DRAINAGE REPORT

For

PROPOSED

"TEAM HOYT COMMUNITY YMCA"

30 Memorial Drive
Ashland, Massachusetts
Middlesex County

Prepared by:

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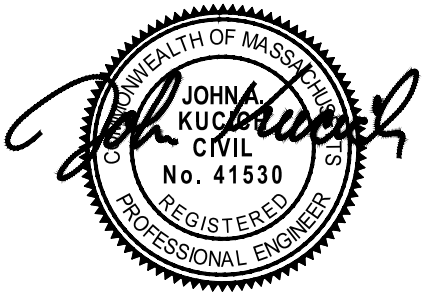

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Massachusetts P.E. Lic. #41530

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BOHLER

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed YMCA fitness facility located on the north side of Memorial Drive in the Town of Ashland, Massachusetts. The site, which contains approximately 12.55 acres of land, is currently undeveloped wooded land with wetlands at the east, west, and north fringes of the property.

The proposed project includes the construction of a new 27,000 sf freestanding YMCA membership building, a 9,340 sf Early Learning Center, play areas and soccer fields, and new paved parking areas, landscaping, storm water management system, and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

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

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	1.50	1.45	**-0.05**	10.00	9.19	**-0.81**	17.65	17.01	**-0.64**	31.21	30.62	**-0.59**

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

II. EXISTING SITE CONDITIONS

Existing Site Description

The site consists of approximately 12.55 acres of land located along the north side of Memorial Drive in the Town of Ashland, Massachusetts. The site is undeveloped consisting of wooded areas and wetlands.

On-Site Soil Information

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

Table 2.1: Existing Soil Information

Soil Unit Symbol	Soil Name / Description	Hydrologic Soil Group (HSG)
106C	Narragansett-Hollis-Rock outcrop complex	A
416B	Narragansett silt loam, very stony	A
416C	Narragansett silt loam, very stony	A

Onsite soil testing was performed by GeoEngineers in August, 2024, and also April 15th and 17th, 2025. Groundwater was not encountered during drilling or test pit exaction. Two monitoring wells were installed and an approximate groundwater elevation of 233 feet was established within the building and parking lot area, which is well below any proposed stormwater management features.

On August 28 and 29, 2025, GeoEngineers performed a supplemental subsurface exploration program consisting of eight (8) test pits, and one (1) in-situ infiltration test, to evaluate subsurface conditions in proposed stormwater management areas. The supplemental testing and previous testing all show that soils on the site are silty sand. The soil infiltration rates range from 0.33 in/hr to approximately 1.0 in/hr, which is typical of a Hydrologic Type B soil. Based on the site specific data obtained in the geotechnical testing, the drainage calculations use a Type B soil. Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

The southern portions of the site drain overland to the Memorial Drive municipal drainage system, which discharges to the wetlands surrounding the site. The remaining portions of the site also drain into the adjacent wetlands surrounding the property. Slopes on the site range from 1%-

57%± with on-site elevations ranging from 264 feet adjacent to Memorial Drive to 195 feet at the northeastern portion of the property.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at one (1) "design point" as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into two (2) separate sub catchments, as described below, to analyze existing and proposed flow rates to the design point. The minimum time of concentration for all existing areas is calculated as 11 minutes (0.18 hr).

Design Point #1 (DP1) is the wetland area surrounding the site. Although the southern part of the site drains to catchbasins within Memorial Drive, those catchbasins discharge to the wetlands surrounding the site, so runoff from all points within the site ultimately discharges to the same continuous wetland system, and therefore can be treated as a single design point. Under existing conditions, this design point receives stormwater flows from approximately 11.7 acres of land within the property (excluding areas unimpacted by proposed development), designated as watersheds "ED1.1" and "ED1.2". Refer to Table 2.1 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
E1.1	4.7±	Woods	30	11.2
E1.2	7.0±	Wooded area, grass	30	12.8

Refer to **Tables 1.1 and 6.1** for the existing conditions peak rates of runoff. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project includes the construction of a new 27,000 sf freestanding YMCA membership building, a 9,340 sf Early Learning Center, play areas and two soccer fields with new paved parking areas, landscaping, storm water management components and associated utilities. The site, including the proposed parking areas, has been designed to drain to deep-sump, hooded catch basins. The catch basins will capture and convey stormwater runoff, via an underground pipe system, to proposed infiltration basins. Pretreatment of stormwater runoff will be provided by a combination of deep-sump, hooded catch basins, isolator rows, and proprietary treatment units prior to discharge into the proposed infiltration basins. A grass filter (longer than 50 feet) will provide pretreatment to the open grassed infiltration basin. Rooftop runoff has been designed to flow to the basins as well.

Proposed Development Collection and Conveyance

Deep sump hooded catch basins are proposed to collect and route runoff from the paved parking areas to the existing surface basins. Pipes have been designed for the 25-year storm using Storm Sewers by Hydraflow Software/Rational Method. Pipe, inlet, and outlet protection sizing calculations are included in **Appendix F**.

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

Proposed Watersheds and Design Point Information

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in **Section II** above. The site was subdivided into twelve (12) separate sub catchments for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP#1 receives stormwater flows from approximately 11.7 acres of land. Refer to Table 3.1 below for additional detail.

Table 3.1: Proposed Sub-catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
P1.1	1.28	pavement, grass	86	6.0	Basin #1 / DP#1
P1.2	0.74	pavement, grass	87	6.0	Basin #1 / DP#1
P1.3	0.98	Rooftops, pavement, grass	92	6.0	Basin #2 / DP#1
P1.5	2.28	Grass, woods, brush	33	8.3	DP#1
P1.6	2.29	Grass, woods, brush	33	6.0	DP#1
P1.7	2.23	paved parking, grass	47	9.8	Basin#5 / DP#1
P1.8	0.61	Grass, woods	32	6.0	DP#1
P1.9	0.15	Pavement, grass	84	6.0	Basin #3 / DP#1
P1.10A	0.18	Grass, pavement	73	6.0	DP#1
P1.10B	0.07	Grass, pavement	44	6.0	DP#1
P1.R1	0.22	Roof	98	6.0	Basin #2 / DP#1
P1.R2	0.70	Roof	98	6.0	Basin #1 / DP#1

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

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in table 4.1 below for stormwater calculations is based on NOAA Atlas 14 rainfall data. Refer to **Appendix F** for more information.

Table 4.1: NOAA Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.36	5.24	6.42	8.23

Values derived from NOAA ATLAS on 04/09/2025

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 including the building roofs and paved parking/driveway areas shall be collected and passed through the proposed drainage system for treatment prior to discharge.

Standard #2: Peak Rate Attenuation

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

Standard #3: Recharge

The stormwater runoff from the project will be collected and diverted to proposed infiltration basins. The project as proposed will involve the creation of 175,800 square feet (4.04 ac.) of new impervious area (includes gravel walks) and is required to infiltrate 4,880 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed infiltration basins will provide a total of over 17,000 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 all of 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 and a groundwater mounding analysis is not required.

Standard #4: Water Quality

Water quality treatment is provided via deep sump catch basins, a grass filter, water quality units, and infiltration basins with isolator rows. Water quality treatment features are proposed prior to infiltration basins to maintain long-term functionality. TSS removal calculations are included in **Appendix F** of this report. Please note that because the outflow from all of the proposed infiltration basins is zero for the one-inch rainfall and all runoff discharged to them is infiltrated, the TSS and

phosphorous removal rates are 100%, even though the TSS calculations may indicate a rate of less than 100%.

The project as proposed will involve the creation of 175,800 square feet (4.04 ac.) of new impervious area (includes gravel walks) and is required to treat 14,651 cubic feet of water quality volume as defined in Stormwater Standard 4. The proposed infiltration basins provide over 17,000 cubic feet of water quality volume below the lowest outlets for water quality treatment. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes.

Standard #5: Land Use with Higher Potential Pollutant Loads

The proposed project involves "Land Uses with Higher Potential Pollutant Loads". Accordingly, the stormwater management system includes an oil-grit separator (water quality units and isolator rows) prior to discharge. In addition, the project will provide 44% TSS removal prior to infiltration and treat the 1.0 in water quality depth, as further illustrated in **Appendix E** of this report.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

Not Applicable for this project.

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

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

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

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

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

VI. SUMMARY

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

Table 6.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	1.50	1.45	**-0.05**	10.00	9.19	**-0.81**	17.65	17.01	**-0.64**	31.21	30.62	**-0.59**

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

The project meets or exceeds the MADEP Stormwater Management Standards as described further herein.

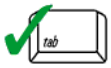
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date 4/25/25

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): Grass filter strip

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

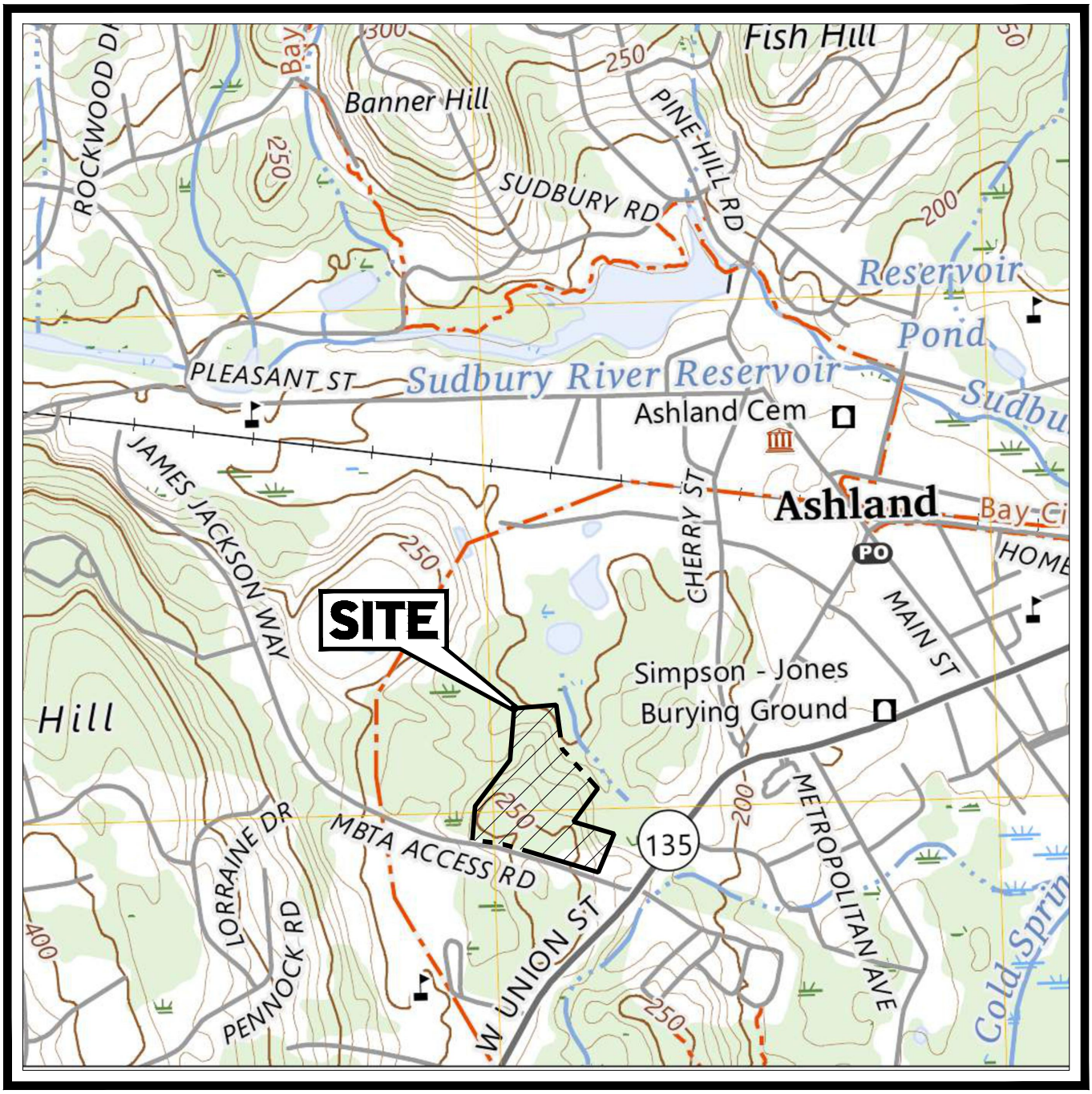
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*



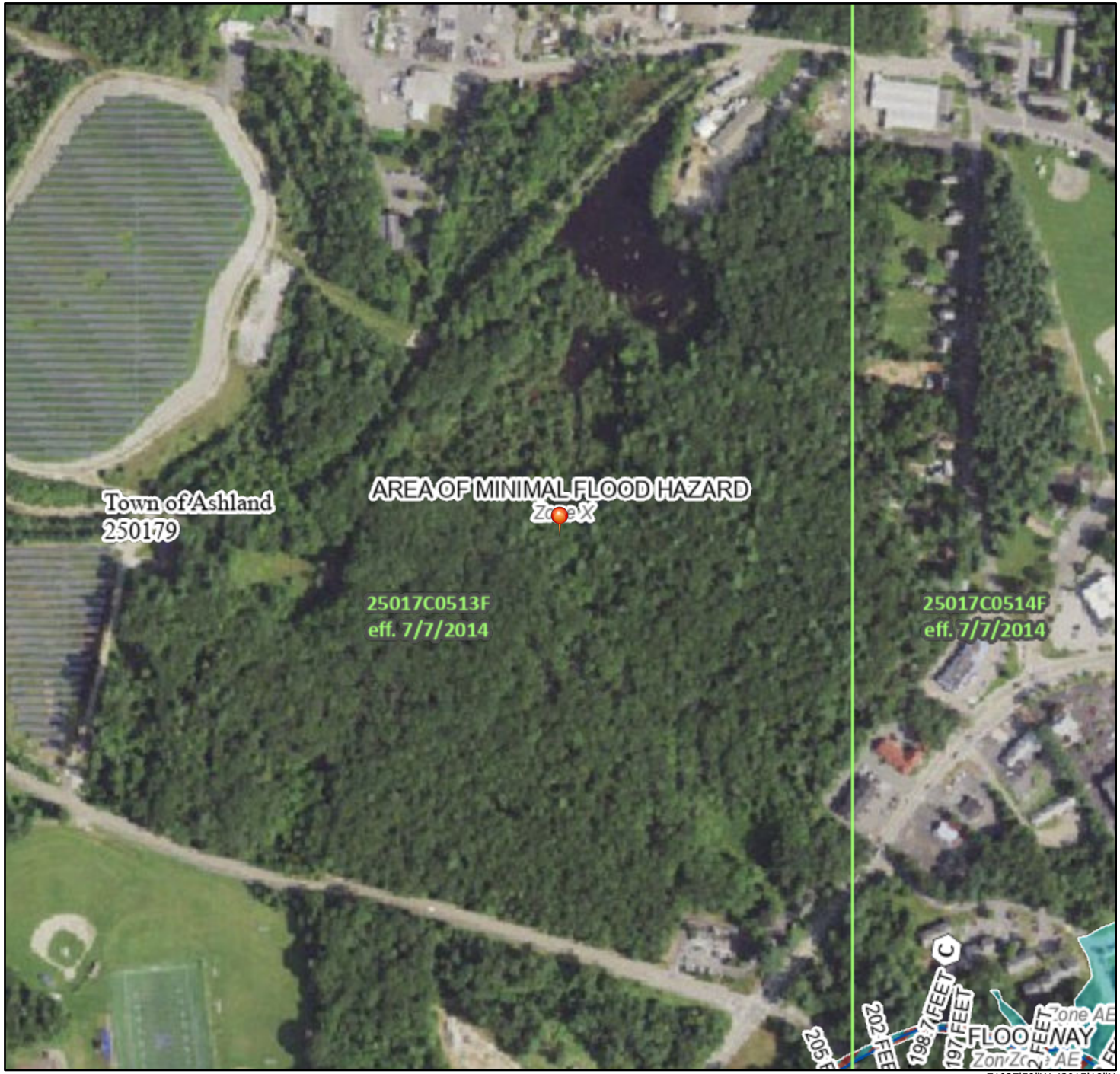
USGS MAP

SCALE: 1" = 1,000'
SOURCE: FRAMINGHAM, MA
USGS QUADRANGLE, 2024

National Flood Hazard Layer FIRMette

FEMA

71°28'36"W 42°15'36"N



71°27'59"W 42°15'10"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

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

N

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

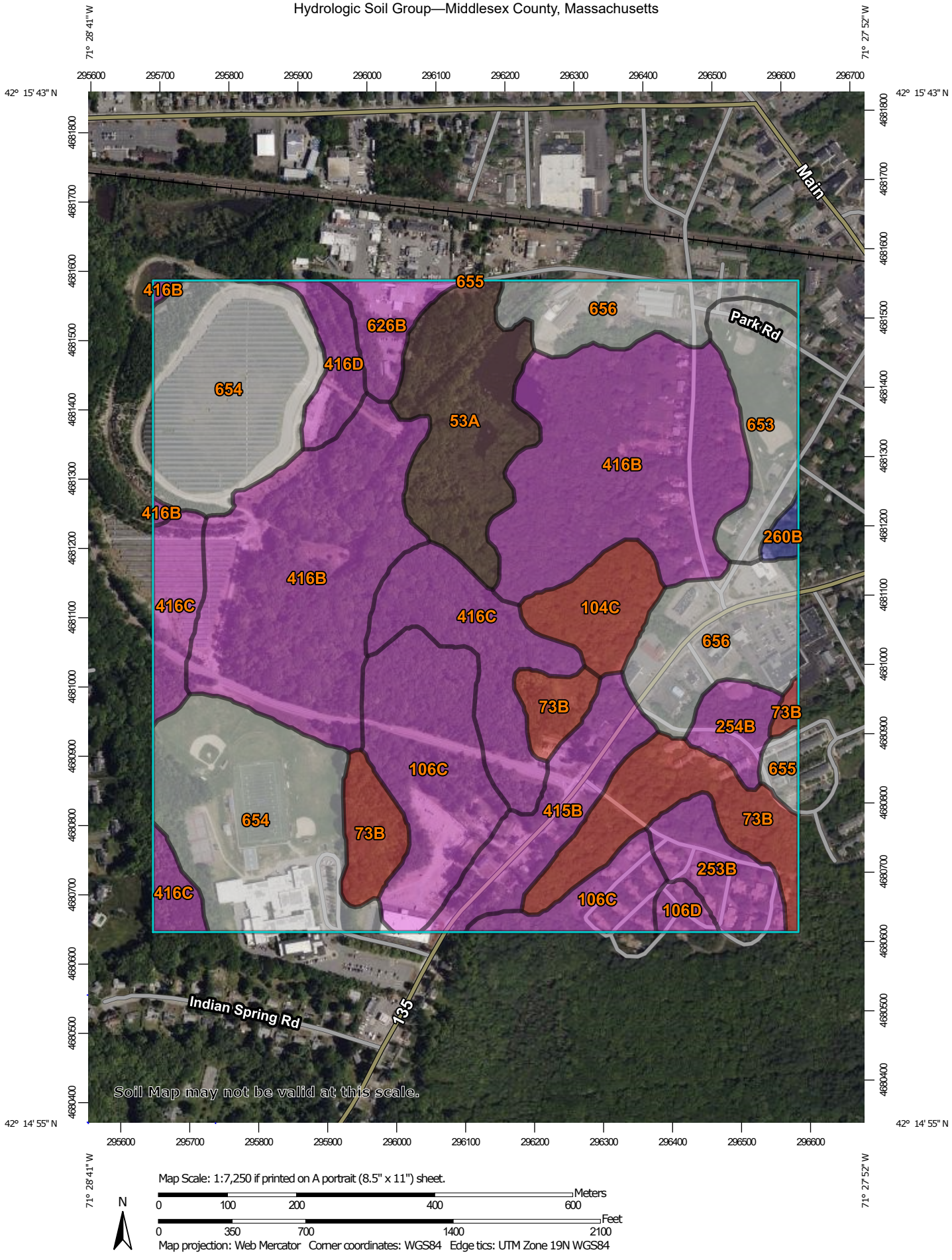
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/23/2025 at 11:52 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *REPORT OF GEOTECHNICAL INVESTIGATION*
- *STORMWATER MANAGEMENT DESIGN CONSIDERATIONS MEMORANDUM*


71° 28' 41" W
71° 27' 52" W
42° 15' 43" N
42° 14' 55" N
295600
295700
295800
295900
296000
296100
296200
296300
296400
296500
296600
296700
4681800
4681700
4681600
4681500
4681400
4681300
4681200
4681100
4681000
4680900
4680800
4680700
4680600
4680500
4680400
Main
Park Rd
Indian Spring Rd
135
416B
655
656
626B
416D
654
53A
653
260B
104C
73B
254B
106C
415B
253B
106D
416C
Soil Map may not be valid at this scale.
Map Scale: 1:7,250 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
100
200
400
600
Feet
0
350
700
1400
2100
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 24, Aug 27, 2024

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	14.5	6.6%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	16.5	7.6%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	D	5.7	2.6%
106C	Narragansett-Hollis-Rock outcrop complex, 3 to 15 percent slopes	A	18.9	8.7%
106D	Narragansett-Hollis-Rock outcrop complex, 15 to 25 percent slopes	A	1.3	0.6%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	5.5	2.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	3.3	1.5%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	0.8	0.4%
415B	Narragansett silt loam, 3 to 8 percent slopes	A	8.9	4.1%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	A	53.2	24.4%
416C	Narragansett silt loam, 8 to 15 percent slopes, very stony	A	17.2	7.9%
416D	Narragansett silt loam, 15 to 25 percent slopes, very stony	A	3.7	1.7%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	3.7	1.7%
653	Udorthents, sandy		8.3	3.8%
654	Udorthents, loamy		37.1	17.0%
655	Udorthents, wet substratum		1.3	0.6%
656	Udorthents-Urban land complex		18.5	8.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Totals for Area of Interest			**218.3**	**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

Geotechnical Engineering Report

28 Memorial Drive
Ashland, Massachusetts

for
MetroWest Young Men's Christian Association, Inc.
"MetroWest YMCA"

September 13, 2024

239 Causeway Street, Suite 400
Boston, Massachusetts 02114
617.749.9220

GeoEngineers USA

Source(s):

- Survey from Scalora Consulting Group, received on 07/24/2024
- Proposed Features from CBT received on 08/30/2024
- Site Boundary downloaded from MassMapper on 08/29/2024

Coordinate System: MA State Plane, Mainland Zone, NAD83, US Foot

Exploration Location Plan

Geotechnical Report
MetroWest YMCA - Future Regional YMCA
Ashland, Massachusetts

GeoEngineers USA

Figure 2

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

Modified California Sampler (6-inch sleeve) or Dames & Moore

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

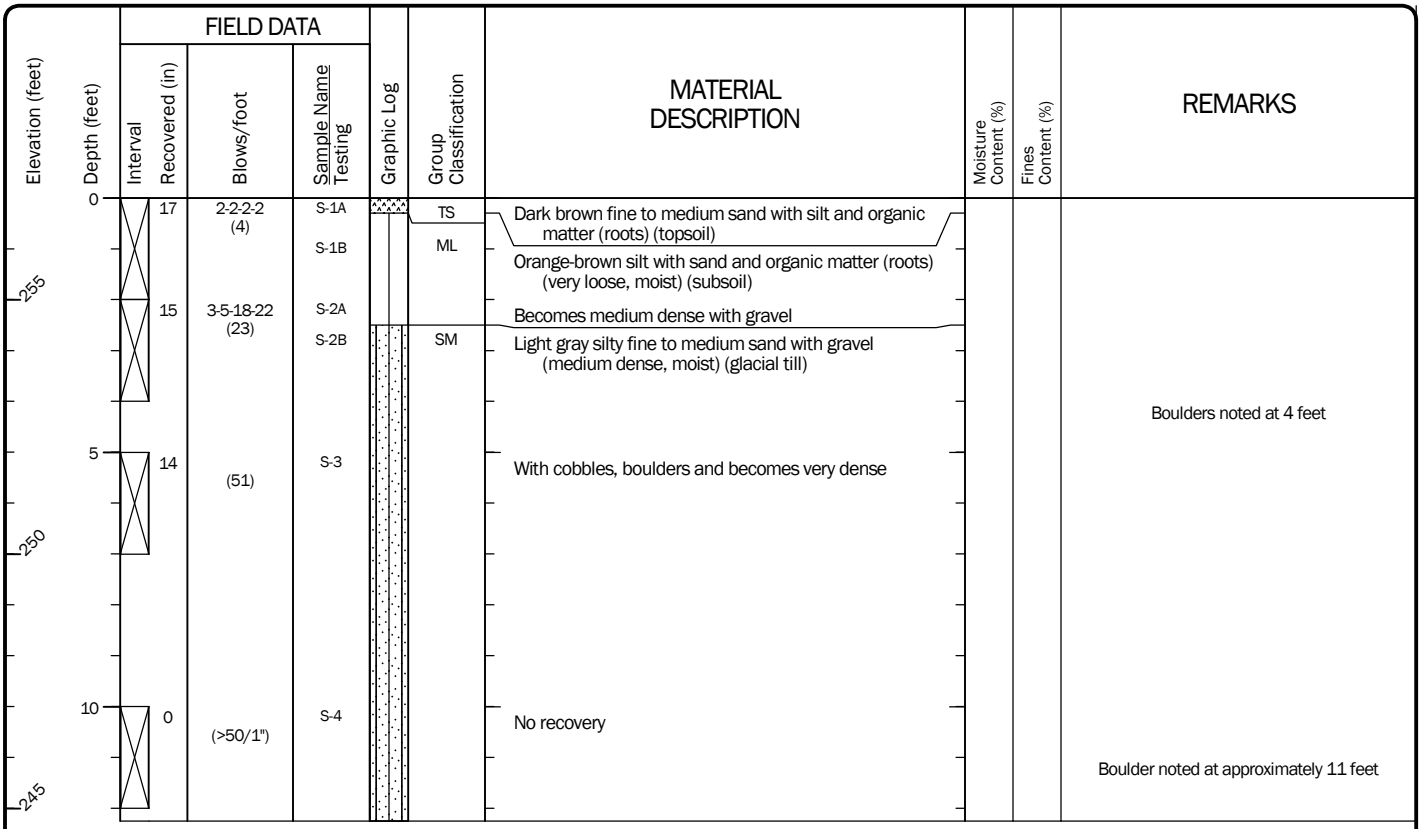
GeoEngineers USA

Figure A-1

Rev. 03/2024

Drilled Start 8/15/2024 End 8/15/2024	Total Depth (ft) 12.25	Logged By SPD Checked By HPC	Driller SoilX Corp.	Drilling Method Air Rotary Casing Hammer	
Surface Elevation (ft) 257 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Diedrich D70	
Easting (X) 663498 Northing (Y) 2917810		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-1

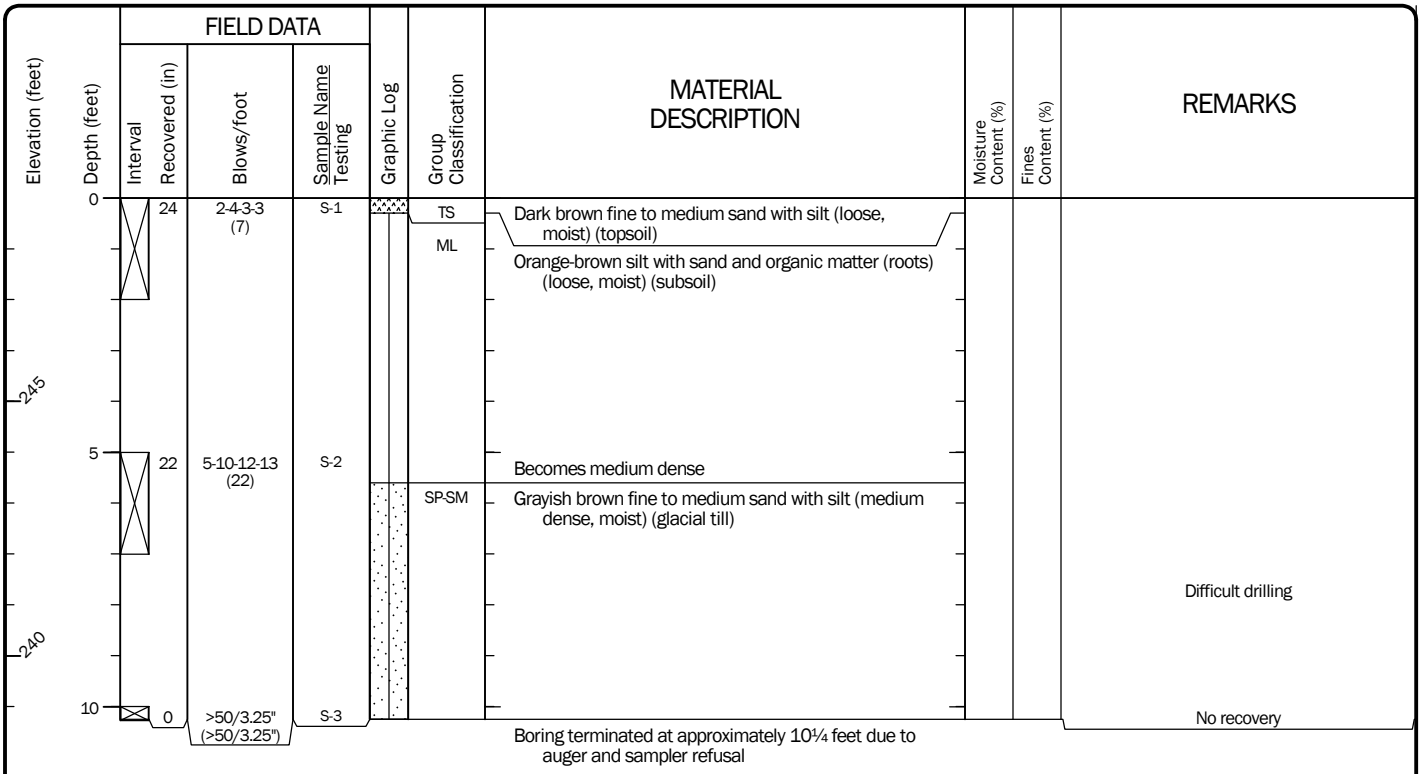
GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-2
Sheet 1 of 1

Drilled: Start 8/20/2024 End 8/20/2024	Total Depth (ft) 10.25	Logged By SPD Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 249 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill	
Easting (X) 663638 Northing (Y) 2917805		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-2

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Drilled	Start 8/20/2024	End 8/20/2024	Total Depth (ft) 7.5	Logged By SPD / Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Hollow-stem Auger
Surface Elevation (ft) 248 / Vertical Datum NAVD88			Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill	
Easting (X) 663641 / Northing (Y) 2917809			System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
245	0						This boring was offset approximately 5 feet northeast of GEO-2 to attempt sample collection below previous depth of auger refusal. No samples were collected during drilling.			
	5						Boring terminated at approximately 7½ feet due to auger refusal on probable boulder			

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Date:9/12/24 Path:P:\27\27530001\GINT\27530001GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Log of Boring GEO-2A

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-4
Sheet 1 of 1

Drilled Start 8/20/2024 End 8/20/2024	Total Depth (ft) 6.5	Logged By SPD Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 246 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill	
Easting (X) 663734 Northing (Y) 2917777		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
245	0		17	1-2-3-2 (5)	S-1A S-1B		TS ML	Dark brown fine to medium sand with silt and organic matter (roots) (loose, moist) (topsoil) Orange-brown silt with sand and organic matter (roots) (loose, moist) (subsoil)			
240	5		12	0-24->50 (>50)	S-2		SP-SM	Grayish brown sand with silt and gravel, boulders (very dense, moist) (glacial till)			Boulders noted at approximately 4½ feet
								Boring terminated at approximately 6½ feet due to auger refusal on probable boulder			

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-3

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-5
Sheet 1 of 1

Drilled	Start 8/20/2024	End 8/20/2024	Total Depth (ft) 5	Logged By SPD / Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Hollow-stem Auger
Surface Elevation (ft) 246 / Vertical Datum NAVD88				Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill
Easting (X) 663737 / Northing (Y) 2917777				System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
245	0						This boring was offset approximately 3 feet east of GEO-3 to attempt sample collection below previous depth of auger refusal. No samples were collected during drilling.			Drill walked approximately 3 feet east due to probable boulder
	5						Boring terminated at approximately 5 feet due to auger refusal on probable boulder			

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-3A

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-6
Sheet 1 of 1

Drilled Start 8/14/2024 End 8/15/2024	Total Depth (ft) 20.5	Logged By SPD Checked By HPC	Driller SoilX Corp.	Drilling Method Air Rotary Casing Hammer	
Surface Elevation (ft) 250 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Diedrich D70	
Easting (X) 663708 Northing (Y) 2917691		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0	12	2-6->50 (>50)	S-1A S-1B		TS	Dark brown fine to medium sand with silt and organic matter (roots) (very loose, moist) (topsoil)			
						ML	Brown silt with sand and organic matter (roots) (very dense, moist) (subsoil)			Probable boulder at approximately 1.0 feet
245	5	16	28-28-22-26 (50)	S-2		SM	Light gray silty fine to medium sand with gravel and cobbles (very dense, moist) (glacial till)			
240	10	20	16-26-30-40 (56)	S-3A S-3B		SM	Dark brown silty fine to medium sand with gravel and cobbles (very dense, moist)			
						SP-SM	Gray fine to coarse sand with silt, gravel and cobbles (very dense, moist)			
235	15	1	>50/2" (>50)	S-4		SP-SM	Gray fine to coarse sand with silt (very dense, moist)			
		0	50/0" (50/0")	S-5						
230	20									Probable boulder beginning at approximately 19½ feet

Boring terminated at approximately 20½ feet bgs due to hammer refusal

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-4

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-7
Sheet 1 of 1

Date:9/12/24 Path:P:\27\27530001\GINT\27530001OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Drilled: Start 8/20/2024 End 8/20/2024	Total Depth (ft) 10.75	Logged By SPD Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 242 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill	
Easting (X) 663876 Northing (Y) 2917745		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
240	0		6	4-4-3-3 (7)	S-1		TS ML	Dark brown fine to medium sand with silt and organic matter (roots) (topsoil) Orange-brown silt with sand and organic matter (roots) (loose, moist) (subsoil)			
235	5		15	35-47-44-44 (91)	S-2		SP-SM	Grayish brown sand with silt, gravel and cobbles (very dense, moist)			Difficult drilling
	10		1	50/5" (50/5")	S-3			Boring terminated at approximately 10¾ feet due to auger refusal			Piece of gravel at sampler tip

