

Hydrology Report

**724 Macarthur Boulevard
Bourne, MA
Map 44.2, Parcel 23**

PREPARED FOR

**Gulf Coast Realty, LLC
736 Washington Street
South Easton, MA 02375**

PREPARED BY

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February 12, 2021

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Introduction:

The purpose of this report is to review the hydrologic impacts associated with the redevelopment of the existing building and associated parking lot at 724 Macarthur Blvd, Bourne, MA.

Existing Conditions:

The locus is shown as Map 44.2 Parcel 23 on of the Town of Bourne Assessors Maps. The total area of the site is 36,180± SF or approximately 0.83 acres.

The property is surrounded by commercial development to the north and south and a residential subdivision to the west. There is a Bordering Vegetated Wetland (BVW) associated with a small pond located to the northwest of the property. The majority of the site and surrounding properties drain to the BVW.

The site is a minimally developed parcel comprised of a 688± SF retail building with associated appurtenances, which include a paved parking lot, patio, decks and building ramps. The remainder of the site is comprised of gravel, lawn, and landscape areas with much of the rear lot covered by trees and low-lying shrub.

Test pits performed on-site indicate a very coarse sand with a high infiltration rate.

Proposed Conditions:

The proposed project consists of renovating the building, constructing a proposed addition, and reconfiguring the existing driveway and parking area. The exterior modifications will result in an approximately 3,400± SF increase in impervious area. The proposed project also consists of installing a subsurface infiltration system to directly recharge roof runoff and the installation of a rain garden with sediment forebay to treat runoff from the parking lot and patio area.

Method of Calculation:

The stormwater management areas were analyzed utilizing standard engineering practices and the Soil Conservation Service (SCS) Technical Release 20 (TR20). The systems were analyzed using the rainfall data for the two (2), ten (10), twenty-five (25) and one hundred (100) year, 24 hour duration storm frequencies. The precipitation is 3.23", 4.89", 6.10" and 8.55" respectively. The precipitation was based on the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 - point precipitation frequency estimates.

To assist in the analysis, the computer software program "HydroCAD" was used to develop hydrographs and infiltration area inflow/outflow calculations.

Conclusion:

The drainage system has been designed to treat, mitigate and recharge stormwater runoff onsite. Previously untreated runoff from the paved parking lot is proposed to be directed to the proposed sediment forebay and rain garden for treatment and infiltration before being discharged to the existing wetland on site. Runoff from the existing and proposed roofs is proposed to be directed to a subsurface leaching area to promote additional groundwater recharge.

TABLE 1:

STORM EVENT (Year)	2		10		25		100	
	PRE (cf)	POST (cf)	PRE (cf)	POST (cf)	PRE (cf)	POST (cf)	PRE (cf)	POST (cf)
1	1,054	1,256	3,012	2,618	4,790	3,712	8,943	6,062
2	132.0	132.0	340.0	340.0	521.0	521.0	933.0	934.0
3	n/a	1.00	n/a	199.0	n/a	531.0	n/a	1,563
4	n/a	364.0	n/a	564.0	n/a	711.0	n/a	1,008

STORMWATER STANDARD COMPLIANCE

Standard 1: No New Untreated Discharges

There are no new untreated discharges.

Standard 2: Peak Rate Attenuation

Peak runoff attenuation is demonstrated. Flows off site do not exceed pre-development flow rates for the two (2), ten (10) and twenty-five (25) year storm events. There is a de-minimis increase in peak flow rate for the one hundred (100) year storm event, but offsite flooding is not increased as the volume has been drastically reduced for this storm event.

Standard 3: Recharge

Recharge has been provided on site for all impervious surfaces including roof areas which directly discharge to infiltration systems.

Standard 4: Required Water Quality Volume

A sediment forebay and rain garden have been sized to treat the required one-half inch (1/2") water quality volume.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

Project does not provide land uses with higher potential pollutant loads.

Standard 6: Critical Areas

There are no discharges to a critical area.

Standard 7: Redevelopments projects subject to the Standards only to the maximum extent practicable

The project is technically a Redevelopment; however, it has been designed to comply with applicable standards to the fullest extent.

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

See attached Construction Period Pollution Prevention Plan

Standard 9: Operation and Maintenance Plan

See attached Operation and Maintenance Plan

Standard 10: Prohibition of Illicit Discharges

The proposed uses will not result in any illicit discharges.



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 8²
- 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.



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



 2/10/2021
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): _____

Standard 1: No New Untreated Discharges

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



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
- Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

RECHARGE CALCULATIONS

SWMA #	Impervious Area (s.f.)	Recharge Volume (c.f.)	Volume Provided (c.f.)	Bottom Area	Draw-down time (hrs.)
Rain Garden	7,437	372	847	158	3.41
Roof System	1,456	73	360	179	0.59

Recharge Volume (Rv)=F x impervious area
 F= 0.6" for HSG "A"
 $Rv = (.6" / 12) (\text{impervious area})$

Draw down time = $Rv / (k)(\text{bot. area})$
 K=8.27 in/hr, 0.69 ft/hr



Project: 724 MacArthur Blvd – Bourne, MA
 Prepared By: RMM

TSS Removal Calculation Worksheet

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (BxC)	Remaining Load (C-D)
Rain Garden	90%	1.00	0.90	0.10
Total TSS Removal =			90%	

Note: Greater than 44% TSS removed prior to infiltration

Required Water Quality

This site falls within area of soils with a rapid infiltration rate. Therefore, 1" water quality volume is to be used.

Required WQV = (1.0 inch) * (1 ft/12 inches) * A_{imp} , where A_{imp} is the impervious area onsite.

WQV = (1.0 inch) * (1 ft/12 inches) * 7,437 s.f. = **620 c.f.**

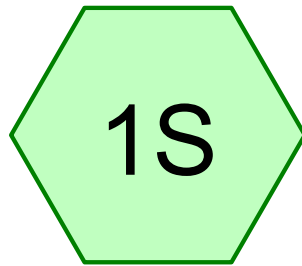
Water Quality Volume below overflow grate elevation 53.2 = **626 c.f.**

Water Quality Volume Provided = 626 c.f. > 620 c.f. Required

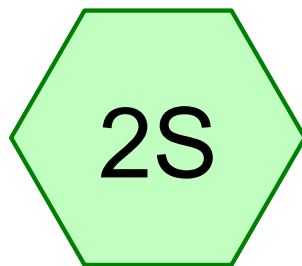
Required Sediment Forebay Volume = (0.1 inch) * (1 ft/12 inches) * A_{imp} = **62 c.f.**

Water Quality Volume below check dam elevation 53.5 = **241 c.f.**

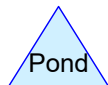
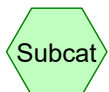
Water Quality Volume Provided = 241 c.f. > 62 c.f. Required



Flow to Wetland



Flow to Road



724 MacArthur Blvd - Predevelopment (rev1)

Prepared by Microsoft

HydroCAD® 10.10-4a s/n 03102 © 2020 HydroCAD Software Solutions LLC

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.23	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.89	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.10	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.55	2

Summary for Subcatchment 1S: Flow to Wetland

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 1,054 cf, Depth> 0.46"

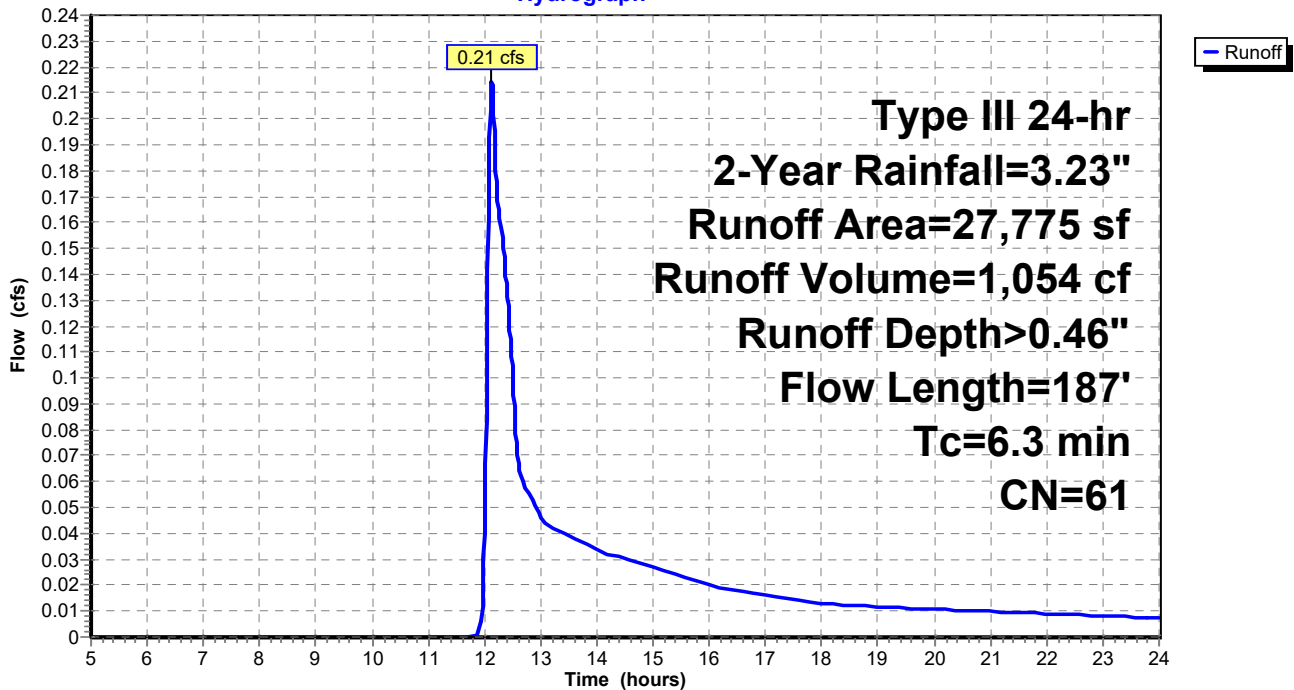
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
* 5,811	98	Impervious Surface
* 5,779	96	Gravel surface
8,045	39	>75% Grass cover, Good, HSG A
8,140	30	Woods, Good, HSG A
27,775	61	Weighted Average
21,964		79.08% Pervious Area
5,811		20.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0238	0.17		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.50"
0.5	66	0.1130	2.35		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
0.8	71	0.0800	1.41		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
6.3	187	Total			

Subcatchment 1S: Flow to Wetland

Hydrograph



Summary for Subcatchment 2S: Flow to Road

Runoff = 0.03 cfs @ 12.09 hrs, Volume= 132 cf, Depth> 0.61"

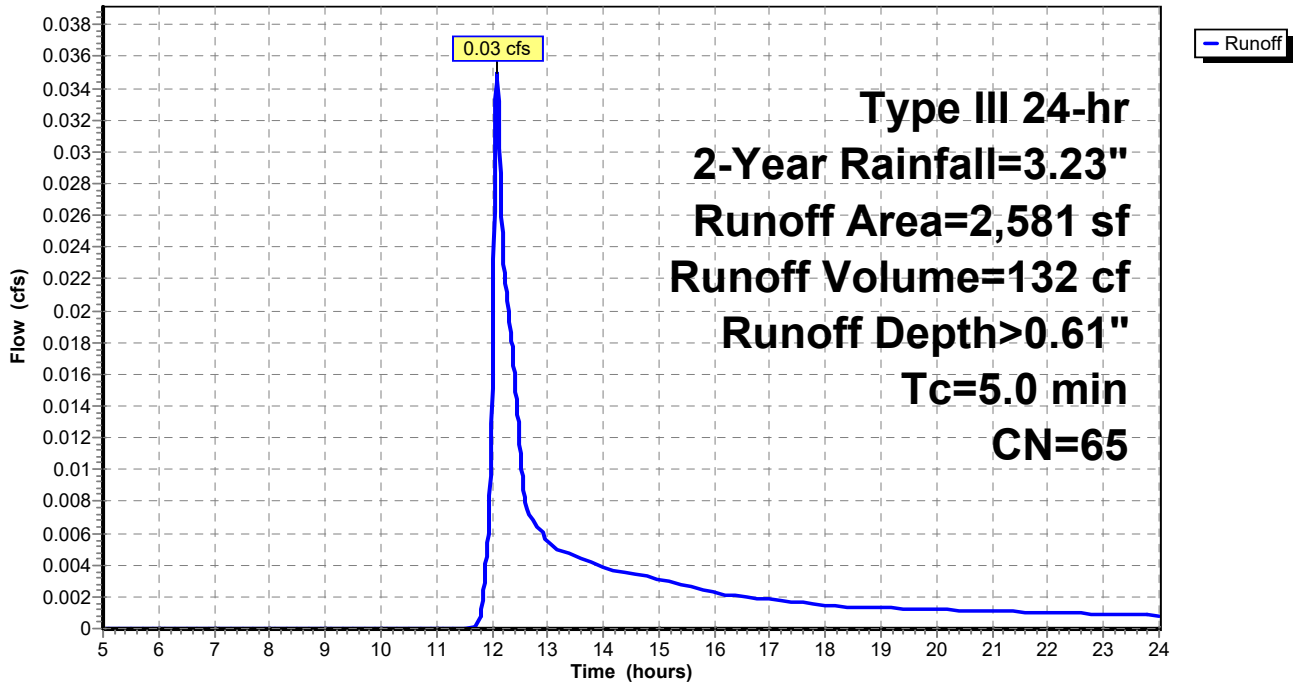
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.23"

	Area (sf)	CN	Description
*	1,325	98	Paved parking
	1,256	30	Woods, Good, HSG A
	2,581	65	Weighted Average
	1,256		48.66% Pervious Area
	1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road

Hydrograph



Summary for Subcatchment 1S: Flow to Wetland

Runoff = 0.87 cfs @ 12.10 hrs, Volume= 3,012 cf, Depth> 1.30"

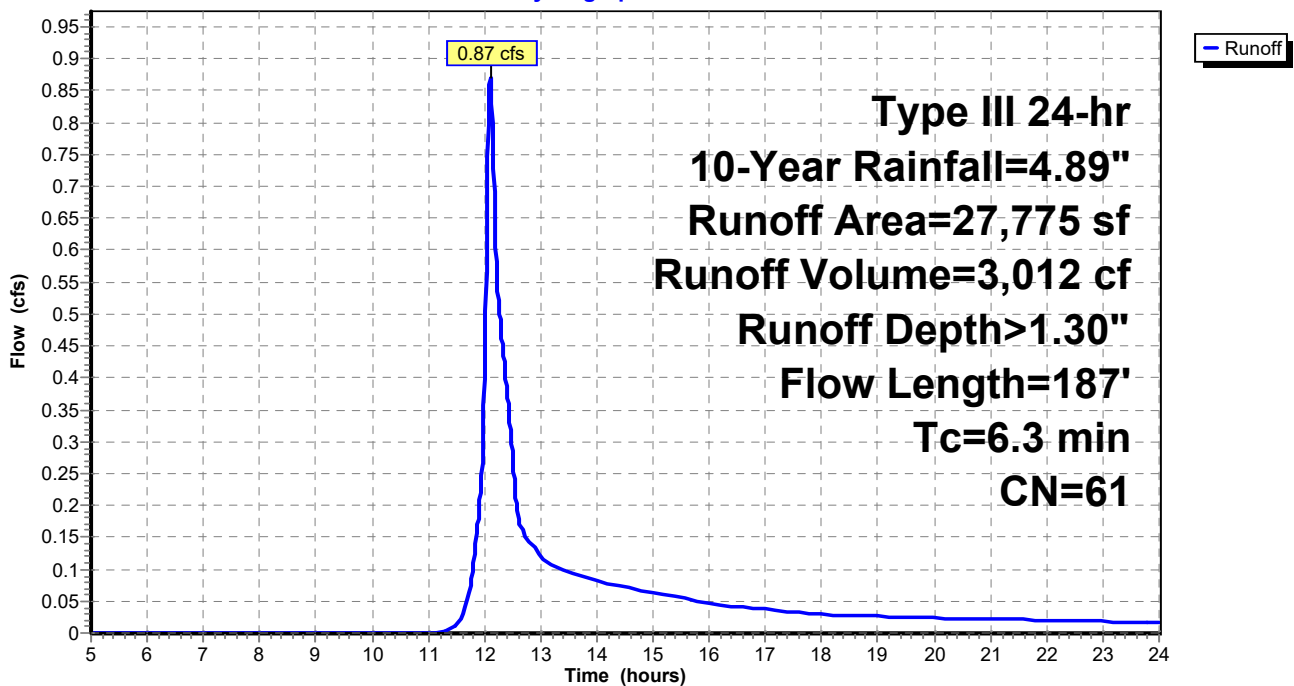
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
* 5,811	98	Impervious Surface
* 5,779	96	Gravel surface
8,045	39	>75% Grass cover, Good, HSG A
8,140	30	Woods, Good, HSG A
27,775	61	Weighted Average
21,964		79.08% Pervious Area
5,811		20.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0238	0.17		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.50"
0.5	66	0.1130	2.35		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
0.8	71	0.0800	1.41		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
6.3	187	Total			

Subcatchment 1S: Flow to Wetland

Hydrograph



Summary for Subcatchment 2S: Flow to Road

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 340 cf, Depth> 1.58"

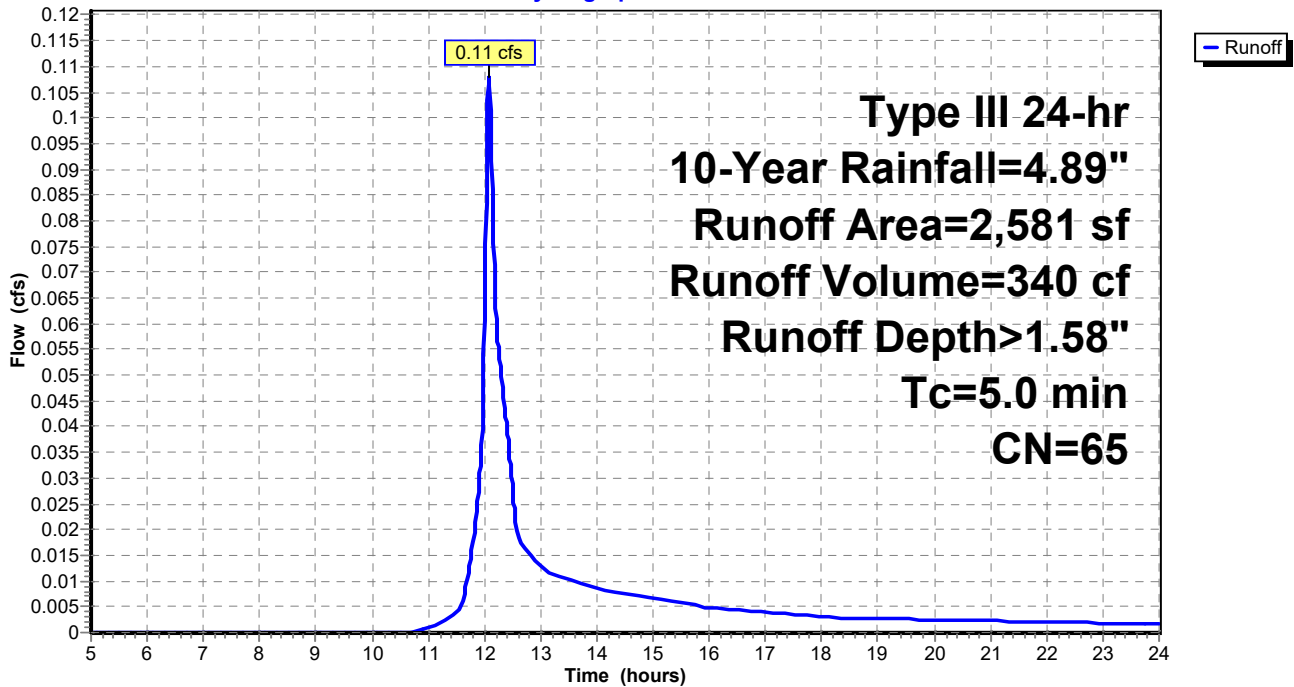
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.89"

	Area (sf)	CN	Description
*	1,325	98	Paved parking
	1,256	30	Woods, Good, HSG A
	2,581	65	Weighted Average
	1,256		48.66% Pervious Area
	1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road

Hydrograph



Summary for Subcatchment 1S: Flow to Wetland

Runoff = 1.47 cfs @ 12.10 hrs, Volume= 4,790 cf, Depth> 2.07"

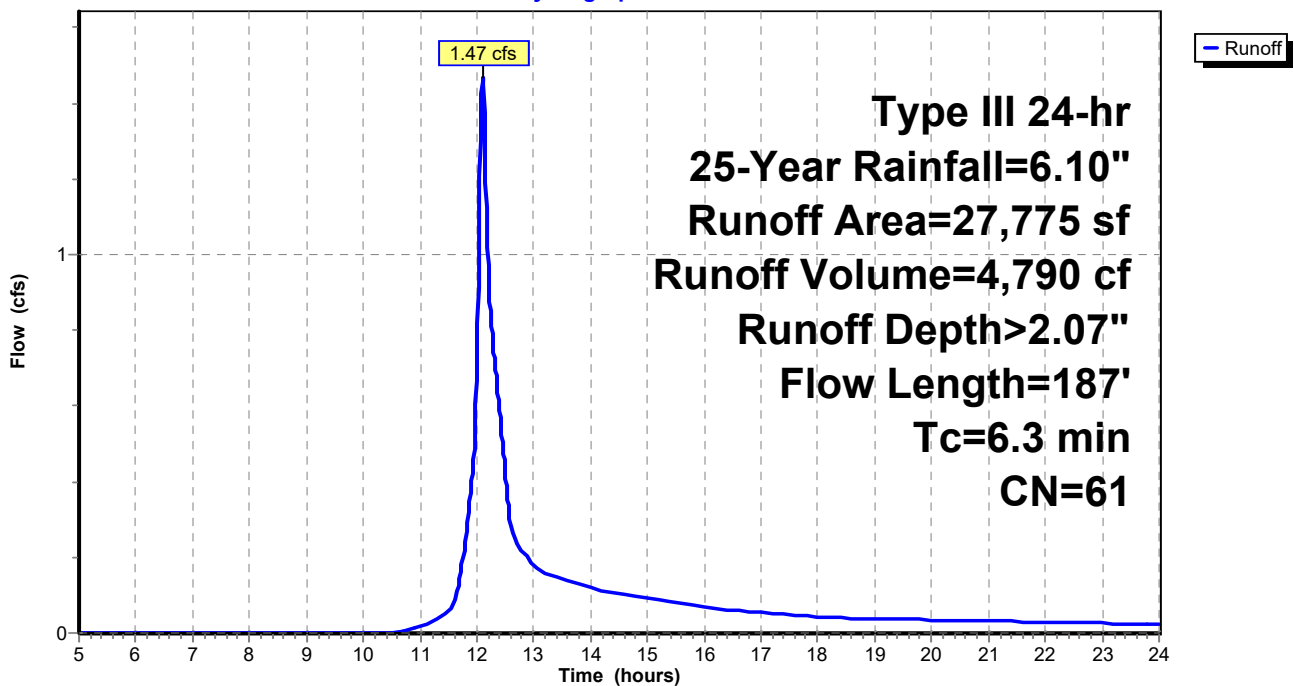
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
* 5,811	98	Impervious Surface
* 5,779	96	Gravel surface
8,045	39	>75% Grass cover, Good, HSG A
8,140	30	Woods, Good, HSG A
27,775	61	Weighted Average
21,964		79.08% Pervious Area
5,811		20.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0238	0.17		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.50"
0.5	66	0.1130	2.35		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
0.8	71	0.0800	1.41		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
6.3	187	Total			

