

# **DRAINAGE REPORT**

*For*

# **cbt**

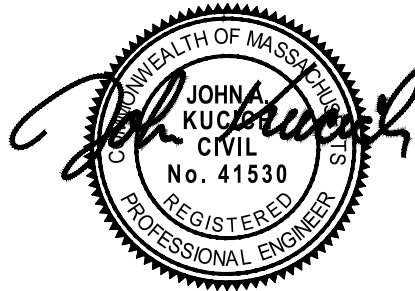
**PROPOSED**

**“TEAM HOYT COMMUNITY YMCA”**

**30 Memorial Drive  
Ashland, Massachusetts  
Middlesex County**

Prepared by:

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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 and Table 1.2** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

**Table 1.1: Design Point Peak Runoff Rate Summary**

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
<b>DP1</b>	1.50	1.21	<b>-0.29</b>	10.00	6.99	<b>-3.01</b>	17.65	14.74	<b>-2.91</b>	31.21	24.52	<b>-6.69</b>

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

**Table 1.2: Design Point Volume 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
<b>DP1</b>	0.293	0.222	<b>-0.071</b>	1.077	0.919	<b>-0.158</b>	1.724	1.529	<b>-0.195</b>	2.875	2.874	<b>-0.001</b>

*\*Volumes are represented in acre-feet (ac-ft)*

## 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**

<b>Soil Unit Symbol</b>	<b>Soil Name / Description</b>	<b>Hydrologic Soil Group (HSG)</b>
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 15<sup>th</sup> and 17<sup>th</sup>, 2025. Groundwater was not encountered during drilling or test pit excavation. 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**

<b>Sub-catchment Name</b>	<b>Total Area (acres)</b>	<b>Cover Description</b>	<b>Curve Number (CN)</b>	<b>Time of Concentration (Tc, minutes)</b>
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 meet, or exceed, 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 5,426 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** and **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
<b>DP1</b>	1.50	1.21	<b>-0.29</b>	10.00	6.99	<b>-3.01</b>	17.65	14.74	<b>-2.91</b>	31.21	24.52	<b>-6.69</b>

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

**Table 6.2: Design Point Volume 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
<b>DP1</b>	0.293	0.222	<b>-0.071</b>	1.077	0.919	<b>-0.158</b>	1.724	1.529	<b>-0.195</b>	2.875	2.874	<b>-0.001</b>

*\*Volumes are represented in acre-feet (ac-ft)*

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

**APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST**



# 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.<sup>1</sup> 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<sup>2</sup>
- 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.

<sup>1</sup> 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.

<sup>2</sup> 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.



# Checklist for Stormwater Report

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## 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.

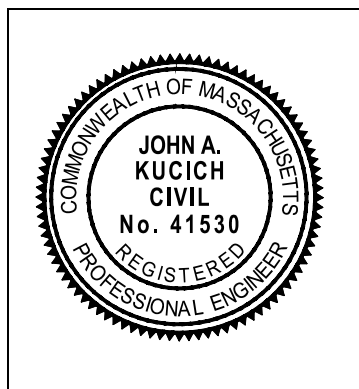
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

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### Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



*John Kucich*  
Signature and Date

4/25/25

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## 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

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## 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

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## 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<sup>1</sup>
- 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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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

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## 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

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## 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

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## 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

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## 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

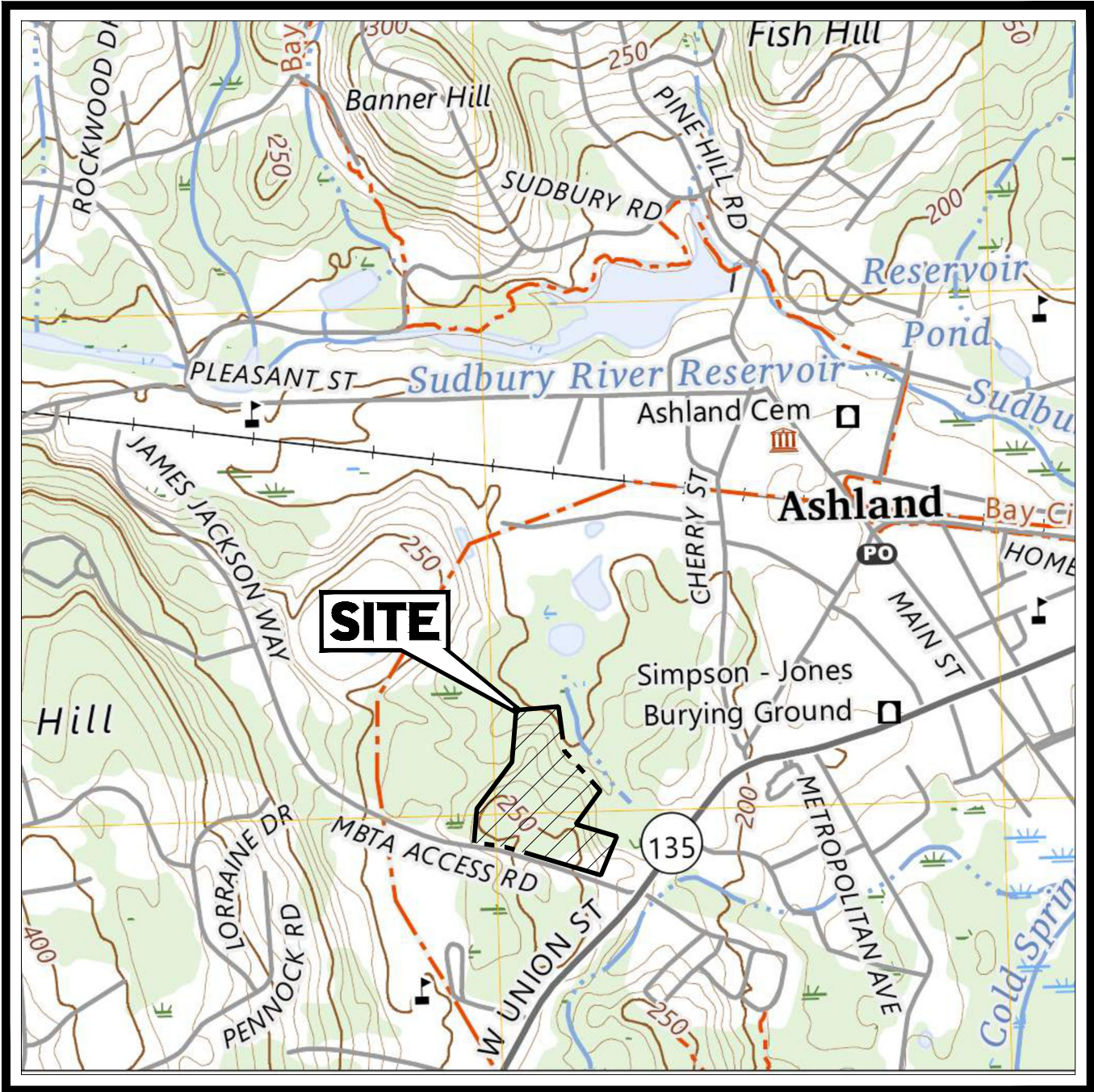
- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - Name of the stormwater management system owners;
  - Party responsible for operation and maintenance;
  - Schedule for implementation of routine and non-routine maintenance 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



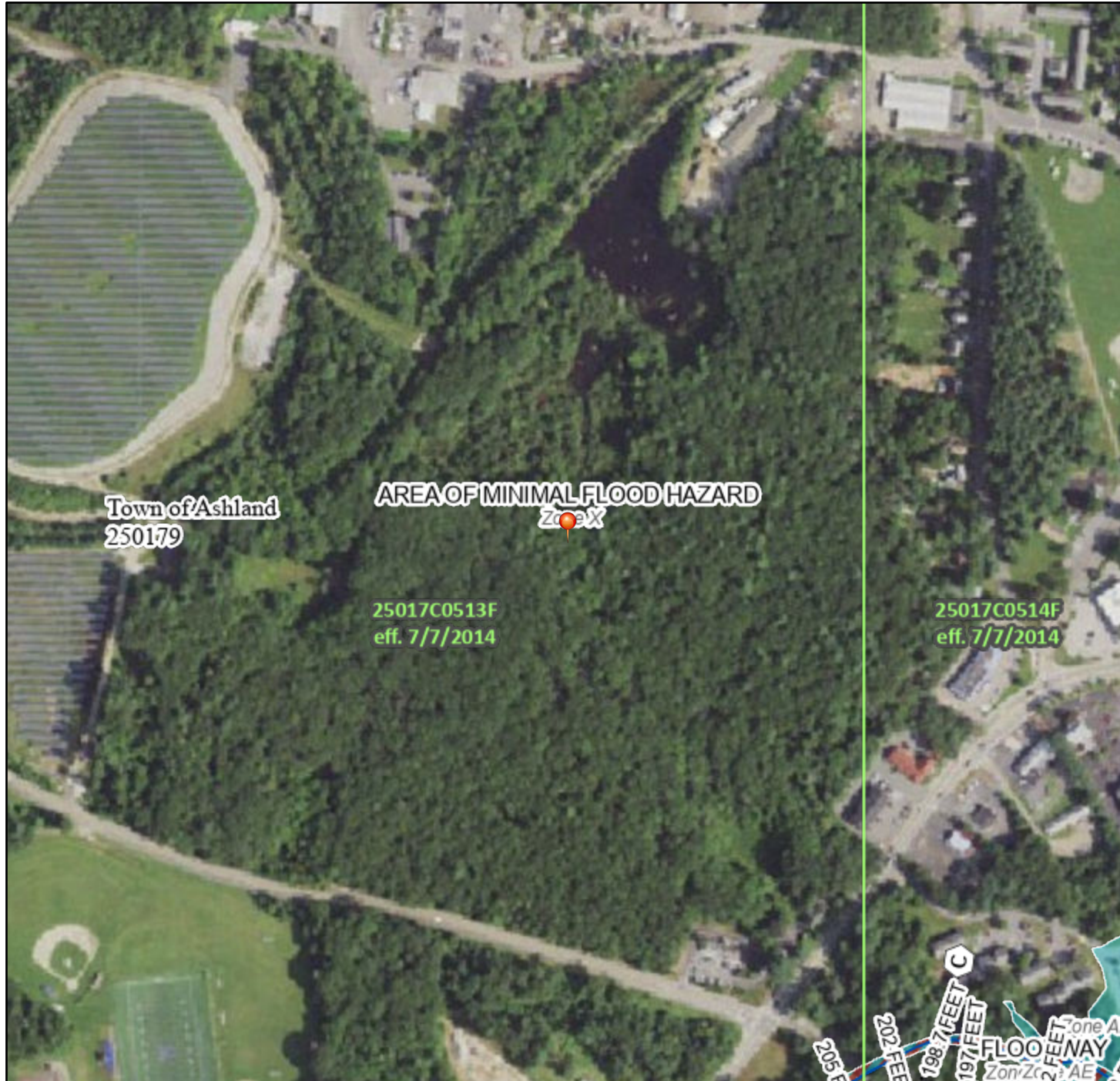
**USGS MAP**

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

# National Flood Hazard Layer FIRMette



71°28'36"W 42°15'36"N



## Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>

OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs

GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall

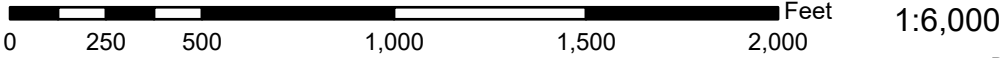
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance
		17.5 Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
OTHER FEATURES		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature

MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped
		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.

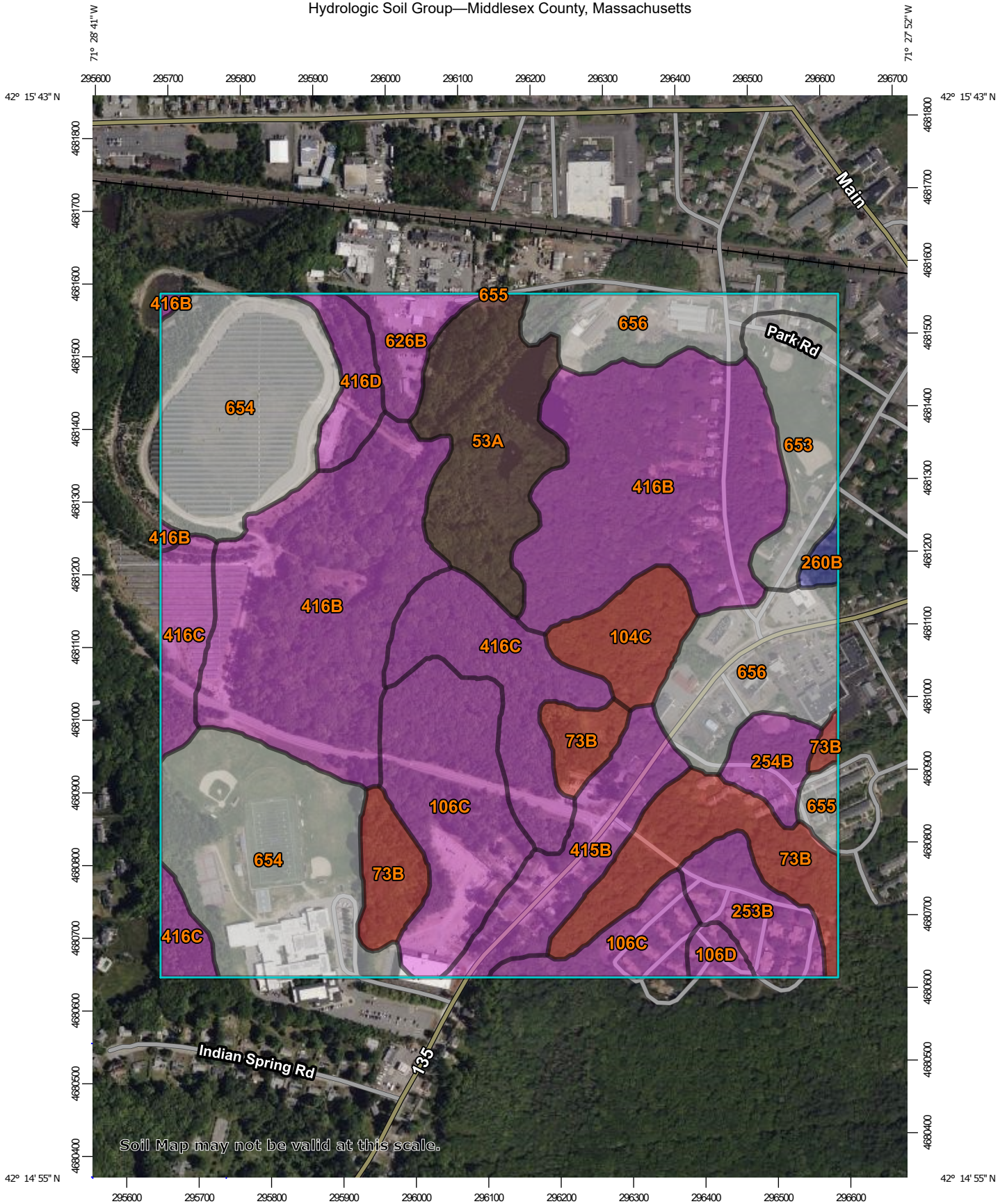


Basemap Imagery Source: USGS National Map 2023

## **APPENDIX C: SOIL AND WETLAND INFORMATION**

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

Hydrologic Soil Group—Middlesex County, Massachusetts




Map Scale: 1:7,250 if printed on A portrait (8.5" x 11") sheet.



## 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
<b>Totals for Area of Interest</b>			<b>218.3</b>	<b>100.0%</b>

## 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

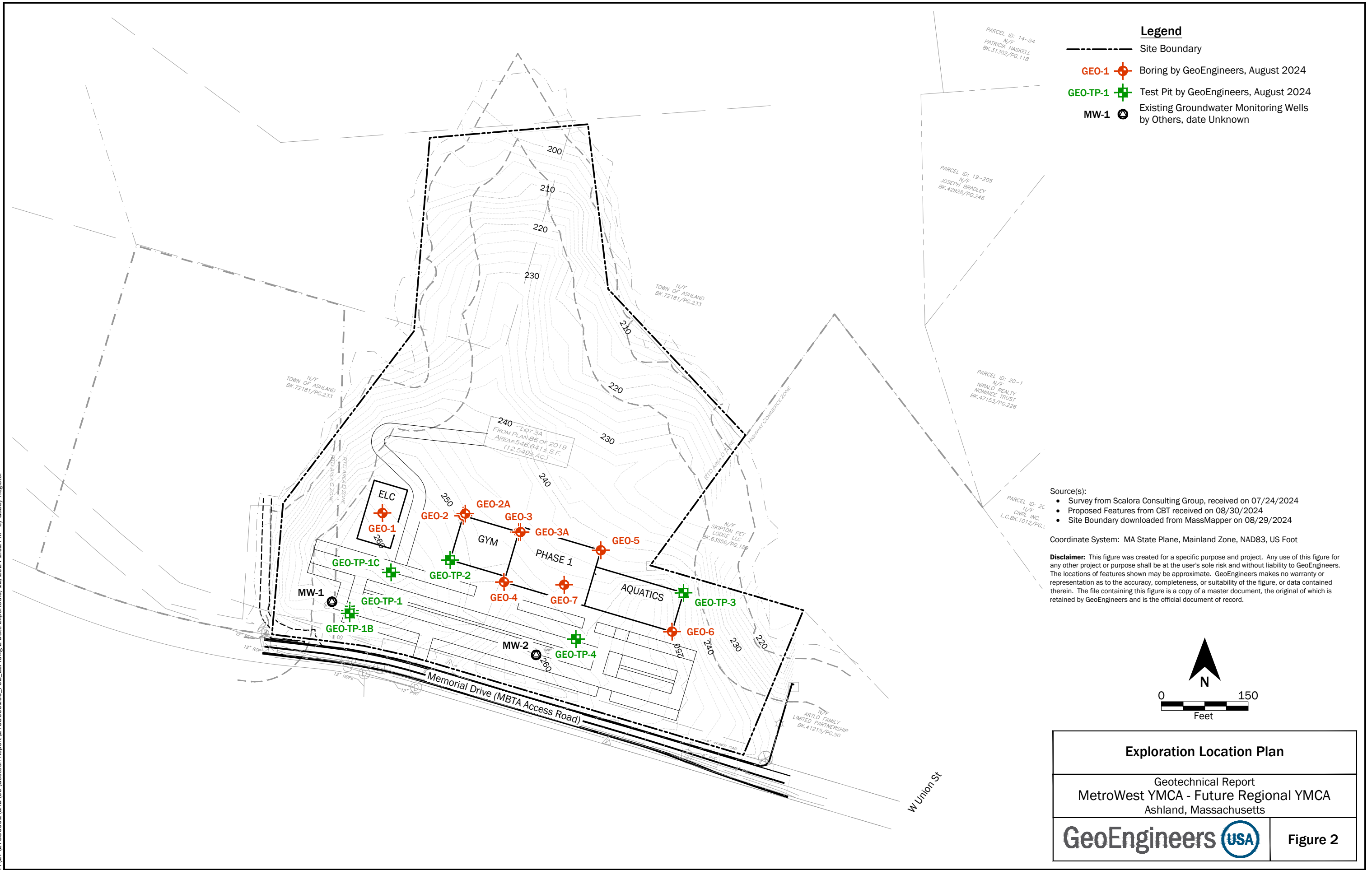
*for*  
**MetroWest Young Men's Christian Association, Inc.**  
**"MetroWest YMCA"**

September 13, 2024

239 Causeway Street, Suite 400  
Boston, Massachusetts 02114  
617.749.9220

GeoEngineers 

P:\27\27530001\CAD\00\_Geotech\_Report\2753000100\_F02\_ELP.dwg 2 Date Exported: 9/12/2024 1:02 PM - by Gabby Register



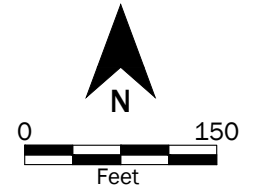
**Legend**

- Site Boundary
- GEO-1 Boring by GeoEngineers, August 2024
- GEO-TP-1 Test Pit by GeoEngineers, August 2024
- MW-1 Existing Groundwater Monitoring Wells by Others, date Unknown

- 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

**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.



<b>Exploration Location Plan</b>	
Geotechnical Report MetroWest YMCA - Future Regional YMCA Ashland, Massachusetts	
	Figure 2

## SOIL CLASSIFICATION CHART

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

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

### 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.

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.

## ADDITIONAL MATERIAL SYMBOLS

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

### 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

## Key to Exploration Logs

Start Drilled	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) Vertical Datum	257 NAVD88			Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop			Drilling Equipment		Diedrich D70			
Easting (X) Northing (Y)	663498 2917810			System Datum	MA State Plane Mainland NAD83 (feet)			Groundwater not observed at time of exploration					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Sample Name Testing							
255	0	17	2-2-2-2 (4)	S-1A	[Symbol]	TS	Dark brown fine to medium sand with silt and organic matter (roots) (topsoil)				
				S-1B		ML	Orange-brown silt with sand and organic matter (roots) (very loose, moist) (subsoil)				
250	15	15	3-5-18-22 (23)	S-2A	[Symbol]	SM	Becomes medium dense with gravel			Boulders noted at 4 feet	
				S-2B			Light gray silty fine to medium sand with gravel (medium dense, moist) (glacial till)				
245	5	14	(51)	S-3	[Symbol]		With cobbles, boulders and becomes very dense			Boulder noted at approximately 11 feet	
				S-4		No recovery					

Boring terminated at approximately 12¼ feet 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.

