DRAINAGE REPORT

For

KIG Silverstrand Walpole, LLC

PROPOSED

"PROPOSED MULTI-FAMILY DEVELOPMENT"

981, 989 & 1015 East Street
Walpole, Massachusetts
Norfolk County

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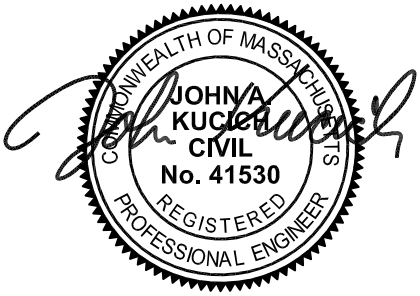

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed multi-family development located on the northerly side of East Street in the Town of Walpole, Massachusetts. The site, which contains approximately 1.9± acres of land on three (3) lots, contains commercial and residential uses consisting of four (4) commercial buildings, two (2) single-family homes, paved and gravel parking areas and driveways, landscaping, and wooded areas.

The proposed project includes the construction of a new 24,650± square-foot six-story multi-family building with 148 total residential units, along with new paved parking areas, driveways, landscaping, storm water management components 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 Preliminary Civil Engineering Plan Set prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

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

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	5.89	1.30	**-4.59**	9.63	3.92	**-5.71**	11.96	5.04	**-6.92**	16.91	7.20	**-9.71**

**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
DP1	0.493	0.106	**-0.387**	0.824	0.245	**-0.579**	1.035	0.339	**-0.696**	1.484	0.583	**-0.901**

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

II. EXISTING SITE CONDITIONS

Existing Site Description

The site, which contains approximately 1.9± acres of land located on three (3) lots, contains four (4) commercial buildings, two (2) residential homes, paved and gravel parking areas and driveways, landscaping, and some wooded areas. In addition, approximately 0.3± acres of offsite land drains onto the subject property and is included as part of this analysis.

On-Site Soil Information

Soils within the analyzed area are classified by the Natural Resource Conservation Service (NRCS) as urban land with no Hydrologic Soil Group (HSG) classification. Onsite soil testing was performed by Bohler and McPhail Associates, LLC ("McPhail") in August 2023. Soils consisted of approximately 3.5-7 feet of fill materials underlain by either Sand, Loamy Sand, or Sandy Loam in the locations of the proposed infiltration basins. Based upon NRCS mapping and soils discovered during onsite testing, the site is characterized as Hydrologic Soil Group (HSG) 'C'.

Fill materials located beneath all infiltration basins are proposed to be excavated to a depth consistent with natural materials. Sandy materials were observed beneath fill deposits at stormwater management area (SWM) #3 and SWM#4 and both basins have been modeled with infiltration rates of 8.27 in/hr. Sandy loam materials were observed at a depth of approximately 2' beneath fill deposits at SWM#1. The project proposes to excavate the sandy loam to a depth consistent with sandy materials and SWM#1 has been modeled with an infiltration rate of 8.27 in/hr. Sandy loam materials were observed beneath fill materials at SWM#2 and the basin has been modeled with an infiltration rate of 1.02 in/hr.

Estimated seasonal high ground water (ESHGW) was observed at depths ranging from 5.5 to 8.5 feet below grade (fbg). Separation from the bottom of SWM#2 and SWM#3 to estimated seasonal high groundwater (ESHGW) is greater than four (4) feet; therefore, a groundwater mounding analysis has not been provided. Separation from the bottom of SWM#1 and SWM#4 to ESHGW is between 2-4 feet. Exfiltration is included in the hydrologic model and a groundwater mounding analysis has been provided.

Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

There are no existing stormwater management or treatment systems installed onsite. Stormwater runoff generated on the commercial parcel to the west is collected via a series of inlets which flow to Spring Brook located north of the Site. Runoff generated on the residential parcels to the east flows overland to the stormwater collection system in East Street and discharges to Spring Brook.

Slopes on the site range from 0.5%-30% with on-site elevations ranging from elevation 146 in the west to elevation 135 at the residential properties in the east.

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 minimum time of concentration is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP1) is Spring Brook. Under existing conditions, this design point receives stormwater flows from approximately 2.2± acres of land, designated as sub-catchments "E1a", "E1b", "E2a, "E2b", and "E2c. Refer to Table 2.2 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
E1a	1.32±	Rooftops, pavement, grass	97	6.0
E1b	0.25±	Pavement, grass	86	6.0
E2a	0.10±	Pavement, grass	97	6.0
E2b	0.49±	Rooftops, pavement, gravel, grass, woods	82	13.6
E2c	0.04±	Pavement	98	6.0

Refer to **Table 1.1 and 1.2** for the existing conditions peak rates of runoff and volumes. Refer to the Existing Conditions Drainage Map in **Appendix D** for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development, Collection, and Conveyance

The proposed project consists of the construction of a new 24,650± square-foot six-story multi-family building along with associated site, utility, and drainage improvements. The site has been designed so that majority of the paved areas onsite drain to deep-sump, hooded catch basins. Catch basins will capture and convey stormwater runoff, via an underground pipe system, to one of four (4) underground stormwater infiltration systems with isolator rows for additional pretreatment. Runoff from building rooftops will flow to the underground infiltration systems. Overflow from SWM#2, SWM#3, and SWM#4 will discharge via an existing 12" storm drain to Spring Brook at the northeast corner of the site. A proprietary water quality inlet is proposed to collect and treat runoff from the northeast corner of the site prior to discharge to Spring Brook. Overflow from SWM#1 will discharge overland to East Street and ultimately Spring Brook.

Pipes and associated outlets have been designed in accordance with the MassDEP Stormwater Standards and Town of Walpole Stormwater Bylaw and are conservatively sized for the 100-year storm using the Rational Method. Refer to calculations provided in **Appendix F**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the standards set forth in the MassDEP Stormwater Handbook. 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 post-development site was subdivided into ten (10) separate sub catchments for the proposed conditions as described below. The minimum time of concentration is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP#1 receives stormwater flows from approximately 2.2± acres of land, designated as watersheds "P1a" through "P1h", "P2a", and "P2b". 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
P1a	0.07±	Pavement, grass	83	6.0	DP#1

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
P1b	0.20±	Pavement, grass	94	6.0	DP#1
P1c	0.04±	Pavement	98	6.0	SWM#2 / DP#1
P1d	0.27±	Pavement, grass	93	6.0	SWM#2 / DP#1
P1e	0.07±	Pavement, grass	90	6.0	SWM#3 / DP#1
P1f	0.65±	Rooftop, pavement, grass	97	6.0	SWM#3 / DP#1
P1g	0.56±	Rooftop, pavement, grass	96	6.0	SWM#4 / DP#1
P1h	0.12±	Pavement, grass	85	6.0	SWM#4 / DP#1
P2a	0.13±	Pavement, grass	97	6.0	SWM#1 / DP#1
P2b	0.09±	Pavement, grass	84	6.0	DP#1

Refer to **Table 1.1 and 1.2** for the calculated proposed conditions peak rates of runoff and volumes. For additional hydrologic information, refer to the Proposed Conditions Drainage Map in **Appendix E** 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 both Cornell University and NOAA rainfall data. Refer to **Appendix F** for more information.

Table 4.1: Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall (inches)	3.46*	5.35*	6.53*	9.03**

Values derived from NOAA ATLAS 14* and Cornell** on 5/9/23

The proposed stormwater management as designed will provide a decrease in peak rates of runoff and volumes from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Refer to **Section V** for a description of how the proposed project complies with the MassDEP Stormwater Standards and the Town of Walpole Stormwater Bylaw.

V. STORMWATER MANAGEMENT STANDARDS

The Project falls under M.G.L. Chapter 40B for affordable housing; therefore, local bylaws can be waived as part of the Chapter 40B process if state regulations are met. However, local stormwater regulations were considered and complied with to the maximum extent practicable. The proposed stormwater management system was designed to comply with the MassDEP Stormwater Standards.

Standard #1: No New Untreated Discharges

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

Standard #2: Peak Rate Attenuation

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

Standard #3: Recharge

The stormwater runoff from the project will be collected and diverted to one of four (4) infiltration systems located onsite. The project as proposed will involve the creation of approximately 4,880 square feet of new impervious area and is required to infiltrate 116 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed infiltration systems have been sized to retain the first 1-inch of runoff from all post-construction impervious surfaces, including the building roof, per the Town of Walpole Stormwater Bylaw. The four (4) systems will provide a total of 6,441 cubic feet of volume below the lowest outlet for groundwater recharge. Refer to **Appendix F** of this report for calculations documenting required and provided recharge volumes per Stormwater Standard 3.

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

Based upon onsite soil testing performed by Bohler and McPhail in August 2023, separation from the bottom of SWM#2 and SWM#3 to ESHGW is greater than four (4) feet and separation from the bottom of SWM#1 and SWM#4 to ESHGW is between 2-4 feet. Exfiltration has been included

in the hydrologic model and a groundwater mounding analysis has been provided. Refer to calculations provided in **Appendix F**.

Standard #4: Water Quality

Water quality treatment is provided via deep sump catch basins, a proprietary water quality inlet, isolator rows, and subsurface infiltration systems. The Project proposes to provide a minimum of 44% pretreatment prior to infiltration and a minimum of 80% TSS removal prior to discharge to Spring Brook. TSS removal calculations are included in **Appendix F** of this report.

The project as proposed will involve the creation of approximately 1.7± total acres of impervious area, including the building rooftop. Per the Town of Walpole Stormwater Bylaw, the project is required to retain the 1-inch water quality volume, which is equal to 6,073 cubic feet. The proposed infiltration systems provide a total of 6,441 cubic feet of water quality volume below the lowest outlet for water quality treatment. In addition, runoff from impervious areas directed to the water quality inlet in the northeast corner of the site has been sized to treat the 1-inch water quality flow rate. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes and flow rates.

Standard #5: Land Use with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

Although the project is classified as a redevelopment, it has been designed to comply with the MassDEP Stormwater Standards as if it were a new development.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets. Additionally, the project is required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution

Prevention Plan (SWPPP) during the construction period. The SWPPP will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the project's proponent.

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

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

Standard #10: Prohibition of Illicit Discharges

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

VI. SUMMARY

In summary and as outlined in **Table 1.1** and **Table 1.2**, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff and volumes from the proposed facility to Spring Brook for the 2-, 10-, 25- and 100-year storm events. Additionally, the project has been designed to comply with the MassDEP Stormwater Standards as if it were a new development.

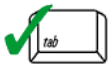
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

1/3/24

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Underground Infiltration Systems

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

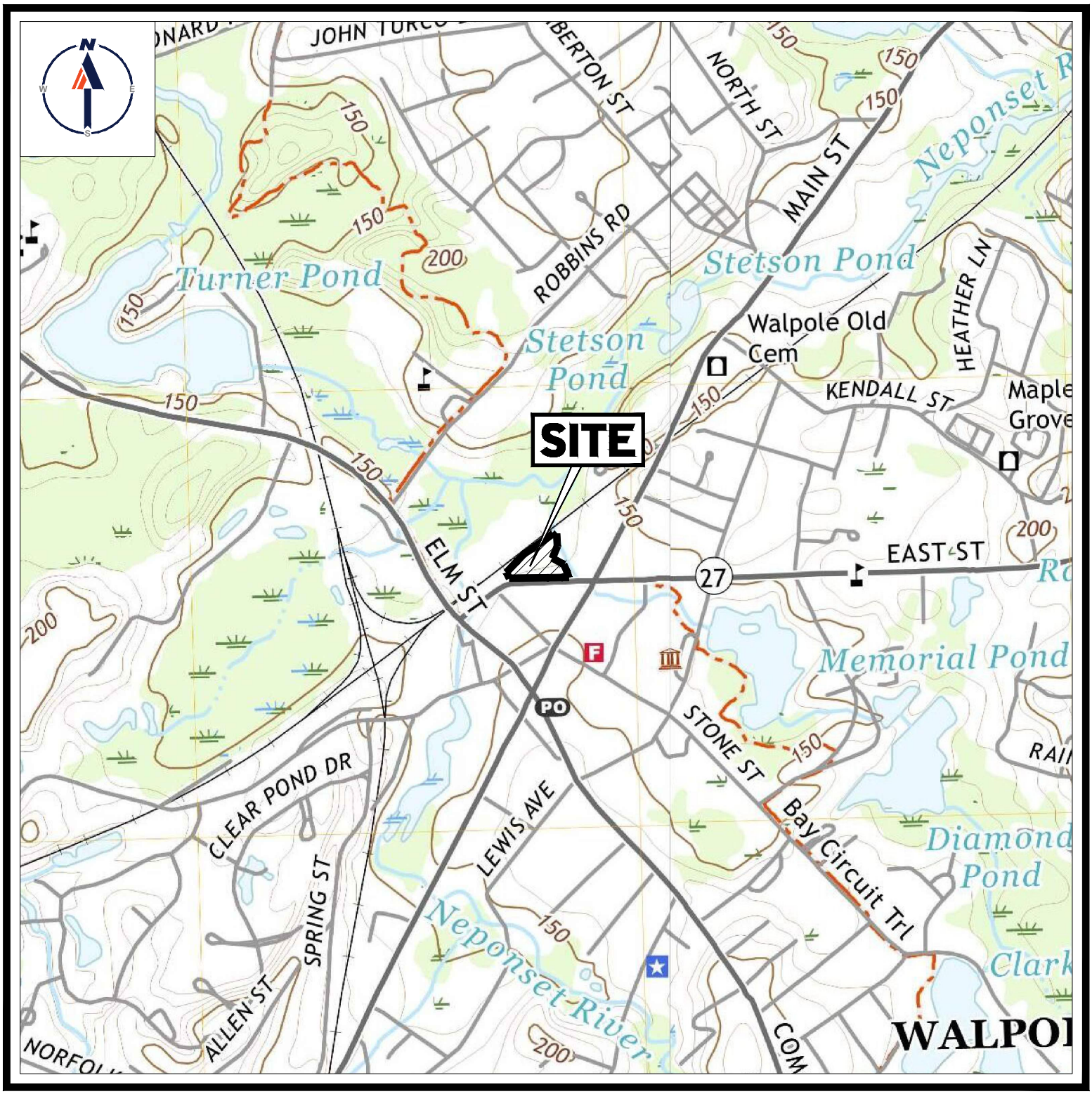
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*
- *WALPOLE GIS MAP*



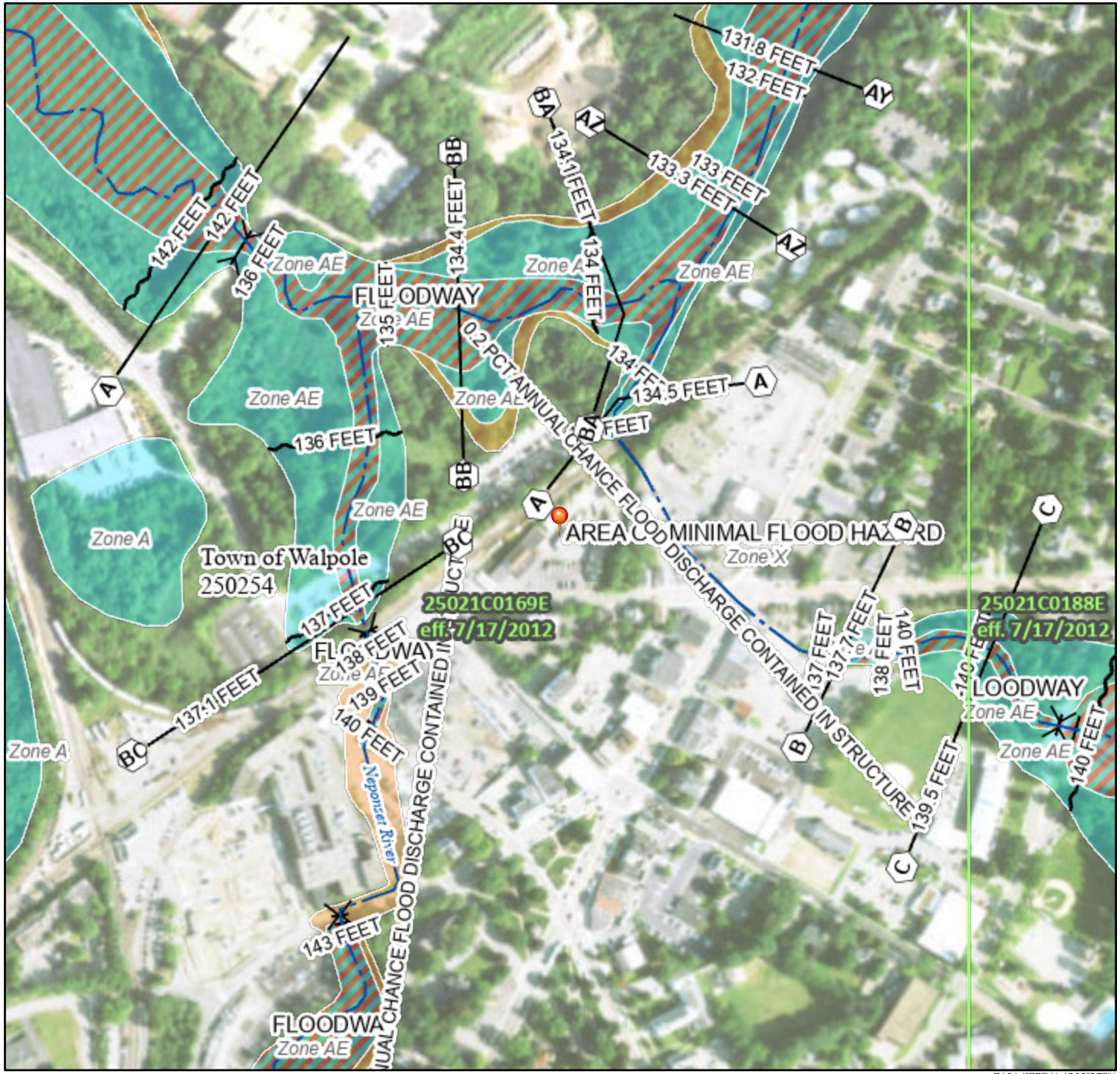
USGS MAP

SCALE: 1" = 1,000'
SOURCE: MEDFIELD AND NORWOOD MASSACHUSETTS USGS QUADRANGLE

National Flood Hazard Layer FIRMette

FEMA

71°15'33"W 42°9'4"N



71°14'55"W 42°8'37"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

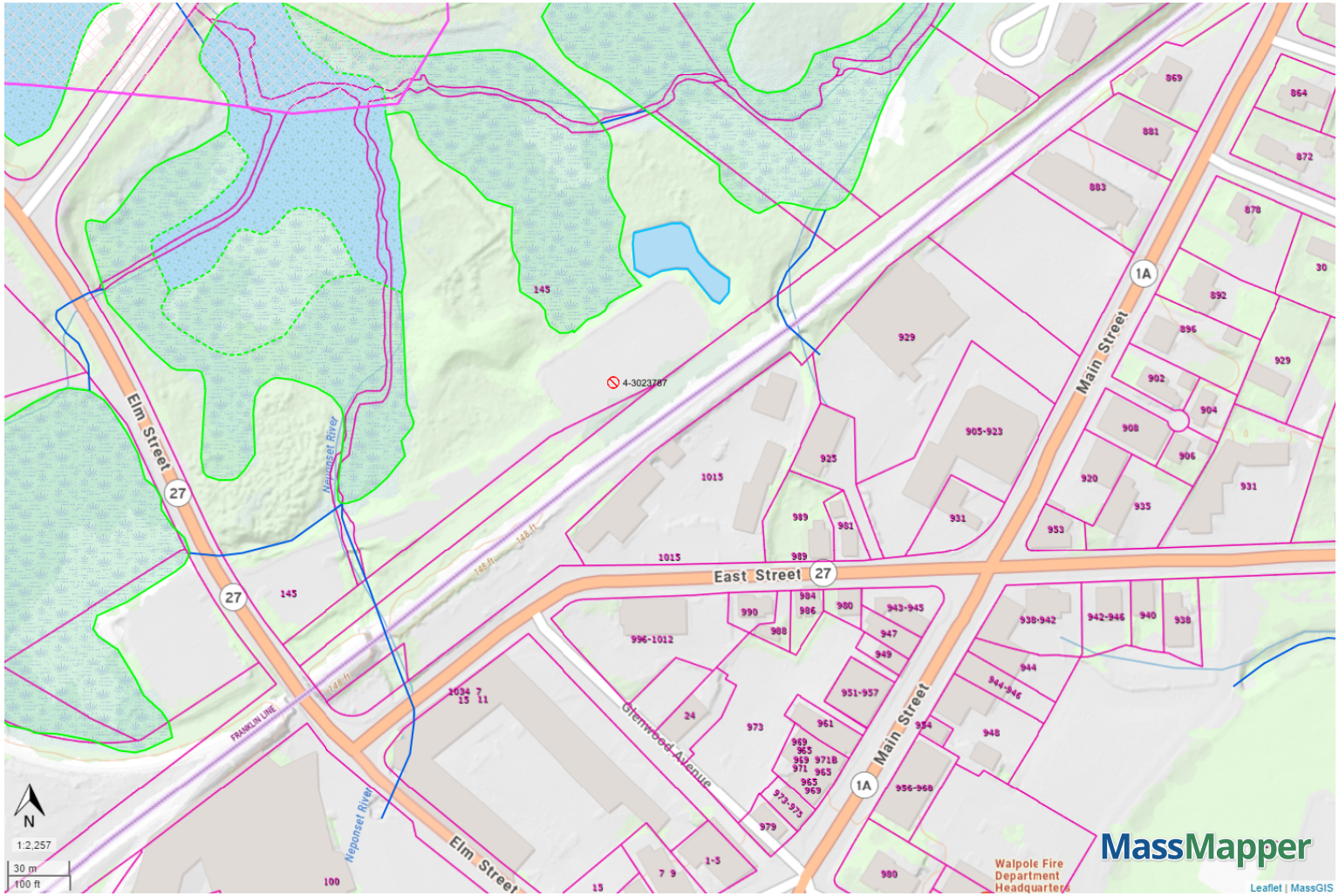
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/12/2022 at 2:17 PM 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.

1015 East St Walpole



Zone IIs Dissolved

Zone IIs

Zone Is Dissolved

Zone Is

IWPAs Dissolved

IWPAs

Underground Storage Tanks

Zone C

Zone B

Zone A

AUL Labels

AULs

Outstanding Resource Waters

- ACEC
- Cape Cod National Seashore
- Protected Shoreline
- Public Water Supply Watershed
- Retired Public Water Supply
- Scenic/Protected River
- Wildlife Refuge

DEP Wetlands Linear Features

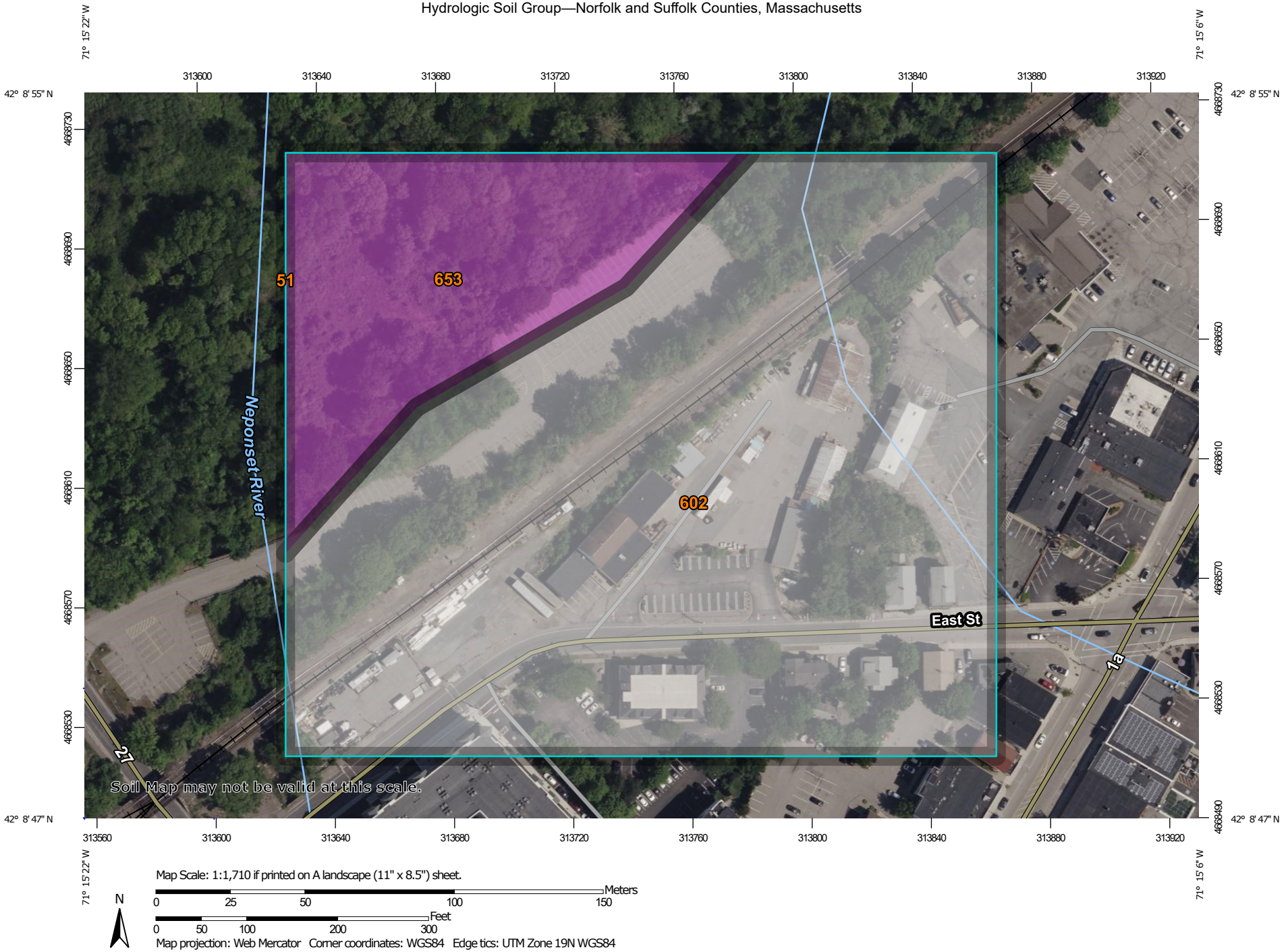
- SHORELINE
- HYDROLOGIC CONNECTION
- MEAN WATER LINE
- APPARENT WETLAND LIMIT
- CLOSURE LINE
- EDGE OF INTERPRETED AREA

Potential Vernal Pools


NHESP Priority Habitats of Rare Species
NHESP Estimated Habitats of Rare Wildlife
NHESP Certified Vernal Pools
Areas of Critical Environmental Concern ACECs Boundaries
ROAD/RAIL BASED
RIVER BASED
WETLAND BASED
FLOODPLAIN BASED
TIDAL BASED
CONTOUR BASED
POLITICAL BOUNDARY
PROPERTY LINE BASED
OTHER
NOT DEFINED
Property Tax Parcels

APPENDIX C: SOIL INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *SOIL TESTING*



Map Scale: 1:1,710 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 18, Sep 9, 2022

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
51	Swansea muck, 0 to 1 percent slopes	B/D	0	0%
602	Urban land, 0 to 15 percent slopes		9.4	78.5%
653	Udorthents, sandy	A	2.6	21.5%
Totals for Area of Interest			**11.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Site Location or lot #	981, 989, & 1015 East Main Street, Walpole, MA				DEEP HOLE # 1
Applicant/owner:	KIG Silverstrand Walpole, LLC				
DATE:	08/17/2023	WEATHER:	Cloudy	TEMP: 70 º	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Connor Ennis (SE #14656) Bohler				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant / Commercial		Landform:	Moraine	
Vegetation:	None		Slope:	0-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 100 ft.	Possible Wet Area:	> 100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	> 10 ft.	Other: N/A	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0"-84"	FILL	-	-	Mix of fill, crushed stone, scattered asphalt and brick
84"-96"	C1	Sandy Loam	10YR 6/3	Massive, friable, redox observed at 84", 5% gravel, strongly stained fingers, formed strong cast
96" - 108"	C2	Sandy Loam	10YR 7/2	Massive, friable, strongly stained fingers, formed strong cast, distinct color change
108" - 120" +	C3	Sand	10YR 6/3	Gravelly sand, single grain, loose, 5-10% cobbles and stones

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	120" (+)
Depth to Groundwater:	Standing Water in Hole:	96"	
	Weeping From Pit Face:	96"	
	Estimated Seasonal High Groundwater:		84"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:		96"			
		Depth to weeping from side of obs. hole:		96"			
		Depth to soil mottles, description:		84"			
		Groundwater adjustment:		NA			
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	Top layer is mix of fill, scattered debris of asphalt and brick; redoximorphic features observed at 84" indicative of seasonal high water table; weeping observed at 96"; standing water observed at 96"

Site Location or lot #	981, 989, & 1015 East Main Street, Walpole, MA				DEEP HOLE # 2
Applicant/owner:	KIG Silverstrand Walpole, LLC				
DATE:	08/17/2023	WEATHER:	Cloudy	TEMP: 70 º	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Connor Ennis (SE #14656) Bohler				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Residential		Landform:	Moraine	
Vegetation:	Grass		Slope:	3-5%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	
Distance From:					
Open Water Bodies:	> 100 ft.	Possible Wet Area:	> 100 ft.		
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.		
Property Line:	> 10 ft.	Other: N/A			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0"-42"	FILL	-	-	Mix of fill, crushed stone
42"-54"	A	Loamy Sand	10YR 2/2	Granular, friable, %5 gravel, 5% cobbles & stones
54" - 84"	C1	Loamy Sand	10YR 7/1	Fine loamy sand, Massive, friable, redox & weeping observed at 66", did not stain fingers, more
84" - 102" +	C2	Sand	10YR 7/2	Gravelly sand, single grain, loose, 5-10% cobbles and stones

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	102" (+)
Depth to Groundwater:	Standing Water in Hole:	96"	
	Weeping From Pit Face:	42" & 66"	
	Estimated Seasonal High Groundwater:		66"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:			96"		
		Depth to weeping from side of obs. hole:			66"		
		Depth to soil mottles, description:			66"		
		Groundwater adjustment:			NA		
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	Top layer is mix of fill; weeping first observed at 42" is not indicitive of seasonal high groundwater (inconsistent, only oberseved in single location, consistently dry soil samples below weeping in oberservation pit); redoximorphic features and weeping observed at 66" indicative of seasonal high water table; standing water observed at 96"; large boulder observed at 60"

Site Location or lot #	981, 989, & 1015 East Main Street, Walpole, MA				DEEP HOLE # 3
Applicant/owner:	KIG Silverstrand Walpole, LLC				
DATE:	08/17/2023	WEATHER:	Cloudy	TEMP: 70 º	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Connor Ennis (SE #14656) Bohler				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant / Commercial		Landform:	Moraine	
Vegetation:	None		Slope:	0-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 100 ft.	Possible Wet Area:	> 100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	> 10 ft.	Other: N/A	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0"-78"	FILL	-	-	Mix of fill, construction backfill material & scattered brick
78"-90"	A	Sand	10YR 6/3	Buried organic layer, sand with high percentage of organics, granular, friable, weeping observed at 78"
90" - 108" +	C1	Sand	10YR 7/2	Gravelly sand, single grain, loose, 5-10% cobbles and stones
	-	-		

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	108" (+)
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	78"	
	Estimated Seasonal High Groundwater:		78"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:		NA			
		Depth to weeping from side of obs. hole:		78"			
		Depth to soil mottles, description:		NA			
		Groundwater adjustment:		NA			
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	Top layer is mix of fill, brick, construction backfill material, cobbles, and stones; weeping observed at 78" indicative of seasonal high water table; pit terminated at 108" due to excavator restrictions.