Subcatchment 1S: Flow to Wetland

Hydrograph



Summary for Subcatchment 2S: Flow to Road

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 521 cf, Depth> 2.42"

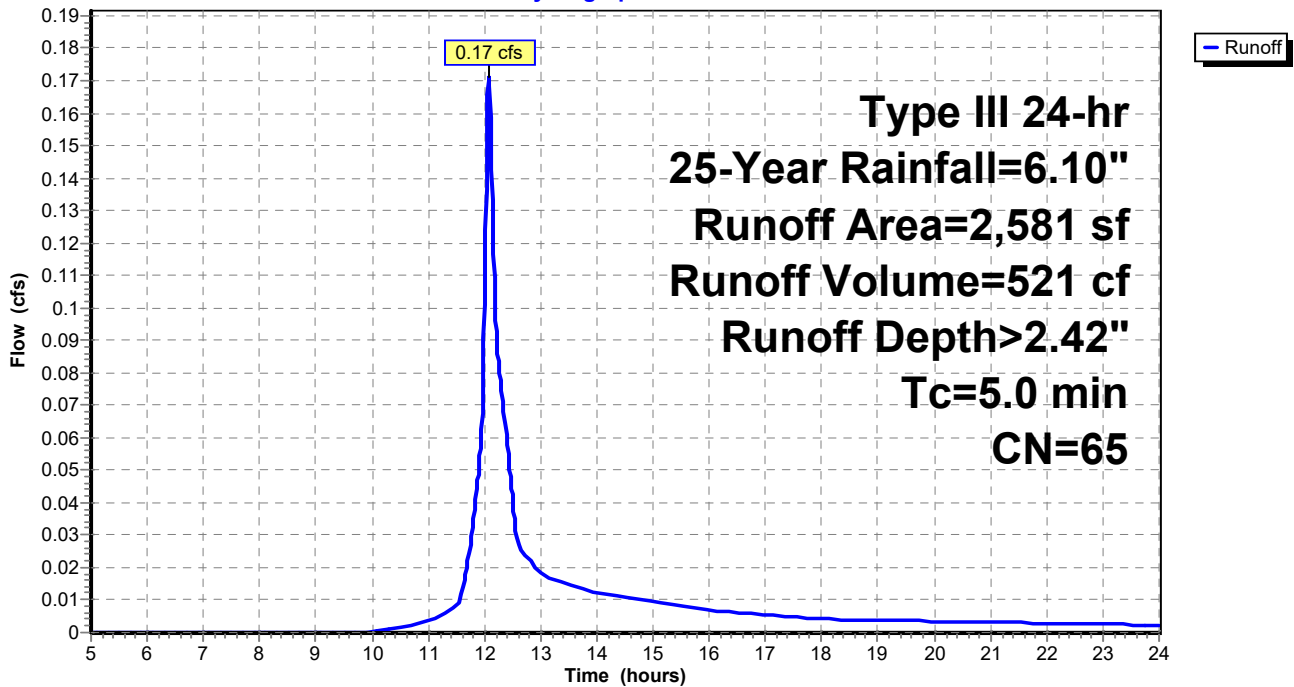
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.10"

	Area (sf)	CN	Description
*	1,325	98	Paved parking
	1,256	30	Woods, Good, HSG A
	2,581	65	Weighted Average
	1,256		48.66% Pervious Area
	1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road

Hydrograph



Summary for Subcatchment 1S: Flow to Wetland

Runoff = 2.84 cfs @ 12.10 hrs, Volume= 8,943 cf, Depth> 3.86"

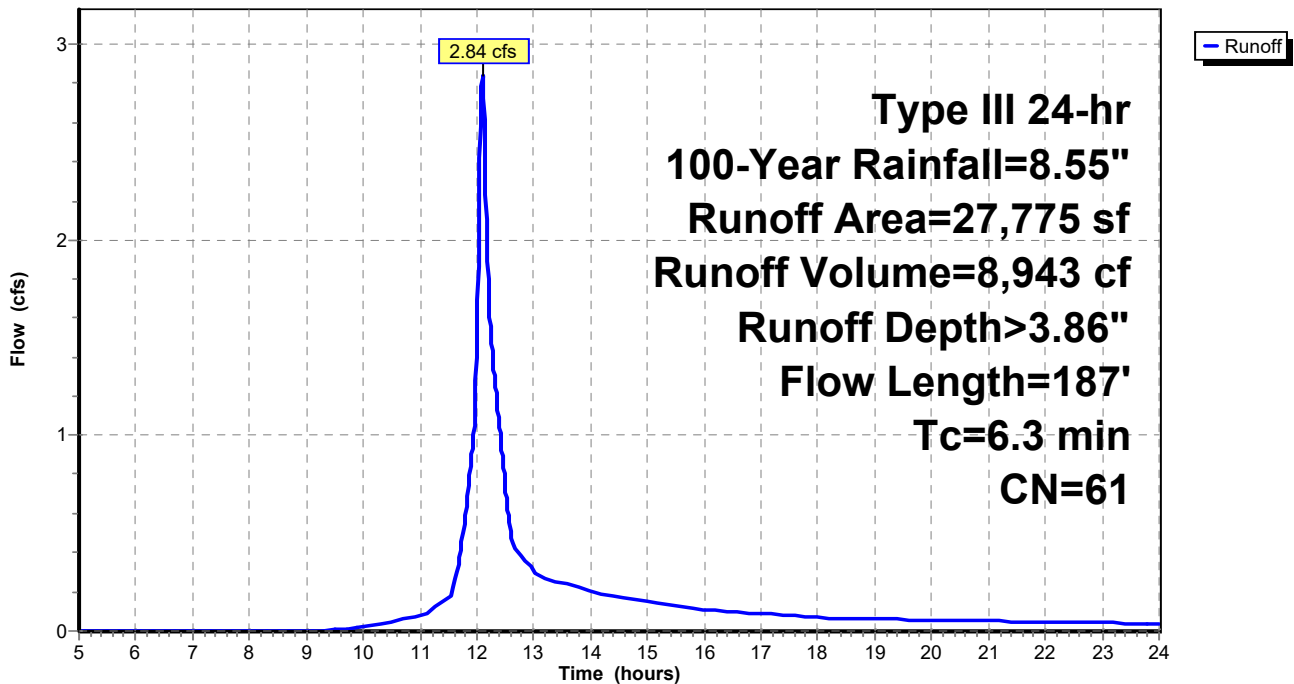
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.55"

Area (sf)	CN	Description
* 5,811	98	Impervious Surface
* 5,779	96	Gravel surface
8,045	39	>75% Grass cover, Good, HSG A
8,140	30	Woods, Good, HSG A
27,775	61	Weighted Average
21,964		79.08% Pervious Area
5,811		20.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0238	0.17		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.50"
0.5	66	0.1130	2.35		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
0.8	71	0.0800	1.41		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
6.3	187	Total			

Subcatchment 1S: Flow to Wetland

Hydrograph



Summary for Subcatchment 2S: Flow to Road

Runoff = 0.31 cfs @ 12.08 hrs, Volume= 933 cf, Depth> 4.34"

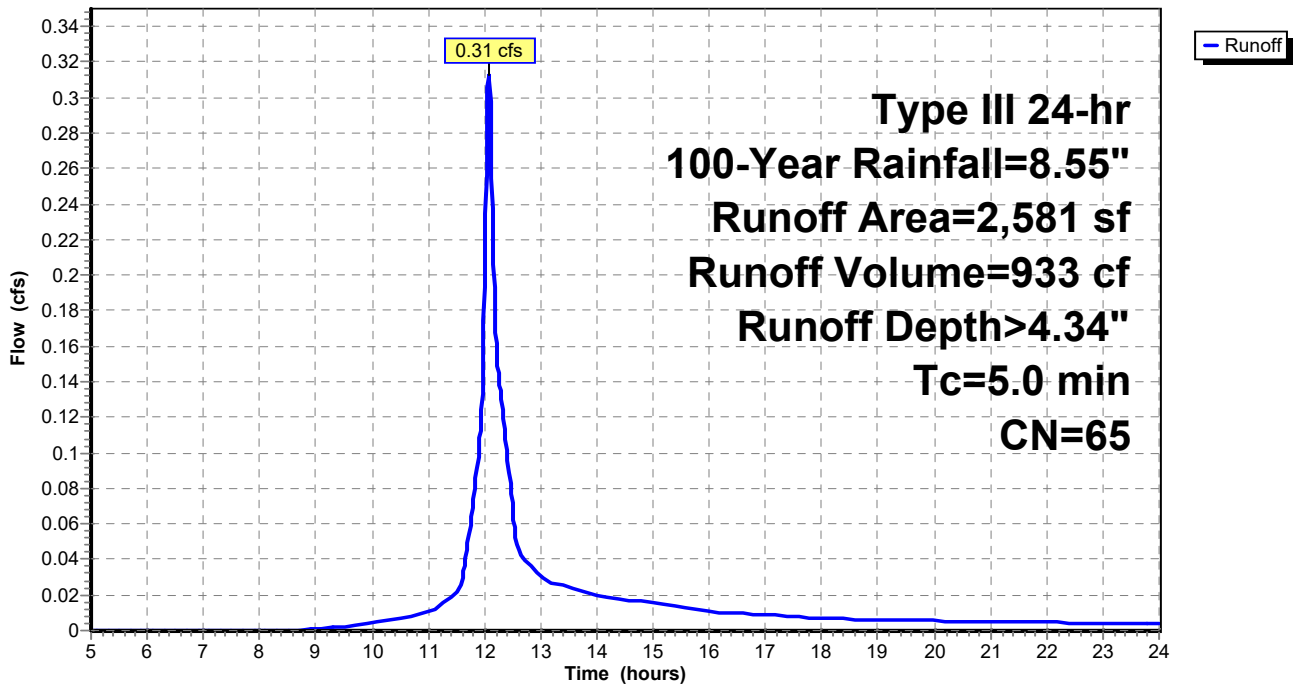
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.55"

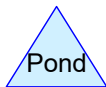
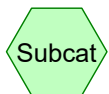
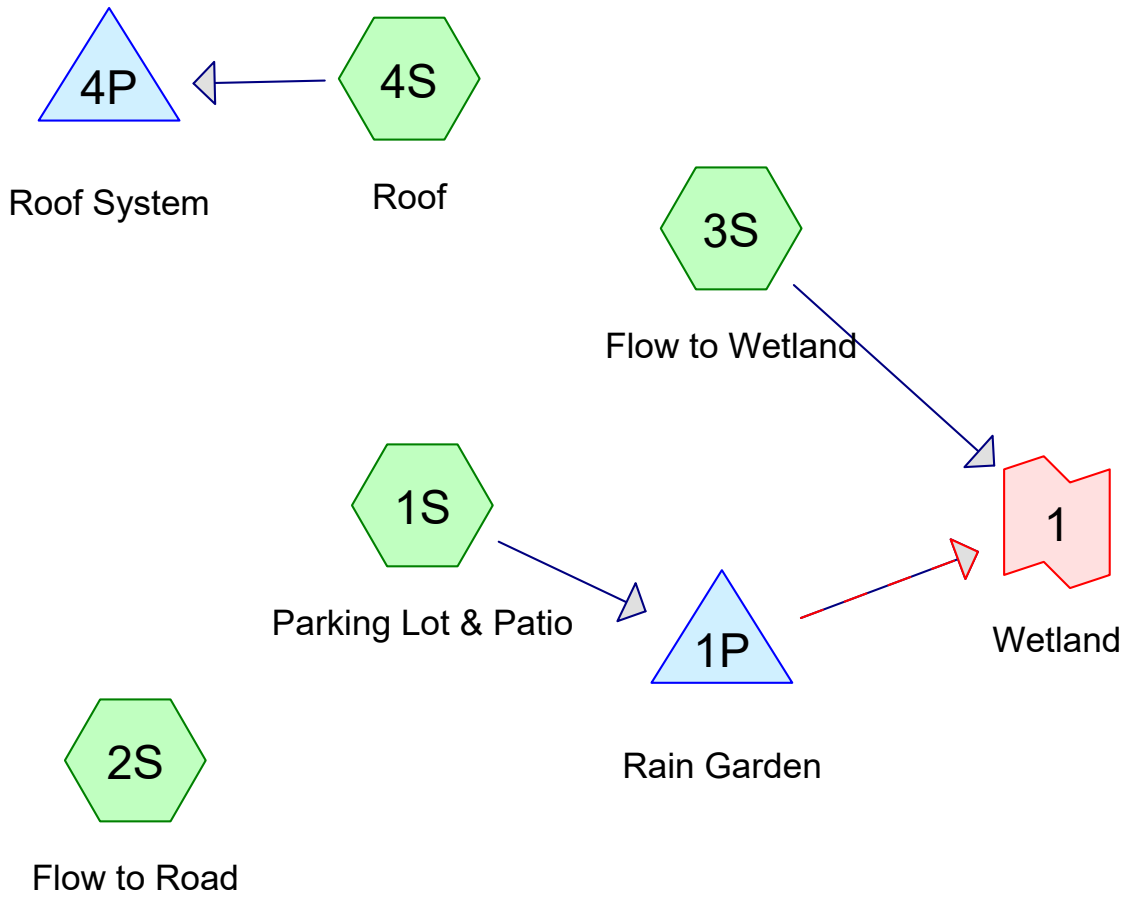
	Area (sf)	CN	Description
*	1,325	98	Paved parking
	1,256	30	Woods, Good, HSG A
	2,581	65	Weighted Average
	1,256		48.66% Pervious Area
	1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road

Hydrograph





Routing Diagram for 724 Macarthur Blvd - Postdevelopment (rev2)

Prepared by Microsoft

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724 Macarthur Blvd - Postdevelopment (rev2)

Prepared by Microsoft

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Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.23	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.89	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.10	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.55	2

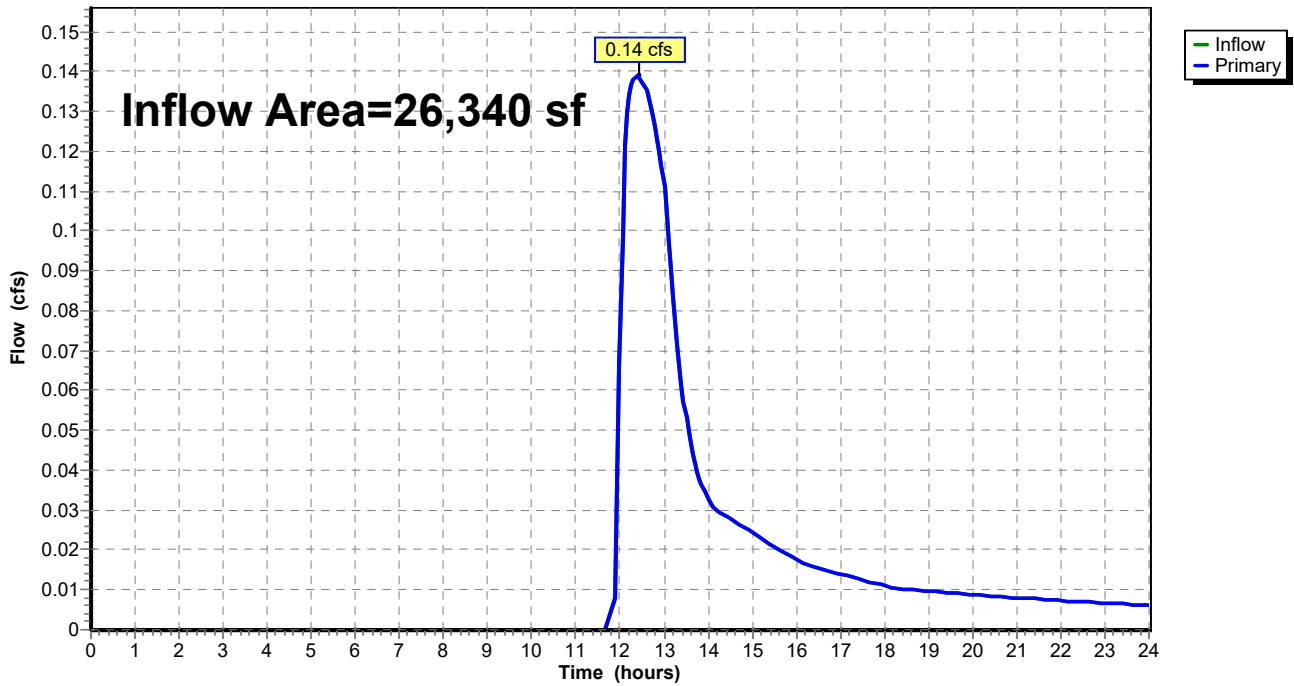
Summary for Link 1: Wetland

Inflow Area = 26,340 sf, 31.91% Impervious, Inflow Depth > 0.52" for 2-Year event
Inflow = 0.14 cfs @ 12.41 hrs, Volume= 1,140 cf
Primary = 0.14 cfs @ 12.41 hrs, Volume= 1,140 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1: Wetland

Hydrograph



Summary for Pond 1P: Rain Garden

Inflow Area = 12,859 sf, 63.85% Impervious, Inflow Depth > 1.17" for 2-Year event
 Inflow = 0.39 cfs @ 12.08 hrs, Volume= 1,256 cf
 Outflow = 0.14 cfs @ 12.41 hrs, Volume= 1,139 cf, Atten= 65%, Lag= 19.5 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.14 cfs @ 12.41 hrs, Volume= 1,139 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 52.04' @ 12.41 hrs Surf.Area= 282 sf Storage= 338 cf

Plug-Flow detention time= 73.5 min calculated for 1,139 cf (91% of inflow)
 Center-of-Mass det. time= 27.9 min (881.5 - 853.6)

Volume	Invert	Avail.Storage	Storage Description			
#1	48.99'	1,550 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
48.99	273	81.8	0.0	0	0	273
49.00	273	81.8	40.0	1	1	274
49.49	273	81.8	40.0	54	55	314
49.50	273	81.8	30.0	1	55	315
51.49	273	81.8	30.0	163	218	477
51.50	158	72.4	100.0	2	221	593
52.00	273	81.8	100.0	106	327	714
53.00	547	100.6	100.0	402	729	1,002
53.20	633	109.1	100.0	118	847	1,146
53.40	700	113.4	100.0	133	980	1,225
54.00	1,222	153.9	100.0	569	1,550	2,090

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.99'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	50.20'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	53.20'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	53.40'	5.0' 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=0.00 cfs @ 0.00 hrs HW=48.99' (Free Discharge)

↑ **1=Exfiltration** (Passes 0.00 cfs of 0.05 cfs potential flow)

↑ **3=Orifice/Grate** (Controls 0.00 cfs)

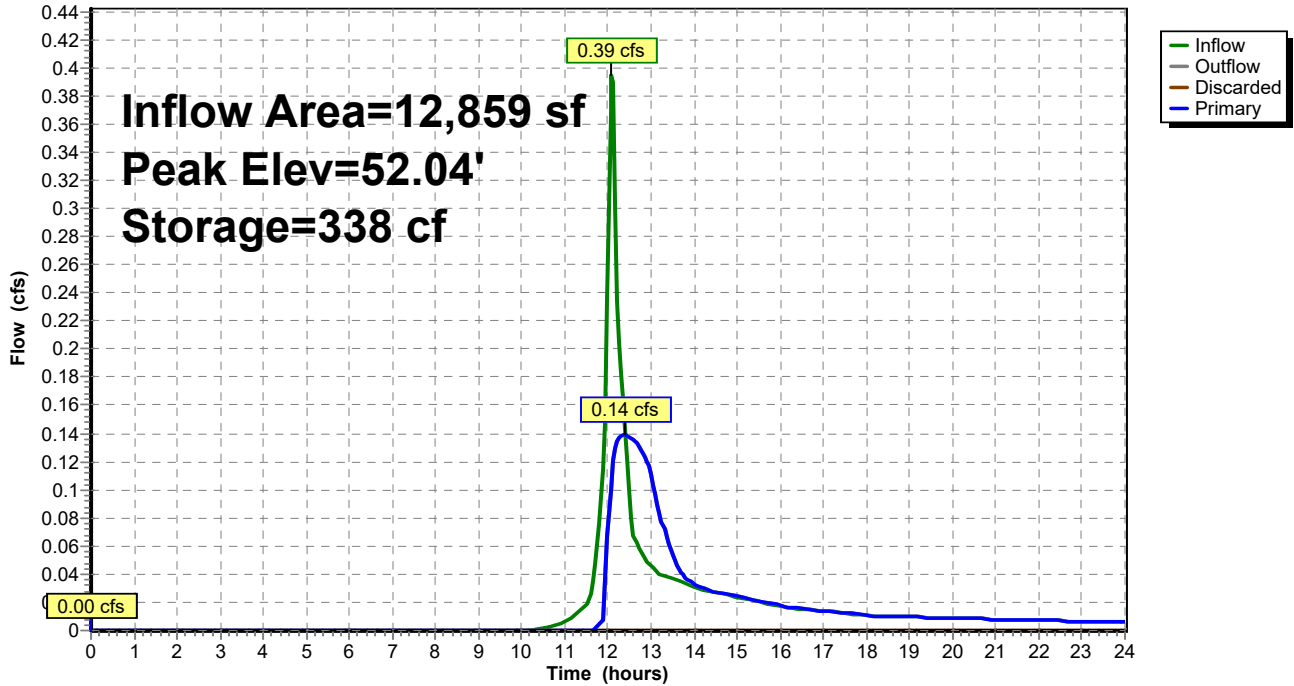
Primary OutFlow Max=0.14 cfs @ 12.41 hrs HW=52.04' (Free Discharge)

↑ **2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.38 fps)

↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

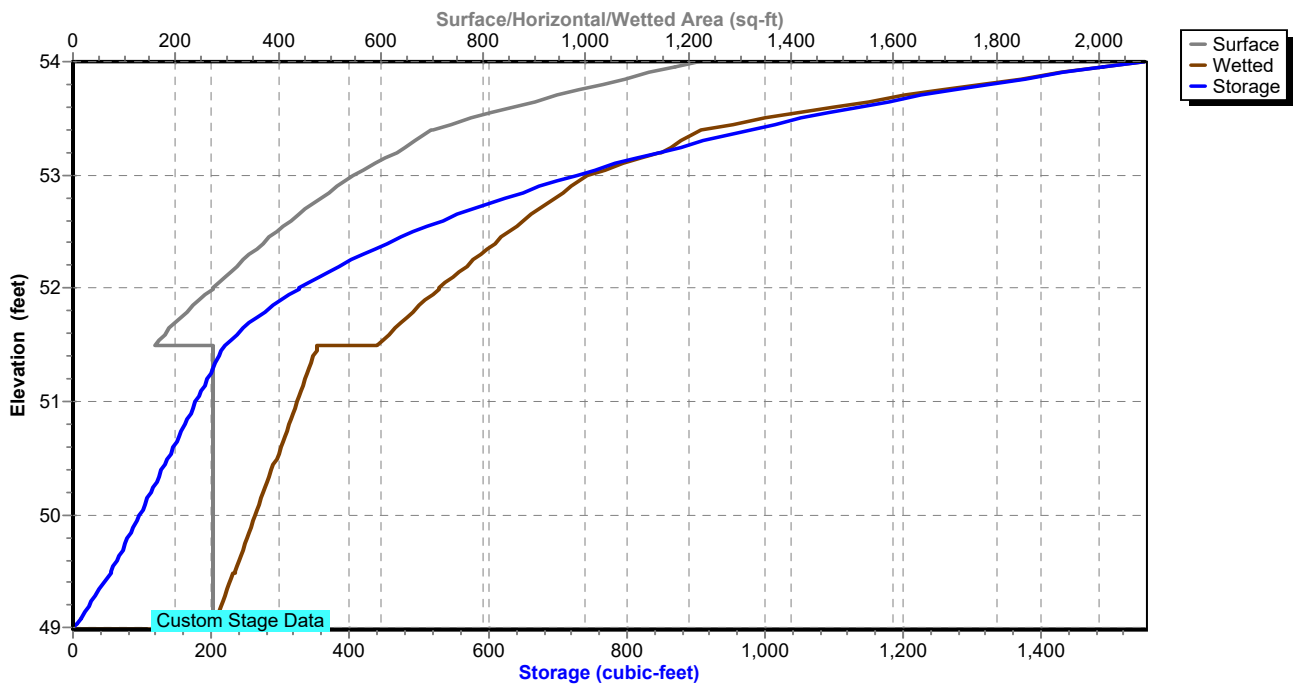
Pond 1P: Rain Garden

Hydrograph



Pond 1P: Rain Garden

Stage-Area-Storage



Summary for Subcatchment 1S: Parking Lot & Patio

[49] Hint: $T_c < 2dt$ may require smaller dt

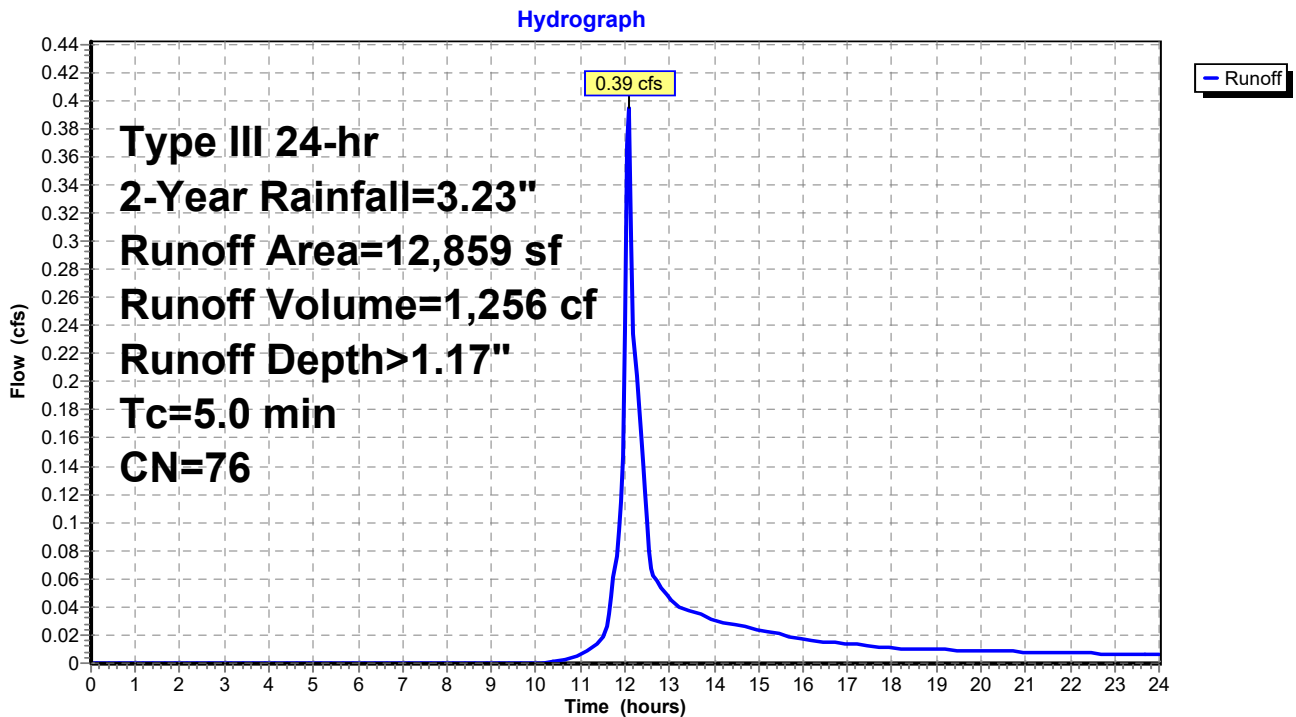
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 1,256 cf, Depth> 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
5,190	98	Paved parking, HSG A
* 2,084	98	Patios/Decks
* 936	98	Rain Garden
4,018	39	>75% Grass cover, Good, HSG A
631	30	Woods, Good, HSG A
12,859	76	Weighted Average
4,649		36.15% Pervious Area
8,210		63.85% Impervious Area

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

Subcatchment 1S: Parking Lot & Patio



Summary for Subcatchment 2S: Flow to Road

[49] Hint: Tc<2dt may require smaller dt

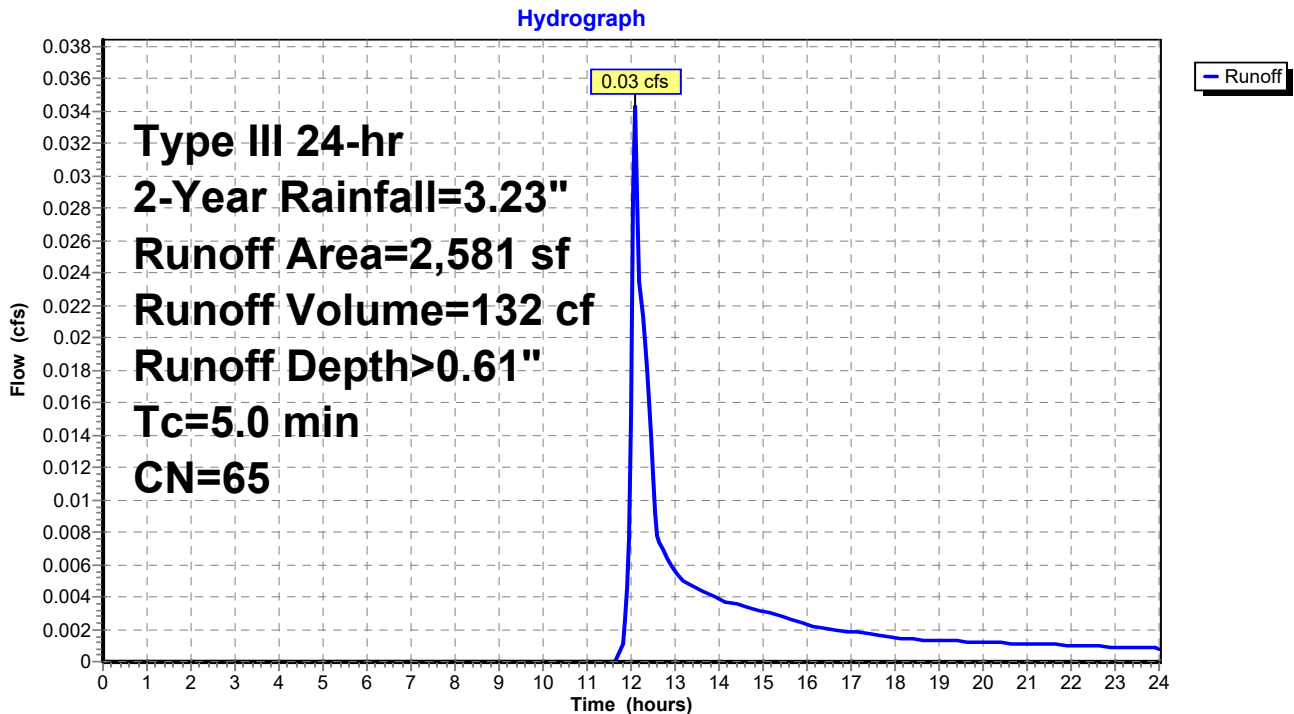
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 132 cf, Depth> 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
1,325	98	Paved parking, HSG A
1,256	30	Woods, Good, HSG A
2,581	65	Weighted Average
1,256		48.66% Pervious Area
1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road



Summary for Subcatchment 3S: Flow to Wetland

[73] Warning: Peak may fall outside time span

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 1 cf, Depth> 0.00"

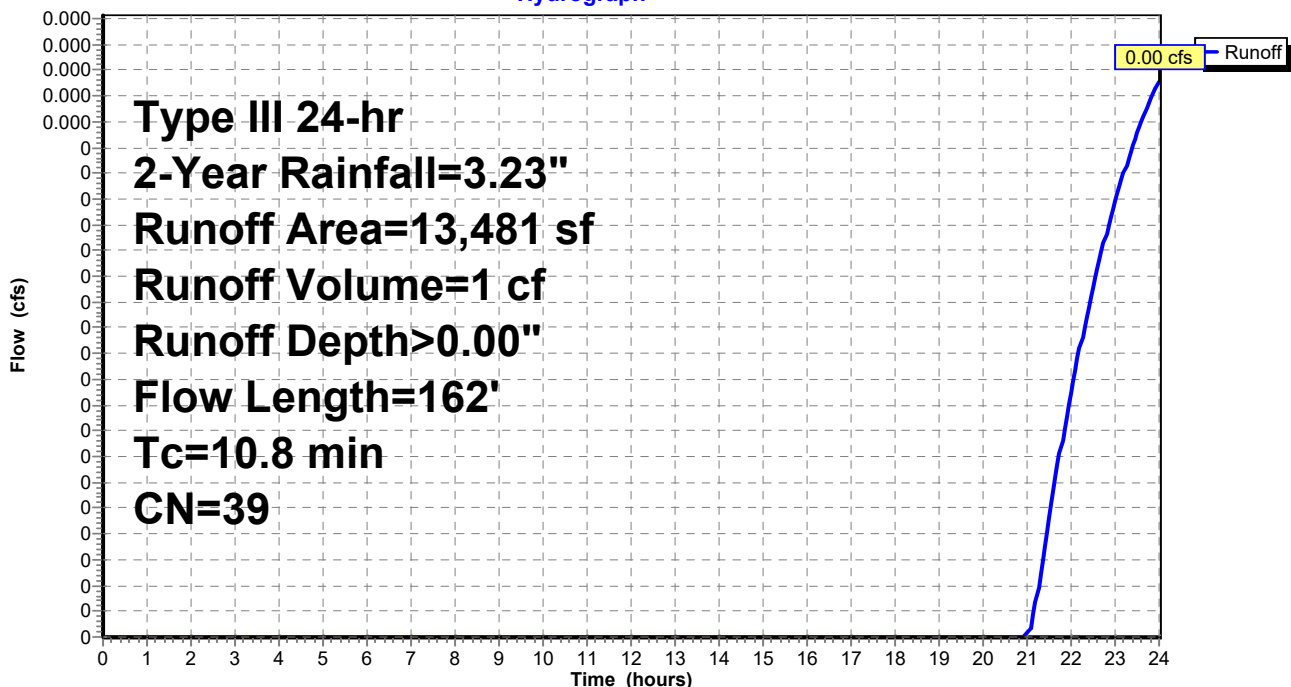
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
6,877	30	Woods, Good, HSG A
4,962	39	>75% Grass cover, Good, HSG A
* 194	98	Wall
1,448	76	Gravel roads, HSG A
13,481	39	Weighted Average
13,287		98.56% Pervious Area
194		1.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0340	0.09		Sheet Flow, AB Woods: Light underbrush n= 0.400 P2= 3.40"
1.1	112	0.1060	1.63		Shallow Concentrated Flow, BC Woodland Kv= 5.0 fps
10.8	162	Total			

Subcatchment 3S: Flow to Wetland

Hydrograph



Summary for Pond 4P: Roof System

Inflow Area = 1,456 sf, 100.00% Impervious, Inflow Depth > 3.00" for 2-Year event
 Inflow = 0.11 cfs @ 12.07 hrs, Volume= 364 cf
 Outflow = 0.04 cfs @ 12.29 hrs, Volume= 363 cf, Atten= 62%, Lag= 13.4 min
 Discarded = 0.04 cfs @ 12.29 hrs, Volume= 363 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 0.58' @ 12.29 hrs Surf.Area= 179 sf Storage= 46 cf

Plug-Flow detention time= 5.4 min calculated for 363 cf (100% of inflow)
 Center-of-Mass det. time= 5.3 min (760.3 - 754.9)

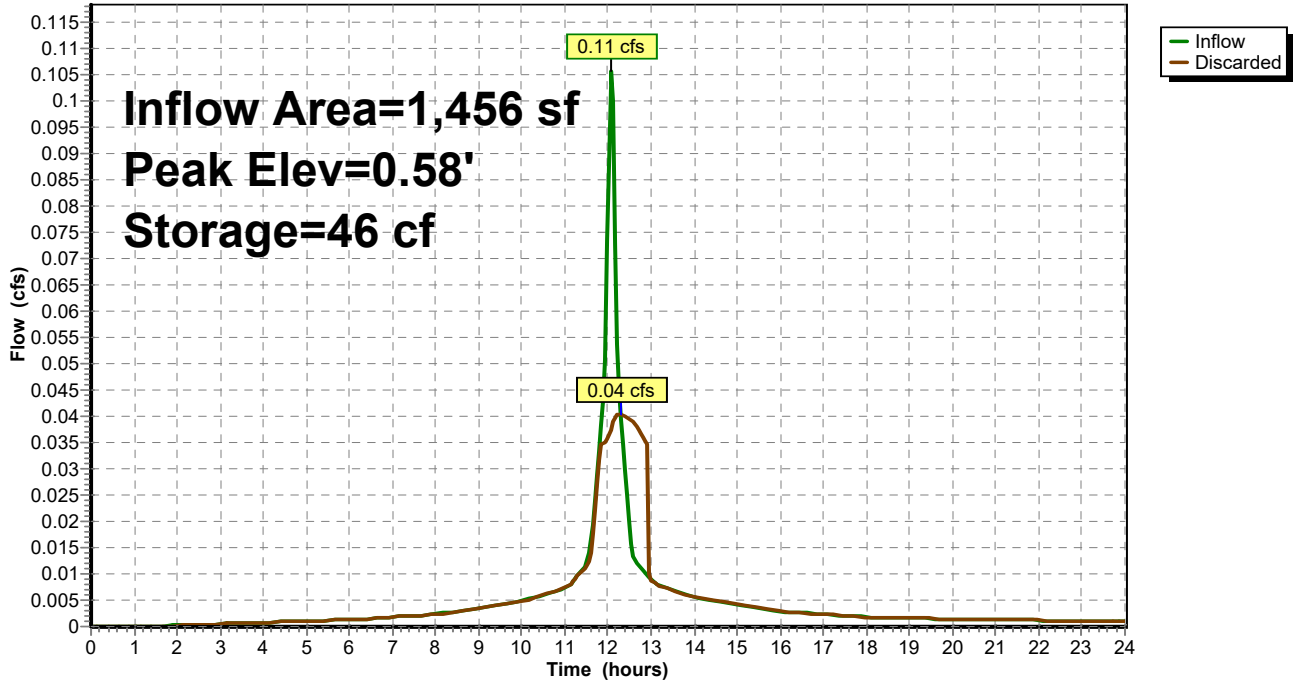
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	177 cf	11.00'W x 16.24'L x 3.50'H Prismatic 625 cf Overall - 184 cf Embedded = 441 cf x 40.0% Voids
#2	0.50'	184 cf	ADS_StormTech SC-740 +Cap x 4 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Chambers in 2 Rows
		360 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.04 cfs @ 12.29 hrs HW=0.58' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.04 cfs)

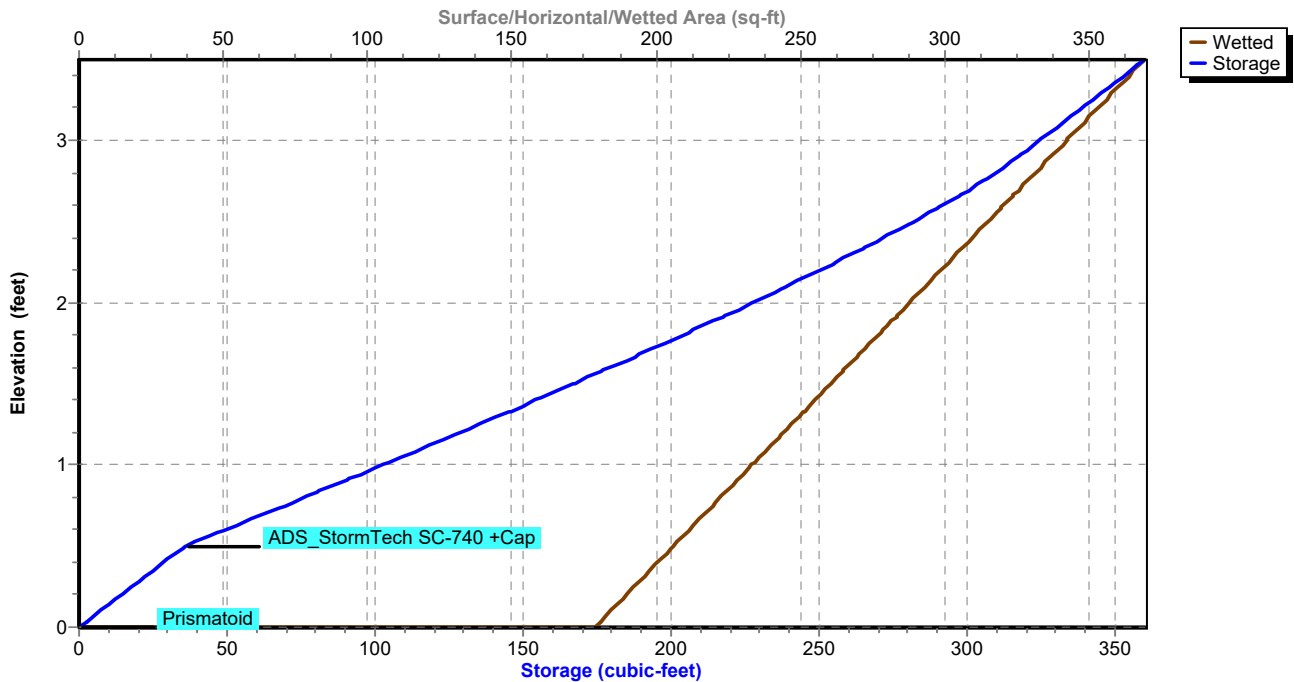
Pond 4P: Roof System

Hydrograph



Pond 4P: Roof System

Stage-Area-Storage



Summary for Subcatchment 4S: Roof

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.11 cfs @ 12.07 hrs, Volume= 364 cf, Depth> 3.00"

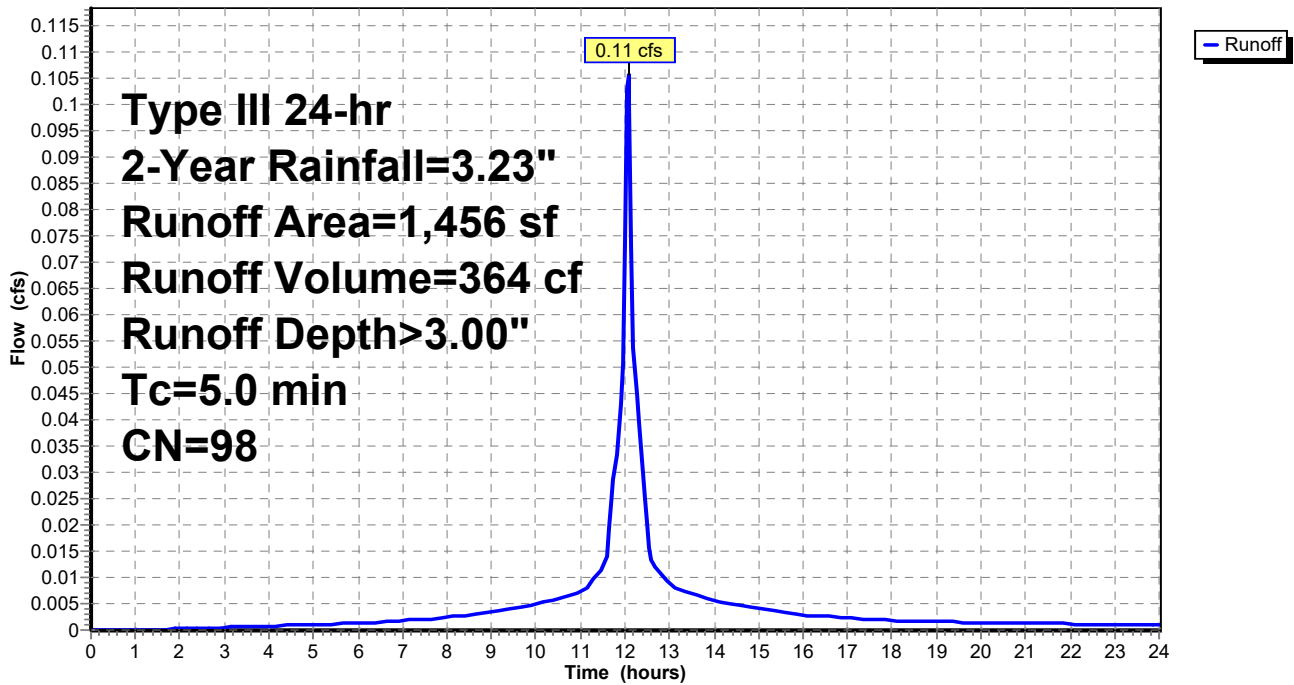
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
* 1,456	98	Roof
1,456		100.00% Impervious Area

