Nitsch Engineering

January 21, 2021

STORMWATER REPORT

For

BOXFORD SENIOR CENTER
10 Elm Street
Boxford, Massachusetts

Prepared for:

Town of Boxford
7A Spofford Road
Boxford, MA

Prepared by:

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Boston, MA 02143

Nitsch Project #14051

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1.0 INTRODUCTION

Nitsch Engineering has prepared this Stormwater Report to support the new Boxford Senior Center in Boxford, Massachusetts. The Project site is located at 10 Elm Street in Boxford, Massachusetts (subsequently referred to as the “Site”).

The site improvements include the following:

1. Construction of parking facilities and pedestrian walkways;
2. Maintenance of the western structure of the existing building;
3. Demolition of the remaining existing building;
4. Construction of a new building addition attached to the existing building;
5. Installation of new utilities to support the proposed building;
6. Installation of a septic field; and
7. Construction of a new stormwater management system.

The proposed stormwater management system has been designed to comply with the requirements of the Town of Boxford Regulations and the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

2.0 EXISTING CONDITIONS

Currently the site includes two existing buildings, a shed, and a parking lot with the remaining project area mostly undeveloped and wooded. A 25-foot buffer from bordering properties extends around the northern, western, and southern edges of the project site with a 50’ buffer extending the length of the eastern side. The Cummings House, the western-most existing building on-site, will be preserved throughout construction and maintained. The adjoined Library Building and the stand-alone shed will be demolished. A new building attached to the Cummings House is proposed, along with site landscaping, sidewalks, and new utilities.

The site topography gradually slopes from the northern edge to the southern edge of the property with localized depressions collecting existing stormwater.

2.1 Existing Drainage Infrastructure

Stormwater generated by the existing Boxford Senior Center site is collected using localized landscape depressions and a singular catch basin. Stormwater in the parking lot is collected using a catch basin that is piped through a 12-inch reinforced concrete pipe, continuing through the existing stormwater infrastructure along Elm Street and ultimately discharging into the Ipswich River. The existing stormwater management system was constructed prior to the 2008 MassDEP Stormwater Management Standards, and the Site provides minimal peak flow attenuation, water quality treatment, and groundwater recharge.

Most stormwater from the existing 10 Elm Street property naturally infiltrates into the pervious landscaping covering the majority of the site. Excess stormwater sheet flows overland to five landscape depressions located throughout the property (shown in Figure 1 – Existing Areas) and infiltrates into the underlying soil. The remaining stormwater continues through the existing infrastructure along Elm Street and towards the Ipswich River.

Record plans show that some stormwater from the properties north of the Site sheet flow onto the 10 Elm Street property and route to the on-site landscape depressions.

2.2 NRSC Soil Designations

The Soil Classification Summary (Table 1) outlines the Natural Resources Conservation Services (NRCS) designation of the soil series at the Site. The majority of soils are classified as silty sand with gravel. Sudbury fine sandy loam and Canton fine sandy loam with hydrologic soil group (HSG) ratings of B, indicating that the soils have a high infiltrative capacity (Appendix E).

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	B
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stoney	B

2.3 On-Site Soil Investigations

Approximately four (4) borings were performed on the Senior Center Site on December 18th, 2020 by John Turner Consulting. The results of the borings were consistent throughout the Site and indicated existing fill material overlying native glacial coarse deposits, which are classified as HSG B. Ledge was not encountered in any of the test pits. Groundwater was found in most of the pits at variable depths.

Three (3) additional test pits were performed by John Turner Consulting on December 18th, 2020 to support the drainage design. The proposed subsurface infiltration systems were designed to maintain a two foot offset to estimated seasonal high groundwater. These test pit logs are provided in Appendix E.

2.4 Wetland Resource Areas

The project does not have any classified wetlands on site.

2.5 Total Maximum Daily Load (TMDL)

The stormwater discharges from the Site to the existing drainage infrastructure below Elm Street, ultimately discharging to the Ipswich River. The Site is located within the Ipswich River Basin and will potentially be subject to a Draft Pathogen Total Maximum Daily Load (TMDL) if it is finalized by MassDEP. The Project has been designed to minimize stormwater discharge and associated pathogen pollutants through extensive infiltration practices to meet the intent of the TMDL.

3.0 PROPOSED CONDITIONS

3.1 Project Description

The Project includes the construction of the Boxford Senior Center building, parking lot, and proposed utilities at 10 Elm Street.

The proposed Senior Center includes the construction of one one-story building to be used as offices with multi-purpose space and a kitchen. The proposed building will be connected to the existing Cummings House structure thought an interior corridor. Cummings House will maintain the two existing floors with renovations proposed for the interior spaces. New driveways, parking areas, and utilities are also proposed to support the new project.

The Project is anticipated to increase the overall impervious area for 10 Elm Street by approximately 13,023 square-feet. Refer to Table 2 for a comparison of the existing and proposed land use for the Site.

Table 2. Proposed land use for 10 Elm Street (in acres)

Land Use	Existing Site (sf)	Proposed Site (sf)	Change
Vehicular Pavement	7,421	17,080	+ 9,659
Site Pavement	594	3,085	+ 2,491
Buildings	5,053	5,926	+ 873
Landscaped Area	36,086	72,528	+ 36,442
Wooded Area	113,675	64,211	- 49,464
Total	162,829	162,829	---

3.2 Stormwater Management System

The project site will include the installation of a stormwater management system that is designed to meet and exceed the MassDEP Stormwater Management Standards and the Town of Boxford Regulations. As a new development, the Project is required to provide peak flow and volume mitigation under the Town of Boxford Regulations and provide water quality treatment and groundwater recharge.

The Project has been designed using environmentally-sensitive site design and LID techniques. This design prevents the generation of stormwater and non-point source pollution by disconnecting flow paths, treating and infiltrating stormwater at its source, and protecting natural processes. Stormwater systems have been designed to model natural hydrologic features, including promoting infiltration throughout the site.

The proposed stormwater management system for the Boxford Senior Center will include deep sump and hooded catch basins, subsurface infiltration systems, a rain garden, and proprietary water quality structures. Overflow from the proposed BMPs will be discharged to the adjacent wooded areas using a level and wide berm to minimize concentrated flow.

The existing drainage system on the 10 Elm Street site will be protected and maintained during construction. Additional catch basins and water quality inlets will be installed in the asphalt parking lot to manage and treat stormwater before discharging into the municipal system below Elm Street.

<u>Deep Sump and Hooded Catch Basins</u>

Deep sump and hooded catch basins are proposed to provide pretreatment in the impervious areas of the parking lot.

<u>Subsurface Infiltration Systems</u>

Stormwater from the building roofs and the asphalt parking lot will be collected and infiltrated using a series of subsurface infiltration systems.

Subsurface Infiltration System 1 is proposed in the parking lot to collect and infiltrate runoff from the proposed building and immediately adjacent impervious and landscaped site area. The system consists of 42 StormTech SC-740 chambers configured into 7 rows of 6 chambers each. The chambers will be enveloped within a crushed stone base that extends 6-inches above and below the chambers and 12-inches around the perimeter of the chambers. The system is 46.34 feet long by 34.75 feet wide. Subsurface Infiltration System 1 is designed to completely infiltration the 2-, 10-, 25- and 50-year, 24-hour design storms, and significantly reduces the peak rate and runoff volumes in the 100-year design storm.

Subsurface Infiltration System 2 is proposed in the landscaping east of the Senior Center building, aligned with the edge of the patio. The system consists of 9 ADS N-12 perforated pipes configured into 3 rows of 3 20' pipes each. The pipes will be surrounded by a crushed stone base that extends 6-inches above and below the chambers and 9-inches around the perimeter of the chambers. The system is 61.50' feet long by 9.13' feet wide and is designed to completely infiltration the 2-, 10-, 25-, 50-, and 100-year, 24-hour design storms.

<u>Rain Garden</u>

Rain Garden 1 is proposed as the third stormwater system on site. Stormwater from the proposed asphalt parking lot as well as overflow from Subsurface Infiltration System 2 will discharge into Rain Garden 1 for additional detention and infiltration. Rain Garden 1 is designed to completely infiltrate the 2-, 10-, 25-, 50-, and 100-year storms. However, a 20' wide level berm is proposed on the east side of the rain garden as an overflow.

Site impervious area that is tributary to these systems will be pretreated using deep sump and hooded catch basins and proprietary water quality units to meet the 44% TSS removal requirement set forth by the MassDEP Stormwater Standards for discharge to highly permeable soils.

Stormceptor® STC 900 Water Quality Structures

Three Stormceptor® STC water quality structures are proposed for water quality pretreatment in areas of the Site where space is limited or additional pretreatment is required prior to infiltration. These BMPs have been designed to remove greater than 80% TSS in conjunction with their associated deep sump and hooded catch basins. Sizing calculations are provided in Appendix A.

Refer to the TSS Removal spreadsheets in Appendix A for TSS removal summaries for each treatment train.

3.3 Stormwater Management During Construction

The Site Contractor will be responsible for stormwater management of the active construction site and is required to adhere to the conditions of the 2012 Construction General Permit under the Environmental Protection Agency (through the preparation and implementation of a Boxford Conservation Commissions and MassDEP). A draft SWPPP will need to be prepared by the contractor in accordance with the MassDEP Stormwater Management Standards and the 2012 Construction General Permit (Appendix F).

4.0 STORMWATER MANAGEMENT ANALYSIS

4.1 Methodology

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.00 computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

The Site was divided into multiple drainage areas, or subcatchments, which drain to the design points along the property boundary and within the site. For each subcatchment area, SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates and runoff volumes for the 2-, 10-, 25- and 100-year 24-hour storm events were then determined by inputting the drainage areas, CNs, and time of concentration (T_c) paths into the HydroCAD model.

4.2 HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-48 hours in order to prevent truncation of the hydrograph.

4.3 Precipitation Data

Nitsch Engineering, Inc. used Stormwater Management Regulations set forth by the Town of Boxford to estimate the rainfall for the 2-year, 10-year, 25-year and 100-year 24-hour storms. The rainfall values for the Town of Boxford that will be used are as follows:

Storm Event	24–hour Rainfall
2-year	3.1 in.
10-year	4.7 in.
25-year	5.8 in.
50-year	7.1 in.
100-year	8.3 in.

4.4 Existing Hydrologic Conditions

As summarized in Table 4, Nitsch Engineering delineated the project site into seven (7) on-site subcatchment (watershed) areas discharging to seven (7) design points utilizing an existing conditions survey and on-site observations (See Figure 1). Table 4 summarizes the design point, location and area of each watershed. The HydroCAD model for existing conditions is provided in Appendix B.

Table 4. Existing Drainage Area Summary

Design Point (DP-EX)	Watershed (CDA-X)	Area (sf)	Description
1	1	6,793	Grassed and wooded areas
2	2	9,782	Existing building, existing parking lot and grassed areas
3	3	41,225	Existing building, walkway, grassed and wooded areas
4	4	15,663	Grassed and wooded areas
5	5	36,627	Grassed and wooded areas
6	6	2,159	Wooded areas
7	7	50,551	Existing parking lot, grassed and wooded areas
Total Area		162,829	

4.5 Proposed Hydrologic Conditions

The proposed project has been designed to mitigate the change in stormwater runoff at each of the design points as required by the DEP Stormwater Management Standards and the Town of Boxford Regulations. The existing watershed areas were modified to reflect the proposed topography, storm drainage structures and BMPs, and roof areas. (See Figure 2 and Table 5). The proposed BMPs included as ponds or reaches in the HydroCAD model are:

- Subsurface Infiltration Systems; and
- A Rain Garden

Table 5. Proposed Drainage Area Summary

Design Point (DP-X)	Watershed (PS-X)	Area (sf)	Description	Proposed Treatment BMP(s)
1	1	6,708	Grassed and wooded areas, utility covers (impervious)	Maintain existing drainage
2	2A	8,096	Building roof, parking lot, site walkways, landscaping	Water quality structure; Subsurface Infiltration System #1
	2B	5,221	Site walkways, parking lot, landscaping	Water quality structures
3	3A	33,204	Building patio, grassed and wooded areas	Rain Garden #1
	3B	13,433	Parking lot, site walkways, and landscaping	Water quality structure; Rain Garden #1
	3C	2,578	Building roof	Subsurface Infiltration System #2 to Rain Garden #1
4	4	15,663	Grassed and wooded areas	Maintain existing drainage
5	5	33,572	Grassed and wooded areas	Maintain existing drainage
6	6	2,159	Grassed and wooded areas	Maintain existing drainage
7	7	42,195	Grassed and wooded areas	Maintain existing drainage
Total Area		**162,829**		

4.6 Peak Flow Rates

The proposed stormwater management system is expected to reduce the proposed peak runoff rates to at or below the existing rates for Design Points DP-1, DP-2, DP-3, DP-4, DP-5, DP-6, and DP-7. Tables 6 through 13 below summarize the existing and proposed hydrologic analyses for the site at each design point.

Table 6 – Peak Rates of Runoff for Design Point DP-1 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.00	0.00	0.01	0.03	0.07
Proposed	0.00	0.00	0.00	0.01	0.02

Table 7 – Peak Rates of Runoff for Design Point DP-2 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.05	0.24	0.39	0.59	0.79
Proposed	0.04	0.16	0.26	0.39	0.52

Table 8 – Peak Rates of Runoff for Design Point DP-3 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.00	0.01	0.03	0.13	0.38
Proposed	0.00	0.00	0.00	0.00	0.00

Table 9 – Peak Rates of Runoff for Design Point DP-4 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.00	0.00	0.00	0.01	0.03
Proposed	0.00	0.00	0.00	0.01	0.03

Table 10 – Peak Rates of Runoff for Design Point DP-5 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.00	0.00	0.01	0.02	0.08
Proposed	0.00	0.00	0.00	0.02	0.07

Table 11 – Peak Rates of Runoff for Design Point DP-6 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.00	0.00	0.00	0.00	0.01
Proposed	0.00	0.00	0.00	0.00	0.01

Table 12 – Peak Rates of Runoff for Design Point DP-7 (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.00	0.01	0.06	0.20	0.45
Proposed	0.00	0.00	0.01	0.03	0.09

Table 13 – Peak Rates of Runoff for Total Site (in cfs)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	0.05	0.26	0.50	0.98	1.81
Proposed	0.01	0.07	0.15	0.32	0.67

Stormwater Requirements from the Boxford Regulations

The Boxford Subdivision Rules and Regulations state that the peak rate and volume of stormwater runoff leaving the post-development site will not exceed that leaving the pre-development site for the 2-, 10-, 25-, 50-, and 100-year storm events. The proposed stormwater management system is expected to reduce or maintain the post-development peak rates of runoff to at or below the pre-development rates. Table 10 below demonstrates a reduction in runoff volumes for the required storm events.

Table 14 –Volumes of Runoff for Total Site (in acre-feet)

Storm Event	2-year	10-year	25-year	50-year	100-year
Existing	329	1,567	3,875	8,208	13,509
Proposed	191	549	1,303	3,245	6,409

5.0 MassDEP Stormwater Management Standards

The Project is considered a ***new development*** under the DEP Stormwater Management System as the project is netting an overall increase in impervious are due to the expanded asphalt parking lot. The Site will be designed to meet and exceed the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

The Project will not discharge any untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards and stormwater outfalls will be stabilized to prevent erosion.

Standard 2: Peak Rate Attenuation

The proposed stormwater management system will be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, 25-, 50-, and 100-year, 24 hour storm events.

In addition to peak rate attenuation, the Boxford Regulations require that the peak volume of stormwater runoff leaving the post-development site will not exceed the peak volume leaving the pre-development site for the 2-, 10-, 25-, 50-, and 100-year storm events. The proposed stormwater management system is expected to reduce or maintain the post-development volumes of runoff to at or below the pre-development volumes. Therefore, the proposed system will exceed the DEP Stormwater Management Guidelines.

Standard 3: Groundwater Recharge

The Site was designed using environmentally-sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. The annual recharge from the post-development site will approximate the annual recharge from pre-development conditions based on soil type using the guidelines provided in the MassDEP Stormwater Management Handbook.

Impervious Area	= 26,091 square-feet
Rv (Recharge Volume)	= 0.35 in. / (12 inches/ft) x 25,955 square-feet
	= 761 cubic feet

The subsurface infiltration systems and rain garden are sized to exceed the recharge volume required under the MassDEP Stormwater Management Standards (Table 11). A minimum of 2-feet of separation has been maintained between the bottom of the infiltration system and seasonal high groundwater. No mounding analysis is required.

Table 11 – Proposed Recharge Volumes for Stormwater BMPs

Infiltration BMP	Recharge Volume (cf)
Rain Garden 1	5,128
Subsurface Infiltration System 1	3,049
Subsurface Infiltration System 2	740
Total	**8,894**

The HydroCAD reports provided in Appendix C indicate that all proposed infiltration BMPs will drain within 48 hours for the 2-, 10-, 25-, 50-, and 100-year storm events, exceeding the 72-hour MassDEP drawdown requirement.

Standard 4: Water Quality Treatment

The proposed stormwater management system will be designed to remove greater than 80% of the average annual post-construction load of Total Suspended Solids (TSS) from the proposed impervious surfaces. Structural stormwater BMPs including deep sump and hooded catch basins, a rain garden, and Stormceptor® water quality units are sized to capture the required water quality volume (.5 inch over the project site) and remove a minimum of 80% of total suspended solids.

The proposed water quality treatment BMPs are subject to the 44% TSS removal pretreatment requirement and the .5-inch rule for calculating water quality volumes.

Pretreatment for all infiltration BMPs will meet or exceed the 44% TSS removal requirement. Pretreatment for the proposed rain garden will be provided using deep sump and hooded catch basins and Stormceptor® water quality units that have been sized using the flow rate associated with the water quality volume. Pretreatment for the subsurface infiltration systems will be provided using deep sump and hooded catch basins. TSS removal calculation spreadsheets and Stormceptor® sizing calculations are provided in Appendix A.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, are included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan (Appendix E).

Standard 5: Land Uses with Higher Potential Pollutant Loads

The project is not considered a LUHPPL and therefore, this standard is not applicable.

Standard 6: Critical Areas

The Project is not located within any critical areas. Therefore, this standard is not applicable.

Standard 7: Redevelopments

The Project is not considered a redevelopment under the MassDEP Stormwater Management Standards. Therefore, this standard is not applicable.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) will be developed and implemented during the Notice of Intent permitting process.

Standard 9: Operation and Maintenance Plan

A post-construction operation and maintenance plan has been prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater BMP operation requirements for the academic campus are summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan provided in Appendix E.

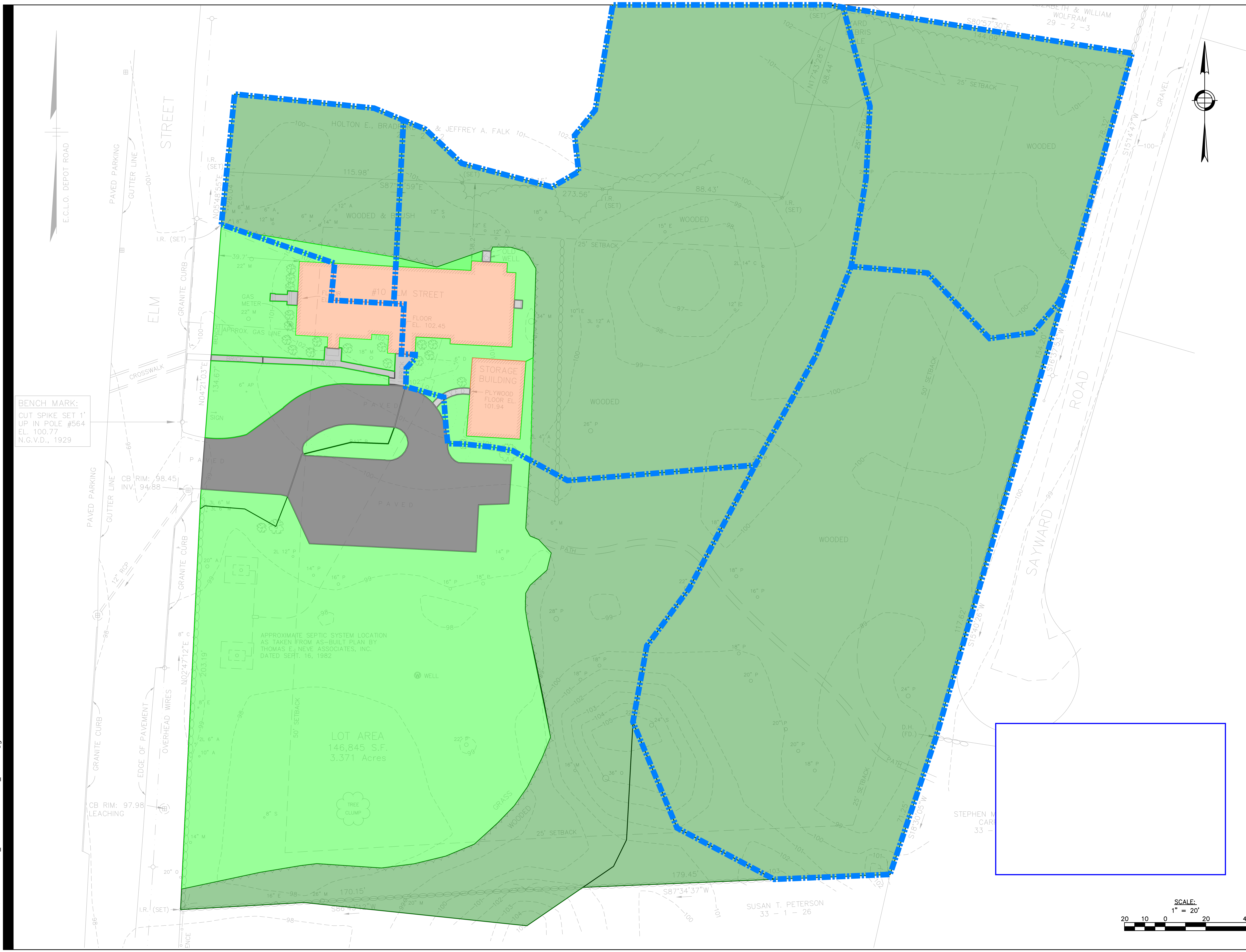
Standard 10: Prohibition of Illicit Discharges

There will be no illicit discharges to the stormwater management system associated with the Project. An Illicit Discharge Compliance Statement is provided in Appendix A.

6.0 CONCLUSION

In conclusion, the Project's stormwater management system will reduce or maintain peak runoff rates and volumes through the widespread use of infiltration BMPs and improve the water quality of stormwater being discharged from the Site. Environmentally sensitive site design and low impact development techniques will be implemented throughout the Site. The Project is being designed to meet and exceed the MassDEP Stormwater Management Standards and the Town of Boxford Subdivision Rules and Regulations.

FIGURES



THE CENTER AT 10 ELM COMMUNITY/ STREET SENIOR CENTER

PROJECT

TOWN OF BOXFORD

TOWN HALL
7A SPOFFORD ROAD
BOXFORD, MA 01921

CLIENT

G | R | L | A

Gorman Richardson Lewis Architects
239 South Street Hopkinton, MA 01748
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FIRM

KEY PLAN

REMARKS

No.	Description	Date

REVISIONS

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Date:	12/21/2020
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DATA

EXISTING DRAINAGE AREA

TITLE

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SHEET

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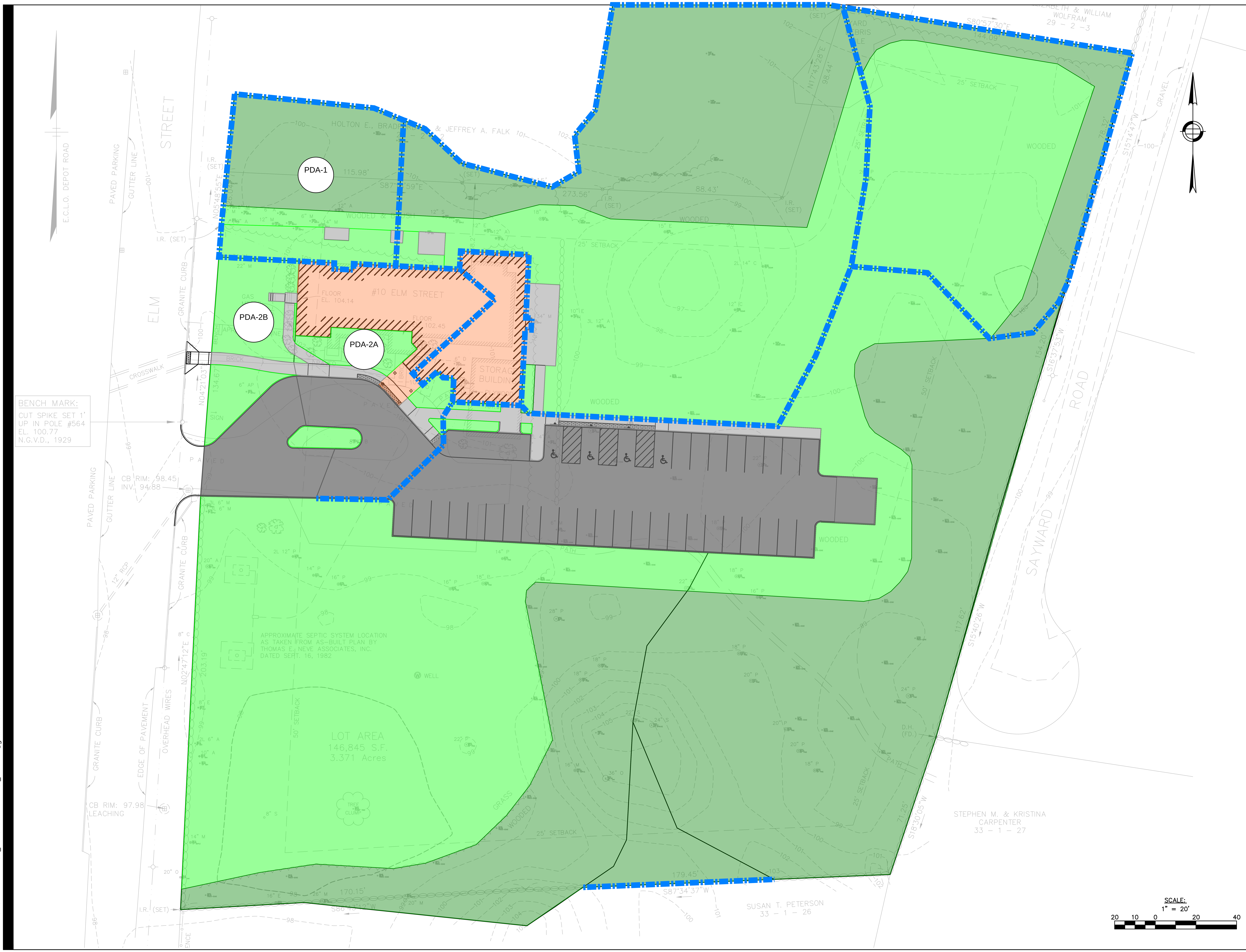

PROJECT

THE CENTER AT 10 ELM COMMUNITY/ STREET SENIOR CENTER

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PROPOSED DRAINAGE AREA

SHEET

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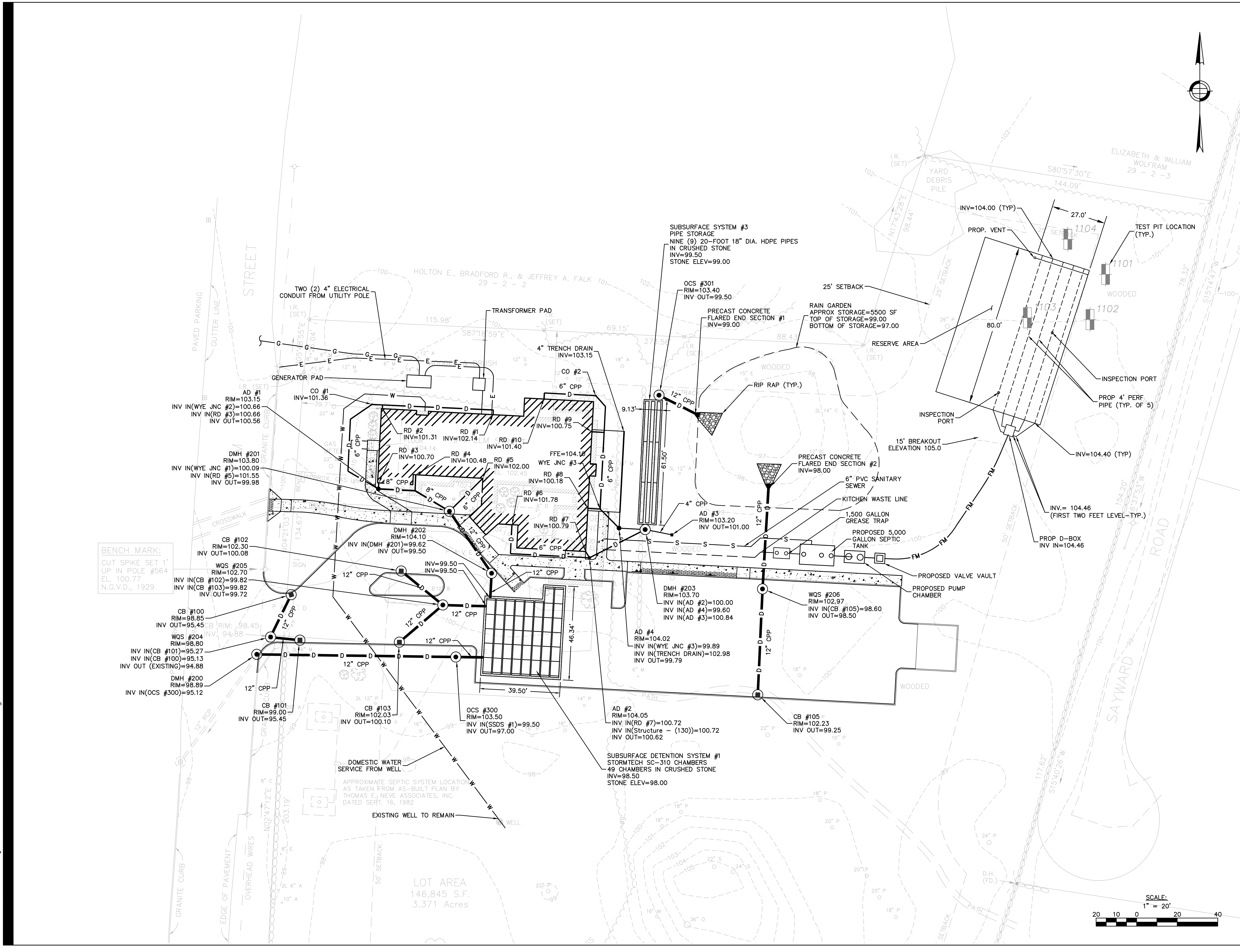

THE CENTER
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CIVIL UTILITY
PLAN

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APPENDIX A

Stormwater Management Standards Documentation

MassDEP Checklist for Stormwater Report

Standard 4: TSS Removal Calculations

Standard 4: Proprietary Water Quality Structure Calculations

Standard 10: Illicit Discharge Compliance Statement

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☒ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface Infiltration System and Water Quality Structures

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 (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (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.

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Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Boxford Senior Center	Nitsch Project #: 14051
Location: 10 Elm Street	Checked by: DC
Prepared by: CJ	Sheet No. 1 of 3
Date: January 21, 2021	Rain Garden

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*761*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*655*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Sandy Loam	B	0.52	**Hours**
			$Time_{drawdown}$ =	26.81
	72-Hour Drawdown Requirement Check:			***OK***

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Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Boxford Senior Center	Nitsch Project #: 14051
Location: 10 Elm Street	Checked by: DC
Prepared by: CJ	Sheet No. 2 of 3
Date: January 21, 2021	StormTech Chambers

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*761*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*1610*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Sandy Loam	B	0.52	**Hours**
			$Time_{drawdown}$ =	10.91
	72-Hour Drawdown Requirement Check:			***OK***

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Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Boxford Senior Center	Nitsch Project #: 14051
Location: 10 Elm Street	Checked by: DC
Prepared by: CJ	Sheet No. 3 of 3
Date: January 21, 2021	Pipe and Stone

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*761*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*561*		
		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate		0	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Sandy Loam	B	0.52	**Hours**
			$Time_{drawdown}$ =	31.30
	72-Hour Drawdown Requirement Check:			***OK***

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BOXFORD SENIOR CENTER
WATER QUALITY TREATMENT SUMMARY (01/22/2021)

Nitsch Engineering has prepared this Water Quality Treatment Summary for the proposed Boxford Senior Center. In compliance with MassDEP Stormwater Management Standard #4, the proposed stormwater management system is designed to remove at least 80% of the average annual post-construction load of TSS prior to discharge.

A summary of treatment trains proposed to provide water quantity control and water quality improvement at the proposed project site is provided below. Subcatchments PS1, PS4, PS5, PS6, and PS7 are not directed to treatment trains because they do not discharge runoff from any vehicular area and the runoff is therefore considered clean.

Treatment Train A
Catchment Area: PS2A
Deep Sump & Hooded Catch Basin → WQS → Subsurface Infiltration System → Discharge

Treatment Train B
Catchment Areas: PS2B
Deep Sump and Hooded Catch Basin → WQS → Discharge

Treatment Train C
Catchment Areas: PSA3B
Deep Sump and Hooded Catch Basin → WQS → Rain Garden

Treatment Train D
Catchment Areas: PSA3C
Deep Sump and Hooded Catch Basin → WQS → Subsurface Infiltration System → Rain Garden

NECP
687 Watertown Street, Newton, MA
February 25, 2020

Nitsch Project No. 3033.3

Nitsch Engineering

Treatment Train A : Deep Sump & Hooded Catch Basin → Water Quality Structure→ Discharge

Treatment Spreadsheet

B BMP	C TSS Removal Rate	D Starting TSS Load	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Structure	**0.75**	**0.75**	**0.56**	**0.19**

Total TSS Removal = **80%** **Meets 80% TSS removal requirement**

NECP
687 Watertown Street, Newton, MA
February 25, 2020

Nitsch Project No. 3033.3

Nitsch Engineering

<u>Treatment Train B :</u>
Deep Sump and Hooded Catch Basin → Infiltration System → Discharge

Treatment Spreadsheet

B BMP	**C** TSS Removal Rate	**D** Starting TSS Load	**E** Amount Removed (C*D)	**F** Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Inlet	**0.75**	**0.75**	**0.56**	**0.19**
Infiltration System	**0.80**	**0.19**	**0.15**	**0.04**

Total TSS Removal = 96%

Meets 80% TSS removal requirement

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1" Calculation Sheet

Nitsch Job #	14051
Calc:	Boxford WQS
Date:	1/22/2021

This spreadsheet should be used to convert water quality volume to an equivilent water quality peak flow rate as outlined in the new MA DEP guidelines that take effect on October 15, 2013.

Glossary

Water Quality Flow Rate =	WQF
Water Quality Volume =	WQV*
unit peak discharge (csm/in) =	qu**
Impervious Area in watershed (square miles) =	Ai

*WQV is expressed in watershed inches (you must use 1.0-inches in all cases with this method and not 0.5-inches)
** calculate the qu based on the time of concentration (see 1" - qu Table)

Compute Water Quality Flow with the following Equation

WQF = (qu)(A)(WQV)

Input Information (in colored cells only)

Site Plan Callout		Enter qu (from 1" - qu Table)	Enter Impervious Area (SF)	Ai (sq/mi)	WQV		WQF	
WQS#204	=	774	2493	0.000089	1	=	0.07	cfs
WQS#205	=	774	6839	0.000245	1	=	0.19	cfs
WQS#206	=	774	13171	0.000472	1	=	0.37	cfs
	=			0.000000	1	=	0.00	cfs
	=			0.000000	1	=	0.00	cfs
	=			0.000000	1	=	0.00	cfs
	=			0.000000	1	=	0.00	cfs
	=			0.000000	1	=	0.00	cfs
	=			0.000000	1	=	0.00	cfs
	=			0.000000	1	=	0.00	cfs

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Sediment Storage Calculation Sheet

Nitsch Job #: 14051 Date: 1/22/2021

Project Name: Boxford Senior Center

Calculated by: CJ Checked by: DC

Water Quality ID: WQS #204

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:
*change these as needed

150	mg/L	TSS Loading
47	inches	Annual Rainfall - Boxford Area
2650	kg/m^3	SG
80%		TSS Removal
3	years	Storage Capacity

Input:

Drainage Area:	0.054	acres	Input Project Specific Values
% Impervious:	100.00%	of area	

Volume of Runoff:	9212.940	cf/year =	260.881	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	39.132	kg/year =	0.015	m^3/year =	0.521	cf/year
Sediment Removal:	0.417	cf/year				

Sediment Storage Required: **1 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Boxford, MA.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #: 14051 Date: 1/22/2021
Project Name: Boxford Senior Center
Calculated by: CJ Checked by: DC
Water Quality ID: WQS #205

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:
*change these as needed

150	mg/L	TSS Loading
47	inches	Annual Rainfall - Boxford Area
2650	kg/m^3	SG
80%		TSS Removal
3	years	Storage Capacity

Input:

Drainage Area:	0.302	acres	Input Project Specific Values
% Impervious:	100.00%	of area	

Volume of Runoff:	51524.220	cf/year =	1459.001	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	218.850	kg/year =	0.083	m^3/year =	2.916	cf/year
Sediment Removal:	2.333	cf/year				

Sediment Storage Required: **7 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Boxford, MA.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #: 14051 Date: 1/22/2021
Project Name: Boxford Senior Center
Calculated by: CJ Checked by: DC
Water Quality ID: WQS #206

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:
*change these as needed

150	mg/L	TSS Loading
47	inches	Annual Rainfall - Boxford Area
2650	kg/m^3	SG
80%		TSS Removal
3	years	Storage Capacity

Input:

Drainage Area: 0.302 acres
% Impervious: 100.00% of area

Input Project Specific Values

Volume of Runoff: 51524.220 cf/year = 1459.001 m^3/year

Loading: 0.150 kg/m^3

Sediment: 218.850 kg/year = 0.083 m^3/year = 2.916 cf/year

Sediment Removal: 2.333 cf/year

Sediment Storage Required: **7 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Boxford, MA.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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STANDARD 10: Illicit Discharge Compliance Statement

Project Name: Boxford Senior Center	Nitsch Project #: 14051
Location: 10 Elm Street, Boxford, MA	Checked by: DC
Prepared by: CJ	Sheet No. 1 of 1
Date: 01-22-2021	

Standard 10 states: All illicit discharges to the stormwater management system are prohibited.

This is to verify:

1. Based on the information available there are no known or suspected illicit discharges to the stormwater management system at the Boxford Senior Center site as defined in the MassDEP Stormwater Handbook.

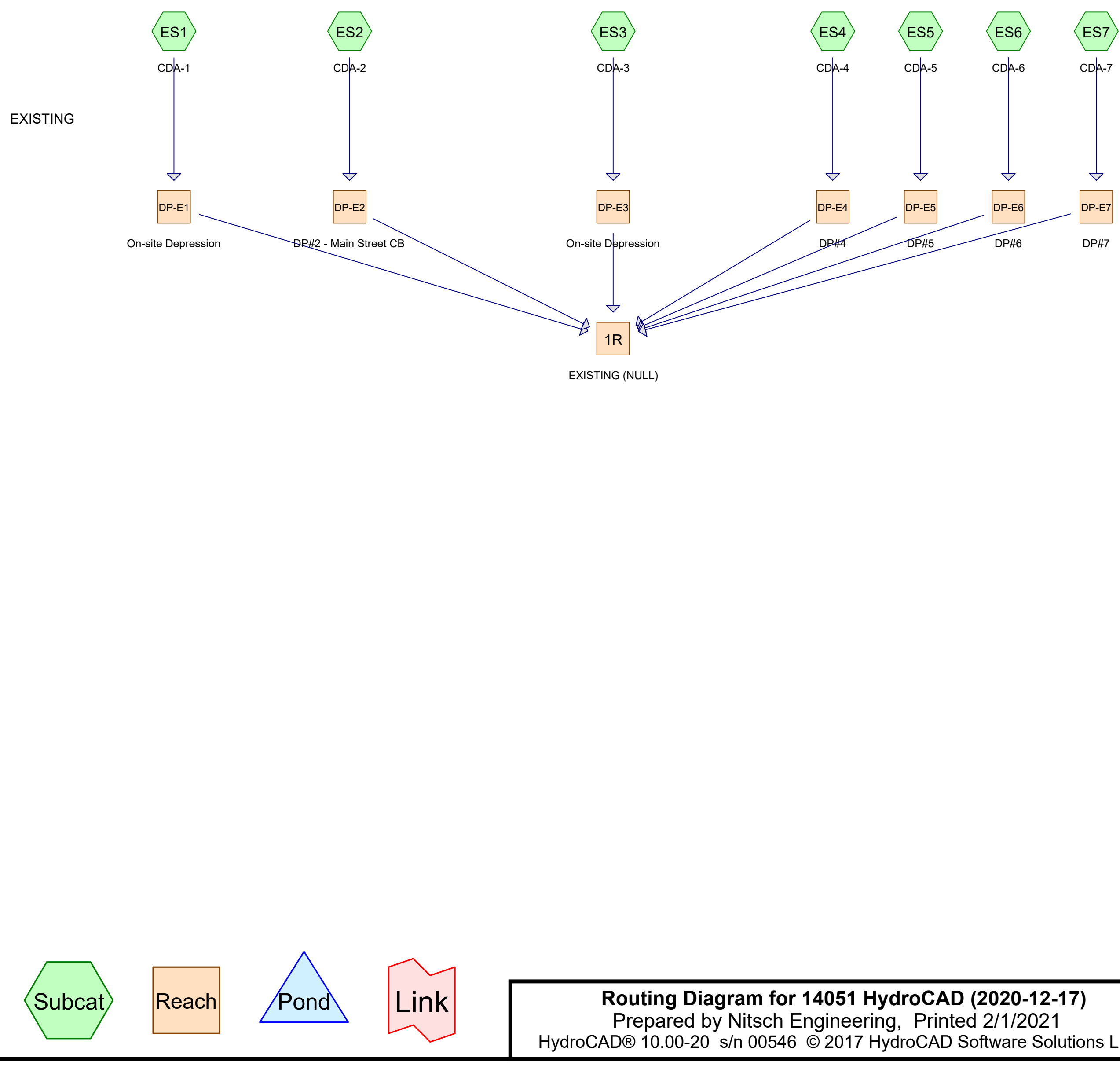
2. The design of the stormwater system includes no proposed illicit discharges.

David Conway, PE

Date

APPENDIX B

Pre-Development Conditions – HydroCAD Calculations



Routing Diagram for 14051 HydroCAD (2020-12-17)
Prepared by Nitsch Engineering, Printed 2/1/2021
HydroCAD® 10.00-20 s/n 00546 © 2017 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
45,683	30	Meadow, non-grazed, HSG A (ES7)
8,015	98	Paved parking, HSG A (ES2, ES3, ES7)
5,053	98	Roofs, HSG A (ES1, ES2, ES3)
104,079	30	Woods, Good, HSG A (ES1, ES2, ES3, ES4, ES5, ES6)
162,830	**35**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
162,830	HSG A	ES1, ES2, ES3, ES4, ES5, ES6, ES7
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
162,830		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcat Numbe
45,683	0	0	0	0	45,683	Meadow, non-grazed	
8,015	0	0	0	0	8,015	Paved parking	
5,053	0	0	0	0	5,053	Roofs	
104,079	0	0	0	0	104,079	Woods, Good	
162,830	**0**	**0**	**0**	**0**	**162,830**	**TOTAL AREA**	

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

SubcatchmentES1: CDA-1 Runoff Area=6,793 sf 8.18% Impervious Runoff Depth=0.00"
Flow Length=75' Slope=0.0260 '/' Tc=20.0 min CN=36 Runoff=0.00 cfs 0 cf

SubcatchmentES2: CDA-2 Runoff Area=9,782 sf 44.86% Impervious Runoff Depth=0.40"
Flow Length=132' Slope=0.0150 '/' Tc=10.9 min CN=61 Runoff=0.05 cfs 329 cf

SubcatchmentES3: CDA-3 Runoff Area=41,255 sf 7.89% Impervious Runoff Depth=0.00"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=35 Runoff=0.00 cfs 0 cf

SubcatchmentES4: CDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentES5: CDA-5 Runoff Area=36,627 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentES6: CDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentES7: CDA-7 Runoff Area=50,551 sf 9.63% Impervious Runoff Depth=0.00"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=37 Runoff=0.00 cfs 0 cf

Reach 1R: EXISTING (NULL) Inflow=0.05 cfs 329 cf
Outflow=0.05 cfs 329 cf

Reach DP-E1: On-site Depression Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E2: DP#2 - Main Street CB Inflow=0.05 cfs 329 cf
Outflow=0.05 cfs 329 cf

Reach DP-E3: On-site Depression Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E4: DP#4 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E5: DP#5 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E6: DP#6 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E7: DP#7 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Total Runoff Area = 162,830 sf Runoff Volume = 329 cf Average Runoff Depth = 0.02"
91.97% Pervious = 149,762 sf 8.03% Impervious = 13,068 sf

Summary for Subcatchment ES1: CDA-1

[45] Hint: Runoff=Zero

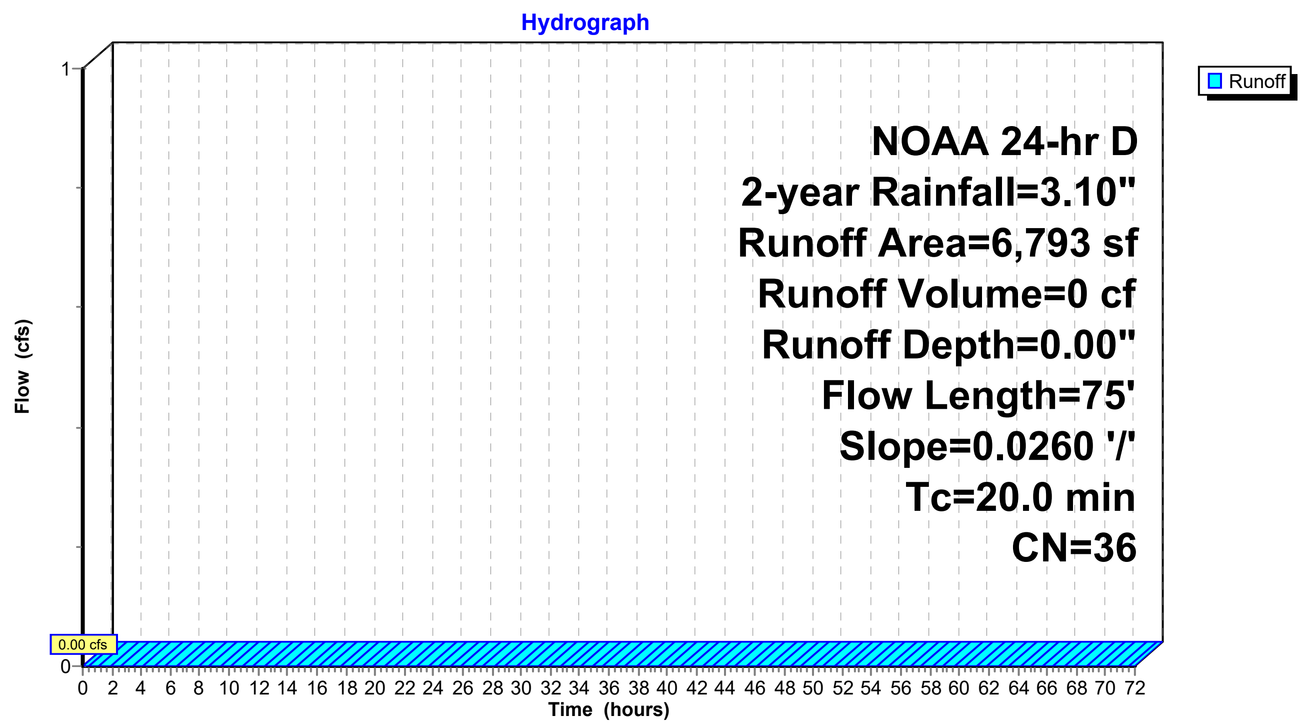
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
556	98	Roofs, HSG A
6,237	30	Woods, Good, HSG A
6,793	36	Weighted Average
6,237		91.82% Pervious Area
556		8.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0260	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	25	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.0	75	Total			

Subcatchment ES1: CDA-1



Summary for Subcatchment ES2: CDA-2

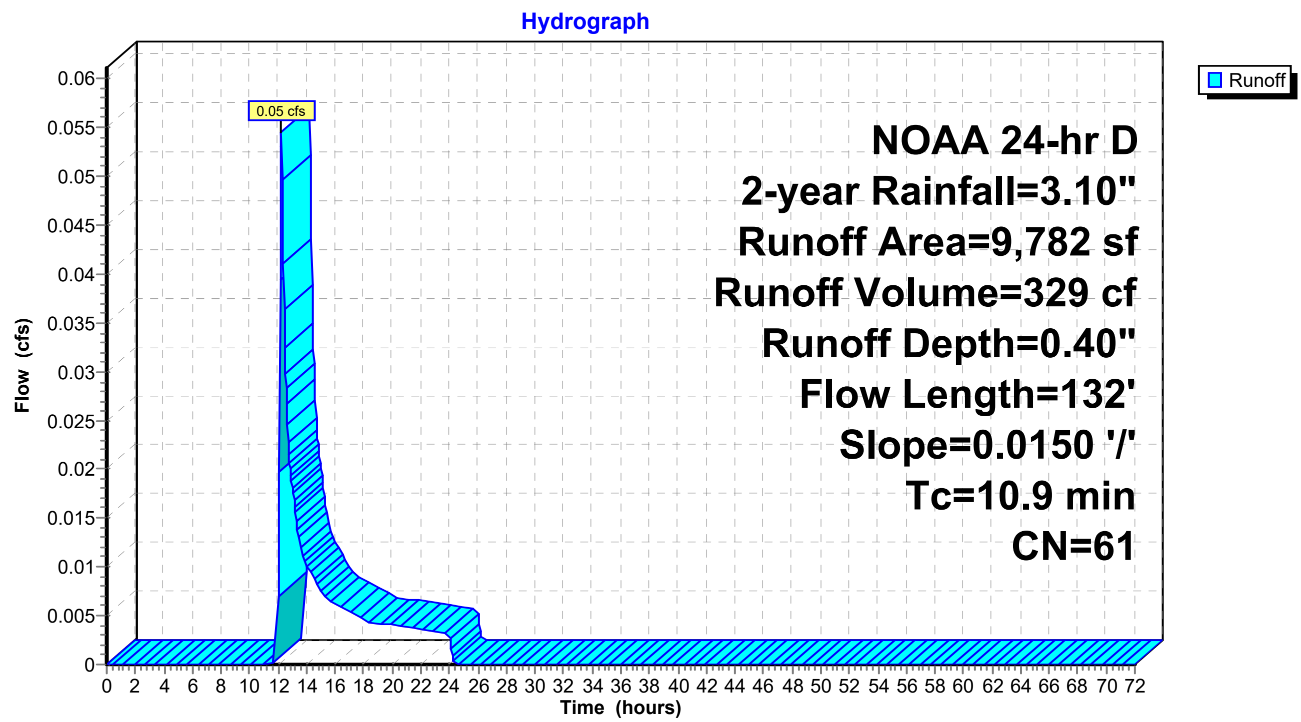
Runoff = 0.05 cfs @ 12.22 hrs, Volume= 329 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
5,394	30	Woods, Good, HSG A
1,320	98	Roofs, HSG A
3,068	98	Paved parking, HSG A
9,782	61	Weighted Average
5,394		55.14% Pervious Area
4,388		44.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0150	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	27	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.9	132	Total			

Subcatchment ES2: CDA-2



Summary for Subcatchment ES3: CDA-3

[45] Hint: Runoff=Zero

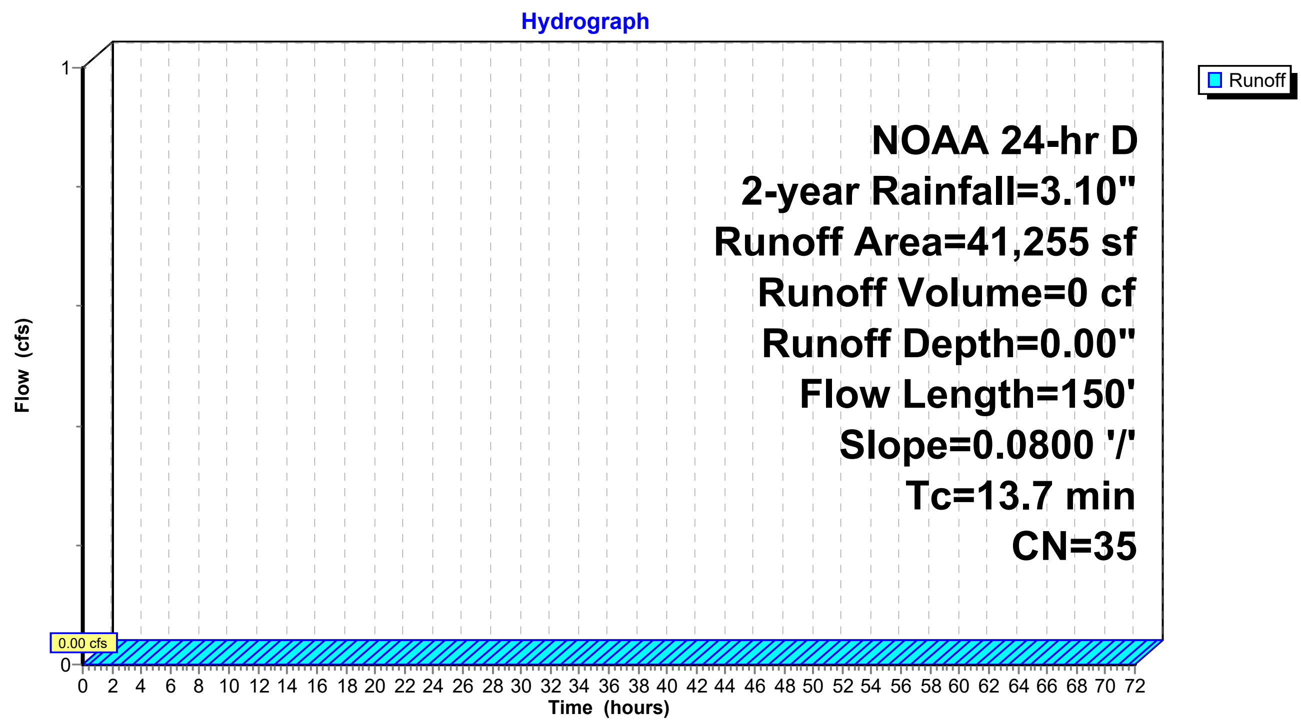
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
79	98	Paved parking, HSG A
3,177	98	Roofs, HSG A
37,999	30	Woods, Good, HSG A
41,255	35	Weighted Average
37,999		92.11% Pervious Area
3,256		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment ES3: CDA-3



Summary for Subcatchment ES4: CDA-4

[45] Hint: Runoff=Zero

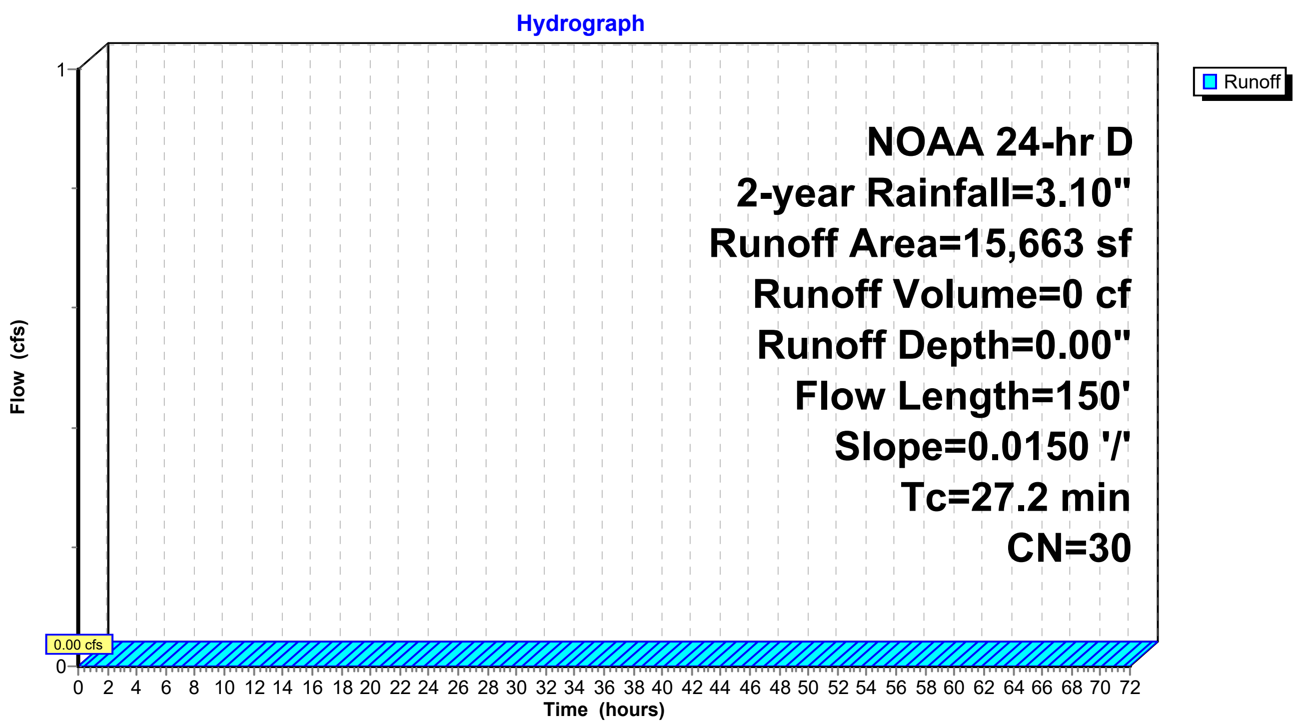
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment ES4: CDA-4



Summary for Subcatchment ES5: CDA-5

[45] Hint: Runoff=Zero

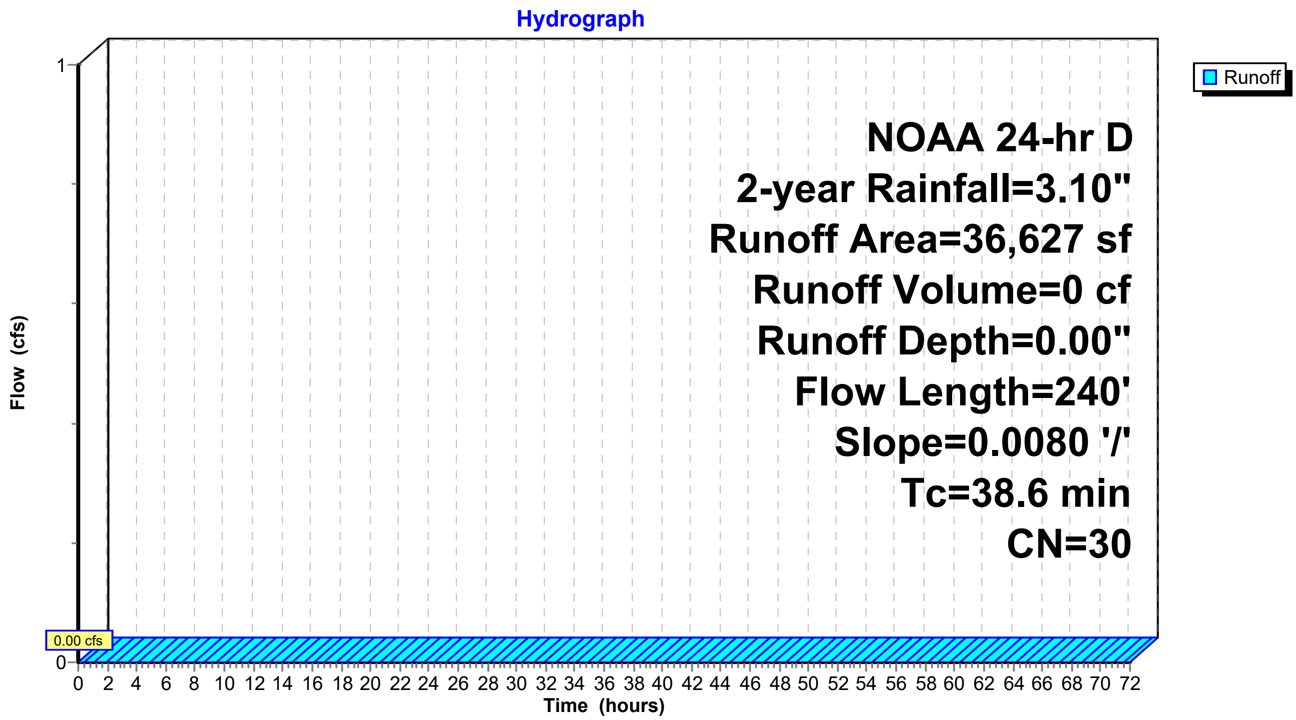
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
36,627	30	Woods, Good, HSG A
36,627		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment ES5: CDA-5



Summary for Subcatchment ES6: CDA-6

[45] Hint: Runoff=Zero

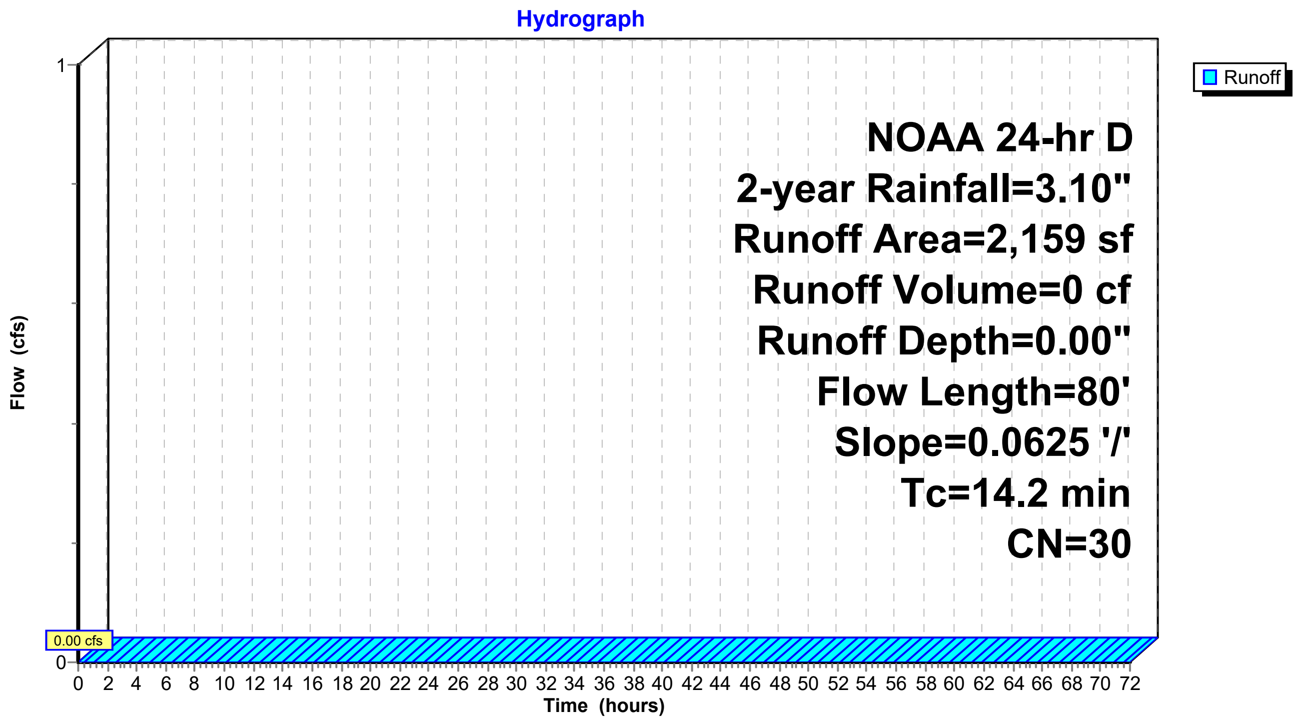
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment ES6: CDA-6



Summary for Subcatchment ES7: CDA-7

[45] Hint: Runoff=Zero

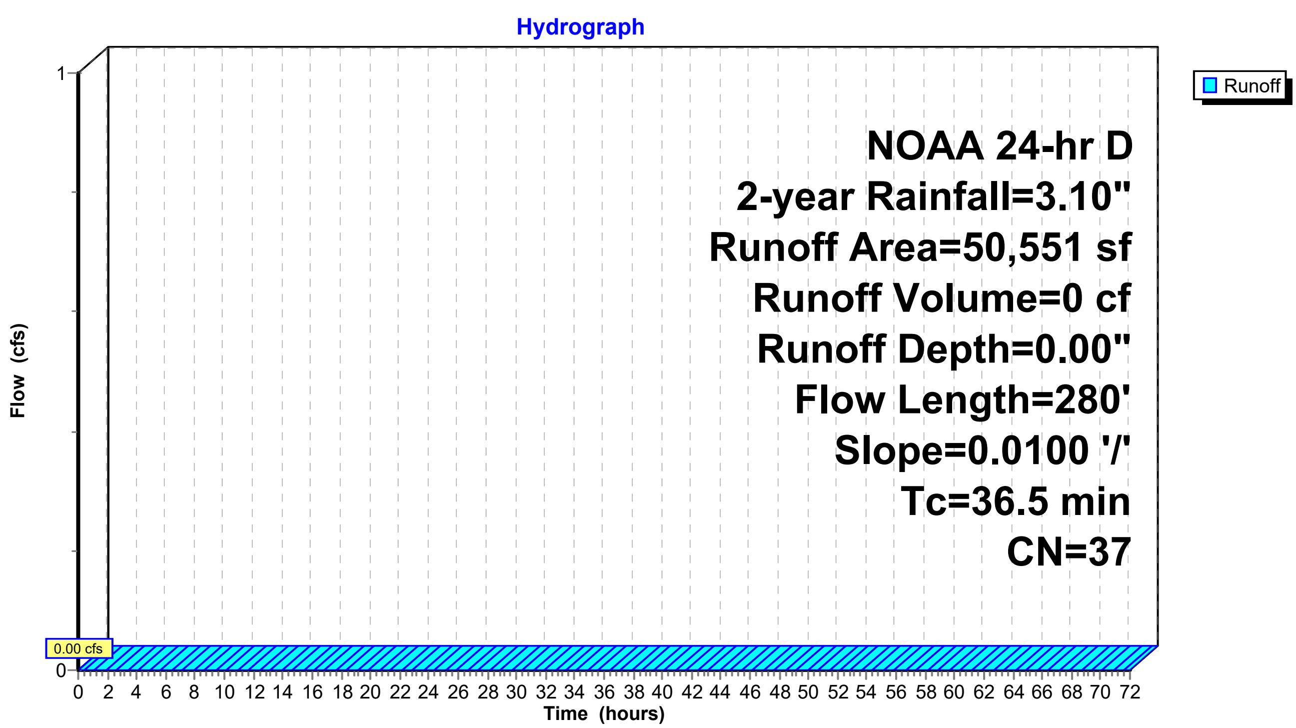
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
4,868	98	Paved parking, HSG A
45,683	30	Meadow, non-grazed, HSG A
50,551	37	Weighted Average
45,683		90.37% Pervious Area
4,868		9.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment ES7: CDA-7

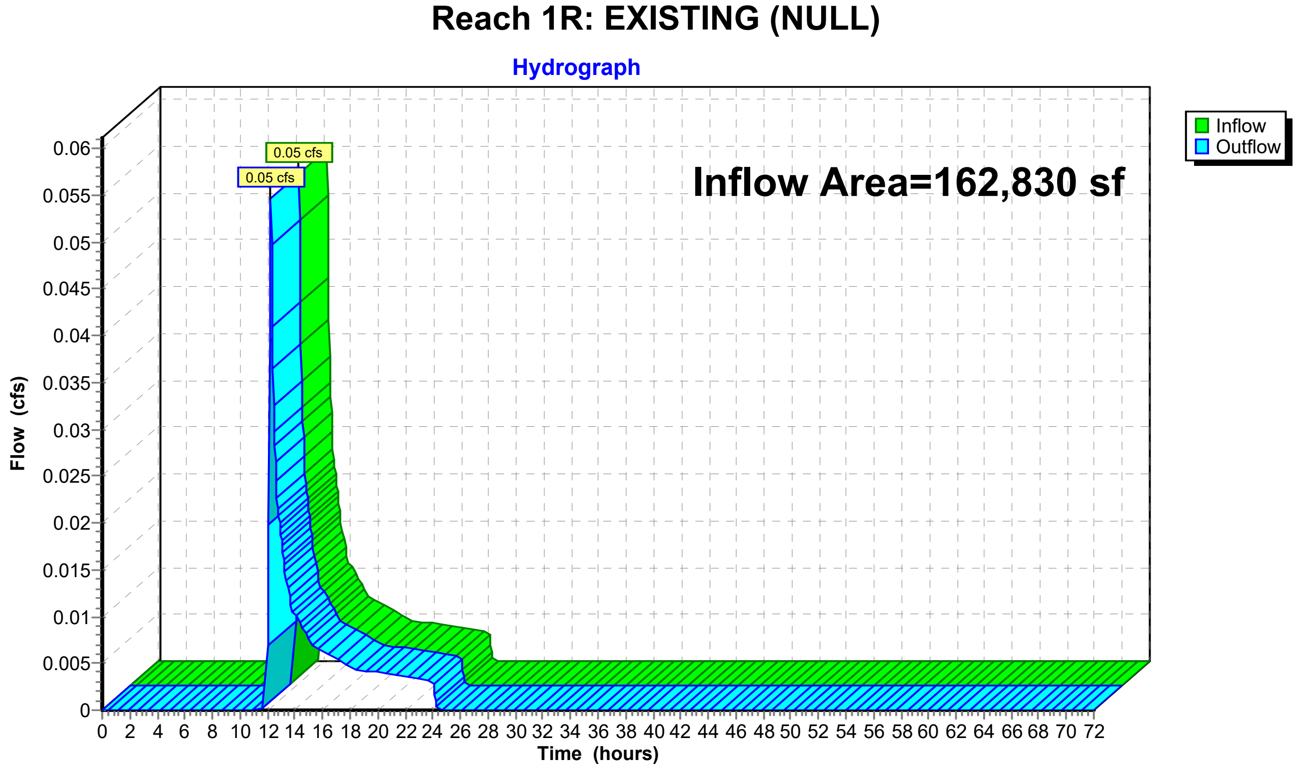


Summary for Reach 1R: EXISTING (NULL)

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

Inflow Area =	162,830 sf,	8.03% Impervious,	Inflow Depth = 0.02"	for 2-year event
Inflow =	0.05 cfs @	12.22 hrs, Volume=	329 cf	
Outflow =	0.05 cfs @	12.22 hrs, Volume=	329 cf,	Atten= 0%, Lag= 0.0 min

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



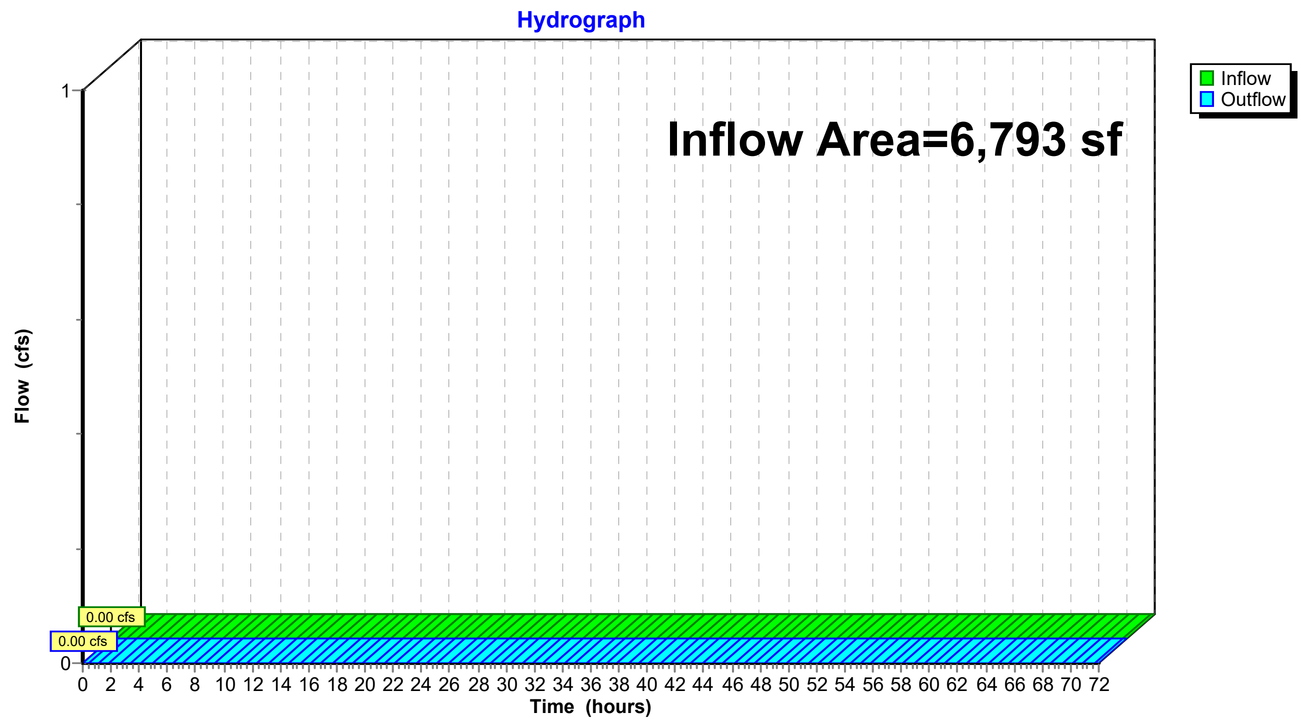
Summary for Reach DP-E1: On-site Depression

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

Inflow Area = 6,793 sf, 8.18% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E1: On-site Depression



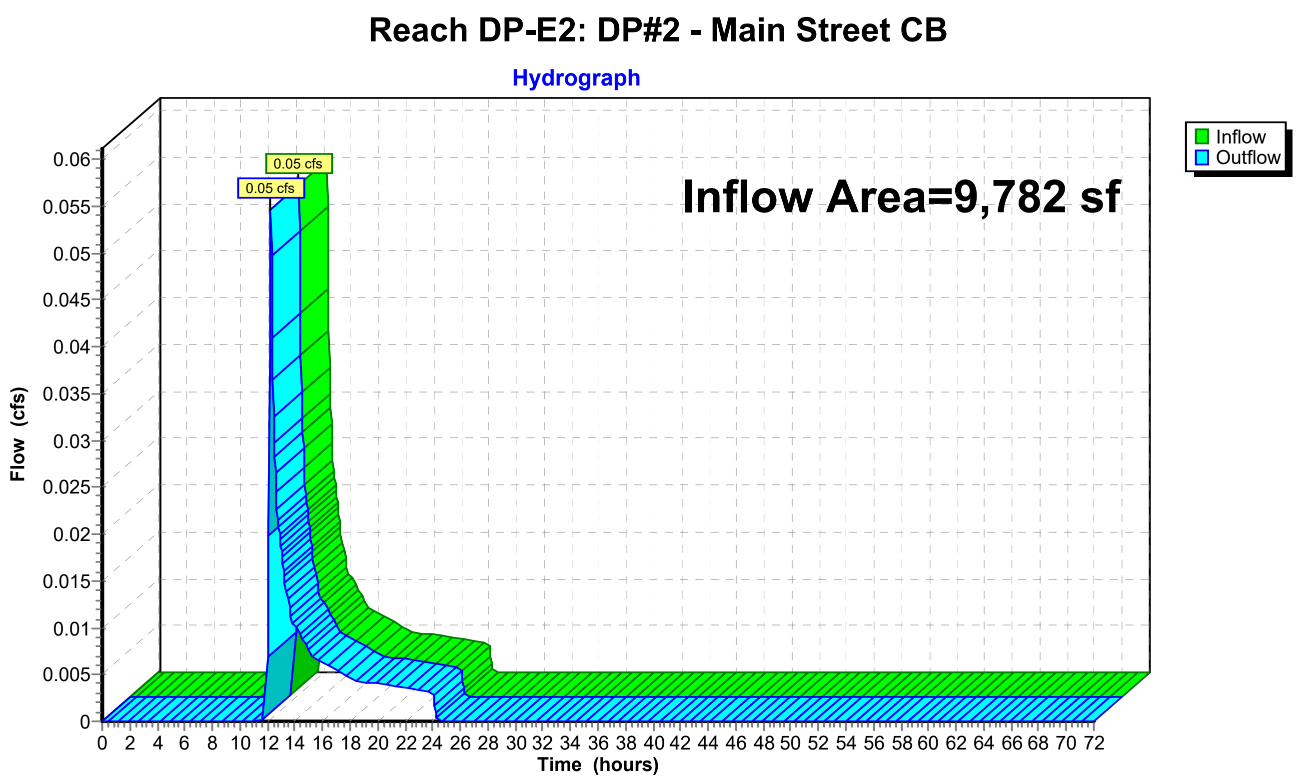
Summary for Reach DP-E2: DP#2 - Main Street CB

MAIN STREET CATCH BASIN

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

Inflow Area =	9,782 sf, 44.86% Impervious,	Inflow Depth = 0.40"	for 2-year event
Inflow =	0.05 cfs @ 12.22 hrs, Volume=	329 cf	
Outflow =	0.05 cfs @ 12.22 hrs, Volume=	329 cf, Atten= 0%, Lag= 0.0 min	

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



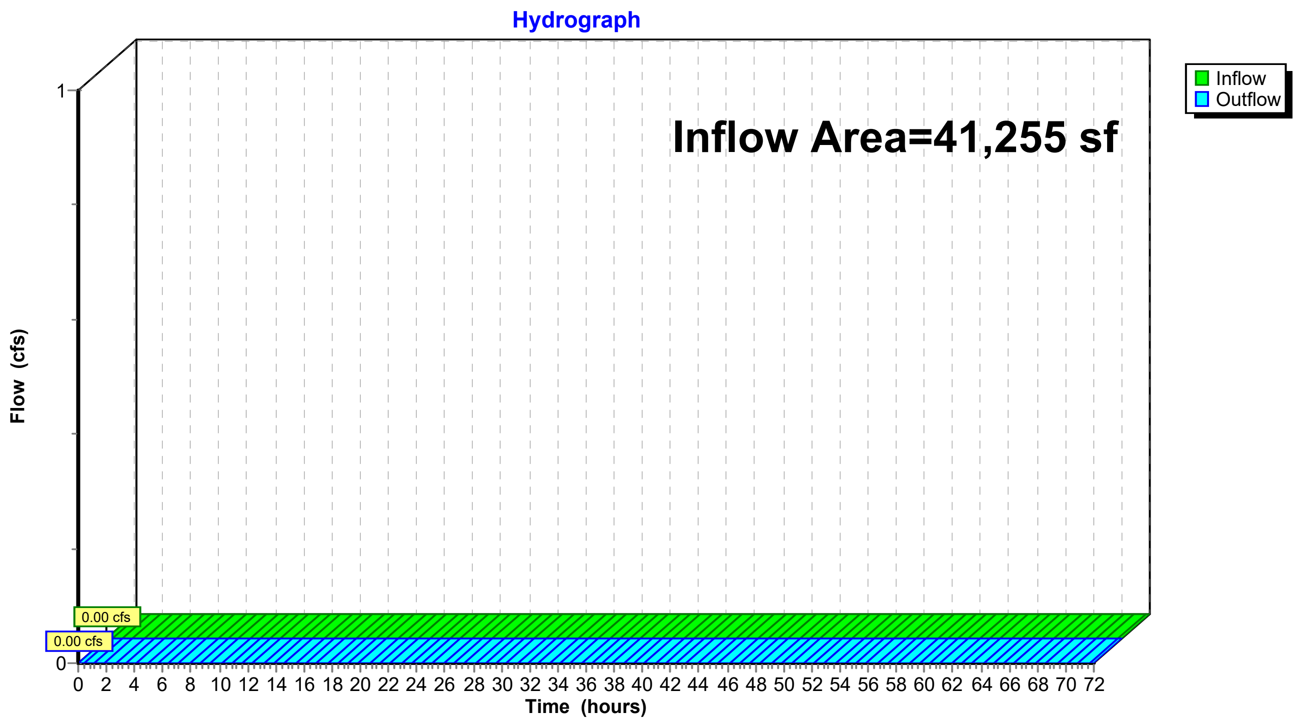
Summary for Reach DP-E3: On-site Depression

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

Inflow Area = 41,255 sf, 7.89% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E3: On-site Depression



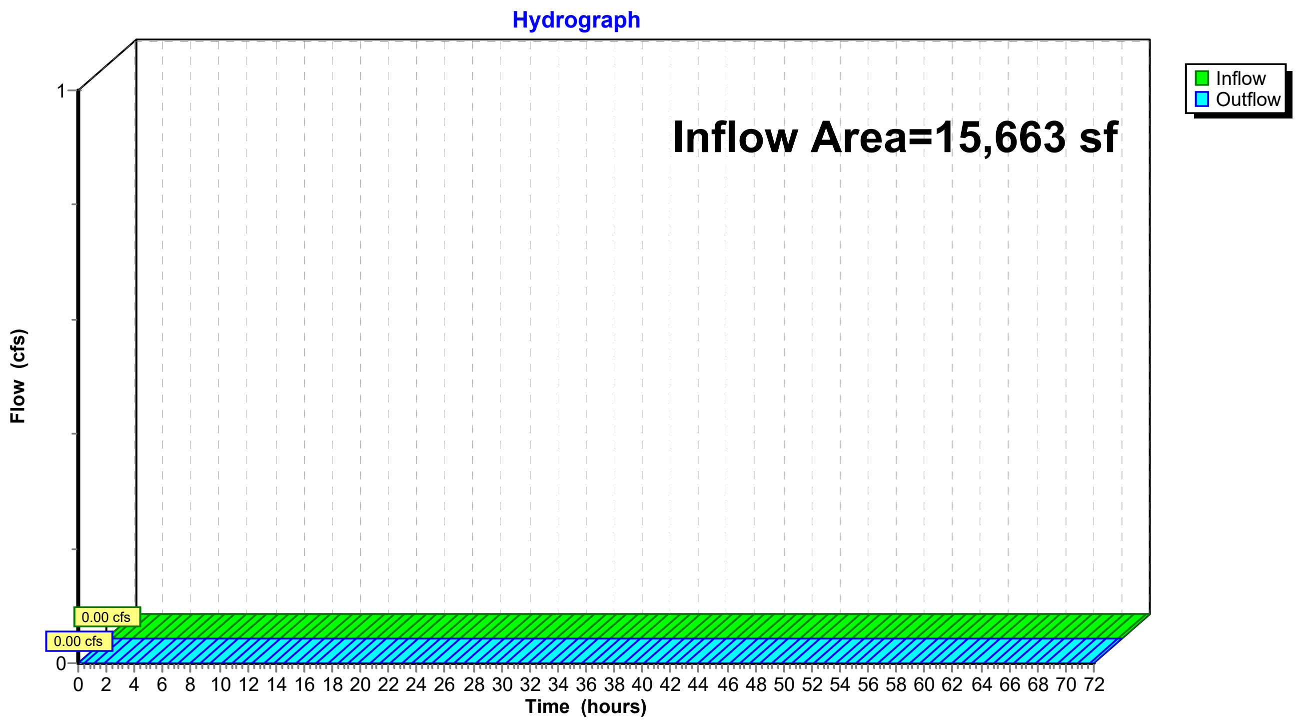
Summary for Reach DP-E4: DP#4

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

Inflow Area = 15,663 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E4: DP#4



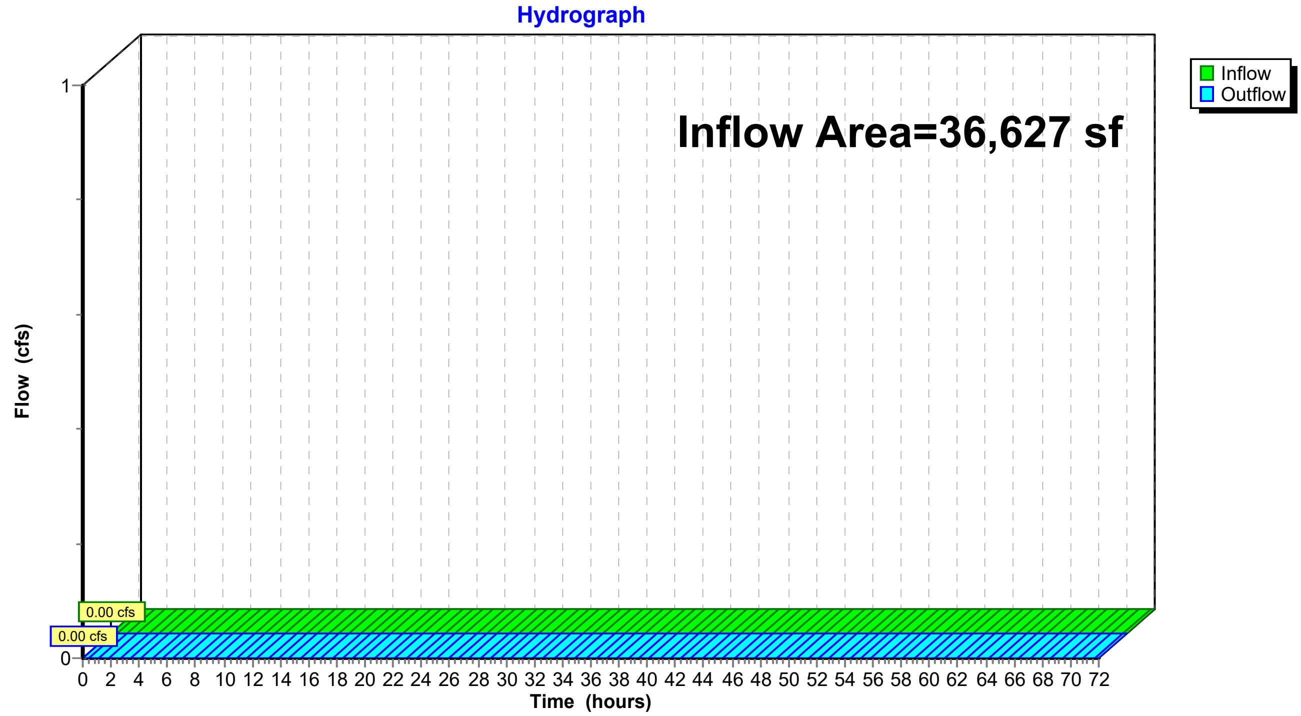
Summary for Reach DP-E5: DP#5

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

Inflow Area = 36,627 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E5: DP#5



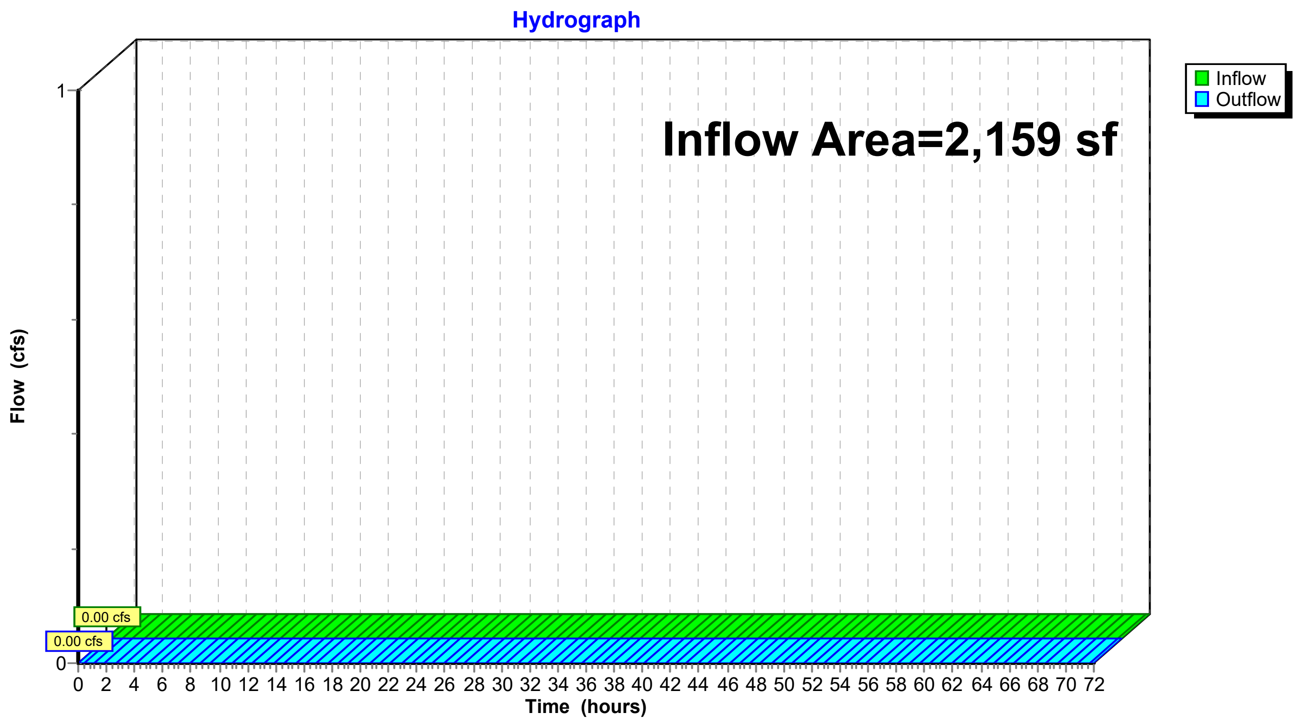
Summary for Reach DP-E6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-year event	
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf		
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf,	Atten= 0%,	Lag= 0.0 min

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

Reach DP-E6: DP#6



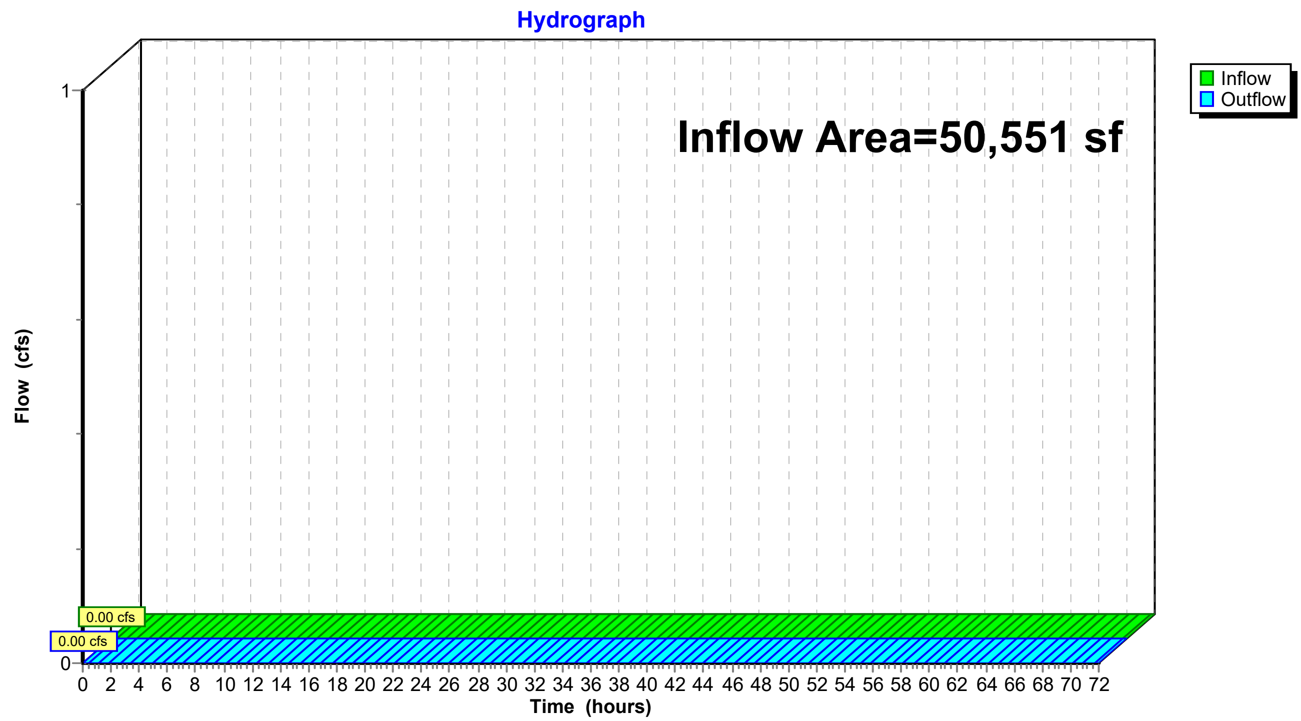
Summary for Reach DP-E7: DP#7

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

Inflow Area = 50,551 sf, 9.63% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E7: DP#7



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

SubcatchmentES1: CDA-1 Runoff Area=6,793 sf 8.18% Impervious Runoff Depth=0.07"
Flow Length=75' Slope=0.0260 '/' Tc=20.0 min CN=36 Runoff=0.00 cfs 39 cf

SubcatchmentES2: CDA-2 Runoff Area=9,782 sf 44.86% Impervious Runoff Depth=1.19"
Flow Length=132' Slope=0.0150 '/' Tc=10.9 min CN=61 Runoff=0.24 cfs 972 cf

SubcatchmentES3: CDA-3 Runoff Area=41,255 sf 7.89% Impervious Runoff Depth=0.05"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=35 Runoff=0.01 cfs 171 cf

SubcatchmentES4: CDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentES5: CDA-5 Runoff Area=36,627 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentES6: CDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentES7: CDA-7 Runoff Area=50,551 sf 9.63% Impervious Runoff Depth=0.09"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=37 Runoff=0.01 cfs 385 cf

Reach 1R: EXISTING (NULL) Inflow=0.24 cfs 1,568 cf
Outflow=0.24 cfs 1,568 cf

Reach DP-E1: On-site Depression Inflow=0.00 cfs 39 cf
Outflow=0.00 cfs 39 cf

Reach DP-E2: DP#2 - Main Street CB Inflow=0.24 cfs 972 cf
Outflow=0.24 cfs 972 cf

Reach DP-E3: On-site Depression Inflow=0.01 cfs 171 cf
Outflow=0.01 cfs 171 cf

Reach DP-E4: DP#4 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E5: DP#5 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E6: DP#6 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-E7: DP#7 Inflow=0.01 cfs 385 cf
Outflow=0.01 cfs 385 cf

Total Runoff Area = 162,830 sf Runoff Volume = 1,568 cf Average Runoff Depth = 0.12"
91.97% Pervious = 149,762 sf 8.03% Impervious = 13,068 sf

Summary for Subcatchment ES1: CDA-1

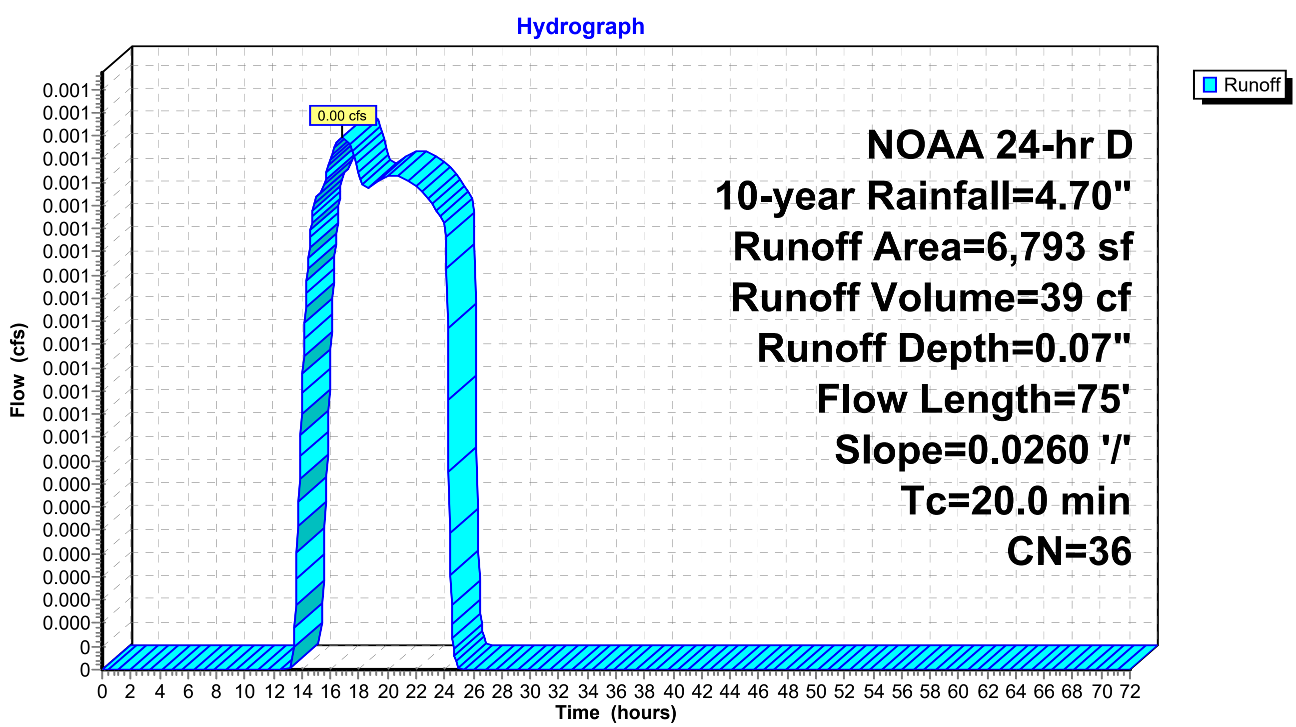
Runoff = 0.00 cfs @ 16.86 hrs, Volume= 39 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
556	98	Roofs, HSG A
6,237	30	Woods, Good, HSG A
6,793	36	Weighted Average
6,237		91.82% Pervious Area
556		8.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0260	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	25	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.0	75	Total			

Subcatchment ES1: CDA-1



Summary for Subcatchment ES2: CDA-2

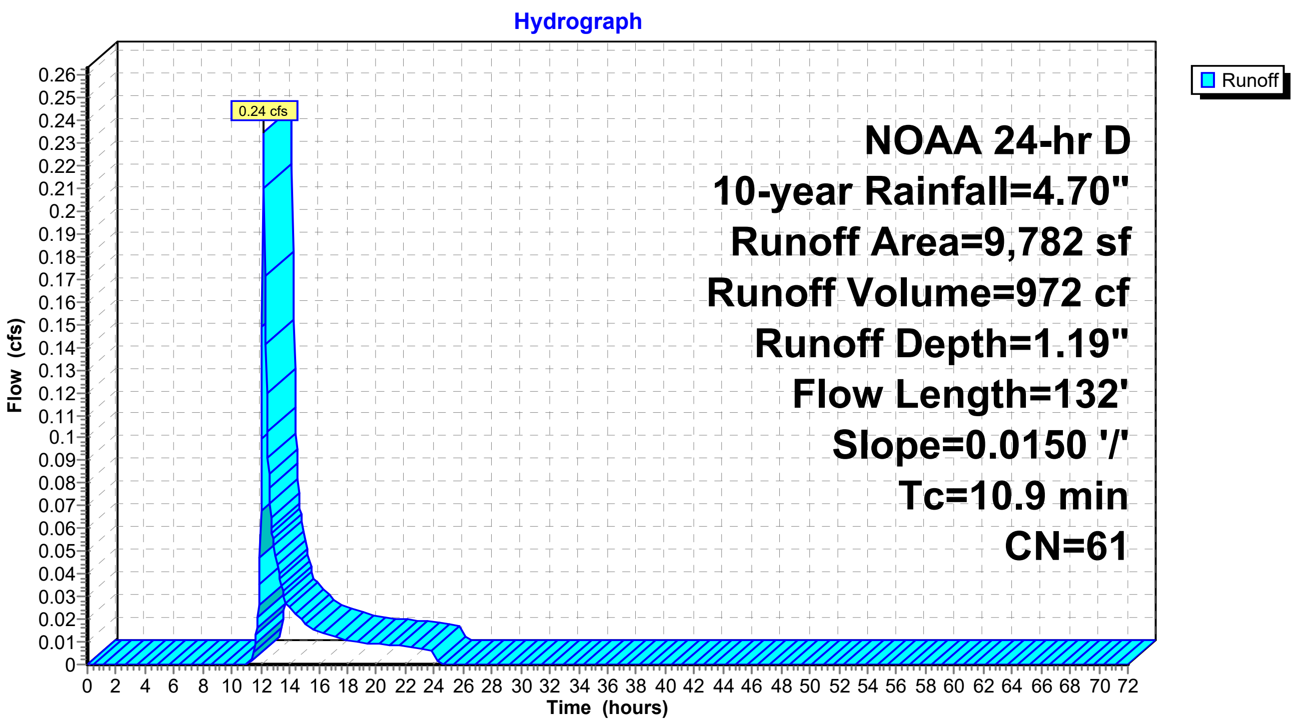
Runoff = 0.24 cfs @ 12.20 hrs, Volume= 972 cf, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
5,394	30	Woods, Good, HSG A
1,320	98	Roofs, HSG A
3,068	98	Paved parking, HSG A
9,782	61	Weighted Average
5,394		55.14% Pervious Area
4,388		44.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0150	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	27	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.9	132	Total			

Subcatchment ES2: CDA-2



Summary for Subcatchment ES3: CDA-3

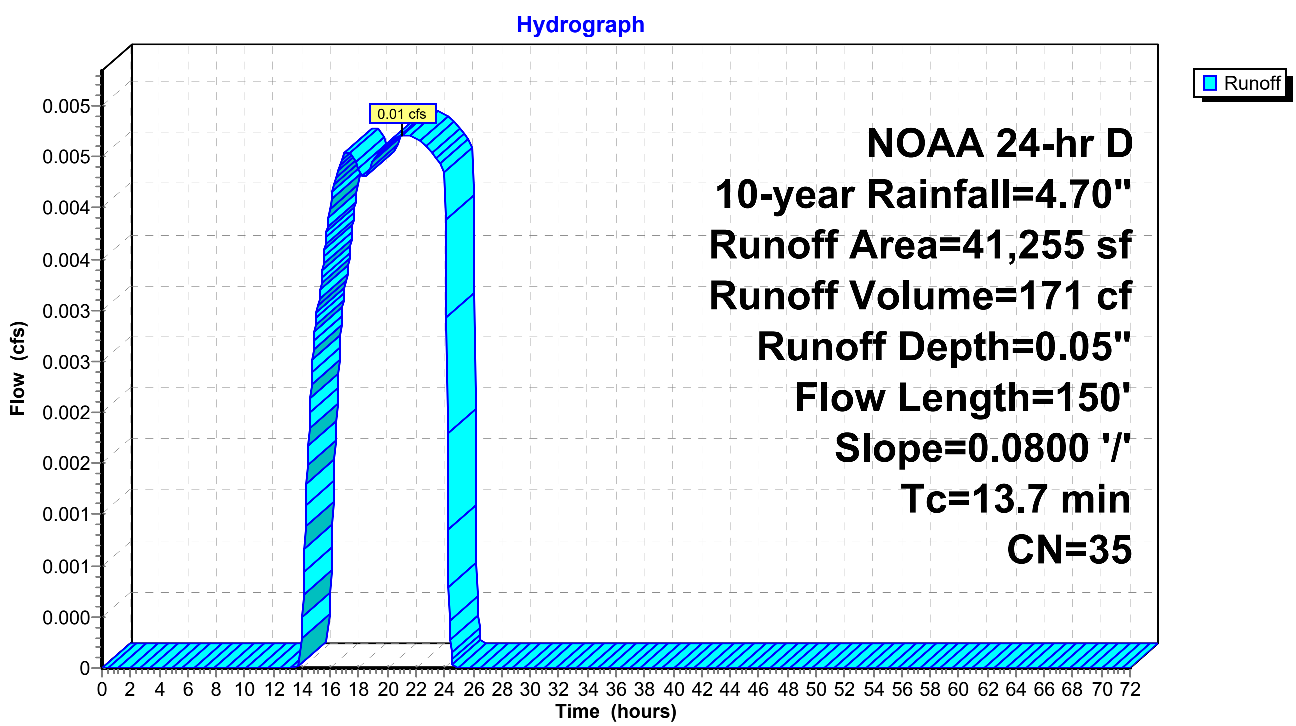
Runoff = 0.01 cfs @ 21.08 hrs, Volume= 171 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
79	98	Paved parking, HSG A
3,177	98	Roofs, HSG A
37,999	30	Woods, Good, HSG A
41,255	35	Weighted Average
37,999		92.11% Pervious Area
3,256		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment ES3: CDA-3



Summary for Subcatchment ES4: CDA-4

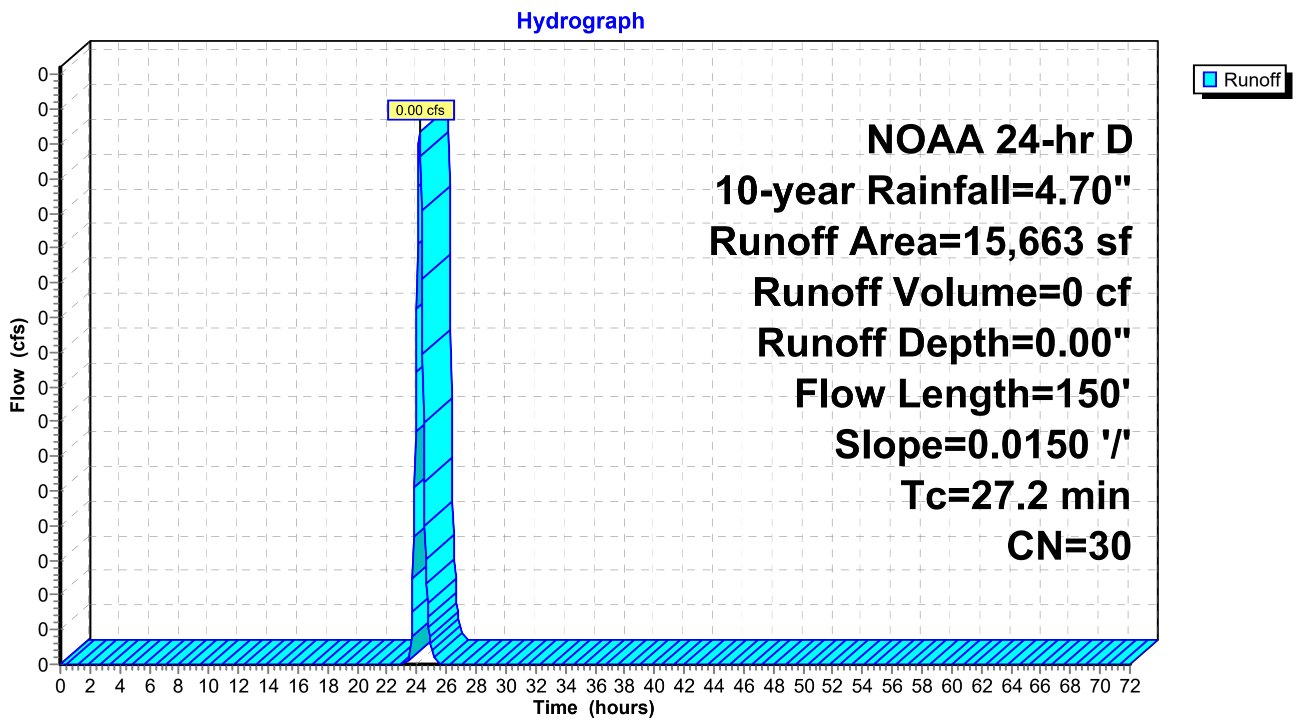
Runoff = 0.00 cfs @ 24.19 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment ES4: CDA-4



Summary for Subcatchment ES5: CDA-5

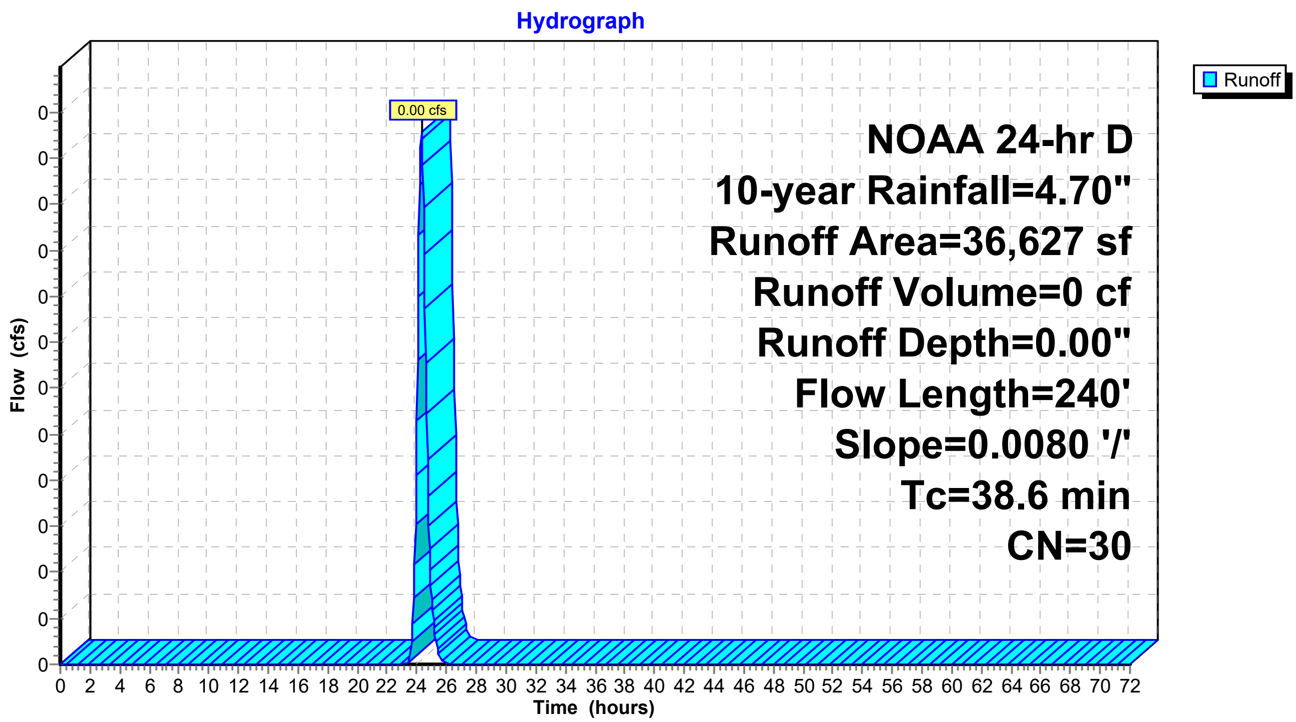
Runoff = 0.00 cfs @ 24.31 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
36,627	30	Woods, Good, HSG A
36,627		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment ES5: CDA-5



