Stormwater Drainage Report

Rivercrest Condominiums

Ferry Street (Map 47, Parcel 76)
South Hadley, Massachusetts

Project Location:

Ferry Street
Map 47, Parcel 76
South Hadley, Massachusetts

Prepared for:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

June 18, 2014

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RLA

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I. INTRODUCTION

The project developer, Ferry Street Nominee Trust, is proposing to construct a 29-unit condominium development and associated site improvements. The project includes a 1,100+/- foot long roadway to access the site and a stormwater management system that utilizes catch basins for runoff collection, proprietary sedimentation devices for water quality treatment, subsurface infiltration basins to provide groundwater recharge and a surface infiltration basin to provide peak rate attenuation. All utilities to the site are accessed via Ferry Street including electric service, water service, sanitary sewer service, and gas service. The stormwater management system has been designed to meet the requirements of the Town of South Hadley Stormwater Management Bylaw and the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook (MassDEP Handbook) to ensure that project will be environmentally responsible.

2. SITE DESCRIPTION

2.1 Predevelopment Conditions

The proposed project is located off of Ferry Street and identified as Assessor's Parcel 76 on Map 47. The parcel to be developed is approximately 10.83 acres and consists of mostly undeveloped woodland in the Residence A-1 district. The property is accessed from Ferry Street which abuts the land to the north. Residential properties abut the land to the east and west and undeveloped land abuts to the south. The elevations of the property range from 212 near the access off of Ferry Street to 155 at the southernmost corner of the property. The topography of the site is such that the highest elevations are at the access off Ferry Street and generally slope in a westerly and southerly direction towards resource areas. See Figure 1 – Site Locus USGS Map.

2.2 Resource Areas

A resource area delineation was performed on the subject property by Charles H. Dauchy, Environmental Consultant, 24 Old Long Plain Road, Leverett, MA 01054 on April 6, 2006, April 20, 2006, and June 29, 2011. Resource areas which were delineated include bordering vegetated wetlands to the south, an isolated vegetated wetland in the south-western corner, and an intermittent stream which follows the eastern-most property line and runs in the north-south direction. Furthermore, there is a perennial stream located just offsite to the south.

The proposed project will not impact the resource areas as the proposed site improvements are only proposed within the 100' buffer zone to the bordering and isolated wetlands and remain outside the 50' buffer zone respectively. Additionally, the project and all of its components will remain outside of the 200' riverfront area associated with the perennial stream to the south. A Notice of Intent filing has been compiled and was submitted to MassDEP and the South Hadley Conservation Commission.

2.3 Floodplain and Endangered Species

R. Levesque & Associates, Inc. performed due diligence research on the property in regards to FEMA flood zone mapping and Natural Heritage and Endangered Species Program areas. The property is not located within any flood hazard areas as defined by the most recent FEMA Flood Insurance Rate Maps, see Figure 2 – FEMA FIRM Map. Furthermore, the property is not located within any areas delineated by NHESP as priority habitats of endangered species, see Figure 3 – NHESP Map.

2.4 Soils

R. Levesque & Associates, Inc. researched the soils located on site with information readily available by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Based on a review of the USDA Soil Survey of Hampden County, Massachusetts, Central Part, the site is comprised of the following soil type:

> Windsor Loamy Sand (255A) – Hydrologic Group A: This soil is excessively drained. Depth to groundwater is typically greater than 80 inches;

Windsor Loamy Sand (255B) – Hydrologic Group A: This soil is excessively drained. Depth to groundwater is typically greater than 80 inches;

Amostown Fine Sandy Loam (258B) – Hydrologic Group C: This soil is moderately well drained. Depth to groundwater is typically 18-36 inches;

Agawam Fine Sandy Loam (275B) – Hydrologic Group B: This soil is well drained. Depth to groundwater is typically greater than 80 inches;

Windsor-Scitico-Amostown Complex (750C) – Hydrologic Group A: This soil is excessively drained. Depth to groundwater is typically greater than 80 inches.

A series of test pits were conducted by Gary Weiner, P.E. and witnessed by the Town of South Hadley Board of Health agent Sharon Hart to evaluate the ability of the site to support stormwater drainage system components on May 15, 2014. Additionally, test pit information performed by Mark P. Reed SE2015 of Heritage Surveys, Inc. on December 9, 2010 of a previous submission was utilized for the surface infiltration basin. Test pit findings varied across the site with some test pits showing no signs of groundwater while in some locations, TP-1, TP-6 and H-2, groundwater was observed at about 60", 39", and 40" deep respectively. See Appendix B for soils information.

2.5 Post Development Conditions

Ferry Street Nominee Trust, is proposing to construct a 29-unit condominium development and associated site improvements. The condominium units are to be duplex units varying in size. The proposed site improvements include the construction of a stormwater management system that has been designed to comply with the Town of South Hadley Stormwater Management Bylaw and the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook. The proposed site improvements will maintain the general drainage patterns of the site by discharging runoff to the same design points in post-development as pre-development conditions. The remaining areas of the property will not be disturbed and will maintain their respective existing runoff characteristics.

3. STORMWATER MANAGEMENT SYSTEM

R. Levesque & Associates, Inc. has prepared the following drainage system calculations for the proposed project site. A detailed hydrologic analysis of the system was completed in order to evaluate the performance of the stormwater management system components, see Appendix C – Pre- and Post-Development Runoff Calculations. The proposed stormwater management system will collect runoff from on-site impervious areas, including the new pavement and roof areas, and utilize stormwater best management practices to provide water quality treatment, groundwater recharge, and peak discharge rate attenuation.

3.1 Hydrologic Calculations

R. Levesque & Associates, Inc. utilized the HydroCAD software program, Version 10.0, developed by HydroCAD Software Solutions LLC, in order to create and analyze the site hydrology. The HydroCAD software is based upon the Soil Conservation Service (SCS) "Technical Release 20 – Urban Hydrology for Small Watersheds" and "Technical Release 55 – Urban Hydrology for small Watersheds" which are generally accepted industry standard methodologies. The analysis was conducted in order to establish the peak discharge rates and estimated run-off volume from the project site. This was accomplished to properly evaluate pre- and post-development conditions during various storm events. Contributing drainage areas were identified and soils, surface cover, watershed slope, and flow paths were evaluated to develop the necessary HydroCAD model input parameters. A minimum Time of Concentration (Tc) of (6) minutes was used in the calculations.

Drainage calculations were performed for the Pre and Post-Development conditions for the 24-hour, 2, 10, and 100-year Type III storm events. The total rainfall for each of the storm events was based upon data provided by the United States Department of Commerce Technical Paper No. 40 – Rainfall Frequency Atlas of the United States. The total rainfall values used in the hydrologic modeling for each event are shown in the following table:

Table 3.1: Design Rainfall Data		
2-year, 24-hour storm	10-year, 24-hour storm	100-year, 24-hour storm
3.00 inches	4.50 inches	6.40 inches

3.1.1 Design Points

In order to compare the difference between pre and post-development peak flows, existing and proposed watersheds were delineated. Multiple Design Points (DP) were established with flow paths representing the longest time of concentration of run-off in each tributary watershed. For this analysis, the design points were chosen as follows:

- DP-1: Offsite to North/West; This design point represents the runoff from the property which flows off site towards the north-west property line; and
- DP-2: Offsite to West; This design point represents the runoff from the property which flows off site towards the north-west property line; and
- DP-3: Offsite to Northeast; This design point represents the runoff from the property which flows off site towards the northeast property line; and
- DP-4: East Edge of Property; This design point represents the runoff from the property which flows in an easterly direction; and
- DP-5: Southwest Corner; This design point represents the runoff from the property which flows in a south-westerly direction; and
- DP-6: South Corner; This design point represents the runoff from the property which flows in a southerly direction.

3.1.2 Pre-Development Hydrology

The project area under existing conditions was broken down into six (6) sub-catchments discharging to the six design points as described above. The sub-catchments were delineated based on existing site topography and the limit-of-work for the proposed development. Any areas down gradient of the limit-of-work were not analyzed as these areas will not be disturbed and maintain their respective runoff characteristics. The existing watershed areas are shown on the attached Figure 4 entitled "Pre-Development Watershed Plan". Peak discharge rates for each watershed are depicted in Table 3.1.4 below.

3.1.3 Post-Development Hydrology

The proposed project site was broken down into nine (9) sub-catchments discharging to the same six design points as the existing conditions. The proposed watershed areas are shown on the attached Figure 5 entitled "Post-Development Watershed Plan". Peak discharge rates for each watershed are depicted in Table 3.1.4 below.

3.1.4 Peak Discharge Rates

The table below summarizes the Pre- and Post-Development peak discharge rates for each design point:

Table 3.1.4: Pre- and Post-Development Peak Discharge Rates						
	2-year storm (cfs)		10-year storm (cfs)		100-year storm (cfs)	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Design Point #1	0.00	0.00	0.00	0.00	0.01	0.02
Design Point #2	0.00	0.00	0.00	0.00	0.01	0.02
Design Point #3	0.00	0.00	0.00	0.00	0.00	0.01
Design Point #4	0.00	0.00	0.00	0.00	0.02	0.07
Design Point #5	0.00	0.00	0.00	0.00	0.03	0.01
Design Point #6	0.08	0.09	0.55	0.49	1.55	1.29

As shown in the table above, the proposed stormwater management system and site improvements have been designed such that the peak discharge rates in the post-development scenario have been reduced, matched, or brought closely to within a de-minimus factor of runoff.

3.2 MassDEP Stormwater Management Standards

R. Levesque & Associates, Inc. has designed the proposed stormwater management system to be in compliance with the MassDEP Stormwater Management Standards. Chapter 1, Volume 3 of the MassDEP Handbook outlines specific calculations, and other information, that must be submitted with each report to document compliance. The following summary highlights elements of the proposed project and how they apply to each standard.

- *Standard #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 project provides water quality treatment to the guidelines of the Town of South Hadley Stormwater Management Bylaw and the MassDEP Handbook. Therefore, no new untreated stormwater is discharged.

- *Standard #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 stormwater management system has been designed such that the post-development peak discharge rates are less than or within a de-minimus factor of the pre-development discharge rates for the 2-year and 10-year 24-hour storms. There are de-minimus increases during the 100-year storm event, in which case, the amount of runoff related to the de-minimus increase will not have adverse effects down gradient. See Appendix C for the Hydrologic Analysis.

- *Standard #3 - Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater BMPs, 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 volume as determined in accordance with the Massachusetts Stormwater Handbook.*

The proposed subsurface infiltration basins and surface infiltration basin have been designed with the capacity to infiltrate the required recharge volume. See Appendix D for the Required Recharge Volume Calculations.

- *Standard #4 – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of TSS. It is presumed that this standard is met when:*

  a. Suitable practices for source control and pollution prevention are identified in a long term pollution prevention plan, and thereafter are implemented and maintained;

  b. Structural stormwater BMPs practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

  c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook

  The proposed stormwater management system has been sized to capture and treat the water quality volume. See Appendix D for the Water Quality Volume Calculations.

- *Standard #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 MassDEP 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.*

  This standard is not applicable.

- *Standard #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 BMPs determined by MassDEP 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.*

  This standard is not applicable.

- *Standard #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 BMPs 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.*

This Standard is not applicable.

- *Standard #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) shall be developed and implemented.*

  A Construction Period Erosion Control Plan has been provided in Appendix E.

- *Standard #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 Plan has been provided in Appendix F.

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

  An illicit discharge statement will be provided prior to discharge of stormwater to post-construction BMPs.

3.3 Stormwater Best Management Practices

The proposed stormwater management system was designed utilizing stormwater best management practices (BMP) as set forth by the MassDEP Handbook. The BMPs utilized as part of the stormwater management system include roadside catch basins, yard drain inlets, proprietary treatment devices, subsurface infiltration systems, and a surface infiltration basin. All of the BMPs were designed to meet the requirements of the MassDEP Handbook and will provide water quality treatment, groundwater recharge, and peak rate attenuation in order to mitigate the impacts of the proposed site improvements.

The proposed site improvements include the construction of new impervious surfaces such as the roadway and roof areas. In order to meet the requirements of the MassDEP Handbook, all of the roadway runoff will be collected via roadside catch basins and treated through proprietary sedimentation devices prior to discharge to the infiltration systems in order to provide the required water quality treatment. Additionally, most of the proposed roof area will also be collected and conveyed to the subsurface infiltration systems, however, in some cases the roof runoff will be discharged directly onto lawn areas. In these cases, the runoff will be collected by drainage swales and yard drains and conveyed to the surface infiltration basin in order to provide the proper peak rate attenuation. Since the roof runoff is not required to be treated for total suspended solids, it can be conveyed directly to the infiltration basin.

The subsurface infiltration systems in conjunction with the surface infiltration basin will provide the required groundwater recharge and peak rate attenuation as set forth by the MassDEP Handbook. The stormwater management system has been designed such that the subsurface infiltration systems will overflow to the surface infiltration basin where an outlet control structure will provide the proper control of discharge rates. The discharge from the surface infiltration basin will be conveyed, via the outlet control structure, to a flared end section directing the runoff to the design point. See Appendix D – MassDEP Calculations for the calculations required to document compliance. The following section provides a description of the best management practices (BMPs) being utilized on site.

3.3.1 Deep Sump Catch Basins

Deep sump catch basins equipped with oil/gas hoods are being utilized as structural pretreatment devices within the proposed stormwater management system. The catch basins will be constructed with 4' deep sumps to act as settling chambers and allow for adequate storage of collected sediments. Catch basins are typically first in the line of water quality treatment.

3.3.2 Proprietary Sedimentation Devices

Proprietary sedimentation devices are being utilized on site for the pretreatment of stormwater runoff, in addition to the catch basin, prior to conveyance to the subsurface infiltration basins. Due to the stormwater management system utilizing an underground infiltration system, pre-treatment of the stormwater runoff is essential to the long term effectiveness of the infiltration system. As much sediment should be removed from the stormwater runoff as possible to avoid clogging of the infiltration media. Therefore, maintenance of the proprietary device is crucial to the long-term effectiveness of the subsurface infiltration system. The stormwater management system is utilizing proprietary treatment devices in order to ensure that the amount of sediment reaching the subsurface infiltration basins is minimal.

3.3.3 Subsurface Infiltration Basins

Subsurface Infiltration Basins are well suited to provide groundwater recharge and water quantity control from watershed areas such as those associated with this project. The subsurface infiltration basin attenuates stormwater runoff by holding the peak runoff volumes and retaining the stormwater over a period of time. The subsurface infiltration basins consist of underground stormwater chambers embedded in stone. The discharge is conveyed to the subsurface infiltration basins via up-gradient drainage infrastructure where it is detained to provide groundwater recharge and peak rate attenuation. During larger storm events, the overflow runoff is discharged via outlet manifolds pipes to down-gradient drainage infrastructure to the surface infiltration basin. The area around the flared end section will also be protected by riprap to prevent scouring and erosion at the outlet.

3.3.4 Surface Infiltration Basin with Sediment Forebay

Surface infiltration basins accompanied by sediment forebays are well suited to meet the water quality and water quantity requirements from watershed areas such as those associated with this project. The infiltration basin, with associated sediment forebay, mitigates the impact of the proposed site improvements by attenuating the peak discharge rates and providing groundwater recharge. The runoff enters the basin via the sediment forebay where it is retained for a period of time as the outlet control structure releases a controlled amount of water. The proposed infiltration basin has been designed to attenuate up to the 100-year storm event without discharge via the emergency overflow weir.

3.4 Protection of Stormwater Best Management Practices during Construction

Protection of the stormwater best management practices during construction will ensure the proper functioning of the stormwater management system and provide protection to the existing infrastructure until the site has been stabilized. Certain specific erosion and sedimentation controls and good practices to be performed by the site contractor have been documented in a Construction Period Erosion Control Plan. See Appendix E – Construction Period Erosion Control Plan.

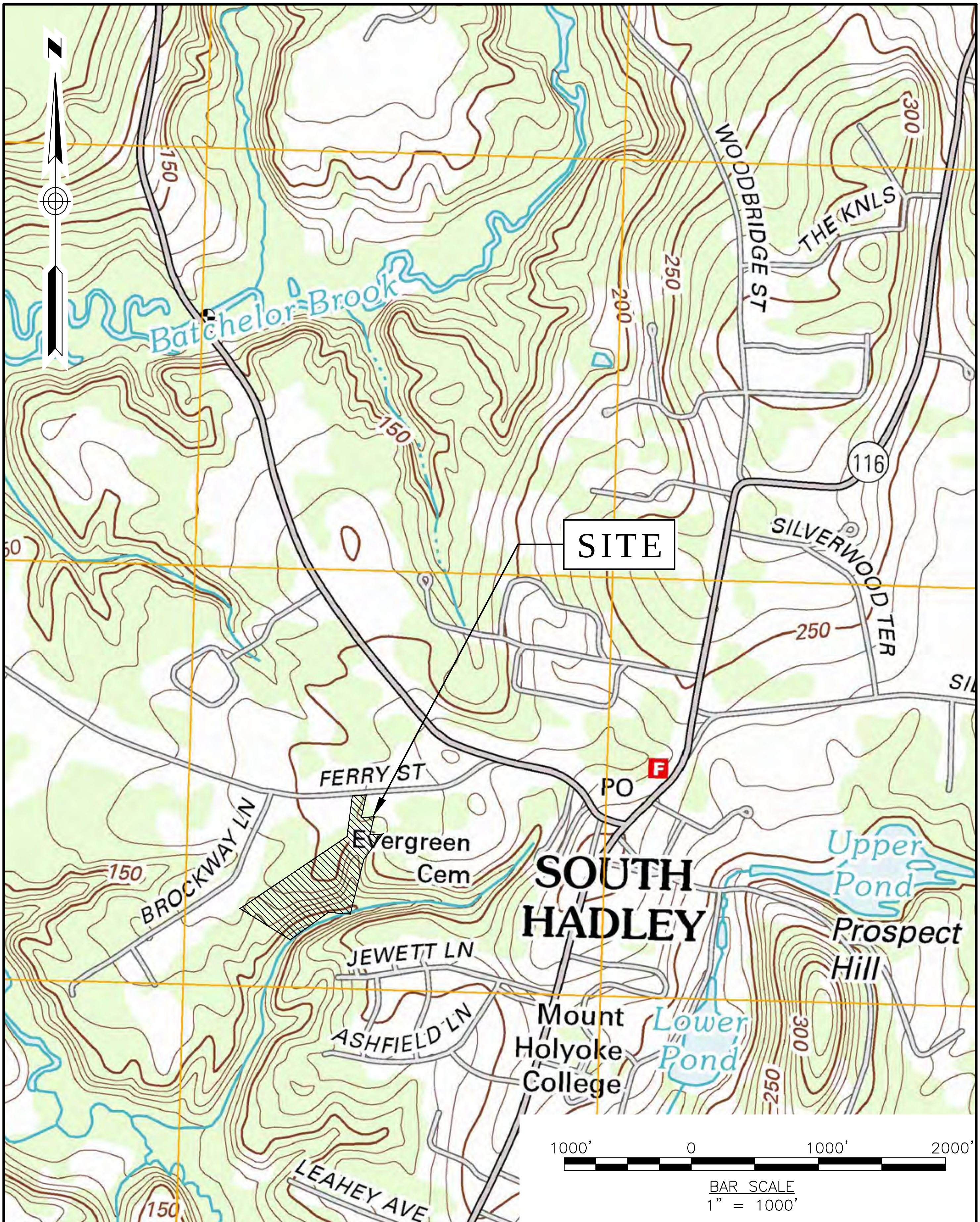
3.5 Inspection and Maintenance of Stormwater Best Management Practices

Frequent maintenance of the stormwater best management practices is essential to ensuring that the stormwater management system will function properly long-term. The MassDEP provides guidelines for the regular inspection and maintenance of the proposed stormwater best management practices. A Long-Term Stormwater Operation and Maintenance Plan has been prepared which dictates the inspection frequency and maintenance operations for each BMP. See Appendix F – Long-Term Operation and Maintenance Plan.

4. CONCLUSION

The stormwater management system has been designed to mitigate the impacts to stormwater runoff from the project due to the construction of the proposed site improvements. The stormwater management system will provide a control for runoff water quality, groundwater recharge, and peak rate attenuation. Implementation of stormwater best management practices such as catch basins, proprietary sedimentation devices, subsurface infiltration systems and a surface infiltration basin allow for a stormwater drainage design that is in conformance with the criteria set forth by the Town of South Hadley Stormwater Management Bylaw and the Massachusetts Department of Environmental Protection Stormwater Management Handbook.

Figure 1: Site Locus – USGS Map



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SITE LOCUS
USGS MAP

DESIGNED BY: N/A	CHECKED BY: FJC
DRAWN BY: JAT	Figure 1 – Locus USGS.dwg

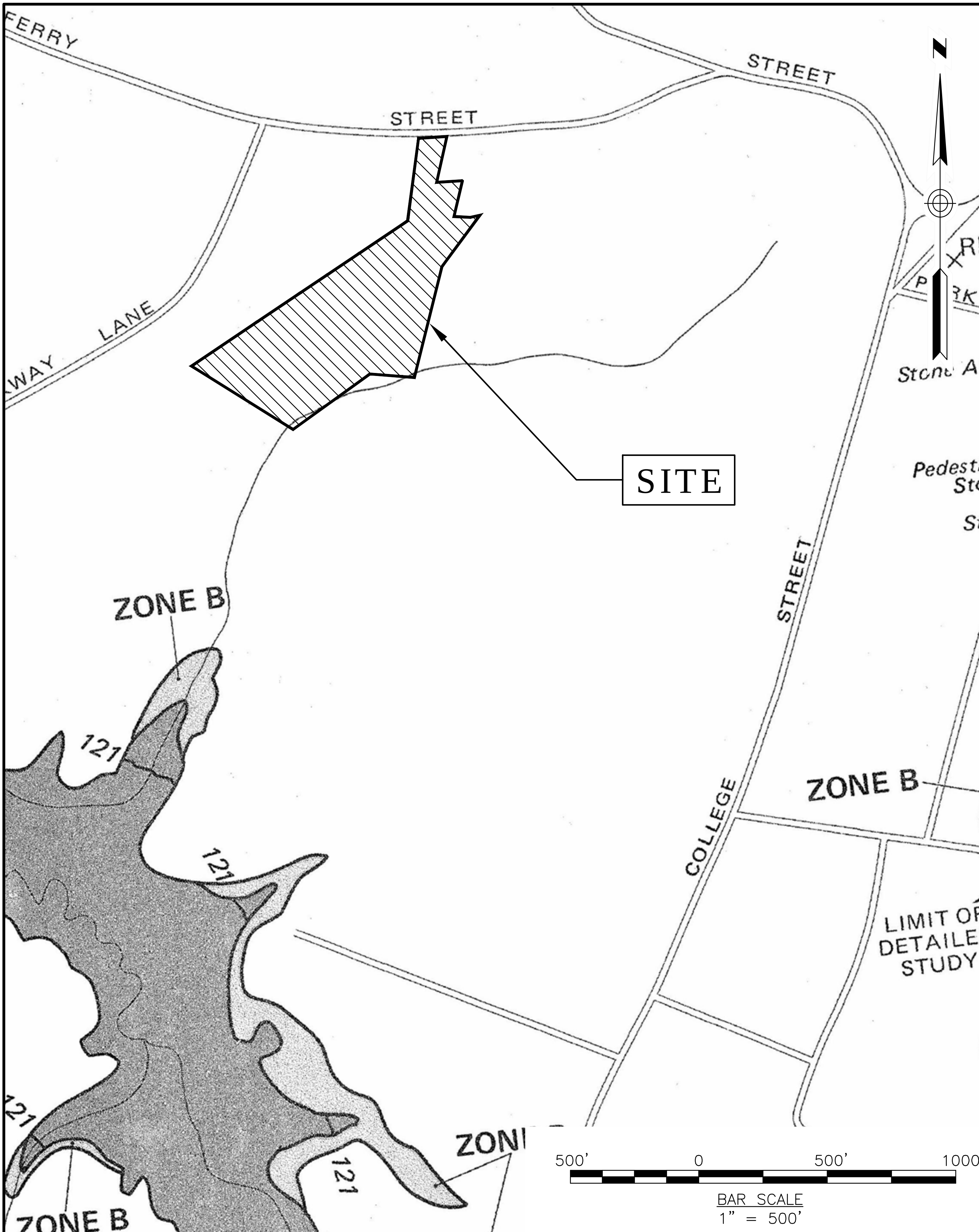
Ferry Street Nominee Trust
P.O. Box 13 – 510 New Ludlow Road
South Hadley, MA

Rivercrest Condominiums
Ferry Street
South Hadley, MA

JOB NO: 130821
DATE: 5/30/14
SCALE: AS NOTED

FIG-1

Figure 2: FEMA Flood Map



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Flood Ins. Rate Map Comm.–
Panel Number 250170 0010 A
Effective Date: Aug. 15, 1979

DESIGNED BY: N/A
CHECKED BY: FJC
DRAWN BY: JAT
Figure 2 – FEMA.dwg

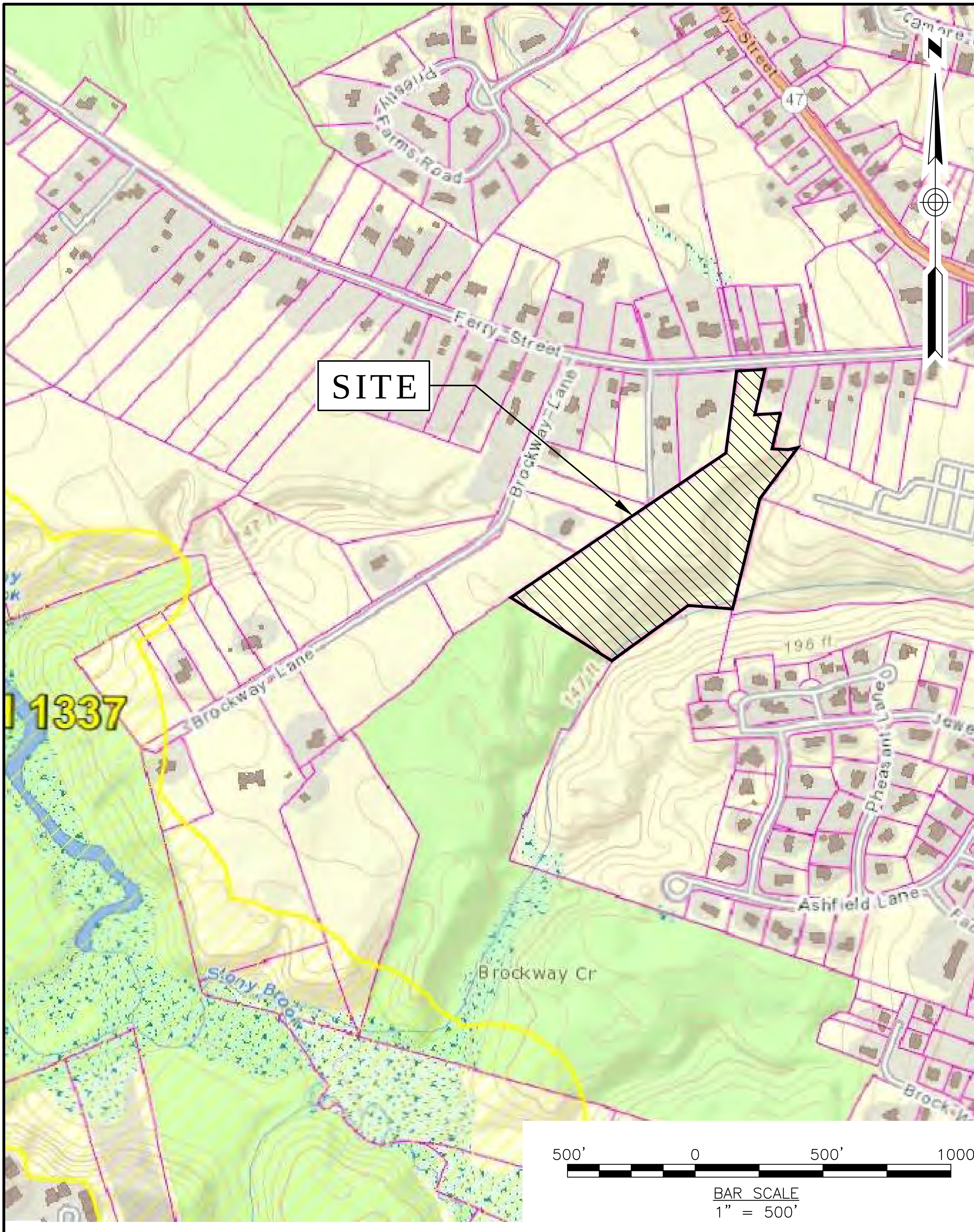
Ferry Street Nominee Trust
P.O. Box 13 – 510 New Ludlow Road
South Hadley, MA

Rivercrest Condominiums
Ferry Street
South Hadley, MA

JOB NO: 131119
DATE: 5/30/14
SCALE: AS NOTED

FIG-2

Figure 3: NHESP Map



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NHESP MAP

DESIGNED BY: N/A	CHECKED BY: N/A
DRAWN BY: JAT	Figure 3 – NHESP.dwg

Ferry Street Nominee Trust
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South Hadley, MA

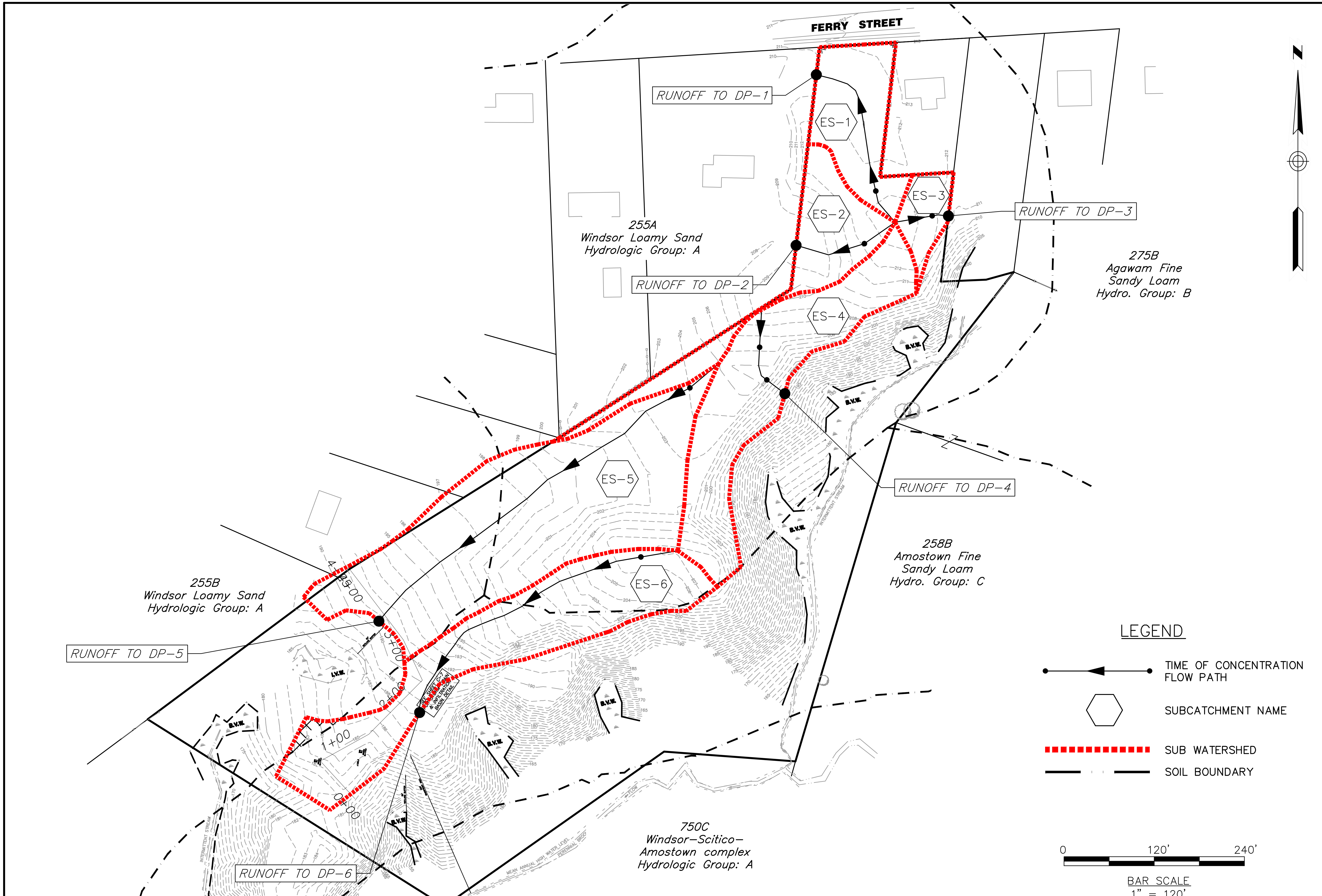
Rivercrest Condominiums
Ferry Street
South Hadley, MA

JOB NO: 131119
DATE: 5/30/14
SCALE: AS NOTED

FIG-3

Figure 4: Pre-Development Watershed Plan

1:1



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R L A

Pre–Development Watershed Plan

DESIGNED BY: JAT | CHECKED BY: FJC
DRAWN BY: JAT | 13–1119 – HYDRO.dwg

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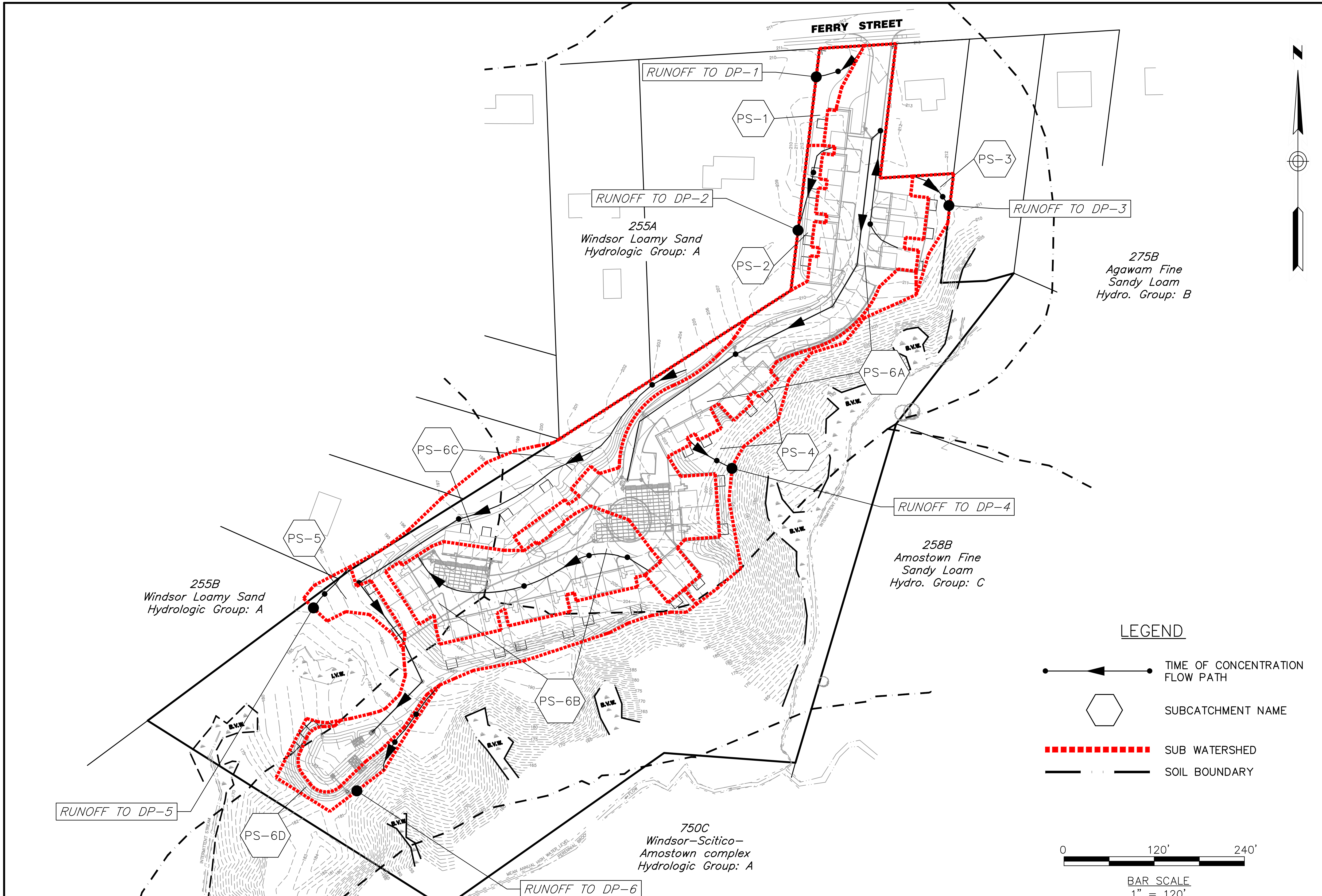
PO Box 13 – 510 New Ludlow Road
South Hadley, MA 01075

Rivercrest Condiniums
Ferry Street
South Hadley, MA

JOB NO: 13–1119
DATE: 6/16/14
SCALE: AS NOTED

FIG-4

Figure 5: Post-Development Watershed Plan



1:1

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R L A

Post-Development
Watershed Plan

DESIGNED BY: JAT
DRAWN BY: JAT
CHECKED BY: FJC
13-1119 - HYDRO.dwg

Ferry Street Nominee Trust
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South Hadley, MA 01075

Rivercrest Condiniums
Ferry Street
South Hadley, MA

JOB NO: 13-1119
DATE: 6/16/14
SCALE: AS NOTED

FIG-5

Appendix A: Checklist for Stormwater Report

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.

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

COMMONWEALTH OF MASSACHUSETTS
FILIPE J.
CRAVO
CIVIL
No. 48376
REGISTERED
PROFESSIONAL ENGINEER

6/18/14

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 (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): ______________________

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

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 (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 (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Appendix B: Soils Information

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 Hampshire County, Massachusetts, Central Part

Rivercrest Condos

January 24, 2014

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 (http://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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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.

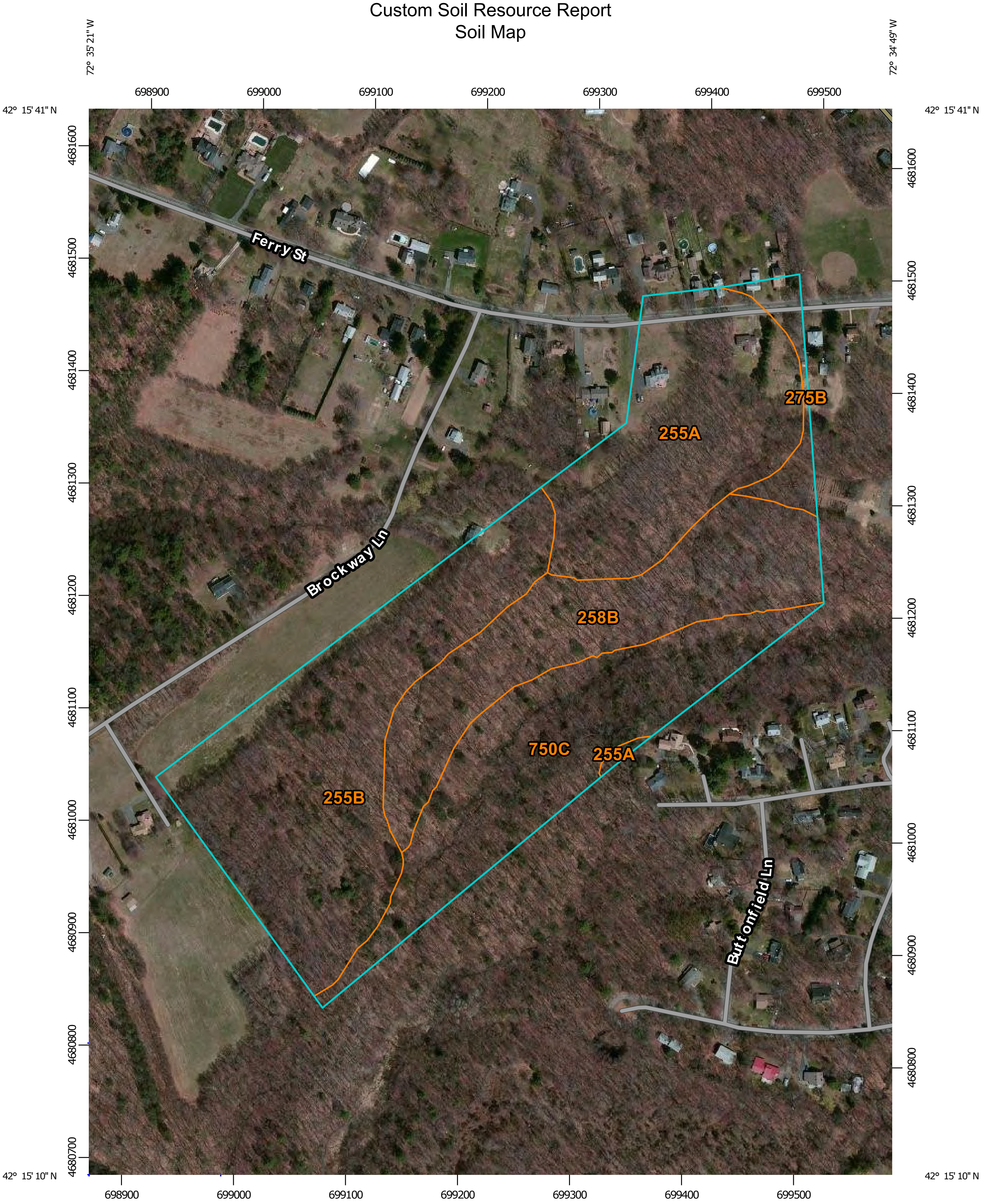
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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 Scale: 1:4,620 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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 1:15,800.

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: http://websoilsurvey.nrcs.usda.gov
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: Hampshire County, Massachusetts, Central Part
Survey Area Data: Version 8, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 28, 2011—May 12, 2011

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

Hampshire County, Massachusetts, Central Part (MA609)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
255A	Windsor loamy sand, 0 to 3 percent slopes	9.1	22.4%
255B	Windsor loamy sand, 3 to 8 percent slopes	13.3	32.6%
258B	Amostown fine sandy loam, 3 to 8 percent slopes	8.4	20.5%
275B	Agawam fine sandy loam, 3 to 8 percent slopes	1.2	2.9%
750C	Windsor-Scitico-Amostown complex, 0 to 15 percent slopes	8.9	21.7%
Totals for Area of Interest		**40.8**	**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.

Hampshire County, Massachusetts, Central Part

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 240 days

Map Unit Composition

Windsor and similar soils: 80 percent
Minor components: 20 percent

Description of Windsor

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3s
Hydrologic Soil Group: A

Typical profile

0 to 8 inches: Loamy sand
8 to 21 inches: Loamy sand
21 to 60 inches: Sand

Minor Components

Unnamed

Percent of map unit: 10 percent

Hinckley

Percent of map unit: 10 percent

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 240 days

Map Unit Composition

Windsor and similar soils: 80 percent
Minor components: 20 percent

Description of Windsor

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 3s
Hydrologic Soil Group: A

Typical profile

0 to 8 inches: Loamy sand
8 to 21 inches: Loamy sand
21 to 60 inches: Sand

Minor Components

Hinckley

Percent of map unit: 10 percent

Unnamed

Percent of map unit: 10 percent

258B—Amostown fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 240 days

Map Unit Composition

Amostown and similar soils: 75 percent
Minor components: 25 percent

Description of Amostown

Setting

Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable sandy glaciofluvial deposits over silty glaciolacustrine deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.3 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 7 inches: Fine sandy loam
7 to 32 inches: Fine sandy loam
32 to 60 inches: Stratified very fine sand to silt loam

Minor Components

Pollux

Percent of map unit: 15 percent

Agawam

Percent of map unit: 10 percent

275B—Agawam fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Elevation: 0 to 1,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 240 days

Map Unit Composition

Agawam and similar soils: 85 percent
Minor components: 15 percent

Description of Agawam

Setting

Landform: Outwash plains, outwash terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: B

Typical profile

0 to 11 inches: Fine sandy loam
11 to 16 inches: Fine sandy loam
16 to 26 inches: Fine sandy loam
26 to 60 inches: Stratified loamy sand to loamy fine sand

Minor Components

Ninigret

Percent of map unit: 5 percent

Merrimac

Percent of map unit: 4 percent

Deerfield

Percent of map unit: 3 percent

Windsor

Percent of map unit: 3 percent

750C—Windsor-Scitico-Amostown complex, 0 to 15 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 240 days

Map Unit Composition

Windsor and similar soils: 40 percent
Scitico and similar soils: 20 percent
Amostown and similar soils: 15 percent
Minor components: 25 percent

Description of Windsor

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7s
Hydrologic Soil Group: A

Typical profile

0 to 8 inches: Loamy sand
8 to 21 inches: Loamy sand

21 to 60 inches: Sand

Description of Scitico

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Hard silty glaciolacustrine deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 10 inches: Silt loam
10 to 22 inches: Silt loam
22 to 36 inches: Silty clay
36 to 65 inches: Silty clay

Description of Amostown

Setting

Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable sandy glaciofluvial deposits over silty glaciolacustrine deposits

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.3 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 7 inches: Fine sandy loam
7 to 32 inches: Fine sandy loam
32 to 60 inches: Stratified very fine sand to silt loam

Minor Components

Hinckley

Percent of map unit: 10 percent

Boxford

Percent of map unit: 5 percent

Agawam

Percent of map unit: 5 percent

Pollux

Percent of map unit: 5 percent

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R LEVESQUE ASSOCIATES, INC
A Land Planning Company
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rlaland.com

RLA

Test Pit Location Plan

DESIGNED BY: JAT
DRAWN BY: JAT
CHECKED BY: FJC
13-1119 - SITE.dwg

Ferry Street Nominee Trust
PO Box 13 - 510 New Ludlow Road
South Hadley, MA 01075

Rivercrest Condiniums
Ferry Street
South Hadley, MA

JOB NO: 13-1119
DATE: 6/8/14
SCALE: AS NOTED

TP-1

5/15/14
CLOUDY, COOL

Commonwealth of Massachusetts
City/Town of SOUTH HADLEY - RIVERCREST

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-10"	Ap	10YR 3/3				SL			FRIABLE		FOREST LITTER
10"-24"	B	10YR 5/8				SL			FRIABLE		ROOTS
24"-84"	C1	2.5Y 6/6	60"	RED 2.5YR 4/8	>7%	S	<15%	NONE			m-c
84"-135"	C2	5YR 4/1				SILT/LOAM			MASSIVE LAMINATED	WET	

Additional Notes:

SEEP @ 70" ; STANDING WATER @ 78" RISING
CAVING TO 38"

5|15|14

Commonwealth of Massachusetts
City/Town of SOUTH HADLEY - RIVERCREST

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP -2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap	10YR 3/4				SL			FRIABLE		ROOTS
12"-31"	B	10YR 6/8		NONE		LS					
31"-125"	C	2.5Y 6/6		OBSERV.		S	<20%	NONE		MOIST	m-c

Additional Notes:

SEEP @ 84" ; STANDING WATER @ 110" RISING

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5/15/14

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap	10YR 3/4				SL			FRIABLE		ROOTS
12"-24"	B	10YR 6/8		NONE		LS					
24"-130"	C	2.5Y 6/8		OBSERV.		S	<20%	NONE		MOIST	m

Additional Notes:

SEEP @ 84" ; STANDING WATER @ 110" RISING

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Commonwealth of Massachusetts
City/Town of SOUTH HADLEY - RIVERCREST

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-10"	AP	10YR 3/3				SL			FRIABLE		FOREST LITTER
10"-24"	B	10YR 5/8		NONE		LS					
24"-121"	C	2.5Y 6/6		OBSERV.		S	∠20%	NONE		MOIST	F-M

Additional Notes:

SEEP @ 85" ; STANDING WATER @ 118"

CAVING @ 60"

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Commonwealth of Massachusetts
City/Town of SOUTH HADLEY- RIVERCREST

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap	10YR 3/3				SL			FRIABLE		ROOTS FOREST LITTER
12"-34"	B	10YR 5/8		NONE		LS					
34"-128"	C	2.5Y 6/6		OBSERV		S	<15%	NONE		MOIST	MED.

Additional Notes:

SEEP @ 84"; STANDING WATER @ 120"

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5|15|14

Commonwealth of Massachusetts
City/Town of SOUTH HADLEY - RIVERCREST

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-10"	Ap	10YR 3/4				SL			FRIABLE		ROOTS
10"-24"	B	10YR 6/8				LS					
24"-80"	C1	2.5Y 6/8	39"	RED 2.5YR 4/8	>7%	S	15%	NONE		WET	MED.
80"-120"	C2	5YR 4/1				SILT/LOAM				WET	

Additional Notes:

SEEP @ 64 ; STANDING WATER @ 106" RISING

Commonwealth of Massachusetts
City/Town of SOUTH HADLEY – RIVERCREST
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: H-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"–11"	AP	10YR 5/8				SL			FRIABLE		
11"-22"	B	10YR 3/3		NONE		LS					ROOTS
22"-126"	C	2.5Y 6/6		OBSERV.		S	<15%	NONE		WET	m-f.

