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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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 Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at one (1) "design point" where stormwater runoff currently drains to under existing conditions. This design point is described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates and volumes for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** 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	5.17	4.14	**-1.03**	8.36	7.45	**-0.91**	10.36	9.72	**-0.64**	14.58	14.12	**-0.46**

**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	0.440	0.216	**-0.224**	0.729	0.455	**-0.274**	0.912	0.614	**-0.298**	1.304	0.967	**-0.337**

**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.

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 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. Estimated seasonal high ground water (ESHGW) was observed at depths ranging from 5.5 to 8.5 feet below grade (fbg). Based upon NRCS mapping and soils discovered during onsite testing, the site is characterized as Hydrologic Soil Group (HSG) 'C', with infiltration rates of 2.41 in/hr at test pits (TP) #2-6 and 1.02 in/hr at TP#1. 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 1.9± acres of land, designated as sub-catchments "E1", "E2a", and "E2b". 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)
E1	1.3±	Rooftops, pavement, grass	97	6.0
E2a	0.1±	Pavement, grass	97	6.0
E2b	0.5±	Rooftops, pavement, gravel, grass, woods	82	13.6

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 the infiltration systems will discharge 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.

Pipes and associated outlets have been designed for the 100-year storm using the Rational Method.

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 seven (7) 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 1.9± acres of land, designated as watersheds "P1" through "P6b". Refer to Table 3.1 below for additional detail.

Table 3.1: Proposed Sub-catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
P1	0.09±	Pavement, grass	84	6.0	DP#1
P2	0.13±	Pavement, grass	97	6.0	SWM#1 / DP#1
P3	0.47±	Rooftop, pavement, grass	95	6.0	SWM#2 / DP#1
P4	0.45±	Rooftop, pavement, grass	96	6.0	SWM#3 / DP#1
P5	0.20±	Pavement, grass	94	6.0	DP#1
P6a	0.36±	Pavement, grass	94	6.0	SWM#4 / DP#1
P6b	0.20±	Rooftop	98	6.0	SWM#4 / 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 D** 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 117 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed infiltration systems are designed to remove sediment from the “first flush” of rainfall and have been sized to retain the first 0.5-inch of runoff from all post-construction impervious surfaces, including the building roof. The four (4) systems

will provide a total of 3,298 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 in August 2023, separation from the bottom of Stormwater Management areas (SWM) #2-4 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 to ESHGW is between 2-4 feet; therefore, exfiltration has been excluded from the hydrologic model and a groundwater mounding analysis has not been provided.

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 MassDEP Stormwater Standards, the project is required to treat the 0.5-inch water quality volume, which is equal to 3,036 cubic feet. The proposed infiltration systems provide a total of 3,298 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.

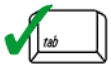
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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.

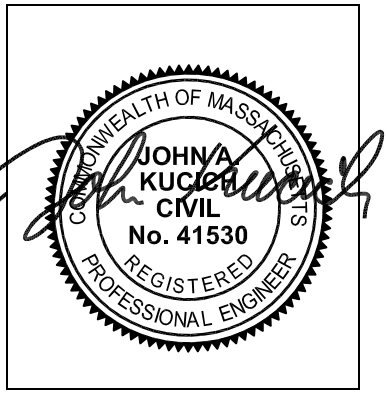
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



8/30/23

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

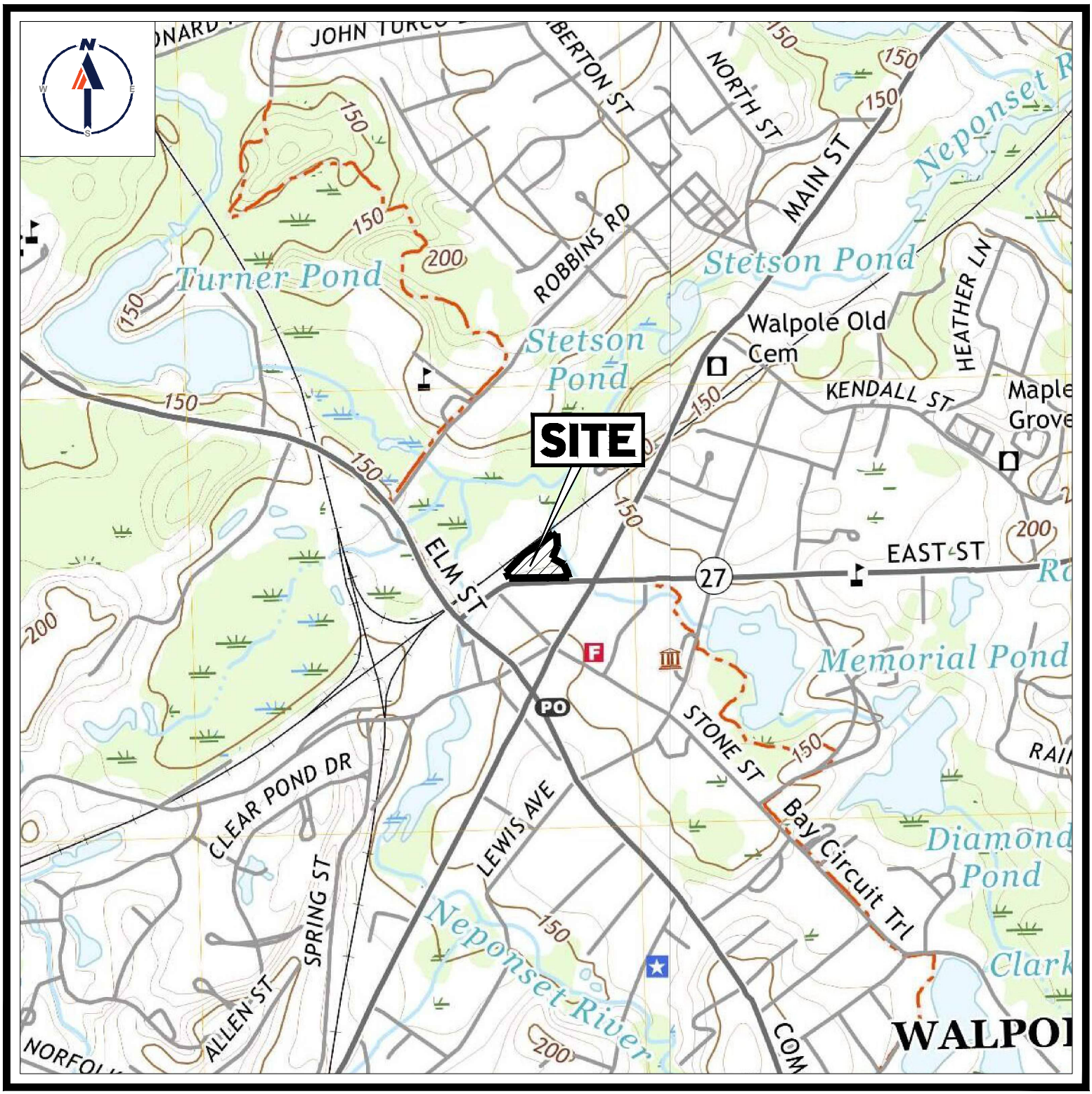
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ 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

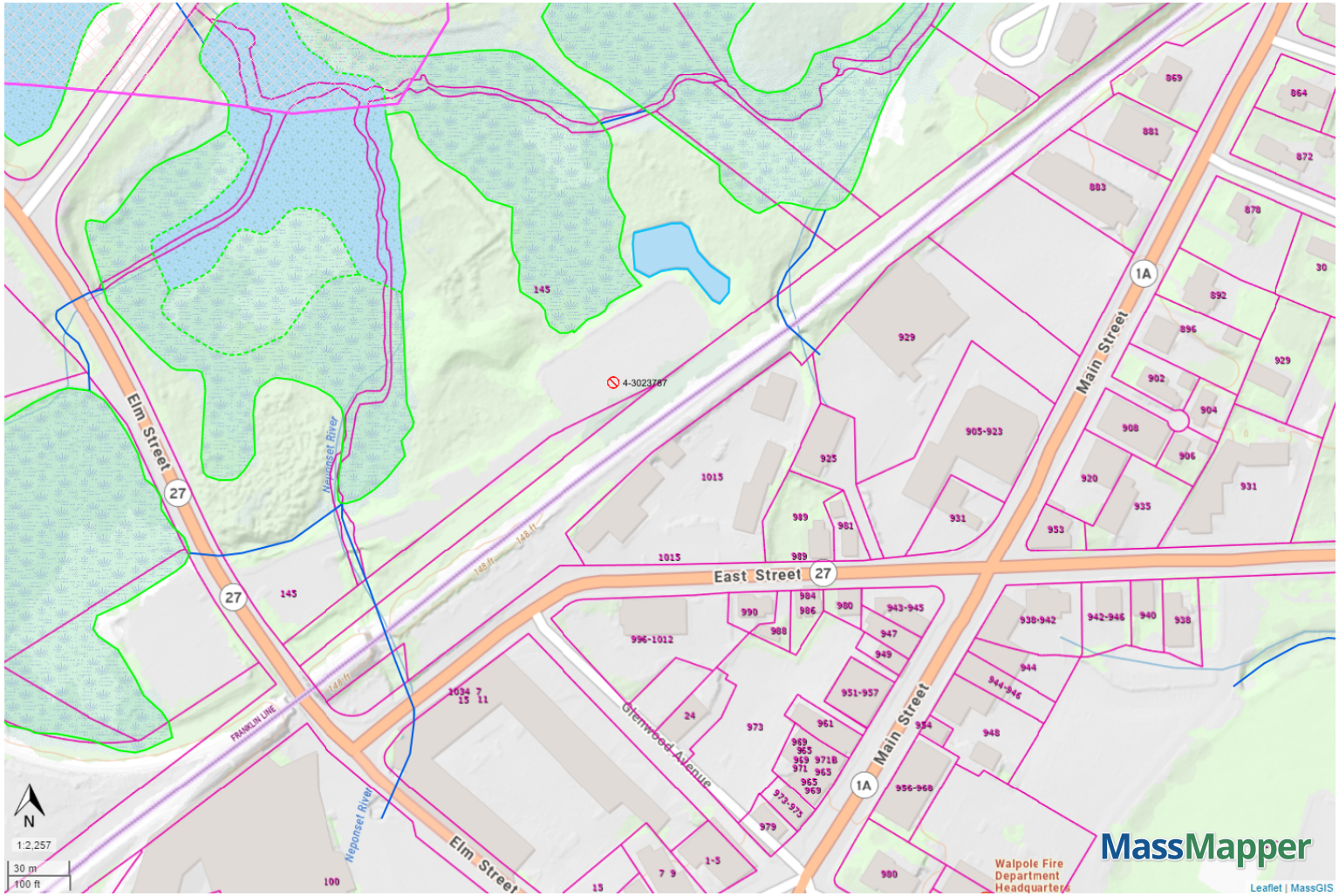
- *USGS MAP*
- *FEMA FIRMETTE*
- *WALPOLE GIS MAP*



USGS MAP

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

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

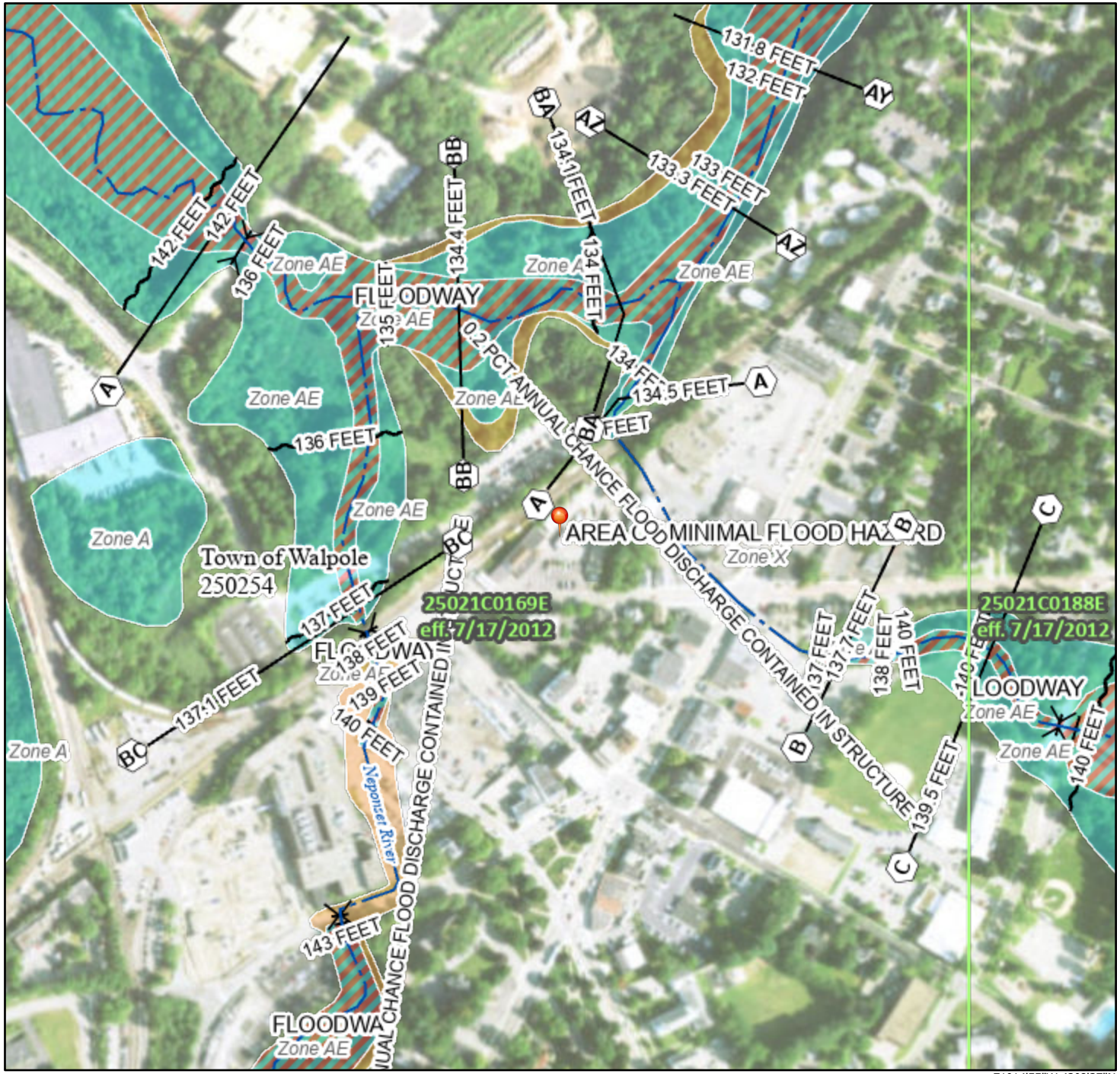
Potential Vernal Pools


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

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.

