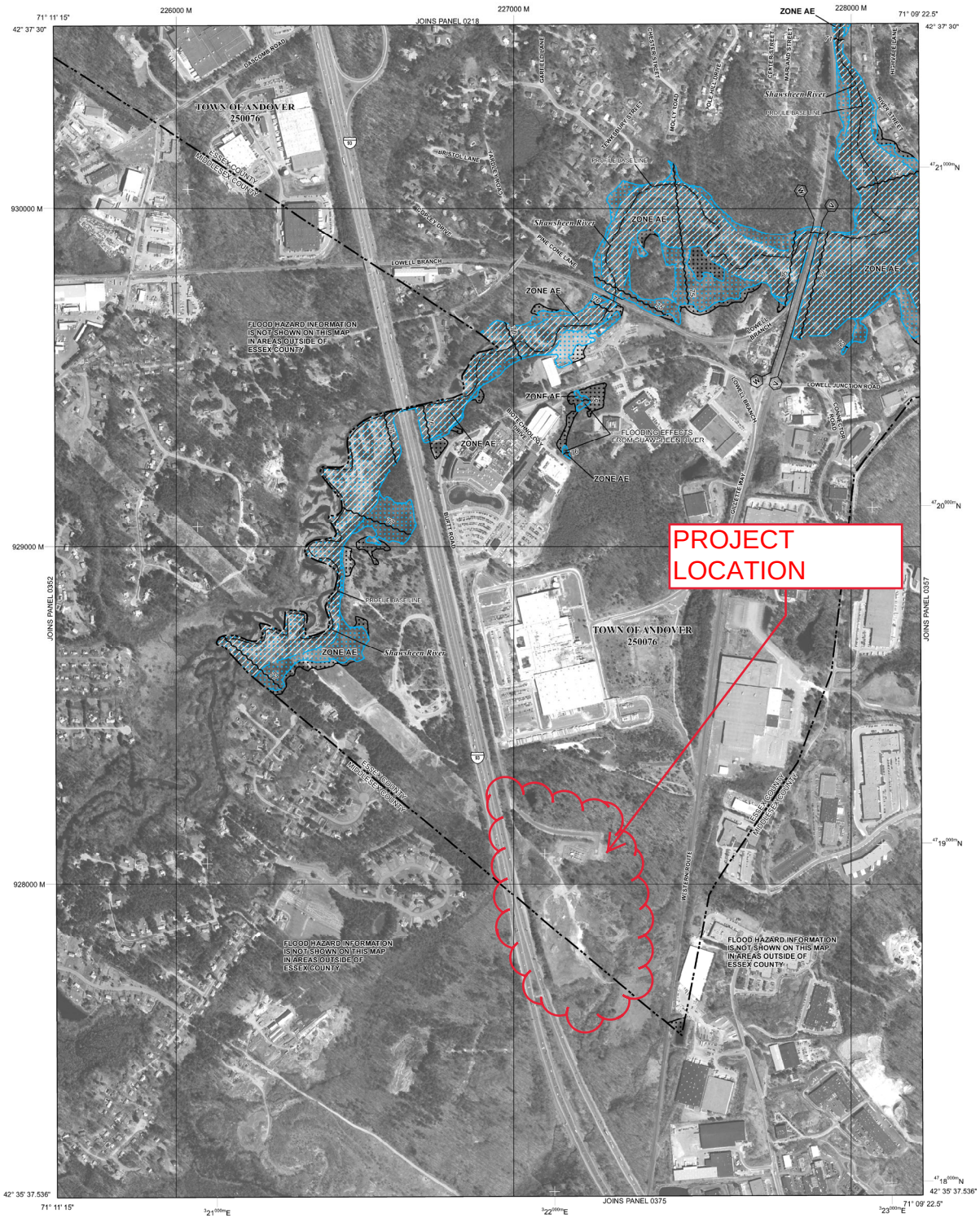
n updated topographic information, this map reflects more detailed and **stream channel configurations and floodplain delineations** than own on the previous FIRM for this jurisdiction. As a result, the Flood and Floodway Data tables for multiple streams in the Flood Study Report (which contains authoritative hydraulic data) may reflect annel distances that differ from what is shown on the map. Also, the loodplain relationships for unrevised streams may differ from what is previous maps.

e limits shown on this map are based on the best data available at the time tion. Because changes due to annexations or de-annexations may have after this map was published, map users should contact appropriate y officials to verify current corporate limit locations.

fer to the separately printed **Map Index** for an overview map of the owing the layout of map panels; community map repository addresses; sting of Communities table containing National Flood Insurance Program each community as well as a listing of the panels on which each community .

mation on available products associated with this FIRM visit the **Map Center (MSC)** website at http://msc.fema.gov. Available products may reviously issued Letters of Map Change, a Flood Insurance Study Report, igital versions of this map. Many of these products can be ordered or irectly from the MSC website.

ve **questions about this map,** how to order products, or the National surance Program in general, please call the **FEMA Map Information e (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazar include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-s elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood El determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); av depths determined. For areas of alluvial fan flooding, velocities also d

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual ch flood by a flood control system that was subsequently decertified. Zo AR indicates that the former flood control system is being restored to protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations deter

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood El determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be k encroachment so that the 1% annual chance flood can be carried without substantial inc flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood wi average depths of less than 1 foot or with drainage areas less than 1 squ mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Are

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and bo dividing Special Flood Hazard Areas of different Base Flood flood depths, or flood velocities.

513 (EL 987) Base Flood Elevation line and value; elevation in feet*

Base Flood elevation value where uniform within zone; ele feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line

23 — 23 Transect line

Culvert

Bridge

43° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American 1983 (NAD 83) Western Hemisphere

4989000 M 1000-meter ticks: Massachusetts State Plane Mainland Zon (FIPS Zone 2001), Lambert Conformal Conic projection

4989000 mN 1000-meter Universal Transverse Mercator grid values, zon

DX5510 × Bench mark (see explanation in Notes to Users section of t panel)

•M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 3, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Commun Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance a or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0356F

FIRM

FLOOD INSURANCE RATE M

ESSEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 356 OF 600

(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
ANDOVER, TOWN OF	250076	0356

Notice to User: The **Map Number** sho should be used when placing map or **Community Number** shown above s used on insurance applications for the community.