Additional Notes:

SEEP @ 60"

Commonwealth of Massachusetts
City/Town of SOUTH HADLEY – RIVERCREST

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: H-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"–8"	A_P	10YR 3/3				SL			FRIABLE		ROOTS
8"–17"	B	10YR 5/8				LS					ROOTS
17"–84"	C_1	2.5Y 6/6	40"	RED	>7%	S	<15%	NONE		MOIST	
84"–120"	C_2	5YR 4/1				SILT/LOAM			MASSIVE LAMINATED	WET	

Additional Notes:

HEAVY SEEP @ 84" – LT. SEEP @ 60"

STANDING WATER @ 100" RISING

HERITAGE SURVEYS, INC.
Professional Surveyors and Engineers
241 College Hwy & Clark St, P O Box 1
Southampton, Massachusetts 01073-0001
Telephone (413) 527-3600 Fax (413) 527-8280

Soil Testing

Project Number:**5560-100113**
Performed by: **Mark P. Reed**
Health Inspector:**None**

Date: **December 9, 2010**
Equipment Operator: **Marion Excavating**

Site Address
Ferry Street
South Hadley, MA

Client Name & Address
Rivercrest Condominiums LLC
1421 Granby Road
Chicopee, MA 01020
Weather: **sunny/cool**

Deep Hole Number: **#1 & 2** Date: **12/9/10** Time: **9:30**
Location (identify on site plan): **woods in proposed detention basin**

TP 1 — DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" – 5"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
5"-26"	Bw	Sandy Loam	10YR 5/6		
26"-60"	C_1	Sandy Loam	10YR 5/4	@38"	Medium to fine sandy loam, friable to firm with silt
60"-108"	C_2	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)
Depth to Groundwater: **Standing Water in the Hole: None**
Estimated Seasonal High Ground Water: @38"
Depth to Bedrock: None @ 9'
Weeping from Pit Face: None

TP 2 — DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" – 12"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
12"-26"	Bw	Sandy Loam	10YR 5/6		
26"-72"	C_1	Sand	10YR 6/6	@54"	Medium to fine sand, loose
72"-108"	C_2	Sand	10YR 6/2		Fine Sand w/some silt, friable
108"-114"	C_3	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)
Depth to Groundwater: **Standing Water in the Hole: None**
Estimated Seasonal High Ground Water: @54"
Depth to Bedrock: None @ 9'-6"
Weeping from Pit Face: @64"

Certification: I certify that in **June 1995,** I passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. **MA soil Eval. Approval No. SE2015**

Signature: [signature]
Mark P. Reed

Date: **December 9, 2010**

HERITAGE SURVEYS, INC.
Professional Surveyors and Engineers
241 College Hwy & Clark St, P O Box 1
Southampton, Massachusetts 01073-0001
Telephone (413) 527-3600 Fax (413) 527-8280

Soil Testing

Project Number:**5560-100113**
Performed by: **Mark P. Reed**
Health Inspector:**None**

Date: **December 9, 2010**
Equipment Operator: **Marion Excavating**

Site Address
Ferry Street
South Hadley, MA

Client Name & Address
Rivercrest Condominiums LLC
1421 Granby Road
Chicopee, MA 01020

Deep Hole Number: **#3 & 4** Date: **12/9/10** Time: **9:30**
Weather: **sunny/cool**
Location (identify on site plan): **woods in proposed detention basin**

TP 3 — DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" – 8"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
8"-26"	Bw	Sandy Loam	10YR 5/6		
26"-48"	C_1	Sandy Loam	10YR 5/4	@44"	Medium to fine sandy loam, friable to firm with silt
48"-114"	C_2	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)
Depth to Groundwater: **Standing Water in the Hole: None**
Estimated Seasonal High Ground Water: @44"
Depth to Bedrock: None @ 9'-6"
Weeping from Pit Face: None

TP 4 — DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" – 8"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
8"-14"	Bw	Sandy Loam	10YR 5/6		
14"-34"	C_1	Sand	10YR 6/6	@40"	Medium to fine sand, loose
34"-102"	C_2	Sand	10YR 6/2		Fine Sand w/some silt, friable
102"-120"	C_3	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

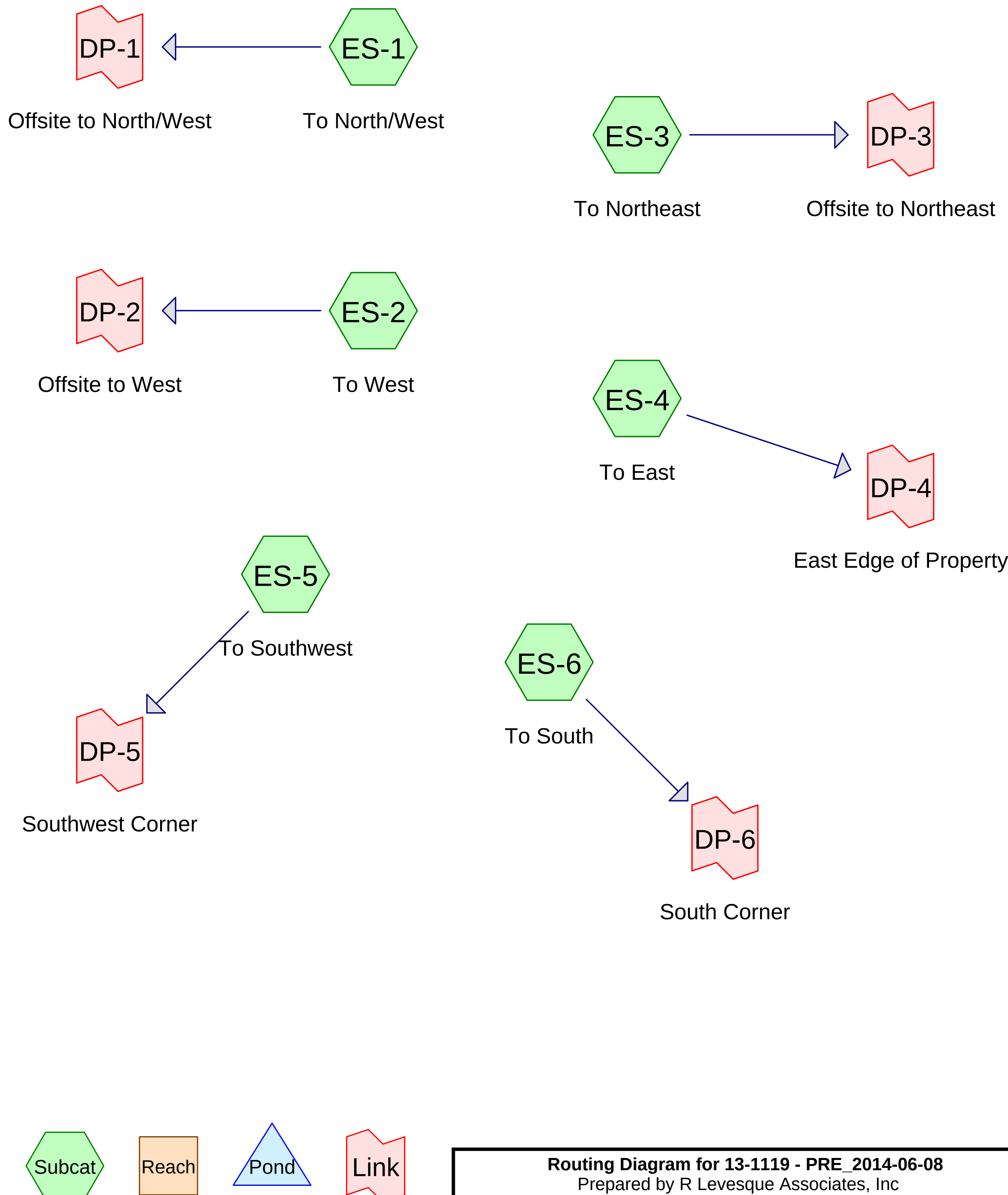
Parent Material (geologic)
Depth to Groundwater: **Standing Water in the Hole: None**
Estimated Seasonal High Ground Water: @40"
Depth to Bedrock: None @ 10'
Weeping from Pit Face: @64"

Certification: I certify that in **June 1995,** I passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. **MA soil Eval. Approval No. SE2015**

Signature: [signature]
Mark P. Reed

Date: **December 9, 2010**

Appendix C: Pre- and Post- Development Runoff Calculations (2, 10, & 100 Year Storm Events)



Routing Diagram for 13-1119 - PRE_2014-06-08
Prepared by R Levesque Associates, Inc
HydroCAD® 10.00 s/n 02175 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,603	39	>75% Grass cover, Good, HSG A (ES-1, ES-2, ES-3)
183,964	30	Woods, Good, HSG A (ES-1, ES-2, ES-3, ES-4, ES-5, ES-6)
32,694	70	Woods, Good, HSG C (ES-5, ES-6)
219,261	**36**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: To North/West	Runoff Area=19,380 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=244' Tc=20.8 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-2: To West	Runoff Area=20,946 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=145' Tc=12.1 min CN=31/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-3: To Northeast	Runoff Area=6,422 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=72' Tc=11.5 min CN=31/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-4: To East	Runoff Area=41,789 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=128' Tc=9.2 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-5: To Southwest	Runoff Area=81,273 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=570' Tc=24.6 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-6: To South	Runoff Area=49,451 sf 0.00% Impervious Runoff Depth=0.22" Flow Length=434' Tc=18.5 min CN=56/0 Runoff=0.08 cfs 906 cf
Link DP-1: Offsite to North/West	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-2: Offsite to West	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-3: Offsite to Northeast	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-4: East Edge of Property	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-5: Southwest Corner	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-6: South Corner	Inflow=0.08 cfs 906 cf Primary=0.08 cfs 906 cf

Total Runoff Area = 219,261 sf Runoff Volume = 906 cf Average Runoff Depth = 0.05"
100.00% Pervious = 219,261 sf 0.00% Impervious = 0 sf

Summary for Subcatchment ES-1: To North/West

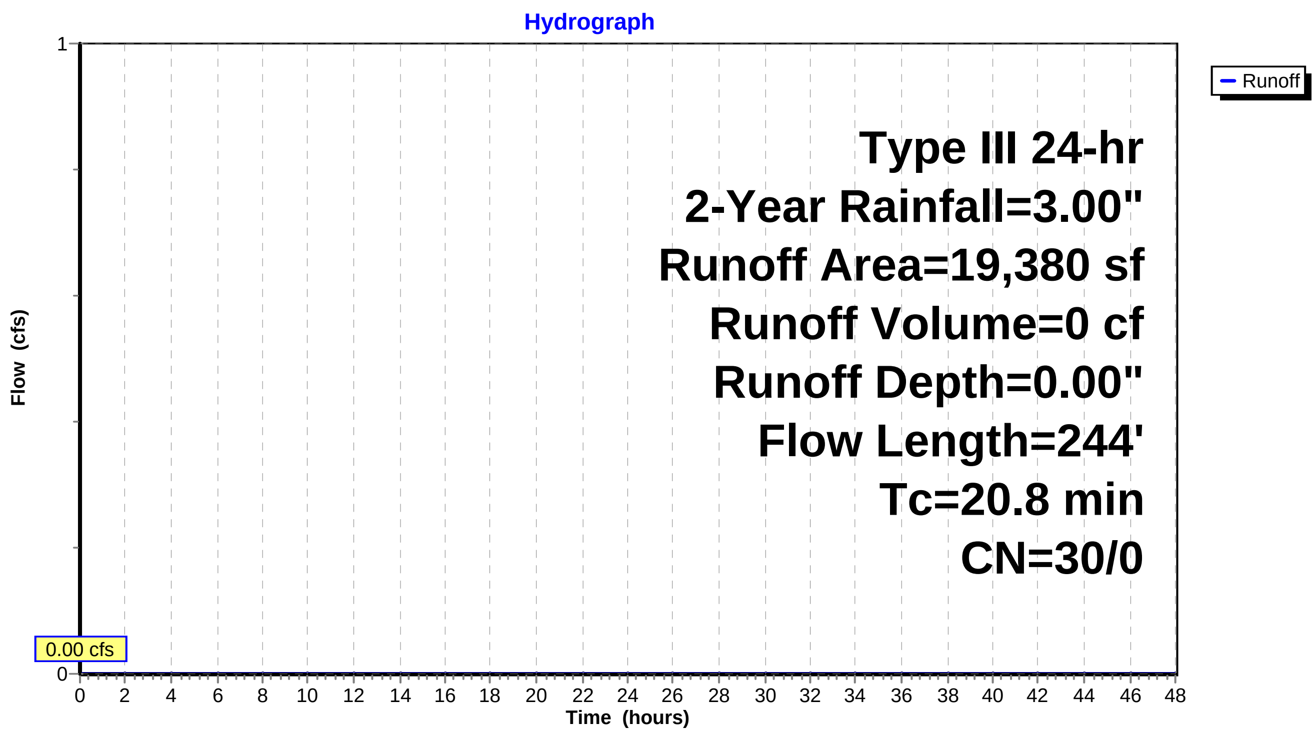
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
18,924	30	Woods, Good, HSG A
456	39	>75% Grass cover, Good, HSG A
19,380	30	Weighted Average
19,380	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0170	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
7.2	194	0.0080	0.45		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.8	244	Total			

Subcatchment ES-1: To North/West



Summary for Subcatchment ES-2: To West

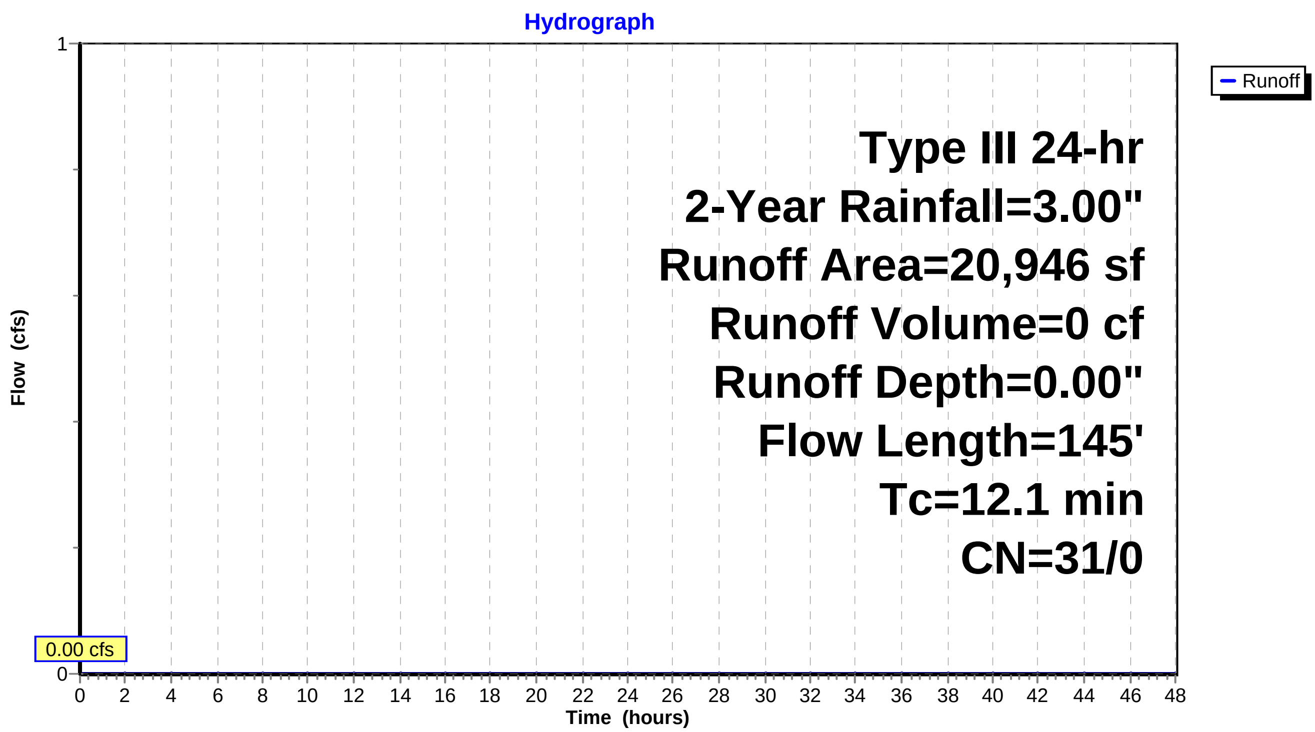
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
19,700	30	Woods, Good, HSG A
1,246	39	>75% Grass cover, Good, HSG A
20,946	31	Weighted Average
20,946	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0450	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
2.9	95	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.1	145	Total			

Subcatchment ES-2: To West



Summary for Subcatchment ES-3: To Northeast

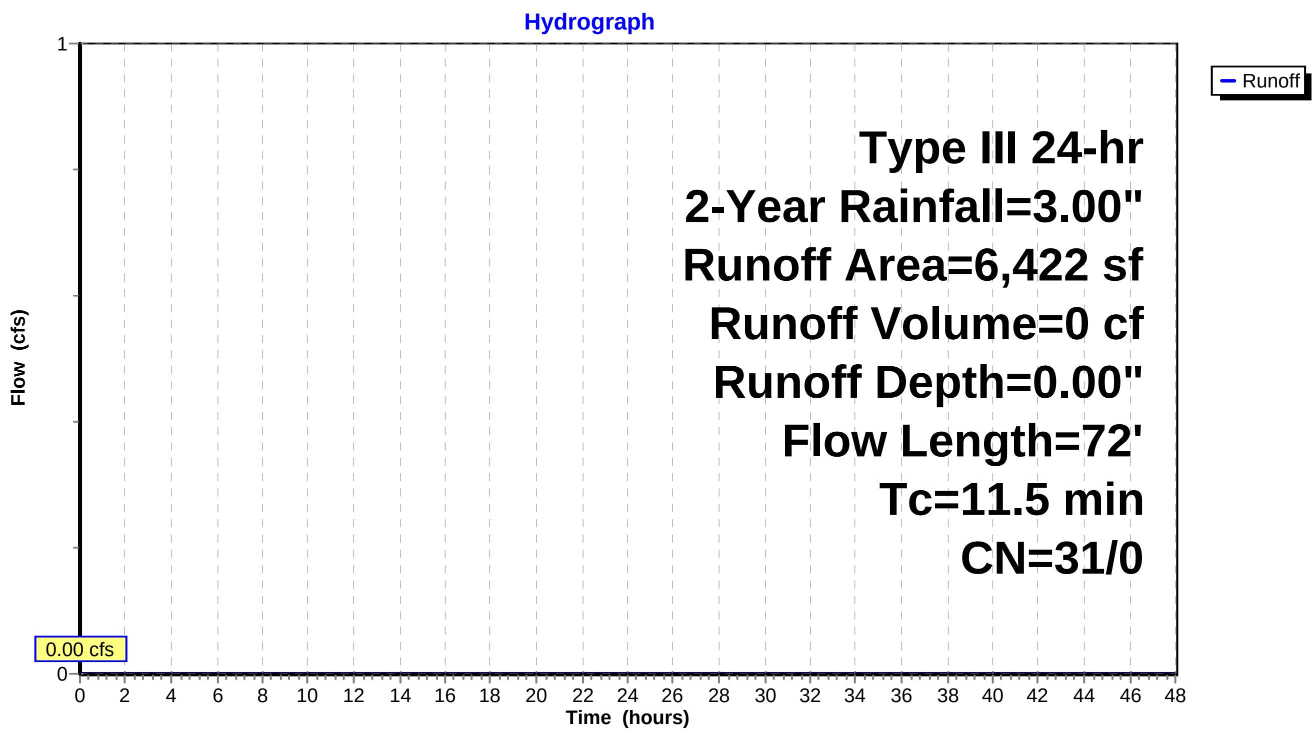
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
5,521	30	Woods, Good, HSG A
901	39	>75% Grass cover, Good, HSG A
6,422	31	Weighted Average
6,422	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0280	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.4	22	0.0270	0.82		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.5	72	Total			

Subcatchment ES-3: To Northeast



Summary for Subcatchment ES-4: To East

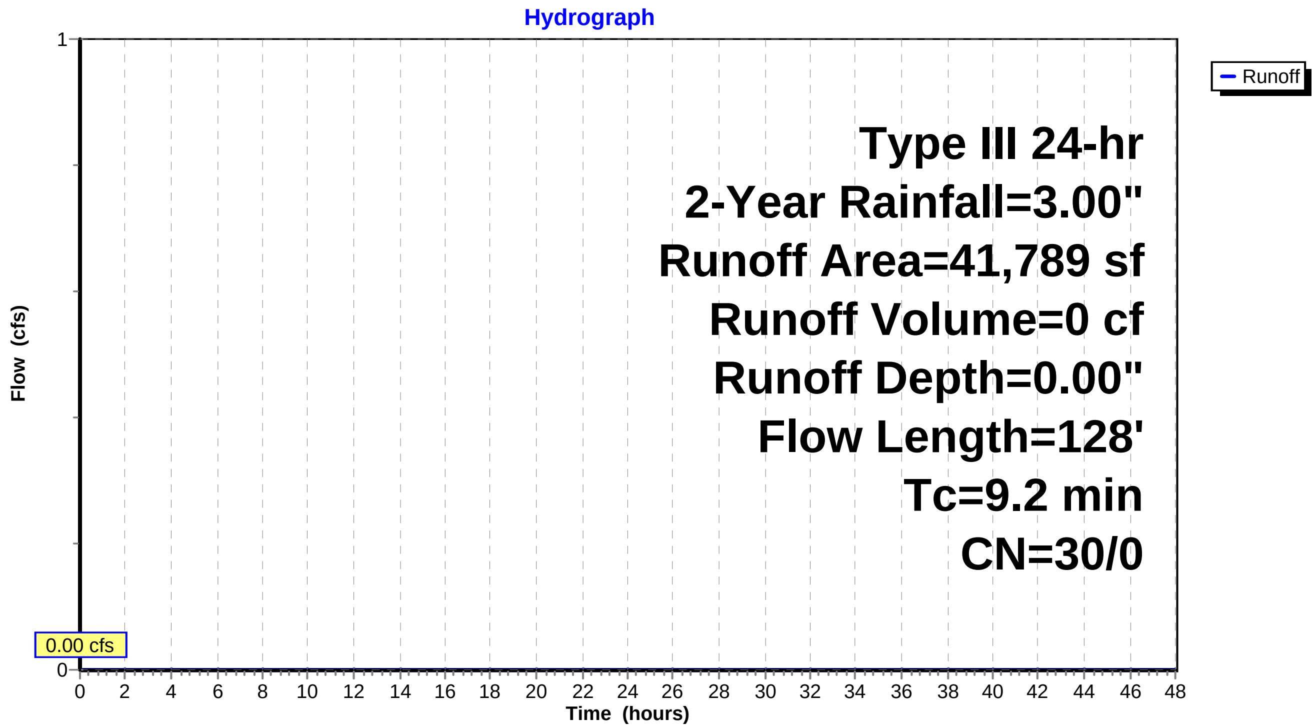
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
41,789	30	Woods, Good, HSG A
41,789	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0580	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.7	48	0.0460	1.07		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	30	0.2300	2.40		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	128	Total			

Subcatchment ES-4: To East



Summary for Subcatchment ES-5: To Southwest

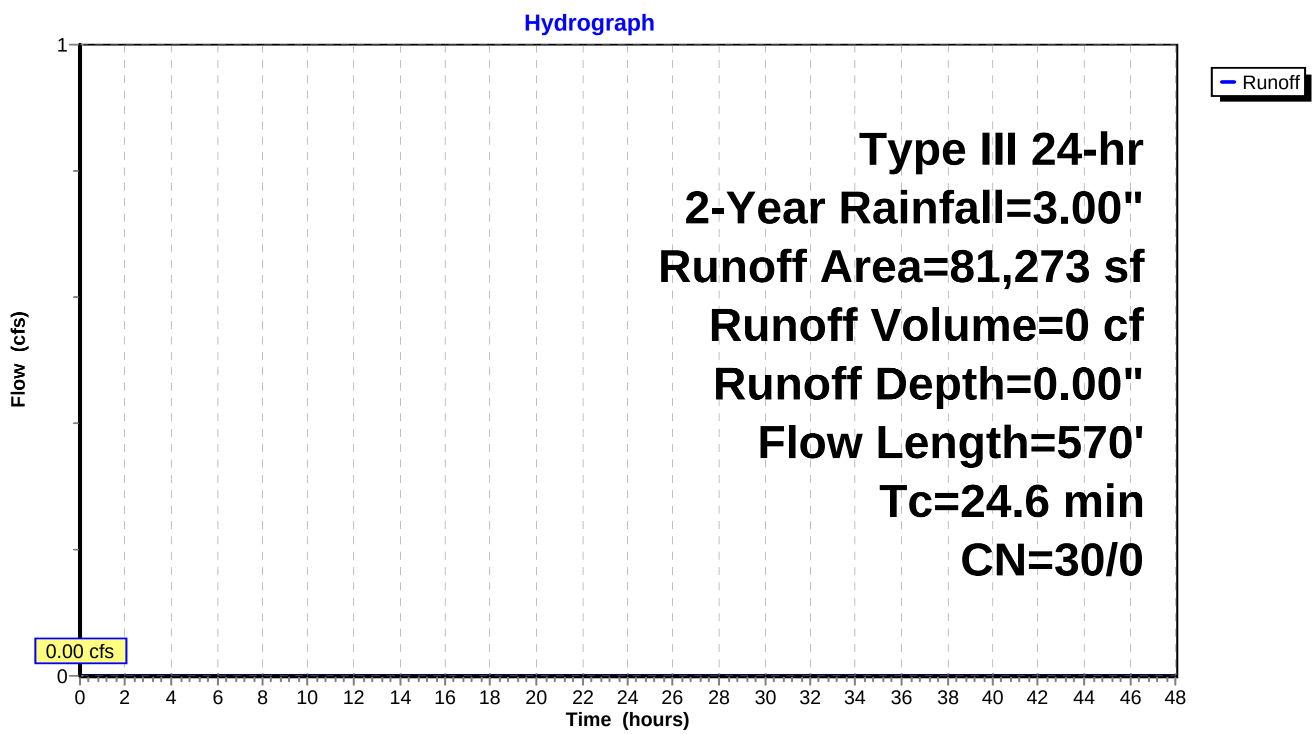
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
80,385	30	Woods, Good, HSG A
888	70	Woods, Good, HSG C
81,273	30	Weighted Average
81,273	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	50	0.0180	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
9.6	407	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.7	113	0.0490	1.11		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.6	570	Total			

Subcatchment ES-5: To Southwest



Summary for Subcatchment ES-6: To South

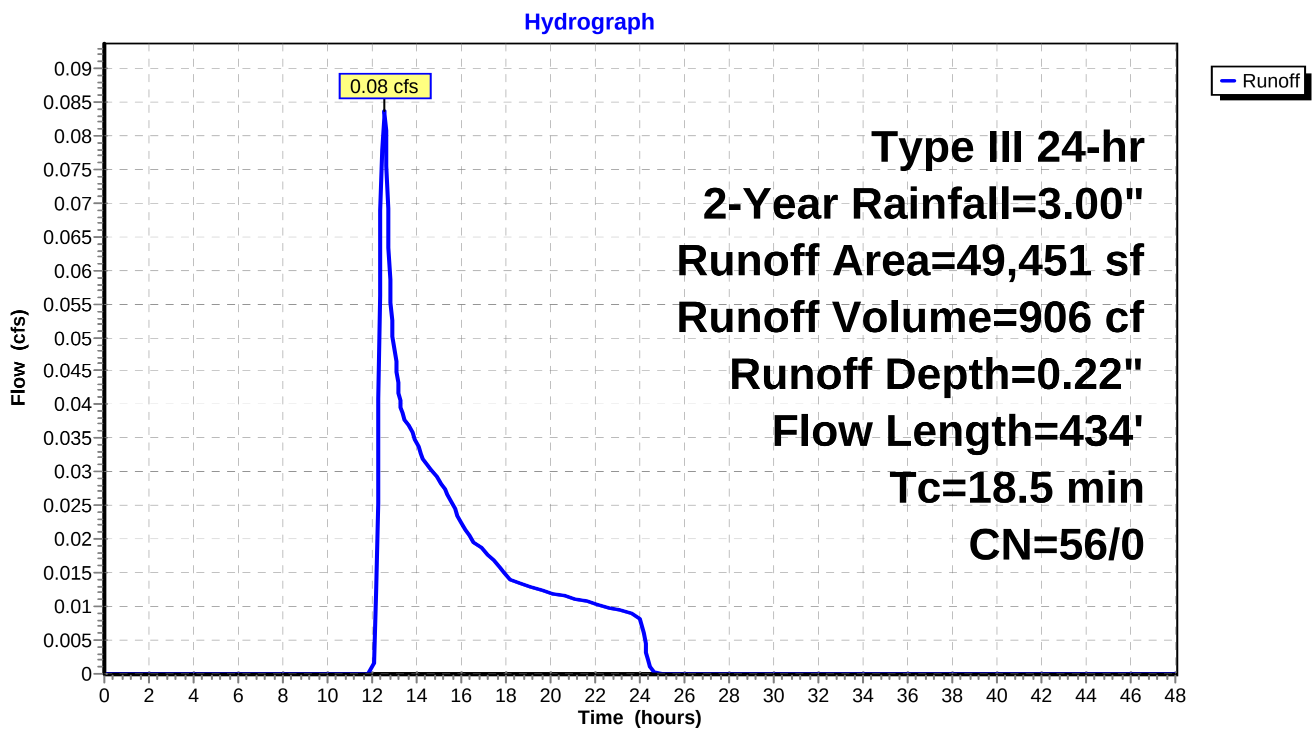
Runoff = 0.08 cfs @ 12.54 hrs, Volume= 906 cf, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
17,645	30	Woods, Good, HSG A
31,806	70	Woods, Good, HSG C
49,451	56	Weighted Average
49,451	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.8	384	0.0480	1.10		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.5	434	Total			

Subcatchment ES-6: To South

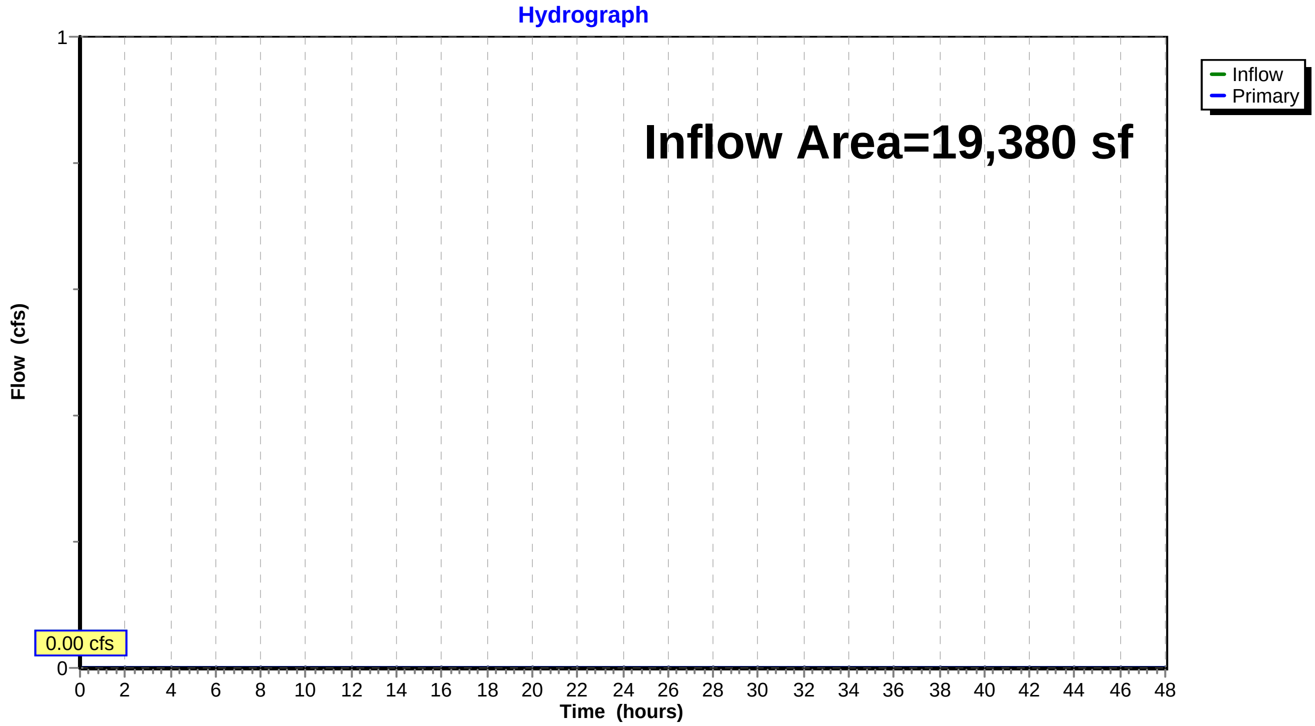


Summary for Link DP-1: Offsite to North/West

Inflow Area =	19,380 sf, 0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event
Inflow =	0.00 cfs @ 0.00 hrs,	Volume=	0 cf
Primary =	0.00 cfs @ 0.00 hrs,	Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

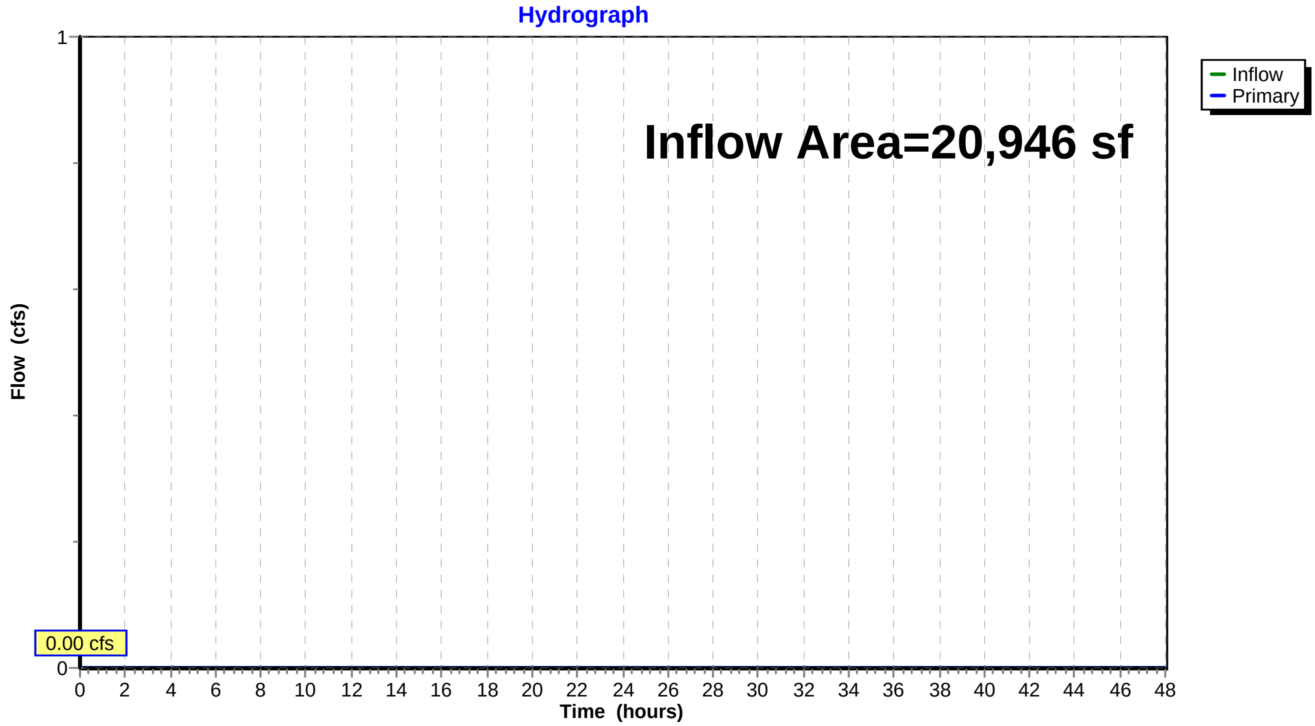


Summary for Link DP-2: Offsite to West

Inflow Area =	20,946 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

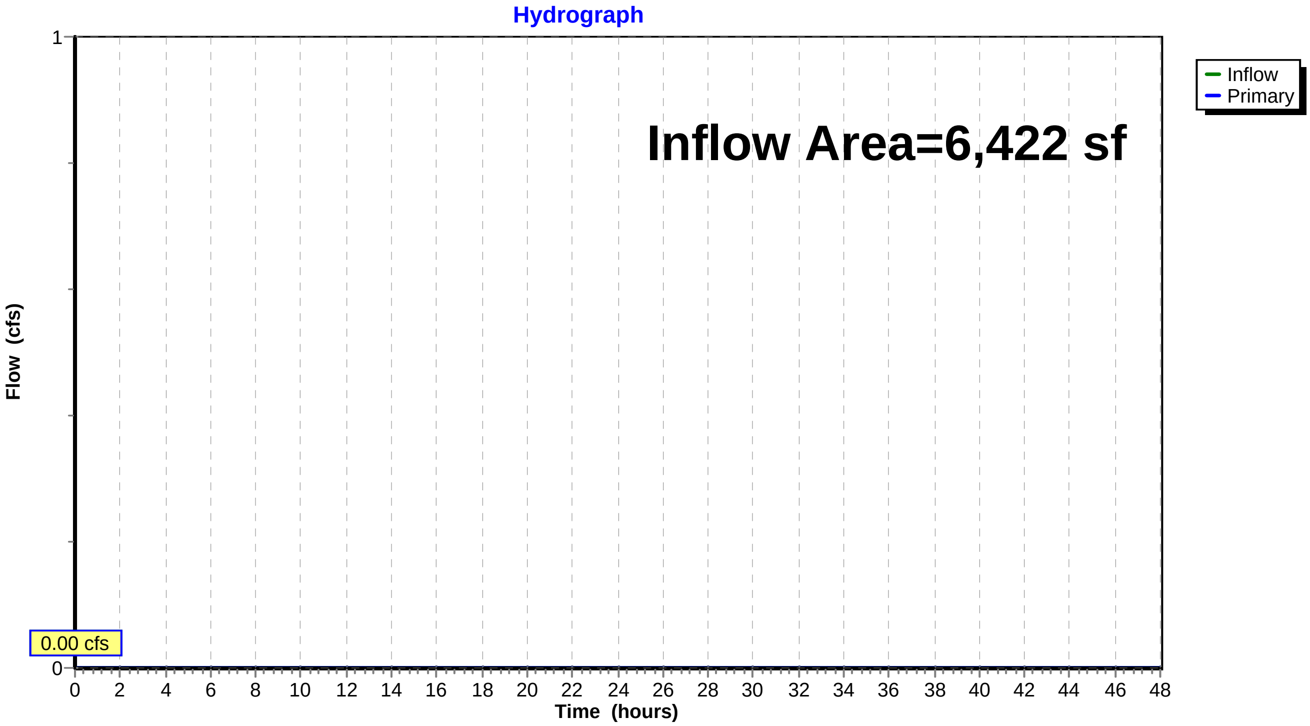


Summary for Link DP-3: Offsite to Northeast

Inflow Area =	6,422 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

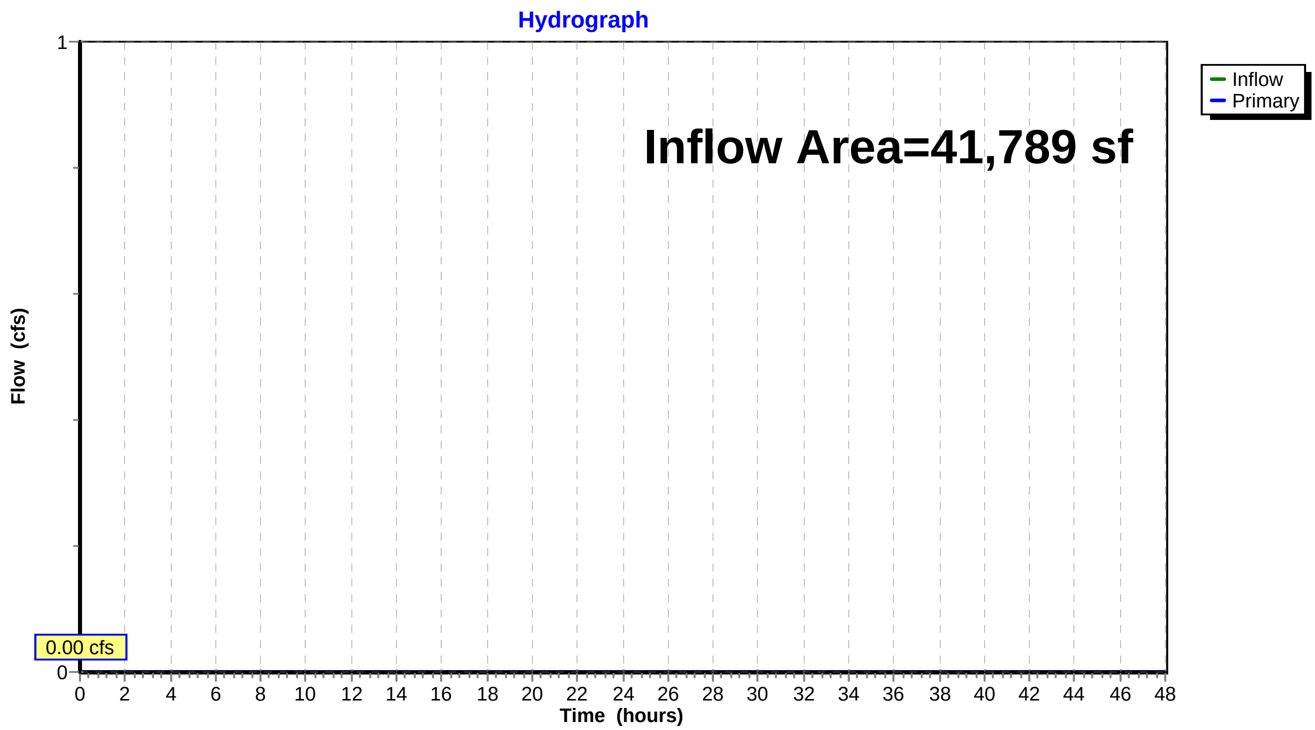


Summary for Link DP-4: East Edge of Property

Inflow Area = 41,789 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

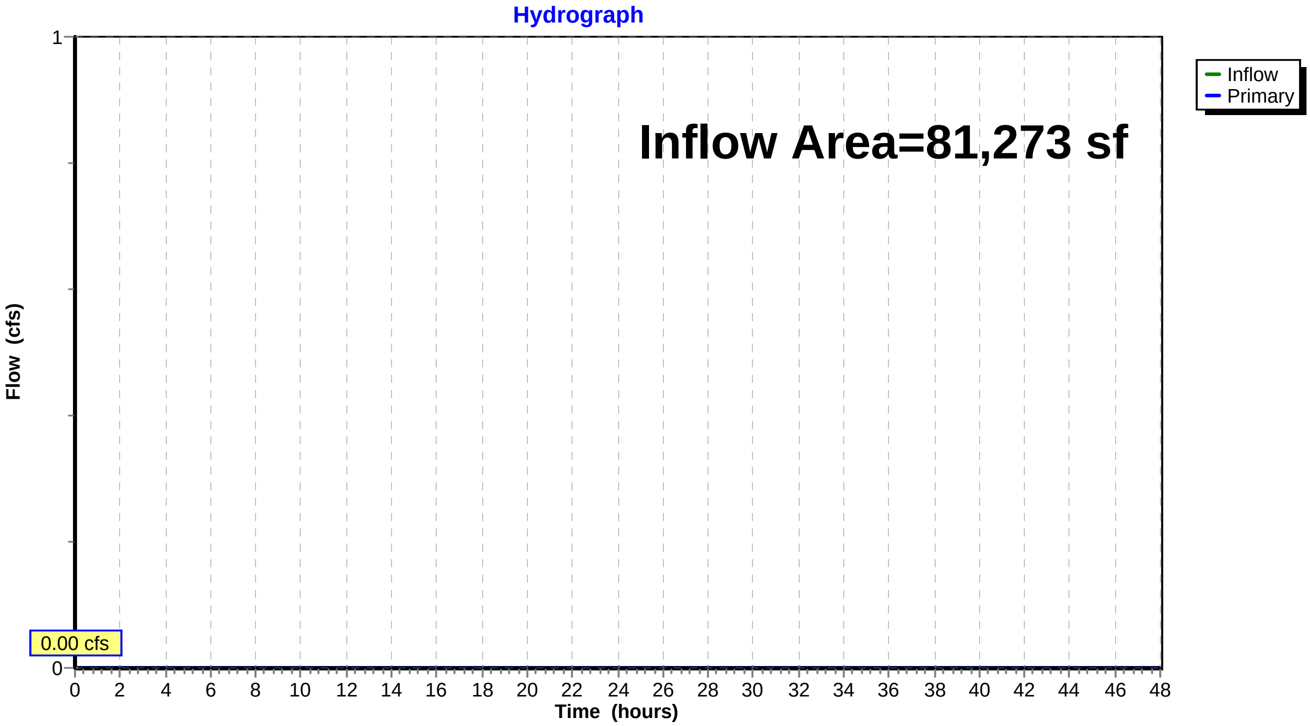


Summary for Link DP-5: Southwest Corner

Inflow Area =	81,273 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf		
Primary =	0.00 cfs @	0.00 hrs, Volume=	0 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

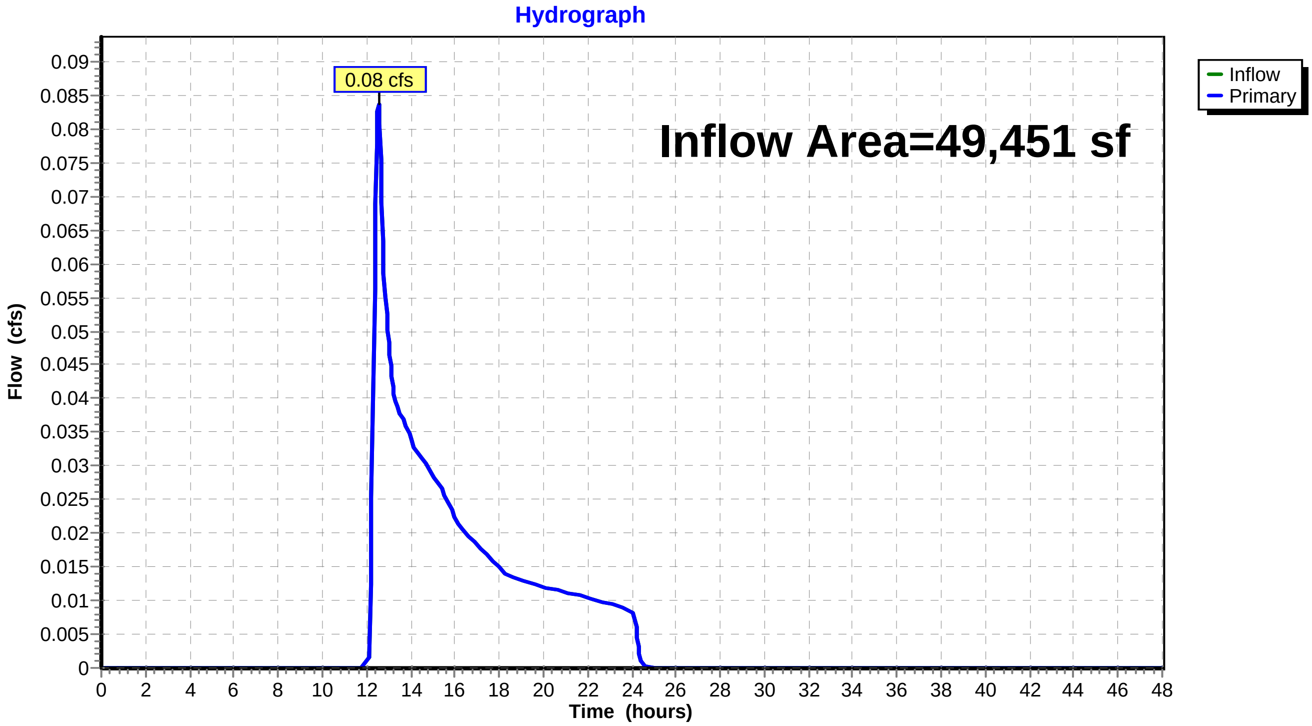


Summary for Link DP-6: South Corner

Inflow Area = 49,451 sf, 0.00% Impervious, Inflow Depth = 0.22" for 2-Year event
Inflow = 0.08 cfs @ 12.54 hrs, Volume= 906 cf
Primary = 0.08 cfs @ 12.54 hrs, Volume= 906 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: To North/West	Runoff Area=19,380 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=244' Tc=20.8 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-2: To West	Runoff Area=20,946 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=145' Tc=12.1 min CN=31/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-3: To Northeast	Runoff Area=6,422 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=72' Tc=11.5 min CN=31/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-4: To East	Runoff Area=41,789 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=128' Tc=9.2 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-5: To Southwest	Runoff Area=81,273 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=570' Tc=24.6 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-6: To South	Runoff Area=49,451 sf 0.00% Impervious Runoff Depth=0.80" Flow Length=434' Tc=18.5 min CN=56/0 Runoff=0.55 cfs 3,277 cf
Link DP-1: Offsite to North/West	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-2: Offsite to West	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-3: Offsite to Northeast	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-4: East Edge of Property	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-5: Southwest Corner	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-6: South Corner	Inflow=0.55 cfs 3,277 cf Primary=0.55 cfs 3,277 cf

Total Runoff Area = 219,261 sf Runoff Volume = 3,277 cf Average Runoff Depth = 0.18"
100.00% Pervious = 219,261 sf 0.00% Impervious = 0 sf

Summary for Subcatchment ES-1: To North/West

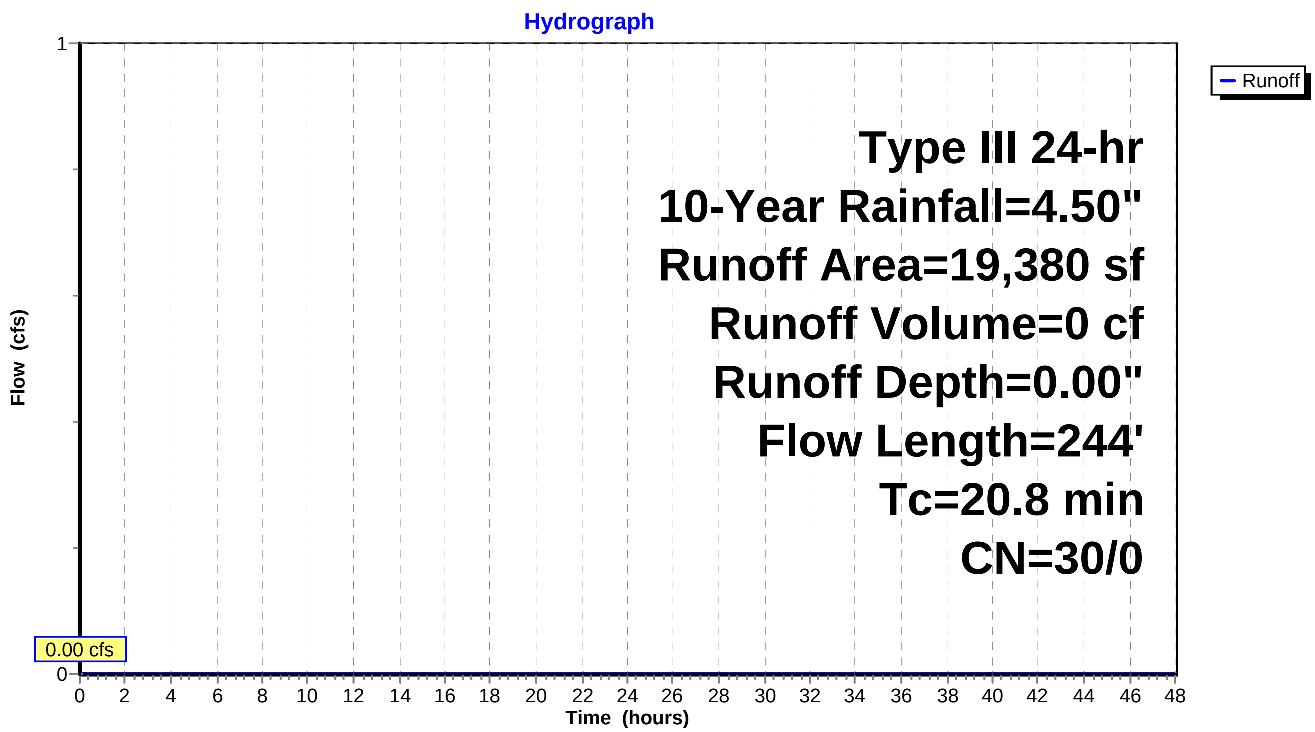
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
18,924	30	Woods, Good, HSG A
456	39	>75% Grass cover, Good, HSG A
19,380	30	Weighted Average
19,380	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0170	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
7.2	194	0.0080	0.45		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.8	244	Total			

Subcatchment ES-1: To North/West



Summary for Subcatchment ES-2: To West

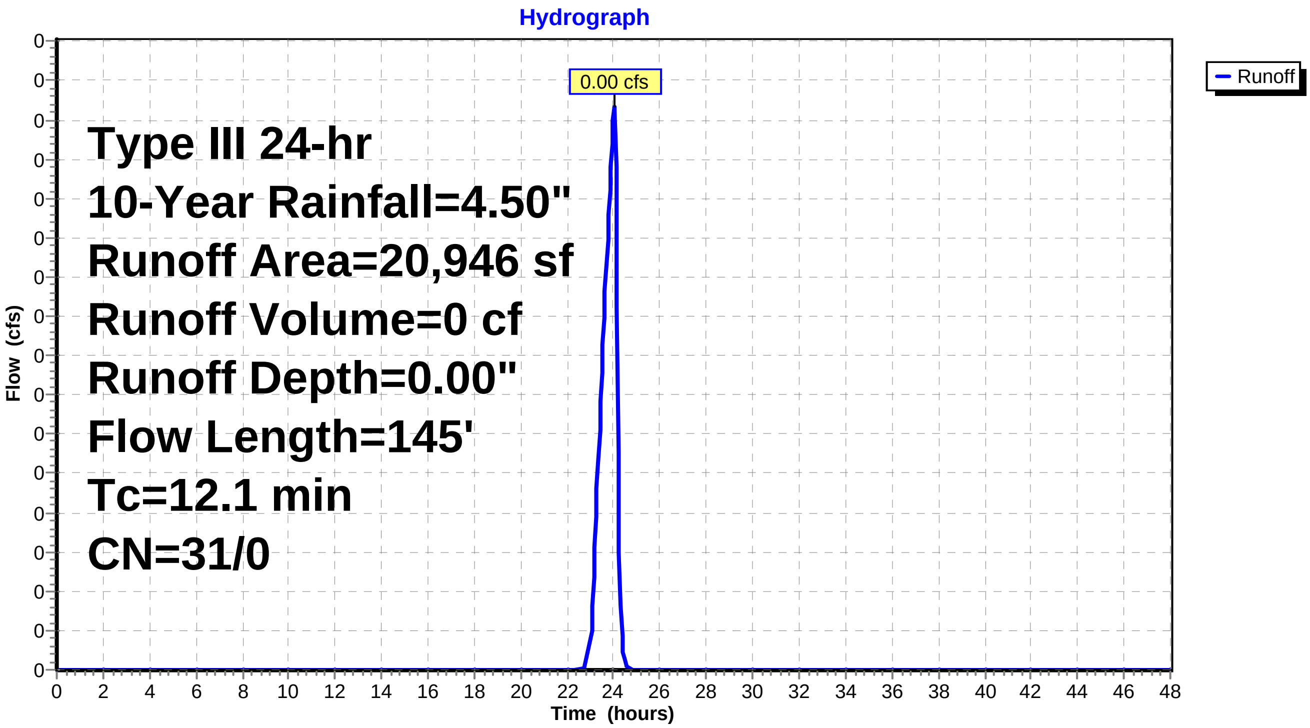
Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
19,700	30	Woods, Good, HSG A
1,246	39	>75% Grass cover, Good, HSG A
20,946	31	Weighted Average
20,946	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0450	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.9	95	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.1	145	Total			

Subcatchment ES-2: To West



Summary for Subcatchment ES-3: To Northeast

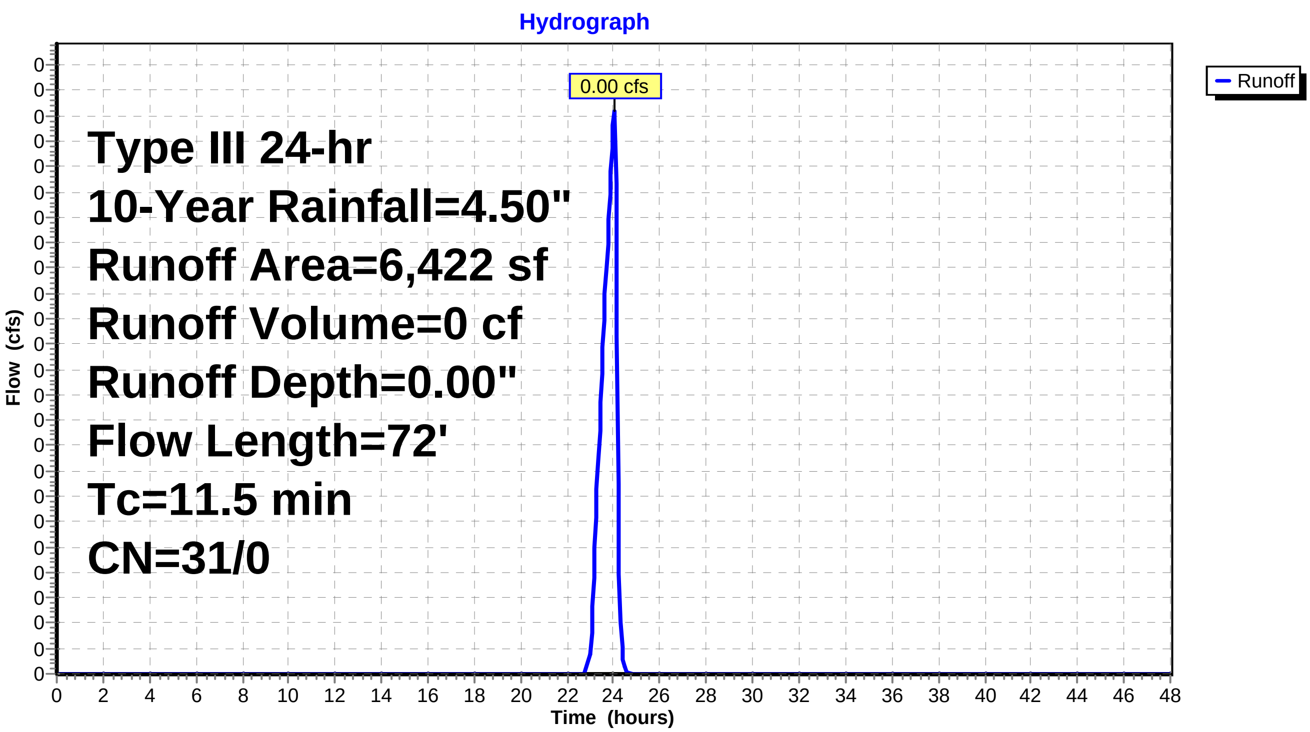
Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,521	30	Woods, Good, HSG A
901	39	>75% Grass cover, Good, HSG A
6,422	31	Weighted Average
6,422	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0280	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.4	22	0.0270	0.82		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.5	72	Total			

Subcatchment ES-3: To Northeast



Summary for Subcatchment ES-4: To East

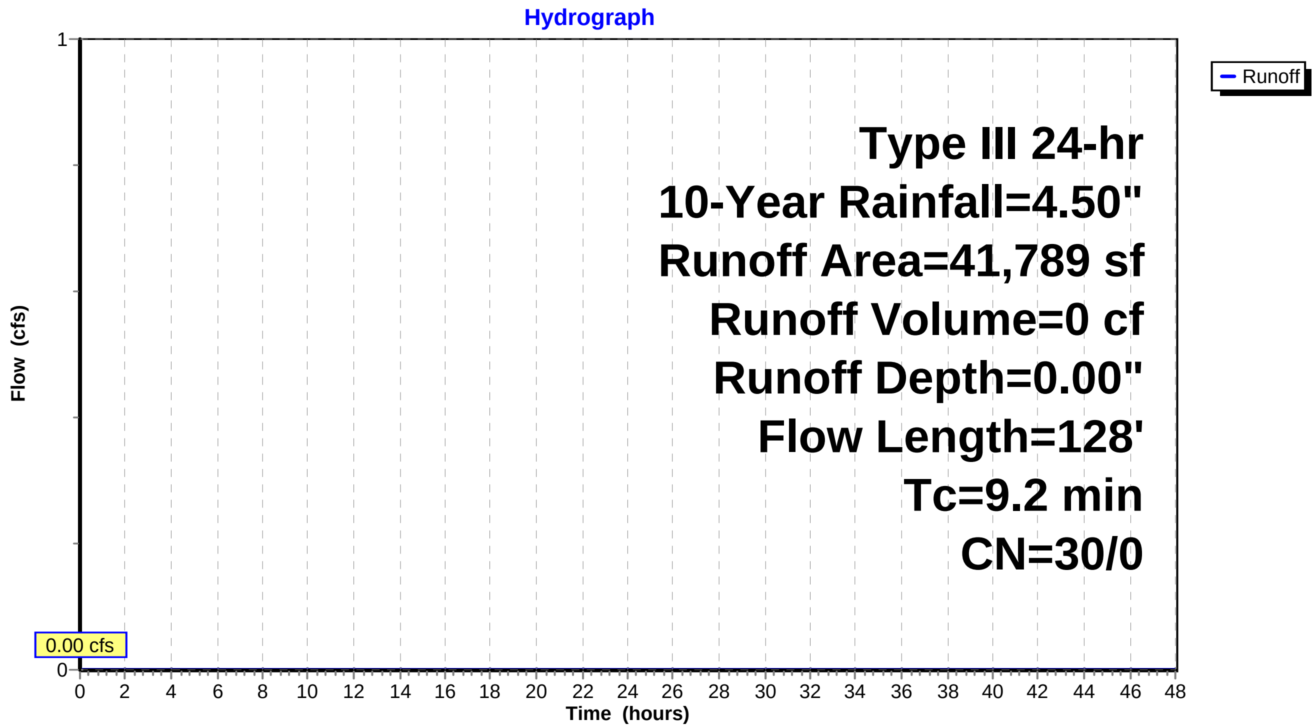
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
41,789	30	Woods, Good, HSG A
41,789	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0580	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.7	48	0.0460	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.2300	2.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.2	128	Total			