Summary for Subcatchment ES6: CDA-6

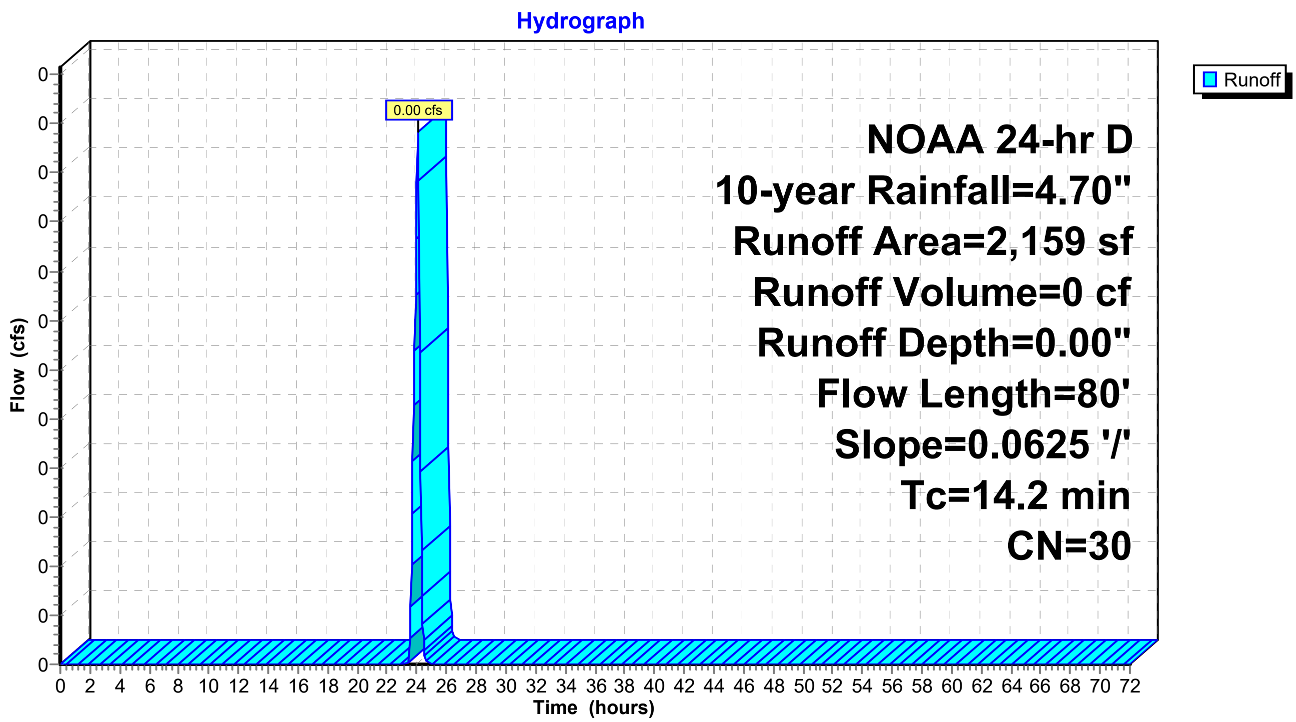
Runoff = 0.00 cfs @ 24.07 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment ES6: CDA-6



Summary for Subcatchment ES7: CDA-7

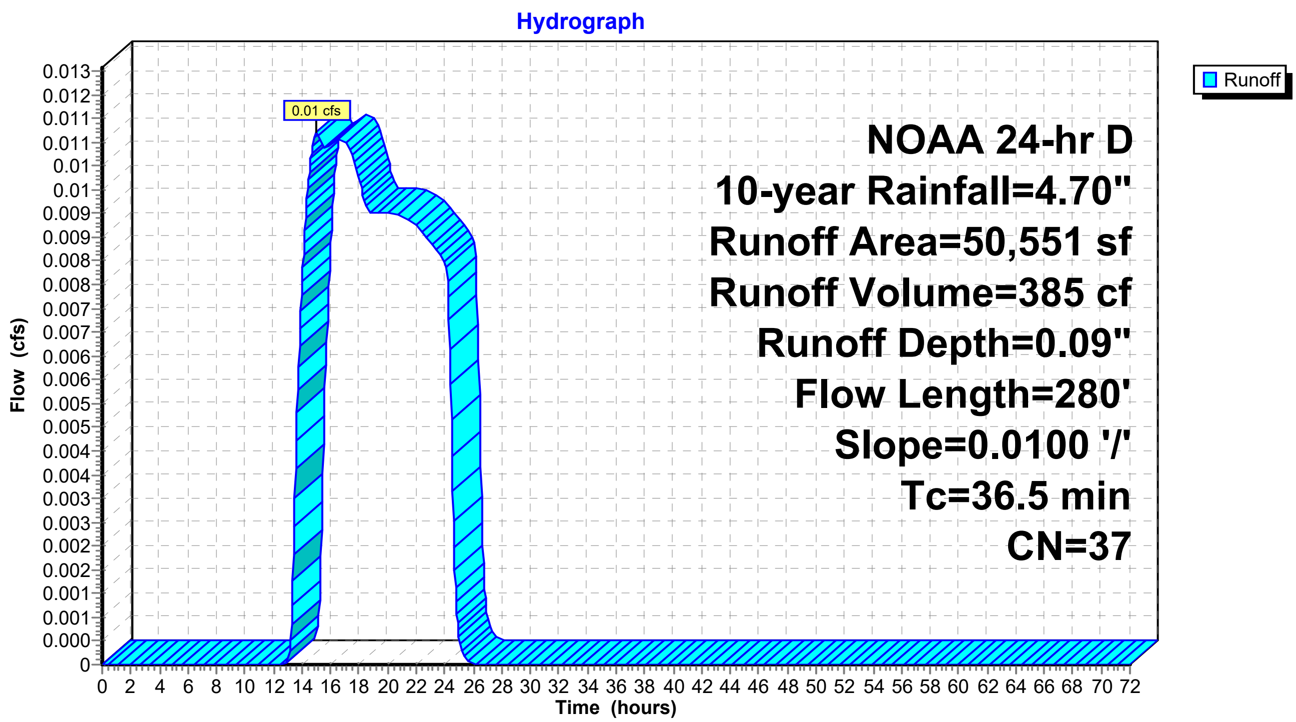
Runoff = 0.01 cfs @ 15.05 hrs, Volume= 385 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
4,868	98	Paved parking, HSG A
45,683	30	Meadow, non-grazed, HSG A
50,551	37	Weighted Average
45,683		90.37% Pervious Area
4,868		9.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment ES7: CDA-7



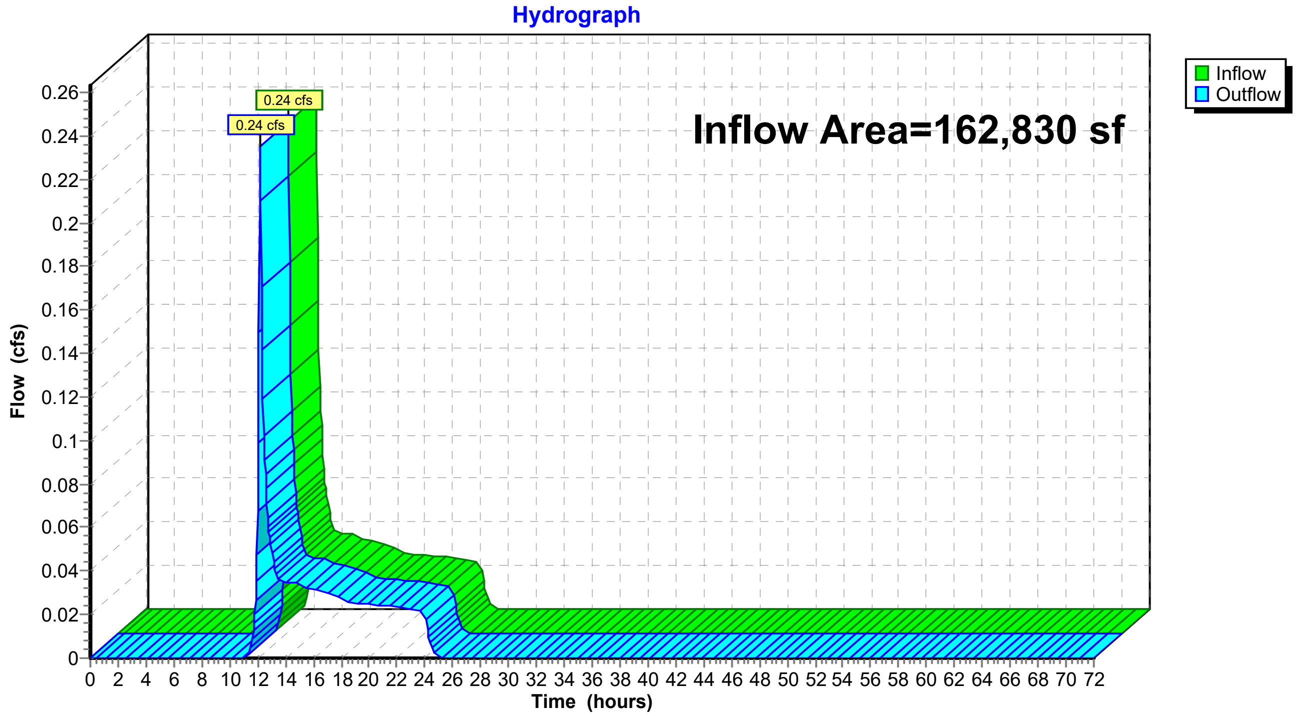
Summary for Reach 1R: EXISTING (NULL)

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

Inflow Area = 162,830 sf, 8.03% Impervious, Inflow Depth = 0.12" for 10-year event
Inflow = 0.24 cfs @ 12.20 hrs, Volume= 1,568 cf
Outflow = 0.24 cfs @ 12.20 hrs, Volume= 1,568 cf, Atten= 0%, Lag= 0.0 min

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

Reach 1R: EXISTING (NULL)



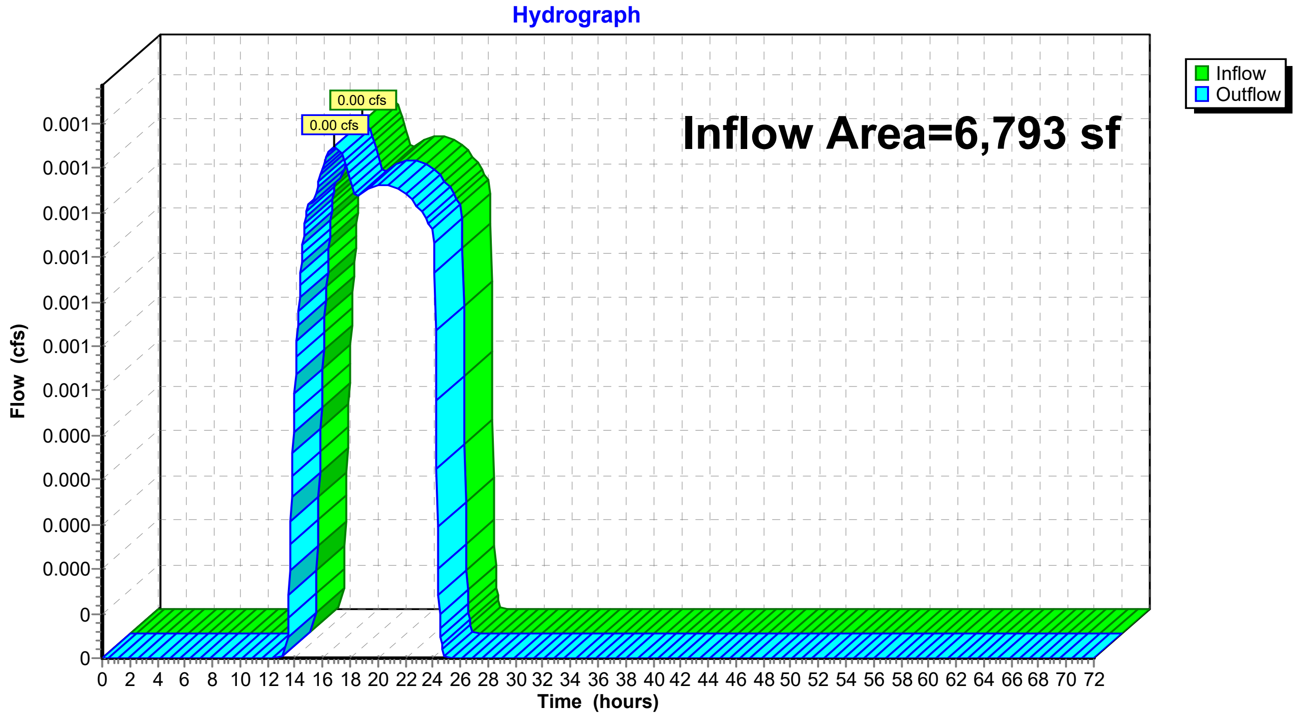
Summary for Reach DP-E1: On-site Depression

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

Inflow Area = 6,793 sf, 8.18% Impervious, Inflow Depth = 0.07" for 10-year event
Inflow = 0.00 cfs @ 16.86 hrs, Volume= 39 cf
Outflow = 0.00 cfs @ 16.86 hrs, Volume= 39 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E1: On-site Depression



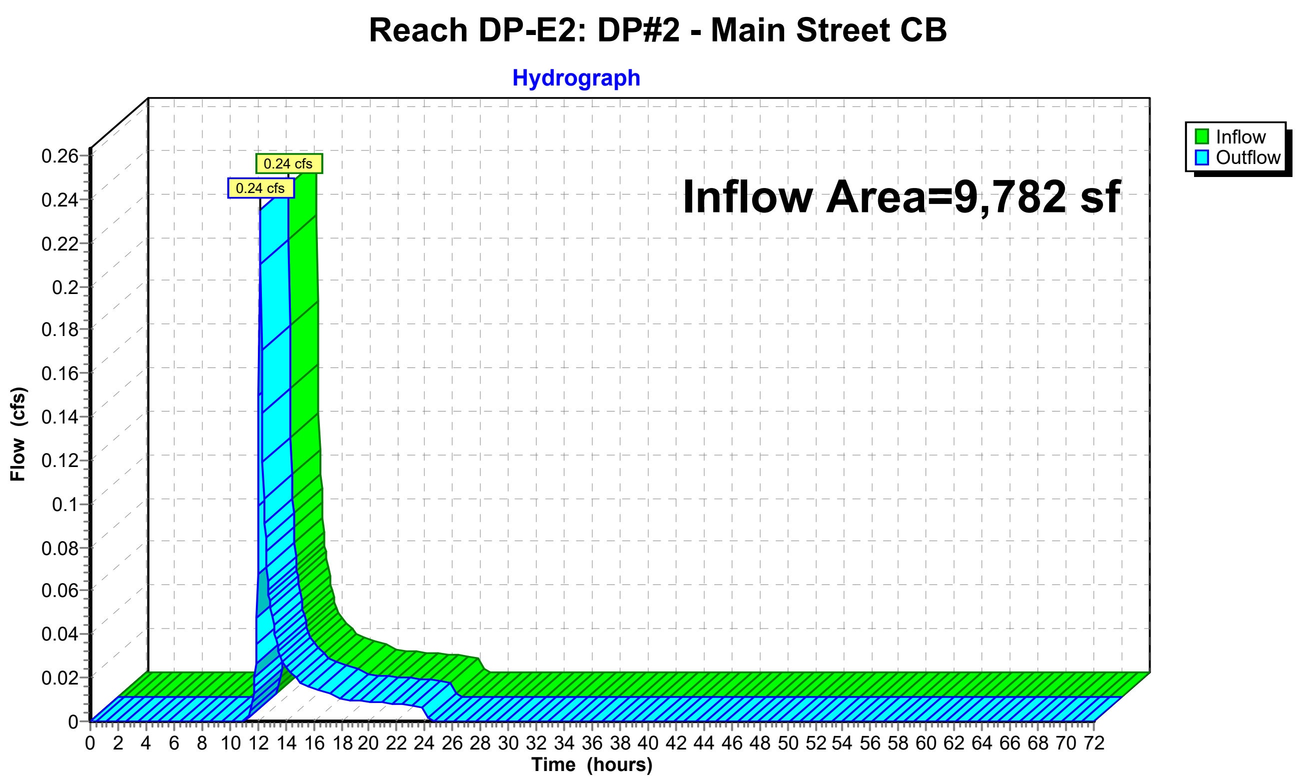
Summary for Reach DP-E2: DP#2 - Main Street CB

MAIN STREET CATCH BASIN

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

Inflow Area = 9,782 sf, 44.86% Impervious, Inflow Depth = 1.19" for 10-year event
Inflow = 0.24 cfs @ 12.20 hrs, Volume= 972 cf
Outflow = 0.24 cfs @ 12.20 hrs, Volume= 972 cf, Atten= 0%, Lag= 0.0 min

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



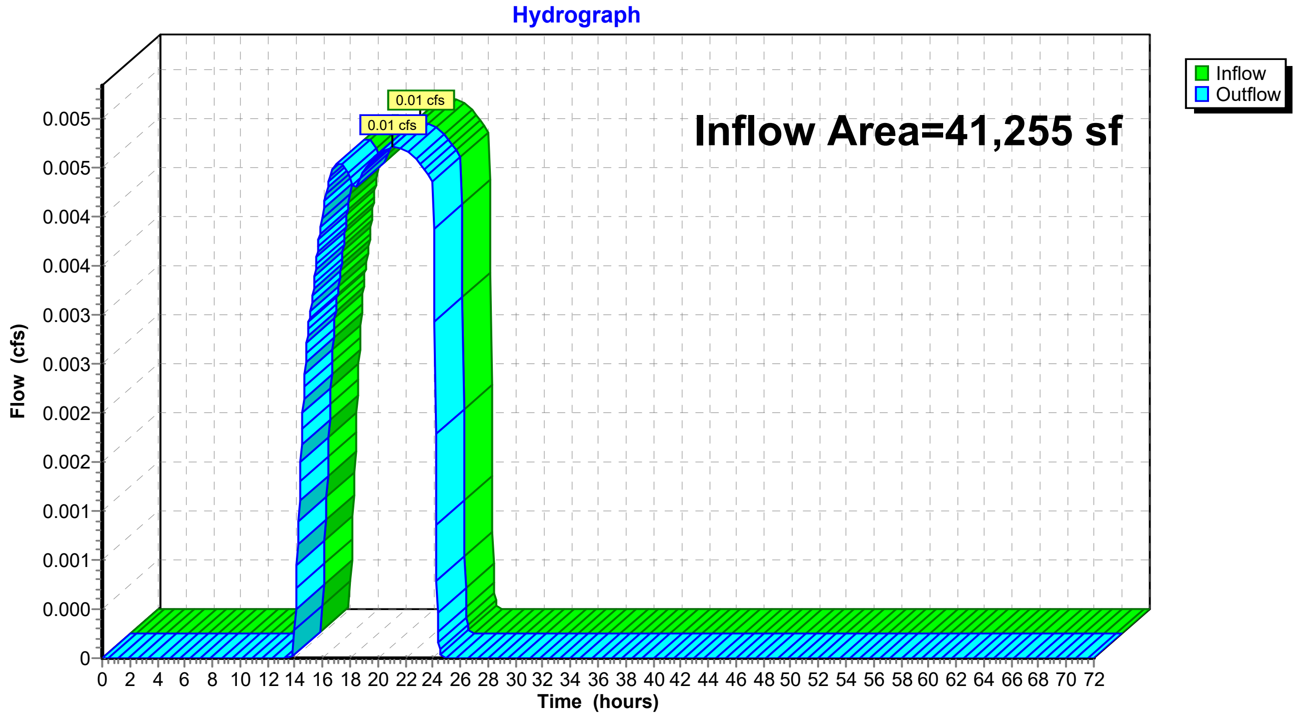
Summary for Reach DP-E3: On-site Depression

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

Inflow Area =	41,255 sf,	7.89% Impervious,	Inflow Depth = 0.05"	for 10-year event
Inflow =	0.01 cfs @	21.08 hrs, Volume=	171 cf	
Outflow =	0.01 cfs @	21.08 hrs, Volume=	171 cf, Atten= 0%, Lag= 0.0 min	

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

Reach DP-E3: On-site Depression



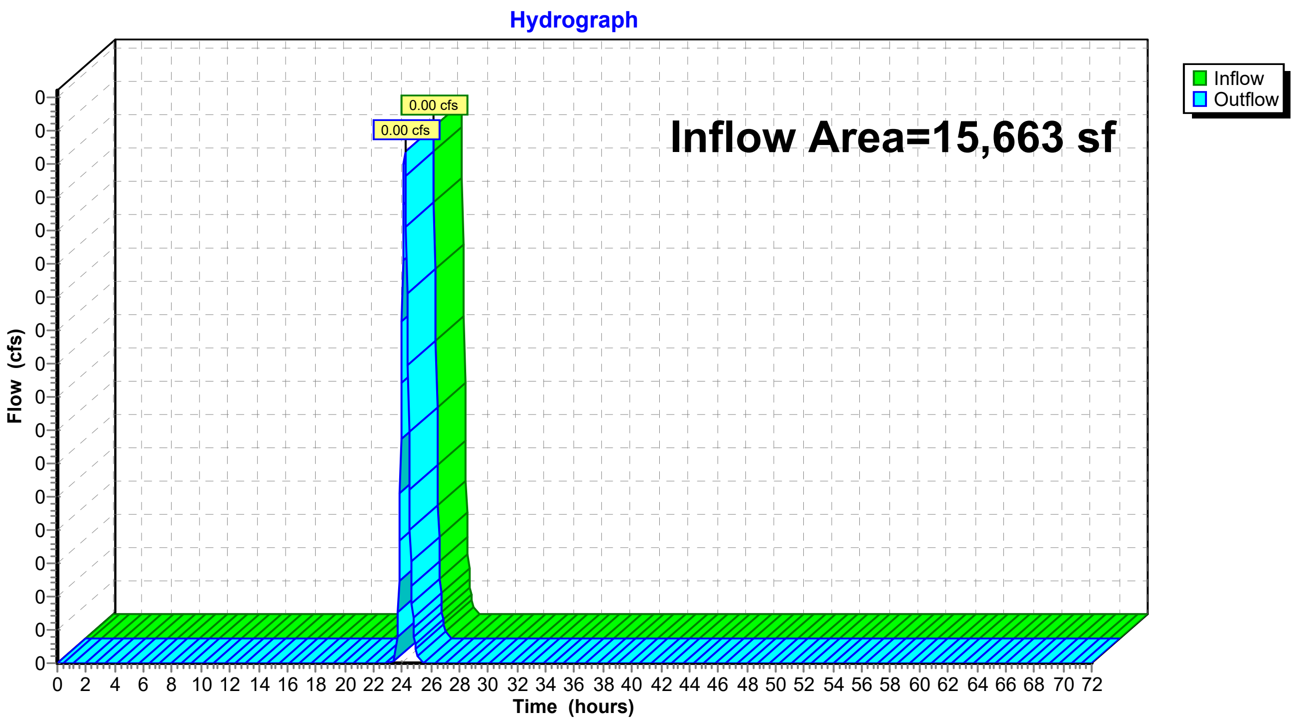
Summary for Reach DP-E4: DP#4

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

Inflow Area = 15,663 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-year event
Inflow = 0.00 cfs @ 24.19 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 24.19 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E4: DP#4



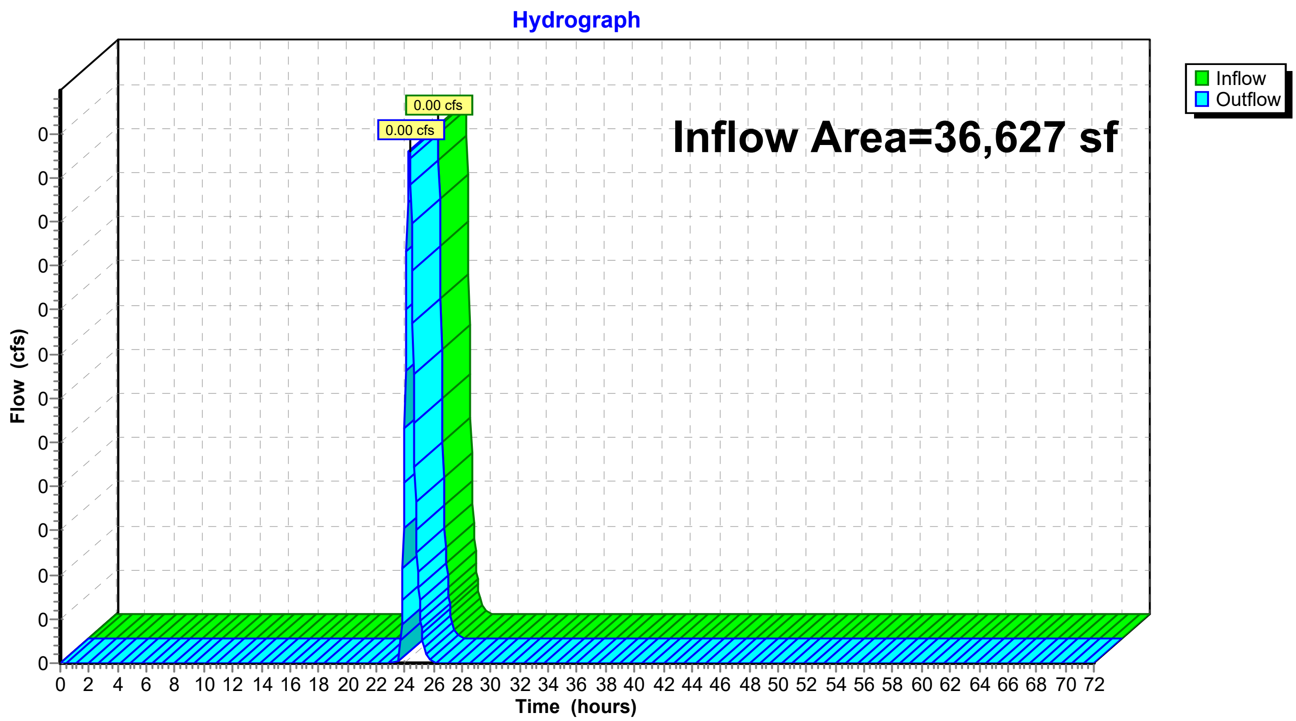
Summary for Reach DP-E5: DP#5

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

Inflow Area =	36,627 sf,	0.00% Impervious, Inflow Depth = 0.00"	for 10-year event
Inflow =	0.00 cfs @	24.31 hrs, Volume=	0 cf
Outflow =	0.00 cfs @	24.31 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E5: DP#5



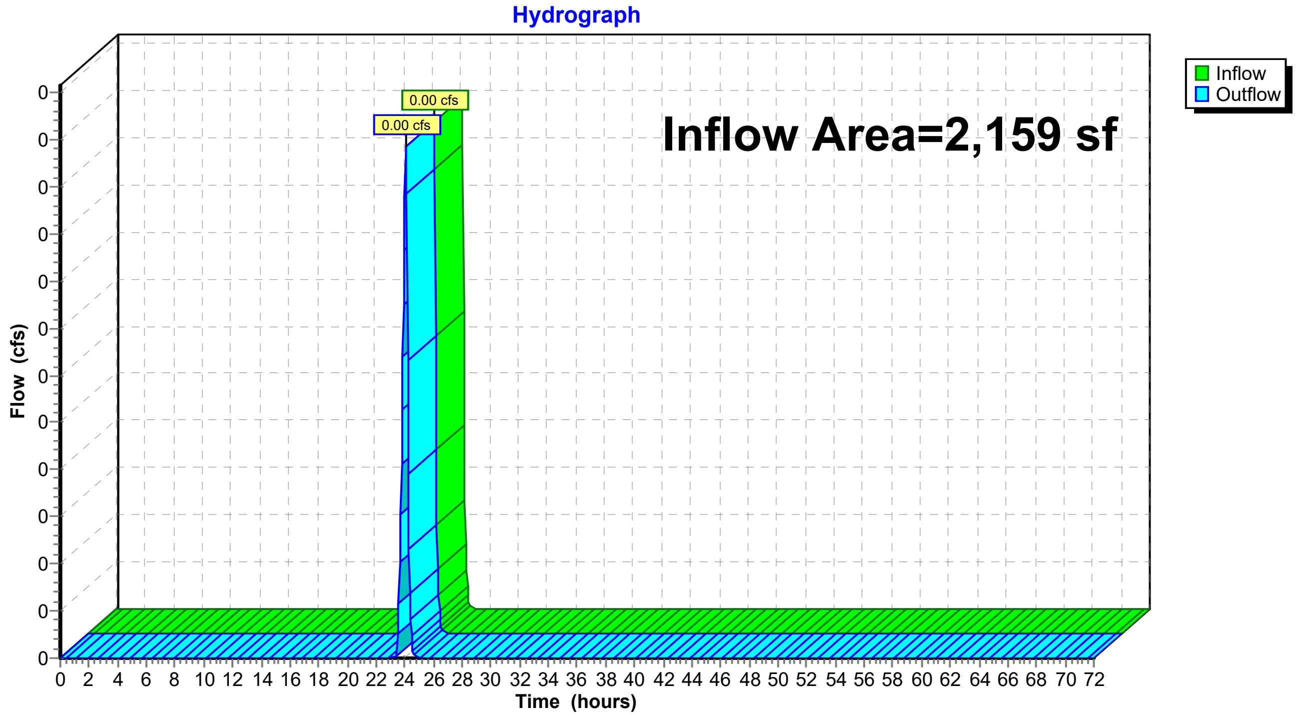
Summary for Reach DP-E6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 10-year event
Inflow =	0.00 cfs @	24.07 hrs, Volume=	0 cf	
Outflow =	0.00 cfs @	24.07 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

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

Reach DP-E6: DP#6

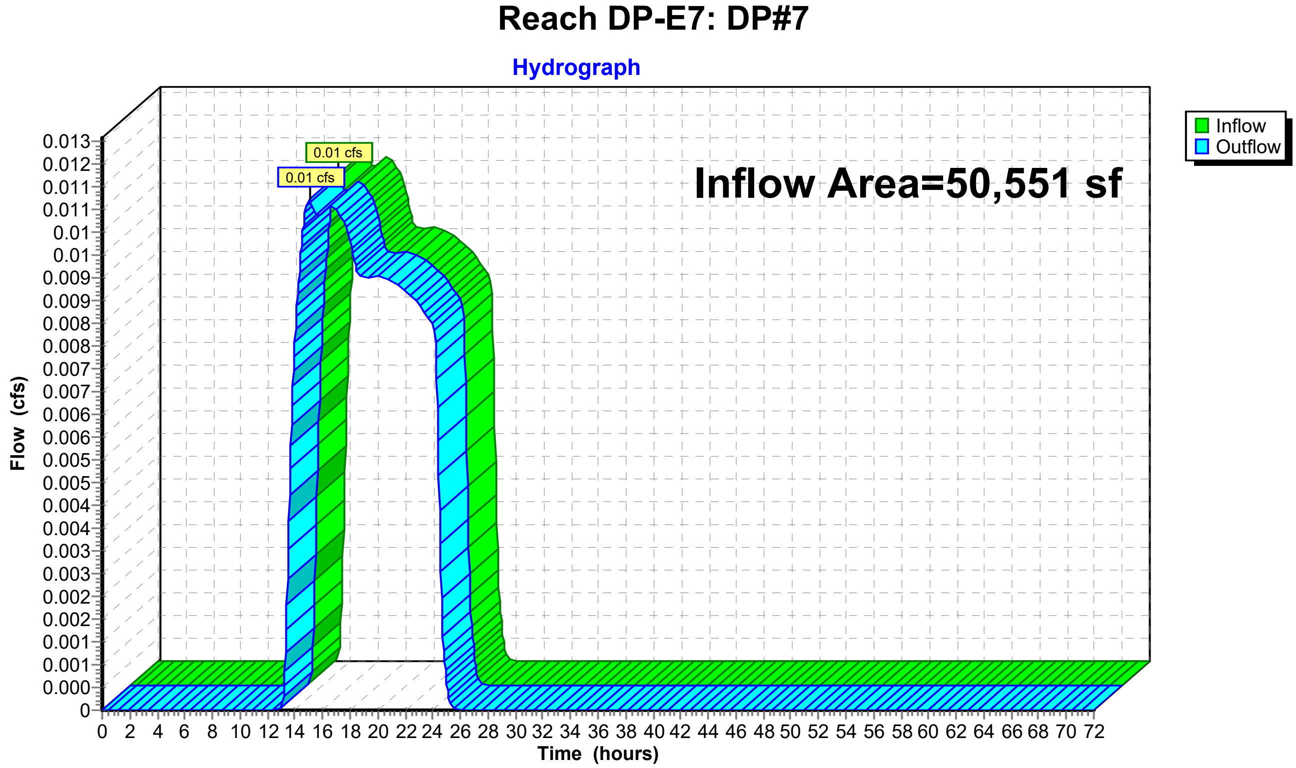


Summary for Reach DP-E7: DP#7

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

Inflow Area = 50,551 sf, 9.63% Impervious, Inflow Depth = 0.09" for 10-year event
Inflow = 0.01 cfs @ 15.05 hrs, Volume= 385 cf
Outflow = 0.01 cfs @ 15.05 hrs, Volume= 385 cf, Atten= 0%, Lag= 0.0 min

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



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

SubcatchmentES1: CDA-1 Runoff Area=6,793 sf 8.18% Impervious Runoff Depth=0.25"
Flow Length=75' Slope=0.0260 '/' Tc=20.0 min CN=36 Runoff=0.01 cfs 142 cf

SubcatchmentES2: CDA-2 Runoff Area=9,782 sf 44.86% Impervious Runoff Depth=1.87"
Flow Length=132' Slope=0.0150 '/' Tc=10.9 min CN=61 Runoff=0.39 cfs 1,527 cf

SubcatchmentES3: CDA-3 Runoff Area=41,255 sf 7.89% Impervious Runoff Depth=0.21"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=35 Runoff=0.03 cfs 724 cf

SubcatchmentES4: CDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.00 cfs 69 cf

SubcatchmentES5: CDA-5 Runoff Area=36,627 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.01 cfs 160 cf

SubcatchmentES6: CDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 9 cf

SubcatchmentES7: CDA-7 Runoff Area=50,551 sf 9.63% Impervious Runoff Depth=0.30"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=37 Runoff=0.06 cfs 1,244 cf

Reach 1R: EXISTING (NULL) Inflow=0.39 cfs 3,875 cf
Outflow=0.39 cfs 3,875 cf

Reach DP-E1: On-site Depression Inflow=0.01 cfs 142 cf
Outflow=0.01 cfs 142 cf

Reach DP-E2: DP#2 - Main Street CB Inflow=0.39 cfs 1,527 cf
Outflow=0.39 cfs 1,527 cf

Reach DP-E3: On-site Depression Inflow=0.03 cfs 724 cf
Outflow=0.03 cfs 724 cf

Reach DP-E4: DP#4 Inflow=0.00 cfs 69 cf
Outflow=0.00 cfs 69 cf

Reach DP-E5: DP#5 Inflow=0.01 cfs 160 cf
Outflow=0.01 cfs 160 cf

Reach DP-E6: DP#6 Inflow=0.00 cfs 9 cf
Outflow=0.00 cfs 9 cf

Reach DP-E7: DP#7 Inflow=0.06 cfs 1,244 cf
Outflow=0.06 cfs 1,244 cf

Total Runoff Area = 162,830 sf Runoff Volume = 3,875 cf Average Runoff Depth = 0.29"
91.97% Pervious = 149,762 sf 8.03% Impervious = 13,068 sf

Summary for Subcatchment ES1: CDA-1

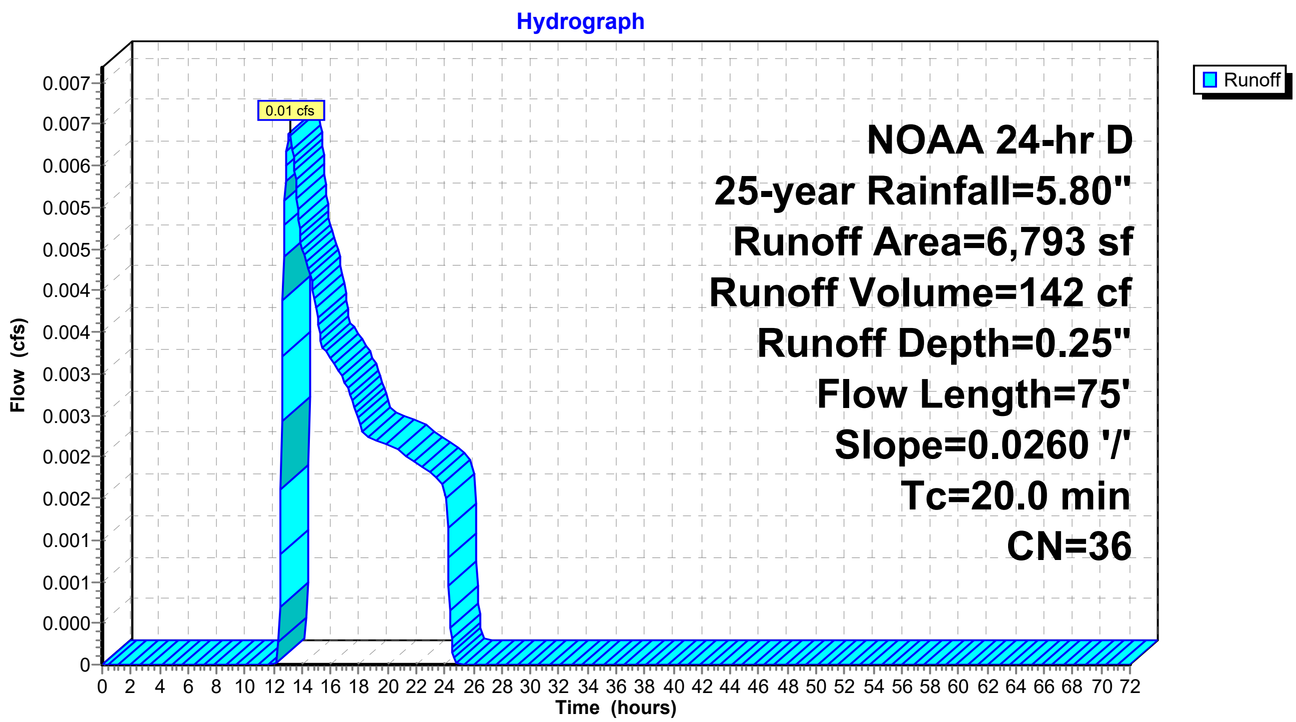
Runoff = 0.01 cfs @ 13.12 hrs, Volume= 142 cf, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
556	98	Roofs, HSG A
6,237	30	Woods, Good, HSG A
6,793	36	Weighted Average
6,237		91.82% Pervious Area
556		8.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0260	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	25	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.0	75	Total			

Subcatchment ES1: CDA-1



Summary for Subcatchment ES2: CDA-2

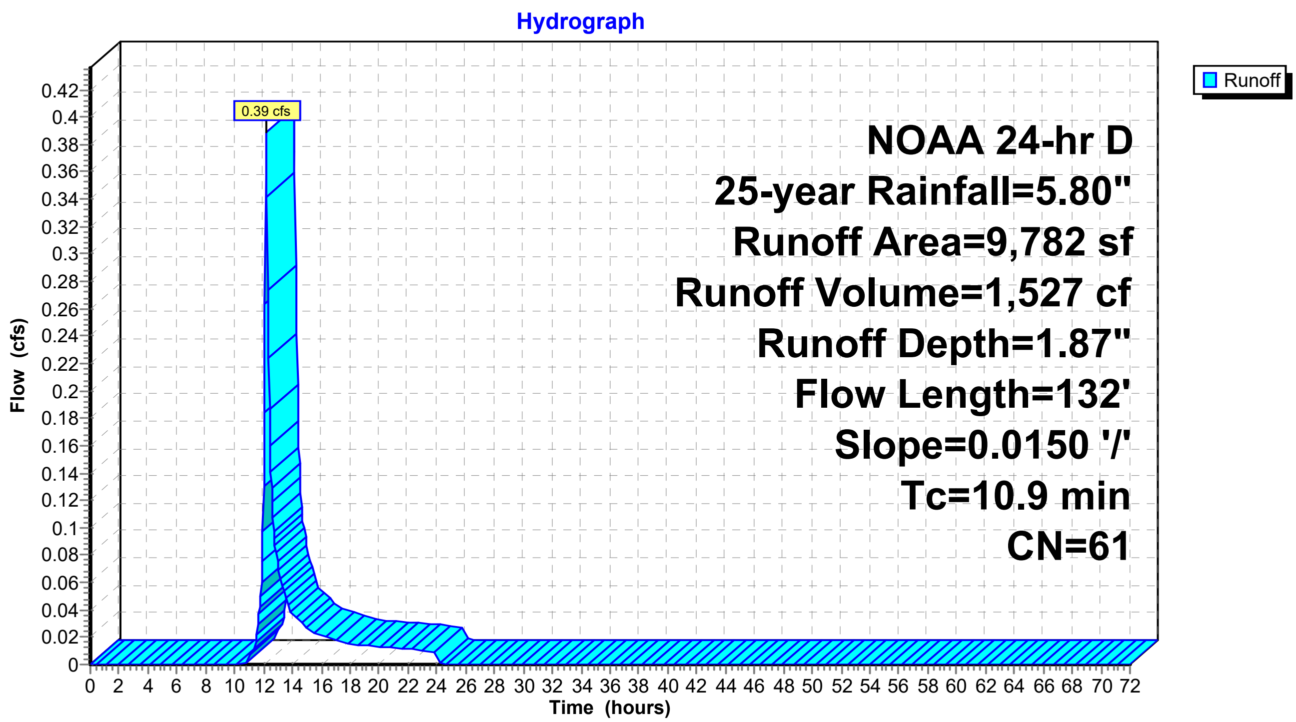
Runoff = 0.39 cfs @ 12.20 hrs, Volume= 1,527 cf, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
5,394	30	Woods, Good, HSG A
1,320	98	Roofs, HSG A
3,068	98	Paved parking, HSG A
9,782	61	Weighted Average
5,394		55.14% Pervious Area
4,388		44.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0150	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	27	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.9	132	Total			

Subcatchment ES2: CDA-2



Summary for Subcatchment ES3: CDA-3

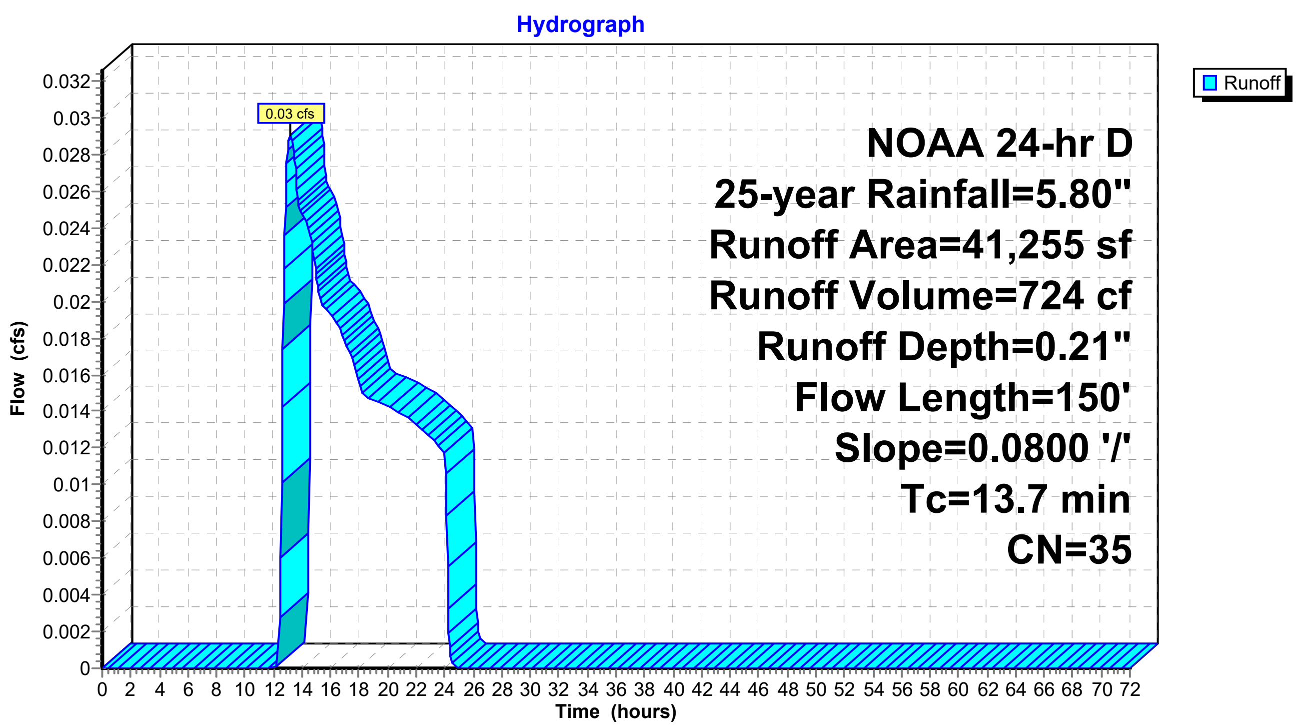
Runoff = 0.03 cfs @ 13.12 hrs, Volume= 724 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
79	98	Paved parking, HSG A
3,177	98	Roofs, HSG A
37,999	30	Woods, Good, HSG A
41,255	35	Weighted Average
37,999		92.11% Pervious Area
3,256		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment ES3: CDA-3



Summary for Subcatchment ES4: CDA-4

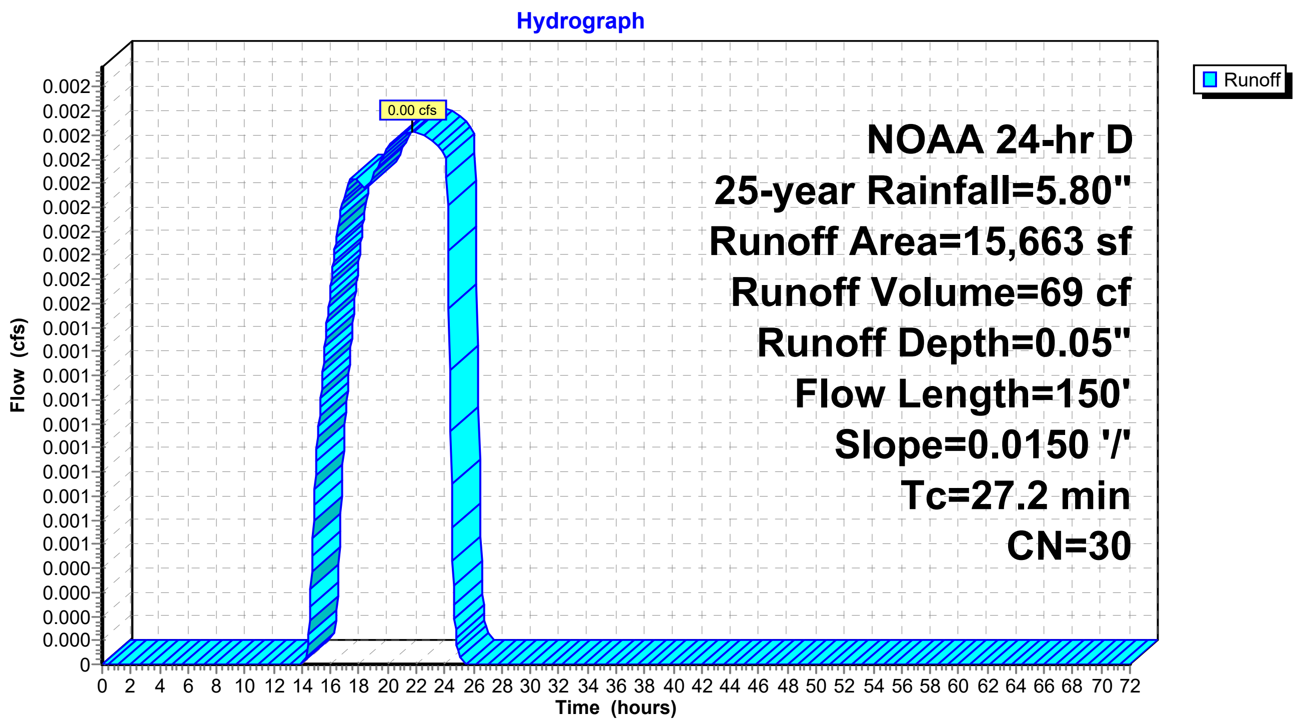
Runoff = 0.00 cfs @ 21.64 hrs, Volume= 69 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment ES4: CDA-4



Summary for Subcatchment ES5: CDA-5

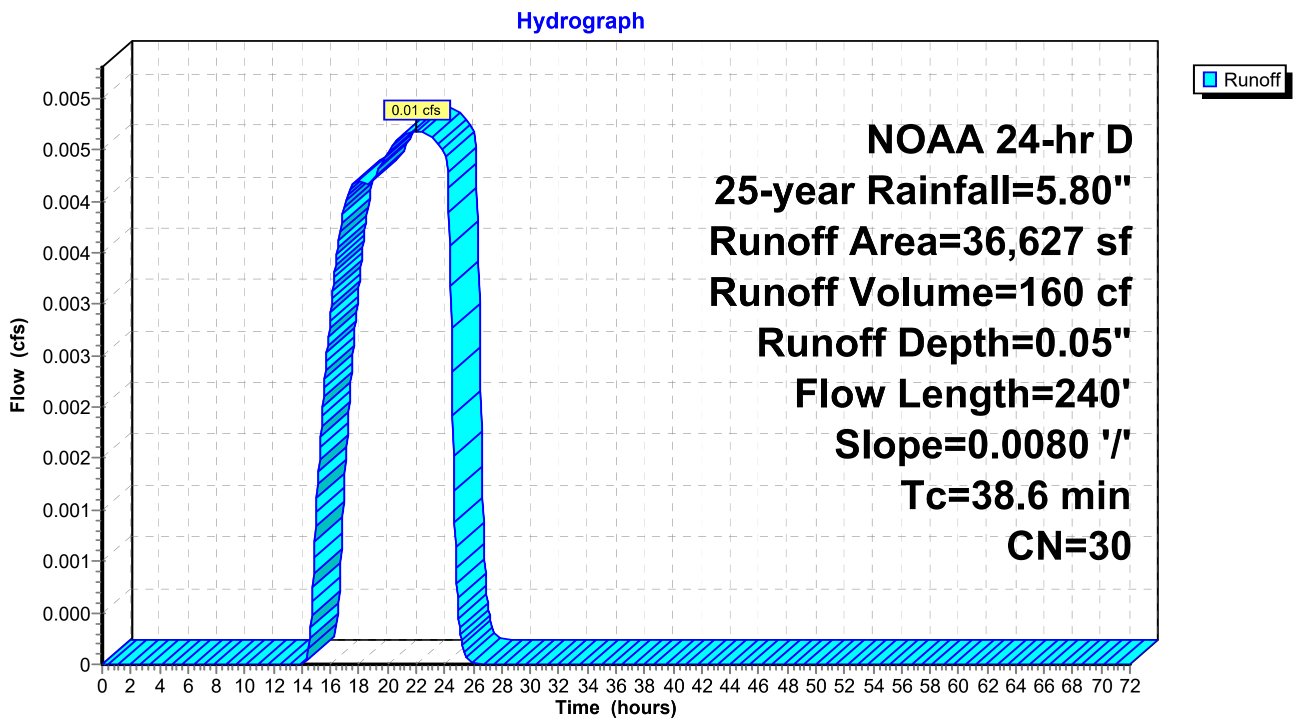
Runoff = 0.01 cfs @ 22.00 hrs, Volume= 160 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
36,627	30	Woods, Good, HSG A
36,627		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment ES5: CDA-5



Summary for Subcatchment ES6: CDA-6

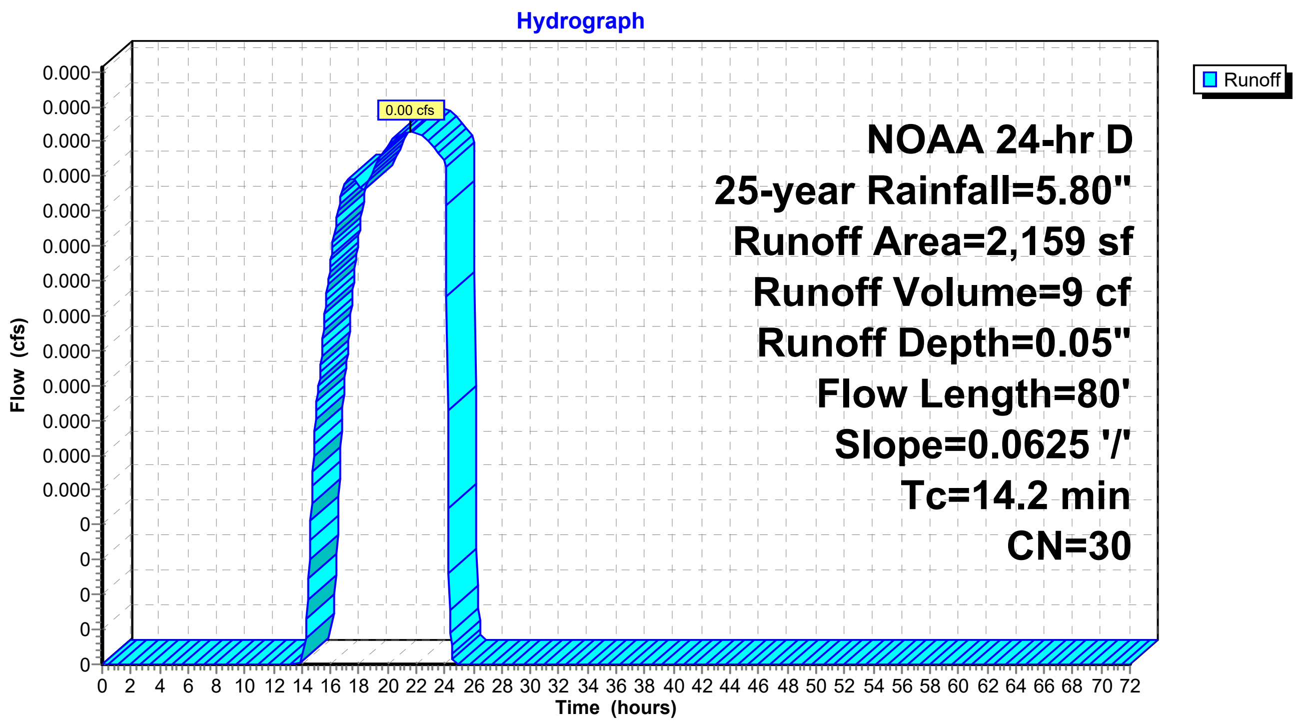
Runoff = 0.00 cfs @ 21.54 hrs, Volume= 9 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment ES6: CDA-6



Summary for Subcatchment ES7: CDA-7

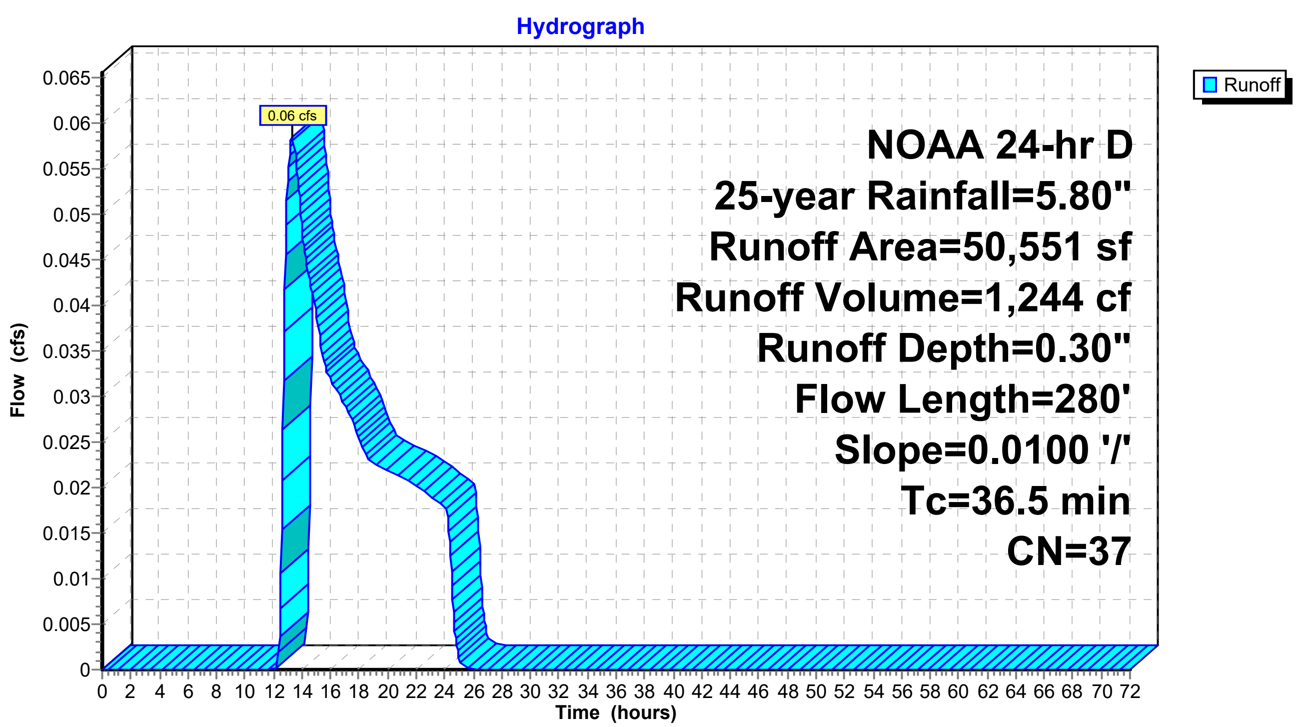
Runoff = 0.06 cfs @ 13.30 hrs, Volume= 1,244 cf, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
4,868	98	Paved parking, HSG A
45,683	30	Meadow, non-grazed, HSG A
50,551	37	Weighted Average
45,683		90.37% Pervious Area
4,868		9.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment ES7: CDA-7



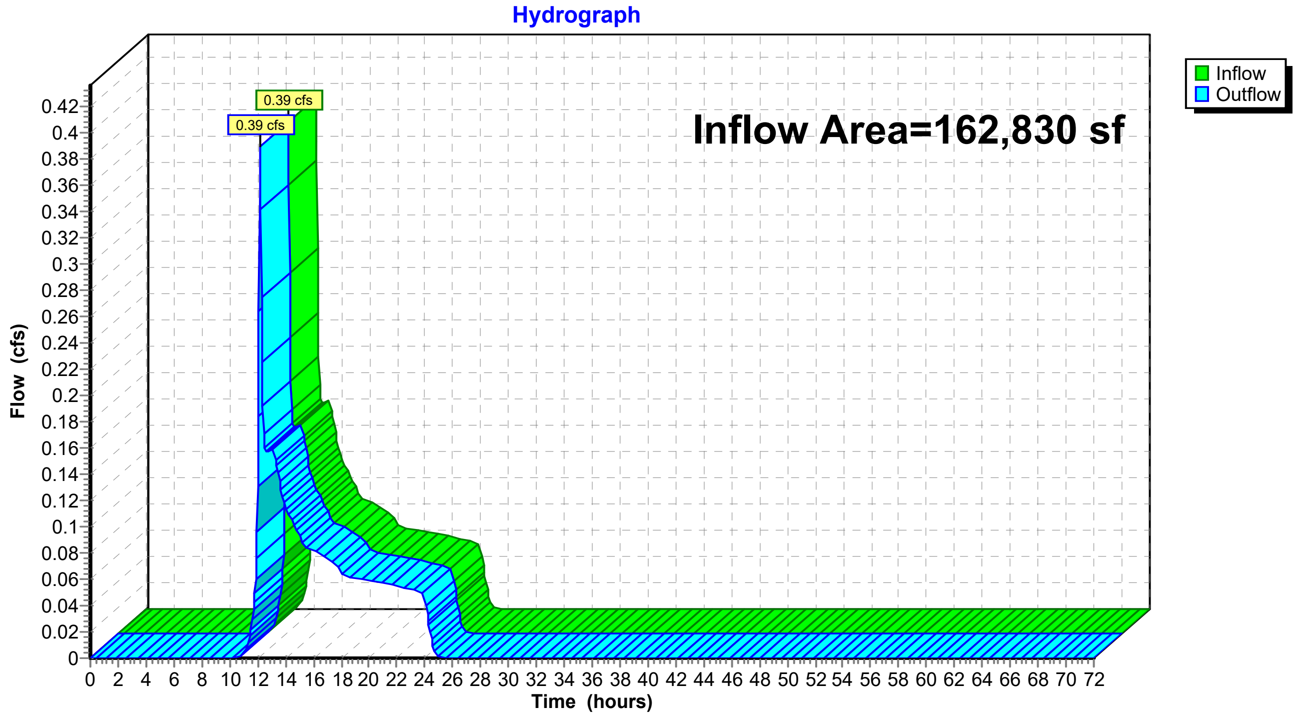
Summary for Reach 1R: EXISTING (NULL)

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

Inflow Area = 162,830 sf, 8.03% Impervious, Inflow Depth = 0.29" for 25-year event
Inflow = 0.39 cfs @ 12.20 hrs, Volume= 3,875 cf
Outflow = 0.39 cfs @ 12.20 hrs, Volume= 3,875 cf, Atten= 0%, Lag= 0.0 min

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

Reach 1R: EXISTING (NULL)

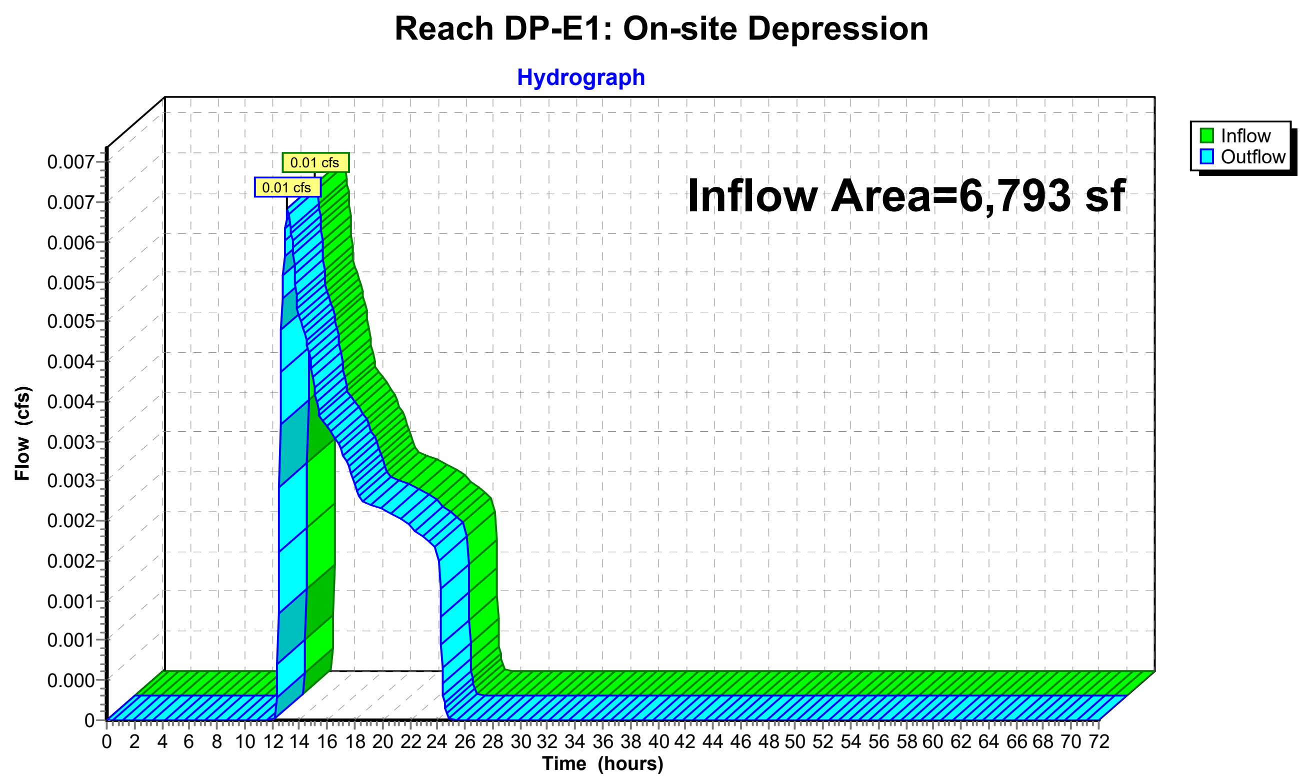


Summary for Reach DP-E1: On-site Depression

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

Inflow Area = 6,793 sf, 8.18% Impervious, Inflow Depth = 0.25" for 25-year event
Inflow = 0.01 cfs @ 13.12 hrs, Volume= 142 cf
Outflow = 0.01 cfs @ 13.12 hrs, Volume= 142 cf, Atten= 0%, Lag= 0.0 min

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



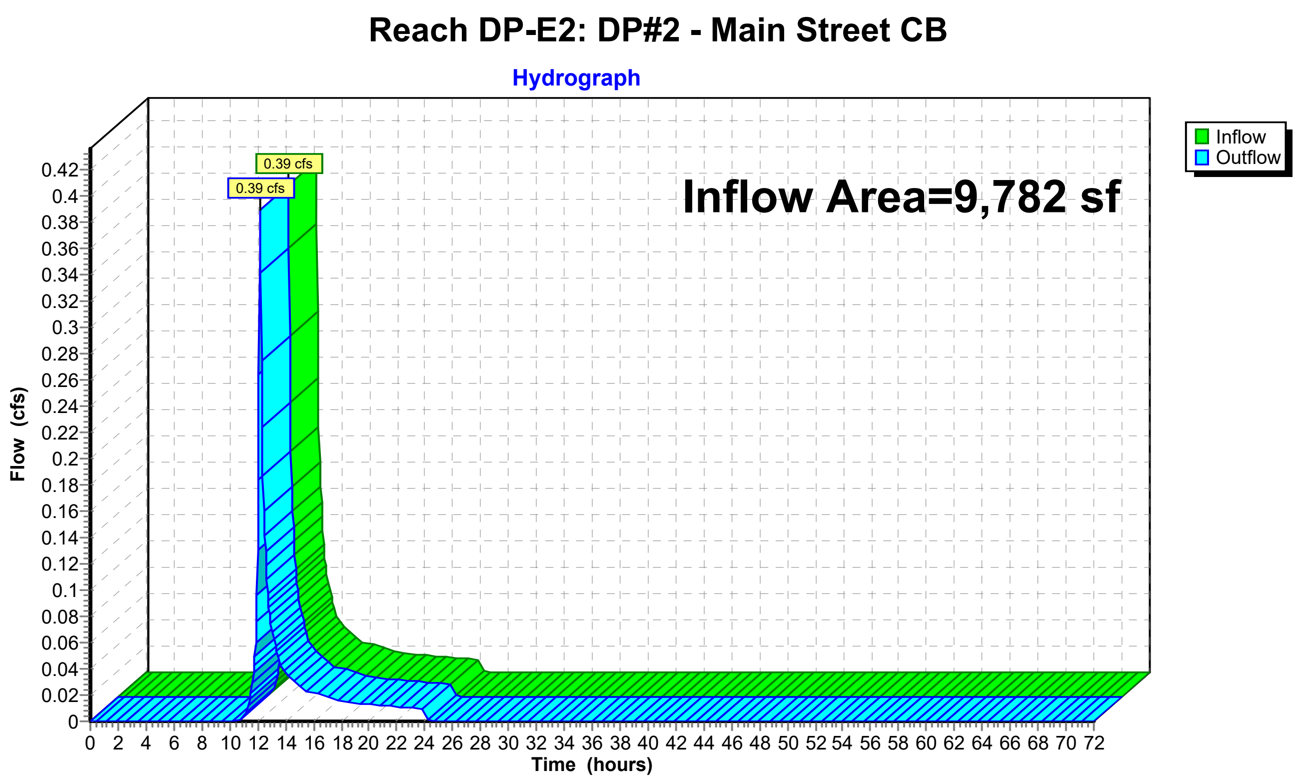
Summary for Reach DP-E2: DP#2 - Main Street CB

MAIN STREET CATCH BASIN

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

Inflow Area =	9,782 sf, 44.86% Impervious,	Inflow Depth = 1.87"	for 25-year event
Inflow =	0.39 cfs @ 12.20 hrs, Volume=	1,527 cf	
Outflow =	0.39 cfs @ 12.20 hrs, Volume=	1,527 cf, Atten= 0%, Lag= 0.0 min	

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

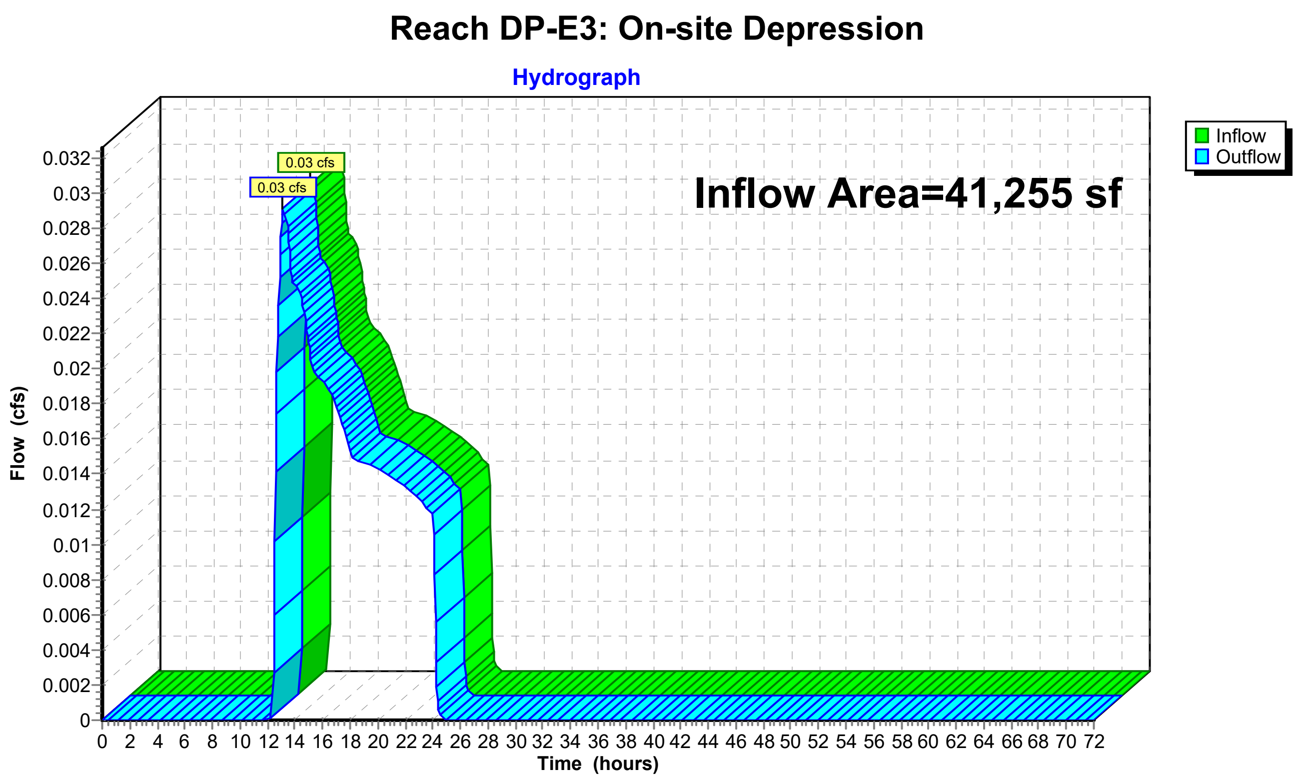


Summary for Reach DP-E3: On-site Depression

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

Inflow Area = 41,255 sf, 7.89% Impervious, Inflow Depth = 0.21" for 25-year event
Inflow = 0.03 cfs @ 13.12 hrs, Volume= 724 cf
Outflow = 0.03 cfs @ 13.12 hrs, Volume= 724 cf, Atten= 0%, Lag= 0.0 min

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

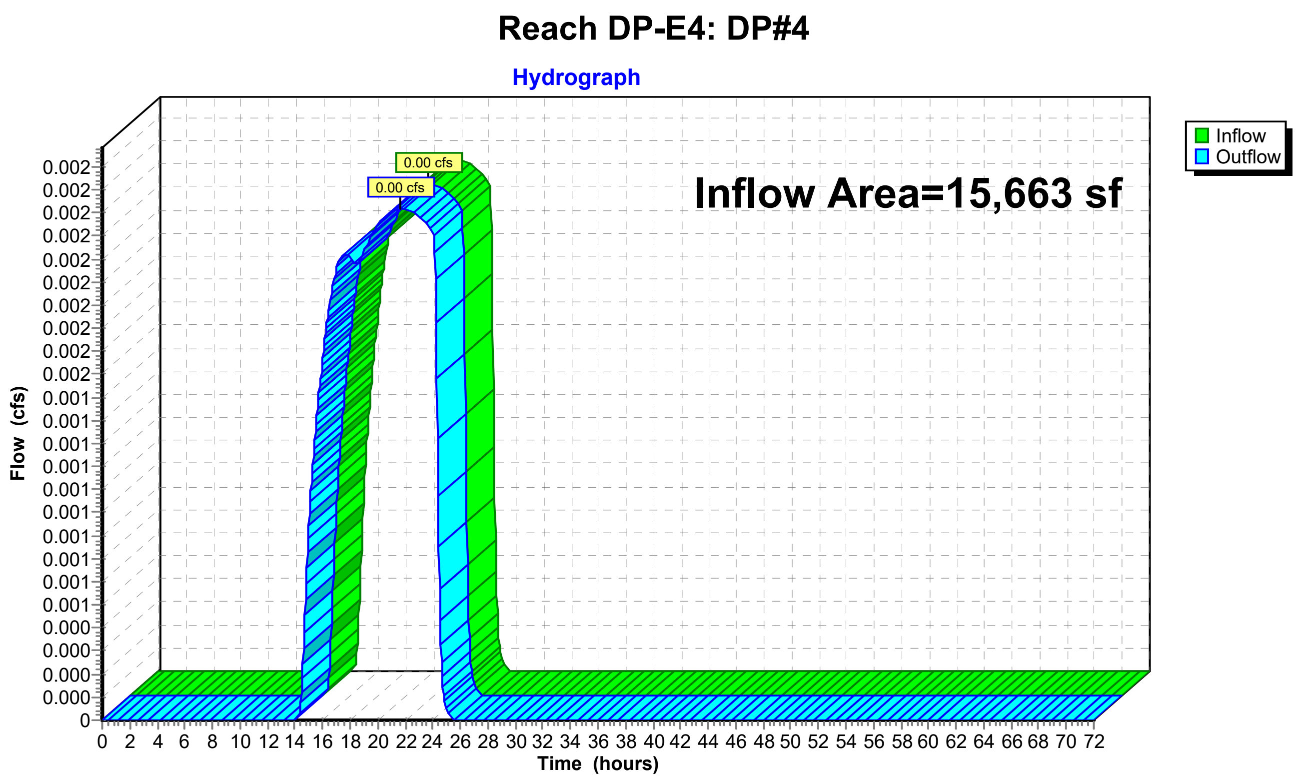


Summary for Reach DP-E4: DP#4

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

Inflow Area =	15,663 sf,	0.00% Impervious,	Inflow Depth = 0.05"	for 25-year event
Inflow =	0.00 cfs @	21.64 hrs, Volume=	69 cf	
Outflow =	0.00 cfs @	21.64 hrs, Volume=	69 cf, Atten= 0%, Lag= 0.0 min	

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

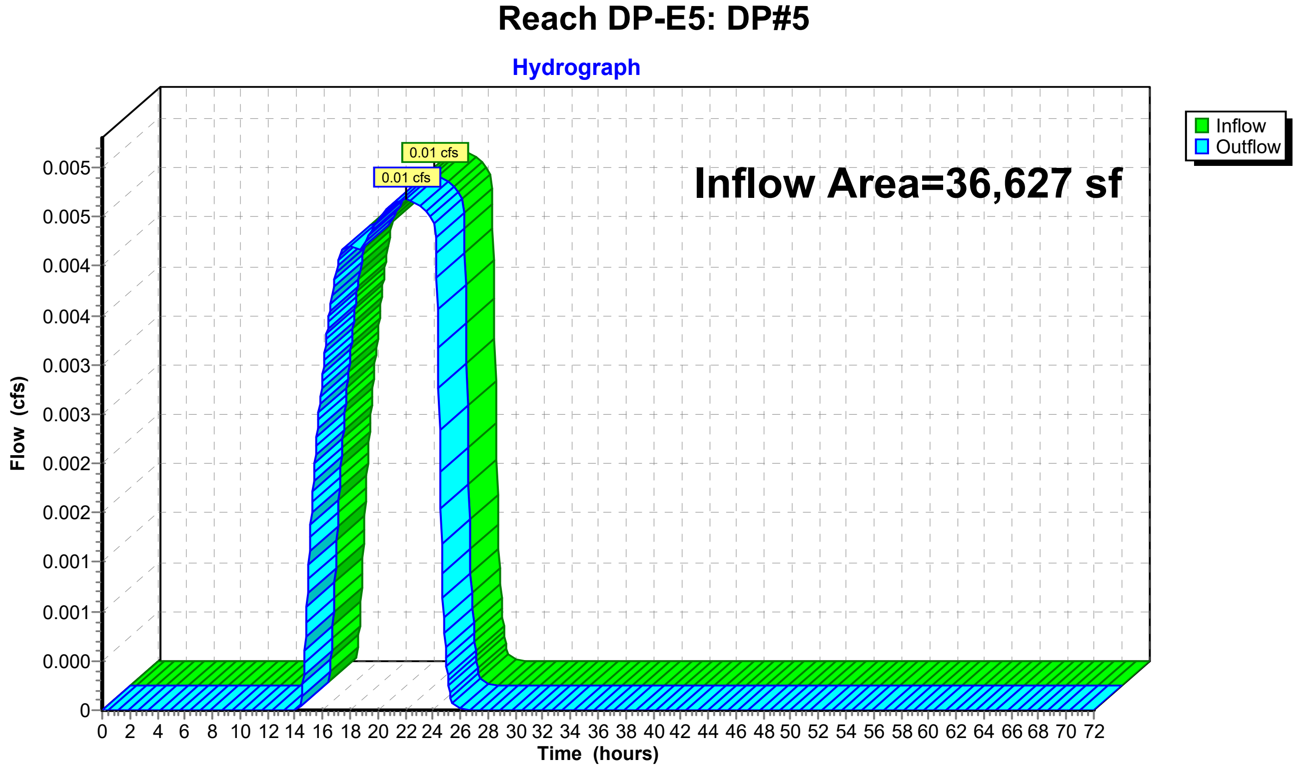


Summary for Reach DP-E5: DP#5

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

Inflow Area =	36,627 sf,	0.00% Impervious,	Inflow Depth = 0.05"	for 25-year event	
Inflow =	0.01 cfs @	22.00 hrs,	Volume=	160 cf	
Outflow =	0.01 cfs @	22.00 hrs,	Volume=	160 cf,	Atten= 0%, Lag= 0.0 min

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



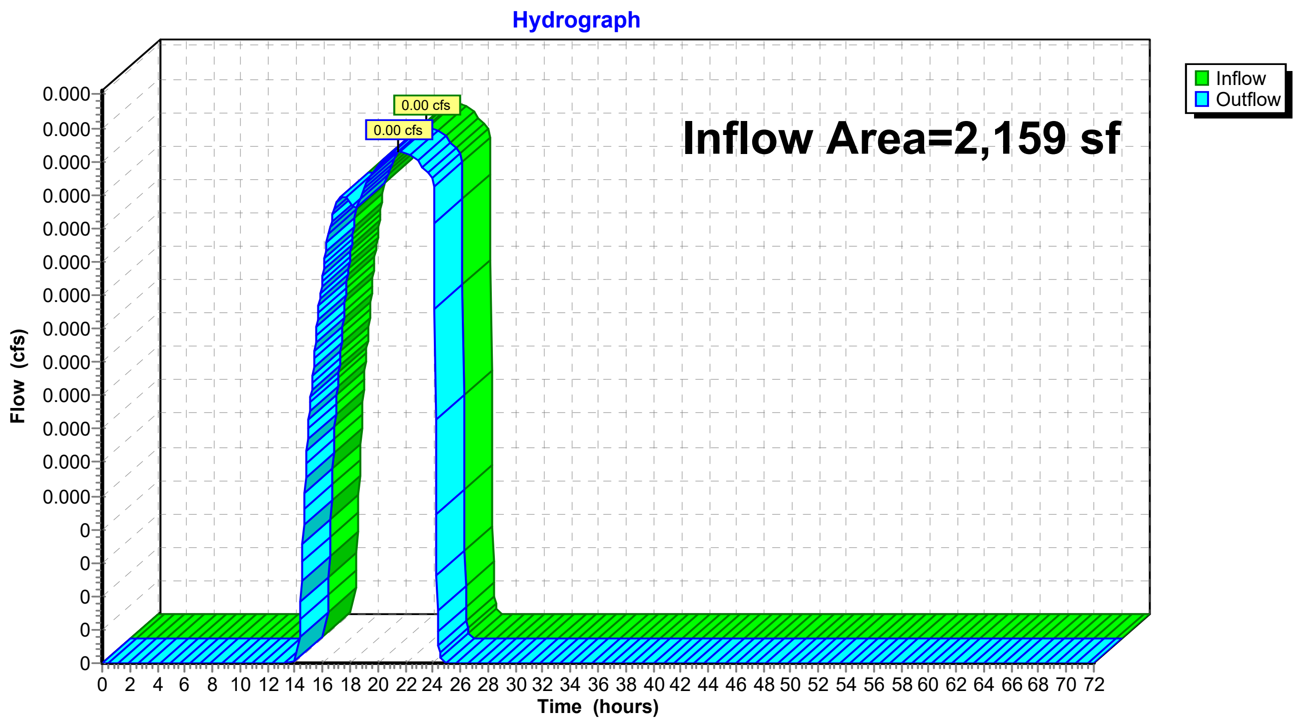
Summary for Reach DP-E6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious, Inflow Depth = 0.05"	for 25-year event
Inflow =	0.00 cfs @	21.54 hrs, Volume=	9 cf
Outflow =	0.00 cfs @	21.54 hrs, Volume=	9 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E6: DP#6

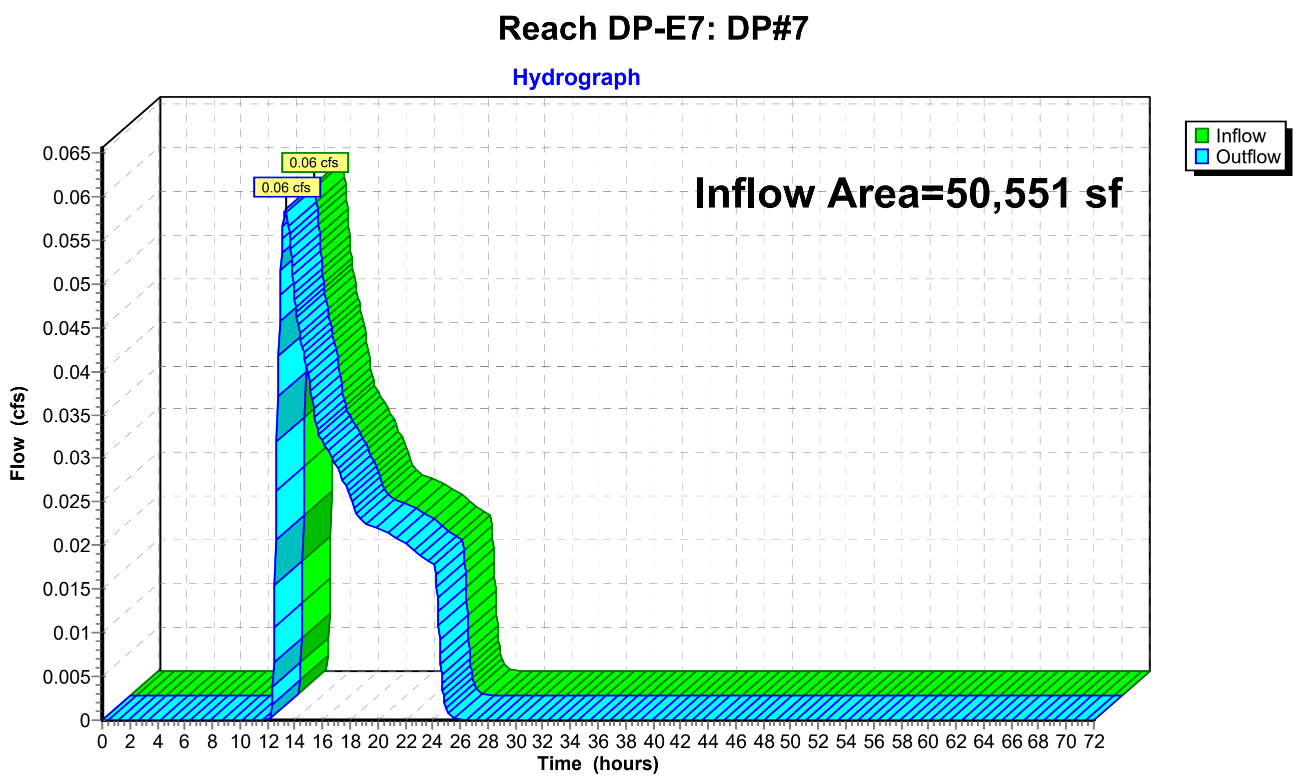


Summary for Reach DP-E7: DP#7

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

Inflow Area =	50,551 sf,	9.63% Impervious,	Inflow Depth = 0.30"	for 25-year event
Inflow =	0.06 cfs @	13.30 hrs, Volume=	1,244 cf	
Outflow =	0.06 cfs @	13.30 hrs, Volume=	1,244 cf,	Atten= 0%, Lag= 0.0 min

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



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

SubcatchmentES1: CDA-1 Runoff Area=6,793 sf 8.18% Impervious Runoff Depth=0.59"
Flow Length=75' Slope=0.0260 '/' Tc=20.0 min CN=36 Runoff=0.03 cfs 334 cf

SubcatchmentES2: CDA-2 Runoff Area=9,782 sf 44.86% Impervious Runoff Depth=2.77"
Flow Length=132' Slope=0.0150 '/' Tc=10.9 min CN=61 Runoff=0.59 cfs 2,262 cf

SubcatchmentES3: CDA-3 Runoff Area=41,255 sf 7.89% Impervious Runoff Depth=0.52"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=35 Runoff=0.13 cfs 1,795 cf

SubcatchmentES4: CDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.01 cfs 300 cf

SubcatchmentES5: CDA-5 Runoff Area=36,627 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.02 cfs 701 cf

SubcatchmentES6: CDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 41 cf

SubcatchmentES7: CDA-7 Runoff Area=50,551 sf 9.63% Impervious Runoff Depth=0.66"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=37 Runoff=0.20 cfs 2,775 cf

Reach 1R: EXISTING (NULL) Inflow=0.65 cfs 8,208 cf
Outflow=0.65 cfs 8,208 cf

Reach DP-E1: On-site Depression Inflow=0.03 cfs 334 cf
Outflow=0.03 cfs 334 cf

Reach DP-E2: DP#2 - Main Street CB Inflow=0.59 cfs 2,262 cf
Outflow=0.59 cfs 2,262 cf

Reach DP-E3: On-site Depression Inflow=0.13 cfs 1,795 cf
Outflow=0.13 cfs 1,795 cf

Reach DP-E4: DP#4 Inflow=0.01 cfs 300 cf
Outflow=0.01 cfs 300 cf

Reach DP-E5: DP#5 Inflow=0.02 cfs 701 cf
Outflow=0.02 cfs 701 cf

Reach DP-E6: DP#6 Inflow=0.00 cfs 41 cf
Outflow=0.00 cfs 41 cf

Reach DP-E7: DP#7 Inflow=0.20 cfs 2,775 cf
Outflow=0.20 cfs 2,775 cf

Total Runoff Area = 162,830 sf Runoff Volume = 8,208 cf Average Runoff Depth = 0.60"
91.97% Pervious = 149,762 sf 8.03% Impervious = 13,068 sf

Summary for Subcatchment ES1: CDA-1

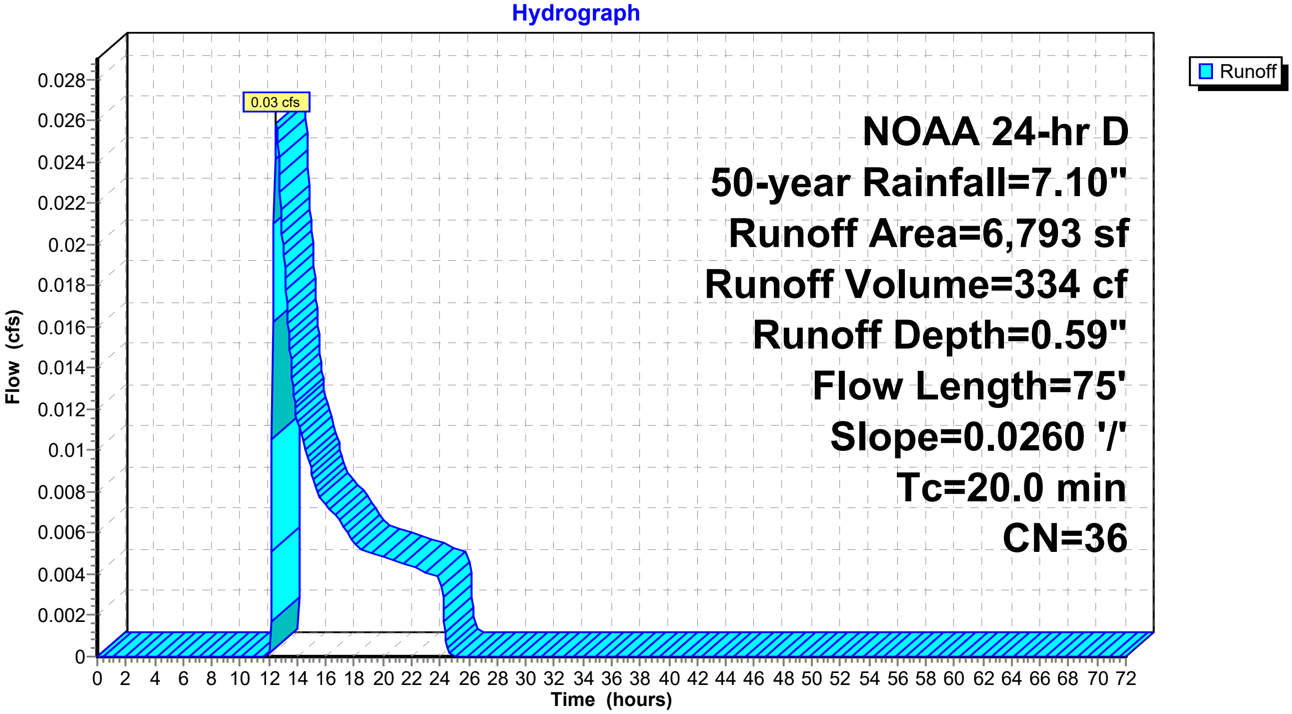
Runoff = 0.03 cfs @ 12.51 hrs, Volume= 334 cf, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
556	98	Roofs, HSG A
6,237	30	Woods, Good, HSG A
6,793	36	Weighted Average
6,237		91.82% Pervious Area
556		8.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0260	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	25	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.0	75	Total			

Subcatchment ES1: CDA-1



Summary for Subcatchment ES2: CDA-2

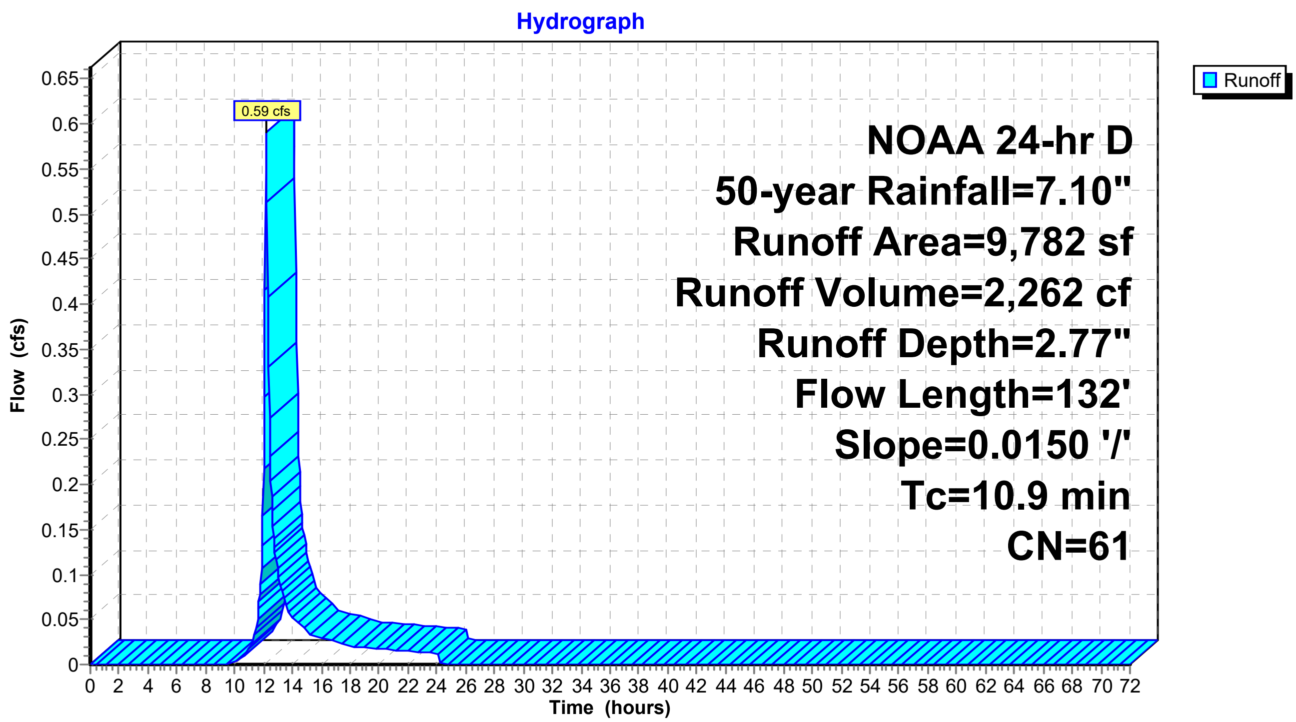
Runoff = 0.59 cfs @ 12.19 hrs, Volume= 2,262 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
5,394	30	Woods, Good, HSG A
1,320	98	Roofs, HSG A
3,068	98	Paved parking, HSG A
9,782	61	Weighted Average
5,394		55.14% Pervious Area
4,388		44.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0150	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	27	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.9	132	Total			

Subcatchment ES2: CDA-2



Summary for Subcatchment ES3: CDA-3

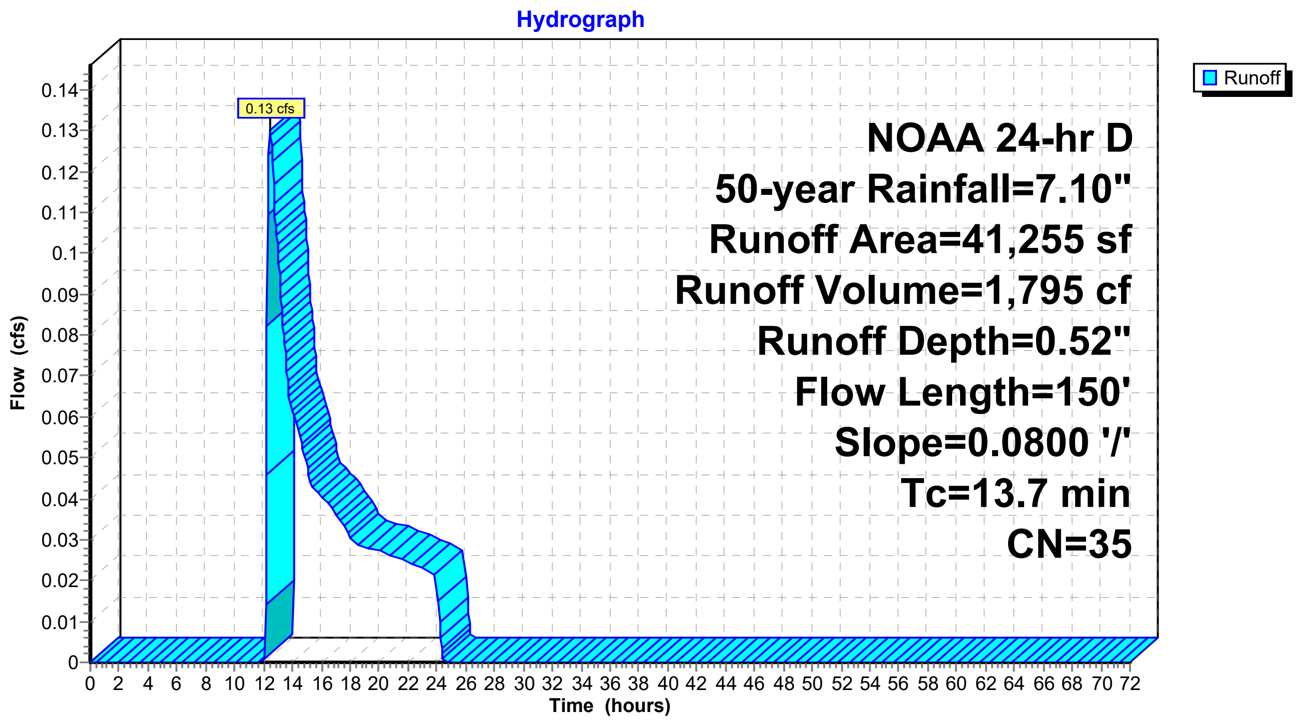
Runoff = 0.13 cfs @ 12.43 hrs, Volume= 1,795 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
79	98	Paved parking, HSG A
3,177	98	Roofs, HSG A
37,999	30	Woods, Good, HSG A
41,255	35	Weighted Average
37,999		92.11% Pervious Area
3,256		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment ES3: CDA-3



Summary for Subcatchment ES4: CDA-4

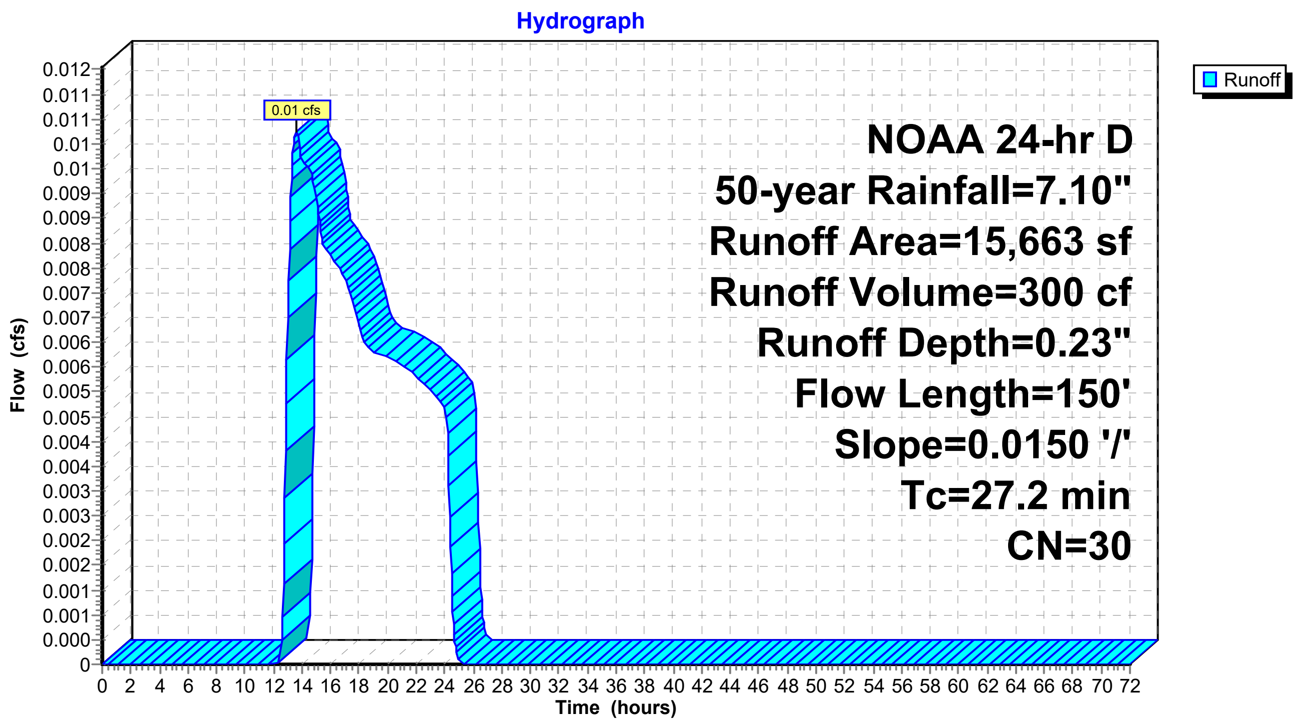
Runoff = 0.01 cfs @ 13.58 hrs, Volume= 300 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment ES4: CDA-4



Summary for Subcatchment ES5: CDA-5

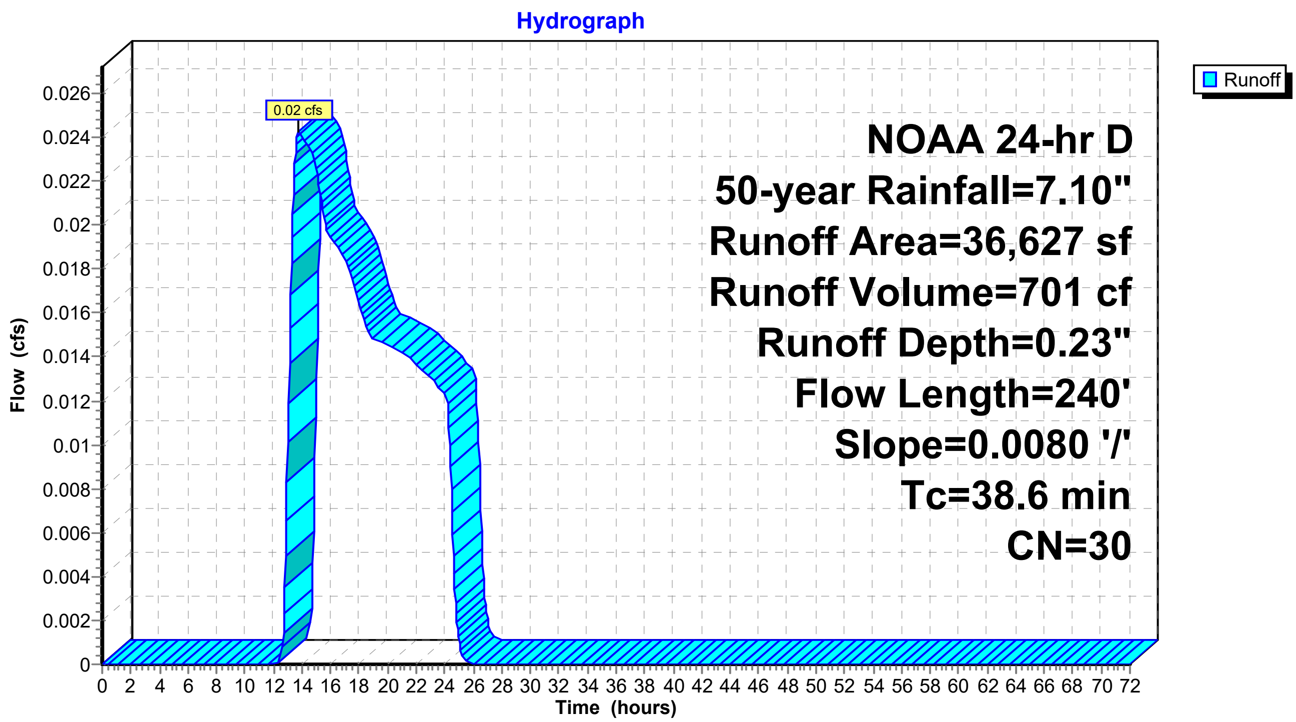
Runoff = 0.02 cfs @ 13.79 hrs, Volume= 701 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
36,627	30	Woods, Good, HSG A
36,627		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment ES5: CDA-5



Summary for Subcatchment ES6: CDA-6

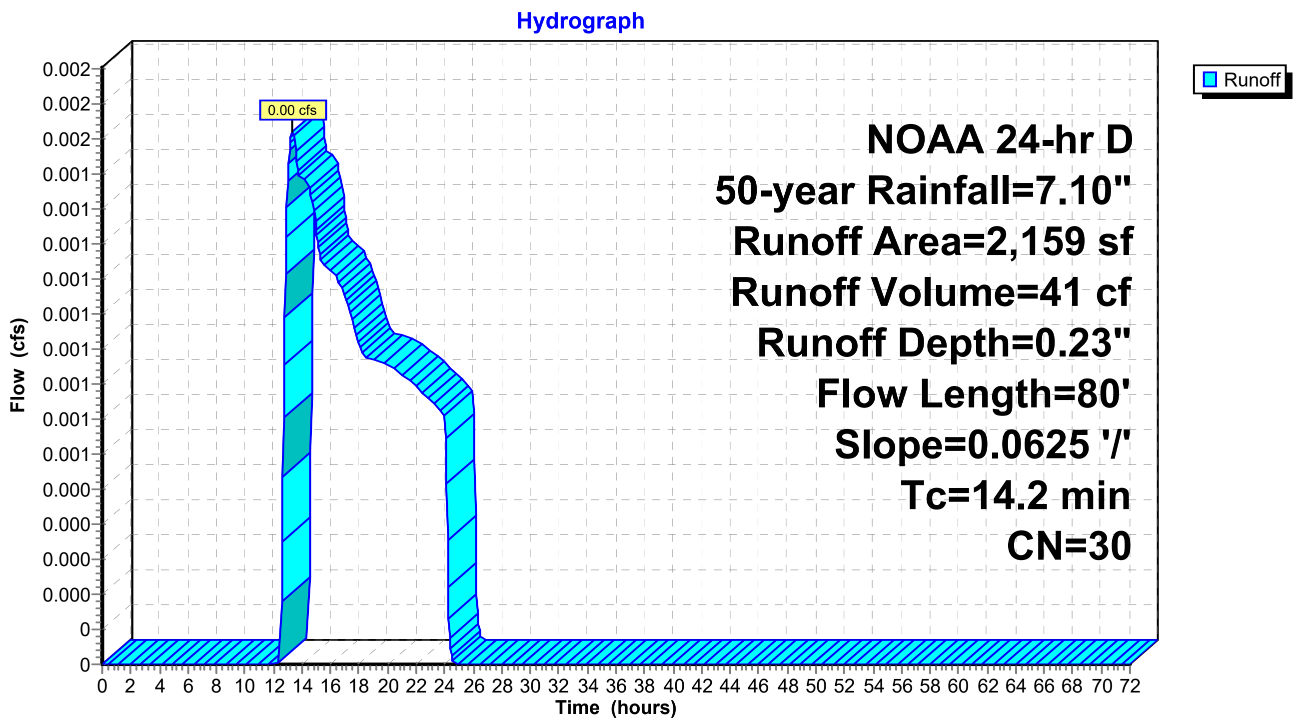
Runoff = 0.00 cfs @ 13.37 hrs, Volume= 41 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment ES6: CDA-6



Summary for Subcatchment ES7: CDA-7

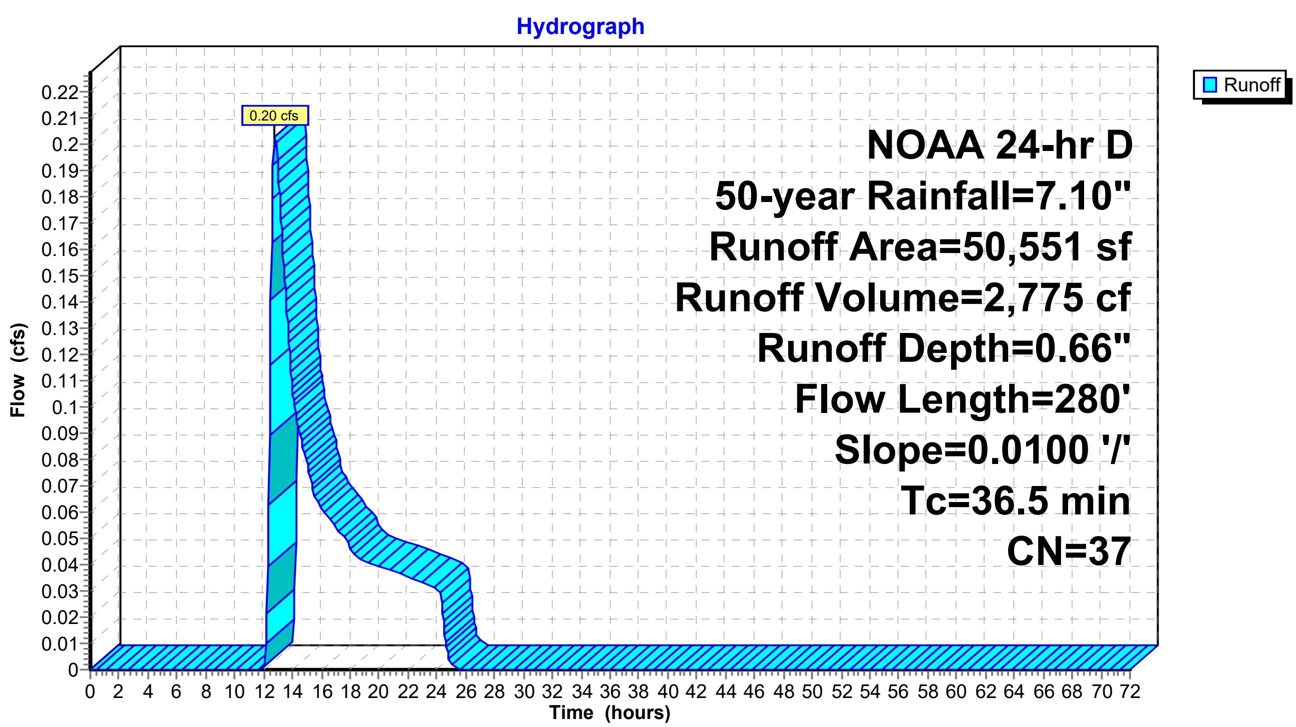
Runoff = 0.20 cfs @ 12.78 hrs, Volume= 2,775 cf, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
4,868	98	Paved parking, HSG A
45,683	30	Meadow, non-grazed, HSG A
50,551	37	Weighted Average
45,683		90.37% Pervious Area
4,868		9.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment ES7: CDA-7



