DRAINAGE REPORT

For

PROPOSED DEVELOPMENT

31 & 33 Davis Street and 1314 Washington Street
Newton, Massachusetts
Middlesex County

Prepared by:

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BOHLER

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a mixed-use building located at the intersection of Washington Street and Highland Street in the City of Newton, Massachusetts. The overall site, which contains approximately 0.69 acres of land, contains an existing building and parking area.

The proposed project includes the construction of a new mixed-use building along with retaining a portion of the existing building along with new 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. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** and **Table 1.2** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	1.92	1.10	**-0.82**	3.04	2.83	**-0.21**	3.91	3.91	**0.00**	5.72	5.45	**-0.27**

**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	0.145	0.051	**-0.094**	0.237	0.107	**-0.130**	0.310	0.158	**-0.152**	0.463	0.277	**-0.186**

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

II. EXISTING SITE CONDITIONS

Existing Site Description

The overall site, which contains approximately 0.69 acres of land, contains an existing building with associated parking, landscape areas and utilities.

On-Site Soil Information

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

Table 2.1: Existing Soil Information

Soil Unit Symbol	Soil Name / Description	Hydrologic Soil Group (HSG)
602	Urban land	N/A

Based off experience with soils in the surrounding area, the site has been modeled entirely using Hydrologic Soil Group (HSG) A with an infiltration rate of 8.27 inches per hour. Refer to **Appendix C** for additional information.

Existing Collection and Conveyance

The entire project area drains towards the existing Newton drainage system. Slopes on the site range from 2%-50% with on-site elevations ranging from 59 at the southwest corner to 49 at the northeast corner.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at one (1) “design point” as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into one (1) sub catchment, as described below, to analyze existing and proposed flow rates at each design point. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP1) is offsite to the Newton drainage system. Under existing conditions, this design point receives stormwater flows from approximately 0.69 acres of land, designated as watershed “E1”. Refer to Table 2.1 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
E1	0.69	Pavement, rooftop and grass	94	6.0

Refer to **Table 1.1, 1.2, 5.1, and 5.2** for the existing conditions peak rates of runoff and volumes. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of the construction of a new mixed-use building including landscaping, associated utilities, and a new stormwater management system. The proposed and existing building has been designed to drain to a proposed underground infiltration basin. Pretreatment of stormwater runoff is not required as the roof runoff is considered clean water. Overflow from the underground infiltration system will be directed towards a Contech Peak Diversion StormFilter Vault SFPD0608-S for additional treatment and phosphorus removal prior to discharge to the City drainage system.

Proposed Development Collection and Conveyance

Roof drains are proposed to collect and route runoff from the proposed and existing building to the proposed underground infiltration system.

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

Proposed Watersheds and Design Point Information

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in **Section II** above. The site was subdivided into two (2) separate sub catchments for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP#1 receives stormwater flows from approximately 0.69 acres of land, designated as watershed “P1” and “P2”. 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	0.50	Rooftop	98	6.0	UG Syst / DP1
P2	0.19	Pavement and grass	79	6.0	DP1

Refer to **Table 1.1, 1.2, 5.1, and 5.2** for the calculated proposed conditions peak rates of runoff and volumes. For additional hydrologic information, refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

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

Table 4.1: Cornell Northeast Regional Climate Center

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.19	4.82	6.10	8.78**

*Values derived from the Cornell Northeast Regional Climate Center

**per the direction of Newton DPW

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

V. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The project does not create any new untreated discharges.

Standard #2: Peak Rate Attenuation

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

Standard #3: Recharge

The stormwater roof runoff from the project will be collected and diverted to a proposed underground infiltration system. The proposed underground infiltration system will provide 535 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.

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing that the proposed underground infiltration system will drain within 1.1 hours are included in **Appendix F** of this report.

Standard #4: Water Quality

Water quality treatment is provided via an underground infiltration system. TSS removal calculations are included in **Appendix F** of this report. The proposed underground infiltration system provides 535 cubic feet of water quality volume below the lowest outlet for water quality treatment. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes.

Standard #5: Land Use with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

The project is a redevelopment and has been designed in accordance with the Massachusetts Stormwater Management regulations to meet all the standards to the maximum extent practicable.

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 protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets. Refer to **Appendix G**.

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

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

Standard #10: Prohibition of Illicit Discharges

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

VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development stormwater discharge comparisons are contained in **Table 5.1** and **Table 5.2** below:

Table 5.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	1.92	1.10	**-0.82**	3.04	2.83	**-0.21**	3.91	3.91	**0.00**	5.72	5.45	**-0.27**

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Table 5.2: Design Point Volume Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
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DP1	0.145	0.051	**-0.094**	0.237	0.107	**-0.130**	0.310	0.158	**-0.152**	0.463	0.277	**-0.186**

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

As outlined in the tables above, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year storm events. Additionally, the project meets or exceeds the MADEP Stormwater Management Standards as described further herein.

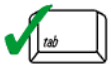
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

08/18/2022

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 Basin

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.

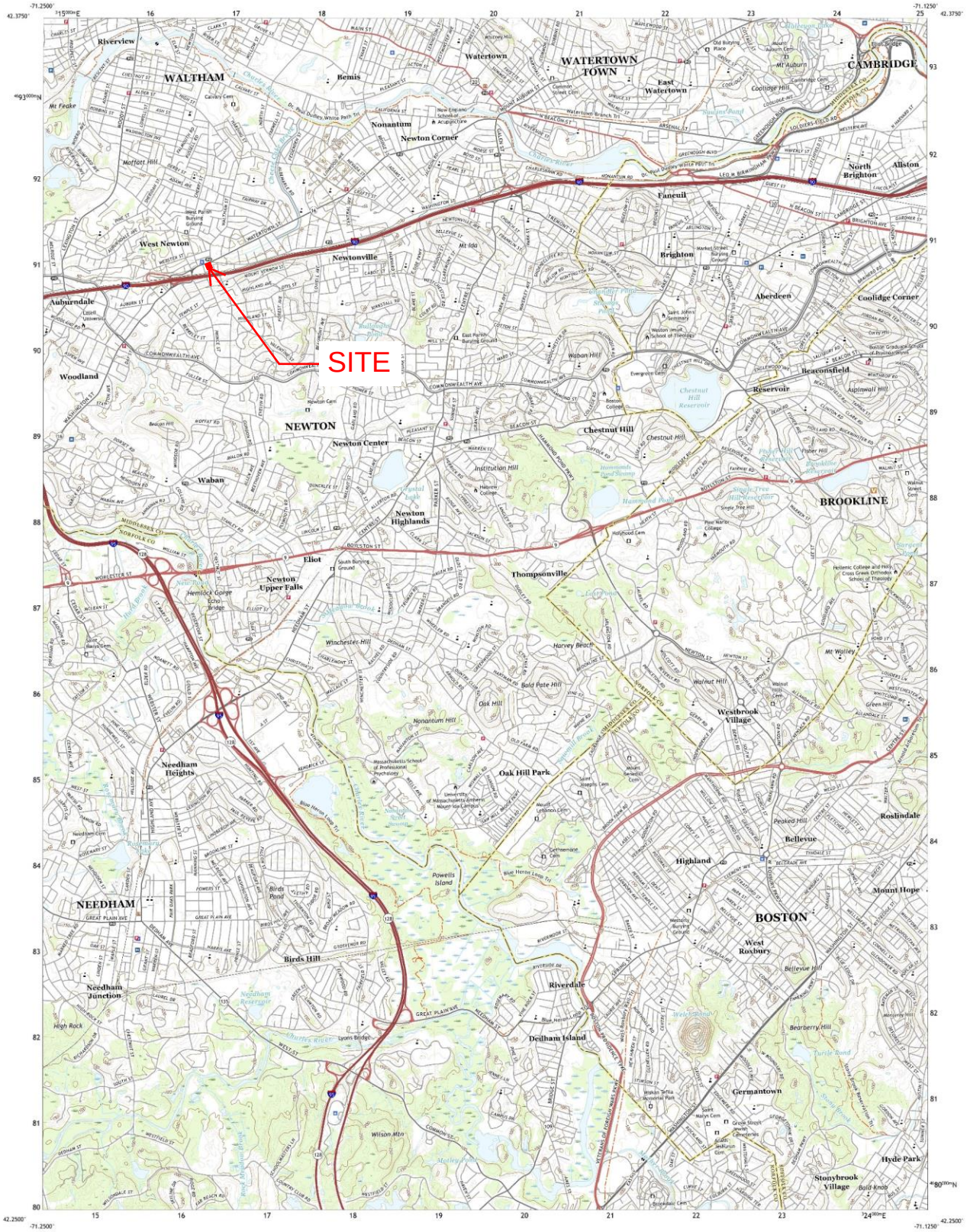
APPENDIX B: PROJECT LOCATION MAPS

- *USGS MAP*
- *FEMA FIRMETTE*

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

NEWTON QUADRANGLE
MASSACHUSETTS
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 19T
This map is not a legal document. Boundaries may be
generalized for this map scale. Private lands within government
reservations may not be shown. Obtain permission before
entering private lands.

Imagery.....NAIP, July 2016 - September 2016
Roads.....U.S. Census Bureau, 2016
Names.....GNIS, 1974 - 2018
Hydrography.....National Hydrography Dataset, 2005
Contours.....National Elevation Dataset, 2008 - 2012
Boundaries.....multiple sources; see metadata file JD16 - 2017

Wetlands.....FWS National Wetlands Inventory 1992 - 2011

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard.

ADJOINING QUADRANGLES
1 Concord
2 Lexington
3 Boston North
4 Natick
5 Boston South
6 Medfield
7 Norwood
8 Blue Hills

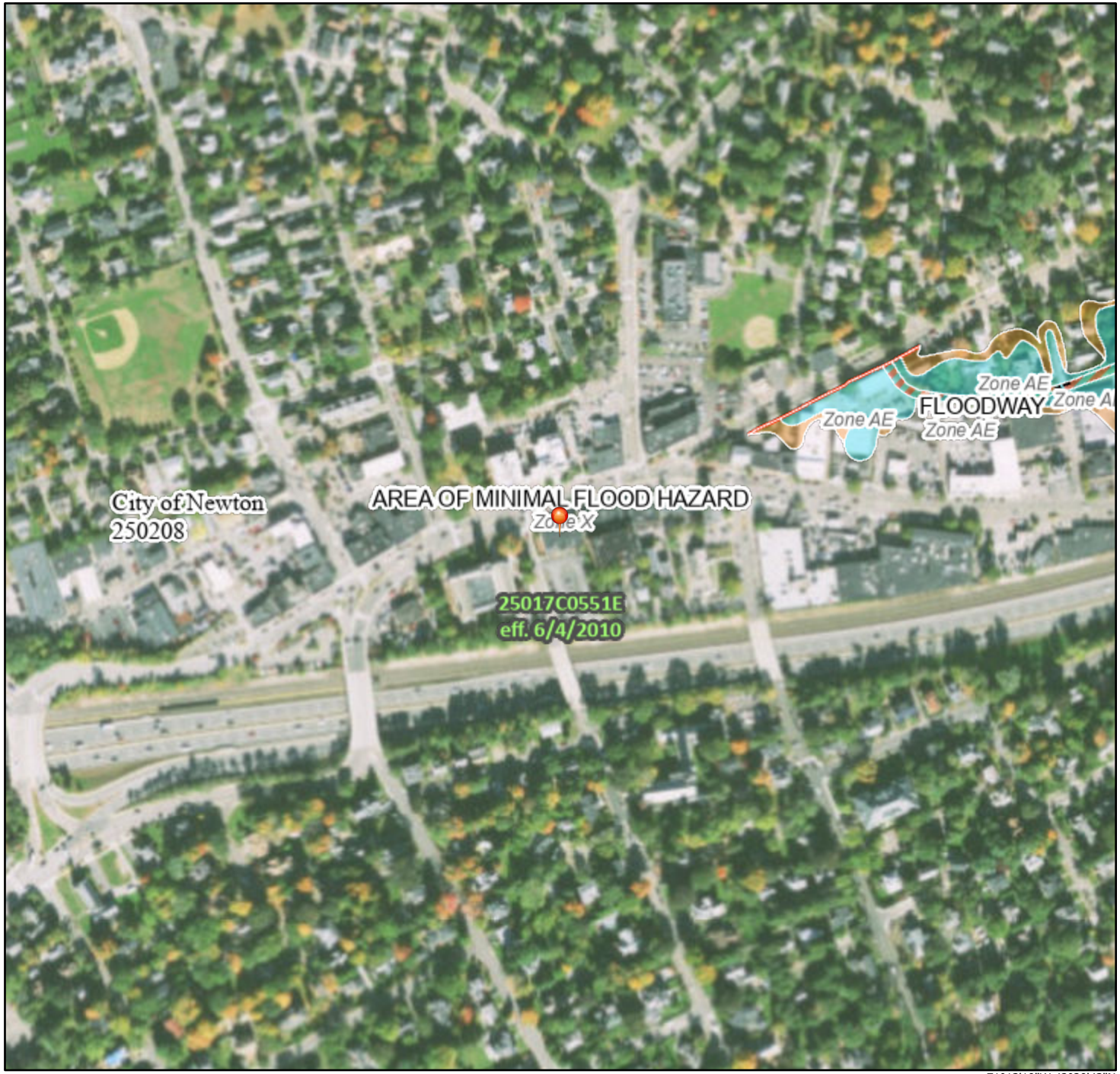
ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

NEWTON, MA
2021

NGA
NGA REF. NO. USGS.24K.2019

National Flood Hazard Layer FIRMette

71°13'56"W 42°21'10"N



71°13'19"W 42°20'43"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 4/27/2022 at 2:05 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 AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*

Map Scale: 1:1,120 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

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: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 4, 2020

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
602	Urban land		6.5	95.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	0.3	4.9%
Totals for Area of Interest			**6.9**	**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

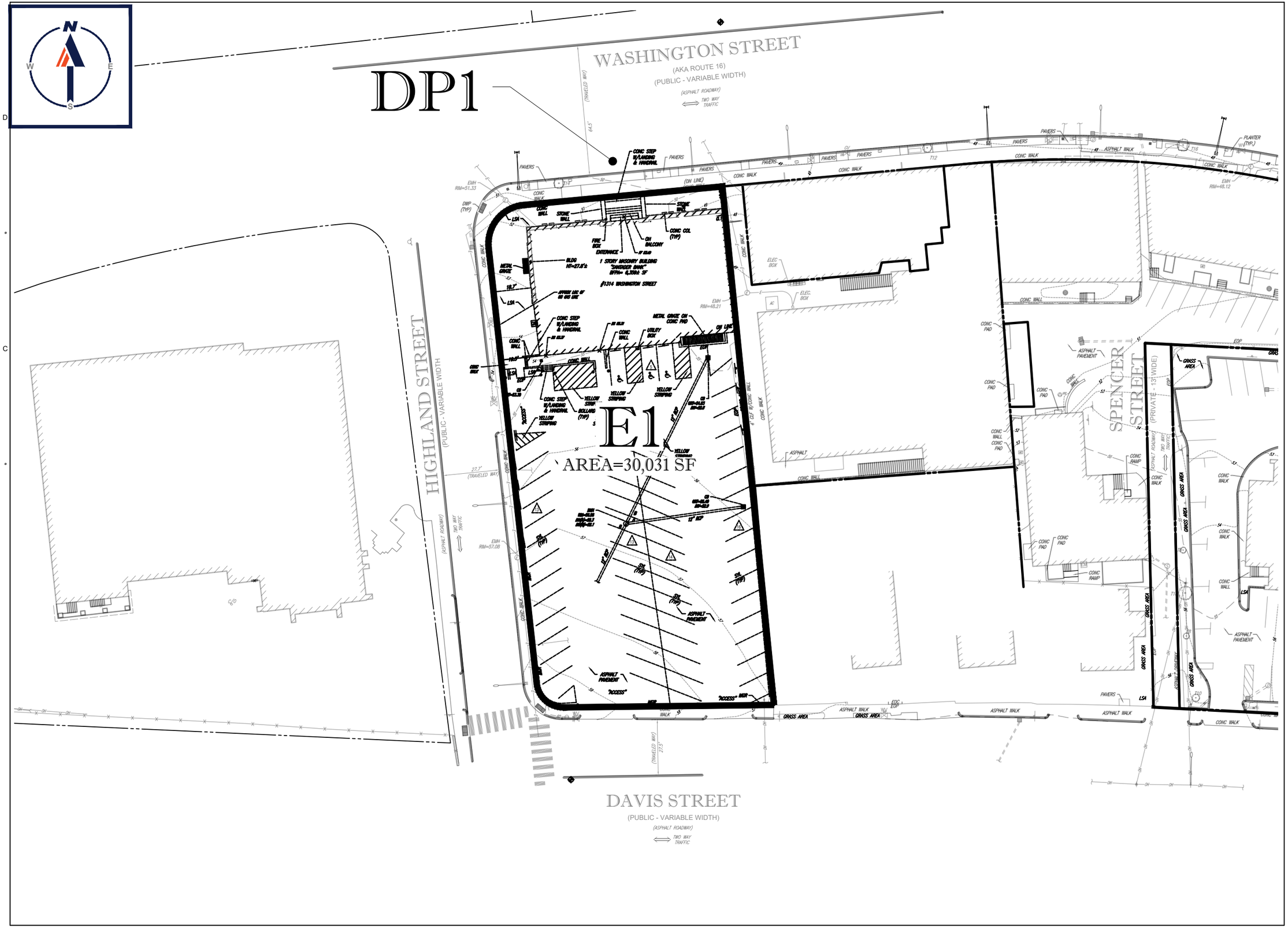
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

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



1314 WASHINGTON STREET

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OWNER

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NEWTON, MA 02466
617.614.9149

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WASHINGTON, DC 20036
202.862.0777

CIVIL ENGINEER

BOHLER
BOHLER ENGINEERING
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SOUTHBOROUGH, MA 01772
508.480.9900

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PROFESSIONAL SEAL

REVISIONS

#	DATE	DESCRIPTION
1	7/29/2022	PER CITY COMMENTS

REVIEW SET

NOT FOR CONSTRUCTION

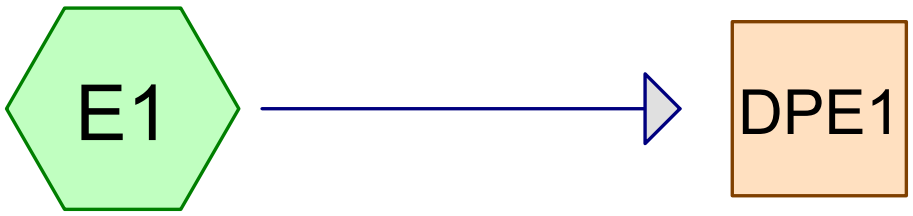
ISSUED: 05/02/2022

SHEET TITLE

EXISTING CONDITIONS WATERSHED MAP

SHEET NUMBER

WS-EX



to Newton Drainage System

Newton Drainage System

Subcat Reach Pond Link

Routing Diagram for W220043 Model
Prepared by {enter your company name here}, Printed 8/17/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.047	39	>75% Grass cover, Good, HSG A (E1)
0.496	98	Paved parking, HSG A (E1)
0.146	98	Roofs, HSG A (E1)
0.689	**94**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.689	HSG A	E1
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.689		**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
0.047	0.000	0.000	0.000	0.000	0.047	>75% Grass cover, Good	E1
0.496	0.000	0.000	0.000	0.000	0.496	Paved parking	E1
0.146	0.000	0.000	0.000	0.000	0.146	Roofs	E1
0.689	**0.000**	**0.000**	**0.000**	**0.000**	**0.689**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: to Newton Drainage Runoff Area=30,031 sf 93.11% Impervious Runoff Depth>2.53"
Tc=6.0 min CN=94 Runoff=1.92 cfs 0.145 af

Reach DPE1: Newton Drainage System Inflow=1.92 cfs 0.145 af
Outflow=1.92 cfs 0.145 af

Total Runoff Area = 0.689 ac Runoff Volume = 0.145 af Average Runoff Depth = 2.53"
6.89% Pervious = 0.047 ac 93.11% Impervious = 0.642 ac

