DRAINAGE REPORT

ALLEN & MAJOR
ASSOCIATES, INC.

Strada Mixed Used Building
252-262 Main Street
Reading, Massachusetts

COMMONWEALTH OF MASSACHUSETTS
CARLTON M. QUINN
CIVIL
No.49923
REGISTERED PROFESSIONAL ENGINEER

APPLICANT:
BLVD Reading, LLC
1 Sylvan Street
Peabody, MA 01960

PREPARED BY:
Allen & Major Associates, Inc.
100 Commerce Way, Suite 5
Woburn, Massachusetts 01801
E.O.R. Carlton Quinn PE

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ISSUED:
October 5, 2023

REVISED:
March 25, 2024

A&M PROJECT NO.:
2398-01A

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Introduction

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the new development located at 252-262 Main Street in Reading. The report will show by means of narrative, calculations and exhibits that the proposed stormwater management system will meet or exceed the Massachusetts Department of Environmental Protection (MassDEP) stormwater standards, and the town Stormwater Management Regulations.

The proposed site improvements include the demolishing of three buildings, clearing of existing vegetation and constructing one mixed-use building. Other improvements to the site include construction of surface parking, landscaping and underground utilities servicing the site. The project will be serviced by connecting existing utilities off Main Street and Pinevale Street.

The proposed SMS incorporates structural and non-structural Best Management Practices (BMPs) to provide stormwater peak flow mitigation, quality treatment, and conveyance.

The SMS includes catch basins, water quality units, drain manholes, roof drains, underground piping, underground infiltration chambers, and an Operation & Maintenance Plan.

Site Categorization for Stormwater Regulations

The proposed site improvements at 252-262 Main Steet are considered a new development under the DEP Stormwater Management Standards due to the net increase in impervious area. A new development project is required to meet all of Stormwater Management Standards listed within the MA DEP Stormwater Handbook.

Site Location and Access

The site consists of three lots with 247 feet of frontage on Main Street entirely within the town of Reading. The site is currently accessed by three curb cuts on Main Street.

Existing Site Conditions

The site currently includes two residential houses, and a retail building. Most of the site is currently wooded, except for the access driveway to the commercial building & a driveway to the north of the site that serves the residential property. The site also has a retaining wall that runs along the frontage that varies in height from one to four-feet tall. The site topography slopes west towards the rear and east towards Main Street from a high point located at the center of the site.

The surface drainage flows were analyzed at three Study Points. Study Point #1 summarizes off-site flows generated from the western area of the site that flow north off site to transition into gutter line flow to the drainage system on Pinevale Avenue. Study Point #2 summarizes off site flows towards the catch basin on Main Street. This catchment

area sits in the eastern side of the site. Once flow has left the site it becomes concentrated in the gutter line and then directly to the drainage system. Study Point #3 has been delineated as the existing wetlands towards the south of the site. Copies of the existing watershed plan, showing the boundaries of each catchment area, are provided in the rear pocket of this report.

Existing Soil Conditions

The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County. The site is primarily soil type 602 – Urban Land. These soil types are assumed to be A-type soils because of the landform (outwash terraces/plans) as well as the surrounding soil types. There are a copy of the stormwater test pits and boring logs taken at this site, provided in the appendix of this report.

A copy of the NRCS Custom Soil Resource Report is included in the appendix of this report.

FEMA Floodplain/Environmental Due Diligence

There are no portions of the site located within the FEMA Zone "AE" Special Flood Hazard Area Subject to Inundation by the 1% Annual Chance Flood (100-year floodplain). The official Flood Insurance Rate Map (FIRM) effective date June 4, 2010, community panel 312 of 656. Map number 25017C0313E. See section 3 of this report for a copy of the FEMA FIRM.

Environmentally Sensitive Zones

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including: Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); Priority and Protected Habitat for rare and endangered species, and areas protected under the Wetlands Protection Act. The subject property is not located within any of these regulated areas.

Drainage Analysis Methodology

A peak rate of runoff will be determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD © Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.00-24. The HydroCAD program was used to generate runoff hydrographs for the watershed areas, to determine discharge/ stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

3. Soil Survey of Middlesex County Massachusetts by United States Department of Agriculture, NRCS. Soil types and boundaries were obtained from this reference.

Proposed Conditions – Peak Rate of Runoff

The stormwater runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Further, the analysis has been prepared in accordance with the MassDEP and the town requirements and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, 25, and 100-year storm events.

The proposed stormwater management system for the site consists of catch basins, water quality units, drain manholes, roof drains, underground piping, area drains, underground infiltration chambers These systems have been designed in accordance with the MA DEP Stormwater Management Policy to recharge groundwater and reduce rate of runoff from the parcel.

The proposed Underground Infiltration System #1 (UIS#1) collects flows from a portion of the proposed parking lot (Sub-catchment P-1B). The proposed Underground Infiltration System #2 (UIS#2) collects water from the roof, portions of the parking lot and the amenities area (Sub-catchment areas R-1, P-1A & P-1C). The two systems have an emergency overflow pipe which outlets the existing drainage system on the public R.O.W. These infiltration systems were designed to contain flow for the 25-year storm, as requested by the town of Reading Engineering department. This will help mitigate extra flow to the existing drainage structures on Pinevale/Main Street and promote infiltration.

Study Point 3 (Flow off-site to the existing wetlands) which captures storm runoff from Sub-catchment 3, which is mostly landscape cover. The peak rate/volume for this study point has been minimized compared to the existing conditions.

The stormwater runoff model indicates that the proposed site development reduces the rate of runoff during all storm events at the identified points of analysis. The following tables provide a summary of the estimated peak rate, in Cubic Feet per Second (CFS) and total runoff volume, in cubic feet (CF) at each of the three Study Points for each of the design storm events. The HydroCAD worksheets are included in Section 4 and 5 of this report.

STUDY POINT #1: (Flow Off-Site to Drainage System)

	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.36	0.94	1.34	1.99
Proposed Flow (CFS)	0.02	0.13	0.21	1.43
Decrease (CFS)	**0.34**	**0.81**	**1.13**	**0.56**
Existing Volume (CF)	1,328	3,262	4,649	6,934
Proposed Volume (CF)	136	458	716	4,511
Change (CF)	**1,192**	**2,804**	**3,933**	**2,423**

STUDY POINT #2: (Flow Off-Site to Drainage System)

	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.72	1.90	2.73	4.07
Proposed Flow (CFS)	0.05	0.19	0.30	1.48
Decrease (CFS)	**0.67**	**1.71**	**2.43**	**2.59**
Existing Volume (CF)	2,631	6,530	9,336	13,970
Proposed Volume (CF)	236	690	1,041	4,987
Change (CF)	**2,395**	**5,840**	**8,295**	**8,983**

STUDY POINT #3: (Flow to Wetlands)

	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.03	0.24	0.41	0.71
Proposed Flow (CFS)	0.00	0.00	0.00	0.01
Decrease (CFS)	**0.03**	**0.24**	**0.41**	**0.70**
Existing Volume (CF)	254	928	1,482	2,462
Proposed Volume (CF)	0	13	30	67
Change (CF)	**254**	**915**	**1,452**	**2,395**

TOTAL

	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	1.11	3.08	4.48	6.77
Proposed Flow (CFS)	0.07	0.32	0.51	2.92
Decrease (CFS)	**1.06**	**2.76**	**3.97**	**3.85**
Existing Volume (CF)	4,213	10,720	15,467	23,366
Proposed Volume (CF)	372	1,161	1,786	9,565
Change (CF)	**3,841**	**9,559**	**13,681**	**13,801**

MASSDEP Stormwater Performance Standards

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for stormwater management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include –

- Deep Sump Catch Basins
- Subsurface Structures
- Water Quality Units

Stormwater Best Management Practices (BMP's) have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale and/or silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are enumerated below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

   The proposed development will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts. All discharges will be treated for water quality and the rate will not be increased over existing conditions.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   The proposed development has been designed so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates. A

summary of the existing and proposed discharge rates is included within this document.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

   The existing annual recharge for the site has been approximated in the proposed condition. There are proposed subsurface infiltration systems designed to meet this requirement. Stormwater runoff generated from the impervious areas of the proposed development are routed through these infiltration BMPs. The proposed Recharge Volume is based on the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1.

   See the appendix located at section 6 of this report for stormwater recharge calculations.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
   - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
   - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
   - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

   Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-term Pollution Prevention Plan. The water quality volume for the site

redevelopment is captured and treated using underground infiltration systems with isolator rows and water quality units.

The implemented BMPs have been designed to treat the contributing water quality volume. These water quality calculations can be seen within the appendix of this report.

The proposed stormwater management system has been designed to remove 80% of the average annual post-construction load for each treatment train. The TSS removal calculations can be seen within the appendix of this report.

The TSS removal efficiencies for the proprietary separator are based on the values assigned under the Technology Acceptance and Reciprocity Partnership (TARP) testing protocol. The TARP is a workgroup of the Environmental Council of States that was originally comprised of California, Illinois, Maryland, Massachusetts, New Jersey, New York, Pennsylvania and Virginia. TARP is recognized in the MA DEP Stormwater Management Handbook as a valid source for assigning TSS removal efficiencies for proprietary separators.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

   The site is not considered a land use with higher potential pollutant loads.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account*

site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

The project site does not discharge stormwater within a Zone II or Interim Wellhead Protection Area or near a critical area. Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

   The proposed project is not considered a re-development project under the Stormwater Management Handbook guidelines as there is an increase in the amount of impervious area.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.

10. *All illicit discharges to the stormwater management system are prohibited.*

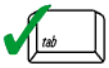
    See appendix for Illicit Discharge Statement

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.

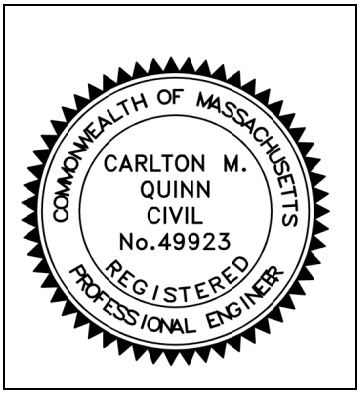
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



3/25/24

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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)

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 Sytstem (Stormtech SC-310, Stormtech SC-740)

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 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.

SECTION 2.0 -
OPERATION & MAINTENANCE PLAN

Introduction

In accordance with the standards set forth by the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection (MassDEP), Allen & Major Associates, Inc. has prepared the following Operations & Maintenance (O&M) Plan for the proposed development at 252-260 Main Street, Reading, MA.

The plan is broken down into three major sections. The first section describes construction-related erosion and sedimentation controls (Demolition & Construction Maintenance Plan). The second section describes the long-term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long-Term Maintenance Plan – Facilities Description).

Notification Procedures for Change of Responsibility for O&M

The Stormwater Management System (SMS) for this project is owned by BLVD Reading LLC (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance Plan.

The owner shall submit an annual summary report and the completed Operation & Maintenance Schedule & Checklist to the Conservation Commission (via email or print copy), highlighting inspection and maintenance activities including performances of BMPs. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Commission that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring owner until the transferee owner notifies the Commission of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the owner(s) shall establish an association on other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the Commission.

Contact Information

Stormwater Management System Owner:	BLVD Reading LLC 1 Slyvan Street Peabody, MA Phone: (781) 389-5989

Emergency Contact Information:

BLVD Reading LLC (Owner/Operator)	Phone: (781) 389-5989
Allen & Major Associates, Inc. (Site Civil Engineer)	Phone: (781) 935-6889
Reading Department of Public Works	Phone: (781) 942-9092
Reading Conservation Commission	Phone: (781) 942-9016
Reading Fire Department (non-emergency line)	Phone: (781) 944-3131
MassDEP Emergency Response	Phone: (888) 304-1133
Clean Harbors Inc (24-Hour Line)	Phone: (800) 645-8265

Demolition & Construction Maintenance Plan

1. Call Digsafe: 1-888-344-7233
2. Contact the town at least three (3) days prior to start of demolition and/or construction activities.
3. Install Erosion Control measures as shown on the Plans prepared by A&M. The town shall review the installation of straw bales and silt fencing prior to the start of any site demolition work. Install Construction fencing if determined to be necessary at the commencement of construction.
4. Install construction entrances, straw bales, and silt fence at the locations shown on the Erosion Control Plan prepared by A&M.
5. Site access shall be achieved only from the designated construction entrances.
6. Cut and clear trees in construction areas only (within the limit of work; see plans).
7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.

9. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on-site for review.
10. All erosion control measures shall be maintained, repaired, or replaced as required or at the direction of the owner's engineer or the town.
11. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
13. Install stone check dams on-site during construction as needed. Refer to the erosion control details. Temporary sediment basins combined with stone check damns shall be installed on-site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.
14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
16. Dust pollution shall be controlled using on-site water trucks and/or an approved soil stabilization product.
17. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.

Long-Term Pollution Prevention Plan

Standard #4 from the MassDEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance Plan of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures of the LTPPP.

- Housekeeping
  The existing development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland areas. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

- Storing of Materials & Water Products
  The trash and waste program for the site includes exterior dumpsters. There is a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- Vehicle Washing
  Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The existing development does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.

- Spill Prevention & Response
  Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

  1. Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
  2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
  3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
  4. All spills shall be cleaned up immediately after discovery.
  5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at (888) 304-1333.

6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

- Maintenance of Lawns, Gardens, and Other Landscaped Areas
  It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. No trees shall be planted over the drain lines or recharge area, and that only shallow rooted plants and shrubs will be allowed.

  - Fertilizer
    Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

    Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

    Type: LESCO® 28-0-12 (Lawn Fertilizer)
    MERIT® 0.2 Plus Turf Fertilizer
    MOMENTUM™ Force Weed & Feed

  - Suggested Aeration Program
    In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The

depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- Landscape Maintenance Program Practices:
  - Lawn
    1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cute, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
    2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
    3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
    4. Do not remove grass clippings after mowing.
    5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.
  - Shrubs
    1. Mulch not more than 3" depth with shredded pine or fir bark.

2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals are to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
3. Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

- Trees
  1. Provide aftercare of new tree plantings for the first three years.
  2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
  3. Water once a week for the first year; twice a month for the second; once a month for the third year.
  4. Prune trees on a four-year cycle.
- Invasive Species
  1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

- Storage and Use of Herbicides and Pesticides

  Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) should be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

  The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor household or structural pests, refer to 333 CMR 13.08.

  Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of

signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice so that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company;
2. Date and time of the application;
3. Name and license number of the applicator;
4. Target pests; and
5. Name and EPA Registration Number of pesticide products applied.

- Pet Waste Management
  The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the development. The pet waste shall be disposed of in accordance with local and state regulations.
- Operations and Management of Septic Systems
  There are no proposed septic systems within the limits of the project.
- Management of Deicing Chemicals and Snow
  Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to MassDEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations

  The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. If used, the de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. If used, de-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand.

Long-Term Maintenance Plan – Facilities Description

A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location

where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

The following is a description of the Stormwater Management System for the project site.

Stormwater Collection System – On-Site:

The stormwater collection system is a series of inlets located at low points within the limits of the paved area. All of the proposed on-site catch basins incorporate a deep sump and hooded outlet. The catch basins are connected by a closed gravity pipe network that pass through proprietary separators prior to entering the underground detention chamber or porous pavement.

Other Maintenance Activity:

- Mosquito Control - Both above ground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential. See the supplemental information for Mosquito Control in Stormwater Management Practices, and the Operation and Maintenance Plan Schedule for inspection schedule.
- Street Sweeping - Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

Inspection and Maintenance Frequency and Corrective Measures

In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the previously described BMPs will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the footprint of the SMS.

Supplemental Information

- Operation & Maintenance Plan Schedule
- Massachusetts Stormwater Handbook, Chapter 5, Miscellaneous Stormwater Topics, Mosquito Control in Stormwater Management Practices.
- Massachusetts Department of Environmental Protection Bureau of Water Resources Snow Disposal Guidance.
- Stormtech Isolator ROW O&M Manual

OPERATION AND MAINTENANCE PLAN SCHEDULE

Date: 10/5/2023

ALLEN & MAJOR ASSOCIATES, INC.

Project: Strada Mixed Use Building
Project Address: 258 Main Street Reading, MA
Responsible for O&M Plan: BLVD Reading, LLC
Address: 1 Sylvan Street, Peabody MA 01960
Phone: (781) 389-5989

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
STRUCTURAL PRETREATMENT BMPs	**DEEP SUMP CATCH BASIN**	Four times per year (quarterly).	Inspect and clean catch basin units 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 basin.	$1,000		
	PROPRIETARY SEPARATORS	In accordance with manufacturers requirements, but no less than twice a year following installation and once a year thereafter.	Remove sediment and other trapped pollutants at frequency or level specified by manufacturer.	$2,000		

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
INFILTRATION BMPs	**DRY WELL**	Inspect after every major storm in the first few months following construction. Thereafter, inspect annually.	Inspect dry wells. Measure the water depth in the observation well at 24- and 48-hour intervals after a storm. Calculate clearance rates by dividing the drop in water level (inches) by the time elapsed (hr.).	$500		
	SUBSURFACE STRUCTURES	Inspect structure inlets at least twice a year. Remove debris that may clog the system as needed.	Because subsurface structures are installed underground, they are extremely difficult to maintain. Remove any debris that might clog the system.	$500		
	OUTLET STRUCTURES	Periodic cleaning of Outlet Control Structures as needed.	Clear trash and debris as necessary.	$500		

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
OTHER MAINTENANCE ACTIVITY	**MISQUITO CONTROL**	Inspect BMPs as needed to ensure the system's drainage time is less than the maximum 72 hour period.	Massachusetts stormwater handbook requires all stormwater practices that are designed to drain do so within 72 hours to reduce the number of mosquitos that mature to adults since the aquatic stage of a mosquito is 7-10 days.	$100		
	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow over catch basins, or in detention ponds, sediment forebays, rivers, wetlands, and flood plains. It is also prohibited to dump snow in the bioretention basins or gravel swales.	$500		
	STREET SWEEPING	Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably spring.	Sweep, power broom or vacuum paved areas. Submit information that confirms that all street sweepings have been completed in accordance with state and local requirements	$2,000		

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the "good housekeeping" requirement of the municipality's or agency's MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.[3] In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project's post-construction BMPs will be operated and maintained.[4]

[3] The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

[4] The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.[5] The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

[5] Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.

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Massachusetts Department of Environmental Protection
Bureau of Water Resources
Snow Disposal Guidance

Effective Date: December 23, 2019

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: **https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/**.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

  If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps***:

- Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

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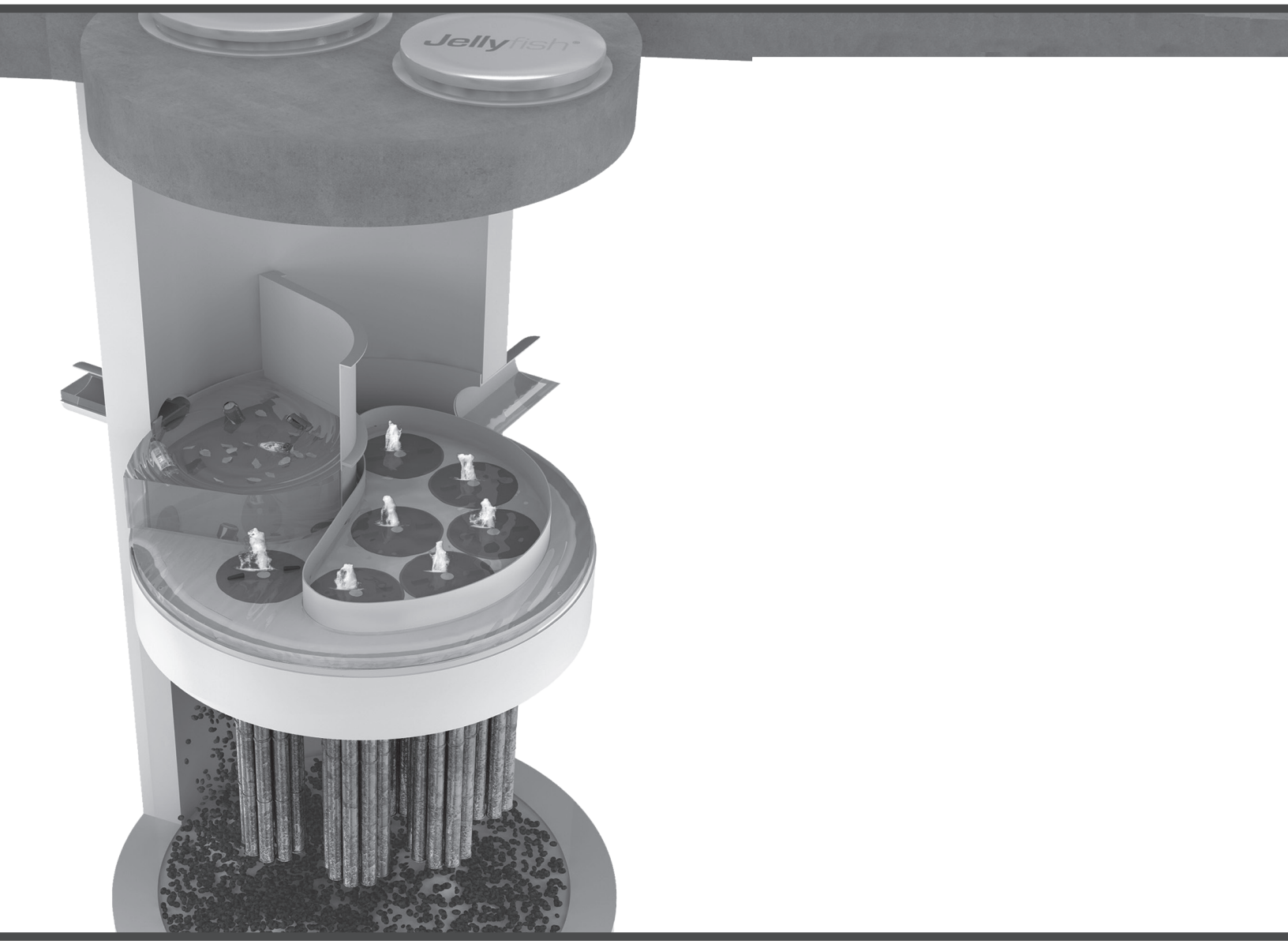
JellyFish® Filter Maintenance Guide



Jellyfish®

JELLYFISH® FILTER MANHOLE CONFIGURATIONS
INSPECTION & MAINTENANCE GUIDE

TABLE OF CONTENTS

1.0 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.

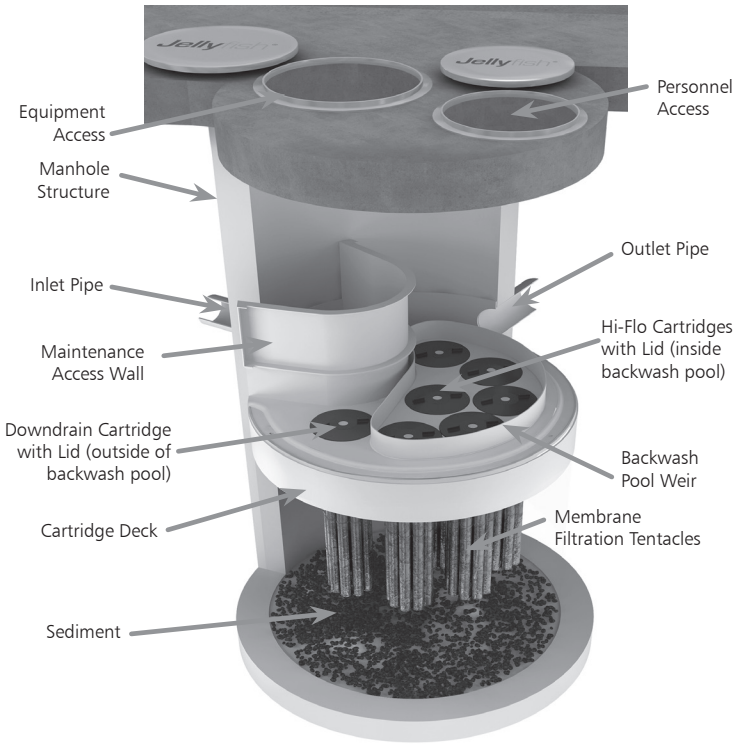
Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Additional maintenance activities may be required in the event of non-storm event runoff, such as base-flow or seasonal flow, an upstream chemical spill or due to excessive sediment loading from site erosion 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)

Maintenance activities typically 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



Note: Separator Skirt not shown

2.0 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*.

1. Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired, before installing the filter cartridges.
2. A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
3. 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.
4. Inspection is recommended after each major storm event.
5. Inspection is required immediately after an upstream oil, fuel or other chemical spill.

3.0 Inspection Procedure

The following procedure is recommended when performing inspections:

1. Provide traffic control measures as necessary.
2. Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
3. Measure oil and sediment depth in several locations, by lowering a sediment probe through the MAW opening 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, cartridge deck, and backwash pool weir, for cracks or broken components. If damaged, repair is required.

3.1 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 Utilitzing Sediment Probe

- Standing water outside the backwash pool 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.

3.2 Wet weather inspections

- Observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
- 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 are occluded with sediment and need to be rinsed

4.0 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.

5.0 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.
3. Caution: Dropping objects onto the cartridge deck may cause damage.
4. Perform Inspection Procedure prior to maintenance activity.
5. To access the cartridge deck for filter cartridge service, descend the ladder 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.
6. Maximum weight of maintenance crew and equipment on the cartridge deck not to exceed 450 lbs.

5.1 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.

5.2 Filter Cartridge Rinsing

1. Remove all 11 tentacles from the cartridge head plate. Take care not to damage or break the plastic threaded nut or connector.
2. Position tentacles in a container (or over the MAW), with the

Cartridge Removal & Lifting Device

threaded connector (open end) facing down, so rinse water is flushed through the membrane and captured in the container.

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. Reattach tentacles to cartridge head plate. Reuse O-rings and nuts, ensuring proper placement on each tentacle.

5.3 Cleaning Procedure

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, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. 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. Alternatively, floatable solids may be removed by a net or skimmer.

Tentacle Rinse Using Jellyfish Rinse Tool

3. Pressure wash cartridge deck and receptacles to remove all 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.
5. Remove the sediment from the bottom of the unit through the MAW opening.

Vacuuming Sump Through MAW

6. For larger diameter Jellyfish Filter manholes (≥8-ft) and vaults without an MAW opening, 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. After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
8. Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.

5.4 Filter Cartridge 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. 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.
3. Lower filter cartridge to the cartridge deck. Remove cartridge lid from deck and carefully lower the filter cartridge into the receptacle until head plate gasket is seated squarely in receptacle. Caution: Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur.
4. Replace the cartridge lid and check fit before completing rotation to a firm hand-tight attachment.

5.5 Chemical Spills

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

6.0 Related Maintenance Activities

Jellyfish units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

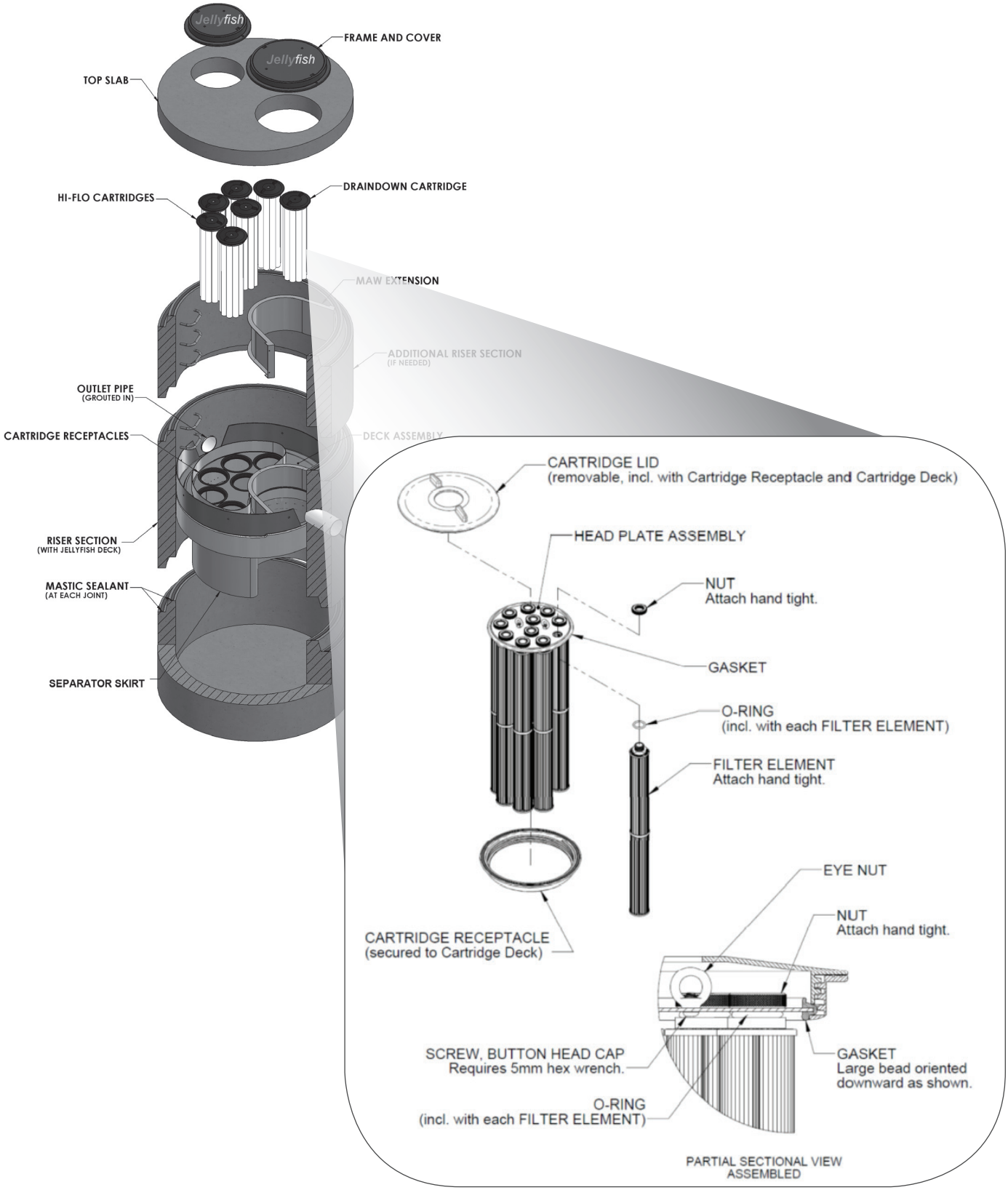
In order for maintenance of the Jellyfish filter to be successful, it is imperative that all other components be properly maintained. The maintenance and repair of upstream facilities should be carried out prior to Jellyfish maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

7.0 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



Jellyfish Filter Inspection and Maintenance Log

Owner:				Jellyfish Model No:		
Location:				GPS Coordinates:		
Lande Use:	Commercial:		Industrial:		Service Station:	
	Roadway/Highway:		Airport:		Residential:	

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						
Draindown Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Cartridges: (Y/N)						
Hi-Flo Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Hi-Flo 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:						

Jellyfish®

CONTECH ENGINEERED SOLUTIONS

Support

- Drawings and specifications are available at ContechES.com/jellyfish.
- Site-specific design support is available from Contech Engineered Solutions.

800.338.1122
www.ContechES.com

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, wastewater treatment and earth stabilization products. For information on other Contech segment offerings, visit ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; related foreign patents or other patents pending.

CONTECH®
ENGINEERED SOLUTIONS

Stormceptor® STC
Owner's Manual

Stormceptor® STC

Table of Contents

For patent information, go to www.ContechES.com/ip.

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a "Hydrodynamic Separator (HDS)" or an "Oil Grit Separator (OGS)", engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- "STORMCEPTOR" is clearly marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site's tailwater conditions)
- Series Unit (combines treatment in two systems)

PLEASE MAINTAIN YOUR STORMCEPTOR

To ensure long-term environmental protection through continued performance as originally designed for your site, Stormceptor must be maintained, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call Contech at 1-800-338-1122.

2 – Stormceptor Operation and Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology. Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

Figure 1.

Inline Stormceptor

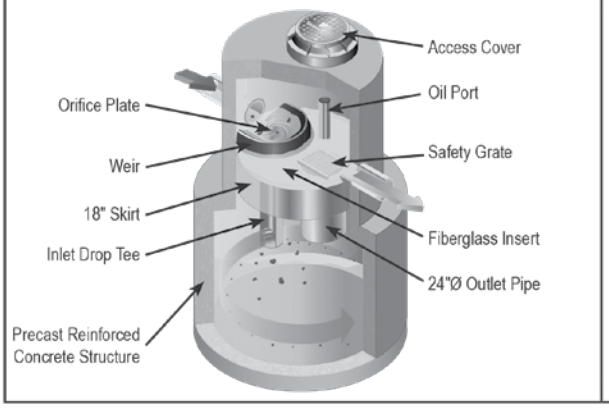
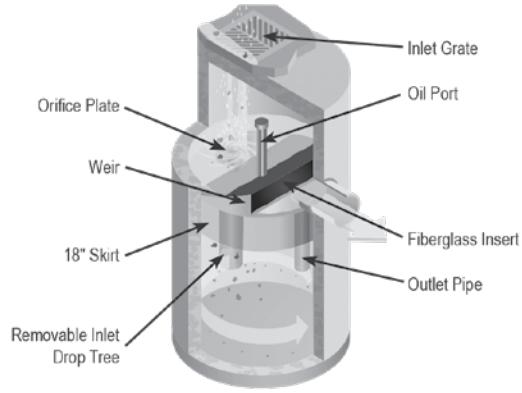


Figure 2.

Inlet Stormceptor



3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS and MAX) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using Table 1.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Contech Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS and OSR Stormceptor models are provided in Tables 1 and 2. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1. Stormceptor Dimensions - Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

Notes:

1. Depth Below Pipe Inlet Invert to the Inside Top Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2. Storage Capacities

STC Model	Hydrocarbon Storage Capacity (gal)	Sediment Capacity (ft^3)
450	86	46
900	251	89
1200	251	127
1800	251	207
2400	840	205
3600	840	373
4800	909	543
6000	909	687
7200	1059	839
11000*	2797	1089
13000*	2797	1374
16000*	3055	1677

Notes:

1. Hydrocarbon and Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series*

4 – Stormceptor Inspection and Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see Table 3). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.
- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in Table 2, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins.

For typical inspection and maintenance activities, no specific supplemental training is required

Recommended Stormceptor Inspection Procedure:

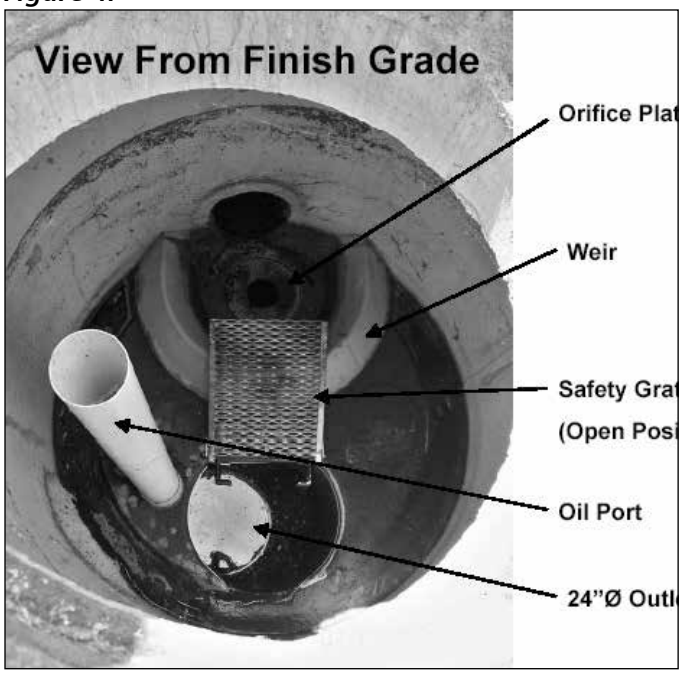
- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch or 6-inch diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, hoist and safety harness for specially trained personnel if confined space entry is required

Figure 3.

Figure 4.



Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck. No entry into the unit is required for maintenance. DO NOT ENTER THE STORMCEPTOR CHAMBER unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
  - » For 6-ft diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch outlet riser pipe (See Fig. 5).
  - » For 4-ft diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch drop tee hole (See Fig. 6).

Figure 5.

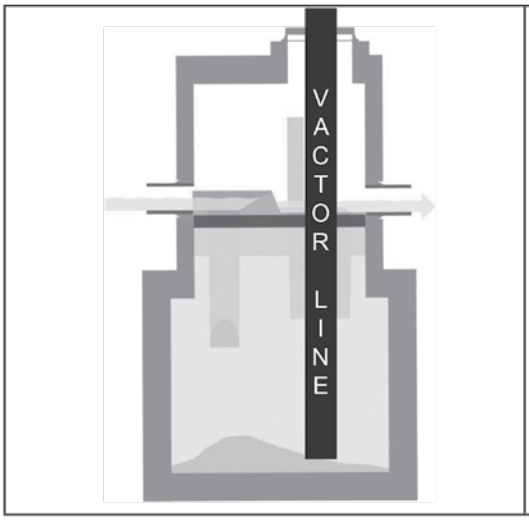
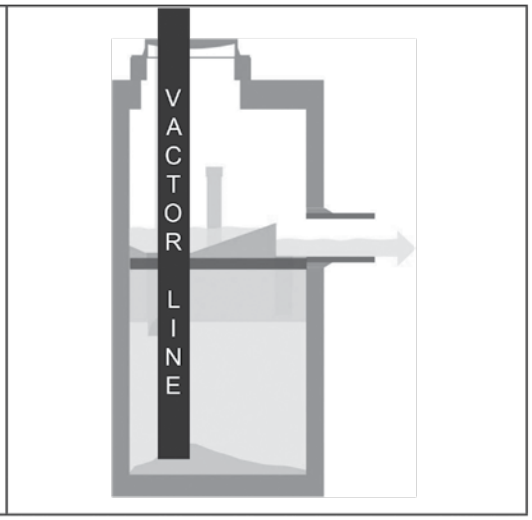


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in Table 3 based on the unit size.

Table 3. Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment Depth (in)
450	8
900	8
1200	10
1800	15
2400	12
3600	17
4800	15
6000	18
7200	15
11000*	17
13000*	20
16000*	17

Notes:

1. The values above are for typical standard units.

** Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Contech Representative or call 800-338-1122.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

5 – Contact Information

Questions regarding the Stormceptor can be addressed by contacting your local Contech representative or by calling 800-338-1122.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

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.

Inspection Report

Date: _____ Personnel: _____

Location: _____ System Size: _____ Months in Service: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

Sediment Thickness in Forebay: _____ Date: _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: _____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: _____

☐ Minor Structural Repairs: _____

☐ Drainage Area Report _____

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

Items Needing Further Work: _____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

_____

_____

_____

_____

_____

_____

_____

_____

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

List Safety Procedures and Equipment Used: _____

_____

_____

System Observations

Months in Service: _____

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

_____

_____

_____

_____

_____

_____

_____

RECYCLED PAPER

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- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

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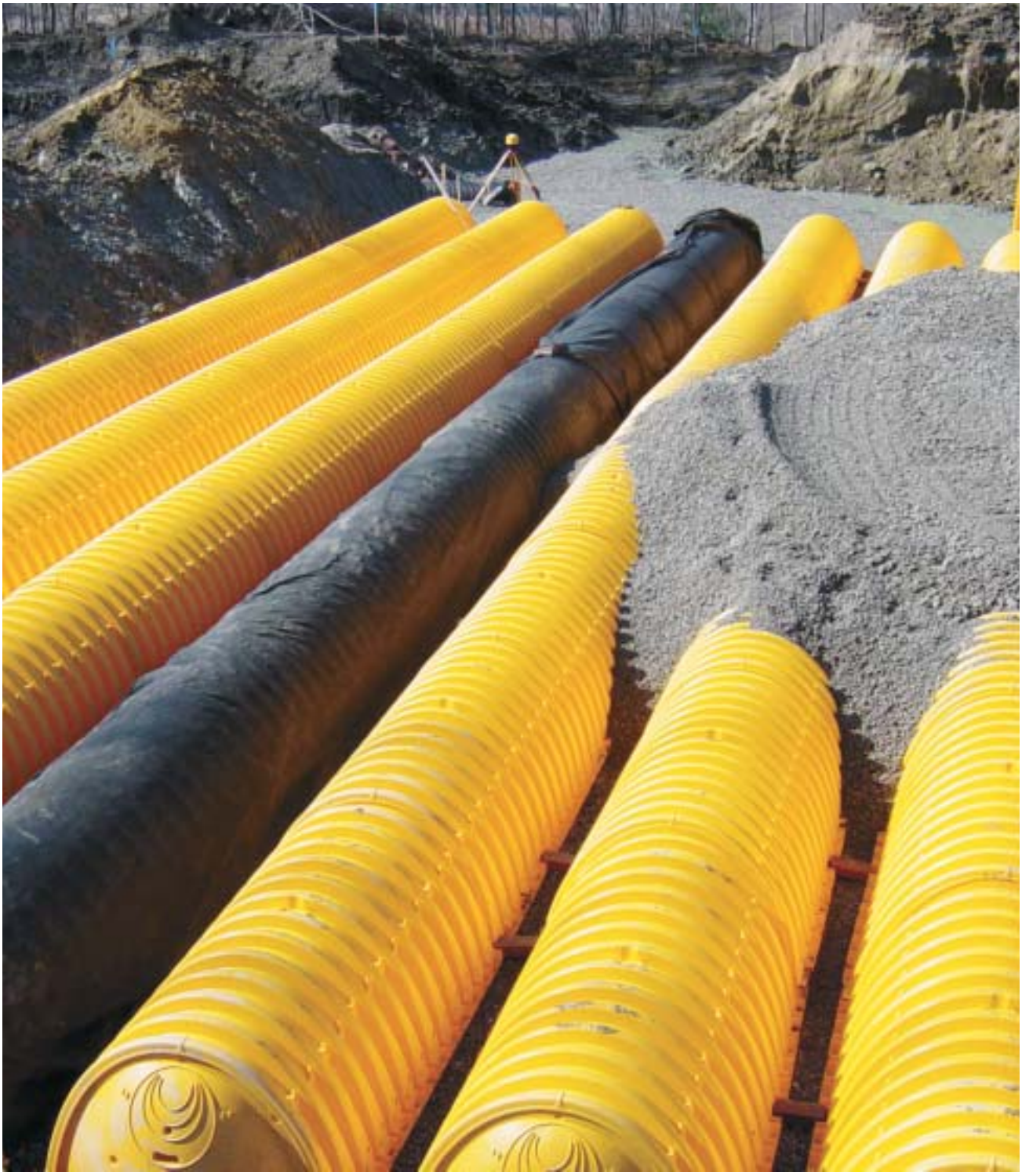


Isolator™ Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator™ Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patent pending technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR™ ROW

The Isolator Row is a row of StormTech chambers, either SC-740 or SC-310 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

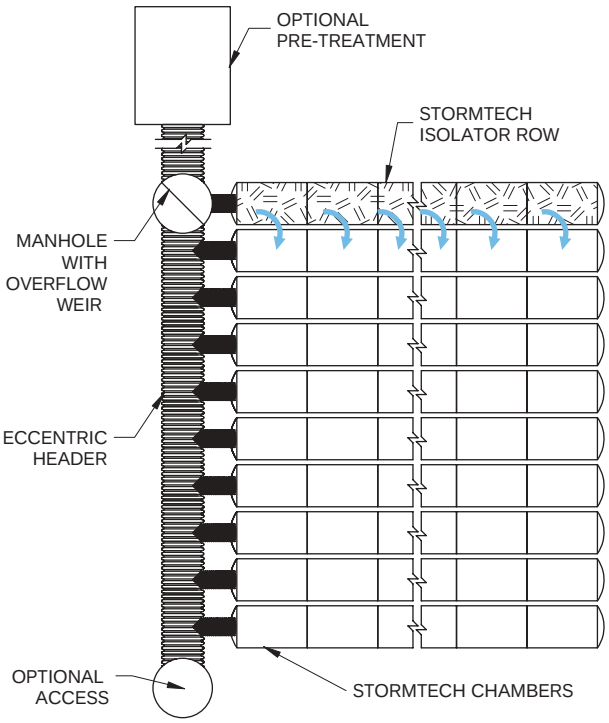
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

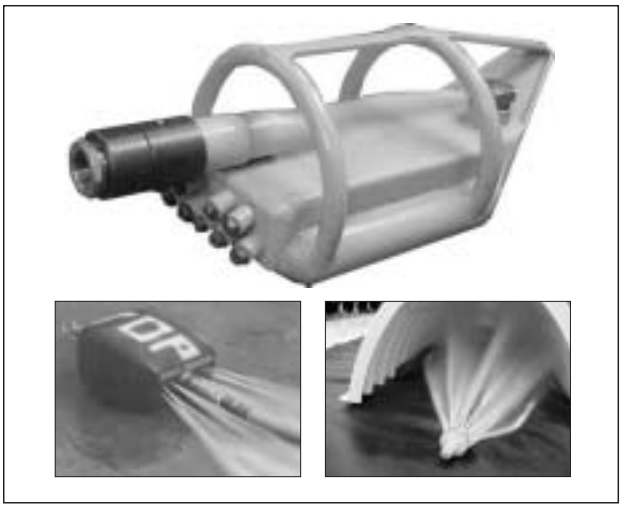
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

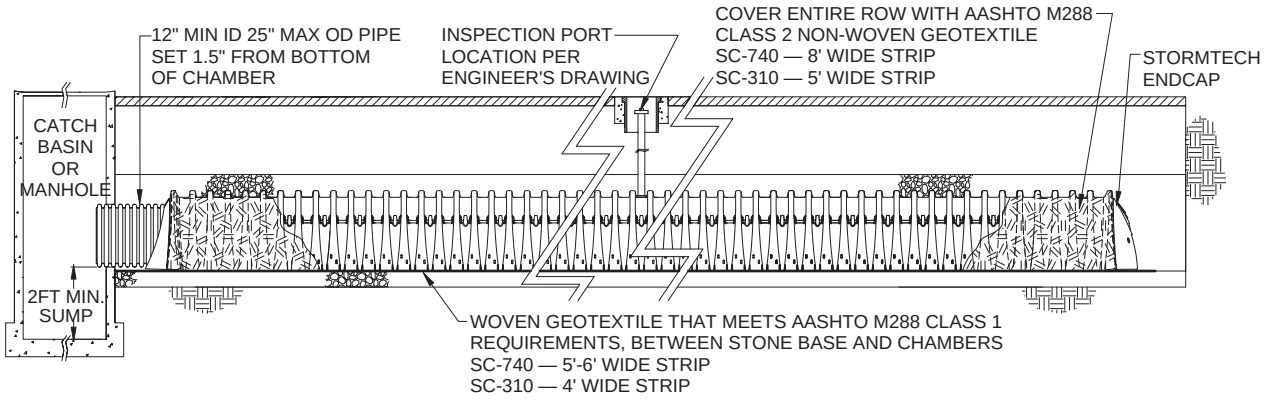
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

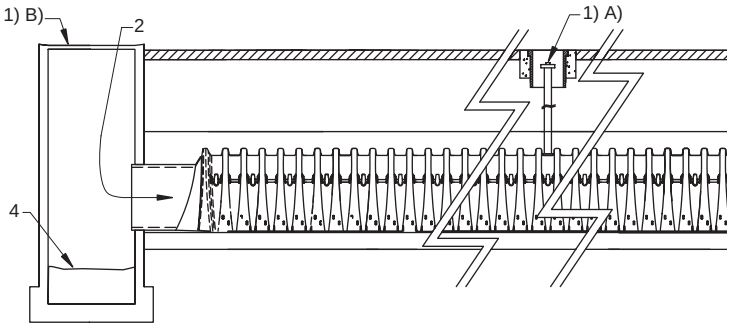
i. Remove cover from manhole at upstream end of Isolator Row

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

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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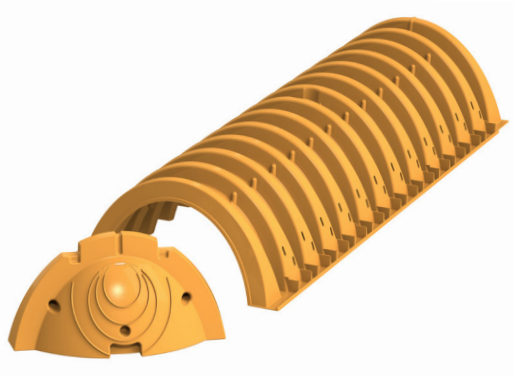
StormTech® SC-310 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
85.4" x 34" x 16"
2170 mm x 864 mm x 406 mm

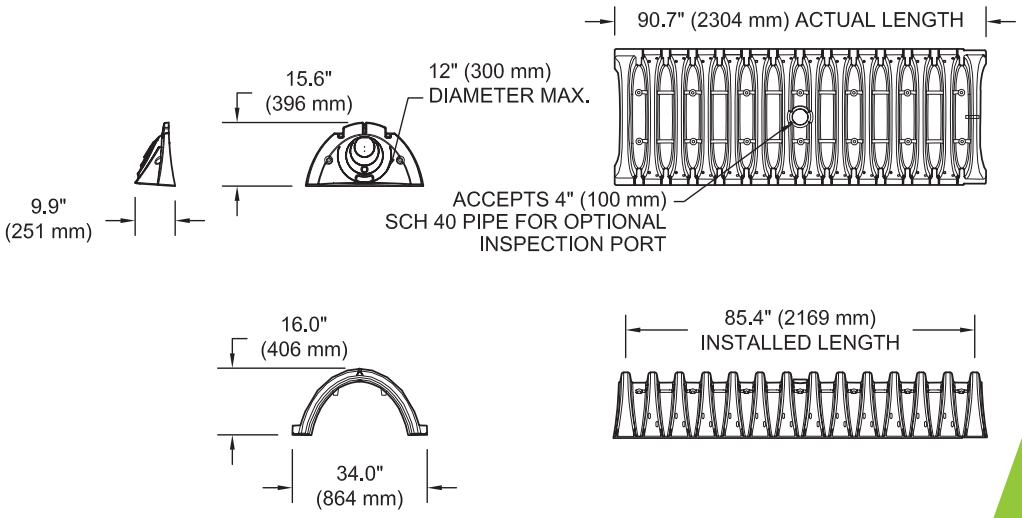
Chamber Storage
14.7 ft³ (0.42 m³)

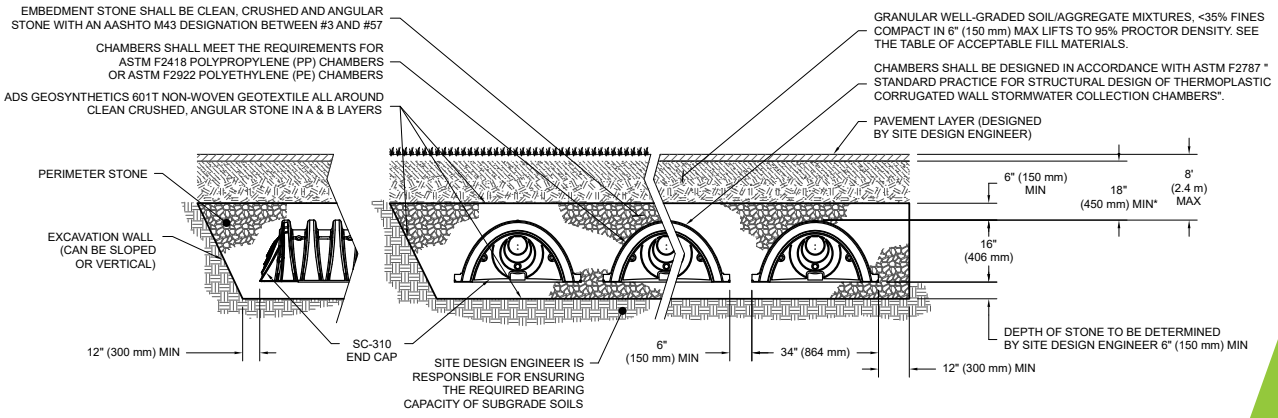
Min. Installed Storage*
31.0 ft³ (0.88 m³)

Weight
37.0 lbs (16.8 kg)

Shipping
55 chambers/pallet
108 end caps/pallet
18 pallets/truck

*Assumes 6" (150 mm) stone above and below chambers and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

ADS StormTech™

StormTech SC-310 Specifications

Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	14.70 (0.416)	31.00 (0.878)
27 (686)	14.70 (0.416)	30.21 (0.855)
26 (660)	Stone Cover 14.70 (0.416)	29.42 (0.833)
25 (635)	14.70 (0.416)	28.63 (0.811)
24 (610)	14.70 (0.416)	27.84 (0.788)
23 (584)	14.70 (0.416)	27.05 (0.766)
22 (559)	14.70 (0.416)	26.26 (0.748)
21 (533)	14.64 (0.415)	25.43 (0.720)
20 (508)	14.49 (0.410)	24.54 (0.695)
19 (483)	14.22 (0.403)	23.58 (0.668)
18 (457)	13.68 (0.387)	22.47 (0.636)
17 (432)	12.99 (0.368)	21.25 (0.602)
16 (406)	12.17 (0.345)	19.97 (0.566)
15 (381)	11.25 (0.319)	18.62 (0.528)
14 (356)	10.23 (0.290)	17.22 (0.488)
13 (330)	9.15 (0.260)	15.78 (0.447)
12 (305)	7.99 (0.227)	14.29 (0.425)
11 (279)	6.78 (0.192)	12.77 (0.362)
10 (254)	5.51 (0.156)	11.22 (0.318)
9 (229)	4.19 (0.119)	9.64 (0.278)
8 (203)	2.83 (0.081)	8.03 (0.227)
7 (178)	1.43 (0.041)	6.40 (0.181)
6 (152)	0	4.74 (0.134)
5 (127)	0	3.95 (0.112)
4 (102)	Stone Foundation 0	3.16 (0.090)
3 (76)	0	2.37 (0.067)
2 (51)	0	1.58 (0.046)
1 (25)	0	0.79 (0.022)

Note: Add 0.79 ft³ (0.022 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-310 Chamber	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth		
	6"	12"	18"
SC-310	2.1 (1.5)	2.7 (1.9)	3.4 (2.4)
Metric Kilograms (m³)	**150 mm**	**300 mm**	**450 mm**
SC-310	1830 (1.1)	2490 (1.5)	2990 (1.8)

Note: Assumes 6" (150 mm) of stone above and between chambers.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as the depth of the cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

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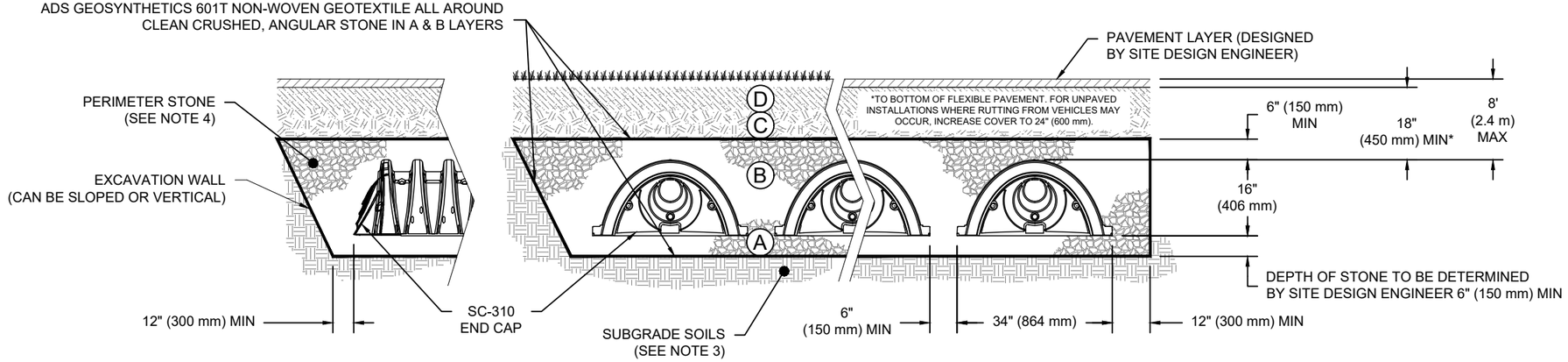
ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-310 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2922 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-310
STANDARD CROSS SECTION
DATE: 9/12/22
DRAWN: KLJ
PROJECT #:
CHECKED: KLJ

DATE	DRWN	CHKD	DESCRIPTION

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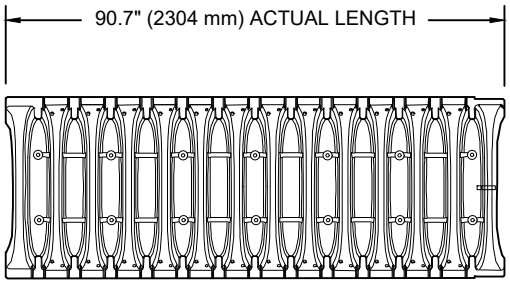
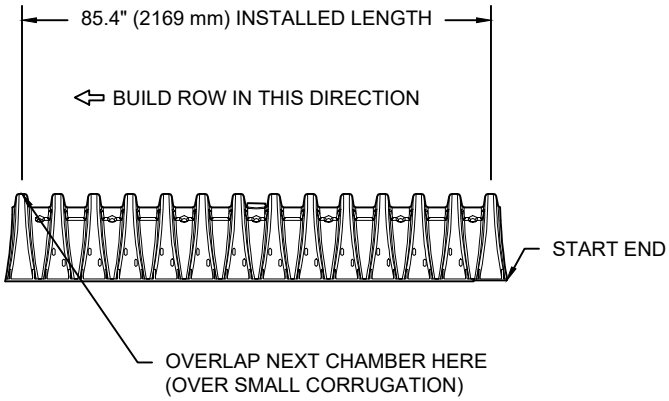
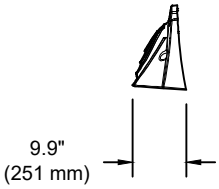
4640 TRUEMAN BLVD
HILLIARD, OH 43026

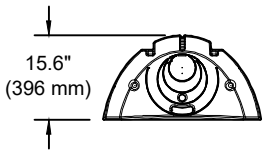
SC-310 TECHNICAL SPECIFICATION

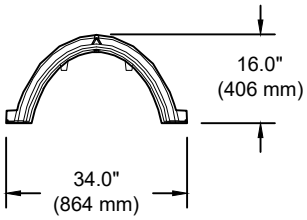
NTS







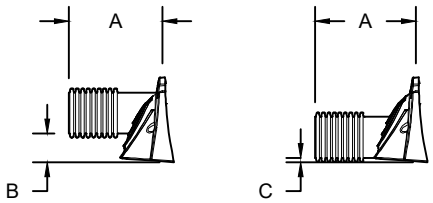




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	34.0" X 16.0" X 85.4"	(864 mm X 406 mm X 2169 mm)
CHAMBER STORAGE	14.7 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	31.0 CUBIC FEET	(0.88 m³)
WEIGHT	35.0 lbs.	(16.8 kg)

*ASSUMES 6" (152 mm) ABOVE, BELOW, AND BETWEEN CHAMBERS



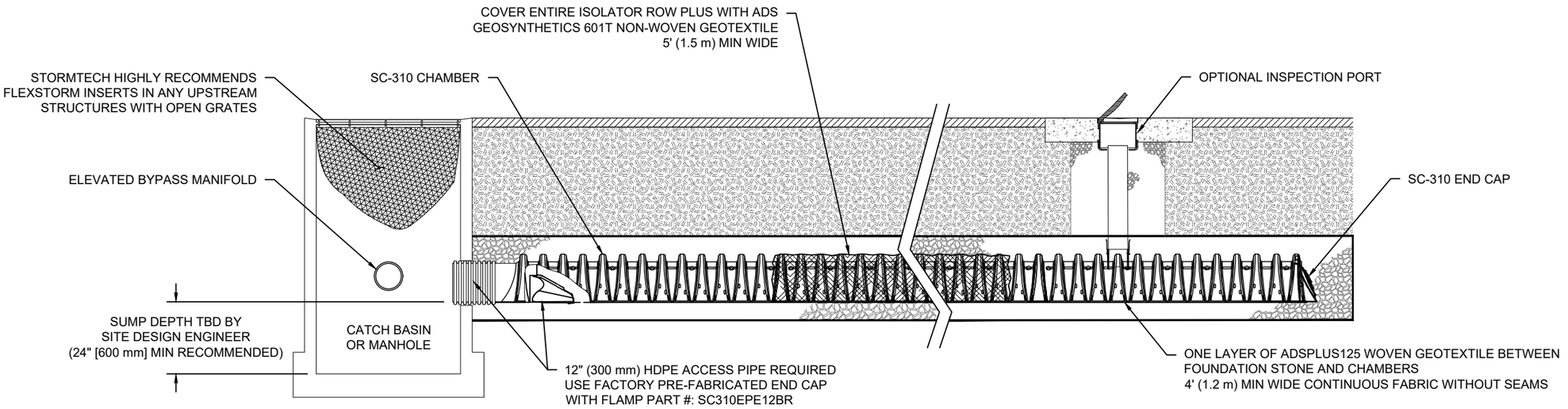
PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC310EPE06T / SC310EPE06TPC	6" (150 mm)	9.6" (244 mm)	5.8" (147 mm)	---
SC310EPE06B / SC310EPE06BPC			---	0.5" (13 mm)
SC310EPE08T / SC310EPE08TPC	8" (200 mm)	11.9" (302 mm)	3.5" (89 mm)	---
SC310EPE08B / SC310EPE08BPC			---	0.6" (15 mm)
SC310EPE10T / SC310EPE10TPC	10" (250 mm)	12.7" (323 mm)	1.4" (36 mm)	---
SC310EPE10B / SC310EPE10BPC			---	0.7" (18 mm)
SC310EPE12B	12" (300 mm)	13.5" (343 mm)	---	0.9" (23 mm)

ALL STUBS, EXCEPT FOR THE SC310EPE12B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC310EPE12B THE 12" (300 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 0.25" (6 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL



SC-310 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

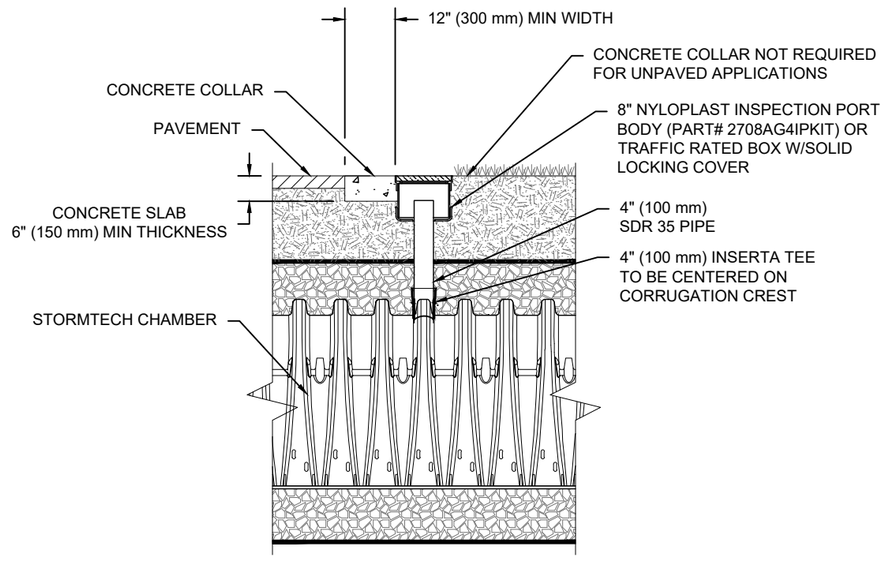
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION CREST.