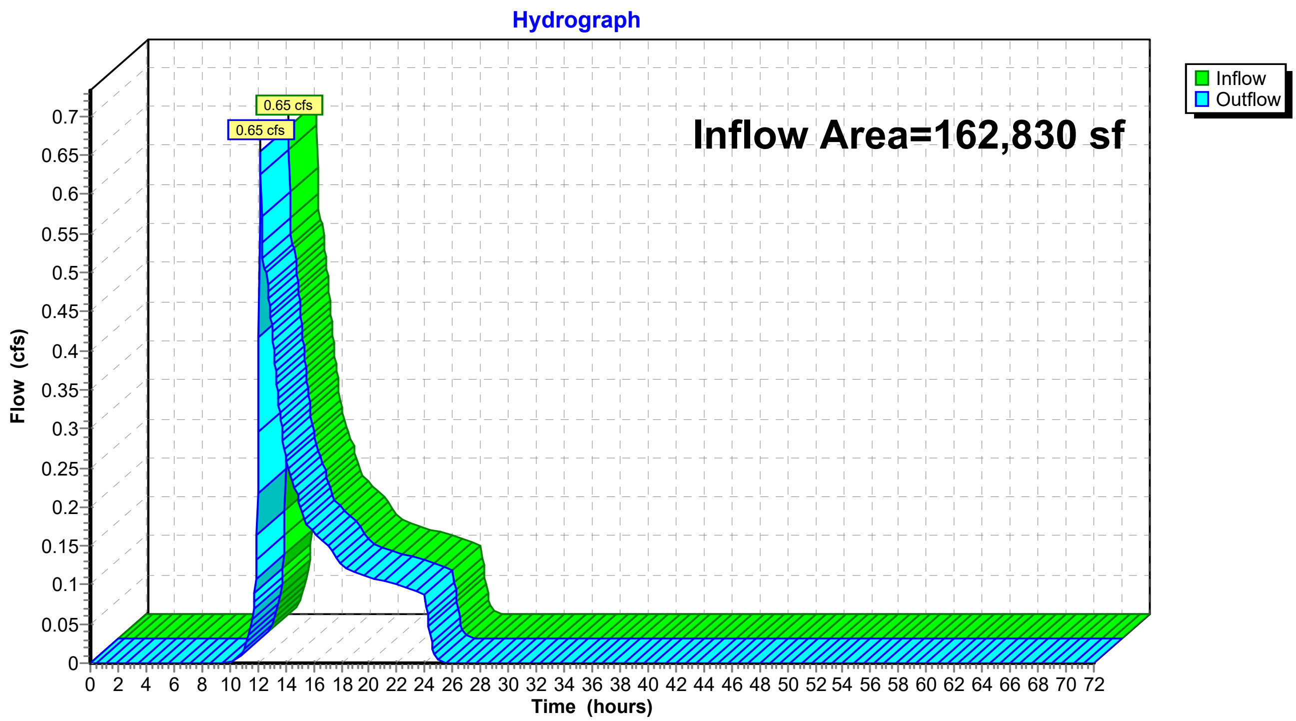
Summary for Reach 1R: EXISTING (NULL)

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

Inflow Area =	162,830 sf,	8.03% Impervious, Inflow Depth = 0.60"	for 50-year event
Inflow =	0.65 cfs @	12.21 hrs, Volume=	8,208 cf
Outflow =	0.65 cfs @	12.21 hrs, Volume=	8,208 cf, Atten= 0%, Lag= 0.0 min

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

Reach 1R: EXISTING (NULL)

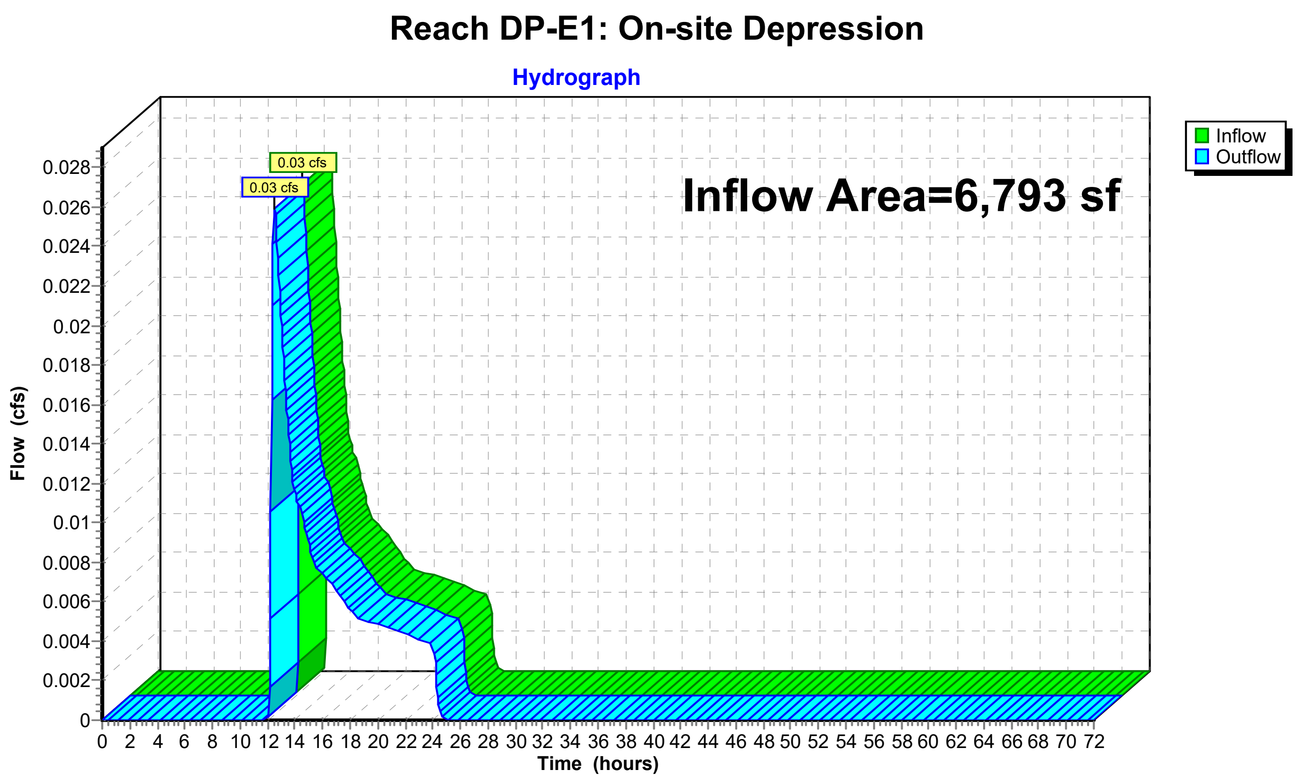


Summary for Reach DP-E1: On-site Depression

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

Inflow Area = 6,793 sf, 8.18% Impervious, Inflow Depth = 0.59" for 50-year event
Inflow = 0.03 cfs @ 12.51 hrs, Volume= 334 cf
Outflow = 0.03 cfs @ 12.51 hrs, Volume= 334 cf, Atten= 0%, Lag= 0.0 min

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



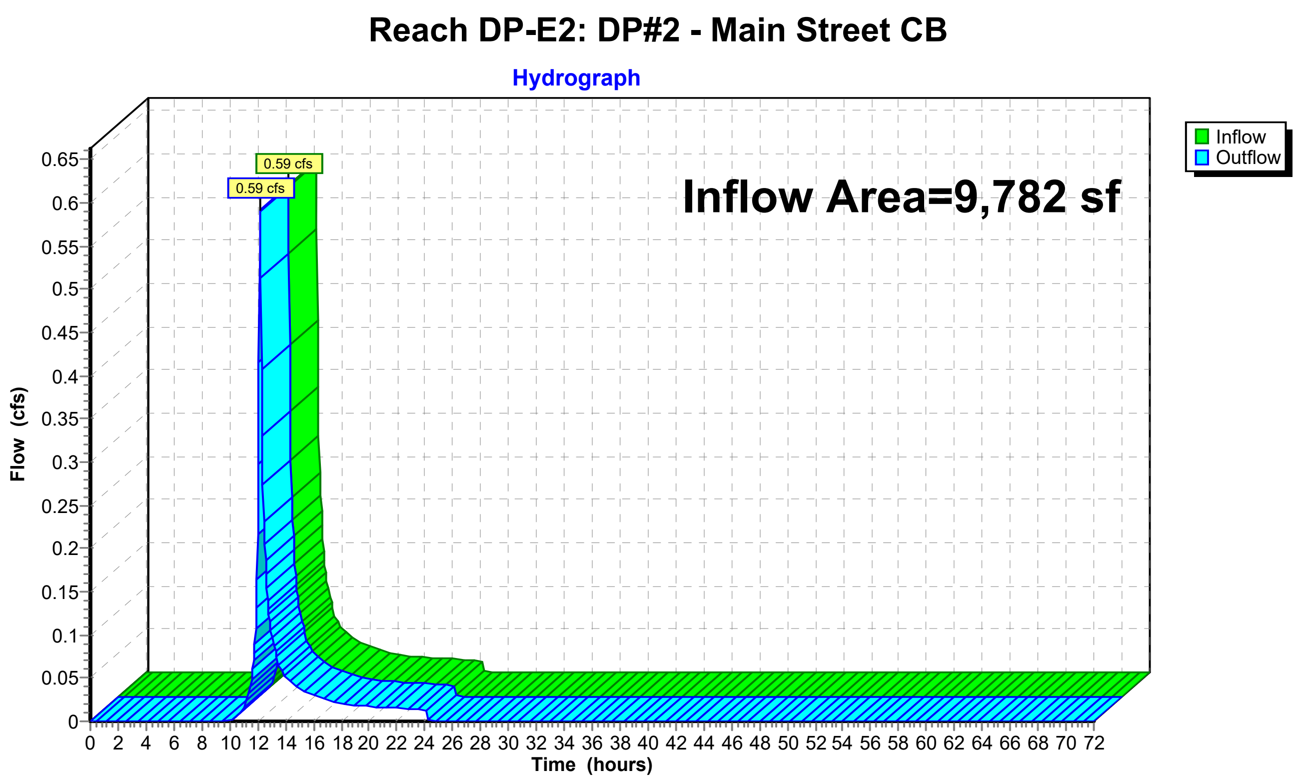
Summary for Reach DP-E2: DP#2 - Main Street CB

MAIN STREET CATCH BASIN

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

Inflow Area = 9,782 sf, 44.86% Impervious, Inflow Depth = 2.77" for 50-year event
Inflow = 0.59 cfs @ 12.19 hrs, Volume= 2,262 cf
Outflow = 0.59 cfs @ 12.19 hrs, Volume= 2,262 cf, Atten= 0%, Lag= 0.0 min

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



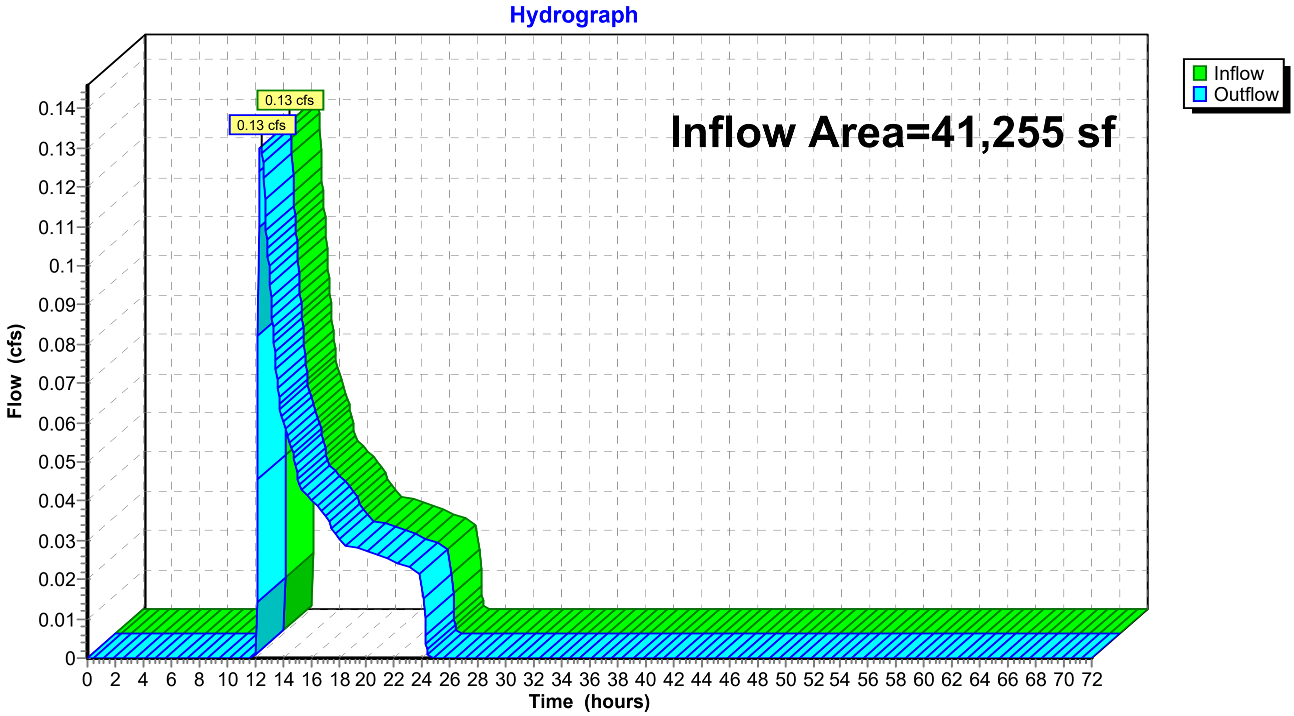
Summary for Reach DP-E3: On-site Depression

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

Inflow Area = 41,255 sf, 7.89% Impervious, Inflow Depth = 0.52" for 50-year event
Inflow = 0.13 cfs @ 12.43 hrs, Volume= 1,795 cf
Outflow = 0.13 cfs @ 12.43 hrs, Volume= 1,795 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E3: On-site Depression

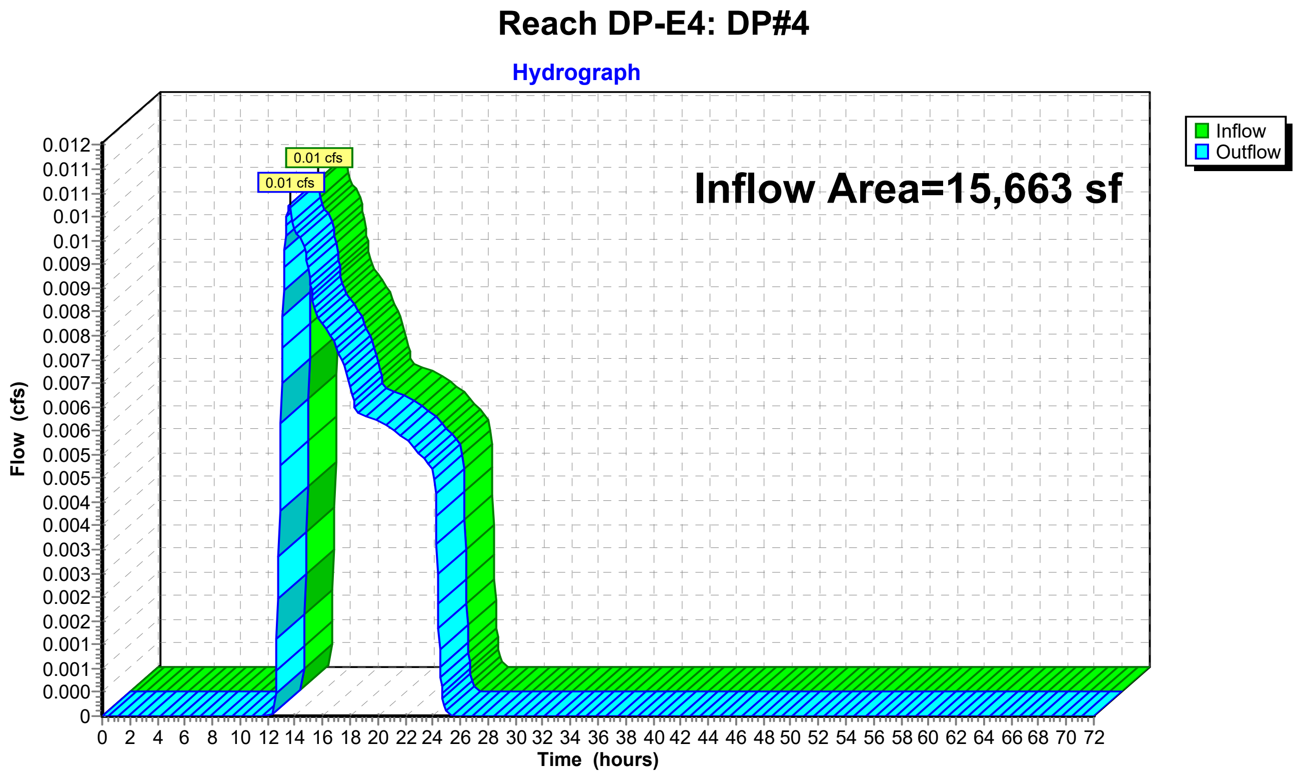


Summary for Reach DP-E4: DP#4

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

Inflow Area = 15,663 sf, 0.00% Impervious, Inflow Depth = 0.23" for 50-year event
Inflow = 0.01 cfs @ 13.58 hrs, Volume= 300 cf
Outflow = 0.01 cfs @ 13.58 hrs, Volume= 300 cf, Atten= 0%, Lag= 0.0 min

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

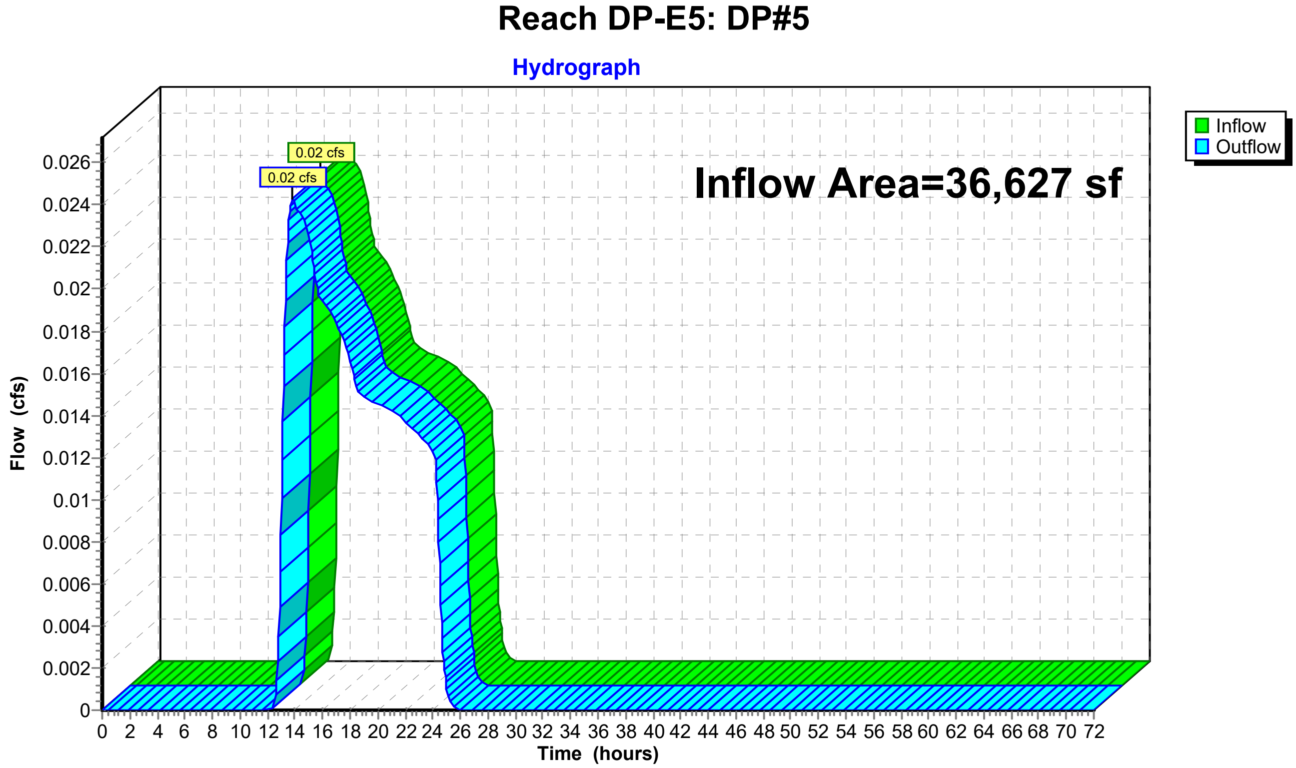


Summary for Reach DP-E5: DP#5

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

Inflow Area =	36,627 sf, 0.00% Impervious,	Inflow Depth = 0.23"	for 50-year event
Inflow =	0.02 cfs @ 13.79 hrs, Volume=	701 cf	
Outflow =	0.02 cfs @ 13.79 hrs, Volume=	701 cf, Atten= 0%, Lag= 0.0 min	

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

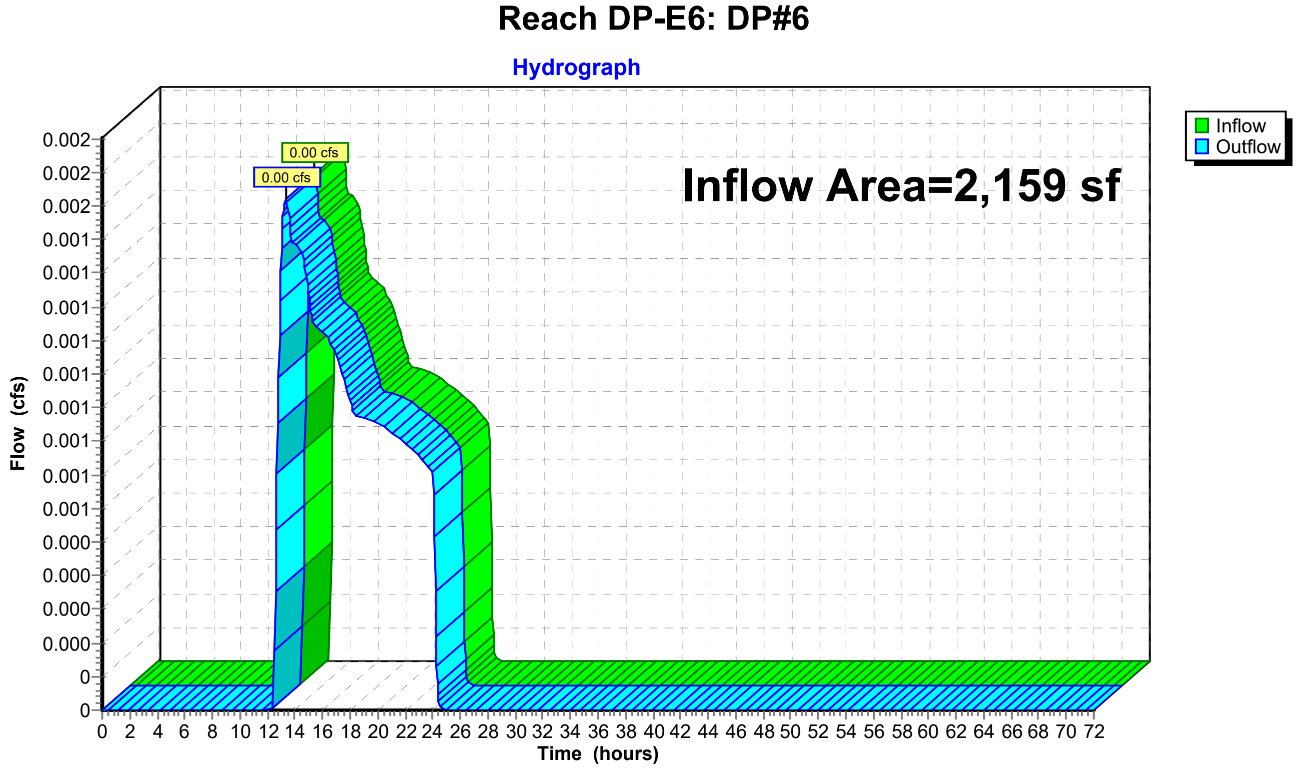


Summary for Reach DP-E6: DP#6

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

Inflow Area =	2,159 sf, 0.00% Impervious,	Inflow Depth = 0.23"	for 50-year event
Inflow =	0.00 cfs @ 13.37 hrs, Volume=	41 cf	
Outflow =	0.00 cfs @ 13.37 hrs, Volume=	41 cf, Atten= 0%, Lag= 0.0 min	

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

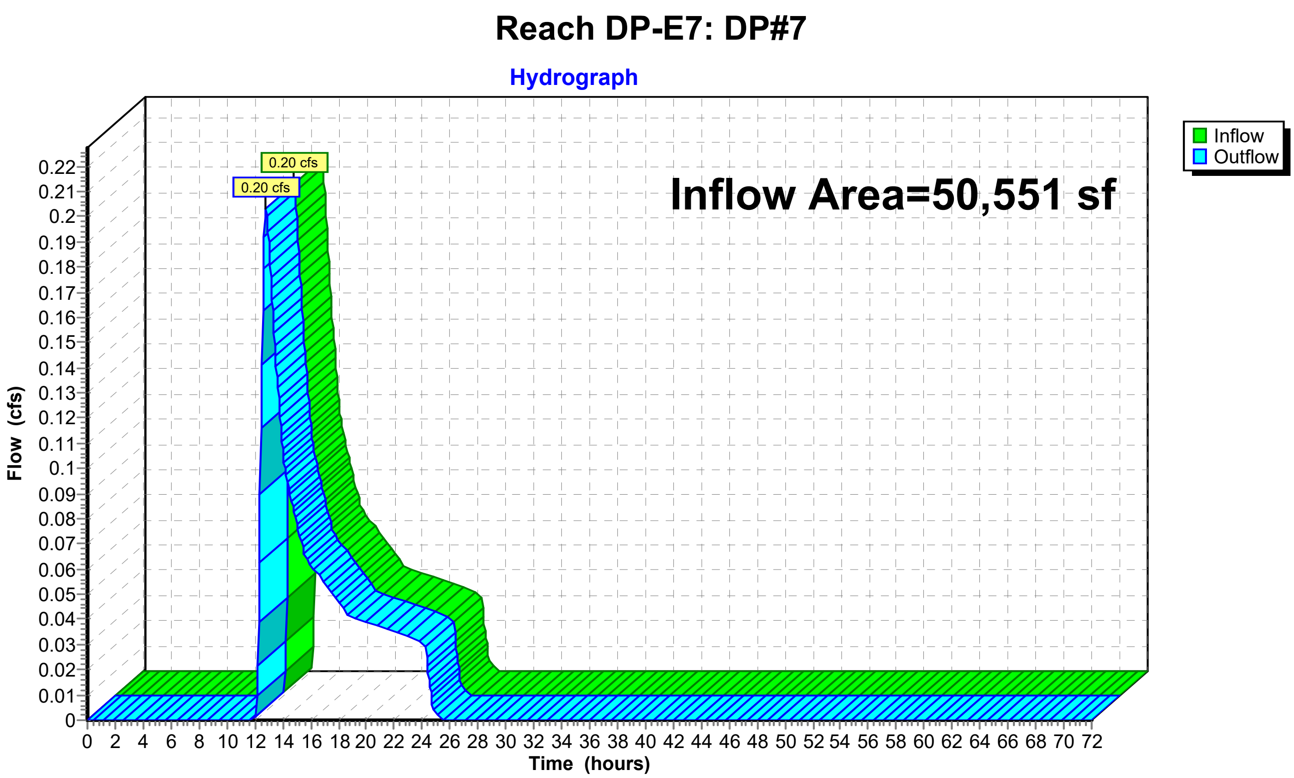


Summary for Reach DP-E7: DP#7

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

Inflow Area =	50,551 sf,	9.63% Impervious, Inflow Depth = 0.66"	for 50-year event
Inflow =	0.20 cfs @	12.78 hrs, Volume=	2,775 cf
Outflow =	0.20 cfs @	12.78 hrs, Volume=	2,775 cf, Atten= 0%, Lag= 0.0 min

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



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

SubcatchmentES1: CDA-1 Runoff Area=6,793 sf 8.18% Impervious Runoff Depth=1.00"
Flow Length=75' Slope=0.0260 '/' Tc=20.0 min CN=36 Runoff=0.07 cfs 566 cf

SubcatchmentES2: CDA-2 Runoff Area=9,782 sf 44.86% Impervious Runoff Depth=3.67"
Flow Length=132' Slope=0.0150 '/' Tc=10.9 min CN=61 Runoff=0.79 cfs 2,996 cf

SubcatchmentES3: CDA-3 Runoff Area=41,255 sf 7.89% Impervious Runoff Depth=0.91"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=35 Runoff=0.38 cfs 3,122 cf

SubcatchmentES4: CDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.03 cfs 639 cf

SubcatchmentES5: CDA-5 Runoff Area=36,627 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.08 cfs 1,494 cf

SubcatchmentES6: CDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.01 cfs 88 cf

SubcatchmentES7: CDA-7 Runoff Area=50,551 sf 9.63% Impervious Runoff Depth=1.09"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=37 Runoff=0.45 cfs 4,604 cf

Reach 1R: EXISTING (NULL) Inflow=1.19 cfs 13,508 cf
Outflow=1.19 cfs 13,508 cf

Reach DP-E1: On-site Depression Inflow=0.07 cfs 566 cf
Outflow=0.07 cfs 566 cf

Reach DP-E2: DP#2 - Main Street CB Inflow=0.79 cfs 2,996 cf
Outflow=0.79 cfs 2,996 cf

Reach DP-E3: On-site Depression Inflow=0.38 cfs 3,122 cf
Outflow=0.38 cfs 3,122 cf

Reach DP-E4: DP#4 Inflow=0.03 cfs 639 cf
Outflow=0.03 cfs 639 cf

Reach DP-E5: DP#5 Inflow=0.08 cfs 1,494 cf
Outflow=0.08 cfs 1,494 cf

Reach DP-E6: DP#6 Inflow=0.01 cfs 88 cf
Outflow=0.01 cfs 88 cf

Reach DP-E7: DP#7 Inflow=0.45 cfs 4,604 cf
Outflow=0.45 cfs 4,604 cf

Total Runoff Area = 162,830 sf Runoff Volume = 13,508 cf Average Runoff Depth = 1.00"
91.97% Pervious = 149,762 sf 8.03% Impervious = 13,068 sf

Summary for Subcatchment ES1: CDA-1

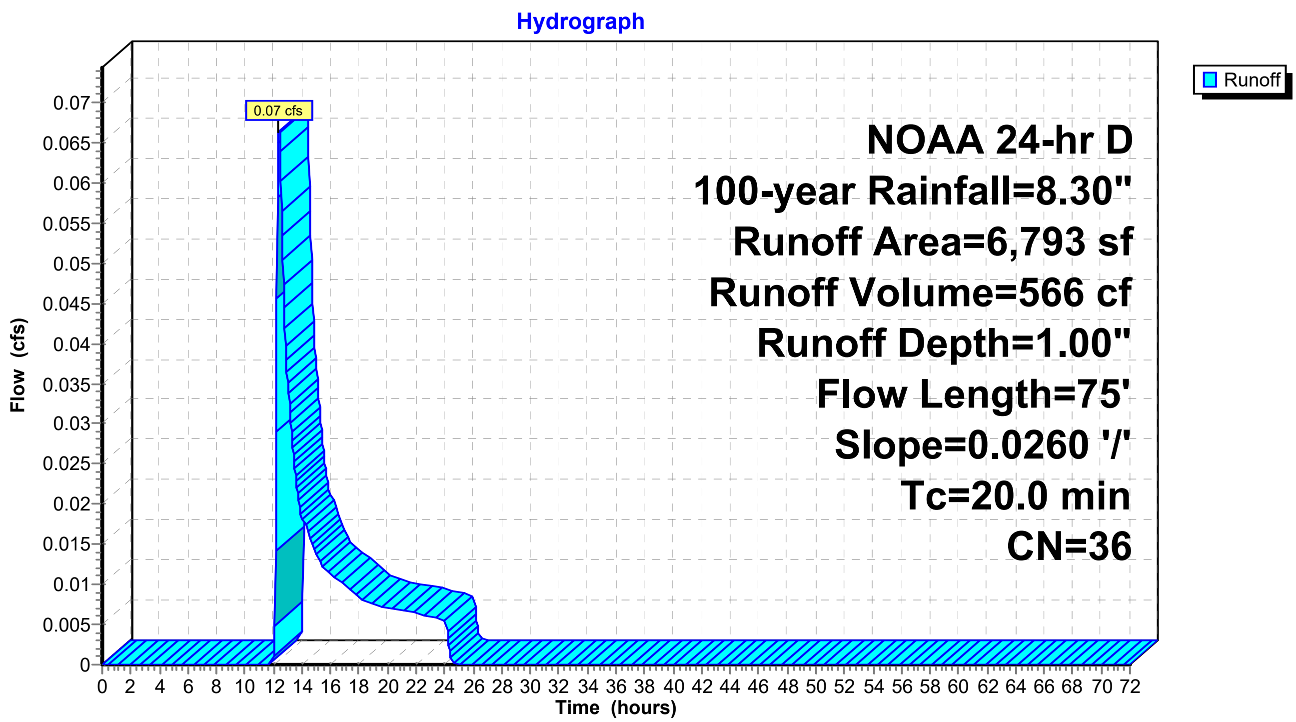
Runoff = 0.07 cfs @ 12.39 hrs, Volume= 566 cf, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
556	98	Roofs, HSG A
6,237	30	Woods, Good, HSG A
6,793	36	Weighted Average
6,237		91.82% Pervious Area
556		8.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	50	0.0260	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	25	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.0	75	Total			

Subcatchment ES1: CDA-1



Summary for Subcatchment ES2: CDA-2

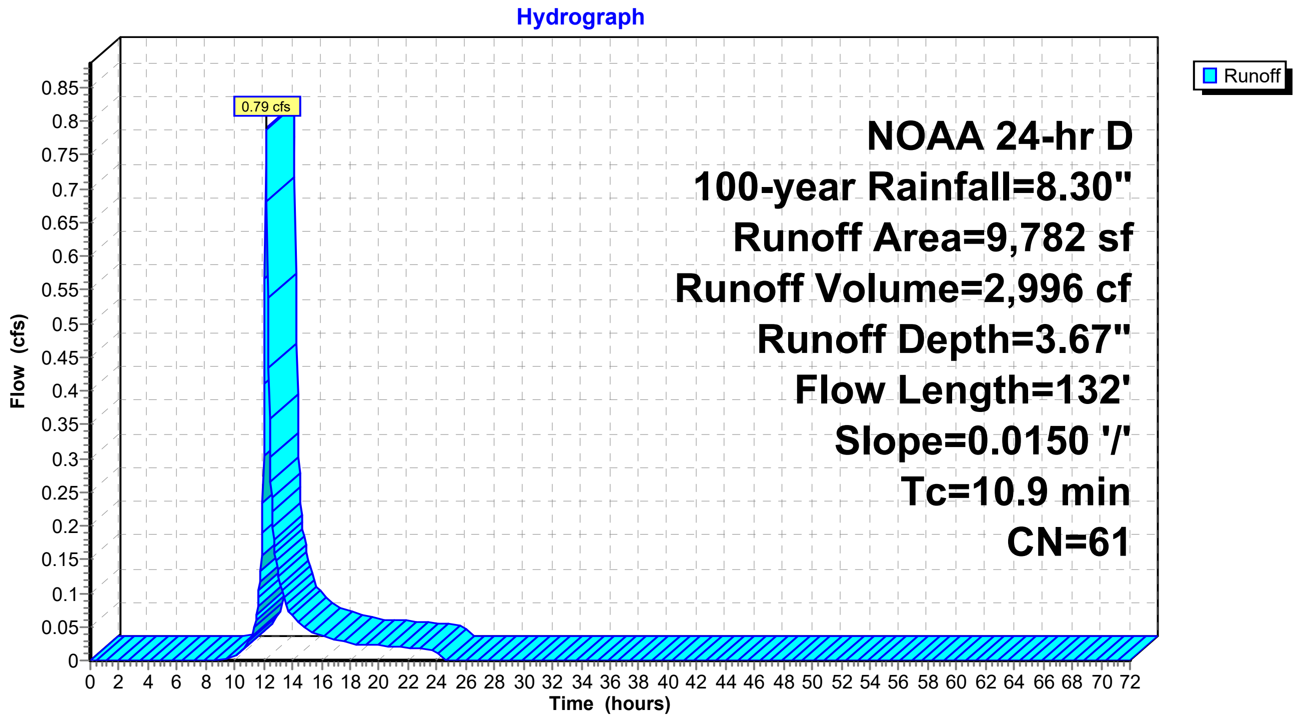
Runoff = 0.79 cfs @ 12.19 hrs, Volume= 2,996 cf, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
5,394	30	Woods, Good, HSG A
1,320	98	Roofs, HSG A
3,068	98	Paved parking, HSG A
9,782	61	Weighted Average
5,394		55.14% Pervious Area
4,388		44.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0150	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	27	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.9	132	Total			

Subcatchment ES2: CDA-2



Summary for Subcatchment ES3: CDA-3

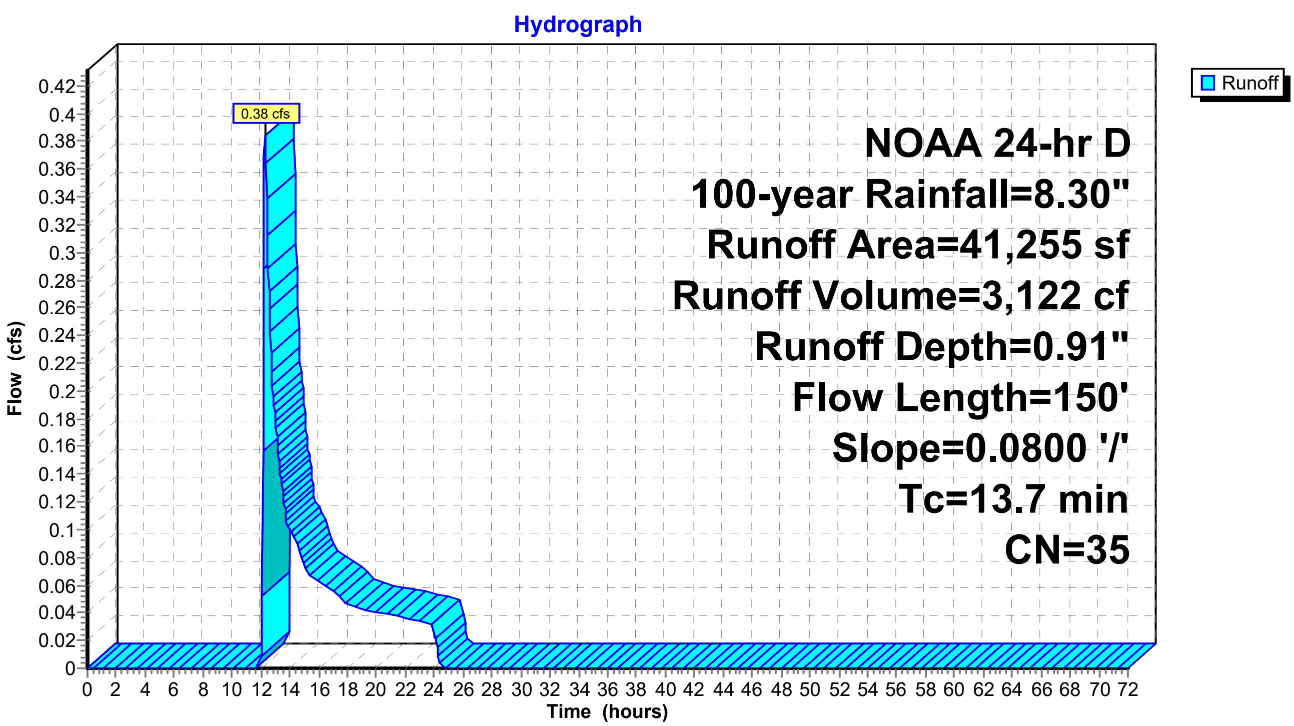
Runoff = 0.38 cfs @ 12.30 hrs, Volume= 3,122 cf, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
79	98	Paved parking, HSG A
3,177	98	Roofs, HSG A
37,999	30	Woods, Good, HSG A
41,255	35	Weighted Average
37,999		92.11% Pervious Area
3,256		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment ES3: CDA-3



Summary for Subcatchment ES4: CDA-4

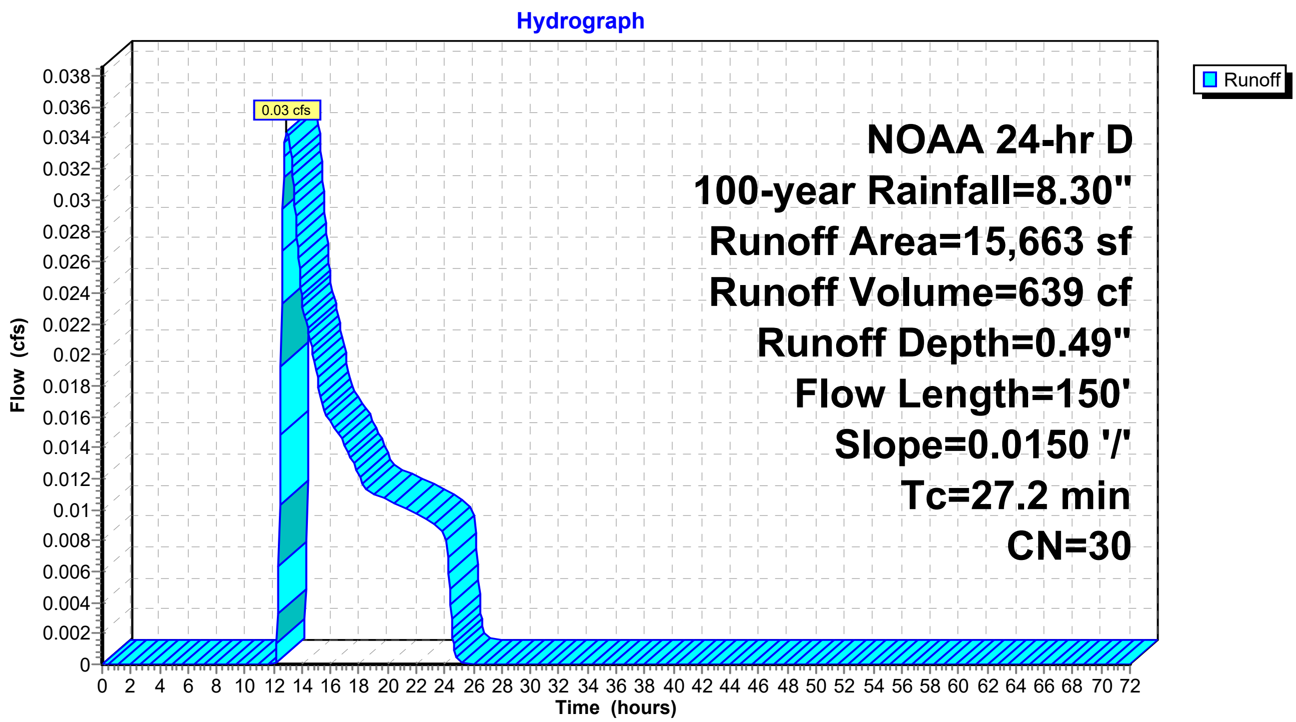
Runoff = 0.03 cfs @ 12.94 hrs, Volume= 639 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment ES4: CDA-4



Summary for Subcatchment ES5: CDA-5

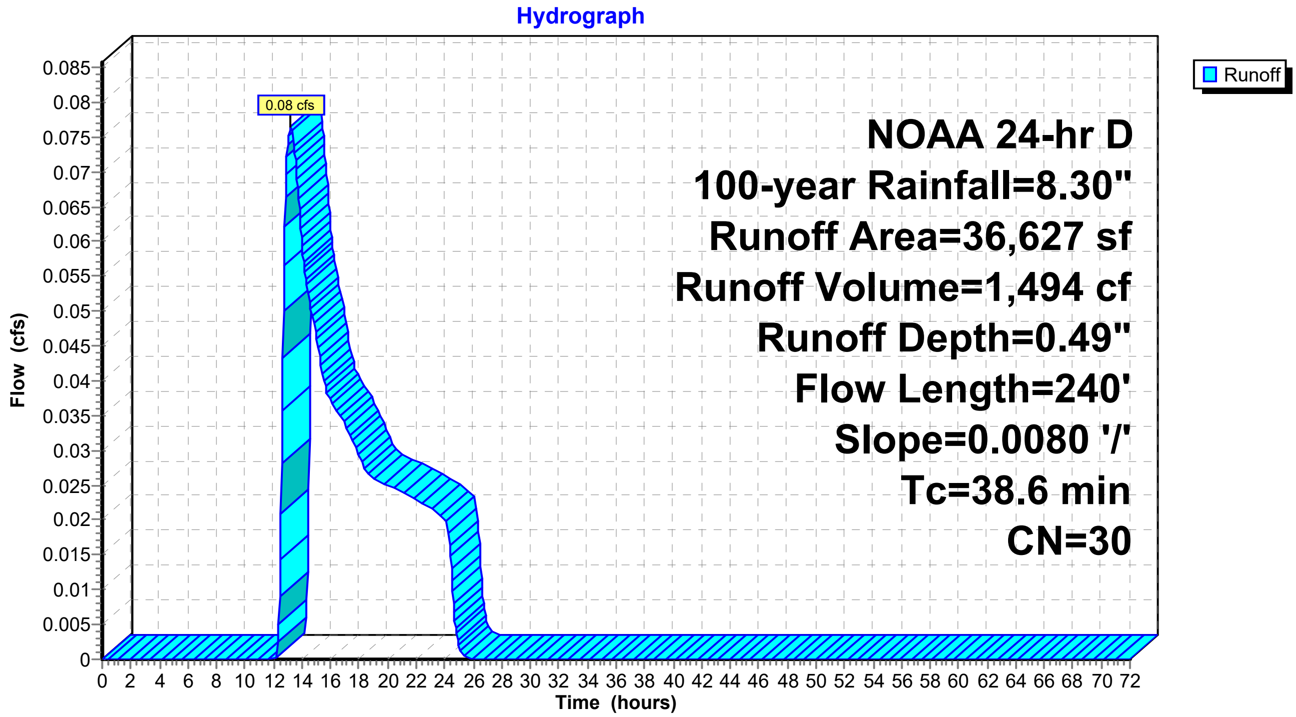
Runoff = 0.08 cfs @ 13.19 hrs, Volume= 1,494 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
36,627	30	Woods, Good, HSG A
36,627		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment ES5: CDA-5



Summary for Subcatchment ES6: CDA-6

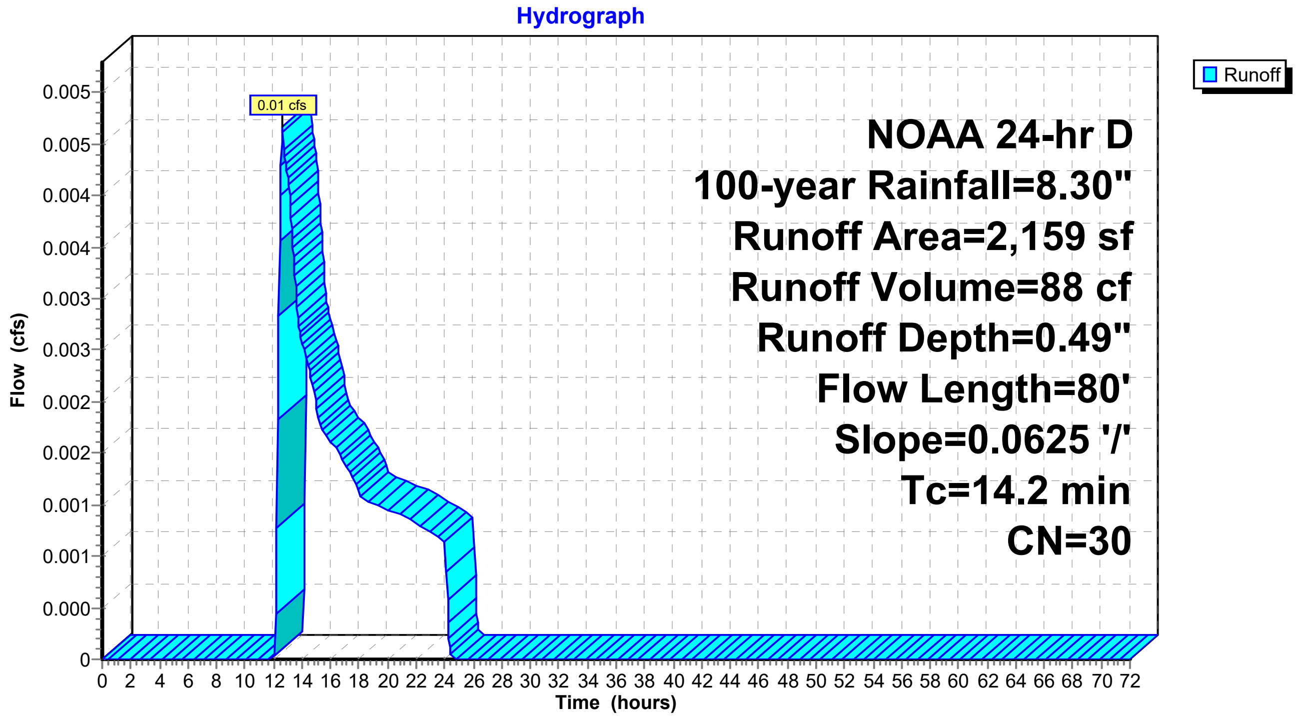
Runoff = 0.01 cfs @ 12.63 hrs, Volume= 88 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment ES6: CDA-6



Summary for Subcatchment ES7: CDA-7

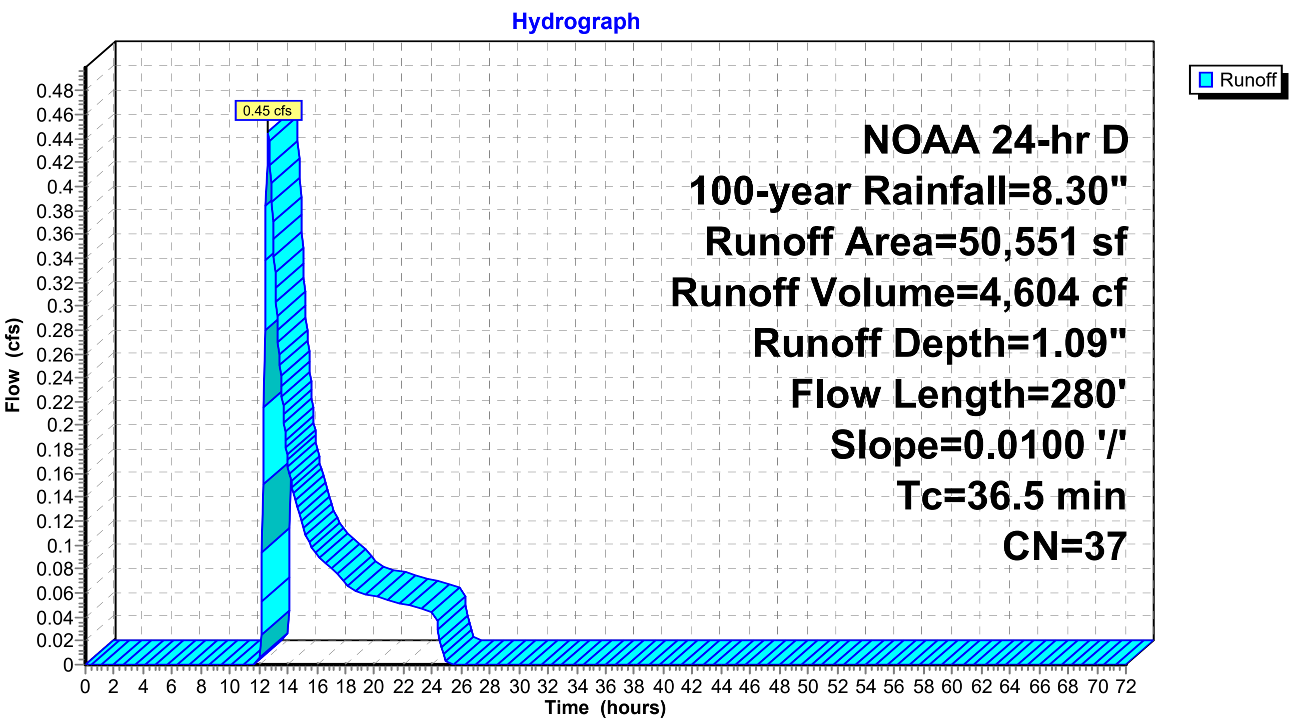
Runoff = 0.45 cfs @ 12.66 hrs, Volume= 4,604 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
4,868	98	Paved parking, HSG A
45,683	30	Meadow, non-grazed, HSG A
50,551	37	Weighted Average
45,683		90.37% Pervious Area
4,868		9.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment ES7: CDA-7

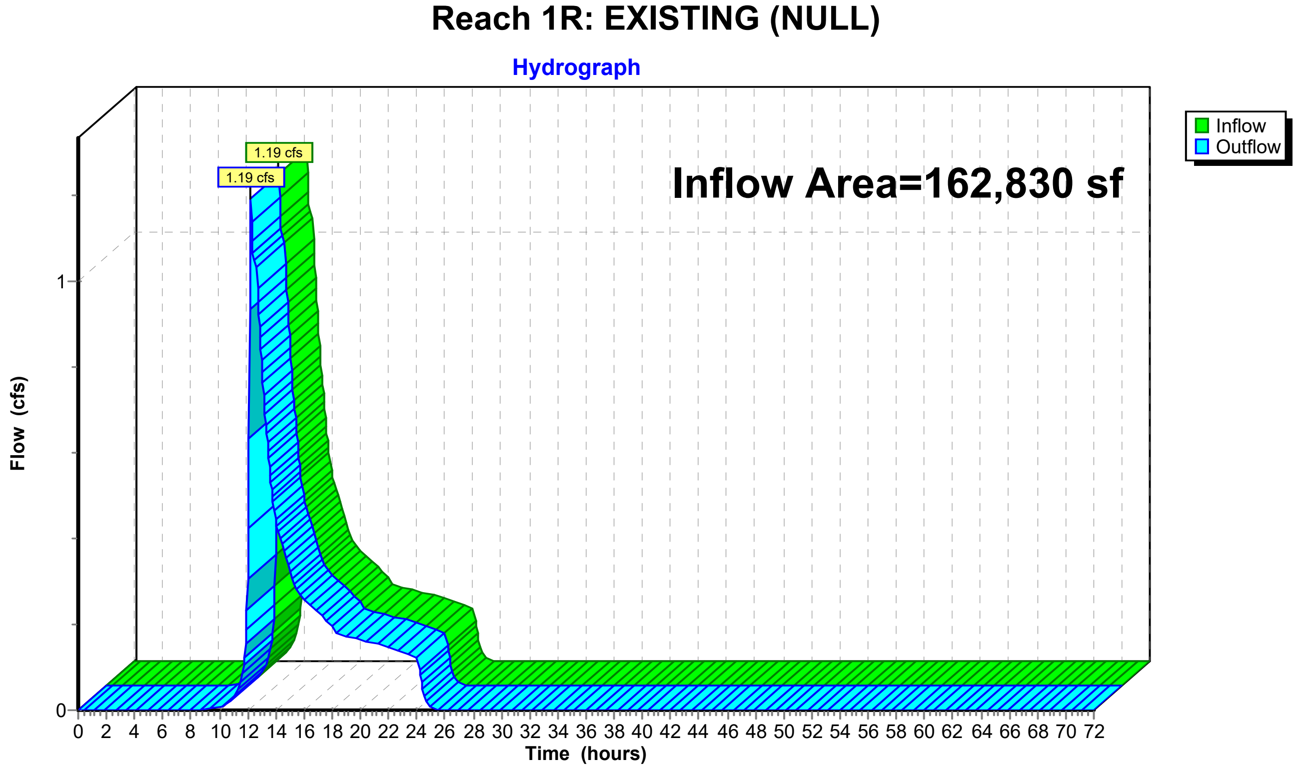


Summary for Reach 1R: EXISTING (NULL)

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

Inflow Area = 162,830 sf, 8.03% Impervious, Inflow Depth = 1.00" for 100-year event
Inflow = 1.19 cfs @ 12.24 hrs, Volume= 13,508 cf
Outflow = 1.19 cfs @ 12.24 hrs, Volume= 13,508 cf, Atten= 0%, Lag= 0.0 min

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



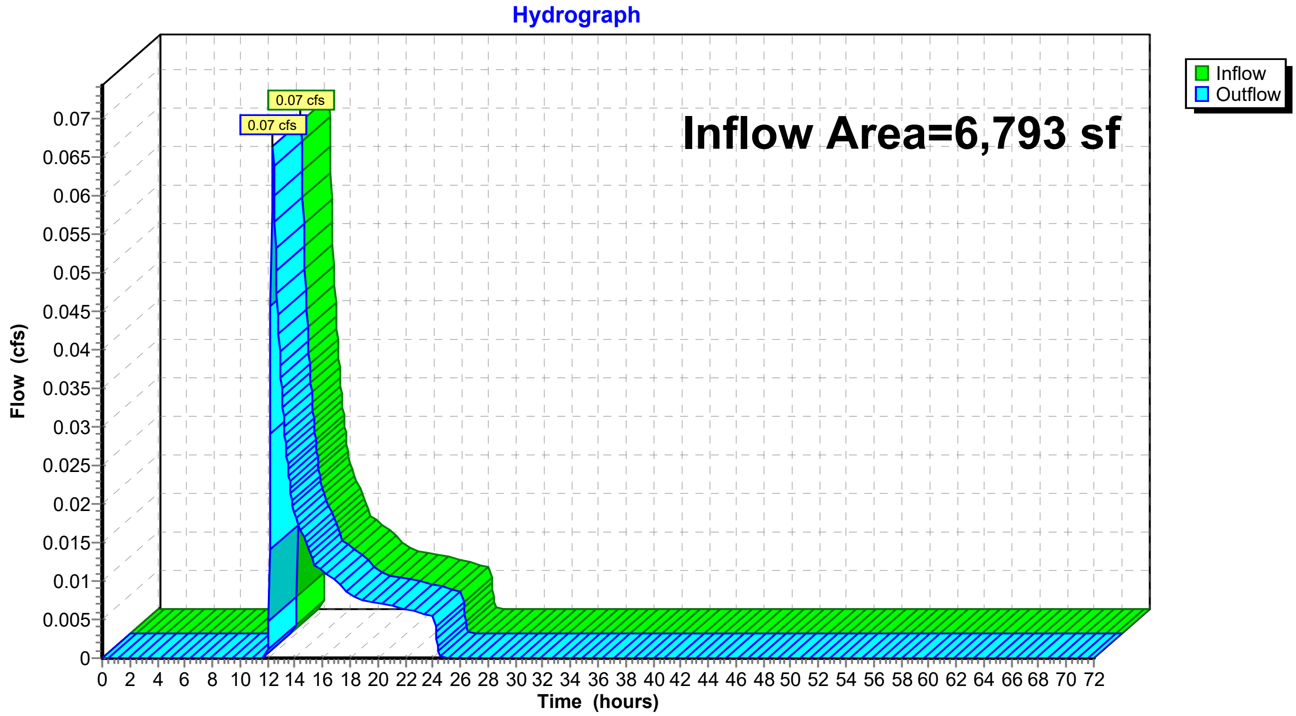
Summary for Reach DP-E1: On-site Depression

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

Inflow Area =	6,793 sf, 8.18% Impervious,	Inflow Depth = 1.00"	for 100-year event
Inflow =	0.07 cfs @ 12.39 hrs, Volume=	566 cf	
Outflow =	0.07 cfs @ 12.39 hrs, Volume=	566 cf, Atten= 0%, Lag= 0.0 min	

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

Reach DP-E1: On-site Depression



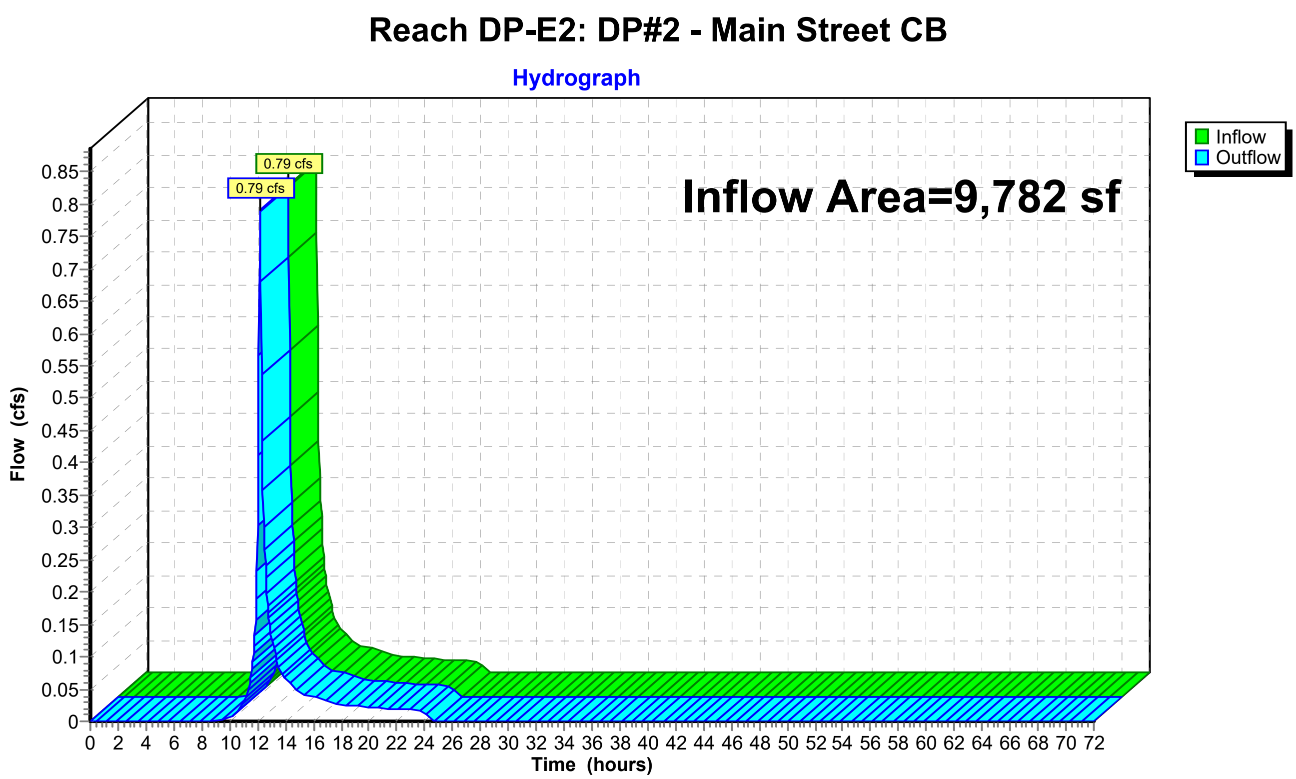
Summary for Reach DP-E2: DP#2 - Main Street CB

MAIN STREET CATCH BASIN

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

Inflow Area = 9,782 sf, 44.86% Impervious, Inflow Depth = 3.67" for 100-year event
Inflow = 0.79 cfs @ 12.19 hrs, Volume= 2,996 cf
Outflow = 0.79 cfs @ 12.19 hrs, Volume= 2,996 cf, Atten= 0%, Lag= 0.0 min

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



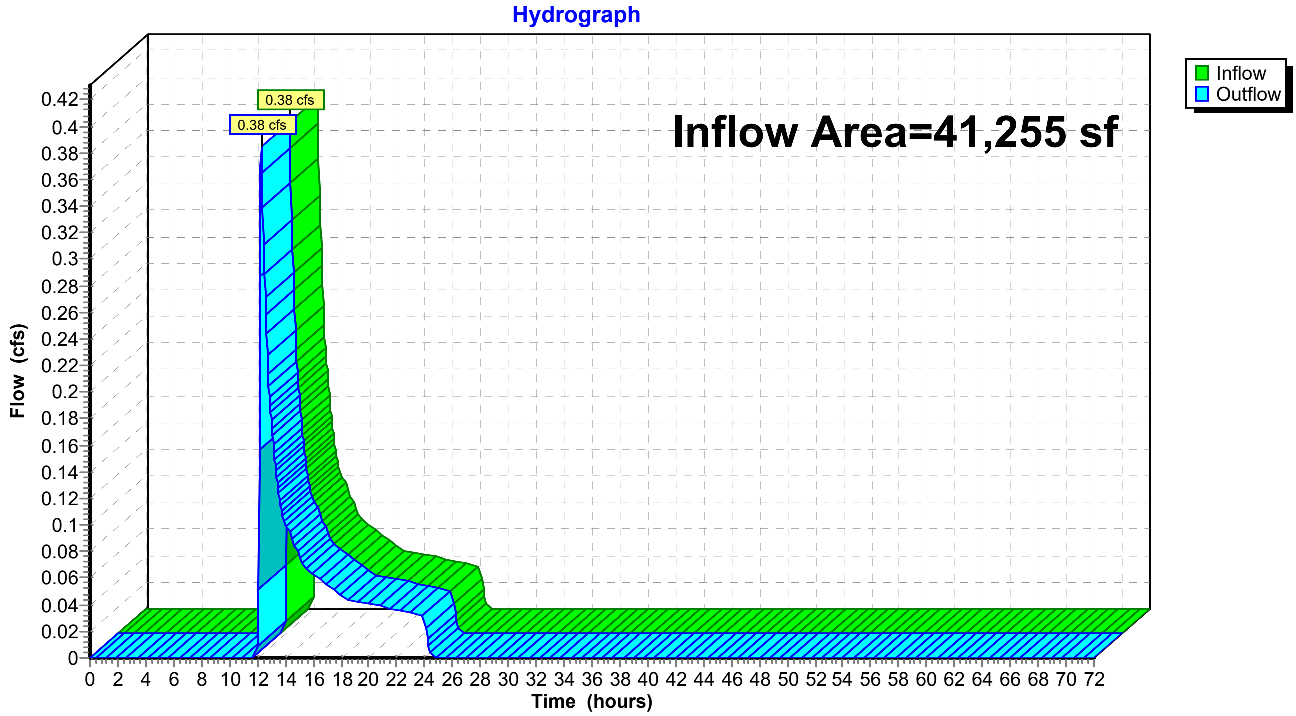
Summary for Reach DP-E3: On-site Depression

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

Inflow Area = 41,255 sf, 7.89% Impervious, Inflow Depth = 0.91" for 100-year event
Inflow = 0.38 cfs @ 12.30 hrs, Volume= 3,122 cf
Outflow = 0.38 cfs @ 12.30 hrs, Volume= 3,122 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-E3: On-site Depression

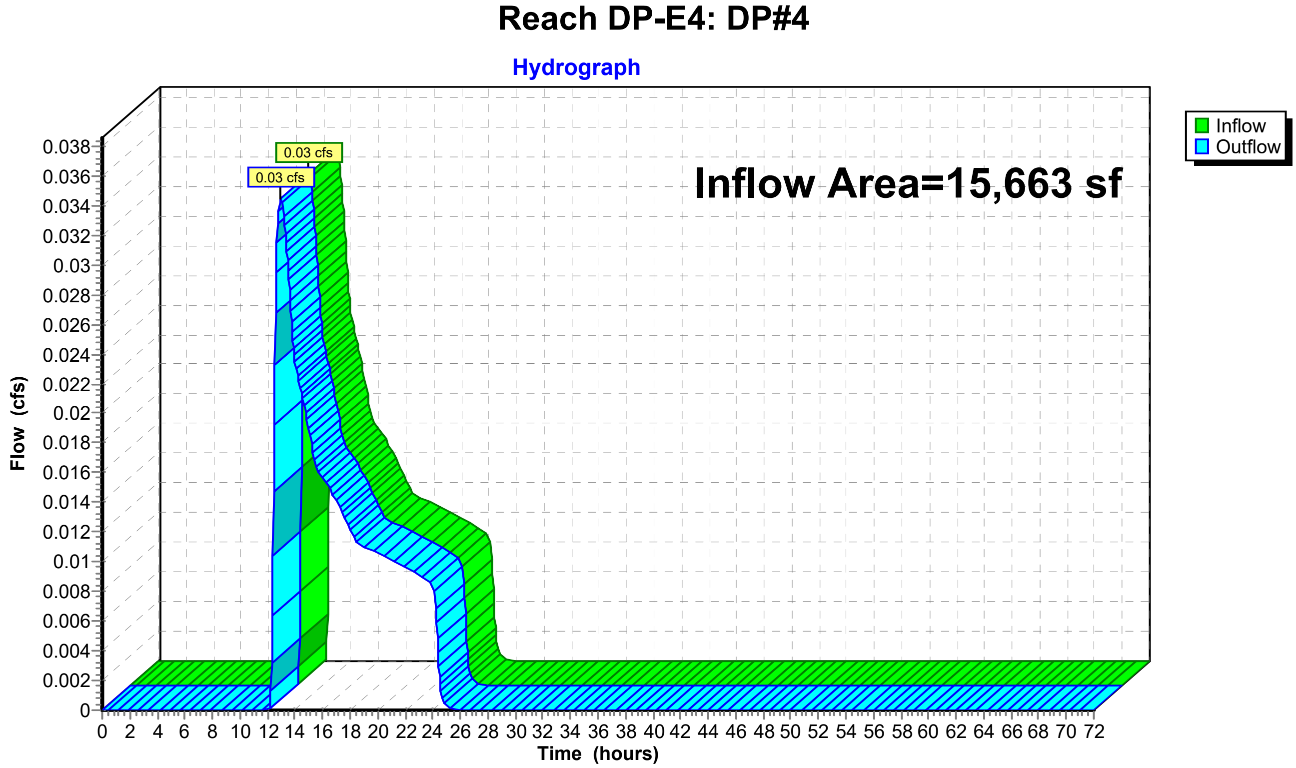


Summary for Reach DP-E4: DP#4

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

Inflow Area =	15,663 sf,	0.00% Impervious, Inflow Depth = 0.49"	for 100-year event
Inflow =	0.03 cfs @	12.94 hrs, Volume=	639 cf
Outflow =	0.03 cfs @	12.94 hrs, Volume=	639 cf, Atten= 0%, Lag= 0.0 min

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

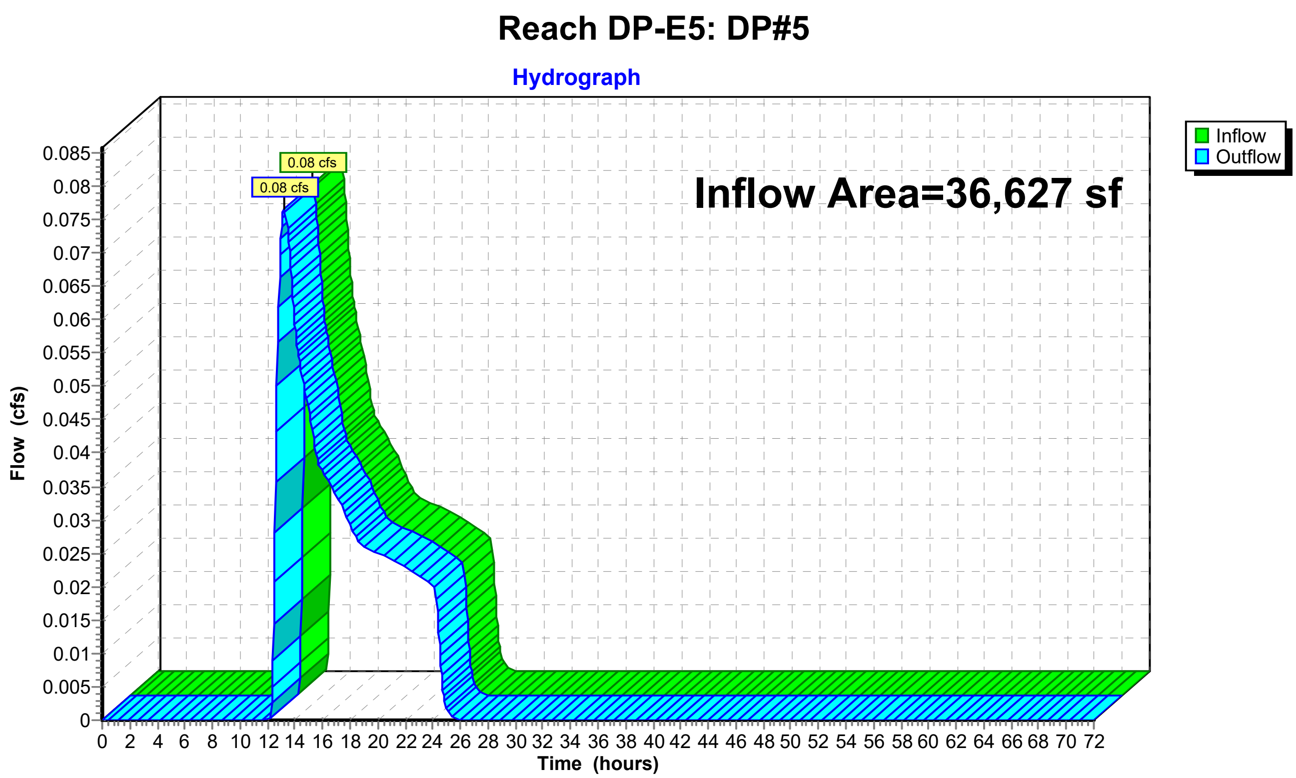


Summary for Reach DP-E5: DP#5

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

Inflow Area =	36,627 sf,	0.00% Impervious,	Inflow Depth = 0.49" for 100-year event
Inflow =	0.08 cfs @	13.19 hrs, Volume=	1,494 cf
Outflow =	0.08 cfs @	13.19 hrs, Volume=	1,494 cf, Atten= 0%, Lag= 0.0 min

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

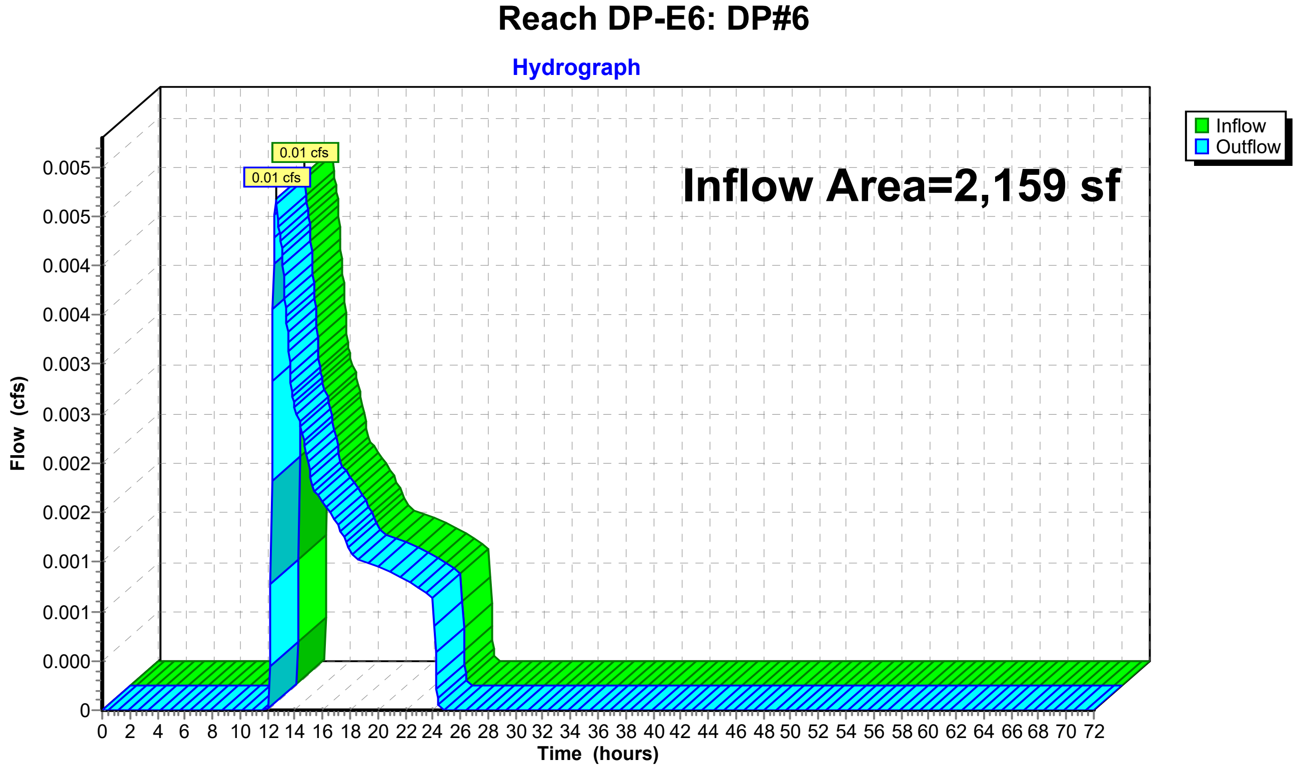


Summary for Reach DP-E6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious,	Inflow Depth = 0.49"	for 100-year event
Inflow =	0.01 cfs @	12.63 hrs, Volume=	88 cf	
Outflow =	0.01 cfs @	12.63 hrs, Volume=	88 cf,	Atten= 0%, Lag= 0.0 min

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

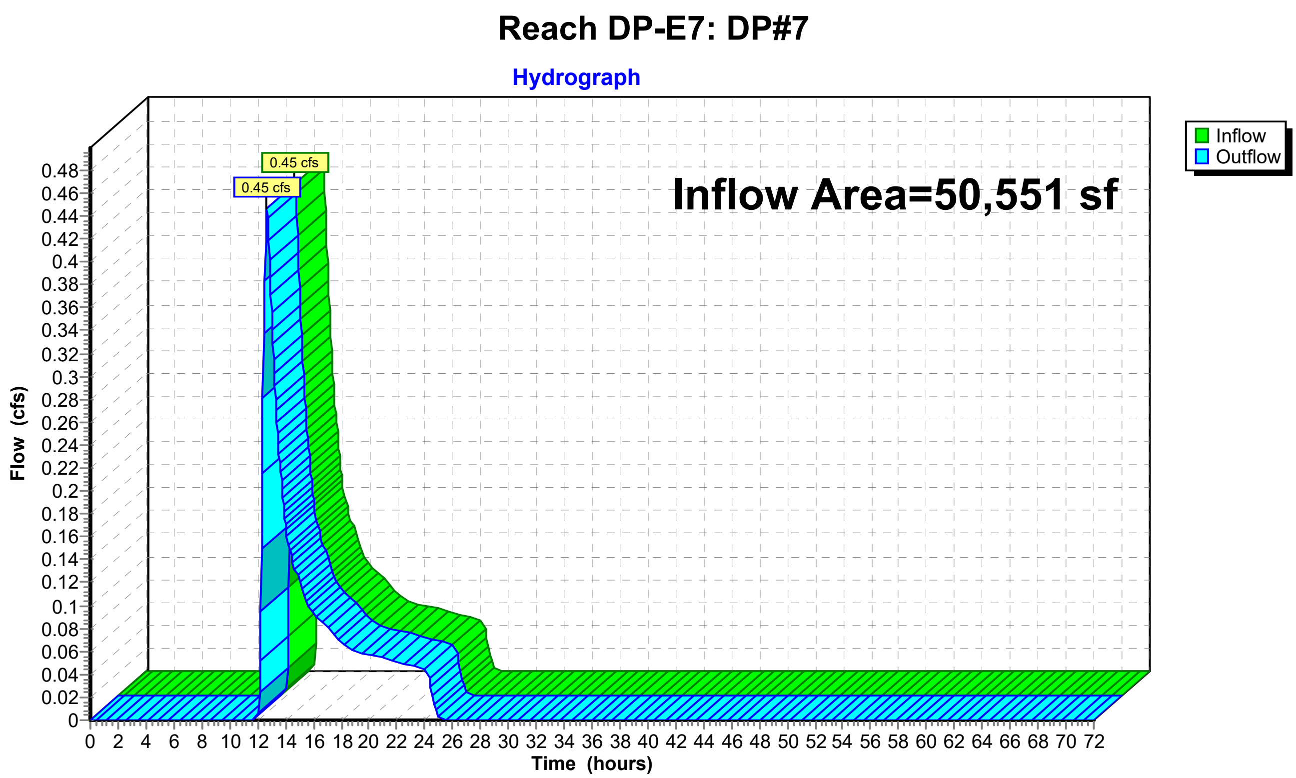


Summary for Reach DP-E7: DP#7

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

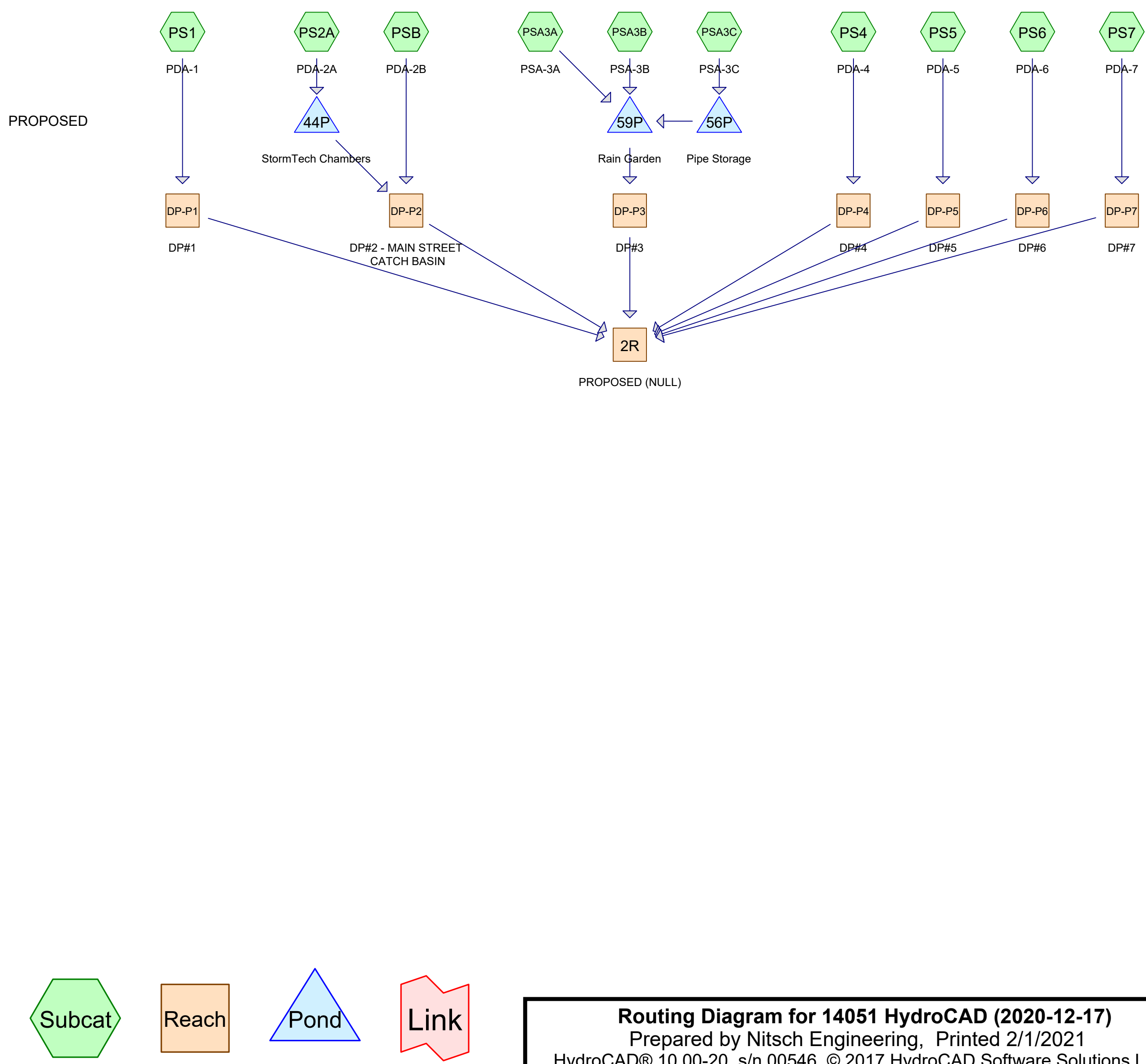
Inflow Area = 50,551 sf, 9.63% Impervious, Inflow Depth = 1.09" for 100-year event
Inflow = 0.45 cfs @ 12.66 hrs, Volume= 4,604 cf
Outflow = 0.45 cfs @ 12.66 hrs, Volume= 4,604 cf, Atten= 0%, Lag= 0.0 min

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



APPENDIX C

Post-Development Conditions – HydroCAD Calculations



Routing Diagram for 14051 HydroCAD (2020-12-17)
Prepared by Nitsch Engineering, Printed 2/1/2021

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
20,165	98	Paved parking, HSG A (PS1, PS2A, PSA3A, PSA3B, PSB)
5,926	98	Roofs, HSG A (PS2A, PSA3C)
136,738	30	Woods, Good, HSG A (PS1, PS2A, PS4, PS5, PS6, PS7, PSA3A, PSA3B, PSB)
162,829	**41**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
162,829	HSG A	PS1, PS2A, PS4, PS5, PS6, PS7, PSA3A, PSA3B, PSA3C, PSB
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
162,829		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchmen Numbers
20,165	0	0	0	0	20,165	Paved parking	
5,926	0	0	0	0	5,926	Roofs	
136,738	0	0	0	0	136,738	Woods, Good	
162,829	**0**	**0**	**0**	**0**	**162,829**	**TOTAL AREA**	

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

SubcatchmentPS1: PDA-1 Runoff Area=6,708 sf 1.37% Impervious Runoff Depth=0.00"
Flow Length=75' Slope=0.0400 '/' Tc=16.8 min CN=31 Runoff=0.00 cfs 0 cf

SubcatchmentPS2A: PDA-2A Runoff Area=8,096 sf 84.47% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=87 Runoff=0.38 cfs 1,232 cf

SubcatchmentPS4: PDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPS5: PDA-5 Runoff Area=33,572 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPS6: PDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPS7: PDA-7 Runoff Area=42,195 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPSA3A: PSA-3A Runoff Area=33,204 sf 2.76% Impervious Runoff Depth=0.00"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=32 Runoff=0.00 cfs 0 cf

SubcatchmentPSA3B: PSA-3B Runoff Area=13,433 sf 98.05% Impervious Runoff Depth=2.76"
Flow Length=130' Slope=0.0150 '/' Tc=6.0 min CN=97 Runoff=0.86 cfs 3,087 cf

SubcatchmentPSA3C: PSA-3C Runoff Area=2,578 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.17 cfs 616 cf

SubcatchmentPSB: PDA-2B Runoff Area=5,221 sf 47.75% Impervious Runoff Depth=0.44"
Flow Length=112' Slope=0.0440 '/' Tc=6.0 min CN=62 Runoff=0.04 cfs 191 cf

Reach 2R: PROPOSED (NULL) Inflow=0.04 cfs 191 cf
Outflow=0.04 cfs 191 cf

Reach DP-P1: DP#1 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN Inflow=0.04 cfs 191 cf
Outflow=0.04 cfs 191 cf

Reach DP-P3: DP#3 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P4: DP#4 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P5: DP#5 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P6: DP#6
Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P7: DP#7
Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 44P: StormTech Chambers
Peak Elev=99.65' Storage=0.010 af Inflow=0.38 cfs 1,232 cf
Discarded=0.04 cfs 1,232 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,232 cf

Pond 55P: StormTech Chambers
Peak Elev=0.00' Storage=0.000 af
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Pond 56P: Pipe Storage
Peak Elev=99.99' Storage=0.005 af Inflow=0.17 cfs 616 cf
Discarded=0.01 cfs 616 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 616 cf

Pond 59P: Rain Garden
Peak Elev=97.02' Storage=11 cf Inflow=0.86 cfs 3,087 cf
Discarded=0.87 cfs 3,087 cf Primary=0.00 cfs 0 cf Outflow=0.87 cfs 3,087 cf

Total Runoff Area = 162,829 sf Runoff Volume = 5,126 cf Average Runoff Depth = 0.38"
83.98% Pervious = 136,738 sf 16.02% Impervious = 26,091 sf

Summary for Subcatchment PS1: PDA-1

[45] Hint: Runoff=Zero

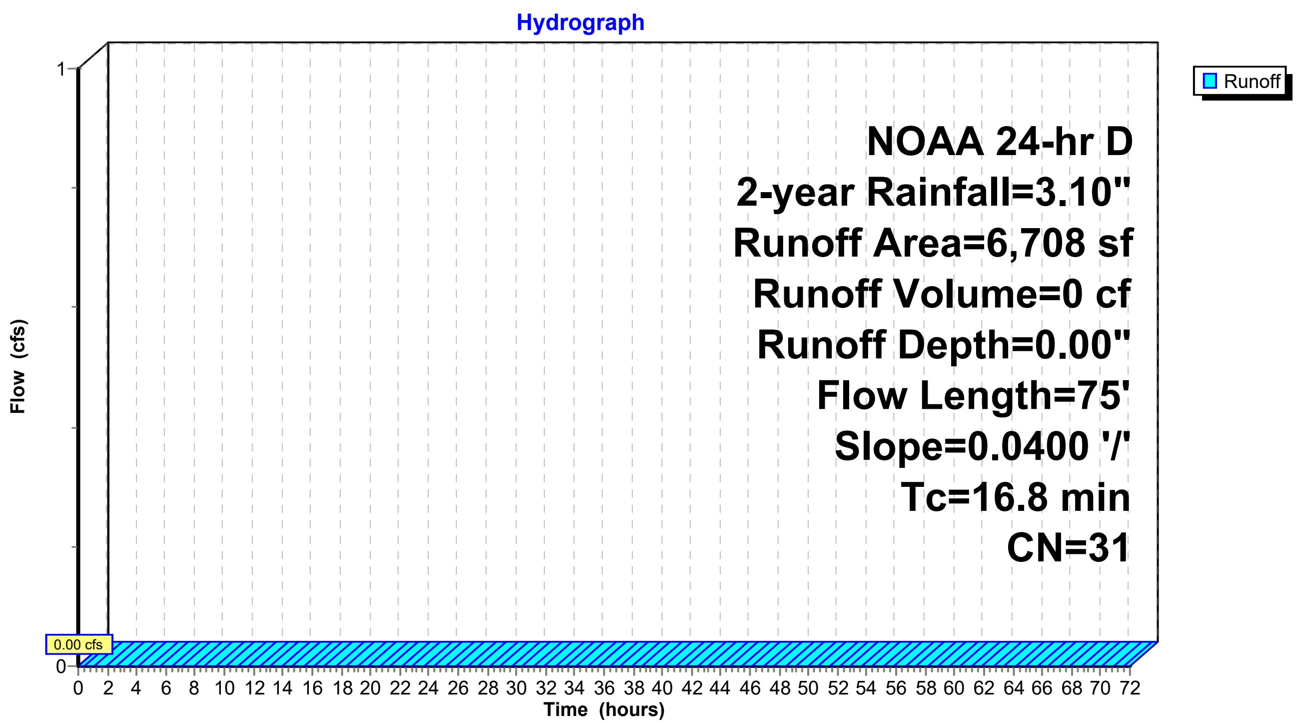
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
92	98	Paved parking, HSG A
6,616	30	Woods, Good, HSG A
6,708	31	Weighted Average
6,616		98.63% Pervious Area
92		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.3	25	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.8	75	Total			

Subcatchment PS1: PDA-1



Summary for Subcatchment PS2A: PDA-2A

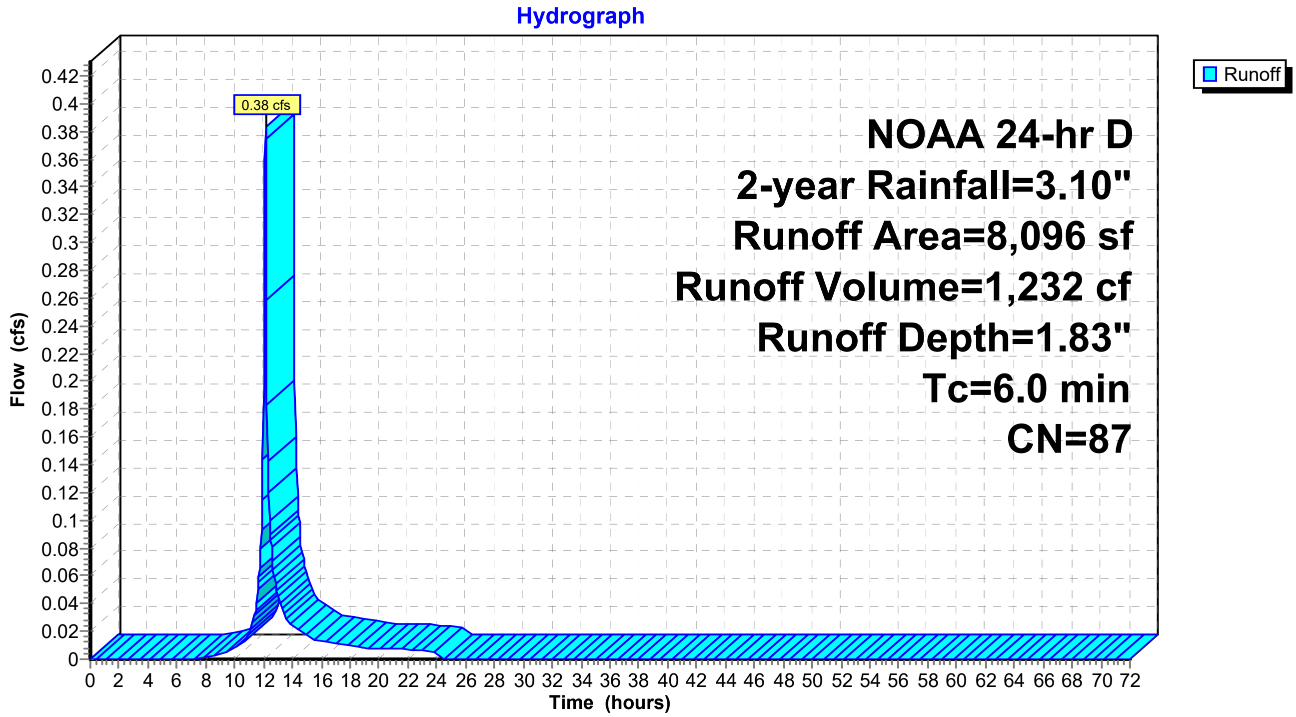
Runoff = 0.38 cfs @ 12.13 hrs, Volume= 1,232 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
3,491	98	Paved parking, HSG A
3,348	98	Roofs, HSG A
1,257	30	Woods, Good, HSG A
8,096	87	Weighted Average
1,257		15.53% Pervious Area
6,839		84.47% Impervious Area

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

Subcatchment PS2A: PDA-2A



Summary for Subcatchment PS4: PDA-4

[45] Hint: Runoff=Zero

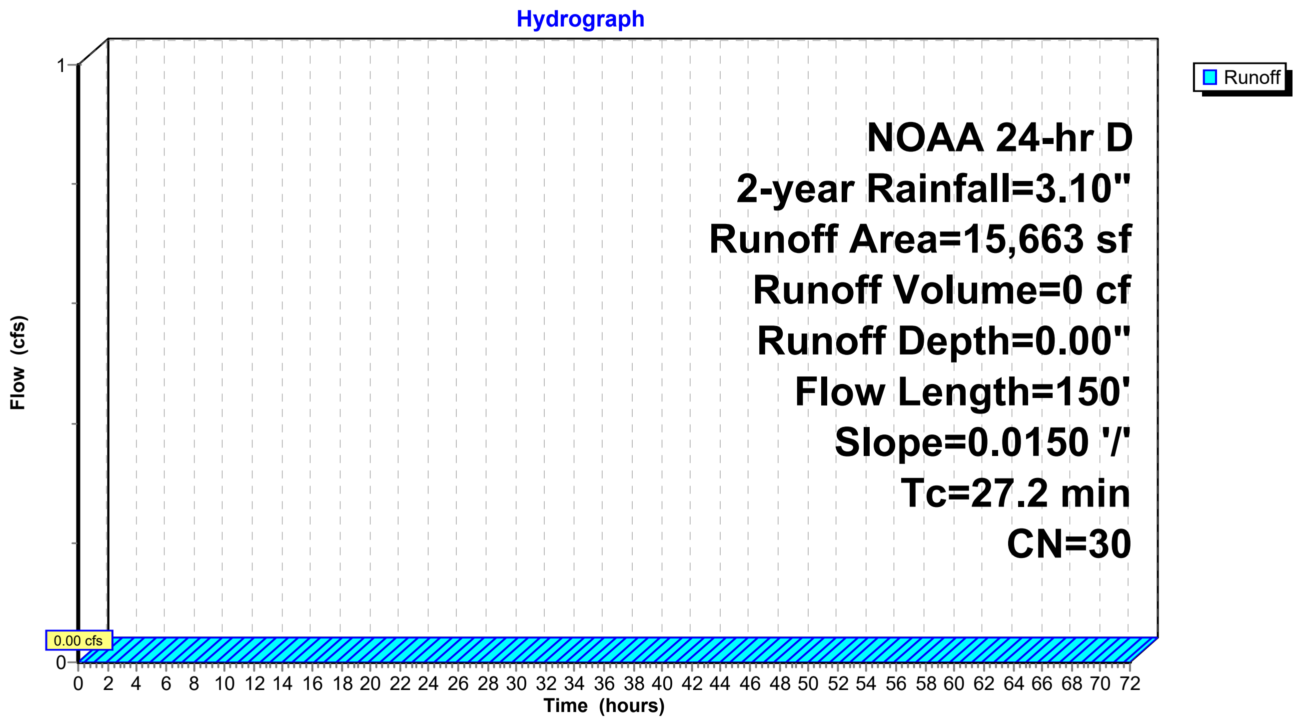
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment PS4: PDA-4



Summary for Subcatchment PS5: PDA-5

[45] Hint: Runoff=Zero

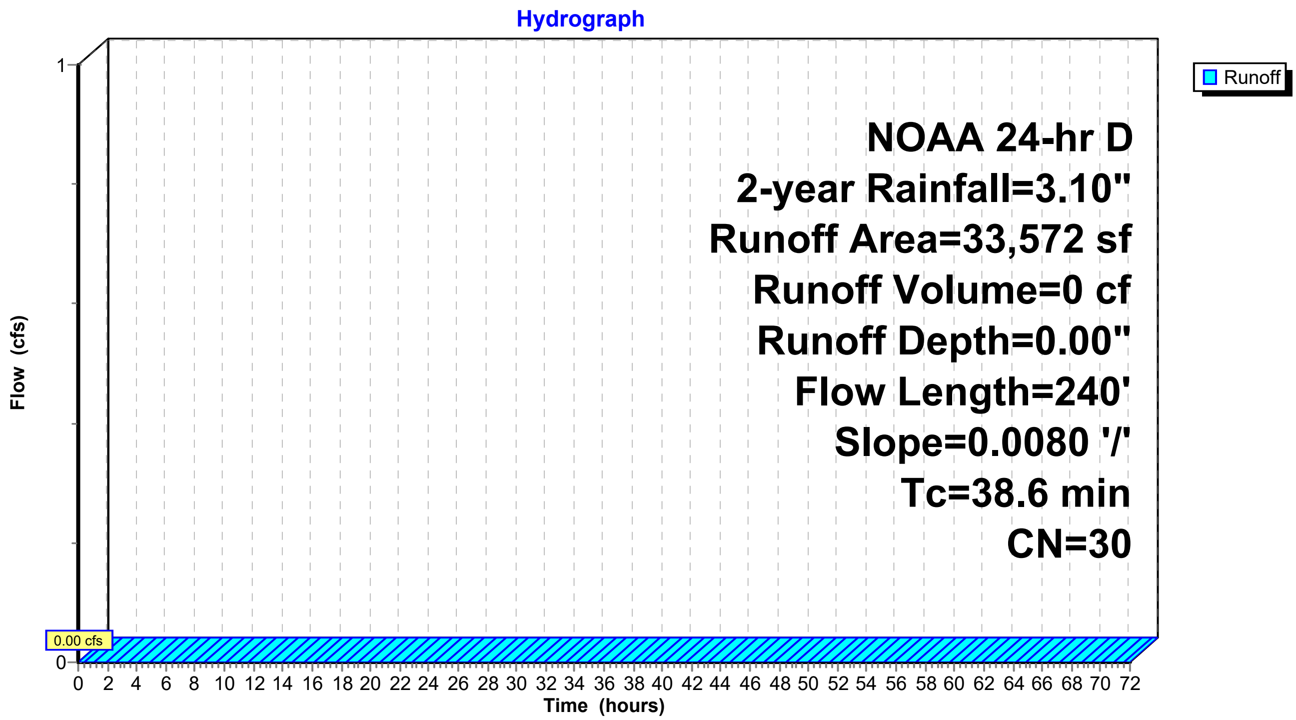
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
33,572	30	Woods, Good, HSG A
33,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment PS5: PDA-5



Summary for Subcatchment PS6: PDA-6

[45] Hint: Runoff=Zero

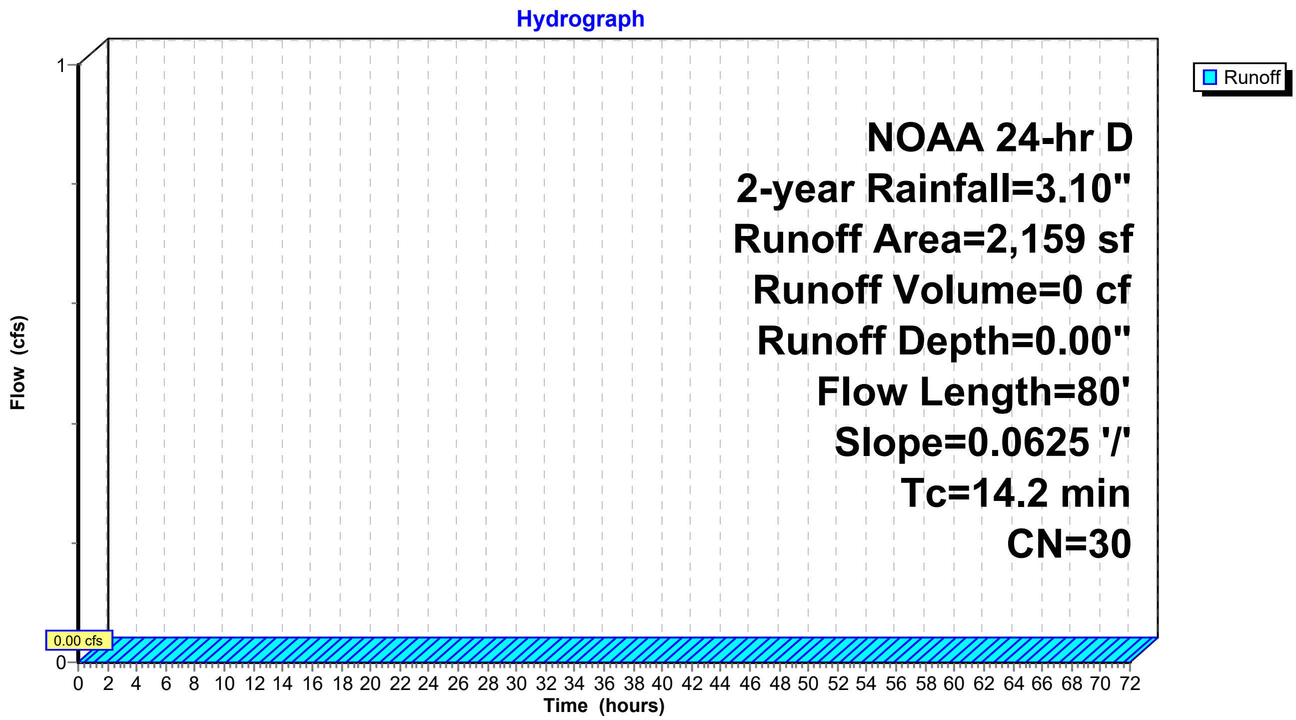
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment PS6: PDA-6



Summary for Subcatchment PS7: PDA-7

[45] Hint: Runoff=Zero

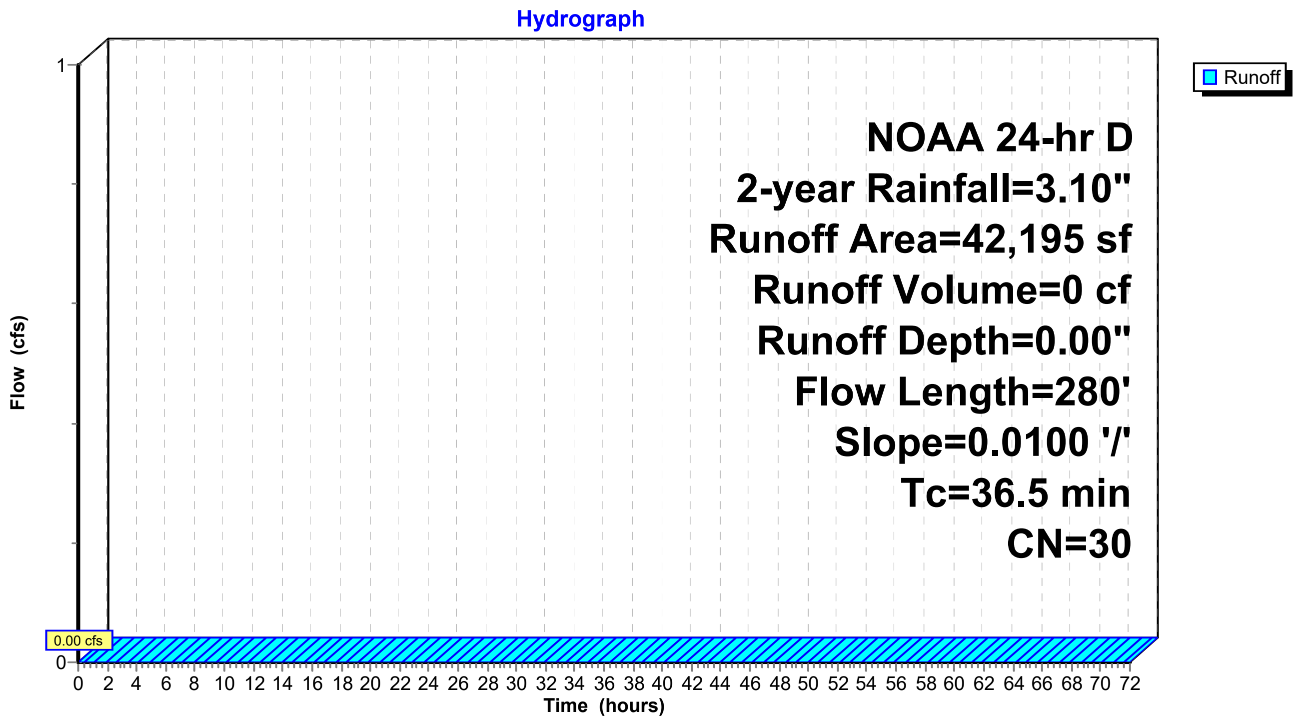
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
42,195	30	Woods, Good, HSG A
42,195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment PS7: PDA-7



Summary for Subcatchment PSA3A: PSA-3A

[45] Hint: Runoff=Zero

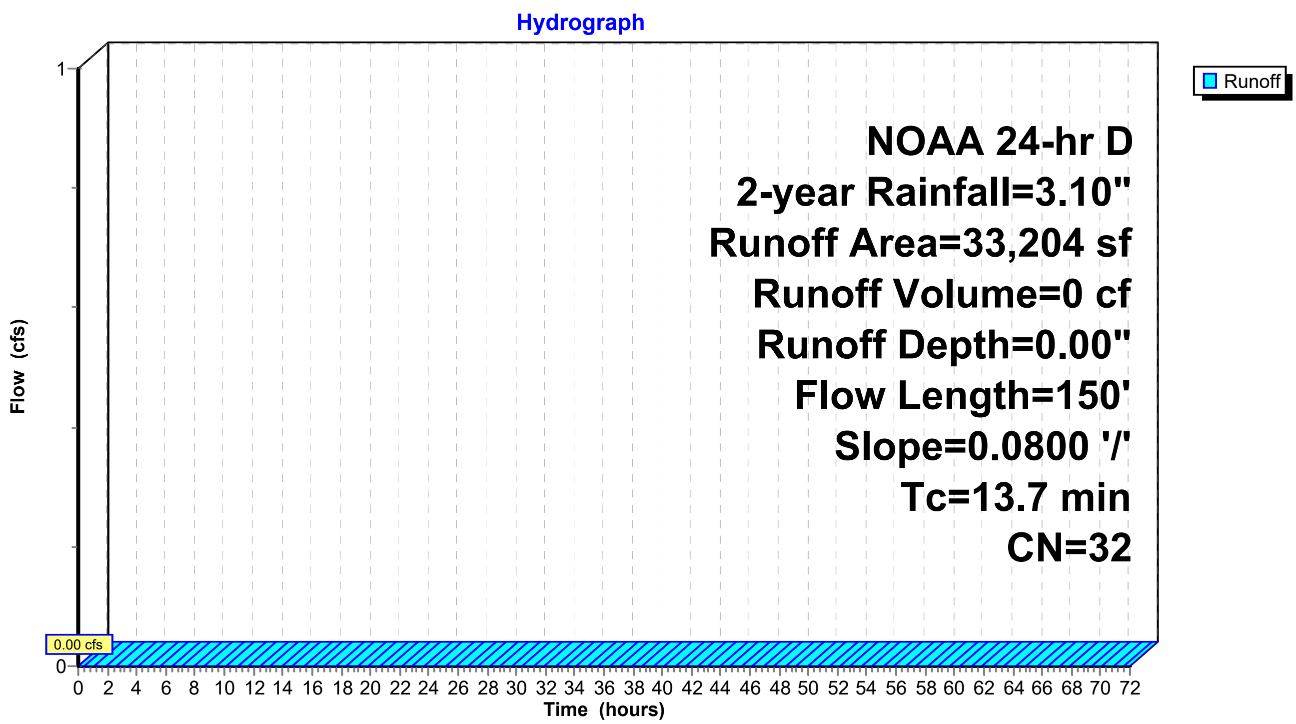
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
918	98	Paved parking, HSG A
32,286	30	Woods, Good, HSG A
33,204	32	Weighted Average
32,286		97.24% Pervious Area
918		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment PSA3A: PSA-3A



Summary for Subcatchment PSA3B: PSA-3B

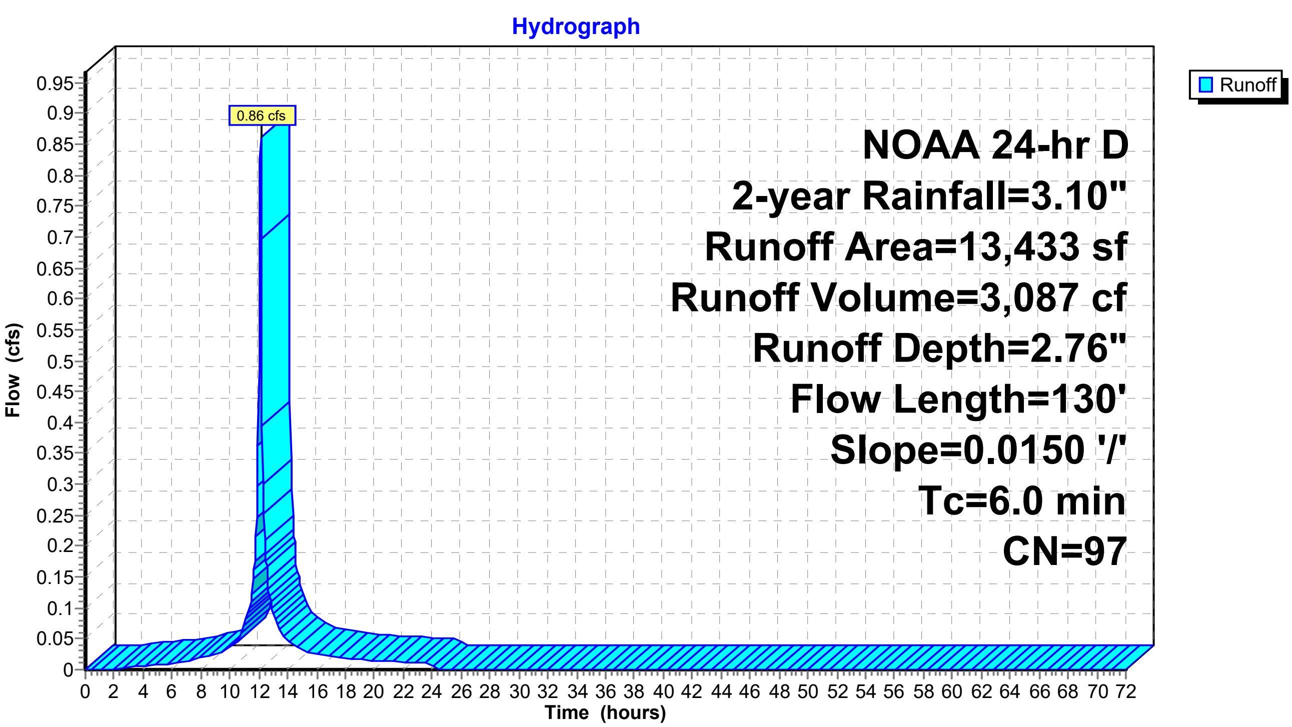
Runoff = 0.86 cfs @ 12.13 hrs, Volume= 3,087 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
13,171	98	Paved parking, HSG A
262	30	Woods, Good, HSG A
13,433	97	Weighted Average
262		1.95% Pervious Area
13,171		98.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.5	80	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSA3B: PSA-3B