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-5

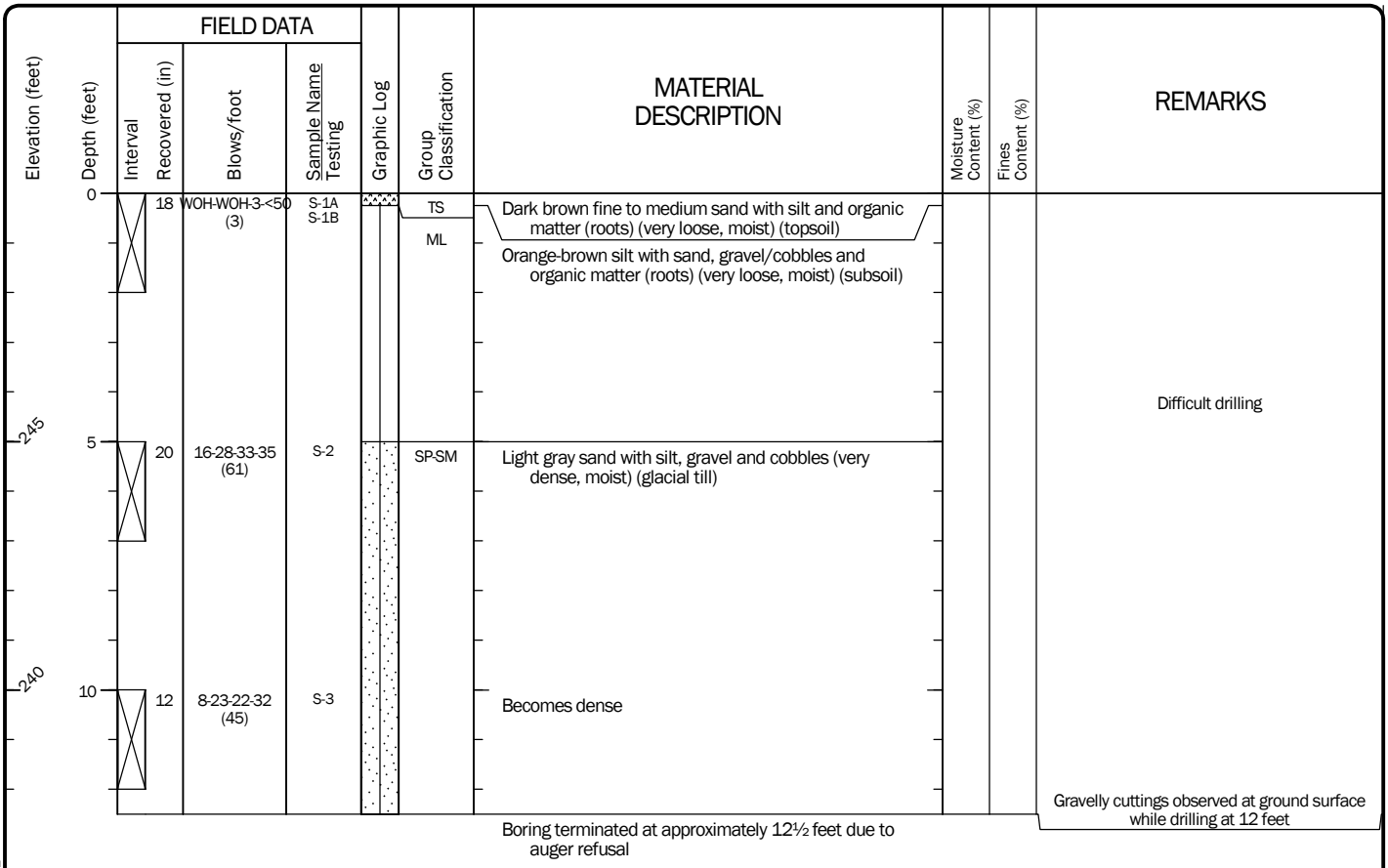
GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-8
Sheet 1 of 1

Drilled: Start 8/20/2024 End 8/20/2024	Total Depth (ft) 12.5	Logged By SPD Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 250 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill	
Easting (X) 663999 Northing (Y) 2917605		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Boring GEO-6

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-9
Sheet 1 of 1

Drilled Start 8/20/2024 End	Total Depth (ft) 30	Logged By SPD Checked By HPC	Driller Northern Drill Service, Inc.	Drilling Method Drive and Wash	
Surface Elevation (ft) 248 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Track-mounted Mobile Drill B-53	
Easting (X) 663812 Northing (Y) 2917686		System Datum MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0						This boring was drilled to assess the potential presence of bedrock within the proposed building footprint. No samples were collected during drilling.			
245										Drill chatter
	5									
240										
	10									
235										
	15									Difficult drilling
230										
	20									
225										
	25									

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Date:9/12/24 Path:P:\27\27530001\GINT\27530001OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW_4BC

Log of Boring GEO-7

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-10
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
-20	25									
	30						Boring terminated at 30 feet due to target depth reached			

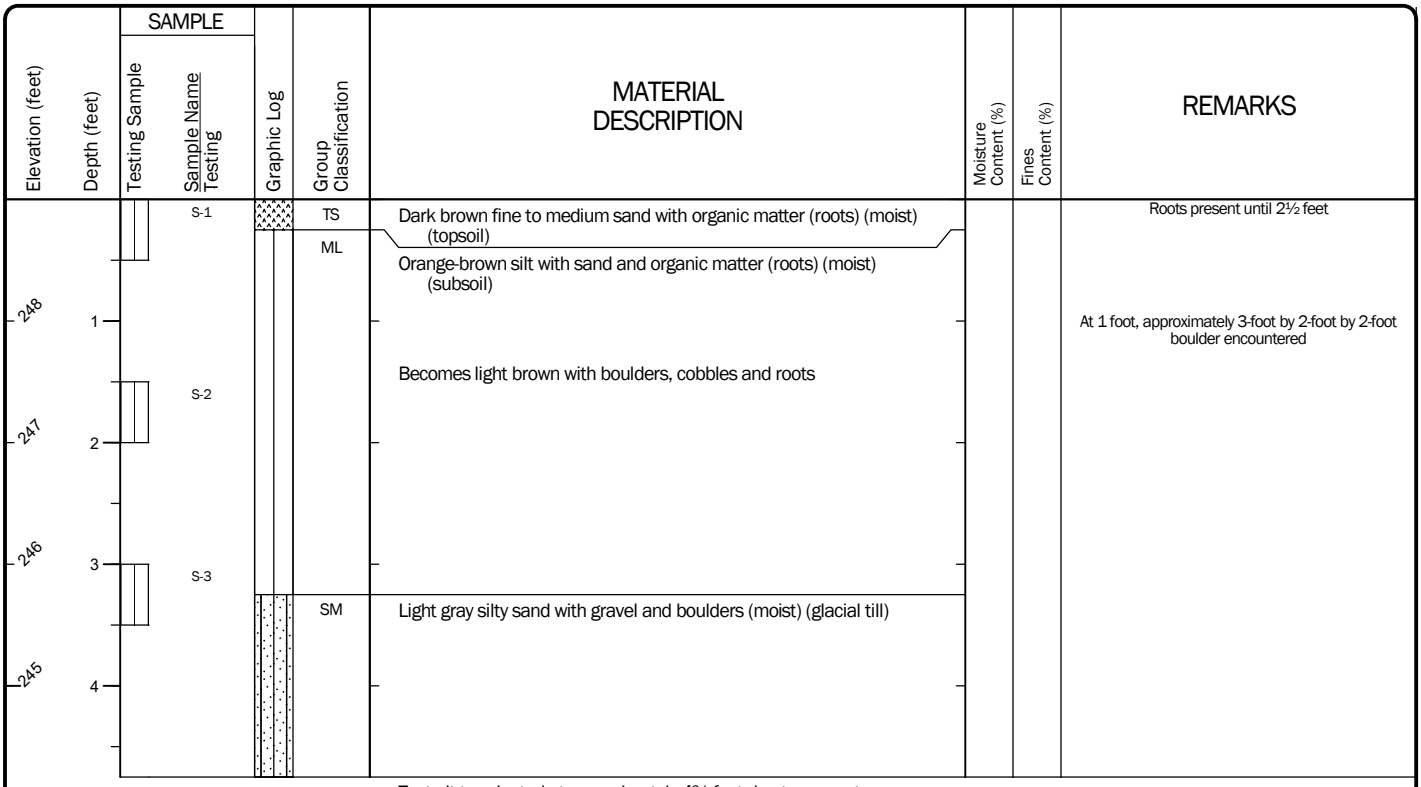
Log of Boring GEO-7 (continued)

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-10
Sheet 2 of 2

Date Excavated 8/13/2024	Total Depth (ft) 4.75	Logged By SPD Checked By HPC	Excavator Machine Time, LLC Equipment Bobcat E50	Groundwater not observed Caving not observed
Surface Elevation (ft) 249 Vertical Datum NAVD88		Easting (X) 663442 Northing (Y) 2917641	Coordinate System MA State Plane Mainland Horizontal Datum NAD83 (feet)	



Test pit terminated at approximately 4¾ feet due to excavator refusal; the test pit was backfilled in approximate 12-inch lifts and each lift was tamped using the excavator bucket

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-1

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-11
Sheet 1 of 1

Date Excavated	8/13/2024	Total Depth (ft)	4.25	Logged By Checked By	SPD HPC	Excavator Equipment	Machine Time, LLC Bobcat E50	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	249 NAVD88	Easting (X) Northing (Y)	663441 2917636	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)			

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
248	1		S-1		TS	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)			
					ML	Orange-brown silt with sand and organic matter (roots) (moist) (subsoil)			
			S-2			Becomes light brown with boulders and cobbles			
247	2								Boulders encountered starting at approximately 2 feet
246	3		S-3		SM	Light gray silty sand with gravel and boulders (moist) (glacial till)			
245	4					Test pit terminated at approximately 4¼ feet due to excavator refusal on boulders; test pit was backfilled in approximate 12-inch lifts and each lift was tamped using the excavator bucket			

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-1B

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-12
Sheet 1 of 1

Date Excavated	8/13/2024	Total Depth (ft)	7	Logged By SPD Checked By HPC	Excavator Machine Time, LLC Equipment Bobcat E50	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	261 NAVD88	Easting (X) Northing (Y)	663513 2917707	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
260	0				TS	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)			
			S-1 SA		ML			65.6	
	1					Orange-brown sandy silt and organic matter (roots) (moist) (subsoil)			
			S-2			Becomes light brown with gravel			
259	2		S-3		GP-GM	Grayish brown fine to coarse gravel with silt and sand (moist) (glacial till)			
258	3								Boulders present at approximately 3½ feet Very difficult excavating from approximately 3½ to 7 feet
257	4								
256	5								
255	6								
254	7					Test pit terminated at 7 feet due to excavator refusal; test pit was backfilled in approximate 12-inch lifts and each lift was tamped using the excavator bucket			

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Date:9/12/24 Path:P:\27\27530001\GINT\27530001GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Log of Test Pit GEO-TP-1C

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-13
Sheet 1 of 1

Date Excavated	8/13/2024	Total Depth (ft)	9.75	Logged By SPD Checked By HPC	Excavator Machine Time, LLC Equipment Bobcat E50	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	253 NAVD88	Easting (X) Northing (Y)	663615 2917729	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)			
			S-1 SA		ML	Orange-brown silt with sand and organic matter (roots) (moist) (subsoil)		80.9	Roots observed to approximately 3¼ feet
252	1		S-2			Becomes light brown			
251	2								
250	3		S-3		SM	Light gray silty fine to medium sand with gravel, cobbles and boulders (moist) (glacial till)			Boulders present at approximately 3½ feet
249	4								
248	5								
247	6								
246	7								
245	8								
244	9								

Test pit terminated at approximately 9¾ feet due to excavator maximum reach; test pit was backfilled in approximate 12-inch lifts and each lift was tamped using the excavator bucket

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Date:9/12/24 Path:P:\27\27530001\GINT\27530001OO.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Log of Test Pit GEO-TP-2

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-14
Sheet 1 of 1

Date Excavated	8/13/2024	Total Depth (ft)	8.75	Logged By SPD Checked By HPC	Excavator Machine Time, LLC Equipment Bobcat E50	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	246 NAVD88	Easting (X) Northing (Y)	664019 2917672	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
245	1		S-1		TS ML	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil) Orange-brown silt with sand and organic matter (roots) (moist) (subsoil)			Boulders present starting at ground surface; roots present to 3 feet
244	2		S-2 SA		GM	Light gray silty fine to coarse gravel with sand, cobbles and boulders (moist) (glacial till)		12.9	
243	3								Large boulder encountered at approximately 3½ feet, extends to 7 feet and is approximately 3 feet wide
242	4								
241	5								
240	6								
239	7								
238	8								

Test pit terminated at approximately 8¾ feet due to excavator maximum reach; test pit was backfilled in approximate 12-inch lifts and each lift was tamped using the excavator bucket

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-3

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-15
Sheet 1 of 1

Date Excavated	8/13/2024	Total Depth (ft)	9.75	Logged By Checked By	SPD HPC	Excavator Equipment	Machine Time, LLC Bobcat E50	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	252 NAVD88			Easting (X) Northing (Y)	663833 2917592	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
251	1		S-1		TS	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)			Boulders observed starting at ½ foot and present throughout test pit Roots present from 0 to approximately 3 feet
					ML	Orange-brown silt with sand, trace gravel and organic matter (roots) (moist) (subsoil)			
250	2		S-2			Becomes light brown			
249	3		S-3		SP-SM	Grayish brown fine to medium sand with silt, trace gravel and cobbles (moist) (glacial till)			
248	4								
247	5								
246	6				SM	Gray silty fine to medium sand with gravel, cobbles and boulders (moist)			
245	7								
244	8								Minor caving observed at approximately 8 feet
243	9								

Test pit terminated at approximately 9¾ feet due to excavator maximum reach; test pit was backfilled in approximate 12-inch lifts and each lift was tamped using the excavator bucket

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-4

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-16
Sheet 1 of 1

GeoEngineers USA

239 Causeway Street, Suite 400, Boston, Massachusetts 02114, Telephone: 617.749.9220 www.geoengineers.com

Memorandum

To:	Victoria Darnell ~ MetroWest YMCA c/o Scalora Consulting Group
From:	Alexander H. Macon, EIT, and Heidi P. Cashman, PE ~ GeoEngineers
Date:	September 26, 2025
File:	27530-001-00
Subject:	Stormwater Management Design Considerations Memorandum MetroWest YMCA – Future Regional YMCA 28 Memorial Drive Ashland, Massachusetts

GeoEngineers USA, PC (GeoEngineers) has prepared this stormwater management design considerations memorandum for MetroWest YMCA (Client) to convey observations of the subsurface conditions encountered at proposed stormwater system locations during our supplemental subsurface exploration program, and provide geotechnical engineering recommendations in support of the stormwater design systems for the Future Regional YMCA development located at 28 Memorial Drive in Ashland, Massachusetts (the Site), as shown in Figure 1 (Locus Map).

Recommendations presented herein are specific to the stormwater management areas explored and are intended to supplement the stormwater recommendations provided in our report titled *Updated Geotechnical Engineering Report* dated May 21, 2025.

Elevations (El.) referenced in this memorandum refer to the North American Vertical Datum of 1988 (NAVD88).

Project Understanding

Based on our review of the grading and drainage plan for the project prepared by Bohler Engineering (Bohler) dated June 24, 2025, and our discussions with you, we understand that the proposed stormwater management approach for the Site consists of four (4) subsurface infiltration basins and one (1) infiltration pond. Information about the proposed basins is as follows:

- Infiltration Basin 1 is proposed as a subsurface infiltration basin within the paved area northwest of the Early Learning Center (ELC) building, with a bottom of stone at approximately El. 240 feet.
- Infiltration Basin 2 is proposed as a subsurface infiltration basin within the landscaped area southwest of the ELC, with a bottom of stone at approximately El. 237.25 feet.
- Infiltration Basin 3 is proposed as a subsurface infiltration basin within the paved area south of the Membership building, with a bottom of stone at approximately El. 241.5 feet.
- Infiltration Basin 4 is proposed as a subsurface infiltration basin within the landscape area southeast of the Membership building, with a bottom of stone at approximately El. 237 feet.
- Infiltration Basin 5 is proposed as an infiltration pond within the landscaped area north of the Membership building, with a bottom of system at approximately El. 231 feet.

Supplemental Subsurface Exploration Program

On August 28 and 29, 2025, GeoEngineers performed a supplemental subsurface exploration program consisting of eight (8) test pits, and one (1) in-situ infiltration test, to evaluate subsurface conditions in proposed stormwater management areas. The test pits were continuously monitored by a representative from our firm who logged and classified the soils encountered, obtained representative soil samples, observed groundwater conditions (if applicable), and prepared logs for the explorations. In-situ infiltration tests were performed by a GeoEngineers representative.

Soils encountered in the test pits were visually classified in general accordance with the classification system described in Figure A-1 within Attachment A, Subsurface Exploration Logs. A key to the exploration log symbols is also presented in Figure A-1. A plan showing approximate exploration locations is provided in Figure 2 (Exploration Location Plan).

GEOTECHNICAL TEST PITS

Eight (8) geotechnical test pits (designated GEO-TP-101, GEO-TP-102, GEO-TP-102A, GEO-TP-103, GEO TP-104(IT), and GEO-TP-105 through GEO-TP-107) were advanced to depths between approximately 8 and 16 feet below ground surface (bgs) by Machine Time, LLC. (Machine Time) of Hudson, New Hampshire. The test pits were advanced with a Doosan DX 104 LC excavator. Upon completion of the test pits, the test pits were backfilled to grade with excavated material placed in lifts tamped with the excavator bucket. The logs of the test pits are presented in Figures A-2 through A-8 within Attachment A.

LABORATORY TESTING

Seven (7) soil samples were submitted to Thielsch Engineering of Cranston, Rhode Island for geotechnical laboratory testing in accordance with the standards provided in ASTM International (ASTM) procedures. The following laboratory tests were conducted:

- Seven (7) gradation analysis (sieve and hydrometer), per ASTM D6913 and ASTM D7928.

Laboratory test data is provided within Attachment B.

Subsurface Conditions

SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

GeoEngineers' understanding of the subsurface conditions at stormwater management areas is based on the results of our field exploration program. The general subsurface conditions consist of surficial topsoil and subsoil, underlain by natural silt and sand deposits, glacial till, and bedrock. The subsurface soils encountered in our explorations are described in more detail below:

- **Surficial Materials**: The *forest mat/topsoil* ranges in thickness from approximately 4 to 6 inches. The surficial topsoil generally consists of silty fine- to medium-grained sand with varying amounts of organics (roots and leaves). Roots were observed to extend as deep as 6 feet bgs in some areas, as noted in the logs.

The surficial *subsoil* generally consists of silt with varying amounts of fine- to medium-grained sand, fine gravel, cobbles, boulders, and organics (roots), and ranged in thickness between 1 to 2.5 feet. Significant cobbles and boulders were observed within test pits GEO-TP-102, GEO-TP-102A, GEO-TP-106, and GEO-TP-107. Surface boulders and/or bedrock outcrops were observed to be frequent across the Site.

- **Natural Silt and Sand Deposits**: Silt and sand deposits were encountered underlying the surficial materials within the test pits, except for test pits GEO-TP-106 and GEO-TP-107 where the surficial materials were directly underlain by glacial till. The natural silt and sand deposits were observed to be approximately 2 to 4.5 feet thick, except for within test pit GEO-TP-105 where the silt and sand deposits were observed to be at least 8 feet thick and extended deeper than 10 feet bgs where the test pit was terminated. The natural silt and sand deposits generally consist of silt, or silty fine-grained sand, with varying amounts of fine gravel, cobbles, boulders, and organics (roots).

  An approximately 0.5-foot-thick silt pocket was encountered underlying the sand (of the silt and sand deposits) within GEO-TP-101, at approximately 4 feet bgs. The silt pocket generally consists of silt, with fine-grained sand. Mottling (i.e. redoximorphic features) was observed within the sand directly above the silt pocket. The mottling within the sand is likely indicative of water perched atop the silt pocket during the wet seasons of the year and is not likely indicative of seasonal high groundwater (SHGW).

- **Glacial Till**: The top of the glacial till deposit was encountered within the test pits (except for GEO-TP-105) across the Site between approximately 2 feet and 6 feet bgs. The glacial till generally consists of fine- to coarse-grained sand with varying amounts of silt, fine to coarse gravel, cobbles, and boulders. Significant amounts of cobbles and boulders were encountered in the glacial till; therefore, cobbles and boulders should be anticipated to be frequent within this layer. Test pits GEO-TP-102A, and GEO-TP-104(IT) were terminated due to refusal on probable boulders.

- **Probable Bedrock**: Probable bedrock, as evidenced by excavator bucket refusal was encountered beneath the glacial till in test pits GEO-TP-106 and GEO-TP-107. Top of probable competent bedrock was encountered at 13.5 and 8.5 feet bgs, respectively (corresponding with El. 241.5 feet and 241 feet, respectively).

  Possible bedrock or large boulders, as evidenced by excavator bucket refusal, were encountered within the glacial till in GEO-TP-102. Top of possible bedrock or large boulders was encountered at 10 feet bgs (corresponding with El. 242.5 feet).

- **Groundwater**: No groundwater was encountered during the excavation of the test pits by GeoEngineers. However, it should be noted that groundwater levels will vary, depending on seasonal variations in temperature and precipitation, and can also be influenced by subsurface utilities, construction activities, and other factors

Stormwater Design Considerations

Hydraulic conductivity estimates presented herein are based upon either empirical correlations or the results of in-situ infiltration testing. Please note that based on the presence of numerous cobbles and boulders throughout the natural soils, hydraulic conductivities presented herein may be misrepresented. As such we recommend using the most conservative of the values presented herein.

HYDRAULIC CONDUCTIVITY ASSESMENT

Estimated infiltration rates are provided in Table 1 below. The estimated infiltration rates herein were estimated either from laboratory test results in general accordance with the Massachusetts Stormwater Handbook (Volume 3) [Rawl's Rate] for selected samples from the test pits, or using empirical correlations for hydraulic conductivity of soils based on soil grain sizes as determined from laboratory test results. The selected design infiltration rates should be based on the receiving layer soils. We anticipate receiving layer soils to consist of natural sand and silt deposits or glacial till at stormwater management areas. For further details at each location, please refer to Attachment A, Subsurface Exploration Logs.

TABLE 1. SUMMARY OF STORMWATER DESIGN CRITERIA

TEST PIT ID	SAMPLE DEPTH (FEET BGS)	SAMPLE ELEVATION (FEET, NAVD88)	SAMPLE DESCRIPTION	USDA TEXTURAL CLASSIFICATION (NRCS HYDROLOGICAL SOIL GROUP) [RAWL'S RATE]	EMPIRICAL ESTIMATED HYDRAULIC CONDUCTIVITY[1]
GEO-TP-101	15.75 to 16.25	+238.25 to +237.75	Silty Sand (SM) light gray-brown, moist; some fine to coarse gravel; little silt; fine to coarse sand; trace clay; few cobbles. [Glacial Till]	Sandy Loam (Group B) [1.02 in/hour (hr)]	1.04 in/hr
GEO-TP-102[2]	9.5 to 10	+243 to +242.5	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; little silt; little to some fine gravel; trace cobbles; trace clay; trace boulders. [Glacial Till]	Sandy Loam (Group B) [1.02 in/hr]	1.22 in/hr
GEO-TP-103	8.75 to 9.25	+237.25 to +236.75	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; little silt; little to some fine gravel; trace clay; few boulders. [Glacial Till]	Sandy Loam (Group B) [1.02 in/hr]	0.88 in/hr

TEST PIT ID	SAMPLE DEPTH (FEET BGS)	SAMPLE ELEVATION (FEET, NAVD88)	SAMPLE DESCRIPTION	USDA TEXTURAL CLASSIFICATION (NRCS HYDROLOGICAL SOIL GROUP) [RAWL'S RATE]	EMPIRICAL ESTIMATED HYDRAULIC CONDUCTIVITY[1]
GEO-TP-104(IT)	3.25 to 3.75	+229.75 to +229.25	Silt with Sand (ML), light brown to light gray, moist; little to some fine sand; trace fine gravel; trace boulders; trace clay.	Silt Loam (Group C) [0.27 in/hr]	0.33 in/hr
GEO-TP-105	7 to 7.5	+238 to +237.5	Silt with Sand (ML), light gray-brown, moist; trace clay; some to mostly fine sand; trace fine gravel; trace boulders.	Sandy Loam (Group B) [1.02 in/hr]	0.34 in/hr
GEO-TP-106[2]	13.5 to 13.75	+241 to +240.75	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; some fine to coarse gravel; little silt; few cobbles; little boulders. [Glacial Till]	Sandy Loam (Group B) [1.02 in/hr]	0.68 in/hr
GEO-TP-107[2]	8 to 8.5	+242 to +241.5	Poorly Graded Sand with Silt and Gravel (SP-SM), light gray-brown, moist; fine to medium sand; few to little silt; some fine to coarse gravel; trace clay; few cobbles; few boulders. [Glacial Till]	Sandy Loam (Group B) [1.02 in/hr]	3.82 in/hr [3]

Notes:

[1]Empirical hydraulic conductivity rates were estimated based upon an average of multiple empirical equations: Hazen Simplified (Freeze and Cherry 1979), Hazen (1892), Slichter (1898), Terzaghi (1925), Beyer (1964), Sauerbrei (1932), Kruger (1919), Kozeny-Carmen (1953), Zunker (1930), Zamarin (1928), United States Bureau of Reclamation and Bialas (1966), Barr (2001), Alyamani and Sen (1993), Chapuis (2004), and Krumbein and Monk (1942).

[2] Probable bedrock was encountered limiting the depth of sampling/explorations. See Figure 2 and Attachment A for more information.

[3] The estimated rate should not be considered accurate and is likely misrepresented due to the substantial presence of gravel sized particulates (51.2 percent gravel) within the sample collected and sent for laboratory testing.

IN-SITU INFILTRATION TEST

The field estimated infiltration rate is provided in Table 2 below. Field infiltration testing was performed using falling head infiltration test methods. The falling head infiltration test is performed by installing a standing pipe into the ground at the desired test elevation, creating a seal between the standing pipe and the ground using bentonite, filling the pipe with water, and measuring the falling water head over time. The falling head infiltration test is performed three (3) times at each location and the field measurements are then used to estimate the hydraulic conductivity of the receiving soils.

Please note, during the field infiltration testing, infiltration rates were higher with each test iteration, which is typically indicative of the seal between the standing pipe and the ground failing. However, there were no visual signs of a seal failure during the test. As such, test results may be misrepresented and the more conservative textural correlations and empirical estimates should be used.

TABLE 2. SUMMARY OF STORMWATER DESIGN CRITERIA

TEST PIT ID	INFILTRATION TEST DEPTH (FEET BGS)	INFILTRATION TEST ELEVATION (FEET, NAVD88)	SAMPLE DESCRIPTION	FIELD ESTIMATED HYDRAULIC CONDUCTIVITY[1]	DESIGN ESTIMATED HYDRAULIC CONDUTIVITY[2]
GEO-TP-104(IT)	3.25	+229.75	Silt with sand (ML), light brown to light gray, moist; little to some fine sand; trace fine gravel; trace boulders; trace clay.	1.56 in/hr	0.78 in/hr

Notes:
[1]Field estimated hydraulic conductivity rates were determined based upon Hvorslev, M.J., 1995. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50.
[2]Design estimated hydraulic conductivity rates have an applied factor of safety of 2.0.

Limitations

We have prepared this memorandum for MetroWest YMCA in support of the stormwater management design for the Future Regional YMCA development located at 28 Memorial Drive in Ashland, Massachusetts. Client may distribute copies of this report to their authorized agents and regulatory agencies as may be required for the project.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment, and experience. No warranty or other conditions, express or implied, should be understood.

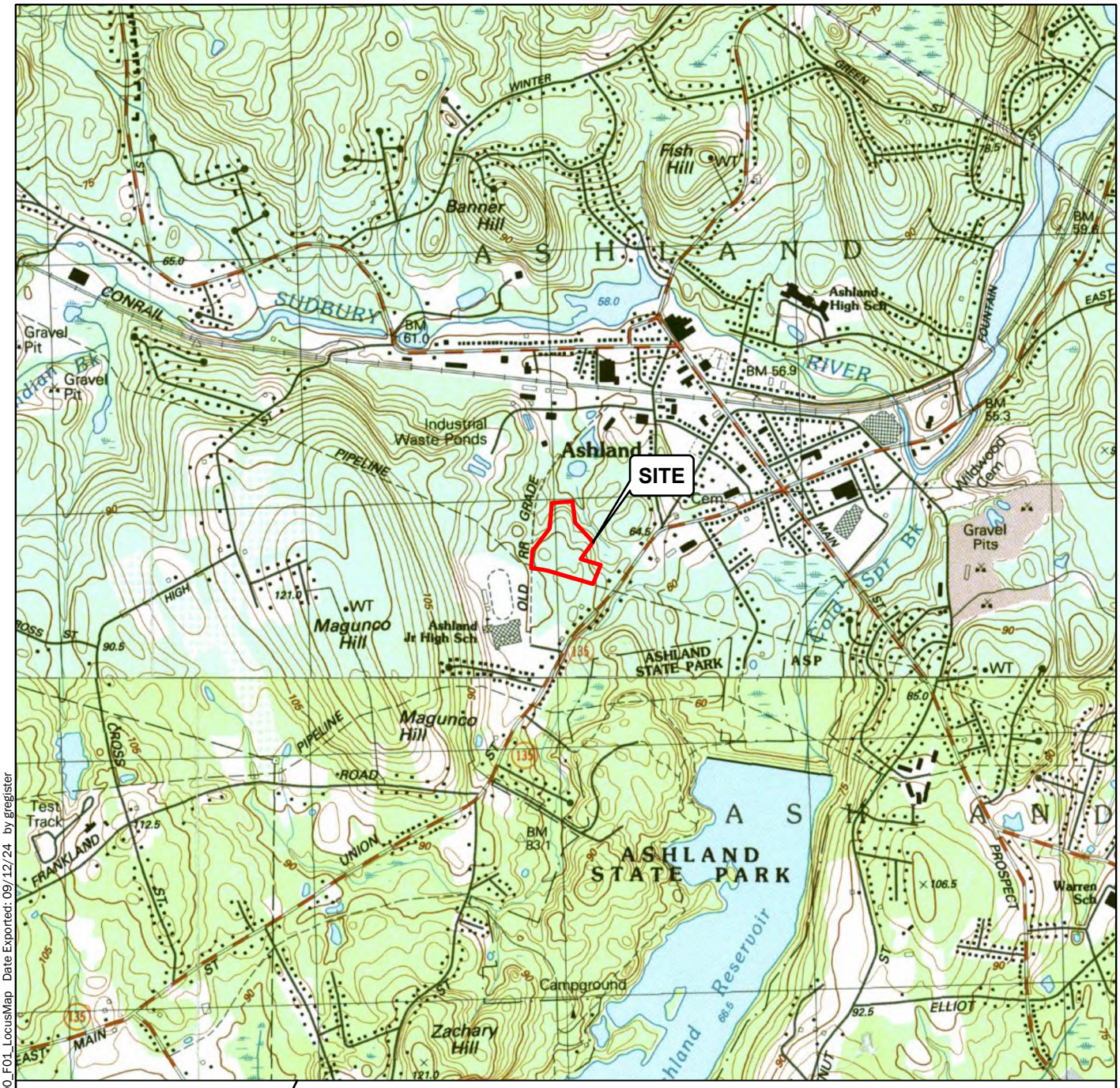
Any electronic form, facsimile, or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers USA, PC and will serve as the official document of record.

Please refer to the Attachment C titled “Memorandum Limitations and Guidelines for Use” for additional information pertaining to use of this report.