Date: 9/12/24 Path: P:\271\27530001\GINT\2753000100.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB8\_GEO TECH\_STANDARD\_%F\_NO\_SW\_4BC

### Log of Boring GEO-1



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

Figure A-2  
Sheet 1 of 1

Start Drilled	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) Vertical Datum	249 NAVD88			Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted Mobile Drill				
Easting (X) Northing (Y)	663638 2917805			System Datum	MA State Plane Mainland NAD83 (feet)			Groundwater not observed at time of exploration					
Notes:													

Elevation (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Sample Name Testing						
0	24	24-33 (7)	S-1	TS ML	Dark brown fine to medium sand with silt (loose, moist) (topsoil) Orange-brown silt with sand and organic matter (roots) (loose, moist) (subsoil)					
5	22	5-10-12-13 (22)	S-2	SP-SM	Becomes medium dense Grayish brown fine to medium sand with silt (medium dense, moist) (glacial till)				Difficult drilling	
10	0	>50/3.25" >50/3.25"	S-3		Boring terminated at approximately 10¼ feet due to auger and sampler refusal				No recovery	

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



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

Figure A-3  
Sheet 1 of 1

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

Elevation (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Sample Name Testing						
0										
245										
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.

### Log of Boring GEO-2A



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

Date: 9/12/24 Path: P:\27530001\GINT\27530001\00.GPJ DBLibrary/Library:GEOUSA\_DF STD\_US.GLB/GE08\_GEOTECH\_STANDARD\_MF\_NO\_SW\_4BC

Start Drilled	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) Vertical Datum	246 NAVD88			Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted Mobile Drill				
Easting (X) Northing (Y)	663734 2917777			System Datum	MA State Plane Mainland NAD83 (feet)			Groundwater not observed at time of exploration					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Sample Name Testing							
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)			Boulders noted at approximately 4½ feet	
240	5	12	0-24->50 (>50)	S-2		SPSM	Grayish brown sand with silt and gravel, boulders (very dense, moist) (glacial till)				
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



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

Date: 9/12/24 Path: P:\27530001\GINT\27530001\00.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB8\_GEOTECH\_STANDARD\_MF\_NO\_SW\_4BC

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

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Sample Name Testing							
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



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

Figure A-6  
Sheet 1 of 1

Date: 9/12/24 Path: P:\27530001\GINT\27530001\00.GPJ DBLibrary/Library:GEOUSA\_DF\_STD\_US.GLB/GE8\_GEOTECH\_STANDARD\_%F\_NO\_SW\_4BC

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

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



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:\27530001\GINT\27530001\00.GPJ DBLibrary/Library:GEOUSA\_DF\_STD\_USGLB\GEB8\_GEOTECH\_STANDARD\_SF\_NO\_SW\_4BC

Start Drilled	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) Vertical Datum	242 NAVD88			Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted Mobile Drill				
Easting (X) Northing (Y)	663876 2917745			System Datum	MA State Plane Mainland NAD83 (feet)			Groundwater not observed at time of exploration					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Sample Name Testing							
0	6	44-33 (7)	S-1		TS	Dark brown fine to medium sand with silt and organic matter (roots) (topsoil)					
240					ML	Orange-brown silt with sand and organic matter (roots) (loose, moist) (subsoil)					
5	15	35-47-44-44 (91)	S-2		SP-SM	Grayish brown sand with silt, gravel and cobbles (very dense, moist)				Difficult drilling	
235											
10	1	50/5" (50/5")	S-3							Piece of gravel at sampler tip	

Boring terminated at approximately 10¾ feet due to auger 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.

Date: 9/12/24 Path: P:\27530001\GINT\2753000100.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB8\_GEOTECH\_STANDARD\_MF\_NO\_LW\_4BC

### Log of Boring GEO-5



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

Figure A-8  
Sheet 1 of 1

Start Drilled	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) Vertical Datum	250 NAVD88			Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted Mobile Drill				
Easting (X) Northing (Y)	663999 2917605			System Datum	MA State Plane Mainland NAD83 (feet)			Groundwater not observed at time of exploration					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Sample Name Testing							
0	18	WOH-WOH-3-30 (3)	S-1A S-1B		TS ML	Dark brown fine to medium sand with silt and organic matter (roots) (very loose, moist) (topsoil) Orange-brown silt with sand, gravel/cobbles and organic matter (roots) (very loose, moist) (subsoil)			Difficult drilling		
245	5	16-28-33-35 (61)	S-2		SP-SM	Light gray sand with silt, gravel and cobbles (very dense, moist) (glacial till)					
240	10	8-23-22-32 (45)	S-3			Becomes dense					
Boring terminated at approximately 12½ feet due to auger refusal											Gravelly cuttings observed at ground surface while drilling at 12 feet

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



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

Date: 9/12/24 Path: P:\27530001\GINT\27530001\00.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB8\_GEO TECH\_STANDARD\_MF\_NO\_SW\_4BC

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

Elevation (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Sample Name Testing						
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.

### Log of Boring GEO-7



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

Date: 9/12/24 Path: P:\27530001\GINT\27530001.00.GPJ DBLibrary/Library:GEOUSA\_DF\_STD\_US.GLB\GEB\_GEOTECH\_STANDARD\_SF\_NO\_SW\_4BC

Date: 9/12/24 Path: P:\27\27530001\GINT\27530001\00.GPJ DBLibrary/Library:GEOUSA\_DF\_STD\_US.GLB/GE8\_GEOTECH\_STANDARD\_%F\_NO\_SW\_4BC

Elevation (feet)	FIELD DATA					MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Sample Name Testing	Graphic Log				
22									
30									Boring terminated at 30 feet due to target depth reached

**Log of Boring GEO-7 (continued)**



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

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

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
248	1	S-1			TS	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)			Roots present until 2½ feet
247	2	S-2			ML	Orange-brown silt with sand and organic matter (roots) (moist) (subsoil)			At 1 foot, approximately 3-foot by 2-foot by 2-foot boulder encountered
246	3	S-3				Becomes light brown with boulders, cobbles and roots			
245	4				SM	Light gray silty sand with gravel and boulders (moist) (glacial till)			

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



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

Figure A-11  
 Sheet 1 of 1

Date: 9/12/24 Path: P:\27530001\GINT\27530001.00.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_IP\_GEOtec.mxd

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

Elevation (feet)	Depth (feet)	SAMPLE		Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing					
248	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)			
247	2	S-2			Becomes light brown with boulders and cobbles			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



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

Figure A-12  
Sheet 1 of 1

Date: 9/12/24 Path: P:\27530001\GINT\2753000100.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_IP\_GEOtec\_\*.XF

Date Excavated	8/13/2024	Total Depth (ft)	7	Logged By	SPD	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Bobcat E50	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
260	1	S-1	SA		TS	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)			
					ML	Orange-brown sandy silt and organic matter (roots) (moist) (subsoil)		65.6	
259	2	S-2				Becomes light brown with gravel			
258	3	S-3			GP-GM	Grayish brown fine to coarse gravel with silt and sand (moist) (glacial till)			
257	4								Boulders present at approximately 3½ feet Very difficult excavating from approximately 3½ to 7 feet
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.

### Log of Test Pit GEO-TP-1C



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

Figure A-13  
Sheet 1 of 1

Date: 9/12/24 Path: P:\27530001\GINT\27530001\00.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_1P\_GEO-TP-1C.XIF

Date Excavated	8/13/2024	Total Depth (ft)	9.75	Logged By	SPD	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Bobcat E50	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
252	1	S-1	SA	TS	ML	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil)		80.9	Roots observed to approximately 3/4 feet
251	2	S-2				Orange-brown silt with sand and organic matter (roots) (moist) (subsoil)			
250	3					Becomes light brown			
249	4	S-3			SM	Light gray silty fine to medium sand with gravel, cobbles and boulders (moist) (glacial till)			Boulders present at approximately 3 1/2 feet
248	5								
247	6								
246	7								
245	8								
244	9								

Test pit terminated at approximately 9 3/4 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 1/2 foot.  
 Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

### Log of Test Pit GEO-TP-2



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

Date: 9/12/24 Path: P:\27530001\GINT\2753000100.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_IP\_GEOTECH.MF

Date Excavated	8/13/2024	Total Depth (ft)	8.75	Logged By	SPD	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Bobcat E50	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
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			GM	Light gray silty fine to coarse gravel with sand, cobbles and boulders (moist) (glacial till)	12.9		Large boulder encountered at approximately 3½ feet, extends to 7 feet and is approximately 3 feet wide
243	3								
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



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

Date: 9/12/24 Path: P:\27530001\GINT\27530001.00.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_IP\_GEOLOC.MF

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

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
251	1	S-1			TS ML	Dark brown fine to medium sand with organic matter (roots) (moist) (topsoil) Orange-brown silt with sand, trace gravel and organic matter (roots) (moist) (subsoil)			Boulders observed starting at ½ foot and present throughout test pit Roots present from 0 to approximately 3 feet
250	2	S-2				Becomes light brown			
249	3	S-3			SPSM	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



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

Date: 9/12/24 Path: P:\27530001\GINT\2753000100.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_IP\_GEOTECH.MF

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**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

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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 ASSESSMENT

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 <sup>1</sup>
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 <sup>2</sup>	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 <sup>1</sup>
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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>3</sup>

Notes:

<sup>1</sup>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).

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

<sup>3</sup> 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 <sup>1</sup>	DESIGN ESTIMATED HYDRAULIC CONDUCTIVITY <sup>2</sup>
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:

<sup>1</sup>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.

<sup>2</sup>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

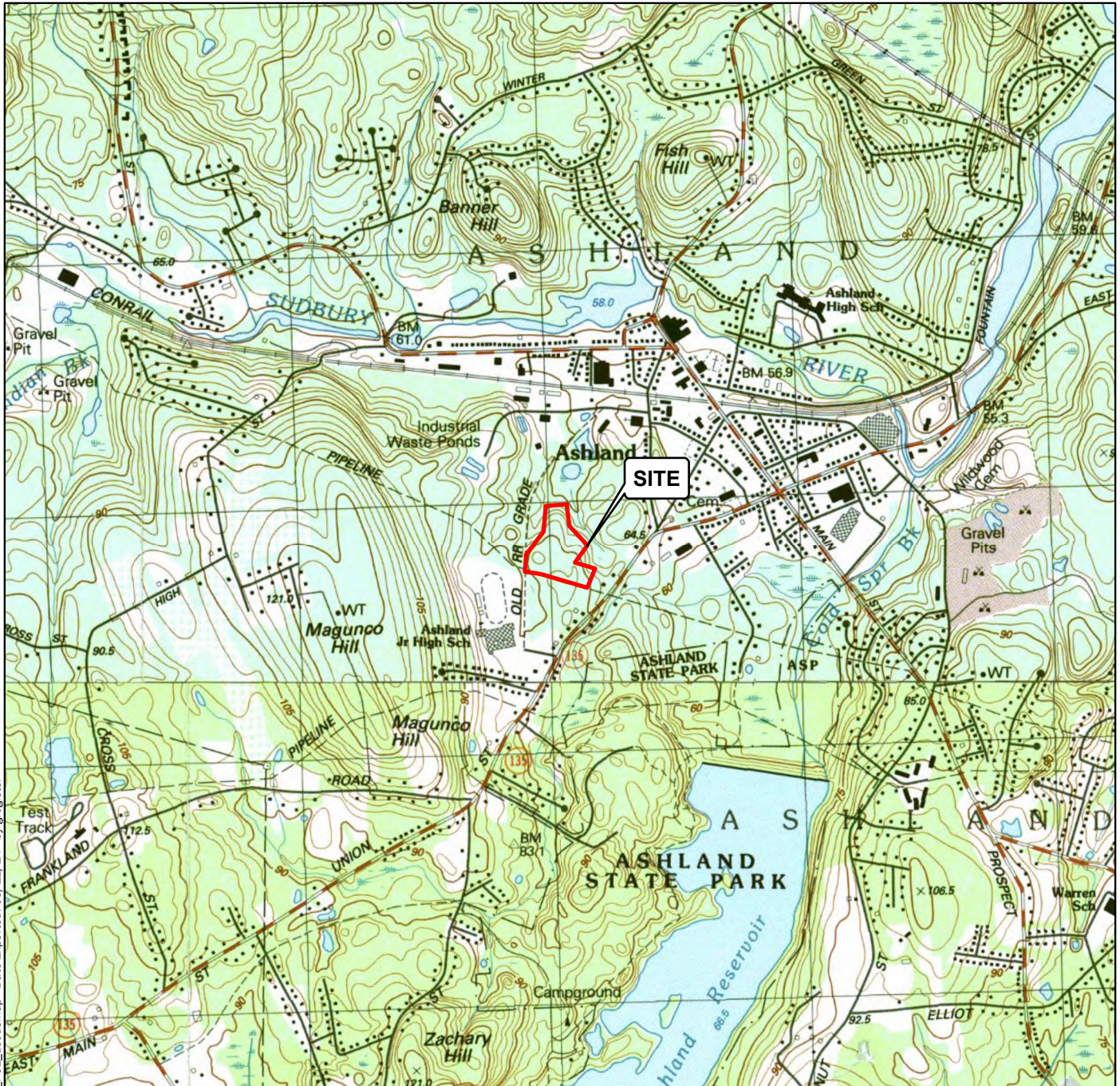
Attachment A. Subsurface Exploration Logs

Attachment B. Laboratory Test Results

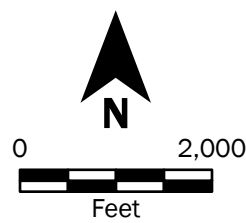
Attachment C. Memorandum Limitations and Guidelines for Use

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

## Figures



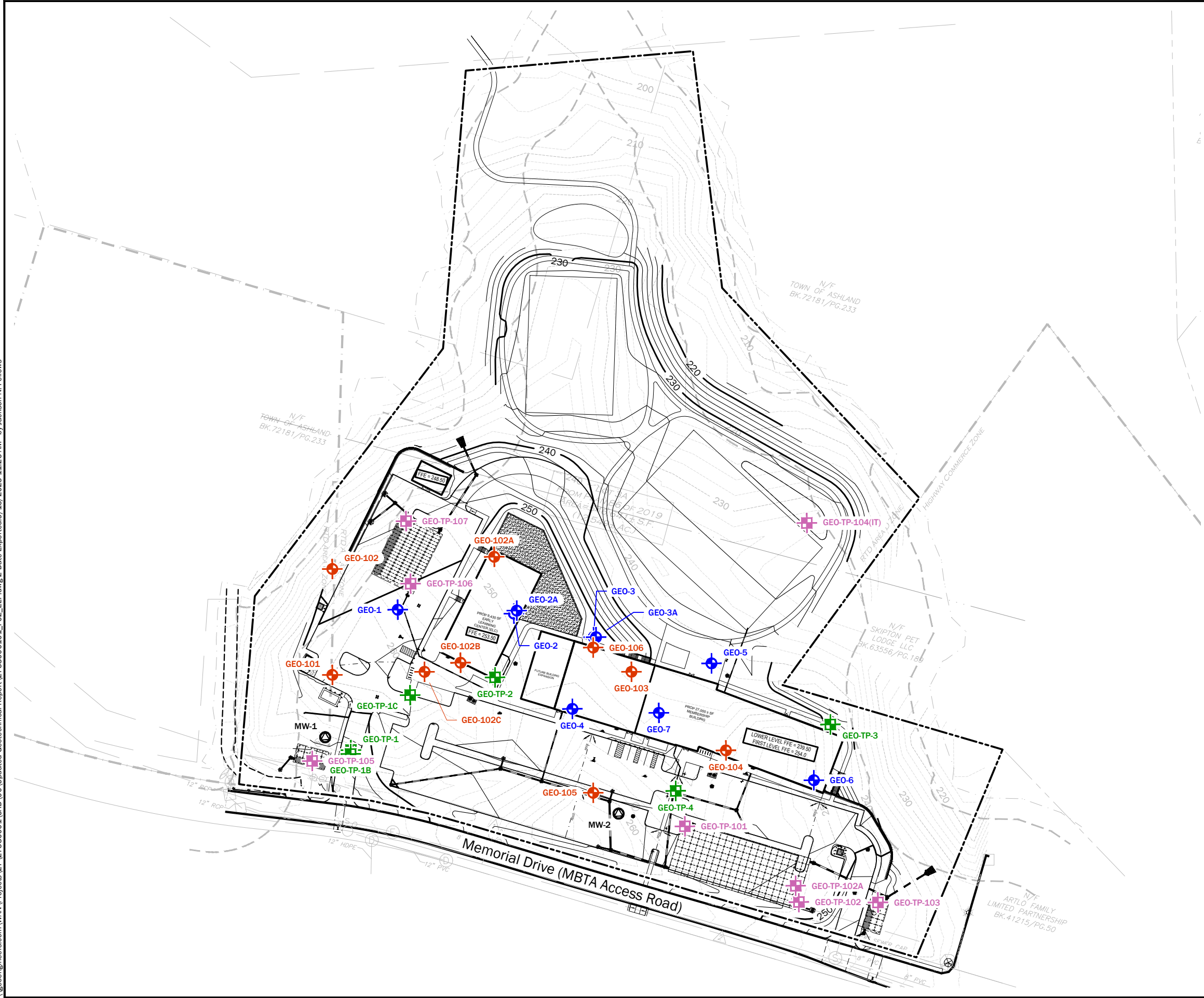
P:\27\7530001\GIS\27530001\_Project\27530001\_LocusMap.aprx\0273000100\_F01\_LocusMap Date Exported: 09/12/24 by Gregster



**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.

<b>Locus Map</b>	
Stormwater Memorandum MetroWest YMCA - Future Regional YMCA Ashland, Massachusetts	
	<b>Figure 1</b>

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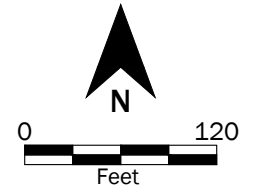


- Legend**
- Site Boundary
  - Proposed Building
  - GEO-TP-1 [Symbol] Test Pit by GeoEngineers, August 2025
  - GEO-101 [Symbol] Boring by GeoEngineers, April 2025
  - GEO-1 [Symbol] Boring by GeoEngineers, August 2024
  - GEO-TP-1 [Symbol] Test Pit by GeoEngineers, August 2024
  - MW-1 [Symbol] Existing Groundwater Monitoring Wells by Others, date Unknown

- 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.



<b>Exploration Location Plan</b>	
Stormwater Memorandum MetroWest YMCA - Future Regional YMCA Ashland, Massachusetts	
<b>GeoEngineers</b>	<b>Figure 2</b>

## Attachments

**Attachment A**  
**Subsurface Exploration Logs**

## SOIL CLASSIFICATION CHART

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

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

### 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.

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.

## ADDITIONAL MATERIAL SYMBOLS

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

### 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

## Key to Exploration Logs

Date Excavated	8/29/2025	Total Depth (ft)	16.25	Logged By	AHM	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
253	1	S-1		TS	Silty Sand (SM), dark brown, moist; fine sand, some silt; some organics (roots, leaves). [Topsoil]			Some roots to 1½ feet	
252	2			ML	Silt (ML), light orange-brown, moist; little fine to medium sand; few organics (roots); trace fine gravel; trace cobbles; trace boulders. [Subsoil]				
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.			Few roots to 2 feet	
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]				
248	6	S-4						Trace roots to 4½	
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								
238	16	S-7		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]		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



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

Date: 9/22/25 Path: P:\27530001\GINT\_2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_LP\_GEOTEC\_%F

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

Elevation (feet)	Depth (feet)	SAMPLE		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
252	1	S-1		TS	Silty Sand (SM), dark brown, moist; fine sand, some silt; some organics (roots, leaves). [Topsoil]			Some roots to 6 inches	
251	2	S-2		ML	Silt (ML), light orange-brown, moist; few fine sand; trace organics (roots); trace boulders. [Subsoil]				
250	3	S-3		SM	Silty Sand (SM), light gray-brown, moist; fine sand; some silt; trace organics (roots).				
249	4			SP	Poorly Graded Sand (SP), light gray-brown, moist; fine to medium sand; trace silt; few fine gravel; trace boulders. [Glacial Till]			Trace roots to 4 feet	
248	5							Nested boulders from 5 to 9 feet	
247	6	S-4		SM	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]			8 foot wide boulder from ¼ to 7 feet	
246	7								
245	8	S-5							
244	9								
243	10	S-6					20.6	% Gravel = 26.2	

Test pit terminated at 10 feet due to refusal on boulders or possible bedrock

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



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

Date: 9/22/25 Path: P:\27530001\GINT\2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_1P\_GEODEC\_%F

Date Excavated	8/29/2025	Total Depth (ft)	8.25	Logged By	AHM	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
252	1				TS	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves). [Topsoil]			Some roots to ¼ foot
					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.			Few roots to 3½ feet
250	3				SM	Silty Sand (SM), light gray-brown, moist; fine sand, some silt; trace organics (roots); some boulders.			
249	4				SP	Poorly Graded Sand (SP), light gray-brown, moist; fine to medium sand; trace silt; few gravel; few boulders. [Glacial Till]			Trace roots to 6 feet
248	5				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]			
247	6								Some 4 to 6 feet wide nested boulders from 1 to 8 feet
246	7								
245	8								

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



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

Figure A-4  
 Sheet 1 of 1

Date: 9/22/25 Path: P:\27530001\GINT\2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_1P\_GEOTEC\_%F

Date Excavated	8/29/2025	Total Depth (ft)	12	Logged By	AHM	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
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	
244	2	S-2		ML	Silt (ML), light orange-brown, moist; few fine sand; trace organics (roots). [Subsoil]				
243	3			ML	Silt with Sand (ML), light brown to light gray, moist; some fine sand; few silt; trace boulders.			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								
238	8			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]				
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



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

Date: 9/22/25 Path: P:\27530001\GINT\2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_1P\_GEOTEC\_%F

Date Excavated	8/28/2025	Total Depth (ft)	9	Logged By	AHM	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
232	1	S-1		TS	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves) [Topsoil]			66.7	Some roots to ¼ foot
				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	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.				
229	4								% 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								Greater than 5 foot wide boulders encountered at 9 feet

Test pit terminated at 9 feet due to refusal in 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-104 (IT)



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

Figure A-5  
Sheet 1 of 1

Date: 9/22/25 Path: P:\27530001\GINT\2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TTESTPIT\_1P\_GEOTEC\_%F

Date Excavated	8/29/2025	Total Depth (ft)	10	Logged By	AHM	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
244	1	S-1		TS	ML	Silty Sand (SM), dark brown, moist; fine to medium sand; some silt; some organics (roots, leaves) [Topsoil]			Some roots to 3 inches
243	2				ML	Silt with Sand (ML), light orange to light brown, moist; little fine sand; trace organics (roots). [Subsoil]			
242	3	S-2			ML	Silt with Sand (ML), light brown, moist; little fine sand; trace organics (roots).			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							5 foot wide boulders encountered from 6 to 9 feet
235	10	S-6			SM	Silty Sand (SM), light gray-brown, moist; fine sand; few fine gravel; trace cobbles; few boulders; some silt.			2 foot wide boulders encountered from 9 to 10 feet
Test pit terminated at 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 1/2 foot.  
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

### Log of Test Pit GEO-TP-105



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

Date: 9/22/25 Path: P:\27530001\GINT\2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_1P\_GEOTEC\_%F

Date Excavated	8/29/2025	Total Depth (ft)	13.75	Logged By	yjytj	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
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				SM	Silty Sand with Gravel (SM), light gray, moist; fine to coarse sand; some silt; little fine gravel; trace cobbles; some boulders. [Glacial Till]			
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]			
250	4				SM	Silty Sand with Gravel (SM), light gray, moist; fine to coarse sand; some silt; little fine gravel; trace cobbles; some boulders. [Glacial Till]			
249	5				SM	Silty Sand with Gravel (SM), light gray, moist; fine to coarse sand; some silt; little fine gravel; trace cobbles; some boulders. [Glacial Till]			
248	6				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 5 3/4 feet Trace roots to 6 feet
247	7				SM	Silty Sand with Gravel (SM), light gray, moist; fine to coarse sand; some silt; little fine gravel; trace cobbles; some boulders. [Glacial Till]			
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				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]			
244	10				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]			
243	11				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]			
242	12				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]			
241	13	S-4			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]		17.8	% Gravel = 25.8

Test pit terminated at 13 3/4 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 1/2 foot.  
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

### Log of Test Pit GEO-TP-106



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

Figure A-7  
Sheet 1 of 1

Date: 9/22/25 Path: P:\27530001\GINT\27530001\GINT\27530001\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_LP\_GEOTECH.F

Date Excavated	8/29/2025	Total Depth (ft)	8.5	Logged By	AHM	Excavator	Machine Time, LLC	Groundwater not observed
				Checked By	HPC	Equipment	Doosan DX 140 LC	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		Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Testing Sample	Sample Name Testing						
249	1	S-1		TS	ML	Silty Sand (SM), dark brown, moist; fine sand; some silt; some organics (roots, leaves) [Topsoil]			Nested surface 4 foot wide boulder observed Some roots to 1/2 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 4 1/2 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 8 1/2 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 1/2 foot.  
 Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Topographic Survey.