Summary for Subcatchment PSA3C: PSA-3C

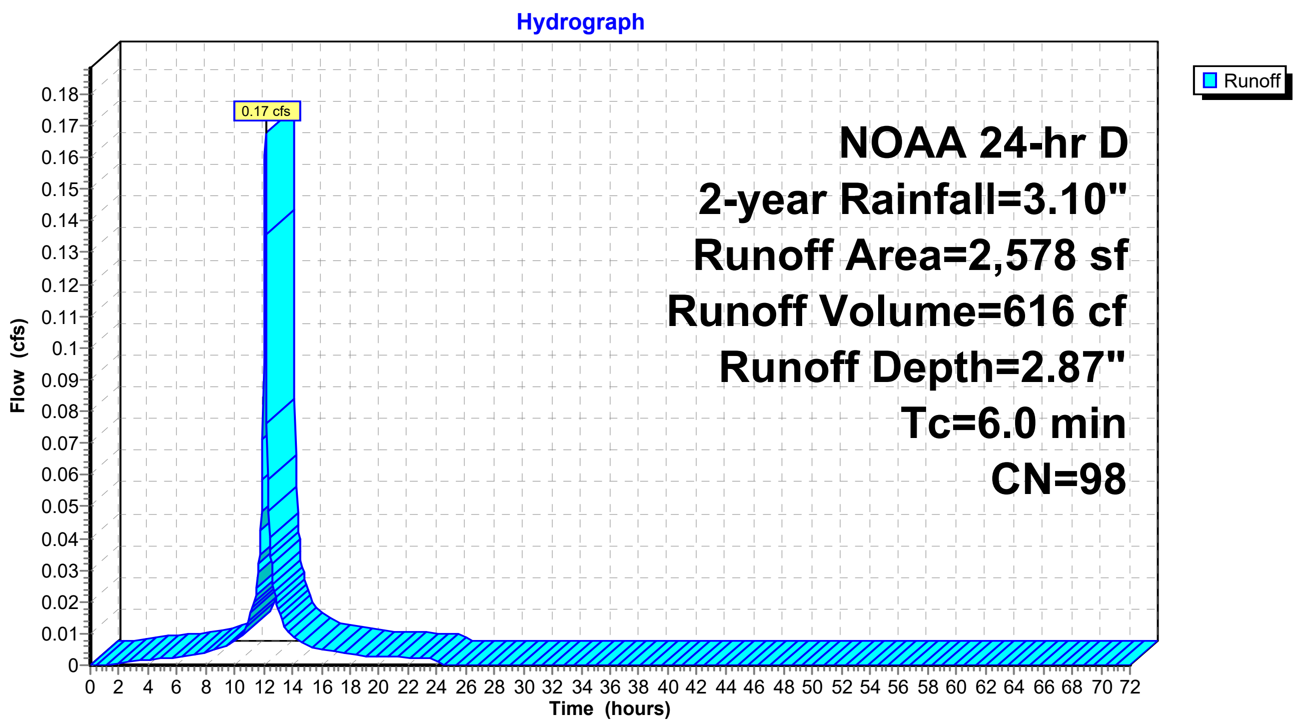
Runoff = 0.17 cfs @ 12.13 hrs, Volume= 616 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
2,578	98	Roofs, HSG A
2,578		100.00% Impervious Area

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

Subcatchment PSA3C: PSA-3C



Summary for Subcatchment PSB: PDA-2B

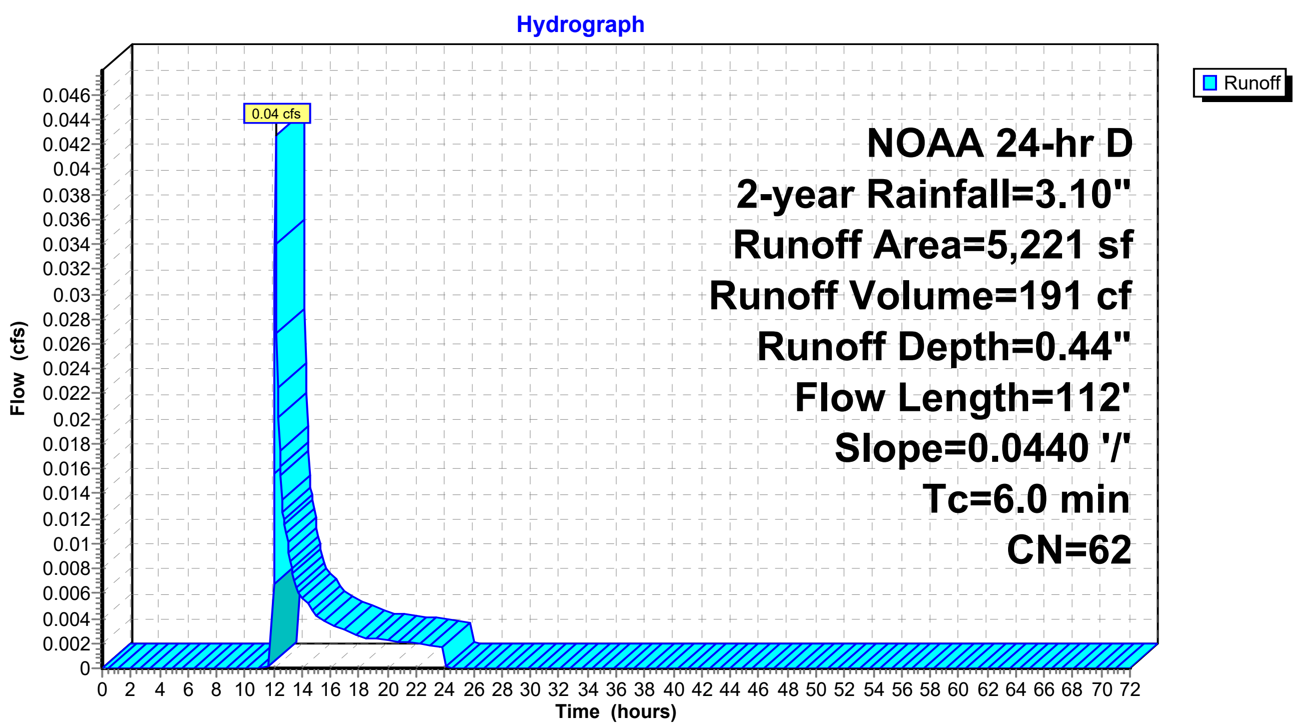
Runoff = 0.04 cfs @ 12.15 hrs, Volume= 191 cf, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-year Rainfall=3.10"

Area (sf)	CN	Description
2,039	98	Paved parking, HSG A
2,728	30	Woods, Good, HSG A
454	98	Paved parking, HSG A
5,221	62	Weighted Average
2,728		52.25% Pervious Area
2,493		47.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0440	1.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.2	62	0.0440	4.26		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	112	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSB: PDA-2B



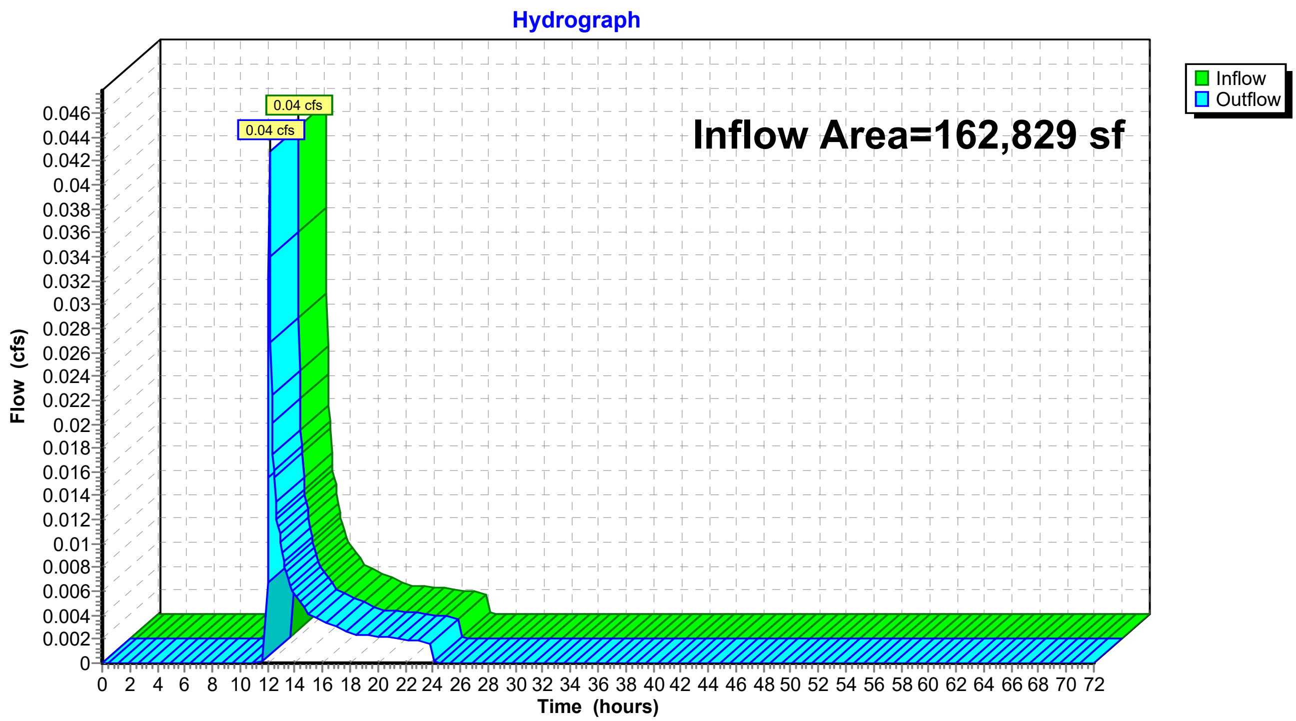
Summary for Reach 2R: PROPOSED (NULL)

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

Inflow Area = 162,829 sf, 16.02% Impervious, Inflow Depth = 0.01" for 2-year event
Inflow = 0.04 cfs @ 12.15 hrs, Volume= 191 cf
Outflow = 0.04 cfs @ 12.15 hrs, Volume= 191 cf, Atten= 0%, Lag= 0.0 min

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

Reach 2R: PROPOSED (NULL)



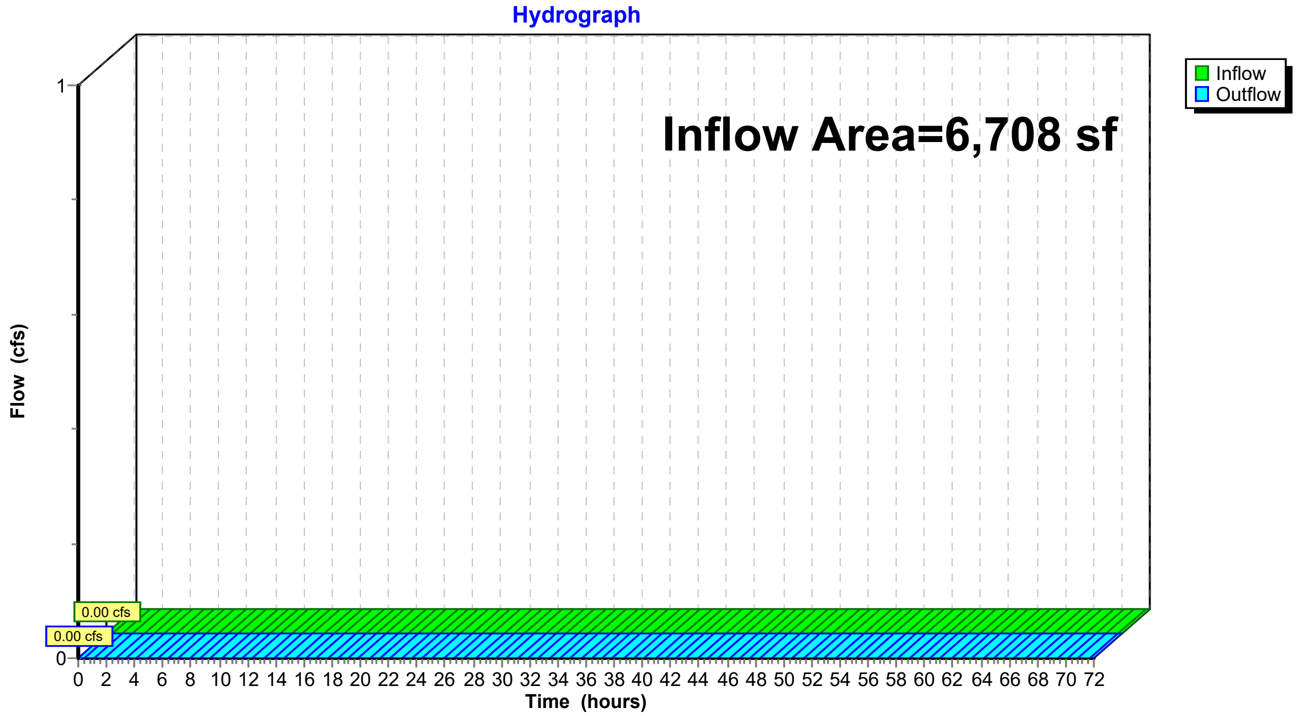
Summary for Reach DP-P1: DP#1

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

Inflow Area =	6,708 sf,	1.37% Impervious,	Inflow Depth = 0.00"	for 2-year event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf	
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

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

Reach DP-P1: DP#1



Summary for Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN

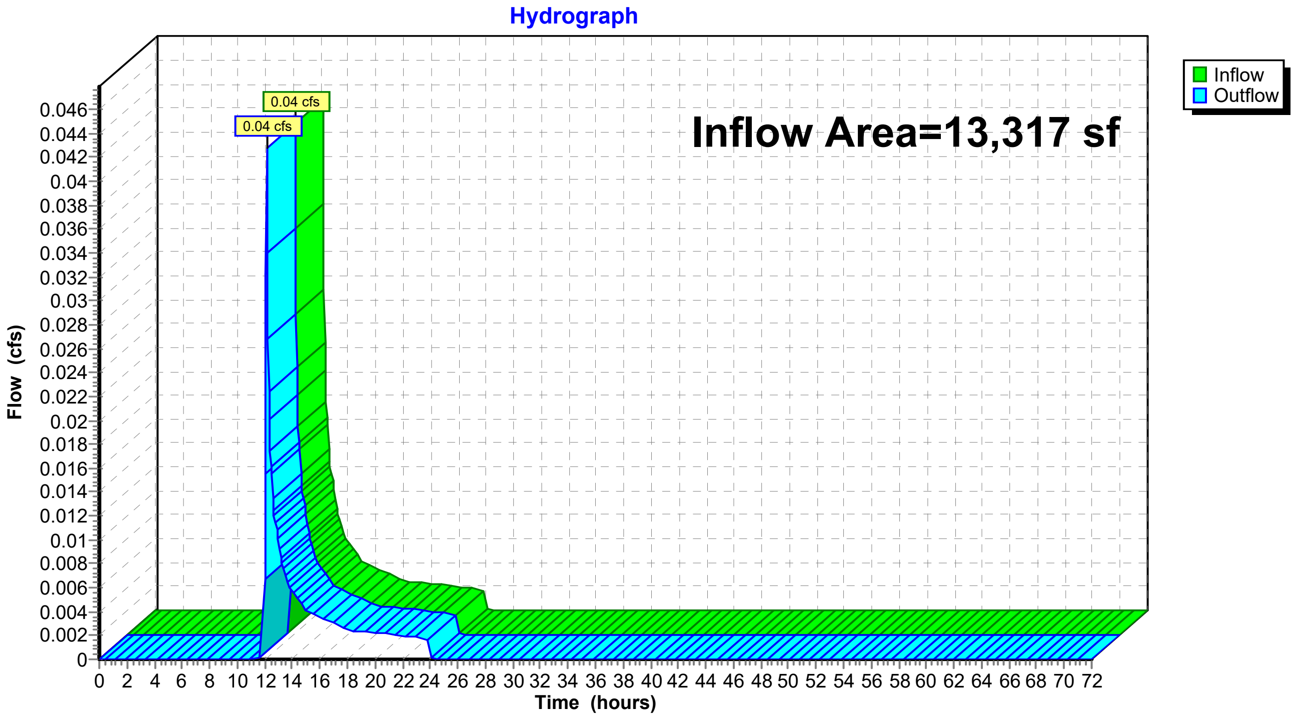
MAIN STREET CATCH BASIN

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

Inflow Area = 13,317 sf, 70.08% Impervious, Inflow Depth = 0.17" for 2-year event
Inflow = 0.04 cfs @ 12.15 hrs, Volume= 191 cf
Outflow = 0.04 cfs @ 12.15 hrs, Volume= 191 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN



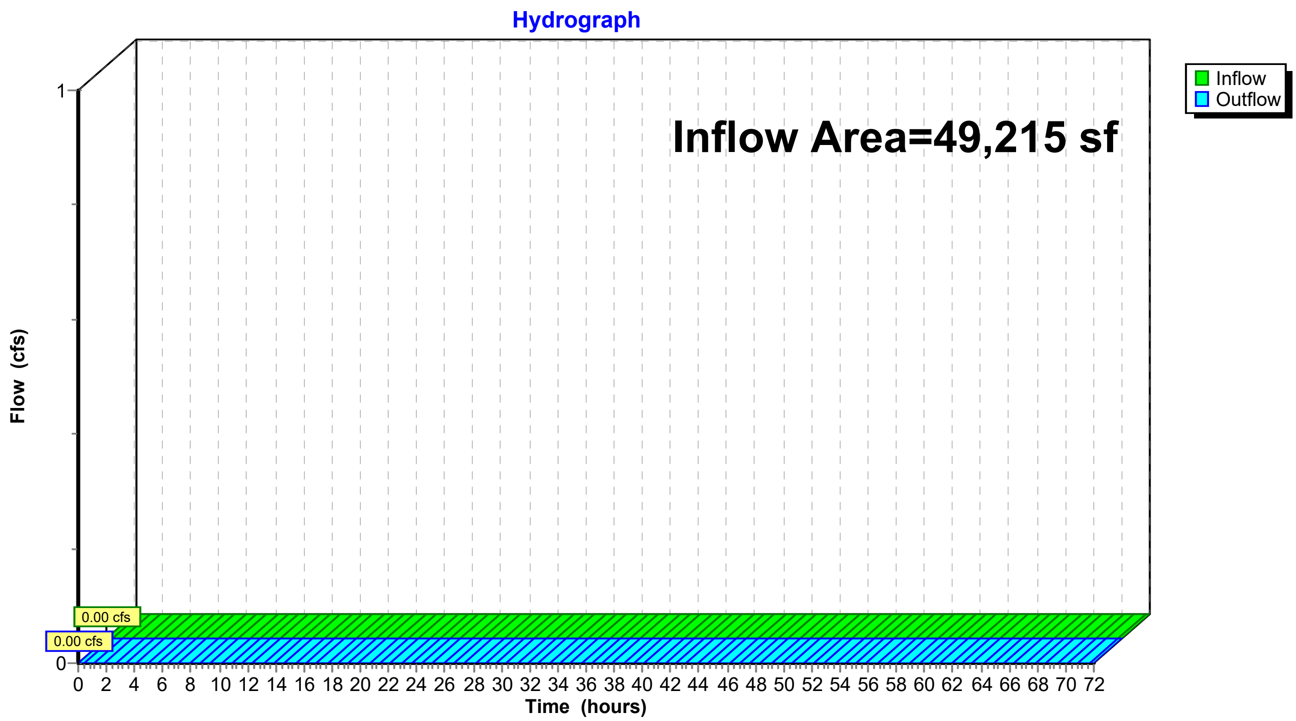
Summary for Reach DP-P3: DP#3

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

Inflow Area =	49,215 sf,	33.87% Impervious,	Inflow Depth = 0.00"	for 2-year event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf	
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

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

Reach DP-P3: DP#3

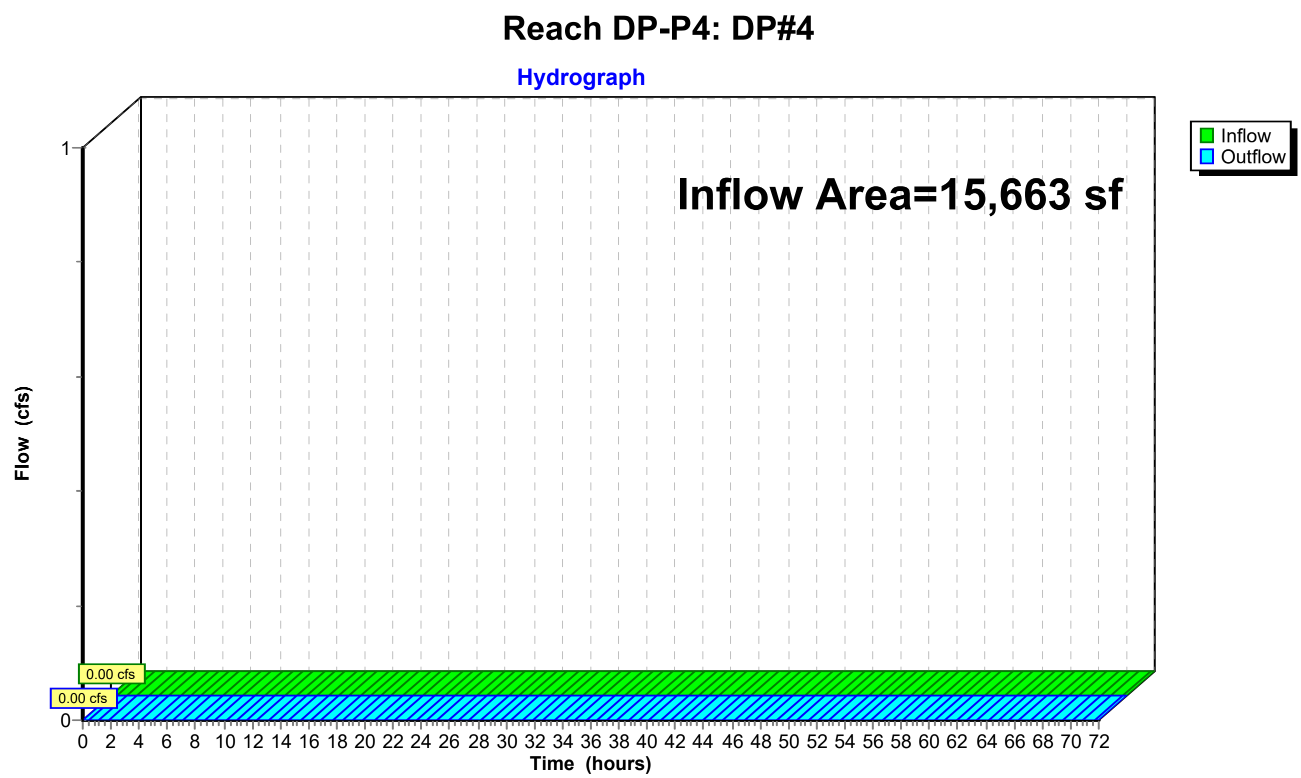


Summary for Reach DP-P4: DP#4

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

Inflow Area = 15,663 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

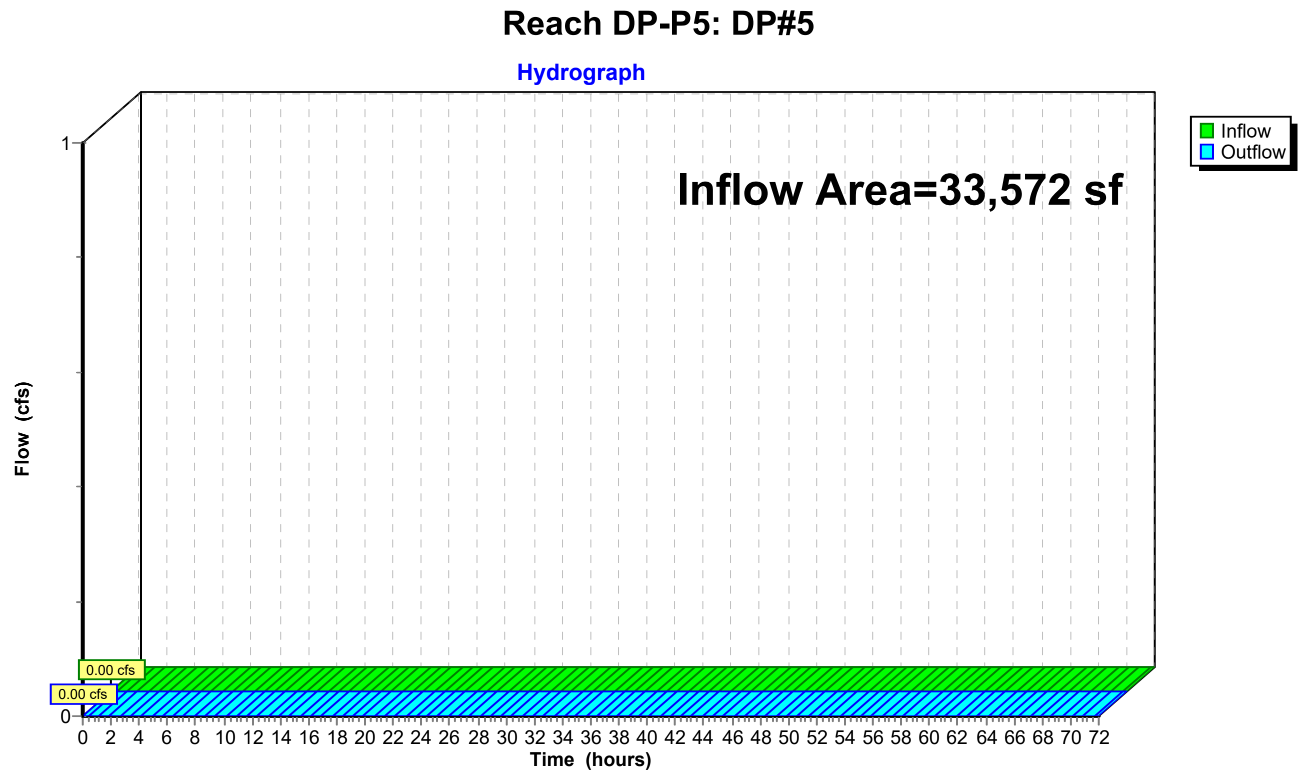


Summary for Reach DP-P5: DP#5

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

Inflow Area = 33,572 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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



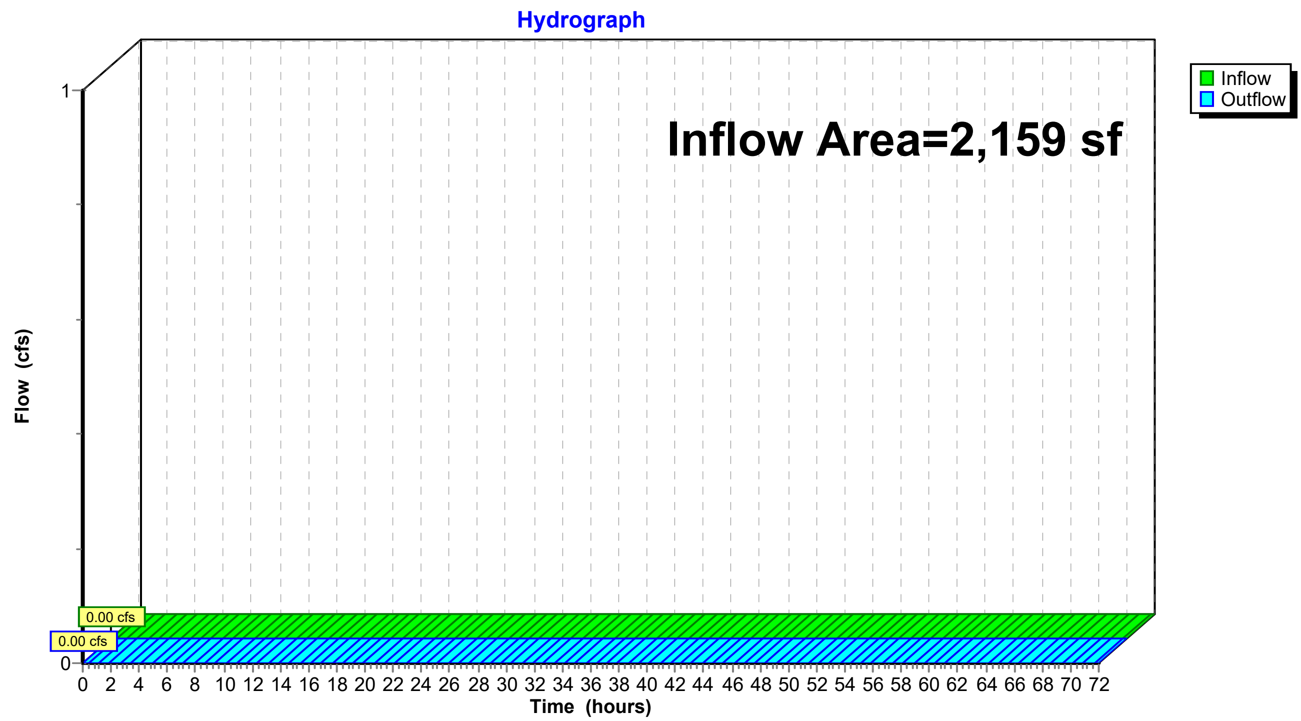
Summary for Reach DP-P6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious, Inflow Depth = 0.00"	for 2-year event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P6: DP#6



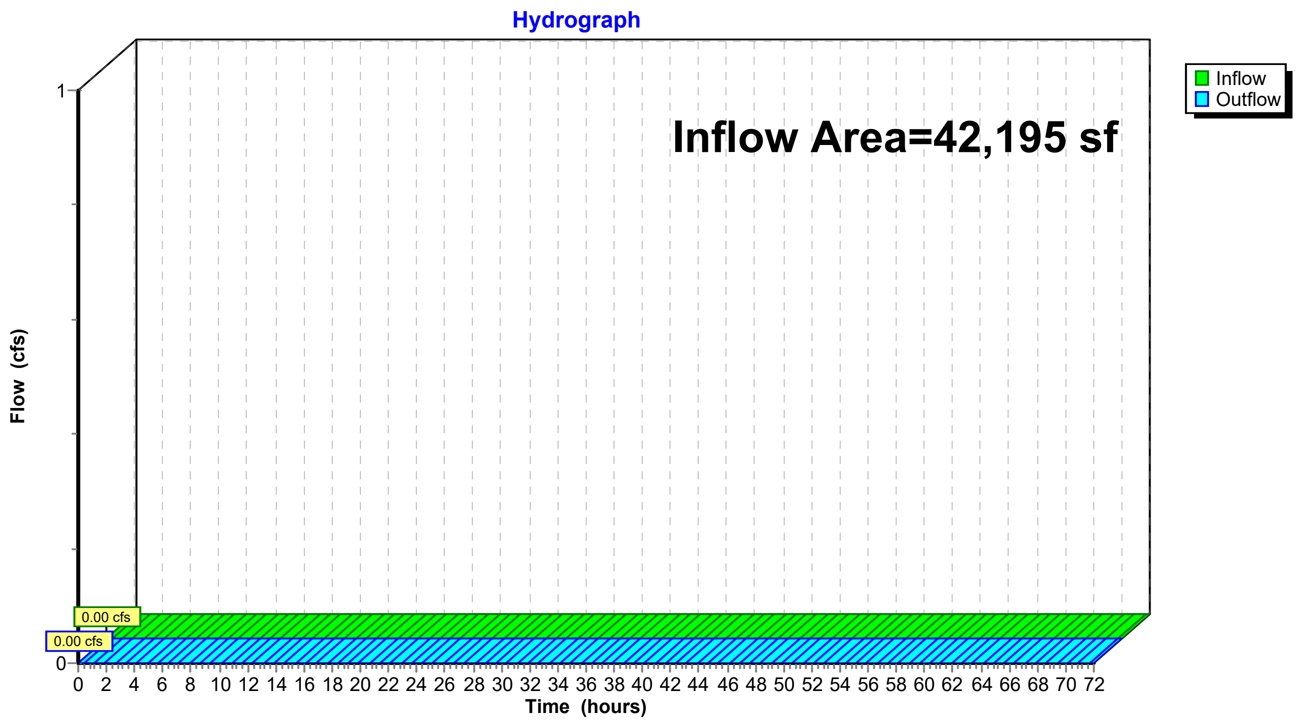
Summary for Reach DP-P7: DP#7

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

Inflow Area = 42,195 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P7: DP#7



Summary for Pond 44P: StormTech Chambers

Inflow Area = 8,096 sf, 84.47% Impervious, Inflow Depth = 1.83" for 2-year event
Inflow = 0.38 cfs @ 12.13 hrs, Volume= 1,232 cf
Outflow = 0.04 cfs @ 11.60 hrs, Volume= 1,232 cf, Atten= 90%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.60 hrs, Volume= 1,232 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 99.65' @ 13.21 hrs Surf.Area= 0.037 ac Storage= 0.010 af

Plug-Flow detention time= 91.3 min calculated for 1,232 cf (100% of inflow)
Center-of-Mass det. time= 91.2 min (920.3 - 829.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.026 af	**34.75'W x 46.34'L x 3.50'H Field A** 0.129 af Overall - 0.044 af Embedded = 0.085 af x 30.0% Voids
#2A	99.50'	0.044 af	**ADS_StormTech SC-740 +Cap** x 42 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 7 Rows of 6 Chambers
		0.070 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.60 hrs HW=99.04' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 44P: StormTech Chambers - Chamber Wizard Field A

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

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

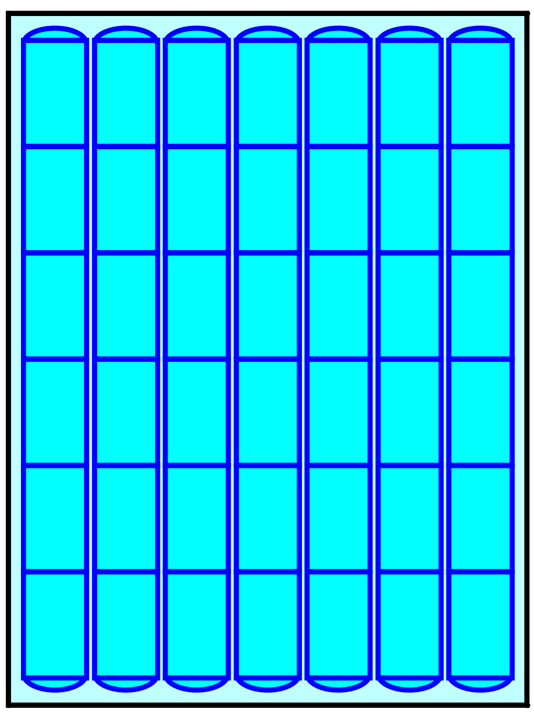
6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

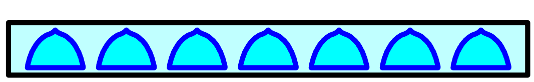
42 Chambers x 45.9 cf = 1,929.5 cf Chamber Storage

5,635.7 cf Field - 1,929.5 cf Chambers = 3,706.2 cf Stone x 30.0% Voids = 1,111.9 cf Stone Storage

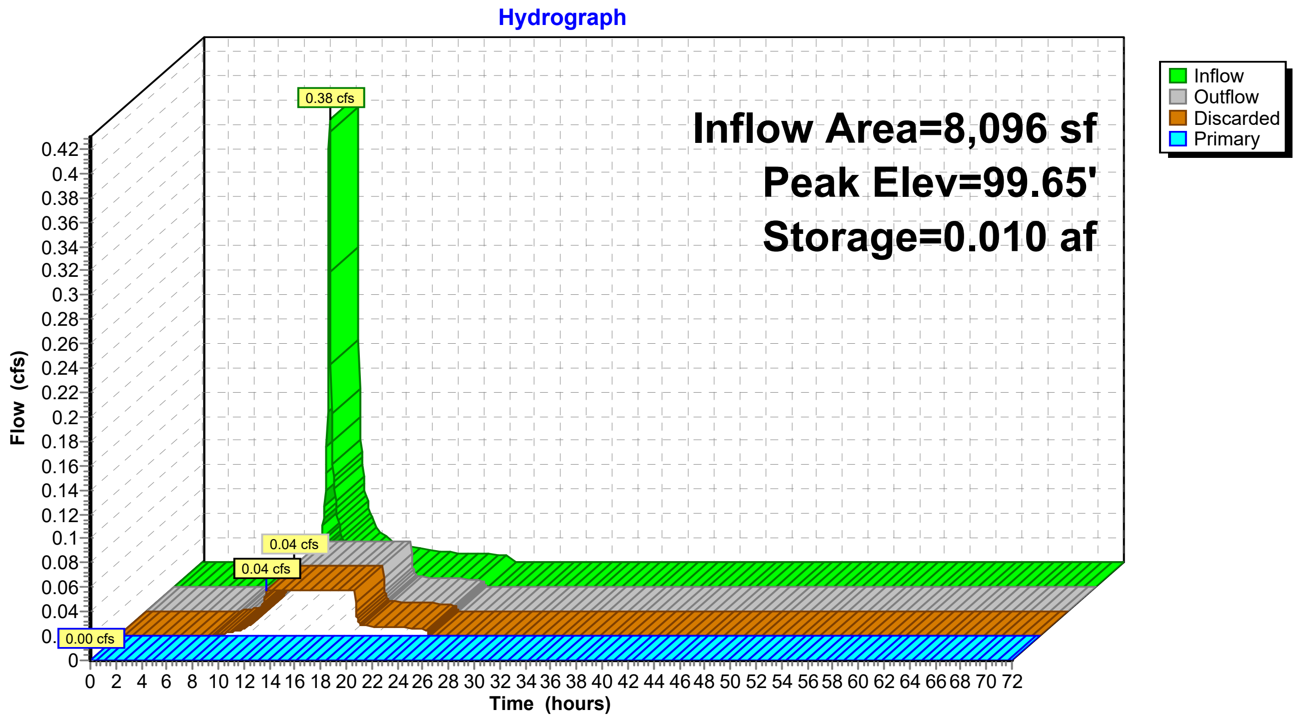
Chamber Storage + Stone Storage = 3,041.3 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 46.34' x 34.75' x 3.50'

42 Chambers
208.7 cy Field
137.3 cy Stone

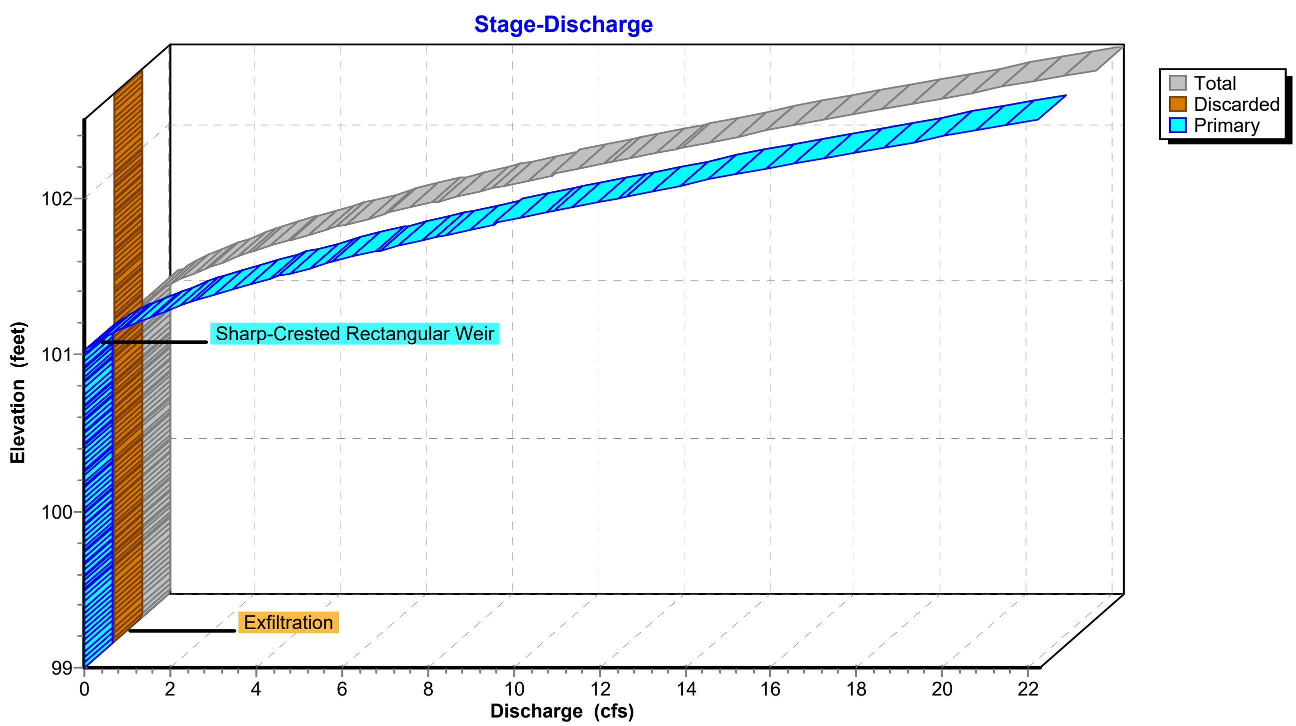




Pond 44P: StormTech Chambers



Pond 44P: StormTech Chambers



Summary for Pond 55P: StormTech Chambers

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.037 af	**39.50'W x 60.58'L x 3.50'H Field A** 0.192 af Overall - 0.067 af Embedded = 0.125 af x 30.0% Voids
#2A	99.50'	0.067 af	**ADS_StormTech SC-740 +Cap** x 64 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 8 Rows of 8 Chambers
		0.105 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.33'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 55P: StormTech Chambers - Chamber Wizard Field A

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

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

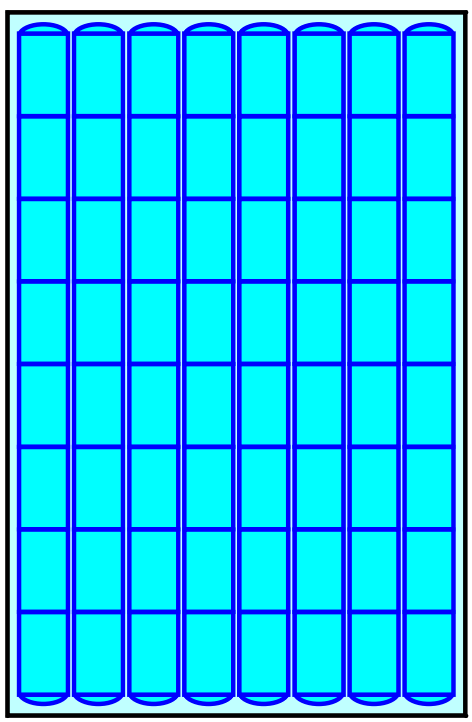
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

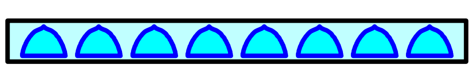
64 Chambers x 45.9 cf = 2,940.2 cf Chamber Storage

8,374.7 cf Field - 2,940.2 cf Chambers = 5,434.6 cf Stone x 30.0% Voids = 1,630.4 cf Stone Storage

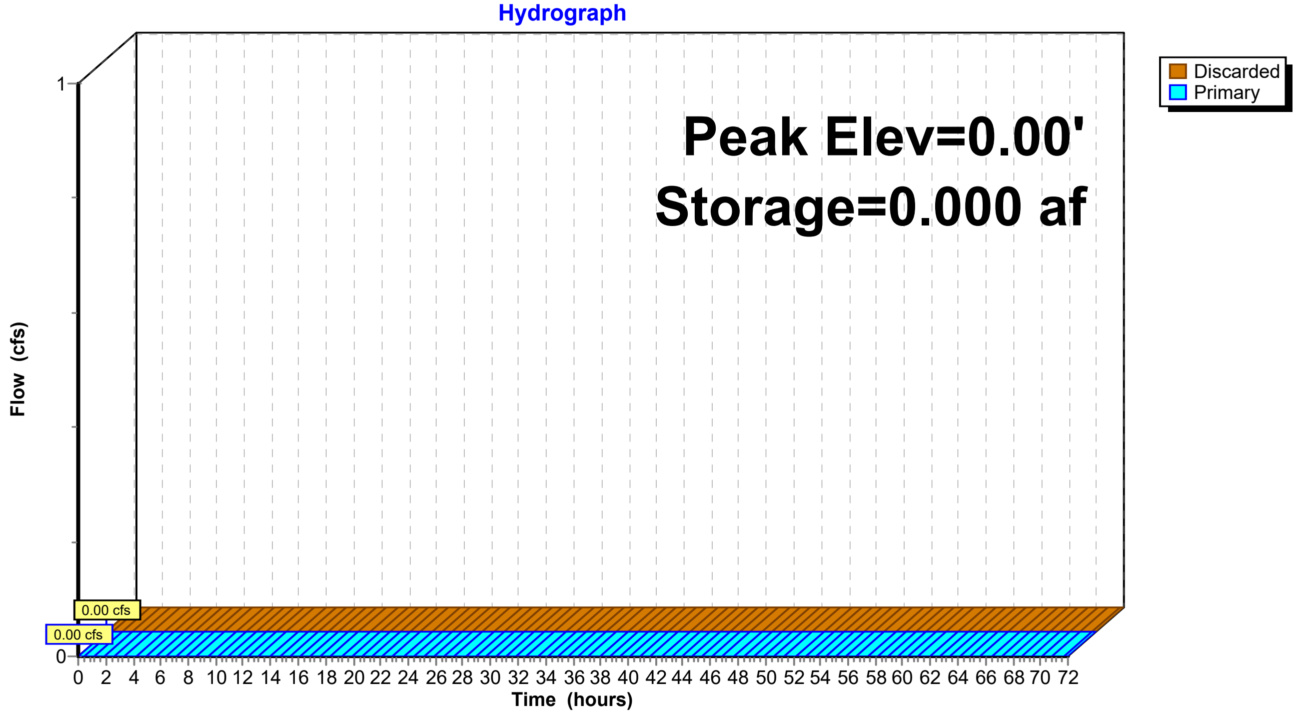
Chamber Storage + Stone Storage = 4,570.5 cf = 0.105 af
Overall Storage Efficiency = 54.6%
Overall System Size = 60.58' x 39.50' x 3.50'

64 Chambers
310.2 cy Field
201.3 cy Stone

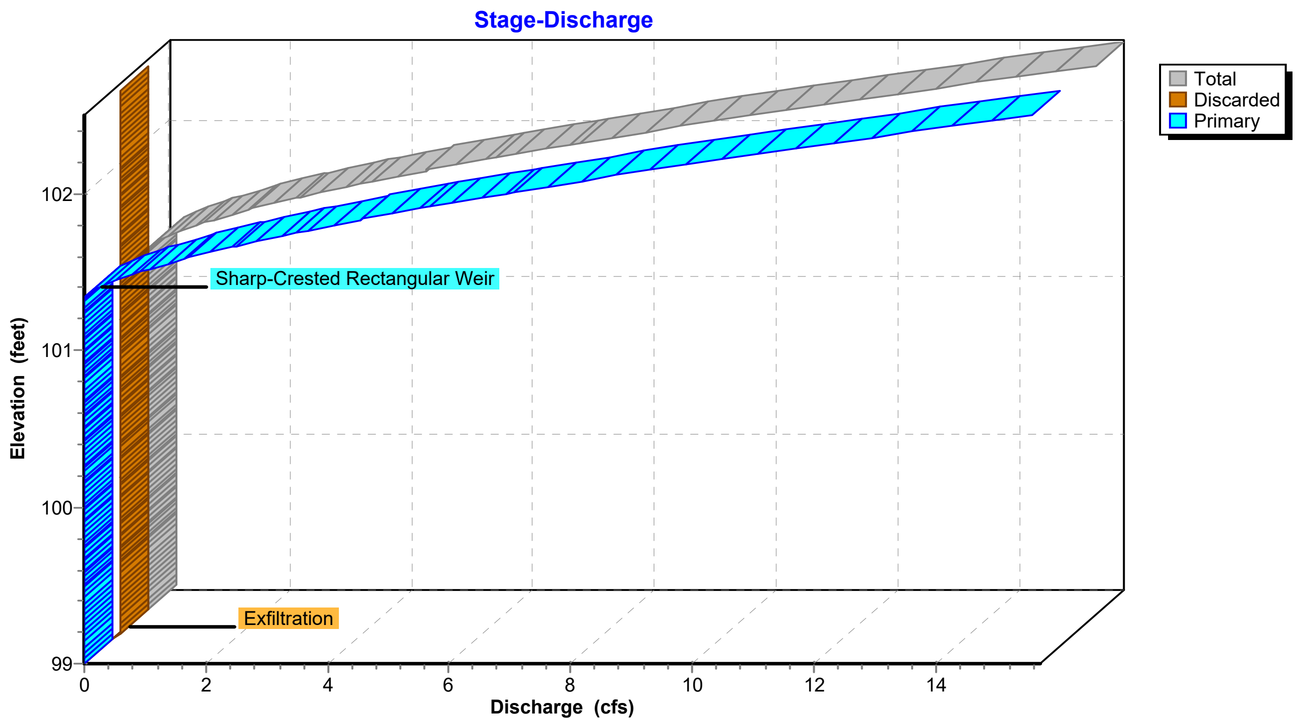




Pond 55P: StormTech Chambers



Pond 55P: StormTech Chambers



Summary for Pond 56P: Pipe Storage

Inflow Area = 2,578 sf,100.00% Impervious, Inflow Depth = 2.87" for 2-year event
Inflow = 0.17 cfs @ 12.13 hrs, Volume= 616 cf
Outflow = 0.01 cfs @ 11.05 hrs, Volume= 616 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.05 hrs, Volume= 616 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 99.99' @ 13.34 hrs Surf.Area= 0.013 ac Storage= 0.005 af

Plug-Flow detention time= 123.5 min calculated for 616 cf (100% of inflow)
Center-of-Mass det. time= 123.5 min (882.6 - 759.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.009 af	**9.13'W x 61.50'L x 2.75'H Field A**
			0.035 af Overall - 0.009 af Embedded = 0.026 af x 35.0% Voids
#2A	99.50'	0.007 af	**ADS N-12 18"** x 9 Inside #1
			Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
			Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf
			3 Rows of 3 Chambers
		0.017 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	101.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 11.05 hrs HW=99.03' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.00' (Free Discharge)
├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 56P: Pipe Storage - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 14.3" Spacing = 35.3" C-C Row Spacing

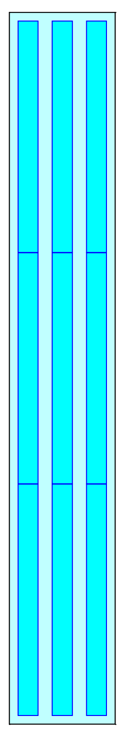
3 Chambers/Row x 20.00' Long = 60.00' Row Length +9.0" End Stone x 2 = 61.50' Base Length
3 Rows x 21.0" Wide + 14.3" Spacing x 2 + 9.0" Side Stone x 2 = 9.13' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

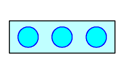
9 Chambers x 36.0 cf = 324.0 cf Chamber Storage
9 Chambers x 44.5 cf = 400.7 cf Displacement

1,545.3 cf Field - 400.7 cf Chambers = 1,144.5 cf Stone x 35.0% Voids = 400.6 cf Stone Storage

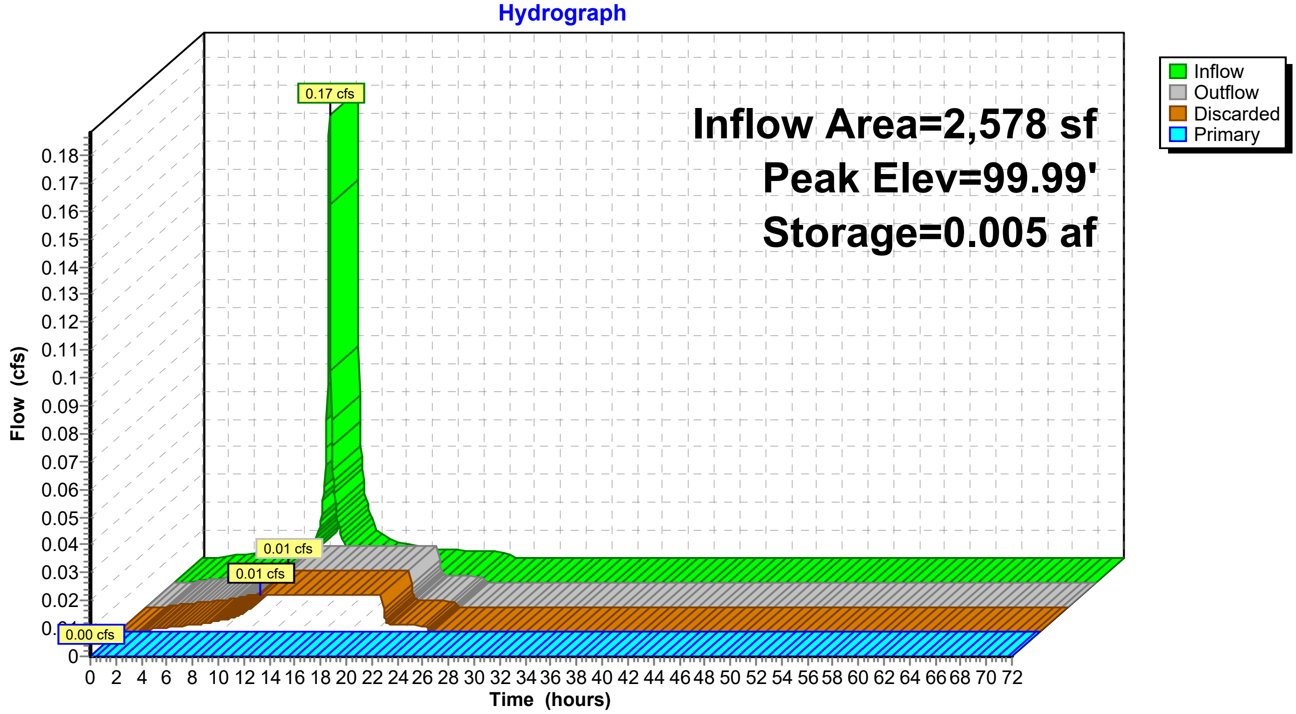
Chamber Storage + Stone Storage = 724.6 cf = 0.017 af
Overall Storage Efficiency = 46.9%
Overall System Size = 61.50' x 9.13' x 2.75'

9 Chambers
57.2 cy Field
42.4 cy Stone

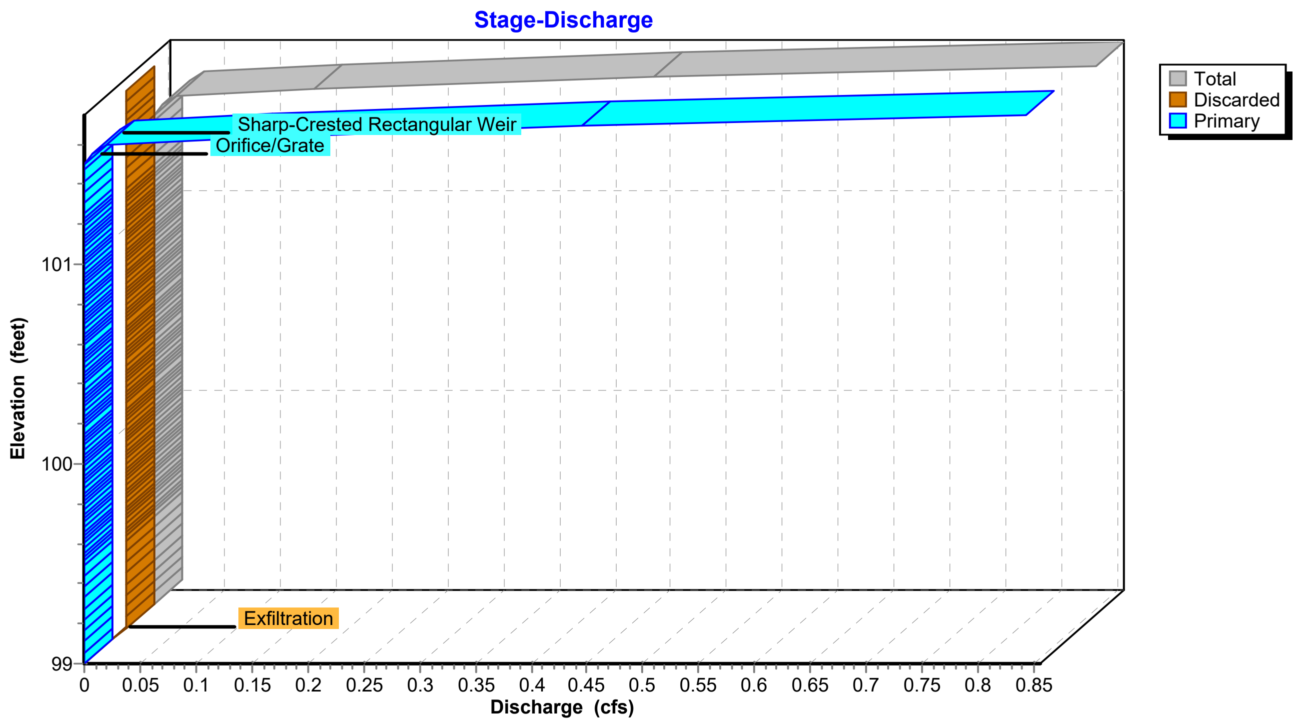




Pond 56P: Pipe Storage



Pond 56P: Pipe Storage



Summary for Pond 59P: Rain Garden

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	49,215 sf,	33.87% Impervious,	Inflow Depth = 0.75"	for 2-year event	
Inflow =	0.86 cfs @	12.13 hrs,	Volume=	3,087 cf	
Outflow =	0.87 cfs @	12.13 hrs,	Volume=	3,087 cf,	Atten= 0%, Lag= 0.3 min
Discarded =	0.87 cfs @	12.13 hrs,	Volume=	3,087 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 97.02' @ 12.13 hrs Surf.Area= 684 sf Storage= 11 cf

Plug-Flow detention time= 0.2 min calculated for 3,085 cf (100% of inflow)
Center-of-Mass det. time= 0.2 min (770.0 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1	97.00'	5,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

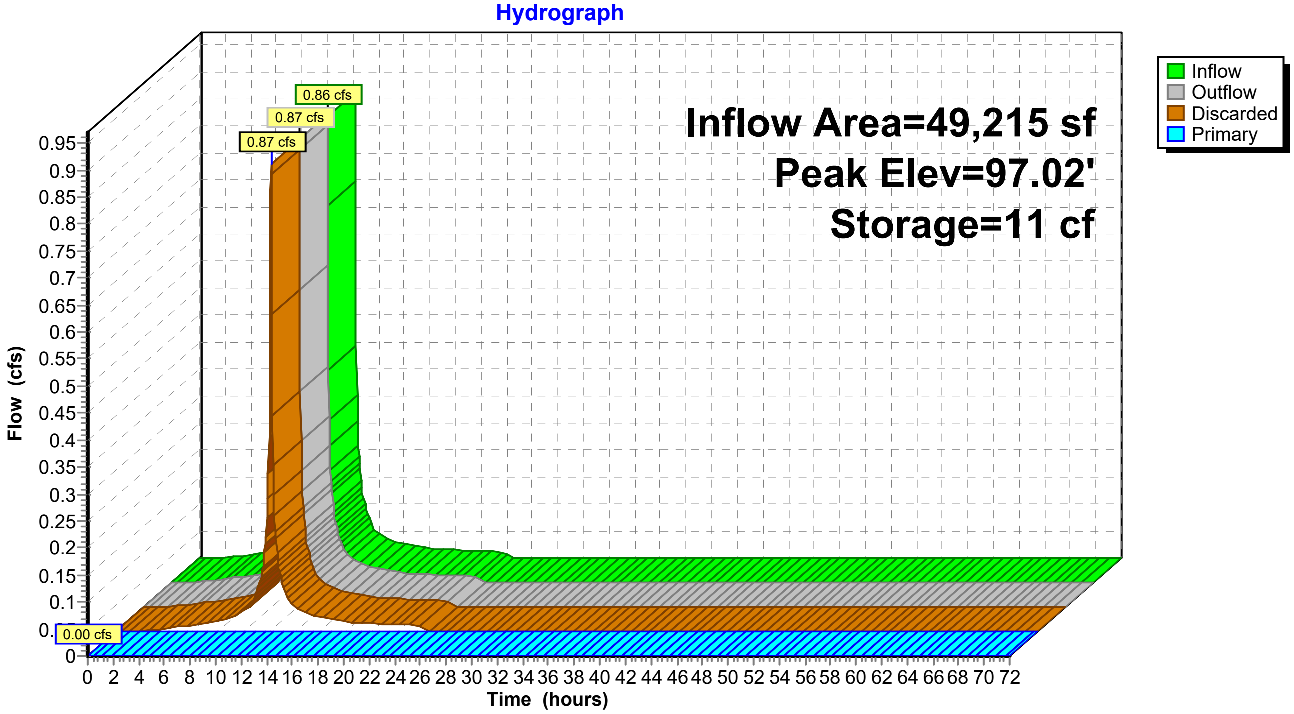
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	655	0	0
98.00	2,362	1,509	1,509
99.00	4,876	3,619	5,128

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	**1.02 cfs Exfiltration at all elevations**
#2	Primary	98.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** 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

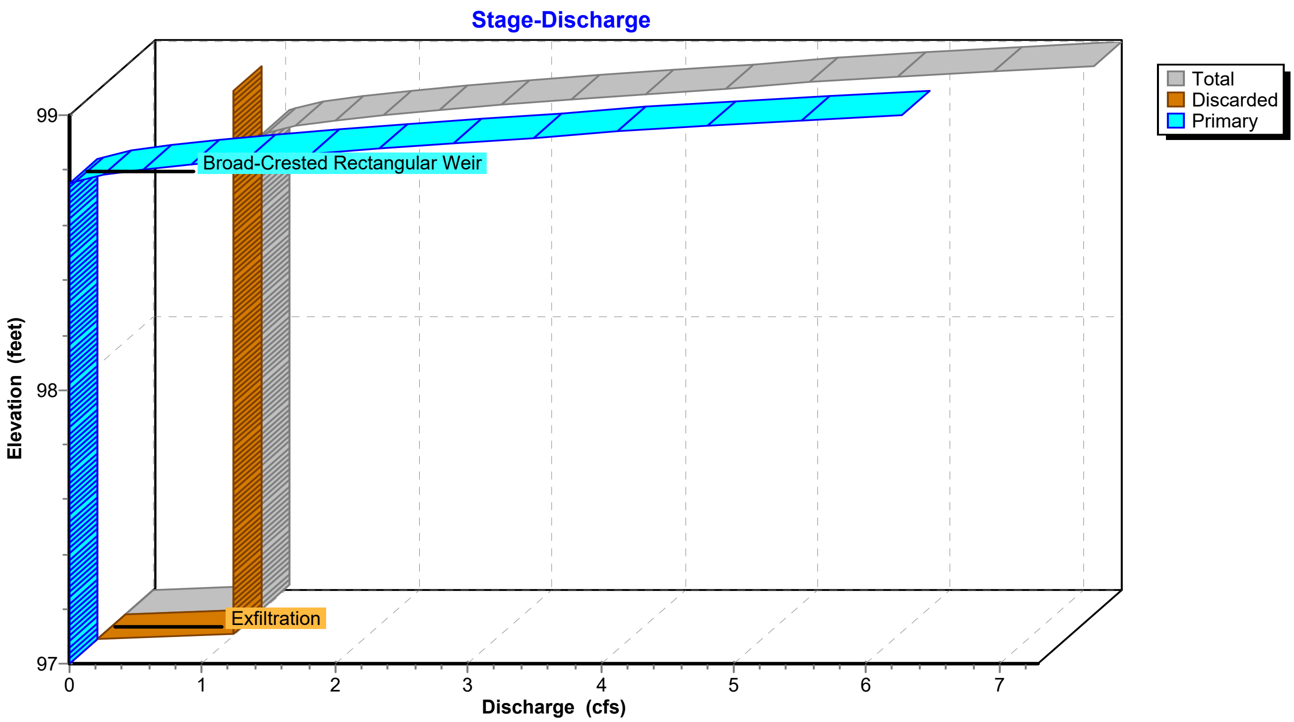
Discarded OutFlow Max=1.02 cfs @ 12.13 hrs HW=97.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=97.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 59P: Rain Garden



Pond 59P: Rain Garden



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

SubcatchmentPS1: PDA-1 Runoff Area=6,708 sf 1.37% Impervious Runoff Depth=0.00"
Flow Length=75' Slope=0.0400 '/' Tc=16.8 min CN=31 Runoff=0.00 cfs 2 cf

SubcatchmentPS2A: PDA-2A Runoff Area=8,096 sf 84.47% Impervious Runoff Depth=3.29"
Tc=6.0 min CN=87 Runoff=0.67 cfs 2,217 cf

SubcatchmentPS4: PDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPS5: PDA-5 Runoff Area=33,572 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPS6: PDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPS7: PDA-7 Runoff Area=42,195 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=30 Runoff=0.00 cfs 0 cf

SubcatchmentPSA3A: PSA-3A Runoff Area=33,204 sf 2.76% Impervious Runoff Depth=0.01"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=32 Runoff=0.00 cfs 26 cf

SubcatchmentPSA3B: PSA-3B Runoff Area=13,433 sf 98.05% Impervious Runoff Depth=4.35"
Flow Length=130' Slope=0.0150 '/' Tc=6.0 min CN=97 Runoff=1.33 cfs 4,867 cf

SubcatchmentPSA3C: PSA-3C Runoff Area=2,578 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=0.26 cfs 959 cf

SubcatchmentPSB: PDA-2B Runoff Area=5,221 sf 47.75% Impervious Runoff Depth=1.26"
Flow Length=112' Slope=0.0440 '/' Tc=6.0 min CN=62 Runoff=0.16 cfs 547 cf

Reach 2R: PROPOSED (NULL) Inflow=0.16 cfs 549 cf
Outflow=0.16 cfs 549 cf

Reach DP-P1: DP#1 Inflow=0.00 cfs 2 cf
Outflow=0.00 cfs 2 cf

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN Inflow=0.16 cfs 547 cf
Outflow=0.16 cfs 547 cf

Reach DP-P3: DP#3 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P4: DP#4 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P5: DP#5 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P6: DP#6
Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P7: DP#7
Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 44P: StormTech Chambers
Peak Elev=100.12' Storage=0.023 af Inflow=0.67 cfs 2,217 cf
Discarded=0.04 cfs 2,217 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 2,217 cf

Pond 55P: StormTech Chambers
Peak Elev=0.00' Storage=0.000 af
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Pond 56P: Pipe Storage
Peak Elev=100.53' Storage=0.010 af Inflow=0.26 cfs 959 cf
Discarded=0.01 cfs 959 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 959 cf

Pond 59P: Rain Garden
Peak Elev=97.12' Storage=95 cf Inflow=1.33 cfs 4,893 cf
Discarded=1.02 cfs 4,893 cf Primary=0.00 cfs 0 cf Outflow=1.02 cfs 4,893 cf

Total Runoff Area = 162,829 sf Runoff Volume = 8,618 cf Average Runoff Depth = 0.64"
83.98% Pervious = 136,738 sf 16.02% Impervious = 26,091 sf

Summary for Subcatchment PS1: PDA-1

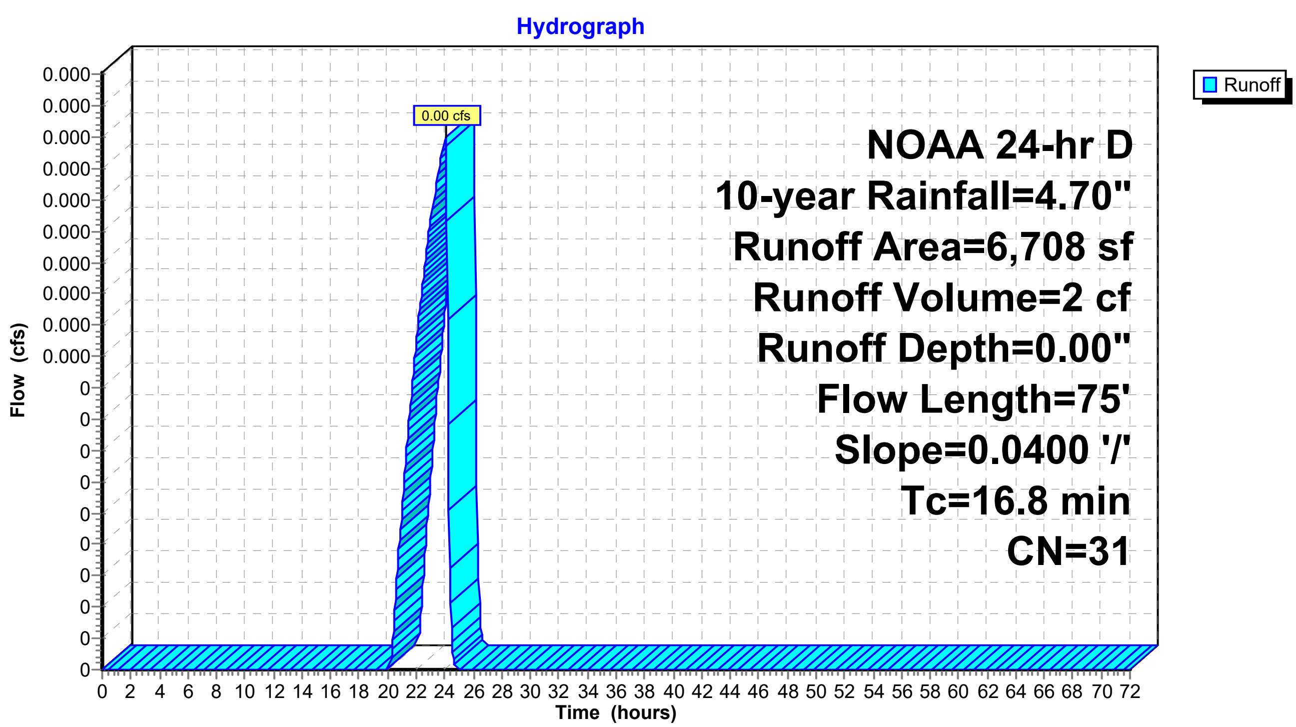
Runoff = 0.00 cfs @ 24.03 hrs, Volume= 2 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
92	98	Paved parking, HSG A
6,616	30	Woods, Good, HSG A
6,708	31	Weighted Average
6,616		98.63% Pervious Area
92		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.3	25	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.8	75	Total			

Subcatchment PS1: PDA-1



Summary for Subcatchment PS2A: PDA-2A

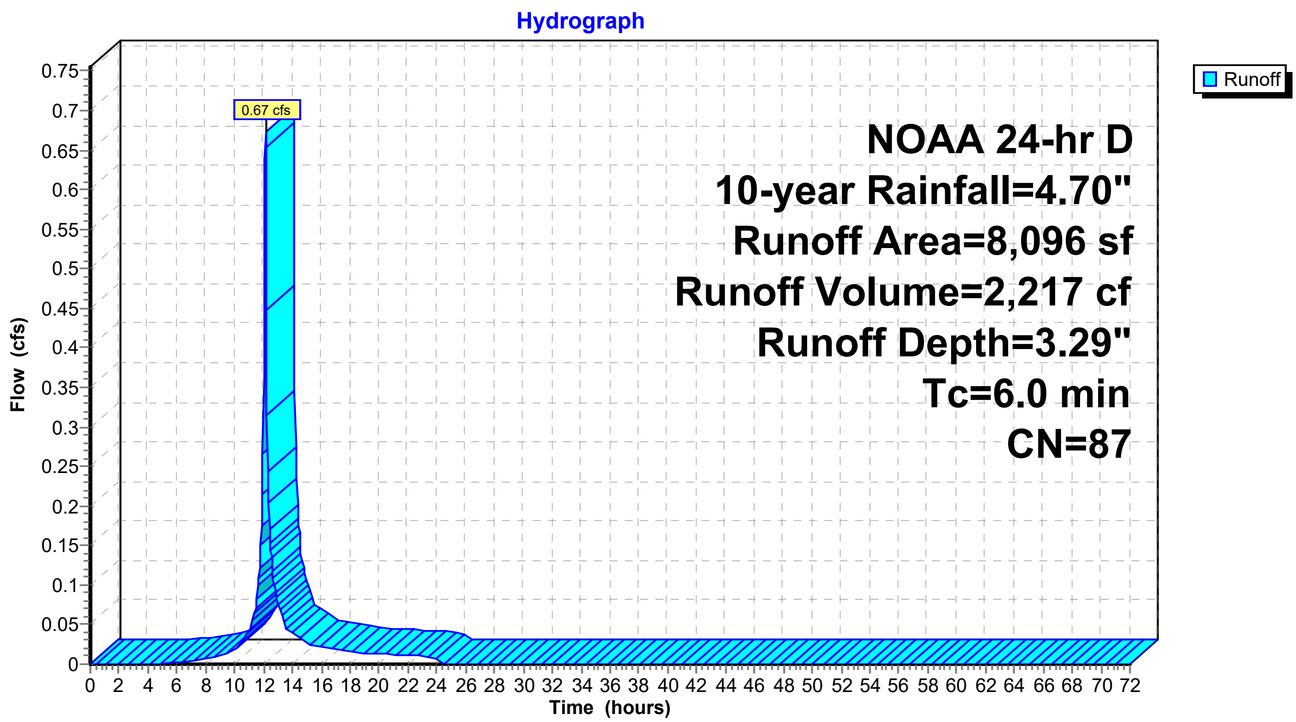
Runoff = 0.67 cfs @ 12.13 hrs, Volume= 2,217 cf, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
3,491	98	Paved parking, HSG A
3,348	98	Roofs, HSG A
1,257	30	Woods, Good, HSG A
8,096	87	Weighted Average
1,257		15.53% Pervious Area
6,839		84.47% Impervious Area

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

Subcatchment PS2A: PDA-2A



Summary for Subcatchment PS4: PDA-4

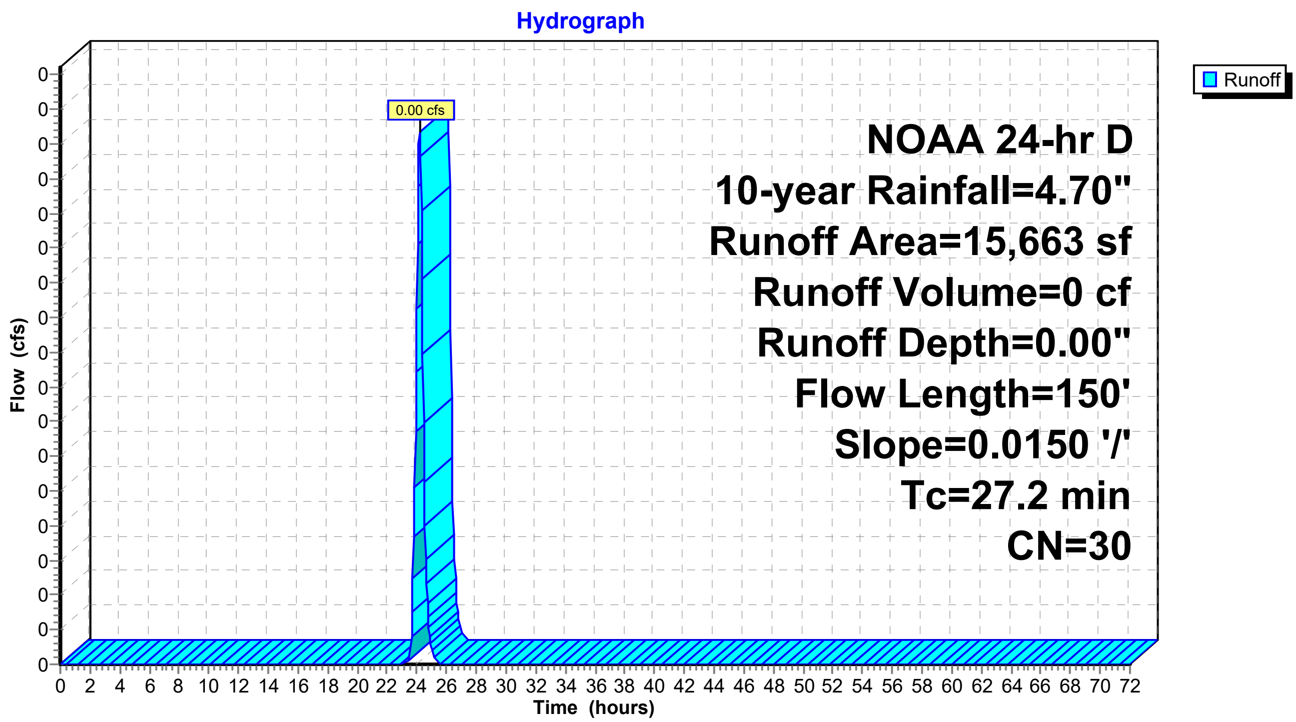
Runoff = 0.00 cfs @ 24.19 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment PS4: PDA-4



Summary for Subcatchment PS5: PDA-5

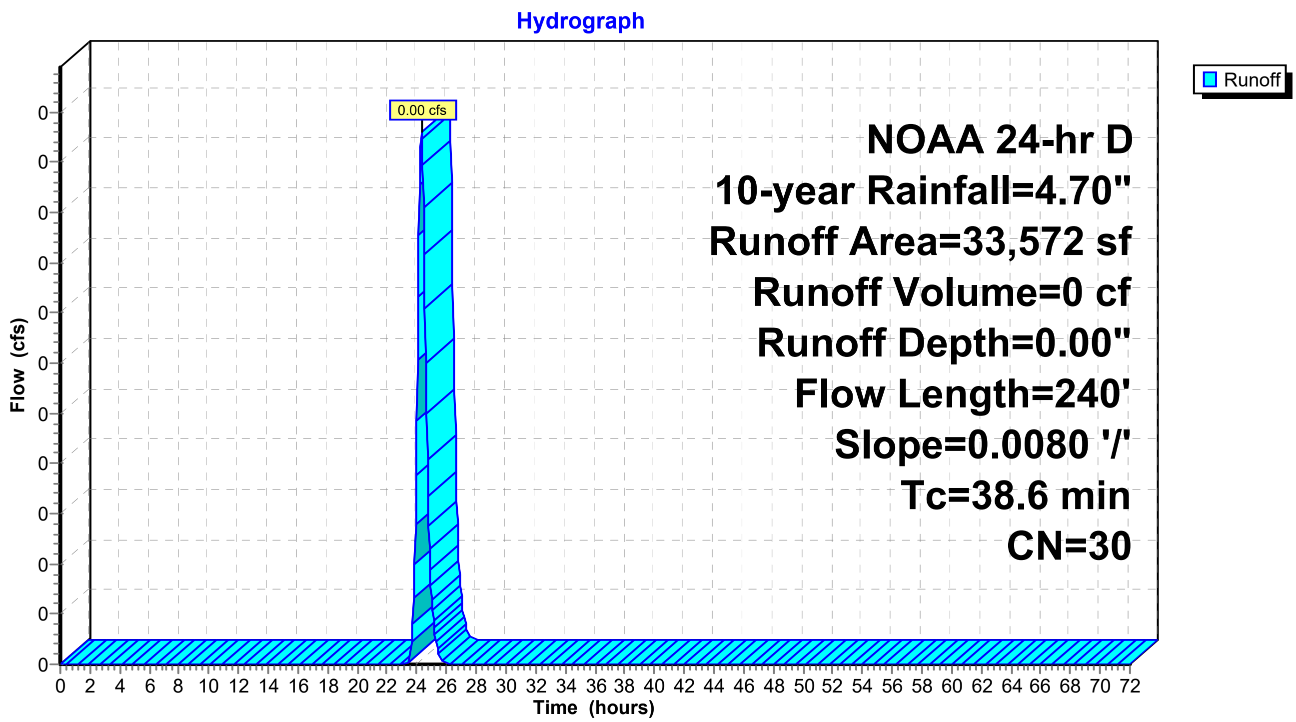
Runoff = 0.00 cfs @ 24.31 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
33,572	30	Woods, Good, HSG A
33,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment PS5: PDA-5



Summary for Subcatchment PS6: PDA-6

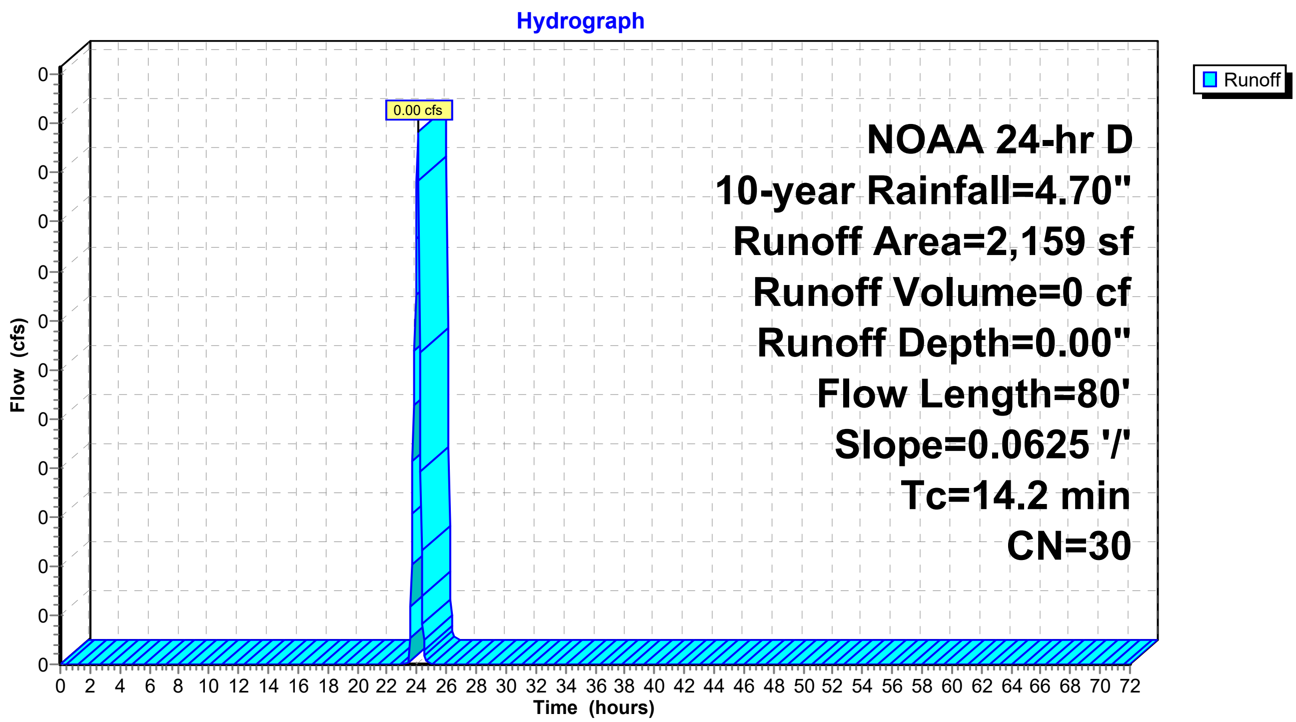
Runoff = 0.00 cfs @ 24.07 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment PS6: PDA-6



Summary for Subcatchment PS7: PDA-7

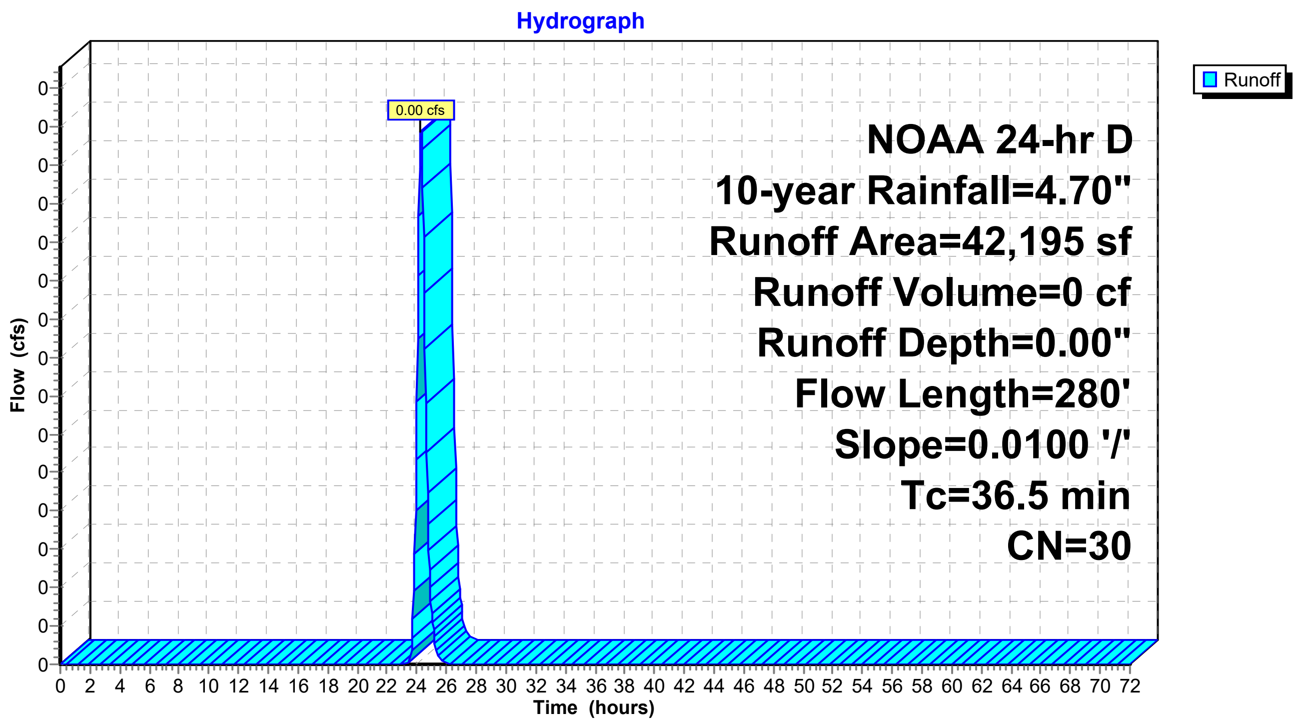
Runoff = 0.00 cfs @ 24.29 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
42,195	30	Woods, Good, HSG A
42,195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment PS7: PDA-7



Summary for Subcatchment PSA3A: PSA-3A

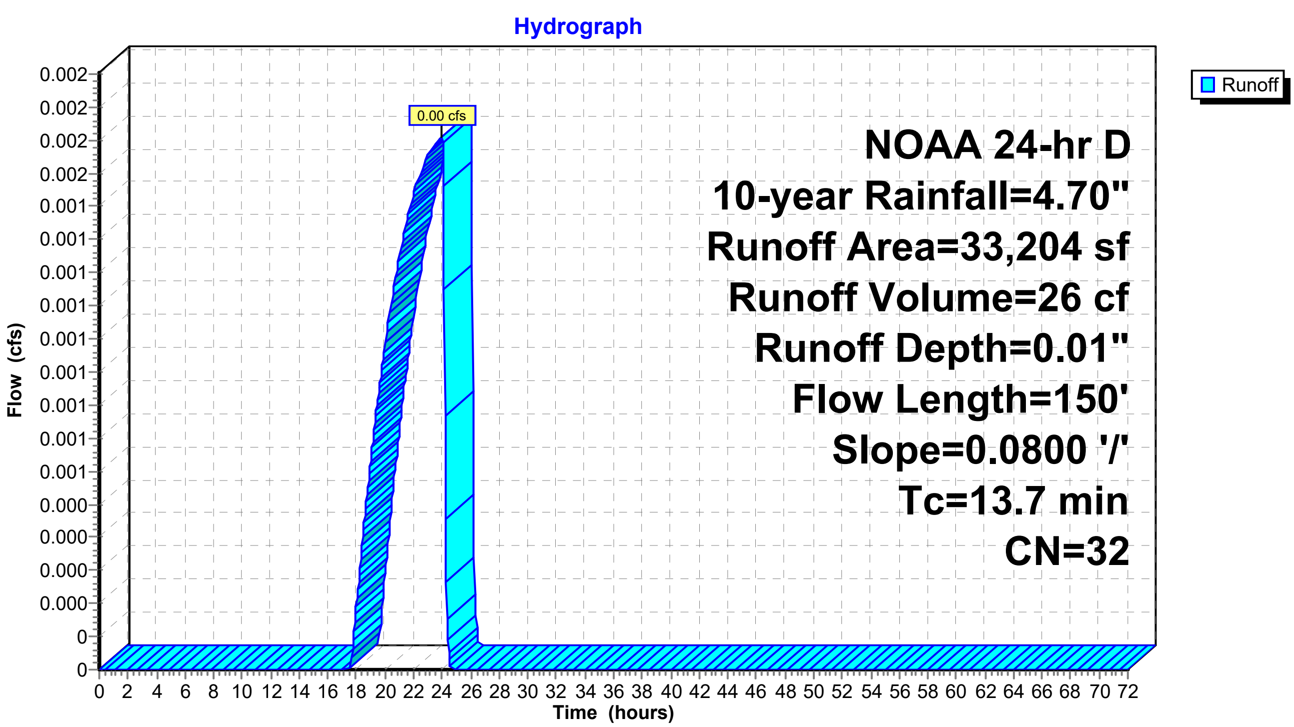
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 26 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
918	98	Paved parking, HSG A
32,286	30	Woods, Good, HSG A
33,204	32	Weighted Average
32,286		97.24% Pervious Area
918		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment PSA3A: PSA-3A



Summary for Subcatchment PSA3B: PSA-3B

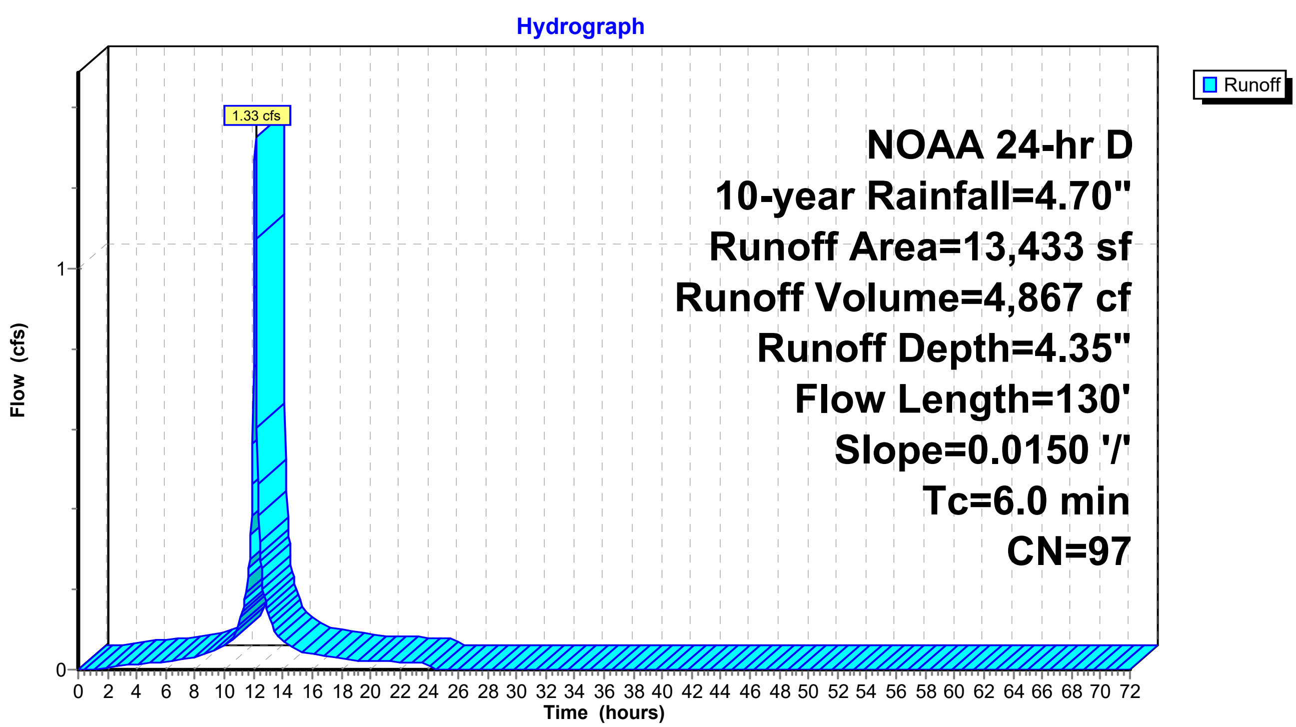
Runoff = 1.33 cfs @ 12.13 hrs, Volume= 4,867 cf, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
13,171	98	Paved parking, HSG A
262	30	Woods, Good, HSG A
13,433	97	Weighted Average
262		1.95% Pervious Area
13,171		98.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.5	80	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total,	Increased to minimum Tc = 6.0 min		

Subcatchment PSA3B: PSA-3B



Summary for Subcatchment PSA3C: PSA-3C

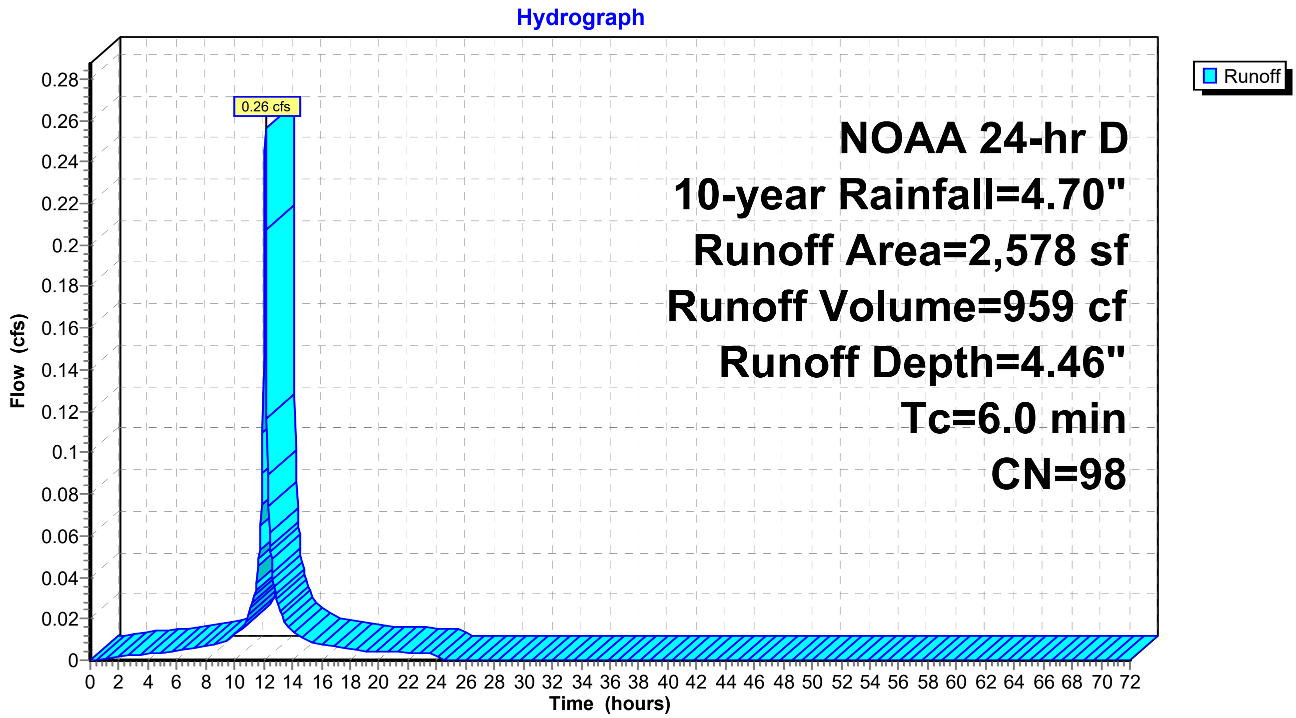
Runoff = 0.26 cfs @ 12.13 hrs, Volume= 959 cf, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
2,578	98	Roofs, HSG A
2,578		100.00% Impervious Area

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

Subcatchment PSA3C: PSA-3C



Summary for Subcatchment PSB: PDA-2B

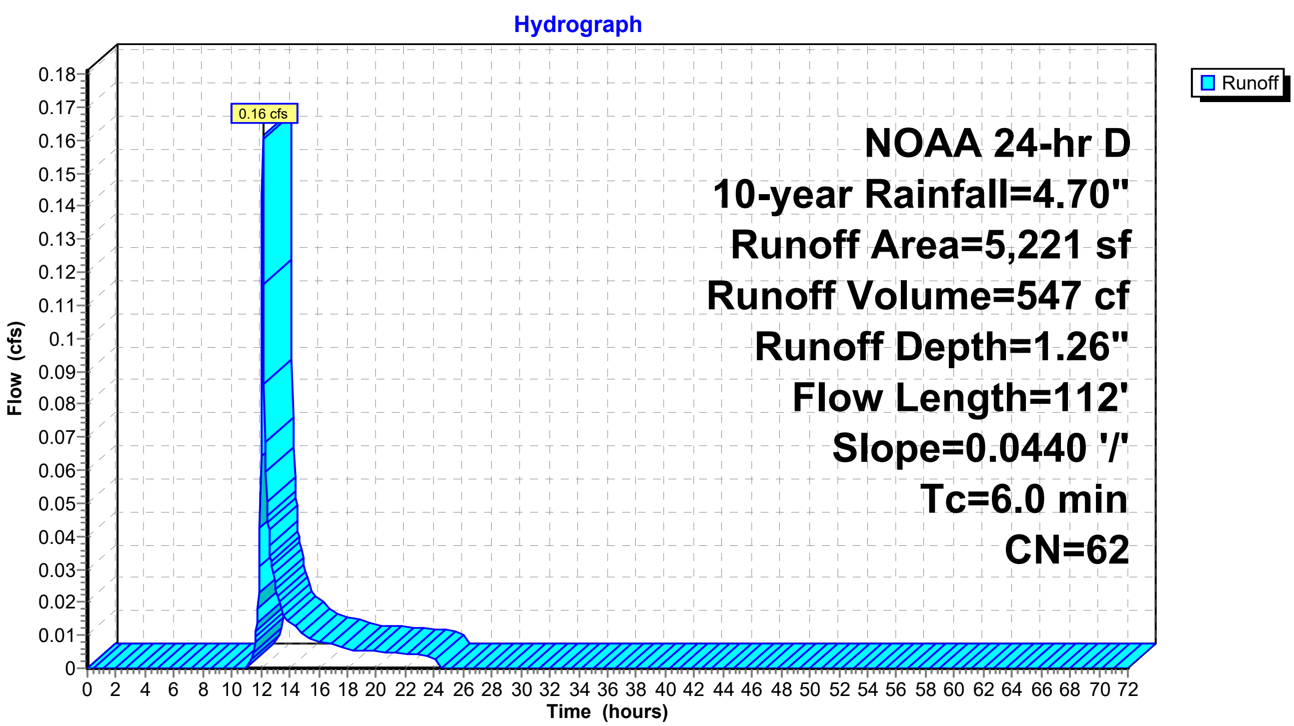
Runoff = 0.16 cfs @ 12.14 hrs, Volume= 547 cf, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-year Rainfall=4.70"

Area (sf)	CN	Description
2,039	98	Paved parking, HSG A
2,728	30	Woods, Good, HSG A
454	98	Paved parking, HSG A
5,221	62	Weighted Average
2,728		52.25% Pervious Area
2,493		47.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0440	1.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.2	62	0.0440	4.26		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	112	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSB: PDA-2B

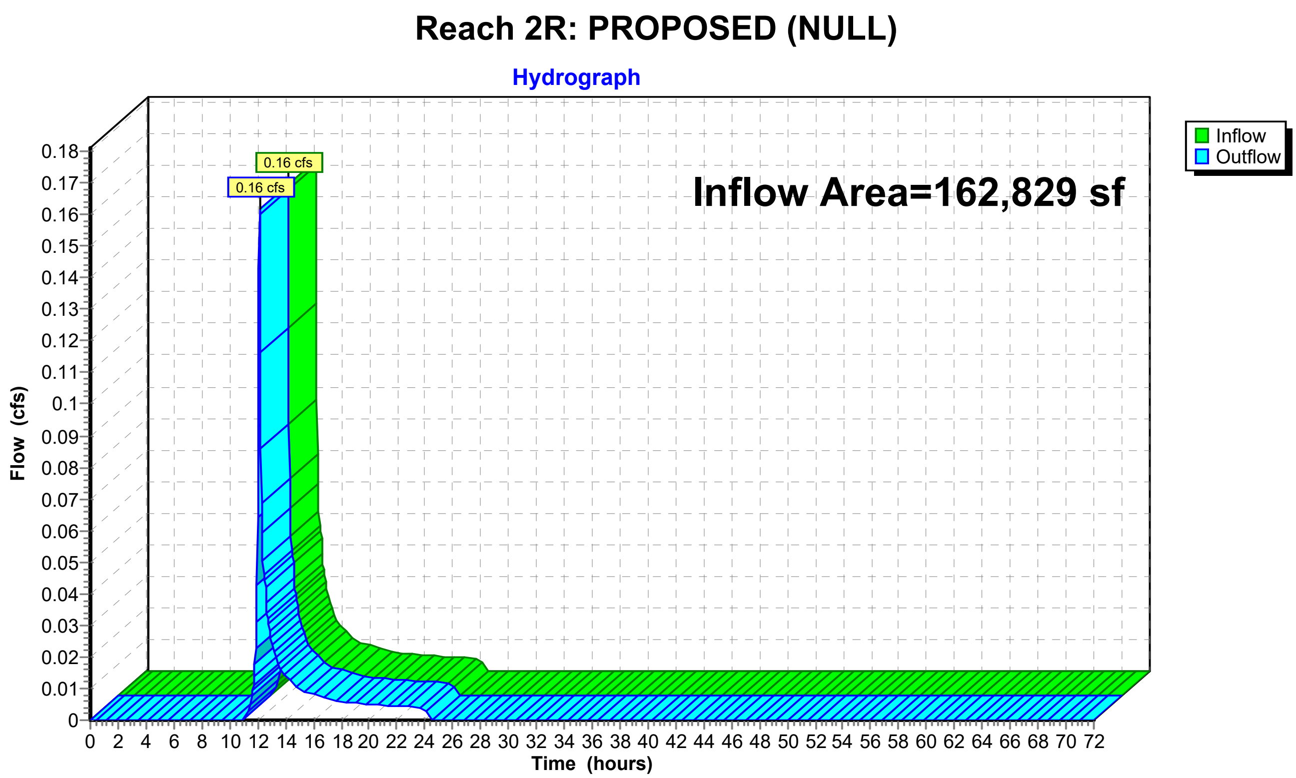


Summary for Reach 2R: PROPOSED (NULL)

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

Inflow Area =	162,829 sf, 16.02% Impervious,	Inflow Depth = 0.04"	for 10-year event
Inflow =	0.16 cfs @ 12.14 hrs, Volume=	549 cf	
Outflow =	0.16 cfs @ 12.14 hrs, Volume=	549 cf, Atten= 0%, Lag= 0.0 min	

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

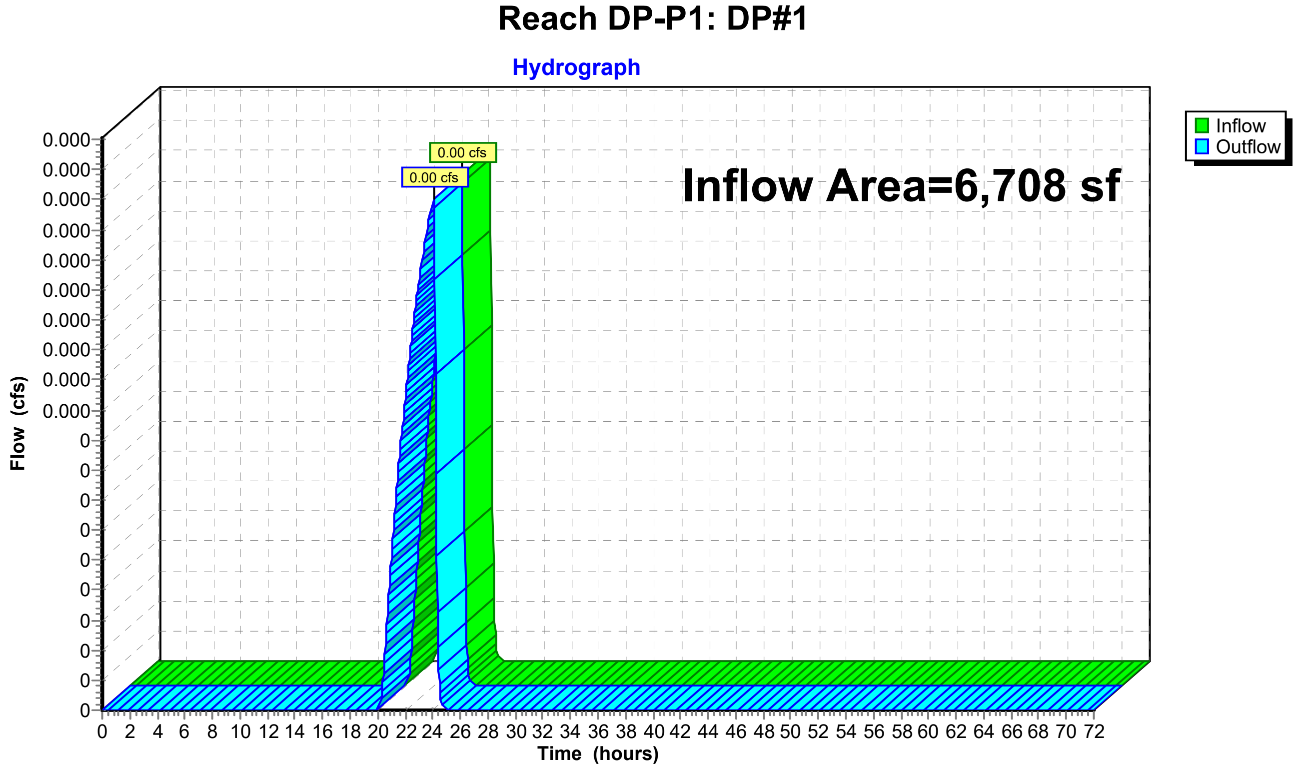


Summary for Reach DP-P1: DP#1

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

Inflow Area =	6,708 sf,	1.37% Impervious,	Inflow Depth = 0.00"	for 10-year event
Inflow =	0.00 cfs @	24.03 hrs, Volume=	2 cf	
Outflow =	0.00 cfs @	24.03 hrs, Volume=	2 cf, Atten= 0%, Lag= 0.0 min	

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



Summary for Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN

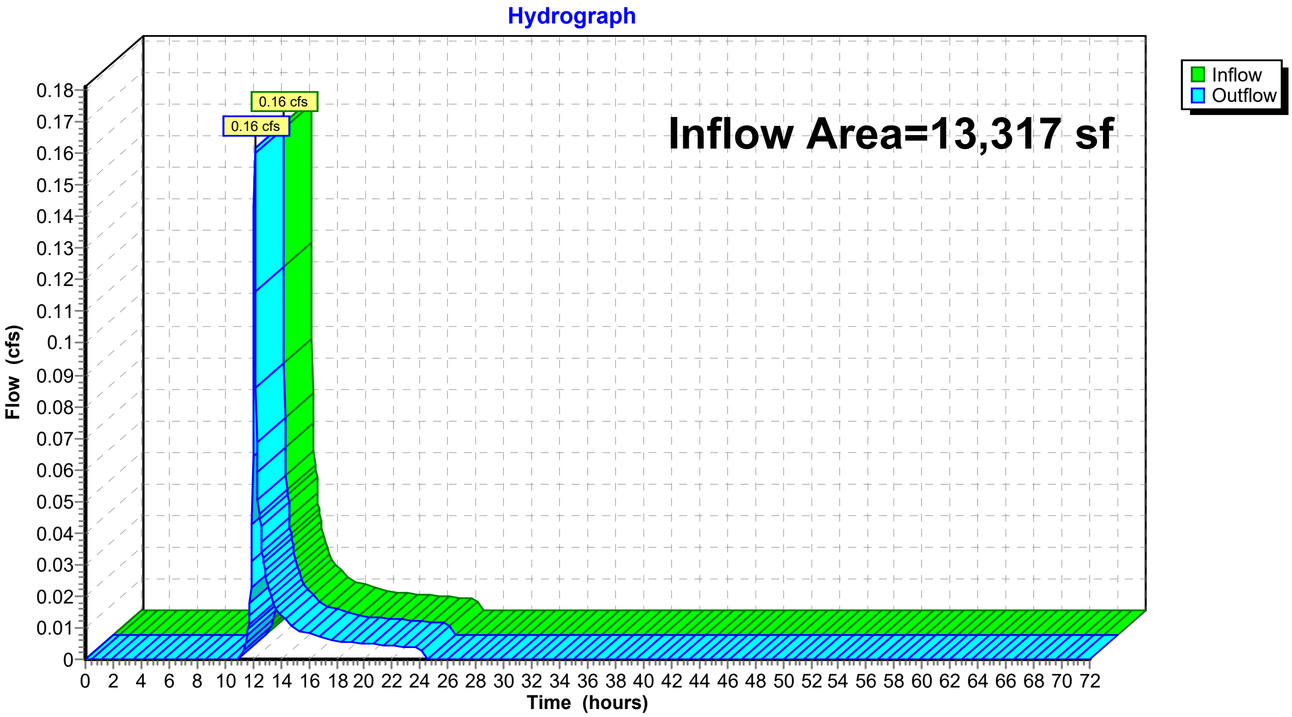
MAIN STREET CATCH BASIN

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

Inflow Area = 13,317 sf, 70.08% Impervious, Inflow Depth = 0.49" for 10-year event
Inflow = 0.16 cfs @ 12.14 hrs, Volume= 547 cf
Outflow = 0.16 cfs @ 12.14 hrs, Volume= 547 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN



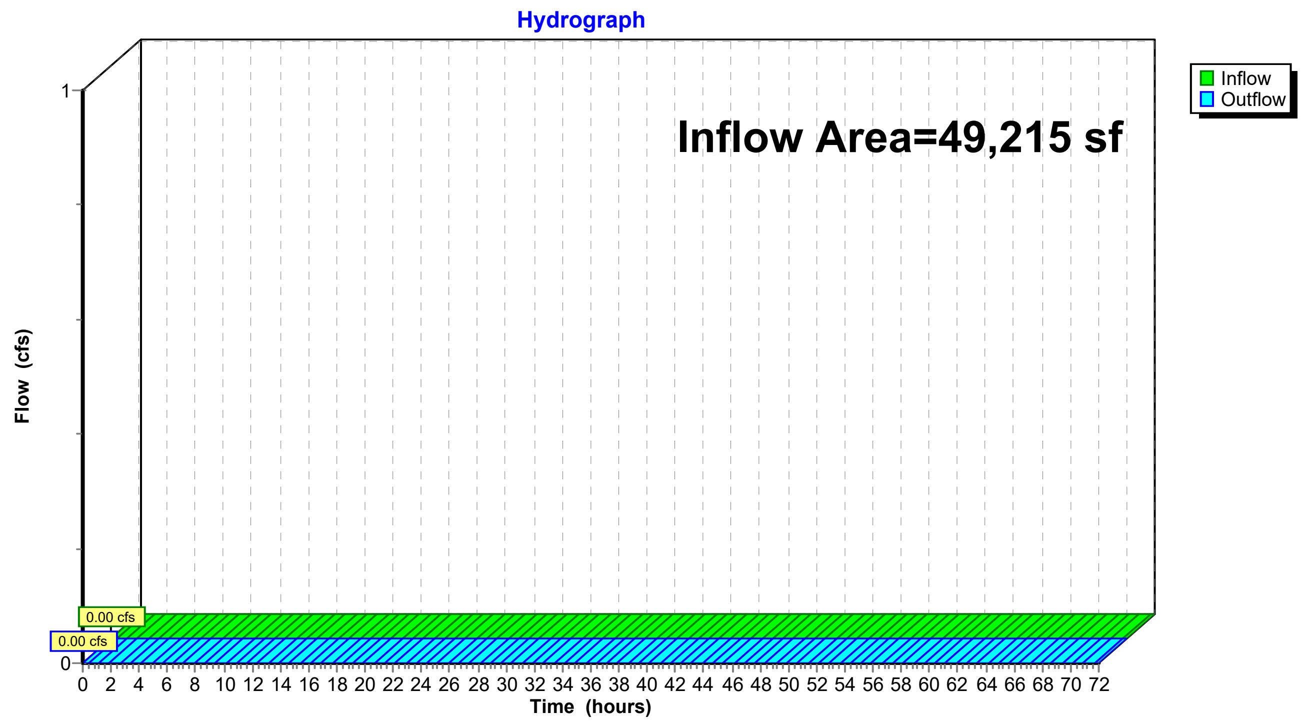
Summary for Reach DP-P3: DP#3

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

Inflow Area = 49,215 sf, 33.87% Impervious, Inflow Depth = 0.00" for 10-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P3: DP#3

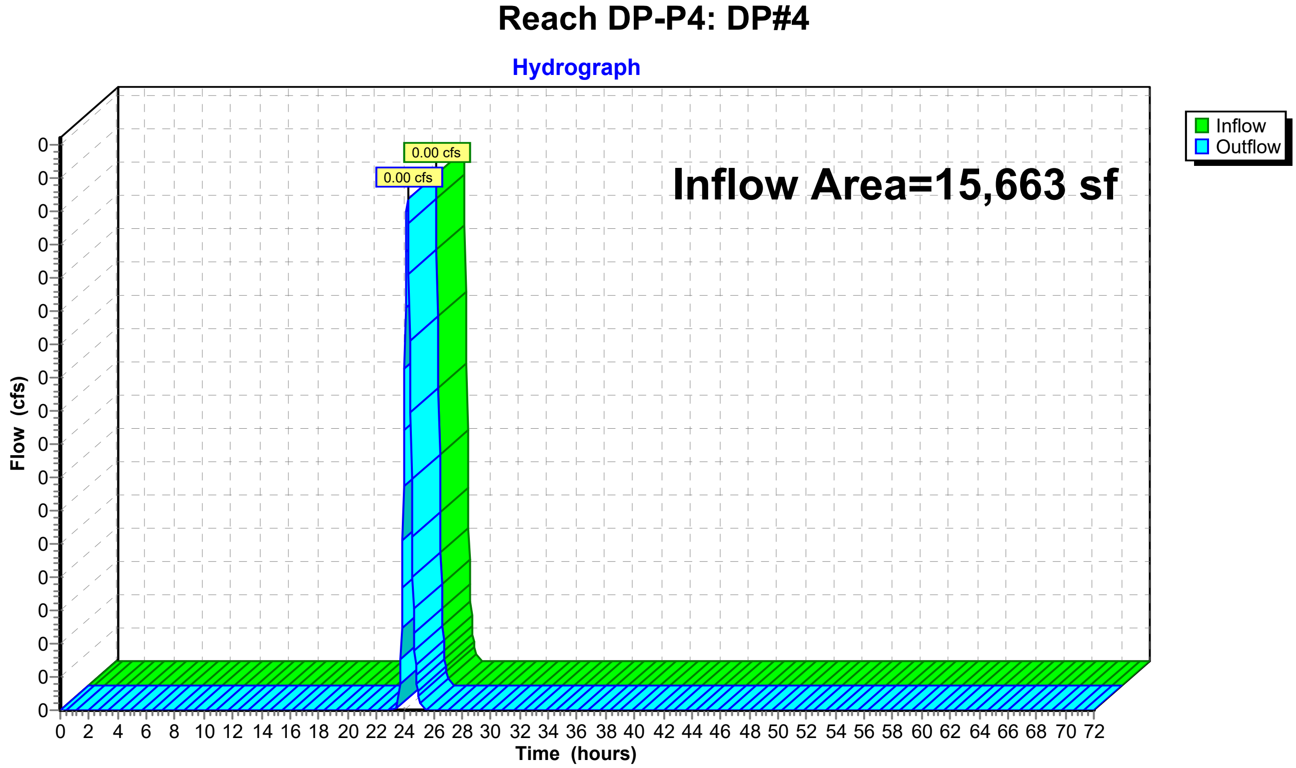


Summary for Reach DP-P4: DP#4

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

Inflow Area =	15,663 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 10-year event
Inflow =	0.00 cfs @	24.19 hrs, Volume=	0 cf	
Outflow =	0.00 cfs @	24.19 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

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

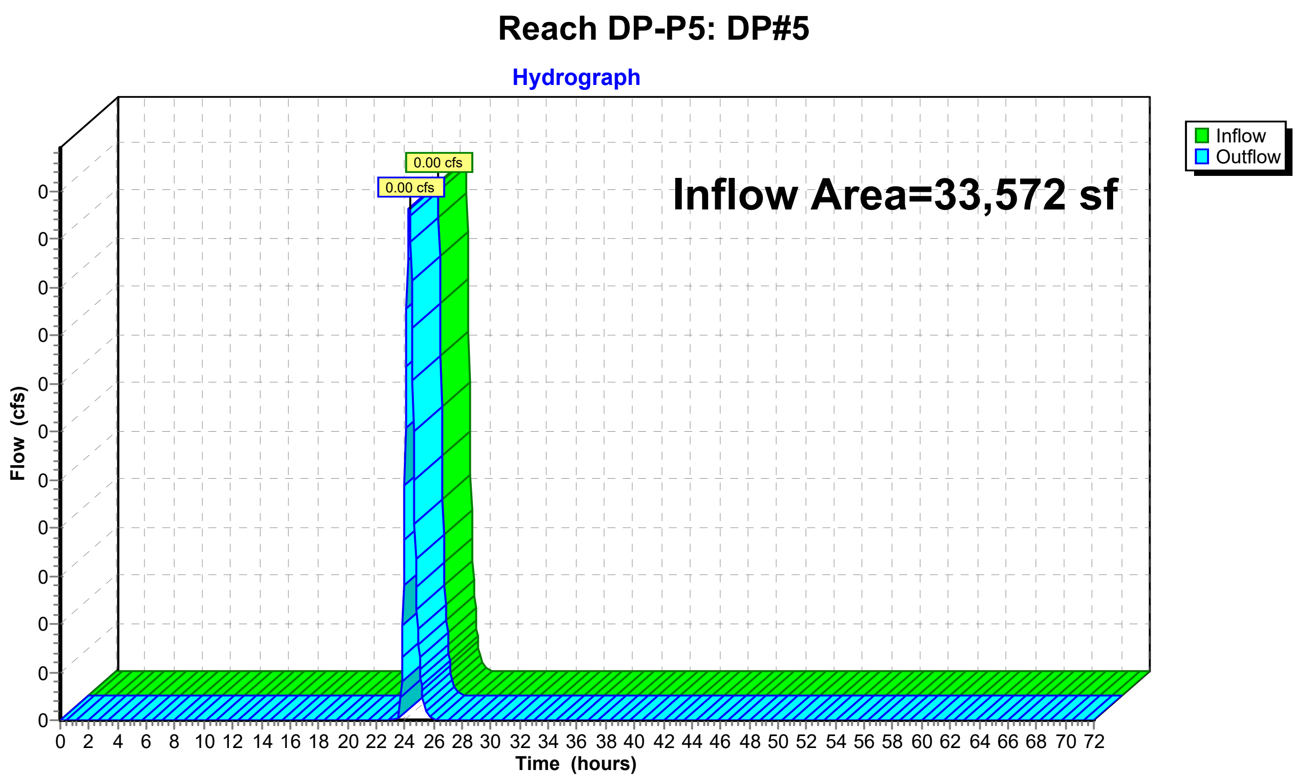


Summary for Reach DP-P5: DP#5

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

Inflow Area = 33,572 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-year event
Inflow = 0.00 cfs @ 24.31 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 24.31 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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



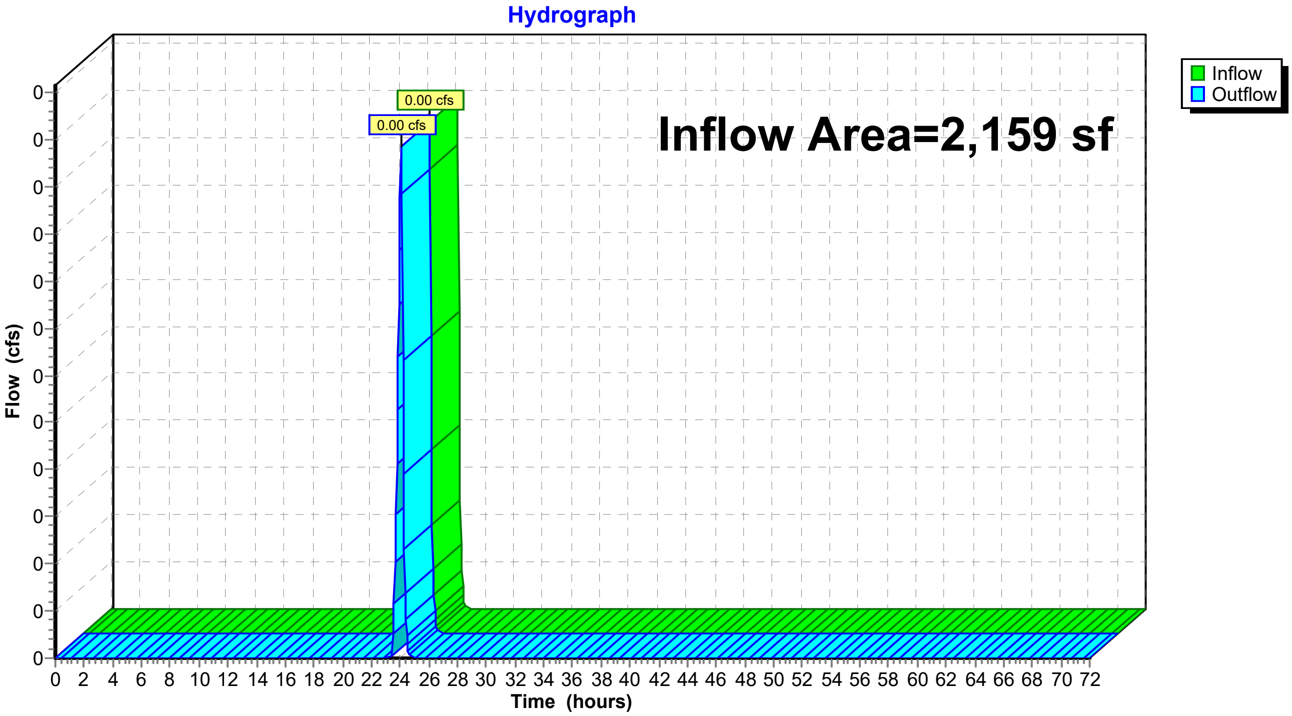
Summary for Reach DP-P6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious, Inflow Depth = 0.00"	for 10-year event
Inflow =	0.00 cfs @	24.07 hrs, Volume=	0 cf
Outflow =	0.00 cfs @	24.07 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P6: DP#6



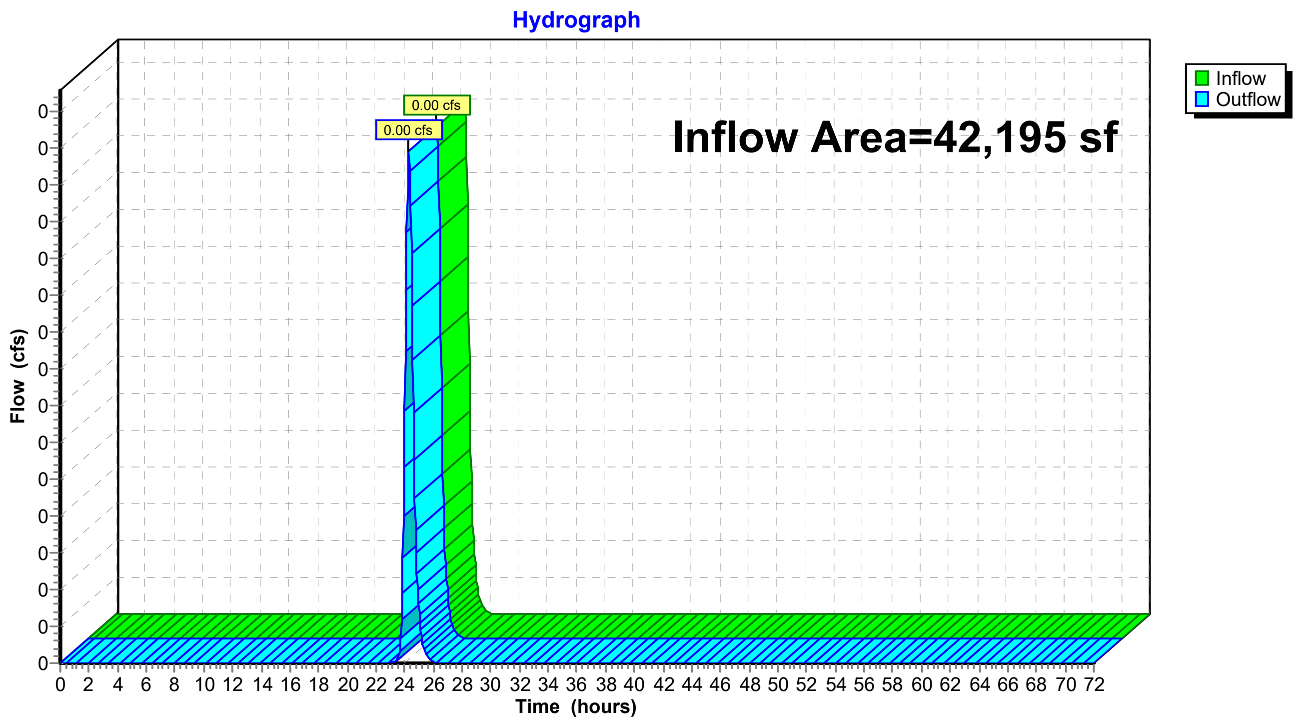
Summary for Reach DP-P7: DP#7

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

Inflow Area =	42,195 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 10-year event
Inflow =	0.00 cfs @	24.29 hrs, Volume=	0 cf	
Outflow =	0.00 cfs @	24.29 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min	

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

Reach DP-P7: DP#7



Summary for Pond 44P: StormTech Chambers

Inflow Area = 8,096 sf, 84.47% Impervious, Inflow Depth = 3.29" for 10-year event
Inflow = 0.67 cfs @ 12.13 hrs, Volume= 2,217 cf
Outflow = 0.04 cfs @ 11.00 hrs, Volume= 2,217 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.00 hrs, Volume= 2,217 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 100.12' @ 14.09 hrs Surf.Area= 0.037 ac Storage= 0.023 af

Plug-Flow detention time= 241.1 min calculated for 2,215 cf (100% of inflow)
Center-of-Mass det. time= 241.0 min (1,051.5 - 810.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.026 af	**34.75'W x 46.34'L x 3.50'H Field A** 0.129 af Overall - 0.044 af Embedded = 0.085 af x 30.0% Voids
#2A	99.50'	0.044 af	**ADS_StormTech SC-740 +Cap** x 42 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 7 Rows of 6 Chambers
		0.070 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.00 hrs HW=99.04' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 44P: StormTech Chambers - Chamber Wizard Field A

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

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

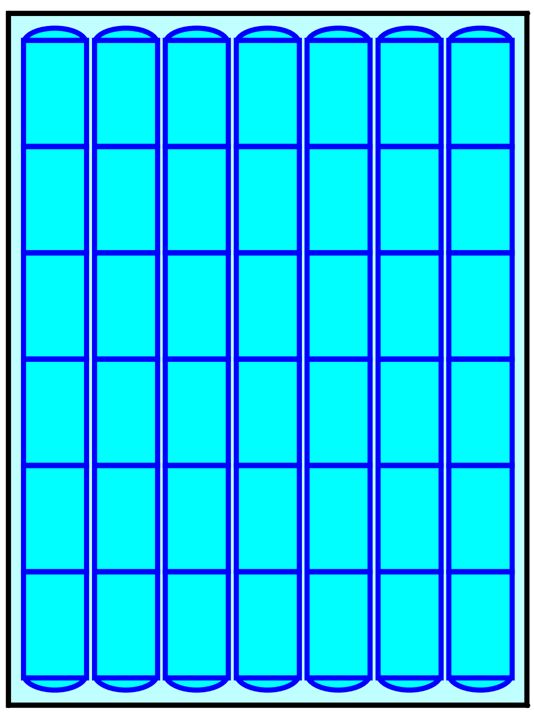
6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

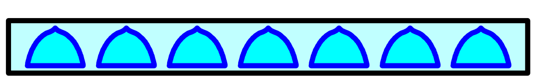
42 Chambers x 45.9 cf = 1,929.5 cf Chamber Storage

5,635.7 cf Field - 1,929.5 cf Chambers = 3,706.2 cf Stone x 30.0% Voids = 1,111.9 cf Stone Storage

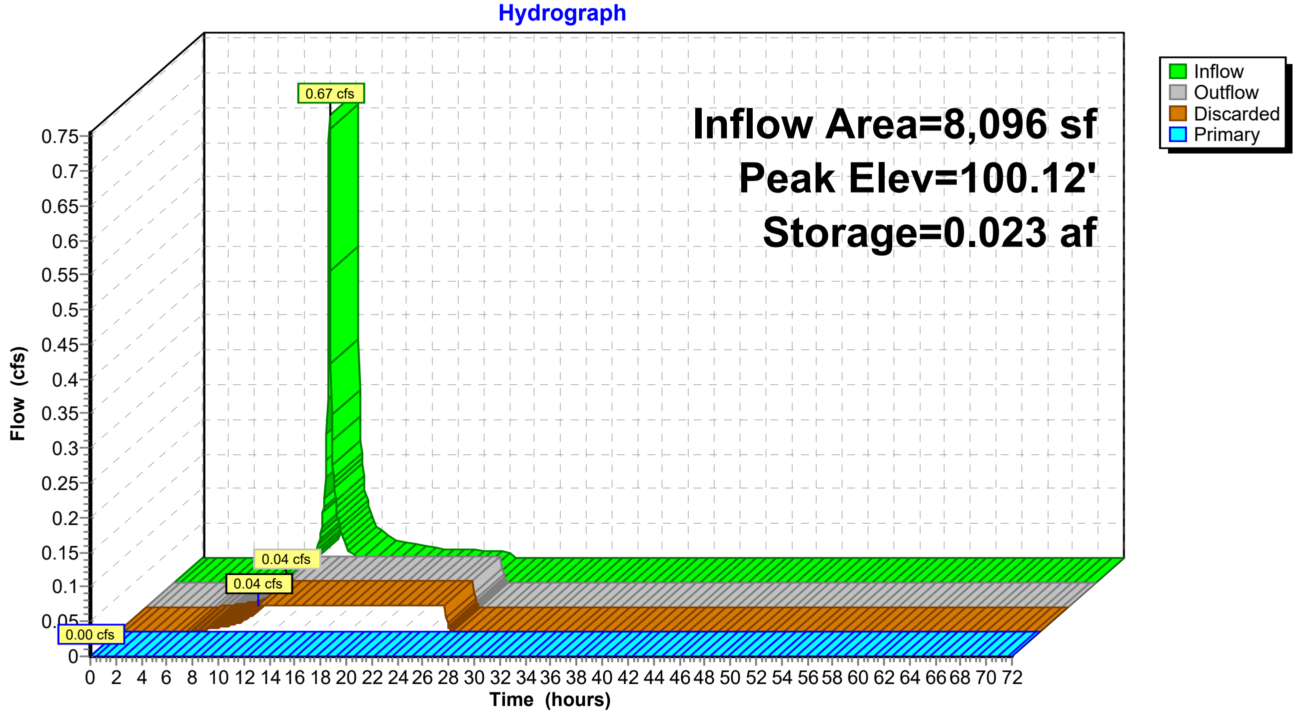
Chamber Storage + Stone Storage = 3,041.3 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 46.34' x 34.75' x 3.50'

42 Chambers
208.7 cy Field
137.3 cy Stone

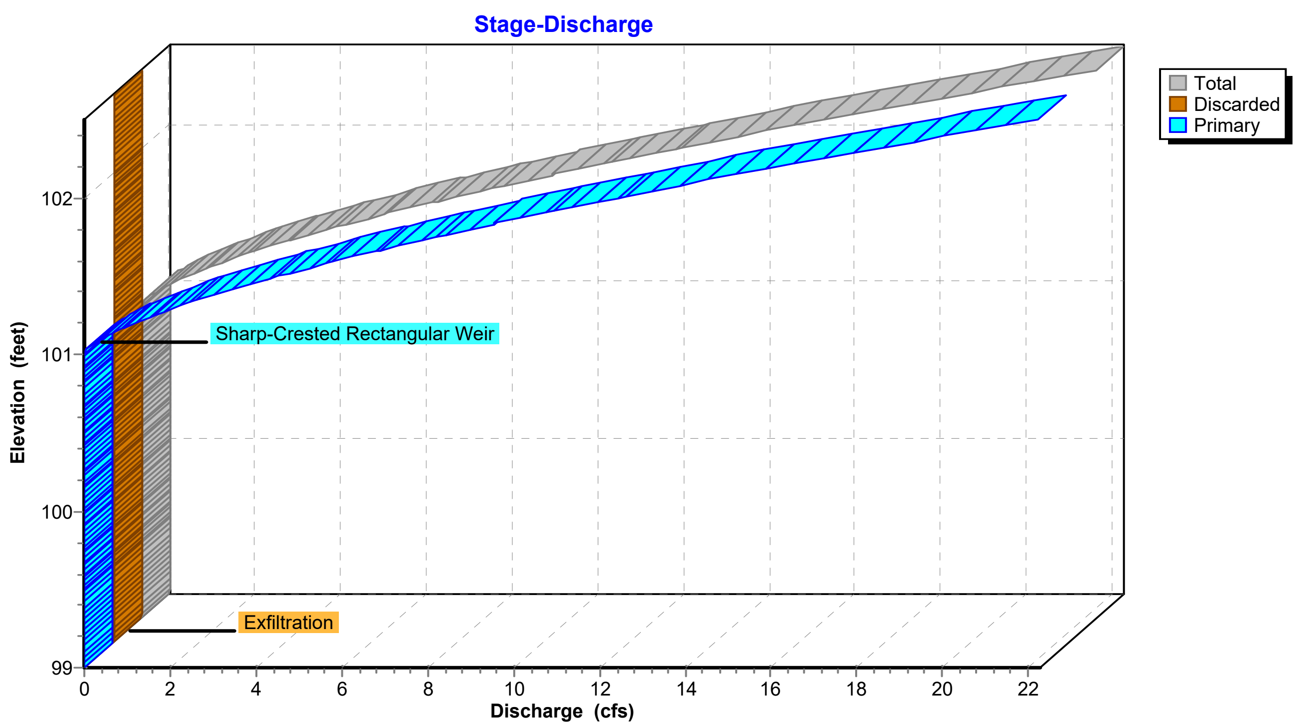




Pond 44P: StormTech Chambers



Pond 44P: StormTech Chambers



Summary for Pond 55P: StormTech Chambers

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.037 af	**39.50'W x 60.58'L x 3.50'H Field A**
			0.192 af Overall - 0.067 af Embedded = 0.125 af x 30.0% Voids
#2A	99.50'	0.067 af	**ADS_StormTech SC-740 +Cap** x 64 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
			8 Rows of 8 Chambers
		0.105 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.33'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 55P: StormTech Chambers - Chamber Wizard Field A

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

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

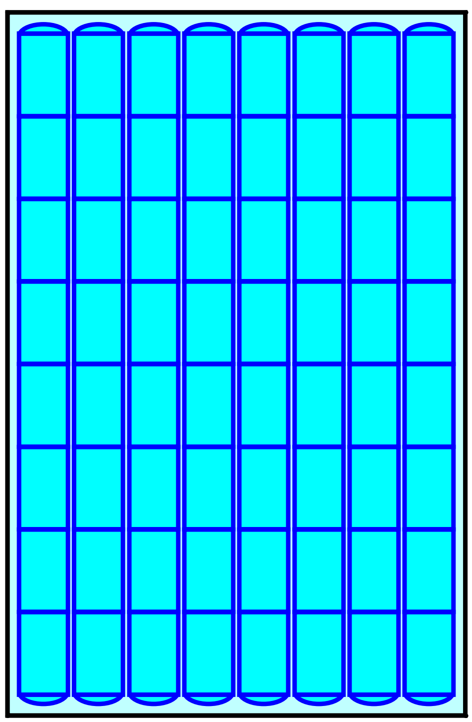
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

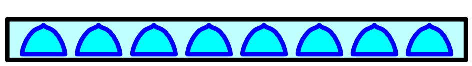
64 Chambers x 45.9 cf = 2,940.2 cf Chamber Storage

8,374.7 cf Field - 2,940.2 cf Chambers = 5,434.6 cf Stone x 30.0% Voids = 1,630.4 cf Stone Storage

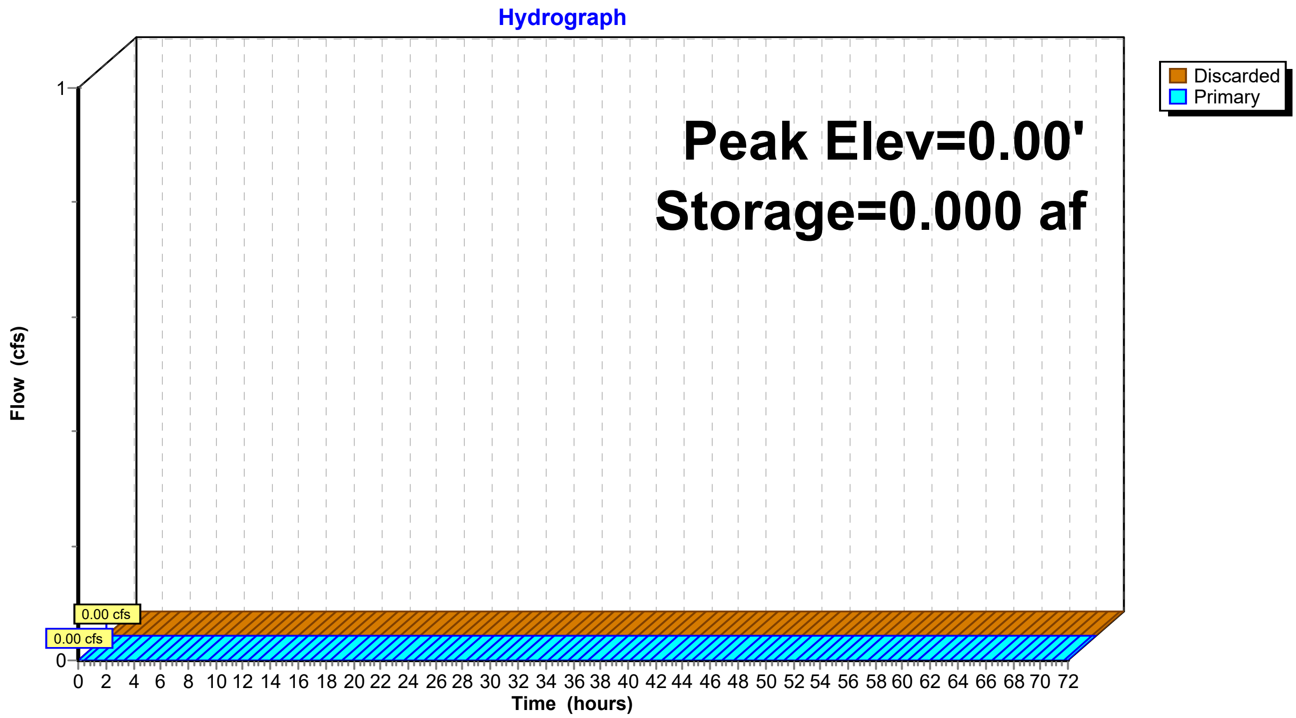
Chamber Storage + Stone Storage = 4,570.5 cf = 0.105 af
Overall Storage Efficiency = 54.6%
Overall System Size = 60.58' x 39.50' x 3.50'

64 Chambers
310.2 cy Field
201.3 cy Stone

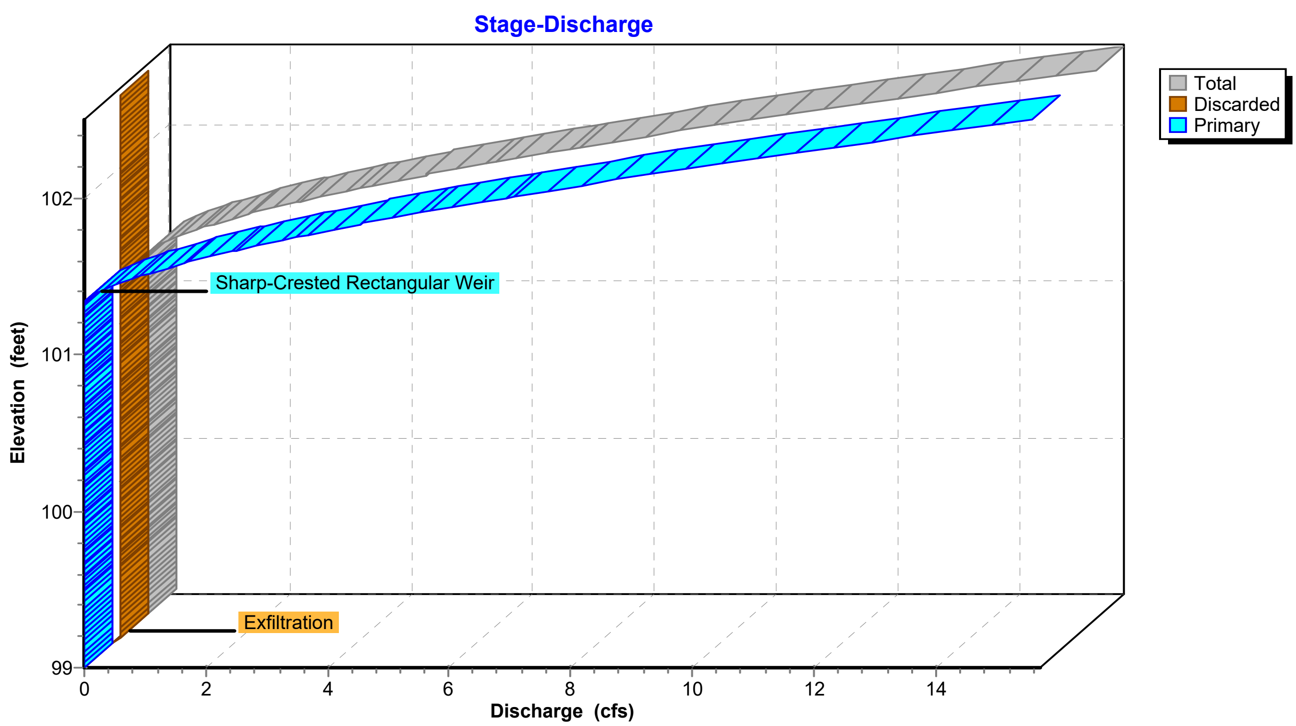




Pond 55P: StormTech Chambers



Pond 55P: StormTech Chambers



Summary for Pond 56P: Pipe Storage

Inflow Area = 2,578 sf,100.00% Impervious, Inflow Depth = 4.46" for 10-year event
Inflow = 0.26 cfs @ 12.13 hrs, Volume= 959 cf
Outflow = 0.01 cfs @ 10.30 hrs, Volume= 959 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.01 cfs @ 10.30 hrs, Volume= 959 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 100.53' @ 14.10 hrs Surf.Area= 0.013 ac Storage= 0.010 af

Plug-Flow detention time= 255.1 min calculated for 959 cf (100% of inflow)
Center-of-Mass det. time= 255.0 min (1,005.5 - 750.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.009 af	**9.13'W x 61.50'L x 2.75'H Field A** 0.035 af Overall - 0.009 af Embedded = 0.026 af x 35.0% Voids
#2A	99.50'	0.007 af	**ADS N-12 18"** x 9 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 3 Chambers
		0.017 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	101.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 10.30 hrs HW=99.03' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.00' (Free Discharge)
├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 56P: Pipe Storage - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 14.3" Spacing = 35.3" C-C Row Spacing

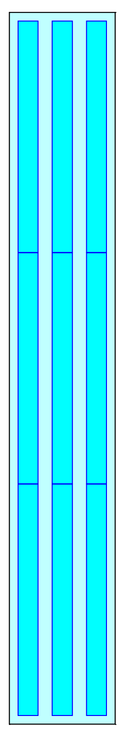
3 Chambers/Row x 20.00' Long = 60.00' Row Length +9.0" End Stone x 2 = 61.50' Base Length
3 Rows x 21.0" Wide + 14.3" Spacing x 2 + 9.0" Side Stone x 2 = 9.13' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

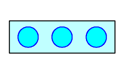
9 Chambers x 36.0 cf = 324.0 cf Chamber Storage
9 Chambers x 44.5 cf = 400.7 cf Displacement

1,545.3 cf Field - 400.7 cf Chambers = 1,144.5 cf Stone x 35.0% Voids = 400.6 cf Stone Storage

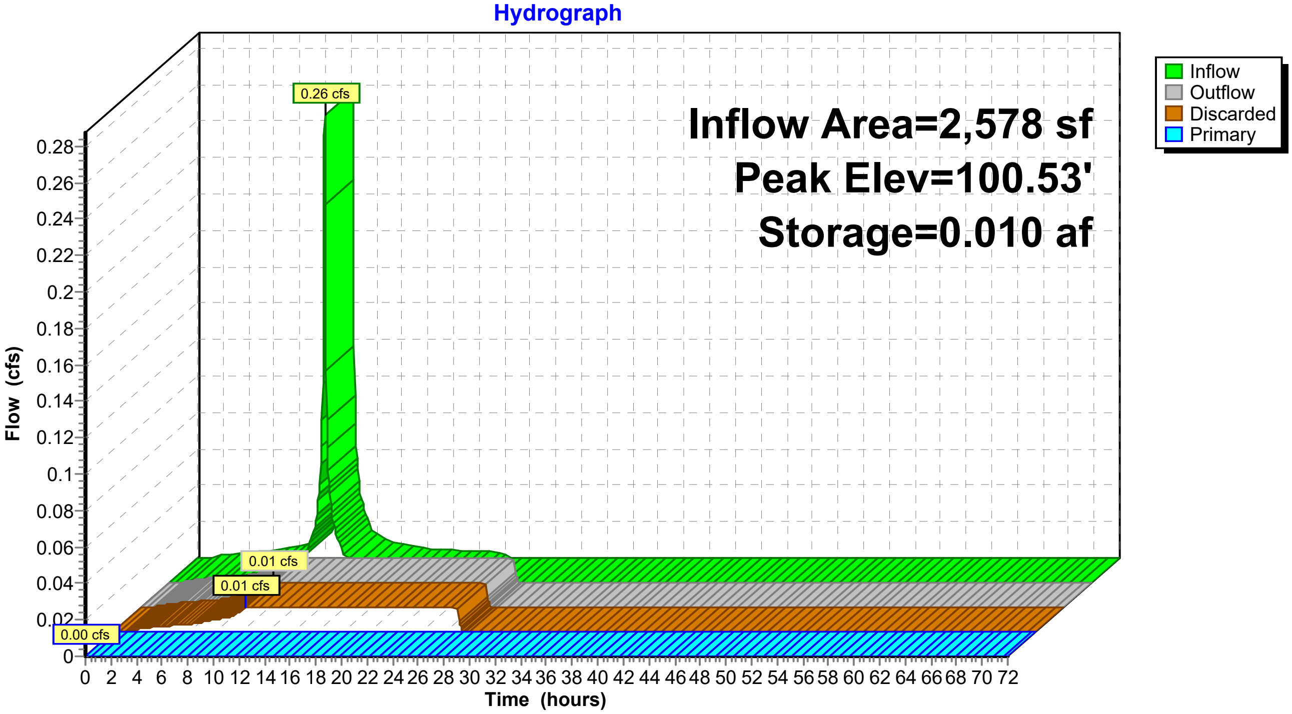
Chamber Storage + Stone Storage = 724.6 cf = 0.017 af
Overall Storage Efficiency = 46.9%
Overall System Size = 61.50' x 9.13' x 2.75'

9 Chambers
57.2 cy Field
42.4 cy Stone

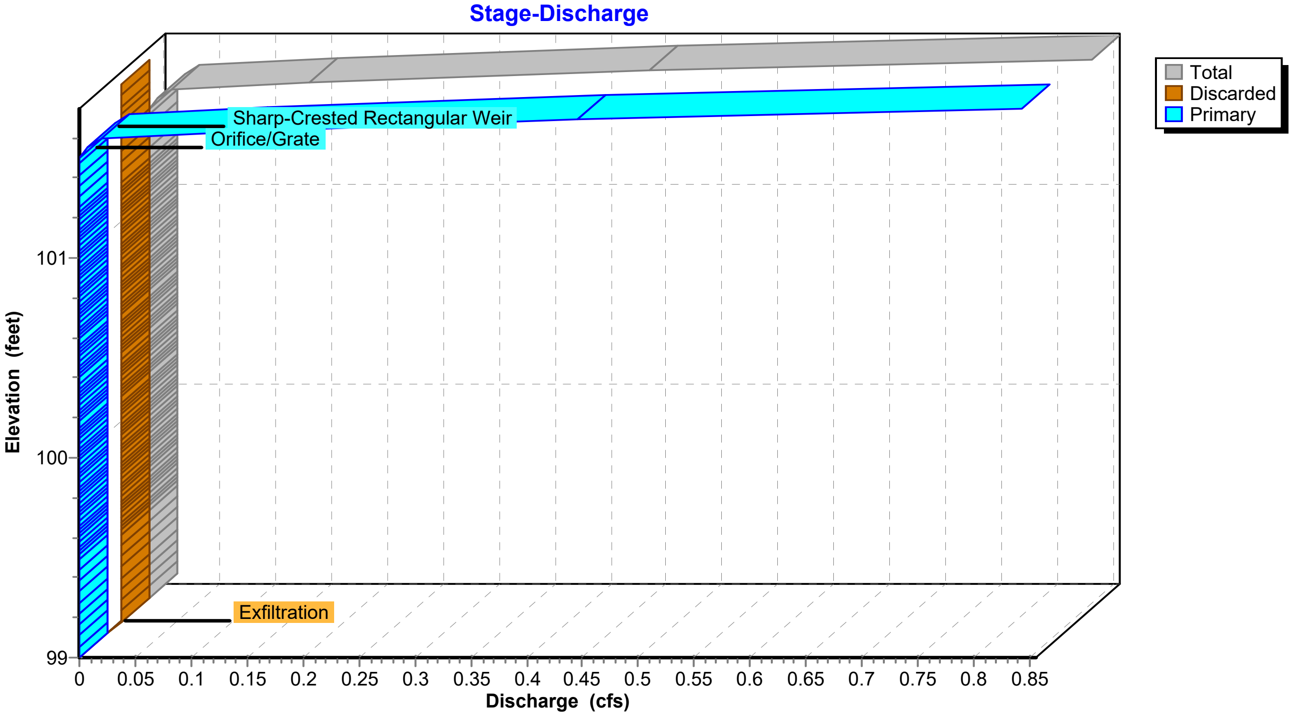




Pond 56P: Pipe Storage



Pond 56P: Pipe Storage



Summary for Pond 59P: Rain Garden

Inflow Area = 49,215 sf, 33.87% Impervious, Inflow Depth = 1.19" for 10-year event
Inflow = 1.33 cfs @ 12.13 hrs, Volume= 4,893 cf
Outflow = 1.02 cfs @ 12.10 hrs, Volume= 4,893 cf, Atten= 23%, Lag= 0.0 min
Discarded = 1.02 cfs @ 12.10 hrs, Volume= 4,893 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 97.12' @ 12.18 hrs Surf.Area= 868 sf Storage= 95 cf

Plug-Flow detention time= 0.3 min calculated for 4,890 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (762.3 - 761.9)

Volume	Invert	Avail.Storage	Storage Description
#1	97.00'	5,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

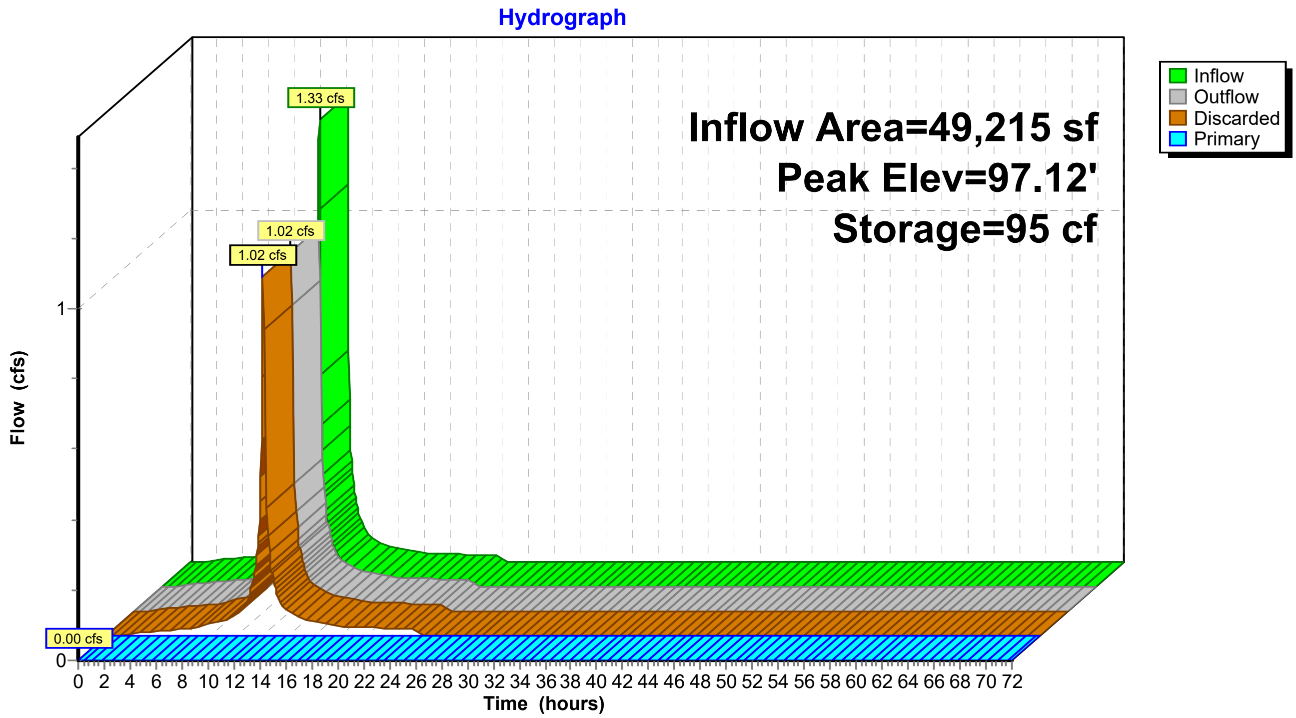
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	655	0	0
98.00	2,362	1,509	1,509
99.00	4,876	3,619	5,128

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	**1.02 cfs Exfiltration at all elevations**
#2	Primary	98.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** 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

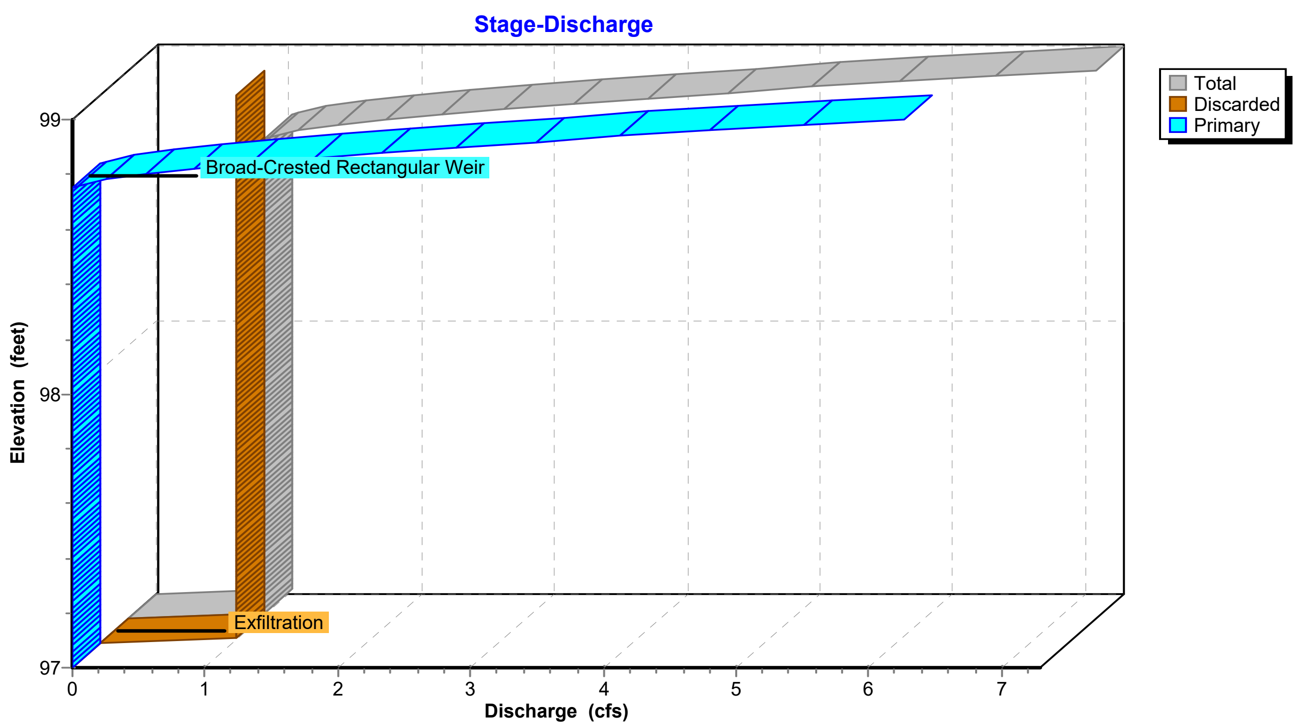
Discarded OutFlow Max=1.02 cfs @ 12.10 hrs HW=97.05' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=97.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 59P: Rain Garden



Pond 59P: Rain Garden



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

SubcatchmentPS1: PDA-1 Runoff Area=6,708 sf 1.37% Impervious Runoff Depth=0.08"
Flow Length=75' Slope=0.0400 '/' Tc=16.8 min CN=31 Runoff=0.00 cfs 43 cf

SubcatchmentPS2A: PDA-2A Runoff Area=8,096 sf 84.47% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=87 Runoff=0.87 cfs 2,919 cf

SubcatchmentPS4: PDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.00 cfs 69 cf

SubcatchmentPS5: PDA-5 Runoff Area=33,572 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.00 cfs 147 cf

SubcatchmentPS6: PDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 9 cf

SubcatchmentPS7: PDA-7 Runoff Area=42,195 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=30 Runoff=0.01 cfs 185 cf

SubcatchmentPSA3A: PSA-3A Runoff Area=33,204 sf 2.76% Impervious Runoff Depth=0.11"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=32 Runoff=0.01 cfs 292 cf

SubcatchmentPSA3B: PSA-3B Runoff Area=13,433 sf 98.05% Impervious Runoff Depth=5.44"
Flow Length=130' Slope=0.0150 '/' Tc=6.0 min CN=97 Runoff=1.65 cfs 6,095 cf

SubcatchmentPSA3C: PSA-3C Runoff Area=2,578 sf 100.00% Impervious Runoff Depth=5.56"
Tc=6.0 min CN=98 Runoff=0.32 cfs 1,195 cf

SubcatchmentPSB: PDA-2B Runoff Area=5,221 sf 47.75% Impervious Runoff Depth=1.95"
Flow Length=112' Slope=0.0440 '/' Tc=6.0 min CN=62 Runoff=0.26 cfs 851 cf

Reach 2R: PROPOSED (NULL) Inflow=0.26 cfs 1,303 cf
Outflow=0.26 cfs 1,303 cf

Reach DP-P1: DP#1 Inflow=0.00 cfs 43 cf
Outflow=0.00 cfs 43 cf

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN Inflow=0.26 cfs 851 cf
Outflow=0.26 cfs 851 cf

Reach DP-P3: DP#3 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P4: DP#4 Inflow=0.00 cfs 69 cf
Outflow=0.00 cfs 69 cf

Reach DP-P5: DP#5 Inflow=0.00 cfs 147 cf
Outflow=0.00 cfs 147 cf

Reach DP-P6: DP#6
Inflow=0.00 cfs 9 cf
Outflow=0.00 cfs 9 cf

Reach DP-P7: DP#7
Inflow=0.01 cfs 185 cf
Outflow=0.01 cfs 185 cf

Pond 44P: StormTech Chambers
Peak Elev=100.51' Storage=0.034 af Inflow=0.87 cfs 2,919 cf
Discarded=0.04 cfs 2,919 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 2,919 cf

Pond 55P: StormTech Chambers
Peak Elev=0.00' Storage=0.000 af
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Pond 56P: Pipe Storage
Peak Elev=100.97' Storage=0.013 af Inflow=0.32 cfs 1,195 cf
Discarded=0.01 cfs 1,195 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 1,195 cf

Pond 59P: Rain Garden
Peak Elev=97.28' Storage=252 cf Inflow=1.65 cfs 6,386 cf
Discarded=1.02 cfs 6,386 cf Primary=0.00 cfs 0 cf Outflow=1.02 cfs 6,386 cf

Total Runoff Area = 162,829 sf Runoff Volume = 11,803 cf Average Runoff Depth = 0.87"
83.98% Pervious = 136,738 sf 16.02% Impervious = 26,091 sf

Summary for Subcatchment PS1: PDA-1

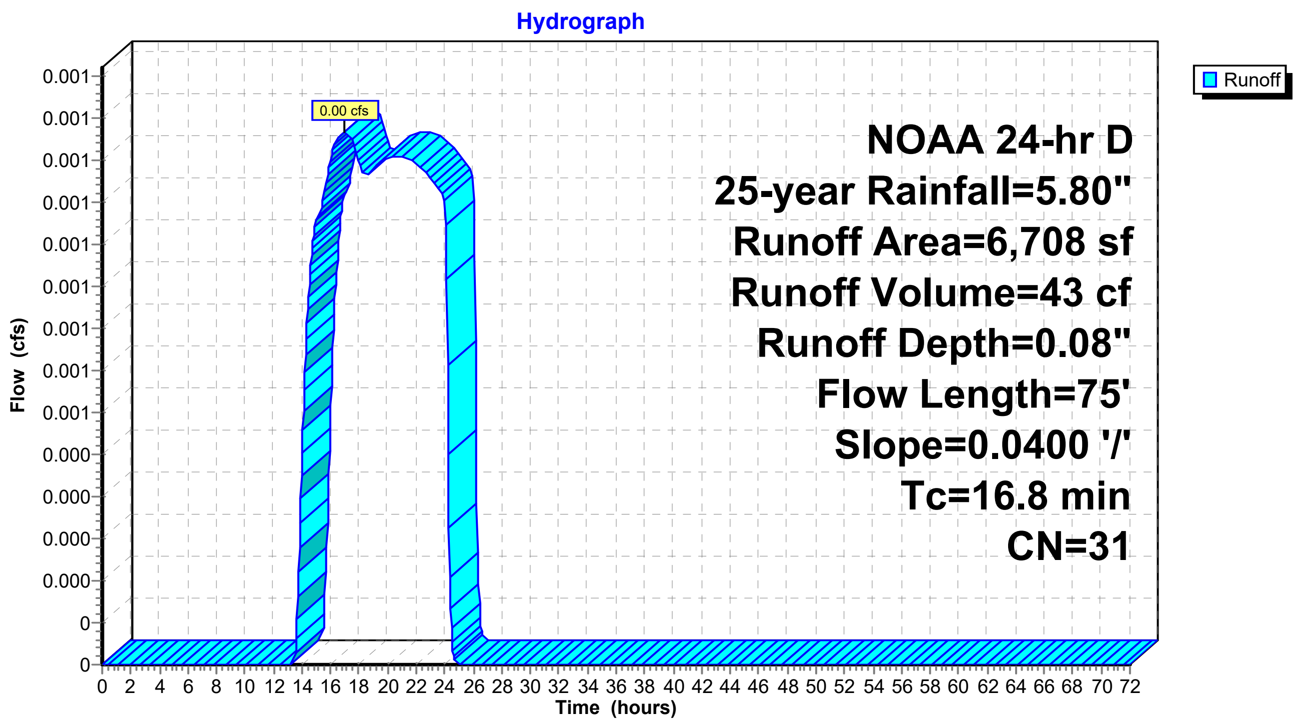
Runoff = 0.00 cfs @ 16.94 hrs, Volume= 43 cf, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
92	98	Paved parking, HSG A
6,616	30	Woods, Good, HSG A
6,708	31	Weighted Average
6,616		98.63% Pervious Area
92		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.3	25	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.8	75	Total			

Subcatchment PS1: PDA-1



Summary for Subcatchment PS2A: PDA-2A

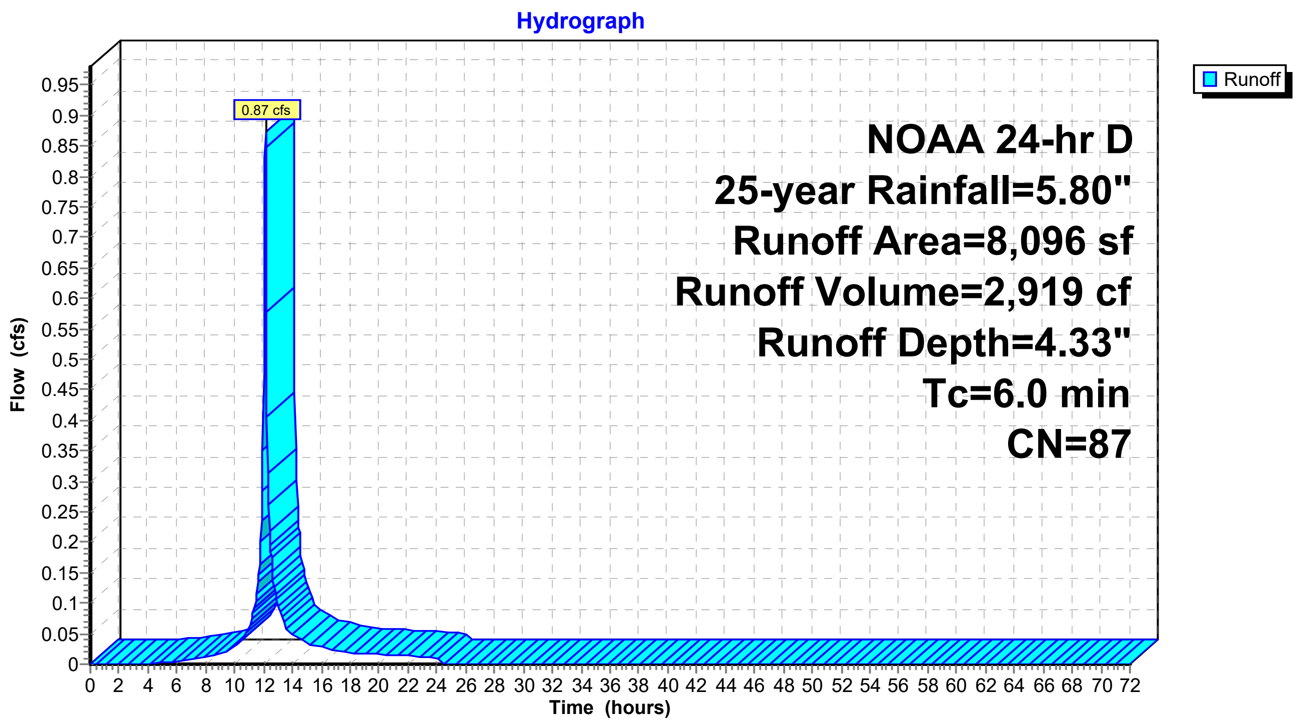
Runoff = 0.87 cfs @ 12.13 hrs, Volume= 2,919 cf, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
3,491	98	Paved parking, HSG A
3,348	98	Roofs, HSG A
1,257	30	Woods, Good, HSG A
8,096	87	Weighted Average
1,257		15.53% Pervious Area
6,839		84.47% Impervious Area

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

Subcatchment PS2A: PDA-2A



Summary for Subcatchment PS4: PDA-4

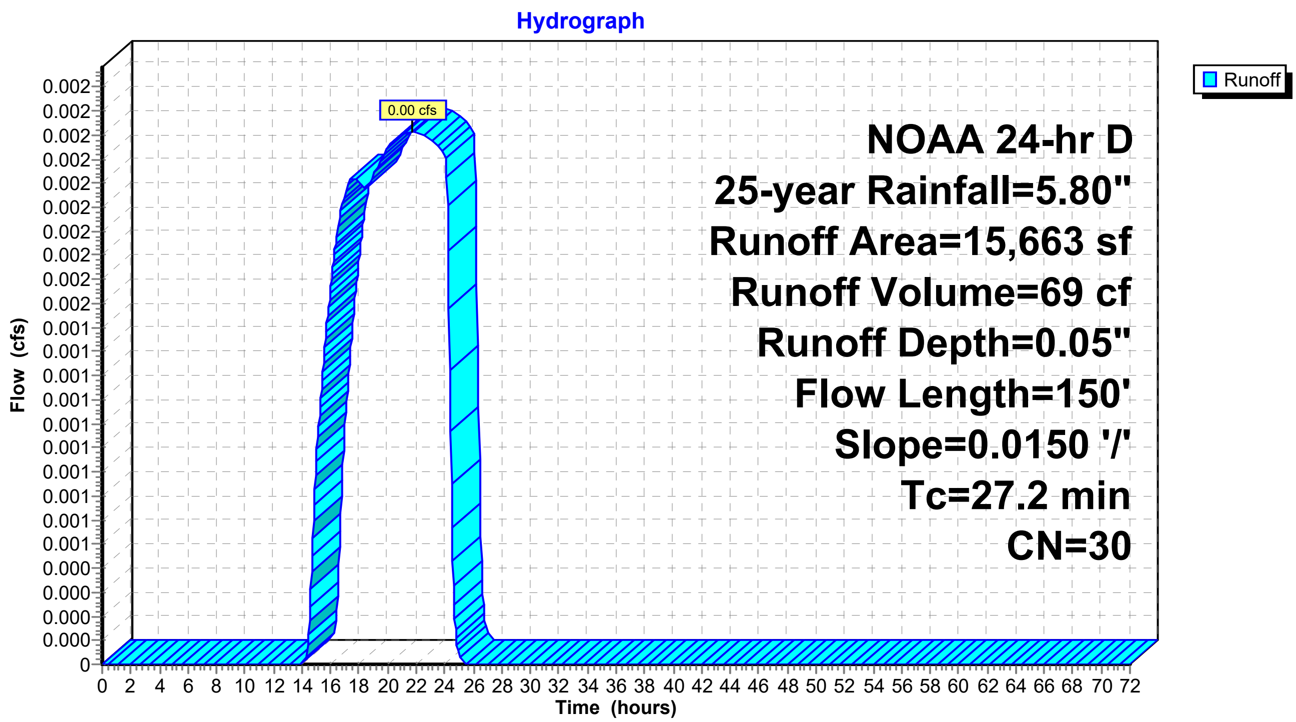
Runoff = 0.00 cfs @ 21.64 hrs, Volume= 69 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment PS4: PDA-4



Summary for Subcatchment PS5: PDA-5

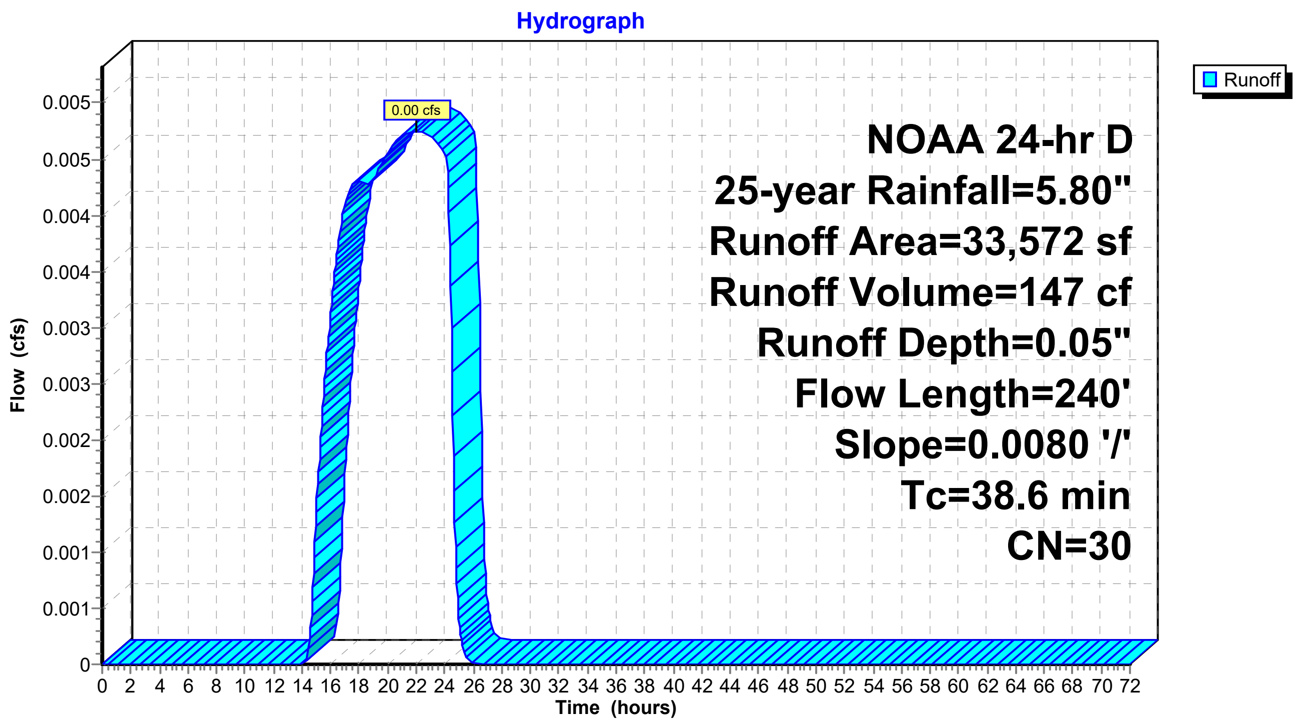
Runoff = 0.00 cfs @ 22.00 hrs, Volume= 147 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
33,572	30	Woods, Good, HSG A
33,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment PS5: PDA-5



Summary for Subcatchment PS6: PDA-6

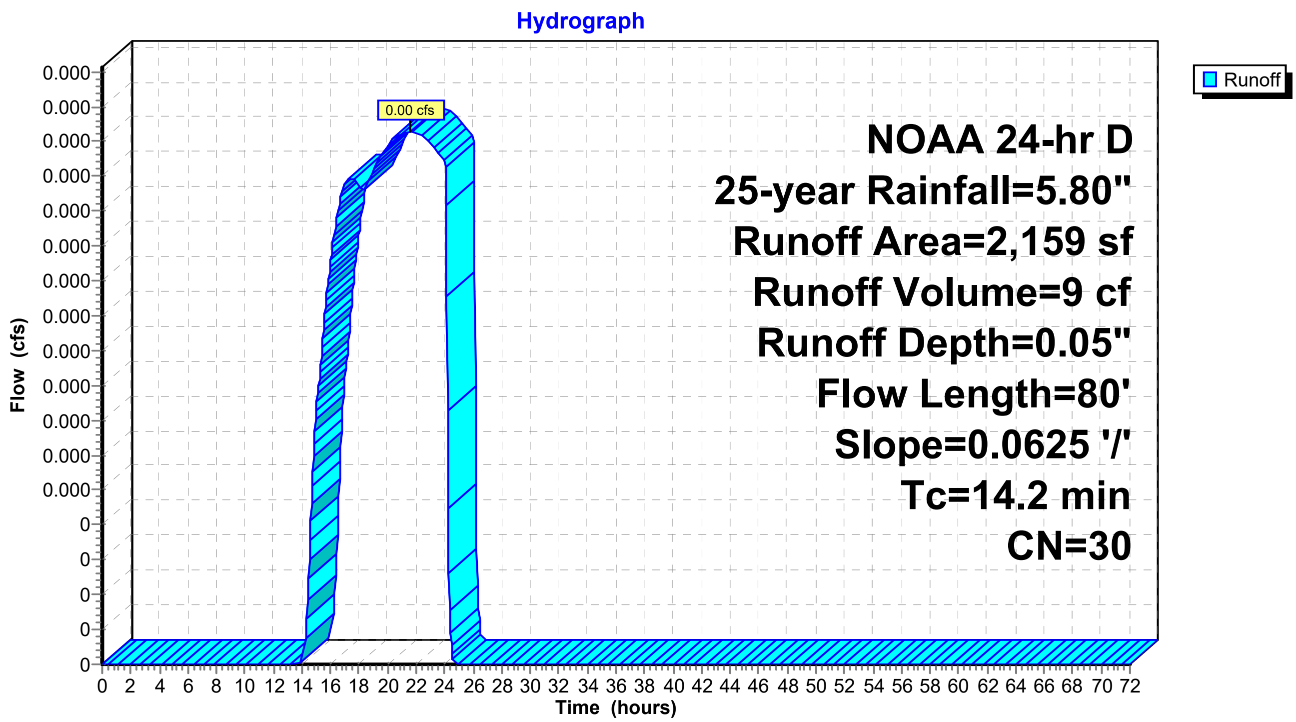
Runoff = 0.00 cfs @ 21.54 hrs, Volume= 9 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment PS6: PDA-6



Summary for Subcatchment PS7: PDA-7

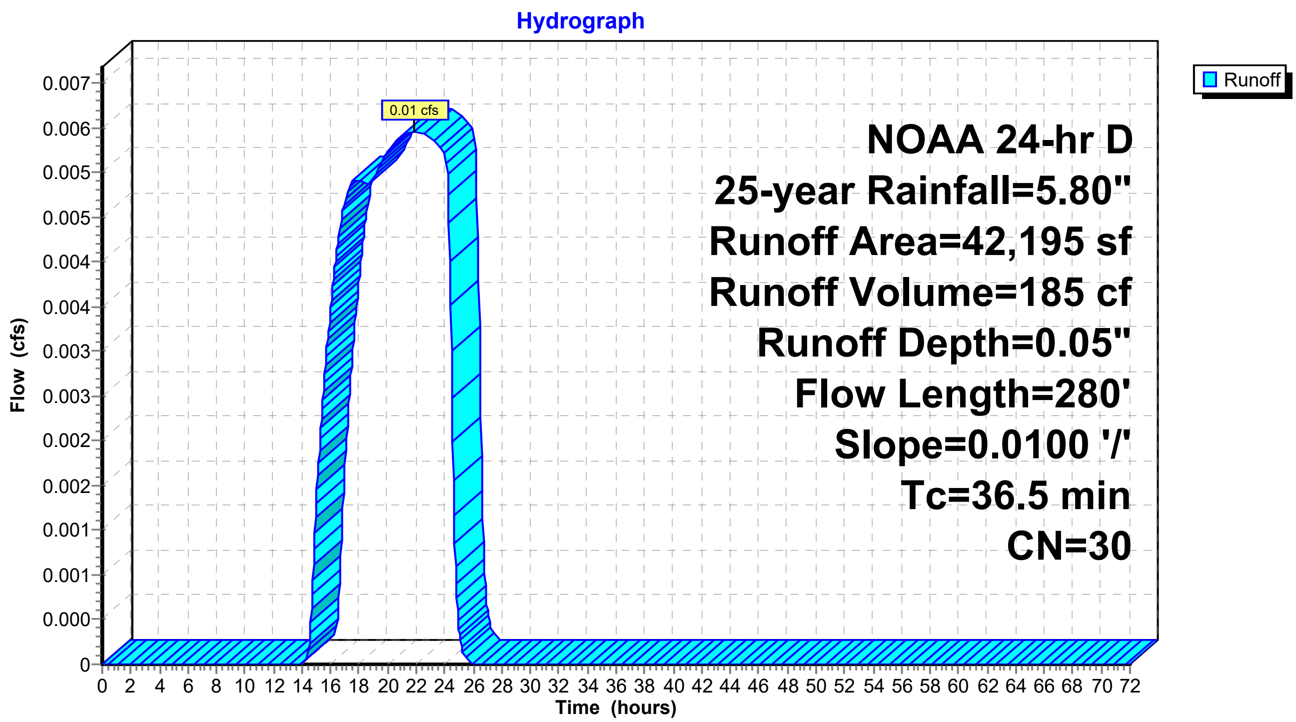
Runoff = 0.01 cfs @ 21.84 hrs, Volume= 185 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
42,195	30	Woods, Good, HSG A
42,195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment PS7: PDA-7



Summary for Subcatchment PSA3A: PSA-3A

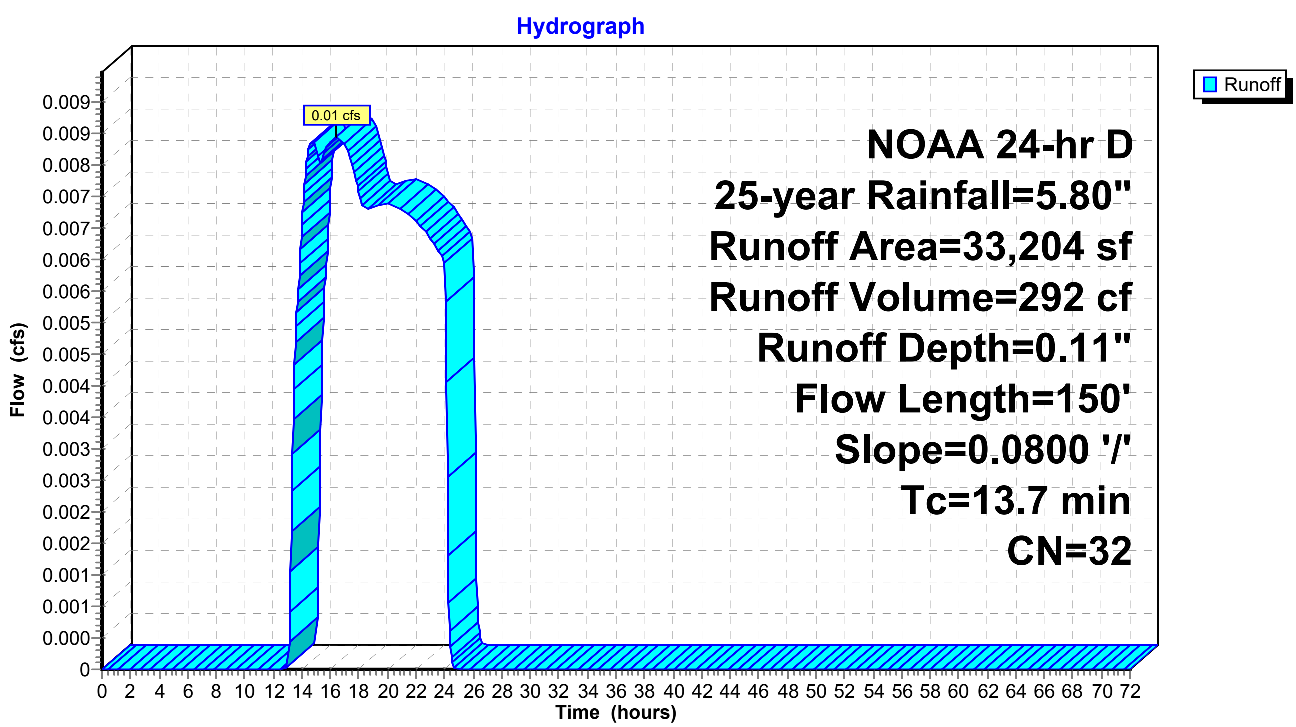
Runoff = 0.01 cfs @ 16.43 hrs, Volume= 292 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
918	98	Paved parking, HSG A
32,286	30	Woods, Good, HSG A
33,204	32	Weighted Average
32,286		97.24% Pervious Area
918		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment PSA3A: PSA-3A



Summary for Subcatchment PSA3B: PSA-3B

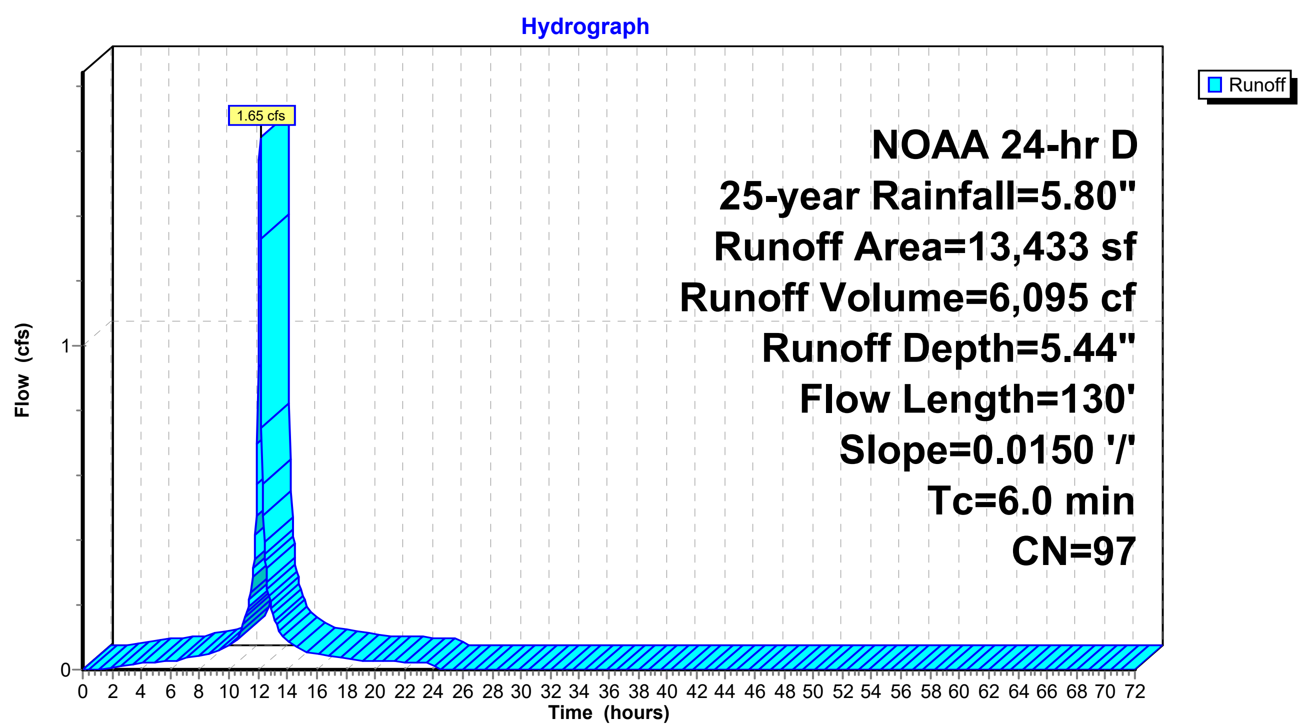
Runoff = 1.65 cfs @ 12.13 hrs, Volume= 6,095 cf, Depth= 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
13,171	98	Paved parking, HSG A
262	30	Woods, Good, HSG A
13,433	97	Weighted Average
262		1.95% Pervious Area
13,171		98.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.5	80	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSA3B: PSA-3B



Summary for Subcatchment PSA3C: PSA-3C

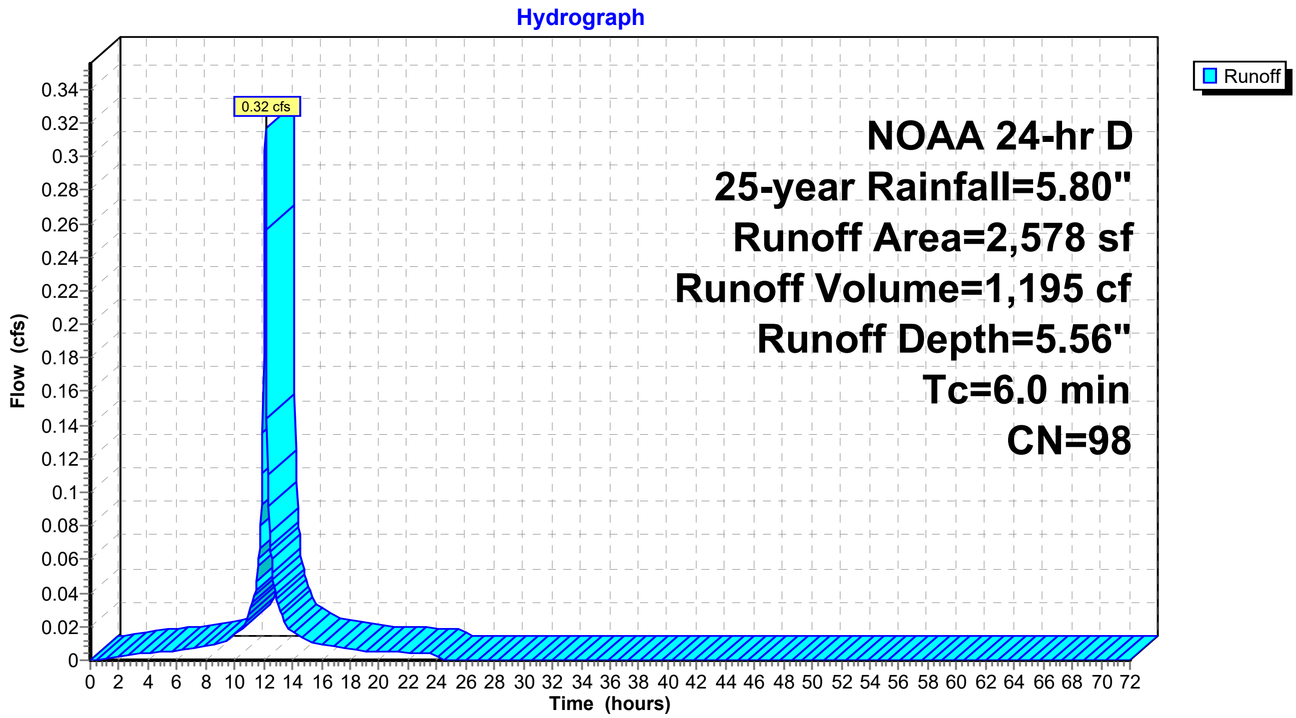
Runoff = 0.32 cfs @ 12.13 hrs, Volume= 1,195 cf, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
2,578	98	Roofs, HSG A
2,578		100.00% Impervious Area

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

Subcatchment PSA3C: PSA-3C



Summary for Subcatchment PSB: PDA-2B

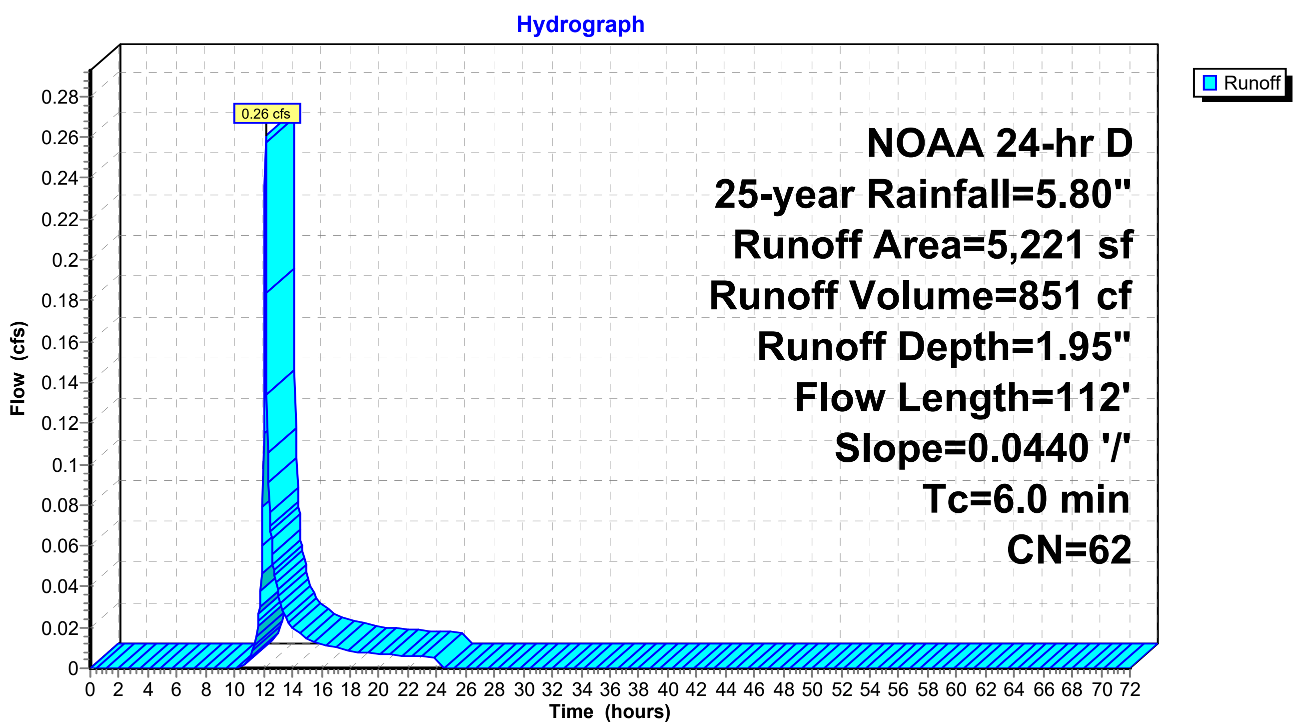
Runoff = 0.26 cfs @ 12.14 hrs, Volume= 851 cf, Depth= 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-year Rainfall=5.80"

Area (sf)	CN	Description
2,039	98	Paved parking, HSG A
2,728	30	Woods, Good, HSG A
454	98	Paved parking, HSG A
5,221	62	Weighted Average
2,728		52.25% Pervious Area
2,493		47.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0440	1.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.2	62	0.0440	4.26		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	112	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSB: PDA-2B



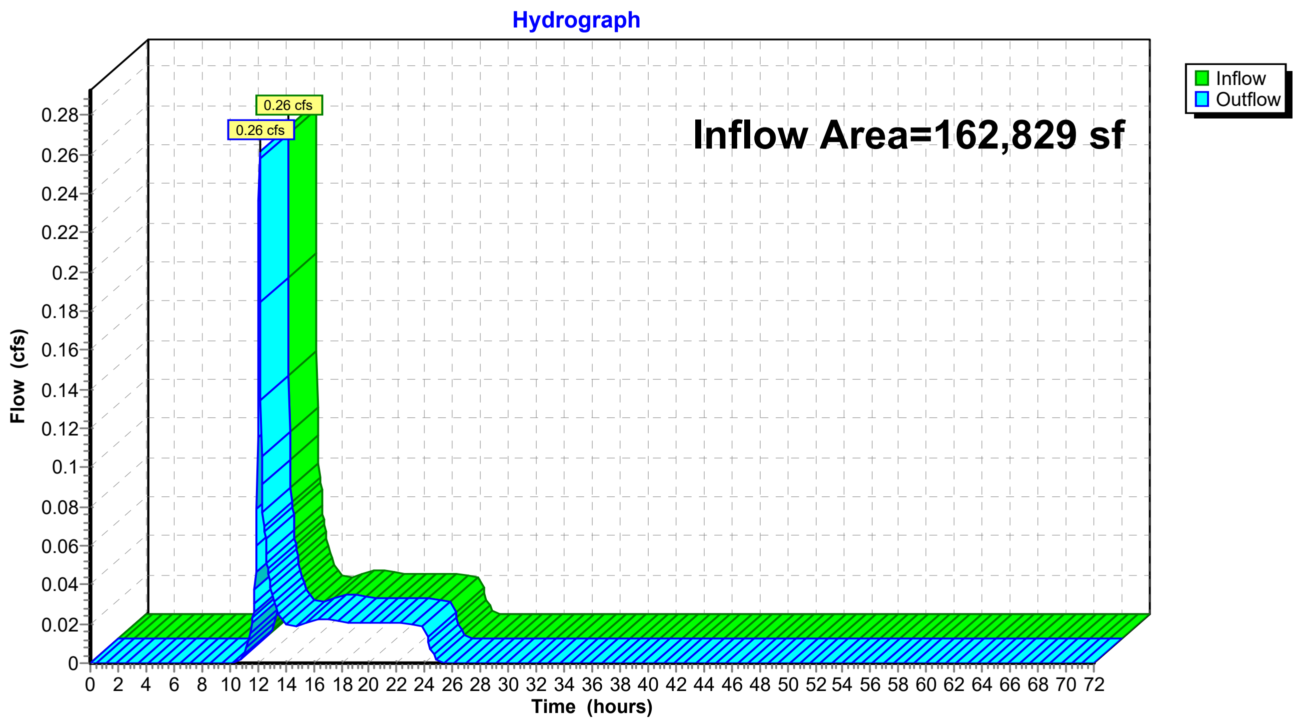
Summary for Reach 2R: PROPOSED (NULL)

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

Inflow Area =	162,829 sf,	16.02% Impervious,	Inflow Depth = 0.10"	for 25-year event
Inflow =	0.26 cfs @	12.14 hrs, Volume=	1,303 cf	
Outflow =	0.26 cfs @	12.14 hrs, Volume=	1,303 cf,	Atten= 0%, Lag= 0.0 min

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

Reach 2R: PROPOSED (NULL)



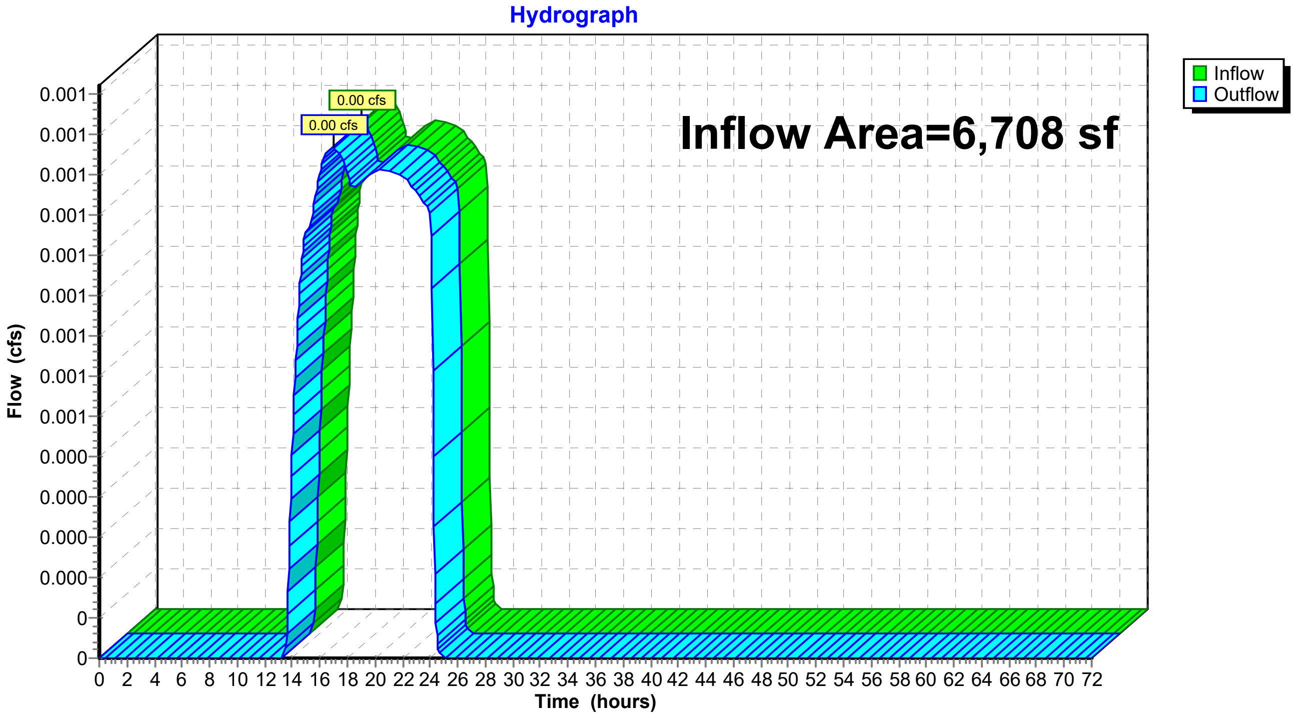
Summary for Reach DP-P1: DP#1

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

Inflow Area = 6,708 sf, 1.37% Impervious, Inflow Depth = 0.08" for 25-year event
Inflow = 0.00 cfs @ 16.94 hrs, Volume= 43 cf
Outflow = 0.00 cfs @ 16.94 hrs, Volume= 43 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P1: DP#1



Summary for Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN

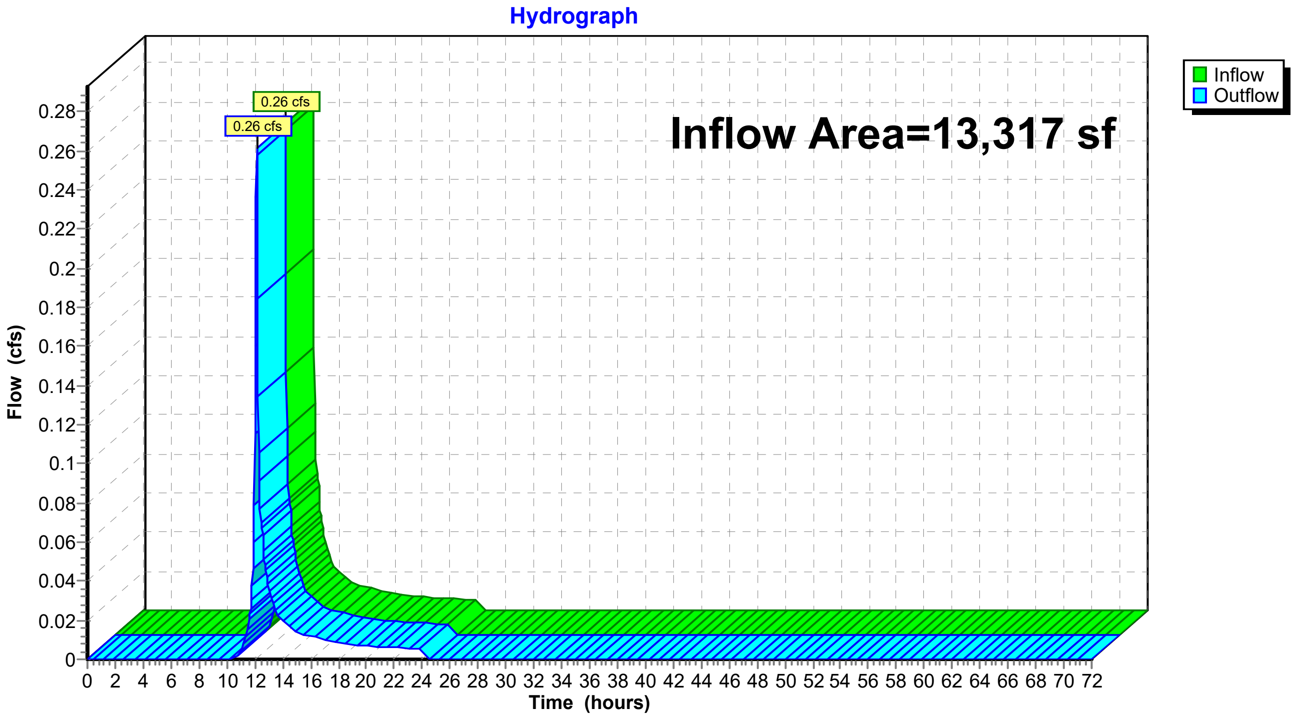
MAIN STREET CATCH BASIN

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

Inflow Area = 13,317 sf, 70.08% Impervious, Inflow Depth = 0.77" for 25-year event
Inflow = 0.26 cfs @ 12.14 hrs, Volume= 851 cf
Outflow = 0.26 cfs @ 12.14 hrs, Volume= 851 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN



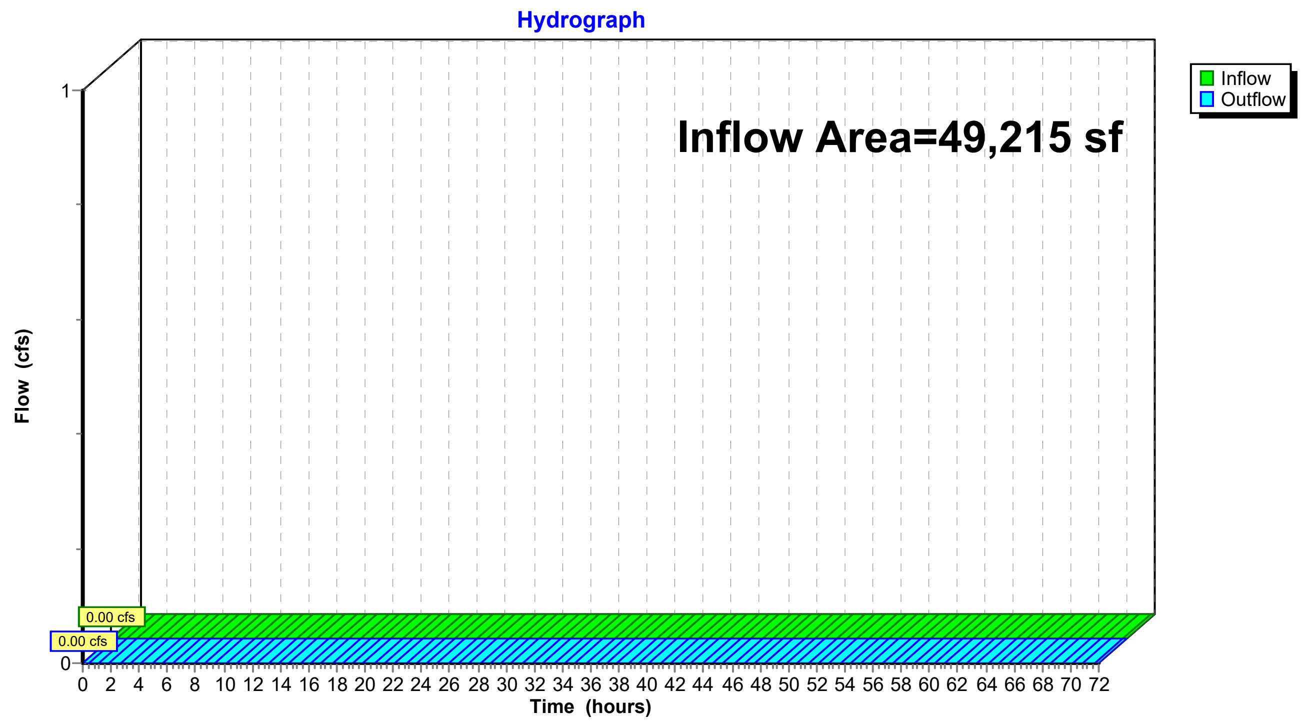
Summary for Reach DP-P3: DP#3

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

Inflow Area = 49,215 sf, 33.87% Impervious, Inflow Depth = 0.00" for 25-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P3: DP#3

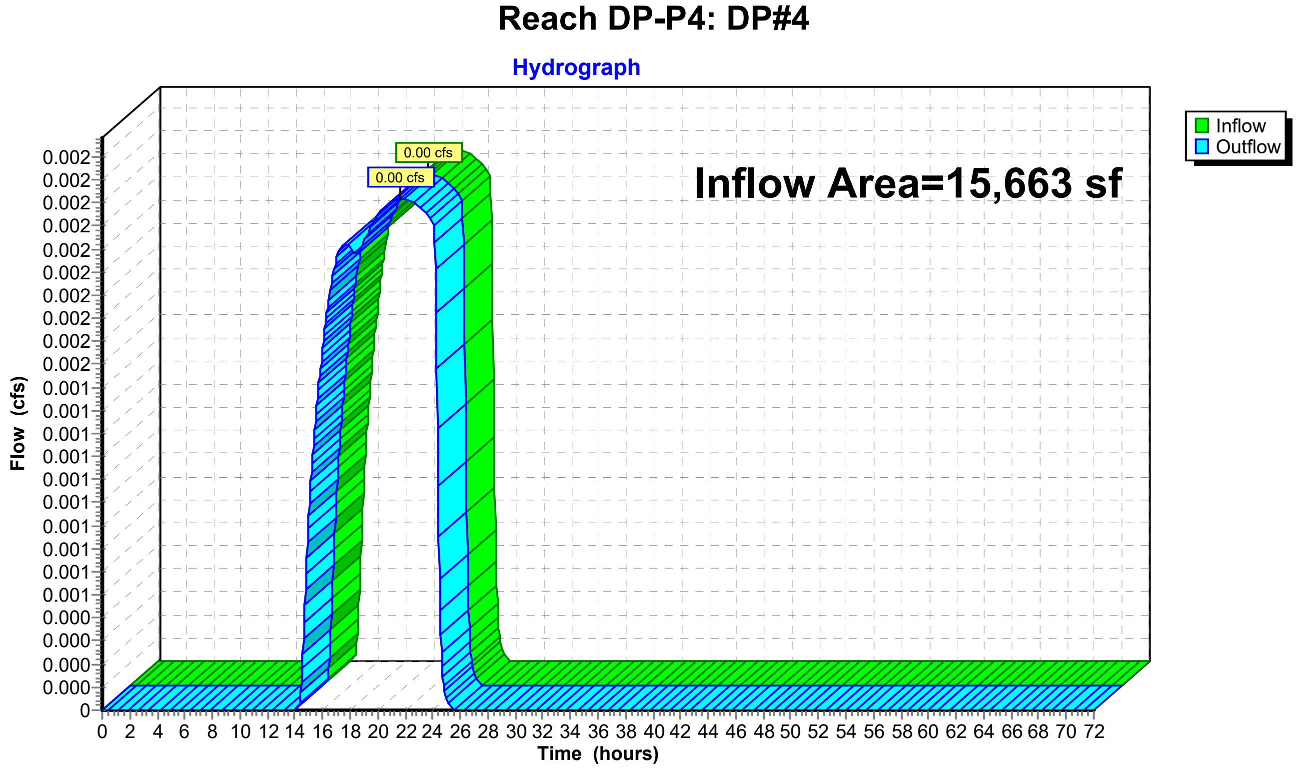


Summary for Reach DP-P4: DP#4

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

Inflow Area =	15,663 sf,	0.00% Impervious, Inflow Depth = 0.05"	for 25-year event
Inflow =	0.00 cfs @ 21.64 hrs, Volume=	69 cf	
Outflow =	0.00 cfs @ 21.64 hrs, Volume=	69 cf, Atten= 0%, Lag= 0.0 min	

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

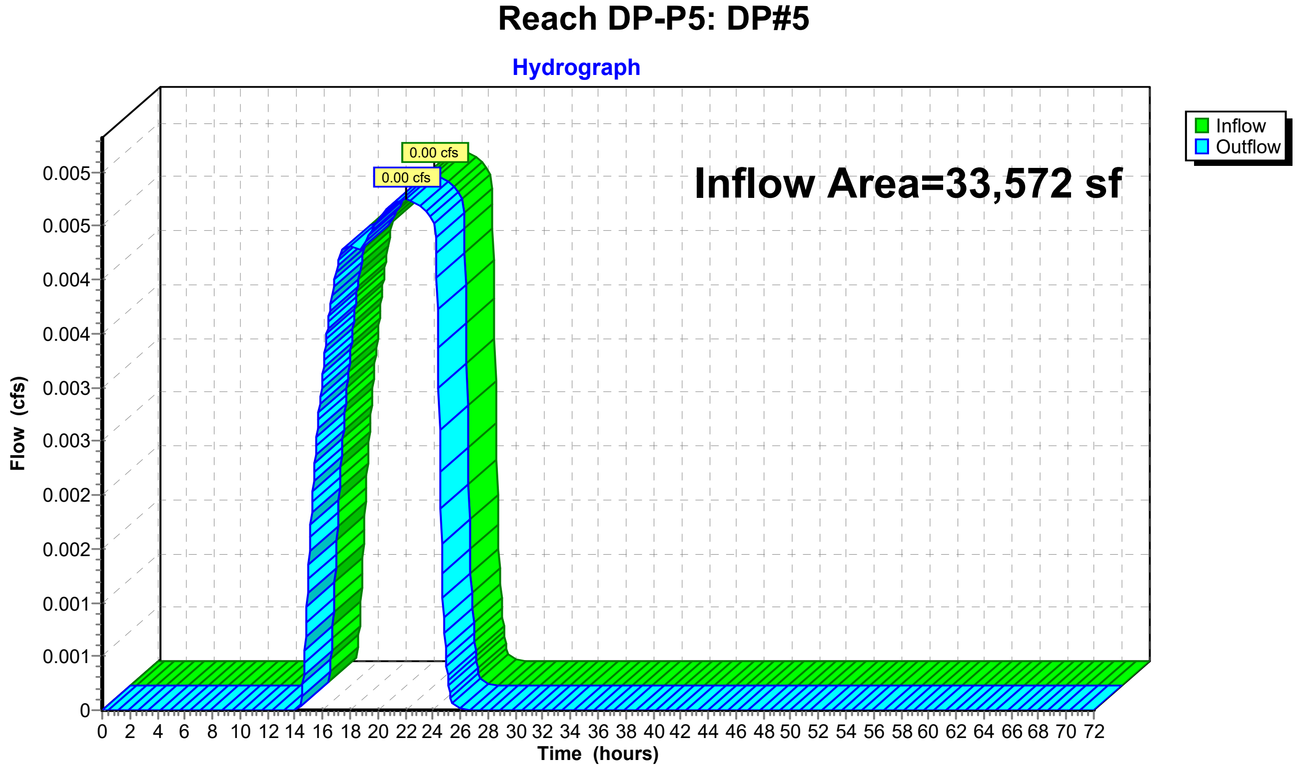


Summary for Reach DP-P5: DP#5

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

Inflow Area =	33,572 sf,	0.00% Impervious, Inflow Depth = 0.05"	for 25-year event
Inflow =	0.00 cfs @	22.00 hrs, Volume=	147 cf
Outflow =	0.00 cfs @	22.00 hrs, Volume=	147 cf, Atten= 0%, Lag= 0.0 min

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

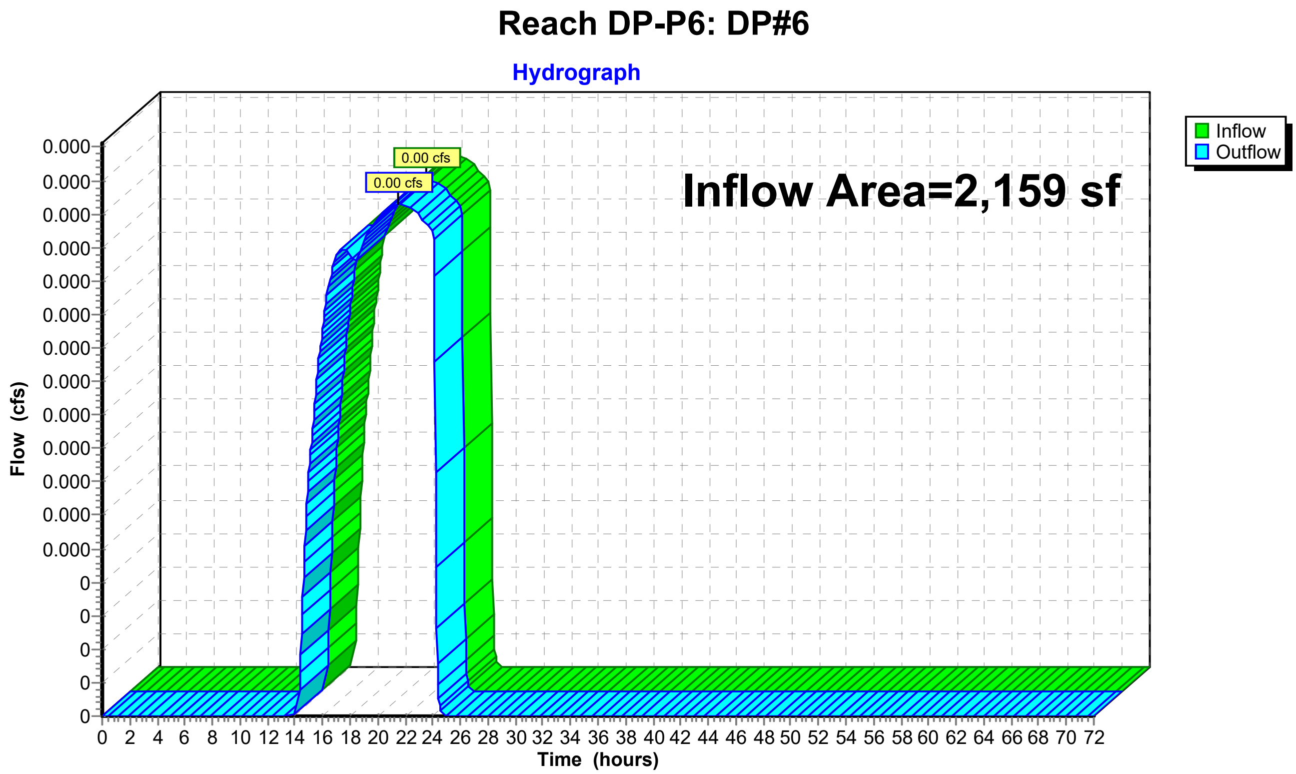


Summary for Reach DP-P6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious,	Inflow Depth = 0.05"	for 25-year event
Inflow =	0.00 cfs @	21.54 hrs, Volume=	9 cf	
Outflow =	0.00 cfs @	21.54 hrs, Volume=	9 cf, Atten= 0%, Lag= 0.0 min	

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

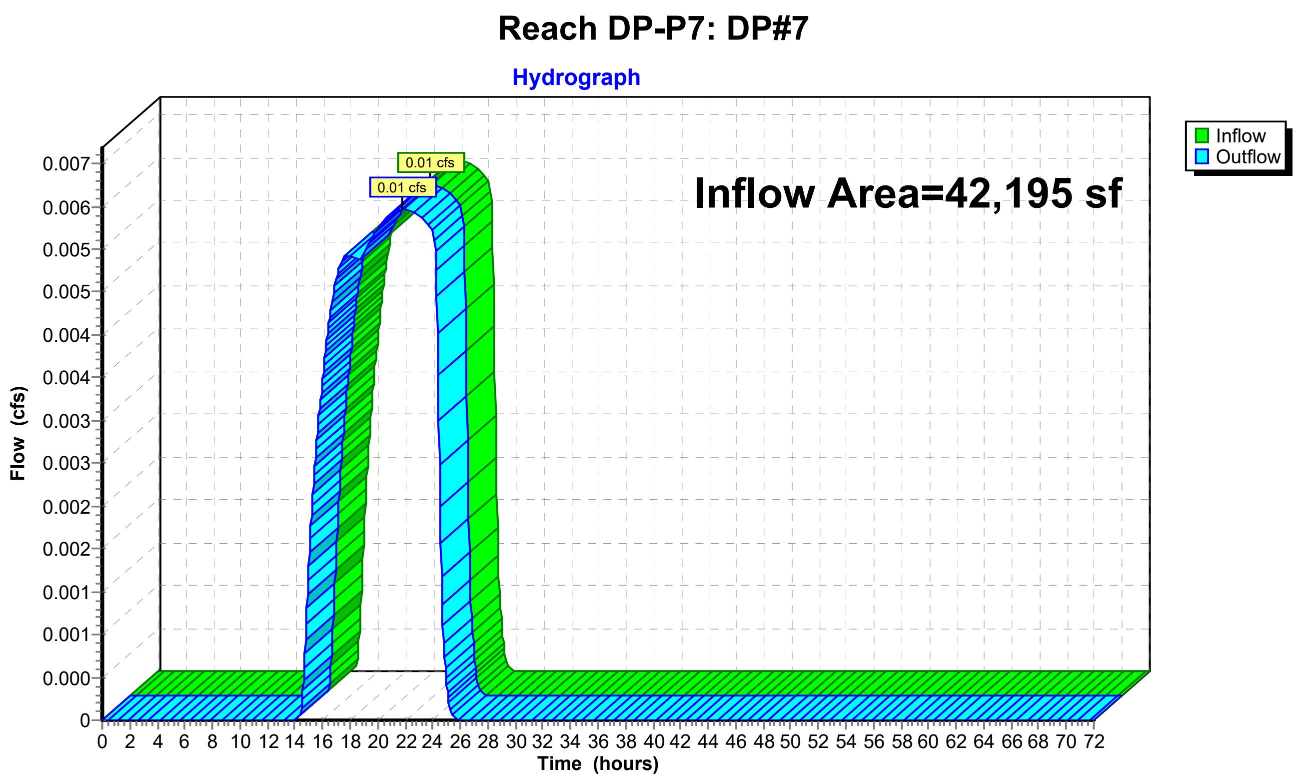


Summary for Reach DP-P7: DP#7

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

Inflow Area = 42,195 sf, 0.00% Impervious, Inflow Depth = 0.05" for 25-year event
Inflow = 0.01 cfs @ 21.84 hrs, Volume= 185 cf
Outflow = 0.01 cfs @ 21.84 hrs, Volume= 185 cf, Atten= 0%, Lag= 0.0 min

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



Summary for Pond 44P: StormTech Chambers

Inflow Area =	8,096 sf, 84.47% Impervious,	Inflow Depth = 4.33"	for 25-year event	
Inflow =	0.87 cfs @	12.13 hrs, Volume=	2,919 cf	
Outflow =	0.04 cfs @	10.65 hrs, Volume=	2,919 cf,	Atten= 96%, Lag= 0.0 min
Discarded =	0.04 cfs @	10.65 hrs, Volume=	2,919 cf	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 100.51' @ 14.74 hrs Surf.Area= 0.037 ac Storage= 0.034 af

Plug-Flow detention time= 357.8 min calculated for 2,917 cf (100% of inflow)
Center-of-Mass det. time= 357.8 min (1,159.8 - 802.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.026 af	**34.75'W x 46.34'L x 3.50'H Field A** 0.129 af Overall - 0.044 af Embedded = 0.085 af x 30.0% Voids
#2A	99.50'	0.044 af	**ADS_StormTech SC-740 +Cap** x 42 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 7 Rows of 6 Chambers
		0.070 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 10.65 hrs HW=99.04' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 44P: StormTech Chambers - Chamber Wizard Field A