AHM:HPC:dt

Attachments:
Figure 1. Locus Map
Figure 2. Exploration Location Plan
Attachment A. Subsurface Exploration Logs
Attachment B. Laboratory Test Results
Attachment C. Memorandum Limitations and Guidelines for Use

Figures



N

0 2,000

Feet

Source(s):

- ESRI/MassGIS & USGS Quadrangle Maps:
  , Massachusetts REV: 1987

Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
Vertical Units: Meters

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Locus Map

Stormwater Memorandum
MetroWest YMCA - Future Regional YMCA
Ashland, Massachusetts

GeoEngineers USA

Figure 1

P:\27\27530001\GIS\27530001_Project\27530001_Project.aprx\0273000100_F01_LocusMap Date Exported: 09/12/24 by gregister

Source(s):

- Survey from Scalora Consulting Group, received on 07/24/2024
- Proposed Features from CBT received on 04/30/2025
- Site Boundary downloaded from MassMapper on 08/29/2024

Coordinate System: MA State Plane, Mainland Zone, NAD83, US Foot

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Exploration Location Plan

Stormwater Memorandum
MetroWest YMCA - Future Regional YMCA
Ashland, Massachusetts

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Figure 2

Attachments

Attachment A
Subsurface Exploration Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

Modified California Sampler (6-inch sleeve) or Dames & Moore

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

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Figure A-1

Rev. 03/2024

Date Excavated	8/29/2025	Total Depth (ft)	16.25	Logged By AHM Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	254 NAVD88	Easting (X) Northing (Y)	663844 2917549	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
253	1		S-1		TS	Silty Sand (SM), dark brown, moist; fine sand, some silt; some organics (roots, leaves). [Topsoil]			
					ML	Silt (ML), light orange-brown,moist; little fine to medium sand; few organics (roots); trace fine gravel; trace cobbles; trace boulders. [Subsoil]			Some roots to 1½ feet
252	2								Few roots to 2 feet
251	3		S-2		SM	Silty Sand (SM), light gray-brown, moist; fine to medium sand; little silt; few fine gravel; trace cobbles; trace boulders.			
250	4		S-3		ML	Silt with Sand (ML), light gray-white, moist; some fine sand; trace clay.			Mottling at 3¾ feet Nested 3 foot boulders from ½ to 4 feet
249	5				SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), light gray-brown, moist; some fine gravel; few silt; fine to coarse sand; trace cobbles; trace boulders. [Glacial Till]			Trace roots to 4½
248	6		S-4						
247	7								
246	8				SP	Poorly Graded Sand with Gravel (SP); light gray-brown, moist; some fine to coarse gravel; trace silt; fine to coarse sand; few cobbles; trace boulders. [Glacial Till]			
245	9								
244	10								
243	11								
242	12		S-5						
241	13								
240	14		S-6						
239	15				SM	Silty Sand (SM), light gray-brown, moist; some fine to coarse gravel; little silt; fine to coarse sand; trace clay;few cobbles. [Glacial Till]			
238	16		S-7					17.7	% Gravel = 31.7

Test pit terminated at 16¼ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

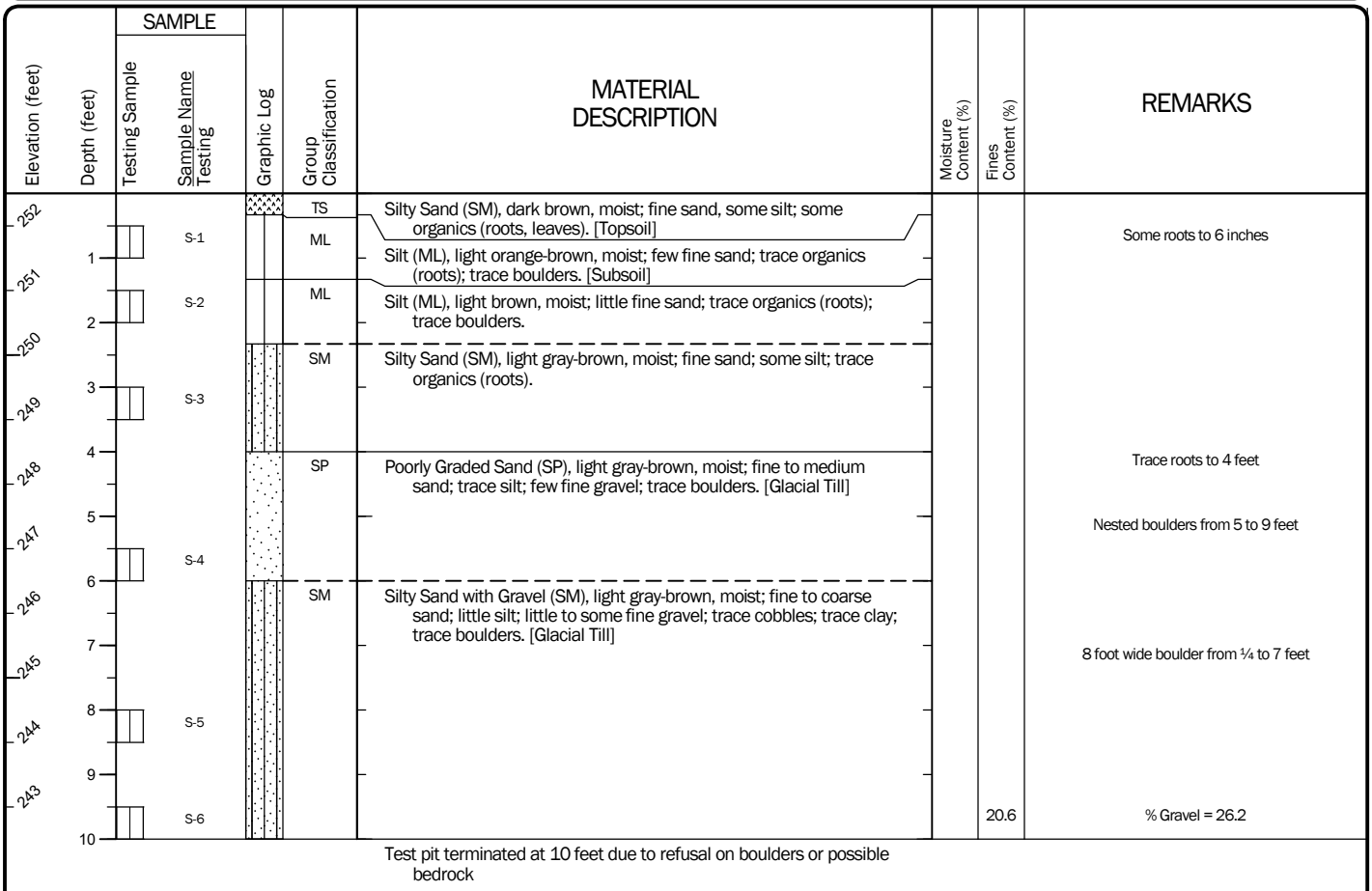
Log of Test Pit GEO-TP-101

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-2
Sheet 1 of 1

Date Excavated	8/29/2025	Total Depth (ft)	10	Logged By AHM Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	252.5 NAVD88	Easting (X) Northing (Y)	663981 2917458	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	



Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-102

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-3
Sheet 1 of 1

Date Excavated	8/29/2025	Total Depth (ft)	8.25	Logged By AHM Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	253 NAVD88	Easting (X) Northing (Y)	663977 2917478	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
252	0				TS	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves). [Topsoil]			Some roots to ¼ foot
	1				ML	Silt (ML), light orange-brown, moist; few fine sand; few organics (roots); few boulders. [Subsoil]			
251	2				ML	Silt (ML), light brown, moist; little fine sand; few organics (roots); some boulders.			
250	3				SM	Silty Sand (SM), light gray-brown, moist; fine sand, some silt; trace organics (roots); some boulders.			Few roots to 3½ feet
249	4								
248	5				SP	Poorly Graded Sand (SP), light gray-brown, moist; fine to medium sand; trace silt; few gravel; few boulders. [Glacial Till]			
247	6								Trace roots to 6 feet
246	7				SM	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; little silt; little fine gravel; trace clay; trace cobbles; few boulders. [Glacial Till]			
245	8								Some 4 to 6 feet wide nested boulders from 1 to 8 feet

Test pit terminated at 8¼ feet due to refusal on boulders

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-102A

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-4
Sheet 1 of 1

Date Excavated	8/29/2025	Total Depth (ft)	12	Logged By AHM Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	246 NAVD88	Easting (X) Northing (Y)	664076 2917458	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
245	1		S-1		TS	Silty Sand (SM), dark brown, moist; fine to medium sand; some silt; some organics (roots, leaves) [Topsoil]			Some roots to ¼ foot
					ML	Silt (ML), light orange-brown, moist; few fine sand; trace organics (roots). [Subsoil]			
244	2		S-2		ML	Silt with Sand (ML), light brown to light gray, moist; some fine sand; few silt; trace boulders.			
243	3								Trace roots to 2¾ feet
242	4		S-3		SP-SM	Poorly Graded Sand with Silt (SP-SM), light gray-brown, moist; fine to medium sand; few silt; few fine gravel; few boulders. [Glacial Till]			
241	5								
240	6								
239	7				SM	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; little silt; little to some fine gravel; trace clay; few boulders. [Glacial Till]			
238	8								
237	9		S-4					23.6	% Gravel = 25.9
236	10								
235	11								
234	12		S-5						

Test pit terminated at 12 feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-103

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-5
Sheet 1 of 1

Date Excavated	8/28/2025	Total Depth (ft)	9	Logged By Checked By	AHM HPC	Excavator Equipment	Machine Time, LLC Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	233 NAVD88			Easting (X) Northing (Y)	663991 2917914	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
232	0				TS	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves) [Topsoil]			Some roots to ¼ foot
	1		S-1		ML	Silt (ML), light orange-brown, moist; few fine sand; trace organics (roots). [Subsoil]			
231	2		S-2		ML	Silt with Sand (ML), light orange-brown, moist; few fine sand; trace fine gravel; trace organics (roots).			
230	3								
229	4		S-3		ML	Silt with Sand (ML), light brown to light gray, moist; little to some fine sand; trace fine gravel; trace boulders; trace clay.		66.7	% Gravel = 3.6 Infiltration test attempted at 3¼ feet
228	5								
227	6		S-4		SM	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; little fine gravel; little silt; few cobbles; trace boulders. [Glacial Till]			Trace roots to 5¾ feet
226	7								
225	8								
224	9					Test pit terminated at 9 feet due to refusal in boulders			Greater than 5 foot wide boulders enounctered at 9 feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-104 (IT)

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-5
Sheet 1 of 1

Date Excavated	8/29/2025	Total Depth (ft)	10	Logged By AHM Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	245 NAVD88	Easting (X) Northing (Y)	663395 2917628	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
244	0				TS	Silty Sand (SM), dark brown, moist; fine to medium sand; some silt; some organics (roots, leaves) [Topsoil]			Some roots to 3 inches
	1		S-1		ML	Silt with Sand (ML), light orange to light brown, moist; little fine sand; trace organics (roots). [Subsoil]			
243	2				ML	Silt with Sand (ML), light brown, moist; little fine sand; trace organics (roots).			
242	3		S-2						Trace roots to 3 feet
241	4		S-3		ML	Silt with Sand (ML), light gray-brown, moist; trace clay; some to mostly fine sand.			
240	5								
239	6					Becomes trace fine gravel; trace boulders.			
238	7		S-4					53.1	
237	8								
236	9		S-5 S-6		SM	Silty Sand (SM), light gray-brown, moist; fine sand; few fine gravel; trace cobbles; few boulders; some silt.			5 foot wide boulders encountered from 6 to 9 feet
235	10					Test pit terminated at 10 feet			2 foot wide boulders encountered from 9 to 10 feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-105

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-6
Sheet 1 of 1

Date Excavated	8/29/2025	Total Depth (ft)	13.75	Logged By yjytj Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	254.5 NAVD88	Easting (X) Northing (Y)	663514 2917841	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
254	0				TS	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves) [Topsoil]			Some roots to 6 inches
253	1		S-1		ML	Silt (ML), light brown, moist; little fine to medium sand; some silt; few fine gravel; trace cobbles; some boulders. [Subsoil]			
252	2								
251	3		S-2		SM	Silty Sand with Gravel (SM), light gray, moist; fine to coarse sand; some silt; little fine gravel; trace cobbles; some boulders. [Glacial Till]			Nested 4 foot wide boulders from 0 to 5¾ feet Trace roots to 6 feet
250	4								
249	5								
248	6								
247	7								
246	8		S-3		SM	Silty Sand with Gravel (SM), light gray-brown, moist; fine to coarse sand; some fine to coarse gravel; little silt; few cobbles; little boulders; trace cobbles. [Glacial Till]			
245	9								
244	10								
243	11								
242	12								
241	13		S-4			Test pit terminated at 13¾ feet due to refusal on possible bedrock or boulders.		17.8	% Gravel = 25.8

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-106

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-7
Sheet 1 of 1

Date Excavated	8/29/2025	Total Depth (ft)	8.5	Logged By AHM Checked By HPC	Excavator Machine Time, LLC Equipment Doosan DX 140 LC	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	250 NAVD88	Easting (X) Northing (Y)	663508 2917917	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
249	1		S-1		TS	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves) [Topsoil]			Nested surface 4 foot wide boulder observed
					ML	Silt (ML), light brown, moist; little fine to medium sand; some silt; trace fine gravel; trace cobbles; some boulders. [Subsoil]			Some roots to ½ foot
248	2				SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), light gray-brown, moist; fine to medium sand; few to little silt; some fine to coarse gravel; trace clay; few cobbles; few boulders. [Glacial Till]			
247	3		S-2						
246	4								
245	5								Trace roots to 4½ feet
244	6								Nested 2 foot wide boulders observed from 0 to 6 feet
243	7								
242	8		S-3					14.1	% Gravel = 51.2

Test pit terminated at 8½ feet due to refusal on possible bedrock or boulders

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

Log of Test Pit GEO-TP-107

GeoEngineers USA

Project: MetroWest YMCA - Future Regional YMCA
Project Location: Ashland, Massachusetts
Project Number: 27530-001-00

Figure A-8
Sheet 1 of 1

Attachment B
Laboratory Test Results

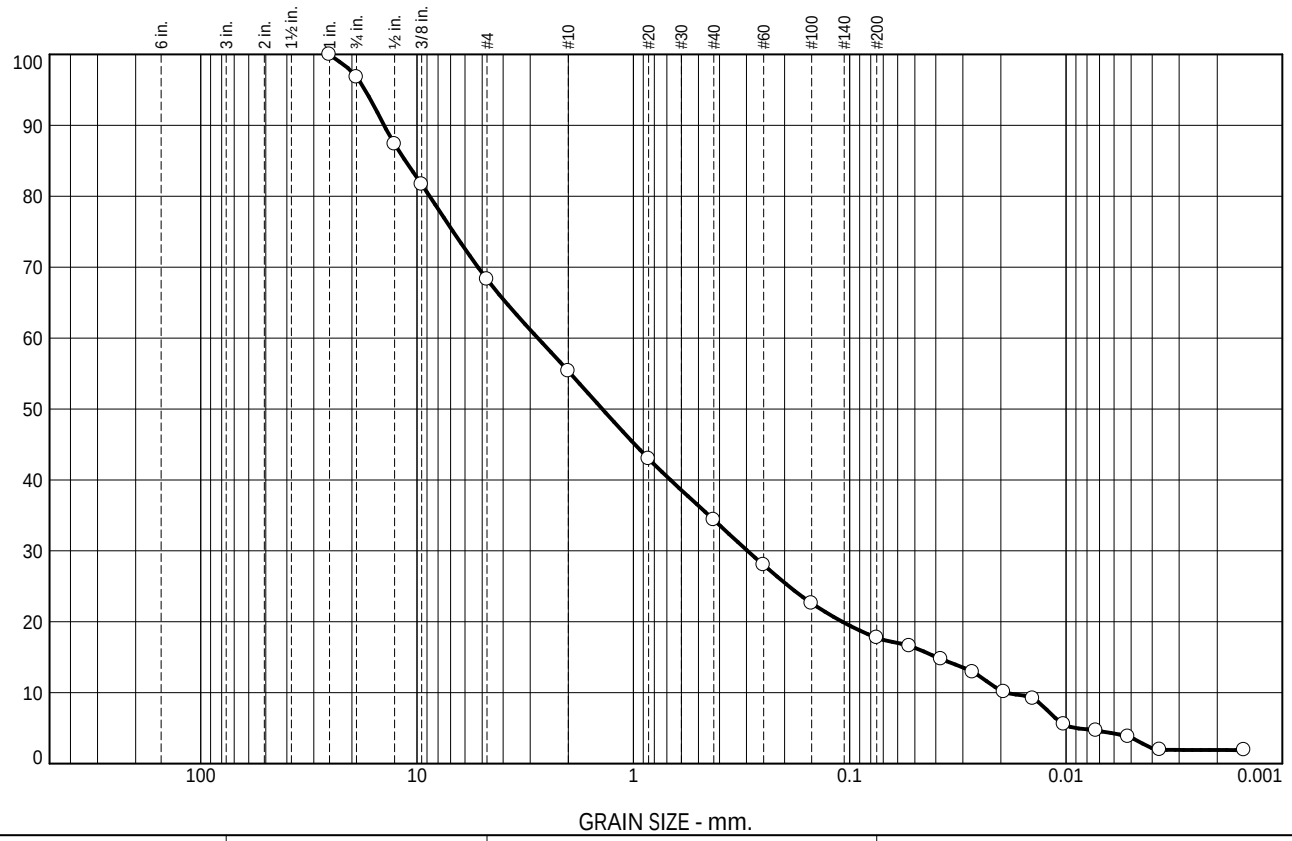
Thielsch DIVISION OF THE RISE GROUP	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 cts.thielsch.com *Let's Build a Solid Foundation*	Client Information: **GeoEngineers** **Boston, MA** **857-772-2217** Project Contact: Alexander Macon Collected By: Client	Project Information: **Metro West YMCA** **Ashland, MA** Project Number: 27530-001-00 Summary Page: 1 of 1 Report Date: 9.17.2025

LABORATORY TESTING DATA SHEET, Report No.: 7425-J-B032

Material Source	Sample ID	Depth (ft)	Laboratory No.	Identification Tests									Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Rcvd Moisture Content %	LL %	PL %	OD LL	Gravel %	Sand %	Fines %	Org. %	pH	g_d MAX (pcf) W_{opt} (%)	g_d MAX (pcf) W_{opt} (%) (Corr.)	Dry unit wt. (pcf)	Test Moisture Content %	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318			D6913			D2974	D4792	D1557								
Grab	GEO-TP-101 / S-7	15.75-16.25	25-S-B1894					31.7	50.6	17.7											Brown silty sand with gravel
Grab	GEO-TP-102 / S-6	9.5-10	25-S-B1895					26.2	53.2	20.6											Tan silty sand with gravel
Grab	GEO-TP-103 / S-4	8.75-9.25	25-S-B1896					25.9	50.7	23.4											Grey silty sand with gravel
Grab	GEO-TP-104(IT) / S-3	3.25-3.75	25-S-B1897					3.6	29.7	66.7											Tans sandy silt
Grab	GEO-TP-105 / S-4	7-7.5	25-S-B1898					0.0	46.9	53.1											Tan sandy silt
Grab	GEO-TP-106 / S-4	13.5-13.75	25-S-B1899					25.8	56.4	17.8											Tan silty gravel with sand
Grab	GEO-TP-107 / S-3	8-8.5	25-S-B1900					51.2	34.7	14.1											Tan silty gravel with sand

Date Received: **9.10.2025** Reviewed By: Michael C Collins Date Reviewed: **9.17.2025**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.2	28.5	13.0	20.9	16.7	15.8	1.9

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	96.8		
1/2"	87.4		
3/8"	81.7		
#4	68.3		
#10	55.3		
#20	43.0		
#40	34.4		
#60	28.0		
#100	22.6		
#200	17.7		
0.0530 mm.	16.6		
0.0378 mm.	14.7		
0.0270 mm.	12.9		
0.0194 mm.	10.1		
0.0142 mm.	9.2		
0.0102 mm.	5.5		
0.0073 mm.	4.7		
0.0052 mm.	3.8		
0.0037 mm.	1.9		
0.0015 mm.	1.9		

* (no specification provided)

Soil Description

Brown silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 14.1994 D_{85}= 11.3117 D_{60}= 2.7649
D_{50}= 1.3929 D_{30}= 0.2969 D_{15}= 0.0396
D_{10}= 0.0190 C_u= 145.65 C_c= 1.68

Classification

USCS= SM AASHTO= A-1-b

Remarks

Source of Sample: Grab Depth: 15.75-16.25
Sample Number: GEO-TP-101 / S-7

Date: 9.16.2025

Thielsch Engineering Inc.

Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1894

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.7	15.5	5.8	14.0	33.4	18.5	2.1

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	89.3		
1/2"	86.3		
3/8"	81.8		
#4	73.8		
#10	68.0		
#20	61.4		
#40	54.0		
#60	45.5		
#100	34.4		
#200	20.6		
0.0535 mm.	15.1		
0.0382 mm.	13.2		
0.0275 mm.	9.5		
0.0196 mm.	7.6		
0.0145 mm.	5.7		
0.0103 mm.	3.9		
0.0073 mm.	3.9		
0.0052 mm.	2.9		
0.0037 mm.	2.1		
0.0015 mm.	2.1		

* (no specification provided)

Soil Description

Tan silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 19.6297 D_{85}= 11.5692 D_{60}= 0.7343
D_{50}= 0.3230 D_{30}= 0.1212 D_{15}= 0.0529
D_{10}= 0.0291 C_u= 25.27 C_c= 0.69

Classification

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

Remarks

Source of Sample: Grab Depth: 9.5-10
Sample Number: GEO-TP-102 / S-6

Date: 9.17.2025

Thielsch Engineering Inc.

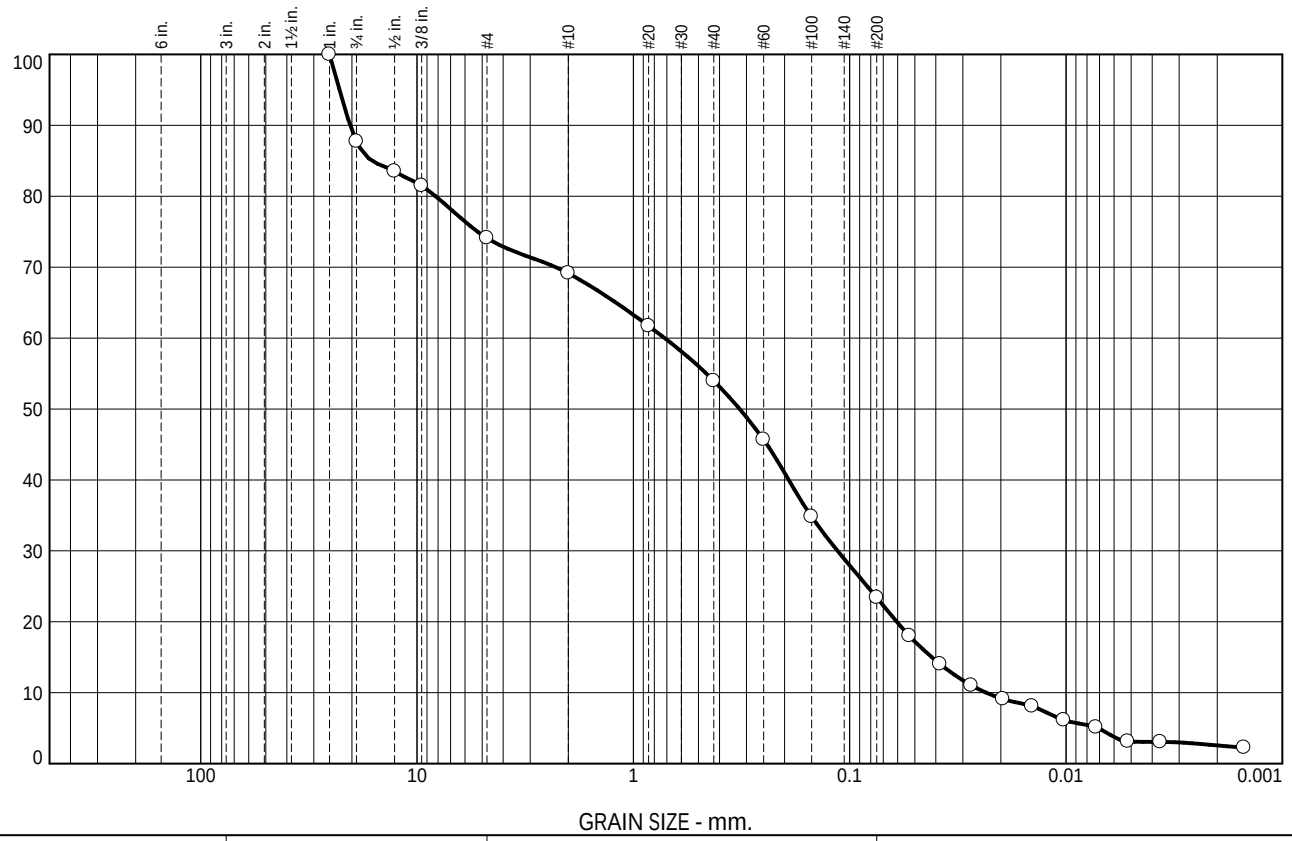
Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1895

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.3	13.6	5.0	15.1	30.6	20.8	2.6

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	87.7		
1/2"	83.5		
3/8"	81.5		
#4	74.1		
#10	69.1		
#20	61.7		
#40	54.0		
#60	45.7		
#100	34.8		
#200	23.4		
0.0530 mm.	18.0		
0.0382 mm.	14.0		
0.0274 mm.	11.0		
0.0196 mm.	9.1		
0.0144 mm.	8.1		
0.0102 mm.	6.1		
0.0073 mm.	5.1		
0.0052 mm.	3.1		
0.0037 mm.	3.1		
0.0015 mm.	2.3		

* (no specification provided)

Soil Description

Grey silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 20.4021 D_{85}= 16.1592 D_{60}= 0.7172
D_{50}= 0.3227 D_{30}= 0.1138 D_{15}= 0.0418
D_{10}= 0.0234 C_u= 30.63 C_c= 0.77

Classification

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

Remarks

Source of Sample: Grab Depth: 8.75-9.25
Sample Number: GEO-TP-103 / S-4

Date: 9.17.2025

Thielsch Engineering Inc.

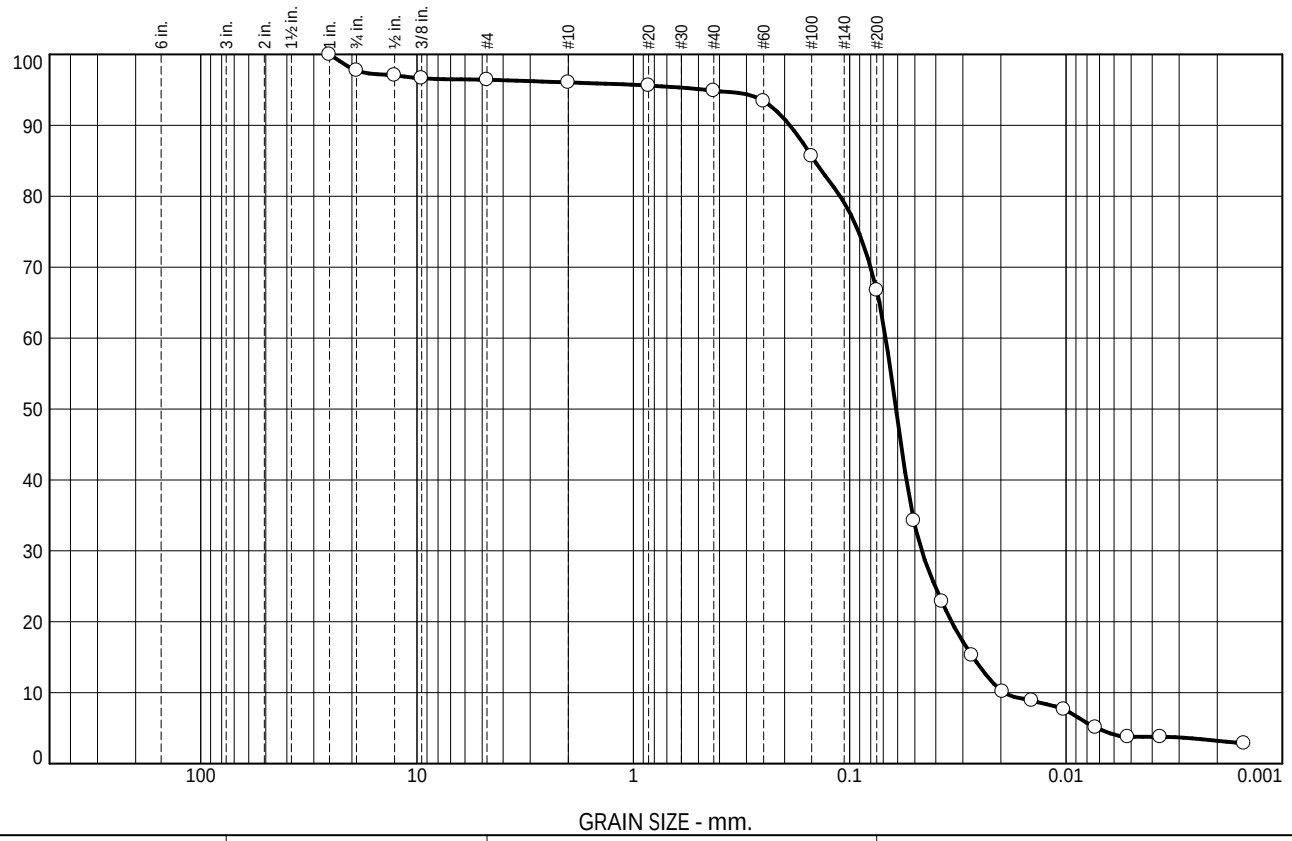
Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1896

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.3	1.3	0.3	1.2	28.2	63.5	3.2

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	97.7		
1/2"	97.0		
3/8"	96.6		
#4	96.4		
#10	96.1		
#20	95.6		
#40	94.9		
#60	93.4		
#100	85.7		
#200	66.7		
0.0506 mm.	34.3		
0.0375 mm.	22.9		
0.0273 mm.	15.3		
0.0197 mm.	10.2		
0.0144 mm.	8.9		
0.0102 mm.	7.6		
0.0073 mm.	5.1		
0.0052 mm.	3.8		
0.0037 mm.	3.8		
0.0015 mm.	2.9		

* (no specification provided)

Soil Description

Tan sandy silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.1891 D_{85}= 0.1453 D_{60}= 0.0682
D_{50}= 0.0611 D_{30}= 0.0465 D_{15}= 0.0269
D_{10}= 0.0193 C_u= 3.53 C_c= 1.64

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Source of Sample: Grab Depth: 3.25-3.75
Sample Number: GEO-TP-104(IT) / S-3

Date: 9.17.2025

Thielsch Engineering Inc.

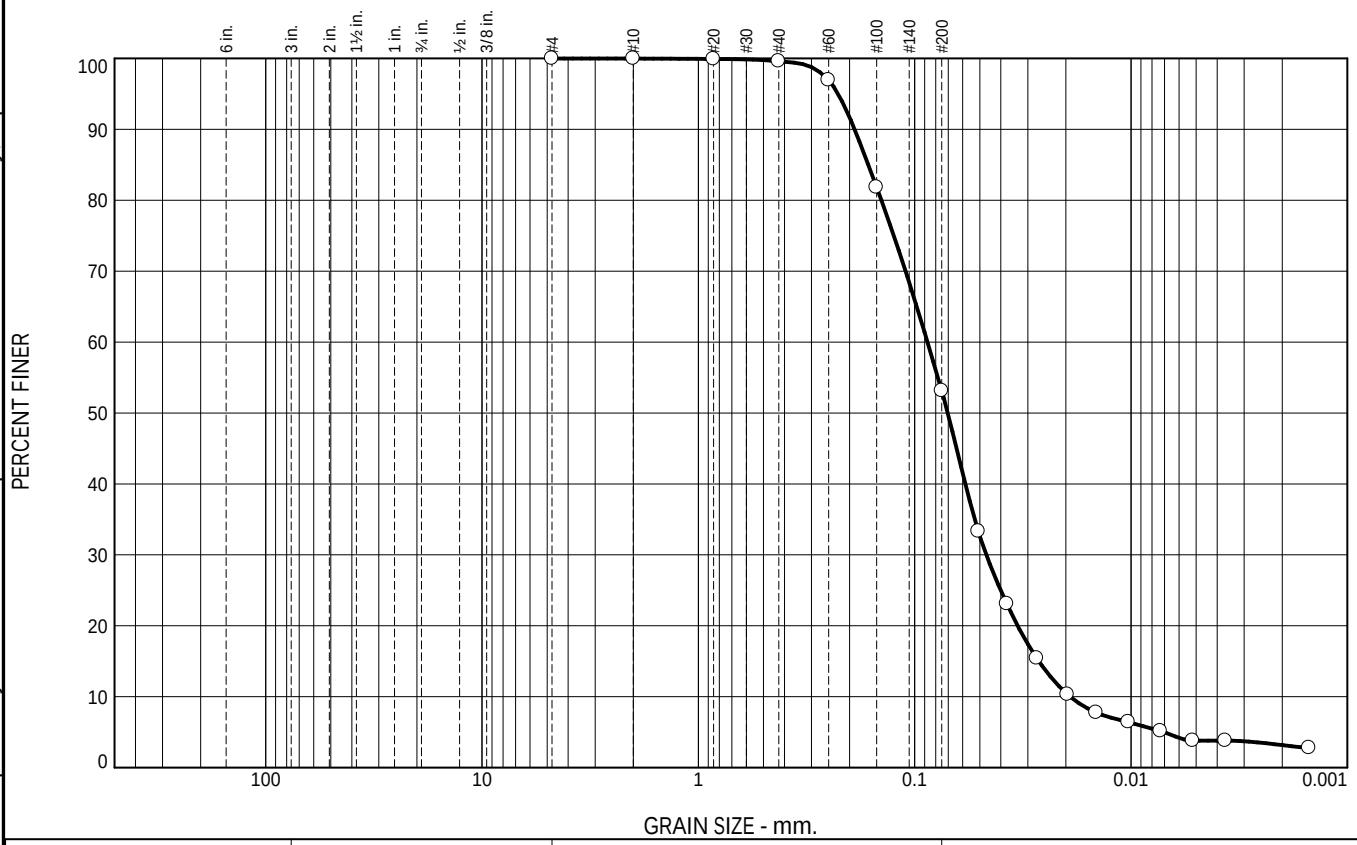
Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1897

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.4	46.5	49.9	3.2

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.6		
#60	96.9		
#100	81.8		
#200	53.1		
0.0508 mm.	33.3		
0.0375 mm.	23.1		
0.0273 mm.	15.4		
0.0197 mm.	10.3		
0.0145 mm.	7.8		
0.0103 mm.	6.4		
0.0073 mm.	5.1		
0.0052 mm.	3.8		
0.0037 mm.	3.8		
0.0015 mm.	2.8		

* (no specification provided)

Soil Description

Tan sandy silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.1895 D_{85}= 0.1640 D_{60}= 0.0873
D_{50}= 0.0704 D_{30}= 0.0467 D_{15}= 0.0267
D_{10}= 0.0191 C_u= 4.56 C_c= 1.31

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Source of Sample: Grab Depth: 7-7.5
Sample Number: GEO-TP-105 / S-4

Date: 9.16.2025

Thielsch Engineering Inc.