Site Location or lot #	981, 989, & 1015 East Main Street, Walpole, MA				DEEP HOLE # 4
Applicant/owner:	KIG Silverstrand Walpole, LLC				
DATE:	08/17/2023	WEATHER:	Cloudy	TEMP: 70 º	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Connor Ennis (SE #14656) Bohler				
WITNESSED BY:	N/A (for drainage only)				

Land Use:	Vacant / Commercial	Landform:	Moraine
Vegetation:	None	Slope:	0-3%
Stone Walls:	☐ Y ☒ N	Surface Stones:	☐ Y ☒ N

Distance From:			
Open Water Bodies:	> 100 ft.	Possible Wet Area:	> 100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	> 10 ft.	Other: N/A	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0"-84"	FILL	-	-	Mix of fill, crushed stone, scattered asphalt and brick
84"-102"	C1	Sand	10YR 6/3	Gravelly sand, single grain, loose, 5-10% cobbles & stones, standing water observed at 84"
	-	-		
	-	-		

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	102" (+)
Depth to Groundwater:	Standing Water in Hole:	84"	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		84"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:		84"			
		Depth to weeping from side of obs. hole:		NA			
		Depth to soil mottles, description:		NA			
		Groundwater adjustment:		NA			
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	Top layer is mix of fill, scattered debris of asphalt and brick; asphalt layer observed at 24"; standing water observed at 84" indicative of seasonal high water table; pit terminated at 102" due to excavator restrictions

Site Location or lot #	981, 989, & 1015 East Main Street, Walpole, MA				DEEP HOLE # 5
Applicant/owner:	KIG Silverstrand Walpole, LLC				
DATE:	08/17/2023	WEATHER:	Cloudy	TEMP: 70 º	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Connor Ennis (SE #14656) Bohler				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant / Commercial		Landform:	Moraine	
Vegetation:	None		Slope:	0-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 100 ft.	Possible Wet Area:	> 100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	> 10 ft.	Other: N/A	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0"-84"	FILL	-	-	Mix of fill, construction backfill material
84"-96"	A	Sand	10YR 2/2	Buried organic layer, sand with high percentage of organics, granular, friable, weeping observed at 84"
96" - 126" +	C1	Sand	10YR 6/3	Gravelly sand, single grain, loose, 5-10% cobbles & stones
	-	-		

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	126" (+)
Depth to Groundwater:	Standing Water in Hole:	96"	
	Weeping From Pit Face:	84"	
	Estimated Seasonal High Groundwater:		84"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:		96"			
		Depth to weeping from side of obs. hole:		84"			
		Depth to soil mottles, description:		NA			
		Groundwater adjustment:		NA			
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	Top layer is mix of fill; weeping observed at 84"; standing water observed at 96"

Site Location or lot #	981, 989, & 1015 East Main Street, Walpole, MA				DEEP HOLE # 6
Applicant/owner:	KIG Silverstrand Walpole, LLC				
DATE:	08/17/2023	WEATHER:	Cloudy	TEMP: 70 º	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Connor Ennis (SE #14656) Bohler				
WITNESSED BY:	N/A (for drainage only)				
Land Use:	Vacant / Commercial		Landform:	Moraine	
Vegetation:	None		Slope:	0-3%	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance From:			
Open Water Bodies:	> 100 ft.	Possible Wet Area:	> 100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	> 10 ft.	Other: N/A	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0"-84"	FILL	-	-	Mix of fill, crushed stone, scattered asphalt and brick
84"-96"	A	Sand	10YR 2/2	Buried organic layer, sand with high percentage of organics, granular, friable
96" - 114"	C1	Sand	10YR 6/3	Gravelly sand, single grain, loose, 5-10% cobbles and stones, weeping observed at 102"
114" - 120" +	C2	Loamy Sand	10YR 7/1	Massive, friable, formed weak cast, slightly stained fingers, 0-5% gravel, 0-5% cobbles

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	120" (+)
Depth to Groundwater:	Standing Water in Hole:	102"	
	Weeping From Pit Face:	102"	
	Estimated Seasonal High Groundwater:		102"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:		102"			
		Depth to weeping from side of obs. hole:		102"			
		Depth to soil mottles, description:		NA			
		Groundwater adjustment:		NA			
Index Well #:	NA	Reading Date:	NA	Index Well Level:	NA	Adj. Factor:	NA
Adj. ground water level:							

Notes:	Top layer is mix of fill, scattered debris of asphalt and brick; weeping observed at 102 indicative of seasonal high water table; standing water observed at 96"

Memorandum

Date:	September 14, 2023
Recipient:	KIG Silverstrand Walpole, LLC – Geoff Engler and Justin Krebs
Copy To:	Bohler – John Kucich and Eric Dubrule
Sender:	Scott S. Smith, P.E.
Project:	1015 East Street; Walpole, Massachusetts
Project No:	7577.2.01
Subject:	Subsurface Conditions and Rawls Infiltration Rate

Background

This memorandum documents the subsurface soil and groundwater conditions encountered in the explorations performed at the project site and provides the Rawls Infiltration Rates for use in the stormwater infiltration system design. Based on the information provided to us, the proposed scope of site redevelopment includes a 6-story residential building with 1 level of below-grade parking. Outside the limits of the proposed structure, site improvements are understood to include paved parking and driveway areas, landscaped areas, and stormwater infiltration systems.

To obtain subsurface information in support of geotechnical design of the proposed structure, and to determine design parameters for the proposed stormwater infiltration systems to be located below the paved and landscaped areas, a subsurface exploration program consisting of six (6) test pits was performed. Additionally, eight (8) soil samples obtained from the test pits were submitted for grain size analyses.

Five (5) borings were previously completed at the site on December 2 and 5, 2022 as part of preliminary geotechnical and geoenvironmental services.

Soil Conditions

A detailed description of the subsurface conditions encountered in the recent and previous explorations is documented on the test pit and boring logs attached to this memorandum. The approximate locations of the subsurface explorations are indicated on the enclosed Subsurface Exploration Plan, **Figure 2**.

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2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

Based on the explorations performed at the site, the following is a description of the generalized subsurface conditions encountered from ground surface downward.

Generalized Subsurface Strata	***Approximate Thickness (Feet)***	***Top of Soil Strata (Elevation)***
Fill	3.5 to 7	Ground Surface (El. +135.2 to El. +144.1)
Organic Deposit	1 to 2.5 (Where Encountered)	El. +131.2 to El. +133.1 (Where Encountered)
Alluvium	2 to 6 (Where Encountered)	El. +130.7 to El. +138.1 (Where Encountered)
Glacial Outwash	Not Fully Penetrated	El. +128.2 to El. +132.5

Fill Material: The fill material generally consists of loose to dense, brown to black silty sand and gravel, varying to silt and sand with trace gravel, varying to sand and gravel with trace to some silt with cobbles, boulders, metal, brick, glass, plastic, slab, ash, and cinders. Grain size distributions of samples of the fill material are presented in the enclosed **Figure 3**.

Organic Deposit: A discontinuous deposit of organic silt was encountered within explorations B-3(OW), B-4(OW), TP-2, TP-3, TP-5, and TP-6 and consists of very soft to stiff, dark brown to gray organic silt, some sand, trace gravel with trace peat fibers, varying to fibrous peat.

Alluvium Deposit: A discontinuous layer of alluvium was encountered underlying the fill material or organic deposit within explorations B-1(OW), TP-1 and TP-2. The alluvium consists of loose to compact, light brown to orange-brown sand, some silt, trace gravel, varying to silt and sand, trace gravel. Grain size distributions of samples of the alluvium deposit are presented in the enclosed **Figure 4**.

Glacial Outwash Deposit: Underlying the fill material, organic deposit or alluvium, a glacial outwash deposit was encountered that generally consists of compact to very dense, brown to gray sand and gravel, trace to some silt, varying to gravelly sand, trace silt. The explorations were terminated within the glacial outwash deposit. Grain size distributions of samples of the glacial outwash deposit are presented in the enclosed **Figure 5**.

Groundwater Conditions

The groundwater level in the completed explorations and observation wells during or immediately following drilling was observed to range from about Elevation +129.7 to Elevation +134.1, or from depths of about 3.9 to 10 feet below the existing ground surface. Stabilized groundwater levels in observation wells were observed from about Elevation +131.9 to Elevation +134.3, or from depths of about 2.8 to 10.5 feet below the existing ground surface. Groundwater monitoring reports documenting groundwater levels observed within the monitoring wells are attached to this memorandum.

It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, runoff particularly during or following periods of heavy precipitation, and alterations of existing drainage patterns.

Rawls Infiltration Rate

Based on the attached laboratory grain-size distributions of soil samples obtained from the borings, the soil texture class was determined using the USDA textural triangle. The soil texture class was then used to determine the Rawls Infiltration Rates. It is understood that the Rawls Infiltration Rates are based on research performed by Rawls, Brakensiek and Sexton in 1982 which used laboratory permeability testing to develop a relationship between texture class and saturated permeability.

The table below contains the USDA soil texture class and the corresponding Rawls Infiltration Rate based on the grain size distribution results for two (2) samples of the fill deposit, two (2) samples of the alluvium deposit, and four (4) samples of the glacial outwash deposit.

Exploration	*Depth Below Ground Surface (ft)*	*Elevation (ft)*	*Strata*	*USDA Soil Texture Class*	*Rawls Infiltration Rate (in/hr)*
TP-1	2-7		Fill	Loamy Sand	2.41
TP-4	3.5-7		Fill	Loamy Sand	2.41
TP-1	7-9		Alluvium	Sandy Loam	1.02
TP-2	4.5-7		Alluvium	Sandy Loam	1.02
TP-3	8.5-9.5		Glacial Outwash	Sand	8.27
TP-4	7-8.5		Glacial Outwash	Sand	8.27
TP-5	8-10		Glacial Outwash	Sand	8.27
TP-6	8-9.5		Glacial Outwash	Sand	8.27

As indicated in the table above, based on the grain-size analyses, the Rawls Infiltration Rate within the fill deposit at the site is estimated to be 2.41 inch per hour (in/hr), the Rawls Infiltration Rate within the alluvium deposit at the site is estimated to be 1.02 in/hr, and the Rawls Infiltration Rate within the glacial outwash deposit at the site is estimated to be 8.27 in/hr.

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to contact us.

\\McPhail-fs4\McPhail\Working Documents\Jobs\7577 - 1015 East Street_Walpole\Stormwater Test Pits\7577_1015EastStreet_Test Pits_Memo 091423.docx

SSS/jgl

Attachments:
Figure 1: Project Location Plan
Figure 2: Subsurface Exploration Plan
Figure 3: Grain Size Distribution (Fill)
Figure 4: Grain Size Distribution (Alluvium)
Figure 5: Grain Size Distribution (Glacial Outwash)
Test Pit Logs
Boring Logs
Groundwater Monitoring Reports

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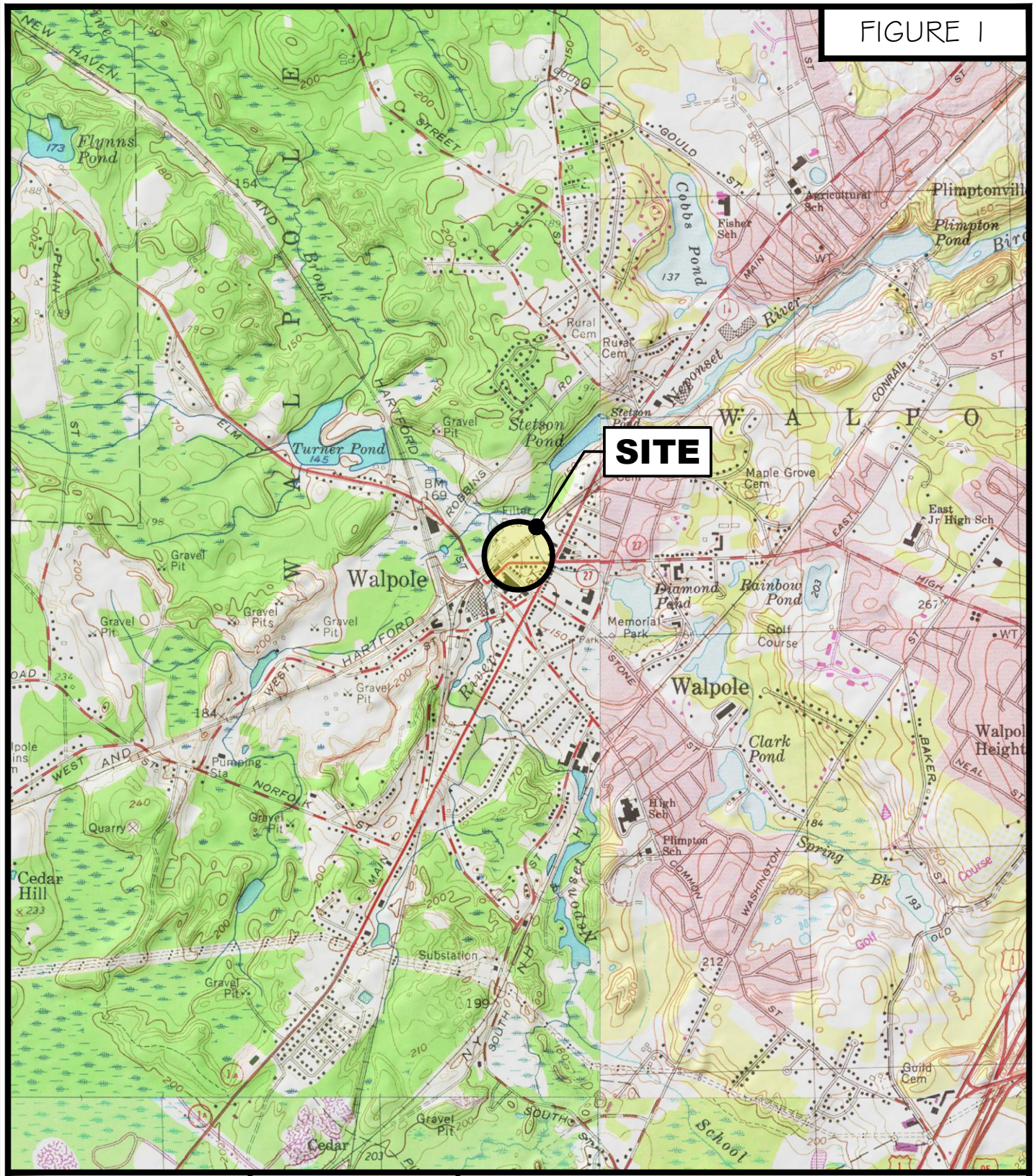
Cambridge, Massachusetts 02140
(617) 868-1420

FIGURE 1



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www.mcphailgeo.com

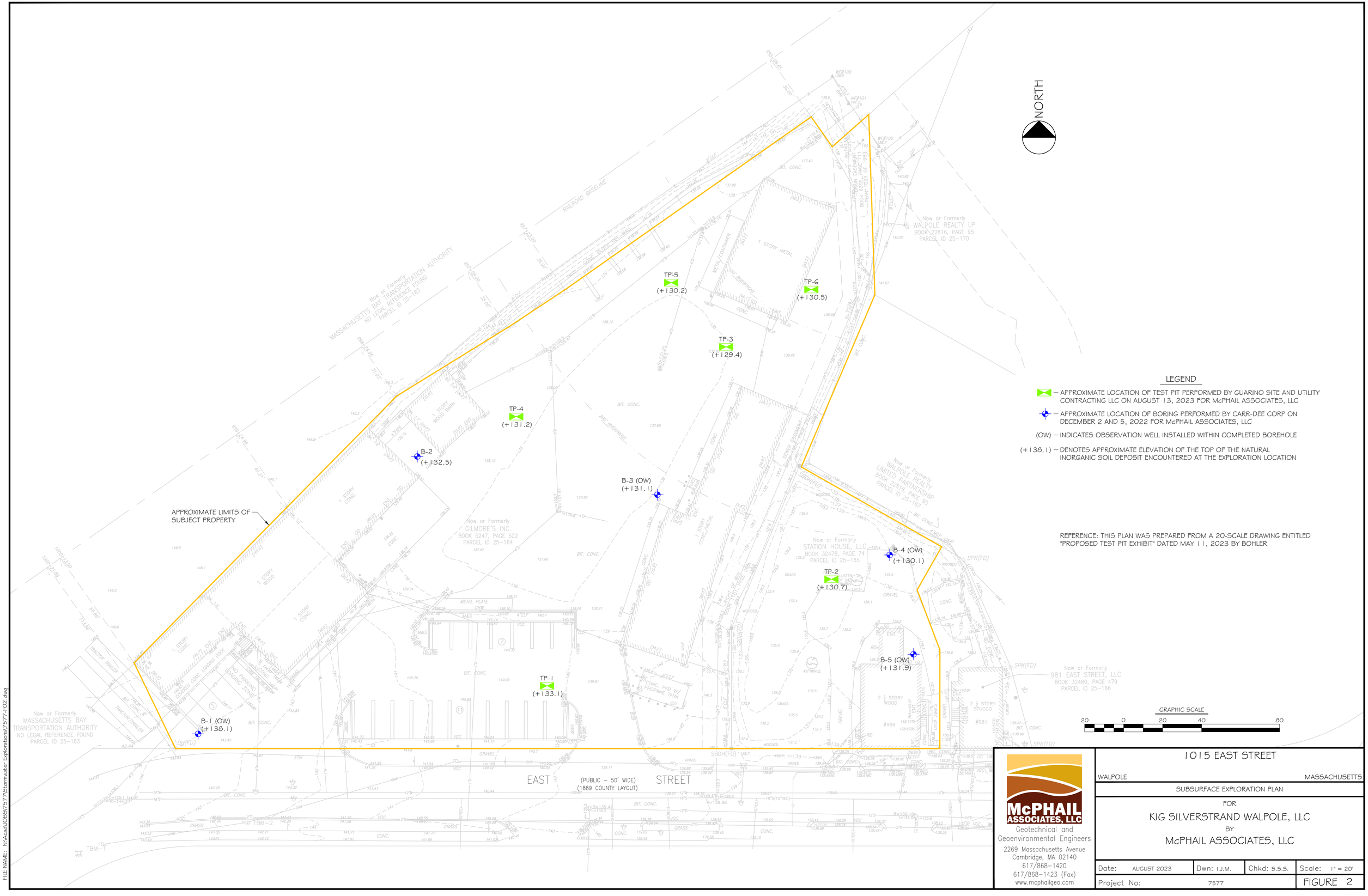
N

SCALE 1:25,000

PROJECT LOCATION PLAN

1015 EAST STREET

WALPOLE MASSACHUSETTS



REFERENCE: THIS PLAN WAS PREPARED FROM A 20-SCALE DRAWING ENTITLED "PROPOSED TEST PIT EXHIBIT" DATED MAY 11, 2023 BY BOHLER

LEGEND

- ⋈ – APPROXIMATE LOCATION OF TEST PIT PERFORMED BY GUARINO SITE AND UTILITY CONTRACTING LLC ON AUGUST 13, 2023 FOR McPHAIL ASSOCIATES, LLC
- ✣ – APPROXIMATE LOCATION OF BORING PERFORMED BY CARR-DEE CORP ON DECEMBER 2 AND 5, 2022 FOR McPHAIL ASSOCIATES, LLC
- (OW) – INDICATES OBSERVATION WELL INSTALLED WITHIN COMPLETED BOREHOLE
- (+138.1) – DENOTES APPROXIMATE ELEVATION OF THE TOP OF THE NATURAL INORGANIC SOIL DEPOSIT ENCOUNTERED AT THE EXPLORATION LOCATION

GRAPHIC SCALE

20 0 20 40 80

FILE NAME: N:\Acad\JOBS\7577\Stormwater Exploration\7577-F02.dwg

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1015 EAST STREET

WALPOLE MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

KIG SILVERSTRAND WALPOLE, LLC

BY

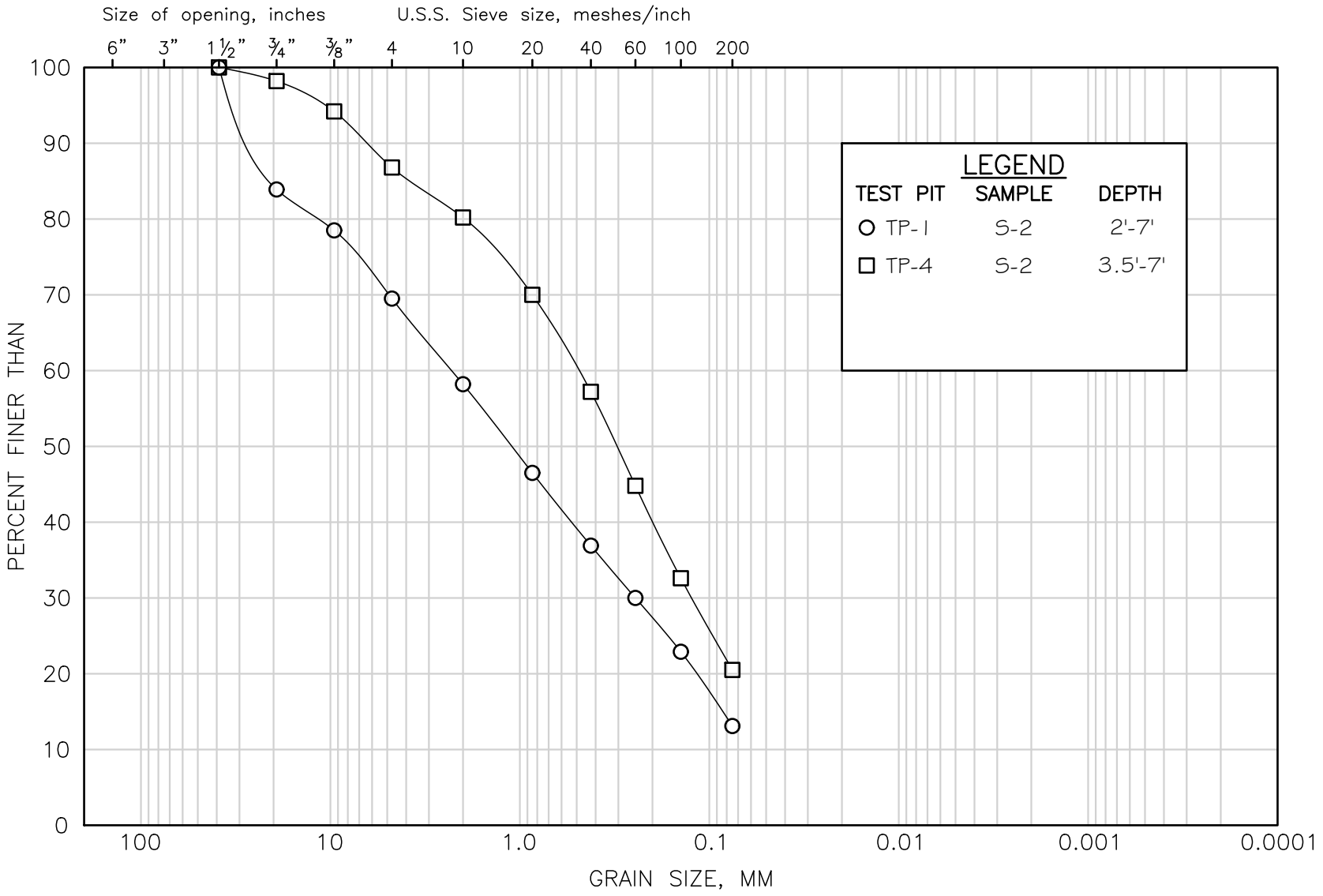
McPHAIL ASSOCIATES, LLC

Date: AUGUST 2023	Dwn: I.J.M.	Chkd: S.S.S.	Scale: 1" = 20'
Project No: 7577			FIGURE 2

FILE NAME: N:\Acad\JOBS\7577\Stormwater Explorations\7577-F03_Sieve.dwg

PROJECT No. 7577

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

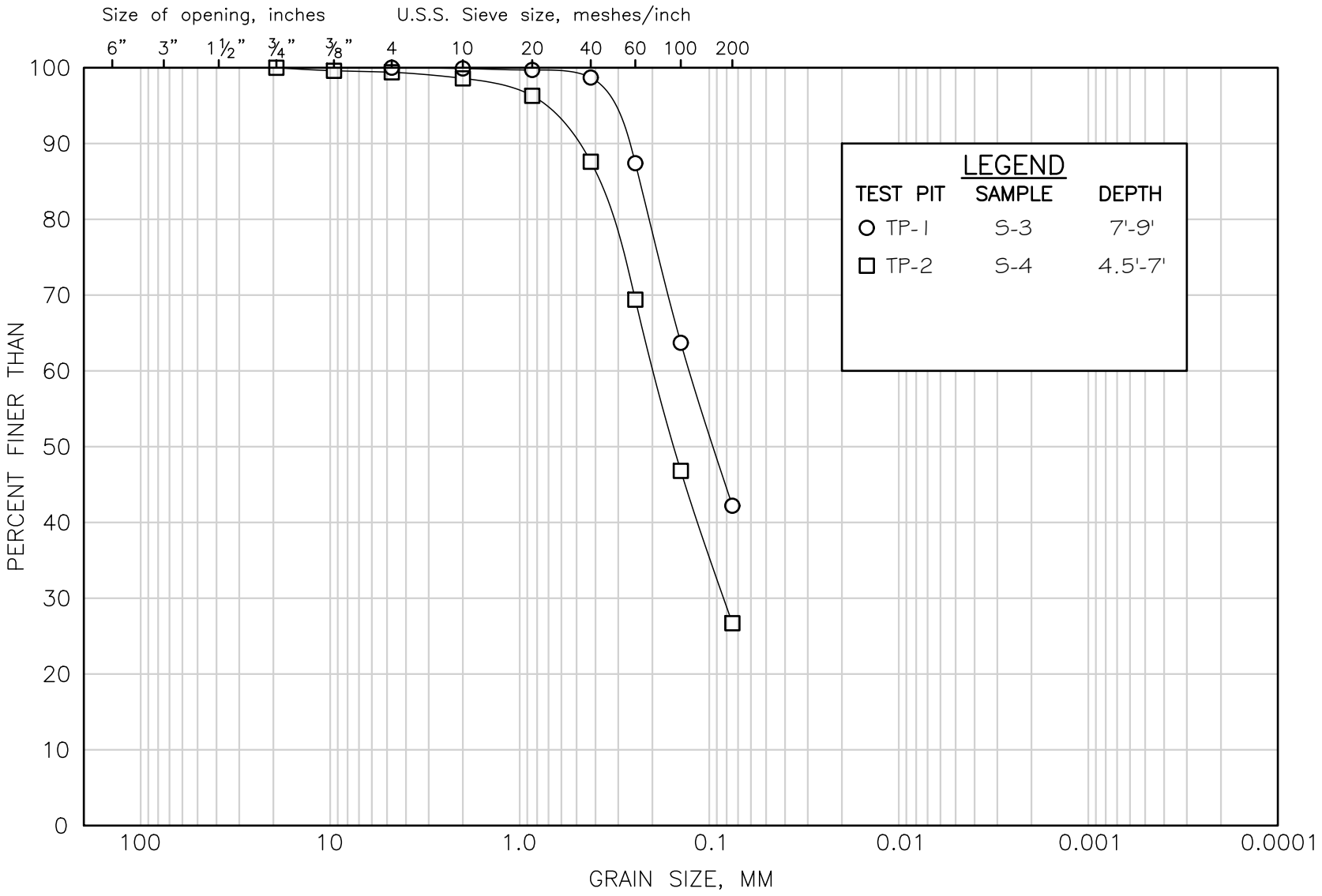
GRAIN SIZE DISTRIBUTION
FILL

FIGURE 3

FILE NAME: N:\Acad\JOBS\7577\Stormwater Explorations\7577-F04_Sieve.dwg

PROJECT No. 7577

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
ALLUVIUM

FIGURE 4

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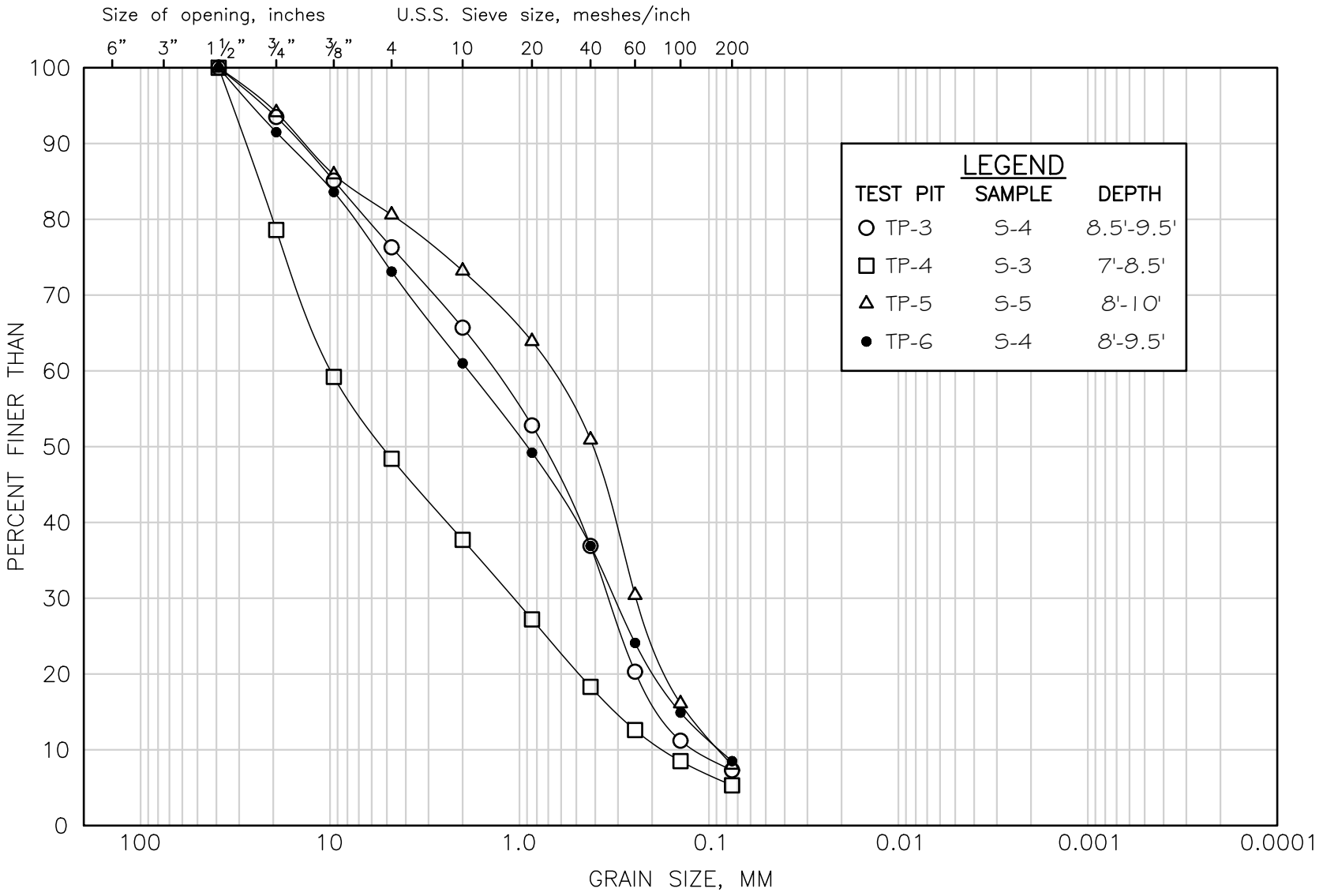
PROJECT No. 7577

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GLACIAL OUTWASH

FIGURE 5

TEST PIT LOG

JOB NO. 7577.2.01
DATE 08/17/23

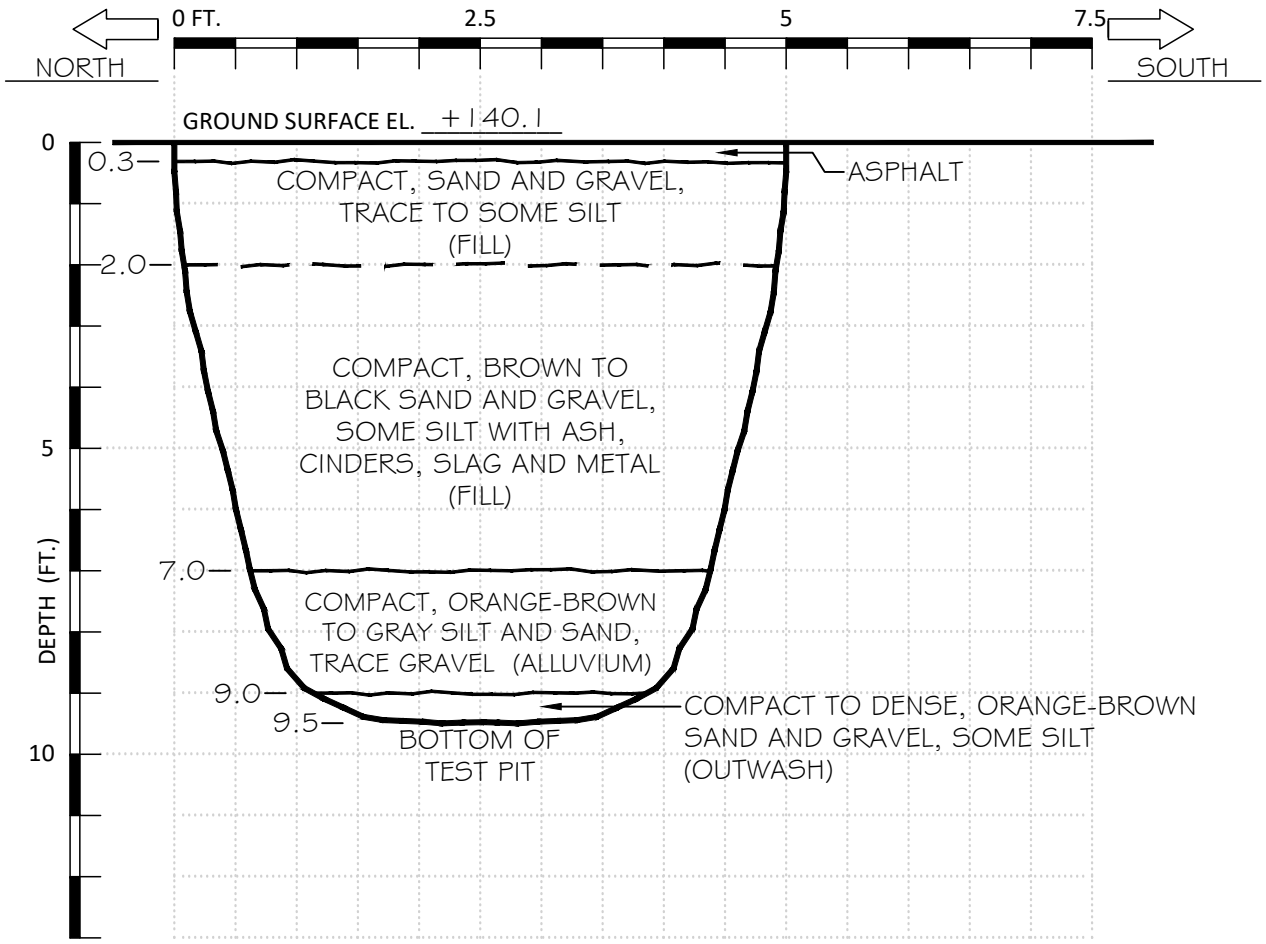
TEST PIT NO. TP-1

McPHAIL REP.: LTE
WEATHER: CLEAR

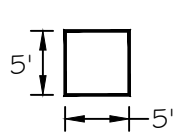
CONTRACTOR: GSU CONTRACTING
OPERATOR: DAVE GUARINO

EXCAVATOR MAKE: CAT
EXCAVATOR MODEL: 304E CR

DEPTH TO GROUNDWATER: 8'
FLOW: ☐ STANDING WATER ☒ TRICKLING ☐ HIGH FLOW



TEST PIT PLAN



COBBLES/BOULDERS/CONCRETE/BRICK

STRATA	FILL	FILL	OUTWASH
COBBLES (2"-8")	≈5%	5-10%	N.E.
SMALL BOULDER (8"-24")	<5%	≈10%	N.E.
LARGE BOULDER (>24")	<5%	<5%	N.E.