4" PVC INSPECTION PORT DETAIL
(SC SERIES CHAMBER)
NTS

SC-310
ISOLATOR ROW PLUS DETAILS

DATE: 9/12/22 | DRAWN: KLJ | PROJECT #: | CHECKED: KLJ

DATE	DRWN	CHKD	DESCRIPTION

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
4640 TRUEMAN BLVD
HILLIARD, OH 43026

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

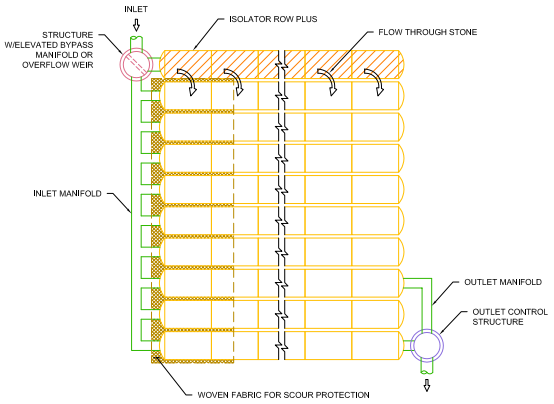
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

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

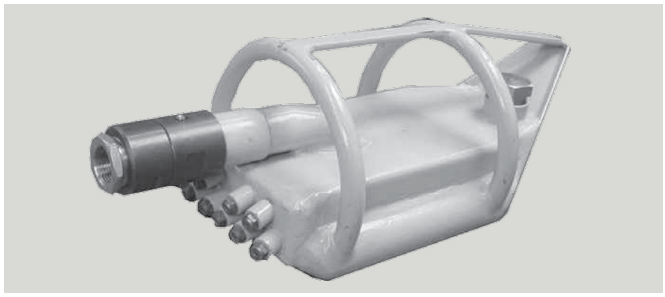
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

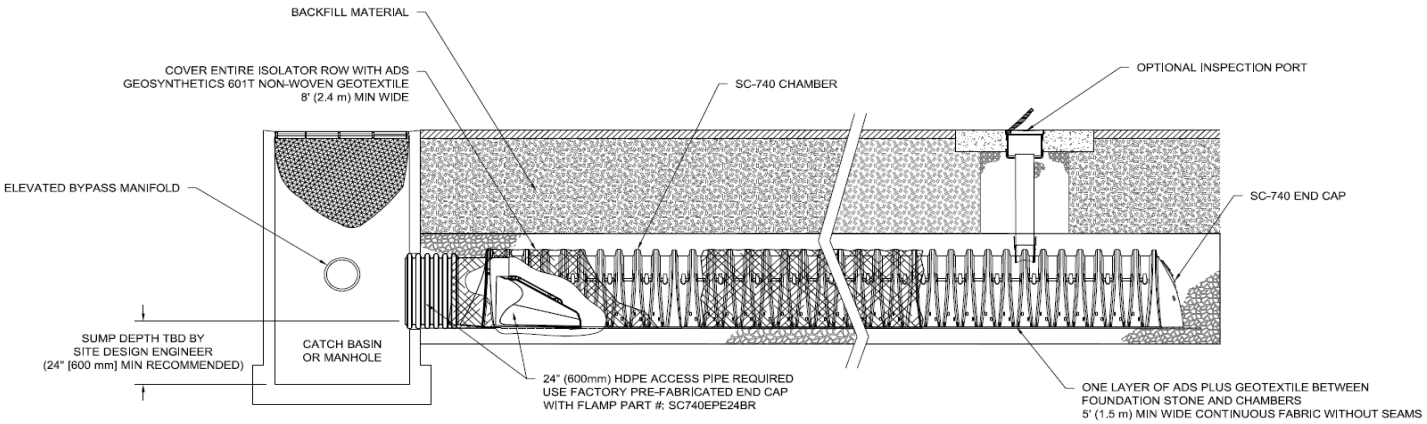
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
- i. Remove lid from floor box frame
- ii. Remove cap from inspection riser
- iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
- iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
- i. Remove cover from manhole at upstream end of Isolator Row Plus
- ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
  1. Mirrors on poles or cameras may be used to avoid a confined space entry
  2. Follow OSHA regulations for confined space entry if entering manhole
- iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
  If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

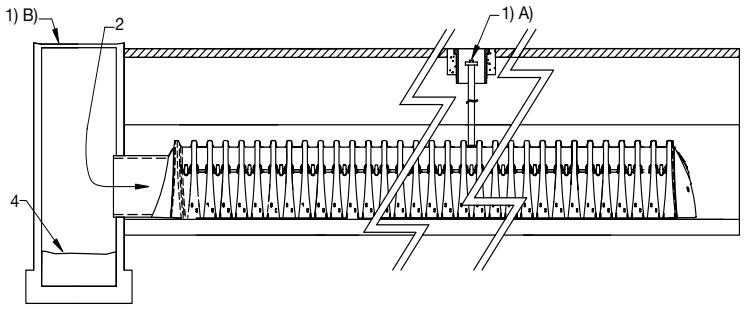
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi-ment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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ADS StormTech® Installation Guide

SC-310/SC-740/DC-780

StormTech Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps and pre-cored end caps
- StormTech chambers
- StormTech manifolds and fittings

Important Notes:

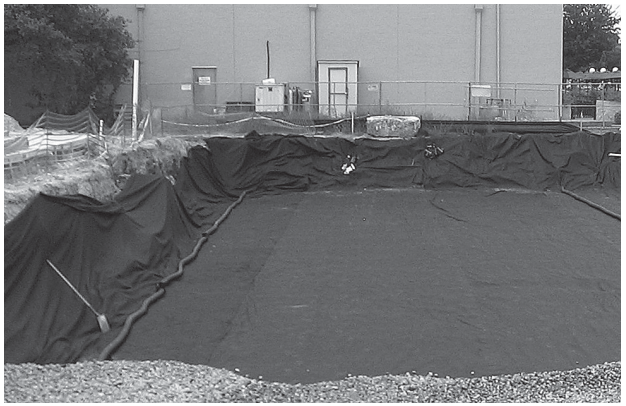
A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

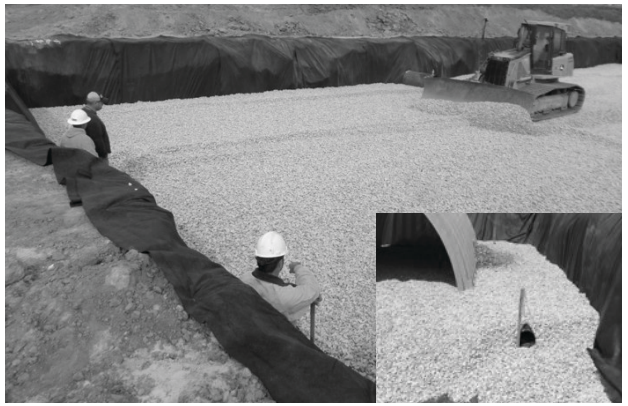
C. Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans.



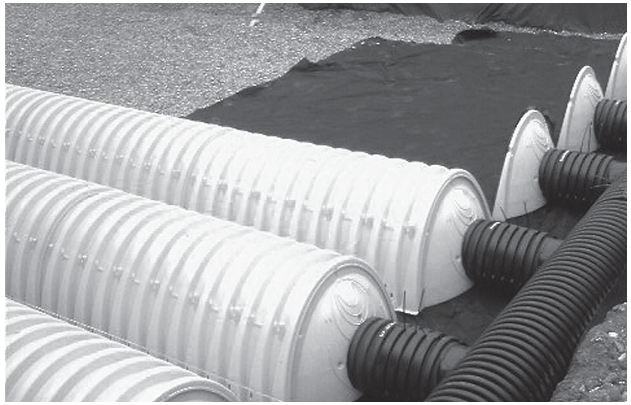
Place non-woven geotextile over prepared soils and up excavation walls. Install underdrains if required.



Place clean, crushed, angular stone foundation 6" (150 mm) min. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

Install manifolds and lay out ADS Plus fabric at inlet rows (min. 12.5 ft (3.8 m)) at each inlet end cap. Place a continuous piece along entire length of Isolator® Plus Row(s).



Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between rows.

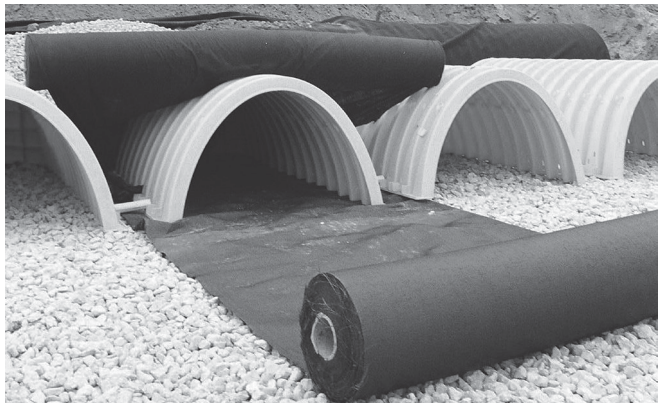
Attaching the End Caps

Lift the end of the chamber a few inches off the ground. With the curved face of the end cap facing outward, place the end cap into the chamber’s end corrugation.

Prefabricated End Caps

24” (600 mm) inlets are the maximum size that can fit into a SC-740/DC-780 end cap and must be prefabricated with a 24” (600 mm) pipe stub. SC-310 chambers with a 12” (300 mm) inlet pipe must use a prefabricated end cap with a 12” (300 mm) pipe stub. When used on an Isolator Row Plus, these end caps will contain a welded FLAMP (flared end ramp) that will lay on top of the ADS Plus fabric (shown above)

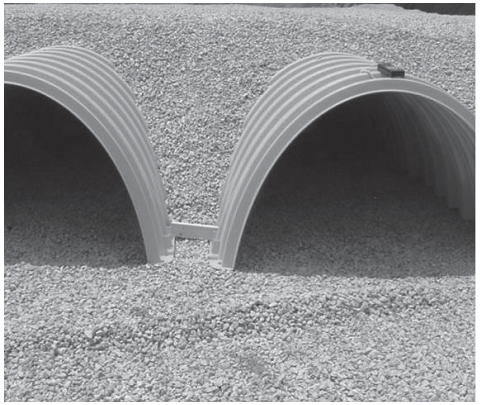
Isolator Row Plus



Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. Drape a strip of ADS non-woven geotextile over the row of chambers (not required over DC-780). This is the same type of non-woven geotextile used as a separation layer around the angular stone of the StormTech system.

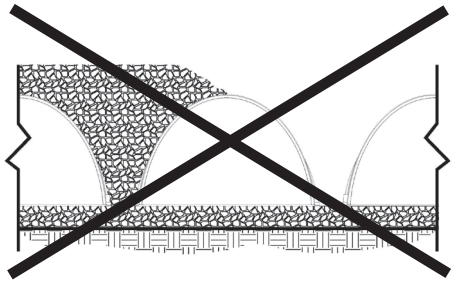
Initial Anchoring of Chambers – Embedment Stone

Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

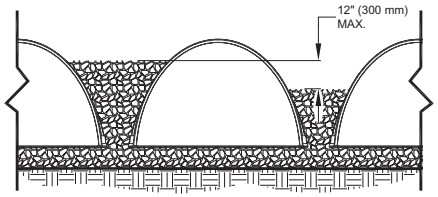


No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

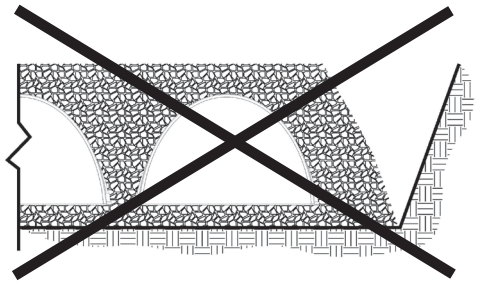


Uneven Backfill

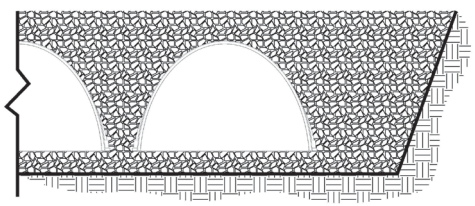


Even Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



Perimeter Not Backfilled



Perimeter Fully Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill - Embedment Stone & Cover Stone

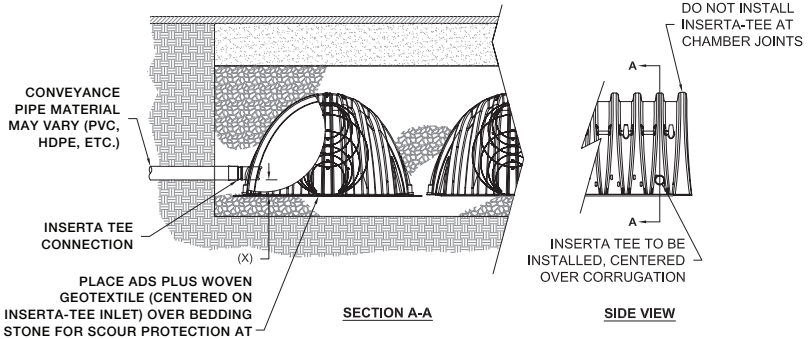
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6” (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone.**

Small dozers and skid loaders may be used to finish grading stone backfill in accordance with ground pressure limits in Table 2. They must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends that the contractor inspect chambers before placing final backfill. Any chambers damaged by construction shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24” (600 mm) min. where edges meet. Compact each lift of backfill as specified in the site design engineer’s drawings. Roller travel parallel with rows.

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6” (150 mm)	4” (100 mm)
SC-740	10” (250 mm)	4” (100 mm)
DC-780	10” (250 mm)	4” (100 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 36, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON.		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

StormTech Isolator Row Plus Detail

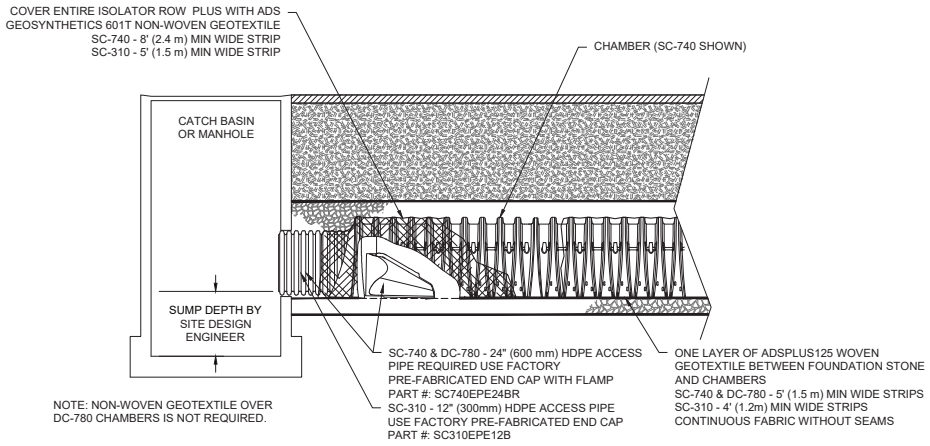


Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M45 A-1, A-2-4, A-3 or AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
(B) **Embedment Stone:** Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	No compaction required.
(A) **Foundation Stone:** Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (150 mm) lifts using two full coverages with a vibratory compactor.[2,3]

Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 1- Inspection Port Detail

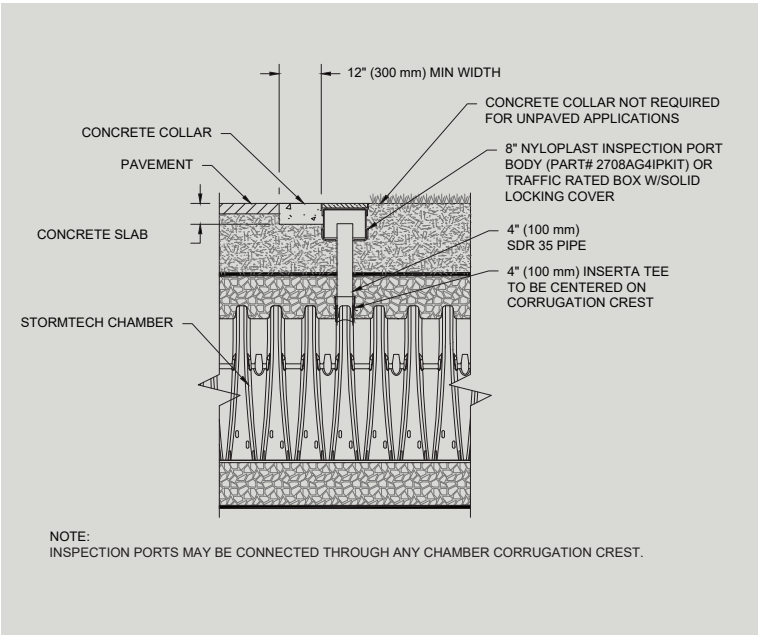
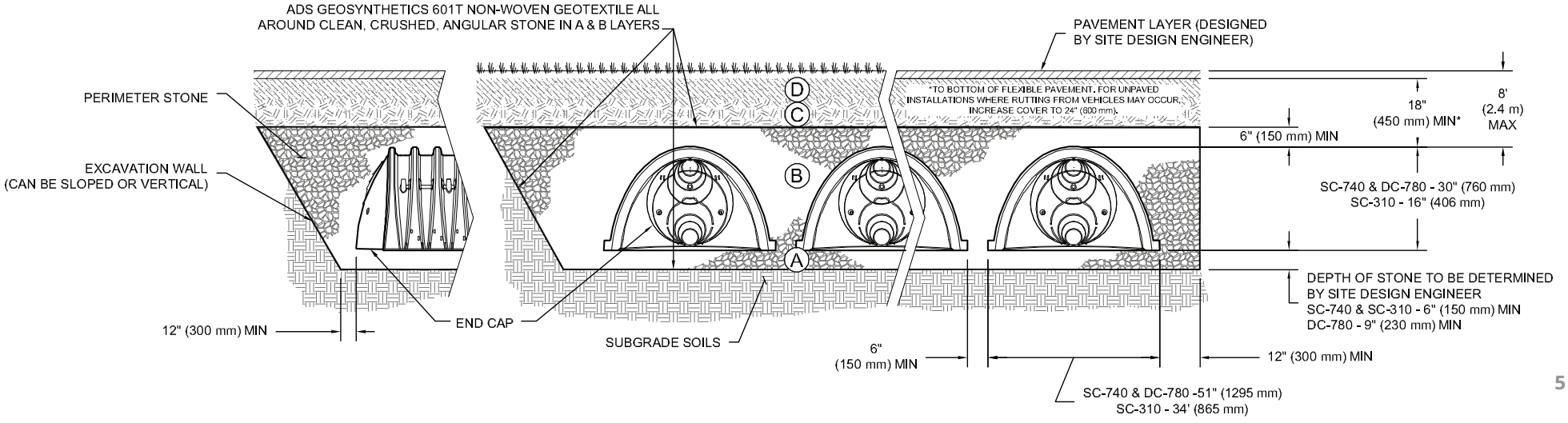


Figure 2 - Fill Material Locations



Notes:

1. 36” (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18” (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18” (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (< 8,000lbs/3,628 kg) can be used with at least 12” (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
6. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36” (900) Compacted	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	3880 (186) 2640 (126) 2040 (97) 1690 (81) 1470 (70)	38,000 (169)
Ⓒ Initial Fill Material	24” (600) Compacted	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	2690 (128) 1880 (90) 1490 (71) 1280 (61) 1150 (55)	20,000 (89)
	24” (600) Loose/ Dumped	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	2390 (114) 1700 (81) 1370 (65) 1190 (57) 1080 (51)	20,000 (89) Roller gross vehicle weight not toexceed 12,000 lbs. (53 kN)
	18” (450)	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	2110 (101) 1510 (72) 1250 (59) 1100 (52) 1020 (48)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
Ⓑ Embedment Stone	12” (300)	16,000 (71)	NOT ALLOWED	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	1540 (74) 1190 (57) 1010 (48) 910 (43) 840 (40)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
	6” (150)	8,000 (35)	NOT ALLOWED	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	1070 (51) 900 (43) 800 (38) 760 (36) 720 (34)	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36” (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows until 36” (900mm) compaced cover is reached.[4]	Roller travel parallel to rows only until 36” (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 18” (450 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 6” (150 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 12” (300 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 6” (150 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

StormTech® Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.

ADS StormTech™

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800-821-6710

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Separation

ADS 315W WOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 315W woven geotextile.

Filter Fabric Requirements

ADS 315W is manufactured using high-tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS 315W conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Tensile Strength (Grab)	ASTM D4632	lbs (N)	315 (1400)
Elongation	ASTM D4632	%	15
CBR Puncture	ASTM D6241	lbs (N)	900 (4005)
Puncture	ASTM D4833	lbs (N)	150 (667)
Mullen Burst	ASTM D3786	psi (kPa)	600 (4134)
Trapezoidal Tear	ASTM D4533	lbs (N)	120 (533)
UV Resistance (at 500 hours)	ASTM D4355	%	70
Apparent Opening Size (AOS)*	ASTM D4751	U.S. Sieve (mm)	40 (.425)
Permittivity	ASTM D4491	sec^{-1}	.05
Water Flow Rate	ASTM D4491	gpm/ft^2 ($l/min/m^2$)	4 (163)

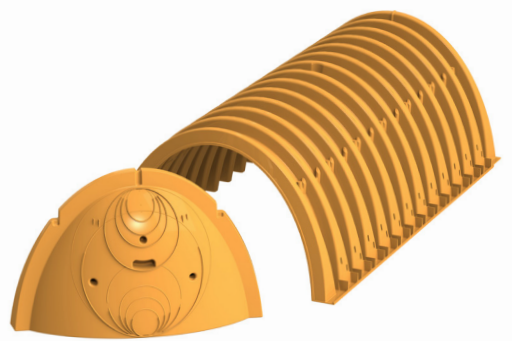
* Maximum average roll value.

Packaging

Roll Dimensions (W x L) - ft. (m)	12.5 x 360/ 15 x 300 / 17.5 x 258 (3.81 x 109.8/ 4.57 x 91.5 / 5.33 x 78.6)

StormTech® SC-740 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

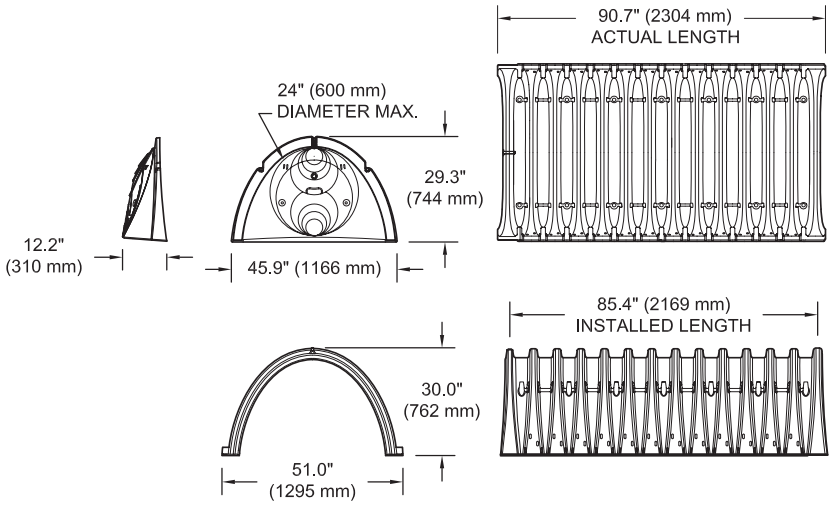
Chamber Storage
45.9 ft³ (1.30 m³)

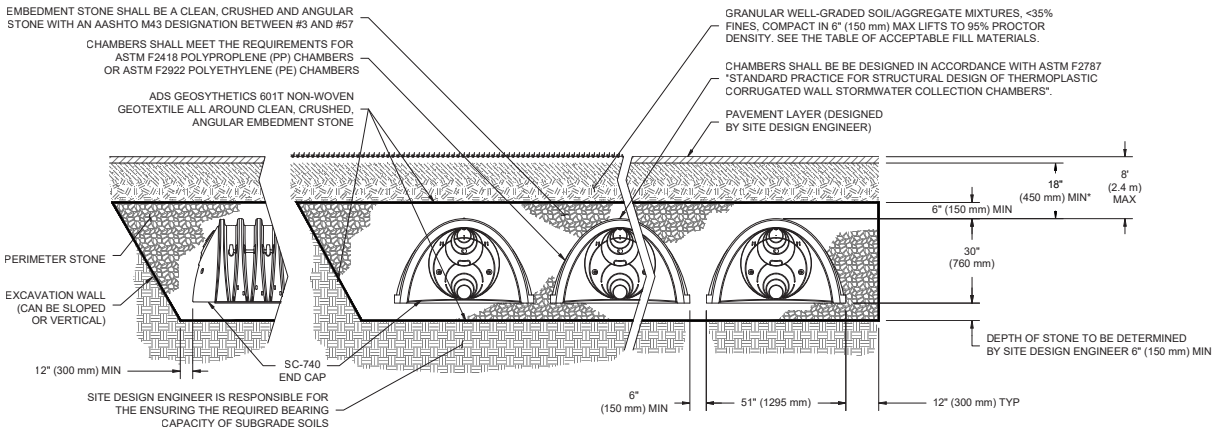
Min. Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

ADS StormTech™

StormTech SC-740 Specifications

Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6” (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	45.90 (1.300)	72.64 (2.057)
39 (991)	45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (940)	45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1.269)	62.97 (1.783)
31 (787)	44.01 (1.246)	61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1.365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	1.85 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37.47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	0 (0)	6.76 (0.191)
5 (127)	0 (0)	5.63 (0.160)
4 (102)	0 (0)	4.51 (0.128)
3 (76)	0 (0)	3.38 (0.096)
2 (51)	0 (0)	2.25 (0.064)
1 (25)	0 (0)	1.13 (0.032)

Stone Cover

Stone Foundation

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6” (150 mm) stone above chambers, 6” (150 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth		
	6”	12”	16”
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
Metric Kilograms (m³)	**150 mm**	**300 mm**	**450 mm**
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6” (150 mm) of stone above and between chambers.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6” (150 mm) of row separation and 18” (450 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

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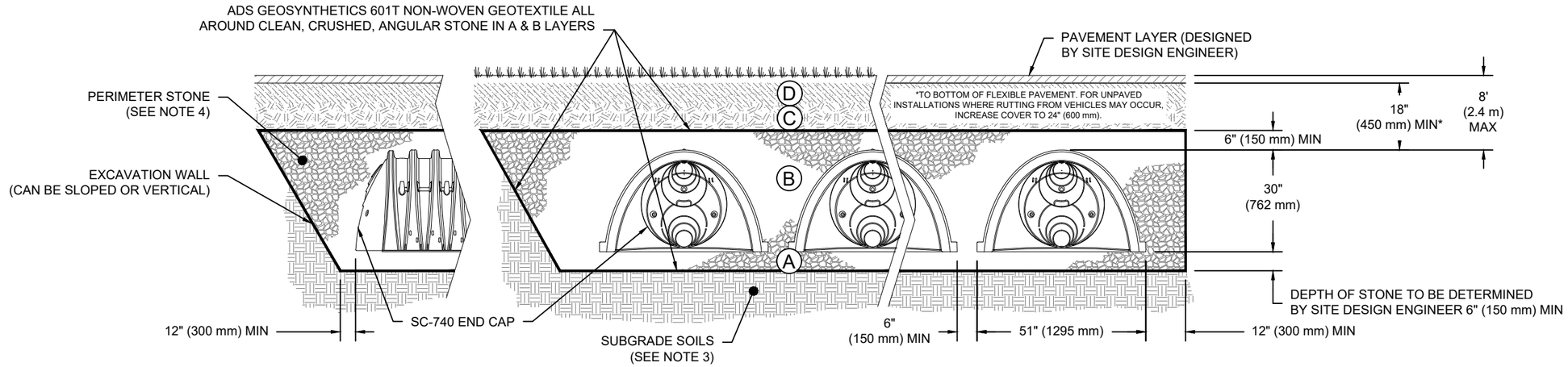
ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-740
STANDARD CROSS SECTION
DATE: 9/12/22
DRAWN: KLJ
PROJECT #:
CHECKED: KLJ

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Chamber System
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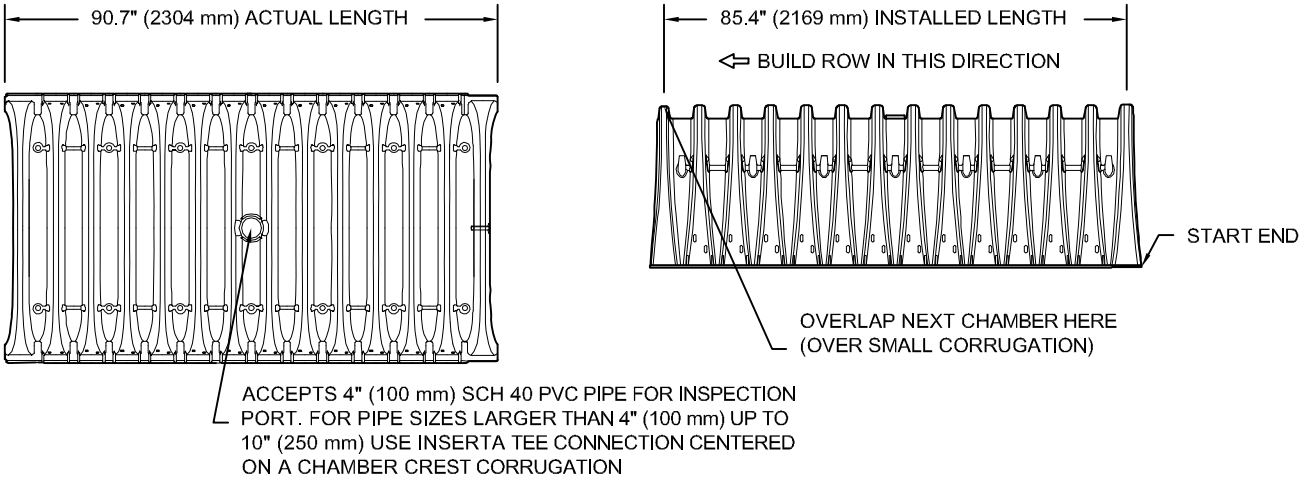
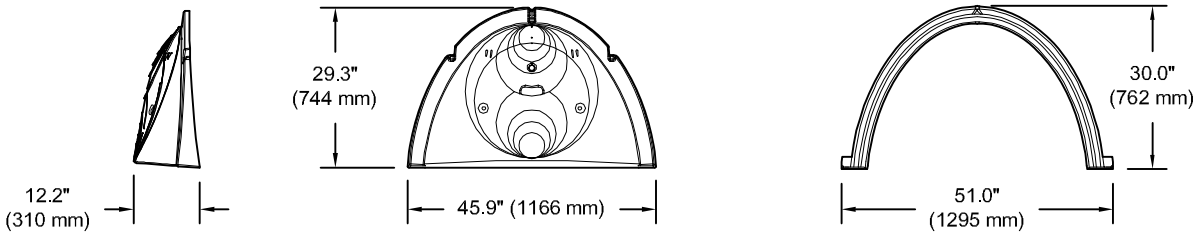
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SC-740 TECHNICAL SPECIFICATION

NTS

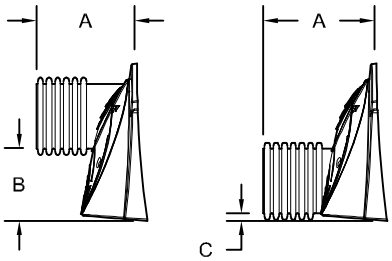




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



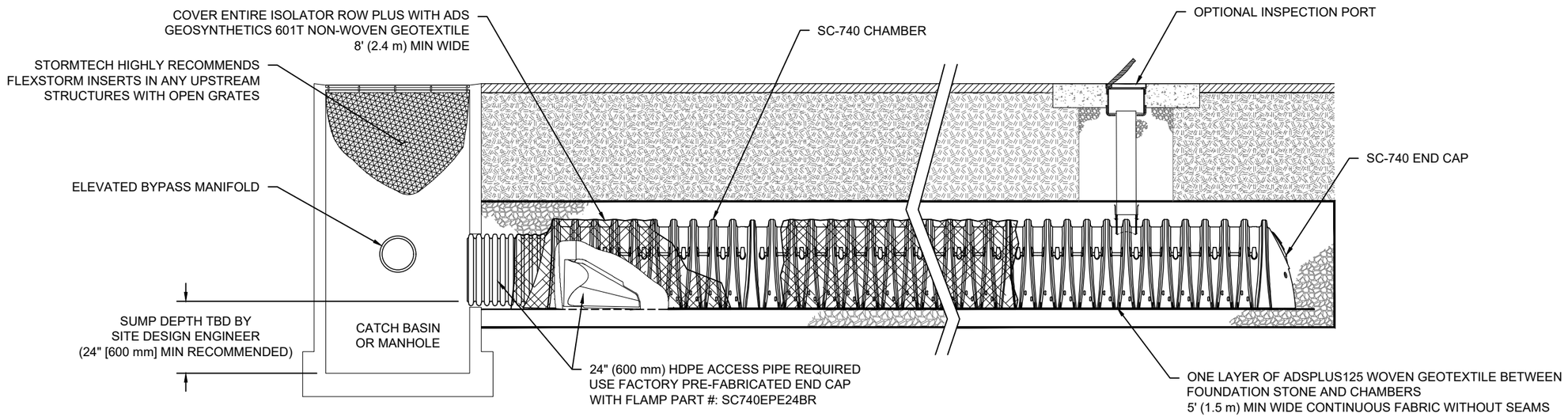
STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	—
SC740EPE06B / SC740EPE06BPC			—	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	—
SC740EPE08B / SC740EPE08BPC			—	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	—
SC740EPE10B / SC740EPE10BPC			—	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	—
SC740EPE12B / SC740EPE12BPC			—	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	—
SC740EPE15B / SC740EPE15BPC			—	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	—
SC740EPE18B / SC740EPE18BPC			—	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	—	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL



SC-740 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

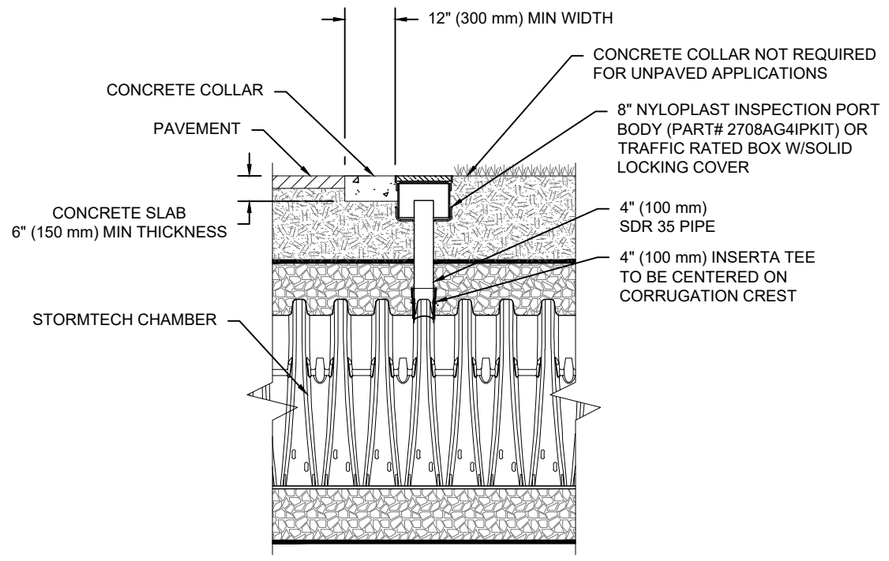
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION CREST.

4" PVC INSPECTION PORT DETAIL
(SC SERIES CHAMBER)
NTS

SC-740
ISOLATOR ROW PLUS DETAILS

DATE: 9/12/22 | DRAWN: KLJ | PROJECT #: | CHECKED: KLJ

DATE	DRWN	CHKD	DESCRIPTION

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

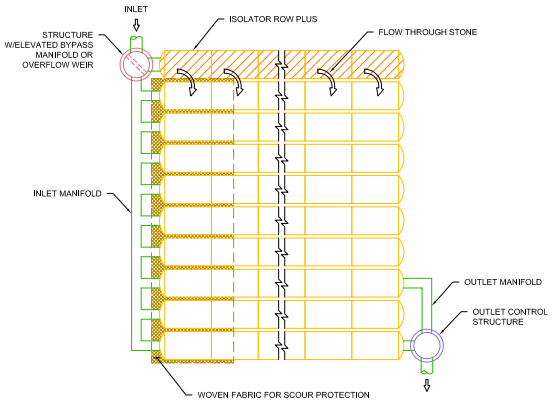
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

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

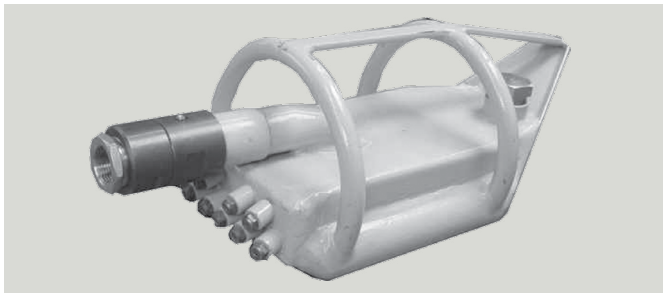
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

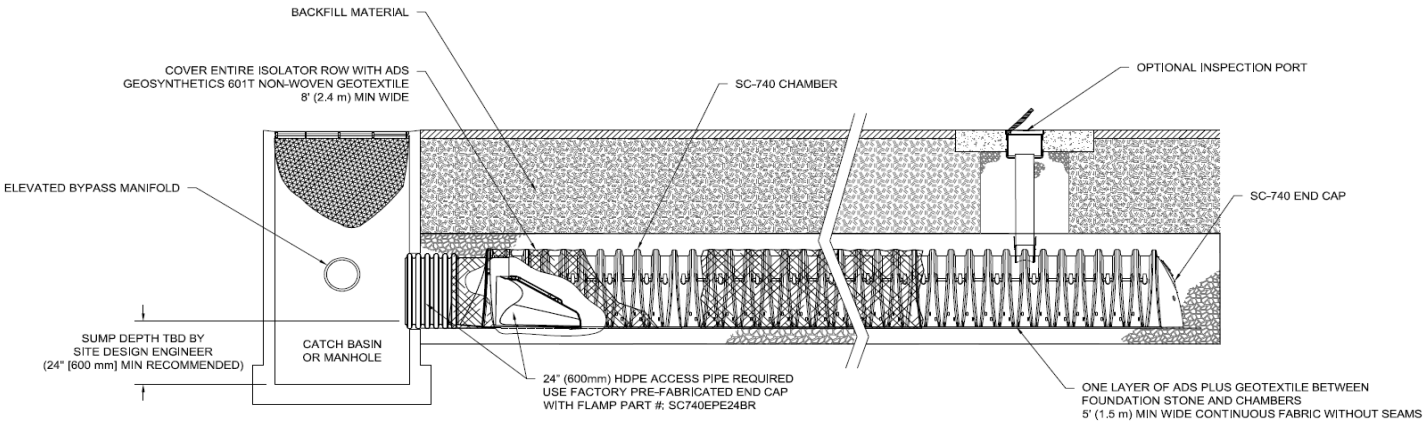
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
- i. Remove lid from floor box frame
- ii. Remove cap from inspection riser
- iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
- iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
- i. Remove cover from manhole at upstream end of Isolator Row Plus
- ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
  1. Mirrors on poles or cameras may be used to avoid a confined space entry
  2. Follow OSHA regulations for confined space entry if entering manhole
- iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
  If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

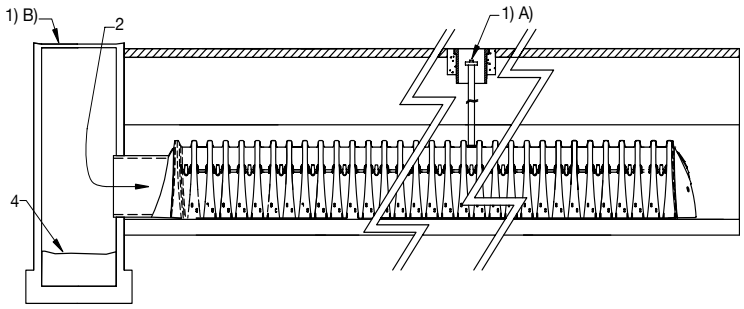
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi-ment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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ADS StormTech® Installation Guide

SC-310/SC-740/DC-780

StormTech Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps and pre-cored end caps
- StormTech chambers
- StormTech manifolds and fittings

Important Notes:

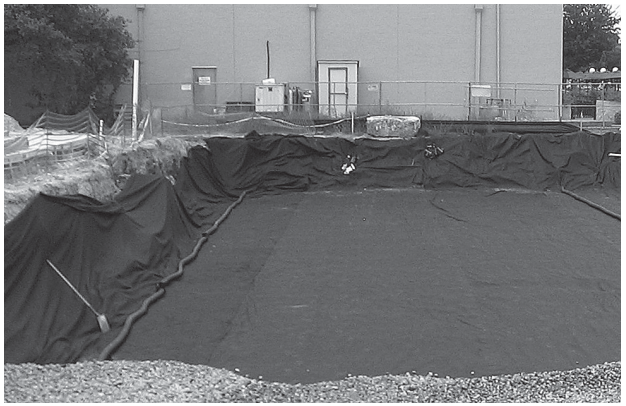
A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

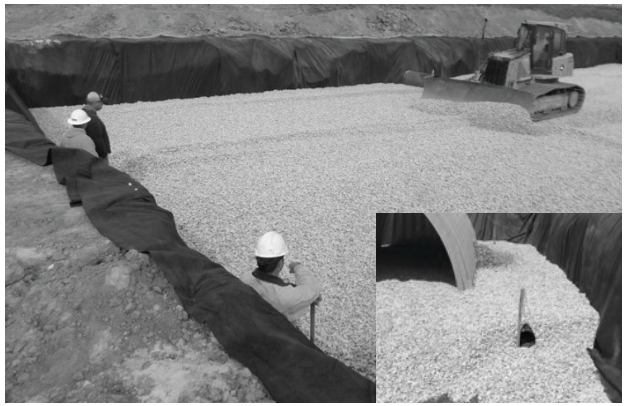
C. Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans.



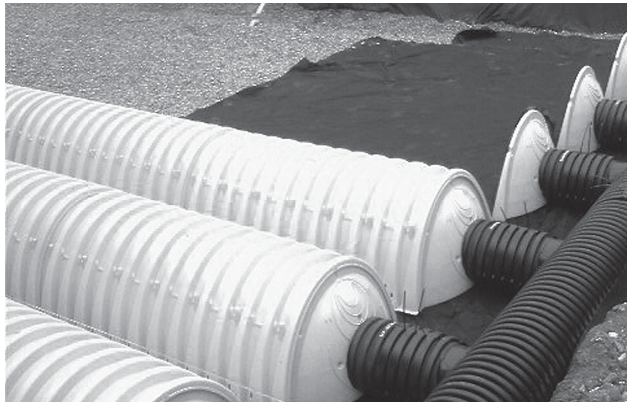
Place non-woven geotextile over prepared soils and up excavation walls. Install underdrains if required.



Place clean, crushed, angular stone foundation 6" (150 mm) min. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

Install manifolds and lay out ADS Plus fabric at inlet rows (min. 12.5 ft (3.8 m)) at each inlet end cap. Place a continuous piece along entire length of Isolator® Plus Row(s).



Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between rows.

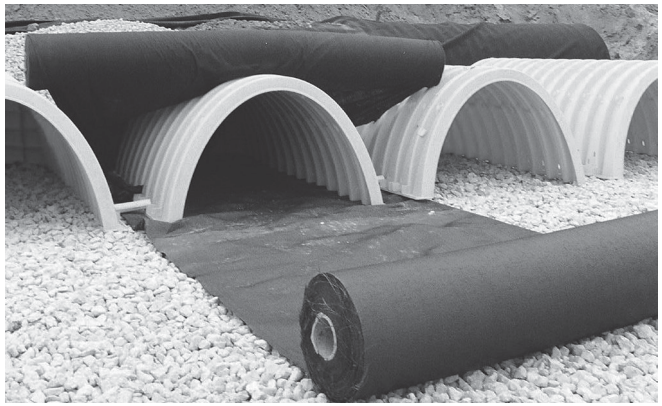
Attaching the End Caps

Lift the end of the chamber a few inches off the ground. With the curved face of the end cap facing outward, place the end cap into the chamber’s end corrugation.

Prefabricated End Caps

24” (600 mm) inlets are the maximum size that can fit into a SC-740/DC-780 end cap and must be prefabricated with a 24” (600 mm) pipe stub. SC-310 chambers with a 12” (300 mm) inlet pipe must use a prefabricated end cap with a 12” (300 mm) pipe stub. When used on an Isolator Row Plus, these end caps will contain a welded FLAMP (flared end ramp) that will lay on top of the ADS Plus fabric (shown above)

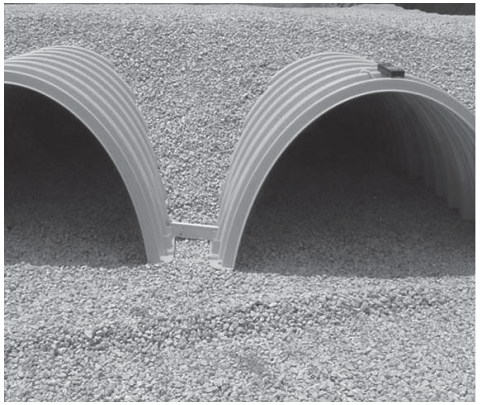
Isolator Row Plus



Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. Drape a strip of ADS non-woven geotextile over the row of chambers (not required over DC-780). This is the same type of non-woven geotextile used as a separation layer around the angular stone of the StormTech system.

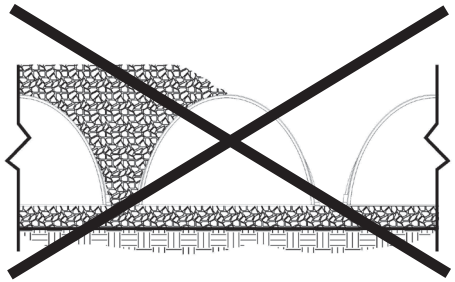
Initial Anchoring of Chambers – Embedment Stone

Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

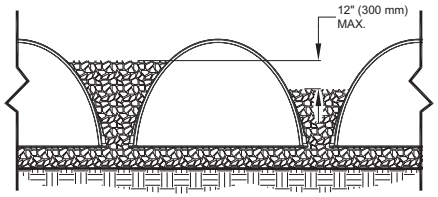


No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

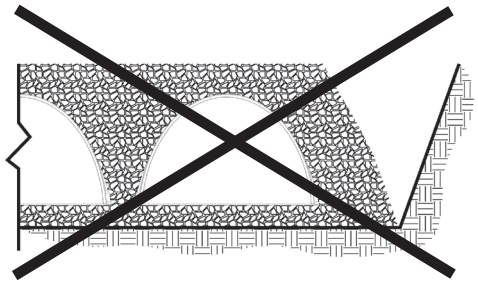


Uneven Backfill

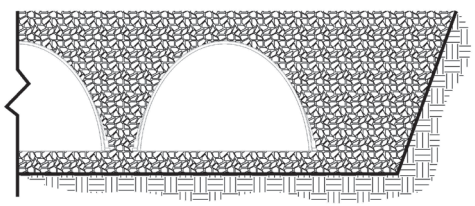


Even Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



Perimeter Not Backfilled



Perimeter Fully Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill - Embedment Stone & Cover Stone

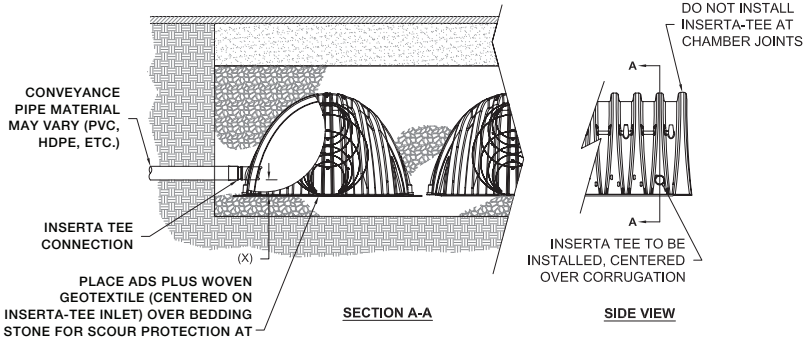
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6” (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone.**

Small dozers and skid loaders may be used to finish grading stone backfill in accordance with ground pressure limits in Table 2. They must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends that the contractor inspect chambers before placing final backfill. Any chambers damaged by construction shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24” (600 mm) min. where edges meet. Compact each lift of backfill as specified in the site design engineer’s drawings. Roller travel parallel with rows.

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6” (150 mm)	4” (100 mm)
SC-740	10” (250 mm)	4” (100 mm)
DC-780	10” (250 mm)	4” (100 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 36, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON.		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

StormTech Isolator Row Plus Detail

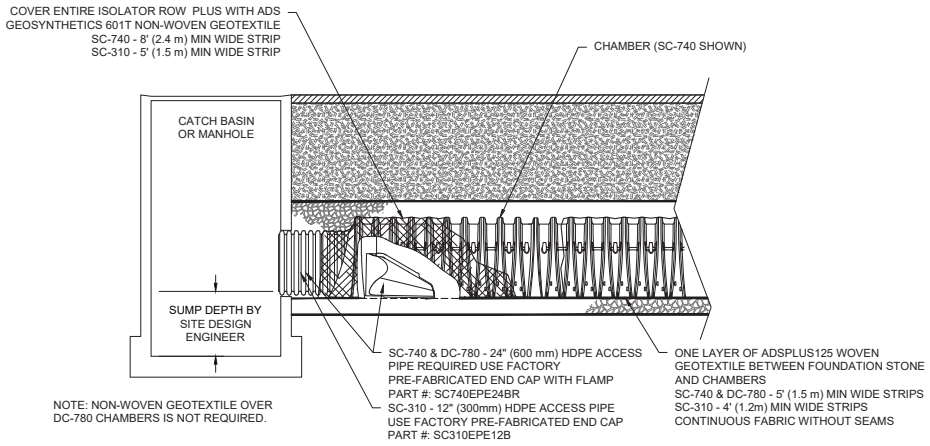


Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M45 A-1, A-2-4, A-3 or AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
(B) **Embedment Stone:** Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	No compaction required.
(A) **Foundation Stone:** Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (150 mm) lifts using two full coverages with a vibratory compactor.[2,3]

Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 1- Inspection Port Detail

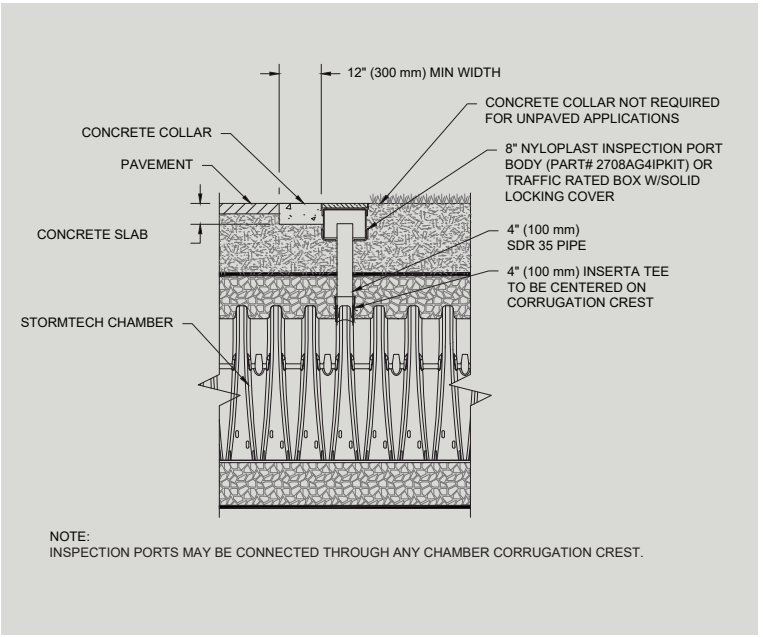
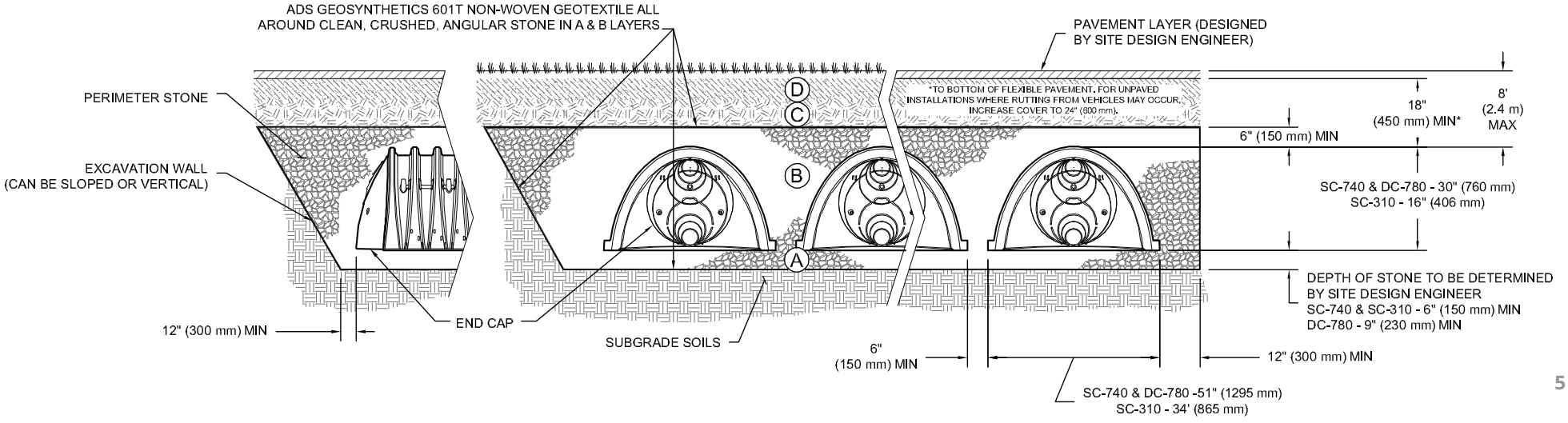


Figure 2 - Fill Material Locations



Notes:

1. 36” (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18” (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18” (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (< 8,000lbs/3,628 kg) can be used with at least 12” (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
6. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36” (900) Compacted	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	3880 (186) 2640 (126) 2040 (97) 1690 (81) 1470 (70)	38,000 (169)
Ⓒ Initial Fill Material	24” (600) Compacted	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	2690 (128) 1880 (90) 1490 (71) 1280 (61) 1150 (55)	20,000 (89)
	24” (600) Loose/ Dumped	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	2390 (114) 1700 (81) 1370 (65) 1190 (57) 1080 (51)	20,000 (89) Roller gross vehicle weight not toexceed 12,000 lbs. (53 kN)
	18” (450)	32,000 (142)	16,000 (71)	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	2110 (101) 1510 (72) 1250 (59) 1100 (52) 1020 (48)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
Ⓑ Embedment Stone	12” (300)	16,000 (71)	NOT ALLOWED	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	1540 (74) 1190 (57) 1010 (48) 910 (43) 840 (40)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
	6” (150)	8,000 (35)	NOT ALLOWED	12” (305) 18” (457) 24” (610) 30” (762) 36” (914)	1070 (51) 900 (43) 800 (38) 760 (36) 720 (34)	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36” (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows until 36” (900mm) compaced cover is reached.[4]	Roller travel parallel to rows only until 36” (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 18” (450 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 6” (150 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 12” (300 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 6” (150 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

StormTech® Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.

ADS StormTech™

adspipe.com
800-821-6710

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Separation

ADS 315W WOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 315W woven geotextile.

Filter Fabric Requirements

ADS 315W is manufactured using high-tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS 315W conforms to the physical property values listed below:

Filter Fabric Properties

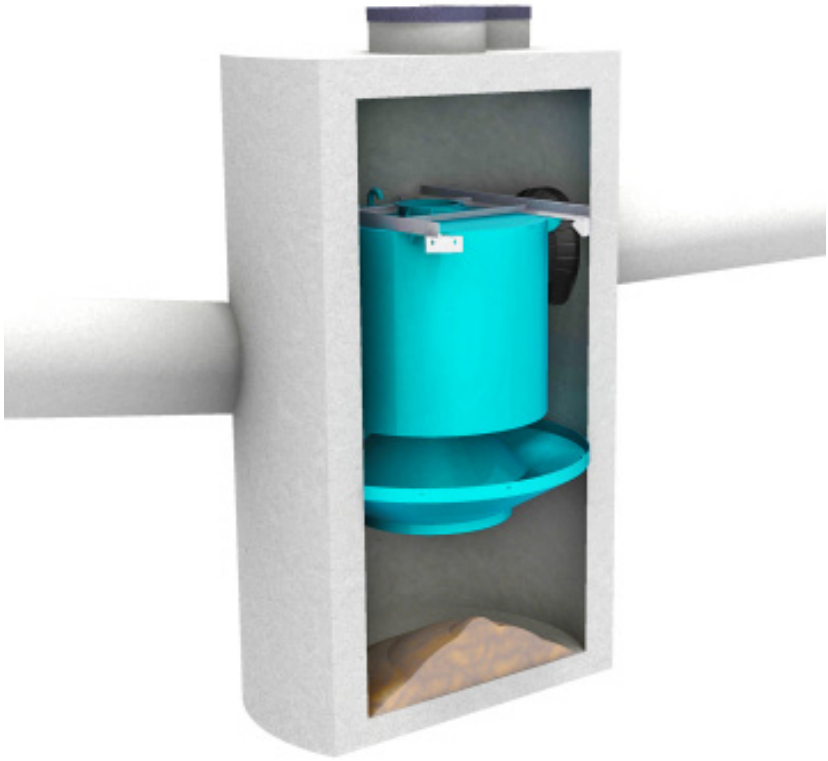
Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Tensile Strength (Grab)	ASTM D4632	lbs (N)	315 (1400)
Elongation	ASTM D4632	%	15
CBR Puncture	ASTM D6241	lbs (N)	900 (4005)
Puncture	ASTM D4833	lbs (N)	150 (667)
Mullen Burst	ASTM D3786	psi (kPa)	600 (4134)
Trapezoidal Tear	ASTM D4533	lbs (N)	120 (533)
UV Resistance (at 500 hours)	ASTM D4355	%	70
Apparent Opening Size (AOS)*	ASTM D4751	U.S. Sieve (mm)	40 (.425)
Permittivity	ASTM D4491	sec^{-1}	.05
Water Flow Rate	ASTM D4491	gpm/ft^2 ($l/min/m^2$)	4 (163)

* Maximum average roll value.

Packaging

Roll Dimensions (W x L) - ft. (m)	12.5 x 360/ 15 x 300 / 17.5 x 258 (3.81 x 109.8/ 4.57 x 91.5 / 5.33 x 78.6)

Hydro International®



Operation and Maintenance Manual

Downstream Defender®

Vortex Separator for Stormwater Treatment

Turning Water Around ...®

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Downstream Defender® by Hydro International

The Downstream Defender® is an advanced Hydrodynamic Vortex Separator designed to provide high removal efficiencies of settleable solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

The Downstream Defender® has unique, flow-modifying internal components developed from extensive full-scale testing, CFD modeling and over thirty years of hydrodynamic separation experience in wastewater, combined sewer and stormwater applications. These internal components distinguish the Downstream Defender® from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and headlosses, enhancing separation, and preventing washout of previously stored pollutants.

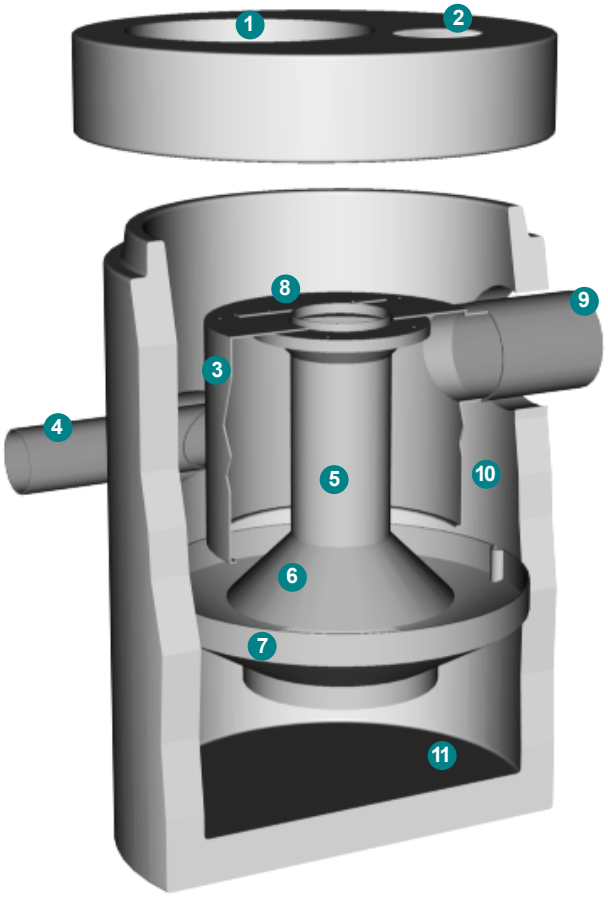
The high removal efficiencies and inherent low headlosses of the Downstream Defender® allow for a small footprint making it a compact and economical solution for the treatment of non-point source pollution.

Benefits of the Downstream Defender®

- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide ranges of flows
- Easy to install
- Low maintenance

Applications

- New developments and retrofits
- Utility yards
- Streets and roadways
- Parking lots
- Pre-treatment for filters, infiltration and storage
- Industrial and commercial facilities
- Wetlands protection



Downstream Defender® Components

1. Central Access Port
2. Floatables Access Port (6-ft., 8-ft. and 10-ft. models only)
3. Dip Plate
4. Tangential Inlet
5. Center Shaft
6. Center Cone
7. Benching Skirt
8. Floatables Lid
9. Outlet Pipe
10. Floatables Storage
11. Isolated Sediment Storage Zone

Operation

Introduction

The Downstream Defender® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The Downstream Defender® has been designed to allow for easy and safe access for inspection/monitoring and clean-out procedures. Entry into the unit or removal of the internal components is not necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the Downstream Defender® have been designed to protect the oil, floatables and sediment storage volumes so that separator performance is not reduced as pollutants accumulate between clean-outs. Additionally, the Downstream Defender® is designed and installed into the storm drain system so that the vessel remains wet between storm events. Oil and floatables are stored on the water surface in the outer annulus separate from the sediment storage volume in the sump of the unit providing the option for separate oil disposal, and accessories such as adsorbant pads. Since the oil/floatables and sediment storage volumes are isolated from the active separation region, the potential for re-suspension and washout of stored pollutants between clean-outs is minimized.

Wet Sump

The sump of the Downstream Defender® retains a standing water level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. The clean-out procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.

Blockage Protection

The Downstream Defender® has large clear openings and no internal restrictions or weirs, minimizing the risk of blockage and hydraulic losses. In addition to increasing the system headloss, orifices and internal weirs can increase the risk of blockage within the unit.

Maintenance

Overview

The Downstream Defender® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the Downstream Defender®. The Downstream Defender® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

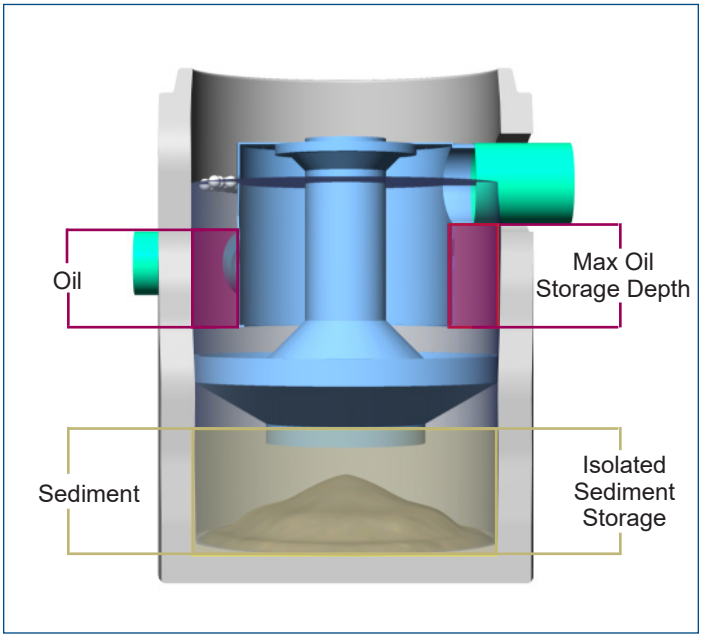


Fig.1 Pollutant storage volumes of the Downswtream Defender®.

