DRAINAGE REPORT

For

NECC Holdings, LLC

PROPOSED

"Subdivision"

180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Norfolk County

Prepared by:

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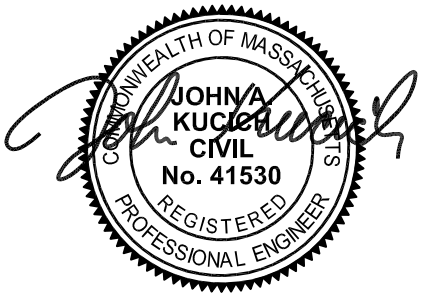

John A. Kucich
Massachusetts P.E. Lic. #41530

BOHLER

June 23, 2025
#MAA230481.00

BOHLER

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the subdivision in the Town of Bellingham, Massachusetts (hereinafter referred to as the "Site"). As shown on the Town Assessor's Maps, the Site is identified as Map 95-Lot 37, Map 95-Lot 37-1, Map 96-Lot62A, Map 97-Lot 15C, and Map 97-Lot 19. The Site, which contains approximately 338.5± acres on five (5) parcels of land, is located at the existing 18-hole New England Country Club golf course and contains a club house, gravel and paved cart paths, gravel and paved parking lots, and landscaped and undeveloped wooded areas.

The proposed project includes the construction of a new 1,055-foot roadway off Paine and maintaining access to the existing driveway servicing the existing clubhouse.

This report addresses a comparative analysis of the pre- and post-development stormwater runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at one (1) "design point" where stormwater runoff currently drains to under existing conditions. This design point is described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates and volumes for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1**. A summary of the existing and proposed volumes for the 2-, 10-, and 25-year storms can be found in **Table 1.2** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

	Peak Flow Discharge in cubic feet per second (cfs)											
	2-year			10-year			25-year			100-year		
	Exist	Prop.	**Delta**	Exist	Prop.	**Delta**	Exist	Prop.	**Delta**	Exist	Prop.	**Delta**
DP1	0.28	0.21	**-0.07**	1.75	1.38	**-0.37**	8.17	8.16	**-0.01**	36.81	36.38	**-0.43**

Table 1.2: Design Point Volume Summary

	Design Point Volume Summary in acre-ft (ac-ft) from 72-hr Time Span											
	2-year			10-year			25-year			100-year		
	Exist	Prop.	**Delta**	Exist	Prop.	**Delta**	Exist	Prop.	**Delta**	Exist	Prop.	**Delta**
DP1	0.058	0.017	**-0.041**	0.809	0.605	**-0.204**	2.278	1.983	**-0.295**	5.262	4.892	**-0.370**

II. EXISTING SITE CONDITIONS

Existing Site Description

The Site consists of approximately 338.5± acres of land located at the existing 18-hole New England Country Club golf course in the Town of Bellingham, MA. The site is bounded by Wrentham Road and residences to the north, Bound Road to the east, commercial businesses to the south, and Paine Street and residences to the west. The site is bordered by Woonsocket, RI to the south, and Wrentham, MA to the east.

The western and central portions of the site contain the existing 18-hole golf course, club house, gravel and paved cart paths, gravel and paved parking lots, and landscaped and wooded areas. The eastern portion of the site is undeveloped and consists of woodland.

Bungay Brook parallels a portion of the Site to the north. Associated wetland resource areas are adjacent to the Brook and located throughout the Site. An Order of Resource Area Delineation (ORAD) was issued 3/5/2025 to confirm the demarcated boundaries of the resource areas. Per MassGIS online mapping, the northern portion of the Site is located within a Zone II and a Zone I is located offsite to the northwest. Refer to **Appendix C** for GIS mapping. Per the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) Number 25021C0313E and Number 25021C0314E, there are Floodplain and Floodway located on site; however, the proposed development areas are outside of these mapped resources. Refer to **Appendix B** for FEMA mapping.

On-Site Soil Information

Soils within the analyzed area consist of the following as classified by the Natural Resource Conservation Service (NRCS) as hydrologic soil group (HSG) ‘A’, ‘B’, and ‘D’ and a variety of soil names and descriptions. Refer to **Appendix C** for the soil unit symbols, names, and descriptions.

Onsite soil testing was performed by Sanborn Head in November and December 2024. Surface soils were determined to be consistent with NRCS mapping. Underlying natural soils were determined to have infiltration rates consistent with HSG ‘A’ (2.41 in/hr) where infiltration practices are proposed. Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

For the purposes of this report, the Site overall analysis area is approximately 20.9± acres. The analysis area flows overland to a wetland system located northwest of the Site. A small portion of the site to the northwest flows overland to a catch basin in Paine Street which ultimately discharges to the northwest wetland system. Slopes range from 1%-30% with on-site elevations ranging from 341 in the south to 187 in the northwest.

Existing Watersheds and Design Point Information

Design Point #1 (DP1) is the wetland system to the northwest. Under existing conditions, this design point receives stormwater flows from approximately 20.9 acres of land. Watershed ED1.3 is routed to a vernal pool identified as EP1.2 prior to discharge to DP1. Watershed ED1.4 is routed to an isolated wetland identified as EP1.1, then conveyed to EP1.2 via a reach identified as ER1, which ultimately discharges to DP1.

The existing site was subdivided into four (4) separate sub catchments to analyze existing flow rates at each design point. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Refer to **Tables 1.1 and 1.2** for the existing conditions peak rates of runoff and volumes. Refer to the Drainage Area Maps provided in **Appendix D** for a graphical representation and breakdown of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of the roadway to serve potential future development, access driveways, landscaping, associated utilities, and stormwater management systems. The Site has been designed to drain to deep-sump, hooded catch basins that will capture and convey stormwater runoff, via a closed-pipe pipe system, to one of three (3) proposed stormwater systems (2 surface infiltration basins and 1 underground infiltration system). Pretreatment of stormwater runoff will be provided by a combination of deep-sump, hooded catch basins, proprietary water quality units and isolator rows.

Proposed Development Collection and Conveyance

Stormwater management systems have been designed for the 100-year storm using NOAA+ rainfall data. Refer to **Appendix E** for proposed hydrologic data. Pipe and outlet protection sizing calculations via Hydraflow Storm Sewers are designed for the 25-year storm for systems into stormwater management systems and for the 100-year storm for cross culverts and stormwater basin outfalls. Refer to **Appendix F** for more information.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet, or exceed, the standards set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards as well as the Town of Bellingham Stormwater Management Regulations. Refer to **Section V** for additional information.

Proposed Watersheds and Design Point Information

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in **Section II** above.

Under proposed conditions DP#1 receives stormwater flows from approximately 20.9 acres of land. The site was subdivided into eight (8) separate sub catchments for the proposed conditions. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Refer to **Tables 1.1 and 1.2** for the calculated proposed conditions peak rates of runoff and volumes. Refer to the Drainage Area Maps provided in **Appendix E** for a graphical representation and breakdown of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

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

Table 4.1: NOAA+ Rainfall Depths

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.74	5.84	7.52	10.35

*NOAA+ rainfall values derived from NOAA ATLAS on 12/17/2024

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

V. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

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

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1**, the development of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points. As outlined in **Table 1.2**, the system has been designed so that post-development volumes are below pre-development conditions for the 2-, 10-, and 25-year storm events at all design points.

Standard #3: Recharge

The stormwater runoff from the project will be collected and diverted to a series of above and underground infiltration systems. The project as proposed will involve the creation of approximately 0.88± acres of new impervious area and is required to infiltrate 5,563 cubic feet of stormwater as defined in Stormwater Standard 3. The project consists of approximately 2.7± total acres of impervious area and is required to recharge 1-inch of runoff times the total impervious area of the post development project, or 9,725 cubic feet of stormwater, as defined in by the Town of Bellingham Stormwater Regulations. The proposed infiltration systems will provide 14,405 cubic feet of volume below the lowest outlets for groundwater recharge. Refer to **Appendix F** of this report for calculations documenting required and provided recharge volumes.

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

A four (4) foot separation to estimated seasonal high groundwater is provided at the infiltration BMP's and a groundwater mounding analysis is not required.

Standard #4: Water Quality

Water quality treatment is provided via deep sump catch basins, proprietary water quality units, isolator rows, and infiltration systems. TSS removal calculations are included in **Appendix F** of this report. The project is required to treat 9,725 cubic feet of water quality volume as defined in Stormwater Standard 4. The proposed infiltration systems provide 14,405 cubic feet of water quality volume below the lowest outlets for water quality treatment. In addition, proprietary water quality units have been sized to treat the 1-inch water quality flow rate.

The project proposes to provide a minimum of 60% total phosphorus removal as required per the Town of Bellingham Stormwater Management Regulations for new developments. Majority of phosphorus removal is provided via recharge. As designed, the stormwater system provides 14,405 cubic feet of volume below the lowest outlets and is equal to approximately 1.5-inches of runoff over the total impervious area of the post development project site. Per Tables 3-17 and 3-18 of Attachment 3 to Appendix F of the MA MS5 General Permit, an infiltration basin and surface infiltration receive at least 99% phosphorus removal when sized for a depth of runoff of 1.5-inches from impervious areas. Additional removal is provided via street sweeping and catch basin cleaning.

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

Standard #5: Land Use with Higher Potential Pollutant Loads

The proposed project accounts for potential "Land Uses with Higher Potential Pollutant Loads" in the final developed condition. Accordingly, the project will provide 44% TSS removal prior to infiltration and treat the 1-inch water quality flow rate, as further outlined in **Appendix F** of this report.

Standard #6: Critical Areas

A Zone II extends across the northern edge of the Site, and a Zone I is located beyond the Site to the northwest. Refer to **Appendix C** for MassGIS mapping. The proposed stormwater management system has been designed to provide at least eighty percent (80%) removal of Total Suspended Solids (TSS), per the Town Regulations, through the use of several Best Management Practices (BMPs), including deep-sump hooded catch basins, proprietary water quality units, isolator rows, and infiltration basins. The deep-sump hooded catch basins, proprietary water quality units, and isolator rows will provide a minimum of 44% TSS removal prior to all infiltration. Refer to **Appendix F** for TSS removal calculations.

Standard #7: Redevelopment

Although a portion of the project may be considered redevelopment, the project has been designed to meet the standards as if it were a new development.

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

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

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

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

Standard #10: Prohibition of Illicit Discharges

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

VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies, as well as volumes for the 2-, 10-, 25-, and 100-year storm events at all design points. Refer to **Table 1.1** and **Table 1.2**. The proposed best management practices will also result in an effective removal of total suspended solids and total phosphorus from the post-development runoff.

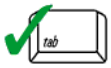
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

6/23/2025

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Surface infiltration basins & underground infiltration systems

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☒ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☒ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☒ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☒ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

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

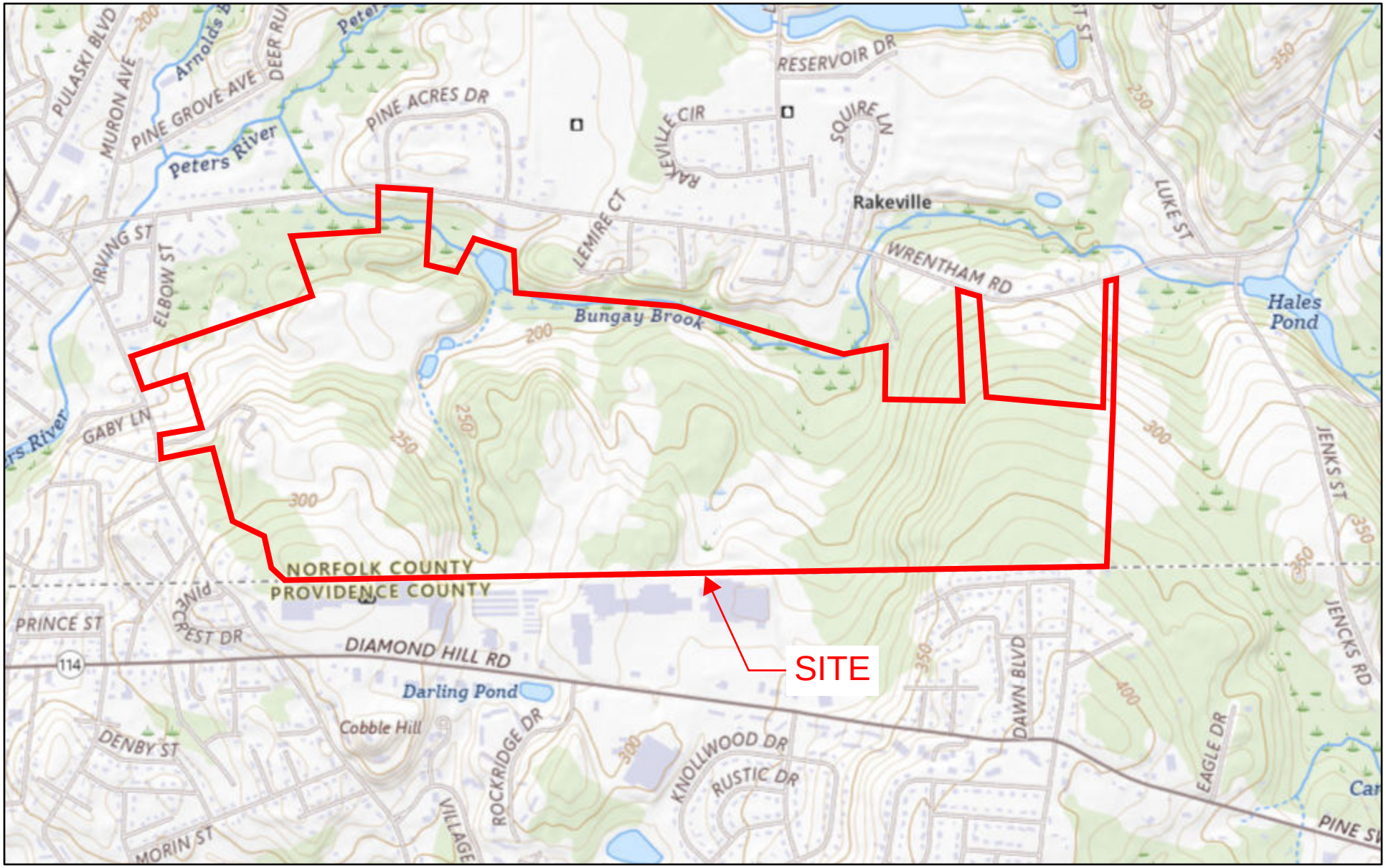
☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*

180 Paine Street, 0 Bound Road, 585 Wrentham Road, Bellingham MA 02019



2/14/2025, 1:11:52 PM

1:18,056

0 0.1 0.2 0.4 mi

0 0.17 0.35 0.7 km

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography

USGS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from digital orthophotography. Base map files were provided in digital format by Massachusetts Geographic Information Systems (MassGIS). Ortho imagery was produced at a scale of 1:5,000. Aerial photography is dated April 2005.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

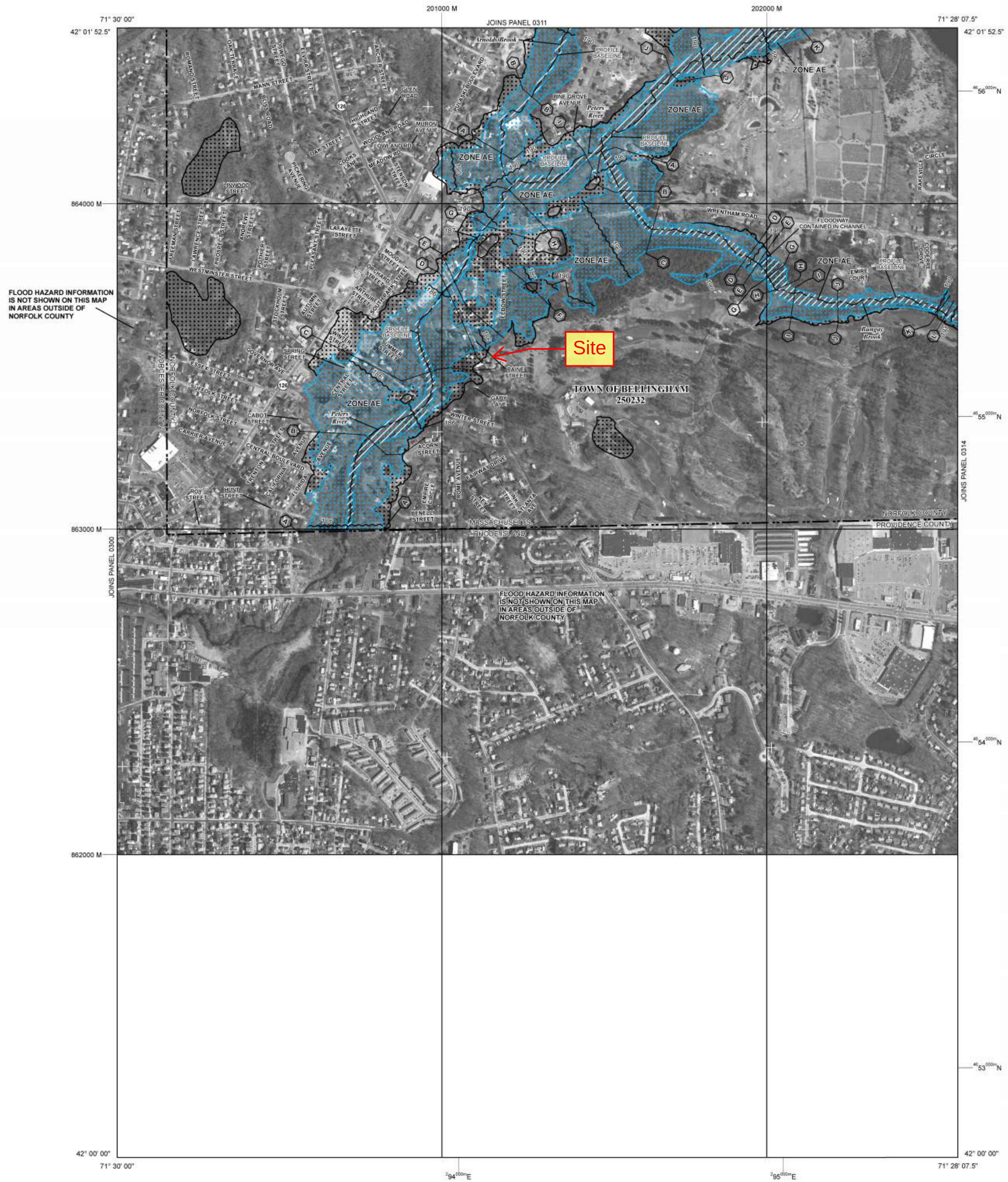
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center** (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at 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 that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface 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 Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide 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 determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square 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 Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

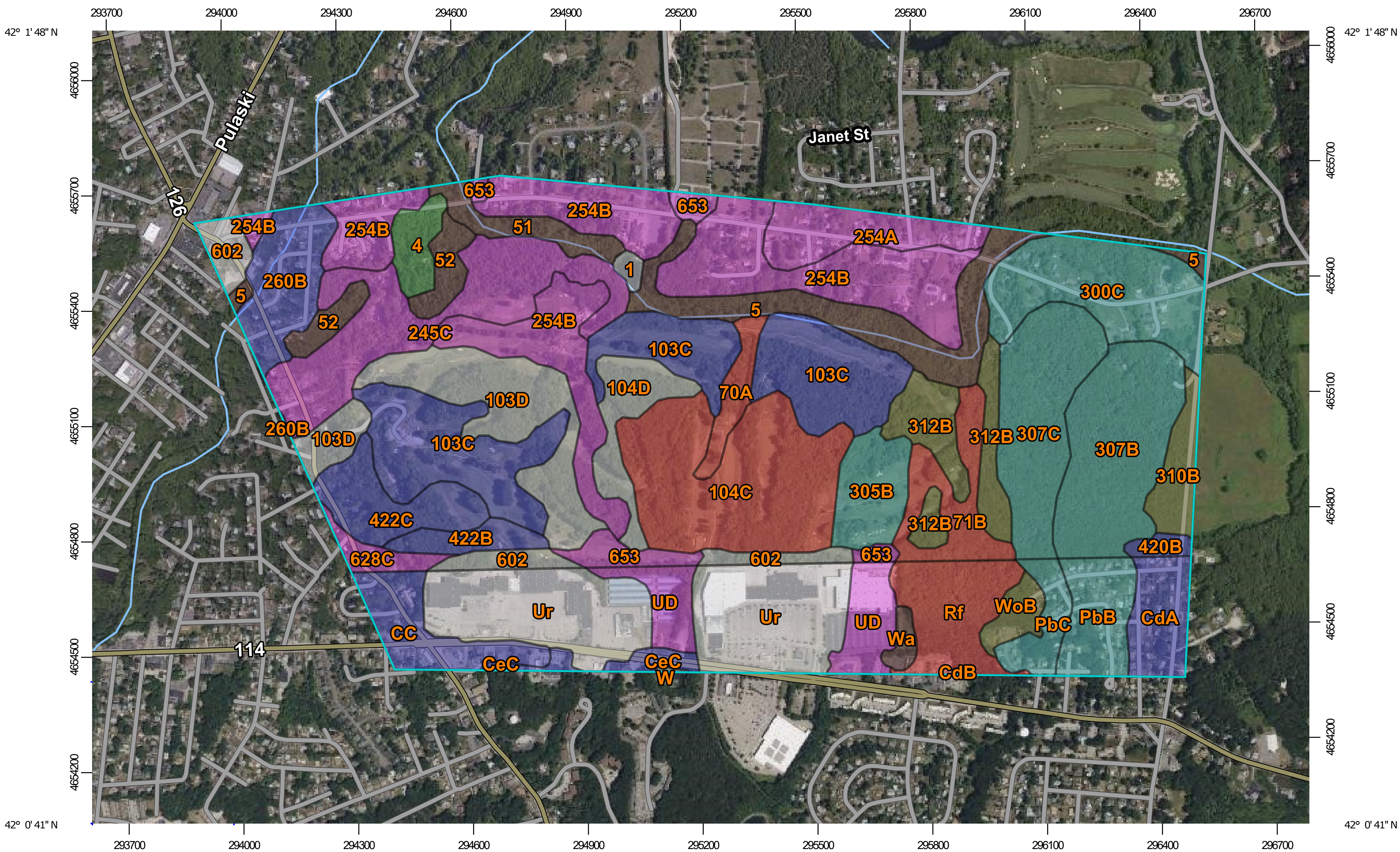
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

~~~ 513 ~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)—(A) Cross section line

(23)- - - -(23) Transect line

Culvert

Bridge

45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

4989000 M 1000-meter ticks: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Lambert Conformal Conic projection

$^{49}89^{000m}$ N 1000-meter Universal Transverse Mercator grid values, zone 19N

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
July 17, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community 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 agent 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

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0313E

FIRM
FLOOD INSURANCE RATE MAP
NORFOLK COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 313 OF 430
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BELLINGHAM, TOWN OF	250232	0313	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25021C0313E

EFFECTIVE DATE
JULY 17, 2012

Federal Emergency Management Agency
~~~

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *MASSGIS MAPPING*
- *STORMWATER INFILTRATION TESTING*
- *REPORT OF GEOTECHNICAL INVESTIGATION*

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts; and State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington ...
(MAA230481 - Bellingham MA)



Map Scale: 1:14,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 200, 400, 800, 1200

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:25,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
Survey Area Data: Version 24, Aug 30, 2024

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.

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

Date(s) aerial images were photographed: May 24, 2020—Jul 1, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		1.4	0.2%
4	Rippowam fine sandy loam, 0 to 3 percent slopes, frequently flooded	A/D	6.3	0.9%
5	Saco silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded	B/D	27.2	3.8%
51	Swansea muck, 0 to 1 percent slopes	B/D	7.7	1.1%
52	Freetown muck, 0 to 1 percent slopes	B/D	9.5	1.3%
70A	Ridgebury fine sandy loam, 0 to 3 percent slopes	D	6.1	0.9%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	14.1	2.0%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	B	63.2	8.9%
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes		33.4	4.7%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	D	47.9	6.7%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 35 percent slopes		11.9	1.7%
245C	Hinckley loamy sand, 8 to 15 percent slopes	A	37.8	5.3%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	14.9	2.1%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	79.5	11.2%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	17.1	2.4%
300C	Montauk fine sandy loam, 8 to 15 percent slopes	C	30.5	4.3%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	12.6	1.8%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	C	34.5	4.9%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	29.3	4.1%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	8.2	1.2%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	18.4	2.6%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	2.2	0.3%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	6.1	0.9%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	B	15.1	2.1%
602	Urban land, 0 to 15 percent slopes		11.7	1.6%
628C	Canton-Urban land complex, 3 to 15 percent slopes	A	4.3	0.6%
653	Udorthents, sandy	A	8.6	1.2%
Subtotals for Soil Survey Area			**559.5**	**78.9%**
Totals for Area of Interest			**709.6**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CC	Canton-Urban land complex, very rocky	B	14.1	2.0%
CdA	Canton and Charlton fine sandy loams, 0 to 3 percent slopes	B	11.5	1.6%
CdB	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	B	0.1	0.0%
CeC	Canton and Charlton fine sandy loams, 3 to 15 percent slopes, very rocky	B	4.3	0.6%
PbB	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	C	13.4	1.9%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
PbC	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	7.6	1.1%
Rf	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	D	18.6	2.6%
UD	Udorthents-Urban land complex	A	16.3	2.3%
Ur	Urban land		56.9	8.0%
W	Water		0.2	0.0%
Wa	Walpole sandy loam, 0 to 3 percent slopes	B/D	2.3	0.3%
WoB	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	C/D	4.7	0.7%
Subtotals for Soil Survey Area			**150.0**	**21.1%**
Totals for Area of Interest			**709.6**	**100.0%**

Description

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

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

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

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

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

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

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

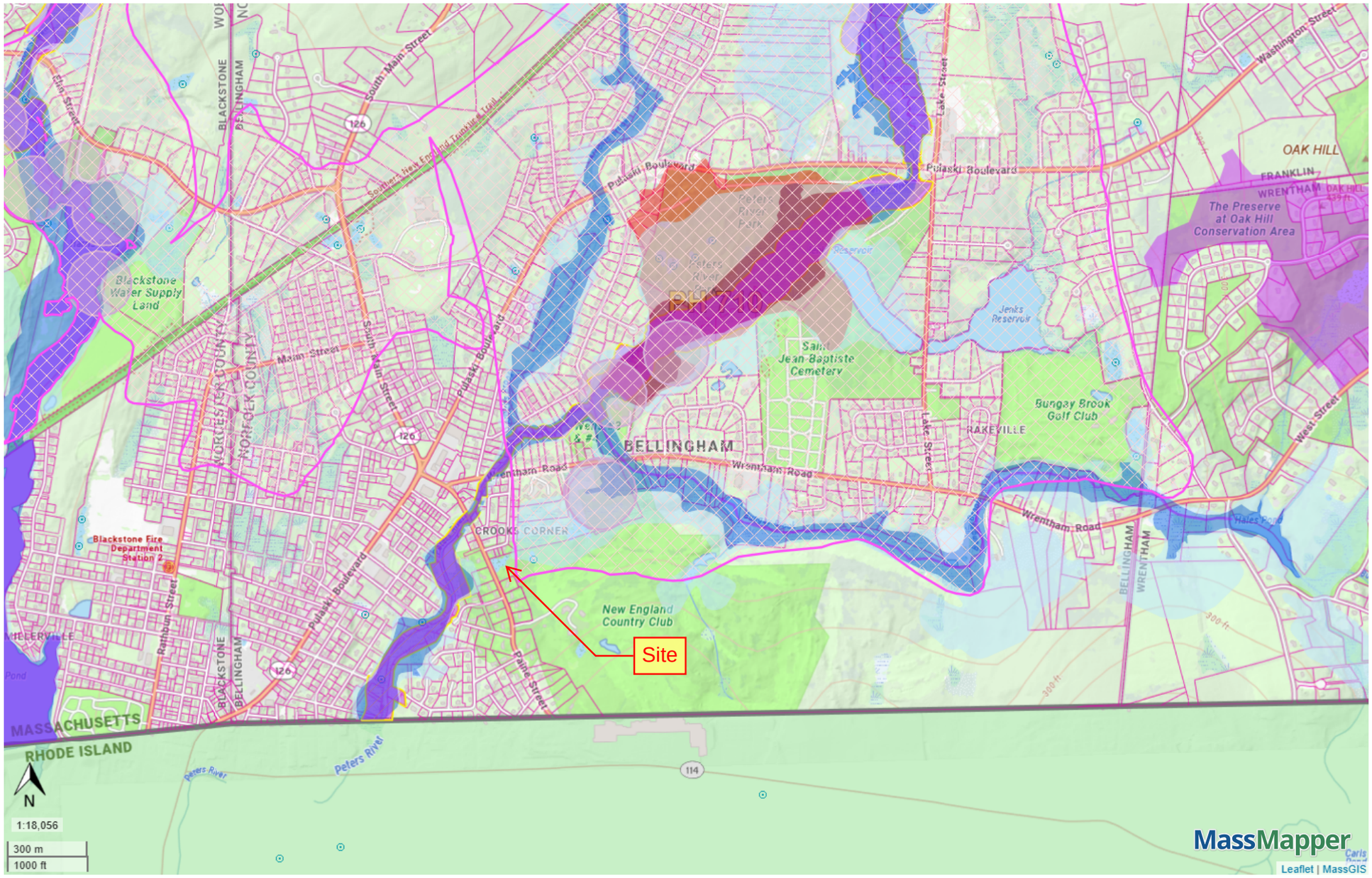
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Bellingham MA



Zone IIs Dissolved

Zone Is Dissolved

BioMap Critical Natural Landscape Components: Aquatic Core Buffer

BioMap Core Habitat Components: Rare Species Core

BioMap Core Habitat Components: Vernal Pool Core

BioMap Core Habitat Components: Aquatic Core

Potential Vernal Pools

NHESP Priority Habitats of Rare Species

NHESP Certified Vernal Pools

Property Tax Parcels

For expedited review, this report is limited only to results relevant to the Definitive Subdivision (TP-1 through TP-4)

SANBORN HEAD

Mark Callahan
Copper Mill Acquisitions, LLC
66 Long Wharf, Suite 403
Boston, Massachusetts 02110

January 10, 2025
File No. 6151.000

Re: Subsurface Evaluation for Stormwater
New England Country Club
180 Paine Street
Bellingham, Massachusetts

Dear Mark:

Sanborn, Head & Associates, Inc. (Sanborn Head) is pleased to provide this subsurface evaluation for stormwater on behalf of Copper Mill Acquisitions, LLC (Client) to summarize subsurface hydrogeologic data for the proposed residential development located at 180 Paine Street in Bellingham, Massachusetts (Site). A locus plan of the Site is included in Figure 1.

Our understanding of the existing conditions and proposed development is based on plans provided electronically entitled "P-RGDC-PROP-MAA230481.00-0a" provided by Bohler Engineering (Bohler) of Southborough, Massachusetts on November 20, 2024, and our evaluation of the subsurface conditions encountered in the subsurface explorations observed by Sanborn Head. This letter is subject to the Limitations provided in Attachment A.

EXISTING CONDITIONS AND PROJECT UNDERSTANDING

Site Description

The Site, identified by the Town of Bellingham Assessor's office as Parcel No. 0095-0037-0000, is an approximately 334-acre commercial golf course with a mixture of open areas for fairways and putting greens, as well as undeveloped woodland areas. An intermittent stream runs through the middle of the Site from south to north and connects to Bungay Brook, which borders the Site to the north. Wetlands, vernal pools, and protected resource areas are present throughout the Site. The Site is bound by the State of Rhode Island to the south, and the Town of Wrentham, Massachusetts to the east. The Site abuts residential properties to the north, southeast, west, and northwest, and commercial properties to the south.

Topography at the Site slopes from a high point along the southern property border at approximate elevation El. 376 feet, towards low points along Bungay Brook to the northeast at approximate El. 180 feet. Elevations provided in this report reference the North American Vertical Datum of 1988 (NAVD 88). The general location of the Site is shown in Figure 1 and existing conditions are provided on Figures 2 through 3.

Project Description

Based on the provided plans, there are two separate proposed development areas at the Site; six (6) residential buildings are proposed on the western portion of the Site and six (6) residential buildings are proposed on the eastern portion of the Site, referred to as the Western and Eastern Parcels herein. Additionally, the proposed development will include access roads, parking areas, retaining walls,

utilities, and surface and underground stormwater management features. . We understand the current stormwater design consists of five (5) surface stormwater basins, twelve (12) subsurface stormwater management systems proposed below the surface parking lots, landscaping, and access roads, and one (1) potential surface/subsurface?? stormwater management feature on the Eastern Parcel. The proposed Site development and approximate locations of the stormwater management areas are shown on Figure 2 and 3.