### Log of Test Pit GEO-TP-107



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

Date: 9/22/25 Path: P:\27530001\GINT\2753000100\_01.GPJ DBLibrary\Library\GEOUSA\_DF\_STD\_US.GLB\GEB\_TESTPIT\_1P\_GEOTEC\_%F

**Attachment B**  
**Laboratory Test Results**



195 Frances Avenue  
 Cranston RI, 02910  
 Phone: (401)-467-6454  
 Fax: (401)-467-2398  
[cts.thielsch.com](http://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	9 <sub>d</sub> MAX (pcf) W <sub>opt</sub> (%)	9 <sub>d</sub> MAX (pcf) W <sub>opt</sub> (%) (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

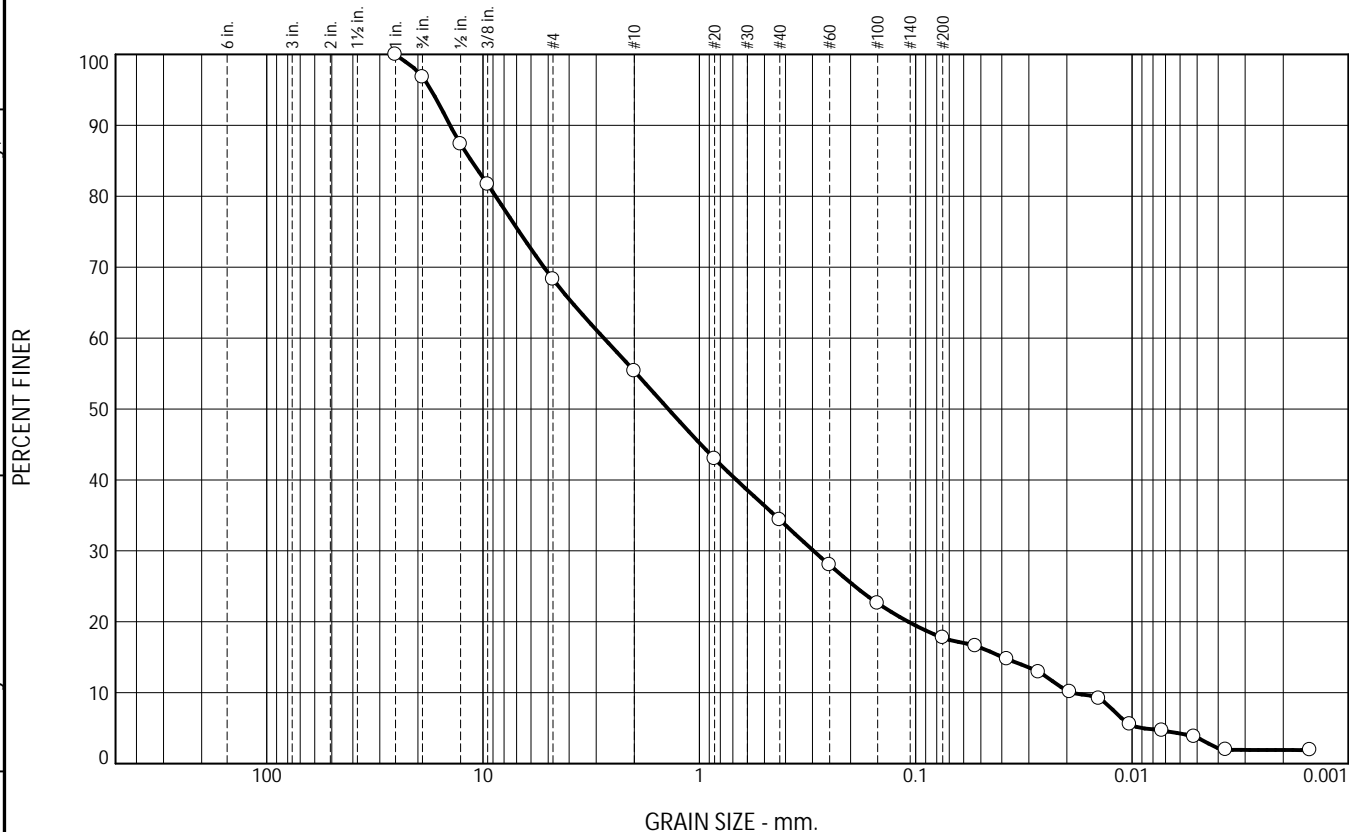
Reviewed By: *Michael Collins*

Date Reviewed: 9.17.2025

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# 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<sub>90</sub>= 14.1994      D<sub>85</sub>= 11.3117      D<sub>60</sub>= 2.7649  
 D<sub>50</sub>= 1.3929      D<sub>30</sub>= 0.2969      D<sub>15</sub>= 0.0396  
 D<sub>10</sub>= 0.0190      C<sub>u</sub>= 145.65      C<sub>c</sub>= 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

<b>Thielsch Engineering Inc.</b>  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

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## 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<sub>90</sub>= 19.6297      D<sub>85</sub>= 11.5692      D<sub>60</sub>= 0.7343  
D<sub>50</sub>= 0.3230      D<sub>30</sub>= 0.1212      D<sub>15</sub>= 0.0529  
D<sub>10</sub>= 0.0291      C<sub>u</sub>= 25.27      C<sub>c</sub>= 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

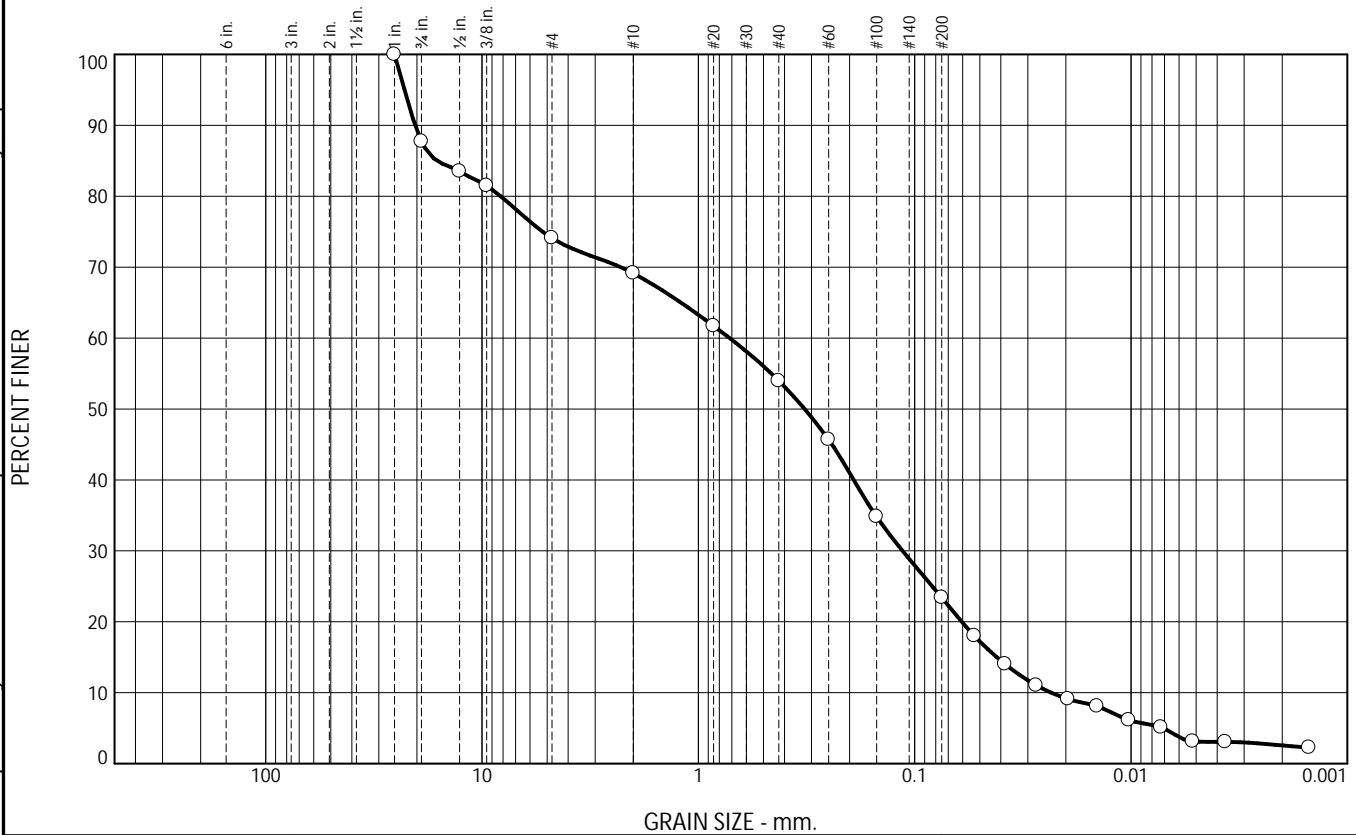
Date: 9.17.2025

<h3>Thielsch Engineering Inc.</h3> <p>Cranston, RI</p>	<p>Client: GeoEngineers, Inc.  Project: Metro West YMCA  Ashland, MA  Project No: 27530-001-00</p>
<p>Figure 25-S-B1895</p>	

Tested By: MA      Checked By: Michael Collins

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# 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<sub>90</sub>= 20.4021      D<sub>85</sub>= 16.1592      D<sub>60</sub>= 0.7172  
 D<sub>50</sub>= 0.3227      D<sub>30</sub>= 0.1138      D<sub>15</sub>= 0.0418  
 D<sub>10</sub>= 0.0234      C<sub>u</sub>= 30.63      C<sub>c</sub>= 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

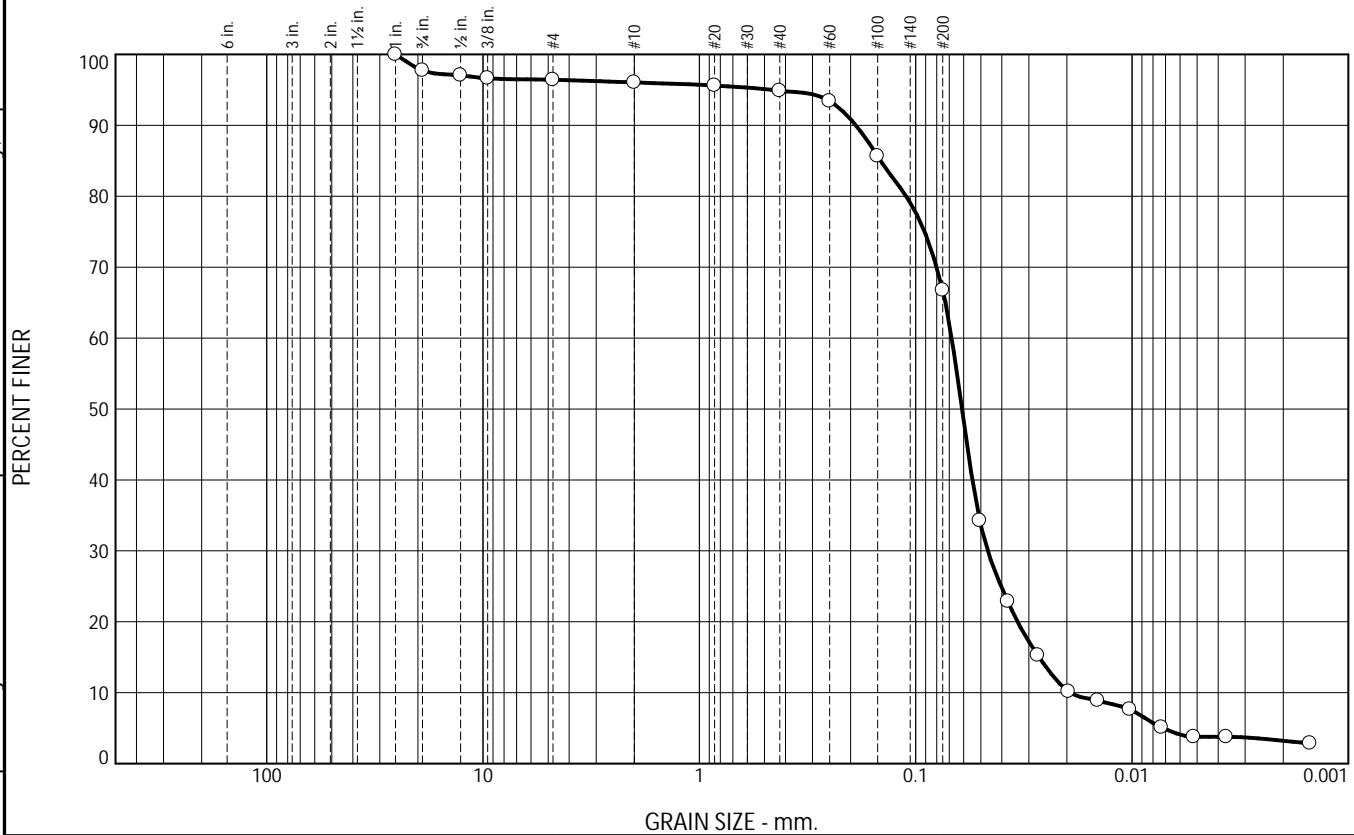
Date: 9.17.2025

<b>Thielsch Engineering Inc.</b>  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

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## 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

PL= NP      Atterberg Limits      LL= NV      PI= NP

Coefficients

D<sub>90</sub>= 0.1891      D<sub>85</sub>= 0.1453      D<sub>60</sub>= 0.0682  
 D<sub>50</sub>= 0.0611      D<sub>30</sub>= 0.0465      D<sub>15</sub>= 0.0269  
 D<sub>10</sub>= 0.0193      C<sub>u</sub>= 3.53      C<sub>c</sub>= 1.64

USCS= ML      Classification      AASHTO= A-4(0)

Remarks

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

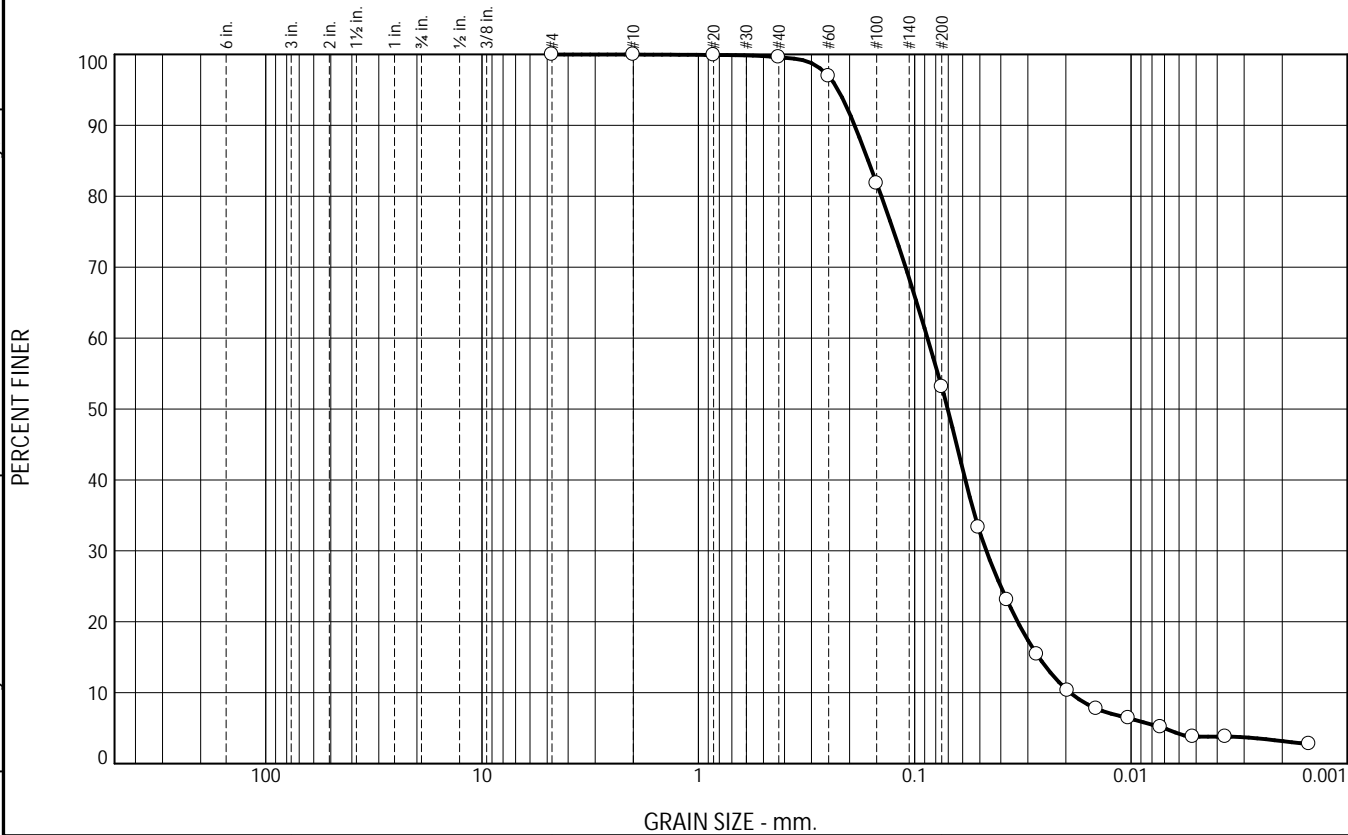
Date: 9.17.2025

<b>Thielsch Engineering Inc.</b>  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

These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspected and/or tested. No warranty, expressed or implied, is made.