The Downstream Defender® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole. On the 6-ft, 8-ft and 10-ft units, the floatables access port is above the outlet pipe between the concrete manhole wall and the dip plate. The sediment removal access ports for all Downstream Defender® models are located directly over the hollow center shaft.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the Downstream Defender®, nor do they require the internal components of the Downstream Defender® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Determining Your Maintenance Schedule

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil/flotables removal, for a 6-ft Downstream Defender® typically takes less than 30 minutes and removes a combined water/oil volume of about 500 gallons.

Inspection Procedures

Inspection is a simple process that does not involve entry into the Downstream Defender®. Maintenance crews should be familiar with the Downstream Defender® and its components prior to inspection.

Scheduling

- It is important to inspect your Downstream Defender® every six months during the first year of operation to determine your site-specific rate of pollutant accumulation
- Typically, inspection may be conducted during any season of the year
- Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1

Recommended Equipment

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Trash bag for removed floatables
- Downstream Defender® Maintenance Log

Table 1. Downstream Defender® Pollutant Storage Capacities and Max. Cleanout Depths.

Unit Diameter	Total Oil Storage	Oil Clean-out Depth	Total Sediment Storage	Sediment Clean-out Depth	Max. Liquid Volume Removed
(feet)	(gallons)	(inches)	(gallons)	(inches)	(gallons)
4	70	<16	141	<18	384
6	216	<23	424	<24	1,239
8	540	<33	939	<30	2,884
10	1,050	<42	1,757	<36	5,546
12	1,770	<49	2,970	<42	9,460

NOTES

1. Refer to Dowmstream Defender® Clean-out Detail (Fig. 1) for measurement of depths.

2. Oil accumulation is typically less than sediment, however, removal of oil and sediment during the same service is recommended.

3. Remove floatables first, then remove sediment storage volume.

4. Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

Fig.4

Fig.5

Fig.6

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the lids to the manhole (Fig. 4). NOTE: The 4-ft Downstream Defender® will only have one lid.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Fig.7 and 8 for typical inspection views.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel (Fig.5).

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Cleanout

Floatables cleanout is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.6).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump cleanout are typically conducted once a year during any season.
- If sediment depths are greater than 75% of maximum clean-out depths stated in Table 1, sediment removal is required.
- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.

Fig.7 View over center shaft into sediment storage zone.

Fig.8 View of outer annulus of floatables and oil collection zone.

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (6-inch flexible hose recommended)
- Downstream Defender® Maintenance Log

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole (NOTE: The 4-ft Downstream Defender® will only have one lid).
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Using the Floatables Port for access, remove oil and floatables stored on the surface of the water with the vactor hose or the skimmer net (Fig.9).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (Pg.9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump via the Central Access Port. Vactor out the sediment and gross debris off the sump floor (Fig.6).
7. Retract the vactor hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
9. Securely replace the grate or lid.

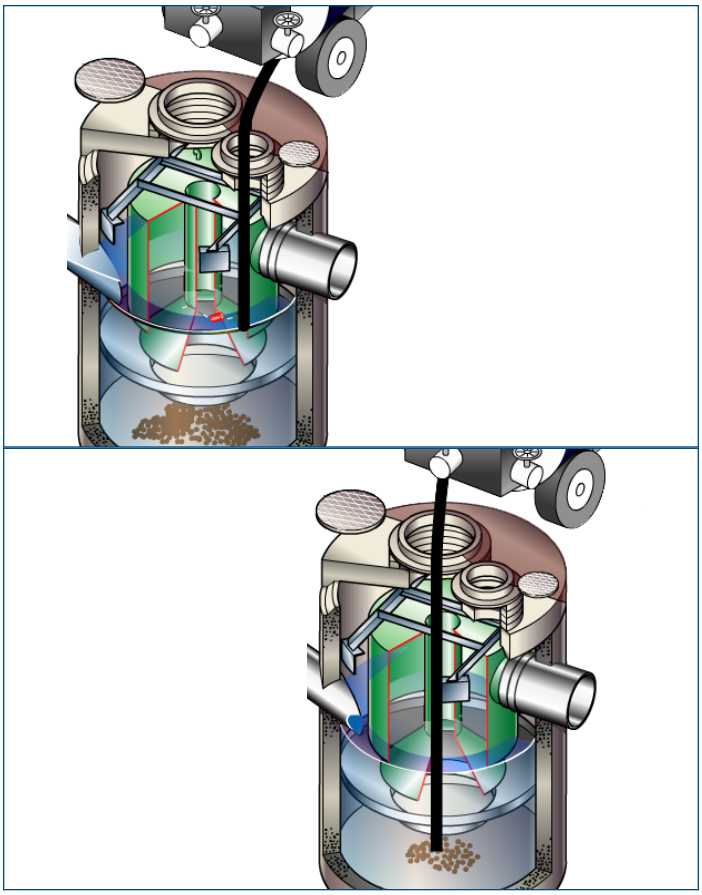


Fig.9 Floatables and sediment are removed with a vactor hose

Maintenance at a Glance

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most cleanouts it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	

Downstream Defender® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL (CIRCLE ONE): **4-FT** **6-FT** **8-FT** **10-FT** **CUSTOM**

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Downstream Defender® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment * Depth Measured	Volume of Sediment Removed	Site Activity and Comments

*Note: Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

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stormwaterinquiry@hydro-int.com

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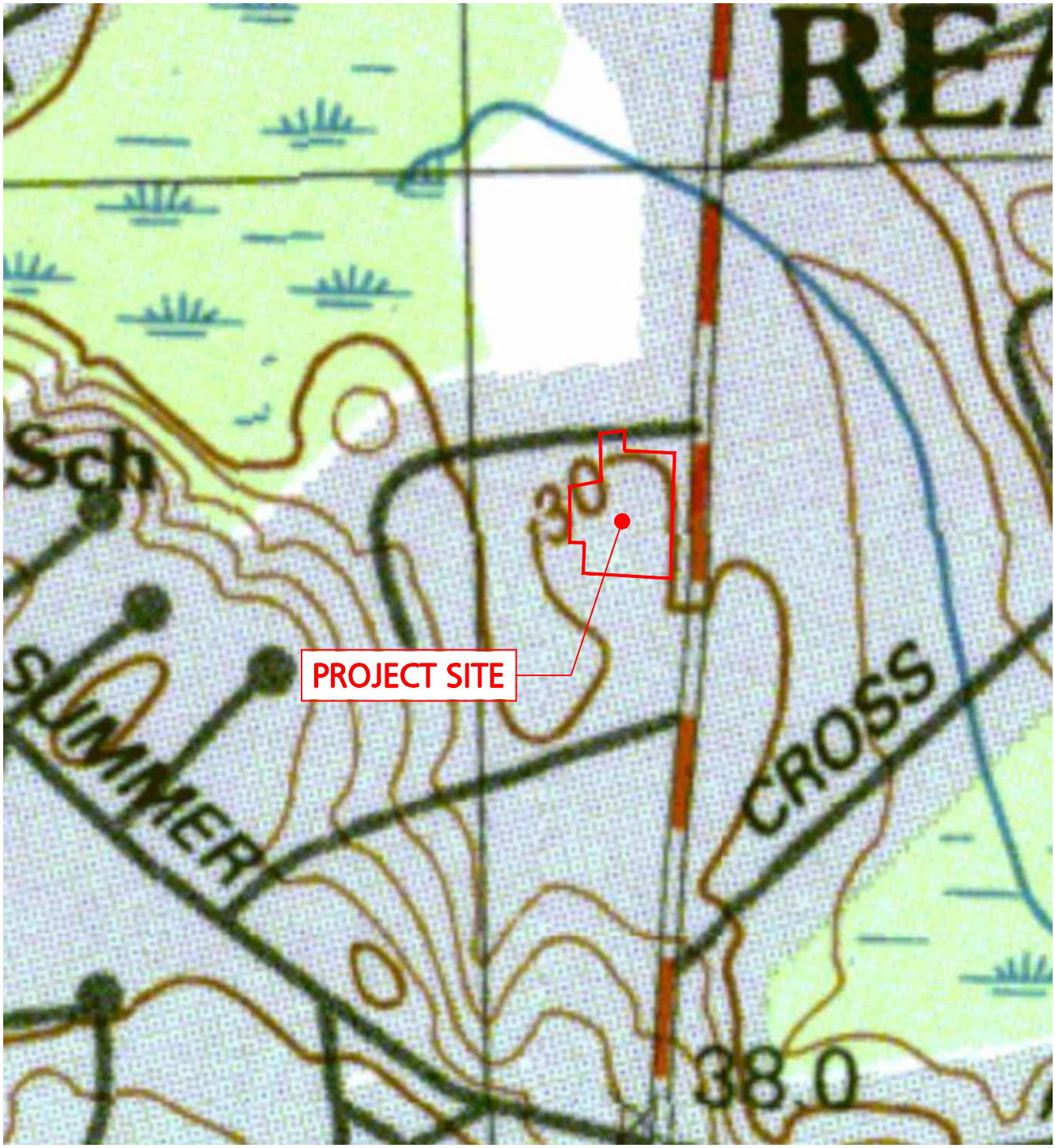
Turning Water Around...®

SECTION 3.0 -
EXHIBITS



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WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT:
STRADA
258 MAIN STREET
READING, MA

USGS SITE LOCUS MAP

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	MTB	CHECKED BY:	CMQ

SHEET No.
EX-1

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WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT:

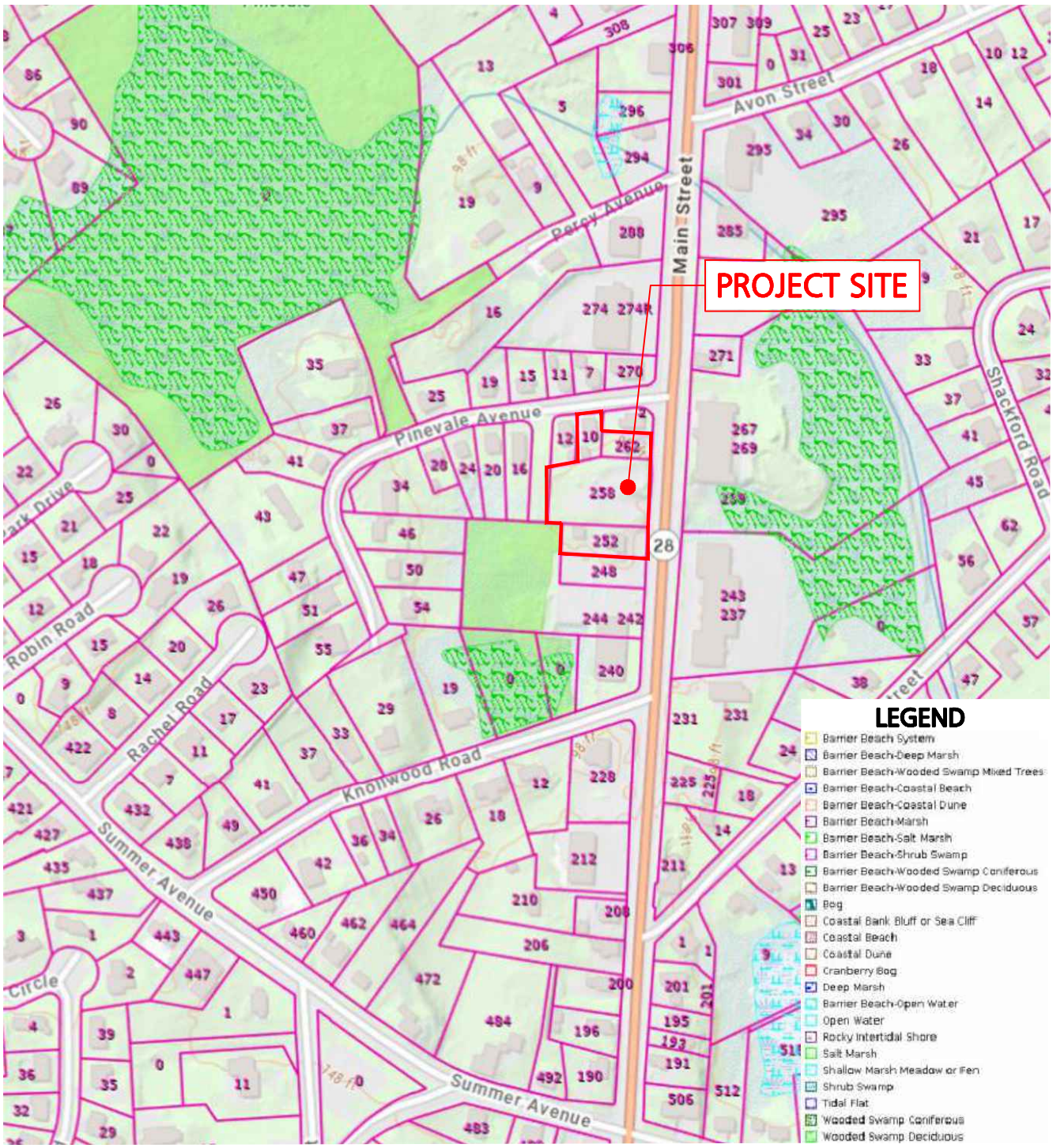
STRADA
258 MAIN STREET
READING, MA

AERIAL PHOTO

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	MTB	CHECKED BY:	CMQ

SHEET No.

EX-2



THERE ARE NO DEP WETLANDS DIRECTLY ON SITE
THE SITE DOES FALLS WITHIN 100 FOOT WETLAND BUFFER

PREPARED BY:

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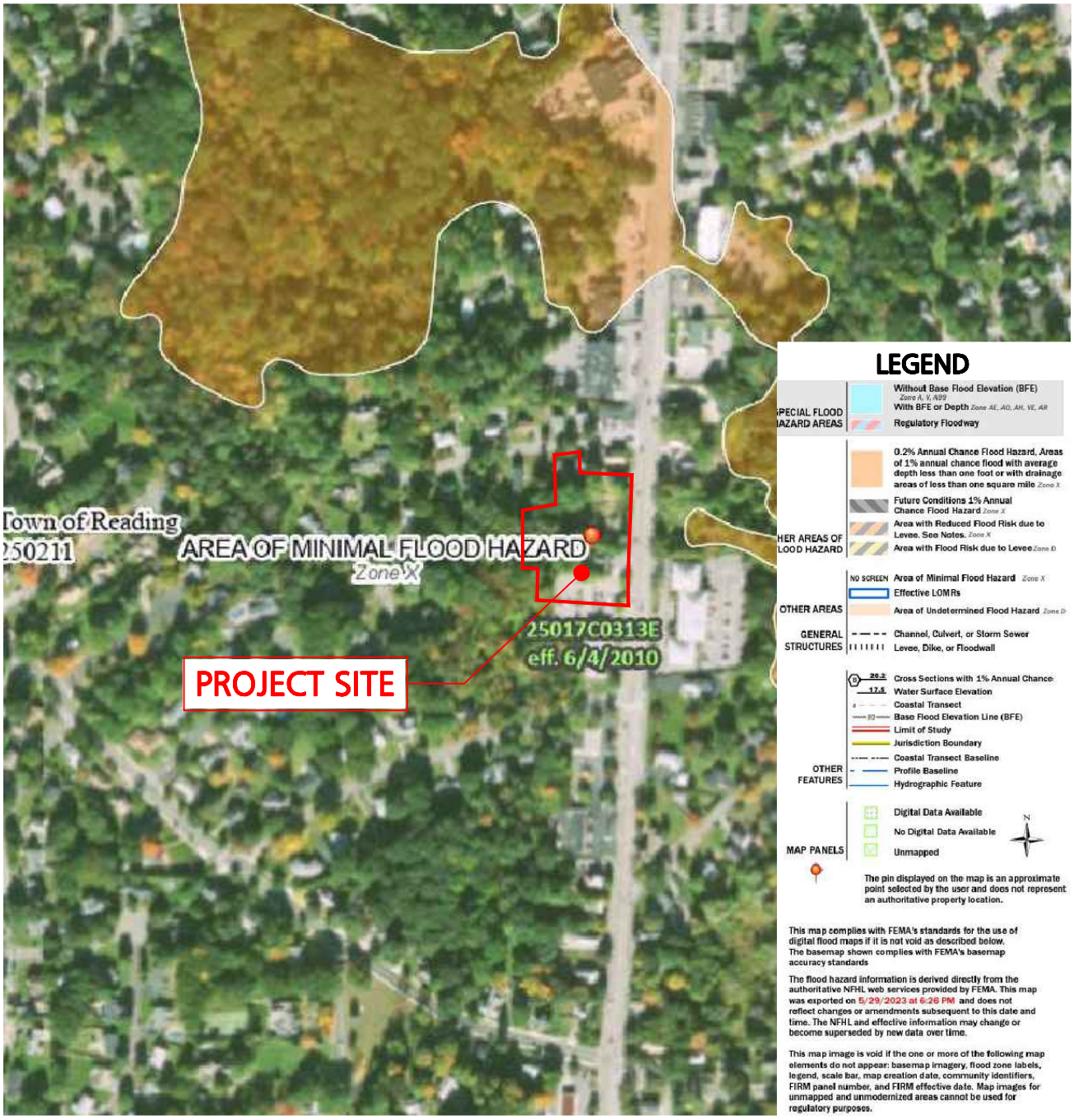
PROJECT: STRADA
258 MAIN STREET
READING, MA

WETLANDS MAP

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	MTB	CHECKED BY:	CMQ

SHEET No.
EX-3



FEMA FLOOD INSURANCE RATE MAP
MIDDLESEX COUNTY, MASSACHUSETTS
COMMUNITY PANEL 312 OF 656
MAP NUMBER 25017C0313E
EFFECTIVE DATE: JUNE 4, 2010

SITE IS NOT LOCATED IN A FLOOD HAZARD ZONE

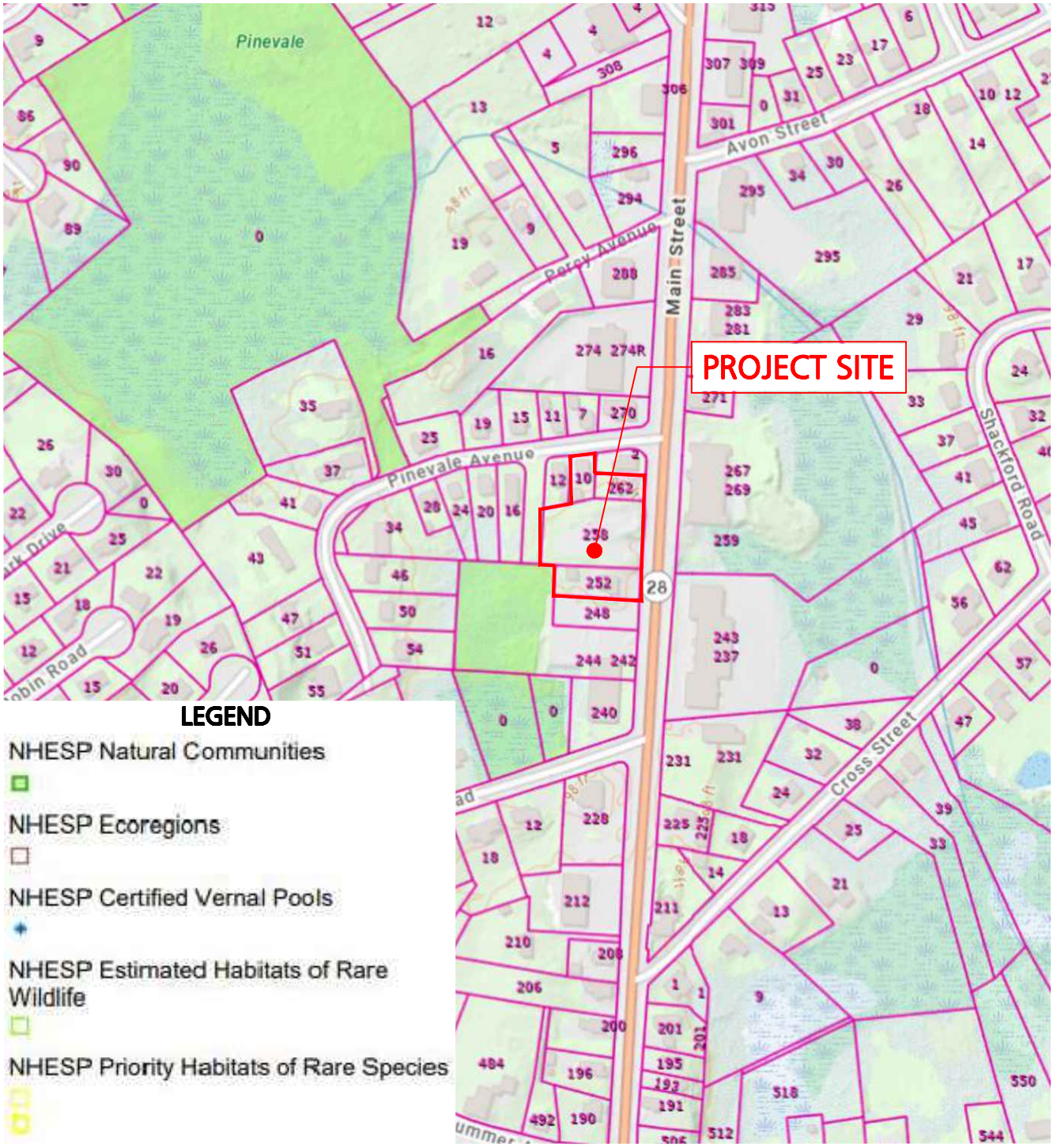
PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY
P.O. BOX 2118
WOBURN MA 01888-0118
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT:
STRADA
258 MAIN STREET
READING, MA

FEMA FIRM MAP

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	MTB	CHECKED BY:	CMQ

SHEET No.
EX-4



LEGEND

NHESP Natural Communities

NHESP Ecoregions

NHESP Certified Vernal Pools

NHESP Estimated Habitats of Rare Wildlife

NHESP Priority Habitats of Rare Species

NO PRIORITY & ESTIMATED HABITATS LOCATED ON SITE

PREPARED BY:

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WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT:

STRADA
258 MAIN STREET
READING, MA

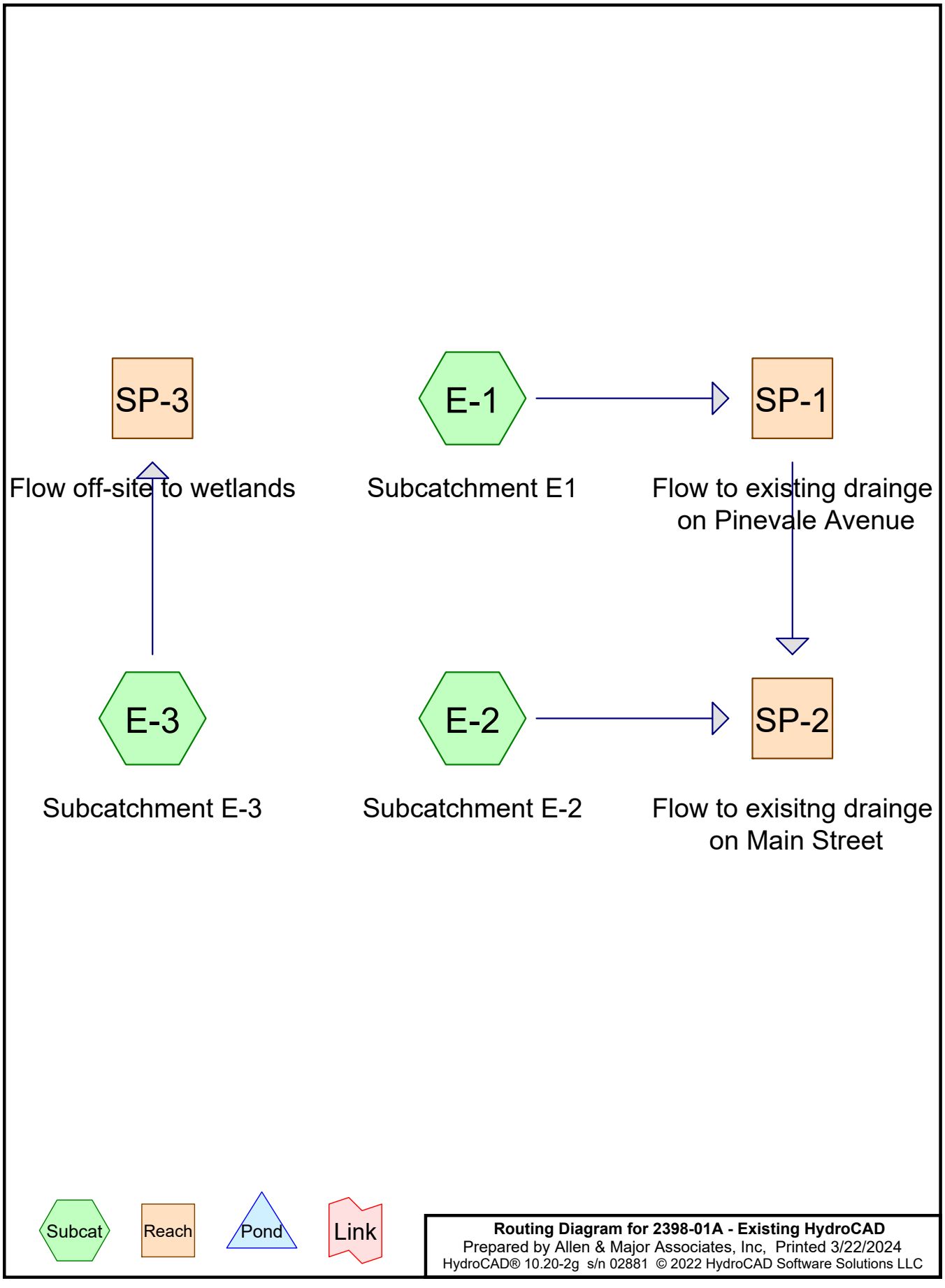
PRIORITY & ESTIMATED HABITATS

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1"=300'	DWG. NAME:	EXHIBITS
DESIGNED BY:	MTB	CHECKED BY:	CMQ

SHEET No.

EX-5

SECTION 4.0 -
EXISTING DRAINAGE ANALYSIS



Routing Diagram for 2398-01A - Existing HydroCAD
Prepared by Allen & Major Associates, Inc, Printed 3/22/2024

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 4245 MA Reading Middlesex County South
Rainfall events imported from "NRCS-Rain.txt" for 4245 MA Reading Middlesex County South

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.31	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	5.21	2
3	25-Year	NRCC 24-hr	D	Default	24.00	1	6.40	2
4	100-Year	NRCC 24-hr	D	Default	24.00	1	8.23	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
8,464	39	>75% Grass cover, Good, HSG A (E-1, E-2, E-3)
19,705	98	Paved parking, HSG A (E-1, E-2, E-3)
1,851	98	Roofs, HSG A (E-2, E-3)
1,595	98	Unconnected roofs, HSG A (E-1)
14,480	32	Woods/grass comb., Good, HSG A (E-1, E-2, E-3)
46,095	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
46,095	HSG A	E-1, E-2, E-3
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
46,095		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
8,464	0	0	0	0	8,464	>75% Grass cover, Good	
19,705	0	0	0	0	19,705	Paved parking	
1,851	0	0	0	0	1,851	Roofs	
1,595	0	0	0	0	1,595	Unconnected roofs	
14,480	0	0	0	0	14,480	Woods/grass comb., Good	
46,095	**0**	**0**	**0**	**0**	**46,095**	**TOTAL AREA**	

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

Subcatchment E-1: Subcatchment E1 Runoff Area=17,847 sf 53.69% Impervious Runoff Depth=0.89"
Flow Length=177' Tc=7.1 min CN=70 Runoff=0.36 cfs 1,328 cf

Subcatchment E-2: Subcatchment E-2 Runoff Area=18,574 sf 55.11% Impervious Runoff Depth=0.84"
Flow Length=333' Tc=6.0 min CN=69 Runoff=0.36 cfs 1,304 cf

Subcatchment E-3: Subcatchment E-3 Runoff Area=9,674 sf 34.45% Impervious Runoff Depth=0.31"
Flow Length=127' Tc=6.8 min CN=56 Runoff=0.03 cfs 254 cf

Reach SP-1: Flow to existing drainge on Pinevale Avenue Inflow=0.36 cfs 1,328 cf
Outflow=0.36 cfs 1,328 cf

Reach SP-2: Flow to exisitng drainge on Main Street Inflow=0.72 cfs 2,632 cf
Outflow=0.72 cfs 2,632 cf

Reach SP-3: Flow off-site to wetlands Inflow=0.03 cfs 254 cf
Outflow=0.03 cfs 254 cf

Total Runoff Area = 46,095 sf Runoff Volume = 2,885 cf Average Runoff Depth = 0.75"
49.78% Pervious = 22,944 sf 50.22% Impervious = 23,151 sf

Summary for Subcatchment E-1: Subcatchment E1

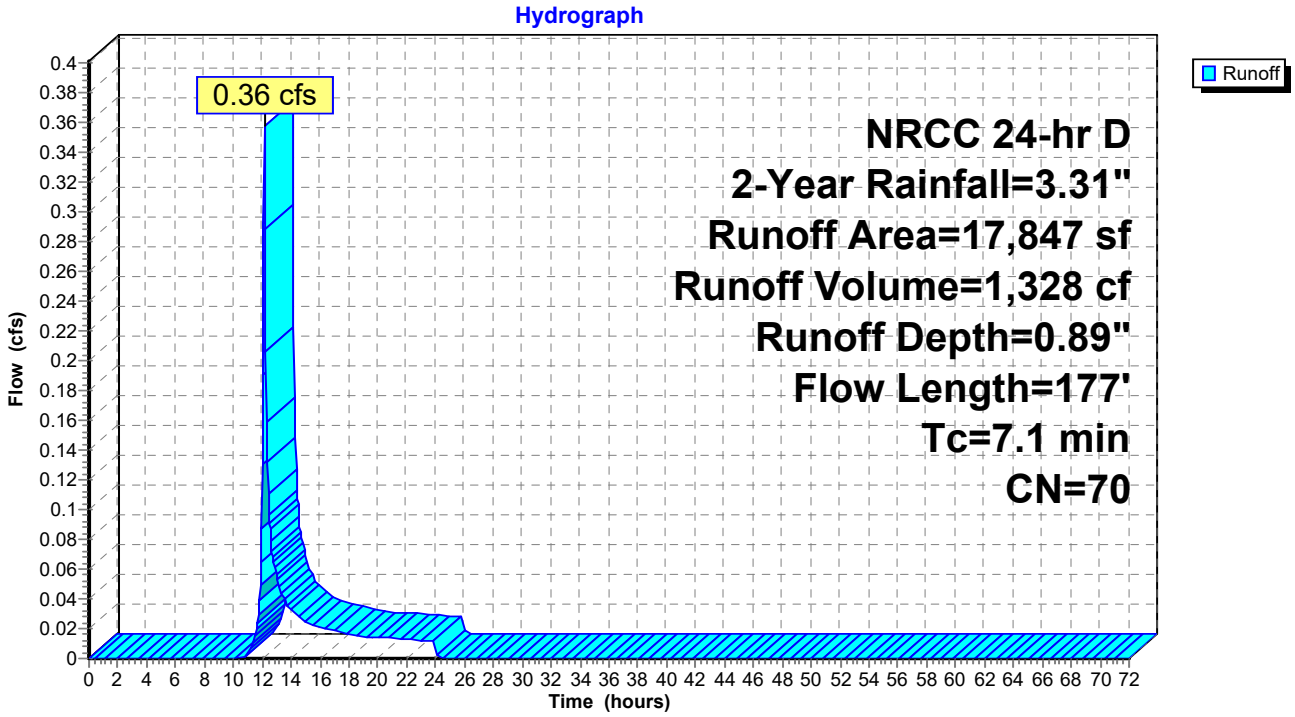
Runoff = 0.36 cfs @ 12.15 hrs, Volume= 1,328 cf, Depth= 0.89"
Routed to Reach SP-1 : Flow to existing drainge on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
1,595	98	Unconnected roofs, HSG A
7,987	98	Paved parking, HSG A
1,752	32	Woods/grass comb., Good, HSG A
6,513	39	>75% Grass cover, Good, HSG A
17,847	70	Weighted Average
8,265		46.31% Pervious Area
9,582		53.69% Impervious Area
1,595		16.65% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	38	0.0500	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.2	23	0.0800	1.79		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
3.6	53	0.0700	0.25		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	63	0.0800	5.74		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
7.1	177	Total			

Subcatchment E-1: Subcatchment E1



Summary for Subcatchment E-2: Subcatchment E-2

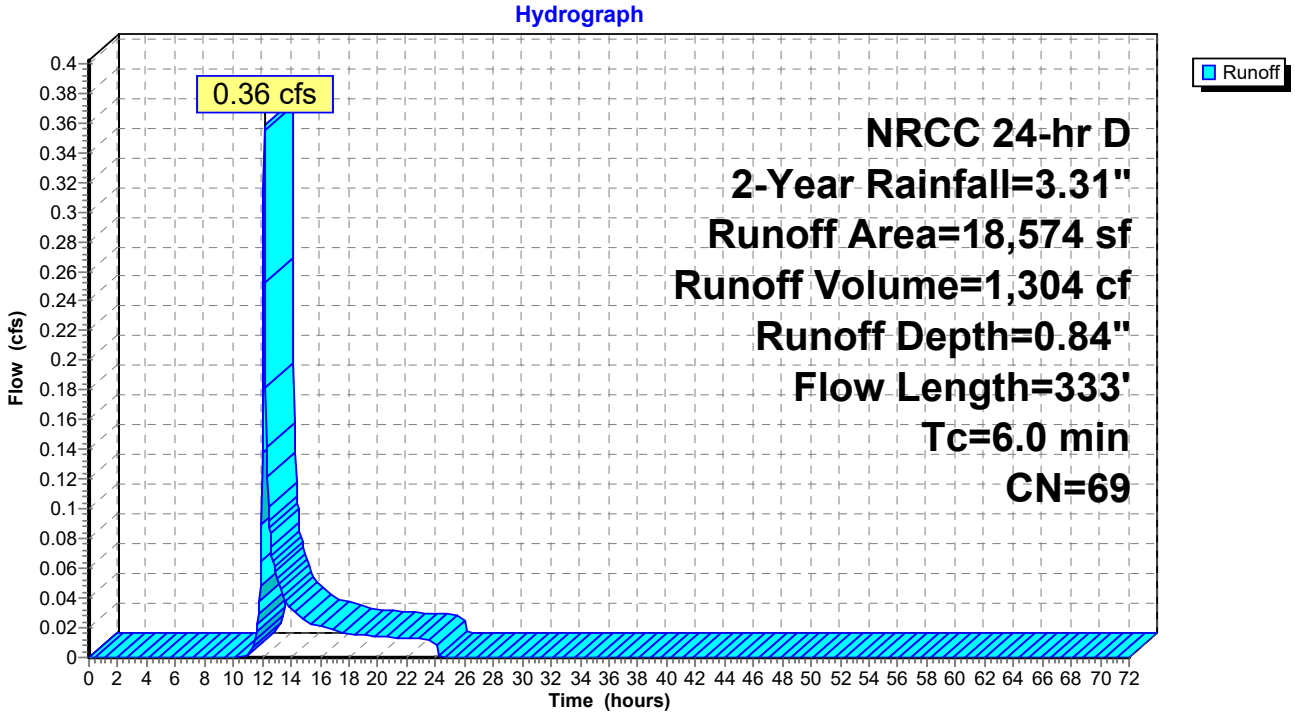
Runoff = 0.36 cfs @ 12.14 hrs, Volume= 1,304 cf, Depth= 0.84"
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
965	98	Roofs, HSG A
9,271	98	Paved parking, HSG A
7,853	32	Woods/grass comb., Good, HSG A
485	39	>75% Grass cover, Good, HSG A
18,574	69	Weighted Average
8,338		44.89% Pervious Area
10,236		55.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	12	0.0800	1.57		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.20"
0.3	36	0.0800	1.95		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	285	0.0100	2.03		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
2.7	333	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Subcatchment E-2



Summary for Subcatchment E-3: Subcatchment E-3

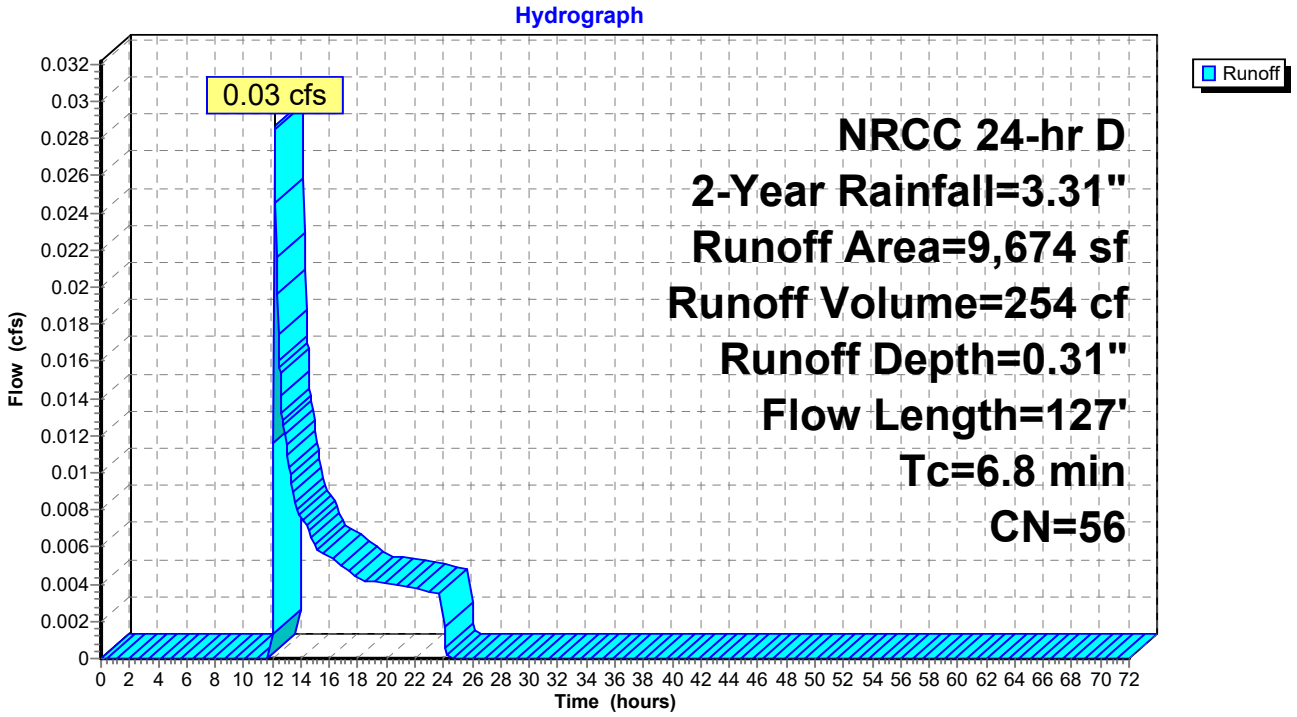
Runoff = 0.03 cfs @ 12.19 hrs, Volume= 254 cf, Depth= 0.31"
Routed to Reach SP-3 : Flow off-site to wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
886	98	Roofs, HSG A
2,447	98	Paved parking, HSG A
4,875	32	Woods/grass comb., Good, HSG A
1,466	39	>75% Grass cover, Good, HSG A
9,674	56	Weighted Average
6,341		65.55% Pervious Area
3,333		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0400	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	20	0.0500	1.44		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	23	0.0400	0.17		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	15	0.0600	1.46		**Sheet Flow, D-E** Smooth surfaces n= 0.011 P2= 3.20"
0.5	44	0.0400	1.40		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
6.8	127	Total			

Subcatchment E-3: Subcatchment E-3



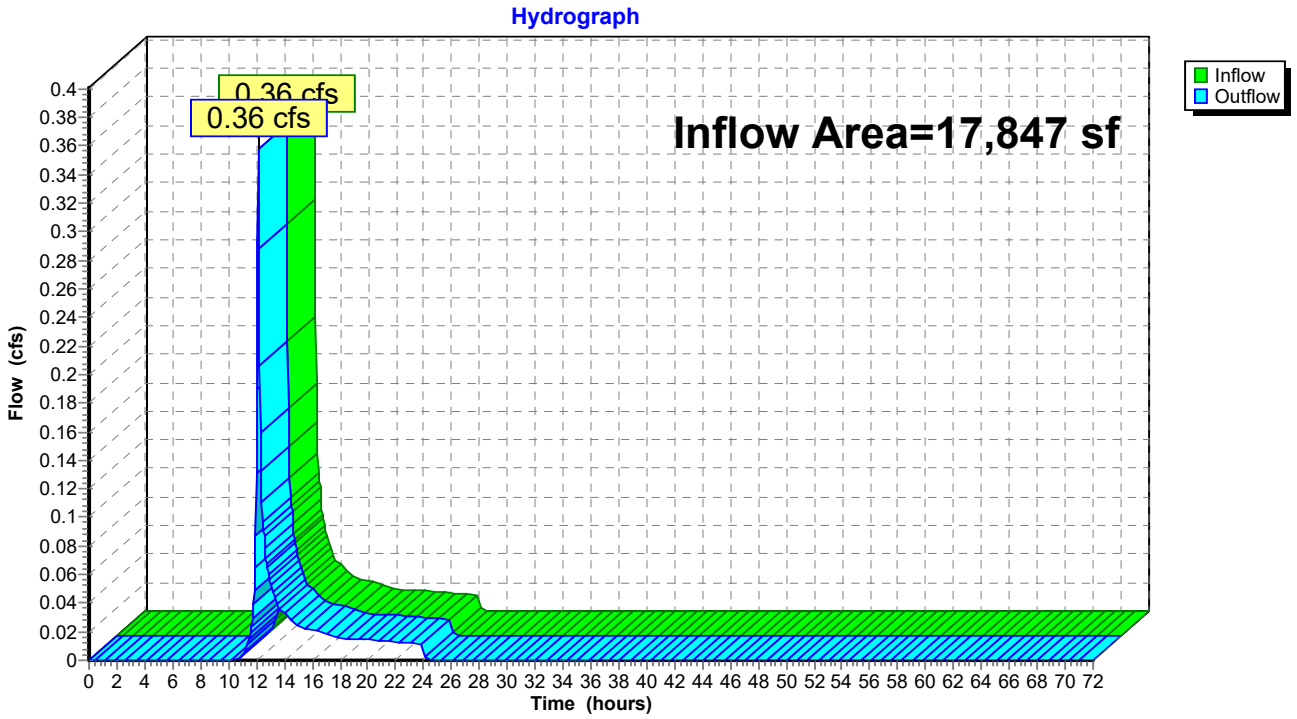
Summary for Reach SP-1: Flow to existing drainge on Pinevale Avenue

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

Inflow Area = 17,847 sf, 53.69% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 0.36 cfs @ 12.15 hrs, Volume= 1,328 cf
Outflow = 0.36 cfs @ 12.15 hrs, Volume= 1,328 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

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

Reach SP-1: Flow to existing drainge on Pinevale Avenue



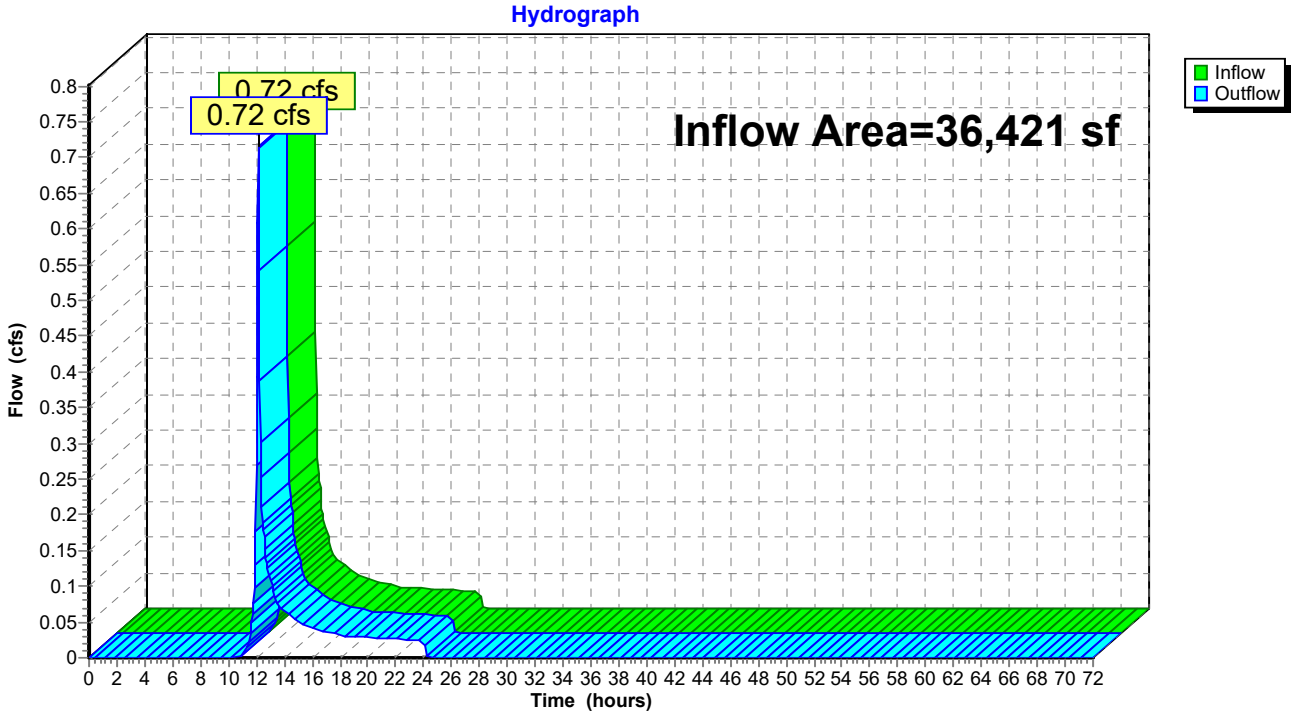
Summary for Reach SP-2: Flow to exisitng drainge on Main Street

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

Inflow Area = 36,421 sf, 54.41% Impervious, Inflow Depth = 0.87" for 2-Year event
Inflow = 0.72 cfs @ 12.14 hrs, Volume= 2,632 cf
Outflow = 0.72 cfs @ 12.14 hrs, Volume= 2,632 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-2: Flow to exisitng drainge on Main Street



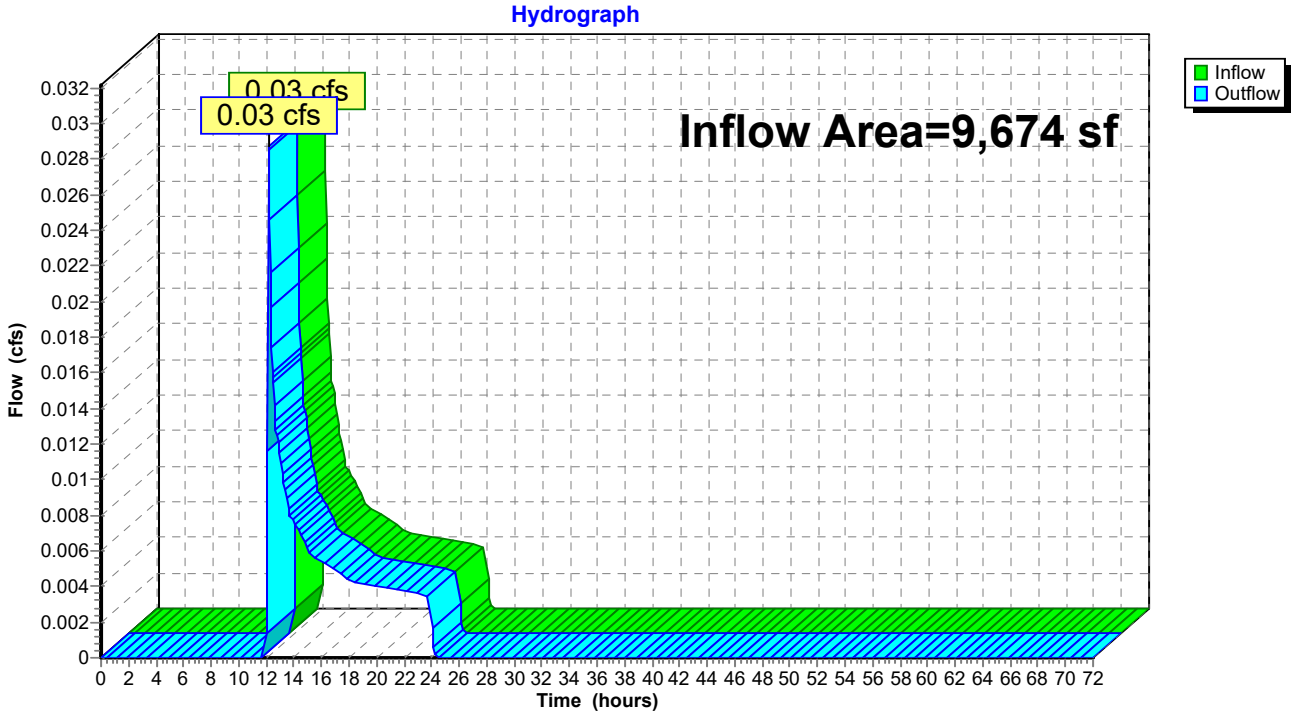
Summary for Reach SP-3: Flow off-site to wetlands

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

Inflow Area = 9,674 sf, 34.45% Impervious, Inflow Depth = 0.31" for 2-Year event
Inflow = 0.03 cfs @ 12.19 hrs, Volume= 254 cf
Outflow = 0.03 cfs @ 12.19 hrs, Volume= 254 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-3: Flow off-site to wetlands



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

Subcatchment E-1: Subcatchment E1 Runoff Area=17,847 sf 53.69% Impervious Runoff Depth=2.19"
Flow Length=177' Tc=7.1 min CN=70 Runoff=0.94 cfs 3,262 cf

Subcatchment E-2: Subcatchment E-2 Runoff Area=18,574 sf 55.11% Impervious Runoff Depth=2.11"
Flow Length=333' Tc=6.0 min CN=69 Runoff=0.96 cfs 3,268 cf

Subcatchment E-3: Subcatchment E-3 Runoff Area=9,674 sf 34.45% Impervious Runoff Depth=1.15"
Flow Length=127' Tc=6.8 min CN=56 Runoff=0.24 cfs 928 cf

Reach SP-1: Flow to existing drainge on Pinevale Avenue Inflow=0.94 cfs 3,262 cf
Outflow=0.94 cfs 3,262 cf

Reach SP-2: Flow to exisitng drainge on Main Street Inflow=1.90 cfs 6,530 cf
Outflow=1.90 cfs 6,530 cf

Reach SP-3: Flow off-site to wetlands Inflow=0.24 cfs 928 cf
Outflow=0.24 cfs 928 cf

Total Runoff Area = 46,095 sf Runoff Volume = 7,458 cf Average Runoff Depth = 1.94"
49.78% Pervious = 22,944 sf 50.22% Impervious = 23,151 sf

Summary for Subcatchment E-1: Subcatchment E1

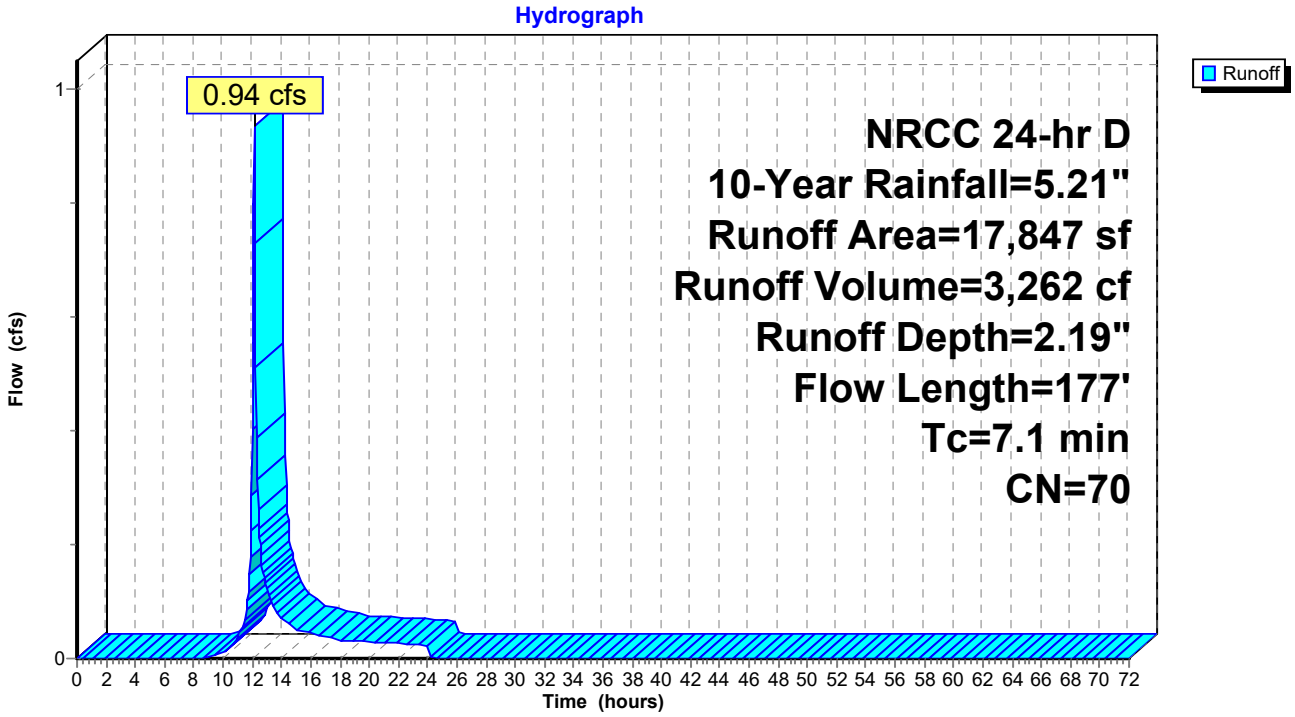
Runoff = 0.94 cfs @ 12.15 hrs, Volume= 3,262 cf, Depth= 2.19"
Routed to Reach SP-1 : Flow to existing drainge on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
1,595	98	Unconnected roofs, HSG A
7,987	98	Paved parking, HSG A
1,752	32	Woods/grass comb., Good, HSG A
6,513	39	>75% Grass cover, Good, HSG A
17,847	70	Weighted Average
8,265		46.31% Pervious Area
9,582		53.69% Impervious Area
1,595		16.65% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	38	0.0500	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.2	23	0.0800	1.79		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
3.6	53	0.0700	0.25		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	63	0.0800	5.74		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
7.1	177	Total			

Subcatchment E-1: Subcatchment E1



Summary for Subcatchment E-2: Subcatchment E-2

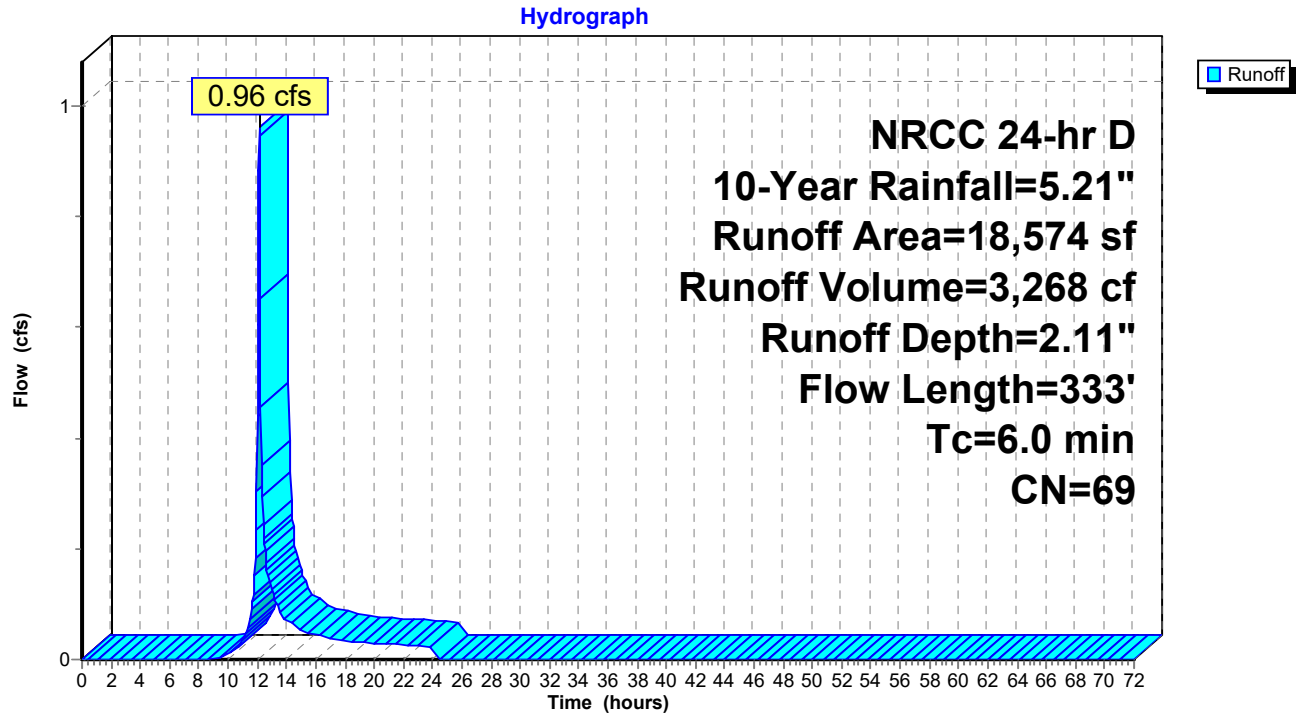
Runoff = 0.96 cfs @ 12.13 hrs, Volume= 3,268 cf, Depth= 2.11"
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
965	98	Roofs, HSG A
9,271	98	Paved parking, HSG A
7,853	32	Woods/grass comb., Good, HSG A
485	39	>75% Grass cover, Good, HSG A
18,574	69	Weighted Average
8,338		44.89% Pervious Area
10,236		55.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	12	0.0800	1.57		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.20"
0.3	36	0.0800	1.95		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	285	0.0100	2.03		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
2.7	333	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Subcatchment E-2



Summary for Subcatchment E-3: Subcatchment E-3

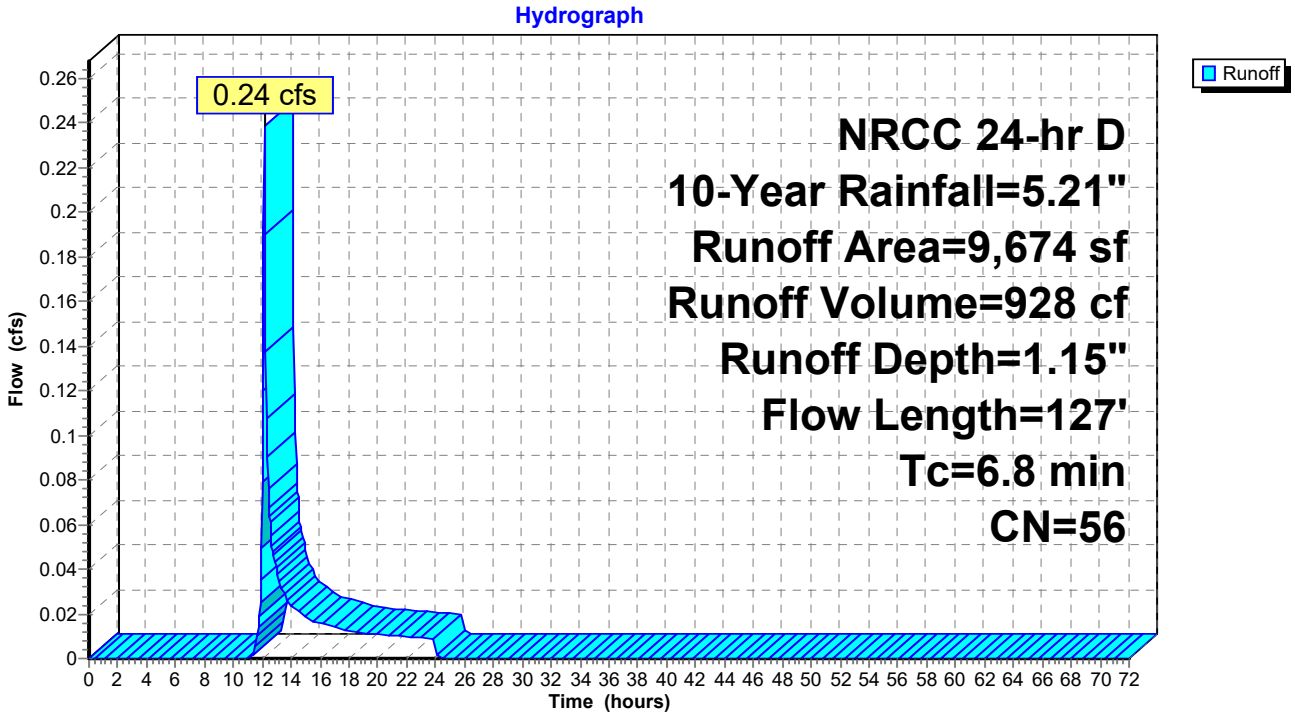
Runoff = 0.24 cfs @ 12.15 hrs, Volume= 928 cf, Depth= 1.15"
Routed to Reach SP-3 : Flow off-site to wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
886	98	Roofs, HSG A
2,447	98	Paved parking, HSG A
4,875	32	Woods/grass comb., Good, HSG A
1,466	39	>75% Grass cover, Good, HSG A
9,674	56	Weighted Average
6,341		65.55% Pervious Area
3,333		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0400	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	20	0.0500	1.44		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	23	0.0400	0.17		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	15	0.0600	1.46		**Sheet Flow, D-E** Smooth surfaces n= 0.011 P2= 3.20"
0.5	44	0.0400	1.40		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
6.8	127	Total			

Subcatchment E-3: Subcatchment E-3



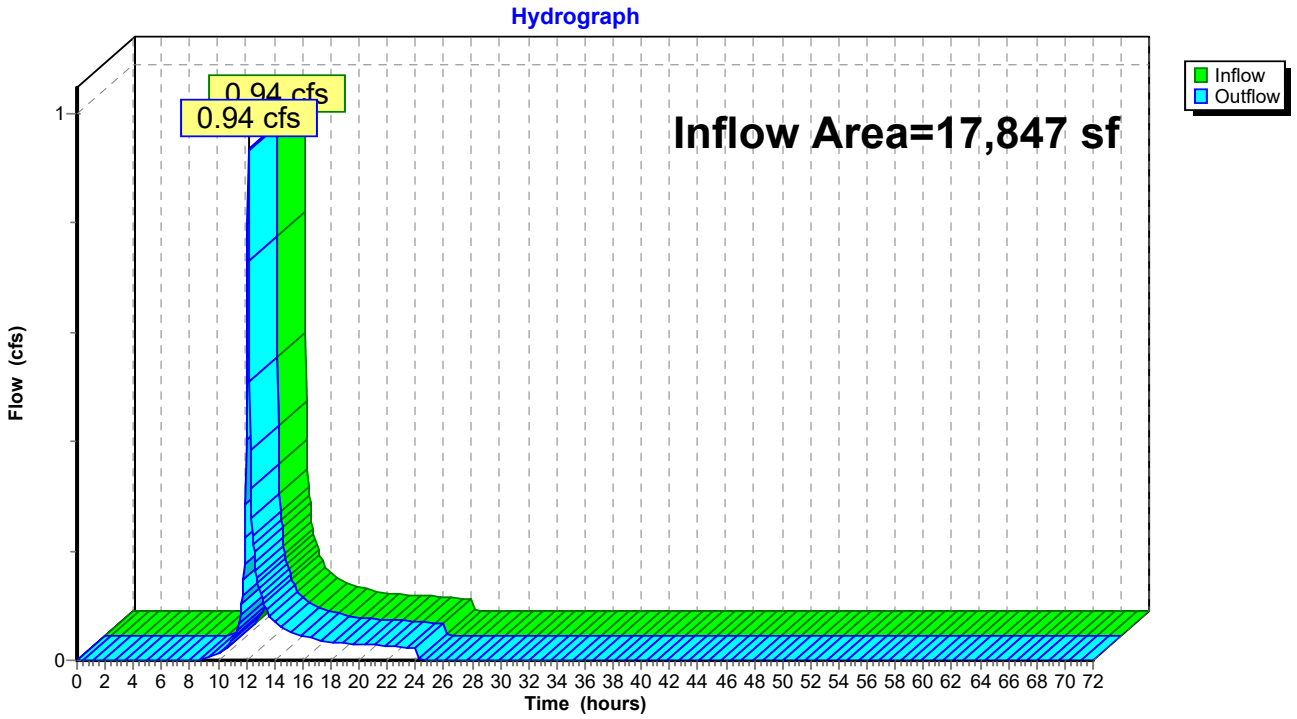
Summary for Reach SP-1: Flow to existing drainge on Pinevale Avenue