Summary for Subcatchment E1: to Newton Drainage System

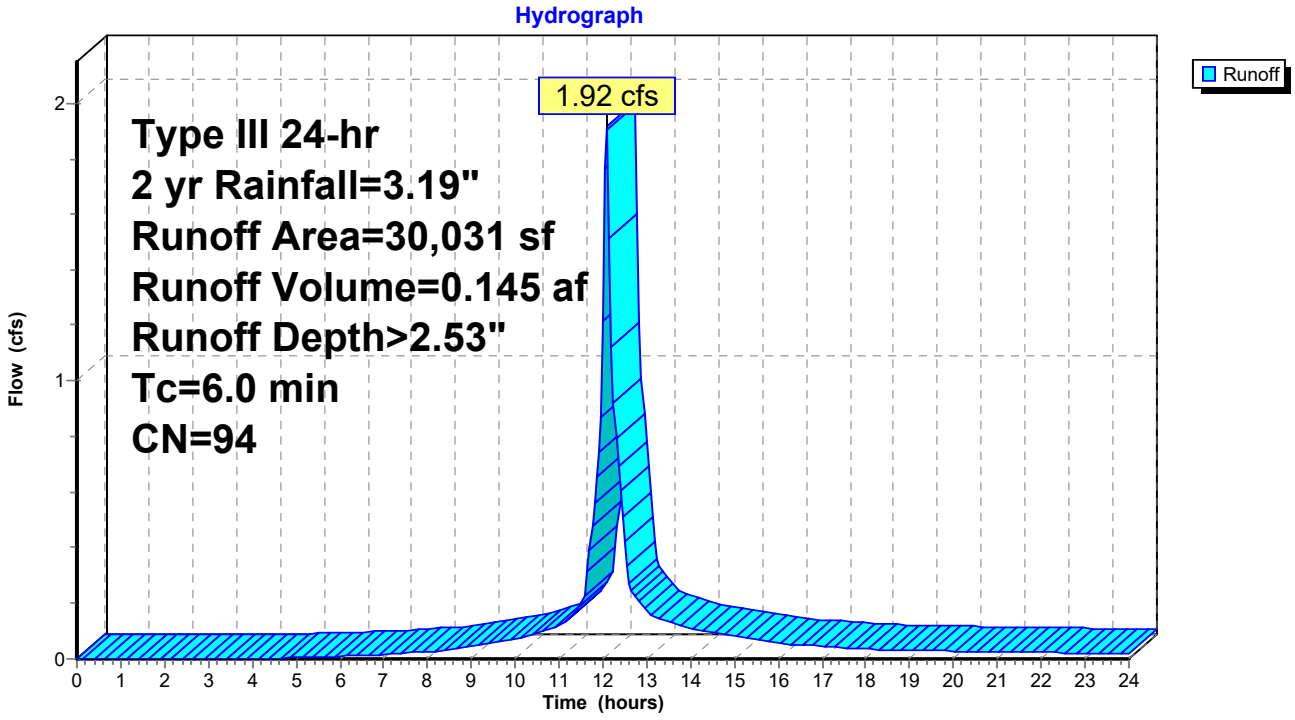
Runoff = 1.92 cfs @ 12.09 hrs, Volume= 0.145 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.19"

Area (sf)	CN	Description
2,069	39	>75% Grass cover, Good, HSG A
6,359	98	Roofs, HSG A
21,603	98	Paved parking, HSG A
30,031	94	Weighted Average
2,069		6.89% Pervious Area
27,962		93.11% Impervious Area

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

Subcatchment E1: to Newton Drainage System



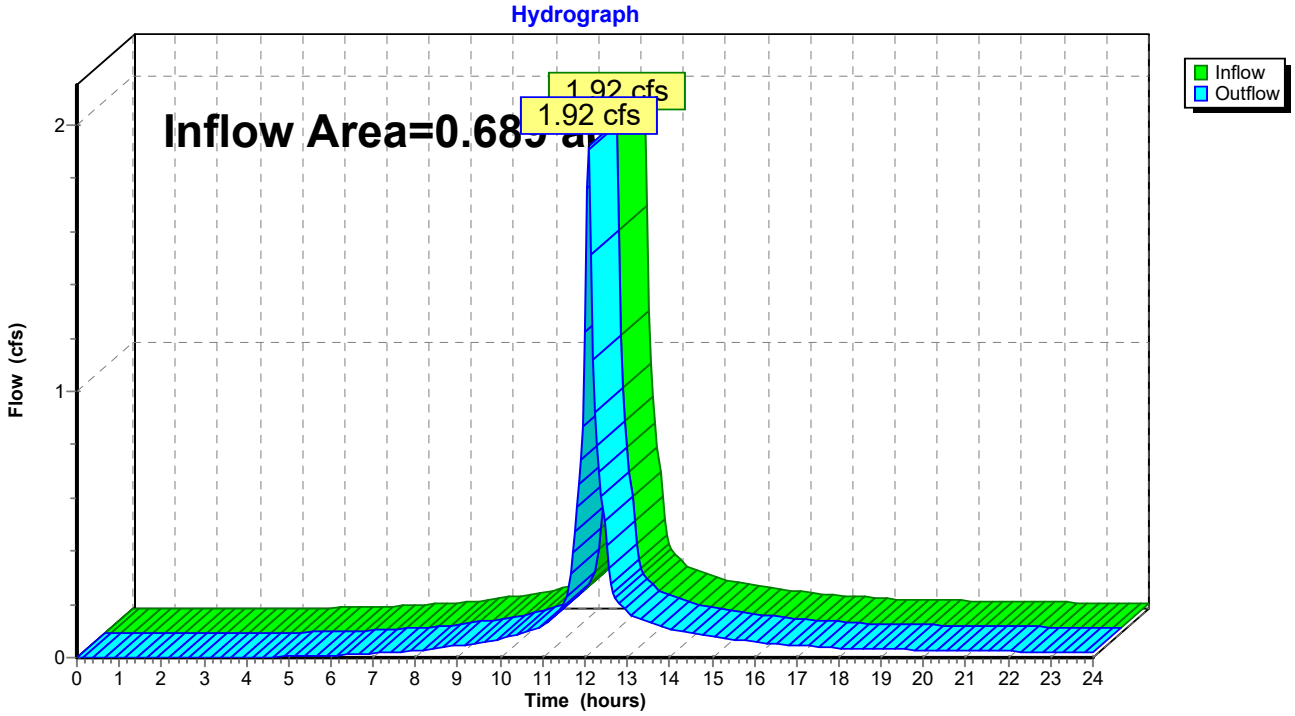
Summary for Reach DPE1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.689 ac, 93.11% Impervious, Inflow Depth > 2.53" for 2 yr event
Inflow = 1.92 cfs @ 12.09 hrs, Volume= 0.145 af
Outflow = 1.92 cfs @ 12.09 hrs, Volume= 0.145 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPE1: Newton Drainage System



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: to Newton Drainage Runoff Area=30,031 sf 93.11% Impervious Runoff Depth>4.13"
Tc=6.0 min CN=94 Runoff=3.04 cfs 0.237 af

Reach DPE1: Newton Drainage System Inflow=3.04 cfs 0.237 af
Outflow=3.04 cfs 0.237 af

Total Runoff Area = 0.689 ac Runoff Volume = 0.237 af Average Runoff Depth = 4.13"
6.89% Pervious = 0.047 ac 93.11% Impervious = 0.642 ac

Summary for Subcatchment E1: to Newton Drainage System

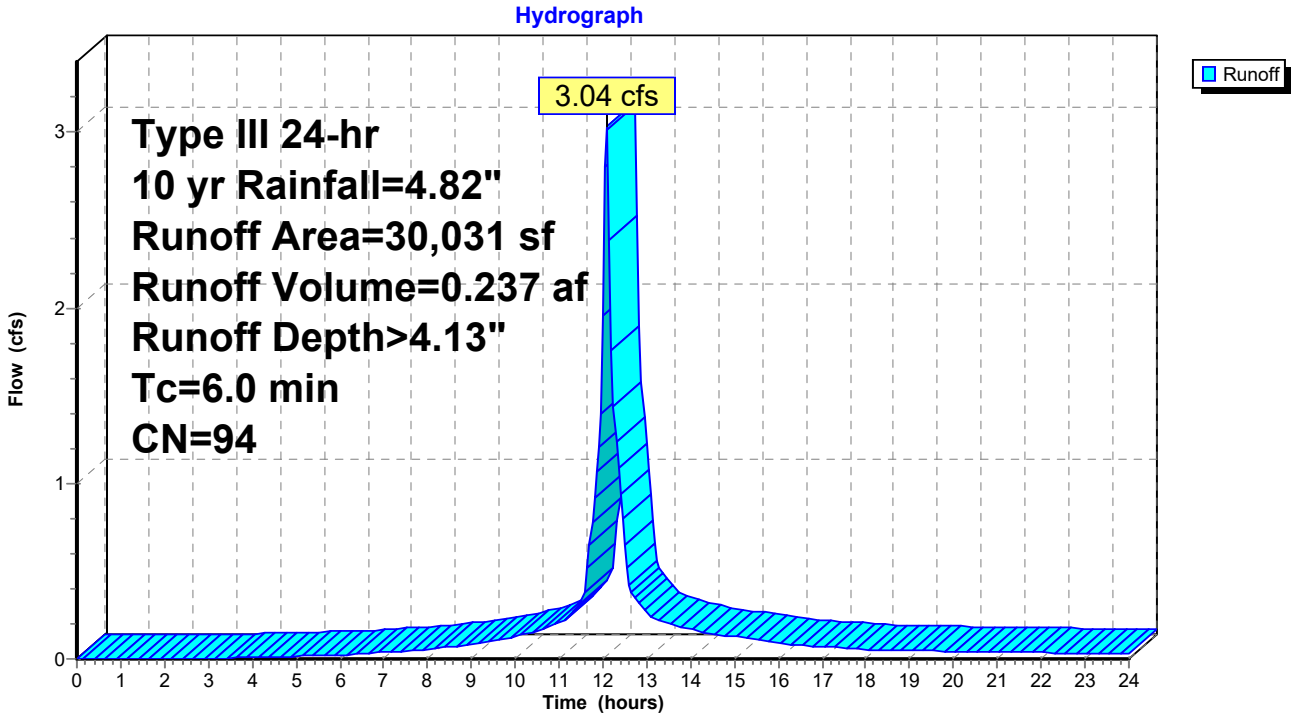
Runoff = 3.04 cfs @ 12.09 hrs, Volume= 0.237 af, Depth> 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.82"

Area (sf)	CN	Description
2,069	39	>75% Grass cover, Good, HSG A
6,359	98	Roofs, HSG A
21,603	98	Paved parking, HSG A
30,031	94	Weighted Average
2,069		6.89% Pervious Area
27,962		93.11% Impervious Area

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

Subcatchment E1: to Newton Drainage System



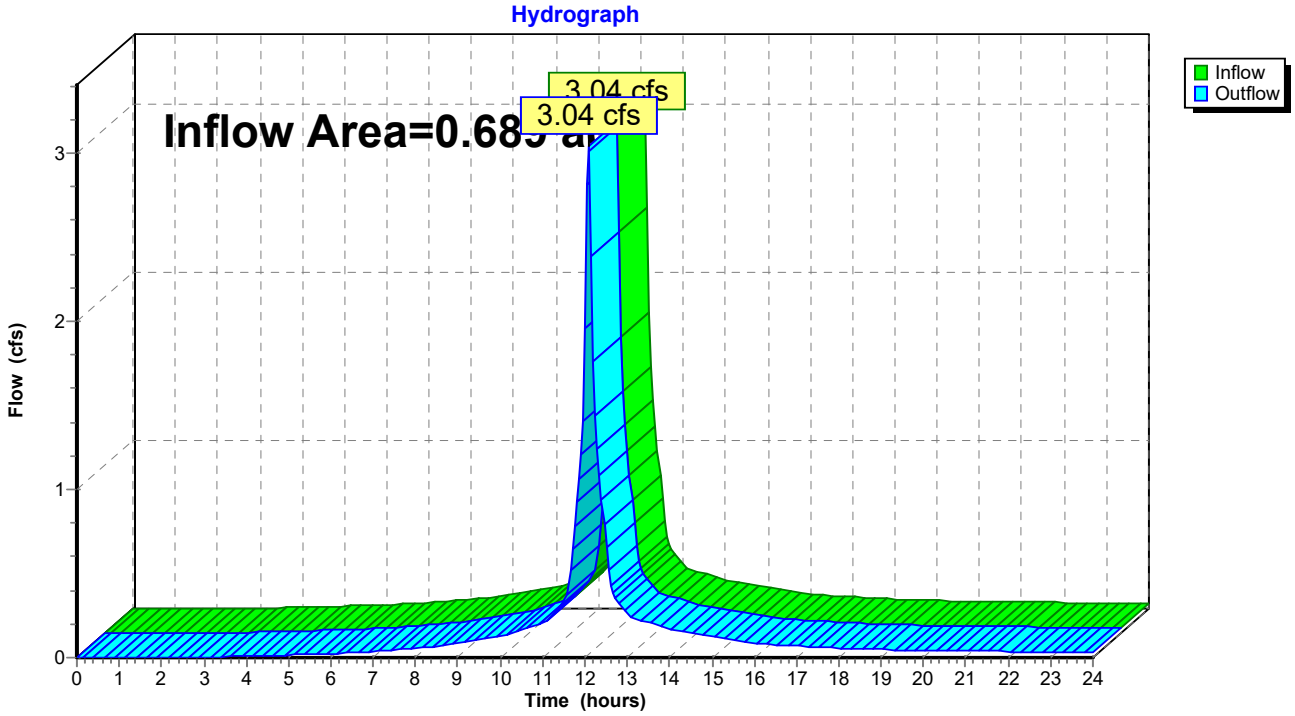
Summary for Reach DPE1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.689 ac, 93.11% Impervious, Inflow Depth > 4.13" for 10 yr event
Inflow = 3.04 cfs @ 12.09 hrs, Volume= 0.237 af
Outflow = 3.04 cfs @ 12.09 hrs, Volume= 0.237 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPE1: Newton Drainage System



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: to Newton Drainage Runoff Area=30,031 sf 93.11% Impervious Runoff Depth>5.39"
Tc=6.0 min CN=94 Runoff=3.91 cfs 0.310 af

Reach DPE1: Newton Drainage System Inflow=3.91 cfs 0.310 af
Outflow=3.91 cfs 0.310 af

Total Runoff Area = 0.689 ac Runoff Volume = 0.310 af Average Runoff Depth = 5.39"
6.89% Pervious = 0.047 ac 93.11% Impervious = 0.642 ac

Summary for Subcatchment E1: to Newton Drainage System

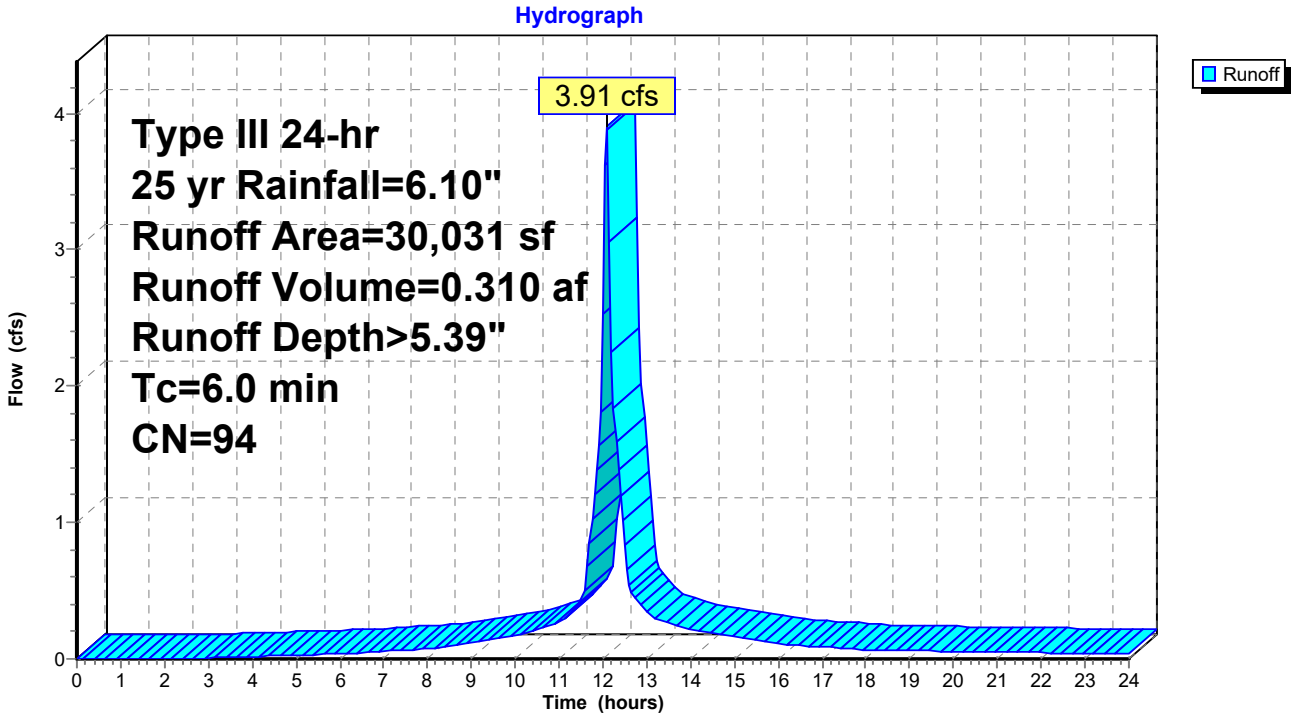
Runoff = 3.91 cfs @ 12.09 hrs, Volume= 0.310 af, Depth> 5.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.10"

Area (sf)	CN	Description
2,069	39	>75% Grass cover, Good, HSG A
6,359	98	Roofs, HSG A
21,603	98	Paved parking, HSG A
30,031	94	Weighted Average
2,069		6.89% Pervious Area
27,962		93.11% Impervious Area

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

Subcatchment E1: to Newton Drainage System



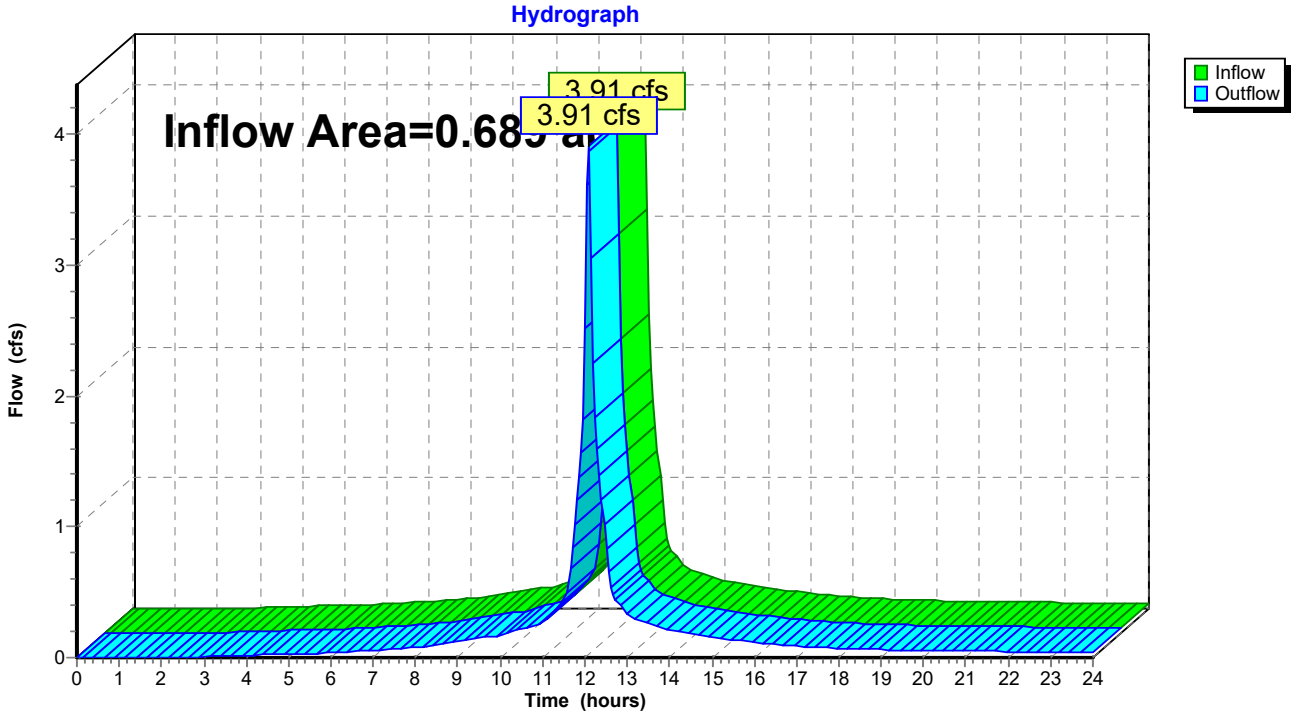
Summary for Reach DPE1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.689 ac, 93.11% Impervious, Inflow Depth > 5.39" for 25 yr event
Inflow = 3.91 cfs @ 12.09 hrs, Volume= 0.310 af
Outflow = 3.91 cfs @ 12.09 hrs, Volume= 0.310 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPE1: Newton Drainage System



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: to Newton Drainage Runoff Area=30,031 sf 93.11% Impervious Runoff Depth>8.05"
Tc=6.0 min CN=94 Runoff=5.72 cfs 0.463 af

Reach DPE1: Newton Drainage System Inflow=5.72 cfs 0.463 af
Outflow=5.72 cfs 0.463 af

Total Runoff Area = 0.689 ac Runoff Volume = 0.463 af Average Runoff Depth = 8.05"
6.89% Pervious = 0.047 ac 93.11% Impervious = 0.642 ac