MAP NU 25009C

EFFECTIVE JULY 3

Federal Emergency Management

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.167 degrees West
Latitude	42.600 degrees North
Elevation	0 feet
Date/Time	Mon, 11 Nov 2019 14:44:08 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.42	0.52	0.69	0.86	1.08	**1yr**	0.74	1.02	1.26	1.60	2.04	2.62	2.85	**1yr**	2.32	2.74	3.18	3.86	4.51	**1yr**
2yr	0.34	0.52	0.65	0.86	1.08	1.36	**2yr**	0.93	1.25	1.58	1.98	2.50	3.15	3.48	**2yr**	2.79	3.34	3.86	4.58	5.22	**2yr**
5yr	0.40	0.62	0.78	1.05	1.34	1.71	**5yr**	1.16	1.56	2.00	2.52	3.18	4.00	4.44	**5yr**	3.54	4.27	4.89	5.81	6.56	**5yr**
10yr	0.45	0.71	0.90	1.22	1.59	2.04	**10yr**	1.37	1.85	2.39	3.03	3.81	4.80	5.34	**10yr**	4.24	5.14	5.86	6.95	7.81	**10yr**
25yr	0.54	0.85	1.08	1.49	1.98	2.58	**25yr**	1.71	2.32	3.02	3.85	4.86	6.10	6.83	**25yr**	5.40	6.57	7.44	8.83	9.83	**25yr**
50yr	0.60	0.97	1.24	1.74	2.35	3.09	**50yr**	2.03	2.76	3.64	4.64	5.85	7.32	8.24	**50yr**	6.48	7.92	8.91	10.58	11.70	**50yr**
100yr	0.69	1.12	1.44	2.04	2.78	3.68	**100yr**	2.40	3.28	4.35	5.55	7.01	8.78	9.93	**100yr**	7.77	9.55	10.68	12.68	13.93	**100yr**
200yr	0.79	1.28	1.67	2.39	3.30	4.40	**200yr**	2.85	3.90	5.21	6.67	8.43	10.55	11.98	**200yr**	9.33	11.52	12.80	15.21	16.60	**200yr**
500yr	0.95	1.56	2.03	2.95	4.14	5.56	**500yr**	3.57	4.90	6.61	8.49	10.75	13.44	15.36	**500yr**	11.90	14.77	16.28	19.34	20.94	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.46	0.61	0.75	0.86	**1yr**	0.65	0.84	1.14	1.39	1.71	2.40	2.44	**1yr**	2.12	2.35	2.76	3.45	4.07	**1yr**
2yr	0.32	0.50	0.61	0.83	1.03	1.23	**2yr**	0.89	1.20	1.41	1.86	2.39	3.04	3.35	**2yr**	2.69	3.22	3.72	4.42	5.06	**2yr**
5yr	0.38	0.58	0.72	0.99	1.26	1.47	**5yr**	1.08	1.44	1.67	2.17	2.78	3.65	4.05	**5yr**	3.23	3.90	4.50	5.33	6.06	**5yr**
10yr	0.42	0.64	0.79	1.11	1.43	1.68	**10yr**	1.24	1.64	1.91	2.45	3.12	4.19	4.64	**10yr**	3.71	4.46	5.16	6.10	6.94	**10yr**
25yr	0.48	0.73	0.91	1.30	1.71	1.99	**25yr**	1.47	1.94	2.26	2.86	3.63	5.00	5.56	**25yr**	4.43	5.35	6.21	7.29	8.30	**25yr**
50yr	0.53	0.81	1.01	1.44	1.94	2.27	**50yr**	1.68	2.22	2.56	3.23	4.08	5.71	6.38	**50yr**	5.05	6.14	7.16	8.31	9.48	**50yr**
100yr	0.59	0.90	1.12	1.62	2.23	2.58	**100yr**	1.92	2.52	2.91	3.65	4.58	6.51	7.34	**100yr**	5.76	7.05	8.26	9.47	10.85	**100yr**
200yr	0.66	1.00	1.27	1.83	2.56	2.93	**200yr**	2.21	2.87	3.29	4.12	5.17	7.40	8.44	**200yr**	6.55	8.12	9.52	10.73	12.39	**200yr**
500yr	0.78	1.15	1.48	2.16	3.07	3.48	**500yr**	2.65	3.40	3.89	4.85	6.06	8.73	10.17	**500yr**	7.72	9.78	11.50	12.60	14.75	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.47	0.57	0.77	0.95	1.11	**1yr**	0.82	1.08	1.28	1.69	2.17	2.79	3.12	**1yr**	2.47	3.00	3.43	4.16	4.91	**1yr**
2yr	0.35	0.54	0.67	0.91	1.12	1.32	**2yr**	0.96	1.29	1.52	2.00	2.56	3.27	3.63	**2yr**	2.89	3.49	4.01	4.77	5.41	**2yr**
5yr	0.44	0.68	0.84	1.15	1.46	1.72	**5yr**	1.26	1.68	1.98	2.56	3.25	4.35	4.85	**5yr**	3.85	4.66	5.34	6.31	7.09	**5yr**
10yr	0.53	0.82	1.01	1.42	1.83	2.10	**10yr**	1.58	2.06	2.42	3.10	3.90	5.40	6.05	**10yr**	4.78	5.81	6.61	7.83	8.69	**10yr**
25yr	0.69	1.05	1.31	1.87	2.46	2.75	**25yr**	2.12	2.69	3.18	3.99	4.95	7.21	8.11	**25yr**	6.38	7.80	8.79	10.43	11.42	**25yr**
50yr	0.83	1.27	1.58	2.27	3.06	3.38	**50yr**	2.64	3.31	3.91	4.83	5.95	8.99	10.14	**50yr**	7.95	9.75	10.87	12.99	14.04	**50yr**
100yr	1.02	1.54	1.94	2.80	3.83	4.15	**100yr**	3.31	4.05	4.81	5.85	7.14	11.22	12.67	**100yr**	9.93	12.19	13.49	16.20	17.28	**100yr**
200yr	1.24	1.87	2.37	3.43	4.79	5.09	**200yr**	4.13	4.98	5.92	7.08	8.56	14.02	15.85	**200yr**	12.41	15.24	16.72	20.19	21.29	**200yr**
500yr	1.62	2.42	3.11	4.51	6.42	6.69	**500yr**	5.54	6.54	7.81	9.13	10.91	18.85	21.31	**500yr**	16.68	20.49	22.22	27.06	28.07	**500yr**

Powered by ACIS Northeast Regional Climate Center

D

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

BURTT ROAD DEVELOPMENT

3, 3R, 4 Executive Road

ANDOVER, MASSACHUSETTS

Prepared for: **MCP/Howland Burtt Owner, LLC**
260 Franklin St.
Boston, MA 02110

Prepared by: **TEC, Inc.**
282 Merrimack St, Floor 2
Lawrence MA, 01843

August 28, 2019
Revised August 30, 2022

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN
August 28, 2019

Name of Applicant: MCP/Howland Burtt Owner, LLC
Name of Facility: Burtt Road Development
Location: Burtt Road Extension
Andover, MA 01810

Good Housekeeping BMPs

Goals

Minimize the potential for contaminants to enter or runoff the site during construction activities. Fuel and other equipment related fluids will be properly stored. The Contractor shall establish secure storage areas that collect any spillage to meet requirements of the Town of Andover Fire Department regarding the storage of flammable materials. The Contractor shall complete and submit the plans to the Engineer.

General Requirements

The following presents a proactive approach to all of the best management practices, erosion and sedimentation controls, mitigation measures, and monitoring activities for this Project.

Compost Filter Sock

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. The filter sock can be used in place of a traditional sediment and erosion control tool such as a silt fence or straw bale barrier.

Compost filter socks are flexible and can be placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Filter socks can also be used on pavement as inlet protection for storm drains and to slow water flow in small ditches. Filter socks used for erosion control are usually 12 inches in diameter, although 8 inch, 18 inch, and 24 inch– diameter socks are used in some applications. The smaller, 8 inch–diameter filter socks are commonly used for stormwater inlet protection. The outer shell of a compost filter sock is typically biodegradable and can remain on pervious surfaces post construction versus having to be removed as construction waste.

Temporary Stabilized Construction Vehicle Entrance/Exit

The purpose of stabilized entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. Installing a pad of gravel over filter cloth where construction traffic leaves a site can help stabilize a construction entrance. As a vehicle drives over the pad, the pad removes mud and sediment from the wheels and reduces soil transport off the site. The filter cloth separates the gravel from the soil below, keeping the gravel from being ground into the soil. The fabric also reduces the amount of rutting caused by vehicle tires. It spreads the vehicle's weight over a soil area larger than the tire width.

Storm Drain Inlet Protection
Storm drain inlet protection measures prevent soil and debris from entering storm drain inlets. These measures will be implemented before the Site is disturbed by using silt sacks, compost filter socks, or staked bales in combination with silt fence. Storm drain inlet protection will be installed at all down gradient catch basins adjacent to the project site outside the protection of other erosion control barriers, all catch basins within the construction site, and at low points within the construction site that are connected to the storm drainage system.

General Maintenance
Refer to the Inspection and Maintenance Checklist (at the end of this section) identifying inspection and maintenance measures for each specific practice.

The contractor or subcontractor will be responsible for implementing each control shown on the Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

The onsite contractor will inspect all sediment and erosion control structures weekly and after each rainfall event meeting the minimum requirements as defined in the Plan. Records of the inspections will be prepared and maintained onsite by the contractor as required by the Plan.

- Silt shall be removed from behind barriers if greater than 6-inches deep or as needed.
- Damaged or deteriorated items will be repaired immediately after identification.
- The underside of straw bales should be kept in close contact with the earth and reset as necessary.
- Sediment that is collected in structures shall be disposed of properly and covered if stored onsite.
- At a minimum establish good housekeeping BMPs for:
    - Material handling and waste management
    - Staging areas
    - Designate washout areas
    - Equipment vehicle fueling and maintenance
    - Spill prevention and control

Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Spill Prevention and Control

The Contractor will actively maintain and manage the site activities with the procedures outlined in this Plan. In the event of petroleum or other deleterious substance spill, action will be taken by the Contractor to contain and remove the spill. The Contractor will comply with the relevant section(s) of the Oil Pollution Prevention Act, 40 CFR 112.7.

Responsibility

All project personnel share the responsibility for the initial control and reporting of the oil and other substance spill, especially the personnel that first discover the spill. The Site Safety and Health Officer (SSHO) will be responsible for determining the necessary safety equipment and for establishing safety practices to be followed by the Contractor during the clean-up operations. All personnel will be trained in the use of and location of this equipment, prior to the commencement of the construction.

The Contractor's goal is to provide effective, efficient and coordinated action to minimize or mitigate damages to the environment and public health and welfare from oil or other substance discharges, conforming to applicable federal, state, and local regulations, as well as other provisions and restrictions. In the event of spills or releases that may occur during the Project, a representative on-site qualified by OSHA training requirements (29 CFR 1910.120) for a Level 3 Hazmat Technician will be provided and will have the responsibility and authority for supervising the cleanup. If the representative determines that the clean up operations are beyond the capacity of the Contractor, assistance shall be requested from its Subcontractor.

In the event of an emergency spill, the Contractor will be responsible for retaining the environmental Subcontractor. The selected environmental subcontractor will develop a Hazardous Materials Health and Safety Plan, which will be referenced when a spill or release is discovered, and the control of the spill or release is beyond the scope of the Spill Prevention Control and Countermeasure plan. The Contractor's Project Manager is responsible for giving the SSHO directions for initiating the Hazardous Materials Health and Safety Plan.

Alert and reporting procedures will become effective immediately upon observance and indication of a spill or discharge of oil or other substances on the project.

Reportable observations are:

1. Leaks or spills
2. Soils which are discolored or have an odor
3. Discharge of oil or other similar substances from drain pipes

The Engineer will be informed immediately of all substantial spills, releases, or other substance discharges. All telephone numbers for the Emergency Response agencies will be posted on site. The Contractor or its Subcontractors will implement control and countermeasures immediately.

Fuel and Oil Delivery Trucks

The equipment superintendent or designee will monitor all truck unloading procedures to verify all hoses are tight and do not leak, and if necessary, will tighten, adjust, or replace them to prevent a release of any kind. In the event of a major spill, alert and initial report procedures will be implemented, and an emergency response contractor will be called in to perform the cleanup.