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

Subcatchment 4S: Roof

Hydrograph



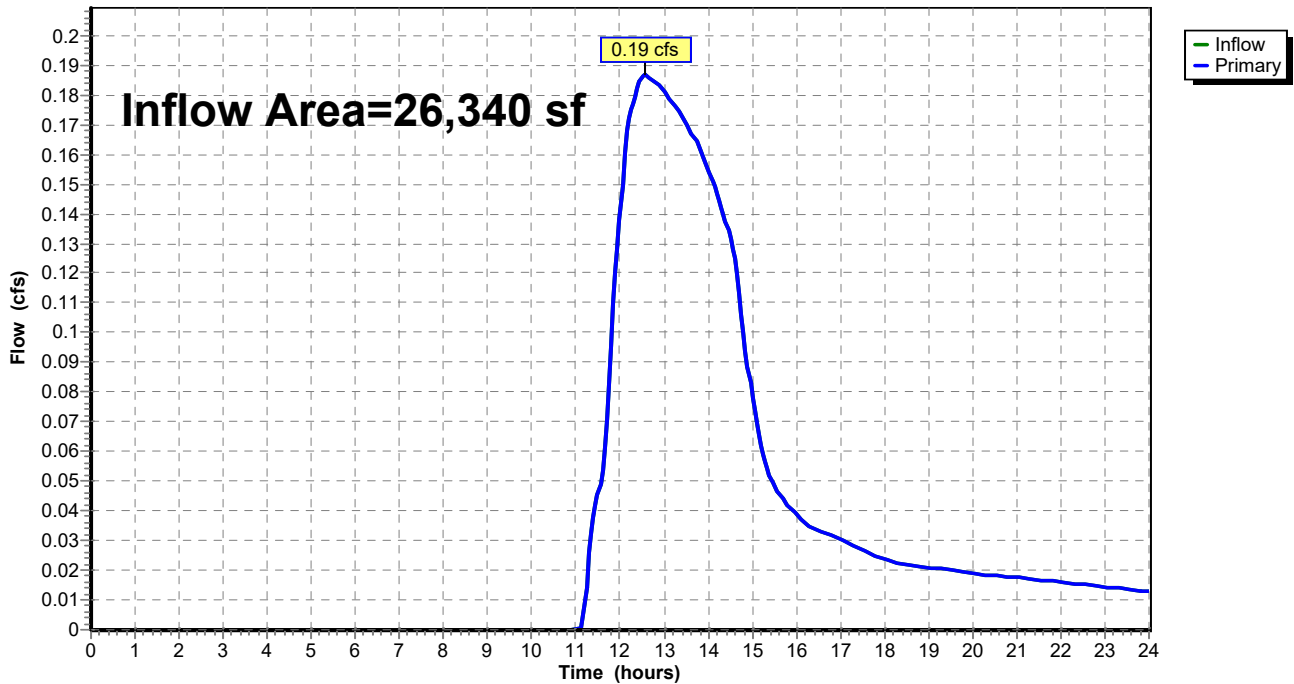
Summary for Link 1: Wetland

Inflow Area = 26,340 sf, 31.91% Impervious, Inflow Depth > 1.22" for 10-Year event
Inflow = 0.19 cfs @ 12.56 hrs, Volume= 2,676 cf
Primary = 0.19 cfs @ 12.56 hrs, Volume= 2,676 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1: Wetland

Hydrograph



Summary for Pond 1P: Rain Garden

Inflow Area = 12,859 sf, 63.85% Impervious, Inflow Depth > 2.44" for 10-Year event
 Inflow = 0.85 cfs @ 12.08 hrs, Volume= 2,618 cf
 Outflow = 0.24 cfs @ 12.46 hrs, Volume= 2,498 cf, Atten= 72%, Lag= 22.8 min
 Discarded = 0.06 cfs @ 12.46 hrs, Volume= 21 cf
 Primary = 0.18 cfs @ 12.46 hrs, Volume= 2,477 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 53.21' @ 12.46 hrs Surf.Area= 637 sf Storage= 855 cf

Plug-Flow detention time= 65.8 min calculated for 2,498 cf (95% of inflow)
 Center-of-Mass det. time= 40.8 min (872.8 - 832.0)

Volume	Invert	Avail.Storage	Storage Description			
#1	48.99'	1,550 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
48.99	273	81.8	0.0	0	0	273
49.00	273	81.8	40.0	1	1	274
49.49	273	81.8	40.0	54	55	314
49.50	273	81.8	30.0	1	55	315
51.49	273	81.8	30.0	163	218	477
51.50	158	72.4	100.0	2	221	593
52.00	273	81.8	100.0	106	327	714
53.00	547	100.6	100.0	402	729	1,002
53.20	633	109.1	100.0	118	847	1,146
53.40	700	113.4	100.0	133	980	1,225
54.00	1,222	153.9	100.0	569	1,550	2,090

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.99'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	50.20'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	53.20'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	53.40'	5.0' 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=0.03 cfs @ 12.46 hrs HW=53.21' (Free Discharge)

↑1=Exfiltration (Passes 0.03 cfs of 0.22 cfs potential flow)

↑3=Orifice/Grate (Weir Controls 0.03 cfs @ 0.36 fps)

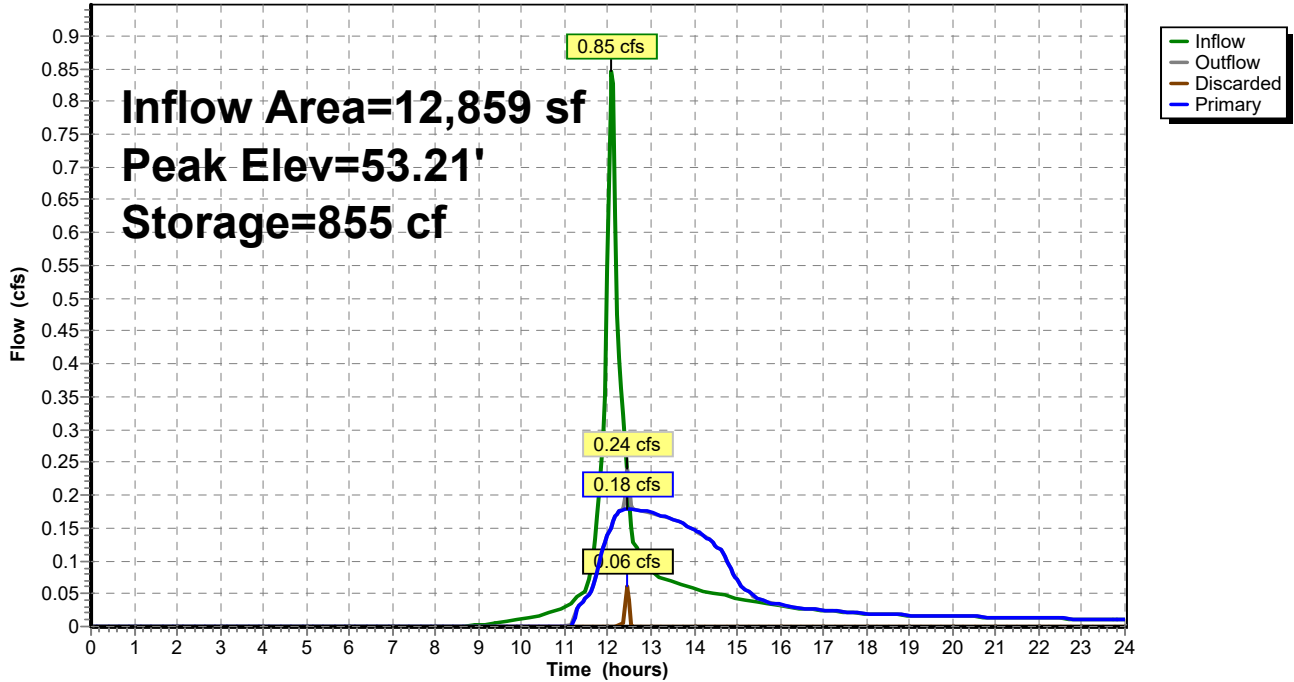
Primary OutFlow Max=0.18 cfs @ 12.46 hrs HW=53.21' (Free Discharge)

↑2=Orifice/Grate (Orifice Controls 0.18 cfs @ 8.24 fps)

↑4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

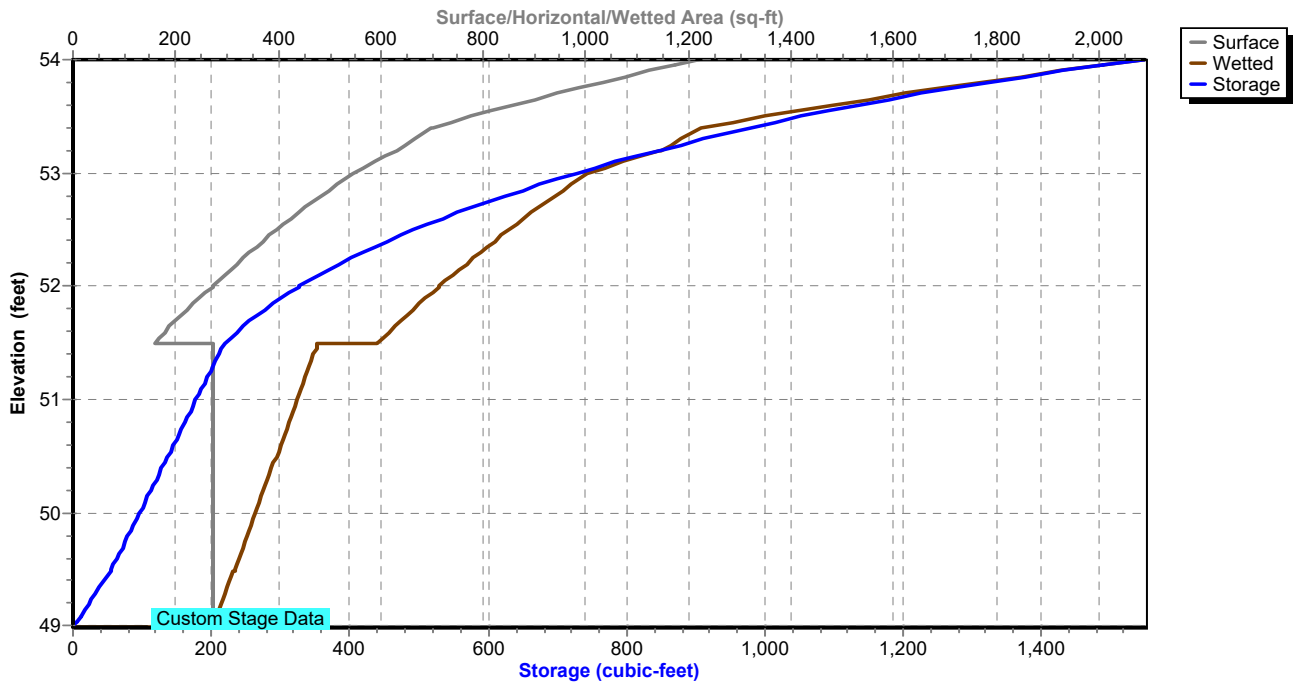
Pond 1P: Rain Garden

Hydrograph



Pond 1P: Rain Garden

Stage-Area-Storage



Summary for Subcatchment 1S: Parking Lot & Patio

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.85 cfs @ 12.08 hrs, Volume= 2,618 cf, Depth> 2.44"

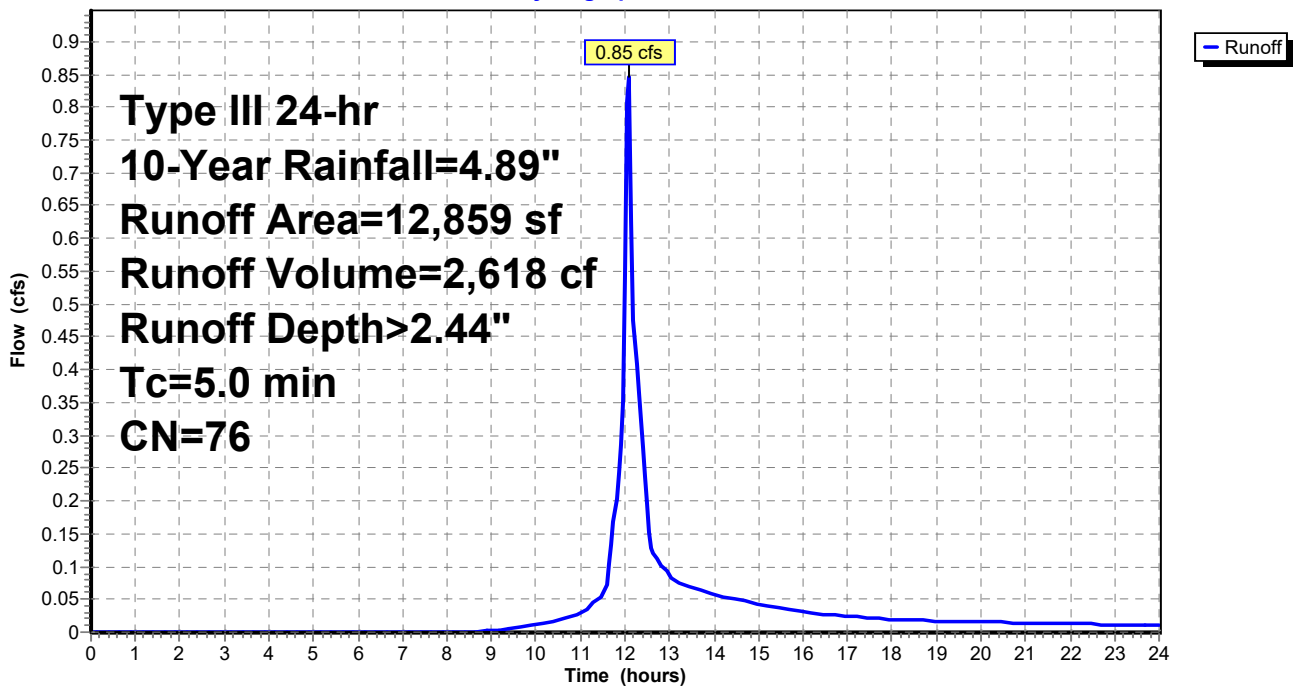
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
5,190	98	Paved parking, HSG A
* 2,084	98	Patios/Decks
* 936	98	Rain Garden
4,018	39	>75% Grass cover, Good, HSG A
631	30	Woods, Good, HSG A
12,859	76	Weighted Average
4,649		36.15% Pervious Area
8,210		63.85% Impervious Area

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

Subcatchment 1S: Parking Lot & Patio

Hydrograph



Summary for Subcatchment 2S: Flow to Road

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 340 cf, Depth > 1.58"

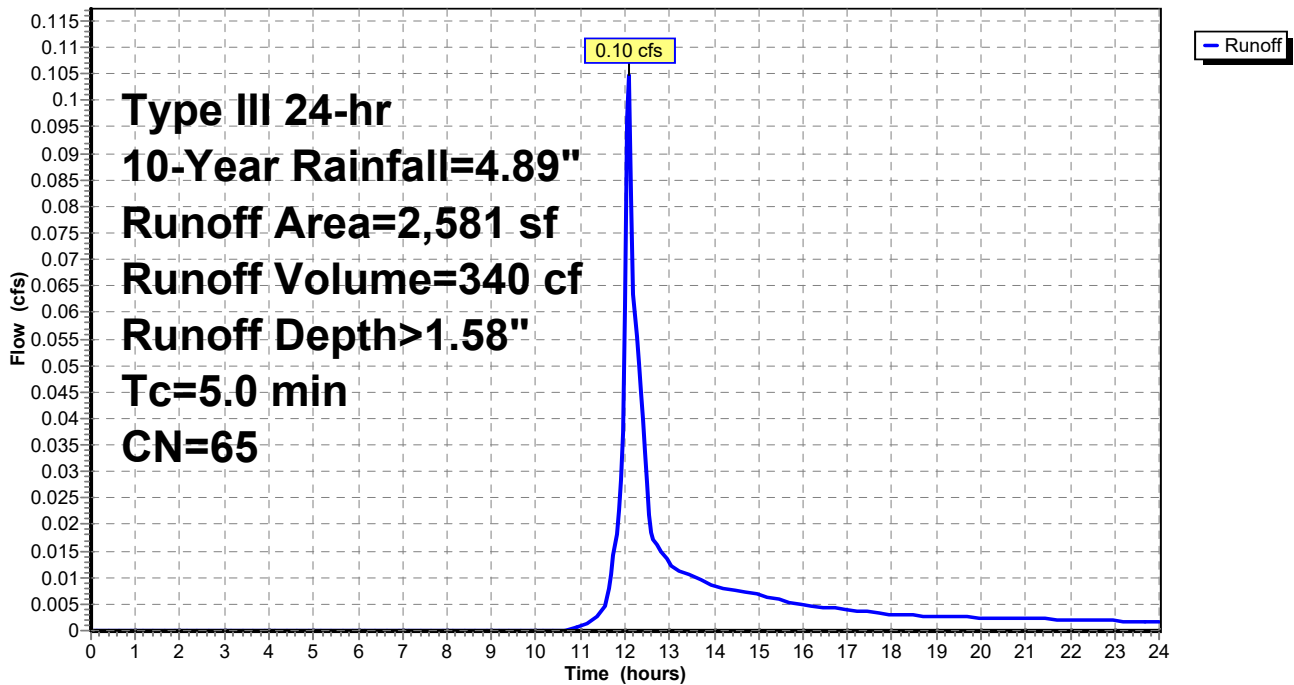
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, $dt=0.05$ hrs
 Type III 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
1,325	98	Paved parking, HSG A
1,256	30	Woods, Good, HSG A
2,581	65	Weighted Average
1,256		48.66% Pervious Area
1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road

Hydrograph



Summary for Subcatchment 3S: Flow to Wetland

Runoff = 0.01 cfs @ 13.68 hrs, Volume= 199 cf, Depth> 0.18"

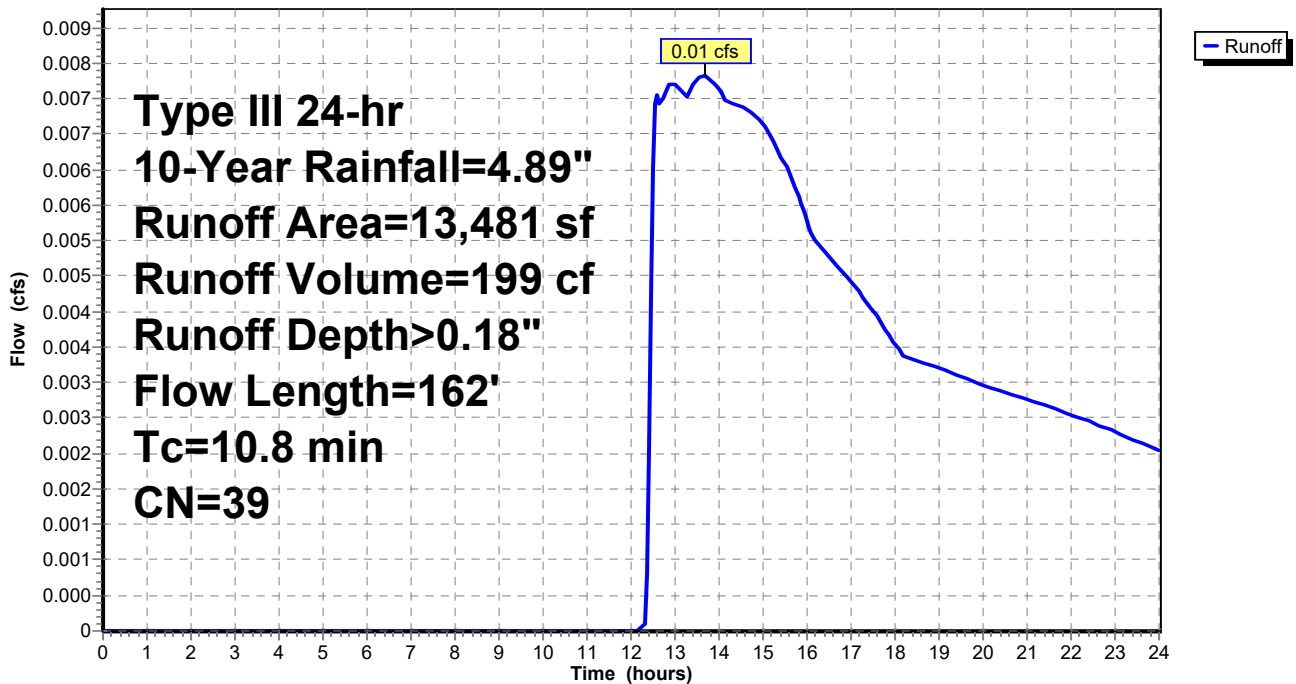
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
6,877	30	Woods, Good, HSG A
4,962	39	>75% Grass cover, Good, HSG A
* 194	98	Wall
1,448	76	Gravel roads, HSG A
13,481	39	Weighted Average
13,287		98.56% Pervious Area
194		1.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0340	0.09		Sheet Flow, AB Woods: Light underbrush n= 0.400 P2= 3.40"
1.1	112	0.1060	1.63		Shallow Concentrated Flow, BC Woodland Kv= 5.0 fps
10.8	162	Total			

Subcatchment 3S: Flow to Wetland

Hydrograph



Summary for Pond 4P: Roof System

Inflow Area = 1,456 sf, 100.00% Impervious, Inflow Depth > 4.65" for 10-Year event
 Inflow = 0.16 cfs @ 12.07 hrs, Volume= 564 cf
 Outflow = 0.04 cfs @ 12.40 hrs, Volume= 564 cf, Atten= 72%, Lag= 19.9 min
 Discarded = 0.04 cfs @ 12.40 hrs, Volume= 564 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 1.02' @ 12.40 hrs Surf.Area= 179 sf Storage= 106 cf

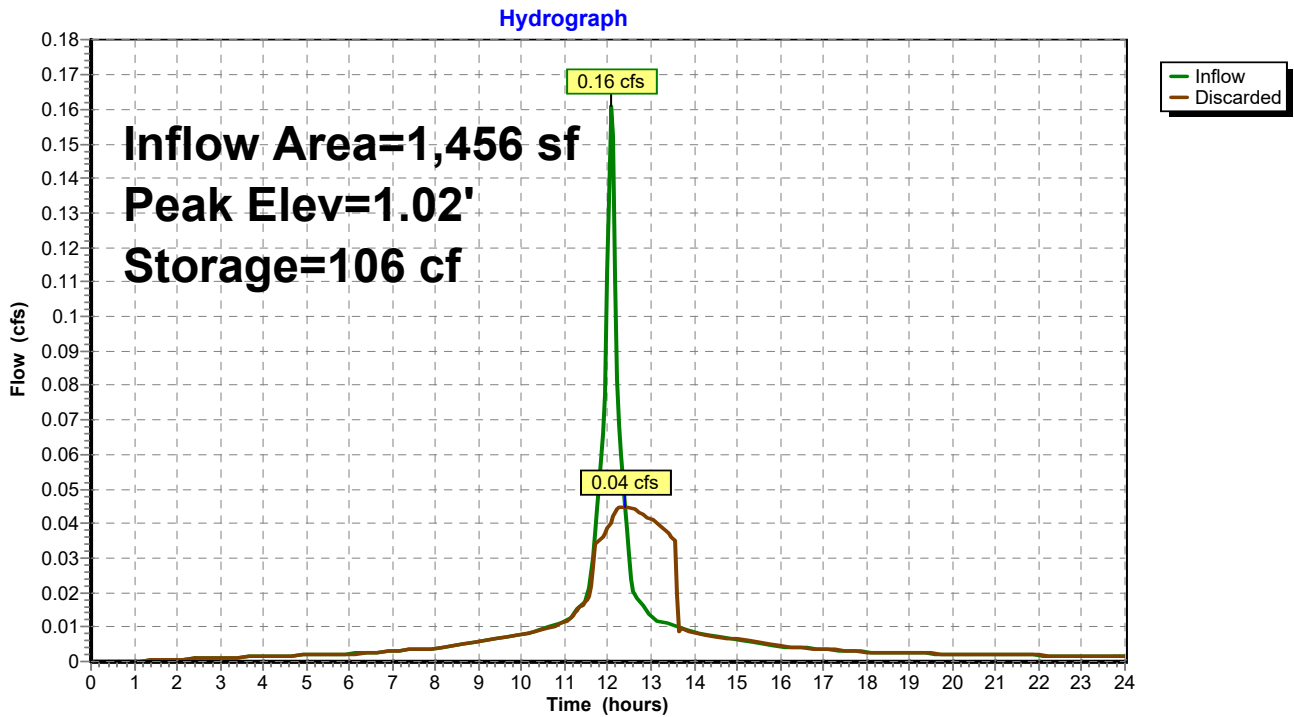
Plug-Flow detention time= 11.8 min calculated for 563 cf (100% of inflow)
 Center-of-Mass det. time= 11.7 min (758.8 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	177 cf	11.00'W x 16.24'L x 3.50'H Prismatic 625 cf Overall - 184 cf Embedded = 441 cf x 40.0% Voids
#2	0.50'	184 cf	ADS_StormTech SC-740 +Cap x 4 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 4 Chambers in 2 Rows
		360 cf	Total Available Storage