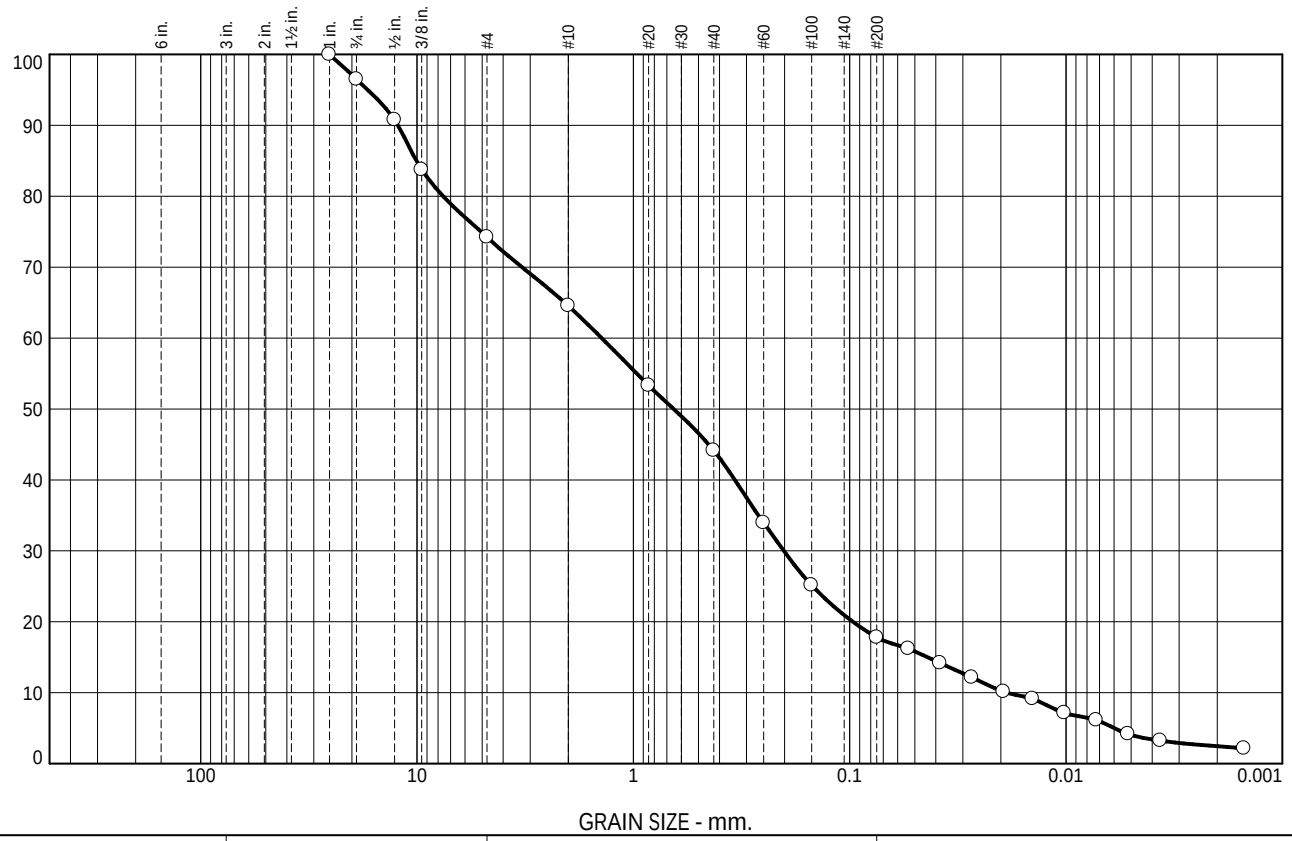
Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1898

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	22.3	9.6	20.5	26.3	15.4	2.4

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	96.5		
1/2"	90.8		
3/8"	83.8		
#4	74.2		
#10	64.6		
#20	53.3		
#40	44.1		
#60	34.0		
#100	25.1		
#200	17.8		
0.0535 mm.	16.2		
0.0382 mm.	14.2		
0.0273 mm.	12.1		
0.0195 mm.	10.1		
0.0143 mm.	9.1		
0.0102 mm.	7.1		
0.0072 mm.	6.1		
0.0052 mm.	4.2		
0.0037 mm.	3.2		
0.0015 mm.	2.1		

* (no specification provided)

Soil Description

Tan silty gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 12.2352 D_{85}= 10.0835 D_{60}= 1.4004
D_{50}= 0.6516 D_{30}= 0.2016 D_{15}= 0.0437
D_{10}= 0.0189 C_u= 74.17 C_c= 1.54

Classification

USCS= SM AASHTO= A-1-b

Remarks

Source of Sample: Grab Depth: 13.5-13.75
Sample Number: GEO-TP-106 / S-4

Date: 9.17.2025

Thielsch Engineering Inc.

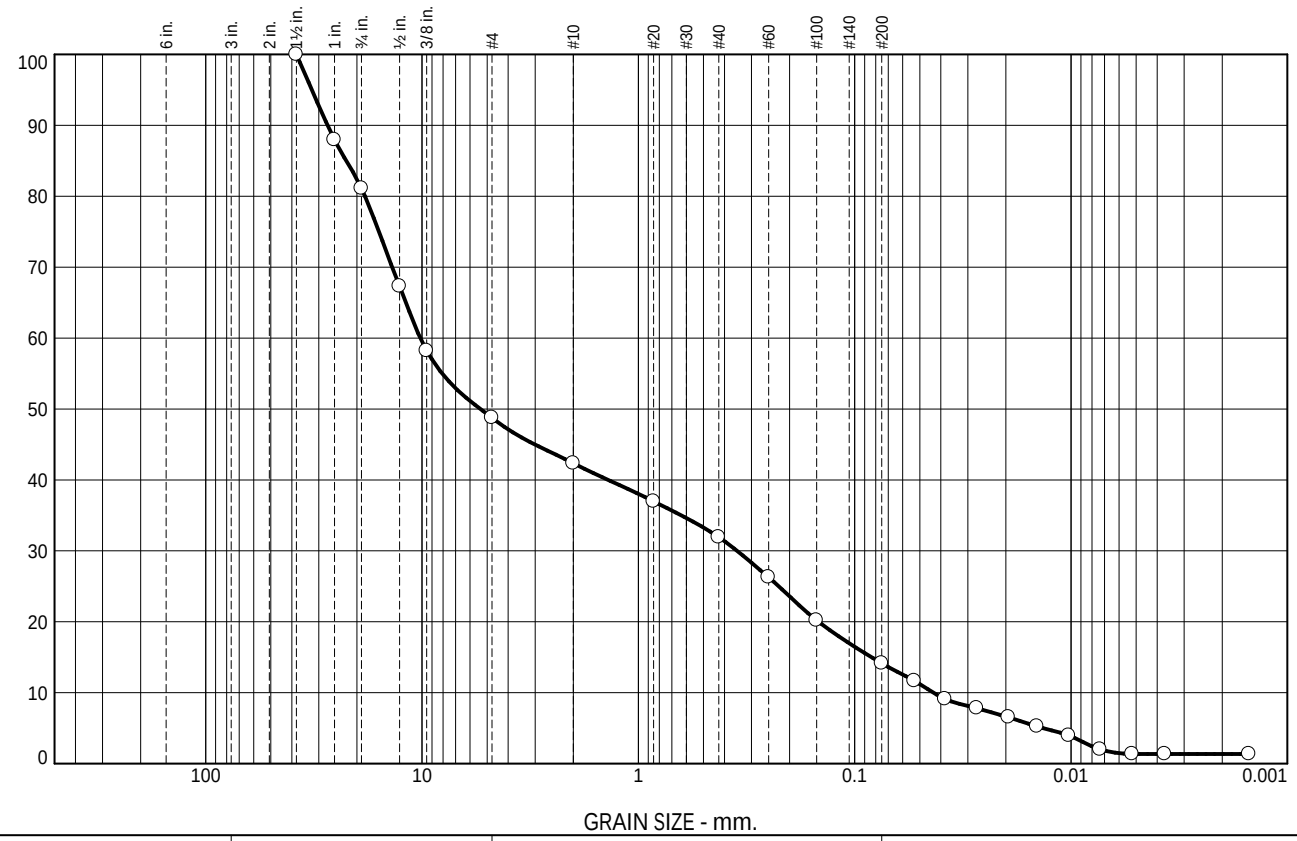
Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1899

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.9	32.3	6.4	10.5	17.8	12.7	1.4

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100.0		
1"	88.0		
3/4"	81.1		
1/2"	67.3		
3/8"	58.2		
#4	48.8		
#10	42.4		
#20	37.0		
#40	31.9		
#60	26.3		
#100	20.2		
#200	14.1		
0.0530 mm.	11.7		
0.0382 mm.	9.1		
0.0273 mm.	7.8		
0.0195 mm.	6.5		
0.0144 mm.	5.2		
0.0102 mm.	4.0		
0.0073 mm.	2.0		
0.0052 mm.	1.4		
0.0037 mm.	1.4		
0.0015 mm.	1.4		

* (no specification provided)

Soil Description

Tan silty gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 27.3294 D_{85}= 22.3899 D_{60}= 10.1967
D_{50}= 5.3658 D_{30}= 0.3495 D_{15}= 0.0836
D_{10}= 0.0433 C_u= 235.34 C_c= 0.28

Classification

USCS= GM AASHTO= A-1-b

Remarks

Source of Sample: Grab Depth: 8-8.5
Sample Number: GEO-TP-107 / S-3

Date: 9.17.2025

Thielsch Engineering Inc.

Cranston, RI

Client: GeoEngineers, Inc.
Project: Metro West YMCA
Ashland, MA
Project No: 27530-001-00

Figure 25-S-B1900

Tested By: MA Checked By: Michael Collins

Attachment C

Memorandum Limitations and Guidelines for Use

Attachment C
Memorandum Limitations and Guidelines For Use[1]

This appendix provides information to help you manage your risks with respect to the use of this memorandum.

READ THESE PROVISIONS CLOSELY

It is important to recognize that the geoscience practices (geotechnical engineering, geology, and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its memorandums. Please confer with GeoEngineers if you need to know more how these "Memorandum Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS, AND PROJECTS

This memorandum has been prepared for MetroWest YMCA and for the Project specifically identified in the memorandum. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this memorandum is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with MetroWest YMCA dated July 3, 2024, and Project Work Order No. 5 executed August 22, 2025 and generally accepted geotechnical practices in this area at the time this memorandum was prepared. We do not authorize, and will not be responsible for, the use of this memorandum for any purposes or projects other than those identified in the memorandum.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC MEMORANDUM IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This memorandum has been prepared for MetroWest YMCA in support of the stormwater management design for the Future Regional YMCA development located at 28 Memorial Drive in Ashland, Massachusetts. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and memorandum. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this memorandum if it was:

- Not prepared for you,
- Not prepared for your project,

1 Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this memorandum include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation, or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this memorandum, GeoEngineers cannot be responsible for any consequences of such changes in relation to this memorandum unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

Unless environmental services were specifically included in our scope of services, this memorandum does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic memorandum is based on conditions that existed at the time the study was performed. The findings and conclusions of this memorandum may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the memorandum date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our memorandum or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this memorandum for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

TOPSOIL

For the purposes of this memorandum, we consider topsoil to consist of generally fine-grained soil with an appreciable amount of organic matter based on visual examination and to be unsuitable for direct support of the proposed improvements. However, the organic content and other mineralogical and gradational characteristics used to evaluate the suitability of soil for use in landscaping and agricultural purposes was not determined, nor considered in our analyses. Therefore, the information and recommendations in this memorandum and our logs and descriptions should not be used as a basis for estimating the volume of topsoil available for such purposes.

GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this memorandum. Our memorandum, conclusions and interpretations are not a warranty of the actual subsurface conditions.

GEOTECHNICAL ENGINEERING MEMORANDUM RECOMMENDATIONS ARE NOT FINAL

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this memorandum are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this memorandum if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC MEMORANDUM COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this memorandum by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the memorandum, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic memorandum should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the memorandum can create a risk of misinterpretation.

GIVE CONTRACTORS A COMPLETE MEMORANDUM AND GUIDANCE

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic memorandum, including these "Memorandum Limitations and Guidelines for Use." When providing the memorandum, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the memorandum was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to conduct additional study to obtain the specific types of information they need or prefer.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule, or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

BIOLOGICAL POLLUTANTS

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants. Accordingly, this memorandum does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

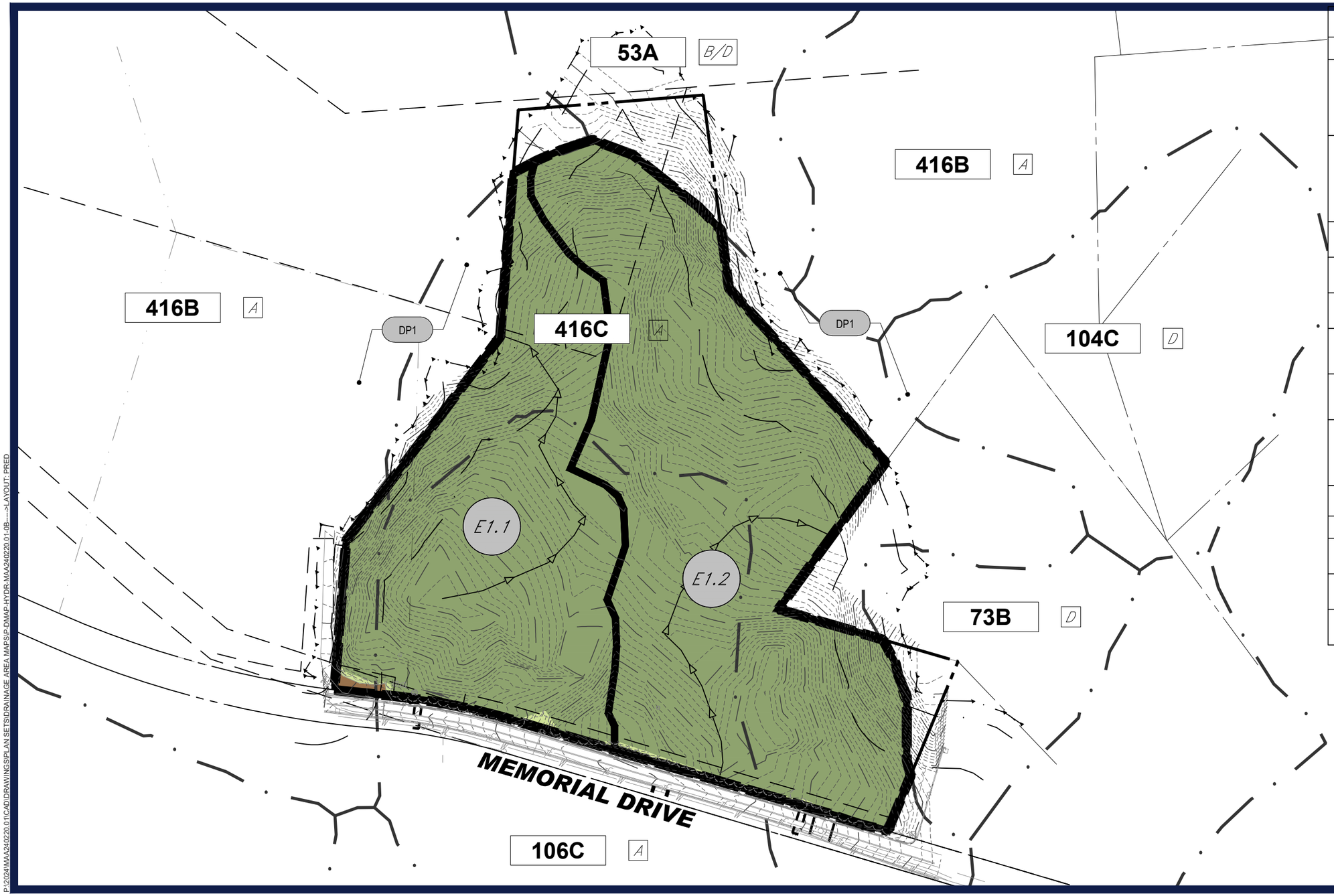
A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

INFORMATION PROVIDED BY OTHERS

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

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



LEGEND

EXISTING WATERSHED

- DESIGN POINT: DP1 / DP1
- SUBCATCHMENT ID: ED1.1 / ED1.1
- SUBCATCHMENT BOUNDARY
- OVERALL 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

LEGEND

EXISTING COVER TYPES

- GRASS / SOD / LAWN
- WOODED AREA
- GRAVEL

P:\2024\MAA240220.01\CAD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\P-DMAP-HYDR-MAA240220.01-0B----->LAYOUT: PRED

BOHLER

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www.BohlerEngineering.com

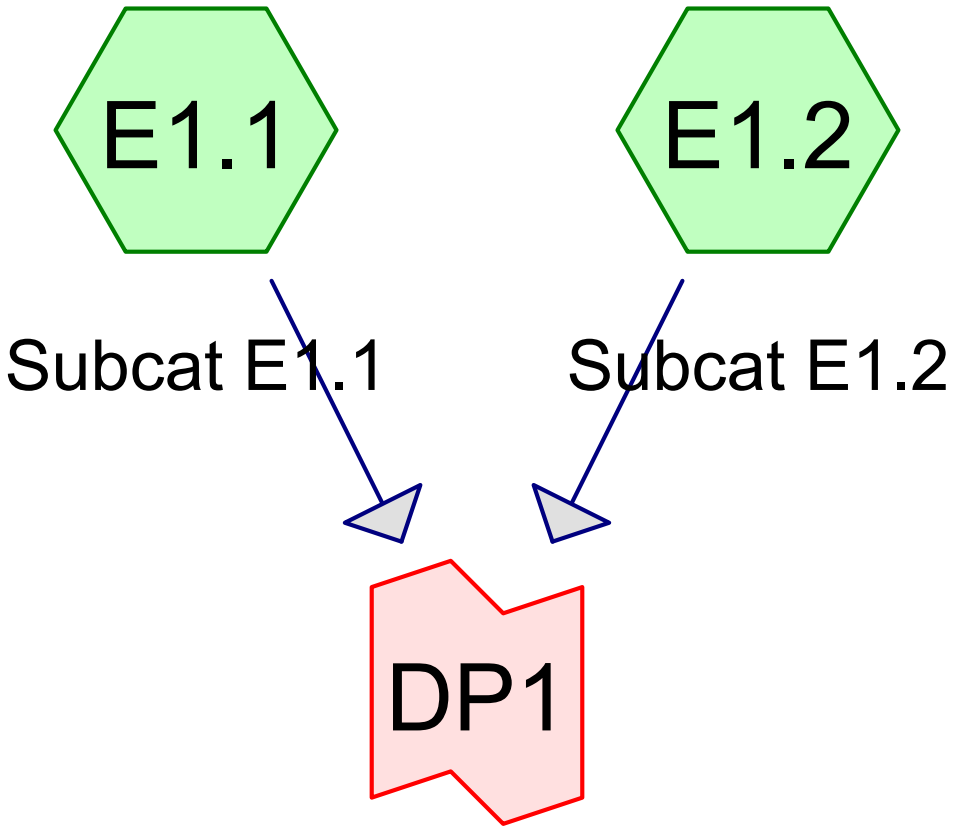
PREDEVELOPMENT WATERSHED MAP

cbt
ASHLAND, MA 01721

02-28-2025 | SB | MAA240220.01 | REV 0b

150 75 37.5 0 150

SCALE: 1" = 150'



Subcat Reach Pond Link

Routing Diagram for MAA240220 PRE TYPE B
Prepared by Bohler Engineering, PC, Printed 10/6/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 yr	Type III 24-hr		Default	24.00	1	3.36	2
2	10 yr	Type III 24-hr		Default	24.00	1	5.24	2
3	25 yr	Type III 24-hr		Default	24.00	1	6.42	2
4	100 yr	Type III 24-hr		Default	24.00	1	8.23	2

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

Subcatchment E1.1: Subcat E1.1 Runoff Area=4.744 ac 0.00% Impervious Runoff Depth=0.30"
Flow Length=590' Tc=11.2 min CN=55 Runoff=0.61 cfs 0.119 af

Subcatchment E1.2: Subcat E1.2 Runoff Area=6.980 ac 0.00% Impervious Runoff Depth=0.30"
Flow Length=570' Tc=12.8 min CN=55 Runoff=0.89 cfs 0.174 af

Link DP1: Trib. to Cold Spring Brook Inflow=1.50 cfs 0.293 af
Primary=1.50 cfs 0.293 af

Total Runoff Area = 11.724 ac Runoff Volume = 0.293 af Average Runoff Depth = 0.30"
100.00% Pervious = 11.724 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1.1: Subcat E1.1

Runoff = 0.61 cfs @ 12.39 hrs, Volume= 0.119 af, Depth= 0.30"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
4.744	55	Woods, Good, HSG B
4.744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.2	590	Total			

Summary for Subcatchment E1.2: Subcat E1.2

Runoff = 0.89 cfs @ 12.41 hrs, Volume= 0.174 af, Depth= 0.30"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
6.980	55	Woods, Good, HSG B
6.980		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	570	Total			

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 0.00% Impervious, Inflow Depth = 0.30" for 2 yr event
Inflow = 1.50 cfs @ 12.40 hrs, Volume= 0.293 af
Primary = 1.50 cfs @ 12.40 hrs, Volume= 0.293 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment E1.1: Subcat E1.1 Runoff Area=4.744 ac 0.00% Impervious Runoff Depth=1.10"
Flow Length=590' Tc=11.2 min CN=55 Runoff=4.15 cfs 0.436 af

Subcatchment E1.2: Subcat E1.2 Runoff Area=6.980 ac 0.00% Impervious Runoff Depth=1.10"
Flow Length=570' Tc=12.8 min CN=55 Runoff=5.88 cfs 0.641 af

Link DP1: Trib. to Cold Spring Brook Inflow=10.00 cfs 1.077 af
Primary=10.00 cfs 1.077 af

Total Runoff Area = 11.724 ac Runoff Volume = 1.077 af Average Runoff Depth = 1.10"
100.00% Pervious = 11.724 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1.1: Subcat E1.1

Runoff = 4.15 cfs @ 12.19 hrs, Volume= 0.436 af, Depth= 1.10"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
4.744	55	Woods, Good, HSG B
4.744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.2	590	Total			

Summary for Subcatchment E1.2: Subcat E1.2

Runoff = 5.88 cfs @ 12.21 hrs, Volume= 0.641 af, Depth= 1.10"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
6.980	55	Woods, Good, HSG B
6.980		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	570	Total			

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 0.00% Impervious, Inflow Depth = 1.10" for 10 yr event
Inflow = 10.00 cfs @ 12.20 hrs, Volume= 1.077 af
Primary = 10.00 cfs @ 12.20 hrs, Volume= 1.077 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment E1.1: Subcat E1.1 Runoff Area=4.744 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=590' Tc=11.2 min CN=55 Runoff=7.42 cfs 0.698 af

Subcatchment E1.2: Subcat E1.2 Runoff Area=6.980 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=570' Tc=12.8 min CN=55 Runoff=10.39 cfs 1.027 af

Link DP1: Trib. to Cold Spring Brook Inflow=17.65 cfs 1.724 af
Primary=17.65 cfs 1.724 af

Total Runoff Area = 11.724 ac Runoff Volume = 1.724 af Average Runoff Depth = 1.76"
100.00% Pervious = 11.724 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1.1: Subcat E1.1

Runoff = 7.42 cfs @ 12.17 hrs, Volume= 0.698 af, Depth= 1.76"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
4.744	55	Woods, Good, HSG B
4.744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.2	590	Total			

Summary for Subcatchment E1.2: Subcat E1.2

Runoff = 10.39 cfs @ 12.20 hrs, Volume= 1.027 af, Depth= 1.76"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
6.980	55	Woods, Good, HSG B
6.980		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	570	Total			

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 0.00% Impervious, Inflow Depth = 1.76" for 25 yr event
Inflow = 17.65 cfs @ 12.19 hrs, Volume= 1.724 af
Primary = 17.65 cfs @ 12.19 hrs, Volume= 1.724 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment E1.1: Subcat E1.1 Runoff Area=4.744 ac 0.00% Impervious Runoff Depth=2.94"
Flow Length=590' Tc=11.2 min CN=55 Runoff=13.14 cfs 1.163 af

Subcatchment E1.2: Subcat E1.2 Runoff Area=6.980 ac 0.00% Impervious Runoff Depth=2.94"
Flow Length=570' Tc=12.8 min CN=55 Runoff=18.36 cfs 1.711 af

Link DP1: Trib. to Cold Spring Brook Inflow=31.21 cfs 2.875 af
Primary=31.21 cfs 2.875 af

Total Runoff Area = 11.724 ac Runoff Volume = 2.875 af Average Runoff Depth = 2.94"
100.00% Pervious = 11.724 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1.1: Subcat E1.1

Runoff = 13.14 cfs @ 12.17 hrs, Volume= 1.163 af, Depth= 2.94"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
4.744	55	Woods, Good, HSG B
4.744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.2	590	Total			

Summary for Subcatchment E1.2: Subcat E1.2

Runoff = 18.36 cfs @ 12.19 hrs, Volume= 1.711 af, Depth= 2.94"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
6.980	55	Woods, Good, HSG B
6.980		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	570	Total			

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 0.00% Impervious, Inflow Depth = 2.94" for 100 yr event
Inflow = 31.21 cfs @ 12.18 hrs, Volume= 2.875 af
Primary = 31.21 cfs @ 12.18 hrs, Volume= 2.875 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

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

LEGEND

PROPOSED WATERSHED

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

LEGEND

PROPOSED COVER TYPES

BUILDING	
CONCRETE / WALK / PATIO PAVERS / MISC IMPERVIOUS	
GRASS / SOD / LAWN	
WOODED AREA	
WATER BODY / SURFACE BASIN	
GRAVEL	

P:\2024\MAA240220.01\CAD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\P-DMAP-HYDR-MAA240220.01-3B-----> LAYOUT: PSTD

POST-DEVELOPMENT WATERSHED MAP

BOHLER
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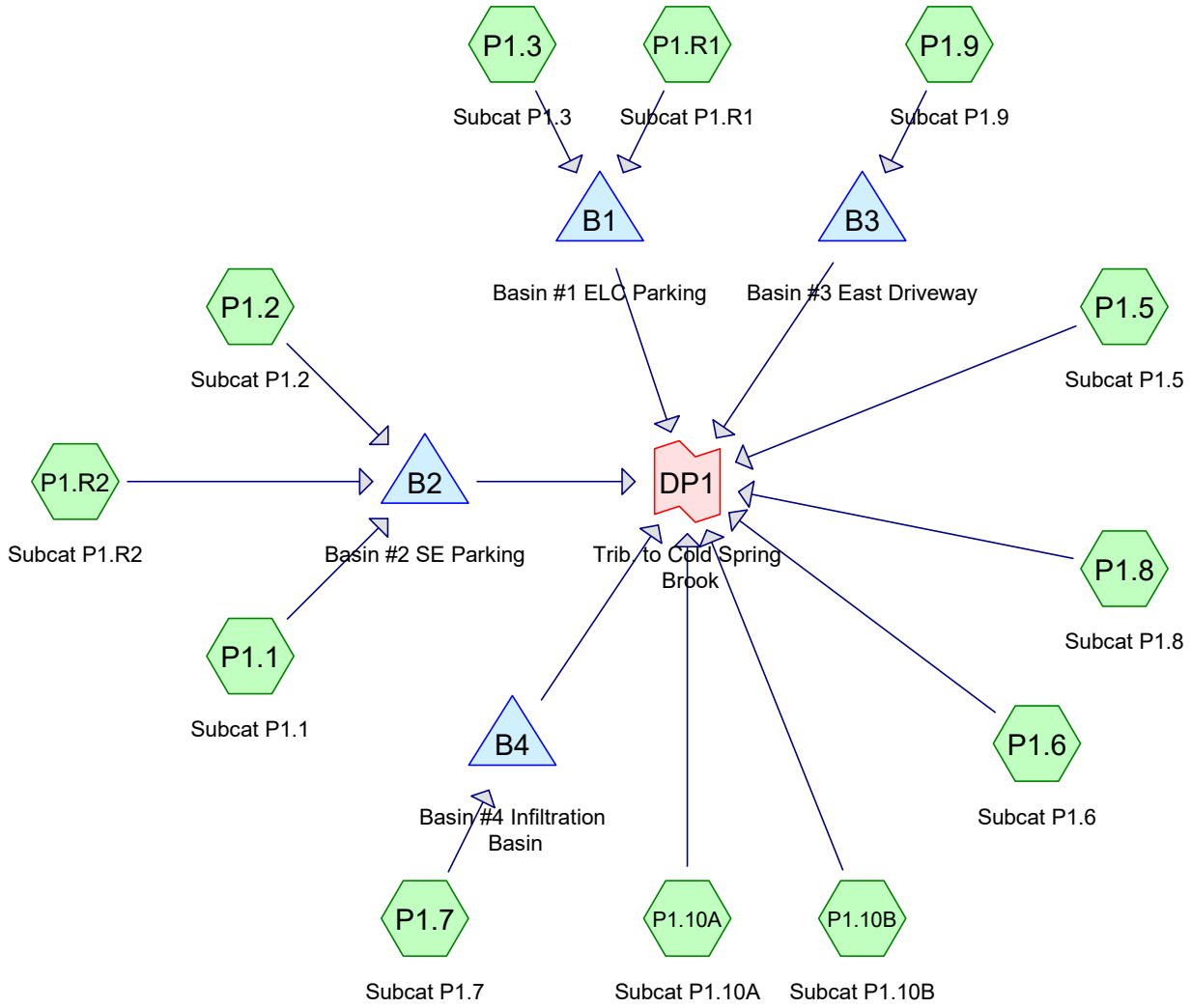
10/06/25 | SB | MAA240220.01 | REV 3b

150 75 37.5 0 150

SCALE: 1" = 150'



Subcat Reach Pond Link

Routing Diagram for MAA240220 POST REV 11-24-25
Prepared by Bohler Engineering, PC, Printed 11/26/2025

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 yr	Type III 24-hr		Default	24.00	1	3.36	2
2	10 yr	Type III 24-hr		Default	24.00	1	5.24	2
3	25 yr	Type III 24-hr		Default	24.00	1	6.42	2
4	100 yr	Type III 24-hr		Default	24.00	1	8.23	2

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

Subcatchment P1.1: Subcat P1.1 Runoff Area=1.226 ac 83.28% Impervious Runoff Depth=2.50"
Tc=6.0 min CN=92 Runoff=3.43 cfs 0.256 af

Subcatchment P1.10A: Subcat P1.10A Runoff Area=0.178 ac 32.02% Impervious Runoff Depth=1.09"
Tc=0.0 min CN=73 Runoff=0.25 cfs 0.016 af

Subcatchment P1.10B: Subcat P1.10B Runoff Area=0.069 ac 8.43% Impervious Runoff Depth=0.64"
Tc=6.0 min CN=64 Runoff=0.04 cfs 0.004 af

Subcatchment P1.2: Subcat P1.2 Runoff Area=0.735 ac 82.18% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=91 Runoff=1.99 cfs 0.148 af

Subcatchment P1.3: Subcat P1.3 Runoff Area=0.983 ac 84.23% Impervious Runoff Depth=2.50"
Tc=6.0 min CN=92 Runoff=2.75 cfs 0.205 af

Subcatchment P1.5: Subcat P1.5 Runoff Area=2.286 ac 0.04% Impervious Runoff Depth=0.36"
Flow Length=170' Tc=8.3 min CN=57 Runoff=0.42 cfs 0.069 af

Subcatchment P1.6: Subcat P1.6 Runoff Area=2.205 ac 0.00% Impervious Runoff Depth=0.40"
Flow Length=220' Tc=6.0 min CN=58 Runoff=0.53 cfs 0.073 af

Subcatchment P1.7: Subcat P1.7 Runoff Area=2.351 ac 12.68% Impervious Runoff Depth=0.87"
Flow Length=200' Tc=9.8 min CN=69 Runoff=1.86 cfs 0.171 af

Subcatchment P1.8: Subcat P1.8 Runoff Area=0.613 ac 0.00% Impervious Runoff Depth=0.36"
Flow Length=90' Tc=6.0 min CN=57 Runoff=0.12 cfs 0.019 af

Subcatchment P1.9: Subcat P1.9 Runoff Area=0.152 ac 62.67% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=84 Runoff=0.32 cfs 0.023 af

Subcatchment P1.R1: Subcat P1.R1 Runoff Area=0.216 ac 100.00% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=0.69 cfs 0.056 af

Subcatchment P1.R2: Subcat P1.R2 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=2.26 cfs 0.185 af

Pond B1: Basin #1 ELC Parking Peak Elev=244.07' Storage=5,260 cf Inflow=3.44 cfs 0.261 af
Discarded=0.08 cfs 0.189 af Primary=0.50 cfs 0.072 af Outflow=0.59 cfs 0.261 af

Pond B2: Basin #2 SE Parking Peak Elev=245.82' Storage=12,142 cf Inflow=7.68 cfs 0.588 af
Discarded=0.34 cfs 0.535 af Primary=0.16 cfs 0.053 af Outflow=0.50 cfs 0.588 af

Pond B3: Basin #3 East Driveway Peak Elev=238.67' Storage=550 cf Inflow=0.32 cfs 0.023 af
Discarded=0.01 cfs 0.023 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.023 af

Pond B4: Basin #4 Infiltration Basin Peak Elev=231.39' Storage=4,094 cf Inflow=1.86 cfs 0.171 af
Discarded=0.03 cfs 0.051 af Primary=0.16 cfs 0.053 af Outflow=0.19 cfs 0.104 af

Link DP1: Trib. to Cold Spring Brook

Inflow=1.45 cfs 0.360 af
Primary=1.45 cfs 0.360 af

Total Runoff Area = 11.724 ac Runoff Volume = 1.224 af Average Runoff Depth = 1.25"
67.28% Pervious = 7.888 ac 32.72% Impervious = 3.836 ac

Summary for Subcatchment P1.1: Subcat P1.1

Runoff = 3.43 cfs @ 12.09 hrs, Volume= 0.256 af, Depth= 2.50"
Routed to Pond B2 : Basin #2 SE Parking

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

Area (ac)	CN	Description
0.205	61	>75% Grass cover, Good, HSG B
1.021	98	Paved parking, HSG B
1.226	92	Weighted Average
0.205		16.72% Pervious Area
1.021		83.28% Impervious Area

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

Summary for Subcatchment P1.10A: Subcat P1.10A

Runoff = 0.25 cfs @ 12.01 hrs, Volume= 0.016 af, Depth= 1.09"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
0.121	61	>75% Grass cover, Good, HSG B
0.057	98	Paved parking, HSG B
0.178	73	Weighted Average
0.121		67.98% Pervious Area
0.057		32.02% Impervious Area

Summary for Subcatchment P1.10B: Subcat P1.10B

Runoff = 0.04 cfs @ 12.11 hrs, Volume= 0.004 af, Depth= 0.64"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
0.063	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.069	64	Weighted Average
0.063		91.57% Pervious Area
0.006		8.43% Impervious Area

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

Summary for Subcatchment P1.2: Subcat P1.2

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 0.148 af, Depth= 2.41"
Routed to Pond B2 : Basin #2 SE Parking

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

Area (ac)	CN	Description
0.131	61	>75% Grass cover, Good, HSG B
0.604	98	Paved parking, HSG B
0.735	91	Weighted Average
0.131		17.82% Pervious Area
0.604		82.18% Impervious Area

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

Summary for Subcatchment P1.3: Subcat P1.3

Runoff = 2.75 cfs @ 12.09 hrs, Volume= 0.205 af, Depth= 2.50"
Routed to Pond B1 : Basin #1 ELC Parking

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

Area (ac)	CN	Description
0.155	61	>75% Grass cover, Good, HSG B
0.804	98	Paved parking, HSG B
0.024	98	Roofs, HSG B
0.983	92	Weighted Average
0.155		15.77% Pervious Area
0.828		84.23% Impervious Area

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

Summary for Subcatchment P1.5: Subcat P1.5

Runoff = 0.42 cfs @ 12.20 hrs, Volume= 0.069 af, Depth= 0.36"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
0.600	61	>75% Grass cover, Good, HSG B
0.171	48	Brush, Good, HSG B
0.044	96	Gravel surface, HSG B
0.001	98	Paved parking, HSG B
0.000	98	Roofs, HSG B
1.470	55	Woods, Good, HSG B
2.286	57	Weighted Average
2.285		99.96% Pervious Area
0.001		0.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	70	0.0150	0.14		**Sheet Flow, Soccer field** Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
8.3	170	Total			