Equipment

Motorized equipment that require fuel and oil to operate will be inspected prior to the start of each work shift by the operator (in the field) to ensure there is no leakage of oil, fuel, or other material. Trucks will be inspected prior to use for potential leaks or drips. If a leak is found, repairs will be made immediately, and spillage will be cleaned up manually using sorbent material. Vehicles that are found to be leaking will be immediately taken out of service until repairs can be made.

Drum Storage

Drum storage, if any, will be located in a secure area within the Project limits away from environmental areas of concern. Petroleum liquids and other substances stored in drums will be kept in a drum container that consists of a drum rack and drip containment pan that is capable of containing 110% of the stored volume should the drum rupture.

Lubrication / Oil Maintenance

Replacement lubrication will be directly deposited from the lubrication truck to the equipment lubrication reservoir. No other container system will be used to transport oil to the equipment. Mobile equipment will be serviced off site or in the lay-down area. Equipment that cannot be moved will be serviced in the field. The Contractor will place a containment pan or absorbent below the service area prior to initiating service activities in the field. Waste disposal will be completed by the Contractor or by a waste disposal firm. Miscellaneous lubricants for operating equipment will be limited to daily quantities.

Spent Oil

Oil that has already been used on the job will be disposed of via a certified waste disposal firm. Spent oil will be stored in a labeled (hazardous waste signs) and vented fuel storage cell located at the staging area awaiting disposal by a certified waste disposal firm (i.e. Enpro, Inc.). The staging area will be located within the boundary of the project and inspected daily for leaks or spills. The storage cell will be bermed to contain 110% of the largest container or 10% of the total volume in storage, whichever is greater.

Special Oil Spill Equipment

Sorbent Pads

Sorbent pads will be available to absorb oil and petroleum compounds. If necessary, the pads will be used to absorb oil spills or leaks by placing them on the oil and giving them antiquated time to absorb it. The sorbent pads will be stored in equipment box located in the maintenance area. The pads shall float and be water repellent, so they can absorb oil on water. Saturated/contaminated pads will be placed in an appropriate container and stored within the maintenance area. A certified waste disposal firm will dispose of the approved containers.

Sorbent Compound

The compound will be used for contaminants spilled on decks or hard surfaces. In most cases, it can be applied directly to spills, but if the spill is large, it can be used to form a dike around the spill to prevent further migration.

Best Management Practices – Maintenance/Evaluation Checklist
Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed ☐yes ☐no (List Items)	Date of Cleaning/Repair	Performed by
Compost Filter Sock	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• Ensure that compost filter sock is intact and the area behind the sock is not filled with sediment. If there is excessive ponding behind the filter sock or accumulated sediments reach the top of the sock, an additional sock should be added on top or in front of the existing filter sock in these areas, without disturbing the soil or accumulated sediment. • If the filter sock was overtopped during a storm event, the operator should consider installing an additional filter sock on top of the original, placing an additional filter sock further up the slope.			
Catch Basin Inlet Protection	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• Check all temporary control measures after each storm event. • To maintain the capacity, remove accumulated sediment when the capacity is reduced by half.			
Stabilized Construction Exit	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• The exit shall be maintained in a condition that will prevent tracking of sediment onto public rights-of-way. • When the control pad becomes ineffective, the stone shall be removed along with the collected soil material and redistributed on site in a stable manner. The entrance should then be reconstructed. • The contractor shall sweep or wash pavement at exits, which have experienced mud-tracking on to the pavement or traveled way. • When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. • All sediment shall be prevented from entering storm drains, ditches, or waterways			

E

Operation & Maintenance Plan

STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE PLAN

Burtt Road Development

Burtt Road, Andover, MASSACHUSETTS

Prepared for:

MCP/Howland Burtt Owner, LLC
260 Franklin St.
Boston, MA 02110

Prepared by:

TEC, Inc.
282 Merrimack St, Floor 2
Lawrence MA, 01843

August 28, 2019
Revised November 12, 2019
Revised February 27, 2020
Revised January 19, 2021
Revised August 30, 2022
Revised September 27, 2022

Stormwater Management Operation and Maintenance Plan
January 19, 2021

Name of Applicant: **MCP/Howland Burtt Owner, LLC**
Name of Facility: **Burtt Road Development**
Location: **Burtt Road, Andover, MA 01810**

A detailed, written log of all scheduled preventative and corrective maintenance performed for the stormwater management measures must be kept on site, including a record of all inspections and copies of maintenance-related work orders.
Attachment 1, "Inspection and Maintenance Check List" shall be maintained as a record of regularly scheduled inspection and maintenance items as outlined below for every year. Maintenance required and actions taken shall be recorded in Attachment 2, Inspection and Maintenance Log". The funding, operation, and maintenance of all stormwater management Best Management Practices (BMPs) shall be provided by MCP/Howland Burtt Owner, LLC or their appointee.

Maintenance routine and schedule: Routine inspections will be conducted on a monthly basis and thorough investigations will be conducted twice a year. Tasks that are common to all systems include regular removal of accumulated sediments, floatables and debris. Inspections will occur after every major storm event for the first six (6) months after construction. Inspections will be conducted by a person trained in stormwater management systems and experienced in drainage design.

Annual reports will be prepared detailing the status of the stormwater system and the maintenance performed. A copy of the annual report will be sent to the Town of Andover, if requested.

The owner agrees to comply with a minimum maintenance schedule as follows:

1. **Monthly inspection for damaged or clogged catch basins.**
   Catch basin grates shall be inspected and cleared of debris to maintain inlet capacity. Culvert shall also have outlet cleared of debris to maintain capacity.

2. **Monthly sweeping of the parking lot.**
   The parking lot shall be swept monthly. Sweepings should be concentrated in the late spring after winter sanding and late fall after the leaves have fallen.

3. Cleaning of catch basins

Sumps and inlets shall be cleaned four times per year and inspected on a monthly basis. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

4. Inspection and cleaning of drainage pipes and manholes.

Drainage pipes and manhole structures shall be inspected and cleaned of sediment at least every five (5) years or as required to maintain adequate functionality of the stormwater conveyance system. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

5. Sediment Forebays

The Sediment Forebays shall be inspected on a monthly basis, and accumulated sediment shall be quarterly, or when filled with at least 3-6 inches of sediment. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

6. Infiltration Basins

As a minimum, the basin will be inspected after every major storm event greater than 0.5", for the first six months after construction, to ensure functionality and inspect for erosion. Thereafter, inspections will occur at twice per year and after every major storm event greater than the 2- year storm event (3.20").

At least twice during growing seasons, the infiltration basin side slopes, embankments, outlet structures, and emergency spillways will be cleared of accumulated sediment, grass clippings, leaves, and trash and then mowed. Sediment collected inside the basin will be removed at a minimum of once every ten (10) years by hand or mechanical equipment. Eroded areas and slopes will be loamed, seeded, and mulched or stabilized with rock rip-rap. All flared end sections and rock rip-rap will be cleaned of all sediment and debris and reset if necessary, to ensure that stormwater flows coming into the basin(s) are not being impeded. Outlet structures should have debris removed to maintain consistent release velocities. Collected debris will be properly disposed of, in accordance with state and federal requirements, at a local facility.

7. Grass Landscaping

The grass landscaping and plantings will be inspected after every major storm event for the two (2) months after seeding to ensure functionality. Thereafter, inspections should take place every six (6) months in the spring and fall and after severe storm events. Grass and

mulched landscaping showing signs of wear and erosion will be re-loamed/re- seeded or re-mulched as necessary to prevent further erosion from taking place.

8. Ernst Mesic to Dry Native Pollinator Mix Landscaping

The Ernst Mesic to Dry Native Pollinator Mix landscaping areas, as referenced in the attached Mowing Plan, will be inspected after every major storm event for the six (6) months following seeding to ensure functionality. Thereafter, inspections should take place every six (6) months in the spring and fall and after severe storm events. Mix landscaping showing signs of wear and erosion will be re-loamed/re-seeded as necessary to prevent further erosion from taking place. Mowing of these areas shall occur once a year, and between October 15th – April 15th for protection of ground nesting birds, pollinators, and other wildlife using these areas.

9. Snow Removal

Snow will be stored within the landscape islands onsite. During large storm events, snow will be trucked offsite.

10. Pervious Pavement

Pervious pavement shall be inspected monthly and cleaned as needed. All inspection and maintenance of pervious pavement shall follow the requirements of the attached Pervious Pavement Maintenance Guide.

11. Slopes adjacent to Pervious Pavement

Slopes adjacent to pervious pavement shall be inspected on a monthly basis to identify any areas of breakout or erosion. During construction, slopes will be stabilized with a combination of hydroseed and jute mesh erosion control. If erosion or breakout occurs, slopes shall be stabilized immediately with additional seeding and jute mesh. If long term erosion occurs, slopes will be stabilized with rip rap stone, minimum 6" diameter.

12. Grass Drainage Swales

Inspect channels monthly for first 6 months after construction and twice annually thereafter. Inspect to make sure vegetation is adequate and for signs of rilling and gullying. Repair any rills or gullies. Replace dead vegetation. Mow swales as necessary to maintain a grass height less than 6 inches. Remove sediment and debris manually, by hand shovel, once per year. Reseed swales as necessary to maintain grass cover.