## 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<sub>90</sub>= 0.1895      D<sub>85</sub>= 0.1640      D<sub>60</sub>= 0.0873  
D<sub>50</sub>= 0.0704      D<sub>30</sub>= 0.0467      D<sub>15</sub>= 0.0267  
D<sub>10</sub>= 0.0191      C<sub>u</sub>= 4.56      C<sub>c</sub>= 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

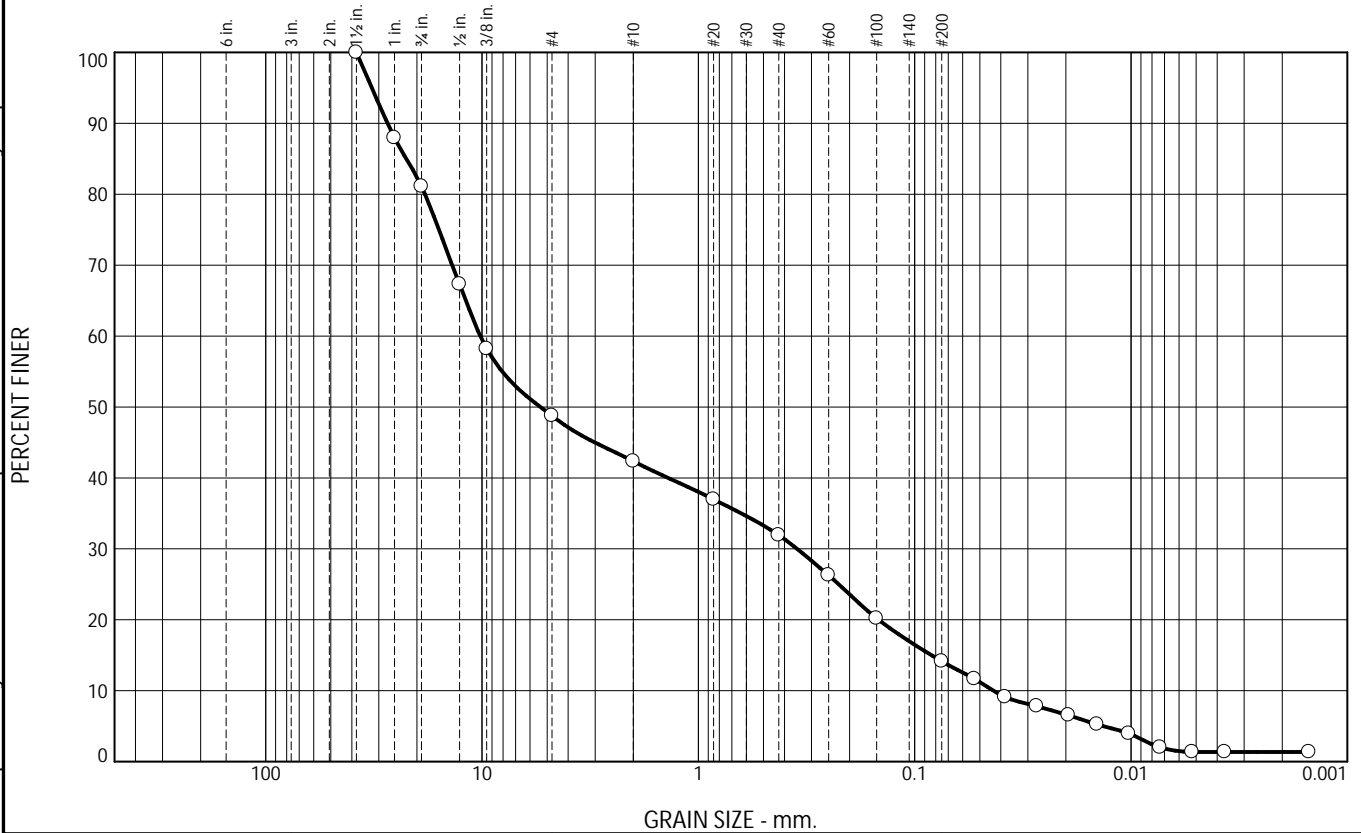
<b>Thielsch Engineering Inc.</b>  Cranston, RI	Client: GeoEngineers, Inc. Project: Metro West YMCA Ashland, MA Project No: 27530-001-00
Figure 25-S-B1898	

Tested By: MA      Checked By: Michael Collins



These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspected and/or tested. No warranty, expressed or implied, is made.

# 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<sub>90</sub>= 27.3294      D<sub>85</sub>= 22.3899      D<sub>60</sub>= 10.1967  
D<sub>50</sub>= 5.3658      D<sub>30</sub>= 0.3495      D<sub>15</sub>= 0.0836  
D<sub>10</sub>= 0.0433      C<sub>u</sub>= 235.34      C<sub>c</sub>= 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

<b>Thielsch Engineering Inc.</b>  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<sup>1</sup>

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,

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<sup>1</sup> Developed based on material provided by GBA, GeoProfessional Business Association; [www.geoprofessional.org](http://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.

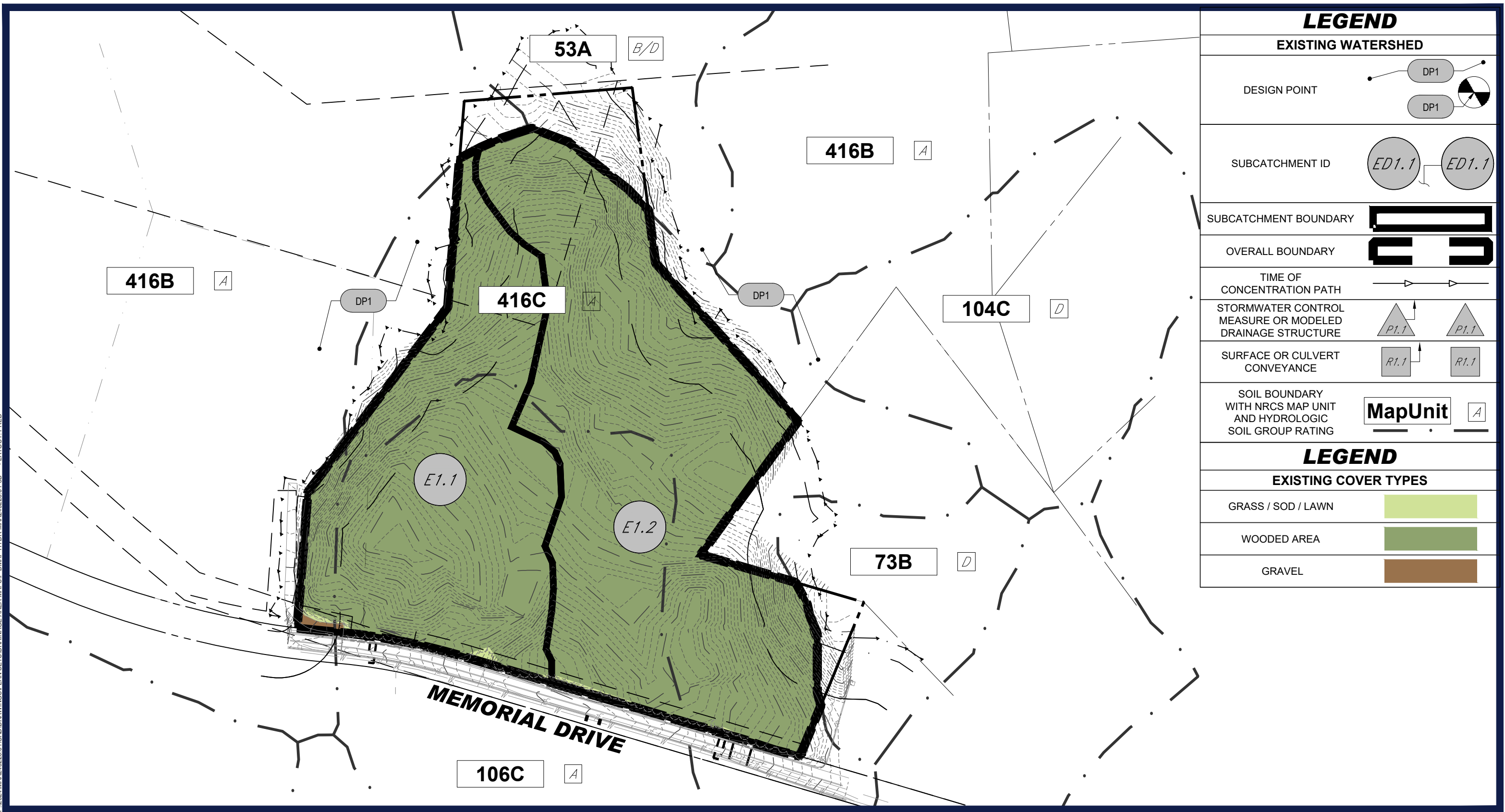
## **INFORMATION PROVIDED BY OTHERS**

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

P:\2024\MAA240220.01\CAD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\FIDMAP-HYDR.MAA240220.01-3B-1-LAYOUT.PRED



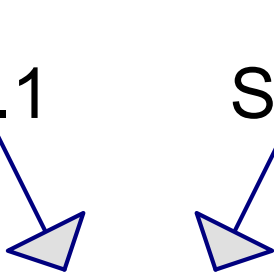
<b>LEGEND</b>	
<b>EXISTING WATERSHED</b>	
DESIGN POINT	
SUBCATCHMENT ID	
SUBCATCHMENT BOUNDARY	
OVERALL BOUNDARY	
TIME OF CONCENTRATION PATH	
STORMWATER CONTROL MEASURE OR MODELED DRAINAGE STRUCTURE	
SURFACE OR CULVERT CONVEYANCE	
SOIL BOUNDARY WITH NRCS MAP UNIT AND HYDROLOGIC SOIL GROUP RATING	
<b>LEGEND</b>	
<b>EXISTING COVER TYPES</b>	
GRASS / SOD / LAWN	
WOODED AREA	
GRAVEL	



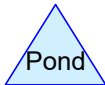
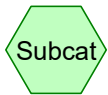
Subcat E1.1



Subcat E1.2



Trib. to Cold Spring Brook



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**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

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Type III 24-hr 2 yr Rainfall=3.36"

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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

**SubcatchmentE1.1: 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

**SubcatchmentE1.2: 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**

**MAA240220 PRE TYPE B**

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Type III 24-hr 2 yr Rainfall=3.36"

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**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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		<b>Shallow Concentrated Flow,</b> 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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		<b>Shallow Concentrated Flow,</b> 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

**MAA240220 PRE TYPE B**

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Type III 24-hr 10 yr Rainfall=5.24"

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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

**SubcatchmentE1.1: 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

**SubcatchmentE1.2: 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**

**MAA240220 PRE TYPE B**

Type III 24-hr 10 yr Rainfall=5.24"

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**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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		<b>Shallow Concentrated Flow,</b> 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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		<b>Shallow Concentrated Flow,</b> 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

**MAA240220 PRE TYPE B**

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Type III 24-hr 25 yr Rainfall=6.42"

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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

**SubcatchmentE1.1: 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

**SubcatchmentE1.2: 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**

**MAA240220 PRE TYPE B**

Type III 24-hr 25 yr Rainfall=6.42"

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**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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		<b>Shallow Concentrated Flow,</b> 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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		<b>Shallow Concentrated Flow,</b> 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

**MAA240220 PRE TYPE B**

Type III 24-hr 100 yr Rainfall=8.23"

Prepared by Bohler Engineering, PC

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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

**SubcatchmentE1.1: 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

**SubcatchmentE1.2: 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**

**MAA240220 PRE TYPE B**

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Type III 24-hr 100 yr Rainfall=8.23"

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**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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	540	0.0710	4.29		<b>Shallow Concentrated Flow,</b> 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		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.36"
2.6	520	0.0430	3.34		<b>Shallow Concentrated Flow,</b> 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

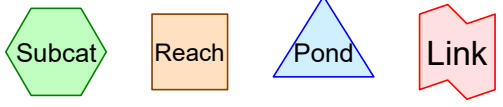
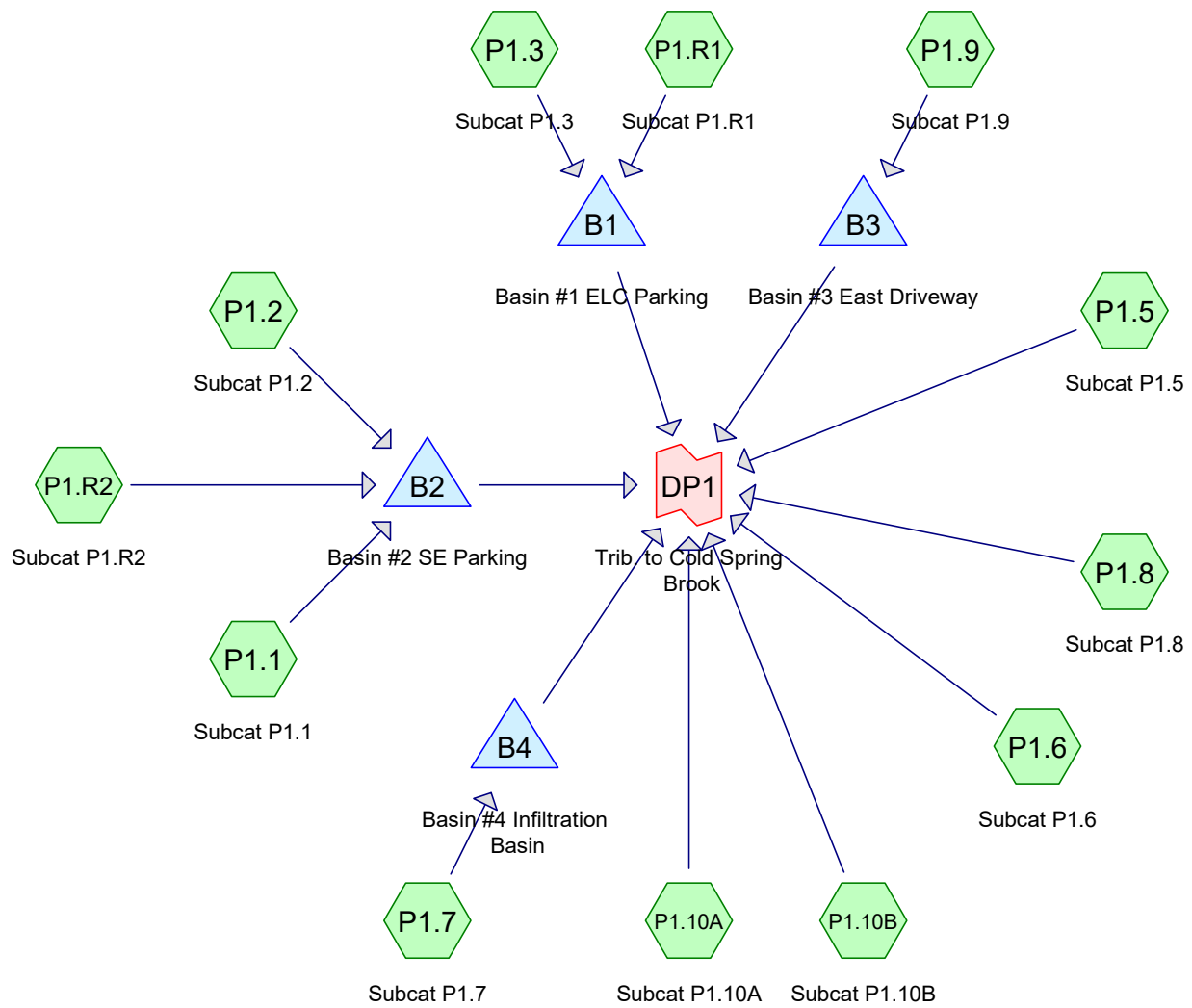
## **APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS**

- PROPOSED CONDITIONS DRAINAGE MAP
- PROPOSED CONDITIONS HYDROCAD CALCULATIONS

M:\MA\2024\MAA240220.01\CADD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\IP.DMAP-HYDR-MAA240220.01-3B-1-LAYOUT.PST



<b>LEGEND</b>	
<b>PROPOSED WATERSHED</b>	
DESIGN POINT	
SUBCATCHMENT ID	
SUBCATCHMENT BOUNDARY	
OVERALL BOUNDARY	
TIME OF CONCENTRATION PATH	
STORMWATER CONTROL MEASURE OR MODELED DRAINAGE STRUCTURE	
SURFACE OR CULVERT CONVEYANCE	
SOIL BOUNDARY WITH NRCS MAP UNIT AND HYDROLOGIC SOIL GROUP RATING	
<b>LEGEND</b>	
<b>PROPOSED COVER TYPES</b>	
BUILDING	
CONCRETE / WALK / PATIO PAVERS / MISC IMPERVIOUS	
GRASS / SOD / LAWN	
WOODED AREA	
WATER BODY / SURFACE BASIN	
GRAVEL	



**Routing Diagram for MAA240220 POST REV 12-26-25**  
 Prepared by Bohler Engineering, PC, Printed 12/30/2025  
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**MAA240220 POST REV 12-26-25**

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**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

<b>Subcatchment P1.1: Subcat P1.1</b>	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
<b>Subcatchment P1.10A: Subcat P1.10A</b>	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
<b>Subcatchment P1.10B: Subcat P1.10B</b>	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
<b>Subcatchment P1.2: Subcat P1.2</b>	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
<b>Subcatchment P1.3: Subcat P1.3</b>	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
<b>Subcatchment P1.5: Subcat P1.5</b>	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
<b>Subcatchment P1.6: Subcat P1.6</b>	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
<b>Subcatchment P1.7: Subcat P1.7</b>	Runoff Area=2.351 ac 21.27% Impervious Runoff Depth=0.92" Flow Length=200' Tc=9.8 min CN=70 Runoff=2.01 cfs 0.181 af
<b>Subcatchment P1.8: Subcat P1.8</b>	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
<b>Subcatchment P1.9: Subcat P1.9</b>	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
<b>Subcatchment P1.R1: Subcat P1.R1</b>	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
<b>Subcatchment P1.R2: Subcat P1.R2</b>	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
<b>Pond B1: Basin #1 ELC Parking</b>	Peak Elev=243.69' Storage=6,207 cf Inflow=3.44 cfs 0.261 af Discarded=0.13 cfs 0.261 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.261 af
<b>Pond B2: Basin #2 SE Parking</b>	Peak Elev=245.72' Storage=12,517 cf Inflow=7.68 cfs 0.588 af Discarded=0.38 cfs 0.588 af Primary=0.00 cfs 0.000 af Outflow=0.38 cfs 0.588 af
<b>Pond B3: Basin #3 East Driveway</b>	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
<b>Pond B4: Basin #4 Infiltration Basin</b>	Peak Elev=231.63' Storage=4,968 cf Inflow=2.01 cfs 0.181 af Discarded=0.03 cfs 0.055 af Primary=0.13 cfs 0.041 af Outflow=0.16 cfs 0.096 af

**MAA240220 POST REV 12-26-25**

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*Type III 24-hr 2 yr Rainfall=3.36"*

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**Link DP1: Trib. to Cold Spring Brook**

Inflow=1.21 cfs 0.222 af

Primary=1.21 cfs 0.222 af

**Total Runoff Area = 11.724 ac   Runoff Volume = 1.235 af   Average Runoff Depth = 1.26"**  
**65.56% Pervious = 7.686 ac   34.44% Impervious = 4.038 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		<b>Sheet Flow, Soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> 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		<b>Sheet Flow, soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
1.1					<b>Direct Entry, To make min. allowable</b>
6.0	220	Total			

**Summary for Subcatchment P1.7: Subcat P1.7**

Runoff = 2.01 cfs @ 12.16 hrs, Volume= 0.181 af, Depth= 0.92"  
 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
1.788	61	>75% Grass cover, Good, HSG B
0.063	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.005	98	Roofs, HSG B
0.345	98	Paved parking, HSG B
2.351	70	Weighted Average
1.851		78.73% Pervious Area
0.500		21.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		<b>Sheet Flow, Playground</b> Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		<b>Shallow Concentrated Flow,</b> 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					<b>Direct Entry, To make min. allowable Sheet Flow,</b>
3.9	50	0.1200	0.21		Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		<b>Shallow Concentrated Flow,</b>
					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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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 = 0.13 cfs @ 15.37 hrs, Volume= 0.261 af, Atten= 96%, Lag= 196.6 min  
 Discarded = 0.13 cfs @ 15.37 hrs, Volume= 0.261 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= 243.69' @ 15.37 hrs Surf.Area= 7,999 sf Storage= 6,207 cf

Plug-Flow detention time= 436.9 min calculated for 0.261 af (100% of inflow)  
 Center-of-Mass det. time= 436.8 min ( 1,224.1 - 787.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	7,427 cf	<b>68.00'W x 117.63'L x 3.75'H Field A</b> 29,997 cf Overall - 11,428 cf Embedded = 18,568 cf x 40.0% Voids
#2A	243.00'	11,428 cf	<b>ADS_StormTech SC-800 +Cap</b> x 224 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 224 Chambers in 14 Rows Cap Storage= 3.4 cf x 2 x 14 rows = 95.8 cf
		18,856 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	<b>0.680 in/hr Exfiltration over Wetted area</b>
#2	Primary	242.50'	<b>12.0" Round Culvert</b> 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	244.75'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	245.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.13 cfs @ 15.37 hrs HW=243.69' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.13 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 = 2.670 ac, 87.42% Impervious, Inflow Depth = 2.64" for 2 yr event  
 Inflow = 7.68 cfs @ 12.09 hrs, Volume= 0.588 af  
 Outflow = 0.38 cfs @ 14.53 hrs, Volume= 0.588 af, Atten= 95%, Lag= 146.7 min  
 Discarded = 0.38 cfs @ 14.53 hrs, Volume= 0.588 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= 245.72' @ 14.53 hrs Surf.Area= 15,543 sf Storage= 12,517 cf

Plug-Flow detention time= 302.6 min calculated for 0.587 af (100% of inflow)  
 Center-of-Mass det. time= 302.5 min ( 1,086.9 - 784.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	14,334 cf	<b>63.25'W x 245.73'L x 3.75'H Field A</b> 58,285 cf Overall - 22,451 cf Embedded = 35,834 cf x 40.0% Voids
#2A	245.00'	22,451 cf	<b>ADS_StormTech SC-800 +Cap</b> x 442 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 442 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		36,784 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	<b>1.000 in/hr Exfiltration over Wetted area</b>
#2	Primary	244.00'	<b>15.0" Round Culvert</b> 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	246.00'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.40'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.38 cfs @ 14.53 hrs HW=245.72' (Free Discharge)

↑1=**Exfiltration** (Exfiltration Controls 0.38 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 = 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	<b>15.58'W x 34.38'L x 5.50'H Field A</b> 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	<b>ADS_StormTech MC-3500 d +Cap</b> 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'	<b>0.880 in/hr Exfiltration over Wetted area</b>
#2	Primary	237.00'	<b>12.0" Round Culvert</b> 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'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 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, 21.27% Impervious, Inflow Depth = 0.92" for 2 yr event  
 Inflow = 2.01 cfs @ 12.16 hrs, Volume= 0.181 af  
 Outflow = 0.16 cfs @ 15.23 hrs, Volume= 0.096 af, Atten= 92%, Lag= 184.2 min  
 Discarded = 0.03 cfs @ 15.23 hrs, Volume= 0.055 af  
 Primary = 0.13 cfs @ 15.23 hrs, Volume= 0.041 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= 231.63' @ 15.23 hrs Surf.Area= 3,730 sf Storage= 4,968 cf