Subcatchment ES-4: To East



Summary for Subcatchment ES-5: To Southwest

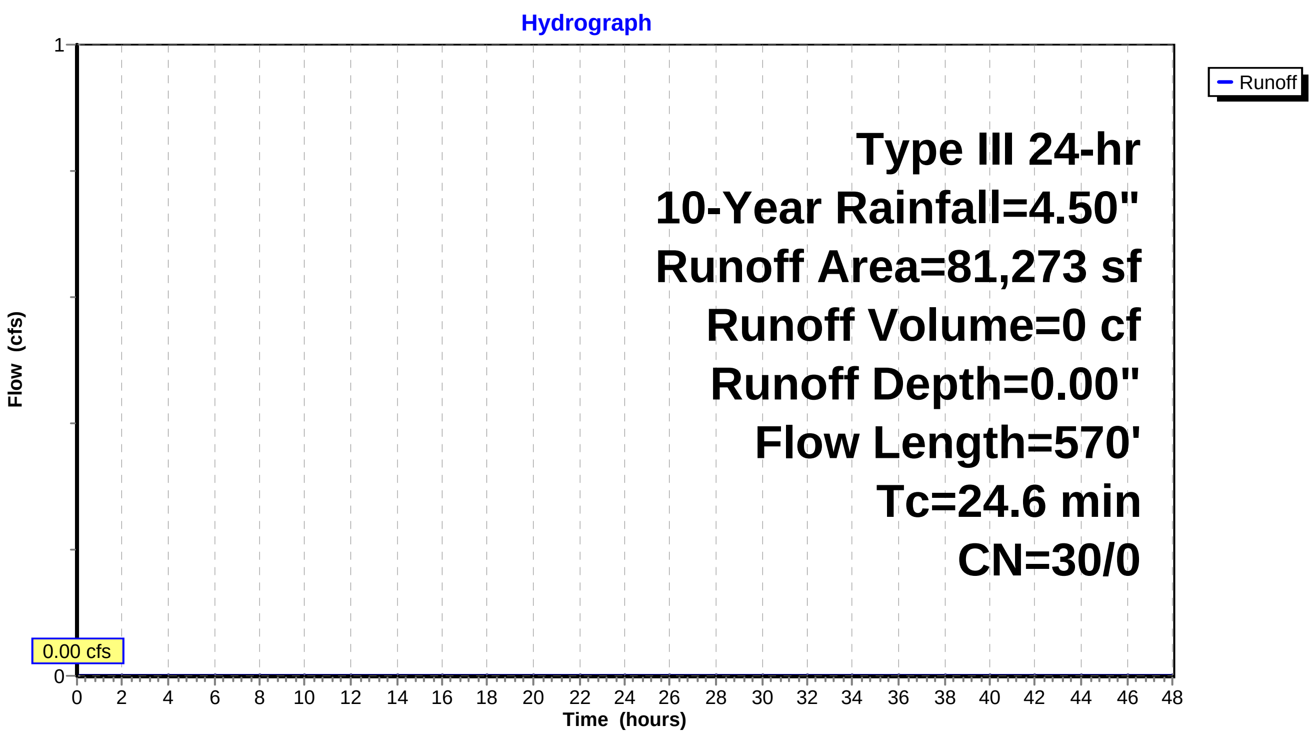
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
80,385	30	Woods, Good, HSG A
888	70	Woods, Good, HSG C
81,273	30	Weighted Average
81,273	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	50	0.0180	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
9.6	407	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.7	113	0.0490	1.11		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.6	570	Total			

Subcatchment ES-5: To Southwest



Summary for Subcatchment ES-6: To South

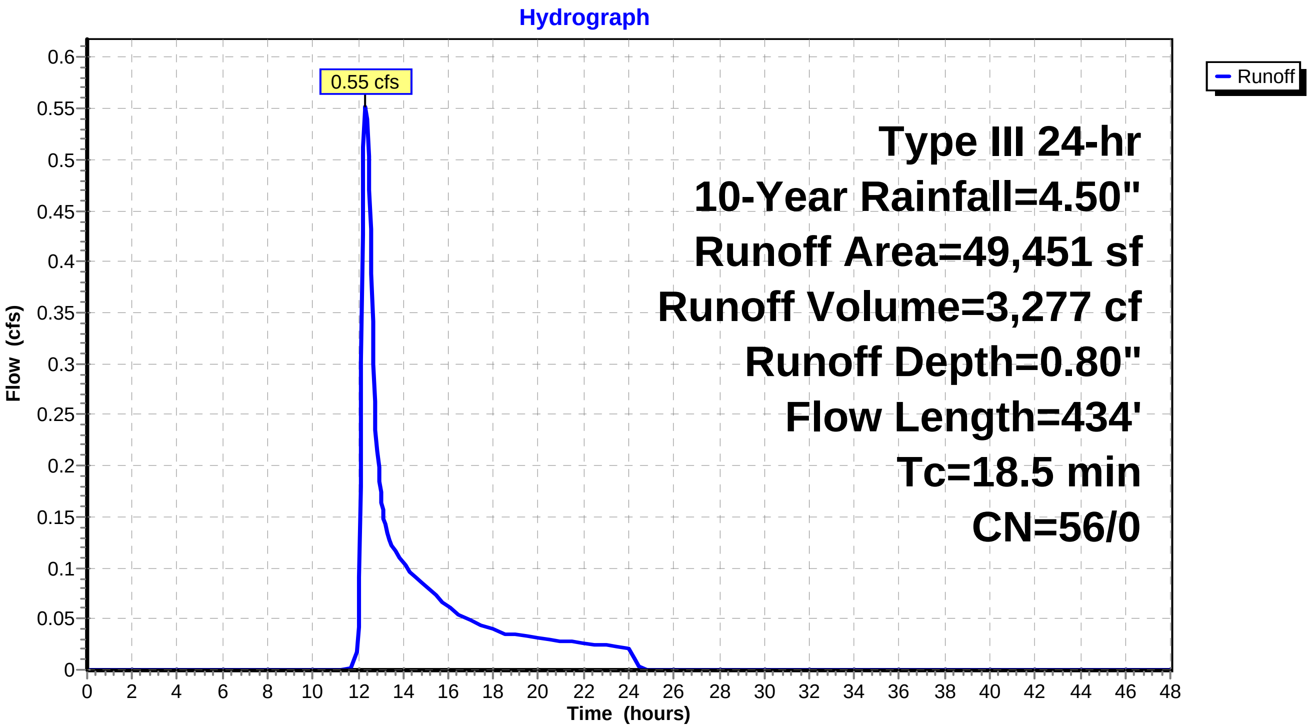
Runoff = 0.55 cfs @ 12.33 hrs, Volume= 3,277 cf, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
17,645	30	Woods, Good, HSG A
31,806	70	Woods, Good, HSG C
49,451	56	Weighted Average
49,451	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.8	384	0.0480	1.10		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.5	434	Total			

Subcatchment ES-6: To South

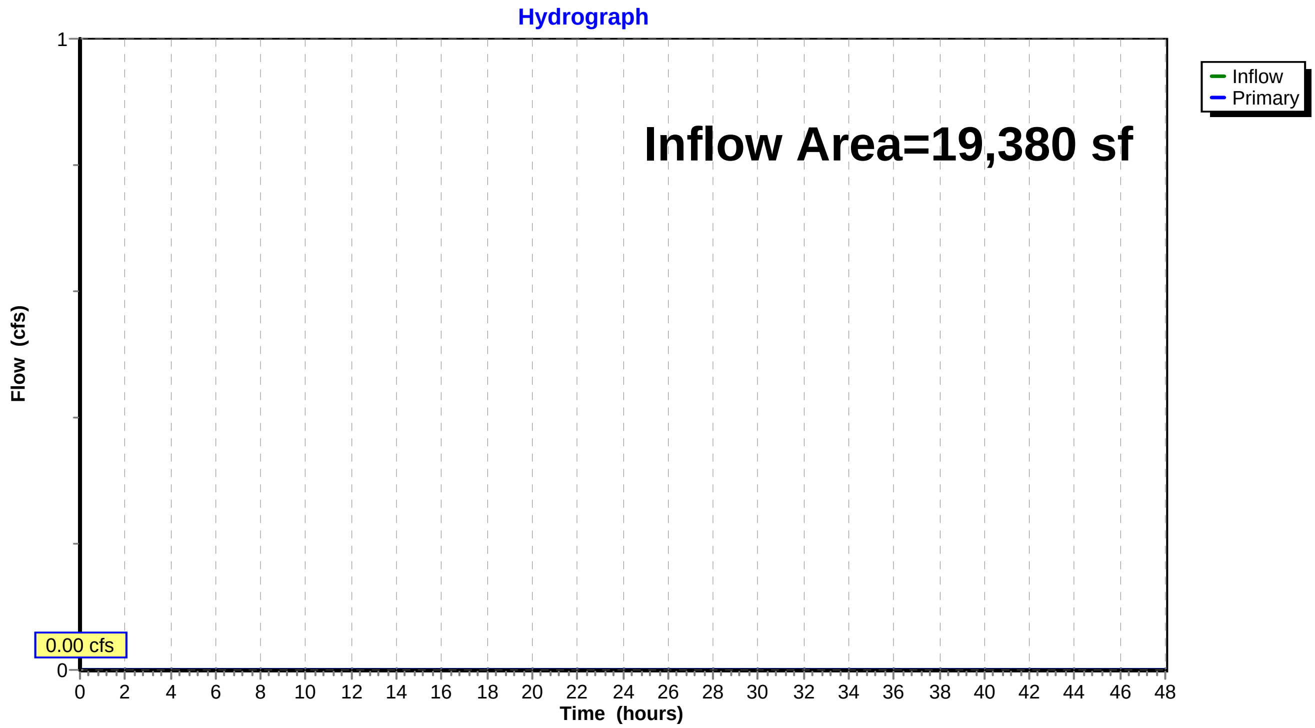


Summary for Link DP-1: Offsite to North/West

Inflow Area =	19,380 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 10-Year event	
Inflow =	0.00 cfs @	0.00 hrs, Volume=		0 cf	
Primary =	0.00 cfs @	0.00 hrs, Volume=		0 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

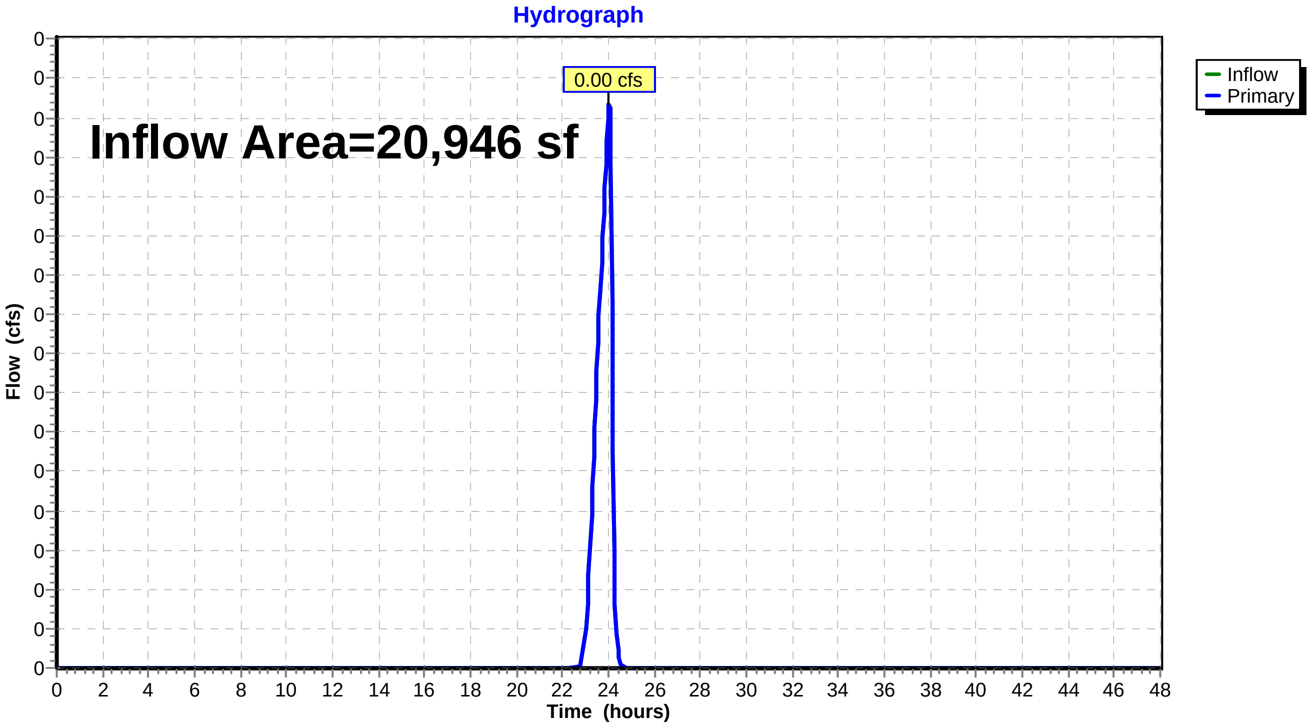


Summary for Link DP-2: Offsite to West

Inflow Area = 20,946 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.03 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

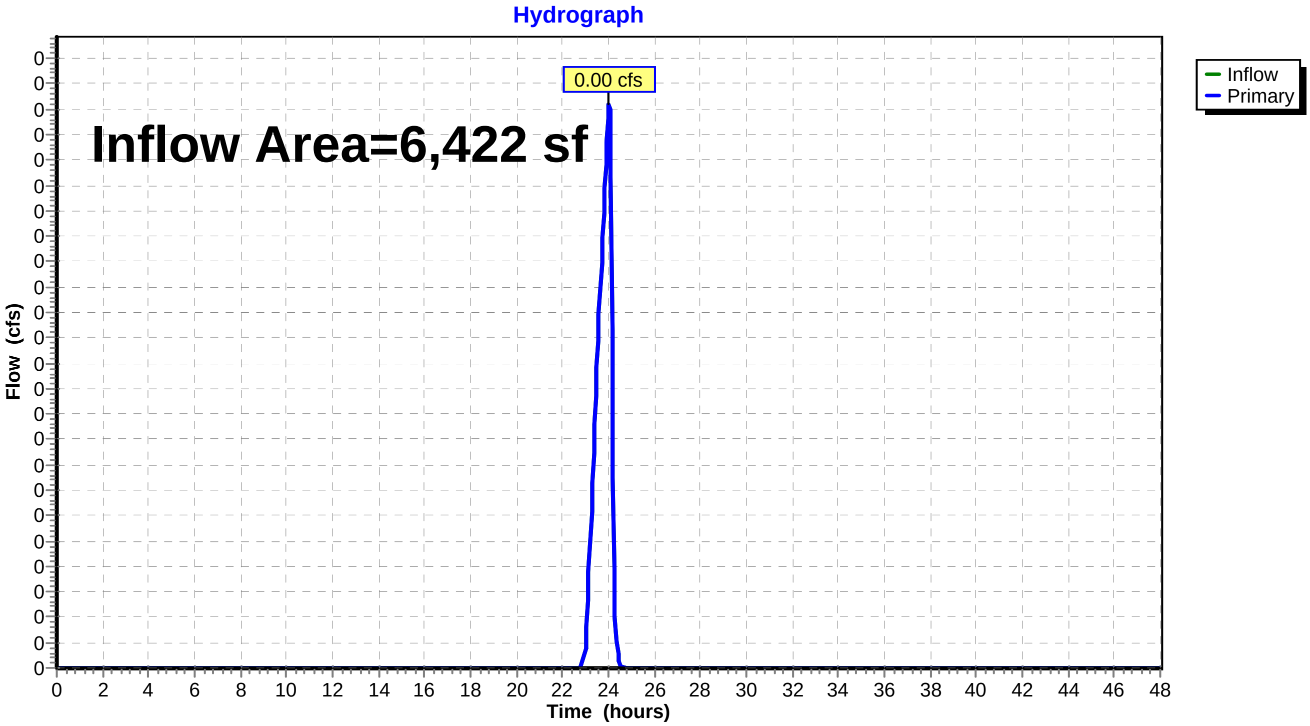


Summary for Link DP-3: Offsite to Northeast

Inflow Area =	6,422 sf,	0.00% Impervious, Inflow Depth = 0.00"	for 10-Year event
Inflow =	0.00 cfs @ 24.03 hrs,	Volume=	0 cf
Primary =	0.00 cfs @ 24.03 hrs,	Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

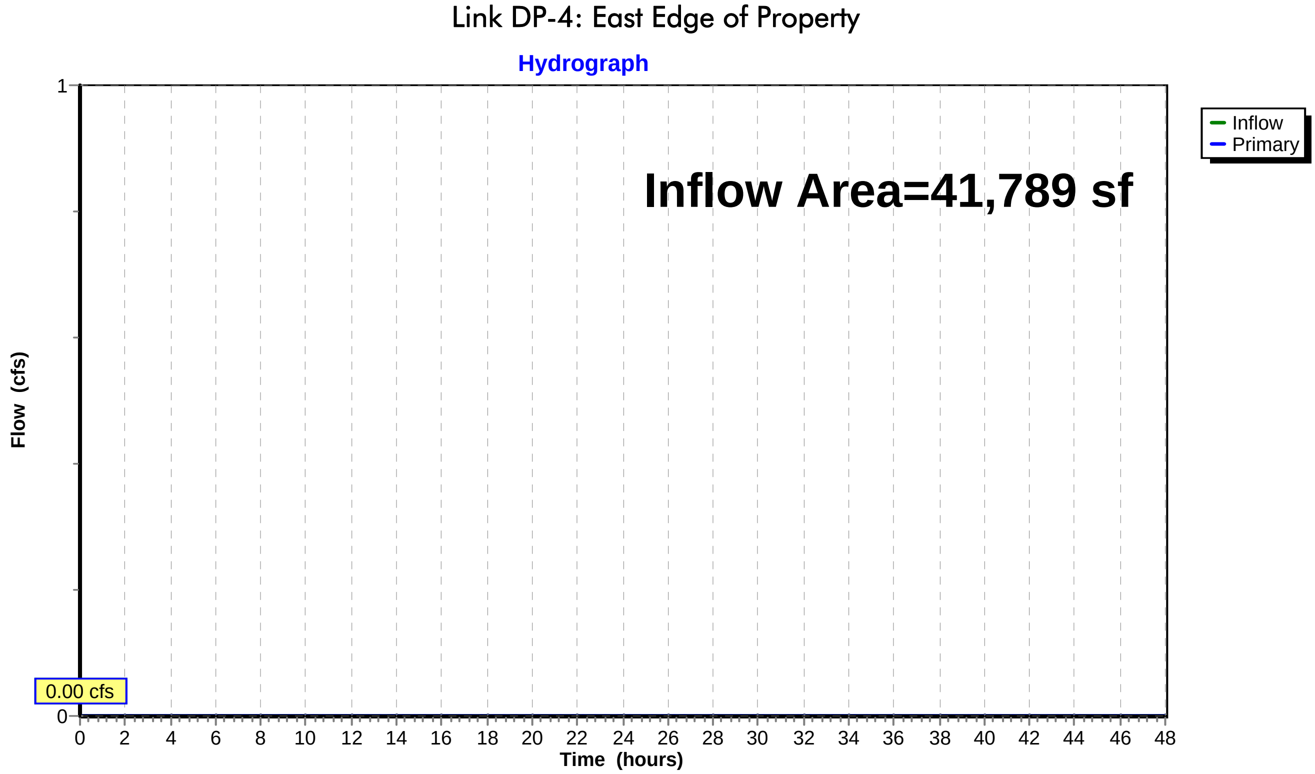
Link DP-3: Offsite to Northeast



Summary for Link DP-4: East Edge of Property

Inflow Area = 41,789 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

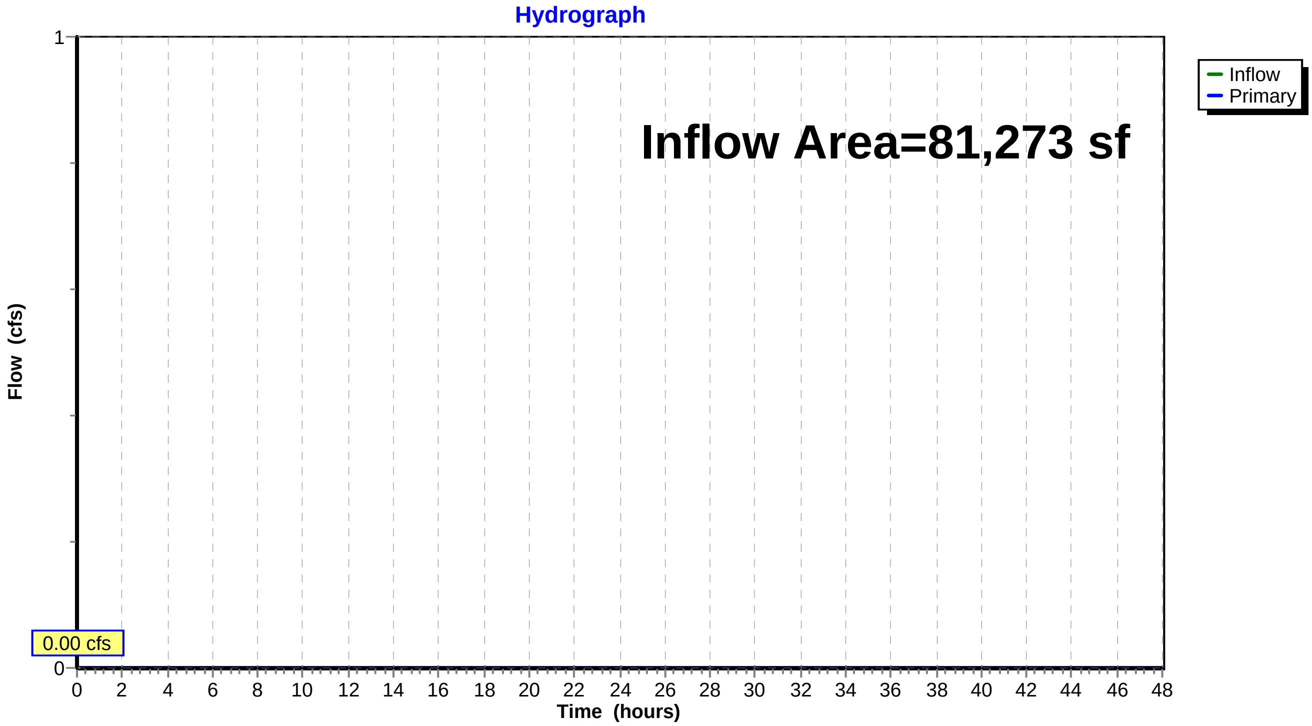


Summary for Link DP-5: Southwest Corner

Inflow Area = 81,273 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

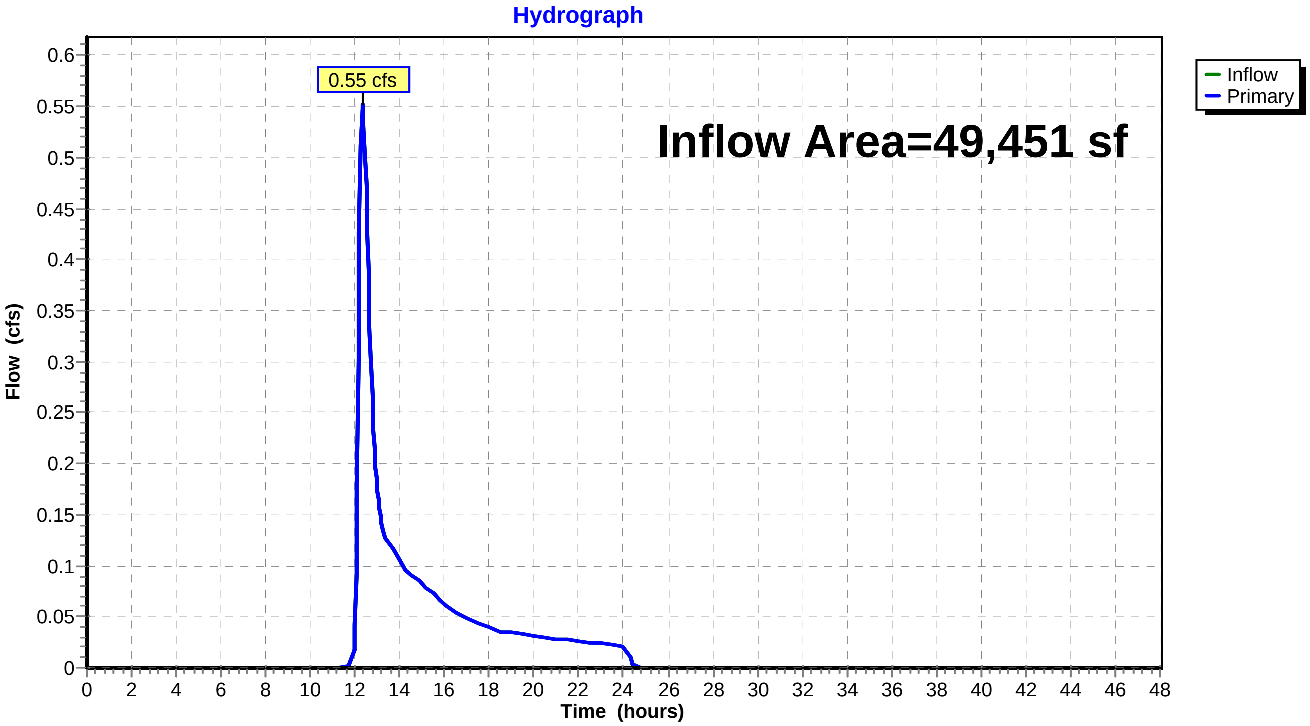


Summary for Link DP-6: South Corner

Inflow Area = 49,451 sf, 0.00% Impervious, Inflow Depth = 0.80" for 10-Year event
Inflow = 0.55 cfs @ 12.33 hrs, Volume= 3,277 cf
Primary = 0.55 cfs @ 12.33 hrs, Volume= 3,277 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: To North/West	Runoff Area=19,380 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=244' Tc=20.8 min CN=30/0 Runoff=0.01 cfs 194 cf
Subcatchment ES-2: To West	Runoff Area=20,946 sf 0.00% Impervious Runoff Depth=0.16" Flow Length=145' Tc=12.1 min CN=31/0 Runoff=0.01 cfs 274 cf
Subcatchment ES-3: To Northeast	Runoff Area=6,422 sf 0.00% Impervious Runoff Depth=0.16" Flow Length=72' Tc=11.5 min CN=31/0 Runoff=0.00 cfs 84 cf
Subcatchment ES-4: To East	Runoff Area=41,789 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=128' Tc=9.2 min CN=30/0 Runoff=0.02 cfs 417 cf
Subcatchment ES-5: To Southwest	Runoff Area=81,273 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=570' Tc=24.6 min CN=30/0 Runoff=0.03 cfs 812 cf
Subcatchment ES-6: To South	Runoff Area=49,451 sf 0.00% Impervious Runoff Depth=1.84" Flow Length=434' Tc=18.5 min CN=56/0 Runoff=1.55 cfs 7,574 cf
Link DP-1: Offsite to North/West	Inflow=0.01 cfs 194 cf Primary=0.01 cfs 194 cf
Link DP-2: Offsite to West	Inflow=0.01 cfs 274 cf Primary=0.01 cfs 274 cf
Link DP-3: Offsite to Northeast	Inflow=0.00 cfs 84 cf Primary=0.00 cfs 84 cf
Link DP-4: East Edge of Property	Inflow=0.02 cfs 417 cf Primary=0.02 cfs 417 cf
Link DP-5: Southwest Corner	Inflow=0.03 cfs 812 cf Primary=0.03 cfs 812 cf
Link DP-6: South Corner	Inflow=1.55 cfs 7,574 cf Primary=1.55 cfs 7,574 cf

Total Runoff Area = 219,261 sf Runoff Volume = 9,354 cf Average Runoff Depth = 0.51"
100.00% Pervious = 219,261 sf 0.00% Impervious = 0 sf

Summary for Subcatchment ES-1: To North/West

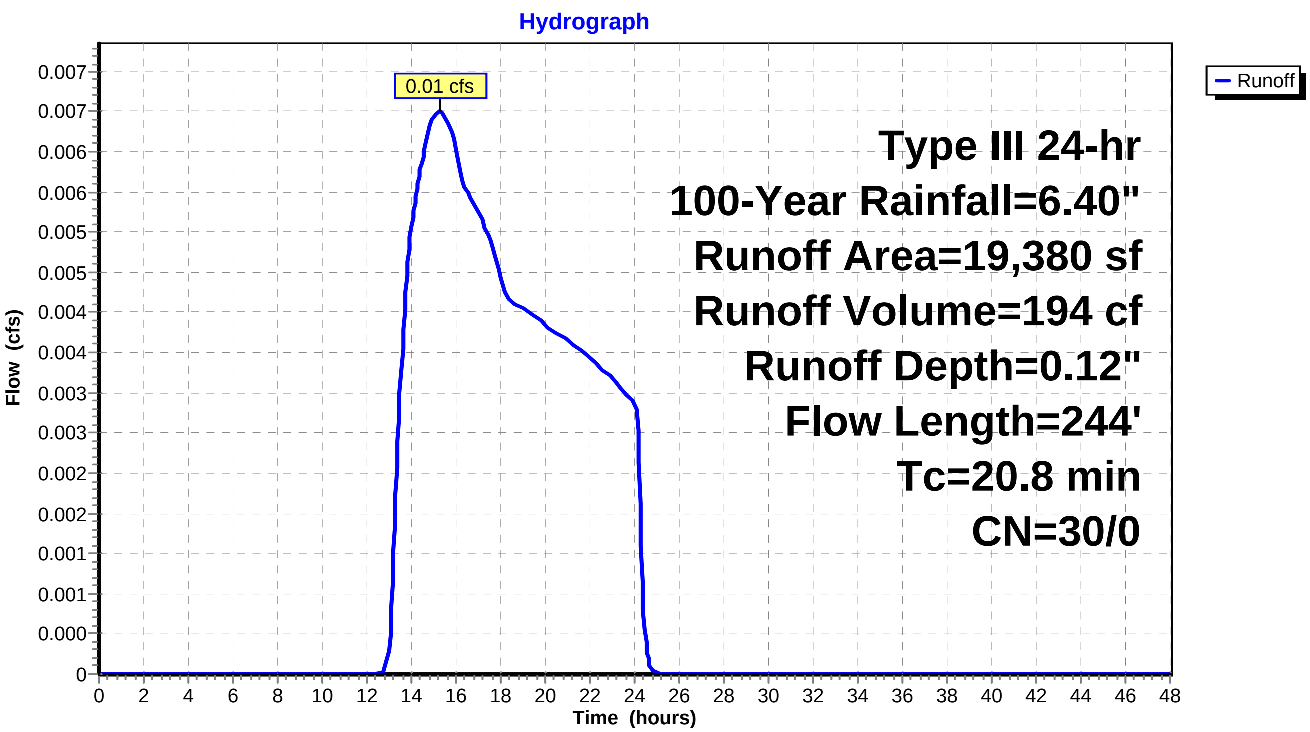
Runoff = 0.01 cfs @ 15.25 hrs, Volume= 194 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
18,924	30	Woods, Good, HSG A
456	39	>75% Grass cover, Good, HSG A
19,380	30	Weighted Average
19,380	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0170	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
7.2	194	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.8	244	Total			

Subcatchment ES-1: To North/West



Summary for Subcatchment ES-2: To West

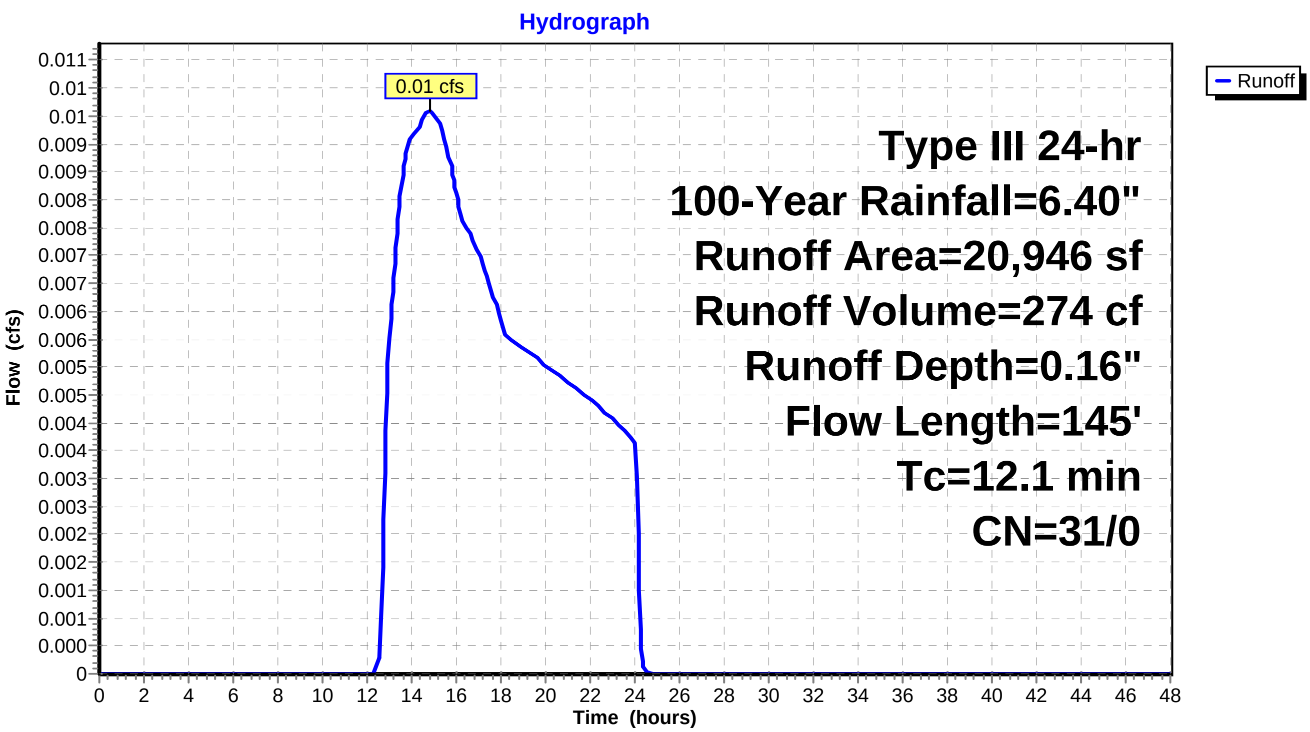
Runoff = 0.01 cfs @ 14.81 hrs, Volume= 274 cf, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
19,700	30	Woods, Good, HSG A
1,246	39	>75% Grass cover, Good, HSG A
20,946	31	Weighted Average
20,946	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0450	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
2.9	95	0.0120	0.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.1	145	Total			

Subcatchment ES-2: To West



Summary for Subcatchment ES-3: To Northeast

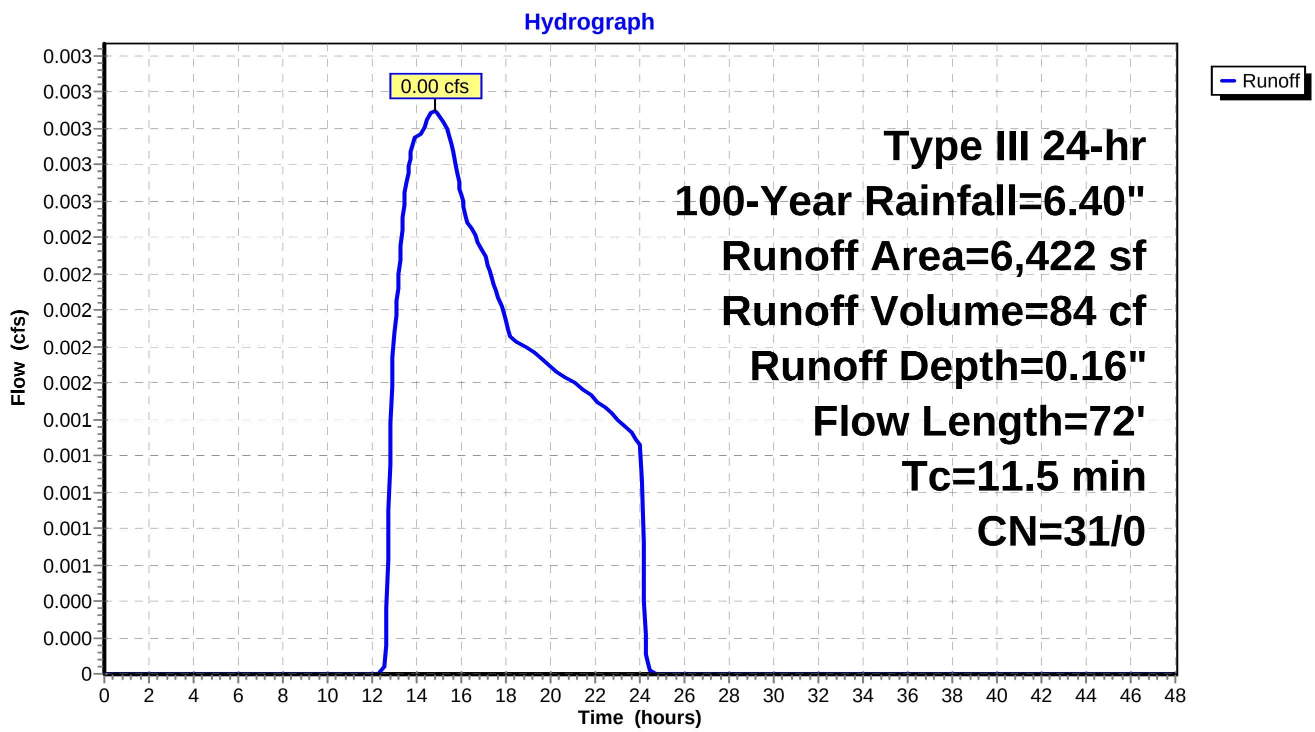
Runoff = 0.00 cfs @ 14.80 hrs, Volume= 84 cf, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
5,521	30	Woods, Good, HSG A
901	39	>75% Grass cover, Good, HSG A
6,422	31	Weighted Average
6,422	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0280	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.4	22	0.0270	0.82		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.5	72	Total			

Subcatchment ES-3: To Northeast



Summary for Subcatchment ES-4: To East

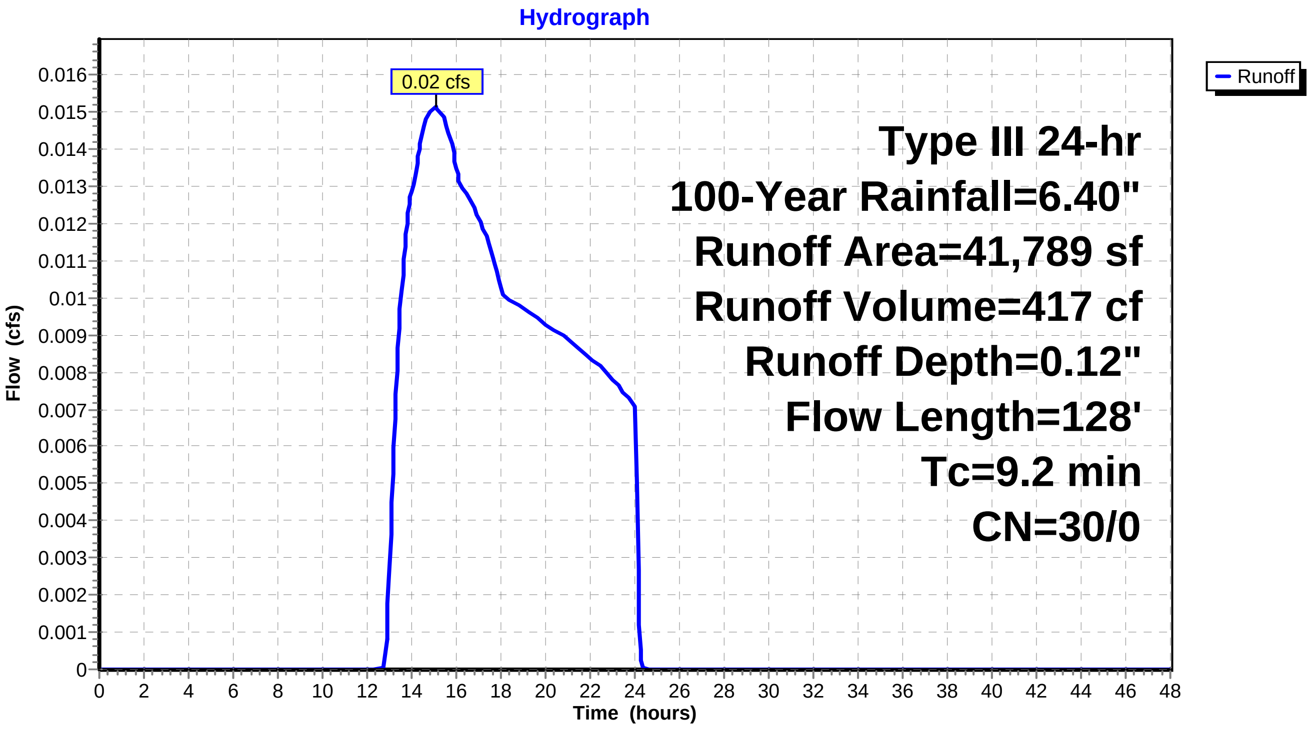
Runoff = 0.02 cfs @ 15.07 hrs, Volume= 417 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
41,789	30	Woods, Good, HSG A
41,789	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0580	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.7	48	0.0460	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	30	0.2300	2.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.2	128	Total			

Subcatchment ES-4: To East



Summary for Subcatchment ES-5: To Southwest

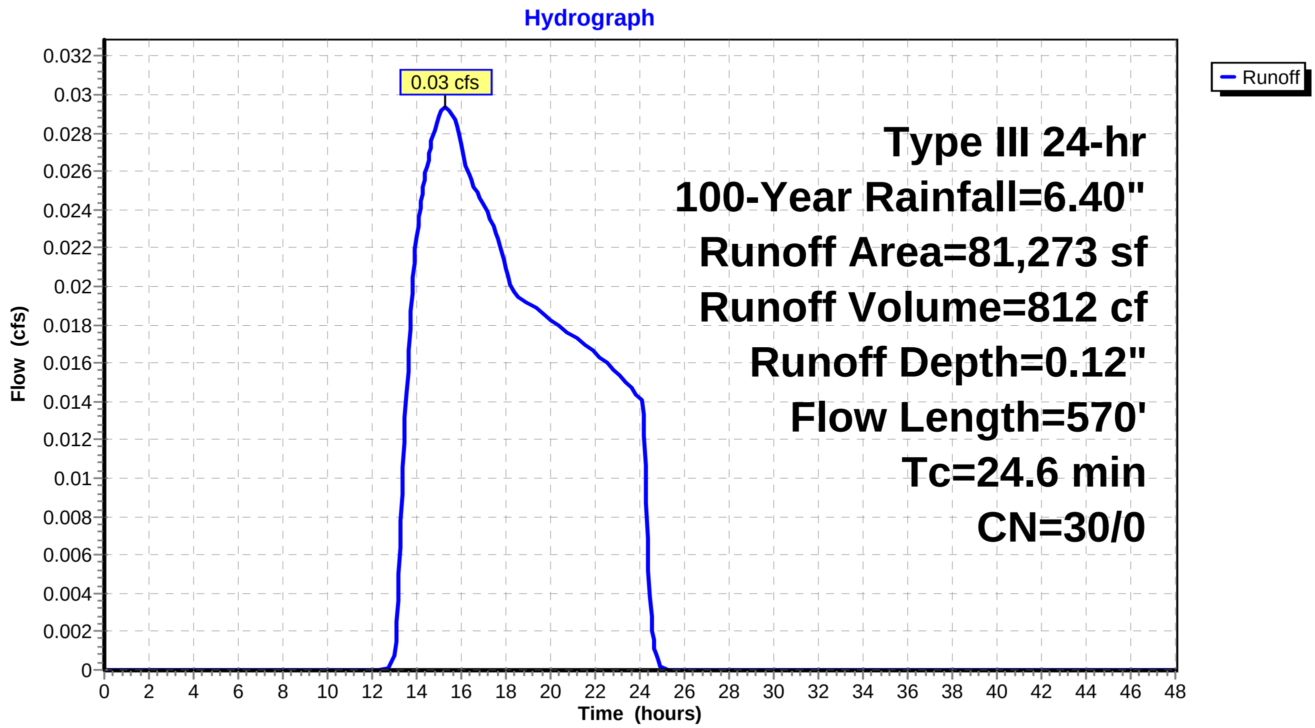
Runoff = 0.03 cfs @ 15.31 hrs, Volume= 812 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
80,385	30	Woods, Good, HSG A
888	70	Woods, Good, HSG C
81,273	30	Weighted Average
81,273	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	50	0.0180	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
9.6	407	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.7	113	0.0490	1.11		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.6	570	Total			

Subcatchment ES-5: To Southwest



Summary for Subcatchment ES-6: To South

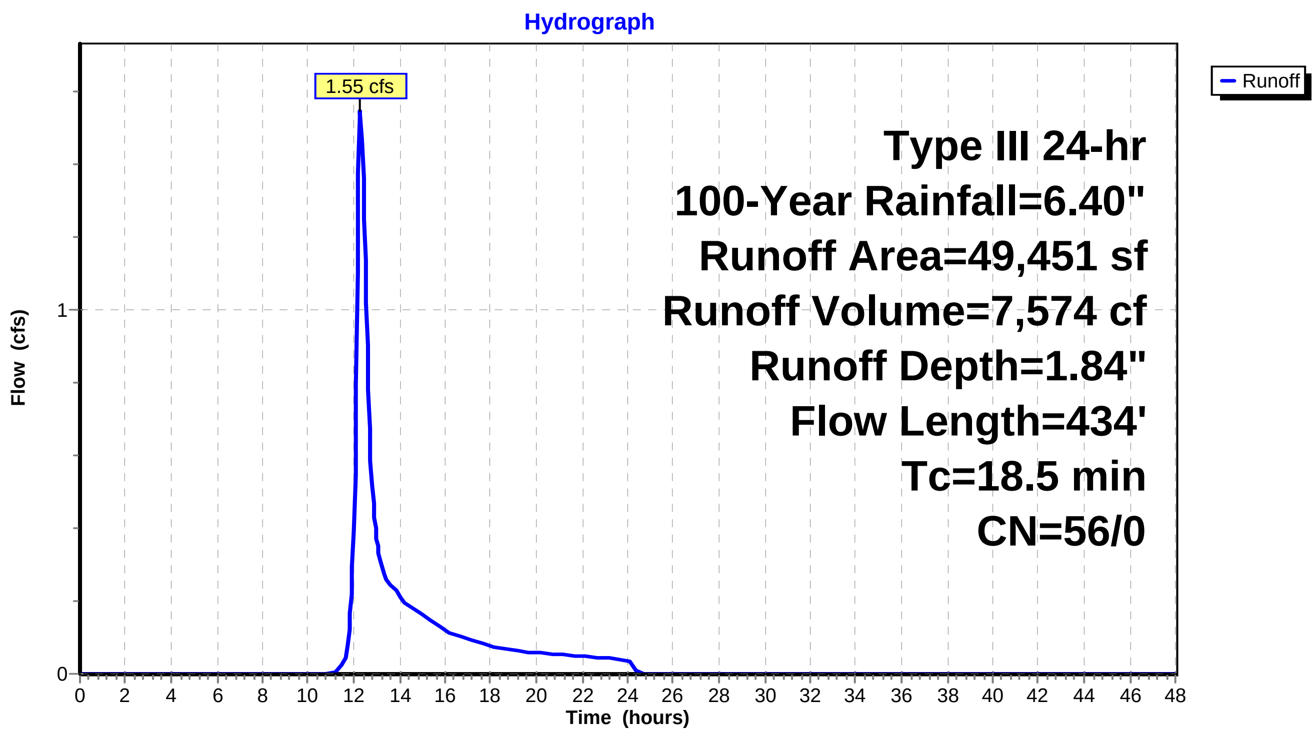
Runoff = 1.55 cfs @ 12.28 hrs, Volume= 7,574 cf, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
17,645	30	Woods, Good, HSG A
31,806	70	Woods, Good, HSG C
49,451	56	Weighted Average
49,451	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
5.8	384	0.0480	1.10		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.5	434	Total			

Subcatchment ES-6: To South

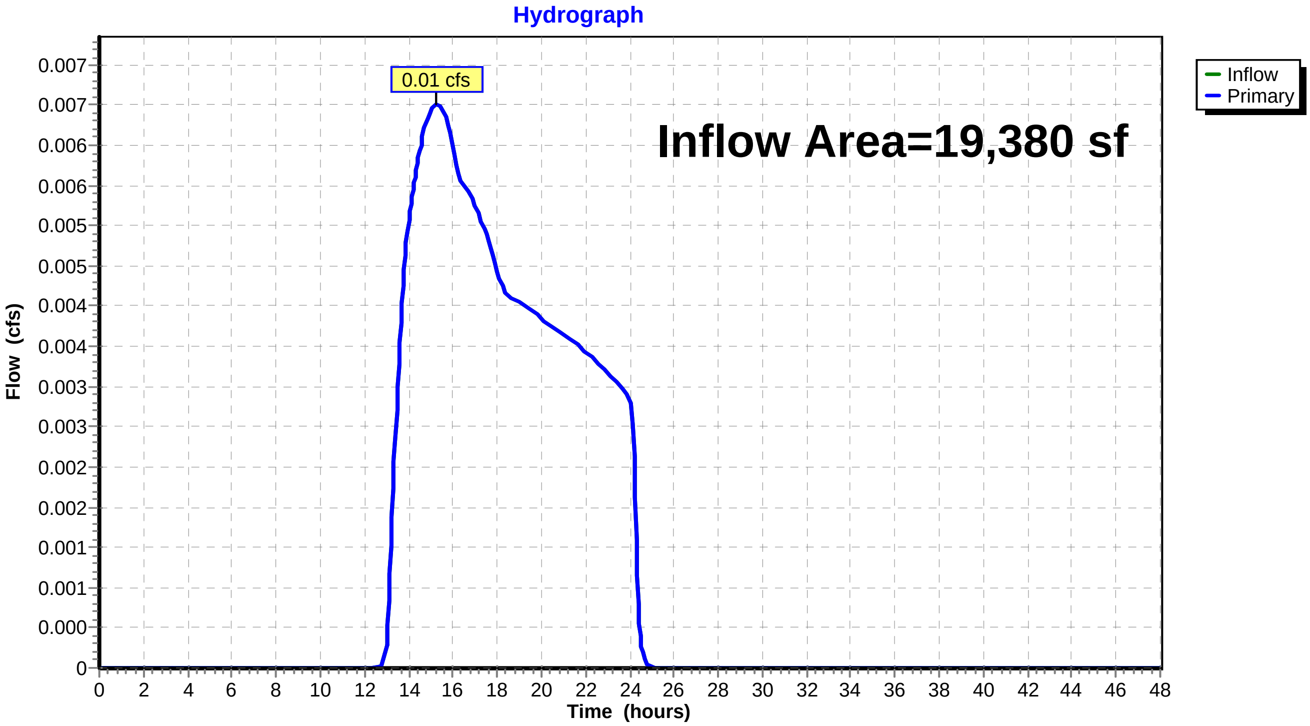


Summary for Link DP-1: Offsite to North/West

Inflow Area = 19,380 sf, 0.00% Impervious, Inflow Depth = 0.12" for 100-Year event
Inflow = 0.01 cfs @ 15.25 hrs, Volume= 194 cf
Primary = 0.01 cfs @ 15.25 hrs, Volume= 194 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

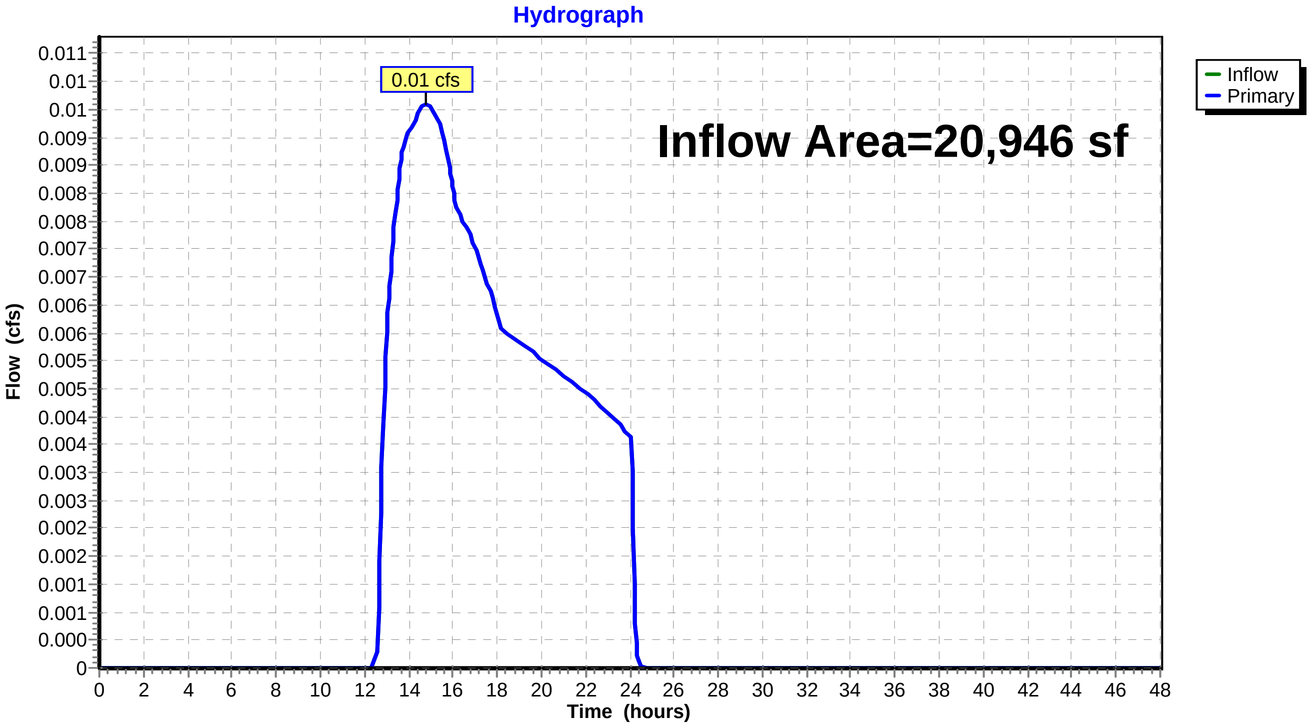


Summary for Link DP-2: Offsite to West

Inflow Area = 20,946 sf, 0.00% Impervious, Inflow Depth = 0.16" for 100-Year event
Inflow = 0.01 cfs @ 14.81 hrs, Volume= 274 cf
Primary = 0.01 cfs @ 14.81 hrs, Volume= 274 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