The Long-Term Pollution Prevention Plan

The Owner agrees to comply with the following Long-Term Pollution Prevention Plan to ensure long-term stormwater quality discharge from the site:

- Good housekeeping practices: The project will be maintained by the owner, including snow removal, de-icing, and BMP inspection and maintenance.

- Provisions for storing materials and waste products inside or under cover: No materials or waste products will be stored on-site.

- Vehicle washing controls: Vehicle washing is not anticipated as a reasonably foreseeable use of the site.

- Requirements for routine inspections and maintenance of stormwater BMPs: The owner will be responsible for providing the necessary inspections and maintenance for the stormwater BMPs.

- Spill prevention and response plans: There are no proposed uses at the site that would provide an opportunity for a spill of oil or hazardous materials, other than a sudden, catastrophic, vehicle failure. If a vehicle release is the result of an accident, the police and fire department will respond and address any release.

- Provisions for maintenance of lawns, gardens, and other landscaped areas: The owner will provide long-term maintenance for the landscaped areas.

- Requirements for storage and use of fertilizers, herbicides, and pesticides: At this time there would be no foreseeable need for fertilizers, herbicides, and pesticides.

- Provisions for operation and management of septic systems: The Owner will be responsible for the operation and management of the septic systems. The Owner will be required to follow Town of Andover standards for inspection and maintenance of the systems.

- Provisions for solid waste management: The development will have a private trash removal contractor that visits the site as needed. All trash will be stored within enclosed dumpsters with closed lids.

- Snow disposal and plowing plans relative to Wetland Resource Areas: Snow will be stored adjacent to the various islands onsite temporarily.

- Street sweeping schedules: The owner will be responsible for monthly street sweeping with sweepings concentrated in the Spring and Fall as stated in the Operations and Maintenance plan.

- Provisions for prevention of illicit discharges to the stormwater management system: Only stormwater is proposed to be conveyed through the stormwater management system. No illicit materials will be permitted. The owner will be responsible to maintain this 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: Not applicable

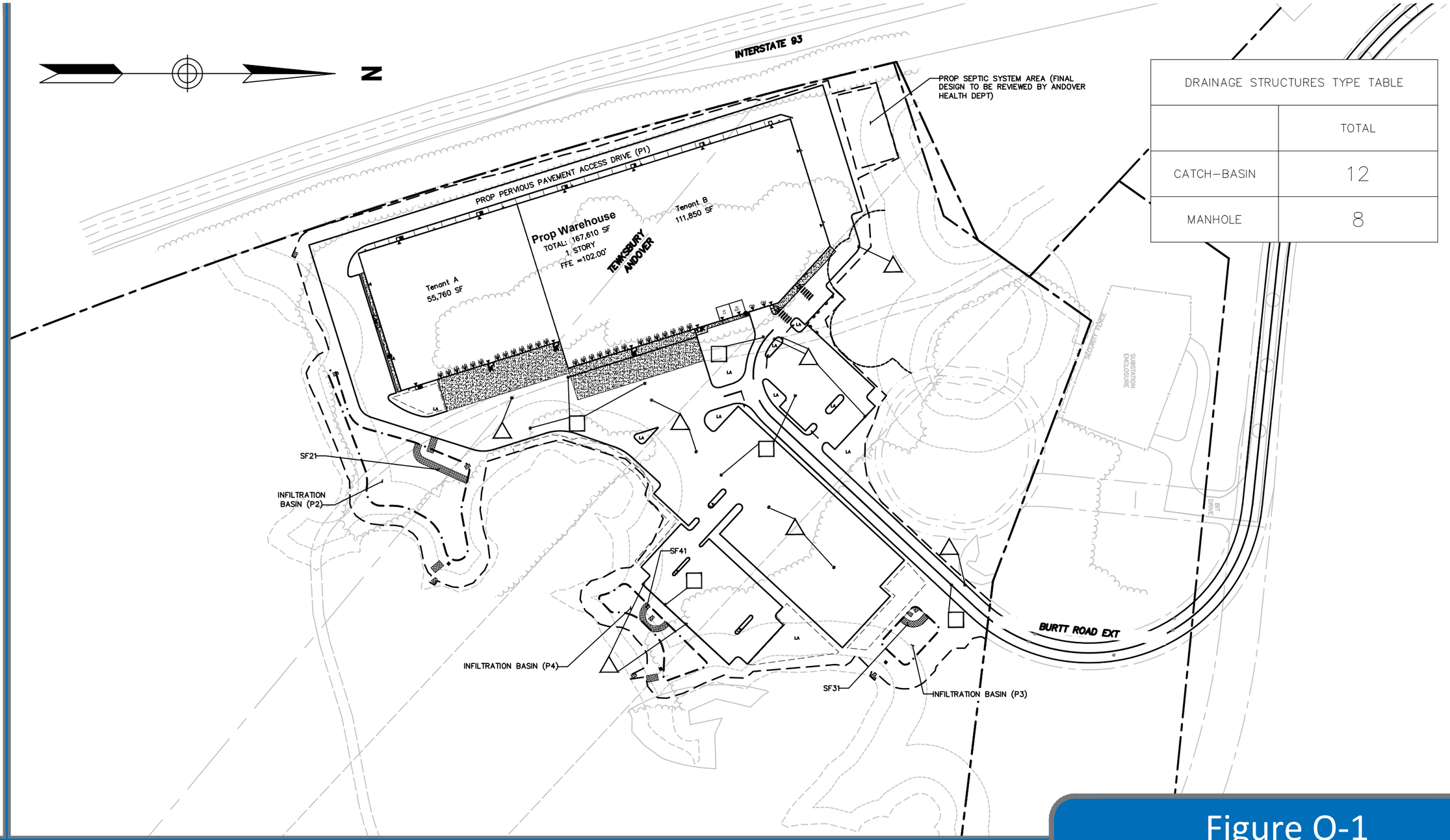
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan: Prior to implementation of the LTPPP, the owner shall provide an on-site meeting with the maintenance personnel to present the contents and requirements of the Stormwater Operation and Maintenance Plan and the LTPPP.

- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

  MCP/Howland Burtt Owner, LLC
  260 Franklin Street, Suite 620
  Boston, MA 02110

X 

Property Owner



DRAINAGE STRUCTURES TYPE TABLE	
	TOTAL
CATCH-BASIN	12
MANHOLE	8

LEGEND

CATCH-BASIN

MANHOLE

SNOW STORAGE

Scale: 1" = 150'

September 26, 2022

Figure O-1

Operations & Maintenance Reference Plan

INSPECTION AND MAINTENANCE CHECK LIST –
BURTT ROAD DEVELOPMENT, ANDOVER, MA

For Year: _____

	Inspection Item**	Inspection Frequency* Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Drainage Pipes and Manholes	at least every 5 years											
2	Sediment Forebay												
3	Infiltration Basin	■	■	■		■	■	■	■	■		■	■
4	Grass Landscaping	■	■	■		■	■	■	■	■		■	■
5	Pervious Pavement												
6	Slopes adjacent to Pervious Pavement												
7	Grass Drainage Swale	■	■	■		■	■	■	■	■		■	■
8	'Mesic to Dry Native Pollinator Mix Landscaping	■	■	■		■	■	■	■	■		■	■

	Maintenance Item**	Maintenance Frequency* Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Parking Lot Sweeping												
2	Catch Basin Cleaning	■	■		■	■		■	■		■	■	
3	Drainage Pipes and Manholes	at least every 5 years											
4	Sediment Forebay	■	■		■	■		■	■		■	■	
5	Infiltration Basin	■	■	■		■	■	■	■	■		■	■
6	Pervious Pavement	Refer to Pervious Pavement Maintenance Guide											
7	Slopes Adjacent to Pervious Pavement	Re-seed, add jute mesh as needed											
8	Grass Drainage Swale	■	■		■	■	■	■	■		■	■	■
9	'Mesic to Dry Native Pollinator Mix Landscaping	Mow annually between Oct 15th-April 15th											

* Actual time of inspecting and maintaining items may vary. Chart shall be used to indicate frequency of events

** This chart shall be used in conjunction with the attached "Stormwater Management Operations and Maintenance Plan", dated January 19, 2021, and with the attached "Mowing Plan", dated January 19, 2021..