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

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

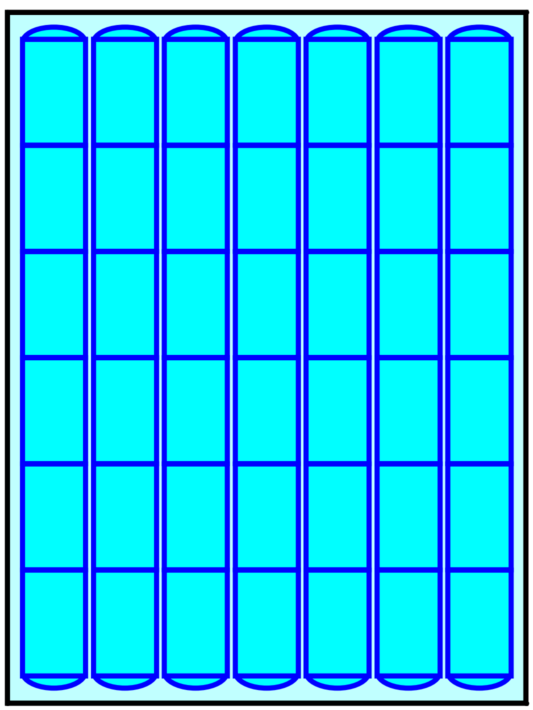
6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

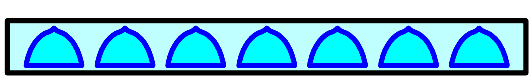
42 Chambers x 45.9 cf = 1,929.5 cf Chamber Storage

5,635.7 cf Field - 1,929.5 cf Chambers = 3,706.2 cf Stone x 30.0% Voids = 1,111.9 cf Stone Storage

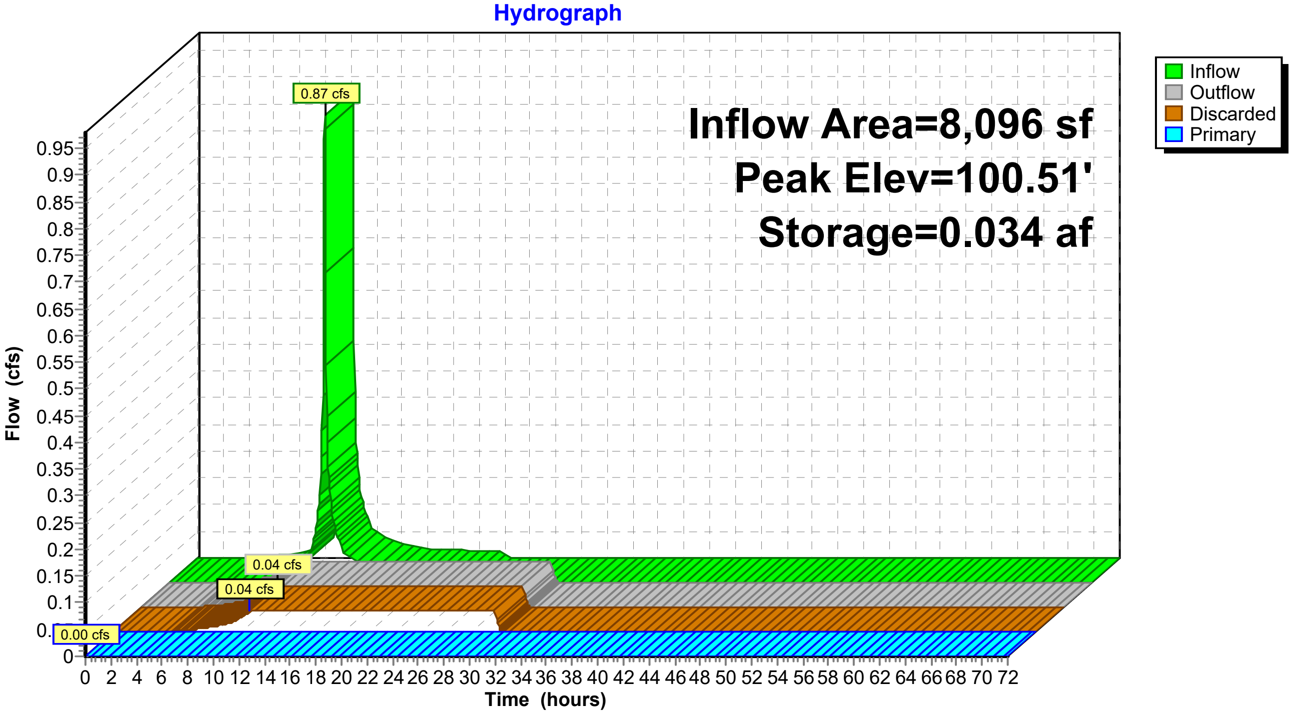
Chamber Storage + Stone Storage = 3,041.3 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 46.34' x 34.75' x 3.50'

42 Chambers
208.7 cy Field
137.3 cy Stone

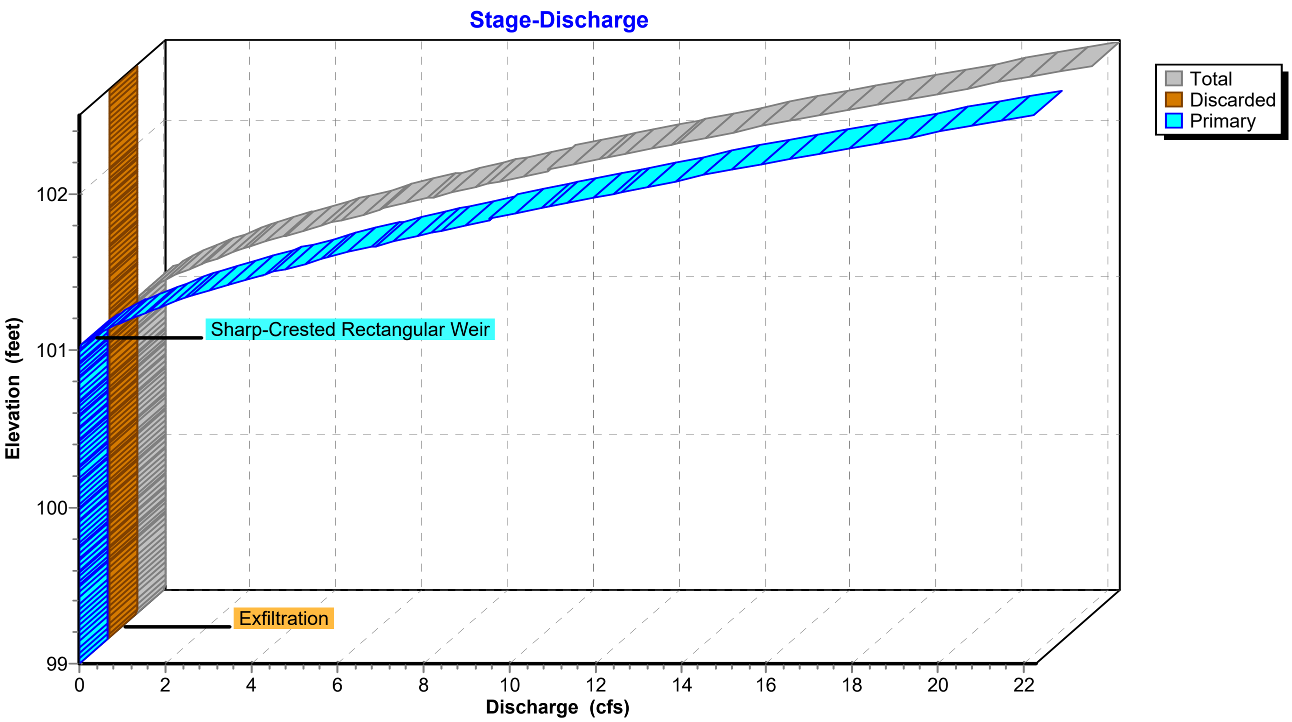




Pond 44P: StormTech Chambers



Pond 44P: StormTech Chambers



Summary for Pond 55P: StormTech Chambers

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.037 af	**39.50'W x 60.58'L x 3.50'H Field A** 0.192 af Overall - 0.067 af Embedded = 0.125 af x 30.0% Voids
#2A	99.50'	0.067 af	**ADS_StormTech SC-740 +Cap** x 64 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 8 Rows of 8 Chambers
		0.105 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.33'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 55P: StormTech Chambers - Chamber Wizard Field A

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

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

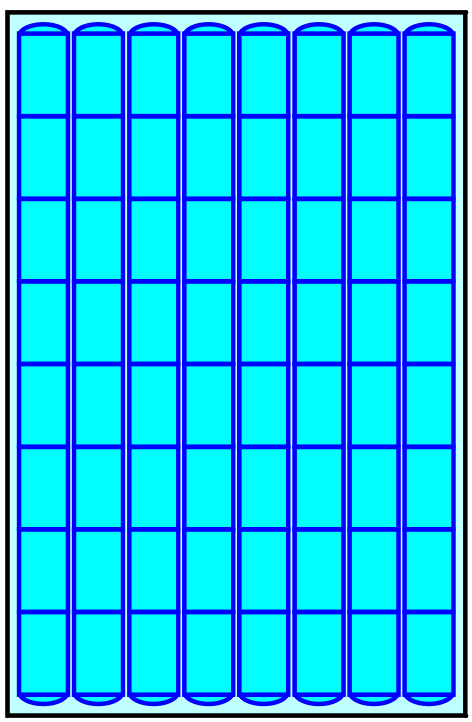
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

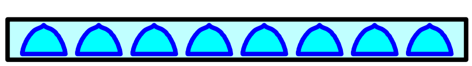
64 Chambers x 45.9 cf = 2,940.2 cf Chamber Storage

8,374.7 cf Field - 2,940.2 cf Chambers = 5,434.6 cf Stone x 30.0% Voids = 1,630.4 cf Stone Storage

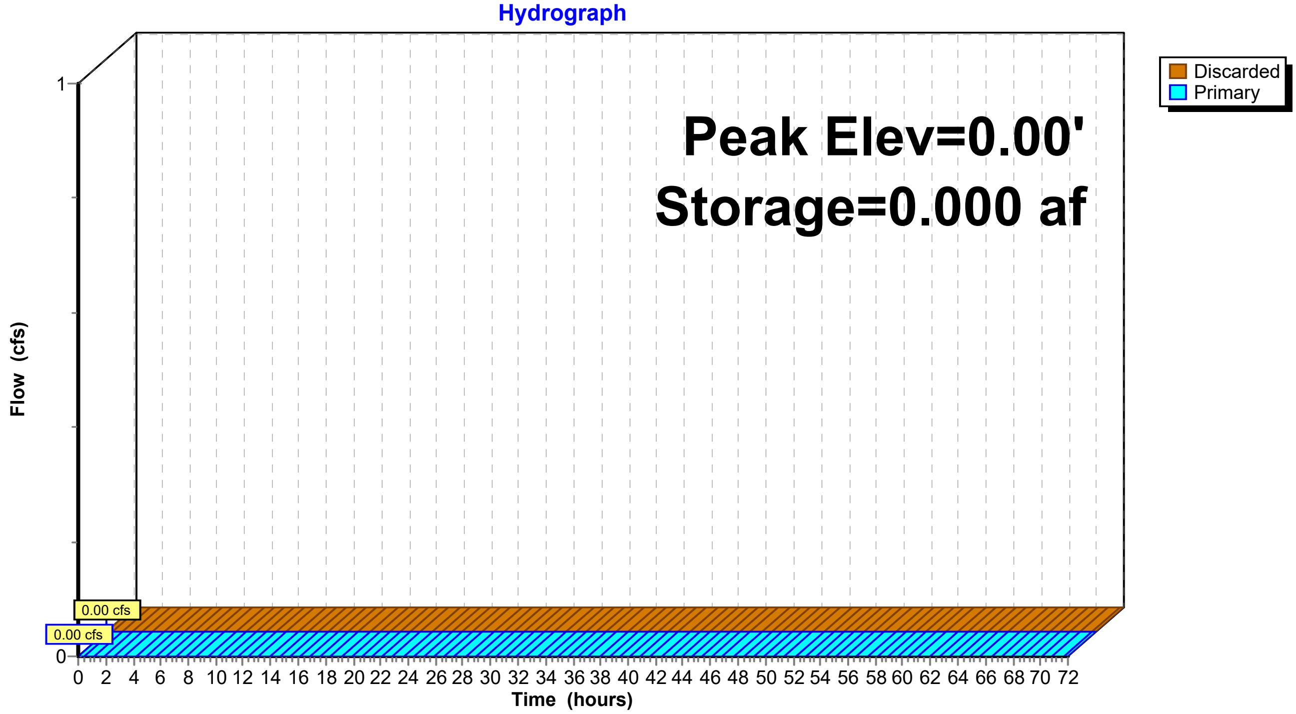
Chamber Storage + Stone Storage = 4,570.5 cf = 0.105 af
Overall Storage Efficiency = 54.6%
Overall System Size = 60.58' x 39.50' x 3.50'

64 Chambers
310.2 cy Field
201.3 cy Stone

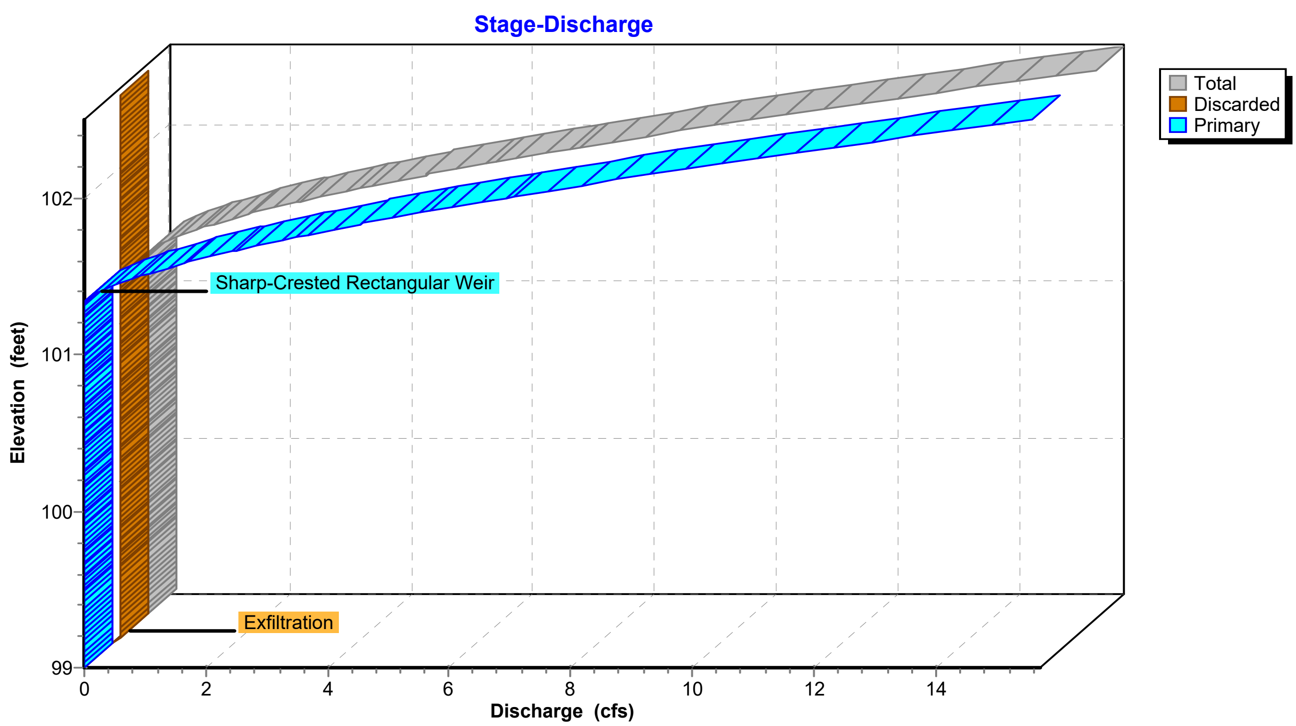




Pond 55P: StormTech Chambers



Pond 55P: StormTech Chambers



Summary for Pond 56P: Pipe Storage

Inflow Area = 2,578 sf,100.00% Impervious, Inflow Depth = 5.56" for 25-year event
Inflow = 0.32 cfs @ 12.13 hrs, Volume= 1,195 cf
Outflow = 0.01 cfs @ 9.70 hrs, Volume= 1,195 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.01 cfs @ 9.70 hrs, Volume= 1,195 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 100.97' @ 14.67 hrs Surf.Area= 0.013 ac Storage= 0.013 af

Plug-Flow detention time= 355.5 min calculated for 1,194 cf (100% of inflow)
Center-of-Mass det. time= 355.5 min (1,102.3 - 746.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.009 af	**9.13'W x 61.50'L x 2.75'H Field A** 0.035 af Overall - 0.009 af Embedded = 0.026 af x 35.0% Voids
#2A	99.50'	0.007 af	**ADS N-12 18"** x 9 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 3 Chambers
		0.017 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	101.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 9.70 hrs HW=99.03' (Free Discharge)
└—**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=99.00' (Free Discharge)
├—**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 56P: Pipe Storage - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 14.3" Spacing = 35.3" C-C Row Spacing

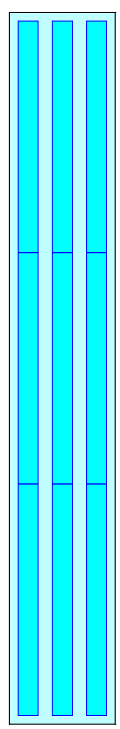
3 Chambers/Row x 20.00' Long = 60.00' Row Length +9.0" End Stone x 2 = 61.50' Base Length
3 Rows x 21.0" Wide + 14.3" Spacing x 2 + 9.0" Side Stone x 2 = 9.13' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

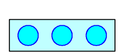
9 Chambers x 36.0 cf = 324.0 cf Chamber Storage
9 Chambers x 44.5 cf = 400.7 cf Displacement

1,545.3 cf Field - 400.7 cf Chambers = 1,144.5 cf Stone x 35.0% Voids = 400.6 cf Stone Storage

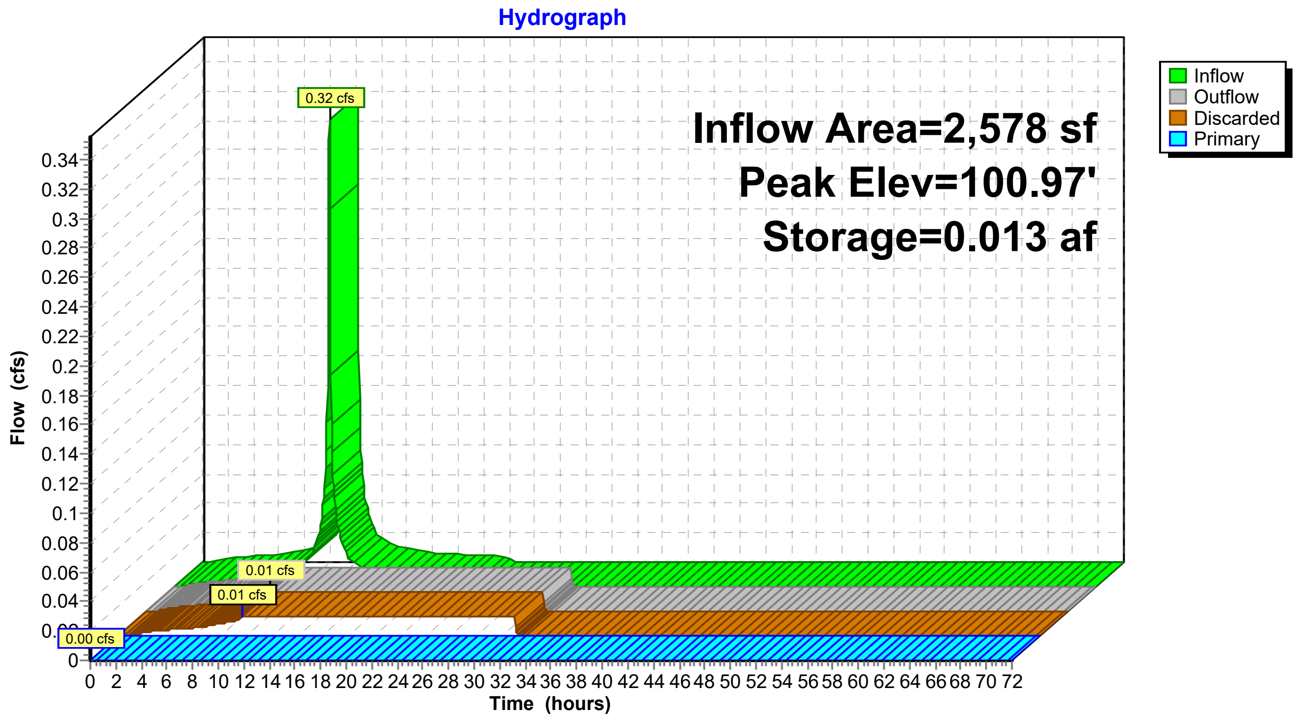
Chamber Storage + Stone Storage = 724.6 cf = 0.017 af
Overall Storage Efficiency = 46.9%
Overall System Size = 61.50' x 9.13' x 2.75'

9 Chambers
57.2 cy Field
42.4 cy Stone

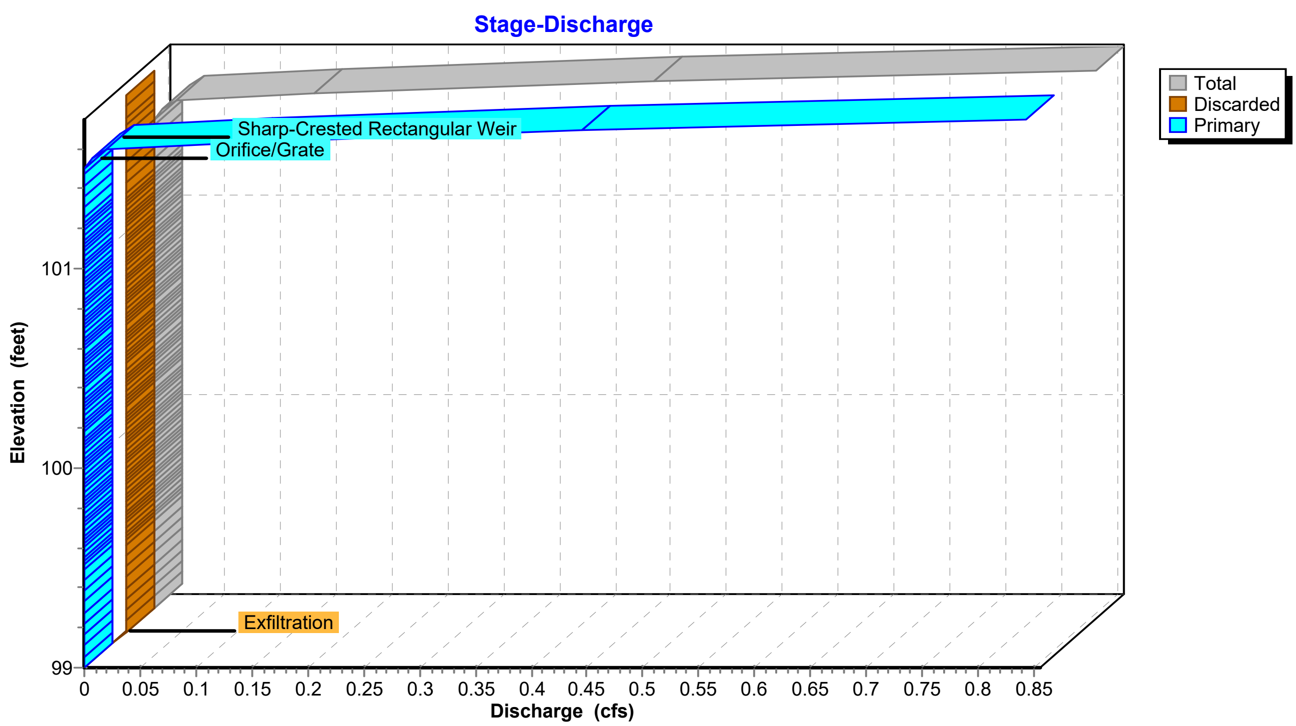




Pond 56P: Pipe Storage



Pond 56P: Pipe Storage



Summary for Pond 59P: Rain Garden

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=3)

Inflow Area =	49,215 sf, 33.87% Impervious,	Inflow Depth = 1.56"	for 25-year event
Inflow =	1.65 cfs @ 12.13 hrs,	Volume= 6,386 cf	
Outflow =	1.02 cfs @ 12.05 hrs,	Volume= 6,386 cf,	Atten= 38%, Lag= 0.0 min
Discarded =	1.02 cfs @ 12.05 hrs,	Volume= 6,386 cf	
Primary =	0.00 cfs @ 0.00 hrs,	Volume= 0 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 97.28' @ 12.21 hrs Surf.Area= 1,135 sf Storage= 252 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.7 min (771.7 - 771.0)

Volume	Invert	Avail.Storage	Storage Description
#1	97.00'	5,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

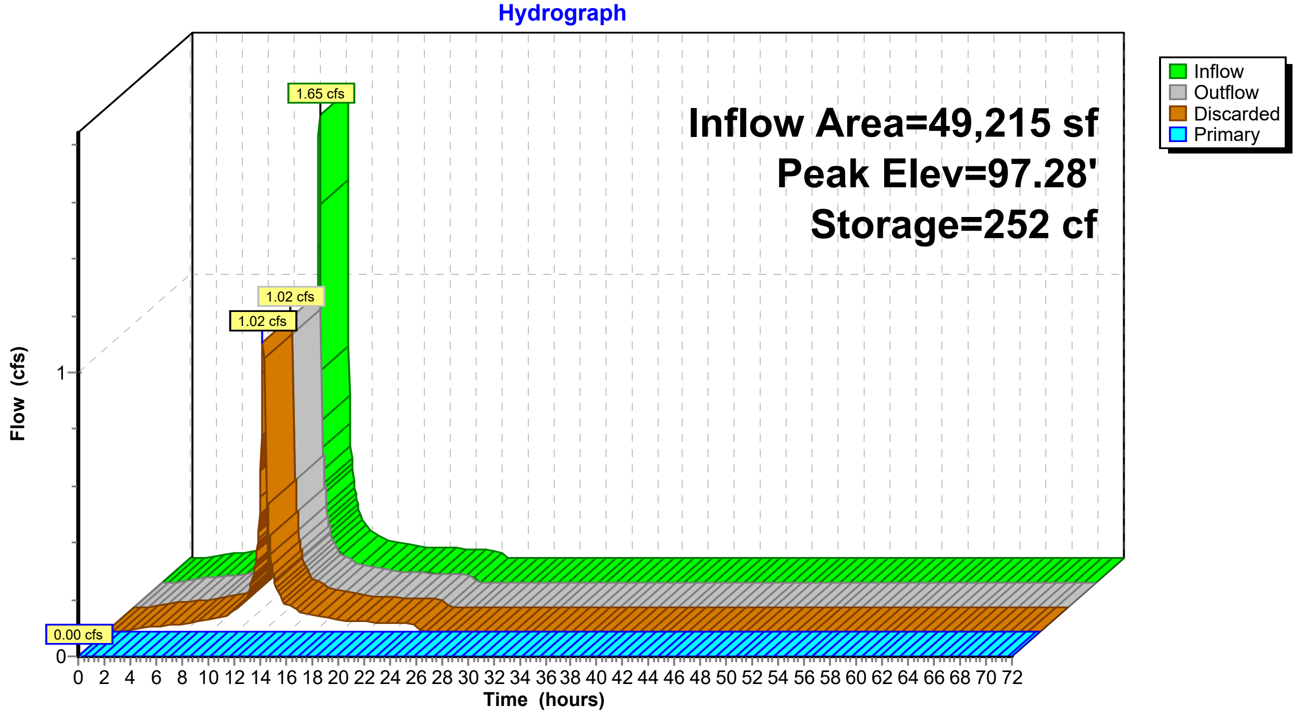
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	655	0	0
98.00	2,362	1,509	1,509
99.00	4,876	3,619	5,128

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	**1.02 cfs Exfiltration at all elevations**
#2	Primary	98.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** 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

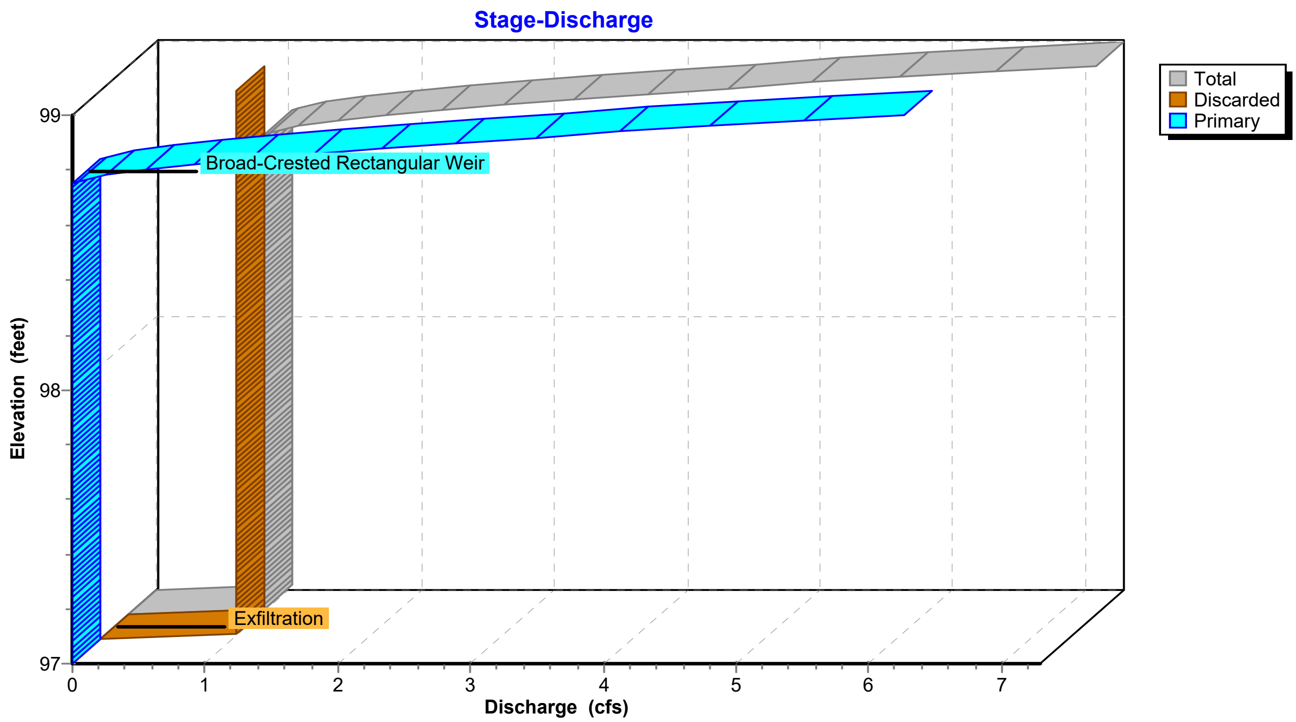
Discarded OutFlow Max=1.02 cfs @ 12.05 hrs HW=97.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=97.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 59P: Rain Garden



Pond 59P: Rain Garden



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

SubcatchmentPS1: PDA-1 Runoff Area=6,708 sf 1.37% Impervious Runoff Depth=0.28"
Flow Length=75' Slope=0.0400 '/' Tc=16.8 min CN=31 Runoff=0.01 cfs 157 cf

SubcatchmentPS2A: PDA-2A Runoff Area=8,096 sf 84.47% Impervious Runoff Depth=5.58"
Tc=6.0 min CN=87 Runoff=1.11 cfs 3,762 cf

SubcatchmentPS4: PDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.01 cfs 300 cf

SubcatchmentPS5: PDA-5 Runoff Area=33,572 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.02 cfs 643 cf

SubcatchmentPS6: PDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.00 cfs 41 cf

SubcatchmentPS7: PDA-7 Runoff Area=42,195 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=30 Runoff=0.03 cfs 808 cf

SubcatchmentPSA3A: PSA-3A Runoff Area=33,204 sf 2.76% Impervious Runoff Depth=0.34"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=32 Runoff=0.05 cfs 933 cf

SubcatchmentPSA3B: PSA-3B Runoff Area=13,433 sf 98.05% Impervious Runoff Depth=6.74"
Flow Length=130' Slope=0.0150 '/' Tc=6.0 min CN=97 Runoff=2.02 cfs 7,547 cf

SubcatchmentPSA3C: PSA-3C Runoff Area=2,578 sf 100.00% Impervious Runoff Depth=6.86"
Tc=6.0 min CN=98 Runoff=0.39 cfs 1,474 cf

SubcatchmentPSB: PDA-2B Runoff Area=5,221 sf 47.75% Impervious Runoff Depth=2.87"
Flow Length=112' Slope=0.0440 '/' Tc=6.0 min CN=62 Runoff=0.39 cfs 1,251 cf

Reach 2R: PROPOSED (NULL) Inflow=0.39 cfs 3,245 cf
Outflow=0.39 cfs 3,245 cf

Reach DP-P1: DP#1 Inflow=0.01 cfs 157 cf
Outflow=0.01 cfs 157 cf

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN Inflow=0.39 cfs 1,295 cf
Outflow=0.39 cfs 1,295 cf

Reach DP-P3: DP#3 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P4: DP#4 Inflow=0.01 cfs 300 cf
Outflow=0.01 cfs 300 cf

Reach DP-P5: DP#5 Inflow=0.02 cfs 643 cf
Outflow=0.02 cfs 643 cf

Reach DP-P6: DP#6 Inflow=0.00 cfs 41 cf
Outflow=0.00 cfs 41 cf

Reach DP-P7: DP#7 Inflow=0.03 cfs 808 cf
Outflow=0.03 cfs 808 cf

Pond 44P: StormTech Chambers Peak Elev=101.01' Storage=0.046 af Inflow=1.11 cfs 3,762 cf
Discarded=0.04 cfs 3,718 cf Primary=0.02 cfs 44 cf Outflow=0.05 cfs 3,762 cf

Pond 55P: StormTech Chambers Peak Elev=0.00' Storage=0.000 af
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Pond 56P: Pipe Storage Peak Elev=101.60' Storage=0.016 af Inflow=0.39 cfs 1,474 cf
Discarded=0.01 cfs 1,398 cf Primary=0.02 cfs 76 cf Outflow=0.03 cfs 1,474 cf

Pond 59P: Rain Garden Peak Elev=97.47' Storage=489 cf Inflow=2.02 cfs 8,556 cf
Discarded=1.02 cfs 8,556 cf Primary=0.00 cfs 0 cf Outflow=1.02 cfs 8,556 cf

Total Runoff Area = 162,829 sf Runoff Volume = 16,916 cf Average Runoff Depth = 1.25"
83.98% Pervious = 136,738 sf 16.02% Impervious = 26,091 sf

Summary for Subcatchment PS1: PDA-1

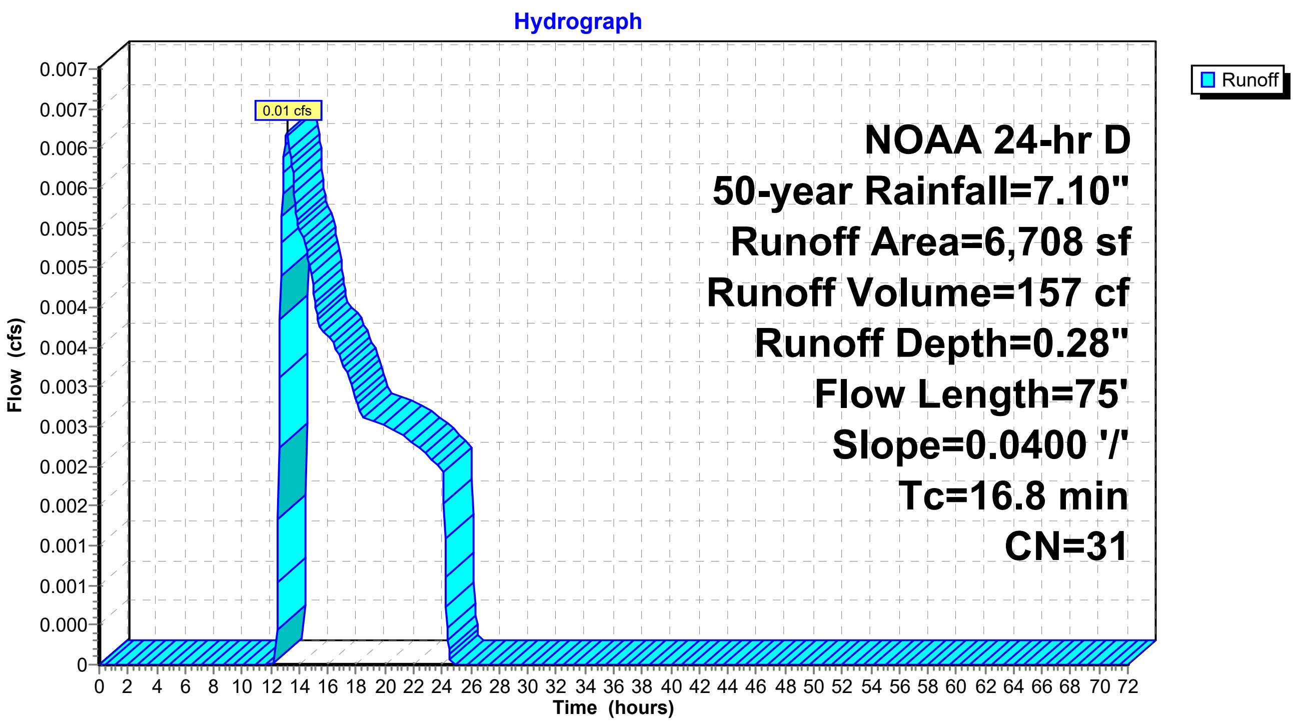
Runoff = 0.01 cfs @ 13.13 hrs, Volume= 157 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
92	98	Paved parking, HSG A
6,616	30	Woods, Good, HSG A
6,708	31	Weighted Average
6,616		98.63% Pervious Area
92		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.3	25	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.8	75	Total			

Subcatchment PS1: PDA-1



Summary for Subcatchment PS2A: PDA-2A

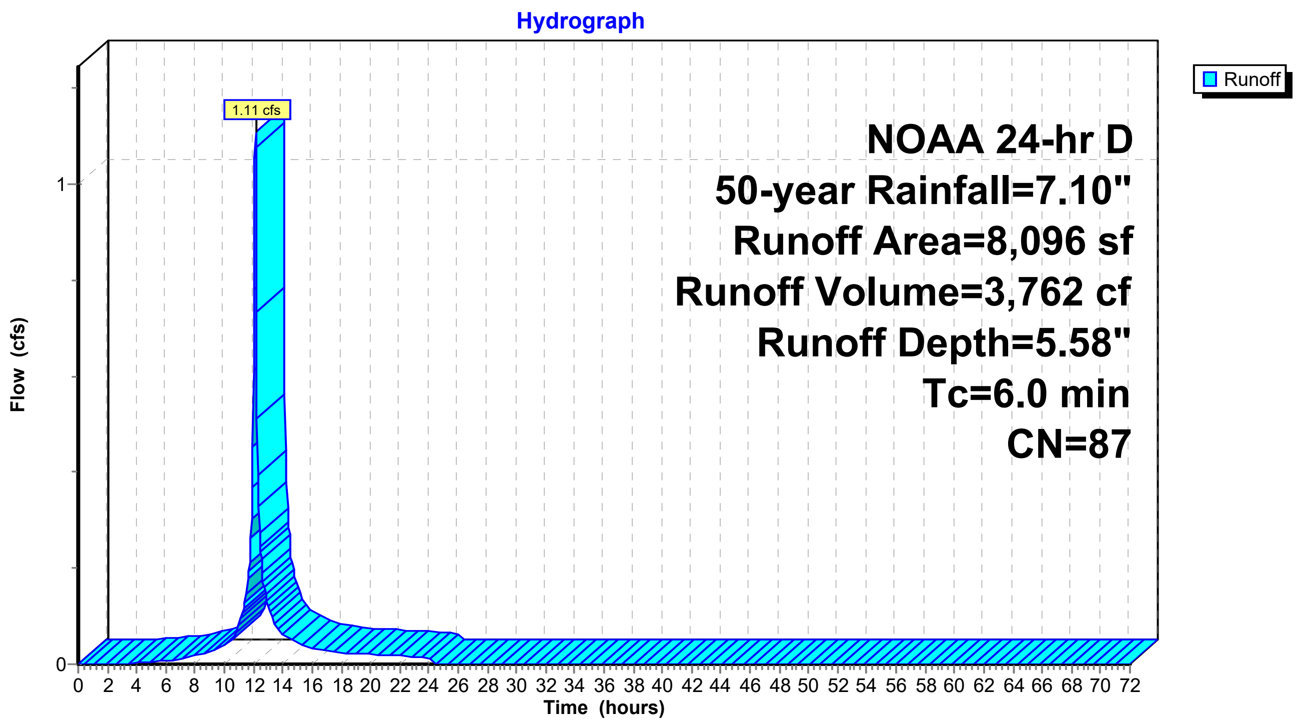
Runoff = 1.11 cfs @ 12.13 hrs, Volume= 3,762 cf, Depth= 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
3,491	98	Paved parking, HSG A
3,348	98	Roofs, HSG A
1,257	30	Woods, Good, HSG A
8,096	87	Weighted Average
1,257		15.53% Pervious Area
6,839		84.47% Impervious Area

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

Subcatchment PS2A: PDA-2A



Summary for Subcatchment PS4: PDA-4

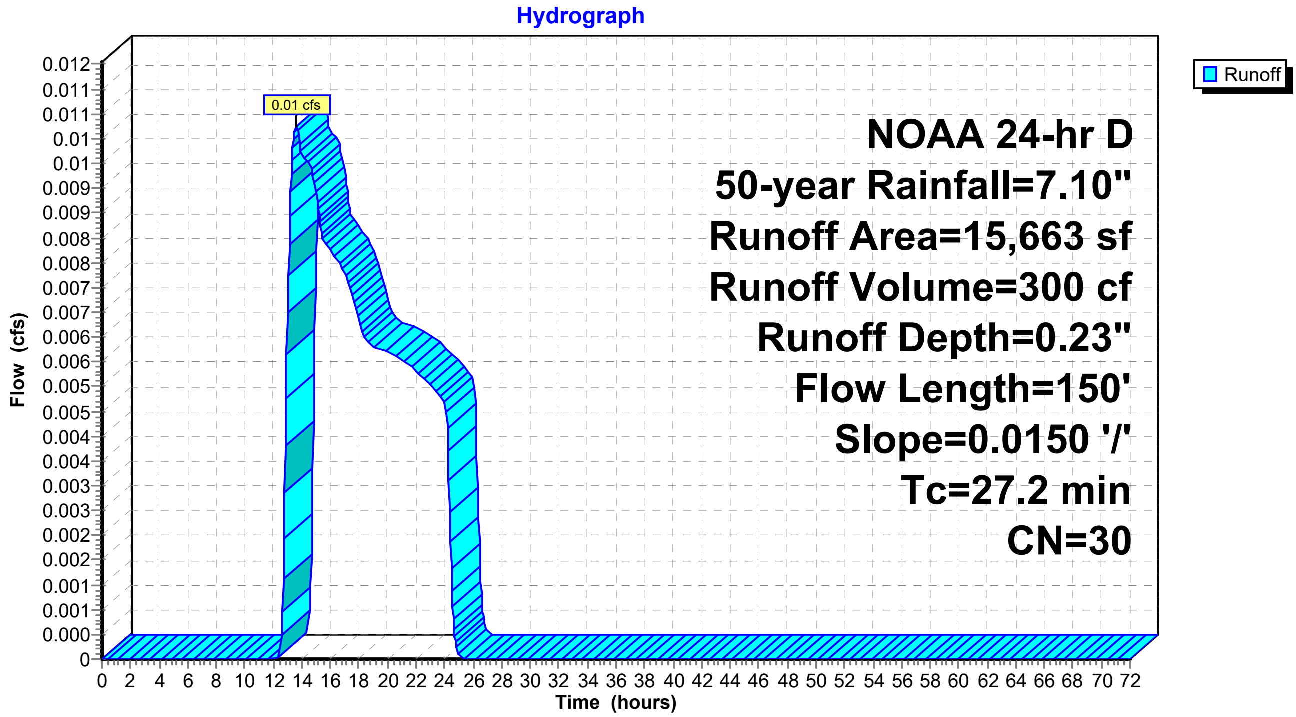
Runoff = 0.01 cfs @ 13.58 hrs, Volume= 300 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment PS4: PDA-4



Summary for Subcatchment PS5: PDA-5

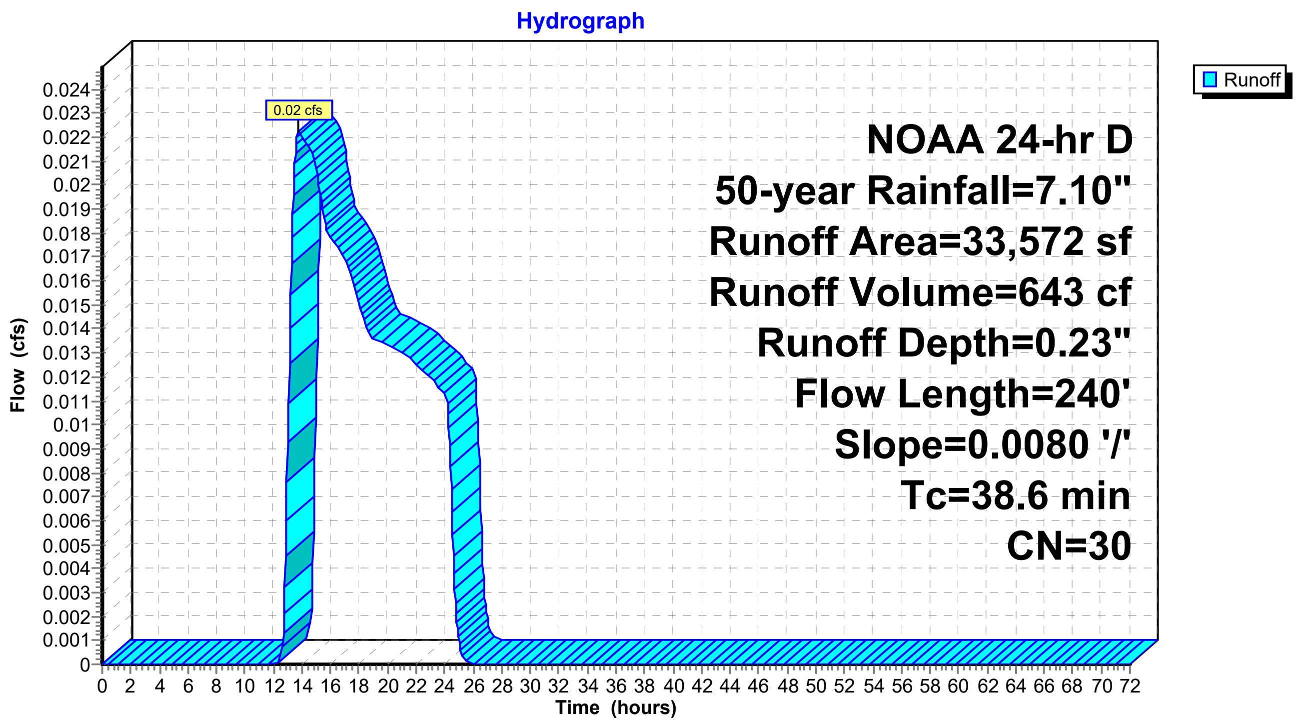
Runoff = 0.02 cfs @ 13.79 hrs, Volume= 643 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
33,572	30	Woods, Good, HSG A
33,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment PS5: PDA-5



Summary for Subcatchment PS6: PDA-6

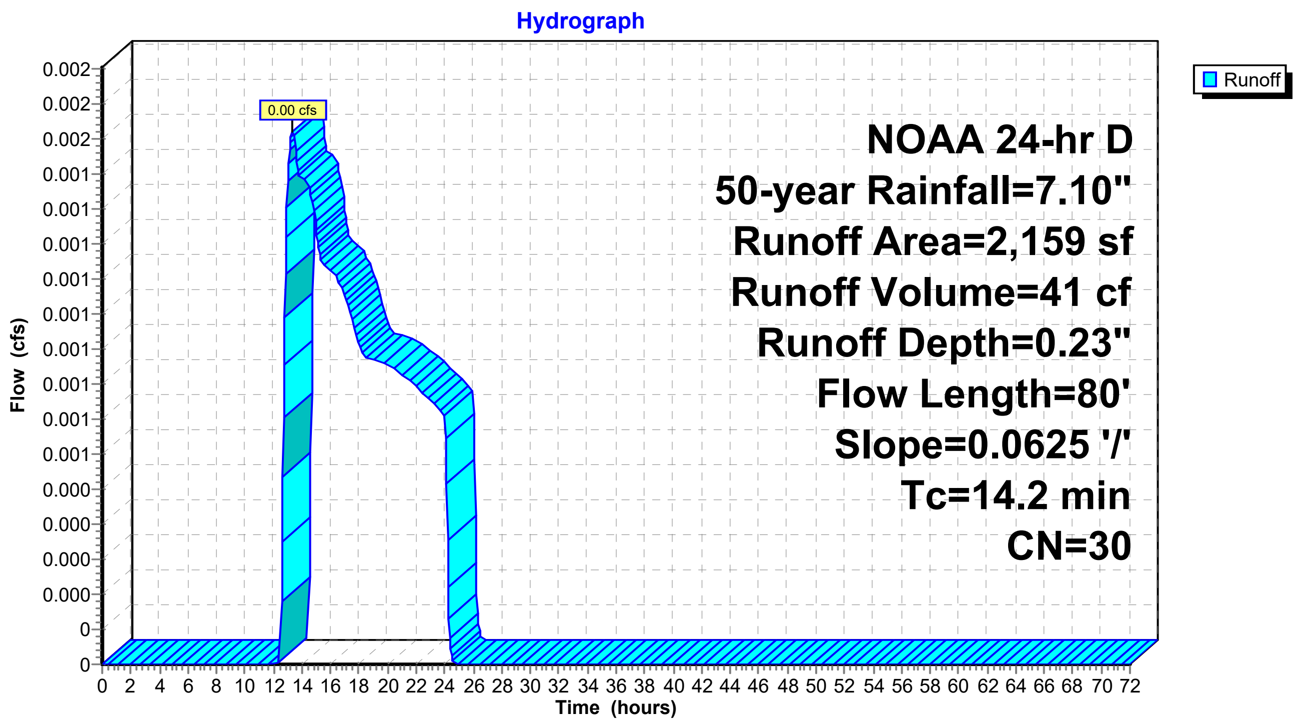
Runoff = 0.00 cfs @ 13.37 hrs, Volume= 41 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment PS6: PDA-6



Summary for Subcatchment PS7: PDA-7

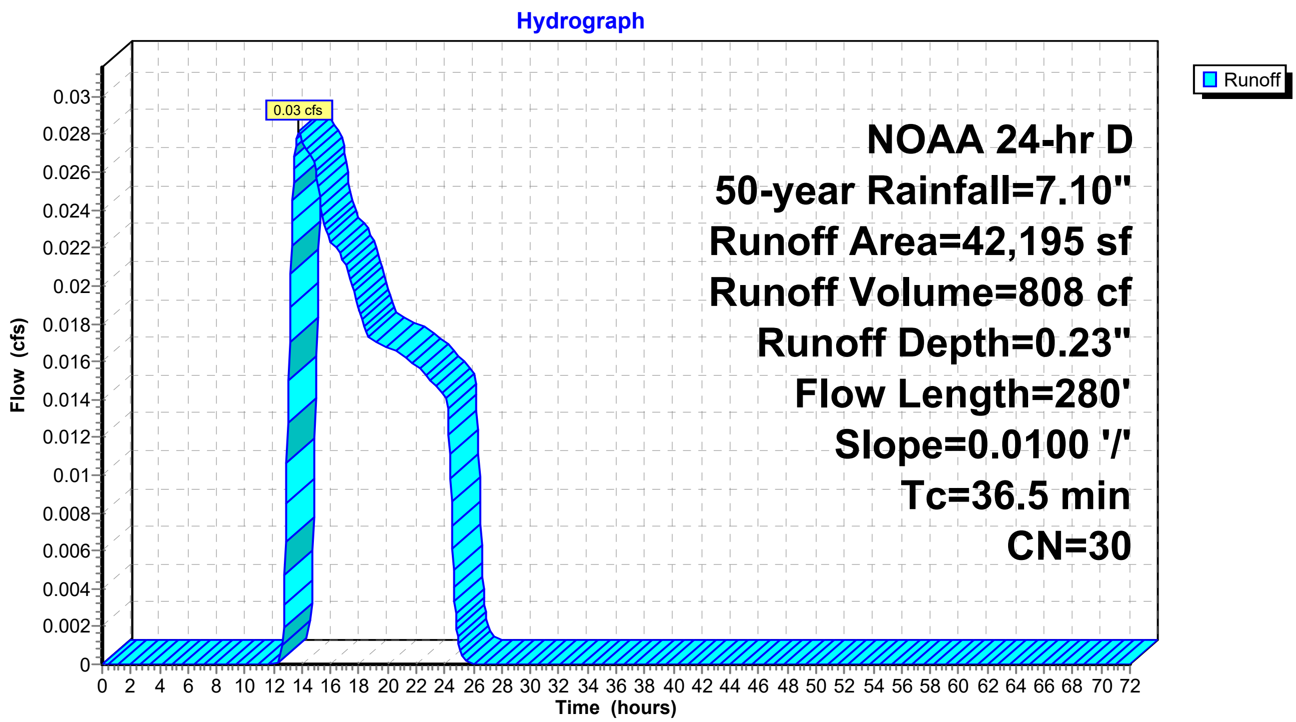
Runoff = 0.03 cfs @ 13.75 hrs, Volume= 808 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
42,195	30	Woods, Good, HSG A
42,195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment PS7: PDA-7



Summary for Subcatchment PSA3A: PSA-3A

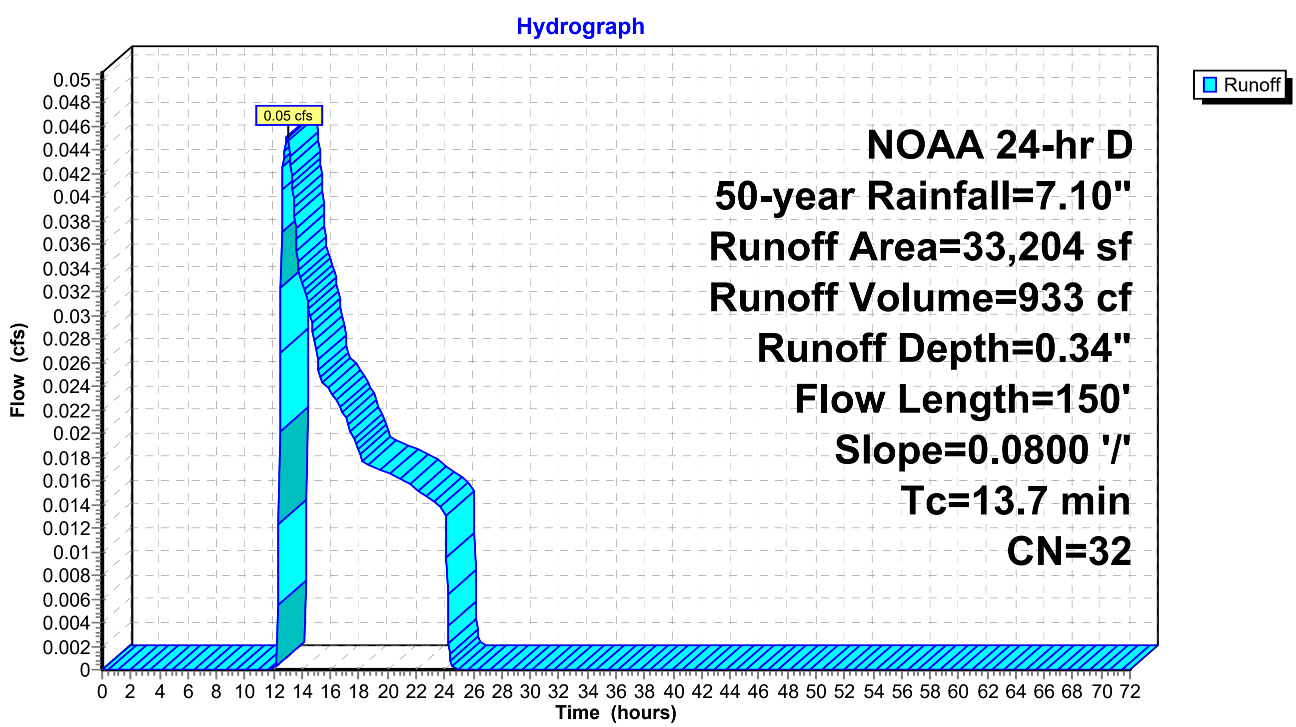
Runoff = 0.05 cfs @ 12.97 hrs, Volume= 933 cf, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
918	98	Paved parking, HSG A
32,286	30	Woods, Good, HSG A
33,204	32	Weighted Average
32,286		97.24% Pervious Area
918		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment PSA3A: PSA-3A



Summary for Subcatchment PSA3B: PSA-3B

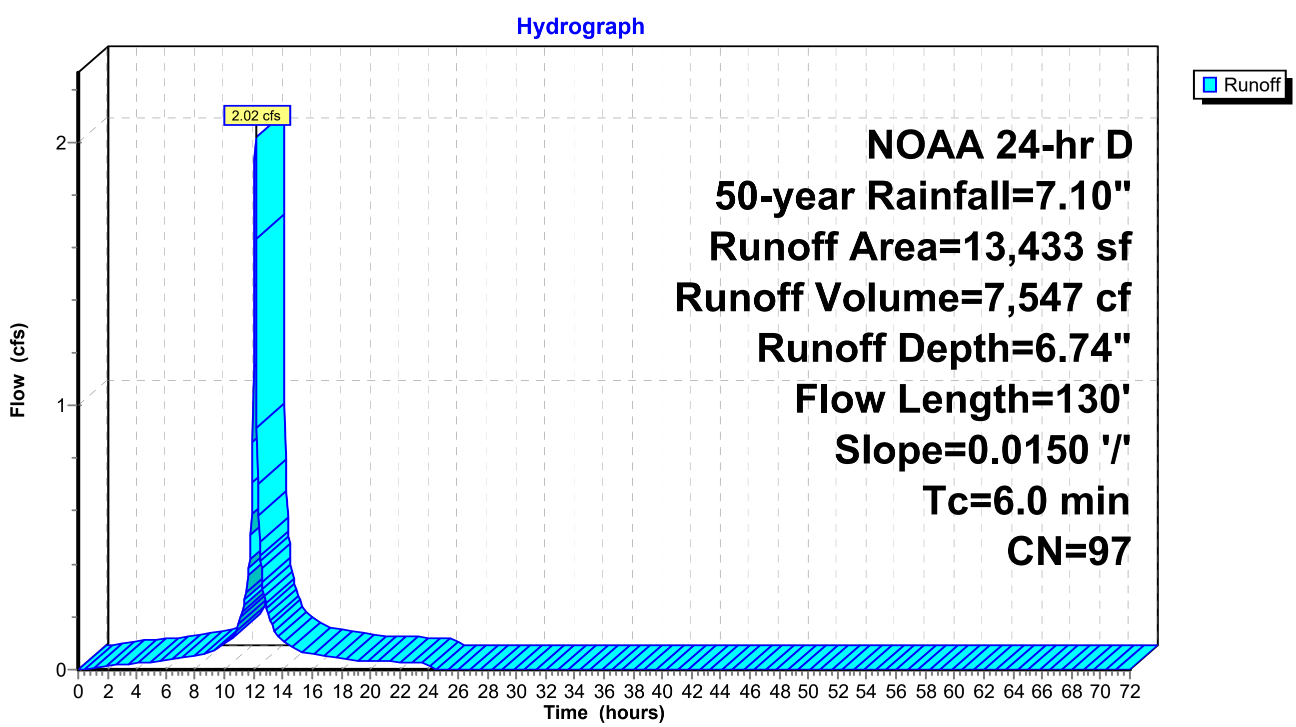
Runoff = 2.02 cfs @ 12.13 hrs, Volume= 7,547 cf, Depth= 6.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
13,171	98	Paved parking, HSG A
262	30	Woods, Good, HSG A
13,433	97	Weighted Average
262		1.95% Pervious Area
13,171		98.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.5	80	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSA3B: PSA-3B



Summary for Subcatchment PSA3C: PSA-3C

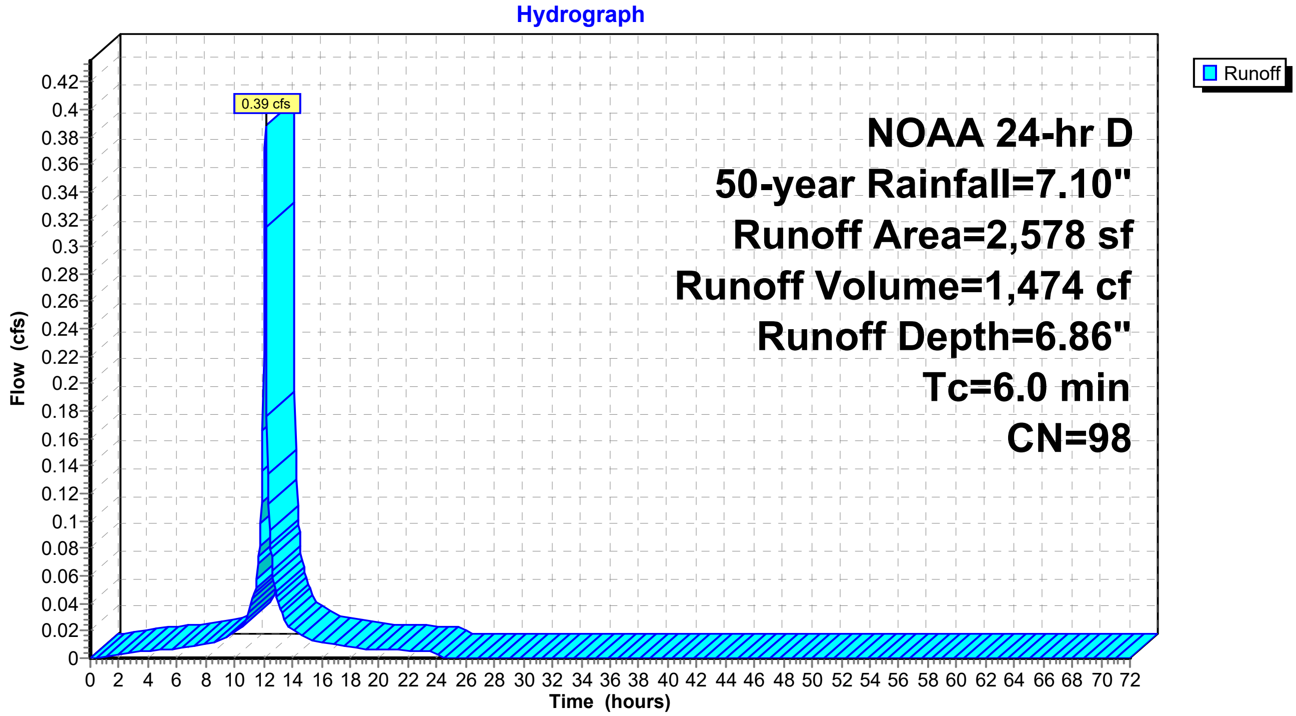
Runoff = 0.39 cfs @ 12.13 hrs, Volume= 1,474 cf, Depth= 6.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
2,578	98	Roofs, HSG A
2,578		100.00% Impervious Area

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

Subcatchment PSA3C: PSA-3C



Summary for Subcatchment PSB: PDA-2B

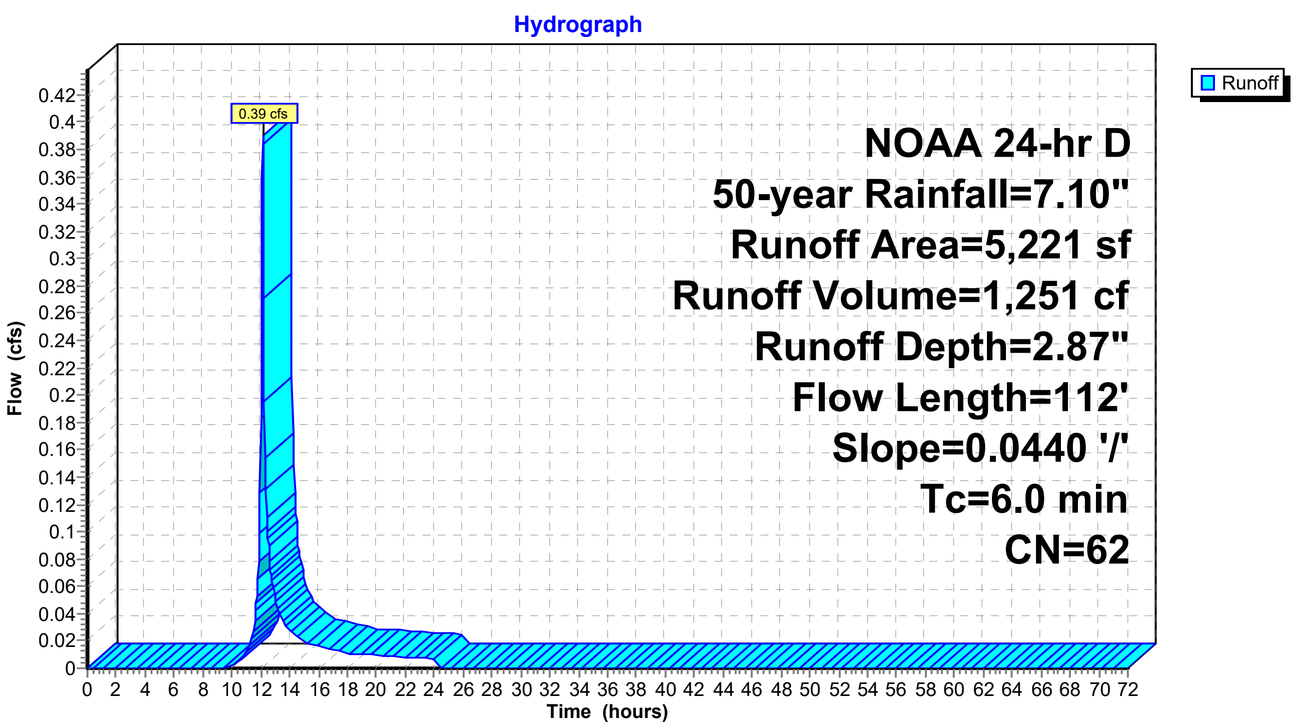
Runoff = 0.39 cfs @ 12.13 hrs, Volume= 1,251 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 50-year Rainfall=7.10"

Area (sf)	CN	Description
2,039	98	Paved parking, HSG A
2,728	30	Woods, Good, HSG A
454	98	Paved parking, HSG A
5,221	62	Weighted Average
2,728		52.25% Pervious Area
2,493		47.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0440	1.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.2	62	0.0440	4.26		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	112	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSB: PDA-2B



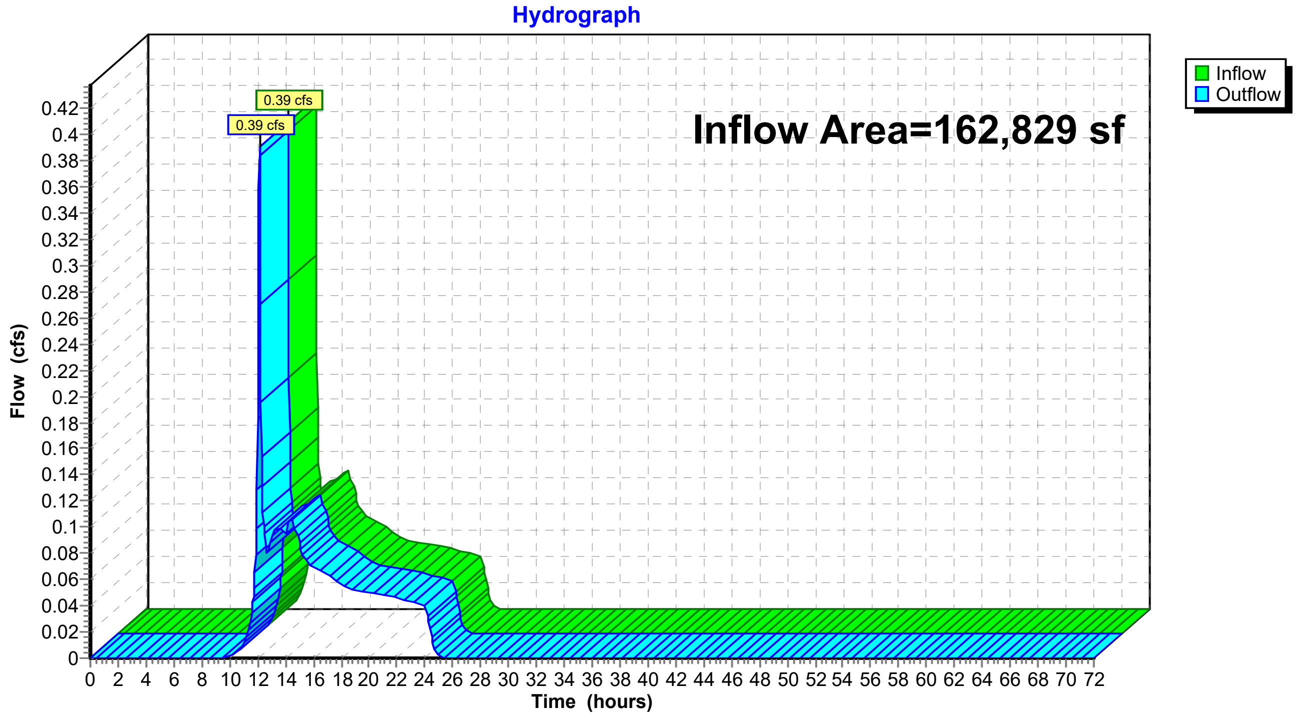
Summary for Reach 2R: PROPOSED (NULL)

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

Inflow Area = 162,829 sf, 16.02% Impervious, Inflow Depth = 0.24" for 50-year event
Inflow = 0.39 cfs @ 12.13 hrs, Volume= 3,245 cf
Outflow = 0.39 cfs @ 12.13 hrs, Volume= 3,245 cf, Atten= 0%, Lag= 0.0 min

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

Reach 2R: PROPOSED (NULL)



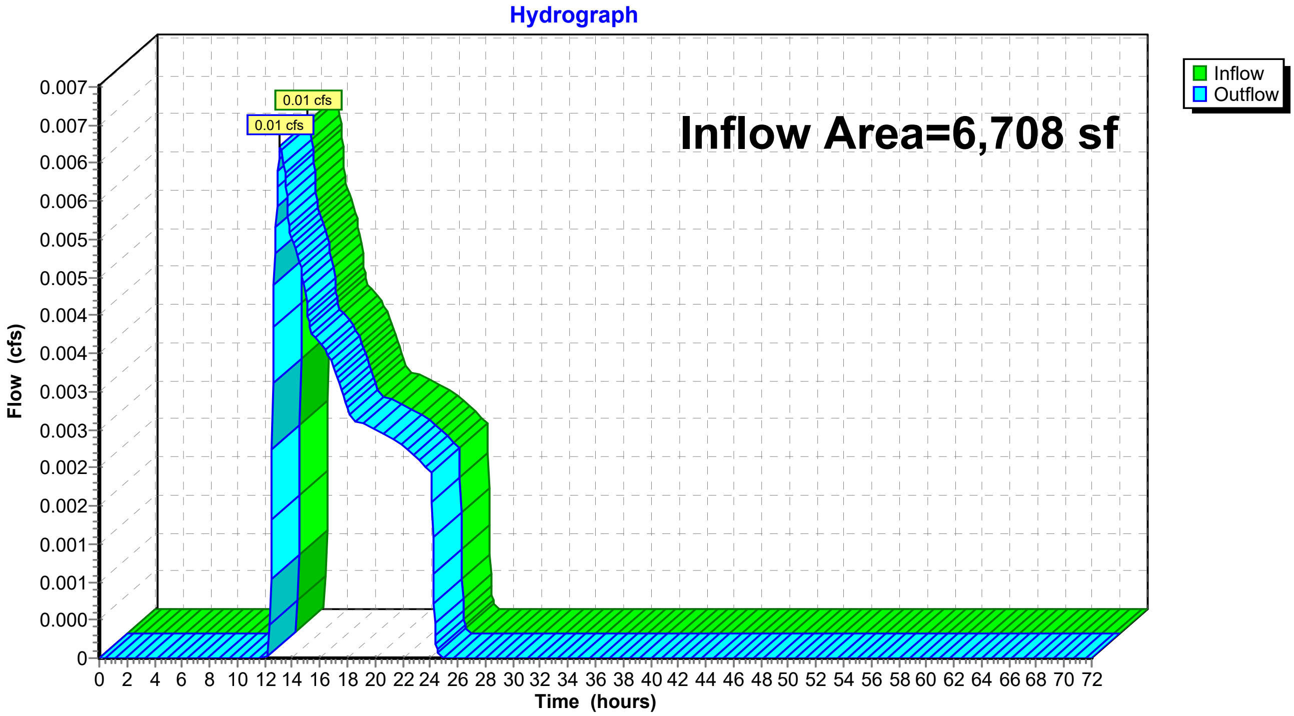
Summary for Reach DP-P1: DP#1

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

Inflow Area = 6,708 sf, 1.37% Impervious, Inflow Depth = 0.28" for 50-year event
Inflow = 0.01 cfs @ 13.13 hrs, Volume= 157 cf
Outflow = 0.01 cfs @ 13.13 hrs, Volume= 157 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P1: DP#1



Summary for Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN

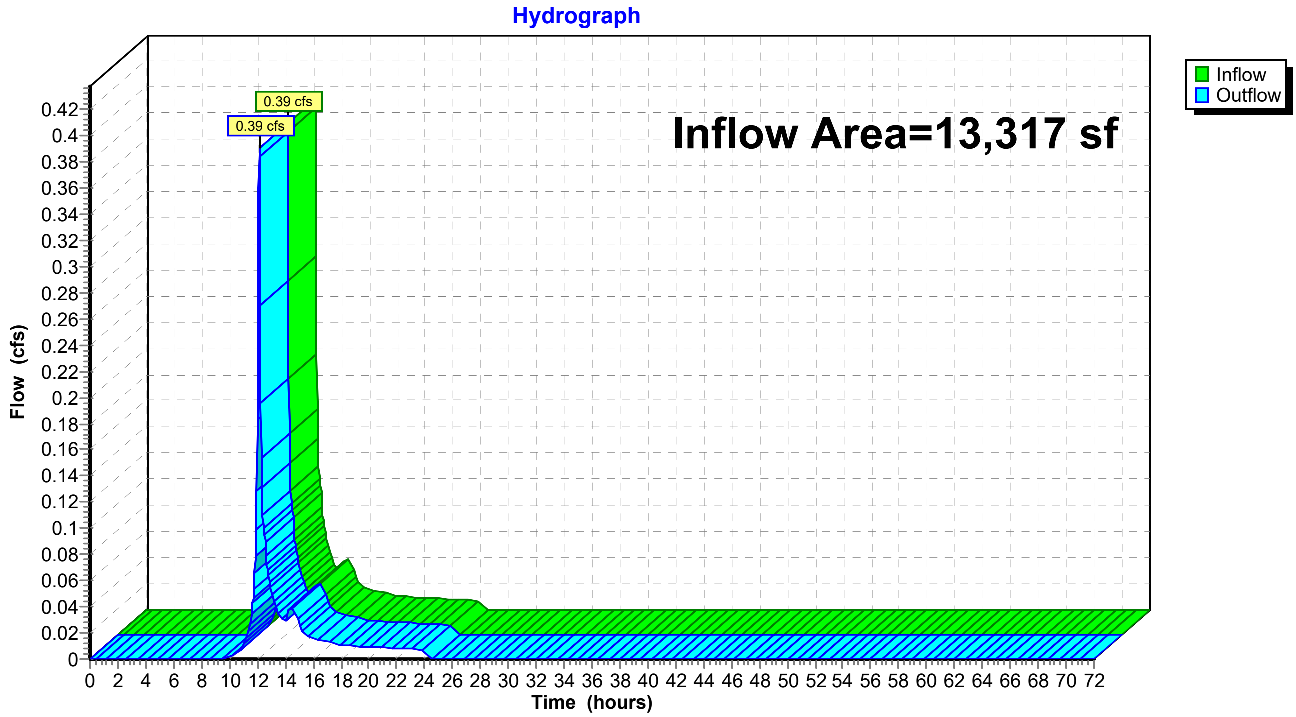
MAIN STREET CATCH BASIN

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

Inflow Area = 13,317 sf, 70.08% Impervious, Inflow Depth = 1.17" for 50-year event
Inflow = 0.39 cfs @ 12.13 hrs, Volume= 1,295 cf
Outflow = 0.39 cfs @ 12.13 hrs, Volume= 1,295 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN

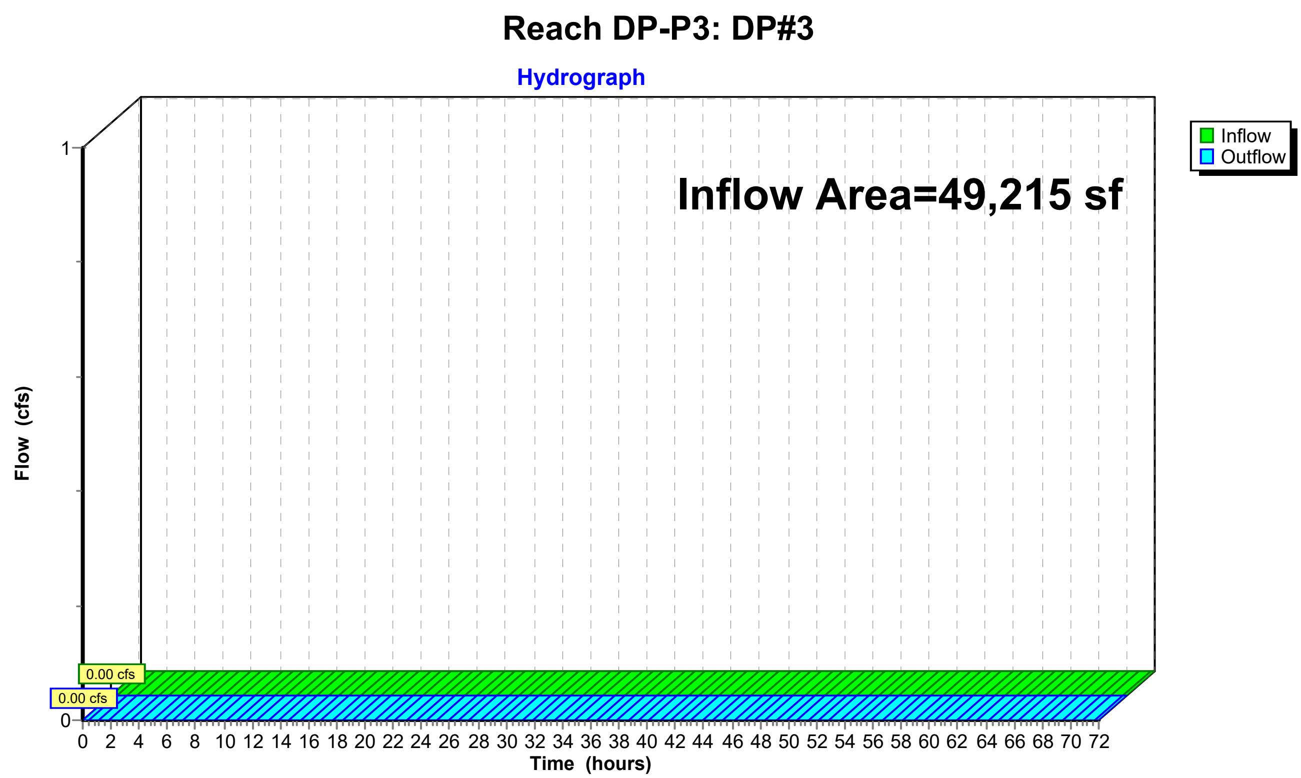


Summary for Reach DP-P3: DP#3

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

Inflow Area = 49,215 sf, 33.87% Impervious, Inflow Depth = 0.00" for 50-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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



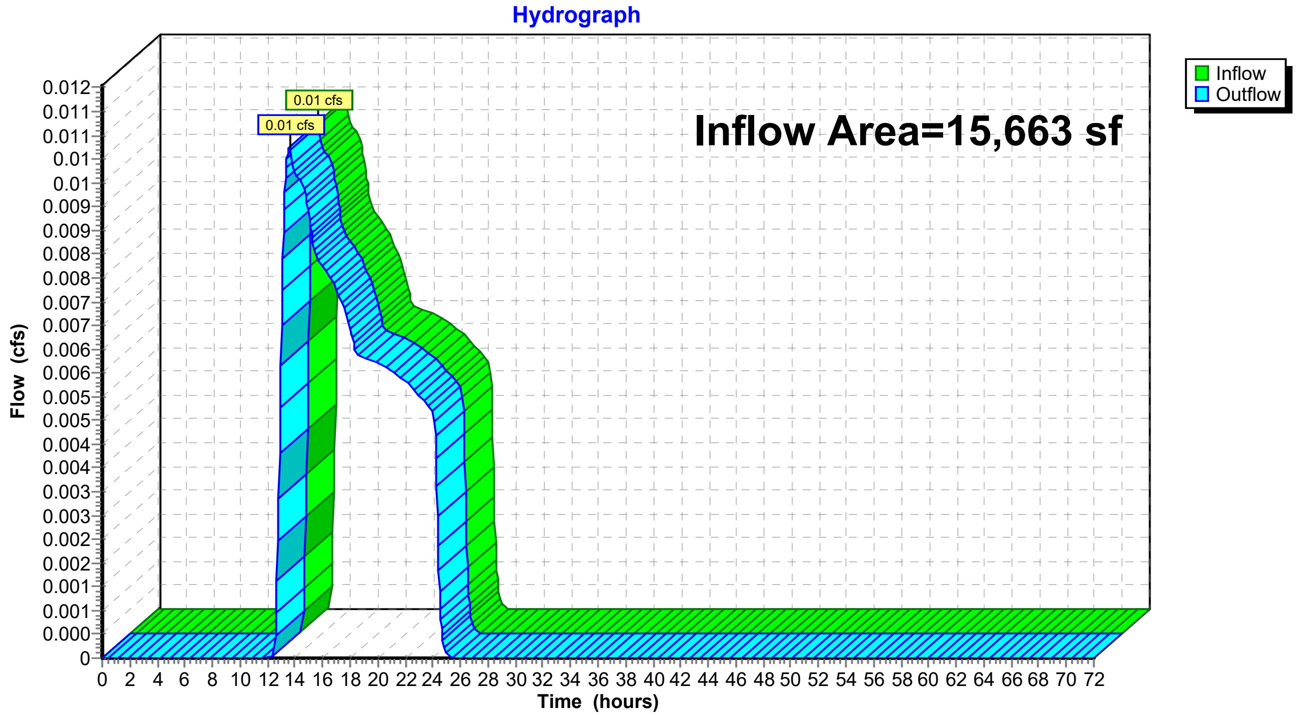
Summary for Reach DP-P4: DP#4

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

Inflow Area = 15,663 sf, 0.00% Impervious, Inflow Depth = 0.23" for 50-year event
Inflow = 0.01 cfs @ 13.58 hrs, Volume= 300 cf
Outflow = 0.01 cfs @ 13.58 hrs, Volume= 300 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P4: DP#4

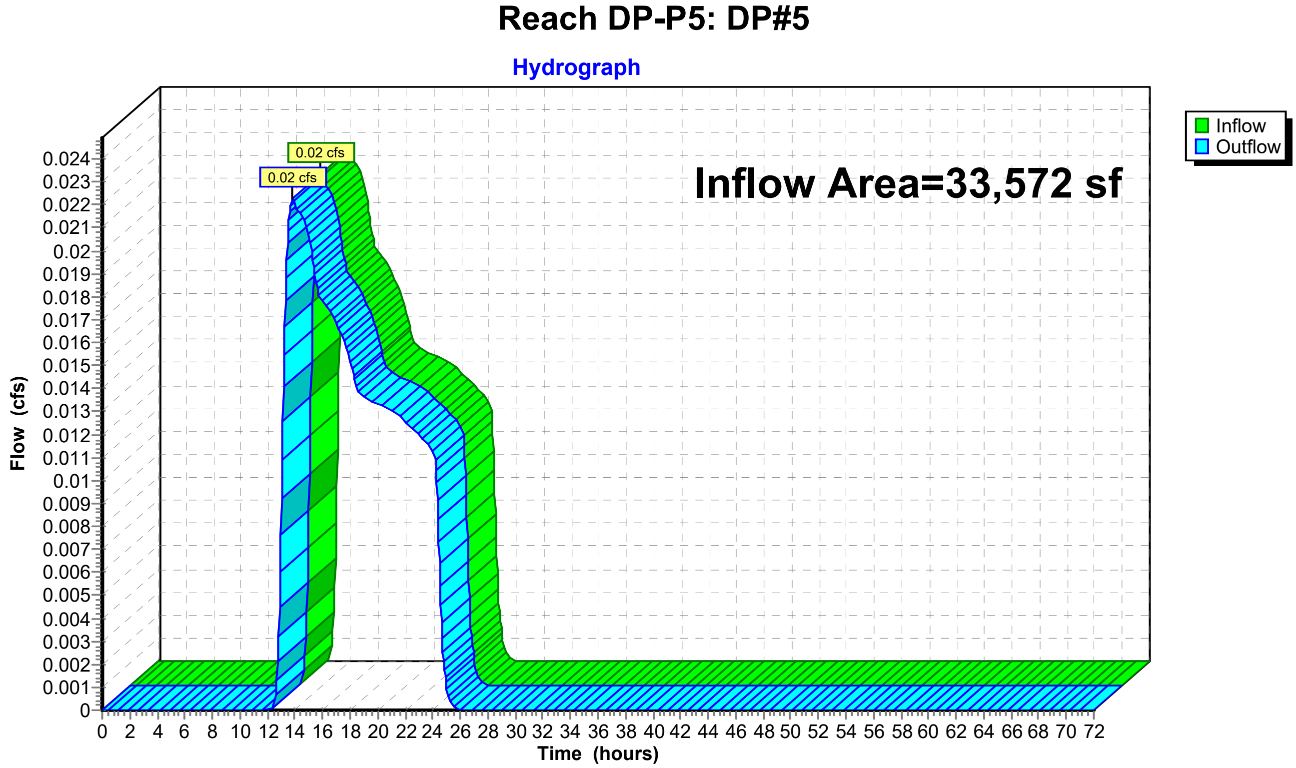


Summary for Reach DP-P5: DP#5

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

Inflow Area =	33,572 sf,	0.00% Impervious, Inflow Depth = 0.23"	for 50-year event
Inflow =	0.02 cfs @	13.79 hrs, Volume=	643 cf
Outflow =	0.02 cfs @	13.79 hrs, Volume=	643 cf, Atten= 0%, Lag= 0.0 min

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

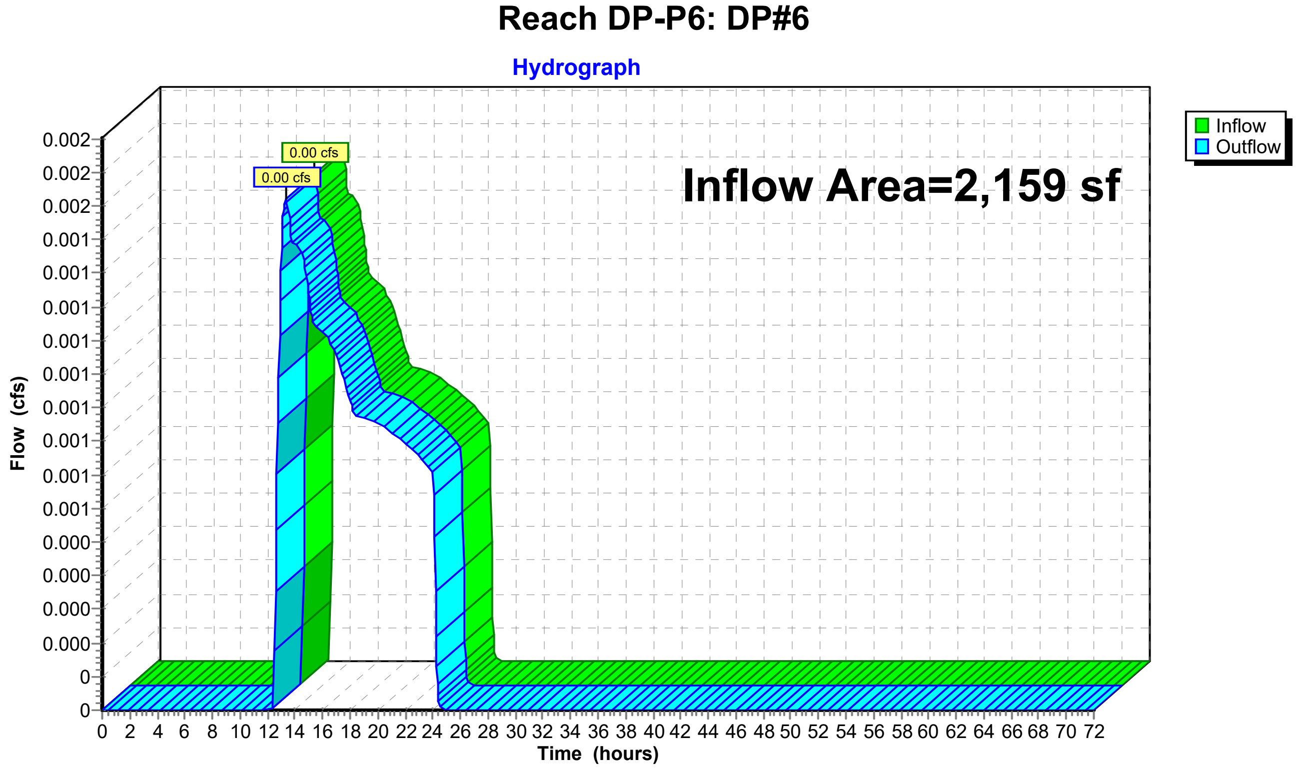


Summary for Reach DP-P6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious, Inflow Depth = 0.23"	for 50-year event
Inflow =	0.00 cfs @	13.37 hrs, Volume=	41 cf
Outflow =	0.00 cfs @	13.37 hrs, Volume=	41 cf, Atten= 0%, Lag= 0.0 min

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

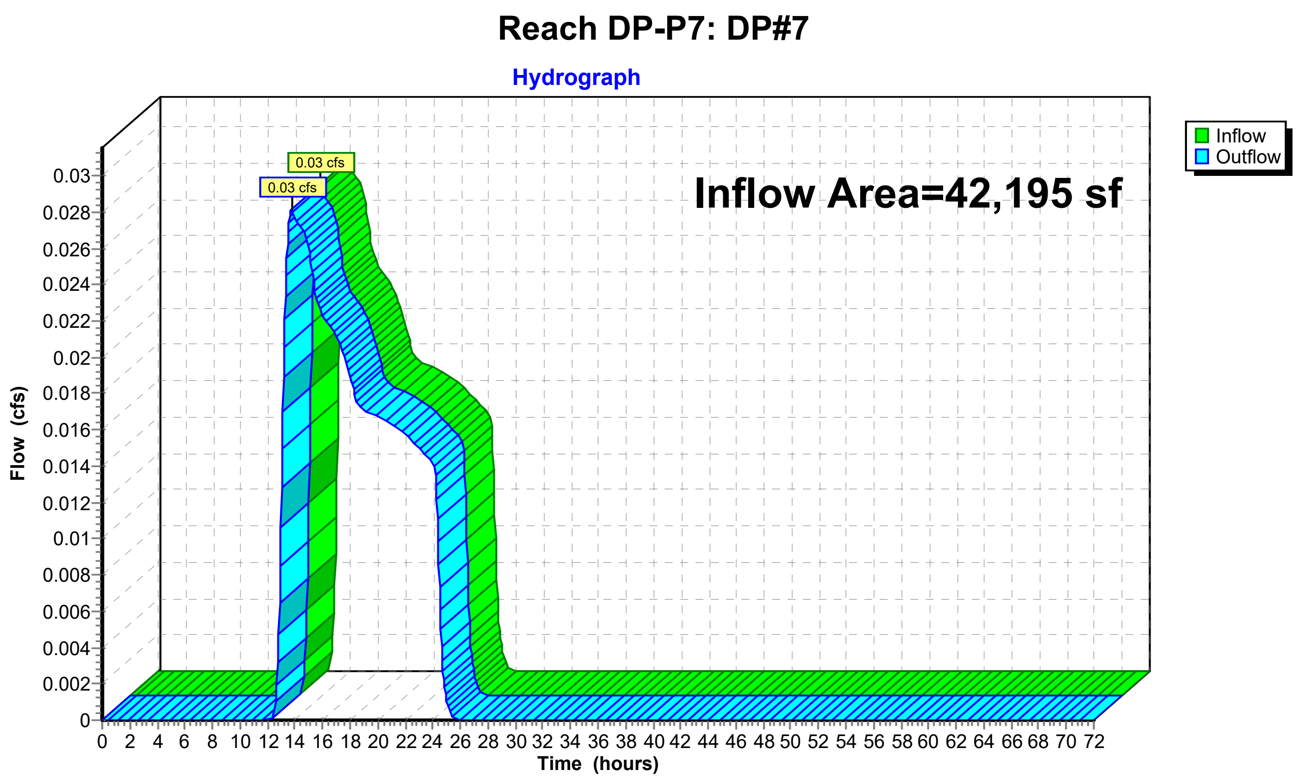


Summary for Reach DP-P7: DP#7

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

Inflow Area = 42,195 sf, 0.00% Impervious, Inflow Depth = 0.23" for 50-year event
Inflow = 0.03 cfs @ 13.75 hrs, Volume= 808 cf
Outflow = 0.03 cfs @ 13.75 hrs, Volume= 808 cf, Atten= 0%, Lag= 0.0 min

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



Summary for Pond 44P: StormTech Chambers

Inflow Area = 8,096 sf, 84.47% Impervious, Inflow Depth = 5.58" for 50-year event
Inflow = 1.11 cfs @ 12.13 hrs, Volume= 3,762 cf
Outflow = 0.05 cfs @ 14.39 hrs, Volume= 3,762 cf, Atten= 95%, Lag= 135.6 min
Discarded = 0.04 cfs @ 10.00 hrs, Volume= 3,718 cf
Primary = 0.02 cfs @ 14.39 hrs, Volume= 44 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 101.01' @ 14.39 hrs Surf.Area= 0.037 ac Storage= 0.046 af

Plug-Flow detention time= 486.1 min calculated for 3,762 cf (100% of inflow)
Center-of-Mass det. time= 486.0 min (1,280.3 - 794.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.026 af	**34.75'W x 46.34'L x 3.50'H Field A** 0.129 af Overall - 0.044 af Embedded = 0.085 af x 30.0% Voids
#2A	99.50'	0.044 af	**ADS_StormTech SC-740 +Cap** x 42 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 7 Rows of 6 Chambers
		0.070 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 10.00 hrs HW=99.04' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.01 cfs @ 14.39 hrs HW=101.01' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.28 fps)

Pond 44P: StormTech Chambers - Chamber Wizard Field A

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

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

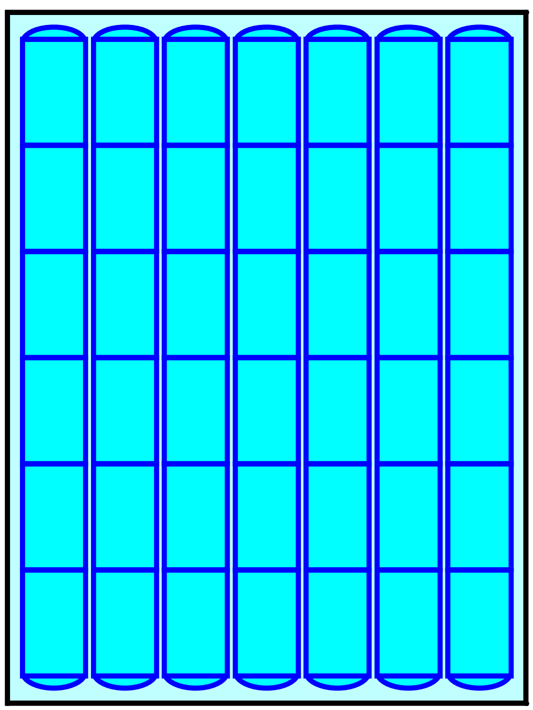
6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

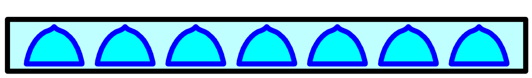
42 Chambers x 45.9 cf = 1,929.5 cf Chamber Storage

5,635.7 cf Field - 1,929.5 cf Chambers = 3,706.2 cf Stone x 30.0% Voids = 1,111.9 cf Stone Storage

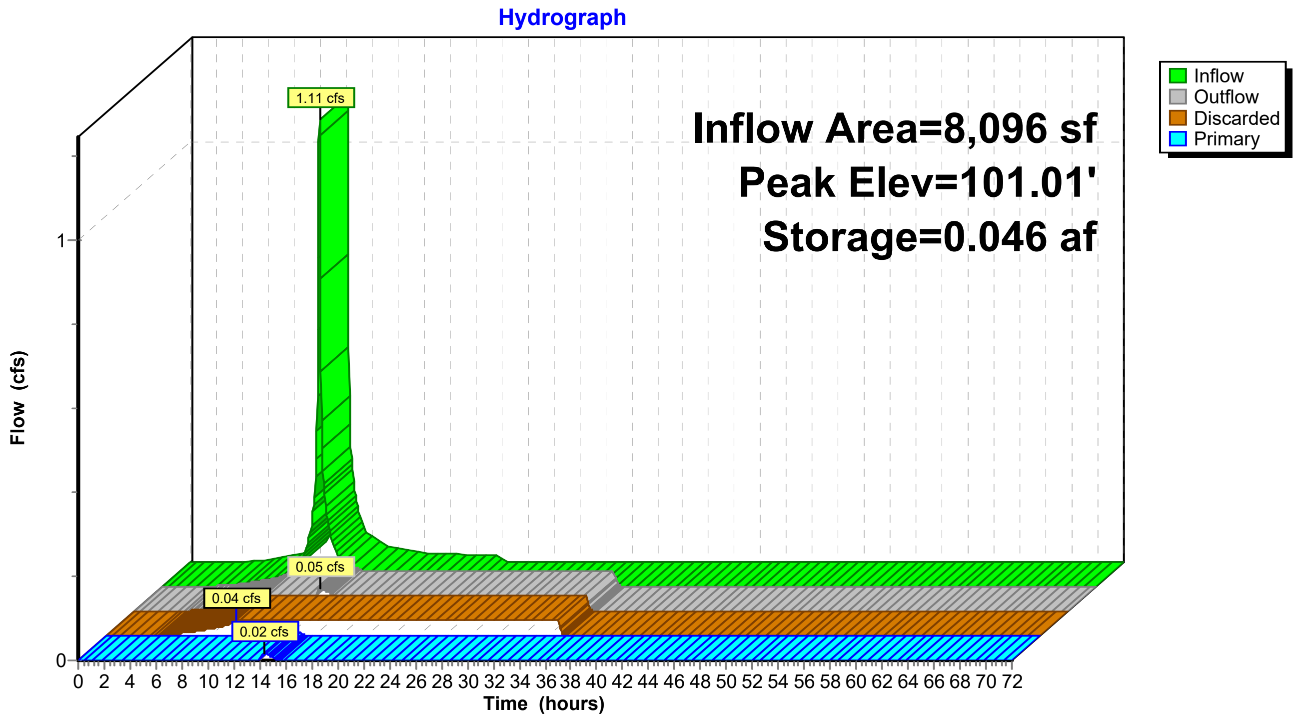
Chamber Storage + Stone Storage = 3,041.3 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 46.34' x 34.75' x 3.50'

42 Chambers
208.7 cy Field
137.3 cy Stone

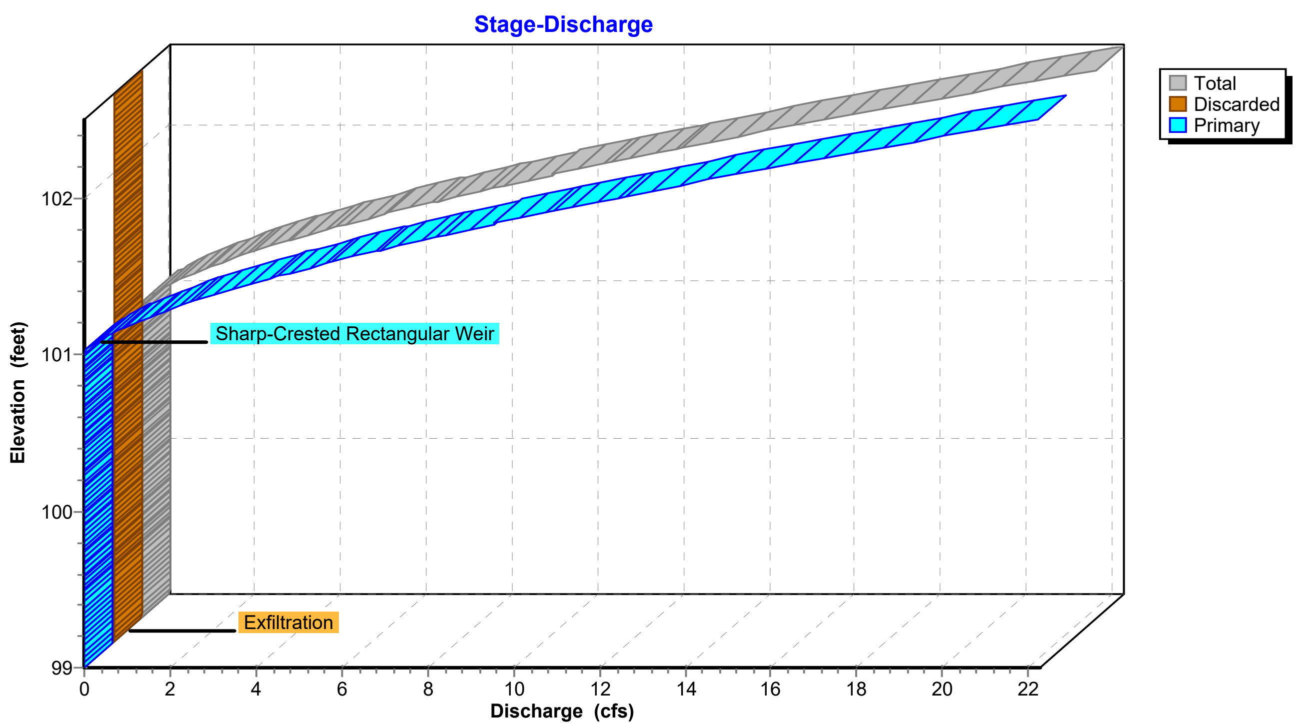




Pond 44P: StormTech Chambers



Pond 44P: StormTech Chambers



Summary for Pond 55P: StormTech Chambers

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.037 af	**39.50'W x 60.58'L x 3.50'H Field A** 0.192 af Overall - 0.067 af Embedded = 0.125 af x 30.0% Voids
#2A	99.50'	0.067 af	**ADS_StormTech SC-740 +Cap** x 64 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 8 Rows of 8 Chambers
		0.105 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.33'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 55P: StormTech Chambers - Chamber Wizard Field A

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

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

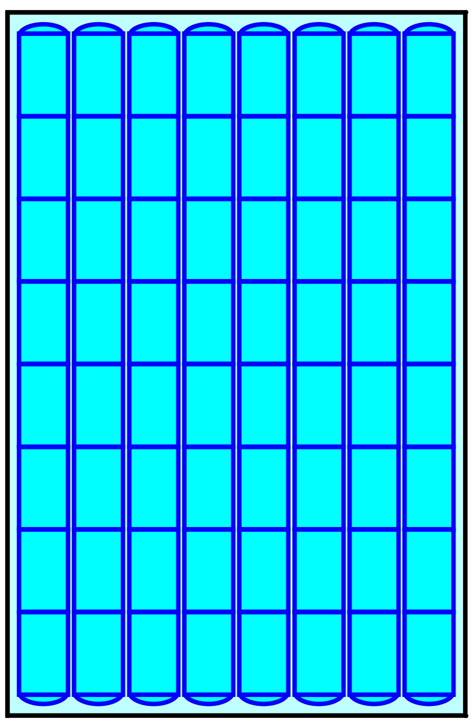
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

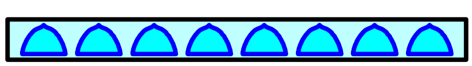
64 Chambers x 45.9 cf = 2,940.2 cf Chamber Storage

8,374.7 cf Field - 2,940.2 cf Chambers = 5,434.6 cf Stone x 30.0% Voids = 1,630.4 cf Stone Storage

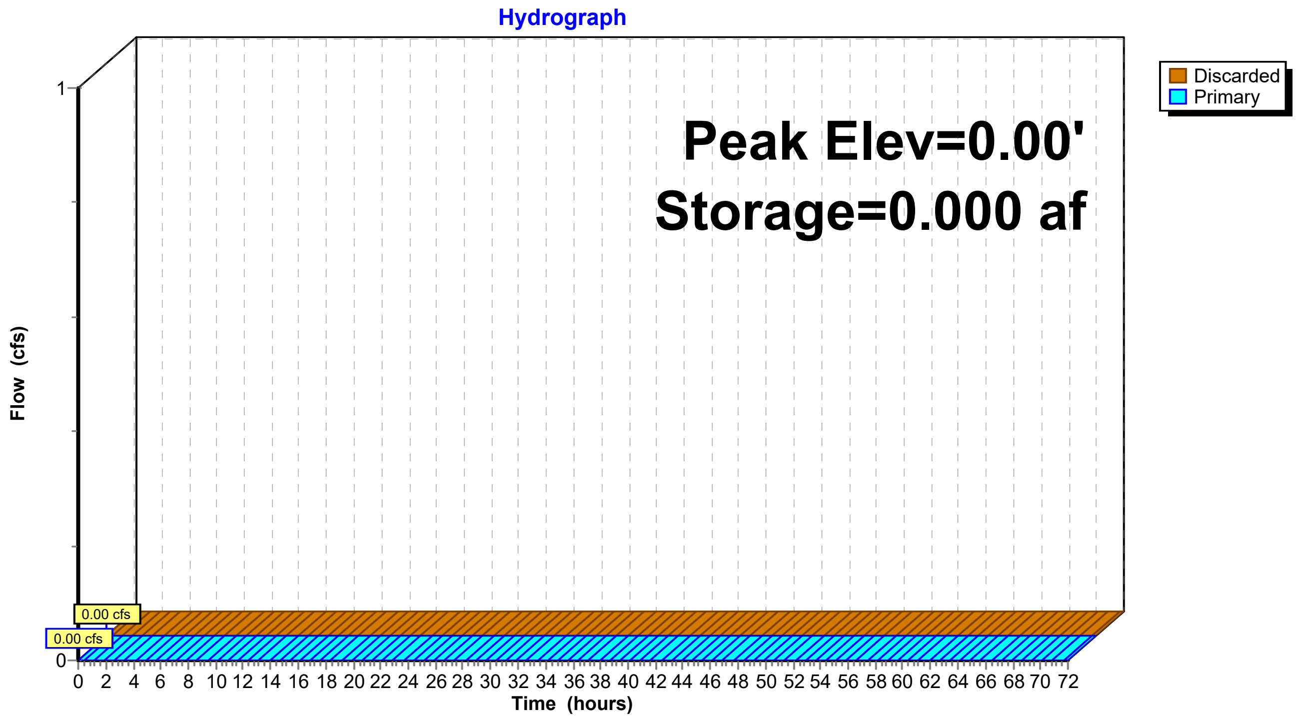
Chamber Storage + Stone Storage = 4,570.5 cf = 0.105 af
Overall Storage Efficiency = 54.6%
Overall System Size = 60.58' x 39.50' x 3.50'

64 Chambers
310.2 cy Field
201.3 cy Stone

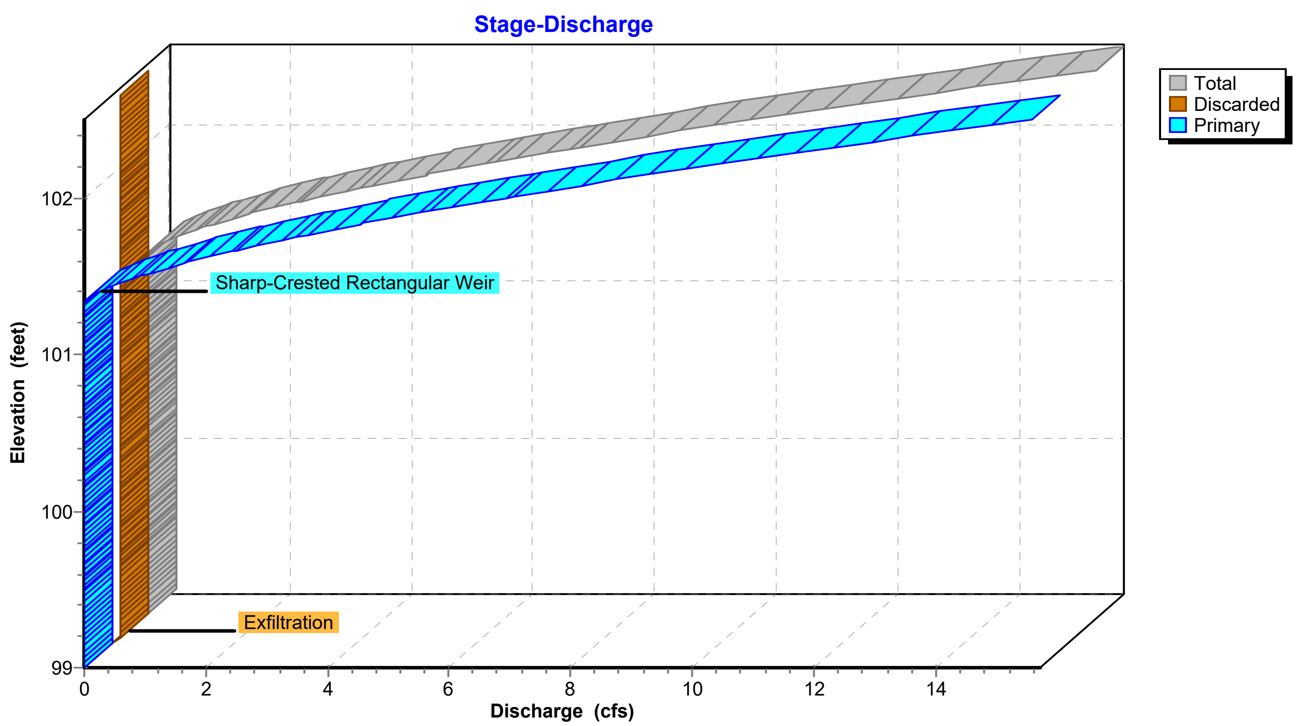




Pond 55P: StormTech Chambers



Pond 55P: StormTech Chambers



Summary for Pond 56P: Pipe Storage

Inflow Area = 2,578 sf,100.00% Impervious, Inflow Depth = 6.86" for 50-year event
Inflow = 0.39 cfs @ 12.13 hrs, Volume= 1,474 cf
Outflow = 0.03 cfs @ 13.30 hrs, Volume= 1,474 cf, Atten= 92%, Lag= 70.2 min
Discarded = 0.01 cfs @ 9.25 hrs, Volume= 1,398 cf
Primary = 0.02 cfs @ 13.30 hrs, Volume= 76 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 101.60' @ 13.30 hrs Surf.Area= 0.013 ac Storage= 0.016 af