Summary for Subcatchment P1.6: Subcat P1.6

Runoff = 0.53 cfs @ 12.15 hrs, Volume= 0.073 af, Depth= 0.40"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
0.608	61	>75% Grass cover, Good, HSG B
0.373	48	Brush, Good, HSG B
0.114	96	Gravel surface, HSG B
0.000	98	Paved parking, HSG B
1.110	55	Woods, Good, HSG B
2.205	58	Weighted Average
2.205		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	100	0.1500	0.39		**Sheet Flow, soccer field** Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
1.1					**Direct Entry, To make min. allowable**
6.0	220	Total			

Summary for Subcatchment P1.7: Subcat P1.7

Runoff = 1.86 cfs @ 12.16 hrs, Volume= 0.171 af, Depth= 0.87"
Routed to Pond B4 : Basin #4 Infiltration Basin

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

Area (ac)	CN	Description
1.857	61	>75% Grass cover, Good, HSG B
0.193	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.003	55	Woods, Good, HSG B
0.046	98	Roofs, HSG B
0.102	98	Paved parking, HSG B
2.351	69	Weighted Average
2.053		87.32% Pervious Area
0.298		12.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		**Sheet Flow, Playgrround** Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	200	Total			

Summary for Subcatchment P1.8: Subcat P1.8

Runoff = 0.12 cfs @ 12.16 hrs, Volume= 0.019 af, Depth= 0.36"
Routed to Link DP1 : Trib. to Cold Spring Brook

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

Area (ac)	CN	Description
0.168	61	>75% Grass cover, Good, HSG B
0.446	55	Woods, Good, HSG B
0.613	57	Weighted Average
0.613		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry, To make min. allowable**
3.9	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	90	Total			

Summary for Subcatchment P1.9: Subcat P1.9

Runoff = 0.32 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 1.82"
Routed to Pond B3 : Basin #3 East Driveway

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

Area (ac)	CN	Description
0.057	61	>75% Grass cover, Good, HSG B
0.095	98	Paved parking, HSG B
0.152	84	Weighted Average
0.057		37.33% Pervious Area
0.095		62.67% Impervious Area

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

Summary for Subcatchment P1.R1: Subcat P1.R1

Runoff = 0.69 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 3.13"
Routed to Pond B1 : Basin #1 ELC Parking

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

Area (ac)	CN	Description
0.216	98	Roofs, HSG B
0.216		100.00% Impervious Area

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

Summary for Subcatchment P1.R2: Subcat P1.R2

Runoff = 2.26 cfs @ 12.09 hrs, Volume= 0.185 af, Depth= 3.13"
Routed to Pond B2 : Basin #2 SE Parking

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

Area (ac)	CN	Description
0.709	98	Roofs, HSG B
0.709		100.00% Impervious Area

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

Summary for Pond B1: Basin #1 ELC Parking

Inflow Area = 1.199 ac, 87.08% Impervious, Inflow Depth = 2.62" for 2 yr event
Inflow = 3.44 cfs @ 12.09 hrs, Volume= 0.261 af
Outflow = 0.59 cfs @ 12.56 hrs, Volume= 0.261 af, Atten= 83%, Lag= 28.3 min
Discarded = 0.08 cfs @ 12.56 hrs, Volume= 0.189 af
Primary = 0.50 cfs @ 12.56 hrs, Volume= 0.072 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 244.07' @ 12.56 hrs Surf.Area= 4,890 sf Storage= 5,260 cf

Plug-Flow detention time= 372.4 min calculated for 0.261 af (100% of inflow)
Center-of-Mass det. time= 371.9 min (1,159.2 - 787.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	4,579 cf	**44.25'W x 110.52'L x 3.75'H Field A** 18,339 cf Overall - 6,892 cf Embedded = 11,447 cf x 40.0% Voids
#2A	243.00'	6,892 cf	**ADS_StormTech SC-800 +Cap** x 135 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 135 Chambers in 9 Rows Cap Storage= 3.4 cf x 2 x 9 rows = 61.6 cf
		11,470 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	**0.680 in/hr Exfiltration over Wetted area**
#2	Primary	242.50'	**12.0" Round Culvert** L= 79.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 242.50' / 242.10' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	243.75'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

#4 Device 2 245.10' **4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.08 cfs @ 12.56 hrs HW=244.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.50 cfs @ 12.56 hrs HW=244.07' (Free Discharge)
└**2=Culvert** (Passes 0.50 cfs of 3.27 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.50 cfs @ 1.93 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B2: Basin #2 SE Parking

Inflow Area = 2.670 ac, 87.42% Impervious, Inflow Depth = 2.64" for 2 yr event
Inflow = 7.68 cfs @ 12.09 hrs, Volume= 0.588 af
Outflow = 0.50 cfs @ 13.70 hrs, Volume= 0.588 af, Atten= 93%, Lag= 96.5 min
Discarded = 0.34 cfs @ 13.70 hrs, Volume= 0.535 af
Primary = 0.16 cfs @ 13.70 hrs, Volume= 0.053 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 245.82' @ 13.70 hrs Surf.Area= 13,742 sf Storage= 12,142 cf

Plug-Flow detention time= 284.4 min calculated for 0.588 af (100% of inflow)
Center-of-Mass det. time= 284.2 min (1,068.6 - 784.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	12,685 cf	**63.25'W x 217.27'L x 3.75'H Field A** 51,533 cf Overall - 19,820 cf Embedded = 31,713 cf x 40.0% Voids
#2A	245.00'	19,820 cf	**ADS_StormTech SC-800 +Cap** x 390 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 390 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		32,505 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	**1.000 in/hr Exfiltration over Wetted area**
#2	Primary	244.00'	**15.0" Round Culvert** L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 244.00' / 242.88' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 2	245.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.30'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.34 cfs @ 13.70 hrs HW=245.82' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=0.17 cfs @ 13.70 hrs HW=245.82' (Free Discharge)
└**2=Culvert** (Passes 0.17 cfs of 6.46 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.17 cfs @ 1.92 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B3: Basin #3 East Driveway

Inflow Area = 0.152 ac, 62.67% Impervious, Inflow Depth = 1.82" for 2 yr event
Inflow = 0.32 cfs @ 12.09 hrs, Volume= 0.023 af
Outflow = 0.01 cfs @ 15.40 hrs, Volume= 0.023 af, Atten= 96%, Lag= 198.1 min
Discarded = 0.01 cfs @ 15.40 hrs, Volume= 0.023 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 238.67' @ 15.40 hrs Surf.Area= 536 sf Storage= 550 cf

Plug-Flow detention time= 408.5 min calculated for 0.023 af (100% of inflow)
Center-of-Mass det. time= 408.6 min (1,235.9 - 827.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	237.00'	803 cf	**15.58'W x 34.38'L x 5.50'H Field A** 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 8 Chambers in 2 Rows Cap Storage= 14.9 cf x 2 x 2 rows = 59.6 cf
		1,742 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**0.880 in/hr Exfiltration over Wetted area**
#2	Primary	237.00'	**12.0" Round Culvert** L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 237.00' / 236.69' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	240.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 15.40 hrs HW=238.67' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=237.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B4: Basin #4 Infiltration Basin

Inflow Area = 2.351 ac, 12.68% Impervious, Inflow Depth = 0.87" for 2 yr event
Inflow = 1.86 cfs @ 12.16 hrs, Volume= 0.171 af
Outflow = 0.19 cfs @ 14.23 hrs, Volume= 0.104 af, Atten= 90%, Lag= 124.6 min
Discarded = 0.03 cfs @ 14.23 hrs, Volume= 0.051 af
Primary = 0.16 cfs @ 14.23 hrs, Volume= 0.053 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 231.39' @ 14.23 hrs Surf.Area= 3,451 sf Storage= 4,094 cf

Plug-Flow detention time= 461.6 min calculated for 0.104 af (61% of inflow)
Center-of-Mass det. time= 337.7 min (1,216.9 - 879.1)

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.50	0	0	0	0
230.00	2,004	334	334	2,004
231.00	3,027	2,498	2,832	3,043
232.00	4,171	3,584	6,416	4,206
233.00	14,809	8,946	15,362	14,849

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.50'	**0.330 in/hr Exfiltration over Wetted area**
#2	Primary	232.50'	**6.0' long x 12.0' 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) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	226.50'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 226.50' / 225.00' S= 0.0375 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	231.35'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 14.23 hrs HW=231.39' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.16 cfs @ 14.23 hrs HW=231.39' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 0.16 cfs of 7.92 cfs potential flow)
└**4=Orifice/Grate** (Weir Controls 0.16 cfs @ 0.65 fps)

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 32.72% Impervious, Inflow Depth = 0.37" for 2 yr event
Inflow = 1.45 cfs @ 12.39 hrs, Volume= 0.360 af
Primary = 1.45 cfs @ 12.39 hrs, Volume= 0.360 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment P1.1: Subcat P1.1 Runoff Area=1.226 ac 83.28% Impervious Runoff Depth=4.32"
Tc=6.0 min CN=92 Runoff=5.75 cfs 0.442 af

Subcatchment P1.10A: Subcat P1.10A Runoff Area=0.178 ac 32.02% Impervious Runoff Depth=2.47"
Tc=0.0 min CN=73 Runoff=0.59 cfs 0.037 af

Subcatchment P1.10B: Subcat P1.10B Runoff Area=0.069 ac 8.43% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=64 Runoff=0.13 cfs 0.010 af

Subcatchment P1.2: Subcat P1.2 Runoff Area=0.735 ac 82.18% Impervious Runoff Depth=4.22"
Tc=6.0 min CN=91 Runoff=3.39 cfs 0.258 af

Subcatchment P1.3: Subcat P1.3 Runoff Area=0.983 ac 84.23% Impervious Runoff Depth=4.32"
Tc=6.0 min CN=92 Runoff=4.61 cfs 0.354 af

Subcatchment P1.5: Subcat P1.5 Runoff Area=2.286 ac 0.04% Impervious Runoff Depth=1.23"
Flow Length=170' Tc=8.3 min CN=57 Runoff=2.58 cfs 0.235 af

Subcatchment P1.6: Subcat P1.6 Runoff Area=2.205 ac 0.00% Impervious Runoff Depth=1.30"
Flow Length=220' Tc=6.0 min CN=58 Runoff=2.94 cfs 0.239 af

Subcatchment P1.7: Subcat P1.7 Runoff Area=2.351 ac 12.68% Impervious Runoff Depth=2.13"
Flow Length=200' Tc=9.8 min CN=69 Runoff=5.01 cfs 0.418 af

Subcatchment P1.8: Subcat P1.8 Runoff Area=0.613 ac 0.00% Impervious Runoff Depth=1.23"
Flow Length=90' Tc=6.0 min CN=57 Runoff=0.76 cfs 0.063 af

Subcatchment P1.9: Subcat P1.9 Runoff Area=0.152 ac 62.67% Impervious Runoff Depth=3.49"
Tc=6.0 min CN=84 Runoff=0.60 cfs 0.044 af

Subcatchment P1.R1: Subcat P1.R1 Runoff Area=0.216 ac 100.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=98 Runoff=1.08 cfs 0.090 af

Subcatchment P1.R2: Subcat P1.R2 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=98 Runoff=3.55 cfs 0.296 af

Pond B1: Basin #1 ELC Parking Peak Elev=244.97' Storage=8,440 cf Inflow=5.69 cfs 0.444 af
Discarded=0.09 cfs 0.205 af Primary=1.29 cfs 0.229 af Outflow=1.38 cfs 0.435 af

Pond B2: Basin #2 SE Parking Peak Elev=246.79' Storage=22,216 cf Inflow=12.68 cfs 0.996 af
Discarded=0.35 cfs 0.703 af Primary=0.44 cfs 0.292 af Outflow=0.79 cfs 0.996 af

Pond B3: Basin #3 East Driveway Peak Elev=240.12' Storage=1,118 cf Inflow=0.60 cfs 0.044 af
Discarded=0.02 cfs 0.034 af Primary=0.02 cfs 0.004 af Outflow=0.04 cfs 0.038 af

Pond B4: Basin #4 Infiltration Basin Peak Elev=231.65' Storage=5,024 cf Inflow=5.01 cfs 0.418 af
Discarded=0.03 cfs 0.053 af Primary=3.35 cfs 0.298 af Outflow=3.38 cfs 0.351 af

Link DP1: Trib. to Cold Spring Brook Inflow=9.19 cfs 1.408 af
Primary=9.19 cfs 1.408 af

Total Runoff Area = 11.724 ac Runoff Volume = 2.487 af Average Runoff Depth = 2.55"
67.28% Pervious = 7.888 ac 32.72% Impervious = 3.836 ac

Summary for Subcatchment P1.1: Subcat P1.1

Runoff = 5.75 cfs @ 12.09 hrs, Volume= 0.442 af, Depth= 4.32"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.205	61	>75% Grass cover, Good, HSG B
1.021	98	Paved parking, HSG B
1.226	92	Weighted Average
0.205		16.72% Pervious Area
1.021		83.28% Impervious Area

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

Summary for Subcatchment P1.10A: Subcat P1.10A

Runoff = 0.59 cfs @ 12.01 hrs, Volume= 0.037 af, Depth= 2.47"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.121	61	>75% Grass cover, Good, HSG B
0.057	98	Paved parking, HSG B
0.178	73	Weighted Average
0.121		67.98% Pervious Area
0.057		32.02% Impervious Area

Summary for Subcatchment P1.10B: Subcat P1.10B

Runoff = 0.13 cfs @ 12.10 hrs, Volume= 0.010 af, Depth= 1.74"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.063	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.069	64	Weighted Average
0.063		91.57% Pervious Area
0.006		8.43% Impervious Area

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

Summary for Subcatchment P1.2: Subcat P1.2

Runoff = 3.39 cfs @ 12.09 hrs, Volume= 0.258 af, Depth= 4.22"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.131	61	>75% Grass cover, Good, HSG B
0.604	98	Paved parking, HSG B
0.735	91	Weighted Average
0.131		17.82% Pervious Area
0.604		82.18% Impervious Area

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

Summary for Subcatchment P1.3: Subcat P1.3

Runoff = 4.61 cfs @ 12.09 hrs, Volume= 0.354 af, Depth= 4.32"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.155	61	>75% Grass cover, Good, HSG B
0.804	98	Paved parking, HSG B
0.024	98	Roofs, HSG B
0.983	92	Weighted Average
0.155		15.77% Pervious Area
0.828		84.23% Impervious Area

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

Summary for Subcatchment P1.5: Subcat P1.5

Runoff = 2.58 cfs @ 12.14 hrs, Volume= 0.235 af, Depth= 1.23"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.600	61	>75% Grass cover, Good, HSG B
0.171	48	Brush, Good, HSG B
0.044	96	Gravel surface, HSG B
0.001	98	Paved parking, HSG B
0.000	98	Roofs, HSG B
1.470	55	Woods, Good, HSG B
2.286	57	Weighted Average
2.285		99.96% Pervious Area
0.001		0.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	70	0.0150	0.14		**Sheet Flow, Soccer field** Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
8.3	170	Total			

Summary for Subcatchment P1.6: Subcat P1.6

Runoff = 2.94 cfs @ 12.11 hrs, Volume= 0.239 af, Depth= 1.30"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.608	61	>75% Grass cover, Good, HSG B
0.373	48	Brush, Good, HSG B
0.114	96	Gravel surface, HSG B
0.000	98	Paved parking, HSG B
1.110	55	Woods, Good, HSG B
2.205	58	Weighted Average
2.205		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	100	0.1500	0.39		**Sheet Flow, soccer field** Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
1.1					**Direct Entry, To make min. allowable**
6.0	220	Total			

Summary for Subcatchment P1.7: Subcat P1.7

Runoff = 5.01 cfs @ 12.15 hrs, Volume= 0.418 af, Depth= 2.13"
Routed to Pond B4 : Basin #4 Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
1.857	61	>75% Grass cover, Good, HSG B
0.193	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.003	55	Woods, Good, HSG B
0.046	98	Roofs, HSG B
0.102	98	Paved parking, HSG B
2.351	69	Weighted Average
2.053		87.32% Pervious Area
0.298		12.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		**Sheet Flow, Playgrround** Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	200	Total			

Summary for Subcatchment P1.8: Subcat P1.8

Runoff = 0.76 cfs @ 12.11 hrs, Volume= 0.063 af, Depth= 1.23"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.168	61	>75% Grass cover, Good, HSG B
0.446	55	Woods, Good, HSG B
0.613	57	Weighted Average
0.613		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry, To make min. allowable**
3.9	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	90	Total			

Summary for Subcatchment P1.9: Subcat P1.9

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.044 af, Depth= 3.49"
Routed to Pond B3 : Basin #3 East Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.057	61	>75% Grass cover, Good, HSG B
0.095	98	Paved parking, HSG B
0.152	84	Weighted Average
0.057		37.33% Pervious Area
0.095		62.67% Impervious Area

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

Summary for Subcatchment P1.R1: Subcat P1.R1

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 5.00"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.216	98	Roofs, HSG B
0.216		100.00% Impervious Area

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

Summary for Subcatchment P1.R2: Subcat P1.R2

Runoff = 3.55 cfs @ 12.09 hrs, Volume= 0.296 af, Depth= 5.00"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=5.24"

Area (ac)	CN	Description
0.709	98	Roofs, HSG B
0.709		100.00% Impervious Area

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

Summary for Pond B1: Basin #1 ELC Parking

Inflow Area = 1.199 ac, 87.08% Impervious, Inflow Depth = 4.45" for 10 yr event
Inflow = 5.69 cfs @ 12.09 hrs, Volume= 0.444 af
Outflow = 1.38 cfs @ 12.47 hrs, Volume= 0.435 af, Atten= 76%, Lag= 23.0 min
Discarded = 0.09 cfs @ 12.47 hrs, Volume= 0.205 af
Primary = 1.29 cfs @ 12.47 hrs, Volume= 0.229 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 244.97' @ 12.47 hrs Surf.Area= 4,890 sf Storage= 8,440 cf

Plug-Flow detention time= 259.2 min calculated for 0.434 af (98% of inflow)
Center-of-Mass det. time= 246.5 min (1,020.9 - 774.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	4,579 cf	**44.25'W x 110.52'L x 3.75'H Field A** 18,339 cf Overall - 6,892 cf Embedded = 11,447 cf x 40.0% Voids
#2A	243.00'	6,892 cf	**ADS_StormTech SC-800 +Cap** x 135 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 135 Chambers in 9 Rows Cap Storage= 3.4 cf x 2 x 9 rows = 61.6 cf
		11,470 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	**0.680 in/hr Exfiltration over Wetted area**
#2	Primary	242.50'	**12.0" Round Culvert** L= 79.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 242.50' / 242.10' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	243.75'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

#4 Device 2 245.10' **4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.47 hrs HW=244.97' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=1.29 cfs @ 12.47 hrs HW=244.97' (Free Discharge)
└**2=Culvert** (Passes 1.29 cfs of 4.53 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 1.29 cfs @ 4.94 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B2: Basin #2 SE Parking

Inflow Area = 2.670 ac, 87.42% Impervious, Inflow Depth = 4.47" for 10 yr event
Inflow = 12.68 cfs @ 12.09 hrs, Volume= 0.996 af
Outflow = 0.79 cfs @ 13.73 hrs, Volume= 0.996 af, Atten= 94%, Lag= 98.6 min
Discarded = 0.35 cfs @ 13.73 hrs, Volume= 0.703 af
Primary = 0.44 cfs @ 13.73 hrs, Volume= 0.292 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 246.79' @ 13.73 hrs Surf.Area= 13,742 sf Storage= 22,216 cf

Plug-Flow detention time= 341.0 min calculated for 0.996 af (100% of inflow)
Center-of-Mass det. time= 340.9 min (1,113.1 - 772.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	12,685 cf	**63.25'W x 217.27'L x 3.75'H Field A** 51,533 cf Overall - 19,820 cf Embedded = 31,713 cf x 40.0% Voids
#2A	245.00'	19,820 cf	**ADS_StormTech SC-800 +Cap** x 390 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 390 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		32,505 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	**1.000 in/hr Exfiltration over Wetted area**
#2	Primary	244.00'	**15.0" Round Culvert** L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 244.00' / 242.88' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 2	245.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.30'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.35 cfs @ 13.73 hrs HW=246.79' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=0.44 cfs @ 13.73 hrs HW=246.79' (Free Discharge)
└**2=Culvert** (Passes 0.44 cfs of 8.31 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.44 cfs @ 5.09 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B3: Basin #3 East Driveway

Inflow Area = 0.152 ac, 62.67% Impervious, Inflow Depth = 3.49" for 10 yr event
Inflow = 0.60 cfs @ 12.09 hrs, Volume= 0.044 af
Outflow = 0.04 cfs @ 13.96 hrs, Volume= 0.038 af, Atten= 94%, Lag= 112.4 min
Discarded = 0.02 cfs @ 13.96 hrs, Volume= 0.034 af
Primary = 0.02 cfs @ 13.96 hrs, Volume= 0.004 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 240.12' @ 13.96 hrs Surf.Area= 536 sf Storage= 1,118 cf

Plug-Flow detention time= 542.7 min calculated for 0.038 af (86% of inflow)
Center-of-Mass det. time= 479.9 min (1,288.6 - 808.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	237.00'	803 cf	**15.58'W x 34.38'L x 5.50'H Field A** 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 8 Chambers in 2 Rows Cap Storage= 14.9 cf x 2 x 2 rows = 59.6 cf
		1,742 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**0.880 in/hr Exfiltration over Wetted area**
#2	Primary	237.00'	**12.0" Round Culvert** L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 237.00' / 236.69' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	240.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 13.96 hrs HW=240.12' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.02 cfs @ 13.96 hrs HW=240.12' (Free Discharge)
└**2=Culvert** (Passes 0.02 cfs of 5.55 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.18 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B4: Basin #4 Infiltration Basin

Inflow Area = 2.351 ac, 12.68% Impervious, Inflow Depth = 2.13" for 10 yr event
Inflow = 5.01 cfs @ 12.15 hrs, Volume= 0.418 af
Outflow = 3.38 cfs @ 12.30 hrs, Volume= 0.351 af, Atten= 32%, Lag= 9.0 min
Discarded = 0.03 cfs @ 12.30 hrs, Volume= 0.053 af
Primary = 3.35 cfs @ 12.30 hrs, Volume= 0.298 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 231.65' @ 12.30 hrs Surf.Area= 3,748 sf Storage= 5,024 cf

Plug-Flow detention time= 178.4 min calculated for 0.351 af (84% of inflow)
Center-of-Mass det. time= 109.0 min (960.2 - 851.2)

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.50	0	0	0	0
230.00	2,004	334	334	2,004
231.00	3,027	2,498	2,832	3,043
232.00	4,171	3,584	6,416	4,206
233.00	14,809	8,946	15,362	14,849

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.50'	**0.330 in/hr Exfiltration over Wetted area**
#2	Primary	232.50'	**6.0' long x 12.0' 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) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	226.50'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 226.50' / 225.00' S= 0.0375 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	231.35'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.30 hrs HW=231.65' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=3.34 cfs @ 12.30 hrs HW=231.65' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 3.34 cfs of 8.15 cfs potential flow)
└**4=Orifice/Grate** (Weir Controls 3.34 cfs @ 1.78 fps)

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 32.72% Impervious, Inflow Depth = 1.44" for 10 yr event
Inflow = 9.19 cfs @ 12.26 hrs, Volume= 1.408 af
Primary = 9.19 cfs @ 12.26 hrs, Volume= 1.408 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment P1.1: Subcat P1.1 Runoff Area=1.226 ac 83.28% Impervious Runoff Depth=5.48"
Tc=6.0 min CN=92 Runoff=7.19 cfs 0.560 af

Subcatchment P1.10A: Subcat P1.10A Runoff Area=0.178 ac 32.02% Impervious Runoff Depth=3.44"
Tc=0.0 min CN=73 Runoff=0.83 cfs 0.051 af

Subcatchment P1.10B: Subcat P1.10B Runoff Area=0.069 ac 8.43% Impervious Runoff Depth=2.57"
Tc=6.0 min CN=64 Runoff=0.20 cfs 0.015 af

Subcatchment P1.2: Subcat P1.2 Runoff Area=0.735 ac 82.18% Impervious Runoff Depth=5.37"
Tc=6.0 min CN=91 Runoff=4.26 cfs 0.329 af

Subcatchment P1.3: Subcat P1.3 Runoff Area=0.983 ac 84.23% Impervious Runoff Depth=5.48"
Tc=6.0 min CN=92 Runoff=5.76 cfs 0.449 af

Subcatchment P1.5: Subcat P1.5 Runoff Area=2.286 ac 0.04% Impervious Runoff Depth=1.94"
Flow Length=170' Tc=8.3 min CN=57 Runoff=4.36 cfs 0.369 af

Subcatchment P1.6: Subcat P1.6 Runoff Area=2.205 ac 0.00% Impervious Runoff Depth=2.02"
Flow Length=220' Tc=6.0 min CN=58 Runoff=4.85 cfs 0.372 af

Subcatchment P1.7: Subcat P1.7 Runoff Area=2.351 ac 12.68% Impervious Runoff Depth=3.04"
Flow Length=200' Tc=9.8 min CN=69 Runoff=7.24 cfs 0.596 af

Subcatchment P1.8: Subcat P1.8 Runoff Area=0.613 ac 0.00% Impervious Runoff Depth=1.94"
Flow Length=90' Tc=6.0 min CN=57 Runoff=1.28 cfs 0.099 af

Subcatchment P1.9: Subcat P1.9 Runoff Area=0.152 ac 62.67% Impervious Runoff Depth=4.59"
Tc=6.0 min CN=84 Runoff=0.79 cfs 0.058 af

Subcatchment P1.R1: Subcat P1.R1 Runoff Area=0.216 ac 100.00% Impervious Runoff Depth=6.18"
Tc=6.0 min CN=98 Runoff=1.33 cfs 0.112 af

Subcatchment P1.R2: Subcat P1.R2 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=6.18"
Tc=6.0 min CN=98 Runoff=4.36 cfs 0.365 af

Pond B1: Basin #1 ELC Parking Peak Elev=245.36' Storage=9,593 cf Inflow=7.09 cfs 0.561 af
Discarded=0.09 cfs 0.212 af Primary=3.19 cfs 0.336 af Outflow=3.28 cfs 0.548 af

Pond B2: Basin #2 SE Parking Peak Elev=247.43' Storage=27,792 cf Inflow=15.80 cfs 1.254 af
Discarded=0.36 cfs 0.779 af Primary=1.20 cfs 0.475 af Outflow=1.55 cfs 1.254 af

Pond B3: Basin #3 East Driveway Peak Elev=240.60' Storage=1,283 cf Inflow=0.79 cfs 0.058 af
Discarded=0.02 cfs 0.036 af Primary=0.08 cfs 0.015 af Outflow=0.09 cfs 0.051 af

Pond B4: Basin #4 Infiltration Basin Peak Elev=231.87' Storage=5,893 cf Inflow=7.24 cfs 0.596 af
Discarded=0.03 cfs 0.054 af Primary=5.47 cfs 0.475 af Outflow=5.50 cfs 0.529 af

Link DP1: Trib. to Cold Spring Brook

Inflow=17.01 cfs 2.206 af
Primary=17.01 cfs 2.206 af

Total Runoff Area = 11.724 ac Runoff Volume = 3.375 af Average Runoff Depth = 3.45"
67.28% Pervious = 7.888 ac 32.72% Impervious = 3.836 ac

Summary for Subcatchment P1.1: Subcat P1.1

Runoff = 7.19 cfs @ 12.09 hrs, Volume= 0.560 af, Depth= 5.48"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.205	61	>75% Grass cover, Good, HSG B
1.021	98	Paved parking, HSG B
1.226	92	Weighted Average
0.205		16.72% Pervious Area
1.021		83.28% Impervious Area

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

Summary for Subcatchment P1.10A: Subcat P1.10A

Runoff = 0.83 cfs @ 12.00 hrs, Volume= 0.051 af, Depth= 3.44"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.121	61	>75% Grass cover, Good, HSG B
0.057	98	Paved parking, HSG B
0.178	73	Weighted Average
0.121		67.98% Pervious Area
0.057		32.02% Impervious Area

Summary for Subcatchment P1.10B: Subcat P1.10B

Runoff = 0.20 cfs @ 12.10 hrs, Volume= 0.015 af, Depth= 2.57"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.063	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.069	64	Weighted Average
0.063		91.57% Pervious Area
0.006		8.43% Impervious Area

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

Summary for Subcatchment P1.2: Subcat P1.2

Runoff = 4.26 cfs @ 12.09 hrs, Volume= 0.329 af, Depth= 5.37"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.131	61	>75% Grass cover, Good, HSG B
0.604	98	Paved parking, HSG B
0.735	91	Weighted Average
0.131		17.82% Pervious Area
0.604		82.18% Impervious Area

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

Summary for Subcatchment P1.3: Subcat P1.3

Runoff = 5.76 cfs @ 12.09 hrs, Volume= 0.449 af, Depth= 5.48"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.155	61	>75% Grass cover, Good, HSG B
0.804	98	Paved parking, HSG B
0.024	98	Roofs, HSG B
0.983	92	Weighted Average
0.155		15.77% Pervious Area
0.828		84.23% Impervious Area

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

Summary for Subcatchment P1.5: Subcat P1.5

Runoff = 4.36 cfs @ 12.13 hrs, Volume= 0.369 af, Depth= 1.94"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.600	61	>75% Grass cover, Good, HSG B
0.171	48	Brush, Good, HSG B
0.044	96	Gravel surface, HSG B
0.001	98	Paved parking, HSG B
0.000	98	Roofs, HSG B
1.470	55	Woods, Good, HSG B
2.286	57	Weighted Average
2.285		99.96% Pervious Area
0.001		0.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	70	0.0150	0.14		**Sheet Flow, Soccer field** Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
8.3	170	Total			

Summary for Subcatchment P1.6: Subcat P1.6

Runoff = 4.85 cfs @ 12.10 hrs, Volume= 0.372 af, Depth= 2.02"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.608	61	>75% Grass cover, Good, HSG B
0.373	48	Brush, Good, HSG B
0.114	96	Gravel surface, HSG B
0.000	98	Paved parking, HSG B
1.110	55	Woods, Good, HSG B
2.205	58	Weighted Average
2.205		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	100	0.1500	0.39		**Sheet Flow, soccer field** Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
1.1					**Direct Entry, To make min. allowable**
6.0	220	Total			

Summary for Subcatchment P1.7: Subcat P1.7

Runoff = 7.24 cfs @ 12.14 hrs, Volume= 0.596 af, Depth= 3.04"
Routed to Pond B4 : Basin #4 Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
1.857	61	>75% Grass cover, Good, HSG B
0.193	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.003	55	Woods, Good, HSG B
0.046	98	Roofs, HSG B
0.102	98	Paved parking, HSG B
2.351	69	Weighted Average
2.053		87.32% Pervious Area
0.298		12.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		**Sheet Flow, Playgrround** Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	200	Total			

Summary for Subcatchment P1.8: Subcat P1.8

Runoff = 1.28 cfs @ 12.10 hrs, Volume= 0.099 af, Depth= 1.94"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.168	61	>75% Grass cover, Good, HSG B
0.446	55	Woods, Good, HSG B
0.613	57	Weighted Average
0.613		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry, To make min. allowable**
3.9	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	90	Total			

Summary for Subcatchment P1.9: Subcat P1.9

Runoff = 0.79 cfs @ 12.09 hrs, Volume= 0.058 af, Depth= 4.59"
Routed to Pond B3 : Basin #3 East Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.057	61	>75% Grass cover, Good, HSG B
0.095	98	Paved parking, HSG B
0.152	84	Weighted Average
0.057		37.33% Pervious Area
0.095		62.67% Impervious Area

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

Summary for Subcatchment P1.R1: Subcat P1.R1

Runoff = 1.33 cfs @ 12.09 hrs, Volume= 0.112 af, Depth= 6.18"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.216	98	Roofs, HSG B
0.216		100.00% Impervious Area

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

Summary for Subcatchment P1.R2: Subcat P1.R2

Runoff = 4.36 cfs @ 12.09 hrs, Volume= 0.365 af, Depth= 6.18"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.42"

Area (ac)	CN	Description
0.709	98	Roofs, HSG B
0.709		100.00% Impervious Area

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

Summary for Pond B1: Basin #1 ELC Parking

Inflow Area = 1.199 ac, 87.08% Impervious, Inflow Depth = 5.61" for 25 yr event
Inflow = 7.09 cfs @ 12.09 hrs, Volume= 0.561 af
Outflow = 3.28 cfs @ 12.27 hrs, Volume= 0.548 af, Atten= 54%, Lag= 10.9 min
Discarded = 0.09 cfs @ 12.27 hrs, Volume= 0.212 af
Primary = 3.19 cfs @ 12.27 hrs, Volume= 0.336 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 245.36' @ 12.27 hrs Surf.Area= 4,890 sf Storage= 9,593 cf

Plug-Flow detention time= 218.8 min calculated for 0.547 af (98% of inflow)
Center-of-Mass det. time= 205.1 min (974.1 - 769.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	4,579 cf	**44.25'W x 110.52'L x 3.75'H Field A** 18,339 cf Overall - 6,892 cf Embedded = 11,447 cf x 40.0% Voids
#2A	243.00'	6,892 cf	**ADS_StormTech SC-800 +Cap** x 135 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 135 Chambers in 9 Rows Cap Storage= 3.4 cf x 2 x 9 rows = 61.6 cf
		11,470 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	**0.680 in/hr Exfiltration over Wetted area**
#2	Primary	242.50'	**12.0" Round Culvert** L= 79.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 242.50' / 242.10' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	243.75'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

#4 Device 2 245.10' **4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.27 hrs HW=245.35' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=3.13 cfs @ 12.27 hrs HW=245.35' (Free Discharge)
└**2=Culvert** (Passes 3.13 cfs of 4.97 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 1.51 cfs @ 5.77 fps)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 1.62 cfs @ 1.64 fps)

Summary for Pond B2: Basin #2 SE Parking

Inflow Area = 2.670 ac, 87.42% Impervious, Inflow Depth = 5.64" for 25 yr event
Inflow = 15.80 cfs @ 12.09 hrs, Volume= 1.254 af
Outflow = 1.55 cfs @ 12.89 hrs, Volume= 1.254 af, Atten= 90%, Lag= 48.1 min
Discarded = 0.36 cfs @ 12.89 hrs, Volume= 0.779 af
Primary = 1.20 cfs @ 12.89 hrs, Volume= 0.475 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 247.43' @ 12.89 hrs Surf.Area= 13,742 sf Storage= 27,792 cf