Plug-Flow detention time= 531.0 min calculated for 0.096 af (53% of inflow)  
 Center-of-Mass det. time= 397.9 min ( 1,273.6 - 875.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	<b>Custom Stage Data (Conic)</b> 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'	<b>0.330 in/hr Exfiltration over Wetted area</b>
#2	Primary	232.50'	<b>6.0' long x 12.0' breadth Broad-Crested Rectangular Weir</b> 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'	<b>12.0" Round Culvert</b> 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	231.60'	<b>12.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.03 cfs @ 15.23 hrs HW=231.63' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.13 cfs @ 15.23 hrs HW=231.63' (Free Discharge)

↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

↑3=Culvert (Passes 0.13 cfs of 8.14 cfs potential flow)

↑4=Orifice/Grate (Weir Controls 0.13 cfs @ 0.60 fps)

### Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 34.44% Impervious, Inflow Depth = 0.23" for 2 yr event

Inflow = 1.21 cfs @ 12.17 hrs, Volume= 0.222 af

Primary = 1.21 cfs @ 12.17 hrs, Volume= 0.222 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

<b>Subcatchment P1.1: Subcat P1.1</b>	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
<b>Subcatchment P1.10A: Subcat P1.10A</b>	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
<b>Subcatchment P1.10B: Subcat P1.10B</b>	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
<b>Subcatchment P1.2: Subcat P1.2</b>	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
<b>Subcatchment P1.3: Subcat P1.3</b>	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
<b>Subcatchment P1.5: Subcat P1.5</b>	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
<b>Subcatchment P1.6: Subcat P1.6</b>	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
<b>Subcatchment P1.7: Subcat P1.7</b>	Runoff Area=2.351 ac 21.27% Impervious Runoff Depth=2.22" Flow Length=200' Tc=9.8 min CN=70 Runoff=5.22 cfs 0.434 af
<b>Subcatchment P1.8: Subcat P1.8</b>	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
<b>Subcatchment P1.9: Subcat P1.9</b>	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
<b>Subcatchment P1.R1: Subcat P1.R1</b>	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
<b>Subcatchment P1.R2: Subcat P1.R2</b>	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
<b>Pond B1: Basin #1 ELC Parking</b>	Peak Elev=244.69' Storage=12,342 cf Inflow=5.69 cfs 0.444 af Discarded=0.14 cfs 0.327 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.327 af
<b>Pond B2: Basin #2 SE Parking</b>	Peak Elev=246.75' Storage=24,773 cf Inflow=12.68 cfs 0.996 af Discarded=0.39 cfs 0.910 af Primary=0.05 cfs 0.040 af Outflow=0.44 cfs 0.950 af
<b>Pond B3: Basin #3 East Driveway</b>	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
<b>Pond B4: Basin #4 Infiltration Basin</b>	Peak Elev=231.88' Storage=5,924 cf Inflow=5.22 cfs 0.434 af Discarded=0.03 cfs 0.057 af Primary=3.04 cfs 0.291 af Outflow=3.07 cfs 0.349 af

**MAA240220 POST REV 12-26-25**

Prepared by Bohler Engineering, PC

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*Type III 24-hr 10 yr Rainfall=5.24"*

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**Link DP1: Trib. to Cold Spring Brook**

Inflow=6.99 cfs 0.919 af

Primary=6.99 cfs 0.919 af

**Total Runoff Area = 11.724 ac   Runoff Volume = 2.503 af   Average Runoff Depth = 2.56"**  
**65.56% Pervious = 7.686 ac   34.44% Impervious = 4.038 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		<b>Sheet Flow, Soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> 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		<b>Sheet Flow, soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
1.1					<b>Direct Entry, To make min. allowable</b>
6.0	220	Total			

**Summary for Subcatchment P1.7: Subcat P1.7**

Runoff = 5.22 cfs @ 12.15 hrs, Volume= 0.434 af, Depth= 2.22"  
 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
1.788	61	>75% Grass cover, Good, HSG B
0.063	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.005	98	Roofs, HSG B
0.345	98	Paved parking, HSG B
2.351	70	Weighted Average
1.851		78.73% Pervious Area
0.500		21.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		<b>Sheet Flow, Playground</b> Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		<b>Shallow Concentrated Flow,</b> 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					<b>Direct Entry, To make min. allowable Sheet Flow,</b>
3.9	50	0.1200	0.21		Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		<b>Shallow Concentrated Flow,</b>
					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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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 = 0.14 cfs @ 16.82 hrs, Volume= 0.327 af, Atten= 98%, Lag= 284.0 min  
 Discarded = 0.14 cfs @ 16.82 hrs, Volume= 0.327 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= 244.69' @ 16.82 hrs Surf.Area= 7,999 sf Storage= 12,342 cf

Plug-Flow detention time= 591.8 min calculated for 0.327 af (74% of inflow)  
 Center-of-Mass det. time= 505.4 min ( 1,279.8 - 774.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	7,427 cf	<b>68.00'W x 117.63'L x 3.75'H Field A</b> 29,997 cf Overall - 11,428 cf Embedded = 18,568 cf x 40.0% Voids
#2A	243.00'	11,428 cf	<b>ADS_StormTech SC-800 +Cap</b> x 224 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 224 Chambers in 14 Rows Cap Storage= 3.4 cf x 2 x 14 rows = 95.8 cf
		18,856 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	<b>0.680 in/hr Exfiltration over Wetted area</b>
#2	Primary	242.50'	<b>12.0" Round Culvert</b> 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	244.75'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	245.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.14 cfs @ 16.82 hrs HW=244.69' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.14 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 = 2.670 ac, 87.42% Impervious, Inflow Depth = 4.47" for 10 yr event  
 Inflow = 12.68 cfs @ 12.09 hrs, Volume= 0.996 af  
 Outflow = 0.44 cfs @ 15.57 hrs, Volume= 0.950 af, Atten= 97%, Lag= 209.1 min  
 Discarded = 0.39 cfs @ 15.57 hrs, Volume= 0.910 af  
 Primary = 0.05 cfs @ 15.57 hrs, Volume= 0.040 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= 246.75' @ 15.57 hrs Surf.Area= 15,543 sf Storage= 24,773 cf

Plug-Flow detention time= 528.1 min calculated for 0.949 af (95% of inflow)  
 Center-of-Mass det. time= 502.3 min ( 1,274.5 - 772.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	14,334 cf	<b>63.25'W x 245.73'L x 3.75'H Field A</b> 58,285 cf Overall - 22,451 cf Embedded = 35,834 cf x 40.0% Voids
#2A	245.00'	22,451 cf	<b>ADS_StormTech SC-800 +Cap</b> x 442 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 442 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		36,784 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	<b>1.000 in/hr Exfiltration over Wetted area</b>
#2	Primary	244.00'	<b>15.0" Round Culvert</b> 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	246.00'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.40'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.39 cfs @ 15.57 hrs HW=246.75' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.39 cfs)

**Primary OutFlow** Max=0.05 cfs @ 15.57 hrs HW=246.75' (Free Discharge)

↑2=Culvert (Passes 0.05 cfs of 8.26 cfs potential flow)

↑3=Orifice/Grate (Orifice Controls 0.05 cfs @ 4.00 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	<b>15.58'W x 34.38'L x 5.50'H Field A</b> 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	<b>ADS_StormTech MC-3500 d +Cap</b> 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'	<b>0.880 in/hr Exfiltration over Wetted area</b>
#2	Primary	237.00'	<b>12.0" Round Culvert</b> 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'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 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, 21.27% Impervious, Inflow Depth = 2.22" for 10 yr event  
 Inflow = 5.22 cfs @ 12.15 hrs, Volume= 0.434 af  
 Outflow = 3.07 cfs @ 12.34 hrs, Volume= 0.349 af, Atten= 41%, Lag= 11.7 min  
 Discarded = 0.03 cfs @ 12.34 hrs, Volume= 0.057 af  
 Primary = 3.04 cfs @ 12.34 hrs, Volume= 0.291 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= 231.88' @ 12.34 hrs Surf.Area= 4,024 sf Storage= 5,924 cf

Plug-Flow detention time= 202.3 min calculated for 0.349 af (80% of inflow)  
 Center-of-Mass det. time= 123.3 min ( 972.0 - 848.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	<b>Custom Stage Data (Conic)</b> 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'	<b>0.330 in/hr Exfiltration over Wetted area</b>
#2	Primary	232.50'	<b>6.0' long x 12.0' breadth Broad-Crested Rectangular Weir</b> 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'	<b>12.0" Round Culvert</b> 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	231.60'	<b>12.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.34 hrs HW=231.88' (Free Discharge)

1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=3.03 cfs @ 12.34 hrs HW=231.88' (Free Discharge)

2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

3=Culvert (Passes 3.03 cfs of 8.35 cfs potential flow)

4=Orifice/Grate (Weir Controls 3.03 cfs @ 1.73 fps)

Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 34.44% Impervious, Inflow Depth = 0.94" for 10 yr event

Inflow = 6.99 cfs @ 12.30 hrs, Volume= 0.919 af

Primary = 6.99 cfs @ 12.30 hrs, Volume= 0.919 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

<b>Subcatchment P1.1: Subcat P1.1</b>	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
<b>Subcatchment P1.10A: Subcat P1.10A</b>	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
<b>Subcatchment P1.10B: Subcat P1.10B</b>	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
<b>Subcatchment P1.2: Subcat P1.2</b>	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
<b>Subcatchment P1.3: Subcat P1.3</b>	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
<b>Subcatchment P1.5: Subcat P1.5</b>	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
<b>Subcatchment P1.6: Subcat P1.6</b>	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
<b>Subcatchment P1.7: Subcat P1.7</b>	Runoff Area=2.351 ac 21.27% Impervious Runoff Depth=3.14" Flow Length=200' Tc=9.8 min CN=70 Runoff=7.49 cfs 0.616 af
<b>Subcatchment P1.8: Subcat P1.8</b>	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
<b>Subcatchment P1.9: Subcat P1.9</b>	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
<b>Subcatchment P1.R1: Subcat P1.R1</b>	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
<b>Subcatchment P1.R2: Subcat P1.R2</b>	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
<b>Pond B1: Basin #1 ELC Parking</b>	Peak Elev=245.45' Storage=16,169 cf Inflow=7.09 cfs 0.561 af Discarded=0.14 cfs 0.344 af Primary=0.02 cfs 0.020 af Outflow=0.16 cfs 0.364 af
<b>Pond B2: Basin #2 SE Parking</b>	Peak Elev=247.48' Storage=31,792 cf Inflow=15.80 cfs 1.254 af Discarded=0.40 cfs 0.952 af Primary=0.35 cfs 0.117 af Outflow=0.76 cfs 1.069 af
<b>Pond B3: Basin #3 East Driveway</b>	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
<b>Pond B4: Basin #4 Infiltration Basin</b>	Peak Elev=232.10' Storage=6,860 cf Inflow=7.49 cfs 0.616 af Discarded=0.04 cfs 0.059 af Primary=5.34 cfs 0.471 af Outflow=5.37 cfs 0.530 af

**MAA240220 POST REV 12-26-25**

Prepared by Bohler Engineering, PC

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*Type III 24-hr 25 yr Rainfall=6.42"*

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**Link DP1: Trib. to Cold Spring Brook**

Inflow=14.74 cfs 1.529 af

Primary=14.74 cfs 1.529 af

**Total Runoff Area = 11.724 ac   Runoff Volume = 3.394 af   Average Runoff Depth = 3.47"**  
**65.56% Pervious = 7.686 ac   34.44% Impervious = 4.038 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		<b>Sheet Flow, Soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> 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		<b>Sheet Flow, soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
1.1					<b>Direct Entry, To make min. allowable</b>
6.0	220	Total			

**Summary for Subcatchment P1.7: Subcat P1.7**

Runoff = 7.49 cfs @ 12.14 hrs, Volume= 0.616 af, Depth= 3.14"  
 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
1.788	61	>75% Grass cover, Good, HSG B
0.063	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.005	98	Roofs, HSG B
0.345	98	Paved parking, HSG B
2.351	70	Weighted Average
1.851		78.73% Pervious Area
0.500		21.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		<b>Sheet Flow, Playground</b> Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		<b>Shallow Concentrated Flow,</b> 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					<b>Direct Entry, To make min. allowable Sheet Flow,</b>
3.9	50	0.1200	0.21		Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		<b>Shallow Concentrated Flow,</b>
					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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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 = 0.16 cfs @ 16.99 hrs, Volume= 0.364 af, Atten= 98%, Lag= 294.5 min  
 Discarded = 0.14 cfs @ 16.99 hrs, Volume= 0.344 af  
 Primary = 0.02 cfs @ 16.99 hrs, Volume= 0.020 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= 245.45' @ 16.99 hrs Surf.Area= 7,999 sf Storage= 16,169 cf

Plug-Flow detention time= 582.4 min calculated for 0.363 af (65% of inflow)  
 Center-of-Mass det. time= 483.9 min ( 1,252.9 - 769.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	7,427 cf	<b>68.00'W x 117.63'L x 3.75'H Field A</b> 29,997 cf Overall - 11,428 cf Embedded = 18,568 cf x 40.0% Voids
#2A	243.00'	11,428 cf	<b>ADS_StormTech SC-800 +Cap</b> x 224 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 224 Chambers in 14 Rows Cap Storage= 3.4 cf x 2 x 14 rows = 95.8 cf
		18,856 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	<b>0.680 in/hr Exfiltration over Wetted area</b>
#2	Primary	242.50'	<b>12.0" Round Culvert</b> 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	244.75'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	245.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.14 cfs @ 16.99 hrs HW=245.45' (Free Discharge)

↑1=**Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.02 cfs @ 16.99 hrs HW=245.45' (Free Discharge)

↑2=**Culvert** (Passes 0.02 cfs of 5.08 cfs potential flow)

↑3=**Orifice/Grate** (Orifice Controls 0.02 cfs @ 3.90 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 = 5.64" for 25 yr event  
 Inflow = 15.80 cfs @ 12.09 hrs, Volume= 1.254 af  
 Outflow = 0.76 cfs @ 14.48 hrs, Volume= 1.069 af, Atten= 95%, Lag= 143.8 min  
 Discarded = 0.40 cfs @ 14.48 hrs, Volume= 0.952 af  
 Primary = 0.35 cfs @ 14.48 hrs, Volume= 0.117 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= 247.48' @ 14.48 hrs Surf.Area= 15,543 sf Storage= 31,792 cf

Plug-Flow detention time= 537.3 min calculated for 1.067 af (85% of inflow)  
 Center-of-Mass det. time= 474.5 min ( 1,241.7 - 767.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	14,334 cf	<b>63.25'W x 245.73'L x 3.75'H Field A</b> 58,285 cf Overall - 22,451 cf Embedded = 35,834 cf x 40.0% Voids
#2A	245.00'	22,451 cf	<b>ADS_StormTech SC-800 +Cap</b> x 442 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 442 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		36,784 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	<b>1.000 in/hr Exfiltration over Wetted area</b>
#2	Primary	244.00'	<b>15.0" Round Culvert</b> 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	246.00'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.40'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.40 cfs @ 14.48 hrs HW=247.48' (Free Discharge)

↑1=**Exfiltration** (Exfiltration Controls 0.40 cfs)

**Primary OutFlow** Max=0.35 cfs @ 14.48 hrs HW=247.48' (Free Discharge)

↑2=**Culvert** (Passes 0.35 cfs of 9.33 cfs potential flow)

↑3=**Orifice/Grate** (Orifice Controls 0.07 cfs @ 5.73 fps)

↑4=**Sharp-Crested Rectangular Weir** (Weir Controls 0.28 cfs @ 0.91 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	<b>15.58'W x 34.38'L x 5.50'H Field A</b> 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	<b>ADS_StormTech MC-3500 d +Cap</b> 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'	<b>0.880 in/hr Exfiltration over Wetted area</b>
#2	Primary	237.00'	<b>12.0" Round Culvert</b> 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'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 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, 21.27% Impervious, Inflow Depth = 3.14" for 25 yr event  
 Inflow = 7.49 cfs @ 12.14 hrs, Volume= 0.616 af  
 Outflow = 5.37 cfs @ 12.26 hrs, Volume= 0.530 af, Atten= 28%, Lag= 7.1 min  
 Discarded = 0.04 cfs @ 12.26 hrs, Volume= 0.059 af  
 Primary = 5.34 cfs @ 12.26 hrs, Volume= 0.471 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= 232.10' @ 12.26 hrs Surf.Area= 4,925 sf Storage= 6,860 cf

Plug-Flow detention time= 147.5 min calculated for 0.530 af (86% of inflow)  
 Center-of-Mass det. time= 85.4 min ( 923.9 - 838.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	<b>Custom Stage Data (Conic)</b> 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'	<b>0.330 in/hr Exfiltration over Wetted area</b>
#2	Primary	232.50'	<b>6.0' long x 12.0' breadth Broad-Crested Rectangular Weir</b> 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'	<b>12.0" Round Culvert</b> 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	231.60'	<b>12.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.04 cfs @ 12.26 hrs HW=232.09' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=5.32 cfs @ 12.26 hrs HW=232.09' (Free Discharge)

↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

↑3=Culvert (Passes 5.32 cfs of 8.54 cfs potential flow)

↑4=Orifice/Grate (Orifice Controls 5.32 cfs @ 3.39 fps)

### Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 34.44% Impervious, Inflow Depth = 1.57" for 25 yr event

Inflow = 14.74 cfs @ 12.15 hrs, Volume= 1.529 af

Primary = 14.74 cfs @ 12.15 hrs, Volume= 1.529 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

<b>Subcatchment P1.1: Subcat P1.1</b>	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
<b>Subcatchment P1.10A: Subcat P1.10A</b>	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
<b>Subcatchment P1.10B: Subcat P1.10B</b>	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
<b>Subcatchment P1.2: Subcat P1.2</b>	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
<b>Subcatchment P1.3: Subcat P1.3</b>	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
<b>Subcatchment P1.5: Subcat P1.5</b>	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
<b>Subcatchment P1.6: Subcat P1.6</b>	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
<b>Subcatchment P1.7: Subcat P1.7</b>	Runoff Area=2.351 ac 21.27% Impervious Runoff Depth=4.66" Flow Length=200' Tc=9.8 min CN=70 Runoff=11.15 cfs 0.913 af
<b>Subcatchment P1.8: Subcat P1.8</b>	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
<b>Subcatchment P1.9: Subcat P1.9</b>	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
<b>Subcatchment P1.R1: Subcat P1.R1</b>	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
<b>Subcatchment P1.R2: Subcat P1.R2</b>	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
<b>Pond B1: Basin #1 ELC Parking</b>	Peak Elev=245.80' Storage=17,424 cf Inflow=9.23 cfs 0.740 af Discarded=0.15 cfs 0.358 af Primary=1.21 cfs 0.162 af Outflow=1.35 cfs 0.521 af
<b>Pond B2: Basin #2 SE Parking</b>	Peak Elev=247.89' Storage=34,576 cf Inflow=20.55 cfs 1.653 af Discarded=0.41 cfs 0.988 af Primary=4.52 cfs 0.447 af Outflow=4.93 cfs 1.435 af
<b>Pond B3: Basin #3 East Driveway</b>	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
<b>Pond B4: Basin #4 Infiltration Basin</b>	Peak Elev=232.45' Storage=9,156 cf Inflow=11.15 cfs 0.913 af Discarded=0.06 cfs 0.062 af Primary=6.98 cfs 0.766 af Outflow=7.04 cfs 0.828 af

**MAA240220 POST REV 12-26-25**

Prepared by Bohler Engineering, PC

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*Type III 24-hr 100 yr Rainfall=8.23"*

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**Link DP1: Trib. to Cold Spring Brook**

Inflow=24.52 cfs 2.874 af

Primary=24.52 cfs 2.874 af

**Total Runoff Area = 11.724 ac   Runoff Volume = 4.851 af   Average Runoff Depth = 4.97"**  
**65.56% Pervious = 7.686 ac   34.44% Impervious = 4.038 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		<b>Sheet Flow, Soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> 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		<b>Sheet Flow, soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
1.1					<b>Direct Entry, To make min. allowable</b>
6.0	220	Total			

**Summary for Subcatchment P1.7: Subcat P1.7**

Runoff = 11.15 cfs @ 12.14 hrs, Volume= 0.913 af, Depth= 4.66"  
 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
1.788	61	>75% Grass cover, Good, HSG B
0.063	96	Gravel surface, HSG B
0.150	98	Water Surface, HSG B
0.005	98	Roofs, HSG B
0.345	98	Paved parking, HSG B
2.351	70	Weighted Average
1.851		78.73% Pervious Area
0.500		21.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	85	0.0150	0.15		<b>Sheet Flow, Playground</b> Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		<b>Shallow Concentrated Flow,</b> 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					<b>Direct Entry, To make min. allowable Sheet Flow,</b>
3.9	50	0.1200	0.21		Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		<b>Shallow Concentrated Flow,</b>
					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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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 = 1.35 cfs @ 12.60 hrs, Volume= 0.521 af, Atten= 85%, Lag= 30.5 min  
 Discarded = 0.15 cfs @ 12.60 hrs, Volume= 0.358 af  
 Primary = 1.21 cfs @ 12.60 hrs, Volume= 0.162 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= 245.80' @ 12.60 hrs Surf.Area= 7,999 sf Storage= 17,424 cf