Summary for Subcatchment E1: to Newton Drainage System

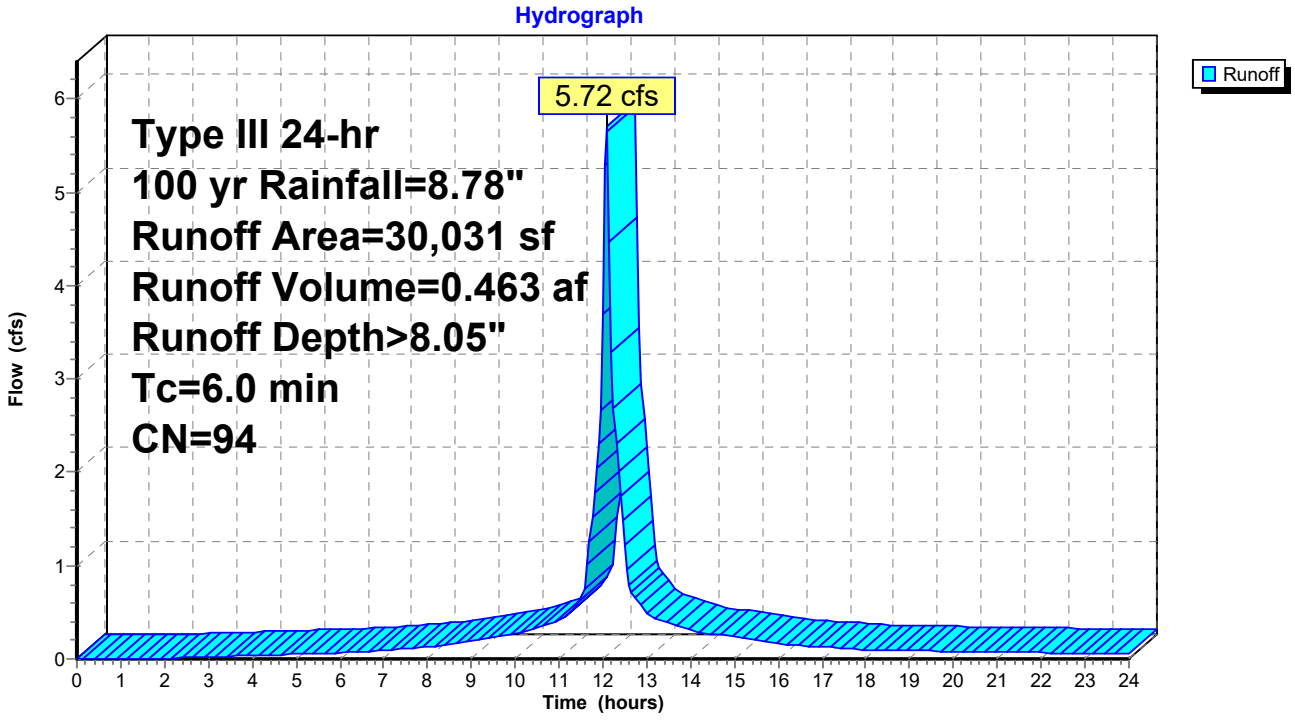
Runoff = 5.72 cfs @ 12.09 hrs, Volume= 0.463 af, Depth> 8.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.78"

Area (sf)	CN	Description
2,069	39	>75% Grass cover, Good, HSG A
6,359	98	Roofs, HSG A
21,603	98	Paved parking, HSG A
30,031	94	Weighted Average
2,069		6.89% Pervious Area
27,962		93.11% Impervious Area

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

Subcatchment E1: to Newton Drainage System



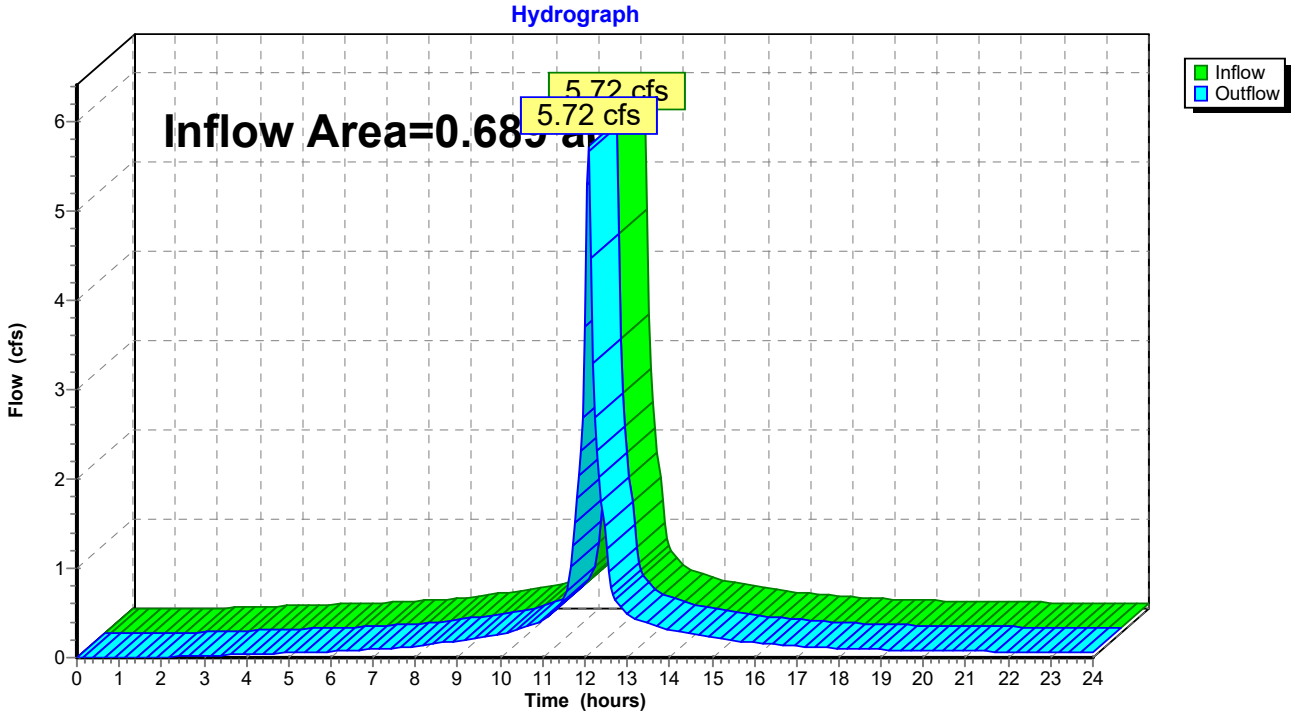
Summary for Reach DPE1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.689 ac, 93.11% Impervious, Inflow Depth > 8.05" for 100 yr event
Inflow = 5.72 cfs @ 12.09 hrs, Volume= 0.463 af
Outflow = 5.72 cfs @ 12.09 hrs, Volume= 0.463 af, Atten= 0%, Lag= 0.0 min

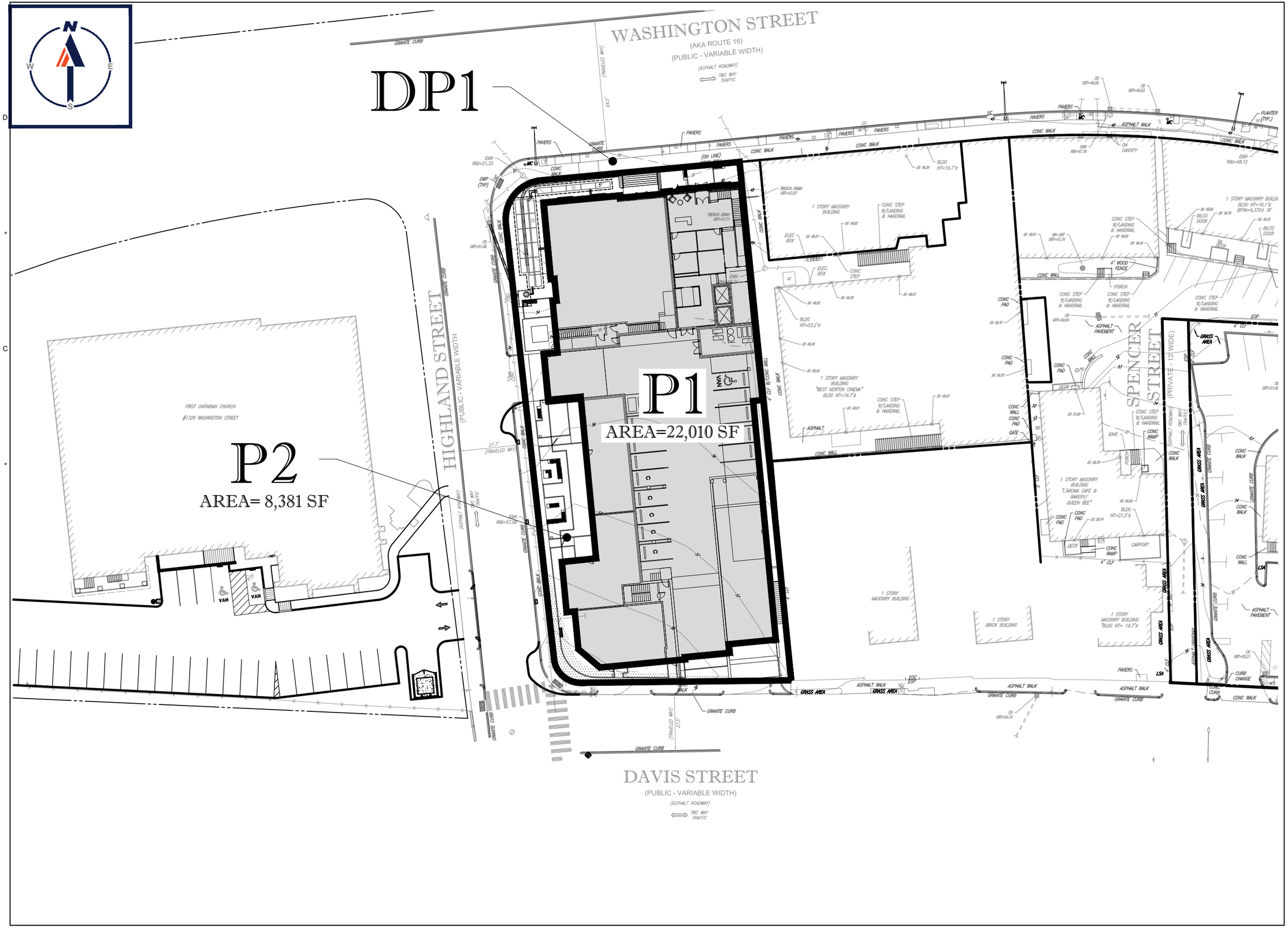
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPE1: Newton Drainage System



APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

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



1314 WASHINGTON STREET

WEST NEWTON, MA

OWNER

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NEWTON, MA 02466
617.614.9149

DESIGN ARCHITECT

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WASHINGTON, DC 20036
202.862.0777

CIVIL ENGINEER

BOHLER ENGINEERING
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
508.480.9900

LANDSCAPE ARCHITECT

HALVORSON | TIGHE & BOND STUDIO
25 KINGSTON STREET
BOSTON, MA 02111-2200
617.536.0380

PROFESSIONAL SEAL

REVISIONS

#	DATE	DESCRIPTION
1	7/29/2022	PER CITY COMMENTS

REVIEW SET

NOT FOR CONSTRUCTION

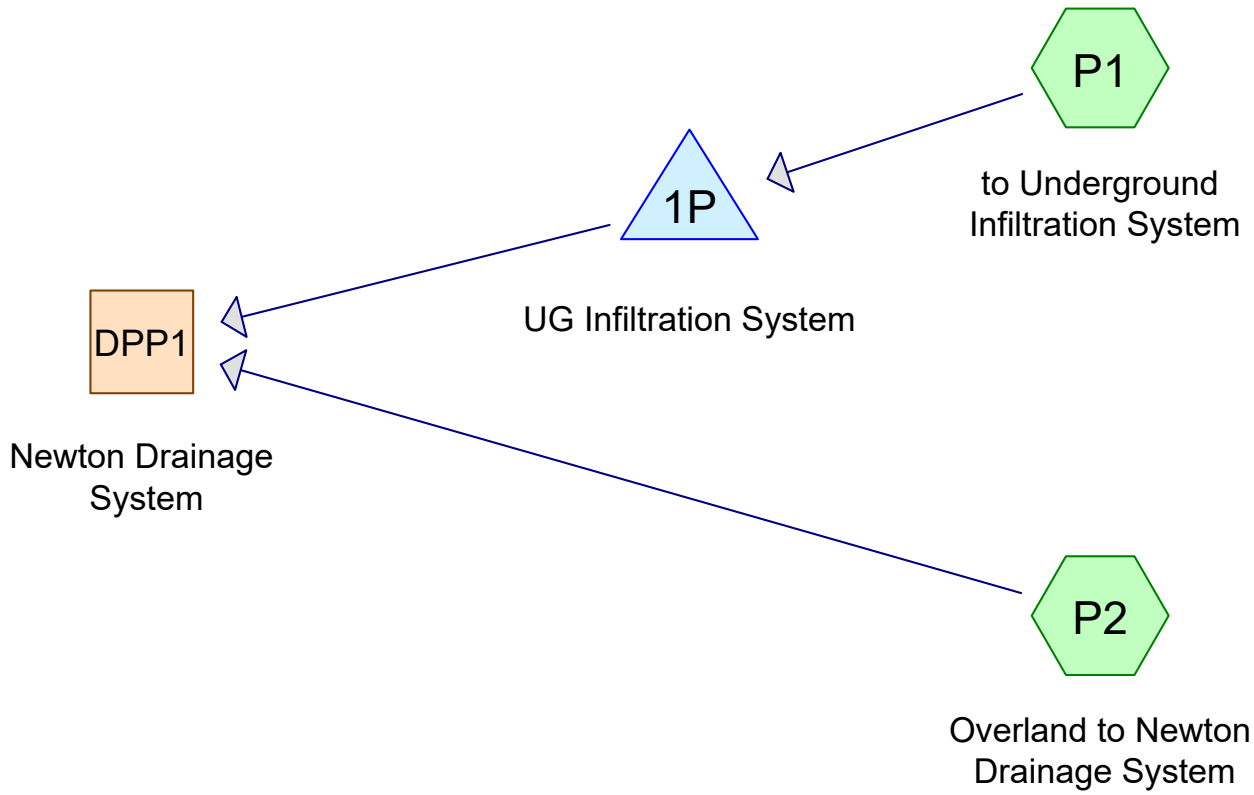
ISSUED: 05/02/2022

SHEET TITLE:

PROPOSED CONDITIONS WATERSHED MAP

SHEET NO:

WS-PR



Subcat Reach Pond Link

Routing Diagram for W220043 Model
Prepared by {enter your company name here}, Printed 8/18/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.061	39	>75% Grass cover, Good, HSG A (P2)
0.132	98	Paved parking, HSG A (P2)
0.505	98	Unconnected roofs, HSG A (P1)
0.698	**93**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.698	HSG A	P1, P2
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.698		**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
0.061	0.000	0.000	0.000	0.000	0.061	>75% Grass cover, Good	P2
0.132	0.000	0.000	0.000	0.000	0.132	Paved parking	P2
0.505	0.000	0.000	0.000	0.000	0.505	Unconnected roofs	P1
0.698	**0.000**	**0.000**	**0.000**	**0.000**	**0.698**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: to Underground Runoff Area=22,010 sf 100.00% Impervious Runoff Depth>2.96"
Tc=6.0 min CN=98 Runoff=1.53 cfs 0.124 af

Subcatchment P2: Overland to Newton Runoff Area=8,381 sf 68.38% Impervious Runoff Depth>1.33"
Tc=6.0 min CN=79 Runoff=0.29 cfs 0.021 af

Reach DPP1: Newton Drainage System Inflow=1.10 cfs 0.051 af
Outflow=1.10 cfs 0.051 af

Pond 1P: UG Infiltration System Peak Elev=52.35' Storage=916 cf Inflow=1.53 cfs 0.124 af
Discarded=0.15 cfs 0.095 af Primary=0.87 cfs 0.029 af Outflow=1.02 cfs 0.124 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.146 af Average Runoff Depth = 2.51"
8.72% Pervious = 0.061 ac 91.28% Impervious = 0.637 ac

Summary for Subcatchment P1: to Underground Infiltration System

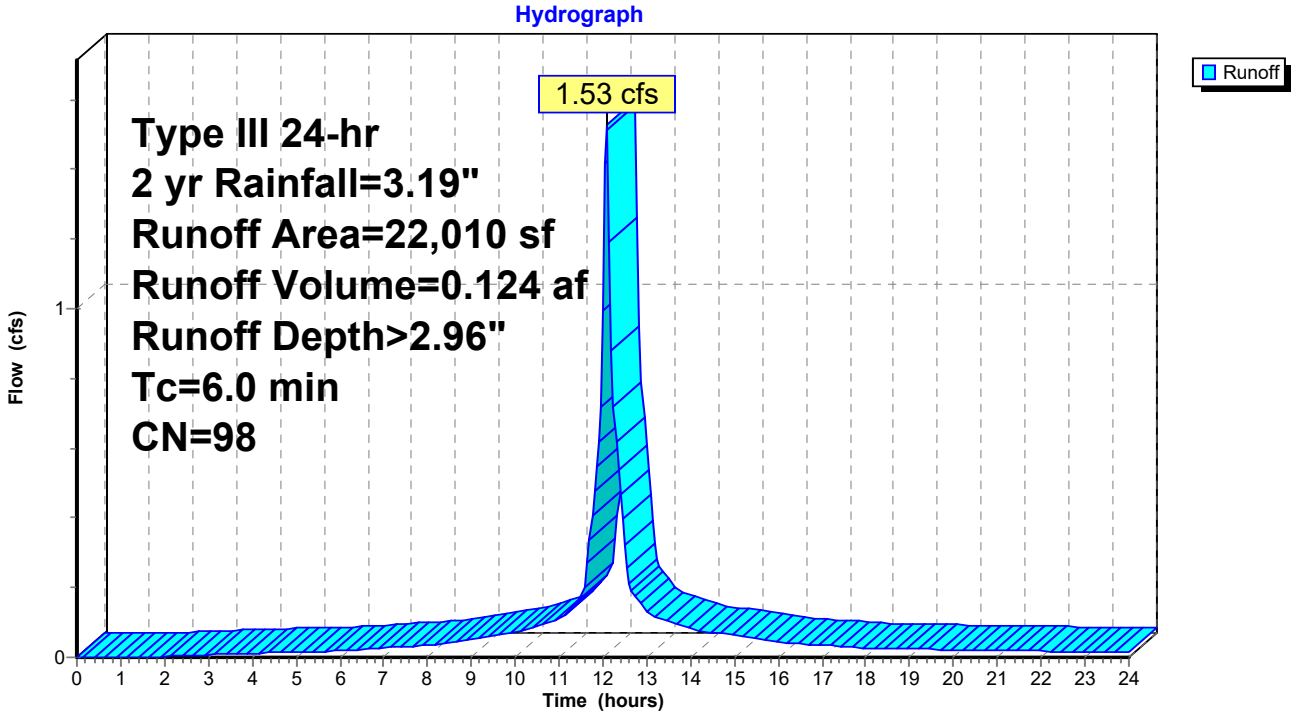
Runoff = 1.53 cfs @ 12.09 hrs, Volume= 0.124 af, Depth> 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.19"

Area (sf)	CN	Description
22,010	98	Unconnected roofs, HSG A
22,010		100.00% Impervious Area
22,010		100.00% Unconnected

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

Subcatchment P1: to Underground Infiltration System



Summary for Subcatchment P2: Overland to Newton Drainage System

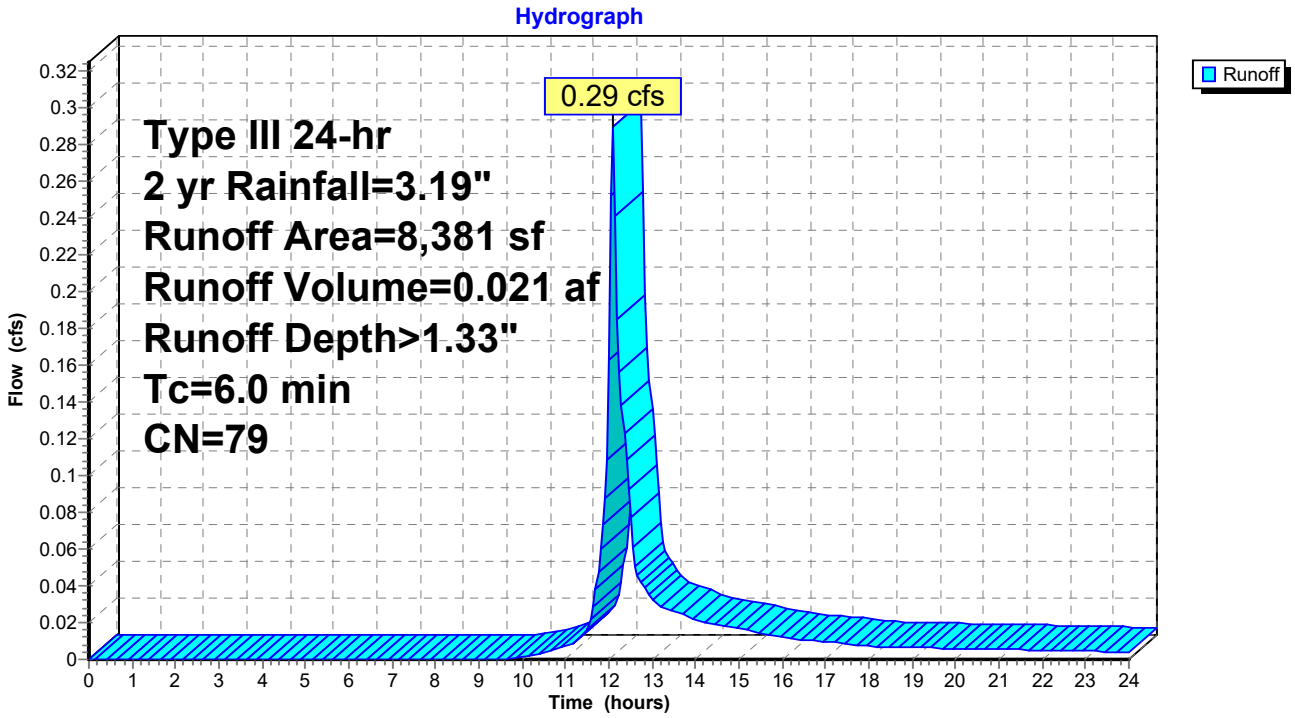
Runoff = 0.29 cfs @ 12.10 hrs, Volume= 0.021 af, Depth> 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.19"