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

TEST PIT LOG

JOB NO. 7577.2.01
DATE 08/17/23

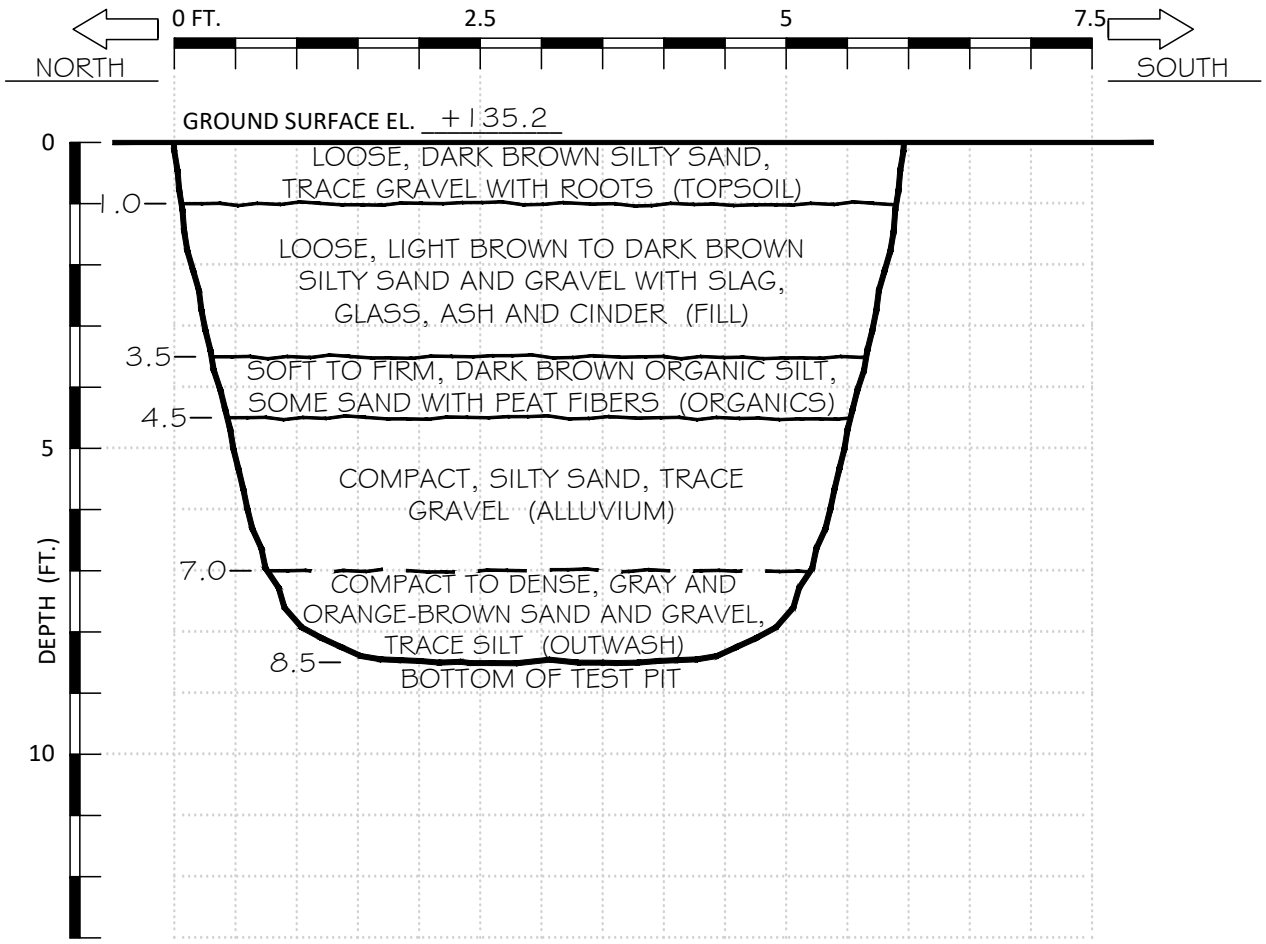
TEST PIT NO. TP-2

McPHAIL REP.: LTE
WEATHER: CLEAR

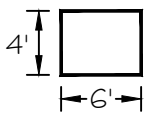
CONTRACTOR: GSU CONTRACTING
OPERATOR: DAVE GUARINO

EXCAVATOR MAKE: CAT
EXCAVATOR MODEL: 304E CR

DEPTH TO GROUNDWATER: 5.5'
FLOW: ☒ TRICKLING ☐ STANDING WATER ☐ HIGH FLOW



TEST PIT PLAN



COBBLES/BOULDERS/CONCRETE/BRICK

STRATA	FILL	ALLUVIUM	OUTWASH
COBBLES (2"-8")	5-10%	<5%	5-10%
SMALL BOULDER (8"-24")	≈5%	<5%	5-10%
LARGE BOULDER (>24")	<5%	<5%	≈10%

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

TEST PIT LOG

JOB NO. 7577.2.01
DATE 08/17/23

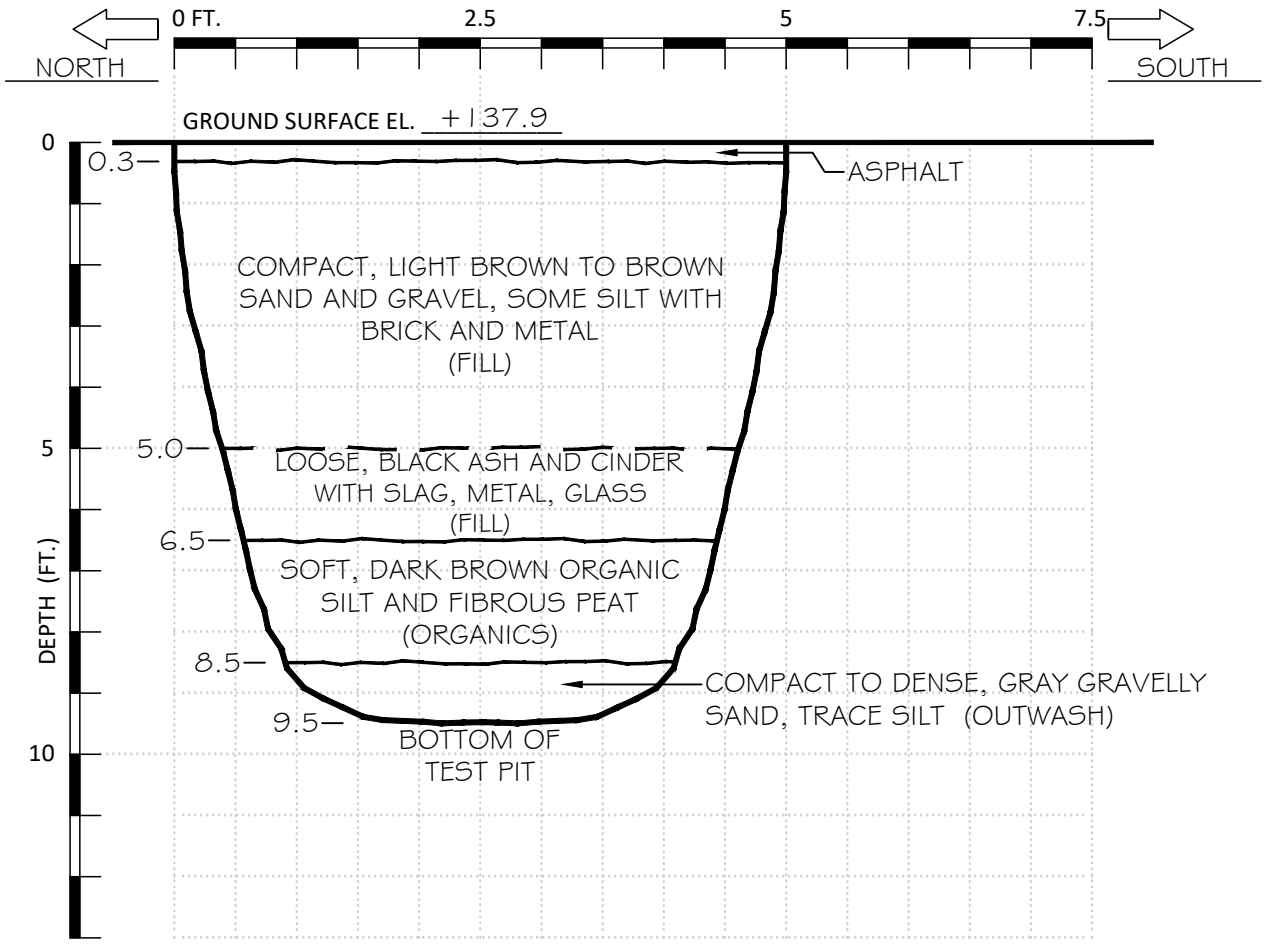
TEST PIT NO. TP-3

McPHAIL REP.: LTE
WEATHER: CLEAR

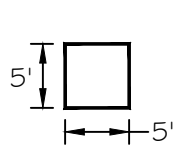
CONTRACTOR: GSU CONTRACTING
OPERATOR: DAVE GUARINO

EXCAVATOR MAKE: CAT
EXCAVATOR MODEL: 304E CR

DEPTH TO GROUNDWATER: 6.5'
FLOW: ☒ TRICKLING ☐ STANDING WATER ☐ HIGH FLOW



TEST PIT PLAN



COBBLES/BOULDERS/CONCRETE/BRICK

STRATA	FILL	FILL	OUTWASH
COBBLES (2"-8")	5-10%	≈5%	≈5%
SMALL BOULDER (8"-24")	10%	<5%	N.E.
LARGE BOULDER (>24")	10%	<5%	N.E.

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

TEST PIT LOG

JOB NO. 7577.2.01
DATE 08/17/23

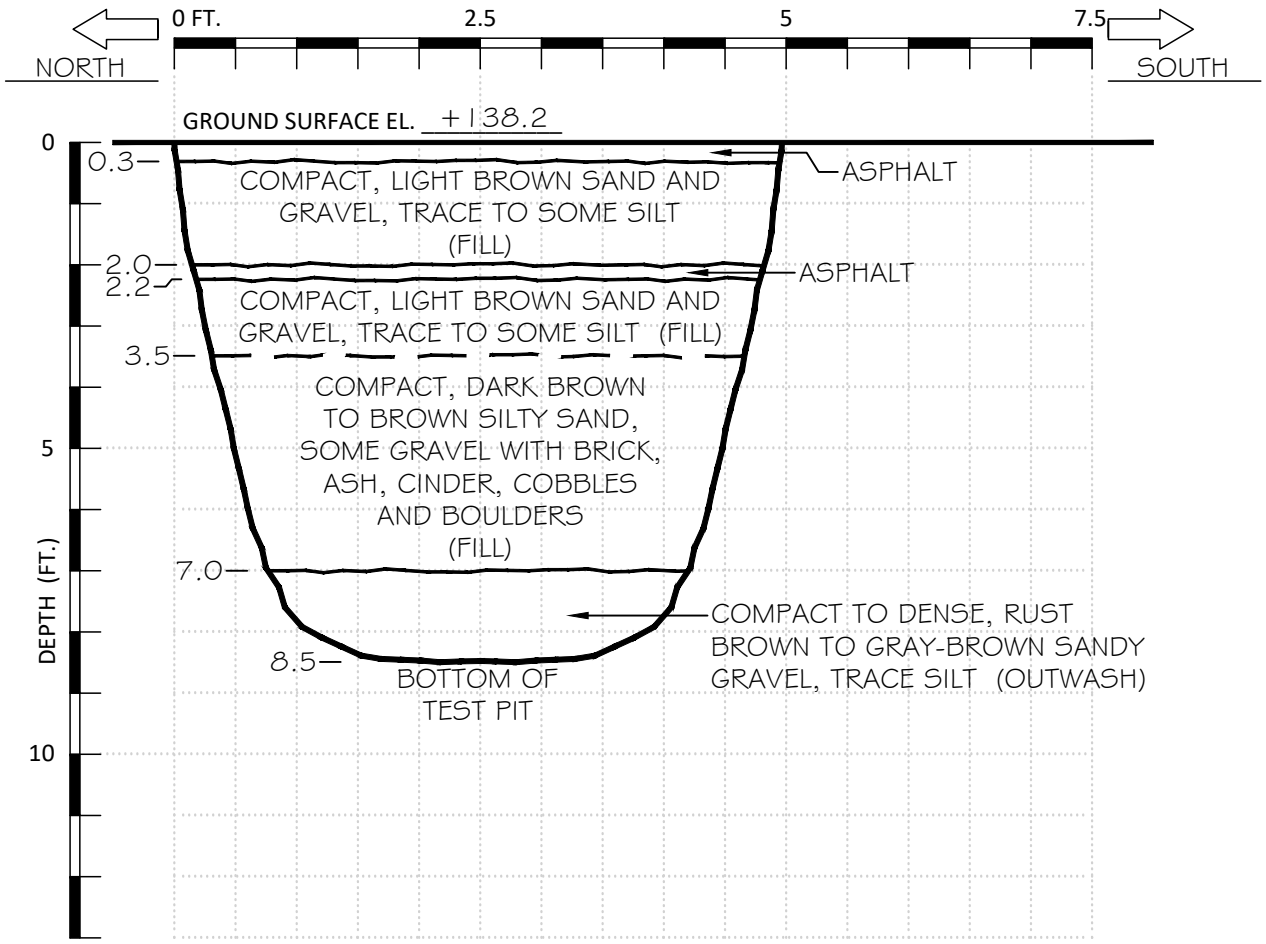
TEST PIT NO. TP-4

McPHAIL REP.: LTE
WEATHER: CLEAR

CONTRACTOR: GSU CONTRACTING
OPERATOR: DAVE GUARINO

EXCAVATOR MAKE: CAT
EXCAVATOR MODEL: 304E CR

DEPTH TO GROUNDWATER: 7'
FLOW: ☒ STANDING WATER ☐ TRICKLING ☐ HIGH FLOW



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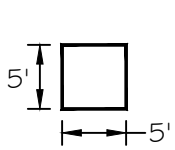


COBBLES/BOULDERS/CONCRETE/BRICK

STRATA	FILL	FILL	OUTWASH
COBBLES (2"-8")	<5%	≈5%	5-10%
SMALL BOULDER (8"-24")	0-5%	5-10%	≈5%
LARGE BOULDER (>24")	0-5%	10-15%	<5%

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

TEST PIT LOG

JOB NO. 7577.2.01
DATE 08/17/23

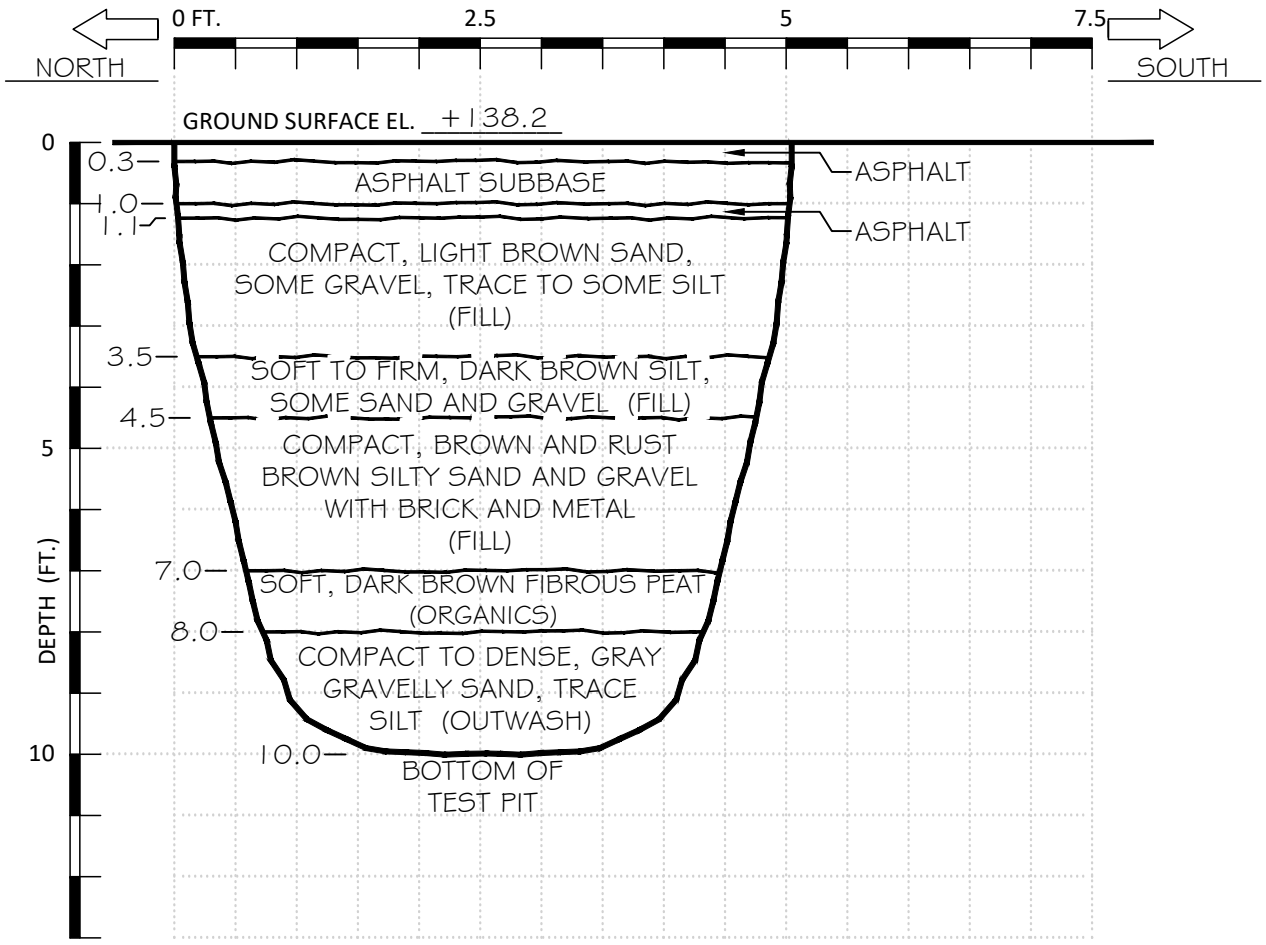
TEST PIT NO. TP-5

McPHAIL REP.: LTE
WEATHER: CLEAR

CONTRACTOR: GSU CONTRACTING
OPERATOR: DAVE GUARINO

EXCAVATOR MAKE: CAT
EXCAVATOR MODEL: 304E CR

DEPTH TO GROUNDWATER: 7'
FLOW: [X] STANDING WATER [X] TRICKLING [ ] HIGH FLOW



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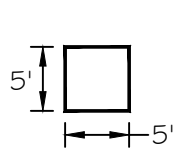


COBBLES/BOULDERS/CONCRETE/BRICK

STRATA	FILL	FILL	OUTWASH
COBBLES (2"-8")	<5%	≈5%	≈5%
SMALL BOULDER (8"-24")	<5%	<5%	≈5%
LARGE BOULDER (>24")	<5%	<5%	<5%

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

TEST PIT LOG

JOB NO. 7577.2.01
DATE 08/17/23

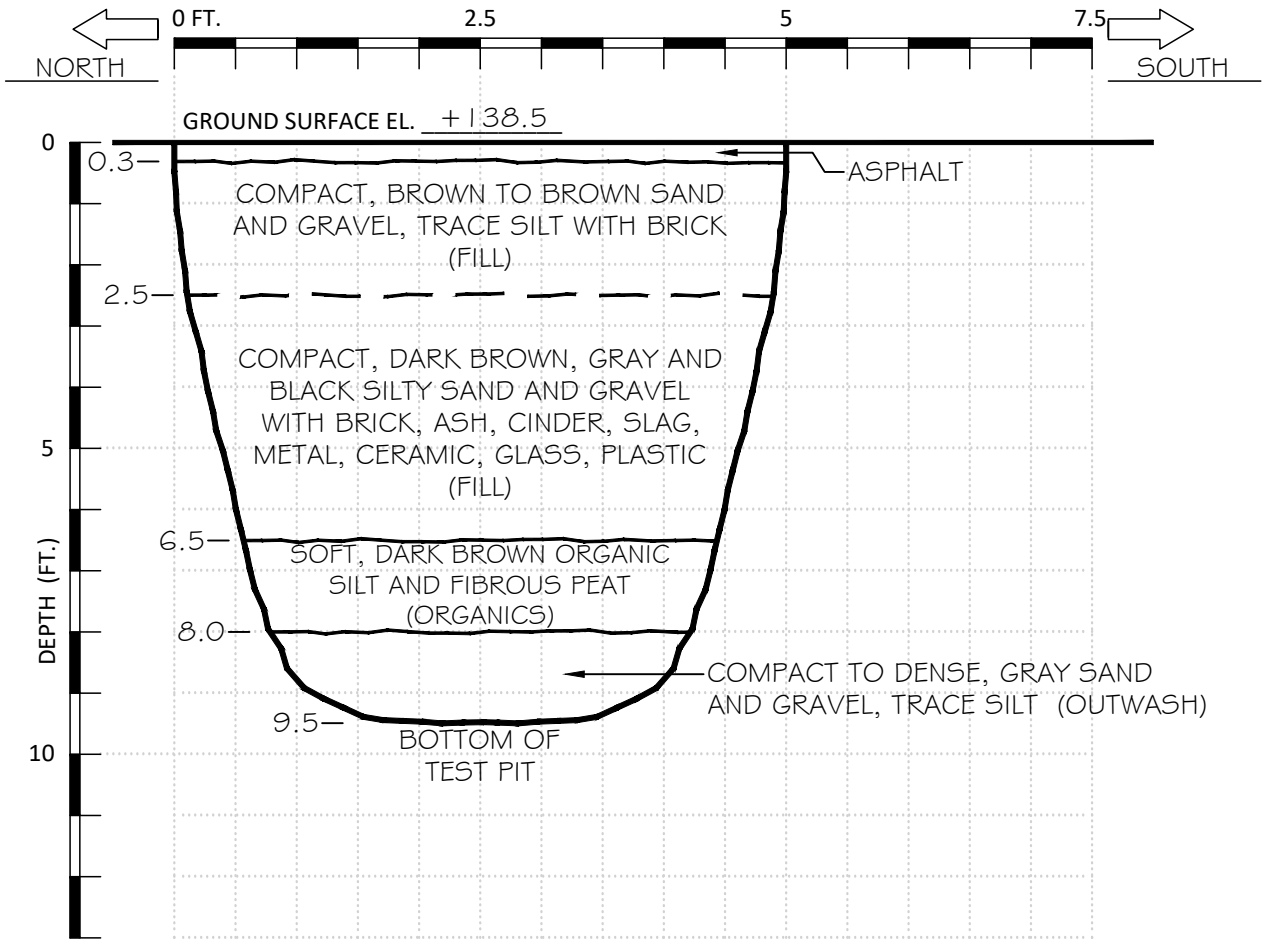
TEST PIT NO. TP-6

McPHAIL REP.: LTE
WEATHER: CLEAR

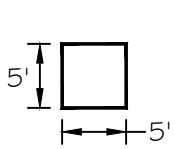
CONTRACTOR: GSU CONTRACTING
OPERATOR: DAVE GUARINO

EXCAVATOR MAKE: CAT
EXCAVATOR MODEL: 304E CR

DEPTH TO GROUNDWATER: 8.5'
FLOW: ☐ STANDING WATER ☒ TRICKLING ☐ HIGH FLOW



TEST PIT PLAN



COBBLES/BOULDERS/CONCRETE/BRICK

STRATA	FILL	FILL	OUTWASH
COBBLES (2"-8")	≈5%	5-10%	≈5%
SMALL BOULDER (8"-24")	≈5%	≈10%	≈5%
LARGE BOULDER (>24")	<5%	5-10%	<5%

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Project: 1015 East Street
Location:
City/State: Walpole, MA

Job #: 7577
Date Started: 12-2-22
Date Finished: 12-2-22

Boring No. B-1(OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Frank
Logged By/Reviewed By: L. Espindola
Surface Elevation (ft): 144.1

Casing Type/Depth (ft): 3.75 ID HSA/ 4" HW Casing
Casing Hammer (lbs)/Drop (in): 300lbs/24"
Sampler Size/Type: 1 3/8" ID Splitspoon
Sampler Hammer (lbs)/Drop (in): 140lbs/30"

Groundwater Observations

Date	Depth	Elev.	Notes
12-2-22	10	134.1	
12-5-22	10.17	133.9	
12-23-22	9.8	134.3	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.4 / 143.7	ASPHALT PAVEMENT							
1	143				0.2	29	S-1	18/12	0.5-2.0	10 12 17	Compact, brown and black, SAND and GRAVEL, some silt, with ash, cinder and asphalt. (FILL)
2	142										
3	141			FILL	0.2	6	S-2	24/10	2.0-4.0	6 3 3 2	Loose, brown to light brown, silty SAND, some gravel. (FILL)
4	140										
5	139				0.1	8	S-3	24/11	4.0-6.0	4 4 4 3	Loose, light brown, fine to medium SAND, some silt, trace gravel. (FILL)
6	138		6.0 / 138.1								
7	137				0.2	10	S-4	24/15	6.0-8.0	4 5 5 8	Loose to compact, light brown, stratifed fine to medium SAND, trace to some silt, trace gravel. (ALLUVIUM)
8	136										
9	135			ALLUVIUM	0.3	9	S-5	24/16	8.0-10.0	4 4 5 5	Loose, light brown and rust-brown, stratified fine to medium SAND, some silt, trace gravel. (ALLUVIUM) NOTE: Interbedded 3" silt seam at approx 10'. Sample moist a 10'. Redox features present in sample.
10	134										
11	133				0.2	7	S-6	24/14	10.0-12.0	3 3 4 4	Loose, light brown and rust-brown, stratfied fine to coarse SAND, some silt and gravel. (ALLUVIUM) NOTE: Sample wet. Redox features present in sample. Switched to HW casing after S-6.
12	132		12.0 / 132.1								
13	131				0.3	17	S-7	24/18	12.0-14.0	8 8 9 9	Compact, light brown to gray-brown, silty fine to medium SAND and GRAVEL. (GLACIAL OUTWASH)
14	130										
15	129										
16	128			GLACIAL OUTWASH	0.5	33	S-8	24/12	15.0-17.0	23 18 15 15	Dense, gray-brown, silty fine to coarse SAND and GRAVEL. (GLACIAL OUTWASH)
17	127										
18	126										
19	125				0.6	33	S-9	24/16	18.0-20.0	19 15 18 25	Dense, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
20	124		20.0 / 124.1								
21	123			Bottom of borehole extends 20' below ground surface.							
22	122										
23	121										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Observation well installed to depth of 18' Below ground surface. Well screen installed from 8'-18' BGS.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model: Tiger
TVOC Background: 0.0 ppm
Weather: Clear
Temperature: 35 F

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: 1015 East Street
Location:
City/State: Walpole, MA

Job #: 7577
Date Started: 12-2-22
Date Finished: 12-5-22

Boring No. B-2

Contractor: Carr-Dee
Driller/Helper: Joe/Frank
Logged By/Reviewed By: L. Espindola
Surface Elevation (ft): 138.5

Casing Type/Depth (ft): 3.75 ID HSA/ 4" HW Casing
Casing Hammer (lbs)/Drop (in): 300lbs/24"
Sampler Size/Type: 1 3/8" ID Splitspoon
Sampler Hammer (lbs)/Drop (in): 140lbs/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
12-2-22	6	132.5	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	138		0.2 / 138.3	ASPHALT PAVEMENT							
1	137				0.3	13	S-1	18/10	0.5-2.0	4 5 8	Compact, brown, SILT, SAND and GRAVEL, with coal ash and asphalt. (FILL)
2	136										
3	135			FILL	0.4	24	S-2	24/8	2.0-4.0	10 7 17 8	Compact, brown, SAND and GRAVEL, some silt, with coal ash. (FILL)
4	134										
5	133				0.2	13	S-3	24/14	4.0-6.0	6 6 7 9	Compact, brown to light brown, silty SAND and GRAVEL. (FILL) NOTE: Sample moist
6	132		6.0 / 132.5								
7	131				0.4	40	S-4	24/6	6.0-8.0	12 17 23 25	Dense, light brown, fine to medium SAND and GRAVEL, some silt. (GLACIAL OUTWASH) NOTE: Sample wet at 6'
8	130										
9	129										
10	128				0.1	37	S-5	24/18	10.0-12.0	20 18 19 15	Dense, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
11	127										
12	126										
13	125			GLACIAL OUTWASH							
14	124										
15	123				0.1	35	S-6	24/14	15.0-17.0	15 18 17 22	Dense, gray-brown, fine to coarse SAND and GRAVEL, trace to some silt. (GLACIAL OUTWASH)
16	122										
17	121										
18	120				0.1	44	S-7	24/14	18.0-20.0	15 25 19 17	Dense, gray-brown, fine to medium SAND and GRAVEL, trace to some silt. (GLACIAL OUTWASH)
19	119		20.0 / 118.5								
20	118			Bottom of borehole extends 20 feet below ground surface.							
21	117										
22	116										
23	115										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model: Tiger
TVOC Background: 0.0 ppm
Weather: Clear
Temperature: 30 F

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: 1015 East Street
Location:
City/State: Walpole, MA

Job #: 7577
Date Started: 12-2-22
Date Finished: 12-2-22

Boring No. B-3(OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Frank
Logged By/Reviewed By: L. Espindola
Surface Elevation (ft): 138.1

Casing Type/Depth (ft): 3.75 ID HSA/ 4" HW Casing
Casing Hammer (lbs)/Drop (in): 300lbs/24"
Sampler Size/Type: 1 3/8" ID Splitspoon
Sampler Hammer (lbs)/Drop (in): 140lbs/30"

Groundwater Observations

Date	Depth	Elev.	Notes
12-2-22	7	131.1	
12-5-22	5.81	132.3	
12-23-22	5.0	133.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.4 / 137.7	ASPHALT PAVEMENT							
1	137			FILL	0.3	29	S-1	18/14	0.5-2.0	17 15 14	Compact, brown, SILT, SAND and GRAVEL, with slag and asphalt. (FILL)
2	136										
3	135				0.3	15	S-2	24/14	2.0-4.0	10 8 7 9	Compact, brown and dark brown, silty SAND and GRAVEL, with coal ash. (FILL)
4	134				0.7	11	S-3	12/3	4.0-5.0	6 5	Compact, brown, SAND and GRAVEL, some silt, with brick and coal ash. (FILL)
5	133		5.0 / 133.1								
6	132			ORGANIC DEPOSIT	3.4	4	S-3a	12/3	5.0-6.0	2 2	Soft to firm, dark brown, ORGANIC SILT, some sand, trace gravel, with trace peat fibers. (ORGANICS)
7	131		7.0 / 131.1		1.5	10	S-4	12/8	6.0-7.0	3 7	Stiff, dark brown to gray, ORGANIC SILT and SAND, trace to some gravel, with trace peat fibers. (ORGANICS)
8	130			GLACIAL OUTWASH	0.4	20	S-4a	12/8	7.0-8.0	10 10	Compact, gray-brown, fine to coarse SAND, some silt and gravel. (GLACIAL OUTWASH) NOTE: Sample wet at 7'
9	129										
10	128										
11	127				0.6	24	S-5	24/15	10.0-12.0	17 14 10 11	Compact, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
12	126										
13	125										
14	124										
15	123				0.3	13	S-6	24/15	15.0-17.0	10 7 6 6	Compact, gray-brown, silty fine to coarse SAND and GRAVEL. (GLACIAL OUTWASH)
16	122										
17	121										
18	120										
19	119										
20	118										
21	117				0.2	10	S-7	24/12	20.0-22.0	10 5 5 5	Compact, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
22	116		22.0 / 116.1								
23	115			Bottom of borehole extends 22 feet below ground surface.							