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

Inflow Area = 17,847 sf, 53.69% Impervious, Inflow Depth = 2.19" for 10-Year event
Inflow = 0.94 cfs @ 12.15 hrs, Volume= 3,262 cf
Outflow = 0.94 cfs @ 12.15 hrs, Volume= 3,262 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

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

Reach SP-1: Flow to existing drainge on Pinevale Avenue



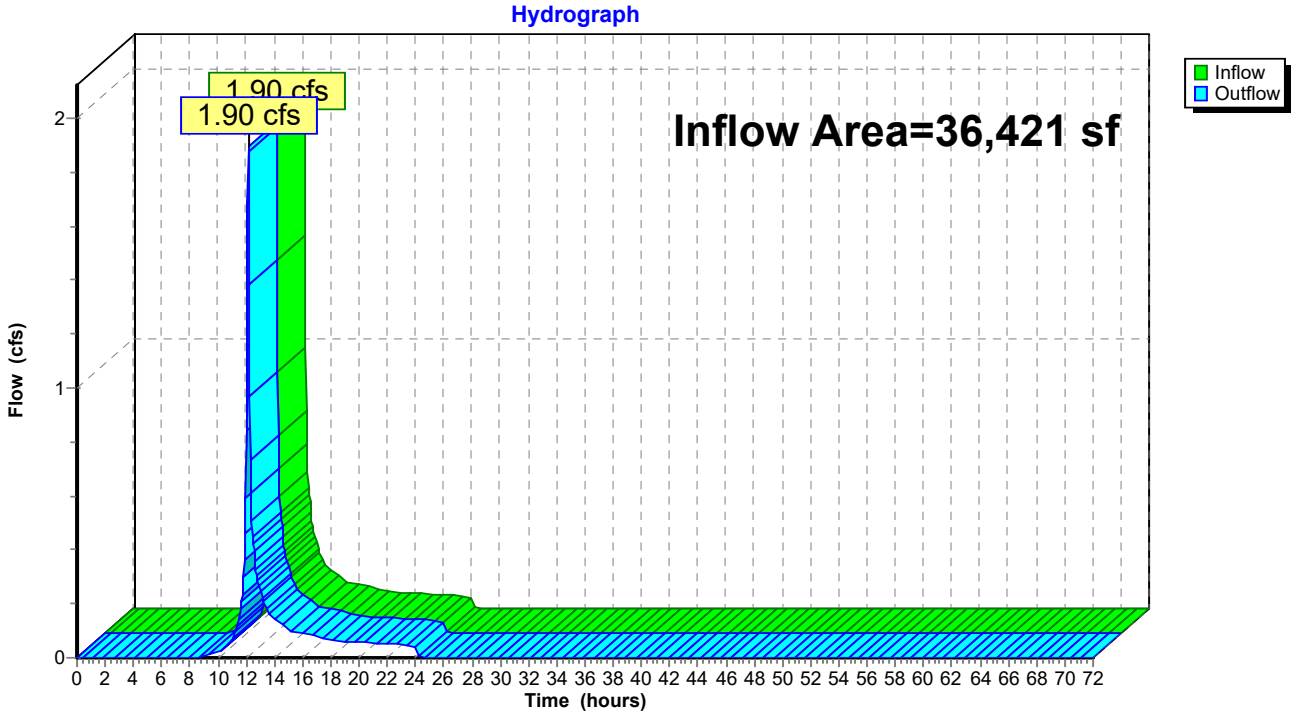
Summary for Reach SP-2: Flow to exisitng drainge on Main Street

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

Inflow Area = 36,421 sf, 54.41% Impervious, Inflow Depth = 2.15" for 10-Year event
Inflow = 1.90 cfs @ 12.14 hrs, Volume= 6,530 cf
Outflow = 1.90 cfs @ 12.14 hrs, Volume= 6,530 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-2: Flow to exisitng drainge on Main Street



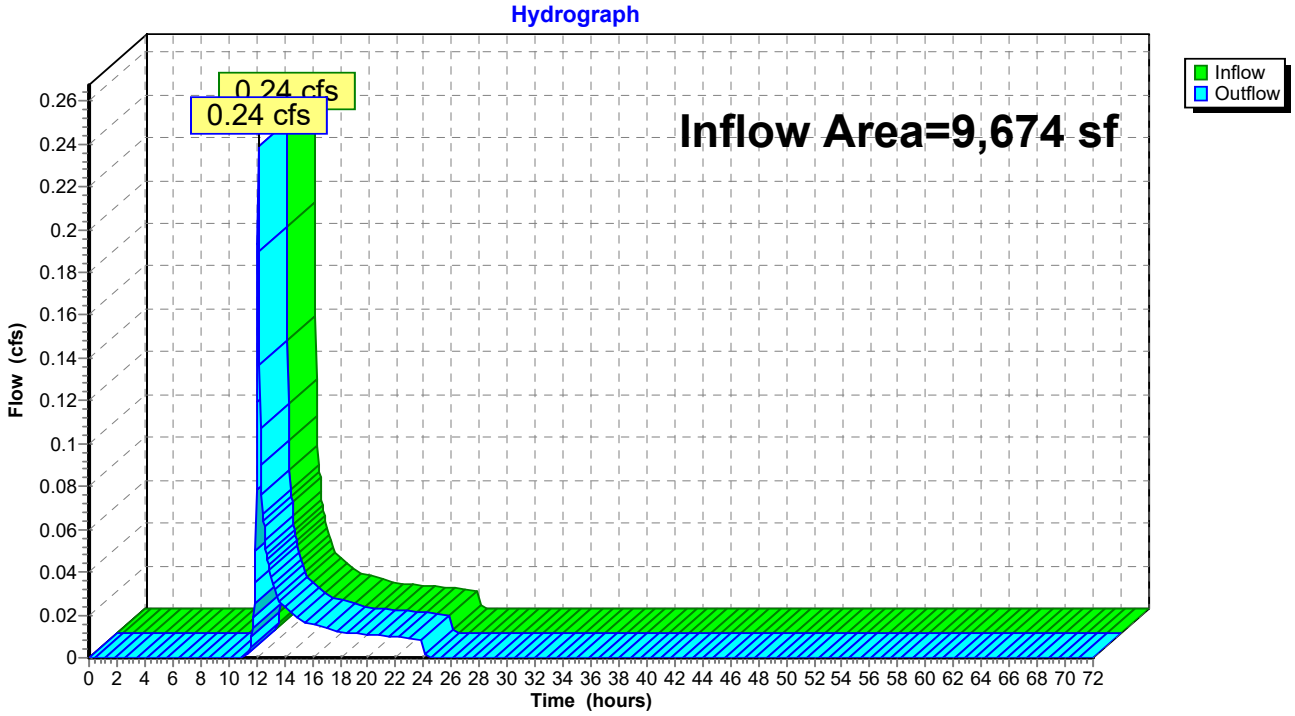
Summary for Reach SP-3: Flow off-site to wetlands

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

Inflow Area = 9,674 sf, 34.45% Impervious, Inflow Depth = 1.15" for 10-Year event
Inflow = 0.24 cfs @ 12.15 hrs, Volume= 928 cf
Outflow = 0.24 cfs @ 12.15 hrs, Volume= 928 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-3: Flow off-site to wetlands



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

Subcatchment E-1: Subcatchment E1 Runoff Area=17,847 sf 53.69% Impervious Runoff Depth=3.13"
Flow Length=177' Tc=7.1 min CN=70 Runoff=1.34 cfs 4,649 cf

Subcatchment E-2: Subcatchment E-2 Runoff Area=18,574 sf 55.11% Impervious Runoff Depth=3.03"
Flow Length=333' Tc=6.0 min CN=69 Runoff=1.39 cfs 4,687 cf

Subcatchment E-3: Subcatchment E-3 Runoff Area=9,674 sf 34.45% Impervious Runoff Depth=1.84"
Flow Length=127' Tc=6.8 min CN=56 Runoff=0.41 cfs 1,482 cf

Reach SP-1: Flow to existing drainge on Pinevale Avenue Inflow=1.34 cfs 4,649 cf
Outflow=1.34 cfs 4,649 cf

Reach SP-2: Flow to exisitng drainge on Main Street Inflow=2.73 cfs 9,336 cf
Outflow=2.73 cfs 9,336 cf

Reach SP-3: Flow off-site to wetlands Inflow=0.41 cfs 1,482 cf
Outflow=0.41 cfs 1,482 cf

Total Runoff Area = 46,095 sf Runoff Volume = 10,818 cf Average Runoff Depth = 2.82"
49.78% Pervious = 22,944 sf 50.22% Impervious = 23,151 sf

Summary for Subcatchment E-1: Subcatchment E1

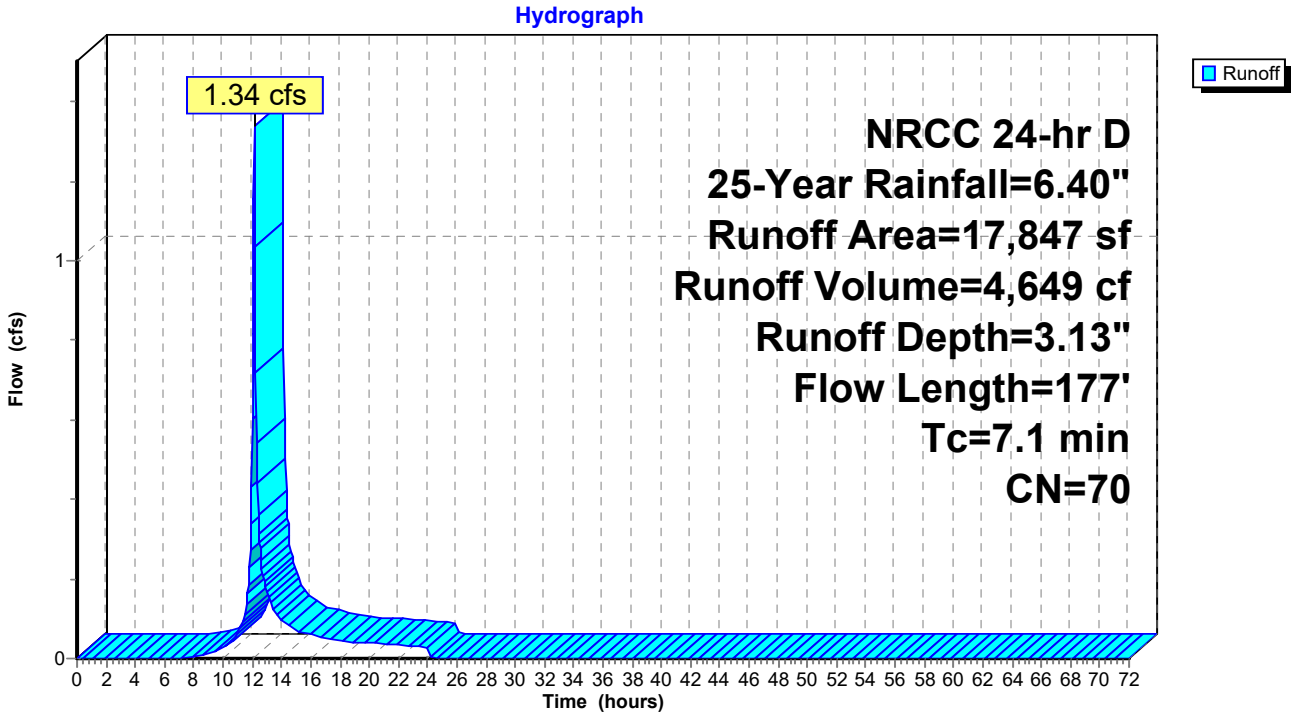
Runoff = 1.34 cfs @ 12.14 hrs, Volume= 4,649 cf, Depth= 3.13"
Routed to Reach SP-1 : Flow to existing drainge on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
1,595	98	Unconnected roofs, HSG A
7,987	98	Paved parking, HSG A
1,752	32	Woods/grass comb., Good, HSG A
6,513	39	>75% Grass cover, Good, HSG A
17,847	70	Weighted Average
8,265		46.31% Pervious Area
9,582		53.69% Impervious Area
1,595		16.65% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	38	0.0500	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.2	23	0.0800	1.79		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
3.6	53	0.0700	0.25		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	63	0.0800	5.74		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
7.1	177	Total			

Subcatchment E-1: Subcatchment E1



Summary for Subcatchment E-2: Subcatchment E-2

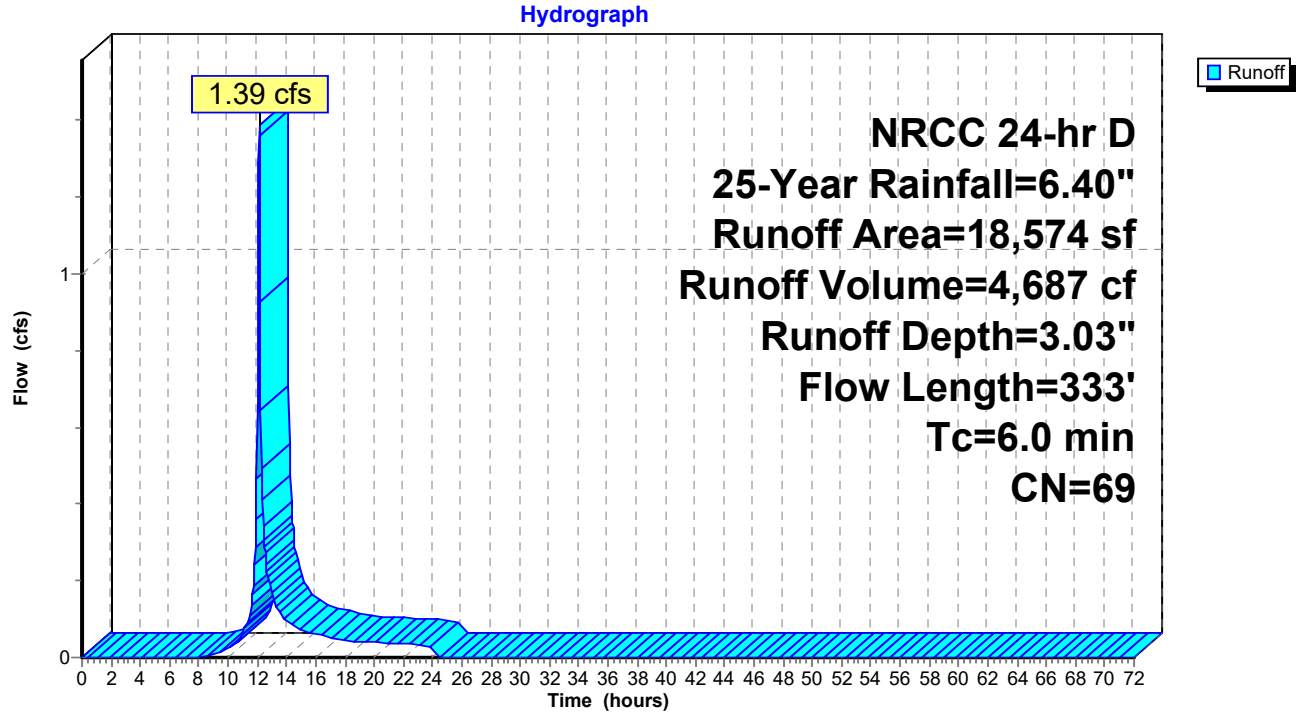
Runoff = 1.39 cfs @ 12.13 hrs, Volume= 4,687 cf, Depth= 3.03"
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
965	98	Roofs, HSG A
9,271	98	Paved parking, HSG A
7,853	32	Woods/grass comb., Good, HSG A
485	39	>75% Grass cover, Good, HSG A
18,574	69	Weighted Average
8,338		44.89% Pervious Area
10,236		55.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	12	0.0800	1.57		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.20"
0.3	36	0.0800	1.95		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	285	0.0100	2.03		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
2.7	333	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Subcatchment E-2



Summary for Subcatchment E-3: Subcatchment E-3

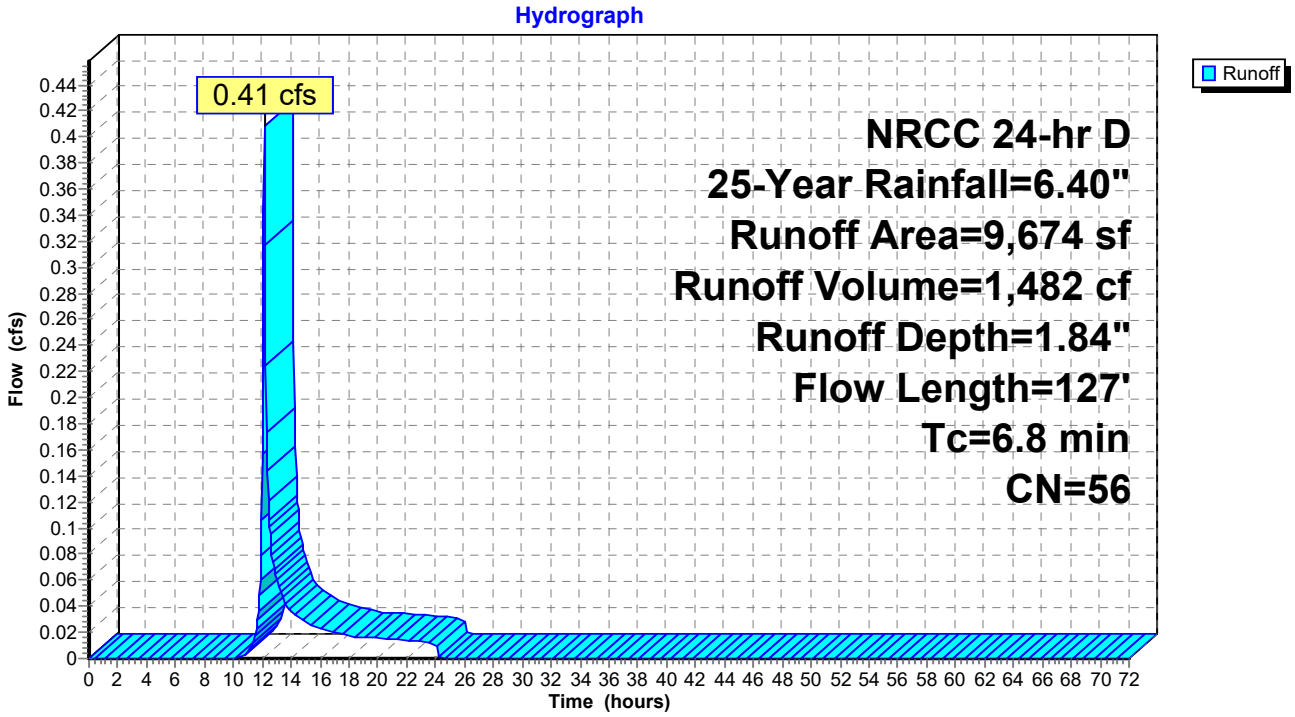
Runoff = 0.41 cfs @ 12.15 hrs, Volume= 1,482 cf, Depth= 1.84"
Routed to Reach SP-3 : Flow off-site to wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
886	98	Roofs, HSG A
2,447	98	Paved parking, HSG A
4,875	32	Woods/grass comb., Good, HSG A
1,466	39	>75% Grass cover, Good, HSG A
9,674	56	Weighted Average
6,341		65.55% Pervious Area
3,333		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0400	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	20	0.0500	1.44		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	23	0.0400	0.17		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	15	0.0600	1.46		**Sheet Flow, D-E** Smooth surfaces n= 0.011 P2= 3.20"
0.5	44	0.0400	1.40		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
6.8	127	Total			

Subcatchment E-3: Subcatchment E-3



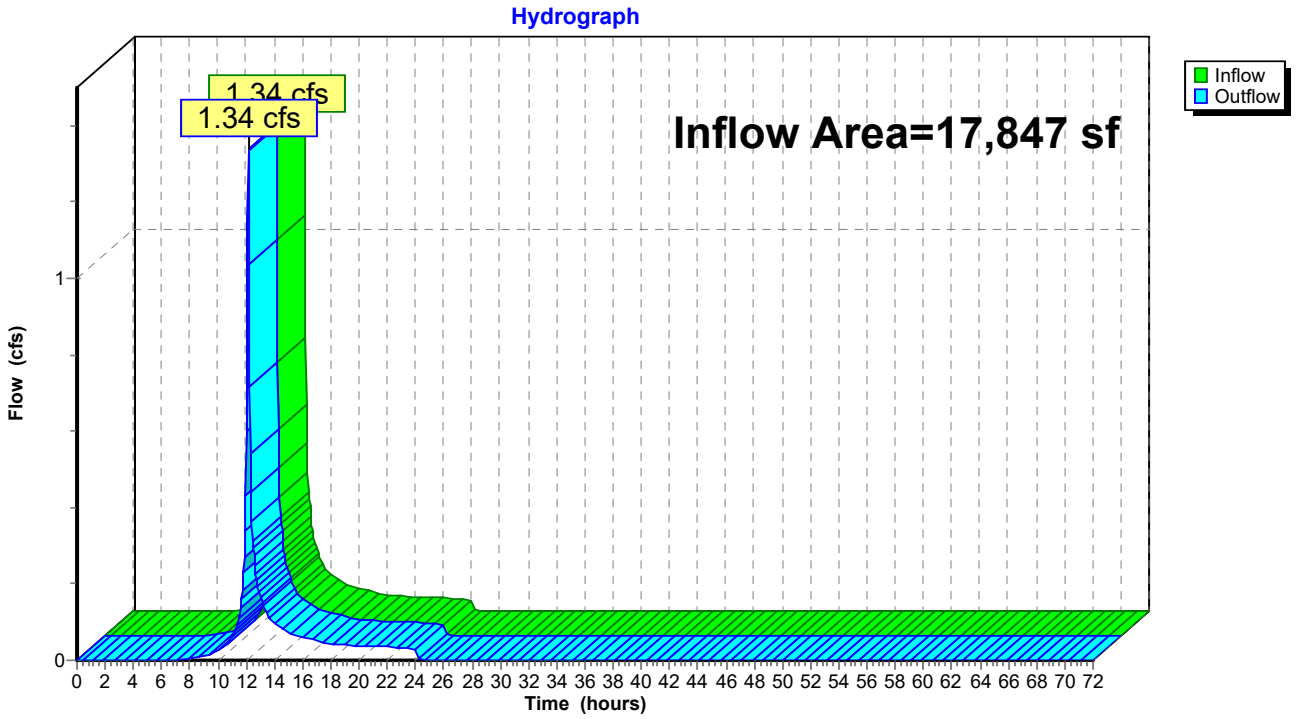
Summary for Reach SP-1: Flow to existing drainge on Pinevale Avenue

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

Inflow Area = 17,847 sf, 53.69% Impervious, Inflow Depth = 3.13" for 25-Year event
Inflow = 1.34 cfs @ 12.14 hrs, Volume= 4,649 cf
Outflow = 1.34 cfs @ 12.14 hrs, Volume= 4,649 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

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

Reach SP-1: Flow to existing drainge on Pinevale Avenue



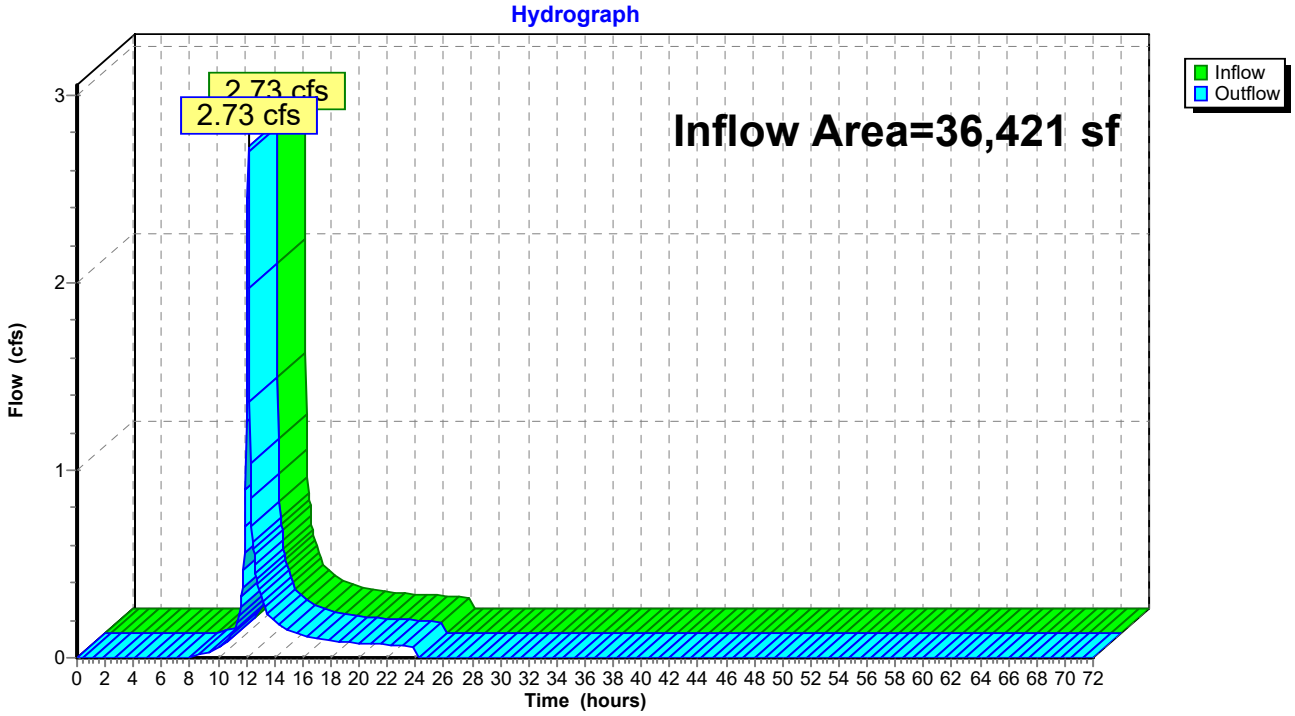
Summary for Reach SP-2: Flow to exisitng drainge on Main Street

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

Inflow Area = 36,421 sf, 54.41% Impervious, Inflow Depth = 3.08" for 25-Year event
Inflow = 2.73 cfs @ 12.14 hrs, Volume= 9,336 cf
Outflow = 2.73 cfs @ 12.14 hrs, Volume= 9,336 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-2: Flow to exisitng drainge on Main Street



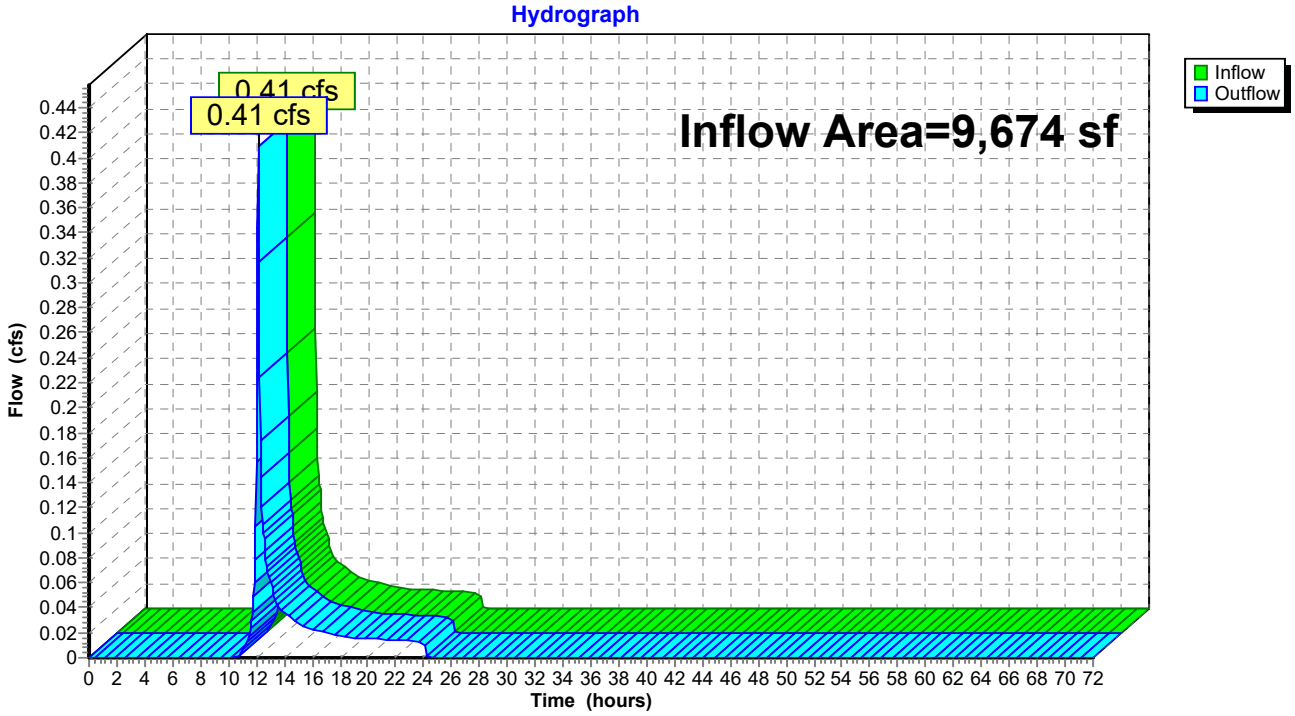
Summary for Reach SP-3: Flow off-site to wetlands

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

Inflow Area = 9,674 sf, 34.45% Impervious, Inflow Depth = 1.84" for 25-Year event
Inflow = 0.41 cfs @ 12.15 hrs, Volume= 1,482 cf
Outflow = 0.41 cfs @ 12.15 hrs, Volume= 1,482 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-3: Flow off-site to wetlands



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

Subcatchment E-1: Subcatchment E1 Runoff Area=17,847 sf 53.69% Impervious Runoff Depth=4.66"
Flow Length=177' Tc=7.1 min CN=70 Runoff=1.99 cfs 6,934 cf

Subcatchment E-2: Subcatchment E-2 Runoff Area=18,574 sf 55.11% Impervious Runoff Depth=4.55"
Flow Length=333' Tc=6.0 min CN=69 Runoff=2.08 cfs 7,036 cf

Subcatchment E-3: Subcatchment E-3 Runoff Area=9,674 sf 34.45% Impervious Runoff Depth=3.05"
Flow Length=127' Tc=6.8 min CN=56 Runoff=0.71 cfs 2,462 cf

Reach SP-1: Flow to existing drainge on Pinevale Avenue Inflow=1.99 cfs 6,934 cf
Outflow=1.99 cfs 6,934 cf

Reach SP-2: Flow to exisitng drainge on Main Street Inflow=4.07 cfs 13,971 cf
Outflow=4.07 cfs 13,971 cf

Reach SP-3: Flow off-site to wetlands Inflow=0.71 cfs 2,462 cf
Outflow=0.71 cfs 2,462 cf

Total Runoff Area = 46,095 sf Runoff Volume = 16,433 cf Average Runoff Depth = 4.28"
49.78% Pervious = 22,944 sf 50.22% Impervious = 23,151 sf

Summary for Subcatchment E-1: Subcatchment E1

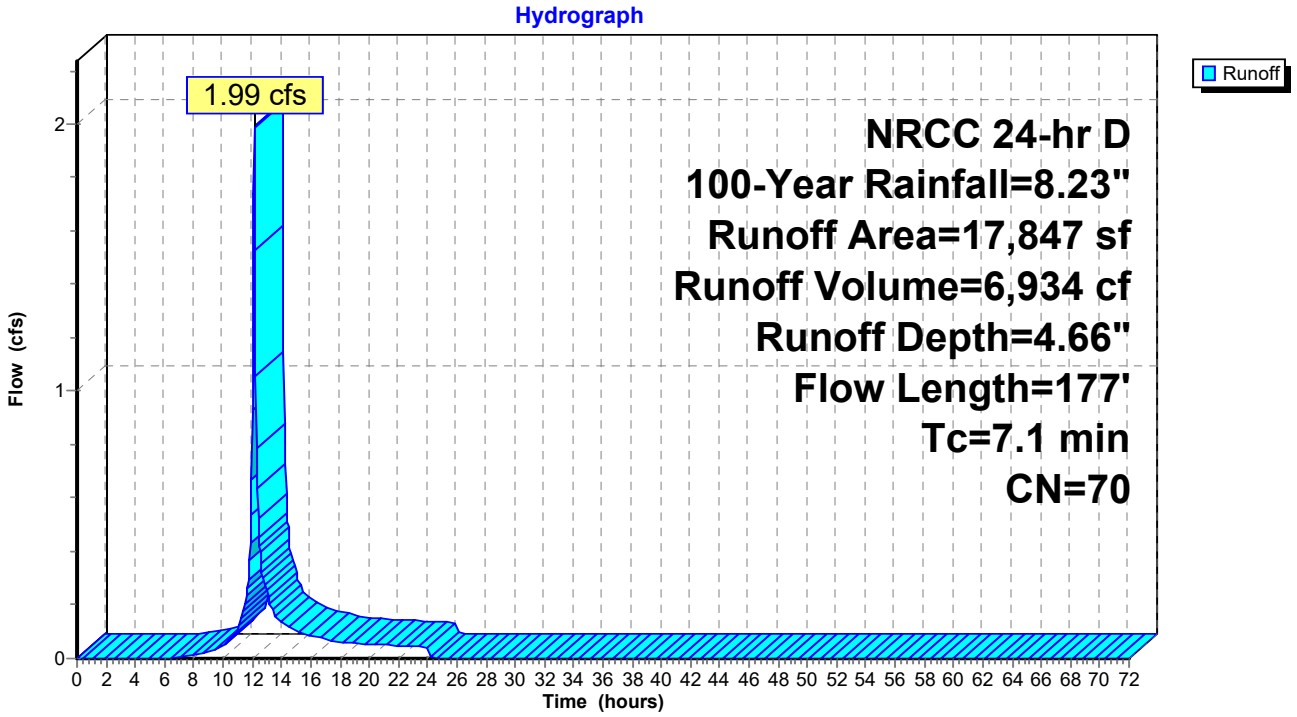
Runoff = 1.99 cfs @ 12.14 hrs, Volume= 6,934 cf, Depth= 4.66"
Routed to Reach SP-1 : Flow to existing drainge on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
1,595	98	Unconnected roofs, HSG A
7,987	98	Paved parking, HSG A
1,752	32	Woods/grass comb., Good, HSG A
6,513	39	>75% Grass cover, Good, HSG A
17,847	70	Weighted Average
8,265		46.31% Pervious Area
9,582		53.69% Impervious Area
1,595		16.65% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	38	0.0500	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.2	23	0.0800	1.79		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
3.6	53	0.0700	0.25		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	63	0.0800	5.74		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
7.1	177	Total			

Subcatchment E-1: Subcatchment E1



Summary for Subcatchment E-2: Subcatchment E-2

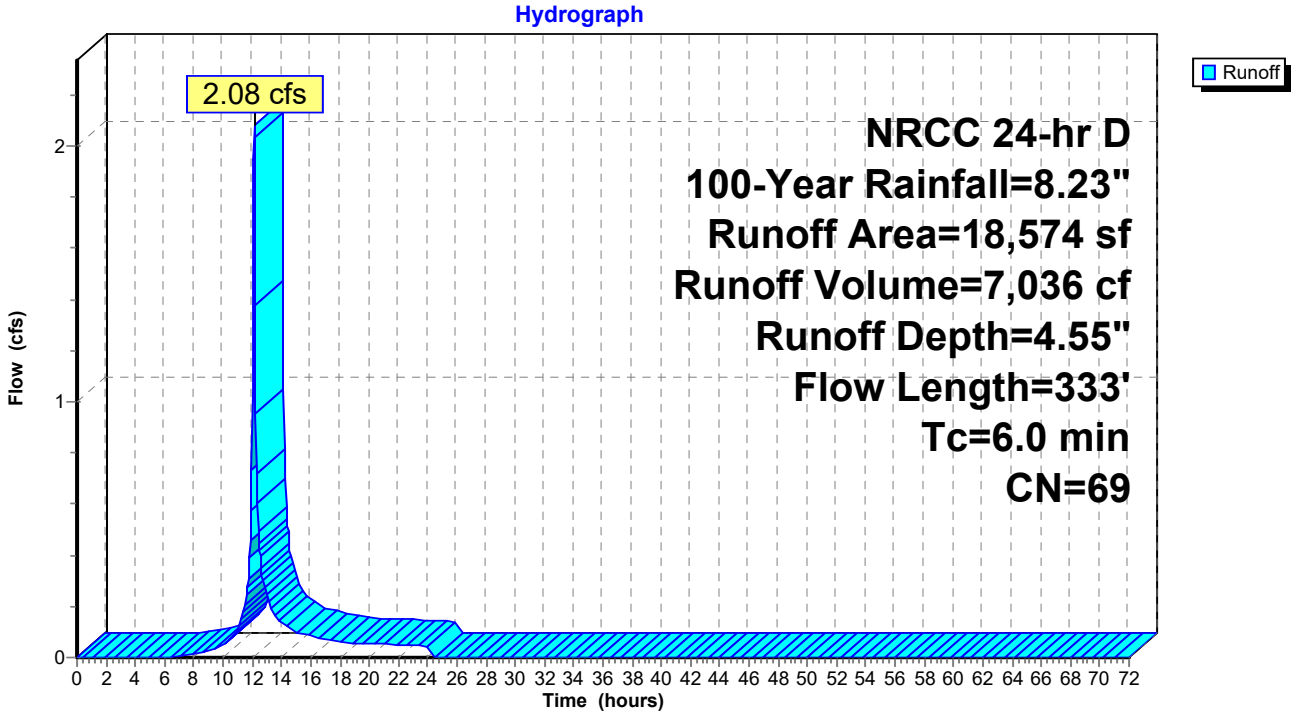
Runoff = 2.08 cfs @ 12.13 hrs, Volume= 7,036 cf, Depth= 4.55"
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
965	98	Roofs, HSG A
9,271	98	Paved parking, HSG A
7,853	32	Woods/grass comb., Good, HSG A
485	39	>75% Grass cover, Good, HSG A
18,574	69	Weighted Average
8,338		44.89% Pervious Area
10,236		55.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	12	0.0800	1.57		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.20"
0.3	36	0.0800	1.95		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	285	0.0100	2.03		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
2.7	333	Total, Increased to minimum Tc = 6.0 min			

Subcatchment E-2: Subcatchment E-2



Summary for Subcatchment E-3: Subcatchment E-3

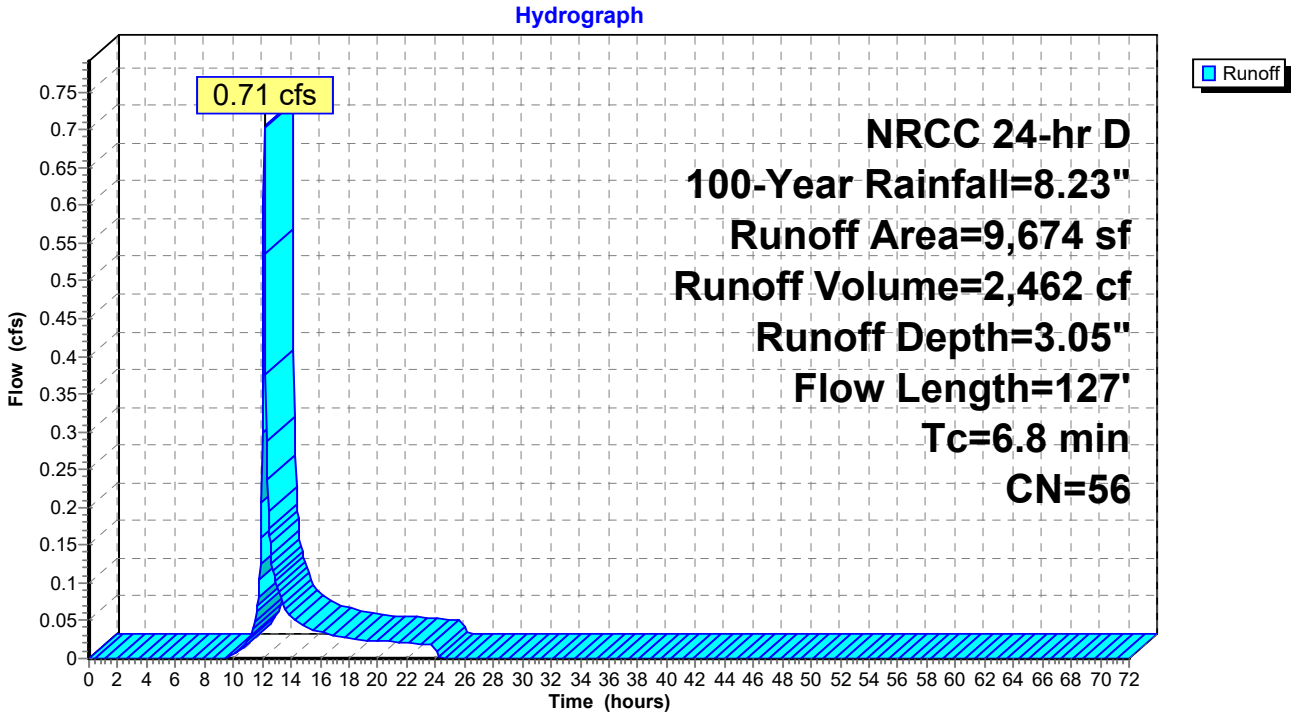
Runoff = 0.71 cfs @ 12.14 hrs, Volume= 2,462 cf, Depth= 3.05"
Routed to Reach SP-3 : Flow off-site to wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
886	98	Roofs, HSG A
2,447	98	Paved parking, HSG A
4,875	32	Woods/grass comb., Good, HSG A
1,466	39	>75% Grass cover, Good, HSG A
9,674	56	Weighted Average
6,341		65.55% Pervious Area
3,333		34.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0400	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	20	0.0500	1.44		**Sheet Flow, B-C** Smooth surfaces n= 0.011 P2= 3.20"
2.3	23	0.0400	0.17		**Sheet Flow, C-D** Grass: Short n= 0.150 P2= 3.20"
0.2	15	0.0600	1.46		**Sheet Flow, D-E** Smooth surfaces n= 0.011 P2= 3.20"
0.5	44	0.0400	1.40		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
6.8	127	Total			

Subcatchment E-3: Subcatchment E-3



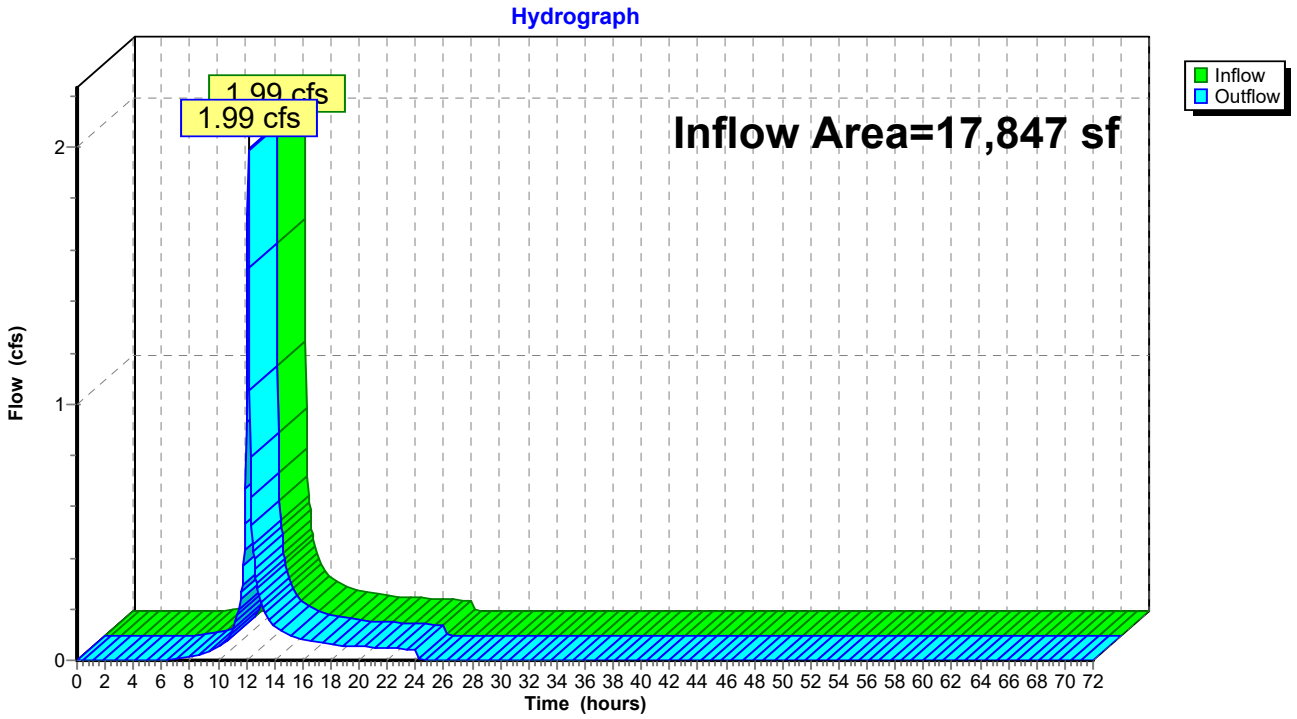
Summary for Reach SP-1: Flow to existing drainge on Pinevale Avenue

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

Inflow Area = 17,847 sf, 53.69% Impervious, Inflow Depth = 4.66" for 100-Year event
Inflow = 1.99 cfs @ 12.14 hrs, Volume= 6,934 cf
Outflow = 1.99 cfs @ 12.14 hrs, Volume= 6,934 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach SP-2 : Flow to exisitng drainge on Main Street

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

Reach SP-1: Flow to existing drainge on Pinevale Avenue



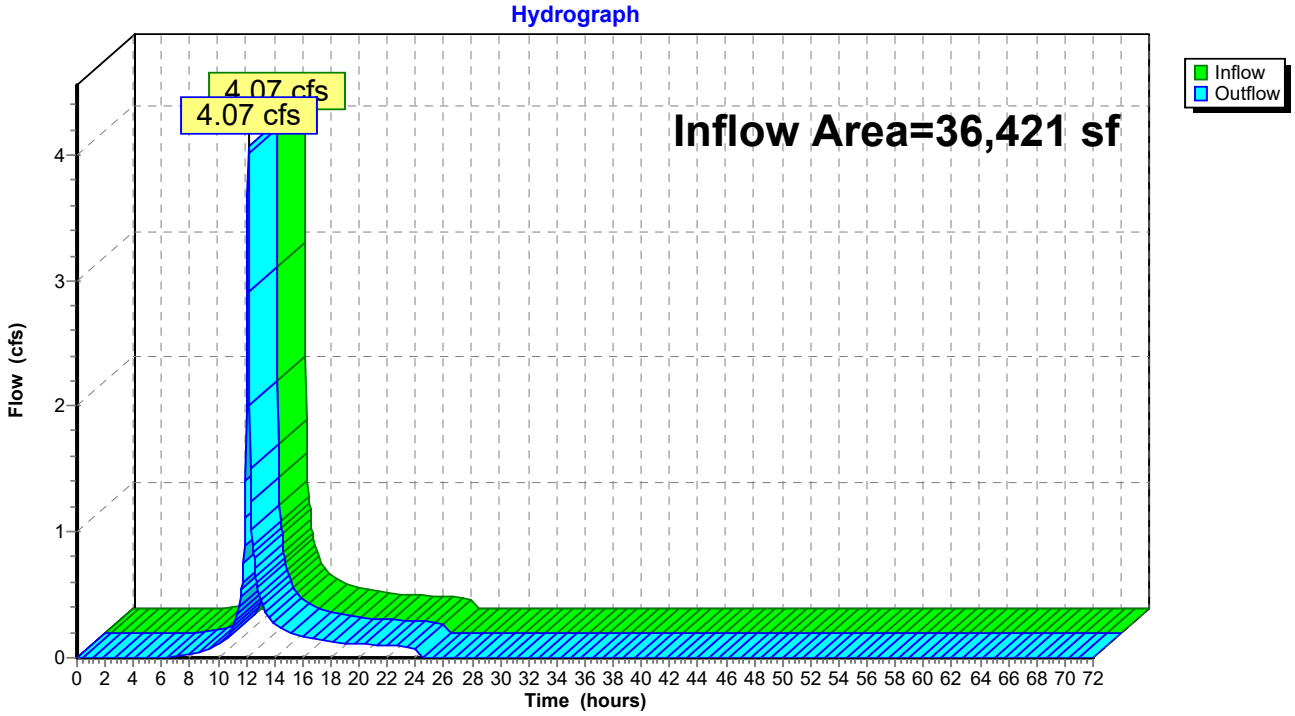
Summary for Reach SP-2: Flow to exisitng drainge on Main Street

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

Inflow Area = 36,421 sf, 54.41% Impervious, Inflow Depth = 4.60" for 100-Year event
Inflow = 4.07 cfs @ 12.14 hrs, Volume= 13,971 cf
Outflow = 4.07 cfs @ 12.14 hrs, Volume= 13,971 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-2: Flow to exisitng drainge on Main Street



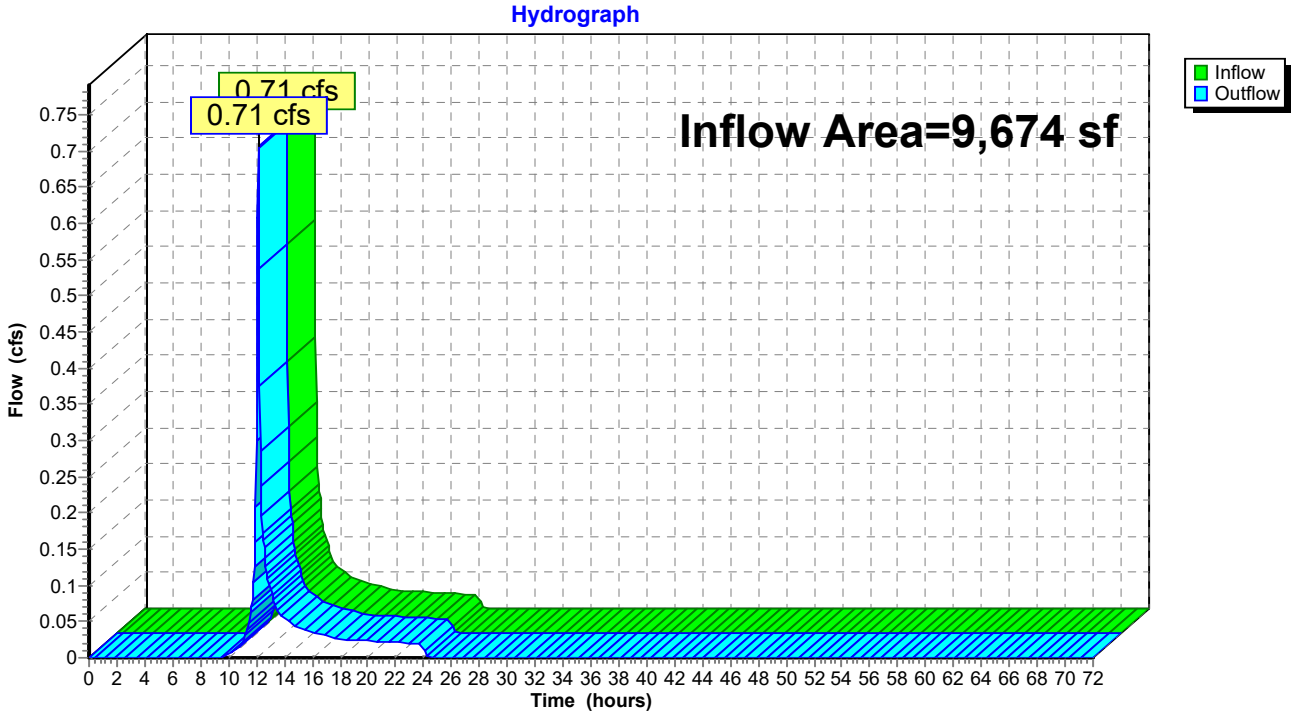
Summary for Reach SP-3: Flow off-site to wetlands

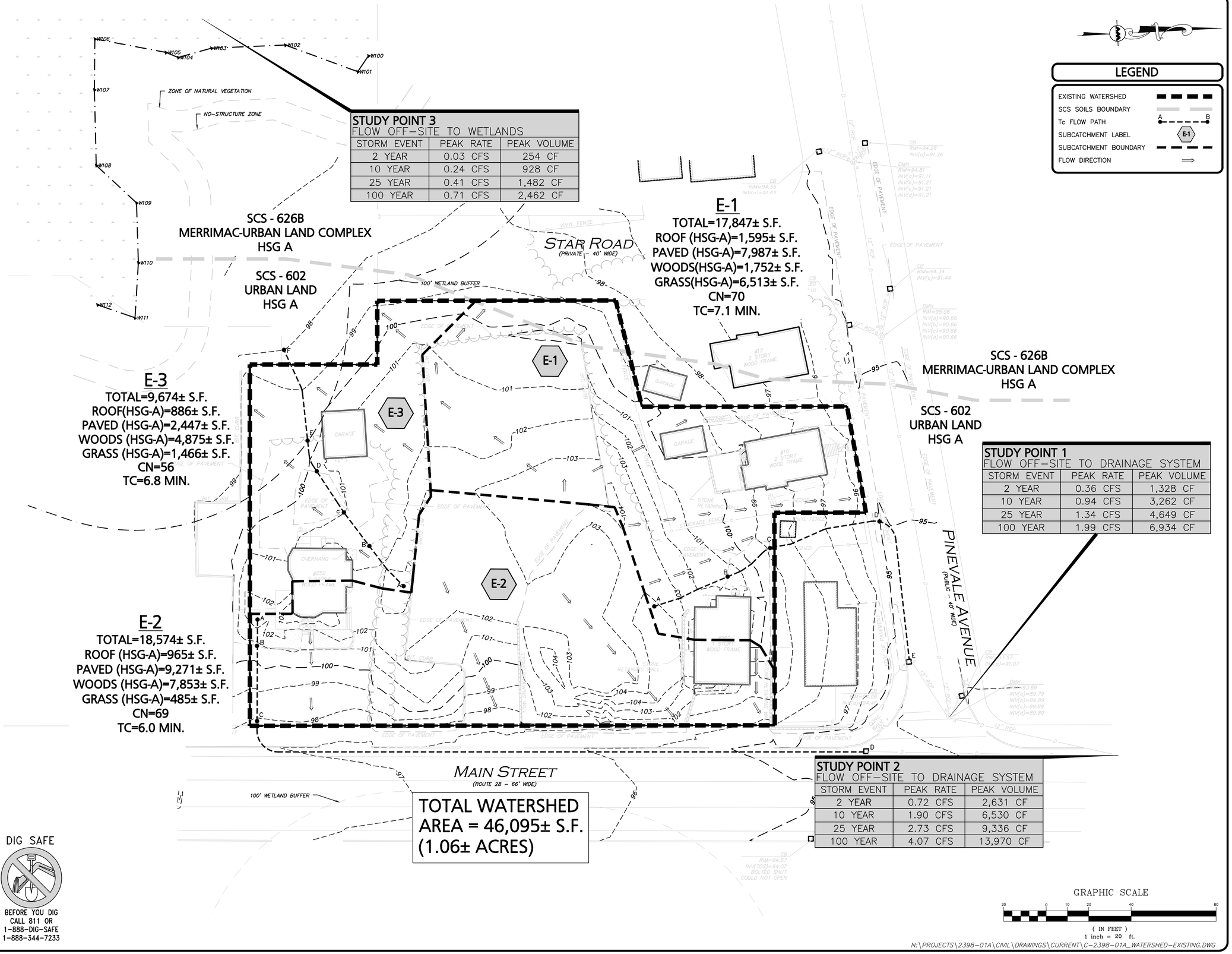
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9,674 sf, 34.45% Impervious, Inflow Depth = 3.05" for 100-Year event
Inflow = 0.71 cfs @ 12.14 hrs, Volume= 2,462 cf
Outflow = 0.71 cfs @ 12.14 hrs, Volume= 2,462 cf, Atten= 0%, Lag= 0.0 min

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

Reach SP-3: Flow off-site to wetlands





STUDY POINT 3
FLOW OFF-SITE TO WETLANDS

STORM EVENT	PEAK RATE	PEAK VOLUME
2 YEAR	0.03 CFS	254 CF
10 YEAR	0.24 CFS	928 CF
25 YEAR	0.41 CFS	1,482 CF
100 YEAR	0.71 CFS	2,462 CF

SCS - 626B
MERRIMAC-URBAN LAND COMPLEX
HSG A

SCS - 602
URBAN LAND
HSG A

E-1
TOTAL=17,847± S.F.
ROOF (HSG-A)=1,595± S.F.
PAVED (HSG-A)=7,987± S.F.
WOODS(HSG-A)=1,752± S.F.
GRASS(HSG-A)=6,513± S.F.
CN=70
TC=7.1 MIN.

SCS - 626B
MERRIMAC-URBAN LAND COMPLEX
HSG A

SCS - 602
URBAN LAND
HSG A

E-3
TOTAL=9,674± S.F.
ROOF(HSG-A)=886± S.F.
PAVED (HSG-A)=2,447± S.F.
WOODS (HSG-A)=4,875± S.F.
GRASS (HSG-A)=1,466± S.F.
CN=56
TC=6.8 MIN.

E-2
TOTAL=18,574± S.F.
ROOF (HSG-A)=965± S.F.
PAVED (HSG-A)=9,271± S.F.
WOODS (HSG-A)=7,853± S.F.
GRASS (HSG-A)=485± S.F.
CN=69
TC=6.0 MIN.