Name of Applicant: MCP/Howland Burtt Owner, LLC
Name of Facility: Burtt Road
Development Location: Burtt Road, Andover, MA 01810

Inspection and Maintenance Log

Inspection No.	Date	Inspections Performed	Maintenance Actions Taken
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			

Additional Sheets shall be added as needed

F

Test Pit Data

146 Dascomb Road
Andover, MA 01810
978.794.1792

169 Ocean Blvd., Unit 101
PO Box 249
Hampton, NH 03842
603.601.8154

TheEngineeringCorp.com

Location: Burtt Road
Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** 95' +/- **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-101 **Elevation:** 100.5' **Start:** 0950 **End:** 1000

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-103"	C	7.5 YR 6/4	52"	7.5 YR 5/8	20%	LS	-	-	M	L	

Parent Material: Sandy Glaciofluvial **Depth to Bedrock:** - **Standing Water:** 82" **ESHGW:** 52"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
2.) Water was observed to weep from sidewalls at approximately 60"

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257

146 Dascomb Road
Andover, MA 01810
978.794.1792

169 Ocean Blvd., Unit 101
PO Box 249
Hampton, NH 03842
603.601.8154

TheEngineeringCorp.com

Location: Burtt Road
Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-102 **Elevation:** 101.2' **Start:** 0750 **End:** 0800

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-18"	Ap	7.5 YR 2.5/1	-	-	-	SL	-	-	Gr	F	
18"-24"	Bw	7.5 YR 5/8	-	-	-	LS	-	-	M	L	
24"-78"	C1	7.5 YR 6/4	-	-	-	LS	-	-	M	L	
78"-96"	C2	7.5 YR 5/1	78"	7.5 YR 5/6	30	LS	-	-	M	L	

Parent Material: Sandy Glaciofluvial **Depth to Bedrock:** - **Standing Water:** 85" **ESHGW:** 78"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
2.) Water was observed to weep from sidewalls at approximately 78"

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257

146 Dascomb Road
Andover, MA 01810
978.794.1792

169 Ocean Blvd., Unit 101
PO Box 249
Hampton, NH 03842
603.601.8154

TheEngineeringCorp.com

Location: Burtt Road
Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-103 **Elevation:** 100.75' **Start:** 0800 **End:** 0815

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	Ap	-	-	-	-	SL	-	-	Gr	F	
12"-18"	Bw	7.5 YR 4/6	-	-	-	LS	-	-	M	L	
18"-102"	C	7.5 YR 6/3	70	7.5 YR 5/6	20%	LS	-	-	M	L	

Parent Material: Sandy Glaciofluvial **Depth to Bedrock:** - **Standing Water:** - **ESHGW:** 70"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
2.) Water was observed to weep from sidewalls at approximately 78"
3.) Significant amount of trash in Ap Layer.

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257

146 Dascomb Road
Andover, MA 01810
978.794.1792

169 Ocean Blvd., Unit 101
PO Box 249
Hampton, NH 03842
603.601.8154

TheEngineeringCorp.com

Location: Burtt Road
Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** 85' +/- **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-104 **Elevation:** 98.6' **Start:** 0900 **End:** 0910

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8"	A	-	-	-	-	SL	-	-	Gr	L	
8"-24"	Bw	7.5 YR 4/6	-	-	-	FLS	-	-	M	L	
24"-54"	C1	7.5 YR 5/1	52"	7.5 YR 5/6	30%	FLS	-	-	M	L	
54"-108"	C2	7.5 YR 6/2		7.5 YR 5/7	30%	FSL	-	-	M	F	

Parent Material: Sandy Glaciofluvial **Depth to Bedrock:** - **Standing Water:** - **ESHGW:** 52"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover).

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257

146 Dascomb Road
Andover, MA 01810
978.794.1792

169 Ocean Blvd., Unit 101
PO Box 249
Hampton, NH 03842
603.601.8154

TheEngineeringCorp.com

Location: Burtt Road
Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 255/260 **Soil Name:** Windsor Loamy Sand/Sudbury fine Sandy Loam **Soil Class:** A/B

Test Pit: TP-105 **Elevation:** 94.75' **Start:** 0720 **End:** 0740

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-4"	A	-	-	-	-	SL	-	-	Gr	F	
4"-60"	C1	7.5 YR 6/4	49"	7.5 YR 5/8	20%	LS	-	-	M	L	
60"-90"	C2	5 YR 6/1		7.5 YR 5/8	20%	LS	-	-	M	L	
90"-108"	C3	7.5 YR 5/2		7.5 YR 5/8	60%	SL	-	-	M	F	

Parent Material: Sandy Glaciofluvial/Eolian over Glaciofluvial **Depth to Bedrock:** - **Standing Water:** 69" **ESHGW:** 49"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
2.) Water was observed to weep from sidewalls at approximately 57"

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257

The Engineering Corp

146 Dascomb Road
Andover, MA 01810
978.794.1792

169 Ocean Blvd., Unit 101
PO Box 249
Hampton, NH 03842
603.601.8154

TheEngineeringCorp.com

Location: Burtt Road
Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** 46' +/- **Zone II:** N/A **Soil Symbol:** 260 **Soil Name:** Sudbury fine Sandy Loam **Soil Class:** B

Test Pit: TP-106 **Elevation:** 93.95' **Start:** 1115 **End:** 1130

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10 YR 2/1	-	-	-	SL	-	-	Gr	F	
12"-24"	Bw	7.5 YR 5/8	-	-	-	SL	-	-	M	F	
24"-104"	C	5 YR 6/1	24"	7.5 YR 5/8	30%	FSL	-	-	M	F	

Parent Material: Eolian over Glaciofluvial **Depth to Bedrock:** - **Standing Water:** - **ESHGW:** 24"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
2.) Water was observed to weep from sidewalls at approximately 60"

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-1
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

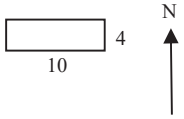
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/11/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	1150
		Capacity	1	Reach	12 ft	Time Completed	1220

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0	Dark brown, fine to medium SAND, little Silt, trace Roots, trace Metal, trace Plastic.			E	-	
1'	1.0' (Loamy Sand)					
	1.7' Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand)			E	-	
2'				E	-	
3'				E	-	
4'				E	-	
5'				E	-	
6'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
7'				E	-	
8'				E	-	
9'				M	-	
10'				M	-	2
	10' Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Groundwater not encountered during excavation.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 14.8 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No. TP-2
Page No. 1 of 1
File No. 18.0173996.00
Checked By: MPS

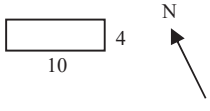
GZA Rep. Brian Cantor
Weather Sunny, 30s
Contractor New England Boring Contractors
Operator Dave Thompson
Make Kubota Model KX057-4
Capacity 1 Reach 12 ft
Date 12/10/2018
Ground Elev. SEE PLAN
Time Started 0930
Time Completed 1010

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
0.9'	Dark brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand)			E	-	
2.0'	Brown, fine to medium SAND, little Silt, trace Roots, trace Plastic. (Loamy Sand)			E	-	
3'				E	-	
4'				E	-	
5'				E	-	
6'				E	-	1
7'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
8'				E	-	2
9'				E	-	
10'				E	-	3
10'	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Oxidation staining of soil observed from approximately 6 to 9 feet bgs.
2. Water seeping through sidewalls into excavation at approximately 7.5 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 14.8 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA
GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No. TP-3
Page No. 1 of 1
File No. 18.0173996.00
Checked By: MPS

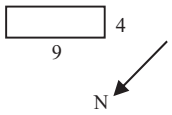
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/11/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	1420
		Capacity	1	Reach	12 ft	Time Completed	1450

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
1'	Dark brown, fine to medium SAND, little Silt, trace Roots, trace Plastic. (Loamy Sand)			E	-	
	1.5'					
2'	Brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand)			E	-	
	2.5'					
3'				E	-	
4'				E	-	
5'				E	-	
6'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
7'				E	-	
8'				E	-	
9'				E	-	
10'				M	-	2
	10'					
	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Groundwater not encountered during excavation.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 13.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-4
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

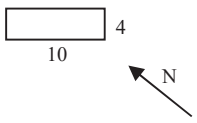
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/10/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	0830
		Capacity	1	Reach	12 ft	Time Completed	0910

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
1'	Dark brown, fine to medium SAND, little Silt, trace Cobbles, trace Metal, trace Roots. (Loamy Sand)			E	1A	
	1.3'			E	-	
2'				E	-	
3'				E	-	
4'				E	-	
5'				E	-	
6'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	1
7'				E	-	
8'				E	-	
9'				M	-	2
10'	10'					
	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation at approximately 7 feet bgs.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 14.8 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER

( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-5
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

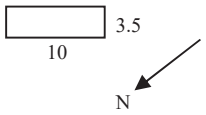
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/10/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 20s	Make	Kubota	Model	KX057-4	Time Started	0730
		Capacity	1	Reach	12 ft	Time Completed	0815

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0	0.7' Dark brown, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam)			E	-	
1'	Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand)					
	1.5'			E	-	1
2'				E	-	
3'				E	-	
4'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
5'				E	-	
6'	7.0'			E	-	2
7'				M	-	
8'	Light brown to gray, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
9'				E	-	
10'	10'			E	-	3
	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation from approximately 1 to 5 feet bgs.
2. Oxidation colored staining of soil observed from approximately 5 to 6 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 13.0 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-6
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

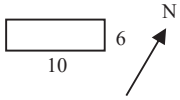
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/10/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	1040
		Capacity	1	Reach	12 ft	Time Completed	1120

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0	Dark brown, fine to medium SAND, little Silt, trace Metal, trace Roots, trace Plastic. (Loamy Sand)			E	-	
1'				E	-	
1.4'	Brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand)			E	-	
2'				E	-	
3'				E	-	
3.0'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	1
4'				E	-	
5'				E	-	
6'				E	-	
7'				E	-	
7.3'	Light brown to gray, fine to medium SAND, trace Silt, trace(-) fine Gravel. (Loamy Sand)			E	-	2
8'				E	-	
9'				E	-	
10'				E	-	
10'	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation at approximately 6 feet bgs.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 22.2 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER

( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-7
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

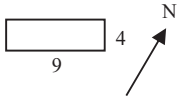
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/10/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	0930
		Capacity	1	Reach	12 ft	Time Completed	1010