SUBSURFACE EXPLORATIONS

The following table summarizes the subsurface explorations by Sanborn Head.

Dates	Firm	Type of Exploration	Designations	Depth (ft)
November 18 through 22, 25, and 26, 2024	G & M Subsurface, LLC of North Dighton, MA	Test Pits	SW-TP-1 through SW-TP-47	3.8 to 12.8 bgs[1]
December 10 and 12, 2024	G & M Subsurface, LLC of North Dighton, MA	Test Borings	SH-1 through SH-10	7.6 to 29.0 bgs[1]

Notes:
1. bgs = below ground surface

Subsurface explorations were observed and logged by Sanborn Head personnel on a full-time basis. Test borings were field classified using the Modified Burmister System and test pits were field classified using the United States Department of Agriculture (USDA) Textural Classification System. The locations of the explorations performed by Sanborn Head are shown on Figures 2 and 3; logs of the test borings, including legend, and test pits are provided in Attachments B.1 and B.2, respectively.

SOIL LABORATORY TESTING

Geotechnical laboratory tests were performed by GeoTesting Express, Inc. of Acton, MA to evaluate the engineering properties of the soils at the Site. Seventeen (17) soil samples from test pits and test borings across the Site were submitted for grain size distribution (sieve) analysis in accordance with ASTM D6913. Of these samples, thirteen (13) were also submitted for hydrometer analysis (ASTM D7928) and USDA Textural Classification in accordance with USDA guidelines.

SUBSURFACE CONDITIONS

Based on Sanborn Head's observations during our subsurface exploration programs, the subsurface conditions at the exploration locations generally consists of topsoil overlying very loose to medium dense sand, sandy silt, and glacial till deposits within the Western Parcel and topsoil overlying medium dense to very dense glacial till deposits and bedrock within the Eastern Parcel.

A summary of our subsurface observations is provided below:

Soil Strata [1]	Locations Encountered	Depth to Top of Layer (feet)	Approximate Layer Thickness (feet)	Layer Composition
General:				
Topsoil	Present at each test pit and test boring with the exception of SH-8	0	0.2 to 2.8	Very loose to medium dense, fine to coarse sand, little to some silt, with varying amounts of gravel and organic particles (roots, leaves).
Subsoil	SW-TP-1 through SW-TP-47, SH-2, SH-3, and SH-6 through SH-10	0.2 to 2.8	0.3 to 4.8	Very loose to medium dense, fine to coarse sand, trace to little silt, with varying amounts of gravel.
Western Parcel:				
Sand	SW-TP-1 through SW-TP-20, and SH-1 through SH-5	0.8 to 5.3	>7.3 to >23.7	Very loose to medium dense, fine to coarse sand, trace to some silt, with varying amounts of gravel, cobbles, and boulders.
Sandy Silt	SH-4 and SH-5	10 to 15	>10 to >14	Loose to medium dense, silt and sand.
Glacial Till	SH-2 and SH-4	17 to 20	1.7 to 6.7	Dense to very dense, silt or fine to coarse sand, with varying amounts of silt, sand, gravel, cobbles, and boulders.
Weathered Rock and Probable Bedrock[2]	SH-1, SH-2, and SH-4	18.7 to 26.7	-	Auger and excavator refusal due probable bedrock was encountered at varying elevations across the Site. Rock coring was not performed during the subsurface explorations. Published mapping indicates schist rock type of the Blackstone Group[2].
Eastern Parcel:				
Sand	SW-TP-21	2.8	3.7	Silty sand with boulders, cobbles, and gravel.
Glacial Till	SW-TP-22 through SW-TP-47 and SH-6 through SH-10	1.9 to 5.1	1.8 to 12.5	Medium dense to very dense, fine to coarse sand, with varying amounts of silt gravel, cobbles, and boulders.
Weathered Rock and Probable Bedrock[2]	SW-TP-21 through SW-TP-24, -26, -27, -32, -33, 36, 37, -40 through -47, and SH-6 through SH-10	3.8 to 14.5	-	Auger and excavator refusal due to probable bedrock was encountered at varying elevations across the Site. Rock coring was not performed during the subsurface explorations. Published mapping indicates schist rock type of the Blackstone Group[2].

Notes:
1. See subsurface exploration logs by Sanborn Head for further observations made during drilling and excavation. The depths and thicknesses listed above reference the ground surface elevation at the time of the exploration.
2. Based on published maps prepared for the United States Geological Survey entitled "The State Geologic Map Compilation geodatabase of the conterminous United States" published in 2017 and authored by Norton, J.D., C.A. San Juan, and D.B. Stoeser.

Where encountered, the depth to groundwater was measured in the test borings immediately following drilling and prior to removing augers. In general, groundwater was not encountered in the subsurface explorations, with the exception of test borings SH-2 and SH-5 which measured groundwater at approximate elevations El. 188.4 feet and El. 187.7 feet, respectively. Groundwater elevations observed at the Site are provided in Figures 2 and 3.

It should be noted that groundwater levels will vary based on seasonal fluctuations in temperature and precipitation. Groundwater levels during other periods of the year may differ from the time the groundwater measurements were made at the Site. Due to the presence of shallow bedrock in the Western Parcel, seasonal groundwater may be encountered in a perched condition on or near the top of the bedrock surface in isolated locations.

RECOMMENDATIONS

Recommended infiltration rates and estimated seasonal high groundwater (ESHGW) are summarized in the table below:

Stormwater System Area Designation	USDA Textural Classification[1]	ESHGW El. (feet)[2]	Rawl's Rate (in/hr)
Above Ground Basin Area 1	Bouldery Gravelly Sand	<195.9	8.27
Above Ground Basin Area 2	Bouldery Sand	<196.7	8.27
Above Ground Basin Area 3	Loamy Sand	<205.8	2.41
Above Ground Basin Area 4	Bouldery Gravelly Sandy Loam	208.5	1.02
Above Ground Basin Area 5	Bouldery Cobbly Loamy Sand	300.0	2.41
Underground Basin Area 1	Loamy Sand	<197.2	2.41
Underground Basin Area 2	Sand	188.4	8.27
Underground Basin Area 3	Bouldery Gravelly Loamy Sand	190.0	2.41
Underground Basin Area 4	Loamy Sand	<204.0	2.41
Underground Basin Area 5	Loamy Sand	187.7	2.41
Underground Basin Area 6	Bouldery Loamy Sand	322.8	2.41
Underground Basin Area 7	Bouldery Loamy Sand	329.3	2.41
Underground Basin Area 8	Bouldery Cobbly Loamy Sand	326.6	2.41
Underground Basin Area 9	Bouldery Sand	332.7	8.27
Underground Basin Area 10	Bouldery Loamy Sand	340.1	2.41
Underground Basin Area 11	Bouldery Loamy Sand	348.1	2.41
Underground Basin Area 12	Sand	350.3	8.27
Stormwater Feature Area 1	Bouldery Cobbly Loamy Sand	<296.2	2.41

Notes:

1. The USDA Soil Texture shown represents the most restrictive C-layer soil texture observed in the test pit.
2. In the absence of soil mottling and visual observations of groundwater, ESHGW elevations were interpreted as top of probable bedrock, bottom of the test pit, or correlated to groundwater observations made in nearby test borings or nearby surface waters.
3. '<' denotes 'less than'

Depth to refusal, depth to ESHGW, and recommended infiltration rate are also summarized by basin on Figures 2 and 3.

Due to the variable textural classification of the existing subsoil, we further recommended that after exposing the proposed subgrade for the proposed stormwater feature(s) any remaining existing topsoil and subsoil be removed within the footprint; and, if necessary, replaced with suitably draining material that meets or exceeds the proposed infiltration rates for the respective basin.

Care should also be taken to limit disturbance to exposed stormwater system subgrades to avoid over-compaction and/or deposition of silty materials by erosion and surface runoff. In the event exposed subgrades are not maintained, unsuitable subgrades should be identified, cleaned or scraped and, if necessary, unsuitable materials over-excavated and replaced with suitably draining material that meets or exceeds the proposed infiltration rates for the respective basin.

We trust this data report meets the current needs of the project. If you should have any questions, please call us at (978) 392-0900.

Very truly yours,
SANBORN, HEAD & ASSOCIATES, INC.

Leigh A. Macedo
Project Manager

Quincy Pratt, P.E.
Project Director

LAM/QP/LDN: lam

Encl. Figures
Attachment A: Limitations
Attachment B: Subsurface Exploration Logs
Attachment B.1: Test Boring Logs
Attachment B.2: USDA Test Pit Logs
Attachment C: Laboratory Test Results

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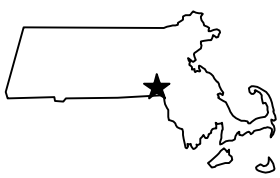
Figures



NOTES:
The base map was taken from the 7.5-minute USGS Topographic Quadrangle Maps mosaic created in June 2001 by MassGIS (Bureau of Geographic Information).

Drawn By: D. Dombrowsky
Designed By: L. Macedo
Reviewed By: Q. Pratt
Project No: 6151.000
Date: January 2025

1000 0 2000 Feet

SANBORN HEAD

Figure No. 1

Locus Plan

Subsurface Evaluation for Stormwater

180 Paine Street
Bellingham, Massachusetts

Underground Basin Area 1
N.E. [<197.2]
N.E. [<197.2]
[<197.1]
Loamy Sand
2.41 in/hr

Underground Basin Area 2
N.E. [<204.2]
N.E. [<204.2]
[188.4]
Sand
8.27 in/hr

Underground Basin Area 3
N.E. [<196.2]
N.E. [<190.0]
[190.0]
Bouldery Gravelly Loamy Sand
2.41 in/hr

Underground Basin Area 4
N.E. [<204.0]
N.E. [<204.0]
[<204]
Loamy Sand
2.41 in/hr

Above Ground Basin Area 3
N.E. [<205.8]
N.E.[<205.8]
[<205.8]
Loamy Sand
2.41 in/hr

Underground Basin Area 5
N.E. [<206.2]
N.E. [<206.2]
[187.7]
Loamy Sand
2.41 in/hr

Above Ground Basin Area 1
N.E. [<195.9]
N.E. [<195.9]
[<195.9]
Bouldery Gravelly Sand
8.27 in/hr

Above Ground Basin Area 2
N.E. [<196.7]
N.E. [<196.7]
[<196.7]
Bouldery Sand
8.27 in/hr

Not Evaluated Per Design Team's Request

For expedited review, this report is limited only to results relevant to the Definitive Subdivision (TP-1 through TP-4)

SW-TP-1 SW-TP-2 SW-TP-3 SW-TP-4 SW-TP-5 SW-TP-6 SW-TP-7 SW-TP-8 SW-TP-9 SW-TP-10 SW-TP-11 SW-TP-12 SW-TP-13 SW-TP-14 SW-TP-15 SW-TP-16 SW-TP-17 SW-TP-18 SW-TP-19 SW-TP-20

SH-1
25.0 [195.0]
N.E. [<195.0]

SH-2
18.6 [182.40]
12.6 [188.40]

SH-3
N.E. [<185.0]
N.E. [<185.0]

SH-4
26.6 [185.4]
N.E. [<185.4]

SH-5
N.E. [<186.0]
27.3 [187.7]

LEGEND:

SW-TP-1	APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT OBSERVED BY SANBORN HEAD (NOVEMBER 2024)
SH-1	APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING OBSERVED BY SANBORN HEAD (DECEMBER 2024)
18.6 [182.4]	DEPTH AND ELEVATION OF PROBABLE BEDROCK, IN FEET
12.6 [188.4]	DEPTH AND ELEVATION OF GROUNDWATER, INFEET
[<196]	ELEVATION OF ESTIMATED SEASONAL HIGH GROUNDWATER (ESHGW), IN FEET
BOULDERY SAND	USDA TEXTURAL CLASSIFICATION OF RECEIVINGLAYER
2.41 in/hr	RECOMMENDED RAWL'S RATE, IN INCHES PER HOUR (IN/HR)
N.E.	NOT ENCOUNTERED
<	DENOTES "LESS THAN" ITEM WAS NOT ENCOUNTERED AND IS AT AN ELEVATION LESS THAN ELEVATION SHOWN

NOTES:

1. THE BASE MAP WAS DRAWN FROM A PLAN TITLED, "GRADING AND DRAINAGE PLAN", PREPARED BY BOHLER ENGINEERING, OF BEDFORD, NH, DATED 11/01/2024 .
2. TEST PITS DESIGNATED SW-TP-1 THROUGH SW-TP-47 WERE EXCAVATED BY G & M SUBSURFACE LLC OF NORTH DIGHTON, MA AND OBSERVED BY SANBORN HEAD BETWEEN NOVEMBER 18 AND 26, 2024.
3. TEST BORINGS DESIGNATED SH-1 THROUGH SH-10 WERE ADVANCED BY G & M SUBSURFACE LLC OF NORTH DIGHTON, MA AND OBSERVED BY SANBORN HEAD ON DECEMBER 10 AND 12, 2024.
4. APPROXIMATE LOCATIONS OF EXPLORATIONS WERE MARKED IN THE FIELD USING A GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) RECEIVER AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. GROUND SURFACE ELEVATIONS AT THE EXPLORATION LOCATIONS WERE ESTIMATED BY INTERPOLATION BETWEEN THE TOPOGRAPHIC CONTOURS SHOWN ON THE BASE PLAN. AS SUCH, THE GROUND ELEVATIONS AT THE EXPLORATIONS AND BEDROCK AND GROUNDWATER ELEVATIONS AT THE EXPLORATIONS SHOULD BE CONSIDERED APPROXIMATE.
6. GROUNDWATER OBSERVATIONS WERE MADE IN THE EXPLORATIONS AT THE TIME OF DRILLING OR EXCAVATING. GROUNDWATER ELEVATIONS IN THE TEST PITS ARE BASED ON OBSERVED GROUNDWATER OR EVIDENCE OF ESHGW. GROUNDWATER ELEVATIONS IN THE BORINGS WERE MADE DURING DRILLING AND SHOULD BE CONSIDERED UNSTABILIZED.

SANBORN HEAD

GRAPHICAL SCALE
90' 45' 0' 90' 180'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: D. DOMBROWSKY/N. JOHNSON
DESIGNED BY: L. MACEDO
REVIEWED BY: Q. PRATT
PROJECT MGR: L. MACEDO
PIC: Q. PRATT
DATE: JANUARY 2025

SUBSURFACE EVALUATION FOR STORMWATER
180 PAINE STREET
BELLINGHAM, MASSACHUSETTS

PROJECT NUMBER: 6151.000

REFUSAL AND GROUNDWATER PLAN WESTERN PARCEL

FIGURE NUMBER: 2

Attachment A

Limitations

APPENDIX A
LIMITATIONS

Explorations

1. The analyses, recommendations, and designs submitted in this report are based in part on the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions may be more or less gradual than indicated. For specific information, refer to the test boring logs.
3. Water level readings have been made in the drill holes at the times and under the conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from those occurring at the time measurements were made.

Review

4. In the event that any changes in the nature, design, or location of the proposed building are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of the report modified or verified in writing by Sanborn Head.

Construction

5. It is recommended that this firm be retained to provide soil engineering services during the excavation and earthwork construction phases of the work. This is to observe compliance with the design concepts, specifications, or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

6. This report has been prepared for the exclusive use of NECC Holdings, LLC c/o Copper Mill Acquisitions, LLC of Boston, Massachusetts for the proposed development at 180 Paine Street in Bellingham, Massachusetts, in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
7. This stormwater, soil and foundation engineering report has been prepared for this project by Sanborn Head for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of this report may secure it with the understanding that its scope is limited to design considerations only.

Attachment B

Subsurface Exploration Logs

Boring / Monitoring Well Log Legend

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Industrial Site Redevelopment
Location: Anytown, State
Project No.: 1234.56

Log of Monitoring Well SH-1

Ground Elevation: 112.2 feet
TOC Elevation: 115.2 feet
PVC Elevation: 115.10 feet
Datum: MSL

Drilling Method: Mobile B-53 Truck, 5" PW Drive & Wash

Sampling Method: 2" O.D. Split Spoon w/140 lb Safety Hammer

Drilling Company: Ground Down Drilling Co.
Foreman: J. Driller
Date Started: 06/25/08 **Date Finished: 06/26/08**
Logged By: A. Engineer **Checked By: A. Principal**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
06/24/08	09:45	10.0'	Ground	27'	27'	<5 min
06/25/08	14:50	12.0'	Top of PVC	Well Installed	50'	15 min
07/03/08	13:00	12.2'	Top of PVC	Well Installed	50'	8 days

Depth (ft)	Casing Blows (per ft)	Drill Rate (min/ft)	Sample Information					Stratum		Geologic Description	Well Diagram	Well Description
			Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Log	Description			
1	2	3	4	5	6	7	8	9	9	10	11	11

1. The numbers in this column report the depth in feet below ground surface.

2. The numbers in this column report the number of blows required to drive the drill casing one foot using a 300 pound hammer, unless otherwise specified.

3. The numbers in this column report the rate of advance when coring rock.

4. The values in this column report the sample designation. In the example S-1, "S" indicates the sample type and "1" indicates the sample number.

"S" indicates split spoon sample
"U" indicates Shelby tube sample
"C" indicates rock core sample
"G" indicates grab sample

5. The numbers in this column report the depth, in feet, from the ground surface of the sample identified in column 4.

6. The numbers in this column report the number of blows required to drive a split spoon sampler 6 inches using a 140 pound hammer free falling 30 inches. The standard split spoon sampler is 1-3/8 inch inside diameter and 2 inches outside diameter. The Standard Penetration Resistance, or N-value in blows per foot, is the sum of the blows recorded over the second and third 6-inch interval.

A number followed by "/3" indicates the distance that the sampler advanced. For example "100/4" indicates that 100 blows of a 140 pound hammer falling 30 inches advanced the sampler 4 inches. "WOR/24" indicates the weight of the drilling rods without the hammer caused the sampler to advance 24 inches.

"WOH" indicates the static weight of the 140 pound hammer and the drilling rods attached to the split spoon sampler were sufficient to cause the sampler to advance.

"WOR" indicates the static weight of the drilling rods attached to the split spoon sampler was sufficient to cause the sampler to advance.

7. The values shown are the length of the soil or rock core sampler penetration and the number of inches of sample recovered from the sampler.

8. The values shown are the results of field tests performed on soil or rock samples. The test method, result and units are indicated. Unless otherwise noted "ND" denotes not detected.

9. These columns provide a graphic illustration and verbal description of the subsurface soil and rock strata. The depths of strata changes should be considered approximate and general in nature, actual strata changes in the field may be more gradual.

10. Descriptions of soil samples include:

- the density or consistency;
- color;
- a listing of MAJOR and minor soil components based on particle size and plasticity;
- structure,
- moisture; and
- other pertinent characteristics.

For example: Medium dense, brown, fine to medium SAND, trace Silt. Stratified. Moist. Faint petroleum odor.

Description of rock core samples include:

- hardness, weathering, rock continuity, color, texture, rock type, structure; and RQD (%)

For example: Hard to very hard, slightly weathered, grey-green, fine grained, RHYOLITE, with joints spaced 4 to 12 inches apart and dipping from near horizontal to approximately 60°. Open crack in core at 14.4', moderately fractured . RQD=58%

NOTE: "RQD" is defined as the summation of all pieces of rock core greater than 4 inches in length divided by the length of the core run and expressed as a percentage.

11. Monitoring well materials or other equipment installed within the borehole are graphically presented in these columns. If no equipment was installed, these columns are used for notes, remarks or other pertinent observations.

Description and Classification of Soil

1. Density or Consistency: The density or consistency of a soil sample is based on the Standard Penetration Test N-value according to the following table:

Density of Granular Soil	SPT N-Value		Consistency of Cohesive Soil
Very Loose	0-4	<2	Very Soft
Loose	5-10	2-4	Soft
Medium Dense	11-30	5-8	Medium Stiff
Dense	31-50	9-15	Stiff
Very Dense	>50	16-30	Very Stiff
		>30	Hard

The Standard Penetration Resistance, or N-value in blows per foot, is the sum of the blows recorded over the second and third 6-inch interval.

A number followed by "/3" indicates the distance that the sampler advanced. For example "100/4" indicates that 100 blows of a 140 pound hammer falling 30 inches advanced the sampler 4 inches. "WOR/24" indicates the weight of the drilling rods without the hammer caused the sampler to advance 24 inches.

"WOH" indicates the static weight of the 140 pound hammer and the drilling rods attached to the split spoon sampler were sufficient to cause the sampler to advance.

"WOR" indicates the static weight of the drilling rods attached to the split spoon sampler was sufficient to cause the sampler to advance.

2. Color: The color of a soil sample is based on visual observation.

3. Soil Components

A. Description: The components of a soil sample are described by visually estimating the percentage of each component by weight of the total sample using a Modified Burmister System.

i. Major Component: The major soil component is written with upper case letters for granular soil (e.g., SAND, GRAVEL) and a combination of upper and lower case letters for fine grained soil (e.g., Silty CLAY, Clayey SILT).

ii. Minor Component: The minor soil components are written with the first letter of each soil type in upper case, and the remaining letters in lower case (e.g., Gravel, Silt). The minor components are identified and prefaced in the description based on the following percentages:

Preface	Percentage
and	35-50
some	20-35
little	10-20
trace	0-10

iii. Note: The actual percentages of gravel soil may differ from that measured when sampling with a standard split spoon sampler because of the relatively small sampler diameter. Also, it is not possible to identify the presence of boulders and cobbles using a standard split spoon sampler.

B. Definitions

i. Granular Soil: A granular soil sample is defined by the following particle sizes as referenced to a standard sieve:

Material	Description	Standard Sieve Limit	
		Upper	Lower
Boulders	C-sized	--	36 inch
	B-sized	36 inch	24 inch
	A-sized	24 inch	12 inch
Cobbles	--	12 inch	3 inch
Gravel	coarse	3 inch	3/4 inch
	fine	3/4 inch	No. 4
Sand	coarse	No. 4	No. 10
	medium	No. 10	No. 40
	fine	No. 40	No. 200

ii. Fine Grained Soil: The degree of plasticity of fine-grained soils is defined as follows:

Material	Degree of Plasticity	Plasticity Index (PI)	Smallest Thread Diameter (in.)
SILT	Non-Plastic	0	None
Clayey SILT	Slight	1 to 5	1/4
SILT & CLAY	Low	5 to 10	1/8
CLAY & SILT	Medium	10 to 20	1/16
Silty CLAY	High	20 to 40	1/32
CLAY	Very High	40+	1/64

iii. Organic Soil: An organic soil sample is classified by observation of the sample structure as follows:

Material	Description
TOPSOIL	Surficial soils that support plant life and which contain organic matter.
SUBSOIL	Soil underlying the topsoil which may contain roots or plant fibers.
PEAT	Deposits of plant remains in which the original plant fibers or root structure are visible.
ORGANIC SILT	Deposit of plant remains in which the original plant fibers or root structure have decomposed.

iv. Non-Soil Constituents: Non-soil constituents (artificial or anthropogenic material, organic materials, cobbles and boulders) are described as follows:

The following terminology is used to denote size ranges of non-soil constituents such as man-made objects or fill material:

Descriptive Term	Size Range	Comparative Term
Specks	< No. 200 Sieve	Silt and Clay fines
Particles	No. 200 Sieve to No. 4 Sieve	Sand
Fragments	No. 4 Sieve to 3 in.	Gravel
Pieces	3 in. to 12 in.	Cobbles
Blocks	> 12 in.	Boulders

The following terminology is used to describe the frequency that a non-soil constituent is observed by estimating the percentage of the constituent by weight of the total sample:

Descriptor	Percentage
very few	0-5
few	5-10
common	10-20
frequent	20-35
numerous	35-50

4. Moisture Content: The moisture content of a soil sample is based on the observable presence of water according to the following table:

Dry	Moisture is not apparent, dusty.
Moist	No visible water.
Wet	Visible free water.

5. Other Pertinent Characteristics: Pertinent characteristics observed in a soil sample should be noted according to the following table:

Soil Structure Produced by Deposition of Sediments	
Stratified	Random soil deposits of varying components of color.
Varved	Alternating soil deposits of varying thickness (i.e., clays or silts).
Stratum	Soil deposit > 12 inches thick.
Layer	Soil deposit 3 inches to 12 inches thick.
Seam	Soil deposit 1/8 inch to 3 inches thick.
Parting/Lens	Soil deposit <1/8 inch thick.

Attachment B.2

USDA Test Pit Logs

Deep Observation Hole

Site Name:	New England Country Club	Date:	11/26/2024
Site Address:	Bellingham, MA	Time:	12:30
Project No.:	6151.00		
Ground Surface Elev. (ft.):	204.0	Weather :	40's, Rainy

SANBORN HEAD

Logged by: A. Baker

Test Pit Number: SW-TP-1

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 9	A	10YR 2/2	-	-	-	Loamy Sand	5	-	Structureless: Massive	Friable	
9 - 48	B_w	10YR 3/6	-	-	-	Bouldery Sand	10	10	Structureless: Single Grain	Loose	1
48 - 97	C	10YR 5/3	-	-	-	Bouldery Gravelly Sand	15	10	Structureless: Single Grain	Loose	2
-											
-											
-											
-											

Test Pit Termination Depth (in.): 97 **Reason for Termination:** Excavator Reach

Groundwater Observations:	N.E.			**In-Situ Testing:**	N.P.		
Depth to water weeping from pit face (in.):	N.E.			Percolation Test:	N.P.	Depth (in.):	N.P.
Depth to standing water in hole (in.):	N.E.	Stabilization Time:	N/A	Permeameter Test:	N.P.	Depth (in.):	N.P.
Depth to estimated seasonal high groundwater [ESHGW] (in.):	>97	Basis for ESHGW:	Bottom of Test Pit	Falling Head Test:	N.P.	Depth (in.):	N.P.
				Other Test:	N.P.	Depth (in.):	N.P.

Additional Notes:

1) Encountered Five (5) 12 to 24-inch diameter boulders during excavation.

2) Encountered numerous 12 to 24-inch diameter boulders during excavation.

N.E. = Not encountered

N.P. = Not performed

Deep Observation Hole

Site Name:	New England Country Club	Date:	11/26/2024
Site Address:	Bellingham, MA	Time:	11:30
Project No.:	6151.00		
Ground Surface Elev. (ft.):	199.0	Weather :	40's, Rainy

SANBORN HEAD

Logged by: A. Baker

Test Pit Number: SW-TP-2

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 9	A	10YR 2/2	-	-	-	Loamy Sand	5	-	Structureless: Massive	Friable	
9 - 29	B_w	10YR 3/6	-	-	-	Loamy Sand	10	10	Structureless: Massive	Friable	
29 - 120	C	10YR 5/3	-	-	-	Bouldery Gravelly Sand	15	10	Structureless: Single Grain	Loose	1
-											
-											
-											
-											

Test Pit Termination Depth (in.): 120 **Reason for Termination:** Excavator Reach

Groundwater Observations:	N.E.			**In-Situ Testing:**	N.P.		
Depth to water weeping from pit face (in.):	N.E.			Percolation Test:	N.P.	Depth (in.):	N.P.
Depth to standing water in hole (in.):	N.E.	Stabilization Time:	N/A	Permeameter Test:	N.P.	Depth (in.):	N.P.
Depth to estimated seasonal high groundwater [ESHGW] (in.):	>120	Basis for ESHGW:	Bottom of Test Pit	Falling Head Test:	N.P.	Depth (in.):	N.P.
				Other Test:	N.P.	Depth (in.):	N.P.

Additional Notes:

1) Encountered numerous 12 to 24-inch diameter boulders during excavation.

N.E. = Not encountered

N.P. = Not performed

Deep Observation Hole

Site Name:	New England Country Club	Date:	11/26/2024
Site Address:	Bellingham, MA	Time:	10:40
Project No.:	6151.00		
Ground Surface Elev. (ft.):	206.0	Weather :	40's, Rainy

SANBORN HEAD

Logged by: A. Baker

Test Pit Number: SW-TP-3

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 8	A	7.5YR 3/2	-	-	-	Loamy Sand	<5	-	Structureless: Massive	Friable	
8 - 38	B_w	2.5Y 5/3	-	-	-	Gravelly Sand	20	10	Structureless: Single Grain	Loose	
38 - 112	C	10YR 5/3	-	-	-	Bouldery Sand	10	10	Structureless: Single Grain	Loose	1, 2
-											
-											
-											
-											

Test Pit Termination Depth (in.): 112 **Reason for Termination:** Excavator Reach

Groundwater Observations:	N.E.			**In-Situ Testing:**	N.P.		
Depth to water weeping from pit face (in.):	N.E.			Percolation Test:	N.P.	Depth (in.):	N.P.
Depth to standing water in hole (in.):	N.E.	Stabilization Time:	N/A	Permeameter Test:	N.P.	Depth (in.):	N.P.
Depth to estimated seasonal high groundwater [ESHGW] (in.):	>112	Basis for ESHGW:	Bottom of Test Pit	Falling Head Test:	N.P.	Depth (in.):	N.P.
				Other Test:	N.P.	Depth (in.):	N.P.

Additional Notes:

1) Encountered numerous 12 to 18-inch diameter boulders during excavation.

2) Encountered one 36-inch diameter boulder during excavation.

N.E. = Not encountered

N.P. = Not performed

Deep Observation Hole

Site Name:	New England Country Club	Date:	11/26/2024
Site Address:	Bellingham, MA	Time:	10:00
Project No.:	6151.00		
Ground Surface Elev. (ft.):	204.0	Weather :	40's, Rainy

Logged by: A. Baker

Test Pit Number: SW-TP-4

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 11	A	7.5YR 3/2	-	-	-	Loamy Sand	<1	-	Structureless: Massive	Friable	
11 - 46	B_w	2.5Y 5/3	-	-	-	Sand	10	5	Structureless: Single Grain	Loose	
46 - 108	C	10YR 5/3	-	-	-	Bouldery Gravelly Sand	20	10	Structureless: Single Grain	Loose	1
-											
-											
-											
-											

Test Pit Termination Depth (in.): 108 **Reason for Termination:** Excavator Reach

Groundwater Observations:	N.E.			**In-Situ Testing:**	N.P.		
Depth to water weeping from pit face (in.):	N.E.			Percolation Test:	N.P.	Depth (in.):	N.P.
Depth to standing water in hole (in.):	N.E.	Stabilization Time:	N/A	Permeameter Test:	N.P.	Depth (in.):	N.P.
Depth to estimated seasonal high groundwater [ESHGW] (in.):	>108	Basis for ESHGW:	Bottom of Test Pit	Falling Head Test:	N.P.	Depth (in.):	N.P.
				Other Test:	N.P.	Depth (in.):	N.P.

Additional Notes:

1) Encountered numerous 12 to 18-inch diameter boulders during excavation.