STUDY POINT 1
FLOW OFF-SITE TO DRAINAGE SYSTEM

STORM EVENT	PEAK RATE	PEAK VOLUME
2 YEAR	0.36 CFS	1,328 CF
10 YEAR	0.94 CFS	3,262 CF
25 YEAR	1.34 CFS	4,649 CF
100 YEAR	1.99 CFS	6,934 CF

STUDY POINT 2
FLOW OFF-SITE TO DRAINAGE SYSTEM

STORM EVENT	PEAK RATE	PEAK VOLUME
2 YEAR	0.72 CFS	2,631 CF
10 YEAR	1.90 CFS	6,530 CF
25 YEAR	2.73 CFS	9,336 CF
100 YEAR	4.07 CFS	13,970 CF

TOTAL WATERSHED AREA = 46,095± S.F. (1.06± ACRES)

LEGEND
- EXISTING WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A - B)
- SUBCATCHMENT LABEL (E-1)
- SUBCATCHMENT BOUNDARY
- FLOW DIRECTION

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

DIG SAFE
BEFORE YOU DIG
CALL 811 OR
1-888-DIG-SAFE
1-888-344-7233

N:\PROJECTS\2398-01A\CIVIL\DRAWINGS\CURRENT\C-2398-01A_WATERSHED-EXISTING.DWG

COMMONWEALTH OF MASSACHUSETTS
CARLTON M. QUINN
CIVIL
No.49923
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
B	3/25/2024	REVISED PER TOWN COMMENTS
A	2/29/2024	REVISED PER TOWN COMMENTS

APPLICANT/OWNER:
BLVD READING, LLC
c/o SAVERIO FULCINITI
1 SYLVAN STREET
PEABODY, MA 01960

PROJECT:

STRADA
MIXED USE BUILDING
258 MAIN STREET
READING, MA

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1" = 20'	DWG. NAME:	C-2398-01A
DESIGNED BY:	MTB	CHECKED BY:	CMQ

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
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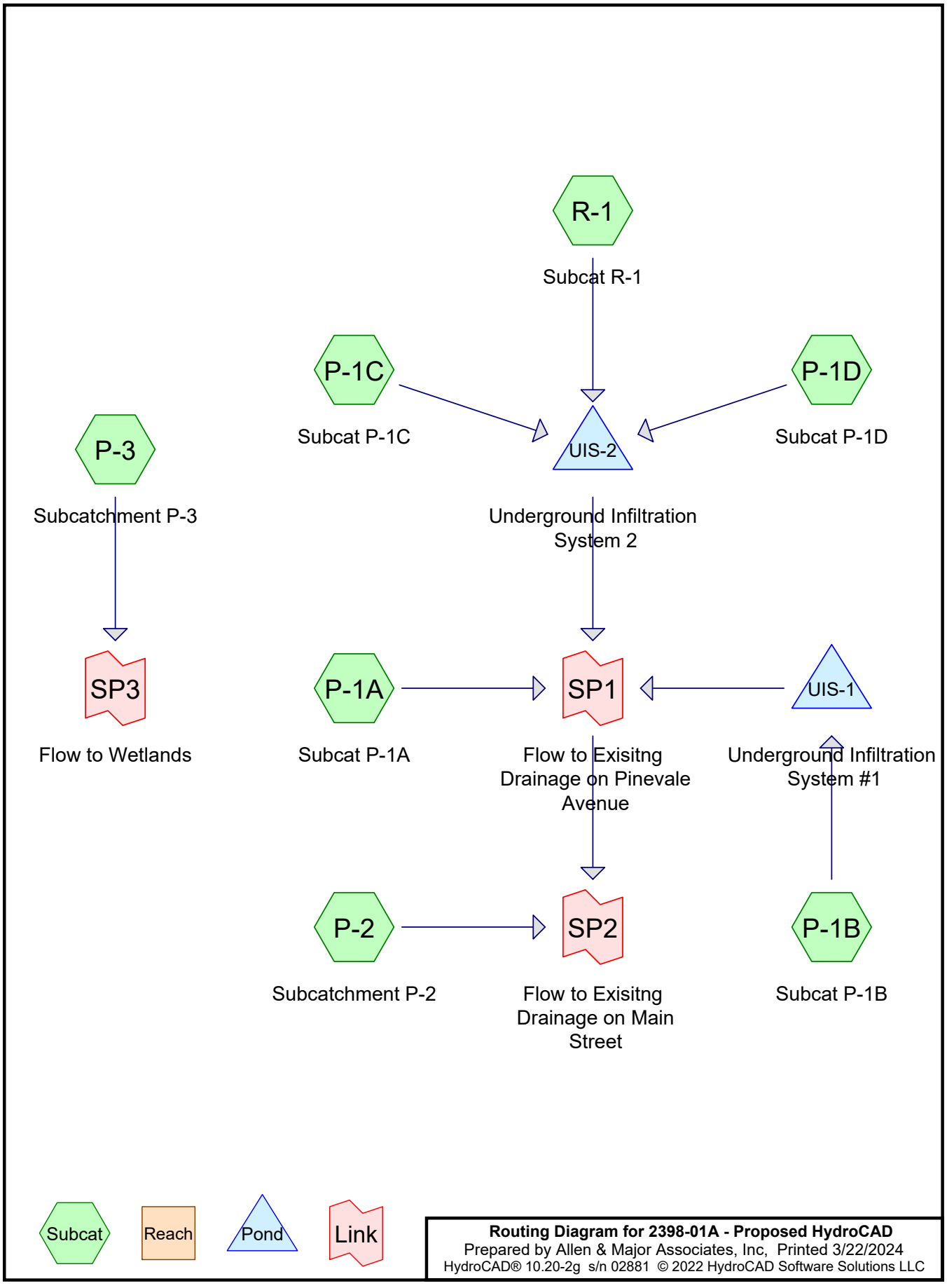
WOBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE: EXISTING WATERSHED PLAN

SHEET No. EWS-1

SECTION 5.0 -
PROPOSED DRAINAGE ANALYSIS



Routing Diagram for 2398-01A - Proposed HydroCAD
Prepared by Allen & Major Associates, Inc, Printed 3/22/2024

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 4245 MA Reading Middlesex County South
Rainfall events imported from "NRCS-Rain.txt" for 4245 MA Reading Middlesex County South

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.31	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	5.21	2
3	25-Year	NRCC 24-hr	D	Default	24.00	1	6.40	2
4	100-Year	NRCC 24-hr	D	Default	24.00	1	8.23	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
10,890	39	>75% Grass cover, Good, HSG A (P-1A, P-1B, P-1C, P-1D, P-2, P-3)
25,266	98	Paved parking, HSG A (P-1A, P-1B, P-1C, P-1D, P-2)
9,938	98	Roofs, HSG A (P-1A, P-1C, R-1)
46,095	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
46,095	HSG A	P-1A, P-1B, P-1C, P-1D, P-2, P-3, R-1
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
46,095		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
10,890	0	0	0	0	10,890	>75% Grass cover, Good	
25,266	0	0	0	0	25,266	Paved parking	
9,938	0	0	0	0	9,938	Roofs	
46,095	**0**	**0**	**0**	**0**	**46,095**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	UIS-1	94.75	93.75	100.0	0.0100	0.013	0.0	12.0	0.0
2	UIS-2	93.00	92.00	100.0	0.0100	0.013	0.0	12.0	0.0

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

Subcatchment P-1A: Subcat P-1A Runoff Area=4,271 sf 31.49% Impervious Runoff Depth=0.38"
Tc=6.0 min CN=58 Runoff=0.02 cfs 136 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=6,985 sf 87.39% Impervious Runoff Depth=2.36"
Tc=0.0 min CN=91 Runoff=0.45 cfs 1,375 cf

Subcatchment P-1C: Subcat P-1C Runoff Area=16,937 sf 69.86% Impervious Runoff Depth=1.49"
Tc=0.0 min CN=80 Runoff=0.72 cfs 2,099 cf

Subcatchment P-1D: Subcat P-1D Runoff Area=7,225 sf 88.12% Impervious Runoff Depth=2.36"
Tc=0.0 min CN=91 Runoff=0.47 cfs 1,422 cf

Subcatchment P-2: Subcatchment P-2 Runoff Area=1,141 sf 58.27% Impervious Runoff Depth=1.05"
Tc=6.0 min CN=73 Runoff=0.03 cfs 100 cf

Subcatchment P-3: Subcatchment P-3 Runoff Area=644 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment R-1: Subcat R-1 Runoff Area=8,892 sf 100.00% Impervious Runoff Depth=3.08"
Tc=0.0 min CN=98 Runoff=0.67 cfs 2,280 cf

Pond UIS-1: Underground Infiltration System #1 Peak Elev=93.98' Storage=315 cf Inflow=0.45 cfs 1,375 cf
Discarded=0.06 cfs 1,375 cf Primary=0.00 cfs 0 cf Outflow=0.06 cfs 1,375 cf

Pond UIS-2: Underground Infiltration System Peak Elev=94.42' Storage=1,646 cf Inflow=1.86 cfs 5,801 cf
Discarded=0.17 cfs 5,801 cf Primary=0.00 cfs 0 cf Outflow=0.17 cfs 5,801 cf

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue Inflow=0.02 cfs 136 cf
Primary=0.02 cfs 136 cf

Link SP2: Flow to Exisitng Drainage on Main Street Inflow=0.05 cfs 236 cf
Primary=0.05 cfs 236 cf

Link SP3: Flow to Wetlands Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 46,095 sf Runoff Volume = 7,411 cf Average Runoff Depth = 1.93"
23.63% Pervious = 10,890 sf 76.37% Impervious = 35,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

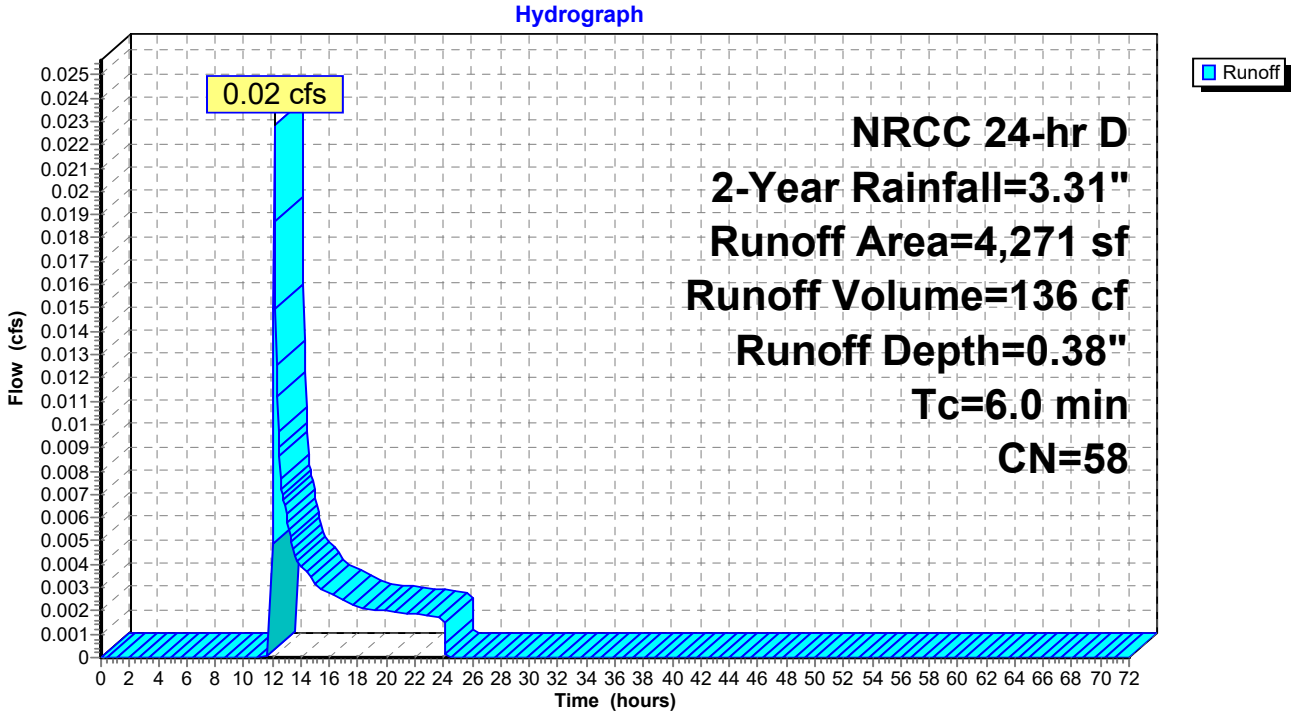
Runoff = 0.02 cfs @ 12.16 hrs, Volume= 136 cf, Depth= 0.38"
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
2,926	39	>75% Grass cover, Good, HSG A
490	98	Paved parking, HSG A
855	98	Roofs, HSG A
4,271	58	Weighted Average
2,926		68.51% Pervious Area
1,345		31.49% Impervious Area

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

Subcatchment P-1A: Subcat P-1A



Summary for Subcatchment P-1B: Subcat P-1B

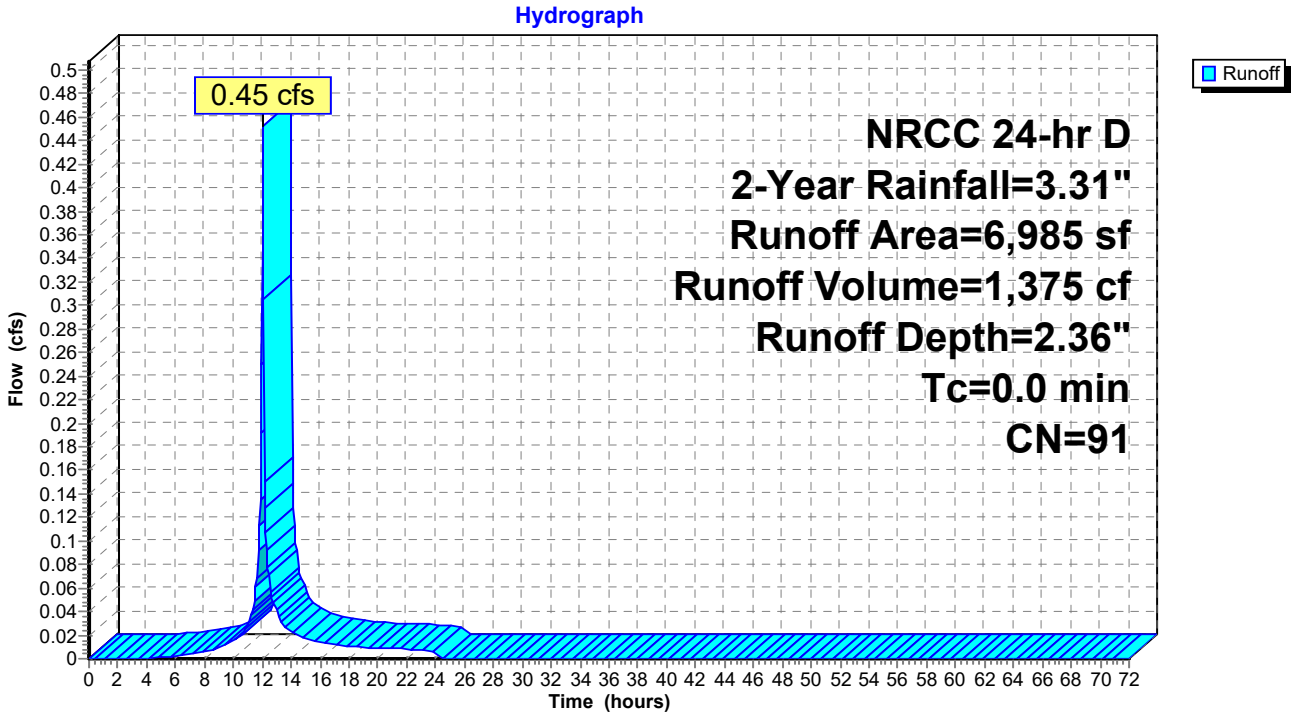
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.45 cfs @ 12.05 hrs, Volume= 1,375 cf, Depth= 2.36"
Routed to Pond UIS-1 : Underground Infiltration System #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
881	39	>75% Grass cover, Good, HSG A
6,105	98	Paved parking, HSG A
6,985	91	Weighted Average
881		12.61% Pervious Area
6,105		87.39% Impervious Area

Subcatchment P-1B: Subcat P-1B



Summary for Subcatchment P-1C: Subcat P-1C

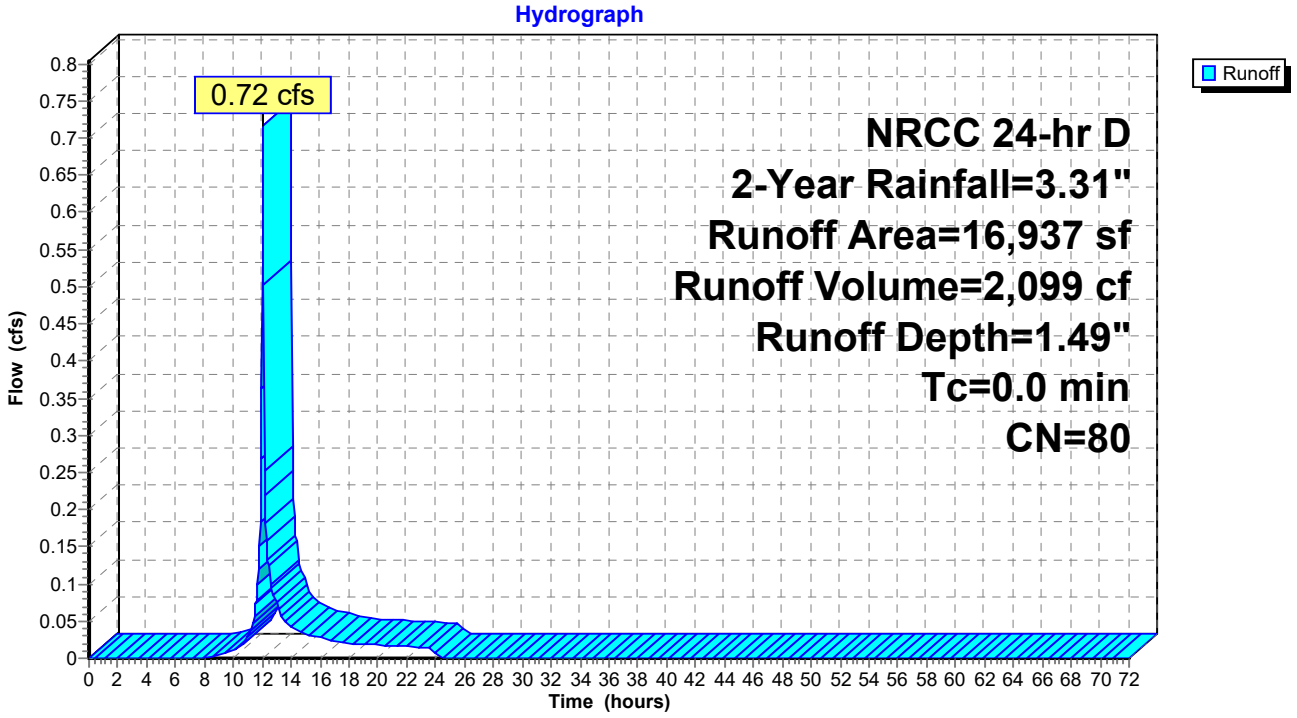
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.72 cfs @ 12.05 hrs, Volume= 2,099 cf, Depth= 1.49"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
5,105	39	>75% Grass cover, Good, HSG A
192	98	Roofs, HSG A
11,640	98	Paved parking, HSG A
16,937	80	Weighted Average
5,105		30.14% Pervious Area
11,832		69.86% Impervious Area

Subcatchment P-1C: Subcat P-1C



Summary for Subcatchment P-1D: Subcat P-1D

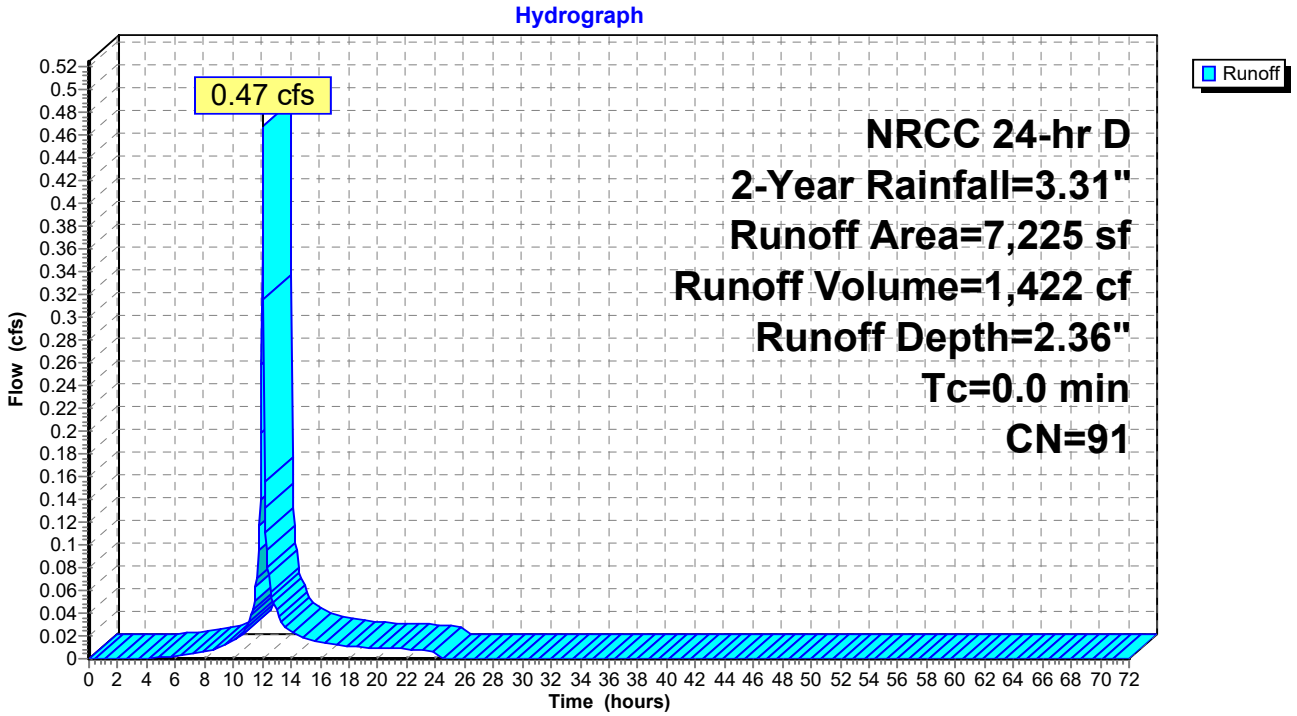
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.47 cfs @ 12.05 hrs, Volume= 1,422 cf, Depth= 2.36"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
858	39	>75% Grass cover, Good, HSG A
6,366	98	Paved parking, HSG A
7,225	91	Weighted Average
858		11.88% Pervious Area
6,366		88.12% Impervious Area

Subcatchment P-1D: Subcat P-1D



Summary for Subcatchment P-2: Subcatchment P-2

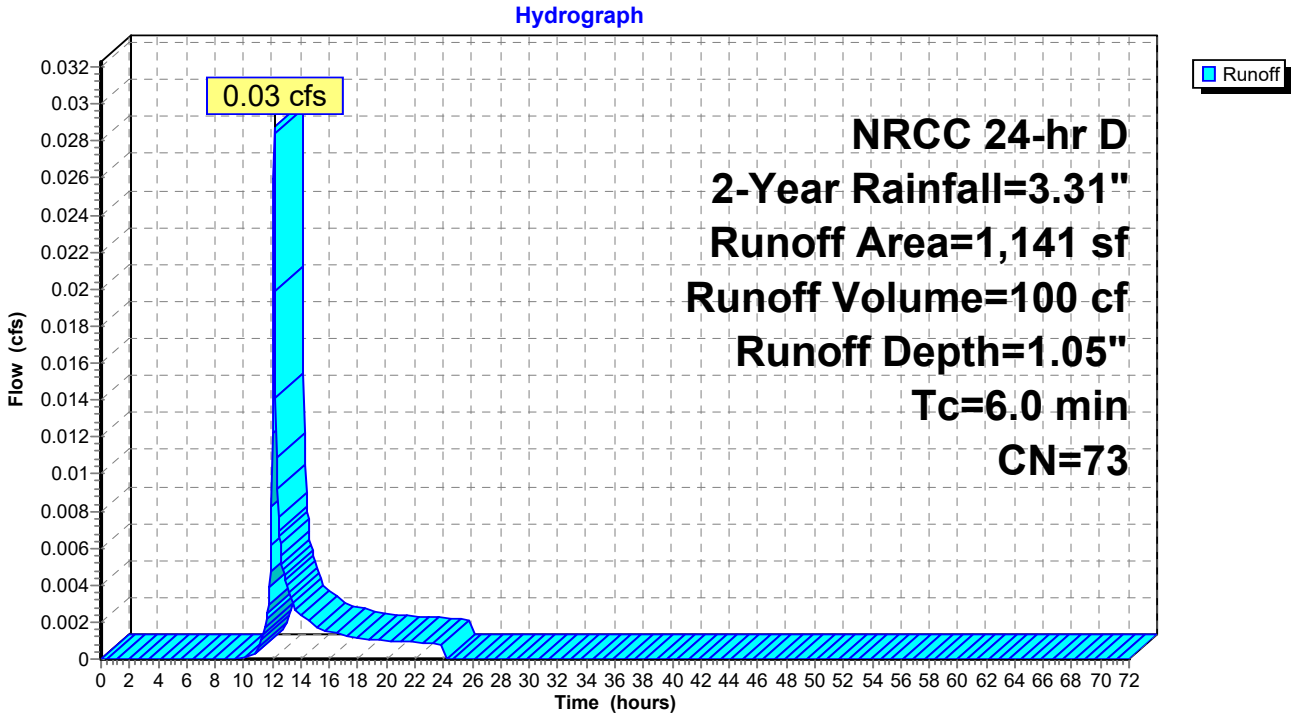
Runoff = 0.03 cfs @ 12.14 hrs, Volume= 100 cf, Depth= 1.05"
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
476	39	>75% Grass cover, Good, HSG A
665	98	Paved parking, HSG A
1,141	73	Weighted Average
476		41.73% Pervious Area
665		58.27% Impervious Area

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

Subcatchment P-2: Subcatchment P-2



Summary for Subcatchment P-3: Subcatchment P-3

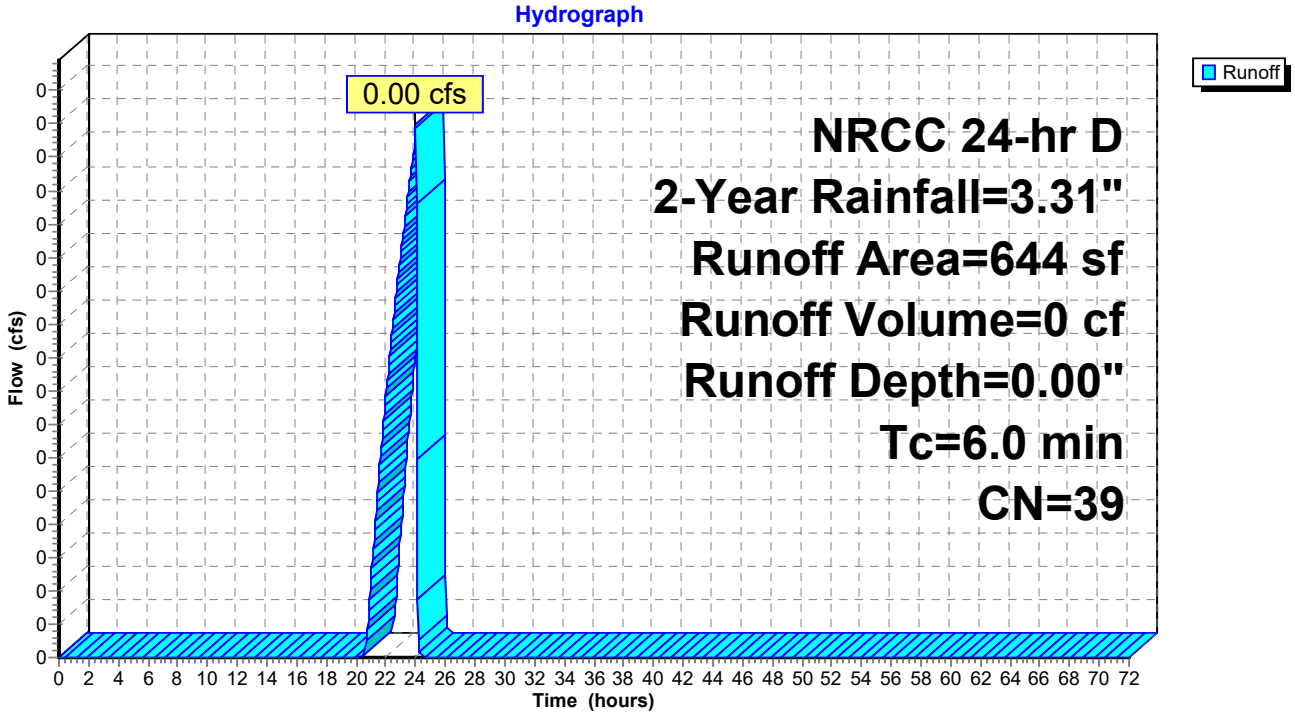
Runoff = 0.00 cfs @ 23.98 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP3 : Flow to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
644	39	>75% Grass cover, Good, HSG A
644		100.00% Pervious Area

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

Subcatchment P-3: Subcatchment P-3



Summary for Subcatchment R-1: Subcat R-1

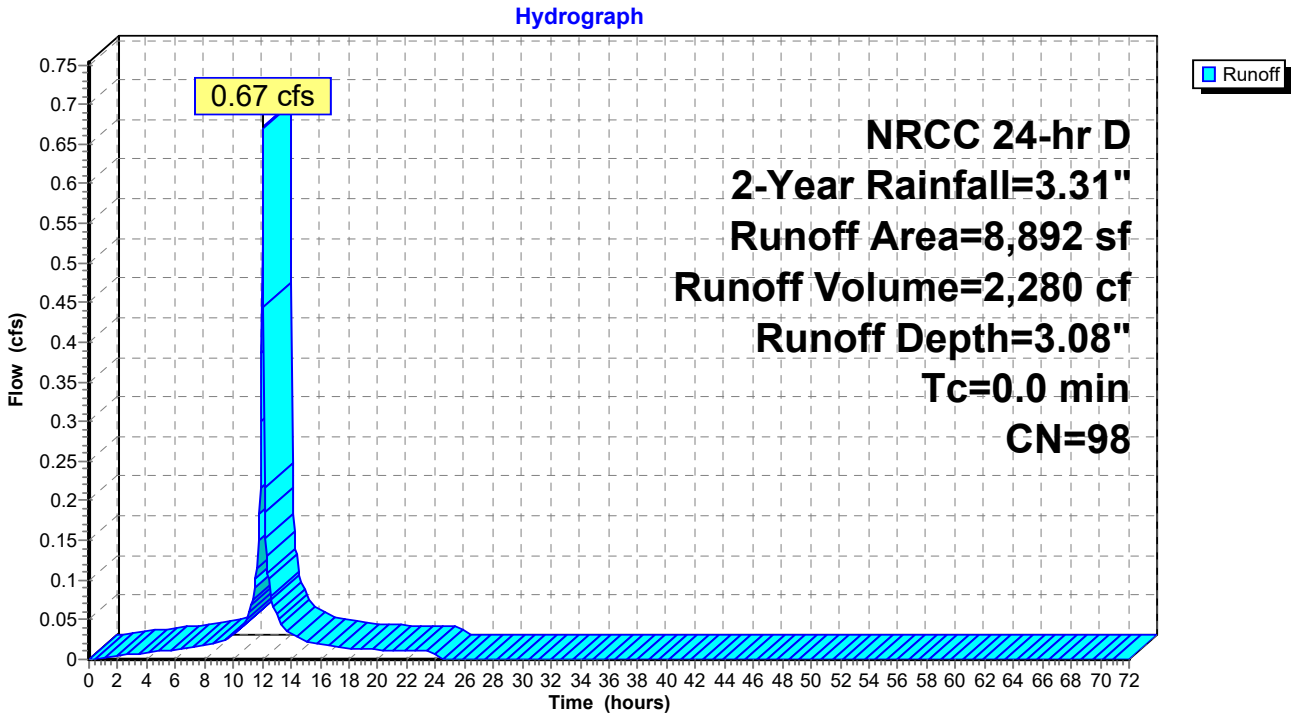
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.67 cfs @ 12.04 hrs, Volume= 2,280 cf, Depth= 3.08"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.31"

Area (sf)	CN	Description
8,892	98	Roofs, HSG A
8,892		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



Summary for Pond UIS-1: Underground Infiltration System #1

Inflow Area = 6,985 sf, 87.39% Impervious, Inflow Depth = 2.36" for 2-Year event
Inflow = 0.45 cfs @ 12.05 hrs, Volume= 1,375 cf
Outflow = 0.06 cfs @ 11.65 hrs, Volume= 1,375 cf, Atten= 87%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.65 hrs, Volume= 1,375 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 93.98' @ 12.52 hrs Surf.Area= 1,093 sf Storage= 315 cf

Plug-Flow detention time= 29.8 min calculated for 1,374 cf (100% of inflow)
Center-of-Mass det. time= 29.8 min (841.2 - 811.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.33'	686 cf	**18.17'W x 60.16'L x 2.33'H Field A** 2,550 cf Overall - 590 cf Embedded = 1,960 cf x 35.0% Voids
#2A	93.83'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 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 40 Chambers in 5 Rows
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.75'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.75' / 93.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	95.55'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.33'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 11.65 hrs HW=93.36' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.33' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UIS-1: Underground Infiltration System #1 - 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

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

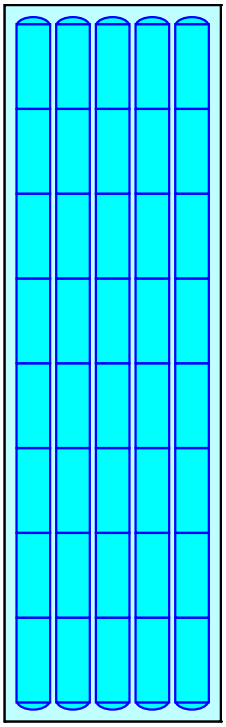
8 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 58.16' Row Length +12.0" End Stone x 2 = 60.16' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

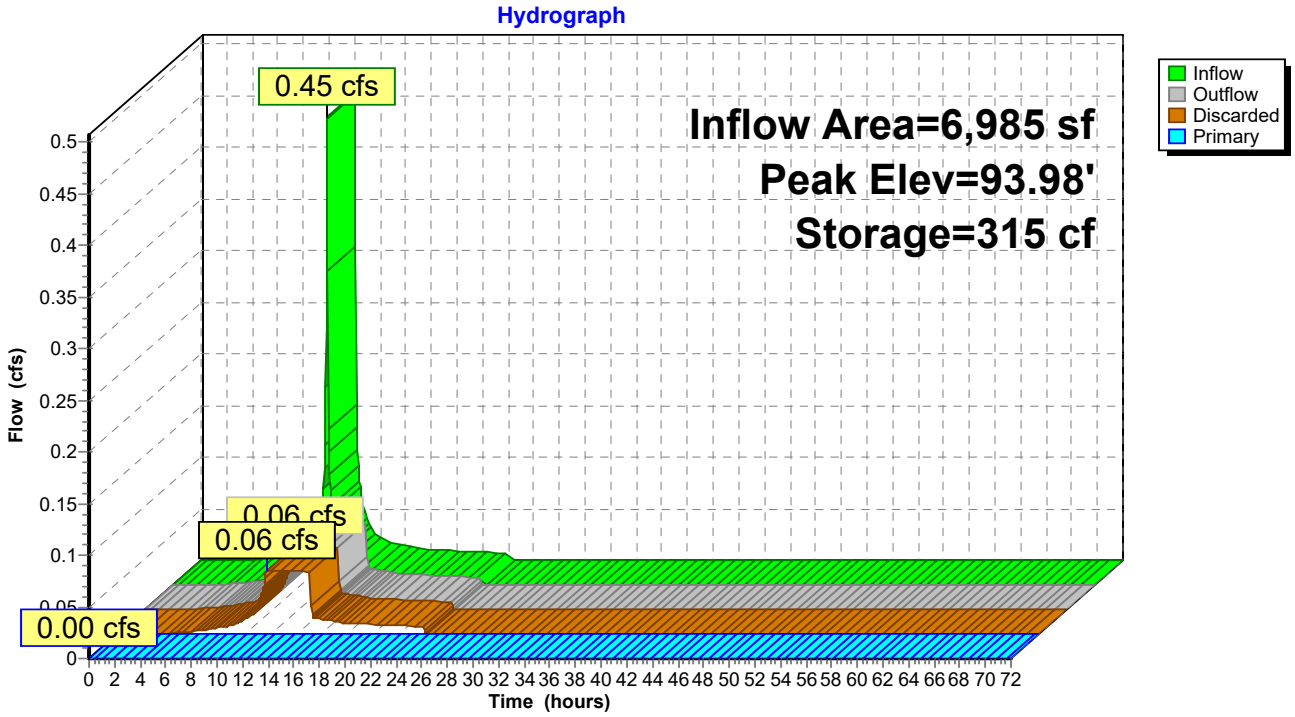
2,550.1 cf Field - 589.7 cf Chambers = 1,960.4 cf Stone x 35.0% Voids = 686.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,275.8 cf = 0.029 af
Overall Storage Efficiency = 50.0%
Overall System Size = 60.16' x 18.17' x 2.33'

40 Chambers
94.4 cy Field
72.6 cy Stone



Pond UIS-1: Underground Infiltration System #1



Summary for Pond UIS-2: Underground Infiltration System 2

Inflow Area = 33,054 sf, 81.96% Impervious, Inflow Depth = 2.11" for 2-Year event
Inflow = 1.86 cfs @ 12.05 hrs, Volume= 5,801 cf
Outflow = 0.17 cfs @ 11.50 hrs, Volume= 5,801 cf, Atten= 91%, Lag= 0.0 min
Discarded = 0.17 cfs @ 11.50 hrs, Volume= 5,801 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 94.42' @ 12.99 hrs Surf.Area= 3,039 sf Storage= 1,646 cf

Plug-Flow detention time= 66.6 min calculated for 5,797 cf (100% of inflow)
Center-of-Mass det. time= 66.5 min (873.9 - 807.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.50'	2,785 cf	**77.50'W x 39.22'L x 3.50'H Field A** 10,638 cf Overall - 3,675 cf Embedded = 6,962 cf x 40.0% Voids
#2A	94.00'	3,675 cf	**ADS_StormTech SC-740 +Cap** x 80 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 80 Chambers in 16 Rows
		6,460 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.00' / 92.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	96.77'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 11.50 hrs HW=93.54' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.50' (Free Discharge)
└**1=Culvert** (Passes 0.00 cfs of 0.75 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UIS-2: Underground Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

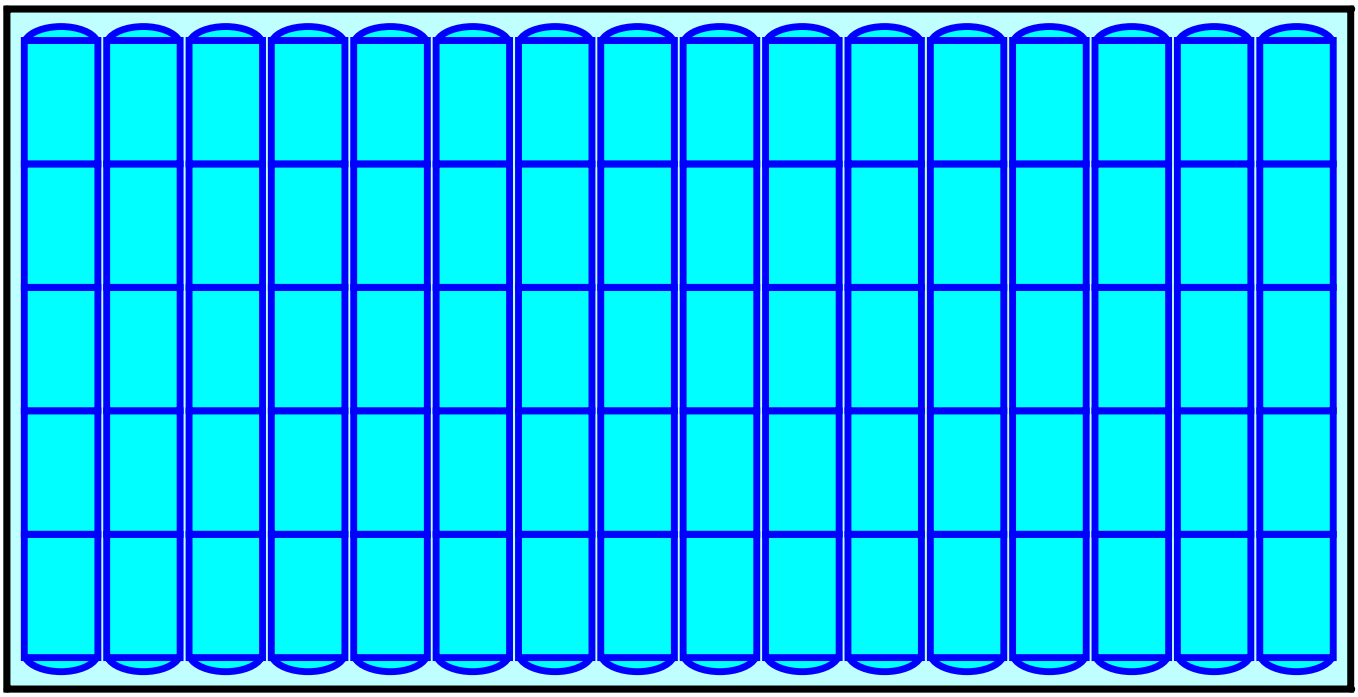
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
16 Rows x 51.0" Wide + 6.0" Spacing x 15 + 12.0" Side Stone x 2 = 77.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

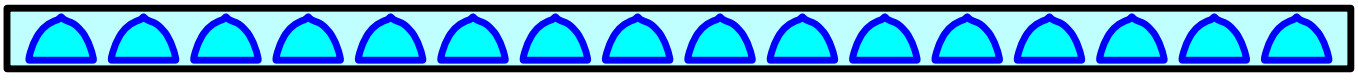
80 Chambers x 45.9 cf = 3,675.2 cf Chamber Storage

10,637.5 cf Field - 3,675.2 cf Chambers = 6,962.3 cf Stone x 40.0% Voids = 2,784.9 cf Stone Storage

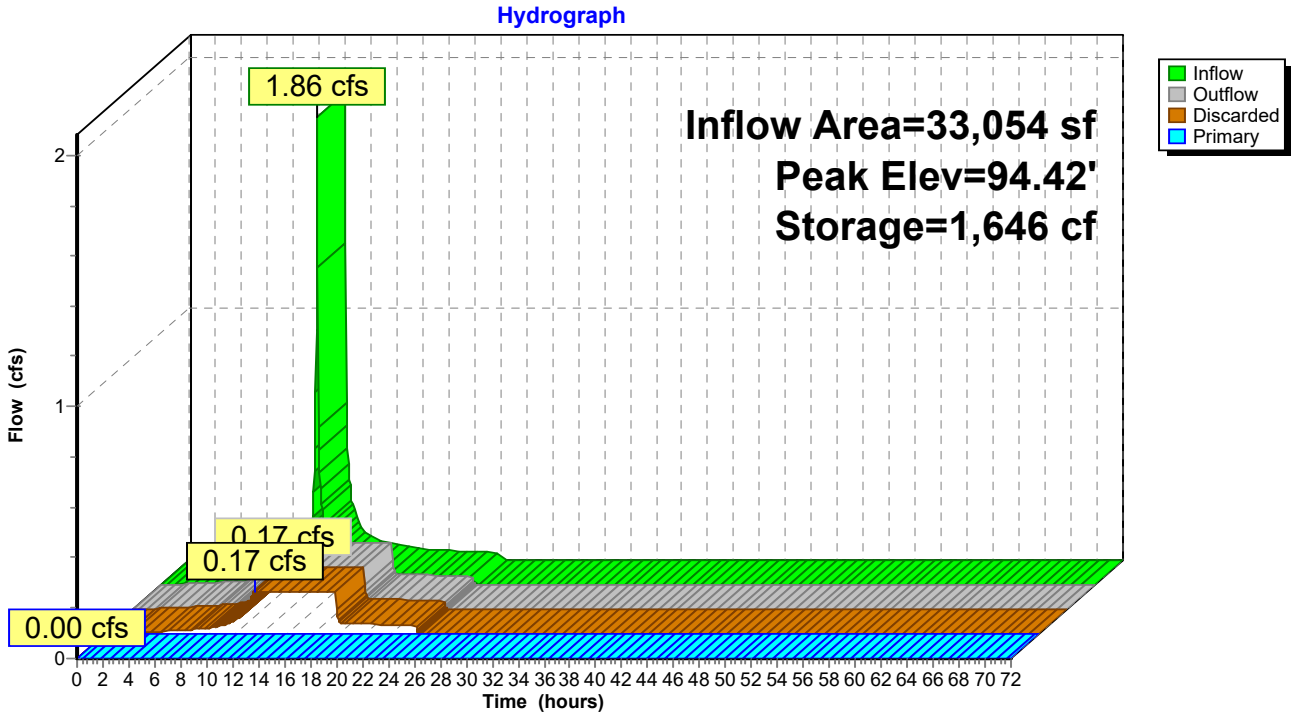
Chamber Storage + Stone Storage = 6,460.1 cf = 0.148 af
Overall Storage Efficiency = 60.7%
Overall System Size = 39.22' x 77.50' x 3.50'

80 Chambers
394.0 cy Field
257.9 cy Stone





Pond UIS-2: Underground Infiltration System 2

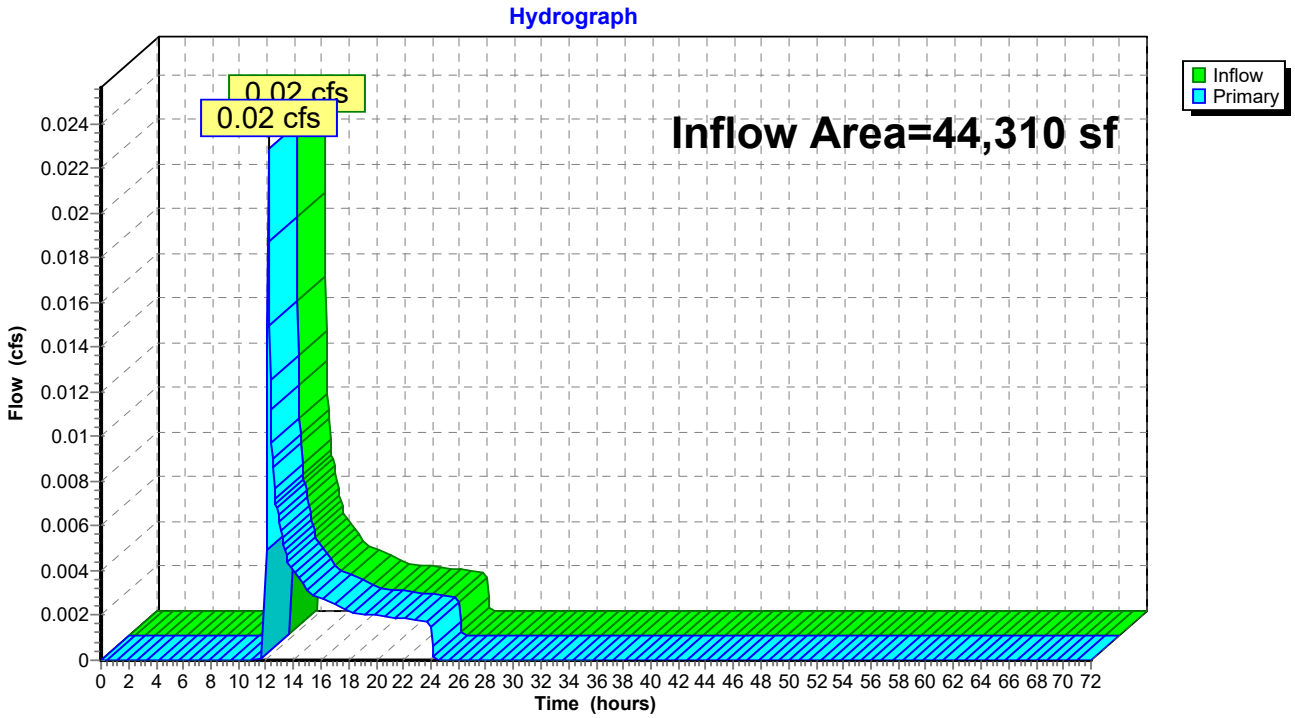


Summary for Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

Inflow Area = 44,310 sf, 77.95% Impervious, Inflow Depth = 0.04" for 2-Year event
Inflow = 0.02 cfs @ 12.16 hrs, Volume= 136 cf
Primary = 0.02 cfs @ 12.16 hrs, Volume= 136 cf, Atten= 0%, Lag= 0.0 min
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

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

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

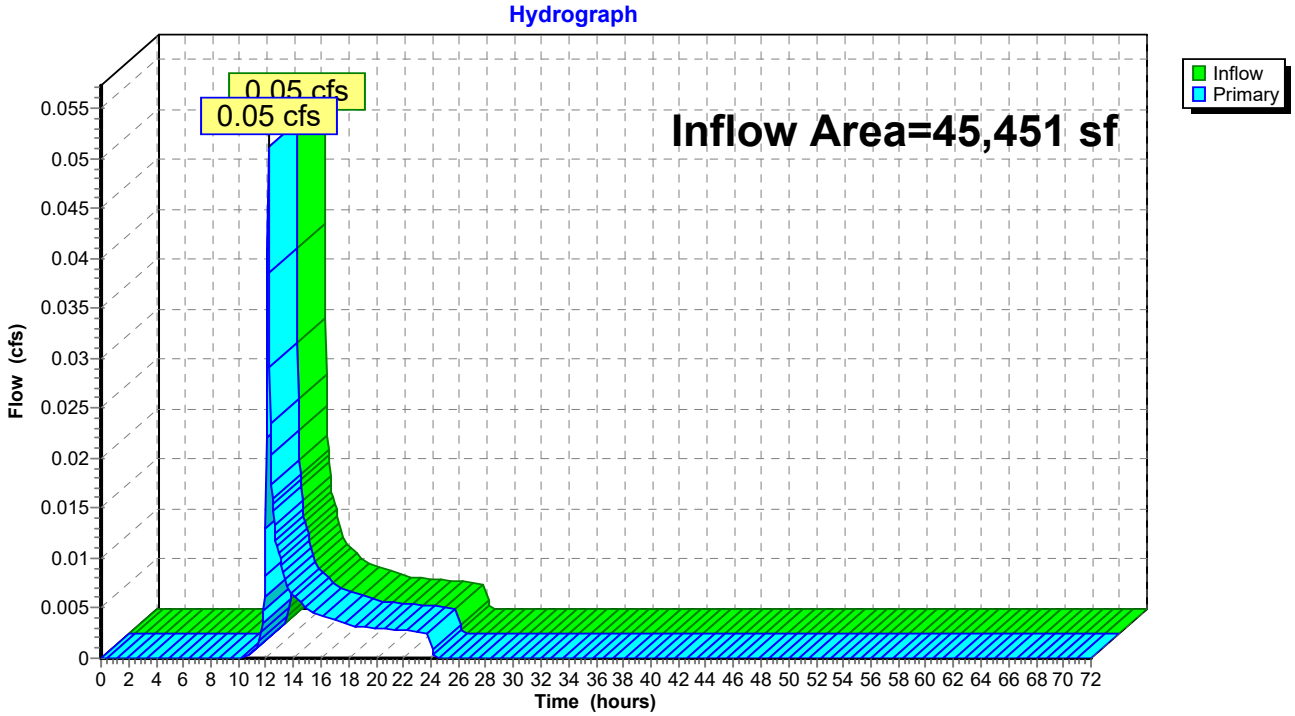


Summary for Link SP2: Flow to Exisitng Drainage on Main Street

Inflow Area = 45,451 sf, 77.46% Impervious, Inflow Depth = 0.06" for 2-Year event
Inflow = 0.05 cfs @ 12.15 hrs, Volume= 236 cf
Primary = 0.05 cfs @ 12.15 hrs, Volume= 236 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP2: Flow to Exisitng Drainage on Main Street

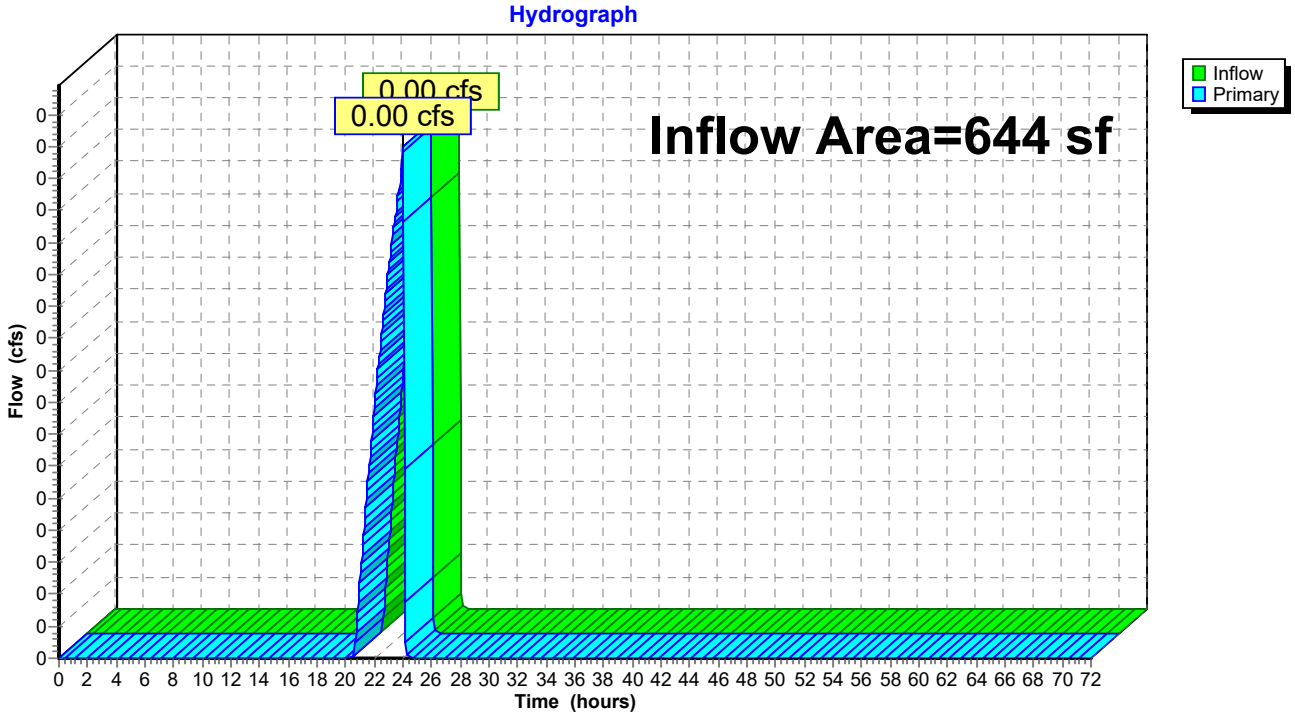


Summary for Link SP3: Flow to Wetlands

Inflow Area = 644 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 23.98 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 23.98 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP3: Flow to Wetlands



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

Subcatchment P-1A: Subcat P-1A Runoff Area=4,271 sf 31.49% Impervious Runoff Depth=1.29"
Tc=6.0 min CN=58 Runoff=0.13 cfs 458 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=6,985 sf 87.39% Impervious Runoff Depth=4.19"
Tc=0.0 min CN=91 Runoff=0.78 cfs 2,437 cf

Subcatchment P-1C: Subcat P-1C Runoff Area=16,937 sf 69.86% Impervious Runoff Depth=3.08"
Tc=0.0 min CN=80 Runoff=1.47 cfs 4,343 cf

Subcatchment P-1D: Subcat P-1D Runoff Area=7,225 sf 88.12% Impervious Runoff Depth=4.19"
Tc=0.0 min CN=91 Runoff=0.80 cfs 2,520 cf

Subcatchment P-2: Subcatchment P-2 Runoff Area=1,141 sf 58.27% Impervious Runoff Depth=2.45"
Tc=6.0 min CN=73 Runoff=0.07 cfs 233 cf

Subcatchment P-3: Subcatchment P-3 Runoff Area=644 sf 0.00% Impervious Runoff Depth=0.24"
Tc=6.0 min CN=39 Runoff=0.00 cfs 13 cf

Subcatchment R-1: Subcat R-1 Runoff Area=8,892 sf 100.00% Impervious Runoff Depth=4.97"
Tc=0.0 min CN=98 Runoff=1.07 cfs 3,685 cf

Pond UIS-1: Underground Infiltration System #1 Peak Elev=94.56' Storage=756 cf Inflow=0.78 cfs 2,437 cf
Discarded=0.06 cfs 2,437 cf Primary=0.00 cfs 0 cf Outflow=0.06 cfs 2,437 cf

Pond UIS-2: Underground Infiltration System Peak Elev=95.48' Storage=4,074 cf Inflow=3.34 cfs 10,548 cf
Discarded=0.17 cfs 10,549 cf Primary=0.00 cfs 0 cf Outflow=0.17 cfs 10,549 cf

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue Inflow=0.13 cfs 458 cf
Primary=0.13 cfs 458 cf

Link SP2: Flow to Exisitng Drainage on Main Street Inflow=0.19 cfs 690 cf
Primary=0.19 cfs 690 cf

Link SP3: Flow to Wetlands Inflow=0.00 cfs 13 cf
Primary=0.00 cfs 13 cf

Total Runoff Area = 46,095 sf Runoff Volume = 13,688 cf Average Runoff Depth = 3.56"
23.63% Pervious = 10,890 sf 76.37% Impervious = 35,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

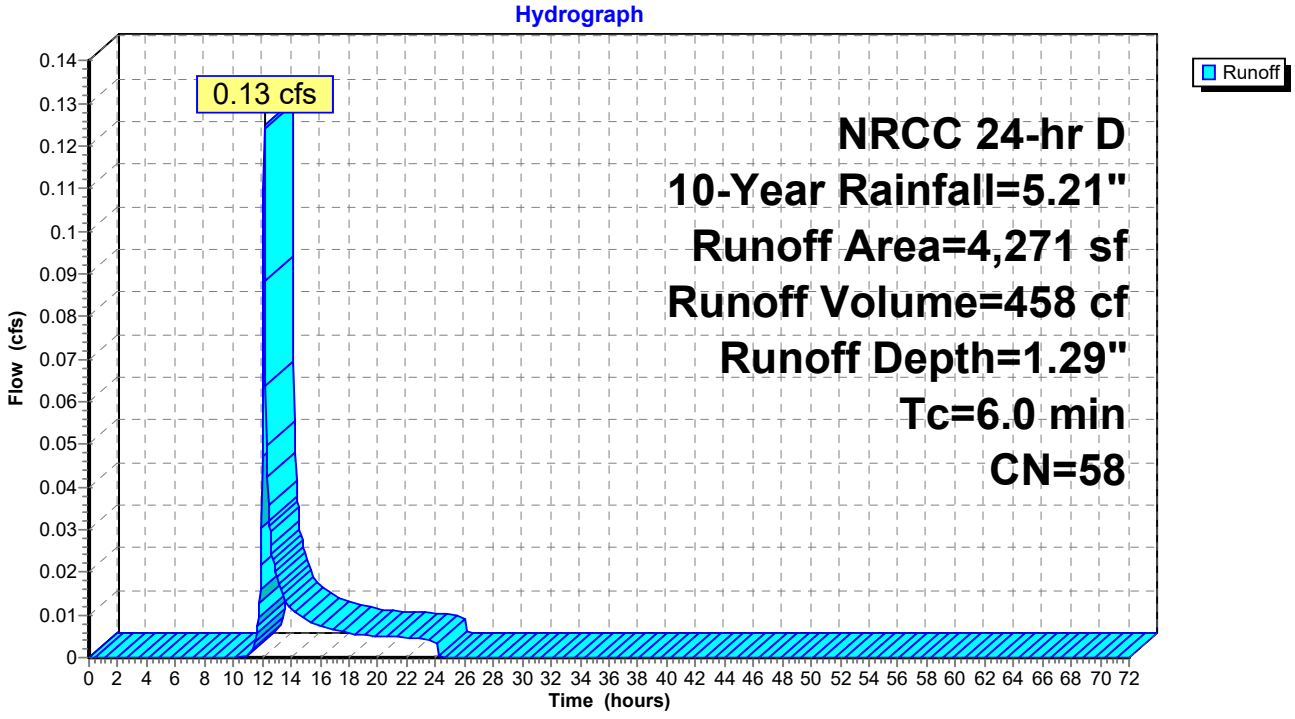
Runoff = 0.13 cfs @ 12.14 hrs, Volume= 458 cf, Depth= 1.29"
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
2,926	39	>75% Grass cover, Good, HSG A
490	98	Paved parking, HSG A
855	98	Roofs, HSG A
4,271	58	Weighted Average
2,926		68.51% Pervious Area
1,345		31.49% Impervious Area

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

Subcatchment P-1A: Subcat P-1A



Summary for Subcatchment P-1B: Subcat P-1B

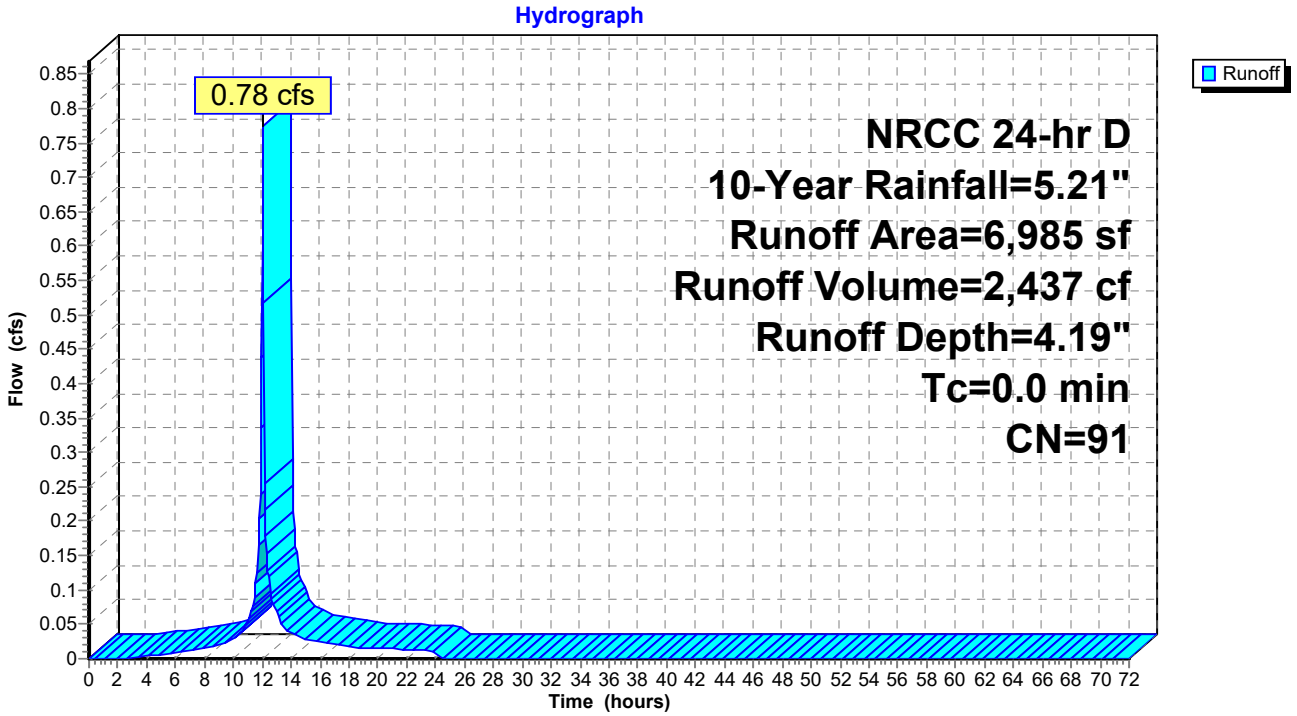
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.78 cfs @ 12.04 hrs, Volume= 2,437 cf, Depth= 4.19"
Routed to Pond UIS-1 : Underground Infiltration System #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
881	39	>75% Grass cover, Good, HSG A
6,105	98	Paved parking, HSG A
6,985	91	Weighted Average
881		12.61% Pervious Area
6,105		87.39% Impervious Area

Subcatchment P-1B: Subcat P-1B



Summary for Subcatchment P-1C: Subcat P-1C

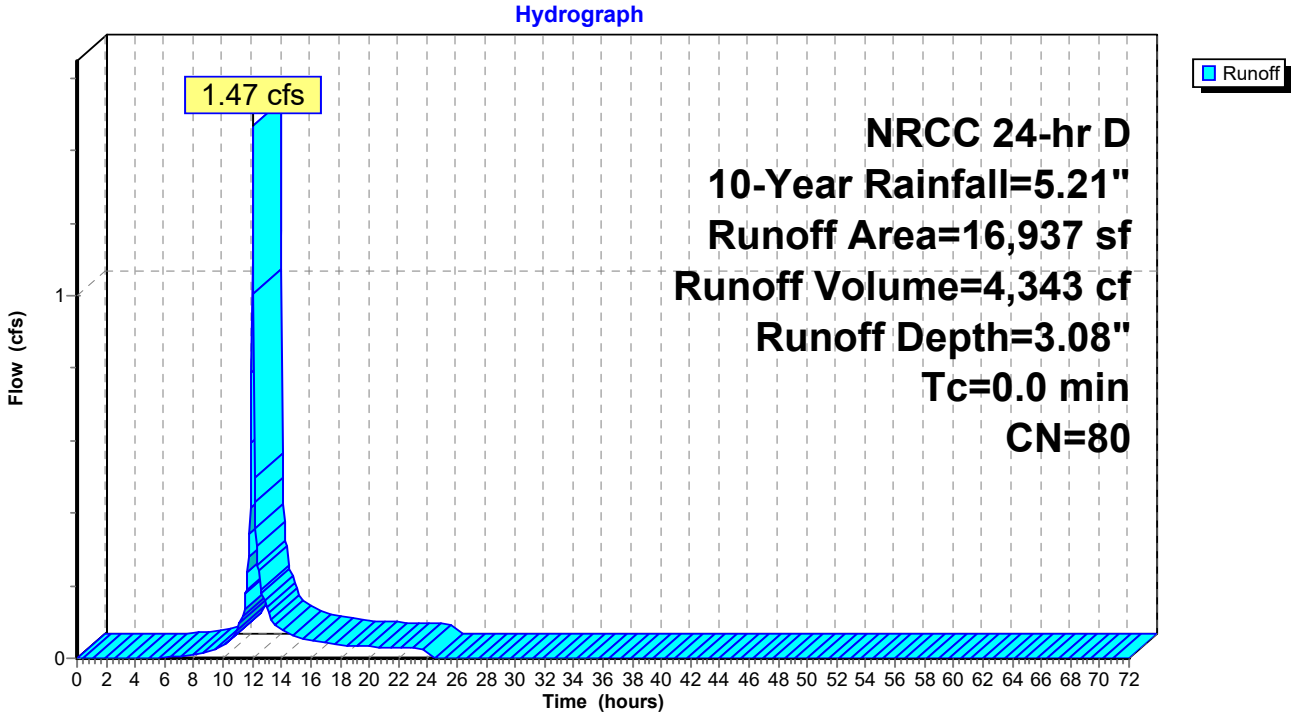
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.47 cfs @ 12.05 hrs, Volume= 4,343 cf, Depth= 3.08"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
5,105	39	>75% Grass cover, Good, HSG A
192	98	Roofs, HSG A
11,640	98	Paved parking, HSG A
16,937	80	Weighted Average
5,105		30.14% Pervious Area
11,832		69.86% Impervious Area