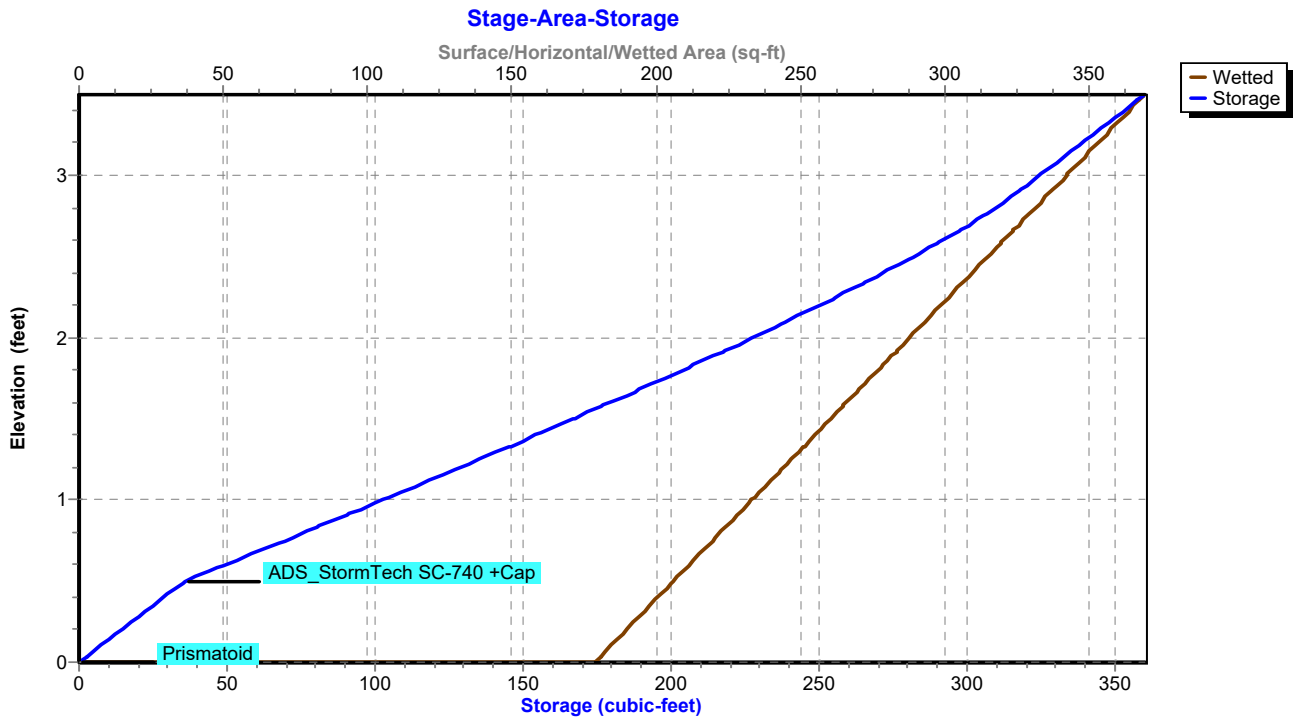
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.04 cfs @ 12.40 hrs HW=1.02' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond 4P: Roof System



Pond 4P: Roof System



Summary for Subcatchment 4S: Roof

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.16 cfs @ 12.07 hrs, Volume= 564 cf, Depth > 4.65"

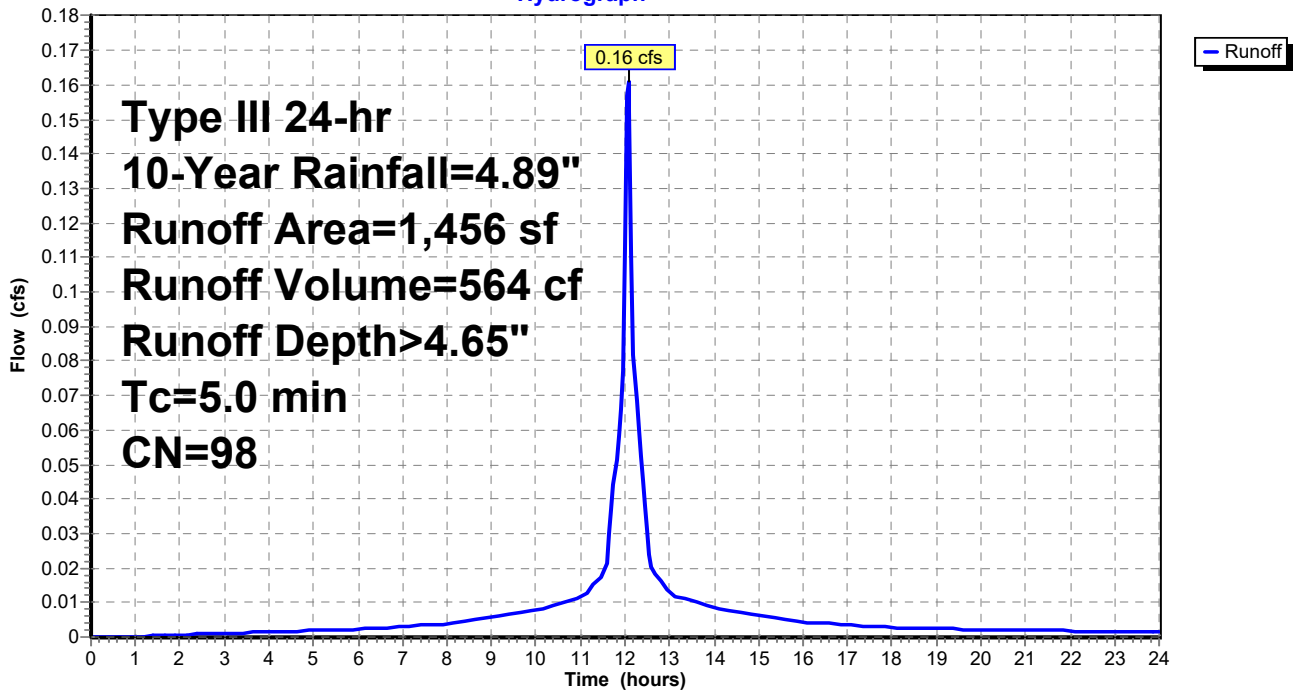
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.89"

Area (sf)	CN	Description
* 1,456	98	Roof
1,456		100.00% Impervious Area

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

Subcatchment 4S: Roof

Hydrograph



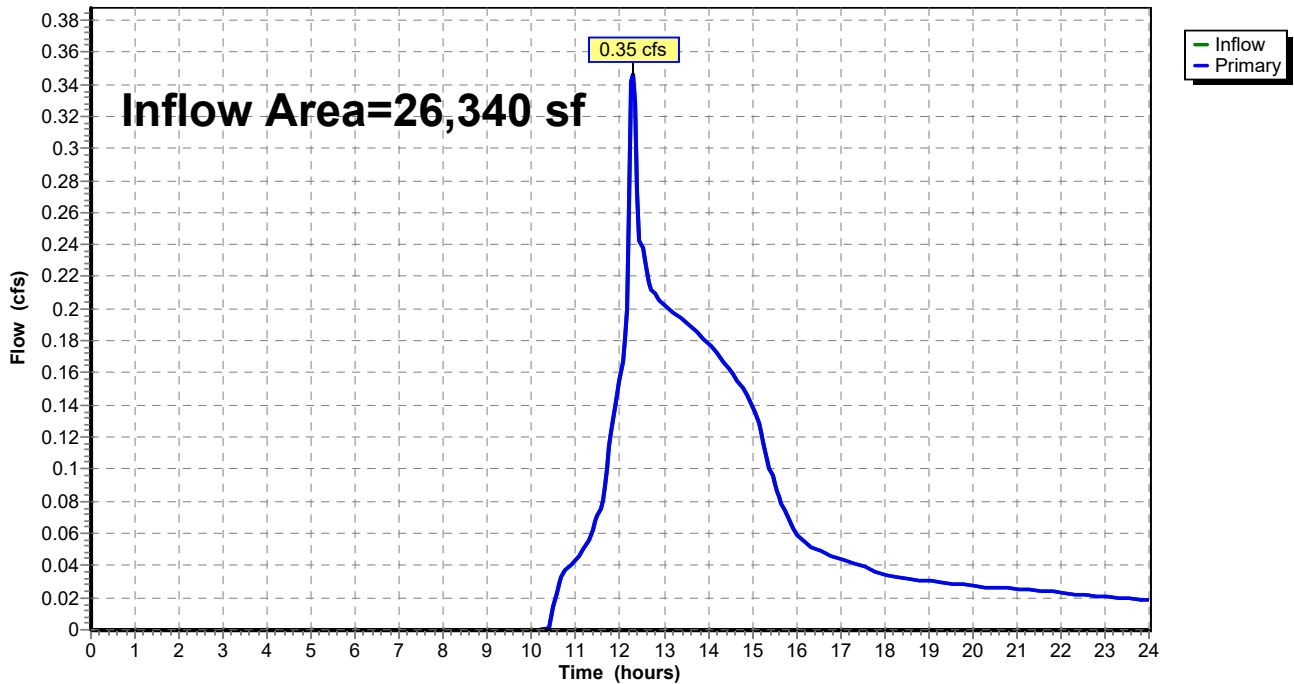
Summary for Link 1: Wetland

Inflow Area = 26,340 sf, 31.91% Impervious, Inflow Depth > 1.68" for 25-Year event
Inflow = 0.35 cfs @ 12.28 hrs, Volume= 3,687 cf
Primary = 0.35 cfs @ 12.28 hrs, Volume= 3,687 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1: Wetland

Hydrograph



Summary for Pond 1P: Rain Garden

Inflow Area = 12,859 sf, 63.85% Impervious, Inflow Depth > 3.46" for 25-Year event
 Inflow = 1.20 cfs @ 12.08 hrs, Volume= 3,712 cf
 Outflow = 0.55 cfs @ 12.27 hrs, Volume= 3,590 cf, Atten= 54%, Lag= 11.6 min
 Discarded = 0.24 cfs @ 12.27 hrs, Volume= 433 cf
 Primary = 0.31 cfs @ 12.27 hrs, Volume= 3,157 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 53.44' @ 12.27 hrs Surf.Area= 733 sf Storage= 1,011 cf

Plug-Flow detention time= 55.4 min calculated for 3,583 cf (97% of inflow)
 Center-of-Mass det. time= 37.0 min (858.9 - 821.9)

Volume	Invert	Avail.Storage	Storage Description			
#1	48.99'	1,550 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
48.99	273	81.8	0.0	0	0	273
49.00	273	81.8	40.0	1	1	274
49.49	273	81.8	40.0	54	55	314
49.50	273	81.8	30.0	1	55	315
51.49	273	81.8	30.0	163	218	477
51.50	158	72.4	100.0	2	221	593
52.00	273	81.8	100.0	106	327	714
53.00	547	100.6	100.0	402	729	1,002
53.20	633	109.1	100.0	118	847	1,146
53.40	700	113.4	100.0	133	980	1,225
54.00	1,222	153.9	100.0	569	1,550	2,090

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.99'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	50.20'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	53.20'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	53.40'	5.0' 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=0.24 cfs @ 12.27 hrs HW=53.44' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.24 cfs)

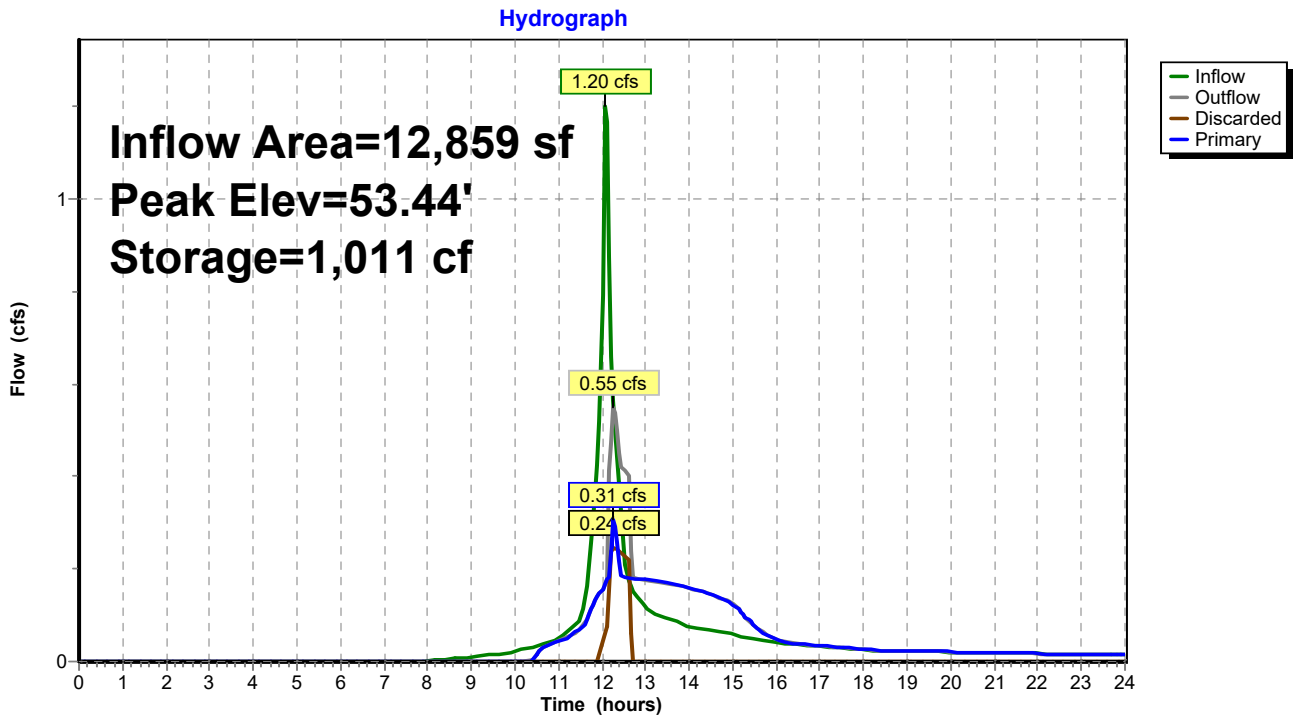
↑ **3=Orifice/Grate** (Passes 0.24 cfs of 2.42 cfs potential flow)

Primary OutFlow Max=0.29 cfs @ 12.27 hrs HW=53.44' (Free Discharge)

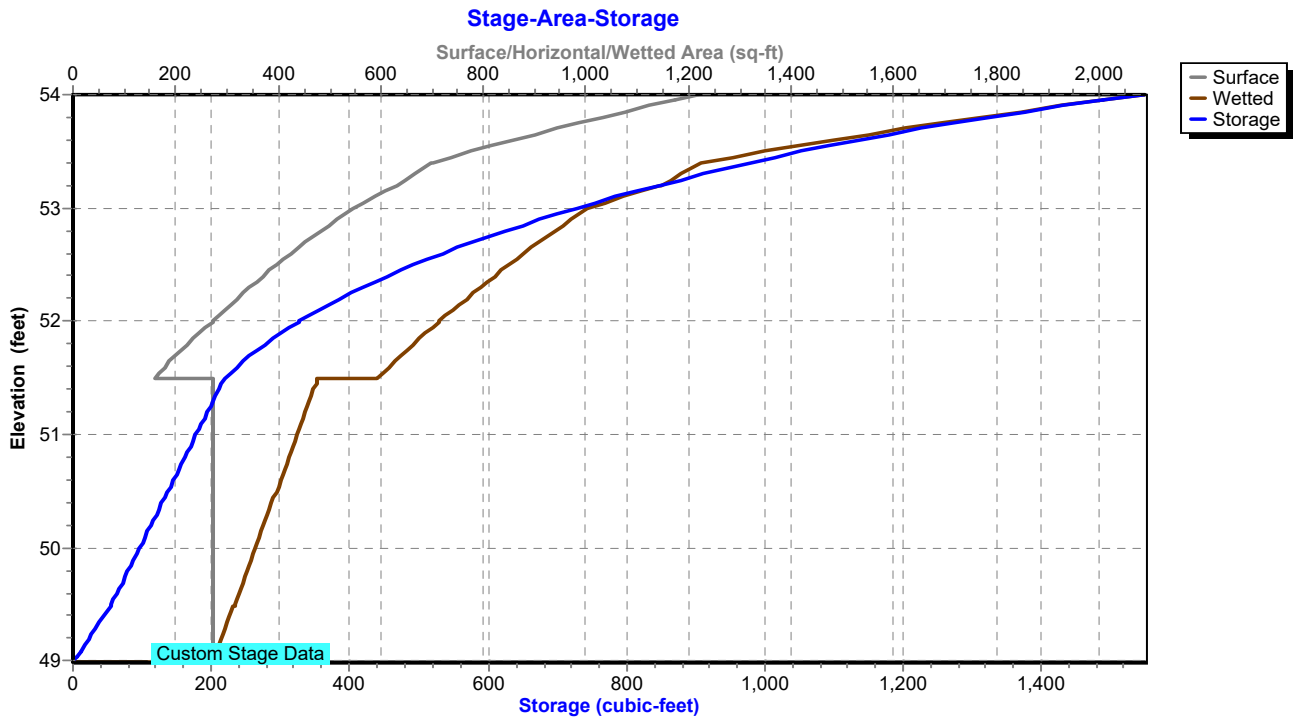
↑ **2=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.55 fps)

↑ **4=Broad-Crested Rectangular Weir** (Weir Controls 0.10 cfs @ 0.50 fps)

Pond 1P: Rain Garden



Pond 1P: Rain Garden



Summary for Subcatchment 1S: Parking Lot & Patio

[49] Hint: Tc<2dt may require smaller dt

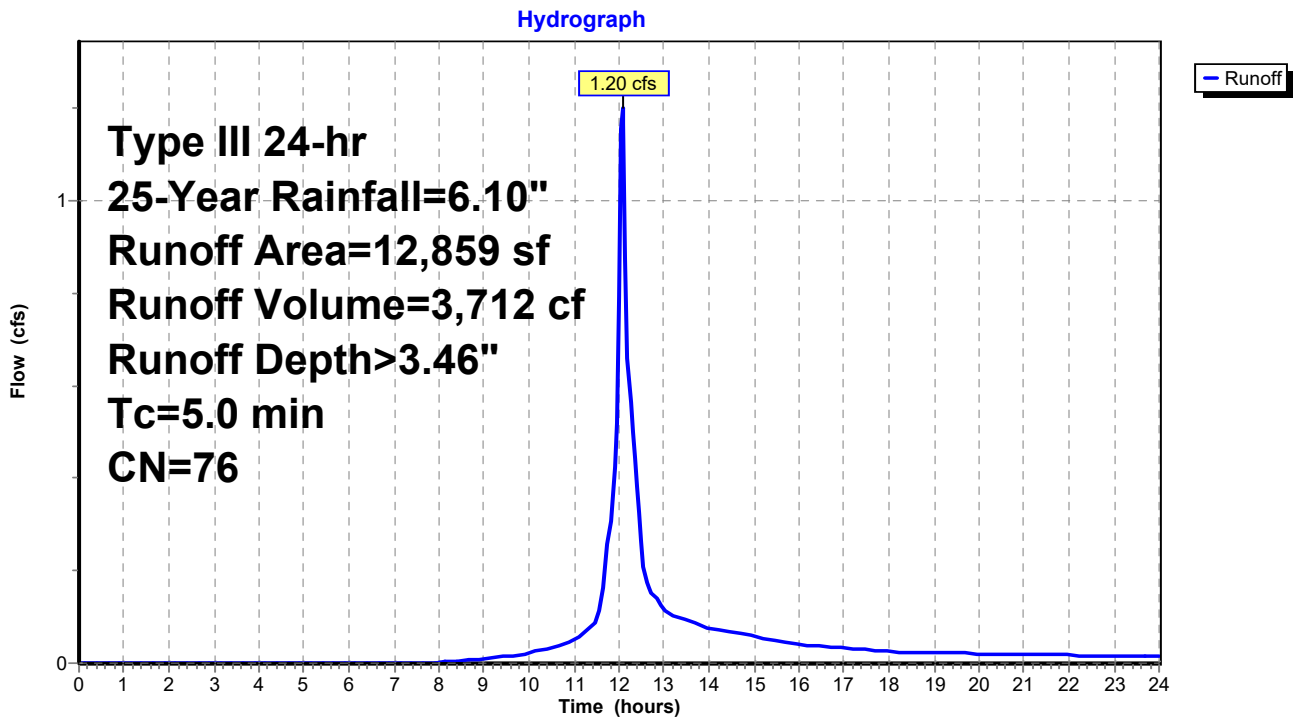
Runoff = 1.20 cfs @ 12.08 hrs, Volume= 3,712 cf, Depth> 3.46"

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

Area (sf)	CN	Description
5,190	98	Paved parking, HSG A
* 2,084	98	Patios/Decks
* 936	98	Rain Garden
4,018	39	>75% Grass cover, Good, HSG A
631	30	Woods, Good, HSG A
12,859	76	Weighted Average
4,649		36.15% Pervious Area
8,210		63.85% Impervious Area

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

Subcatchment 1S: Parking Lot & Patio



Summary for Subcatchment 2S: Flow to Road

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 521 cf, Depth> 2.42"