N.E. = Not encountered

N.P. = Not performed

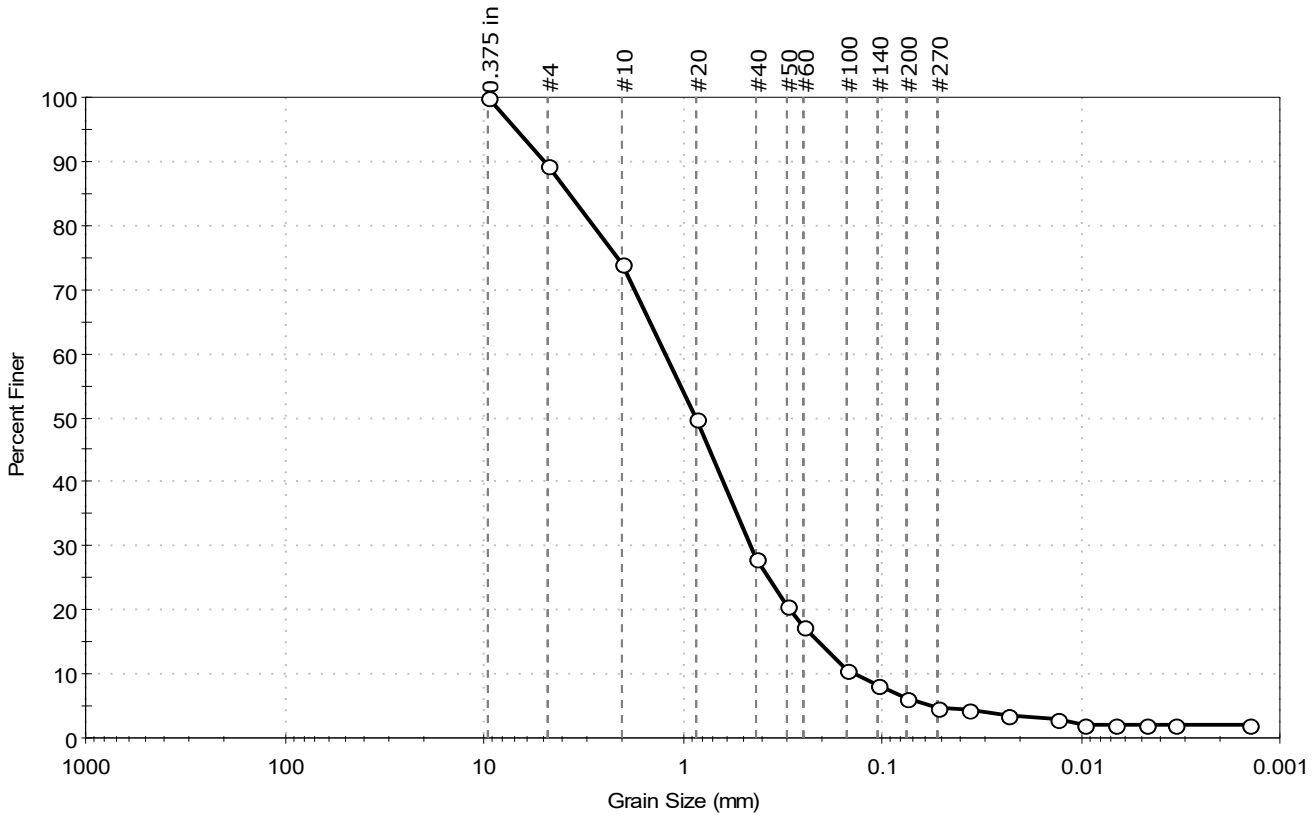
Attachment C

Laboratory Test Results

GeoTesting EXPRESS
A Sercel Business

Client:	Sanborn, Head & Associates, Inc.				
Project:	New England Country Club				
Location:	Bellingham, MA			Project No:	GTX-320282
Boring ID:	SW-TP-1	Sample Type:	Bag	Tested By:	ajl
Sample ID:	C	Test Date:	12/20/24	Checked By:	jsc
Depth :	48-97	Test Id:	797001		
Test Comment:	---				
Visual Description:	Moist, light olive brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
–	10.6	83.2	6.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	89		
#10	2.00	74		
#20	0.85	50		
#40	0.42	28		
#50	0.30	21		
#60	0.25	17		
#100	0.15	11		
#140	0.11	8		
#200	0.075	6.2		
#270	0.053	5		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0370	4		
---	0.0235	3		
---	0.0132	3		
---	0.0095	2		
---	0.0067	2		
---	0.0048	2		
---	0.0034	2		
---	0.0014	2		

Coefficients

D_{85} = 3.7227 mm D_{30} = 0.4520 mm
D_{60} = 1.2195 mm D_{15} = 0.2089 mm
D_{50} = 0.8545 mm D_{10} = 0.1357 mm
C_u = 8.987 C_c = 1.235

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	New England Country Club				
Location:	Bellingham, MA			Project No:	GTX-320282
Boring ID:	SW-TP-1	Sample Type:	Bag	Tested By:	ajl
Sample ID:	C	Test Date:	12/26/24	Checked By:	jsc
Depth :	48-97	Test Id:	797014		
Test Comment:	---				
Visual Description:	Moist, light olive brown sand with silt				
Sample Comment:	---				

USDA Textural Classification

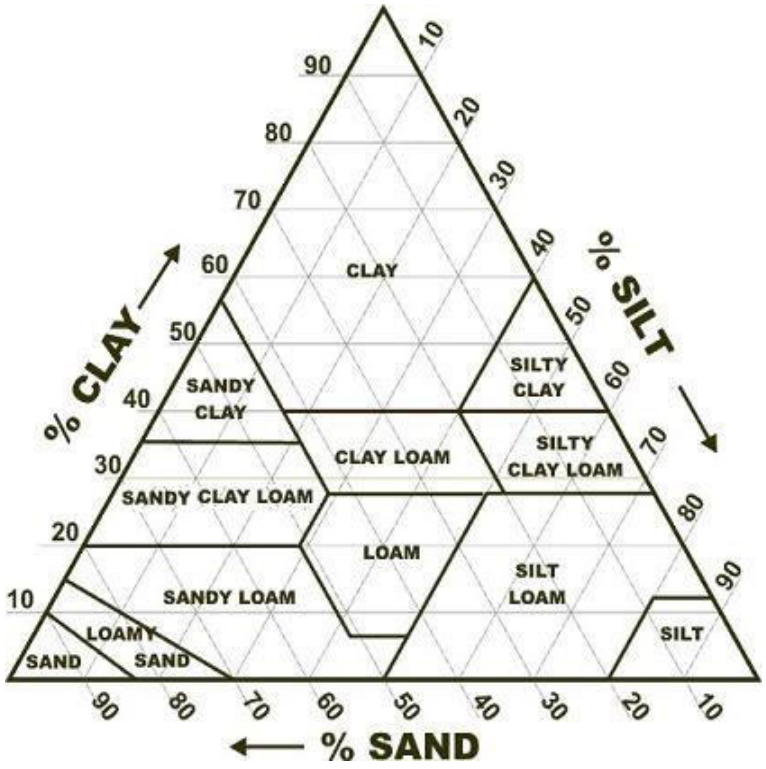
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-1	C	48-97	94	4	2	SAND

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

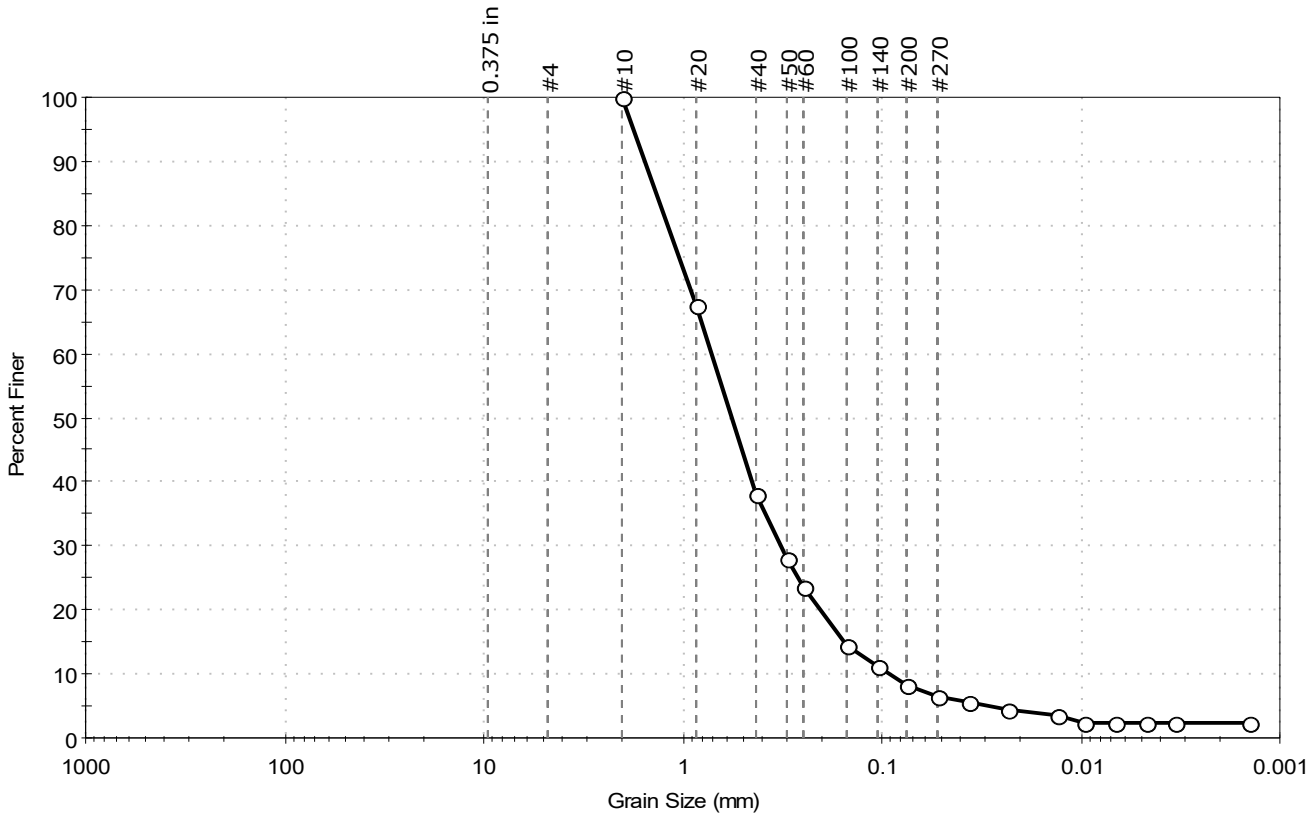
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS
A Sercel Business

Client:	Sanborn, Head & Associates, Inc.				
Project:	New England Country Club				
Location:	Bellingham, MA			Project No:	GTX-320282
Boring ID:	SW-TP-1	Sample Type:	Bag	Tested By:	ajl
Sample ID:	C	Test Date:	12/20/24	Checked By:	jsc
Depth :	48-97	Test Id:	797001		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, light olive brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
–	0.0	91.7	8.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	67		
#40	0.42	38		
#50	0.30	28		
#60	0.25	23		
#100	0.15	14		
#140	0.11	11		
#200	0.075	8.3		
#270	0.053	6		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0370	6		
---	0.0235	4		
---	0.0132	4		
---	0.0095	2		
---	0.0067	2		
---	0.0048	2		
---	0.0034	2		
---	0.0014	2		

Coefficients

D_{85} = 1.3483 mm	D_{30} = 0.3225 mm
D_{60} = 0.7134 mm	D_{15} = 0.1546 mm
D_{50} = 0.5639 mm	D_{10} = 0.0915 mm
C_u = 7.797	C_c = 1.593

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

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

LEGEND

EXISTING WATERSHED

- DESIGN POINT
- SUBCATCHMENT ID (EDA1.1)
- SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION PATH
- STORMWATER CONTROL MEASURE OR MODELED DRAINAGE STRUCTURE (P1.1)
- SURFACE OR CULVERT CONVEYANCE (R1.1)
- SOIL BOUNDARY WITH NRCS MAP UNIT AND HYDROLOGIC SOIL GROUP RATING (MapUnit A)

100 60 30 0 100

SCALE: 1" = 100'

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REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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DEFINITIVE PLAN

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PROJECT No.:	MAA230481.00-0A
DRAWN BY:	VH
CHECKED BY:	ASJK
DATE:	06/20/2025
CAD I.D.:	P-FSDP-HYDR

PROJECT:

DEFINITIVE SUBDIVISION PLANS

FOR

NECC HOLDINGS, LLC

PROPOSED SUBDIVISION

PARCEL ID: 0095-0037-0000, 0097-015C-0000, 0096-062A-0000, 0095-0037-0001, 0097-0019-0000
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BELLINGHAM, MA

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SHEET TITLE:

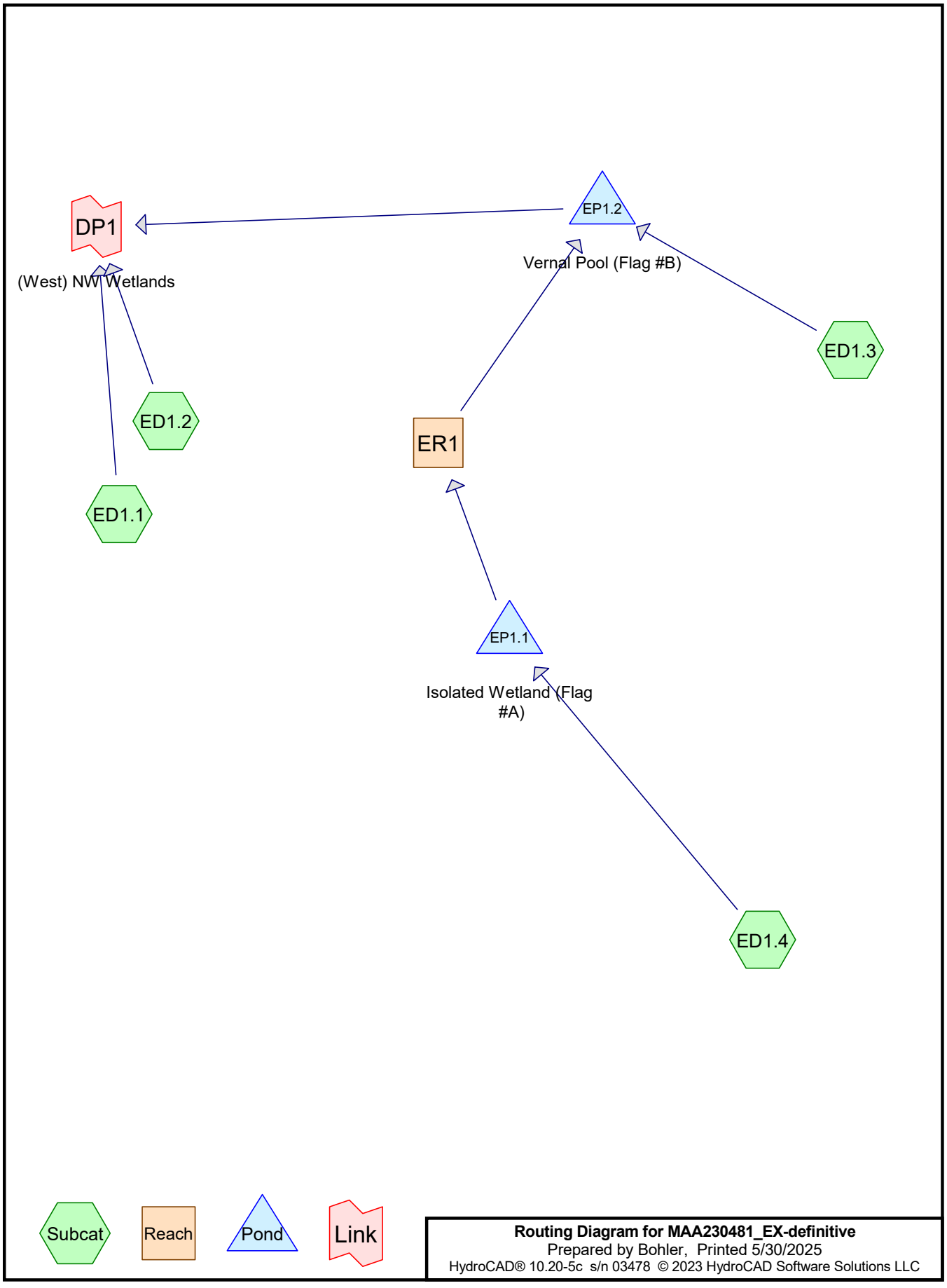
EXISTING DRAINAGE AREA MAP

SHEET NUMBER:

PRED

ORG. DATE - 06/20/2025

I:\BOHLERENG.NET\SHARES\MA-PROJECTS\2023\MAA230481.00\CAD\DRAWINGS\PLAN SETS\FINAL SITE DEVELOPMENT PLANS\P-FSDP-HYDR-MAA230481.00-0A-----LAYOUT: PRED



Routing Diagram for MAA230481_EX-definitive
Prepared by Bohler, Printed 5/30/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.74	2
2	10-year	Type III 24-hr		Default	24.00	1	5.84	2
3	25-year	Type III 24-hr		Default	24.00	1	7.52	2
4	100-year	Type III 24-hr		Default	24.00	1	10.35	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.819	39	>75% Grass cover, Good, HSG A (ED1.1, ED1.3, ED1.4)
2.968	61	>75% Grass cover, Good, HSG B (ED1.3, ED1.4)
0.000	80	>75% Grass cover, Good, HSG D (ED1.3)
0.757	96	Gravel surface, HSG B (ED1.4)
0.186	98	Paved parking, HSG A (ED1.4)
0.500	98	Paved parking, HSG B (ED1.3, ED1.4)
0.047	98	Roofs, HSG A (ED1.4)
0.309	98	Roofs, HSG B (ED1.4)
5.605	30	Woods, Good, HSG A (ED1.1, ED1.2, ED1.3, ED1.4)
7.740	55	Woods, Good, HSG B (ED1.3, ED1.4)
0.050	77	Woods, Good, HSG D (ED1.1, ED1.3)
20.981	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.657	HSG A	ED1.1, ED1.2, ED1.3, ED1.4
12.274	HSG B	ED1.3, ED1.4
0.000	HSG C	
0.051	HSG D	ED1.1, ED1.3
0.000	Other	
20.981		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ED1.1: Runoff Area=19,574 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=254' Tc=12.7 min CN=WQ Runoff=0.00 cfs 0.000 af

Subcatchment ED1.2: Runoff Area=7,137 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=148' Tc=19.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment ED1.3: Runoff Area=230,369 sf 1.35% Impervious Runoff Depth=0.19"
Flow Length=320' Tc=14.8 min CN=WQ Runoff=0.68 cfs 0.084 af

Subcatchment ED1.4: Runoff Area=656,846 sf 6.44% Impervious Runoff Depth=0.71"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=5.28 cfs 0.887 af

Reach ER1: Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.035 L=215.0' S=0.0656 '/' Capacity=121.44 cfs Outflow=0.00 cfs 0.000 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=198.27' Storage=38,623 cf Inflow=5.28 cfs 0.887 af
Outflow=0.00 cfs 0.000 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=185.63' Storage=1,308 cf Inflow=0.68 cfs 0.084 af
Outflow=0.28 cfs 0.058 af

Link DP1: (West) NW Wetlands Inflow=0.28 cfs 0.058 af
Primary=0.28 cfs 0.058 af

Total Runoff Area = 20.981 ac Runoff Volume = 0.970 af Average Runoff Depth = 0.55"
95.03% Pervious = 19.939 ac 4.97% Impervious = 1.042 ac

Summary for Subcatchment ED1.1:

Runoff = 0.00 cfs @ 20.87 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
1,622	39	>75% Grass cover, Good, HSG A
17,953	30	Woods, Good, HSG A
0	77	Woods, Good, HSG D
19,574		Weighted Average
19,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0300	0.09		**Sheet Flow, 201.9-200.35** Woods: Light underbrush n= 0.400 P2= 3.74"
3.0	204	0.0500	1.12		**Shallow Concentrated Flow, 200.35-190** Woodland Kv= 5.0 fps
12.7	254	Total			

Summary for Subcatchment ED1.2:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
7,137	30	Woods, Good, HSG A
7,137		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	50	0.0060	0.05		**Sheet Flow, 199-198.7** Woods: Light underbrush n= 0.400 P2= 3.74"
0.7	98	0.1100	2.32		**Shallow Concentrated Flow, 198.7-188** Short Grass Pasture Kv= 7.0 fps
19.2	148	Total			

Summary for Subcatchment ED1.3:

Runoff = 0.68 cfs @ 12.23 hrs, Volume= 0.084 af, Depth= 0.19"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
65,488	39	>75% Grass cover, Good, HSG A
38,171	61	>75% Grass cover, Good, HSG B
12	80	>75% Grass cover, Good, HSG D
3,106	98	Paved parking, HSG B
117,626	30	Woods, Good, HSG A
3,774	55	Woods, Good, HSG B
2,192	77	Woods, Good, HSG D
230,369		Weighted Average
227,263		98.65% Pervious Area
3,106		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0310	0.09		**Sheet Flow, 208.5-206.95** Woods: Light underbrush n= 0.400 P2= 3.74"
5.2	270	0.0300	0.87		**Shallow Concentrated Flow, 206.95-197.5** Woodland Kv= 5.0 fps
14.8	320	Total			

Summary for Subcatchment ED1.4:

Runoff = 5.28 cfs @ 12.48 hrs, Volume= 0.887 af, Depth= 0.71"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
55,670	39	>75% Grass cover, Good, HSG A
91,104	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
8,092	98	Paved parking, HSG A
18,683	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,451	98	Roofs, HSG B
101,433	30	Woods, Good, HSG A
333,398	55	Woods, Good, HSG B
656,846		Weighted Average
614,559		93.56% Pervious Area
42,287		6.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Reach ER1:

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 121.44 cfs

10.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 215.0' Slope= 0.0656 '/'
Inlet Invert= 200.10', Outlet Invert= 186.00'

‡

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 0.71" for 2-year event
Inflow = 5.28 cfs @ 12.48 hrs, Volume= 0.887 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach ER1 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 198.27' @ 25.73 hrs Surf.Area= 12,193 sf Storage= 38,623 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	200.10'	**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

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=191.60' TW=200.10' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.368 ac, 5.12% Impervious, Inflow Depth = 0.05" for 2-year event
Inflow = 0.68 cfs @ 12.23 hrs, Volume= 0.084 af
Outflow = 0.28 cfs @ 12.65 hrs, Volume= 0.058 af, Atten= 58%, Lag= 25.2 min
Primary = 0.28 cfs @ 12.65 hrs, Volume= 0.058 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.63' @ 12.65 hrs Surf.Area= 5,606 sf Storage= 1,308 cf

Plug-Flow detention time= 218.3 min calculated for 0.058 af (69% of inflow)
Center-of-Mass det. time= 98.7 min (974.6 - 875.8)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.28 cfs @ 12.65 hrs HW=185.63' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.28 cfs @ 0.43 fps)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 4.97% Impervious, Inflow Depth = 0.03" for 2-year event
Inflow = 0.28 cfs @ 12.65 hrs, Volume= 0.058 af
Primary = 0.28 cfs @ 12.65 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ED1.1: Runoff Area=19,574 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=254' Tc=12.7 min CN=WQ Runoff=0.01 cfs 0.003 af

Subcatchment ED1.2: Runoff Area=7,137 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=148' Tc=19.2 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment ED1.3: Runoff Area=230,369 sf 1.35% Impervious Runoff Depth=0.59"
Flow Length=320' Tc=14.8 min CN=WQ Runoff=2.00 cfs 0.259 af

Subcatchment ED1.4: Runoff Area=656,846 sf 6.44% Impervious Runoff Depth=1.66"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=14.27 cfs 2.086 af

Reach ER1: Avg. Flow Depth=0.07' Max Vel=1.84 fps Inflow=1.33 cfs 0.572 af
n=0.035 L=215.0' S=0.0656 '/' Capacity=121.44 cfs Outflow=1.33 cfs 0.572 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=200.19' Storage=67,623 cf Inflow=14.27 cfs 2.086 af
Outflow=1.33 cfs 0.572 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=185.71' Storage=1,798 cf Inflow=2.00 cfs 0.832 af
Outflow=1.74 cfs 0.806 af

Link DP1: (West) NW Wetlands Inflow=1.75 cfs 0.809 af
Primary=1.75 cfs 0.809 af

Total Runoff Area = 20.981 ac Runoff Volume = 2.349 af Average Runoff Depth = 1.34"
95.03% Pervious = 19.939 ac 4.97% Impervious = 1.042 ac

Summary for Subcatchment ED1.1:

Runoff = 0.01 cfs @ 12.46 hrs, Volume= 0.003 af, Depth= 0.08"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
1,622	39	>75% Grass cover, Good, HSG A
17,953	30	Woods, Good, HSG A
0	77	Woods, Good, HSG D
19,574		Weighted Average
19,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0300	0.09		**Sheet Flow, 201.9-200.35** Woods: Light underbrush n= 0.400 P2= 3.74"
3.0	204	0.0500	1.12		**Shallow Concentrated Flow, 200.35-190** Woodland Kv= 5.0 fps
12.7	254	Total			

Summary for Subcatchment ED1.2:

Runoff = 0.00 cfs @ 16.92 hrs, Volume= 0.001 af, Depth= 0.06"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
7,137	30	Woods, Good, HSG A
7,137		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	50	0.0060	0.05		**Sheet Flow, 199-198.7** Woods: Light underbrush n= 0.400 P2= 3.74"
0.7	98	0.1100	2.32		**Shallow Concentrated Flow, 198.7-188** Short Grass Pasture Kv= 7.0 fps
19.2	148	Total			

Summary for Subcatchment ED1.3:

Runoff = 2.00 cfs @ 12.22 hrs, Volume= 0.259 af, Depth= 0.59"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
65,488	39	>75% Grass cover, Good, HSG A
38,171	61	>75% Grass cover, Good, HSG B
12	80	>75% Grass cover, Good, HSG D
3,106	98	Paved parking, HSG B
117,626	30	Woods, Good, HSG A
3,774	55	Woods, Good, HSG B
2,192	77	Woods, Good, HSG D
230,369		Weighted Average
227,263		98.65% Pervious Area
3,106		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0310	0.09		**Sheet Flow, 208.5-206.95** Woods: Light underbrush n= 0.400 P2= 3.74"
5.2	270	0.0300	0.87		**Shallow Concentrated Flow, 206.95-197.5** Woodland Kv= 5.0 fps
14.8	320	Total			

Summary for Subcatchment ED1.4:

Runoff = 14.27 cfs @ 12.45 hrs, Volume= 2.086 af, Depth= 1.66"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
55,670	39	>75% Grass cover, Good, HSG A
91,104	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
8,092	98	Paved parking, HSG A
18,683	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,451	98	Roofs, HSG B
101,433	30	Woods, Good, HSG A
333,398	55	Woods, Good, HSG B
656,846		Weighted Average
614,559		93.56% Pervious Area
42,287		6.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Reach ER1:

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 0.46" for 10-year event
Inflow = 1.33 cfs @ 16.00 hrs, Volume= 0.572 af
Outflow = 1.33 cfs @ 16.02 hrs, Volume= 0.572 af, Atten= 0%, Lag= 1.1 min
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.84 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 4.3 min

Peak Storage= 156 cf @ 16.02 hrs
Average Depth at Peak Storage= 0.07' , Surface Width= 10.43'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 121.44 cfs

10.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 215.0' Slope= 0.0656 '/'
Inlet Invert= 200.10', Outlet Invert= 186.00'

‡

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 1.66" for 10-year event
Inflow = 14.27 cfs @ 12.45 hrs, Volume= 2.086 af
Outflow = 1.33 cfs @ 16.00 hrs, Volume= 0.572 af, Atten= 91%, Lag= 213.0 min
Primary = 1.33 cfs @ 16.00 hrs, Volume= 0.572 af
Routed to Reach ER1 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.19' @ 16.01 hrs Surf.Area= 18,514 sf Storage= 67,623 cf

Plug-Flow detention time= 483.0 min calculated for 0.572 af (27% of inflow)
Center-of-Mass det. time= 300.9 min (1,154.9 - 853.9)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	200.10'	**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

Primary OutFlow Max=1.33 cfs @ 16.00 hrs HW=200.19' TW=200.17' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.33 cfs @ 0.48 fps)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.368 ac, 5.12% Impervious, Inflow Depth = 0.49" for 10-year event
Inflow = 2.00 cfs @ 12.22 hrs, Volume= 0.832 af
Outflow = 1.74 cfs @ 12.33 hrs, Volume= 0.806 af, Atten= 13%, Lag= 6.6 min
Primary = 1.74 cfs @ 12.33 hrs, Volume= 0.806 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.71' @ 12.33 hrs Surf.Area= 6,927 sf Storage= 1,798 cf

Plug-Flow detention time= 35.8 min calculated for 0.805 af (97% of inflow)
Center-of-Mass det. time= 21.7 min (1,094.9 - 1,073.2)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.74 cfs @ 12.33 hrs HW=185.71' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.74 cfs @ 0.78 fps)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 4.97% Impervious, Inflow Depth = 0.46" for 10-year event
Inflow = 1.75 cfs @ 12.33 hrs, Volume= 0.809 af
Primary = 1.75 cfs @ 12.33 hrs, Volume= 0.809 af, Atten= 0%, Lag= 0.0 min

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ED1.1: Runoff Area=19,574 sf 0.00% Impervious Runoff Depth=0.36"
Flow Length=254' Tc=12.7 min CN=WQ Runoff=0.04 cfs 0.014 af

Subcatchment ED1.2: Runoff Area=7,137 sf 0.00% Impervious Runoff Depth=0.31"
Flow Length=148' Tc=19.2 min CN=30 Runoff=0.01 cfs 0.004 af

Subcatchment ED1.3: Runoff Area=230,369 sf 1.35% Impervious Runoff Depth=1.13"
Flow Length=320' Tc=14.8 min CN=WQ Runoff=3.82 cfs 0.497 af

Subcatchment ED1.4: Runoff Area=656,846 sf 6.44% Impervious Runoff Depth=2.63"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=23.42 cfs 3.303 af

Reach ER1: Avg. Flow Depth=0.20' Max Vel=3.58 fps Inflow=7.64 cfs 1.789 af
n=0.035 L=215.0' S=0.0656 '/' Capacity=121.44 cfs Outflow=7.63 cfs 1.789 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=200.38' Storage=71,133 cf Inflow=23.42 cfs 3.303 af
Outflow=7.64 cfs 1.789 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=185.90' Storage=3,493 cf Inflow=8.46 cfs 2.286 af
Outflow=8.14 cfs 2.260 af

Link DP1: (West) NW Wetlands Inflow=8.17 cfs 2.278 af
Primary=8.17 cfs 2.278 af

Total Runoff Area = 20.981 ac Runoff Volume = 3.818 af Average Runoff Depth = 2.18"
95.03% Pervious = 19.939 ac 4.97% Impervious = 1.042 ac

Summary for Subcatchment ED1.1:

Runoff = 0.04 cfs @ 12.53 hrs, Volume= 0.014 af, Depth= 0.36"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
1,622	39	>75% Grass cover, Good, HSG A
17,953	30	Woods, Good, HSG A
0	77	Woods, Good, HSG D
19,574		Weighted Average
19,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0300	0.09		**Sheet Flow, 201.9-200.35** Woods: Light underbrush n= 0.400 P2= 3.74"
3.0	204	0.0500	1.12		**Shallow Concentrated Flow, 200.35-190** Woodland Kv= 5.0 fps
12.7	254	Total			

Summary for Subcatchment ED1.2:

Runoff = 0.01 cfs @ 12.70 hrs, Volume= 0.004 af, Depth= 0.31"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
7,137	30	Woods, Good, HSG A
7,137		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	50	0.0060	0.05		**Sheet Flow, 199-198.7** Woods: Light underbrush n= 0.400 P2= 3.74"
0.7	98	0.1100	2.32		**Shallow Concentrated Flow, 198.7-188** Short Grass Pasture Kv= 7.0 fps
19.2	148	Total			

Summary for Subcatchment ED1.3:

Runoff = 3.82 cfs @ 12.22 hrs, Volume= 0.497 af, Depth= 1.13"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
65,488	39	>75% Grass cover, Good, HSG A
38,171	61	>75% Grass cover, Good, HSG B
12	80	>75% Grass cover, Good, HSG D
3,106	98	Paved parking, HSG B
117,626	30	Woods, Good, HSG A
3,774	55	Woods, Good, HSG B
2,192	77	Woods, Good, HSG D
230,369		Weighted Average
227,263		98.65% Pervious Area
3,106		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0310	0.09		**Sheet Flow, 208.5-206.95** Woods: Light underbrush n= 0.400 P2= 3.74"
5.2	270	0.0300	0.87		**Shallow Concentrated Flow, 206.95-197.5** Woodland Kv= 5.0 fps
14.8	320	Total			

Summary for Subcatchment ED1.4:

Runoff = 23.42 cfs @ 12.45 hrs, Volume= 3.303 af, Depth= 2.63"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
55,670	39	>75% Grass cover, Good, HSG A
91,104	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
8,092	98	Paved parking, HSG A
18,683	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,451	98	Roofs, HSG B
101,433	30	Woods, Good, HSG A
333,398	55	Woods, Good, HSG B
656,846		Weighted Average
614,559		93.56% Pervious Area
42,287		6.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Reach ER1:

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 1.42" for 25-year event
Inflow = 7.64 cfs @ 13.10 hrs, Volume= 1.789 af
Outflow = 7.63 cfs @ 13.12 hrs, Volume= 1.789 af, Atten= 0%, Lag= 0.7 min
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.58 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.11 fps, Avg. Travel Time= 3.2 min

Peak Storage= 458 cf @ 13.12 hrs
Average Depth at Peak Storage= 0.20' , Surface Width= 11.21'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 121.44 cfs

10.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 215.0' Slope= 0.0656 '/'
Inlet Invert= 200.10', Outlet Invert= 186.00'

‡

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 2.63" for 25-year event
Inflow = 23.42 cfs @ 12.45 hrs, Volume= 3.303 af
Outflow = 7.64 cfs @ 13.10 hrs, Volume= 1.789 af, Atten= 67%, Lag= 39.3 min
Primary = 7.64 cfs @ 13.10 hrs, Volume= 1.789 af
Routed to Reach ER1 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.38' @ 13.11 hrs Surf.Area= 19,254 sf Storage= 71,133 cf