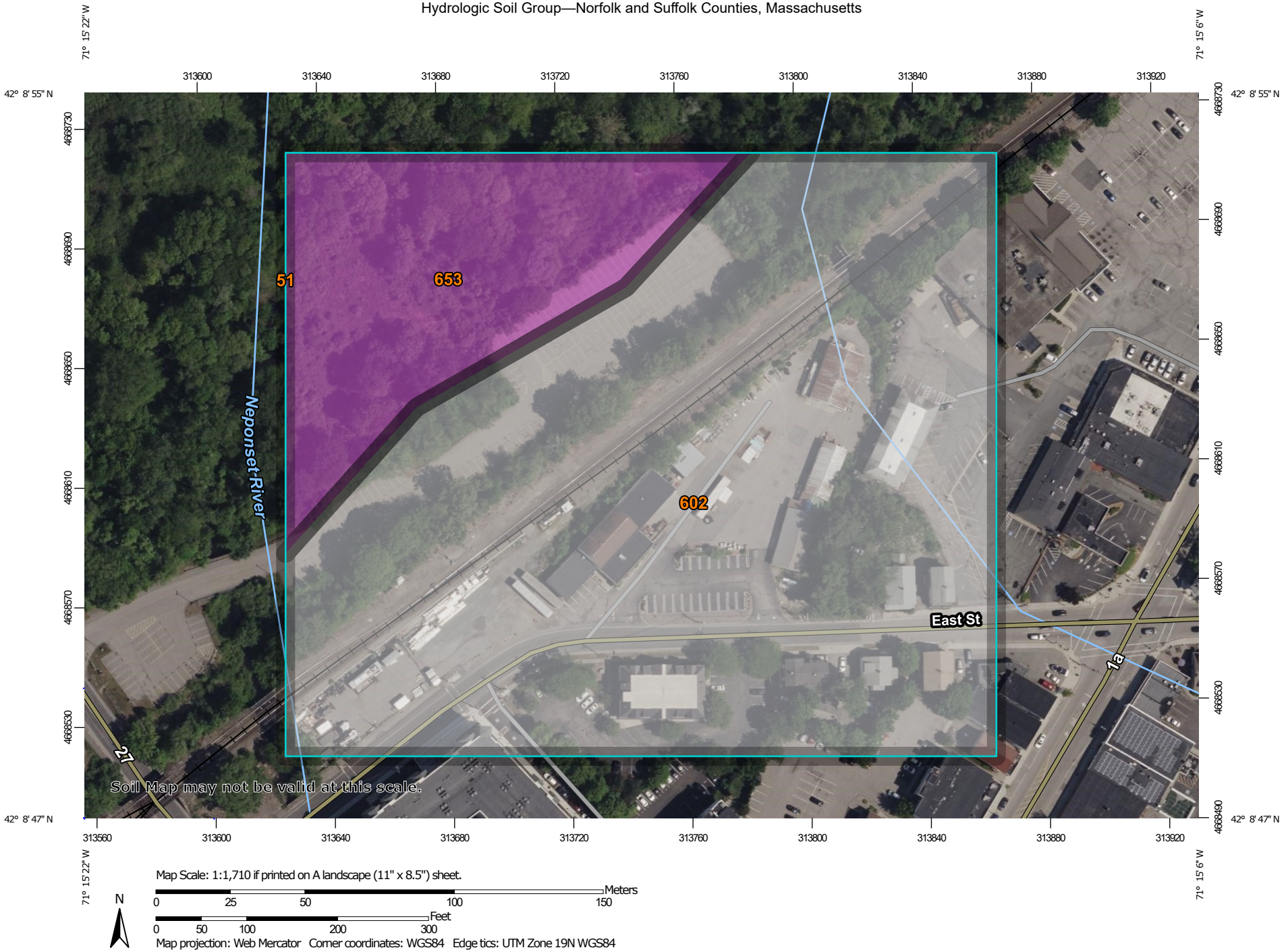
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

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.

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"

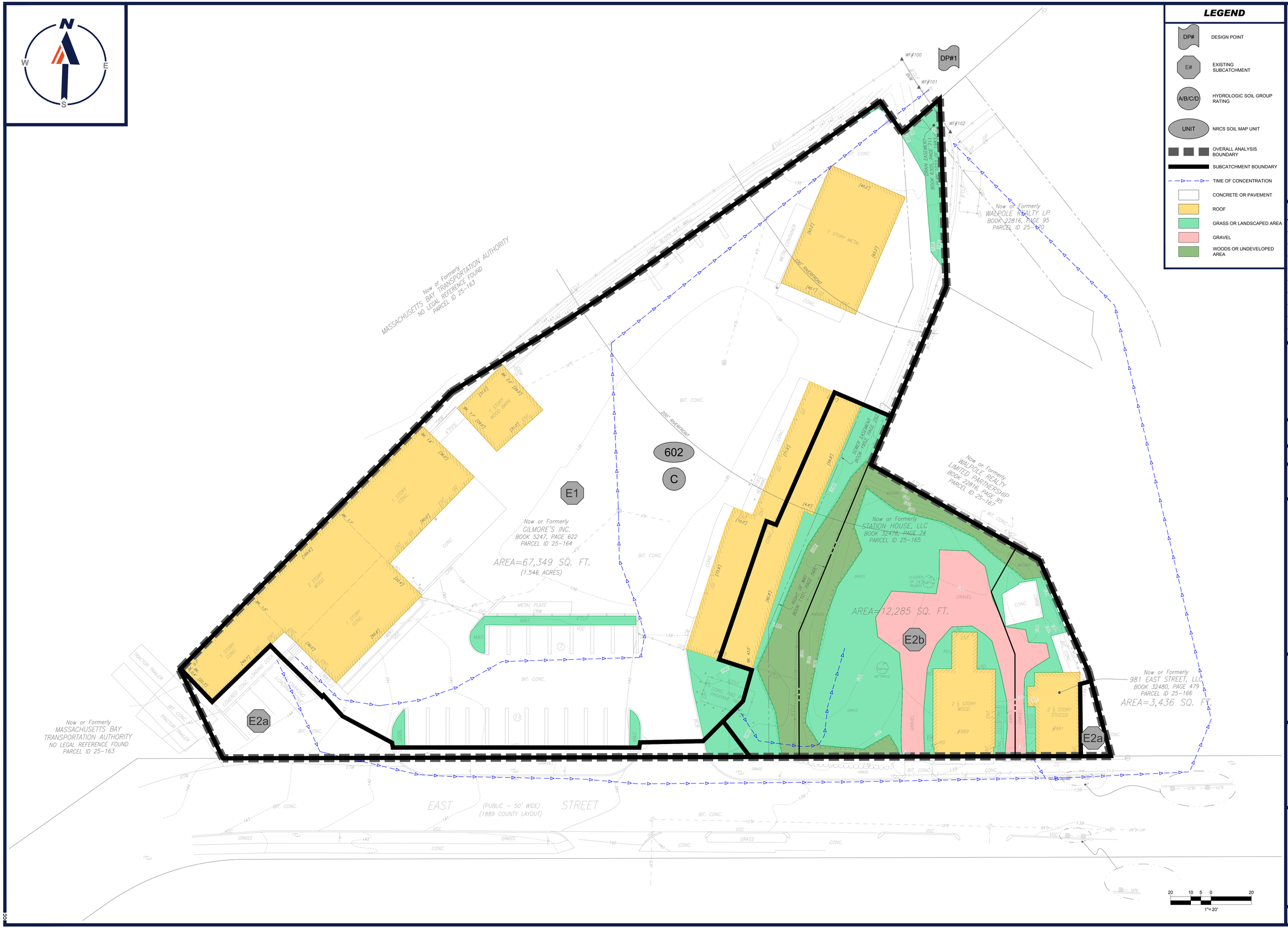
DETERMINATION FOR SEASONAL HIGH WATER TABLE

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"

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	08/30/2023	.	CMC / ED/JAK

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THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	W211263
DRAWN BY:	CMC/LC
CHECKED BY:	ED/JAK
DATE:	05/31/2023
CAD I.D.:	REV0 - 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

J.A. KUCICH
PROFESSIONAL ENGINEER
MASSACHUSETTS LICENSE No. 41639
NEW HAMPSHIRE LICENSE No. 15426
CONNECTICUT LICENSE No. 26127
RHODE ISLAND LICENSE No. 7416
MAINE LICENSE No. 22553

SHEET TITLE:

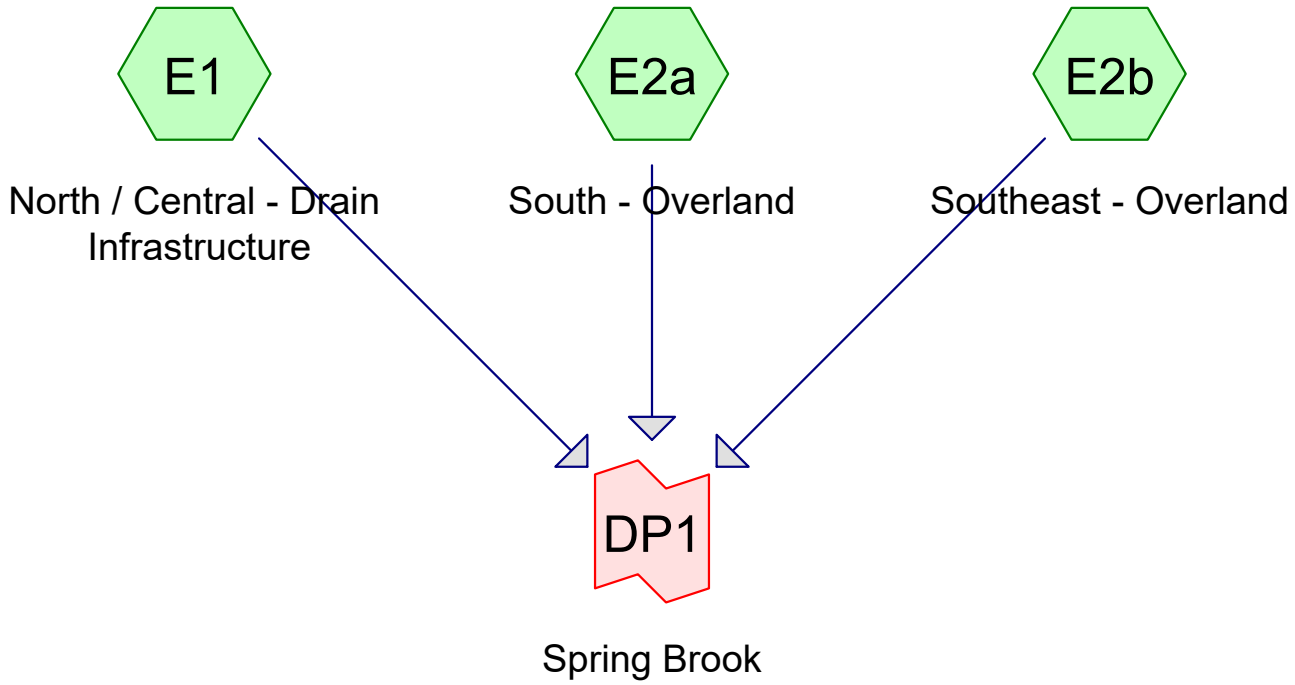
EXISTING CONDITIONS DRAINAGE AREA MAP

SHEET NUMBER:

EXDAM

REVISION 1 - 08/30/2023

P:\211263\TECH\CAL\STORMWATER\2023-08-30 DRAFT DRAINAGE REPORT AS SUBMITTED TO CLIENT\REV0- EX-SW-----LAYOUT EXDAM EXIST WATERSHED-24X36



Subcat Reach Pond Link

Routing Diagram for REV0 - W211263-EX
Prepared by Bohler Engineers, Printed 8/23/2023

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)
0.251	74	>75% Grass cover, Good, HSG C (E1, E2a, E2b)
0.076	89	Gravel roads, HSG C (E2b)
1.090	98	Paved parking, HSG C (E1, E2a, E2b)
0.395	98	Roofs, HSG C (E1, E2b)
0.095	70	Woods, Good, HSG C (E2b)
1.907	**93**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.907	HSG C	E1, E2a, E2b
0.000	HSG D	
0.000	Other	
1.907		**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	0.251	0.000	0.000	0.251	>75% Grass cover, Good	E1, E2a, E2b
0.000	0.000	0.076	0.000	0.000	0.076	Gravel roads	E2b
0.000	0.000	1.090	0.000	0.000	1.090	Paved parking	E1, E2a, E2b
0.000	0.000	0.395	0.000	0.000	0.395	Roofs	E1, E2b
0.000	0.000	0.095	0.000	0.000	0.095	Woods, Good	E2b
0.000	**0.000**	**1.907**	**0.000**	**0.000**	**1.907**	**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	E1	0.00	0.00	83.0	0.0010	0.013	0.0	8.0	0.0
2	E1	0.00	0.00	99.0	0.0050	0.013	0.0	10.0	0.0
3	E1	0.00	0.00	76.0	0.0013	0.013	0.0	12.0	0.0
4	E1	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

SubcatchmentE1: 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

SubcatchmentE2a: 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

SubcatchmentE2b: 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

Link DP1: Spring Brook Inflow=5.17 cfs 0.440 af
Primary=5.17 cfs 0.440 af

Total Runoff Area = 1.907 ac Runoff Volume = 0.440 af Average Runoff Depth = 2.77"
22.13% Pervious = 0.422 ac 77.87% Impervious = 1.485 ac

Summary for Subcatchment E1: North / Central - Drain Infrastructure

Runoff = 4.27 cfs @ 12.09 hrs, Volume= 0.342 af, Depth= 3.11"
Routed to Link DP1 : Spring Brook

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 E2a: South - Overland

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 3.11"
Routed to Link DP1 : Spring Brook

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 Link DP1 : Spring Brook

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 Link DP1: Spring Brook

Inflow Area = 1.907 ac, 77.87% Impervious, Inflow Depth = 2.77" for 2-YR event
Inflow = 5.17 cfs @ 12.09 hrs, Volume= 0.440 af
Primary = 5.17 cfs @ 12.09 hrs, Volume= 0.440 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 E1: 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

Subcatchment E2a: 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

Subcatchment E2b: 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

Link DP1: Spring Brook Inflow=8.36 cfs 0.729 af
Primary=8.36 cfs 0.729 af

Total Runoff Area = 1.907 ac Runoff Volume = 0.729 af Average Runoff Depth = 4.59"
22.13% Pervious = 0.422 ac 77.87% Impervious = 1.485 ac

Summary for Subcatchment E1: North / Central - Drain Infrastructure

Runoff = 6.69 cfs @ 12.09 hrs, Volume= 0.548 af, Depth= 5.00"
Routed to Link DP1 : Spring Brook

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 E2a: South - Overland

Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 5.00"
Routed to Link DP1 : Spring Brook