Plug-Flow detention time= 452.0 min calculated for 0.520 af (70% of inflow)  
 Center-of-Mass det. time= 360.5 min ( 1,123.4 - 763.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	242.50'	7,427 cf	<b>68.00'W x 117.63'L x 3.75'H Field A</b> 29,997 cf Overall - 11,428 cf Embedded = 18,568 cf x 40.0% Voids
#2A	243.00'	11,428 cf	<b>ADS_StormTech SC-800 +Cap</b> x 224 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 224 Chambers in 14 Rows Cap Storage= 3.4 cf x 2 x 14 rows = 95.8 cf
		18,856 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	242.50'	<b>0.680 in/hr Exfiltration over Wetted area</b>
#2	Primary	242.50'	<b>12.0" Round Culvert</b> 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	244.75'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	245.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.15 cfs @ 12.60 hrs HW=245.80' (Free Discharge)

↑1=**Exfiltration** (Exfiltration Controls 0.15 cfs)

**Primary OutFlow** Max=1.20 cfs @ 12.60 hrs HW=245.80' (Free Discharge)

↑2=**Culvert** (Passes 1.20 cfs of 5.45 cfs potential flow)

↑3=**Orifice/Grate** (Orifice Controls 0.03 cfs @ 4.84 fps)

↑4=**Sharp-Crested Rectangular Weir** (Weir Controls 1.18 cfs @ 1.47 fps)

**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 = 4.93 cfs @ 12.47 hrs, Volume= 1.435 af, Atten= 76%, Lag= 23.2 min  
 Discarded = 0.41 cfs @ 12.47 hrs, Volume= 0.988 af  
 Primary = 4.52 cfs @ 12.47 hrs, Volume= 0.447 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= 247.89' @ 12.47 hrs Surf.Area= 15,543 sf Storage= 34,576 cf

Plug-Flow detention time= 420.9 min calculated for 1.435 af (87% of inflow)  
 Center-of-Mass det. time= 361.3 min ( 1,122.7 - 761.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	244.50'	14,334 cf	<b>63.25'W x 245.73'L x 3.75'H Field A</b> 58,285 cf Overall - 22,451 cf Embedded = 35,834 cf x 40.0% Voids
#2A	245.00'	22,451 cf	<b>ADS_StormTech SC-800 +Cap</b> x 442 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 442 Chambers in 13 Rows Cap Storage= 3.4 cf x 2 x 13 rows = 88.9 cf
		36,784 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	244.50'	<b>1.000 in/hr Exfiltration over Wetted area</b>
#2	Primary	244.00'	<b>15.0" Round Culvert</b> 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	246.00'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.40'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Discarded OutFlow** Max=0.41 cfs @ 12.47 hrs HW=247.89' (Free Discharge)

↑1=**Exfiltration** (Exfiltration Controls 0.41 cfs)

**Primary OutFlow** Max=4.46 cfs @ 12.47 hrs HW=247.89' (Free Discharge)

↑2=**Culvert** (Passes 4.46 cfs of 9.89 cfs potential flow)

↑3=**Orifice/Grate** (Orifice Controls 0.08 cfs @ 6.51 fps)

↑4=**Sharp-Crested Rectangular Weir** (Weir Controls 4.38 cfs @ 2.29 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	<b>15.58'W x 34.38'L x 5.50'H Field A</b> 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	<b>ADS_StormTech MC-3500 d +Cap</b> 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'	<b>0.880 in/hr Exfiltration over Wetted area</b>
#2	Primary	237.00'	<b>12.0" Round Culvert</b> 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'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 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, 21.27% Impervious, Inflow Depth = 4.66" for 100 yr event  
 Inflow = 11.15 cfs @ 12.14 hrs, Volume= 0.913 af  
 Outflow = 7.04 cfs @ 12.29 hrs, Volume= 0.828 af, Atten= 37%, Lag= 9.1 min  
 Discarded = 0.06 cfs @ 12.29 hrs, Volume= 0.062 af  
 Primary = 6.98 cfs @ 12.29 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= 232.45' @ 12.29 hrs Surf.Area= 8,173 sf Storage= 9,156 cf

Plug-Flow detention time= 107.6 min calculated for 0.828 af (91% of inflow)  
 Center-of-Mass det. time= 61.3 min ( 888.4 - 827.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	229.50'	15,362 cf	<b>Custom Stage Data (Conic)</b> 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'	<b>0.330 in/hr Exfiltration over Wetted area</b>
#2	Primary	232.50'	<b>6.0' long x 12.0' breadth Broad-Crested Rectangular Weir</b> 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'	<b>12.0" Round Culvert</b> 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	231.60'	<b>12.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.06 cfs @ 12.29 hrs HW=232.45' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.06 cfs)

**Primary OutFlow** Max=6.98 cfs @ 12.29 hrs HW=232.45' (Free Discharge)

↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

↑3=Culvert (Passes 6.98 cfs of 8.83 cfs potential flow)

↑4=Orifice/Grate (Orifice Controls 6.98 cfs @ 4.44 fps)

### Summary for Link DP1: Trib. to Cold Spring Brook

Inflow Area = 11.724 ac, 34.44% Impervious, Inflow Depth = 2.94" for 100 yr event

Inflow = 24.52 cfs @ 12.12 hrs, Volume= 2.874 af

Primary = 24.52 cfs @ 12.12 hrs, Volume= 2.874 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

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
**Ashland, MA**  
**Bohler Job Number: MAA240220.01**  
**December 30, 2025**

**MA DEP Standard 3: Recharge Volume Calculations**

<b>Required Recharge Volume - A Soils (0.60 in.)</b>	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
<b>Recharge Volume Required (cf)</b>	<b>0</b>

<b>Required Recharge Volume - B Soils (0.35 in.)</b>	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	4.036
Proposed Increase in Site Impervious Area (ac)	4.036
<b>Recharge Volume Required (cf)</b>	<b>5,128</b>

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

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

<b>Total Recharge Volume Required (cf)</b>	<b>5,128</b>
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<b>Recharge Volume Adjustment Factor</b>	
Impervious Area Directed to Infiltration BMP (ac)	<b>3.814</b>
%Impervious Directed to Infiltration BMP	94%
Adjustment Factor	1.06
<b>Adjusted Total Recharge Volume Required (cf)</b>	<b>5,426</b>

<b>Provided Recharge Volume*</b>	
Basin #1	4,844
Basin #2	8,552
Basin #3	1,074
Basin #4	3,429
<b>Total Recharge Volume Provided (cf)</b>	<b>17,899</b>

**Required Recharge Volume is Provided**

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

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
**Ashland, MA**  
**Bohler Job Number: MAA240220.01**  
**December 30, 2025**

**MA DEP Standard 3: Drawdown Time Calculations**

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<b>Drawdown Time - Basin #1</b>	
Volume below outlet pipe (Rv) (cf)	12,682
Soil Type	Sandy Loam - B
Infiltration rate (K)*	0.68
Bottom Area (sf)	7,999
<b>Drawdown time (Hours)*</b>	<b>28.0</b>
<b>Drawdown Time - Basin #2</b>	
Volume below outlet pipe (Rv) (cf)	15,995
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.00
Bottom Area (sf)	16,112
<b>Drawdown time (Hours)**</b>	<b>11.9</b>
<b>Drawdown Time - Basin #3</b>	
Volume below outlet pipe (Rv) (cf)	1,074
Soil Type	Loamy Sand - B
Infiltration rate (K)*	0.88
Bottom Area (sf)	782
<b>Drawdown time (Hours)**</b>	<b>18.7</b>
<b>Drawdown Time - Basin #4</b>	
Volume below outlet pipe (Rv) (cf)	4,844
Soil Type	Silt Loam - C
Infiltration rate (K)*	0.33
Bottom Area (sf)	3,027
<b>Drawdown time (Hours)**</b>	<b>58.2</b>

\*Infiltration Rates taken from Rawls Table

\*\*Drawdown time =  $Rv / (K \times \text{bottom area})$

Prepared By:

**BOHLER //**

352 Turnpike Road  
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 (508) 480-9900

12/30/2025

**Stage-Area-Storage for Pond B1: Basin #1 ELC Parking**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
242.50	7,999	0	245.10	8,964	14,554
242.55	8,018	160	245.15	8,983	14,805
242.60	8,036	320	245.20	9,001	15,051
242.65	8,055	480	245.25	9,020	15,291
242.70	8,073	640	245.30	9,039	15,525
242.75	8,092	800	245.35	9,057	15,752
242.80	8,110	960	245.40	9,076	15,971
242.85	8,129	1,120	245.45	9,094	16,180
242.90	8,148	1,280	245.50	9,113	16,377
242.95	8,166	1,440	245.55	9,131	16,566
243.00	8,185	1,600	245.60	9,150	16,747
243.05	8,203	1,940	245.65	9,169	16,922
243.10	8,222	2,280	245.70	9,187	17,092
243.15	8,240	2,619	245.75	9,206	17,256
243.20	8,259	2,957	245.80	9,224	17,416
243.25	8,278	3,294	245.85	9,243	17,576
243.30	8,296	3,630	245.90	9,261	17,736
243.35	8,315	3,964	245.95	9,280	17,896
243.40	8,333	4,298	246.00	9,299	18,056
243.45	8,352	4,630	246.05	9,317	18,216
243.50	8,370	4,961	246.10	9,336	18,376
243.55	8,389	5,291	246.15	9,354	18,536
243.60	8,407	5,620	246.20	9,373	18,696
243.65	8,426	5,947	246.25	<b>9,391</b>	<b>18,856</b>
243.70	8,445	6,272			
243.75	8,463	6,597			
243.80	8,482	6,919			
243.85	8,500	7,241			
243.90	8,519	7,560			
243.95	8,537	7,878			
244.00	8,556	8,194			
244.05	8,575	8,509			
244.10	8,593	8,821			
244.15	8,612	9,132			
244.20	8,630	9,441			
244.25	8,649	9,747			
244.30	8,667	10,052			
244.35	8,686	10,354			
244.40	8,704	10,654			
244.45	8,723	10,952			
244.50	8,742	11,247			
244.55	8,760	11,539			
244.60	8,779	11,829			
244.65	8,797	12,117			
244.70	8,816	12,401			
<b>244.75</b>	<b>8,834</b>	<b>12,682</b>	<b>outlet elev.</b>		
244.80	8,853	12,960			
244.85	8,872	13,235			
244.90	8,890	13,507			
244.95	8,909	13,775			
245.00	8,927	14,038			
245.05	8,946	14,298			

**Stage-Area-Storage for Pond B2: Basin #2 SE Parking**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
244.50	15,543	0	247.10	17,149	28,412
244.55	15,574	311	247.15	17,180	28,902
244.60	15,604	622	247.20	17,211	29,381
244.65	15,635	933	247.25	17,242	29,850
244.70	15,666	1,243	247.30	17,273	30,306
244.75	15,697	1,554	247.35	17,304	30,750
244.80	15,728	1,865	247.40	17,335	31,175
244.85	15,759	2,176	247.45	17,366	31,582
244.90	15,790	2,487	247.50	17,397	31,967
244.95	15,821	2,798	247.55	17,427	32,334
245.00	15,852	3,109	247.60	17,458	32,686
245.05	15,883	3,774	247.65	17,489	33,027
245.10	15,913	4,438	247.70	17,520	33,357
245.15	15,944	5,101	247.75	17,551	33,676
245.20	15,975	5,761	247.80	17,582	33,987
245.25	16,006	6,419	247.85	17,613	34,298
245.30	16,037	7,075	247.90	17,644	34,608
245.35	16,068	7,730	247.95	17,675	34,919
245.40	16,099	8,381	248.00	17,706	35,230
245.45	16,130	9,031	248.05	17,736	35,541
245.50	16,161	9,678	248.10	17,767	35,852
245.55	16,191	10,322	248.15	17,798	36,163
245.60	16,222	10,964	248.20	17,829	36,474
245.65	16,253	11,603	248.25	<b>17,860</b>	<b>36,784</b>
245.70	16,284	12,240			
245.75	16,315	12,873			
245.80	16,346	13,504			
245.85	16,377	14,132			
245.90	16,408	14,756			
245.95	16,439	15,377			
<b>246.00</b>	<b>16,470</b>	<b>15,995</b>	outlet elev.		
246.05	16,500	16,609			
246.10	16,531	17,219			
246.15	16,562	17,826			
246.20	16,593	18,429			
246.25	16,624	19,028			
246.30	16,655	19,623			
246.35	16,686	20,213			
246.40	16,717	20,799			
246.45	16,748	21,380			
246.50	16,779	21,957			
246.55	16,809	22,528			
246.60	16,840	23,094			
246.65	16,871	23,655			
246.70	16,902	24,210			
246.75	16,933	24,760			
246.80	16,964	25,303			
246.85	16,995	25,839			
246.90	17,026	26,369			
246.95	17,057	26,892			
247.00	17,088	27,407			
247.05	17,118	27,914			

**Stage-Area-Storage for Pond B3: Basin #3 East Driveway**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
237.00	536	0	242.20	1,055	1,678
237.10	546	21	242.30	1,065	1,699
237.20	556	43	242.40	1,075	1,721
237.30	566	64	242.50	<b>1,085</b>	<b>1,742</b>
237.40	576	86			
237.50	586	107			
237.60	596	129			
237.70	606	150			
237.80	616	182			
237.90	626	225			
238.00	636	268			
238.10	646	310			
238.20	656	353			
238.30	666	395			
238.40	676	437			
238.50	686	479			
238.60	696	521			
238.70	706	562			
238.80	716	603			
238.90	726	644			
239.00	736	685			
239.10	746	725			
239.20	756	765			
239.30	766	805			
239.40	776	845			
239.50	786	884			
239.60	796	923			
239.70	806	961			
239.80	816	999			
239.90	826	1,037			
<b>240.00</b>	<b>836</b>	<b>1,074</b>	<b>outlet elev.</b>		
240.10	846	1,110			
240.20	856	1,146			
240.30	866	1,181			
240.40	876	1,216			
240.50	885	1,250			
240.60	895	1,283			
240.70	905	1,316			
240.80	915	1,347			
240.90	925	1,378			
241.00	935	1,407			
241.10	945	1,434			
241.20	955	1,460			
241.30	965	1,483			
241.40	975	1,506			
241.50	985	1,528			
241.60	995	1,549			
241.70	1,005	1,571			
241.80	1,015	1,592			
241.90	1,025	1,614			
242.00	1,035	1,635			
242.10	1,045	1,656			

**Stage-Area-Storage for Pond B4: Basin #4 Infiltration Basin**

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
229.50	0	0	0
229.60	80	80	3
229.70	321	321	21
229.80	721	722	72
229.90	1,283	1,283	171
230.00	2,004	2,004	334
230.10	2,097	2,099	539
230.20	2,192	2,195	753
230.30	2,289	2,293	977
230.40	2,388	2,394	1,211
230.50	2,489	2,497	1,455
230.60	2,593	2,602	1,709
230.70	2,698	2,709	1,974
230.80	2,806	2,818	2,249
230.90	2,915	2,929	2,535
231.00	3,027	3,043	2,832
231.10	3,133	3,151	3,140
231.20	3,241	3,260	3,459
231.30	3,351	3,372	3,788
231.40	3,463	3,486	4,129
231.50	3,576	3,601	4,481
231.60	3,691	3,718	4,844
231.70	3,809	3,837	5,219
231.80	3,928	3,958	5,606
231.90	4,048	4,081	6,005
232.00	4,171	4,206	6,416
232.10	4,941	4,977	6,871
232.20	5,777	5,813	7,406
232.30	6,677	6,714	8,028
232.40	7,643	7,680	8,744
232.50	8,675	8,712	9,559
232.60	9,771	9,809	10,481
232.70	10,933	10,971	11,516
232.80	12,160	12,198	12,670
232.90	13,452	13,491	13,950
233.00	<b>14,809</b>	<b>14,849</b>	<b>15,362</b>

outlet elev.

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
**Ashland, MA**  
**Bohler Job Number: MAA240220.01**  
**December 30, 2025**

**MA DEP Standard 4: Water Quality Volume Calculations**

---

<b>Water Quality Volume Required</b>	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	175,808
<b>Required Water Quality Volume (cf)</b>	<b>14,651</b>
*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.	

<b>Water Quality Volume Provided*</b>	
Basin #1	4,844
Basin #2	8,552
Basin #3	1,074
Basin #4	3,429
<b>Total Provided Water Quality Volume (cf)</b>	<b>17,899</b>

**Required Water Quality Volume Provided**

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

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
**Ashland, MA**  
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**October 6, 2025**

**MA DEP Standard 4: TSS Removal Calculation Worksheet**

---

BMP Treatment Train: Pretreatment 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)
<b>Deep Sump CBs</b>	<b>0.25</b>	<b>1.00</b>	<b>0.25</b>	<b>0.75</b>
<b>Isolator Row</b>	<b>0.25</b>	<b>0.75</b>	<b>0.19</b>	<b>0.56</b>
<b>Total TSS Removal =</b>			<b>44%</b>	

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

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
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**October 6, 2025**

**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
<b>Total TSS Removal =</b>			<b>89%</b>	

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

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
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**October 6, 2025**

**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)
<b>Deep Sump CBs</b>	<b>0.25</b>	<b>1.00</b>	<b>0.25</b>	<b>0.75</b>
<b>Water Quality Unit</b>	<b>0.50</b>	<b>0.75</b>	<b>0.38</b>	<b>0.38</b>
<b>Total TSS Removal =</b>			<b>63%</b>	

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

**Team Hoyt Community YMCA**  
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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
			<b>Total TSS Removal =</b>	<b>93%</b>

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

**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)
<b>Grass Filter (&gt;50' long)</b>	<b>0.45</b>	<b>1.00</b>	<b>0.45</b>	<b>0.55</b>
<b>Total TSS Removal =</b>			<b>45%</b>	

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

**Team Hoyt Community YMCA**  
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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)
<b>Grass Filter (&gt;50' long)</b>	<b>0.45</b>	<b>1.00</b>	<b>0.45</b>	<b>0.55</b>
<b>Infiltration Basin</b>	<b>0.80</b>	<b>0.55</b>	<b>0.44</b>	<b>0.11</b>
<b>Total TSS Removal =</b>			<b>89%</b>	

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

**Team Hoyt Community YMCA**  
**30 Memorial Drive**  
**Ashland, MA**  
**Bohler Job Number: MAA240220.01**  
**December 30, 2025**

**MA DEP Standard 4: TSS Removal Calculation Worksheet**

---

BMP Treatment Train: Pretreatment- From D40 pipe outfall to sediment forebay before open basin

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
<b>Deep Sump CB</b>	<b>0.25</b>	<b>1.00</b>	<b>0.25</b>	<b>0.75</b>
<b>Sediment Forebay</b>	<b>0.25</b>	<b>0.75</b>	<b>0.19</b>	<b>0.56</b>
<b>Total TSS Removal =</b>			<b>44%</b>	

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

Team Hoyt Community YMCA  
30 Memorial Drive  
Ashland, MA  
Bohler Job Number: MAA240220.01  
December 30, 2025

MA DEP Standard 4: Weighted TSS Removal Rate

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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	0.345	0	0.000	0.345
<b>Weighted TSS Removal Rate</b>	<b>88.70</b>				2.932

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)	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)
0.01	835	2.7	197	7.1	95
0.03	835	2.8	192	7.2	94
0.05	831	2.9	187	7.3	93
0.067	814	3	183	7.4	92
0.083	795	3.1	179	7.5	91
0.1	774	3.2	175	7.6	90
0.116	755	3.3	171	7.7	89
0.133	736	3.4	168	7.8	88
0.15	717	3.5	164	7.9	87
0.167	700	3.6	161	8	86
0.183	685	3.7	158	8.1	85
0.2	669	3.8	155	8.2	84
0.217	654	3.9	152	8.3	84
0.233	641	4	149	8.4	83
0.25	628	4.1	146	8.5	82
0.3	593	4.2	144	8.6	81
0.333	572	4.3	141	8.7	80
0.35	563	4.4	139	8.8	79
0.4	536	4.5	137	8.9	79
0.416	528	4.6	134	9	78
0.5	491	4.7	132	9.1	77
0.583	460	4.8	130	9.2	76
0.6	454	4.9	128	9.3	76
0.667	433	5	126	9.4	75
0.7	424	5.1	124	9.5	74
0.8	398	5.2	122	9.6	74
0.9	376	5.3	120	9.7	73
1	356	5.4	119	9.8	72
1.1	339	5.5	117	9.9	72
1.2	323	5.6	115	10	71
1.3	309	5.7	114		
1.4	296	5.8	112		
1.5	285	5.9	111		
1.6	274	6	109		
1.7	264	6.1	108		
1.8	255	6.2	106		
1.9	247	6.3	105		
2	239	6.4	104		
2.1	232	6.5	102		
2.2	225	6.6	101		
2.3	219	6.7	100		
2.4	213	6.8	99		
2.5	207	6.9	98		
2.6	202	7	96		



**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 & aeriels](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
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)