Plug-Flow detention time= 269.2 min calculated for 1.789 af (54% of inflow)
Center-of-Mass det. time= 138.2 min (988.9 - 850.7)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	200.10'	**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

Primary OutFlow Max=7.63 cfs @ 13.10 hrs HW=200.38' TW=200.30' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 7.63 cfs @ 0.92 fps)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.368 ac, 5.12% Impervious, Inflow Depth = 1.35" for 25-year event
Inflow = 8.46 cfs @ 13.11 hrs, Volume= 2.286 af
Outflow = 8.14 cfs @ 13.20 hrs, Volume= 2.260 af, Atten= 4%, Lag= 5.7 min
Primary = 8.14 cfs @ 13.20 hrs, Volume= 2.260 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.90' @ 13.20 hrs Surf.Area= 10,784 sf Storage= 3,493 cf

Plug-Flow detention time= 16.7 min calculated for 2.260 af (99% of inflow)
Center-of-Mass det. time= 10.2 min (978.0 - 967.7)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=8.14 cfs @ 13.20 hrs HW=185.90' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 8.14 cfs @ 1.34 fps)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 4.97% Impervious, Inflow Depth = 1.30" for 25-year event
Inflow = 8.17 cfs @ 13.20 hrs, Volume= 2.278 af
Primary = 8.17 cfs @ 13.20 hrs, Volume= 2.278 af, Atten= 0%, Lag= 0.0 min

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ED1.1: Runoff Area=19,574 sf 0.00% Impervious Runoff Depth=1.21"
Flow Length=254' Tc=12.7 min CN=WQ Runoff=0.27 cfs 0.045 af

Subcatchment ED1.2: Runoff Area=7,137 sf 0.00% Impervious Runoff Depth=1.11"
Flow Length=148' Tc=19.2 min CN=30 Runoff=0.08 cfs 0.015 af

Subcatchment ED1.3: Runoff Area=230,369 sf 1.35% Impervious Runoff Depth=2.38"
Flow Length=320' Tc=14.8 min CN=WQ Runoff=8.94 cfs 1.049 af

Subcatchment ED1.4: Runoff Area=656,846 sf 6.44% Impervious Runoff Depth=4.53"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=41.74 cfs 5.692 af

Reach ER1: Avg. Flow Depth=0.49' Max Vel=6.16 fps Inflow=34.44 cfs 4.179 af
n=0.035 L=215.0' S=0.0656 '/' Capacity=121.44 cfs Outflow=34.43 cfs 4.179 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=200.80' Storage=79,734 cf Inflow=41.74 cfs 5.692 af
Outflow=34.44 cfs 4.179 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=186.38' Storage=9,935 cf Inflow=38.48 cfs 5.227 af
Outflow=36.61 cfs 5.201 af

Link DP1: (West) NW Wetlands Inflow=36.81 cfs 5.262 af
Primary=36.81 cfs 5.262 af

Total Runoff Area = 20.981 ac Runoff Volume = 6.802 af Average Runoff Depth = 3.89"
95.03% Pervious = 19.939 ac 4.97% Impervious = 1.042 ac

Summary for Subcatchment ED1.1:

Runoff = 0.27 cfs @ 12.29 hrs, Volume= 0.045 af, Depth= 1.21"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
1,622	39	>75% Grass cover, Good, HSG A
17,953	30	Woods, Good, HSG A
0	77	Woods, Good, HSG D
19,574		Weighted Average
19,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0300	0.09		**Sheet Flow, 201.9-200.35** Woods: Light underbrush n= 0.400 P2= 3.74"
3.0	204	0.0500	1.12		**Shallow Concentrated Flow, 200.35-190** Woodland Kv= 5.0 fps
12.7	254	Total			

Summary for Subcatchment ED1.2:

Runoff = 0.08 cfs @ 12.46 hrs, Volume= 0.015 af, Depth= 1.11"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
7,137	30	Woods, Good, HSG A
7,137		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	50	0.0060	0.05		**Sheet Flow, 199-198.7** Woods: Light underbrush n= 0.400 P2= 3.74"
0.7	98	0.1100	2.32		**Shallow Concentrated Flow, 198.7-188** Short Grass Pasture Kv= 7.0 fps
19.2	148	Total			

Summary for Subcatchment ED1.3:

Runoff = 8.94 cfs @ 12.23 hrs, Volume= 1.049 af, Depth= 2.38"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
65,488	39	>75% Grass cover, Good, HSG A
38,171	61	>75% Grass cover, Good, HSG B
12	80	>75% Grass cover, Good, HSG D
3,106	98	Paved parking, HSG B
117,626	30	Woods, Good, HSG A
3,774	55	Woods, Good, HSG B
2,192	77	Woods, Good, HSG D
230,369		Weighted Average
227,263		98.65% Pervious Area
3,106		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0310	0.09		**Sheet Flow, 208.5-206.95** Woods: Light underbrush n= 0.400 P2= 3.74"
5.2	270	0.0300	0.87		**Shallow Concentrated Flow, 206.95-197.5** Woodland Kv= 5.0 fps
14.8	320	Total			

Summary for Subcatchment ED1.4:

Runoff = 41.74 cfs @ 12.45 hrs, Volume= 5.692 af, Depth= 4.53"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
55,670	39	>75% Grass cover, Good, HSG A
91,104	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
8,092	98	Paved parking, HSG A
18,683	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,451	98	Roofs, HSG B
101,433	30	Woods, Good, HSG A
333,398	55	Woods, Good, HSG B
656,846		Weighted Average
614,559		93.56% Pervious Area
42,287		6.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Reach ER1:

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 3.33" for 100-year event
Inflow = 34.44 cfs @ 12.62 hrs, Volume= 4.179 af
Outflow = 34.43 cfs @ 12.63 hrs, Volume= 4.179 af, Atten= 0%, Lag= 0.4 min
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.16 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 2.7 min

Peak Storage= 1,201 cf @ 12.63 hrs
Average Depth at Peak Storage= 0.49' , Surface Width= 12.92'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 121.44 cfs

10.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 215.0' Slope= 0.0656 '/'
Inlet Invert= 200.10', Outlet Invert= 186.00'

‡

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 15.079 ac, 6.44% Impervious, Inflow Depth = 4.53" for 100-year event
Inflow = 41.74 cfs @ 12.45 hrs, Volume= 5.692 af
Outflow = 34.44 cfs @ 12.62 hrs, Volume= 4.179 af, Atten= 17%, Lag= 10.6 min
Primary = 34.44 cfs @ 12.62 hrs, Volume= 4.179 af
Routed to Reach ER1 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.80' @ 12.63 hrs Surf.Area= 21,012 sf Storage= 79,734 cf

Plug-Flow detention time= 170.0 min calculated for 4.179 af (73% of inflow)
Center-of-Mass det. time= 73.5 min (917.4 - 843.9)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	200.10'	**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

Primary OutFlow Max=34.39 cfs @ 12.62 hrs HW=200.80' TW=200.59' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 34.39 cfs @ 1.63 fps)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.368 ac, 5.12% Impervious, Inflow Depth = 3.08" for 100-year event
Inflow = 38.48 cfs @ 12.61 hrs, Volume= 5.227 af
Outflow = 36.61 cfs @ 12.69 hrs, Volume= 5.201 af, Atten= 5%, Lag= 4.7 min
Primary = 36.61 cfs @ 12.69 hrs, Volume= 5.201 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 186.38' @ 12.69 hrs Surf.Area= 15,318 sf Storage= 9,935 cf

Plug-Flow detention time= 10.0 min calculated for 5.201 af (99% of inflow)
Center-of-Mass det. time= 6.9 min (916.2 - 909.3)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=36.61 cfs @ 12.69 hrs HW=186.38' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 36.61 cfs @ 2.36 fps)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 4.97% Impervious, Inflow Depth = 3.01" for 100-year event
Inflow = 36.81 cfs @ 12.69 hrs, Volume= 5.262 af
Primary = 36.81 cfs @ 12.69 hrs, Volume= 5.262 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*
- *25-YEAR FROZEN CONDITIONS HYDROCAD CALCULATIONS*

LEGEND

PROPOSED WATERSHED

DESIGN POINT	DP1 / DP1
SUBCATCHMENT ID	PD1.1 / PD1.1
SUBCATCHMENT BOUNDARY	
TIME OF CONCENTRATION PATH	
STORMWATER CONTROL MEASURE OR MODELED DRAINAGE STRUCTURE	P1.1 / P1.1
SURFACE OR CULVERT CONVEYANCE	R1.1 / R1.1
SOIL BOUNDARY WITH NRCS MAP UNIT AND HYDROLOGIC SOIL GROUP RATING	MapUnit / A

100 60 30 0 100

SCALE: 1" = 100'

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REV	DATE	COMMENT	DRAWN BY / CHECKED BY

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DEFINITIVE PLAN

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PROJECT No.:	MAA230481.00-0A
DRAWN BY:	VH
CHECKED BY:	AS/JK
DATE:	06/20/2025
CAD I.D.:	P-FSDP-HYDR

PROJECT:

DEFINITIVE SUBDIVISION PLANS

FOR

NECC HOLDINGS, LLC

PROPOSED SUBDIVISION

PARCEL ID: 0095-0037-0000, 0097-015C-0000, 0096-062A-0000, 0095-0037-0001, 0097-0019-0000
180 PAINE STREET, 0 BOUND RD, 585 WRENTHAM RD
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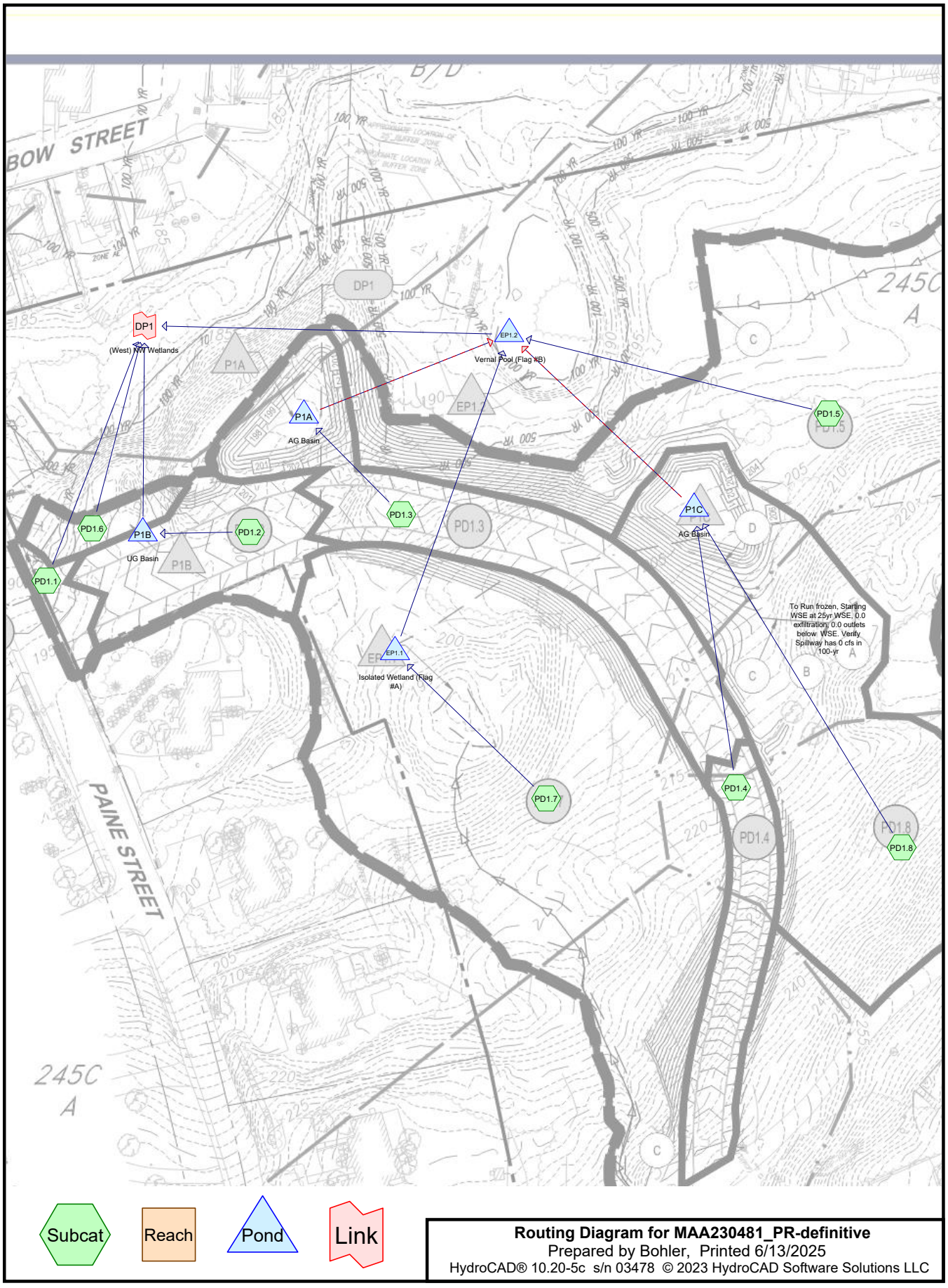
SHEET TITLE:

PROPOSED DRAINAGE AREA MAP

SHEET NUMBER:

PSTD

ORG. DATE - 06/20/2025



Routing Diagram for MAA230481_PR-definitive
Prepared by Bohler, Printed 6/13/2025
HydroCAD® 10.20-5c s/n 03478 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.74	2
2	10-year	Type III 24-hr		Default	24.00	1	5.84	2
3	25-year	Type III 24-hr		Default	24.00	1	7.52	2
4	100-year	Type III 24-hr		Default	24.00	1	10.35	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.216	39	>75% Grass cover, Good, HSG A (PD1.1, PD1.2, PD1.3, PD1.4, PD1.5, PD1.6, PD1.7, PD1.8)
3.090	61	>75% Grass cover, Good, HSG B (PD1.3, PD1.4, PD1.5, PD1.7, PD1.8)
0.043	80	>75% Grass cover, Good, HSG D (PD1.3)
0.757	96	Gravel surface, HSG B (PD1.7)
0.394	30	Meadow, non-grazed, HSG A (PD1.5, PD1.7)
0.007	78	Meadow, non-grazed, HSG D (PD1.5)
1.002	98	Paved parking, HSG A (PD1.1, PD1.2, PD1.3, PD1.4, PD1.5, PD1.6, PD1.7, PD1.8)
0.564	98	Paved parking, HSG B (PD1.4, PD1.7, PD1.8)
0.047	98	Roofs, HSG A (PD1.7)
0.309	98	Roofs, HSG B (PD1.7, PD1.8)
0.070	98	Water Surface, 0% imp, HSG A (PD1.3)
0.000	98	Water Surface, 0% imp, HSG D (PD1.3)
3.927	30	Woods, Good, HSG A (PD1.2, PD1.3, PD1.5, PD1.7, PD1.8)
7.555	55	Woods, Good, HSG B (PD1.5, PD1.7, PD1.8)
20.981	**54**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.657	HSG A	PD1.1, PD1.2, PD1.3, PD1.4, PD1.5, PD1.6, PD1.7, PD1.8
12.274	HSG B	PD1.3, PD1.4, PD1.5, PD1.7, PD1.8
0.000	HSG C	
0.051	HSG D	PD1.3, PD1.5
0.000	Other	
20.981		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPD1.1: Runoff Area=3,972 sf 63.69% Impervious Runoff Depth=2.24"
Tc=6.0 min CN=WQ Runoff=0.21 cfs 0.017 af

SubcatchmentPD1.2: Runoff Area=19,278 sf 53.29% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=WQ Runoff=0.86 cfs 0.069 af

SubcatchmentPD1.3: Runoff Area=36,687 sf 44.91% Impervious Runoff Depth=1.97"
Tc=6.0 min CN=WQ Runoff=1.73 cfs 0.138 af

SubcatchmentPD1.4: Runoff Area=15,882 sf 56.74% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=WQ Runoff=0.78 cfs 0.064 af

SubcatchmentPD1.5: Runoff Area=2.459 ac 0.01% Impervious Runoff Depth=0.02"
Tc=14.8 min CN=WQ Runoff=0.03 cfs 0.005 af

SubcatchmentPD1.6: Runoff Area=4,518 sf 0.00% Impervious Runoff Depth=0.02"
Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.000 af

SubcatchmentPD1.7: Runoff Area=647,398 sf 6.52% Impervious Runoff Depth=0.71"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=5.25 cfs 0.880 af

SubcatchmentPD1.8: Runoff Area=1.816 ac 4.03% Impervious Runoff Depth=0.51"
Flow Length=145' Tc=7.3 min CN=WQ Runoff=0.79 cfs 0.077 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=198.25' Storage=38,330 cf Inflow=5.25 cfs 0.880 af
Outflow=0.00 cfs 0.000 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=185.31' Storage=201 cf Inflow=0.03 cfs 0.005 af
Outflow=0.00 cfs 0.000 af

Pond P1A: AG Basin Peak Elev=198.59' Storage=1,943 cf Inflow=1.73 cfs 0.138 af
Discarded=0.20 cfs 0.138 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.20 cfs 0.138 af

Pond P1B: UG Basin Peak Elev=190.89' Storage=868 cf Inflow=0.86 cfs 0.069 af
Discarded=0.12 cfs 0.069 af Primary=0.00 cfs 0.000 af Outflow=0.12 cfs 0.069 af

Pond P1C: AG Basin Peak Elev=200.58' Storage=1,818 cf Inflow=1.54 cfs 0.140 af
Discarded=0.19 cfs 0.140 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.140 af

Link DP1: (West) NW Wetlands Inflow=0.21 cfs 0.017 af
Primary=0.21 cfs 0.017 af

Total Runoff Area = 20.981 ac Runoff Volume = 1.250 af Average Runoff Depth = 0.71"
90.84% Pervious = 19.059 ac 9.16% Impervious = 1.922 ac

Summary for Subcatchment PD1.1:

Runoff = 0.21 cfs @ 12.08 hrs, Volume= 0.017 af, Depth= 2.24"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
1,442	39	>75% Grass cover, Good, HSG A
2,530	98	Paved parking, HSG A
3,972		Weighted Average
1,442		36.31% Pervious Area
2,530		63.69% Impervious Area

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

Summary for Subcatchment PD1.2:

Runoff = 0.86 cfs @ 12.08 hrs, Volume= 0.069 af, Depth= 1.88"
Routed to Pond P1B : UG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
7,895	39	>75% Grass cover, Good, HSG A
10,274	98	Paved parking, HSG A
1,109	30	Woods, Good, HSG A
19,278		Weighted Average
9,004		46.71% Pervious Area
10,274		53.29% Impervious Area

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

Summary for Subcatchment PD1.3:

Runoff = 1.73 cfs @ 12.08 hrs, Volume= 0.138 af, Depth= 1.97"
Routed to Pond P1A : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
15,241	39	>75% Grass cover, Good, HSG A
29	61	>75% Grass cover, Good, HSG B
1,878	80	>75% Grass cover, Good, HSG D
16,475	98	Paved parking, HSG A
3,058	98	Water Surface, 0% imp, HSG A
5	98	Water Surface, 0% imp, HSG D
0	30	Woods, Good, HSG A
36,687		Weighted Average
20,212		55.09% Pervious Area
16,475		44.91% Impervious Area

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

Summary for Subcatchment PD1.4:

Runoff = 0.78 cfs @ 12.08 hrs, Volume= 0.064 af, Depth= 2.09"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
4,637	39	>75% Grass cover, Good, HSG A
2,234	61	>75% Grass cover, Good, HSG B
6,246	98	Paved parking, HSG A
2,765	98	Paved parking, HSG B
15,882		Weighted Average
6,871		43.26% Pervious Area
9,011		56.74% Impervious Area

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

Summary for Subcatchment PD1.5:

Runoff = 0.03 cfs @ 12.24 hrs, Volume= 0.005 af, Depth= 0.02"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (ac)	CN	Description
0.568	39	>75% Grass cover, Good, HSG A
0.036	61	>75% Grass cover, Good, HSG B
0.306	30	Meadow, non-grazed, HSG A
0.007	78	Meadow, non-grazed, HSG D
0.000	98	Paved parking, HSG A
1.531	30	Woods, Good, HSG A
0.009	55	Woods, Good, HSG B
2.459		Weighted Average
2.459		99.99% Pervious Area
0.000		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8					**Direct Entry, Same as ED1.3**

Summary for Subcatchment PD1.6:

Runoff = 0.00 cfs @ 20.70 hrs, Volume= 0.000 af, Depth= 0.02"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
4,518	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
4,518		Weighted Average
4,518		100.00% Pervious Area
0		0.00% Impervious Area

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

Summary for Subcatchment PD1.7:

Runoff = 5.25 cfs @ 12.48 hrs, Volume= 0.880 af, Depth= 0.71"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (sf)	CN	Description
55,244	39	>75% Grass cover, Good, HSG A
91,440	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
3,847	30	Meadow, non-grazed, HSG A
8,092	98	Paved parking, HSG A
18,650	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,422	98	Roofs, HSG B
96,474	30	Woods, Good, HSG A
325,215	55	Woods, Good, HSG B
647,398		Weighted Average
605,172		93.48% Pervious Area
42,225		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Subcatchment PD1.8:

Runoff = 0.79 cfs @ 12.12 hrs, Volume= 0.077 af, Depth= 0.51"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.74"

Area (ac)	CN	Description
0.605	39	>75% Grass cover, Good, HSG A
0.902	61	>75% Grass cover, Good, HSG B
0.000	98	Paved parking, HSG A
0.072	98	Paved parking, HSG B
0.001	98	Roofs, HSG B
0.155	30	Woods, Good, HSG A
0.079	55	Woods, Good, HSG B
1.816		Weighted Average
1.743		95.97% Pervious Area
0.073		4.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	30	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.74"
0.3	44	0.2500	2.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	71	0.0800	1.98		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.3	145	Total			

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 14.862 ac, 6.52% Impervious, Inflow Depth = 0.71" for 2-year event
Inflow = 5.25 cfs @ 12.48 hrs, Volume= 0.880 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 198.25' @ 25.73 hrs Surf.Area= 12,128 sf Storage= 38,330 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	199.00'	**72.0" W x 24.0" H Box Culvert** L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 199.00' / 195.00' S= 0.0308 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.00 sf
#2	Device 1	200.10'	**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

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=191.60' TW=185.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.344 ac, 8.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.03 cfs @ 12.24 hrs, Volume= 0.005 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.31' @ 24.84 hrs Surf.Area= 1,615 sf Storage= 201 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1A: AG Basin

Inflow Area = 0.842 ac, 44.91% Impervious, Inflow Depth = 1.97" for 2-year event
Inflow = 1.73 cfs @ 12.08 hrs, Volume= 0.138 af
Outflow = 0.20 cfs @ 12.70 hrs, Volume= 0.138 af, Atten= 89%, Lag= 37.1 min
Discarded = 0.20 cfs @ 12.70 hrs, Volume= 0.138 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 198.59' @ 12.70 hrs Surf.Area= 3,542 sf Storage= 1,943 cf

Plug-Flow detention time= 67.0 min calculated for 0.138 af (100% of inflow)
Center-of-Mass det. time= 67.0 min (826.2 - 759.2)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	14,276 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	3,063	0	0
199.00	3,877	3,470	3,470
200.00	4,736	4,307	7,777
201.25	5,663	6,499	14,276

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	193.50'	**12.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.50' / 193.00' S= 0.0122 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	198.80'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	199.50'	**3.0" Vert. Orifice X 2.00** C= 0.600 Limited to weir flow at low heads
#5	Device 2	200.10'	**24.0" x 24.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#6	Secondary	200.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.20 cfs @ 12.70 hrs HW=198.59' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=198.00' TW=185.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 5.97 cfs potential flow)
  ├**3=Orifice** (Controls 0.00 cfs)
  ├**4=Orifice** (Controls 0.00 cfs)
  └**5=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=198.00' TW=185.00' (Dynamic Tailwater)
└**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1B: UG Basin

Inflow Area = 0.443 ac, 53.29% Impervious, Inflow Depth = 1.88" for 2-year event
Inflow = 0.86 cfs @ 12.08 hrs, Volume= 0.069 af
Outflow = 0.12 cfs @ 11.74 hrs, Volume= 0.069 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.74 hrs, Volume= 0.069 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 190.89' @ 12.60 hrs Surf.Area= 2,069 sf Storage= 868 cf

Plug-Flow detention time= 44.1 min calculated for 0.069 af (100% of inflow)
Center-of-Mass det. time= 44.1 min (799.5 - 755.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.00'	2,075 cf	**25.25'W x 81.94'L x 3.75'H Field A** 7,758 cf Overall - 2,570 cf Embedded = 5,189 cf x 40.0% Voids
#2A	190.75'	2,570 cf	**ADS_StormTech DC-780 b +Cap** x 55 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 55 Chambers in 5 Rows Cap Storage= 2.7 cf x 2 x 5 rows = 26.5 cf
		4,645 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	**12.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 189.80' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	193.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Discarded	190.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 11.74 hrs HW=190.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=190.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1C: AG Basin

Inflow Area = 2.180 ac, 12.85% Impervious, Inflow Depth = 0.77" for 2-year event
Inflow = 1.54 cfs @ 12.10 hrs, Volume= 0.140 af
Outflow = 0.19 cfs @ 13.03 hrs, Volume= 0.140 af, Atten= 88%, Lag= 55.6 min
Discarded = 0.19 cfs @ 13.03 hrs, Volume= 0.140 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond ep1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.58' @ 13.03 hrs Surf.Area= 3,384 sf Storage= 1,818 cf

Plug-Flow detention time= 75.7 min calculated for 0.140 af (100% of inflow)
Center-of-Mass det. time= 75.7 min (893.0 - 817.2)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	22,748 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	2,910	0	0
204.70	6,770	22,748	22,748

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	200.00'	**18.0" Round Culvert** L= 33.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 200.00' / 199.00' S= 0.0303 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	202.00'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	203.60'	**48.0" x 48.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#5	Secondary	204.00'	**20.0' long + 3.0 '/' SideZ 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=0.19 cfs @ 13.03 hrs HW=200.58' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.00' TW=185.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)
  ├**3=Orifice** (Controls 0.00 cfs)
  └**4=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.00' TW=185.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 9.16% Impervious, Inflow Depth = 0.01" for 2-year event
Inflow = 0.21 cfs @ 12.08 hrs, Volume= 0.017 af
Primary = 0.21 cfs @ 12.08 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPD1.1: Runoff Area=3,972 sf 63.69% Impervious Runoff Depth=3.71"
Tc=6.0 min CN=WQ Runoff=0.33 cfs 0.028 af

SubcatchmentPD1.2: Runoff Area=19,278 sf 53.29% Impervious Runoff Depth=3.15"
Tc=6.0 min CN=WQ Runoff=1.35 cfs 0.116 af

SubcatchmentPD1.3: Runoff Area=36,687 sf 44.91% Impervious Runoff Depth=3.34"
Tc=6.0 min CN=WQ Runoff=2.75 cfs 0.234 af

SubcatchmentPD1.4: Runoff Area=15,882 sf 56.74% Impervious Runoff Depth=3.56"
Tc=6.0 min CN=WQ Runoff=1.29 cfs 0.108 af

SubcatchmentPD1.5: Runoff Area=2.459 ac 0.01% Impervious Runoff Depth=0.18"
Tc=14.8 min CN=WQ Runoff=0.13 cfs 0.037 af

SubcatchmentPD1.6: Runoff Area=4,518 sf 0.00% Impervious Runoff Depth=0.40"
Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.003 af

SubcatchmentPD1.7: Runoff Area=647,398 sf 6.52% Impervious Runoff Depth=1.67"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=14.12 cfs 2.064 af

SubcatchmentPD1.8: Runoff Area=1.816 ac 4.03% Impervious Runoff Depth=1.37"
Flow Length=145' Tc=7.3 min CN=WQ Runoff=2.34 cfs 0.207 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=200.17' Storage=67,199 cf Inflow=14.12 cfs 2.064 af
Outflow=1.34 cfs 0.550 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=185.69' Storage=1,684 cf Inflow=1.38 cfs 0.599 af
Outflow=1.37 cfs 0.573 af

Pond P1A: AG Basin Peak Elev=199.04' Storage=3,635 cf Inflow=2.75 cfs 0.234 af
Discarded=0.22 cfs 0.222 af Primary=0.08 cfs 0.012 af Secondary=0.00 cfs 0.000 af Outflow=0.30 cfs 0.234 af

Pond P1B: UG Basin Peak Elev=191.40' Storage=1,727 cf Inflow=1.35 cfs 0.116 af
Discarded=0.12 cfs 0.116 af Primary=0.00 cfs 0.000 af Outflow=0.12 cfs 0.116 af

Pond P1C: AG Basin Peak Elev=201.66' Storage=5,977 cf Inflow=3.58 cfs 0.316 af
Discarded=0.24 cfs 0.316 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.24 cfs 0.316 af

Link DP1: (West) NW Wetlands Inflow=1.38 cfs 0.605 af
Primary=1.38 cfs 0.605 af

Total Runoff Area = 20.981 ac Runoff Volume = 2.799 af Average Runoff Depth = 1.60"
90.84% Pervious = 19.059 ac 9.16% Impervious = 1.922 ac

Summary for Subcatchment PD1.1:

Runoff = 0.33 cfs @ 12.08 hrs, Volume= 0.028 af, Depth= 3.71"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
1,442	39	>75% Grass cover, Good, HSG A
2,530	98	Paved parking, HSG A
3,972		Weighted Average
1,442		36.31% Pervious Area
2,530		63.69% Impervious Area

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

Summary for Subcatchment PD1.2:

Runoff = 1.35 cfs @ 12.08 hrs, Volume= 0.116 af, Depth= 3.15"
Routed to Pond P1B : UG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
7,895	39	>75% Grass cover, Good, HSG A
10,274	98	Paved parking, HSG A
1,109	30	Woods, Good, HSG A
19,278		Weighted Average
9,004		46.71% Pervious Area
10,274		53.29% Impervious Area

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

Summary for Subcatchment PD1.3:

Runoff = 2.75 cfs @ 12.08 hrs, Volume= 0.234 af, Depth= 3.34"
Routed to Pond P1A : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
15,241	39	>75% Grass cover, Good, HSG A
29	61	>75% Grass cover, Good, HSG B
1,878	80	>75% Grass cover, Good, HSG D
16,475	98	Paved parking, HSG A
3,058	98	Water Surface, 0% imp, HSG A
5	98	Water Surface, 0% imp, HSG D
0	30	Woods, Good, HSG A
36,687		Weighted Average
20,212		55.09% Pervious Area
16,475		44.91% Impervious Area

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

Summary for Subcatchment PD1.4:

Runoff = 1.29 cfs @ 12.08 hrs, Volume= 0.108 af, Depth= 3.56"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
4,637	39	>75% Grass cover, Good, HSG A
2,234	61	>75% Grass cover, Good, HSG B
6,246	98	Paved parking, HSG A
2,765	98	Paved parking, HSG B
15,882		Weighted Average
6,871		43.26% Pervious Area
9,011		56.74% Impervious Area

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

Summary for Subcatchment PD1.5:

Runoff = 0.13 cfs @ 12.42 hrs, Volume= 0.037 af, Depth= 0.18"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (ac)	CN	Description
0.568	39	>75% Grass cover, Good, HSG A
0.036	61	>75% Grass cover, Good, HSG B
0.306	30	Meadow, non-grazed, HSG A
0.007	78	Meadow, non-grazed, HSG D
0.000	98	Paved parking, HSG A
1.531	30	Woods, Good, HSG A
0.009	55	Woods, Good, HSG B
2.459		Weighted Average
2.459		99.99% Pervious Area
0.000		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8					**Direct Entry, Same as ED1.3**

Summary for Subcatchment PD1.6:

Runoff = 0.02 cfs @ 12.36 hrs, Volume= 0.003 af, Depth= 0.40"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
4,518	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
4,518		Weighted Average
4,518		100.00% Pervious Area
0		0.00% Impervious Area

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

Summary for Subcatchment PD1.7:

Runoff = 14.12 cfs @ 12.45 hrs, Volume= 2.064 af, Depth= 1.67"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (sf)	CN	Description
55,244	39	>75% Grass cover, Good, HSG A
91,440	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
3,847	30	Meadow, non-grazed, HSG A
8,092	98	Paved parking, HSG A
18,650	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,422	98	Roofs, HSG B
96,474	30	Woods, Good, HSG A
325,215	55	Woods, Good, HSG B
647,398		Weighted Average
605,172		93.48% Pervious Area
42,225		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Subcatchment PD1.8:

Runoff = 2.34 cfs @ 12.11 hrs, Volume= 0.207 af, Depth= 1.37"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.84"

Area (ac)	CN	Description
0.605	39	>75% Grass cover, Good, HSG A
0.902	61	>75% Grass cover, Good, HSG B
0.000	98	Paved parking, HSG A
0.072	98	Paved parking, HSG B
0.001	98	Roofs, HSG B
0.155	30	Woods, Good, HSG A
0.079	55	Woods, Good, HSG B
1.816		Weighted Average
1.743		95.97% Pervious Area
0.073		4.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	30	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.74"
0.3	44	0.2500	2.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	71	0.0800	1.98		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.3	145	Total			

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 14.862 ac, 6.52% Impervious, Inflow Depth = 1.67" for 10-year event
Inflow = 14.12 cfs @ 12.45 hrs, Volume= 2.064 af
Outflow = 1.34 cfs @ 15.95 hrs, Volume= 0.550 af, Atten= 91%, Lag= 209.8 min
Primary = 1.34 cfs @ 15.95 hrs, Volume= 0.550 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.17' @ 15.95 hrs Surf.Area= 18,423 sf Storage= 67,199 cf

Plug-Flow detention time= 484.2 min calculated for 0.550 af (27% of inflow)
Center-of-Mass det. time= 299.8 min (1,153.2 - 853.4)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	199.00'	**72.0" W x 24.0" H Box Culvert** L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 199.00' / 195.00' S= 0.0308 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.00 sf
#2	Device 1	200.10'	**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

Primary OutFlow Max=1.34 cfs @ 15.95 hrs HW=200.17' TW=185.69' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.34 cfs of 24.33 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.34 cfs @ 0.65 fps)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.344 ac, 8.00% Impervious, Inflow Depth = 0.35" for 10-year event
Inflow = 1.38 cfs @ 15.94 hrs, Volume= 0.599 af
Outflow = 1.37 cfs @ 16.06 hrs, Volume= 0.573 af, Atten= 1%, Lag= 6.9 min
Primary = 1.37 cfs @ 16.06 hrs, Volume= 0.573 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.69' @ 16.06 hrs Surf.Area= 6,634 sf Storage= 1,684 cf

Plug-Flow detention time= 39.7 min calculated for 0.573 af (96% of inflow)
Center-of-Mass det. time= 24.0 min (1,159.8 - 1,135.9)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.37 cfs @ 16.06 hrs HW=185.69' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.37 cfs @ 0.72 fps)

Summary for Pond P1A: AG Basin

Inflow Area = 0.842 ac, 44.91% Impervious, Inflow Depth = 3.34" for 10-year event
Inflow = 2.75 cfs @ 12.08 hrs, Volume= 0.234 af
Outflow = 0.30 cfs @ 12.84 hrs, Volume= 0.234 af, Atten= 89%, Lag= 45.4 min
Discarded = 0.22 cfs @ 12.84 hrs, Volume= 0.222 af
Primary = 0.08 cfs @ 12.84 hrs, Volume= 0.012 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 199.04' @ 12.84 hrs Surf.Area= 3,913 sf Storage= 3,635 cf

Plug-Flow detention time= 118.9 min calculated for 0.234 af (100% of inflow)
Center-of-Mass det. time= 118.9 min (879.4 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	14,276 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	3,063	0	0
199.00	3,877	3,470	3,470
200.00	4,736	4,307	7,777
201.25	5,663	6,499	14,276

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	193.50'	**12.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.50' / 193.00' S= 0.0122 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	198.80'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	199.50'	**3.0" Vert. Orifice X 2.00** C= 0.600 Limited to weir flow at low heads
#5	Device 2	200.10'	**24.0" x 24.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#6	Secondary	200.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.22 cfs @ 12.84 hrs HW=199.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.08 cfs @ 12.84 hrs HW=199.04' TW=185.43' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.08 cfs of 6.70 cfs potential flow)
  ├**3=Orifice** (Orifice Controls 0.08 cfs @ 1.68 fps)
  ├**4=Orifice** (Controls 0.00 cfs)
  └**5=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=198.00' TW=185.00' (Dynamic Tailwater)
└**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1B: UG Basin

Inflow Area = 0.443 ac, 53.29% Impervious, Inflow Depth = 3.15" for 10-year event
Inflow = 1.35 cfs @ 12.08 hrs, Volume= 0.116 af
Outflow = 0.12 cfs @ 11.54 hrs, Volume= 0.116 af, Atten= 91%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.54 hrs, Volume= 0.116 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 191.40' @ 13.08 hrs Surf.Area= 2,069 sf Storage= 1,727 cf

Plug-Flow detention time= 106.9 min calculated for 0.116 af (100% of inflow)
Center-of-Mass det. time= 106.9 min (864.3 - 757.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.00'	2,075 cf	**25.25'W x 81.94'L x 3.75'H Field A** 7,758 cf Overall - 2,570 cf Embedded = 5,189 cf x 40.0% Voids
#2A	190.75'	2,570 cf	**ADS_StormTech DC-780 b +Cap** x 55 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 55 Chambers in 5 Rows Cap Storage= 2.7 cf x 2 x 5 rows = 26.5 cf
		4,645 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	**12.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 189.80' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	193.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Discarded	190.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 11.54 hrs HW=190.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=190.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1C: AG Basin

Inflow Area = 2.180 ac, 12.85% Impervious, Inflow Depth = 1.74" for 10-year event
Inflow = 3.58 cfs @ 12.10 hrs, Volume= 0.316 af
Outflow = 0.24 cfs @ 14.96 hrs, Volume= 0.316 af, Atten= 93%, Lag= 171.3 min
Discarded = 0.24 cfs @ 14.96 hrs, Volume= 0.316 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond ep1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 201.66' @ 14.96 hrs Surf.Area= 4,276 sf Storage= 5,977 cf

Plug-Flow detention time= 260.6 min calculated for 0.316 af (100% of inflow)
Center-of-Mass det. time= 260.6 min (1,084.0 - 823.5)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	22,748 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	2,910	0	0
204.70	6,770	22,748	22,748

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	200.00'	**18.0" Round Culvert** L= 33.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 200.00' / 199.00' S= 0.0303 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	202.00'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	203.60'	**48.0" x 48.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#5	Secondary	204.00'	**20.0' long + 3.0 '/' SideZ 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=0.24 cfs @ 14.96 hrs HW=201.66' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.00' TW=185.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)
  ├**3=Orifice** (Controls 0.00 cfs)
  └**4=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.00' TW=185.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 9.16% Impervious, Inflow Depth = 0.35" for 10-year event
Inflow = 1.38 cfs @ 16.06 hrs, Volume= 0.605 af
Primary = 1.38 cfs @ 16.06 hrs, Volume= 0.605 af, Atten= 0%, Lag= 0.0 min

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPD1.1: Runoff Area=3,972 sf 63.69% Impervious Runoff Depth=4.99"
Tc=6.0 min CN=WQ Runoff=0.45 cfs 0.038 af

SubcatchmentPD1.2: Runoff Area=19,278 sf 53.29% Impervious Runoff Depth=4.29"
Tc=6.0 min CN=WQ Runoff=1.84 cfs 0.158 af

SubcatchmentPD1.3: Runoff Area=36,687 sf 44.91% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=WQ Runoff=3.76 cfs 0.319 af

SubcatchmentPD1.4: Runoff Area=15,882 sf 56.74% Impervious Runoff Depth=4.85"
Tc=6.0 min CN=WQ Runoff=1.77 cfs 0.147 af

SubcatchmentPD1.5: Runoff Area=2.459 ac 0.01% Impervious Runoff Depth=0.53"
Tc=14.8 min CN=WQ Runoff=0.43 cfs 0.108 af

SubcatchmentPD1.6: Runoff Area=4,518 sf 0.00% Impervious Runoff Depth=0.96"
Tc=6.0 min CN=WQ Runoff=0.07 cfs 0.008 af

SubcatchmentPD1.7: Runoff Area=647,398 sf 6.52% Impervious Runoff Depth=2.64"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=23.14 cfs 3.264 af

SubcatchmentPD1.8: Runoff Area=1.816 ac 4.03% Impervious Runoff Depth=2.28"
Flow Length=145' Tc=7.3 min CN=WQ Runoff=4.12 cfs 0.345 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=200.33' Storage=70,153 cf Inflow=23.14 cfs 3.264 af
Outflow=8.07 cfs 1.750 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=185.90' Storage=3,484 cf Inflow=8.56 cfs 1.962 af
Outflow=8.11 cfs 1.937 af

Pond P1A: AG Basin Peak Elev=199.43' Storage=5,208 cf Inflow=3.76 cfs 0.319 af
Discarded=0.24 cfs 0.271 af Primary=0.17 cfs 0.048 af Secondary=0.00 cfs 0.000 af Outflow=0.40 cfs 0.319 af

Pond P1B: UG Basin Peak Elev=192.01' Storage=2,691 cf Inflow=1.84 cfs 0.158 af
Discarded=0.12 cfs 0.158 af Primary=0.00 cfs 0.000 af Outflow=0.12 cfs 0.158 af

Pond P1C: AG Basin Peak Elev=202.50' Storage=9,836 cf Inflow=5.82 cfs 0.492 af
Discarded=0.28 cfs 0.435 af Primary=0.14 cfs 0.057 af Secondary=0.00 cfs 0.000 af Outflow=0.42 cfs 0.492 af

Link DP1: (West) NW Wetlands Inflow=8.16 cfs 1.983 af
Primary=8.16 cfs 1.983 af

Total Runoff Area = 20.981 ac Runoff Volume = 4.388 af Average Runoff Depth = 2.51"
90.84% Pervious = 19.059 ac 9.16% Impervious = 1.922 ac

Summary for Subcatchment PD1.1:

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.038 af, Depth= 4.99"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
1,442	39	>75% Grass cover, Good, HSG A
2,530	98	Paved parking, HSG A
3,972		Weighted Average
1,442		36.31% Pervious Area
2,530		63.69% Impervious Area

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

Summary for Subcatchment PD1.2:

Runoff = 1.84 cfs @ 12.09 hrs, Volume= 0.158 af, Depth= 4.29"
Routed to Pond P1B : UG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
7,895	39	>75% Grass cover, Good, HSG A
10,274	98	Paved parking, HSG A
1,109	30	Woods, Good, HSG A
19,278		Weighted Average
9,004		46.71% Pervious Area
10,274		53.29% Impervious Area

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

Summary for Subcatchment PD1.3:

Runoff = 3.76 cfs @ 12.09 hrs, Volume= 0.319 af, Depth= 4.54"
Routed to Pond P1A : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
15,241	39	>75% Grass cover, Good, HSG A
29	61	>75% Grass cover, Good, HSG B
1,878	80	>75% Grass cover, Good, HSG D
16,475	98	Paved parking, HSG A
3,058	98	Water Surface, 0% imp, HSG A
5	98	Water Surface, 0% imp, HSG D
0	30	Woods, Good, HSG A
36,687		Weighted Average
20,212		55.09% Pervious Area
16,475		44.91% Impervious Area

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

Summary for Subcatchment PD1.4:

Runoff = 1.77 cfs @ 12.09 hrs, Volume= 0.147 af, Depth= 4.85"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
4,637	39	>75% Grass cover, Good, HSG A
2,234	61	>75% Grass cover, Good, HSG B
6,246	98	Paved parking, HSG A
2,765	98	Paved parking, HSG B
15,882		Weighted Average
6,871		43.26% Pervious Area
9,011		56.74% Impervious Area

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

Summary for Subcatchment PD1.5:

Runoff = 0.43 cfs @ 12.28 hrs, Volume= 0.108 af, Depth= 0.53"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (ac)	CN	Description
0.568	39	>75% Grass cover, Good, HSG A
0.036	61	>75% Grass cover, Good, HSG B
0.306	30	Meadow, non-grazed, HSG A
0.007	78	Meadow, non-grazed, HSG D
0.000	98	Paved parking, HSG A
1.531	30	Woods, Good, HSG A
0.009	55	Woods, Good, HSG B
2.459		Weighted Average
2.459		99.99% Pervious Area
0.000		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8					**Direct Entry, Same as ED1.3**

Summary for Subcatchment PD1.6:

Runoff = 0.07 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 0.96"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
4,518	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
4,518		Weighted Average
4,518		100.00% Pervious Area
0		0.00% Impervious Area

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

Summary for Subcatchment PD1.7:

Runoff = 23.14 cfs @ 12.45 hrs, Volume= 3.264 af, Depth= 2.64"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (sf)	CN	Description
55,244	39	>75% Grass cover, Good, HSG A
91,440	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
3,847	30	Meadow, non-grazed, HSG A
8,092	98	Paved parking, HSG A
18,650	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,422	98	Roofs, HSG B
96,474	30	Woods, Good, HSG A
325,215	55	Woods, Good, HSG B
647,398		Weighted Average
605,172		93.48% Pervious Area
42,225		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Subcatchment PD1.8:

Runoff = 4.12 cfs @ 12.11 hrs, Volume= 0.345 af, Depth= 2.28"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=7.52"

Area (ac)	CN	Description
0.605	39	>75% Grass cover, Good, HSG A
0.902	61	>75% Grass cover, Good, HSG B
0.000	98	Paved parking, HSG A
0.072	98	Paved parking, HSG B
0.001	98	Roofs, HSG B
0.155	30	Woods, Good, HSG A
0.079	55	Woods, Good, HSG B
1.816		Weighted Average
1.743		95.97% Pervious Area
0.073		4.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	30	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.74"
0.3	44	0.2500	2.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	71	0.0800	1.98		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.3	145	Total			

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 14.862 ac, 6.52% Impervious, Inflow Depth = 2.64" for 25-year event
Inflow = 23.14 cfs @ 12.45 hrs, Volume= 3.264 af
Outflow = 8.07 cfs @ 13.07 hrs, Volume= 1.750 af, Atten= 65%, Lag= 37.3 min
Primary = 8.07 cfs @ 13.07 hrs, Volume= 1.750 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.33' @ 13.07 hrs Surf.Area= 19,049 sf Storage= 70,153 cf

Plug-Flow detention time= 267.4 min calculated for 1.750 af (54% of inflow)
Center-of-Mass det. time= 135.7 min (986.0 - 850.3)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	199.00'	**72.0" W x 24.0" H Box Culvert** L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 199.00' / 195.00' S= 0.0308 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.00 sf
#2	Device 1	200.10'	**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

Primary OutFlow Max=8.07 cfs @ 13.07 hrs HW=200.33' TW=185.89' (Dynamic Tailwater)
↑**1=Culvert** (Passes 8.07 cfs of 29.42 cfs potential flow)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 8.07 cfs @ 1.19 fps)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.344 ac, 8.00% Impervious, Inflow Depth = 1.16" for 25-year event
Inflow = 8.56 cfs @ 13.07 hrs, Volume= 1.962 af
Outflow = 8.11 cfs @ 13.17 hrs, Volume= 1.937 af, Atten= 5%, Lag= 5.9 min
Primary = 8.11 cfs @ 13.17 hrs, Volume= 1.937 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 185.90' @ 13.17 hrs Surf.Area= 10,765 sf Storage= 3,484 cf

Plug-Flow detention time= 16.2 min calculated for 1.936 af (99% of inflow)
Center-of-Mass det. time= 9.4 min (988.3 - 978.9)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=8.11 cfs @ 13.17 hrs HW=185.90' TW=0.00' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 8.11 cfs @ 1.33 fps)

Summary for Pond P1A: AG Basin

Inflow Area = 0.842 ac, 44.91% Impervious, Inflow Depth = 4.54" for 25-year event
Inflow = 3.76 cfs @ 12.09 hrs, Volume= 0.319 af
Outflow = 0.40 cfs @ 12.87 hrs, Volume= 0.319 af, Atten= 89%, Lag= 47.3 min
Discarded = 0.24 cfs @ 12.87 hrs, Volume= 0.271 af
Primary = 0.17 cfs @ 12.87 hrs, Volume= 0.048 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 199.43' @ 12.87 hrs Surf.Area= 4,245 sf Storage= 5,208 cf

Plug-Flow detention time= 138.0 min calculated for 0.319 af (100% of inflow)
Center-of-Mass det. time= 138.0 min (899.4 - 761.4)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	14,276 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	3,063	0	0
199.00	3,877	3,470	3,470
200.00	4,736	4,307	7,777
201.25	5,663	6,499	14,276

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	193.50'	**12.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.50' / 193.00' S= 0.0122 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	198.80'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	199.50'	**3.0" Vert. Orifice X 2.00** C= 0.600 Limited to weir flow at low heads
#5	Device 2	200.10'	**24.0" x 24.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#6	Secondary	200.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.24 cfs @ 12.87 hrs HW=199.43' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.17 cfs @ 12.87 hrs HW=199.43' TW=185.67' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.17 cfs of 6.96 cfs potential flow)
  ├**3=Orifice** (Orifice Controls 0.17 cfs @ 3.42 fps)
  ├**4=Orifice** (Controls 0.00 cfs)
  └**5=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=198.00' TW=185.00' (Dynamic Tailwater)
└**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1B: UG Basin

Inflow Area = 0.443 ac, 53.29% Impervious, Inflow Depth = 4.29" for 25-year event
Inflow = 1.84 cfs @ 12.09 hrs, Volume= 0.158 af
Outflow = 0.12 cfs @ 11.25 hrs, Volume= 0.158 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.25 hrs, Volume= 0.158 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 192.01' @ 13.95 hrs Surf.Area= 2,069 sf Storage= 2,691 cf

Plug-Flow detention time= 185.8 min calculated for 0.158 af (100% of inflow)
Center-of-Mass det. time= 185.8 min (945.3 - 759.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.00'	2,075 cf	**25.25'W x 81.94'L x 3.75'H Field A** 7,758 cf Overall - 2,570 cf Embedded = 5,189 cf x 40.0% Voids
#2A	190.75'	2,570 cf	**ADS_StormTech DC-780 b +Cap** x 55 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 55 Chambers in 5 Rows Cap Storage= 2.7 cf x 2 x 5 rows = 26.5 cf
		4,645 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	**12.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 189.80' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	193.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Discarded	190.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 11.25 hrs HW=190.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=190.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1C: AG Basin

Inflow Area = 2.180 ac, 12.85% Impervious, Inflow Depth = 2.71" for 25-year event
Inflow = 5.82 cfs @ 12.10 hrs, Volume= 0.492 af
Outflow = 0.42 cfs @ 14.37 hrs, Volume= 0.492 af, Atten= 93%, Lag= 135.8 min
Discarded = 0.28 cfs @ 14.37 hrs, Volume= 0.435 af
Primary = 0.14 cfs @ 14.37 hrs, Volume= 0.057 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond ep1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 202.50' @ 14.37 hrs Surf.Area= 4,962 sf Storage= 9,836 cf

Plug-Flow detention time= 324.4 min calculated for 0.492 af (100% of inflow)
Center-of-Mass det. time= 324.4 min (1,146.4 - 822.0)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	22,748 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	2,910	0	0
204.70	6,770	22,748	22,748

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	200.00'	**18.0" Round Culvert** L= 33.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 200.00' / 199.00' S= 0.0303 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	202.00'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	203.60'	**48.0" x 48.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#5	Secondary	204.00'	**20.0' long + 3.0 '/' SideZ 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=0.28 cfs @ 14.37 hrs HW=202.50' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.14 cfs @ 14.37 hrs HW=202.50' TW=185.79' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.14 cfs of 8.88 cfs potential flow)
  ├**3=Orifice** (Orifice Controls 0.14 cfs @ 2.94 fps)
  └**4=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.00' TW=185.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 9.16% Impervious, Inflow Depth = 1.13" for 25-year event
Inflow = 8.16 cfs @ 13.17 hrs, Volume= 1.983 af
Primary = 8.16 cfs @ 13.17 hrs, Volume= 1.983 af, Atten= 0%, Lag= 0.0 min

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

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPD1.1: Runoff Area=3,972 sf 63.69% Impervious Runoff Depth=7.27"
Tc=6.0 min CN=WQ Runoff=0.66 cfs 0.055 af

SubcatchmentPD1.2: Runoff Area=19,278 sf 53.29% Impervious Runoff Depth=6.39"
Tc=6.0 min CN=WQ Runoff=2.81 cfs 0.236 af

SubcatchmentPD1.3: Runoff Area=36,687 sf 44.91% Impervious Runoff Depth=6.74"
Tc=6.0 min CN=WQ Runoff=5.72 cfs 0.473 af

SubcatchmentPD1.4: Runoff Area=15,882 sf 56.74% Impervious Runoff Depth=7.15"
Tc=6.0 min CN=WQ Runoff=2.66 cfs 0.217 af

SubcatchmentPD1.5: Runoff Area=2.459 ac 0.01% Impervious Runoff Depth=1.48"
Tc=14.8 min CN=WQ Runoff=2.05 cfs 0.303 af

SubcatchmentPD1.6: Runoff Area=4,518 sf 0.00% Impervious Runoff Depth=2.28"
Tc=6.0 min CN=WQ Runoff=0.23 cfs 0.020 af

SubcatchmentPD1.7: Runoff Area=647,398 sf 6.52% Impervious Runoff Depth=4.54"
Flow Length=1,872' Tc=30.7 min CN=WQ Runoff=41.19 cfs 5.620 af

SubcatchmentPD1.8: Runoff Area=1.816 ac 4.03% Impervious Runoff Depth=4.10"
Flow Length=145' Tc=7.3 min CN=WQ Runoff=7.84 cfs 0.621 af

Pond EP1.1: Isolated Wetland (Flag #A) Peak Elev=200.68' Storage=77,236 cf Inflow=41.19 cfs 5.620 af
Outflow=36.04 cfs 4.106 af

Pond EP1.2: Vernal Pool (Flag #B) Peak Elev=186.37' Storage=9,855 cf Inflow=38.44 cfs 4.828 af
Outflow=36.25 cfs 4.802 af

Pond P1A: AG Basin Peak Elev=200.04' Storage=7,969 cf Inflow=5.72 cfs 0.473 af
Discarded=0.27 cfs 0.333 af Primary=0.55 cfs 0.140 af Secondary=0.00 cfs 0.000 af Outflow=0.82 cfs 0.473 af

Pond P1B: UG Basin Peak Elev=193.31' Storage=4,279 cf Inflow=2.81 cfs 0.236 af
Discarded=0.12 cfs 0.221 af Primary=0.18 cfs 0.015 af Outflow=0.29 cfs 0.236 af

Pond P1C: AG Basin Peak Elev=203.66' Storage=16,172 cf Inflow=10.41 cfs 0.838 af
Discarded=0.33 cfs 0.560 af Primary=1.13 cfs 0.279 af Secondary=0.00 cfs 0.000 af Outflow=1.46 cfs 0.838 af

Link DP1: (West) NW Wetlands Inflow=36.38 cfs 4.892 af
Primary=36.38 cfs 4.892 af

Total Runoff Area = 20.981 ac Runoff Volume = 7.545 af Average Runoff Depth = 4.32"
90.84% Pervious = 19.059 ac 9.16% Impervious = 1.922 ac

Summary for Subcatchment PD1.1:

Runoff = 0.66 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 7.27"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
1,442	39	>75% Grass cover, Good, HSG A
2,530	98	Paved parking, HSG A
3,972		Weighted Average
1,442		36.31% Pervious Area
2,530		63.69% Impervious Area

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

Summary for Subcatchment PD1.2:

Runoff = 2.81 cfs @ 12.09 hrs, Volume= 0.236 af, Depth= 6.39"
Routed to Pond P1B : UG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
7,895	39	>75% Grass cover, Good, HSG A
10,274	98	Paved parking, HSG A
1,109	30	Woods, Good, HSG A
19,278		Weighted Average
9,004		46.71% Pervious Area
10,274		53.29% Impervious Area

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

Summary for Subcatchment PD1.3:

Runoff = 5.72 cfs @ 12.09 hrs, Volume= 0.473 af, Depth= 6.74"
Routed to Pond P1A : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
15,241	39	>75% Grass cover, Good, HSG A
29	61	>75% Grass cover, Good, HSG B
1,878	80	>75% Grass cover, Good, HSG D
16,475	98	Paved parking, HSG A
3,058	98	Water Surface, 0% imp, HSG A
5	98	Water Surface, 0% imp, HSG D
0	30	Woods, Good, HSG A
36,687		Weighted Average
20,212		55.09% Pervious Area
16,475		44.91% Impervious Area

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

Summary for Subcatchment PD1.4:

Runoff = 2.66 cfs @ 12.09 hrs, Volume= 0.217 af, Depth= 7.15"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
4,637	39	>75% Grass cover, Good, HSG A
2,234	61	>75% Grass cover, Good, HSG B
6,246	98	Paved parking, HSG A
2,765	98	Paved parking, HSG B
15,882		Weighted Average
6,871		43.26% Pervious Area
9,011		56.74% Impervious Area

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

Summary for Subcatchment PD1.5:

Runoff = 2.05 cfs @ 12.28 hrs, Volume= 0.303 af, Depth= 1.48"
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (ac)	CN	Description
0.568	39	>75% Grass cover, Good, HSG A
0.036	61	>75% Grass cover, Good, HSG B
0.306	30	Meadow, non-grazed, HSG A
0.007	78	Meadow, non-grazed, HSG D
0.000	98	Paved parking, HSG A
1.531	30	Woods, Good, HSG A
0.009	55	Woods, Good, HSG B
2.459		Weighted Average
2.459		99.99% Pervious Area
0.000		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8					**Direct Entry, Same as ED1.3**

Summary for Subcatchment PD1.6:

Runoff = 0.23 cfs @ 12.10 hrs, Volume= 0.020 af, Depth= 2.28"
Routed to Link DP1 : (West) NW Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
4,518	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
4,518		Weighted Average
4,518		100.00% Pervious Area
0		0.00% Impervious Area

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

Summary for Subcatchment PD1.7:

Runoff = 41.19 cfs @ 12.45 hrs, Volume= 5.620 af, Depth= 4.54"
Routed to Pond EP1.1 : Isolated Wetland (Flag #A)

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
55,244	39	>75% Grass cover, Good, HSG A
91,440	61	>75% Grass cover, Good, HSG B
32,954	96	Gravel surface, HSG B
3,847	30	Meadow, non-grazed, HSG A
8,092	98	Paved parking, HSG A
18,650	98	Paved parking, HSG B
2,061	98	Roofs, HSG A
13,422	98	Roofs, HSG B
96,474	30	Woods, Good, HSG A
325,215	55	Woods, Good, HSG B
647,398		Weighted Average
605,172		93.48% Pervious Area
42,225		6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0340	0.09		**Sheet Flow, 334.9-333.2** Woods: Light underbrush n= 0.400 P2= 3.74"
6.5	537	0.0760	1.38		**Shallow Concentrated Flow, 333.2-292.4** Woodland Kv= 5.0 fps
0.4	74	0.0430	3.34		**Shallow Concentrated Flow, 292.4-289.2** Unpaved Kv= 16.1 fps
9.8	729	0.0620	1.24		**Shallow Concentrated Flow, 289.2-243.9** Woodland Kv= 5.0 fps
0.0	21	0.1330	23.48	41.50	**Pipe Channel, 243.9-241.1** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.8	461	0.1040	1.61		**Shallow Concentrated Flow, 241.1-193** Woodland Kv= 5.0 fps
30.7	1,872	Total			

Summary for Subcatchment PD1.8:

Runoff = 7.84 cfs @ 12.11 hrs, Volume= 0.621 af, Depth= 4.10"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (ac)	CN	Description
0.605	39	>75% Grass cover, Good, HSG A
0.902	61	>75% Grass cover, Good, HSG B
0.000	98	Paved parking, HSG A
0.072	98	Paved parking, HSG B
0.001	98	Roofs, HSG B
0.155	30	Woods, Good, HSG A
0.079	55	Woods, Good, HSG B
1.816		Weighted Average
1.743		95.97% Pervious Area
0.073		4.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	30	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.74"
0.3	44	0.2500	2.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	71	0.0800	1.98		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.3	145	Total			

Summary for Pond EP1.1: Isolated Wetland (Flag #A)

Inflow Area = 14.862 ac, 6.52% Impervious, Inflow Depth = 4.54" for 100-year event
Inflow = 41.19 cfs @ 12.45 hrs, Volume= 5.620 af
Outflow = 36.04 cfs @ 12.59 hrs, Volume= 4.106 af, Atten= 13%, Lag= 8.8 min
Primary = 36.04 cfs @ 12.59 hrs, Volume= 4.106 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 200.68' @ 12.59 hrs Surf.Area= 20,509 sf Storage= 77,236 cf

Plug-Flow detention time= 168.6 min calculated for 4.106 af (73% of inflow)
Center-of-Mass det. time= 71.4 min (915.0 - 843.6)

Volume	Invert	Avail.Storage	Storage Description
#1	191.60'	83,917 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)
191.60	0	0.0	0	0	0
192.00	420	106.0	56	56	894
193.00	2,129	189.0	1,165	1,221	2,848
194.00	3,844	292.0	2,945	4,165	6,798
195.00	6,150	324.0	4,952	9,118	8,397
196.00	7,911	348.0	7,012	16,130	9,724
197.00	9,587	375.0	8,736	24,865	11,318
198.00	11,472	412.0	10,515	35,381	13,669
199.00	14,207	481.0	12,815	48,196	18,592
200.00	17,766	557.0	15,953	64,149	24,892
201.00	21,840	614.0	19,768	83,917	30,235

Device	Routing	Invert	Outlet Devices
#1	Primary	199.00'	**72.0" W x 24.0" H Box Culvert** L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 199.00' / 195.00' S= 0.0308 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.00 sf
#2	Device 1	200.10'	**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

Primary OutFlow Max=36.03 cfs @ 12.59 hrs HW=200.68' TW=186.32' (Dynamic Tailwater)
↑**1=Culvert** (Passes 36.03 cfs of 42.10 cfs potential flow)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 36.03 cfs @ 2.06 fps)

Summary for Pond EP1.2: Vernal Pool (Flag #B)

Inflow Area = 20.344 ac, 8.00% Impervious, Inflow Depth = 2.85" for 100-year event
Inflow = 38.44 cfs @ 12.60 hrs, Volume= 4.828 af
Outflow = 36.25 cfs @ 12.68 hrs, Volume= 4.802 af, Atten= 6%, Lag= 4.8 min
Primary = 36.25 cfs @ 12.68 hrs, Volume= 4.802 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 186.37' @ 12.68 hrs Surf.Area= 15,284 sf Storage= 9,855 cf

Plug-Flow detention time= 9.4 min calculated for 4.802 af (99% of inflow)
Center-of-Mass det. time= 6.1 min (922.9 - 916.8)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	20,812 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)
185.00	52	27.0	0	0	52
186.00	13,009	573.0	4,628	4,628	26,123
187.00	19,583	590.0	16,184	20,812	27,801

Device	Routing	Invert	Outlet Devices
#1	Primary	185.60'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=36.25 cfs @ 12.68 hrs HW=186.37' TW=0.00' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 36.25 cfs @ 2.35 fps)

Summary for Pond P1A: AG Basin

Inflow Area = 0.842 ac, 44.91% Impervious, Inflow Depth = 6.74" for 100-year event
Inflow = 5.72 cfs @ 12.09 hrs, Volume= 0.473 af
Outflow = 0.82 cfs @ 12.61 hrs, Volume= 0.473 af, Atten= 86%, Lag= 31.3 min
Discarded = 0.27 cfs @ 12.61 hrs, Volume= 0.333 af
Primary = 0.55 cfs @ 12.61 hrs, Volume= 0.140 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 200.04' @ 12.61 hrs Surf.Area= 4,766 sf Storage= 7,969 cf

Plug-Flow detention time= 147.2 min calculated for 0.473 af (100% of inflow)
Center-of-Mass det. time= 147.2 min (909.5 - 762.3)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	14,276 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	3,063	0	0
199.00	3,877	3,470	3,470
200.00	4,736	4,307	7,777
201.25	5,663	6,499	14,276

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	193.50'	**12.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.50' / 193.00' S= 0.0122 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	198.80'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	199.50'	**3.0" Vert. Orifice X 2.00** C= 0.600 Limited to weir flow at low heads
#5	Device 2	200.10'	**24.0" x 24.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#6	Secondary	200.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.27 cfs @ 12.61 hrs HW=200.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.55 cfs @ 12.61 hrs HW=200.04' TW=186.34' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.55 cfs of 7.34 cfs potential flow)
  ├**3=Orifice** (Orifice Controls 0.25 cfs @ 5.09 fps)
  ├**4=Orifice** (Orifice Controls 0.30 cfs @ 3.10 fps)
  └**5=Rim** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=198.00' TW=185.00' (Dynamic Tailwater)
└**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1B: UG Basin