Area (sf)	CN	Description
2,650	39	>75% Grass cover, Good, HSG A
5,731	98	Paved parking, HSG A
8,381	79	Weighted Average
2,650		31.62% Pervious Area
5,731		68.38% Impervious Area

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

Subcatchment P2: Overland to Newton Drainage System



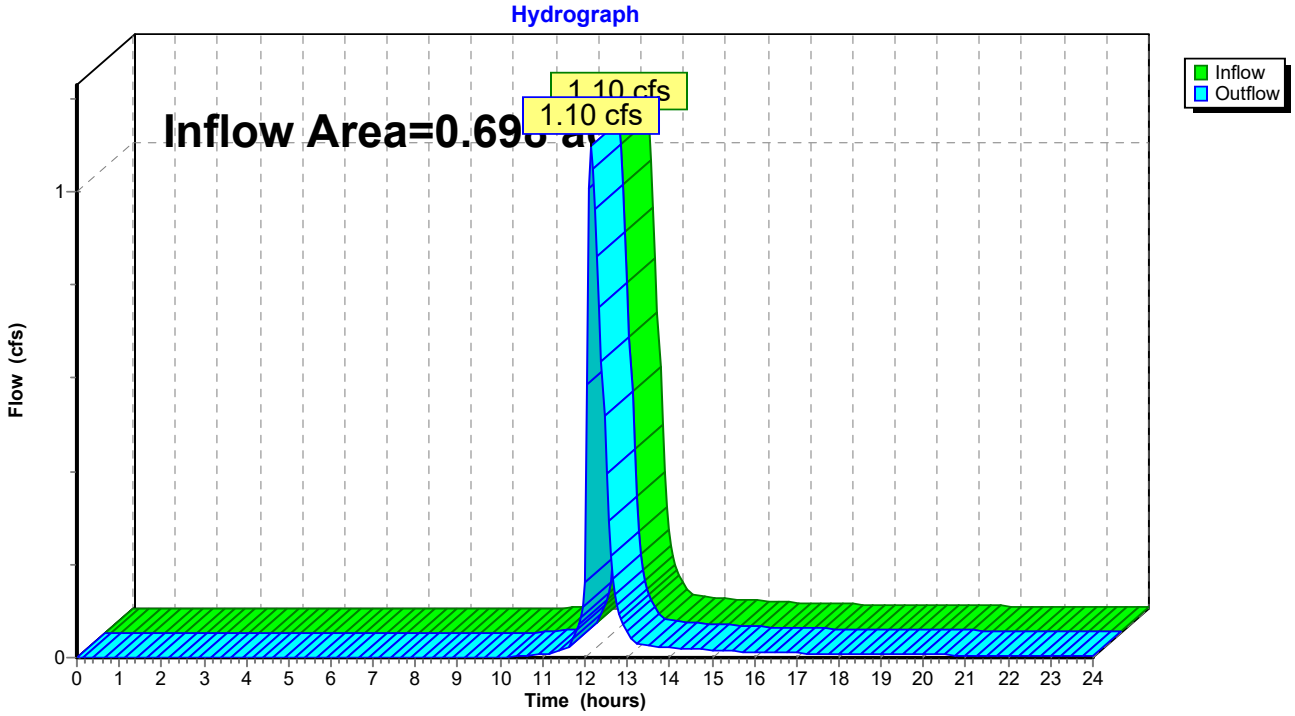
Summary for Reach DPP1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.698 ac, 91.28% Impervious, Inflow Depth > 0.87" for 2 yr event
Inflow = 1.10 cfs @ 12.16 hrs, Volume= 0.051 af
Outflow = 1.10 cfs @ 12.16 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPP1: Newton Drainage System



Summary for Pond 1P: UG Infiltration System

[93] Warning: Storage range exceeded by 0.01'

Inflow Area = 0.505 ac,100.00% Impervious, Inflow Depth > 2.96" for 2 yr event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.124 af
Outflow = 1.02 cfs @ 12.18 hrs, Volume= 0.124 af, Atten= 33%, Lag= 5.7 min
Discarded = 0.15 cfs @ 11.35 hrs, Volume= 0.095 af
Primary = 0.87 cfs @ 12.18 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.35' @ 12.18 hrs Surf.Area= 773 sf Storage= 916 cf

Plug-Flow detention time= 17.8 min calculated for 0.124 af (100% of inflow)
Center-of-Mass det. time= 17.7 min (773.8 - 756.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	50.00'	591 cf	**4.83'W x 159.84'L x 2.33'H Field A** 1,803 cf Overall - 324 cf Embedded = 1,478 cf x 40.0% Voids
#2A	50.50'	324 cf	**ADS_StormTech SC-310 +Cap** x 22 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
		916 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.25'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.15 cfs @ 11.35 hrs HW=50.02' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.86 cfs @ 12.18 hrs HW=52.33' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.86 cfs @ 4.39 fps)

Pond 1P: UG Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
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

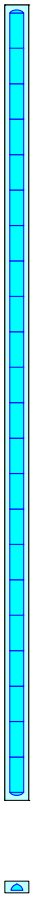
22 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 157.84' Row Length +12.0" End Stone x 2 = 159.84' Base Length
1 Rows x 34.0" Wide + 12.0" Side Stone x 2 = 4.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

22 Chambers x 14.7 cf = 324.3 cf Chamber Storage

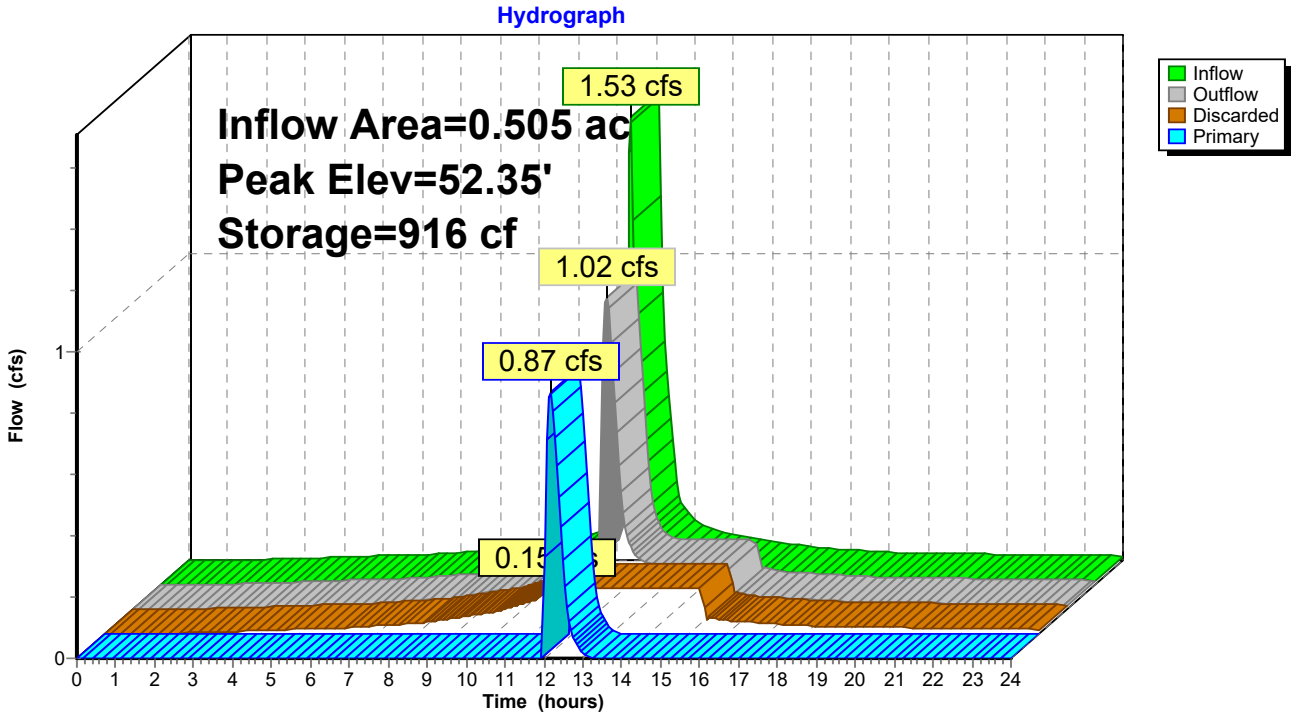
1,802.6 cf Field - 324.3 cf Chambers = 1,478.3 cf Stone x 40.0% Voids = 591.3 cf Stone Storage

Chamber Storage + Stone Storage = 915.6 cf = 0.021 af
Overall Storage Efficiency = 50.8%
Overall System Size = 159.84' x 4.83' x 2.33'

22 Chambers
66.8 cy Field
54.8 cy Stone



Pond 1P: UG Infiltration System



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: to Underground Runoff Area=22,010 sf 100.00% Impervious Runoff Depth>4.58"
Tc=6.0 min CN=98 Runoff=2.33 cfs 0.193 af

Subcatchment P2: Overland to Newton Runoff Area=8,381 sf 68.38% Impervious Runoff Depth>2.64"
Tc=6.0 min CN=79 Runoff=0.59 cfs 0.042 af

Reach DPP1: Newton Drainage System Inflow=2.83 cfs 0.107 af
Outflow=2.83 cfs 0.107 af

Pond 1P: UG Infiltration System Peak Elev=57.10' Storage=916 cf Inflow=2.33 cfs 0.193 af
Discarded=0.15 cfs 0.128 af Primary=2.24 cfs 0.065 af Outflow=2.39 cfs 0.193 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.235 af Average Runoff Depth = 4.05"
8.72% Pervious = 0.061 ac 91.28% Impervious = 0.637 ac

Summary for Subcatchment P1: to Underground Infiltration System

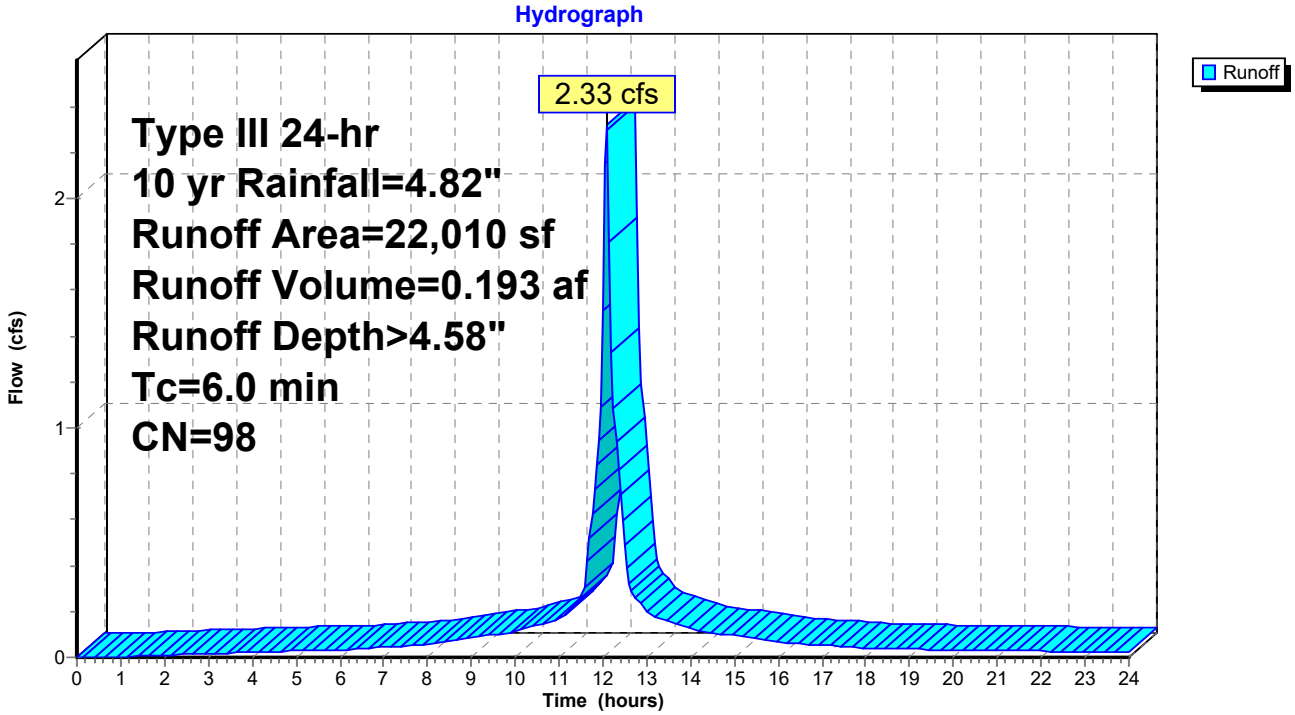
Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.193 af, Depth> 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.82"

Area (sf)	CN	Description
22,010	98	Unconnected roofs, HSG A
22,010		100.00% Impervious Area
22,010		100.00% Unconnected

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

Subcatchment P1: to Underground Infiltration System



Summary for Subcatchment P2: Overland to Newton Drainage System

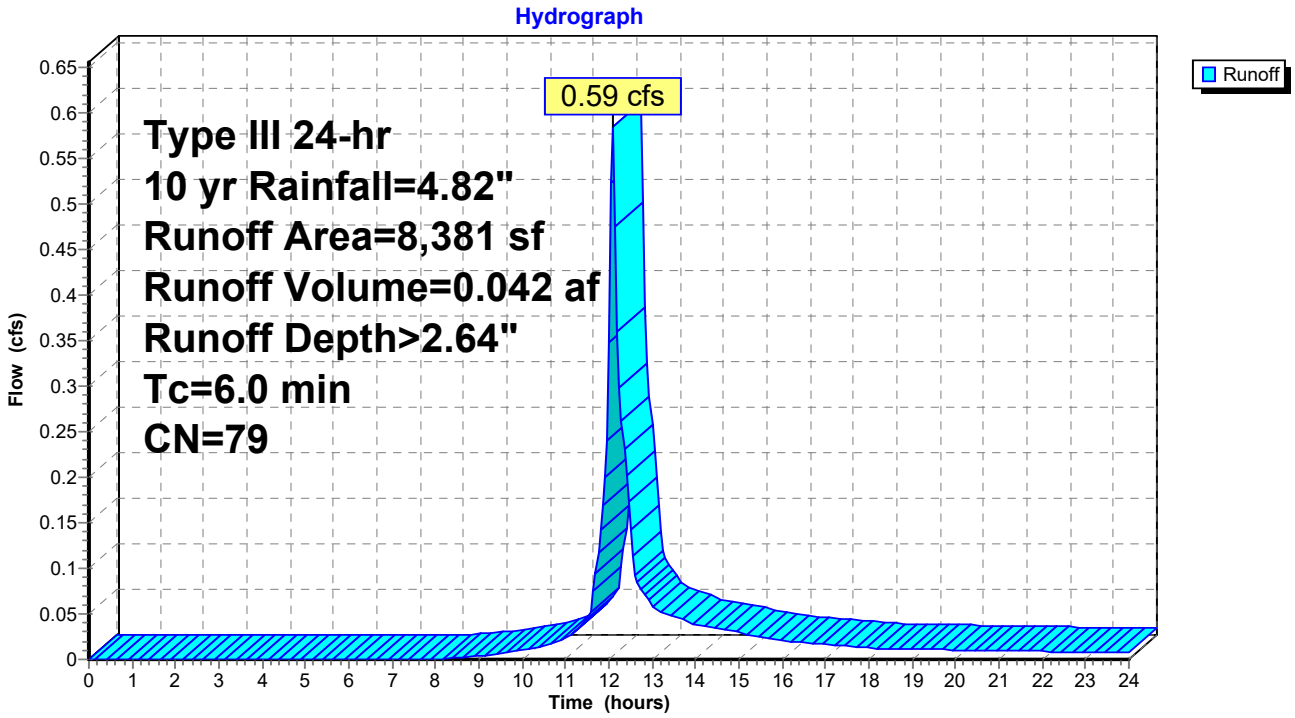
Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.82"

Area (sf)	CN	Description
2,650	39	>75% Grass cover, Good, HSG A
5,731	98	Paved parking, HSG A
8,381	79	Weighted Average
2,650		31.62% Pervious Area
5,731		68.38% Impervious Area

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

Subcatchment P2: Overland to Newton Drainage System



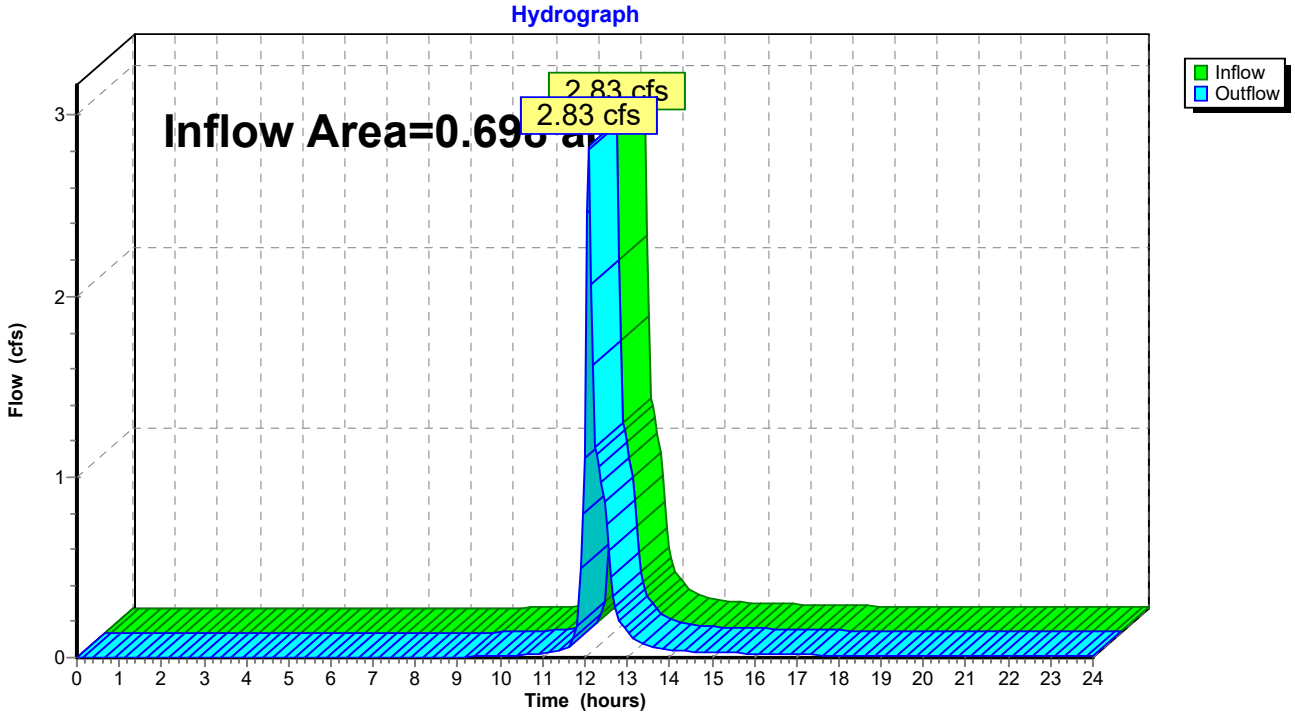
Summary for Reach DPP1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.698 ac, 91.28% Impervious, Inflow Depth > 1.85" for 10 yr event
Inflow = 2.83 cfs @ 12.09 hrs, Volume= 0.107 af
Outflow = 2.83 cfs @ 12.09 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPP1: Newton Drainage System