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
0.9'	Dark brown, fine to medium SAND, little Silt, trace Roots, trace Plastic. (Loamy Sand)			E	-	
2.0'	Brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand)			E	-	
				E	-	1
				E	-	
				E	-	
	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
				E	-	
7.0'				E	-	
				E	-	2
	Light brown to gray, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
10'				E	-	3
	Bottom of test pit at 10 feet Below Ground Surface (bgs)					

Notes:

1. Water seeping through sidewalls into excavation at approximately 3 feet bgs.
2. Oxidation colored staining of soil observed from approximately 7 to 7.5 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 13.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-8
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

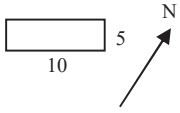
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/11/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	0920
		Capacity	1	Reach	12 ft	Time Completed	1000

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0				E	-	
1'	Dark brown to black, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam)			E	-	
2'				E	-	
2.4'	Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand)			E	-	
3'				E	-	
3.2'				E	-	
4'				E	-	
5'				E	-	
6'	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	1,2
7'				E	-	
8'				E	-	
9'				E	-	
10'				E	-	3
10'	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation at approximately 7 feet bgs.
2. Oxidation colored staining of soil observed from approximately 6 to 7 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 18.5 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-9
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

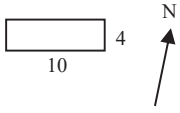
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/11/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	0830
		Capacity	1	Reach	12 ft	Time Completed	0910

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
0.9'	Dark brown, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam)			E	-	
2.0'	Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand)			E	-	
				E	-	
				E	-	1,2
				M	-	
				M	-	
	Light brown, fine to medium SAND, little Silt. (Loamy Sand)			M	-	
				M	-	
				M	-	
10'				M	-	3
	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation at approximately 3.5 feet bgs.
2. Oxidation colored staining of soil observed from approximately 3.5 to 5 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 14.8 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-11
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

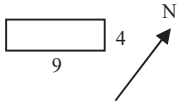
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/10/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	1245
		Capacity	1	Reach	12 ft	Time Completed	1330

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0				E	-	
1'	Dark brown to black, fine to coarse SAND, some Silt, trace Roots, trace Plastic. (Sandy Loam)			E	-	
2'				E	-	
2.5'				E	-	
3'	Brown, fine to medium SAND, little Silt. (Loamy Sand)			E	-	
4'				E	-	
5'	5.0'			M	-	1,2
6'	Brown to orange-brown, fine to medium SAND, little Silt. (Loamy Sand)			M	-	
6.0'				M	-	
7'				M	-	
8'	Light gray, SILT, little fine Sand. (Silt)			M	-	3
9'						
10'	10'					
10'	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation at approximately 5.5 feet bgs.
2. Oxidation colored staining of soil observed from approximately 5 to 6 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 13.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-12
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

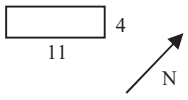
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/10/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 30s	Make	Kubota	Model	KX057-4	Time Started	1400
		Capacity	1	Reach	12 ft	Time Completed	1450

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
1'	Dark brown, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam) 1.0'			E	-	
2'				E	-	
3'	Brown to light brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand)			E	-	
4'	4.0'			M	-	
5'	Brown to orange-brown, fine to medium SAND, little Silt. (Loamy Sand) 5.0'			D	-	1,2,3
6'				D	-	
7'				D	-	
8'	Light gray, SILT, little fine Sand. (Silt) rock obstruction			D	-	
9'				D	-	
10'	10'			D	-	4
11'	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
12'						
13'						
14'						
15'						
16'						

Notes:

1. Oxidation colored staining of soil observed from approximately 4 to 5 feet bgs.
2. Possible bedrock or boulder encountered at 4 feet in the southwest portion of the excavation. Bottom of boulder or bedrock not observed.
3. Water seeping through sidewalls into excavation at approximately 5 feet bgs.
4. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
5. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 8.9 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA GeoEnvironmental, Inc.
Engineers/Scientists
144 Elm Street
Amesbury, Massachusetts

TEC
Burtt Road Development
Andover, Massachusetts

Test Pit No.	TP-13
Page No.	1 of 1
File No.	18.0173996.00
Checked By:	MPS

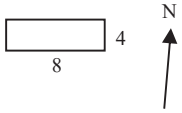
GZA Rep.	Brian Cantor	Contractor	New England Boring Contractors			Date	12/11/2018
		Operator	Dave Thompson			Ground Elev.	SEE PLAN
Weather	Sunny, 20s	Make	Kubota	Model	KX057-4	Time Started	0730
		Capacity	1	Reach	12 ft	Time Completed	0815

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulders: Count/ Class	Note No.
0						
0.9'	Dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots. (Fine Sandy Loam)			E	1A	
1'						
2'	Brown, fine to medium SAND, little Gravel, little Silt, trace Roots. (Loamy Sand)			M	2A	
2.5'				M	2A	
3'				D	3A	1
4'				D	4A	
5'				D	4A	
6'	Light brown to brown, fine to coarse SAND, some Gravel, little Cobbles, little Silt. (Coarse Sand)			D	3A	
7'				D	3A	
8'				D	3A	
9'				D	2A	2
10'						
10'	Bottom of test pit at 10 feet Below Ground Surface (bgs)					
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1. Water seeping through sidewalls into excavation at approximately 4 feet bgs.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil texturural classification indicated in ( ).

Test Pit Plan



Volume = 11.9 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" and Larger

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(x) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
20 mins	6.0 feet

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

TEST BORING LOG

GZA GeoEnvironmental, Inc. *Engineers and Scientists*	**TEC, Inc.** **Burtt Road Development** **Andover, MA**	**BORING NO.:** B-1 **SHEET:** 1 of 1 **PROJECT NO:** 18.0173996.00 **REVIEWED BY:** Z. Morris

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** -
Foreman: Ben Cross	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):**	
Logged By: Brian Cantor	**Drilling Method:** Hollow Stem Auger	**Final Boring Depth (ft.):** 27	
		Date Start - Finish: 12/14/2018 - 12/14/2018	**V. Datum:** -

Auger/Casing Type: HSA	**Sampler Type:** SS	
I.D/O.D.(in): 4.25/7.625	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): -	**Sampler Hmr Wt (lb):** 140 lb.	
Hammer Fall (in.): -	**Sampler Hmr Fall (in):** 30"	
Other:	**Other:** Safety Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/14/2018	10:00	5.7	none	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	17	35 42 17 13	59	S-1: Top 10": Brown to light brown, fine to medium SAND, trace Gravel, little Silt. Bottom 7": Light brown, fine to medium SAND, little Silt, trace Gravel.	1				
5		S-2	5-7	24	18	6 7 6 7	13	S-2: Medium dense, light brown, fine to medium SAND, little Silt.					
10		S-3	10-12	24	16	4 4 5 7	9	S-3: Loose, light brown to brown, fine SAND, some Silt.				SAND & SILT	
15		S-4	15-17	24	15	4 6 8 9	14	S-4: Medium dense, light brown to brown, fine SAND, some Silt.					
20		S-5	20-22	24	17	10 10 10 11	20	S-5: Medium dense, light brown to brown, fine SAND, some Silt.					
25		S-6	25-27	24	18	7 8 10 8	18	S-6: Medium dense, light brown to brown, fine SAND, some Silt (piece of severely weathered rock 4.5 to 5 inches from bottom of spoon).	2		27'		
								Bottom of boring at 27 feet.					
30													
35													

REMARKS

1. Top 10-inches of S-1 frozen.
2. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-1

18.0173996.00.GPJ; STRATUM ONLY; 12/28/2018

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** -
Foreman: Ben Cross	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):**	
Logged By: Brian Cantor	**Drilling Method:** HSA/D&W	**Final Boring Depth (ft.):** 31	
		Date Start - Finish: 12/14/2018 - 12/14/2018	**V. Datum:** -

Auger/Casing Type: HSA/HW	**Sampler Type:** SS		
I.D/O.D.(in): 4.25/7.625 / 4.0/4.5	**I.D./O.D. (in.):** 1.375"/2"		
Hammer Weight (lb.): 300 lb.	**Sampler Hmr Wt (lb):** 140 lb.		
Hammer Fall (in.): 30 in.	**Sampler Hmr Fall (in):** 30"		
Other: Safety Hammer	**Other:** Safety Hammer		

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/14/2018	13:15	6.2	none	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	16	8 7 6 6	13	S-1: Top 6": Dark brown, fine to medium SAND, little Silt, trace Roots. Bottom 10": Dry, light brown, fine to medium SAND, little Silt.			0.5'	TOPSOIL	
5		S-2	5-7	24	18	3 4 6 6	10	S-2: Moist, medium dense, light brown to gray, fine to medium SAND, little Silt.					
10		S-3	10-12	24	19	4 6 10 27	16	S-3: Top 13": Light brown, fine to medium SAND, little Silt. Bottom 6": Moist, light brown, fine to medium SAND, little Silt.	1				
									2				
15		S-4	15-17	24	17	7 8 8 12	16	S-4: Light brown, fine to medium SAND, little Silt.	3			SAND & SILT	
20		S-5	19-21	24	16	6 8 8 8	16	S-5: Medium dense, light brown, fine SAND, some Silt.	4				
25		S-6	24-25	24	16	7 8 5 6	13	S-6: Medium dense, light brown, fine SAND, some Silt.					
30		S-7	29-31	24	15	8 9 8 8	17	S-7: Medium dense, gray, fine SAND, some Silt.			31'		
35								Bottom of boring at 31 feet.	5				