Subcatchment P-1C: Subcat P-1C



Summary for Subcatchment P-1D: Subcat P-1D

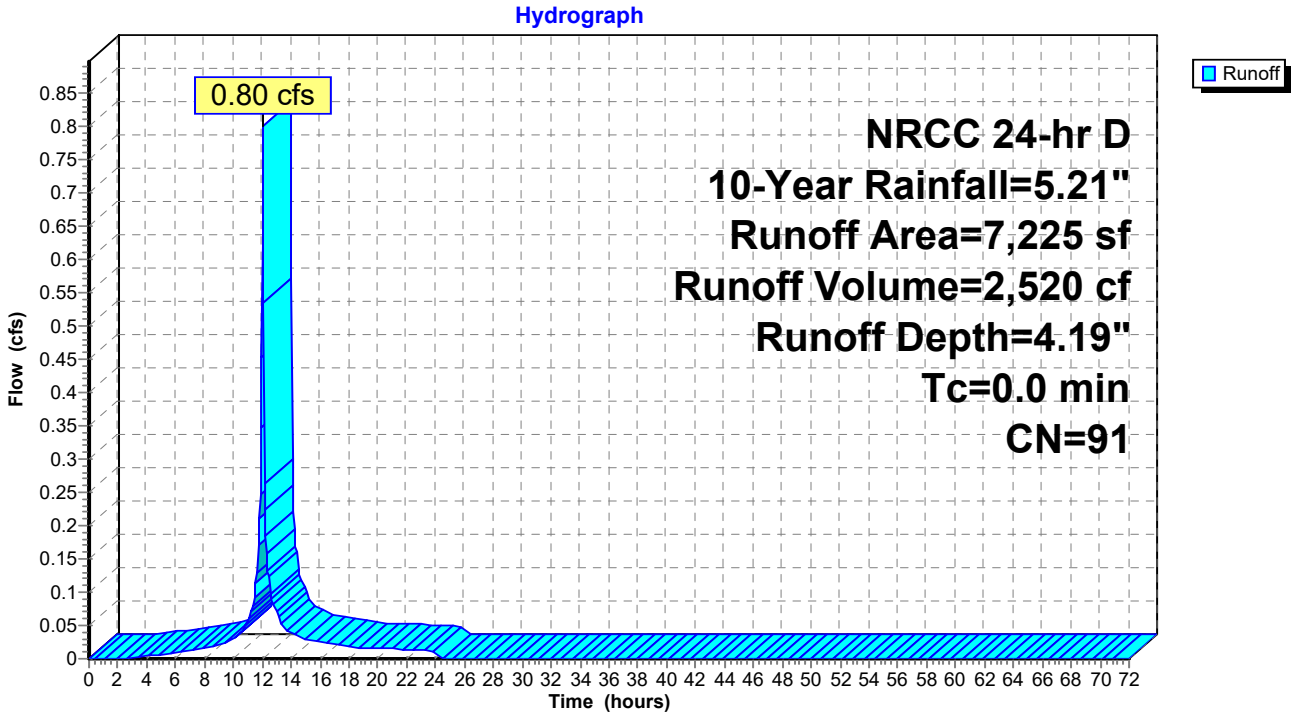
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.80 cfs @ 12.04 hrs, Volume= 2,520 cf, Depth= 4.19"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
858	39	>75% Grass cover, Good, HSG A
6,366	98	Paved parking, HSG A
7,225	91	Weighted Average
858		11.88% Pervious Area
6,366		88.12% Impervious Area

Subcatchment P-1D: Subcat P-1D



Summary for Subcatchment P-2: Subcatchment P-2

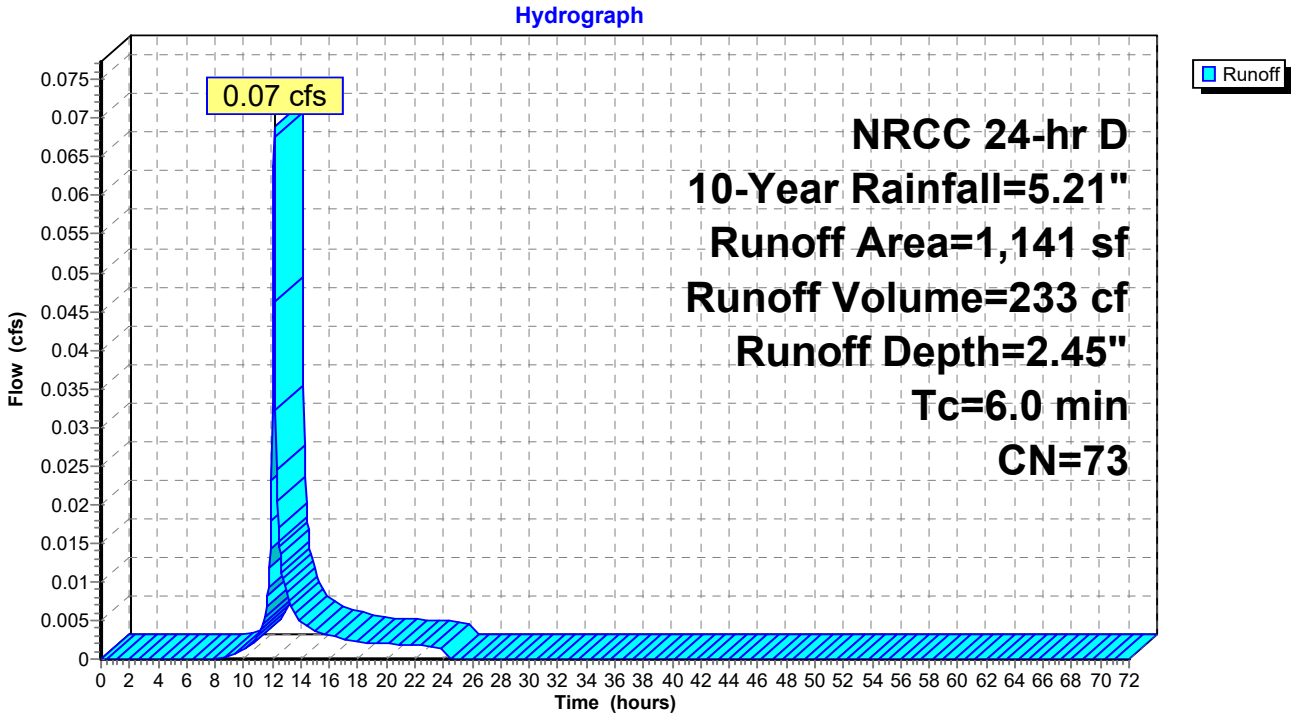
Runoff = 0.07 cfs @ 12.13 hrs, Volume= 233 cf, Depth= 2.45"
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
476	39	>75% Grass cover, Good, HSG A
665	98	Paved parking, HSG A
1,141	73	Weighted Average
476		41.73% Pervious Area
665		58.27% Impervious Area

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

Subcatchment P-2: Subcatchment P-2



Summary for Subcatchment P-3: Subcatchment P-3

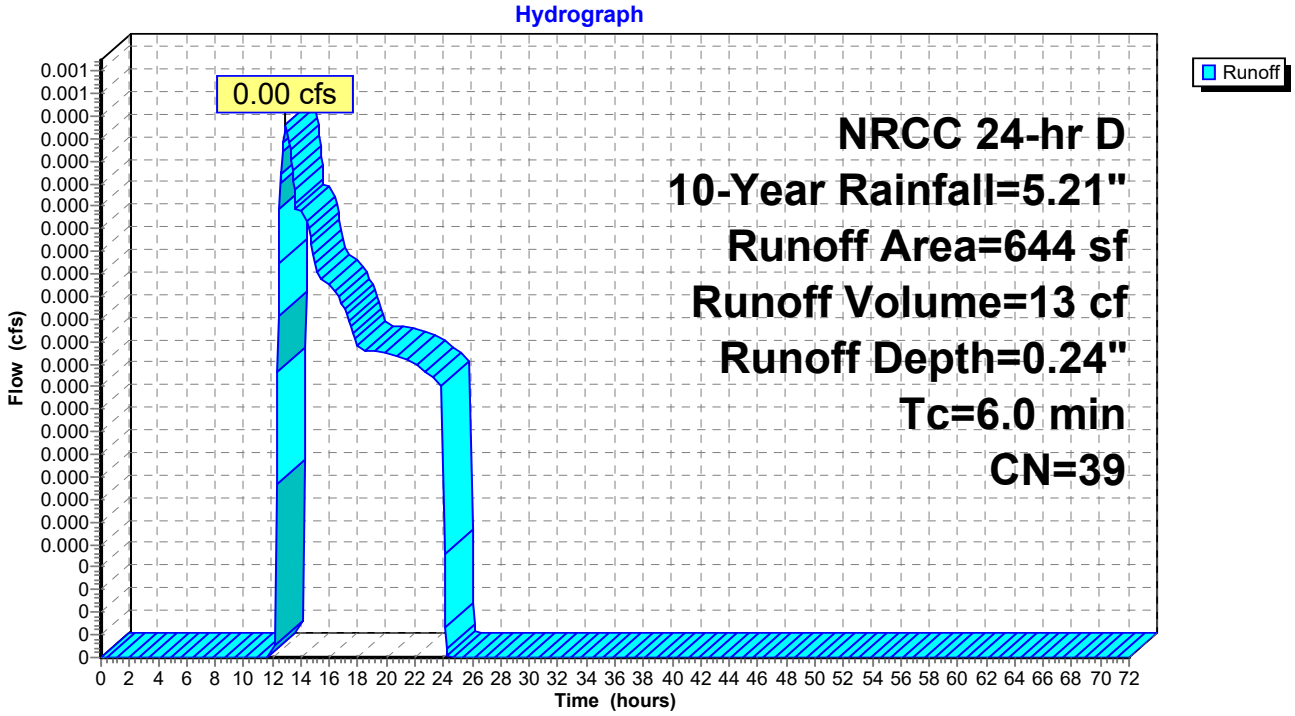
Runoff = 0.00 cfs @ 12.95 hrs, Volume= 13 cf, Depth= 0.24"
Routed to Link SP3 : Flow to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
644	39	>75% Grass cover, Good, HSG A
644		100.00% Pervious Area

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

Subcatchment P-3: Subcatchment P-3



Summary for Subcatchment R-1: Subcat R-1

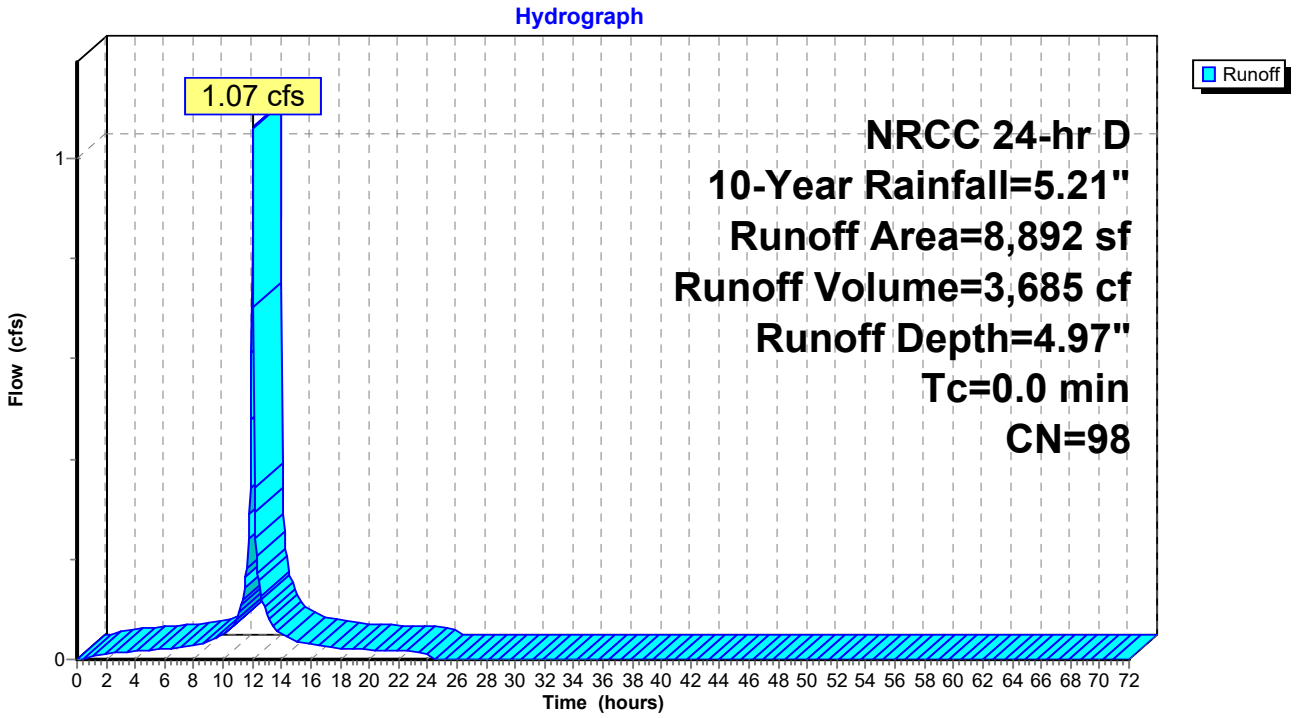
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.07 cfs @ 12.04 hrs, Volume= 3,685 cf, Depth= 4.97"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=5.21"

Area (sf)	CN	Description
8,892	98	Roofs, HSG A
8,892		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



Summary for Pond UIS-1: Underground Infiltration System #1

Inflow Area = 6,985 sf, 87.39% Impervious, Inflow Depth = 4.19" for 10-Year event
Inflow = 0.78 cfs @ 12.04 hrs, Volume= 2,437 cf
Outflow = 0.06 cfs @ 11.15 hrs, Volume= 2,437 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.15 hrs, Volume= 2,437 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 94.56' @ 13.10 hrs Surf.Area= 1,093 sf Storage= 756 cf

Plug-Flow detention time= 86.1 min calculated for 2,435 cf (100% of inflow)
Center-of-Mass det. time= 86.1 min (877.1 - 791.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.33'	686 cf	**18.17'W x 60.16'L x 2.33'H Field A** 2,550 cf Overall - 590 cf Embedded = 1,960 cf x 35.0% Voids
#2A	93.83'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 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 40 Chambers in 5 Rows
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.75'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.75' / 93.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	95.55'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.33'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 11.15 hrs HW=93.36' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.33' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UIS-1: Underground Infiltration System #1 - 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

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

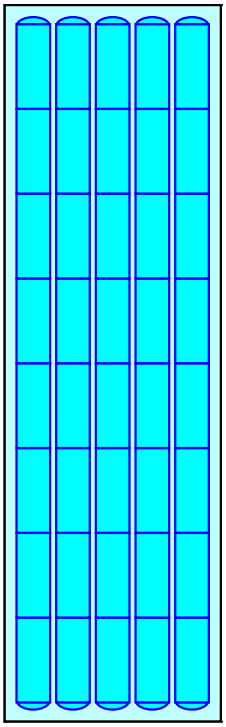
8 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 58.16' Row Length +12.0" End Stone x 2 = 60.16' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

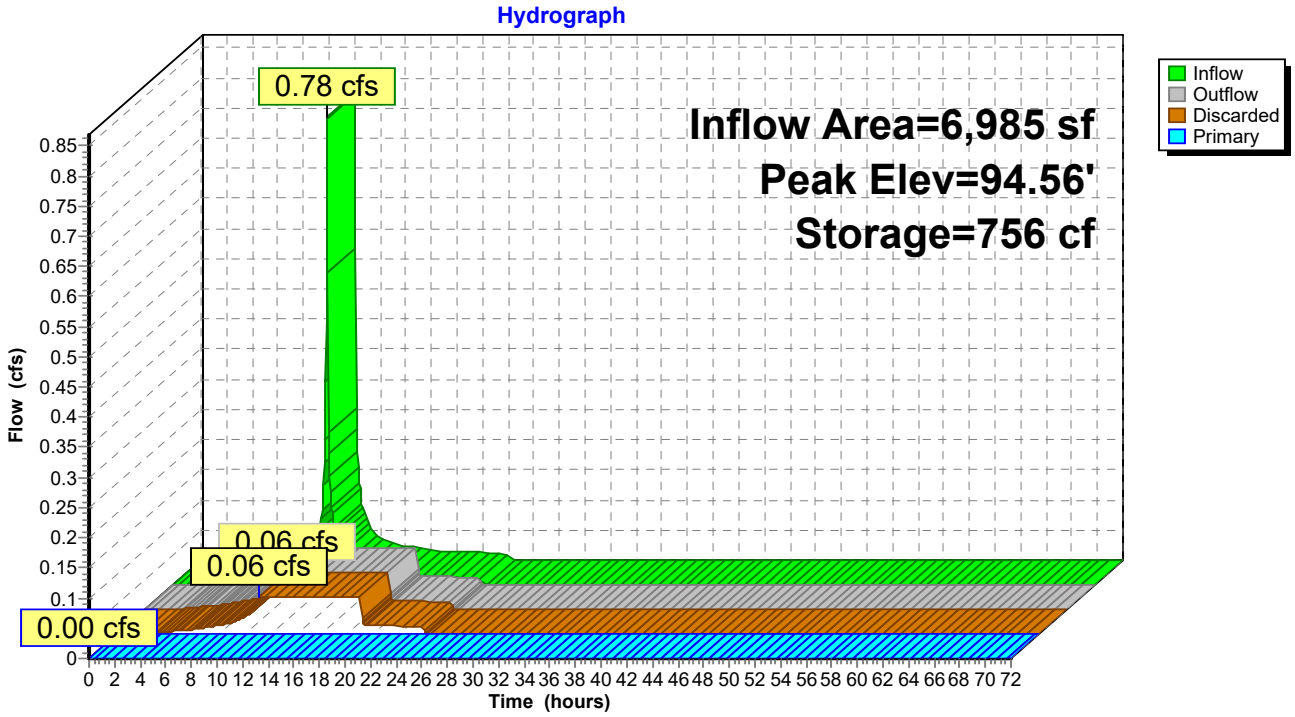
2,550.1 cf Field - 589.7 cf Chambers = 1,960.4 cf Stone x 35.0% Voids = 686.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,275.8 cf = 0.029 af
Overall Storage Efficiency = 50.0%
Overall System Size = 60.16' x 18.17' x 2.33'

40 Chambers
94.4 cy Field
72.6 cy Stone



Pond UIS-1: Underground Infiltration System #1



Summary for Pond UIS-2: Underground Infiltration System 2

Inflow Area = 33,054 sf, 81.96% Impervious, Inflow Depth = 3.83" for 10-Year event
Inflow = 3.34 cfs @ 12.05 hrs, Volume= 10,548 cf
Outflow = 0.17 cfs @ 10.75 hrs, Volume= 10,549 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.17 cfs @ 10.75 hrs, Volume= 10,549 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 95.48' @ 14.04 hrs Surf.Area= 3,039 sf Storage= 4,074 cf

Plug-Flow detention time= 206.8 min calculated for 10,542 cf (100% of inflow)
Center-of-Mass det. time= 206.8 min (999.9 - 793.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.50'	2,785 cf	**77.50'W x 39.22'L x 3.50'H Field A** 10,638 cf Overall - 3,675 cf Embedded = 6,962 cf x 40.0% Voids
#2A	94.00'	3,675 cf	**ADS_StormTech SC-740 +Cap** x 80 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 80 Chambers in 16 Rows
		6,460 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.00' / 92.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	96.77'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 10.75 hrs HW=93.54' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.50' (Free Discharge)
└**1=Culvert** (Passes 0.00 cfs of 0.75 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UIS-2: Underground Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

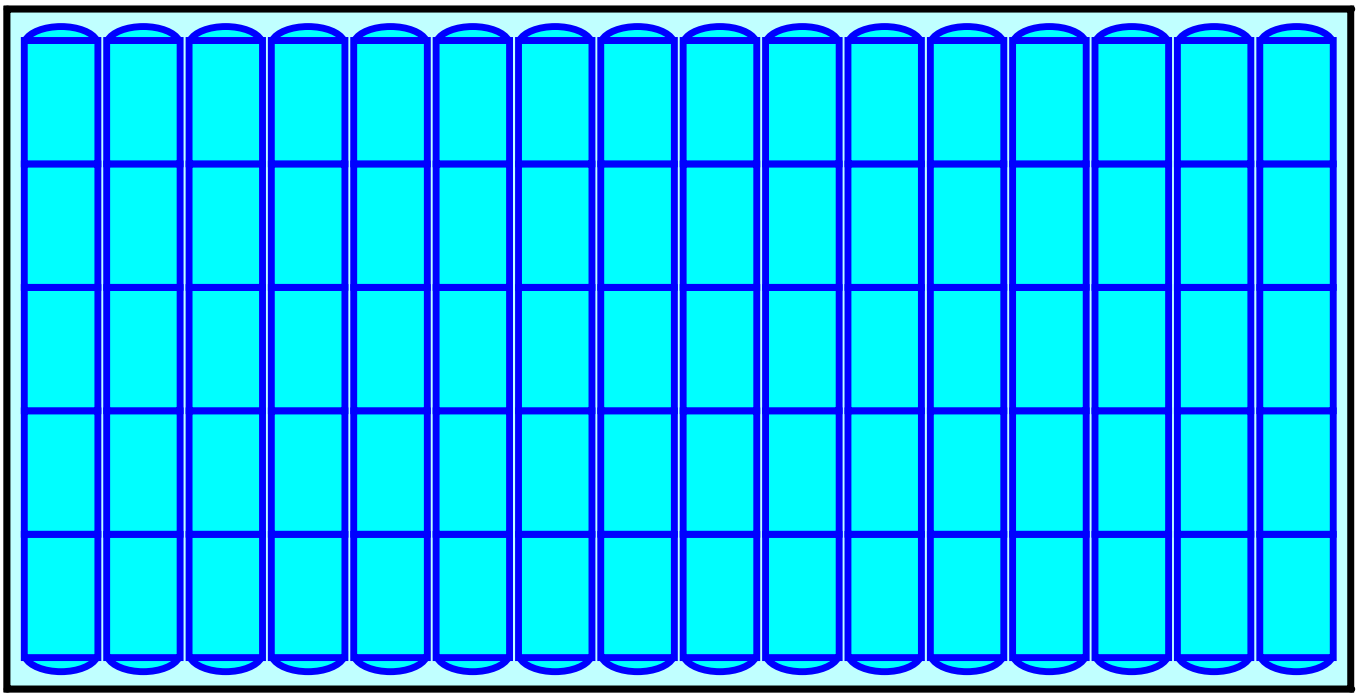
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
16 Rows x 51.0" Wide + 6.0" Spacing x 15 + 12.0" Side Stone x 2 = 77.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

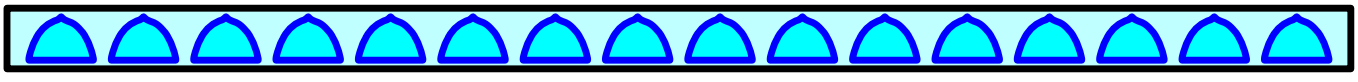
80 Chambers x 45.9 cf = 3,675.2 cf Chamber Storage

10,637.5 cf Field - 3,675.2 cf Chambers = 6,962.3 cf Stone x 40.0% Voids = 2,784.9 cf Stone Storage

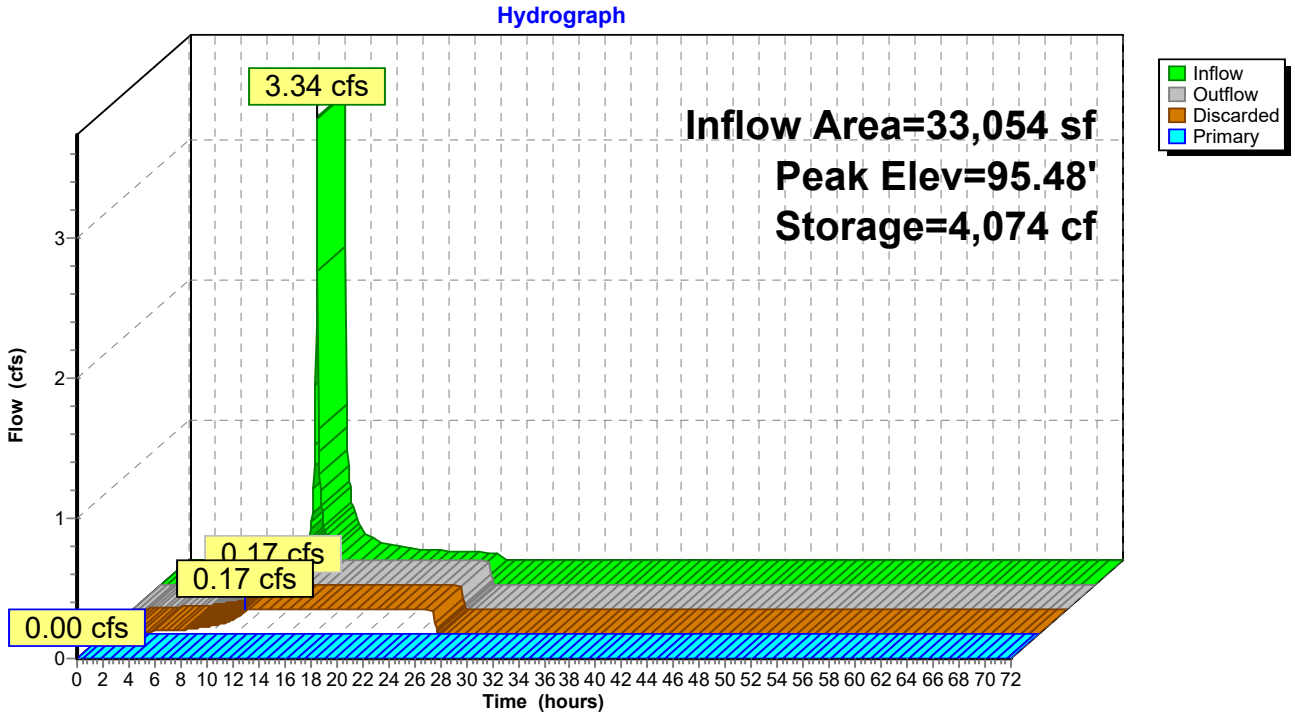
Chamber Storage + Stone Storage = 6,460.1 cf = 0.148 af
Overall Storage Efficiency = 60.7%
Overall System Size = 39.22' x 77.50' x 3.50'

80 Chambers
394.0 cy Field
257.9 cy Stone





Pond UIS-2: Underground Infiltration System 2

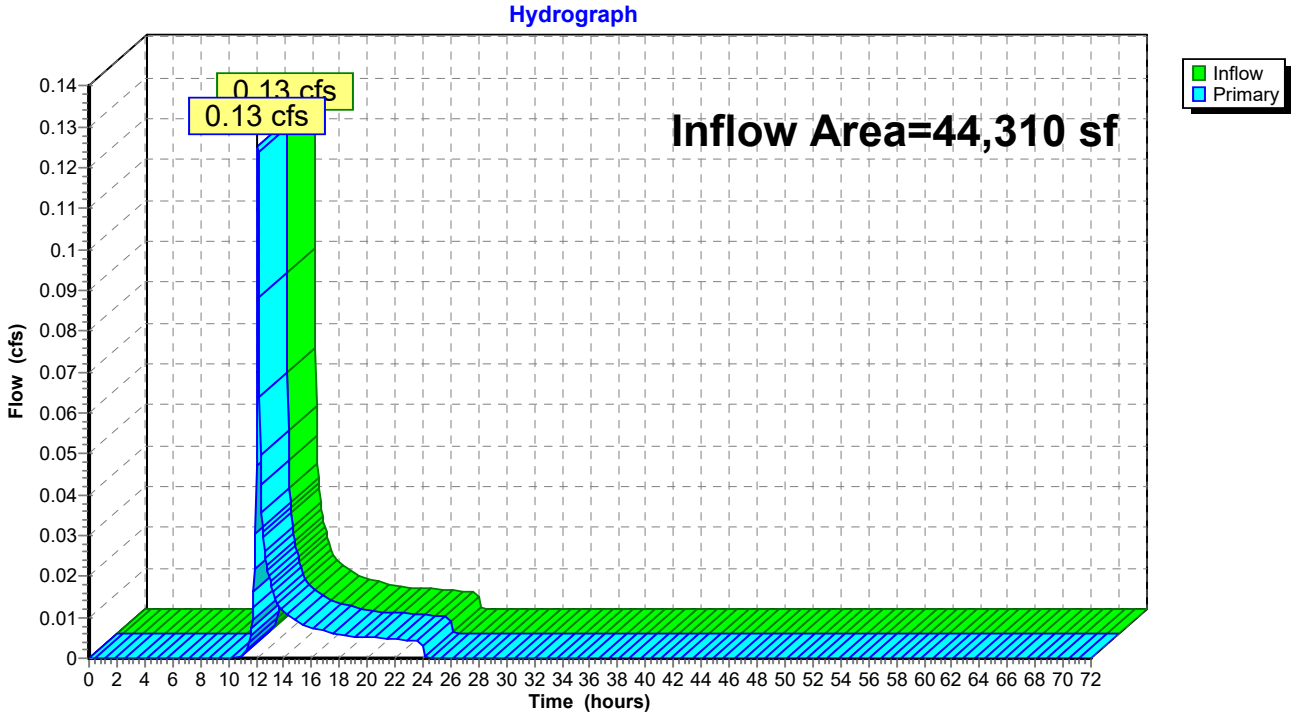


Summary for Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

Inflow Area = 44,310 sf, 77.95% Impervious, Inflow Depth = 0.12" for 10-Year event
Inflow = 0.13 cfs @ 12.14 hrs, Volume= 458 cf
Primary = 0.13 cfs @ 12.14 hrs, Volume= 458 cf, Atten= 0%, Lag= 0.0 min
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

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

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

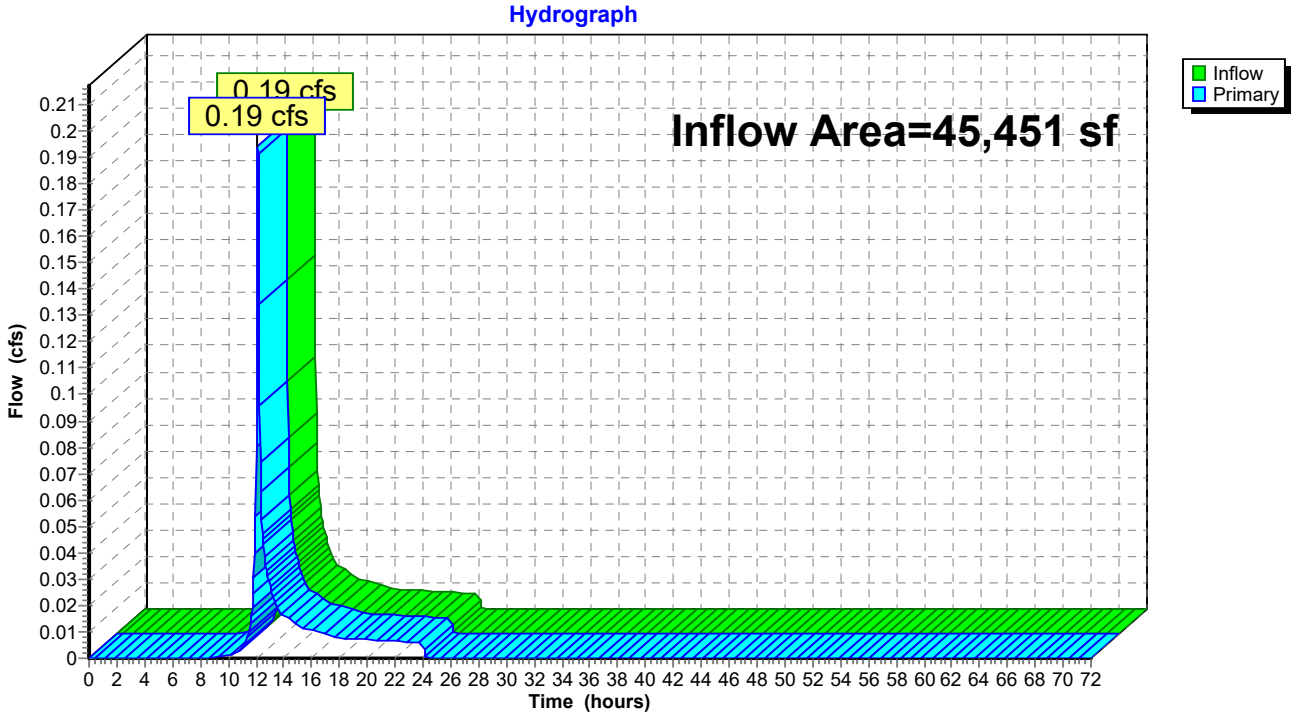


Summary for Link SP2: Flow to Exisitng Drainage on Main Street

Inflow Area = 45,451 sf, 77.46% Impervious, Inflow Depth = 0.18" for 10-Year event
Inflow = 0.19 cfs @ 12.14 hrs, Volume= 690 cf
Primary = 0.19 cfs @ 12.14 hrs, Volume= 690 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP2: Flow to Exisitng Drainage on Main Street

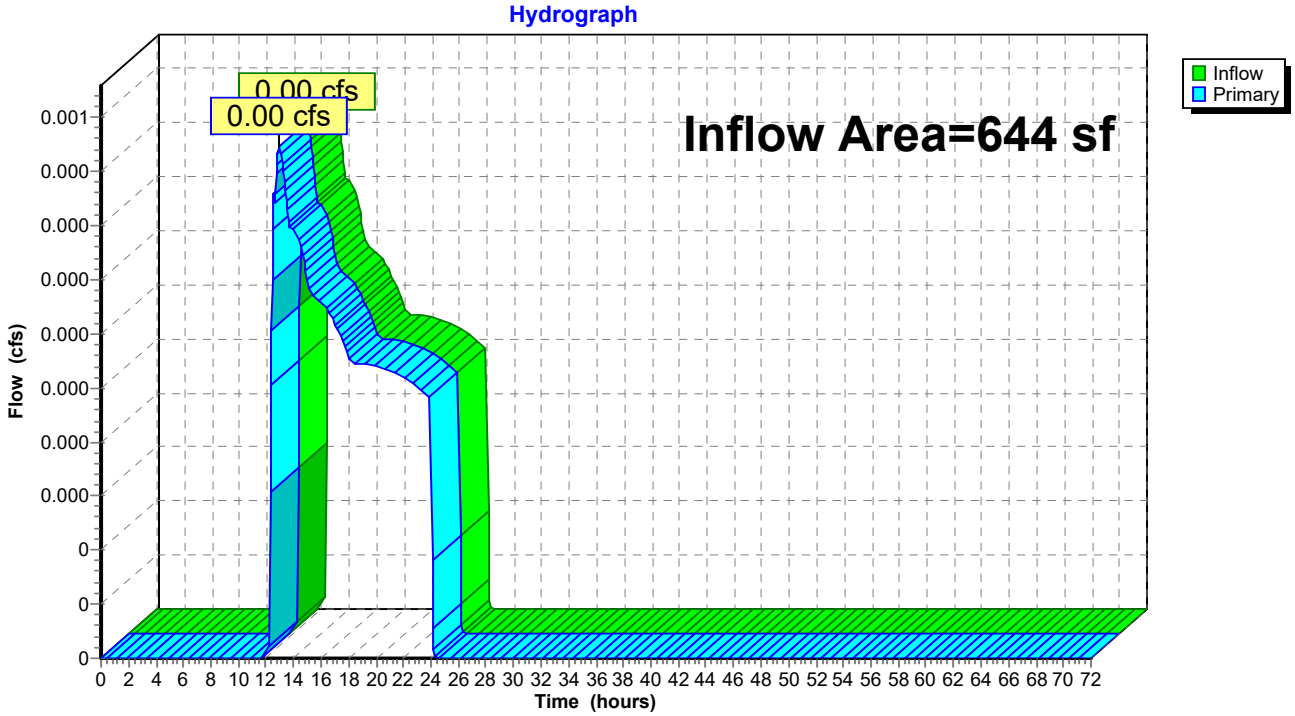


Summary for Link SP3: Flow to Wetlands

Inflow Area = 644 sf, 0.00% Impervious, Inflow Depth = 0.24" for 10-Year event
Inflow = 0.00 cfs @ 12.95 hrs, Volume= 13 cf
Primary = 0.00 cfs @ 12.95 hrs, Volume= 13 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP3: Flow to Wetlands



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

Subcatchment P-1A: Subcat P-1A Runoff Area=4,271 sf 31.49% Impervious Runoff Depth=2.01"
Tc=6.0 min CN=58 Runoff=0.21 cfs 716 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=6,985 sf 87.39% Impervious Runoff Depth=5.35"
Tc=0.0 min CN=91 Runoff=0.98 cfs 3,114 cf

Subcatchment P-1C: Subcat P-1C Runoff Area=16,937 sf 69.86% Impervious Runoff Depth=4.14"
Tc=0.0 min CN=80 Runoff=1.96 cfs 5,849 cf

Subcatchment P-1D: Subcat P-1D Runoff Area=7,225 sf 88.12% Impervious Runoff Depth=5.35"
Tc=0.0 min CN=91 Runoff=1.01 cfs 3,221 cf

Subcatchment P-2: Subcatchment P-2 Runoff Area=1,141 sf 58.27% Impervious Runoff Depth=3.42"
Tc=6.0 min CN=73 Runoff=0.10 cfs 325 cf

Subcatchment P-3: Subcatchment P-3 Runoff Area=644 sf 0.00% Impervious Runoff Depth=0.57"
Tc=6.0 min CN=39 Runoff=0.00 cfs 30 cf

Subcatchment R-1: Subcat R-1 Runoff Area=8,892 sf 100.00% Impervious Runoff Depth=6.16"
Tc=0.0 min CN=98 Runoff=1.31 cfs 4,565 cf

Pond UIS-1: Underground Infiltration System Peak Elev=95.16' Storage=1,085 cf Inflow=0.98 cfs 3,114 cf
Discarded=0.06 cfs 3,114 cf Primary=0.00 cfs 0 cf Outflow=0.06 cfs 3,114 cf

Pond UIS-2: Underground Infiltration System Peak Elev=96.55' Storage=5,913 cf Inflow=4.28 cfs 13,635 cf
Discarded=0.17 cfs 13,637 cf Primary=0.00 cfs 0 cf Outflow=0.17 cfs 13,637 cf

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue Inflow=0.21 cfs 716 cf
Primary=0.21 cfs 716 cf

Link SP2: Flow to Exisitng Drainage on Main Street Inflow=0.30 cfs 1,041 cf
Primary=0.30 cfs 1,041 cf

Link SP3: Flow to Wetlands Inflow=0.00 cfs 30 cf
Primary=0.00 cfs 30 cf

Total Runoff Area = 46,095 sf Runoff Volume = 17,820 cf Average Runoff Depth = 4.64"
23.63% Pervious = 10,890 sf 76.37% Impervious = 35,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

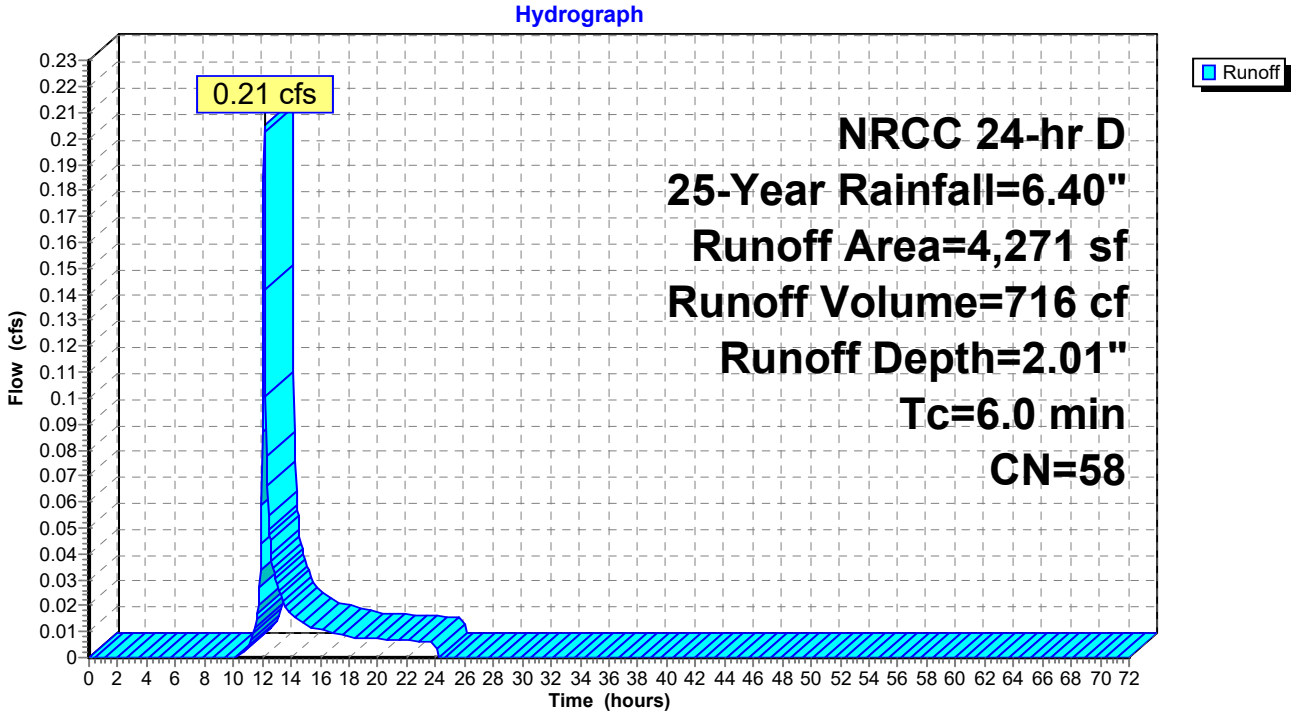
Runoff = 0.21 cfs @ 12.14 hrs, Volume= 716 cf, Depth= 2.01"
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
2,926	39	>75% Grass cover, Good, HSG A
490	98	Paved parking, HSG A
855	98	Roofs, HSG A
4,271	58	Weighted Average
2,926		68.51% Pervious Area
1,345		31.49% Impervious Area

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

Subcatchment P-1A: Subcat P-1A



Summary for Subcatchment P-1B: Subcat P-1B

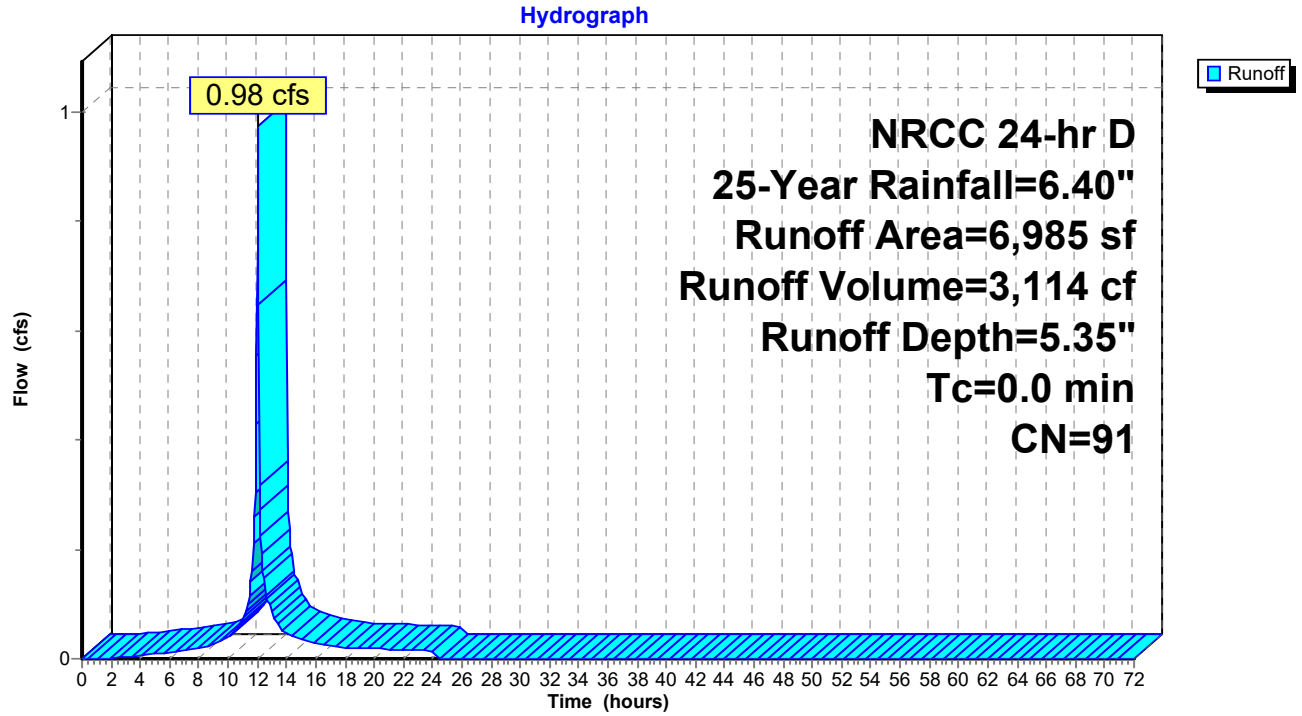
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.98 cfs @ 12.04 hrs, Volume= 3,114 cf, Depth= 5.35"
Routed to Pond UIS-1 : Underground Infiltration System #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
881	39	>75% Grass cover, Good, HSG A
6,105	98	Paved parking, HSG A
6,985	91	Weighted Average
881		12.61% Pervious Area
6,105		87.39% Impervious Area

Subcatchment P-1B: Subcat P-1B



Summary for Subcatchment P-1C: Subcat P-1C

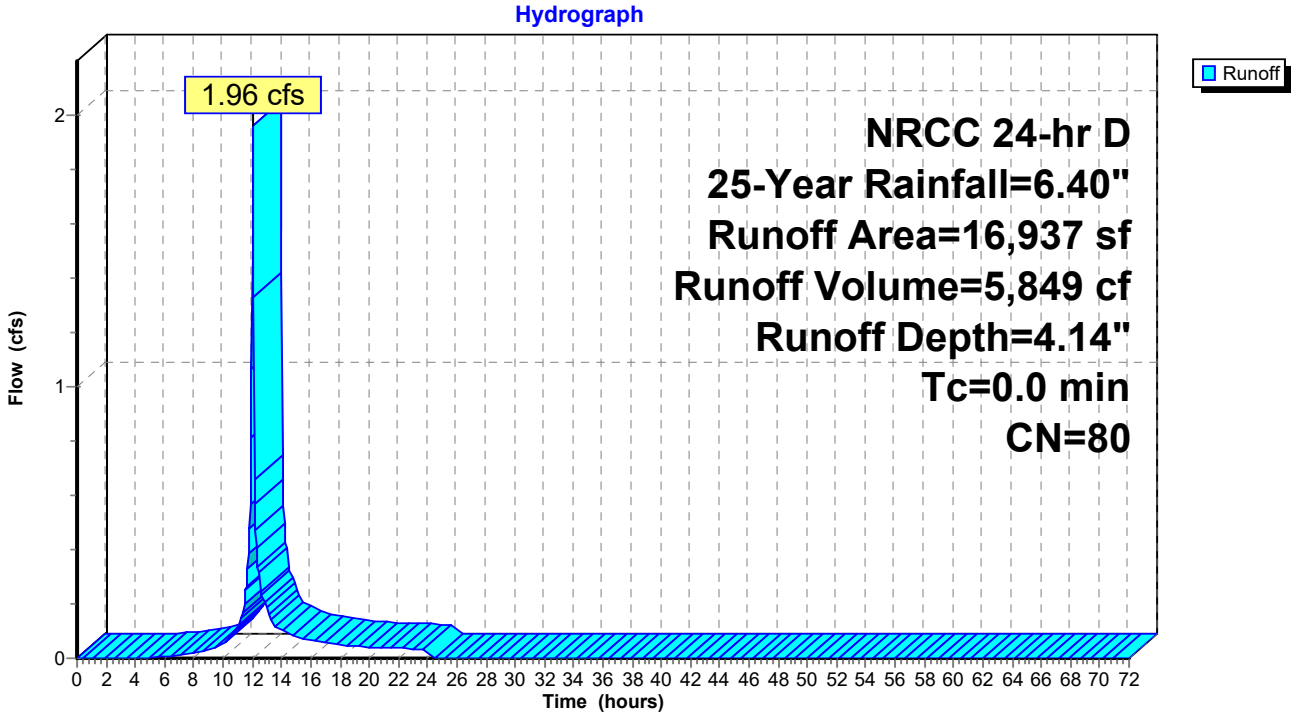
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.96 cfs @ 12.05 hrs, Volume= 5,849 cf, Depth= 4.14"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
5,105	39	>75% Grass cover, Good, HSG A
192	98	Roofs, HSG A
11,640	98	Paved parking, HSG A
16,937	80	Weighted Average
5,105		30.14% Pervious Area
11,832		69.86% Impervious Area

Subcatchment P-1C: Subcat P-1C



Summary for Subcatchment P-1D: Subcat P-1D

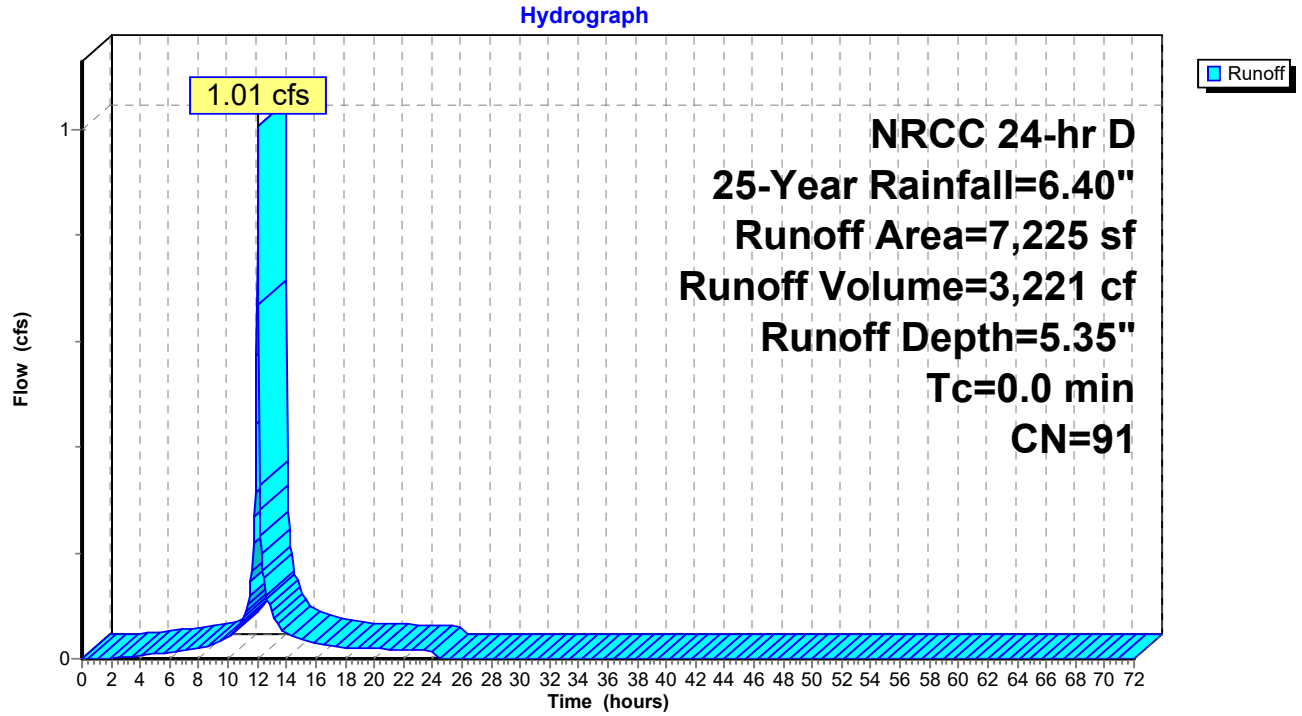
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.01 cfs @ 12.04 hrs, Volume= 3,221 cf, Depth= 5.35"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
858	39	>75% Grass cover, Good, HSG A
6,366	98	Paved parking, HSG A
7,225	91	Weighted Average
858		11.88% Pervious Area
6,366		88.12% Impervious Area

Subcatchment P-1D: Subcat P-1D



Summary for Subcatchment P-2: Subcatchment P-2

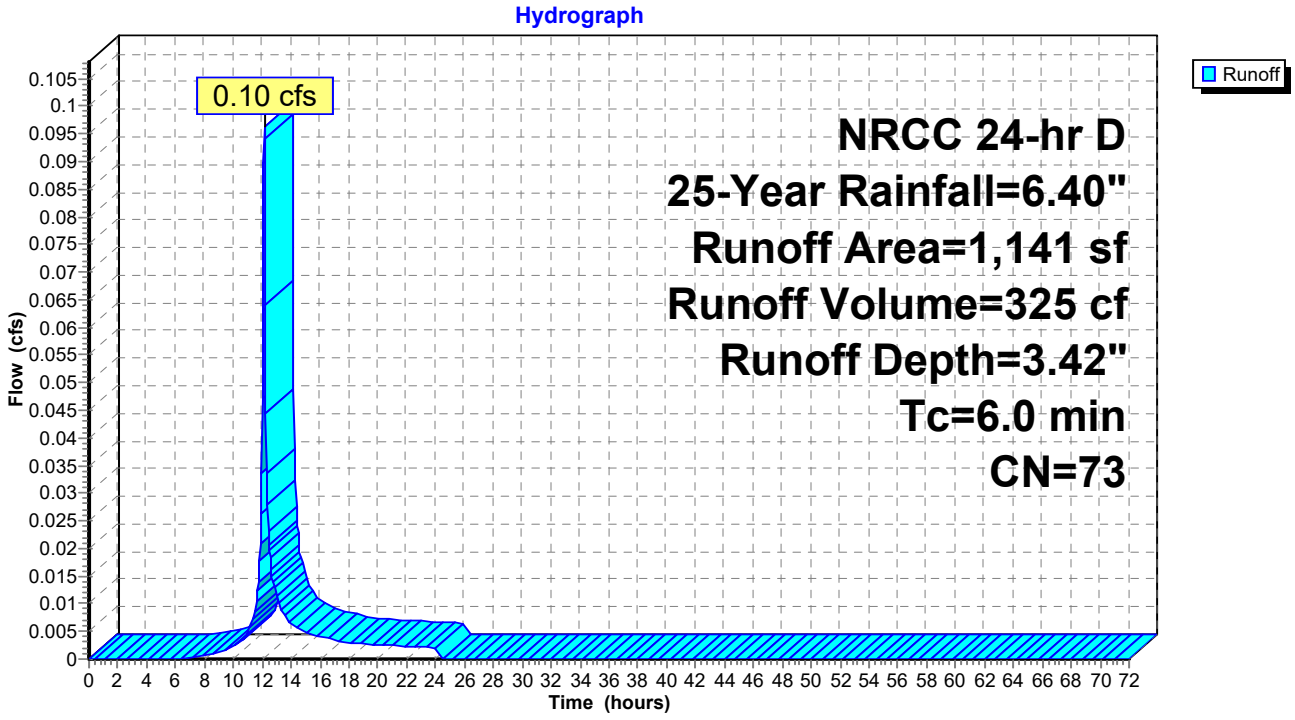
Runoff = 0.10 cfs @ 12.13 hrs, Volume= 325 cf, Depth= 3.42"
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
476	39	>75% Grass cover, Good, HSG A
665	98	Paved parking, HSG A
1,141	73	Weighted Average
476		41.73% Pervious Area
665		58.27% Impervious Area

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

Subcatchment P-2: Subcatchment P-2



Summary for Subcatchment P-3: Subcatchment P-3

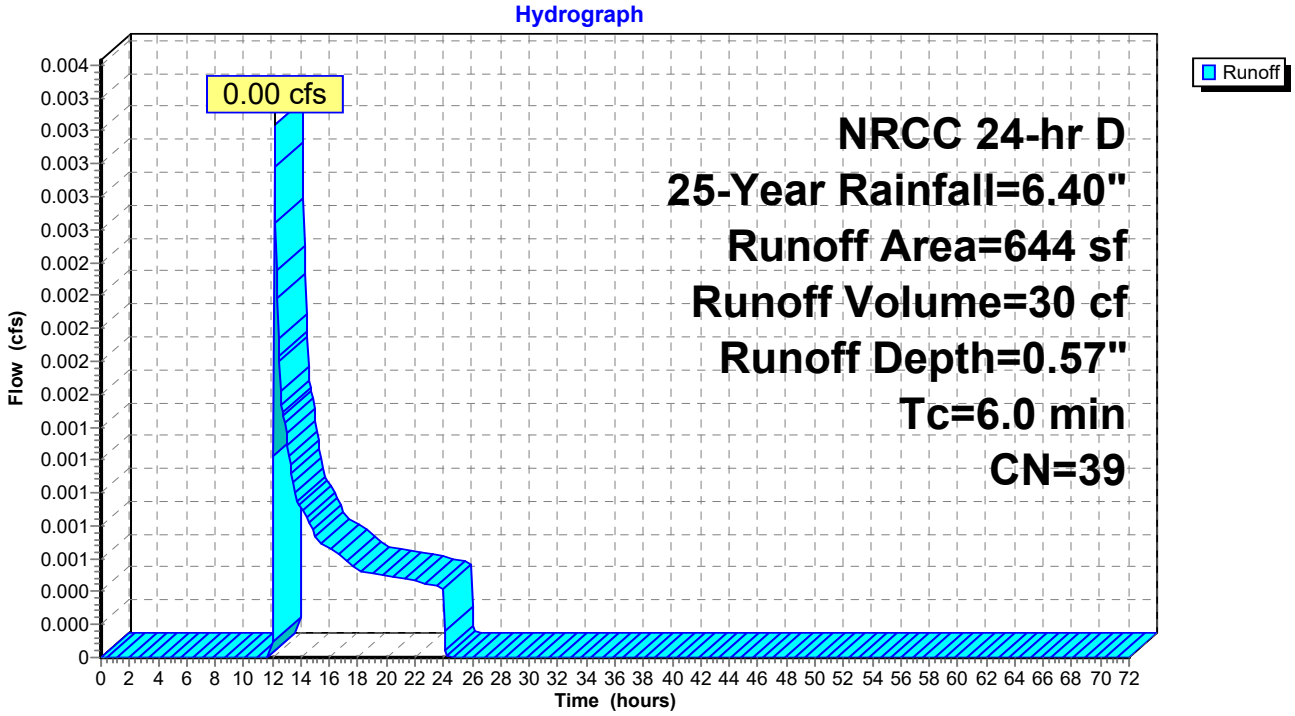
Runoff = 0.00 cfs @ 12.17 hrs, Volume= 30 cf, Depth= 0.57"
Routed to Link SP3 : Flow to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
644	39	>75% Grass cover, Good, HSG A
644		100.00% Pervious Area

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

Subcatchment P-3: Subcatchment P-3



Summary for Subcatchment R-1: Subcat R-1

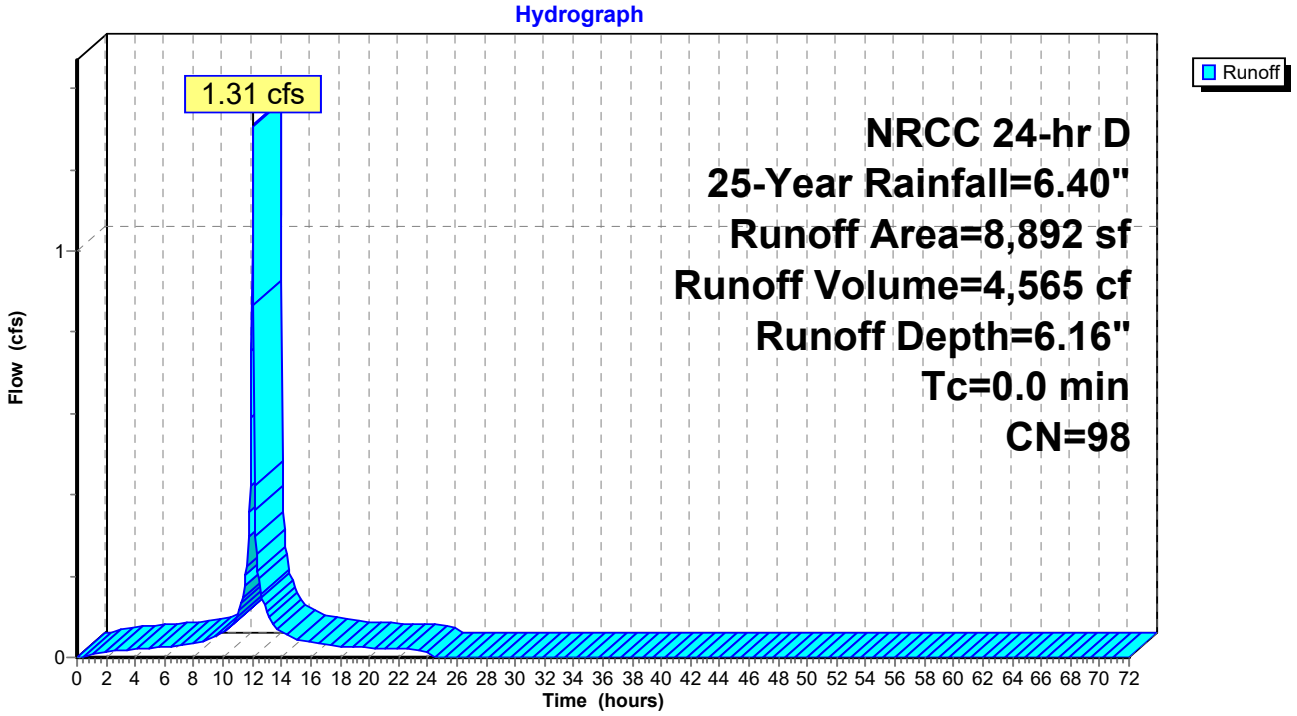
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.31 cfs @ 12.04 hrs, Volume= 4,565 cf, Depth= 6.16"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.40"

Area (sf)	CN	Description
8,892	98	Roofs, HSG A
8,892		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



Summary for Pond UIS-1: Underground Infiltration System #1

Inflow Area = 6,985 sf, 87.39% Impervious, Inflow Depth = 5.35" for 25-Year event
Inflow = 0.98 cfs @ 12.04 hrs, Volume= 3,114 cf
Outflow = 0.06 cfs @ 10.85 hrs, Volume= 3,114 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.06 cfs @ 10.85 hrs, Volume= 3,114 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 95.16' @ 13.41 hrs Surf.Area= 1,093 sf Storage= 1,085 cf

Plug-Flow detention time= 134.7 min calculated for 3,112 cf (100% of inflow)
Center-of-Mass det. time= 134.7 min (917.6 - 782.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.33'	686 cf	**18.17'W x 60.16'L x 2.33'H Field A** 2,550 cf Overall - 590 cf Embedded = 1,960 cf x 35.0% Voids
#2A	93.83'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 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 40 Chambers in 5 Rows
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.75'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.75' / 93.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	95.55'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.33'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 10.85 hrs HW=93.35' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.33' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UIS-1: Underground Infiltration System #1 - 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

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

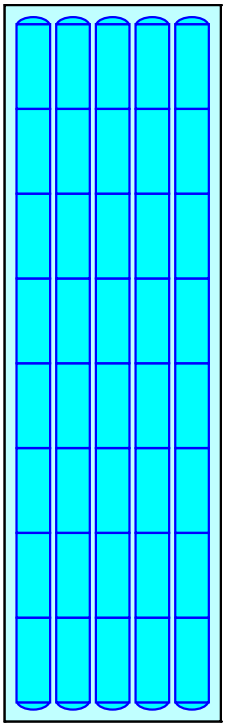
8 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 58.16' Row Length +12.0" End Stone x 2 = 60.16' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