Summary for Pond 1P: UG Infiltration System

[93] Warning: Storage range exceeded by 4.77'
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 0.505 ac,100.00% Impervious, Inflow Depth > 4.58" for 10 yr event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.193 af
Outflow = 2.39 cfs @ 12.09 hrs, Volume= 0.193 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.15 cfs @ 10.70 hrs, Volume= 0.128 af
Primary = 2.24 cfs @ 12.09 hrs, Volume= 0.065 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 57.10' @ 12.09 hrs Surf.Area= 773 sf Storage= 916 cf

Plug-Flow detention time= 17.7 min calculated for 0.193 af (100% of inflow)
Center-of-Mass det. time= 17.5 min (765.7 - 748.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	50.00'	591 cf	**4.83'W x 159.84'L x 2.33'H Field A** 1,803 cf Overall - 324 cf Embedded = 1,478 cf x 40.0% Voids
#2A	50.50'	324 cf	**ADS_StormTech SC-310 +Cap** x 22 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
		916 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.25'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.15 cfs @ 10.70 hrs HW=50.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=2.18 cfs @ 12.09 hrs HW=56.79' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 2.18 cfs @ 11.08 fps)

Pond 1P: UG Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
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

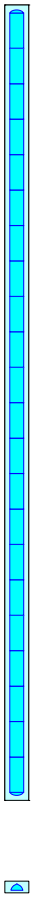
22 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 157.84' Row Length +12.0" End Stone x 2 = 159.84' Base Length
1 Rows x 34.0" Wide + 12.0" Side Stone x 2 = 4.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

22 Chambers x 14.7 cf = 324.3 cf Chamber Storage

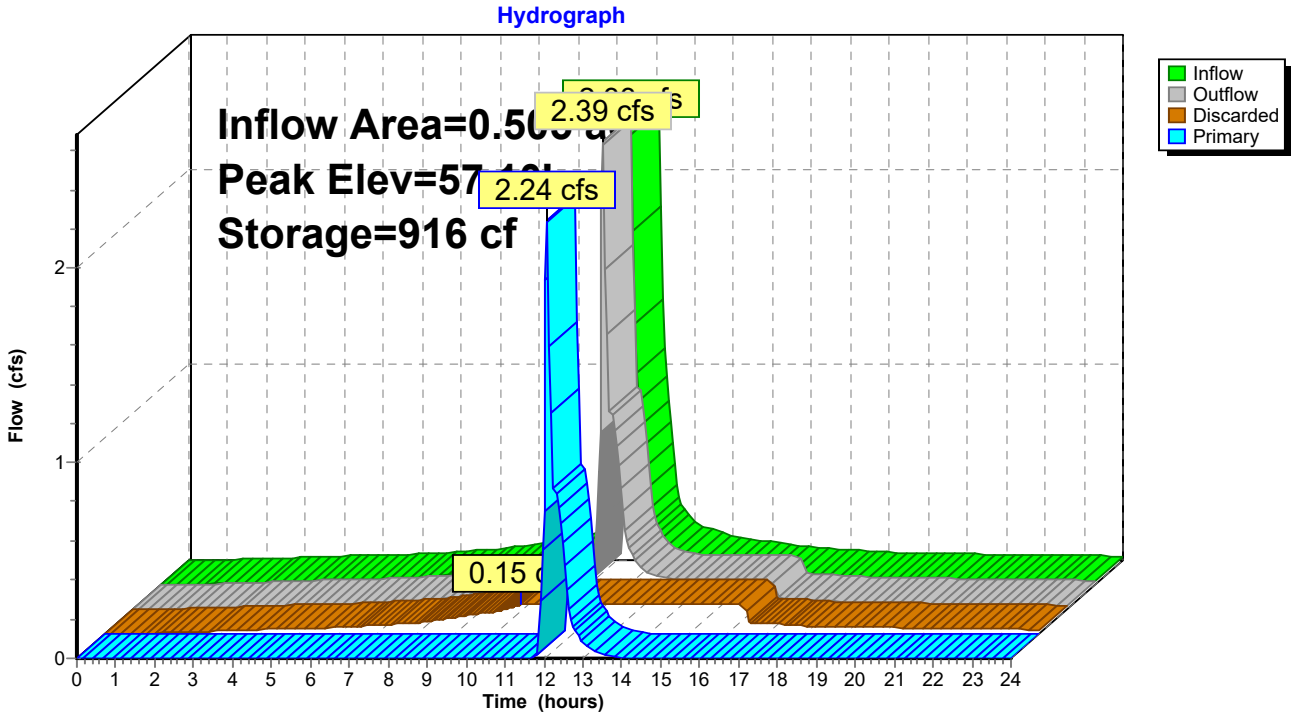
1,802.6 cf Field - 324.3 cf Chambers = 1,478.3 cf Stone x 40.0% Voids = 591.3 cf Stone Storage

Chamber Storage + Stone Storage = 915.6 cf = 0.021 af
Overall Storage Efficiency = 50.8%
Overall System Size = 159.84' x 4.83' x 2.33'

22 Chambers
66.8 cy Field
54.8 cy Stone



Pond 1P: UG Infiltration System



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: to Underground Runoff Area=22,010 sf 100.00% Impervious Runoff Depth>5.86"
Tc=6.0 min CN=98 Runoff=2.95 cfs 0.247 af

Subcatchment P2: Overland to Newton Runoff Area=8,381 sf 68.38% Impervious Runoff Depth>3.77"
Tc=6.0 min CN=79 Runoff=0.83 cfs 0.060 af

Reach DPP1: Newton Drainage System Inflow=3.91 cfs 0.158 af
Outflow=3.91 cfs 0.158 af

Pond 1P: UG Infiltration System Peak Elev=62.10' Storage=916 cf Inflow=2.95 cfs 0.247 af
Discarded=0.15 cfs 0.149 af Primary=3.08 cfs 0.098 af Outflow=3.23 cfs 0.247 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.307 af Average Runoff Depth = 5.28"
8.72% Pervious = 0.061 ac 91.28% Impervious = 0.637 ac

Summary for Subcatchment P1: to Underground Infiltration System

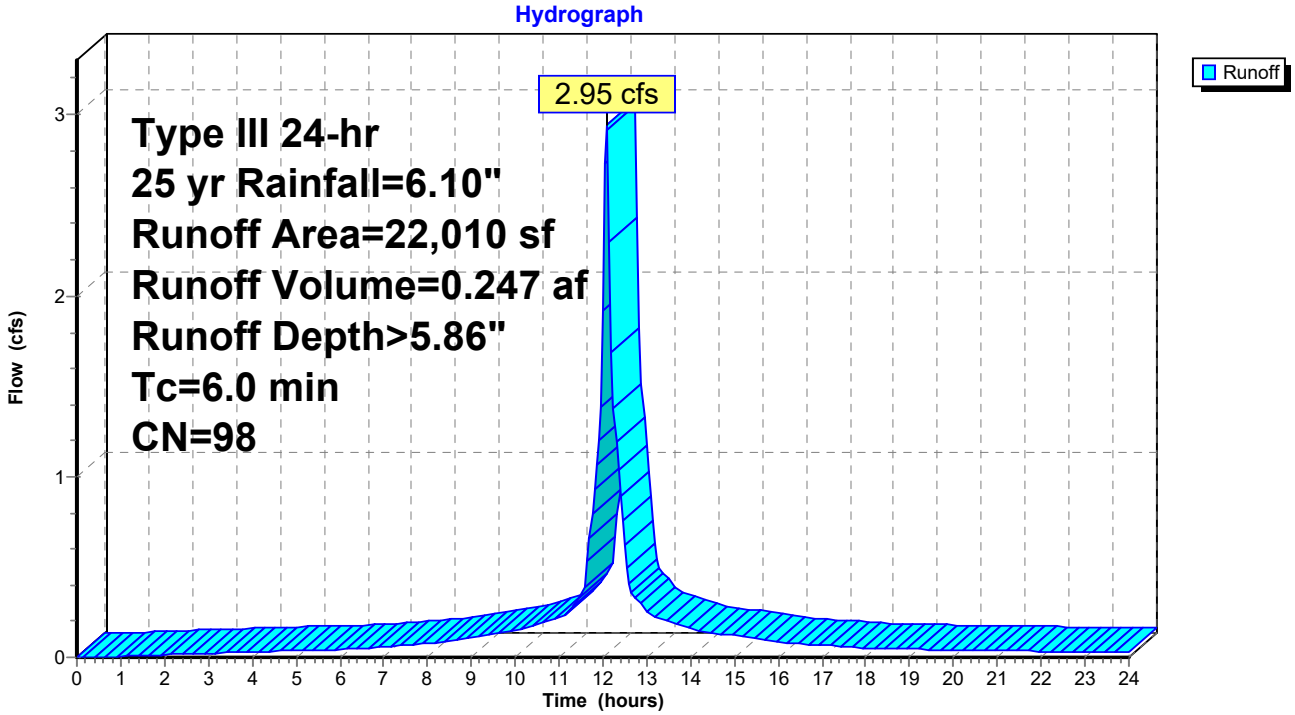
Runoff = 2.95 cfs @ 12.09 hrs, Volume= 0.247 af, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.10"

Area (sf)	CN	Description
22,010	98	Unconnected roofs, HSG A
22,010		100.00% Impervious Area
22,010		100.00% Unconnected

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

Subcatchment P1: to Underground Infiltration System



Summary for Subcatchment P2: Overland to Newton Drainage System

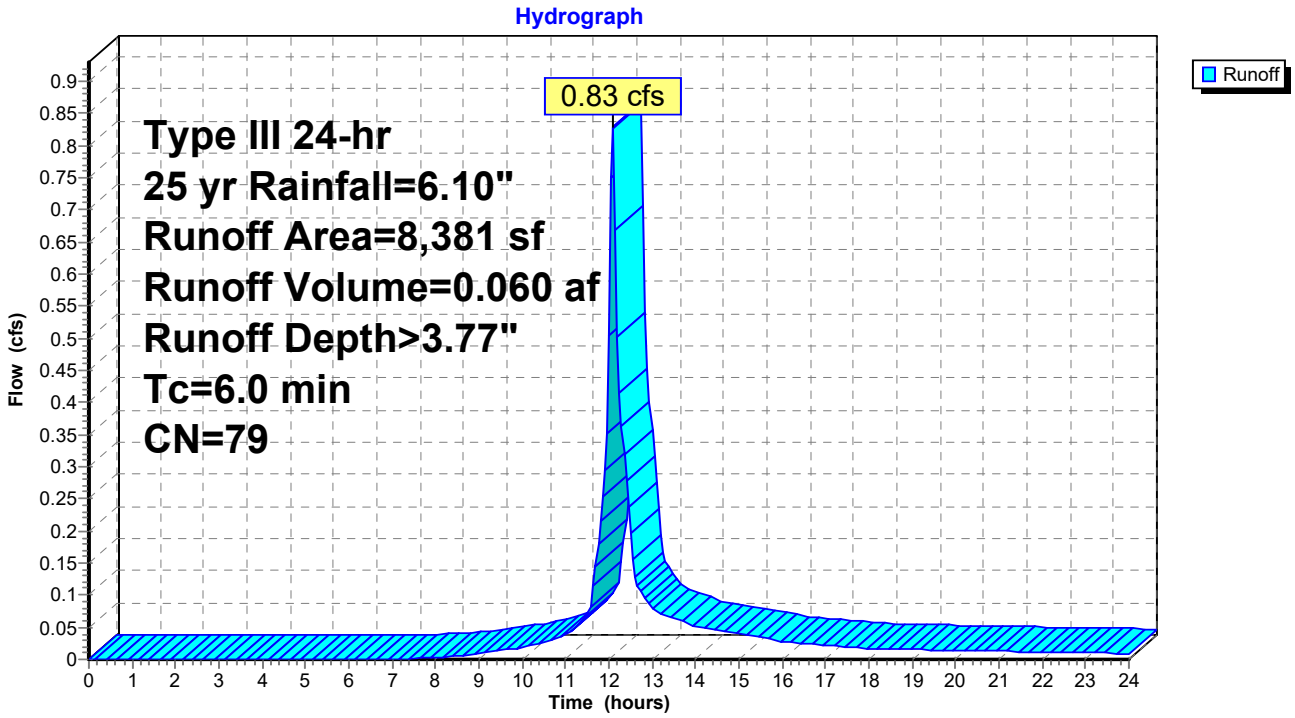
Runoff = 0.83 cfs @ 12.09 hrs, Volume= 0.060 af, Depth> 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=6.10"

Area (sf)	CN	Description
2,650	39	>75% Grass cover, Good, HSG A
5,731	98	Paved parking, HSG A
8,381	79	Weighted Average
2,650		31.62% Pervious Area
5,731		68.38% Impervious Area

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

Subcatchment P2: Overland to Newton Drainage System



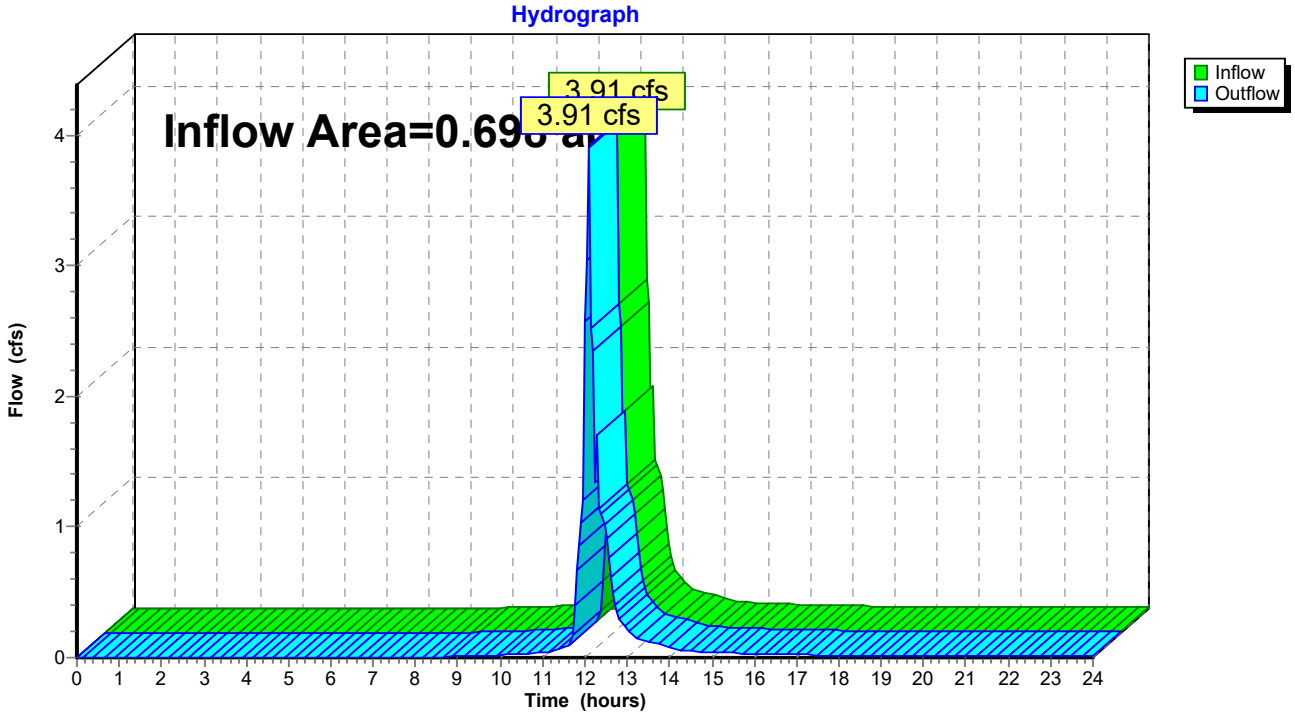
Summary for Reach DPP1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.698 ac, 91.28% Impervious, Inflow Depth > 2.72" for 25 yr event
Inflow = 3.91 cfs @ 12.09 hrs, Volume= 0.158 af
Outflow = 3.91 cfs @ 12.09 hrs, Volume= 0.158 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPP1: Newton Drainage System



Summary for Pond 1P: UG Infiltration System

[93] Warning: Storage range exceeded by 9.77'
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 0.505 ac,100.00% Impervious, Inflow Depth > 5.86" for 25 yr event
Inflow = 2.95 cfs @ 12.09 hrs, Volume= 0.247 af
Outflow = 3.23 cfs @ 12.09 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.5 min
Discarded = 0.15 cfs @ 10.15 hrs, Volume= 0.149 af
Primary = 3.08 cfs @ 12.09 hrs, Volume= 0.098 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 62.10' @ 12.10 hrs Surf.Area= 773 sf Storage= 916 cf

Plug-Flow detention time= 18.3 min calculated for 0.246 af (100% of inflow)
Center-of-Mass det. time= 17.9 min (762.4 - 744.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	50.00'	591 cf	**4.83'W x 159.84'L x 2.33'H Field A** 1,803 cf Overall - 324 cf Embedded = 1,478 cf x 40.0% Voids
#2A	50.50'	324 cf	**ADS_StormTech SC-310 +Cap** x 22 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
		916 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.25'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.15 cfs @ 10.15 hrs HW=50.10' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=3.00 cfs @ 12.09 hrs HW=61.54' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 3.00 cfs @ 15.26 fps)

Pond 1P: UG Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
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

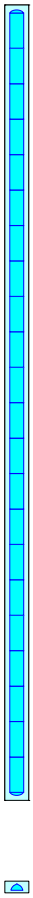
22 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 157.84' Row Length +12.0" End Stone x 2 = 159.84' Base Length
1 Rows x 34.0" Wide + 12.0" Side Stone x 2 = 4.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

22 Chambers x 14.7 cf = 324.3 cf Chamber Storage

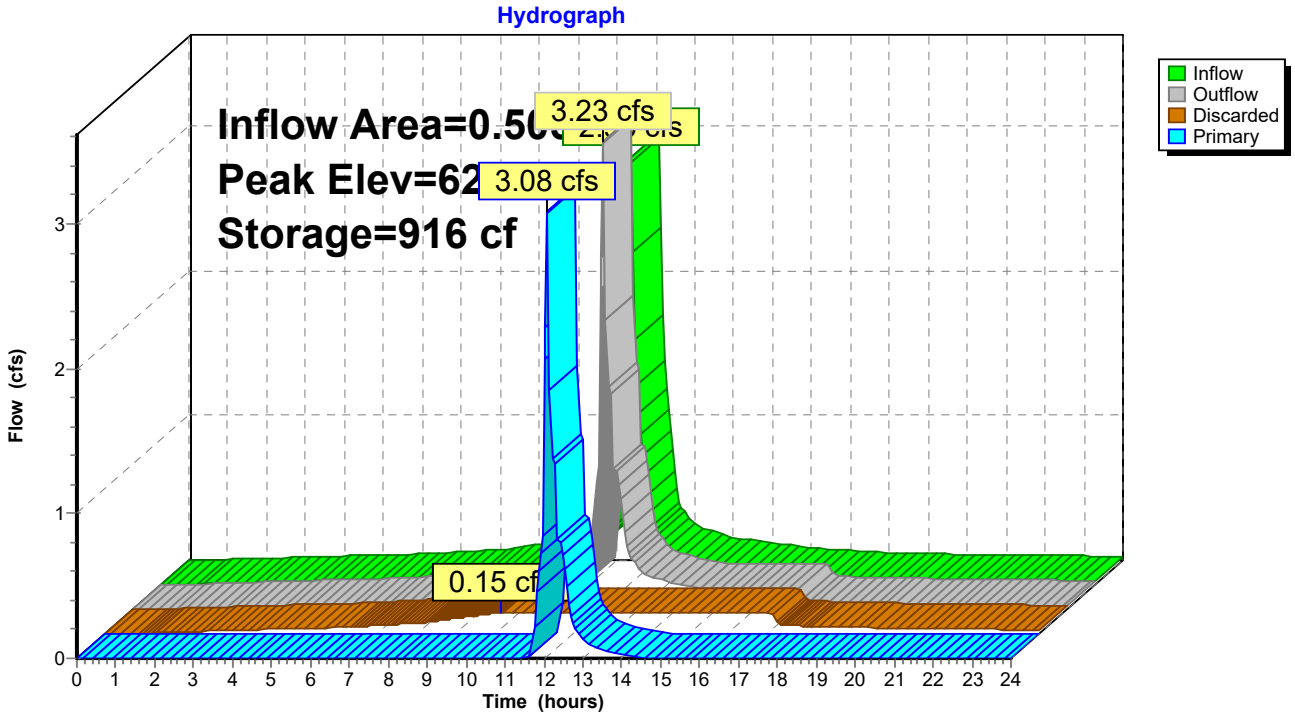
1,802.6 cf Field - 324.3 cf Chambers = 1,478.3 cf Stone x 40.0% Voids = 591.3 cf Stone Storage

Chamber Storage + Stone Storage = 915.6 cf = 0.021 af
Overall Storage Efficiency = 50.8%
Overall System Size = 159.84' x 4.83' x 2.33'

22 Chambers
66.8 cy Field
54.8 cy Stone



Pond 1P: UG Infiltration System



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: to Underground Runoff Area=22,010 sf 100.00% Impervious Runoff Depth>8.53"
Tc=6.0 min CN=98 Runoff=4.25 cfs 0.359 af