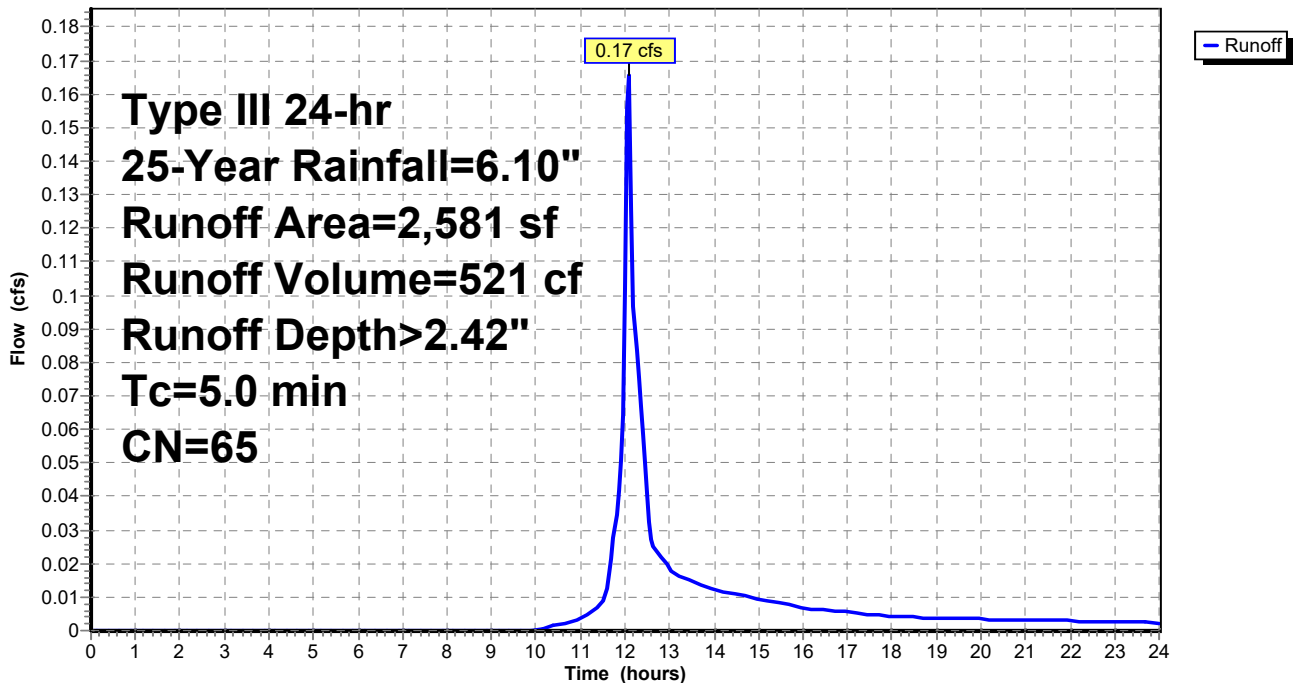
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
1,325	98	Paved parking, HSG A
1,256	30	Woods, Good, HSG A
2,581	65	Weighted Average
1,256		48.66% Pervious Area
1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road

Hydrograph



Summary for Subcatchment 3S: Flow to Wetland

Runoff = 0.06 cfs @ 12.41 hrs, Volume= 531 cf, Depth> 0.47"

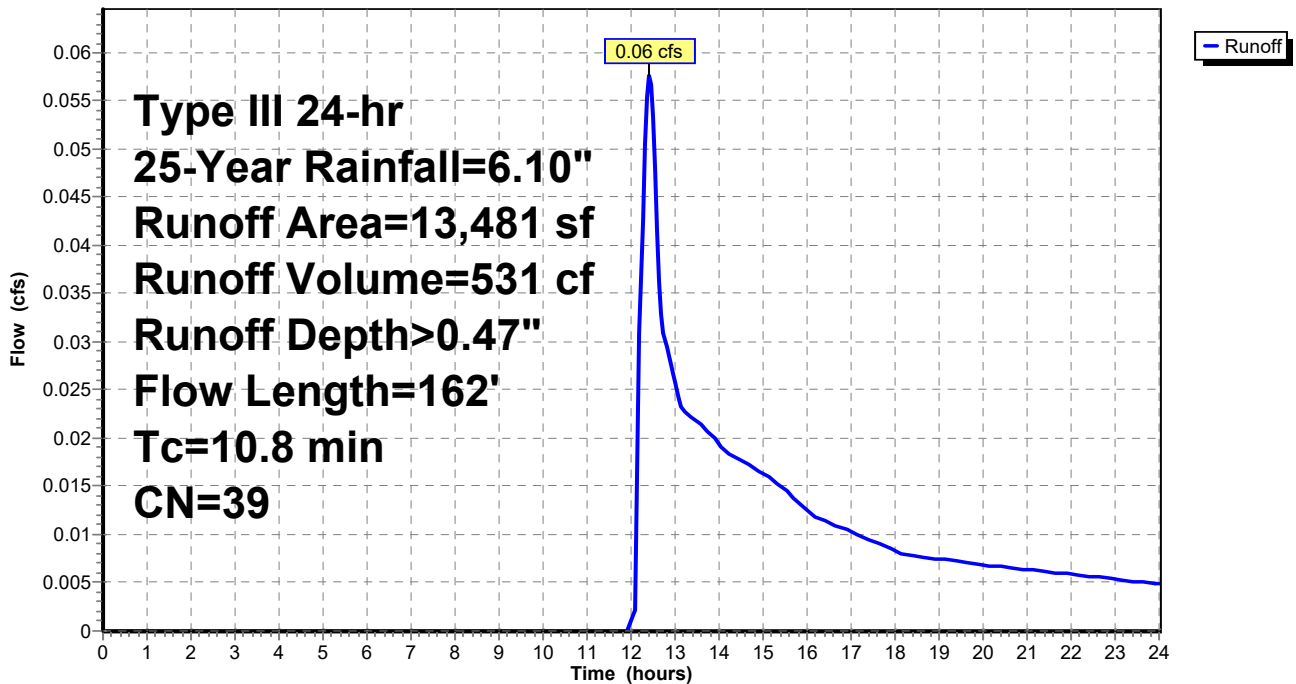
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
6,877	30	Woods, Good, HSG A
4,962	39	>75% Grass cover, Good, HSG A
* 194	98	Wall
1,448	76	Gravel roads, HSG A
13,481	39	Weighted Average
13,287		98.56% Pervious Area
194		1.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0340	0.09		Sheet Flow, AB Woods: Light underbrush n= 0.400 P2= 3.40"
1.1	112	0.1060	1.63		Shallow Concentrated Flow, BC Woodland Kv= 5.0 fps
10.8	162	Total			

Subcatchment 3S: Flow to Wetland

Hydrograph



Summary for Pond 4P: Roof System

Inflow Area = 1,456 sf, 100.00% Impervious, Inflow Depth > 5.86" for 25-Year event
 Inflow = 0.20 cfs @ 12.07 hrs, Volume= 711 cf
 Outflow = 0.05 cfs @ 12.44 hrs, Volume= 711 cf, Atten= 76%, Lag= 22.4 min
 Discarded = 0.05 cfs @ 12.44 hrs, Volume= 711 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 1.39' @ 12.44 hrs Surf.Area= 179 sf Storage= 153 cf

Plug-Flow detention time= 16.8 min calculated for 711 cf (100% of inflow)
 Center-of-Mass det. time= 16.7 min (760.3 - 743.6)

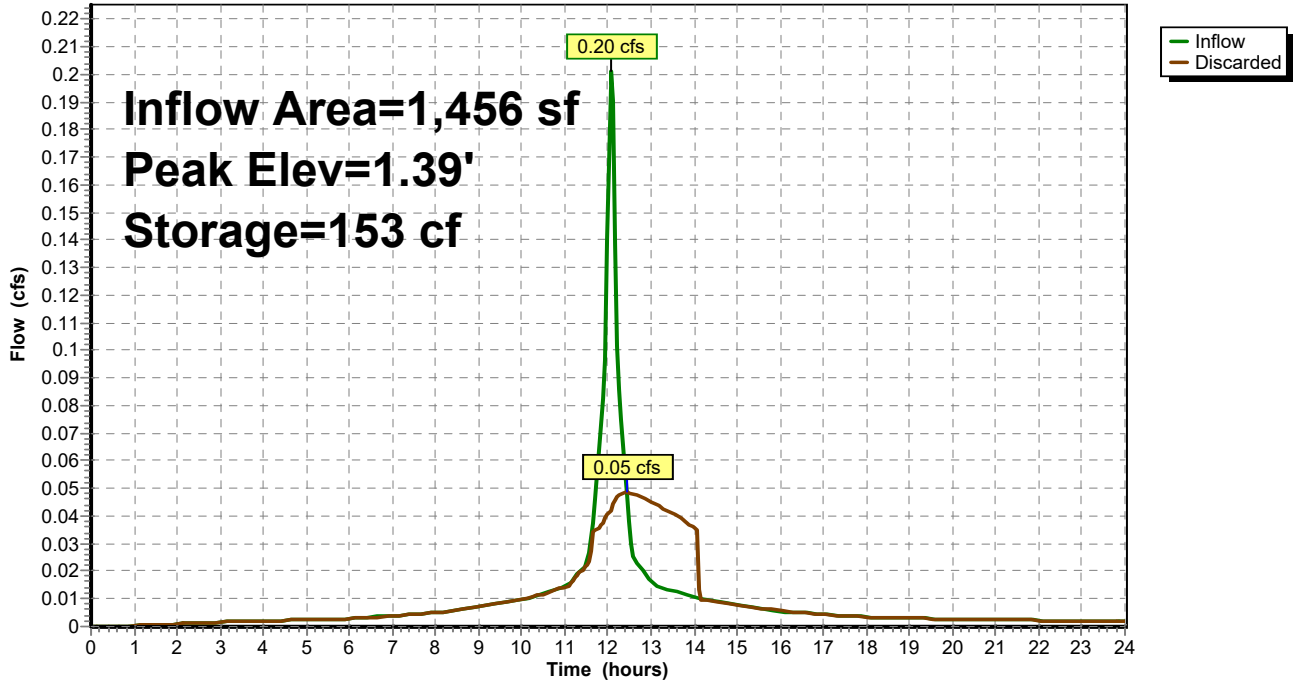
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	177 cf	11.00'W x 16.24'L x 3.50'H Prismatic 625 cf Overall - 184 cf Embedded = 441 cf x 40.0% Voids
#2	0.50'	184 cf	ADS_StormTech SC-740 +Cap x 4 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Chambers in 2 Rows
		360 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.05 cfs @ 12.44 hrs HW=1.39' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.05 cfs)

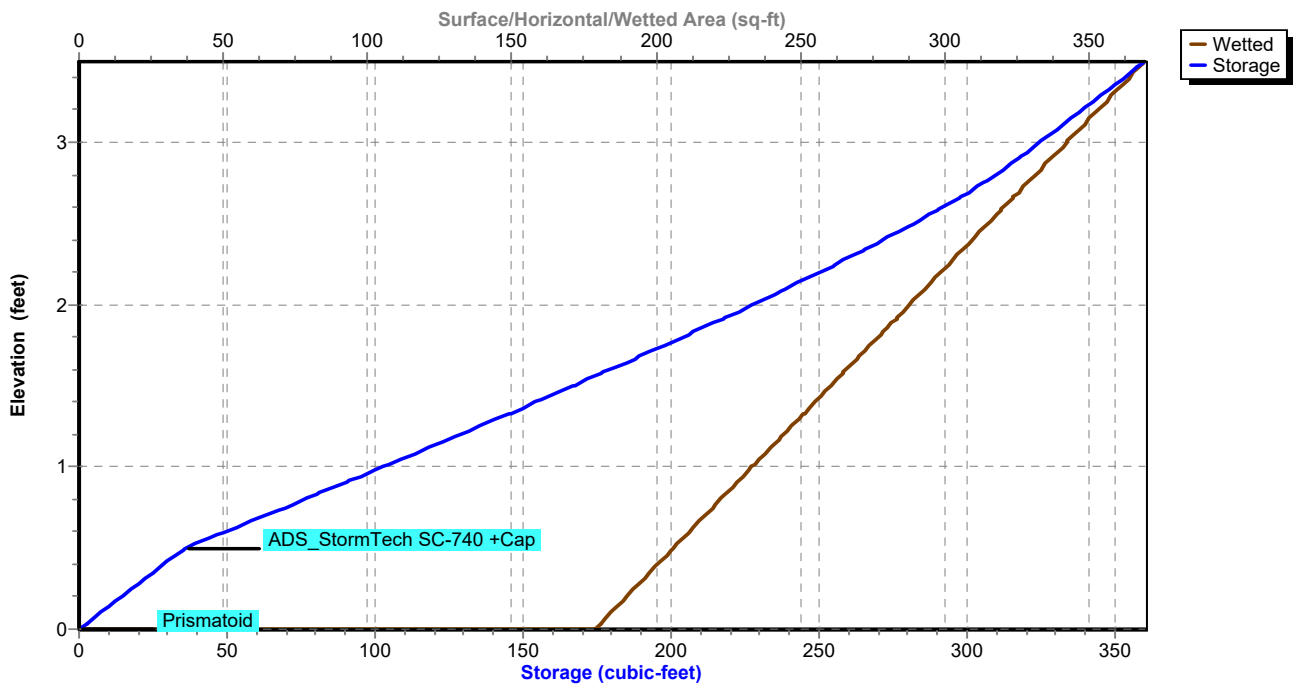
Pond 4P: Roof System

Hydrograph



Pond 4P: Roof System

Stage-Area-Storage



Summary for Subcatchment 4S: Roof

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.20 cfs @ 12.07 hrs, Volume= 711 cf, Depth > 5.86"

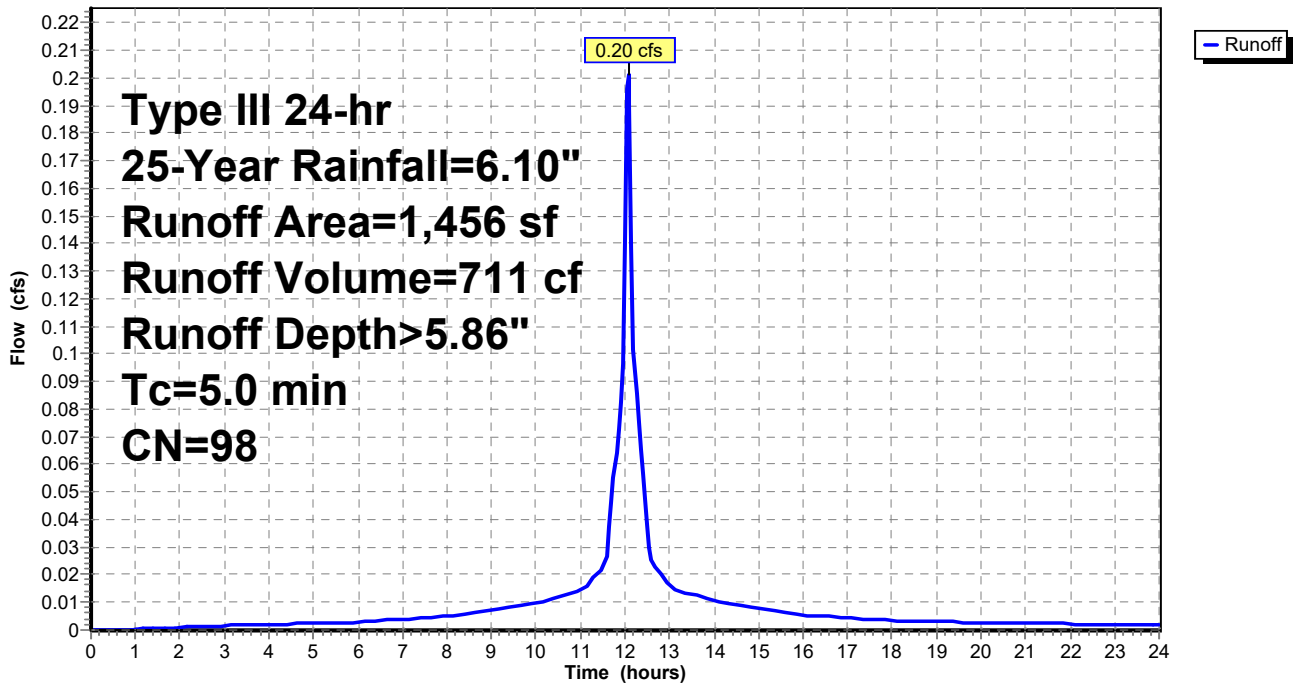
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
* 1,456	98	Roof
1,456		100.00% Impervious Area

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

Subcatchment 4S: Roof

Hydrograph



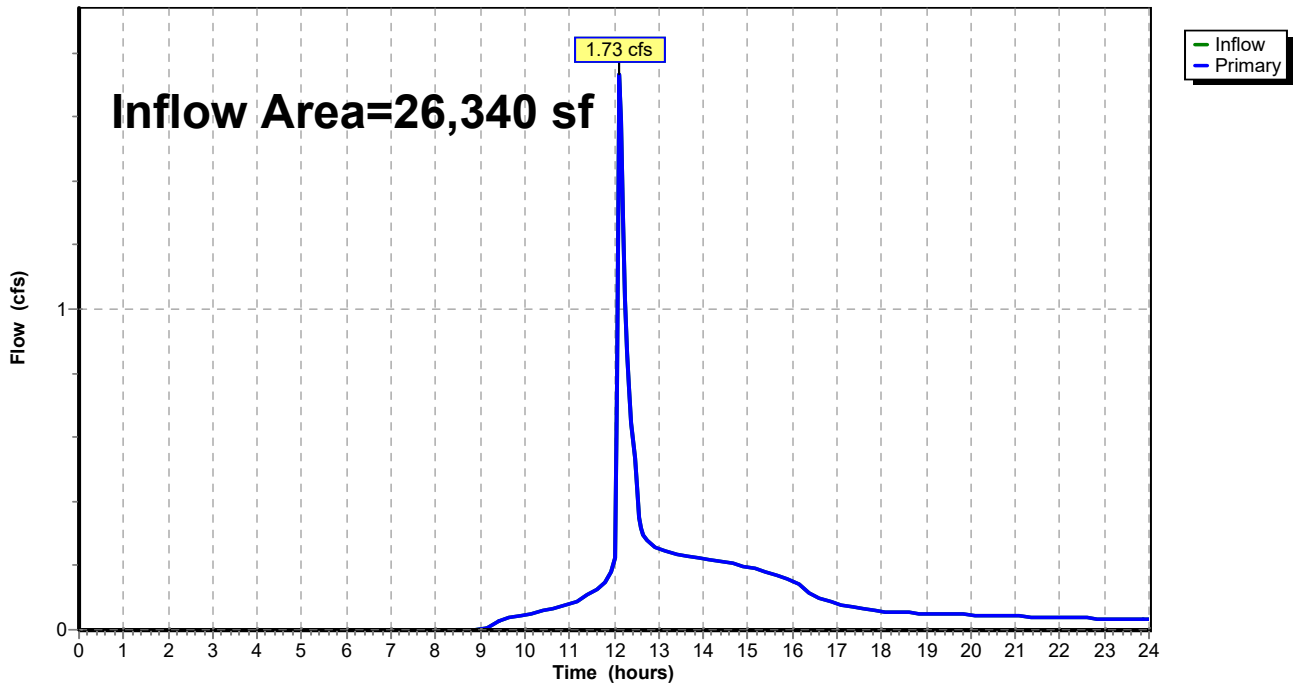
Summary for Link 1: Wetland

Inflow Area = 26,340 sf, 31.91% Impervious, Inflow Depth > 3.09" for 100-Year event
Inflow = 1.73 cfs @ 12.12 hrs, Volume= 6,781 cf
Primary = 1.73 cfs @ 12.12 hrs, Volume= 6,781 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1: Wetland

Hydrograph



Summary for Pond 1P: Rain Garden

Inflow Area = 12,859 sf, 63.85% Impervious, Inflow Depth > 5.66" for 100-Year event
 Inflow = 1.95 cfs @ 12.07 hrs, Volume= 6,062 cf
 Outflow = 1.78 cfs @ 12.12 hrs, Volume= 5,948 cf, Atten= 9%, Lag= 2.6 min
 Discarded = 0.29 cfs @ 12.12 hrs, Volume= 729 cf
 Primary = 1.49 cfs @ 12.12 hrs, Volume= 5,219 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 53.62' @ 12.12 hrs Surf.Area= 877 sf Storage= 1,155 cf

Plug-Flow detention time= 43.2 min calculated for 5,948 cf (98% of inflow)
 Center-of-Mass det. time= 32.0 min (840.0 - 808.0)

Volume	Invert	Avail.Storage	Storage Description			
#1	48.99'	1,550 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
48.99	273	81.8	0.0	0	0	273
49.00	273	81.8	40.0	1	1	274
49.49	273	81.8	40.0	54	55	314
49.50	273	81.8	30.0	1	55	315
51.49	273	81.8	30.0	163	218	477
51.50	158	72.4	100.0	2	221	593
52.00	273	81.8	100.0	106	327	714
53.00	547	100.6	100.0	402	729	1,002
53.20	633	109.1	100.0	118	847	1,146
53.40	700	113.4	100.0	133	980	1,225
54.00	1,222	153.9	100.0	569	1,550	2,090

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.99'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	50.20'	2.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	53.20'	24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	53.40'	5.0' 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=0.29 cfs @ 12.12 hrs HW=53.61' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.29 cfs)

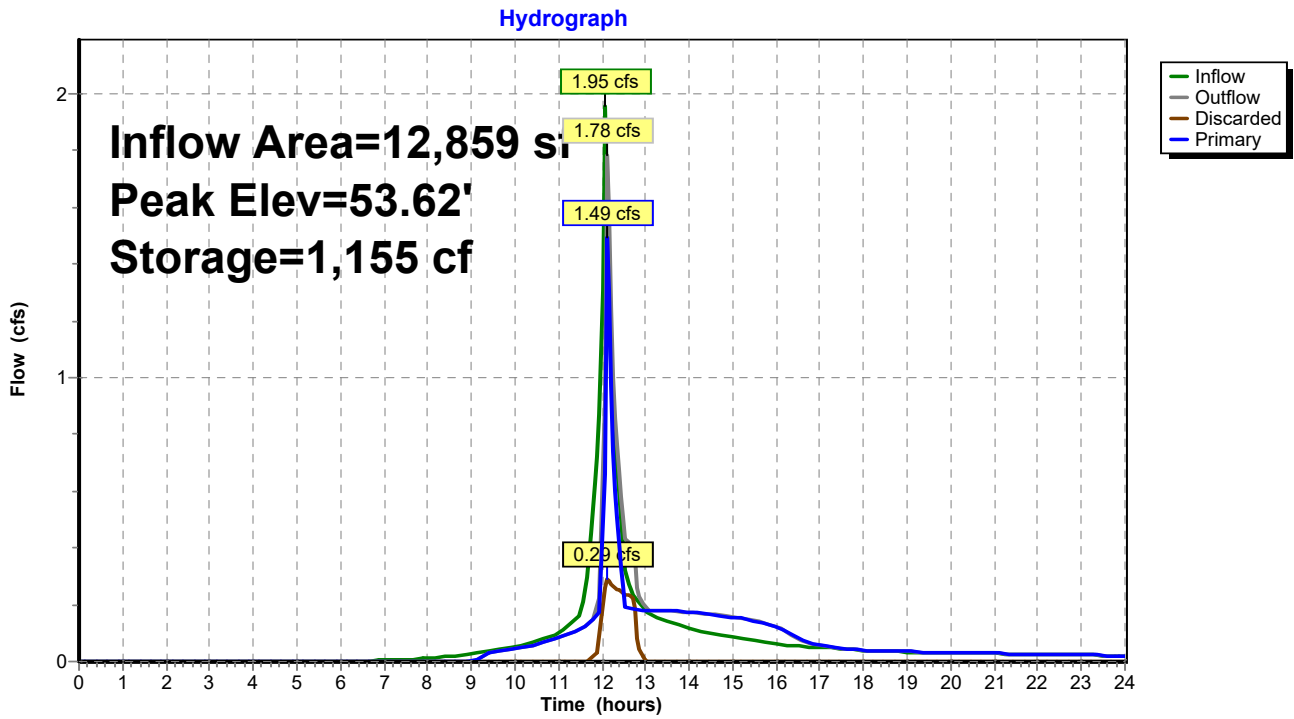
↑ **3=Orifice/Grate** (Passes 0.29 cfs of 5.37 cfs potential flow)