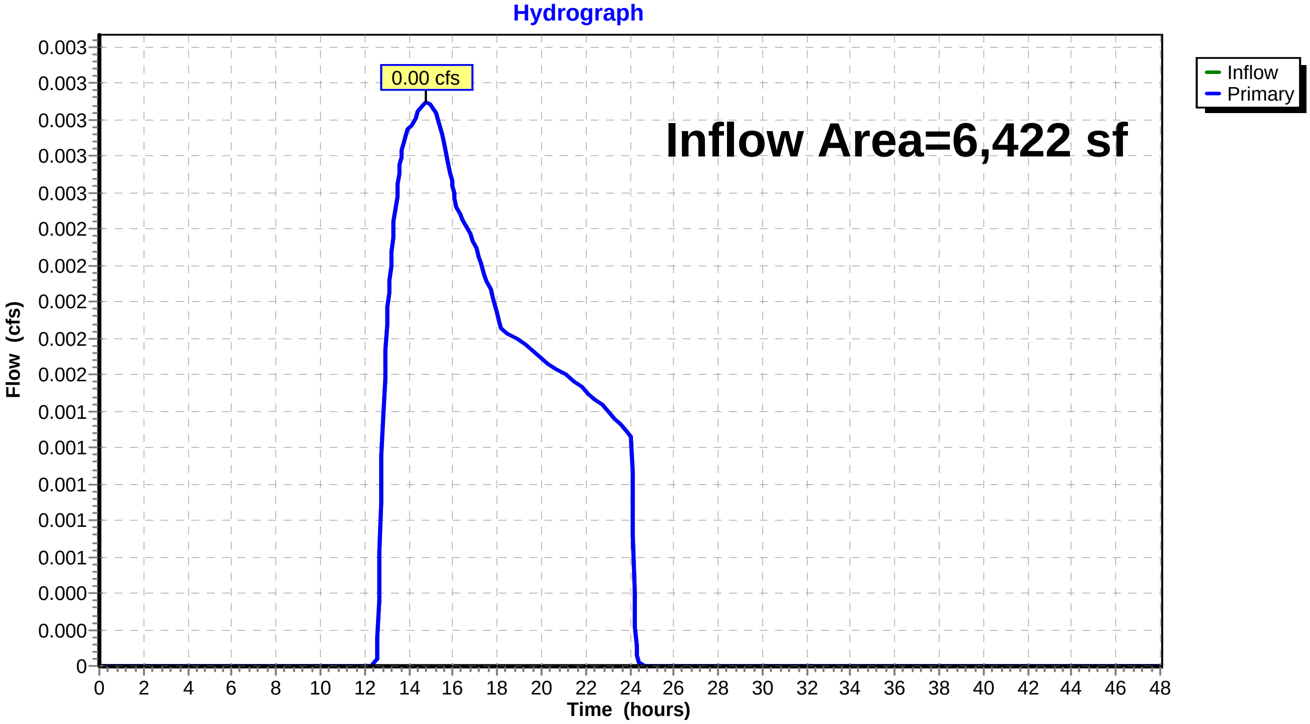


Summary for Link DP-3: Offsite to Northeast

Inflow Area = 6,422 sf, 0.00% Impervious, Inflow Depth = 0.16" for 100-Year event
Inflow = 0.00 cfs @ 14.80 hrs, Volume= 84 cf
Primary = 0.00 cfs @ 14.80 hrs, Volume= 84 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

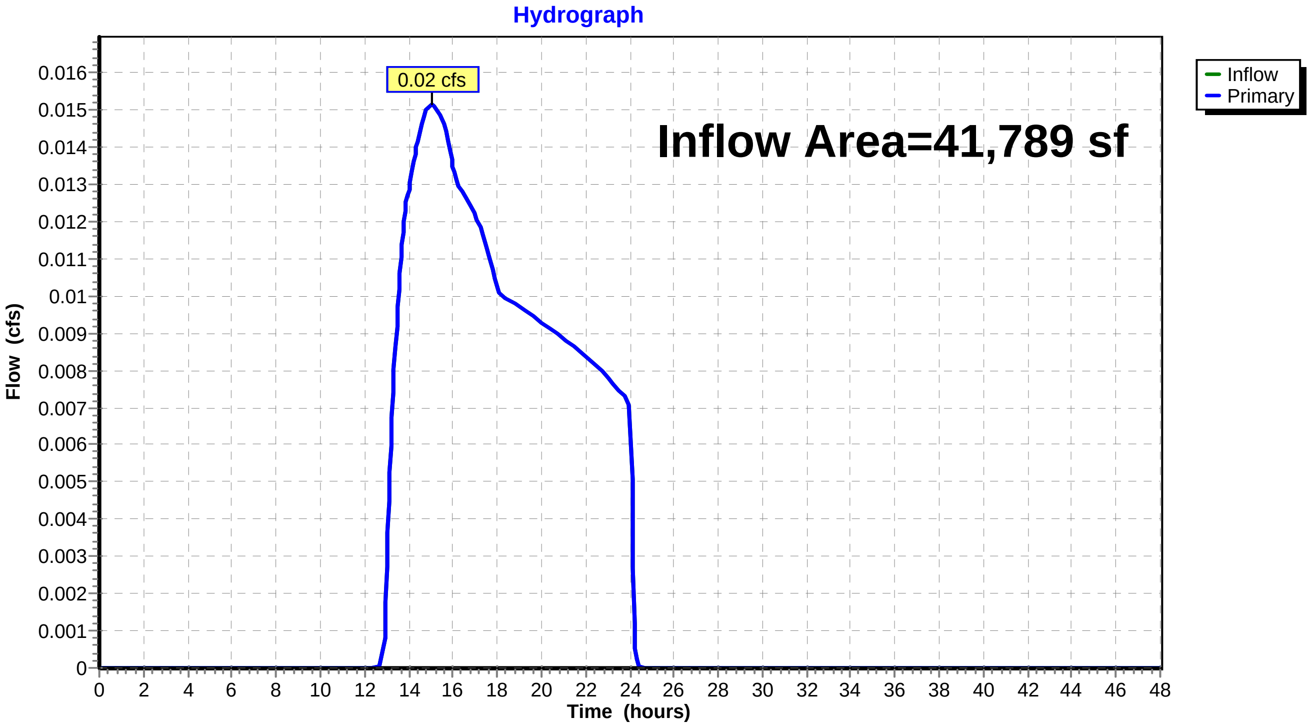


Summary for Link DP-4: East Edge of Property

Inflow Area = 41,789 sf, 0.00% Impervious, Inflow Depth = 0.12" for 100-Year event
Inflow = 0.02 cfs @ 15.07 hrs, Volume= 417 cf
Primary = 0.02 cfs @ 15.07 hrs, Volume= 417 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

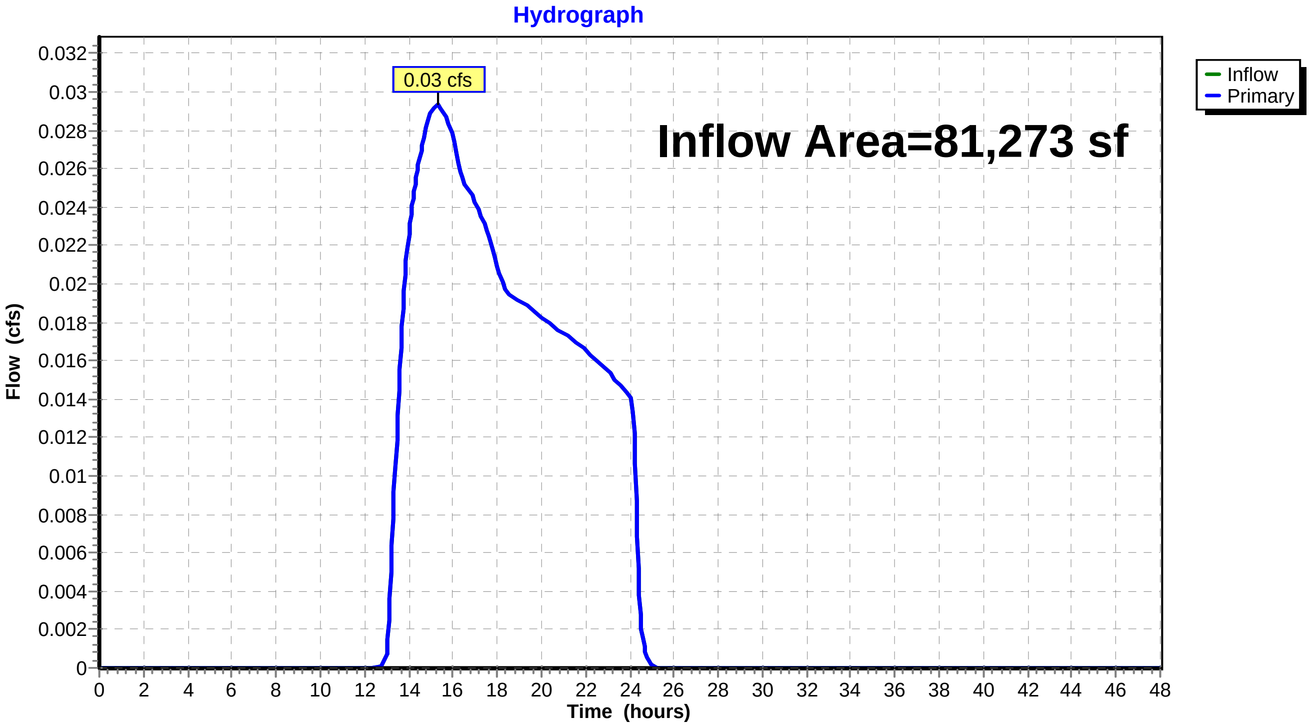


Summary for Link DP-5: Southwest Corner

Inflow Area = 81,273 sf, 0.00% Impervious, Inflow Depth = 0.12" for 100-Year event
Inflow = 0.03 cfs @ 15.31 hrs, Volume= 812 cf
Primary = 0.03 cfs @ 15.31 hrs, Volume= 812 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

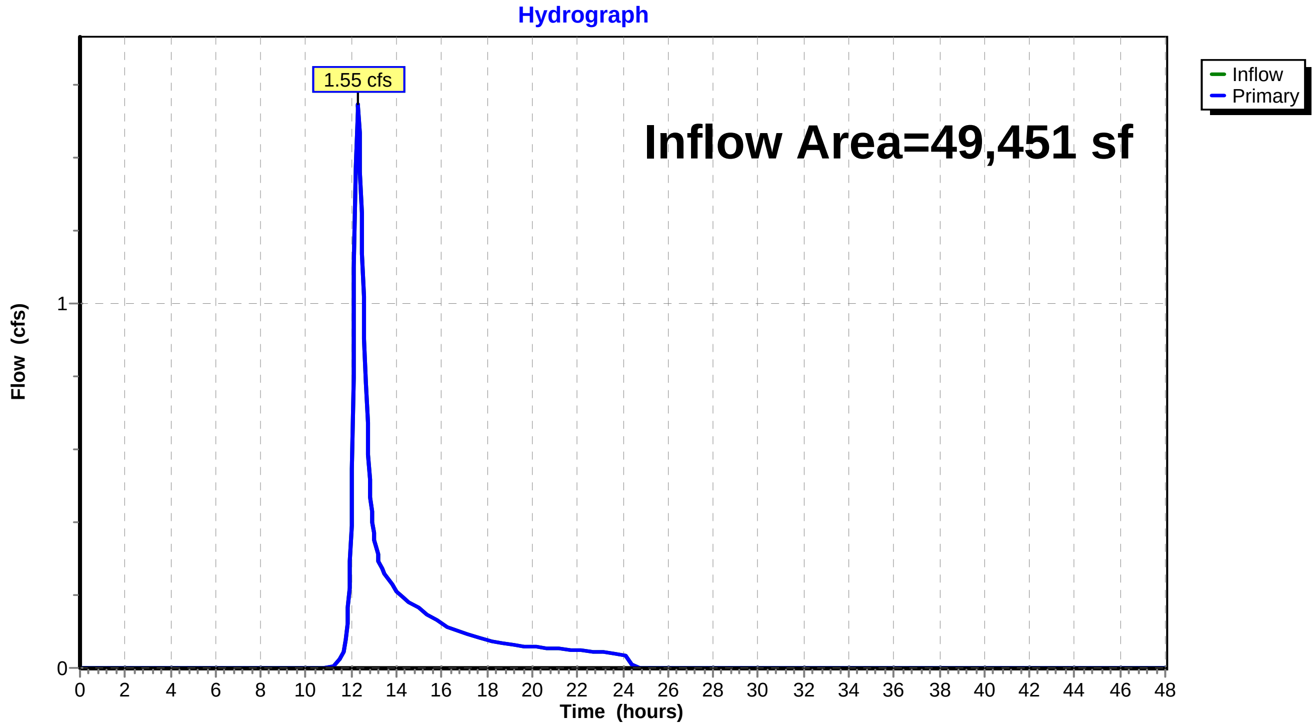


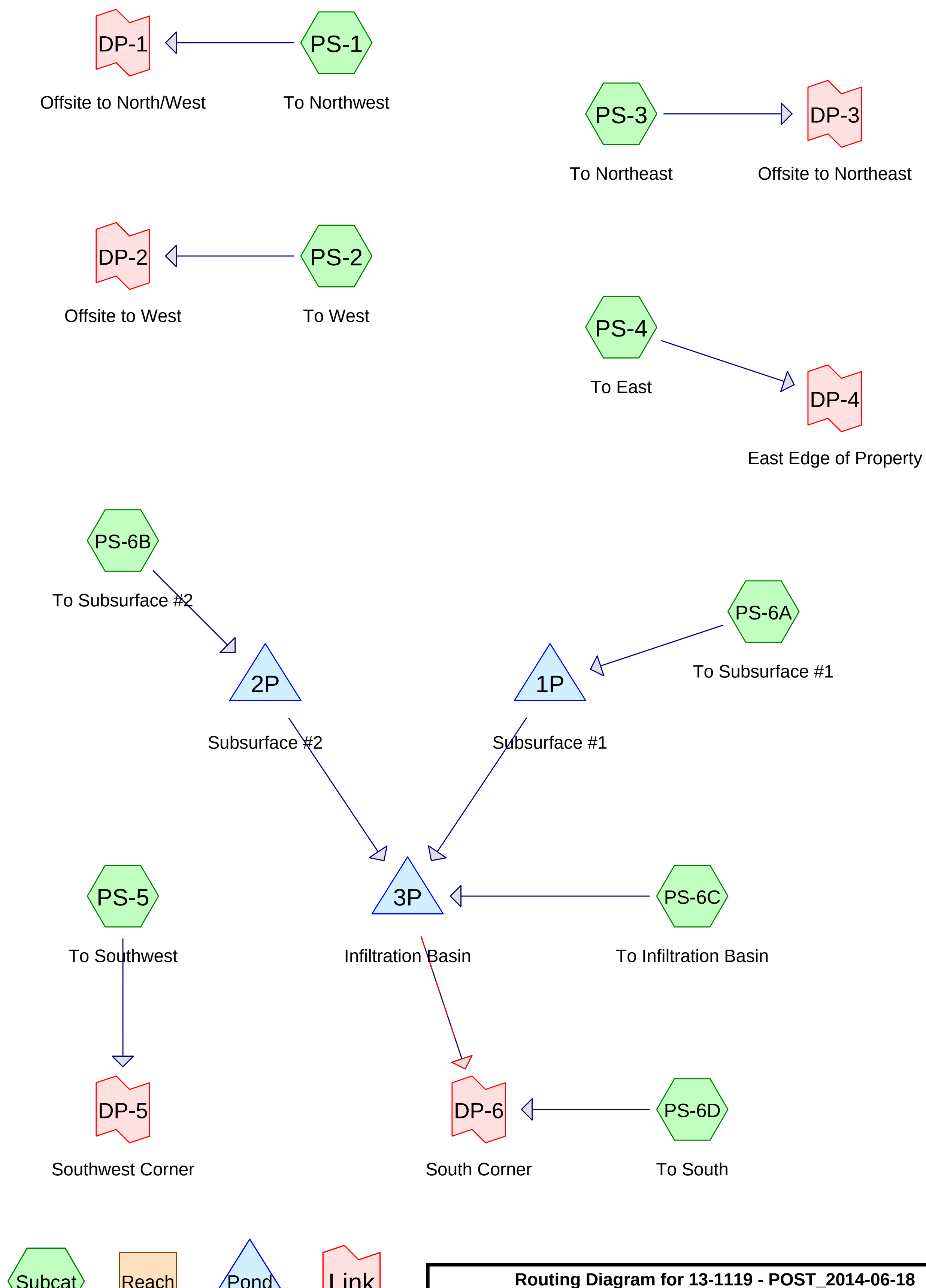
Summary for Link DP-6: South Corner

Inflow Area = 49,451 sf, 0.00% Impervious, Inflow Depth = 1.84" for 100-Year event
Inflow = 1.55 cfs @ 12.28 hrs, Volume= 7,574 cf
Primary = 1.55 cfs @ 12.28 hrs, Volume= 7,574 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner





Routing Diagram for 13-1119 - POST_2014-06-18
Prepared by R Levesque Associates, Inc
HydroCAD® 10.00 s/n 02175 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
78,963	39	>75% Grass cover, Good, HSG A (PS-1, PS-2, PS-3, PS-4, PS-5, PS-6A, PS-6B, PS-6C, PS-6D)
23,560	74	>75% Grass cover, Good, HSG C (PS-6B, PS-6C, PS-6D)
51,112	98	Paved parking, HSG A (PS-6A, PS-6B)
514	98	Paved parking, HSG C (PS-6B)
28,920	98	Roofs, HSG A (PS-6A, PS-6B, PS-6C)
2,914	98	Roofs, HSG C (PS-6B)
5,420	98	Unconnected roofs, HSG A (PS-6C)
3,928	98	Unconnected roofs, HSG C (PS-6C)
1,778	98	Water Surface, HSG C (PS-6C)
22,152	30	Woods, Good, HSG A (PS-3, PS-4, PS-5, PS-6C)
219,261	**67**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1: To Northwest
Runoff Area=4,495 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=80' Slope=0.0100 '/' Tc=11.5 min CN=39/0 Runoff=0.00 cfs 0 cf

Subcatchment PS-2: To West
Runoff Area=4,426 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=129' Tc=12.6 min CN=39/0 Runoff=0.00 cfs 0 cf

Subcatchment PS-3: To Northeast
Runoff Area=4,223 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=66' Slope=0.0100 '/' Tc=11.4 min CN=35/0 Runoff=0.00 cfs 0 cf

Subcatchment PS-4: To East
Runoff Area=18,101 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=72' Tc=13.0 min CN=37/0 Runoff=0.00 cfs 0 cf

Subcatchment PS-5: To Southwest
Runoff Area=5,338 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=74' Tc=9.6 min CN=34/0 Runoff=0.00 cfs 0 cf

Subcatchment PS-6A: To Subsurface #1
Runoff Area=79,064 sf 69.61% Impervious Runoff Depth=1.93"
Flow Length=804' Tc=15.0 min CN=39/98 Runoff=2.79 cfs 12,697 cf

Subcatchment PS-6B: To Subsurface #2
Runoff Area=34,605 sf 76.54% Impervious Runoff Depth=2.12"
Flow Length=345' Tc=11.8 min CN=41/98 Runoff=1.46 cfs 6,111 cf

Subcatchment PS-6C: To Infiltration Basin
Runoff Area=63,222 sf 5.87% Impervious Runoff Depth=0.39"
Flow Length=780' Tc=14.2 min CN=57/98 Runoff=0.26 cfs 2,076 cf

Subcatchment PS-6D: To South
Runoff Area=5,787 sf 0.00% Impervious Runoff Depth=0.67"
Flow Length=137' Tc=6.7 min CN=69/0 Runoff=0.09 cfs 323 cf

Pond 1P: Subsurface #1
Peak Elev=201.66' Storage=4,633 cf Inflow=2.79 cfs 12,697 cf
Discarded=0.31 cfs 12,697 cf Primary=0.00 cfs 0 cf Outflow=0.31 cfs 12,697 cf

Pond 2P: Subsurface #2
Peak Elev=197.21' Storage=2,413 cf Inflow=1.46 cfs 6,111 cf
Discarded=0.12 cfs 6,111 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 6,111 cf

Pond 3P: Infiltration Basin
Peak Elev=183.32' Storage=600 cf Inflow=0.26 cfs 2,076 cf
Discarded=0.05 cfs 2,076 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.05 cfs 2,076 cf

Link DP-1: Offsite to North/West
Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-2: Offsite to West
Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-3: Offsite to Northeast
Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-4: East Edge of Property
Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-5: Southwest Corner
Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-6: South Corner
Inflow=0.09 cfs 323 cf
Primary=0.09 cfs 323 cf

Total Runoff Area = 219,261 sf Runoff Volume = 21,208 cf Average Runoff Depth = 1.16"
61.12% Pervious = 134,023 sf 38.88% Impervious = 85,238 sf

Summary for Subcatchment PS-1: To Northwest

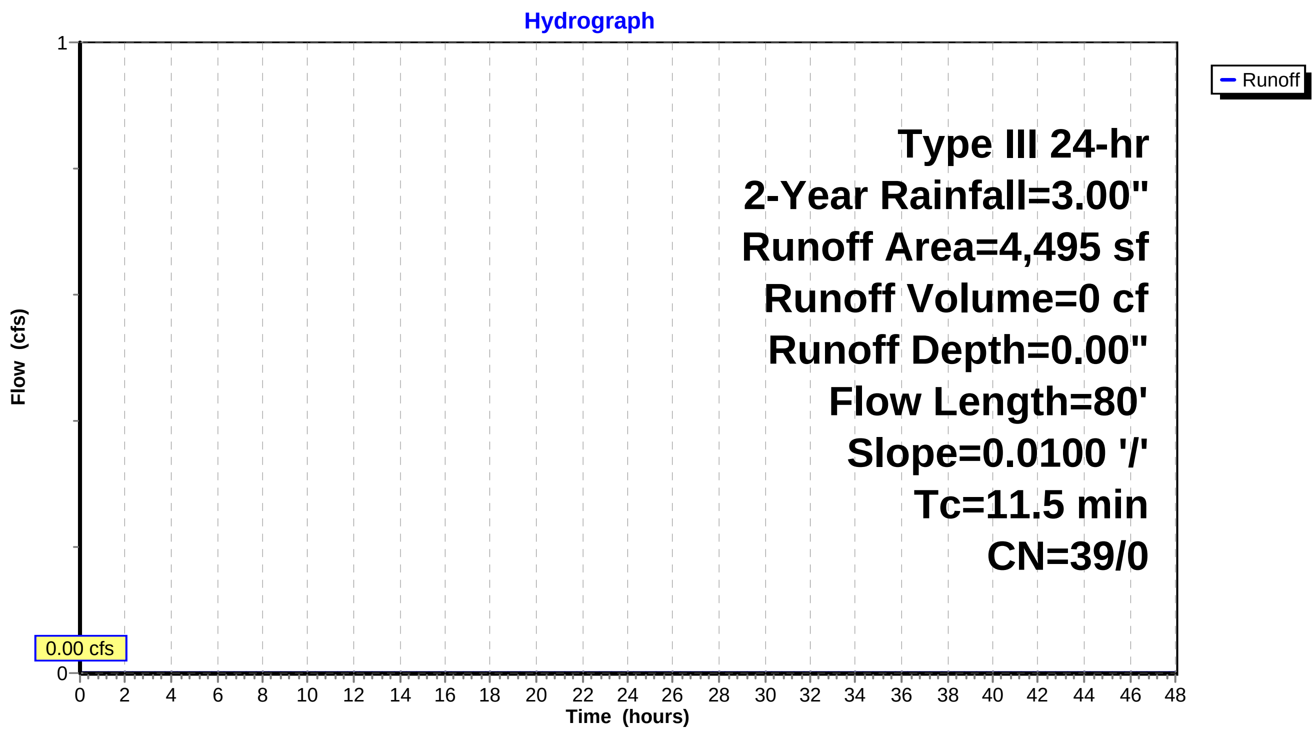
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
4,495	39	>75% Grass cover, Good, HSG A
4,495	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	30	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.5	80	Total			

Subcatchment PS-1: To Northwest



Summary for Subcatchment PS-2: To West

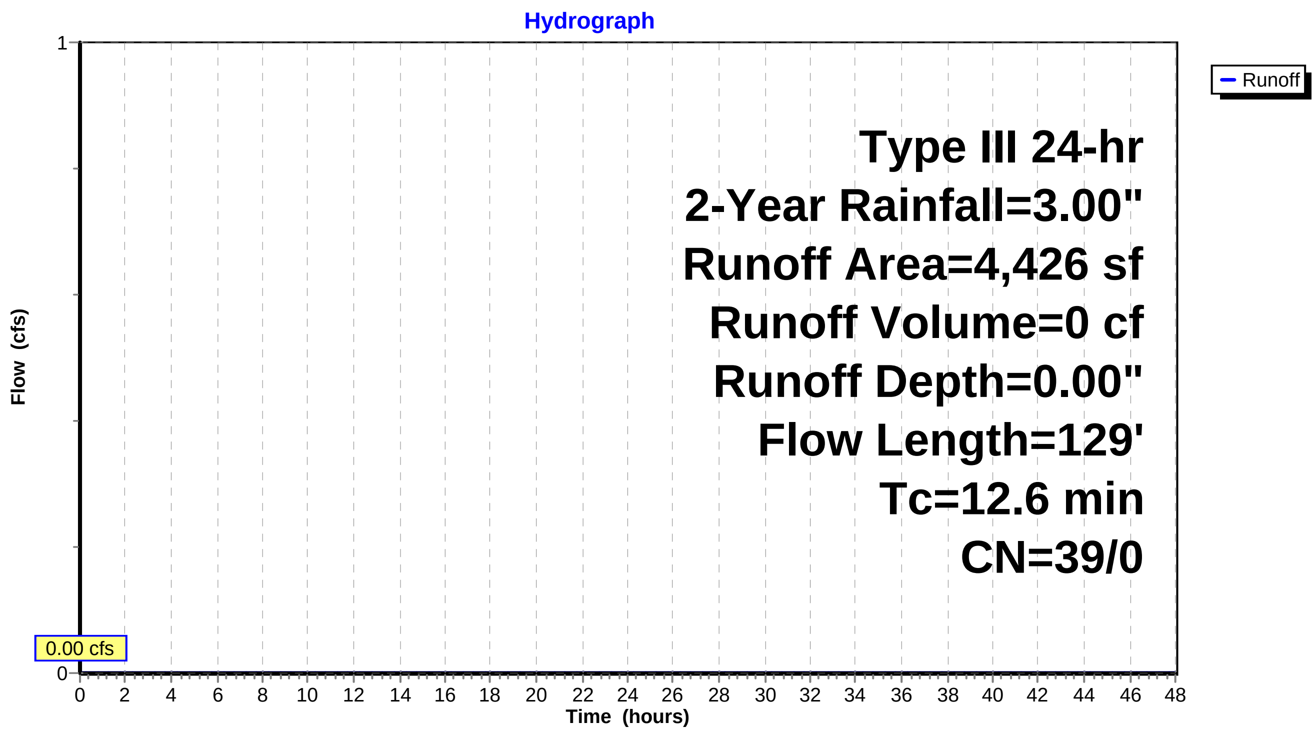
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
4,426	39	>75% Grass cover, Good, HSG A
4,426	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0080	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.4	79	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.6	129	Total			

Subcatchment PS-2: To West



Summary for Subcatchment PS-3: To Northeast

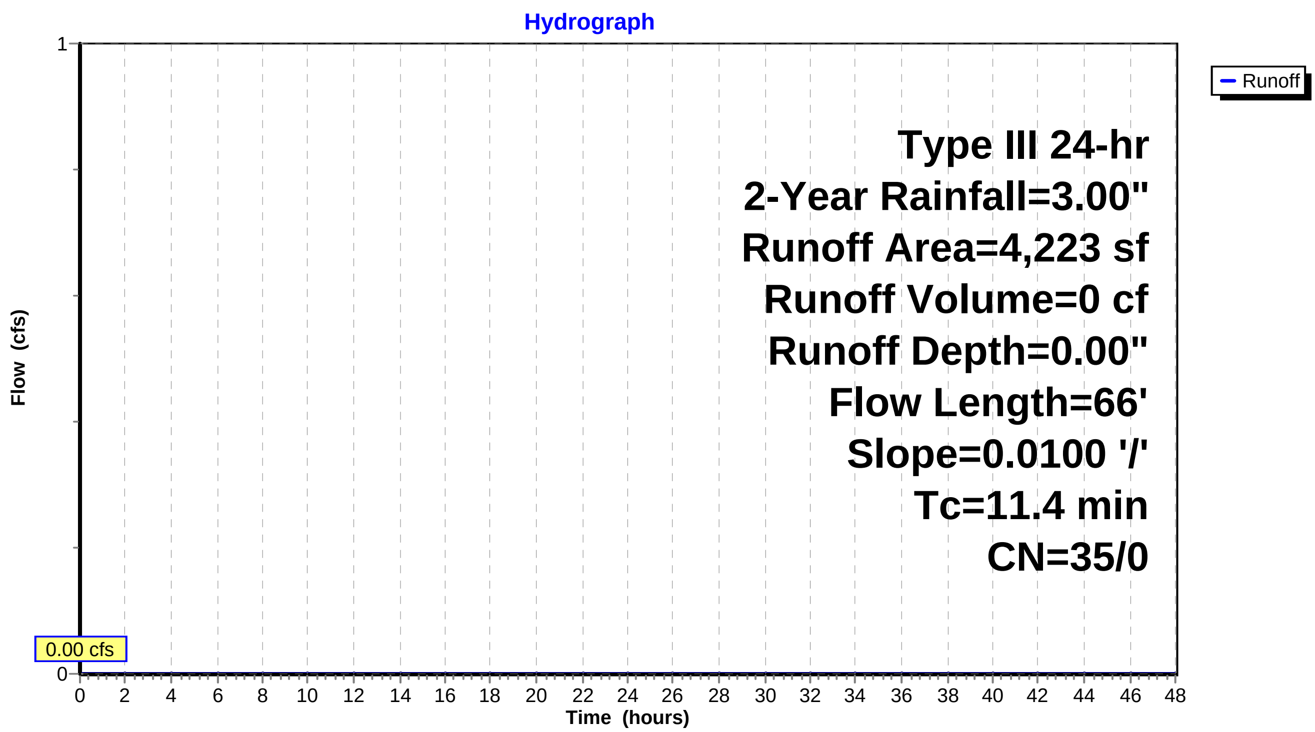
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,427	39	>75% Grass cover, Good, HSG A
1,796	30	Woods, Good, HSG A
4,223	35	Weighted Average
4,223	35	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	16	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	66	Total			

Subcatchment PS-3: To Northeast



Summary for Subcatchment PS-4: To East

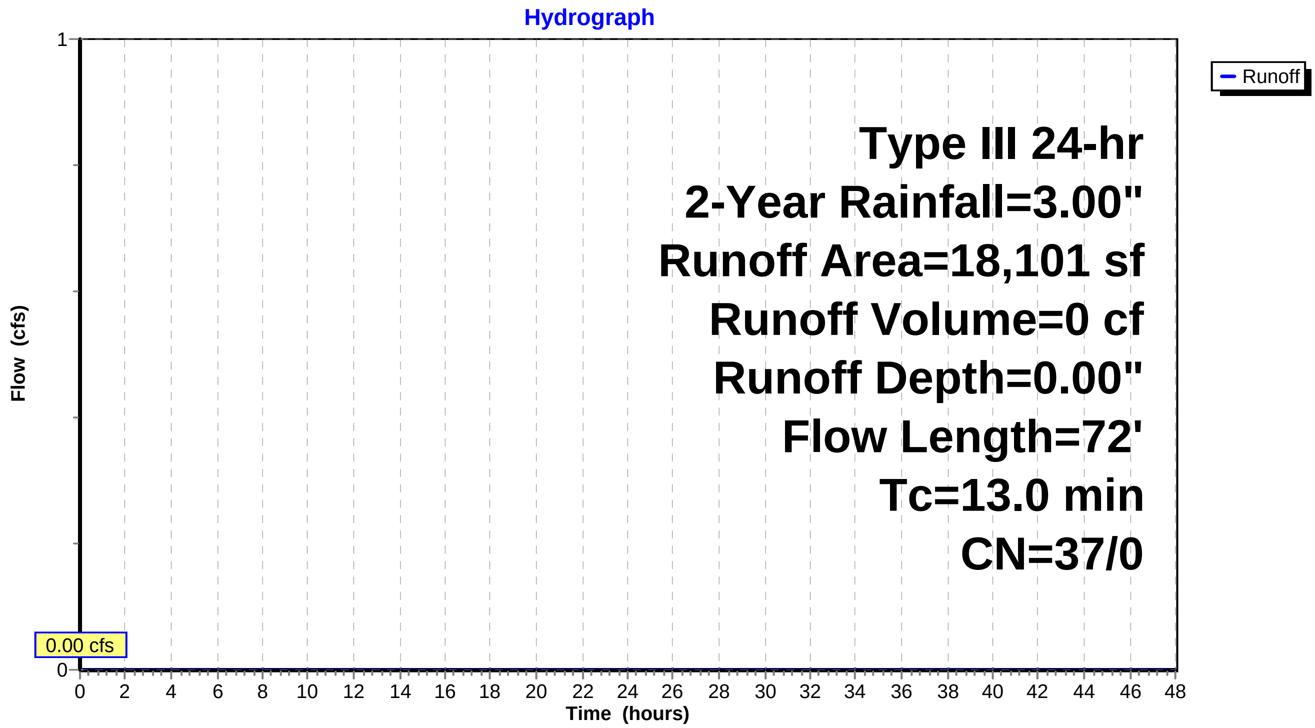
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
14,935	39	>75% Grass cover, Good, HSG A
3,166	30	Woods, Good, HSG A
18,101	37	Weighted Average
18,101	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0070	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.1	22	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	72	Total			

Subcatchment PS-4: To East



Summary for Subcatchment PS-5: To Southwest

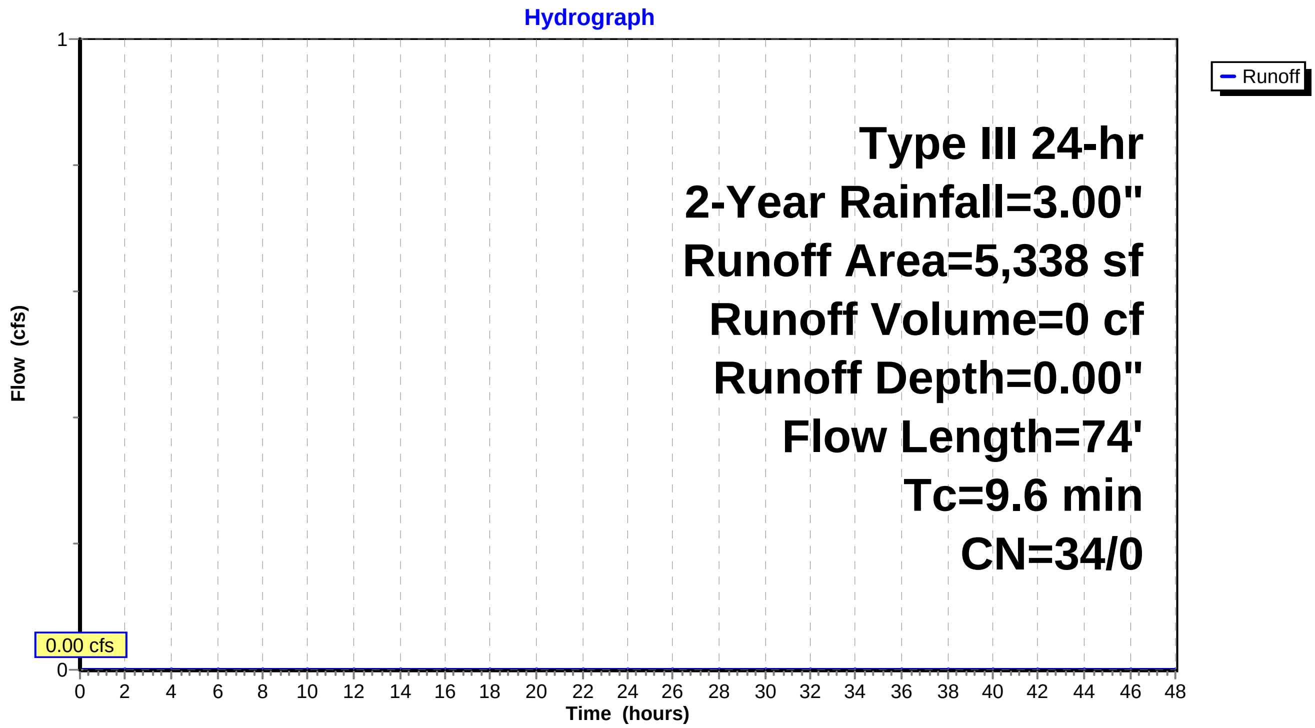
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,173	39	>75% Grass cover, Good, HSG A
3,165	30	Woods, Good, HSG A
5,338	34	Weighted Average
5,338	34	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0420	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.1	24	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.6	74	Total			

Subcatchment PS-5: To Southwest



Summary for Subcatchment PS-6A: To Subsurface #1

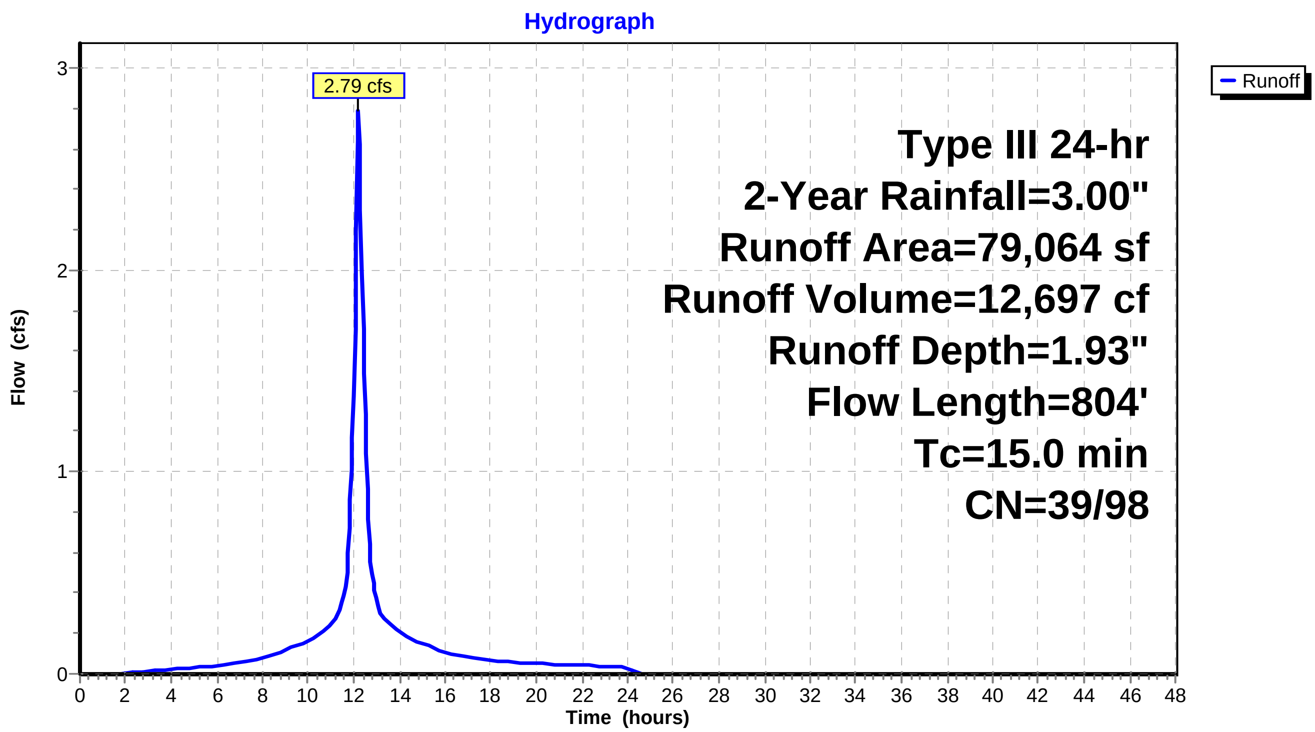
Runoff = 2.79 cfs @ 12.20 hrs, Volume= 12,697 cf, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
34,605	98	Paved parking, HSG A
20,435	98	Roofs, HSG A
24,024	39	>75% Grass cover, Good, HSG A
79,064	80	Weighted Average
24,024	39	30.39% Pervious Area
55,040	98	69.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0090	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	124	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.0	392	0.0150	6.57	5.16	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.9	238	0.0050	4.55	8.05	Pipe Channel, 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
15.0	804	Total			

Subcatchment PS-6A: To Subsurface #1



Summary for Subcatchment PS-6B: To Subsurface #2

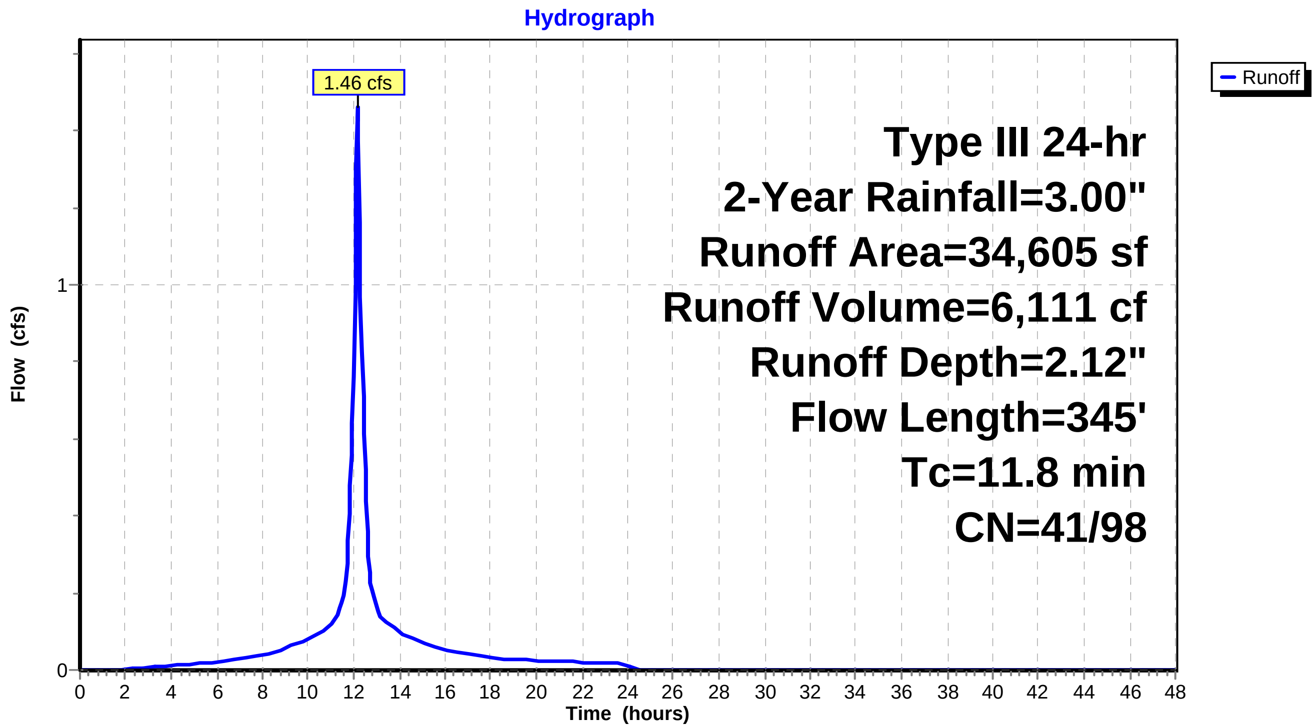
Runoff = 1.46 cfs @ 12.16 hrs, Volume= 6,111 cf, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
16,507	98	Paved parking, HSG A
6,553	98	Roofs, HSG A
7,595	39	>75% Grass cover, Good, HSG A
514	98	Paved parking, HSG C
2,914	98	Roofs, HSG C
522	74	>75% Grass cover, Good, HSG C
34,605	85	Weighted Average
8,117	41	23.46% Pervious Area
26,488	98	76.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	35	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.0150	2.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	96	0.0420	4.16		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	162	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.8	345	Total			

Subcatchment PS-6B: To Subsurface #2



Summary for Subcatchment PS-6C: To Infiltration Basin

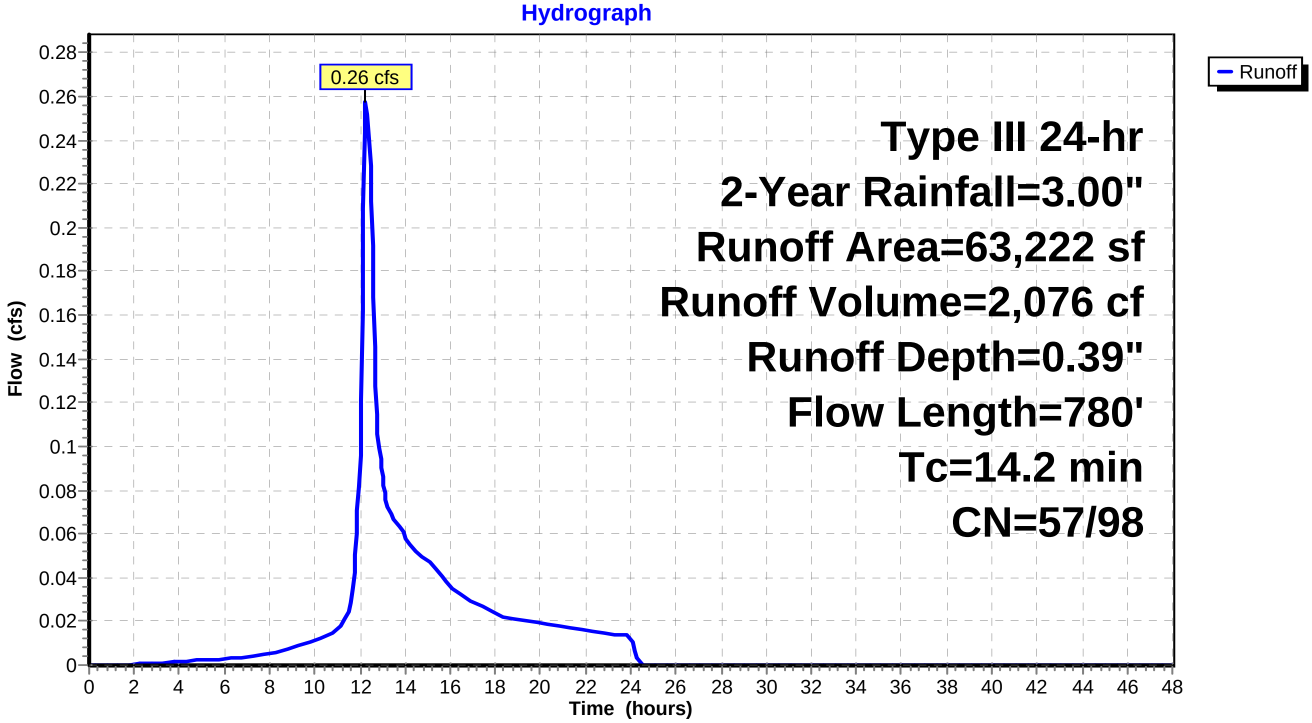
Runoff = 0.26 cfs @ 12.27 hrs, Volume= 2,076 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,932	98	Roofs, HSG A
5,420	98	Unconnected roofs, HSG A
18,071	39	>75% Grass cover, Good, HSG A
14,025	30	Woods, Good, HSG A
3,928	98	Unconnected roofs, HSG C
1,778	98	Water Surface, HSG C
18,068	74	>75% Grass cover, Good, HSG C
63,222	59	Weighted Average
59,512	57	94.13% Pervious Area
3,710	98	5.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0110	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.3	321	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	157	0.0350	9.19	7.22	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.8	252	0.0120	5.38	4.23	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
14.2	780	Total			

Subcatchment PS-6C: To Infiltration Basin



Summary for Subcatchment PS-6D: To South

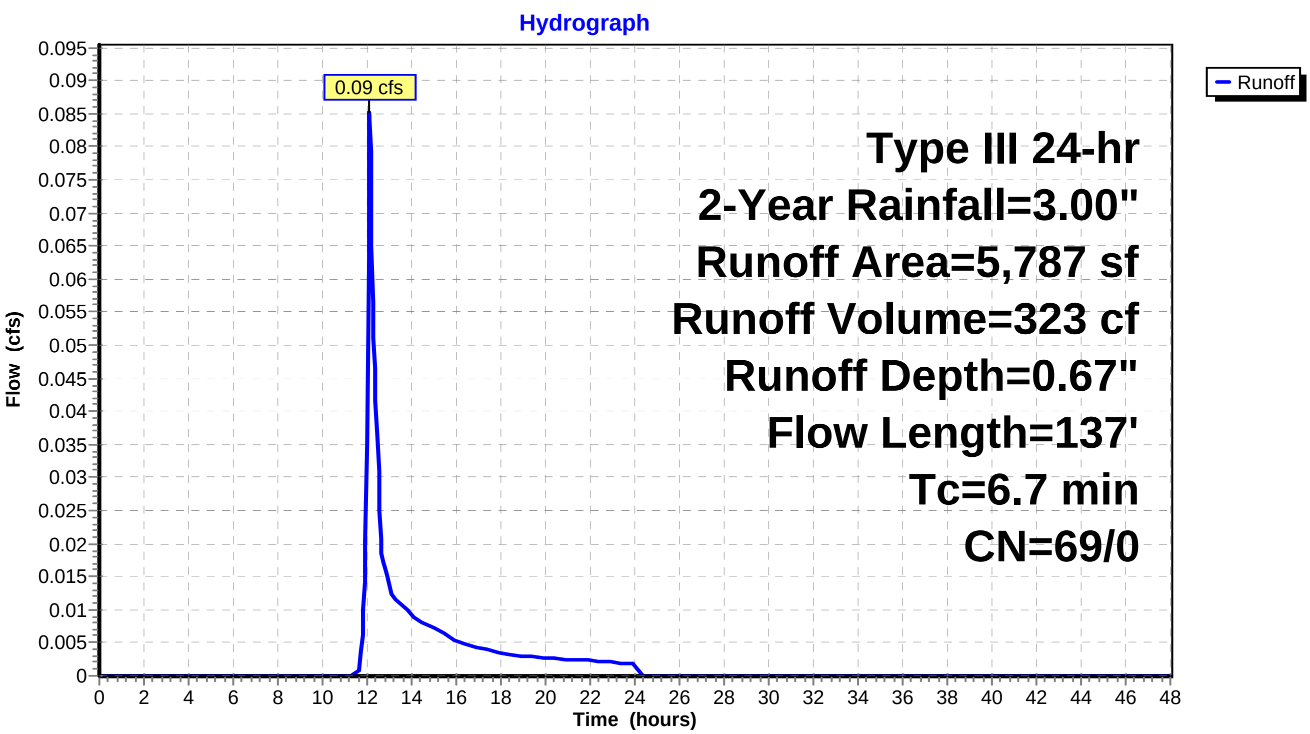
Runoff = 0.09 cfs @ 12.12 hrs, Volume= 323 cf, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
817	39	>75% Grass cover, Good, HSG A
4,970	74	>75% Grass cover, Good, HSG C
5,787	69	Weighted Average
5,787	69	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.2	46	0.0420	3.30		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	41	0.1500	6.24		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.7	137	Total			

Subcatchment PS-6D: To South



Summary for Pond 1P: Subsurface #1

Inflow Area = 79,064 sf, 69.61% Impervious, Inflow Depth = 1.93" for 2-Year event
Inflow = 2.79 cfs @ 12.20 hrs, Volume= 12,697 cf
Outflow = 0.31 cfs @ 11.50 hrs, Volume= 12,697 cf, Atten= 89%, Lag= 0.0 min
Discarded = 0.31 cfs @ 11.50 hrs, Volume= 12,697 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 201.66' @ 13.15 hrs Surf.Area= 5,558 sf Storage= 4,633 cf
Flood Elev= 203.90' Surf.Area= 5,558 sf Storage= 12,104 cf

Plug-Flow detention time= 109.2 min calculated for 12,697 cf (100% of inflow)
Center-of-Mass det. time= 109.1 min (875.2 - 766.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	200.40'	4,900 cf	63.25'W x 87.88'L x 3.50'H Field A 19,454 cf Overall - 7,203 cf Embedded = 12,251 cf x 40.0% Voids
#2A	200.90'	7,203 cf	ADS_StormTech SC-740 x 156 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 Row Length Adjustment= +0.44' x 6.45 sf x 13 rows
#3	205.40'	120 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		12,223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
205.40	2	4.0	0	0	2
205.60	138	76.0	10	10	460
205.80	1,108	1,939.0	109	120	299,190

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.40'	2.410 in/hr Exfiltration over Surface area
#2	Primary	200.40'	12.0" Round Culvert L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 200.40' / 196.10' S= 0.0277 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	201.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	203.90'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.31 cfs @ 11.50 hrs HW=200.46' (Free Discharge)
└1=Exfiltration (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=200.40' (Free Discharge)
└2=Culvert (Controls 0.00 cfs)
 ├3=Orifice/Grate (Controls 0.00 cfs)
 └4=Overflow Weir (Controls 0.00 cfs)

Pond 1P: Subsurface #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740
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
Row Length Adjustment= +0.44' x 6.45 sf x 13 rows

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

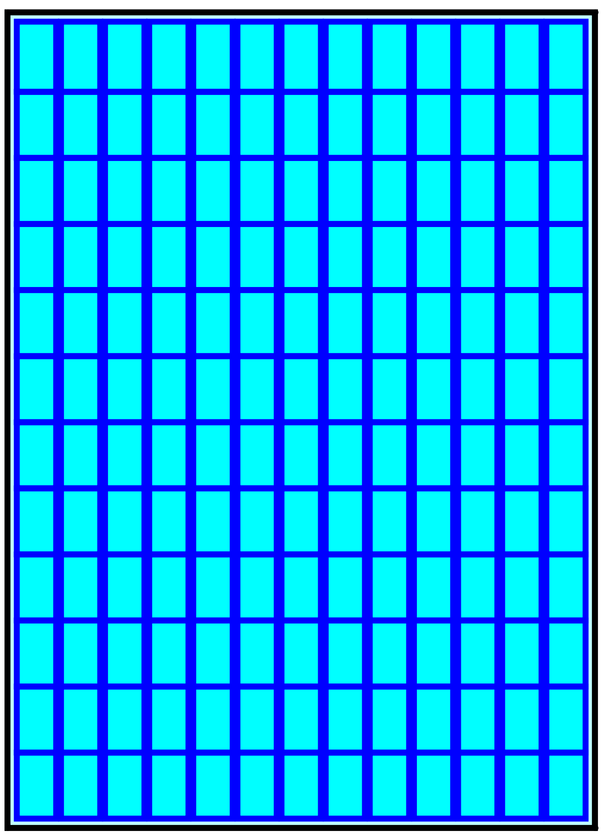
12 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 85.88' Row Length +12.0" End Stone x 2 = 87.88' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

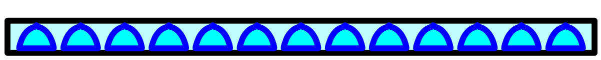
156 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 13 Rows = 7,203.4 cf Chamber Storage

19,454.1 cf Field - 7,203.4 cf Chambers = 12,250.7 cf Stone x 40.0% Voids = 4,900.3 cf Stone Storage