Inflow Area = 0.443 ac, 53.29% Impervious, Inflow Depth = 6.39" for 100-year event
Inflow = 2.81 cfs @ 12.09 hrs, Volume= 0.236 af
Outflow = 0.29 cfs @ 12.91 hrs, Volume= 0.236 af, Atten= 90%, Lag= 49.3 min
Discarded = 0.12 cfs @ 10.48 hrs, Volume= 0.221 af
Primary = 0.18 cfs @ 12.91 hrs, Volume= 0.015 af
Routed to Link DP1 : (West) NW Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 193.31' @ 12.91 hrs Surf.Area= 2,069 sf Storage= 4,279 cf

Plug-Flow detention time= 296.7 min calculated for 0.236 af (100% of inflow)
Center-of-Mass det. time= 296.7 min (1,058.4 - 761.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.00'	2,075 cf	**25.25'W x 81.94'L x 3.75'H Field A** 7,758 cf Overall - 2,570 cf Embedded = 5,189 cf x 40.0% Voids
#2A	190.75'	2,570 cf	**ADS_StormTech DC-780 b +Cap** x 55 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 55 Chambers in 5 Rows Cap Storage= 2.7 cf x 2 x 5 rows = 26.5 cf
		4,645 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	190.00'	**12.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 190.00' / 189.80' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	193.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Discarded	190.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 10.48 hrs HW=190.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.18 cfs @ 12.91 hrs HW=193.31' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.18 cfs of 5.00 cfs potential flow)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.18 cfs @ 0.78 fps)

Summary for Pond P1C: AG Basin

Inflow Area = 2.180 ac, 12.85% Impervious, Inflow Depth = 4.61" for 100-year event
Inflow = 10.41 cfs @ 12.10 hrs, Volume= 0.838 af
Outflow = 1.46 cfs @ 12.78 hrs, Volume= 0.838 af, Atten= 86%, Lag= 40.3 min
Discarded = 0.33 cfs @ 12.78 hrs, Volume= 0.560 af
Primary = 1.13 cfs @ 12.78 hrs, Volume= 0.279 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond ep1.2 : Vernal Pool (Flag #B)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 203.66' @ 12.78 hrs Surf.Area= 5,919 sf Storage= 16,172 cf

Plug-Flow detention time= 324.4 min calculated for 0.838 af (100% of inflow)
Center-of-Mass det. time= 324.4 min (1,141.3 - 816.9)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	22,748 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	2,910	0	0
204.70	6,770	22,748	22,748

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	200.00'	**18.0" Round Culvert** L= 33.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 200.00' / 199.00' S= 0.0303 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	202.00'	**3.0" Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#4	Device 2	203.60'	**48.0" x 48.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#5	Secondary	204.00'	**20.0' long + 3.0 '/' SideZ 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=0.33 cfs @ 12.78 hrs HW=203.66' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

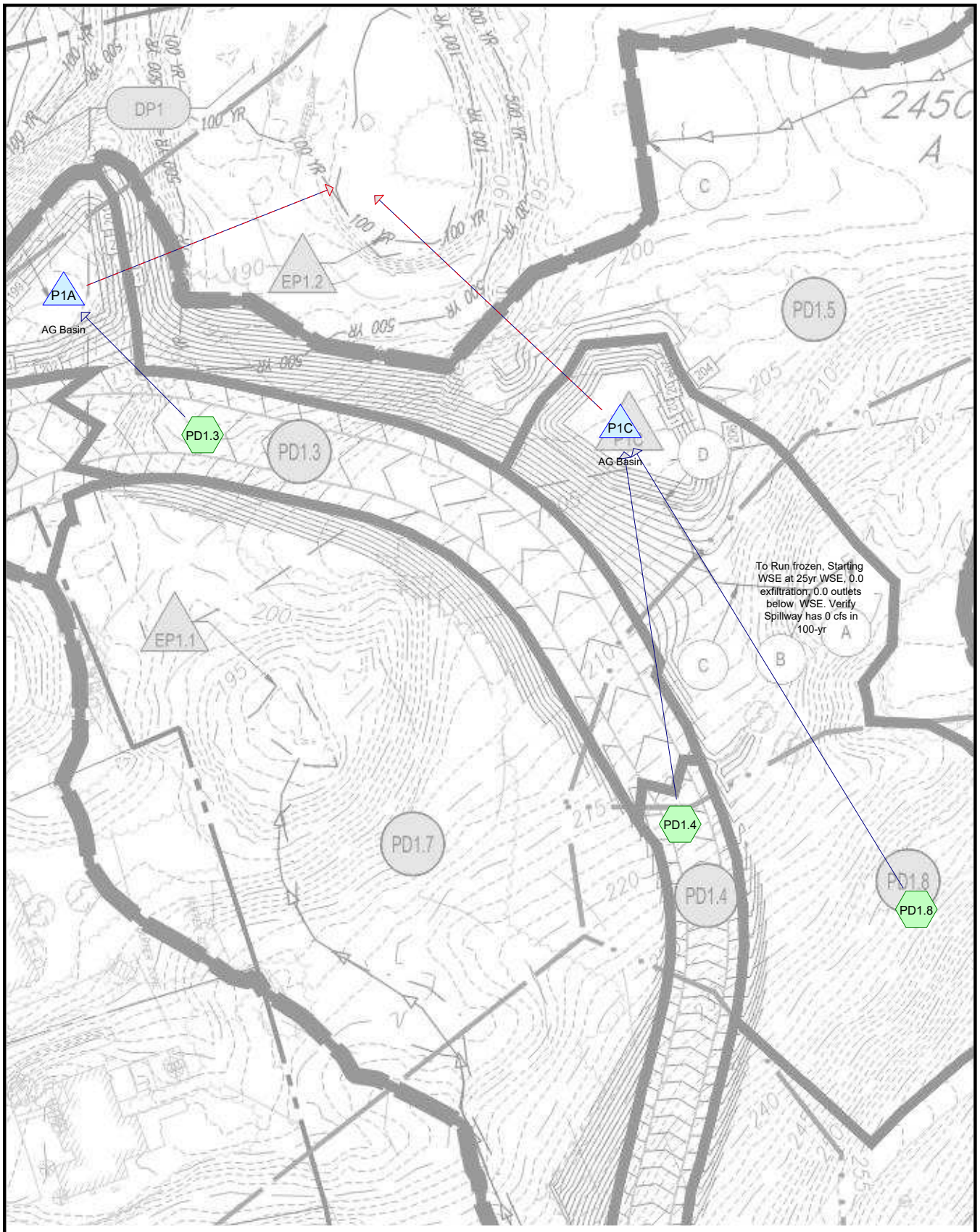
Primary OutFlow Max=1.13 cfs @ 12.78 hrs HW=203.66' TW=186.33' (Dynamic Tailwater)
└**2=Culvert** (Passes 1.13 cfs of 11.47 cfs potential flow)
  ├**3=Orifice** (Orifice Controls 0.29 cfs @ 5.97 fps)
  └**4=Rim** (Weir Controls 0.84 cfs @ 0.82 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.00' TW=185.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: (West) NW Wetlands

Inflow Area = 20.981 ac, 9.16% Impervious, Inflow Depth = 2.80" for 100-year event
Inflow = 36.38 cfs @ 12.68 hrs, Volume= 4.892 af
Primary = 36.38 cfs @ 12.68 hrs, Volume= 4.892 af, Atten= 0%, Lag= 0.0 min

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



Routing Diagram for MAA230481_PR-definitive
Prepared by Bohler, Printed 6/13/2025

Summary for Subcatchment PD1.3:

Runoff = 5.72 cfs @ 12.09 hrs, Volume= 0.473 af, Depth= 6.74"
Routed to Pond P1A : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
15,241	39	>75% Grass cover, Good, HSG A
29	61	>75% Grass cover, Good, HSG B
1,878	80	>75% Grass cover, Good, HSG D
16,475	98	Paved parking, HSG A
3,058	98	Water Surface, 0% imp, HSG A
5	98	Water Surface, 0% imp, HSG D
0	30	Woods, Good, HSG A
36,687		Weighted Average
20,212		55.09% Pervious Area
16,475		44.91% Impervious Area

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

Summary for Subcatchment PD1.4:

Runoff = 2.66 cfs @ 12.09 hrs, Volume= 0.217 af, Depth= 7.15"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (sf)	CN	Description
4,637	39	>75% Grass cover, Good, HSG A
2,234	61	>75% Grass cover, Good, HSG B
6,246	98	Paved parking, HSG A
2,765	98	Paved parking, HSG B
15,882		Weighted Average
6,871		43.26% Pervious Area
9,011		56.74% Impervious Area

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

Summary for Subcatchment PD1.8:

Runoff = 7.84 cfs @ 12.11 hrs, Volume= 0.621 af, Depth= 4.10"
Routed to Pond p1c : AG Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=10.35"

Area (ac)	CN	Description
0.605	39	>75% Grass cover, Good, HSG A
0.902	61	>75% Grass cover, Good, HSG B
0.000	98	Paved parking, HSG A
0.072	98	Paved parking, HSG B
0.001	98	Roofs, HSG B
0.155	30	Woods, Good, HSG A
0.079	55	Woods, Good, HSG B
1.816		Weighted Average
1.743		95.97% Pervious Area
0.073		4.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	30	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.74"
0.3	44	0.2500	2.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	71	0.0800	1.98		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.3	145	Total			

Summary for Pond P1A: AG Basin

Inflow Area = 0.842 ac, 44.91% Impervious, Inflow Depth = 6.74" for 100-year event
Inflow = 5.72 cfs @ 12.09 hrs, Volume= 0.473 af
Outflow = 4.76 cfs @ 12.14 hrs, Volume= 0.465 af, Atten= 17%, Lag= 3.2 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 4.76 cfs @ 12.14 hrs, Volume= 0.465 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond EP1.2 : Vernal Pool (Flag #B)

Starting at 25-yr water surface as frozen condition

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 199.43' Surf.Area= 4,246 sf Storage= 5,217 cf
Peak Elev= 200.40' @ 12.14 hrs Surf.Area= 5,034 sf Storage= 9,741 cf (4,525 cf above start)

Plug-Flow detention time= 271.6 min calculated for 0.346 af (73% of inflow)
Center-of-Mass det. time= 98.9 min (861.2 - 762.3)

Peak stays below spillway elevation 200.75

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	14,276 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	3,063	0	0
199.00	3,877	3,470	3,470
200.00	4,736	4,307	7,777
201.25	5,663	6,499	14,276

Discharge multiplier set to zero for no discharges below the frozen elevation

Device	Routing	Invert	Outlet Devices
#1	Discarded	198.00'	**2.410 in/hr Exfiltration X 0.00 over Surface area** Phase-In= 0.01'
#2	Primary	193.50'	**12.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 193.50' / 193.00' S= 0.0122 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	198.80'	**3.0" Vert. Orifice X 0.00** C= 0.600 Limited to weir flow at low heads
#4	Device 2	199.50'	**3.0" Vert. Orifice X 2.00** C= 0.600 Limited to weir flow at low heads
#5	Device 2	200.10'	**24.0" x 24.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#6	Secondary	200.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=199.43' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=4.76 cfs @ 12.14 hrs HW=200.40' TW=185.98' (Dynamic Tailwater)
└**2=Culvert** (Passes 4.76 cfs of 7.55 cfs potential flow)
  └**3=Orifice** (Controls 0.00 cfs)
  └**4=Orifice** (Orifice Controls 0.42 cfs @ 4.24 fps)
  └**5=Rim** (Weir Controls 4.34 cfs @ 1.80 fps)

No flow received

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=199.43' TW=185.00' (Dynamic Tailwater)
└**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P1C: AG Basin

Inflow Area = 2.180 ac, 12.85% Impervious, Inflow Depth = 4.61" for 100-year event
Inflow = 10.41 cfs @ 12.10 hrs, Volume= 0.838 af
Outflow = 9.61 cfs @ 12.14 hrs, Volume= 0.702 af, Atten= 8%, Lag= 2.2 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 9.61 cfs @ 12.14 hrs, Volume= 0.702 af
  Routed to Pond EP1.2 : Vernal Pool (Flag #B)
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
  Routed to Pond ep1.2 : Vernal Pool (Flag #B)

Starting at 25-yr water surface as frozen condition

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Starting Elev= 202.50' Surf.Area= 4,963 sf Storage= 9,841 cf
Peak Elev= 203.92' @ 12.14 hrs Surf.Area= 6,132 sf Storage= 17,737 cf (7,895 cf above start)

Peak stays below spillway elevation 204

Plug-Flow detention time= 237.2 min calculated for 0.476 af (57% of inflow)
Center-of-Mass det. time= 49.2 min (866.1 - 816.9)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	22,748 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	2,910	0	0
204.70	6,770	22,748	22,748

Discharge multiplier set to zero for no discharges below the frozen elevation

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.00'	**2.410 in/hr Exfiltration X 0.00 over Surface area** Phase-In= 0.01'
#2	Primary	200.00'	**18.0" Round Culvert** L= 33.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 200.00' / 199.00' S= 0.0303 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	202.00'	**3.0" Vert. Orifice X 0.00** C= 0.600 Limited to weir flow at low heads
#4	Device 2	203.60'	**48.0" x 48.0" Horiz. Rim** C= 0.600 Limited to weir flow at low heads
#5	Secondary	204.00'	**20.0' long + 3.0 '/' SideZ 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 @ 0.00 hrs HW=202.50' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=9.61 cfs @ 12.14 hrs HW=203.92' TW=185.98' (Dynamic Tailwater)
└**2=Culvert** (Passes 9.61 cfs of 11.97 cfs potential flow)
  ├**3=Orifice** (Controls 0.00 cfs)
  └**4=Rim** (Weir Controls 9.61 cfs @ 1.86 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' TW=185.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

No flow received

APPENDIX F: STORMWATER CALCULATIONS

- *NOAA+ RAINFALL DATA*
- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *BASIN STAGE STORAGE VOLUMES*
- *PIPE SIZING AND OUTLET PROTECTION SIZING*
- *MS4 GENERAL PERMIT: ATTACHMENT 3 TO APPENDIX 4*

NOAA Atlas 14, Volume 10, Version 3
Location name: Bellingham, Massachusetts, USA*
Latitude: 42.0214°, Longitude: -71.4763°
Elevation: 245 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.327 (0.254-0.415)	0.396 (0.307-0.503)	0.509 (0.394-0.648)	0.603 (0.464-0.772)	0.732 (0.545-0.977)	0.830 (0.606-1.13)	0.932 (0.660-1.31)	1.04 (0.703-1.50)	1.20 (0.781-1.80)	1.33 (0.844-2.03)
10-min	0.464 (0.360-0.587)	0.562 (0.435-0.712)	0.722 (0.558-0.918)	0.855 (0.657-1.09)	1.04 (0.772-1.38)	1.18 (0.857-1.60)	1.32 (0.935-1.86)	1.48 (0.995-2.13)	1.71 (1.10-2.54)	1.89 (1.20-2.87)
15-min	0.545 (0.423-0.691)	0.661 (0.512-0.838)	0.850 (0.657-1.08)	1.01 (0.773-1.29)	1.22 (0.908-1.63)	1.38 (1.01-1.88)	1.55 (1.10-2.19)	1.74 (1.17-2.51)	2.01 (1.30-2.99)	2.22 (1.41-3.38)
30-min	0.747 (0.579-0.946)	0.905 (0.701-1.15)	1.16 (0.899-1.48)	1.38 (1.06-1.76)	1.67 (1.24-2.23)	1.90 (1.38-2.58)	2.13 (1.51-3.00)	2.39 (1.61-3.44)	2.75 (1.78-4.10)	3.05 (1.93-4.64)
60-min	0.948 (0.736-1.20)	1.15 (0.891-1.46)	1.48 (1.14-1.88)	1.75 (1.34-2.24)	2.13 (1.58-2.84)	2.41 (1.76-3.28)	2.70 (1.92-3.81)	3.03 (2.04-4.37)	3.50 (2.27-5.22)	3.88 (2.46-5.90)
2-hr	1.21 (0.948-1.53)	1.49 (1.16-1.87)	1.93 (1.50-2.44)	2.30 (1.78-2.92)	2.81 (2.10-3.73)	3.19 (2.34-4.32)	3.59 (2.56-5.05)	4.05 (2.73-5.80)	4.71 (3.06-6.97)	5.25 (3.33-7.93)
3-hr	1.40 (1.10-1.76)	1.72 (1.35-2.16)	2.24 (1.75-2.83)	2.68 (2.08-3.39)	3.28 (2.46-4.34)	3.72 (2.74-5.03)	4.19 (3.01-5.89)	4.74 (3.21-6.77)	5.55 (3.62-8.20)	6.23 (3.96-9.37)
6-hr	1.81 (1.43-2.25)	2.22 (1.75-2.76)	2.88 (2.26-3.60)	3.43 (2.68-4.31)	4.19 (3.18-5.52)	4.74 (3.53-6.41)	5.35 (3.89-7.54)	6.10	7.24	8.23
12-hr	2.31 (1.84-2.86)	2.81 (2.23-3.48)	3.62 (2.87-4.50)	4.30 (3.38-5.37)	5.23 (4.00-6.88)	5.92 (4.45-7.98)	6.67 (4.91-9.41)			
24-hr	2.77 (2.22-3.40)	3.39 (2.71-4.16)	4.40 (3.50-5.42)	5.23 (4.14-6.49)	6.39 (4.92-8.36)	7.23 (5.48-9.71)	8.16 (6.05-11.5)			
2-day	3.13 (2.52-3.82)	3.88 (3.12-4.74)	5.12 (4.10-6.28)	6.15 (4.90-7.58)	7.56 (5.85-9.82)	8.60 (6.54-11.5)	9.74 (7.23-13.6)			
3-day	3.41 (2.75-4.14)	4.22 (3.41-5.14)	5.55 (4.47-6.78)	6.66 (5.32-8.17)	8.18 (6.34-10.6)	9.30 (7.08-12.3)	10.5 (7.82-14.6)	12.0 (8.29-16.7)	14.4 (9.52-20.6)	16.5 (10.6-24.0)
4-day	3.67 (2.98-4.45)	4.52 (3.66-5.48)	5.90 (4.76-7.18)	7.05 (5.65-8.62)	8.62 (6.70-11.1)	9.79 (7.46-12.9)	11.1 (8.22-15.2)	12.6 (8.72-17.5)	15.1 (10.0-21.6)	17.3 (11.2-25.1)
7-day	4.42 (3.60-5.32)	5.32 (4.33-6.41)	6.79 (5.50-8.21)	8.01 (6.45-9.74)	9.68 (7.55-12.3)	10.9 (8.34-14.2)	12.3 (9.10-16.6)	13.9 (9.62-19.1)	16.3 (10.8-23.2)	18.4 (11.9-26.7)
10-day	5.14 (4.20-6.17)	6.06 (4.96-7.29)	7.59 (6.17-9.15)	8.85 (7.15-10.7)	10.6 (8.26-13.4)	11.9 (9.07-15.4)	13.3 (9.82-17.8)	14.9 (10.3-20.3)	17.3 (11.5-24.4)	19.3 (12.5-27.8)
20-day	7.27 (5.99-8.67)	8.26 (6.79-9.86)	9.87 (8.09-11.8)	11.2 (9.13-13.5)	13.1 (10.2-16.3)	14.5 (11.1-18.4)	15.9 (11.7-21.0)	17.5 (12.2-23.7)	19.7 (13.2-27.6)	21.4 (13.9-30.7)
30-day	9.03 (7.47-10.7)	10.1 (8.31-12.0)	11.7 (9.65-14.0)	13.1 (10.7-15.7)	15.0 (11.8-18.7)	16.5 (12.6-20.9)	18.0 (13.3-23.5)	19.5 (13.7-26.3)	21.5 (14.4-30.0)	23.1 (15.0-32.9)
45-day	11.2 (9.31-13.3)	12.3 (10.2-14.5)	14.0 (11.6-16.7)	15.5 (12.7-18.5)	17.5 (13.8-21.5)	19.0 (14.6-23.9)	20.5 (15.1-26.5)	22.0 (15.5-29.5)	23.7 (16.0-33.0)	25.0 (16.3-35.5)
60-day	13.0 (10.9-15.4)	14.1 (11.8-16.7)	15.9 (13.2-18.9)	17.4 (14.4-20.8)	19.5 (15.4-23.9)	21.1 (16.2-26.4)	22.7 (16.6-29.0)	24.0 (16.9-32.1)	25.6 (17.3-35.4)	26.6 (17.4-37.6)

(2yr) 4.16 x 0.9 = 3.74
(10yr) 6.49 x 0.9 = 5.84
(25yr) 8.36 x 0.9 = 7.52
(50yr) 9.71x 0.9 = 8.74
(100yr) 11.5 x 0.9 = 10.35

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

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

Please refer to NOAA Atlas 14 document for more information.

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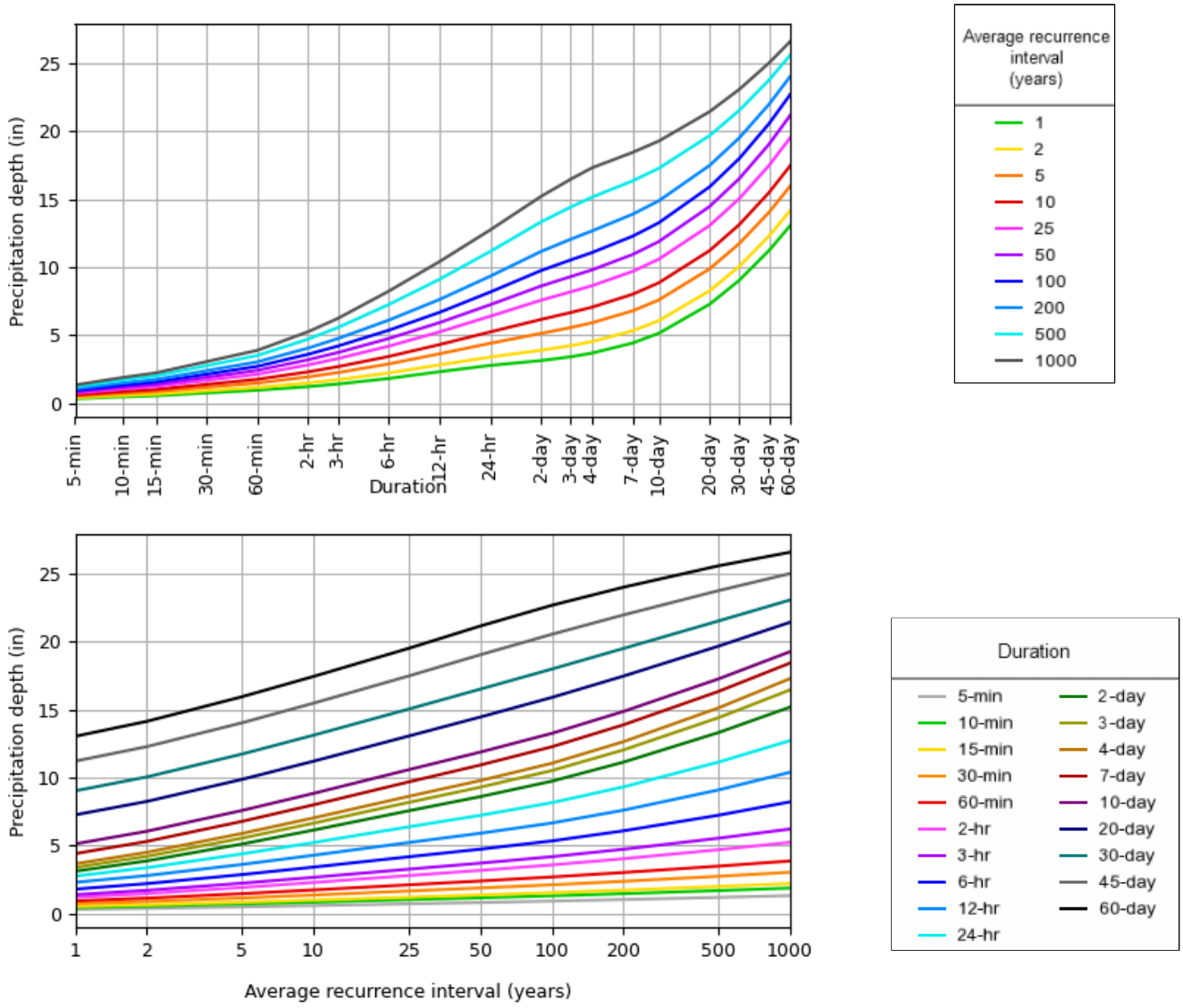
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.0214°, Longitude: -71.4763°



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Created (GMT): Tue Dec 17 18:52:39 2024

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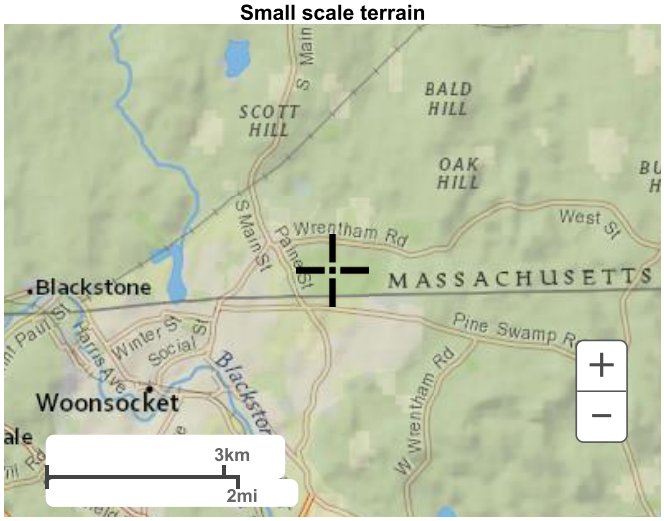
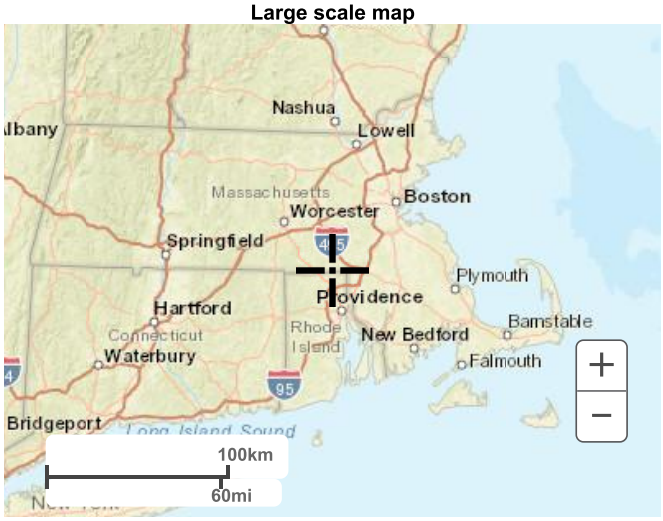
Maps & aerials

Small scale terrain

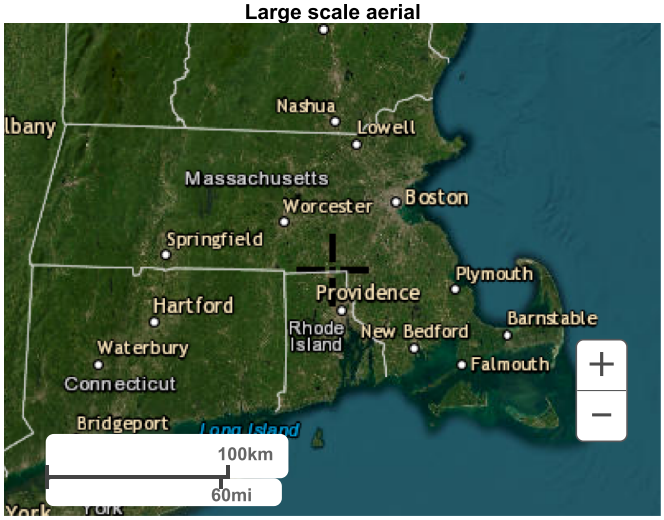


Large scale terrain

Large scale map



Large scale aerial



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National Weather Service
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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

NOAA Atlas 14, Volume 10, Version 3
Location name: Bellingham, Massachusetts, USA*
Latitude: 42.0214°, Longitude: -71.4763°
Elevation: 245 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.92** (3.05-4.98)	**4.75** (3.68-6.04)	**6.11** (4.73-7.78)	**7.24** (5.57-9.26)	**8.78** (6.54-11.7)	**9.96** (7.27-13.5)	**11.2** (7.92-15.8)	**12.5** (8.44-18.1)	**14.5** (9.37-21.5)	**16.0** (10.1-24.3)
10-min	**2.78** (2.16-3.52)	**3.37** (2.61-4.27)	**4.33** (3.35-5.51)	**5.13** (3.94-6.56)	**6.23** (4.63-8.30)	**7.06** (5.14-9.60)	**7.92** (5.61-11.2)	**8.88** (5.97-12.8)	**10.2** (6.63-15.3)	**11.3** (7.18-17.2)
15-min	**2.18** (1.69-2.76)	**2.64** (2.05-3.35)	**3.40** (2.63-4.32)	**4.02** (3.09-5.14)	**4.88** (3.63-6.52)	**5.54** (4.04-7.53)	**6.21** (4.40-8.75)	**6.96** (4.68-10.0)	**8.03** (5.20-12.0)	**8.89** (5.63-13.5)
30-min	**1.49** (1.16-1.89)	**1.81** (1.40-2.30)	**2.33** (1.80-2.96)	**2.76** (2.12-3.53)	**3.35** (2.49-4.47)	**3.79** (2.77-5.16)	**4.26** (3.02-6.00)	**4.77** (3.21-6.88)	**5.51** (3.57-8.21)	**6.10** (3.86-9.28)
60-min	**0.948** (0.736-1.20)	**1.15** (0.891-1.46)	**1.48** (1.14-1.88)	**1.75** (1.34-2.24)	**2.13** (1.58-2.84)	**2.41** (1.76-3.28)	**2.70** (1.92-3.81)	**3.03** (2.04-4.37)	**3.50** (2.27-5.22)	**3.88** (2.46-5.90)
2-hr	**0.606** (0.474-0.763)	**0.743** (0.579-0.936)	**0.965** (0.750-1.22)	**1.15** (0.889-1.46)	**1.40** (1.05-1.86)	**1.59** (1.17-2.16)	**1.80** (1.28-2.52)	**2.02** (1.37-2.90)	**2.35** (1.53-3.48)	**2.62** (1.67-3.96)
3-hr	**0.467** (0.366-0.586)	**0.573** (0.449-0.720)	**0.747** (0.583-0.941)	**0.892** (0.692-1.13)	**1.09** (0.820-1.44)	**1.24** (0.914-1.68)	**1.40** (1.00-1.96)	**1.58** (1.07-2.26)	**1.85** (1.20-2.73)	**2.07** (1.32-3.12)
6-hr	**0.302** (0.238-0.376)	**0.370** (0.291-0.461)	**0.480** (0.377-0.601)	**0.572** (0.447-0.719)	**0.699** (0.530-0.922)	**0.792** (0.590-1.07)	**0.894** (0.649-1.26)	**1.02** (0.691-1.44)	**1.21** (0.789-1.77)	**1.37** (0.876-2.05)
12-hr	**0.191** (0.152-0.237)	**0.233** (0.184-0.288)	**0.300** (0.237-0.373)	**0.356** (0.280-0.445)	**0.434** (0.332-0.571)	**0.491** (0.369-0.662)	**0.553** (0.407-0.780)	**0.631** (0.430-0.891)	**0.755** (0.494-1.10)	**0.863** (0.552-1.28)
24-hr	**0.115** (0.092-0.141)	**0.141** (0.112-0.173)	**0.183** (0.145-0.226)	**0.218** (0.172-0.270)	**0.266** (0.204-0.348)	**0.301** (0.228-0.404)	**0.340** (0.252-0.478)	**0.388** (0.265-0.544)	**0.464** (0.304-0.672)	**0.530** (0.340-0.781)
2-day	**0.065** (0.052-0.079)	**0.080** (0.065-0.098)	**0.106** (0.085-0.130)	**0.128** (0.102-0.157)	**0.157** (0.121-0.204)	**0.179** (0.136-0.238)	**0.202** (0.150-0.282)	**0.232** (0.159-0.323)	**0.277** (0.182-0.398)	**0.316** (0.203-0.463)
3-day	**0.047** (0.038-0.057)	**0.058** (0.047-0.071)	**0.077** (0.062-0.094)	**0.092** (0.073-0.113)	**0.113** (0.088-0.146)	**0.129** (0.098-0.170)	**0.146** (0.108-0.202)	**0.167** (0.115-0.231)	**0.200** (0.132-0.286)	**0.228** (0.147-0.333)
4-day	**0.038** (0.031-0.046)	**0.047** (0.038-0.057)	**0.061** (0.049-0.074)	**0.073** (0.058-0.089)	**0.089** (0.069-0.115)	**0.101** (0.077-0.134)	**0.115** (0.085-0.158)	**0.131** (0.090-0.182)	**0.157** (0.104-0.225)	**0.180** (0.116-0.261)
7-day	**0.026** (0.021-0.031)	**0.031** (0.025-0.038)	**0.040** (0.032-0.048)	**0.047** (0.038-0.057)	**0.057** (0.044-0.073)	**0.065** (0.049-0.084)	**0.073** (0.054-0.099)	**0.082** (0.057-0.113)	**0.097** (0.064-0.138)	**0.109** (0.071-0.158)
10-day	**0.021** (0.017-0.025)	**0.025** (0.020-0.030)	**0.031** (0.025-0.038)	**0.036** (0.029-0.044)	**0.044** (0.034-0.055)	**0.049** (0.037-0.064)	**0.055** (0.040-0.074)	**0.061** (0.043-0.084)	**0.071** (0.047-0.101)	**0.080** (0.052-0.115)
20-day	**0.015** (0.012-0.018)	**0.017** (0.014-0.020)	**0.020** (0.016-0.024)	**0.023** (0.019-0.028)	**0.027** (0.021-0.034)	**0.030** (0.023-0.038)	**0.033** (0.024-0.043)	**0.036** (0.025-0.049)	**0.040** (0.027-0.057)	**0.044** (0.029-0.063)
30-day	**0.012** (0.010-0.014)	**0.013** (0.011-0.016)	**0.016** (0.013-0.019)	**0.018** (0.014-0.021)	**0.020** (0.016-0.025)	**0.022** (0.017-0.028)	**0.024** (0.018-0.032)	**0.027** (0.018-0.036)	**0.029** (0.020-0.041)	**0.032** (0.020-0.045)
45-day	**0.010** (0.008-0.012)	**0.011** (0.009-0.013)	**0.012** (0.010-0.015)	**0.014** (0.011-0.017)	**0.016** (0.012-0.019)	**0.017** (0.013-0.022)	**0.019** (0.013-0.024)	**0.020** (0.014-0.027)	**0.021** (0.014-0.030)	**0.023** (0.015-0.032)
60-day	**0.009** (0.007-0.010)	**0.009** (0.008-0.011)	**0.011** (0.009-0.013)	**0.012** (0.009-0.014)	**0.013** (0.010-0.016)	**0.014** (0.011-0.018)	**0.015** (0.011-0.020)	**0.016** (0.011-0.022)	**0.017** (0.011-0.024)	**0.018** (0.012-0.026)

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

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

Please refer to NOAA Atlas 14 document for more information.