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 Link DP1 : Spring Brook

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 Link DP1: Spring Brook

Inflow Area = 1.907 ac, 77.87% Impervious, Inflow Depth = 4.59" for 10-YR event
Inflow = 8.36 cfs @ 12.09 hrs, Volume= 0.729 af
Primary = 8.36 cfs @ 12.09 hrs, Volume= 0.729 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 E1: 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

Subcatchment E2a: 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

Subcatchment E2b: 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

Link DP1: Spring Brook Inflow=10.36 cfs 0.912 af
Primary=10.36 cfs 0.912 af

Total Runoff Area = 1.907 ac Runoff Volume = 0.912 af Average Runoff Depth = 5.74"
22.13% Pervious = 0.422 ac 77.87% Impervious = 1.485 ac

Summary for Subcatchment E1: North / Central - Drain Infrastructure

Runoff = 8.20 cfs @ 12.09 hrs, Volume= 0.677 af, Depth= 6.17"
Routed to Link DP1 : Spring Brook

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 E2a: South - Overland

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.053 af, Depth= 6.17"
Routed to Link DP1 : Spring Brook

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 Link DP1 : Spring Brook

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 Link DP1: Spring Brook

Inflow Area = 1.907 ac, 77.87% Impervious, Inflow Depth = 5.74" for 25-YR event
Inflow = 10.36 cfs @ 12.09 hrs, Volume= 0.912 af
Primary = 10.36 cfs @ 12.09 hrs, Volume= 0.912 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 E1: 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 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

Link DP1: Spring Brook Inflow=14.58 cfs 1.304 af
Primary=14.58 cfs 1.304 af

Total Runoff Area = 1.907 ac Runoff Volume = 1.304 af Average Runoff Depth = 8.20"
22.13% Pervious = 0.422 ac 77.87% Impervious = 1.485 ac

Summary for Subcatchment E1: North / Central - Drain Infrastructure

Runoff = 11.38 cfs @ 12.09 hrs, Volume= 0.951 af, Depth= 8.67"
Routed to Link DP1 : Spring Brook

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 E2a: South - Overland

Runoff = 0.89 cfs @ 12.09 hrs, Volume= 0.074 af, Depth= 8.67"
Routed to Link DP1 : Spring Brook

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 Link DP1 : Spring Brook

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			

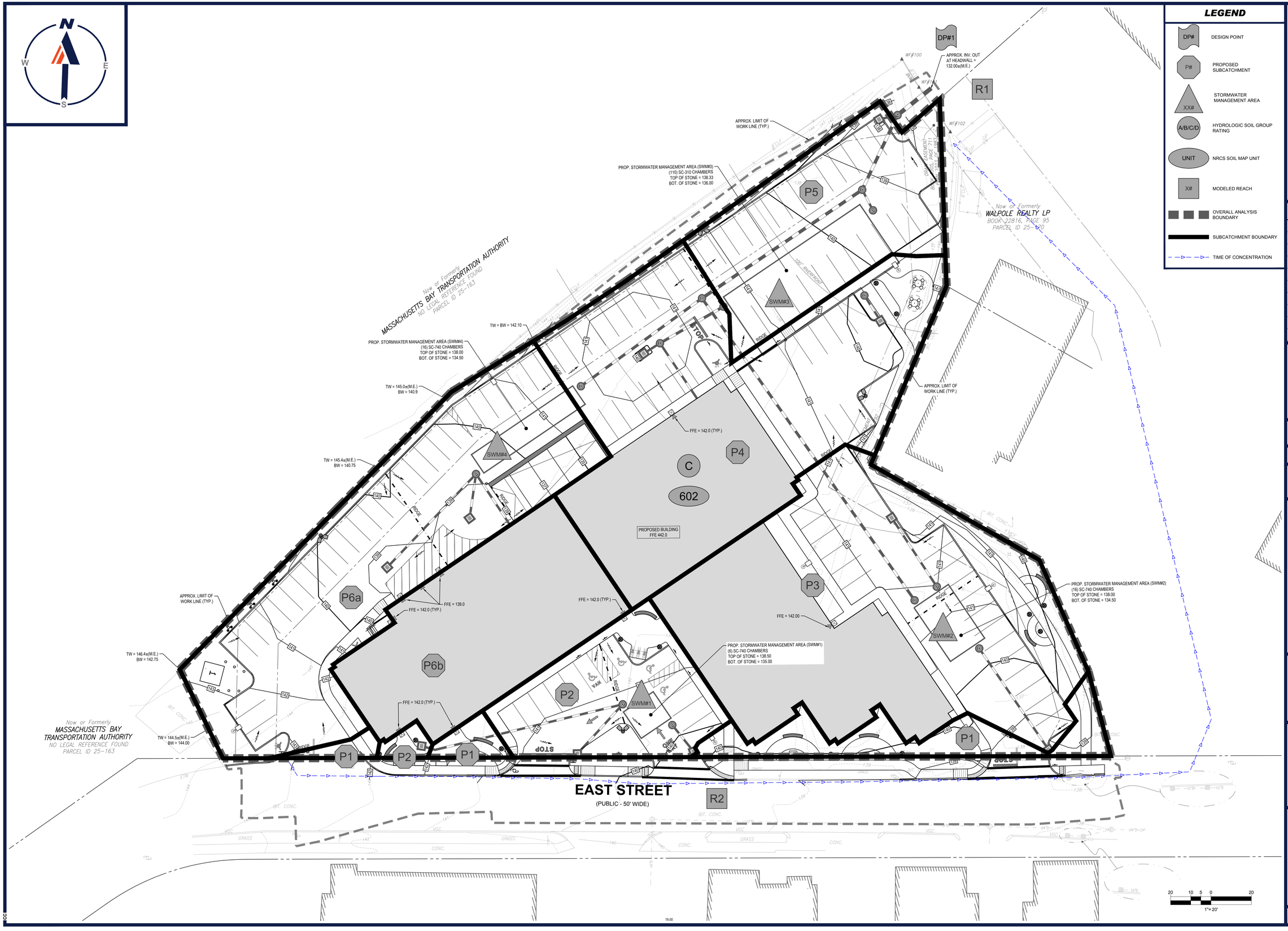
Summary for Link DP1: Spring Brook

Inflow Area = 1.907 ac, 77.87% Impervious, Inflow Depth = 8.20" for 100-YR event
Inflow = 14.58 cfs @ 12.09 hrs, Volume= 1.304 af
Primary = 14.58 cfs @ 12.09 hrs, Volume= 1.304 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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REV	DATE	COMMENT	DRAWN BY / CHECKED BY
1	08/30/2023	.	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.:	REV0 - 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
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CONNECTICUT LICENSE No. 28177
RHODE ISLAND LICENSE No. 2416
MAINE LICENSE No. 22553

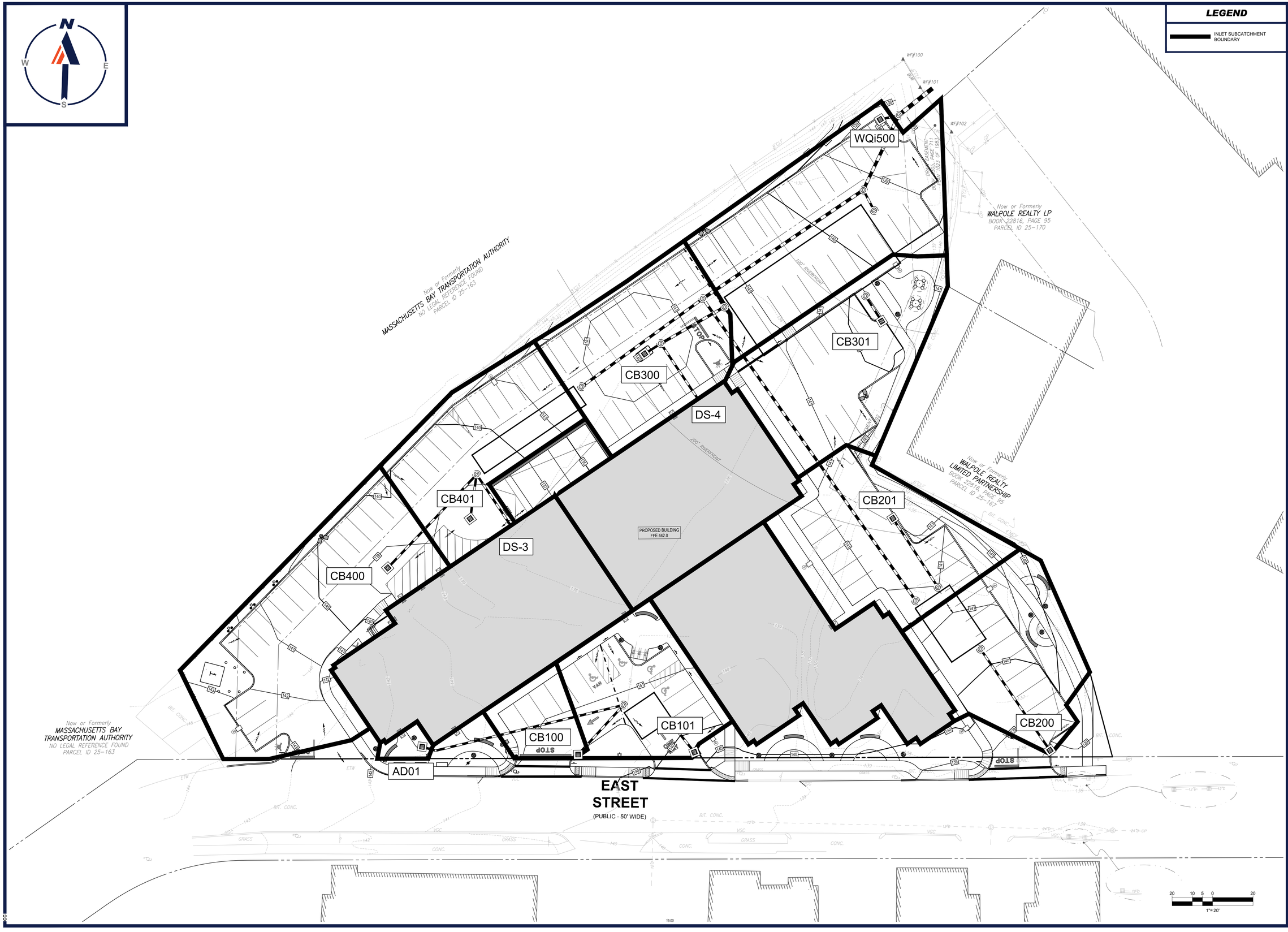
SHEET TITLE:

PROPOSED CONDITIONS DRAINAGE AREA MAP

SHEET NUMBER:

PRDAM

REVISION 1 - 08/30/2023



P:\21\W211263\TECH\CAL\STORMWATER\2023-08-30 DRAFT DRAINAGE REPORT AS SUBMITTED TO CLIENT\REV3 - PR-SW-----\LAYOUT, DAIM PROP. WATERSHED-24X36

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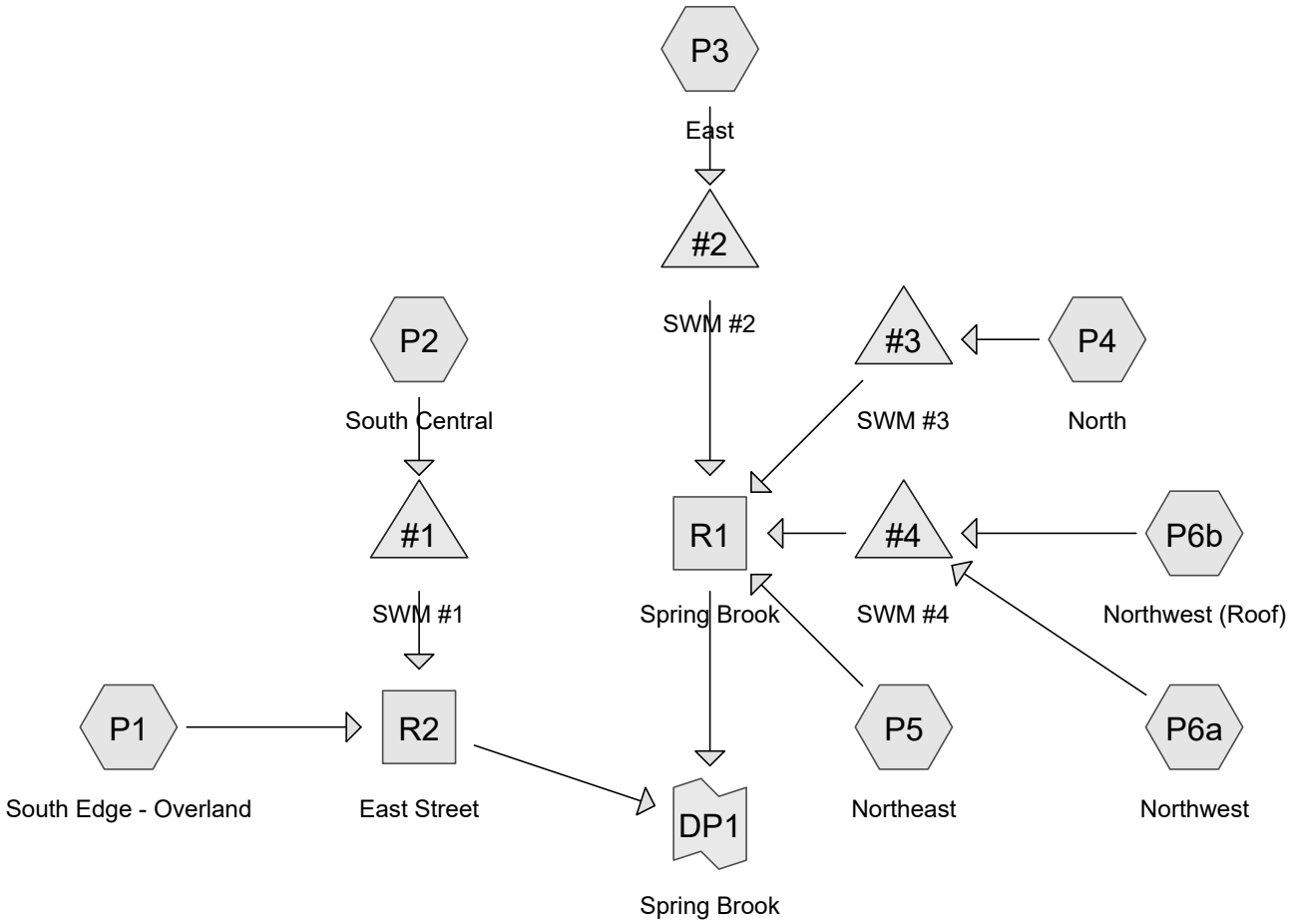
SHEET TITLE:

DRAINAGE AREA INLET MAP

SHEET NUMBER:

DAIM

REVISION 1 - 08/30/2023



Subcat Reach Pond Link

Routing Diagram for REV0 - W211263-PR
Prepared by Bohler Engineers, Printed 8/30/2023