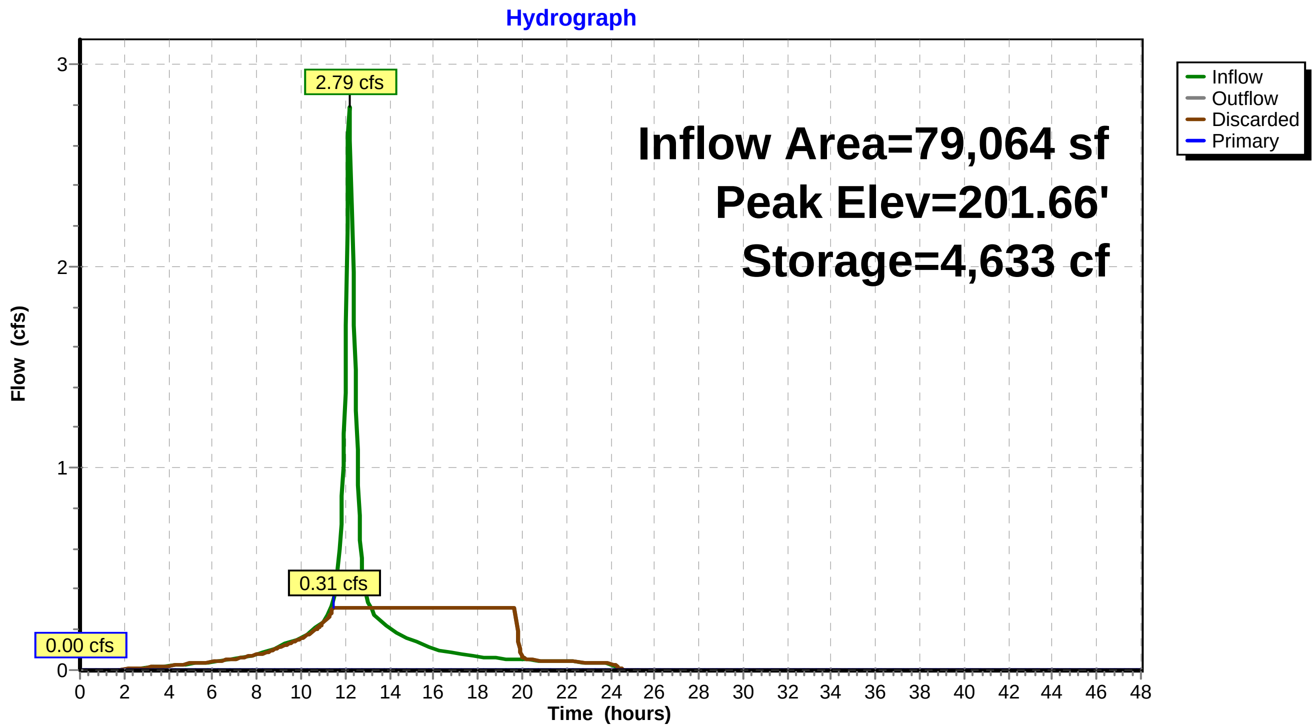
Chamber Storage + Stone Storage = 12,103.7 cf = 0.278 af
Overall Storage Efficiency = 62.2%

156 Chambers
720.5 cy Field
453.7 cy Stone





Pond 1P: Subsurface #1



Summary for Pond 2P: Subsurface #2

Inflow Area = 34,605 sf, 76.54% Impervious, Inflow Depth = 2.12" for 2-Year event
Inflow = 1.46 cfs @ 12.16 hrs, Volume= 6,111 cf
Outflow = 0.12 cfs @ 11.20 hrs, Volume= 6,111 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.20 hrs, Volume= 6,111 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 197.21' @ 13.42 hrs Surf.Area= 2,209 sf Storage= 2,413 cf
Flood Elev= 199.10' Surf.Area= 2,209 sf Storage= 4,757 cf

Plug-Flow detention time= 151.3 min calculated for 6,105 cf (100% of inflow)
Center-of-Mass det. time= 151.1 min (914.4 - 763.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	195.60'	1,983 cf	**30.00'W x 73.64'L x 3.50'H Field A**
			7,732 cf Overall - 2,773 cf Embedded = 4,959 cf x 40.0% Voids
#2A	196.10'	2,773 cf	**ADS_StormTech SC-740** x 60 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
			Row Length Adjustment= +0.44' x 6.45 sf x 6 rows
#3	200.92'	84 cf	**Roadway Flooding (Irregular)** Listed below (Recalc) -Impervious
		4,841 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
200.92	2	4.0	0	0	2
201.00	37	38.0	1	1	116
201.20	1,009	242.0	83	84	4,661

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.60'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	193.10'	**12.0" Round Culvert** L= 135.0' Ke= 0.500
			Inlet / Outlet Invert= 193.10' / 186.51' S= 0.0488 '/' Cc= 0.900
			n= 0.012, Flow Area= 0.79 sf
#3	Device 2	197.35'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	199.10'	**4.0' long Overflow Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 11.20 hrs HW=195.66' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=195.60' (Free Discharge)
└2=**Culvert** (Passes 0.00 cfs of 5.35 cfs potential flow)
  ├3=**Orifice/Grate** (Controls 0.00 cfs)
  └4=**Overflow Weir** (Controls 0.00 cfs)

Pond 2P: Subsurface #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740
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
Row Length Adjustment= +0.44' x 6.45 sf x 6 rows

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

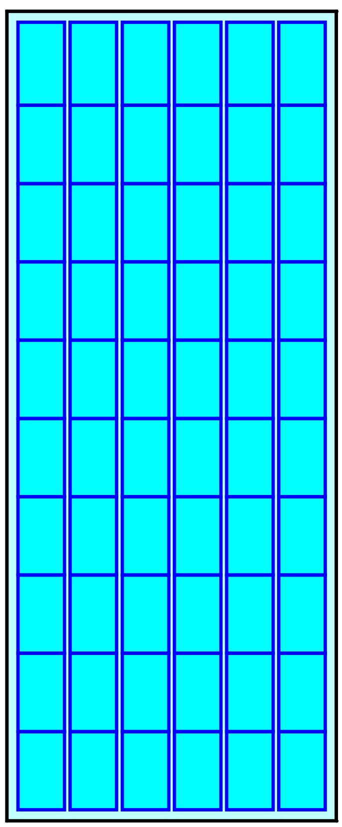
10 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 71.64' Row Length +12.0" End Stone x 2 = 73.64' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

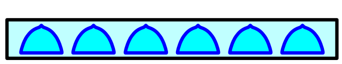
60 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 6 Rows = 2,773.4 cf Chamber Storage

7,732.0 cf Field - 2,773.4 cf Chambers = 4,958.7 cf Stone x 40.0% Voids = 1,983.5 cf Stone Storage

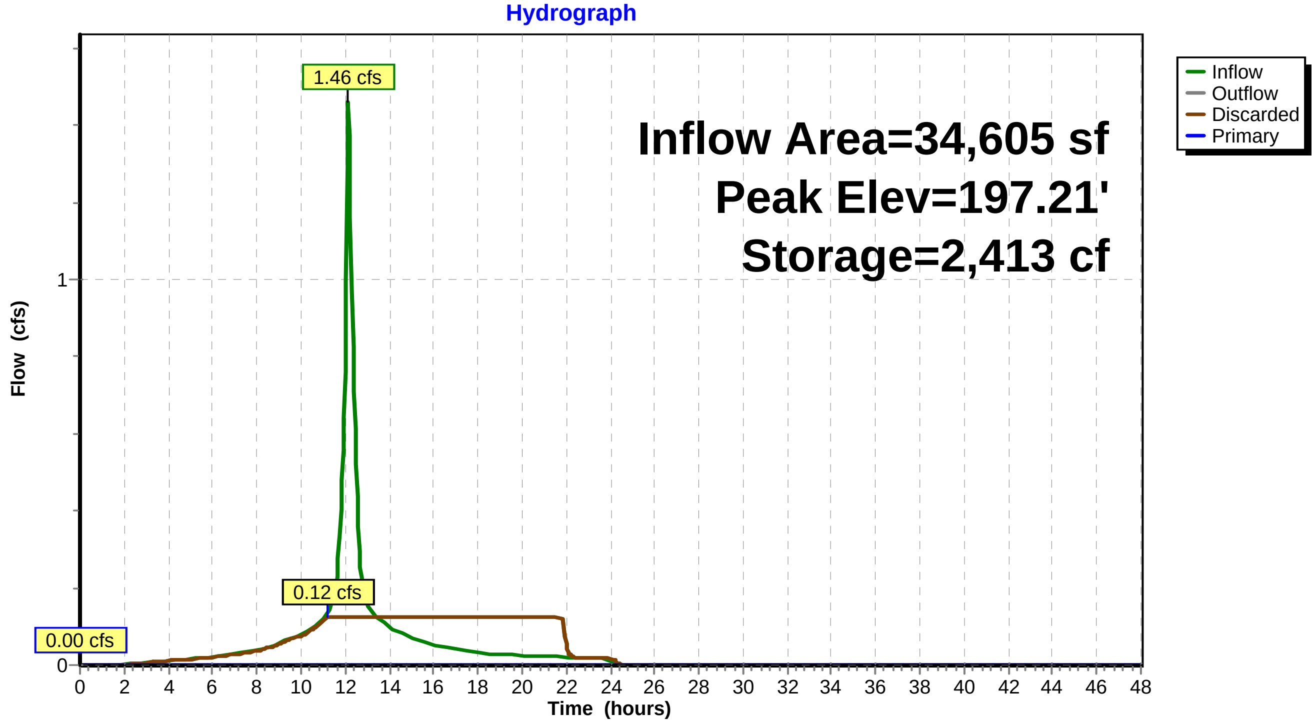
Chamber Storage + Stone Storage = 4,756.8 cf = 0.109 af
Overall Storage Efficiency = 61.5%

60 Chambers
286.4 cy Field
183.7 cy Stone





Pond 2P: Subsurface #2



Summary for Pond 3P: Infiltration Basin

Inflow Area = 176,891 sf, 48.19% Impervious, Inflow Depth = 0.14" for 2-Year event
Inflow = 0.26 cfs @ 12.27 hrs, Volume= 2,076 cf
Outflow = 0.05 cfs @ 14.96 hrs, Volume= 2,076 cf, Atten= 81%, Lag= 161.2 min
Discarded = 0.05 cfs @ 14.96 hrs, Volume= 2,076 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 183.32' @ 14.96 hrs Surf.Area= 2,032 sf Storage= 600 cf
Flood Elev= 185.50' Surf.Area= 4,201 sf Storage= 7,288 cf

Plug-Flow detention time= 125.1 min calculated for 2,074 cf (100% of inflow)
Center-of-Mass det. time= 125.0 min (1,004.5 - 879.5)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	9,534 cf	**Basin Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
183.00	1,778	198.0	0	0	1,778
184.00	2,642	227.0	2,196	2,196	2,782
185.00	3,648	258.0	3,132	5,327	4,002
186.00	4,792	288.0	4,207	9,534	5,334

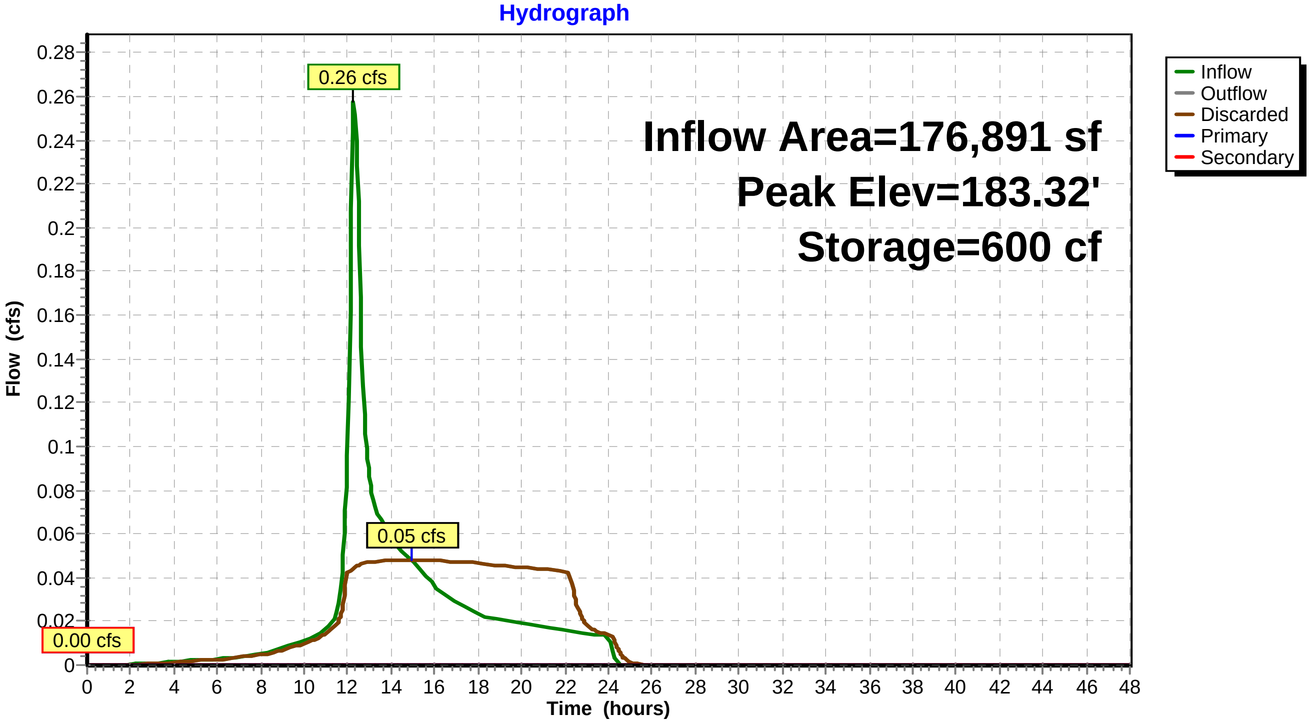
Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 3	184.00'	**7.0" Vert. Orifice** C= 0.600
#3	Primary	183.00'	**12.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 183.00' / 182.04' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	185.25'	**4.0" W x 4.0" H Vert. Outlet Structure Grate** C= 0.600
#5	Secondary	185.50'	**10.0' long x 10.0' breadth Emergency Overflow** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.05 cfs @ 14.96 hrs HW=183.32' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=183.00' (Free Discharge)
└3=**Culvert** (Controls 0.00 cfs)
 ├2=**Orifice** (Controls 0.00 cfs)
 └4=**Outlet Structure Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=183.00' (Free Discharge)
└5=**Emergency Overflow** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

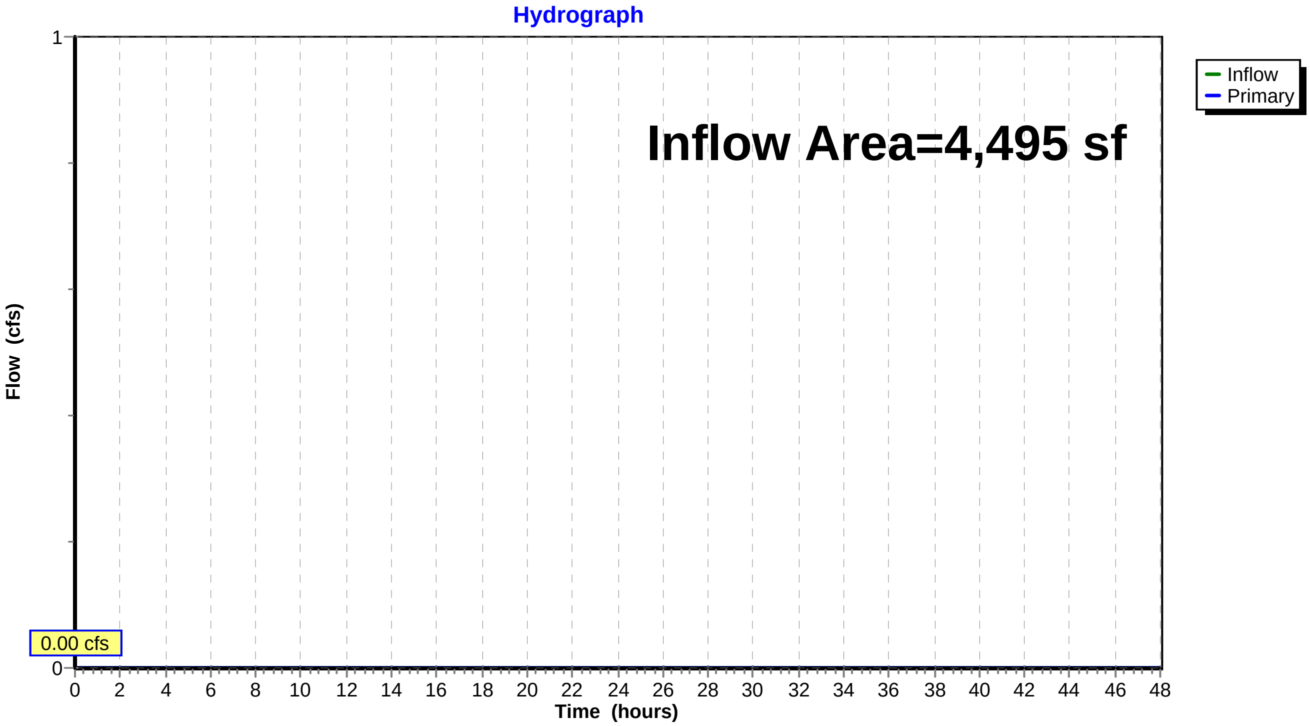


Summary for Link DP-1: Offsite to North/West

Inflow Area = 4,495 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

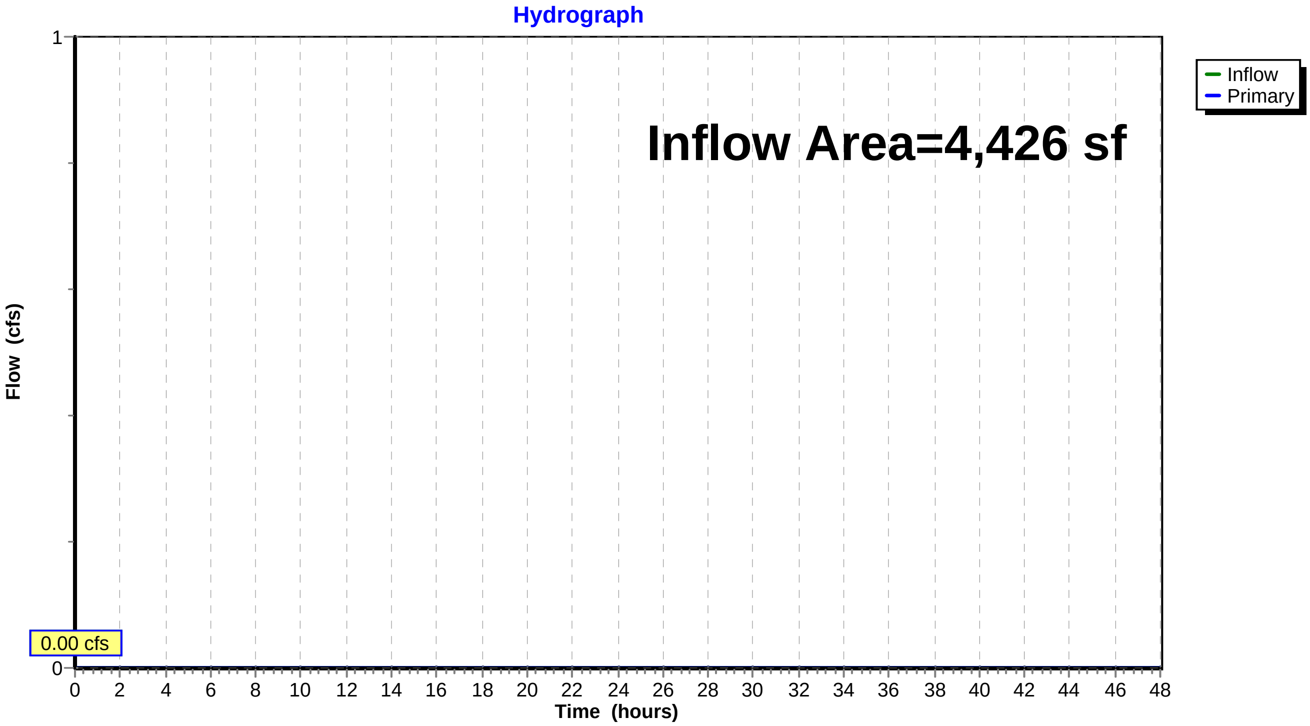


Summary for Link DP-2: Offsite to West

Inflow Area =	4,426 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

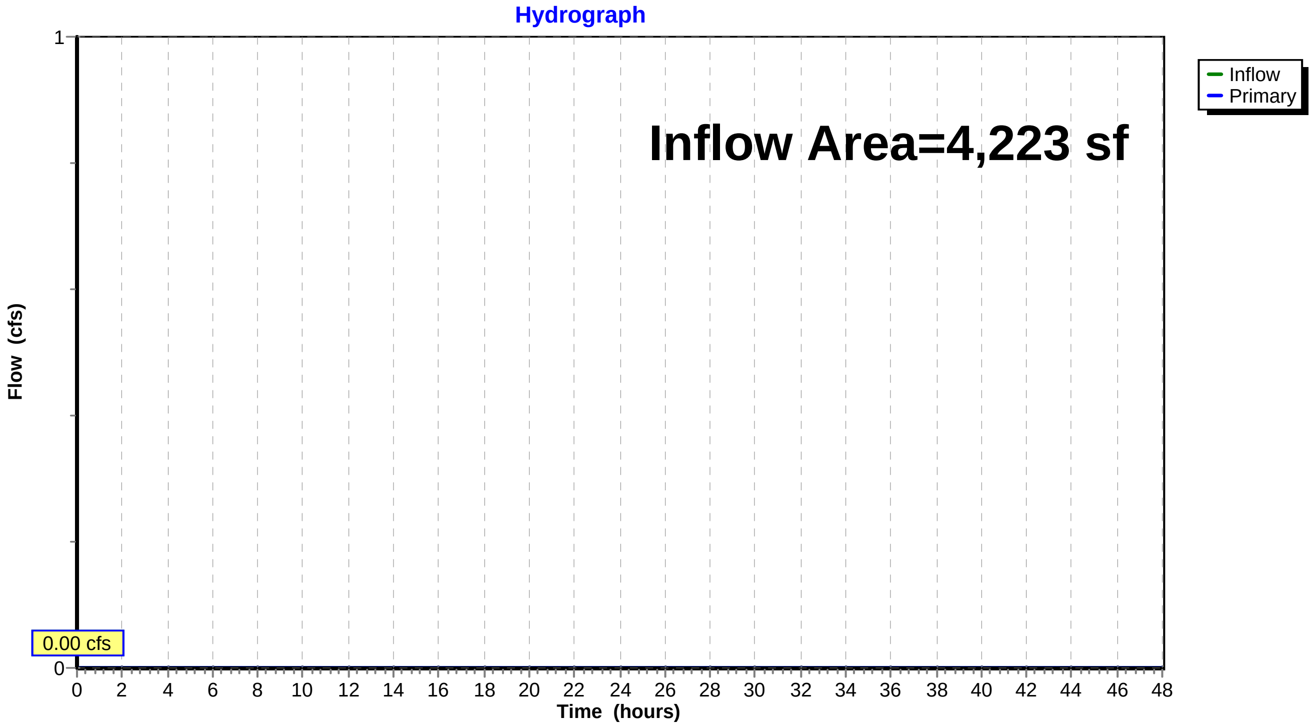


Summary for Link DP-3: Offsite to Northeast

Inflow Area =	4,223 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

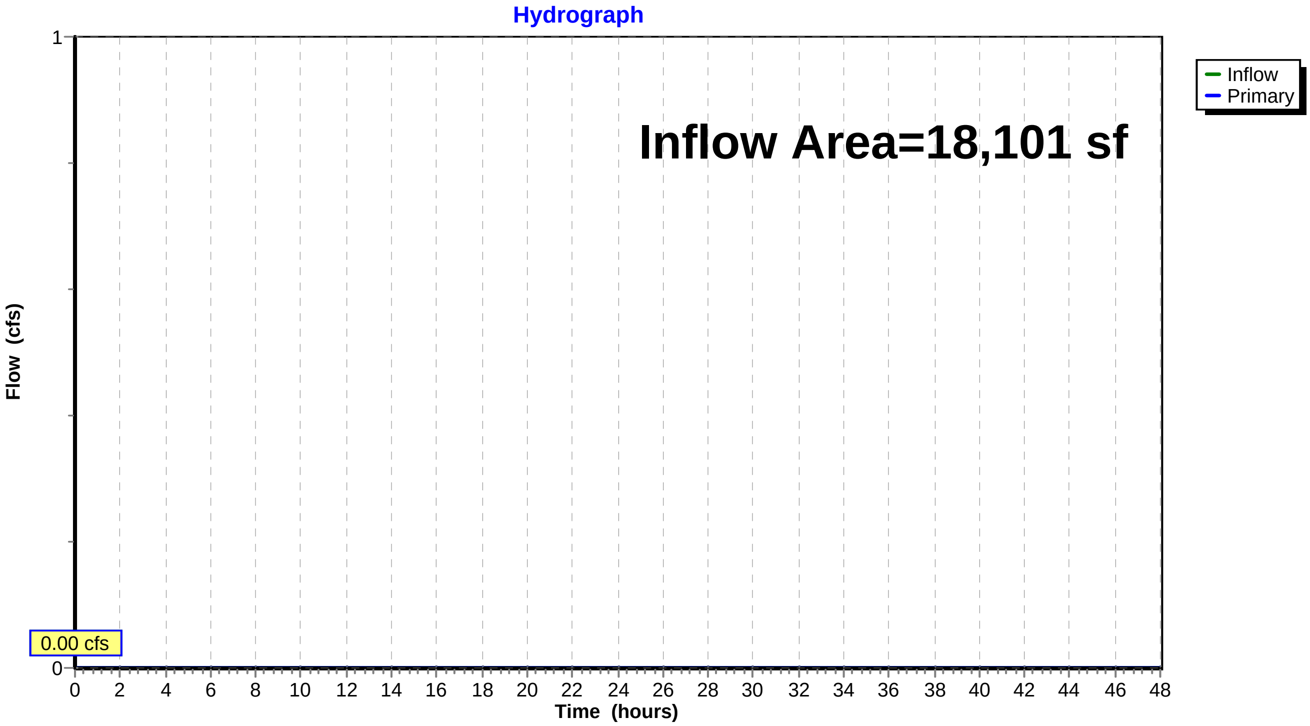


Summary for Link DP-4: East Edge of Property

Inflow Area = 18,101 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

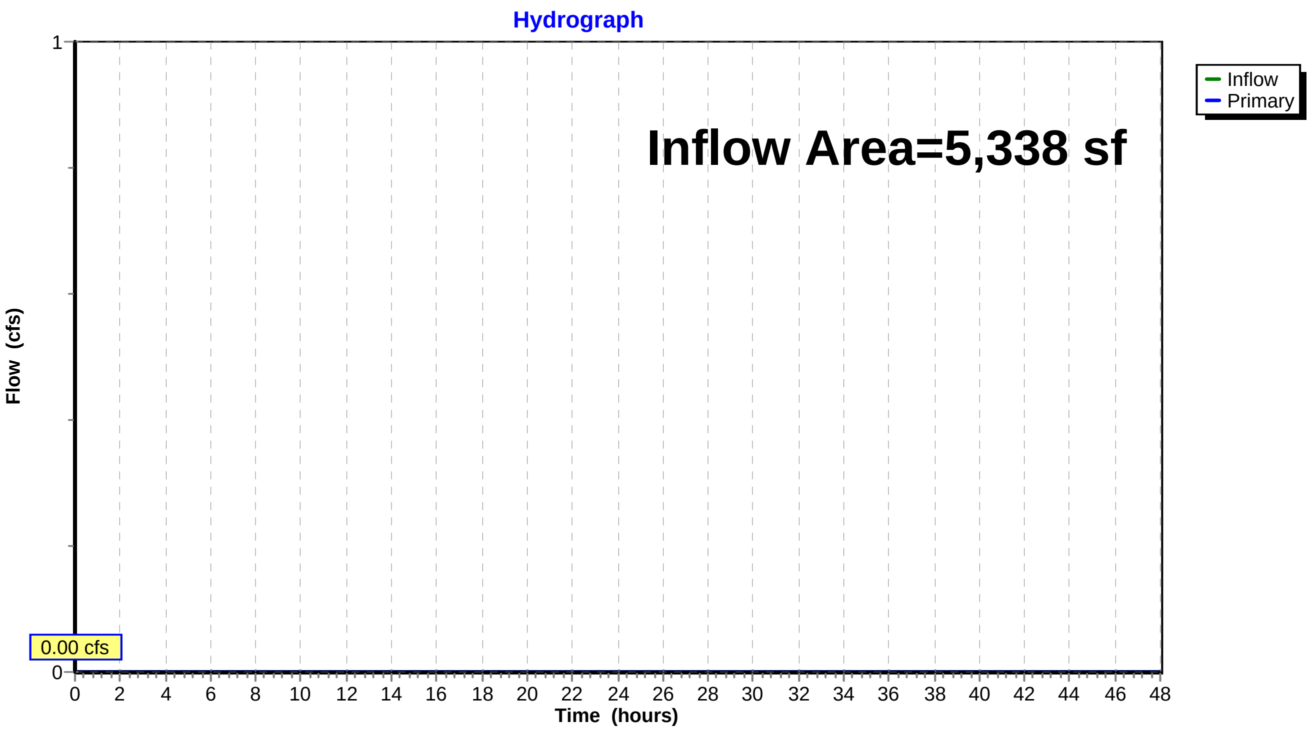


Summary for Link DP-5: Southwest Corner

Inflow Area =	5,338 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf		
Primary =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min		

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

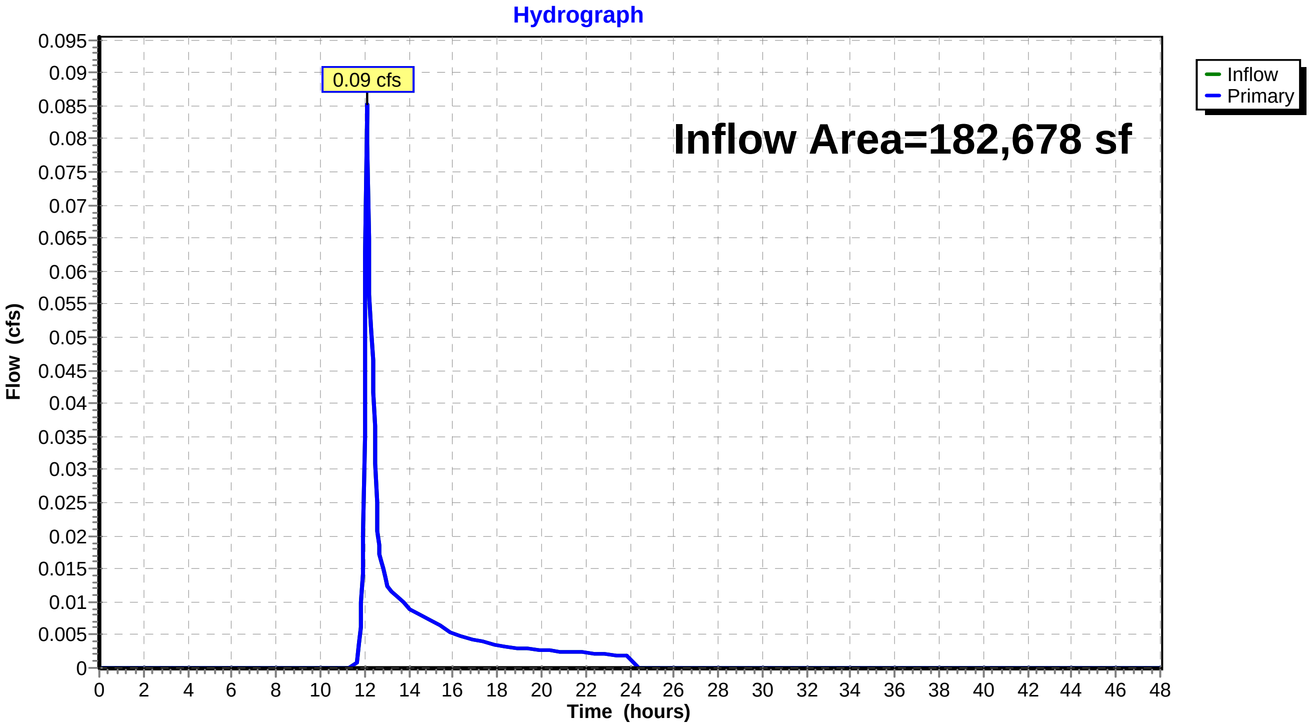


Summary for Link DP-6: South Corner

Inflow Area = 182,678 sf, 46.66% Impervious, Inflow Depth = 0.02" for 2-Year event
Inflow = 0.09 cfs @ 12.12 hrs, Volume= 323 cf
Primary = 0.09 cfs @ 12.12 hrs, Volume= 323 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1: To Northwest
Runoff Area=4,495 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=80' Slope=0.0100 '/' Tc=11.5 min CN=39/0 Runoff=0.00 cfs 41 cf

Subcatchment PS-2: To West
Runoff Area=4,426 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=129' Tc=12.6 min CN=39/0 Runoff=0.00 cfs 41 cf

Subcatchment PS-3: To Northeast
Runoff Area=4,223 sf 0.00% Impervious Runoff Depth=0.03"
Flow Length=66' Slope=0.0100 '/' Tc=11.4 min CN=35/0 Runoff=0.00 cfs 11 cf

Subcatchment PS-4: To East
Runoff Area=18,101 sf 0.00% Impervious Runoff Depth=0.07"
Flow Length=72' Tc=13.0 min CN=37/0 Runoff=0.00 cfs 100 cf

Subcatchment PS-5: To Southwest
Runoff Area=5,338 sf 0.00% Impervious Runoff Depth=0.02"
Flow Length=74' Tc=9.6 min CN=34/0 Runoff=0.00 cfs 8 cf

Subcatchment PS-6A: To Subsurface #1
Runoff Area=79,064 sf 69.61% Impervious Runoff Depth=3.00"
Flow Length=804' Tc=15.0 min CN=39/98 Runoff=4.22 cfs 19,779 cf

Subcatchment PS-6B: To Subsurface #2
Runoff Area=34,605 sf 76.54% Impervious Runoff Depth=3.30"
Flow Length=345' Tc=11.8 min CN=41/98 Runoff=2.21 cfs 9,523 cf

Subcatchment PS-6C: To Infiltration Basin
Runoff Area=63,222 sf 5.87% Impervious Runoff Depth=1.05"
Flow Length=780' Tc=14.2 min CN=57/98 Runoff=1.08 cfs 5,530 cf

Subcatchment PS-6D: To South
Runoff Area=5,787 sf 0.00% Impervious Runoff Depth=1.60"
Flow Length=137' Tc=6.7 min CN=69/0 Runoff=0.23 cfs 773 cf

Pond 1P: Subsurface #1
Peak Elev=202.38' Storage=7,668 cf Inflow=4.22 cfs 19,779 cf
Discarded=0.31 cfs 17,893 cf Primary=0.23 cfs 1,886 cf Outflow=0.54 cfs 19,779 cf

Pond 2P: Subsurface #2
Peak Elev=197.99' Storage=3,619 cf Inflow=2.21 cfs 9,523 cf
Discarded=0.12 cfs 7,879 cf Primary=0.29 cfs 1,644 cf Outflow=0.41 cfs 9,523 cf

Pond 3P: Infiltration Basin
Peak Elev=184.43' Storage=3,411 cf Inflow=1.09 cfs 9,061 cf
Discarded=0.07 cfs 5,015 cf Primary=0.47 cfs 4,045 cf Secondary=0.00 cfs 0 cf Outflow=0.54 cfs 9,061 cf

Link DP-1: Offsite to North/West
Inflow=0.00 cfs 41 cf
Primary=0.00 cfs 41 cf

Link DP-2: Offsite to West
Inflow=0.00 cfs 41 cf
Primary=0.00 cfs 41 cf

Link DP-3: Offsite to Northeast
Inflow=0.00 cfs 11 cf
Primary=0.00 cfs 11 cf

Link DP-4: East Edge of Property
Inflow=0.00 cfs 100 cf
Primary=0.00 cfs 100 cf

Link DP-5: Southwest Corner
Inflow=0.00 cfs 8 cf
Primary=0.00 cfs 8 cf

Link DP-6: South Corner
Inflow=0.49 cfs 4,818 cf
Primary=0.49 cfs 4,818 cf

Total Runoff Area = 219,261 sf Runoff Volume = 35,807 cf Average Runoff Depth = 1.96"
61.12% Pervious = 134,023 sf 38.88% Impervious = 85,238 sf

Summary for Subcatchment PS-1: To Northwest

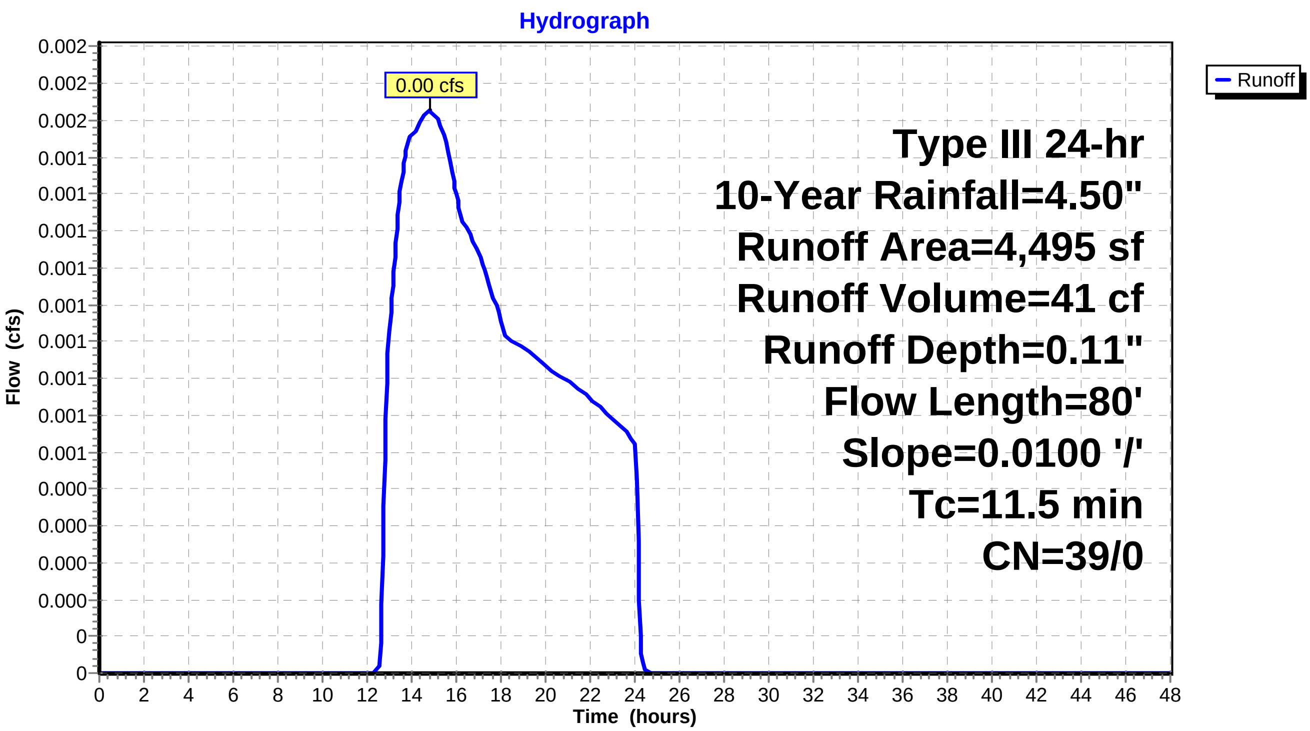
Runoff = 0.00 cfs @ 14.79 hrs, Volume= 41 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,495	39	>75% Grass cover, Good, HSG A
4,495	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.3	30	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.5	80	Total			

Subcatchment PS-1: To Northwest



Summary for Subcatchment PS-2: To West

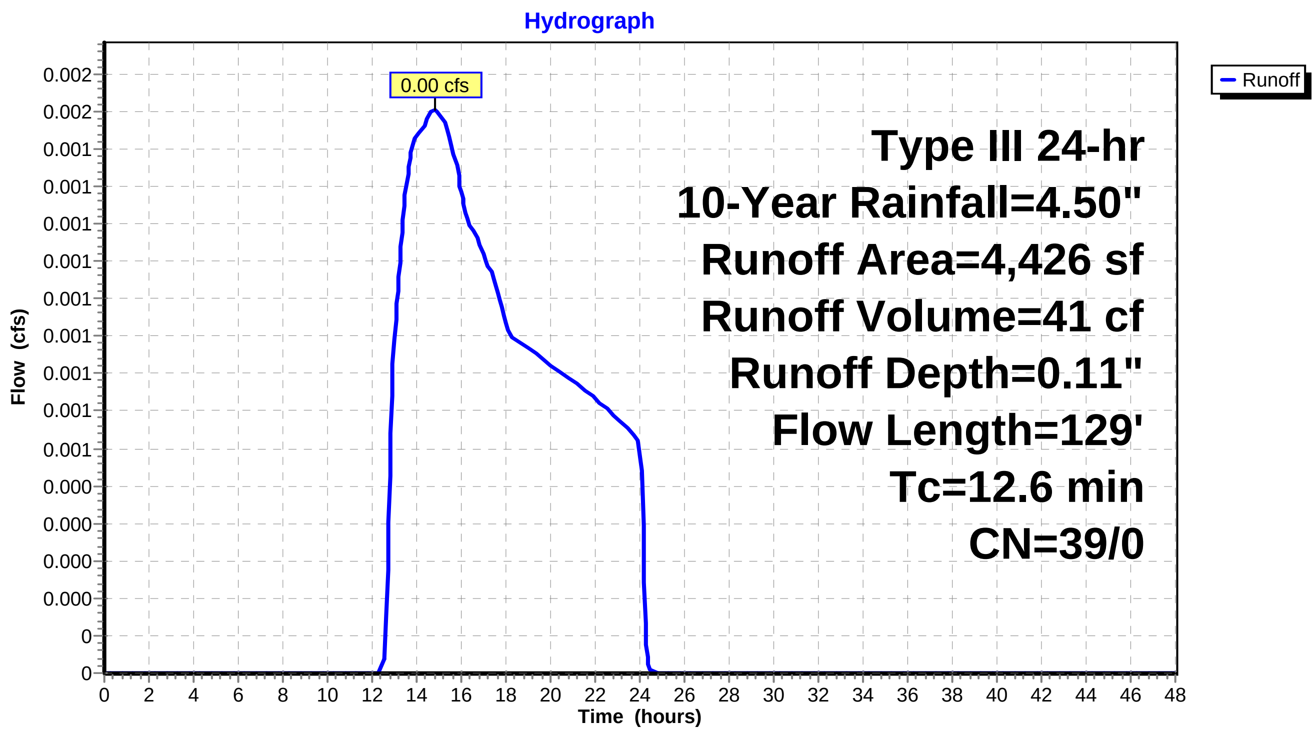
Runoff = 0.00 cfs @ 14.81 hrs, Volume= 41 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,426	39	>75% Grass cover, Good, HSG A
4,426	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0080	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.4	79	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.6	129	Total			

Subcatchment PS-2: To West



Summary for Subcatchment PS-3: To Northeast

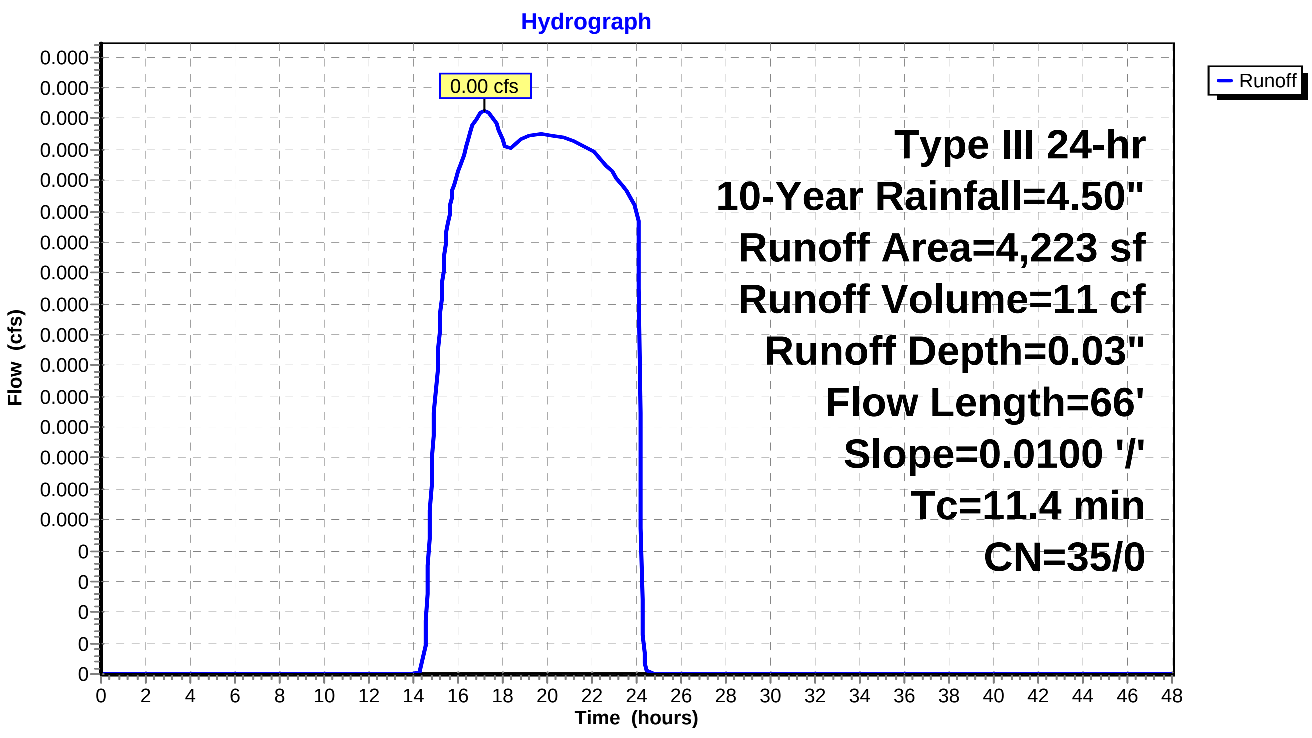
Runoff = 0.00 cfs @ 17.20 hrs, Volume= 11 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,427	39	>75% Grass cover, Good, HSG A
1,796	30	Woods, Good, HSG A
4,223	35	Weighted Average
4,223	35	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	16	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	66	Total			

Subcatchment PS-3: To Northeast



Summary for Subcatchment PS-4: To East

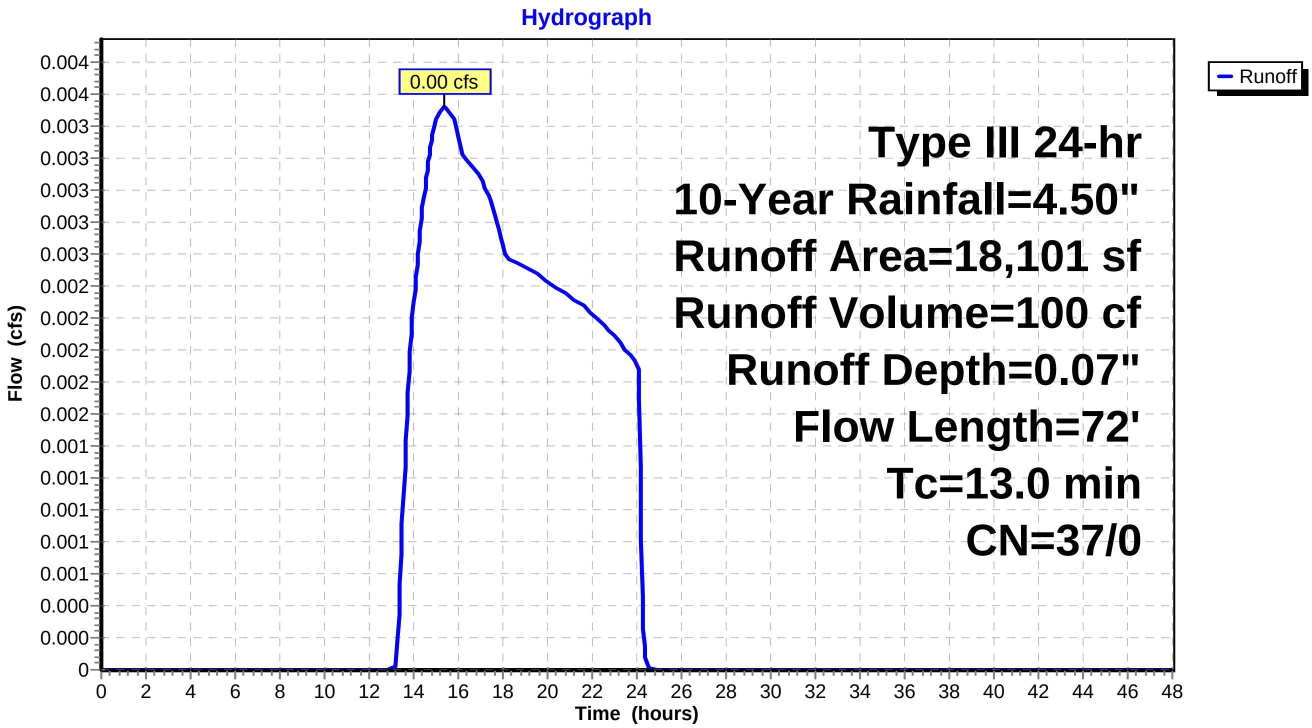
Runoff = 0.00 cfs @ 15.39 hrs, Volume= 100 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
14,935	39	>75% Grass cover, Good, HSG A
3,166	30	Woods, Good, HSG A
18,101	37	Weighted Average
18,101	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0070	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.1	22	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	72	Total			

Subcatchment PS-4: To East



Summary for Subcatchment PS-5: To Southwest

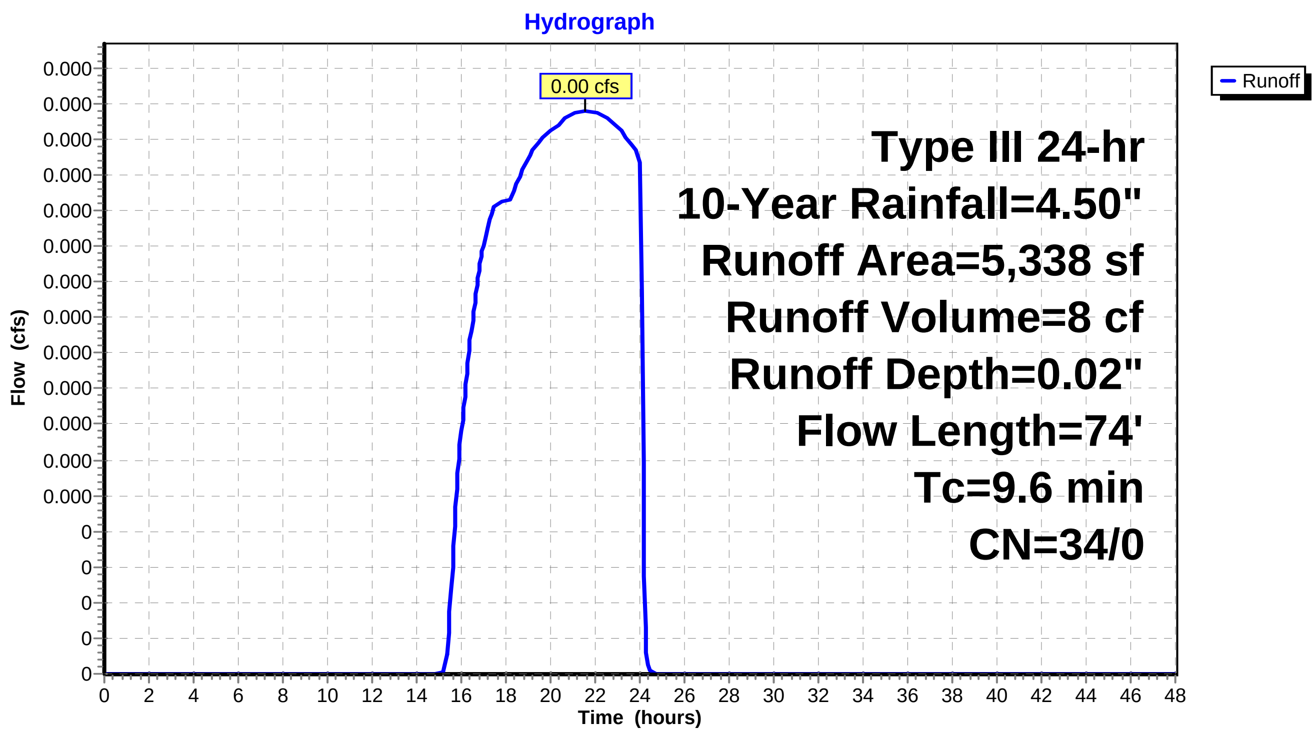
Runoff = 0.00 cfs @ 21.59 hrs, Volume= 8 cf, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,173	39	>75% Grass cover, Good, HSG A
3,165	30	Woods, Good, HSG A
5,338	34	Weighted Average
5,338	34	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0420	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.1	24	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.6	74	Total			

Subcatchment PS-5: To Southwest



Summary for Subcatchment PS-6A: To Subsurface #1

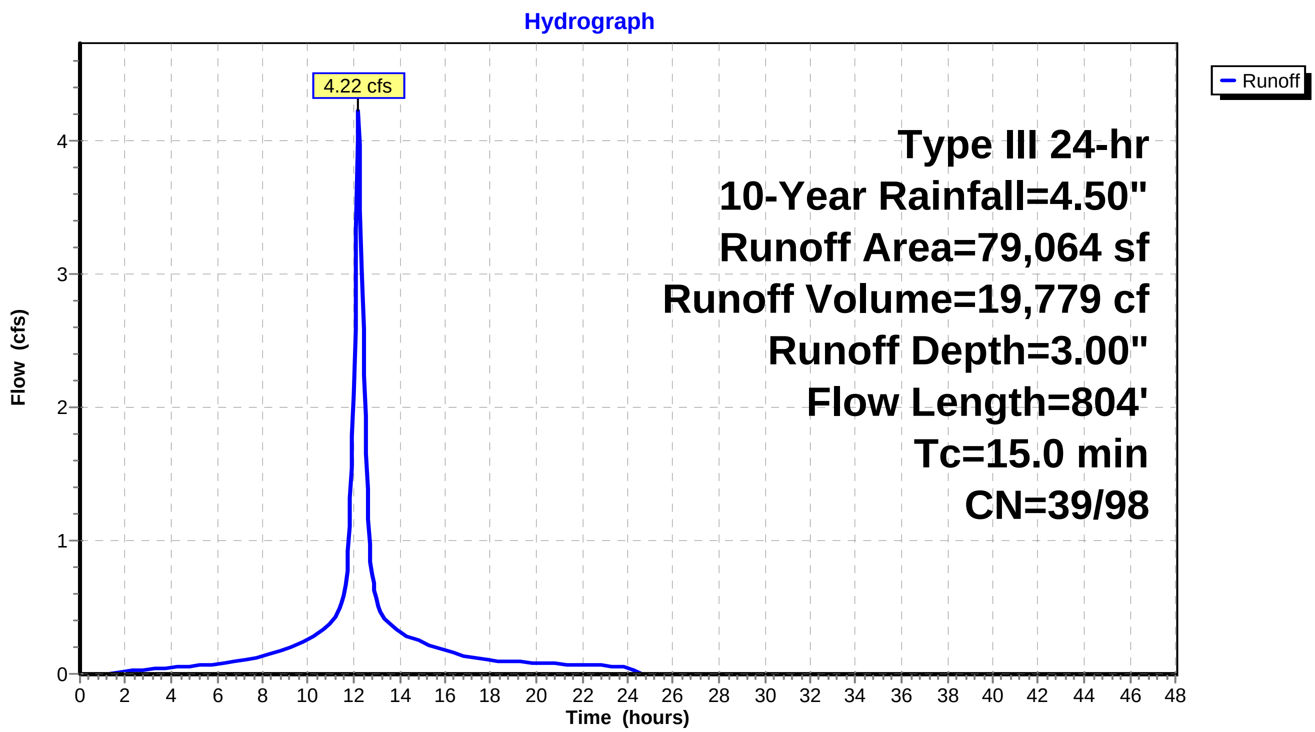
Runoff = 4.22 cfs @ 12.20 hrs, Volume= 19,779 cf, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
34,605	98	Paved parking, HSG A
20,435	98	Roofs, HSG A
24,024	39	>75% Grass cover, Good, HSG A
79,064	80	Weighted Average
24,024	39	30.39% Pervious Area
55,040	98	69.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0090	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
1.4	124	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	392	0.0150	6.57	5.16	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.9	238	0.0050	4.55	8.05	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
15.0	804	Total			