Plug-Flow detention time= 354.3 min calculated for 1.254 af (100% of inflow)
Center-of-Mass det. time= 354.2 min (1,121.4 - 767.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	12,685 cf	**63.25'W x 217.27'L x 3.75'H Field A** 51,533 cf Overall - 19,820 cf Embedded = 31,713 cf x 40.0% Voids
#2A	245.00'	19,820 cf	**ADS_StormTech SC-800 +Cap** x 390 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 390 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		32,505 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	**1.000 in/hr Exfiltration over Wetted area**
#2	Primary	244.00'	**15.0" Round Culvert** L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 244.00' / 242.88' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 2	245.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.30'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.36 cfs @ 12.89 hrs HW=247.43' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=1.19 cfs @ 12.89 hrs HW=247.43' (Free Discharge)
└**2=Culvert** (Passes 1.19 cfs of 9.27 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.56 cfs @ 6.40 fps)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.64 cfs @ 1.20 fps)

Summary for Pond B3: Basin #3 East Driveway

Inflow Area = 0.152 ac, 62.67% Impervious, Inflow Depth = 4.59" for 25 yr event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 0.058 af
Outflow = 0.09 cfs @ 12.75 hrs, Volume= 0.051 af, Atten= 88%, Lag= 39.6 min
Discarded = 0.02 cfs @ 12.75 hrs, Volume= 0.036 af
Primary = 0.08 cfs @ 12.75 hrs, Volume= 0.015 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 240.60' @ 12.75 hrs Surf.Area= 536 sf Storage= 1,283 cf

Plug-Flow detention time= 425.4 min calculated for 0.051 af (87% of inflow)
Center-of-Mass det. time= 368.7 min (1,169.6 - 801.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	237.00'	803 cf	**15.58'W x 34.38'L x 5.50'H Field A** 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 8 Chambers in 2 Rows Cap Storage= 14.9 cf x 2 x 2 rows = 59.6 cf
		1,742 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**0.880 in/hr Exfiltration over Wetted area**
#2	Primary	237.00'	**12.0" Round Culvert** L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 237.00' / 236.69' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	240.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 12.75 hrs HW=240.60' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.08 cfs @ 12.75 hrs HW=240.60' (Free Discharge)
└**2=Culvert** (Passes 0.08 cfs of 6.07 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.08 cfs @ 3.45 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B4: Basin #4 Infiltration Basin

Inflow Area = 2.351 ac, 12.68% Impervious, Inflow Depth = 3.04" for 25 yr event
Inflow = 7.24 cfs @ 12.14 hrs, Volume= 0.596 af
Outflow = 5.50 cfs @ 12.25 hrs, Volume= 0.529 af, Atten= 24%, Lag= 6.2 min
Discarded = 0.03 cfs @ 12.25 hrs, Volume= 0.054 af
Primary = 5.47 cfs @ 12.25 hrs, Volume= 0.475 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 231.87' @ 12.25 hrs Surf.Area= 4,015 sf Storage= 5,893 cf

Plug-Flow detention time= 129.6 min calculated for 0.529 af (89% of inflow)
Center-of-Mass det. time= 76.2 min (916.9 - 840.8)

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.50	0	0	0	0
230.00	2,004	334	334	2,004
231.00	3,027	2,498	2,832	3,043
232.00	4,171	3,584	6,416	4,206
233.00	14,809	8,946	15,362	14,849

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.50'	**0.330 in/hr Exfiltration over Wetted area**
#2	Primary	232.50'	**6.0' long x 12.0' 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) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	226.50'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 226.50' / 225.00' S= 0.0375 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	231.35'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.25 hrs HW=231.87' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=5.46 cfs @ 12.25 hrs HW=231.87' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 5.46 cfs of 8.35 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 5.46 cfs @ 3.48 fps)

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 32.72% Impervious, Inflow Depth = 2.26" for 25 yr event
Inflow = 17.01 cfs @ 12.17 hrs, Volume= 2.206 af
Primary = 17.01 cfs @ 12.17 hrs, Volume= 2.206 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment P1.1: Subcat P1.1 Runoff Area=1.226 ac 83.28% Impervious Runoff Depth=7.27"
Tc=6.0 min CN=92 Runoff=9.38 cfs 0.743 af

Subcatchment P1.10A: Subcat P1.10A Runoff Area=0.178 ac 32.02% Impervious Runoff Depth=5.01"
Tc=0.0 min CN=73 Runoff=1.20 cfs 0.074 af

Subcatchment P1.10B: Subcat P1.10B Runoff Area=0.069 ac 8.43% Impervious Runoff Depth=3.97"
Tc=6.0 min CN=64 Runoff=0.31 cfs 0.023 af

Subcatchment P1.2: Subcat P1.2 Runoff Area=0.735 ac 82.18% Impervious Runoff Depth=7.15"
Tc=6.0 min CN=91 Runoff=5.57 cfs 0.438 af

Subcatchment P1.3: Subcat P1.3 Runoff Area=0.983 ac 84.23% Impervious Runoff Depth=7.27"
Tc=6.0 min CN=92 Runoff=7.52 cfs 0.596 af

Subcatchment P1.5: Subcat P1.5 Runoff Area=2.286 ac 0.04% Impervious Runoff Depth=3.17"
Flow Length=170' Tc=8.3 min CN=57 Runoff=7.45 cfs 0.603 af

Subcatchment P1.6: Subcat P1.6 Runoff Area=2.205 ac 0.00% Impervious Runoff Depth=3.28"
Flow Length=220' Tc=6.0 min CN=58 Runoff=8.16 cfs 0.603 af

Subcatchment P1.7: Subcat P1.7 Runoff Area=2.351 ac 12.68% Impervious Runoff Depth=4.55"
Flow Length=200' Tc=9.8 min CN=69 Runoff=10.87 cfs 0.891 af

Subcatchment P1.8: Subcat P1.8 Runoff Area=0.613 ac 0.00% Impervious Runoff Depth=3.17"
Flow Length=90' Tc=6.0 min CN=57 Runoff=2.18 cfs 0.162 af

Subcatchment P1.9: Subcat P1.9 Runoff Area=0.152 ac 62.67% Impervious Runoff Depth=6.32"
Tc=6.0 min CN=84 Runoff=1.07 cfs 0.080 af

Subcatchment P1.R1: Subcat P1.R1 Runoff Area=0.216 ac 100.00% Impervious Runoff Depth=7.99"
Tc=6.0 min CN=98 Runoff=1.71 cfs 0.144 af

Subcatchment P1.R2: Subcat P1.R2 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=7.99"
Tc=6.0 min CN=98 Runoff=5.59 cfs 0.472 af

Pond B1: Basin #1 ELC Parking Peak Elev=245.86' Storage=10,713 cf Inflow=9.23 cfs 0.740 af
Discarded=0.09 cfs 0.220 af Primary=5.51 cfs 0.504 af Outflow=5.60 cfs 0.724 af

Pond B2: Basin #2 SE Parking Peak Elev=247.95' Storage=30,853 cf Inflow=20.55 cfs 1.653 af
Discarded=0.36 cfs 0.835 af Primary=7.26 cfs 0.818 af Outflow=7.62 cfs 1.653 af

Pond B3: Basin #3 East Driveway Peak Elev=240.72' Storage=1,324 cf Inflow=1.07 cfs 0.080 af
Discarded=0.02 cfs 0.037 af Primary=0.66 cfs 0.034 af Outflow=0.68 cfs 0.072 af

Pond B4: Basin #4 Infiltration Basin Peak Elev=232.27' Storage=7,815 cf Inflow=10.87 cfs 0.891 af
Discarded=0.05 cfs 0.057 af Primary=7.24 cfs 0.766 af Outflow=7.29 cfs 0.823 af

Link DP1: Trib. to Cold Spring Brook

Inflow=30.62 cfs 3.588 af
Primary=30.62 cfs 3.588 af

Total Runoff Area = 11.724 ac Runoff Volume = 4.828 af Average Runoff Depth = 4.94"
67.28% Pervious = 7.888 ac 32.72% Impervious = 3.836 ac

Summary for Subcatchment P1.1: Subcat P1.1

Runoff = 9.38 cfs @ 12.09 hrs, Volume= 0.743 af, Depth= 7.27"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.205	61	>75% Grass cover, Good, HSG B
1.021	98	Paved parking, HSG B
1.226	92	Weighted Average
0.205		16.72% Pervious Area
1.021		83.28% Impervious Area

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

Summary for Subcatchment P1.10A: Subcat P1.10A

Runoff = 1.20 cfs @ 12.00 hrs, Volume= 0.074 af, Depth= 5.01"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.121	61	>75% Grass cover, Good, HSG B
0.057	98	Paved parking, HSG B
0.178	73	Weighted Average
0.121		67.98% Pervious Area
0.057		32.02% Impervious Area

Summary for Subcatchment P1.10B: Subcat P1.10B

Runoff = 0.31 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 3.97"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.063	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.069	64	Weighted Average
0.063		91.57% Pervious Area
0.006		8.43% Impervious Area

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

Summary for Subcatchment P1.2: Subcat P1.2

Runoff = 5.57 cfs @ 12.09 hrs, Volume= 0.438 af, Depth= 7.15"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.131	61	>75% Grass cover, Good, HSG B
0.604	98	Paved parking, HSG B
0.735	91	Weighted Average
0.131		17.82% Pervious Area
0.604		82.18% Impervious Area

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

Summary for Subcatchment P1.3: Subcat P1.3

Runoff = 7.52 cfs @ 12.09 hrs, Volume= 0.596 af, Depth= 7.27"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.155	61	>75% Grass cover, Good, HSG B
0.804	98	Paved parking, HSG B
0.024	98	Roofs, HSG B
0.983	92	Weighted Average
0.155		15.77% Pervious Area
0.828		84.23% Impervious Area

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

Summary for Subcatchment P1.5: Subcat P1.5

Runoff = 7.45 cfs @ 12.13 hrs, Volume= 0.603 af, Depth= 3.17"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.600	61	>75% Grass cover, Good, HSG B
0.171	48	Brush, Good, HSG B
0.044	96	Gravel surface, HSG B
0.001	98	Paved parking, HSG B
0.000	98	Roofs, HSG B
1.470	55	Woods, Good, HSG B
2.286	57	Weighted Average
2.285		99.96% Pervious Area
0.001		0.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	70	0.0150	0.14		**Sheet Flow, Soccer field** Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
8.3	170	Total			

Summary for Subcatchment P1.6: Subcat P1.6

Runoff = 8.16 cfs @ 12.10 hrs, Volume= 0.603 af, Depth= 3.28"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.608	61	>75% Grass cover, Good, HSG B
0.373	48	Brush, Good, HSG B
0.114	96	Gravel surface, HSG B
0.000	98	Paved parking, HSG B
1.110	55	Woods, Good, HSG B
2.205	58	Weighted Average
2.205		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	100	0.1500	0.39		**Sheet Flow, soccer field** Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
1.1					**Direct Entry, To make min. allowable**
6.0	220	Total			

Summary for Subcatchment P1.7: Subcat P1.7

Runoff = 10.87 cfs @ 12.14 hrs, Volume= 0.891 af, Depth= 4.55"
Routed to Pond B4 : Basin #4 Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
1.857	61	>75% Grass cover, Good, HSG B
0.193	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.003	55	Woods, Good, HSG B
0.046	98	Roofs, HSG B
0.102	98	Paved parking, HSG B
2.351	69	Weighted Average
2.053		87.32% Pervious Area
0.298		12.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		**Sheet Flow, Playgrround** Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	200	Total			

Summary for Subcatchment P1.8: Subcat P1.8

Runoff = 2.18 cfs @ 12.10 hrs, Volume= 0.162 af, Depth= 3.17"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.168	61	>75% Grass cover, Good, HSG B
0.446	55	Woods, Good, HSG B
0.613	57	Weighted Average
0.613		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry, To make min. allowable**
3.9	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	90	Total			

Summary for Subcatchment P1.9: Subcat P1.9

Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.080 af, Depth= 6.32"
Routed to Pond B3 : Basin #3 East Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.057	61	>75% Grass cover, Good, HSG B
0.095	98	Paved parking, HSG B
0.152	84	Weighted Average
0.057		37.33% Pervious Area
0.095		62.67% Impervious Area

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

Summary for Subcatchment P1.R1: Subcat P1.R1

Runoff = 1.71 cfs @ 12.09 hrs, Volume= 0.144 af, Depth= 7.99"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.216	98	Roofs, HSG B
0.216		100.00% Impervious Area

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

Summary for Subcatchment P1.R2: Subcat P1.R2

Runoff = 5.59 cfs @ 12.09 hrs, Volume= 0.472 af, Depth= 7.99"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.23"

Area (ac)	CN	Description
0.709	98	Roofs, HSG B
0.709		100.00% Impervious Area

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

Summary for Pond B1: Basin #1 ELC Parking

Inflow Area = 1.199 ac, 87.08% Impervious, Inflow Depth = 7.40" for 100 yr event
Inflow = 9.23 cfs @ 12.09 hrs, Volume= 0.740 af
Outflow = 5.60 cfs @ 12.20 hrs, Volume= 0.724 af, Atten= 39%, Lag= 6.7 min
Discarded = 0.09 cfs @ 12.20 hrs, Volume= 0.220 af
Primary = 5.51 cfs @ 12.20 hrs, Volume= 0.504 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 245.86' @ 12.20 hrs Surf.Area= 4,890 sf Storage= 10,713 cf

Plug-Flow detention time= 179.3 min calculated for 0.724 af (98% of inflow)
Center-of-Mass det. time= 165.8 min (928.8 - 763.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	4,579 cf	**44.25'W x 110.52'L x 3.75'H Field A** 18,339 cf Overall - 6,892 cf Embedded = 11,447 cf x 40.0% Voids
#2A	243.00'	6,892 cf	**ADS_StormTech SC-800 +Cap** x 135 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 135 Chambers in 9 Rows Cap Storage= 3.4 cf x 2 x 9 rows = 61.6 cf
		11,470 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	**0.680 in/hr Exfiltration over Wetted area**
#2	Primary	242.50'	**12.0" Round Culvert** L= 79.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 242.50' / 242.10' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	243.75'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

#4 Device 2 245.10' **4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.20 hrs HW=245.86' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=5.51 cfs @ 12.20 hrs HW=245.86' (Free Discharge)
└**2=Culvert** (Barrel Controls 5.51 cfs @ 7.02 fps)
└**3=Orifice/Grate** (Passes < 1.76 cfs potential flow)
└**4=Sharp-Crested Rectangular Weir** (Passes < 8.36 cfs potential flow)

Summary for Pond B2: Basin #2 SE Parking

Inflow Area = 2.670 ac, 87.42% Impervious, Inflow Depth = 7.43" for 100 yr event
Inflow = 20.55 cfs @ 12.09 hrs, Volume= 1.653 af
Outflow = 7.62 cfs @ 12.34 hrs, Volume= 1.653 af, Atten= 63%, Lag= 15.1 min
Discarded = 0.36 cfs @ 12.34 hrs, Volume= 0.835 af
Primary = 7.26 cfs @ 12.34 hrs, Volume= 0.818 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 247.95' @ 12.34 hrs Surf.Area= 13,742 sf Storage= 30,853 cf

Plug-Flow detention time= 300.5 min calculated for 1.653 af (100% of inflow)
Center-of-Mass det. time= 300.5 min (1,061.9 - 761.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	12,685 cf	**63.25'W x 217.27'L x 3.75'H Field A** 51,533 cf Overall - 19,820 cf Embedded = 31,713 cf x 40.0% Voids
#2A	245.00'	19,820 cf	**ADS_StormTech SC-800 +Cap** x 390 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 390 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		32,505 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	**1.000 in/hr Exfiltration over Wetted area**
#2	Primary	244.00'	**15.0" Round Culvert** L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 244.00' / 242.88' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 2	245.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.30'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.36 cfs @ 12.34 hrs HW=247.95' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=7.22 cfs @ 12.34 hrs HW=247.95' (Free Discharge)
└**2=Culvert** (Passes 7.22 cfs of 9.97 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.63 cfs @ 7.27 fps)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 6.59 cfs @ 2.63 fps)

Summary for Pond B3: Basin #3 East Driveway

Inflow Area = 0.152 ac, 62.67% Impervious, Inflow Depth = 6.32" for 100 yr event
Inflow = 1.07 cfs @ 12.09 hrs, Volume= 0.080 af
Outflow = 0.68 cfs @ 12.21 hrs, Volume= 0.072 af, Atten= 36%, Lag= 7.1 min
Discarded = 0.02 cfs @ 12.21 hrs, Volume= 0.037 af
Primary = 0.66 cfs @ 12.21 hrs, Volume= 0.034 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 240.72' @ 12.21 hrs Surf.Area= 536 sf Storage= 1,324 cf

Plug-Flow detention time= 316.1 min calculated for 0.072 af (89% of inflow)
Center-of-Mass det. time= 266.3 min (1,058.4 - 792.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	237.00'	803 cf	**15.58'W x 34.38'L x 5.50'H Field A** 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 8 Chambers in 2 Rows Cap Storage= 14.9 cf x 2 x 2 rows = 59.6 cf
		1,742 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**0.880 in/hr Exfiltration over Wetted area**
#2	Primary	237.00'	**12.0" Round Culvert** L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 237.00' / 236.69' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	240.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 12.21 hrs HW=240.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.63 cfs @ 12.21 hrs HW=240.72' (Free Discharge)
└**2=Culvert** (Passes 0.63 cfs of 6.20 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.08 cfs @ 3.84 fps)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.55 cfs @ 1.14 fps)

Summary for Pond B4: Basin #4 Infiltration Basin

Inflow Area = 2.351 ac, 12.68% Impervious, Inflow Depth = 4.55" for 100 yr event
Inflow = 10.87 cfs @ 12.14 hrs, Volume= 0.891 af
Outflow = 7.29 cfs @ 12.27 hrs, Volume= 0.823 af, Atten= 33%, Lag= 7.9 min
Discarded = 0.05 cfs @ 12.27 hrs, Volume= 0.057 af
Primary = 7.24 cfs @ 12.27 hrs, Volume= 0.766 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 232.27' @ 12.27 hrs Surf.Area= 6,376 sf Storage= 7,815 cf

Plug-Flow detention time= 93.8 min calculated for 0.823 af (92% of inflow)
Center-of-Mass det. time= 54.8 min (884.0 - 829.2)

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.50	0	0	0	0
230.00	2,004	334	334	2,004
231.00	3,027	2,498	2,832	3,043
232.00	4,171	3,584	6,416	4,206
233.00	14,809	8,946	15,362	14,849

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.50'	**0.330 in/hr Exfiltration over Wetted area**
#2	Primary	232.50'	**6.0' long x 12.0' 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) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	226.50'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 226.50' / 225.00' S= 0.0375 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	231.35'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.27 hrs HW=232.26' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=7.22 cfs @ 12.27 hrs HW=232.26' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 7.22 cfs of 8.67 cfs potential flow)
└**4=Orifice/Grate** (Orifice Controls 7.22 cfs @ 4.60 fps)

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 32.72% Impervious, Inflow Depth = 3.67" for 100 yr event
Inflow = 30.62 cfs @ 12.23 hrs, Volume= 3.588 af
Primary = 30.62 cfs @ 12.23 hrs, Volume= 3.588 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *NOAA ATLAS 14 RAINFALL DATA*
- *PIPE SIZING*
- *OUTLET PROTECTION SIZING*
- *ISOLATOR ROW SIZING*

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Ashland, MA
Bohler Job Number: MAA240220.01
November 26, 2025

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 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 - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	4.036
Proposed Increase in Site Impervious Area (ac)	4.036
Recharge Volume Required (cf)	**5,128**

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)	**5,128**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**3.814**
%Impervious Directed to Infiltration BMP	94%
Adjustment Factor	1.06
Adjusted Total Recharge Volume Required (cf)	**5,426**

Provided Recharge Volume*	
Basin #1	4,011
Basin #2	8,552
Basin #3	1,074
Basin #4	3,429
Total Recharge Volume Provided (cf)	**17,066**

Required Recharge Volume is Provided

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

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MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - Basin #1	
Volume below outlet pipe (Rv) (cf)	4,011
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	4,920
Drawdown time (Hours)*	**9.6**
Drawdown Time - Basin #3	
Volume below outlet pipe (Rv) (cf)	8,552
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	13,742
Drawdown time (Hours)**	**7.3**
Drawdown Time - Basin #4	
Volume below outlet pipe (Rv) (cf)	1,074
Soil Type	Loamy Sand - B
Infiltration rate (K)*	0.52
Bottom Area (sf)	782
Drawdown time (Hours)**	**31.7**
Drawdown Time - Basin #5	
Volume below outlet pipe (Rv) (cf)	3,429
Soil Type	Silt Loam - C
Infiltration rate (K)*	0.27
Bottom Area (sf)	3,027
Drawdown time (Hours)**	**50.3**

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

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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)	175,808
Required Water Quality Volume (cf)	**14,651**
*Water Quality volume runoff is equal to 0.5 or 1.0 inches of runoff times the total impervious area of the post development project site.	

Water Quality Volume Provided*	
Basin #1	4,011
Basin #2	8,552
Basin #3	1,074
Basin #4	3,429
Total Provided Water Quality Volume (cf)	**17,066**

Required Water Quality Volume Provided

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreament at Driveways to UG Stormtech basins

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump CBs	**0.25**	**1.00**	**0.25**	**0.75**
Isolator Row	**0.25**	**0.75**	**0.19**	**0.56**
		Total TSS Removal =	**44%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Full treatment train: Driveways to UG Stormtech basins

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump CBs	**0.25**	**1.00**	**0.25**	**0.75**
Isolator Row	**0.25**	**0.75**	**0.19**	**0.56**
Infiltration Basin	**0.80**	**0.56**	**0.45**	**0.11**
		Total TSS Removal =	**89%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment - Parking Areas to UG parking lot infiltration basins

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump CBs	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
		Total TSS Removal =	**63%**	

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

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October 6, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Full treatment train: Parking Areas to UG parking lot infiltration basins

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump CBs	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
Infiltration Basin	**0.80**	**0.38**	**0.30**	**0.08**
		Total TSS Removal =	**93%**	

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

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Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA
Bohler Job Number: MAA240220.01
October 6, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment- Rear driveway and soccer fields to grass infiltration basin

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Grass Filter (>50' long)	**0.45**	**1.00**	**0.45**	**0.55**
		Total TSS Removal =	**45%**	

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

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October 6, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Full treatment train: Rear driveway and soccer fields to grass infiltration basin

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Grass Filter (>50' long)	**0.45**	**1.00**	**0.45**	**0.55**
Infiltration Basin	**0.80**	**0.55**	**0.44**	**0.11**
		Total TSS Removal =	**89%**	

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

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Figure 4: for First 1-inch Runoff, Table of qu values for Ia/P Curve = 0.034, listed by tc, for Type III Storm Distribution

Tc (Hours)	qu (csm/in)
0.01	835
0.03	835
0.05	831
0.067	814
0.083	795
0.1	774
0.116	755
0.133	736
0.15	717
0.167	700
0.183	685
0.2	669
0.217	654
0.233	641
0.25	628
0.3	593
0.333	572
0.35	563
0.4	536
0.416	528
0.5	491
0.583	460
0.6	454
0.667	433
0.7	424
0.8	398
0.9	376
1	356
1.1	339
1.2	323
1.3	309
1.4	296
1.5	285
1.6	274
1.7	264
1.8	255
1.9	247
2	239
2.1	232
2.2	225
2.3	219
2.4	213
2.5	207
2.6	202
2.7	197
2.8	192
2.9	187
3	183
3.1	179
3.2	175
3.3	171
3.4	168
3.5	164
3.6	161
3.7	158
3.8	155
3.9	152
4	149
4.1	146
4.2	144
4.3	141
4.4	139
4.5	137
4.6	134
4.7	132
4.8	130
4.9	128
5	126
5.1	124
5.2	122
5.3	120
5.4	119
5.5	117
5.6	115
5.7	114
5.8	112
5.9	111
6	109
6.1	108
6.2	106
6.3	105
6.4	104
6.5	102
6.6	101
6.7	100
6.8	99
6.9	98
7	96
7.1	95
7.2	94
7.3	93
7.4	92
7.5	91
7.6	90
7.7	89
7.8	88
7.9	87
8	86
8.1	85
8.2	84
8.3	84
8.4	83
8.5	82
8.6	81
8.7	80
8.8	79
8.9	79
9	78
9.1	77
9.2	76
9.3	76
9.4	75
9.5	74
9.6	74
9.7	73
9.8	72
9.9	72
10	71

Team Hoyt Community YMCA
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October 6, 2025

MA DEP Standard 4: Weighted TSS Removal Rate

Design Point - Treatment Train Description(s)	TSS Removal (%)	Treated Imp. Area* (ac)	TSS Removal (%)	Untreated Imp. Area (ac)	Total Area
Driveways	89	0.095	0	0.063	0.158
Parking Areas	93	2.429	0	0.000	2.429
Rear driveway and soccer fields	89	0.295	0	0.000	0.295
Weighted TSS Removal Rate	**88.70**				2.882

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NOAA Atlas 14, Volume 10, Version 3
Location name: Ashland, Massachusetts, USA*
Latitude: 42.2558°, Longitude: -71.4767°
Elevation: 261 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	**0.334** (0.260-0.427)	**0.401** (0.312-0.514)	**0.511** (0.396-0.657)	**0.602** (0.463-0.778)	**0.728** (0.543-0.983)	**0.823** (0.601-1.13)	**0.922** (0.654-1.32)	**1.03** (0.695-1.51)	**1.19** (0.773-1.81)	**1.32** (0.838-2.04)
10-min	**0.473** (0.368-0.605)	**0.569** (0.441-0.728)	**0.725** (0.562-0.932)	**0.854** (0.657-1.10)	**1.03** (0.769-1.39)	**1.17** (0.852-1.61)	**1.31** (0.927-1.87)	**1.46** (0.985-2.14)	**1.69** (1.10-2.56)	**1.88** (1.19-2.90)
15-min	**0.557** (0.433-0.712)	**0.669** (0.519-0.857)	**0.852** (0.659-1.10)	**1.00** (0.773-1.30)	**1.21** (0.905-1.64)	**1.37** (1.00-1.89)	**1.54** (1.09-2.20)	**1.72** (1.16-2.52)	**1.99** (1.29-3.01)	**2.21** (1.40-3.41)
30-min	**0.764** (0.593-0.976)	**0.917** (0.712-1.17)	**1.17** (0.903-1.50)	**1.38** (1.06-1.78)	**1.66** (1.24-2.24)	**1.88** (1.37-2.59)	**2.10** (1.49-3.01)	**2.36** (1.59-3.45)	**2.72** (1.76-4.12)	**3.02** (1.91-4.66)
60-min	**0.970** (0.754-1.24)	**1.16** (0.904-1.49)	**1.48** (1.15-1.91)	**1.75** (1.34-2.26)	**2.11** (1.57-2.85)	**2.38** (1.74-3.29)	**2.67** (1.90-3.82)	**2.99** (2.02-4.38)	**3.45** (2.24-5.22)	**3.82** (2.42-5.91)
2-hr	**1.23** (0.963-1.56)	**1.49** (1.16-1.89)	**1.91** (1.48-2.43)	**2.25** (1.74-2.89)	**2.73** (2.05-3.68)	**3.09** (2.28-4.25)	**3.47** (2.49-4.97)	**3.92** (2.65-5.70)	**4.61** (3.00-6.94)	**5.20** (3.30-7.97)
3-hr	**1.42** (1.11-1.79)	**1.72** (1.35-2.18)	**2.21** (1.72-2.80)	**2.61** (2.03-3.34)	**3.17** (2.40-4.26)	**3.59** (2.66-4.93)	**4.04** (2.92-5.79)	**4.59** (3.10-6.64)	**5.43** (3.54-8.14)	**6.16** (3.92-9.41)
6-hr	**1.81** (1.43-2.28)	**2.20** (1.74-2.77)	**2.84** (2.24-3.59)	**3.37** (2.64-4.28)	**4.10** (3.12-5.47)	**4.64** (3.46-6.34)	**5.22** (3.80-7.46)	**5.95** (4.04-8.56)	**7.08** (4.62-10.5)	**8.06** (5.14-12.2)
12-hr	**2.30** (1.83-2.87)	**2.80** (2.23-3.50)	**3.62** (2.87-4.54)	**4.30** (3.39-5.42)	**5.24** (4.00-6.94)	**5.93** (4.44-8.04)	**6.68** (4.88-9.46)	**7.61** (5.19-10.9)	**9.04** (5.92-13.4)	**10.3** (6.57-15.5)
24-hr	**2.73** (2.19-3.39)	**3.36** (2.69-4.17)	**4.39** (3.50-5.47)	**5.24** (4.16-6.57)	**6.42** (4.94-8.46)	**7.28** (5.50-9.83)	**8.23** (6.06-11.6)	**9.41** (6.44-13.3)	**11.2** (7.39-16.5)	**12.8** (8.23-19.2)
2-day	**3.04** (2.45-3.74)	**3.80** (3.06-4.68)	**5.03** (4.04-6.22)	**6.06** (4.83-7.53)	**7.47** (5.79-9.80)	**8.50** (6.46-11.4)	**9.65** (7.17-13.6)	**11.1** (7.63-15.7)	**13.4** (8.85-19.6)	**15.5** (9.96-23.0)
3-day	**3.28** (2.66-4.03)	**4.09** (3.31-5.02)	**5.41** (4.36-6.66)	**6.51** (5.21-8.06)	**8.02** (6.23-10.5)	**9.12** (6.96-12.2)	**10.3** (7.70-14.5)	**11.9** (8.19-16.7)	**14.4** (9.51-20.9)	**16.6** (10.7-24.5)
4-day	**3.52** (2.86-4.31)	**4.36** (3.54-5.34)	**5.72** (4.63-7.03)	**6.86** (5.51-8.47)	**8.42** (6.56-11.0)	**9.56** (7.31-12.8)	**10.8** (8.07-15.1)	**12.4** (8.57-17.4)	**15.0** (9.91-21.7)	**17.2** (11.1-25.4)
7-day	**4.21** (3.44-5.12)	**5.10** (4.16-6.20)	**6.54** (5.32-7.99)	**7.74** (6.25-9.50)	**9.39** (7.34-12.1)	**10.6** (8.12-14.0)	**11.9** (8.89-16.4)	**13.6** (9.40-18.9)	**16.1** (10.7-23.2)	**18.3** (11.9-26.8)
10-day	**4.88** (4.00-5.92)	**5.80** (4.75-7.03)	**7.29** (5.95-8.87)	**8.53** (6.91-10.4)	**10.2** (8.02-13.1)	**11.5** (8.82-15.1)	**12.9** (9.57-17.6)	**14.5** (10.1-20.1)	**17.0** (11.3-24.3)	**19.1** (12.4-27.9)
20-day	**6.88** (5.68-8.28)	**7.86** (6.48-9.47)	**9.46** (7.77-11.4)	**10.8** (8.81-13.1)	**12.6** (9.92-16.0)	**14.0** (10.7-18.1)	**15.4** (11.4-20.7)	**17.0** (11.9-23.4)	**19.3** (12.9-27.4)	**21.1** (13.8-30.6)
30-day	**8.52** (7.06-10.2)	**9.54** (7.90-11.4)	**11.2** (9.25-13.5)	**12.6** (10.3-15.2)	**14.5** (11.4-18.2)	**16.0** (12.3-20.4)	**17.4** (12.9-23.0)	**19.0** (13.3-25.9)	**21.1** (14.1-29.7)	**22.7** (14.8-32.7)
45-day	**10.5** (8.77-12.6)	**11.6** (9.64-13.8)	**13.3** (11.0-16.0)	**14.8** (12.2-17.8)	**16.8** (13.2-20.9)	**18.3** (14.1-23.2)	**19.8** (14.6-25.9)	**21.3** (15.0-28.8)	**23.1** (15.6-32.4)	**24.4** (15.9-35.1)
60-day	**12.2** (10.2-14.5)	**13.3** (11.1-15.8)	**15.1** (12.5-18.0)	**16.5** (13.6-19.9)	**18.6** (14.7-23.0)	**20.2** (15.5-25.5)	**21.7** (16.0-28.1)	**23.1** (16.3-31.2)	**24.7** (16.7-34.6)	**25.8** (16.9-36.9)

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

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

Please refer to NOAA Atlas 14 document for more information.