Subcatchment P2: Overland to Newton Runoff Area=8,381 sf 68.38% Impervious Runoff Depth>6.23"
Tc=6.0 min CN=79 Runoff=1.35 cfs 0.100 af

Reach DPP1: Newton Drainage System Inflow=5.45 cfs 0.277 af
Outflow=5.45 cfs 0.277 af

Pond 1P: UG Infiltration System Peak Elev=70.21' Storage=916 cf Inflow=4.25 cfs 0.359 af
Discarded=0.15 cfs 0.182 af Primary=4.10 cfs 0.177 af Outflow=4.25 cfs 0.359 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.459 af Average Runoff Depth = 7.90"
8.72% Pervious = 0.061 ac 91.28% Impervious = 0.637 ac

Summary for Subcatchment P1: to Underground Infiltration System

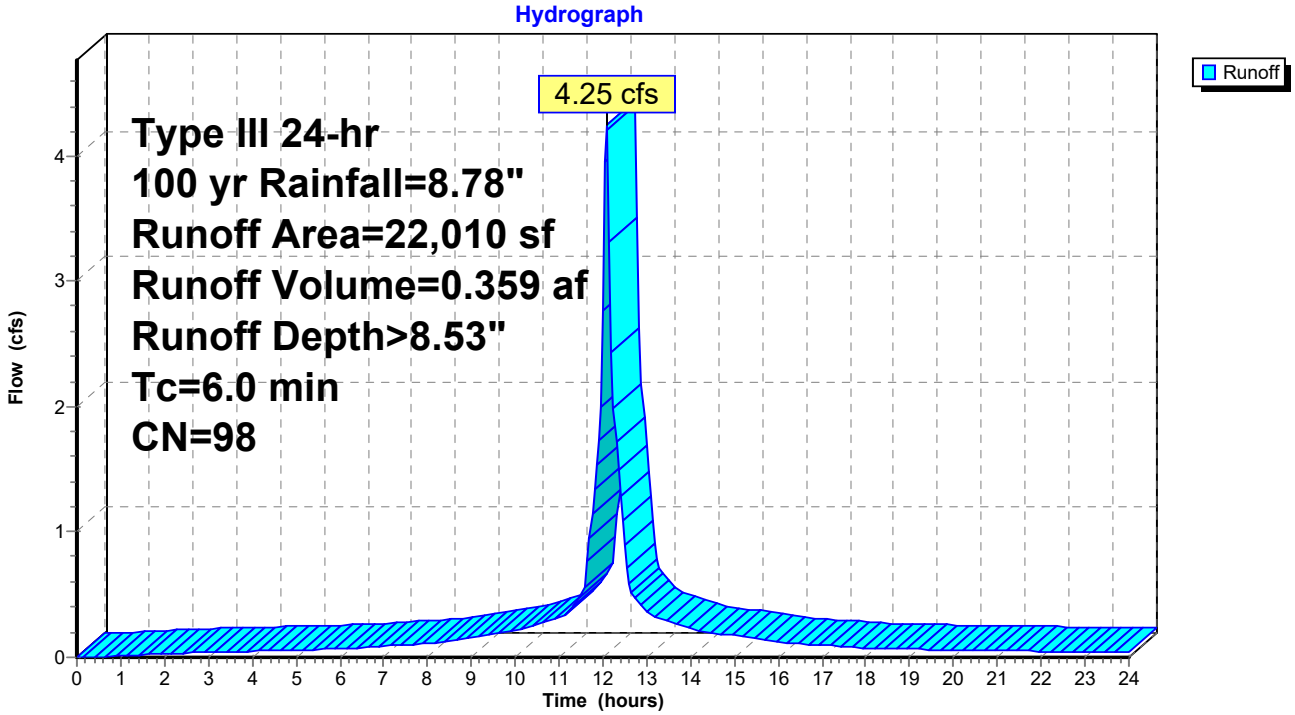
Runoff = 4.25 cfs @ 12.09 hrs, Volume= 0.359 af, Depth> 8.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.78"

Area (sf)	CN	Description
22,010	98	Unconnected roofs, HSG A
22,010		100.00% Impervious Area
22,010		100.00% Unconnected

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

Subcatchment P1: to Underground Infiltration System



Summary for Subcatchment P2: Overland to Newton Drainage System

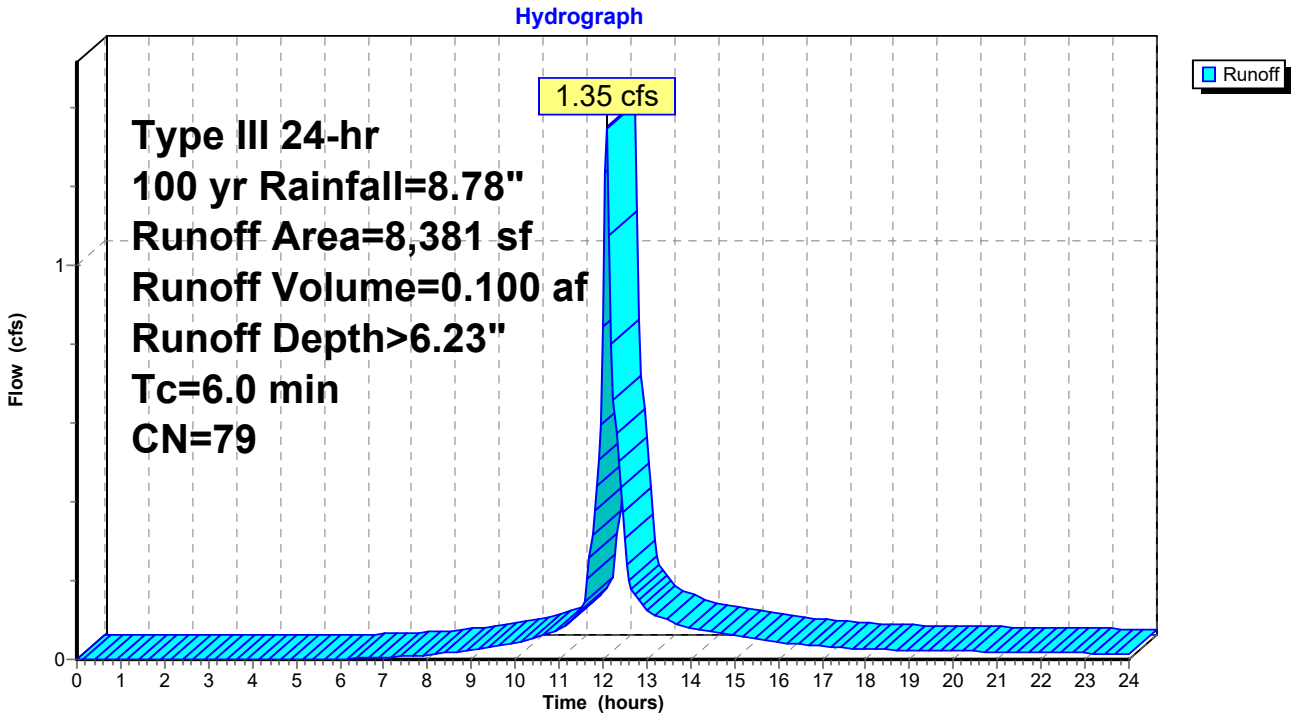
Runoff = 1.35 cfs @ 12.09 hrs, Volume= 0.100 af, Depth> 6.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=8.78"

Area (sf)	CN	Description
2,650	39	>75% Grass cover, Good, HSG A
5,731	98	Paved parking, HSG A
8,381	79	Weighted Average
2,650		31.62% Pervious Area
5,731		68.38% Impervious Area

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

Subcatchment P2: Overland to Newton Drainage System



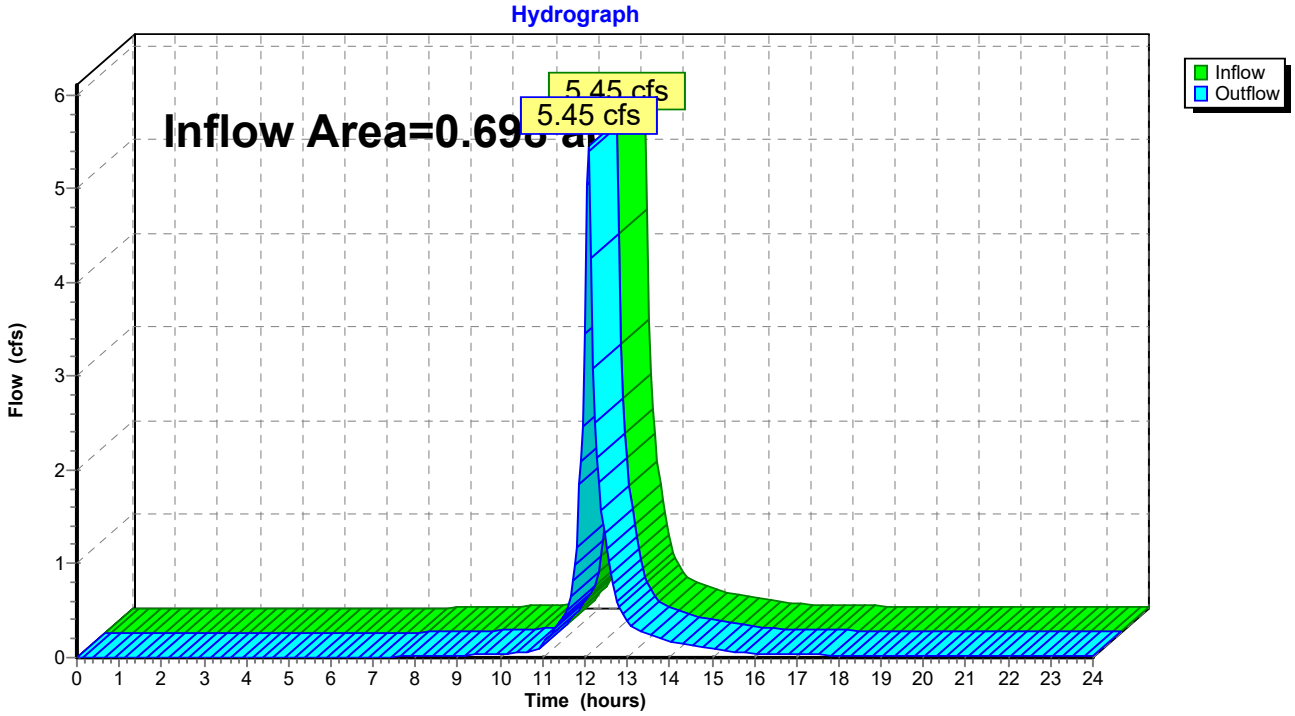
Summary for Reach DPP1: Newton Drainage System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.698 ac, 91.28% Impervious, Inflow Depth > 4.76" for 100 yr event
Inflow = 5.45 cfs @ 12.09 hrs, Volume= 0.277 af
Outflow = 5.45 cfs @ 12.09 hrs, Volume= 0.277 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DPP1: Newton Drainage System



Summary for Pond 1P: UG Infiltration System

[93] Warning: Storage range exceeded by 17.88'

Inflow Area = 0.505 ac,100.00% Impervious, Inflow Depth > 8.53" for 100 yr event
Inflow = 4.25 cfs @ 12.09 hrs, Volume= 0.359 af
Outflow = 4.25 cfs @ 12.09 hrs, Volume= 0.359 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.15 cfs @ 8.90 hrs, Volume= 0.182 af
Primary = 4.10 cfs @ 12.09 hrs, Volume= 0.177 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 70.21' @ 12.09 hrs Surf.Area= 773 sf Storage= 916 cf

Plug-Flow detention time= 19.0 min calculated for 0.358 af (100% of inflow)
Center-of-Mass det. time= 18.3 min (757.9 - 739.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	50.00'	591 cf	**4.83'W x 159.84'L x 2.33'H Field A** 1,803 cf Overall - 324 cf Embedded = 1,478 cf x 40.0% Voids
#2A	50.50'	324 cf	**ADS_StormTech SC-310 +Cap** x 22 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
		916 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.25'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.15 cfs @ 8.90 hrs HW=50.19' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=3.99 cfs @ 12.09 hrs HW=69.27' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 3.99 cfs @ 20.30 fps)

Pond 1P: UG Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
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

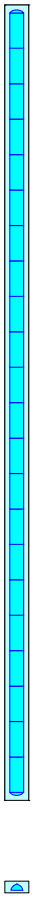
22 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 157.84' Row Length +12.0" End Stone x 2 = 159.84' Base Length
1 Rows x 34.0" Wide + 12.0" Side Stone x 2 = 4.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

22 Chambers x 14.7 cf = 324.3 cf Chamber Storage

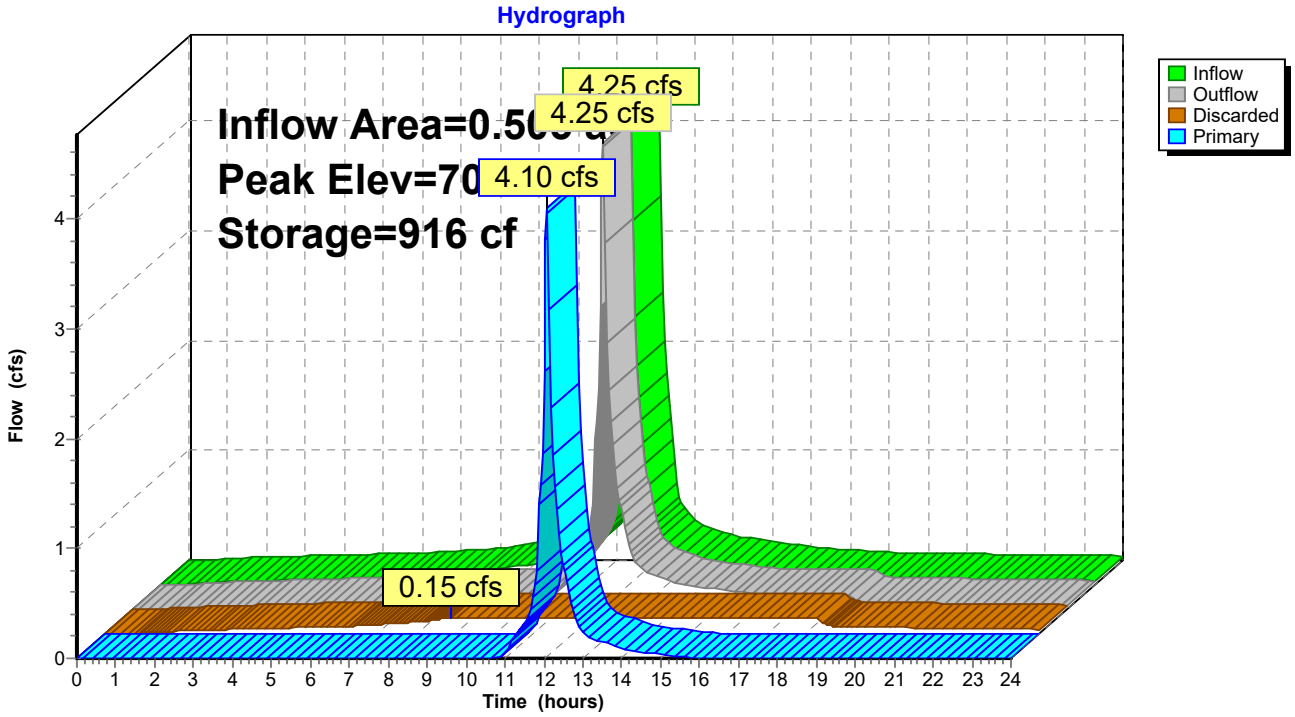
1,802.6 cf Field - 324.3 cf Chambers = 1,478.3 cf Stone x 40.0% Voids = 591.3 cf Stone Storage

Chamber Storage + Stone Storage = 915.6 cf = 0.021 af
Overall Storage Efficiency = 50.8%
Overall System Size = 159.84' x 4.83' x 2.33'

22 Chambers
66.8 cy Field
54.8 cy Stone



Pond 1P: UG Infiltration System



APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *RAINFALL DATA*

Mixed-Use Development
1314 Washington Street
Newton, MA
Bohler Job Number: W220043
August 18, 2022

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	0.640
Proposed Site Impervious Area (ac)	0.630
Proposed Increase in Site Impervious Area (ac)	-0.010
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)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**
Required Recharge Volume - D Soils (0.10 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**
Total Recharge Volume Required (cf)	**0**
Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**0.000**
%Impervious Directed to Infiltration BMP	
Adjustment Factor	
Adjusted Total Recharge Volume Required (cf)	
Provided Recharge Volume*	
Underground Infiltration System	535
Total Recharge Volume Provided (cf)	**535**
	Input Required

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

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Mixed-Use Development
1314 Washington Street
Newton, MA
Bohler Job Number: W220043
August 18, 2022

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - Underground Infiltration System	
Volume below outlet pipe (Rv) (cf)	535
Soil Type	Sand - A
Infiltration rate (K)*	8.27
Bottom Area (sf)	690
Drawdown time (Hours)*	1.1

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

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Mixed-Use Development
1314 Washington Street
Newton, MA
Bohler Job Number: W220043
August 18, 2022

MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Increase in Impervious Area (sf)	0
Required Water Quality Volume (cf)	0

*Water Quality volume runoff is equal to 0.5 or 1.0 inches of runoff times the total impervious area of the post development project site.

Water Quality Volume Provided*	
Underground Infiltration System	535
Total Provided Water Quality Volume (cf)	535

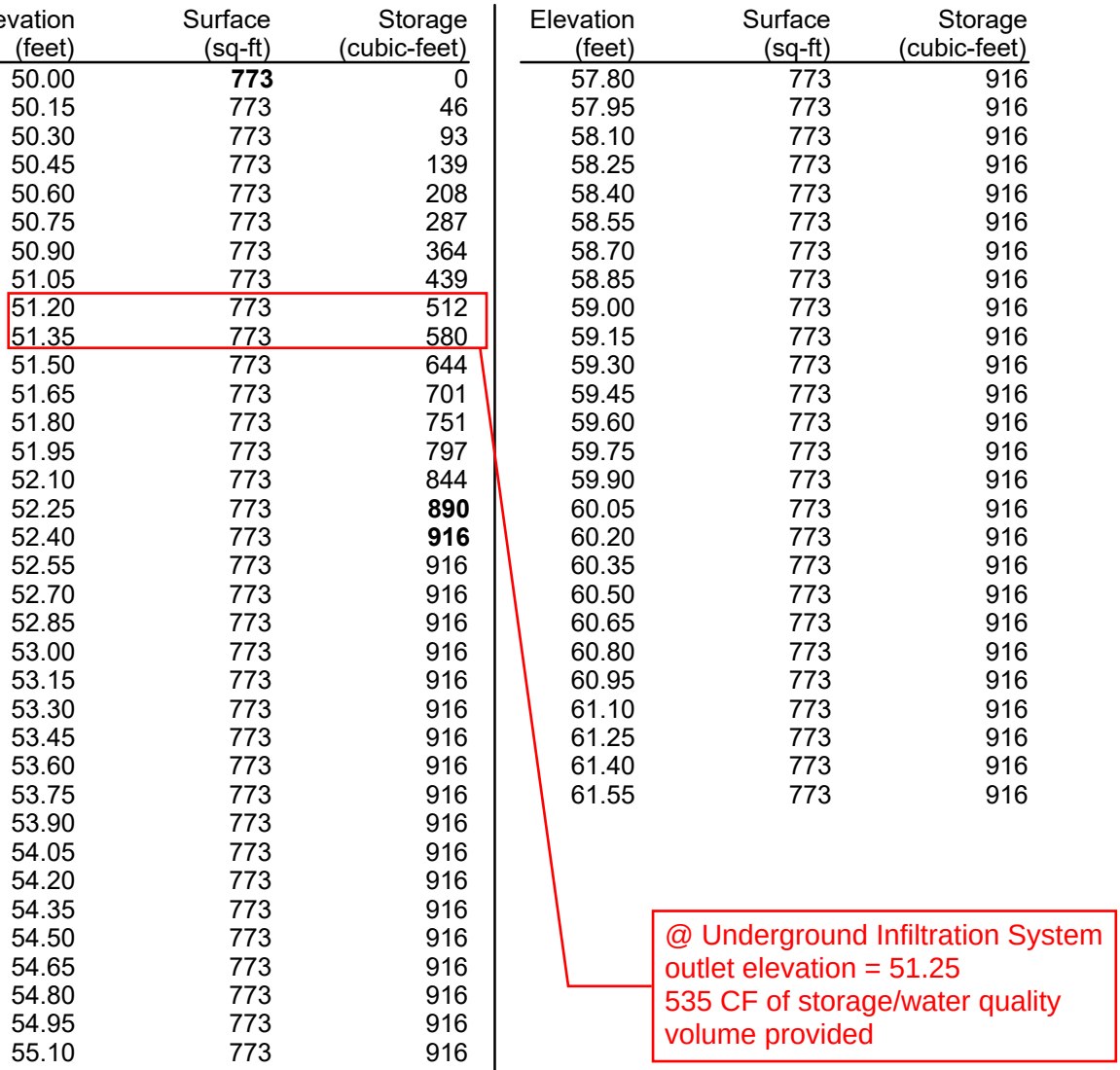
Input Required

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

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Stage-Area-Storage for Pond 1P: UG Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
50.00	**773**	0
50.15	773	46
50.30	773	93
50.45	773	139
50.60	773	208
50.75	773	287
50.90	773	364
51.05	773	439
51.20	773	512
51.35	773	580
51.50	773	644
51.65	773	701
51.80	773	751
51.95	773	797
52.10	773	844
52.25	773	**890**
52.40	773	**916**
52.55	773	916
52.70	773	916
52.85	773	916
53.00	773	916
53.15	773	916
53.30	773	916
53.45	773	916
53.60	773	916
53.75	773	916
53.90	773	916
54.05	773	916
54.20	773	916
54.35	773	916
54.50	773	916
54.65	773	916
54.80	773	916
54.95	773	916
55.10	773	916
55.25	773	916
55.40	773	916
55.55	773	916
55.70	773	916
55.85	773	916
56.00	773	916
56.15	773	916
56.30	773	916
56.45	773	916
56.60	773	916
56.75	773	916
56.90	773	916
57.05	773	916
57.20	773	916
57.35	773	916
57.50	773	916
57.65	773	916
57.80	773	916
57.95	773	916
58.10	773	916
58.25	773	916
58.40	773	916
58.55	773	916
58.70	773	916
58.85	773	916
59.00	773	916
59.15	773	916
59.30	773	916
59.45	773	916
59.60	773	916
59.75	773	916
59.90	773	916
60.05	773	916
60.20	773	916
60.35	773	916
60.50	773	916
60.65	773	916
60.80	773	916
60.95	773	916
61.10	773	916
61.25	773	916
61.40	773	916
61.55	773	916