Primary OutFlow Max=1.38 cfs @ 12.12 hrs HW=53.61' (Free Discharge)

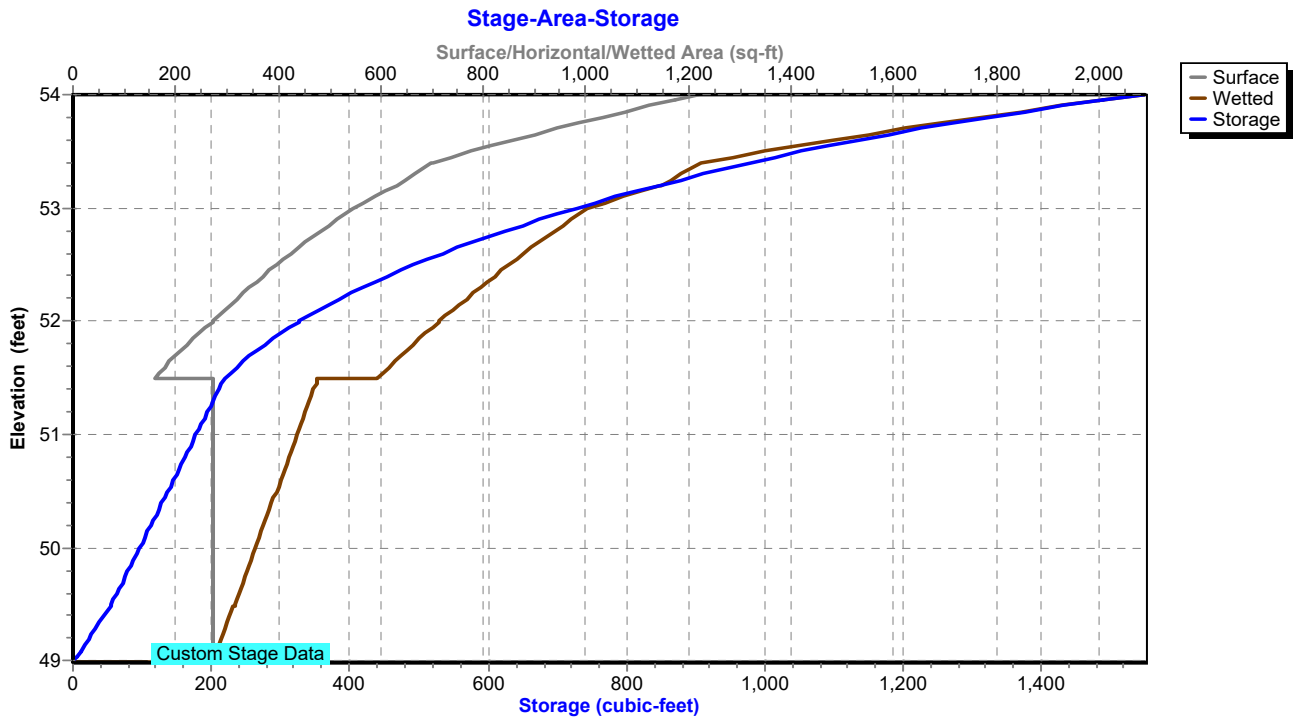
↑ **2=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.78 fps)

↑ **4=Broad-Crested Rectangular Weir** (Weir Controls 1.19 cfs @ 1.14 fps)

Pond 1P: Rain Garden



Pond 1P: Rain Garden



Summary for Subcatchment 1S: Parking Lot & Patio

[49] Hint: Tc<2dt may require smaller dt

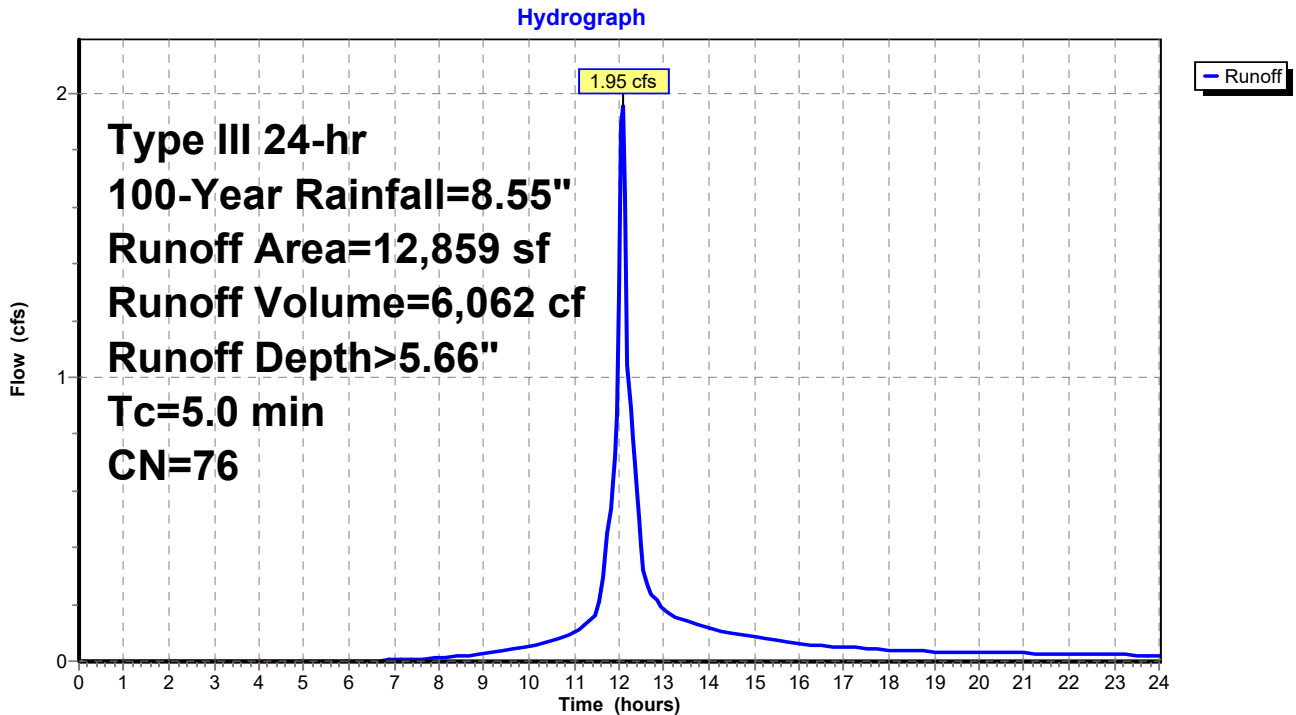
Runoff = 1.95 cfs @ 12.07 hrs, Volume= 6,062 cf, Depth> 5.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.55"

Area (sf)	CN	Description
5,190	98	Paved parking, HSG A
* 2,084	98	Patios/Decks
* 936	98	Rain Garden
4,018	39	>75% Grass cover, Good, HSG A
631	30	Woods, Good, HSG A
12,859	76	Weighted Average
4,649		36.15% Pervious Area
8,210		63.85% Impervious Area

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

Subcatchment 1S: Parking Lot & Patio



Summary for Subcatchment 2S: Flow to Road

[49] Hint: Tc<2dt may require smaller dt

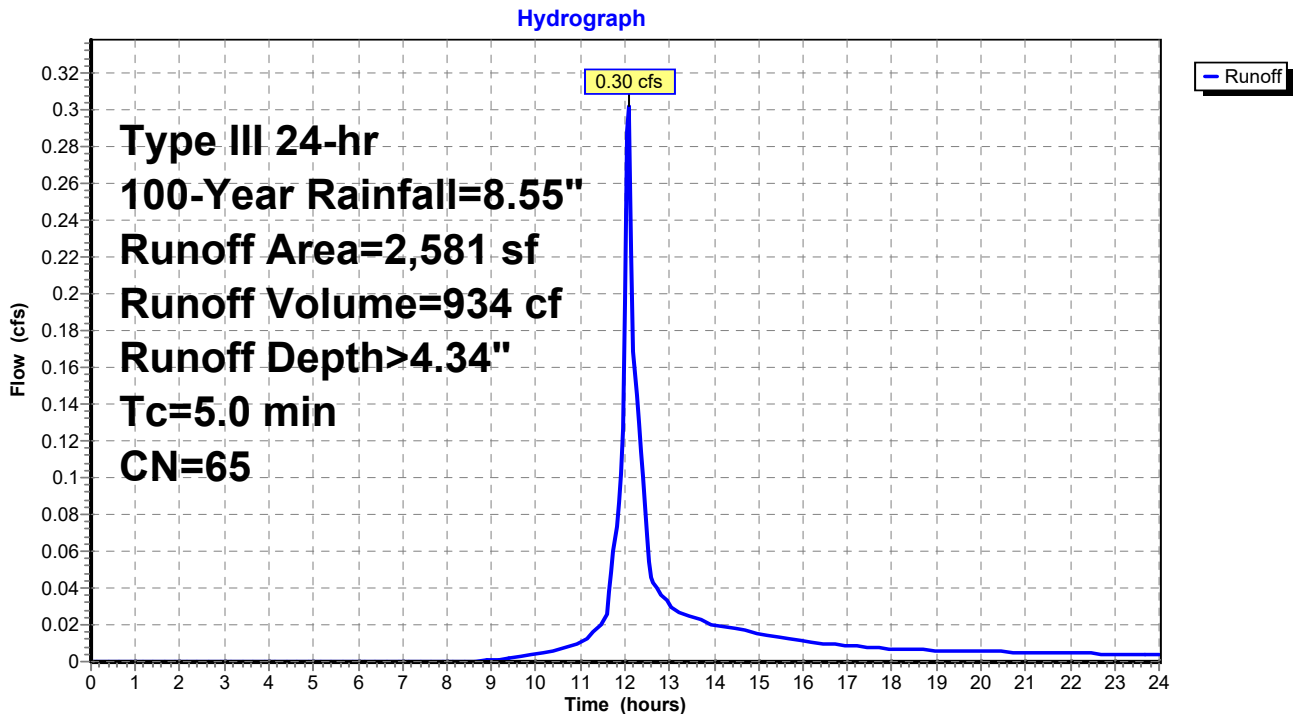
Runoff = 0.30 cfs @ 12.08 hrs, Volume= 934 cf, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.55"

Area (sf)	CN	Description
1,325	98	Paved parking, HSG A
1,256	30	Woods, Good, HSG A
2,581	65	Weighted Average
1,256		48.66% Pervious Area
1,325		51.34% Impervious Area

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

Subcatchment 2S: Flow to Road



Summary for Subcatchment 3S: Flow to Wetland

Runoff = 0.30 cfs @ 12.20 hrs, Volume= 1,563 cf, Depth> 1.39"

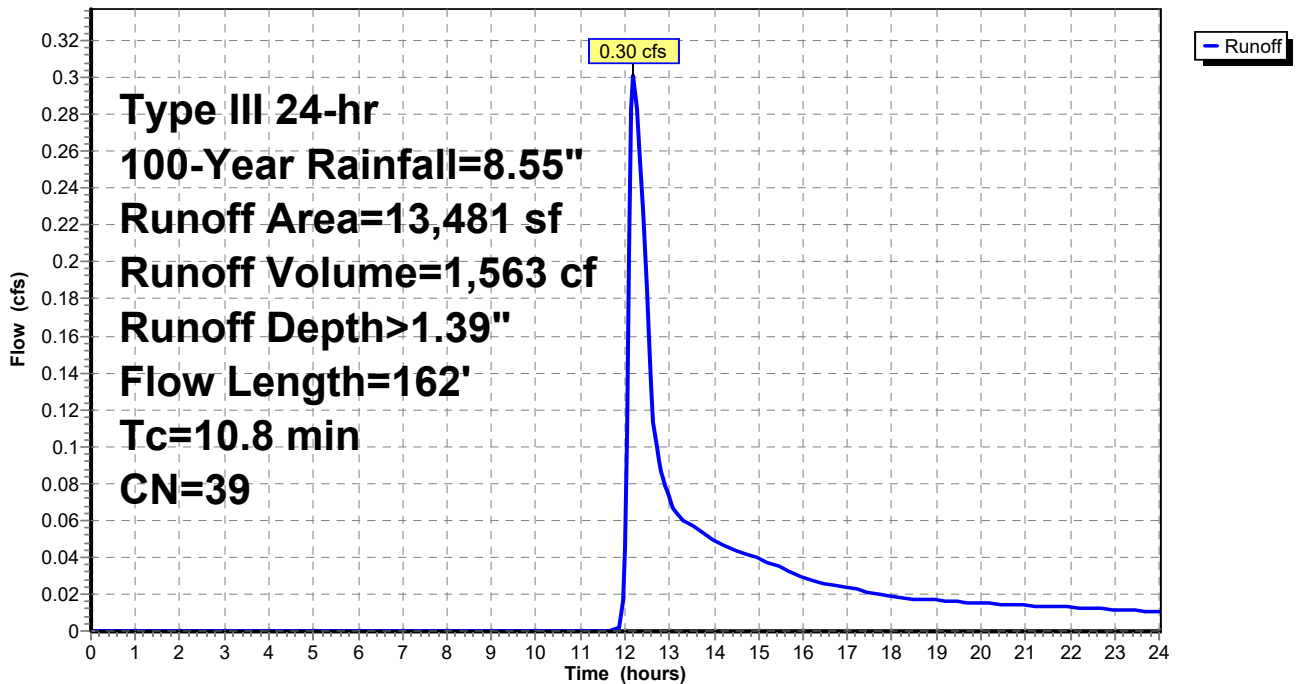
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.55"

Area (sf)	CN	Description
6,877	30	Woods, Good, HSG A
4,962	39	>75% Grass cover, Good, HSG A
* 194	98	Wall
1,448	76	Gravel roads, HSG A
13,481	39	Weighted Average
13,287		98.56% Pervious Area
194		1.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0340	0.09		Sheet Flow, AB Woods: Light underbrush n= 0.400 P2= 3.40"
1.1	112	0.1060	1.63		Shallow Concentrated Flow, BC Woodland Kv= 5.0 fps
10.8	162	Total			

Subcatchment 3S: Flow to Wetland

Hydrograph



Summary for Pond 4P: Roof System

Inflow Area = 1,456 sf, 100.00% Impervious, Inflow Depth > 8.31" for 100-Year event
 Inflow = 0.28 cfs @ 12.07 hrs, Volume= 1,008 cf
 Outflow = 0.06 cfs @ 12.49 hrs, Volume= 1,008 cf, Atten= 80%, Lag= 25.0 min
 Discarded = 0.06 cfs @ 12.49 hrs, Volume= 1,008 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 2.23' @ 12.49 hrs Surf.Area= 179 sf Storage= 253 cf

Plug-Flow detention time= 26.5 min calculated for 1,006 cf (100% of inflow)
 Center-of-Mass det. time= 26.3 min (765.5 - 739.2)

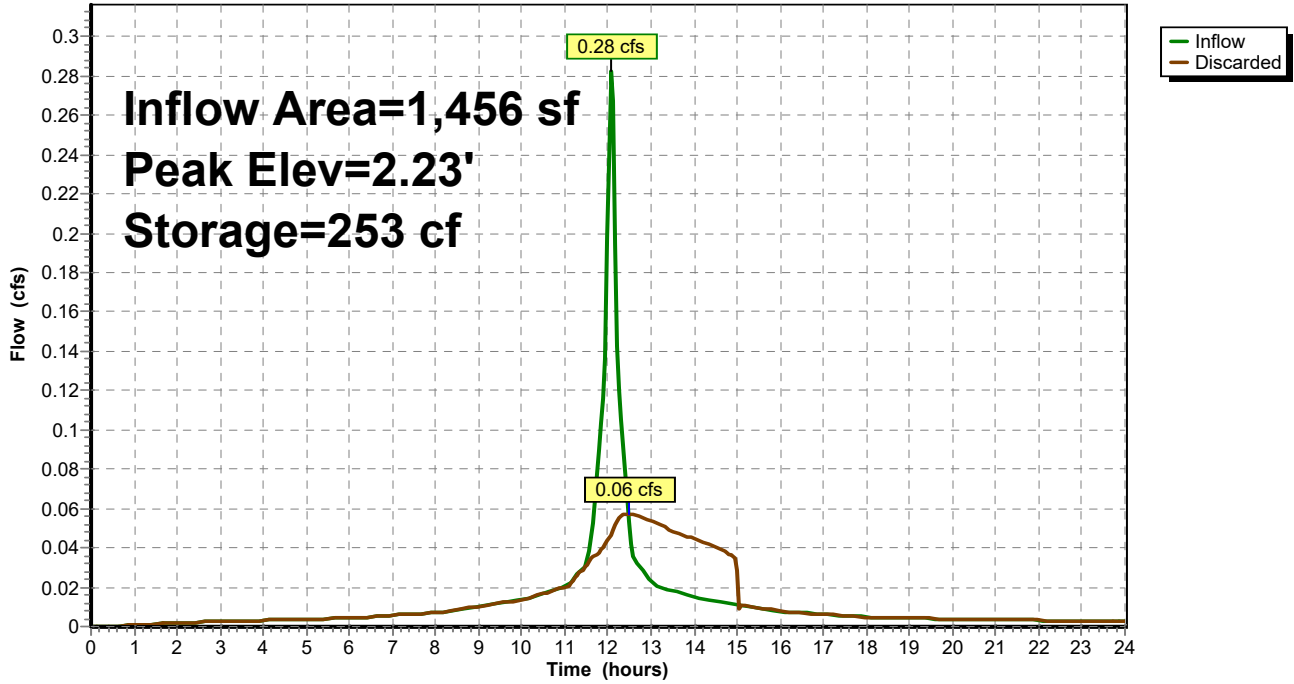
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	177 cf	11.00'W x 16.24'L x 3.50'H Prismatic 625 cf Overall - 184 cf Embedded = 441 cf x 40.0% Voids
#2	0.50'	184 cf	ADS_StormTech SC-740 +Cap x 4 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Chambers in 2 Rows
		360 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.06 cfs @ 12.49 hrs HW=2.23' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.06 cfs)

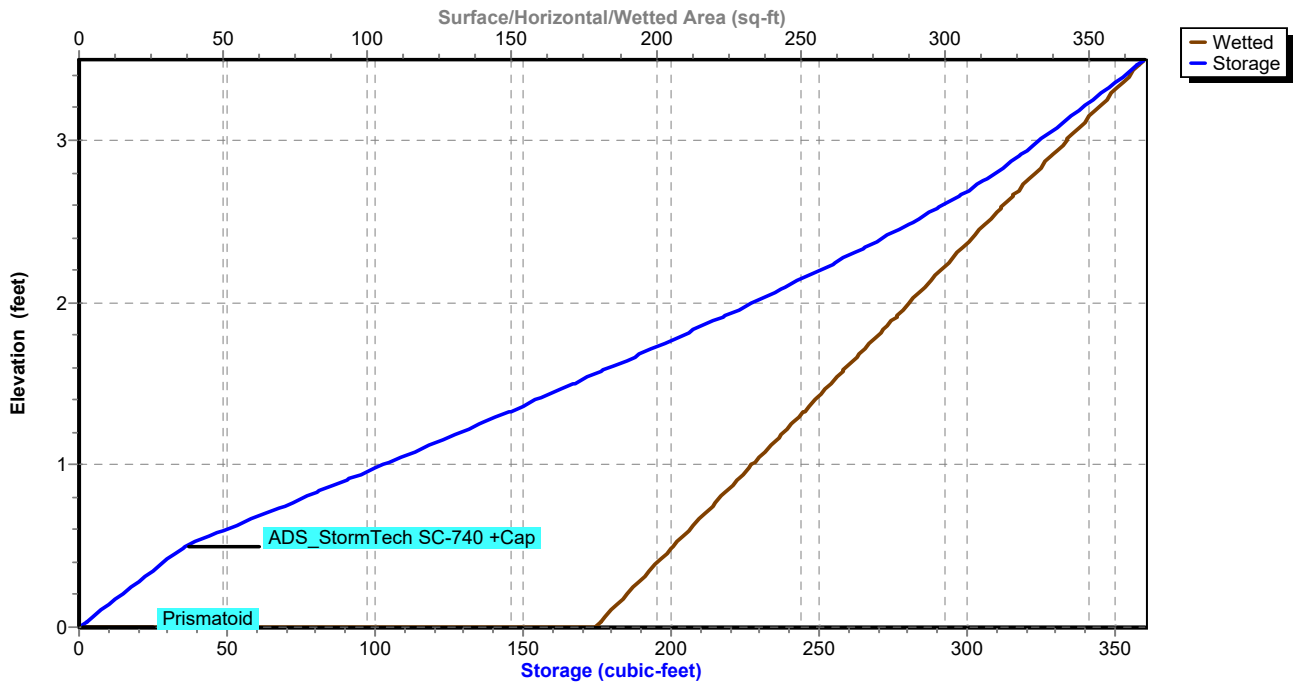
Pond 4P: Roof System

Hydrograph



Pond 4P: Roof System

Stage-Area-Storage



Summary for Subcatchment 4S: Roof

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.28 cfs @ 12.07 hrs, Volume= 1,008 cf, Depth> 8.31"

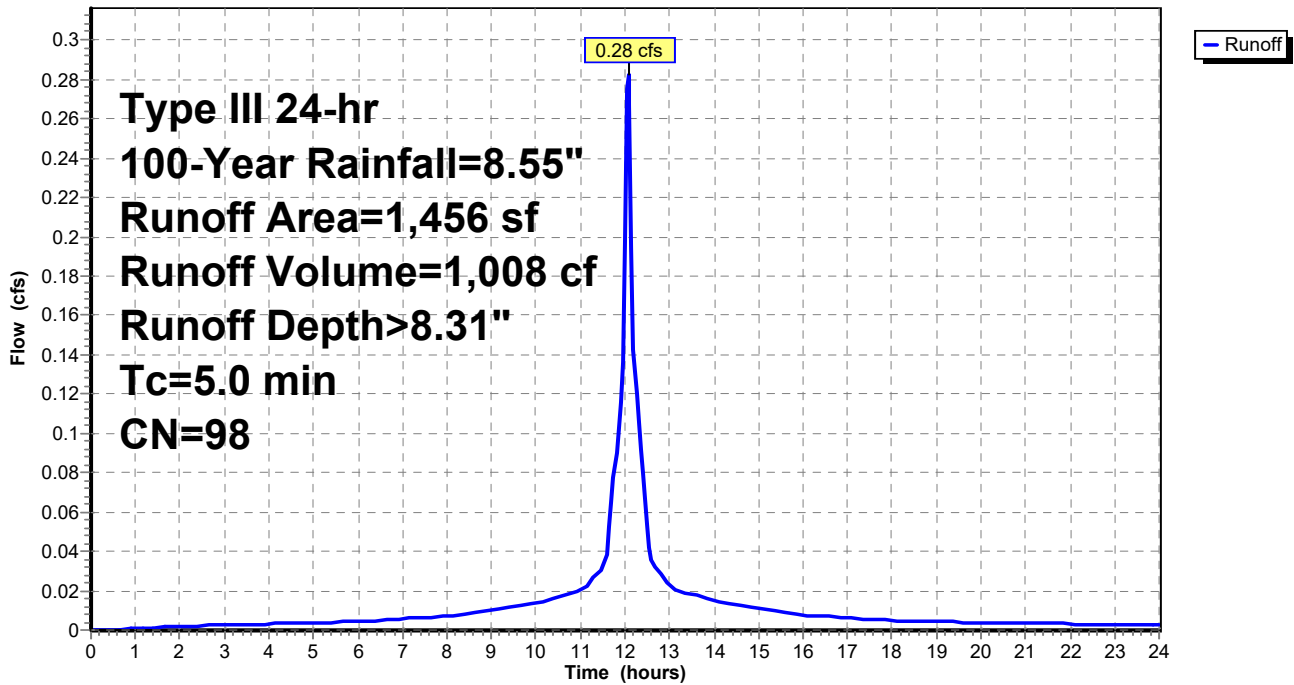
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.55"

Area (sf)	CN	Description
* 1,456	98	Roof
1,456		100.00% Impervious Area

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

Subcatchment 4S: Roof

Hydrograph



**CONSTRUCTION POLLUTION
PREVENTION PLAN**

&

OPERATION AND MAINTENANCE PLAN

PREPARED FOR

**724 MacArthur Boulevard
Bourne, MA
Map 44.2 Parcel 23**

OWNER AND OPERATOR:

**Gulf Coast Realty, LLC
736 Washington Street
South Easton, MA 02375**

PREPARED BY

**BRACKEN ENGINEERING, INC.
49 HERRING POND ROAD
BUZZARDS BAY, MA 02532**

FEBRUARY 12, 2021

CONSTRUCTION POLLUTION PREVENTION PLAN

SITE EVALUATION AND DESIGN DEVELOPMENT

EXISTING CONDITIONS

The locus is shown as Map 44.2 Parcel 23 on of the Town of Bourne Assessors Maps. The total area of the site is 36,180± SF or approximately 0.83 acres.