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)
0.234	74	>75% Grass cover, Good, HSG C (P1, P2, P3, P4, P5, P6a)
1.107	98	Paved parking, HSG C (P1, P2, P3, P4, P5, P6a)
0.566	98	Roofs, HSG C (P3, P4, P6b)
1.907	**95**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.907	HSG C	P1, P2, P3, P4, P5, P6a, P6b
0.000	HSG D	
0.000	Other	
1.907		**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	0.234	0.000	0.000	0.234	>75% Grass cover, Good	P1, P2, P3, P4, P5, P6a
0.000	0.000	1.107	0.000	0.000	1.107	Paved parking	P1, P2, P3, P4, P5, P6a
0.000	0.000	0.566	0.000	0.000	0.566	Roofs	P3, P4, P6b
0.000	**0.000**	**1.907**	**0.000**	**0.000**	**1.907**	**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	#1	135.50	135.70	17.0	-0.0118	0.013	0.0	12.0	0.0
2	#2	135.00	134.00	183.0	0.0055	0.013	0.0	15.0	0.0
3	#3	136.50	136.05	11.5	0.0391	0.013	0.0	12.0	0.0
4	#4	135.00	134.00	74.0	0.0135	0.013	0.0	15.0	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

Subcatchment P1: 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

Subcatchment P2: 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

Subcatchment P3: East Runoff Area=0.465 ac 87.74% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=95 Runoff=1.49 cfs 0.112 af

Subcatchment P4: North Runoff Area=0.449 ac 92.65% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=96 Runoff=1.47 cfs 0.112 af

Subcatchment P5: 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

Subcatchment P6a: Northwest Runoff Area=0.362 ac 84.25% Impervious Runoff Depth=2.80"
Tc=6.0 min CN=94 Runoff=1.13 cfs 0.084 af

Subcatchment P6b: Northwest (Roof) Runoff Area=0.206 ac 100.00% Impervious Runoff Depth=3.23"
Tc=6.0 min CN=98 Runoff=0.69 cfs 0.055 af

Reach R1: Spring Brook Inflow=3.50 cfs 0.176 af
Outflow=3.50 cfs 0.176 af

Reach R2: East Street Inflow=0.66 cfs 0.040 af
Outflow=0.66 cfs 0.040 af

Pond #1: SWM #1 Peak Elev=137.61' Storage=453 cf Inflow=0.46 cfs 0.036 af
Outflow=0.46 cfs 0.026 af

Pond #2: SWM #2 Peak Elev=136.93' Storage=1,045 cf Inflow=1.49 cfs 0.112 af
Discarded=0.04 cfs 0.063 af Primary=1.35 cfs 0.050 af Outflow=1.39 cfs 0.112 af

Pond #3: SWM #3 Peak Elev=136.86' Storage=1,370 cf Inflow=1.47 cfs 0.112 af
Discarded=0.16 cfs 0.101 af Primary=0.24 cfs 0.011 af Outflow=0.40 cfs 0.112 af

Pond #4: SWM #4 Peak Elev=137.50' Storage=1,240 cf Inflow=1.82 cfs 0.140 af
Discarded=0.04 cfs 0.071 af Primary=1.58 cfs 0.069 af Outflow=1.62 cfs 0.140 af

Link DP1: Spring Brook Inflow=4.14 cfs 0.216 af
Primary=4.14 cfs 0.216 af

Total Runoff Area = 1.907 ac Runoff Volume = 0.461 af Average Runoff Depth = 2.90"
12.27% Pervious = 0.234 ac 87.73% Impervious = 1.673 ac

Summary for Subcatchment P1: 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 Subcatchment P2: 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 P3: East

Runoff = 1.49 cfs @ 12.08 hrs, Volume= 0.112 af, Depth= 2.90"
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
0.197	98	Roofs, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.465	95	Weighted Average
0.057		12.26% Pervious Area
0.408		87.74% Impervious Area

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

Summary for Subcatchment P4: North

Runoff = 1.47 cfs @ 12.08 hrs, Volume= 0.112 af, Depth= 3.01"
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
0.163	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.449	96	Weighted Average
0.033		7.35% Pervious Area
0.416		92.65% Impervious Area

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

Summary for Subcatchment P5: Northeast

Runoff = 0.62 cfs @ 12.08 hrs, Volume= 0.046 af, Depth= 2.80"
Routed to Reach R1 : Spring Brook

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 P6a: Northwest

Runoff = 1.13 cfs @ 12.08 hrs, Volume= 0.084 af, Depth= 2.80"
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 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
0.362	94	Weighted Average
0.057		15.75% Pervious Area
0.305		84.25% Impervious Area

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

Summary for Subcatchment P6b: Northwest (Roof)

Runoff = 0.69 cfs @ 12.08 hrs, Volume= 0.055 af, Depth= 3.23"
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
0.206	98	Roofs, HSG C
0.206		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: Spring Brook

Inflow Area = 1.679 ac, 89.52% Impervious, Inflow Depth = 1.26" for 2-YR event
Inflow = 3.50 cfs @ 12.11 hrs, Volume= 0.176 af
Outflow = 3.50 cfs @ 12.11 hrs, Volume= 0.176 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 = 2.12" for 2-YR event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 0.040 af
Outflow = 0.66 cfs @ 12.09 hrs, Volume= 0.040 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 = 0.46 cfs @ 12.09 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.4 min
Primary = 0.46 cfs @ 12.09 hrs, Volume= 0.026 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= 137.61' @ 12.09 hrs Surf.Area= 281 sf Storage= 453 cf

Plug-Flow detention time= 160.6 min calculated for 0.026 af (72% of inflow)
Center-of-Mass det. time= 71.3 min (835.4 - 764.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	283 cf	**15.75'W x 17.86'L x 3.50'H Field A** 984 cf Overall - 276 cf Embedded = 709 cf x 40.0% Voids
#2A	135.50'	276 cf	**ADS_StormTech SC-740 +Cap** x 6 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 6 Chambers in 3 Rows
		559 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.70'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.50' / 135.70' S= -0.0118 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.46 cfs @ 12.09 hrs HW=137.61' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.46 cfs of 3.54 cfs potential flow)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.46 cfs @ 1.08 fps)

Summary for Pond #2: SWM #2

Inflow Area = 0.465 ac, 87.74% Impervious, Inflow Depth = 2.90" for 2-YR event
Inflow = 1.49 cfs @ 12.08 hrs, Volume= 0.112 af
Outflow = 1.39 cfs @ 12.11 hrs, Volume= 0.112 af, Atten= 6%, Lag= 1.8 min
Discarded = 0.04 cfs @ 9.30 hrs, Volume= 0.063 af
Primary = 1.35 cfs @ 12.11 hrs, Volume= 0.050 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.93' @ 12.11 hrs Surf.Area= 658 sf Storage= 1,045 cf

Plug-Flow detention time= 131.4 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 131.4 min (910.0 - 778.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	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	135.00'	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
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 183.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0055 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.50'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 9.30 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.35 cfs @ 12.11 hrs HW=136.93' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.35 cfs of 5.14 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.35 cfs @ 2.43 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #3: SWM #3

Inflow Area = 0.449 ac, 92.65% Impervious, Inflow Depth = 3.01" for 2-YR event
Inflow = 1.47 cfs @ 12.08 hrs, Volume= 0.112 af
Outflow = 0.40 cfs @ 12.43 hrs, Volume= 0.112 af, Atten= 73%, Lag= 20.8 min
Discarded = 0.16 cfs @ 11.66 hrs, Volume= 0.101 af
Primary = 0.24 cfs @ 12.43 hrs, Volume= 0.011 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.86' @ 12.43 hrs Surf.Area= 2,840 sf Storage= 1,370 cf

Plug-Flow detention time= 42.4 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 42.4 min (814.3 - 771.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	2,002 cf	**34.83'W x 81.52'L x 2.33'H Field A** 6,626 cf Overall - 1,622 cf Embedded = 5,004 cf x 40.0% Voids
#2A	136.50'	1,622 cf	**ADS_StormTech SC-310 +Cap** x 110 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 110 Chambers in 10 Rows
		3,623 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.50'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.50' / 136.05' S= 0.0391 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	136.70'	**14.0" W x 4.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.16 cfs @ 11.66 hrs HW=136.03' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.24 cfs @ 12.43 hrs HW=136.86' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.24 cfs of 0.41 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.24 cfs @ 1.29 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.568 ac, 89.96% Impervious, Inflow Depth = 2.95" for 2-YR event
Inflow = 1.82 cfs @ 12.08 hrs, Volume= 0.140 af
Outflow = 1.62 cfs @ 12.13 hrs, Volume= 0.140 af, Atten= 11%, Lag= 2.5 min
Discarded = 0.04 cfs @ 8.76 hrs, Volume= 0.071 af
Primary = 1.58 cfs @ 12.13 hrs, Volume= 0.069 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.50' @ 12.13 hrs Surf.Area= 666 sf Storage= 1,240 cf

Plug-Flow detention time= 136.0 min calculated for 0.140 af (100% of inflow)
Center-of-Mass det. time= 136.0 min (908.8 - 772.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	639 cf	**11.00'W x 60.58'L x 3.50'H Field A** 2,332 cf Overall - 735 cf Embedded = 1,597 cf x 40.0% Voids
#2A	135.00'	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 2 Rows
		1,374 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 74.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0135 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.75'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 8.76 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.58 cfs @ 12.13 hrs HW=137.50' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.58 cfs of 6.38 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.58 cfs @ 3.79 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: Spring Brook

Inflow Area = 1.907 ac, 87.73% Impervious, Inflow Depth = 1.36" for 2-YR event
Inflow = 4.14 cfs @ 12.11 hrs, Volume= 0.216 af
Primary = 4.14 cfs @ 12.11 hrs, Volume= 0.216 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

Subcatchment P1: 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

Subcatchment P2: 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

Subcatchment P3: East Runoff Area=0.465 ac 87.74% Impervious Runoff Depth=4.77"
Tc=6.0 min CN=95 Runoff=2.38 cfs 0.185 af

Subcatchment P4: North Runoff Area=0.449 ac 92.65% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=96 Runoff=2.32 cfs 0.183 af

Subcatchment P5: 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

Subcatchment P6a: Northwest Runoff Area=0.362 ac 84.25% Impervious Runoff Depth=4.65"
Tc=6.0 min CN=94 Runoff=1.83 cfs 0.140 af

Subcatchment P6b: Northwest (Roof) Runoff Area=0.206 ac 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=1.08 cfs 0.088 af

Reach R1: Spring Brook Inflow=6.39 cfs 0.380 af
Outflow=6.39 cfs 0.380 af

Reach R2: East Street Inflow=1.09 cfs 0.075 af
Outflow=1.09 cfs 0.075 af

Pond #1: SWM #1 Peak Elev=137.65' Storage=458 cf Inflow=0.73 cfs 0.058 af
Outflow=0.73 cfs 0.048 af

Pond #2: SWM #2 Peak Elev=137.30' Storage=1,174 cf Inflow=2.38 cfs 0.185 af
Discarded=0.04 cfs 0.074 af Primary=2.12 cfs 0.111 af Outflow=2.15 cfs 0.185 af

Pond #3: SWM #3 Peak Elev=137.11' Storage=1,893 cf Inflow=2.32 cfs 0.183 af
Discarded=0.16 cfs 0.136 af Primary=0.91 cfs 0.047 af Outflow=1.07 cfs 0.183 af

Pond #4: SWM #4 Peak Elev=137.69' Storage=1,291 cf Inflow=2.91 cfs 0.228 af
Discarded=0.04 cfs 0.082 af Primary=2.86 cfs 0.146 af Outflow=2.89 cfs 0.228 af

Link DP1: Spring Brook Inflow=7.45 cfs 0.455 af
Primary=7.45 cfs 0.455 af

Total Runoff Area = 1.907 ac Runoff Volume = 0.756 af Average Runoff Depth = 4.76"
12.27% Pervious = 0.234 ac 87.73% Impervious = 1.673 ac

Summary for Subcatchment P1: 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 Subcatchment P2: 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 P3: East

Runoff = 2.38 cfs @ 12.08 hrs, Volume= 0.185 af, Depth= 4.77"
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
0.197	98	Roofs, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.465	95	Weighted Average
0.057		12.26% Pervious Area
0.408		87.74% Impervious Area

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

Summary for Subcatchment P4: North

Runoff = 2.32 cfs @ 12.08 hrs, Volume= 0.183 af, Depth= 4.88"
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
0.163	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.449	96	Weighted Average
0.033		7.35% Pervious Area
0.416		92.65% Impervious Area

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

Summary for Subcatchment P5: Northeast

Runoff = 0.99 cfs @ 12.08 hrs, Volume= 0.076 af, Depth= 4.65"
Routed to Reach R1 : Spring Brook

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 P6a: Northwest

Runoff = 1.83 cfs @ 12.08 hrs, Volume= 0.140 af, Depth= 4.65"
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
0.362	94	Weighted Average
0.057		15.75% Pervious Area
0.305		84.25% Impervious Area

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

Summary for Subcatchment P6b: Northwest (Roof)

Runoff = 1.08 cfs @ 12.08 hrs, Volume= 0.088 af, Depth= 5.11"
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
0.206	98	Roofs, HSG C
0.206		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: Spring Brook

Inflow Area = 1.679 ac, 89.52% Impervious, Inflow Depth = 2.72" for 10-YR event
Inflow = 6.39 cfs @ 12.11 hrs, Volume= 0.380 af
Outflow = 6.39 cfs @ 12.11 hrs, Volume= 0.380 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 = 3.93" for 10-YR event
Inflow = 1.09 cfs @ 12.09 hrs, Volume= 0.075 af
Outflow = 1.09 cfs @ 12.09 hrs, Volume= 0.075 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 = 0.73 cfs @ 12.09 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.3 min
Primary = 0.73 cfs @ 12.09 hrs, Volume= 0.048 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= 137.65' @ 12.09 hrs Surf.Area= 281 sf Storage= 458 cf

Plug-Flow detention time= 127.7 min calculated for 0.048 af (83% of inflow)
Center-of-Mass det. time= 57.5 min (811.8 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	283 cf	**15.75'W x 17.86'L x 3.50'H Field A** 984 cf Overall - 276 cf Embedded = 709 cf x 40.0% Voids
#2A	135.50'	276 cf	**ADS_StormTech SC-740 +Cap** x 6 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 6 Chambers in 3 Rows
		559 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.70'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.50' / 135.70' S= -0.0118 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.73 cfs @ 12.09 hrs HW=137.65' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.73 cfs of 3.59 cfs potential flow)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.73 cfs @ 1.25 fps)