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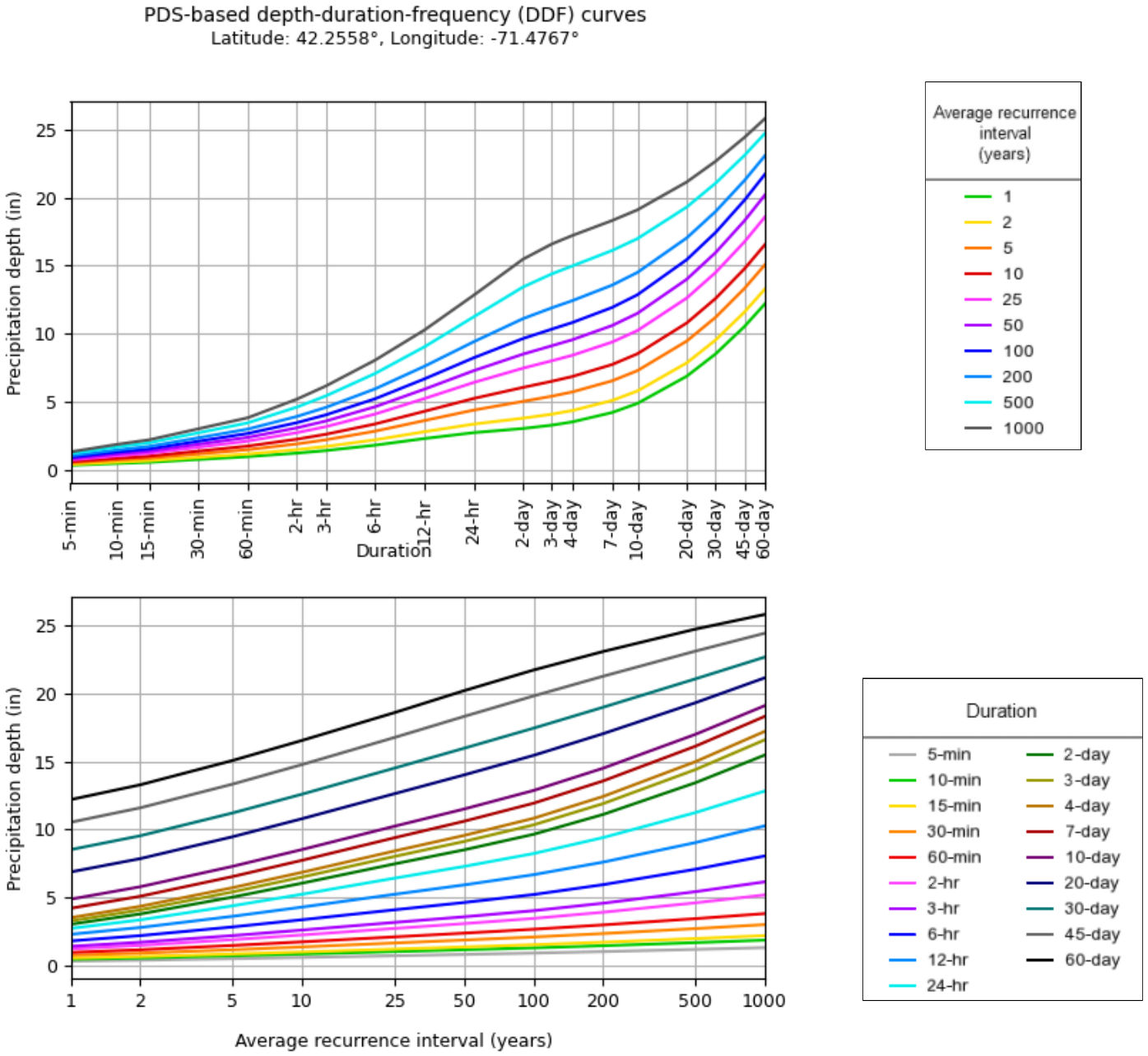
PF graphical



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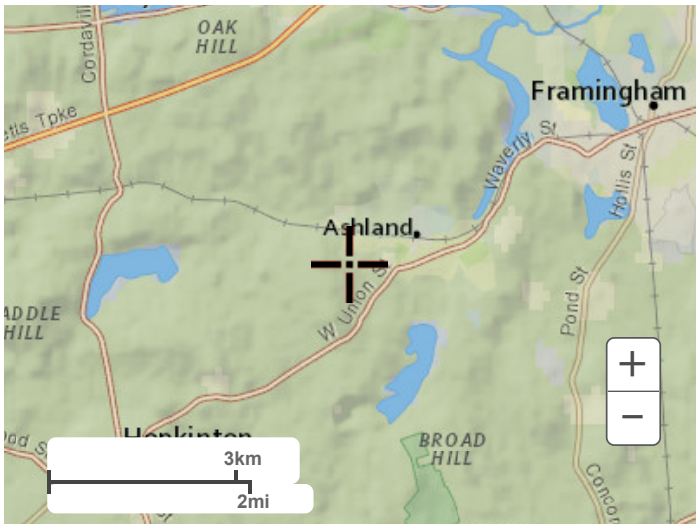
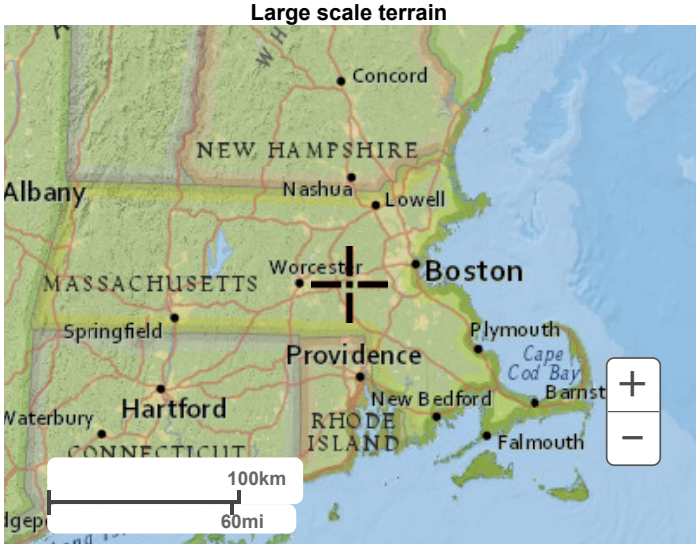
Maps & aerials

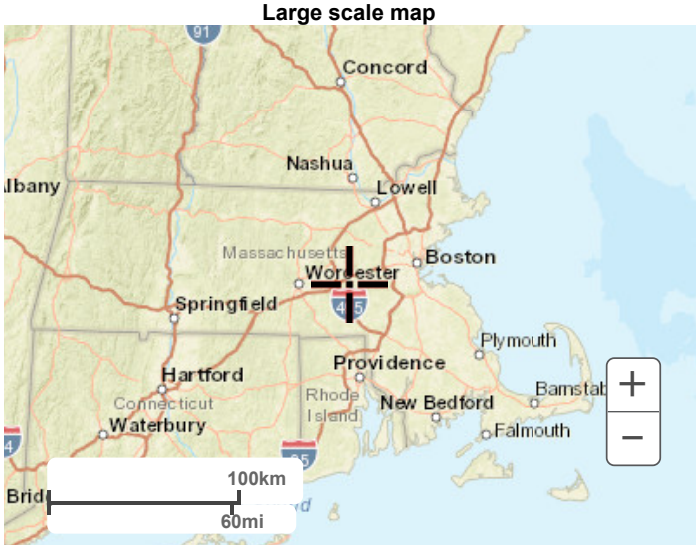
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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National Weather Service
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Available Models

CDS Model	Treatment Capacity[3] (cfs)	Maximum Sediment Storage Capacity (CF)
1515	1.0	26
w/ 1' added sump	1.0	33
w/ 2' added sump	1.0	40
w/ 3' added sump	1.0	47
2015_4	1.4	50
w/ 1' added sump	1.4	63
w/ 2' added sump	1.4	75
w/ 3' added sump	1.4	88
2015	1.4	79
w/ 1' added sump	1.4	98
w/ 2' added sump	1.4	118
2020	2.2	90
w/ 1' added sump	2.2	110
w/ 2' added sump	2.2	129
2025	3.2	97
w/ 1' added sump	3.2	117
w/ 2' added sump	3.2	136
3020	3.9	134
w/ 1' added sump	3.9	163
w/ 2' added sump	3.9	191
3030	6.1	157
w/ 1' added sump	6.1	185
w/ 2' added sump	6.1	213
4030	7.9	329
w/ 1' added sump	7.9	379
w/ 2' added sump	7.9	429
4040	12.4	381
w/ 1' added sump	12.4	431
w/ 2' added sump	12.4	482

1. Structure diameter represents the typical inside dimension of the concrete structure. Offline systems will require additional concrete diversion components
2. Depth below pipe can vary to accommodate site specific design. Depth below pipe invert represents the depth from the pipe invert to the inside bottom of concrete structure.
3. Treatment Capacity is based on laboratory testing using OK-110 (average d50 particle size of approximately 100 microns) and a 2400 micron screen.

Sediment Depths Indicating Required Servicing*			
CDS Model	Standard Sediment Depth (in.)	w/ 1' added Sump Sediment Depth (in.)	w/ 2' added Sump Sediment Depth (in.)
1515	18	27	36
2015_4	18	30	42
2015	18	30	42
2020	18	30	42
2025	18	30	42
3020	18	30	42
3030	18	39	42
4030	27	39	51
4040	27	39	51

* Based on 75% capacity of isolated sump.

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MASTEP Technology Review

Technology Name: CDS (Continuous Deflective Separator) - Contech Stormwater Solutions, Inc.

Studies Reviewed:

- NJCAT Technology Verification High Efficiency Continuous Deflective Separators CDS Technologies Inc. January 2010.
- Independent Review of CDS 2015 Product Evaluation, FB Environmental Associates, 2009.
- NJCAT Technology Verification Addendum Report High Efficiency Continuous Deflective Separators CDS Technologies Inc. December 2004
- Continuous Deflection Separation (CDS) Unit For Sediment Control In Brevard County, Florida January, 2000

Date: 5/13/2011
Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: MASTEP rating is based primarily on NJCAT 2010 field study and FB Environmental 2009 laboratory study. Both studies generally followed TARP field or NJDEP-recommended laboratory test protocols, with some exceptions. The 2010 field study sampled storms totaling 37% of average annual rainfall (50% is required), and experienced excessively large influent particles. This is discussed further below and in the MASTEP study description. In the FB lab study, no evidence of a Quality Assurance Project Plan, little discussion of quality control, higher than recommended particle size distribution, limited range of influent sediment concentration, sediments analyzed by SSC method but not TSS.

The Florida field study monitored 5 storm events and encountered sampling/equipment problems in four of them. The NJCAT lab study was conducted on a unit that was specially modified for testing in New Jersey, and is now being sold in NJ and NY.

Other Comments:

FB Environmental Associates study:

- OK-110 sediment mix used. This is recommended by Maine DEP, but produces sediments somewhat larger than those recommended by New Jersey DEP.
- Sediment analysis conducted with whole sample; essentially SSC method. SSC is generally regarded as more accurate than TSS method, but comparisons with other studies or products that use TSS data are problematic.
- Full range of flows were tested.
- Only one target sediment concentration was tested; average influent SSC was 313 mg/l, slightly outside of recommended 100-300 mg/l range.
- Scour test was performed; system produced no scour at flows up to 137% of capacity.

NJCAT 2010 Study

- Mean influent particle size was 500-600 microns, well above the TARP criteria of < 100 microns. To address this problem, the testing agency separated samples into

filtered subsamples of several size ranges (> 2000 microns, < 2000, < 500 and < 50). Removal efficiencies were calculated for each of these ranges, with results ranging from 64% (for <50 micron particles) to 99% (for > 2000 microns).
- TSS and SSC efficiencies were calculated by Event Mean Concentration and by Sum Of Loads methods.
- Study was well document. Other than issues of particle size and % annual rainfall, study closely followed TARP guidelines.

NJCAT 2004 Study

- Expectations of sediment removal performance comparable to this study should be confined to units that contain the sediment weir and a 2400 micron screen.
- The study did not include a scour test.
- A particularly fine sediment mix (Sil-Col-Sil 106, pre-washed to remove all particles > 100 microns), which makes sediment removal more difficult. Higher removal efficiencies may be obtained if sediment particle size range is larger.
- A narrow range of influent sediment (164 – 203 mg/l, average 184), was tested but this is within the NJDEP-recommended 100-300 mg/l range.
- TSS analysis appears to have been performed by a non- standardized method.
- No discussion of quality control.

Brevard County FL study

- This study was performed before release of the TARP Tier II Protocols and does not conform to them.
- The study states that "testing under higher flow conditions would be desirable."
- TSS, BOD, COD, pH, total phosphorus, and turbidity were monitored.

STATEMENT OF THIRD PARTY OBSERVER

To: Derek Berg, Contech Engineered Solutions, Scarborough, Maine

From: Forrest Bell, FB Environmental Associates

Subject: Third Party Review Under *Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology* (NJDEP, January 25 2013)[1]

Date: September 16, 2013

cc: Cayce Dalton, FB Environmental Associates

Statement of Third Party Observer

FB Environmental has served as the third-party observer for tests performed by Contech Engineered Solutions (Contech) in March through June of 2013. The tests measured the performance of the CDS-4 hydrodynamic separator, including particle size distribution tests for the sediment used in testing. Tests were performed by Contech at their laboratory at 200 Enterprise Drive, Scarborough, Maine, to meet the standards described in *Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology* (NJDEP, January 25 2013)[1]. On March 12, 2013, we submitted a statement of our qualifications and disclosure record stating we have no conflict of interests, as required by NJCAT MTD process.

A member of our staff verified compliance with the laboratory test protocol above, and our staff member was physically present to observe the full duration of all laboratory testing. We have also reviewed the data, calculations, and conclusions associated with CDS and particle size distribution testing in the *Verification Testing Report for the CONTINUOUS DEFLECTIVE SEPARATOR (CDS®) Stormwater Treatment Device*, by Contech Engineered Solutions, dated July 1, 2013, and state that they conform to what we saw during our supervision as third-party observer.

Signed: Date

September 16, 2013

[1] Available at http://www.nj.gov/dep/stormwater/treatment.html

CONTECH
ENGINEERED SOLUTIONS

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www.ContechES.com

July 2, 2013

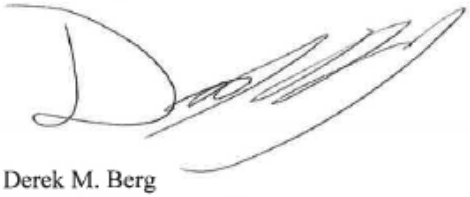
Dr. Richard Magee
Technical Director
New Jersey Corporation for Advanced Technology
c/o Center for Environmental Systems
Stevens Institute of Technology
One Castle Point on Hudson
Hoboken, NJ 07030

RE: 2013 Verification of the CDS Stormwater Treatment Device

Dr. Magee,
This correspondence is being sent to you in accordance with the "*Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology*" (Process Document) dated January 25, 2013. Specifically, the process document requires that manufacturers submit a signed statement confirming that all of the procedures and requirements identified in the aforementioned process document and the accompanying NJDEP HDS Laboratory Testing Protocol have been met. We believe that the testing executed at Contech's laboratory in Scarborough, ME on the CDS stormwater treatment system during the spring of 2013 under the direct supervision of FB Environmental Associates was conducted in full compliance with all applicable protocol and process criteria. Additionally, we believe that all of the required documentation of the testing and resulting performance calculations has been provided within the submittal accompanying this correspondence.

Please do not hesitate to contact me with any additional questions related to this matter.

Respectfully,



Derek M. Berg
Regulatory Manager- Stormwater

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Center for Environmental Systems
Stevens Institute of Technology
Castle Point on Hudson
Hoboken, NJ 07030-0000

September 15, 2013

Elizabeth Dragon
Environmental Engineer
New Jersey Department of Environmental Protection
Bureau of Nonpoint Pollution Control
401-02B, PO Box 420
Trenton, NJ 08625-0420

Derek M. Berg
CONTECH Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Forrest Bell
FB Environmental Associates Inc.
97A Exchange Street, Suite 305
Portland, ME 04101

To all,

Based on my review, evaluation and assessment of the testing conducted on the Continuous Deflective Separator (CDS®) by Contech and observed by FB Environmental Associates, the test protocol requirements contained in the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" (NJDEP HDS Protocol) were met or exceeded. Specifically:

Test Sediment Feed

The mean PSD of Contech's test sediment complies with the PSD criteria established by the NJDEP HDS protocol. The Contech PSD was plotted against the NJDEP PSD specification.

The Contech sediment gradation is equivalent to or finer than the NJDEP gradation at all points along the curve. Overall, the Contech sediment blend contains more fines than the NJDEP gradation, particularly below 50 microns. The median particle size of the Contech gradation is approximately 60 microns.

Prior to the start of testing Contech procured a 2500 lbs. batch of scour sediment deemed compliant with the scour sediment PSD specification defined in the NJDEP HDS Protocol. The results of the three scour sediment PSD analysis confirmed that the batch of scour test sediment procured by Contech is in compliance with the NJDEP scour test PSD specification.

Removal Efficiency Testing

In accordance with the NJDEP HDS Protocol, removal efficiency testing was executed on the CDS-4 laboratory unit in order to establish the ability of the CDS to remove the specified test sediment at 25%, 50%, 75%, 100% and 125% of the target MTFR. Prior to the start of testing Contech reviewed existing data and decided to utilize a target MTFR of 0.93 cfs. This target was chosen based on the ultimate goal of demonstrating greater than 50% annualized weighted solids removal as defined in the NJDEP HDS Protocol. The flow rates, feed rates and influent concentration all met the Test protocol's coefficient of variance requirements and the background concentration for all five test runs never exceeded 20 mg/L.

Scour Testing

In order to demonstrate the ability of the CDS to be used as an online treatment device scour testing was conducted at greater than 200% of MTFR in accordance with the NJDEP HDS Protocol. The average flow rate during the online scour test was 1.99 cfs, which is equivalent to 214% of the MTFR (MTFR = 0.93 cfs). With the exception of one background sample and one effluent sample that both had concentrations of 4 mg/l all background and effluent samples were measured as Non Detect during the online scour testing. These results confirm that the CDS-4 did not scour at 214% MTFR and meets the criteria for online use.

Maintenance Frequency

The predicted maintenance frequency for all models is 96 months.

Sincerely,

Richard S. Magee, Sc.D., P.E., BCEE

Memorandum

August 11, 2014

To: Deborah Beck, Contech Engineered Solutions LLC

From: Dr. Chris Berger and Dr. Scott Wells

Re: NJDEP Scour Testing Results for the CDS-4

Scour testing of the Contech CDS-4 were overseen by Dr. Chris Berger during July, 2014 at the Contech Portland, Oregon laboratory. Except for the particle size analysis which was conducted by an outside laboratory, all phases of the test were observed. This included the randomized mixing of the test sediment, preloading and filling of the CDS-4, and the scour test itself. During preloading the initial sediment depths measured in the sedimentation sump and within annular area outside of the screening chamber were confirmed by the observer. The flow rates and frequency of sampling reported for the scour test were also observed and are reported accurately. The test used applicable NJCAT protocol and that their report accurately reflects the testing observed by Dr. Berger.

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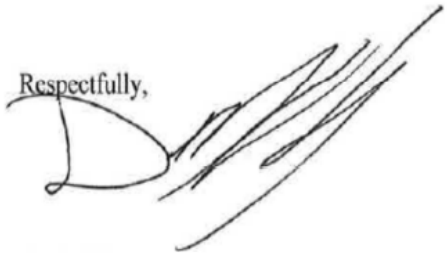
www.ContechES.com

August 13, 2014

Dr. Richard Magee
Technical Director
New Jersey Corporation for Advanced Technology (NJCAT)
c/o Center for Environmental Systems
Stevens Institute of Technology
One Castle Point on Hudson
Hoboken, NJ 07030

RE: Updated CDS-4 Scour Test Results

Dr. Magee,
This correspondence is to confirm that Contech has successfully completed online scour testing on a full-scale CDS-4 in full compliance with the applicable policies and procedures detailed in the "*2013 NJDEP Laboratory Protocol for Hydrodynamic Separators*". Specifically testing was limited to completion of the applicable scour testing criteria for use as an online BMP. Also, said scour testing was completed according to the additional conditions described to and agreed upon by NJCAT and the commenters that had raised concern with scour testing previously completed and reported to NJCAT for public review and comment. Please do not hesitate to contact me at any time if you need any additional information about this testing.



Derek M. Berg
Regulatory Manager- Stormwater

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Center for Environmental Systems
Stevens Institute of Technology
One Castle Point
Hoboken, NJ 07030-0000

August 27, 2014

Lisa Schafer
Environmental Engineer
New Jersey Department of Environmental Protection
Bureau of Nonpoint Pollution Control
401-02B, PO Box 420
Trenton, NJ 08625-0420

To all,

Based on my review, evaluation and assessment of the scour retesting conducted on the Continuous Deflective Separator (CDS®) by Contech and observed by Dr. Chris Berger, a colleague of Dr. Scott Wells, from Portland State University, the scour test protocol requirements contained in the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" (NJDEP HDS Protocol) were met or exceeded. The scour retesting was conducted to address concerns raised during the public comment process that sediment that may have been deposited in the annular area outside of the screening chamber during removal efficiency testing could subsequently washout at higher flows.

During the retesting sediment meeting the NJDEP PSD scour test requirement was loaded to a depth of four inches in this annular region and the scour testing repeated. The results confirmed the earlier testing that the resulting effluent concentrations are all 3mg/l or less and well below the 20mg/l threshold established by the NJDEP scour protocol. Therefore the CDS meets the criteria for online use.

Sincerely,

Richard S. Magee, Sc.D., P.E., BCEE

8. References

Contech 2013. *Verification Testing Report for the CONTINUOUS DEFLECTIVE SEPARATOR (CDS®) Stormwater Treatment Device*. Prepared by Contech Engineered Solutions LLC. July 1.

Contech 2014. *NJDEP Scour Testing Results for the CDS-4*. Prepared by Contech Engineered Solutions, LLC. August 1.

NJDEP 2013a. *New Jersey Department of Environmental Protection Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology*. Trenton, NJ. January 25.

NJDEP 2013b. *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device*. Trenton, NJ. January 25.

Empirical Preformed Scour Hole Equations:

Type 1: Scour Hole Depression = one-half pipe rise, m (ft)

$d_{50} = (0.0276\ R_p^{\ 2}/TW)\ (Q/R_p^{\ 2.5})^{1.333}$ **(** $d_{50} = (0.0125 R_p^{\ 2}/TW)\ (Q/R_p^{\ 2.5})^{1.333}$ **)** **(11.35)**

Type 2: Scour Hole Depression = full pipe rise, m (ft)

$d_{50} = (0.0181\ R_p^{\ 2}/TW)\ (Q/R_p^{\ 2.5})^{1.333}$ **(** $d_{50} = (0.0082 R_p^{\ 2}/TW)\ (Q/R_p^{\ 2.5})^{1.333}$**)** **(11.36)**

d_{50} = median stone size required, m (ft)

For variables S_p, R_p, TW and Q, see Section 11.13.5.

Type 1 and 2 preformed scour hole dimensions (See Figure 11-15)

$C = 3S_p + 6F$	Basin Length m (ft)	
$B = 2S_p + 6F$	Basin Inlet and Outlet Width m (ft)	**(11.37)**
$F = 0.5R_p$ (Type 1) or R_p (Type 2)	Basin Depression m (ft)	

Table 11-14 solves the above set of equations for Type 1 and 2 preformed scour holes for various pipe sizes.

The type of riprap required is as follows:

Modified	$d_{50} < 0.13$m (0.42 ft)
Intermediate	0.13m (0.42 ft) $< d_{50} <$ 0.20m (0.67 ft)
Standard	0.20m (0.67 ft) $< d_{50} <$ 0.38m (1.25 ft)
Special Design	0.38m (1.25 ft) $< d_{50}$

Reference: Report No. FHWA-RD-75-508 (“Culvert Outlet Protection Design: Computer Program Documentation”)

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

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

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

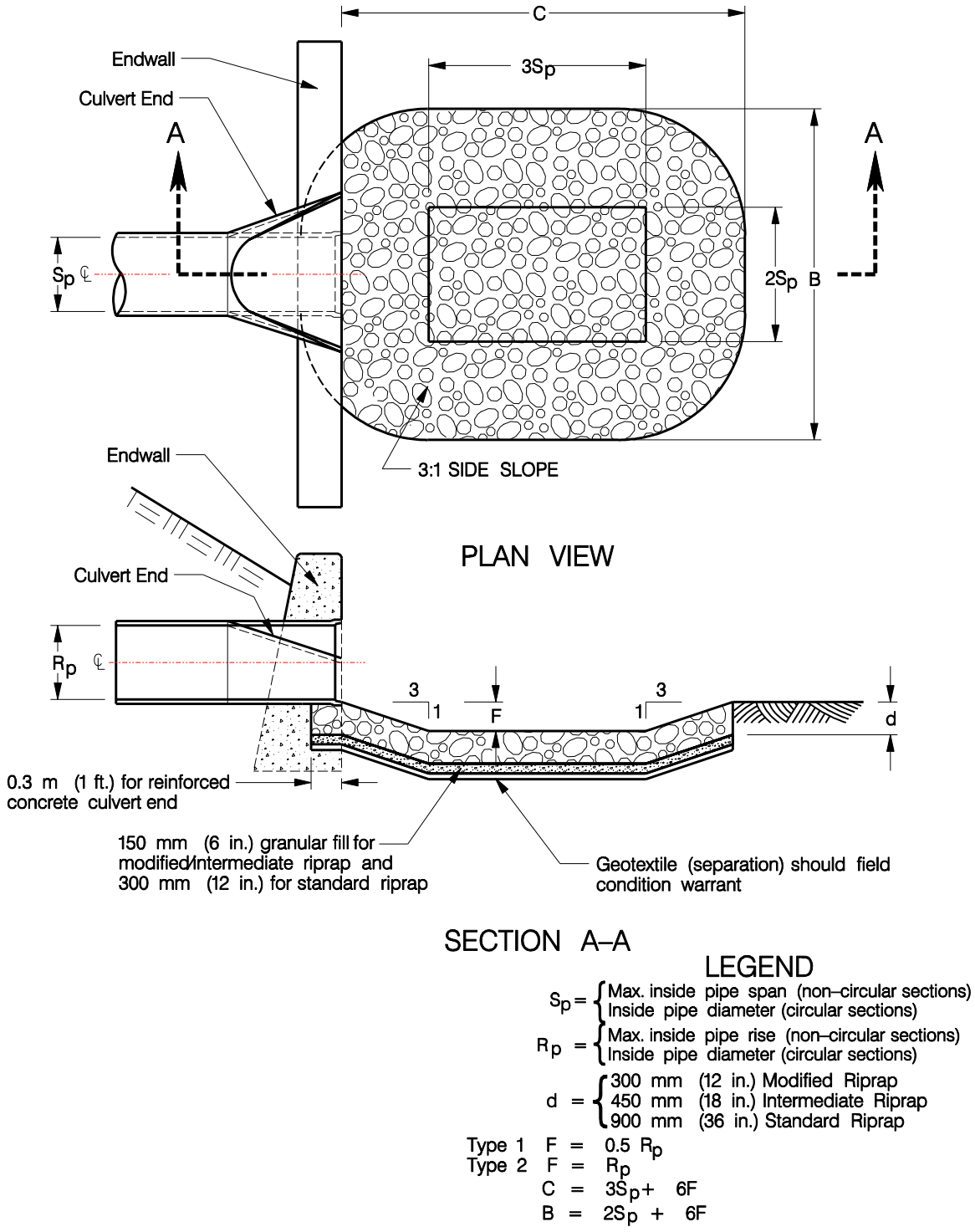
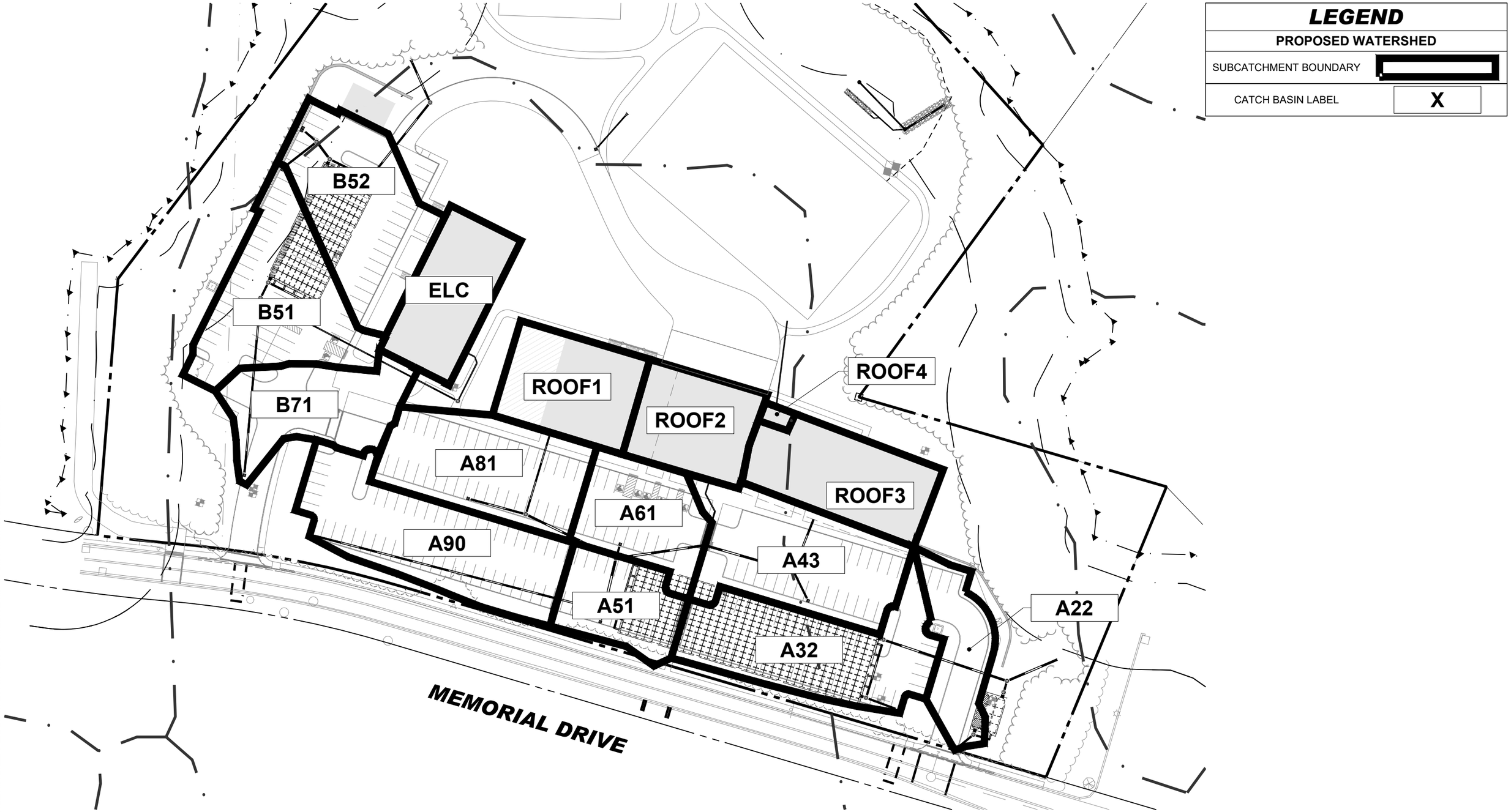


Figure 11-15 Preformed Scour Hole Type 1 and Type 2



LEGEND

PROPOSED WATERSHED	
SUBCATCHMENT BOUNDARY	
CATCH BASIN LABEL	X

P:\2024\MAA240220.01\CAD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\P-DMAP-HYDR-MAA240220.01-3B----->LAYOUT: CB AREAS

BOHLER
50 WASHINGTON ST., SUITE 2000
WESTBOROUGH, MA 01581
Phone: (508) 480-9900
www.BohlerEngineering.com

CATCH BASIN AREAS PLAN

cbt
ASHLAND, MA 01721

10/06/25 | SB | MAA240220.01 | REV 3b

80 40 20 0 80
SCALE: 1" = 80'

Results

Line No.	Line ID	Inlet Time (min)	Pipe Travel (min)	Tc (min)	i Sys (in/hr)	Drng Area (ac)	Runoff Coeff (C)	Total CxA	Q Capt (cfs)	Line Length (ft)	Line Slope (%)	Line Size (in)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	
1	A40-BSN2	5.0	0.01	6.6	5.97	0.00	0.00	1.78	....	5.000	0.20	18	10.65	5.09	6.03	245.16	245.15	253.09	247.47	
2	A50-A40	5.0	0.04	6.6	5.98	0.00	0.00	1.78	....	13.000	1.00	18	10.66	11.38	6.04	245.38	245.25	252.97	248.01	
3	A60-A50	5.0	0.17	6.3	6.07	0.00	0.00	1.32	....	46.000	0.70	18	8.00	9.49	4.53	245.80	245.48	253.56	248.81	
4	A51-A50	5.0	0.15	5.0	6.49	0.18	0.77	0.14	0.90	10.000	3.10	12	0.90	6.79	4.55	249.00	248.69	252.86	249.40	
5	A61-A60	5.0	0.16	5.0	6.49	0.22	0.73	0.16	1.04	13.000	0.46	12	1.04	2.62	3.14	249.14	249.08	252.15	249.58	
6	A70-A60	5.0	0.60	5.5	6.32	0.00	0.00	0.47	....	87.000	0.49	15	2.96	4.92	2.41	246.33	245.90	252.13	249.28	
7	ROOF1-A70	5.0	0.49	5.0	6.49	0.23	0.90	0.21	1.34	73.000	3.59	10	1.34	4.49	3.12	251.00	248.38	254.00	251.52 j	
8	A41-A60	5.0	0.37	5.9	6.18	0.00	0.00	0.69	....	77.000	0.51	15	4.26	4.98	3.47	247.87	247.48	253.31	249.41	
9	A42-A41	5.0	0.50	5.4	6.35	0.00	0.00	0.50	....	79.000	0.49	15	3.18	4.92	2.59	248.36	247.97	252.38	249.76	
10	ROOF2-A41	5.0	0.29	5.0	6.49	0.21	0.90	0.19	1.23	61.000	1.98	8	1.23	1.84	4.91	251.50	250.29	254.00	252.02	
11	ROOF3-A42	5.0	0.41	5.0	6.49	0.26	0.90	0.23	1.52	48.000	0.65	12	1.52	3.10	3.79	251.00	250.69	254.00	251.52	
12	A43-A42	5.0	0.22	5.0	6.49	0.36	0.74	0.27	1.73	29.000	0.48	12	1.73	2.68	2.20	248.60	248.46	251.64	249.92	
13	A81-A70	5.0	0.40	5.0	6.49	0.33	0.79	0.26	1.69	52.000	0.50	12	1.69	2.73	2.15	248.15	247.89	251.15	249.47	
14	A90-A50	5.0	1.60	5.0	6.49	0.41	0.80	0.33	2.13	260.000	0.50	12	2.13	2.73	2.71	246.78	245.48	249.88	249.37	
15	B40-BSN1	5.0	0.07	5.3	6.37	0.00	0.00	0.59	....	5.000	0.20	24	3.78	10.96	1.20	243.19	243.18	247.72	245.36	
16	B50-B40	5.0	0.10	5.2	6.40	0.00	0.00	0.59	....	19.000	1.00	15	3.80	7.00	3.10	243.52	243.33	247.18	245.44	
17	B51-B50	5.0	0.24	5.0	6.49	0.36	0.86	0.31	2.01	37.000	2.16	12	2.01	5.67	2.56	244.42	243.62	247.43	245.69	
18	B52-B50	5.0	0.12	5.0	6.49	0.36	0.79	0.28	1.85	17.000	0.47	12	1.85	2.65	2.35	243.70	243.62	246.73	245.63	
19	A31-BSN2	5.0	0.08	5.2	6.42	0.00	0.00	0.30	....	5.000	0.20	18	1.95	5.09	1.10	245.19	245.18	251.15	246.78	
20	A32-A31	5.0	0.21	5.0	6.49	0.37	0.82	0.30	1.97	31.000	0.48	12	1.97	2.68	2.51	245.44	245.29	250.55	246.87	
21	A10-HDWL	5.0	0.75	9.9	0.00	0.00	0.00	0.00	....	47.000	0.51	15	1.29	5.00	3.34	236.85	236.61	244.92	237.30	
22	A30-A10	5.0	1.89	5.2	0.00	0.00	0.00	0.00	....	112.000	1.00	15	1.21	7.00	3.74	244.00	242.88	252.52	244.43	
23	BSN2-A30	5.0	0.22	5.0	0.00	0.00	0.00	0.00	....	5.000	0.20	24	1.21	10.95	2.30	245.20	245.19	252.50	245.65	