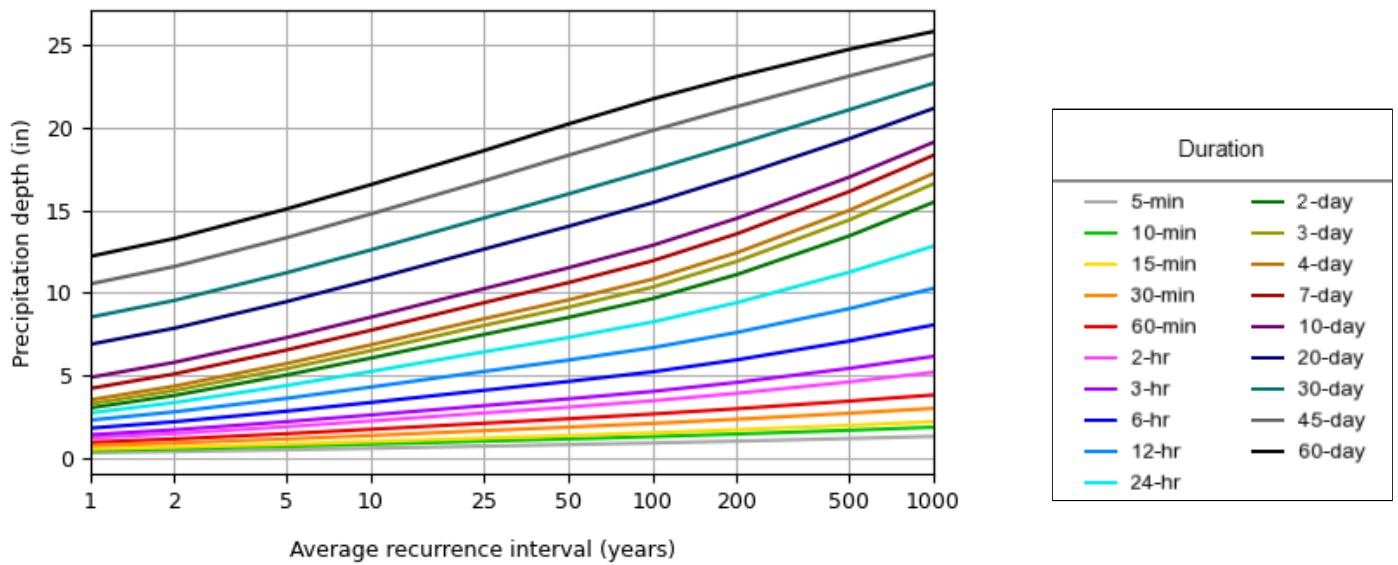
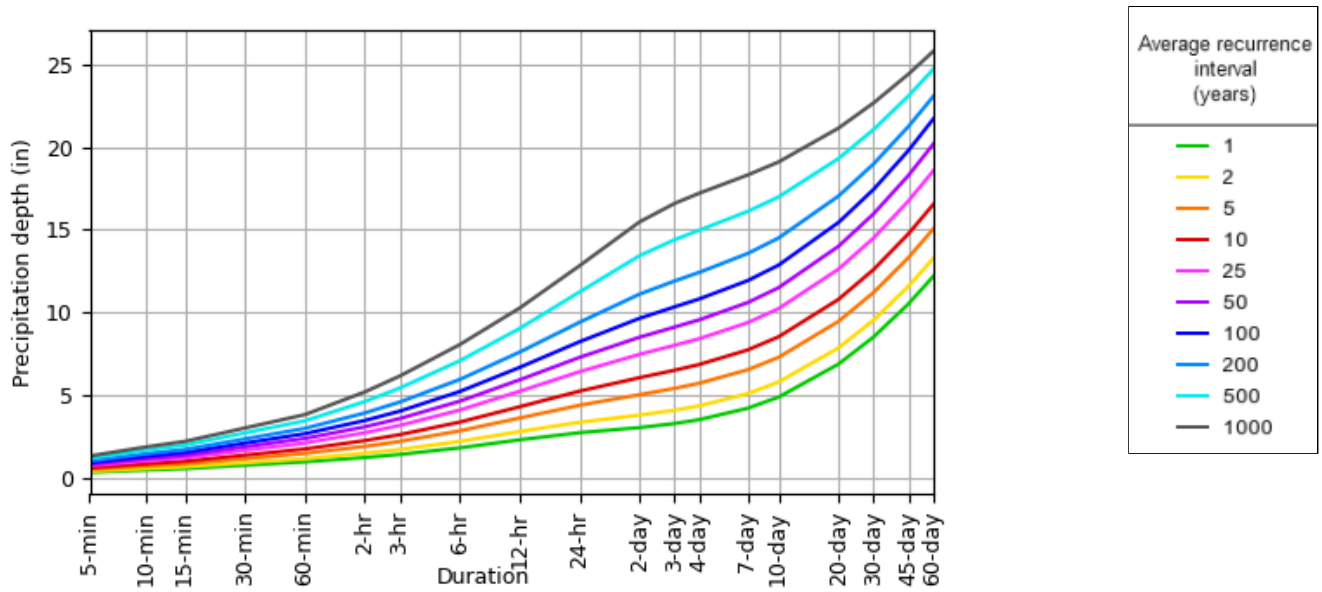
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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**PF graphical**

PDS-based depth-duration-frequency (DDF) curves

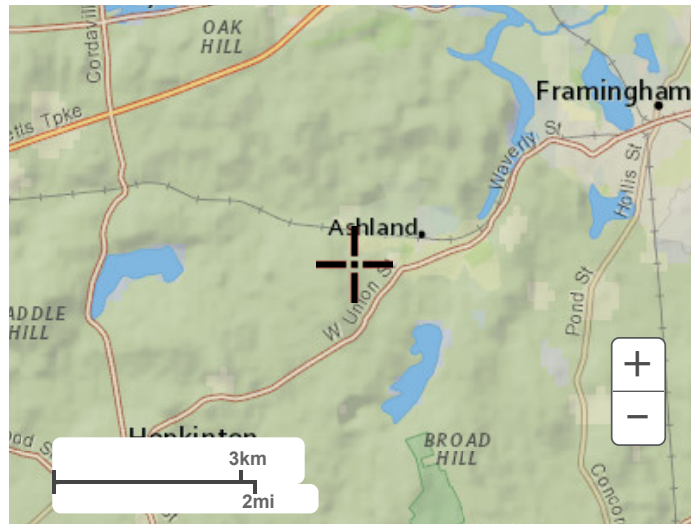
Latitude: 42.2558°, Longitude: -71.4767°



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**Maps & aerials**

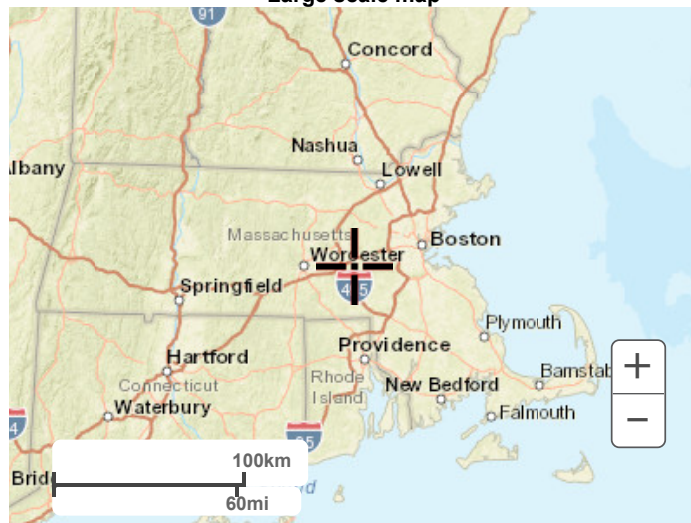
**Small scale terrain**



Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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# Available Models

CDS Model	Treatment Capacity <sup>3</sup> (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.



UNIVERSITY OF MASSACHUSETTS  
AT AMHERST

Water Resources Research Center  
Blaisdell House, UMass  
310 Hicks Way  
Amherst, MA 01003

Massachusetts Stormwater  
Evaluation Project

(413) 545-5532  
(413) 545-2304 FAX  
[www.mastep.net](http://www.mastep.net)

## MASTEP Technology Review

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**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.



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**STATEMENT OF THIRD PARTY OBSERVER**

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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)<sup>1</sup>  
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)<sup>1</sup>. 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.

September 16, 2013

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Signed:

Date

---

<sup>1</sup> Available at <http://www.nj.gov/dep/stormwater/treatment.html>

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

CONTECH Engineered Solutions LLC  
71 US Route 1, Suite F | Scarborough, ME 04074  
T: 207.885.6174 F: 207.885.9825  
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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

Handwritten signatures of Dr. Chris Berger and Dr. Scott Wells. The signature of Dr. Chris Berger is on the left, and the signature of Dr. Scott Wells is on the right.

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.

August 13, 2014

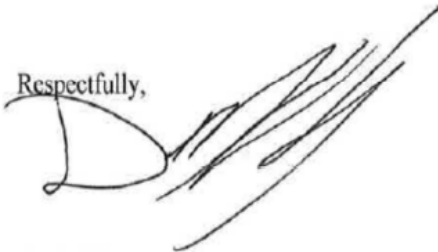
Dr. Richard Magee  
Technical Director  
New Jersey Corporation for Advanced Technology (NJCAT)  
c/o Center for Environmental Systems  
Stevens Institute of Technology  
One Castle Point on Hudson  
Hoboken, NJ 07030

**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.

Respectfully,



Derek M. Berg  
Regulatory Manager- Stormwater

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[www.ContechES.com](http://www.ContechES.com)



**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,

A handwritten signature in blue ink that reads 'Richard S. Magee'. The signature is written in a cursive, flowing style.

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)

$$d_{50} = (0.0276 R_p^2 / TW) (Q/R_p^{2.5})^{1.333} \quad ( d_{50} = (0.0125 R_p^2 / TW) (Q/R_p^{2.5})^{1.333} ) \quad (11.35)$$

Type 2: Scour Hole Depression = full pipe rise, m (ft)

$$d_{50} = (0.0181 R_p^2 / TW) (Q/R_p^{2.5})^{1.333} \quad ( d_{50} = (0.0082 R_p^2 / TW) (Q/R_p^{2.5})^{1.333} ) \quad (11.36)$$

$d_{50}$  = 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)

$$\begin{aligned} C &= 3S_p + 6F && \text{Basin Length m (ft)} \\ B &= 2S_p + 6F && \text{Basin Inlet and Outlet Width m (ft)} \\ F &= 0.5R_p \text{ (Type 1) or } R_p \text{ (Type 2)} && \text{Basin Depression m (ft)} \end{aligned} \quad (11.37)$$

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	$d_{50} < 0.13\text{m (0.42 ft)}$
Intermediate	$0.13\text{m (0.42 ft)} < d_{50} < 0.20\text{m (0.67 ft)}$
Standard	$0.20\text{m (0.67 ft)} < d_{50} < 0.38\text{m (1.25 ft)}$
Special Design	$0.38\text{m (1.25 ft)} < d_{50}$

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**

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

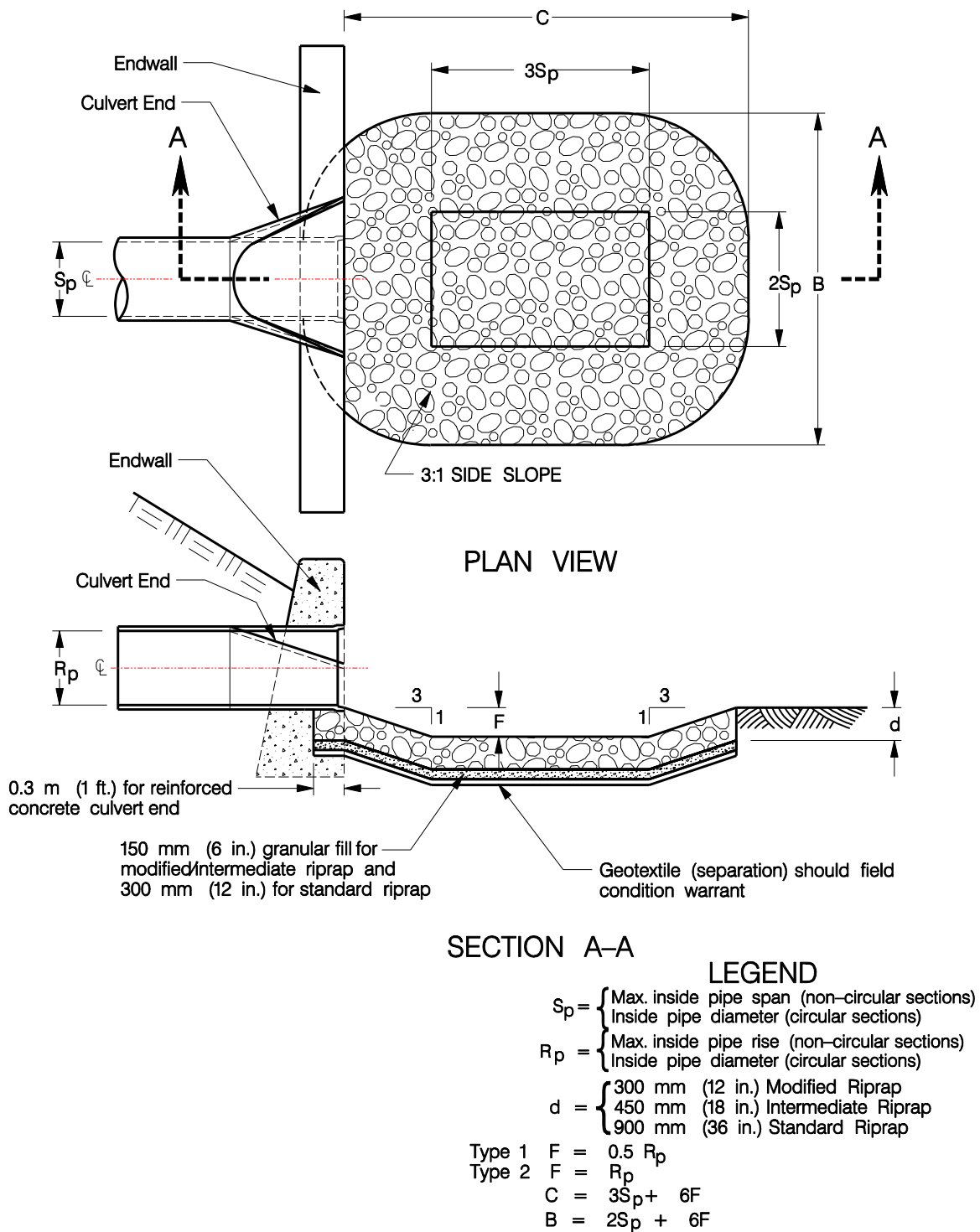


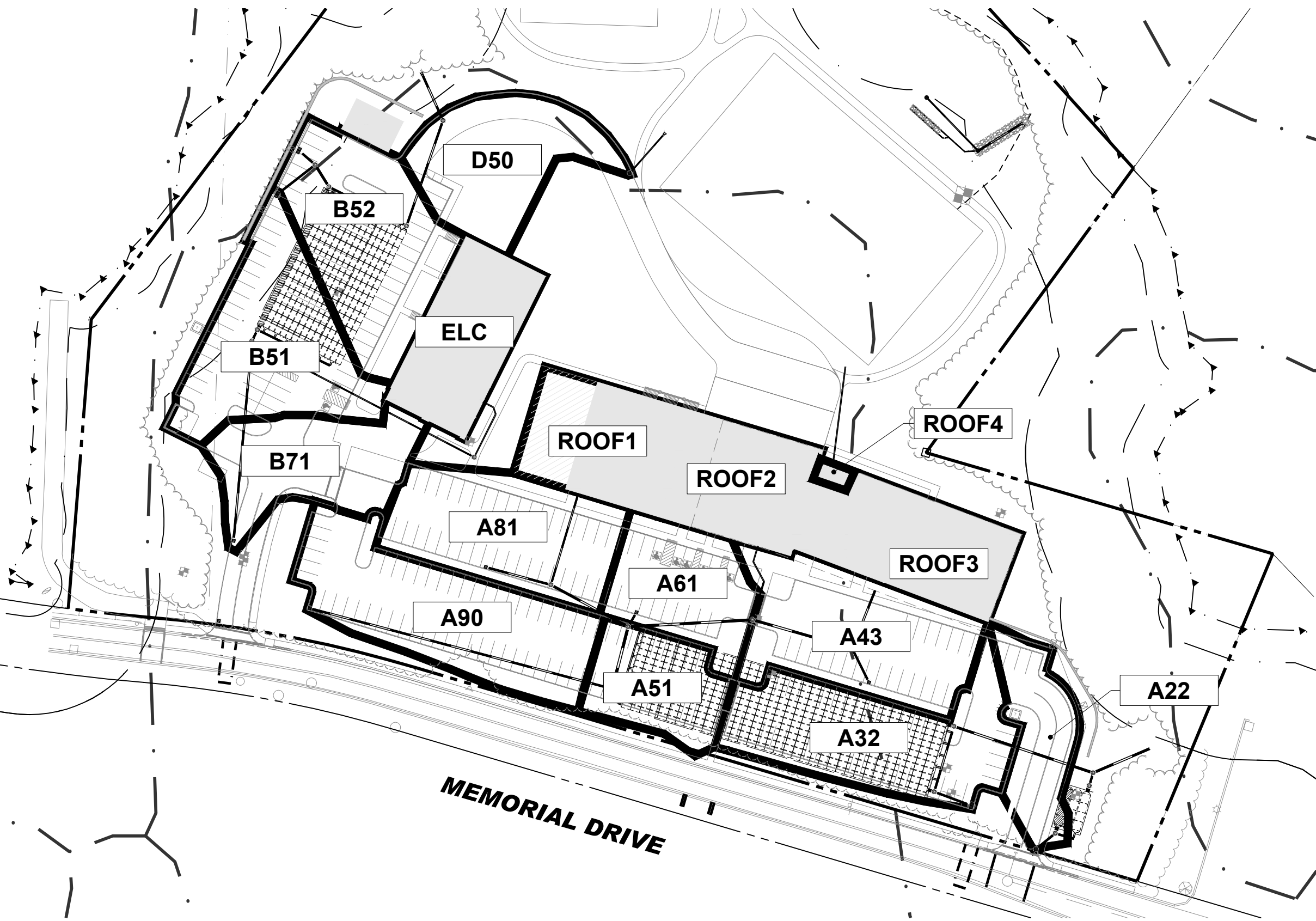


Figure 11-15 Preformed Scour Hole Type 1 and Type 2

P:\2025\MAA240220.01\CAD\DRAWINGS\PLAN SETS\DRAINAGE AREA MAPS\F-DMAP-HYDR-MAA240220.01-3B- -LAYOUT: CB AREAS

<b>LEGEND</b>	
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10/06/25 | AP | 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	5.99	0.00	0.00	1.78	....	3.000	0.33	18	10.68	6.57	6.04	245.16	245.15	252.79	247.46
2	A50-A40	5.0	0.02	6.5	5.99	0.00	0.00	1.78	....	7.000	1.86	18	10.69	15.50	6.05	245.38	245.25	252.73	247.94
3	A60-A50	5.0	0.18	6.4	6.04	0.00	0.00	1.32	....	49.000	0.69	18	7.96	9.48	4.51	245.80	245.46	253.69	248.75
4	A51-A50	5.0	0.12	5.0	6.49	0.18	0.77	0.14	0.90	8.000	2.87	12	0.90	6.54	4.47	249.00	248.77	252.56	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	252.13	249.58
6	A70-A60	5.0	0.46	5.5	6.32	0.00	0.00	0.47	....	67.000	0.49	15	2.96	4.91	2.41	246.33	246.00	252.12	249.19
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	0.45	5.9	6.18	0.00	0.00	0.69	....	95.000	0.51	15	4.26	4.97	3.47	247.87	247.39	253.31	249.42
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	249.77
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	249.93
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	249.38
14	A90-A50	5.0	1.48	5.0	6.49	0.41	0.80	0.33	2.13	240.000	0.50	12	2.13	2.73	2.71	246.78	245.58	249.88	249.24
15	B40-BSN1	5.0	0.04	5.3	6.37	0.00	0.00	0.59	....	3.000	0.33	24	3.78	14.15	1.20	243.19	243.18	247.76	245.36
16	B50-B40	5.0	0.11	5.2	6.40	0.00	0.00	0.59	....	20.000	1.00	15	3.80	7.00	3.10	243.52	243.32	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	10.96	2.30	245.19	245.18	252.50	245.64

Project File: Ashland YMCA Rev 12-26.stm

Number of lines: 36

Date: 12/30/2025

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	0.08	7.5	5.72	0.00	0.00	0.32	....	3.000	0.33	24	1.85	14.15	0.59	243.19	243.18	250.04	245.36
27	B70-B60	0.0	0.07	7.5	5.74	0.00	0.00	0.32	....	10.000	1.90	12	1.85	5.32	2.36	243.40	243.21	250.22	245.38
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	247.32
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	245.54
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	0.35	5.1	0.00	0.00	0.00	0.00	....	85.000	2.98	12	3.19	6.66	4.06	242.50	239.97	249.27	246.76
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	246.80
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	7.67	5.0	6.49	0.01	0.90	0.01	0.06	77.000	3.23	8	0.06	2.35	2.20	237.50	235.01	239.50	237.61
36	D50-D40	5.0	0.25	5.0	6.49	0.27	0.55	0.15	0.96	41.000	0.51	8	0.96	0.94	3.32	236.96	236.75	239.59	237.55