Summary for Pond #2: SWM #2

Inflow Area = 0.465 ac, 87.74% Impervious, Inflow Depth = 4.77" for 10-YR event
Inflow = 2.38 cfs @ 12.08 hrs, Volume= 0.185 af
Outflow = 2.15 cfs @ 12.12 hrs, Volume= 0.185 af, Atten= 9%, Lag= 2.3 min
Discarded = 0.04 cfs @ 7.77 hrs, Volume= 0.074 af
Primary = 2.12 cfs @ 12.12 hrs, Volume= 0.111 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.30' @ 12.12 hrs Surf.Area= 658 sf Storage= 1,174 cf

Plug-Flow detention time= 103.3 min calculated for 0.185 af (100% of inflow)
Center-of-Mass det. time= 103.4 min (869.9 - 766.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	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	135.00'	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
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 183.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0055 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.50'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 7.77 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.11 cfs @ 12.12 hrs HW=137.30' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 2.11 cfs of 5.67 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.11 cfs @ 3.81 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #3: SWM #3

Inflow Area = 0.449 ac, 92.65% Impervious, Inflow Depth = 4.88" for 10-YR event
Inflow = 2.32 cfs @ 12.08 hrs, Volume= 0.183 af
Outflow = 1.07 cfs @ 12.25 hrs, Volume= 0.183 af, Atten= 54%, Lag= 9.9 min
Discarded = 0.16 cfs @ 11.25 hrs, Volume= 0.136 af
Primary = 0.91 cfs @ 12.25 hrs, Volume= 0.047 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.11' @ 12.25 hrs Surf.Area= 2,840 sf Storage= 1,893 cf

Plug-Flow detention time= 38.6 min calculated for 0.183 af (100% of inflow)
Center-of-Mass det. time= 38.6 min (799.4 - 760.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	2,002 cf	**34.83'W x 81.52'L x 2.33'H Field A** 6,626 cf Overall - 1,622 cf Embedded = 5,004 cf x 40.0% Voids
#2A	136.50'	1,622 cf	**ADS_StormTech SC-310 +Cap** x 110 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 110 Chambers in 10 Rows
		3,623 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.50'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.50' / 136.05' S= 0.0391 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	136.70'	**14.0" W x 4.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.16 cfs @ 11.25 hrs HW=136.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.91 cfs @ 12.25 hrs HW=137.11' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.91 cfs of 1.06 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.91 cfs @ 2.33 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.568 ac, 89.96% Impervious, Inflow Depth = 4.82" for 10-YR event
Inflow = 2.91 cfs @ 12.08 hrs, Volume= 0.228 af
Outflow = 2.89 cfs @ 12.09 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.5 min
Discarded = 0.04 cfs @ 7.06 hrs, Volume= 0.082 af
Primary = 2.86 cfs @ 12.09 hrs, Volume= 0.146 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.69' @ 12.09 hrs Surf.Area= 666 sf Storage= 1,291 cf

Plug-Flow detention time= 104.5 min calculated for 0.228 af (100% of inflow)
Center-of-Mass det. time= 104.6 min (866.7 - 762.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	639 cf	**11.00'W x 60.58'L x 3.50'H Field A** 2,332 cf Overall - 735 cf Embedded = 1,597 cf x 40.0% Voids
#2A	135.00'	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 2 Rows
		1,374 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 74.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0135 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.75'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 7.06 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.85 cfs @ 12.09 hrs HW=137.69' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 2.85 cfs of 6.70 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.81 cfs @ 4.33 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.05 cfs @ 1.41 fps)

Summary for Link DP1: Spring Brook

Inflow Area = 1.907 ac, 87.73% Impervious, Inflow Depth = 2.86" for 10-YR event
Inflow = 7.45 cfs @ 12.11 hrs, Volume= 0.455 af
Primary = 7.45 cfs @ 12.11 hrs, Volume= 0.455 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

Subcatchment P1: 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

Subcatchment P2: 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

Subcatchment P3: East Runoff Area=0.465 ac 87.74% Impervious Runoff Depth=5.94"
Tc=6.0 min CN=95 Runoff=2.93 cfs 0.230 af

Subcatchment P4: North Runoff Area=0.449 ac 92.65% Impervious Runoff Depth=6.06"
Tc=6.0 min CN=96 Runoff=2.85 cfs 0.227 af

Subcatchment P5: 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

Subcatchment P6a: Northwest Runoff Area=0.362 ac 84.25% Impervious Runoff Depth=5.82"
Tc=6.0 min CN=94 Runoff=2.26 cfs 0.176 af

Subcatchment P6b: Northwest (Roof) Runoff Area=0.206 ac 100.00% Impervious Runoff Depth=6.29"
Tc=6.0 min CN=98 Runoff=1.32 cfs 0.108 af

Reach R1: Spring Brook Inflow=8.38 cfs 0.517 af
Outflow=8.38 cfs 0.517 af

Reach R2: East Street Inflow=1.37 cfs 0.096 af
Outflow=1.37 cfs 0.096 af

Pond #1: SWM #1 Peak Elev=137.67' Storage=461 cf Inflow=0.89 cfs 0.072 af
Outflow=0.89 cfs 0.062 af

Pond #2: SWM #2 Peak Elev=137.56' Storage=1,247 cf Inflow=2.93 cfs 0.230 af
Discarded=0.04 cfs 0.079 af Primary=2.74 cfs 0.151 af Outflow=2.78 cfs 0.230 af

Pond #3: SWM #3 Peak Elev=137.31' Storage=2,280 cf Inflow=2.85 cfs 0.227 af
Discarded=0.16 cfs 0.154 af Primary=1.24 cfs 0.073 af Outflow=1.40 cfs 0.227 af

Pond #4: SWM #4 Peak Elev=137.75' Storage=1,308 cf Inflow=3.58 cfs 0.284 af
Discarded=0.04 cfs 0.086 af Primary=3.53 cfs 0.198 af Outflow=3.56 cfs 0.284 af

Link DP1: Spring Brook Inflow=9.72 cfs 0.614 af
Primary=9.72 cfs 0.614 af

Total Runoff Area = 1.907 ac Runoff Volume = 0.942 af Average Runoff Depth = 5.93"
12.27% Pervious = 0.234 ac 87.73% Impervious = 1.673 ac

Summary for Subcatchment P1: 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 Subcatchment P2: 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 P3: East

Runoff = 2.93 cfs @ 12.08 hrs, Volume= 0.230 af, Depth= 5.94"
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
0.197	98	Roofs, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.465	95	Weighted Average
0.057		12.26% Pervious Area
0.408		87.74% Impervious Area

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

Summary for Subcatchment P4: North

Runoff = 2.85 cfs @ 12.08 hrs, Volume= 0.227 af, Depth= 6.06"
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
0.163	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.449	96	Weighted Average
0.033		7.35% Pervious Area
0.416		92.65% Impervious Area

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

Summary for Subcatchment P5: Northeast

Runoff = 1.23 cfs @ 12.08 hrs, Volume= 0.096 af, Depth= 5.82"
Routed to Reach R1 : Spring Brook

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 P6a: Northwest

Runoff = 2.26 cfs @ 12.08 hrs, Volume= 0.176 af, Depth= 5.82"
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
0.362	94	Weighted Average
0.057		15.75% Pervious Area
0.305		84.25% Impervious Area

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

Summary for Subcatchment P6b: Northwest (Roof)

Runoff = 1.32 cfs @ 12.08 hrs, Volume= 0.108 af, Depth= 6.29"
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
0.206	98	Roofs, HSG C
0.206		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: Spring Brook

Inflow Area = 1.679 ac, 89.52% Impervious, Inflow Depth = 3.70" for 25-YR event
Inflow = 8.38 cfs @ 12.11 hrs, Volume= 0.517 af
Outflow = 8.38 cfs @ 12.11 hrs, Volume= 0.517 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 = 5.08" for 25-YR event
Inflow = 1.37 cfs @ 12.09 hrs, Volume= 0.096 af
Outflow = 1.37 cfs @ 12.09 hrs, Volume= 0.096 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 = 0.89 cfs @ 12.09 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.3 min
Primary = 0.89 cfs @ 12.09 hrs, Volume= 0.062 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= 137.67' @ 12.09 hrs Surf.Area= 281 sf Storage= 461 cf

Plug-Flow detention time= 113.9 min calculated for 0.062 af (86% of inflow)
Center-of-Mass det. time= 51.9 min (802.5 - 750.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	283 cf	**15.75'W x 17.86'L x 3.50'H Field A** 984 cf Overall - 276 cf Embedded = 709 cf x 40.0% Voids
#2A	135.50'	276 cf	**ADS_StormTech SC-740 +Cap** x 6 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 6 Chambers in 3 Rows
		559 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.70'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.50' / 135.70' S= -0.0118 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.89 cfs @ 12.09 hrs HW=137.67' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.89 cfs of 3.62 cfs potential flow)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.89 cfs @ 1.34 fps)

Summary for Pond #2: SWM #2

Inflow Area = 0.465 ac, 87.74% Impervious, Inflow Depth = 5.94" for 25-YR event
Inflow = 2.93 cfs @ 12.08 hrs, Volume= 0.230 af
Outflow = 2.78 cfs @ 12.11 hrs, Volume= 0.230 af, Atten= 5%, Lag= 1.7 min
Discarded = 0.04 cfs @ 6.93 hrs, Volume= 0.079 af
Primary = 2.74 cfs @ 12.11 hrs, Volume= 0.151 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.56' @ 12.11 hrs Surf.Area= 658 sf Storage= 1,247 cf

Plug-Flow detention time= 91.5 min calculated for 0.230 af (100% of inflow)
Center-of-Mass det. time= 91.5 min (853.1 - 761.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	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	135.00'	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
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 183.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0055 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.50'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 6.93 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.73 cfs @ 12.11 hrs HW=137.56' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 2.73 cfs of 6.03 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 2.53 cfs @ 4.55 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.21 cfs @ 0.82 fps)

Summary for Pond #3: SWM #3

Inflow Area = 0.449 ac, 92.65% Impervious, Inflow Depth = 6.06" for 25-YR event
Inflow = 2.85 cfs @ 12.08 hrs, Volume= 0.227 af
Outflow = 1.40 cfs @ 12.23 hrs, Volume= 0.227 af, Atten= 51%, Lag= 8.7 min
Discarded = 0.16 cfs @ 10.78 hrs, Volume= 0.154 af
Primary = 1.24 cfs @ 12.23 hrs, Volume= 0.073 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.31' @ 12.23 hrs Surf.Area= 2,840 sf Storage= 2,280 cf

Plug-Flow detention time= 37.8 min calculated for 0.227 af (100% of inflow)
Center-of-Mass det. time= 37.8 min (794.3 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	2,002 cf	**34.83'W x 81.52'L x 2.33'H Field A** 6,626 cf Overall - 1,622 cf Embedded = 5,004 cf x 40.0% Voids
#2A	136.50'	1,622 cf	**ADS_StormTech SC-310 +Cap** x 110 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 110 Chambers in 10 Rows
		3,623 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.50'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.50' / 136.05' S= 0.0391 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	136.70'	**14.0" W x 4.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.16 cfs @ 10.78 hrs HW=136.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=1.24 cfs @ 12.23 hrs HW=137.31' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.24 cfs of 1.66 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.24 cfs @ 3.19 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond #4: SWM #4

Inflow Area = 0.568 ac, 89.96% Impervious, Inflow Depth = 5.99" for 25-YR event
Inflow = 3.58 cfs @ 12.08 hrs, Volume= 0.284 af
Outflow = 3.56 cfs @ 12.09 hrs, Volume= 0.284 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.04 cfs @ 6.23 hrs, Volume= 0.086 af
Primary = 3.53 cfs @ 12.09 hrs, Volume= 0.198 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.75' @ 12.09 hrs Surf.Area= 666 sf Storage= 1,308 cf

Plug-Flow detention time= 90.3 min calculated for 0.284 af (100% of inflow)
Center-of-Mass det. time= 90.3 min (848.1 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	639 cf	**11.00'W x 60.58'L x 3.50'H Field A** 2,332 cf Overall - 735 cf Embedded = 1,597 cf x 40.0% Voids
#2A	135.00'	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 2 Rows
		1,374 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 74.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0135 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.75'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 6.23 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=3.53 cfs @ 12.09 hrs HW=137.75' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 3.53 cfs of 6.81 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.88 cfs @ 4.51 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.65 cfs @ 1.65 fps)

Summary for Link DP1: Spring Brook

Inflow Area = 1.907 ac, 87.73% Impervious, Inflow Depth = 3.86" for 25-YR event
Inflow = 9.72 cfs @ 12.10 hrs, Volume= 0.614 af
Primary = 9.72 cfs @ 12.10 hrs, Volume= 0.614 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

Subcatchment P1: 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

Subcatchment P2: 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

Subcatchment P3: East Runoff Area=0.465 ac 87.74% Impervious Runoff Depth=8.43"
Tc=6.0 min CN=95 Runoff=4.08 cfs 0.327 af

Subcatchment P4: North Runoff Area=0.449 ac 92.65% Impervious Runoff Depth=8.55"
Tc=6.0 min CN=96 Runoff=3.96 cfs 0.320 af

Subcatchment P5: 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

Subcatchment P6a: Northwest Runoff Area=0.362 ac 84.25% Impervious Runoff Depth=8.31"
Tc=6.0 min CN=94 Runoff=3.16 cfs 0.251 af

Subcatchment P6b: Northwest (Roof) Runoff Area=0.206 ac 100.00% Impervious Runoff Depth=8.79"
Tc=6.0 min CN=98 Runoff=1.83 cfs 0.151 af

Reach R1: Spring Brook Inflow=12.18 cfs 0.824 af
Outflow=12.18 cfs 0.824 af

Reach R2: East Street Inflow=1.94 cfs 0.143 af
Outflow=1.94 cfs 0.143 af

Pond #1: SWM #1 Peak Elev=137.71' Storage=467 cf Inflow=1.24 cfs 0.101 af
Outflow=1.24 cfs 0.091 af

Pond #2: SWM #2 Peak Elev=137.72' Storage=1,287 cf Inflow=4.08 cfs 0.327 af
Discarded=0.04 cfs 0.084 af Primary=4.03 cfs 0.242 af Outflow=4.07 cfs 0.327 af

Pond #3: SWM #3 Peak Elev=137.86' Storage=3,089 cf Inflow=3.96 cfs 0.320 af
Discarded=0.16 cfs 0.186 af Primary=1.94 cfs 0.134 af Outflow=2.10 cfs 0.320 af

Pond #4: SWM #4 Peak Elev=137.87' Storage=1,340 cf Inflow=4.99 cfs 0.401 af
Discarded=0.04 cfs 0.090 af Primary=4.94 cfs 0.312 af Outflow=4.98 cfs 0.401 af

Link DP1: Spring Brook Inflow=14.12 cfs 0.967 af
Primary=14.12 cfs 0.967 af

Total Runoff Area = 1.907 ac Runoff Volume = 1.337 af Average Runoff Depth = 8.42"
12.27% Pervious = 0.234 ac 87.73% Impervious = 1.673 ac