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Observation well installed to depth of 15' Below ground surface. Well screen installed from 5'-15' BGS.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model: Tiger
TVOC Background: 0.0 ppm
Weather: Clear
Temperature: 35 F

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: 1015 East Street
Location:
City/State: Walpole, MA

Job #: 7577
Date Started: 12-5-22
Date Finished: 12-5-22

Boring No. B-4(OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Frank
Logged By/Reviewed By: L. Espindola
Surface Elevation (ft): 136.6

Casing Type/Depth (ft): 3.75 ID HSA/ 4" HW Casing
Casing Hammer (lbs)/Drop (in): 300lbs/24"
Sampler Size/Type: 1 3/8" ID Splitspoon
Sampler Hammer (lbs)/Drop (in): 140lbs/30"

Groundwater Observations

Date	Depth	Elev.	Notes
12-5-22	3.85	132.7	
12-23-22	2.8	133.4	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample: TVOC (ppm)	N-Value / RQD	No.	Pen. /Rec. (in)	Depth (ft)	Blows/6" / Min/ft	Sample Description and Boring Notes
1	136			FILL	0.3	5	S-1	24/8	0.0-2.0	2 3 2 2	Loose, dark gray to dark brown, SAND and GRAVEL, some silt, with coal ash and roots. (FILL)
2	135										
3	134				21.3	17	S-2	24/15	2.0-4.0	4 5 12 5	Compact, dark brown to brown, silty fine SAND, trace to some gravel, with coal ash. (FILL)
4	133		4.0 / 132.6								
5	132			ORGANICS	0.2	3	S-3	24/3	4.0-6.0	3 2 1 1	Soft, dark brown, sandy ORGANIC SILT, trace to some gravel, with peat fibers. (ORGANICS) NOTE: Sample wet. Minimal recovery likey due to gravel in splitspoon tip.
6	131		6.5 / 130.1		0.3	1/6"	S-4	6/5	6.0-6.5	1	Very soft, dark brown, ORGANIC SILT, some sand, trace gravel, with peat fibers. (ORGANICS)
7	130			GLACIAL OUTWASH	0.4	28	S-4a	18/10	6.5-8.0	9 12 16	Compact, light gray, silty fine to coarse SAND and GRAVEL, with an interbedded silty sand seam. (GLACIAL OUTWASH) NOTE: 2" silty fine SAND seam at approx 7.5' BGS
8	129										
9	128										
10	127										
11	126				0.2	17	S-5	24/16	10.0-12.0	12 9 8 11	Compact, gray, silty fine to coarse SAND, some gravel, with an interbedded silt and sand seam. (GLACIAL OUTWASH) NOTE: 6" fine sand and silt seam at approx 11' BGS
12	125										
13	124										
14	123										
15	122										
16	121				0.1	23	S-6	24/12	15.0-17.0	13 12 11 14	Compact, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
17	120										
18	119										
19	118										
20	117										
21	116				0.3	49	S-7	16/8	20.0-21.3	25 24 100/4"	Very dense, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
22	115		22.0 / 114.6								
23	114			Bottom of borehole extends 22 feet below ground surface.							
	113										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Observation well installed to depth of 12' below ground surface. Well screen installed from 2'-12' BGS.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model: Tiger
TVOC Background: 0.0 ppm
Weather: Clear
Temperature: 35 F

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: 1015 East Street
Location:
City/State: Walpole, MA

Job #: 7577
Date Started: 12-5-22
Date Finished: 12-5-22

Boring No. B-5(OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Frank
Logged By/Reviewed By: L. Espindola
Surface Elevation (ft): 135.9

Casing Type/Depth (ft): 3.75 ID HSA/ 4" HW Casing
Casing Hammer (lbs)/Drop (in): 300lbs/24"
Sampler Size/Type: 1 3/8" ID Splitspoon
Sampler Hammer (lbs)/Drop (in): 140lbs/30"

Groundwater Observations

Date	Depth	Elev.	Notes
12-5-22	4.12	131.7	
12-23-22	3.1	132.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample: TVOC (ppm)	Sample: N-Value / RQD	Sample: No.	Sample: Pen./Rec. (in)	Sample: Depth (ft)	Sample: Blows/6" / Min/ft	Sample Description and Boring Notes
1	135			FILL	12.8	10	S-1	24/12	0.0-2.0	4 7 3 1	Loose to compact, dark brown, SILT, SAND and GRAVEL, with ash, cinder and asphalt. (FILL)
2	134										
3	133				0.2	5	S-2	24/13	2.0-4.0	3 3 2 3	Loose, dark brown, SILT and SAND, some gravel, with ash, cinder, brick and wood. (FILL)
4	132		4.0 / 131.9								
5	131			GLACIAL OUTWASH	0.2	16	S-3	24/15	4.0-6.0	4 6 10 18	Compact, gray, silty fine to medium SAND and GRAVEL. (GLACIAL OUTWASH) NOTE: Sample wet at 4'
6	130										
7	129				0.1	30	S-4	24/12	6.0-8.0	19 17 13 17	Compact to dense, gray, silty fine to coarse SAND and GRAVEL. (GLACIAL OUTWASH)
8	128										
9	127										
10	126										
11	125				0.2	27	S-5	24/10	10.0-12.0	26 12 15 15	Compact, gray-brown and rust-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH) NOTE: Redox features present.
12	124										
13	123										
14	122										
15	121										
16	120				0.1	40	S-6	24/8	15.0-17.0	17 18 22 26	Dense, gray-brown, fine to coarse SAND and GRAVEL, some silt. (GLACIAL OUTWASH)
17	119										
18	118										
19	117				0.2	37	S-7	24/13	18.0-20.0	22 19 18 17	Dense, gray-brown, medium coarse SAND and GRAVEL, trace to some silt. (GLACIAL OUTWASH)
20	116		20.0 / 115.9								
21	115			Bottom of borehole extends 20 feet below ground surface.							
22	114										
23	113										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
Observation well installed to depth of 12' below ground surface. Well screen installed from 2'-12' BGS.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model: Tiger
TVOC Background: 0.0 ppm
Weather: Clear
Temperature: 40 F

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Groundwater Monitoring Report

Well I.D.:	B-1 (OW)	**Road Box Elev.:**	+144.1
Project:	1015 East Street	**Top of PVC Elev.:**	+144.0
Location:	Walpole, MA	**Top of Well Screen Elev.:**	+136.1
Project No.:	7577	**Bot. of Well Screen Elev.:**	+126.1
Elev. Datum:	NAVD88	**Well Diameter:**	2.0 in.

Date	Time	Elapsed Time	Depth from Road Box (feet)	Groundwater Elev. (feet)	McPhail Representative	Comments
12/02/22	3:00 PM	Initial	10.0	+134.1	L. Espindola	
12/05/22	7:00 AM	3 Day(s)	10.2	+133.9	L. Espindola	
12/23/22	10:00 AM	21 Day(s)	9.8	+134.3	L. Espindola	
08/17/23	3:00 PM	258 Day(s)	10.5	+133.6	L. Espindola	

Groundwater Monitoring Report

Well I.D.: B-3 (OW)
Project: 1015 East Street
Location: Walpole, MA
Project No.: 7577
Elev. Datum: NAVD88

Road Box Elev.: +138.1
Top of PVC Elev.: +138.0
Top of Well Screen Elev.: +133.1
Bot. of Well Screen Elev.: +123.1
Well Diameter: 2.0 in.

Date	Time	Elapsed Time	Depth from Road Box (feet)	Groundwater Elev. (feet)	McPhail Representative	Comments
12/02/22	3:10 PM	Initial	7.0	+131.1	L. Espindola	
12/05/22	7:10 AM	3 Day(s)	5.8	+132.3	L. Espindola	
12/23/22	9:30 AM	21 Day(s)	5.0	+133.1	L. Espindola	
08/17/23	3:05 PM	258 Day(s)	5.8	+132.3	L. Espindola	

Groundwater Monitoring Report

Well I.D.: B-4 (OW)
Project: 1015 East Street
Location: Walpole, MA
Project No.: 7577
Elev. Datum: NAVD88

Road Box Elev.: +136.1
Top of PVC Elev.: +136.0
Top of Well Screen Elev.: +134.1
Bot. of Well Screen Elev.: +124.1
Well Diameter: 2.0 in.

Date	Time	Elapsed Time	Depth from Road Box (feet)	Groundwater Elev. (feet)	McPhail Representative	Comments
12/05/22	3:20 PM	Initial	3.9	+132.3	L. Espindola	
12/23/22	8:30 AM	18 Day(s)	2.8	+133.4	L. Espindola	
08/17/23	3:10 PM	255 Day(s)	4.1	+132.0	L. Espindola	

Groundwater Monitoring Report

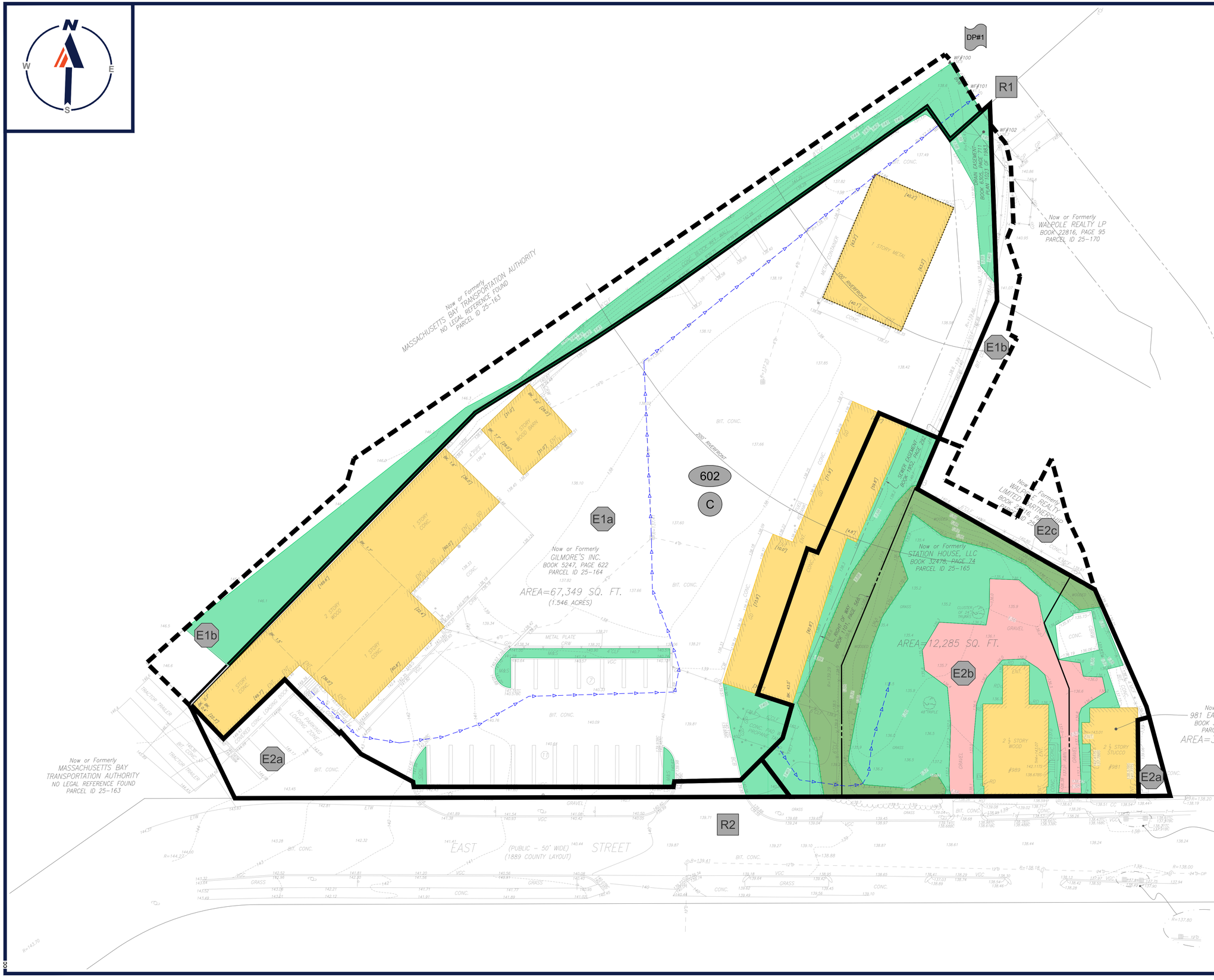
Well I.D.: B-5 (OW)
Project: 1015 East Street
Location: Walpole, MA
Project No.: 7577
Elev. Datum: NAVD88

Road Box Elev.: +135.9
Top of PVC Elev.: +135.8
Top of Well Screen Elev.: +133.9
Bot. of Well Screen Elev.: +123.9
Well Diameter: 2.0 in.

Date	Time	Elapsed Time	Depth from Road Box (feet)	Groundwater Elev. (feet)	McPhail Representative	Comments
12/05/22	3:30 PM	Initial	4.1	+131.8	L. Espindola	
12/23/22	7:00 AM	18 Day(s)	3.1	+132.8	L. Espindola	
08/17/23	3:15 PM	255 Day(s)	4.0	+131.9	L. Espindola	

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

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



LEGEND

- DP# — DESIGN POINT
- E# — EXISTING SUBCATCHMENT
- A/B/C/D — HYDROLOGIC SOIL GROUP RATING
- UNIT — NRCS SOIL MAP UNIT
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION
- CONCRETE OR PAVEMENT
- ROOF
- GRASS OR LANDSCAPED AREA
- GRAVEL
- WOODS OR UNDEVELOPED AREA

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY
1	01/03/2024	PER TOWN AND PEER REVIEW COMMENTS	CMC / ED/JAK

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PROJECT No.:	W211263
DRAWN BY:	CMC/LC
CHECKED BY:	ED/JAK
DATE:	05/31/2023
CAD I.D.:	REV1 - EX-SW.DWG

PROJECT:

PRELIMINARY CIVIL ENGINEERING PLAN SET

FOR

KIG SILVERSTRAND WALPOLE, LLC

PROPOSED
MULTI-FAMILY DEVELOPMENT

MAP 25, BLOCK 164, 165 & 166
981, 989 & 1015 EAST STREET
TOWN OF WALPOLE
NORFOLK COUNTY,
MASSACHUSETTS

BOHLER

352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone: (508) 480-9900

www.BohlerEngineering.com

SHEET TITLE:

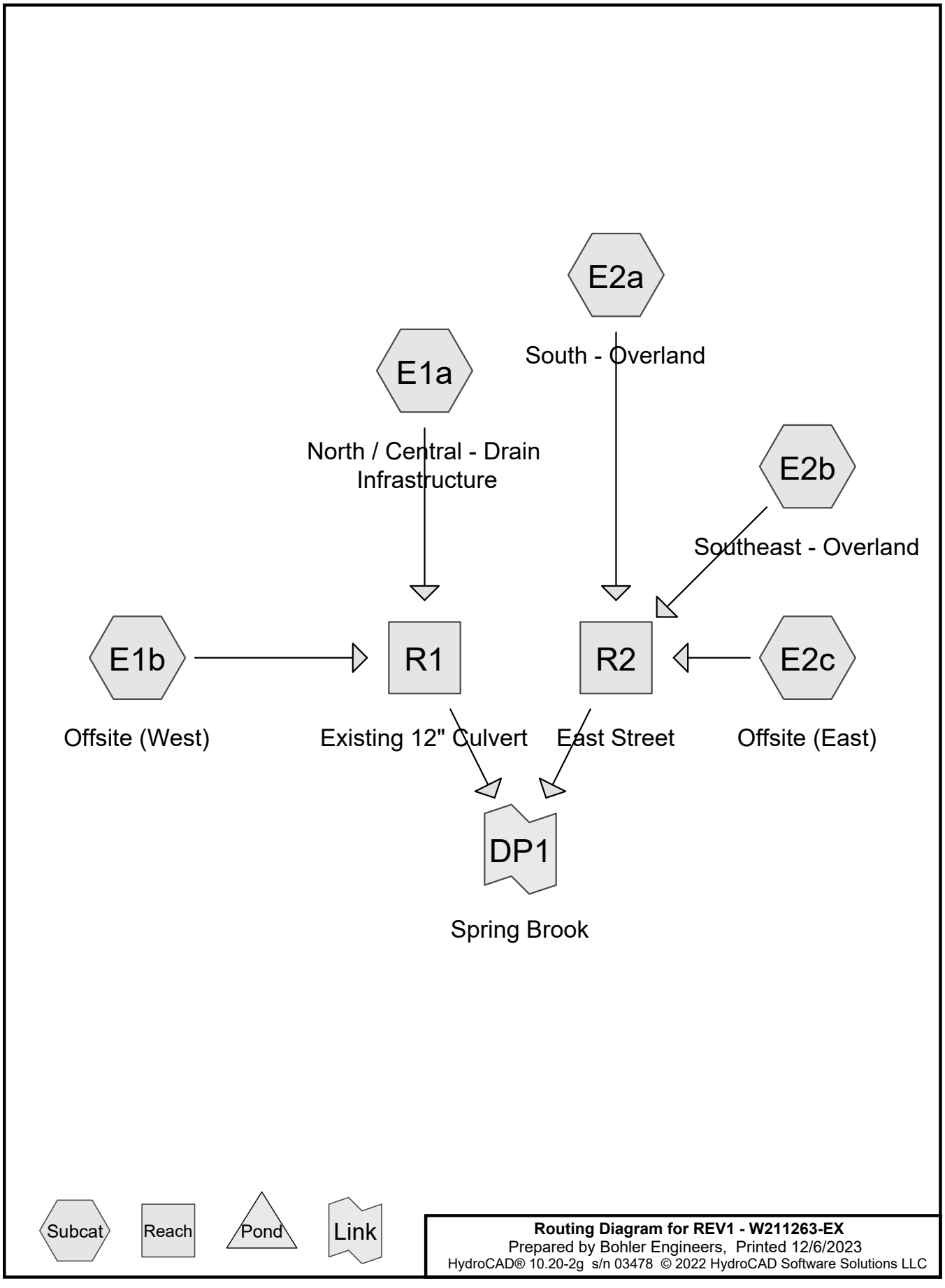
EXISTING CONDITIONS DRAINAGE AREA MAP

SHEET NUMBER:

EXDAM

REVISION 1 - 01/03/2024

P:\21\W211263\TECH\NCAL\STORMWATER\2024-01-03 REV1 RESPONSE TO COMMENTS\REV1 - EX-SW-----LAYOUT: EXDAM EXIST WATERSHED-24X36



Routing Diagram for REV1 - W211263-EX
Prepared by Bohler Engineers, Printed 12/6/2023

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	3.46	2
2	10-YR	Type III 24-hr		Default	24.00	1	5.35	2
3	25-YR	Type III 24-hr		Default	24.00	1	6.53	2
4	100-YR	Type III 24-hr		Default	24.00	1	9.03	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.379	74	>75% Grass cover, Good, HSG C (E1a, E1b, E2a, E2b)
0.076	89	Gravel roads, HSG C (E2b)
1.250	98	Paved parking, HSG C (E1a, E1b, E2a, E2b, E2c)
0.395	98	Roofs, HSG C (E1a, E2b)
0.095	70	Woods, Good, HSG C (E2b)
2.195	**92**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.195	HSG C	E1a, E1b, E2a, E2b, E2c
0.000	HSG D	
0.000	Other	
2.195		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.379	0.000	0.000	0.379	>75% Grass cover, Good	E1a, E1b, E2a, E2b
0.000	0.000	0.076	0.000	0.000	0.076	Gravel roads	E2b
0.000	0.000	1.250	0.000	0.000	1.250	Paved parking	E1a, E1b, E2a, E2b, E2c
0.000	0.000	0.395	0.000	0.000	0.395	Roofs	E1a, E2b
0.000	0.000	0.095	0.000	0.000	0.095	Woods, Good	E2b
0.000	**0.000**	**2.195**	**0.000**	**0.000**	**2.195**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	E1a	0.00	0.00	83.0	0.0010	0.013	0.0	8.0	0.0
2	E1a	0.00	0.00	99.0	0.0050	0.013	0.0	10.0	0.0
3	E1a	0.00	0.00	76.0	0.0013	0.013	0.0	12.0	0.0
4	E1a	0.00	0.00	26.0	0.0230	0.013	0.0	12.0	0.0
5	E2a	0.00	0.00	413.0	0.0040	0.013	0.0	36.0	0.0
6	E2b	0.00	0.00	413.0	0.0040	0.013	0.0	36.0	0.0

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1a: North / Central - Drain Runoff Area=1.317 ac 96.05% Impervious Runoff Depth=3.11"
Flow Length=543' Tc=6.0 min CN=97 Runoff=4.27 cfs 0.342 af

Subcatchment E1b: Offsite (West) Runoff Area=0.249 ac 48.59% Impervious Runoff Depth=2.06"
Tc=6.0 min CN=86 Runoff=0.59 cfs 0.043 af

Subcatchment E2a: South - Overland Runoff Area=0.103 ac 95.15% Impervious Runoff Depth=3.11"
Flow Length=836' Tc=6.0 min CN=97 Runoff=0.33 cfs 0.027 af

Subcatchment E2b: Southeast - Overland Runoff Area=0.487 ac 25.05% Impervious Runoff Depth=1.75"
Flow Length=539' Tc=13.6 min CN=82 Runoff=0.78 cfs 0.071 af

Subcatchment E2c: Offsite (East) Runoff Area=0.039 ac 100.00% Impervious Runoff Depth=3.23"
Tc=6.0 min CN=98 Runoff=0.13 cfs 0.010 af

Reach R1: Existing 12" Culvert Inflow=4.86 cfs 0.385 af
Outflow=4.86 cfs 0.385 af

Reach R2: East Street Inflow=1.10 cfs 0.108 af
Outflow=1.10 cfs 0.108 af

Link DP1: Spring Brook Inflow=5.89 cfs 0.493 af
Primary=5.89 cfs 0.493 af

Total Runoff Area = 2.195 ac Runoff Volume = 0.493 af Average Runoff Depth = 2.69"
25.06% Pervious = 0.550 ac 74.94% Impervious = 1.645 ac

Summary for Subcatchment E1a: North / Central - Drain Infrastructure

Runoff = 4.27 cfs @ 12.09 hrs, Volume= 0.342 af, Depth= 3.11"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.052	74	>75% Grass cover, Good, HSG C
0.287	98	Roofs, HSG C
0.978	98	Paved parking, HSG C
1.317	97	Weighted Average
0.052		3.95% Pervious Area
1.265		96.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0586	1.91		**Sheet Flow, 145.28-142.35** Smooth surfaces n= 0.011 P2= 3.46"
1.1	209	0.0236	3.12		**Shallow Concentrated Flow, 142.35-137.41** Paved Kv= 20.3 fps
1.3	83	0.0010	1.09	0.38	**Pipe Channel, 133.7-133.7** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.6	99	0.0050	2.84	1.55	**Pipe Channel, 133.5-133** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.013 Corrugated PE, smooth interior
0.8	76	0.0013	1.64	1.28	**Pipe Channel, 132.9-132.8** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	26	0.0230	6.88	5.40	**Pipe Channel, 132.6-132** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
4.3	543	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E1b: Offsite (West)

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 2.06"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.128	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.249	86	Weighted Average
0.128		51.41% Pervious Area
0.121		48.59% Impervious Area

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

Summary for Subcatchment E2a: South - Overland

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 3.11"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.005	74	>75% Grass cover, Good, HSG C
0.098	98	Paved parking, HSG C
0.103	97	Weighted Average
0.005		4.85% Pervious Area
0.098		95.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0420	1.68		**Sheet Flow, 144.9-142.8** Smooth surfaces n= 0.011 P2= 3.46"
2.6	373	0.0140	2.40		**Shallow Concentrated Flow, 142.8-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
4.3	836	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E2b: Southeast - Overland

Runoff = 0.78 cfs @ 12.19 hrs, Volume= 0.071 af, Depth= 1.75"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.108	98	Roofs, HSG C
0.076	89	Gravel roads, HSG C
0.095	70	Woods, Good, HSG C
0.194	74	>75% Grass cover, Good, HSG C
0.014	98	Paved parking, HSG C
0.487	82	Weighted Average
0.365		74.95% Pervious Area
0.122		25.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	30	0.0150	0.06		**Sheet Flow, 140.2-139.75** Grass: Bermuda n= 0.410 P2= 3.46"
2.6	20	0.1380	0.13		**Sheet Flow, 139.75-137** Woods: Light underbrush n= 0.400 P2= 3.46"
0.7	50	0.0300	1.21		**Shallow Concentrated Flow, 137-135.5** Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0270	3.34		**Shallow Concentrated Flow, 138.43-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
13.6	539	Total			

Summary for Subcatchment E2c: Offsite (East)

Runoff = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 3.23"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.039	98	Paved parking, HSG C
0.039		100.00% Impervious Area

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

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.566 ac, 88.51% Impervious, Inflow Depth = 2.95" for 2-YR event
Inflow = 4.86 cfs @ 12.09 hrs, Volume= 0.385 af
Outflow = 4.86 cfs @ 12.09 hrs, Volume= 0.385 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach R2: East Street

Inflow Area = 0.629 ac, 41.18% Impervious, Inflow Depth = 2.06" for 2-YR event
Inflow = 1.10 cfs @ 12.15 hrs, Volume= 0.108 af
Outflow = 1.10 cfs @ 12.15 hrs, Volume= 0.108 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 74.94% Impervious, Inflow Depth = 2.69" for 2-YR event
Inflow = 5.89 cfs @ 12.09 hrs, Volume= 0.493 af
Primary = 5.89 cfs @ 12.09 hrs, Volume= 0.493 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentE1a: North / Central - Drain Runoff Area=1.317 ac 96.05% Impervious Runoff Depth=5.00"
Flow Length=543' Tc=6.0 min CN=97 Runoff=6.69 cfs 0.548 af

SubcatchmentE1b: Offsite (West) Runoff Area=0.249 ac 48.59% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=86 Runoff=1.06 cfs 0.079 af

SubcatchmentE2a: South - Overland Runoff Area=0.103 ac 95.15% Impervious Runoff Depth=5.00"
Flow Length=836' Tc=6.0 min CN=97 Runoff=0.52 cfs 0.043 af

SubcatchmentE2b: Southeast - Overland Runoff Area=0.487 ac 25.05% Impervious Runoff Depth=3.39"
Flow Length=539' Tc=13.6 min CN=82 Runoff=1.50 cfs 0.138 af

SubcatchmentE2c: Offsite (East) Runoff Area=0.039 ac 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.20 cfs 0.017 af

Reach R1: Existing 12" Culvert Inflow=7.76 cfs 0.627 af
Outflow=7.76 cfs 0.627 af

Reach R2: East Street Inflow=2.02 cfs 0.197 af
Outflow=2.02 cfs 0.197 af

Link DP1: Spring Brook Inflow=9.63 cfs 0.824 af
Primary=9.63 cfs 0.824 af

Total Runoff Area = 2.195 ac Runoff Volume = 0.824 af Average Runoff Depth = 4.51"
25.06% Pervious = 0.550 ac 74.94% Impervious = 1.645 ac

Summary for Subcatchment E1a: North / Central - Drain Infrastructure

Runoff = 6.69 cfs @ 12.09 hrs, Volume= 0.548 af, Depth= 5.00"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.052	74	>75% Grass cover, Good, HSG C
0.287	98	Roofs, HSG C
0.978	98	Paved parking, HSG C
1.317	97	Weighted Average
0.052		3.95% Pervious Area
1.265		96.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0586	1.91		**Sheet Flow, 145.28-142.35** Smooth surfaces n= 0.011 P2= 3.46"
1.1	209	0.0236	3.12		**Shallow Concentrated Flow, 142.35-137.41** Paved Kv= 20.3 fps
1.3	83	0.0010	1.09	0.38	**Pipe Channel, 133.7-133.7** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.6	99	0.0050	2.84	1.55	**Pipe Channel, 133.5-133** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.013 Corrugated PE, smooth interior
0.8	76	0.0013	1.64	1.28	**Pipe Channel, 132.9-132.8** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	26	0.0230	6.88	5.40	**Pipe Channel, 132.6-132** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
4.3	543	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E1b: Offsite (West)

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.079 af, Depth= 3.79"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.128	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.249	86	Weighted Average
0.128		51.41% Pervious Area
0.121		48.59% Impervious Area

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

Summary for Subcatchment E2a: South - Overland

Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 5.00"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.005	74	>75% Grass cover, Good, HSG C
0.098	98	Paved parking, HSG C
0.103	97	Weighted Average
0.005		4.85% Pervious Area
0.098		95.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0420	1.68		**Sheet Flow, 144.9-142.8** Smooth surfaces n= 0.011 P2= 3.46"
2.6	373	0.0140	2.40		**Shallow Concentrated Flow, 142.8-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
4.3	836	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E2b: Southeast - Overland

Runoff = 1.50 cfs @ 12.19 hrs, Volume= 0.138 af, Depth= 3.39"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.108	98	Roofs, HSG C
0.076	89	Gravel roads, HSG C
0.095	70	Woods, Good, HSG C
0.194	74	>75% Grass cover, Good, HSG C
0.014	98	Paved parking, HSG C
0.487	82	Weighted Average
0.365		74.95% Pervious Area
0.122		25.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	30	0.0150	0.06		**Sheet Flow, 140.2-139.75** Grass: Bermuda n= 0.410 P2= 3.46"
2.6	20	0.1380	0.13		**Sheet Flow, 139.75-137** Woods: Light underbrush n= 0.400 P2= 3.46"
0.7	50	0.0300	1.21		**Shallow Concentrated Flow, 137-135.5** Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0270	3.34		**Shallow Concentrated Flow, 138.43-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
13.6	539	Total			

Summary for Subcatchment E2c: Offsite (East)

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.017 af, Depth= 5.11"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.039	98	Paved parking, HSG C
0.039		100.00% Impervious Area

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

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.566 ac, 88.51% Impervious, Inflow Depth = 4.80" for 10-YR event
Inflow = 7.76 cfs @ 12.09 hrs, Volume= 0.627 af
Outflow = 7.76 cfs @ 12.09 hrs, Volume= 0.627 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach R2: East Street

Inflow Area = 0.629 ac, 41.18% Impervious, Inflow Depth = 3.76" for 10-YR event
Inflow = 2.02 cfs @ 12.15 hrs, Volume= 0.197 af
Outflow = 2.02 cfs @ 12.15 hrs, Volume= 0.197 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 74.94% Impervious, Inflow Depth = 4.51" for 10-YR event
Inflow = 9.63 cfs @ 12.09 hrs, Volume= 0.824 af
Primary = 9.63 cfs @ 12.09 hrs, Volume= 0.824 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentE1a: North / Central - Drain Runoff Area=1.317 ac 96.05% Impervious Runoff Depth=6.17"
Flow Length=543' Tc=6.0 min CN=97 Runoff=8.20 cfs 0.677 af

SubcatchmentE1b: Offsite (West) Runoff Area=0.249 ac 48.59% Impervious Runoff Depth=4.91"
Tc=6.0 min CN=86 Runoff=1.36 cfs 0.102 af

SubcatchmentE2a: South - Overland Runoff Area=0.103 ac 95.15% Impervious Runoff Depth=6.17"
Flow Length=836' Tc=6.0 min CN=97 Runoff=0.64 cfs 0.053 af

SubcatchmentE2b: Southeast - Overland Runoff Area=0.487 ac 25.05% Impervious Runoff Depth=4.48"
Flow Length=539' Tc=13.6 min CN=82 Runoff=1.97 cfs 0.182 af

SubcatchmentE2c: Offsite (East) Runoff Area=0.039 ac 100.00% Impervious Runoff Depth=6.29"
Tc=6.0 min CN=98 Runoff=0.24 cfs 0.020 af

Reach R1: Existing 12" Culvert Inflow=9.56 cfs 0.779 af
Outflow=9.56 cfs 0.779 af

Reach R2: East Street Inflow=2.60 cfs 0.255 af
Outflow=2.60 cfs 0.255 af

Link DP1: Spring Brook Inflow=11.96 cfs 1.035 af
Primary=11.96 cfs 1.035 af

Total Runoff Area = 2.195 ac Runoff Volume = 1.035 af Average Runoff Depth = 5.66"
25.06% Pervious = 0.550 ac 74.94% Impervious = 1.645 ac

Summary for Subcatchment E1a: North / Central - Drain Infrastructure

Runoff = 8.20 cfs @ 12.09 hrs, Volume= 0.677 af, Depth= 6.17"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.052	74	>75% Grass cover, Good, HSG C
0.287	98	Roofs, HSG C
0.978	98	Paved parking, HSG C
1.317	97	Weighted Average
0.052		3.95% Pervious Area
1.265		96.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0586	1.91		**Sheet Flow, 145.28-142.35** Smooth surfaces n= 0.011 P2= 3.46"
1.1	209	0.0236	3.12		**Shallow Concentrated Flow, 142.35-137.41** Paved Kv= 20.3 fps
1.3	83	0.0010	1.09	0.38	**Pipe Channel, 133.7-133.7** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.6	99	0.0050	2.84	1.55	**Pipe Channel, 133.5-133** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.013 Corrugated PE, smooth interior
0.8	76	0.0013	1.64	1.28	**Pipe Channel, 132.9-132.8** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	26	0.0230	6.88	5.40	**Pipe Channel, 132.6-132** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
4.3	543	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E1b: Offsite (West)

Runoff = 1.36 cfs @ 12.09 hrs, Volume= 0.102 af, Depth= 4.91"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.128	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.249	86	Weighted Average
0.128		51.41% Pervious Area
0.121		48.59% Impervious Area

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

Summary for Subcatchment E2a: South - Overland

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.053 af, Depth= 6.17"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.005	74	>75% Grass cover, Good, HSG C
0.098	98	Paved parking, HSG C
0.103	97	Weighted Average
0.005		4.85% Pervious Area
0.098		95.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0420	1.68		**Sheet Flow, 144.9-142.8** Smooth surfaces n= 0.011 P2= 3.46"
2.6	373	0.0140	2.40		**Shallow Concentrated Flow, 142.8-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
4.3	836	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E2b: Southeast - Overland

Runoff = 1.97 cfs @ 12.19 hrs, Volume= 0.182 af, Depth= 4.48"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.108	98	Roofs, HSG C
0.076	89	Gravel roads, HSG C
0.095	70	Woods, Good, HSG C
0.194	74	>75% Grass cover, Good, HSG C
0.014	98	Paved parking, HSG C
0.487	82	Weighted Average
0.365		74.95% Pervious Area
0.122		25.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	30	0.0150	0.06		**Sheet Flow, 140.2-139.75** Grass: Bermuda n= 0.410 P2= 3.46"
2.6	20	0.1380	0.13		**Sheet Flow, 139.75-137** Woods: Light underbrush n= 0.400 P2= 3.46"
0.7	50	0.0300	1.21		**Shallow Concentrated Flow, 137-135.5** Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0270	3.34		**Shallow Concentrated Flow, 138.43-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
13.6	539	Total			

Summary for Subcatchment E2c: Offsite (East)

Runoff = 0.24 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 6.29"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.039	98	Paved parking, HSG C
0.039		100.00% Impervious Area

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

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.566 ac, 88.51% Impervious, Inflow Depth = 5.97" for 25-YR event
Inflow = 9.56 cfs @ 12.09 hrs, Volume= 0.779 af
Outflow = 9.56 cfs @ 12.09 hrs, Volume= 0.779 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach R2: East Street

Inflow Area = 0.629 ac, 41.18% Impervious, Inflow Depth = 4.87" for 25-YR event
Inflow = 2.60 cfs @ 12.15 hrs, Volume= 0.255 af
Outflow = 2.60 cfs @ 12.15 hrs, Volume= 0.255 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 74.94% Impervious, Inflow Depth = 5.66" for 25-YR event
Inflow = 11.96 cfs @ 12.09 hrs, Volume= 1.035 af
Primary = 11.96 cfs @ 12.09 hrs, Volume= 1.035 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1a: North / Central - Drain Runoff Area=1.317 ac 96.05% Impervious Runoff Depth=8.67"
Flow Length=543' Tc=6.0 min CN=97 Runoff=11.38 cfs 0.951 af

Subcatchment E1b: Offsite (West) Runoff Area=0.249 ac 48.59% Impervious Runoff Depth=7.33"
Tc=6.0 min CN=86 Runoff=1.99 cfs 0.152 af

Subcatchment E2a: South - Overland Runoff Area=0.103 ac 95.15% Impervious Runoff Depth=8.67"
Flow Length=836' Tc=6.0 min CN=97 Runoff=0.89 cfs 0.074 af