Plug-Flow detention time= 413.4 min calculated for 1,473 cf (100% of inflow)
Center-of-Mass det. time= 413.6 min (1,157.3 - 743.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.009 af	**9.13'W x 61.50'L x 2.75'H Field A**
			0.035 af Overall - 0.009 af Embedded = 0.026 af x 35.0% Voids
#2A	99.50'	0.007 af	**ADS N-12 18"** x 9 Inside #1
			Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
			Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf
			3 Rows of 3 Chambers
		0.017 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	101.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 9.25 hrs HW=99.03' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.02 cfs @ 13.30 hrs HW=101.60' (Free Discharge)
├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.06 fps)

Pond 56P: Pipe Storage - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 14.3" Spacing = 35.3" C-C Row Spacing

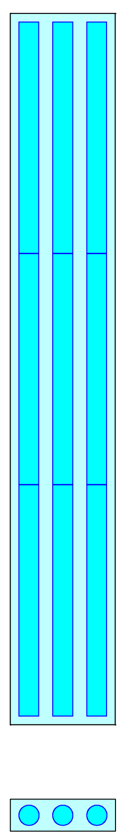
3 Chambers/Row x 20.00' Long = 60.00' Row Length +9.0" End Stone x 2 = 61.50' Base Length
3 Rows x 21.0" Wide + 14.3" Spacing x 2 + 9.0" Side Stone x 2 = 9.13' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

9 Chambers x 36.0 cf = 324.0 cf Chamber Storage
9 Chambers x 44.5 cf = 400.7 cf Displacement

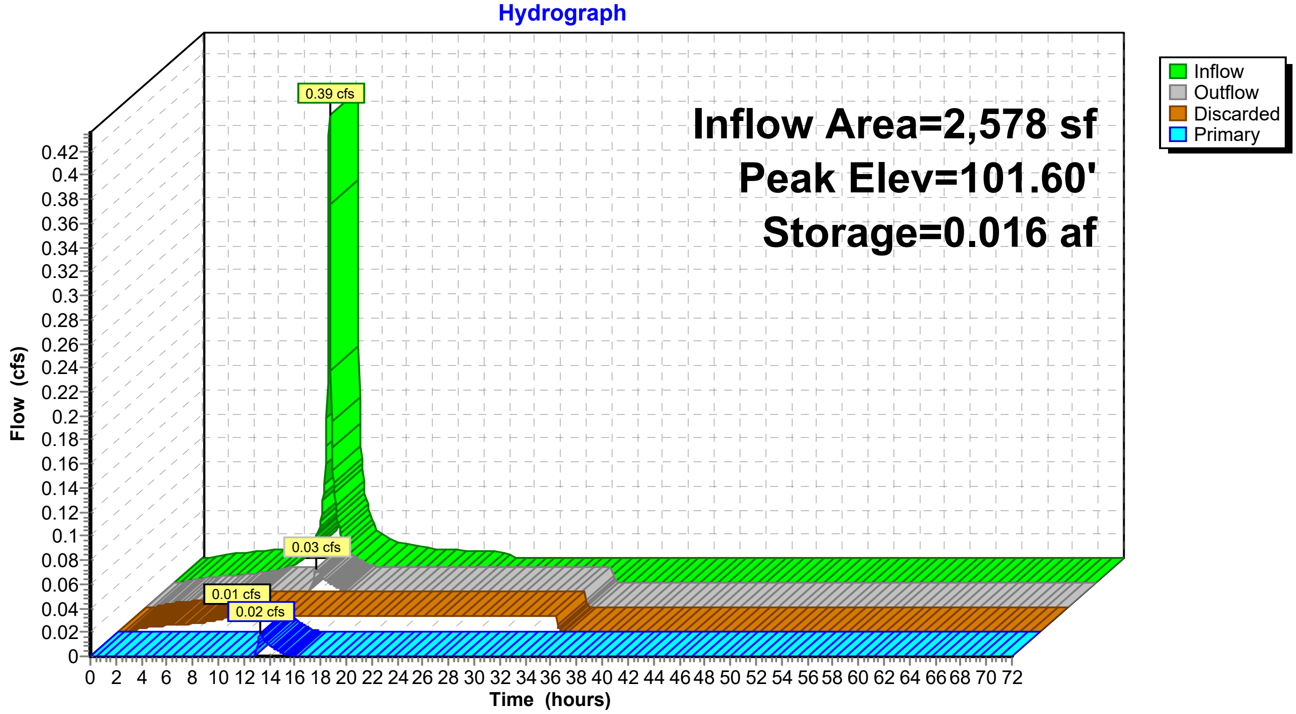
1,545.3 cf Field - 400.7 cf Chambers = 1,144.5 cf Stone x 35.0% Voids = 400.6 cf Stone Storage

Chamber Storage + Stone Storage = 724.6 cf = 0.017 af
Overall Storage Efficiency = 46.9%
Overall System Size = 61.50' x 9.13' x 2.75'

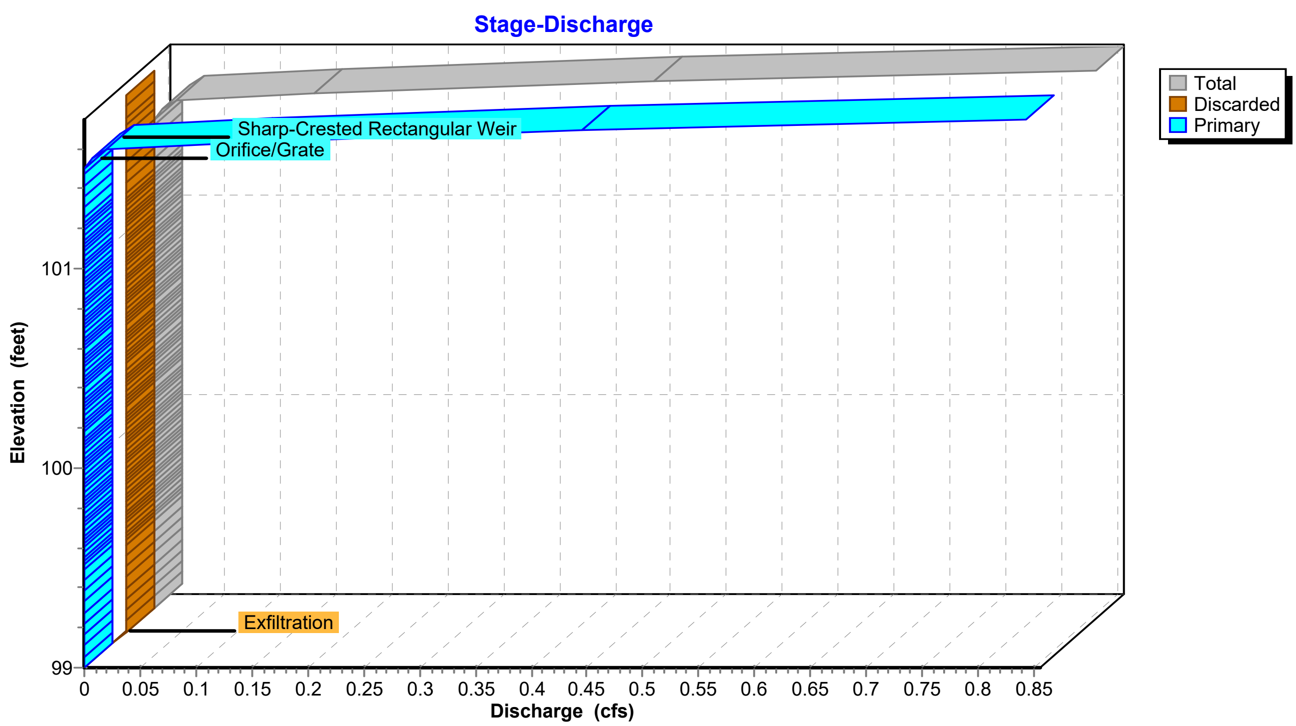
9 Chambers
57.2 cy Field
42.4 cy Stone



Pond 56P: Pipe Storage



Pond 56P: Pipe Storage



Summary for Pond 59P: Rain Garden

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=5)

Inflow Area =	49,215 sf,	33.87% Impervious,	Inflow Depth = 2.09"	for 50-year event	
Inflow =	2.02 cfs @	12.13 hrs,	Volume=	8,556 cf	
Outflow =	1.02 cfs @	12.00 hrs,	Volume=	8,556 cf,	Atten= 50%, Lag= 0.0 min
Discarded =	1.02 cfs @	12.00 hrs,	Volume=	8,556 cf	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 97.47' @ 12.24 hrs Surf.Area= 1,449 sf Storage= 489 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.2 min (782.5 - 781.3)

Volume	Invert	Avail.Storage	Storage Description
#1	97.00'	5,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

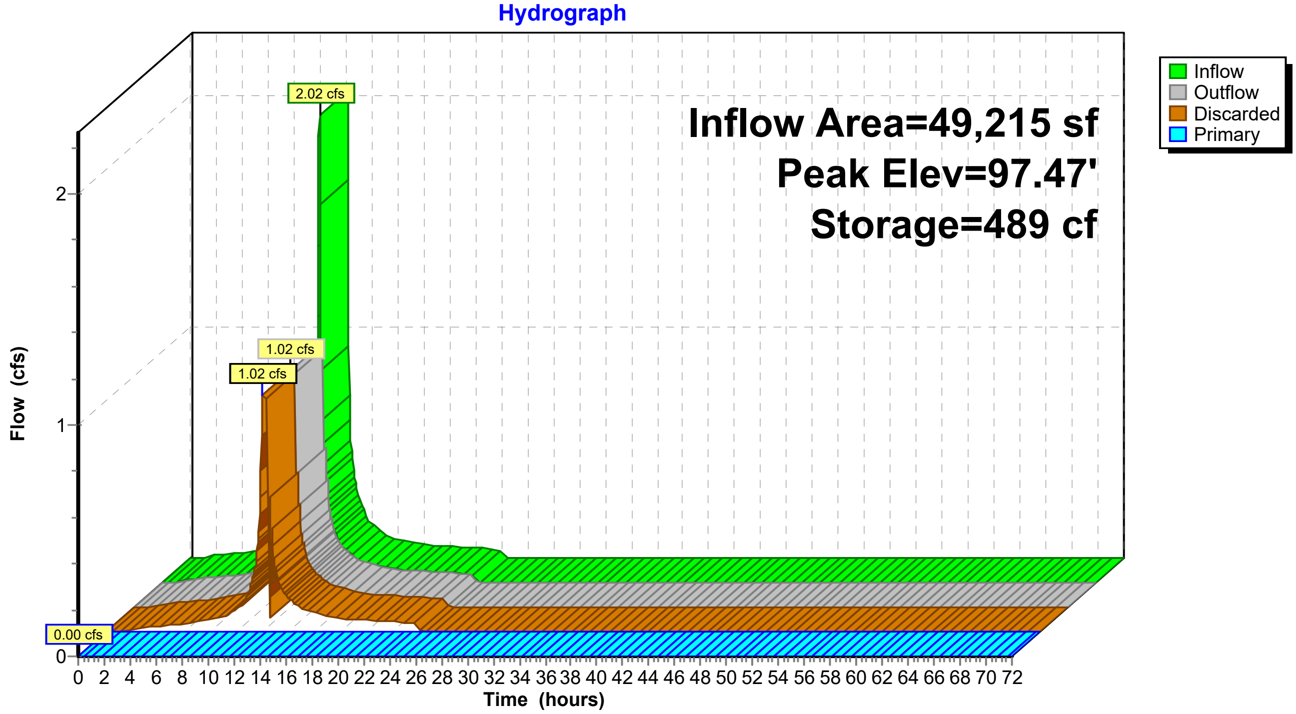
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	655	0	0
98.00	2,362	1,509	1,509
99.00	4,876	3,619	5,128

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	**1.02 cfs Exfiltration at all elevations**
#2	Primary	98.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** 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

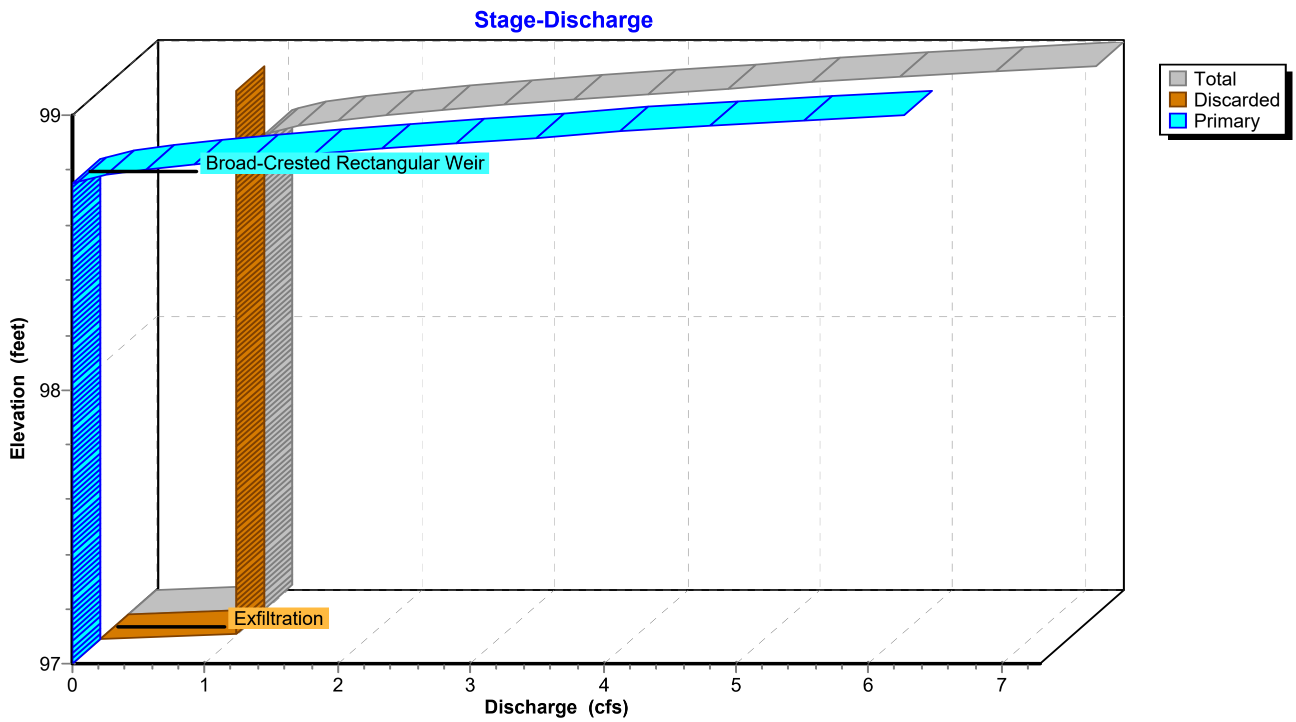
Discarded OutFlow Max=1.02 cfs @ 12.00 hrs HW=97.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=97.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 59P: Rain Garden



Pond 59P: Rain Garden



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

Subcatchment PS1: PDA-1 Runoff Area=6,708 sf 1.37% Impervious Runoff Depth=0.57"
Flow Length=75' Slope=0.0400 '/' Tc=16.8 min CN=31 Runoff=0.02 cfs 317 cf

Subcatchment PS2A: PDA-2A Runoff Area=8,096 sf 84.47% Impervious Runoff Depth=6.74"
Tc=6.0 min CN=87 Runoff=1.33 cfs 4,549 cf

Subcatchment PS4: PDA-4 Runoff Area=15,663 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=150' Slope=0.0150 '/' Tc=27.2 min CN=30 Runoff=0.03 cfs 639 cf

Subcatchment PS5: PDA-5 Runoff Area=33,572 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=240' Slope=0.0080 '/' Tc=38.6 min CN=30 Runoff=0.07 cfs 1,370 cf

Subcatchment PS6: PDA-6 Runoff Area=2,159 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=80' Slope=0.0625 '/' Tc=14.2 min CN=30 Runoff=0.01 cfs 88 cf

Subcatchment PS7: PDA-7 Runoff Area=42,195 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=280' Slope=0.0100 '/' Tc=36.5 min CN=30 Runoff=0.09 cfs 1,721 cf

Subcatchment PSA3A: PSA-3A Runoff Area=33,204 sf 2.76% Impervious Runoff Depth=0.65"
Flow Length=150' Slope=0.0800 '/' Tc=13.7 min CN=32 Runoff=0.14 cfs 1,794 cf

Subcatchment PSA3B: PSA-3B Runoff Area=13,433 sf 98.05% Impervious Runoff Depth=7.94"
Flow Length=130' Slope=0.0150 '/' Tc=6.0 min CN=97 Runoff=2.37 cfs 8,888 cf

Subcatchment PSA3C: PSA-3C Runoff Area=2,578 sf 100.00% Impervious Runoff Depth=8.06"
Tc=6.0 min CN=98 Runoff=0.46 cfs 1,732 cf

Subcatchment PSB: PDA-2B Runoff Area=5,221 sf 47.75% Impervious Runoff Depth=3.79"
Flow Length=112' Slope=0.0440 '/' Tc=6.0 min CN=62 Runoff=0.52 cfs 1,649 cf

Reach 2R: PROPOSED (NULL) Inflow=0.52 cfs 6,409 cf
Outflow=0.52 cfs 6,409 cf

Reach DP-P1: DP#1 Inflow=0.02 cfs 317 cf
Outflow=0.02 cfs 317 cf

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN Inflow=0.52 cfs 2,274 cf
Outflow=0.52 cfs 2,274 cf

Reach DP-P3: DP#3 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-P4: DP#4 Inflow=0.03 cfs 639 cf
Outflow=0.03 cfs 639 cf

Reach DP-P5: DP#5 Inflow=0.07 cfs 1,370 cf
Outflow=0.07 cfs 1,370 cf

Reach DP-P6: DP#6 Inflow=0.01 cfs 88 cf
Outflow=0.01 cfs 88 cf

Reach DP-P7: DP#7 Inflow=0.09 cfs 1,721 cf
Outflow=0.09 cfs 1,721 cf

Pond 44P: StormTech Chambers Peak Elev=101.05' Storage=0.047 af Inflow=1.33 cfs 4,549 cf
Discarded=0.04 cfs 3,924 cf Primary=0.17 cfs 625 cf Outflow=0.21 cfs 4,549 cf

Pond 55P: StormTech Chambers Peak Elev=0.00' Storage=0.000 af
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Pond 56P: Pipe Storage Peak Elev=101.63' Storage=0.016 af Inflow=0.46 cfs 1,732 cf
Discarded=0.01 cfs 1,471 cf Primary=0.12 cfs 260 cf Outflow=0.13 cfs 1,732 cf

Pond 59P: Rain Garden Peak Elev=97.64' Storage=777 cf Inflow=2.38 cfs 10,942 cf
Discarded=1.02 cfs 10,942 cf Primary=0.00 cfs 0 cf Outflow=1.02 cfs 10,942 cf

Total Runoff Area = 162,829 sf Runoff Volume = 22,746 cf Average Runoff Depth = 1.68"
83.98% Pervious = 136,738 sf 16.02% Impervious = 26,091 sf

Summary for Subcatchment PS1: PDA-1

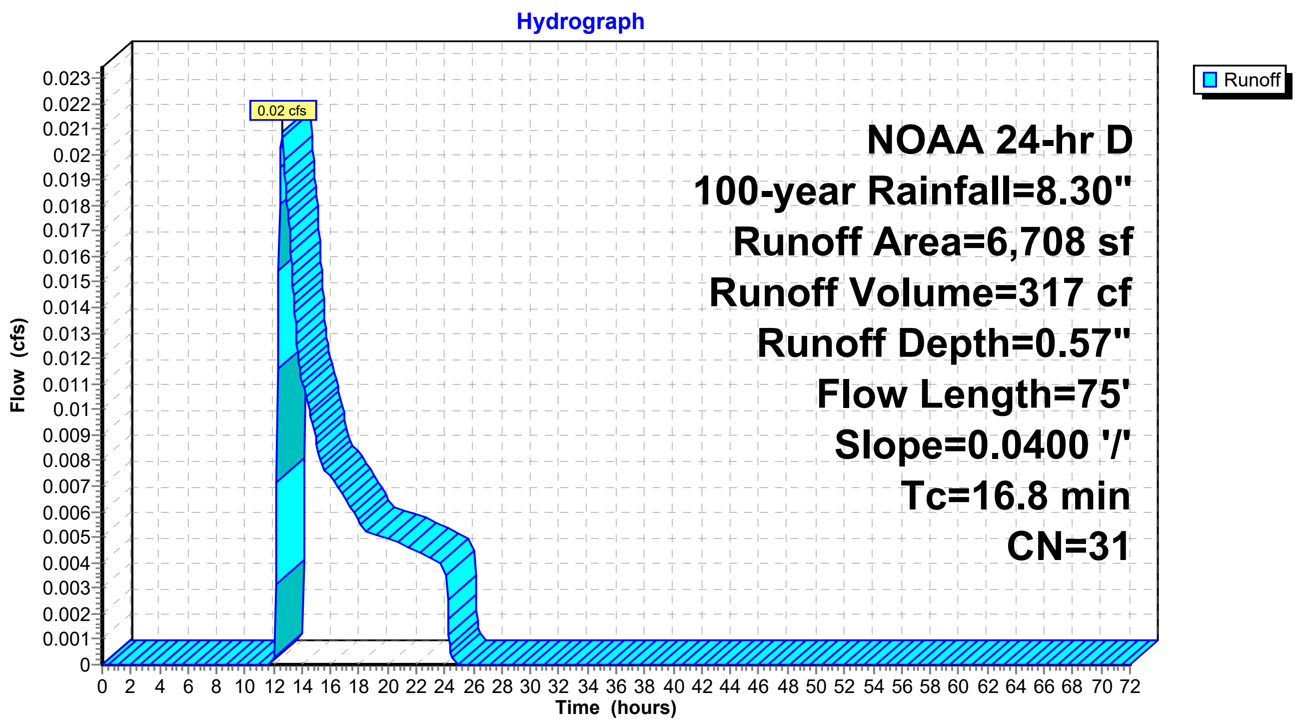
Runoff = 0.02 cfs @ 12.61 hrs, Volume= 317 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
92	98	Paved parking, HSG A
6,616	30	Woods, Good, HSG A
6,708	31	Weighted Average
6,616		98.63% Pervious Area
92		1.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.3	25	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.8	75	Total			

Subcatchment PS1: PDA-1



Summary for Subcatchment PS2A: PDA-2A

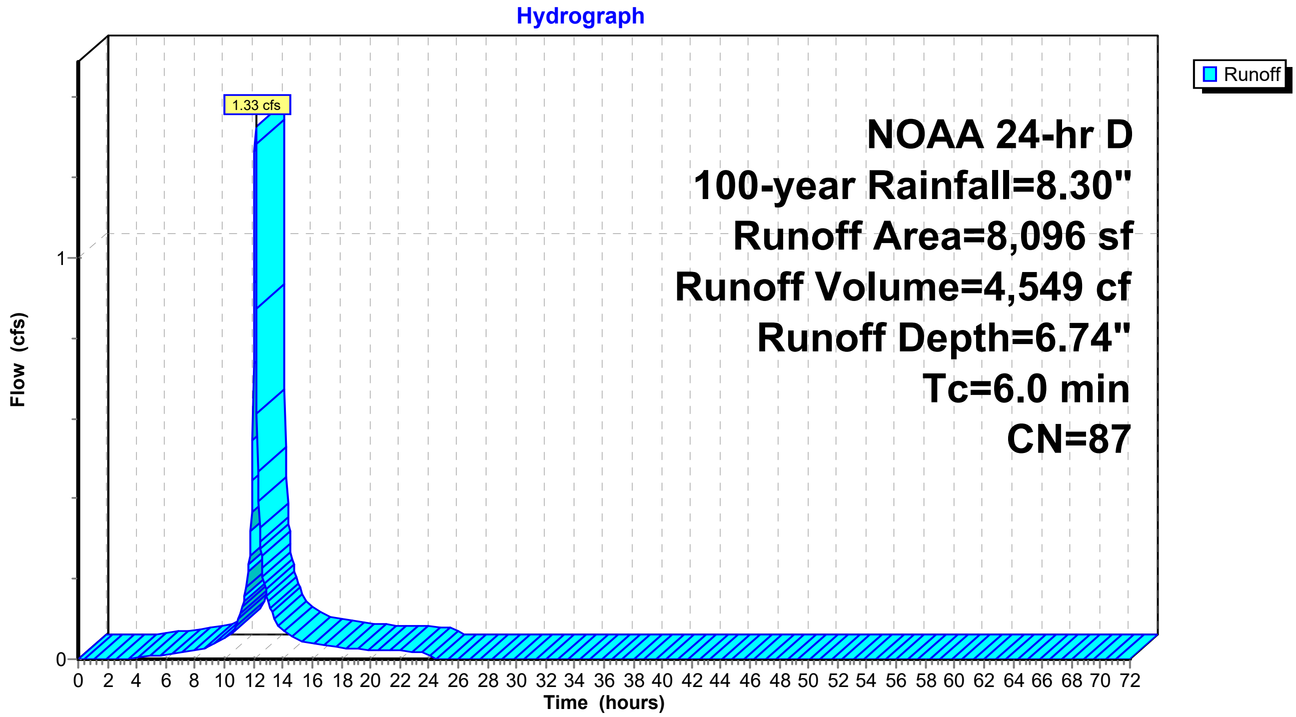
Runoff = 1.33 cfs @ 12.13 hrs, Volume= 4,549 cf, Depth= 6.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
3,491	98	Paved parking, HSG A
3,348	98	Roofs, HSG A
1,257	30	Woods, Good, HSG A
8,096	87	Weighted Average
1,257		15.53% Pervious Area
6,839		84.47% Impervious Area

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

Subcatchment PS2A: PDA-2A



Summary for Subcatchment PS4: PDA-4

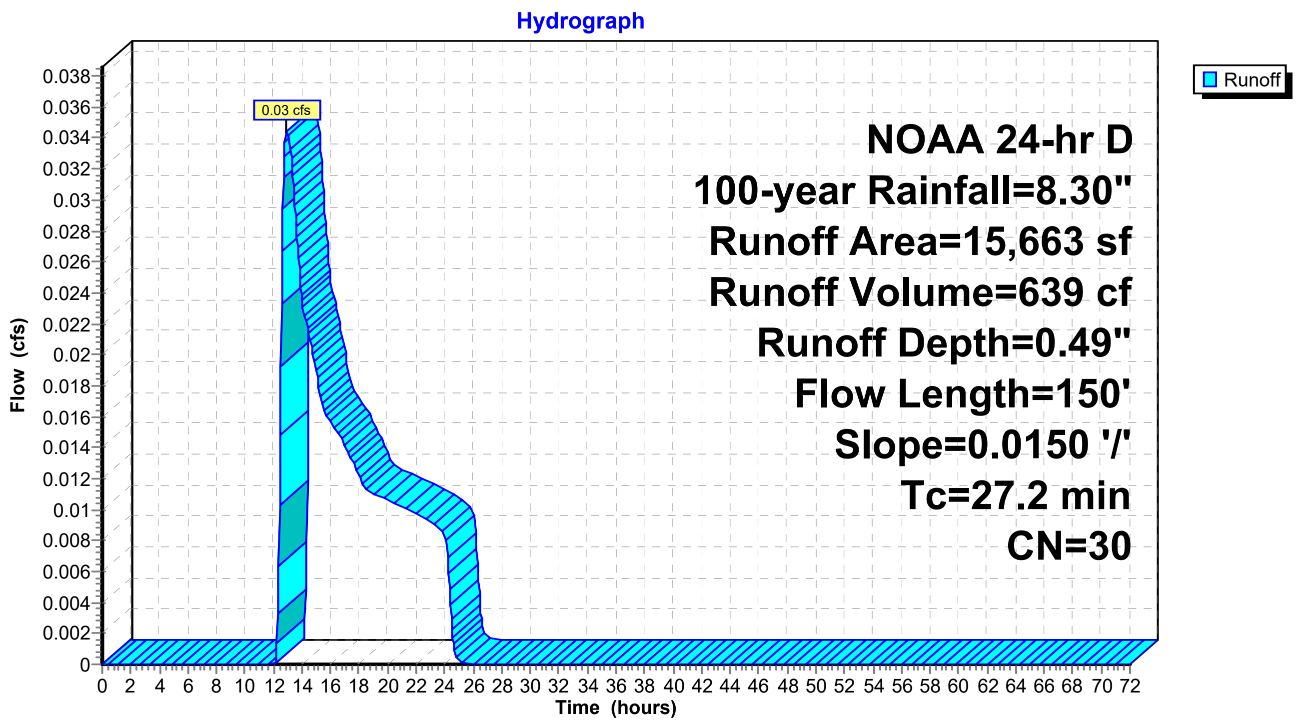
Runoff = 0.03 cfs @ 12.94 hrs, Volume= 639 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
15,663	30	Woods, Good, HSG A
15,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	50	0.0150	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
2.7	100	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
27.2	150	Total			

Subcatchment PS4: PDA-4



Summary for Subcatchment PS5: PDA-5

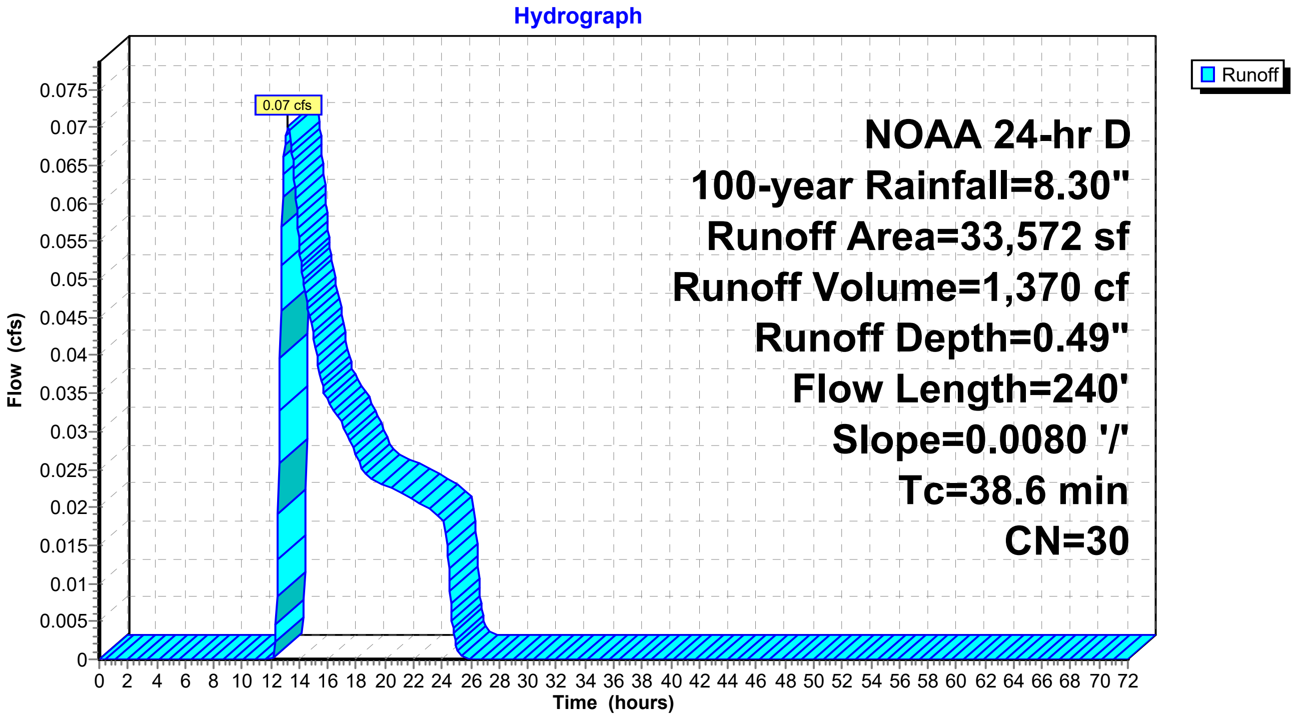
Runoff = 0.07 cfs @ 13.19 hrs, Volume= 1,370 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
33,572	30	Woods, Good, HSG A
33,572		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	50	0.0080	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.1	190	0.0080	0.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
38.6	240	Total			

Subcatchment PS5: PDA-5



Summary for Subcatchment PS6: PDA-6

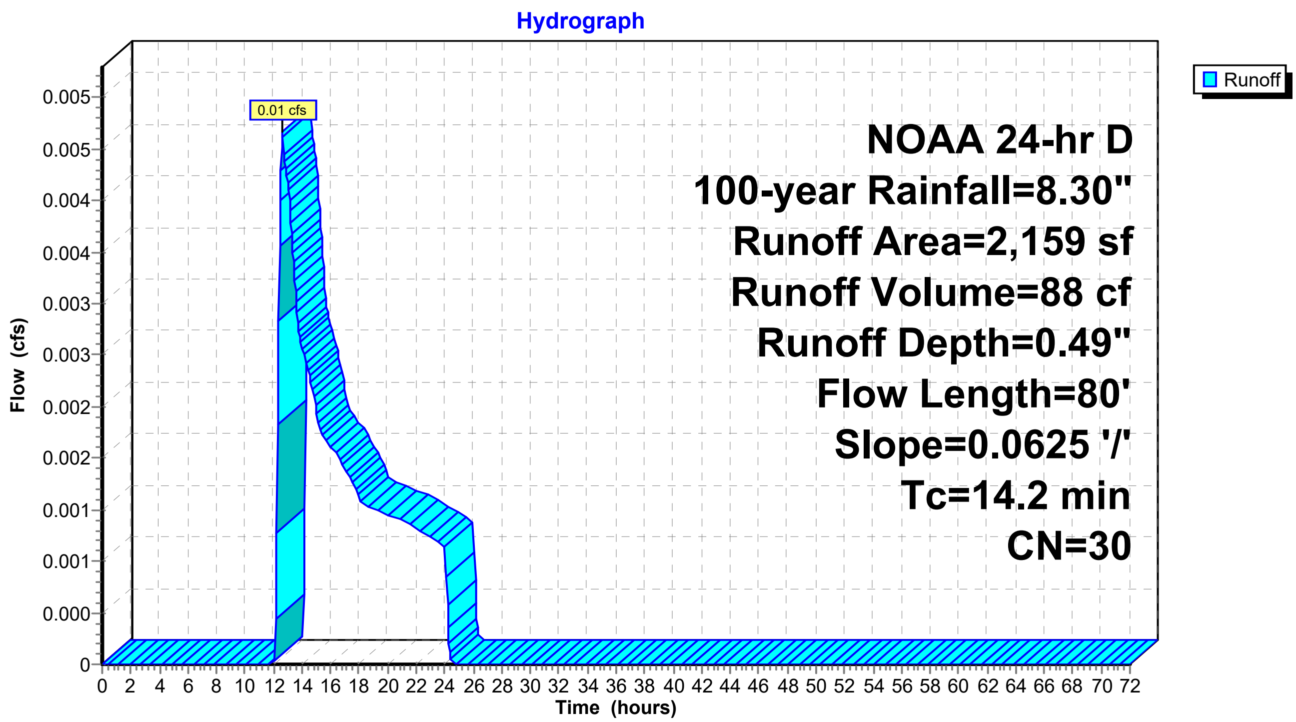
Runoff = 0.01 cfs @ 12.63 hrs, Volume= 88 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
2,159	30	Woods, Good, HSG A
2,159		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0625	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
0.4	30	0.0625	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.2	80	Total			

Subcatchment PS6: PDA-6



Summary for Subcatchment PS7: PDA-7

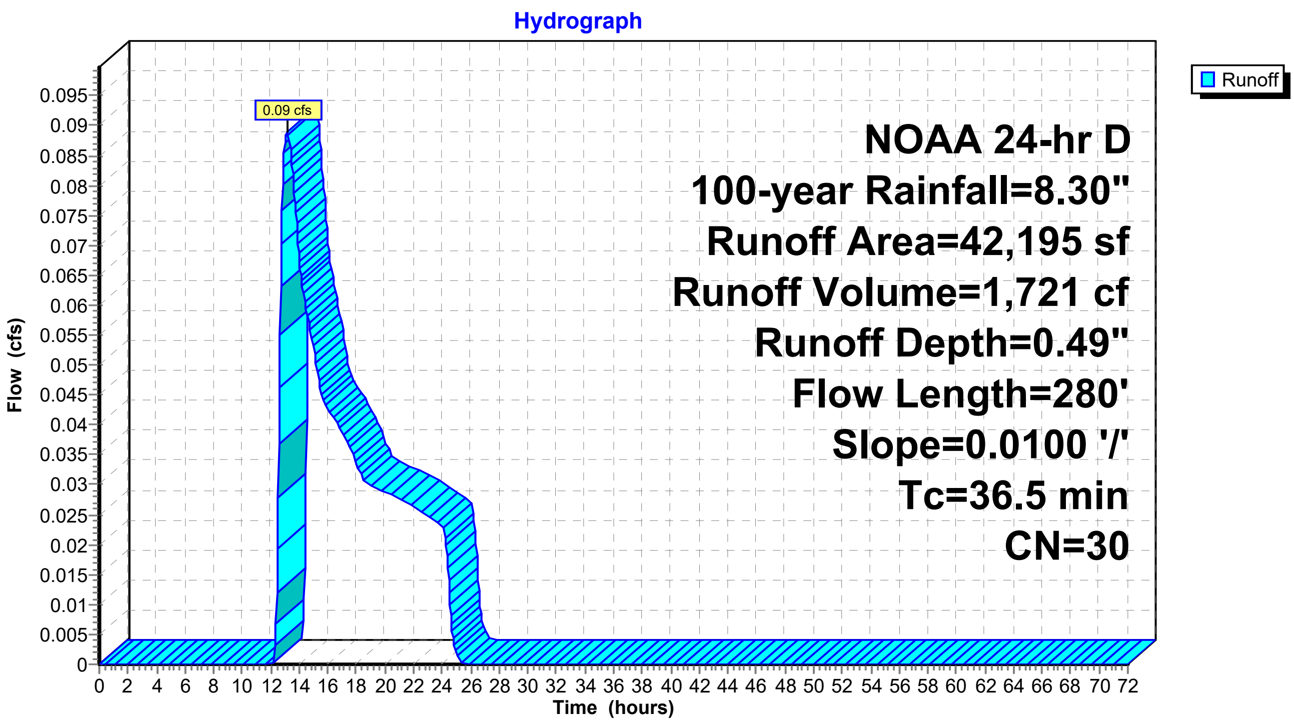
Runoff = 0.09 cfs @ 13.16 hrs, Volume= 1,721 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
42,195	30	Woods, Good, HSG A
42,195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	50	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
7.7	230	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.5	280	Total			

Subcatchment PS7: PDA-7



Summary for Subcatchment PSA3A: PSA-3A

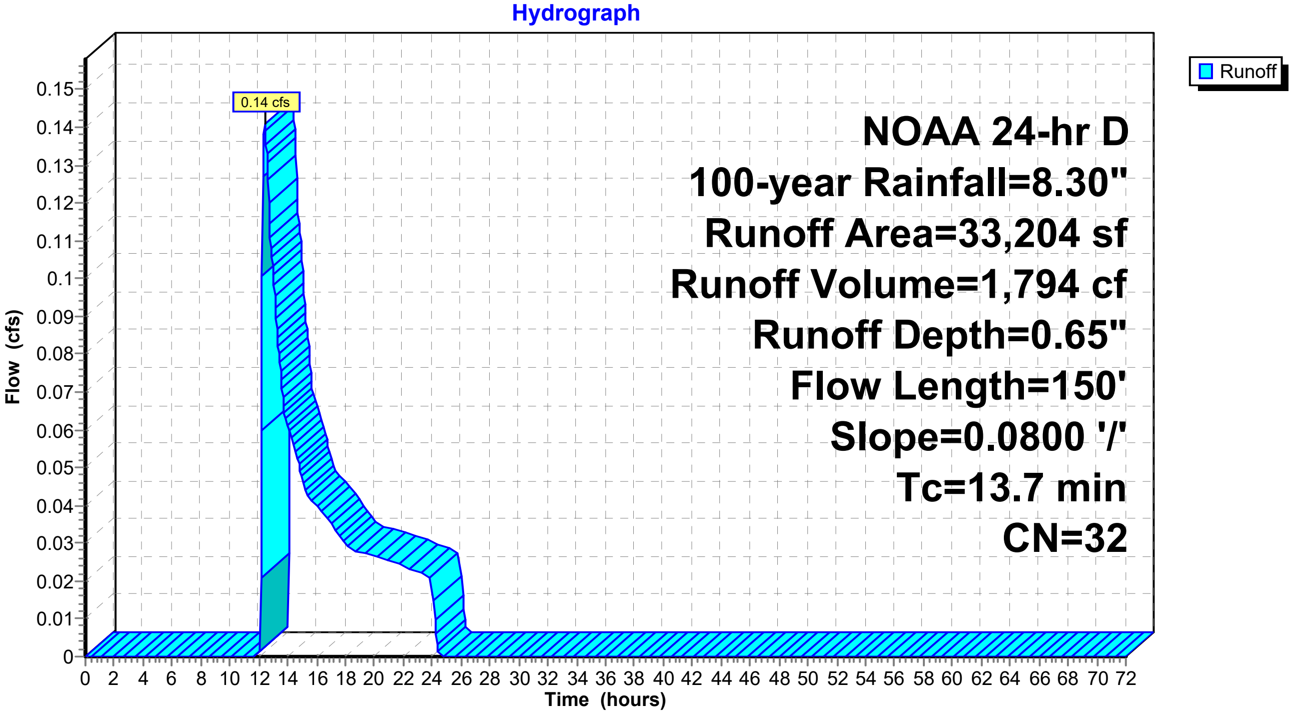
Runoff = 0.14 cfs @ 12.40 hrs, Volume= 1,794 cf, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
918	98	Paved parking, HSG A
32,286	30	Woods, Good, HSG A
33,204	32	Weighted Average
32,286		97.24% Pervious Area
918		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	100	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.7	150	Total			

Subcatchment PSA3A: PSA-3A



Summary for Subcatchment PSA3B: PSA-3B

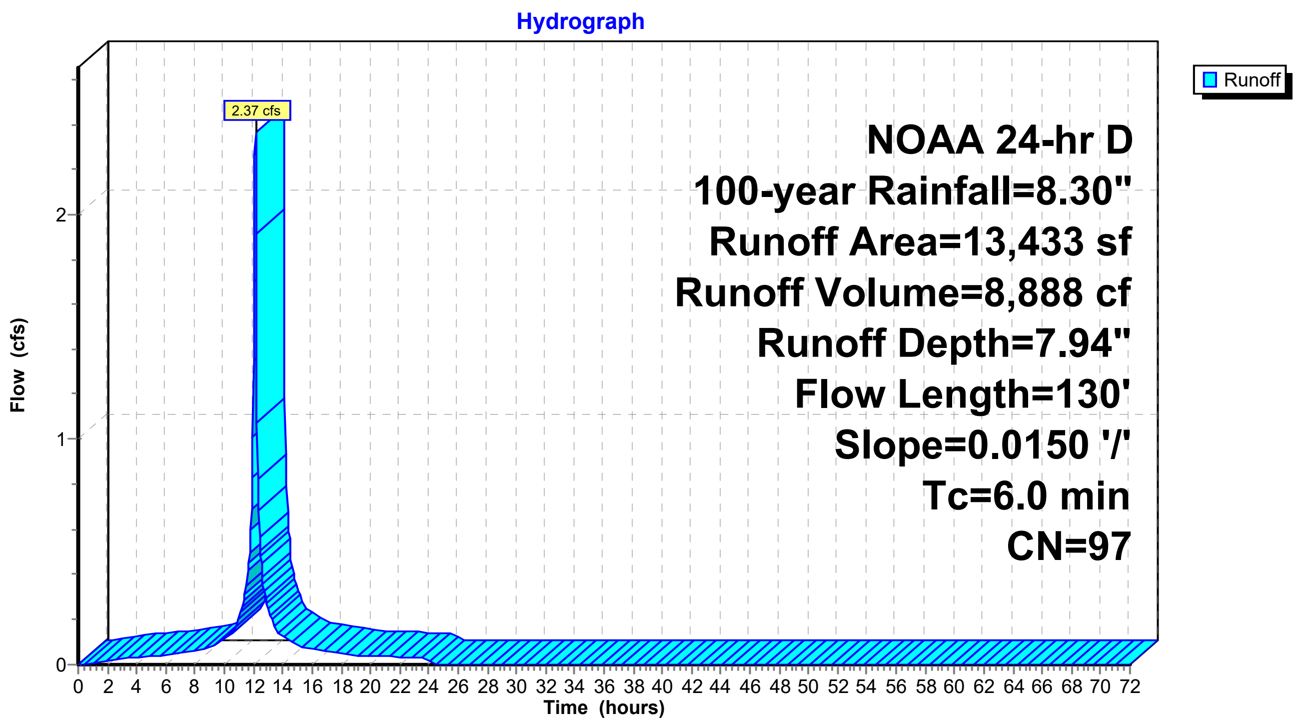
Runoff = 2.37 cfs @ 12.13 hrs, Volume= 8,888 cf, Depth= 7.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
13,171	98	Paved parking, HSG A
262	30	Woods, Good, HSG A
13,433	97	Weighted Average
262		1.95% Pervious Area
13,171		98.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.5	80	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	130	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSA3B: PSA-3B



Summary for Subcatchment PSA3C: PSA-3C

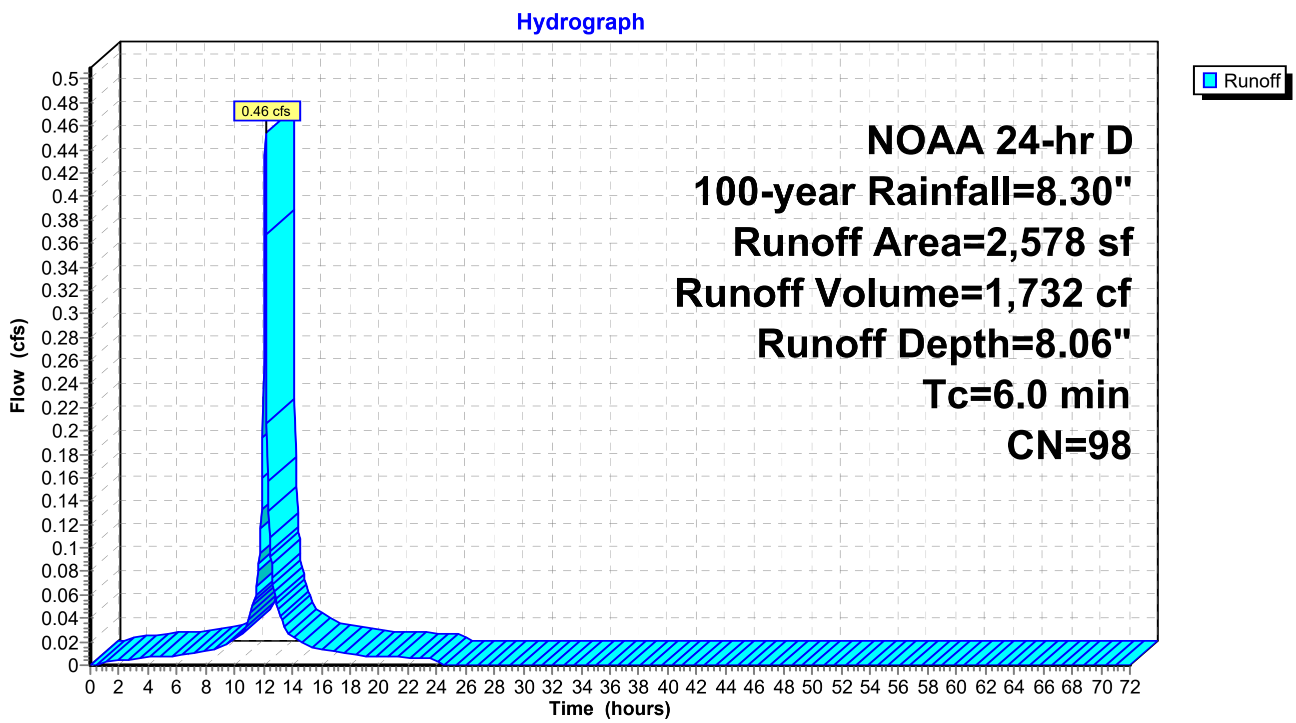
Runoff = 0.46 cfs @ 12.13 hrs, Volume= 1,732 cf, Depth= 8.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
2,578	98	Roofs, HSG A
2,578		100.00% Impervious Area

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

Subcatchment PSA3C: PSA-3C



Summary for Subcatchment PSB: PDA-2B

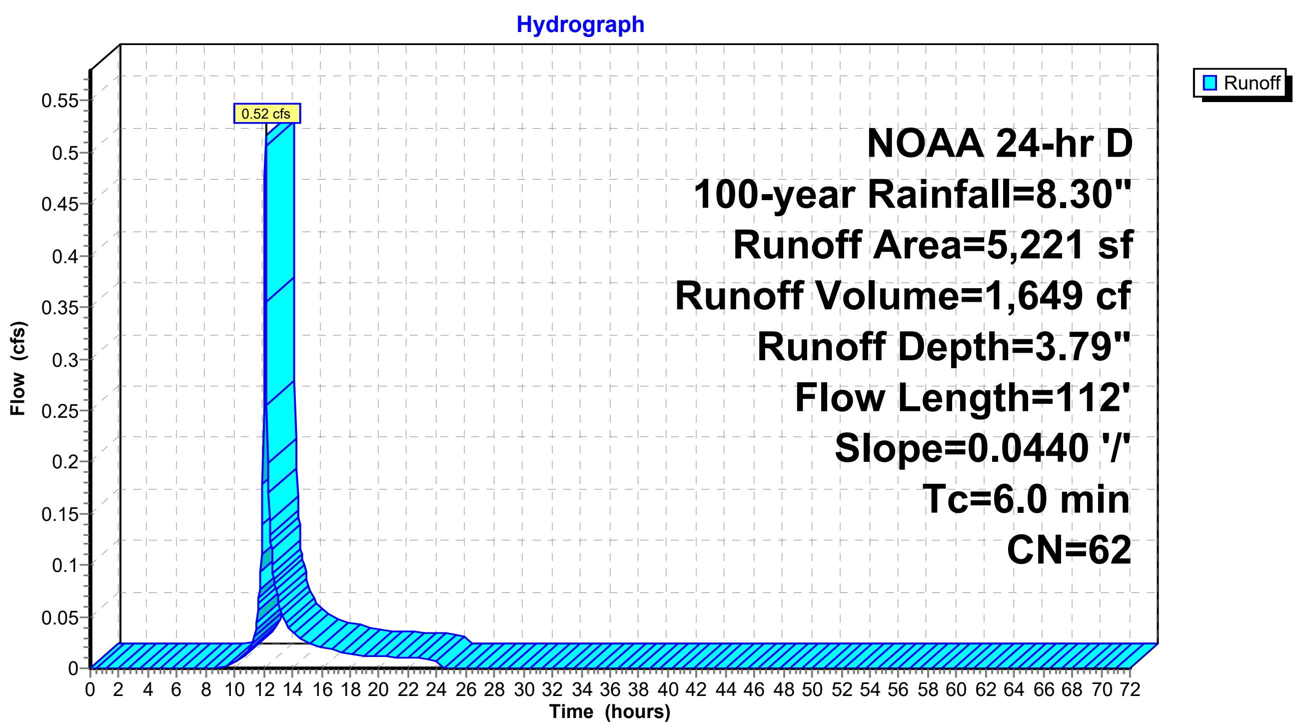
Runoff = 0.52 cfs @ 12.13 hrs, Volume= 1,649 cf, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-year Rainfall=8.30"

Area (sf)	CN	Description
2,039	98	Paved parking, HSG A
2,728	30	Woods, Good, HSG A
454	98	Paved parking, HSG A
5,221	62	Weighted Average
2,728		52.25% Pervious Area
2,493		47.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0440	1.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.2	62	0.0440	4.26		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	112	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PSB: PDA-2B



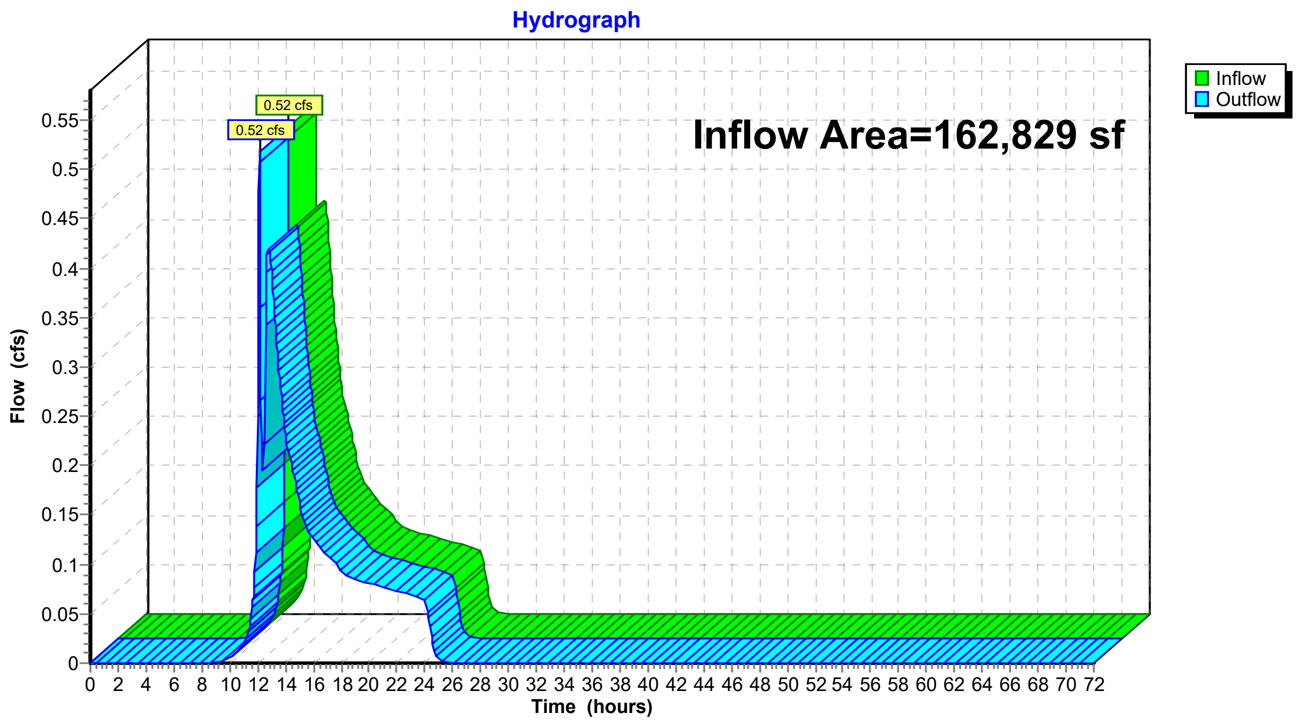
Summary for Reach 2R: PROPOSED (NULL)

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

Inflow Area = 162,829 sf, 16.02% Impervious, Inflow Depth = 0.47" for 100-year event
Inflow = 0.52 cfs @ 12.13 hrs, Volume= 6,409 cf
Outflow = 0.52 cfs @ 12.13 hrs, Volume= 6,409 cf, Atten= 0%, Lag= 0.0 min

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

Reach 2R: PROPOSED (NULL)

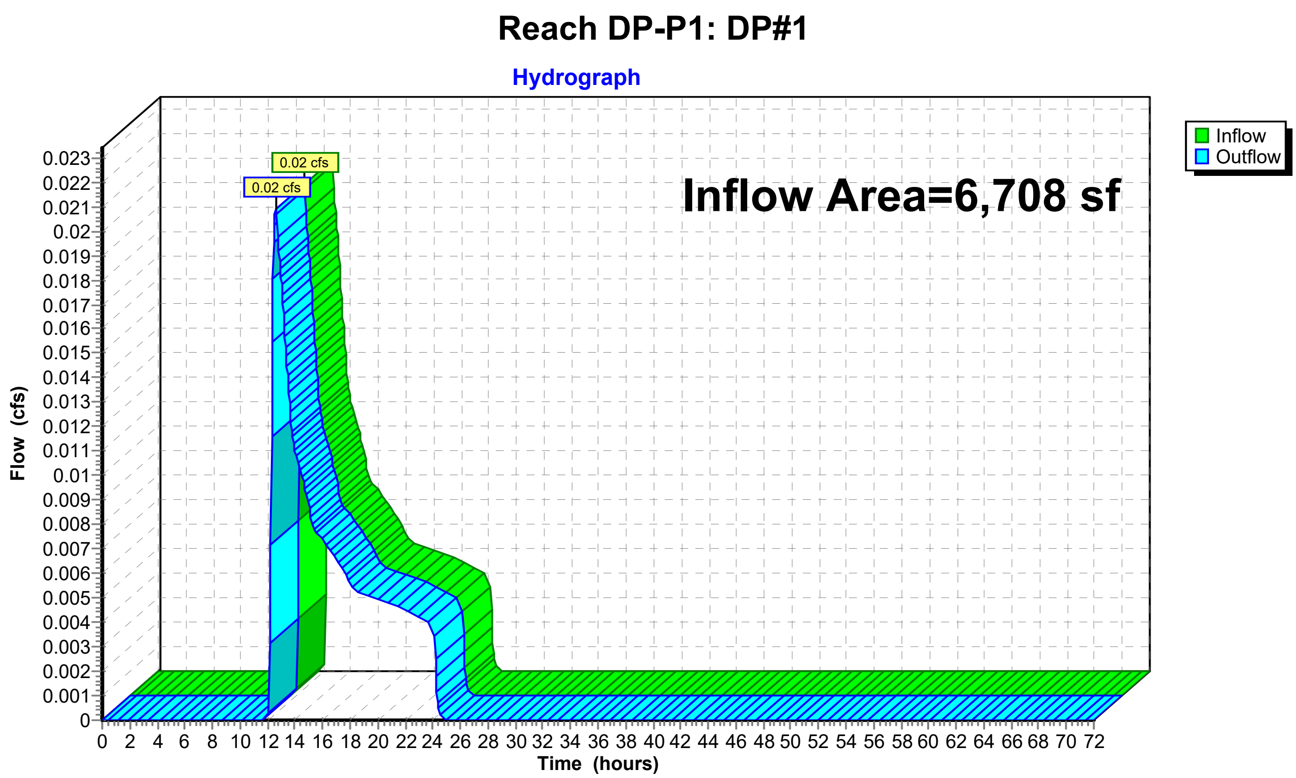


Summary for Reach DP-P1: DP#1

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

Inflow Area =	6,708 sf,	1.37% Impervious, Inflow Depth = 0.57"	for 100-year event
Inflow =	0.02 cfs @	12.61 hrs, Volume=	317 cf
Outflow =	0.02 cfs @	12.61 hrs, Volume=	317 cf, Atten= 0%, Lag= 0.0 min

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



Summary for Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN

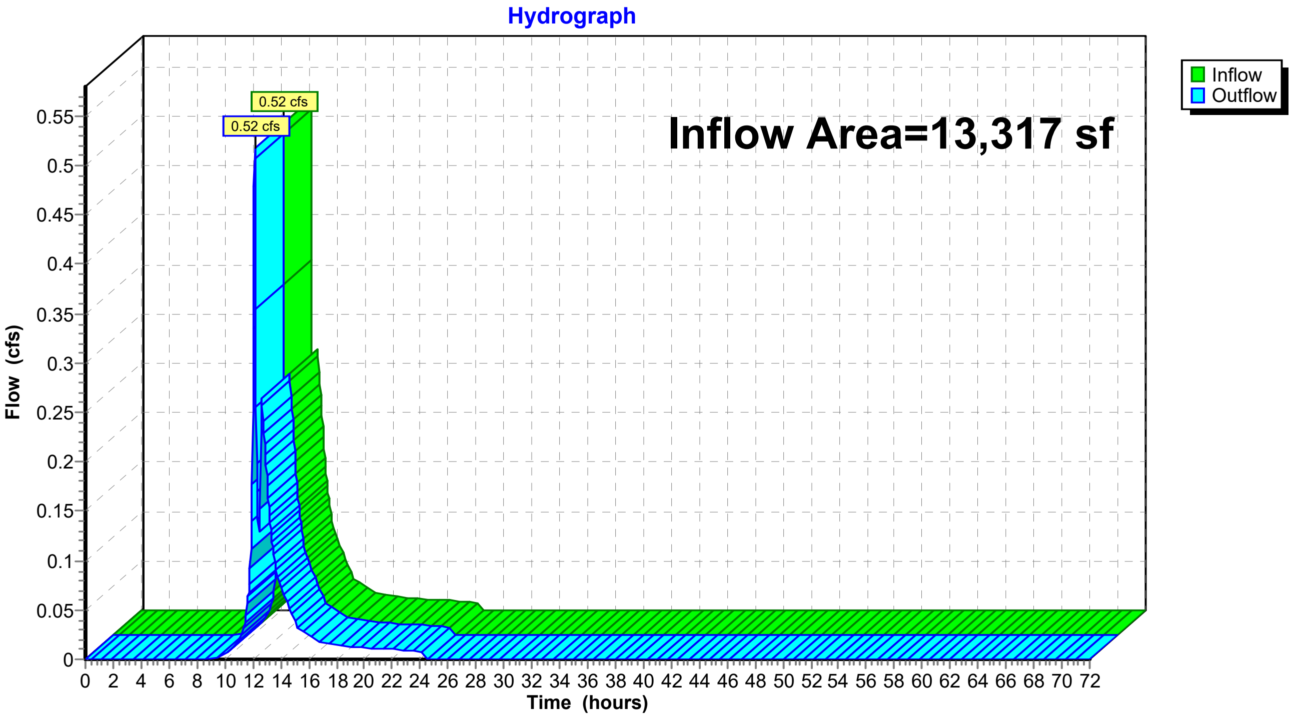
MAIN STREET CATCH BASIN

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

Inflow Area = 13,317 sf, 70.08% Impervious, Inflow Depth = 2.05" for 100-year event
Inflow = 0.52 cfs @ 12.13 hrs, Volume= 2,274 cf
Outflow = 0.52 cfs @ 12.13 hrs, Volume= 2,274 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P2: DP#2 - MAIN STREET CATCH BASIN



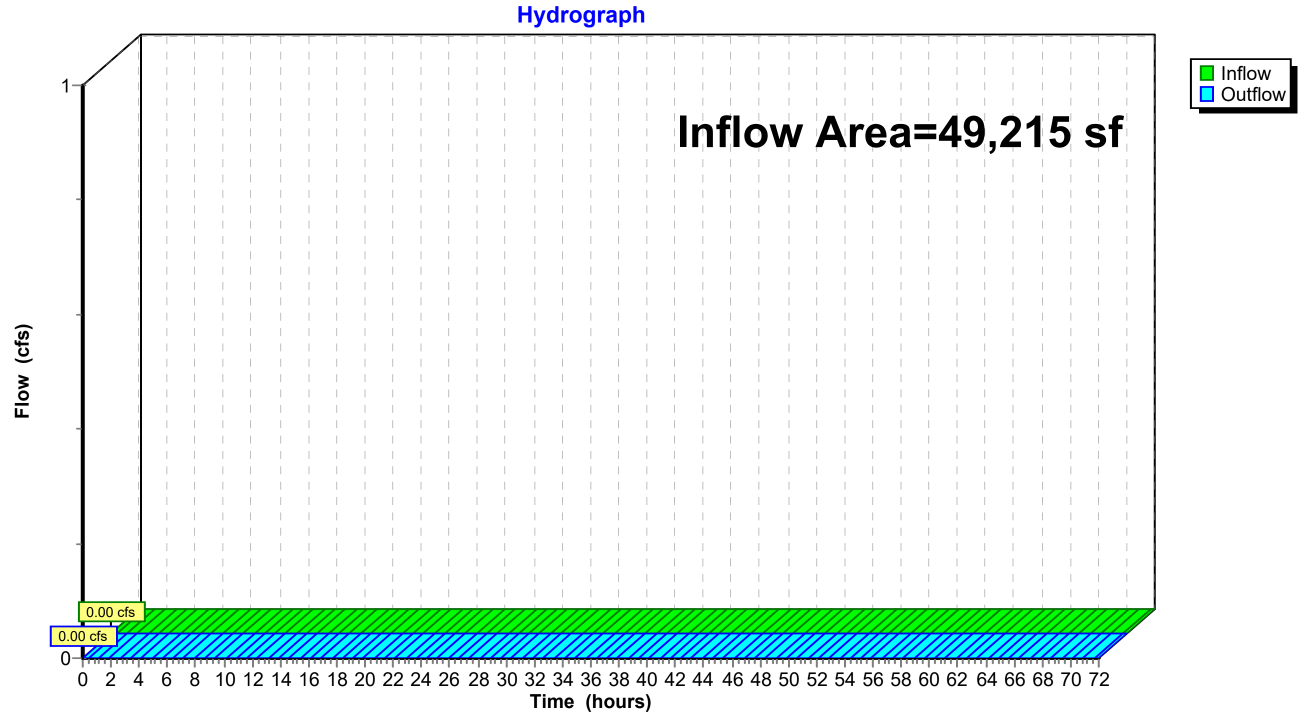
Summary for Reach DP-P3: DP#3

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

Inflow Area = 49,215 sf, 33.87% Impervious, Inflow Depth = 0.00" for 100-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P3: DP#3



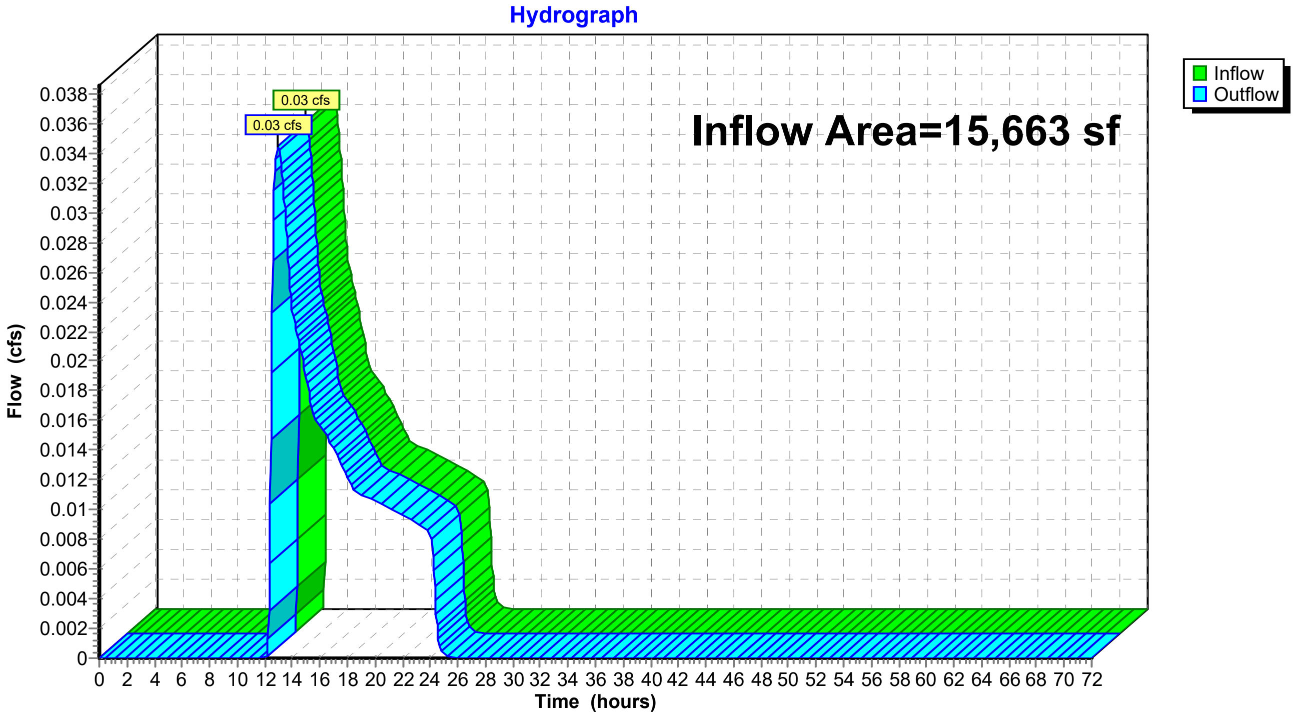
Summary for Reach DP-P4: DP#4

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

Inflow Area =	15,663 sf,	0.00% Impervious, Inflow Depth = 0.49"	for 100-year event
Inflow =	0.03 cfs @	12.94 hrs, Volume=	639 cf
Outflow =	0.03 cfs @	12.94 hrs, Volume=	639 cf, Atten= 0%, Lag= 0.0 min

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

Reach DP-P4: DP#4

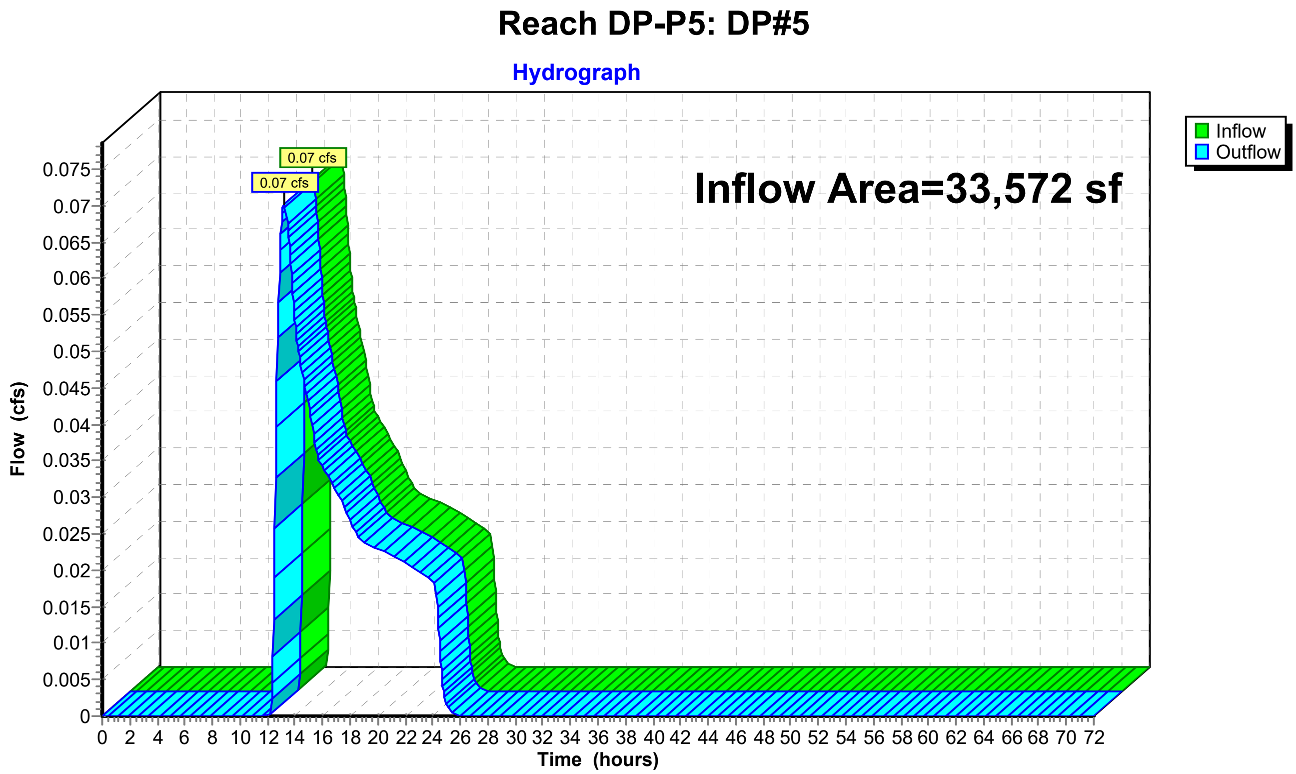


Summary for Reach DP-P5: DP#5

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

Inflow Area = 33,572 sf, 0.00% Impervious, Inflow Depth = 0.49" for 100-year event
Inflow = 0.07 cfs @ 13.19 hrs, Volume= 1,370 cf
Outflow = 0.07 cfs @ 13.19 hrs, Volume= 1,370 cf, Atten= 0%, Lag= 0.0 min

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

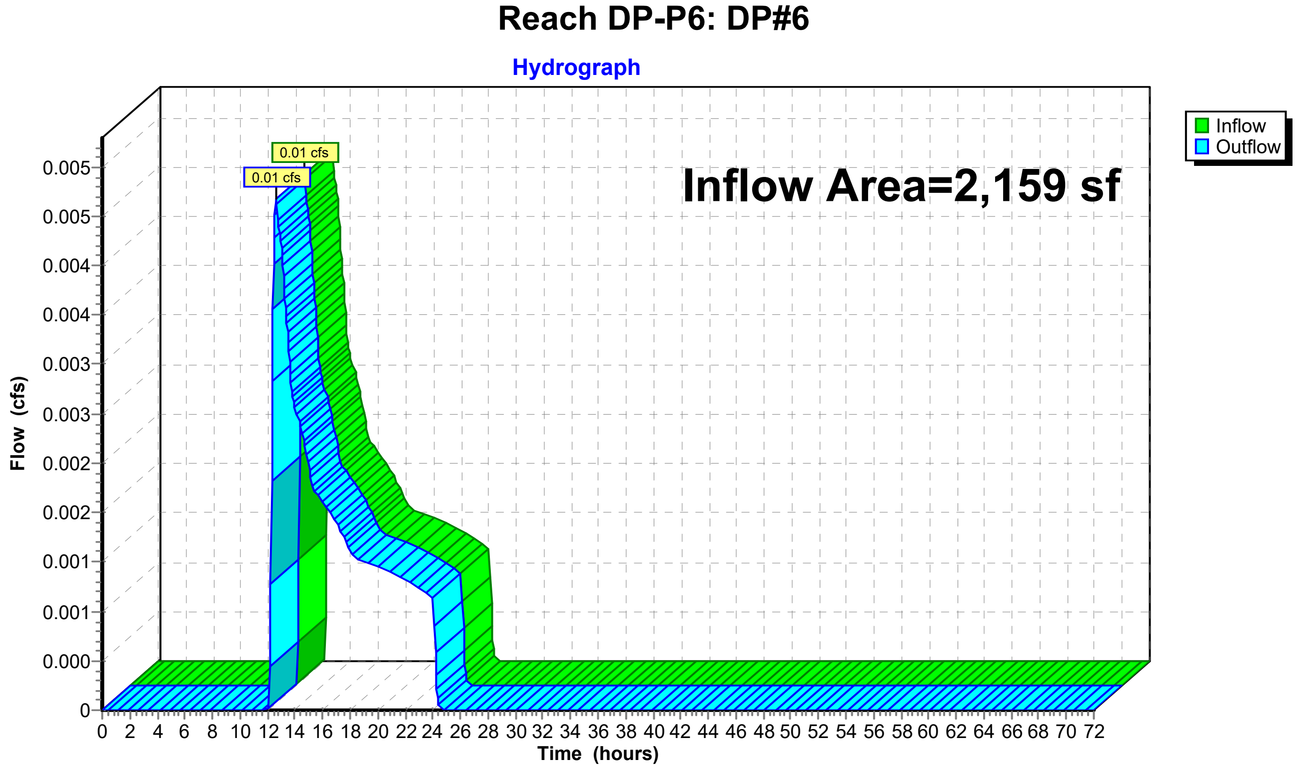


Summary for Reach DP-P6: DP#6

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

Inflow Area =	2,159 sf,	0.00% Impervious,	Inflow Depth = 0.49"	for 100-year event
Inflow =	0.01 cfs @	12.63 hrs, Volume=	88 cf	
Outflow =	0.01 cfs @	12.63 hrs, Volume=	88 cf, Atten= 0%, Lag= 0.0 min	

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

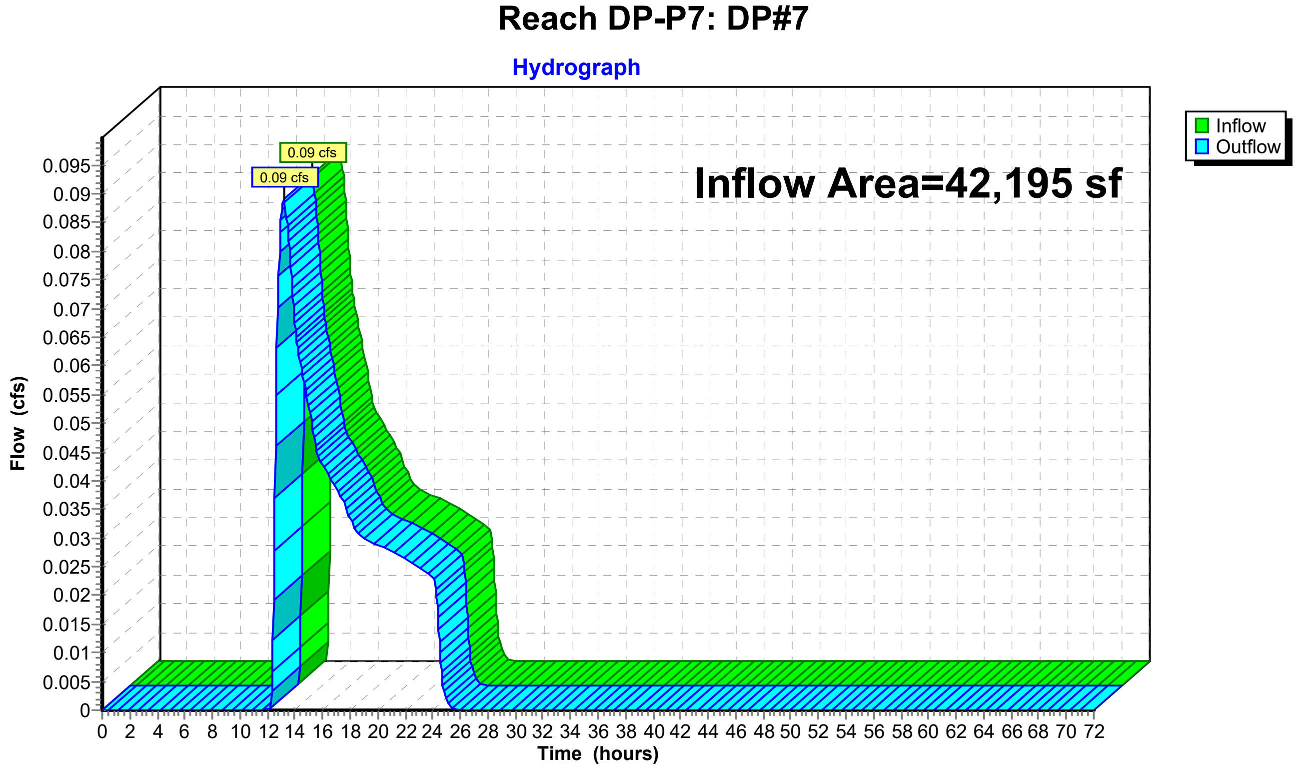


Summary for Reach DP-P7: DP#7

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

Inflow Area =	42,195 sf,	0.00% Impervious,	Inflow Depth = 0.49"	for 100-year event
Inflow =	0.09 cfs @	13.16 hrs, Volume=	1,721 cf	
Outflow =	0.09 cfs @	13.16 hrs, Volume=	1,721 cf, Atten= 0%, Lag= 0.0 min	

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



Summary for Pond 44P: StormTech Chambers

Inflow Area = 8,096 sf, 84.47% Impervious, Inflow Depth = 6.74" for 100-year event
Inflow = 1.33 cfs @ 12.13 hrs, Volume= 4,549 cf
Outflow = 0.21 cfs @ 12.65 hrs, Volume= 4,549 cf, Atten= 84%, Lag= 31.5 min
Discarded = 0.04 cfs @ 9.55 hrs, Volume= 3,924 cf
Primary = 0.17 cfs @ 12.65 hrs, Volume= 625 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 101.05' @ 12.65 hrs Surf.Area= 0.037 ac Storage= 0.047 af

Plug-Flow detention time= 433.4 min calculated for 4,545 cf (100% of inflow)
Center-of-Mass det. time= 433.6 min (1,222.1 - 788.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.026 af	**34.75'W x 46.34'L x 3.50'H Field A** 0.129 af Overall - 0.044 af Embedded = 0.085 af x 30.0% Voids
#2A	99.50'	0.044 af	**ADS_StormTech SC-740 +Cap** x 42 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 7 Rows of 6 Chambers
		0.070 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 9.55 hrs HW=99.04' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.16 cfs @ 12.65 hrs HW=101.05' (Free Discharge)
└─**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.16 cfs @ 0.76 fps)

Pond 44P: StormTech Chambers - Chamber Wizard Field A

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

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

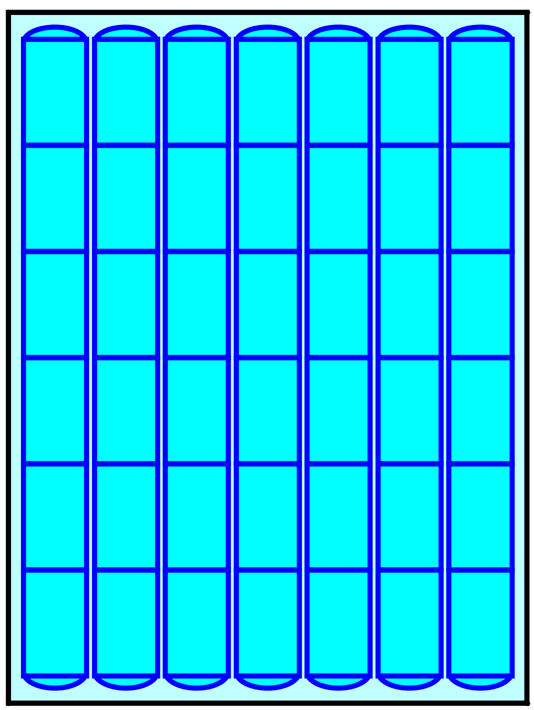
6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

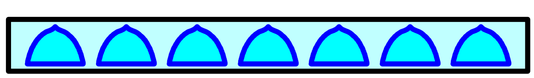
42 Chambers x 45.9 cf = 1,929.5 cf Chamber Storage

5,635.7 cf Field - 1,929.5 cf Chambers = 3,706.2 cf Stone x 30.0% Voids = 1,111.9 cf Stone Storage

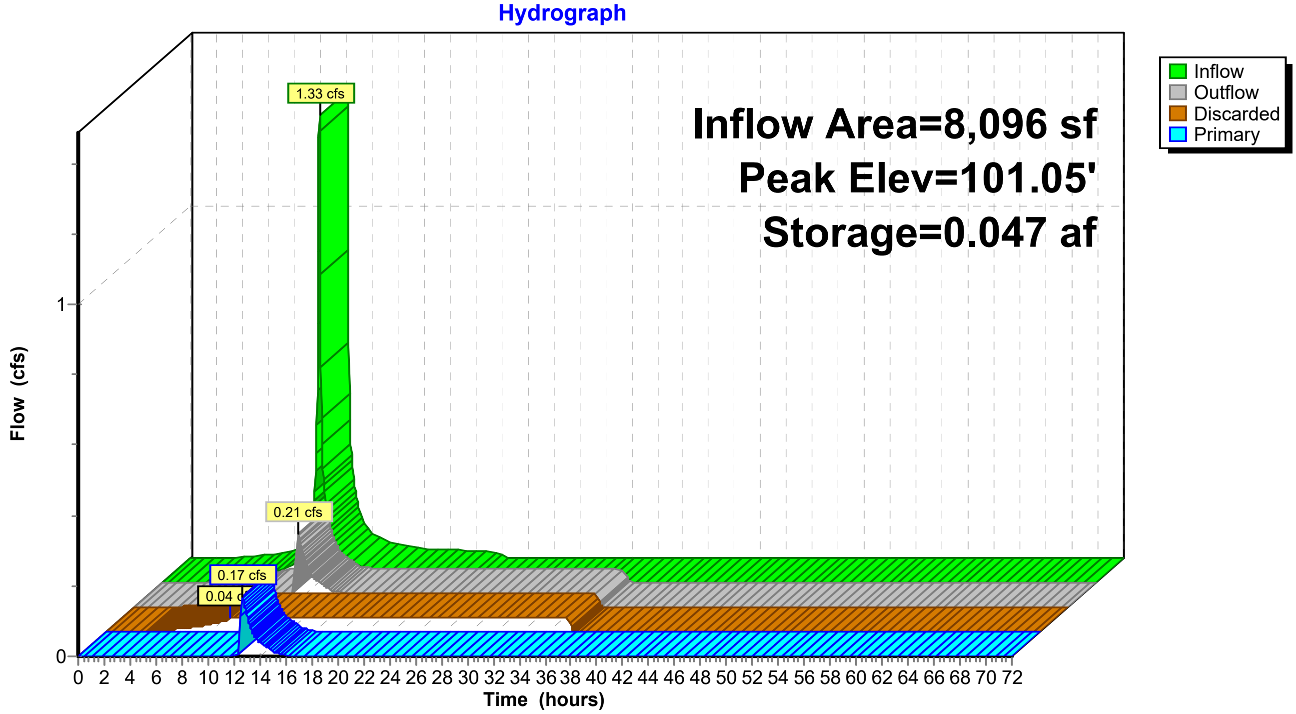
Chamber Storage + Stone Storage = 3,041.3 cf = 0.070 af
Overall Storage Efficiency = 54.0%
Overall System Size = 46.34' x 34.75' x 3.50'

42 Chambers
208.7 cy Field
137.3 cy Stone

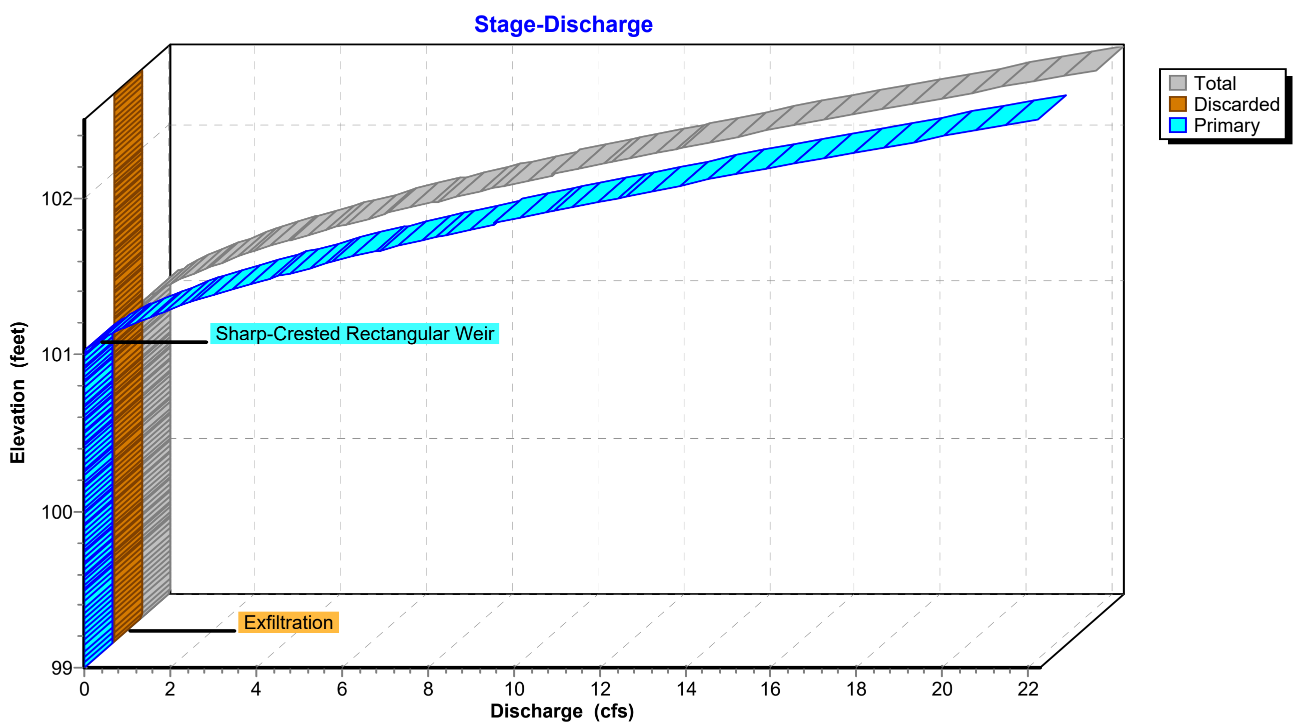




Pond 44P: StormTech Chambers



Pond 44P: StormTech Chambers



Summary for Pond 55P: StormTech Chambers

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.037 af	**39.50'W x 60.58'L x 3.50'H Field A** 0.192 af Overall - 0.067 af Embedded = 0.125 af x 30.0% Voids
#2A	99.50'	0.067 af	**ADS_StormTech SC-740 +Cap** x 64 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 8 Rows of 8 Chambers
		0.105 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.33'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Discarded	99.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
2=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 55P: StormTech Chambers - Chamber Wizard Field A

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

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

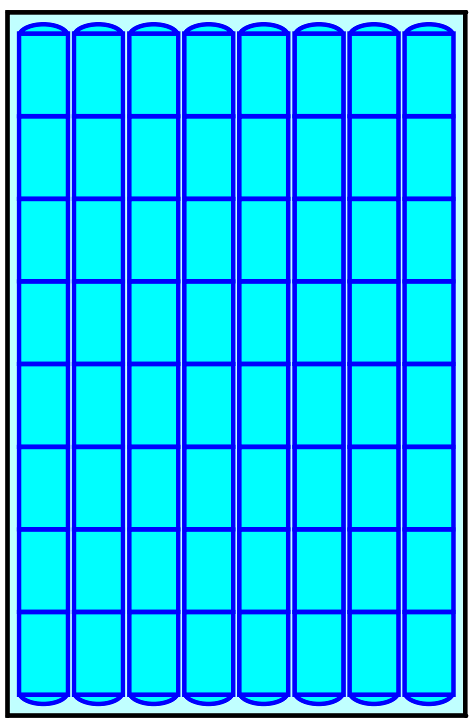
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

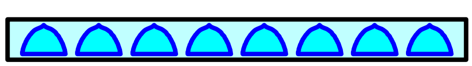
64 Chambers x 45.9 cf = 2,940.2 cf Chamber Storage

8,374.7 cf Field - 2,940.2 cf Chambers = 5,434.6 cf Stone x 30.0% Voids = 1,630.4 cf Stone Storage

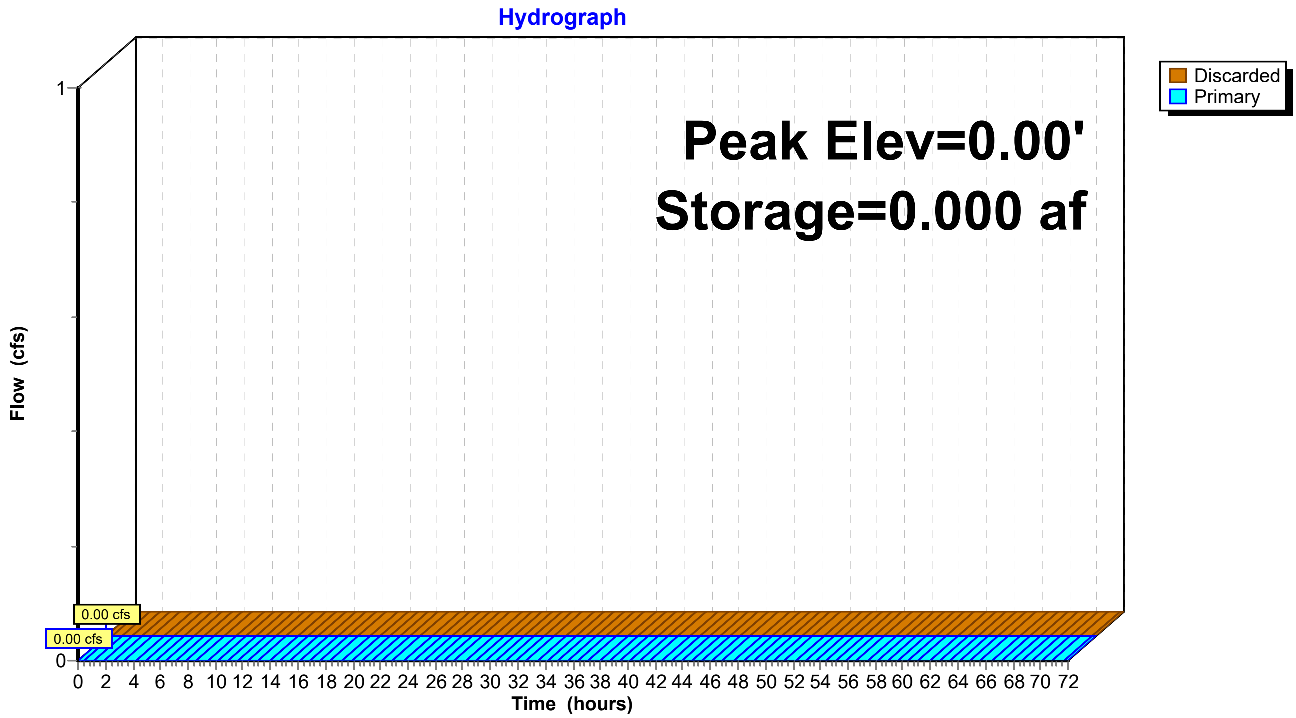
Chamber Storage + Stone Storage = 4,570.5 cf = 0.105 af
Overall Storage Efficiency = 54.6%
Overall System Size = 60.58' x 39.50' x 3.50'

64 Chambers
310.2 cy Field
201.3 cy Stone

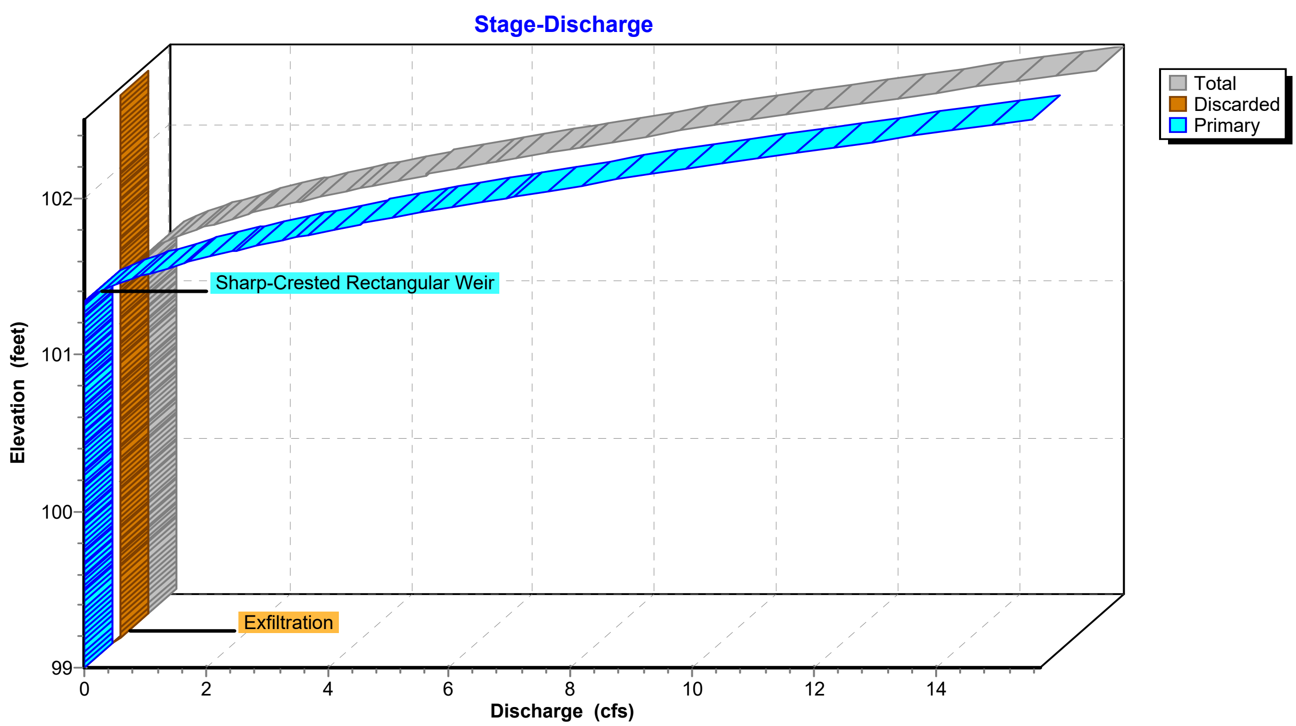




Pond 55P: StormTech Chambers



Pond 55P: StormTech Chambers



Summary for Pond 56P: Pipe Storage

Inflow Area = 2,578 sf,100.00% Impervious, Inflow Depth = 8.06" for 100-year event
Inflow = 0.46 cfs @ 12.13 hrs, Volume= 1,732 cf
Outflow = 0.13 cfs @ 12.41 hrs, Volume= 1,732 cf, Atten= 71%, Lag= 17.3 min
Discarded = 0.01 cfs @ 8.40 hrs, Volume= 1,471 cf
Primary = 0.12 cfs @ 12.41 hrs, Volume= 260 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 101.63' @ 12.42 hrs Surf.Area= 0.013 ac Storage= 0.016 af

Plug-Flow detention time= 377.1 min calculated for 1,732 cf (100% of inflow)
Center-of-Mass det. time= 377.1 min (1,118.6 - 741.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.00'	0.009 af	**9.13'W x 61.50'L x 2.75'H Field A** 0.035 af Overall - 0.009 af Embedded = 0.026 af x 35.0% Voids
#2A	99.50'	0.007 af	**ADS N-12 18"** x 9 Inside #1 Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf 3 Rows of 3 Chambers
		0.017 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	101.60'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	101.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Discarded	99.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 8.40 hrs HW=99.03' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.10 cfs @ 12.41 hrs HW=101.63' (Free Discharge)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.07 cfs @ 0.57 fps)
└─**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 1.23 fps)

Pond 56P: Pipe Storage - Chamber Wizard Field A

Chamber Model = ADS N-12 18" (ADS N-12® Pipe)
Inside= 18.2"W x 18.2"H => 1.80 sf x 20.00'L = 36.0 cf
Outside= 21.0"W x 21.0"H => 2.23 sf x 20.00'L = 44.5 cf

21.0" Wide + 14.3" Spacing = 35.3" C-C Row Spacing

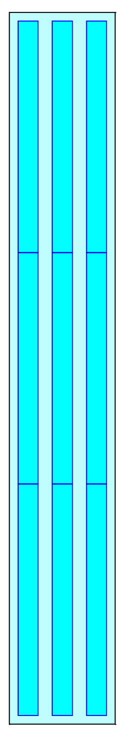
3 Chambers/Row x 20.00' Long = 60.00' Row Length +9.0" End Stone x 2 = 61.50' Base Length
3 Rows x 21.0" Wide + 14.3" Spacing x 2 + 9.0" Side Stone x 2 = 9.13' Base Width
6.0" Base + 21.0" Chamber Height + 6.0" Cover = 2.75' Field Height

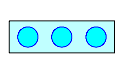
9 Chambers x 36.0 cf = 324.0 cf Chamber Storage
9 Chambers x 44.5 cf = 400.7 cf Displacement

1,545.3 cf Field - 400.7 cf Chambers = 1,144.5 cf Stone x 35.0% Voids = 400.6 cf Stone Storage

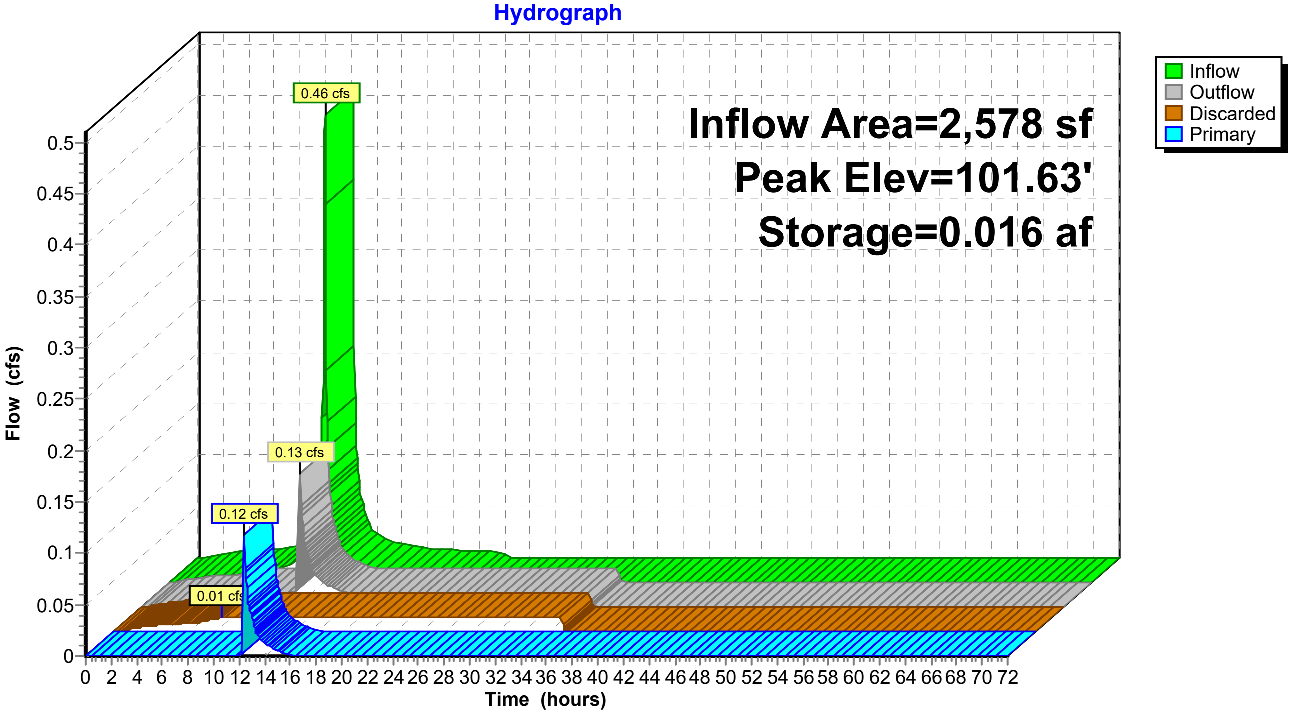
Chamber Storage + Stone Storage = 724.6 cf = 0.017 af
Overall Storage Efficiency = 46.9%
Overall System Size = 61.50' x 9.13' x 2.75'

9 Chambers
57.2 cy Field
42.4 cy Stone

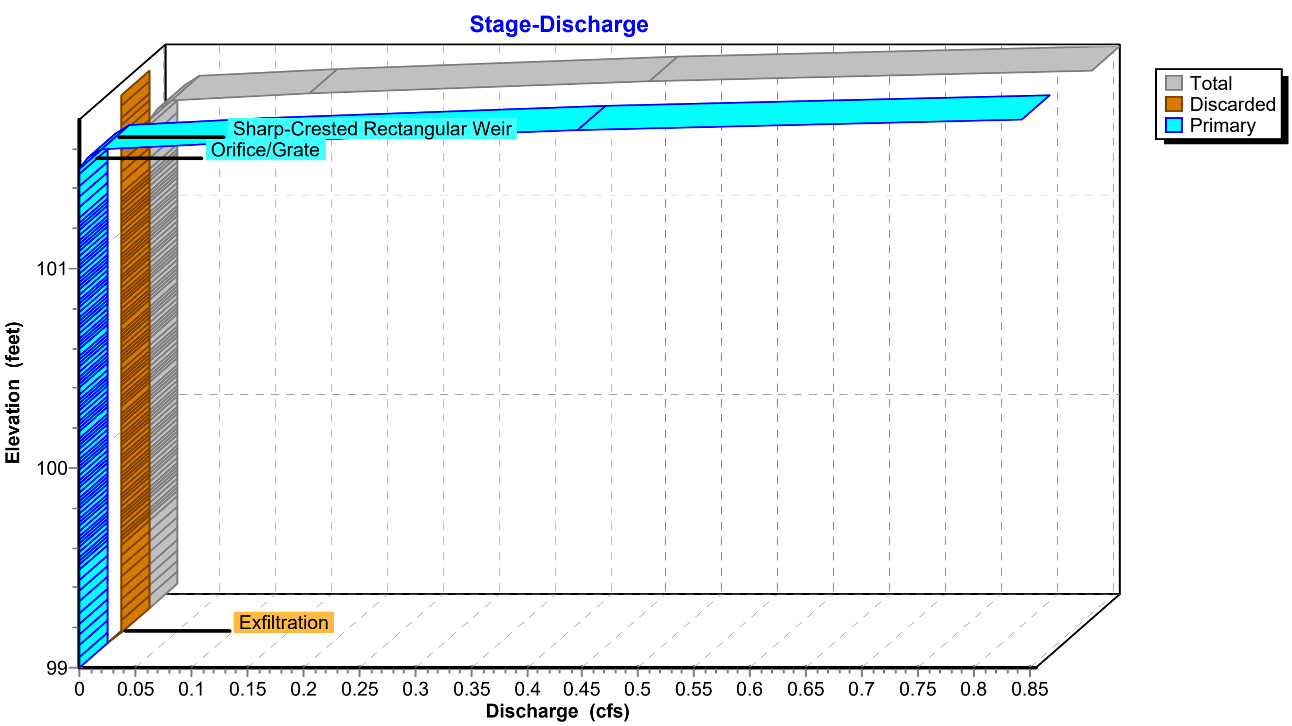




Pond 56P: Pipe Storage



Pond 56P: Pipe Storage



Summary for Pond 59P: Rain Garden

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=5)

Inflow Area = 49,215 sf, 33.87% Impervious, Inflow Depth = 2.67" for 100-year event
Inflow = 2.38 cfs @ 12.13 hrs, Volume= 10,942 cf
Outflow = 1.02 cfs @ 12.00 hrs, Volume= 10,942 cf, Atten= 57%, Lag= 0.0 min
Discarded = 1.02 cfs @ 12.00 hrs, Volume= 10,942 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 97.64' @ 12.29 hrs Surf.Area= 1,755 sf Storage= 777 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.4 min (789.9 - 787.5)

Volume	Invert	Avail.Storage	Storage Description
#1	97.00'	5,128 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

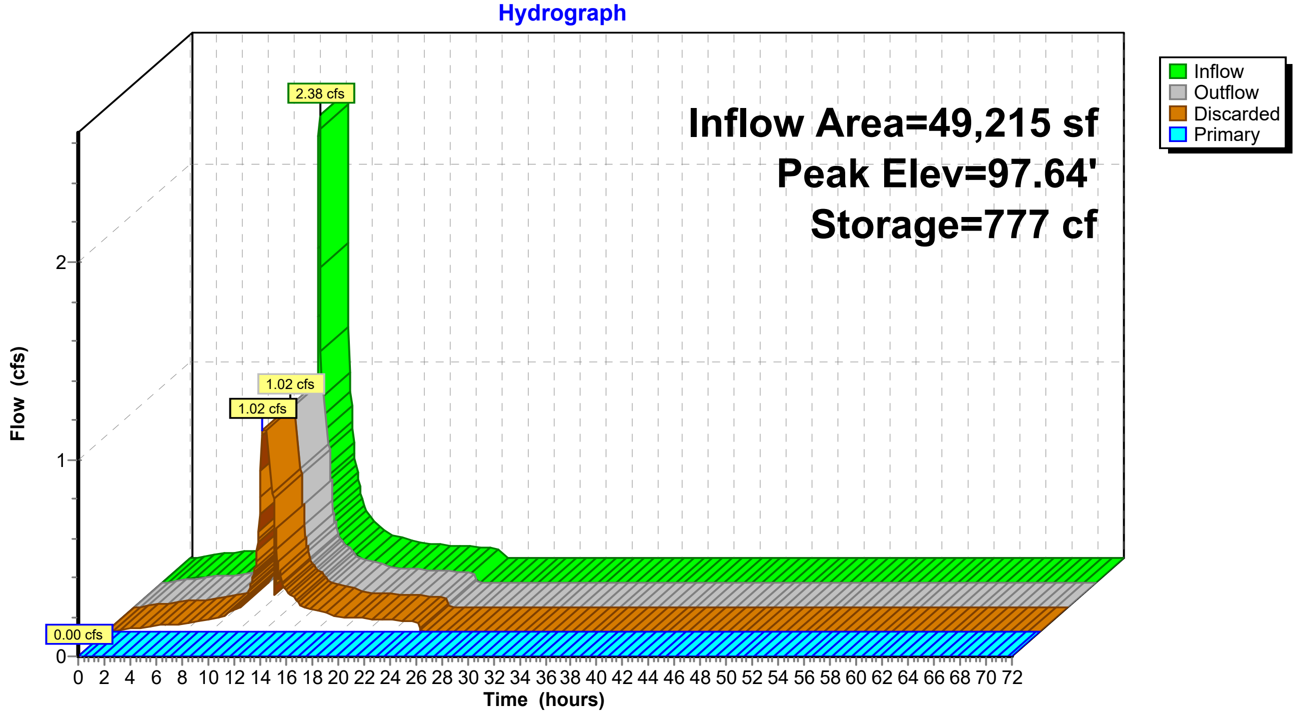
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	655	0	0
98.00	2,362	1,509	1,509
99.00	4,876	3,619	5,128

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	**1.02 cfs Exfiltration at all elevations**
#2	Primary	98.75'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** 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

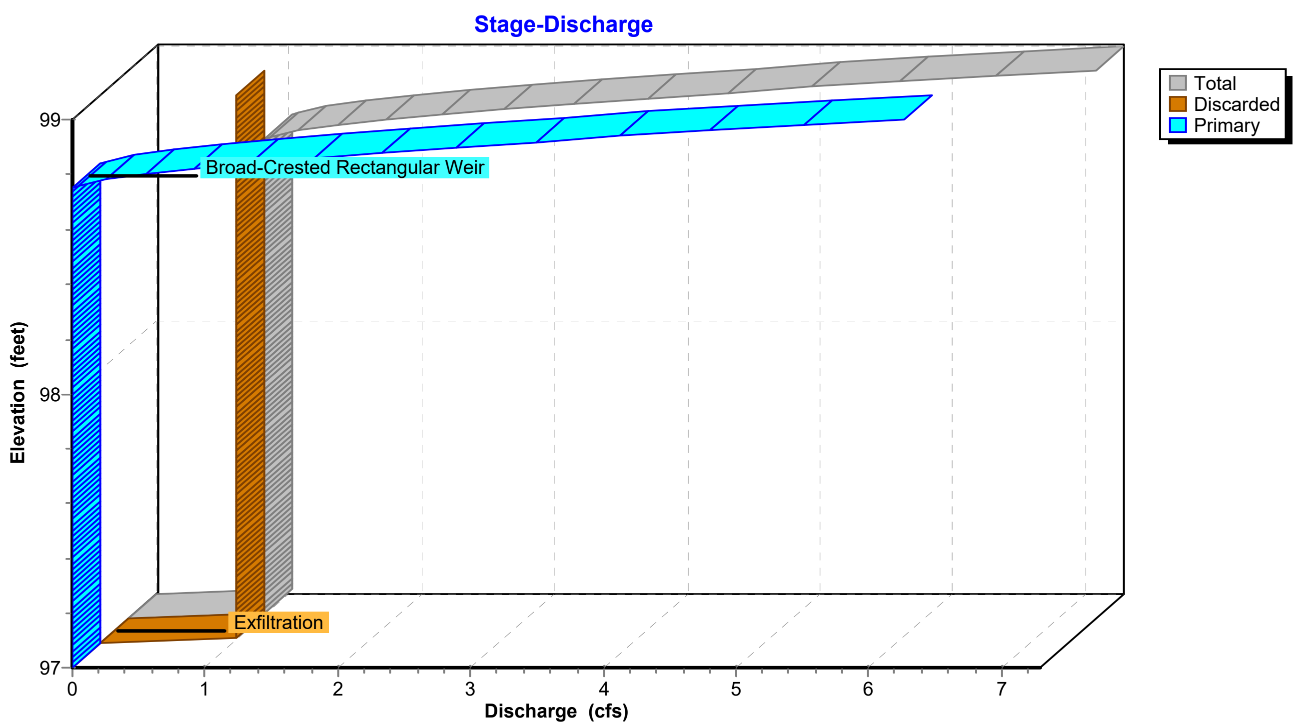
Discarded OutFlow Max=1.02 cfs @ 12.00 hrs HW=97.06' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=97.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 59P: Rain Garden



Pond 59P: Rain Garden



APPENDIX D

Long-Term Pollution Prevention and Stormwater Operation and Maintenance Plan

Nitsch Engineering

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LONG-TERM POLLUTION PREVENTION PLAN AND STORMWATER OPERATION AND MAINTENANCE PLAN

THE CENTER AT 10 ELM STREET COMMUNITY/SENIOR CENTER BOXFORD, MA

TABLE OF CONTENTS

FIGURES

1.0 INTRODUCTION

The purpose of this document is to specify the pollution prevention measures and stormwater management system operation and maintenance for The Center at 10 Elm Community/Senior Center (Boxford Community/Senior Center) project site. The Responsible Party indicated below shall implement the management practices outlined in this document and proactively conduct operations at the project site in an environmentally responsible manner. Compliance with this Manual does not in any way dismiss the responsible party, owner, property manager, or occupants from compliance with other applicable federal, state or local laws.