Summary for Subcatchment P1: 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 Subcatchment P2: 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 P3: East

Runoff = 4.08 cfs @ 12.08 hrs, Volume= 0.327 af, Depth= 8.43"
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
0.197	98	Roofs, HSG C
0.057	74	>75% Grass cover, Good, HSG C
0.465	95	Weighted Average
0.057		12.26% Pervious Area
0.408		87.74% Impervious Area

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

Summary for Subcatchment P4: North

Runoff = 3.96 cfs @ 12.08 hrs, Volume= 0.320 af, Depth= 8.55"
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
0.163	98	Roofs, HSG C
0.033	74	>75% Grass cover, Good, HSG C
0.449	96	Weighted Average
0.033		7.35% Pervious Area
0.416		92.65% Impervious Area

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

Summary for Subcatchment P5: Northeast

Runoff = 1.72 cfs @ 12.08 hrs, Volume= 0.136 af, Depth= 8.31"
Routed to Reach R1 : Spring Brook

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 P6a: Northwest

Runoff = 3.16 cfs @ 12.08 hrs, Volume= 0.251 af, Depth= 8.31"
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
0.362	94	Weighted Average
0.057		15.75% Pervious Area
0.305		84.25% Impervious Area

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

Summary for Subcatchment P6b: Northwest (Roof)

Runoff = 1.83 cfs @ 12.08 hrs, Volume= 0.151 af, Depth= 8.79"
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
0.206	98	Roofs, HSG C
0.206		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: Spring Brook

Inflow Area = 1.679 ac, 89.52% Impervious, Inflow Depth = 5.89" for 100-YR event
Inflow = 12.18 cfs @ 12.09 hrs, Volume= 0.824 af
Outflow = 12.18 cfs @ 12.09 hrs, Volume= 0.824 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 = 7.53" for 100-YR event
Inflow = 1.94 cfs @ 12.09 hrs, Volume= 0.143 af
Outflow = 1.94 cfs @ 12.09 hrs, Volume= 0.143 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 = 1.24 cfs @ 12.09 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.3 min
Primary = 1.24 cfs @ 12.09 hrs, Volume= 0.091 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= 137.71' @ 12.09 hrs Surf.Area= 281 sf Storage= 467 cf

Plug-Flow detention time= 93.0 min calculated for 0.091 af (90% of inflow)
Center-of-Mass det. time= 43.3 min (788.5 - 745.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	135.00'	283 cf	**15.75'W x 17.86'L x 3.50'H Field A** 984 cf Overall - 276 cf Embedded = 709 cf x 40.0% Voids
#2A	135.50'	276 cf	**ADS_StormTech SC-740 +Cap** x 6 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 6 Chambers in 3 Rows
		559 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.70'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.50' / 135.70' S= -0.0118 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	137.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.24 cfs @ 12.09 hrs HW=137.71' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 1.24 cfs of 3.67 cfs potential flow)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.24 cfs @ 1.49 fps)

Summary for Pond #2: SWM #2

Inflow Area = 0.465 ac, 87.74% Impervious, Inflow Depth = 8.43" for 100-YR event
Inflow = 4.08 cfs @ 12.08 hrs, Volume= 0.327 af
Outflow = 4.07 cfs @ 12.09 hrs, Volume= 0.327 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.04 cfs @ 5.18 hrs, Volume= 0.084 af
Primary = 4.03 cfs @ 12.09 hrs, Volume= 0.242 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.72' @ 12.09 hrs Surf.Area= 658 sf Storage= 1,287 cf

Plug-Flow detention time= 71.9 min calculated for 0.327 af (100% of inflow)
Center-of-Mass det. time= 71.9 min (826.5 - 754.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	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	135.00'	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
		1,362 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 183.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0055 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.50'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 5.18 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=4.03 cfs @ 12.09 hrs HW=137.72' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 4.03 cfs of 6.23 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 2.74 cfs @ 4.93 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.29 cfs @ 1.52 fps)

Summary for Pond #3: SWM #3

Inflow Area = 0.449 ac, 92.65% Impervious, Inflow Depth = 8.55" for 100-YR event
Inflow = 3.96 cfs @ 12.08 hrs, Volume= 0.320 af
Outflow = 2.10 cfs @ 12.21 hrs, Volume= 0.320 af, Atten= 47%, Lag= 7.6 min
Discarded = 0.16 cfs @ 9.82 hrs, Volume= 0.186 af
Primary = 1.94 cfs @ 12.21 hrs, Volume= 0.134 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.86' @ 12.21 hrs Surf.Area= 2,840 sf Storage= 3,089 cf

Plug-Flow detention time= 37.4 min calculated for 0.320 af (100% of inflow)
Center-of-Mass det. time= 37.4 min (787.6 - 750.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	136.00'	2,002 cf	**34.83'W x 81.52'L x 2.33'H Field A** 6,626 cf Overall - 1,622 cf Embedded = 5,004 cf x 40.0% Voids
#2A	136.50'	1,622 cf	**ADS_StormTech SC-310 +Cap** x 110 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 110 Chambers in 10 Rows
		3,623 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.50'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.50' / 136.05' S= 0.0391 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	136.70'	**14.0" W x 4.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.16 cfs @ 9.82 hrs HW=136.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=1.94 cfs @ 12.21 hrs HW=137.86' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.94 cfs of 2.77 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 1.87 cfs @ 4.80 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.08 cfs @ 0.59 fps)

Summary for Pond #4: SWM #4

Inflow Area = 0.568 ac, 89.96% Impervious, Inflow Depth = 8.48" for 100-YR event
Inflow = 4.99 cfs @ 12.08 hrs, Volume= 0.401 af
Outflow = 4.98 cfs @ 12.09 hrs, Volume= 0.401 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.04 cfs @ 4.23 hrs, Volume= 0.090 af
Primary = 4.94 cfs @ 12.09 hrs, Volume= 0.312 af
Routed to Reach R1 : Spring Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.87' @ 12.09 hrs Surf.Area= 666 sf Storage= 1,340 cf

Plug-Flow detention time= 69.8 min calculated for 0.401 af (100% of inflow)
Center-of-Mass det. time= 69.8 min (821.4 - 751.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.50'	639 cf	**11.00'W x 60.58'L x 3.50'H Field A** 2,332 cf Overall - 735 cf Embedded = 1,597 cf x 40.0% Voids
#2A	135.00'	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 2 Rows
		1,374 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.00'	**15.0" Round Culvert** L= 74.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 135.00' / 134.00' S= 0.0135 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	136.75'	**20.0" 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'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 4.23 hrs HW=134.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=4.94 cfs @ 12.09 hrs HW=137.87' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 4.94 cfs of 7.00 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.00 cfs @ 4.81 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.94 cfs @ 2.00 fps)

Summary for Link DP1: Spring Brook

Inflow Area = 1.907 ac, 87.73% Impervious, Inflow Depth = 6.09" for 100-YR event
Inflow = 14.12 cfs @ 12.09 hrs, Volume= 0.967 af
Primary = 14.12 cfs @ 12.09 hrs, Volume= 0.967 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*

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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)	**1.454**
%Impervious Directed to Infiltration BMP	87%
Adjustment Factor	1.15
Adjusted Total Recharge Volume Required (cf)	**117**

Provided Recharge Volume*	
SWM #1	436
SWM #2	865
SWM #3	1,018
SWM #4	979
Total Recharge Volume Provided (cf)	**3,298**

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)	436
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	281
Drawdown time (Hours)*	**18.3**
Drawdown Time - SWM #2	
Volume below outlet pipe (Rv) (cf)	865
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	658
Drawdown time (Hours)**	**6.5**
Drawdown Time - SWM #3	
Volume below outlet pipe (Rv) (cf)	1,018
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	2,839
Drawdown time (Hours)**	**1.8**
Drawdown Time - SWM #4	
Volume below outlet pipe (Rv) (cf)	979
Soil Type	Loamy Sand - A
Infiltration rate (K)*	2.41
Bottom Area (sf)	666
Drawdown time (Hours)**	**7.3**

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

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MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	0.5
Total Post Development Impervious Area (sf)	72,876
Required Water Quality Volume (cf)	**3,036**
*Water Quality volume runoff is equal to 0.5 inches of runoff times the total impervious area of the post development project site (including roof)	

Water Quality Volume Provided*	
SWM #1	436
SWM #2	865
SWM #3	1,018
SWM #4	979
Total Provided Water Quality Volume (cf)	**3,298**

Required Recharge 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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Proposed Multi-Family Development
981, 989 & 1015 East Street
Walpole, MA
Bohler Job Number: W211263
August 30, 2023

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)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
136.53	264	137.04	359	137.55	444
136.54	266	137.05	361	137.56	446
136.55	268	137.06	363	137.57	447
136.56	270	137.07	364	137.58	449
136.57	272	137.08	366	137.59	450
136.58	274	137.09	368	137.60	452
136.59	276	137.10	370	137.61	453
136.60	278	137.11	371	137.62	455
136.61	280	137.12	373	137.63	456
136.62	281	137.13	375	137.64	457
136.63	283	137.14	377	137.65	459
136.64	285	137.15	378	137.66	460
136.65	287	137.16	380	137.67	462
136.66	289	137.17	382	137.68	463
136.67	291	137.18	384	137.69	465
136.68	293	137.19	385	137.70	466
136.69	295	137.20	387	137.71	467
136.70	297	137.21	389	137.72	469
136.71	298	137.22	390	137.73	470
136.72	300	137.23	392	137.74	471
136.73	302	137.24	394	137.75	473
136.74	304	137.25	396	137.76	474
136.75	306	137.26	397	137.77	475
136.76	308	137.27	399	137.78	477
136.77	310	137.28	401	137.79	478
136.78	312	137.29	402	137.80	479
136.79	313	137.30	404	137.81	480
136.80	315	137.31	406	137.82	482
136.81	317	137.32	407	137.83	483
136.82	319	137.33	409	137.84	484
136.83	321	137.34	411	137.85	485
136.84	323	137.35	412	137.86	487
136.85	325	137.36	414	137.87	488
136.86	326	137.37	415	137.88	489
136.87	328	137.38	417	137.89	490
136.88	330	137.39	419	137.90	491
136.89	332	137.40	420	137.91	493
136.90	334	137.41	422	137.92	494
136.91	336	137.42	424	137.93	495
136.92	337	137.43	425	137.94	496
136.93	339	137.44	427	137.95	497
136.94	341	137.45	428	137.96	498
136.95	343	137.46	430	137.97	499
136.96	345	137.47	432	137.98	501
136.97	346	137.48	433	137.99	502
136.98	348	137.49	435	138.00	503
136.99	350	137.50	436	138.01	504
137.00	352	137.51	438	138.02	505
137.01	354	137.52	439	138.03	506
137.02	355	137.53	441	138.04	507
137.03	357	137.54	442	138.05	508

Stage-Area-Storage for Pond #2: SWM #2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
135.52	658	398
135.53	658	403
135.54	658	408
135.55	658	413
135.56	658	418
135.57	658	423
135.58	658	428
135.59	658	433
135.60	658	438
135.61	658	443
135.62	658	448
135.63	658	453
135.64	658	458
135.65	658	463
135.66	658	468
135.67	658	473
135.68	658	478
135.69	658	483
135.70	658	488
135.71	658	493
135.72	658	497
135.73	658	502
135.74	658	507
135.75	658	512
135.76	658	517
135.77	658	522
135.78	658	527
135.79	658	532
135.80	658	537
135.81	658	542
135.82	658	547
135.83	658	552
135.84	658	556
135.85	658	561
135.86	658	566
135.87	658	571
135.88	658	576
135.89	658	581
135.90	658	586
135.91	658	590
135.92	658	595
135.93	658	600
135.94	658	605
135.95	658	610
135.96	658	615
135.97	658	619
135.98	658	624
135.99	658	629
136.00	658	634
136.01	658	639
136.02	658	643
136.03	658	648
136.04	658	653
136.05	658	658
136.06	658	662
136.07	658	667
136.08	658	672
136.09	658	677
136.10	658	681
136.11	658	686
136.12	658	691
136.13	658	696
136.14	658	700
136.15	658	705
136.16	658	710
136.17	658	714
136.18	658	719
136.19	658	724
136.20	658	728
136.21	658	733
136.22	658	738
136.23	658	742
136.24	658	747
136.25	658	752
136.26	658	756
136.27	658	761
136.28	658	765
136.29	658	770
136.30	658	775
136.31	658	779
136.32	658	784
136.33	658	788
136.34	658	793
136.35	658	797
136.36	658	802
136.37	658	806
136.38	658	811
136.39	658	815
136.40	658	820
136.41	658	824
136.42	658	829
136.43	658	833
136.44	658	838
136.45	658	842
136.46	658	847
136.47	658	851
136.48	658	856
136.49	658	860
136.50	658	865
136.51	658	869
136.52	658	873
136.53	658	878

Stage-Area-Storage for Pond #3: SWM #3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
136.00	**2,840**	0
136.01	2,840	11
136.02	2,840	23
136.03	2,840	34
136.04	2,840	45
136.05	2,840	57
136.06	2,840	68
136.07	2,840	80
136.08	2,840	91
136.09	2,840	102
136.10	2,840	114
136.11	2,840	125
136.12	2,840	136
136.13	2,840	148
136.14	2,840	159
136.15	2,840	170
136.16	2,840	182
136.17	2,840	193
136.18	2,840	204
136.19	2,840	216
136.20	2,840	227
136.21	2,840	239
136.22	2,840	250
136.23	2,840	261
136.24	2,840	273
136.25	2,840	284
136.26	2,840	295
136.27	2,840	307
136.28	2,840	318
136.29	2,840	329
136.30	2,840	341
136.31	2,840	352
136.32	2,840	363
136.33	2,840	375
136.34	2,840	386
136.35	2,840	398
136.36	2,840	409
136.37	2,840	420
136.38	2,840	432
136.39	2,840	443
136.40	2,840	454
136.41	2,840	466
136.42	2,840	477
136.43	2,840	488
136.44	2,840	500
136.45	2,840	511
136.46	2,840	522
136.47	2,840	534
136.48	2,840	545
136.49	2,840	557
136.50	2,840	568
136.51	2,840	591
136.52	2,840	613
136.53	2,840	636
136.54	2,840	659
136.55	2,840	681
136.56	2,840	704
136.57	2,840	726
136.58	2,840	749
136.59	2,840	772
136.60	2,840	794
136.61	2,840	817
136.62	2,840	839
136.63	2,840	862
136.64	2,840	884
136.65	2,840	906
136.66	2,840	929
136.67	2,840	951
136.68	2,840	973
136.69	2,840	996
136.70	2,840	1,018
136.71	2,840	1,040
136.72	2,840	1,062
136.73	2,840	1,084
136.74	2,840	1,106
136.75	2,840	1,128
136.76	2,840	1,150
136.77	2,840	1,172
136.78	2,840	1,194
136.79	2,840	1,216
136.80	2,840	1,238
136.81	2,840	1,260
136.82	2,840	1,281
136.83	2,840	1,303
136.84	2,840	1,325
136.85	2,840	1,346
136.86	2,840	1,368
136.87	2,840	1,389
136.88	2,840	1,411
136.89	2,840	1,432
136.90	2,840	1,454
136.91	2,840	1,475
136.92	2,840	1,496
136.93	2,840	1,517
136.94	2,840	1,538
136.95	2,840	1,559
136.96	2,840	1,580
136.97	2,840	1,601
136.98	2,840	1,622
136.99	2,840	1,643
137.00	2,840	1,664
137.01	2,840	1,685