Subcatchment E2b: Southeast - Overland Runoff Area=0.487 ac 25.05% Impervious Runoff Depth=6.84"
Flow Length=539' Tc=13.6 min CN=82 Runoff=2.96 cfs 0.278 af

Subcatchment E2c: Offsite (East) Runoff Area=0.039 ac 100.00% Impervious Runoff Depth=8.79"
Tc=6.0 min CN=98 Runoff=0.34 cfs 0.029 af

Reach R1: Existing 12" Culvert Inflow=13.37 cfs 1.104 af
Outflow=13.37 cfs 1.104 af

Reach R2: East Street Inflow=3.84 cfs 0.381 af
Outflow=3.84 cfs 0.381 af

Link DP1: Spring Brook Inflow=16.91 cfs 1.484 af
Primary=16.91 cfs 1.484 af

Total Runoff Area = 2.195 ac Runoff Volume = 1.484 af Average Runoff Depth = 8.11"
25.06% Pervious = 0.550 ac 74.94% Impervious = 1.645 ac

Summary for Subcatchment E1a: North / Central - Drain Infrastructure

Runoff = 11.38 cfs @ 12.09 hrs, Volume= 0.951 af, Depth= 8.67"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.052	74	>75% Grass cover, Good, HSG C
0.287	98	Roofs, HSG C
0.978	98	Paved parking, HSG C
1.317	97	Weighted Average
0.052		3.95% Pervious Area
1.265		96.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0586	1.91		**Sheet Flow, 145.28-142.35** Smooth surfaces n= 0.011 P2= 3.46"
1.1	209	0.0236	3.12		**Shallow Concentrated Flow, 142.35-137.41** Paved Kv= 20.3 fps
1.3	83	0.0010	1.09	0.38	**Pipe Channel, 133.7-133.7** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.6	99	0.0050	2.84	1.55	**Pipe Channel, 133.5-133** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.013 Corrugated PE, smooth interior
0.8	76	0.0013	1.64	1.28	**Pipe Channel, 132.9-132.8** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	26	0.0230	6.88	5.40	**Pipe Channel, 132.6-132** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
4.3	543	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E1b: Offsite (West)

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 0.152 af, Depth= 7.33"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.128	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.249	86	Weighted Average
0.128		51.41% Pervious Area
0.121		48.59% Impervious Area

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

Summary for Subcatchment E2a: South - Overland

Runoff = 0.89 cfs @ 12.09 hrs, Volume= 0.074 af, Depth= 8.67"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.005	74	>75% Grass cover, Good, HSG C
0.098	98	Paved parking, HSG C
0.103	97	Weighted Average
0.005		4.85% Pervious Area
0.098		95.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0420	1.68		**Sheet Flow, 144.9-142.8** Smooth surfaces n= 0.011 P2= 3.46"
2.6	373	0.0140	2.40		**Shallow Concentrated Flow, 142.8-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
4.3	836	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E2b: Southeast - Overland

Runoff = 2.96 cfs @ 12.18 hrs, Volume= 0.278 af, Depth= 6.84"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.108	98	Roofs, HSG C
0.076	89	Gravel roads, HSG C
0.095	70	Woods, Good, HSG C
0.194	74	>75% Grass cover, Good, HSG C
0.014	98	Paved parking, HSG C
0.487	82	Weighted Average
0.365		74.95% Pervious Area
0.122		25.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	30	0.0150	0.06		**Sheet Flow, 140.2-139.75** Grass: Bermuda n= 0.410 P2= 3.46"
2.6	20	0.1380	0.13		**Sheet Flow, 139.75-137** Woods: Light underbrush n= 0.400 P2= 3.46"
0.7	50	0.0300	1.21		**Shallow Concentrated Flow, 137-135.5** Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0270	3.34		**Shallow Concentrated Flow, 138.43-137.74** Paved Kv= 20.3 fps
1.2	413	0.0040	5.97	42.18	**Pipe Channel, 133.7-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013 Corrugated PE, smooth interior
13.6	539	Total			

Summary for Subcatchment E2c: Offsite (East)

Runoff = 0.34 cfs @ 12.09 hrs, Volume= 0.029 af, Depth= 8.79"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.039	98	Paved parking, HSG C
0.039		100.00% Impervious Area

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

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.566 ac, 88.51% Impervious, Inflow Depth = 8.46" for 100-YR event
Inflow = 13.37 cfs @ 12.09 hrs, Volume= 1.104 af
Outflow = 13.37 cfs @ 12.09 hrs, Volume= 1.104 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach R2: East Street

Inflow Area = 0.629 ac, 41.18% Impervious, Inflow Depth = 7.26" for 100-YR event
Inflow = 3.84 cfs @ 12.15 hrs, Volume= 0.381 af
Outflow = 3.84 cfs @ 12.15 hrs, Volume= 0.381 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 74.94% Impervious, Inflow Depth = 8.11" for 100-YR event
Inflow = 16.91 cfs @ 12.09 hrs, Volume= 1.484 af
Primary = 16.91 cfs @ 12.09 hrs, Volume= 1.484 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

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

LEGEND

- DP# — DESIGN POINT
- P# — PROPOSED SUBCATCHMENT
- XX# — STORMWATER MANAGEMENT AREA
- A/B/C/D — HYDROLOGIC SOIL GROUP RATING
- UNIT — NRCS SOIL MAP UNIT
- X# — MODELED REACH
- OVERALL ANALYSIS BOUNDARY
- SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION

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LAND SURVEYING
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REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY
1	01/03/2024	PER TOWN AND PEER REVIEW COMMENTS	CMC / ED/JAK

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PROJECT No.: W211263
DRAWN BY: CMC/LC
CHECKED BY: ED/JAK
DATE: 05/31/2023
CAD I.D.: REV1 - PR-SW.DWG

PROJECT:

PRELIMINARY CIVIL ENGINEERING PLAN SET

FOR

KIG SILVERSTRAND WALPOLE, LLC

PROPOSED
MULTI-FAMILY DEVELOPMENT

MAP 25, BLOCK 164, 165 & 166
981, 989 & 1015 EAST STREET
TOWN OF WALPOLE
NORFOLK COUNTY,
MASSACHUSETTS

BOHLER
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone: (508) 480-9900
www.BohlerEngineering.com

SHEET TITLE:

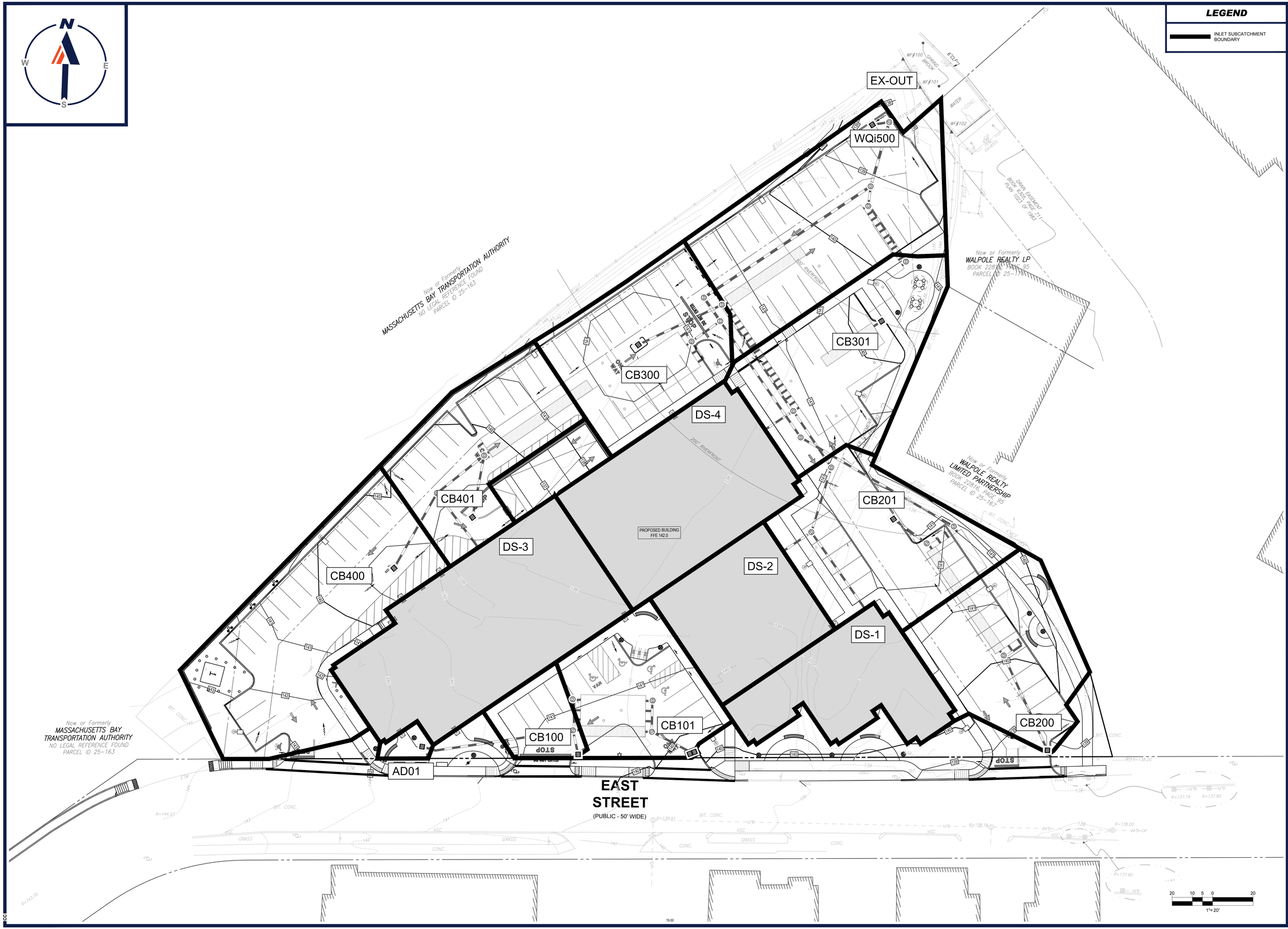
PROPOSED CONDITIONS DRAINAGE AREA MAP

SHEET NUMBER:

PRDAM

REVISION 1 - 01/03/2024

P:\2021\W211263\TECH\CAL\STORMWATER\2024-01-03 REV1 RESPONSE TO COMMENTS\REV1 - PR-SW-------LAYOUT: PRDAM PROP WATERSHED-24X36



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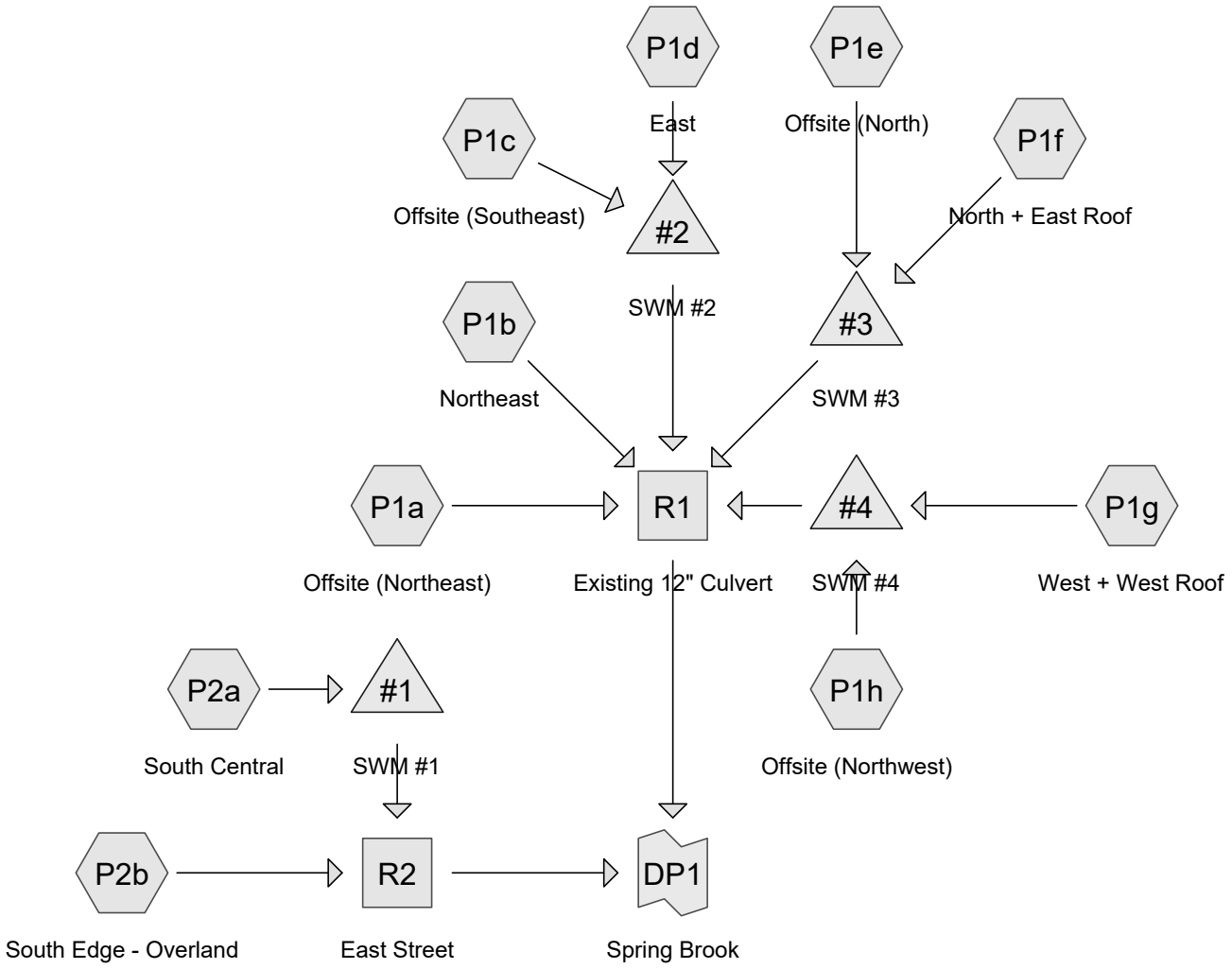
SHEET TITLE:

DRAINAGE AREA INLET MAP

SHEET NUMBER:

DAIM

REVISION 1 - 01/03/2024



Subcat Reach Pond Link

Routing Diagram for REV1 - W211263-PR
Prepared by Bohler Engineers, Printed 12/6/2023

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	3.46	2
2	10-YR	Type III 24-hr		Default	24.00	1	5.35	2
3	25-YR	Type III 24-hr		Default	24.00	1	6.53	2
4	100-YR	Type III 24-hr		Default	24.00	1	9.03	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.362	74	>75% Grass cover, Good, HSG C (P1a, P1b, P1d, P1e, P1f, P1g, P1h, P2a, P2b)
1.267	98	Paved parking, HSG C (P1a, P1b, P1c, P1d, P1e, P1f, P1g, P1h, P2a, P2b)
0.566	98	Roofs, HSG C (P1f, P1g)
2.195	**94**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.195	HSG C	P1a, P1b, P1c, P1d, P1e, P1f, P1g, P1h, P2a, P2b
0.000	HSG D	
0.000	Other	
2.195		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.362	0.000	0.000	0.362	>75% Grass cover, Good	P1a, P1b, P1d, P1e, P1f, P1g, P1h, P2a, P2b
0.000	0.000	1.267	0.000	0.000	1.267	Paved parking	P1a, P1b, P1c, P1d, P1e, P1f, P1g, P1h, P2a, P2b
0.000	0.000	0.566	0.000	0.000	0.566	Roofs	P1f, P1g
0.000	**0.000**	**2.195**	**0.000**	**0.000**	**2.195**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	#2	135.00	134.55	87.5	0.0051	0.013	0.0	12.0	0.0
2	#3	135.30	135.20	10.0	0.0100	0.013	0.0	12.0	0.0
3	#4	135.00	134.80	17.4	0.0115	0.013	0.0	12.0	0.0

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

SubcatchmentP1a: Offsite (Northeast) Runoff Area=0.071 ac 39.44% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=83 Runoff=0.15 cfs 0.011 af

SubcatchmentP1b: Northeast Runoff Area=0.197 ac 85.28% Impervious Runoff Depth=2.80"
Tc=6.0 min CN=94 Runoff=0.62 cfs 0.046 af

SubcatchmentP1c: Offsite (Southeast) Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=3.23"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.009 af

SubcatchmentP1d: East Runoff Area=0.268 ac 78.73% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=93 Runoff=0.82 cfs 0.060 af

SubcatchmentP1e: Offsite (North) Runoff Area=0.065 ac 67.69% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=90 Runoff=0.18 cfs 0.013 af

SubcatchmentP1f: North + East Roof Runoff Area=0.646 ac 94.89% Impervious Runoff Depth=3.11"
Tc=6.0 min CN=97 Runoff=2.14 cfs 0.168 af

SubcatchmentP1g: West + West Roof Runoff Area=0.568 ac 89.96% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=96 Runoff=1.85 cfs 0.142 af

SubcatchmentP1h: Offsite (Northwest) Runoff Area=0.117 ac 45.30% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=85 Runoff=0.27 cfs 0.019 af

SubcatchmentP2a: South Central Runoff Area=0.140 ac 95.00% Impervious Runoff Depth=3.11"
Tc=6.0 min CN=97 Runoff=0.46 cfs 0.036 af

SubcatchmentP2b: South Edge - Overland Runoff Area=0.088 ac 42.05% Impervious Runoff Depth=1.90"
Flow Length=394' Tc=6.0 min CN=84 Runoff=0.20 cfs 0.014 af

Reach R1: Existing 12" Culvert Inflow=1.17 cfs 0.092 af
Outflow=1.17 cfs 0.092 af

Reach R2: East Street Inflow=0.20 cfs 0.014 af
Outflow=0.20 cfs 0.014 af

Pond #1: SWM #1 Peak Elev=135.74' Storage=268 cf Inflow=0.46 cfs 0.036 af
Discarded=0.13 cfs 0.036 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.036 af

Pond #2: SWM #2 Peak Elev=136.05' Storage=1,273 cf Inflow=0.93 cfs 0.070 af
Discarded=0.03 cfs 0.056 af Primary=0.19 cfs 0.014 af Outflow=0.22 cfs 0.070 af

Pond #3: SWM #3 Peak Elev=136.41' Storage=817 cf Inflow=2.33 cfs 0.181 af
Discarded=0.94 cfs 0.181 af Primary=0.00 cfs 0.000 af Outflow=0.94 cfs 0.181 af

Pond #4: SWM #4 Peak Elev=135.74' Storage=1,330 cf Inflow=2.13 cfs 0.162 af
Discarded=0.32 cfs 0.140 af Primary=0.75 cfs 0.022 af Outflow=1.07 cfs 0.162 af

Link DP1: Spring Brook

Inflow=1.30 cfs 0.106 af
Primary=1.30 cfs 0.106 af

Total Runoff Area = 2.195 ac Runoff Volume = 0.519 af Average Runoff Depth = 2.84"
16.49% Pervious = 0.362 ac 83.51% Impervious = 1.833 ac

Summary for Subcatchment P1a: Offsite (Northeast)

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 1.82"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.043	74	>75% Grass cover, Good, HSG C
0.028	98	Paved parking, HSG C
0.071	83	Weighted Average
0.043		60.56% Pervious Area
0.028		39.44% Impervious Area

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

Summary for Subcatchment P1b: Northeast

Runoff = 0.62 cfs @ 12.08 hrs, Volume= 0.046 af, Depth= 2.80"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.168	98	Paved parking, HSG C
0.029	74	>75% Grass cover, Good, HSG C
0.197	94	Weighted Average
0.029		14.72% Pervious Area
0.168		85.28% Impervious Area

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

Summary for Subcatchment P1c: Offsite (Southeast)

Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Depth= 3.23"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG C
0.035		100.00% Impervious Area

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

Summary for Subcatchment P1d: East

Runoff = 0.82 cfs @ 12.09 hrs, Volume= 0.060 af, Depth= 2.70"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.211	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.268	93	Weighted Average
0.057		21.27% Pervious Area
0.211		78.73% Impervious Area

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

Summary for Subcatchment P1e: Offsite (North)

Runoff = 0.18 cfs @ 12.09 hrs, Volume= 0.013 af, Depth= 2.41"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.021	74	>75% Grass cover, Good, HSG C
0.044	98	Paved parking, HSG C
0.065	90	Weighted Average
0.021		32.31% Pervious Area
0.044		67.69% Impervious Area

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

Summary for Subcatchment P1f: North + East Roof

Runoff = 2.14 cfs @ 12.08 hrs, Volume= 0.168 af, Depth= 3.11"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.253	98	Paved parking, HSG C
0.360	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.646	97	Weighted Average
0.033		5.11% Pervious Area
0.613		94.89% Impervious Area

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

Summary for Subcatchment P1g: West + West Roof

Runoff = 1.85 cfs @ 12.08 hrs, Volume= 0.142 af, Depth= 3.01"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.305	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.206	98	Roofs, HSG C
0.568	96	Weighted Average
0.057		10.04% Pervious Area
0.511		89.96% Impervious Area

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

Summary for Subcatchment P1h: Offsite (Northwest)

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 0.019 af, Depth= 1.98"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.064	74	>75% Grass cover, Good, HSG C
0.053	98	Paved parking, HSG C
0.117	85	Weighted Average
0.064		54.70% Pervious Area
0.053		45.30% Impervious Area

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

Summary for Subcatchment P2a: South Central

Runoff = 0.46 cfs @ 12.08 hrs, Volume= 0.036 af, Depth= 3.11"
Routed to Pond #1 : SWM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG C
0.007	74	>75% Grass cover, Good, HSG C
0.140	97	Weighted Average
0.007		5.00% Pervious Area
0.133		95.00% Impervious Area

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

Summary for Subcatchment P2b: South Edge - Overland

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 1.90"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.46"

Area (ac)	CN	Description
0.051	74	>75% Grass cover, Good, HSG C
0.037	98	Paved parking, HSG C
0.088	84	Weighted Average
0.051		57.95% Pervious Area
0.037		42.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0260	1.38		**Sheet Flow, 143.3-142** Smooth surfaces n= 0.011 P2= 3.46"
2.6	344	0.0120	2.22		**Shallow Concentrated Flow, 142-137.74** Paved Kv= 20.3 fps
3.2	394	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.967 ac, 84.54% Impervious, Inflow Depth = 0.56" for 2-YR event
Inflow = 1.17 cfs @ 12.19 hrs, Volume= 0.092 af
Outflow = 1.17 cfs @ 12.19 hrs, Volume= 0.092 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Reach R2: East Street

Inflow Area = 0.228 ac, 74.56% Impervious, Inflow Depth = 0.73" for 2-YR event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 0.014 af
Outflow = 0.20 cfs @ 12.09 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Pond #1: SWM #1

Inflow Area = 0.140 ac, 95.00% Impervious, Inflow Depth = 3.11" for 2-YR event
Inflow = 0.46 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.13 cfs @ 11.91 hrs, Volume= 0.036 af, Atten= 72%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.91 hrs, Volume= 0.036 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach R2 : East Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 135.74' @ 12.42 hrs Surf.Area= 678 sf Storage= 268 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 8.9 min (773.0 - 764.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	627 cf	**20.50'W x 32.10'L x 3.50'H Field A** 2,303 cf Overall - 735 cf Embedded = 1,568 cf x 40.0% Voids
#2A	135.50'	735 cf	**ADS_StormTech SC-740 +Cap** x 16 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 16 Chambers in 4 Rows
#3	135.00'	94 cf	**5.00'D x 4.80'H Vertical Cone/Cylinder**

1,456 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	135.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 11.91 hrs HW=135.05' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=135.00' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond #2: SWM #2

Inflow Area = 0.303 ac, 81.19% Impervious, Inflow Depth = 2.76" for 2-YR event
Inflow = 0.93 cfs @ 12.08 hrs, Volume= 0.070 af
Outflow = 0.22 cfs @ 12.47 hrs, Volume= 0.070 af, Atten= 76%, Lag= 23.4 min
Discarded = 0.03 cfs @ 10.35 hrs, Volume= 0.056 af
Primary = 0.19 cfs @ 12.47 hrs, Volume= 0.014 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.05' @ 12.47 hrs Surf.Area= 1,242 sf Storage= 1,273 cf

Plug-Flow detention time= 297.3 min calculated for 0.070 af (100% of inflow)
Center-of-Mass det. time= 297.3 min (1,082.5 - 785.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,151 cf	**20.50'W x 60.58'L x 3.50'H Field A** 4,346 cf Overall - 1,470 cf Embedded = 2,876 cf x 40.0% Voids
#2A	135.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
		2,621 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 87.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.55' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.90'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 10.35 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.19 cfs @ 12.47 hrs HW=136.05' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.19 cfs of 2.22 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.19 cfs @ 1.26 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Pond #3: SWM #3

Inflow Area = 0.711 ac, 92.41% Impervious, Inflow Depth = 3.05" for 2-YR event
Inflow = 2.33 cfs @ 12.08 hrs, Volume= 0.181 af
Outflow = 0.94 cfs @ 11.99 hrs, Volume= 0.181 af, Atten= 59%, Lag= 0.0 min
Discarded = 0.94 cfs @ 11.99 hrs, Volume= 0.181 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.41' @ 12.29 hrs Surf.Area= 4,932 sf Storage= 817 cf

Plug-Flow detention time= 3.4 min calculated for 0.181 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (770.4 - 767.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	3,453 cf	**51.50'W x 95.76'L x 2.33'H Field A** 11,507 cf Overall - 2,875 cf Embedded = 8,632 cf x 40.0% Voids
#2A	136.50'	2,875 cf	**ADS_StormTech SC-310 +Cap** x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 15 Rows
		6,328 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.30'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.30' / 135.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.00'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.83'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	136.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.94 cfs @ 11.99 hrs HW=136.03' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=136.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 1.18 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.685 ac, 82.34% Impervious, Inflow Depth = 2.83" for 2-YR event
Inflow = 2.13 cfs @ 12.08 hrs, Volume= 0.162 af
Outflow = 1.07 cfs @ 12.23 hrs, Volume= 0.162 af, Atten= 50%, Lag= 8.5 min
Discarded = 0.32 cfs @ 11.71 hrs, Volume= 0.140 af
Primary = 0.75 cfs @ 12.23 hrs, Volume= 0.022 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 135.74' @ 12.23 hrs Surf.Area= 1,680 sf Storage= 1,330 cf

Plug-Flow detention time= 15.3 min calculated for 0.162 af (100% of inflow)
Center-of-Mass det. time= 15.3 min (793.3 - 777.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,543 cf	**20.50'W x 81.94'L x 3.50'H Field A** 5,879 cf Overall - 2,021 cf Embedded = 3,858 cf x 40.0% Voids
#2A	135.00'	2,021 cf	**ADS_StormTech SC-740 +Cap** x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 44 Chambers in 4 Rows
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 17.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.80' S= 0.0115 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.45'	**18.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.32 cfs @ 11.71 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.75 cfs @ 12.23 hrs HW=135.74' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.75 cfs of 1.44 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.75 cfs @ 1.73 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 83.51% Impervious, Inflow Depth = 0.58" for 2-YR event
Inflow = 1.30 cfs @ 12.18 hrs, Volume= 0.106 af
Primary = 1.30 cfs @ 12.18 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

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

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

SubcatchmentP1a: Offsite (Northeast) Runoff Area=0.071 ac 39.44% Impervious Runoff Depth=3.49"
Tc=6.0 min CN=83 Runoff=0.29 cfs 0.021 af

SubcatchmentP1b: Northeast Runoff Area=0.197 ac 85.28% Impervious Runoff Depth=4.65"
Tc=6.0 min CN=94 Runoff=0.99 cfs 0.076 af

SubcatchmentP1c: Offsite (Southeast) Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.18 cfs 0.015 af

SubcatchmentP1d: East Runoff Area=0.268 ac 78.73% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=93 Runoff=1.34 cfs 0.101 af

SubcatchmentP1e: Offsite (North) Runoff Area=0.065 ac 67.69% Impervious Runoff Depth=4.21"
Tc=6.0 min CN=90 Runoff=0.31 cfs 0.023 af

SubcatchmentP1f: North + East Roof Runoff Area=0.646 ac 94.89% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=97 Runoff=3.36 cfs 0.269 af

SubcatchmentP1g: West + West Roof Runoff Area=0.568 ac 89.96% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=96 Runoff=2.93 cfs 0.231 af

SubcatchmentP1h: Offsite (Northwest) Runoff Area=0.117 ac 45.30% Impervious Runoff Depth=3.69"
Tc=6.0 min CN=85 Runoff=0.50 cfs 0.036 af

SubcatchmentP2a: South Central Runoff Area=0.140 ac 95.00% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=97 Runoff=0.73 cfs 0.058 af

SubcatchmentP2b: South Edge - Overland Runoff Area=0.088 ac 42.05% Impervious Runoff Depth=3.59"
Flow Length=394' Tc=6.0 min CN=84 Runoff=0.37 cfs 0.026 af

Reach R1: Existing 12" Culvert Inflow=3.59 cfs 0.218 af
Outflow=3.59 cfs 0.218 af

Reach R2: East Street Inflow=0.37 cfs 0.026 af
Outflow=0.37 cfs 0.026 af

Pond #1: SWM #1 Peak Elev=136.42' Storage=622 cf Inflow=0.73 cfs 0.058 af
Discarded=0.13 cfs 0.058 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.058 af

Pond #2: SWM #2 Peak Elev=136.47' Storage=1,640 cf Inflow=1.52 cfs 0.116 af
Discarded=0.03 cfs 0.065 af Primary=0.80 cfs 0.052 af Outflow=0.83 cfs 0.116 af

Pond #3: SWM #3 Peak Elev=136.84' Storage=2,329 cf Inflow=3.67 cfs 0.292 af
Discarded=0.94 cfs 0.292 af Primary=0.00 cfs 0.000 af Outflow=0.94 cfs 0.292 af

Pond #4: SWM #4 Peak Elev=136.21' Storage=1,926 cf Inflow=3.43 cfs 0.267 af
Discarded=0.32 cfs 0.197 af Primary=1.85 cfs 0.070 af Outflow=2.17 cfs 0.267 af

Link DP1: Spring Brook

Inflow=3.92 cfs 0.245 af
Primary=3.92 cfs 0.245 af

Total Runoff Area = 2.195 ac Runoff Volume = 0.857 af Average Runoff Depth = 4.68"
16.49% Pervious = 0.362 ac 83.51% Impervious = 1.833 ac

Summary for Subcatchment P1a: Offsite (Northeast)

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 0.021 af, Depth= 3.49"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.043	74	>75% Grass cover, Good, HSG C
0.028	98	Paved parking, HSG C
0.071	83	Weighted Average
0.043		60.56% Pervious Area
0.028		39.44% Impervious Area

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

Summary for Subcatchment P1b: Northeast

Runoff = 0.99 cfs @ 12.08 hrs, Volume= 0.076 af, Depth= 4.65"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.168	98	Paved parking, HSG C
0.029	74	>75% Grass cover, Good, HSG C
0.197	94	Weighted Average
0.029		14.72% Pervious Area
0.168		85.28% Impervious Area

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

Summary for Subcatchment P1c: Offsite (Southeast)

Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.015 af, Depth= 5.11"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG C
0.035		100.00% Impervious Area

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

Summary for Subcatchment P1d: East

Runoff = 1.34 cfs @ 12.08 hrs, Volume= 0.101 af, Depth= 4.54"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.211	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.268	93	Weighted Average
0.057		21.27% Pervious Area
0.211		78.73% Impervious Area

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

Summary for Subcatchment P1e: Offsite (North)

Runoff = 0.31 cfs @ 12.08 hrs, Volume= 0.023 af, Depth= 4.21"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.021	74	>75% Grass cover, Good, HSG C
0.044	98	Paved parking, HSG C
0.065	90	Weighted Average
0.021		32.31% Pervious Area
0.044		67.69% Impervious Area

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

Summary for Subcatchment P1f: North + East Roof

Runoff = 3.36 cfs @ 12.08 hrs, Volume= 0.269 af, Depth= 5.00"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.253	98	Paved parking, HSG C
0.360	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.646	97	Weighted Average
0.033		5.11% Pervious Area
0.613		94.89% Impervious Area

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

Summary for Subcatchment P1g: West + West Roof

Runoff = 2.93 cfs @ 12.08 hrs, Volume= 0.231 af, Depth= 4.88"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.305	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.206	98	Roofs, HSG C
0.568	96	Weighted Average
0.057		10.04% Pervious Area
0.511		89.96% Impervious Area

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

Summary for Subcatchment P1h: Offsite (Northwest)

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.036 af, Depth= 3.69"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.064	74	>75% Grass cover, Good, HSG C
0.053	98	Paved parking, HSG C
0.117	85	Weighted Average
0.064		54.70% Pervious Area
0.053		45.30% Impervious Area

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

Summary for Subcatchment P2a: South Central

Runoff = 0.73 cfs @ 12.08 hrs, Volume= 0.058 af, Depth= 5.00"
Routed to Pond #1 : SWM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG C
0.007	74	>75% Grass cover, Good, HSG C
0.140	97	Weighted Average
0.007		5.00% Pervious Area
0.133		95.00% Impervious Area

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

Summary for Subcatchment P2b: South Edge - Overland

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 0.026 af, Depth= 3.59"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.35"

Area (ac)	CN	Description
0.051	74	>75% Grass cover, Good, HSG C
0.037	98	Paved parking, HSG C
0.088	84	Weighted Average
0.051		57.95% Pervious Area
0.037		42.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0260	1.38		**Sheet Flow, 143.3-142** Smooth surfaces n= 0.011 P2= 3.46"
2.6	344	0.0120	2.22		**Shallow Concentrated Flow, 142-137.74** Paved Kv= 20.3 fps
3.2	394	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.967 ac, 84.54% Impervious, Inflow Depth = 1.33" for 10-YR event
Inflow = 3.59 cfs @ 12.13 hrs, Volume= 0.218 af
Outflow = 3.59 cfs @ 12.13 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Reach R2: East Street