Responsible Party: Name
Contact, Title
Address
Phone

This Document has been prepared in compliance with Standards 4 and 9 of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards, which state:

Standard 4:
The Long Term Pollution Prevention Plan shall include the proper procedures for the following:

- Good housekeeping
- Storing materials and waste products inside or under cover
- Vehicle washing
- Routine inspections of stormwater best management practices
- Spill prevention and response
- Maintenance of lawns, gardens, and other landscaped areas
- Storage and use of fertilizers, herbicides, and pesticides
- Pet waste management
- Operation and management of septic systems
- Proper management of deicing chemicals and snow

Standard 9:
The Long-Term Operation and Maintenance Plan shall at a minimum include:

- Stormwater management system(s) owner(s)
- The party or parties responsible for operation and maintenance, including how future property owners shall be notified of the presence of the stormwater management system and the requirement for operation and maintenance
- The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks
- A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point
- A description and delineation of public safety features
- An estimated operations and maintenance budget

2.0 LONG-TERM POLLUTION PREVENTION PLAN

The Responsible Party shall implement the following good housekeeping procedures at the project site to reduce the possibility of accidental releases and to reduce safety hazards.

2.1 Storage of Hazardous Materials

To prevent leaks and spills, keep hazardous materials and waste products under cover or inside. Use drip pans or spill containment systems to prevent chemicals from entering the drainage system. Inspect storage areas for materials and waste products at least once per year to determine amount and type of the material on site, and if the material requires disposal.

Securely store liquid petroleum products and other liquid chemicals in federally- and state-approved containers. Restrict access to maintenance personnel and administrators.

2.2 Storage of Waste Products

Collect and store all waste materials in securely lidded dumpster(s) or other secure containers as applicable to the material. Keep dumpster lids closed and the areas around them clean. Do not fill the dumpsters with liquid waste or hose them out. Sweep areas around the dumpster regularly and put the debris in the garbage, instead of sweeping or hosing it into the parking lot. Legally dispose of collected waste on a regular basis.

Segregate liquid wastes, including motor oil, antifreeze, solvents, and lubricants, from solid waste and recycle through hazardous waste disposal companies, whenever possible. Separate oil filters, batteries, tires, and metal filings from grinding and polishing metal parts from common trash items and recycle. These items are not trash and are illegal to dump. Contact a hazardous waste hauler for proper disposal to a hazardous waste collection center.

2.3 Spill Prevention and Response

Implement spill response procedures for releases of significant materials such as fuels, oils, or chemical materials onto the ground or other area that could reasonably be expected to discharge to surface or groundwater.

- For minor spills, keep fifty (50) gallon spill control kits and Speedy Dry at all shop and work areas.
- Immediately contact applicable Federal, State, and local agencies for reportable quantities as required by law.
- Immediately perform applicable containment and cleanup procedures following a spill release.
- Promptly remove and dispose of all material collected during the response in accordance with Federal, State and local requirements. A licensed emergency response contractor may be required to assist in cleanup of releases depending on the amount of the release, and the ability of the Contractor to perform the required response.
- Reportable quantities of chemicals, fuels, or oils are established under the Clean Water Act and enforced through Massachusetts Department of Environmental Protection (DEP).

2.4 Minimize Soil Erosion

Soil erosion facilitates mechanical transport of nutrients, pathogens, and organic matter to surface water bodies. Repair all areas where erosion is occurring throughout the project site. Stabilize bare soil with riprap, seed, mulch, or vegetation.

2.5 Vehicle Washing

Vehicle washing will occur within the covered service area. The car wash will be a state-of-the art system that will reclaim and reuse water for the car wash operation. Eventual discharge of the wash water will be directed to the sanitary sewer.

2.6 Maintenance of Lawns, Gardens, and other Landscaped Areas

Pesticides and fertilizers shall not be used in the landscaped areas associated with the project site and shall not be stored on-site. Dumping of lawn wastes, brush or leaves or other materials or debris is not permitted in any Resource Area. Grass clippings, pruned branches and any other landscaped waste should be disposed of or composted in an appropriate location. No irrigation shall be used in the landscaped areas for this project.

2.7 Management of Deicing Chemicals and Snow

The qualified contractor selected for snow plowing and deicing shall be made fully aware of the requirements of this section.

No road salt (sodium chloride) shall be stored on-site. The use of magnesium chloride de-icing product with a 0.5 to 1.0 percent sodium chloride mix for snow and ice treatment is permitted. The product shall be stored in a locked room inside the building and shall be used at exterior stairs and walkways. The snow plow contractor shall adhere to these magnesium chloride use and storage requirements.

During typical snow plowing operations, snow shall be pushed to the designated snow removal areas noted on the Snow Storage Plan (Figure 2). Snow shall not be stockpiled in wetland resource areas or the 100-foot Buffer Zone, catch basins, or bioretention basins, . In severe conditions where snow cannot be stockpiled on site, the snow shall be removed from the site and properly disposed of in accordance with DEP Guideline BRP601-01.

Use of sand is permitted only for impervious roadways and parking areas.

Before winter begins, the property owner and the contractor shall review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris. Street and parking lot sweeping should be followed in accordance with the Operation and Maintenance Plan.

2.8 Coordination with other Permits and Requirements

Certain conditions of other approvals affecting the long term management of the property shall be considered part of this Long Term Pollution Prevention Plan. The Owner shall become familiar with those documents and comply with the guidelines set forth in those documents.

3.0 STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN

3.1 Introduction

This Operation and Maintenance Plan (O&M Plan) for Boxford Community/Senior Center site is required under Standard 9 of the 2008 MassDEP Stormwater Handbook to provide best management practices for implementing maintenance activities for the stormwater management system in a manner that minimizes impacts to wetland resource areas.

The Owner shall implement this O&M Plan and proactively conduct operations at the site in an environmentally responsible manner. Compliance with this O&M Plan does not in any way dismiss the Owner from compliance with other applicable Federal, State or local laws.

Routine maintenance during construction and post-development phases of the project, as defined in the Operation and Maintenance Plan, shall be permitted without amendment to the Order of Conditions. A continuing condition in the Certificate of Compliance shall ensure that maintenance can be performed without triggering further filings under the Wetlands Protection Act.

All stormwater best management practices (BMPs) shall be operated and maintained in accordance with the design plans and the Operation and Maintenance Plan approved by the issuing authority. The Owner shall:

a. Maintain an operation and maintenance log for the last three years, including inspections, repairs, replacement and disposal (for disposal the log shall indicate the type of material and the disposal location). This is a rolling log in which the responsible party records all operation and maintenance activities for the past three years.

b. Make this log available to MassDEP and the Conservation Commission upon request; and

c. Allow members and agents of the MassDEP and the Conservation Commission to enter and inspect the premises to evaluate and ensure that the Owner complies with the Operation and Maintenance requirements for each BMP.

3.2 Stormwater Operation and Maintenance Requirements

Inspect and maintain the stormwater management system as directed below. Refer to the Stormwater Management System Location Map (Figure 1) for the location of each component of the system. Repairs to any component of the system shall be made as soon as possible to prevent any potential pollutants (including silt) from entering the resource areas.

<u>Area Drains</u>

Inspect area drains at least once per month and remove debris from the grate. Clean out accumulated sediments at least once per year and more frequently as necessary.

<u>Subsurface Detention/Infiltration Structures</u>

- Inspect subsurface detention/infiltration structures twice per year. Inspect the inlets and observation ports to determine if there is accumulated sediment within the system. Remove all debris and accumulated sediment that may clog the system.

<u>Detention Basin</u>

Inspect the detention basin at least once per year to ensure that the basin is operating as intended.

Inspect the detention basin during and after major storms to determine if the basin is meeting the expected detention times.

- Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.
    - Potential problems that should be checked include: subsidence, erosion, cracking or tree growth on the embankment; damage to the emergency spillway; sediment accumulation around the outlet; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel; and erosion within the basin and banks. Make any necessary repairs immediately.
- During inspections, note any changes to the extended dry detention basin or the contributing watershed, because these could affect basin performance.
- Inspect basins to ensure they are operating as designed at least once per year
- Mow the upper-stage, side slopes, embankment, and emergency spillway at least twice per year. Also remove trash and debris at this time.
- Check the sediment forebay for accumulated sediment, trash and debris and remove it at least twice per year.
- Remove sediment from the extended dry detention basin as necessary, but at least once every 5 years. Providing an on-site sediment disposal area will reduce the overall sediment removal costs.

<u>Stormwater Outfalls</u>

Inspect flared end sections and associated riprap spillways at least once per year and after major storm events (rainfall totals greater than 2.5 inches in 24 hours) to ensure that the stability of the outlet area is maintained. Keep the outfall area clear of debris such as trash, branches, and sediment. Make repairs immediately if riprap displacement or downstream channel scour is observed.

<u>Oil/Water Separators</u>

At a minimum, inspect oil/water separators monthly, and clean them out at least twice per year. In the event of a hazardous waste spill, the oil/water separator should be cleaned immediately. Cleaning involves the removal of accumulated oil and grease and sediment using a vacuum truck. Polluted water or sediments removed from the oil/water separators shall be disposed of in accordance with all applicable local, state, and federal laws and regulations, including M.G.L.c. 21C and 310 CMR 30.00.

3.3 Street Sweeping

Perform street sweeping at least twice per year, whenever there is significant debris present on roads and parking lots. Street sweeping shall occur in the spring and fall. Sweepings must be handled and disposed of properly according to the Boxford Conservation Commission.

3.4 Repair of the Stormwater Management System

The stormwater management system shall be maintained. The repair of any component of the system shall be made as soon as possible to prevent any potential pollutants including silt from entering the resource areas or the existing closed drainage system.

3.5 Reporting

The Owner shall maintain a record of drainage system inspections and maintenance (per this Plan) and submit a yearly report to the Boxford Conservation Commission.

STORMWATER MANAGEMENT SYSTEM INSPECTION FORM

The Center at 10 Elm Street Community / Senior Center **Boxford, MA**		**Inspected by:____________** **Date:____________**
Component	**Status/Inspection**	**Action Taken**
Deep Sump Catch Basins, Area Drains and Drain Manholes		
Subsurface Infiltration System		
Oil/Water Separator		
Stormwater Outfalls & Level Spreaders		
General site conditions – evidence of erosion, etc.		

SUBMIT COPIES OF STORMWATER MANAGEMENT SYSTEM INSPECTION FORM TO THE BOXFORD CONSERVATION COMMISSION WITH THE YEARLY REPORT.

APPENDIX E

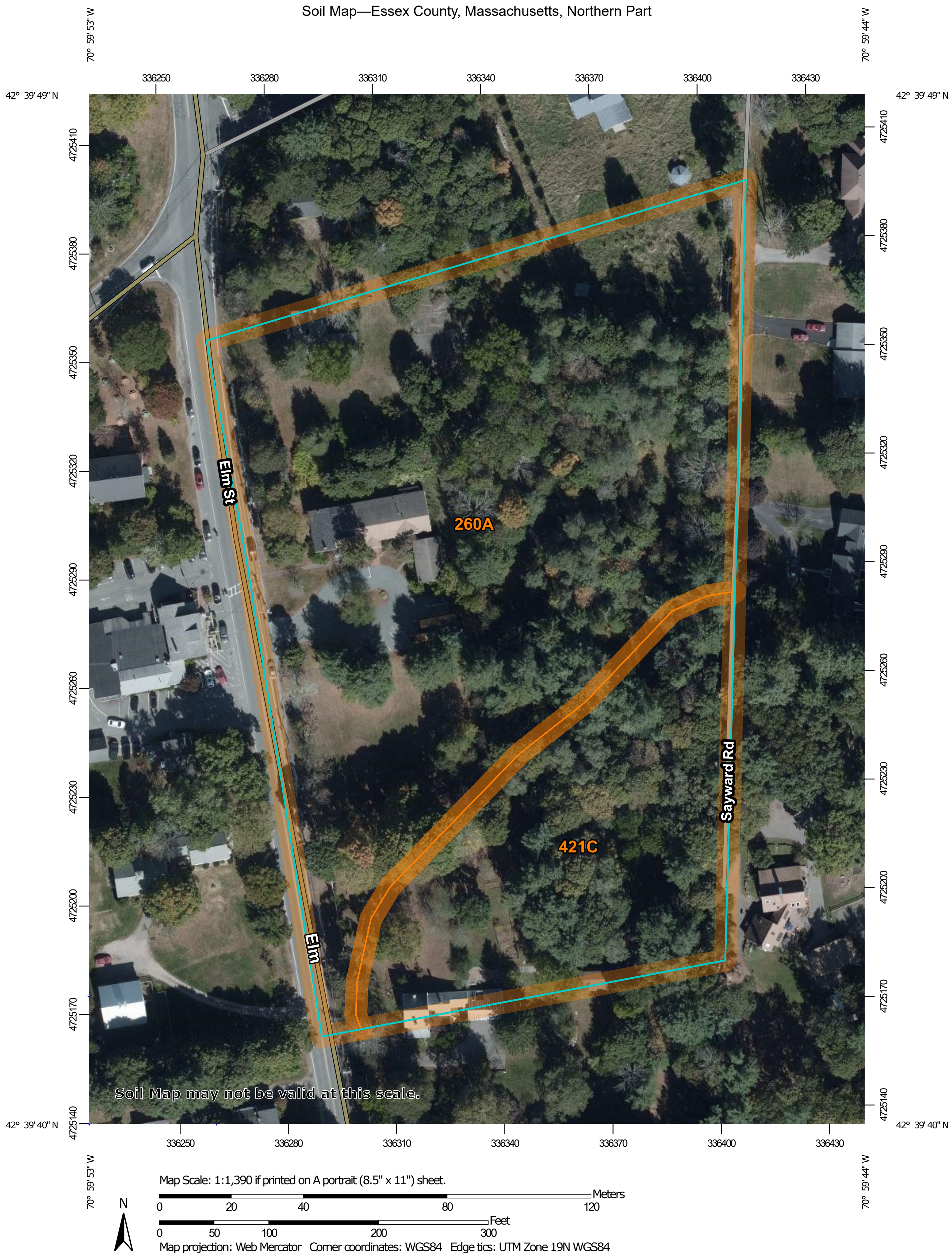
DRAFT Stormwater Pollution Prevention Plan (SWPPP)

SWPPP TO BE SUBMITTED AT A LATER DATE

APPENDIX F

Soil Investigations

NRCS Soil Maps and Descriptions
Geotechnical Report
Soil Test Pit Logs


70° 59' 53" W
70° 59' 44" W
42° 39' 49" N
42° 39' 40" N
336250
336280
336310
336340
336370
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336430
4725410
4725380
4725350
4725320
4725290
4725260
4725230
4725200
4725170
4725140
Elm St
Elm
Sayward Rd
260A
421C
Soil Map may not be valid at this scale.
Map Scale: 1:1,390 if printed on A portrait (8.5" x 11") sheet.
N
0 20 40 80 120 Meters
0 50 100 200 300 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil 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:
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

Date(s) aerial images were photographed: Sep 13, 2019—Oct 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	4.9	73.1%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	1.8	26.9%
Totals for Area of Interest		**6.7**	**100.0%**

JOHN TURNER
CONSULTING

GEOTECHNICAL INVESTIGATION REPORT

COMMUNITY/SENIOR CENTER
10 Elm Street
Boxford, Massachusetts 01921

Prepared for:

GRLA
239 South Street
Hopkinton, MA 01748

Prepared by:

John Turner Consulting, Inc.
356 Manchaug Road
Sutton, Massachusetts 01590

JTC Project No. 20-04-109

January 21, 2021

COMMONWEALTH OF MASSACHUSETTS
JUDSON D. ZACHAR
CIVIL
NO. 48177
REGISTERED PROFESSIONAL ENGINEER

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JOHN TURNER
CONSULTING

January 21, 2021

Scott Richardson, AIA - Principal
G | R | L | A
Gorman Richardson Lewis Architects
239 South Street
Hopkinton, MA 01748

RE: Geotechnical Investigation Report
Community/Senior Center
10 Elm Street
Boxford, Massachusetts 01921

Dear Mr. Richardson:

In accordance with our proposal and authorization to proceed, John Turner Consulting, Inc. (JTC) has performed a geotechnical investigation for the proposed Community/Senior Center to be located at 10 Elm Street in Boxford, Massachusetts. Presented herein and attached are the results of the site subsurface investigation, and our recommendations regarding the design and construction of the foundation, and other geotechnical related concerns or issues.

We appreciate the opportunity to assist you on this venture and we look forward to working with you on this project through its completion. Please do not hesitate to contact us if you have any questions or require additional information.

Sincerely,
JOHN TURNER CONSULTING, INC.

Thomas A. McIntosh III

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Table of Contents

1.0 INTRODUCTION

John Turner Consulting, Inc. (JTC) is pleased to present this *Geotechnical Investigation Report* for the proposed Community/Senior center to be located at 10 Elm Street in Boxford, Massachusetts. JTC conducted geotechnical explorations, laboratory testing, and engineering evaluations in general accordance with our proposed scope of services submitted to GRLA on November 18, 2020. The work was authorized on December 01, 2020.

The purpose of the geotechnical investigation was to obtain information on the subsurface conditions at the site and to provide geotechnical engineering recommendations to support the planning, design, and construction of the proposed development. Geotechnical explorations and laboratory testing services were performed in December and January of 2020/2021.

This report summarizes available project information, presents the geotechnical exploration and laboratory testing programs, describes the subsurface conditions encountered, and provides geotechnical engineering recommendations to support the planning, design, and construction of the Community/Senior Center building. The contents of this report are subject to the attached *Limitations*.

2.0 PROJECT INFORMATION

The following subsections provide general descriptions of the site, the regional geologic setting, and the proposed development.

2.1 Site Description

Presently, the subject property is a 3.371-acre lot, developed with a two-story residential structure and a single-story barn/garage. Paved parking/drive lanes are located to the south of the existing residence. The site is bounded by undeveloped woodlands and grass fields to the north, east, and south, and Elm Street to the west.

The site is generally flat and level. Based on the provided, *Civil Utility Plan*, grades within the area to be developed vary from approximately EL. 100.0 feet to EL. 101.0 feet within the proposed parking area and EL. 101.0 feet to EL. 102.0 feet within the proposed building footprint.

2.2 Regional Geologic Setting

JTC's review of the "Surficial Materials Map of the Georgetown Quadrangle, Massachusetts" (Stone & DiGiacomo-Cohen, 2018) indicates that the site soils are characterized primarily by Coarse Glacial Deposits typically consisting of layered gravel deposits, sand and gravel deposits, and sand deposits. Finer layers may contain some very fine sand, silt, and clay.

2.3 Proposed Development

JTC understands the proposed development involves the demolition of the existing structures and construction of a new, single-story building primarily over the footprint of the existing structures. The intent is to support the building on conventional shallow, spread footing, foundations with a cast-in-place concrete, slab-on-grade floor, i.e., no basement.

The Finished Floor Elevation (FFE) of the proposed building has been set at EL. 104.0 feet. With grades varying across the proposed building from approximately EL. 101.0 feet to EL. 102.0 feet, fills of up to 3.0± may be required.

The building plans are still in the schematic stage and finished floor elevations and structural loading conditions were not available at the time of this writing. As such, JTC has assumed the following structural loading conditions based on our experience with similar developments:

- Strip/wall footing loads will be on the order of 3 kips per linear foot or less
- Column loads will be on the order of up to 50 kips
- Live loads applied to the floor slab-on-grade will be on the order of 100 pounds per square foot (psf) or less.

3.0 GEOTECHNICAL EXPLORATIONS

3.1 Subsurface Investigations

JTC subcontracted Soil Exploration Corp (Soil-X) to perform four (4) geotechnical test borings designated as B-1 through B-3, inclusive, B-3A and B-4. Boring B-3A was drilled approximately 10 feet east of B-3 upon shallow auger refusal. The borings were advanced via an Acker AD II atv-mounted drill rig. The test borings were advanced to depths ranging from 12 feet to 71 feet below the ground surface (bgs) utilizing 4¼-inch inner-diameter hollow stem augers (HSAs). Borings B-2 and B-4 were advanced to 27.0 feet bgs while boring B-2 was advanced to 26.0 feet bgs. Borings B-3 and B-3A were drilled to depths of 6.0 feet bgs and 9.0 feet bgs, respectively. As the borings were advanced, standard penetration tests (SPTs) were conducted at regular intervals and soil samples were obtained via a 2-inch outside-diameter split-spoon sampler driven by a 140-pound automatic hammer dropping 30 inches. SPTs were performed in general accordance with ASTM D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

JTC also witnessed the excavation of three (3) test pits by New England Style, Inc. via a Takeuchi TB260 Mini-Excavator. The test pits were designated as TP-1 through TP-3, inclusive. The test pits were excavated to depths ranging from 7.0 feet bgs to 8.0 feet bgs. Bulk soil samples were collected from within the excavations during the investigation.

Representative soil samples collected during the investigations were sealed in moisture-tight containers and returned to JTC's office for further review, classification, and geotechnical laboratory testing.

JTC directed the drilling, excavation, testing, and sampling activities and logged the subsurface conditions encountered at each exploration location. The test boring and test pit locations were selected by the Client on the annotated *Civil Utility Plan*. Subsequently, the relative location of each boring and test pit was chosen based upon the existing site features and proposed development, and under the constraints of drill rig access and utility conflicts. The test borings and test pits were backfilled with soil cuttings upon completion of drilling.

Detailed records of the drilling/excavation, testing, and sampling performed, and the soil, bedrock, and groundwater conditions observed at each test boring and test pit location are provided on the attached *Test Boring & Test Pit Logs*. The attached *Exploration Location Plan* depicts the approximate exploration locations.

4.0 GEOTECHNICAL LABORATORY TESTING

JTC selected representative soil samples for geotechnical laboratory testing at our in-house laboratory. The following tests were performed:

- 6 Moisture contents
- 6 Particle-size analyses
- 6 Hydrometer analyses

Geotechnical laboratory testing was performed in general accordance with ASTM procedures. Test results are provided on the attached *Geotechnical Laboratory Testing Reports* and are summarized in the following table:

Summary of Sieve and Moisture Analyses

Location	Depth (ft bgs)	Soil Type	% Gravel	% Sand	% Silt	In-Situ Moisture (%)
B-3 SS02	2 - 4	Silty Sand (SM) with gravel	29.4	53.8	16.8	4.8
B-2 SS03	5 - 7	Gravel (GP-GM) with silt and sand	47.4	41.3	11.3	3.9
B-4 SS06	20 - 22	Silty Sand (SM) with gravel	31.3	51.4	17.3	11.7
TP-1/IT-1	5.5 - 7.5	Gravel (GP) with sand	49.3	46.2	4.5	5.7
TP-2/IT-2	5.5 - 6.5	Gravel (GP) with sand	49.3	46.8	3.9	4.7
TP-3/IT-3	5.0 - 5.5	Gravel (GP) with silt and sand	46.3	47.2	6.5	7.5

5.0 GEOTECHNICAL FIELD TESTING - INFILTRATION TESTING

JTC performed infiltration tests at the bottom of test pits TP-1 through TP-3. Testing was performed in accordance with the Massachusetts Stormwater Handbook: Volume 3, Chapter 1.

5.1 Testing Setup

At the bottom of each test pit, a clean, flat surface was prepared in the native soils approximately

5.5 feet bgs at test pits TP-1 and TP-2 and 5.0 feet bgs at TP-3. A 4-inch diameter Schedule 40 PVC pipe was placed on the testing surface and the surrounding soils were tamped and secured around the pipe. Subsequently, JTC added approximately 2 inches of fine gravel inside the PVC pipe to prevent scouring and hydraulic conductivity laterally during testing. A 2 feet head of water was added to the pipe on December 23, 2021 and the soils left to soak for the next 24 hours.

5.2 Infiltration Test Procedure

JTC returned to the site the following day to perform infiltration testing at the prepared locations. The testing procedure consisted of:

- Filling the pipes with water to a depth of 2 feet above the bottom of pipe;
- Taking regular water level measurements over the following hour;
- Refilling the water after each hour and repeating the process for a total of four cycles.

5.3 Infiltration Test Results

The test results are summarized in the following tables:

Summary of Infiltration Testing

Infiltration Test #	Proximal Test Pit Designation	Depth (feet bgs)	Soil Type	Measured Infiltration Rate (in/hr)				Average Measured Rate (in/hr)
				Trial 1	Trial 2	Trial 3	Trial 4	
IT-1	TP-1	5.5	GP	**136.8**	**135.4**	**133.2**	**115.2**	**130.2**
IT-2	TP-2	5.5	GP	**108.0**	**61.2**	**34.2**	**18.0**	**55.4**
IT-3	TP-3	5.0	GP	NA	NA	NA	NA	NA

As presented in the tables above, JTC concludes that the Gravel (GP) with silt and sand encountered at test location TP-1/IT-1 and TP-2/IT-2 exhibited infiltration rates of approximately 130.2 in/hr and 55.4 inches/hr respectively. A 2 ft head of water was unable to be maintained in TP-3/IT-2 long enough to perform the infiltration test. The results indicate that the Gravel (GP) with silt and sand at the test locations is generally a free draining soil.

No factors of safety have been applied to the measured rates presented in the table. JTC recommends applying a minimum safety factor of 2 to the measured rates for design purposes.

6.0 SUBSURFACE CONDITIONS

The following subsections describe the site soil, bedrock, and groundwater conditions encountered, based on results of the geotechnical explorations and laboratory testing. Detailed descriptions of the conditions observed at each test boring are provided on the attached *Test Boring Logs*.

6.1 Soils - Borings

The overburden soils encountered at the test boring locations appear to be consistent with those described by the published geologic data. The primary soil strata are briefly described in the paragraphs below.

6.1.1 Pavement

Approximately 3" of bituminous asphalt concrete pavement was encountered at the ground surface at boring location B-3.

6.1.2 Fill

Fill soil consisting primarily of dark tan, silty Sand (SM) with gravel was encountered below the asphalt pavement to a depth of approximately 4 to 5 feet bgs at boring location B-3. The Fill soil was typically considered to be very dense based on SPT N-Values.

6.1.3 Topsoil - Fill

Fill soil consisting primarily of dark brown, silty Sand (SM) with gravel, organics and roots was encountered at boring locations B-1, B-2, and B-4. This layer was typically encountered to depths ranging from approximately of 2.2 feet to 2.67 feet bgs. These soils were typically considered to be loose to medium dense based on SPT N-Values.

6.1.4 Glacial Coarse Deposits

Native Glacial Coarse Deposits were encountered beneath the Fill layer and Topsoil Fill Layer to the full depth of boring at each boring location. These deposits typically consisted of tan layered, silty Sand (SM) with gravel and poorly graded Gravel (GP-GM) with silt and sand. The native gravel layer was encountered from 5.0 to 10.0 feet bgs at boring B-1; 2.67 to 15.0 feet bgs at boring B-2; 5.0 to 6.0 feet bgs at boring B-3; and 2.67 feet to 5.0 feet bgs at boring B-4. The native silty Sand was encountered underlying the native Gravel deposits to the full depth of boring at boring locations B-1, B-2, and B-4. The native silty Sand was also encountered overlying the native Gravel deposits from 2.2 to 5.0 feet bgs at boring B-1 and from 2.0 to 5.0 feet bgs at boring location B-3. These soils were typically considered to be dense to very dense based on SPT N-Values.

6.2 Soils – Test Pits

6.2.1 Topsoil - Fill

Fill soil consisting primarily of dark brown, silty Sand (SM) with gravel, organics and roots was encountered at test pit TP-2. This layer was encountered to a depth of 2.5 feet bgs.

6.2.2 Forest Mat

Soil consisting primarily of dark brown, sandy Silt (ML) with trace gravel, organics and roots was encountered at test pit TP-2. This layer was encountered to a depth of 2.0 feet bgs at TP-1 and 1.5 feet at TP-3. A 0.5 ft layer of grey tan sandy Silt (ML) was encountered underlying the forest mat at test pit TP-3.

6.2.3 Glacial Coarse Deposits

Native Glacial Coarse Deposits were encountered beneath the Topsoil - Fill and Forest Mat to the full extent of each test pit. Orange tan layered, silty Sand (SM) with gravel was encountered underlying the Topsoil – Fill and Forest Mat at test pit locations TP-1 and TP-2 to a depth of 4.5 feet bgs and 4.75 feet bgs respectively.

Tan to orange-tan, poorly graded Gravel (GP-GM) with silt and sand was encountered underlying the silty Sand layer at test pits TP-1 and TP-2 to a depth of 7.5 feet and 7.0 feet respectively. This layer was observed underlying the Forest Mat at test pit TP-3 to a depth of 8.0 feet bgs. A 0.5 ft lens of tan, medium Sand (SP) was encountered at the interface of the silty Sand (SM) and poorly graded Gravel (GP-GM) at test pits TP-1 and TP-2.

6.3 Bedrock

Practical refusal to further penetration of the augers was encountered at boring B-3 and B-3A to a depth of 6.0 feet bgs and 9.0 feet bgs, respectively. The refusal in each exploration is interpreted to be refusal on probable bedrock. Bedrock is not expected to impact the project, based on the results of this investigation.

6.4 Groundwater

Groundwater was encountered within test borings B-1, B-2, and B-4 to depths of 15.0 feet bgs, 15.0 feet bgs and 14.0 feet bgs, respectively. However, short-term (i.e., during drilling, upon completion of drilling, and/or a few hours after drilling) water levels observed in test borings performed in silty soils should be considered approximate.

JTC estimates that this investigation occurred during a period of seasonally normal to low ground water. Site groundwater levels should be expected to fluctuate seasonally and in response to precipitation events, construction activity, site use, and adjacent site use.

7.0 GEOTECHNICAL ANALYSIS & RECOMMENDATIONS

The evaluation of the site and the proposed development was based on the subsurface conditions encountered at the exploration locations, results of geotechnical laboratory testing, provided site plans/grading, and provided structural loading conditions, as described herein.

The evaluation of the site and the proposed development was based on the subsurface conditions encountered at the exploration locations, results of geotechnical laboratory testing, provided site/grading plans, and provided structural loading conditions, as described herein.

The Topsoil – Fill, Forest Mat, and Existing Fill materials are not suitable for direct support of foundations. These soils should be completely removed from the building pad (i.e., the proposed building footprint plus at least 5 feet laterally) during the initial phases of site preparation and grading. Subsequently, JTC believes that the proposed building can be supported upon shallow foundations bearing on undisturbed native Glacial Coarse Deposits, and/or *Structural Fill* built-up from properly prepared native soils, provided that the geotechnical design and construction recommendations presented herein are satisfied.

7.1 Site Preparation and Grading

Site preparation and grading should be performed in accordance with the following procedures:

- A geotechnical engineer should directly observe site preparation and grading activities;
- The site soils contain substantial proportions of fine sand, silt, and/or clay, and may degrade and/or become unworkable when subjected to construction traffic or other disturbance during wet conditions. As such, site preparations, grading, and earthworks should be performed during a dry season if possible. The Contractor shall be aware of these conditions and must take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, grading (and compacting) exposed subgrades to promote surface water run-off, and maintaining an effective dewatering program, as necessary. Over-excavation to remove degraded or unworkable subgrade soils should be anticipated and budgeted (cost and schedule);
- Any existing buildings, structures, and/or associated foundations (including footings, foundation walls, slabs-on-grade, and/or basements) should be completely removed from proposed building and pavement areas and replaced/backfilled with properly placed and compacted *Structural Fill;*
- Any existing subsurface utilities and underground structures, including any private septic tank, leach field, and associated piping, should be completely removed from the footprint of the proposed building, and replaced/backfilled with properly placed and compacted *Structural Fill.* Any existing subsurface utilities in proposed pavement areas should be removed and/or appropriately abandoned in place (e.g., pressure grouting), as approved

by the on-site geotechnical engineer;

- The site should be cleared and stripped of any existing pavement/concrete not designated to remain; existing trees/vegetation not designated to remain; Topsoil, Rootmat, Forest Mat; loamy/organic-laden Subsoil; and any otherwise unsuitable materials;
- Existing Fill and/or any otherwise unsuitable materials should be completely removed from the proposed building footprint, plus about 5 feet laterally;
    - Additional Existing/Undocumented Fill materials should be expected proximate to any former building(s), foundations, and/or subsurface utilities.
- In cut areas, the final foot of excavation should be performed using a smooth-edged cutting bucket (no teeth) to minimize subgrade disturbance;
- Following clearing, stripping, removal of any Existing Fill/Undocumented Fill/unsuitable soil, and/or cutting to subgrade, the exposed subgrade soils should be proof-rolled using a large smooth-drum roller with successive passes aligned perpendicularly. However, proof-rolling should not be performed if/when the exposed subgrade soils are wet (i.e., due to presence of groundwater, stormwater, perched water, etc.) because this may result in soil pumping and instability. Therefore, the proof-rolling efforts, including the number of passes and whether to employ static or vibratory methods, should be directed by the on-site geotechnical engineer (static methods should be anticipated based on the results of the test borings);
    - Any loose, soft, wet, and/or otherwise unsuitable soils (typically evidenced by rutting, pumping, and/or deflection of the subgrade) should be over-excavated to expose suitable soils, or other remedial measures should be taken, as approved by the on-site geotechnical engineer; and
    - Any over-excavations should be backfilled with properly placed and compacted *Structural Fill*.
- *Structural Fill* should be used for subgrade fill within the building pad. The placement of *Structural Fill* materials to achieve design subgrades in the building pad should not begin until the exposed subgrade soils have been directly observed and approved by the on-site geotechnical engineer;
- *Common Fill* is acceptable for subgrade fill in parking and driveway areas. The placement of *Common Fill* materials to achieve design subgrades in pavement areas should not begin until the exposed subgrade soils have been directly observed and approved by the on-site geotechnical engineer; and
- *Structural Fill* and *Common Fill* materials along with placement and compaction requirements are provided in the attached *Tables*.

7.2 Shallow Foundations and Foundation Walls

Based on the subsurface conditions encountered at the exploration locations and our current understanding and assumptions relative to the proposed development, the following foundation design recommendations are provided:

- The Topsoil – Fill, Forest Mat, and Fill materials are not suitable for direct support of shallow foundations. These materials should be completely removed from the footprint of the addition, plus 5 feet laterally, as described in Sections 7.0 and 7.1.
- The buildings may be supported on a system of continuous and/or isolated shallow spread footings bearing on undisturbed native Glaciofluvial Sand Deposits and/or on Structural Fill or Crushed Stone built-up from properly prepared native soil subgrades;
- Shallow foundations may be designed using an allowable bearing pressure of 5,000 psf (2.5 TSF). Design bearing pressures may be increased by one-third (⅓) when considering seismic and or transient wind loading conditions;
- Continuous wall footings should have a minimum width of 2 feet. Isolated column footings should have a minimum width of 3 feet;
- Exterior footings should be founded at least 4 feet below the lowest adjacent grade to provide adequate frost protection. Interior footings in heated portions of the building should be founded at least 2 feet below FFE to develop adequate bearing capacity;
- All foundations should be located such that they are below a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of all adjacent existing or proposed footings, structures, and utilities. Where new footings are constructed immediately adjacent to existing footings, we recommend that the proposed footings match the existing footing elevations.
- Total post-construction settlements due to applied foundation loads are estimated to be on the order of 1 inch or less, based on strip footing widths and column footing widths of up to 3 feet and 5 feet, respectively. Differential settlements along continuous wall footings and/or between isolated column footings are estimated to be on the order of 0.5 inches or less. The estimated settlements and resulting angular distortion are anticipated to be within the allowable limits for this type of structure;
- Global stability analysis is recommended on foundations located at slopes. All foundations shall be placed in accordance with IBC section 1808.7 *Foundations on or Adjacent to Slopes.*
- Due to soil indicators, i.e rust staining, mottling, etc. at shallow depths up to 5' bgs, a foundation drain system should be installed around the perimeter of the building at the exterior toe of the exterior footings. Foundation drains should consist of 4-inch diameter PVC-SDR35 perforated pipe encased in at least 6 inches of ¾-inch stone protected with a filter fabric such as Mirafi 140N or equal. The drains should be graded to positively drain to a suitable discharge point away from the proposed structure. Drains should not be connected to surface or roof drain discharge points. Clean-outs should be located at bends and no greater than 150 feet on-center. It is recommended that a backflow preventer be installed at the outlet of the drains to reduce the impact of potential surcharges.

Recommendations for shallow foundation subgrade preparation and construction are provided as follows:

- A geotechnical engineer or his/her representative should directly observe foundation subgrade preparation activities;
- If shallow and/or perched groundwater is encountered, it must be removed in advance of excavation and continuously maintained at least 2 feet below the bottom of excavation and subsequent construction grade until the backfilling is complete;
- Excavations for shallow foundations must extend into undisturbed native Glacial Sand Deposits and/or *Structural Fill* built-up from properly prepared native soils, as described herein;
- The native foundation subgrade soils will be sensitive to moisture and may disturb or soften if exposed to wet conditions and construction activities. Therefore, the final foot, at a minimum, of excavation for foundations should be performed using a smooth-edged cutting bucket (no teeth) to minimize subgrade disturbance. Furthermore, if wet conditions are present or anticipated due to groundwater seepage, perched groundwater, and/or precipitation/stormwater, the foundation subgrade should be protected with a 6-inch (minimum) thick layer of ¾-inch minus crushed stone encased in a geotextile fabric (e.g., Mirafi 140N or equal). The fabric and Crushed Stone shall be placed immediately upon exposure of the native foundation subgrade soils and densified with a plate compactor until exhibiting stable conditions. The purpose of the Crushed Stone is to protect the subgrade soils from disturbance, facilitate construction dewatering (if necessary), and provide a dry/stable subgrade upon which to progress construction;
  - If Undocumented Fill and/or otherwise unsuitable soils/materials are encountered at the foundation subgrade, over-excavations should remove all Fill and/or unsuitable soils within the footing zone of influence, which is defined as the area extending laterally 1 foot from edges of the footing and then outward and downward at a 1H:1.5V (horizontal to vertical) splay of bearing until a suitable native subgrade soil is encountered; and
  - Any over-excavations should be backfilled with properly placed and compacted *Structural Fill* or Crushed Stone, within the footing zone of influence described above, as approved by the on-site geotechnical engineer.
- Prior to setting forms and placing reinforcing steel, a geotechnical engineer should directly observe footing subgrades;
  - Footing subgrades should be level or suitably benched and free of standing water and/or debris;
  - Loose, soft, wet, frozen, or otherwise unsuitable soils should either be re-compacted or over-excavated to a suitable subgrade, as approved by the on-site geotechnical engineer; and
  - Over-excavations should be backfilled with properly placed and compacted *Structural*

Fill or crushed stone as approved by the on-site geotechnical engineer.

- Foundation subgrade soils should be protected against physical disturbance, precipitation, and/or frost throughout construction. Surface water run-on/run-off should be diverted away from open foundation excavations. The Contractor shall ultimately be responsible for the means and methods to protect the foundation subgrade during construction;
- Interior footings, piers, and/or walls and the interior side of balanced perimeter foundation walls should be backfilled with *Clean Granular Fill* and/or 3-inch minus material meeting the requirements of *Structural Fill,* as described in the attached *Specifications*;
- Exterior footings, piers, and the exterior side of balanced foundation walls should be backfilled with non-frost-susceptible fill in order to mitigate potential adverse effects of frost. Backfill for exterior footings, piers, and foundation walls should consist of well-graded, free-draining, granular soil conforming to the requirements of *Clean Granular Fill*, as described in the attached *Specifications*. Alternatively, a suitable bond break (such as rigid polystyrene insulation) may be provided as approved by the on-site geotechnical engineer. In this case, footings and walls (excluding unbalanced/basement walls) may be backfilled with *Common Fill* (see attached *Specifications*) having a maximum particle-size of 3 inches, as approved by the on-site geotechnical engineer;
- Backfill for footings, piers, and foundation walls should be placed in uniform horizontal lifts having a maximum loose lift thickness of 8 inches and compacted to 95 percent of its modified proctor maximum dry density (MPMDD; per ASTM D1557). Thinner lifts may be required in order to achieve the required compaction criteria;
- To minimize the potential for foundation wall damage during the backfill and compaction activities, it is recommended that foundation wall backfill be placed in a manner that maintains a balanced fill height on both sides of the wall (except for unbalanced walls).

7.3 Floor Slab-On-Grade

Design recommendations for the floor slab-on-grade are provided as follows:

- A modulus of vertical subgrade reaction, k_{vi}, of 175 pounds per cubic inch (pci) should be available for structural design of floor slabs-on-grade, provided that the subgrade, *Structural Fill*, and the *Clean Granular Fill* are prepared as recommended in Subsections 7.1, 7.2, and 7.3;
- The floor slab-on-grade should be underlain by a minimum 9-inch thick layer of *Clean Granular Fill* to provide a capillary break and a stable working surface;
- The floor slab should be isolated structurally from foundation walls and columns/piers to allow for differential movement; and
- The need/desire to provide a moisture/vapor barrier beneath floor slab-on-grade should be evaluated by the architect and/or the structural engineer, based on the building's

specific interior usage requirements.

During construction, we expect that much of the building footprint will be excavated or disturbed during site preparation and grading (Subsection 7.1), excavations for shallow foundations (Subsection 7.2), and/or excavations for new underground utilities. It is imperative that the subgrade beneath the floor slab-on-grade be reinstated with properly placed and compacted *Structural Fill* and/or prepared as recommended herein. Additionally:

- A geotechnical engineer should directly observe the subgrade soils prior to the placement of the recommended *Clean Granular Fill* base course;
  - The subgrade should be level and free of standing water and/or debris;
  - Loose, soft, wet, frozen, or otherwise unsuitable soils should either be re-compacted or over-excavated to a suitable subgrade, as approved by the on-site geotechnical engineer; and
  - Over-excavations should be backfilled with properly placed and compacted *Structural Fill*.
- The *Clean Granular Fill* base course should not be placed until the subgrade has been reviewed by the on-site geotechnical engineer. Subsequently, the *Clean Granular Fill* should be compacted to the satisfaction of the geotechnical engineer to 95% of its MPMDD.

7.4 Seismic Considerations

Earthquake loadings must be considered under the requirements of the current edition of the *Massachusetts State Building Code* which refer to the 2015 edition of the International Building Code (IBC). IBC Table 1613.5.2 is used to establish the site class based on the average soil properties and soil profile. Site class is then used to determine the site coefficient and mapped spectral response for a given structure. Based on the conditions encountered at the test boring locations, the site is classified as:

Site Class D: Stiff Soil Profile.

Liquefaction refers to the loss of strength in saturated cohesionless soils due to the buildup of pore water pressures during cyclic or seismic loading. Based on the conditions encountered at the test boring locations, the site is NOT considered to be susceptible to liquefaction.

7.5 Re-Use of Site Soils

Some of the native, silty Sand (SM) with gravel materials encountered at the exploration locations should be suitable for re-use as *Common Fill* and some of the native Gravel (GP-GM) with silt and sand may be suitable for re-use as *Structural Fill or Clean Granular Fill* subject to laboratory testing to demonstrate conformance with the project specifications. Otherwise, these soils may be re-used in areas to be landscaped, subject to conformance with the project specifications

7.6 Construction Monitoring and Quality Control Testing

A qualified geotechnical engineer or representative should be retained to review the site preparation and grading activities and foundation subgrade preparations, at a minimum. Similarly, quality control testing, including in-place field density and moisture tests, should be performed to confirm that the specified compaction is achieved. It is recommended that JTC be retained to provide earthwork construction monitoring and quality control testing services.

Quality control testing recommendations are provided as follows:

- During site grading and foundation subgrade preparation, 3 field density tests should be performed for every 5,000 square feet (per lift) of *Structural Fill* placement, at a minimum. At least 3 tests should be performed on each lift of material even if the lift is less than 5,000 square feet;
- During foundation wall backfilling, 3 field density tests should be performed for every 100 linear feet (per lift) of fill placement, at a minimum. At least 3 tests should be performed on each lift of material even if the lift is less than 100 linear feet;
- During placement and compaction of *Clean Granular Fill* as the base course below the floor slab-on-grade and sidewalks, 3 field density tests should be performed for every 5,000 square feet of placement. At least 3 tests should be performed on each lift of material even if the lift is less than 5,000 square feet;
- During backfilling of utility trenches, at least 1 test should be conducted on *Structural Fill* per 50 linear feet (per lift) of trench; and
- During site grading and pavement subgrade preparation, 3 field density tests should be performed for every 5,000 square feet (per lift) of *Common Fill*, at a minimum. At least 3 tests should be performed on each lift even if the lift is less than 5,000 square feet.

7.7 Additional Considerations

Additional design recommendations are provided as follows:

- Exterior concrete sidewalks shall be underlain by at least 12 inches of *Clean Granular Fill*. The thickness of the *Clean Granular Fill* shall be increased to no less than 18 inches for exterior concrete slabs located adjacent to exterior doorways and ramps to provide additional frost protection at building entry/exit points;
- Roof drains or similar features should be provided to collect roof run-off and prevent ponding near the building. Roof drains and other stormwater controls should not discharge to foundation drains;
- The exterior ground surface adjacent to the building should be sloped away from the building to provide for positive drainage. Similarly, the final surface materials adjacent to

the building should be relatively impermeable to reduce the volume of precipitation infiltrating into the subsurface proximate to building foundations. Such impermeable materials include cement concrete, bituminous concrete, and/or vegetated silty/clayey topsoil; and

- Permanent fill or cut slopes should have a maximum slope of 2.5H:1V (horizontal to vertical) or flatter for dry conditions. Permanent fill or cut slopes should be no steeper than 3H:1V for wet/submerged conditions (e.g., stormwater basin) unless a properly designed surface slope stabilization system (e.g. rip rap, geosynthetics) is provided.

Additional construction considerations/recommendations are provided as follows:

- Safe temporary excavation and/or fill slopes are the responsibility of the Contractor. Excavations should be conducted in accordance with local, state, and federal (OSHA) requirements, at a minimum. If an excavation cannot be properly sloped or benched due to space limitations, adjacent structures, and/or seepage, the Contractor should install an engineered shoring system to support the temporary excavation;
- Subgrade conditions will be influenced by excavation methods, precipitation, stormwater management, groundwater control(s), and/or construction activities. Most of the site soils are poorly-drained, moisture-sensitive, and considered susceptible to disturbance when exposed to wet conditions and construction activities. As such, the Contractor shall be aware of these conditions and must take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, and maintaining an effective dewatering program, as necessary;
- Proper groundwater control and stormwater management are necessary to maintain site stability. Groundwater should be removed in advance and continuously maintained at least 2 feet below the working construction grade until earthworks and/or backfilling are complete;
- If groundwater seepage and/or wet soils due to shallow groundwater are observed, a ¾-inch minus crushed stone base should be placed atop the exposed subgrade soils. The stone should be immediately placed atop the undisturbed subgrade and then tamped with a plate compactor until exhibiting stable conditions. The stone shall be protected, as required, with a geotextile filter fabric such as Mirafi 140N or equal. The purpose of the stone base is to protect the wet subgrade, facilitate dewatering, and provide a dry/stable base upon which to progress construction; and
- All slopes should be protected from erosion during (and after) construction.

8.0 CLOSING

We trust the contents of this report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

APPENDIX A: LIMITATIONS

Explorations

1. The analyses and recommendations presented in this report are based in part upon the data obtained from widely-spaced subsurface explorations. Subsurface conditions between exploration locations may vary from those encountered at the exploration locations. The nature and extent of variations between explorations may not become evident until construction. If variations appear, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely-spaced explorations and samples; actual strata transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.
3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that John Turner Consulting, Inc. be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the geotechnical engineering recommendations provided herein.
5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

Construction

6. It is recommended that John Turner Consulting, Inc. be retained to provide geotechnical engineering services during the installation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of GRLA for the project located at 10 Elm Street in Boxford, Massachusetts. All considerations are based on the available information and is in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to preliminary geotechnical design considerations.

APPENDIX B: RECOMMENDED SOIL GRADATION & COMPACTION SPECIFICATIONS

TABLE 1: Structural Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5-inch	100
¾-inch	60 - 100
No. 4	20 - 80
No. 200	0 - 10

NOTES:

1. For use as structural load support below foundations and within the building pad. Structural Fill placed beneath building foundations should include the Footing Zone of Influence which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1:1.5 (H:V) splay.
2. ¾-inch crushed stone may be used in wet conditions.
3. Structural Fill should be free of construction and demolition debris, frozen soil, organic soil, peat, stumps, brush, trash, and refuse;
4. Structural Fill should not be placed on soft, saturated, or frozen subgrade soils;
5. Structural Fill should be placed in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
6. Place and compact within ± 3% of optimum moisture content.
7. Compact to at least 95% relative compaction per ASTM D1557.
8. The adequacy of the compaction efforts should be verified by field density testing.

TABLE 2: Clean Granular Fill

Clean SIEVE SIZE	PERCENT PASSING BY WEIGHT
3-inch	100
¾-inch	60 – 90
No. 4	20 – 70
No. 200	2 – 8

NOTES:

1. Should consist of *crushed stone* beneath the concrete pad, as approved by on-site geotechnical engineer.
2. For minimum 9-inch base below the cast-in-place concrete pads.
3. For minimum 12-inch base for exterior concrete slabs exposed to frost.
4. For minimum 36-inch base at exterior ramps, aprons, and loading bays adjacent to entrances/exit ways.
5. For use as footing and foundation wall backfill.
6. For use as backfill behind unbalanced foundation/retaining walls.
7. Place in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
8. Place and compact within ± 3% of optimum moisture content.
9. Compact to at least 95% relative compaction per ASTM D1557.
10. Compact to at least 95% relative compaction per ASTM D1557 when placed as foundation wall backfill in conjunction with a bond break.
11. The adequacy of the compaction efforts should be verified by field density testing.

TABLE 3: Common Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
6-inch	100
¾-inch	60 – 100
No. 4	20 – 85
No. 200	0 – 25

NOTES:

1. For use as common/subgrade fill in parking areas and roadway embankments.
2. For use as foundation wall backfill if used in conjunction with a bond break and sized/screened to 3-inch minus.
3. Place in lifts not exceeding 12 inches.
4. Maximum stone size should not exceed ½ the actual lift thickness.
5. Compact to at least 92% relative compaction per ASTM D1557 when placed as subgrade fill in parking areas or roadway embankments.
6. Compact to at least 95% relative compaction per ASTM D1557 when placed as foundation wall backfill in conjunction with a bond break.
7. The adequacy of the compaction efforts should be verified by field density testing.

APPENDIX C: RECOMMENDED LATERAL EARTH PRESSURES, DRAINAGE REQUIREMENTS, & FRICTION FACTOR FOR UNBALANCED WALLS

Lateral earth pressures for the structural design and stability analysis of unbalanced foundation walls (basement walls, retaining walls, etc.) are provided herein. The following table outlines the recommended lateral earth pressure coefficients and equivalent fluid weights:

WALL CONDITION	LATERAL TRANSLATION (Δ/H)	EARTH PRESSURE COEFFICIENT (K)
restrained	0	Ko = 0.50
no restraint	0.002	Ka = 0.33
no restraint	0.02	Kp = 3.0
seismic	n/a	Keq

where: Δ = movement at top of wall by rotation or lateral translation
H = height of wall

The recommended lateral earth parameters are based upon and/or assume:

1. Rankine earth pressure theory;
2. Retaining wall backfilled with *Clean Granular Fill* (Table 1);
3. Unit weight of backfill less than 135 pcf;
4. **No hydrostatic pressures;**
5. Surcharge loading; Parking areas and roadway will be proximally located to the proposed foundation walls, and where applicable, the walls should be designed with a minimum surcharge load of 250 psf in accordance with the AASHTO *Standard Specification for Highway Bridges*.;
6. A level backfill in front and behind of wall;
7. Dynamic/compaction stresses limited to 200 psf/foot;
8. The top 2 feet should not be considered for passive resistance;
9. Seismic loading shall be applied as required by the *IBC.* Seismic loads shall be a 15% increase from those values outlined in Table 2;
10. Use of only small plate compactors within 3 feet of the top of walls.

The lateral resistance of retaining walls should also accommodate any surcharge loads. Uniformly distributed loads should be superimposed along the face of the wall at a magnitude equal to the surcharge pressure multiplied by the appropriate earth pressure coefficient. Surcharge loads should be considered where they are located within a horizontal distance equivalent to 1 times the height of the wall. Any anticipated point or line loads situated behind the wall should be evaluated in accordance with linear elastic theory.

For frost protection and proper drainage, it is recommended that *Clean Granular Fill* be placed directly behind unbalanced walls. The ground surface immediately adjacent to the unbalanced wall should be sloped away from the building to allow for positive drainage. It is also recommended that the final surface materials adjacent to the wall be relatively impermeable to reduce the volume of precipitation infiltrating into the subgrade. Such impermeable materials include cement concrete, bituminous concrete, and/or vegetated silty/clayey topsoil.

Retaining walls (including basement walls) should be provided with adequate footing drains per Section 1805 of the 2015 International Building Code. The perimeter foundation drain should be located at least 4 inches above the bottom of footing elevation and six inches outward from the edge of footing. The drains should not encroach within the Footing Zone of Influence, which is defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1.5V splay. Furthermore, the invert elevation of the drain should be at least 12 inches below the underside of the adjacent floor slab. The drains should consist of minimum 4-inch diameter perforated PVC-SDR 35 drain pipe encased within 12 inches of ¾-inch stone and wrapped with a filter fabric such as Mirafi 140N or equal. **If unbalanced walls cannot be drained to alleviate hydrostatic forces, then the lateral earth pressure should be increased to include full hydrostatic pressures.**

Any footing and under-slab drains may discharge via gravity to a storm drain line not subject to surcharge. The Civil Engineer should review the discharge of the drains. The drains should be provided with permanent clean-outs at convenient locations to facilitate access to all sections of the system. Roof gutters and other storm collection should not be discharged to the footing/under-slab drains. Any recharge systems, infiltrators, and/or dry wells shall be kept away from the unbalanced/retaining walls to prevent hydrostatic surcharge.

The following interface friction angle(s), ϕ, and associated friction factors (=tan ϕ) are recommended for sliding resistance/overturning:

Condition	Interface Friction Angle	Friction Factor
Mass concrete (base of wall) on crushed gravel/stone	30	0.57
Mass concrete (base of wall) on Native Glacial Deposits	22	0.40
Formed concrete (wall) against Clean Granular Fill	22	0.40

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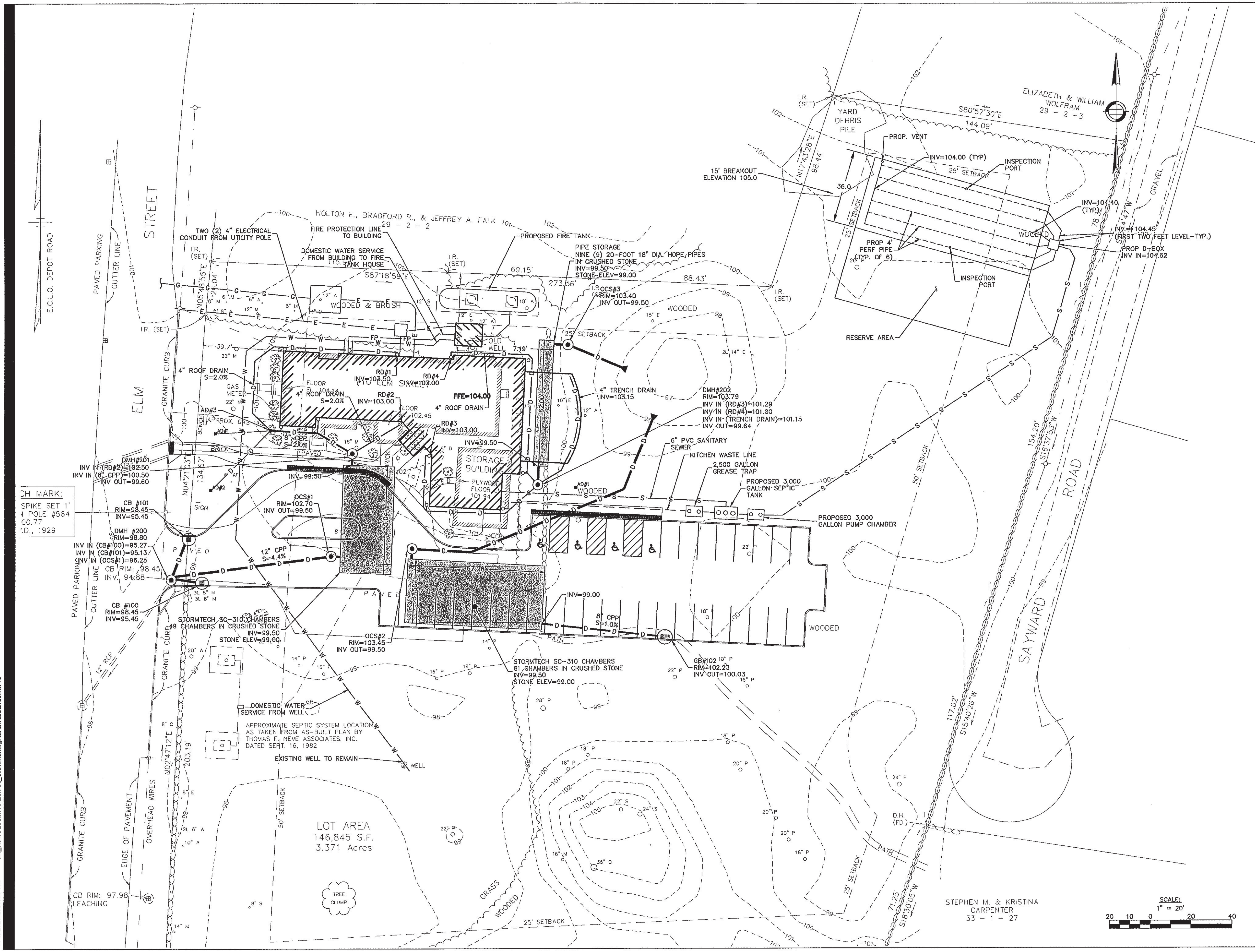
APPENDIX D: EXISTING CONDITIONS PLAN & EXPLORATION LOCATION PLAN



THE CENTER AT 10 ELM COMMUNITY/ STREET SENIOR CENTER

TOWN OF BOXFORD

TOWN HALL
7A SPOFFORD ROAD
BOXFORD, MA 01921

G | R | L | A

Gorman Richardson Lewis Architects
239 South Street Hopkinton, MA 01748
www.grlarchitects.com

No.	Description	Date

Date:	09/24/2020
Proj. No.:	2020120.01
Scale:	1" = 20'-0"
Drawn By:	BB
Checked By:	DC

CIVIL UTILITY PLAN

C-500

2020120.01 - TOWN OF BOXFORD THE CENTER AT 10 ELM STREET COMMUNITY/ SENIOR CENTER - SCHEMATIC DESIGN - 09/24/2020

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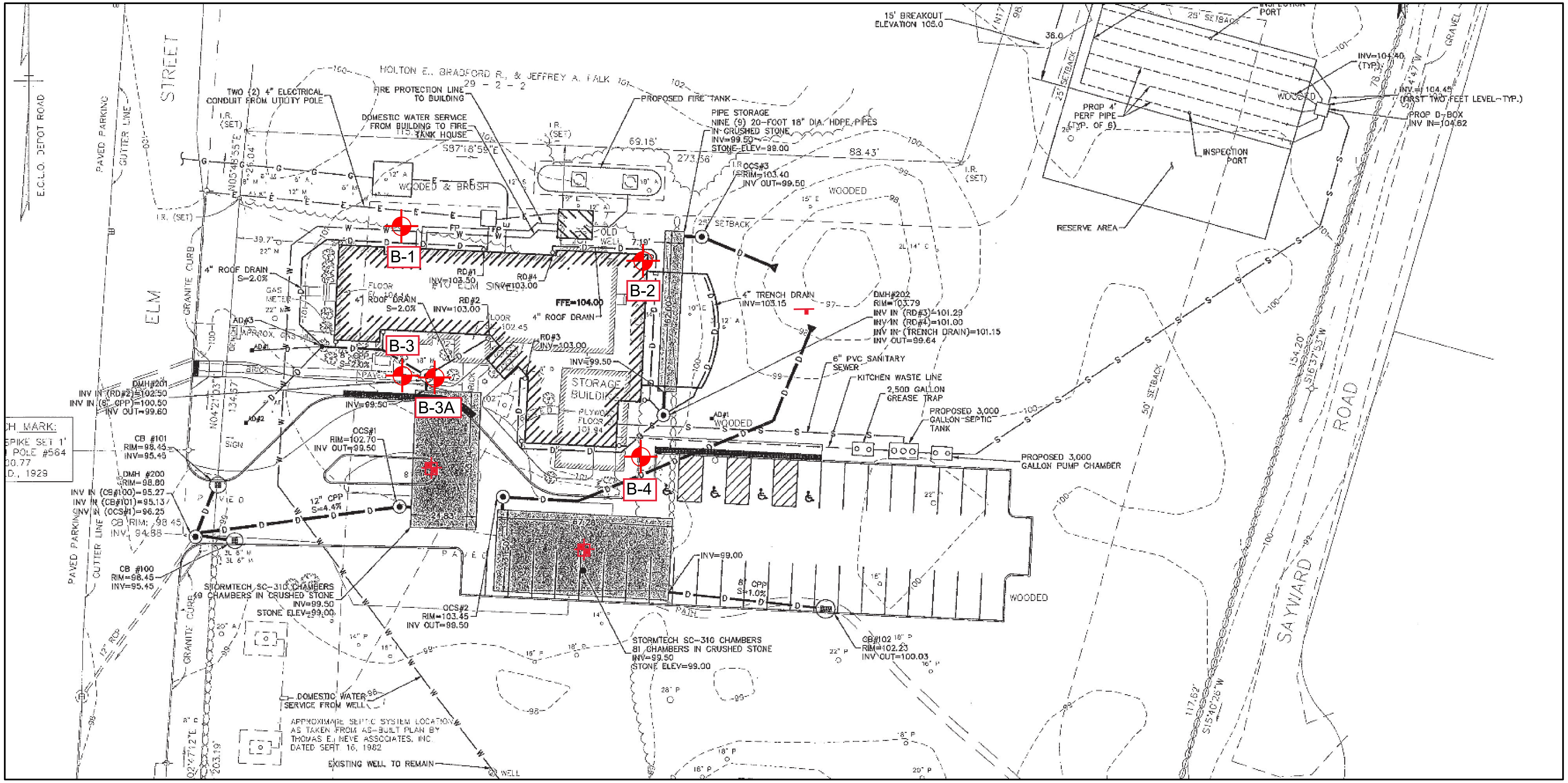


Notes:

1. Test Borings & Test Pits were performed on 18 December 2020 under the direction of JTC. Infiltration testing was performed on 24 December 2020.
2. Test boring locations should be considered approximate.
3. Refer to the Test Boring & Test Pit Logs for the subsurface conditions encountered at each exploration location.
4. Basemap source(s): "Civil Utility Plan", Sheet C-500, dated 24 September 2020; prepared by GRLA – Hopkinton, MA
5. Not to Scale.

GRLA **239 South Street** **Hopkinton, Massachusetts 01748**	**Proposed Community/Senior Center** **10 Elm Street** **Boxford, Massachusetts 01921**
JOHN TURNER CONSULTING	**EXPLORATION LOCATION PLAN**

JOHN TURNER
CONSULTING

APPENDIX E: TEST BORING LOGS, TEST PIT LOGS & KEY TO SYMBOLS AND DESCRIPTIONS

JOHN TURNER CONSULTING	**PROJECT:** Proposed Community/Senior Center **PROJECT NO.:** 20-04-109
	CLIENT: GRLA
	PROJECT LOCATION:
	LOCATION: See Boring Location Plan **ELEVATION:** G.S.
LOG OF BORING	**DRILLER:** Soil Exporation Corp. **LOGGED BY:** SK
No. B-1	**DRILLING METHOD:** 4.25" ID HSA **DATE:** 12/18/2020
	DEPTH TO - WATER> INITIAL: 15 **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS: Plastic Limit ├─┤ Liquid Limit; Water Content - ●; Penetration - (10 20 30 40 50)
0	[TOPSOIL - FILL] Dark brown, sandy Silt (ML), trace gravel, roots, organics; Loose			SS01	5 5 4 4		
2.2	[GLACIAL COARSE DEPOSITS] Orange tan, silty Sand (SM) with gravel; Medium dense -Orange Mottling			SS02	3 6 21 27		
5	Dark tan, Gravel (GP-GM) with silt and sand; Very dense -Shattered Rock -Orange Mottling			SS03	25 26 25 29		
10	Tan, silty sand (SM) with gravel; Very dense -Shattered Rock -Orange Mottling			SS04	21 33 45 52		78
15	-becomes dark tan -Shattered Rock -Orange Mottling			SS05	18 38 57 33		95
20	-Shattered Rock -Orange Mottling			SS06	12 25 38 28		63

Test boring backfilled with soil cuttings upon completion.

JOHN TURNER CONSULTING

LOG OF BORING No. B-1

PROJECT: Proposed Community/Senior Center **PROJECT NO.:** 20-04-109
CLIENT: GRLA
PROJECT LOCATION:
LOCATION: See Boring Location Plan **ELEVATION:** G.S.
DRILLER: Soil Exporation Corp. **LOGGED BY:** SK
DRILLING METHOD: 4.25" ID HSA **DATE:** 12/18/2020
DEPTH TO - WATER> INITIAL: 15 **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
24							
	Spoon refusal @ 26.0 feet bgs			SS07	23 100/3 - -		
27	Boring terminated at 26 ft.						
30							
33							
36							
39							
42							

TEST RESULTS: Plastic Limit —— Liquid Limit; Water Content - ●; Penetration - (hatched bar); scale 10 20 30 40 50

Test boring backfilled with soil cuttings upon completion.

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-2

PROJECT: Proposed Community/Senior Center **PROJECT NO.:** 20-04-109

CLIENT: GRLA

PROJECT LOCATION:

LOCATION: See Boring Location Plan **ELEVATION:** G.S.

DRILLER: Soil Exporation Corp. **LOGGED BY:** SK

DRILLING METHOD: 4.25" ID HSA **DATE:** 12/18/2020

DEPTH TO - WATER> INITIAL: 15 **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
0	[TOPSOIL - FILL] Dark brown, sandy Silt (ML), trace gravel, roots, organics; Medium dense			SS01	3 6 7 7		
	-becomes dense -shattered rock -Orange Mottling			SS02	10 14 23 25		
2.67	[GLACIAL COARSE DEPOSITS] Tan, Gravel (GP-GM) with silt and sand; Dense						
	-becomes very dense			SS03	18 22 31 39		
				SS04	20 30 26 32		
15	Dark tan, silty sand (SM) with gravel; Very dense -Shattered Rock -Orange Mottling			SS05	46 29 28 16		
	-becomes dense			SS06	8 17 29 25		

Depth scale (feet): 0, 3, 6, 9, 12, 15, 18, 21

TEST RESULTS: Plastic Limit ├──┤ Liquid Limit; Water Content - ●; Penetration - ▨; scale 10, 20, 30, 40, 50

Test boring backfilled with soil cuttings upon completion.

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-2

PROJECT: Proposed Community/Senior Center **PROJECT NO.:** 20-04-109
CLIENT: GRLA
PROJECT LOCATION:
LOCATION: See Boring Location Plan **ELEVATION:** G.S.
DRILLER: Soil Exporation Corp. **LOGGED BY:** SK
DRILLING METHOD: 4.25" ID HSA **DATE:** 12/18/2020
DEPTH TO - WATER> INITIAL: 15 **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS (Plastic Limit ├─┤ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50)
24							
				SS07	15 16 22 35		
27	Boring terminated at 27 ft.						
30							
33							
36							
39							
42							

Test boring backfilled with soil cuttings upon completion.

JOHN TURNER CONSULTING

LOG OF BORING No. B-3

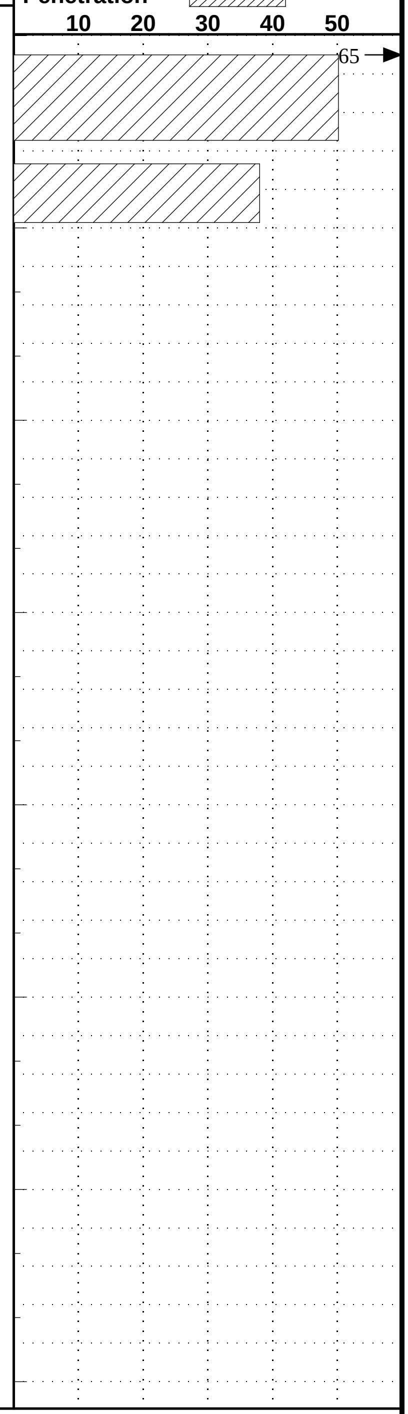
PROJECT: Proposed Community/Senior Center **PROJECT NO.:** 20-04-109
CLIENT: GRLA
PROJECT LOCATION:
LOCATION: See Boring Location Plan **ELEVATION:** G.S.
DRILLER: Soil Exporation Corp. **LOGGED BY:** SK
DRILLING METHOD: 4.25" ID HSA **DATE:** 12/18/2020
DEPTH TO - WATER> INITIAL: **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[PAVEMENT] 3" Bituminous concrete pavement					
0.3	[FILL] Dark tan, silty Sand (SM) with gravel; very dense			SS01	16 37 28 25	
2	[GLACIAL COARSE DEPOSITS] Orange tan, silty Sand (SM) with gravel; Medium dense			SS02	19 17 21 30	
5	Tan, Gravel (GP-GM) with silt and sand; Dense -shattered rock			SS03	29 100/4 - -	
6	Boring terminated at 6 ft. Auger refusal at 6.0 feet					

Depth scale: 0, 3, 6, 9, 12, 15, 18, 21

TEST RESULTS
Plastic Limit ├──┤ **Liquid Limit**
Water Content - ●
Penetration -



Test boring backfilled with soil cuttings upon completion.

JOHN TURNER CONSULTING

LOG OF BORING No. B-3A

PROJECT: Proposed Community/Senior Center **PROJECT NO.:** 20-04-109
CLIENT: GRLA
PROJECT LOCATION:
LOCATION: See Boring Location Plan **ELEVATION:** G.S.
DRILLER: Soil Exporation Corp. **LOGGED BY:** SK
DRILLING METHOD: 4.25" ID HSA **DATE:** 12/18/2020
DEPTH TO - WATER> INITIAL: **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS: Plastic Limit ├─┤ Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50)
0	Located B-3A approximately 10 feet esat of B-3. Drilled directly to 9.0 feet.						
3							
6							
9	Auger refusal at 9.0 feet bgs						
	Boring terminated at 9 ft.						
12							
15							
18							
21							

Test boring backfilled with soil cuttings upon completion.

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-4

PROJECT: Proposed Community/Senior Center **PROJECT NO.:** 20-04-109
CLIENT: GRLA
PROJECT LOCATION:
LOCATION: See Boring Location Plan **ELEVATION:** G.S.
DRILLER: Soil Exporation Corp. **LOGGED BY:** SK
DRILLING METHOD: 4.25" ID HSA **DATE:** 12/18/2020
DEPTH TO - WATER> INITIAL: 14 **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS (Plastic Limit ├─┤ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50)
0	[TOPSOIL - FILL] Dark brown, sandy Silt (ML), trace gravel, roots, organics; Medium dense			SS01	3 3 2 2		
2.67	[GLACIAL COARSE DEPOSITS] Tan, Gravel (GP-GM) with silt and sand ; Medium dense -Orange Mottling			SS02	1 3 13 22		
5	Orange tan, silty Sand (SM) with gravel; dense; -Shattered Rock -Orange Mottling			SS03	22 17 18 28		
	-becomes very dense -Shattered Rock			SS04	27 32 36 27		68
	-becomes medium dense			SS05	9 12 9 9		
	-becomes dense			SS06	16 19 21 26		

Test boring backfilled with soil cuttings upon completion.

This information pertains only to this boring and should not be interpreted as being indicative of the site.

LOG OF BORING No. B-4	**PROJECT:** Proposed Community/Senior Center	**PROJECT NO.:** 20-04-109	
	CLIENT: GRLA		
	PROJECT LOCATION:		
	LOCATION: See Boring Location Plan	**ELEVATION:** G.S.	
	DRILLER: Soil Exporation Corp.	**LOGGED BY:** SK	
	DRILLING METHOD: 4.25" ID HSA	**DATE:** 12/18/2020	
	DEPTH TO - WATER> INITIAL: 14	**AFTER 24 HOURS:**	

This information pertains only to this boring and should not be interpreted as being indicative of the site.

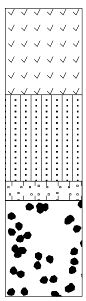
Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS: Plastic Limit ├──┤ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50
24	-Shattered rock			SS07	65 20 21 21		
27	Boring terminated at 27 ft.						
30							
33							
36							
39							
42							

Test boring backfilled with soil cuttings upon completion.

TEST PIT LOG
Test Pit No.: TP-1

JOHN TURNER CONSULTING

PROJECT Proposed Community/Senior Center 10 Elm Street - Boxford, MA	PROJECT NO. 20-04-109
CLIENT GRLA	DATE 12/18/2020
LOCATION See Boring Location Plan	ELEV. G.S.
EXCAVATION METHOD Takeuchi TB240 Mini-Excavator	LOGGER TMc
DEPTH TO - Water: When checked:	



ELEVATION/ DEPTH	SOIL SYMBOLS AND SAMPLERS: GRAPHIC	BULK	USCS	DESCRIPTION
0				[FOREST MAT] Dark brown, sandy Silt (ML), trace gravel, roots, organics
			SM	[GLACIAL COARSE DEPOSITS] Orange tan, silty Sand (SM) with gravel; frequent cobbles -orange/rust staining & mottling
5			SP-SM	0.5 ft lens of tan-grey, poorly graded, medium Sand (SP-SM) with silt
			GP	Dark, grey-tan, Gravel (GP)with sand; occasional cobbles
				B.O.E. at 7.5 feet bgs
10				
15				
20				
25				

Notes: *Test pit backfilled with soil cuttings upon completion.*

TEST PIT LOG
Test Pit No.: TP-2

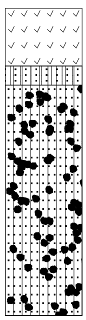
PROJECT Proposed Community/Senior Center 10 Elm Street - Boxford, MA	PROJECT NO. 20-04-109
CLIENT GRLA	DATE 12/18/2020
LOCATION See Boring Location Plan	ELEV. G.S.
EXCAVATION METHOD Takeuchi TB240 Mini-Excavator	LOGGER TMc
DEPTH TO - Water: When checked:	

ELEVATION/ DEPTH	SOIL SYMBOLS AND SAMPLERS: GRAPHIC	BULK	USCS	DESCRIPTION
0				[TOPSOIL - FILL] Dark brown, sandy Silt (ML), trace gravel, rootlets, organics;
			SM	[GLACIAL COARSE DEPOSITS] Orange tan, silty Sand (SM) with gravel; frequent cobbles -orange/rust staining & mottling
5			SP-SM	0.5 ft lense of tan-grey, poorly graded, medium Sand (SP-SM) with silt
			GP	Dark, grey-tan, Gravel (GP)with sand; occasional cobbles
				B.O.E. at 7.0 feet bgs
10				
15				
20				
25				

Notes: *Test pit backfilled with soil cuttings upon completion.*

TEST PIT LOG
Test Pit No.: TP-3

PROJECT Proposed Community/Senior Center 10 Elm Street - Boxford, MA	PROJECT NO. 20-04-109
CLIENT GRLA	DATE 12/18/2020
LOCATION See Boring Location Plan	ELEV. G.S.
EXCAVATION METHOD Takeuchi TB240 Mini-Excavator	LOGGER TMc
DEPTH TO - Water: When checked:	



ELEVATION/ DEPTH	SOIL SYMBOLS AND SAMPLERS: GRAPHIC	BULK	USCS	DESCRIPTION
0				[FOREST MAT] Dark brown, sandy Silt (ML), trace gravel, roots, organics;
			ML/SM	Lens of tan grey, Silt (ML) with sand
			GP-GM	[GLACIAL COARSE DEPOSITS] Grey-tan, Gravel (GP-GM) with silt and sand; frequent cobbles
5				
				B.O.E. at 8.0 feet bgs
10				
15				
20				
25				

Notes: *Test pit backfilled with soil cuttings upon completion.*

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KEY TO SYMBOLS AND DESCRIPTIONS

MAJOR DIVISIONS			SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION > No.4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVELS WITH OVER 15% FINES	GM	Silty gravels, gravel-sand mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS MORE THAN 1/2 OF COARSE FRACTION < No.4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW	Well-graded sand or gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH OVER 15% FINES	SM	Silty sand, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE	SILTS & CLAYS LIQUID LIMIT 50% OR LESS		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

TYPICAL SYMBOLS

Shelby Tube

Standard Split Spoon Sample

Rock Core

Vane Shear

Geoprobe Sample

Water Table (at time of drilling)

Auger Cuttings

3" Split Spoon Sample

Dynamic Cone Penetrometer

Bulk/Grab Sample

Sonic or Vibro-Core Sample

Water Table (after 24 hours)

WELL SYMBOLS

Recessed Cover Set in Concrete Top of Well, Recessed Pipe

Covered Riser

Capped Riser w/ Locking Cover

Pipe Riser

Concrete Seal

Gravel Backfill

Assorted Cuttings

Bentonite Slurry

Bentonite Pellets

Silica Sand, blank PVC

Slotted Pipe w/ Sand

Endcap on Pipe Packed in Sand

Silica Sand, No Pipe (End Plug)

SOIL MOISTURE MODIFIERS

Term	Description
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

The descriptor "damp" should not be used (use "moist").
The descriptor "saturated" should not be used (use "wet").

CLASSIFICATION	RANGE OF GRAIN SIZES U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.75
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.75
SAND	No. 4 to No. 200	4.75 to 0.075
coarse	No. 4 to No. 10	4.75 to 2.00
medium	No. 10 to No. 40	2.00 to 0.425
fine	No. 40 to No. 200	0.425 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

RELATIVE DENSITY/CONSISTENCY

Gravel, Sand, and Silt (nonplastic)		Silt (plastic) and Clay		
N-Value	Relative Density	N-Value	Su	Consistency
0 - 4	Very Loose	0 - 2	0 - 250	Very Soft
5 - 10	Loose	3 - 4	251 - 500	Soft
11-30	Medium Dense	5 - 8	501 - 1000	Medium Stiff
31 - 50	Dense	9 - 15	1001 - 2000	Stiff
51 +	Very Dense	16 - 30	2001 - 4000	Very Stiff
		31 +	4001+	Hard

Standard Penetration Testing (SPT) N_{60} based on blows per 12 inches.
WR = Weight of Rods; WH = Weight of Hammer

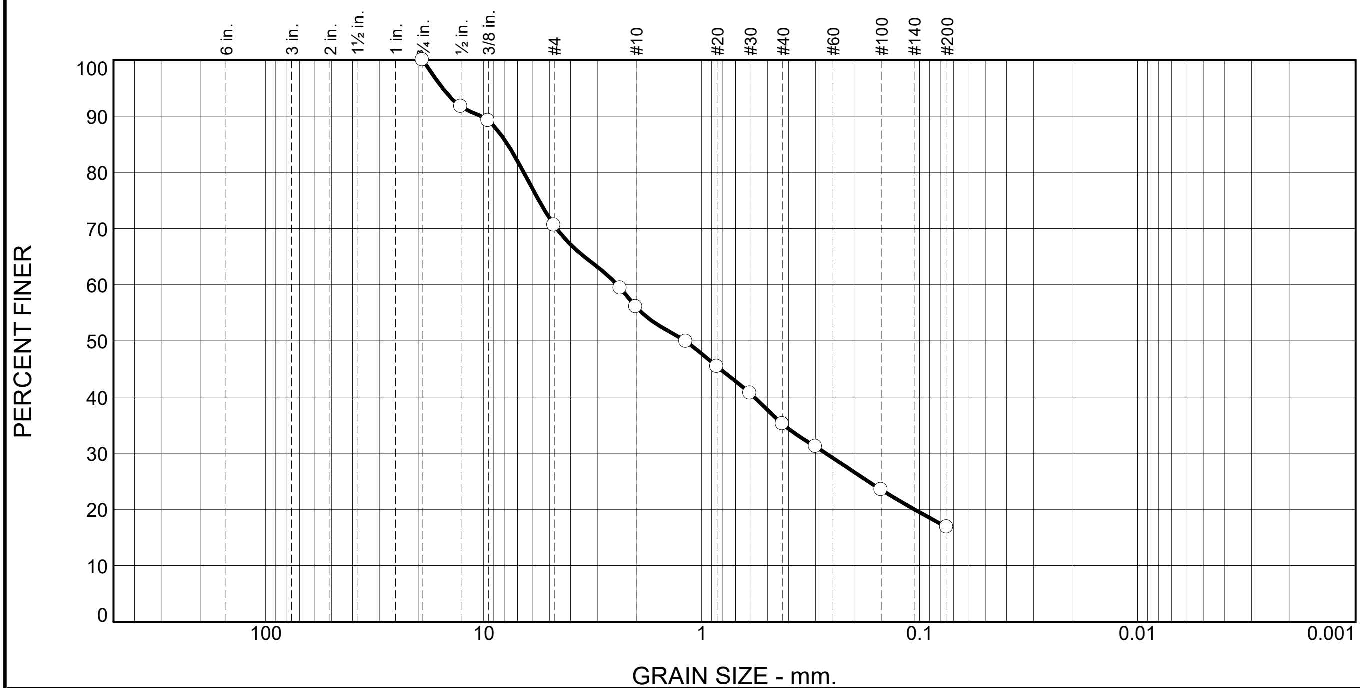
PERCENT OR PORTIONS OF SOIL

Term	Description
Parting:	> 1/16 in.
Seam:	0.5 in. to 1/16 in.
Layer:	12 in. to 0.5 in.
Stratum:	> 12 in.
Pocket:	Small erratic deposit
Lens:	Lenticular deposit
Occasional:	One or less per foot of thickness
Frequent	More than one per foot of thickness
Varved	Alternating seams or layers of silt and/or clay and sometimes f. sand

REFERENCE: UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488-93

APPENDIX F: GEOTECHNICAL LABORATORY TESTING REPORTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.4	14.6	20.8	18.4	16.8	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
1/2"	91.7		
3/8"	89.2		
#4	70.6		
#8	59.4		
#10	56.0		
#16	49.9		
#20	45.4		
#30	40.7		
#40	35.2		
#50	31.1		
#100	23.5		
#200	16.8		

* (no specification provided)

Material Description

Orangish - medium brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** -

Coefficients

D_{90}= 10.2877 D_{85}= 7.7821 D_{60}= 2.4412
D_{50}= 1.1956 D_{30}= 0.2699 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture content 4.8%

Date Received: 12/21/2020 **Date Tested:** 12/22/2020
Tested By: Matt Watson
Checked By: Rob Faria
Title: Lab Manager

Location: B-3 SS02
Sample Number: 3520-812 **Depth:** 2'-4' **Date Sampled:** 12/21/2020

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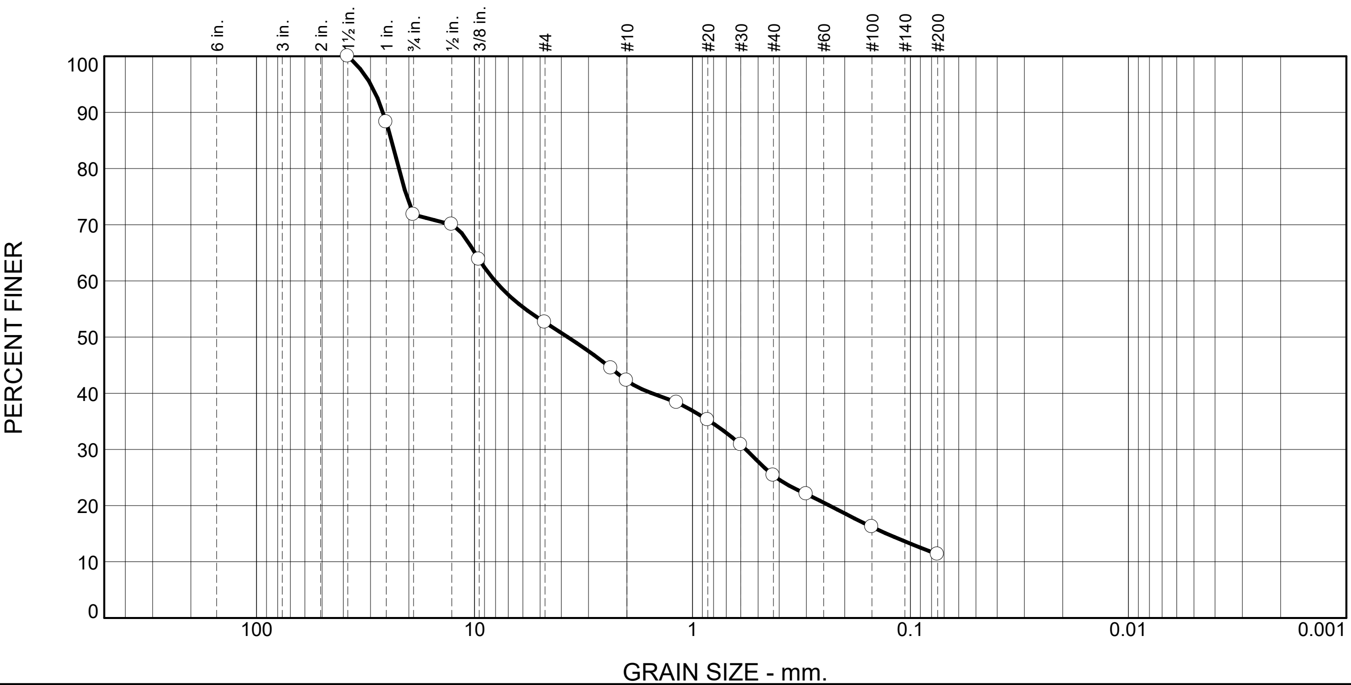
Client: Gorman Richardson Lewis Architects
Project: Center at 10 Elm Street Boxford, MA
Project No: 20-04-109 **Figure** 812A

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.2	19.2	10.4	16.8	14.1	11.3	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
1"	88.3		
3/4"	71.8		
1/2"	70.0		
3/8"	63.8		
#4	52.6		
#8	44.4		
#10	42.2		
#16	38.3		
#20	35.2		
#30	30.8		
#40	25.4		
#50	22.0		
#100	16.2		
#200	11.3		

* (no specification provided)

Material Description

Medium dark brown gravel with silt and sand

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= GP-GM **AASHTO (M 145)=** -

Coefficients

D_{90}= 26.2606 D_{85}= 24.0214 D_{60}= 8.0504
D_{50}= 3.7345 D_{30}= 0.5692 D_{15}= 0.1284
D_{10}= C_u= C_c=

Remarks

Moisture content 3.9%

Date Received: 12/21/2020 **Date Tested:** 12/22/2020

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: B-2 SS03
Sample Number: 3520-811 **Depth:** 5'-7'

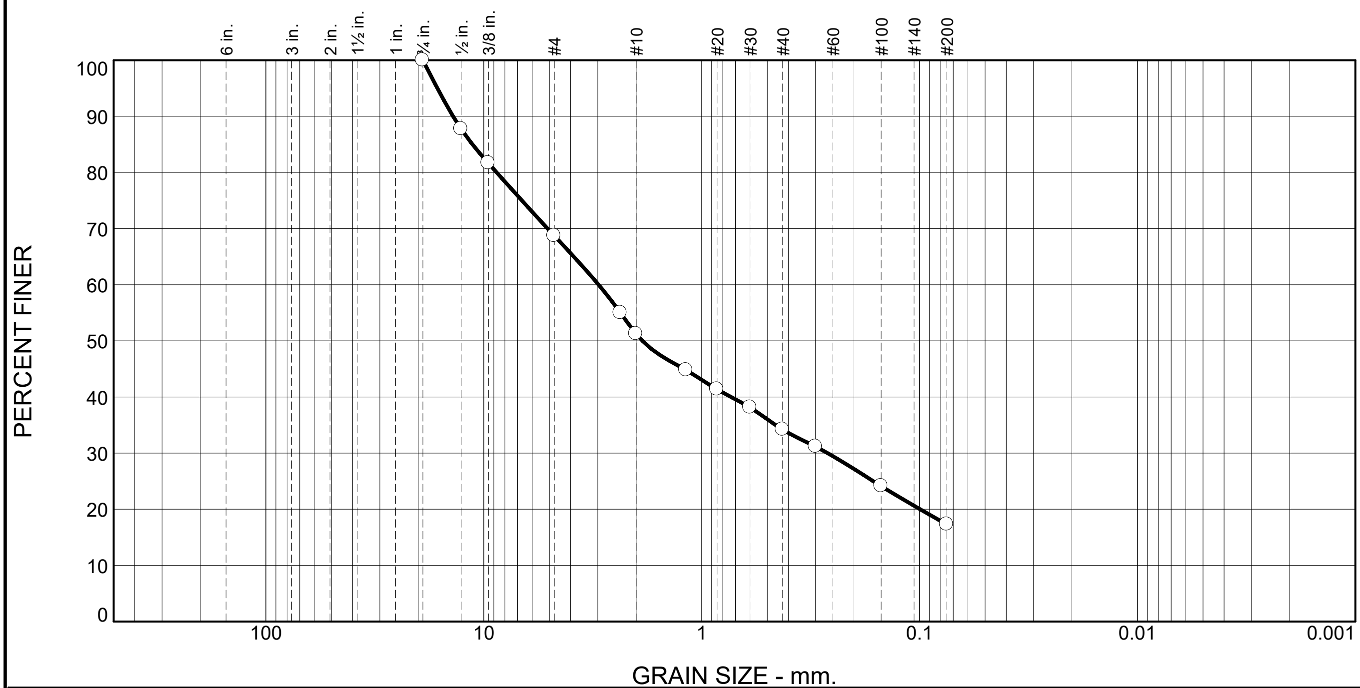
Date Sampled: 12/21/2020

JOHN TURNER CONSULTING

Client: Gorman Richardson Lewis Architects
Project: Center at 10 Elm Street Boxford, MA

Project No: 20-04-109 **Figure** 811A

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	31.3	17.4	17.1	16.9	17.3	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
1/2"	87.7		
3/8"	81.7		
#4	68.7		
#8	55.0		
#10	51.3		
#16	44.8		
#20	41.4		
#30	38.1		
#40	34.2		
#50	31.1		
#100	24.1		
#200	17.3		

* (no specification provided)

Material Description

Medium brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** -

Coefficients

D_{90}= 13.8347 D_{85}= 11.2739 D_{60}= 2.9752
D_{50}= 1.8701 D_{30}= 0.2643 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture content 11.7%

Date Received: 12/21/2020 **Date Tested:** 12/22/2020

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: B-4 SS06
Sample Number: 3520-813 **Depth:** 20'-22'
Date Sampled: 12/21/2020

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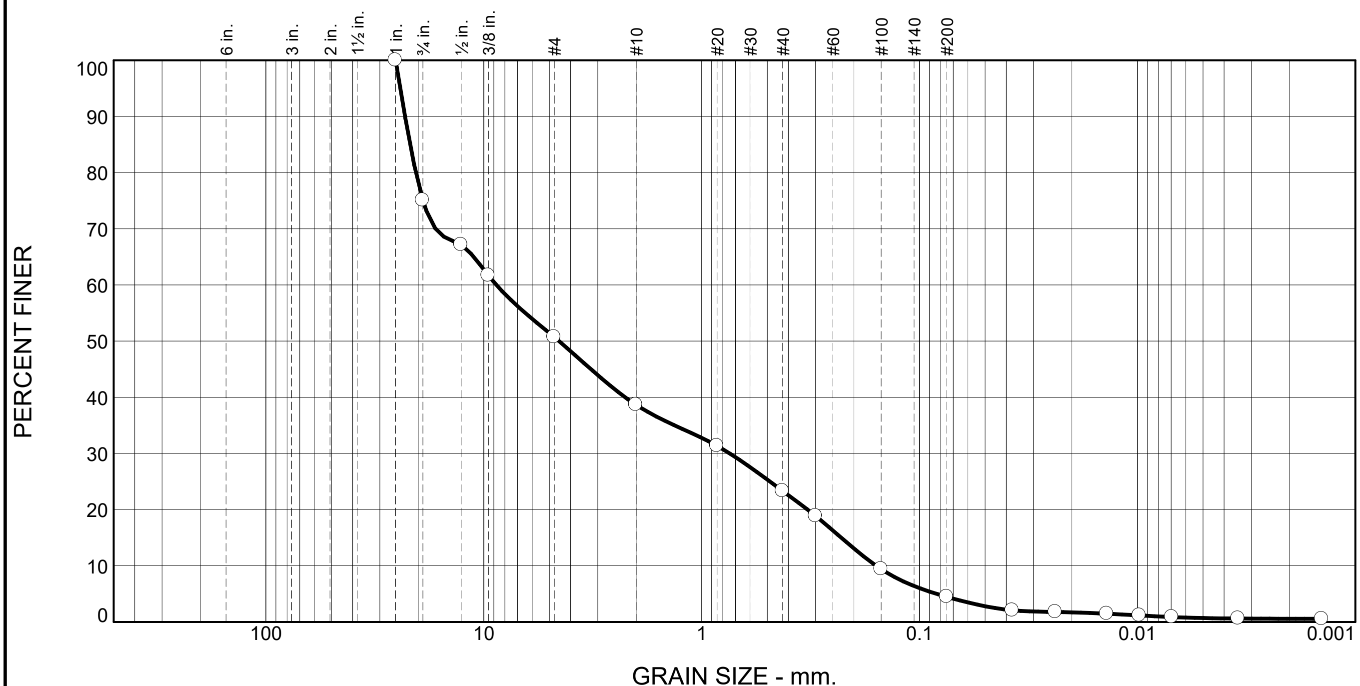
Client: Gorman Richardson Lewis Architects
Project: Center at 10 Elm Street Boxford, MA

Project No: 20-04-109 **Figure** 813A

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.9	24.4	12.0	15.4	18.8	3.8	0.7

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	75.1		
1/2"	67.1		
3/8"	61.7		
#4	50.7		
#10	38.7		
#20	31.3		
#40	23.3		
#50	18.9		
#100	9.4		
#200	4.5		
0.0375 mm.	2.1		
0.0238 mm.	1.8		
0.0138 mm.	1.5		
0.0098 mm.	1.2		
0.0069 mm.	0.9		
0.0034 mm.	0.6		
0.0014 mm.	0.5		

* (no specification provided)

Material Description

Medium brown gravel with sand

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** -

Coefficients

D_{90}= 22.9834 D_{85}= 21.7783 D_{60}= 8.7519
D_{50}= 4.5183 D_{30}= 0.7440 D_{15}= 0.2287
D_{10}= 0.1580 C_u= 55.38 C_c= 0.40

Remarks

Moisture content 5.7%

Date Received: 12/21/2020 **Date Tested:** 12/23/2020

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: TP-1
Sample Number: 3520-816 **Depth:** 5.5'-7.5' **Date Sampled:** 12/21/2020

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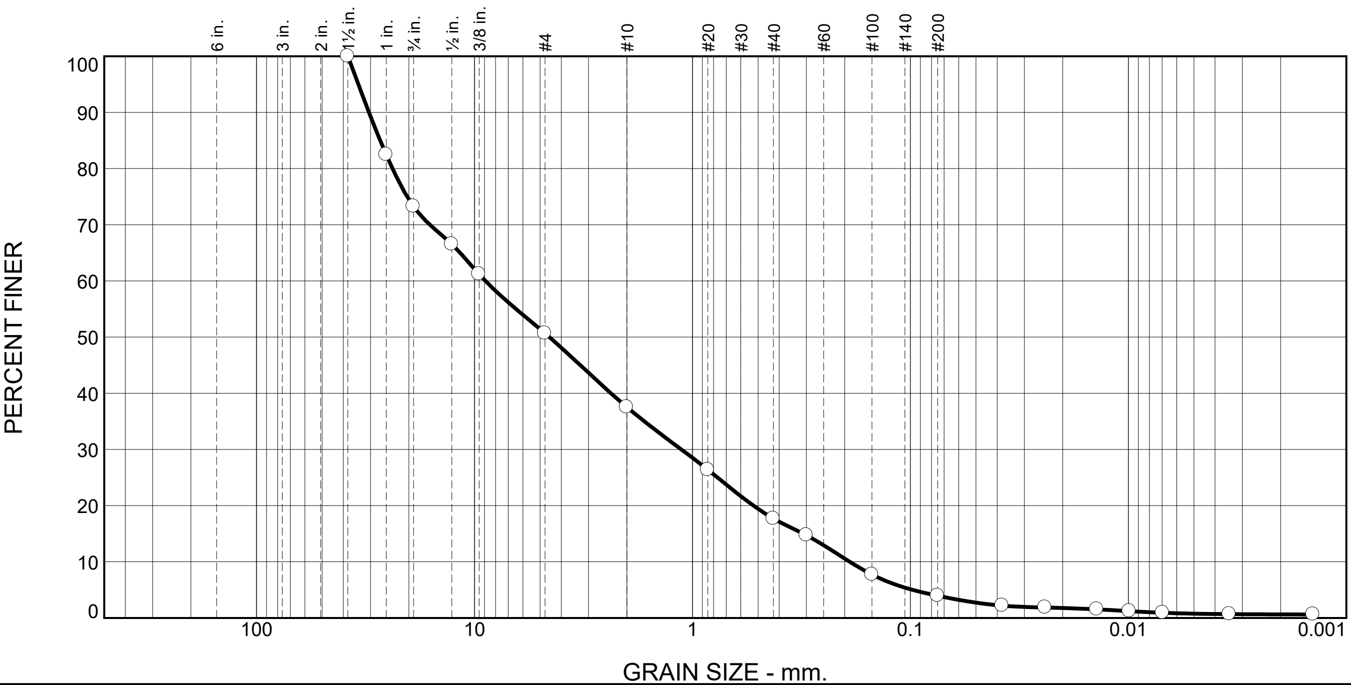
Client: Gorman Richardson Lewis Architects
Project: Center at 10 Elm Street Boxford, MA

Project No: 20-04-109 **Figure** 816A

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	26.7	22.6	13.2	19.8	13.8	3.1	0.8

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
1"	82.5		
3/4"	73.3		
1/2"	66.5		
3/8"	61.2		
#4	50.7		
#10	37.5		
#20	26.4		
#40	17.7		
#50	14.7		
#100	7.7		
#200	3.9		
0.0379 mm.	2.2		
0.0241 mm.	1.8		
0.0139 mm.	1.5		
0.0099 mm.	1.2		
0.0070 mm.	0.9		
0.0034 mm.	0.7		
0.0014 mm.	0.6		

* (no specification provided)

Material Description

Brown gravel with sand

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** -

Coefficients

D_{90}= 30.4942 D_{85}= 27.0831 D_{60}= 8.9020
D_{50}= 4.5323 D_{30}= 1.1249 D_{15}= 0.3097
D_{10}= 0.1898 C_u= 46.89 C_c= 0.75

Remarks

Moisture content 4.7%

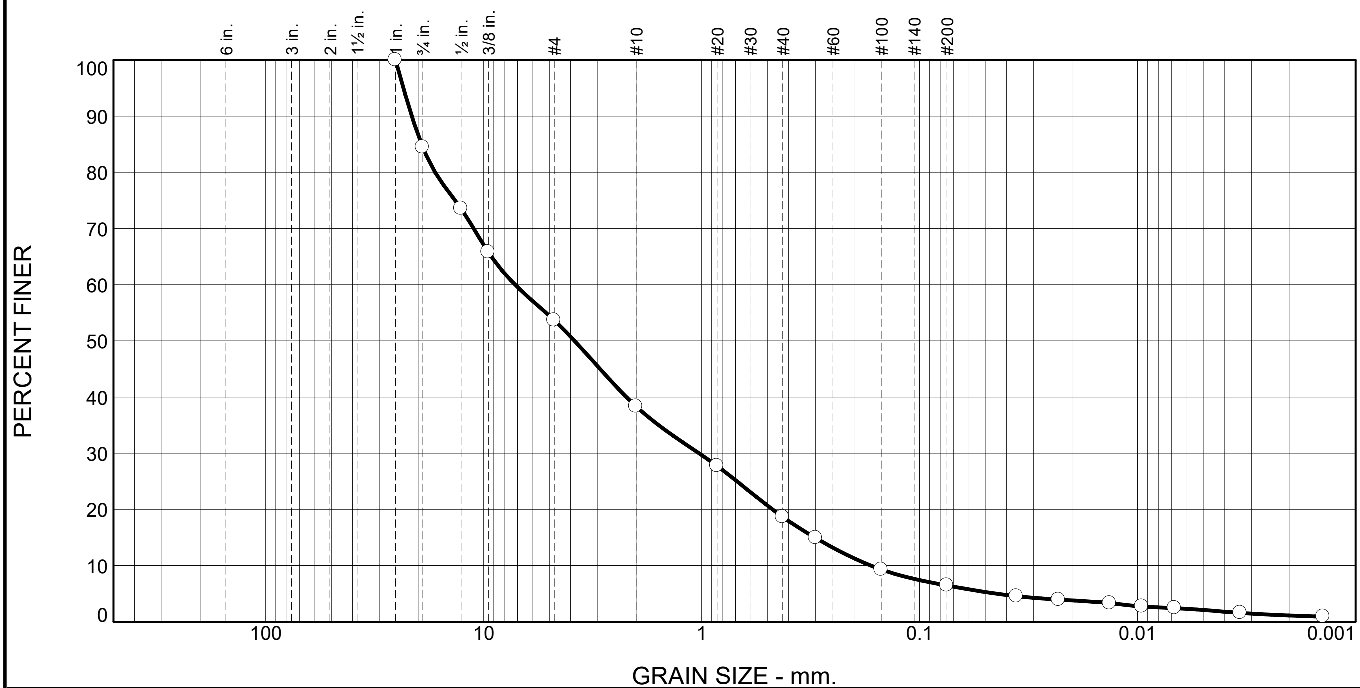
Date Received: 12/21/2020 **Date Tested:** 12/23/2020
Tested By: Matt Watson
Checked By: Rob Faria
Title: Lab Manager

Location: TP-2
Sample Number: 3520-814 **Depth:** 5.5'-6.5'
Date Sampled: 12/21/2020

JOHN TURNER CONSULTING

Client: Gorman Richardson Lewis Architects
Project: Center at 10 Elm Street Boxford, MA
Project No: 20-04-109 **Figure** 814A

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.5	30.8	15.4	19.6	12.2	4.4	2.1

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	84.5		
1/2"	73.5		
3/8"	65.8		
#4	53.7		
#10	38.3		
#20	27.7		
#40	18.7		
#50	14.9		
#100	9.3		
#200	6.5		
0.0360 mm.	4.5		
0.0230 mm.	3.9		
0.0134 mm.	3.3		
0.0096 mm.	2.7		
0.0068 mm.	2.4		
0.0034 mm.	1.6		
0.0014 mm.	0.9		

* (no specification provided)

Material Description

Dark brown gravel with silt and sand

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** -

Coefficients

D_{90}= 21.3806 D_{85}= 19.2957 D_{60}= 7.1862
D_{50}= 3.8311 D_{30}= 1.0298 D_{15}= 0.3028
D_{10}= 0.1677 C_u= 42.85 C_c= 0.88

Remarks

Moisture content 7.5%

Date Received: 12/21/2020 **Date Tested:** 12/23/2020
Tested By: Matt Watson
Checked By: Rob Faria
Title: Lab Manager

Location: TP-3
Sample Number: 3520-815 **Depth:** 5'-5.5' **Date Sampled:** 12/21/2020

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Client: Gorman Richardson Lewis Architects
Project: Center at 10 Elm Street Boxford, MA
Project No: 20-04-109 **Figure** 815A

APPENDIX G: SITE PHOTOGRAPHS

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Proposed Community/Senior Center
10 Elm Street
Boxford, Massachusetts

SITE PHOTOGRAPHS

Site Facing East

Typical Drill Rig Setup

Silty Sand (SM) with Gravel (0' – 2')

Silty Sand (SM) with Gravel (20' – 22')

Gravel (GP-GM) with Silt and Sand

Gravel (GP) with Sand

February 2, 2021

Gorman Richardson Lewis Architects
239 South Street
Hopkinton, MA 01748

Attn: Scott Richardson – Principal
P: (508) 544-2600
srichardson@grlarchitects.com

RE: **Geotechnical Investigation**
Center at 10 Elm Street
Boxford, Massachusetts

Date Performed: 12/18/2020 Ground Water Observed At: **15’**

B-1								
Sample No.	Sample depths From-To	Blows Per 6” on Sampler				Density (N-Value)	Field Soil Identification	Recovery
SS01	0’-2’	5	5	4	4	9 (Loose)	[FILL] Dark brown Silt, little Sand, trace Gravel, trace rootlets	7”
SS02	2’-4’	3	6	21	27	27 (Medium Dense)	Top 2” – [FILL] Bottom -Tan Coarse to Fine Sand, Some Gravel -Shattered Rock -Orange Mottling	10”
SS03	5’-7’	25	26	25	29	51 (Very Dense)	Tan Sand and Gravel -Shattered Rock -Orange Mottling	7”
SS04	10’-12’	21	33	45	52	78 (Very Dense)	Tan Sand and Gravel -Shattered Rock -Orange Mottling	18”
SS05	15’-17’	18	38	57	33	95 (Very Dense)	Dark Tan Sand and Gravel, little Silt -Shattered Rock -Orange Mottling	13”
SS06	20’-22’	12	25	38	28	63 (Very Dense)	Top 7”- Tan Medium to Fine Sand, trace Silt Bottom 8” – Gravel, little Silt, little Sand -Shattered Rock	15”
SS07	25’-27’	23	100/3”	-	-	-	Dark Tan Medium to Fine Sand, little Silt, Some Gravel	3”

Date Performed: 12/18/2020 Ground Water Observed At: **15'**

B-2								
Sample No.	Sample depths From-To	Blows Per 6" on Sampler				Density (N-Value)	Field Soil Identification	Recovery
SS01	0'-2'	3	6	7	7	13 (Medium Dense)	[FILL] Dark brown Silt, little Sand, little Gravel, trace rootlets	12"
SS02	2'-4'	10	14	23	25	37 (Dense)	Top 8" – [FILL] Bottom - Shattered Rock -Orange Mottling	11"
SS03	5'-7'	18	22	31	39	53 (Very Dense)	Tan Coarse to Fine Sand and Gravel, trace Silt -Shattered Rock	8"
SS04	10'-12'	20	30	26	32	56 (Very Dense)	Light Tan Coarse to Fine Sand and Gravel, trace Silt -Shattered Rock -Orange Mottling	12"
SS05	15'-17'	46	29	28	16	57 (Very Dense)	Dark Tan Medium to Fine Sand, little Silt	6"
SS06	20'-22'	8	17	29	25	46 (Dense)	Top 16"- Tan Medium to Fine Sand, trace Silt Bottom 8" – Light Tan Fine Sand, Some Silt -Orange Mottling	24"
SS07	25'-27'	15	16	22	35	38 (Dense)	Top 14"- Tan Medium to Fine Sand, trace Silt Bottom 6" – Coarse to Fine Sand, little Gravel	22"

Date Performed: 12/18/2020 Ground Water Observed At: **N/A**

B-3								
Sample No.	Sample depths From-To	Blows Per 6" on Sampler				Density (N-Value)	Field Soil Identification	Recovery
SS01	0'-2'	16	37	28	21	65 (Very Dense)	-3" PAVEMENT Dark tan Sand and Gravel -Shattered Rock	16"
SS02	2'-4'	19	17	21	30	38 (Dense)	Dark tan Sand and Gravel -Shattered Rock -Orange Mottling	11"
SS03	5'-7'	29	100/4'	-	-	-	Tan Coarse to Fine Sand and Gravel -Shattered Rock	7"
SS04	10'-12'	-	-	-	-	-	Auger Refusal at 6'	-

B-3A – Auger Refusal at 9'

Date Performed: 12/18/2020 Ground Water Observed At: **14'**

B-4								
Sample No.	Sample depths From-To	Blows Per 6" on Sampler				Density (N-Value)	Field Soil Identification	Recovery
SS01	0'-2'	3	3	2	2	5 (Loose)	[FILL] Dark brown Silt, little Sand, trace Gravel, trace rootlets	8"
SS02	2'-4'	1	3	13	22	16 (Medium Dense)	Top 8" – [FILL] Bottom – Tan Coarse to Fine Sand, little Silt, little Gravel -Orange Mottling	16"
SS03	5'-7'	22	17	18	28	35 (Dense)	Tan Coarse to Fine Sand, little Silt, little Gravel -Shattered Rock -Orange Mottling	16"
SS04	10'-12'	27	32	36	27	68 (Very Dense)	Tan Coarse to Medium Sand and Gravel, trace Silt -Shattered Rock	13"
SS05	15'-17'	9	12	9	9	21 (Medium Dense)	-	0
SS06	20'-22'	16	19	21	26	40 (Dense)	Dark Tan Coarse to Medium Sand and Gravel, little Silt	13"
SS07	25'-27'	65	20	21	21	41 (Dense)	Dark Tan Coarse to Medium Sand and Gravel, little Silt -Shattered Rock	15"

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