Subcatchment PS-6A: To Subsurface #1



Summary for Subcatchment PS-6B: To Subsurface #2

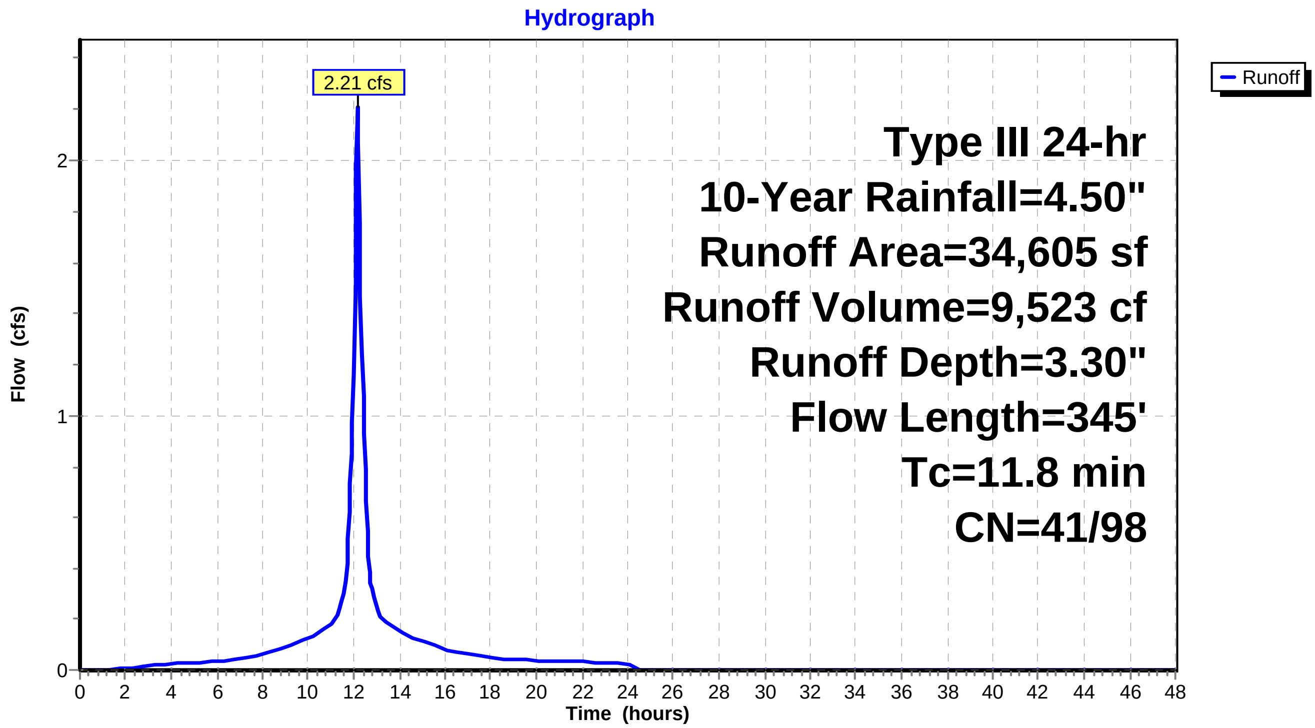
Runoff = 2.21 cfs @ 12.16 hrs, Volume= 9,523 cf, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
16,507	98	Paved parking, HSG A
6,553	98	Roofs, HSG A
7,595	39	>75% Grass cover, Good, HSG A
514	98	Paved parking, HSG C
2,914	98	Roofs, HSG C
522	74	>75% Grass cover, Good, HSG C
34,605	85	Weighted Average
8,117	41	23.46% Pervious Area
26,488	98	76.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	35	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.0150	2.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	96	0.0420	4.16		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	162	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.8	345	Total			

Subcatchment PS-6B: To Subsurface #2



Summary for Subcatchment PS-6C: To Infiltration Basin

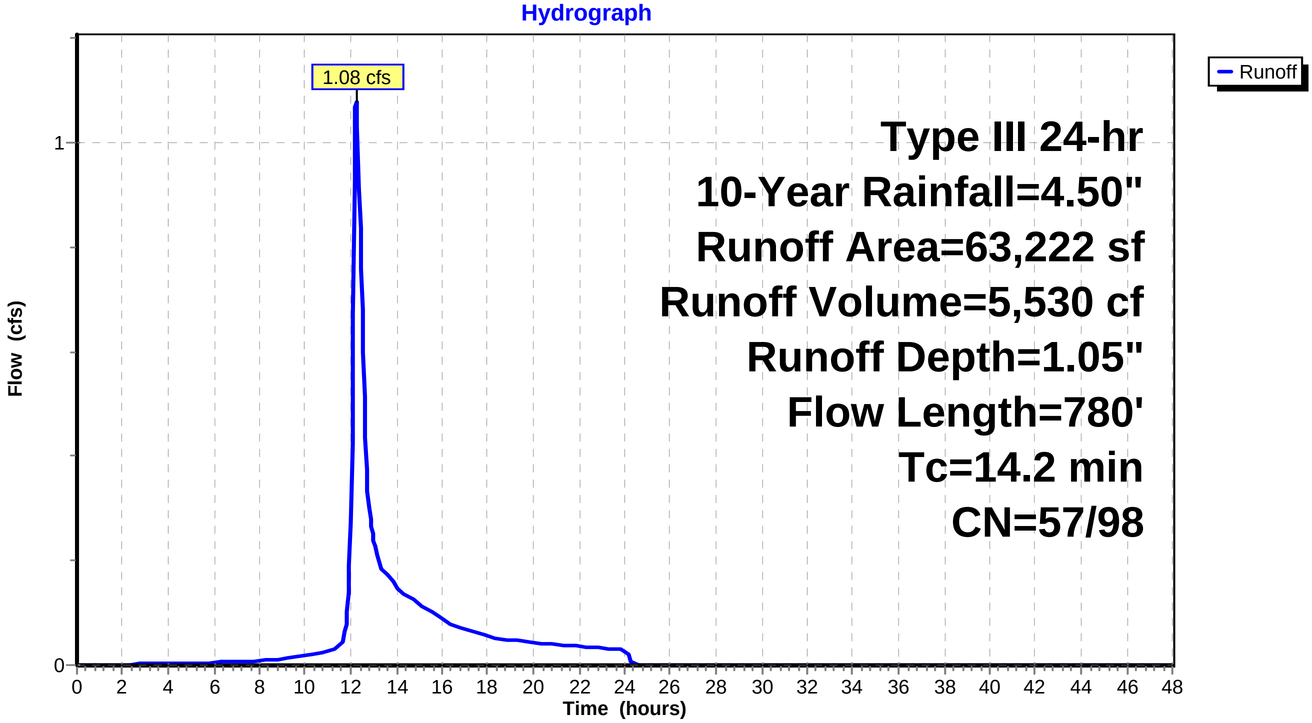
Runoff = 1.08 cfs @ 12.23 hrs, Volume= 5,530 cf, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,932	98	Roofs, HSG A
5,420	98	Unconnected roofs, HSG A
18,071	39	>75% Grass cover, Good, HSG A
14,025	30	Woods, Good, HSG A
3,928	98	Unconnected roofs, HSG C
1,778	98	Water Surface, HSG C
18,068	74	>75% Grass cover, Good, HSG C
63,222	59	Weighted Average
59,512	57	94.13% Pervious Area
3,710	98	5.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0110	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.3	321	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	157	0.0350	9.19	7.22	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.8	252	0.0120	5.38	4.23	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
14.2	780	Total			

Subcatchment PS-6C: To Infiltration Basin



Summary for Subcatchment PS-6D: To South

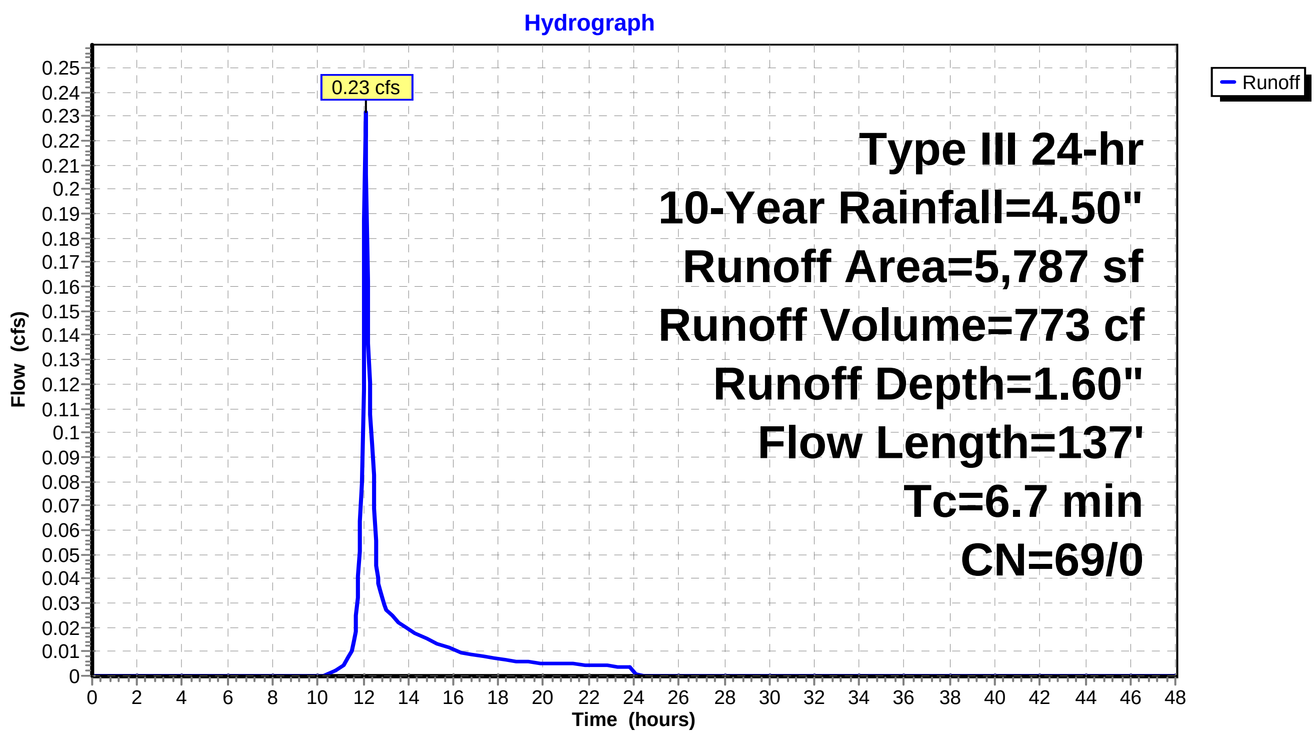
Runoff = 0.23 cfs @ 12.11 hrs, Volume= 773 cf, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
817	39	>75% Grass cover, Good, HSG A
4,970	74	>75% Grass cover, Good, HSG C
5,787	69	Weighted Average
5,787	69	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	46	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.1	41	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.7	137	Total			

Subcatchment PS-6D: To South



Summary for Pond 1P: Subsurface #1

Inflow Area = 79,064 sf, 69.61% Impervious, Inflow Depth = 3.00" for 10-Year event
Inflow = 4.22 cfs @ 12.20 hrs, Volume= 19,779 cf
Outflow = 0.54 cfs @ 13.02 hrs, Volume= 19,779 cf, Atten= 87%, Lag= 49.2 min
Discarded = 0.31 cfs @ 10.65 hrs, Volume= 17,893 cf
Primary = 0.23 cfs @ 13.02 hrs, Volume= 1,886 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 202.38' @ 13.02 hrs Surf.Area= 5,558 sf Storage= 7,668 cf
Flood Elev= 203.90' Surf.Area= 5,558 sf Storage= 12,104 cf

Plug-Flow detention time= 158.1 min calculated for 19,779 cf (100% of inflow)
Center-of-Mass det. time= 158.1 min (919.7 - 761.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	200.40'	4,900 cf	**63.25'W x 87.88'L x 3.50'H Field A**
			19,454 cf Overall - 7,203 cf Embedded = 12,251 cf x 40.0% Voids
#2A	200.90'	7,203 cf	**ADS_StormTech SC-740** x 156 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
			Row Length Adjustment= +0.44' x 6.45 sf x 13 rows
#3	205.40'	120 cf	**Roadway Flooding (Irregular)** Listed below (Recalc) -Impervious
		12,223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
205.40	2	4.0	0	0	2
205.60	138	76.0	10	10	460
205.80	1,108	1,939.0	109	120	299,190

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.40'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	200.40'	**12.0" Round Culvert** L= 155.0' Ke= 0.500
			Inlet / Outlet Invert= 200.40' / 196.10' S= 0.0277 '/' Cc= 0.900
			n= 0.012, Flow Area= 0.79 sf
#3	Device 2	201.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	203.90'	**4.0' long Overflow Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.31 cfs @ 10.65 hrs HW=200.45' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.23 cfs @ 13.02 hrs HW=202.38' (Free Discharge)
└2=**Culvert** (Passes 0.23 cfs of 4.60 cfs potential flow)
 ├3=**Orifice/Grate** (Orifice Controls 0.23 cfs @ 2.68 fps)
 └4=**Overflow Weir** (Controls 0.00 cfs)

Pond 1P: Subsurface #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740
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
Row Length Adjustment= +0.44' x 6.45 sf x 13 rows

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

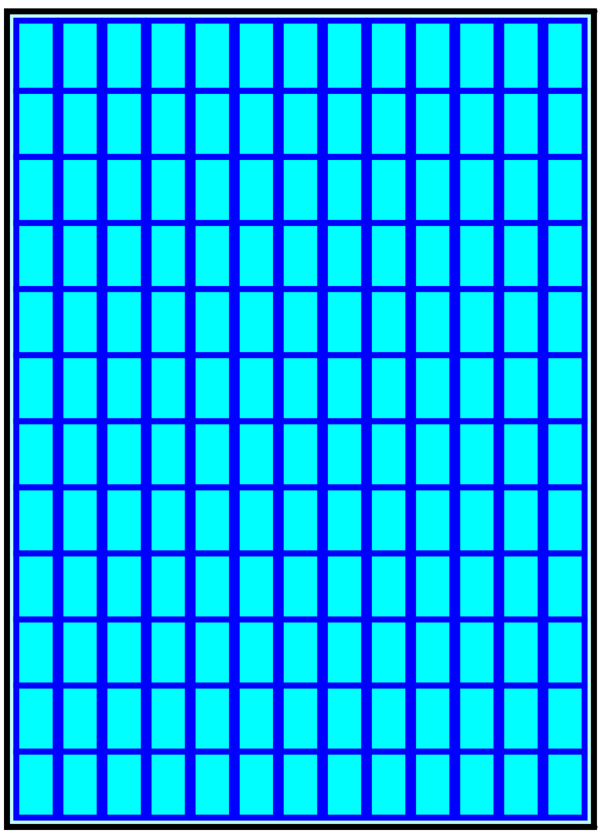
12 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 85.88' Row Length +12.0" End Stone x 2 = 87.88' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

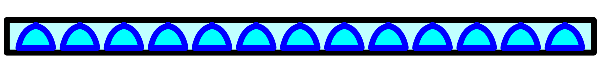
156 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 13 Rows = 7,203.4 cf Chamber Storage

19,454.1 cf Field - 7,203.4 cf Chambers = 12,250.7 cf Stone x 40.0% Voids = 4,900.3 cf Stone Storage

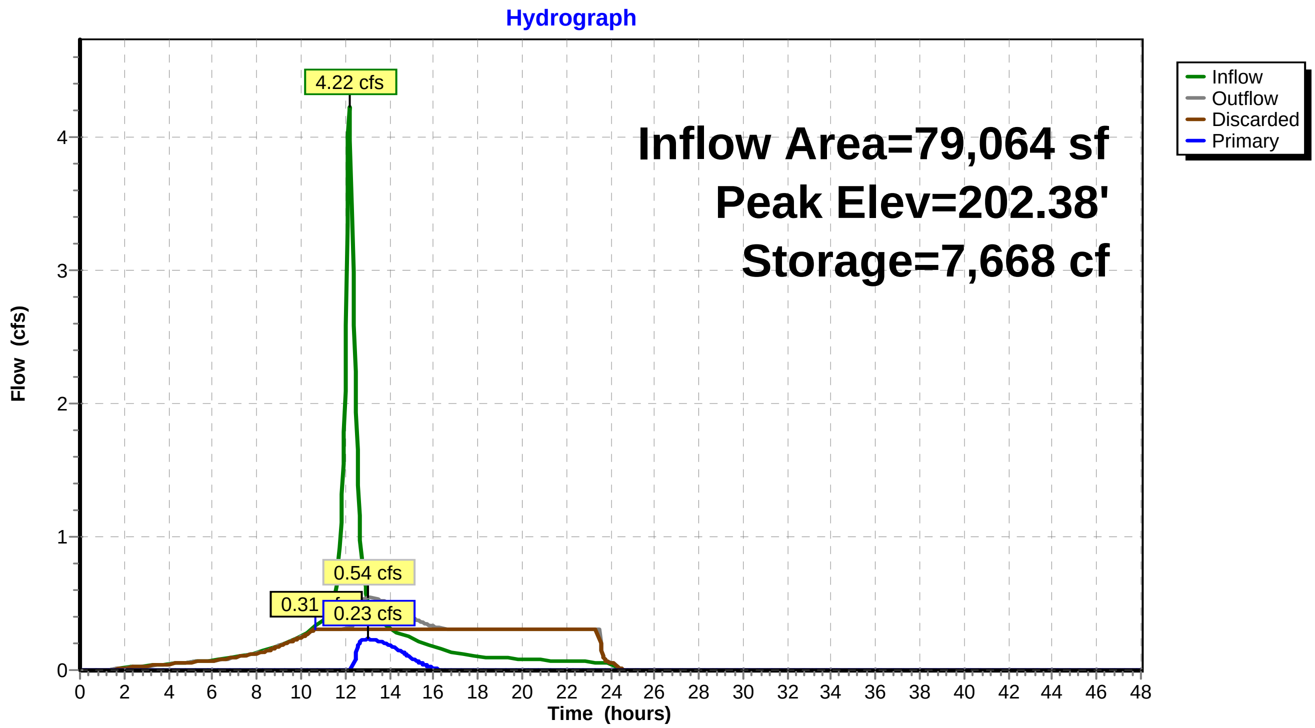
Chamber Storage + Stone Storage = 12,103.7 cf = 0.278 af
Overall Storage Efficiency = 62.2%

156 Chambers
720.5 cy Field
453.7 cy Stone





Pond 1P: Subsurface #1



Summary for Pond 2P: Subsurface #2

Inflow Area = 34,605 sf, 76.54% Impervious, Inflow Depth = 3.30" for 10-Year event
Inflow = 2.21 cfs @ 12.16 hrs, Volume= 9,523 cf
Outflow = 0.41 cfs @ 12.68 hrs, Volume= 9,523 cf, Atten= 81%, Lag= 31.4 min
Discarded = 0.12 cfs @ 10.10 hrs, Volume= 7,879 cf
Primary = 0.29 cfs @ 12.68 hrs, Volume= 1,644 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 197.99' @ 12.68 hrs Surf.Area= 2,209 sf Storage= 3,619 cf
Flood Elev= 199.10' Surf.Area= 2,209 sf Storage= 4,757 cf

Plug-Flow detention time= 162.7 min calculated for 9,513 cf (100% of inflow)
Center-of-Mass det. time= 162.6 min (920.9 - 758.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	195.60'	1,983 cf	**30.00'W x 73.64'L x 3.50'H Field A**
			7,732 cf Overall - 2,773 cf Embedded = 4,959 cf x 40.0% Voids
#2A	196.10'	2,773 cf	**ADS_StormTech SC-740** x 60 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
			Row Length Adjustment= +0.44' x 6.45 sf x 6 rows
#3	200.92'	84 cf	**Roadway Flooding (Irregular)** Listed below (Recalc) -Impervious
		4,841 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
200.92	2	4.0	0	0	2
201.00	37	38.0	1	1	116
201.20	1,009	242.0	83	84	4,661

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.60'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	193.10'	**12.0" Round Culvert** L= 135.0' Ke= 0.500
			Inlet / Outlet Invert= 193.10' / 186.51' S= 0.0488 '/' Cc= 0.900
			n= 0.012, Flow Area= 0.79 sf
#3	Device 2	197.35'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	199.10'	**4.0' long Overflow Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 10.10 hrs HW=195.66' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.29 cfs @ 12.68 hrs HW=197.99' (Free Discharge)
└2=**Culvert** (Passes 0.29 cfs of 7.92 cfs potential flow)
  ├3=**Orifice/Grate** (Orifice Controls 0.29 cfs @ 3.31 fps)
  └4=**Overflow Weir** (Controls 0.00 cfs)

Pond 2P: Subsurface #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740
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
Row Length Adjustment= +0.44' x 6.45 sf x 6 rows

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

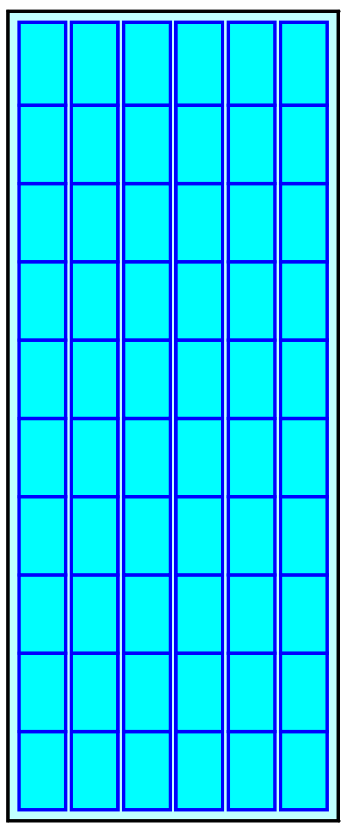
10 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 71.64' Row Length +12.0" End Stone x 2 = 73.64' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

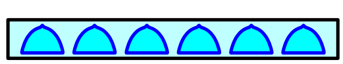
60 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 6 Rows = 2,773.4 cf Chamber Storage

7,732.0 cf Field - 2,773.4 cf Chambers = 4,958.7 cf Stone x 40.0% Voids = 1,983.5 cf Stone Storage

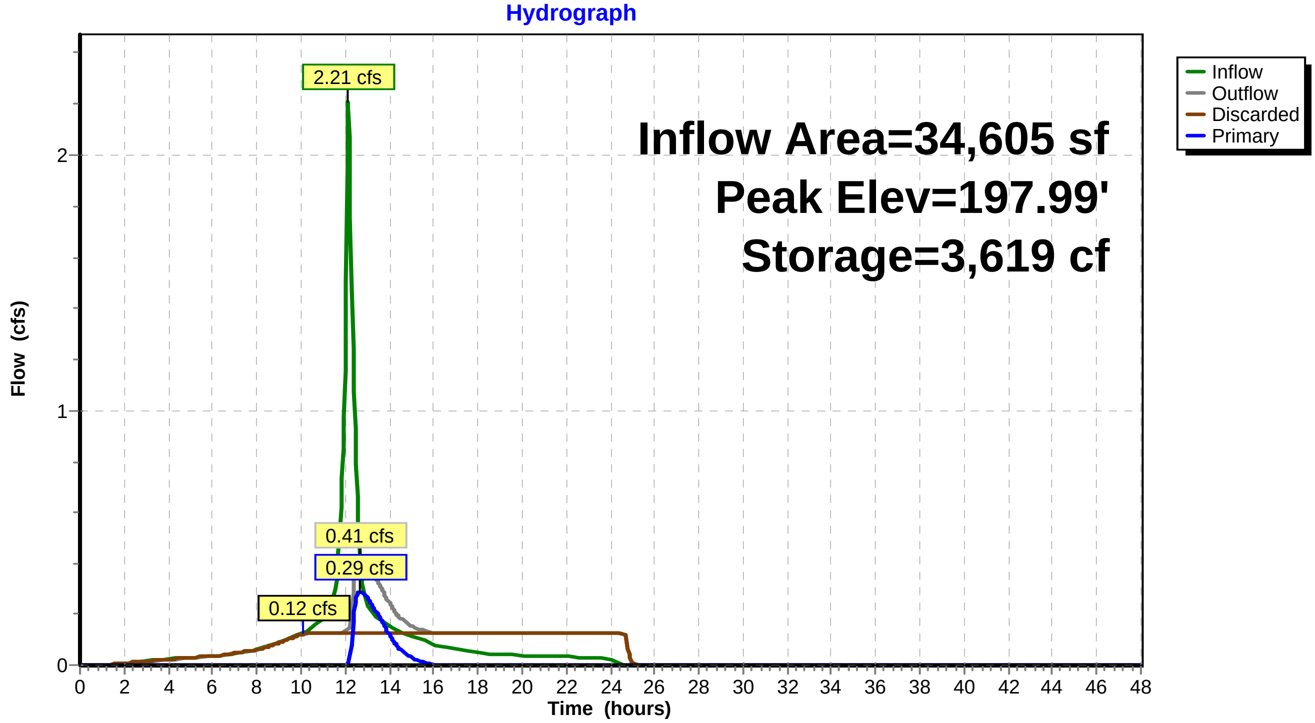
Chamber Storage + Stone Storage = 4,756.8 cf = 0.109 af
Overall Storage Efficiency = 61.5%

60 Chambers
286.4 cy Field
183.7 cy Stone





Pond 2P: Subsurface #2



Summary for Pond 3P: Infiltration Basin

Inflow Area = 176,891 sf, 48.19% Impervious, Inflow Depth = 0.61" for 10-Year event
Inflow = 1.09 cfs @ 12.45 hrs, Volume= 9,061 cf
Outflow = 0.54 cfs @ 13.71 hrs, Volume= 9,061 cf, Atten= 50%, Lag= 75.4 min
Discarded = 0.07 cfs @ 13.71 hrs, Volume= 5,015 cf
Primary = 0.47 cfs @ 13.71 hrs, Volume= 4,045 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 184.43' @ 13.71 hrs Surf.Area= 3,052 sf Storage= 3,411 cf
Flood Elev= 185.50' Surf.Area= 4,201 sf Storage= 7,288 cf

Plug-Flow detention time= 254.2 min calculated for 9,051 cf (100% of inflow)
Center-of-Mass det. time= 254.6 min (1,101.6 - 847.0)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	9,534 cf	**Basin Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
183.00	1,778	198.0	0	0	1,778
184.00	2,642	227.0	2,196	2,196	2,782
185.00	3,648	258.0	3,132	5,327	4,002
186.00	4,792	288.0	4,207	9,534	5,334

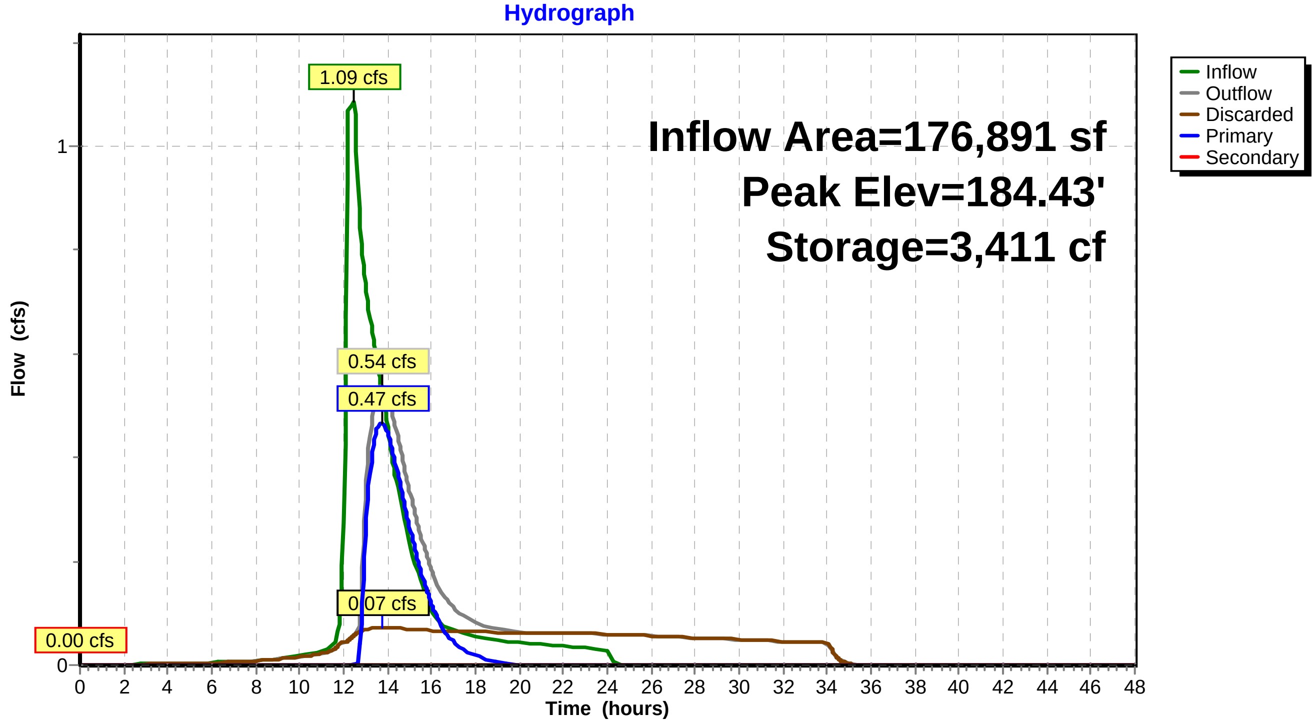
Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 3	184.00'	**7.0" Vert. Orifice** C= 0.600
#3	Primary	183.00'	**12.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 183.00' / 182.04' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	185.25'	**4.0" W x 4.0" H Vert. Outlet Structure Grate** C= 0.600
#5	Secondary	185.50'	**10.0' long x 10.0' breadth Emergency Overflow** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.07 cfs @ 13.71 hrs HW=184.43' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.47 cfs @ 13.71 hrs HW=184.43' (Free Discharge)
└3=**Culvert** (Passes 0.47 cfs of 3.64 cfs potential flow)
  ├2=**Orifice** (Orifice Controls 0.47 cfs @ 2.23 fps)
  └4=**Outlet Structure Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=183.00' (Free Discharge)
└5=**Emergency Overflow** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

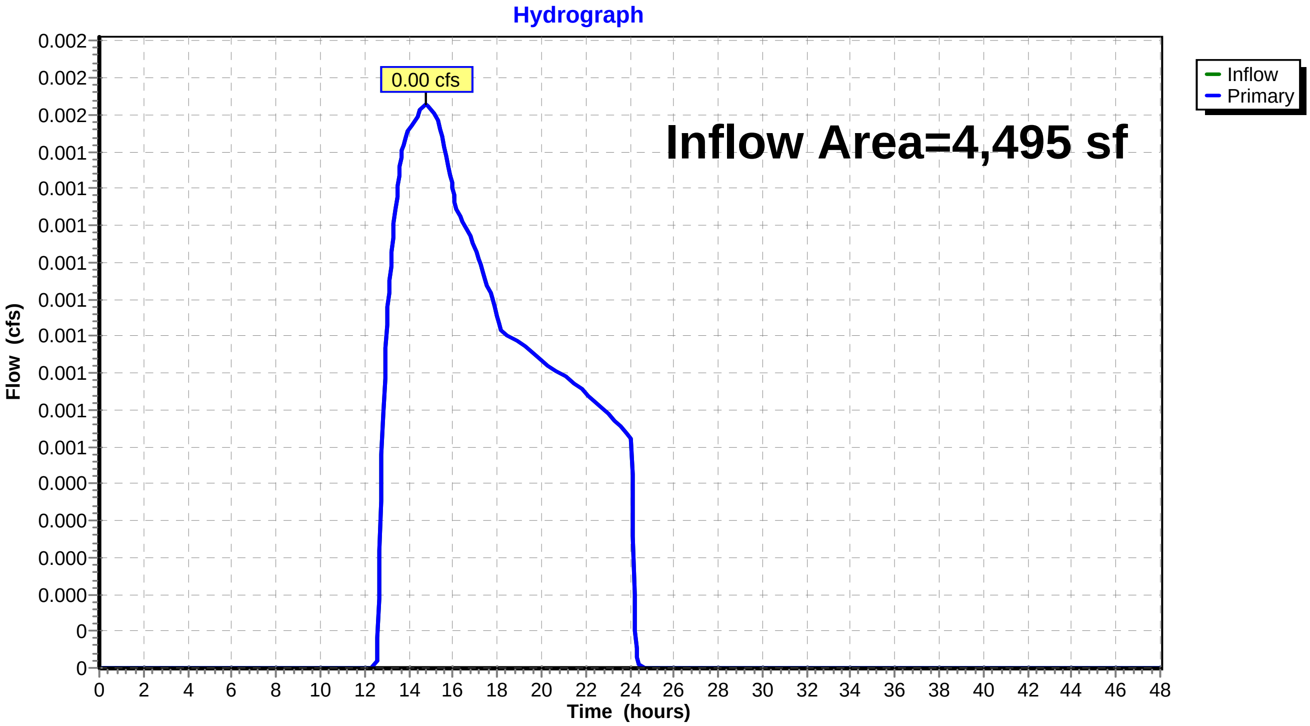


Summary for Link DP-1: Offsite to North/West

Inflow Area = 4,495 sf, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 14.79 hrs, Volume= 41 cf
Primary = 0.00 cfs @ 14.79 hrs, Volume= 41 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

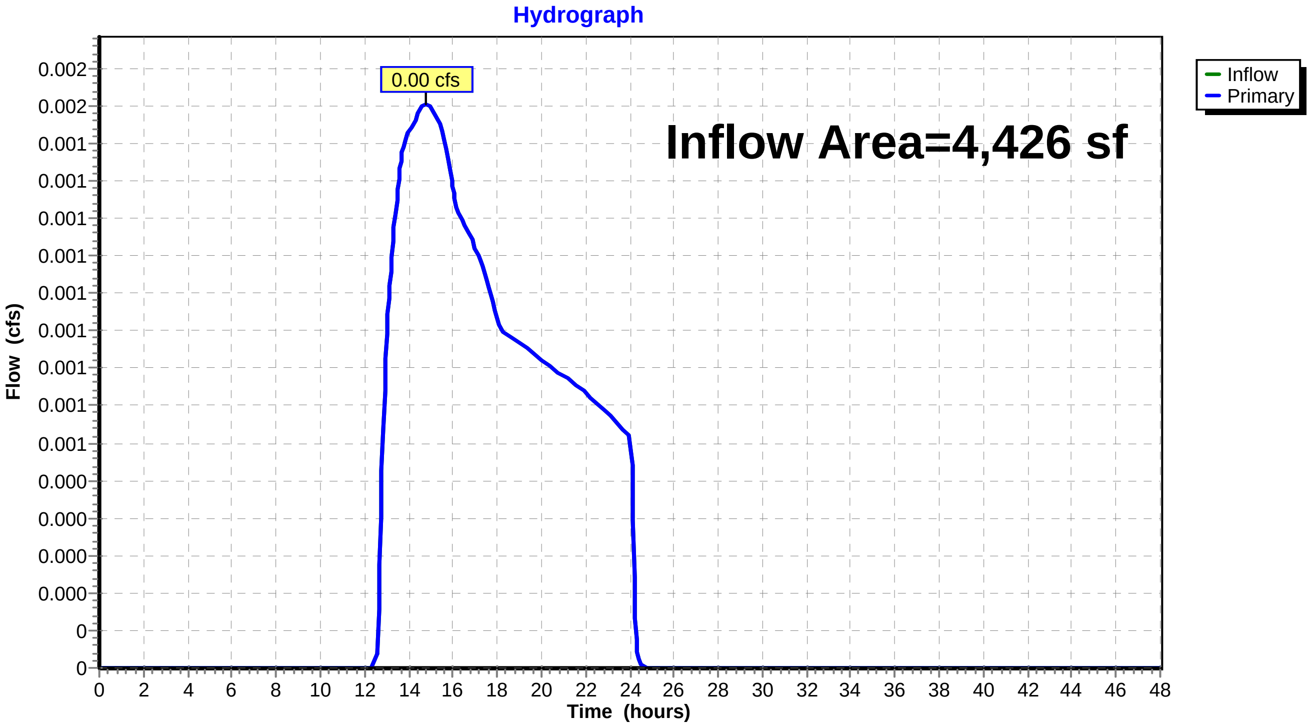


Summary for Link DP-2: Offsite to West

Inflow Area = 4,426 sf, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 14.81 hrs, Volume= 41 cf
Primary = 0.00 cfs @ 14.81 hrs, Volume= 41 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

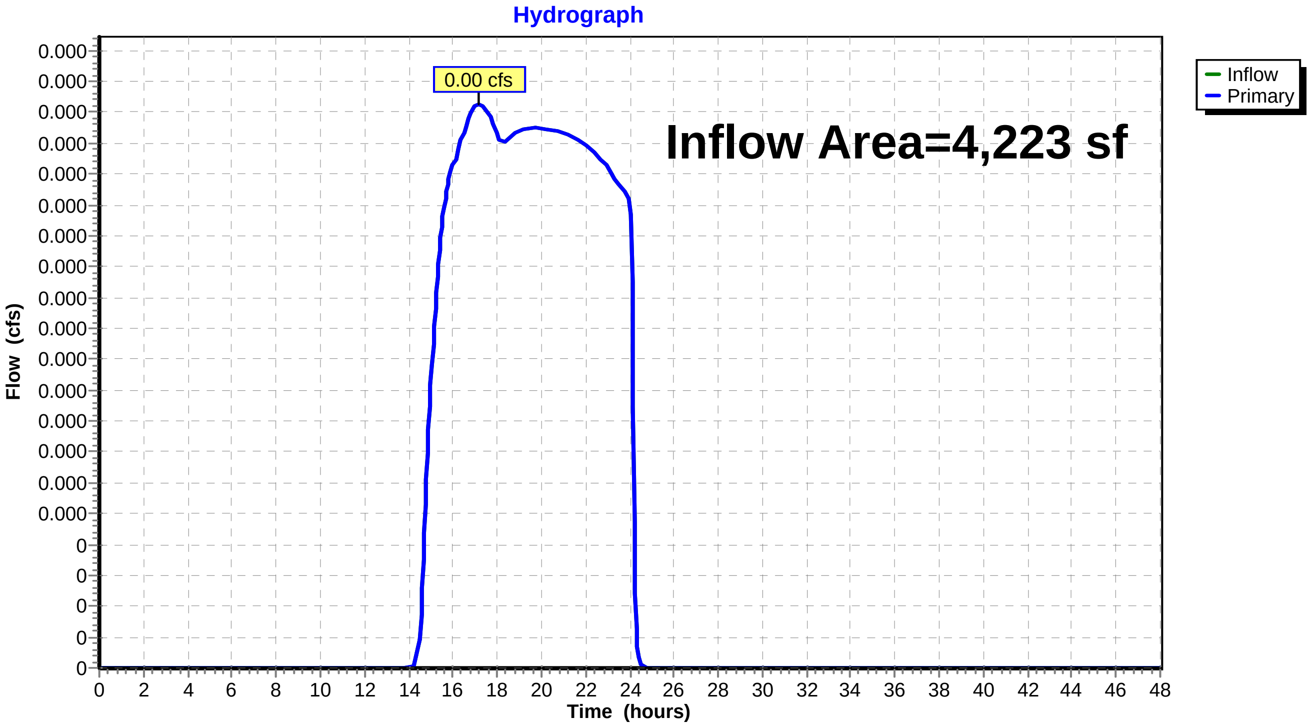


Summary for Link DP-3: Offsite to Northeast

Inflow Area = 4,223 sf, 0.00% Impervious, Inflow Depth = 0.03" for 10-Year event
Inflow = 0.00 cfs @ 17.20 hrs, Volume= 11 cf
Primary = 0.00 cfs @ 17.20 hrs, Volume= 11 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

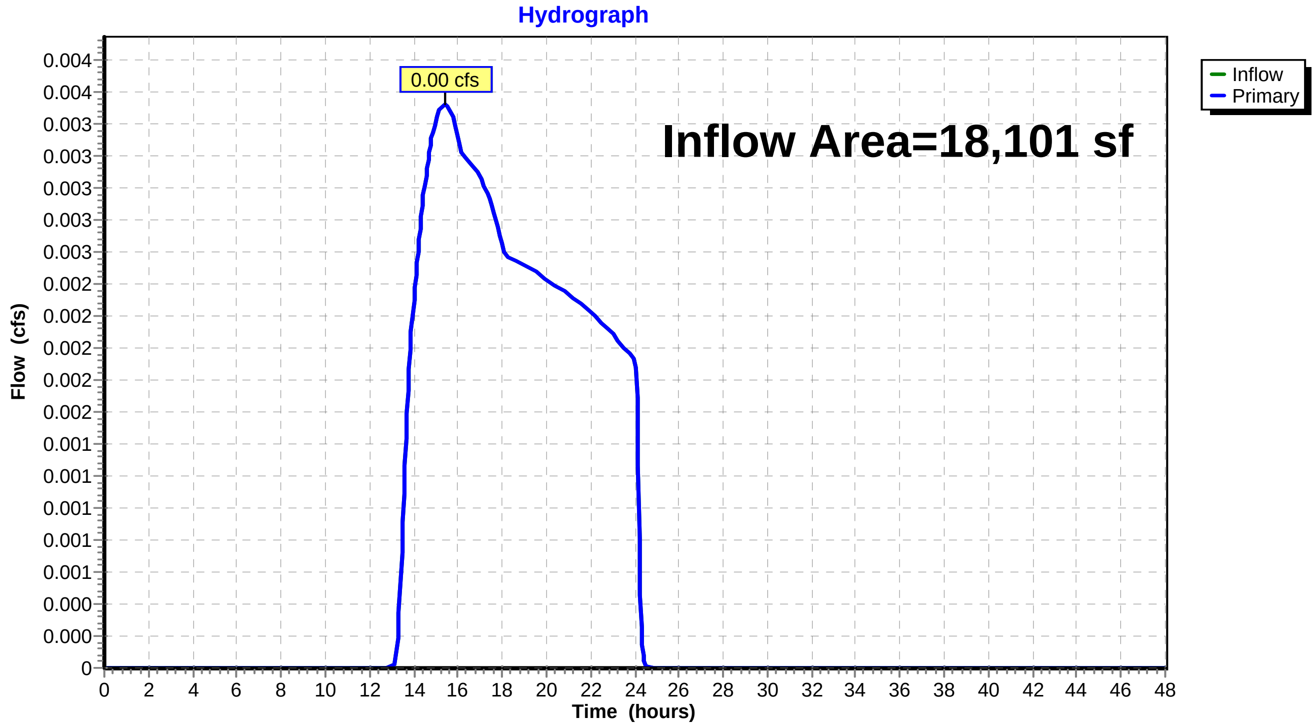


Summary for Link DP-4: East Edge of Property

Inflow Area = 18,101 sf, 0.00% Impervious, Inflow Depth = 0.07" for 10-Year event
Inflow = 0.00 cfs @ 15.39 hrs, Volume= 100 cf
Primary = 0.00 cfs @ 15.39 hrs, Volume= 100 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

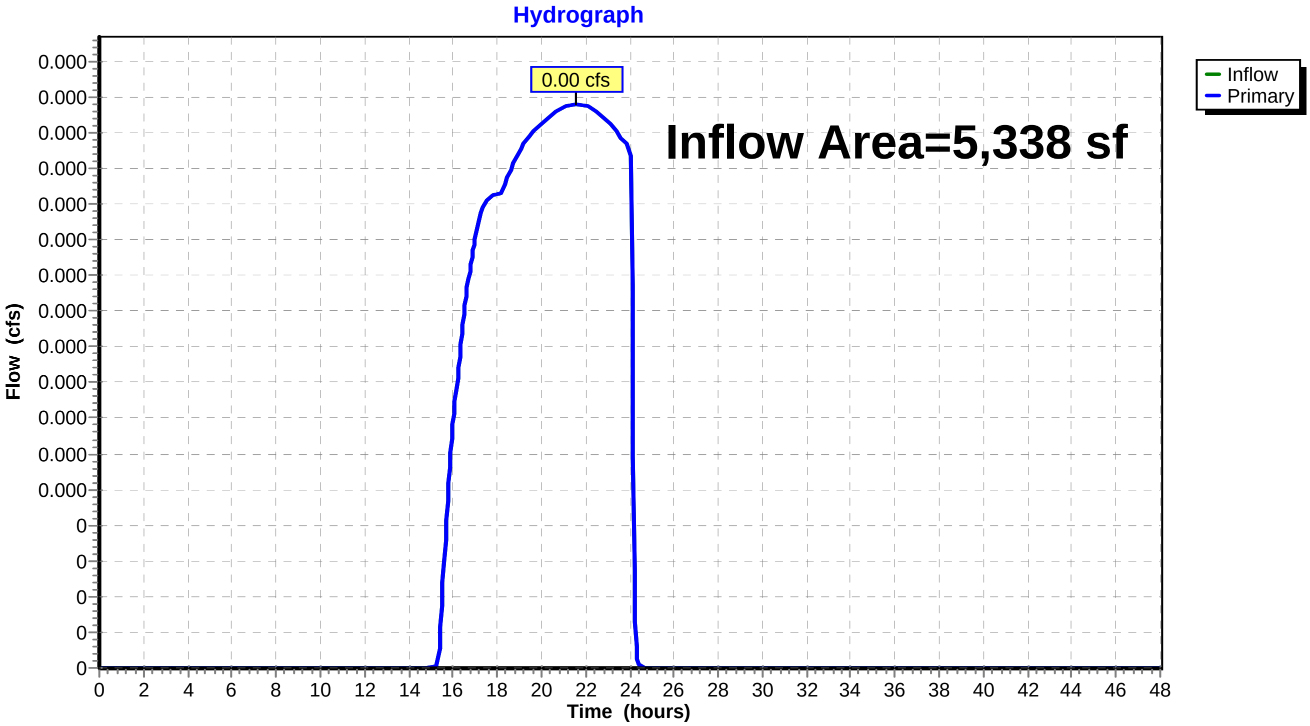


Summary for Link DP-5: Southwest Corner

Inflow Area = 5,338 sf, 0.00% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.00 cfs @ 21.59 hrs, Volume= 8 cf
Primary = 0.00 cfs @ 21.59 hrs, Volume= 8 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

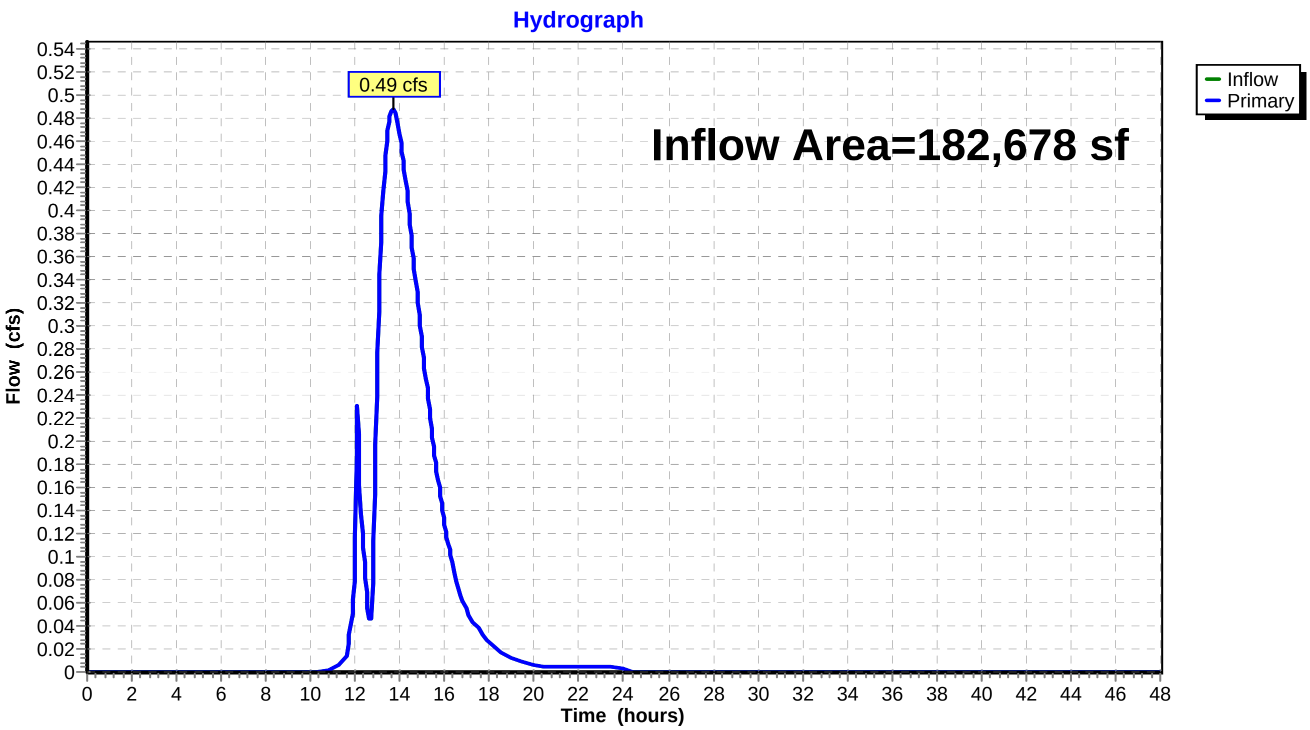


Summary for Link DP-6: South Corner

Inflow Area = 182,678 sf, 46.66% Impervious, Inflow Depth = 0.32" for 10-Year event
Inflow = 0.49 cfs @ 13.70 hrs, Volume= 4,818 cf
Primary = 0.49 cfs @ 13.70 hrs, Volume= 4,818 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1: To Northwest
Runoff Area=4,495 sf 0.00% Impervious Runoff Depth=0.57"
Flow Length=80' Slope=0.0100 '/' Tc=11.5 min CN=39/0 Runoff=0.02 cfs 212 cf

Subcatchment PS-2: To West
Runoff Area=4,426 sf 0.00% Impervious Runoff Depth=0.57"
Flow Length=129' Tc=12.6 min CN=39/0 Runoff=0.02 cfs 209 cf

Subcatchment PS-3: To Northeast
Runoff Area=4,223 sf 0.00% Impervious Runoff Depth=0.34"
Flow Length=66' Slope=0.0100 '/' Tc=11.4 min CN=35/0 Runoff=0.01 cfs 119 cf

Subcatchment PS-4: To East
Runoff Area=18,101 sf 0.00% Impervious Runoff Depth=0.45"
Flow Length=72' Tc=13.0 min CN=37/0 Runoff=0.07 cfs 676 cf

Subcatchment PS-5: To Southwest
Runoff Area=5,338 sf 0.00% Impervious Runoff Depth=0.29"
Flow Length=74' Tc=9.6 min CN=34/0 Runoff=0.01 cfs 129 cf

Subcatchment PS-6A: To Subsurface #1
Runoff Area=79,064 sf 69.61% Impervious Runoff Depth=4.46"
Flow Length=804' Tc=15.0 min CN=39/98 Runoff=6.08 cfs 29,394 cf

Subcatchment PS-6B: To Subsurface #2
Runoff Area=34,605 sf 76.54% Impervious Runoff Depth=4.88"
Flow Length=345' Tc=11.8 min CN=41/98 Runoff=3.20 cfs 14,069 cf

Subcatchment PS-6C: To Infiltration Basin
Runoff Area=63,222 sf 5.87% Impervious Runoff Depth=2.17"
Flow Length=780' Tc=14.2 min CN=57/98 Runoff=2.60 cfs 11,446 cf

Subcatchment PS-6D: To South
Runoff Area=5,787 sf 0.00% Impervious Runoff Depth=3.03"
Flow Length=137' Tc=6.7 min CN=69/0 Runoff=0.45 cfs 1,460 cf

Pond 1P: Subsurface #1
Peak Elev=203.80' Storage=11,882 cf Inflow=6.08 cfs 29,394 cf
Discarded=0.31 cfs 21,825 cf Primary=0.55 cfs 7,569 cf Outflow=0.86 cfs 29,394 cf

Pond 2P: Subsurface #2
Peak Elev=199.31' Storage=4,757 cf Inflow=3.20 cfs 14,069 cf
Discarded=0.12 cfs 9,197 cf Primary=1.84 cfs 4,872 cf Outflow=1.97 cfs 14,069 cf

Pond 3P: Infiltration Basin
Peak Elev=185.24' Storage=6,226 cf Inflow=4.09 cfs 23,887 cf
Discarded=0.09 cfs 5,941 cf Primary=1.25 cfs 17,946 cf Secondary=0.00 cfs 0 cf Outflow=1.34 cfs 23,887 cf

Link DP-1: Offsite to North/West
Inflow=0.02 cfs 212 cf
Primary=0.02 cfs 212 cf

Link DP-2: Offsite to West
Inflow=0.02 cfs 209 cf
Primary=0.02 cfs 209 cf

Link DP-3: Offsite to Northeast
Inflow=0.01 cfs 119 cf
Primary=0.01 cfs 119 cf

Link DP-4: East Edge of Property
Inflow=0.07 cfs 676 cf
Primary=0.07 cfs 676 cf

Link DP-5: Southwest Corner
Inflow=0.01 cfs 129 cf
Primary=0.01 cfs 129 cf

Link DP-6: South Corner
Inflow=1.29 cfs 19,407 cf
Primary=1.29 cfs 19,407 cf

Total Runoff Area = 219,261 sf   Runoff Volume = 57,713 cf   Average Runoff Depth = 3.16"
61.12% Pervious = 134,023 sf   38.88% Impervious = 85,238 sf