Inflow Area = 0.228 ac, 74.56% Impervious, Inflow Depth = 1.39" for 10-YR event
Inflow = 0.37 cfs @ 12.09 hrs, Volume= 0.026 af
Outflow = 0.37 cfs @ 12.09 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Pond #1: SWM #1

Inflow Area = 0.140 ac, 95.00% Impervious, Inflow Depth = 5.00" for 10-YR event
Inflow = 0.73 cfs @ 12.08 hrs, Volume= 0.058 af
Outflow = 0.13 cfs @ 11.77 hrs, Volume= 0.058 af, Atten= 82%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.77 hrs, Volume= 0.058 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach R2 : East Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.42' @ 12.53 hrs Surf.Area= 678 sf Storage= 622 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 24.5 min (778.9 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	627 cf	**20.50'W x 32.10'L x 3.50'H Field A** 2,303 cf Overall - 735 cf Embedded = 1,568 cf x 40.0% Voids
#2A	135.50'	735 cf	**ADS_StormTech SC-740 +Cap** x 16 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 16 Chambers in 4 Rows
#3	135.00'	94 cf	**5.00'D x 4.80'H Vertical Cone/Cylinder**

1,456 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	135.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 11.77 hrs HW=135.05' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=135.00' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond #2: SWM #2

Inflow Area = 0.303 ac, 81.19% Impervious, Inflow Depth = 4.61" for 10-YR event
Inflow = 1.52 cfs @ 12.08 hrs, Volume= 0.116 af
Outflow = 0.83 cfs @ 12.21 hrs, Volume= 0.116 af, Atten= 46%, Lag= 7.3 min
Discarded = 0.03 cfs @ 8.85 hrs, Volume= 0.065 af
Primary = 0.80 cfs @ 12.21 hrs, Volume= 0.052 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.47' @ 12.21 hrs Surf.Area= 1,242 sf Storage= 1,640 cf

Plug-Flow detention time= 218.3 min calculated for 0.116 af (100% of inflow)
Center-of-Mass det. time= 218.4 min (990.9 - 772.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,151 cf	**20.50'W x 60.58'L x 3.50'H Field A** 4,346 cf Overall - 1,470 cf Embedded = 2,876 cf x 40.0% Voids
#2A	135.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
		2,621 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 87.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.55' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.90'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 8.85 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.80 cfs @ 12.21 hrs HW=136.47' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.80 cfs of 2.80 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.80 cfs @ 3.18 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #3: SWM #3

Inflow Area = 0.711 ac, 92.41% Impervious, Inflow Depth = 4.92" for 10-YR event
Inflow = 3.67 cfs @ 12.08 hrs, Volume= 0.292 af
Outflow = 0.94 cfs @ 11.82 hrs, Volume= 0.292 af, Atten= 74%, Lag= 0.0 min
Discarded = 0.94 cfs @ 11.82 hrs, Volume= 0.292 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.84' @ 12.44 hrs Surf.Area= 4,932 sf Storage= 2,329 cf

Plug-Flow detention time= 11.0 min calculated for 0.292 af (100% of inflow)
Center-of-Mass det. time= 11.0 min (768.1 - 757.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	3,453 cf	**51.50'W x 95.76'L x 2.33'H Field A** 11,507 cf Overall - 2,875 cf Embedded = 8,632 cf x 40.0% Voids
#2A	136.50'	2,875 cf	**ADS_StormTech SC-310 +Cap** x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 15 Rows
		6,328 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.30'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.30' / 135.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.00'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.83'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	136.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.94 cfs @ 11.82 hrs HW=136.03' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=136.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.00 cfs of 1.18 cfs potential flow)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.685 ac, 82.34% Impervious, Inflow Depth = 4.68" for 10-YR event
Inflow = 3.43 cfs @ 12.08 hrs, Volume= 0.267 af
Outflow = 2.17 cfs @ 12.18 hrs, Volume= 0.267 af, Atten= 37%, Lag= 5.7 min
Discarded = 0.32 cfs @ 11.54 hrs, Volume= 0.197 af
Primary = 1.85 cfs @ 12.18 hrs, Volume= 0.070 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.21' @ 12.18 hrs Surf.Area= 1,680 sf Storage= 1,926 cf

Plug-Flow detention time= 14.6 min calculated for 0.267 af (100% of inflow)
Center-of-Mass det. time= 14.6 min (781.4 - 766.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,543 cf	**20.50'W x 81.94'L x 3.50'H Field A** 5,879 cf Overall - 2,021 cf Embedded = 3,858 cf x 40.0% Voids
#2A	135.00'	2,021 cf	**ADS_StormTech SC-740 +Cap** x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 44 Chambers in 4 Rows
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 17.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.80' S= 0.0115 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.45'	**18.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.32 cfs @ 11.54 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=1.85 cfs @ 12.18 hrs HW=136.21' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.85 cfs of 2.51 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.85 cfs @ 3.69 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 83.51% Impervious, Inflow Depth = 1.34" for 10-YR event
Inflow = 3.92 cfs @ 12.13 hrs, Volume= 0.245 af
Primary = 3.92 cfs @ 12.13 hrs, Volume= 0.245 af, Atten= 0%, Lag= 0.0 min

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

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

SubcatchmentP1a: Offsite (Northeast) Runoff Area=0.071 ac 39.44% Impervious Runoff Depth=4.59"
Tc=6.0 min CN=83 Runoff=0.38 cfs 0.027 af

SubcatchmentP1b: Northeast Runoff Area=0.197 ac 85.28% Impervious Runoff Depth=5.82"
Tc=6.0 min CN=94 Runoff=1.23 cfs 0.096 af

SubcatchmentP1c: Offsite (Southeast) Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=6.29"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af

SubcatchmentP1d: East Runoff Area=0.268 ac 78.73% Impervious Runoff Depth=5.71"
Tc=6.0 min CN=93 Runoff=1.66 cfs 0.127 af

SubcatchmentP1e: Offsite (North) Runoff Area=0.065 ac 67.69% Impervious Runoff Depth=5.36"
Tc=6.0 min CN=90 Runoff=0.39 cfs 0.029 af

SubcatchmentP1f: North + East Roof Runoff Area=0.646 ac 94.89% Impervious Runoff Depth=6.17"
Tc=6.0 min CN=97 Runoff=4.12 cfs 0.332 af

SubcatchmentP1g: West + West Roof Runoff Area=0.568 ac 89.96% Impervious Runoff Depth=6.06"
Tc=6.0 min CN=96 Runoff=3.60 cfs 0.287 af

SubcatchmentP1h: Offsite (Northwest) Runoff Area=0.117 ac 45.30% Impervious Runoff Depth=4.80"
Tc=6.0 min CN=85 Runoff=0.64 cfs 0.047 af

SubcatchmentP2a: South Central Runoff Area=0.140 ac 95.00% Impervious Runoff Depth=6.17"
Tc=6.0 min CN=97 Runoff=0.89 cfs 0.072 af

SubcatchmentP2b: South Edge - Overland Runoff Area=0.088 ac 42.05% Impervious Runoff Depth=4.69"
Flow Length=394' Tc=6.0 min CN=84 Runoff=0.47 cfs 0.034 af

Reach R1: Existing 12" Culvert Inflow=4.61 cfs 0.305 af
Outflow=4.61 cfs 0.305 af

Reach R2: East Street Inflow=0.47 cfs 0.034 af
Outflow=0.47 cfs 0.034 af

Pond #1: SWM #1 Peak Elev=136.90' Storage=859 cf Inflow=0.89 cfs 0.072 af
Discarded=0.13 cfs 0.072 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.072 af

Pond #2: SWM #2 Peak Elev=136.78' Storage=1,901 cf Inflow=1.88 cfs 0.146 af
Discarded=0.03 cfs 0.069 af Primary=1.04 cfs 0.077 af Outflow=1.07 cfs 0.146 af

Pond #3: SWM #3 Peak Elev=137.14' Storage=3,392 cf Inflow=4.51 cfs 0.361 af
Discarded=0.94 cfs 0.359 af Primary=0.08 cfs 0.002 af Outflow=1.02 cfs 0.361 af

Pond #4: SWM #4 Peak Elev=136.55' Storage=2,337 cf Inflow=4.24 cfs 0.333 af
Discarded=0.32 cfs 0.230 af Primary=2.33 cfs 0.103 af Outflow=2.65 cfs 0.333 af

Link DP1: Spring Brook

Inflow=5.04 cfs 0.339 af
Primary=5.04 cfs 0.339 af

Total Runoff Area = 2.195 ac Runoff Volume = 1.070 af Average Runoff Depth = 5.85"
16.49% Pervious = 0.362 ac 83.51% Impervious = 1.833 ac

Summary for Subcatchment P1a: Offsite (Northeast)

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 4.59"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.043	74	>75% Grass cover, Good, HSG C
0.028	98	Paved parking, HSG C
0.071	83	Weighted Average
0.043		60.56% Pervious Area
0.028		39.44% Impervious Area

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

Summary for Subcatchment P1b: Northeast

Runoff = 1.23 cfs @ 12.08 hrs, Volume= 0.096 af, Depth= 5.82"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.168	98	Paved parking, HSG C
0.029	74	>75% Grass cover, Good, HSG C
0.197	94	Weighted Average
0.029		14.72% Pervious Area
0.168		85.28% Impervious Area

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

Summary for Subcatchment P1c: Offsite (Southeast)

Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth= 6.29"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG C
0.035		100.00% Impervious Area

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

Summary for Subcatchment P1d: East

Runoff = 1.66 cfs @ 12.08 hrs, Volume= 0.127 af, Depth= 5.71"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.211	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.268	93	Weighted Average
0.057		21.27% Pervious Area
0.211		78.73% Impervious Area

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

Summary for Subcatchment P1e: Offsite (North)

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.029 af, Depth= 5.36"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.021	74	>75% Grass cover, Good, HSG C
0.044	98	Paved parking, HSG C
0.065	90	Weighted Average
0.021		32.31% Pervious Area
0.044		67.69% Impervious Area

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

Summary for Subcatchment P1f: North + East Roof

Runoff = 4.12 cfs @ 12.08 hrs, Volume= 0.332 af, Depth= 6.17"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.253	98	Paved parking, HSG C
0.360	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.646	97	Weighted Average
0.033		5.11% Pervious Area
0.613		94.89% Impervious Area

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

Summary for Subcatchment P1g: West + West Roof

Runoff = 3.60 cfs @ 12.08 hrs, Volume= 0.287 af, Depth= 6.06"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.305	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.206	98	Roofs, HSG C
0.568	96	Weighted Average
0.057		10.04% Pervious Area
0.511		89.96% Impervious Area

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

Summary for Subcatchment P1h: Offsite (Northwest)

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.047 af, Depth= 4.80"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.064	74	>75% Grass cover, Good, HSG C
0.053	98	Paved parking, HSG C
0.117	85	Weighted Average
0.064		54.70% Pervious Area
0.053		45.30% Impervious Area

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

Summary for Subcatchment P2a: South Central

Runoff = 0.89 cfs @ 12.08 hrs, Volume= 0.072 af, Depth= 6.17"
Routed to Pond #1 : SWM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG C
0.007	74	>75% Grass cover, Good, HSG C
0.140	97	Weighted Average
0.007		5.00% Pervious Area
0.133		95.00% Impervious Area

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

Summary for Subcatchment P2b: South Edge - Overland

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af, Depth= 4.69"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=6.53"

Area (ac)	CN	Description
0.051	74	>75% Grass cover, Good, HSG C
0.037	98	Paved parking, HSG C
0.088	84	Weighted Average
0.051		57.95% Pervious Area
0.037		42.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0260	1.38		**Sheet Flow, 143.3-142** Smooth surfaces n= 0.011 P2= 3.46"
2.6	344	0.0120	2.22		**Shallow Concentrated Flow, 142-137.74** Paved Kv= 20.3 fps
3.2	394	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.967 ac, 84.54% Impervious, Inflow Depth = 1.86" for 25-YR event
Inflow = 4.61 cfs @ 12.12 hrs, Volume= 0.305 af
Outflow = 4.61 cfs @ 12.12 hrs, Volume= 0.305 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Reach R2: East Street

Inflow Area = 0.228 ac, 74.56% Impervious, Inflow Depth = 1.81" for 25-YR event
Inflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af
Outflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Pond #1: SWM #1

Inflow Area = 0.140 ac, 95.00% Impervious, Inflow Depth = 6.17" for 25-YR event
Inflow = 0.89 cfs @ 12.08 hrs, Volume= 0.072 af
Outflow = 0.13 cfs @ 11.72 hrs, Volume= 0.072 af, Atten= 85%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.72 hrs, Volume= 0.072 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach R2 : East Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.90' @ 12.57 hrs Surf.Area= 678 sf Storage= 859 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 36.9 min (787.5 - 750.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	627 cf	**20.50'W x 32.10'L x 3.50'H Field A** 2,303 cf Overall - 735 cf Embedded = 1,568 cf x 40.0% Voids
#2A	135.50'	735 cf	**ADS_StormTech SC-740 +Cap** x 16 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 16 Chambers in 4 Rows
#3	135.00'	94 cf	**5.00'D x 4.80'H Vertical Cone/Cylinder**

1,456 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	135.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 11.72 hrs HW=135.05' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=135.00' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond #2: SWM #2

Inflow Area = 0.303 ac, 81.19% Impervious, Inflow Depth = 5.77" for 25-YR event
Inflow = 1.88 cfs @ 12.08 hrs, Volume= 0.146 af
Outflow = 1.07 cfs @ 12.20 hrs, Volume= 0.146 af, Atten= 43%, Lag= 6.7 min
Discarded = 0.03 cfs @ 8.16 hrs, Volume= 0.069 af
Primary = 1.04 cfs @ 12.20 hrs, Volume= 0.077 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.78' @ 12.20 hrs Surf.Area= 1,242 sf Storage= 1,901 cf

Plug-Flow detention time= 191.8 min calculated for 0.146 af (100% of inflow)
Center-of-Mass det. time= 191.8 min (959.1 - 767.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,151 cf	**20.50'W x 60.58'L x 3.50'H Field A** 4,346 cf Overall - 1,470 cf Embedded = 2,876 cf x 40.0% Voids
#2A	135.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
		2,621 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 87.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.55' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.90'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 8.16 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.04 cfs @ 12.20 hrs HW=136.78' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.04 cfs of 3.24 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.04 cfs @ 4.18 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #3: SWM #3

Inflow Area = 0.711 ac, 92.41% Impervious, Inflow Depth = 6.10" for 25-YR event
Inflow = 4.51 cfs @ 12.08 hrs, Volume= 0.361 af
Outflow = 1.02 cfs @ 12.48 hrs, Volume= 0.361 af, Atten= 77%, Lag= 23.6 min
Discarded = 0.94 cfs @ 11.76 hrs, Volume= 0.359 af
Primary = 0.08 cfs @ 12.48 hrs, Volume= 0.002 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.14' @ 12.48 hrs Surf.Area= 4,932 sf Storage= 3,392 cf

Plug-Flow detention time= 16.9 min calculated for 0.361 af (100% of inflow)
Center-of-Mass det. time= 16.9 min (770.0 - 753.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	3,453 cf	**51.50'W x 95.76'L x 2.33'H Field A** 11,507 cf Overall - 2,875 cf Embedded = 8,632 cf x 40.0% Voids
#2A	136.50'	2,875 cf	**ADS_StormTech SC-310 +Cap** x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 15 Rows
		6,328 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.30'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.30' / 135.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.00'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.83'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	136.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.94 cfs @ 11.76 hrs HW=136.03' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=0.08 cfs @ 12.48 hrs HW=137.14' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.08 cfs of 3.45 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 1.18 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.685 ac, 82.34% Impervious, Inflow Depth = 5.84" for 25-YR event
Inflow = 4.24 cfs @ 12.08 hrs, Volume= 0.333 af
Outflow = 2.65 cfs @ 12.18 hrs, Volume= 0.333 af, Atten= 38%, Lag= 5.8 min
Discarded = 0.32 cfs @ 11.31 hrs, Volume= 0.230 af
Primary = 2.33 cfs @ 12.18 hrs, Volume= 0.103 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.55' @ 12.18 hrs Surf.Area= 1,680 sf Storage= 2,337 cf

Plug-Flow detention time= 15.0 min calculated for 0.333 af (100% of inflow)
Center-of-Mass det. time= 15.0 min (777.2 - 762.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,543 cf	**20.50'W x 81.94'L x 3.50'H Field A** 5,879 cf Overall - 2,021 cf Embedded = 3,858 cf x 40.0% Voids
#2A	135.00'	2,021 cf	**ADS_StormTech SC-740 +Cap** x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 44 Chambers in 4 Rows
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 17.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.80' S= 0.0115 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.45'	**18.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.32 cfs @ 11.31 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=2.33 cfs @ 12.18 hrs HW=136.55' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 2.33 cfs of 3.07 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.33 cfs @ 4.66 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 83.51% Impervious, Inflow Depth = 1.85" for 25-YR event
Inflow = 5.04 cfs @ 12.12 hrs, Volume= 0.339 af
Primary = 5.04 cfs @ 12.12 hrs, Volume= 0.339 af, Atten= 0%, Lag= 0.0 min

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

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

SubcatchmentP1a: Offsite (Northeast) Runoff Area=0.071 ac 39.44% Impervious Runoff Depth=6.97"
Tc=6.0 min CN=83 Runoff=0.56 cfs 0.041 af

SubcatchmentP1b: Northeast Runoff Area=0.197 ac 85.28% Impervious Runoff Depth=8.31"
Tc=6.0 min CN=94 Runoff=1.72 cfs 0.136 af

SubcatchmentP1c: Offsite (Southeast) Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=8.79"
Tc=6.0 min CN=98 Runoff=0.31 cfs 0.026 af

SubcatchmentP1d: East Runoff Area=0.268 ac 78.73% Impervious Runoff Depth=8.19"
Tc=6.0 min CN=93 Runoff=2.33 cfs 0.183 af

SubcatchmentP1e: Offsite (North) Runoff Area=0.065 ac 67.69% Impervious Runoff Depth=7.82"
Tc=6.0 min CN=90 Runoff=0.55 cfs 0.042 af

SubcatchmentP1f: North + East Roof Runoff Area=0.646 ac 94.89% Impervious Runoff Depth=8.67"
Tc=6.0 min CN=97 Runoff=5.72 cfs 0.467 af

SubcatchmentP1g: West + West Roof Runoff Area=0.568 ac 89.96% Impervious Runoff Depth=8.55"
Tc=6.0 min CN=96 Runoff=5.01 cfs 0.405 af

SubcatchmentP1h: Offsite (Northwest) Runoff Area=0.117 ac 45.30% Impervious Runoff Depth=7.21"
Tc=6.0 min CN=85 Runoff=0.95 cfs 0.070 af

SubcatchmentP2a: South Central Runoff Area=0.140 ac 95.00% Impervious Runoff Depth=8.67"
Tc=6.0 min CN=97 Runoff=1.24 cfs 0.101 af

SubcatchmentP2b: South Edge - Overland Runoff Area=0.088 ac 42.05% Impervious Runoff Depth=7.09"
Flow Length=394' Tc=6.0 min CN=84 Runoff=0.70 cfs 0.052 af

Reach R1: Existing 12" Culvert Inflow=6.62 cfs 0.531 af
Outflow=6.62 cfs 0.531 af

Reach R2: East Street Inflow=0.70 cfs 0.052 af
Outflow=0.70 cfs 0.052 af

Pond #1: SWM #1 Peak Elev=138.36' Storage=1,391 cf Inflow=1.24 cfs 0.101 af
Discarded=0.13 cfs 0.101 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.101 af

Pond #2: SWM #2 Peak Elev=137.47' Storage=2,359 cf Inflow=2.64 cfs 0.208 af
Discarded=0.03 cfs 0.075 af Primary=1.45 cfs 0.134 af Outflow=1.48 cfs 0.208 af

Pond #3: SWM #3 Peak Elev=137.83' Storage=5,332 cf Inflow=6.27 cfs 0.509 af
Discarded=0.94 cfs 0.473 af Primary=0.50 cfs 0.036 af Outflow=1.45 cfs 0.509 af

Pond #4: SWM #4 Peak Elev=137.49' Storage=3,219 cf Inflow=5.96 cfs 0.475 af
Discarded=0.32 cfs 0.292 af Primary=3.29 cfs 0.183 af Outflow=3.61 cfs 0.475 af

Link DP1: Spring Brook

Inflow=7.20 cfs 0.583 af
Primary=7.20 cfs 0.583 af

Total Runoff Area = 2.195 ac Runoff Volume = 1.523 af Average Runoff Depth = 8.33"
16.49% Pervious = 0.362 ac 83.51% Impervious = 1.833 ac

Summary for Subcatchment P1a: Offsite (Northeast)

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 0.041 af, Depth= 6.97"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.043	74	>75% Grass cover, Good, HSG C
0.028	98	Paved parking, HSG C
0.071	83	Weighted Average
0.043		60.56% Pervious Area
0.028		39.44% Impervious Area

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

Summary for Subcatchment P1b: Northeast

Runoff = 1.72 cfs @ 12.08 hrs, Volume= 0.136 af, Depth= 8.31"
Routed to Reach R1 : Existing 12" Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.168	98	Paved parking, HSG C
0.029	74	>75% Grass cover, Good, HSG C
0.197	94	Weighted Average
0.029		14.72% Pervious Area
0.168		85.28% Impervious Area

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

Summary for Subcatchment P1c: Offsite (Southeast)

Runoff = 0.31 cfs @ 12.08 hrs, Volume= 0.026 af, Depth= 8.79"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG C
0.035		100.00% Impervious Area

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

Summary for Subcatchment P1d: East

Runoff = 2.33 cfs @ 12.08 hrs, Volume= 0.183 af, Depth= 8.19"
Routed to Pond #2 : SWM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.211	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.268	93	Weighted Average
0.057		21.27% Pervious Area
0.211		78.73% Impervious Area

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

Summary for Subcatchment P1e: Offsite (North)

Runoff = 0.55 cfs @ 12.08 hrs, Volume= 0.042 af, Depth= 7.82"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.021	74	>75% Grass cover, Good, HSG C
0.044	98	Paved parking, HSG C
0.065	90	Weighted Average
0.021		32.31% Pervious Area
0.044		67.69% Impervious Area

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

Summary for Subcatchment P1f: North + East Roof

Runoff = 5.72 cfs @ 12.08 hrs, Volume= 0.467 af, Depth= 8.67"
Routed to Pond #3 : SWM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.253	98	Paved parking, HSG C
0.360	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.646	97	Weighted Average
0.033		5.11% Pervious Area
0.613		94.89% Impervious Area

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

Summary for Subcatchment P1g: West + West Roof

Runoff = 5.01 cfs @ 12.08 hrs, Volume= 0.405 af, Depth= 8.55"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.305	98	Paved parking, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.206	98	Roofs, HSG C
0.568	96	Weighted Average
0.057		10.04% Pervious Area
0.511		89.96% Impervious Area

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

Summary for Subcatchment P1h: Offsite (Northwest)

Runoff = 0.95 cfs @ 12.08 hrs, Volume= 0.070 af, Depth= 7.21"
Routed to Pond #4 : SWM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.064	74	>75% Grass cover, Good, HSG C
0.053	98	Paved parking, HSG C
0.117	85	Weighted Average
0.064		54.70% Pervious Area
0.053		45.30% Impervious Area

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

Summary for Subcatchment P2a: South Central

Runoff = 1.24 cfs @ 12.08 hrs, Volume= 0.101 af, Depth= 8.67"
Routed to Pond #1 : SWM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG C
0.007	74	>75% Grass cover, Good, HSG C
0.140	97	Weighted Average
0.007		5.00% Pervious Area
0.133		95.00% Impervious Area

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

Summary for Subcatchment P2b: South Edge - Overland

Runoff = 0.70 cfs @ 12.08 hrs, Volume= 0.052 af, Depth= 7.09"
Routed to Reach R2 : East Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=9.03"

Area (ac)	CN	Description
0.051	74	>75% Grass cover, Good, HSG C
0.037	98	Paved parking, HSG C
0.088	84	Weighted Average
0.051		57.95% Pervious Area
0.037		42.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0260	1.38		**Sheet Flow, 143.3-142** Smooth surfaces n= 0.011 P2= 3.46"
2.6	344	0.0120	2.22		**Shallow Concentrated Flow, 142-137.74** Paved Kv= 20.3 fps
3.2	394	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach R1: Existing 12" Culvert

Inflow Area = 1.967 ac, 84.54% Impervious, Inflow Depth = 3.24" for 100-YR event
Inflow = 6.62 cfs @ 12.14 hrs, Volume= 0.531 af
Outflow = 6.62 cfs @ 12.14 hrs, Volume= 0.531 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Reach R2: East Street

Inflow Area = 0.228 ac, 74.56% Impervious, Inflow Depth = 2.74" for 100-YR event
Inflow = 0.70 cfs @ 12.08 hrs, Volume= 0.052 af
Outflow = 0.70 cfs @ 12.08 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min
Routed to Link DP1 : Spring Brook

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

Summary for Pond #1: SWM #1

Inflow Area = 0.140 ac, 95.00% Impervious, Inflow Depth = 8.67" for 100-YR event
Inflow = 1.24 cfs @ 12.08 hrs, Volume= 0.101 af
Outflow = 0.13 cfs @ 11.63 hrs, Volume= 0.101 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.63 hrs, Volume= 0.101 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach R2 : East Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 138.36' @ 12.78 hrs Surf.Area= 678 sf Storage= 1,391 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 67.8 min (813.1 - 745.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	627 cf	**20.50'W x 32.10'L x 3.50'H Field A** 2,303 cf Overall - 735 cf Embedded = 1,568 cf x 40.0% Voids
#2A	135.50'	735 cf	**ADS_StormTech SC-740 +Cap** x 16 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 16 Chambers in 4 Rows
#3	135.00'	94 cf	**5.00'D x 4.80'H Vertical Cone/Cylinder**

1,456 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.75'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	135.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 11.63 hrs HW=135.05' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=135.00' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond #2: SWM #2

Inflow Area = 0.303 ac, 81.19% Impervious, Inflow Depth = 8.26" for 100-YR event
Inflow = 2.64 cfs @ 12.08 hrs, Volume= 0.208 af
Outflow = 1.48 cfs @ 12.20 hrs, Volume= 0.208 af, Atten= 44%, Lag= 6.9 min
Discarded = 0.03 cfs @ 6.79 hrs, Volume= 0.075 af
Primary = 1.45 cfs @ 12.20 hrs, Volume= 0.134 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.47' @ 12.20 hrs Surf.Area= 1,242 sf Storage= 2,359 cf

Plug-Flow detention time= 153.6 min calculated for 0.208 af (100% of inflow)
Center-of-Mass det. time= 153.6 min (913.3 - 759.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,151 cf	**20.50'W x 60.58'L x 3.50'H Field A** 4,346 cf Overall - 1,470 cf Embedded = 2,876 cf x 40.0% Voids
#2A	135.00'	1,470 cf	**ADS_StormTech SC-740 +Cap** x 32 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 32 Chambers in 4 Rows
		2,621 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 87.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.55' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.90'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 6.79 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.45 cfs @ 12.20 hrs HW=137.47' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.45 cfs of 4.06 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.45 cfs @ 5.79 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #3: SWM #3

Inflow Area = 0.711 ac, 92.41% Impervious, Inflow Depth = 8.59" for 100-YR event
Inflow = 6.27 cfs @ 12.08 hrs, Volume= 0.509 af
Outflow = 1.45 cfs @ 12.47 hrs, Volume= 0.509 af, Atten= 77%, Lag= 23.4 min
Discarded = 0.94 cfs @ 11.68 hrs, Volume= 0.473 af
Primary = 0.50 cfs @ 12.47 hrs, Volume= 0.036 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.83' @ 12.47 hrs Surf.Area= 4,932 sf Storage= 5,332 cf

Plug-Flow detention time= 23.6 min calculated for 0.509 af (100% of inflow)
Center-of-Mass det. time= 23.6 min (771.2 - 747.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	3,453 cf	**51.50'W x 95.76'L x 2.33'H Field A** 11,507 cf Overall - 2,875 cf Embedded = 8,632 cf x 40.0% Voids
#2A	136.50'	2,875 cf	**ADS_StormTech SC-310 +Cap** x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 15 Rows
		6,328 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.30'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.30' / 135.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.00'	**6.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.83'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	136.00'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.94 cfs @ 11.68 hrs HW=136.03' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=0.50 cfs @ 12.47 hrs HW=137.83' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.50 cfs of 4.25 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.50 cfs @ 4.03 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.685 ac, 82.34% Impervious, Inflow Depth = 8.32" for 100-YR event
Inflow = 5.96 cfs @ 12.08 hrs, Volume= 0.475 af
Outflow = 3.61 cfs @ 12.18 hrs, Volume= 0.475 af, Atten= 39%, Lag= 6.1 min
Discarded = 0.32 cfs @ 10.64 hrs, Volume= 0.292 af
Primary = 3.29 cfs @ 12.18 hrs, Volume= 0.183 af
Routed to Reach R1 : Existing 12" Culvert

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.49' @ 12.18 hrs Surf.Area= 1,680 sf Storage= 3,219 cf

Plug-Flow detention time= 16.0 min calculated for 0.475 af (100% of inflow)
Center-of-Mass det. time= 16.0 min (771.5 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	1,543 cf	**20.50'W x 81.94'L x 3.50'H Field A** 5,879 cf Overall - 2,021 cf Embedded = 3,858 cf x 40.0% Voids
#2A	135.00'	2,021 cf	**ADS_StormTech SC-740 +Cap** x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 44 Chambers in 4 Rows
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**12.0" Round Culvert** L= 17.4' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.80' S= 0.0115 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	135.45'	**18.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.50'	**8.270 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.32 cfs @ 10.64 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=3.29 cfs @ 12.18 hrs HW=137.48' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 3.29 cfs of 4.21 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 3.29 cfs @ 6.58 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Link DP1: Spring Brook

Inflow Area = 2.195 ac, 83.51% Impervious, Inflow Depth = 3.19" for 100-YR event
Inflow = 7.20 cfs @ 12.13 hrs, Volume= 0.583 af
Primary = 7.20 cfs @ 12.13 hrs, Volume= 0.583 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *STAGE STORAGE VOLUME*
- *WATER QUALITY UNIT SIZING*
- *PIPE SIZING*
- *RAINFALL DATA*
- *RAINFALL INTENSITY DATA*
- *MOUNDING CALCULATIONS*

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MA DEP Standard 3: Recharge Volume Calculations

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

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - C Soils (0.25 in.)	
Existing Site Impervious Area (ac)	1.561
Proposed Site Impervious Area (ac)	1.673
Proposed Increase in Site Impervious Area (ac)	0.112
Recharge Volume Required (cf)	**102**

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

Total Recharge Volume Required (cf)	**102**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**1.468**
%Impervious Directed to Infiltration BMP	88%
Adjustment Factor	1.14
Adjusted Total Recharge Volume Required (cf)	**116**

Provided Recharge Volume*	
SWM #1	1,455
SWM #2	1,130
SWM #3	2,909
SWM #4	947
Total Recharge Volume Provided (cf)	**6,441**

Provided greater than or Equal to Required

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

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MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - SWM #1	
Volume below outlet pipe (Rv) (cf)	1,455
Soil Type	Sand - A
Infiltration rate (K)*	8.27
Bottom Area (sf)	658
Drawdown time (Hours)*	**3.2**
Drawdown Time - SWM #2	
Volume below outlet pipe (Rv) (cf)	1,130
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	1,242
Drawdown time (Hours)**	**10.7**
Drawdown Time - SWM #3	
Volume below outlet pipe (Rv) (cf)	2,909
Soil Type	Sand - A
Infiltration rate (K)*	8.27
Bottom Area (sf)	4,932
Drawdown time (Hours)**	**0.9**
Drawdown Time - SWM #4	
Volume below outlet pipe (Rv) (cf)	947
Soil Type	Sand - A
Infiltration rate (K)*	8.27
Bottom Area (sf)	1,680
Drawdown time (Hours)**	**0.8**

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

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MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	72,876
Required Water Quality Volume (cf)	**6,073**
*Water Quality volume runoff is equal to 1 inch of runoff times the total impervious area of the post development project site (including roof)	

Water Quality Volume Provided*	
SWM #1	1,455
SWM #2	1,130
SWM #3	2,909
SWM #4	947
Total Provided Water Quality Volume (cf)	**6,441**

Required Volume Provided

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment to SWM#1 (CB to Isolator Row)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Isolator Row	**0.25**	**0.75**	**0.19**	**0.56**
Total TSS Removal =			**44%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment at SWM#1 (Underground Infiltration System)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Underground Infiltration System (Stormtech SC-740) with isolator row pretreatment	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment to SWM#2-4 (CB to Isolator Row)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Isolator Row	**0.25**	**0.75**	**0.19**	**0.56**
Total TSS Removal =			**44%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment at SWM#2 & 4 (Underground Infiltration System)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Underground Infiltration System (Stormtech SC-740) with isolator row pretreatment	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment at SWM#3 (Underground Infiltration System)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Underground Infiltration System (Stormtech SC-310) with isolator row pretreatment	**0.80**	**0.75**	**0.60**	**0.15**
		Total TSS Removal =	**85%**	

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

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MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Treatment at Proprietary Water Quality Inlet (WQi500)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Proprietary Water Quality Inlet (WQi500)	**0.80**	**1.00**	**0.80**	**0.20**
Total TSS Removal =			**80%**	

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

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MA DEP Standard 4: Weighted TSS Removal Rate

Design Point - Treatment Train Description(s)	TSS Removal (%)	Treated Imp. Area* (ac)	TSS Removal (%)	Untreated Imp. Area (ac)	Total Area
DP1 - Overland to East Street	0.00	0.000	0.00	0.037	0.037
DP1 - To Wqi500	0.80	0.168	0.12	0.000	0.168
DP1 - CBs to UG Basins 1-4 w/ pretreatment	0.85	0.902	0.69	0.000	0.902
Total Weighted TSS Removal Rate	**0.81**				1.107

*Excludes roof runoff

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Stage-Area-Storage for Pond #1: SWM #1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.08	678	1,442
139.09	678	1,443
139.10	678	1,443
139.11	678	1,443
139.12	678	1,443
139.13	678	1,443
139.14	678	1,443
139.15	678	1,444
139.16	678	1,444
139.17	678	1,444
139.18	678	1,444
139.19	678	1,444
139.20	678	1,445
139.21	678	1,445
139.22	678	1,445
139.23	678	1,445
139.24	678	1,445
139.25	678	1,446
139.26	678	1,446
139.27	678	1,446
139.28	678	1,446
139.29	678	1,446
139.30	678	1,447
139.31	678	1,447
139.32	678	1,447
139.33	678	1,447
139.34	678	1,447
139.35	678	1,448
139.36	678	1,448
139.37	678	1,448
139.38	678	1,448
139.39	678	1,448
139.40	678	1,449
139.41	678	1,449
139.42	678	1,449
139.43	678	1,449
139.44	678	1,449
139.45	678	1,450
139.46	678	1,450
139.47	678	1,450
139.48	678	1,450
139.49	678	1,450
139.50	678	1,451
139.51	678	1,451
139.52	678	1,451
139.53	678	1,451
139.54	678	1,451
139.55	678	1,452
139.56	678	1,452
139.57	678	1,452
139.58	678	1,452
139.59	678	1,452
139.60	678	1,453
139.61	678	1,453
139.62	678	1,453
139.63	678	1,453
139.64	678	1,453
139.65	678	1,454
139.66	678	1,454
139.67	678	1,454
139.68	678	1,454
139.69	678	1,454
139.70	678	1,454
139.71	678	1,455
139.72	678	1,455
139.73	678	1,455
139.74	678	1,455
139.75	678	1,455
139.76	678	1,456
139.77	678	1,456
139.78	678	1,456
139.79	678	1,456
139.80	678	**1,456**

Stage-Area-Storage for Pond #2: SWM #2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
135.52	1,242	765	136.03	1,242	1,251
135.53	1,242	775	136.04	1,242	1,260
135.54	1,242	785	136.05	1,242	1,269
135.55	1,242	795	136.06	1,242	1,279
135.56	1,242	804	136.07	1,242	1,288
135.57	1,242	814	136.08	1,242	1,297
135.58	1,242	824	136.09	1,242	1,306
135.59	1,242	833	136.10	1,242	1,315
135.60	1,242	843	136.11	1,242	1,325
135.61	1,242	853	136.12	1,242	1,334
135.62	1,242	863	136.13	1,242	1,343
135.63	1,242	872	136.14	1,242	1,352
135.64	1,242	882	136.15	1,242	1,361
135.65	1,242	892	136.16	1,242	1,370
135.66	1,242	901	136.17	1,242	1,379
135.67	1,242	911	136.18	1,242	1,388
135.68	1,242	920	136.19	1,242	1,397
135.69	1,242	930	136.20	1,242	1,406
135.70	1,242	940	136.21	1,242	1,415
135.71	1,242	949	136.22	1,242	1,424
135.72	1,242	959	136.23	1,242	1,433
135.73	1,242	968	136.24	1,242	1,442
135.74	1,242	978	136.25	1,242	1,451
135.75	1,242	988	136.26	1,242	1,460
135.76	1,242	997	136.27	1,242	1,469
135.77	1,242	1,007	136.28	1,242	1,478
135.78	1,242	1,016	136.29	1,242	1,487
135.79	1,242	1,026	136.30	1,242	1,496
135.80	1,242	1,035	136.31	1,242	1,505
135.81	1,242	1,045	136.32	1,242	1,513
135.82	1,242	1,054	136.33	1,242	1,522
135.83	1,242	1,064	136.34	1,242	1,531
135.84	1,242	1,073	136.35	1,242	1,540
135.85	1,242	1,083	136.36	1,242	1,549
135.86	1,242	1,092	136.37	1,242	1,557
135.87	1,242	1,101	136.38	1,242	1,566
135.88	1,242	1,111	136.39	1,242	1,575
135.89	1,242	1,120	136.40	1,242	1,584
135.90	1,242	1,130	136.41	1,242	1,592
135.91	1,242	1,139	136.42	1,242	1,601
135.92	1,242	1,148	136.43	1,242	1,610
135.93	1,242	1,158	136.44	1,242	1,618
135.94	1,242	1,167	136.45	1,242	1,627
135.95	1,242	1,177	136.46	1,242	1,636
135.96	1,242	1,186	136.47	1,242	1,644
135.97	1,242	1,195	136.48	1,242	1,653
135.98	1,242	1,205	136.49	1,242	1,661
135.99	1,242	1,214	136.50	1,242	1,670
136.00	1,242	1,223	136.51	1,242	1,678
136.01	1,242	1,232	136.52	1,242	1,687
136.02	1,242	1,242	136.53	1,242	1,695

Stage-Area-Storage for Pond #3: SWM #3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
136.00	**4,932**	0	136.51	4,932	1,026
136.01	4,932	20	136.52	4,932	1,066
136.02	4,932	39	136.53	4,932	1,106
136.03	4,932	59	136.54	4,932	1,145
136.04	4,932	79	136.55	4,932	1,185
136.05	4,932	99	136.56	4,932	1,225
136.06	4,932	118	136.57	4,932	1,264
136.07	4,932	138	136.58	4,932	1,304
136.08	4,932	158	136.59	4,932	1,344
136.09	4,932	178	136.60	4,932	1,383
136.10	4,932	197	136.61	4,932	1,423
136.11	4,932	217	136.62	4,932	1,462
136.12	4,932	237	136.63	4,932	1,502
136.13	4,932	256	136.64	4,932	1,541
136.14	4,932	276	136.65	4,932	1,580
136.15	4,932	296	136.66	4,932	1,619
136.16	4,932	316	136.67	4,932	1,659
136.17	4,932	335	136.68	4,932	1,698
136.18	4,932	355	136.69	4,932	1,737
136.19	4,932	375	136.70	4,932	1,776
136.20	4,932	395	136.71	4,932	1,815
136.21	4,932	414	136.72	4,932	1,854
136.22	4,932	434	136.73	4,932	1,892
136.23	4,932	454	136.74	4,932	1,931
136.24	4,932	473	136.75	4,932	1,970
136.25	4,932	493	136.76	4,932	2,008
136.26	4,932	513	136.77	4,932	2,047
136.27	4,932	533	136.78	4,932	2,085
136.28	4,932	552	136.79	4,932	2,124
136.29	4,932	572	136.80	4,932	2,162
136.30	4,932	592	136.81	4,932	2,200
136.31	4,932	612	136.82	4,932	2,238
136.32	4,932	631	136.83	4,932	2,276
136.33	4,932	651	136.84	4,932	2,314
136.34	4,932	671	136.85	4,932	2,352
136.35	4,932	690	136.86	4,932	2,390
136.36	4,932	710	136.87	4,932	2,427
136.37	4,932	730	136.88	4,932	2,465
136.38	4,932	750	136.89	4,932	2,503
136.39	4,932	769	136.90	4,932	2,540
136.40	4,932	789	136.91	4,932	2,577
136.41	4,932	809	136.92	4,932	2,615
136.42	4,932	829	136.93	4,932	2,652
136.43	4,932	848	136.94	4,932	2,689
136.44	4,932	868	136.95	4,932	2,726
136.45	4,932	888	136.96	4,932	2,762
136.46	4,932	907	136.97	4,932	2,799
136.47	4,932	927	136.98	4,932	2,836
136.48	4,932	947	136.99	4,932	2,872
136.49	4,932	967	137.00	4,932	2,909
136.50	4,932	986	137.01	4,932	2,945

Stage-Area-Storage for Pond #4: SWM #4

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
134.50	**1,680**	0	135.01	1,680	350
134.51	1,680	7	135.02	1,680	363
134.52	1,680	13	135.03	1,680	377
134.53	1,680	20	135.04	1,680	391
134.54	1,680	27	135.05	1,680	404
134.55	1,680	34	135.06	1,680	418
134.56	1,680	40	135.07	1,680	432
134.57	1,680	47	135.08	1,680	446
134.58	1,680	54	135.09	1,680	459
134.59	1,680	60	135.10	1,680	473
134.60	1,680	67	135.11	1,680	487
134.61	1,680	74	135.12	1,680	500
134.62	1,680	81	135.13	1,680	514
134.63	1,680	87	135.14	1,680	528
134.64	1,680	94	135.15	1,680	541
134.65	1,680	101	135.16	1,680	555
134.66	1,680	108	135.17	1,680	569
134.67	1,680	114	135.18	1,680	582
134.68	1,680	121	135.19	1,680	596
134.69	1,680	128	135.20	1,680	610
134.70	1,680	134	135.21	1,680	623
134.71	1,680	141	135.22	1,680	637
134.72	1,680	148	135.23	1,680	650
134.73	1,680	155	135.24	1,680	664
134.74	1,680	161	135.25	1,680	678
134.75	1,680	168	135.26	1,680	691
134.76	1,680	175	135.27	1,680	705
134.77	1,680	181	135.28	1,680	718
134.78	1,680	188	135.29	1,680	732
134.79	1,680	195	135.30	1,680	745
134.80	1,680	202	135.31	1,680	759
134.81	1,680	208	135.32	1,680	773
134.82	1,680	215	135.33	1,680	786
134.83	1,680	222	135.34	1,680	800
134.84	1,680	228	135.35	1,680	813
134.85	1,680	235	135.36	1,680	827
134.86	1,680	242	135.37	1,680	840
134.87	1,680	249	135.38	1,680	853
134.88	1,680	255	135.39	1,680	867
134.89	1,680	262	135.40	1,680	880
134.90	1,680	269	135.41	1,680	894
134.91	1,680	275	135.42	1,680	907
134.92	1,680	282	135.43	1,680	921
134.93	1,680	289	135.44	1,680	934
134.94	1,680	296	135.45	1,680	947
134.95	1,680	302	135.46	1,680	961
134.96	1,680	309	135.47	1,680	974
134.97	1,680	316	135.48	1,680	988
134.98	1,680	323	135.49	1,680	1,001
134.99	1,680	329	135.50	1,680	1,014
135.00	1,680	336	135.51	1,680	1,028

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA
Bohler Job Number: W211263
8/30/2023
1" Water Quality Volume to Flow Rate Calculation Sheet

Compute Water Quality Flow with the following Equation

WQF = (qu)(A)(WQV)

Site Plan Callout		qu (from 1" - qu Table)	Impervious Area (SF)	Ai (sq/mi)	WQV (inches)		WQF (cfs)
Wqi500	=	774	7318	0.000262	1	=	**0.20**

Water Quality Flow Rate = WQF
Water Quality Volume = WQV*
Unit peak discharge (csm/in) = qu**
Impervious Area in watershed (square miles) = Ai

*WQV is expressed in watershed inches (you must use 1.0-inches in all cases with this method and not 0.5-inches)
** calculate the qu based on the time of concentration (see 1" - qu Table)

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

1" qu Sheet

	Tc (hours)	qu (csm/in)
	0.01	835
	0.03	835
	0.05	831
	0.067	814
5 Minutes	0.083	795
	0.1	774
	0.116	755
	0.133	736
	0.15	717
10 minutes	0.167	700
	0.183	685
	0.2	669
	0.217	654
	0.233	641
15 minutes	0.25	628
	0.3	593
	0.333	572
	0.35	563
	0.4	536
	0.416	528
	0.5	491
	0.583	460
	0.6	454
	0.667	433
	0.7	424
	0.8	398
	0.9	376
	1	356
	1.1	339
	1.2	323
	1.3	309
	1.4	296
	1.5	285
	1.6	274
	1.7	264
	1.8	255
	1.9	247
	2	239
	2.1	232
	2.2	225
	2.3	219
	2.4	213
	2.5	207
	2.6	202

Tc (hours)	qu (csm/in)
2.7	197
2.8	192
2.9	187
3	183
3.1	179
3.2	175
3.3	171
3.4	168
3.5	164
3.6	161
3.7	158
3.8	155
3.9	152
4	149
4.1	146
4.2	144
4.3	141
4.4	139
4.5	137
4.6	134
4.7	132
4.8	130
4.9	128
5	126
5.1	124
5.2	122
5.3	120
5.4	119
5.5	117
5.6	115
5.7	114
5.8	112
5.9	111
6	109
6.1	108
6.2	106
6.3	105
6.4	104
6.5	102
6.6	101
6.7	100
6.8	99
6.9	98
7	96

Tc (hours)	qu (csm/in)
7.1	95
7.2	94
7.3	93
7.4	92
7.5	91
7.6	90
7.7	89
7.8	88
7.9	87
8	86
8.1	85
8.2	84
8.3	84
8.4	83
8.5	82
8.6	81
8.7	80
8.8	79
8.9	79
9	78
9.1	77
9.2	76
9.3	76
9.4	75
9.5	74
9.6	74
9.7	73
9.8	72
9.9	72
10	71

*Table of qu values for Ia/P Curve =0.034, listed by Tc, for Type III Storm Distribution

http://www.mass.gov/eea/docs/dep/water/resources/07v5/13wqvwqf.pdf

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA
Bohler Job Number: W211263
August 30, 2023
Revised January 3, 2024

Rational Pipe Sizing Calculations

Design Period Storm		**100**	**Year**	**Design Period Intensity***			**11.3**	**in/hr**								
LOCATION		IMPERVIOUS			OTHER			SUM	Tc	I	Q	D	S	Matieral	n	Q Full	V Full
FROM	TO	A	C	CA	A	C	CA	CA	(min)	(in/hr)	(cfs)	(in)	(ft/ft)			(cfs)	(fps)
EX CB	EX Out	HydroCAD 100-year storm @ R1 = 6.62 cfs										12	0.030	HDPE	0.012	**6.69**	8.51
AD01	DMH100	0.01	0.95	0.01	0.01	0.30	0.00	0.01	6	11.3	0.14	12	0.017	HDPE	0.012	5.00	6.37
CB100	DMH100	0.03	0.95	0.03	0.00	0.30	0.00	0.03	6	11.3	0.32	12	0.016	HDPE	0.012	4.94	6.29
CB101	DMH101	0.09	0.95	0.09	0.01	0.30	0.00	0.09	6	11.3	1.00	12	0.009	HDPE	0.012	3.58	4.56
CB200	DMH200	0.09	0.95	0.09	0.03	0.30	0.01	0.09	6	11.3	1.07	12	0.006	HDPE	0.012	2.99	3.81
CB201	DMH201	0.11	0.95	0.10	0.03	0.30	0.01	0.11	6	11.3	1.28	12	0.015	HDPE	0.012	4.68	5.96
OCS200	DMH204	HydroCAD 100-year storm (SWM2)									1.45	12	0.005	HDPE	0.012	2.73	3.47
DMH204	DMH203	Q from DMH204									1.45	12	0.005	HDPE	0.012	2.73	3.47
CB400	DMH400	0.16	0.95	0.15	0.05	0.30	0.02	0.17	6	11.3	1.89	12	0.007	HDPE	0.012	3.23	4.11
DS3	DMH400	0.21	0.95	0.20	0.00	0.30	0.00	0.20	6	11.3	2.25	12	0.009	HDPE	0.012	3.66	4.66
DMH400	DMH401	0.37	0.95	0.35	0.05	0.30	0.02	0.37	6	11.3	4.14	15	0.005	HDPE	0.012	4.95	4.03
CB401	DMH401	0.11	0.95	0.10	0.01	0.30	0.00	0.11	6	11.3	1.21	12	0.006	HDPE	0.012	3.09	3.93
OCS400	DMH203	HydroCAD 100-year storm (SWM4)									3.29	15	0.012	HDPE	0.012	7.50	6.12
DMH203	DMH202	HydroCAD 100-year storm (SWM2+SWM4)									4.74	15	0.007	HDPE	0.012	5.86	4.77
DMH202	DMH201	Q from DMH202									4.74	15	0.008	HDPE	0.012	6.30	5.13
CB300	DMH304	0.12	0.95	0.11	0.01	0.30	0.00	0.12	6	11.3	1.32	12	0.007	HDPE	0.012	3.11	3.96
DS4	DMH302	0.16	0.95	0.15	0.00	0.30	0.00	0.15	6	11.3	1.72	12	0.012	HDPE	0.012	4.23	5.38
CB301	SWM3	0.13	0.95	0.12	0.02	0.30	0.01	0.13	6	11.3	1.46	12	0.021	HDPE	0.012	5.59	7.12
DS1	DMH300	0.10	0.95	0.10	0.00	0.30	0.00	0.10	6	11.3	1.07	12	0.007	HDPE	0.012	3.11	3.96
DS2	DMH300	0.10	0.95	0.10	0.00	0.30	0.00	0.10	6	11.3	1.07	12	0.018	HDPE	0.012	5.18	6.59
DMH300	DMH301	0.20	0.95	0.19	0.00	0.30	0.00	0.19	6	11.3	2.15	12	0.009	HDPE	0.012	3.66	4.66
DMH301	DMH302	0.20	0.95	0.19	0.00	0.30	0.00	0.19	6	11.3	2.15	12	0.006	HDPE	0.012	2.99	3.81
OCS300	DMH201	HydroCAD 100-year storm (SWM3)									0.50	12	0.010	HDPE	0.012	3.86	4.91
DMH201	EX-CB	Q from DMH201									5.24	15	0.006	HDPE	0.012	5.42	4.42
WQi500	EX-CB	0.16	0.95	0.15	0.03	0.30	0.01	0.16	6	11.3	1.82	12	0.012	HDPE	0.012	4.19	5.34

*Rainfall intesity provided by NOAA Atlas 14, Volume 10, Version 2 on 8/30/23

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point

Smoothing	Yes
State	
Location	
Latitude	42.147 degrees North
Longitude	71.254 degrees West
Elevation	40 feet
Date/Time	Tue May 09 2023 14:13:45 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.55	0.72	0.90	1.14	**1yr**	0.78	1.07	1.32	1.67	2.12	2.71	2.98	**1yr**	2.40	2.87	3.34	3.98	4.68	**1yr**
2yr	0.36	0.55	0.68	0.90	1.13	1.43	**2yr**	0.98	1.32	1.65	2.07	2.60	3.26	3.62	**2yr**	2.88	3.48	3.98	4.74	5.37	**2yr**
5yr	0.43	0.67	0.84	1.13	1.44	1.83	**5yr**	1.24	1.65	2.12	2.66	3.31	4.13	4.62	**5yr**	3.65	4.45	5.09	6.02	6.71	**5yr**
10yr	0.49	0.77	0.97	1.32	1.72	2.20	**10yr**	1.48	1.95	2.56	3.21	3.99	4.94	5.58	**10yr**	4.37	5.36	6.13	7.21	7.95	**10yr**
25yr	0.58	0.93	1.18	1.64	2.18	2.82	**25yr**	1.88	2.45	3.29	4.12	5.11	6.27	7.14	**25yr**	5.55	6.87	7.85	9.15	9.94	**25yr**
50yr	0.67	1.08	1.39	1.95	2.62	3.41	**50yr**	2.26	2.90	3.98	4.98	6.15	7.52	8.62	**50yr**	6.66	8.29	9.46	10.97	11.78	**50yr**
100yr	0.78	1.26	1.63	2.30	3.14	4.11	**100yr**	2.71	3.45	4.81	6.02	7.42	9.03	10.41	**100yr**	7.99	10.01	11.42	13.16	13.96	**100yr**
200yr	0.90	1.47	1.91	2.73	3.77	4.96	**200yr**	3.26	4.09	5.82	7.28	8.95	10.86	12.59	**200yr**	9.61	12.10	13.79	15.78	16.56	**200yr**
500yr	1.11	1.82	2.37	3.44	4.82	6.37	**500yr**	4.16	5.13	7.48	9.36	11.47	13.87	16.18	**500yr**	12.28	15.55	17.69	20.09	20.75	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.61	0.75	0.90	**1yr**	0.65	0.88	1.04	1.40	1.85	2.37	2.65	**1yr**	2.09	2.55	2.95	3.51	4.02	**1yr**
2yr	0.34	0.53	0.65	0.89	1.09	1.29	**2yr**	0.94	1.26	1.48	1.96	2.53	3.15	3.47	**2yr**	2.79	3.34	3.80	4.54	5.16	**2yr**
5yr	0.39	0.60	0.75	1.02	1.30	1.55	**5yr**	1.12	1.52	1.76	2.31	2.95	3.77	4.19	**5yr**	3.34	4.03	4.55	5.67	6.07	**5yr**
10yr	0.43	0.67	0.83	1.16	1.50	1.77	**10yr**	1.29	1.73	2.00	2.61	3.31	4.29	4.86	**10yr**	3.79	4.67	5.20	6.16	6.86	**10yr**
25yr	0.50	0.76	0.95	1.35	1.78	2.09	**25yr**	1.54	2.05	2.38	3.08	3.85	5.10	5.92	**25yr**	4.52	5.69	6.20	7.36	8.06	**25yr**
50yr	0.55	0.84	1.05	1.51	2.03	2.38	**50yr**	1.75	2.32	2.70	3.48	4.33	5.89	6.89	**50yr**	5.21	6.63	7.10	8.43	9.11	**50yr**
100yr	0.62	0.93	1.16	1.68	2.31	2.70	**100yr**	1.99	2.64	3.07	3.94	4.87	6.79	8.05	**100yr**	6.01	7.74	8.14	9.68	10.27	**100yr**
200yr	0.68	1.02	1.29	1.87	2.61	3.08	**200yr**	2.26	3.01	3.49	4.47	5.47	7.87	9.43	**200yr**	6.97	9.07	9.30	11.13	11.61	**200yr**

NOAA Atlas 14, Volume 10, Version 3
Location name: Walpole, Massachusetts, USA*
Latitude: 42.1474°, Longitude: -71.2538°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.319 (0.243-0.411)	0.391 (0.297-0.503)	0.508 (0.385-0.656)	0.605 (0.456-0.788)	0.739 (0.543-1.01)	0.838 (0.607-1.18)	0.945 (0.670-1.38)	1.07 (0.717-1.60)	1.27 (0.818-1.96)	1.43 (0.906-2.26)
10-min	0.452 (0.344-0.582)	0.554 (0.421-0.713)	0.720 (0.546-0.931)	0.857 (0.646-1.11)	1.05 (0.770-1.43)	1.19 (0.859-1.67)	1.34 (0.949-1.96)	1.52 (1.01-2.26)	1.79 (1.16-2.77)	2.03 (1.28-3.20)
15-min	0.532 (0.405-0.684)	0.651 (0.495-0.839)	0.846 (0.642-1.09)	1.01 (0.761-1.31)	1.23 (0.906-1.69)	1.40 (1.01-1.96)	1.57 (1.12-2.31)	1.79 (1.19-2.66)	2.11 (1.36-3.26)	2.39 (1.51-3.76)
30-min	0.728 (0.554-0.936)	0.896 (0.681-1.15)	1.17 (0.887-1.51)	1.40 (1.05-1.82)	1.71 (1.26-2.34)	1.94 (1.41-2.73)	2.19 (1.55-3.21)	2.49 (1.67-3.71)	2.95 (1.90-4.55)	3.33 (2.11-5.25)
60-min	0.924 (0.703-1.19)	1.14 (0.867-1.47)	1.49 (1.13-1.93)	1.79 (1.35-2.32)	2.19 (1.61-3.00)	2.49 (1.80-3.49)	2.81 (1.99-4.12)	3.20 (2.14-4.76)	3.78 (2.44-5.83)	4.28 (2.71-6.74)
2-hr	1.17 (0.897-1.50)	1.47 (1.13-1.89)	1.97 (1.50-2.52)	2.38 (1.80-3.07)	2.94 (2.17-4.00)	3.36 (2.44-4.68)	3.81 (2.72-5.55)	4.36 (2.92-6.42)	5.20 (3.37-7.93)	5.91 (3.75-9.22)
3-hr	1.36 (1.04-1.73)	1.71 (1.31-2.18)	2.29 (1.75-2.93)	2.77 (2.11-3.57)	3.43 (2.55-4.65)	3.92 (2.87-5.45)	4.45 (3.19-6.46)	5.10 (3.43-7.48)	6.09 (3.95-9.25)	6.94 (4.41-10.7)
6-hr	1.77 (1.37-2.24)	2.21 (1.71-2.80)	2.93 (2.25-3.72)	3.52 (2.70-4.50)	4.34 (3.24-5.83)	4.95 (3.63-6.81)	5.60 (4.03-8.04)	6.40 (4.32-9.28)	7.60 (4.95-11.4)	8.63 (5.50-13.2)
12-hr	2.31 (1.80-2.90)	2.82 (2.19-3.55)	3.67 (2.84-4.62)	4.36 (3.36-5.54)	5.32 (3.99-7.08)	6.04 (4.45-8.22)	6.81 (4.90-9.64)	7.72 (5.23-11.1)	9.09 (5.94-13.5)	10.2 (6.56-15.5)
24-hr	2.83 (2.21-3.53)	3.46 (2.71-4.32)	4.49 (3.50-5.63)	5.35 (4.15-6.74)	6.53 (4.93-8.63)	7.41 (5.49-10.0)	8.35 (6.05-11.8)	9.50 (6.46-13.5)	11.2 (7.37-16.5)	12.7 (8.17-19.1)
2-day	3.25 (2.56-4.02)	4.05 (3.19-5.03)	5.37 (4.21-6.68)	6.46 (5.04-8.08)	7.96 (6.05-10.5)	9.07 (6.78-12.2)	10.3 (7.53-14.5)	11.8 (8.06-16.6)	14.2 (9.35-20.7)	16.3 (10.5-24.2)
3-day	3.56 (2.81-4.39)	4.43 (3.50-5.47)	5.86 (4.61-7.26)	7.04 (5.51-8.77)	8.67 (6.61-11.4)	9.86 (7.40-13.2)	11.2 (8.22-15.7)	12.9 (8.79-18.0)	15.5 (10.2-22.4)	17.8 (11.5-26.2)
4-day	3.85 (3.05-4.73)	4.75 (3.76-5.85)	6.22 (4.91-7.69)	7.44 (5.84-9.24)	9.13 (6.98-11.9)	10.4 (7.79-13.8)	11.7 (8.64-16.3)	13.5 (9.22-18.8)	16.2 (10.7-23.3)	18.6 (12.0-27.2)
7-day	4.64 (3.69-5.67)	5.58 (4.43-6.83)	7.11 (5.64-8.74)	8.39 (6.61-10.4)	10.1 (7.78-13.1)	11.4 (8.62-15.1)	12.8 (9.47-17.7)	14.6 (10.1-20.2)	17.4 (11.5-24.8)	19.8 (12.9-28.8)
10-day	5.37 (4.29-6.55)	6.34 (5.06-7.73)	7.91 (6.29-9.68)	9.22 (7.29-11.3)	11.0 (8.47-14.2)	12.3 (9.32-16.2)	13.8 (10.2-18.8)	15.6 (10.7-21.4)	18.3 (12.1-25.9)	20.7 (13.4-29.8)
20-day	7.52 (6.05-9.10)	8.55 (6.87-10.4)	10.2 (8.20-12.4)	11.6 (9.26-14.2)	13.6 (10.5-17.2)	15.0 (11.3-19.4)	16.5 (12.1-22.0)	18.3 (12.7-24.8)	20.7 (13.8-29.0)	22.7 (14.8-32.4)
30-day	9.28 (7.49-11.2)	10.4 (8.35-12.5)	12.1 (9.75-14.7)	13.6 (10.9-16.6)	15.6 (12.1-19.6)	17.2 (13.0-21.9)	18.8 (13.7-24.6)	20.4 (14.2-27.5)	22.6 (15.1-31.4)	24.3 (15.9-34.4)
45-day	11.5 (9.28-13.8)	12.6 (10.2-15.1)	14.5 (11.7-17.4)	16.0 (12.8-19.4)	18.1 (14.0-22.6)	19.8 (14.9-25.0)	21.4 (15.6-27.7)	23.0 (16.1-30.7)	24.9 (16.7-34.3)	26.3 (17.2-37.0)
60-day	13.3 (10.8-15.9)	14.5 (11.7-17.3)	16.4 (13.2-19.7)	18.0 (14.5-21.7)	20.2 (15.6-25.0)	21.9 (16.6-27.5)	23.6 (17.1-30.3)	25.1 (17.6-33.4)	26.8 (18.0-36.8)	28.0 (18.3-39.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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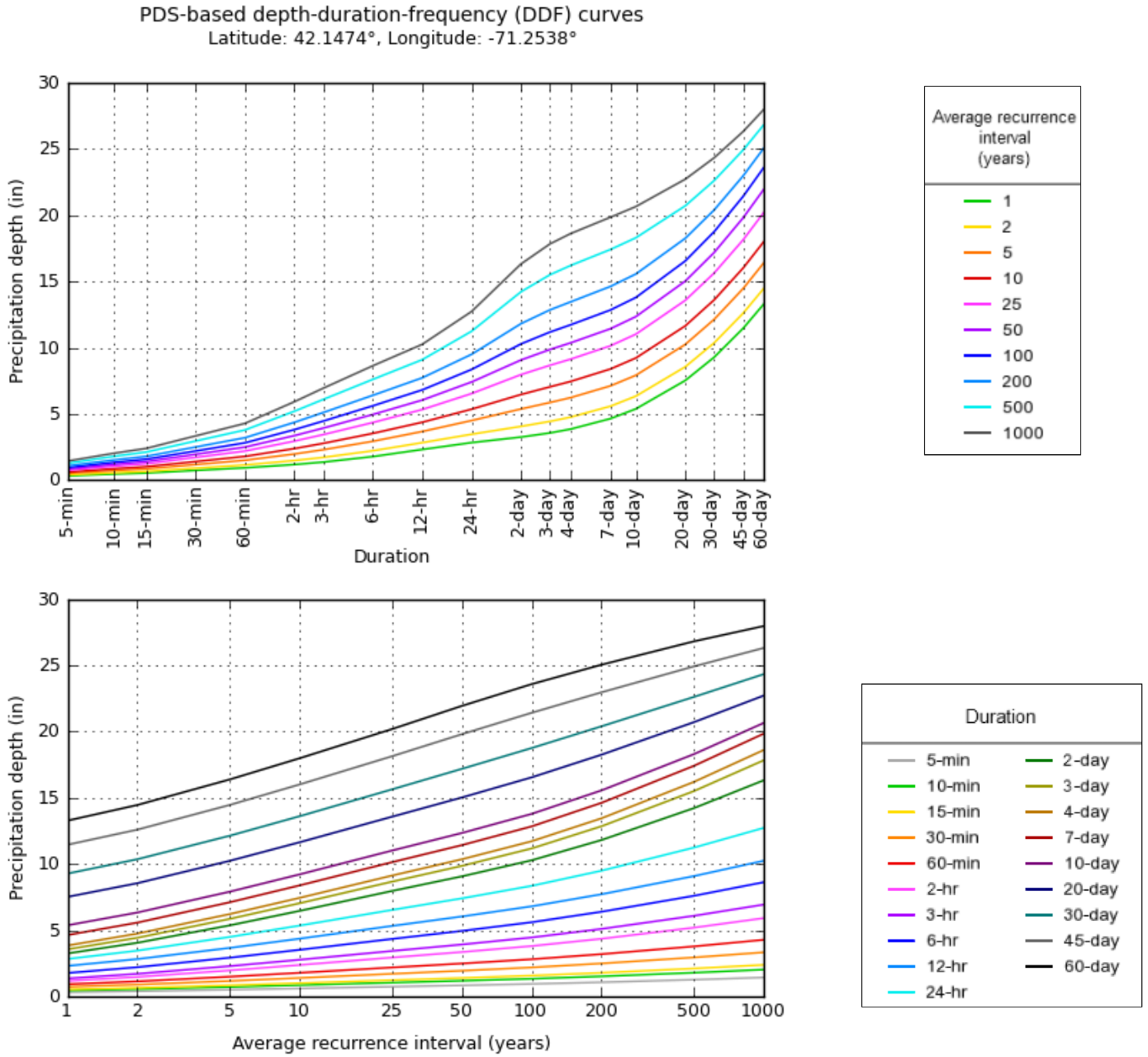
PF graphical



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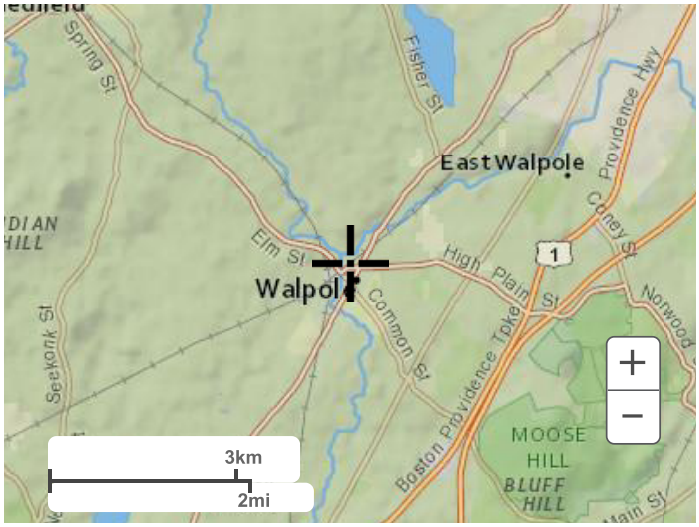
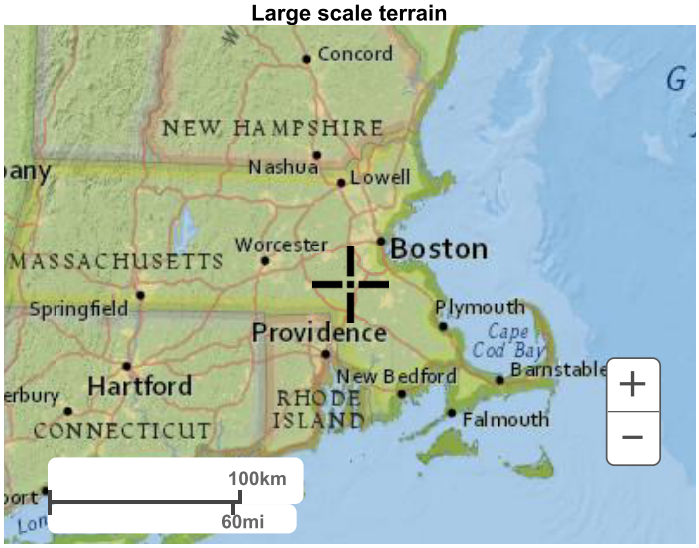
Maps & aerials