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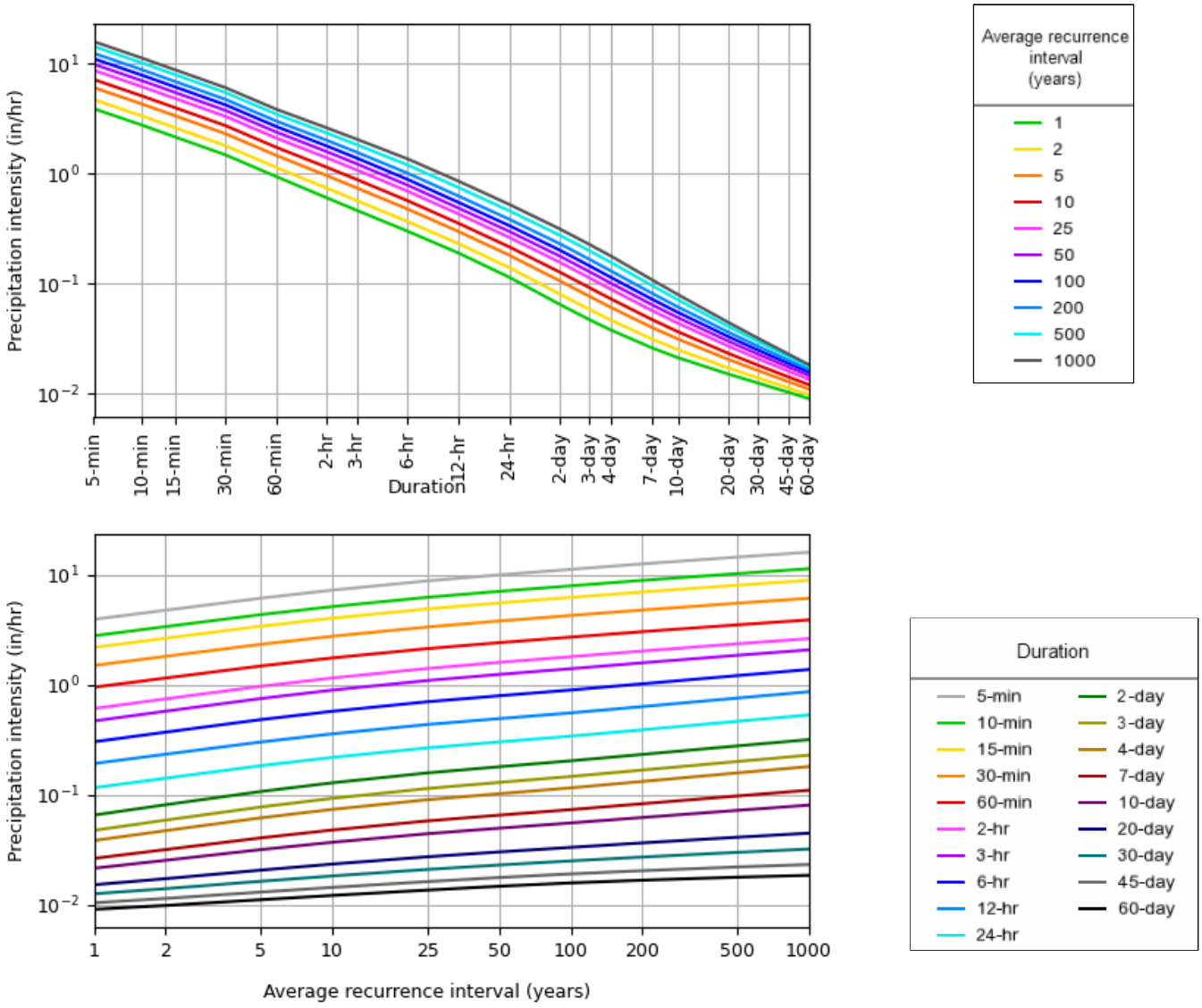
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 42.0214°, Longitude: -71.4763°



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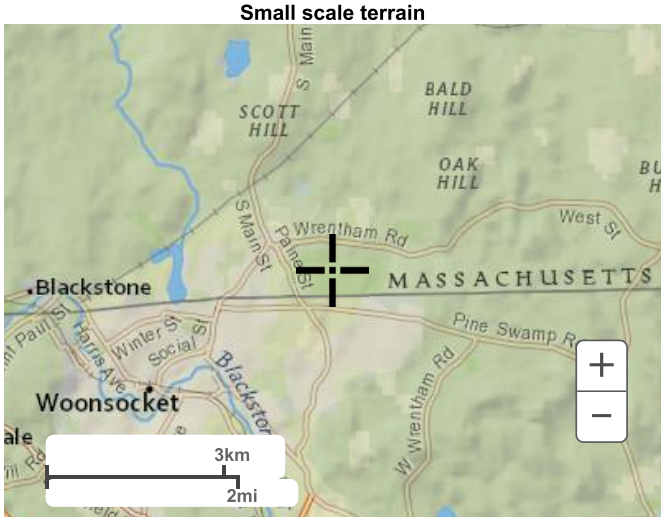
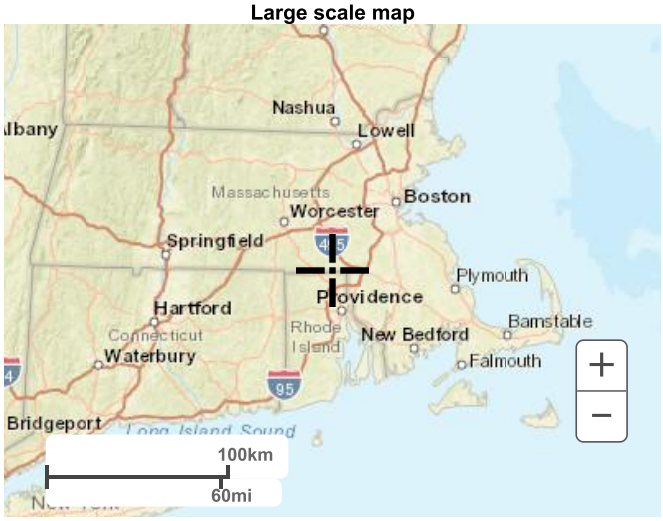
Maps & aerials

Small scale terrain

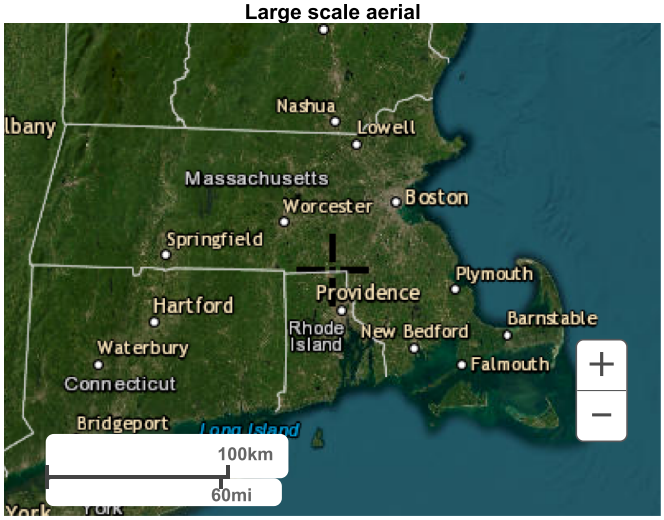


Large scale terrain

Large scale map



Large scale aerial



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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	0.233
Proposed Site Impervious Area (ac)	1.049
Proposed Increase in Site Impervious Area (ac)	0.816
Recharge Volume Required (cf)	**1,777**

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	1.566
Proposed Site Impervious Area (ac)	1.630
Proposed Increase in Site Impervious Area (ac)	0.064
Recharge Volume Required (cf)	**81**

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

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

Total Recharge Volume Required (cf)	**1,859**

Recharge Volume Adjustment Factor	
New Imp. Area Directed to Infiltration BMP (ac)	**0.894**
%Impervious Directed to Infiltration BMP	94%
Adjustment Factor	1.06
Adjusted Total Recharge Volume Required (cf)	**1,979**

Provided Recharge Volume*	
P1A - Surface Basin	2,711
P1B - UG Basin	4,231
P1C - Surface Basin	7,463
Total Recharge Volume Provided (cf)	**14,405**

Provided greater than or Equal to Required

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

Definitive Subdivision
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June 13, 2025

MA DEP Standard 3: Drawdown Time Calculations

P1A - Surface Basin	
Volume below outlet pipe (Rv) (cf)	2,711
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	3,063
Drawdown time (Hours)*	**4.4**
P1B - UG Basin	
Volume below outlet pipe (Rv) (cf)	4,231
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	2,069
Drawdown time (Hours)**	**10.2**
P1C - Surface Basin	
Volume below outlet pipe (Rv) (cf)	7,463
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	2,910
Drawdown time (Hours)**	**12.8**

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	116,697
Required Water Quality Volume (cf)	**9,725**
*Water Quality volume runoff is equal to 1.0 inch of runoff times the total impervious area of the post development project site / analysis area.	

Water Quality Volume Provided*	
P1A - Surface Basin	2,711
P1B - UG Basin	4,231
P1C - Surface Basin	7,463
Total Provided Water Quality Volume (cf)	**14,405**

Required Water Quality Volume Provided

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025
1" Water Quality Volume to Flow Rate Calculation Sheet

Compute Water Quality Flow with the following Equation

WQF = (qu)(A)(WQV)

Site Plan Callout		qu (from 1" - qu Table)	Impervious Area (SF)	Ai (sq/mi)	WQV (inches)		**WQF (cfs) Required**	**WQF (cfs) Provided and Product selection**
A-60 WQU (to pond P1B)	=	774	10,274	0.000369	1	=	**0.29**	**1.0, CDS 1515-3**
B-40 WQU (to pond P1A)	=	774	16,475	0.000591	1	=	**0.46**	**1.4, CDS 2015-4**
D-20 WQU (to pond P1C)	=	774	9,011	0.000323	1	=	**0.25**	**1.0, CDS 1515-3**

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

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment (CB --> WQU)

A BMP	B TSS Removal Rate	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**
Proprietary Water Quality Unit	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment (CB --> WQU --> Isolator Row)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Water Quality Unit	**0.80**	**0.75**	**0.60**	**0.15**
Isolator Row	**0.80**	**0.15**	**0.12**	**0.03**
		Total TSS Removal =	**97%**	

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment (CB --> WQU)

A BMP	B TSS Removal Rate	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**
Proprietary Water Quality Unit	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment (CB --> WQU --> UG Infiltration System w/ pretreatment)

A BMP	B TSS Removal Rate	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**
Proprietary Water Quality Unit	**0.80**	**0.75**	**0.60**	**0.15**
UG Infiltration System (with isolator row pretreatment)	**0.80**	**0.15**	**0.12**	**0.03**
		Total TSS Removal =	**97%**	

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

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment (CB --> AG Infiltration Basin w/ pretreatment)

A BMP	B TSS Removal Rate	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**
AG Infiltration Basin (with WQS pretreatment)	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

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

Stage-Area-Storage for Pond EP1.1: Isolated Wetland (Flag #A)

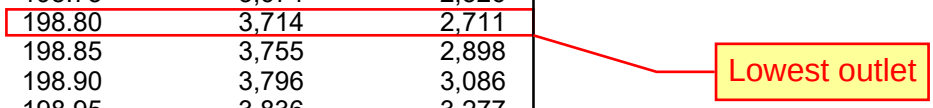
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
191.60	0	0
191.70	26	1
191.80	105	7
191.90	236	24
192.00	420	56
192.10	532	103
192.20	657	163
192.30	795	235
192.40	946	322
192.50	1,110	425
192.60	1,288	545
192.70	1,478	683
192.80	1,682	841
192.90	1,899	1,020
193.00	2,129	1,221
193.10	2,278	1,441
193.20	2,432	1,677
193.30	2,591	1,928
193.40	2,755	2,195
193.50	2,924	2,479
193.60	3,098	2,780
193.70	3,277	3,098
193.80	3,461	3,435
193.90	3,650	3,791
194.00	3,844	4,165
194.10	4,050	4,560
194.20	4,262	4,976
194.30	4,479	5,413
194.40	4,702	5,872
194.50	4,930	6,353
194.60	5,163	6,858
194.70	5,402	7,386
194.80	5,646	7,938
194.90	5,895	8,515
195.00	6,150	9,118
195.10	6,316	9,741
195.20	6,484	10,381
195.30	6,655	11,038
195.40	6,828	11,712
195.50	7,003	12,403
195.60	7,180	13,113
195.70	7,359	13,839
195.80	7,541	14,584
195.90	7,725	15,348
196.00	7,911	16,130
196.10	8,071	16,929
196.20	8,233	17,744
196.30	8,397	18,575
196.40	8,562	19,423
196.50	8,729	20,288
196.60	8,897	21,169
196.70	9,067	22,067
196.80	9,239	22,983
196.90	9,412	23,915
197.00	9,587	24,865
197.10	9,768	25,833
197.20	9,950	26,819
197.30	10,135	27,823
197.40	10,321	28,846
197.50	10,508	29,887
197.60	10,698	30,948
197.70	10,889	32,027
197.80	11,081	33,125
197.90	11,276	34,243
198.00	11,472	35,381
198.10	11,732	36,541
198.20	11,996	37,727
198.30	12,262	38,940
198.40	12,531	40,180
198.50	12,803	41,446
198.60	13,078	42,740
198.70	13,356	44,062
198.80	13,637	45,412
198.90	13,920	46,789
199.00	14,207	48,196
199.10	14,545	49,633
199.20	14,887	51,105
199.30	15,233	52,611
199.40	15,583	54,152
199.50	15,937	55,728
199.60	16,295	57,339
199.70	16,657	58,987
199.80	17,022	60,671
199.90	17,392	62,391
200.00	17,766	64,149
200.10	18,154	65,945
200.20	18,547	67,780
200.30	18,944	69,655
200.40	19,345	71,569
200.50	19,750	73,524
200.60	20,160	75,519
200.70	20,574	77,556
200.80	20,992	79,634
200.90	21,414	81,754
201.00	**21,840**	**83,917**

Stage-Area-Storage for Pond EP1.2: Vernal Pool (Flag #B)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
185.00	52	0
185.02	87	1
185.04	132	4
185.06	186	7
185.08	248	11
185.10	320	17
185.12	401	24
185.14	491	33
185.16	591	44
185.18	699	57
185.20	817	72
185.22	944	89
185.24	1,079	109
185.26	1,224	132
185.28	1,378	159
185.30	1,542	188
185.32	1,714	220
185.34	1,896	256
185.36	2,086	296
185.38	2,286	340
185.40	2,495	388
185.42	2,713	440
185.44	2,940	496
185.46	3,176	557
185.48	3,422	623
185.50	3,676	694
185.52	3,940	770
185.54	4,213	852
185.56	4,495	939
185.58	4,786	1,032
185.60	5,086	1,131
185.62	5,396	1,235
185.64	5,714	1,346
185.66	6,042	1,464
185.68	6,379	1,588
185.70	6,725	1,719
185.72	7,080	1,857
185.74	7,444	2,002
185.76	7,817	2,155
185.78	8,199	2,315
185.80	8,591	2,483
185.82	8,992	2,659
185.84	9,402	2,843
185.86	9,821	3,035
185.88	10,249	3,236
185.90	10,686	3,445
185.92	11,132	3,663
185.94	11,588	3,890
185.96	12,052	4,127
185.98	12,526	4,372
186.00	13,009	4,628
186.02	13,127	4,889
186.04	13,246	5,153
186.06	13,366	5,419
186.08	13,486	5,688
186.10	13,606	5,958
186.12	13,727	6,232
186.14	13,849	6,508
186.16	13,971	6,786
186.18	14,093	7,066
186.20	14,217	7,349
186.22	14,340	7,635
186.24	14,465	7,923
186.26	14,589	8,214
186.28	14,715	8,507
186.30	14,841	8,802
186.32	14,967	9,100
186.34	15,094	9,401
186.36	15,221	9,704
186.38	15,349	10,010
186.40	15,478	10,318
186.42	15,607	10,629
186.44	15,736	10,942
186.46	15,867	11,258
186.48	15,997	11,577
186.50	16,129	11,898
186.52	16,260	12,222
186.54	16,393	12,549
186.56	16,525	12,878
186.58	16,659	13,210
186.60	16,793	13,544
186.62	16,927	13,881
186.64	17,062	14,221
186.66	17,198	14,564
186.68	17,334	14,909
186.70	17,470	15,257
186.72	17,607	15,608
186.74	17,745	15,962
186.76	17,883	16,318
186.78	18,022	16,677
186.80	18,161	17,039
186.82	18,301	17,403
186.84	18,441	17,771
186.86	18,582	18,141
186.88	18,723	18,514
186.90	18,865	18,890
186.92	19,008	19,269
186.94	19,151	19,650
186.96	19,294	20,035
186.98	19,438	20,422
187.00	**19,583**	**20,812**

Stage-Area-Storage for Pond P1A: AG Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
198.00	3,063	0
198.05	3,104	154
198.10	3,144	310
198.15	3,185	469
198.20	3,226	629
198.25	3,267	791
198.30	3,307	956
198.35	3,348	1,122
198.40	3,389	1,290
198.45	3,429	1,461
198.50	3,470	1,633
198.55	3,511	1,808
198.60	3,551	1,984
198.65	3,592	2,163
198.70	3,633	2,344
198.75	3,674	2,526
198.80	3,714	2,711
198.85	3,755	2,898
198.90	3,796	3,086
198.95	3,836	3,277
199.00	3,877	3,470
199.05	3,920	3,665
199.10	3,963	3,862
199.15	4,006	4,061
199.20	4,049	4,263
199.25	4,092	4,466
199.30	4,135	4,672
199.35	4,178	4,880
199.40	4,221	5,090
199.45	4,264	5,302
199.50	4,307	5,516
199.55	4,349	5,732
199.60	4,392	5,951
199.65	4,435	6,172
199.70	4,478	6,394
199.75	4,521	6,619
199.80	4,564	6,846
199.85	4,607	7,076
199.90	4,650	7,307
199.95	4,693	7,541
200.00	4,736	7,777
200.05	4,773	8,014
200.10	4,810	8,254
200.15	4,847	8,495
200.20	4,884	8,739
200.25	4,921	8,984
200.30	4,958	9,231
200.35	4,996	9,480
200.40	5,033	9,730
200.45	5,070	9,983
200.50	5,107	10,237
200.55	5,144	10,493
200.60	5,181	10,752
200.65	5,218	11,012
200.70	5,255	11,273
200.75	5,292	11,537
200.80	5,329	11,803
200.85	5,366	12,070
200.90	5,403	12,339
200.95	5,441	12,610
201.00	5,478	12,883
201.05	5,515	13,158
201.10	5,552	13,435
201.15	5,589	13,713
201.20	5,626	13,994
201.25	**5,663**	**14,276**



Pond P1B: UG Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTech DC-780 b +Cap (ADS StormTech® DC-780 with cap storage)
Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 5 rows = 26.5 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

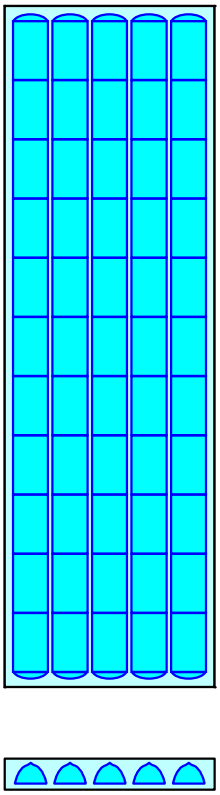
11 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 79.94' Row Length +12.0" End Stone x 2 = 81.94' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
9.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.75' Field Height

55 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 5 Rows = 2,569.7 cf Chamber Storage

7,758.4 cf Field - 2,569.7 cf Chambers = 5,188.7 cf Stone x 40.0% Voids = 2,075.5 cf Stone Storage

Chamber Storage + Stone Storage = 4,645.2 cf = 0.107 af
Overall Storage Efficiency = 59.9%
Overall System Size = 81.94' x 25.25' x 3.75'

55 Chambers
287.3 cy Field
192.2 cy Stone



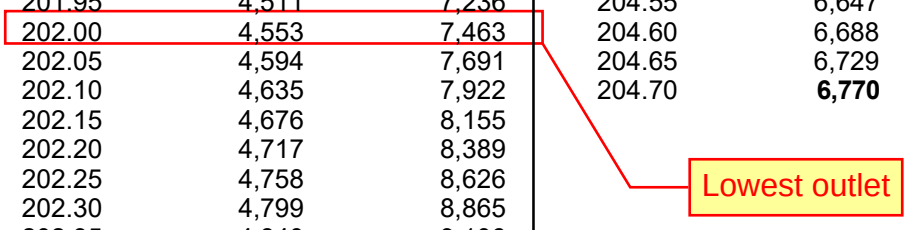
Stage-Area-Storage for Pond P1B: UG Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
190.00	**2,069**	0
190.05	2,069	41
190.10	2,069	83
190.15	2,069	124
190.20	2,069	166
190.25	2,069	207
190.30	2,069	248
190.35	2,069	290
190.40	2,069	331
190.45	2,069	372
190.50	2,069	414
190.55	2,069	455
190.60	2,069	497
190.65	2,069	538
190.70	2,069	579
190.75	2,069	621
190.80	2,069	707
190.85	2,069	793
190.90	2,069	879
190.95	2,069	964
191.00	2,069	1,050
191.05	2,069	1,134
191.10	2,069	1,219
191.15	2,069	1,303
191.20	2,069	1,387
191.25	2,069	1,471
191.30	2,069	1,554
191.35	2,069	1,637
191.40	2,069	1,720
191.45	2,069	1,802
191.50	2,069	1,883
191.55	2,069	1,965
191.60	2,069	2,045
191.65	2,069	2,126
191.70	2,069	2,206
191.75	2,069	2,285
191.80	2,069	2,363
191.85	2,069	2,442
191.90	2,069	2,519
191.95	2,069	2,596
192.00	2,069	2,673
192.05	2,069	2,749
192.10	2,069	2,824
192.15	2,069	2,898
192.20	2,069	2,972
192.25	2,069	3,045
192.30	2,069	3,117
192.35	2,069	3,188
192.40	2,069	3,258
192.45	2,069	3,328
192.50	2,069	3,396
192.55	2,069	3,463
192.60	2,069	3,530
192.65	2,069	3,595
192.70	2,069	3,659
192.75	2,069	3,721
192.80	2,069	3,782
192.85	2,069	3,841
192.90	2,069	3,899
192.95	2,069	3,954
193.00	2,069	4,006
193.05	2,069	4,055
193.10	2,069	4,101
193.15	2,069	4,146
193.20	2,069	4,189
193.25	2,069	4,231
193.30	2,069	4,273
193.35	2,069	4,314
193.40	2,069	4,356
193.45	2,069	4,397
193.50	2,069	4,438
193.55	2,069	4,480
193.60	2,069	4,521
193.65	2,069	4,562
193.70	2,069	4,604
193.75	2,069	**4,645**

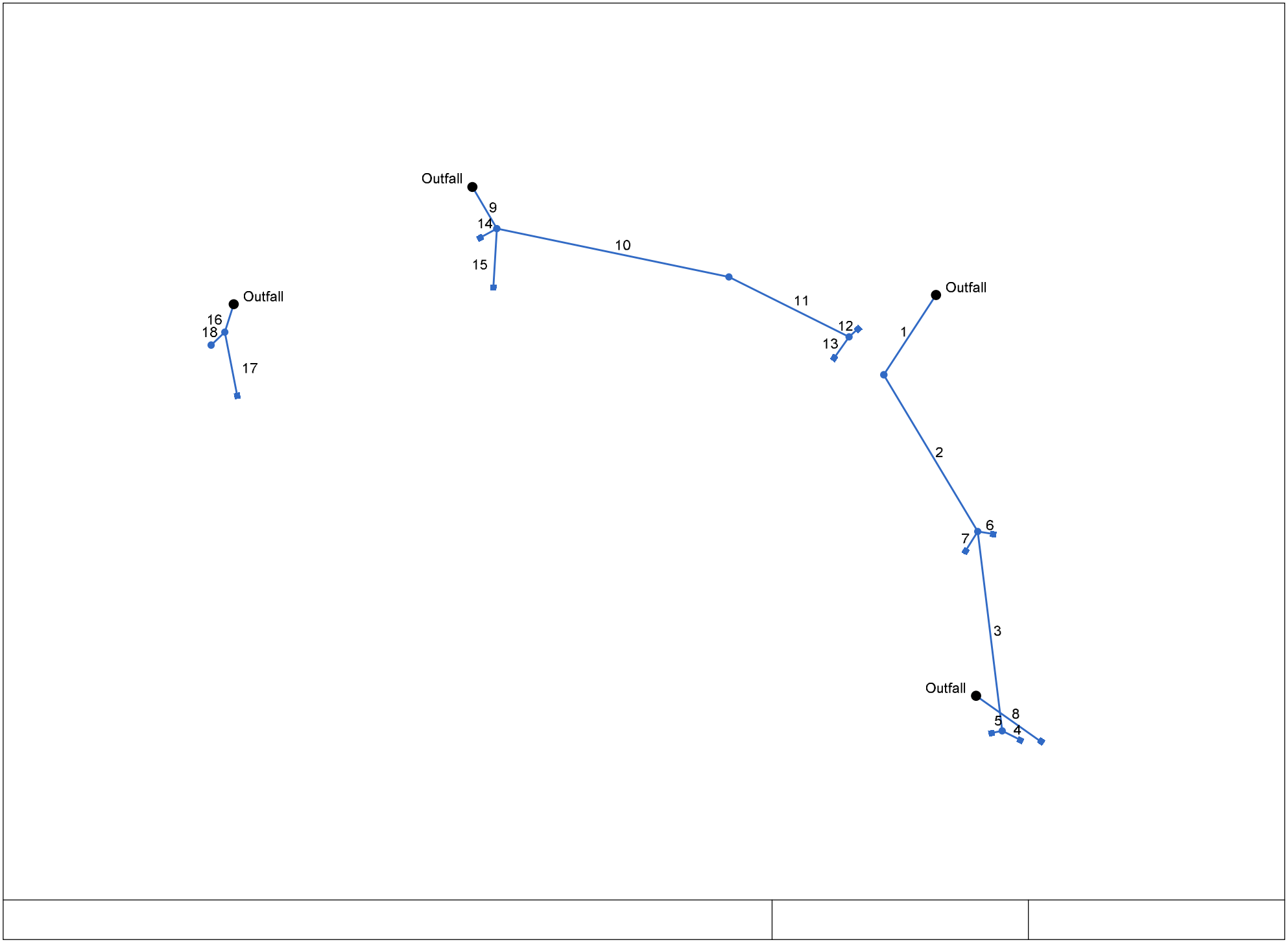
Lowest outlet

Stage-Area-Storage for Pond P1C: AG Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
200.00	2,910	0
200.05	2,951	147
200.10	2,992	295
200.15	3,033	446
200.20	3,074	598
200.25	3,115	753
200.30	3,156	910
200.35	3,197	1,069
200.40	3,239	1,230
200.45	3,280	1,393
200.50	3,321	1,558
200.55	3,362	1,725
200.60	3,403	1,894
200.65	3,444	2,065
200.70	3,485	2,238
200.75	3,526	2,413
200.80	3,567	2,591
200.85	3,608	2,770
200.90	3,649	2,952
200.95	3,690	3,135
201.00	3,731	3,321
201.05	3,772	3,508
201.10	3,813	3,698
201.15	3,854	3,890
201.20	3,896	4,083
201.25	3,937	4,279
201.30	3,978	4,477
201.35	4,019	4,677
201.40	4,060	4,879
201.45	4,101	5,083
201.50	4,142	5,289
201.55	4,183	5,497
201.60	4,224	5,707
201.65	4,265	5,919
201.70	4,306	6,134
201.75	4,347	6,350
201.80	4,388	6,568
201.85	4,429	6,789
201.90	4,470	7,011
201.95	4,511	7,236
202.00	4,553	7,463
202.05	4,594	7,691
202.10	4,635	7,922
202.15	4,676	8,155
202.20	4,717	8,389
202.25	4,758	8,626
202.30	4,799	8,865
202.35	4,840	9,106
202.40	4,881	9,349
202.45	4,922	9,594
202.50	4,963	9,841
202.55	5,004	10,091
202.60	5,045	10,342
202.65	5,086	10,595
202.70	5,127	10,851
202.75	5,169	11,108
202.80	5,210	11,367
202.85	5,251	11,629
202.90	5,292	11,892
202.95	5,333	12,158
203.00	5,374	12,426
203.05	5,415	12,695
203.10	5,456	12,967
203.15	5,497	13,241
203.20	5,538	13,517
203.25	5,579	13,795
203.30	5,620	14,075
203.35	5,661	14,357
203.40	5,702	14,641
203.45	5,743	14,927
203.50	5,784	15,215
203.55	5,826	15,506
203.60	5,867	15,798
203.65	5,908	16,092
203.70	5,949	16,389
203.75	5,990	16,687
203.80	6,031	16,988
203.85	6,072	17,290
203.90	6,113	17,595
203.95	6,154	17,901
204.00	6,195	18,210
204.05	6,236	18,521
204.10	6,277	18,834
204.15	6,318	19,149
204.20	6,359	19,466
204.25	6,400	19,785
204.30	6,441	20,106
204.35	6,483	20,429
204.40	6,524	20,754
204.45	6,565	21,081
204.50	6,606	21,410
204.55	6,647	21,742
204.60	6,688	22,075
204.65	6,729	22,411
204.70	**6,770**	**22,748**