Summary for Subcatchment PS-1: To Northwest

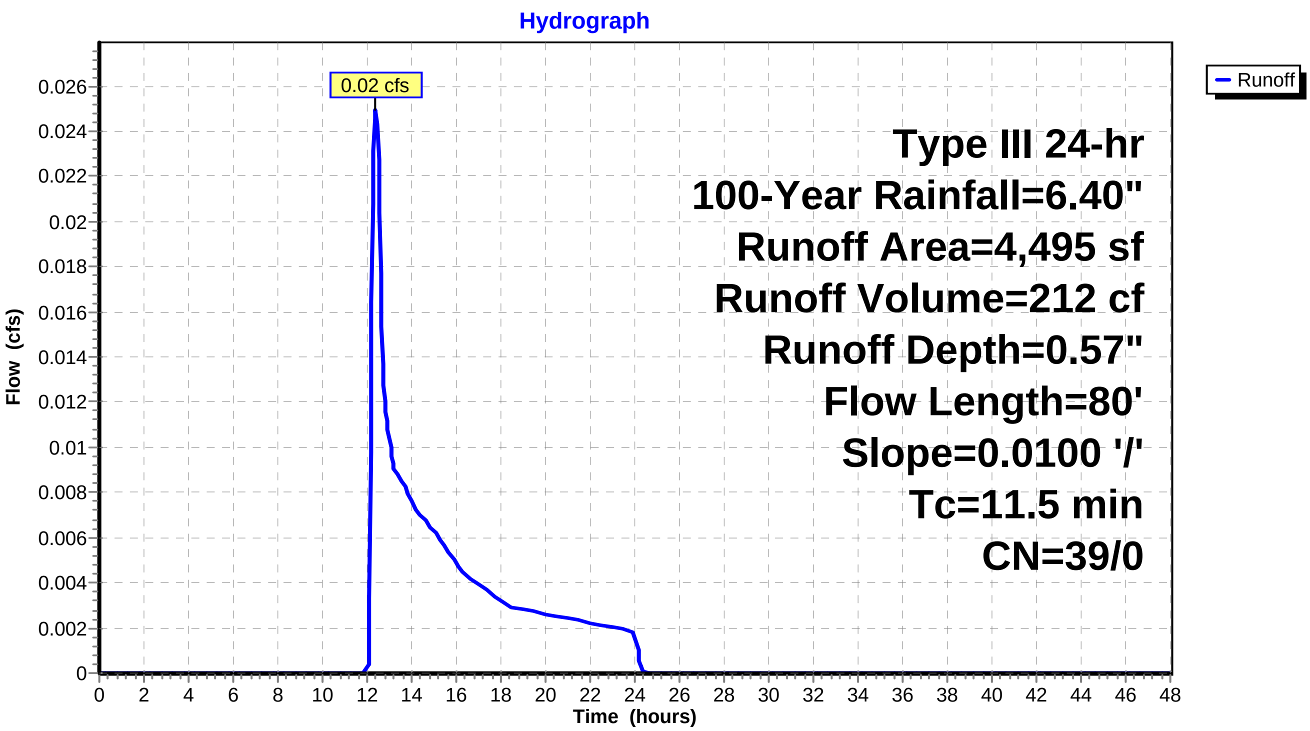
Runoff = 0.02 cfs @ 12.39 hrs, Volume= 212 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
4,495	39	>75% Grass cover, Good, HSG A
4,495	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.3	30	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.5	80	Total			

Subcatchment PS-1: To Northwest



Summary for Subcatchment PS-2: To West

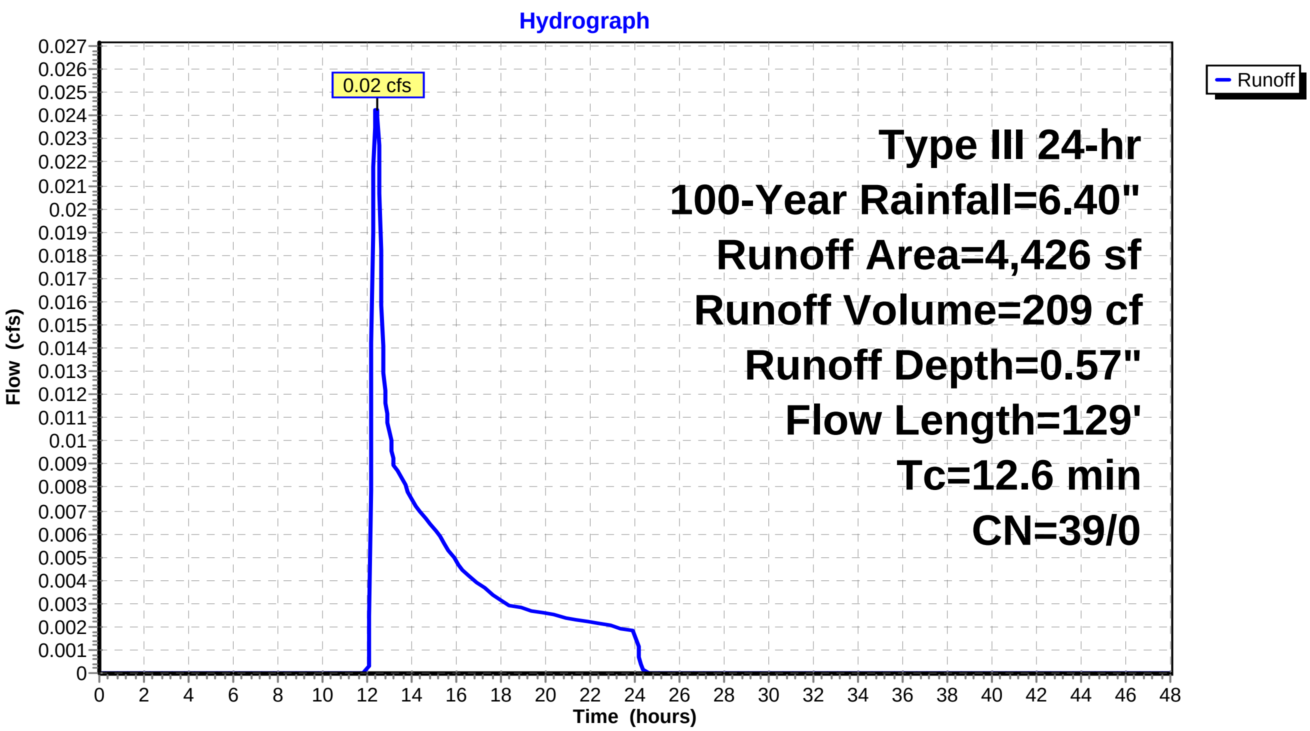
Runoff = 0.02 cfs @ 12.41 hrs, Volume= 209 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
4,426	39	>75% Grass cover, Good, HSG A
4,426	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0080	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.4	79	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.6	129	Total			

Subcatchment PS-2: To West



Summary for Subcatchment PS-3: To Northeast

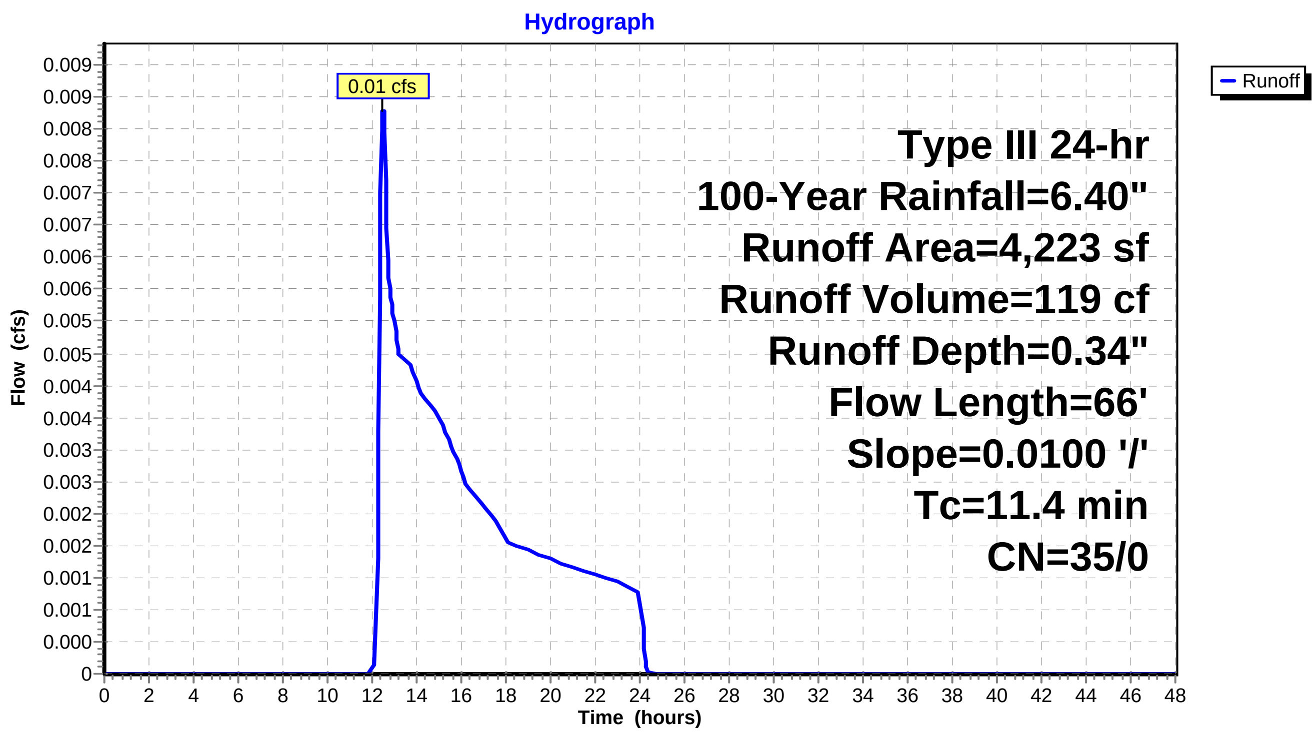
Runoff = 0.01 cfs @ 12.50 hrs, Volume= 119 cf, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,427	39	>75% Grass cover, Good, HSG A
1,796	30	Woods, Good, HSG A
4,223	35	Weighted Average
4,223	35	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	16	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	66	Total			

Subcatchment PS-3: To Northeast



Summary for Subcatchment PS-4: To East

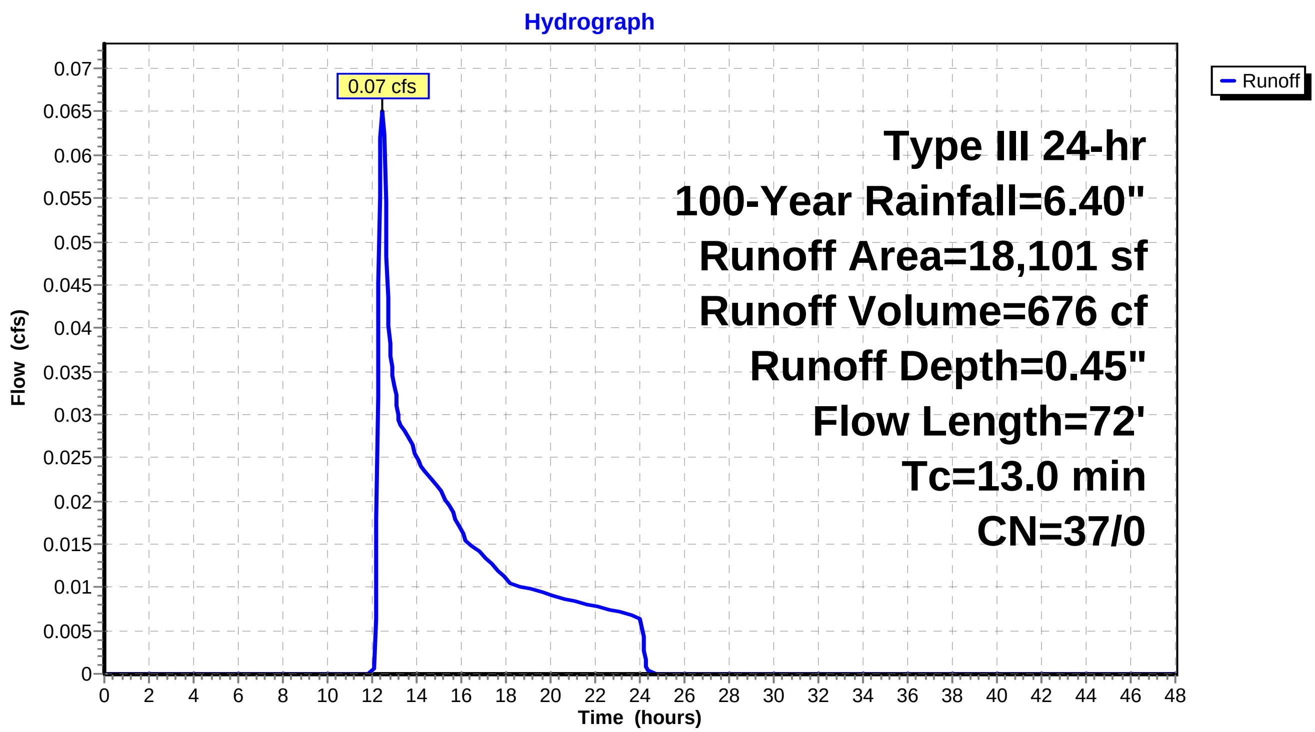
Runoff = 0.07 cfs @ 12.47 hrs, Volume= 676 cf, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
14,935	39	>75% Grass cover, Good, HSG A
3,166	30	Woods, Good, HSG A
18,101	37	Weighted Average
18,101	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0070	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
0.1	22	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	72	Total			

Subcatchment PS-4: To East



Summary for Subcatchment PS-5: To Southwest

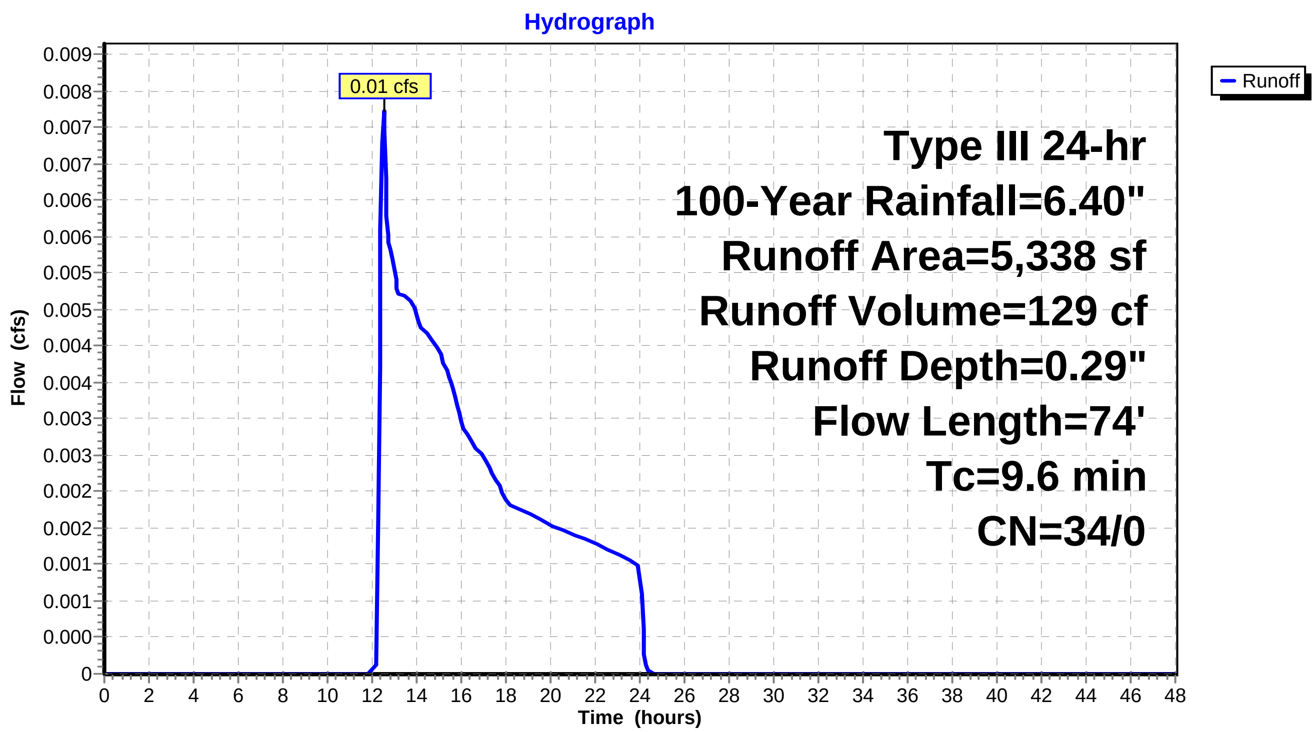
Runoff = 0.01 cfs @ 12.51 hrs, Volume= 129 cf, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,173	39	>75% Grass cover, Good, HSG A
3,165	30	Woods, Good, HSG A
5,338	34	Weighted Average
5,338	34	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0420	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
0.1	24	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.6	74	Total			

Subcatchment PS-5: To Southwest



Summary for Subcatchment PS-6A: To Subsurface #1

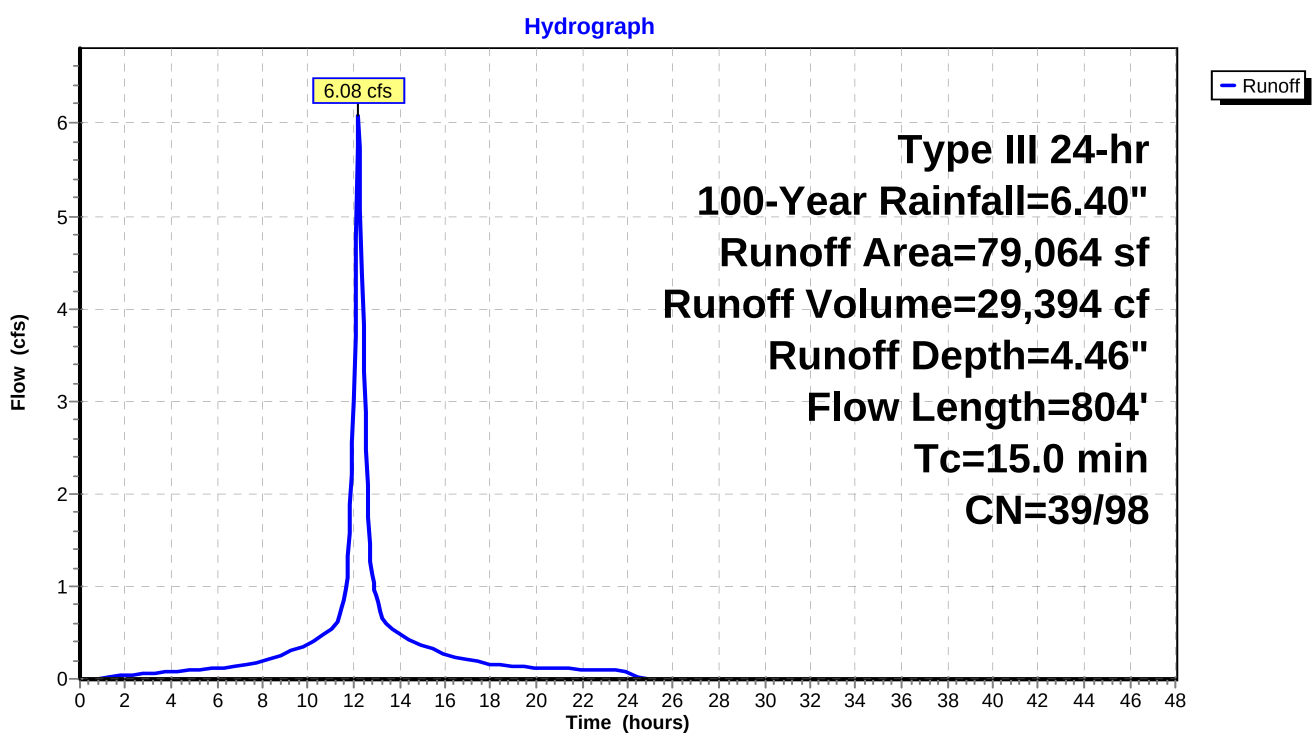
Runoff = 6.08 cfs @ 12.20 hrs, Volume= 29,394 cf, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
34,605	98	Paved parking, HSG A
20,435	98	Roofs, HSG A
24,024	39	>75% Grass cover, Good, HSG A
79,064	80	Weighted Average
24,024	39	30.39% Pervious Area
55,040	98	69.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0090	0.07		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
1.4	124	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	392	0.0150	6.57	5.16	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.9	238	0.0050	4.55	8.05	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
15.0	804	Total			

Subcatchment PS-6A: To Subsurface #1



Summary for Subcatchment PS-6B: To Subsurface #2

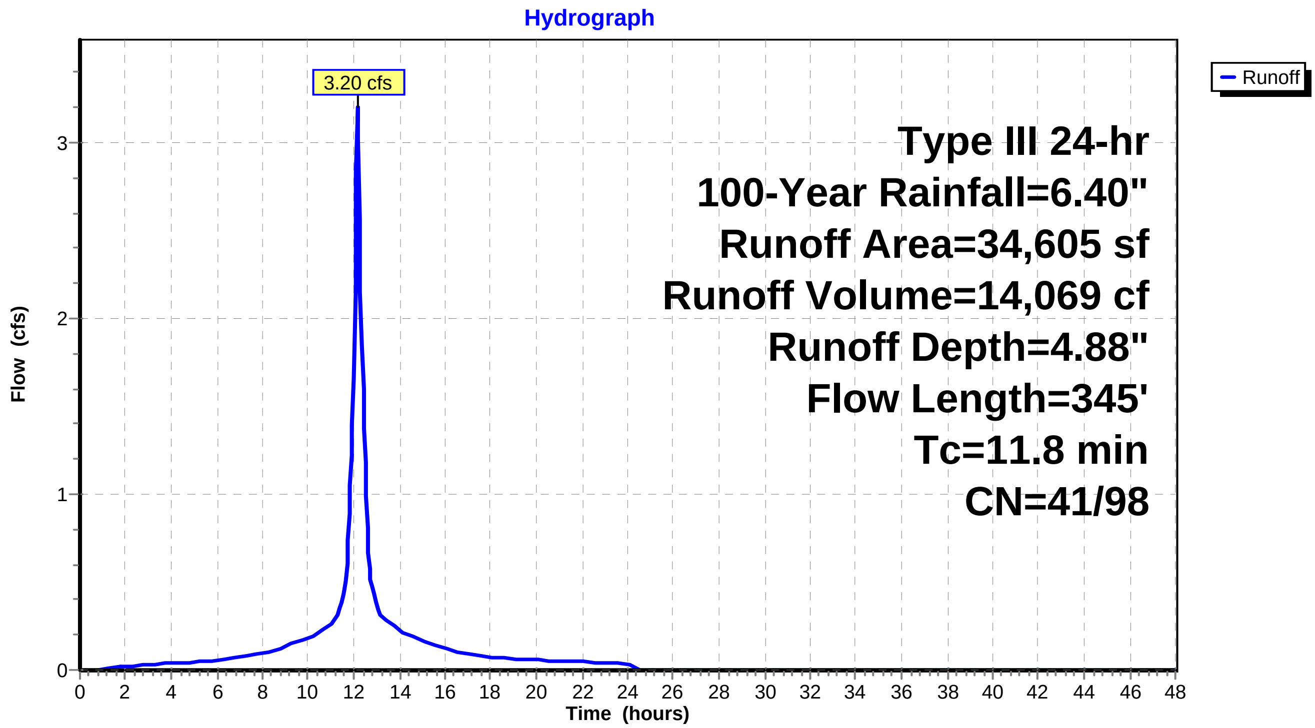
Runoff = 3.20 cfs @ 12.16 hrs, Volume= 14,069 cf, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
16,507	98	Paved parking, HSG A
6,553	98	Roofs, HSG A
7,595	39	>75% Grass cover, Good, HSG A
514	98	Paved parking, HSG C
2,914	98	Roofs, HSG C
522	74	>75% Grass cover, Good, HSG C
34,605	85	Weighted Average
8,117	41	23.46% Pervious Area
26,488	98	76.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	35	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.0150	2.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	96	0.0420	4.16		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	162	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.8	345	Total			

Subcatchment PS-6B: To Subsurface #2



Summary for Subcatchment PS-6C: To Infiltration Basin

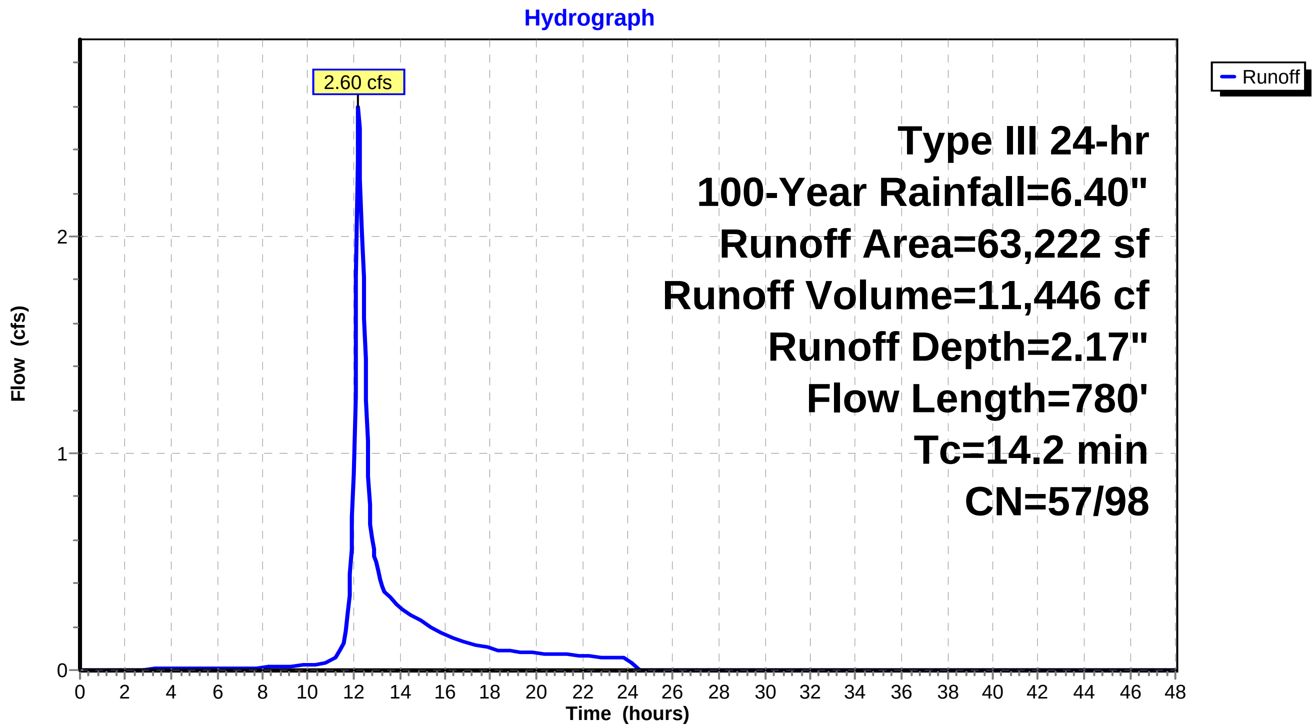
Runoff = 2.60 cfs @ 12.21 hrs, Volume= 11,446 cf, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
1,932	98	Roofs, HSG A
5,420	98	Unconnected roofs, HSG A
18,071	39	>75% Grass cover, Good, HSG A
14,025	30	Woods, Good, HSG A
3,928	98	Unconnected roofs, HSG C
1,778	98	Water Surface, HSG C
18,068	74	>75% Grass cover, Good, HSG C
63,222	59	Weighted Average
59,512	57	94.13% Pervious Area
3,710	98	5.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0110	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.3	321	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	157	0.0350	9.19	7.22	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.8	252	0.0120	5.38	4.23	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
14.2	780	Total			

Subcatchment PS-6C: To Infiltration Basin



Summary for Subcatchment PS-6D: To South

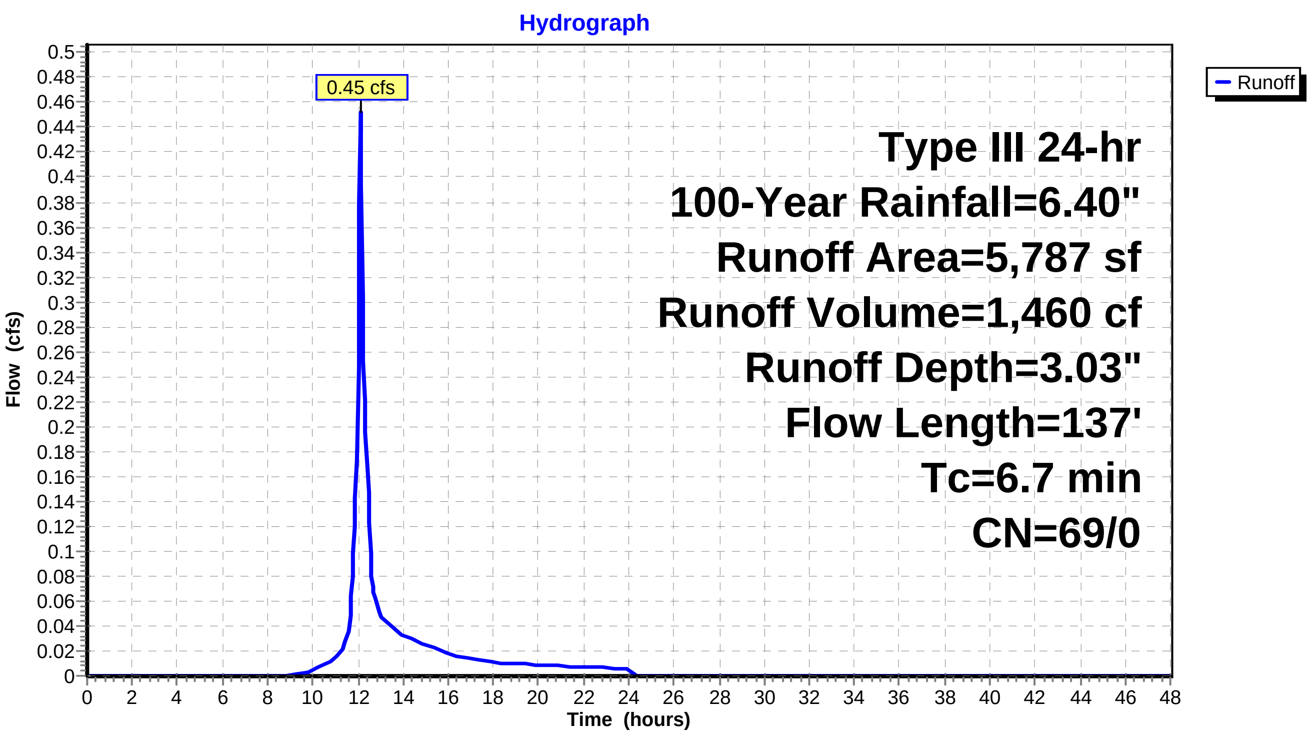
Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,460 cf, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
817	39	>75% Grass cover, Good, HSG A
4,970	74	>75% Grass cover, Good, HSG C
5,787	69	Weighted Average
5,787	69	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	46	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.1	41	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.7	137	Total			

Subcatchment PS-6D: To South



Summary for Pond 1P: Subsurface #1

Inflow Area = 79,064 sf, 69.61% Impervious, Inflow Depth = 4.46" for 100-Year event
Inflow = 6.08 cfs @ 12.20 hrs, Volume= 29,394 cf
Outflow = 0.86 cfs @ 12.98 hrs, Volume= 29,394 cf, Atten= 86%, Lag= 46.8 min
Discarded = 0.31 cfs @ 9.50 hrs, Volume= 21,825 cf
Primary = 0.55 cfs @ 12.98 hrs, Volume= 7,569 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 203.80' @ 12.98 hrs Surf.Area= 5,558 sf Storage= 11,882 cf
Flood Elev= 203.90' Surf.Area= 5,558 sf Storage= 12,104 cf

Plug-Flow detention time= 174.8 min calculated for 29,363 cf (100% of inflow)
Center-of-Mass det. time= 174.8 min (935.1 - 760.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	200.40'	4,900 cf	**63.25'W x 87.88'L x 3.50'H Field A**
			19,454 cf Overall - 7,203 cf Embedded = 12,251 cf x 40.0% Voids
#2A	200.90'	7,203 cf	**ADS_StormTech SC-740** x 156 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
			Row Length Adjustment= +0.44' x 6.45 sf x 13 rows
#3	205.40'	120 cf	**Roadway Flooding (Irregular)** Listed below (Recalc) -Impervious
		12,223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
205.40	2	4.0	0	0	2
205.60	138	76.0	10	10	460
205.80	1,108	1,939.0	109	120	299,190

Device	Routing	Invert	Outlet Devices
#1	Discarded	200.40'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	200.40'	**12.0" Round Culvert** L= 155.0' Ke= 0.500
			Inlet / Outlet Invert= 200.40' / 196.10' S= 0.0277 '/' Cc= 0.900
			n= 0.012, Flow Area= 0.79 sf
#3	Device 2	201.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	203.90'	**4.0' long Overflow Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.31 cfs @ 9.50 hrs HW=200.45' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.55 cfs @ 12.98 hrs HW=203.80' (Free Discharge)
└2=**Culvert** (Passes 0.55 cfs of 6.44 cfs potential flow)
 ├3=**Orifice/Grate** (Orifice Controls 0.55 cfs @ 6.34 fps)
 └4=**Overflow Weir** (Controls 0.00 cfs)

Pond 1P: Subsurface #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740
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
Row Length Adjustment= +0.44' x 6.45 sf x 13 rows

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

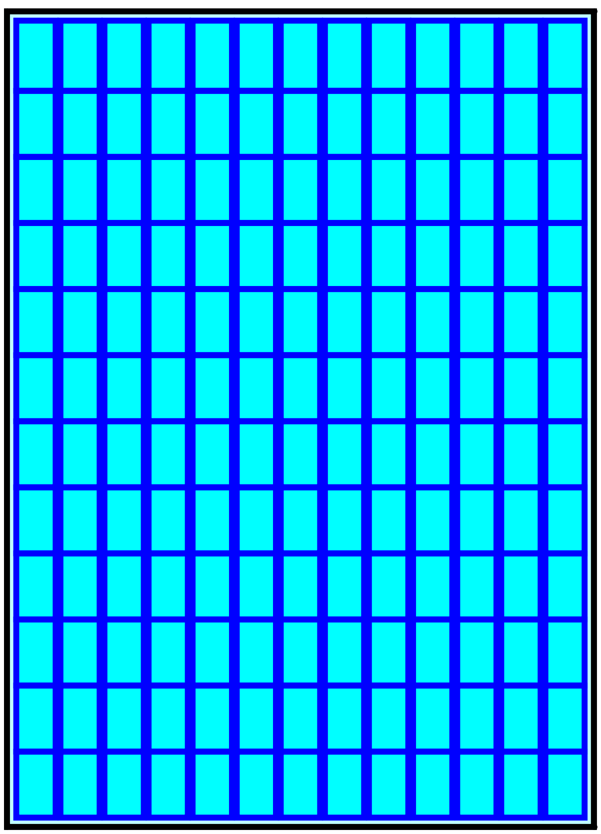
12 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 85.88' Row Length +12.0" End Stone x 2 = 87.88' Base Length
13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

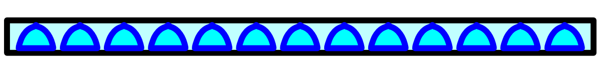
156 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 13 Rows = 7,203.4 cf Chamber Storage

19,454.1 cf Field - 7,203.4 cf Chambers = 12,250.7 cf Stone x 40.0% Voids = 4,900.3 cf Stone Storage

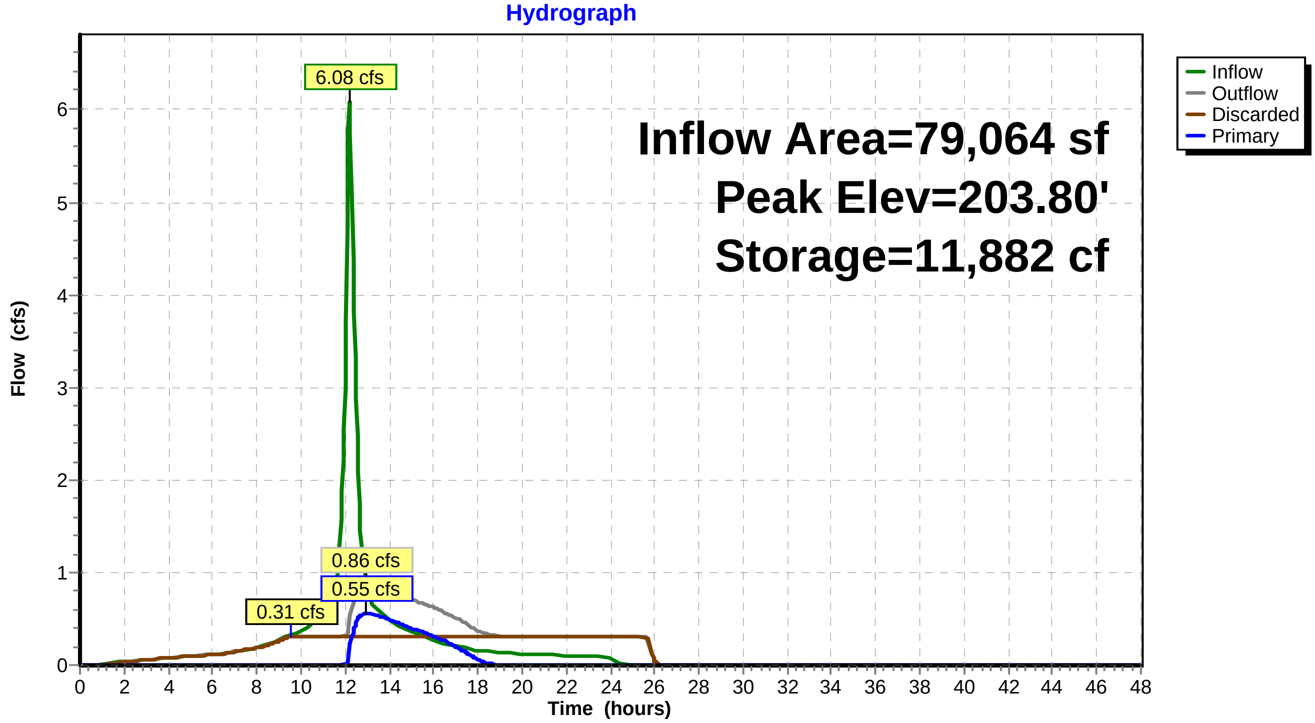
Chamber Storage + Stone Storage = 12,103.7 cf = 0.278 af
Overall Storage Efficiency = 62.2%

156 Chambers
720.5 cy Field
453.7 cy Stone





Pond 1P: Subsurface #1



Summary for Pond 2P: Subsurface #2

Inflow Area = 34,605 sf, 76.54% Impervious, Inflow Depth = 4.88" for 100-Year event
Inflow = 3.20 cfs @ 12.16 hrs, Volume= 14,069 cf
Outflow = 1.97 cfs @ 12.39 hrs, Volume= 14,069 cf, Atten= 39%, Lag= 14.0 min
Discarded = 0.12 cfs @ 8.90 hrs, Volume= 9,197 cf
Primary = 1.84 cfs @ 12.39 hrs, Volume= 4,872 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 199.31' @ 12.39 hrs Surf.Area= 2,209 sf Storage= 4,757 cf
Flood Elev= 199.10' Surf.Area= 2,209 sf Storage= 4,757 cf

Plug-Flow detention time= 146.6 min calculated for 14,069 cf (100% of inflow)
Center-of-Mass det. time= 146.5 min (902.3 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	195.60'	1,983 cf	**30.00'W x 73.64'L x 3.50'H Field A** 7,732 cf Overall - 2,773 cf Embedded = 4,959 cf x 40.0% Voids
#2A	196.10'	2,773 cf	**ADS_StormTech SC-740** x 60 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 Row Length Adjustment= +0.44' x 6.45 sf x 6 rows
#3	200.92'	84 cf	**Roadway Flooding (Irregular)** Listed below (Recalc) -Impervious
		4,841 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
200.92	2	4.0	0	0	2
201.00	37	38.0	1	1	116
201.20	1,009	242.0	83	84	4,661

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.60'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	193.10'	**12.0" Round Culvert** L= 135.0' Ke= 0.500 Inlet / Outlet Invert= 193.10' / 186.51' S= 0.0488 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	197.35'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	199.10'	**4.0' long Overflow Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 8.90 hrs HW=195.66' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=1.73 cfs @ 12.39 hrs HW=199.30' (Free Discharge)
└2=**Culvert** (Passes 1.73 cfs of 9.03 cfs potential flow)
  ├3=**Orifice/Grate** (Orifice Controls 0.56 cfs @ 6.43 fps)
  └4=**Overflow Weir** (Weir Controls 1.17 cfs @ 1.47 fps)

Pond 2P: Subsurface #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740
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
Row Length Adjustment= +0.44' x 6.45 sf x 6 rows

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

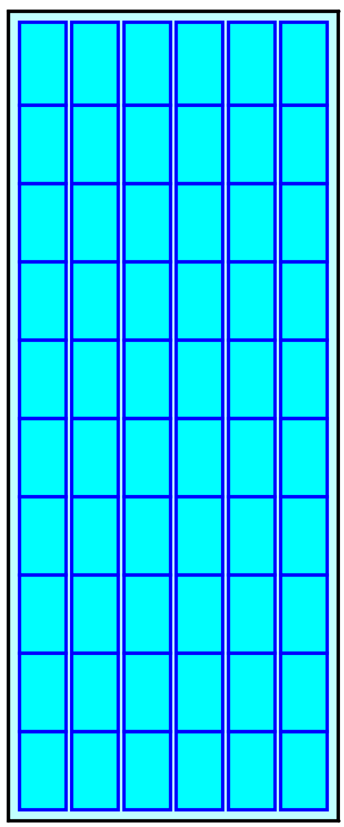
10 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 71.64' Row Length +12.0" End Stone x 2 = 73.64' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

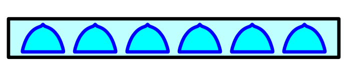
60 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 6 Rows = 2,773.4 cf Chamber Storage

7,732.0 cf Field - 2,773.4 cf Chambers = 4,958.7 cf Stone x 40.0% Voids = 1,983.5 cf Stone Storage

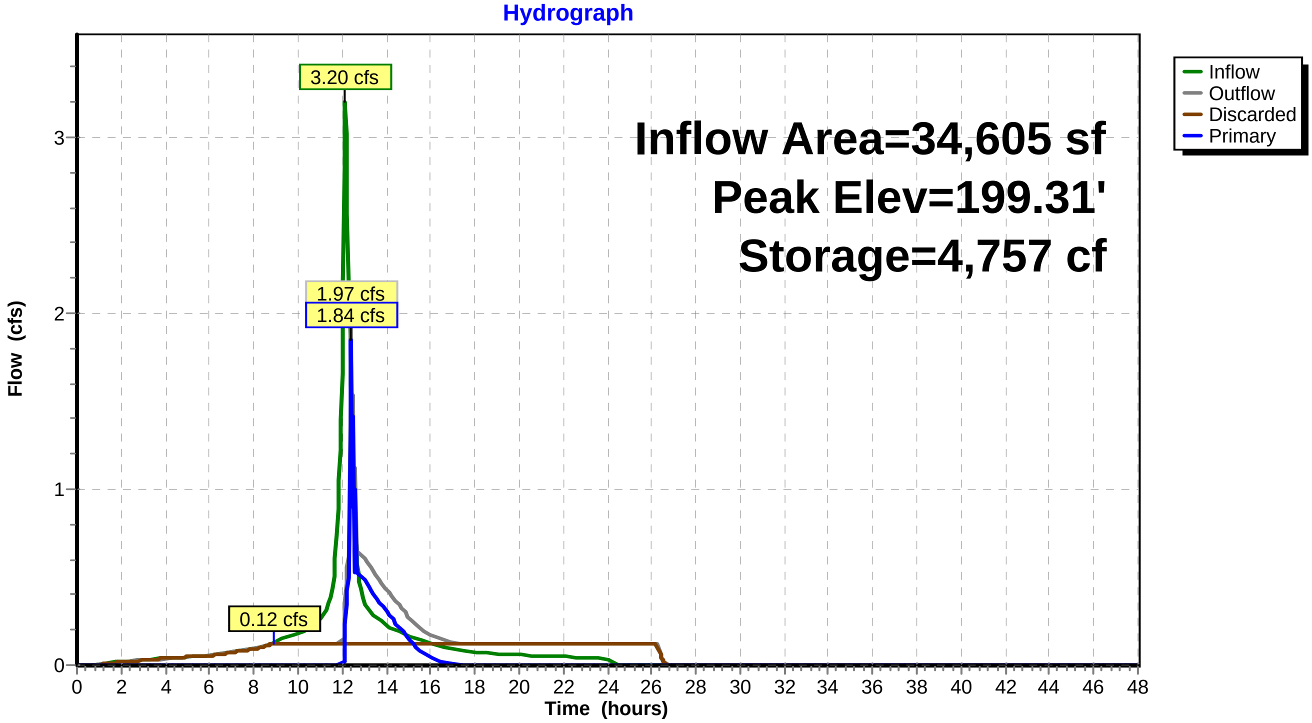
Chamber Storage + Stone Storage = 4,756.8 cf = 0.109 af
Overall Storage Efficiency = 61.5%

60 Chambers
286.4 cy Field
183.7 cy Stone





Pond 2P: Subsurface #2



Summary for Pond 3P: Infiltration Basin

Inflow Area = 176,891 sf, 48.19% Impervious, Inflow Depth = 1.62" for 100-Year event
Inflow = 4.09 cfs @ 12.39 hrs, Volume= 23,887 cf
Outflow = 1.34 cfs @ 13.29 hrs, Volume= 23,887 cf, Atten= 67%, Lag= 54.1 min
Discarded = 0.09 cfs @ 13.29 hrs, Volume= 5,941 cf
Primary = 1.25 cfs @ 13.29 hrs, Volume= 17,946 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 185.24' @ 13.29 hrs Surf.Area= 3,906 sf Storage= 6,226 cf
Flood Elev= 185.50' Surf.Area= 4,201 sf Storage= 7,288 cf

Plug-Flow detention time= 137.9 min calculated for 23,862 cf (100% of inflow)
Center-of-Mass det. time= 138.6 min (988.1 - 849.6)

Volume	Invert	Avail.Storage	Storage Description
#1	183.00'	9,534 cf	**Basin Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
183.00	1,778	198.0	0	0	1,778
184.00	2,642	227.0	2,196	2,196	2,782
185.00	3,648	258.0	3,132	5,327	4,002
186.00	4,792	288.0	4,207	9,534	5,334

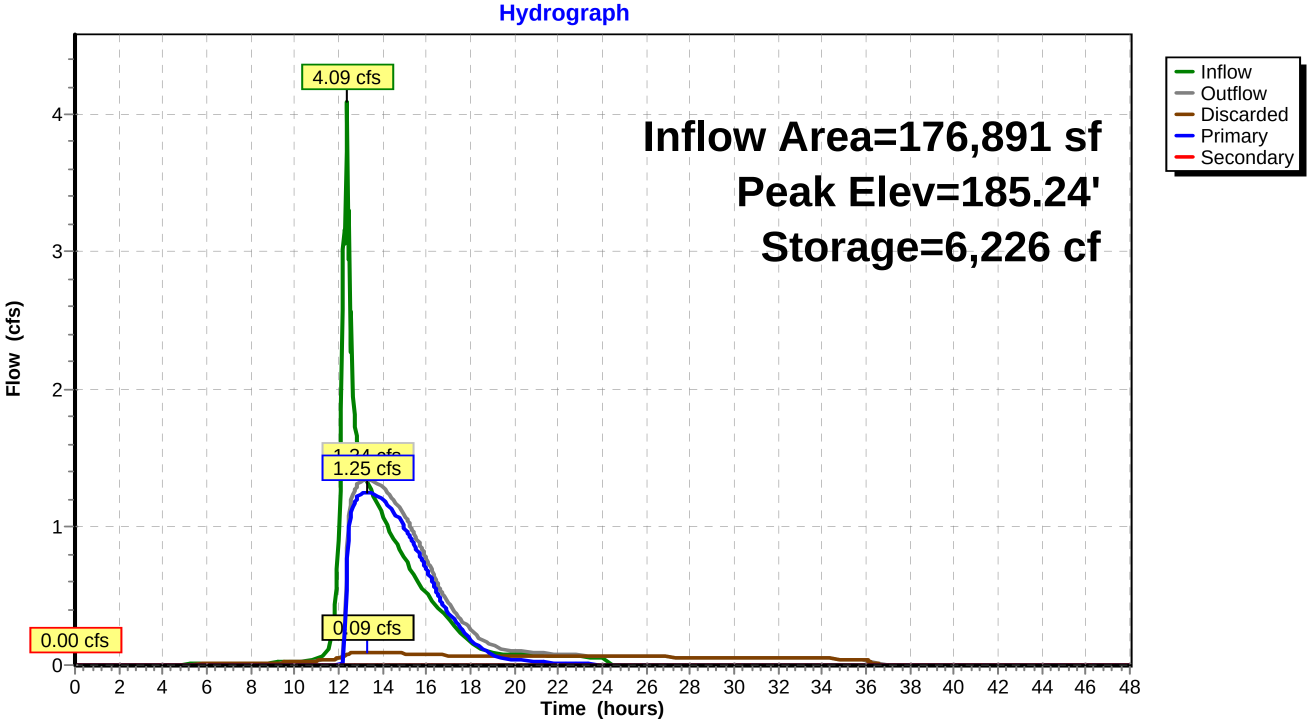
Device	Routing	Invert	Outlet Devices
#1	Discarded	183.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 3	184.00'	**7.0" Vert. Orifice** C= 0.600
#3	Primary	183.00'	**12.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 183.00' / 182.04' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Device 3	185.25'	**4.0" W x 4.0" H Vert. Outlet Structure Grate** C= 0.600
#5	Secondary	185.50'	**10.0' long x 10.0' breadth Emergency Overflow** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.09 cfs @ 13.29 hrs HW=185.24' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=1.25 cfs @ 13.29 hrs HW=185.24' (Free Discharge)
└3=**Culvert** (Passes 1.25 cfs of 4.99 cfs potential flow)
  ├2=**Orifice** (Orifice Controls 1.25 cfs @ 4.68 fps)
  └4=**Outlet Structure Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=183.00' (Free Discharge)
└5=**Emergency Overflow** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

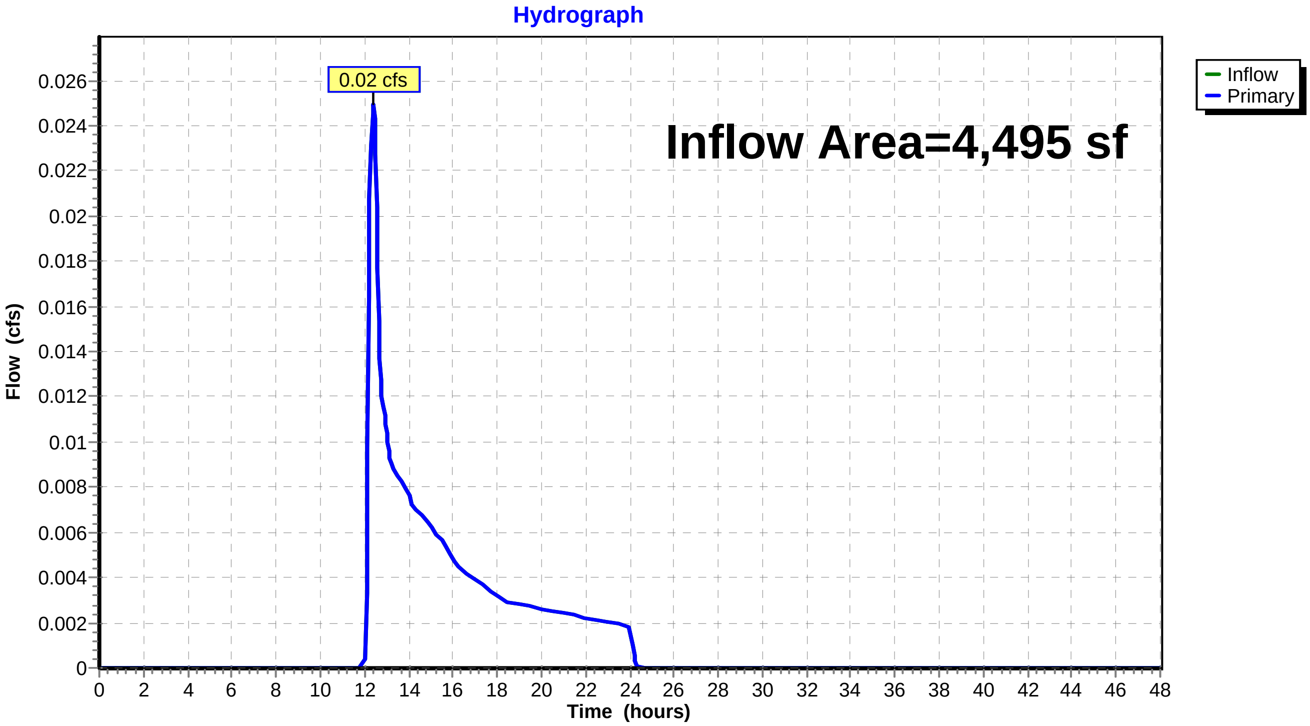


Summary for Link DP-1: Offsite to North/West

Inflow Area =	4,495 sf,	0.00% Impervious, Inflow Depth = 0.57"	for 100-Year event
Inflow =	0.02 cfs @ 12.39 hrs, Volume=	212 cf	
Primary =	0.02 cfs @ 12.39 hrs, Volume=	212 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

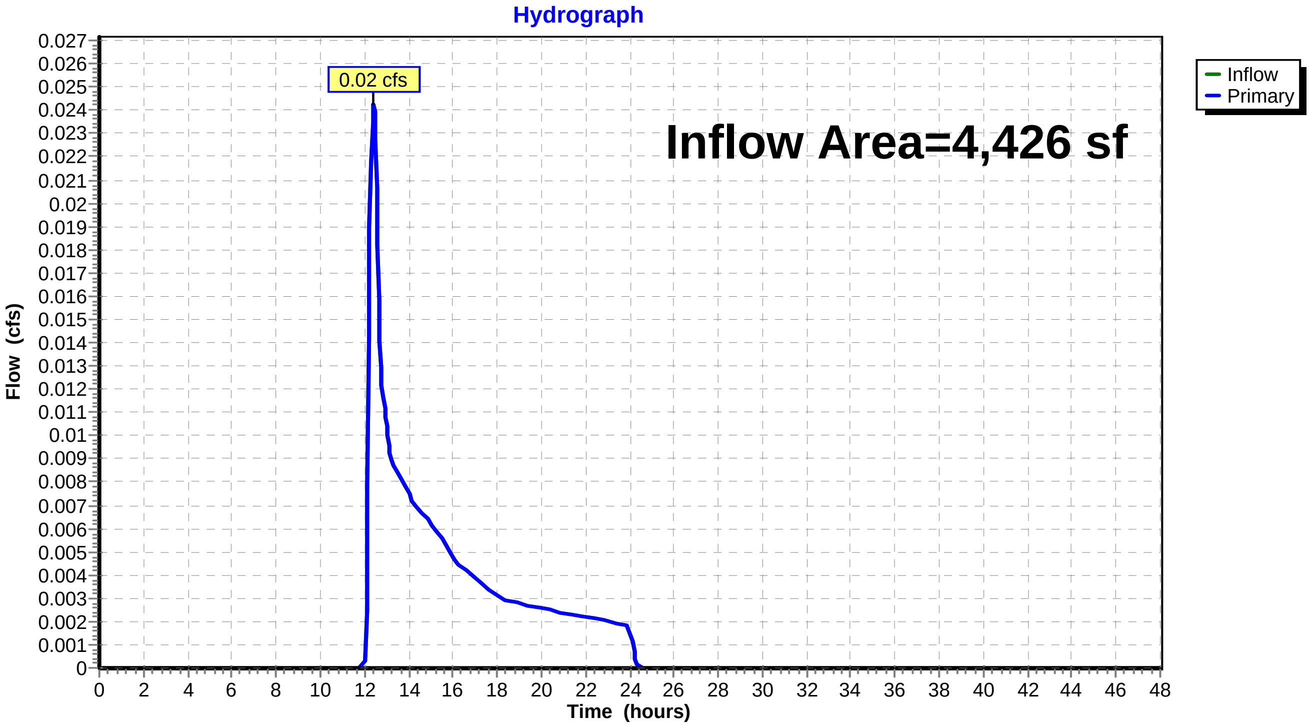


Summary for Link DP-2: Offsite to West

Inflow Area = 4,426 sf, 0.00% Impervious, Inflow Depth = 0.57" for 100-Year event
Inflow = 0.02 cfs @ 12.41 hrs, Volume= 209 cf
Primary = 0.02 cfs @ 12.41 hrs, Volume= 209 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