Project File: Ashland YMCA Rev 11-24.stm | Number of lines: 35 | Date: 12/1/2025

NOTES: Intensity = 33.11 / (Inlet time + 7.00) ^ 0.66 -- Return period = 25 Yrs. ; ** Critical depth

Results

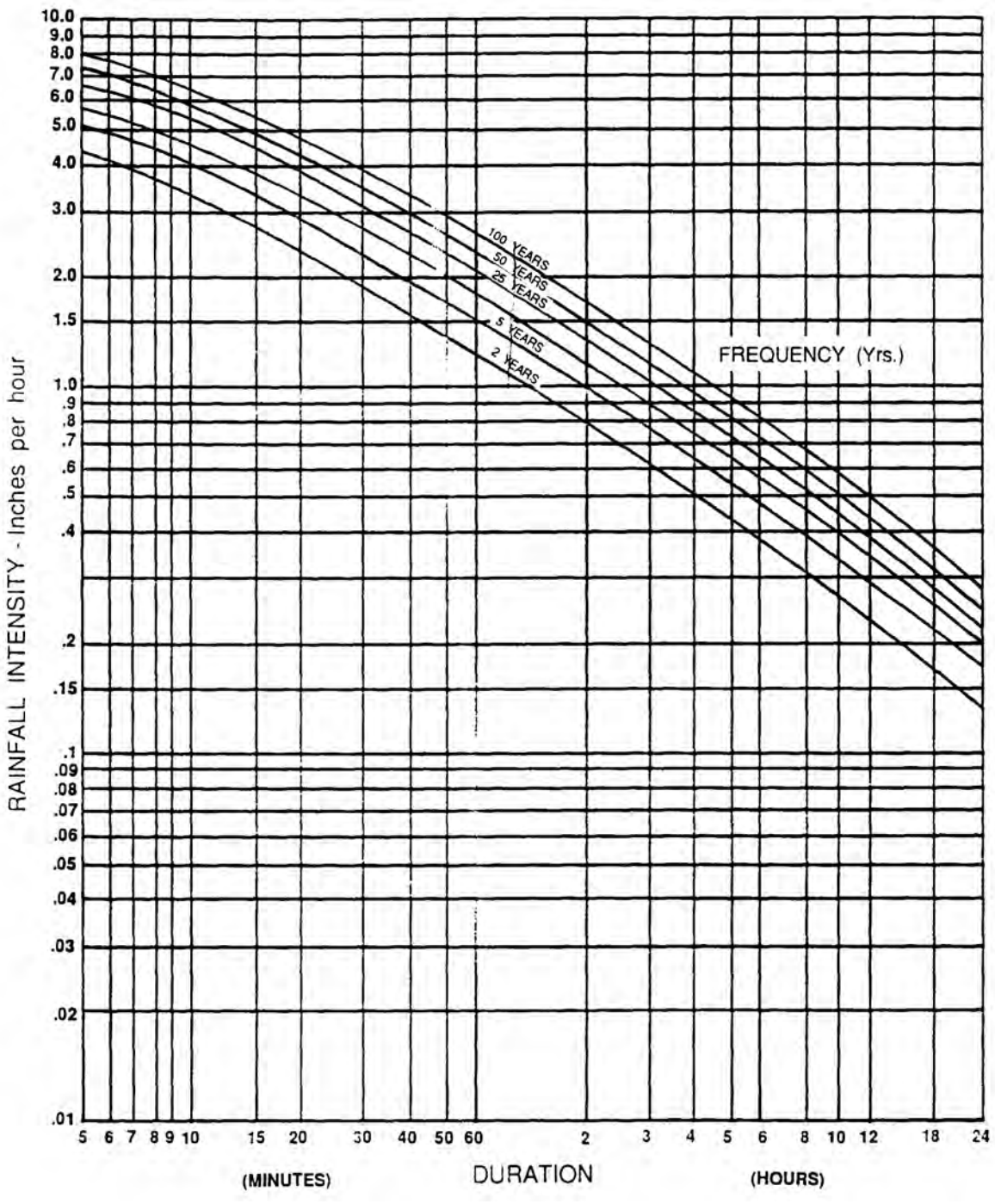
Line No.	Line ID	Inlet Time (min)	Pipe Travel (min)	Tc (min)	i Sys (in/hr)	Drng Area (ac)	Runoff Coeff (C)	Total CxA	Q Capt (cfs)	Line Length (ft)	Line Slope (%)	Line Size (in)	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	
24	A20-A10	0.0	1.64	8.3	0.00	0.00	0.00	0.00	....	10.000	0.50	12	0.08	2.73	0.37	237.00	236.95	245.70	237.30	
25	BSN3-A20	5.0	3.27	5.0	0.00	0.00	0.00	0.00	....	5.000	0.20	24	0.08	10.95	1.02	237.93	237.92	246.00	238.05	
26	B60-BSN1	5.0	0.13	7.6	5.71	0.00	0.00	0.32	....	5.000	0.20	24	1.84	10.96	0.59	243.19	243.18	249.94	245.36	
27	B70-B60	0.0	0.10	7.5	5.74	0.00	0.00	0.32	....	15.000	1.40	12	1.85	4.56	2.36	243.40	243.19	250.22	245.40	
28	B80-B70	5.0	0.87	5.0	6.49	0.22	0.90	0.20	1.28	192.000	1.20	8	1.28	1.43	3.68	246.45	244.15	253.50	247.33	
29	B71-B70	5.0	2.48	5.0	6.49	0.14	0.89	0.12	0.81	153.000	0.50	12	0.81	2.74	1.03	244.27	243.50	247.26	245.55	
30	B20-B10	5.0	0.16	5.4	0.00	0.00	0.00	0.00	....	40.000	3.02	12	3.19	6.71	4.06	238.62	237.41	246.41	245.95	
31	B30-B20	5.0	0.34	5.1	0.00	0.00	0.00	0.00	....	84.000	3.01	12	3.19	6.70	4.06	242.50	239.97	248.58	246.75	
32	BSN1-B30	5.0	0.08	5.0	0.00	0.00	0.00	0.00	....	5.000	0.20	24	3.19	10.95	1.02	243.20	243.19	248.50	246.79	
33	A21-BSN3	5.0	0.33	5.3	6.38	0.00	0.00	0.12	....	5.000	0.20	24	0.79	10.95	0.25	237.93	237.92	244.32	243.93	
34	A22-A21	5.0	0.31	5.0	6.49	0.16	0.77	0.12	0.80	19.000	0.53	12	0.80	2.80	1.02	241.72	241.62	244.34	243.94	
35	ROOF4-FES	5.0	4.98	5.0	6.49	0.01	0.90	0.01	0.06	50.000	4.98	8	0.06	2.92	2.28	237.50	235.01	240.00	237.61	

Project File: Ashland YMCA Rev 11-24.stm | Number of lines: 35 | Date: 12/1/2025

NOTES: Intensity = 33.11 / (Inlet time + 7.00) ^ 0.66 -- Return period = 25 Yrs. ; ** Critical depth

Exhibit 8-14

Intensity – Duration – Frequency Curve for Worcester, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA
Bohler Job Number: MAA240220.01
December 1, 2025

Isolator Row Sizing Calculations

Basin #1	
Total Post Development Impervious Area (acres)	1.04
Isolator Row Volume Required (cf)	378
Isolator Row Volume Provided (cf)*	**1,176**

Basin #3	
Total Post Development Impervious Area (acres)	0.095
Isolator Row Volume Required (cf)	34
Isolator Row Volume Provided (cf)*	**563**

*Volume provided below lowest outlet of forebay, refer to attached storage tables

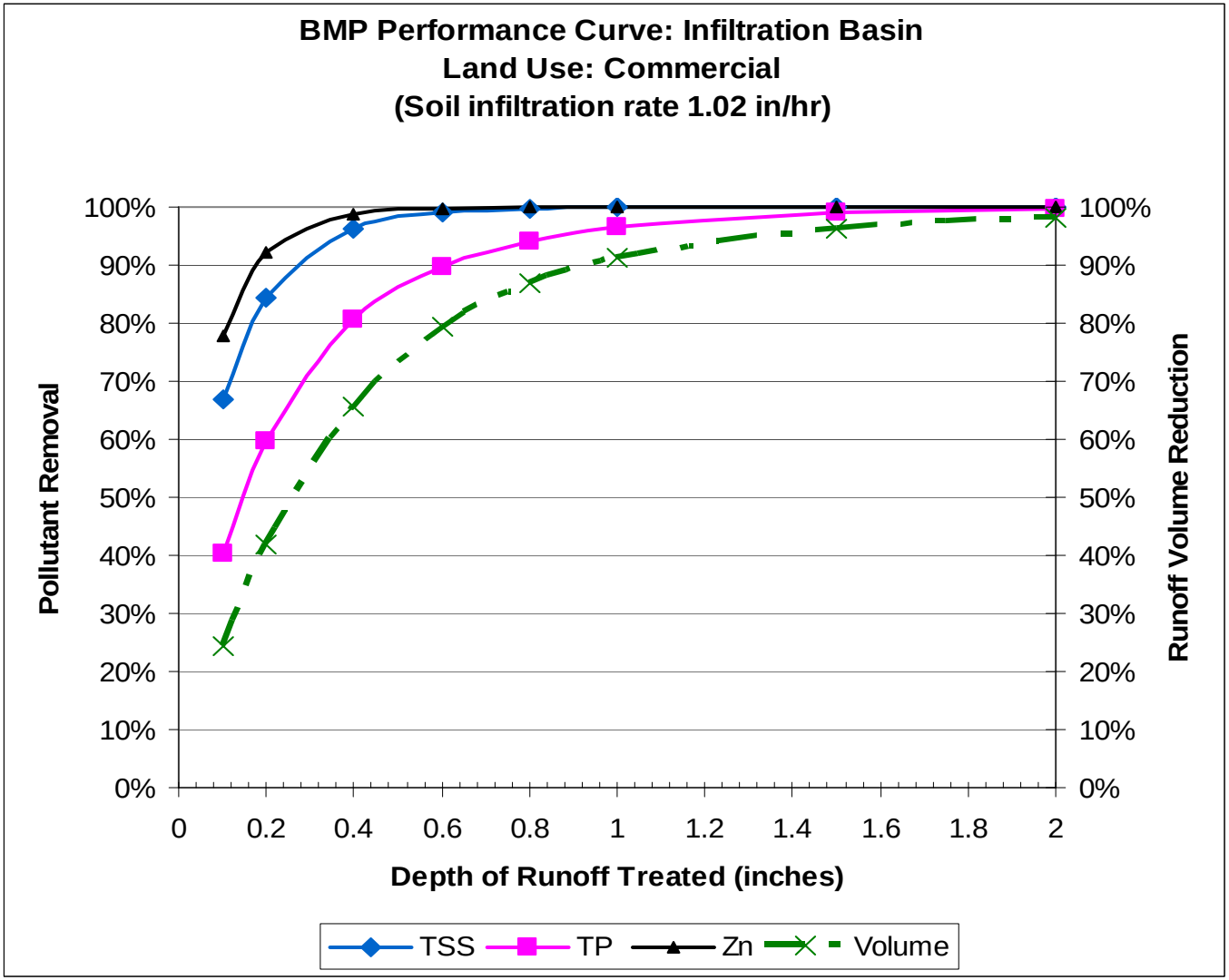
Prepared By: Bohler
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Stage-Area-Storage for Pond B1: Basin #1 ELC Parking

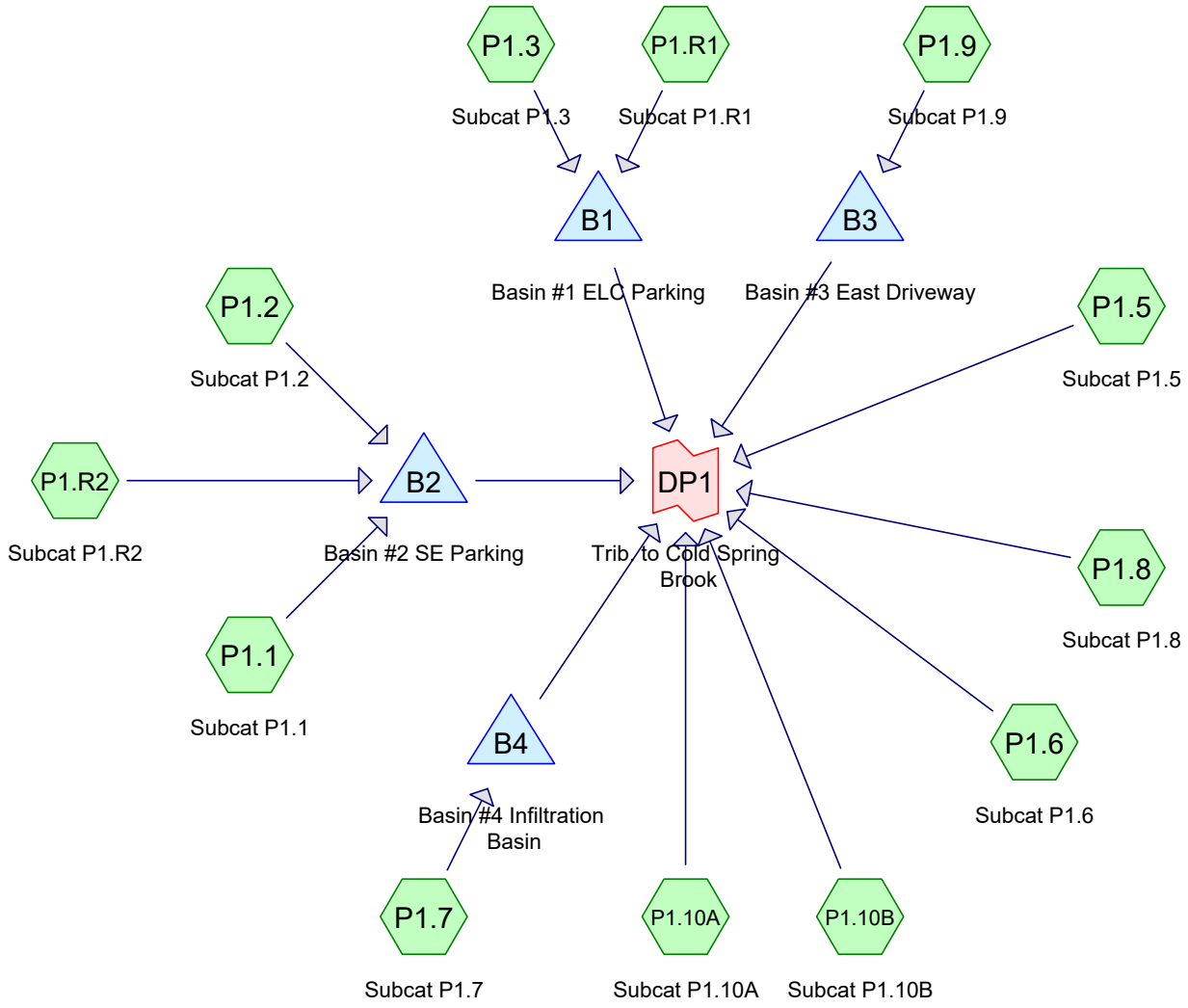
Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
242.50	691	0
242.55	702	14
242.60	714	28
242.65	726	41
242.70	737	55
242.75	749	69
242.80	761	83
242.85	772	97
242.90	784	111
242.95	796	124
243.00	807	138
243.05	819	164
243.10	831	190
243.15	843	216
243.20	854	241
243.25	866	267
243.30	878	293
243.35	889	318
243.40	901	344
243.45	913	369
243.50	924	394
243.55	936	420
243.60	948	445
243.65	959	470
243.70	971	495
243.75	983	519
243.80	994	544
243.85	1,006	569
243.90	1,018	593
243.95	1,029	618
244.00	1,041	642
244.05	1,053	666
244.10	1,064	690
244.15	1,076	714
244.20	1,088	738
244.25	1,099	761
244.30	1,111	785
244.35	1,123	808
244.40	1,134	831
244.45	1,146	854
244.50	1,158	877
244.55	1,169	900
244.60	1,181	923
244.65	1,193	945
244.70	1,205	967
244.75	1,216	989
244.80	1,228	1,011
244.85	1,240	1,032
244.90	1,251	1,054
244.95	1,263	1,075
245.00	1,275	1,095
245.05	1,286	1,116
245.10	1,298	1,136
245.15	1,310	1,156
245.20	1,321	1,176
245.25	1,333	1,195
245.30	1,345	1,214
245.35	1,356	1,232
245.40	1,368	1,250
245.45	1,380	1,267
245.50	1,391	1,283
245.55	1,403	1,299
245.60	1,415	1,314
245.65	1,426	1,329
245.70	1,438	1,343
245.75	1,450	1,357
245.80	1,461	1,371
245.85	1,473	1,385
245.90	1,485	1,399
245.95	1,496	1,413
246.00	1,508	1,426
246.05	1,520	1,440
246.10	1,531	1,454
246.15	1,543	1,468
246.20	1,555	1,482
246.25	**1,566**	**1,496**

Stage-Area-Storage for Pond B3: Basin #3 East Driveway

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
237.00	289	0
237.10	298	12
237.20	306	23
237.30	315	35
237.40	324	46
237.50	332	58
237.60	341	69
237.70	349	81
237.80	358	98
237.90	366	120
238.00	375	142
238.10	384	165
238.20	392	187
238.30	401	209
238.40	409	231
238.50	418	252
238.60	426	274
238.70	435	296
238.80	443	317
238.90	452	338
239.00	461	360
239.10	469	381
239.20	478	402
239.30	486	422
239.40	495	443
239.50	503	463
239.60	512	484
239.70	520	504
239.80	529	524
239.90	538	543
240.00	546	563
240.10	555	582
240.20	563	601
240.30	572	619
240.40	580	637
240.50	589	655
240.60	598	673
240.70	606	690
240.80	615	706
240.90	623	722
241.00	632	738
241.10	640	752
241.20	649	766
241.30	657	779
241.40	666	791
241.50	675	803
241.60	683	814
241.70	692	826
241.80	700	837
241.90	709	849
242.00	717	860
242.10	726	872
242.20	734	884
242.30	743	895
242.40	752	907
242.50	**760**	**918**


BMP Performance Curve: Infiltration Basin
Land Use: Commercial
(Soil infiltration rate 1.02 in/hr)
Pollutant Removal
Runoff Volume Reduction
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Depth of Runoff Treated (inches)
TSS
TP
Zn
Volume

One inch rainfall demonstrating no discharge from infiltration basins (100% TSS and P Removal)



Subcat Reach Pond Link

Routing Diagram for MAA240220 POST REV 09-22-25 TYPE B
Prepared by Bohler Engineering, PC, Printed 10/6/2025

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 inch	Type III 24-hr		Default	24.00	1	1.00	2

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

Subcatchment P1.1: Subcat P1.1 Runoff Area=1.283 ac 79.58% Impervious Runoff Depth=0.32"
Tc=6.0 min CN=90 Runoff=0.45 cfs 0.034 af

Subcatchment P1.10A: Subcat P1.10A Runoff Area=0.178 ac 32.02% Impervious Runoff Depth=0.02"
Tc=0.0 min CN=73 Runoff=0.00 cfs 0.000 af

Subcatchment P1.10B: Subcat P1.10B Runoff Area=0.069 ac 8.43% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=64 Runoff=0.00 cfs 0.000 af

Subcatchment P1.2: Subcat P1.2 Runoff Area=0.735 ac 82.18% Impervious Runoff Depth=0.36"
Tc=6.0 min CN=91 Runoff=0.29 cfs 0.022 af

Subcatchment P1.3: Subcat P1.3 Runoff Area=0.983 ac 84.23% Impervious Runoff Depth=0.40"
Tc=6.0 min CN=92 Runoff=0.45 cfs 0.033 af

Subcatchment P1.5: Subcat P1.5 Runoff Area=2.286 ac 0.04% Impervious Runoff Depth=0.00"
Flow Length=170' Tc=8.3 min CN=57 Runoff=0.00 cfs 0.000 af

Subcatchment P1.6: Subcat P1.6 Runoff Area=2.205 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=220' Tc=6.0 min CN=58 Runoff=0.00 cfs 0.000 af

Subcatchment P1.7: Subcat P1.7 Runoff Area=2.397 ac 11.10% Impervious Runoff Depth=0.00"
Flow Length=200' Tc=9.8 min CN=68 Runoff=0.00 cfs 0.000 af

Subcatchment P1.8: Subcat P1.8 Runoff Area=0.613 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=90' Tc=6.0 min CN=57 Runoff=0.00 cfs 0.000 af

Subcatchment P1.9: Subcat P1.9 Runoff Area=0.152 ac 62.67% Impervious Runoff Depth=0.15"
Tc=6.0 min CN=84 Runoff=0.02 cfs 0.002 af

Subcatchment P1.R1: Subcat P1.R1 Runoff Area=0.216 ac 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=98 Runoff=0.19 cfs 0.014 af

Subcatchment P1.R2: Subcat P1.R2 Runoff Area=0.606 ac 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=98 Runoff=0.53 cfs 0.040 af

Pond B1: Basin #1 ELC Parking Peak Elev=242.87' Storage=723 cf Inflow=0.63 cfs 0.047 af
Discarded=0.08 cfs 0.047 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.047 af

Pond B2: Basin #2 SE Parking Peak Elev=244.68' Storage=998 cf Inflow=1.27 cfs 0.096 af
Discarded=0.32 cfs 0.096 af Primary=0.00 cfs 0.000 af Outflow=0.32 cfs 0.096 af

Pond B3: Basin #3 East Driveway Peak Elev=237.05' Storage=11 cf Inflow=0.02 cfs 0.002 af
Discarded=0.01 cfs 0.002 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.002 af

Pond B4: Basin #4 Infiltration Basin Peak Elev=229.58' Storage=2 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Link DP1: Trib. to Cold Spring Brook Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 11.724 ac Runoff Volume = 0.146 af Average Runoff Depth = 0.15"
68.43% Pervious = 8.023 ac 31.57% Impervious = 3.701 ac

Summary for Subcatchment P1.1: Subcat P1.1

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 0.034 af, Depth= 0.32"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.262	61	>75% Grass cover, Good, HSG B
1.021	98	Paved parking, HSG B
1.283	90	Weighted Average
0.262		20.42% Pervious Area
1.021		79.58% Impervious Area

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

Summary for Subcatchment P1.10A: Subcat P1.10A

Runoff = 0.00 cfs @ 15.02 hrs, Volume= 0.000 af, Depth= 0.02"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.121	61	>75% Grass cover, Good, HSG B
0.057	98	Paved parking, HSG B
0.178	73	Weighted Average
0.121		67.98% Pervious Area
0.057		32.02% Impervious Area

Summary for Subcatchment P1.10B: Subcat P1.10B

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.063	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.069	64	Weighted Average
0.063		91.57% Pervious Area
0.006		8.43% Impervious Area

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

Summary for Subcatchment P1.2: Subcat P1.2

Runoff = 0.29 cfs @ 12.10 hrs, Volume= 0.022 af, Depth= 0.36"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.131	61	>75% Grass cover, Good, HSG B
0.604	98	Paved parking, HSG B
0.735	91	Weighted Average
0.131		17.82% Pervious Area
0.604		82.18% Impervious Area

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

Summary for Subcatchment P1.3: Subcat P1.3

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 0.40"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.155	61	>75% Grass cover, Good, HSG B
0.804	98	Paved parking, HSG B
0.024	98	Roofs, HSG B
0.983	92	Weighted Average
0.155		15.77% Pervious Area
0.828		84.23% Impervious Area

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

Summary for Subcatchment P1.5: Subcat P1.5

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.600	61	>75% Grass cover, Good, HSG B
0.171	48	Brush, Good, HSG B
0.044	96	Gravel surface, HSG B
0.001	98	Paved parking, HSG B
0.000	98	Roofs, HSG B
1.470	55	Woods, Good, HSG B
2.286	57	Weighted Average
2.285		99.96% Pervious Area
0.001		0.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	70	0.0150	0.14		**Sheet Flow, Soccer field** Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
8.3	170	Total			

Summary for Subcatchment P1.6: Subcat P1.6

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.608	61	>75% Grass cover, Good, HSG B
0.373	48	Brush, Good, HSG B
0.114	96	Gravel surface, HSG B
0.000	98	Paved parking, HSG B
1.110	55	Woods, Good, HSG B
2.205	58	Weighted Average
2.205		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	100	0.1500	0.39		**Sheet Flow, soccer field** Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
1.1					**Direct Entry, To make min. allowable**
6.0	220	Total			

Summary for Subcatchment P1.7: Subcat P1.7

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond B4 : Basin #4 Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
1.935	61	>75% Grass cover, Good, HSG B
0.193	96	Gravel surface, HSG B
0.072	98	Water Surface, HSG B
0.003	55	Woods, Good, HSG B
0.092	98	Roofs, HSG B
0.102	98	Paved parking, HSG B
2.397	68	Weighted Average
2.131		88.90% Pervious Area
0.266		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		**Sheet Flow, Playgrround** Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		**Shallow Concentrated Flow, slope** Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.8	200	Total			

Summary for Subcatchment P1.8: Subcat P1.8

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : Trib. to Cold Spring Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.168	61	>75% Grass cover, Good, HSG B
0.446	55	Woods, Good, HSG B
0.613	57	Weighted Average
0.613		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					**Direct Entry, To make min. allowable**
3.9	50	0.1200	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.0	90	Total			

Summary for Subcatchment P1.9: Subcat P1.9

Runoff = 0.02 cfs @ 12.12 hrs, Volume= 0.002 af, Depth= 0.15"
Routed to Pond B3 : Basin #3 East Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.057	61	>75% Grass cover, Good, HSG B
0.095	98	Paved parking, HSG B
0.152	84	Weighted Average
0.057		37.33% Pervious Area
0.095		62.67% Impervious Area

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

Summary for Subcatchment P1.R1: Subcat P1.R1

Runoff = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 0.79"
Routed to Pond B1 : Basin #1 ELC Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.216	98	Roofs, HSG B
0.216		100.00% Impervious Area

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

Summary for Subcatchment P1.R2: Subcat P1.R2

Runoff = 0.53 cfs @ 12.09 hrs, Volume= 0.040 af, Depth= 0.79"
Routed to Pond B2 : Basin #2 SE Parking

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (ac)	CN	Description
0.606	98	Roofs, HSG B
0.606		100.00% Impervious Area

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

Summary for Pond B1: Basin #1 ELC Parking

Inflow Area = 1.199 ac, 87.08% Impervious, Inflow Depth = 0.47" for 1 inch event
Inflow = 0.63 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.08 cfs @ 12.85 hrs, Volume= 0.047 af, Atten= 88%, Lag= 45.5 min
Discarded = 0.08 cfs @ 12.85 hrs, Volume= 0.047 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 242.87' @ 12.85 hrs Surf.Area= 4,890 sf Storage= 723 cf

Plug-Flow detention time= 77.6 min calculated for 0.047 af (100% of inflow)
Center-of-Mass det. time= 77.6 min (907.7 - 830.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	4,579 cf	**44.25'W x 110.52'L x 3.75'H Field A** 18,339 cf Overall - 6,892 cf Embedded = 11,447 cf x 40.0% Voids
#2A	243.00'	6,892 cf	**ADS_StormTech SC-800 +Cap** x 135 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 135 Chambers in 9 Rows Cap Storage= 3.4 cf x 2 x 9 rows = 61.6 cf
		11,470 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	**0.680 in/hr Exfiltration over Wetted area**
#2	Primary	242.50'	**12.0" Round Culvert** L= 79.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 242.50' / 242.10' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	243.75'	**4.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

#4 Device 2 245.10' **4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.08 cfs @ 12.85 hrs HW=242.87' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=242.50' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B2: Basin #2 SE Parking

Inflow Area = 2.624 ac, 85.02% Impervious, Inflow Depth = 0.44" for 1 inch event
Inflow = 1.27 cfs @ 12.10 hrs, Volume= 0.096 af
Outflow = 0.32 cfs @ 12.51 hrs, Volume= 0.096 af, Atten= 75%, Lag= 24.6 min
Discarded = 0.32 cfs @ 12.51 hrs, Volume= 0.096 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 244.68' @ 12.51 hrs Surf.Area= 13,742 sf Storage= 998 cf

Plug-Flow detention time= 22.8 min calculated for 0.096 af (100% of inflow)
Center-of-Mass det. time= 22.8 min (852.8 - 830.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	12,685 cf	**63.25'W x 217.27'L x 3.75'H Field A** 51,533 cf Overall - 19,820 cf Embedded = 31,713 cf x 40.0% Voids
#2A	245.00'	19,820 cf	**ADS_StormTech SC-800 +Cap** x 390 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 390 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		32,505 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	**1.000 in/hr Exfiltration over Wetted area**
#2	Primary	244.00'	**15.0" Round Culvert** L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 244.00' / 242.88' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Device 2	245.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.10'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.32 cfs @ 12.51 hrs HW=244.68' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=244.50' (Free Discharge)
└**2=Culvert** (Passes 0.00 cfs of 1.10 cfs potential flow)
  └**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B3: Basin #3 East Driveway

Inflow Area = 0.152 ac, 62.67% Impervious, Inflow Depth = 0.15" for 1 inch event
Inflow = 0.02 cfs @ 12.12 hrs, Volume= 0.002 af
Outflow = 0.01 cfs @ 12.43 hrs, Volume= 0.002 af, Atten= 45%, Lag= 18.4 min
Discarded = 0.01 cfs @ 12.43 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 237.05' @ 12.43 hrs Surf.Area= 536 sf Storage= 11 cf

Plug-Flow detention time= 17.8 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 17.8 min (926.7 - 908.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	237.00'	803 cf	**15.58'W x 34.38'L x 5.50'H Field A** 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 8 Chambers in 2 Rows Cap Storage= 14.9 cf x 2 x 2 rows = 59.6 cf
		1,742 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**0.880 in/hr Exfiltration over Wetted area**
#2	Primary	237.00'	**12.0" Round Culvert** L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 237.00' / 236.69' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	240.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 12.43 hrs HW=237.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=237.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B4: Basin #4 Infiltration Basin

Inflow Area = 2.397 ac, 11.10% Impervious, Inflow Depth = 0.00" for 1 inch event
Inflow = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.07 hrs, Volume= 0.000 af, Atten= 14%, Lag= 4.5 min
Discarded = 0.00 cfs @ 24.07 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : Trib. to Cold Spring Brook

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 229.58' @ 24.07 hrs Surf.Area= 55 sf Storage= 2 cf

Plug-Flow detention time= 53.4 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 53.6 min (1,385.4 - 1,331.8)

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
229.50	0	0	0	0
230.00	2,004	334	334	2,004
231.00	3,027	2,498	2,832	3,043
232.00	4,171	3,584	6,416	4,206
233.00	14,809	8,946	15,362	14,849

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.50'	**0.330 in/hr Exfiltration over Wetted area**
#2	Primary	232.50'	**6.0' long x 12.0' 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) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64
#3	Primary	226.50'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 226.50' / 225.00' S= 0.0375 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	231.35'	**12.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 24.07 hrs HW=229.58' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=229.50' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Passes 0.00 cfs of 5.98 cfs potential flow)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 31.57% Impervious, Inflow Depth = 0.00" for 1 inch event
Inflow = 0.00 cfs @ 15.02 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 15.02 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX G: OPERATION AND MAINTENANCE

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

STORMWATER OPERATION AND MAINTENANCE PLAN

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

TBD
Address TBD
City and State TBD

RESPONSIBLE PARTY POST CONSTRUCTION:

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA

Construction Phase

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

Post Development Controls

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

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

   Approximate Maintenance Budget: $1,000/year

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

   Approximate Maintenance Budget: $500/year per structure.

3. Riprap apron / Scour Hole: 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.

Approximate Maintenance Budget: $250/year per location.

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

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

5. 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.

   Approximate Maintenance Budget: $2,000/year per basin

6. Underground Infiltration Basins: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. The outlet of the basin, if any, shall be inspected for erosion and sedimentation, and 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.

   Approximate Maintenance Budget: $2,000/year per basin

7. Grass Filter Strip (east playing field): Inspect field for the first few months after construction and at least twice a year thereafter to make sure vegetation is adequate and slopes are not eroding. Check for rilling and gullying. Repair eroded areas and re-vegetate. Mow as needed and do not let the grass height exceed six inches. Regular maintenance includes mowing, fertilizing, liming, watering, pruning, weeding, and pest control as necessary. Remove sediment and debris manually at least once a year. Re-seed as necessary. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

   Approximate Maintenance Budget: $500/year per field

8. Roof leaders, roof gutters & downspouts: Roof leaders, gutters, and downspouts shall be inspected a minimum of twice a year for signs of clogging or damage. Roof drainage shall be cleaned or repaired as needed to provide roof drainage as designed.

   Approximate Maintenance Budget: $500/year

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

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA

RESPONSIBLE PARTY:

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA

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:	
Infiltration Basin:	
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:
Infiltration Basin:
Water Quality Units:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Team Hoyt Community YMCA
30 Memorial Drive Ashland, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

TBD

RESPONSIBLE PARTY POST CONSTRUCTION:

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, MA

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

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

- Trash and other debris shall be removed from all areas of the site at least twice yearly.

- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.

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

- Plants shall be pruned as necessary.

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

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

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

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

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

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

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

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

OPERATON AND MAINTENANCE TRAINING PROGRAM

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

Discuss the Operations and Maintenance Plan:

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

Discuss the Spill Prevention and Response Procedures:

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

ILLICIT DISCHARGE STATEMENT

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

Duly Acknowledged:

_____

Name & Title Date

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

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

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

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

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

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

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

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

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

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

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

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

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

Team Hoyt Community YMCA
30 Memorial Drive
Ashland, Massachusetts

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 of Ashland 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 Town Health Department at (508) 881-0114 and the Town Conservation Commission at (508) 881-0100.

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

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

Weather Conditions:_____

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

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

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

_____

_____

Additional Contact Numbers:

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

LEGEND

O&M PLAN

CATCH BASIN ("PROP CB") (SINGLE AND DOUBLE)	
OUTLET CONTROL STRUCTURE ("PROP OCS")	
WATER QUALITY UNIT	
OUTFALLS	
UNDERGROUND INFILTRATION BASIN	
ABOVEGROUND INFILTRATION BASIN	
ISOLATOR ROW	
RIP RAP BLANKETS	
GRASS FILTER STRIP	

P:\2024\MAA240220.01\CAD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\P-DMAP-HYDR-MAA240220.01-3B----->LAYOUT: O&M

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OPERATIONS AND MAINTENANCE PLAN

cbt

ASHLAND, MA 01721

Date | SB | MAA240220.01 | REV 3b

150 75 37.5 0 150

SCALE: 1" = 150'