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	70	123	MH	0.00	0.00	0.00	0.0	202.00	2.82	203.97	15	Cir	0.012	0.92	214.51	D-10toD-20
2	1	134	-64	MH	0.00	0.00	0.00	0.0	211.14	1.90	213.69	15	Cir	0.012	0.91	218.61	D-20toD-30
3	2	147	24	MH	0.00	0.00	0.00	0.0	213.79	6.59	223.50	15	Cir	0.012	1.00	229.69	D-30toD-40
4	3	15	-56	Grate	0.00	0.10	0.65	5.0	226.57	0.74	226.68	12	Cir	0.012	1.00	229.81	D-40toD-40B
5	3	8	85	Grate	0.00	0.11	0.64	5.0	226.56	1.40	226.67	12	Cir	0.012	1.00	229.80	D-40toD-40A
6	2	11	-50	Grate	0.00	0.08	0.63	5.0	215.43	0.52	215.49	12	Cir	0.012	1.00	218.61	D-30toD-30B
7	2	17	63	Grate	0.00	0.07	0.64	5.0	215.39	0.53	215.48	12	Cir	0.012	1.00	218.60	D-30toD-30A
8	End	58	35	DrCrb	0.00	1.61	0.42	5.0	225.00	1.71	226.00	15	Cir	0.012	1.00	229.00	G-10toG-20
9	End	35	60	MH	0.00	0.00	0.00	0.0	198.00	0.57	198.20	15	Cir	0.012	1.00	202.88	B-30toB-40
10	9	173	-48	MH	0.00	0.00	0.00	0.0	199.41	4.16	206.62	12	Cir	0.012	0.30	210.19	B-40toB-50
11	10	98	15	MH	0.00	0.00	0.00	0.0	207.07	2.16	209.19	12	Cir	0.012	1.00	213.34	B-50toB-60
12	11	9	-69	Grate	0.00	0.11	0.69	5.0	209.93	0.57	209.98	12	Cir	0.012	1.00	213.10	B-60toB-60B
13	11	19	99	Grate	0.00	0.12	0.61	5.0	209.89	0.48	209.98	12	Cir	0.012	1.00	213.11	B-60toB-60A
14	9	14	91	Grate	0.00	0.20	0.74	5.0	198.88	0.50	198.95	12	Cir	0.012	1.00	202.08	B-40toB-40A
15	9	43	34	Grate	0.00	0.18	0.62	5.0	198.74	0.51	198.96	12	Cir	0.012	1.00	202.09	B-40toB-40B
16	End	22	107	MH	0.00	0.00	0.00	0.0	190.80	0.93	191.00	15	Cir	0.012	0.54	194.42	A-50toA-60
17	16	47	-28	Grate	0.00	0.23	0.57	5.0	191.00	0.63	191.30	12	Cir	0.012	1.00	194.60	A-60toA-70
18	16	14	29	Grate	0.00	0.21	0.68	5.0	191.00	0.72	191.10	12	Cir	0.012	1.00	193.62	A-60toA-60A

Project File: Z-FSDP-SMTS-MAA230481.00.stm | Number of lines: 18 | Date: 6/6/2025

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	70	0.00	0.36	0.00	0.00	0.23	0.0	6.2	10.6	2.45	11.75	4.74	15	2.82	202.00	203.97	202.49	204.60	203.71	214.51	D-10toD-20
2	1	134	0.00	0.36	0.00	0.00	0.23	0.0	5.8	11.0	2.53	9.65	5.32	15	1.90	211.14	213.69	211.58	214.33	214.51	218.61	D-20toD-30
3	2	147	0.00	0.21	0.00	0.00	0.14	0.0	5.1	11.6	1.57	17.96	3.29	15	6.59	213.79	223.50	214.33	224.00	218.61	229.69	D-30toD-40
4	3	15	0.10	0.10	0.65	0.07	0.07	5.0	5.0	11.7	0.76	3.31	3.18	12	0.74	226.57	226.68	226.90	227.04	229.69	229.81	D-40toD-40B
5	3	8	0.11	0.11	0.64	0.07	0.07	5.0	5.0	11.7	0.82	4.57	3.71	12	1.40	226.56	226.67	226.85	227.05	229.69	229.80	D-40toD-40A
6	2	11	0.08	0.08	0.63	0.05	0.05	5.0	5.0	11.7	0.59	2.79	2.77	12	0.52	215.43	215.49	215.74	215.81	218.61	218.61	D-30toD-30B
7	2	17	0.07	0.07	0.64	0.04	0.04	5.0	5.0	11.7	0.52	2.81	2.69	12	0.53	215.39	215.48	215.68	215.78	218.61	218.60	D-30toD-30A
8	End	58	1.61	1.61	0.42	0.68	0.68	5.0	5.0	11.7	7.90	9.15	7.61	15	1.71	225.00	226.00	225.90	227.11	226.46	229.00	G-10toG-20
9	End	35	0.00	0.61	0.00	0.00	0.41	0.0	6.0	10.8	4.43	5.26	3.61	15	0.57	198.00	198.20	199.43	199.57	196.08	202.88	B-30toB-40
10	9	173	0.00	0.23	0.00	0.00	0.15	0.0	5.4	11.3	1.68	7.87	5.16	12	4.16	199.41	206.62	199.77	207.17	202.88	210.19	B-40toB-50
11	10	98	0.00	0.23	0.00	0.00	0.15	0.0	5.1	11.6	1.73	5.67	5.08	12	2.16	207.07	209.19	207.45	209.75	210.19	213.34	B-50toB-60
12	11	9	0.11	0.11	0.69	0.08	0.08	5.0	5.0	11.7	0.89	2.90	3.16	12	0.57	209.93	209.98	210.31	210.37	213.34	213.10	B-60toB-60B
13	11	19	0.12	0.12	0.61	0.07	0.07	5.0	5.0	11.7	0.86	2.66	3.02	12	0.48	209.89	209.98	210.28	210.37	213.34	213.11	B-60toB-60A
14	9	14	0.20	0.20	0.74	0.15	0.15	5.0	5.0	11.7	1.73	2.74	2.39	12	0.50	198.88	198.95	199.77	199.79	202.88	202.08	B-40toB-40A
15	9	43	0.18	0.18	0.62	0.11	0.11	5.0	5.0	11.7	1.30	2.75	1.74	12	0.51	198.74	198.96	199.77	199.81	202.88	202.09	B-40toB-40B
16	End	22	0.00	0.44	0.00	0.00	0.27	0.0	5.3	11.4	3.14	6.74	3.46	15	0.93	190.80	191.00	192.01	191.71	196.26	194.42	A-50toA-60
17	16	47	0.23	0.23	0.57	0.13	0.13	5.0	5.0	11.7	1.53	3.07	3.12	12	0.63	191.00	191.30	191.71	191.82	194.42	194.60	A-60toA-70
18	16	14	0.21	0.21	0.68	0.14	0.14	5.0	5.0	11.7	1.67	3.28	3.29	12	0.72	191.00	191.10	191.71	191.65	194.42	193.62	A-60toA-60A

Project File: Z-FSDP-SMTS-MAA230481.00.stm

Number of lines: 18

Run Date: 6/6/2025

NOTES:Intensity = 55.20 / (Inlet time + 3.80) ^ 0.71; Return period =Yrs. 25 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	D-20	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	D-30	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
3	D-40	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
4	D-40B	0.76	0.00	0.65	0.11	Grate	0.0	0.00	0.00	2.00	2.00	0.095	2.00	0.020	0.020	0.013	0.08	3.95	0.04	1.92	0.0	6
5	D-40A	0.82	0.00	0.69	0.13	Grate	0.0	0.00	0.00	2.00	2.00	0.095	2.00	0.020	0.020	0.013	0.08	4.07	0.04	2.04	0.0	7
6	D-30B	0.59	0.11	0.55	0.15	Grate	0.0	0.00	0.00	2.00	2.00	0.030	2.00	0.020	0.020	0.013	0.10	4.75	0.05	2.66	0.0	12
7	D-30A	0.52	0.13	0.52	0.13	Grate	0.0	0.00	0.00	2.00	2.00	0.030	2.00	0.020	0.020	0.013	0.09	4.63	0.05	2.54	0.0	13
8	G-20	7.90	0.00	7.90	0.00	DrCrb	4.0	2.00	0.00	0.00	0.00	Sag	0.00	0.020	0.020	0.000	5.03	251.54	5.03	251.54	0.0	Off
9	B-40	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
10	B-50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
11	B-60	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
12	B-60B	0.89	0.15	0.75	0.29	Grate	0.0	0.00	0.00	2.00	2.00	0.030	2.00	0.020	0.020	0.013	0.11	5.50	0.07	3.41	0.0	14
13	B-60A	0.86	0.13	0.72	0.27	Grate	0.0	0.00	0.00	2.00	2.00	0.030	2.00	0.020	0.020	0.013	0.11	5.40	0.07	3.32	0.0	15
14	B-40A	1.73	0.29	1.28	0.73	Grate	0.0	0.00	0.00	2.00	2.00	0.045	2.00	0.020	0.020	0.013	0.13	6.55	0.09	4.48	0.0	18
15	B-40B	1.30	0.27	1.07	0.50	Grate	0.0	0.00	0.00	2.00	2.00	0.045	2.00	0.020	0.020	0.013	0.12	5.96	0.08	3.90	0.0	17
16	A-60	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
17	A-70	1.53	0.50	1.28	0.76	Grate	0.0	0.00	0.00	2.00	2.00	0.040	2.00	0.020	0.020	0.013	0.13	6.72	0.09	4.64	0.0	Off
18	A-60A	1.67	0.73	1.44	0.96	Grate	0.0	0.00	0.00	2.00	2.00	0.040	2.00	0.020	0.020	0.013	0.14	7.15	0.10	5.07	0.0	Off

Project File: Z-FSDP-SMTS-MAA230481.00.stm | Number of lines: 18 | Run Date: 6/6/2025

NOTES: Inlet N-Values = 0.016; Intensity = 55.20 / (Inlet time + 3.80) ^ 0.71; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

DEFINITIVE SUBDIVISION
BELLINGHAM, MA

Area	0.24 ac	Unit Site Designation	A-60
Weighted C	0.9	Rainfall Station #	68
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.00	0.00	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.01	0.01	8.7
0.08	10.1%	37.6%	0.02	0.02	10.1
0.10	7.2%	44.8%	0.02	0.02	7.2
0.12	6.0%	50.8%	0.03	0.03	6.0
0.14	6.3%	57.1%	0.03	0.03	6.3
0.16	5.6%	62.7%	0.03	0.03	5.6
0.18	4.7%	67.4%	0.04	0.04	4.7
0.20	3.6%	71.0%	0.04	0.04	3.6
0.25	8.2%	79.1%	0.05	0.05	8.1
0.50	14.9%	94.0%	0.11	0.11	14.4
0.75	3.2%	97.3%	0.16	0.16	3.0
1.00	1.2%	98.5%	0.21	0.21	1.1
1.50	0.7%	99.2%	0.32	0.32	0.6
2.00	0.8%	100.0%	0.42	0.42	0.6
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					98.8
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.3%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

DEFINITIVE SUBDIVISION
BELLINGHAM, MA

Area	**0.38 ac**	Unit Site Designation	**B-40**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.02	0.02	8.7
0.08	10.1%	37.6%	0.03	0.03	10.1
0.10	7.2%	44.8%	0.03	0.03	7.2
0.12	6.0%	50.8%	0.04	0.04	6.0
0.14	6.3%	57.1%	0.05	0.05	6.3
0.16	5.6%	62.7%	0.05	0.05	5.6
0.18	4.7%	67.4%	0.06	0.06	4.7
0.20	3.6%	71.0%	0.07	0.07	3.6
0.25	8.2%	79.1%	0.09	0.09	8.0
0.50	14.9%	94.0%	0.17	0.17	14.3
0.75	3.2%	97.3%	0.26	0.26	3.0
1.00	1.2%	98.5%	0.34	0.34	1.1
1.50	0.7%	99.2%	0.51	0.51	0.6
2.00	0.8%	100.0%	0.68	0.68	0.6
					98.5
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.0%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

DEFINITIVE SUBDIVISION
BELLINGHAM, MA

Area	**0.21 ac**	Unit Site Designation	**D-20**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**1515-3**	CDS Treatment Capacity	**1.0 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.00	0.00	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.01	0.01	8.7
0.08	10.1%	37.6%	0.01	0.01	10.1
0.10	7.2%	44.8%	0.02	0.02	7.2
0.12	6.0%	50.8%	0.02	0.02	6.0
0.14	6.3%	57.1%	0.03	0.03	6.3
0.16	5.6%	62.7%	0.03	0.03	5.6
0.18	4.7%	67.4%	0.03	0.03	4.7
0.20	3.6%	71.0%	0.04	0.04	3.6
0.25	8.2%	79.1%	0.05	0.05	8.1
0.50	14.9%	94.0%	0.09	0.09	14.5
0.75	3.2%	97.3%	0.14	0.14	3.1
1.00	1.2%	98.5%	0.19	0.19	1.1
1.50	0.7%	99.2%	0.28	0.28	0.6
2.00	0.8%	100.0%	0.37	0.37	0.6
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					99.0
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.5%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Definitive Subdivision
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, Massachusetts
Bohler Job Number: MAA230481.00
June 13, 2025

Rip Rap Sizing Calculations

Design Period Storm: 25 & ***100*** **Year**

Rip Rap Apron Sizing Calculations

Location	Pipe Size (in.)	Pipe Size (ft.)	Q (cfs)	TW (ft.)	V (fps)	W1 (ft.)	La (ft.)	W2 (ft.)	W3 (ft.)	Apron Type	Rip Rap Type
A-10 FES	12	1.0	0.18	0.18	4.53	3.00	10	10	NA	A	Modified
B-30 FES	15	1.3	4.02	0.80	3.28	3.75	10	8	NA	B	Modified
***B-10 FES* Frozen condition**	12	1.0	4.76	0.93	11.15	3.00	10	7	NA	B	Standard
D-10 FES	15	1.3	2.15	0.59	4.32	3.75	10	11	NA	A	Modified
F-10 FES	12	1.0	4.73	0.92	6.02	3.00	10	7	NA	B	Modified

Based ConnDOT Drainage Manual - Type A, B, and C Riprap Aprons

Outlet Velocity (fps)
0-8 - Modified
8-10 - Intermediate
10-14 - Standard

Scour Hole Sizing Calculations

Location	Pipe Size/ Span (in)	Pipe Size/ Span (ft)	Q (cfs)	TW (ft.)	Scour Hole Type	D_{50} (ft)	F (ft)	C (ft)	B (ft)	Rip Rap Type
***E-10 FES* Frozen condition**	18	1.5	9.55	1.18	Type 1	0.12	0.75	9	8	Modified
C-10 FES	24	2.0	36.04	2.13	Type 1	0.28	1.00	12	10	Modified
G-10 FES	15	1.3	7.90	1.12	Type 1	0.13	0.63	8	6	Modified

Based on ConnDOT Drainage Manual - Type 1 and 2 Scour Holes

D_{50} < 0.42 ft - Modified
0.42 ft < D_{50} < 0.67 ft - Intermediate
0.67 ft < D_{50} < 1.25 ft - Standard
1.25 ft < D_{50} - Special Design

Riprap Type D_{50} (inches)
Modified - 5
Intermediate - 8
Standard - 15

Table 3- 17: Infiltration Basin (1.02 in/hr) SCM Performance Table

Surface Infiltration (1.02 in/hr) SCM Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
SCM Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	24.5%	42.0%	65.6%	79.4%	86.8%	91.3%	96.2%	98.1%
Cumulative Phosphorus Load Reduction	41%	60%	81%	90%	94%	97%	99%	100%
Cumulative Nitrogen Load Reduction	59%	77%	92%	96%	98%	100%	100%	100%

Figure 3-12: SCM Performance Curve: Surface Infiltration (Soil infiltration rate = 1.02 in/hr)

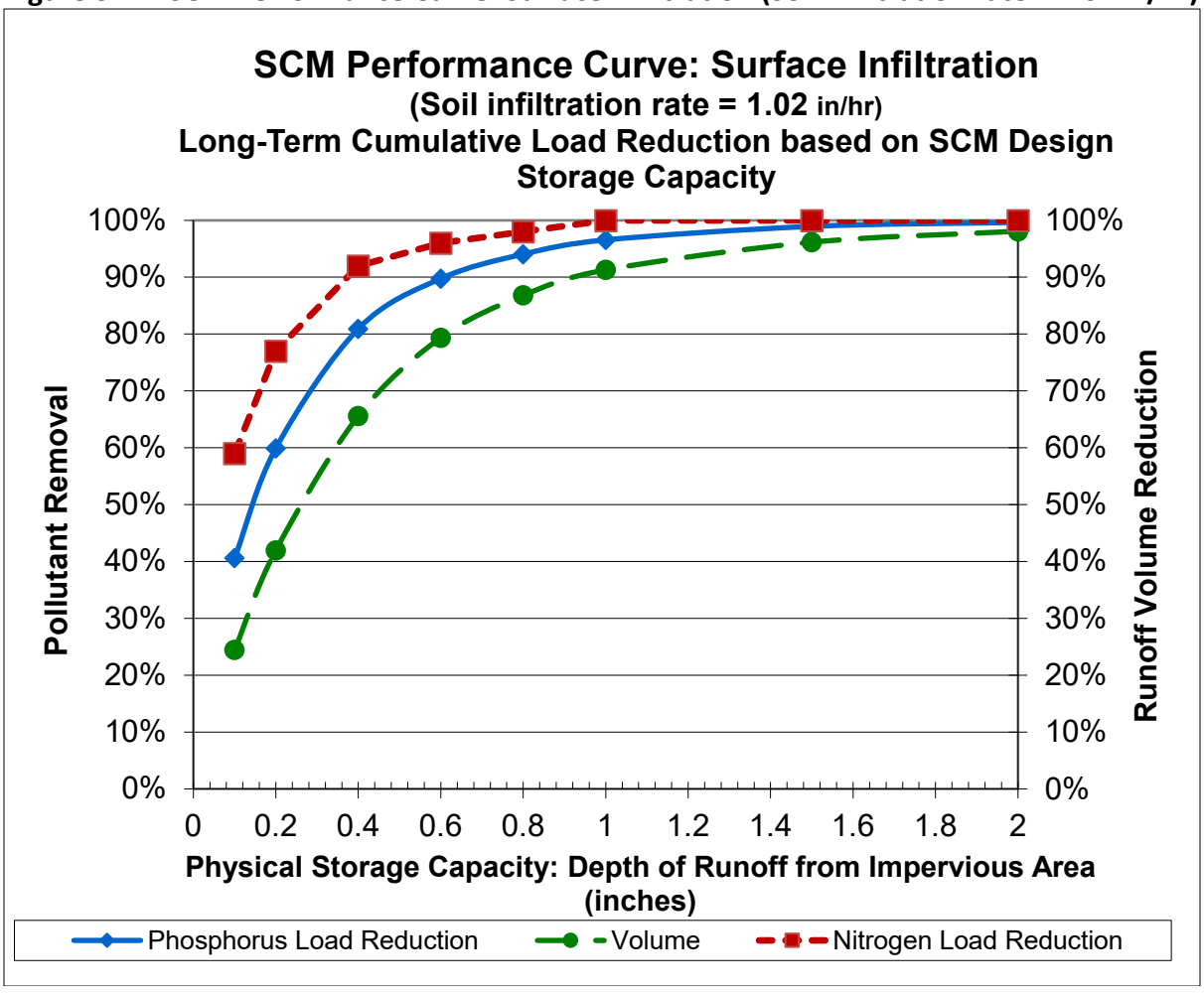
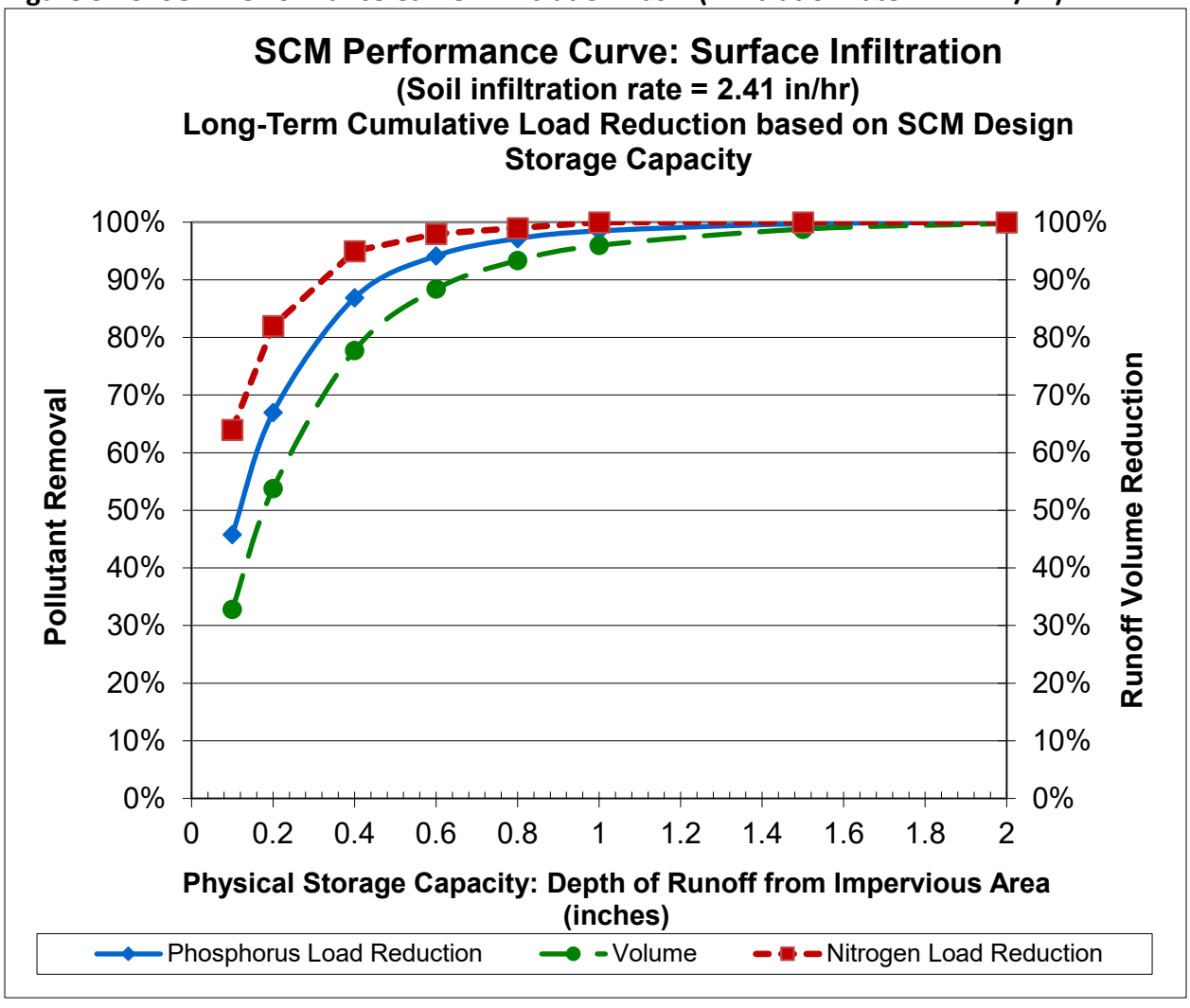


Table 3- 18: Surface Infiltration (2.41 in/hr) SCM Performance Table

Surface Infiltration (2.41 in/hr) SCM Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
SCM Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	32.8%	53.8%	77.8%	88.4%	93.4%	96.0%	98.8%	99.8%
Cumulative Phosphorus Load Reduction	46%	67%	87%	94%	97%	98%	100%	100%
Cumulative Nitrogen Load Reduction	64%	82%	95%	98%	99%	100%	100%	100%

Figure 3-13: SCM Performance Curve: Infiltration Basin (infiltration rate = 2.41 in/hr)



APPENDIX G: OPERATION AND MAINTENANCE

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

STORMWATER OPERATION AND MAINTENANCE PLAN

Proposed Active Adult Community
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

NECC Holdings, LLC
66 Long Wharf, Suite 403
Boston, MA 02110

RESPONSIBLE PARTY POST CONSTRUCTION:

TBD

Construction Phase

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

Post Development Controls

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

1. Parking lots: Sweep at least two (2) times per year and on a more frequent basis depending on sanding operations. Swept areas shall include all parking, drive aisles, and access aisles. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

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

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

and properly disposed of off-site in accordance with MADEP and other applicable requirements.

4. Riprap apron / Scour Hole / Level Spreader: Riprap and scour holes should be checked at least annually and after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for displaced stones, slumping, and erosion at edges, especially downstream or downslope. If the riprap is damaged, it should be repaired before further damage can take place. Note and repair any erosion, stone displacement or low spots in the areas. Woody vegetation should be removed from the riprap annually.

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

6. Infiltration Basin: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. Mow the buffer area, side slopes and basin bottom if grassed floor, rake if stone or sand bottom, remove trash and debris, remove grass clippings and accumulated organic matter. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

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

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

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Proposed Active Adult Community
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, MA

RESPONSIBLE PARTY:

TBD

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Discharge Points/ Flared End Sections / Rip Rap / Level Spreader:	
Surface Infiltration Basin:	
Subsurface Infiltration / Detention System:	
Water Quality Units:	

Other:
Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):
Catch Basins:
Discharge Points / Flared End Sections / Rip Rap / Level Spreader:
Surface Infiltration Basin:
Subsurface Infiltration / Detention System:
Water Quality Units:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Proposed Active Adult Community
180 Paine Street, 8 Bound Road, 585 Wrentham Road, Bellingham, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Proposed Active Adult Community
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

NECC Holdings, LLC
66 Long Wharf, Suite 403
Boston, MA 02110

RESPONSIBLE PARTY POST CONSTRUCTION:

TBD

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

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Sweeping of roadways a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.

- Plants shall be pruned as necessary.

- The use of fertilizers will be kept at a level consistent with typical residential use. Fertilizer will be applied a maximum of once to twice per year during the initial planting and stabilization of landscaped areas. Once plants are established and growing well fertilizer will be applied judiciously.

- The use of pesticides will be kept at a level consistent with typical residential use. Where possible mechanical methods (i.e. pest traps) or biological methods (i.e. beneficial insects) of pest control shall be implemented. If pesticides (insecticide, herbicide, and fungicide) are required to be used, a pesticide which poses the lowest risk to public health and the environment shall be used.

- Pet waste shall be disposed of in accordance with local regulations. Pet waste shall not be disposed of in a storm drain or catch basin.

- Homeowners will be encouraged to implement the following methods when washing vehicles: Use soap sparingly, use a hose nozzle with a trigger to save water, and pour the bucket of soapy water down the sink when done and not in the street or when possible use a commercial car wash.

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

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

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

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

OPERATON AND MAINTENANCE TRAINING PROGRAM

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

Discuss the Operations and Maintenance Plan:

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

Discuss the Spill Prevention and Response Procedures:

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

ILLICIT DISCHARGE STATEMENT

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

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

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

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

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

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

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

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

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

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

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

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

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

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

Proposed Active Adult Community
180 Paine Street, 8 Bound Road, 585 Wrentham Road
Bellingham, MA

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

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

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

3. Notify the Bellingham Board of Health at (508) 966-5820 and the Conservation Commission at (508) 657-2858.

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

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

Weather Conditions:_____

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

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

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

_____

_____

Additional Contact Numbers:

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

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Detention • Retention • Water Quality

A division of ADS

Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

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

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

1.2 THE ISOLATOR ROW

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

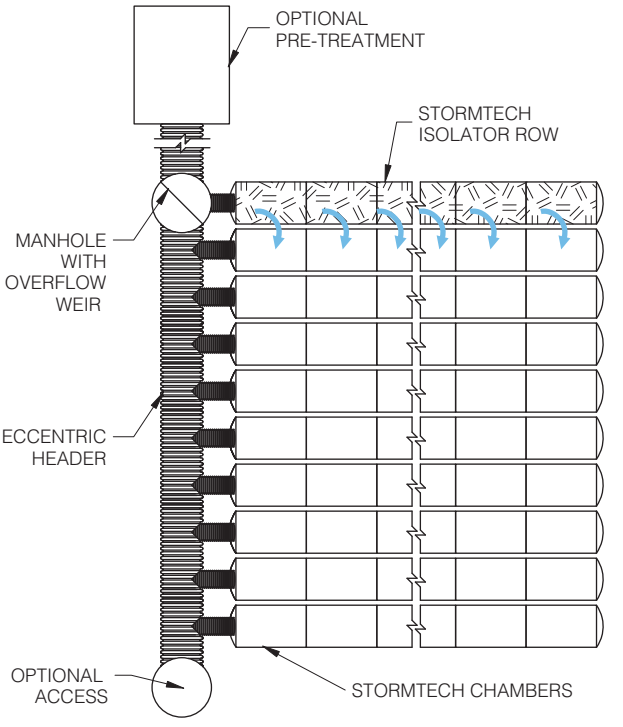
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of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

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

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

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

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

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

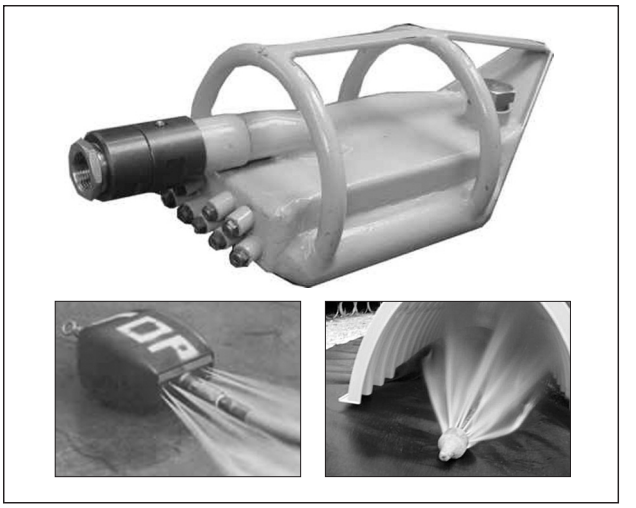
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

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

2.2 MAINTENANCE

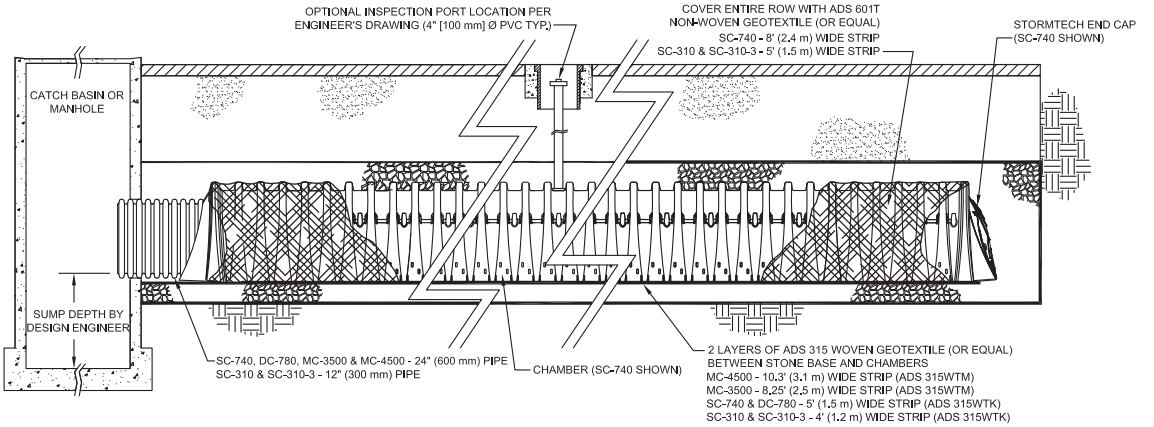
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via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



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

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

StormTech Isolator Row (not to scale)



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

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

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

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

B) All Isolator Rows

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

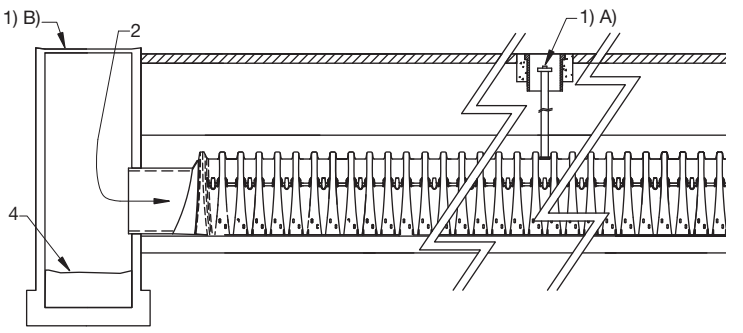
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

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

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

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

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

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

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

C) Vacuum manhole sump as required

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

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

Sample Maintenance Log

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

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.