TSS Removal Calculation Worksheet

Location: to Underground Infiltration System

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Underground Infiltration System	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = **80%**

Project: **1314 Washington Street**
Prepared By: **Bohler**
Date: **8/18/2022**

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

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.227 degrees West
Latitude	42.349 degrees North
Elevation	0 feet
Date/Time	Wed, 27 Apr 2022 10:57:17 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.54	0.70	0.88	1.11	**1yr**	0.76	1.05	1.29	1.63	2.08	2.66	2.88	**1yr**	2.36	2.77	3.26	3.93	4.60	**1yr**
2yr	0.35	0.54	0.67	0.89	1.12	1.41	**2yr**	0.96	1.29	1.63	2.04	2.55	3.19	3.53	**2yr**	2.82	3.40	3.90	4.63	5.28	**2yr**
5yr	0.42	0.65	0.82	1.10	1.41	1.79	**5yr**	1.21	1.62	2.07	2.60	3.24	4.03	4.50	**5yr**	3.57	4.33	4.95	5.89	6.60	**5yr**
10yr	0.48	0.75	0.95	1.29	1.67	2.14	**10yr**	1.44	1.92	2.49	3.12	3.89	4.82	5.41	**10yr**	4.26	5.20	5.94	7.07	7.81	**10yr**
25yr	0.56	0.90	1.14	1.58	2.10	2.73	**25yr**	1.82	2.41	3.18	3.99	4.95	6.10	6.89	**25yr**	5.40	6.63	7.57	9.00	9.77	**25yr**
50yr	0.65	1.04	1.33	1.87	2.51	3.27	**50yr**	2.17	2.86	3.83	4.81	5.95	7.30	8.29	**50yr**	6.46	7.97	9.09	10.80	11.57	**50yr**
100yr	0.74	1.20	1.55	2.20	3.00	3.93	**100yr**	2.59	3.40	4.61	5.79	7.15	8.73	9.97	**100yr**	7.73	9.59	10.92	12.97	13.72	**100yr**
200yr	0.86	1.40	1.82	2.60	3.59	4.72	**200yr**	3.09	4.04	5.54	6.95	8.58	10.46	12.01	**200yr**	9.26	11.54	13.12	15.58	16.27	**200yr**
500yr	1.04	1.71	2.23	3.24	4.55	6.03	**500yr**	3.92	5.08	7.09	8.90	10.95	13.28	15.35	**500yr**	11.75	14.76	16.74	19.87	20.39	**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	0.60	0.74	0.85	**1yr**	0.64	0.83	1.09	1.44	1.80	2.37	2.52	**1yr**	2.10	2.42	2.84	3.53	4.14	**1yr**
2yr	0.33	0.52	0.64	0.86	1.06	1.27	**2yr**	0.92	1.24	1.45	1.92	2.48	3.10	3.43	**2yr**	2.74	3.30	3.75	4.51	5.15	**2yr**
5yr	0.39	0.60	0.75	1.02	1.30	1.51	**5yr**	1.12	1.48	1.74	2.26	2.91	3.73	4.16	**5yr**	3.30	4.00	4.55	5.47	6.13	**5yr**
10yr	0.44	0.67	0.83	1.16	1.50	1.72	**10yr**	1.29	1.68	1.93	2.55	3.27	4.29	4.78	**10yr**	3.80	4.60	5.19	6.31	6.96	**10yr**
25yr	0.50	0.76	0.95	1.36	1.78	2.03	**25yr**	1.54	1.99	2.27	2.99	3.82	5.15	5.73	**25yr**	4.56	5.51	6.14	7.62	8.23	**25yr**
50yr	0.55	0.84	1.05	1.51	2.03	2.32	**50yr**	1.76	2.26	2.57	3.38	4.31	5.89	6.56	**50yr**	5.21	6.31	6.93	8.79	9.34	**50yr**
100yr	0.62	0.93	1.17	1.68	2.31	2.63	**100yr**	1.99	2.57	2.89	3.56	4.86	6.76	7.48	**100yr**	5.98	7.20	7.82	10.13	10.60	**100yr**
200yr	0.69	1.03	1.31	1.89	2.64	2.99	**200yr**	2.28	2.92	3.27	3.96	5.49	7.74	8.52	**200yr**	6.85	8.20	8.75	11.67	11.99	**200yr**
500yr	0.79	1.18	1.52	2.20	3.14	3.54	**500yr**	2.71	3.46	3.84	4.57	6.46	9.24	10.10	**500yr**	8.18	9.71	10.08	14.06	14.12	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.80	0.98	1.16	**1yr**	0.85	1.14	1.35	1.80	2.29	2.86	3.11	**1yr**	2.53	2.99	3.48	4.20	4.94	**1yr**
2yr	0.37	0.57	0.70	0.95	1.17	1.37	**2yr**	1.01	1.34	1.58	2.09	2.69	3.29	3.66	**2yr**	2.91	3.52	4.06	4.78	5.46	**2yr**
5yr	0.46	0.71	0.88	1.21	1.53	1.81	**5yr**	1.32	1.77	2.06	2.67	3.40	4.35	4.89	**5yr**	3.85	4.70	5.34	6.35	7.07	**5yr**
10yr	0.56	0.86	1.06	1.48	1.91	2.24	**10yr**	1.65	2.19	2.59	3.23	4.08	5.40	6.13	**10yr**	4.78	5.89	6.65	7.91	8.66	**10yr**
25yr	0.72	1.10	1.37	1.96	2.57	2.97	**25yr**	2.22	2.90	3.46	4.17	5.20	7.19	8.30	**25yr**	6.36	7.98	8.90	10.58	11.35	**25yr**
50yr	0.88	1.34	1.66	2.39	3.22	3.68	**50yr**	2.78	3.60	4.29	5.07	6.26	8.94	10.44	**50yr**	7.91	10.04	11.09	13.20	13.93	**50yr**
100yr	1.08	1.63	2.04	2.94	4.03	4.56	**100yr**	3.48	4.46	5.34	6.58	7.53	11.14	13.15	**100yr**	9.86	12.64	13.87	16.49	17.12	**100yr**
200yr	1.31	1.98	2.50	3.63	5.06	5.65	**200yr**	4.36	5.53	6.65	8.07	9.03	13.90	16.60	**200yr**	12.30	15.96	17.41	20.62	21.05	**200yr**
500yr	1.72	2.56	3.30	4.79	6.82	7.48	**500yr**	5.88	7.31	8.89	10.59	11.52	18.64	22.62	**500yr**	16.50	21.75	23.56	27.74	27.71	**500yr**

Powered by ACIS Northeast Regional Climate Center

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*

STORMWATER OPERATION AND MAINTENANCE PLAN

Mark Development
1314 Washington Street
Newton, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Mark Development
1314 Washington Street
Newton, MA

RESPONSIBLE PARTY POST CONSTRUCTION:

Mark Development
1314 Washington Street
Newton, MA

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP). Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and on-site driveways: Sweep at least four (4) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off-site in accordance with MADEP and other applicable requirements.

2. Drain manholes and piping: Inspect four (4) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned four (4) times per year. or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.

3. 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.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Mark Development
1314 Washington Street
Newton, MA

RESPONSIBLE PARTY:

Mark Development
1314 Washington Street
Newton, MA

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Discharge Points:	
Infiltration Basin:	
Other:	
Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):	

Catch Basins:
Discharge Points:
Infiltration Basin:
Other:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Mark Development
1314 Washington Street – Newton, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Mark Development
1314 Washington Street
Newton, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Mark Development
1314 Washington Street
Newton, MA

RESPONSIBLE PARTY POST CONSTRUCTION:

Mark Development
1314 Washington Street
Newton, MA

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- No outdoor maintenance or washing of vehicles allowed.
- 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.

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.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.
- 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.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

_____

Name & Title

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

Mark Development
1314 Washington Street
Newton, 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 Newton 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 Newton Health Department at (617) 796-1420 and the Newton Conservation Office at (617) 796-1120.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the City of Newton Health Department and Conservation Office.

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

CONTECH®
ENGINEERED SOLUTIONS

Jellyfish® Filter
Owner's Manual

Jellyfish® Filter

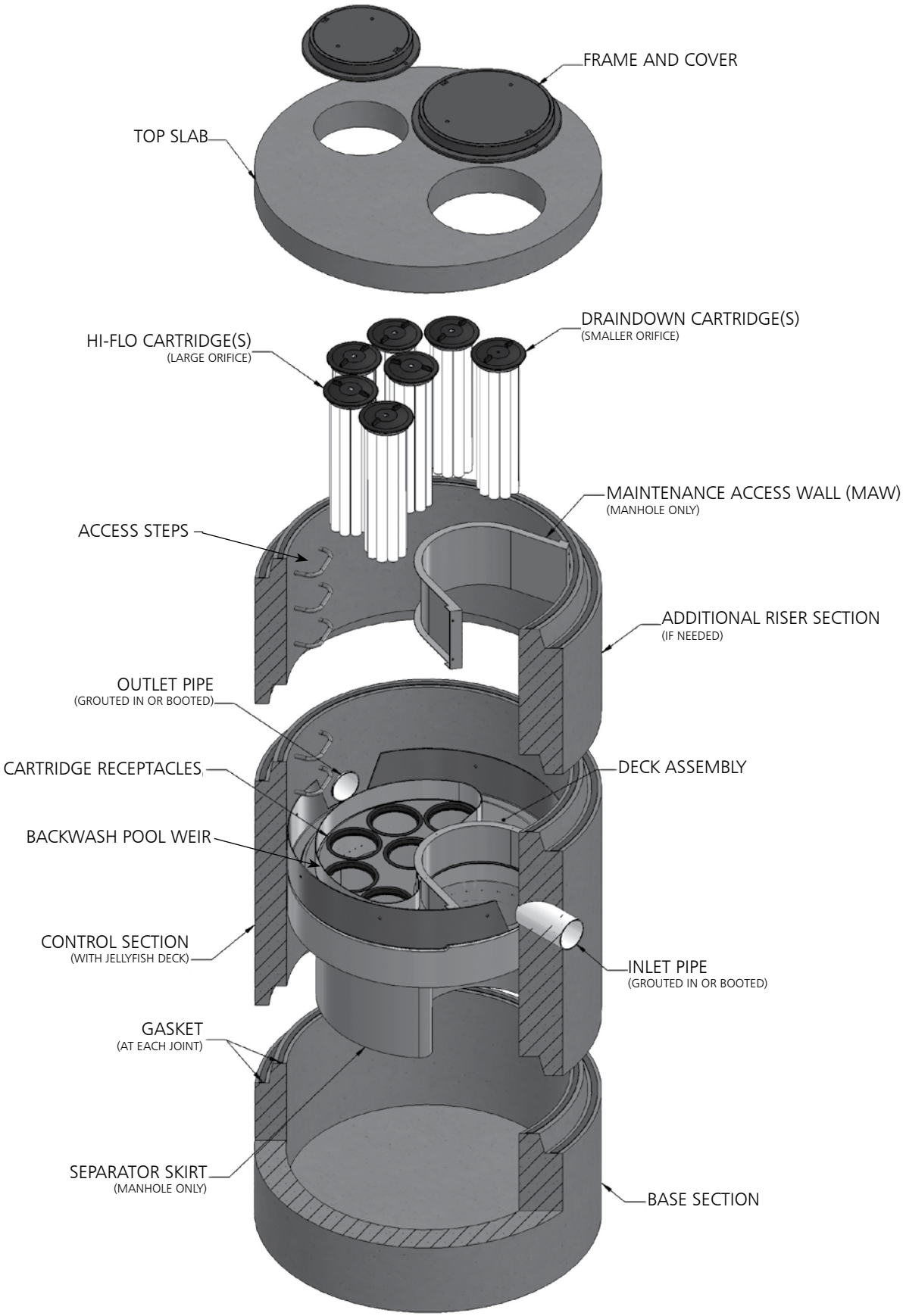
Table of Contents

THANK YOU FOR PURCHASING THE JELLYFISH® FILTER!

Contech Engineered Solutions would like to thank you for selecting the Jellyfish Filter to meet your project's stormwater treatment needs. With proper inspection and maintenance, the Jellyfish Filter is designed to deliver ongoing, high levels of stormwater pollutant removal.

If you have any questions, please feel free to call us or e-mail us:

Contech Engineered Solutions
9025 Centre Pointe Drive, Suite 400 | West Chester, OH 45069
513-645-7000 | 800-338-1122
www.ContechES.com
info@conteches.com


FRAME AND COVER
TOP SLAB
DRAINDOWN CARTRIDGE(S)
(SMALLER ORIFICE)
HI-FLO CARTRIDGE(S)
(LARGE ORIFICE)
MAINTENANCE ACCESS WALL (MAW)
(MANHOLE ONLY)
ACCESS STEPS
ADDITIONAL RISER SECTION
(IF NEEDED)
OUTLET PIPE
(GROUTED IN OR BOOTED)
CARTRIDGE RECEPTACLES
DECK ASSEMBLY
BACKWASH POOL WEIR
CONTROL SECTION
(WITH JELLYFISH DECK)
INLET PIPE
(GROUTED IN OR BOOTED)
GASKET
(AT EACH JOINT)
SEPARATOR SKIRT
(MANHOLE ONLY)
BASE SECTION

WARNINGS / CAUTION

1. FALL PROTECTION may be required.
2. WATCH YOUR STEP if standing on the Jellyfish Filter Deck at any time; Great care and safety must be taken while walking or maneuvering on the Jellyfish Filter Deck. Attentive care must be taken while standing on the Jellyfish Filter Deck at all times to prevent stepping onto a lid, into or through a cartridge hole or slipping on the deck.
3. The Jellyfish Filter Deck can be SLIPPERY WHEN WET.
4. If the Top Slab, Covers or Hatches have not yet been installed, or are removed for any reason, great care must be taken to NOT DROP ANYTHING ONTO THE JELLYFISH FILTER DECK. The Jellyfish Filter Deck and Cartridge Receptacle Rings can be damaged under high impact loads. This type of activity voids all warranties. All damaged items to be replaced at owner's expense.
5. Maximum deck load 2 persons, total weight 450 lbs.

Safety Notice

Jobsite safety is a topic and practice addressed comprehensively by others. The inclusions here are intended to be reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s) and Contractor(s). OSHA and Canadian OSH, and Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Contractor's responsibility and outside the scope of Contech Engineered Solutions.

Confined Space Entry

Secure all equipment and perform all training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to proceed safely at all times.

Personal Safety Equipment

Contractor is responsible to provide and wear appropriate personal protection equipment as needed including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment as necessary. Make sure all equipment is staffed with trained and/or certified personnel, and all equipment is checked for proper operation and safety features prior to use.

- Fall protection equipment
- Eye protection
- Safety boots
- Ear protection
- Gloves
- Ventilation and respiratory protection
- Hard hat
- Maintenance and protection of traffic plan

Chapter 1

1.0 – Owner Specific Jellyfish Filter Product Information

Below you will find a reference page that can be filled out according to your Jellyfish Filter specification to help you easily inspect, maintain and order parts for your system.

Owner Name:	
Phone Number:	
Site Address:	
Site GPS Coordinates/unit location:	
Unit Location Description:	
Jellyfish Filter Model No.:	
Contech Project & Sequence Number	
No. of Hi-Flo Cartridges	
No. of Cartridges:	
Length of Draindown Cartridges:	
No. of Blank Cartridge Lids:	
Bypass Configuration (Online/Offline):	

Notes:

_____

_____

_____

_____

Chapter 2

2.0 – Jellyfish Filter System Operations and Functions

The Jellyfish Filter is an engineered stormwater quality treatment technology that removes a high level and wide variety of stormwater pollutants. Each Jellyfish Filter cartridge consists of eleven membrane - encased filter elements ("filtration tentacles") attached to a cartridge head plate. The filtration tentacles provide a large filtration surface area, resulting in high flow and high pollutant removal capacity.

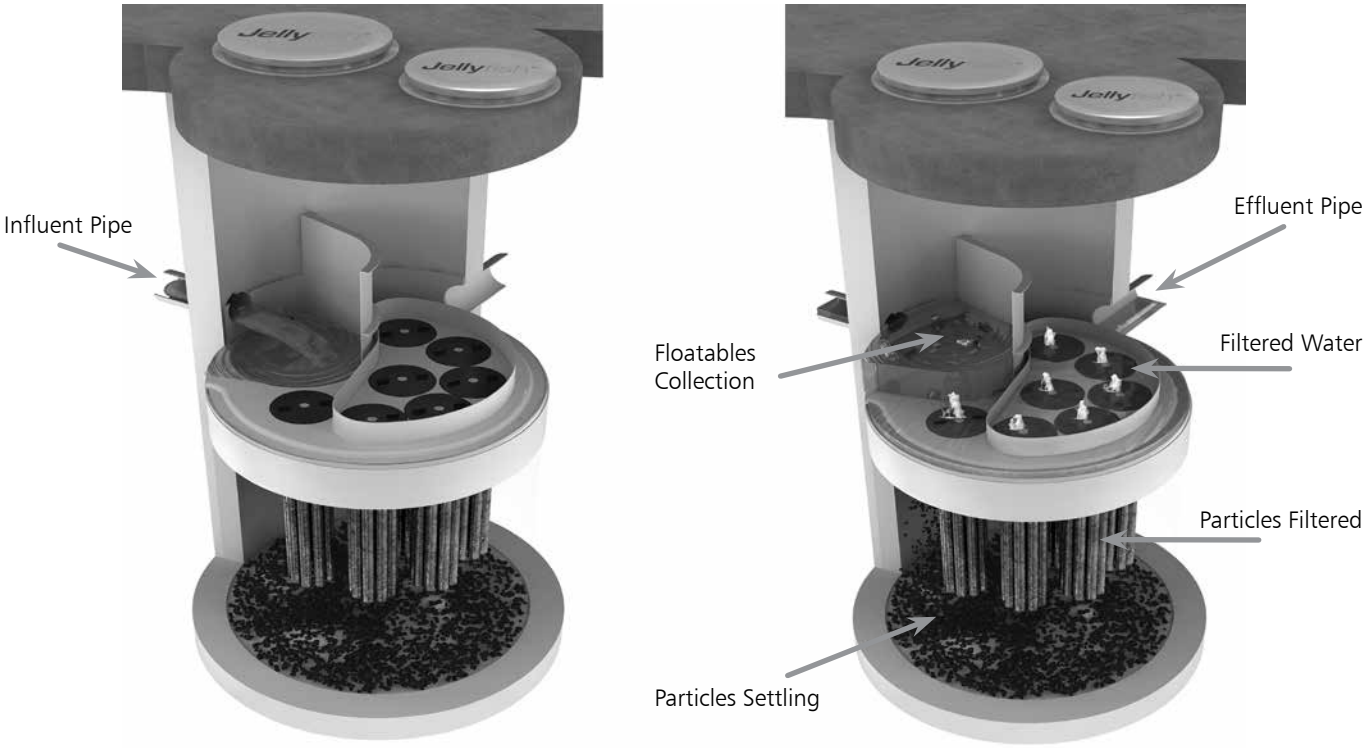
The Jellyfish Filter functions are depicted in Figure 1 below.