REMARKS

1. Oxidation staining observed in S-3 at approximate depth of 11.5 feet below ground surface.
2. Sand blowing into hole before attempting to sample from 15 to 17 feet below ground surface (S-4).
3. Prior to sampling S-4, driller removed the hollow stem augers. Driller advanced 4-inch casing to 15 feet below ground surface and then sampled from 15 to 17 feet.
4. Drilled open hole from 15 to 31 feet below ground surface.
5. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-2

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

Drilling Co.: New England Boring Contractors
Foreman: Ben Cross
Logged By: Brian Cantor

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.):
Final Boring Depth (ft.): 31
Date Start - Finish: 12/14/2018 - 12/14/2018

H. Datum: -
V. Datum: -

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300 lb.
Hammer Fall (in.): 30 in.
Other: Safety Hammer

Sampler Type: SS
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lb.
Sampler Hmr Fall (in): 30"
Other: Safety Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/14/2018	14:40	4.8	none	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	9 7 7 7	14	S-1: Top 8": Dark brown, fine to medium SAND, little Silt, trace Root. Bottom 10": Light brown to brown, fine to medium SAND, trace Gravel, little Silt.			0.7'	TOPSOIL	
5		S-2	4-6	24	13	6 8 10 10	18	S-2: Medium dense, light brown to brown, fine to coarse SAND, trace Gravel, little Silt.					
10		S-3	9-11	24	14	4 5 5 7	10	S-3: Medium dense, light brown to brown, fine to coarse SAND, little Silt.					
15		S-4	14-16	24	15	1 2 WOH 1	2	S-4: Very loose, light brown, fine SAND, some Silt.				SAND & SILT	
20		S-5	19-21	24	18	4 6 9 7	15	S-5: Top 9": Light brown, fine to medium SAND, little Silt. Bottom 9": Gray, fine SAND, little Silt.	1				
25		S-6	24-26	24	19	9 11 8 8	19	S-6: Top 13": Light brown, fine SAND, some Silt. Bottom 5": Gray, fine SAND, little Silt.					
30		S-7	29-31	24	18	5 6 9 8	15	S-7: Medium dense, gray, fine SAND, some Silt.			31'		
35								Bottom of boring at 31 feet.	2				

REMARKS

1. Drilled open hole from 19 to 31 feet below ground surface.
2. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-3

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-4
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** -
Foreman: Ben Cross	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):**	
Logged By: Brian Cantor	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 31	**V. Datum:** -
		Date Start - Finish: 12/14/2018 - 12/14/2018	

Auger/Casing Type: HW	**Sampler Type:** SS	
I.D/O.D.(in): 4.0/4.5	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): 300 lb.	**Sampler Hmr Wt (lb):** 140 lb.	
Hammer Fall (in.): 30 in.	**Sampler Hmr Fall (in):** 30"	
Other: Safety Hammer	**Other:** Safety Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/14/2018	11:15	3.5	none	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	14	3 3 3 4	6	S-1: Top 12": Dark brown, fine to medium SAND, little Silt, trace Roots. Bottom 2": Light brown to brown, fine to medium SAND, trace Silt, trace Roots.			1'	TOPSOIL	'
5		S-2	4-6	24	15	6 11 10 10	21	S-2: Medium dense, light brown, fine to medium SAND, little Silt.					
10		S-3	9-11	24	14	4 4 4 4	8	S-3: Loose, light brown, fine SAND, little Silt.					
15		S-4	14-16	24	13	4 3 3 3	6	S-4: Loose, light brown, fine SAND, some Silt.				SAND & SILT	
20		S-5	19-21	24	16	3 3 6 6	9	S-5: Top 9": Light brown, fine to medium SAND, little Silt. Bottom 7"; Light brown, fine SAND, some Silt.	1 2				
25		S-6	24-26	24	16	6 7 7 7	14	S-6: Top 10": Light brown, fine SAND and Silt. Bottom 6": Gray, SILT, trace fine Sand.					
30		S-7	29-31	24	19	8 8 9 8	17	S-7: Very stiff, gray, Clayey SILT, little fine Sand.			31'		'
								Bottom of boring at 31 feet.	3				
35													

REMARKS

1. Black lens of fine to medium SAND observed in S-5 in middle of sample.
2. Drilled open hole from 19 to 31 feet below ground surface.
3. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-4

18.0173996.00.GPJ; STRATUM ONLY; 12/28/2018

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-5
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

Drilling Co.: New England Boring Contractors	**Type of Rig:** ATV	**Boring Location:** See Plan	**H. Datum:** -
Foreman: Ben Cross	**Rig Model:** Mobile B-53	**Ground Surface Elev. (ft.):**	
Logged By: Brian Cantor	**Drilling Method:** Drive & Wash	**Final Boring Depth (ft.):** 31	**V. Datum:** -
		Date Start - Finish: 12/14/2018 - 12/14/2018	

Auger/Casing Type: HW	**Sampler Type:** SS	
I.D/O.D.(in): 4.0/4.5	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.): 300 lb.	**Sampler Hmr Wt (lb):** 140 lb.	
Hammer Fall (in.): 30 in.	**Sampler Hmr Fall (in):** 30"	
Other: Safety Hammer	**Other:** Safety Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/14/2018	15:45	2.2	none	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	3 4 5 8	9	S-1: Top 12": Dark brown, fine to medium SAND, little Silt, trace Glass, trace Roots. Bottom 6": Brown, fine to medium SAND, little Silt.			1'	TOPSOIL/FILL	
5		S-2	4-6	24	15	5 9 11 11	20	S-2: Medium dense, light brown, fine to medium SAND, little Silt.					
10		S-3	9-11	24	16	4 5 5 5	10	S-3: Loose, light brown to gray, fine to medium SAND, little Silt.					
15		S-4	14-16	24	14	3 4 4 5	8	S-4: Loose, gray to light brown, fine SAND, some Silt.				SAND & SILT	
20		S-5	19-21	24	15	6 8 8 9	16	S-5: Medium dense, light brown, fine SAND, some Silt.					
25		S-6	24-25	24	18	6 6 7 6	13	S-6: Medium dense, gray, fine SAND, little Clayey Silt.					
30		S-7	29-31	24	19	4 3 4 4	7	S-7: Loose, gray, SILT, trace fine Sand.			31'		
35								Bottom of boring at 31 feet.	1				

REMARKS

1. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-5

18.0173996.00.GPJ; STRATUM ONLY; 12/28/2018

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-8
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

Drilling Co.: New England Boring Contractors
Foreman: Ben Cross
Logged By: Brian Cantor

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.):
Final Boring Depth (ft.): 36
Date Start - Finish: 12/14/2018 - 12/14/2018

H. Datum: -
V. Datum: -

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300 lb.
Hammer Fall (in.): 30 in.
Other: Safety Hammer

Sampler Type: SS
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lb.
Sampler Hmr Fall (in): 30"
Other: Safety Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/17/2018	14:40	3.1	none	15 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	18	1 1 2 3	3	S-1: Top 5": Dark brown to black, fine to medium SAND, some Silt, trace Roots. Bottom 13": Brown to light brown, fine to medium SAND, trace Gravel, little Silt.			0.7'	TOPSOIL	'
5		S-2	4-6	24	18	6 5 8 9	13	S-2: Medium dense, light brown, fine to medium SAND, trace Silt, trace Roots.					
10		S-3	9-11	24	16	8 6 7 8	13	S-3: Stiff, light brown, Clayey SILT and fine SAND.					
15		S-4	14-16	24	18	3 5 5 5	10	S-4: Medium dense, light brown, fine SAND and SILT.	1			SAND & SILT	
20		S-5	19-21	24	18	3 5 5 5	10	S-5: Medium dense, light brown, fine SAND and SILT.	2				
25		S-6	24-26	24	21	2 1 2 5	3	S-6: Very loose, gray, SILT and fine SAND.					
30		S-7	29-31	24	20	2 2 2 1	4	S-7: Very loose, gray, SILT and fine SAND.					
35		S-8	34-36	24	21	22 17 18 35	35	S-8: Dense, gray, SILT, some fine SAND, trace Gravel.			36'		'
								Bottom of boring at 36 feet.	3				

REMARKS

1. Oxidation staining of soil observed from approximately 15 to 15.2 feet below ground surface.
2. Drilled open hole from 19 to 36 feet below ground surface.
3. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-8

18.0173996.00.GPJ; STRATUM ONLY; 12/28/2018

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-9
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

Drilling Co.: New England Boring Contractors
Foreman: Ben Cross
Logged By: Brian Cantor

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.):
Final Boring Depth (ft.): 21
Date Start - Finish: 12/14/2018 - 12/14/2018

H. Datum: -
V. Datum: -

Auger/Casing Type: HW
I.D/O.D.(in): 4.0/4.5
Hammer Weight (lb.): 300 lb.
Hammer Fall (in.): 30 in.
Other: Safety Hammer