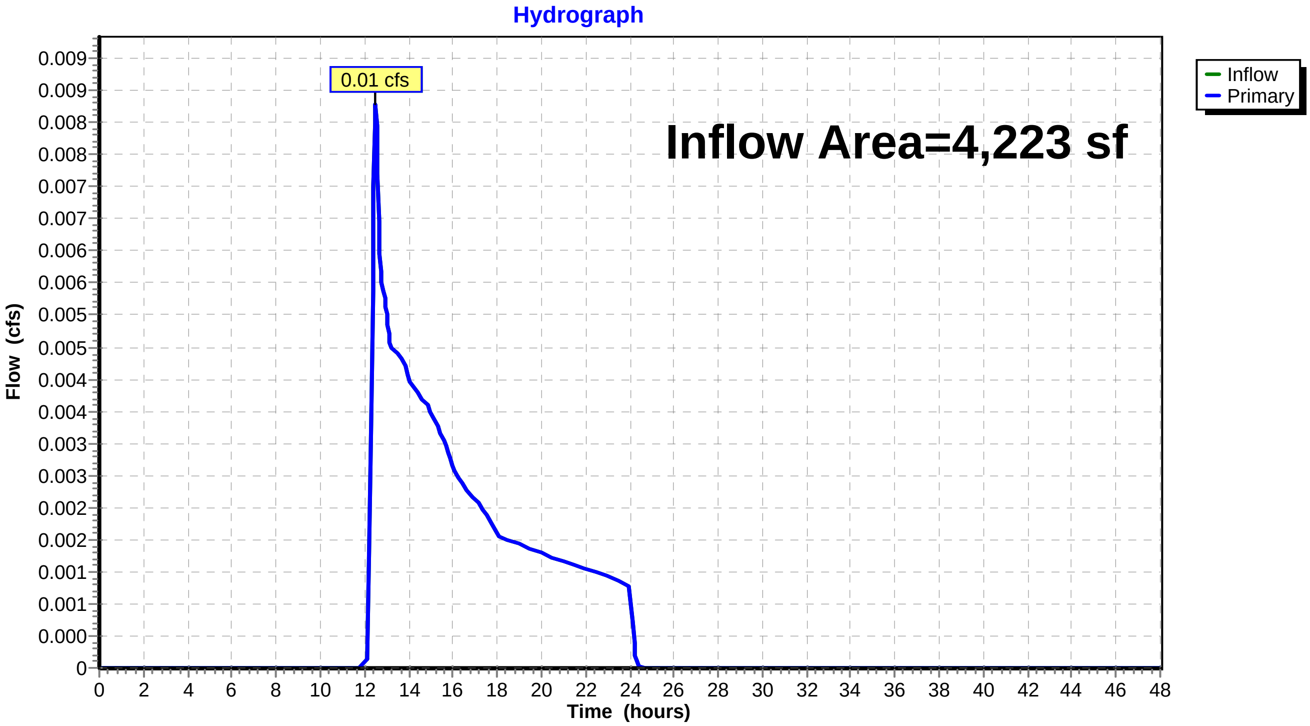


Summary for Link DP-3: Offsite to Northeast

Inflow Area = 4,223 sf, 0.00% Impervious, Inflow Depth = 0.34" for 100-Year event
Inflow = 0.01 cfs @ 12.50 hrs, Volume= 119 cf
Primary = 0.01 cfs @ 12.50 hrs, Volume= 119 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

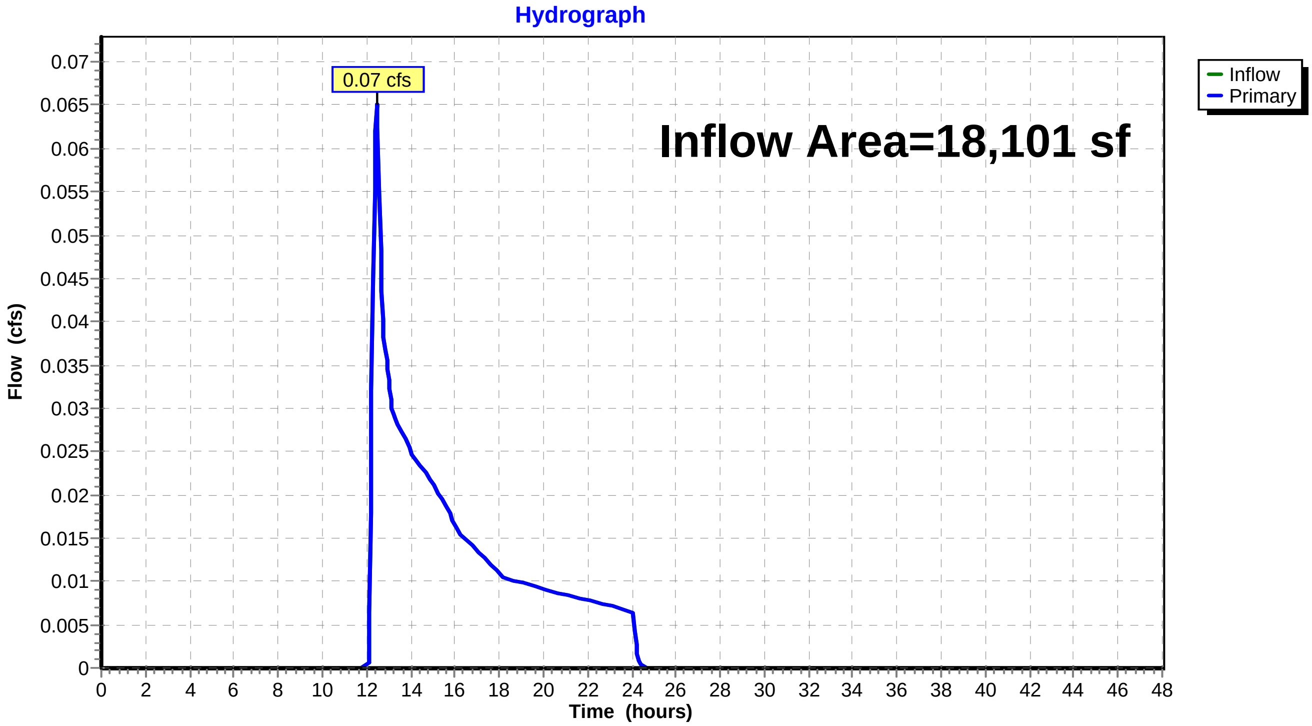


Summary for Link DP-4: East Edge of Property

Inflow Area = 18,101 sf, 0.00% Impervious, Inflow Depth = 0.45" for 100-Year event
Inflow = 0.07 cfs @ 12.47 hrs, Volume= 676 cf
Primary = 0.07 cfs @ 12.47 hrs, Volume= 676 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

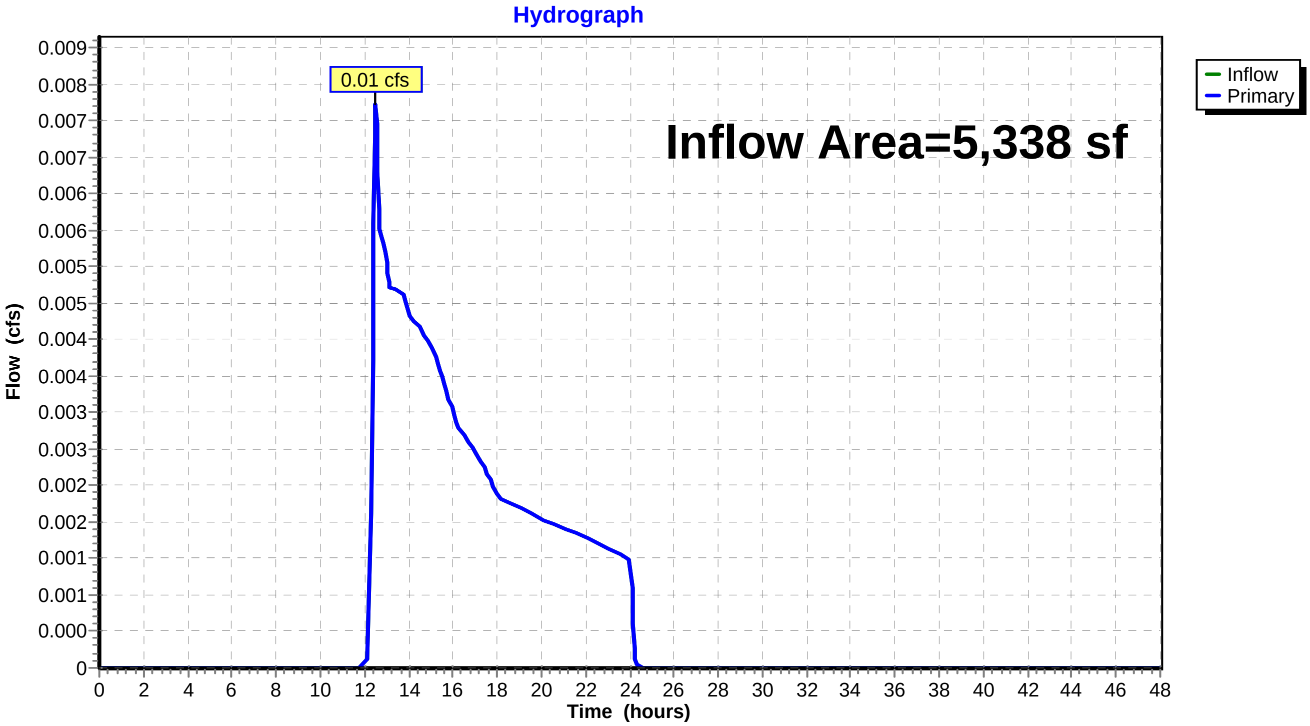


Summary for Link DP-5: Southwest Corner

Inflow Area = 5,338 sf, 0.00% Impervious, Inflow Depth = 0.29" for 100-Year event
Inflow = 0.01 cfs @ 12.51 hrs, Volume= 129 cf
Primary = 0.01 cfs @ 12.51 hrs, Volume= 129 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

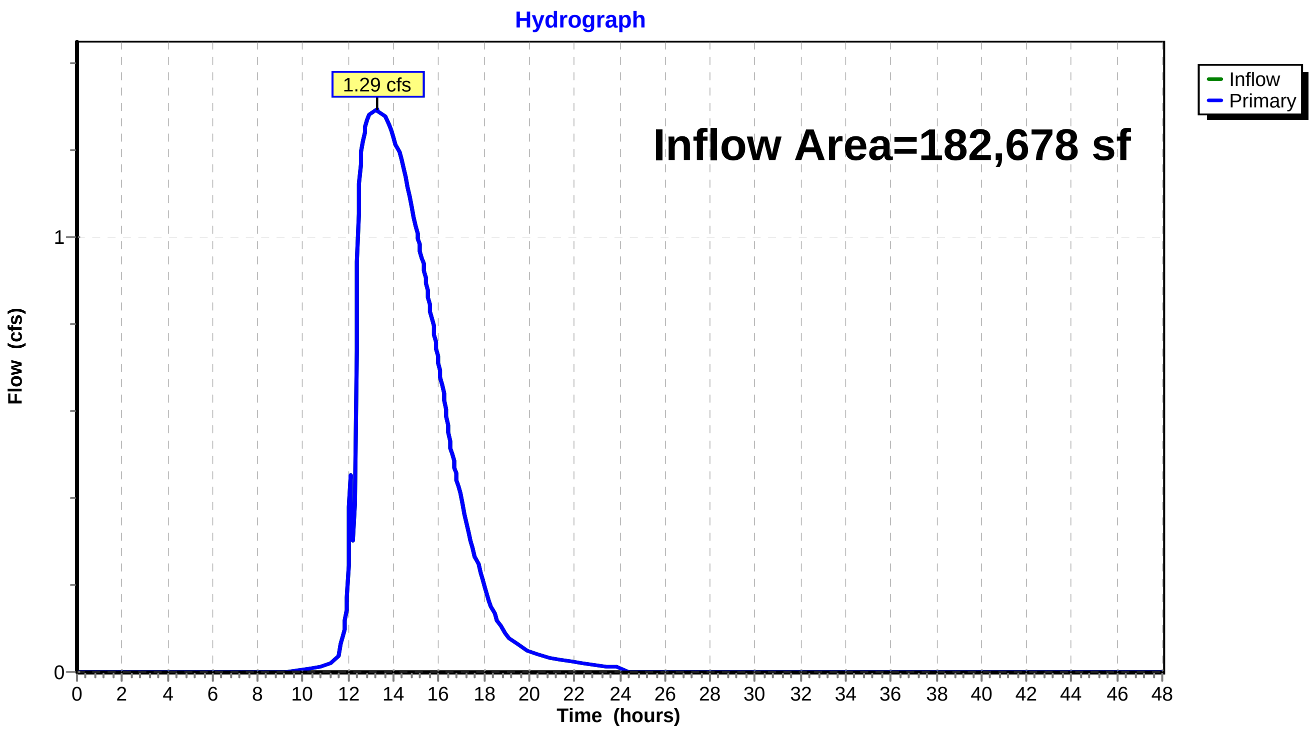


Summary for Link DP-6: South Corner

Inflow Area =	182,678 sf, 46.66% Impervious, Inflow Depth = 1.27" for 100-Year event	
Inflow =	1.29 cfs @ 13.24 hrs, Volume=	19,407 cf
Primary =	1.29 cfs @ 13.24 hrs, Volume=	19,407 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner



Appendix D: MassDEP Calculations

Standard 3: Recharge Calculations

Required Recharge Volume Sizing (R_V)

R_V (required) = F x Impervious Area

where: R_V = Required Recharge Volume (cu. ft.)

F = Target Depth Factor

0.60 inch	(A-soils)
0.35 inch	(B-soils)
0.25 inch	(C-soils)
0.10 inch	(D-soils)

New Impervious Area by Hydrologic Soil Type

Impervious Area (A-soils)	**85,452 sq. ft.**	92.1%
Impervious Area (B-soils)	**0 sq. ft.**	0.0%
Impervious Area (C-soils)	**7,356 sq. ft.**	7.9%
Impervious Area (D-soils)	**0 sq. ft.**	0.0%
Total Impervious area	**92,808 sq. ft.**	100.0%

R_v (required) = $\sum$ [$F_{\text{Soil Type}}$ x Impervious $\text{Area}_{\text{Soil Type}}$] x 1 ft./12 in.

R_v (required) = **4,426 cu. ft.**

Recharge Volume Storage Provided

Recharge Facility	Volume Provided	
Subsurface Basin #1	5,677 cu. ft.*	54.0% (A-soils)
Subsurface Basin #2	2,644 cu. ft.**	25.1% (A-soils)
Infiltration Basin	2,196 cu. ft.***	20.9% (C-soils)
Total	10,517 cu. ft.	

R_V (provided) 10,517 cu. ft. > 4,426 cu. ft.

* Volume represents the available storage in Subsurface Basin #1 to outlet:
Elevation = 201.9 (depth of water in basin above stone bottom = 1.50 feet)

** Volume represents the available storage in Subsurface Basin #2 to outlet:
Elevation = 197.35 (depth of water in basin above stone bottom = 1.75 feet)

*** Volume represents the available storage in the Infiltration Basin to outlet:
Elevation = 184.00 (depth of water in basin = 1.0 feet)

Drawdown Analysis

$$T_{DRAWDOWN} = \frac{R_V}{KA}$$

where: $T_{DRAWDOWN}$ = time in hours

R_V = required recharge volume **(cu. ft.)**

K = Rawls rate **2.41 inches/hour** (A-soils)*
0.52 inches/hour (B-soils)*
0.27 inches/hour (C-soils)*

A = bottom area of recharge facility **(cu. ft.)**

*Most conservative Rawls rate values for given soil type used for analysis purposes

Subsurface Basin #1

R_V = 5,677 cu. ft.
A = 5,558 cu. ft.

$T_{DRAWDOWN}$ = **5.1 hours < 72 hours (A-soils)**

Subsurface Basin #2

R_V = 2,644 cu. ft.
A = 2,209 cu. ft.

$T_{DRAWDOWN}$ = **6.0 hours < 72 hours (A-soils)**

Infiltratration Basin

R_V = 2,196 cu. ft.
A = 1,778 cu. ft.

$T_{DRAWDOWN}$ = **54.9 hours < 72 hours (C-soils)**

Standard 4: Water Quality

Water Quality Volume Conversion to Flow Rate

Note: Required water quality volume based on 0.5-inch of runoff

$$Q_{0.5} = (qu)\ (A)\ (WQV)$$

where: **$Q_{0.5}$** = peak flow rate associated with first 0.5-inch of runoff (c.f.s.)

qu = unit peak discharge (csm/in) - value taken from table based on t_c

A = impervious surface drainage area (sq. mi.)

WQV = water quality volume in watershed inches (0.5-inch)

· Proposed Water Quality Unit #1 (PWQU-1)

t_c =	0.250	hrs	
qu =	606	csm/in	(from table)
A =	0.00160	sq. mi.*	
WQV =	0.5	inch	

$Q_{0.5}$ = **0.48 c.f.s**

The Stormceptor STC-900 provides 80% TSS removal for flows up to 0.89 c.f.s.

· Proposed Water Quality Unit #2 (PWQU-2)

t_c =	0.197	hrs	(Use T_C = 0.183 hrs)
qu =	662	csm/in	(from table)
A =	0.00061	sq. mi.*	
WQV =	0.5	inch	

$Q_{0.5}$ = **0.20 c.f.s**

The Stormceptor STC-450i provides 80% TSS removal for flows up to 0.40 c.f.s.

* Excludes roof runoff that ties directly into subsurface system

TSS Removal Form - Subsurface Basin #1

Total TSS Removal

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump, Hooded CB	0.25	1.00	0.25	0.75
Stormceptor Manhole (STC-900)	0.80	0.75	0.60	0.15
Subsurface Basin #1	0.80	0.15	0.12	0.03

Total TSS Removal = 97%

TSS Removal Form - Subsurface Basin #2

Total TSS Removal

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump, Hooded CB	0.25	1.00	0.25	0.75
Stormceptor Manhole (STC-450i)	0.80	0.75	0.60	0.15
Subsurface Basin #2	0.80	0.15	0.12	0.03

Total TSS Removal = 97%

Sediment Forebay Sizing - Infiltration Basin

$$V_{SF}\text{ (required)} = \frac{\text{0.1-inch}}{\text{Impervious Acre}}$$

where: V_{SF} (required) = required volume of the sediment forebay (cu. ft.)

Impervious Acre = amount of impervious area tributary to recharge facility (acres)

= 0.26 acres *

V_{SF} (required) = 94 cu.ft.

V_{SF} (provided) = 145 cu. ft.

* Includes both "connected" and "unconnected" impervious area

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

Massachusetts Stormwater Evaluation Project

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MASTEP Technology Review

Technology Name: Stormceptor

Studies Reviewed: Final NJCAT Technology Verification Stormceptor STC900 September 2004; Coventry University Study, 1996; Technology Assessment, University of Massachusetts, 1997; SeaTac Stormceptor Performance report 2001; SWAMP report Ontario 2004; Phoenix Group Edmonton report 1995; Stormceptor 1200 Field Evaluation report 2004; Applied Hydrology Associates Denver report 2003; Rinker Materials Como Park St. Paul MN report 2002; VA DOT / UVA "Testing of Ultra-Urban Stormwater Best Management Practices" report 2001.
Hydrodynamic Separator Sediment Retention Testing, Mohseni, 2010.

Date: September 17, 2013

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: This rating is primarily based on the 2005 NJCAT Technology Verification study. In general, this was a well-conducted test, which in large part followed NJDEP test guidelines for laboratory studies, which MASTEP considers as the laboratory equivalent of TARP field protocols. Issues of concern: the study measured suspended sediment concentration (SSC) rather than total suspended solids (TSS). Although SSC is considered by many scientists to be the preferred method, it is at odds with Massachusetts stormwater regulations, which are based on TSS treatment. Comparing SSC and TSS results is considered an inexact science. The test was conducted with higher influent sediment concentrations than is preferred, but results were fairly consistent across all ranges studied. The particle size distribution also appears to be slightly higher than the target test range. There are additional field studies that in general support the results obtained in this laboratory studies. These studies do not satisfy TARP protocols, but they do not contradict results obtained in the NJCAT study.

TARP Requirements Not Met*:

- Measurements in TSS.
- Influent sediment concentration is 100 – 300 mg/l: actual was 153-460.
- No documentation of a Quality Assurance Project Plan
- Third party studies are preferred. This was conducted by Stormceptor personnel, with sample analyses conducted by an external laboratory.

Other Comments:
* The 2010 Mohseni study evaluates the susceptibility of the Stormceptor to scouring, or washout of collected sediments. Report concluded that the unit does not scour at high flows as long as sediment depth does not exceed maintenance level.

* Criteria also based on NJDEP laboratory testing guidelines.

Stormceptor® STC

Stormceptor® is an underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention. With thousands of systems operating worldwide, Stormceptor delivers protection every day in every storm.

With patented technology, optimal treatment occurs by allowing free oil to rise and sediment to settle. The Stormceptor design prohibits scour and release of previously captured pollutants, ensuring superior treatment and protection during even the most extreme storm events.

Stormceptor is very easy to design and provides flexibility under varying site constraints such as tight right-of-ways, zero lot lines and retrofit projects. Design flexibility allows for a cost-effective approach to stormwater treatment. Stormceptor has proven performance backed by the longest record of lab and field verification in the industry.

Tested Performance

- Fine particle capture
- Prevents scour or release
- 95%+ Oil removal

Massachusetts – Water Quality (Q) Flow Rate

Stormceptor STC Model	Inside Diameter (ft)	Typical Depth Below Inlet Pipe Invert [1] (in)	Water Quality Flow Rate Q [2] (cfs)	Peak Conveyance Flow Rate [3] (cfs)	Hydrocarbon Capacity [4] (Gallons)	Maximum Sediment Capacity [4] (ft^3)
STC 450i	4	68	0.40	5.5	86	46
STC 900	6	63	0.89	22	251	89
STC 2400	8	104	1.58	22	840	205
STC 4800	10	140	2.47	22	909	543
STC 7200	12	148	3.56	22	1,059	839
STC 11000	2 x 10	142	4.94	48	2,792	1,086
STC 16000	2 x 12	148	7.12	48	3,055	1,677

[1] Depth Below Pipe Inlet Invert to the Bottom of Base Slab, and Maximum Sediment Capacity can vary to accommodate specific site designs and pollutant loads. Depths can vary to accommodate special designs or site conditions. Contact your local representative for assistance.
[2] Water Quality Flow Rate (Q) is based on 80% annual average TSS removal of the OK110 particle size distribution.
[3] Peak Conveyance Flow Rate is based upon ideal velocity of 3 feet per second and outlet pipe diameters of 18-inch, 36-inch, and 54-inch diameters.
[4] Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

Figure 2: For First ½-inch of Runoff, Table of qu values for Ia/P Curve = 0.0.058, listed by tc, for Type III Storm Distribution

	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)
	0.01	821	1.8	246	5.3	116	8.8	77
	0.03	821	1.9	238	5.4	115	8.9	76
	0.05	813	2	230	5.5	113	9	76
	0.067	794	2.1	223	5.6	112	9.1	75
	0.083	773	2.2	217	5.7	110	9.2	74
	0.1	752	2.3	211	5.8	109	9.3	74
	0.116	733	2.4	205	5.9	107	9.4	73
	0.133	713	2.5	200	6	106	9.5	72
	0.15	694	2.6	194	6.1	104	9.6	72
	0.167	677	2.7	190	6.2	103	9.7	71
PWQU-2	0.183	662	2.8	185	6.3	102	9.8	70
	0.2	646	2.9	181	6.4	100	9.9	70
	0.217	632	3	176	6.5	99	10	69
	0.233	619	3.1	173	6.6	98		
PWQU-1	0.25	606	3.2	169	6.7	97		
	0.3	572	3.3	165	6.8	96		
	0.333	552	3.4	162	6.9	94		
	0.35	542	3.5	158	7	93		
	0.4	516	3.6	155	7.1	92		
	0.416	508	3.7	152	7.2	91		
	0.5	472	3.8	149	7.3	90		
	0.583	443	3.9	147	7.4	89		
	0.6	437	4	144	7.5	88		
	0.667	417	4.1	141	7.6	87		
	0.7	408	4.2	139	7.7	86		
	0.8	383	4.3	136	7.8	85		
	0.9	361	4.4	134	7.9	84		
	1	342	4.5	132	8	84		
	1.1	325	4.6	130	8.1	83		
	1.2	311	4.7	128	8.2	82		
	1.3	297	4.8	126	8.3	81		
	1.4	285	4.9	124	8.4	80		
	1.5	274	5	122	8.5	79		
	1.6	264	5.1	120	8.6	79		
	1.7	254	5.2	118	8.7	78		

Appendix E: Construction Period Erosion Control Plan

Construction Period Erosion Control Plan

Rivercrest Condominiums

Ferry Street (Map 47, Parcel 76)
South Hadley, Massachusetts

Project Location:

Ferry Street
Map 47, Parcel 76
South Hadley, Massachusetts

Prepared for:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

June 18, 2014

R LEVESQUE ASSOCIATES, INC
A LAND PLANNING SERVICES COMPANY
40 School Street · Westfield, MA 01085
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RLA

The project shall implement a construction period erosion control plan. The following provides descriptions and guidelines to ensure that the areas surrounding the project site will be protected from excessive sedimentation and runoff during construction.

1.1 Construction Period Pollution Prevention And Erosion Control Measures

1.1.1 Preconstruction Notifications And Meetings

Prior to the start of construction, the contractor shall call together a pre-construction meeting including a representative from the Town of South Hadley, the design engineer, contractor, and any pertinent persons that should be in attendance. These requirements shall be the responsibility of the Contractor to arrange, attend, and document.

1.1.2 Sediment Barrier And Work Limit

Before installation of the sediment barriers, the location shall be staked in the field for review and approval by the owner or their representative. To facilitate sediment barrier installation, woody vegetation may then be removed and any required trench may be cut by machine, provided all other ground cover is left intact. No excavation, grading, filling, or removal of vegetative ground cover shall begin until sediment barriers have been installed as shown on the plans and have been inspected by the owner or their representative.

1.1.3 Silt Fence

The bottom of the fence shall be trenched into the ground a minimum of 6" and back-filled with compacted soil. Where trenching is not feasible, silt fence skirt shall be covered with compacted soil or crushed stone. The top of the fabric shall be stretched as tightly as is practical, with intermediate stakes added to correct excessive sags. Stakes shall be driven at least 12" into the ground. Splices between sections shall be made by rolling end stakes together one complete turn and driving into the ground together.

1.1.4 Straw Bales

Straw bales may be used as temporary and moveable control measures, temporary check dams, or as reinforcement for silt fence in areas of concentrated runoff or high fills. Bales shall be tightly butted and staked 12" into the ground. Where used without silt fence in front, the bales shall be trenched 4" into the ground, back-filled with compacted soil, and the spaces between bales shall be chinked with loose hay.

1.1.5 Filter Sock (Filtrexx Or Equivalent)

In areas of expected sheet flow, filter sock may be placed directly on the ground without trenching or stakes. In areas of expected concentrated flow, mulch or crushed stone shall be placed along the up-slope face to control and filter underflow. Additional layers of Filter Sock may be required for adequate freeboard. The filter sock shall be staked at 10 feet on-center or in cases where they cannot be staked, utilize heavy concrete blocks to hold in place.

1.1.6 Temporary Sedimentation Basins

Temporary sediment basins may be excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion. If the temporary basin is to be located within an area of future infiltration as part of the stormwater management system, the excavation for the temporary sedimentation basin shall be limited to one foot above final grade of the infiltration structure.

1.1.7 Stocking Additional Materials

A stock of additional erosion control materials shall be available on the site for emergency repairs and temporary measures. Stock shall be replenished when decreased to 50% of the numbers below. Stock shall include:

Straw Bales – 10 (kept dry) with 20 oak stakes

Or

Silt Fence – 30 Linear feet.

Or

Filter Sock – 4 – 8 foot sections (kept dry)

Washed Stone – One (1) cubic yard, ¾″ to 2″ diameter

1.1.8 Trench Protection

Open trenches shall be protected from accumulation of surface water or groundwater that could result in erosion of the trench and discharge of sediment. Where feasible, spoil shall be stockpiled on the up-slope side of the trench to prevent entrance of surface runoff. Backfill shall be crowned to allow for settlement and to avoid concentration of runoff on top of the trench.

1.1.9 Site Stabilization – Temporary

Where a portion of the site will not be subject to construction activity for over 14 days, measures shall be taken to provide temporary stabilization of that inactive portion of the site, within 14 days of the cessation of construction activity. Stabilization measures may include seeding for temporary cover, mulching, or other measures to protect exposed soil from erosion and prevent sediment movement.

1.1.10 Site Stabilization – Permanent

Within 14 days of completion of loaming and finish grading on any portion of the site, that area shall be seeded or planted for permanent cover (season permitting) in accordance with USDA NRCS guidelines or equivalent.

1.1.11 Roadway Sweeping

The entrance to the site and affected portions of the access drive or paved project areas shall be swept as needed to control sediment runoff into storm drains or waterways and to control blowing dust.

1.2 Short-Term Erosion Control Maintenance

The following provides short-term erosion control maintenance guidelines and requirements.

1. The contractor or subcontractor will be responsible for implementing each control shown on the sedimentation and erosion control plan.
2. All erosion and sediment control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed areas have been stabilized. Additional control measures will be installed during construction in order to control erosion and/or off-site sedimentation if deemed necessary by on-site inspection.
3. Effective erosion control measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operations that will disturb the natural protection.
4. All sediment and erosion control devices shall be inspected at least once every seven (7) calendar days and after any storm event greater than 0.5 inches of precipitation during any 24-hour period, and the inspection shall be documented in writing. Damaged or ineffective devices shall be repaired or replaced, as necessary.
5. The contractor shall take all reasonable precautions to avoid excess erosion of the site due to the construction of this project.
6. Silt shall be removed from behind barriers if greater than 6-inches deep or as needed. Sediment that is collected in structures shall be disposed of properly and covered if stored on-site
7. Damaged or deteriorated items will be repaired immediately after identification.
8. All ditches shall be stabilized as soon as is practicable to minimize erosion.
9. The contractor shall maintain all erosion control devices in a good, working state of repair. Upon complete stabilization of any tributary areas, the erosion control devices shall be removed and disposed of so as to cause no off-site siltation.
10. Inspect and maintain construction entrance stone such that sediment does not track onto the street. Any sediment tracked onto the street shall be swept daily.
11. After catch basins have been constructed, the contractor shall protect the inlets by constructing inlet protection as shown on the plans.
12. Once the site has been paved, all catch basin inlets shall receive a silt sack type protection.
13. Erosion control measures shall remain in place until all disturbed earth has been substantially stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Appendix F: Long-Term Operation And Maintenance Plan

Long-Term Operation & Maintenance Plan

Rivercrest Condominiums

Ferry Street (Map 47, Parcel 76)
South Hadley, Massachusetts

Project Location:

Ferry Street
Map 47, Parcel 76
South Hadley, Massachusetts

Prepared for:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

June 18, 2014

R LEVESQUE ASSOCIATES, INC
A LAND PLANNING SERVICES COMPANY
40 School Street · Westfield, MA 01085
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I. Long-Term Stormwater Maintenance Program:

This Long-Term Operation and Maintenance Plan (O&M) identifies inspection and maintenance requirements for the proposed stormwater management system. The O&M references guidelines set forth by the Stormwater Management Handbook developed by the Massachusetts Department of Environmental Protection.

Owner*:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

Responsible Party*:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

*The party listed shall be responsible for implementation and record keeping of the requirements listed in this operation and maintenance plan. Upon completion of construction, the responsible party shall be reinstated as the homeowner's association or any other group created as part of the condominium governance. Each individual owner shall be responsible to contribute to the operation and maintenance of the stormwater management system or as decided and agreed upon in the homeowner's association/governing group documents.

2. Inspection and Maintenance Program:

Regular inspection and routine maintenance are necessary to ensure that the stormwater management system continues to control and treat runoff. The following lists the inspection schedule and maintenance procedures for the proposed stormwater Best Management Practices:

BMP	Inspection Schedule	Maintenance Schedule	Maintenance Procedures
Bituminous Concrete Roadway	Four times per year	Twice per year	• Roadway to be swept in March or April following snow melt and again in late November or early December to remove fallen leaves and debris
Deep-Sump Catch Basins	Four times per year	Four times per year	• Remove sediment once deposits reach one half the depth from the bottom sump to the lowest invert.
Stormwater Piping	Once per year	Once per year	• Inspect pipe entrances in catch basins and manholes and remove any blockages
Proprietary Sedimentation Device*	As specified by the manufacturer	As specified by the manufacturer	• Clean the unit using the method specified by the manufacturer. Vactor trucks are typically used to clean these units.
Subsurface Infiltration Basins	Twice per year	Twice per Year	• Verify that the inlet structure has no accumulation of sediment; • Clean Isolator Row as specified by manufacturer
Sediment Forebay	Monthly	Four times per year	• Remove sediment when it reaches one foot; • Mow the grass to no less than 3 inches and no greater than 6 inches; • Replace vegetation damaged during sediment removal.
Infiltration Basin	• After ever major storm for the first three months; • Twice per year thereafter.	Twice Per year	• Check for signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth, riprap condition, sediment accumulation, and health of the turf; • Mow side slopes and basin bottom and remove clippings; • Remove accumulated trash and debris.

See the attached Long-Term Operation & Maintenance Inspection Checklist for record keeping purposes.

*See attached Device Operation and Maintenance Guide

3. Additional Long-Term Operation and Maintenance Items

The following is a list of additional operation and maintenance items to be implemented by the owner/governing group to maintain the features proposed in this project.

A. Proper storage, use, and disposal of hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc. shall be required. Information should be provided on chemicals of concern, proper use, and disposal options. Recycling programs for used motor oil, antifreeze, and other products should be developed, promoted and distributed to the homeowners.

B. Vehicle Washing. This management measure involves educating the owner on the water quality impacts of the outdoor washing of vehicles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons which is conveyed by the detergent-rich water into storm drains.

C. Recycling, spill prevention and response plans, and proper material storage and disposal of potentially hazardous materials shall be implemented. It will be the responsibility of each owner to contain and legally remove any materials that are spilled onsite. The use of dry floor cleaners and absorbent materials and limiting the use of water to clean driveways is encouraged. Care should be taken to avoid accidental disposal of hazardous materials.

D. Provisions for storing trash and waste products shall be implemented. The waste materials shall be collected by the owner and all materials shall be properly disposed of.

E. Requirements for routine inspections and maintenance of stormwater best management practices. Routine inspections shall be performed to ensure the correct functioning of stormwater best management practices. See the specific maintenance criteria for detail regarding inspections and maintenance frequency.

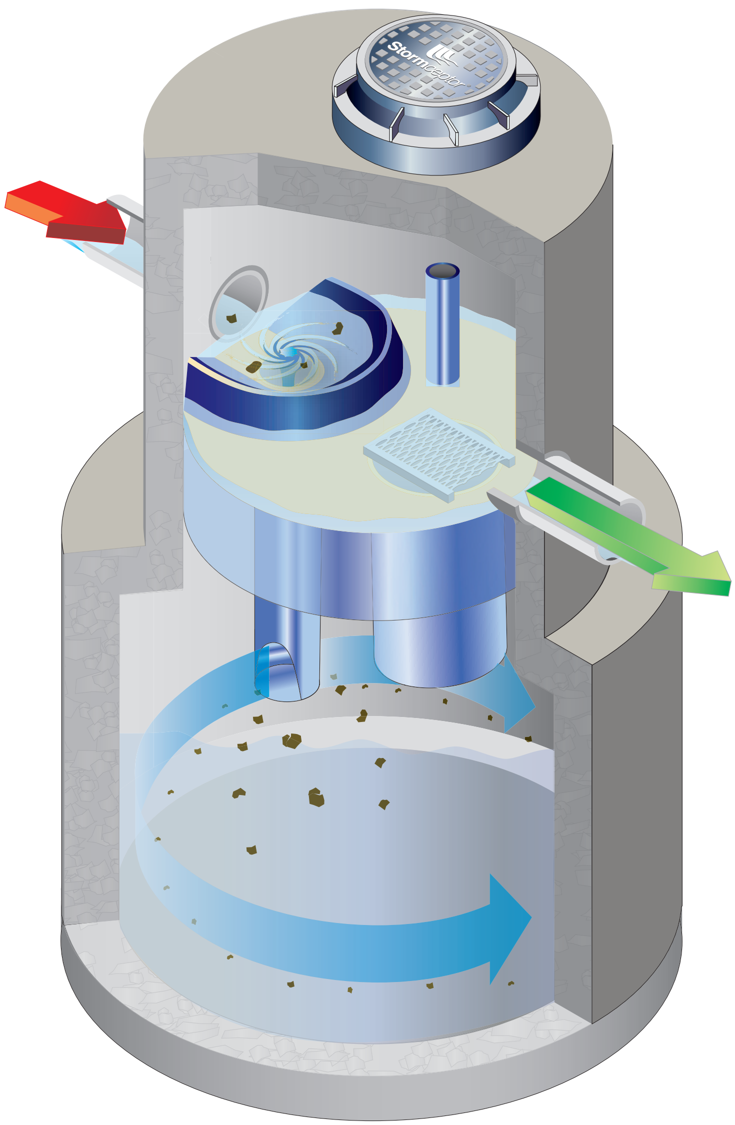
F. Requirements for Storage and Use of Fertilizers, Herbicides, and Pesticides. Fertilizers, pesticides, herbicides, lawn care chemicals, or other leachable materials shall be used in accordance with the Lawn Care Regulations of the Massachusetts Pesticide Board, 33 CMR 10.03 (30,31), as amended, with manufacturer's label instructions and all other necessary precautions to minimize adverse impacts on surface and groundwater. The storage of any such materials shall be within structure designed to prevent the escape of contaminated runoff or leachate.

G. Provisions for prevention of illicit discharges to the stormwater management system shall be implemented. Any illicit discharges to the stormwater management system shall be prohibited. It will be the owner's responsibility to ensure compliance with the legal disposal of all materials and containment/cleanup of any illicit discharges.

H. Training for staff or personnel involved with implementation of the Long-Term Pollution Prevention Plan shall be required. The owner/governing group will be responsible for the implementation of the measures set forth in the Long-Term Pollution Prevention Plan. Documentation that personnel and owners involved with the implementation of the Long-Term Pollution Prevention Plan have been trained to conduct such tasks shall be documented.

Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Japan Patent No. 9-11476
Korean Patent No. 0519212
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

Congratulations!

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)
- STF (Fiberglass)
- 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 your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & 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.

Figure 1.

Inline Stormceptor

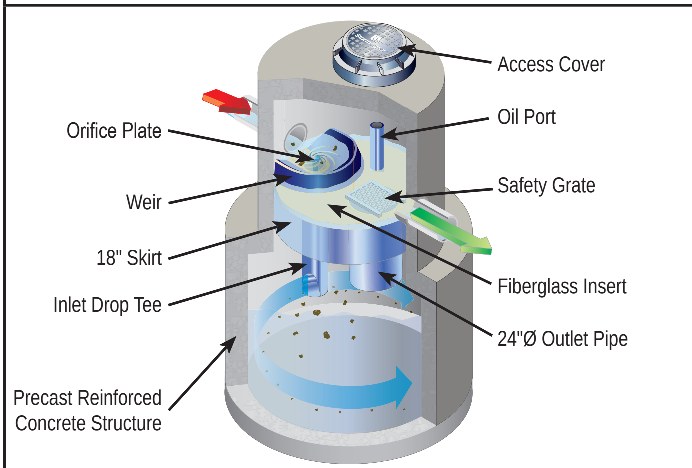
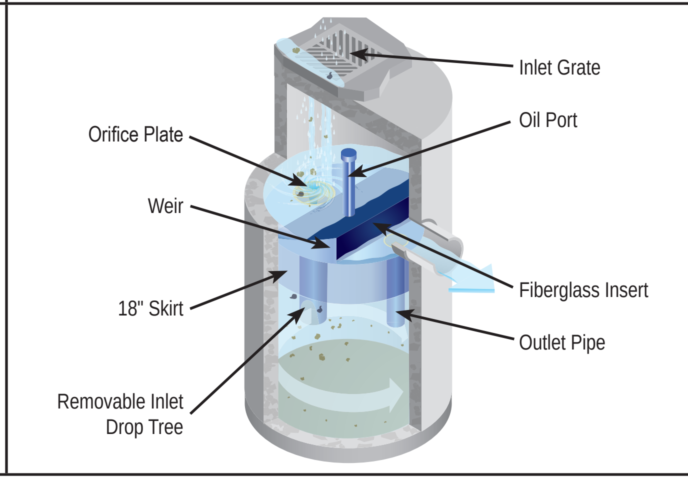


Figure 2.

Inlet Stormceptor



- **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

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, MAX and STF) 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 Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) 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 1A. (US) 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

EOS Model	Insert to Base (in.)
4-175	60
9-365	55
12-950	71
24-1400	94
36-1700	134
48-2000	128
60-2500	150
72-3400	134
110-5000*	128
130-6000*	150
160-7800*	134

OSR Model	Insert to Base (in.)
65	60
140	55
250	94
390	128
560	134
780*	128
1125*	134

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of 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 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)	EOS Model	Insert to Base (m)	OSR Model	Insert to Base (m)	Typical STF m (in.)
300	1.5	300	1.5	300	1.7	1.5 (60)
750	1.5	750	1.5	750	1.6	1.5 (61)
1000	1.8	1000	1.8			1.8 (73)
1500	2.8					2.9 (115)
2000	2.8	2000	2.8	2000	2.6	2.3 (89)
3000	3.7	3000	3.7			3.2 (127)
4000	3.4	4000	3.4	4000	3.6	2.9 (113)
5000	4.0	5000	4.0			3.5 (138)
6000	3.7	6000	3.7	6000	3.7	3.3 (128)
9000*	3.4	9000*	3.4	9000*	3.6	
11000*	4.0	10000*	4.0			
14000*	3.7	14000*	3.7	14000*	3.7	

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of 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 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	EOS Model	Hydrocarbon Storage Capacity gal	OSR Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	75	**9-365**	365	**140**	233	58
1200	251	113	**12-950**	591			
1800	251	193					
2400	840	155	**24-1400**	1457	**250**	792	156
3600	840	232	**36-1700**	1773			
4800	909	465	**48-2000**	2005	**390**	1233	465
6000	909	609	**60-2500**	2514			
7200	1059	726	**72-3400**	3418	**560**	1384	690
11000*	2797	942	**110-5000***	5023	**780***	2430	930
13000*	2797	1230	**130-6000***	6041			
16000*	3055	1470	**160-7800***	7850	**1125***	2689	1378

Notes:

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

   **Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & 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 & 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 2**). 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 for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

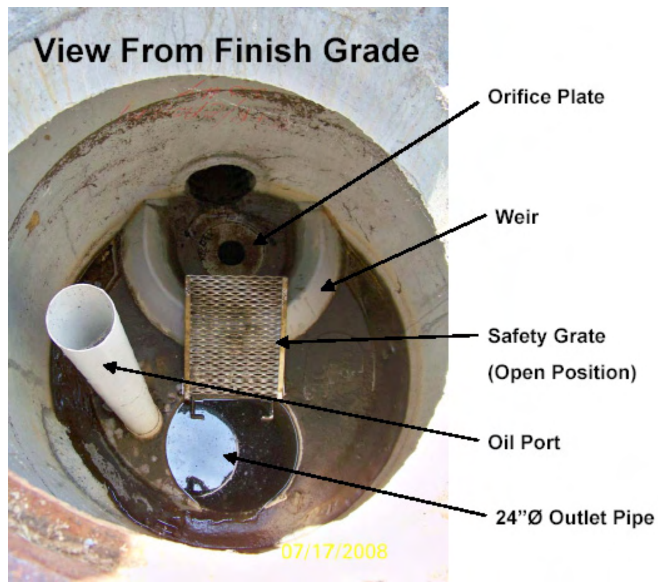
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

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 (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



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, and safety harness for specially trained personnel if confined space entry is required

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 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, 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 (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
  - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

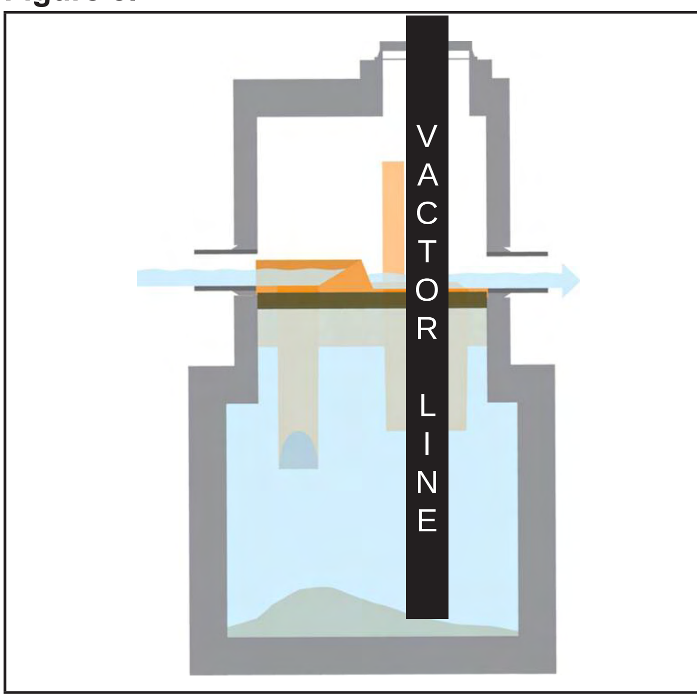
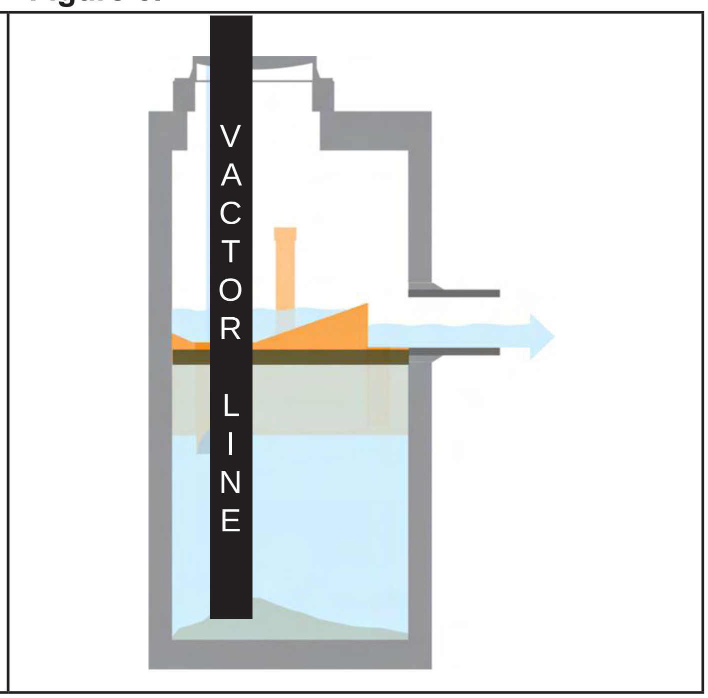


Figure 6.



- 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.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

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 that the 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 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:
1. *The values above are for typical standard units.*

**Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

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 Stormceptor Representative, or Imbrium Systems.

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: ______________________

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com

403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com

604-502-5236	BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com

519-622-7574 / 1-888-888-3222	ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com

450-454-3928 / 1-800-561-0970	QC

Strescon Limited
www.strescon.com

902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827
Email	info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

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Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

U.S. GREEN BUILDING COUNCIL MEMBER

1.0 The Isolator® Row

1.1 INTRODUCTION

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

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

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

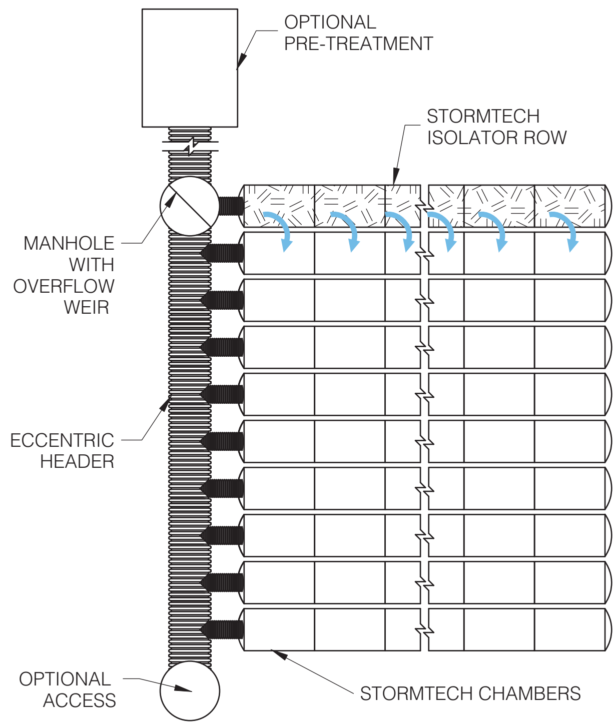
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

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

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

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

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

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

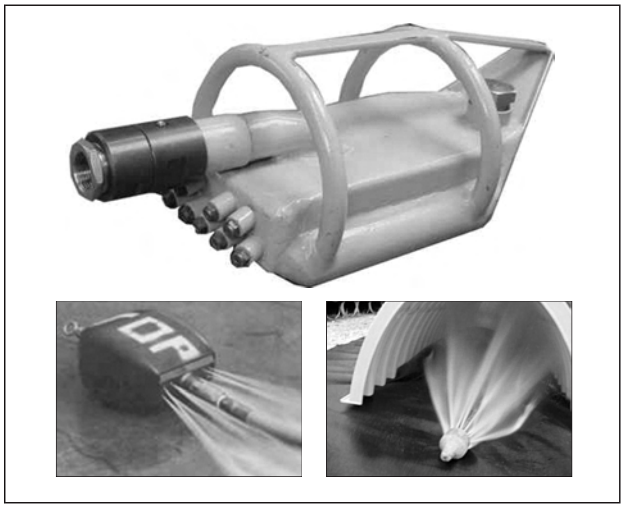
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

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

2.2 MAINTENANCE

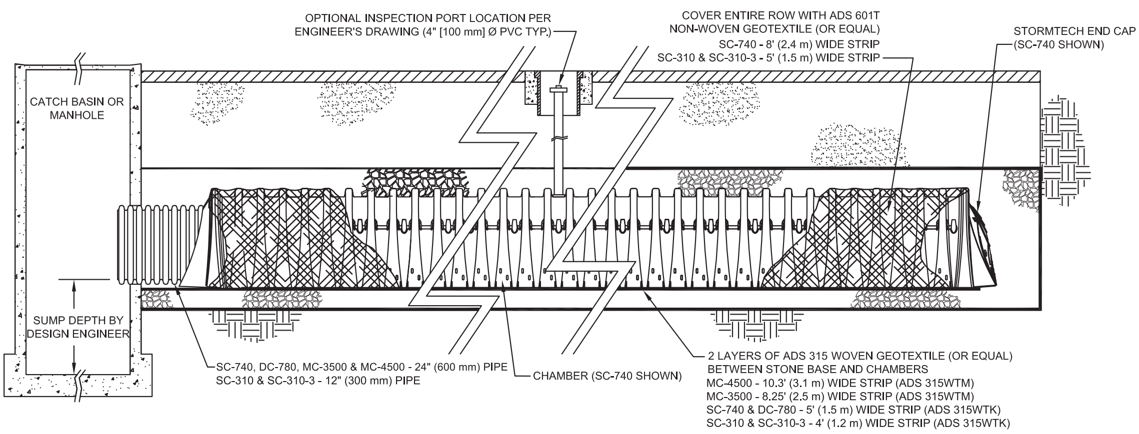
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via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



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

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

StormTech Isolator Row (not to scale)

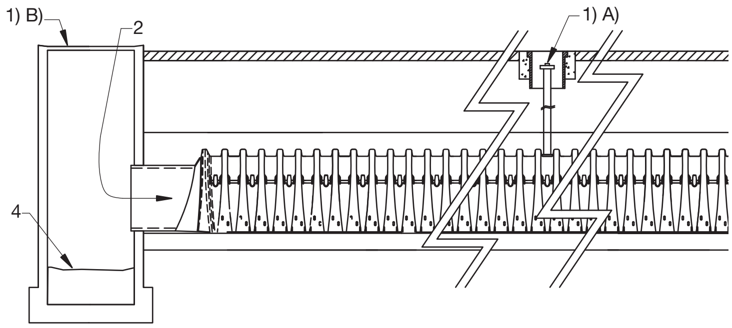


NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment
A) Inspection ports (if present)
i. Remove lid from floor box frame
ii. Remove cap from inspection riser
iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.
B) All Isolator Rows
i. Remove cover from manhole at upstream end of Isolator Row
ii. Using a flashlight, inspect down Isolator Row through outlet pipe
1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole
iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process
A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

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

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

Sample Maintenance Log

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

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70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067
860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

Project:	Rivercrest Condominiums
Address:	Ferry Street
Responsible Party:	
Date:	

Operation & Maintenance Inspection Checklist

BMP Element:	Potential Problem:	Resolution:	Passed	Failed	Recommended Remediation
Bituminous Concrete Roadway	Build-up of sediment over the winter months and collection of leaves during the fall months.	Sweep roadway using a high-efficiency street sweeper.			
Deep-Sump Catch Basins	Sediment has accumulated to a depth greater than the original design depth for sediment storage, approximately 2-feet of sediment.	Remove the sediment and dispose of in accordance with local and state regulations.			
Stormwater Piping	Blockage of inlet/outlet pipes due to debris or sediment accumulation.	Remove any debris and sediment via proper means. Dispose of debris/sediment in accordance with local and state regulations.			
Proprietary Treatment Device	Sediment has accumulated to a depth greater that the original design depth for sediment storage.	Remove sediment and disposed of in accordance with local and state regulations.			
Subsurface Infiltration Basin	Accumulation of sediment at the inlet structure above the maintenance level.	Remove the sediment and conduct the proper maintenance to the up-gradient pretreatment devices.			
Sediment Forebay	Excessive sediment accumulation.	Remove sediment and debris.			
	Erosion is occuring on the side slope or around the flared end section.	Remedy scoured area and/or replace riprap immediately.			
	Debris has collected inside the basin.	Remove debris and remedy any damage caused.			
Infiltration Basin	Standing water inside basin.	Verify that sediment is not entering the basin. Remove collected sediment and scour basin bottom. Replace damaged vegetation			
	Erosion is occuring on the side slope or around the flared end section.	Remedy scoured area and replace vegetation.			
	Trees/Shrubs are starting to grow within the basin.	Remove trees/shrubs and vegetate with grass.			
	Debris has collected inside the basin.	Remove debris and remedy any damage caused.			
Flared End Sections	Vegetation has started to grow within the riprap area.	Remove vegetation immediately.			
	Accumulation of sediment/debris at the culvert inlet.	Remove sediment or debris such that the culvert has free flow.			
	Erosion is occuring where riprap has been dislodged.	Remedy scoured area and replace riprap immediately.			

Inspector's Signature

Date

Appendix G: Town of South Hadley Inspection Sheet

Town of South Hadley Inspection Schedule Sign-Off Sheet

Inspection Schedule	Description	Date of Inspection	Inspector	Passed	Failed	Notes
Initial Inspection	Prior to approval of any plan.					
Erosion and Sediment Control Inspections	After site clearing					
	Rough Grading					
	Final Grading					
Bury Inspection	Prior to backfilling of any underground drainage or stormwater conveyance structures.					
Final Inspection	Conducted when all work, inlcuding construction of stormwater management facilities and landscaping have been completed. Final inspection shall include a full, dated TV inspcetion of all stormwater pipes installed.					