Stage-Area-Storage for Pond #4: SWM #4 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
136.54	666	889	137.05	666	1,099
136.55	666	893	137.06	666	1,102
136.56	666	898	137.07	666	1,106
136.57	666	902	137.08	666	1,110
136.58	666	907	137.09	666	1,114
136.59	666	911	137.10	666	1,117
136.60	666	915	137.11	666	1,121
136.61	666	920	137.12	666	1,124
136.62	666	924	137.13	666	1,128
136.63	666	928	137.14	666	1,132
136.64	666	933	137.15	666	1,135
136.65	666	937	137.16	666	1,139
136.66	666	941	137.17	666	1,142
136.67	666	946	137.18	666	1,146
136.68	666	950	137.19	666	1,149
136.69	666	954	137.20	666	1,152
136.70	666	958	137.21	666	1,156
136.71	666	963	137.22	666	1,159
136.72	666	967	137.23	666	1,162
136.73	666	971	137.24	666	1,165
136.74	666	975	137.25	666	1,169
136.75	666	979	137.26	666	1,172
136.76	666	984	137.27	666	1,175
136.77	666	988	137.28	666	1,178
136.78	666	992	137.29	666	1,181
136.79	666	996	137.30	666	1,184
136.80	666	1,000	137.31	666	1,187
136.81	666	1,004	137.32	666	1,190
136.82	666	1,008	137.33	666	1,193
136.83	666	1,012	137.34	666	1,196
136.84	666	1,016	137.35	666	1,199
136.85	666	1,021	137.36	666	1,202
136.86	666	1,025	137.37	666	1,205
136.87	666	1,029	137.38	666	1,208
136.88	666	1,033	137.39	666	1,210
136.89	666	1,037	137.40	666	1,213
136.90	666	1,041	137.41	666	1,216
136.91	666	1,045	137.42	666	1,219
136.92	666	1,049	137.43	666	1,222
136.93	666	1,053	137.44	666	1,224
136.94	666	1,056	137.45	666	1,227
136.95	666	1,060	137.46	666	1,230
136.96	666	1,064	137.47	666	1,233
136.97	666	1,068	137.48	666	1,235
136.98	666	1,072	137.49	666	1,238
136.99	666	1,076	137.50	666	1,241
137.00	666	1,080	137.51	666	1,243
137.01	666	1,084	137.52	666	1,246
137.02	666	1,087	137.53	666	1,249
137.03	666	1,091	137.54	666	1,251
137.04	666	1,095	137.55	666	1,254

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)

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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

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)
AD01	DMH100	0.01	0.95	0.01	0.01	0.30	0.00	0.01	6	11.3	0.14	12	0.013	HDPE	0.012	4.40	5.60
CB100	DMH100	0.03	0.95	0.03	0.00	0.30	0.00	0.03	6	11.3	0.32	12	0.024	HDPE	0.012	5.98	7.61
CB101	DMH101	0.09	0.95	0.09	0.01	0.30	0.00	0.09	6	11.3	1.00	12	0.012	HDPE	0.012	4.23	5.38
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	0.025	HDPE	0.012	6.10	7.77
OCS200	DMH202	HydroCAD 25-year storm (UG2)									4.03	15	0.006	HDPE	0.012	5.42	4.42
CB400	DMH400	0.16	0.95	0.15	0.05	0.30	0.02	0.17	6	11.3	1.89	12	0.008	HDPE	0.012	3.45	4.40
CB401	DMH400	0.11	0.95	0.10	0.01	0.30	0.00	0.11	6	11.3	1.21	12	0.009	HDPE	0.012	3.66	4.66
DS3	DMH400	0.21	0.95	0.20	0.00	0.30	0.00	0.20	6	11.3	2.25	12	0.010	HDPE	0.012	3.86	4.91
OCS400	DMH202	HydroCAD 25-year storm (UG4)									4.94	15	0.012	HDPE	0.012	7.50	6.12
DMH202	DMH203	HydroCAD 25-year storm (UG2+UG4)									8.97	18	0.010	HDPE	0.012	11.38	6.44
CB300	DMH302	0.12	0.95	0.11	0.01	0.30	0.00	0.12	6	11.3	1.32	12	0.010	HDPE	0.012	3.86	4.91
DS4	DMH302	0.16	0.95	0.15	0.00	0.30	0.00	0.15	6	11.3	1.72	12	0.008	HDPE	0.012	3.36	4.28
DMH302	DMH300	0.28	0.95	0.27	0.01	0.30	0.00	0.27	6	11.3	3.04	12	0.008	HDPE	0.012	3.45	4.40
OCS300	DMH203	HydroCAD 25-year storm (UG3)									1.94	12	0.039	HDPE	0.012	7.62	9.70
DMH203	DMH204	HydroCAD 25-year storm (UG2+UG3+UG4)									10.91	18	0.013	HDPE	0.012	12.97	7.34
WQi500	DMH204	0.17	0.95	0.16	0.03	0.30	0.01	0.17	6	11.3	1.93	12	0.010	HDPE	0.012	3.86	4.91
DMH204	Out	HydroCAD 25-year storm (UG2+UG3+UG4) + WQi500									12.84	24	0.012	HDPE	0.012	26.62	8.47

*Rainfall intesity provided by NOAA Atlas 14, Volume 10, Version 2 on 8/30/23

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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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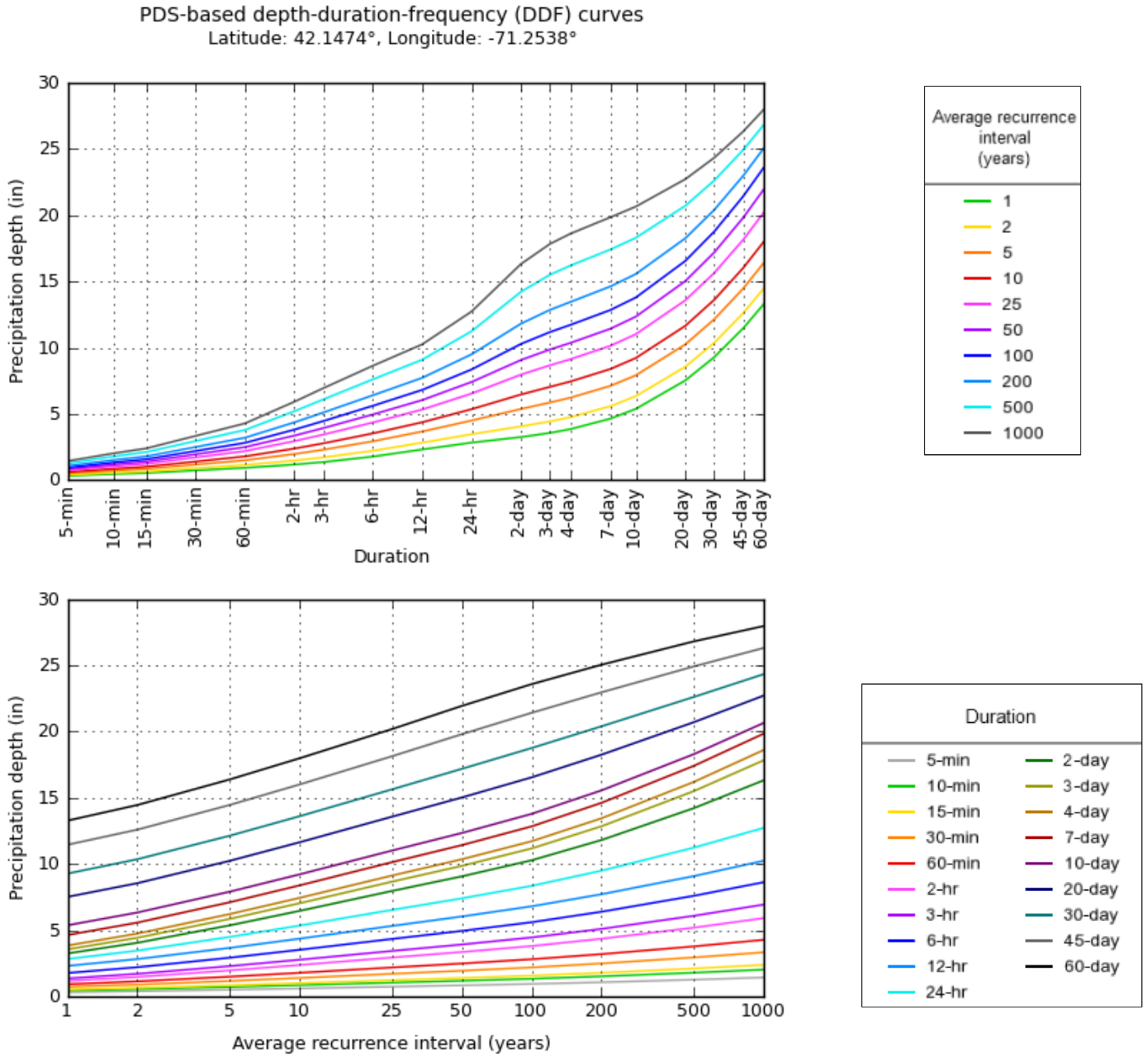
PF graphical



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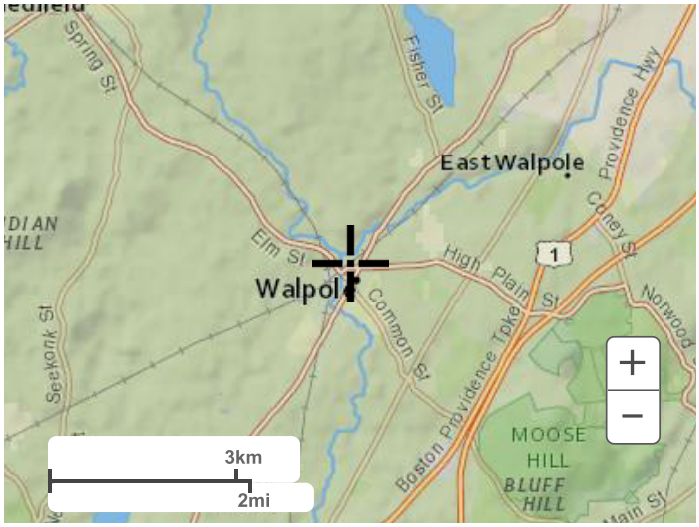
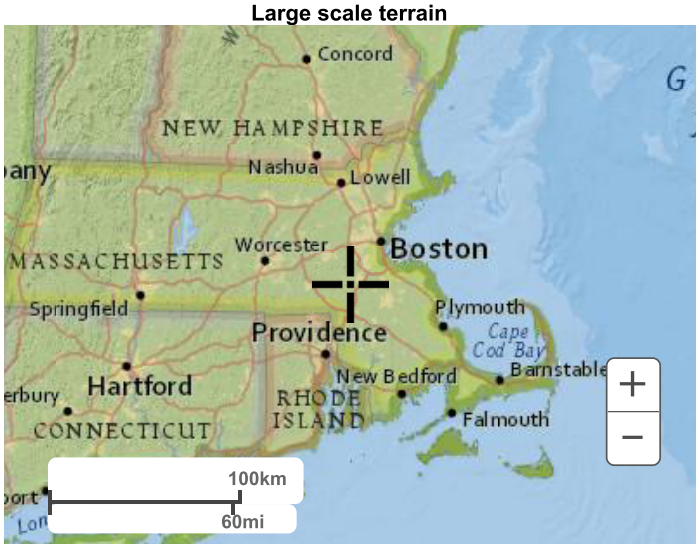
Maps & aerials

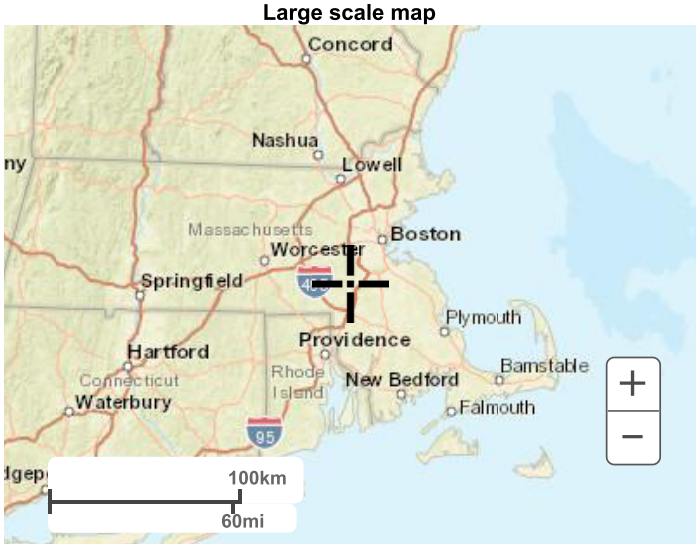
Small scale terrain



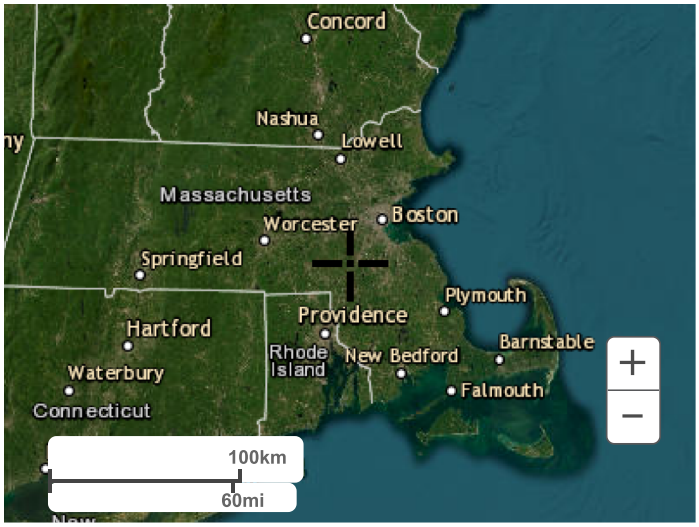
Large scale terrain



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.