Sampler Type: SS
I.D./O.D. (in.): 1.375"/2"
Sampler Hmr Wt (lb): 140 lb.
Sampler Hmr Fall (in): 30"
Other: Safety Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
12/17/2018	15:50	2.5	none	10 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	17	2 1 2 2	3	S-1: Top 7": Dark brown to black, fine to medium SAND, some Silt, trace Gravel, trace Roots. Bottom 10": Brown, fine to medium SAND, trace Silt.			0.8'	TOPSOIL	'
5		S-2	4-6	24	14	4 5 8 9	13	S-2: Medium dense, light brown, fine to medium SAND, trace Silt.					
10		S-3	9-11	24	16	3 3 5 6	8	S-3: Loose, light brown, fine to medium SAND, trace Silt.				SAND & SILT	
15		S-4	14-16	24	20	7 7 8 9	15	S-4: Very stiff, light brown, Clayey SILT, little fine Sand.					
20		S-5	19-21	24	18	3 3 3 3	6	S-5: Loose, light brown, SILT, little Sand.			21'		'
								Bottom of boring at 21 feet.	1				
25													
30													
35													

REMARKS

1. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: B-9

18.0173996.00.GPJ; STRATUM ONLY; 12/28/2018

Stormwater Basin P1 - Mounding Analysis

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

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

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

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

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

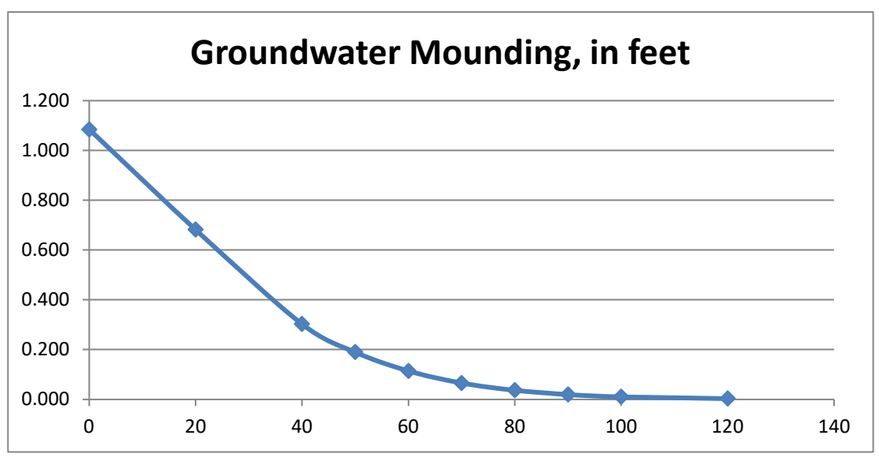
Input Values

4.8200	*R*	**Recharge (infiltration) rate (feet/day)**
0.320	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
12.000	x	**1/2 length of basin (x direction, in feet)**
375.000	y	**1/2 width of basin (y direction, in feet)**
0.188	t	**duration of infiltration period (days)**
30.000	hi(0)	**initial thickness of saturated zone (feet)**

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

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.084	0
0.682	20
0.303	40
0.190	50
0.114	60
0.066	70
0.036	80
0.019	90
0.010	100
0.003	120

Re-Calculate Now



Stormwater Basin P2 - Mounding Analysis

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

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

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

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

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

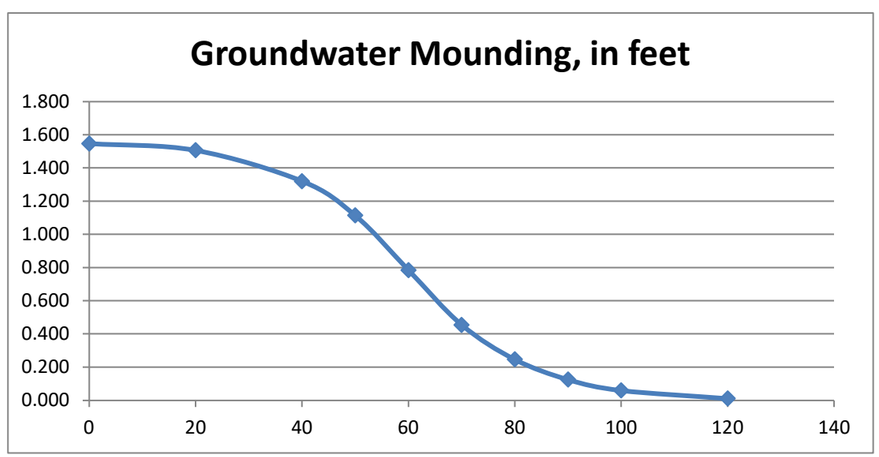
Input Values

4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.320	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
60.000	**x**	**1/2 length of basin (x direction, in feet)**
177.500	**y**	**1/2 width of basin (y direction, in feet)**
0.104	**t**	**duration of infiltration period (days)**
30.000	**hi(0)**	**initial thickness of saturated zone (feet)**

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

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.547	0
1.507	20
1.320	40
1.114	50
0.785	60
0.454	70
0.246	80
0.125	90
0.059	100
0.011	120

Re-Calculate Now



Stormwater Basin P3 - Mounding Analysis

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

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

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

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

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

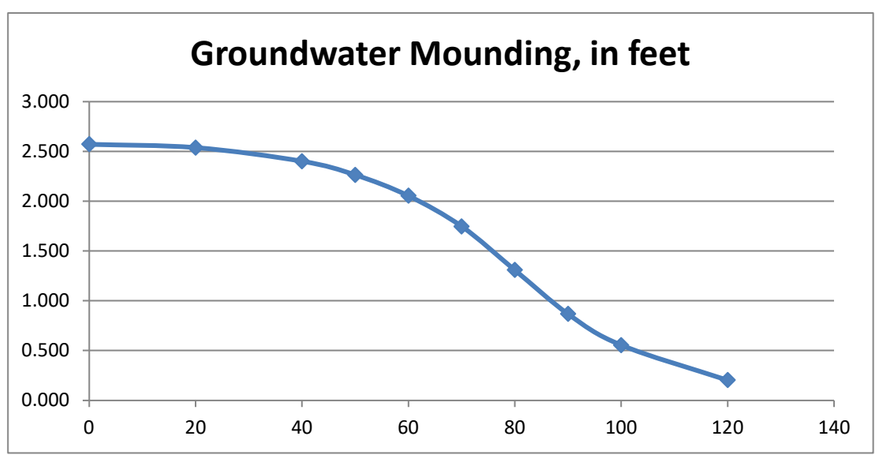
Input Values

4.8200	*R*	**Recharge (infiltration) rate (feet/day)**
0.320	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
80.000	x	**1/2 length of basin (x direction, in feet)**
54.000	y	**1/2 width of basin (y direction, in feet)**
0.188	t	**duration of infiltration period (days)**
30.000	hi(0)	**initial thickness of saturated zone (feet)**

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

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.573	0
2.538	20
2.402	40
2.264	50
2.055	60
1.747	70
1.309	80
0.867	90
0.554	100
0.203	120

Re-Calculate Now



Stormwater Basin P4 - Mounding Analysis

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

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

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

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

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

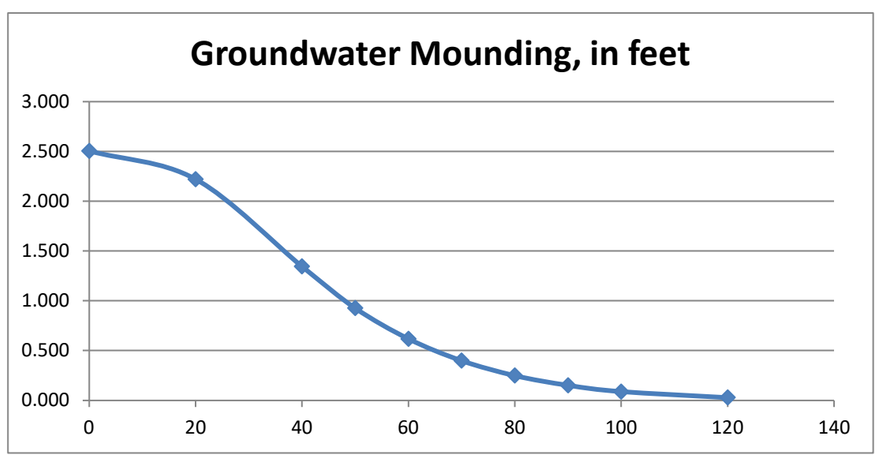
Input Values

4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.320	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
35.000	**x**	**1/2 length of basin (x direction, in feet)**
87.000	**y**	**1/2 width of basin (y direction, in feet)**
0.225	**t**	**duration of infiltration period (days)**
30.000	**hi(0)**	**initial thickness of saturated zone (feet)**

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

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.505	0
2.221	20
1.345	40
0.926	50
0.618	60
0.399	70
0.249	80
0.150	90
0.088	100
0.027	120

Re-Calculate Now



G

Illicit Discharge Statement

Illicit Discharge Compliance Statement

Name of Owner: MCP/Howland Burtt Owner, LLC.
Name of Facility: Burtt Road Development
Location: Burtt Road, Andover, MA 01810

The Site Plans and Drainage Report for the Proposed warehouse, located at Burtt Road Extension, MA, meets the requirements of Standard 10 of the Massachusetts Stormwater Handbook.

The Site Plans were prepared by qualified personnel at the direction of **MCP/Howland Burtt Owner, LLC** The Site Plans identify the location of stormwater management and utility systems. As designed, the systems do not allow for any connections between the stormwater management and sanitary sewer utilities.

All new utilities will service the proposed buildings.

Signature:_____
(To be signed prior to occupancy)