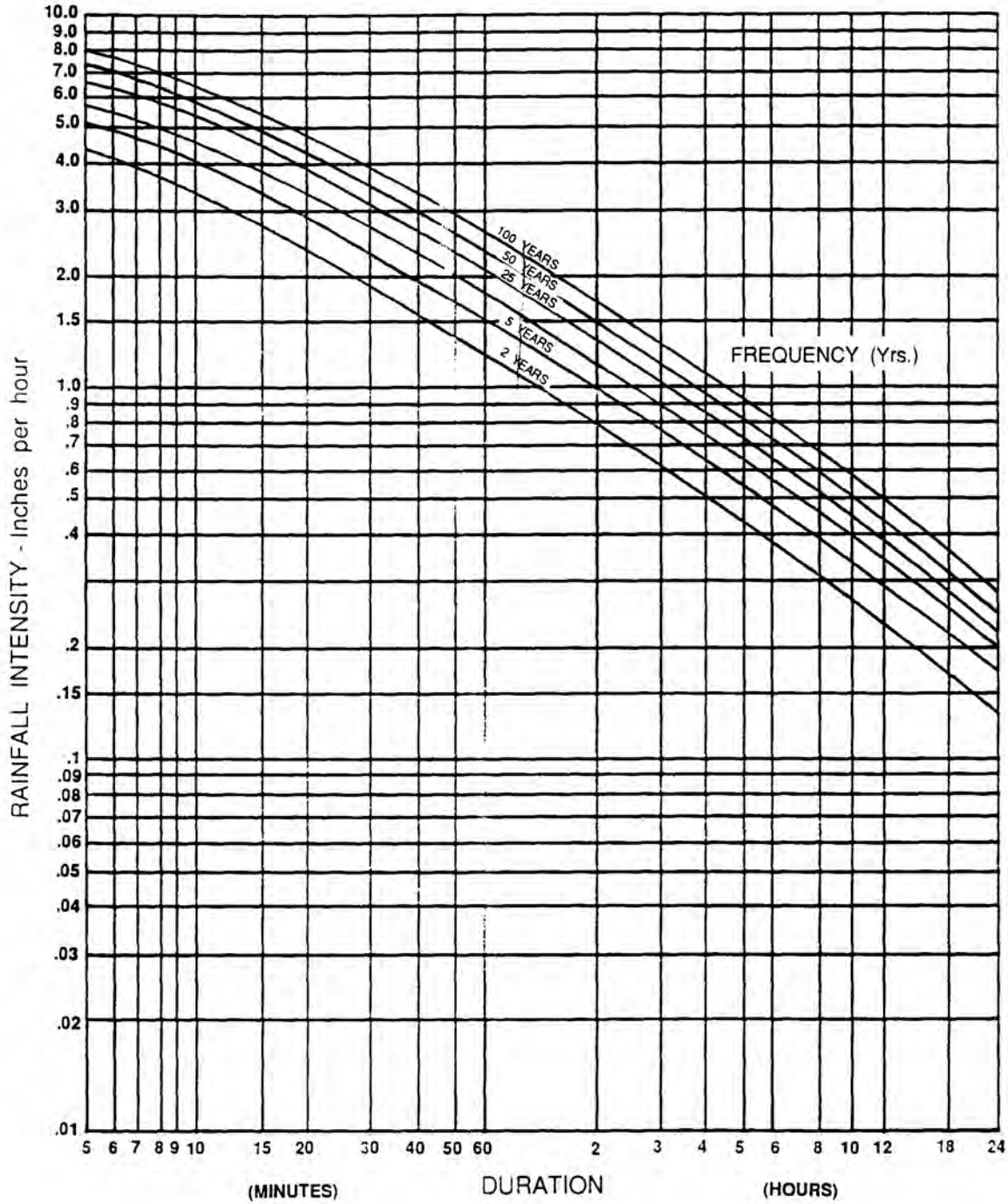
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Number of lines: 36

Date: 12/30/2025

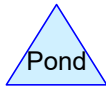
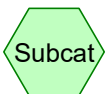
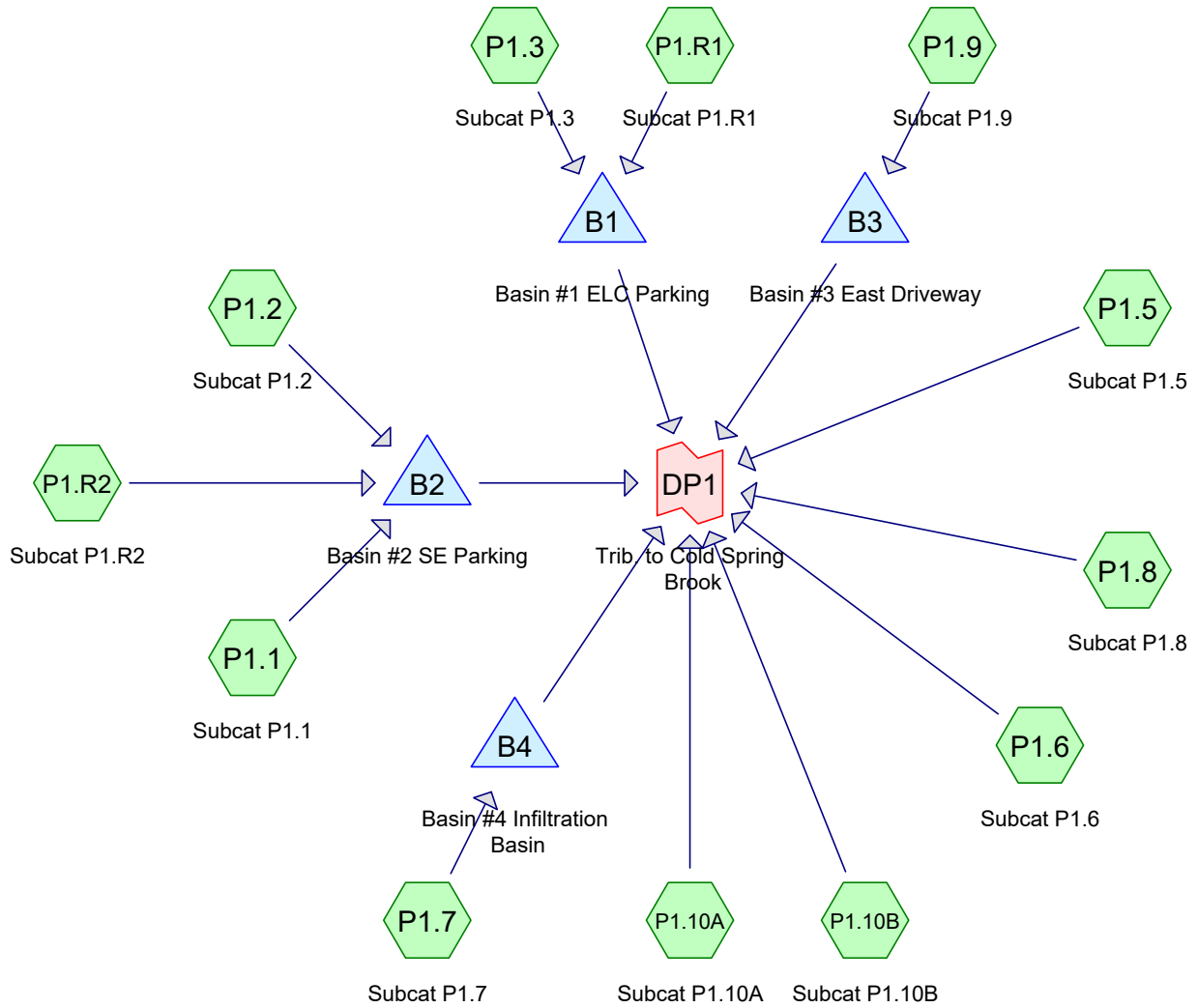
NOTES: Intensity = 33.11 / (Inlet time + 7.00) ^ 0.66 -- Return period = 25 Yrs. ; \*\* Critical depth

Exhibit 8-14  
Intensity - Duration - Frequency Curve for Worcester, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

One inch rainfall demonstrating no discharge from infiltration basins  
(100% TSS and P Removal)



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**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

<b>SubcatchmentP1.1: Subcat P1.1</b>	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
<b>SubcatchmentP1.10A: Subcat P1.10A</b>	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
<b>SubcatchmentP1.10B: Subcat P1.10B</b>	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
<b>SubcatchmentP1.2: Subcat P1.2</b>	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
<b>SubcatchmentP1.3: Subcat P1.3</b>	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
<b>SubcatchmentP1.5: Subcat P1.5</b>	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
<b>SubcatchmentP1.6: Subcat P1.6</b>	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
<b>SubcatchmentP1.7: Subcat P1.7</b>	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
<b>SubcatchmentP1.8: Subcat P1.8</b>	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
<b>SubcatchmentP1.9: Subcat P1.9</b>	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
<b>SubcatchmentP1.R1: Subcat P1.R1</b>	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
<b>SubcatchmentP1.R2: Subcat P1.R2</b>	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
<b>Pond B1: Basin #1 ELC Parking</b>	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
<b>Pond B2: Basin #2 SE Parking</b>	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
<b>Pond B3: Basin #3 East Driveway</b>	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
<b>Pond B4: Basin #4 Infiltration Basin</b>	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

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*Type III 24-hr 1 inch Rainfall=1.00"*

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**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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"

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Type III 24-hr 1 inch Rainfall=1.00"

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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		<b>Sheet Flow, Soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.2	100	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> 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		<b>Sheet Flow, soccer field</b> Grass: Short n= 0.150 P2= 3.36"
0.5	80	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	40	0.3330	9.29		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
1.1					<b>Direct Entry, To make min. allowable</b>
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		<b>Sheet Flow, Playground</b> Grass: Short n= 0.150 P2= 3.36"
0.1	35	0.3300	9.25		<b>Shallow Concentrated Flow, slope</b> Unpaved Kv= 16.1 fps
0.3	80	0.1000	5.09		<b>Shallow Concentrated Flow,</b> 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

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0					<b>Direct Entry, To make min. allowable Sheet Flow,</b>
3.9	50	0.1200	0.21		Grass: Dense n= 0.240 P2= 3.36"
0.1	40	0.1800	6.83		<b>Shallow Concentrated Flow,</b>
					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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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	<b>44.25'W x 110.52'L x 3.75'H Field A</b> 18,339 cf Overall - 6,892 cf Embedded = 11,447 cf x 40.0% Voids
#2A	243.00'	6,892 cf	<b>ADS_StormTech SC-800 +Cap</b> 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'	<b>0.680 in/hr Exfiltration over Wetted area</b>
#2	Primary	242.50'	<b>12.0" Round Culvert</b> 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'	<b>4.0" Vert. Orifice/Grate X 3.00</b> 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	<b>63.25'W x 217.27'L x 3.75'H Field A</b> 51,533 cf Overall - 19,820 cf Embedded = 31,713 cf x 40.0% Voids
#2A	245.00'	19,820 cf	<b>ADS_StormTech SC-800 +Cap</b> 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'	<b>1.000 in/hr Exfiltration over Wetted area</b>
#2	Primary	244.00'	<b>15.0" Round Culvert</b> 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'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	247.10'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 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	<b>15.58'W x 34.38'L x 5.50'H Field A</b> 2,947 cf Overall - 939 cf Embedded = 2,007 cf x 40.0% Voids
#2A	237.75'	939 cf	<b>ADS_StormTech MC-3500 d +Cap x 8</b> 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'	<b>0.880 in/hr Exfiltration over Wetted area</b>
#2	Primary	237.00'	<b>12.0" Round Culvert</b> 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'	<b>2.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Device 2	240.60'	<b>4.0' long Sharp-Crested Rectangular Weir</b> 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	<b>Custom Stage Data (Conic)</b> 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'	<b>0.330 in/hr Exfiltration over Wetted area</b>
#2	Primary	232.50'	<b>6.0' long x 12.0' breadth Broad-Crested Rectangular Weir</b> 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'	<b>12.0" Round Culvert</b> 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'	<b>12.0" Horiz. Orifice/Grate X 2.00</b> 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**

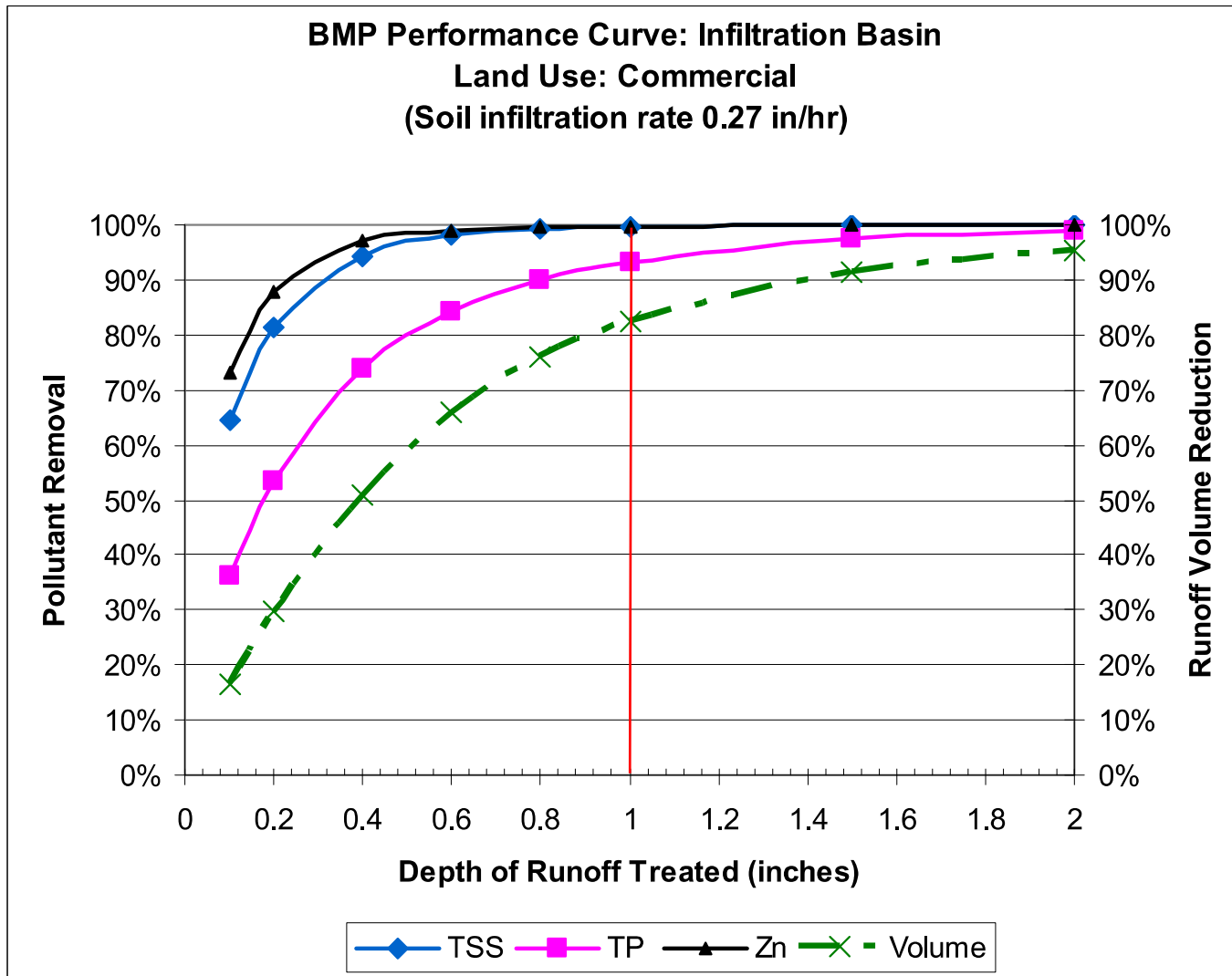
Inflow Area = 11.724 ac, 31.57% Impervious, Inflow Depth = 0.00" for 1 inch event

Inflow = 0.00 cfs @ 15.02 hrs, Volume= 0.000 af

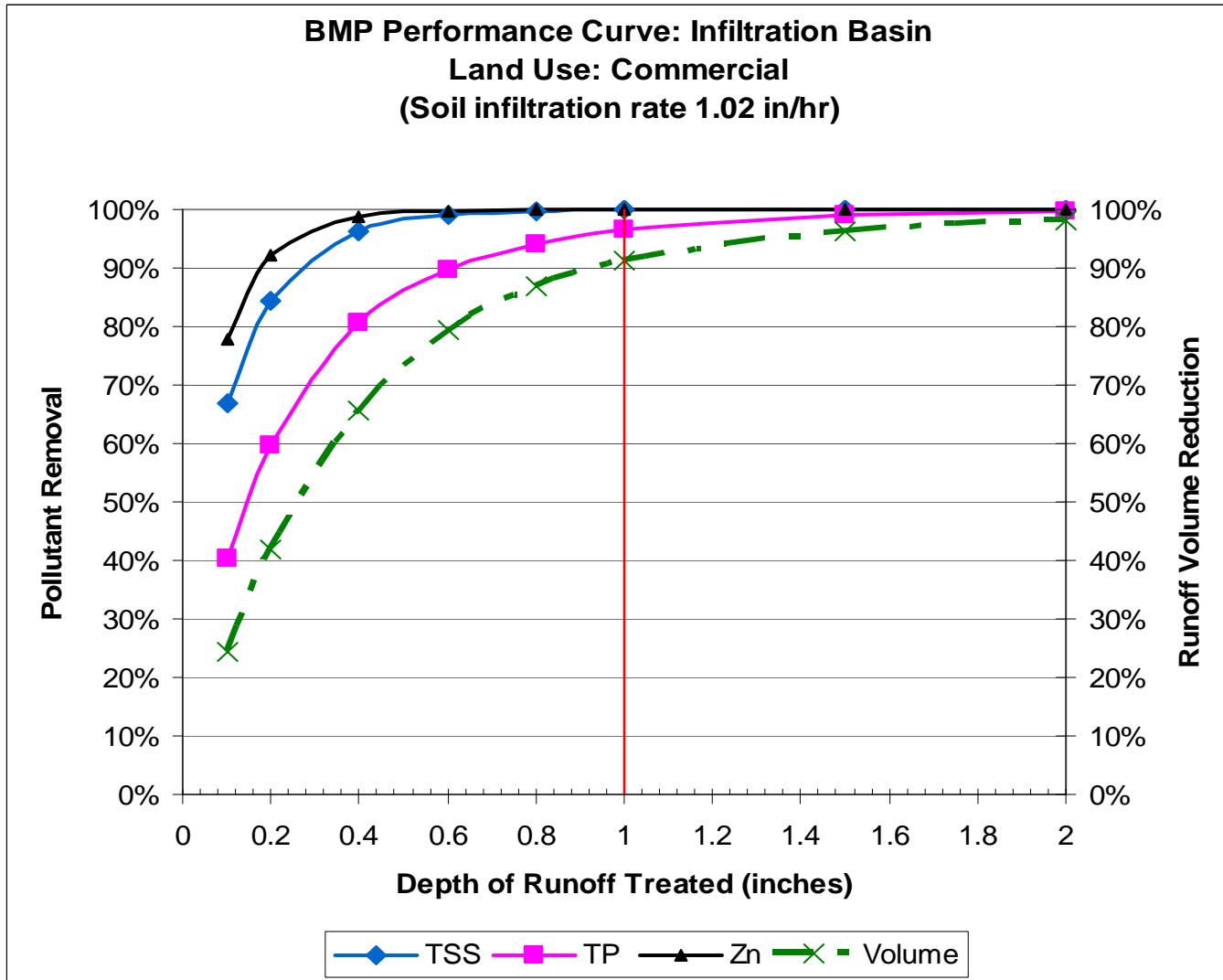
Primary = 0.00 cfs @ 15.02 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

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

From: Stormwater Best Management Practices (BMP) Performance Analysis, prepared for the EPA in December, 2008, revised March, 2010



From: Stormwater Best Management Practices (BMP) Performance Analysis, prepared for the EPA in December, 2008, revised March, 2010



Team Hoyt Community YMCA  
30 Memorial Drive  
Ashland, MA  
Bohler Job Number: MAA240220.01  
December 30, 2025

**Isolator Row Sizing Calculations**

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<b>Basin #1</b>	
Total Post Development Impervious Area (acres)	1.04
Isolator Row Volume Required (cf)	378
<b>Isolator Row Volume Provided (cf)*</b>	<b>1,176</b>

<b>Basin #3</b>	
Total Post Development Impervious Area (acres)	0.095
Isolator Row Volume Required (cf)	34
<b>Isolator Row Volume Provided (cf)*</b>	<b>563</b>

<b>D-40 Outlet</b>	
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**Stage-Area-Storage for Pond B1: Basin #1 ELC Parking**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
242.50	691	0	245.10	1,298	1,136
242.55	702	14	245.15	1,310	1,156
242.60	714	28	245.20	1,321	1,176
242.65	726	41	245.25	1,333	1,195
242.70	737	55	245.30	1,345	1,214
242.75	749	69	245.35	1,356	1,232
242.80	761	83	245.40	1,368	1,250
242.85	772	97	245.45	1,380	1,267
242.90	784	111	245.50	1,391	1,283
242.95	796	124	245.55	1,403	1,299
243.00	807	138	245.60	1,415	1,314
243.05	819	164	245.65	1,426	1,329
243.10	831	190	245.70	1,438	1,343
243.15	843	216	245.75	1,450	1,357
243.20	854	241	245.80	1,461	1,371
243.25	866	267	245.85	1,473	1,385
243.30	878	293	245.90	1,485	1,399
243.35	889	318	245.95	1,496	1,413
243.40	901	344	246.00	1,508	1,426
243.45	913	369	246.05	1,520	1,440
243.50	924	394	246.10	1,531	1,454
243.55	936	420	246.15	1,543	1,468
243.60	948	445	246.20	1,555	1,482
243.65	959	470	246.25	<b>1,566</b>	<b>1,496</b>
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			

**Stage-Area-Storage for Pond B3: Basin #3 East Driveway**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
237.00	289	0	242.20	734	884
237.10	298	12	242.30	743	895
237.20	306	23	242.40	752	907
237.30	315	35	242.50	<b>760</b>	<b>918</b>
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			

**Stage-Area-Storage for Pond 1P: D40**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
232.50	20	0
232.51	24	0
232.52	28	0
232.53	32	1
232.54	36	1
232.55	40	1
232.56	44	2
232.57	47	2
232.58	51	3
232.59	55	3
232.60	59	4
232.61	63	5
232.62	67	5
232.63	71	6
232.64	75	7
232.65	79	7
232.66	83	8
232.67	87	9
232.68	91	10
232.69	94	11
232.70	98	12
232.71	102	13
232.72	106	14
232.73	110	15
232.74	114	16
232.75	118	17
232.76	122	18
232.77	126	20
232.78	130	21
232.79	134	22
232.80	138	24
232.81	142	25
232.82	145	26
232.83	149	28
232.84	153	29
232.85	157	31
232.86	161	33
232.87	165	34
232.88	169	36
232.89	173	38
232.90	177	39
232.91	181	41
232.92	185	43
232.93	189	45
232.94	192	47
232.95	196	49
232.96	200	51
232.97	204	53
232.98	208	55
232.99	212	57
233.00	<b>216</b>	<b>59</b>

## **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:



## **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:

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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.



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