The property is surrounded by commercial development to the north and south and a residential subdivision to the west. There is a Bordering Vegetated Wetland (BVW) associated with a small pond located to the northwest of the property. The majority of the site and surrounding properties drain to the BVW.

The site is a minimally developed parcel comprised of a 688± SF retail building with associated appurtenances, which include a paved parking lot, patio, decks and building ramps. The remainder of the site is comprised of gravel, lawn, and landscape areas with much of the rear lot covered by trees and low-lying shrub.

SOILS INFORMATION

Soils on the site are mapped as a Carver loamy coarse sand as shown on the soil survey maps prepared by the Soil Conservation Service.

Test pits performed on-site indicate a very coarse sand with a high infiltration rate.

RUNOFF WATER QUALITY

Currently there is no available information regarding the quality of runoff from the site.

NAME OF RECEIVING WATER

There is no direct receiving water. Drainage is contained onsite and infiltrated.

RAINFALL DATA

The stormwater management areas were analyzed utilizing standard engineering practices and the Soil Conservation Service (SCS) Technical Release 20 (TR20). The systems were analyzed using the rainfall data for the two (2), ten (10), twenty-five (25) and one hundred (100) year, 24 hour duration storm frequencies. The precipitation is 3.23", 4.89", 6.10" and 8.55" respectively. The precipitation was based on the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 - point precipitation frequency estimates.

SITE PLAN DEVELOPMENT

The site improvements will include site grubbing, grading, foundation installation, utility installation and site stabilization. Various landscaping and the installation of a drainage collection and infiltration system is proposed to stabilize all areas and allow for onsite recharge of runoff to replicate pre-construction conditions.

SITE MAP

Refer to the grading, drainage and utilities sheet as part of the development plan set. These plans indicate areas of disturbance, grading, stormwater controls, erosion control measures, etc.

Existing and proposed drainage patterns are indicated on the Pre- and Post- development Watershed Maps as well as the Grading and Drainage plan. These plans show the location of proposed subsurface infiltration systems to control runoff.

ASSESSMENT

MEASURE SITE AREA

The total project area is 36,180 S.F.

DRAINAGE AREAS AND HYDROLOGICAL ANALYSIS

Refer to the Pre- and Post-Development Watershed Maps for drainage areas.

EROSION AND SEDIMENT CONTROLS

Silt fence shall be located at all downgradient areas of construction activity and/or along the limit of work. Erosion control shall be inspected weekly and after significant rainfalls and replaced where necessary.

Additional siltation fencing may also be required, as directed by the engineer. All finished slopes and graded areas are to be stabilized with landscaping. Temporary measures such as mulching of slopes during non-planting seasons will be required.

CONSTRUCTION ENTRANCE

The existing paved driveway shall be utilized. Contractor is to maintain a clean entrance at all times and prevent any tracking of material out onto MacArthur Boulevard.

STORMWATER MANAGEMENT CONTROLS

All runoff shall be infiltrated into the ground. The collection system is comprised of a subsurface infiltration system or a sediment forebay and rain garden. Refer to hydrology report for detailed analysis along with Total Suspended Solids (TSS) removal rates. See site plans for design and details.

CONSTRUCTION OPERATION AND MAINTENANCE PLAN

The following is an Operations and Maintenance Plan during construction activities:

FACILITY DESCRIPTION:

The drainage system components consist of the following:

- One (1) Rain Garden
- One (1) Subsurface Leaching System

MAINTENANCE DURING SITE CONSTRUCTION:

Tree clearing and removal of topsoil shall be kept at a minimum in conformance with the Design Plan.

Stockpile areas for top and subsoil shall be located in an area away from the driveway/parking areas to avoid entering proposed stormwater management systems and/or the abutting properties. The perimeter of any stockpile area is to be staked with silt fence, if required. Any stockpile to be left in place for greater than 30 days is to be stabilized with an approved means.

Onsite installed area drains and swale shall be protected during construction with filter fabric to prevent silt from entering the system. The paved driveway/parking/patio areas shall be constructed prior to opening the area drains, swale & rain garden. The rain garden shall not receive runoff until tributary areas can be adequately stabilized.

Subsurface infiltration units shall be protected during construction with haybales and/or silt fence. Avoid excessive soil compaction around the infiltration areas. Runoff is to be directed to the planned infiltration areas only after the contributing drainage areas are fully stabilized.

All erosion control measures shall be inspected and repaired or replaced following every rainfall event of 0.5" or greater.

MAINTENANCE DURING BUILDING CONSTRUCTION:

Areas that drain to the driveway/parking areas, such as lawn areas, shall be permanently stabilized prior to final driveway/parking surfacing.

The site contractor shall be responsible for maintaining all erosion control measures.

FINAL CONSTRUCTION MAINTENANCE:

The permanent operation and maintenance plan shall begin only after the following:

Driveway/parking area construction and slope stabilization is complete;

Building construction is complete;

All disturbed areas are adequately vegetated and stabilized;

The subsurface system, sediment forebay and rain garden have been pumped and completely cleaned, and;

The systems have been completely inspected by the design engineer and the town's representative and found to be functioning as designed in that no clogging of the leaching systems has occurred during construction.

PERMANENT OPERATION AND MAINTENANCE PLAN

RESPONSIBLE PARTY: Gulf Coast Realty, LLC

Non-Structural BMP's

Implementing source controls can aid in reducing the types and concentrations of contaminants in stormwater runoff, which in turn can result in improved water quality. This principle for pollution prevention and non-structural controls, or Best Management Practices (BMP's), is to minimize the volume of runoff and to minimize contact of storm water with potential pollutants. Measures such as managing snow removal and educating the owner/operator of good maintenance practices are examples of non-structural BMP's.

PUBLIC AWARENESS

Periodically, the facility owner or property management shall issue reminder to its guests to prevent dumping or releasing pollutants to the storm drain, the ground, and the parking areas.

SNOW AND SNOWMELT MANAGEMENT

It is suggested that during minor snowfall events the snow be stockpiled along the edge of parking areas up gradient of the proposed rain garden. It is the responsibility of the owner to make sure the snow removal contractor does not pile the snow on top of the sediment forebay or within the rain garden. The owner is to remove sediment from snow storage areas every spring.

It is suggested that no de-icing compounds, such as CaCl₂, calcium magnesium acetate (CMA) be used on the site. The snow removal contractor shall store all sand off-site. No quantities of sand compounds shall be stored or disposed of on-site.

STRUCTURAL BMP'S

Structural BMP's are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMP's will ensure design performance and promote longevity of the structure and may decrease operator maintenance costs. The structural BMP's selected for the proposed site development include: a sediment forebay, rain garden and subsurface infiltration system.

DEEP SUMP CATCH BASINS

Rain Garden

A rain garden shall be utilized on this project as a water quality structure to provide removal of total suspended solids (TSS) from storm water runoff from the parking and patio areas. As runoff passes through the rain garden, TSS is settled out at the bottom of the basin.

To ensure proper operation, the rain garden should be inspected at least four times a year to ensure that they are operating as intended. Inspections conducted at intervals during and after a storm will help to determine if the rain garden is meeting the expected retention times. Potential problems that should be checked include: subsidence, erosion, cracking or tree growth on the embankments; damage to the side slopes; sediment accumulation around the outlet and inlet; inadequacy of the inlet/outlet channel erosion control measures; and erosion within the rain garden and banks. Any necessary repairs should be made immediately. During inspections, changes to the rain garden or the contributing watershed should be noted, as these may affect rain garden performance.

Rain Garden to be inspected at a minimum four (4) times per year and trash and debris should be removed at this time. The garden is to be mulched, fertilized, pruned and dead vegetation removed annually. The side slopes, embankments, and berm should be mowed at least twice per year. Sediment should be removed from the rain garden when the depth is 1" or greater and at least once every 3 years. Disposal of accumulated sediment and trash is to be in accordance with applicable local, state and federal guidelines and regulations.

SUBSURFACE INFILTRATION SYSTEM

The subsurface infiltration system shall be used to retain, mitigate and recharge proposed runoff back into the aquifer. Infiltration system shall be inspected four times a year to ensure that the systems are clean of debris and sediment. Access is available via the access covers to grade. Remove accumulated sediment and debris from the chambers and dispose at an approved off-site location. Excessive scour around the inlet splash pads shall be inspected. Maintenance of the upstream gutter systems will reduce the possibility of debris and sediment accumulating in the infiltration systems.

If a system is found to be clogged, it first shall be cleaned with a vacuum truck. If it is still found not to be operational then the system shall be dug out. A certified soil inspector shall confirm the remove and replace limits of the subsoil prior to rebuilding the system.

STANDARD 10

**Illicit Discharge Pollution Prevention Statement
For
#724 MacArthur Boulevard – Bourne, MA**

February 12, 2021

There is to be no dumping of toxins, pollutants, or illicit materials into the storm drainage systems on-site as it is strictly prohibited by law.

Toxins, pollutants, or illicit materials consist of, but are not limited to: paint, bleach, antifreeze, motor oil, raw sewage, hydrocarbons, kitchen grease, lubricating grease, etc.

The on-site storm drainage systems are to be inspected periodically in accordance with the Operations and Maintenance plan. At the time of inspection, an inspection for illicit discharges shall be conducted. If illicit discharges are found during inspection, then immediate action should be taken to remediate and clean up the illicit discharge.

The remediation and/or clean-up is to be performed by a qualified company, such as Clean Harbors, 42 Longwater Dr., Norwell, MA 02061, Phone 1-800-645-8265 or equivalent.

Acknowledgement:

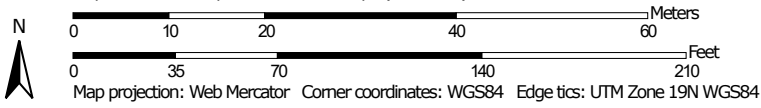
Gulf Coast Realty, LLC
736 Washington Street
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Soil Map—Barnstable County, Massachusetts



Map Scale: 1:789 if printed on A landscape (11" x 8.5") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barnstable County, Massachusetts

Survey Area Data: Version 13, Sep 14, 2016

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

Date(s) aerial images were photographed: Dec 31, 2009—Jun 7, 2016

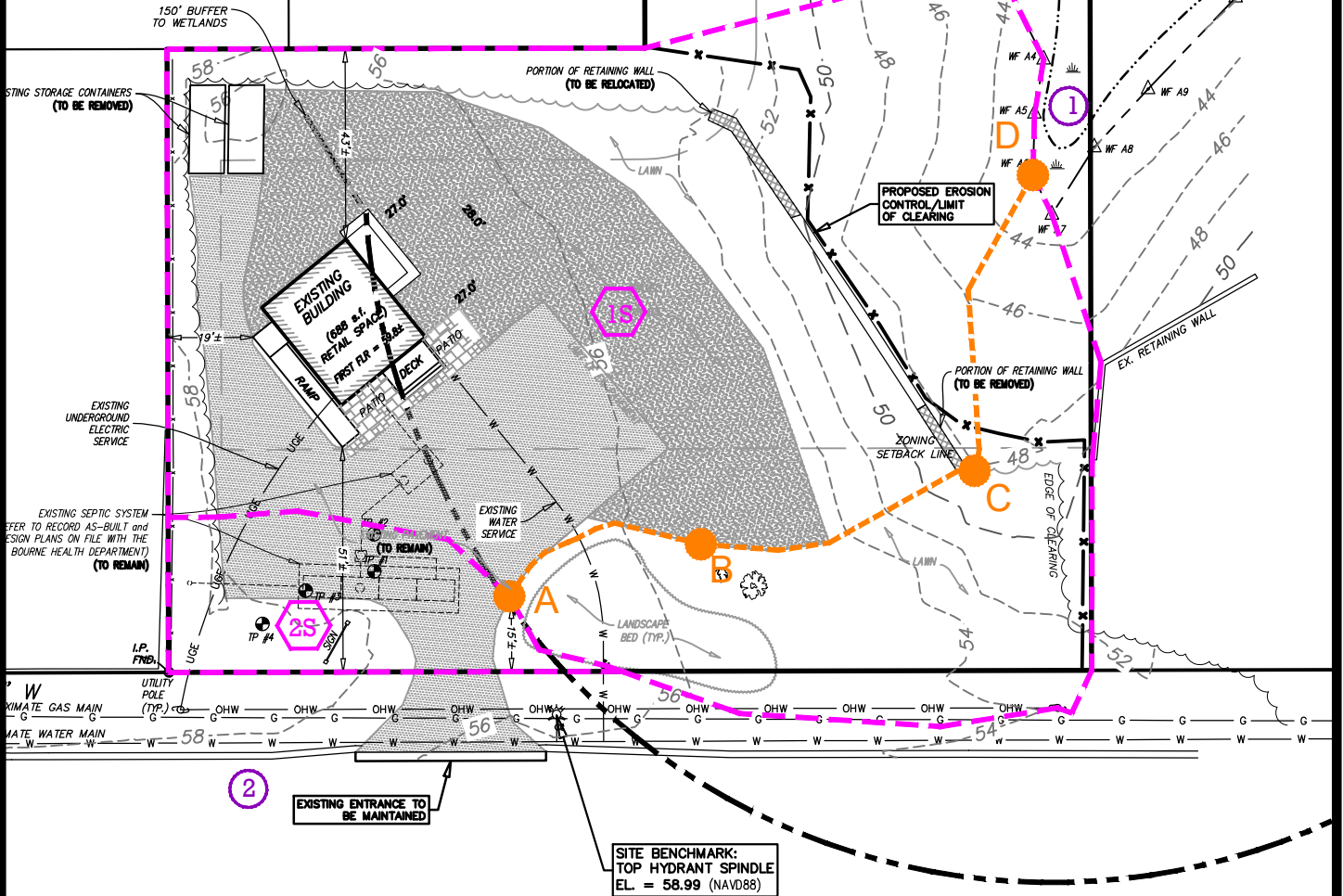
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	0.1	5.5%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	2.3	94.5%
Totals for Area of Interest		2.4	100.0%



**MAP 44.2
PARCEL 23
36,180± s.f.**



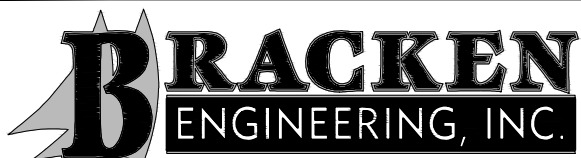
LEGEND

- = DESIGN POINT/POND
- = SUBCATCHMENT AREA
- = SUBCATCHMENT BOUNDARY
- = FLOW PATH

MACARTHUR BOULEVARD

SUBCATCHMENT AREA 1S:
 5,811 S.F. - IMPERVIOUS
 5,779 S.F. - GRAVEL
 8,045 S.F. - GRASS
 8,140 S.F. - WOODS
 CN = 61
 Tc = 6.3 MIN.

SUBCATCHMENT AREA 2S:
 1,325 S.F. - IMPERVIOUS
 1,256 S.F. - WOODS
 CN = 65
 Tc = 5.0 MIN.



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**PRE-DEVELOPMENT
WATERSHED PLAN**

Prepared for: #724 MACARTHUR BOULEVARD
 MAP 44.2 PARCEL 23
 IN BOURNE, MASSACHUSETTS

Date: FEB. 12, 2021

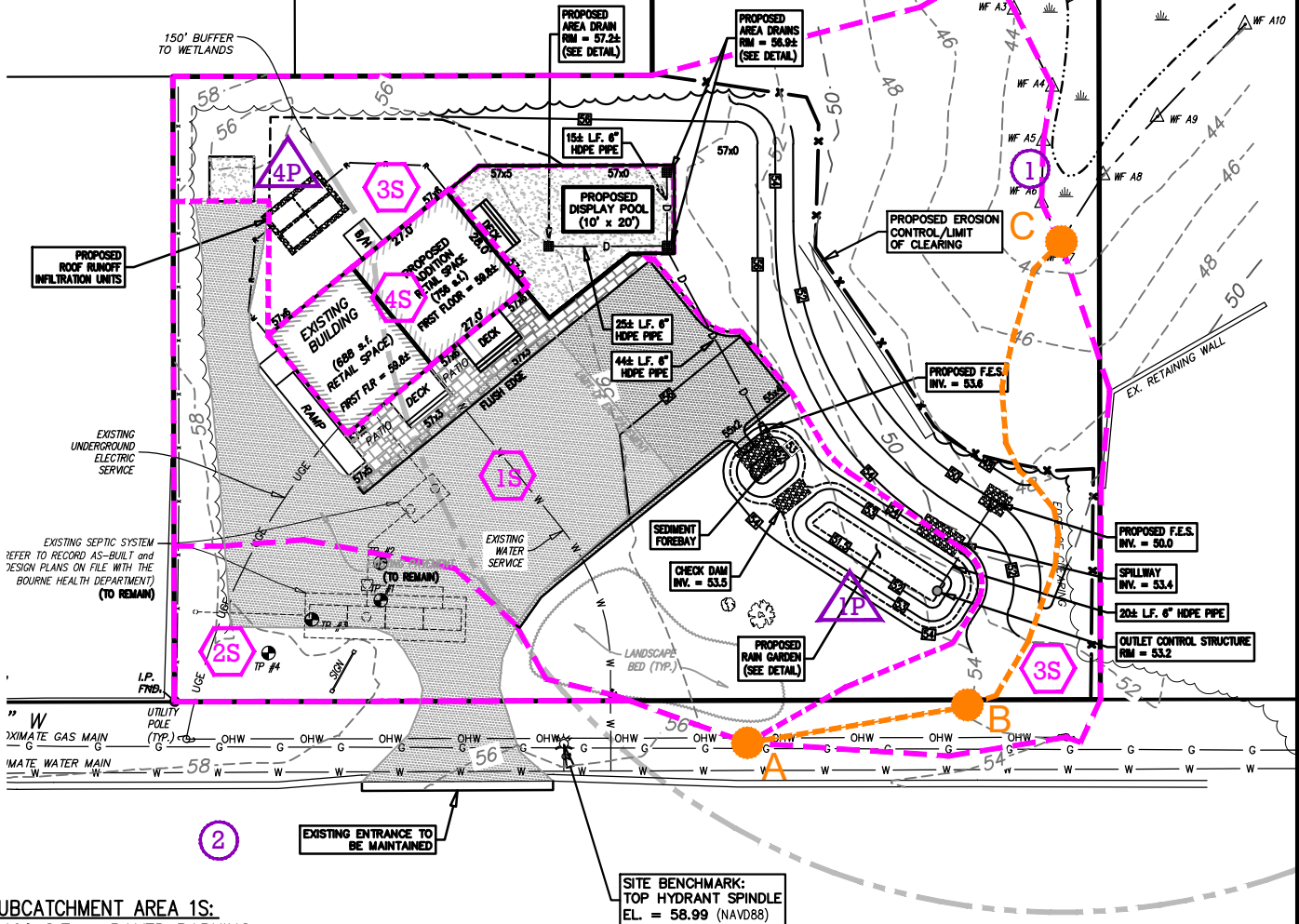
Rev:

Checked: ZLB

Drawn By: RMM/BEI



MAP 44.2
PARCEL 23
 36,180± s.f.



SUBCATCHMENT AREA 1S:
 5,190 S.F. – PAVED PARKING
 2,084 S.F. – PATIOS/DECKS
 936 S.F. – RAIN GARDEN
 4,018 S.F. – GRASS
 631 S.F. – WOODS
 CN = 76
 Tc = 5.0 MIN.

SUBCATCHMENT AREA 4S:
 1,456 S.F. – ROOF
 CN = 98
 Tc = 5.0 MIN.

SUBCATCHMENT AREA 3S:
 6,877 S.F. – WOODS
 4,962 S.F. – GRASS
 194 S.F. – WALL
 1448 S.F. – GRAVEL
 CN = 39
 Tc = 10.8 MIN.

SUBCATCHMENT AREA 2S:
 1,256 S.F. – WOODS
 1,325 S.F. – PAVED PARKING
 CN = 65
 Tc = 5.0 MIN.

MACARTHUR BOULEVARD

LEGEND

- = DESIGN POINT/POND
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**POST-DEVELOPMENT
 WATERSHED PLAN**

Prepared for: #724 MACARTHUR BOULEVARD
 MAP 44.2 PARCEL 23
 IN BOURNE, MASSACHUSETTS

Date: FEB. 12, 2021

Rev:

Drawn By: RMM/BEI

Checked: ZLB