FIGURE 1

Jellyfish Filter Treatment Functions

Membrane Filtration

Section View with Maintenance Access Wall (MAW) Cutaway



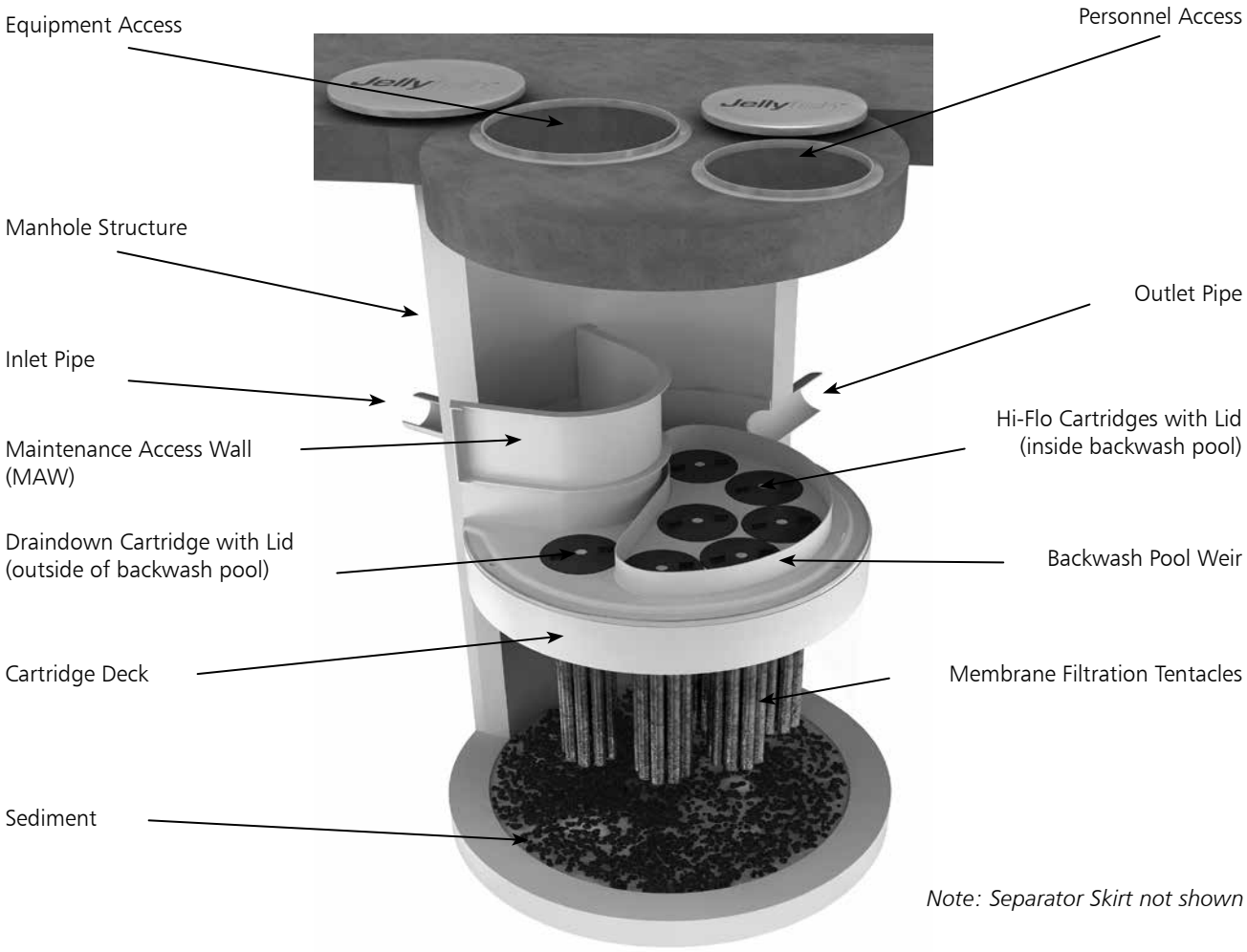
Jellyfish Filter cartridges are backwashed after each peak storm event, which removes accumulated sediment from the membranes. This backwash process extends the service life of the cartridges and increases the time between maintenance events.

For additional details on the operation and pollutant capabilities of the Jellyfish Filter please refer to additional details on our website at www.ContechES.com.

2.1 – Components and Cartridges

The Jellyfish Filter and components are depicted in Figure 2 below.

FIGURE 2 **Jellyfish Filter Components**



Tentacles are available in various lengths as depicted in Table 1 below.

Table 1 – Cartridge Lengths / Weights and Cartridge Lid Orifice Diameters

Cartridge Lengths	Dry Weight	Hi-Flo Orifice Diameter	Draindown Orifice Diameter
15 inches (381 mm)	10 lbs (4.5 kg)	35 mm	20 mm
27 inches (686 mm)	14.5 lbs (6.6 kg)	45 mm	25 mm
40 inches (1,016 mm)	19.5 lbs (8.9 kg)	55 mm	30 mm
54 inches (1,372 mm)	25 lbs (11.4 kg)	70 mm	35 mm

2.2 – Jellyfish Membrane Filtration Cartridge Assembly

The Jellyfish Filter utilizes multiple membrane filtration cartridges. Each cartridge consists of removable cylindrical filtration "tentacles" attached to a cartridge head plate. Each filtration tentacle has a threaded pipe nipple and o-ring. To attach, insert the top pipe nipples with the o-ring through the head plate holes and secure with locking nuts. Hex nuts to be hand tightened and checked with a wrench as shown below.

2.3 – Jellyfish Membrane Filtration Cartridge Installation

- Cartridge installation will be performed by trained individuals and coordinated with the installing site Contractor. Flow diversion devices are required to be in place until the site is stabilized (final paving and landscaping in place). Failure to address this step completely will reduce the time between required maintenance.
- Descend to the cartridge deck (see Safety Notice and page 3).
- Refer to Contech's submittal drawings to determine proper quantity and placement of Hi-Flo, Draindown and Blank cartridges with appropriate lids. Lower the Jellyfish membrane filtration cartridges into the cartridge receptacles within the cartridge deck. It is possible that not all cartridge receptacles will be filled with a filter cartridge. In that case, a blank headplate and blank cartridge lid (no orifice) would be installed.

Cartridge Assembly

Do not force the tentacles down into the cartridge receptacle, as this may damage the membranes. Apply downward pressure on the cartridge head plate to seat the lubricated rim gasket (thick circular gasket surrounding the circumference of the head plate) into the cartridge receptacle. (See Figure 3 for details on approved lubricants for use with rim gasket.)

- Examine the cartridge lids to differentiate lids with a small orifice, a large orifice, and no orifice.
  - Lids with a small orifice are to be inserted into the Draindown cartridge receptacles, outside of the backwash pool weir.
  - Lids with a large orifice are to be inserted into the Hi-Flo cartridge receptacles within the backwash pool weir.
  - Lids with no orifice (blank cartridge lids) and a blank headplate are to be inserted into unoccupied cartridge receptacles.
- To install a cartridge lid, align both cartridge lid male threads with the cartridge receptacle female threads before rotating approximately 1/3 of a full rotation until firmly seated. Use of an approved rim gasket lubricant may facilitate installation.

3.0 Inspection and Maintenance Overview

The primary purpose of the Jellyfish® Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.
Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Additional maintenance activities may be required in the event of non-storm event runoff, such as base-flow or seasonal flow, an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.
Inspection activities are typically conducted from surface observations and include:

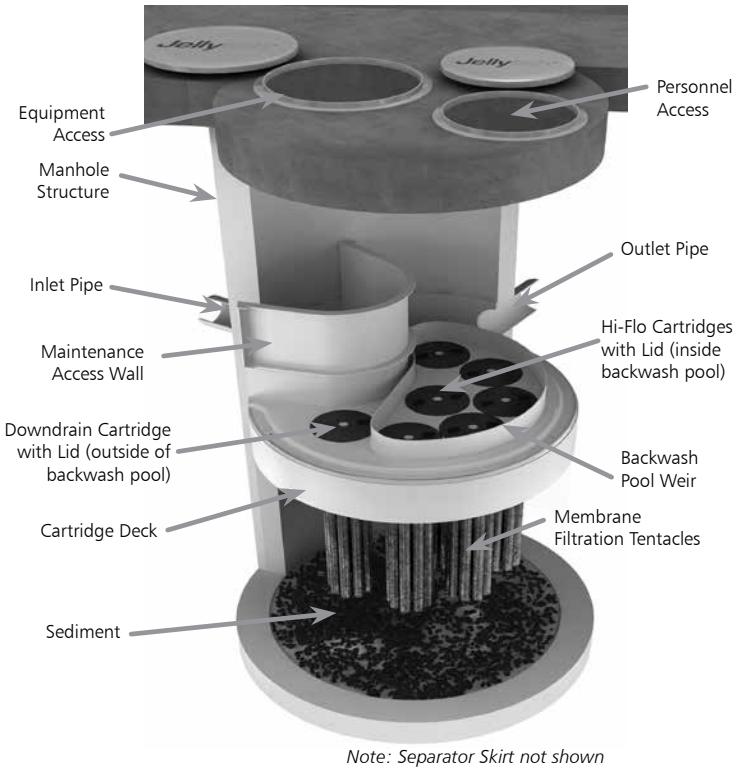
- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW) or inlet bay for vault systems

Maintenance activities include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed

4.0 Inspection Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of, the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent*.



Note: Separator Skirt not shown

1. A minimum of quarterly inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
2. Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
3. Inspection is recommended after each major storm event.
4. Inspection is required immediately after an upstream oil, fuel or other chemical spill.

5.0 Inspection Procedure

The following procedure is recommended when performing inspections:

1. Provide traffic control measures as necessary.
2. Inspect the MAW or inlet bay for floatable pollutants such as trash, debris, and oil sheen.
3. Measure oil and sediment depth in several locations, by lowering a sediment probe until contact is made with the floor of the structure. Record sediment depth, and presences of any oil layers.
4. Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
5. Inspect the MAW (where appropriate), cartridge deck and receptacles, and backwash pool weir, for damaged or broken components.

5.1 Dry weather inspections

- Inspect the cartridge deck for standing water, and/or sediment on the deck.
- No standing water under normal operating conditions.
- Standing water inside the backwash pool, but not outside the backwash pool indicates, that the filter cartridges need to be rinsed.

Inspection Utilizing Sediment Probe

- Standing water outside the backwash pool is not anticipated and may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- Any appreciable sediment (≥1/16") accumulated on the deck surface should be removed.

5.2 Wet weather inspections

- Observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW or inlet bay.
- Less than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
- Greater than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
- 18 inches or greater and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges need to be rinsed.

6.0 Maintenance Requirements

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

1. Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.
2. Floatable trash, debris, and oil removal.
3. Deck cleaned and free from sediment.
4. Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
5. Replace tentacles if rinsing does not restore adequate hydraulic capacity, remove accumulated sediment, or if damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
6. Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
7. The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged or compromised by the spill.

7.0 Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

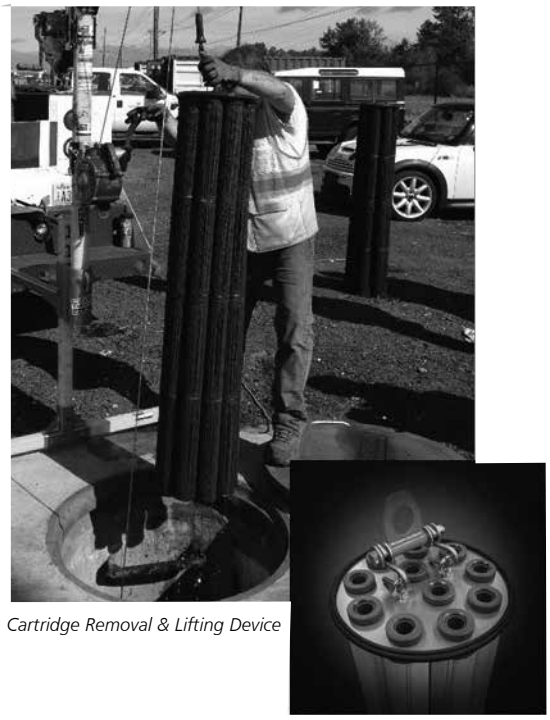
1. Provide traffic control measures as necessary.
2. Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures. *Caution: Dropping objects onto the cartridge deck may cause damage*.
3. Perform Inspection Procedure prior to maintenance activity.
4. To access the cartridge deck for filter cartridge service, descend into the structure and step directly onto the deck. Caution: Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.
5. Maximum weight of maintenance crew and equipment on the cartridge deck not to exceed 450 lbs.

7.1 Filter Cartridge Removal

1. Remove a cartridge lid.
2. Remove cartridges from the deck using the lifting loops in the cartridge head plate. Rope or a lifting device (available from Contech) should be used. *Caution: Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Wet cartridges typically weigh between 100 and 125 lbs*.
3. Replace and secure the cartridge lid on the exposed empty receptacle as a safety precaution. Contech does not recommend exposing more than one empty cartridge receptacle at a time.

7.2 Filter Cartridge Rinsing

1. Remove all 11 tentacles from the cartridge head plate. Take care not to lose or damage the O-ring seal as well as the plastic threaded nut and connector.
2. Position tentacles in a container (or over the MAW), with the threaded connector (open end) facing down, so rinse water is flushed through the membrane and captured in the container.



Cartridge Removal & Lifting Device

3. Using the Jellyfish rinse tool (available from Contech) or a low-pressure garden hose sprayer, direct water spray onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. *Caution: Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane*.
4. Collected rinse water is typically removed by vacuum hose.

5. Reassemble cartridges as detailed later in this document. Reuse O-rings and nuts, ensuring proper placement on each tentacle.

7.3 Sediment and Flotables Extraction

1. Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning only through the maintenance access wall (MAW) opening. Be careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck on manhole systems. Do not lower the vacuum wand through a cartridge receptacle, as damage to the receptacle will result.
2. Vacuum floatable trash, debris, and oil, from the MAW opening or inlet bay. Alternatively, floatable solids may be removed by a net or skimmer.
3. Pressure wash cartridge deck and receptacles to remove all

Rinsing Cartridge with Contech Rinse Tool

sediment and debris. Sediment should be rinsed into the sump area. Take care not to flush rinse water into the outlet pipe.

4. Remove water from the sump area. Vacuum or pump equipment should only be introduced through the MAW or inlet bay.
5. Remove the sediment from the bottom of the unit through the MAW or inlet bay opening.
6. For larger diameter Jellyfish Filter manholes (≥8-ft) and some

Vacuuming Sump Through MAW

vaults complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle.

7.4 Filter Cartridge Reinstallation and Replacement

1. Cartridges should be installed after the deck has been cleaned. It is important that the receptacle surfaces be free from grit and debris.
2. Remove cartridge lid from deck and carefully lower the filter cartridge into the receptacle until head plate gasket is seated squarely in receptacle. *Caution: Do not force the cartridge downward; damage may occur.*
3. Replace the cartridge lid and check to see that both male threads are properly seated before rotating approximately 1/3 of a full rotation until firmly seated. Use of an approved rim gasket lubricant may facilitate installation. See next page for additional details.
4. If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.

7.5 Chemical Spills

Caution: If a chemical spill has been captured, do not attempt maintenance. Immediately contact the local hazard response agency and contact Contech.

7.6 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Jellyfish Filter Components & Filter Cartridge Assembly and Installation

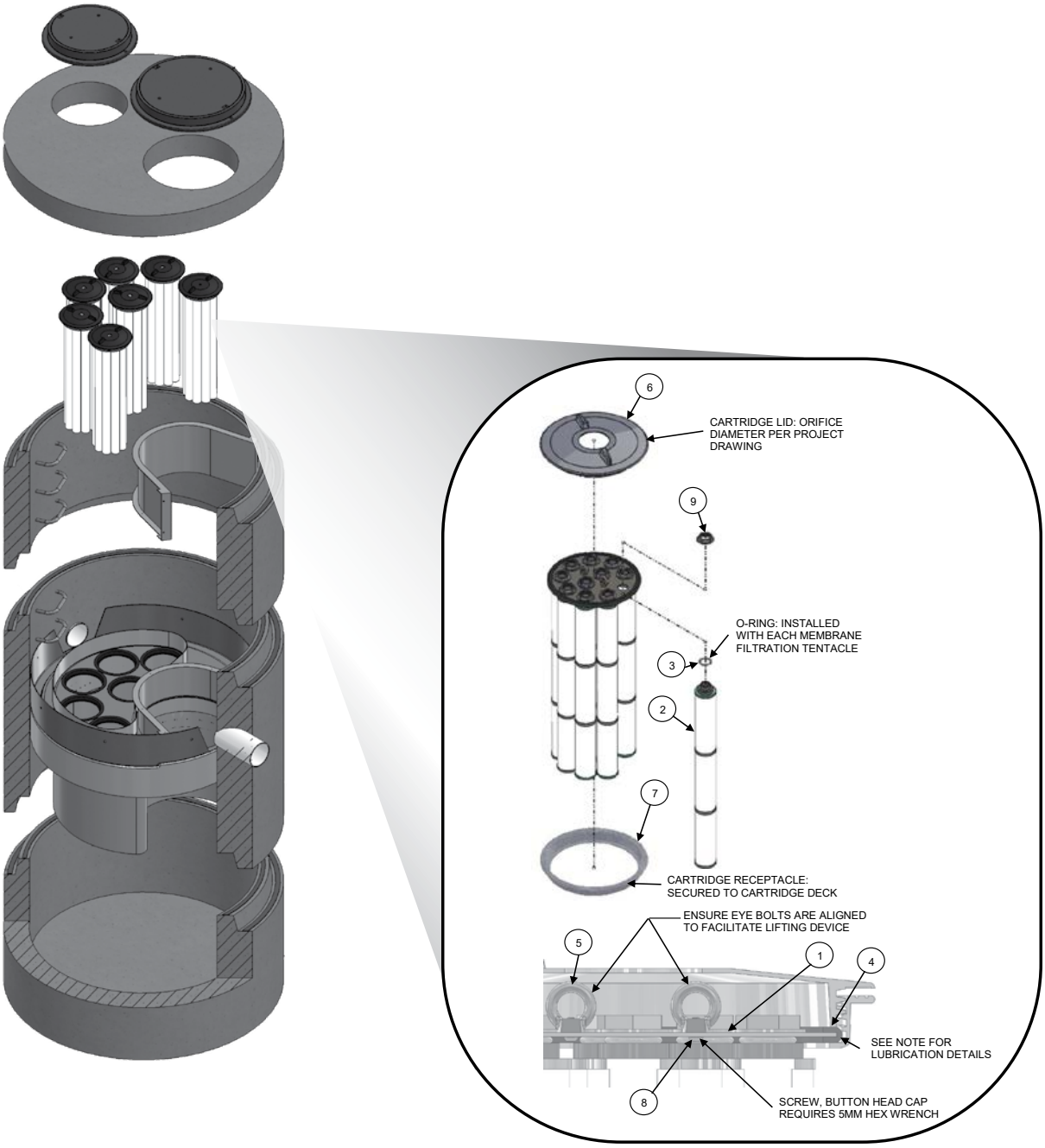


TABLE 1: BOM

ITEM NO.	DESCRIPTION
1	JF HEAD PLATE
2	JF TENTACLE
3	JF O-RING
4	JF HEAD PLATE GASKET
5	JF CARTRIDGE EYELET
6	JF 14IN COVER
7	JF RECEPTACLE
8	BUTTON HEAD CAP SCREW M6X14MM SS
9	JF CARTRIDGE NUT

TABLE 2: APPROVED GASKET LUBRICANTS

PART NO.	MFR	DESCRIPTION
78713	LA-CO	LUBRI-JOINT
40501	HERCULES	DUCK BUTTER
30600	OATEY	PIPE LUBRICANT
PSLUBXL1Q	PROSELECT	PIPE JOINT LUBRICANT

NOTES:

Head Plate Gasket Installation:
Install Head Plate Gasket (Item 4) onto the Head Plate (Item 1) and liberally apply a lubricant from Table 2: Approved Gasket Lubricants onto the gasket where it contacts the Receptacle (Item 7) and Cartridge Lid (Item 6). Follow Lubricant manufacturer's instructions.

Lid Assembly:
Rotate Cartridge Lid counter-clockwise until both male threads drop down and properly seat. Then rotate Cartridge Lid clock-wise approximately one-third of a full rotation until Cartridge Lid is firmly secured, creating a watertight seal.

Jellyfish Filter Inspection and Maintenance Log

Owner: _____ Jellyfish Model No.:_____

Location: _____ GPS Coordinates: _____

Land Use: Commercial:_____ Industrial: _____ Service Station:_____

Road/Highway:____ Airport: _____ Residential: _____ Parking Lot:_____

Date/Time:					
Inspector:					
Maintenance Contractor:					
Visible Oil Present: (Y/N)					
Oil Quantity Removed					
Floatable Debris Present: (Y/N)					
Floatable Debris removed: (Y/N)					
Water Depth in Backwash Pool					
Cartridges externally rinsed/re-commissioned: (Y/N)					
New tentacles put on Cartridges: (Y/N)					
Sediment Depth Measured: (Y/N)					
Sediment Depth (inches or mm):					
Sediment Removed: (Y/N)					
Cartridge Lids intact: (Y/N)					
Observed Damage:					
Comments:					