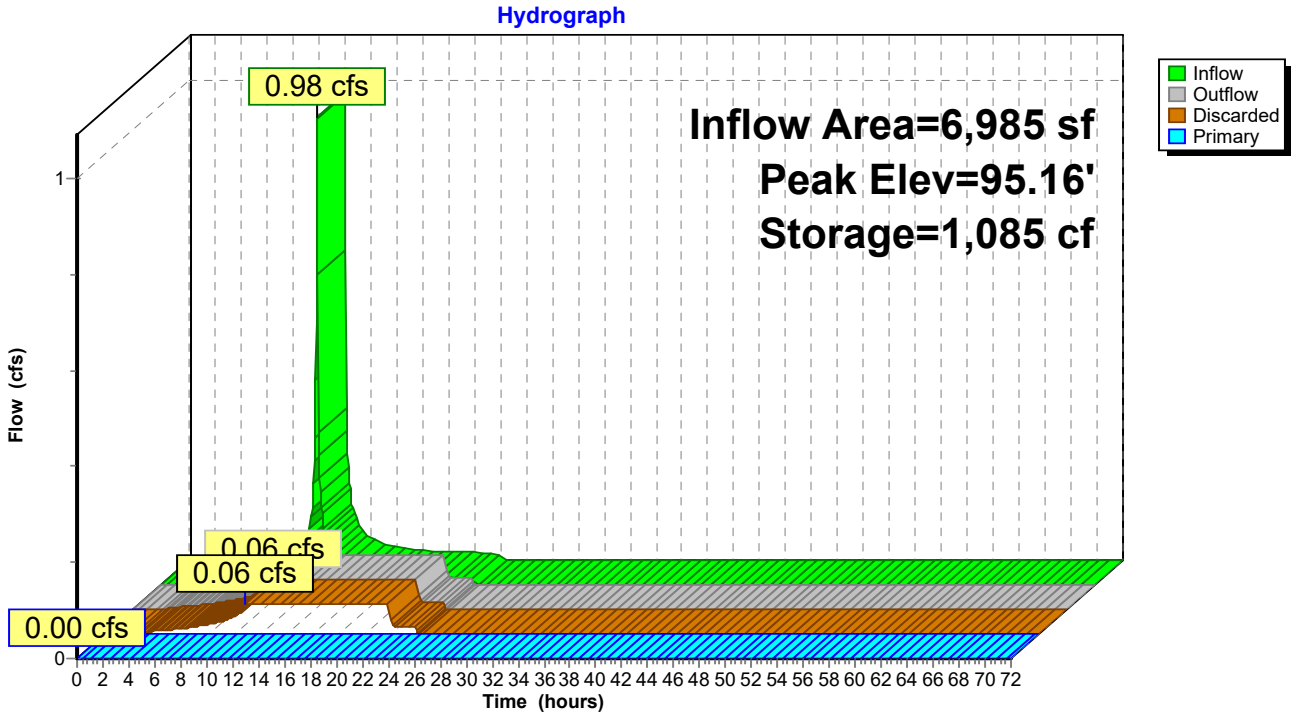
2,550.1 cf Field - 589.7 cf Chambers = 1,960.4 cf Stone x 35.0% Voids = 686.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,275.8 cf = 0.029 af
Overall Storage Efficiency = 50.0%
Overall System Size = 60.16' x 18.17' x 2.33'

40 Chambers
94.4 cy Field
72.6 cy Stone



Pond UIS-1: Underground Infiltration System #1



Summary for Pond UIS-2: Underground Infiltration System 2

Inflow Area = 33,054 sf, 81.96% Impervious, Inflow Depth = 4.95" for 25-Year event
Inflow = 4.28 cfs @ 12.05 hrs, Volume= 13,635 cf
Outflow = 0.17 cfs @ 10.25 hrs, Volume= 13,637 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.17 cfs @ 10.25 hrs, Volume= 13,637 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 96.55' @ 14.75 hrs Surf.Area= 3,039 sf Storage= 5,913 cf

Plug-Flow detention time= 313.0 min calculated for 13,627 cf (100% of inflow)
Center-of-Mass det. time= 313.1 min (1,099.7 - 786.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.50'	2,785 cf	**77.50'W x 39.22'L x 3.50'H Field A** 10,638 cf Overall - 3,675 cf Embedded = 6,962 cf x 40.0% Voids
#2A	94.00'	3,675 cf	**ADS_StormTech SC-740 +Cap** x 80 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 80 Chambers in 16 Rows
		6,460 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.00' / 92.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	96.77'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 10.25 hrs HW=93.54' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.50' (Free Discharge)
└**1=Culvert** (Passes 0.00 cfs of 0.75 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond UIS-2: Underground Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

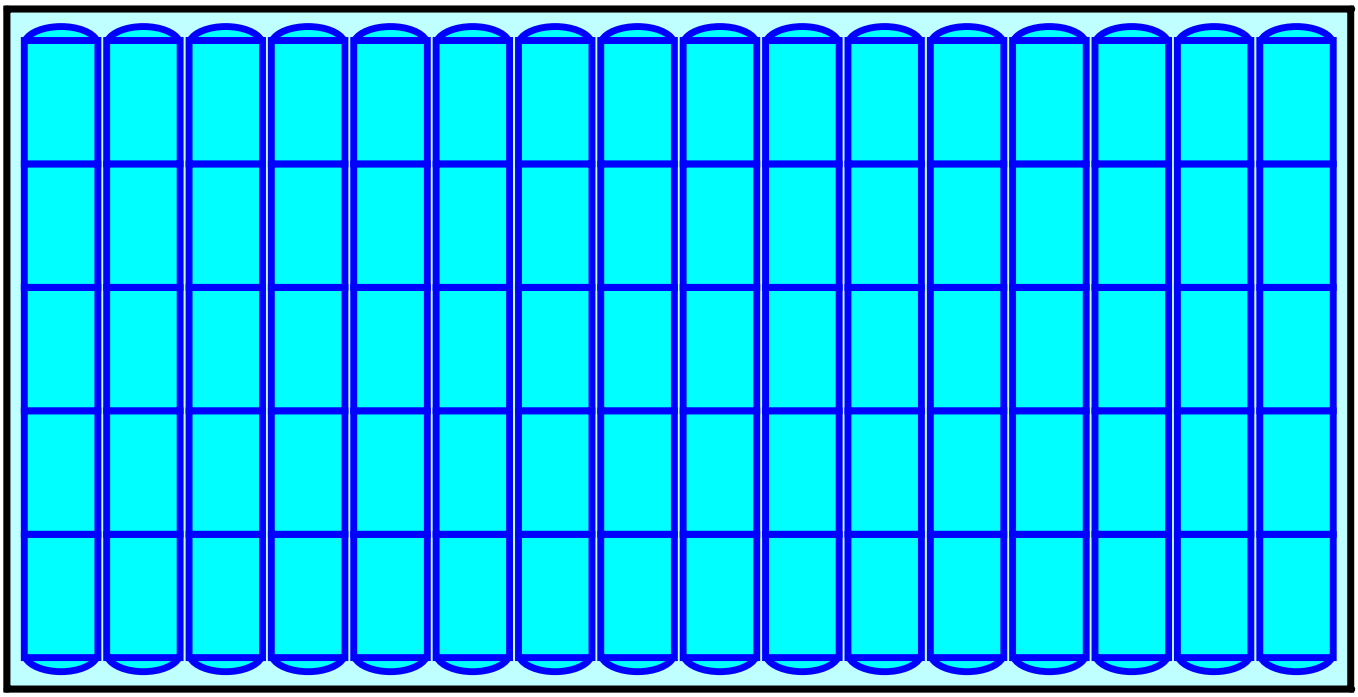
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
16 Rows x 51.0" Wide + 6.0" Spacing x 15 + 12.0" Side Stone x 2 = 77.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

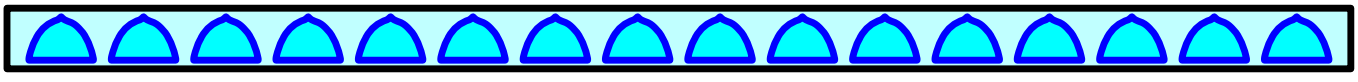
80 Chambers x 45.9 cf = 3,675.2 cf Chamber Storage

10,637.5 cf Field - 3,675.2 cf Chambers = 6,962.3 cf Stone x 40.0% Voids = 2,784.9 cf Stone Storage

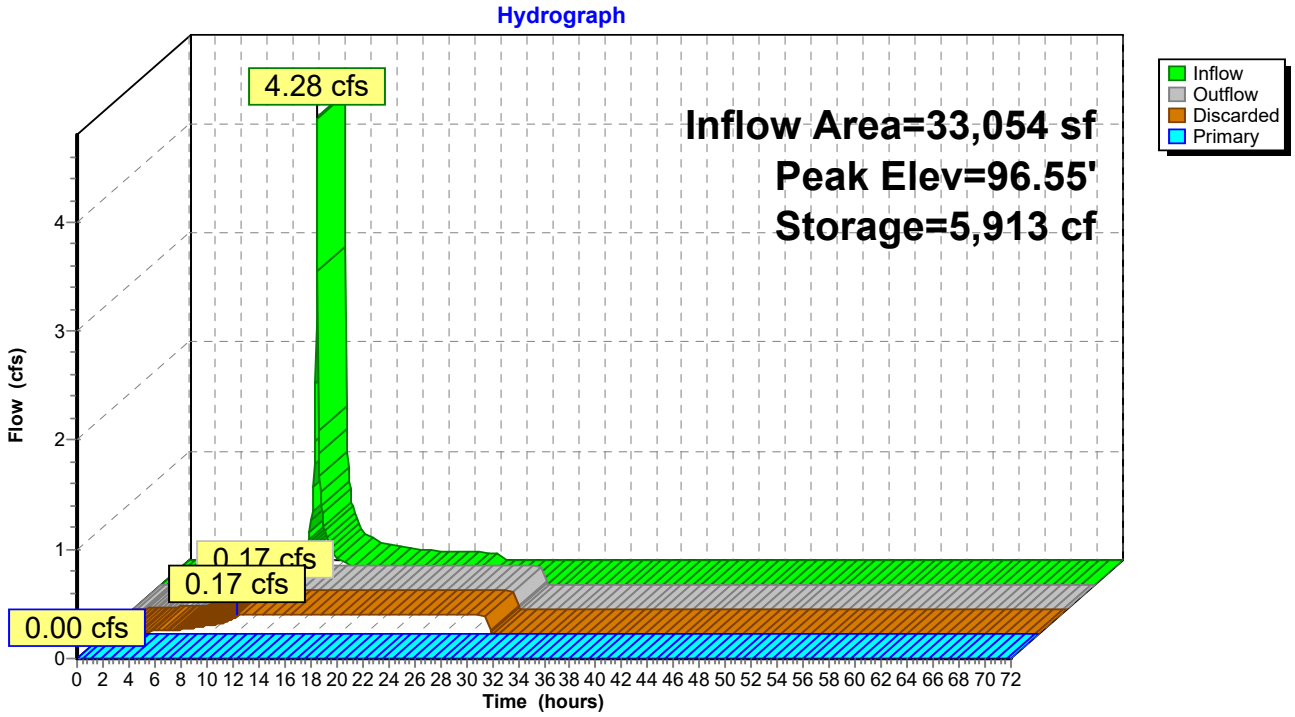
Chamber Storage + Stone Storage = 6,460.1 cf = 0.148 af
Overall Storage Efficiency = 60.7%
Overall System Size = 39.22' x 77.50' x 3.50'

80 Chambers
394.0 cy Field
257.9 cy Stone





Pond UIS-2: Underground Infiltration System 2

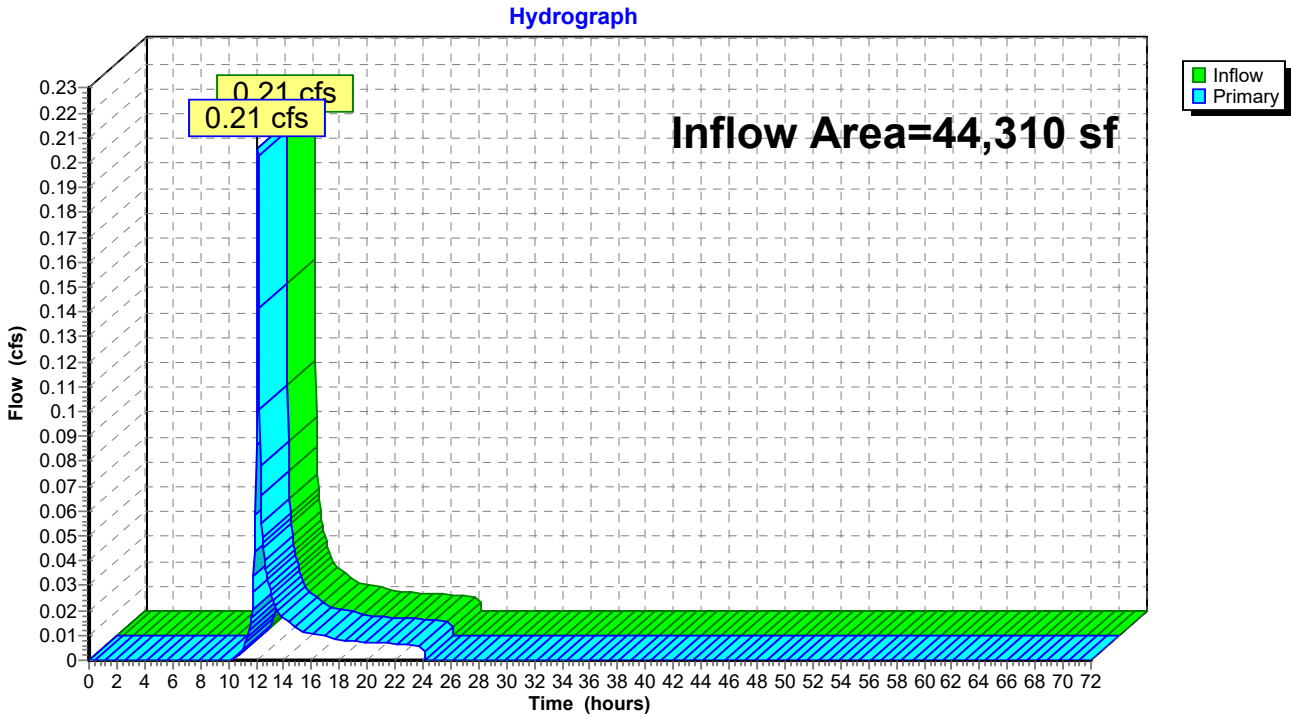


Summary for Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

Inflow Area = 44,310 sf, 77.95% Impervious, Inflow Depth = 0.19" for 25-Year event
Inflow = 0.21 cfs @ 12.14 hrs, Volume= 716 cf
Primary = 0.21 cfs @ 12.14 hrs, Volume= 716 cf, Atten= 0%, Lag= 0.0 min
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

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

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

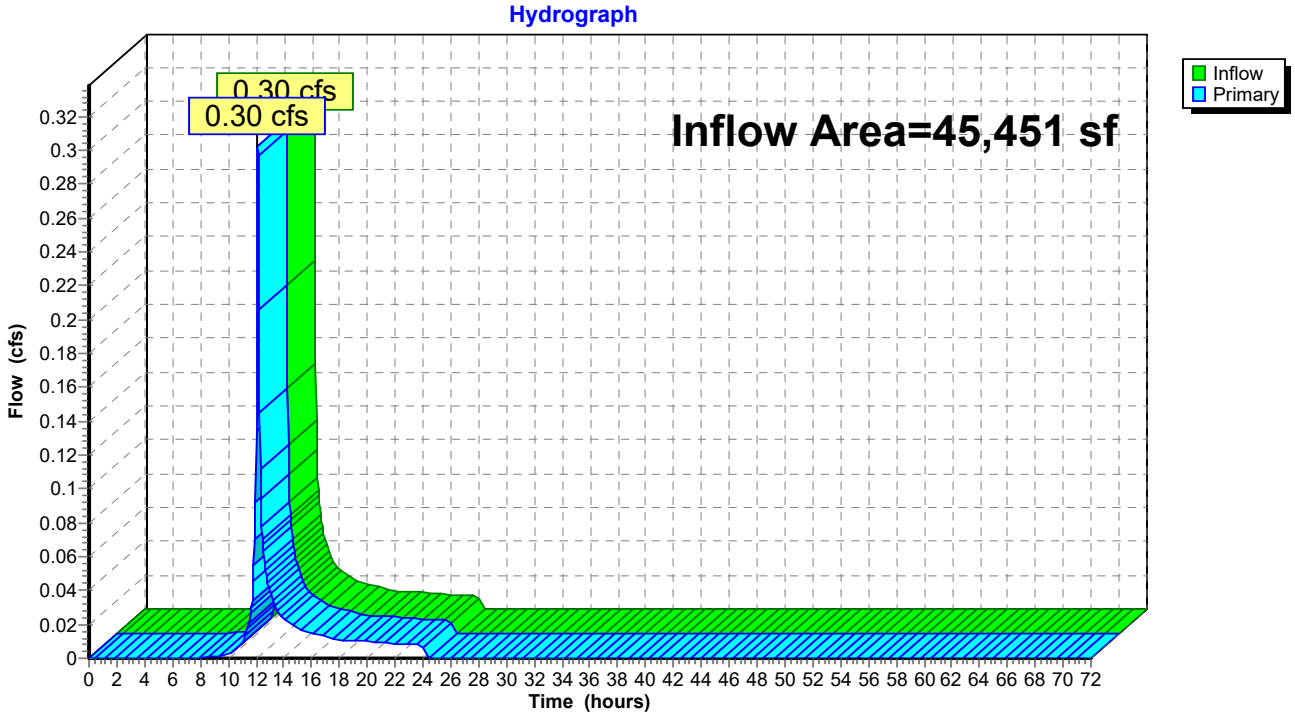


Summary for Link SP2: Flow to Exisitng Drainage on Main Street

Inflow Area = 45,451 sf, 77.46% Impervious, Inflow Depth = 0.27" for 25-Year event
Inflow = 0.30 cfs @ 12.13 hrs, Volume= 1,041 cf
Primary = 0.30 cfs @ 12.13 hrs, Volume= 1,041 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP2: Flow to Exisitng Drainage on Main Street

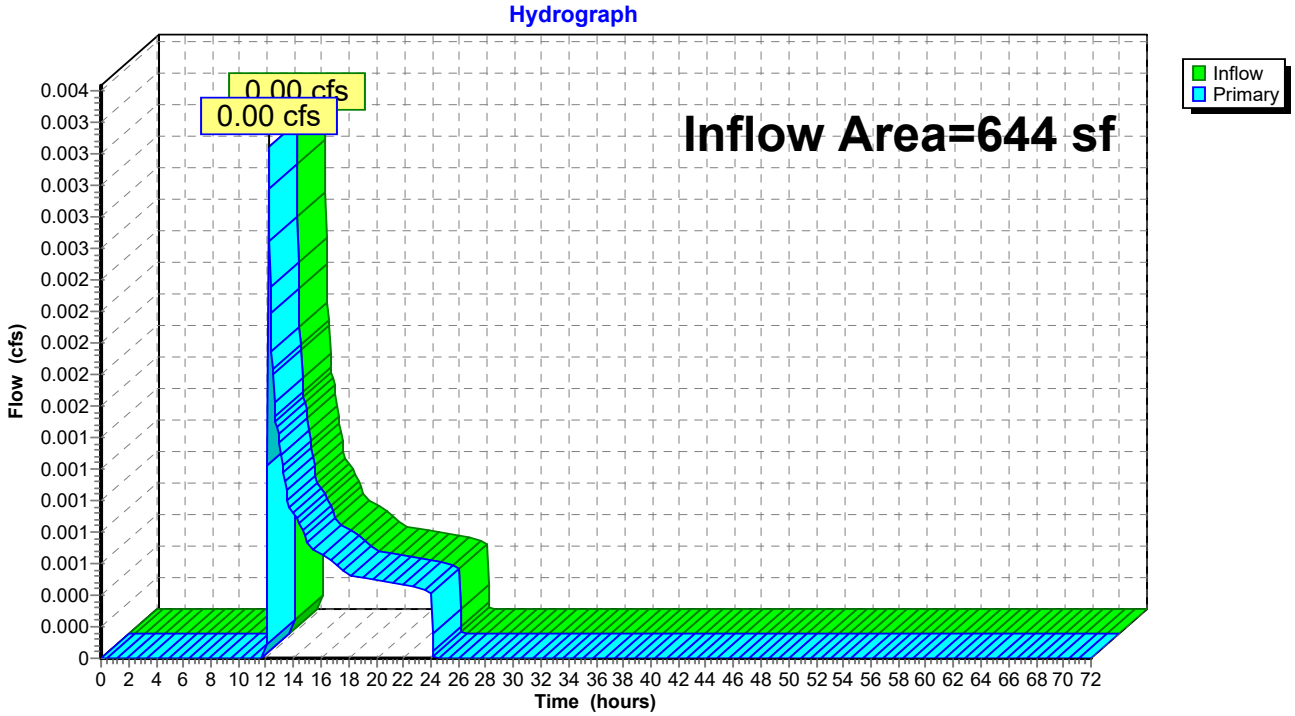


Summary for Link SP3: Flow to Wetlands

Inflow Area = 644 sf, 0.00% Impervious, Inflow Depth = 0.57" for 25-Year event
Inflow = 0.00 cfs @ 12.17 hrs, Volume= 30 cf
Primary = 0.00 cfs @ 12.17 hrs, Volume= 30 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP3: Flow to Wetlands



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

Subcatchment P-1A: Subcat P-1A Runoff Area=4,271 sf 31.49% Impervious Runoff Depth=3.28"
Tc=6.0 min CN=58 Runoff=0.34 cfs 1,167 cf

Subcatchment P-1B: Subcat P-1B Runoff Area=6,985 sf 87.39% Impervious Runoff Depth=7.15"
Tc=0.0 min CN=91 Runoff=1.28 cfs 4,163 cf

Subcatchment P-1C: Subcat P-1C Runoff Area=16,937 sf 69.86% Impervious Runoff Depth=5.84"
Tc=0.0 min CN=80 Runoff=2.72 cfs 8,244 cf

Subcatchment P-1D: Subcat P-1D Runoff Area=7,225 sf 88.12% Impervious Runoff Depth=7.15"
Tc=0.0 min CN=91 Runoff=1.32 cfs 4,306 cf

Subcatchment P-2: Subcatchment P-2 Runoff Area=1,141 sf 58.27% Impervious Runoff Depth=5.01"
Tc=6.0 min CN=73 Runoff=0.14 cfs 477 cf

Subcatchment P-3: Subcatchment P-3 Runoff Area=644 sf 0.00% Impervious Runoff Depth=1.25"
Tc=6.0 min CN=39 Runoff=0.01 cfs 67 cf

Subcatchment R-1: Subcat R-1 Runoff Area=8,892 sf 100.00% Impervious Runoff Depth=7.99"
Tc=0.0 min CN=98 Runoff=1.69 cfs 5,920 cf

Pond UIS-1: Underground Infiltration System Peak Elev=95.63' Storage=1,262 cf Inflow=1.28 cfs 4,163 cf
Discarded=0.06 cfs 3,755 cf Primary=0.24 cfs 410 cf Outflow=0.31 cfs 4,166 cf

Pond UIS-2: Underground Infiltration System Peak Elev=96.97' Storage=6,426 cf Inflow=5.73 cfs 18,470 cf
Discarded=0.17 cfs 15,543 cf Primary=1.02 cfs 2,933 cf Outflow=1.19 cfs 18,477 cf

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue Inflow=1.43 cfs 4,511 cf
Primary=1.43 cfs 4,511 cf

Link SP2: Flow to Exisitng Drainage on Main Street Inflow=1.48 cfs 4,987 cf
Primary=1.48 cfs 4,987 cf

Link SP3: Flow to Wetlands Inflow=0.01 cfs 67 cf
Primary=0.01 cfs 67 cf

Total Runoff Area = 46,095 sf Runoff Volume = 24,345 cf Average Runoff Depth = 6.34"
23.63% Pervious = 10,890 sf 76.37% Impervious = 35,204 sf

Summary for Subcatchment P-1A: Subcat P-1A

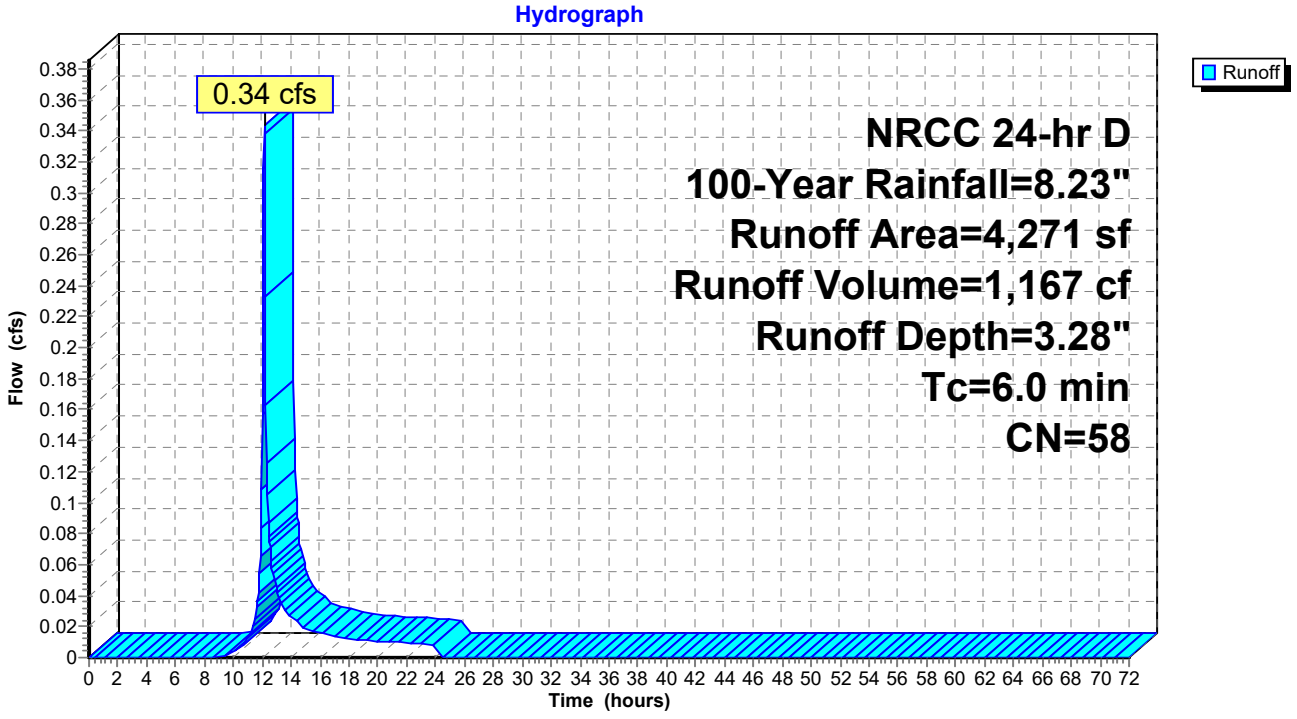
Runoff = 0.34 cfs @ 12.13 hrs, Volume= 1,167 cf, Depth= 3.28"
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
2,926	39	>75% Grass cover, Good, HSG A
490	98	Paved parking, HSG A
855	98	Roofs, HSG A
4,271	58	Weighted Average
2,926		68.51% Pervious Area
1,345		31.49% Impervious Area

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

Subcatchment P-1A: Subcat P-1A



Summary for Subcatchment P-1B: Subcat P-1B

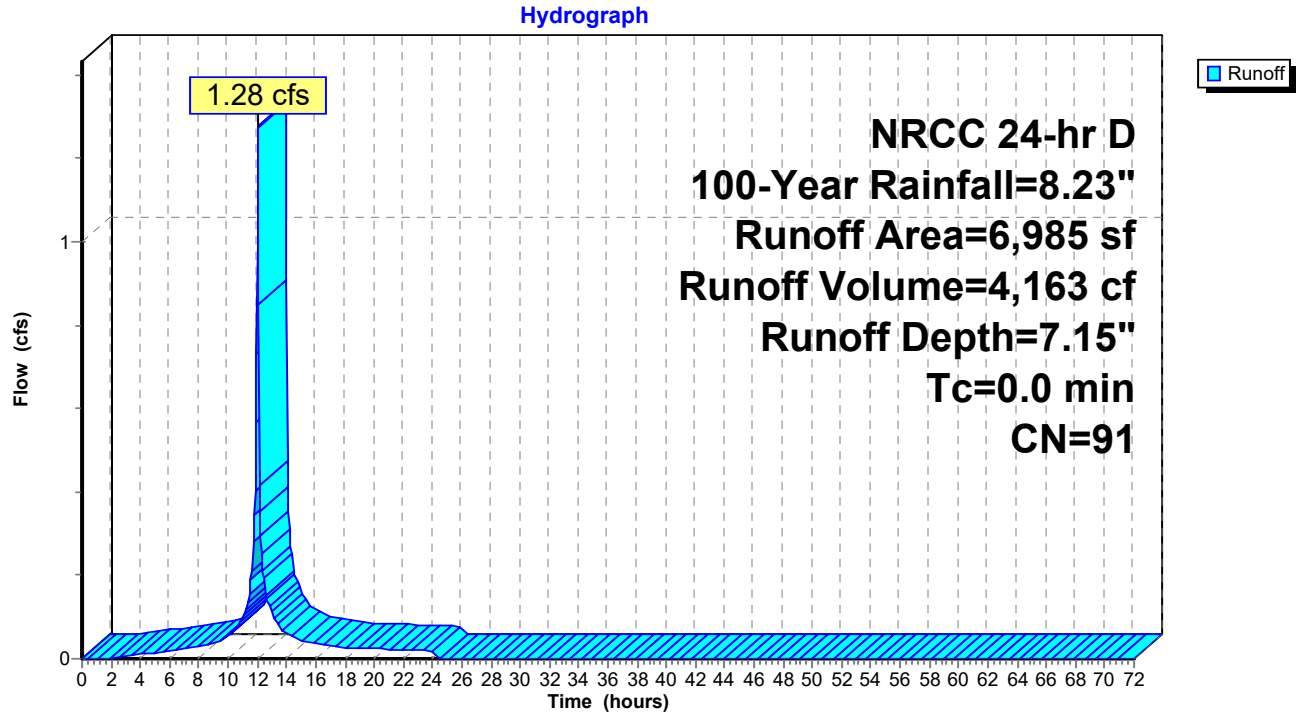
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.28 cfs @ 12.04 hrs, Volume= 4,163 cf, Depth= 7.15"
Routed to Pond UIS-1 : Underground Infiltration System #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
881	39	>75% Grass cover, Good, HSG A
6,105	98	Paved parking, HSG A
6,985	91	Weighted Average
881		12.61% Pervious Area
6,105		87.39% Impervious Area

Subcatchment P-1B: Subcat P-1B



Summary for Subcatchment P-1C: Subcat P-1C

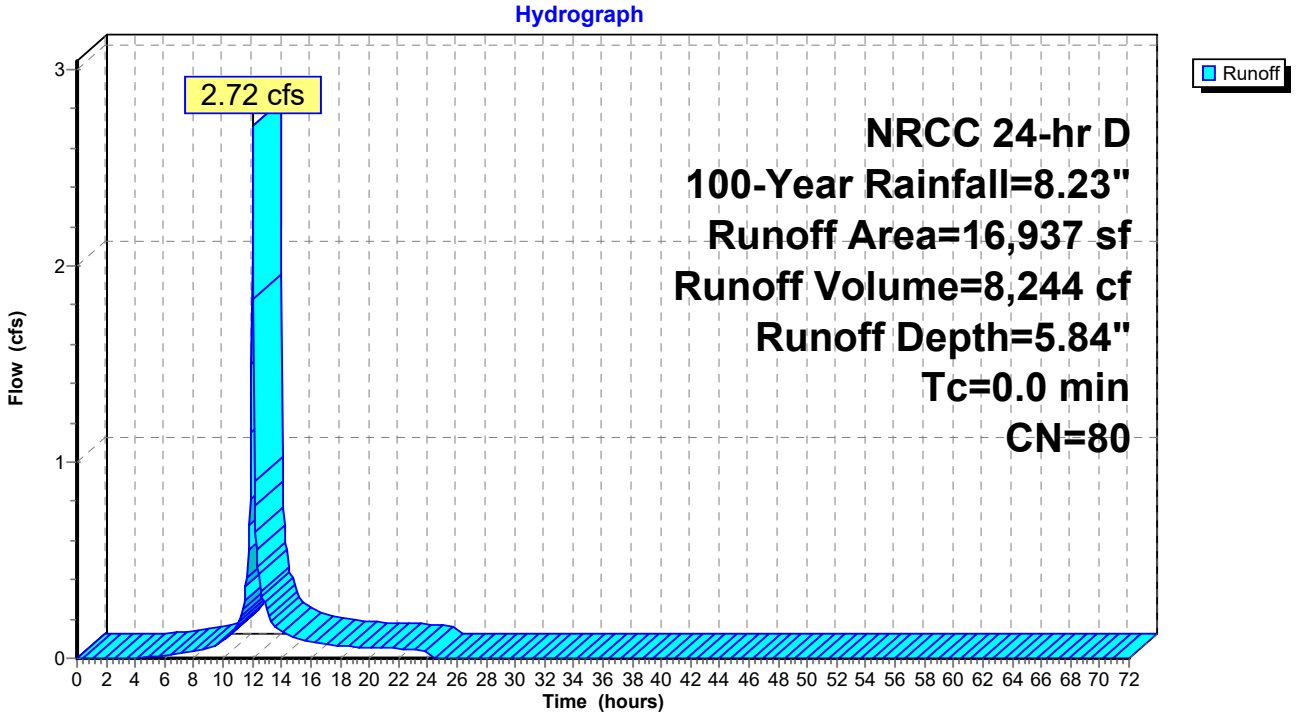
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 2.72 cfs @ 12.05 hrs, Volume= 8,244 cf, Depth= 5.84"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
5,105	39	>75% Grass cover, Good, HSG A
192	98	Roofs, HSG A
11,640	98	Paved parking, HSG A
16,937	80	Weighted Average
5,105		30.14% Pervious Area
11,832		69.86% Impervious Area

Subcatchment P-1C: Subcat P-1C



Summary for Subcatchment P-1D: Subcat P-1D

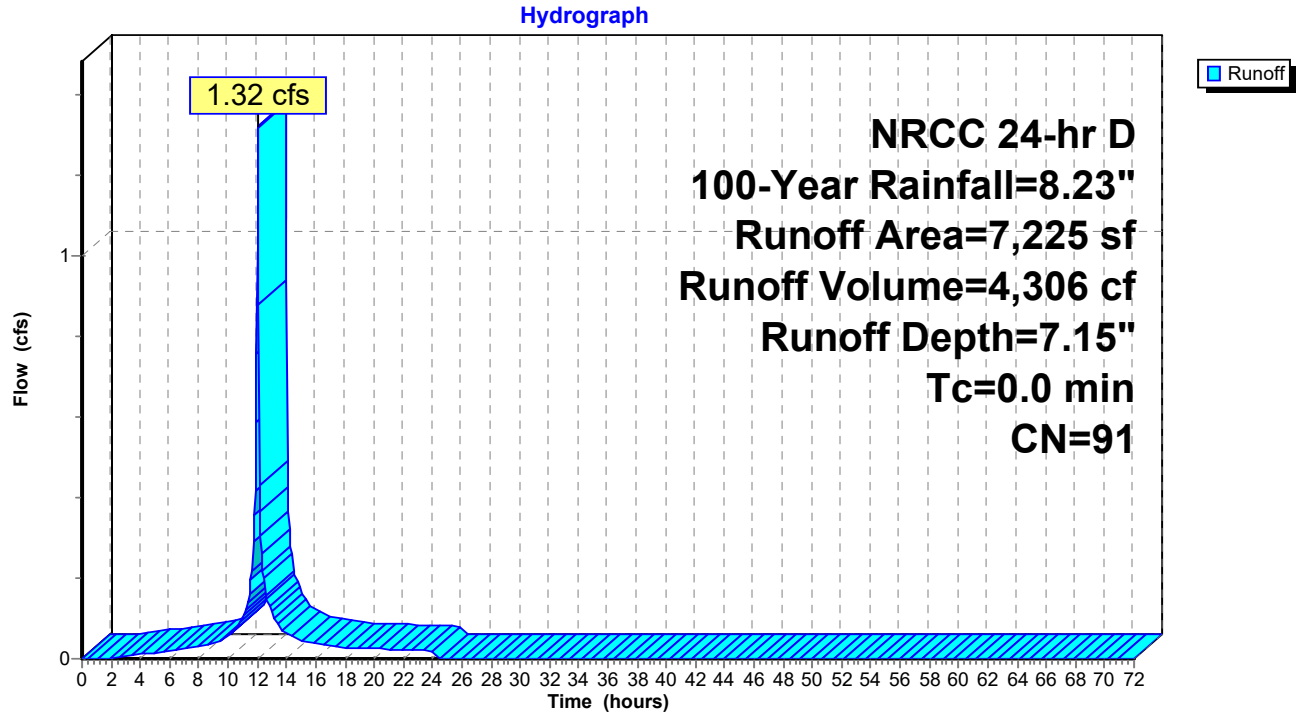
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.32 cfs @ 12.04 hrs, Volume= 4,306 cf, Depth= 7.15"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
858	39	>75% Grass cover, Good, HSG A
6,366	98	Paved parking, HSG A
7,225	91	Weighted Average
858		11.88% Pervious Area
6,366		88.12% Impervious Area

Subcatchment P-1D: Subcat P-1D



Summary for Subcatchment P-2: Subcatchment P-2

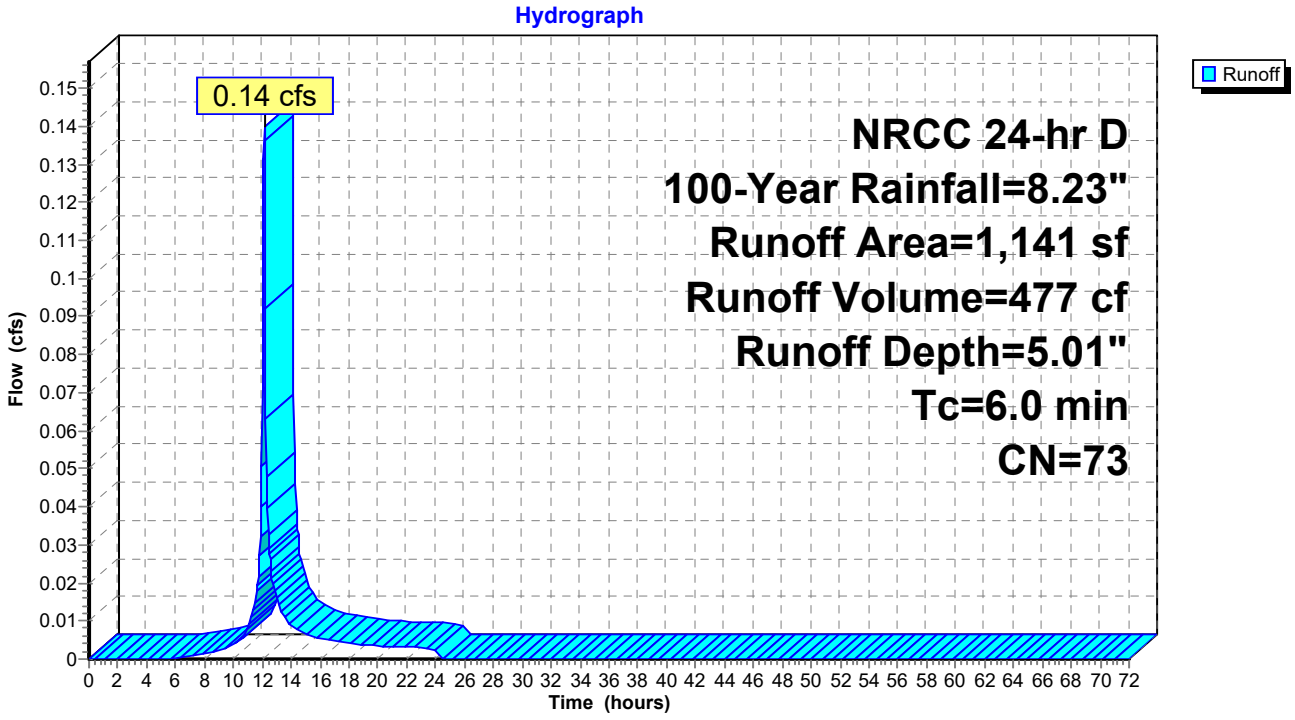
Runoff = 0.14 cfs @ 12.13 hrs, Volume= 477 cf, Depth= 5.01"
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
476	39	>75% Grass cover, Good, HSG A
665	98	Paved parking, HSG A
1,141	73	Weighted Average
476		41.73% Pervious Area
665		58.27% Impervious Area

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

Subcatchment P-2: Subcatchment P-2



Summary for Subcatchment P-3: Subcatchment P-3

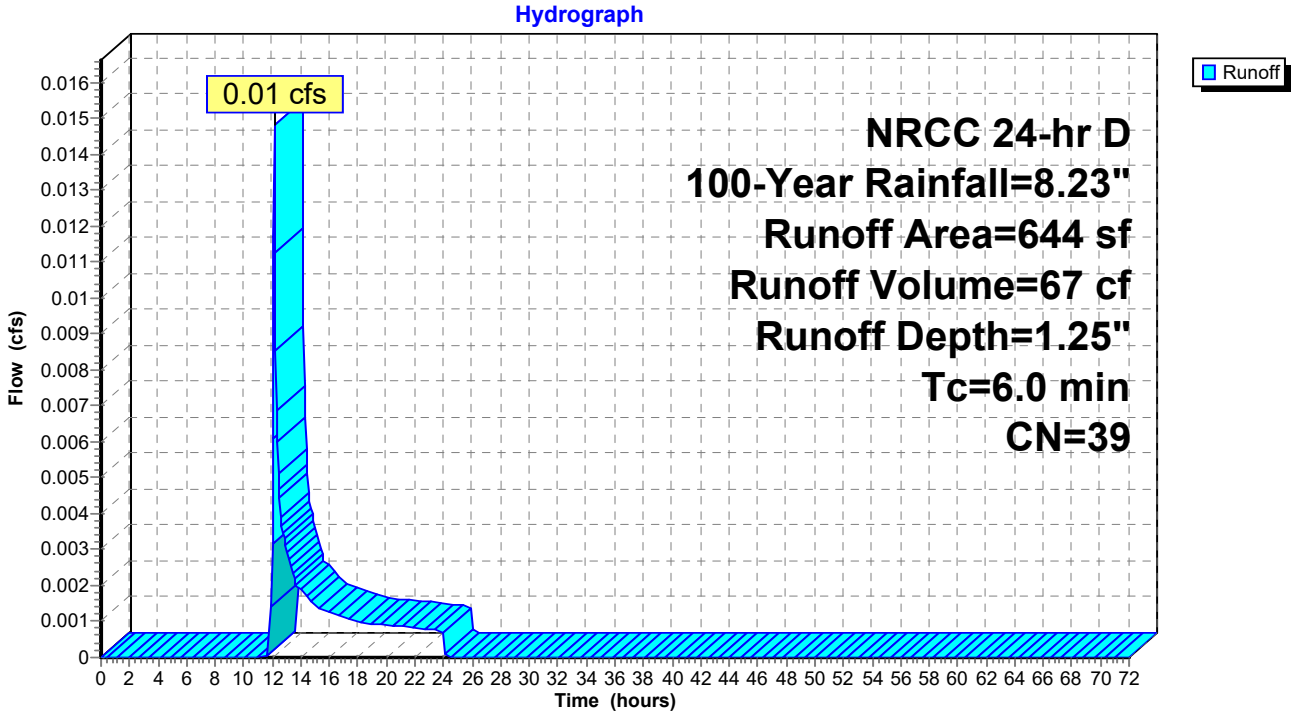
Runoff = 0.01 cfs @ 12.15 hrs, Volume= 67 cf, Depth= 1.25"
Routed to Link SP3 : Flow to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
644	39	>75% Grass cover, Good, HSG A
644		100.00% Pervious Area

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

Subcatchment P-3: Subcatchment P-3



Summary for Subcatchment R-1: Subcat R-1

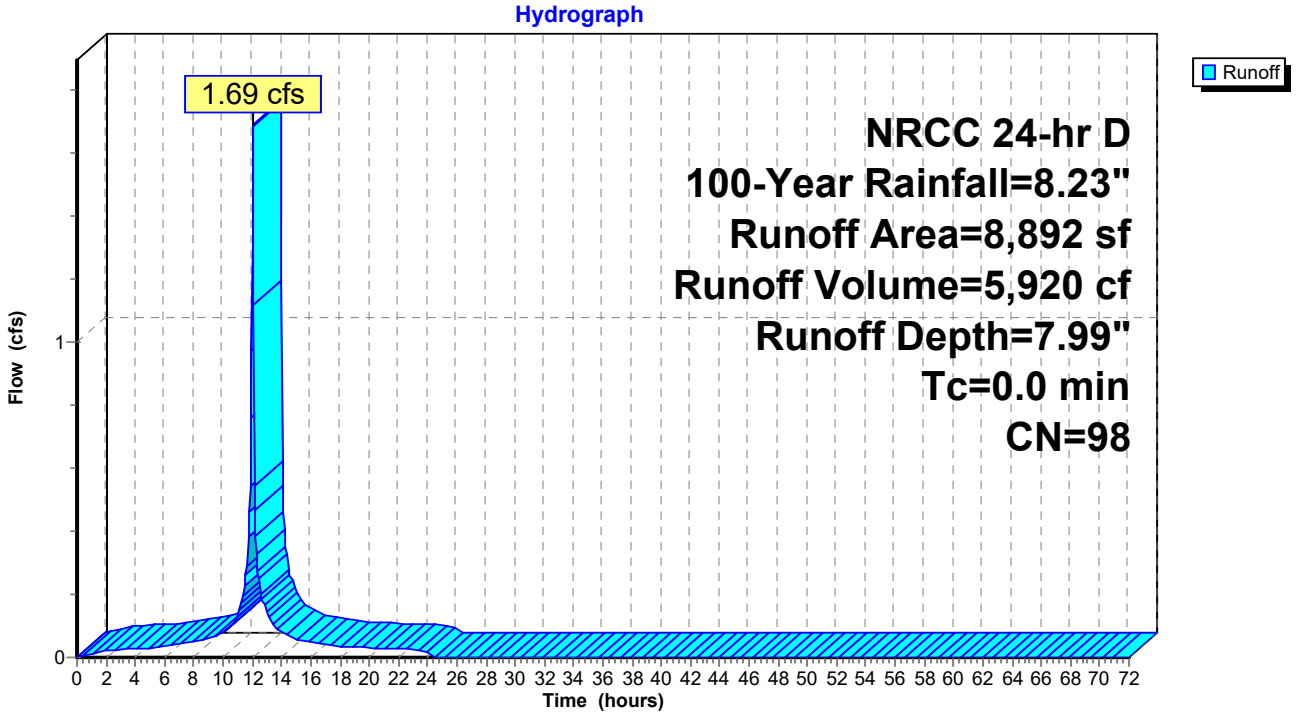
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.69 cfs @ 12.04 hrs, Volume= 5,920 cf, Depth= 7.99"
Routed to Pond UIS-2 : Underground Infiltration System 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.23"

Area (sf)	CN	Description
8,892	98	Roofs, HSG A
8,892		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



Summary for Pond UIS-1: Underground Infiltration System #1

Inflow Area = 6,985 sf, 87.39% Impervious, Inflow Depth = 7.15" for 100-Year event
Inflow = 1.28 cfs @ 12.04 hrs, Volume= 4,163 cf
Outflow = 0.31 cfs @ 12.26 hrs, Volume= 4,166 cf, Atten= 76%, Lag= 13.1 min
Discarded = 0.06 cfs @ 10.40 hrs, Volume= 3,755 cf
Primary = 0.24 cfs @ 12.26 hrs, Volume= 410 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 95.63' @ 12.26 hrs Surf.Area= 1,093 sf Storage= 1,262 cf

Plug-Flow detention time= 148.7 min calculated for 4,163 cf (100% of inflow)
Center-of-Mass det. time= 149.1 min (922.8 - 773.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.33'	686 cf	**18.17'W x 60.16'L x 2.33'H Field A** 2,550 cf Overall - 590 cf Embedded = 1,960 cf x 35.0% Voids
#2A	93.83'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 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 40 Chambers in 5 Rows
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.75'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.75' / 93.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	95.55'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.33'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 10.40 hrs HW=93.35' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.23 cfs @ 12.26 hrs HW=95.62' (Free Discharge)
└**1=Culvert** (Passes 0.23 cfs of 1.83 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.23 cfs @ 0.77 fps)

Pond UIS-1: Underground Infiltration System #1 - 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

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

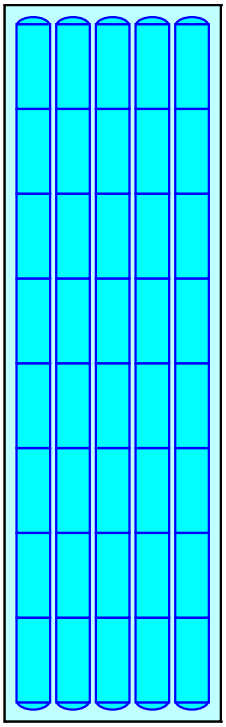
8 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 58.16' Row Length +12.0" End Stone x 2 = 60.16' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

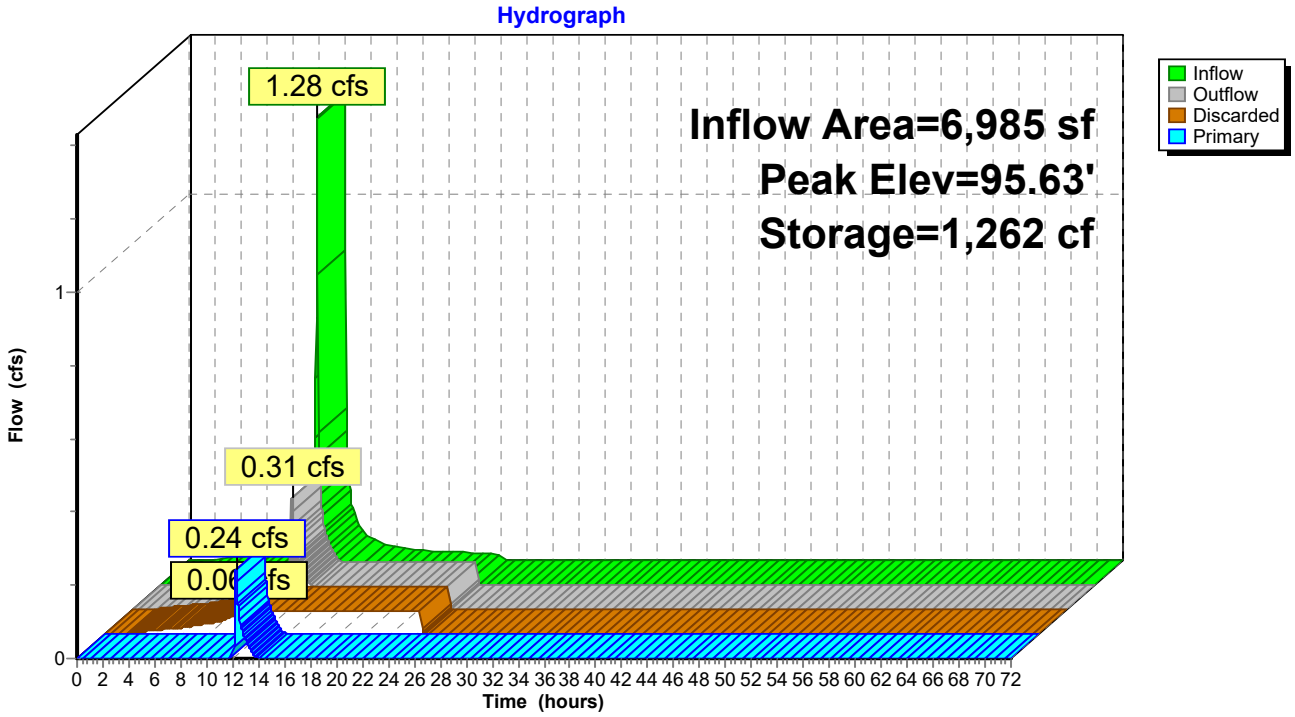
2,550.1 cf Field - 589.7 cf Chambers = 1,960.4 cf Stone x 35.0% Voids = 686.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,275.8 cf = 0.029 af
Overall Storage Efficiency = 50.0%
Overall System Size = 60.16' x 18.17' x 2.33'

40 Chambers
94.4 cy Field
72.6 cy Stone



Pond UIS-1: Underground Infiltration System #1



Summary for Pond UIS-2: Underground Infiltration System 2

Inflow Area = 33,054 sf, 81.96% Impervious, Inflow Depth = 6.71" for 100-Year event
Inflow = 5.73 cfs @ 12.04 hrs, Volume= 18,470 cf
Outflow = 1.19 cfs @ 12.29 hrs, Volume= 18,477 cf, Atten= 79%, Lag= 14.9 min
Discarded = 0.17 cfs @ 9.40 hrs, Volume= 15,543 cf
Primary = 1.02 cfs @ 12.29 hrs, Volume= 2,933 cf
Routed to Link SP1 : Flow to Exisitng Drainage on Pinevale Avenue

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 96.97' @ 12.29 hrs Surf.Area= 3,039 sf Storage= 6,426 cf

Plug-Flow detention time= 288.5 min calculated for 18,464 cf (100% of inflow)
Center-of-Mass det. time= 288.8 min (1,067.8 - 779.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	93.50'	2,785 cf	**77.50'W x 39.22'L x 3.50'H Field A** 10,638 cf Overall - 3,675 cf Embedded = 6,962 cf x 40.0% Voids
#2A	94.00'	3,675 cf	**ADS_StormTech SC-740 +Cap** x 80 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 80 Chambers in 16 Rows
		6,460 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	93.00'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.00' / 92.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	96.77'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	93.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.17 cfs @ 9.40 hrs HW=93.54' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=1.01 cfs @ 12.29 hrs HW=96.97' (Free Discharge)
└**1=Culvert** (Passes 1.01 cfs of 5.56 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.01 cfs @ 1.26 fps)

Pond UIS-2: Underground Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

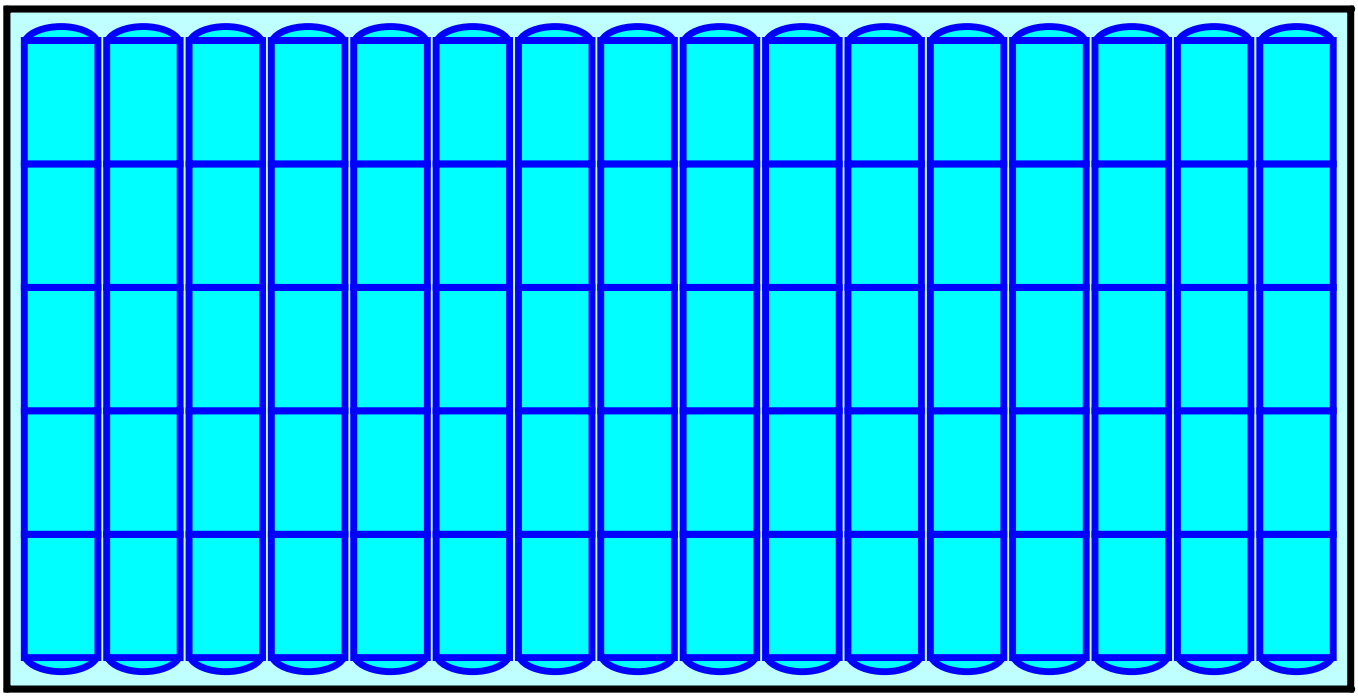
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
16 Rows x 51.0" Wide + 6.0" Spacing x 15 + 12.0" Side Stone x 2 = 77.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

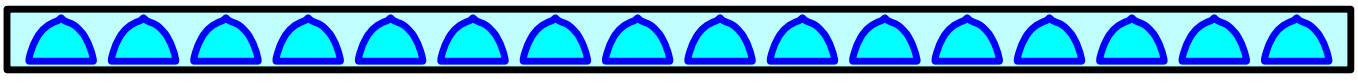
80 Chambers x 45.9 cf = 3,675.2 cf Chamber Storage

10,637.5 cf Field - 3,675.2 cf Chambers = 6,962.3 cf Stone x 40.0% Voids = 2,784.9 cf Stone Storage

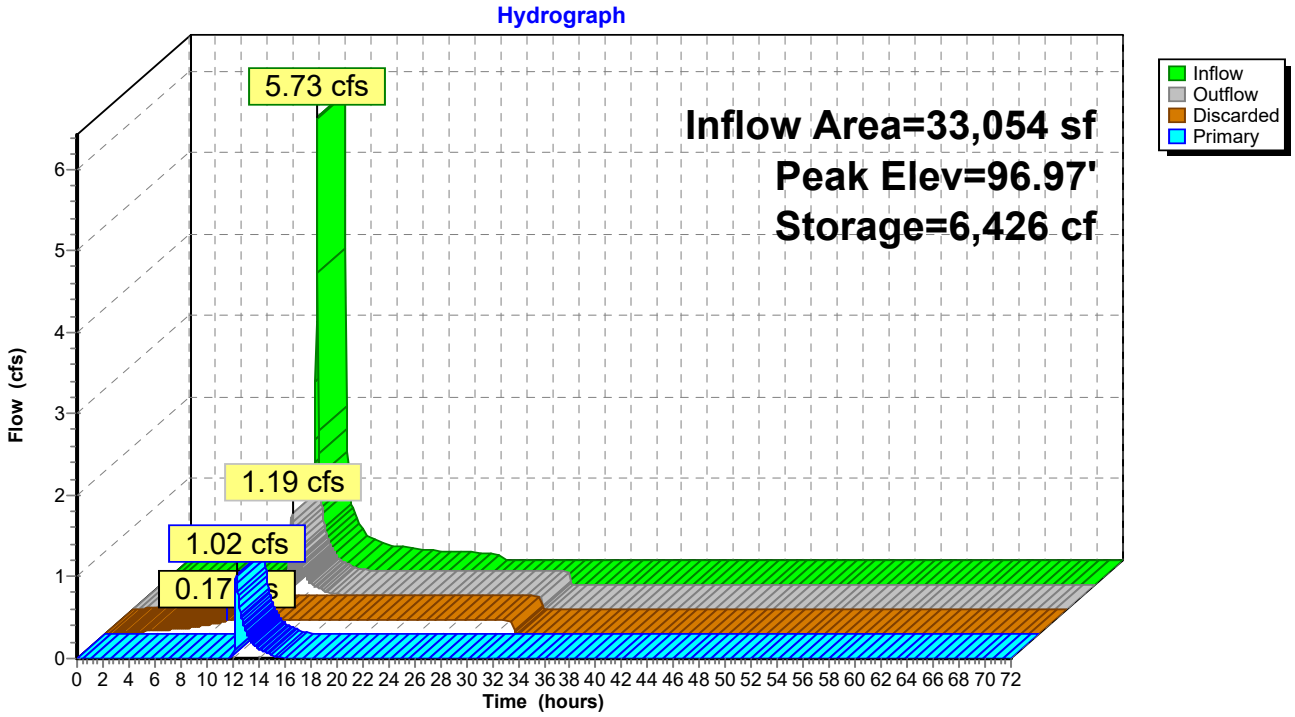
Chamber Storage + Stone Storage = 6,460.1 cf = 0.148 af
Overall Storage Efficiency = 60.7%
Overall System Size = 39.22' x 77.50' x 3.50'

80 Chambers
394.0 cy Field
257.9 cy Stone





Pond UIS-2: Underground Infiltration System 2

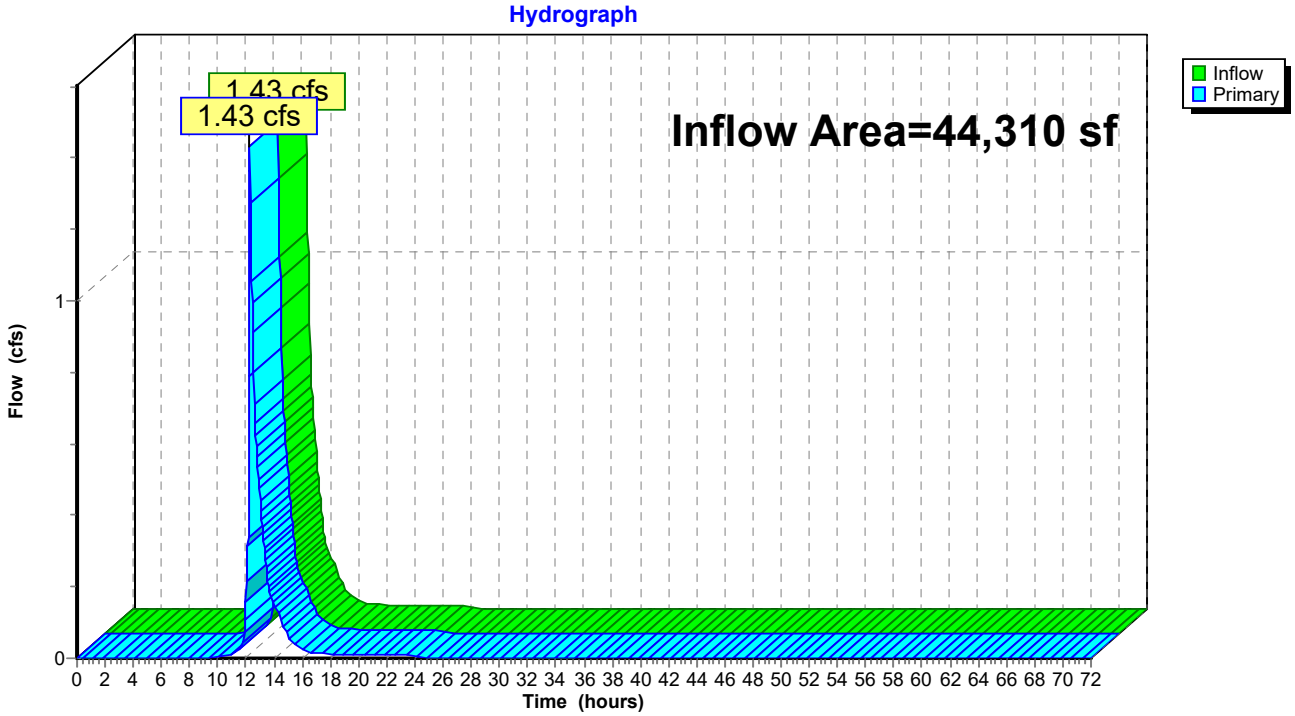


Summary for Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

Inflow Area = 44,310 sf, 77.95% Impervious, Inflow Depth = 1.22" for 100-Year event
Inflow = 1.43 cfs @ 12.27 hrs, Volume= 4,511 cf
Primary = 1.43 cfs @ 12.27 hrs, Volume= 4,511 cf, Atten= 0%, Lag= 0.0 min
Routed to Link SP2 : Flow to Exisitng Drainage on Main Street