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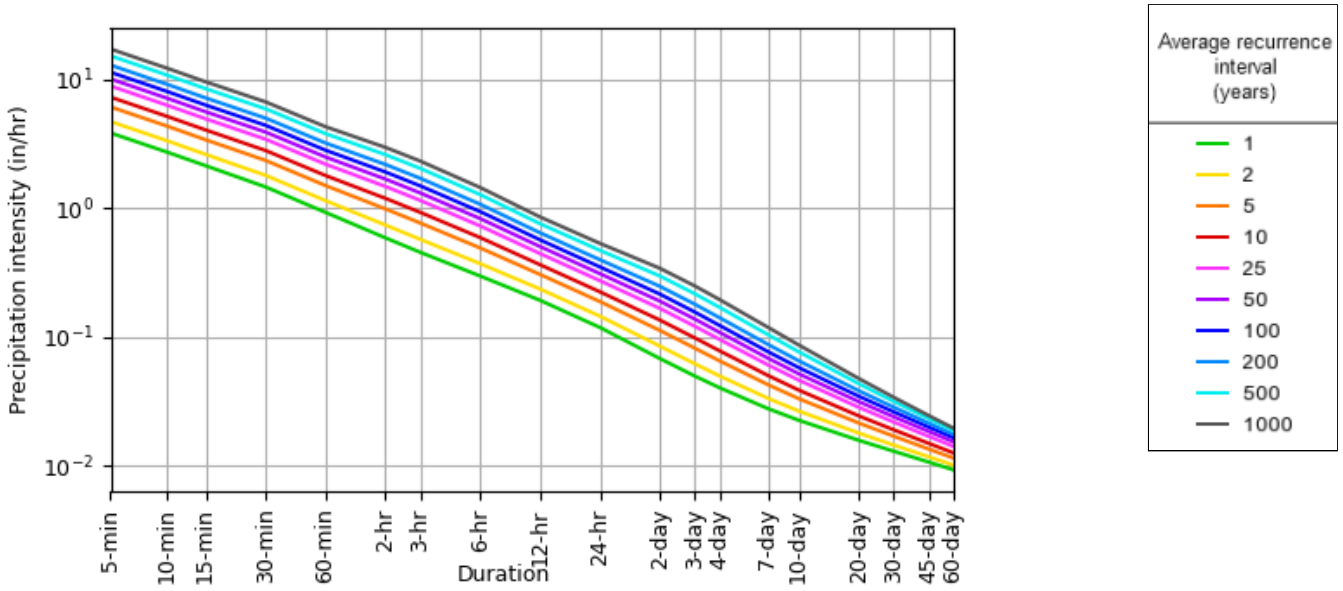
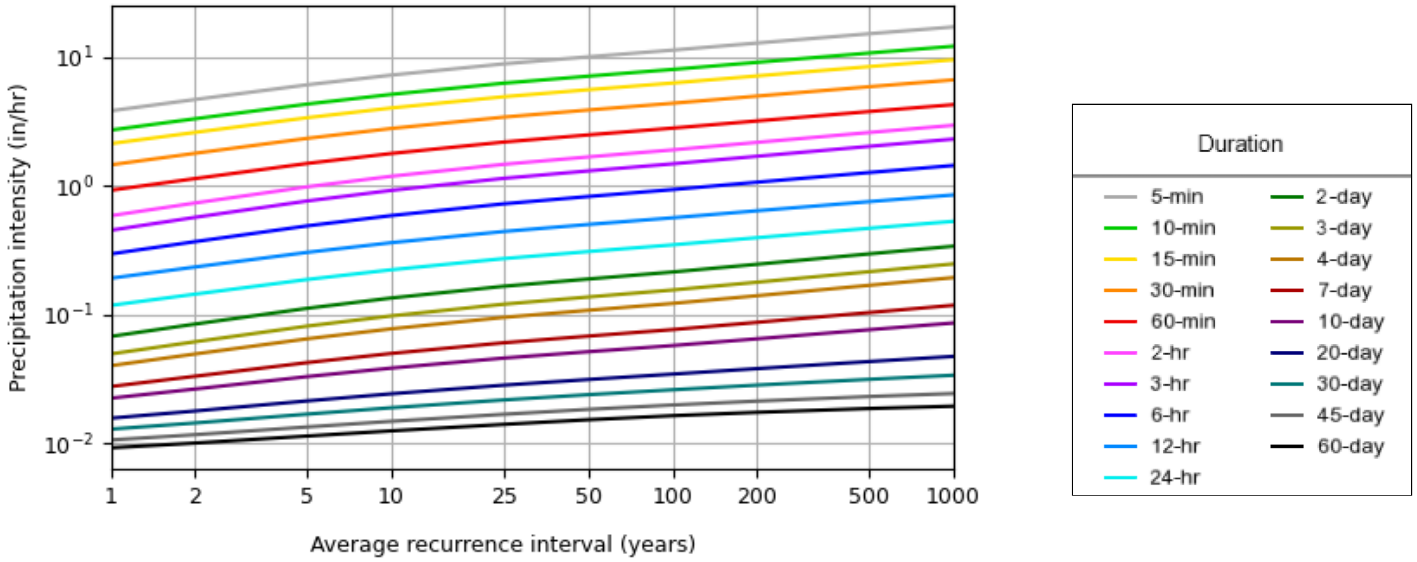
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 42.1474°, Longitude: -71.2538°





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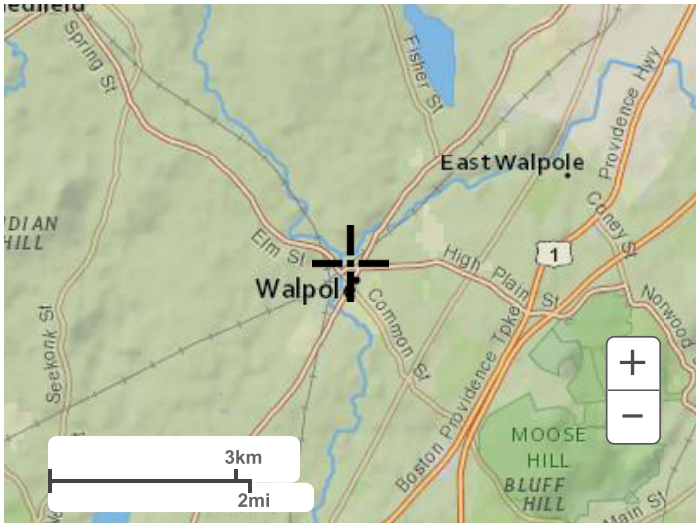
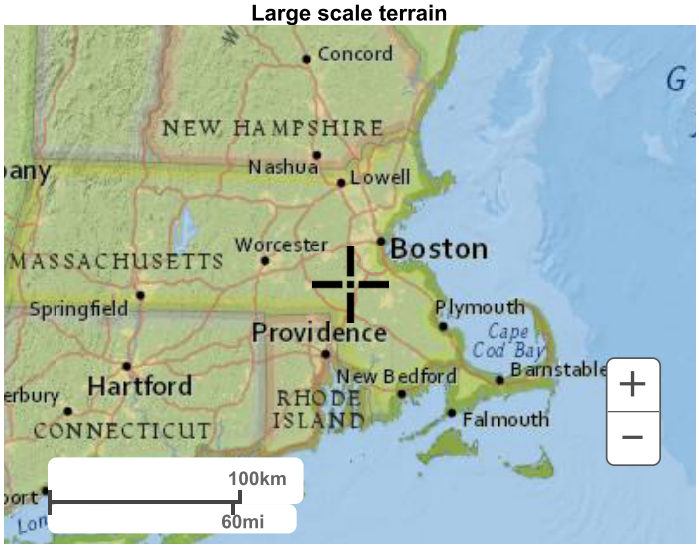
Maps & aerials

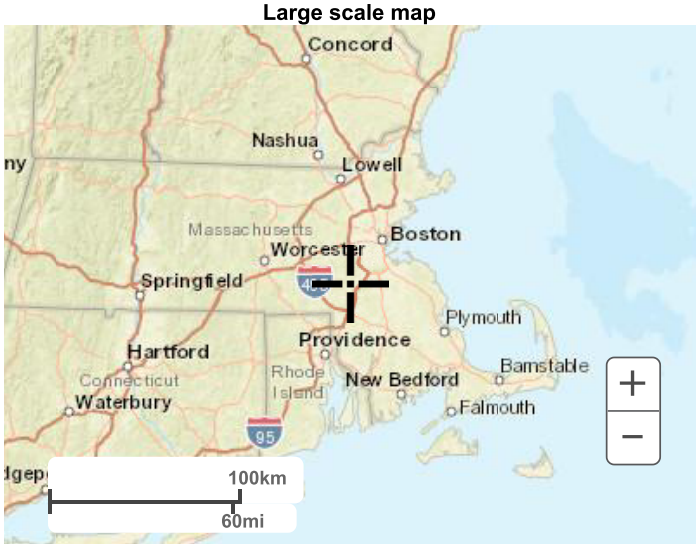
Small scale terrain



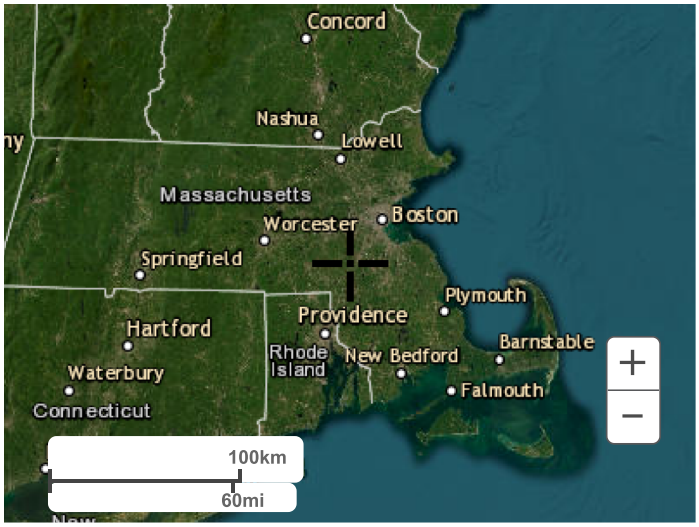
Large scale terrain



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

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

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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.

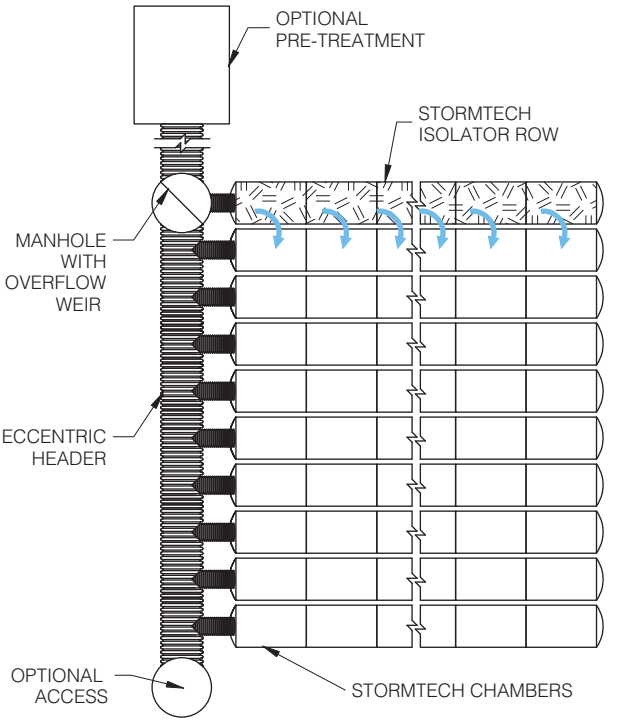
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of 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.

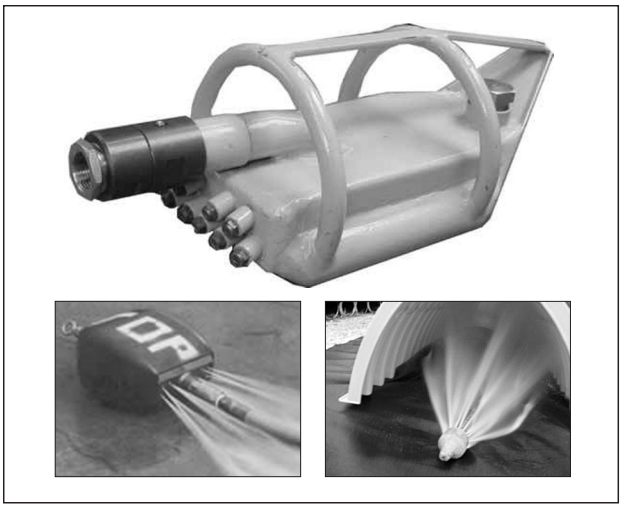
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

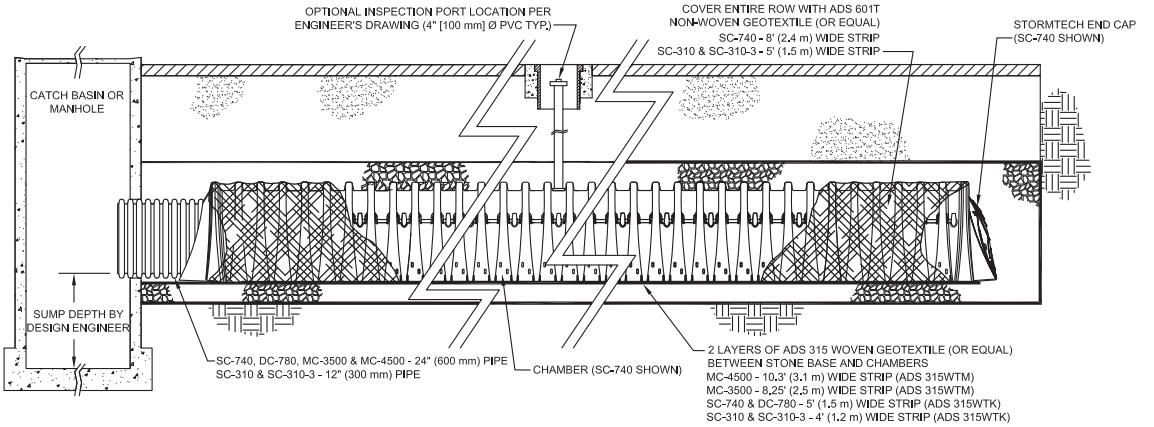
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via 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

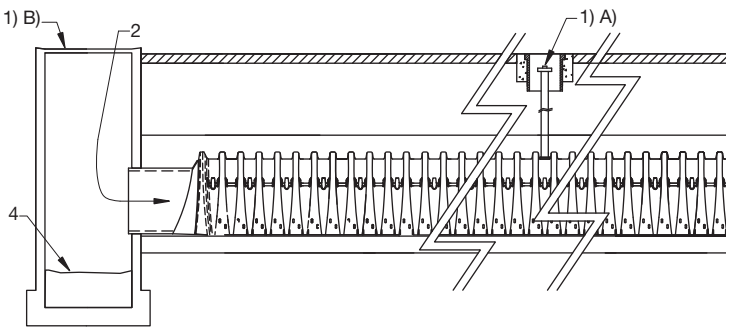
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

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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CONTECH®
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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.