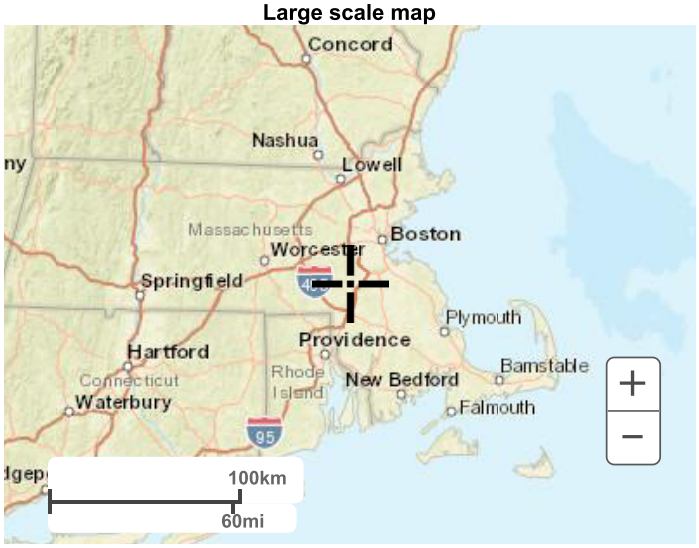
Small scale terrain



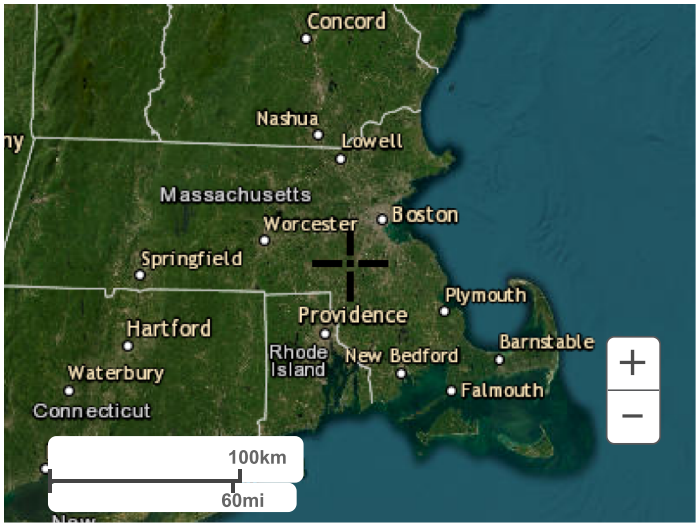
Large scale terrain



Large scale map



Large scale aerial



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Disclaimer

NOAA Atlas 14, Volume 10, Version 3
Location name: Walpole, Massachusetts, USA*
Latitude: 42.1474°, Longitude: -71.2538°
Elevation: 138 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.83** (2.92-4.93)	**4.69** (3.56-6.04)	**6.10** (4.62-7.87)	**7.26** (5.47-9.46)	**8.87** (6.52-12.1)	**10.1** (7.28-14.1)	**11.3** (8.04-16.6)	**12.9** (8.60-19.2)	**15.2** (9.82-23.5)	**17.2** (10.9-27.1)
10-min	**2.71** (2.06-3.49)	**3.32** (2.53-4.28)	**4.32** (3.28-5.59)	**5.14** (3.88-6.68)	**6.28** (4.62-8.60)	**7.12** (5.15-9.99)	**8.03** (5.69-11.8)	**9.12** (6.09-13.6)	**10.8** (6.95-16.6)	**12.2** (7.70-19.2)
15-min	**2.13** (1.62-2.74)	**2.60** (1.98-3.36)	**3.38** (2.57-4.38)	**4.03** (3.04-5.24)	**4.92** (3.62-6.74)	**5.58** (4.04-7.83)	**6.30** (4.46-9.23)	**7.15** (4.78-10.6)	**8.44** (5.45-13.0)	**9.54** (6.04-15.0)
30-min	**1.46** (1.11-1.87)	**1.79** (1.36-2.31)	**2.34** (1.77-3.02)	**2.79** (2.11-3.63)	**3.42** (2.52-4.68)	**3.88** (2.81-5.45)	**4.38** (3.11-6.43)	**4.98** (3.33-7.42)	**5.89** (3.80-9.09)	**6.66** (4.22-10.5)
60-min	**0.924** (0.703-1.19)	**1.14** (0.867-1.47)	**1.49** (1.13-1.93)	**1.79** (1.35-2.32)	**2.19** (1.61-3.00)	**2.49** (1.80-3.49)	**2.81** (1.99-4.12)	**3.20** (2.14-4.76)	**3.78** (2.44-5.83)	**4.28** (2.71-6.74)
2-hr	**0.586** (0.448-0.748)	**0.736** (0.563-0.942)	**0.983** (0.749-1.26)	**1.19** (0.901-1.53)	**1.47** (1.09-2.00)	**1.68** (1.22-2.34)	**1.90** (1.36-2.78)	**2.18** (1.46-3.21)	**2.60** (1.68-3.97)	**2.96** (1.88-4.61)
3-hr	**0.451** (0.347-0.575)	**0.569** (0.437-0.726)	**0.762** (0.583-0.975)	**0.923** (0.702-1.19)	**1.14** (0.849-1.55)	**1.31** (0.954-1.81)	**1.48** (1.06-2.15)	**1.70** (1.14-2.49)	**2.03** (1.32-3.08)	**2.31** (1.47-3.58)
6-hr	**0.295** (0.228-0.373)	**0.368** (0.284-0.467)	**0.488** (0.376-0.620)	**0.588** (0.450-0.751)	**0.724** (0.540-0.973)	**0.826** (0.606-1.14)	**0.935** (0.672-1.34)	**1.07** (0.720-1.55)	**1.27** (0.826-1.91)	**1.44** (0.919-2.21)
12-hr	**0.191** (0.149-0.240)	**0.234** (0.182-0.294)	**0.304** (0.235-0.383)	**0.362** (0.278-0.459)	**0.441** (0.331-0.587)	**0.501** (0.369-0.682)	**0.564** (0.406-0.800)	**0.640** (0.434-0.919)	**0.754** (0.493-1.12)	**0.850** (0.544-1.29)
24-hr	**0.117** (0.092-0.146)	**0.144** (0.112-0.180)	**0.187** (0.145-0.234)	**0.223** (0.172-0.280)	**0.272** (0.205-0.359)	**0.308** (0.228-0.417)	**0.348** (0.252-0.489)	**0.395** (0.269-0.562)	**0.468** (0.307-0.688)	**0.530** (0.340-0.794)
2-day	**0.067** (0.053-0.083)	**0.084** (0.066-0.104)	**0.111** (0.087-0.139)	**0.134** (0.104-0.168)	**0.165** (0.126-0.218)	**0.188** (0.141-0.254)	**0.214** (0.156-0.301)	**0.246** (0.167-0.346)	**0.296** (0.194-0.430)	**0.339** (0.218-0.503)
3-day	**0.049** (0.039-0.060)	**0.061** (0.048-0.076)	**0.081** (0.063-0.100)	**0.097** (0.076-0.121)	**0.120** (0.091-0.157)	**0.136** (0.102-0.183)	**0.155** (0.114-0.217)	**0.178** (0.122-0.249)	**0.215** (0.141-0.311)	**0.247** (0.159-0.364)
4-day	**0.040** (0.031-0.049)	**0.049** (0.039-0.060)	**0.064** (0.051-0.080)	**0.077** (0.060-0.096)	**0.095** (0.072-0.124)	**0.107** (0.081-0.144)	**0.122** (0.089-0.170)	**0.140** (0.096-0.195)	**0.168** (0.111-0.242)	**0.193** (0.125-0.283)
7-day	**0.027** (0.021-0.033)	**0.033** (0.026-0.040)	**0.042** (0.033-0.051)	**0.049** (0.039-0.061)	**0.060** (0.046-0.078)	**0.068** (0.051-0.089)	**0.076** (0.056-0.105)	**0.087** (0.059-0.120)	**0.103** (0.068-0.147)	**0.118** (0.076-0.171)
10-day	**0.022** (0.017-0.027)	**0.026** (0.021-0.032)	**0.032** (0.026-0.040)	**0.038** (0.030-0.047)	**0.045** (0.035-0.058)	**0.051** (0.038-0.067)	**0.057** (0.042-0.078)	**0.064** (0.044-0.089)	**0.076** (0.050-0.107)	**0.086** (0.055-0.124)
20-day	**0.015** (0.012-0.018)	**0.017** (0.014-0.021)	**0.021** (0.017-0.025)	**0.024** (0.019-0.029)	**0.028** (0.021-0.035)	**0.031** (0.023-0.040)	**0.034** (0.025-0.045)	**0.038** (0.026-0.051)	**0.043** (0.028-0.060)	**0.047** (0.030-0.067)
30-day	**0.012** (0.010-0.015)	**0.014** (0.011-0.017)	**0.016** (0.013-0.020)	**0.018** (0.015-0.022)	**0.021** (0.016-0.027)	**0.023** (0.017-0.030)	**0.026** (0.018-0.034)	**0.028** (0.019-0.038)	**0.031** (0.021-0.043)	**0.033** (0.022-0.047)
45-day	**0.010** (0.008-0.012)	**0.011** (0.009-0.014)	**0.013** (0.010-0.016)	**0.014** (0.011-0.017)	**0.016** (0.012-0.020)	**0.018** (0.013-0.023)	**0.019** (0.014-0.025)	**0.021** (0.014-0.028)	**0.023** (0.015-0.031)	**0.024** (0.015-0.034)
60-day	**0.009** (0.007-0.011)	**0.010** (0.008-0.012)	**0.011** (0.009-0.013)	**0.012** (0.010-0.015)	**0.014** (0.010-0.017)	**0.015** (0.011-0.019)	**0.016** (0.011-0.021)	**0.017** (0.012-0.023)	**0.018** (0.012-0.025)	**0.019** (0.012-0.027)

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

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

Please refer to NOAA Atlas 14 document for more information.

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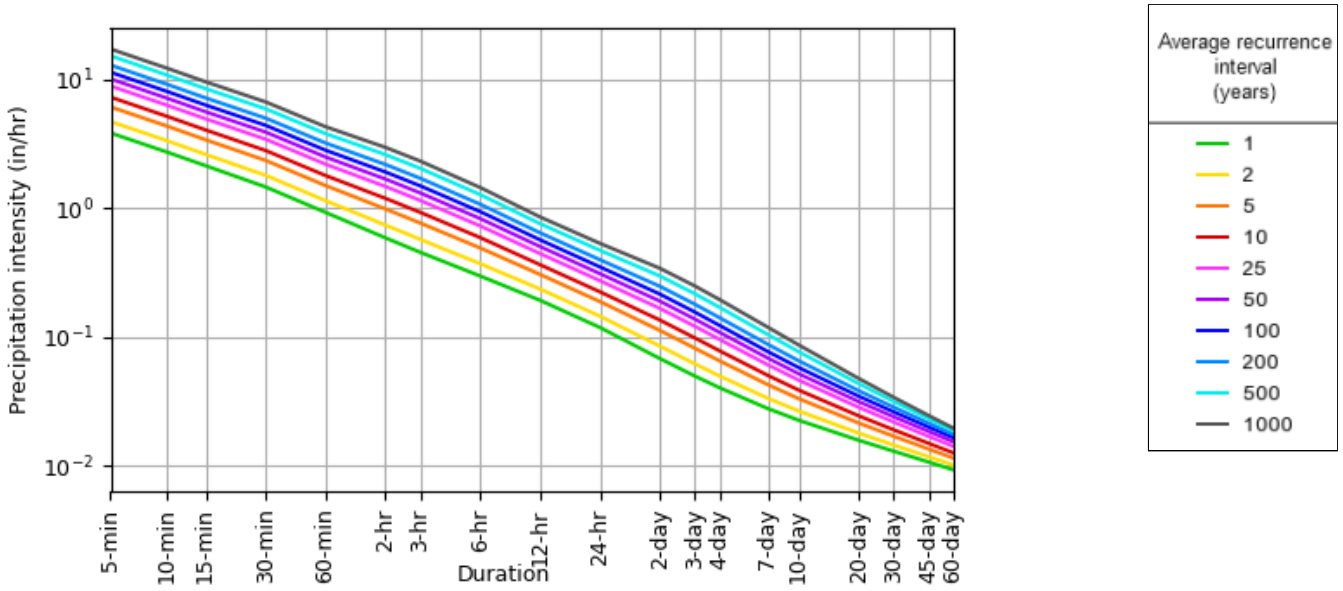
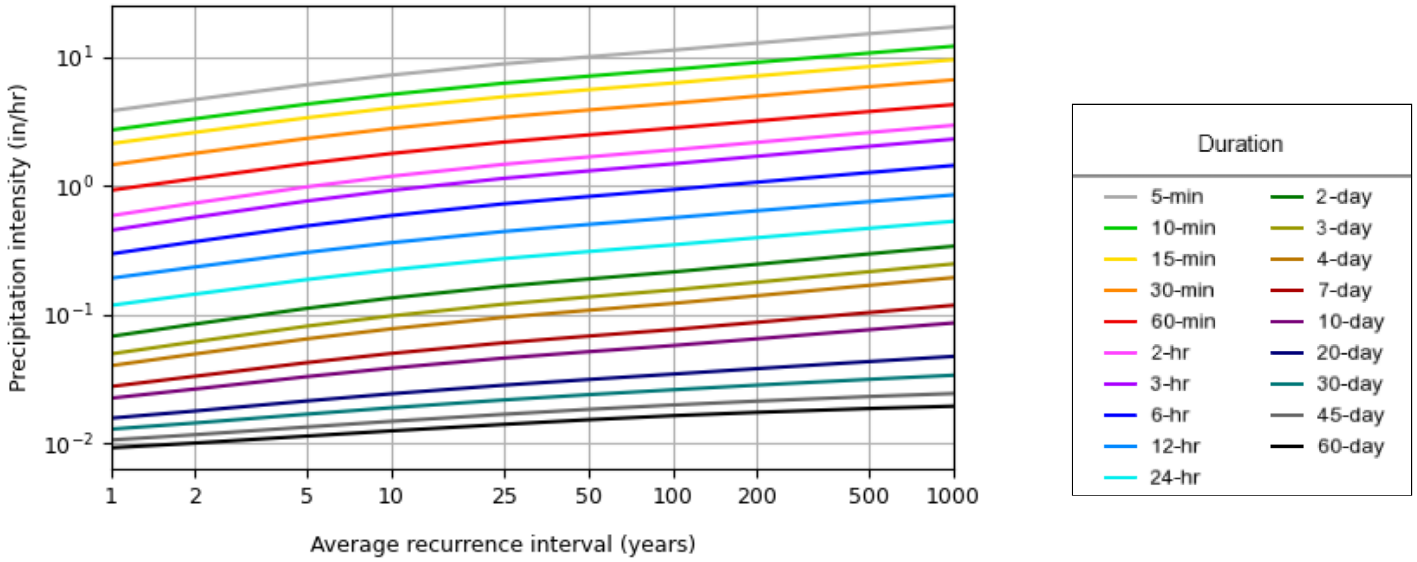
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 42.1474°, Longitude: -71.2538°





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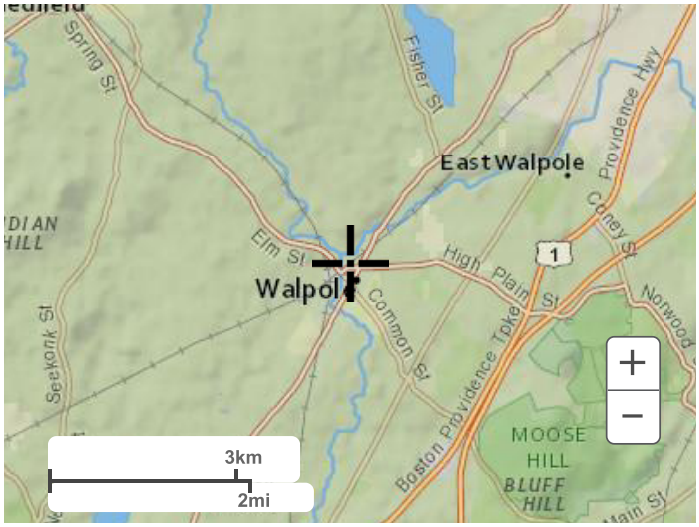
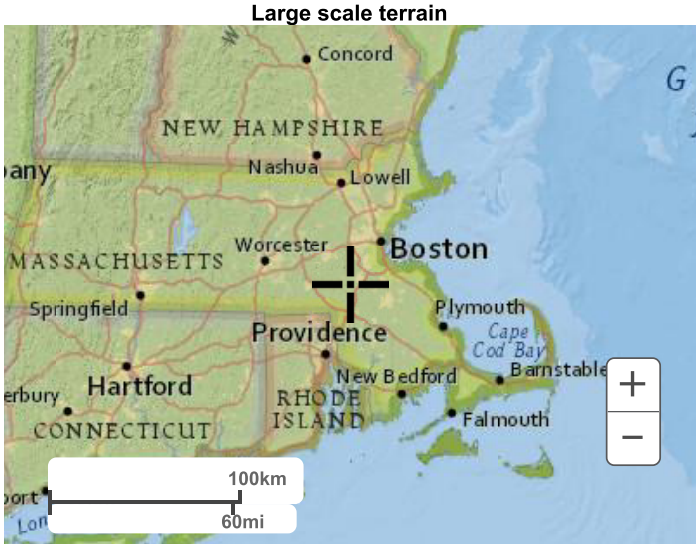
Maps & aerials

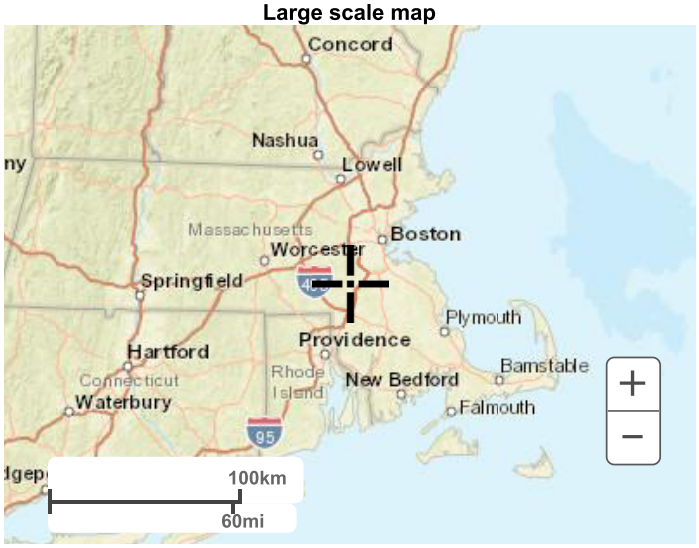
Small scale terrain



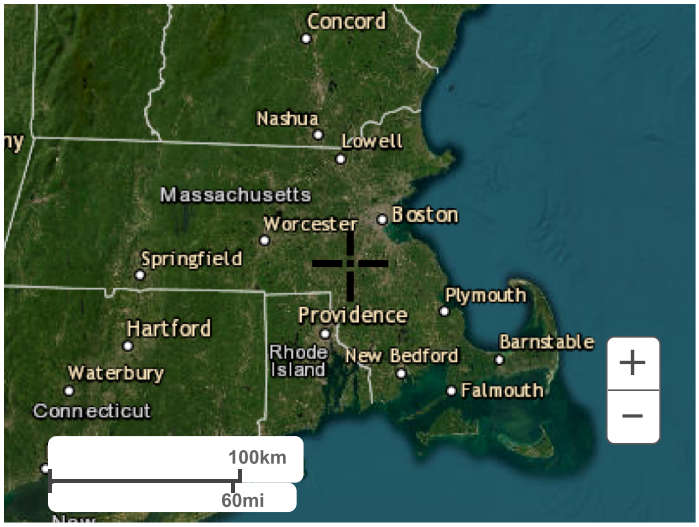
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

GROUNDWATER MOUNDING CALCULATIONS

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA

BE Project No: W211263

Methodology

SWM# 1 and SWM#4 for this project are designed with less than 4 feet of groundwater separation. They are also designed to attenuate the 10-year storm event or larger. Therefore, groundwater mounding calculations are required according to MA DEP Stormwater Management Guidelines. The purpose of the calculations is to ensure that the mound will not prevent the full draining of the basin.

The groundwater mounding analysis was performed by a proprietary program using the Hantush Method with Glover's Solution. Input parameters are site specific and determined based on existing and proposed conditions. The required input parameters are the following: application rate; duration of application; fillable porosity; hydraulic conductivity; initial saturated thickness; length of application area; width of application area; and distance to closest resource area (constant head boundary).

Calculations using the Hantush Method are considered conservative due to the fact that the unsaturated soil zone is not incorporated. In practice, this zone will have a significant positive effect on reducing the groundwater mounding under an infiltration basin by allowing horizontal migration. A minimum of a 2-foot unsaturated zone has been provided in each basin and the mounding in each basin (Δh) falls below the lowest outlet in each basin ensuring that stormwater will not bypass the basin floor and discharge though the outlet device. Please refer to the table below:

Stormwater Basin	Groundwater Elev.	Groundwater Mounding Δh (FT)	Basin Bottom Elev.	Lowest Outlet Elev.
SWM#1	**133.0±**	**0.243 (Elev. 133.243)**	**135.00**	**135.60**
SWM#4	**131.2±**	**0.061 (Elev. 131.261)**	**134.50**	**135.45**

The infiltration rate used is converted from the Rawls value selected for an exfiltration rate in HydroCAD. The duration of application used for the analysis is the 24-hour based duration of the storm event. The fillable porosity, hydraulic conductivity, and initial saturated thickness used for the analysis are based on the existing soil conditions.

Results

Based on the criteria mentioned above, the analysis (see attached) indicates the mound in each stormwater system falls within the unsaturated zone below the bottom of the system. Given these results, we feel as though the basins will recharge the stormwater volume as required.

SWM#1
W211263
1/3/24

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

	inch/hour	**feet/day**
	0.67	1.33
	2.00	4.00
hours		**days**
	36	1.50

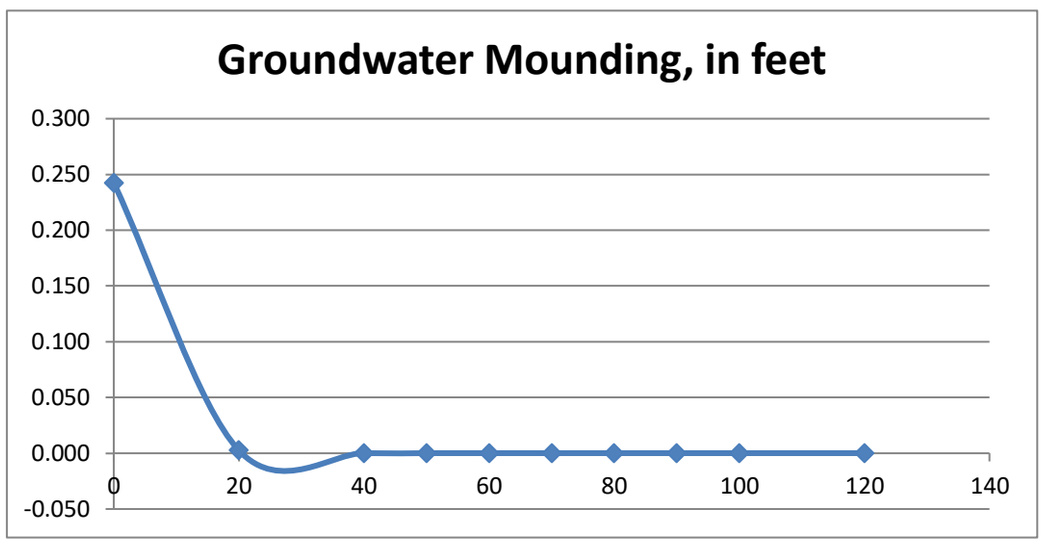
In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values		
16.5400	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
165.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
16.050	**x**	**1/2 length of basin (x direction, in feet)**
10.250	**y**	**1/2 width of basin (y direction, in feet)**
0.002	**t**	**duration of infiltration period (days)**
1.000	**hi(0)**	**initial thickness of saturated zone (feet)**

1.243	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.243	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.243	**0**
0.003	**20**
0.000	**40**
0.000	**50**
0.000	**60**
0.000	**70**
0.000	**80**
0.000	**90**
0.000	**100**
0.000	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

SWM#4
W211263
1/3/24

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
16.5400	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
165.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
40.970	**x**	**1/2 length of basin (x direction, in feet)**
10.250	**y**	**1/2 width of basin (y direction, in feet)**
0.001	**t**	**duration of infiltration period (days)**
1.500	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

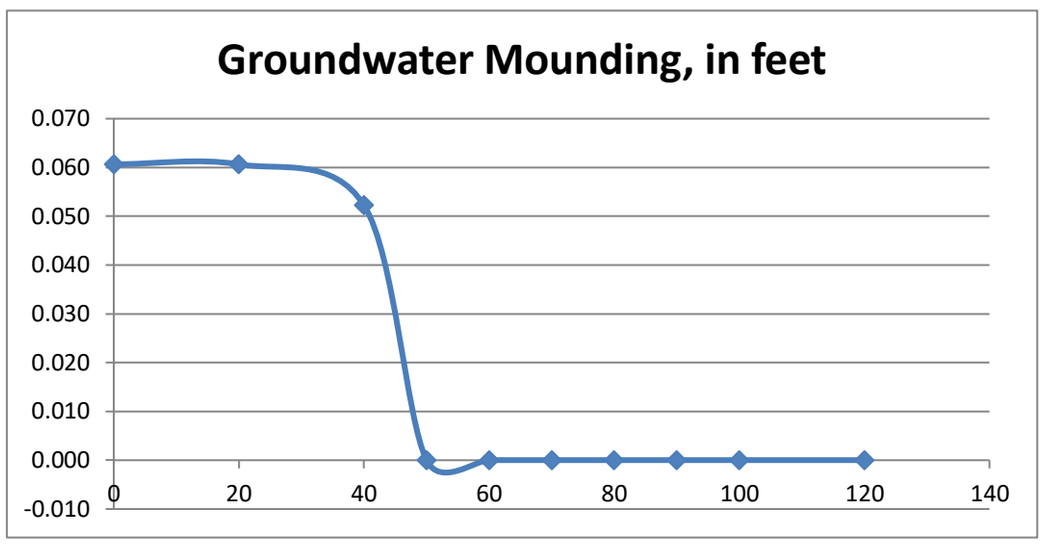
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

1.561	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.061	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.061	0
0.061	20
0.052	40
0.000	50
0.000	60
0.000	70
0.000	80
0.000	90
0.000	100
0.000	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

APPENDIX G: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

KIG/Silverstrand Walpole, LLC
Attn: Sean Henry
257 Hillside Avenue
Needham, MA 02492
Phone: 781-957-6102

RESPONSIBLE PARTY POST CONSTRUCTION:

KIG/Silverstrand Walpole, LLC
Attn: Sean Henry
257 Hillside Avenue
Needham, MA 02492
Phone: 781-957-6102

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and on-site driveways: Sweep at least two (2) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off site in accordance with MADEP and other applicable requirements.

2. Catch basins, yard drains, trench drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) times per year or whenever the depth of deposits is greater than or equal to one

half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off site in accordance with MADEP and other applicable requirements.

3. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).

4. 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 rip-rap shall be promptly repaired in the case of erosion. Sediment collecting in the bottom of the basin shall be inspected twice annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the basin. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

All components of the stormwater system will be accessible by the owner or their assignee.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA

RESPONSIBLE PARTY:

KIG/Silverstrand Walpole, LLC
Attn: Sean Henry
257 Hillside Avenue
Needham, MA 02492
Phone: 781-957-6102

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:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM			
Proposed Multi-Family Development ***981, 989 & 1015 East Street – Walpole, MA***			
Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

KIG/Silverstrand Walpole, LLC
Attn: Sean Henry
257 Hillside Avenue
Needham, MA 02492
Phone: 781-957-6102

RESPONSIBLE PARTY POST CONSTRUCTION:

KIG/Silverstrand Walpole, LLC
Attn: Sean Henry
257 Hillside Avenue
Needham, MA 02492
Phone: 781-957-6102

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 driveways 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.
- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams or other water bodies).
- 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.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify the Walpole Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Walpole Board of Health at (508) 660-7321 and the Walpole Conservation Commission at (508) 660-7268.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town of Walpole Board of Health and Conservation Commission.

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill:_____
_____

Measures Taken to Clean up Spill:_____
_____

Type of equipment: _____ Make: _____ Size:_____

License or S/N: _____

Location and Method of Disposal_____
_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring:_____
_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCYPHONE: (888) 372-7341

StormTech®

Detention • Retention • Water Quality

A division of ADS

Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

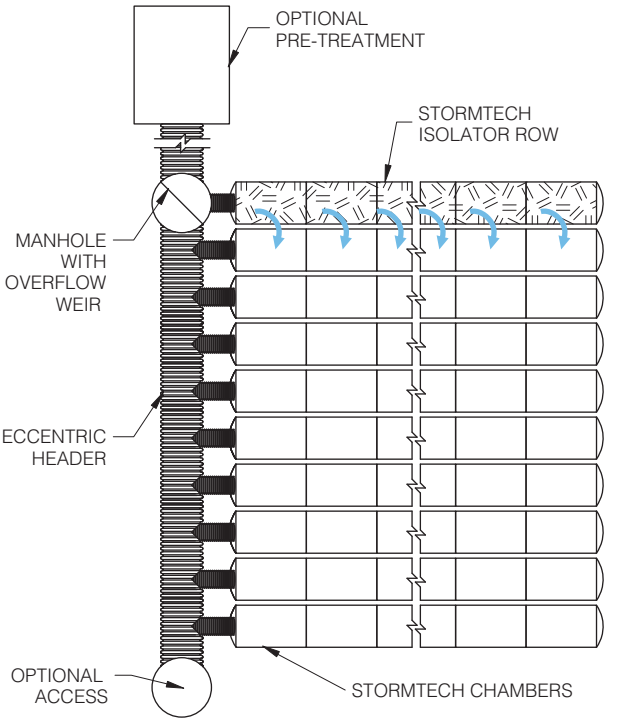
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

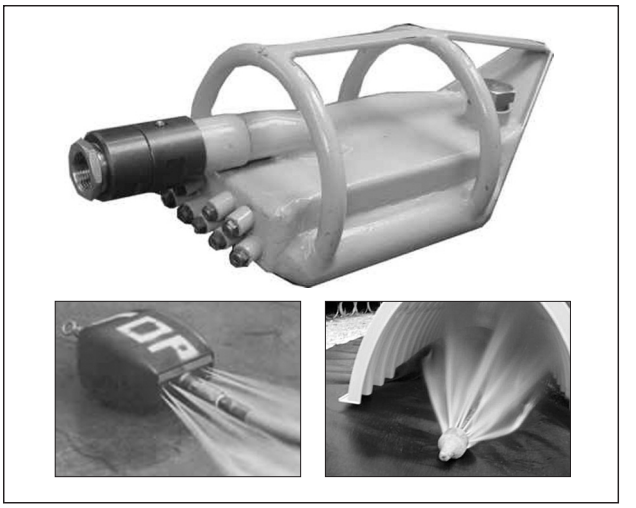
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

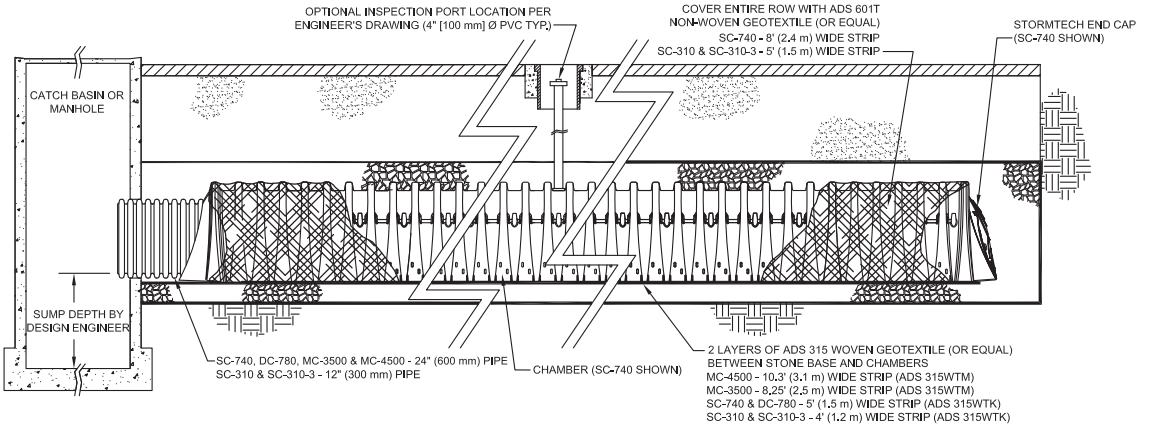
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

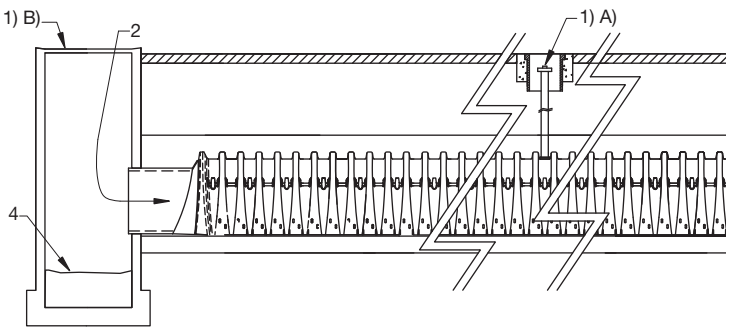
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry

2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.