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

Link SP1: Flow to Exisitng Drainage on Pinevale Avenue

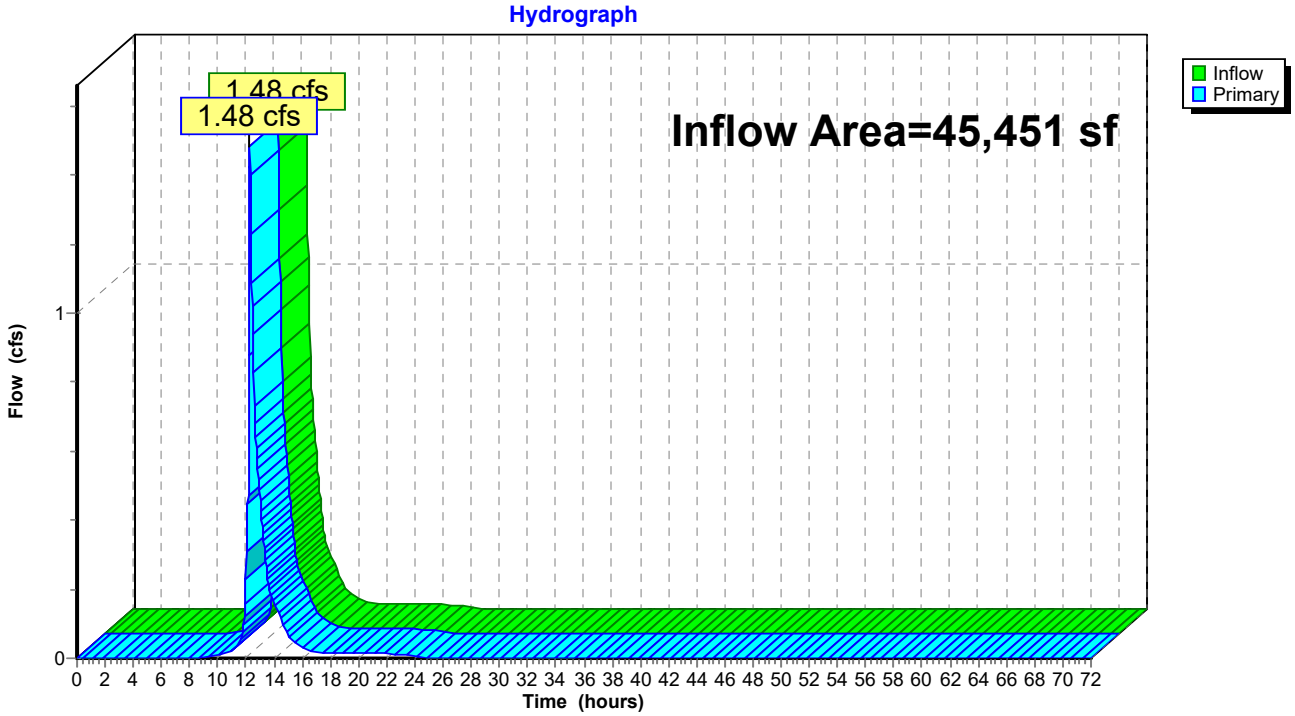


Summary for Link SP2: Flow to Exisitng Drainage on Main Street

Inflow Area = 45,451 sf, 77.46% Impervious, Inflow Depth = 1.32" for 100-Year event
Inflow = 1.48 cfs @ 12.27 hrs, Volume= 4,987 cf
Primary = 1.48 cfs @ 12.27 hrs, Volume= 4,987 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP2: Flow to Exisitng Drainage on Main Street

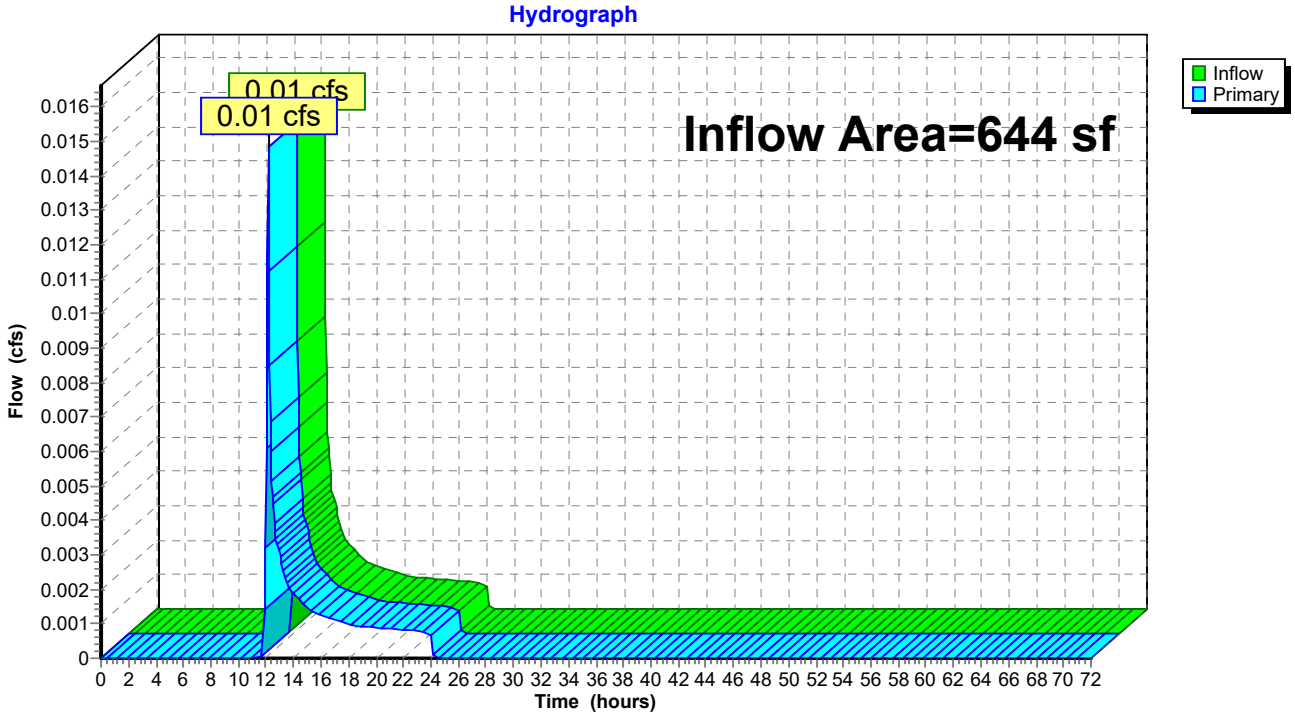


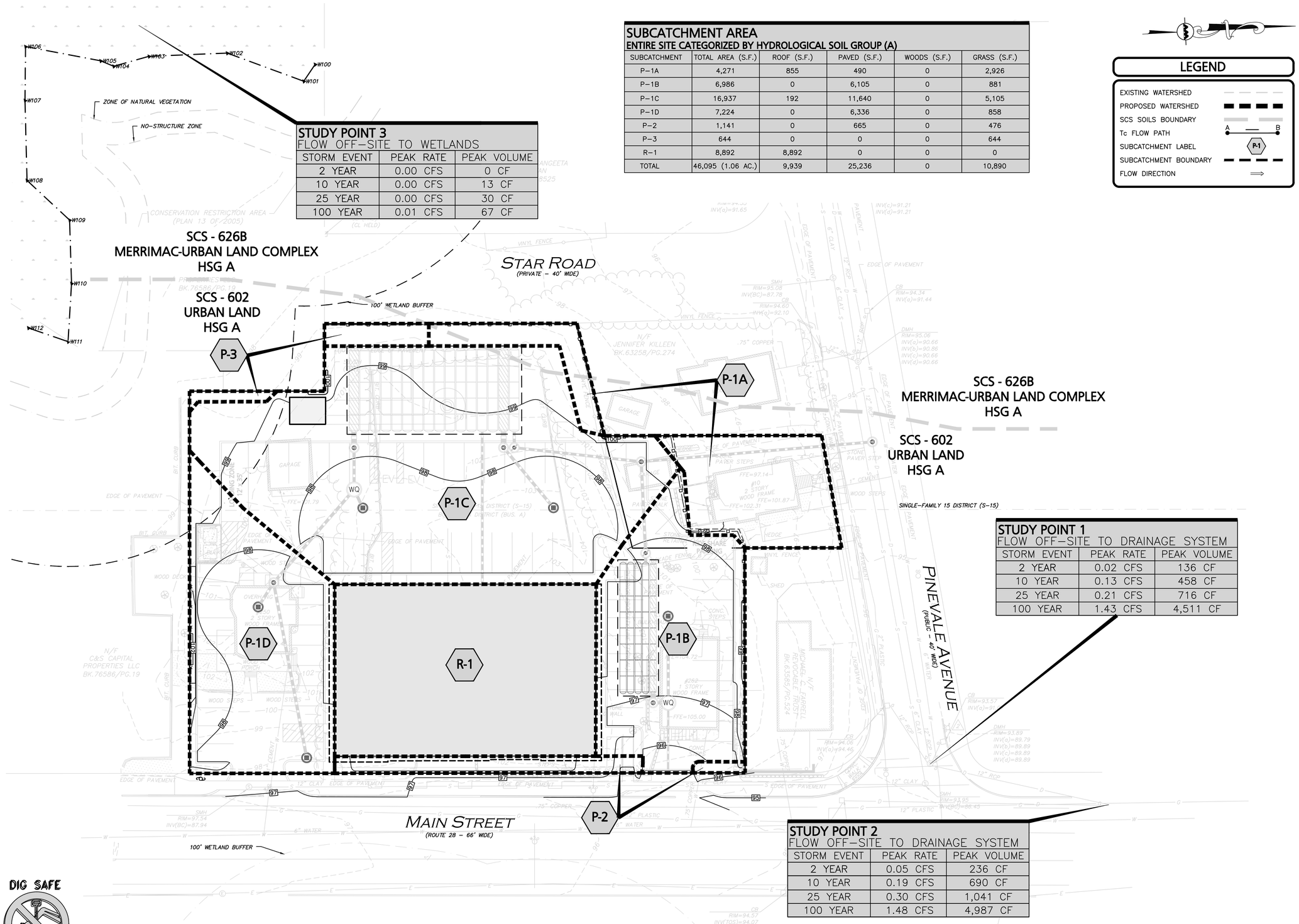
Summary for Link SP3: Flow to Wetlands

Inflow Area = 644 sf, 0.00% Impervious, Inflow Depth = 1.25" for 100-Year event
Inflow = 0.01 cfs @ 12.15 hrs, Volume= 67 cf
Primary = 0.01 cfs @ 12.15 hrs, Volume= 67 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

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

Link SP3: Flow to Wetlands





SCS - 626B
MERRIMAC-URBAN LAND COMPLEX
HSG A

SCS - 602
URBAN LAND
HSG A

SCS - 626B
MERRIMAC-URBAN LAND COMPLEX
HSG A

SCS - 602
URBAN LAND
HSG A

STUDY POINT 3
FLOW OFF-SITE TO WETLANDS

STORM EVENT	PEAK RATE	PEAK VOLUME
2 YEAR	0.00 CFS	0 CF
10 YEAR	0.00 CFS	13 CF
25 YEAR	0.00 CFS	30 CF
100 YEAR	0.01 CFS	67 CF

SUBCATCHMENT AREA
ENTIRE SITE CATEGORIZED BY HYDROLOGICAL SOIL GROUP (A)

SUBCATCHMENT	TOTAL AREA (S.F.)	ROOF (S.F.)	PAVED (S.F.)	WOODS (S.F.)	GRASS (S.F.)
P-1A	4,271	855	490	0	2,926
P-1B	6,986	0	6,105	0	881
P-1C	16,937	192	11,640	0	5,105
P-1D	7,224	0	6,336	0	858
P-2	1,141	0	665	0	476
P-3	644	0	0	0	644
R-1	8,892	8,892	0	0	0
TOTAL	46,095 (1.06 AC.)	9,939	25,236	0	10,890

LEGEND

- EXISTING WATERSHED
- PROPOSED WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A — B)
- SUBCATCHMENT LABEL (P-1)
- SUBCATCHMENT BOUNDARY
- FLOW DIRECTION

STUDY POINT 1
FLOW OFF-SITE TO DRAINAGE SYSTEM

STORM EVENT	PEAK RATE	PEAK VOLUME
2 YEAR	0.02 CFS	136 CF
10 YEAR	0.13 CFS	458 CF
25 YEAR	0.21 CFS	716 CF
100 YEAR	1.43 CFS	4,511 CF

STUDY POINT 2
FLOW OFF-SITE TO DRAINAGE SYSTEM

STORM EVENT	PEAK RATE	PEAK VOLUME
2 YEAR	0.05 CFS	236 CF
10 YEAR	0.19 CFS	690 CF
25 YEAR	0.30 CFS	1,041 CF
100 YEAR	1.48 CFS	4,987 CF

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

N:\PROJECTS\2398-01A\CIVIL\DRAWINGS\CURRENT\C-2398-01A_WATERSHED-PROPOSED.DWG

DIG SAFE
BEFORE YOU DIG CALL 811 OR 1-888-DIG-SAFE 1-888-344-7233

COMMONWEALTH OF MASSACHUSETTS
CARLTON M. QUINN
CIVIL
No.49923
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER FOR ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
B	3/25/2024	REVISED PER TOWN COMMENTS
A	2/29/2024	REVISED PER TOWN COMMENTS

APPLICANT/OWNER:
BLVD READING, LLC
c/o SAVERIO FULCINITI
1 SYLVAN STREET
PEABODY, MA 01960

PROJECT:

STRADA
MIXED USE BUILDING
258 MAIN STREET
READING, MA

PROJECT NO.	2398-01A	DATE:	10-05-2023
SCALE:	1" = 20'	DWG. NAME:	C-2398-01A
DESIGNED BY:	MTB	CHECKED BY:	CMQ

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY, SUITE 5
WOBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
PROPOSED WATERSHED PLAN

SHEET No.
PWS-1

SECTION 6.0 -
APPENDIX

NOAA Atlas 14, Volume 10, Version 3
Location name: Reading, Massachusetts, USA*
Latitude: 42.5055°, Longitude: -71.1034°
Elevation: 182 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.309** (0.238-0.390)	**0.373** (0.287-0.471)	**0.478** (0.367-0.606)	**0.566** (0.432-0.722)	**0.686** (0.508-0.917)	**0.775** (0.565-1.06)	**0.871** (0.619-1.24)	**0.983** (0.660-1.43)	**1.15** (0.744-1.73)	**1.29** (0.816-1.98)
10-min	**0.438** (0.337-0.552)	**0.529** (0.407-0.668)	**0.678** (0.519-0.859)	**0.801** (0.611-1.02)	**0.971** (0.720-1.30)	**1.10** (0.800-1.50)	**1.23** (0.876-1.76)	**1.39** (0.934-2.02)	**1.63** (1.05-2.45)	**1.83** (1.16-2.81)
15-min	**0.515** (0.396-0.649)	**0.622** (0.478-0.785)	**0.797** (0.611-1.01)	**0.943** (0.720-1.20)	**1.14** (0.847-1.53)	**1.29** (0.940-1.77)	**1.45** (1.03-2.07)	**1.64** (1.10-2.38)	**1.92** (1.24-2.89)	**2.15** (1.36-3.30)
30-min	**0.708** (0.545-0.893)	**0.855** (0.658-1.08)	**1.10** (0.841-1.39)	**1.30** (0.989-1.65)	**1.57** (1.17-2.11)	**1.78** (1.30-2.44)	**2.00** (1.42-2.86)	**2.26** (1.52-3.28)	**2.65** (1.71-3.99)	**2.97** (1.88-4.57)
60-min	**0.901** (0.693-1.14)	**1.09** (0.838-1.38)	**1.40** (1.07-1.77)	**1.65** (1.26-2.11)	**2.00** (1.49-2.68)	**2.27** (1.65-3.11)	**2.55** (1.81-3.64)	**2.88** (1.93-4.18)	**3.38** (2.18-5.09)	**3.80** (2.40-5.84)
2-hr	**1.17** (0.904-1.46)	**1.42** (1.10-1.78)	**1.83** (1.42-2.31)	**2.18** (1.67-2.76)	**2.65** (1.98-3.54)	**3.00** (2.20-4.10)	**3.38** (2.43-4.83)	**3.85** (2.59-5.56)	**4.58** (2.97-6.85)	**5.22** (3.31-7.95)
3-hr	**1.36** (1.06-1.69)	**1.65** (1.29-2.07)	**2.14** (1.66-2.69)	**2.55** (1.96-3.21)	**3.11** (2.33-4.13)	**3.52** (2.60-4.80)	**3.97** (2.87-5.66)	**4.53** (3.06-6.51)	**5.41** (3.52-8.06)	**6.18** (3.93-9.38)
6-hr	**1.75** (1.37-2.17)	**2.14** (1.67-2.66)	**2.77** (2.16-3.46)	**3.30** (2.56-4.14)	**4.03** (3.04-5.32)	**4.56** (3.38-6.17)	**5.14** (3.74-7.28)	**5.88** (3.98-8.38)	**7.02** (4.58-10.4)	**8.02** (5.12-12.1)
12-hr	**2.23** (1.76-2.74)	**2.72** (2.15-3.36)	**3.54** (2.78-4.37)	**4.21** (3.28-5.24)	**5.13** (3.90-6.72)	**5.81** (4.34-7.80)	**6.56** (4.78-9.19)	**7.48** (5.08-10.6)	**8.90** (5.82-13.0)	**10.1** (6.48-15.1)
24-hr	**2.67** (2.12-3.27)	**3.31** (2.62-4.05)	**4.35** (3.44-5.34)	**5.21** (4.10-6.44)	**6.40** (4.89-8.33)	**7.27** (5.46-9.70)	**8.23** (6.04-11.5)	**9.42** (6.43-13.2)	**11.3** (7.42-16.4)	**12.9** (8.30-19.1)
2-day	**3.03** (2.42-3.68)	**3.83** (3.06-4.66)	**5.13** (4.08-6.26)	**6.21** (4.92-7.62)	**7.70** (5.93-9.99)	**8.78** (6.65-11.7)	**10.0** (7.42-14.0)	**11.6** (7.92-16.1)	**14.1** (9.27-20.3)	**16.3** (10.5-24.0)
3-day	**3.31** (2.66-4.01)	**4.17** (3.35-5.06)	**5.58** (4.46-6.78)	**6.74** (5.36-8.24)	**8.34** (6.45-10.8)	**9.51** (7.23-12.6)	**10.8** (8.05-15.0)	**12.5** (8.59-17.4)	**15.3** (10.1-21.9)	**17.7** (11.4-25.9)
4-day	**3.59** (2.89-4.33)	**4.47** (3.60-5.40)	**5.92** (4.75-7.18)	**7.12** (5.67-8.68)	**8.77** (6.80-11.3)	**9.98** (7.60-13.2)	**11.3** (8.45-15.7)	**13.1** (9.00-18.1)	**15.9** (10.5-22.8)	**18.5** (11.9-26.9)
7-day	**4.36** (3.53-5.23)	**5.28** (4.27-6.34)	**6.78** (5.47-8.17)	**8.03** (6.43-9.73)	**9.75** (7.59-12.4)	**11.0** (8.41-14.4)	**12.4** (9.26-17.0)	**14.2** (9.80-19.5)	**17.1** (11.3-24.3)	**19.7** (12.7-28.4)
10-day	**5.06** (4.11-6.05)	**6.00** (4.88-7.19)	**7.55** (6.11-9.07)	**8.84** (7.11-10.7)	**10.6** (8.27-13.5)	**11.9** (9.10-15.5)	**13.3** (9.94-18.1)	**15.1** (10.5-20.7)	**18.0** (12.0-25.4)	**20.5** (13.3-29.5)
20-day	**7.04** (5.76-8.36)	**8.08** (6.61-9.60)	**9.78** (7.97-11.7)	**11.2** (9.07-13.4)	**13.1** (10.3-16.4)	**14.6** (11.2-18.6)	**16.1** (11.9-21.4)	**17.9** (12.5-24.2)	**20.5** (13.7-28.7)	**22.7** (14.7-32.3)
30-day	**8.69** (7.14-10.3)	**9.80** (8.05-11.6)	**11.6** (9.51-13.8)	**13.1** (10.7-15.7)	**15.2** (11.9-18.9)	**16.8** (12.8-21.2)	**18.4** (13.6-24.1)	**20.2** (14.1-27.1)	**22.6** (15.1-31.3)	**24.4** (15.9-34.7)
45-day	**10.8** (8.90-12.7)	**12.0** (9.88-14.1)	**13.9** (11.4-16.5)	**15.5** (12.7-18.5)	**17.8** (14.0-21.8)	**19.5** (14.9-24.4)	**21.2** (15.6-27.3)	**22.9** (16.1-30.6)	**25.1** (16.9-34.6)	**26.7** (17.4-37.7)
60-day	**12.6** (10.4-14.8)	**13.8** (11.4-16.2)	**15.9** (13.1-18.7)	**17.5** (14.4-20.8)	**19.9** (15.6-24.3)	**21.7** (16.6-27.0)	**23.5** (17.2-30.0)	**25.1** (17.7-33.4)	**27.2** (18.3-37.4)	**28.6** (18.7-40.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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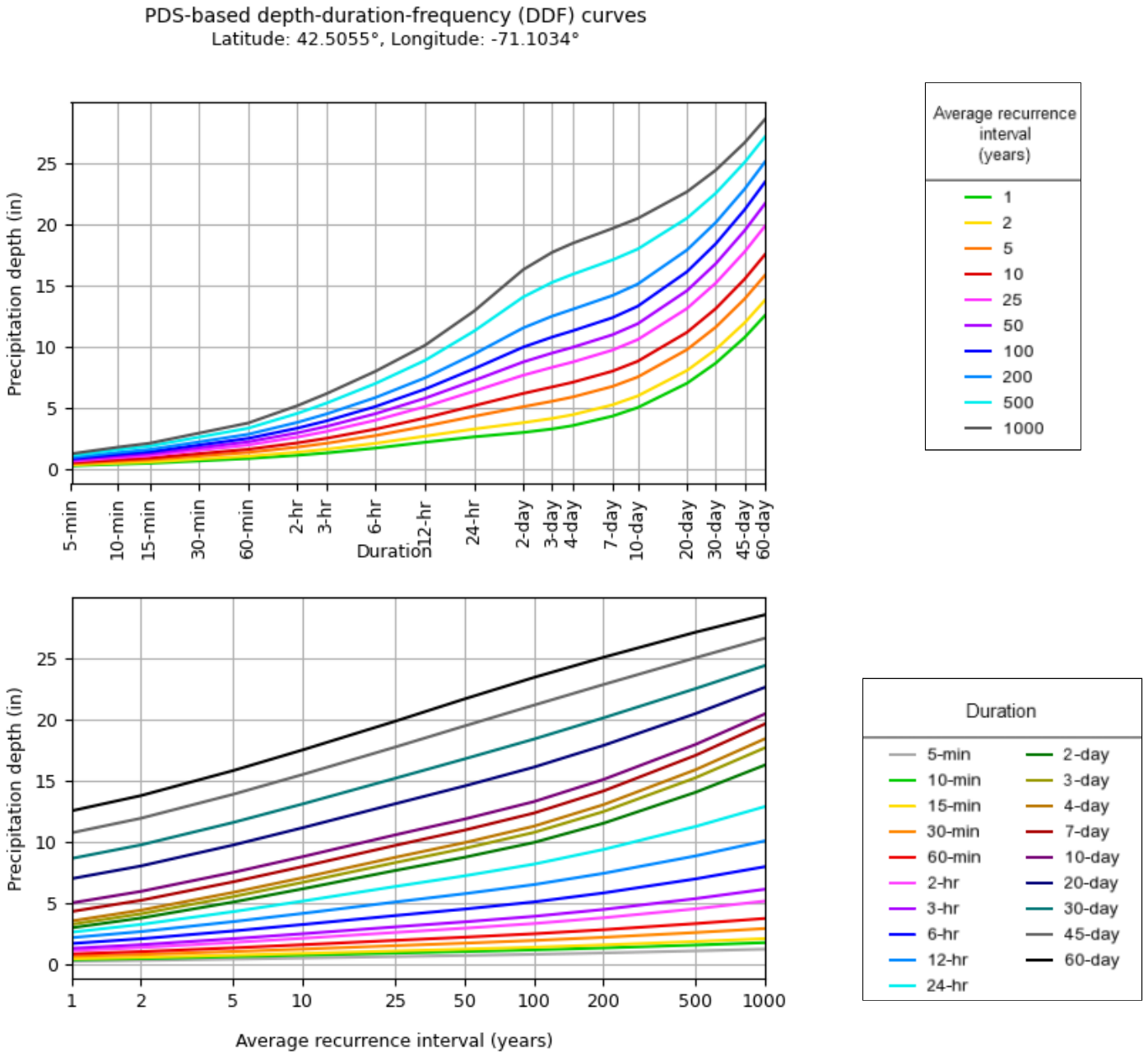
PF graphical



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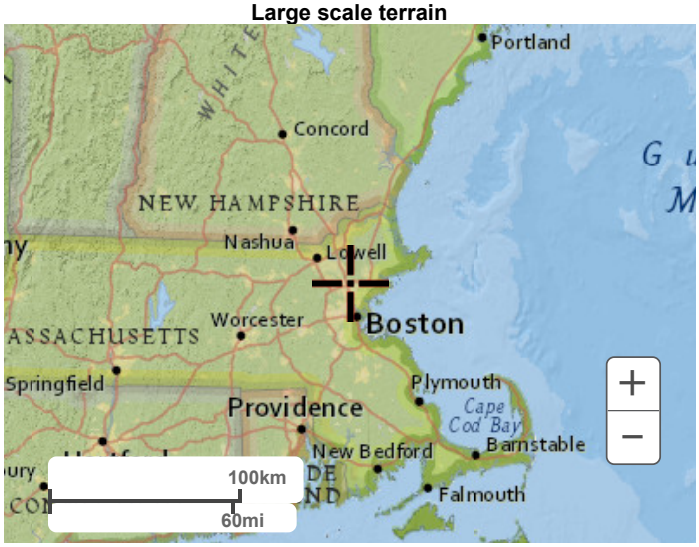
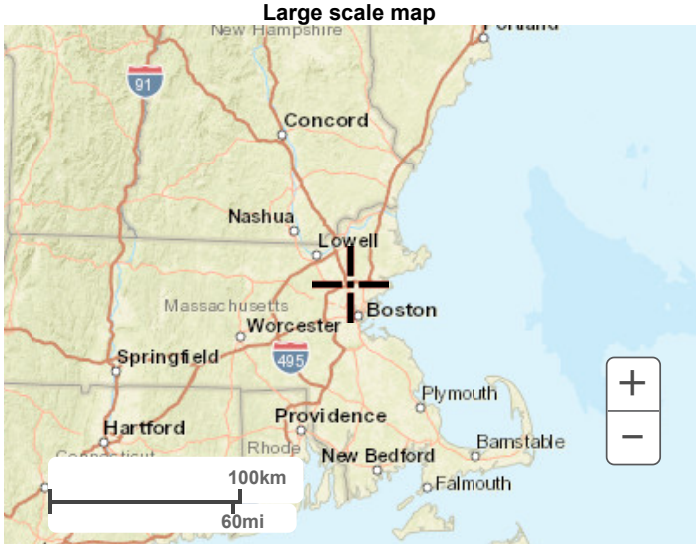
Maps & aerials

Small scale terrain

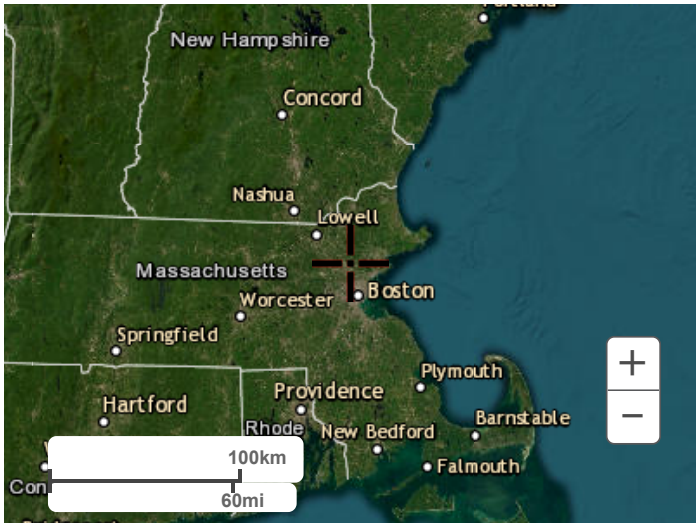
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe	
Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic)	
Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgtn.)	
Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay	
Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
Open Channels	
Lined Channels	
Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged	
Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet)	
Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Middlesex County, Massachusetts

July 17, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 22, Sep 9, 2022

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	1.6	57.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	1.2	42.9%
Totals for Area of Interest		**2.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

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Allen & Major Associates, Inc. — Computation Sheet

Title	***Pipe Sizing Table***
Project	*STRADA Mixed Use Building*
Location	258 MAIN STREET, READING
Date	December 10, 2023
Revised	March 25, 2024

By	SMF
Chk'd	CMQ
Apprv'd	CMQ

Minimum Slope:	0.005
Minimum Pipe Size:	12"
Rainfall Intensity (in/hr):	6.40 (25 year storm)
Manning's n:	0.013 HDPE (SMOOTH BORE)
Minimum Pipe Cover:	1.5'

Line						Req'd. Capac.	Pipe Size	Slope	Flow at Inv. Slope		Drop	Invert Elevation		Rim Elev.		Pipe
From Upper	To Lower	Length (feet)	Area (acres)	wgt. *C*	*CA*	*Qd* (cfs)	*D* (in)	*s* (%)	Q_{full} (cfs)	V_{full} (fps)	(feet)	Upper (ft)	Lower (ft)	Upper (ft)	Cover (ft)	Material
CB-1A	DMH-1	79	0.066	0.85	0.056	0.36	12	0.50%	2.54	3.22	0.40	94.14	93.74	97.05	1.79	HDPE
CB-1B	DMH-1	13	0.100	0.81	0.080	0.52	12	1.00%	3.57	4.54	0.13	93.87	93.74	97.50	2.51	HDPE
DMH-1	WQU-1	55				0.88	12	1.00%	3.58	4.55	0.55	93.64	93.09	97.75	2.99	HDPE
CB-2	WQU-1	9	0.217	0.74	0.160	1.02	12	1.00%	3.58	4.54	0.09	93.18	93.09	97.40	3.09	HDPE
WQU-1	DMH-2	19				1.02	12	0.50%	2.51	3.19	0.09	94.09	94.00	98.05	2.83	HDPE
RD-1	UIS-2	68	0.204	0.90	0.184	1.18	10	0.50%	1.55	2.84	0.34	94.44	94.10	98.50	3.10	HDPE
WQU-3	DMH-3	35	0.172	0.72	0.123	0.79	12	1.00%	3.56	4.53	0.35	94.35	94.00	97.40	1.93	HDPE
CB-3	WQU-2	37	0.082	0.82	0.067	0.43	12	1.00%	3.58	4.54	0.37	92.74	92.36	96.50	2.64	HDPE
TD-1	WQU-2	30	0.078	0.85	0.066	0.42	12	5.00%	7.98	10.14	1.48	93.84	92.36	95.50	0.53	HDPE
WQU-2	DMH-7	7				0.85	12	0.50%	2.54	3.22	0.03	93.36	93.33	97.00	2.51	HDPE
OCS-1	DMH-5	59	**HYDROCAD: 25 YEAR STORM**			0.00	12	1.00%	3.58	4.54	0.59	93.69	93.10	98.18	3.37	HDPE
DMH-6	DMH-5	41	**HYDROCAD: 25 YEAR STORM**			0.00	12	1.00%	3.57	4.54	0.41	93.51	93.10	97.85	3.22	HDPE
DMH-5	DMH-8	101	**HYDROCAD: 25 YEAR STORM**			0.00	12	0.99%	3.55	4.51	1.00	93.00	92.00	98.70	4.58	HDPE

			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	MTB
Project	*Strada, Mixed Use Building*		Chk'd	CMQ
Location	258 Main Street, Reading MA		Apprv'd	CMQ
Date	October 10, 2024			
Revised	March 25, 2024			

Stormwater Recharge/Water Quality Volume Table

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

					Recharge Required			***Water Quality Volume Required***	
Watershed	**Area (Sq. Ft.)**	**Landscaped**	**Impervious Area (Square Feet)**		***F Avg. (Inches)***	***Impervious Area (Feet)***	***Rv*** (ft^3)	D_{WQ} *(Inch)*	A_{WQ}
			HSG A (F=.6)	**HSG B (F=.35)**					
P-1A	4,271	2,926	1,345	0	0.6	1,345	67	1.0	112
P-1B	6,986	881	6,105	0	0.6	6,105	305	1.0	509
P-1C	16,937	5,105	11,832	0	0.6	11,832	592	1.0	986
P-1D	7,224	858	6,366	0	0.6	6,366	318	1.0	531
P-2	1,141	476	665	0	0.6	665	33	1.0	55
P-3	644	644	0	0	0.0	0	0	1.0	0
R-1	8,892	0	8,892	0	0.6	8,892	445	1.0	741
Total	**46,095**	**10,890**	**35,205**	**0**	0.6	**35,205**	**1,760**	1.0	**2,934**

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

	Required (cf)	***Provided (cf)***	
ARv =	***305***	***1,262***	***Underground Infiltration System #1 (P-1B)***
ARv =	***305***	***1,262***	***Total***

	Required (cf)	***Provided (cf)***	
ARv =	***1,355***	***6,423***	***Underground Infiltration System #2 (P-1C,P-1D,R-1)***
ARv =	***1,355***	***6,423***	***Total***

Water Quality Volume

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	MTB
Project	*Strada, Mixed Use Building*		Chk'd	CMQ
Location	258 Main Street, Reading MA		Apprv'd	CMQ
Date	March 25, 2024			

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***909***	***1,262***	***Underground Infiltration System #1 (P-1B)***
A_{WQ} =	***909***	***1,262***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***509***	***6,423***	***Underground Infiltration System #2 (P-1C,P-1D,R-1)***
A_{WQ} =	***509***	***6,423***	***Total***

Draindown Within 72 Hours

$Time_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration System #1 - HSG A	
Infiltration Rate (in/Hr)=	2.41
Bottom Area (ft^2) =	1,093
Infiltration Volume (ft^3) =	1,262
$Time_{drawdown}$ (Hours)=	5.75

Infiltration System #2 - HSG A	
Infiltration Rate (in/Hr)=	2.41
Bottom Area (ft^2) =	3,039
Infiltration Volume (ft^3) =	6,423
$Time_{drawdown}$ (Hours)=	10.52

TSS Removal Worksheet

Location:	258 Main Street, Reading MA
Date:	10/05/23
Project:	Strada - Mixed Use Builidng
Prepared By:	MTB
Date:	10/05/23

Underground Infiltration System #1,2,3

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump Catch Basins	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
StormTech Chambers	**0.80**	**0.38**	**0.30**	**0.08**

Total TSS Removal = **93%**

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

ALLEN & MAJOR ASSOCIATES,

Project No.	2398-01A	**Sheet:** 1 of 2	
Project Description:	Mixed Use Building		
Calculated By:	SMF	**Date**: 2/28/2024	
Revision By:	SMF	**Date:** 3/25/2024	
Checked By:	CMQ	**Date:** 3/25/2024	

ESTIMATION FOR PHOSPHORUS REMOVAL

Proposed Condition Phosphorus Loading			
Site Use	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)
High Density Residential	2.32	0.80	1.86
Open Space Soil Type A	0.03	0.25	0.01
Forest	0.13	0.03	0.00
	Total	**1.08**	**1.88**

Proposed Condition Phosphorus Loading Reduction				
BMP	BMP (Appendix F Category)	Total Phosphorous Load to BMP (lbs/yr)***	BMP Removal %**	Phosphorus Removed by BMPs (lbs/year)
Infiltration Chambers #1	Infiltration Trench	0.33	100%	0.33
Infiltration Chambers #2	Infiltration Trench	1.44	100%	1.44
Note: See following pages for phosphorus removal calculations			**Total**	**1.76**

Proposed Load before reduction		**-**	**Loading Reduction**	**=Actual Constructed Phosphorus Load**	
Actual Constructed Phosphorus Load	1.88	-	1.76		
Actual Constructed Phosphorus Load	**0.11**	**lb/yr**			

Percent Phosphorus Removed =	Loading Reduction / Proposed Load before reduction x 100			
Percent Phosphorus Removed =	**94%**	**>**	**60%**	**TARGET IS MET**

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	2398-01A	**Sheet:** 2 of 2	
Project Description:	Mixed Use Building		
Calculated By:	SMF	**Date**: 2/28/2024	
Revision By:	SMF	**Date:** 3/25/2024	
Checked By:	CMQ	**Date:** 3/25/2024	

Phosphorus Calculations Per BMP

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Infiltration Chambers #1			(per BMP)	Area to Chambers*	6,986	S.F.
High Density Residential	2.32	0.14	0.33	Volume Treated	1,232	C.F.
Open Space Soil Type A	0.03	0.02	0.00	Depth of runoff treated	2.1	IN.
Open Space Soil Type C	0.21	0.00	0.00	**BMP Removal %****	**100%**	
Open Space Soil Type D	0.37	0.00	0.00			
Forest	0.13	0.00	0.00			
	total	**0.16**	**0.33**			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Infiltration Chambers #2			(per BMP)	Area to Chambers*	33,054	S.F.
High Density Residential	2.32	0.62	1.43	Volume Treated	6,181	C.F.
Open Space Soil Type A	0.03	0.14	0.00	Depth of runoff treated	2.2	IN.
Open Space Soil Type C	0.21	0.00	0.00	**BMP Removal %****	**100%**	
Open Space Soil Type D	0.37	0.00	0.00			
Forest	0.13	0.00	0.00			
	total	**0.76**	**1.44**			

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

One Sylvan LLC
Owner Name

258 Main Street
Street Address

011.0-0000-0193.0
Map/Lot #

Reading
City

MA
State

01867
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — Web Soil Survey (Source); 602 (Soil Map Unit); Urban Land (Soil Series)

   Ledges (Landform); N/A (Soil Limitations)

   Excavated and Filled land. (Soil Parent material)

3. Surficial Geological Report — 2018 / Stone, Stone, DiGiacomo-Cohen (Year Published/Source); Coarse Deposits. (Map Unit)

   consist of gravel deposits, sand and gravel deposits, and sand deposits. (Description of Geologic Map Unit:)

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): 12/8/2023 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
   Not in Zone A, Zone II, or IWPA.
   N/A

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: STP - 1 (Hole #) | 11/28/2023 (Date) | 11:10 (Time) | Sunny (Weather) | 42.514180 (Latitude) | -71.104250 (Longitude)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) | Trees/weeds (Vegetation) | Damaged asphalt (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: Appx. 11' south of the center of the bend in the southern bit curb in vacant parking lot.

2. Soil Parent Material: Excavated and filled land | Ledge (Landform) | SU (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ± feet | Drainage Way ± feet | Wetlands ± feet | Property Line ± feet | Drinking Water Well ± feet | Other ± feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: - Depth to Weeping in Hole - Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	FSL	10YR 3/2	-	Cnc :- Dpl: -	-	-	-	Massive	Friable	-
12-34	Bw	FSL	10YR 5/4	-	Cnc :- Dpl: -	-	15-35	15-35	Massive	Friable	Boulders encountered
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Large boulders encountered at 34".

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: STP - 2 (Hole #) | 11/28/2023 (Date) | 11:32 (Time) | Sunny (Weather) | 42.514180 (Latitude) | -71.104250 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Trees/weeds (Vegetation) | Damaged asphalt (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

   Description of Location: Appx. 14' southwest of the edge of the southwest bit curb.

2. Soil Parent Material: Excavated and filled land | Ledges (Landform) | SU (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ± feet | Drainage Way ± feet | Wetlands ± feet | Property Line ± feet | Drinking Water Well ± feet | Other ± feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: - Depth to Weeping in Hole - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	FSL	10YR 3/2	-	Cnc :- Dpl: -	-	-	-	Massive	Friable	-
12-27	Bw	FSL	10YR 5/4	-	Cnc :- Dpl: -	-	-	-	Massive	Friable	-
27-104	C	Fine-Medium Sand	10YR 5/2	-	Cnc :- Dpl: -	-	15-35	15-35	S. Grain	Loose	Bouldery
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):	Obs. Hole #STP - 1	Obs. Hole #STP - 2
☐ Depth to soil redoximorphic features	- inches	- inches
☐ Depth to observed standing water in observation hole	- inches	- inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☐ Yes ☒ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: 12 inches Lower boundary: 34 inches

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

William Simmons

Signature of Soil Evaluator

12/8/2023
Date

William Simmons / SE 14606
Typed or Printed Name of Soil Evaluator / License #

May 1, 2025
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

One Sylvan LLC
Owner Name

258 Main Street
Street Address

011.0-0000-0193.0
Map/Lot #

Reading
City

MA
State

01867
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — Web Soil Survey (Source); 602 (Soil Map Unit); Urban Land (Soil Series)

   Ledges
   Landform

   N/A
   Soil Limitations

   Excavated and Filled land.
   Soil Parent material

3. Surficial Geological Report — 2018 / Stone, Stone, DiGiacomo-Cohen (Year Published/Source); Coarse Deposits (Map Unit)

   Consist of gravel deposits, sand and gravel deposits, and sand deposits.
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): 12/8/2023 (Month/Day/ Year) — Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
   Not in Zone A, Zone II, or IWPA.

   N/A

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: STP - 3 (Hole #) | 11/28/2023 (Date) | 12:11 (Time) | Sunny (Weather) | 42.514180 (Latitude) | -71.104250 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Trees/weeds (Vegetation) | Damaged Asphalt (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: Appx. 11' NW of the NW bit curb in the vacant parking lot.

2. Soil Parent Material: Excavated and filled land | Ledge (Landform) | SU (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ± feet | Drainage Way ± feet | Wetlands ± feet | Property Line ± feet | Drinking Water Well ± feet | Other ± feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: - Depth to Weeping in Hole - Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-30	A	FSL	10YR 3/2	-	Cnc :- / Dpl: -	-	-	-	Massive	Friable	Comm. root through layer
30-62	Bw	FSL	10YR 5/4	-	Cnc :- / Dpl: -	-	-	-	Massive	Friable	Comm. root to 62"
62-108	C	fine-medium sand	10YR 5/2	-	Cnc :- / Dpl: -	-	15-35	15-35	S. Grain	Loose	
					Cnc : / Dpl:						
					Cnc : / Dpl:						
					Cnc : / Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: STP - 4 (Hole #) | 11/28/2023 (Date) | 12:50 (Time) | Sunny (Weather) | 42.514180 (Latitude) | -71.104250 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | Stonewall nearby (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: 10' NE of the center of the chamfer side of the edge of the bottom concrete step to 262 Main St.

2. Soil Parent Material: Excavated and filled land | Ledges (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ± feet | Drainage Way ± feet | Wetlands ± feet | Property Line 7 feet | Drinking Water Well ± feet | Other ± feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: - Depth to Weeping in Hole - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	Bw	FSL	10YR 5/4	-	Cnc :- Dpl: -	-	15-35	-	Massive	Friable	Fill Layer
4-8	Ab	FSL	10YR 3/2	-	Cnc :- Dpl: -	-	-	-	Massive	Friable	
8-34	Bw2	FSL	10YR 5/4	-	Cnc :- Dpl: -	-	15-35	15-35	Massive	Friable	Fill Layer
34-109	C	fine-medium sand	10YR 5/2	-	Cnc :- Dpl: -	-	15-35	15-35	S. Grain	Loose	Fill Layer
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):	Obs. Hole #STP - 3	Obs. Hole #STP - 4
☐ Depth to soil redoximorphic features	- inches	- inches
☐ Depth to observed standing water in observation hole	- inches	- inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☐ Yes ☒ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: 8 inches Lower boundary: 109 inches

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

William Simmons	12/8/2023
Signature of Soil Evaluator	Date
William Simmons / SE 14606	May 1, 2025
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

One Sylvan LLC
Owner Name

258 Main Street
Street Address

011.0-0000-0193.0
Map/Lot #

Reading
City

MA
State

01867
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — Web Soil Survey (Source); 602 (Soil Map Unit); Urban Land (Soil Series)

   Ledges (Landform); N/A (Soil Limitations)

   Excavated and Filled land. (Soil Parent material)

3. Surficial Geological Report — 2018 / Stone, Stone, DiGiacomo-Cohen (Year Published/Source); Coarse Deposits (Map Unit)

   Consist of gravel deposits, sand and gravel deposits, and sand deposits.
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): 12/8/2023 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
   Not in Zone A, Zone II, or IWPA.
   N/A

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: STP - 5 (Hole #) | 11/28/2023 (Date) | 1:40 (Time) | P. Sunny/Cloudy (Weather) | 42.514180 (Latitude) | -71.104250 (Longitude)

1. Land Use: Single Family Dwelling (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | Stonewall (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: Appx. 14' SE of the E corner of the stonewall in the backyard of 10 Pinevale Ave.

2. Soil Parent Material: Excavated and filled land | Ledge (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ± feet | Drainage Way ± feet | Wetlands ± feet | Property Line 2 feet | Drinking Water Well ± feet | Other ± feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: - Depth to Weeping in Hole - Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-6	A	FSL	10YR 3/2	-	Cnc :- Dpl: -	-	-	-	Massive	Friable	Comm. roots to 6"
6-14	Bw	FSL	10YR 5/6	-	Cnc :- Dpl: -	-	-	-	Massive	Friable	
14-113	C	fine-medium sand	10YR 5/2	-	Cnc :- Dpl: -	-	15-35	15-35	S. Grain	Loose	Lightly Bouldery (>10%)
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
2' away from property line shared with 262 Main St, a vacant lot.

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):	Obs. Hole #STP-5	Obs. Hole #_____
☐ Depth to soil redoximorphic features	- inches	_____ inches
☐ Depth to observed standing water in observation hole	- inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 14 inches Lower boundary: 113 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Reading

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

William Simmons

Signature of Soil Evaluator

12/8/2023

Date

William Simmons / SE 14606

Typed or Printed Name of Soil Evaluator / License #

May 1, 2025

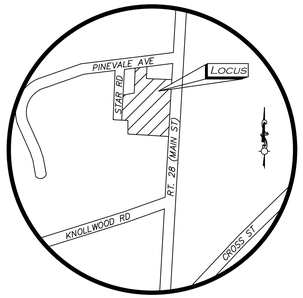
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:



LOCUS MAP
(NOT TO SCALE)

LEGEND

STONE BOUND (SB)	⊡
DRAIN MANHOLE (DMH)	Ⓓ
SEWER MANHOLE (SMH)	Ⓢ
ELECTRIC MANHOLE (EMH)	Ⓔ
MISC. MANHOLE (MH)	Ⓜ
CATCH BASIN (CB)	□
UTILITY POLE	
FIRE HYDRANT	
WATER GATE	
GAS GATE	
TREE	
SIGN	
MAILBOX	MB
WETLAND FLAG	▶A31
GAS METER	G
ELECTRIC METER	E
CONCRETE	
LANDSCAPED AREA (LSA)	
STONE PAVERS	
TACTILE DOME STRIP	
BUILDING	
BUILDING OVERHANG	
WETLAND	
BUFFER ZONE	
1' CONTOUR	53
5' CONTOUR	55
PROPERTY LINE	
ABUTTERS LINE	
INTERIOR PROPERTY LINE	
ZONE LINE	
STONE RETAINING WALL	
TREE LINE	
EDGE OF PAVEMENT	
CURB	
CHAIN LINK FENCE	x
STOCKADE FENCE	
VINYL FENCE	o
WATER LINE	W
SEWER LINE	S
DRAIN LINE	D
GAS LINE	G
ELECTRIC LINE	E
TELEPHONE LINE	T
FINISHED FLOOR ELEVATION	FFE
CONCRETE	CONC.
STONE BOUND W/DRILL HOLE	SB/DH
CENTER LINE	CL
FOUND	FND
NOW OR FORMERLY	N/F
BOOK	BK.
PAGE	PG.

NOTES
1. NORTH ARROW IS BASED ON MASSACHUSETTS GRID COORDINATE SYSTEM (MAINLAND ZONE) (NAD 83).
2. BOOK/PAGE AND PLAN REFERENCES ARE TAKEN FROM MIDDLESEX (SOUTH) REGISTRY OF DEEDS IN CAMBRIDGE, MA.
3. VERTICAL DATUM IS NAVD 88.
4. CONTOUR INTERVAL IS ONE FOOT (1').
5. ALL CURBING SHOWN HEREON IS GRANITE, UNLESS OTHERWISE NOTED.
6. WETLAND FLAGS DELINEATED BY GODDARD CONSULTING, LLC ON MARCH 7, 2023.

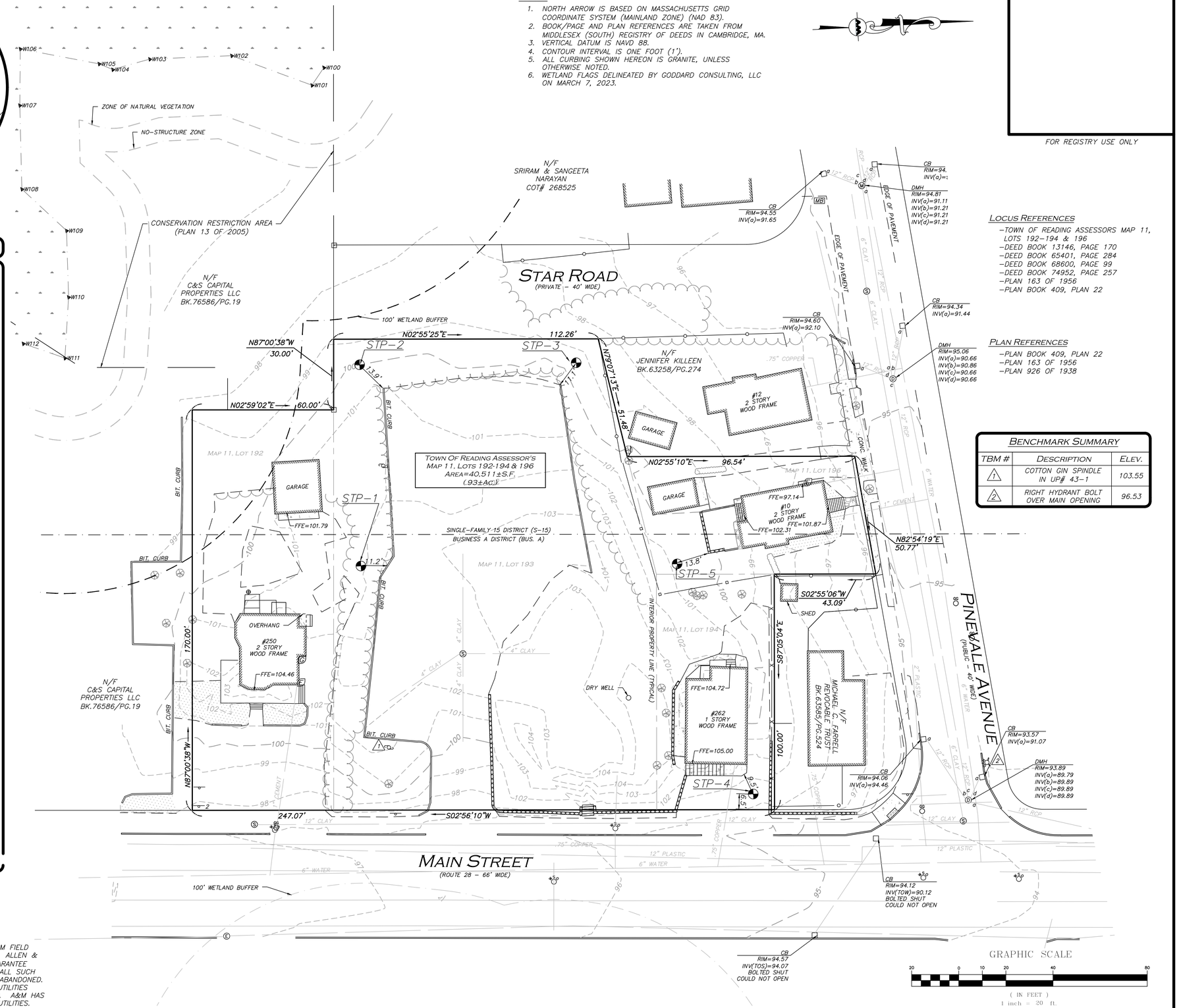
FOR REGISTRY USE ONLY

LOCUS REFERENCES
- TOWN OF READING ASSESSORS MAP 11, LOTS 192-194 & 196
- DEED BOOK 13146, PAGE 170
- DEED BOOK 65401, PAGE 284
- DEED BOOK 68600, PAGE 99
- DEED BOOK 74952, PAGE 257
- PLAN 163 OF 1956
- PLAN BOOK 409, PLAN 22

PLAN REFERENCES
- PLAN BOOK 409, PLAN 22
- PLAN 163 OF 1956
- PLAN 926 OF 1938

BENCHMARK SUMMARY

TBM #	DESCRIPTION	ELEV.
1	COTTON GIN SPINDLE IN UP# 43-1	103.55
2	RIGHT HYDRANT BOLT OVER MAIN OPENING	96.53



UTILITY STATEMENT
THE UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. ALLEN & MAJOR ASSOCIATES, INC. (A&M) MAKES NO GUARANTEE THAT THE UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. A&M FURTHER DOES NOT WARRANT THAT THE UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. A&M HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

N:\PROJECTS\2398-01A\SURVEY\DRAWINGS\CURRENT\S-2398-01A-EC.DWG

WE HEREBY CERTIFY THAT:

THIS PLAN IS THE RESULT OF AN ACTUAL ON THE GROUND SURVEY PERFORMED ON OR BETWEEN APRIL 3, 2023 AND APRIL 13, 2023.

THIS PLAN WAS PREPARED IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS DATED JANUARY 1, 1976 AND REVISED JANUARY 12, 1988.

ACCORDING TO DEEDS AND PLANS OF RECORD, THE PROPERTY LINES SHOWN ON THIS PLAN ARE THE LINES DIVIDING EXISTING OWNERSHIP, AND THE LINES OF THE STREETS OR WAYS SHOWN ARE THOSE OF PUBLIC OR PRIVATE STREETS AND WAYS ALREADY ESTABLISHED, AND THAT NO NEW LINES FOR THE DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN.

THE ABOVE CERTIFICATION IS INTENDED TO MEET REGISTRY OF DEEDS REQUIREMENTS FOR THE RECORDING OF PLANS AND IS NOT A CERTIFICATION TO THE TITLE OR OWNERSHIP OF THE PROPERTY SHOWN. OWNERS OF ADJOINING PROPERTIES ARE SHOWN ACCORDING TO CURRENT TOWN OF READING ASSESSOR'S INFORMATION.

THE ABOVE IS CERTIFIED TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION AND BELIEF.

ALLEN & MAJOR ASSOCIATES, INC.

SEPT. 6, 2023

C:\Users\cobrien\Desktop\Norman Lipsitz .jpg

PROFESSIONAL LAND SURVEYOR FOR ALLEN & MAJOR ASSOCIATES, INC.

9/6/23

COMMONWEALTH OF MASSACHUSETTS
NORMAN I. LIPSITZ
No.28446
PROFESSIONAL LAND SURVEYOR

C:\Users\cobrien\Desktop\Norman Lipsitz .jpg

REV	DATE	DESCRIPTION

APPLICANT\OWNER:
ONE SYLVAN LLC
PO BOX 4449
PEABODY, MA 01961

PROJECT:
252-260 MAIN STREET
READING, MA

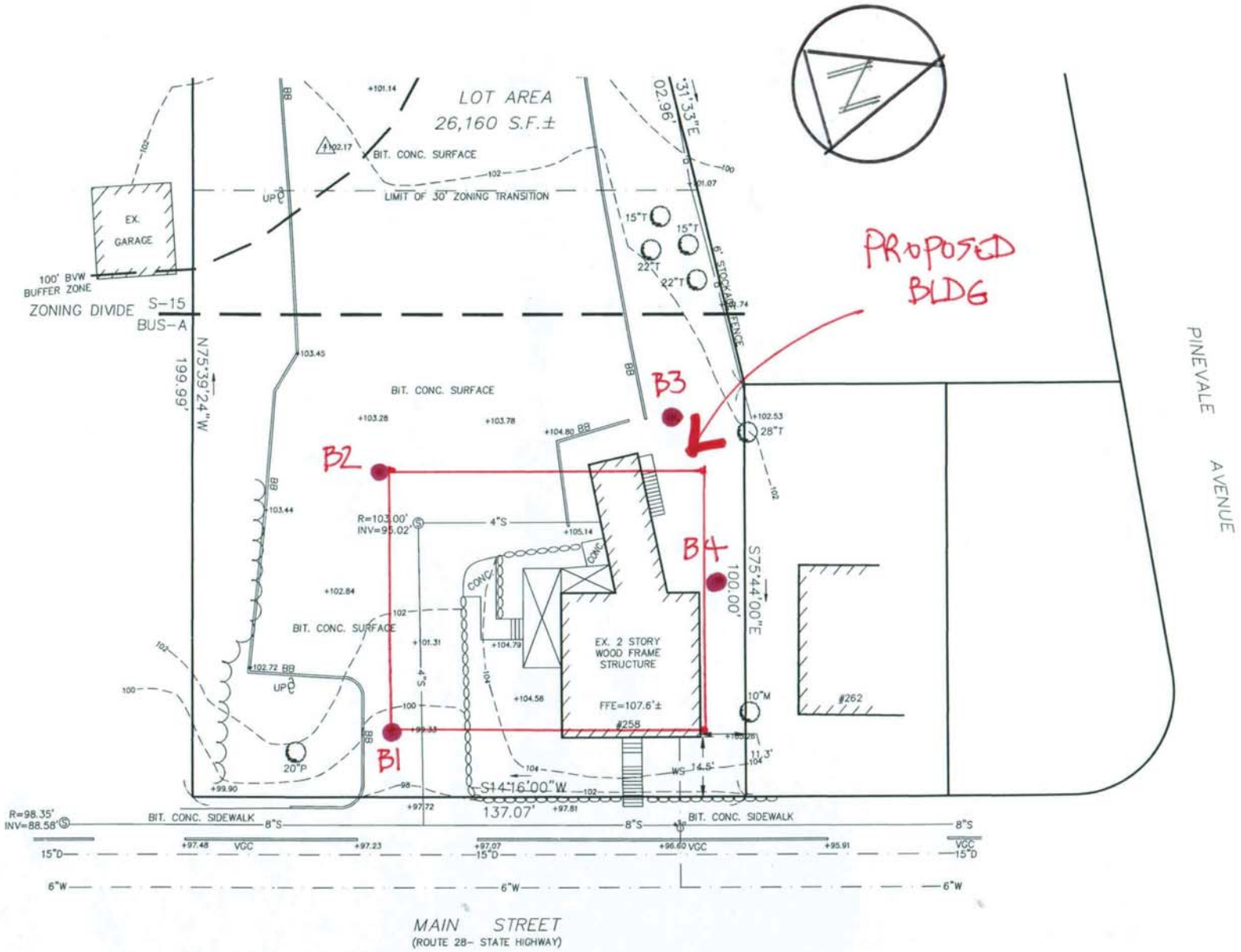
PROJECT NO. 2398-01A	DATE: 09/06/23
SCALE: 1" = 20'	DWG. NAME: 2398-01A-EC
DRAFTED BY: COB/SMM	CHECKED BY: COB/NIL

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY
WOBURN MA 01801-8501
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
PROPERTY LINE/ EXISTING CONDITIONS

SHEET No.
V-101


LOT AREA
26,160 S.F.±
BIT. CONC. SURFACE
LIMIT OF 30' ZONING TRANSITION
EX. GARAGE
100' BVW BUFFER ZONE
ZONING DIVIDE S-15 BUS-A
PROPOSED BLDG
B1
B2
B3
B4
N75°39'24"W 199.99'
S75°44'00"E 100.00'
S14°16'00"W 137.07'
N31°33"E 102.96'
R=103.00' INV=95.02'
EX. 2 STORY WOOD FRAME STRUCTURE
FFE=107.6'±
#258
#262
6' STOCKADE FENCE
BIT. CONC. SIDEWALK
R=98.35' INV=88.58'
MAIN STREET
(ROUTE 28- STATE HIGHWAY)
PINEVALE AVENUE

TEST BORING LOG

SHEET 1

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Site: 258 Main Street
Reading, MA

BORING B-1

PROJECT NO. 13-0733

DATE: July 29, 2013

Ground Elevation:	100 ft+/-
Date Started:	July 26, 2013
Date Finished:	July 26, 2013
Driller:	TF
Soil Engineer/Geologist:	KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
7/25/13	12 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
						4"	Pavement
1		1	10"	1'0"-3'0"	4-7-6-6		Brown, fine to coarse Sand, some silt, little gravel (FILL)
		2	12"	3'0"-5'0"	11-14-20-26	3'	
5		3	8"	5'0"-7'0"	16-21-28-29		Brown, fine to coarse Sand & Gravel, little silt (GLACIAL)
10		4	10"	10'0"-12'0"	19-16-23-20		Brown, fine to coarse Sand & Gravel, trace silt, cobbles,
15		5	8"	15'0"-17'0"	26-40-39-58		Same, wet
						18'	Auger Refusal at 18 ft
20							
25							
30							
35							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 2

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Site: 258 Main Street
Reading, MA

BORING B-2

PROJECT NO. 13-0733

DATE: July 29, 2013

Ground Elevation:	103 ft+/-
Date Started:	July 26, 2013
Date Finished:	July 26, 2013
Driller:	TF
Soil Engineer/Geologist:	KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
7/26/13	14 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
							Pavement
1		1	8"	1'0"-3'0"	7-10-12-9	3'	Brown, fine to medium Sand, some gravel, little silt, dry (FILL)
		2	4"	3'0"-5'0"	12-16-17-21		Brown, fine to medium Sand & Gravel, trace silt, cobbles, dry
5		3	12"	5'0"-7'0"	28-29-31-34		Same, dry (GLACIAL) w/ cobbles
10		4	12"	10'0"-12'0"	23-20-29-35		Brown, fine to medium Sand, some gravel, little silt, cobbles, boulders
15		5	10"	15'0"-16'6"	42-68-87	16'6"	Brown, fine to medium Sand & Gravel, little silt, cobbles, wet
							Refusal at 16'6"
20							
25							
30							
35							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 3

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Site: 258 Main Street
Reading, MA

BORING B-3/B-3A

PROJECT NO. 13-0733

DATE: July 29, 2013

Ground Elevation:	103 ft+/-
Date Started:	July 26, 2013
Date Finished:	July 26, 2013
Driller:	TF
Soil Engineer/Geologist:	KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
7/26/13	14 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
1		1	6"	0"-2'0"	3-3-4-5		Topsoil
		2	4"	2'0"-4'0"	9-31-12-13	2'	Rust Brown, fine to medium Sand, some silt, trace loam (SUBSOIL/FILL)
5		3	8"	5'0"-7'0"	26-32-29-31	5'	Brown, fine to medium Sand & Gravel, trace silt, cobbles, boulders, dry
10		4	10"	10'0"-12'0"	24-31-28-29		Brown, fine to coarse Sand & Gravel, little silt, cobbles (GLACIAL)
15		5	10"	15'0"-17'0"	34-51-72-68		Same, wet
20						18'	B-3 refusal at 5 ft B-3A refusal at 18 ft
25							
30							
35							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 4

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Site: 258 Main Street
Reading, MA

BORING B-4

PROJECT NO. 13-0733

DATE: July 29, 2013

Ground Elevation:	103 ft+/-
Date Started:	July 26, 2013
Date Finished:	July 26, 2013
Driller:	TF
Soil Engineer/Geologist:	KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
7/26/13	14 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
1		1	4"	0"-2'0"	2-3-3-5	2'	Black, Organic Silt, roots (TOPSOIL)
		2	6"	2'0"-4'0"	5-8-9-12		Brown, fine to medium Sand & Gravel, little silt, dry (FILL)
5		3	6"	5'0"-6'6"	18-29-85	5'	Brown, fine to medium Sand & Gravel, little silt, cobbles, boulders, dry
10		4	6"	10'0"-12'0"	12-18-15-24		Same (GLACIAL)
15		5	10"	15'0"-15'10"	63-100/4"	17'	Same, wet Refusal at 17 ft
20							
25							
30							
35							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V
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	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: BLVD Reading, LLC

ADDRESS: 1 Sylvan Road
Peabody, MA 01960

TEL. NUMBER: (781) 389-5989

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.

Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents.