Project Narrative

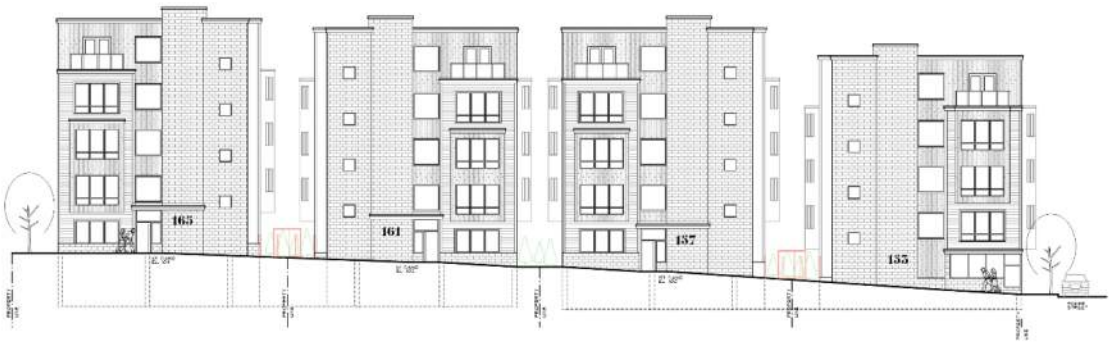
For a Proposed

132-Unit Residential Complex
Power Street Apartments

Located at

157, 159, 165 Gano Street & 256 Power Street
Providence, Rhode Island
AP 14, Lots 272, 273, 296 & 576

Prepared for:
Power 250 LLC
374 Wickenden Street
Providence, RI 02903



Elevation View Courtesy of ACME Architect LLC, May 2022

Submission Date:
May 2022

Submitted by:

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1 INTRODUCTION

On behalf of Power 250 LLC, Joe Casali Engineering, Inc. (JCE) has prepared the following Project Narrative to identify existing and proposed site conditions associated with a 132-Unit Residential Complex, entitled Power Street Apartments, proposed at the intersection of Gano Street and Power Street in Providence, Rhode Island. The subject properties can be identified as Providence's Tax Assessor's Plat Map (AP) 14, Lots 272, 273, 296 and 576, with frontage on Gano Street and Power Street (Figure 1 – Locus Map).

The project scope includes construction of four (4), five-story apartment buildings each with an approximate building footprint of 6,510 – 6,520 sq. ft. The proposed buildings will be constructed with associated parking areas on the lower level, utility connections, green roofs for stormwater quality and landscaping improvements. Other site improvements include closing the three (3) existing driveways on Gano Street and providing a new driveway on Power Street to access the proposed development.

2 SITE LOCATION AND PHYSICAL DESCRIPTION

2.1 Existing Conditions

According to a February 2022 Class I Limited Content Boundary Survey performed by Ocean State Planners, Inc., the total area of the four (4) subject parcels is approximately 33,040 square feet (0.758 acres). The first lot, AP 14, Lot 272 formerly contained a three-story building (store and apartment building) and associated parking lot within 10,540 square feet. AP 14, Lot 273 is a 12,500 square foot parcel formerly containing two (2) one-story commercial buildings and associated parking area. AP 14, Lots 296 and 596 are each 5,000 square foot lots and consisted entirely of parking. All these existing structures have been recently razed and the pavement has been removed. The subject parcels are bound by AP 14, Lot 245, a commercial lot to the north (medical building), AP 14, Lot 566 containing Gano Park to the east, Power Street to the south, and Gano Street to the west, as shown in Figure 1 – Locus Map. The subject parcels are within the City of Providence's C-2, General Commercial District.

Figure 1 - Locus Map

NOT TO SCALE

2.2 Soil Classification

According to the *Web Soil Survey (WSS)* operated by the US Department of Agriculture Natural Resources Conservation Service (NRCS*)*, produced by the National Cooperative Soil Survey, the soils on site consist entirely of Udorthents-Urban land complex (UD). UD soils consist of human transported material.

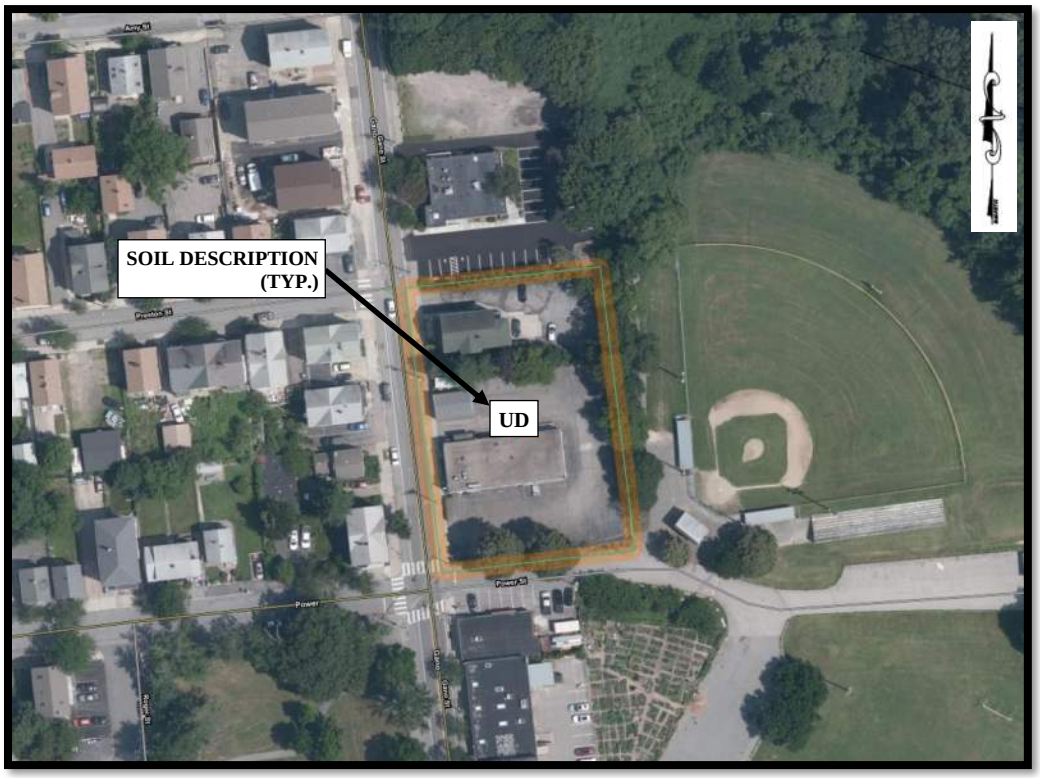


Figure 2 - Soils Map
NOT TO SCALE

2.3 Natural Resource Inventory

According to the Rhode Island Department of Environmental Management (RIDEM) Environmental Resource Mapping, there are no known wetlands, wetland buffers or natural watercourses on, or adjacent to, the subject parcel. In addition, the parcel is not located within a historic planning district, land conservation area or natural heritage area.

The project site lies within the Seekonk-River - Providence River Watershed (RI DEM Inventory #010900040901). Stormwater runoff from the site drains to the Seekonk River (RI0007019E-01) which has impairments for fecal coliform, total nitrogen. and dissolved oxygen. There are no Total Maximum Daily Loads (TMDLs) established at this time.

2.4 Recreational Resource Inventory

There are no known existing public, recreational or cultural resources within the subject site. The parcel is not located in a historic planning district, land conservation area or natural heritage area.

The project site lies adjacent to Gano Street Park, a local conservation land used for public recreation. There are no boat launches, lake, and/or stream access points, beaches, or water trails.

2.5 FEMA Flood Hazard

The site is located on the Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map for the City of Warwick, Rhode Island, Map Number 44007C0309K, effective date October 2, 2015. The subject parcel is located within Flood Zone X, which is defined as areas determined to be outside the 0.2% annual chance flood plain.

Figure 3 – FEMA Flood Insurance Rate Map (44007C0309K)
NOT TO SCALE

2.6 Zoning

According to the City of Providence Zoning Ordinance and Zoning Map, the subject parcels are currently zoned C-2, General Commercial Zoning District. This district is intended for intensive commercial uses and key commercial nodes, including larger retail establishments. The following are the current dimensional requirements for a residential use in the C-2 Zoning District:

Requirement	C-2 Zone
Minimum Lot Area	None
Minimum Building Height	16’
Minimum First Story Height	9’ Residential Use 11’ Non-Residential Use
Maximum Building Height	50’, Not to Exceed 4 Stories
Maximum Building Coverage	None
Total Maximum Impervious Surface Coverage	None
Minimum Front Setback	Build to zone of 0’ to 5’
Minimum Interior Side Setback	None, unless abutting residential district, then 10’
Minimum Corner Side Setback	Build to zone of 0’ to 5’
Minimum Rear Setback	None, unless abutting residential district, then 20’

2.7 Easements

According to the February 2022 Class I Limited Content Boundary Survey performed by Ocean State Planners, Inc., there are no known easements within the subject properties.

2.8 Utilities

Water: There is an 8-inch ductile iron water main within Gano Street. A 6-inch AC water main exists within Power Street. Water utilities in this area are owned and maintained by the Providence Water Supply Board.

Sewer: There is an existing 18-inch sanitary sewer main available within Gano Street, owned and maintained by City of Providence. A 42-inch brick combined sewer overflow (CSO) main exists within Power Street, which is owned and maintained by Narragansett Bay Commission (NBC).

Drainage: A dedicated 12-inch public drainage main existing within Gano Street. This drainage main continues in a southerly direction within Gano St., ultimately discharging to the Seekonk River via an outfall located at the end of East Transit St (Gano Park Boat Launch).

Gas: A 4-inch cast iron gas main lies within Gano Street. Gas services are owned and maintained by National Grid.

Electric/Communications/Gas: Electric and communication services are available to the subject site via overhead lines along Gano Street. Utility poles and electrical lines are owned and maintained by National Grid. Gas is also available throughout Gano Street.

3 PROPOSED SCOPE OF WORK

3.1 General

The proposed project includes the construction of four (4), five-story apartment buildings, each with an approximate footprint of 6,510 – 6,520 sq. ft., with associated parking areas on the lower level, utility connections, green roofs, and landscaping improvements. Other site improvements include closing the three (3) existing driveways on Gano Street and providing a new driveway on Power Street. Parking is accessed from Power Street with shared driving lanes via easements along the eastern property line and across common property lines. Pedestrian access for each building is available on Gano Street. Each building will contain an elevator and egress stairs, basement level utility rooms, parking access and bicycle parking, and a trash chute serving each floor.

The interior lot lines will be abandoned, and the four (4) parcels will be reconfigured. Parcel A will contain approximately 7,542 square feet and the building located at 153 Gano Street. This building will have 6,520 square foot footprint, contain 28 apartments with 13 parking spaces (1 ADA accessible) provided within the lower garage level. Parcel B will contain approximately 8,250 square feet and the building located at 157 Gano Street. This building will have a 6,510 square foot footprint, 34 apartments and 17 parking spaces (1 ADA) provided within the lower garage level. Parcel C will contain approximately 8,250 square feet and the building located at 161 Gano Street. This building will have a 6,510 square foot footprint, 35 apartments and 17 parking spaces (1 ADA) provided within the lower garage level. A green space area will be located within Parcels B and C. Parcel D will contain approximately 9,000 square feet and the building located at 165 Gano Street. This building will have a 6,510 square foot footprint, 35 apartments and 21 parking spaces (1 ADA) provided within the lower garage level. A private garden area will be located to north of this building.

Given the complex parking design located within the building's basement, a series of AutoTurn vehicle swept path analyses have been prepared and are included in Appendix A.

3.2 Utility Improvements

Fire Protection and Domestic Water: Each building will be serviced by a 2-inch domestic and 6-inch fire protection service tapped off the existing 8-inch ductile iron main within Gano Street. A fire hydrant exists at the intersection of Gano Street and Power Street, adjacent to the Gano Street Park. The proposed water design will require review and approval by the Providence Water Supply Board.

Sewer: The proposed buildings will each be serviced by new 6-inch PVC sewer services which will connect into the existing stubs associated with the 18-inch sewer main within Gano Street. The sewer design will require review and approval by the Narragansett Bay Commission (via an indirect connect permit) and by the City of Providence Engineering Division.

Drainage: The overall size of the proposed development requires the project comply with the City's Stormwater Ordinance. An Extensive GreenRoof system is proposed on each rooftop to achieve the required water quality volume prescribed by the City's Stormwater Ordinance. Excess rooftop runoff from the proposed buildings will be conveyed via roof drains to a series of underground drainage pipes that will connect directly to the existing 12-inch drainage main within Gano Street. The stormwater design and connection will require review and approval by the City of Providence Engineering Division. Given the size of the development, a permit is not required from the RI Department of Environmental Management. Additional drainage design details are provided in Section 4 below.

Gas: Gas services will be provided to the proposed buildings via connection to the existing main within Gano Street. The proposed gas connection will be coordinated with National Grid.

Electric/Communications: Proposed site improvements include coordination with National Grid to provide primary electric to service the proposed buildings. Two (2) electric transformers are proposed to service the proposed buildings.

3.3 Permit Requirements

3.3.1 City Plan Commission (CPC)

The proposed development is considering a Minor Land Development project and will need to be reviewed by the City Plan Commission. The project requires two (2) stages of review: (1) Preliminary Plan, and (2) Final Plan.

3.3.2 City of Providence Engineering Division & Traffic Division; City Forester

The proposed development will require review and approval from the City of Providence Engineering Division for the proposed sewer and stormwater connections. In addition, the development will require review and approval from the City of Providence Traffic Division. Coordination with the City Forester will be required regarding existing street trees.

3.3.3 Fire Department

The site will require review and approval from the City of Providence Fire Department.

3.3.4 Providence Water Supply Board

The proposed development will require approval from the Providence Water Supply Board for the proposed fire protection and domestic water service design.

3.3.5 Narragansett Bay Commission (NBC)

All effluent from the subject parcel is ultimately treated at the Fields Point Wastewater Facility, operated by the Narragansett Bay Commission (NBC). Accordingly, the proposed sewer service will require a Sewer Connection Permit from the Narragansett Bay Commission.

4 STORMWATER MANAGEMENT

The proposed development is subject to the requirements of the City's Post-Construction Stormwater Control Ordinance, which references the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM), implemented in December 2010, amended March 2015, by both the Rhode Island Department of Environmental Management (RIDEM) and the Rhode Island Coastal Resources Management Council (CRMC). As the site currently lies, there is no stormwater management system servicing the site. In general, stormwater runoff from the site sheet flows to Power Street and the adjacent Gano Park to the south and east.

Under typical conditions, the site's proposed stormwater management system would be designed to generally mimic existing conditions – discharging stormwater to the same design point as existing conditions; or Power Street and the adjacent Gano Park. However, based on conversations with City staff, we understand that this scenario is not desirable due to existing high groundwater tables and flooding within the Park. Accordingly, the City recommended that the Applicant provide water quality appurtenances within the project site, and excess stormwater may be discharged directly to the dedicated storm main within Gano Street.

The stormwater management design adheres to all City of Providence standards and provides attenuation of peak stormwater runoff rates and total stormwater runoff volumes for the 1-, 2-, 10, 25- and 100-year storm events while improving the quality of stormwater leaving the site. The proposed Stormwater Management Plan improves the overall quality of stormwater leaving the site by using Best Management Practices (BMPs) including four (4) separate green roof systems.

4.1 Green Roof

The pre-existing condition of the site included 100 percent impervious surface coverage via a combination of buildings and paved parking areas. The proposed condition improves on this by providing two landscape strips; one along the northern property line and one between the second the third buildings. These landscape strips inherently provide some level of water quality; however, the primary water quality appurtenance is proposed to be a green roof system. Each building will be provided with a partial green roof system, designed to provide ¼ of the total water quality volume required by the proposed development. Once the initial water quality volume is captured within the green roof system, excess stormwater runoff will be captured via traditional roof scuppers and downspouts, and hard piped into the stormwater main within Gano Street.

The green roof system is proposed to consist of LiveRoof Deep Modules, which includes a soil depth of approximately 6-inches. The LiveRoof Deep Module system is primarily used for biodiversity, prairies and garden-like perennial plantings. It also allows for food growing and shade planting, on roofs that are too shady for succulent plants. The Deep System is excellent for saving energy and is a good option for storm water management. Because it can support a broad array of plants, it can provide habitat and food for pollinators such as butterflies and honeybees and various bird species. Plantings can be random and naturalistic as well as patterned.

The type of plants used in the Deep System include a full array of low to tall growing Sedums, hundreds of different fibrous rooted herbaceous perennials, including native forbs, sedges, grasses and edible plants. Foliage colors can vary widely; green, yellow, red, purple and blue are possible, and flowers of any color and shape are found within the broad palette of plants capable of growing in its 6 inch soil profile.

Based on the RISDM, the site is considered a redevelopment, therefore all impervious areas must be treated for 50% of the required water quality volume. Calculations were completed in accordance with Section 3.3.3 of the RISDM using the following formula:

$$WQ_v = (1") (I) /12 \text{ in/ft}$$

Therefore, the required water quality volume for the site is as follows:

$$WQ_v \text{ Req.} = (1") (29{,}570 \text{ SF}) /12 \text{ in/ft} * 50\% = 1{,}232 \text{ CF}$$

As noted above, each LiveRoof Deep Module consists of a 6-inch-thick soil layer, therefore each building will be outfitted with a 1,875 sq. ft. LiveRoof area. The resulting total water quality volume is calculated as follows:

$$WQ_v \text{ Prov.} = (1{,}875 \text{ sq. ft.})(6")(33\% \text{ void space}) * 4 \text{ buildings} = 1{,}238 \text{ CF}$$

4.2 Drainage Analysis

The comparative pre- versus post-development hydrologic analysis was performed using the Soil Conservation Service, Technical Release 20 and 55 (TR-20 and TR-55) methodology. The 1-, 2-, 10-, 25-, and 100-year storm events were modeled for a 24-hour, Type III storm utilizing HydroCAD version 10.00. HydroCAD modeling reports for the existing and proposed conditions can be found in Appendices C and E, respectively.

As shown in the following sections, the proposed stormwater management system has been designed to attenuate peak stormwater runoff rates and reduce stormwater volumes leaving the site for the 1-, 2-, 10-, 25- and 100-year design storm events.

4.2.1 Existing Conditions

The existing site consists of one (1) watershed discharging to one (1) off-site design point further described as the Seekonk River (DP1). The site was previously comprised of four (4) lots containing a combination of residential and commercial buildings with associated parking areas. Under existing conditions, stormwater runoff from the site sheet flows towards the south and east towards Gano Park and ultimately the Seekonk River. An Existing Conditions Watershed Map is included in Appendix B.

Design Point 1 – Seekonk River

Watershed 1: Consists of 61,793 sq. ft. of area consisting of a combination of impervious building and parking areas, and minimal landscaped areas from the adjacent Gano Park. Accordingly, this watershed area has been assigned a minimum time of concentration (T_C) of 6 minutes and a composite Runoff Number (CN) of 94. Runoff from this area sheet flows to Gano Park and ultimately the Seekonk River (Design Point 1).

4.2.2 Proposed Conditions

As described elsewhere in this report, typically proposed conditions will be designed to mimic existing conditions. However, based on conversations with City staff, we understand that this scenario is not desirable due to existing high groundwater tables and flooding within the Park. Accordingly, the City recommended that the Applicant provide water quality appurtenances within the project site, and excess stormwater may be discharged directly to the dedicated storm main within Gano Street. The dedicated storm main discharges to the Seekonk River (Design Point 1). These conditions are shown in detail on the Proposed Conditions Watershed Map included in Appendix D.

Design Point 1 – Seekonk River

Subwatershed 1A: This Subwatershed remains unchanged under proposed conditions consisting of the existing offsite development to the north of the subject parcels. This Subwatershed area contains approximately 11,336 sq. ft. of primarily impervious rooftop and paved areas and therefore has been assigned a minimum T_C of 6 minutes and a CN of 74. Runoff from this area sheet flows to Gano Park and ultimately the Seekonk River (Design Point 1).

Subwatershed 1B: This Subwatershed area consists of the LiveRoof (green roof) Module area, consisting of approximately 7,500 sq. ft. of rooftop area. Based on the RISDISM, this Subwatershed area has been assigned a minimum T_C of 6 minutes and a composite CN Runoff Number of 85 (per Table 5-6 of the RISDISM for a 6-inch growing media thickness). The proposed rooftop area is conveyed via roof drains directly to the existing public drainage system within Gano Street which ultimately discharges to the Seekonk River (Design Point 1).

Subwatershed 1C: Consists of 24,457 sq. ft. area containing all surfaces outside of the building footprints, including the landscaped areas, transformer pads and associated screening areas, and ground floor paved areas. Accordingly, this Subwatershed area has been assigned a Tc of 10.8 minutes and a CN of 80. Stormwater runoff from this Subwatershed area sheet flows to Gano Park and ultimately the Seekonk River (Design Point 1).

Subwatershed 1D: This Subwatershed area consists of the remainder of the standard rooftop area (outside of the green roof footprints), consisting of approximately 18,500 sq. ft. of rooftop area. This Subwatershed area has been assigned a minimum T_C of 6 minutes and a composite CN Runoff Number of 98. The proposed rooftop area is conveyed via roof drains directly to the existing public drainage system within Gano Street which ultimately discharges to the Seekonk River (Design Point 1).

4.2.3 Results

A runoff analysis of the pre- and post-construction conditions was completed using the TR-20 methodology and is summarized in Table 1 below. Supporting calculations for the pre- and post-construction conditions are included in Appendices C and E respectively.

Table 1: Watershed Data

	Area (SF)	**CN**	**Tc (min.)**
Existing Conditions			
Watershed 1	61,793	94	6.0
Existing Total	**61,793**	**94**	**--**
Proposed Conditions			
Subwatershed 1A	11,336	97	6.0
Subwatershed 1B	7,500	85	6.0
Subwatershed 1C	24,457	80	10.8
Subwatershed 1D	18,500	98	6.0
Proposed Total	**61,793**	**89**	**--**
Delta (∆)	***0***	***-5***	**--**

Note: Minimum Tc = 6 minutes.

As shown in Table 1 above, the overall watershed area remains unchanged when comparing existing to proposed conditions. However, due to the implementation of increased pervious landscaped areas and the green roof water quality system within the proposed site, the CN value has decreased.

Table 2: Stormwater Runoff Discharge

	Peak Discharge (cfs) to Design Point				
	1-Year	2-Year	10-Year	25-Year	100-Year
Existing DP #1	3.25	4.10	6.37	8.05	11.65
Proposed DP #1	2.19	2.82	4.56	5.89	10.05
ΔQ	-1.06	-1.28	-1.81	-2.16	-1.60

As shown in Table 2, the peak stormwater runoff rates realized at Design Point 1 (Seekonk River) have been reduced for all design storm events.

Table 3: Stormwater Total Runoff Volume

	Total Runoff Volume (cf) to Design Point				
	1-yr	2-yr	10-yr	25-yr	100-yr
Existing DP #1	10,613	13,599	21,676	27,785	41,083
Proposed DP #1	8,137	10,536	18,087	23,921	36,875
ΔV	-2,476	-3,063	-3,589	-3,864	-4,208

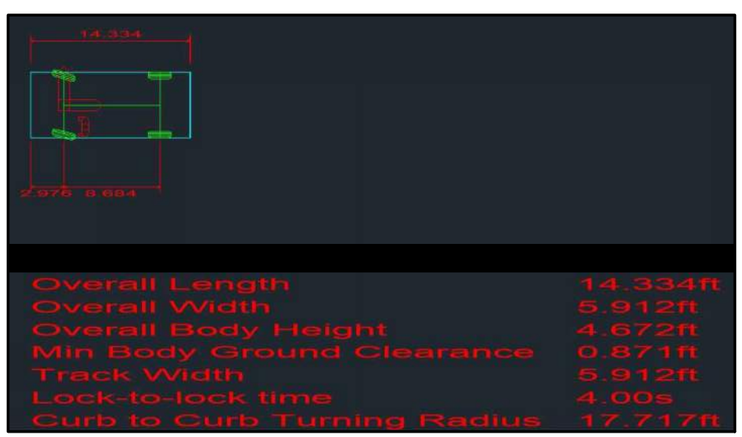
As shown in Tables 2 and 3, the peak stormwater runoff rates and total volume of stormwater being conveyed through Design Point 1 has been reduced for all design storm events via the implementation of additional pervious landscaped areas and the LiveRoof Modules. This will reduce the overall impact on the Gano Park and ultimately improve the quality of stormwater runoff being routed to the Seekonk River.

5 CONCLUSIONS

As shown above, the proposed improvements have been designed to minimize impacts of the proposed site development by attenuating peak stormwater runoff rates and volumes for the 1-, 2-, 10-, 25-, and 100-year design storm events. The stormwater management system design results in decreases in peak stormwater flows and total runoff volumes to Gano Park and ultimately the Seekonk River. The proposed site's stormwater BMP (LiveRoof Modules) has been designed to provide the required water quality in accordance with the City's Post-Construction Stormwater Management Ordinance. The result is a significant improvement in the quality of stormwater leaving the site and a reduction in stormwater runoff rates and volumes to Gano Park and the Seekonk River.

Appendix A

AutoTurn Vehicle Swept Path Analysis



SCALE (FEET)

0 10 20 40 80

1 INCH = 20 FT

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PROPOSED RESIDENTIAL DEVELOPMENT
157, 159 & 165 GANO ST., 2 POWER STREET
PROVIDENCE, RHODE ISLAND
AP 14, LOTS 272, 273, 296 & 576

REVISIONS:

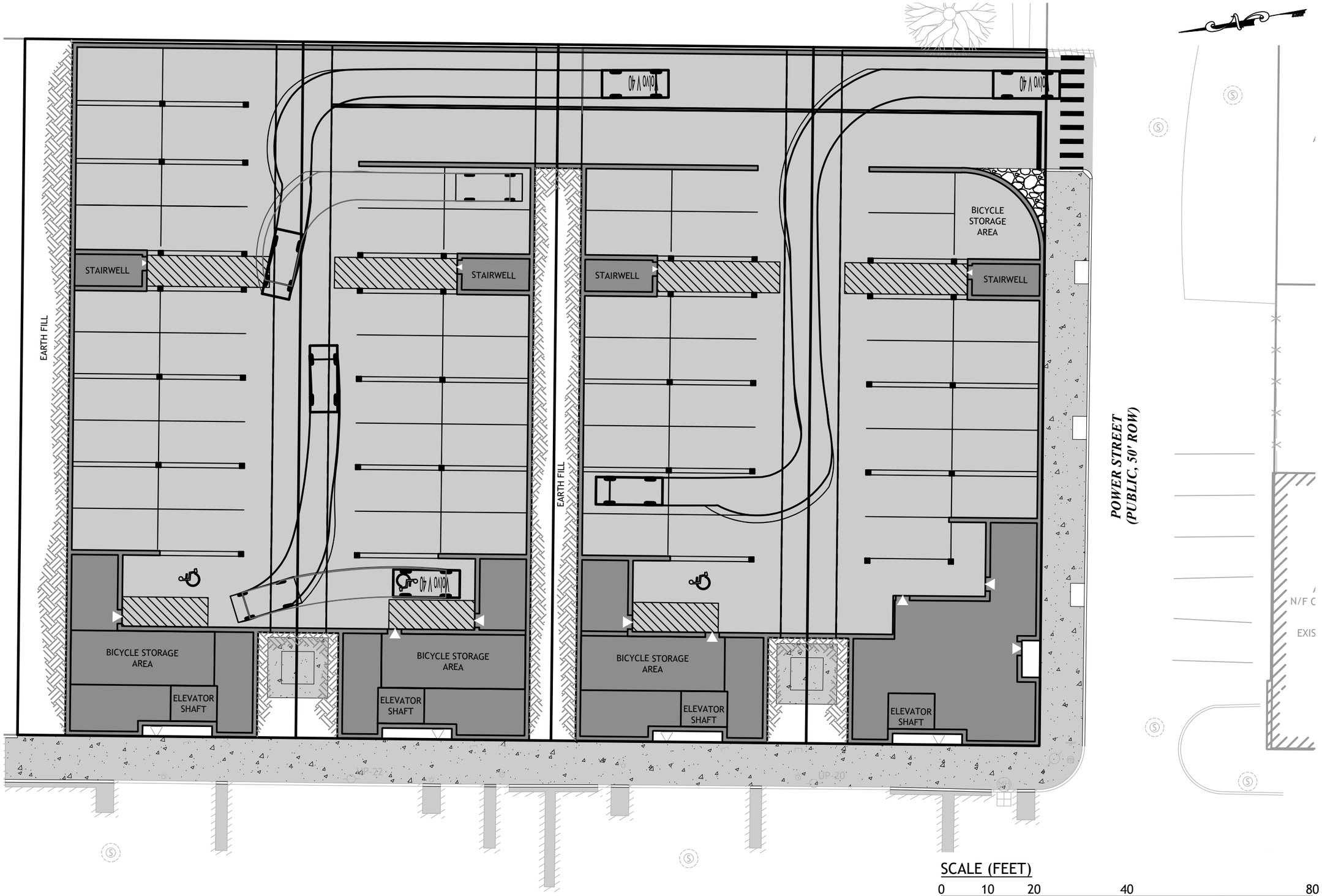
NO.	DATE.	DESCRIPTION

DESIGNED BY:	DRD
DRAWN BY:	DRD
CHECKED BY:	JAC
DATE:	MAY 2022
PROJECT NO:	21-80

PRELIMINARY, NOT FOR CONSTRUCTION

AUTOTURN VEHICLE SWEPT PATH ANALYSIS

SHEET 1 OF 2



SCALE (FEET)

0 10 20 40 80

1 INCH = 20 FT

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DRAWN BY:	DRD
CHECKED BY:	JAC
DATE:	MAY 2022
PROJECT NO:	21-80

PRELIMINARY, NOT FOR CONSTRUCTION

AUTOTURN VEHICLE SWEPT PATH ANALYSIS

SHEET 2 OF 2

Appendix B

Existing Condition Watershed Map

LEGEND

WATERSHED BOUNDARY LINE
TIME OF CONCENTRATION LINE
UNDERGROUND TIME OF CONCENTRATION LINE

GANO STREET

POWER STREET

TIME OF CONCENTRATION LINE (TYP.)

PROPERTY LINE (TYP.)

EXISTING CONCRETE BLEACHERS

WATERSHED 1
AREA = 61,793 SF
TC = 6.0 MIN.
CN = 94

DP1

42 40 38 36 34 32 30 28 26 24 22 20 22

SCALE (FEET)
0 25 50 100 200
1 INCH = 50 FT

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PROPOSED RESIDENTIAL DEVELOPMENT
B157, 159 & 165 GANO STREET AND 256 POWER STREET
PROVIDENCE, RHODE ISLAND
AP 14, LOTS 272,296 & 576

REVISIONS:

NO.	DATE.	DESCRIPTION

DESIGNED BY:	SD
DRAWN BY:	SD
CHECKED BY:	JAC
DATE:	MARCH 2022
PROJECT NO:	21-80

STORMWATER REPORT

EXISTING CONDITIONS WATERSHED MAP

SHEET 1 OF 1

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DESIGNED BY:	SD
DRAWN BY:	SD
CHECKED BY:	JAC
DATE:	MARCH 2022
PROJECT NO:	21-80

STORMWATER REPORT

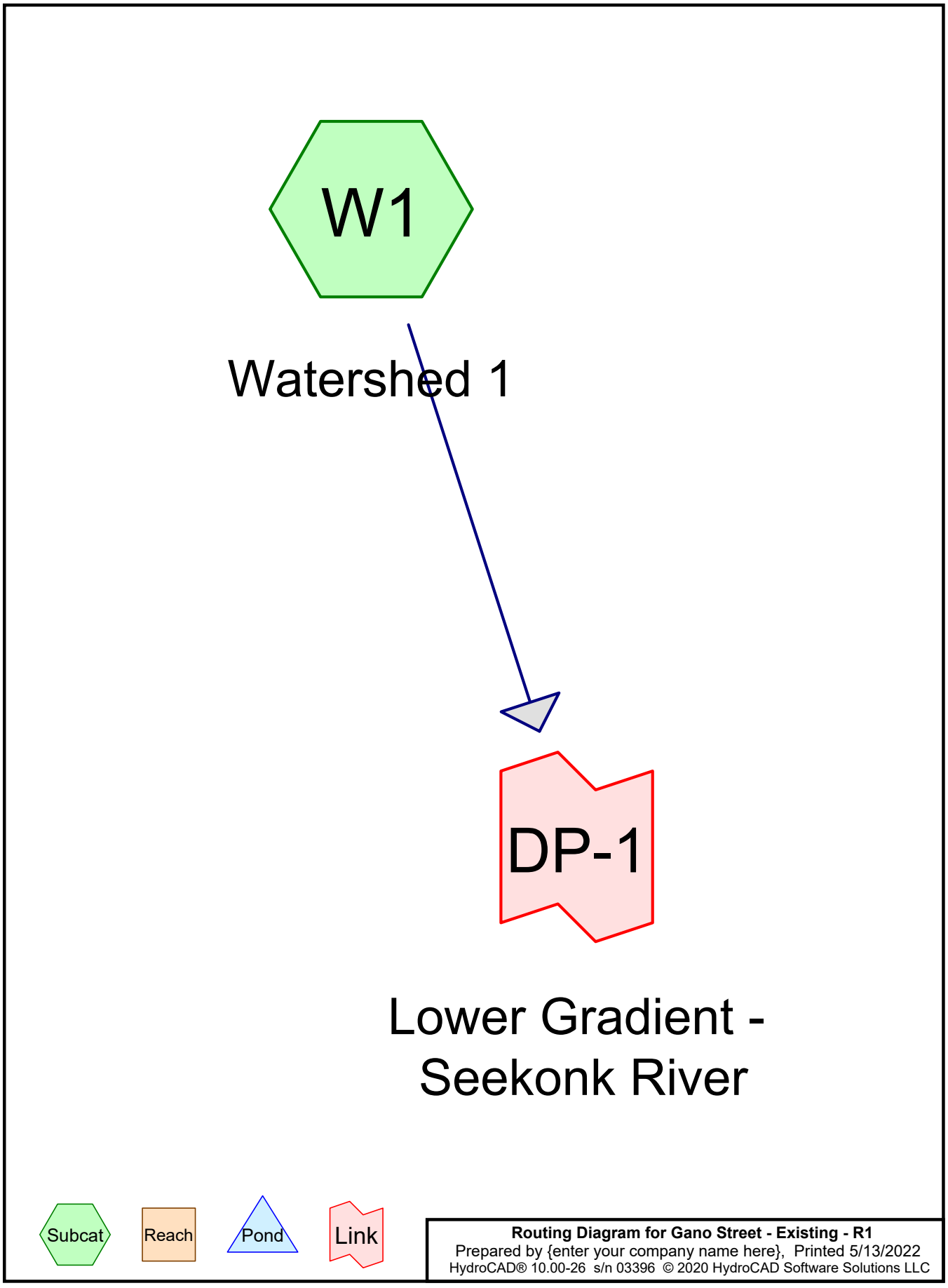
EXISTING CONDITIONS OVERALL WATERSHED MAP

SHEET 1 OF 1

Q:\21-80 Bahman Jalili\Drainage\Watershed Maps\Gano & Power Street [Overall Watershed Plan - OUTFALL].dwg Mar. 22, 2022 3:48pm

Appendix C

Existing Condition HydroCAD Calculations



Routing Diagram for Gano Street - Existing - R1
Prepared by {enter your company name here}, Printed 5/13/2022

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
10,321	74	>75% Grass cover, Good, HSG C (W1)
3,200	98	Concrete Bleachers, HSG C (W1)
48,272	98	Roofs & Parking Lot, HSG C (W1)
61,793	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
61,793	HSG C	W1
0	HSG D	
0	Other	
61,793		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	0	10,321	0	0	10,321	>75% Grass cover, Good	
0	0	3,200	0	0	3,200	Concrete Bleachers	
0	0	48,272	0	0	48,272	Roofs & Parking Lot	
0	**0**	**61,793**	**0**	**0**	**61,793**	**TOTAL AREA**	

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1: Watershed 1 Runoff Area=61,793 sf 83.30% Impervious Runoff Depth=2.06"
Flow Length=396' Tc=6.0 min CN=94 Runoff=3.25 cfs 10,613 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=3.25 cfs 10,613 cf
Primary=3.25 cfs 10,613 cf

Total Runoff Area = 61,793 sf Runoff Volume = 10,613 cf Average Runoff Depth = 2.06"
16.70% Pervious = 10,321 sf 83.30% Impervious = 51,472 sf

Summary for Subcatchment W1: Watershed 1

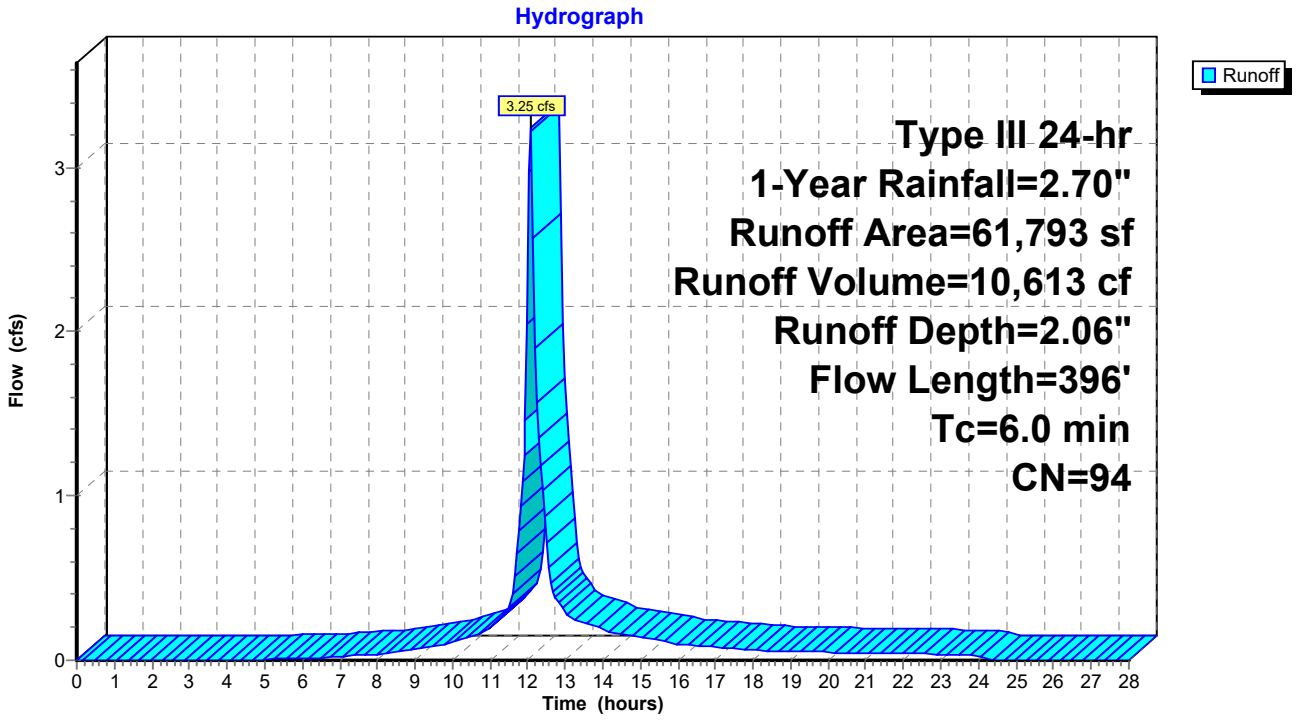
Runoff = 3.25 cfs @ 12.09 hrs, Volume= 10,613 cf, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	48,272	98	Roofs & Parking Lot, HSG C
	10,321	74	>75% Grass cover, Good, HSG C
*	3,200	98	Concrete Bleachers, HSG C
	61,793	94	Weighted Average
	10,321	74	16.70% Pervious Area
	51,472	98	83.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
1.2	296	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
2.2	396	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1: Watershed 1

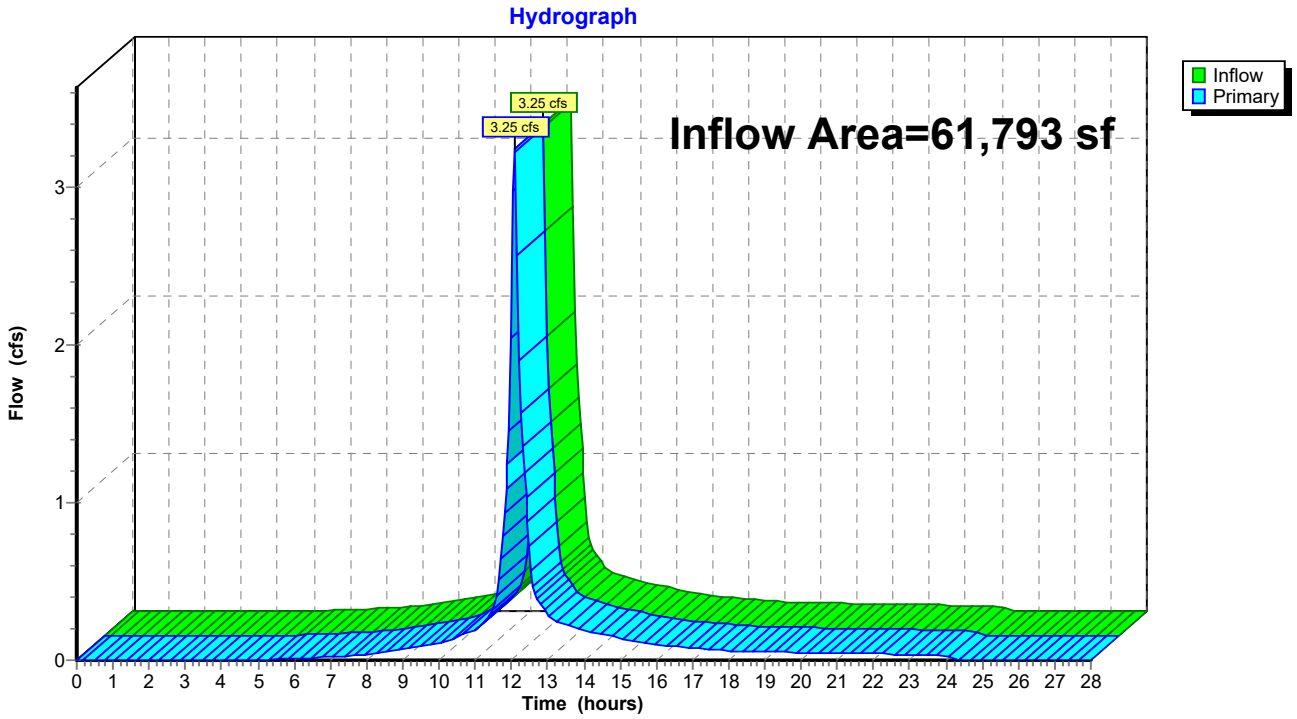


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 83.30% Impervious, Inflow Depth = 2.06" for 1-Year event
Inflow = 3.25 cfs @ 12.09 hrs, Volume= 10,613 cf
Primary = 3.25 cfs @ 12.09 hrs, Volume= 10,613 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1: Watershed 1 Runoff Area=61,793 sf 83.30% Impervious Runoff Depth=2.64"
Flow Length=396' Tc=6.0 min CN=94 Runoff=4.10 cfs 13,599 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=4.10 cfs 13,599 cf
Primary=4.10 cfs 13,599 cf

Total Runoff Area = 61,793 sf Runoff Volume = 13,599 cf Average Runoff Depth = 2.64"
16.70% Pervious = 10,321 sf 83.30% Impervious = 51,472 sf

Summary for Subcatchment W1: Watershed 1

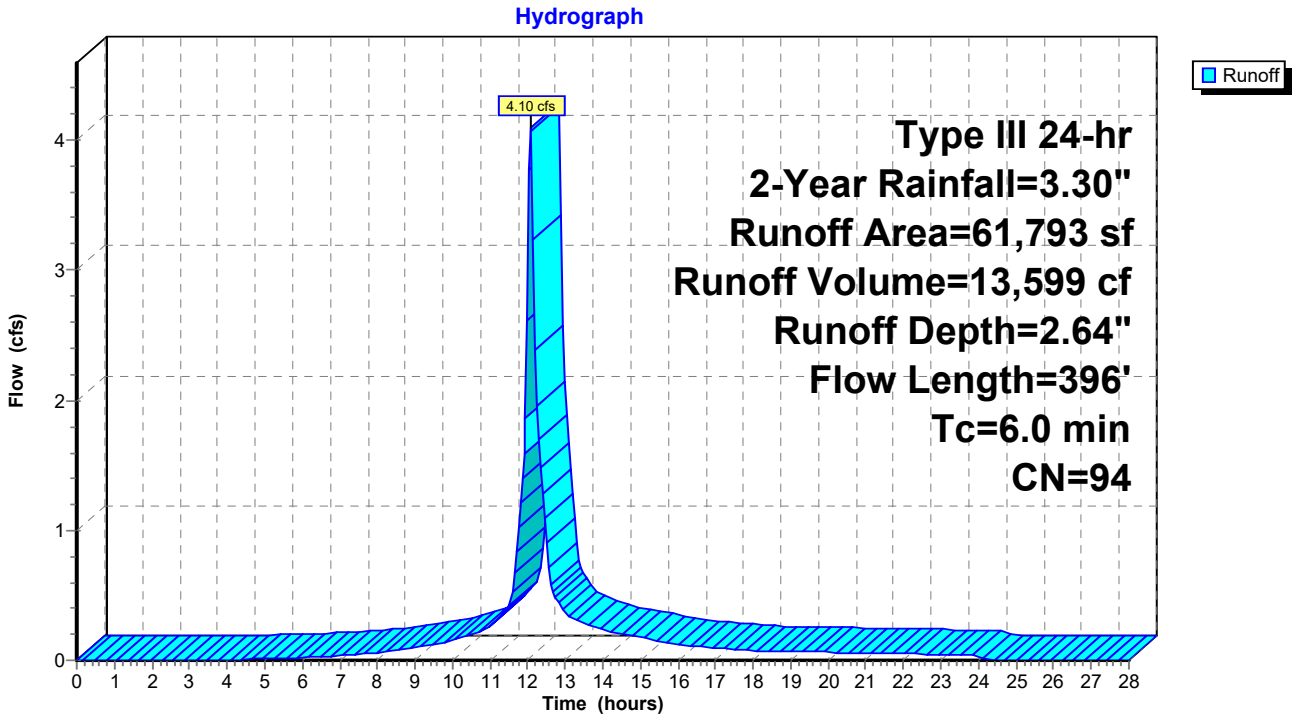
Runoff = 4.10 cfs @ 12.09 hrs, Volume= 13,599 cf, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
*	48,272	98	Roofs & Parking Lot, HSG C
	10,321	74	>75% Grass cover, Good, HSG C
*	3,200	98	Concrete Bleachers, HSG C
	61,793	94	Weighted Average
	10,321	74	16.70% Pervious Area
	51,472	98	83.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
1.2	296	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
2.2	396	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1: Watershed 1

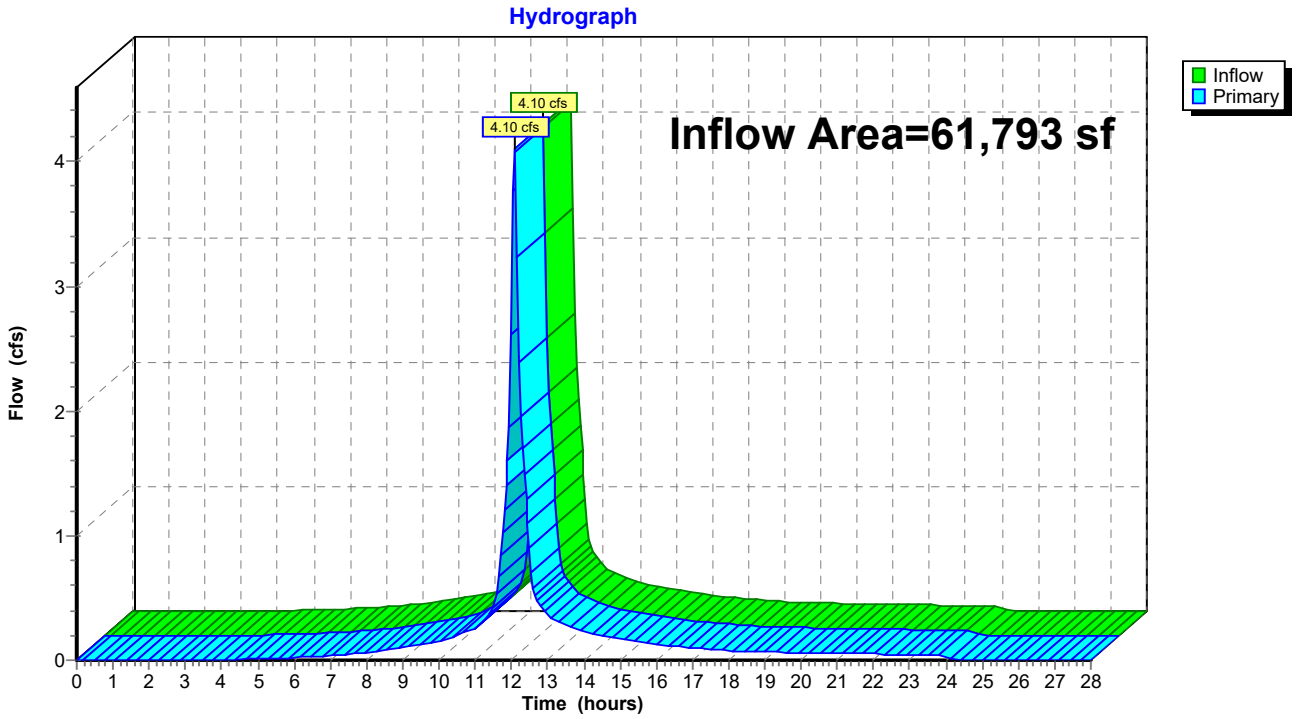


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 83.30% Impervious, Inflow Depth = 2.64" for 2-Year event
Inflow = 4.10 cfs @ 12.09 hrs, Volume= 13,599 cf
Primary = 4.10 cfs @ 12.09 hrs, Volume= 13,599 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1: Watershed 1 Runoff Area=61,793 sf 83.30% Impervious Runoff Depth=4.21"
Flow Length=396' Tc=6.0 min CN=94 Runoff=6.37 cfs 21,676 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=6.37 cfs 21,676 cf
Primary=6.37 cfs 21,676 cf

Total Runoff Area = 61,793 sf Runoff Volume = 21,676 cf Average Runoff Depth = 4.21"
16.70% Pervious = 10,321 sf 83.30% Impervious = 51,472 sf

Summary for Subcatchment W1: Watershed 1

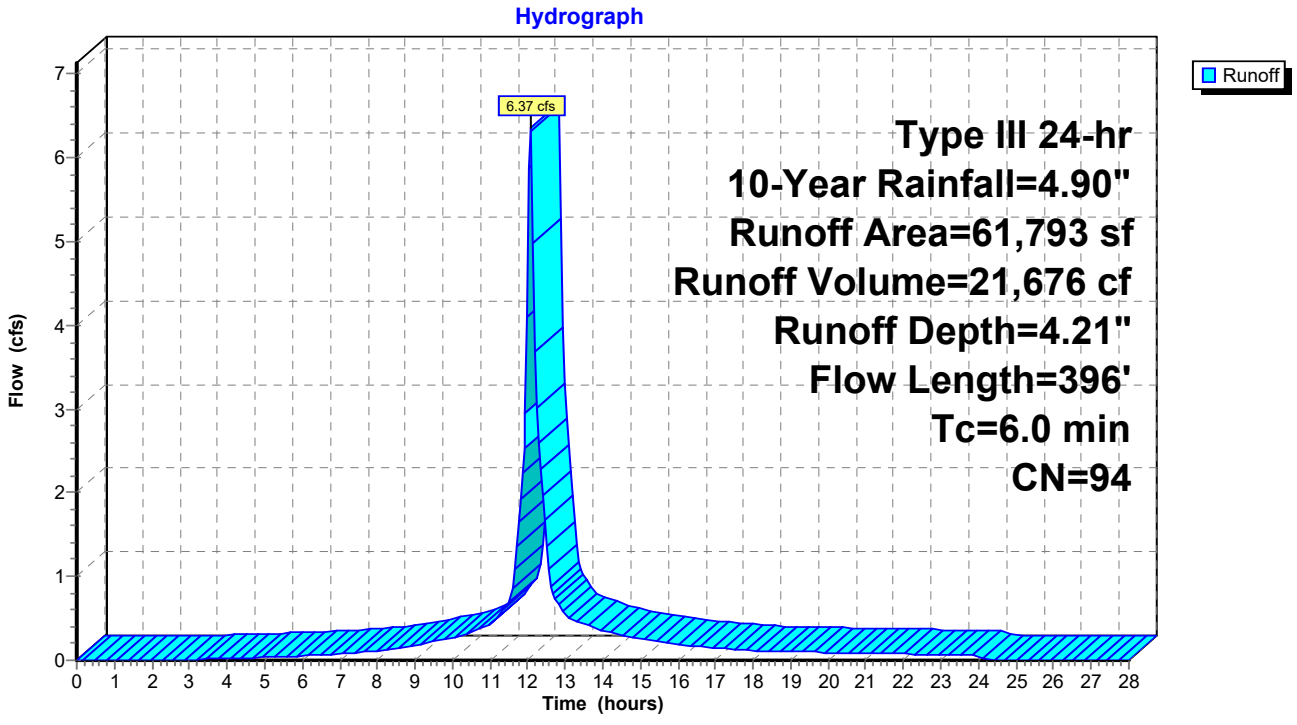
Runoff = 6.37 cfs @ 12.09 hrs, Volume= 21,676 cf, Depth= 4.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	48,272	98	Roofs & Parking Lot, HSG C
	10,321	74	>75% Grass cover, Good, HSG C
*	3,200	98	Concrete Bleachers, HSG C
	61,793	94	Weighted Average
	10,321	74	16.70% Pervious Area
	51,472	98	83.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
1.2	296	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
2.2	396	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1: Watershed 1

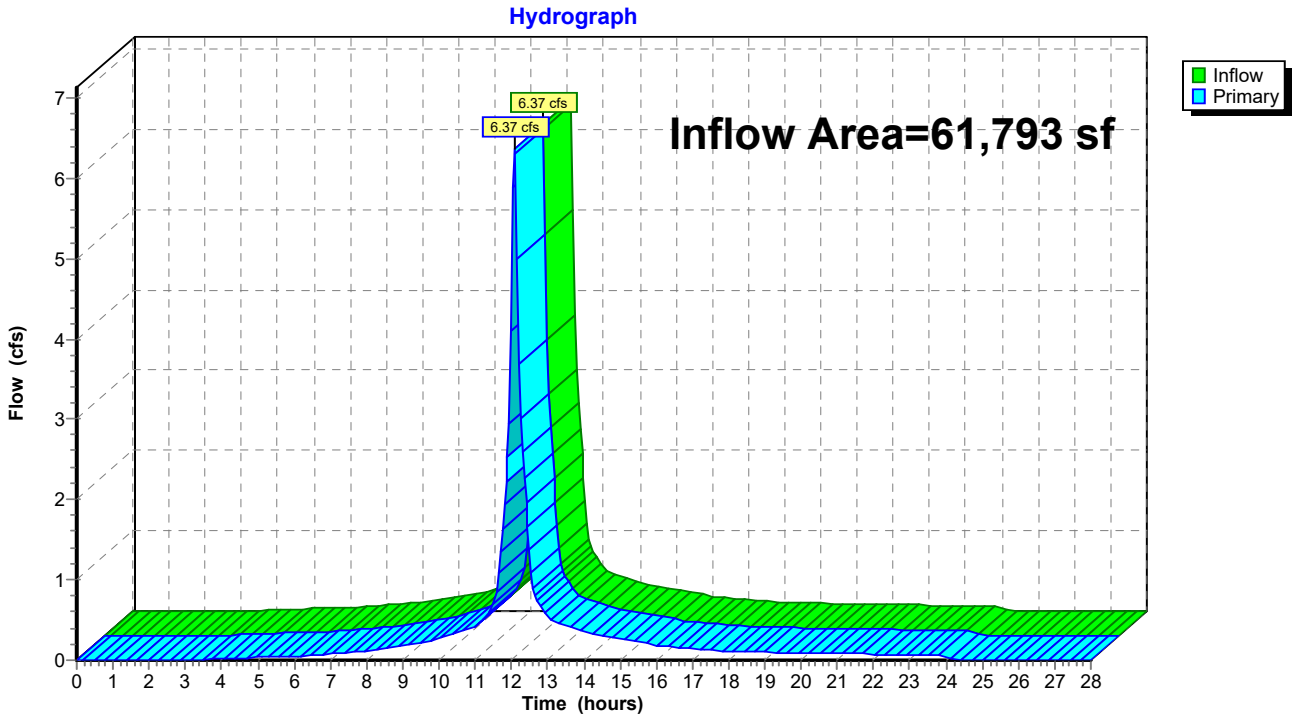


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 83.30% Impervious, Inflow Depth = 4.21" for 10-Year event
Inflow = 6.37 cfs @ 12.09 hrs, Volume= 21,676 cf
Primary = 6.37 cfs @ 12.09 hrs, Volume= 21,676 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1: Watershed 1 Runoff Area=61,793 sf 83.30% Impervious Runoff Depth=5.40"
Flow Length=396' Tc=6.0 min CN=94 Runoff=8.05 cfs 27,785 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=8.05 cfs 27,785 cf
Primary=8.05 cfs 27,785 cf

Total Runoff Area = 61,793 sf Runoff Volume = 27,785 cf Average Runoff Depth = 5.40"
16.70% Pervious = 10,321 sf 83.30% Impervious = 51,472 sf

Summary for Subcatchment W1: Watershed 1

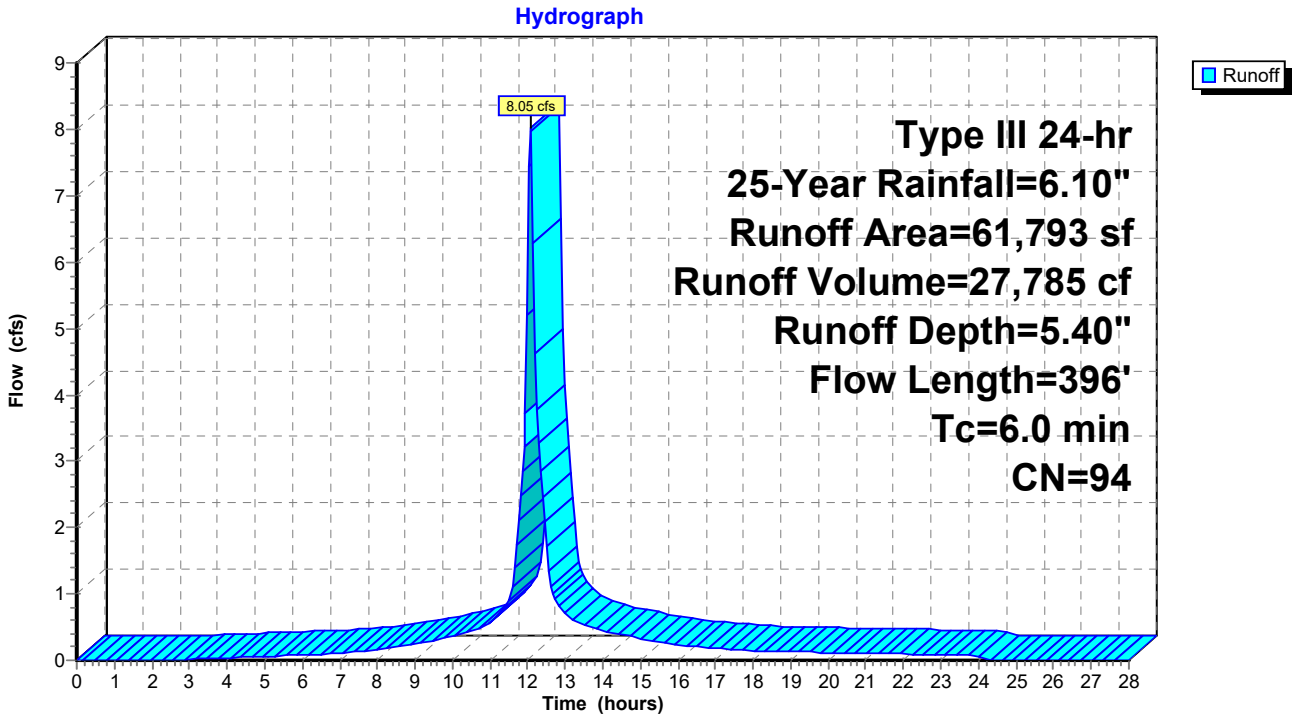
Runoff = 8.05 cfs @ 12.09 hrs, Volume= 27,785 cf, Depth= 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

	Area (sf)	CN	Description
*	48,272	98	Roofs & Parking Lot, HSG C
	10,321	74	>75% Grass cover, Good, HSG C
*	3,200	98	Concrete Bleachers, HSG C
	61,793	94	Weighted Average
	10,321	74	16.70% Pervious Area
	51,472	98	83.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
1.2	296	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
2.2	396	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1: Watershed 1

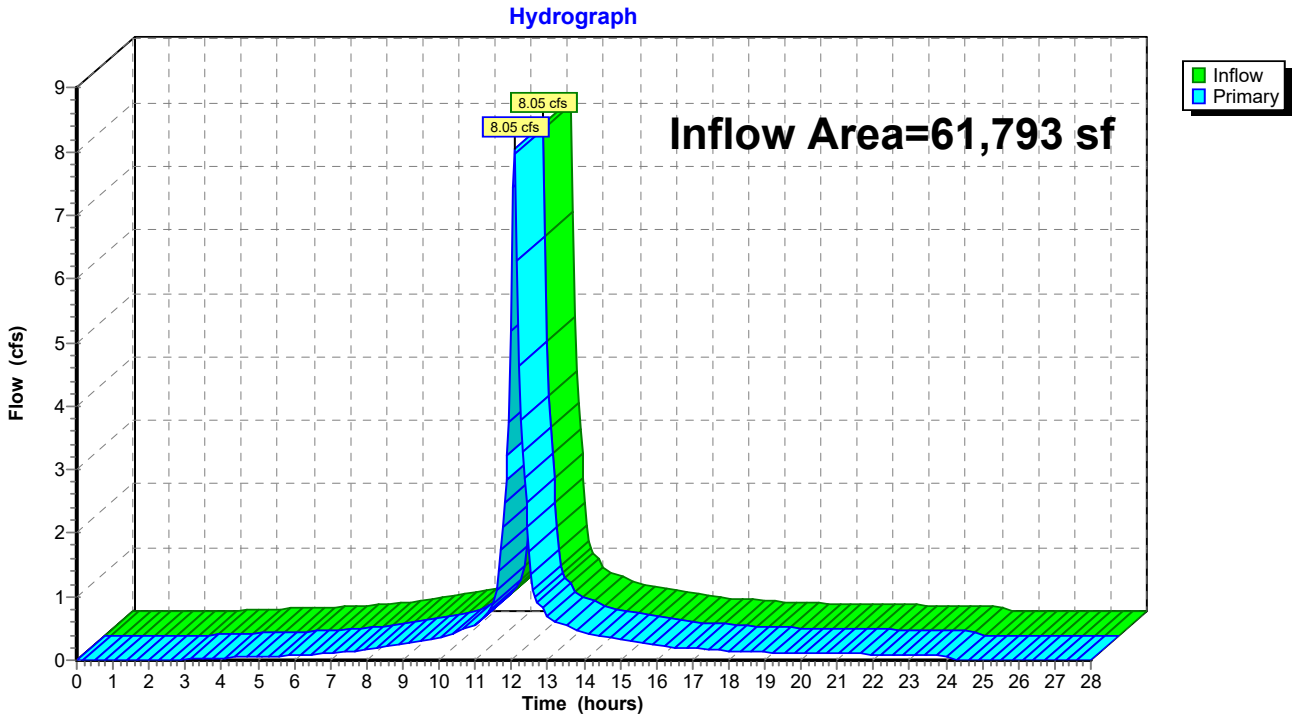


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 83.30% Impervious, Inflow Depth = 5.40" for 25-Year event
Inflow = 8.05 cfs @ 12.09 hrs, Volume= 27,785 cf
Primary = 8.05 cfs @ 12.09 hrs, Volume= 27,785 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1: Watershed 1 Runoff Area=61,793 sf 83.30% Impervious Runoff Depth=7.98"
Flow Length=396' Tc=6.0 min CN=94 Runoff=11.65 cfs 41,083 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=11.65 cfs 41,083 cf
Primary=11.65 cfs 41,083 cf

Total Runoff Area = 61,793 sf Runoff Volume = 41,083 cf Average Runoff Depth = 7.98"
16.70% Pervious = 10,321 sf 83.30% Impervious = 51,472 sf

Summary for Subcatchment W1: Watershed 1

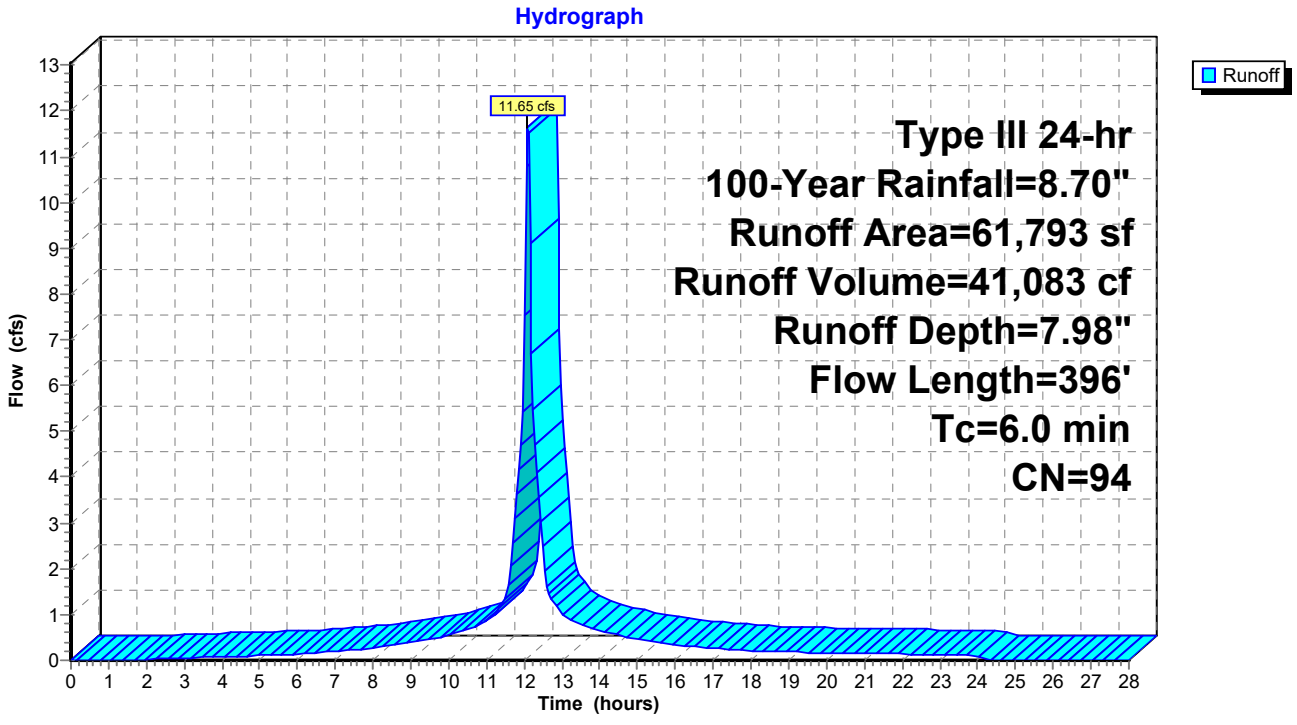
Runoff = 11.65 cfs @ 12.09 hrs, Volume= 41,083 cf, Depth= 7.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	48,272	98	Roofs & Parking Lot, HSG C
	10,321	74	>75% Grass cover, Good, HSG C
*	3,200	98	Concrete Bleachers, HSG C
	61,793	94	Weighted Average
	10,321	74	16.70% Pervious Area
	51,472	98	83.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
1.2	296	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
2.2	396	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1: Watershed 1

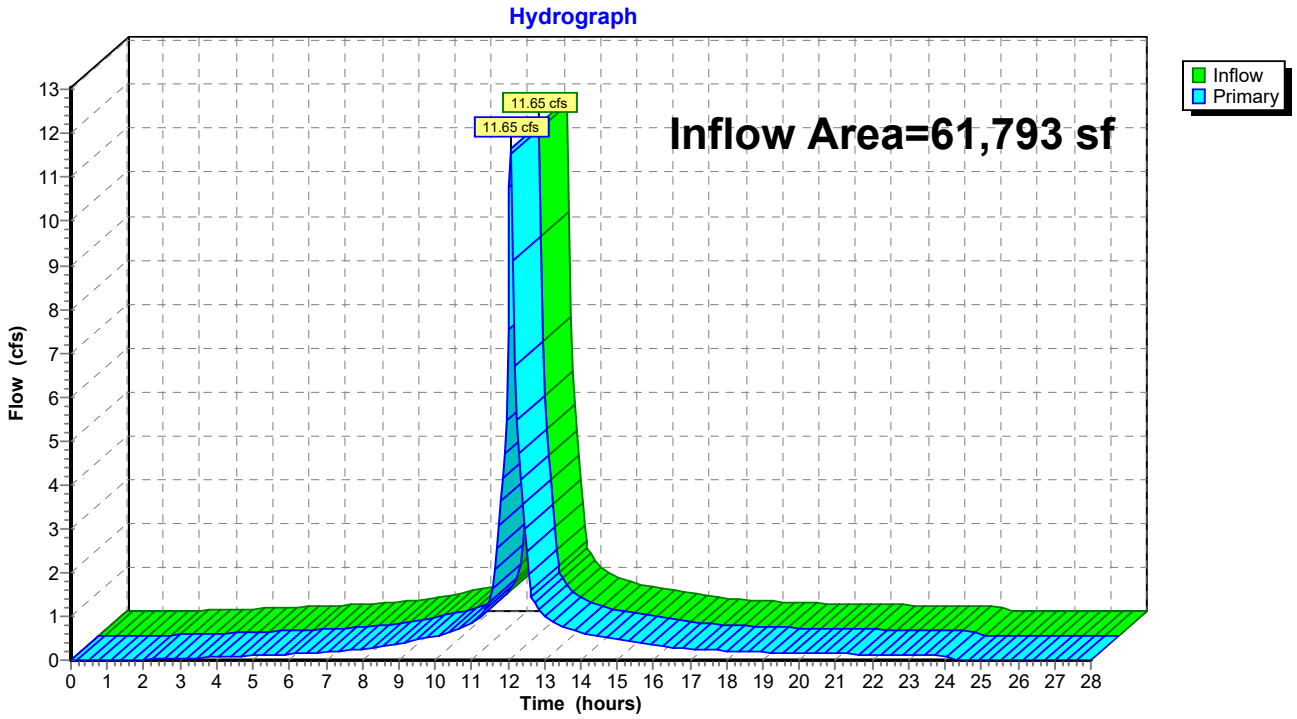


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 83.30% Impervious, Inflow Depth = 7.98" for 100-Year event
Inflow = 11.65 cfs @ 12.09 hrs, Volume= 41,083 cf
Primary = 11.65 cfs @ 12.09 hrs, Volume= 41,083 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1: Watershed 1 Runoff Area=61,793 sf 83.30% Impervious Runoff Depth=0.67"
Flow Length=396' Tc=6.0 min CN=94 Runoff=1.10 cfs 3,462 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=1.10 cfs 3,462 cf
Primary=1.10 cfs 3,462 cf

Total Runoff Area = 61,793 sf Runoff Volume = 3,462 cf Average Runoff Depth = 0.67"
16.70% Pervious = 10,321 sf 83.30% Impervious = 51,472 sf

Summary for Subcatchment W1: Watershed 1

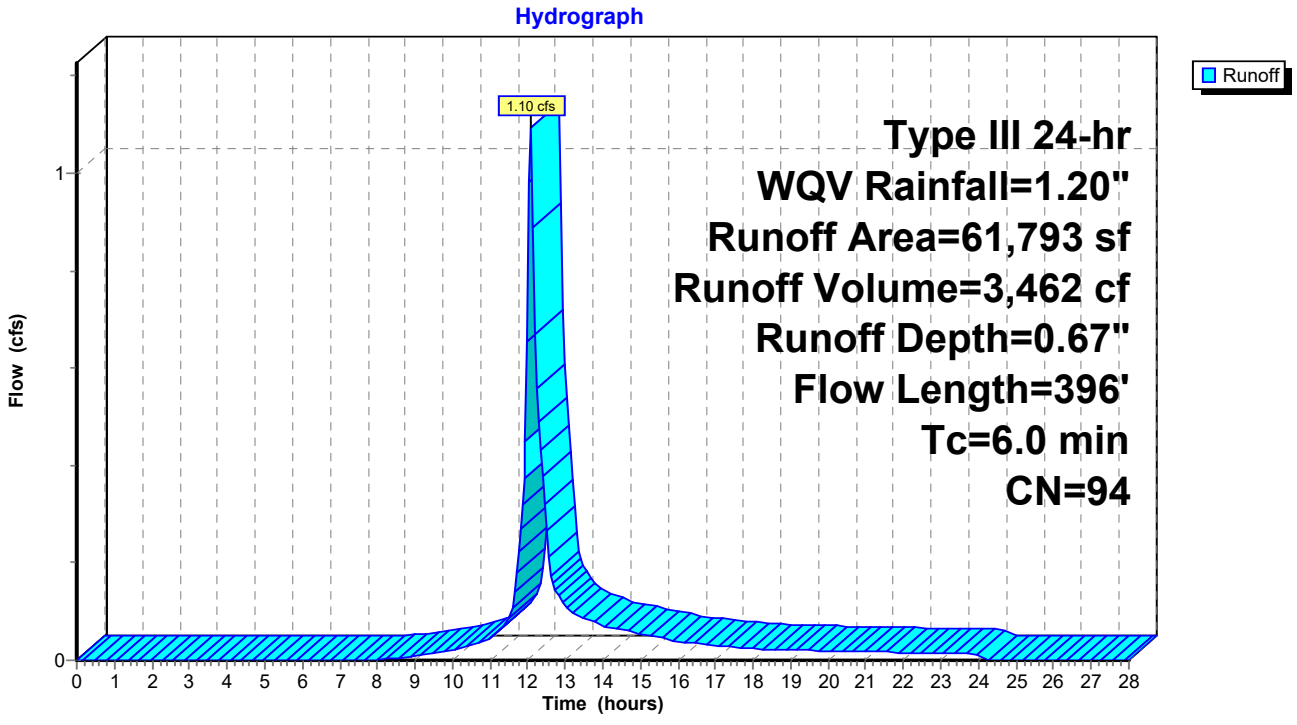
Runoff = 1.10 cfs @ 12.09 hrs, Volume= 3,462 cf, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
*	48,272	98	Roofs & Parking Lot, HSG C
	10,321	74	>75% Grass cover, Good, HSG C
*	3,200	98	Concrete Bleachers, HSG C
	61,793	94	Weighted Average
	10,321	74	16.70% Pervious Area
	51,472	98	83.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
1.2	296	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
2.2	396	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1: Watershed 1

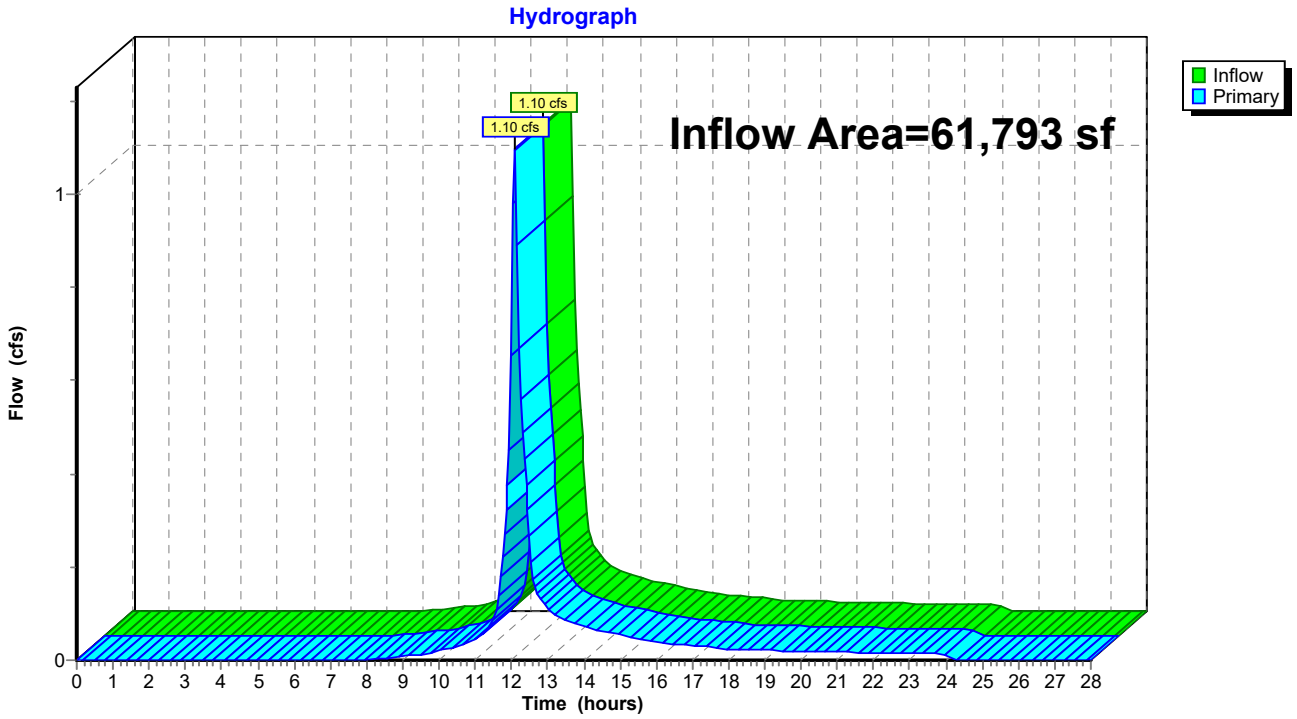


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 83.30% Impervious, Inflow Depth = 0.67" for WQV event
Inflow = 1.10 cfs @ 12.09 hrs, Volume= 3,462 cf
Primary = 1.10 cfs @ 12.09 hrs, Volume= 3,462 cf, Atten= 0%, Lag= 0.0 min

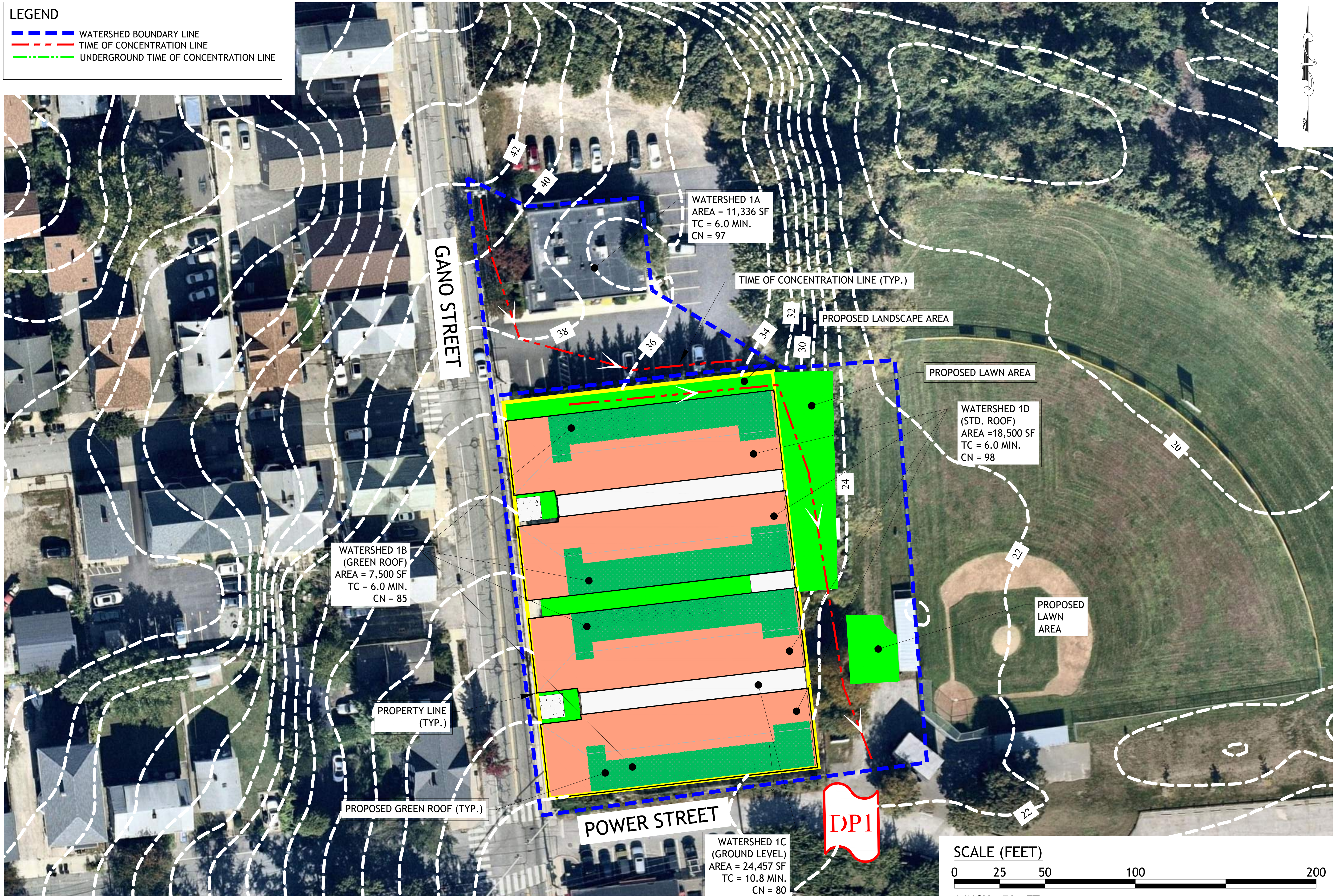
Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Appendix D

Proposed Condition Watershed Map



Q:\21-80 Bahman Jalili\Drainage\Watershed Maps\Gano & Power Street [Watershed Plan] - R1.dwg May. 13, 2022 12:14pm

JCE

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PROPOSED RESIDENTIAL DEVELOPMENT

B157, 159 & 165 GANO STREET AND 256 POWER STREET
PROVIDENCE, RHODE ISLAND
AP 14, LOTS 272,296 & 576

REVISIONS:

NO.	DATE.	DESCRIPTION

DESIGNED BY:	SD
DRAWN BY:	SD
CHECKED BY:	JAC
DATE:	MARCH 2022
PROJECT NO:	21-80

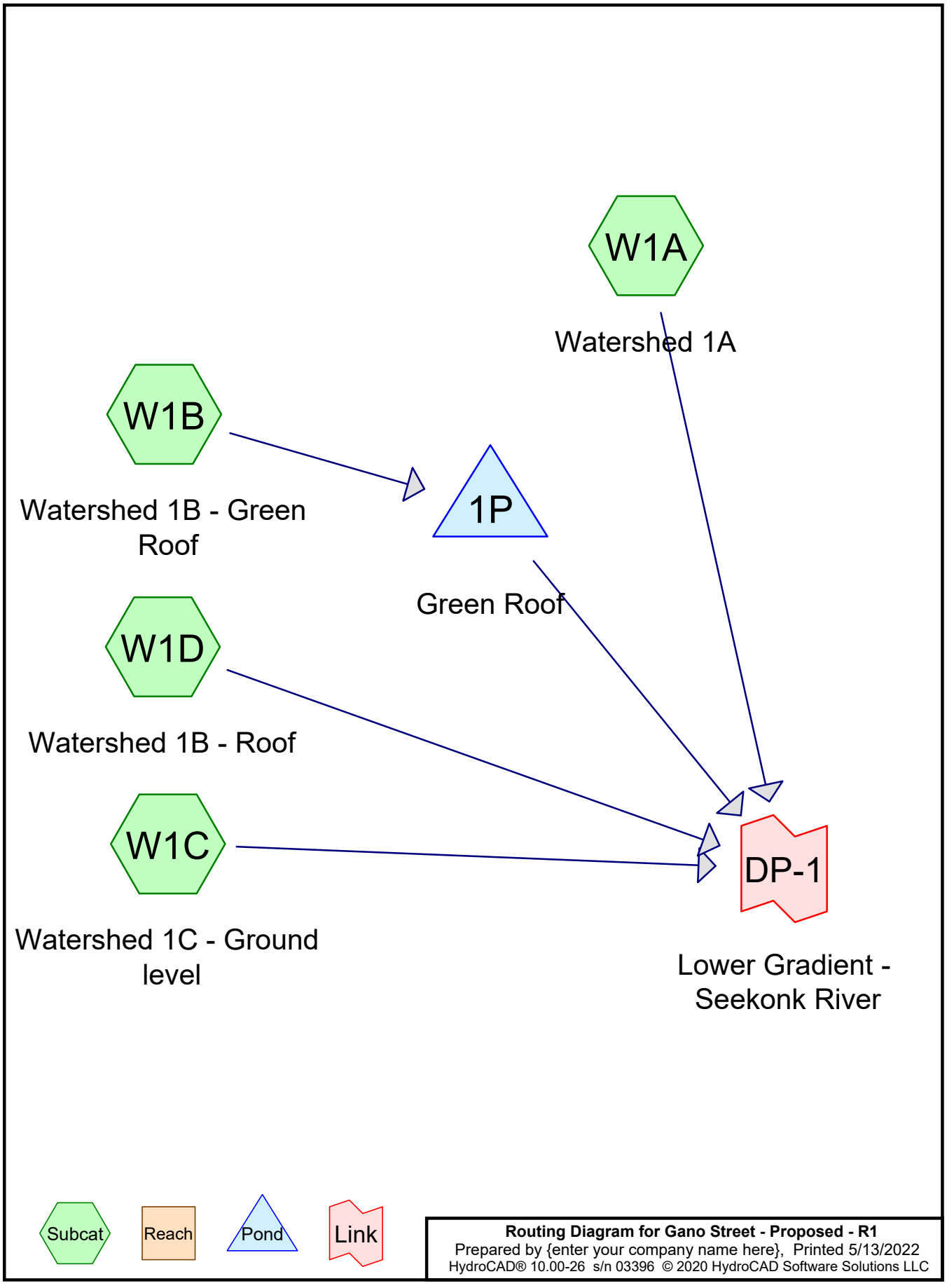
STORMWATER REPORT

PROPOSED CONDITIONS WATERSHED MAP

SHEET 1 OF 1

Appendix E

Proposed Condition HydroCAD Calculations



Routing Diagram for Gano Street - Proposed - R1
Prepared by {enter your company name here}, Printed 5/13/2022
HydroCAD® 10.00-26 s/n 03396 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
19,359	74	>75% Grass cover, Good, HSG C (W1A, W1C)
338	98	Concrete Pads, HSG C (W1C)
7,500	85	Green Roofs (W1B)
5,341	98	Paved parking + Roof, HSG C (W1C)
10,755	98	Roofs & Parking Lot, HSG C (W1A)
18,500	98	Roofs, HSG C (W1D)
61,793	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
54,293	HSG C	W1A, W1C, W1D
0	HSG D	
7,500	Other	W1B
61,793		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	0	19,359	0	0	19,359	>75% Grass cover, Good	
0	0	338	0	0	338	Concrete Pads	
0	0	0	0	7,500	7,500	Green Roofs	
0	0	5,341	0	0	5,341	Paved parking + Roof	
0	0	18,500	0	0	18,500	Roofs	
0	0	10,755	0	0	10,755	Roofs & Parking Lot	
0	**0**	**54,293**	**0**	**7,500**	**61,793**	**TOTAL AREA**	

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=11,336 sf 94.87% Impervious Runoff Depth=2.36"
Flow Length=225' Tc=6.0 min CN=97 Runoff=0.65 cfs 2,231 cf

SubcatchmentW1B: Watershed 1B - Green Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=1.34"
Flow Length=50' Slope=0.0200 '/' Tc=6.0 min CN=85 Runoff=0.26 cfs 837 cf

SubcatchmentW1C: Watershed 1C - Runoff Area=24,457 sf 23.22% Impervious Runoff Depth=1.03"
Flow Length=330' Tc=10.8 min CN=80 Runoff=0.56 cfs 2,099 cf

SubcatchmentW1D: Watershed 1B - Roof Runoff Area=18,500 sf 100.00% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=98 Runoff=1.08 cfs 3,807 cf

Pond 1P: Green Roof Peak Elev=141.34' Storage=837 cf Inflow=0.26 cfs 837 cf
Outflow=0.00 cfs 0 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=2.19 cfs 8,137 cf
Primary=2.19 cfs 8,137 cf

Total Runoff Area = 61,793 sf Runoff Volume = 8,974 cf Average Runoff Depth = 1.74"
43.47% Pervious = 26,859 sf 56.53% Impervious = 34,934 sf

Summary for Subcatchment W1A: Watershed 1A

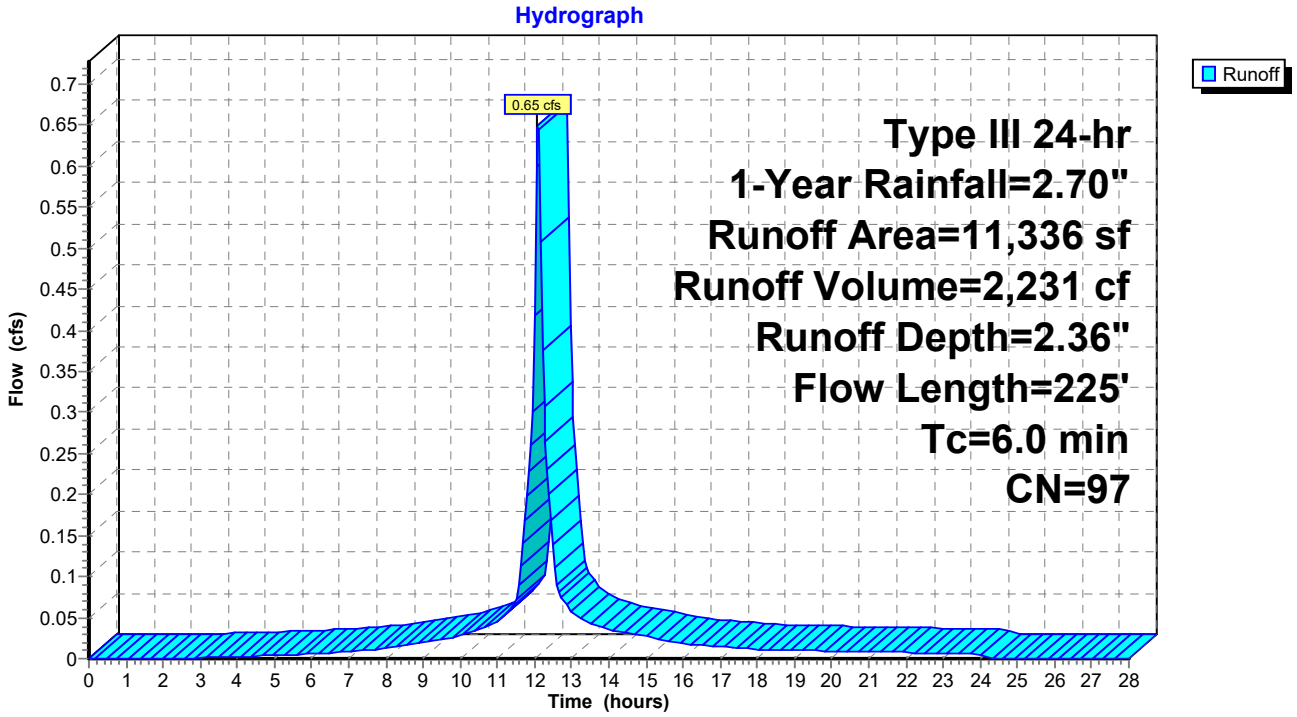
Runoff = 0.65 cfs @ 12.09 hrs, Volume= 2,231 cf, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	10,755	98	Roofs & Parking Lot, HSG C
	581	74	>75% Grass cover, Good, HSG C
	11,336	97	Weighted Average
	581	74	5.13% Pervious Area
	10,755	98	94.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
0.5	125	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.5	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1A: Watershed 1A



Summary for Subcatchment W1B: Watershed 1B - Green Roof

Per RISDISM

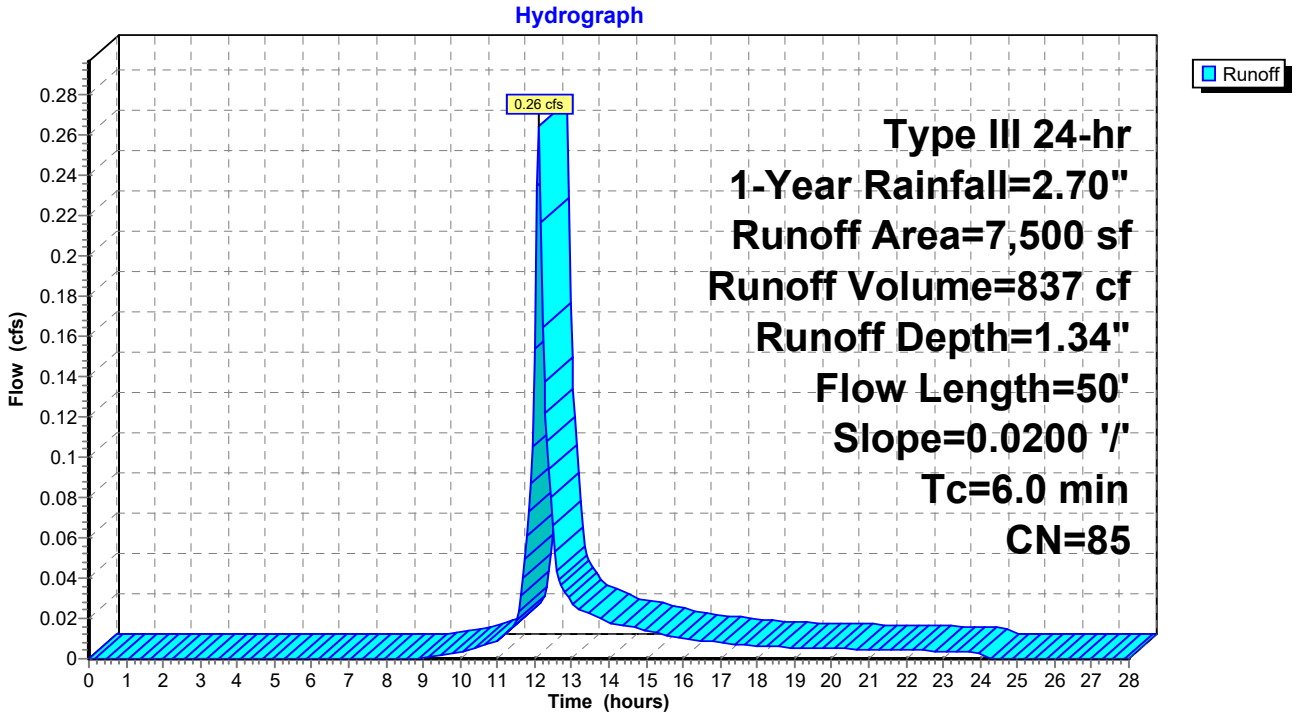
Runoff = 0.26 cfs @ 12.09 hrs, Volume= 837 cf, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	7,500	85	Green Roofs
	7,500	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
5.5	50	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1B: Watershed 1B - Green Roof



Summary for Subcatchment W1C: Watershed 1C - Ground level

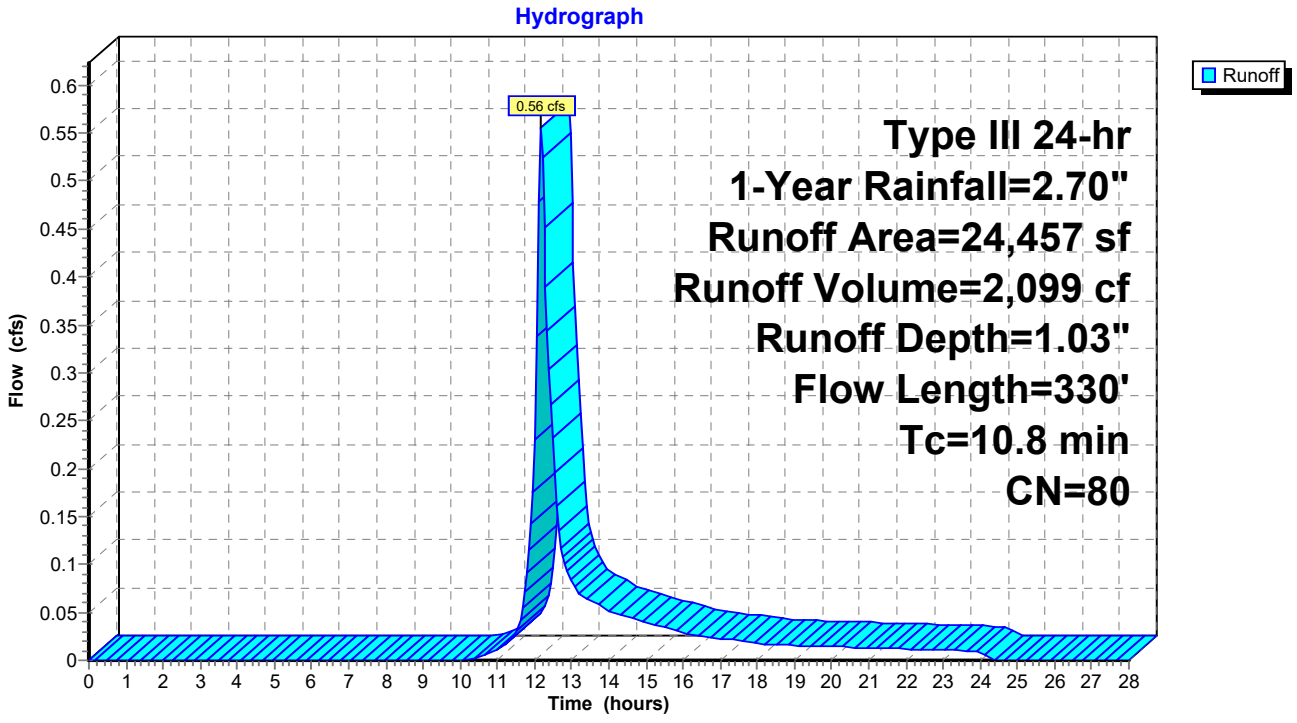
Runoff = 0.56 cfs @ 12.16 hrs, Volume= 2,099 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
	18,778	74	>75% Grass cover, Good, HSG C
*	5,341	98	Paved parking + Roof, HSG C
*	338	98	Concrete Pads, HSG C
	24,457	80	Weighted Average
	18,778	74	76.78% Pervious Area
	5,679	98	23.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
1.2	230	0.0430	3.11		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
10.8	330	Total			

Subcatchment W1C: Watershed 1C - Ground level



Summary for Subcatchment W1D: Watershed 1B - Roof

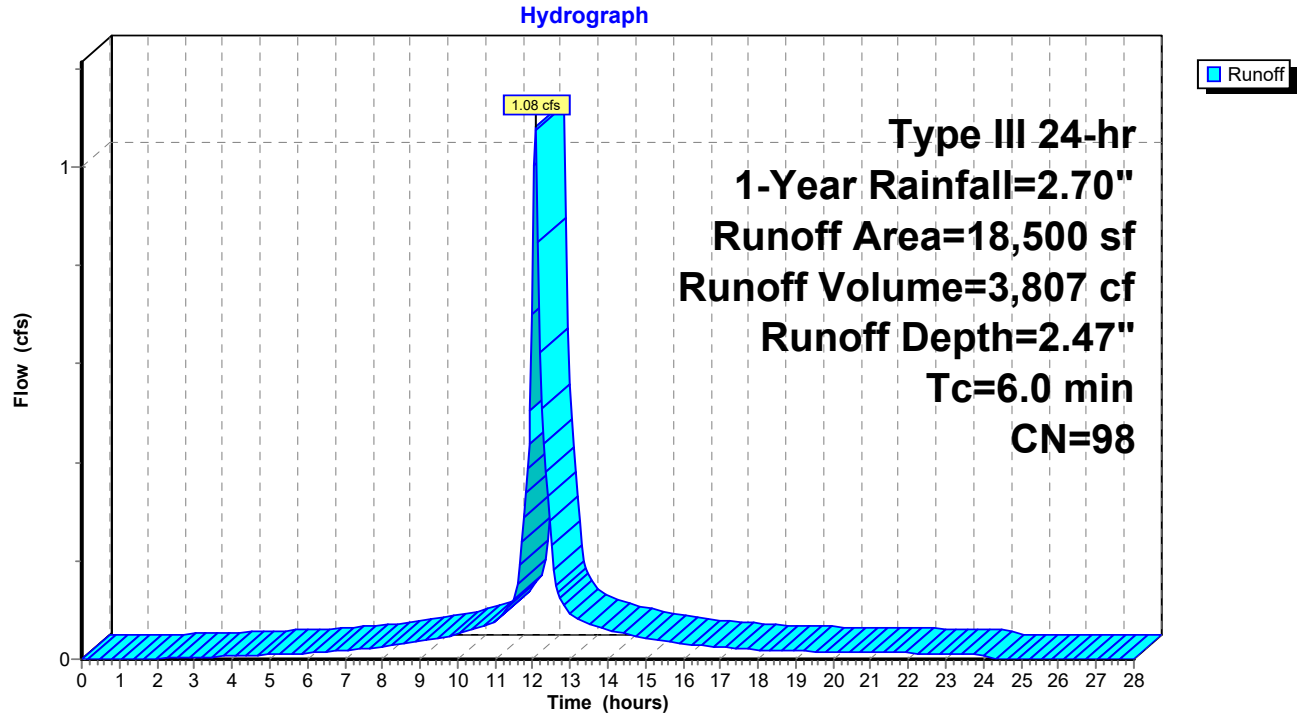
Runoff = 1.08 cfs @ 12.09 hrs, Volume= 3,807 cf, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (sf)	CN	Description
18,500	98	Roofs, HSG C
18,500	98	100.00% Impervious Area

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

Subcatchment W1D: Watershed 1B - Roof



Summary for Pond 1P: Green Roof

Inflow Area = 7,500 sf, 0.00% Impervious, Inflow Depth = 1.34" for 1-Year event
Inflow = 0.26 cfs @ 12.09 hrs, Volume= 837 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 141.34' @ 24.40 hrs Surf.Area= 7,500 sf Storage= 837 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

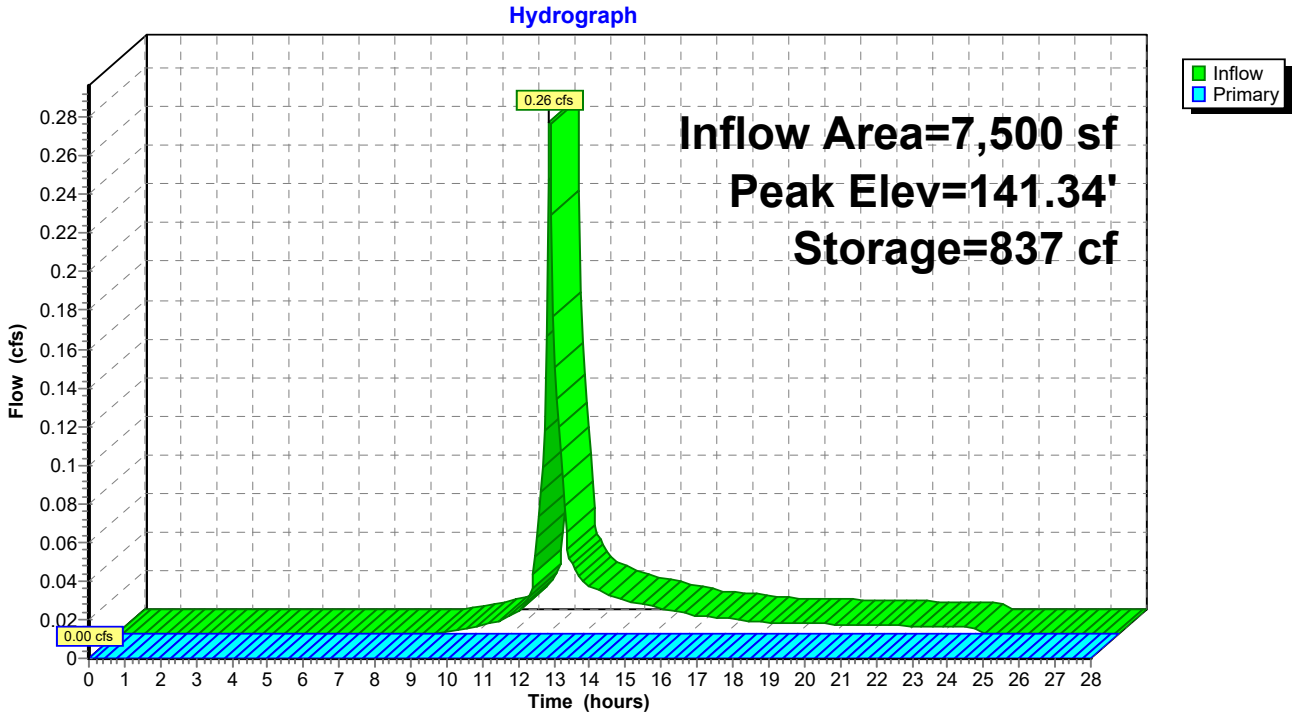
Volume	Invert	Avail.Storage	Storage Description
#1	141.00'	309 cf	**Green Roof (Prismatic)**Listed below (Recalc) 938 cf Overall x 33.0% Voids
		309 cf	x 4.00 = 1,238 cf Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
141.00	1,875	0	0
141.50	1,875	938	938

Device	Routing	Invert	Outlet Devices
#1	Primary	141.47'	**124.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=141.00' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Green Roof

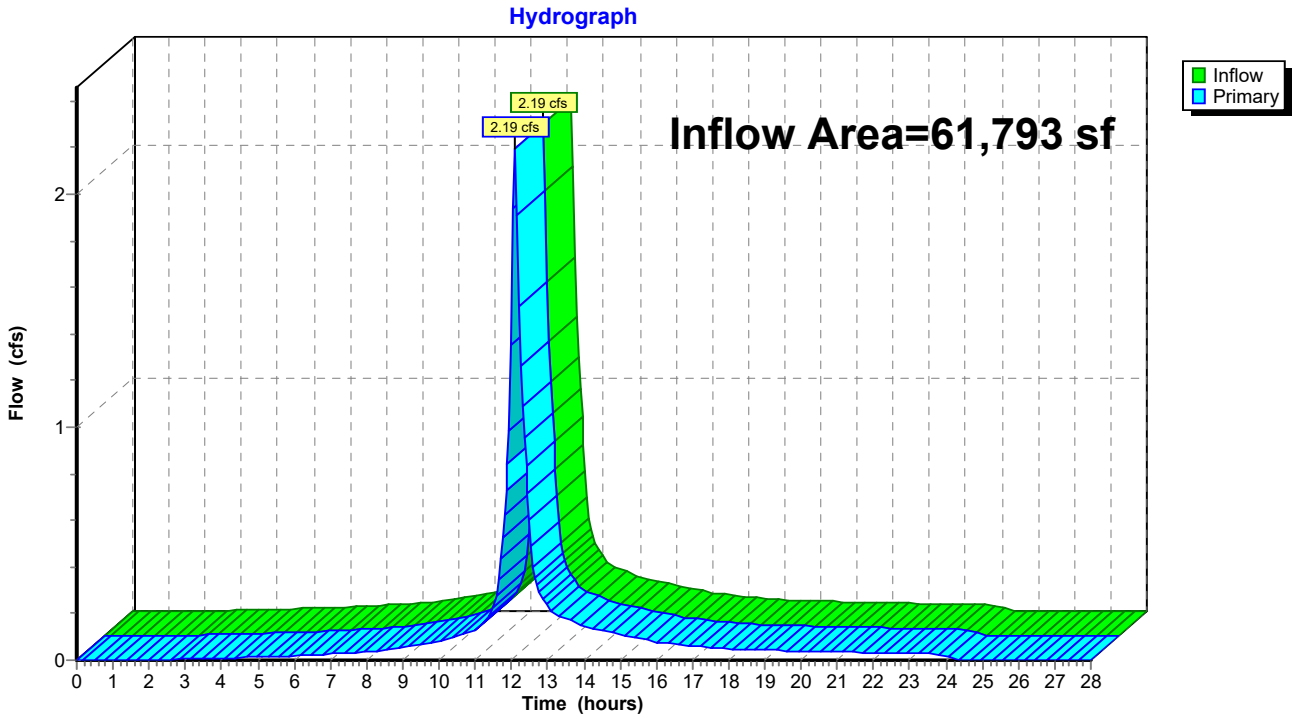


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 56.53% Impervious, Inflow Depth = 1.58" for 1-Year event
Inflow = 2.19 cfs @ 12.10 hrs, Volume= 8,137 cf
Primary = 2.19 cfs @ 12.10 hrs, Volume= 8,137 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=11,336 sf 94.87% Impervious Runoff Depth=2.96"
Flow Length=225' Tc=6.0 min CN=97 Runoff=0.80 cfs 2,792 cf

SubcatchmentW1B: Watershed 1B - Green Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=50' Slope=0.0200 '/' Tc=6.0 min CN=85 Runoff=0.36 cfs 1,152 cf

SubcatchmentW1C: Watershed 1C - Runoff Area=24,457 sf 23.22% Impervious Runoff Depth=1.48"
Flow Length=330' Tc=10.8 min CN=80 Runoff=0.81 cfs 3,015 cf

SubcatchmentW1D: Watershed 1B - Roof Runoff Area=18,500 sf 100.00% Impervious Runoff Depth=3.07"
Tc=6.0 min CN=98 Runoff=1.33 cfs 4,728 cf

Pond 1P: Green Roof Peak Elev=141.47' Storage=1,152 cf Inflow=0.36 cfs 1,152 cf
Outflow=0.00 cfs 0 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=2.82 cfs 10,536 cf
Primary=2.82 cfs 10,536 cf

Total Runoff Area = 61,793 sf Runoff Volume = 11,688 cf Average Runoff Depth = 2.27"
43.47% Pervious = 26,859 sf 56.53% Impervious = 34,934 sf

Summary for Subcatchment W1A: Watershed 1A

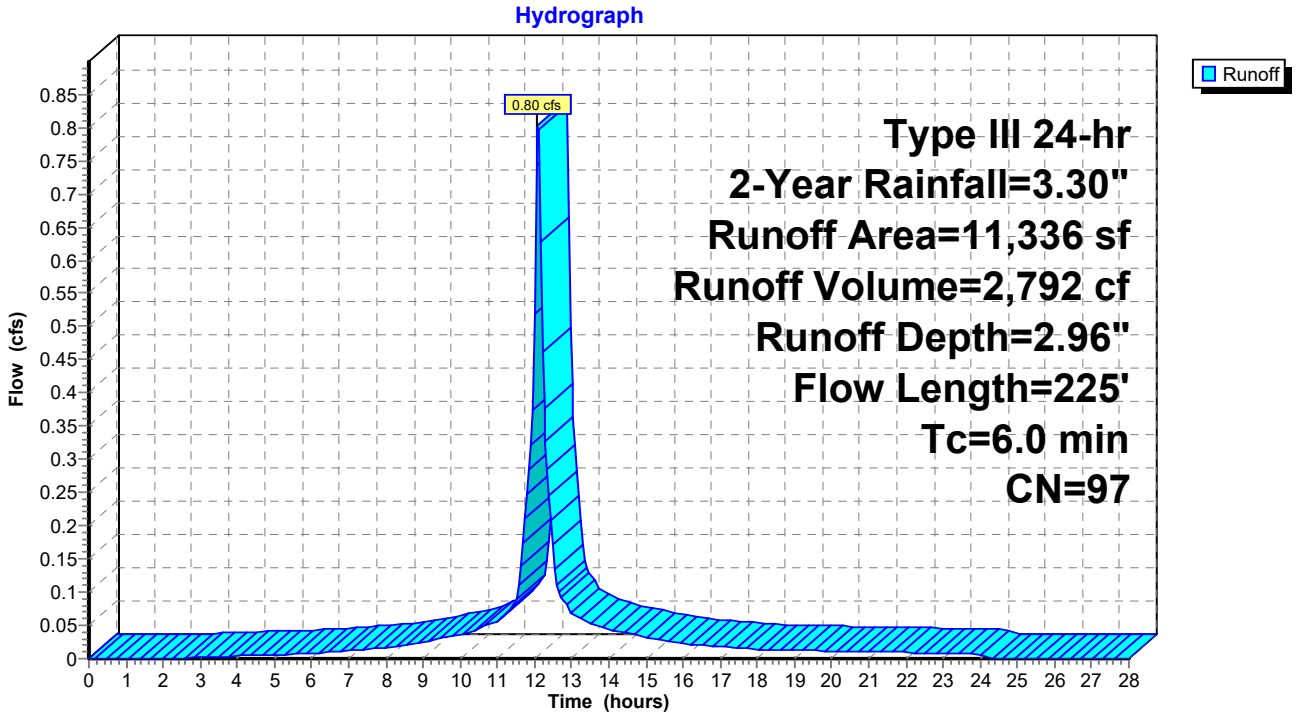
Runoff = 0.80 cfs @ 12.09 hrs, Volume= 2,792 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
*	10,755	98	Roofs & Parking Lot, HSG C
	581	74	>75% Grass cover, Good, HSG C
	11,336	97	Weighted Average
	581	74	5.13% Pervious Area
	10,755	98	94.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
0.5	125	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.5	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1A: Watershed 1A



Summary for Subcatchment W1B: Watershed 1B - Green Roof

Per RISDISM

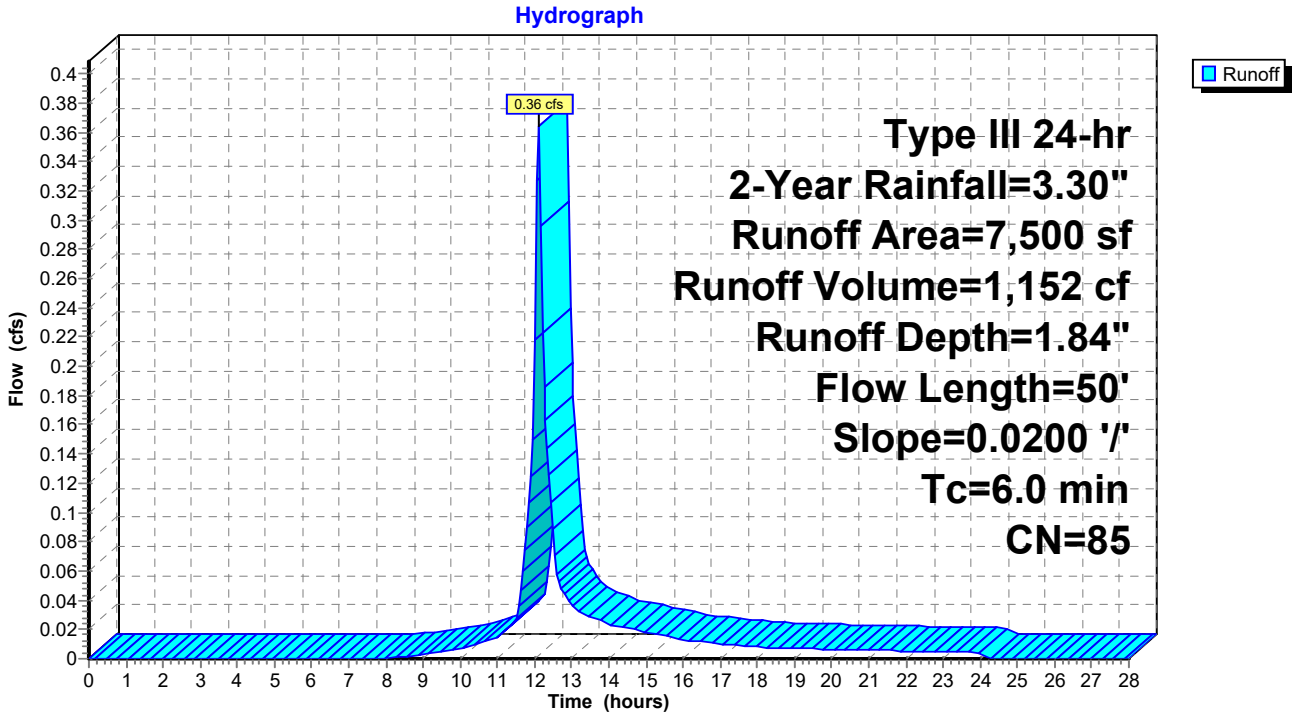
Runoff = 0.36 cfs @ 12.09 hrs, Volume= 1,152 cf, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
*	7,500	85	Green Roofs
	7,500	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
5.5	50	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1B: Watershed 1B - Green Roof



Summary for Subcatchment W1C: Watershed 1C - Ground level

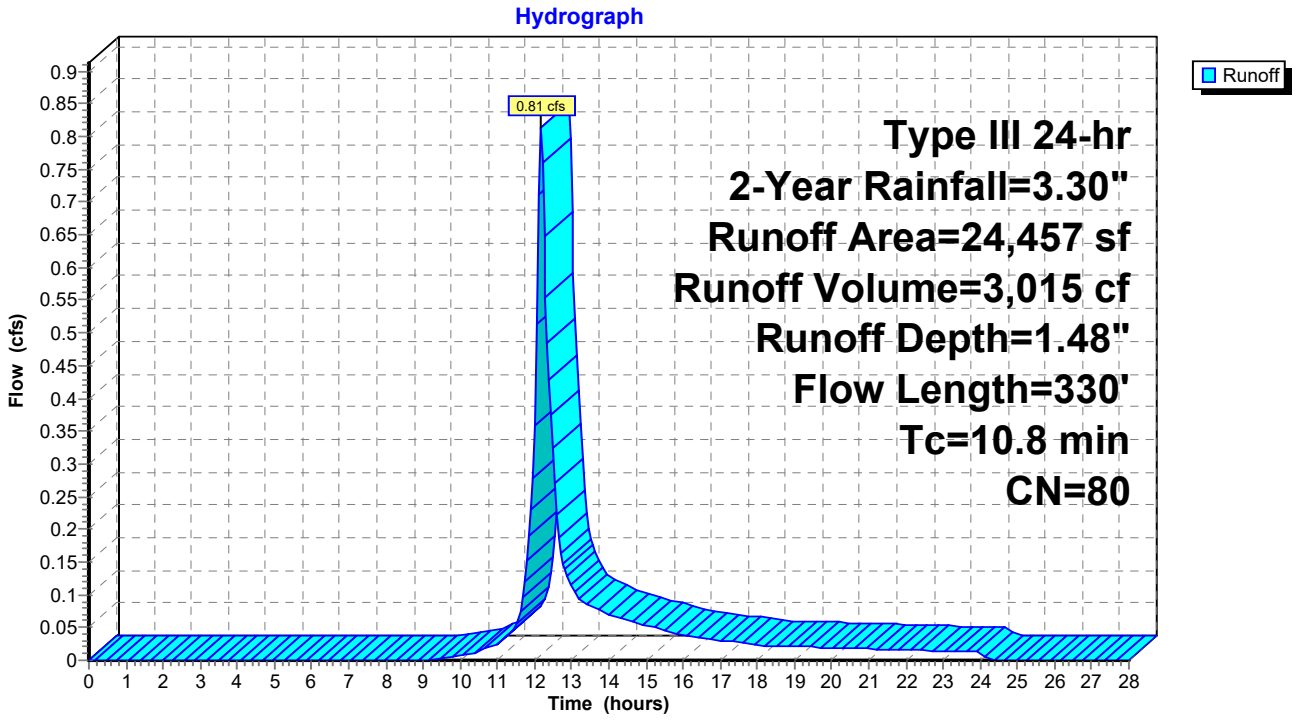
Runoff = 0.81 cfs @ 12.16 hrs, Volume= 3,015 cf, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	18,778	74	>75% Grass cover, Good, HSG C
*	5,341	98	Paved parking + Roof, HSG C
*	338	98	Concrete Pads, HSG C
	24,457	80	Weighted Average
	18,778	74	76.78% Pervious Area
	5,679	98	23.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
1.2	230	0.0430	3.11		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
10.8	330	Total			

Subcatchment W1C: Watershed 1C - Ground level



Summary for Subcatchment W1D: Watershed 1B - Roof

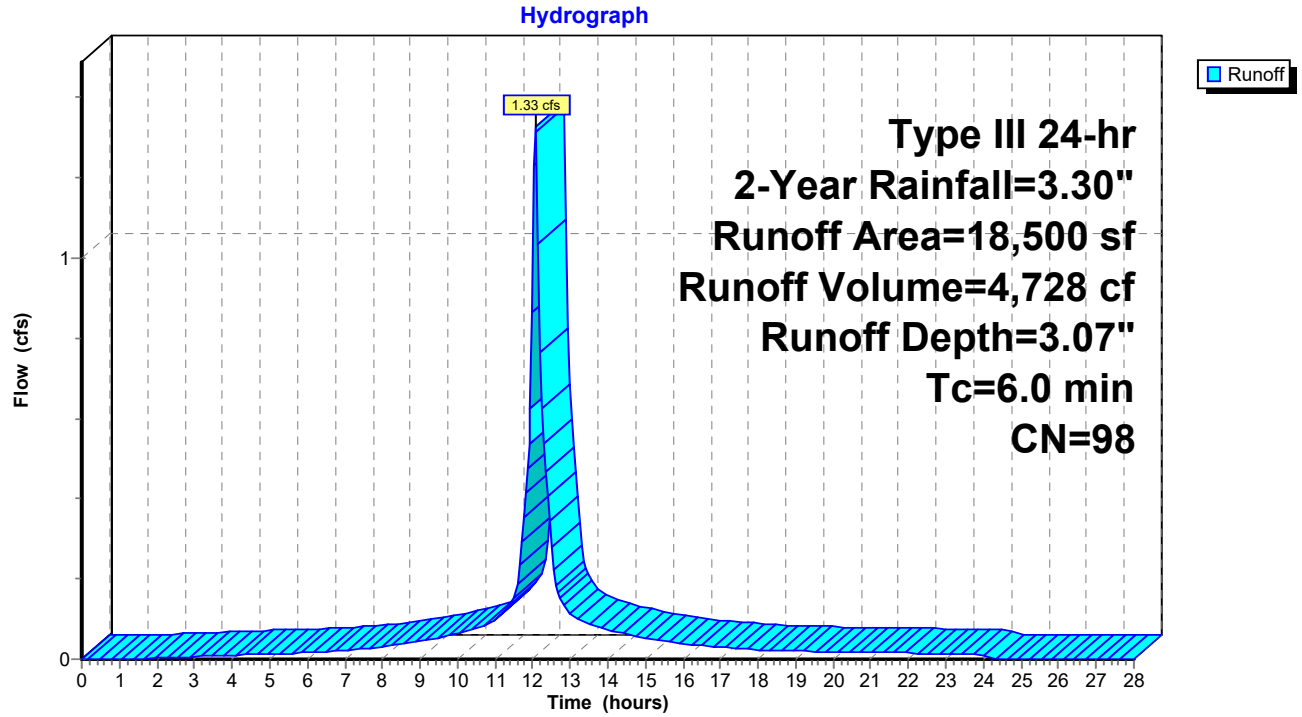
Runoff = 1.33 cfs @ 12.09 hrs, Volume= 4,728 cf, Depth= 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
18,500	98	Roofs, HSG C
18,500	98	100.00% Impervious Area

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

Subcatchment W1D: Watershed 1B - Roof



Summary for Pond 1P: Green Roof

Inflow Area = 7,500 sf, 0.00% Impervious, Inflow Depth = 1.84" for 2-Year event
Inflow = 0.36 cfs @ 12.09 hrs, Volume= 1,152 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 141.47' @ 24.40 hrs Surf.Area= 7,500 sf Storage= 1,152 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

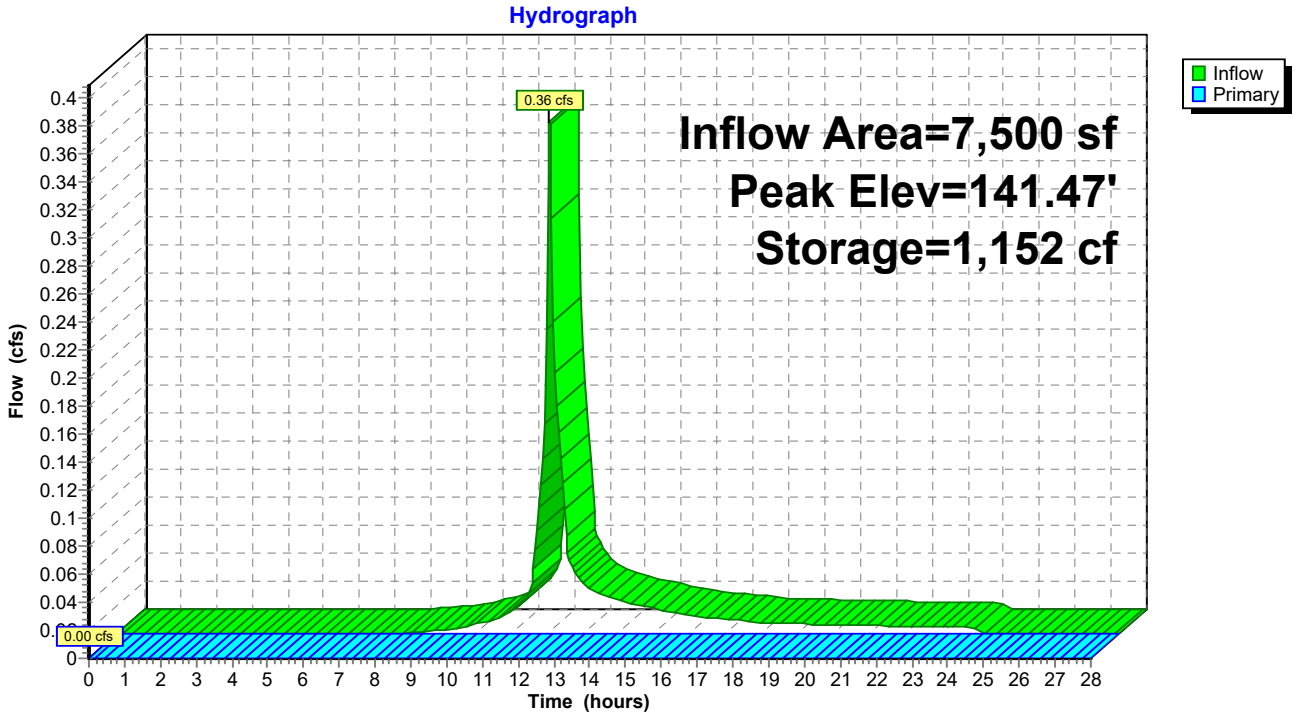
Volume	Invert	Avail.Storage	Storage Description
#1	141.00'	309 cf	**Green Roof (Prismatic)**Listed below (Recalc) 938 cf Overall x 33.0% Voids
		309 cf	x 4.00 = 1,238 cf Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
141.00	1,875	0	0
141.50	1,875	938	938

Device	Routing	Invert	Outlet Devices
#1	Primary	141.47'	**124.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=141.00' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Green Roof

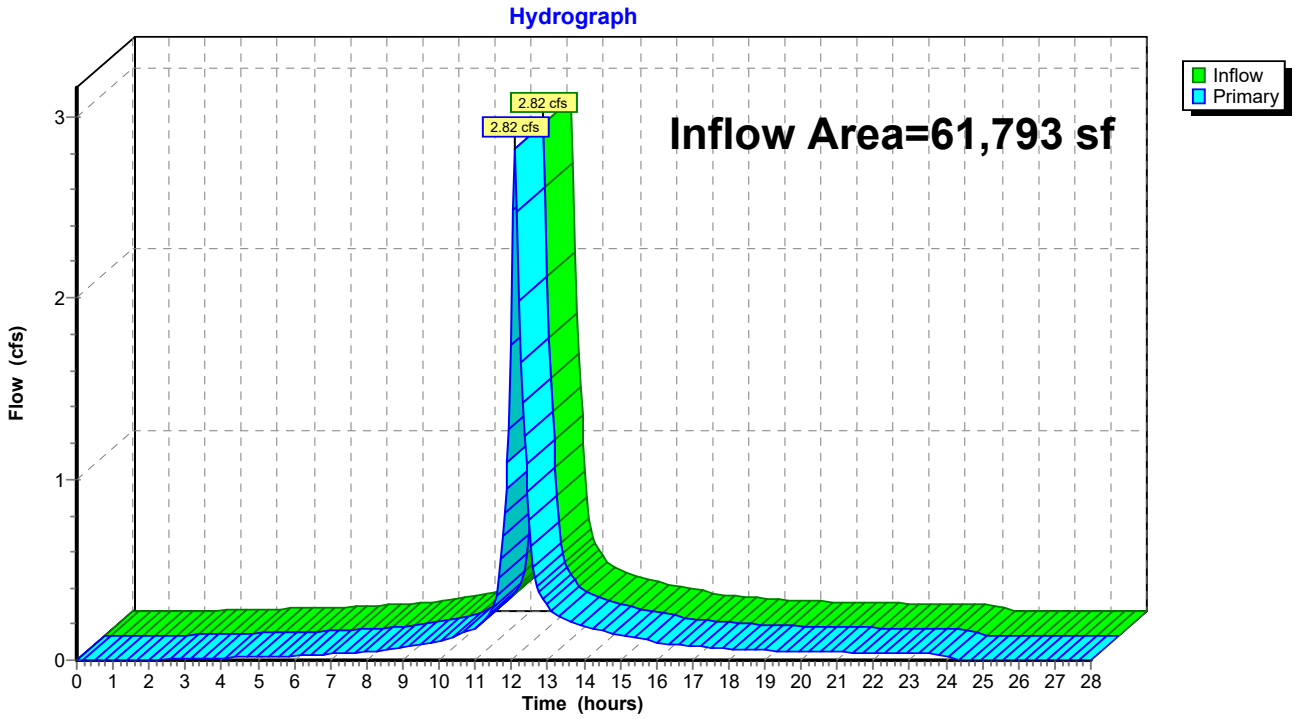


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 56.53% Impervious, Inflow Depth = 2.05" for 2-Year event
Inflow = 2.82 cfs @ 12.10 hrs, Volume= 10,536 cf
Primary = 2.82 cfs @ 12.10 hrs, Volume= 10,536 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=11,336 sf 94.87% Impervious Runoff Depth=4.55"
Flow Length=225' Tc=6.0 min CN=97 Runoff=1.21 cfs 4,296 cf

SubcatchmentW1B: Watershed 1B - Green Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=3.28"
Flow Length=50' Slope=0.0200 '/' Tc=6.0 min CN=85 Runoff=0.64 cfs 2,047 cf

SubcatchmentW1C: Watershed 1C - Runoff Area=24,457 sf 23.22% Impervious Runoff Depth=2.81"
Flow Length=330' Tc=10.8 min CN=80 Runoff=1.56 cfs 5,718 cf

SubcatchmentW1D: Watershed 1B - Roof Runoff Area=18,500 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=1.99 cfs 7,189 cf

Pond 1P: Green Roof Peak Elev=141.47' Storage=1,174 cf Inflow=0.64 cfs 2,047 cf
Outflow=0.13 cfs 884 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=4.56 cfs 18,087 cf
Primary=4.56 cfs 18,087 cf

Total Runoff Area = 61,793 sf Runoff Volume = 19,251 cf Average Runoff Depth = 3.74"
43.47% Pervious = 26,859 sf 56.53% Impervious = 34,934 sf

Summary for Subcatchment W1A: Watershed 1A

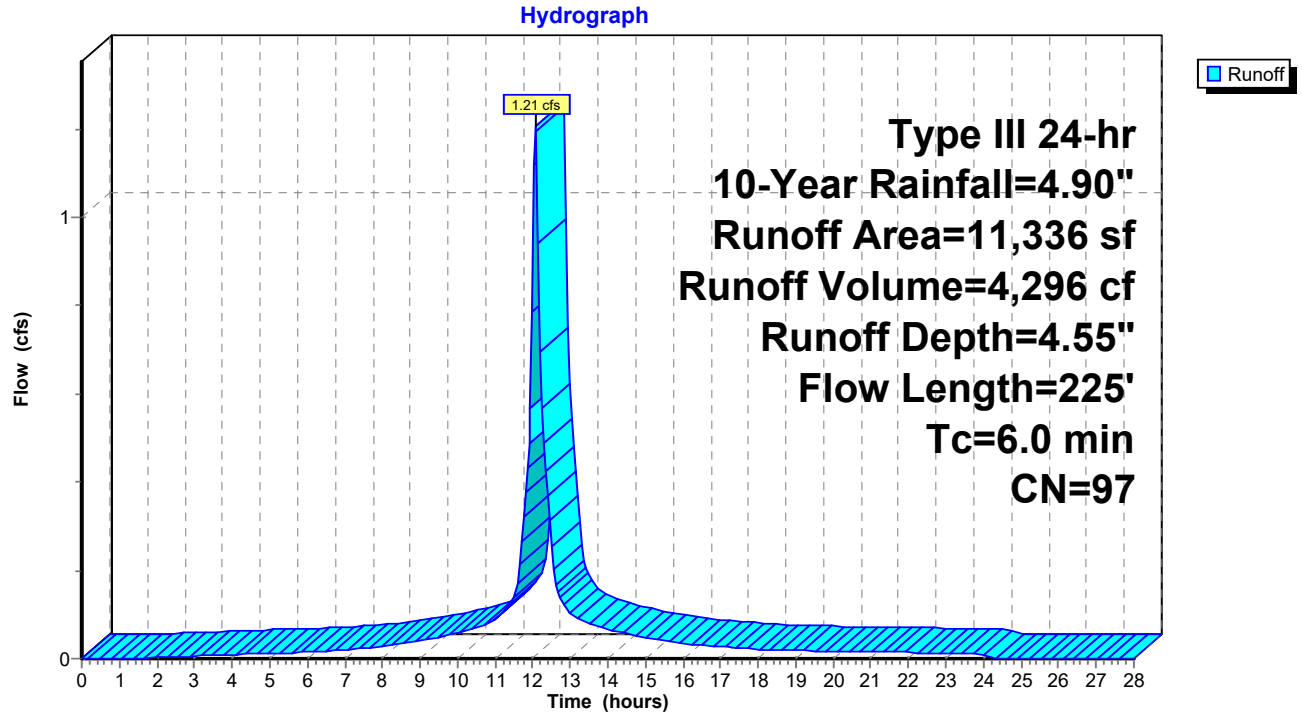
Runoff = 1.21 cfs @ 12.09 hrs, Volume= 4,296 cf, Depth= 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	10,755	98	Roofs & Parking Lot, HSG C
	581	74	>75% Grass cover, Good, HSG C
	11,336	97	Weighted Average
	581	74	5.13% Pervious Area
	10,755	98	94.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
0.5	125	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.5	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1A: Watershed 1A



Summary for Subcatchment W1B: Watershed 1B - Green Roof

Per RISDISM

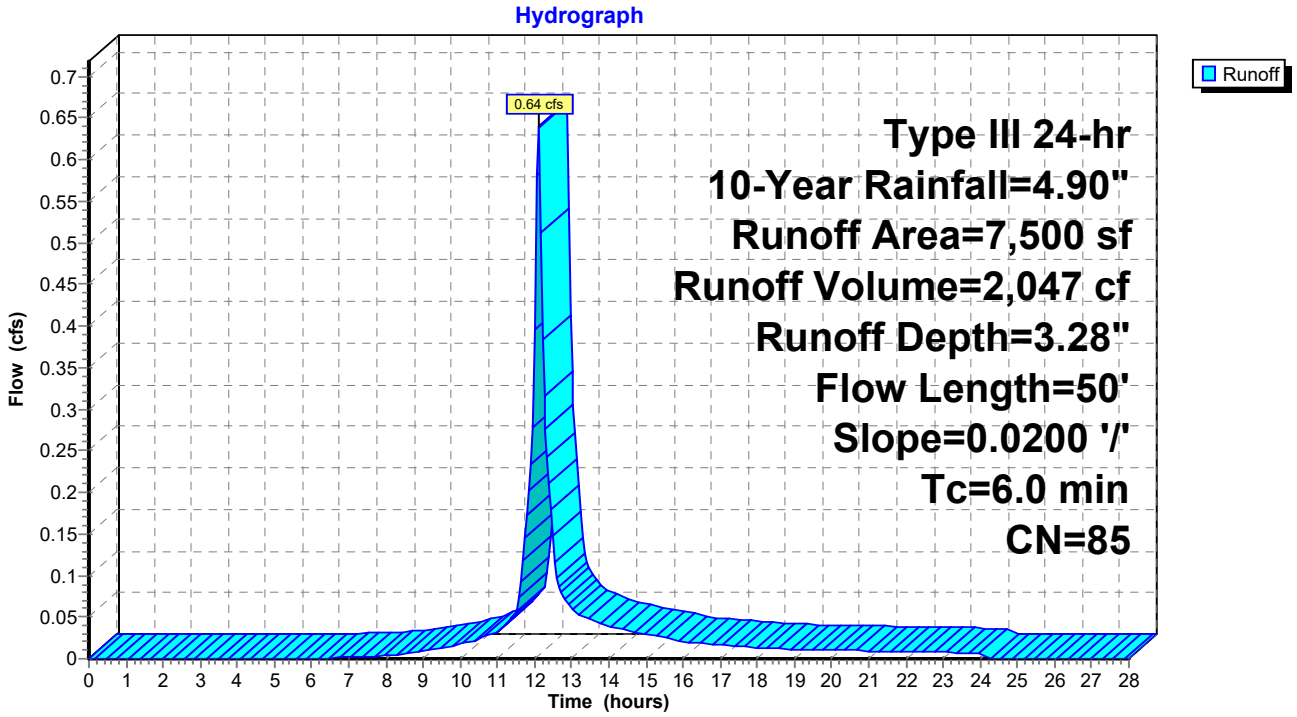
Runoff = 0.64 cfs @ 12.09 hrs, Volume= 2,047 cf, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	7,500	85	Green Roofs
	7,500	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
5.5	50	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1B: Watershed 1B - Green Roof



Summary for Subcatchment W1C: Watershed 1C - Ground level

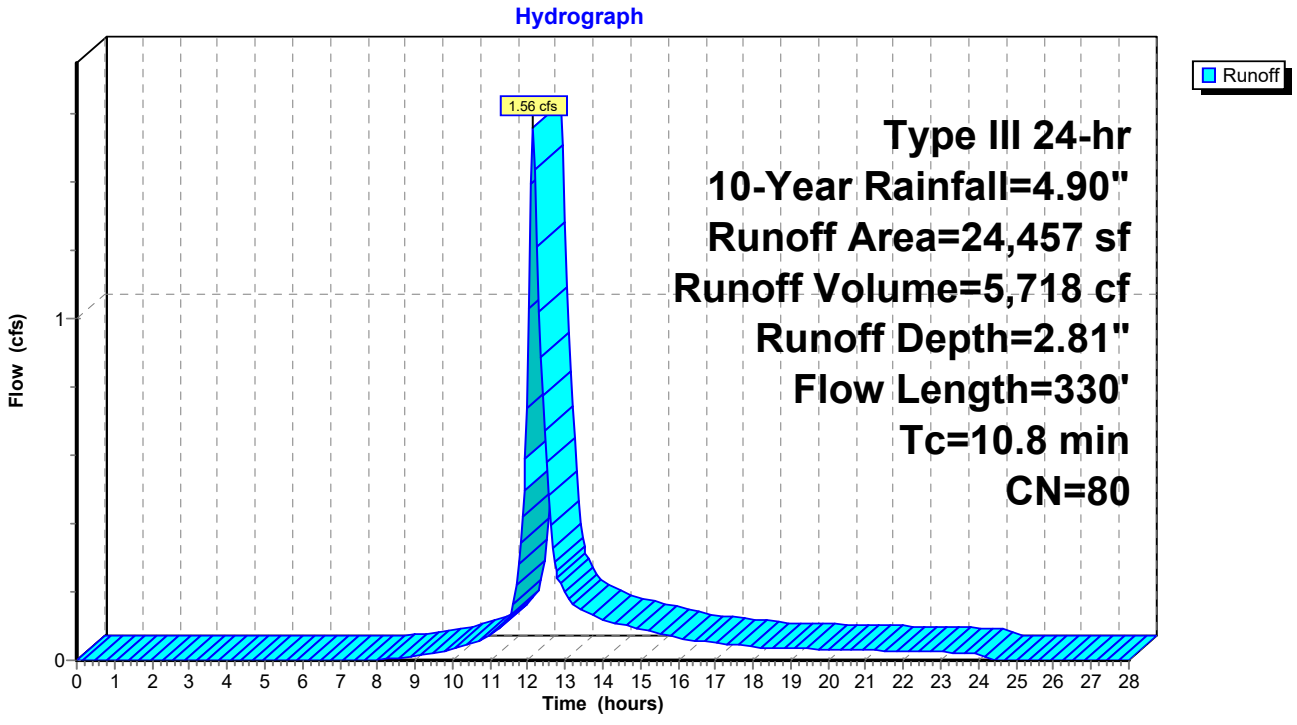
Runoff = 1.56 cfs @ 12.15 hrs, Volume= 5,718 cf, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
	18,778	74	>75% Grass cover, Good, HSG C
*	5,341	98	Paved parking + Roof, HSG C
*	338	98	Concrete Pads, HSG C
	24,457	80	Weighted Average
	18,778	74	76.78% Pervious Area
	5,679	98	23.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
1.2	230	0.0430	3.11		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
10.8	330	Total			

Subcatchment W1C: Watershed 1C - Ground level



Summary for Subcatchment W1D: Watershed 1B - Roof

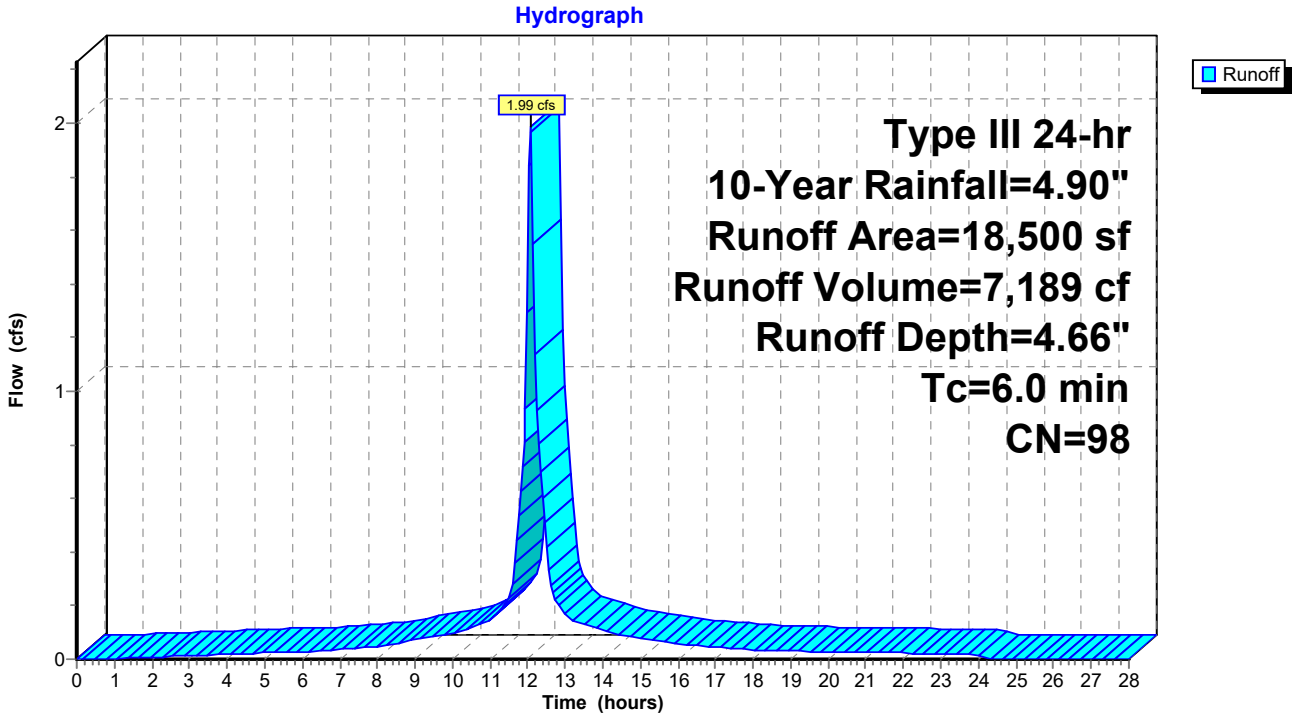
Runoff = 1.99 cfs @ 12.09 hrs, Volume= 7,189 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
18,500	98	Roofs, HSG C
18,500	98	100.00% Impervious Area

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

Subcatchment W1D: Watershed 1B - Roof



Summary for Pond 1P: Green Roof

Inflow Area = 7,500 sf, 0.00% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 2,047 cf
Outflow = 0.13 cfs @ 12.53 hrs, Volume= 884 cf, Atten= 80%, Lag= 26.3 min
Primary = 0.13 cfs @ 12.53 hrs, Volume= 884 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 141.47' @ 12.53 hrs Surf.Area= 7,500 sf Storage= 1,174 cf

Plug-Flow detention time= 261.3 min calculated for 884 cf (43% of inflow)
Center-of-Mass det. time= 142.7 min (951.0 - 808.3)

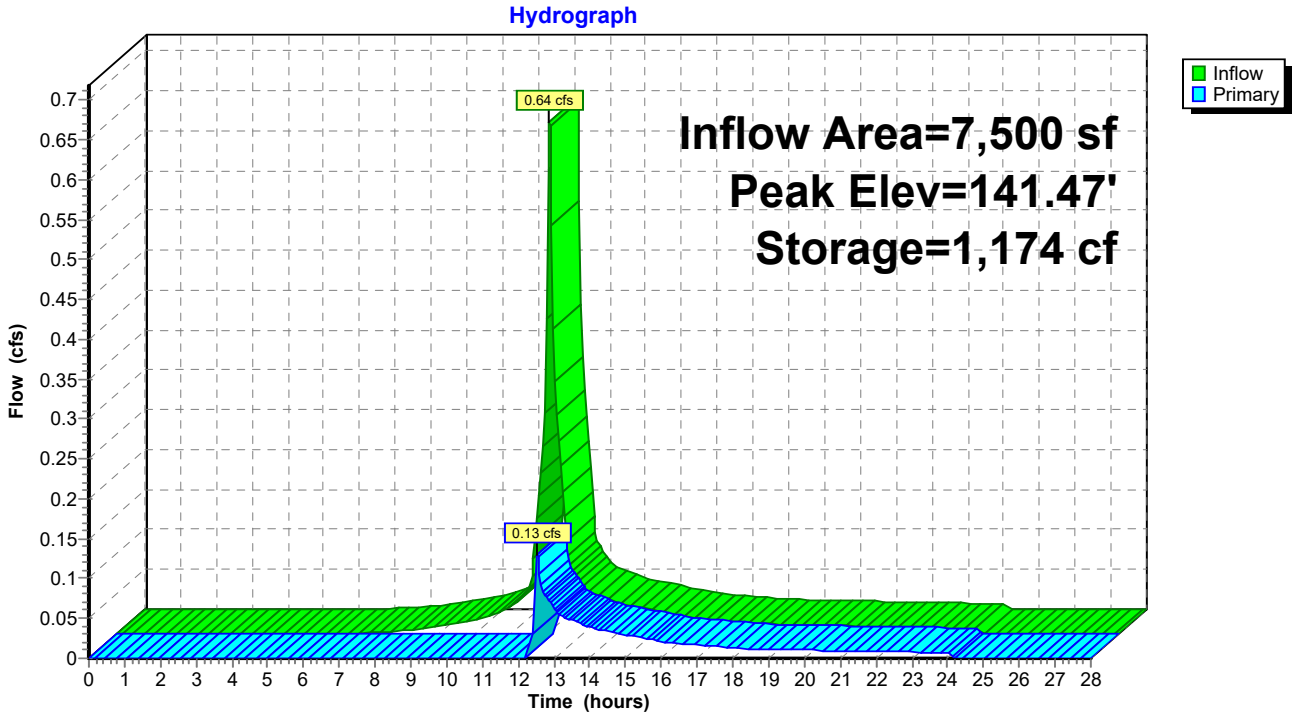
Volume	Invert	Avail.Storage	Storage Description
#1	141.00'	309 cf	**Green Roof (Prismatic)**Listed below (Recalc) 938 cf Overall x 33.0% Voids
		309 cf	x 4.00 = 1,238 cf Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
141.00	1,875	0	0
141.50	1,875	938	938

Device	Routing	Invert	Outlet Devices
#1	Primary	141.47'	**124.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.12 cfs @ 12.53 hrs HW=141.47' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.12 cfs @ 0.22 fps)

Pond 1P: Green Roof

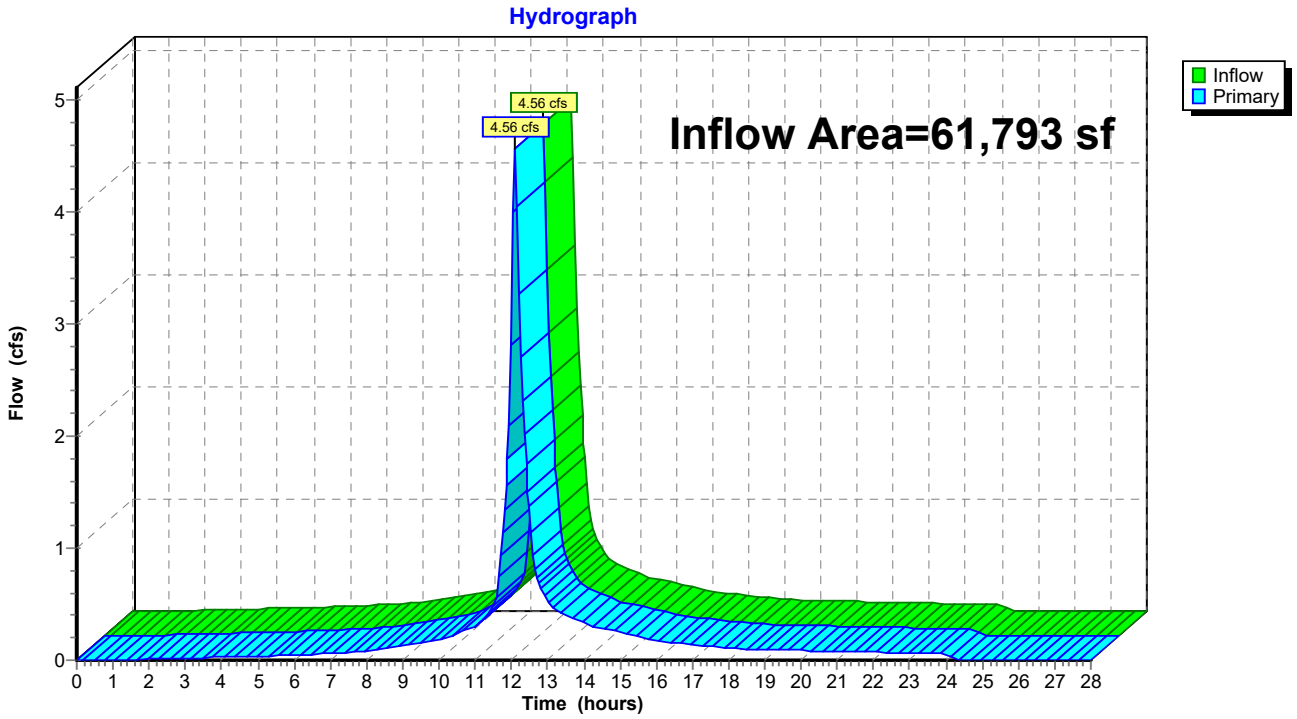


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 56.53% Impervious, Inflow Depth = 3.51" for 10-Year event
Inflow = 4.56 cfs @ 12.10 hrs, Volume= 18,087 cf
Primary = 4.56 cfs @ 12.10 hrs, Volume= 18,087 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=11,336 sf 94.87% Impervious Runoff Depth=5.74"
Flow Length=225' Tc=6.0 min CN=97 Runoff=1.51 cfs 5,426 cf

SubcatchmentW1B: Watershed 1B - Green Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=4.40"
Flow Length=50' Slope=0.0200 '/' Tc=6.0 min CN=85 Runoff=0.85 cfs 2,748 cf

SubcatchmentW1C: Watershed 1C - Runoff Area=24,457 sf 23.22% Impervious Runoff Depth=3.87"
Flow Length=330' Tc=10.8 min CN=80 Runoff=2.15 cfs 7,891 cf

SubcatchmentW1D: Watershed 1B - Roof Runoff Area=18,500 sf 100.00% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=98 Runoff=2.48 cfs 9,037 cf

Pond 1P: Green Roof Peak Elev=141.48' Storage=1,193 cf Inflow=0.85 cfs 2,748 cf
Outflow=0.55 cfs 1,568 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=5.89 cfs 23,921 cf
Primary=5.89 cfs 23,921 cf

Total Runoff Area = 61,793 sf Runoff Volume = 25,102 cf Average Runoff Depth = 4.87"
43.47% Pervious = 26,859 sf 56.53% Impervious = 34,934 sf

Summary for Subcatchment W1A: Watershed 1A

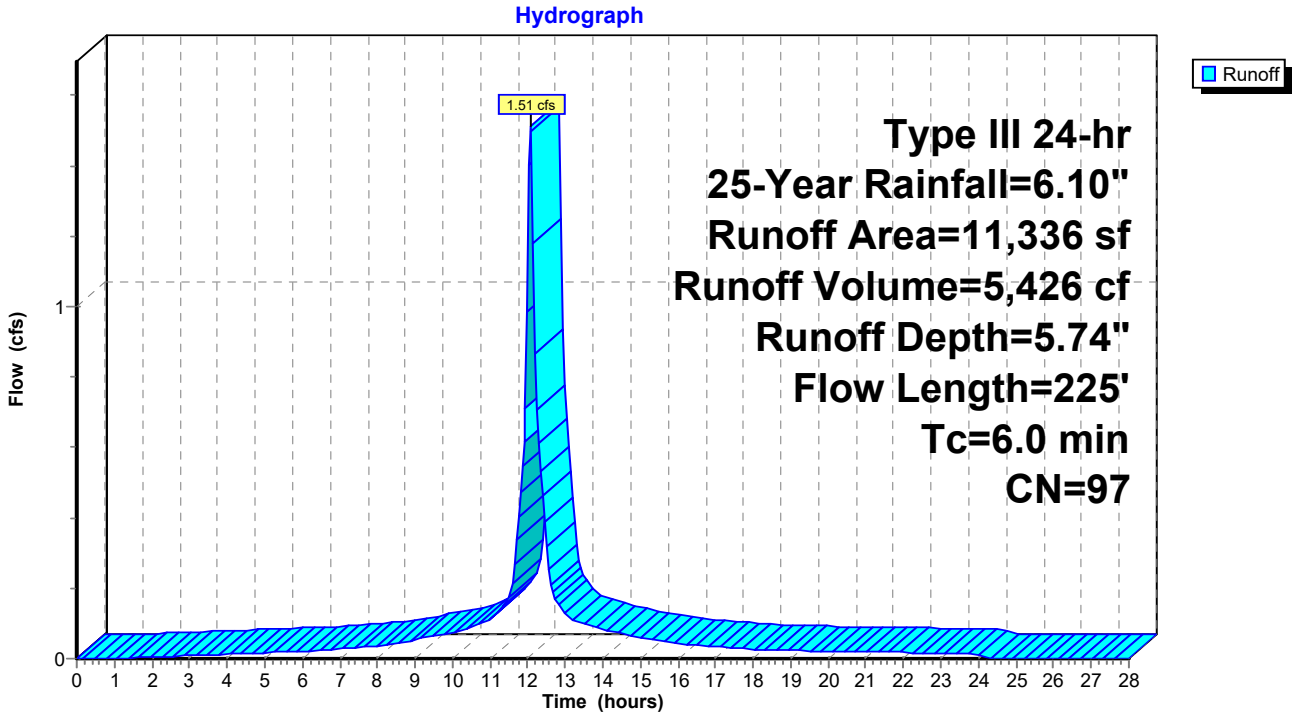
Runoff = 1.51 cfs @ 12.09 hrs, Volume= 5,426 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

	Area (sf)	CN	Description
*	10,755	98	Roofs & Parking Lot, HSG C
	581	74	>75% Grass cover, Good, HSG C
	11,336	97	Weighted Average
	581	74	5.13% Pervious Area
	10,755	98	94.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
0.5	125	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.5	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1A: Watershed 1A



Summary for Subcatchment W1B: Watershed 1B - Green Roof

Per RISDISM

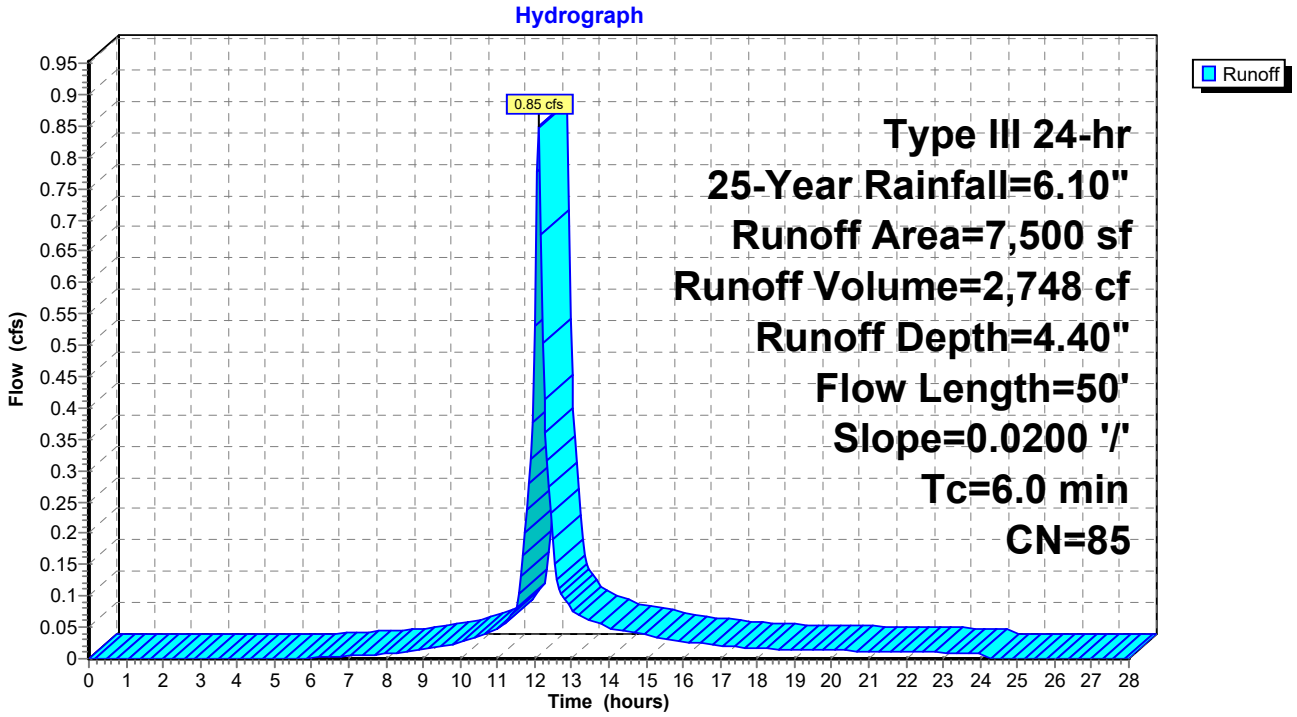
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 2,748 cf, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

	Area (sf)	CN	Description
*	7,500	85	Green Roofs
	7,500	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
5.5	50	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1B: Watershed 1B - Green Roof



Summary for Subcatchment W1C: Watershed 1C - Ground level

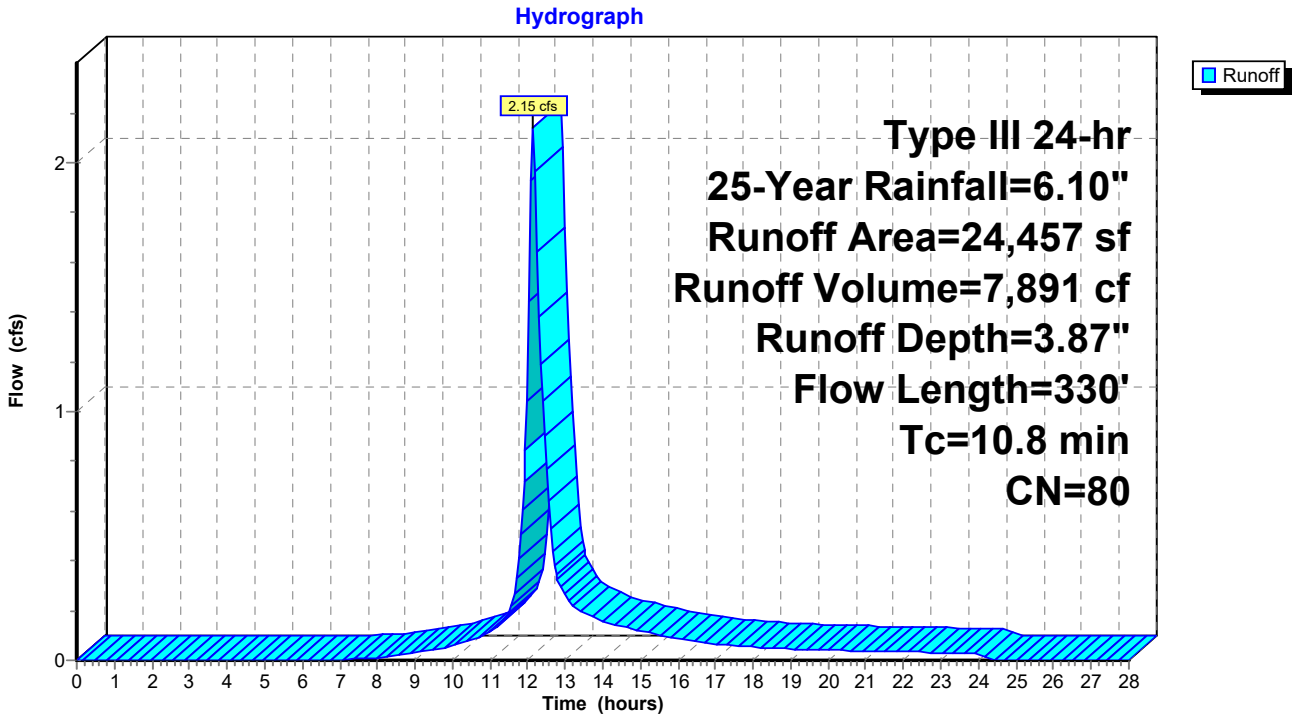
Runoff = 2.15 cfs @ 12.15 hrs, Volume= 7,891 cf, Depth= 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

	Area (sf)	CN	Description
	18,778	74	>75% Grass cover, Good, HSG C
*	5,341	98	Paved parking + Roof, HSG C
*	338	98	Concrete Pads, HSG C
	24,457	80	Weighted Average
	18,778	74	76.78% Pervious Area
	5,679	98	23.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
1.2	230	0.0430	3.11		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
10.8	330	Total			

Subcatchment W1C: Watershed 1C - Ground level



Summary for Subcatchment W1D: Watershed 1B - Roof

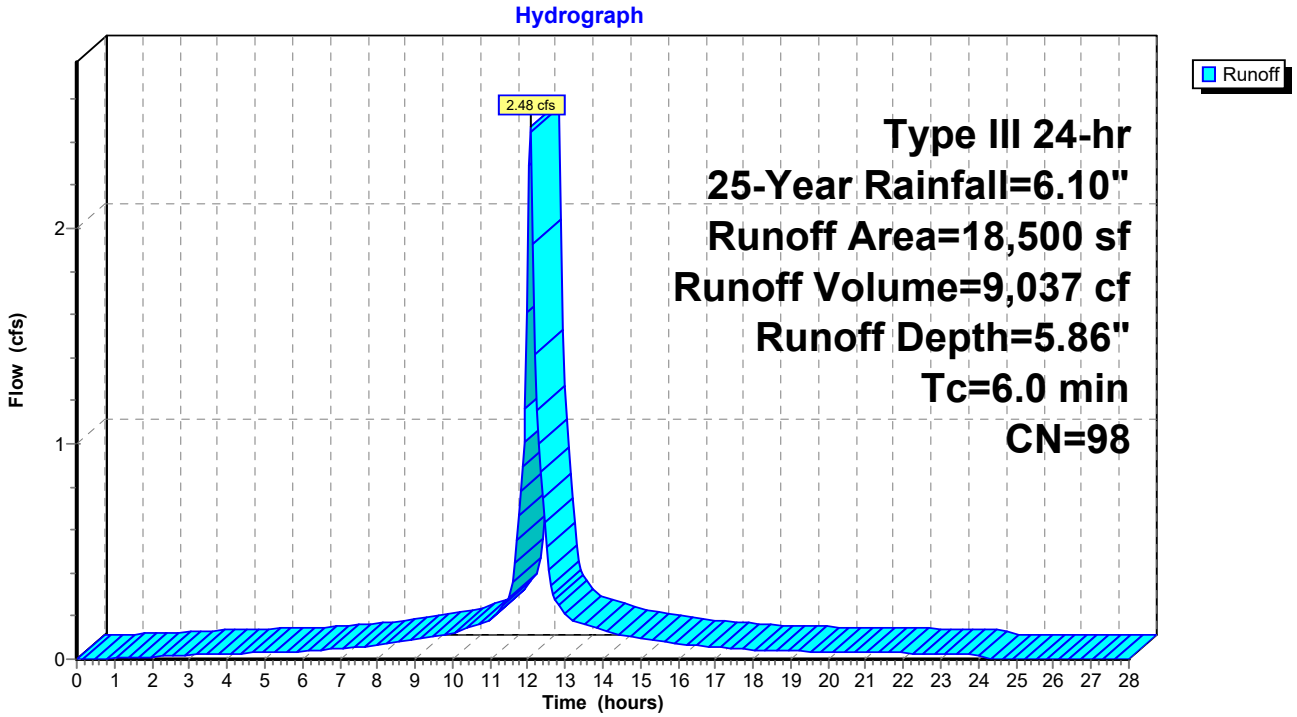
Runoff = 2.48 cfs @ 12.09 hrs, Volume= 9,037 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
18,500	98	Roofs, HSG C
18,500	98	100.00% Impervious Area

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

Subcatchment W1D: Watershed 1B - Roof



Summary for Pond 1P: Green Roof

Inflow Area = 7,500 sf, 0.00% Impervious, Inflow Depth = 4.40" for 25-Year event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 2,748 cf
Outflow = 0.55 cfs @ 12.21 hrs, Volume= 1,568 cf, Atten= 35%, Lag= 7.5 min
Primary = 0.55 cfs @ 12.21 hrs, Volume= 1,568 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 141.48' @ 12.20 hrs Surf.Area= 7,500 sf Storage= 1,193 cf

Plug-Flow detention time= 197.7 min calculated for 1,568 cf (57% of inflow)
Center-of-Mass det. time= 91.7 min (891.7 - 800.0)

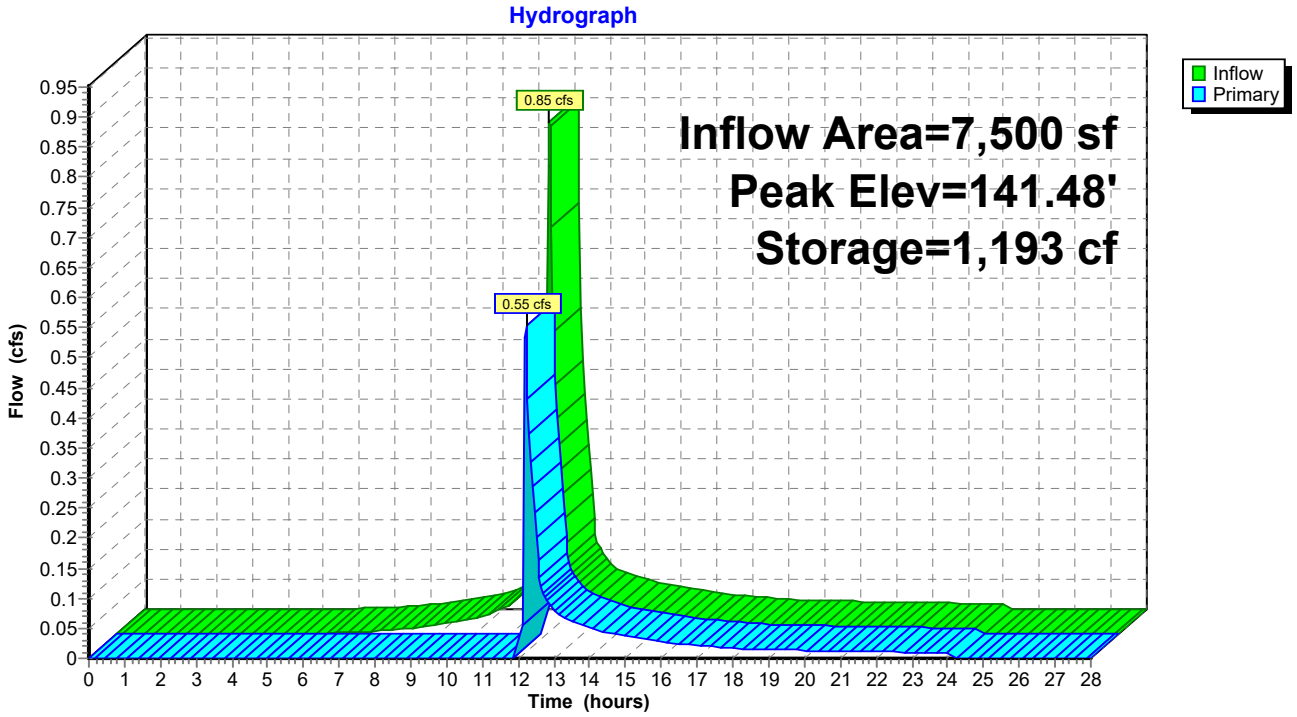
Volume	Invert	Avail.Storage	Storage Description
#1	141.00'	309 cf	**Green Roof (Prismatic)**Listed below (Recalc) 938 cf Overall x 33.0% Voids
		309 cf	x 4.00 = 1,238 cf Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
141.00	1,875	0	0
141.50	1,875	938	938

Device	Routing	Invert	Outlet Devices
#1	Primary	141.47'	**124.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.50 cfs @ 12.21 hrs HW=141.48' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.50 cfs @ 0.35 fps)

Pond 1P: Green Roof

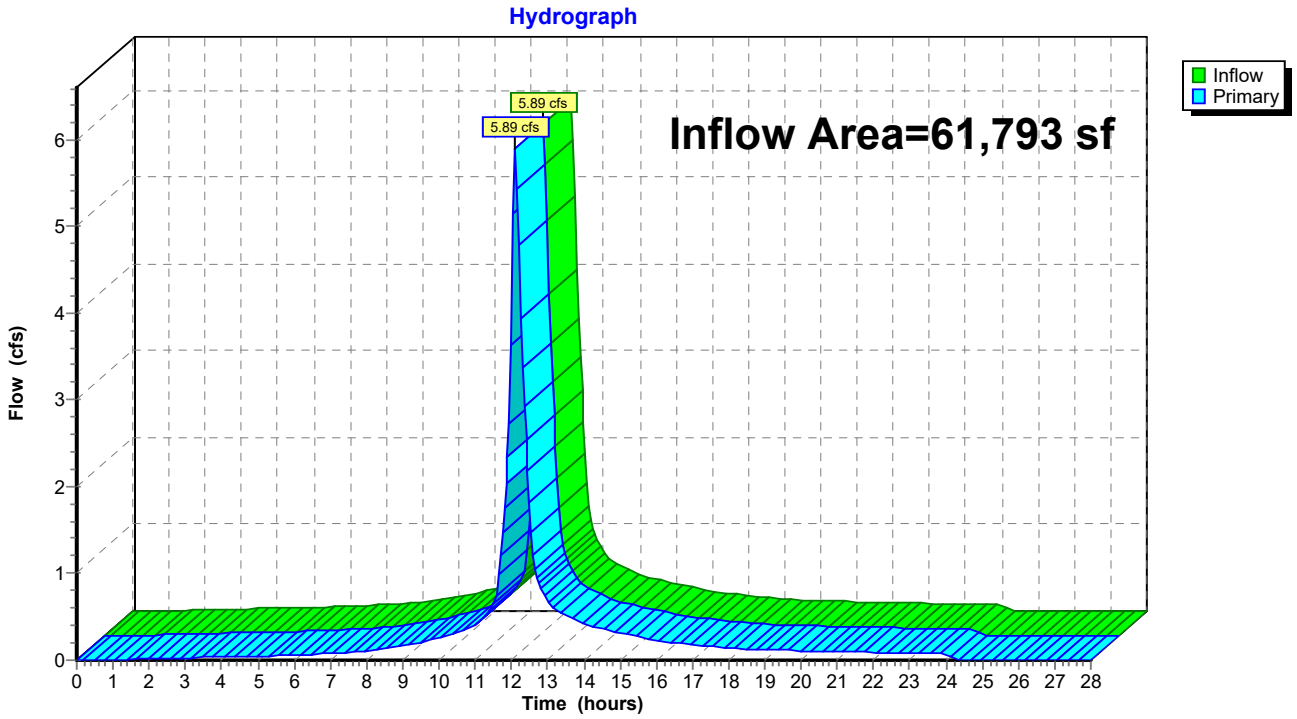


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 56.53% Impervious, Inflow Depth = 4.65" for 25-Year event
Inflow = 5.89 cfs @ 12.11 hrs, Volume= 23,921 cf
Primary = 5.89 cfs @ 12.11 hrs, Volume= 23,921 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=11,336 sf 94.87% Impervious Runoff Depth=8.34"
Flow Length=225' Tc=6.0 min CN=97 Runoff=2.17 cfs 7,878 cf

SubcatchmentW1B: Watershed 1B - Green Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=6.89"
Flow Length=50' Slope=0.0200 '/' Tc=6.0 min CN=85 Runoff=1.30 cfs 4,306 cf

SubcatchmentW1C: Watershed 1C - Runoff Area=24,457 sf 23.22% Impervious Runoff Depth=6.28"
Flow Length=330' Tc=10.8 min CN=80 Runoff=3.43 cfs 12,808 cf

SubcatchmentW1D: Watershed 1B - Roof Runoff Area=18,500 sf 100.00% Impervious Runoff Depth=8.46"
Tc=6.0 min CN=98 Runoff=3.54 cfs 13,042 cf

Pond 1P: Green Roof Peak Elev=141.49' Storage=1,216 cf Inflow=1.30 cfs 4,306 cf
Outflow=1.28 cfs 3,147 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=10.05 cfs 36,875 cf
Primary=10.05 cfs 36,875 cf

Total Runoff Area = 61,793 sf Runoff Volume = 38,034 cf Average Runoff Depth = 7.39"
43.47% Pervious = 26,859 sf 56.53% Impervious = 34,934 sf

Summary for Subcatchment W1A: Watershed 1A

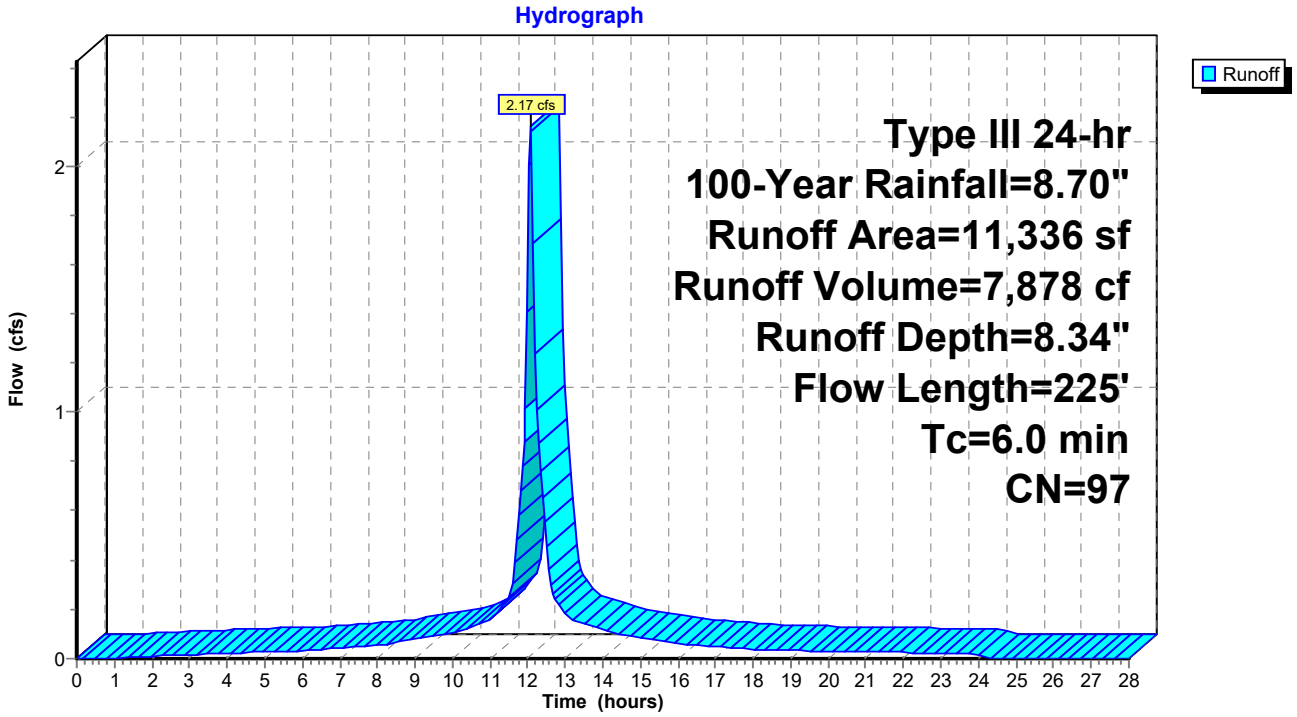
Runoff = 2.17 cfs @ 12.09 hrs, Volume= 7,878 cf, Depth= 8.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	10,755	98	Roofs & Parking Lot, HSG C
	581	74	>75% Grass cover, Good, HSG C
	11,336	97	Weighted Average
	581	74	5.13% Pervious Area
	10,755	98	94.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
0.5	125	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.5	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1A: Watershed 1A



Summary for Subcatchment W1B: Watershed 1B - Green Roof

Per RISDISM

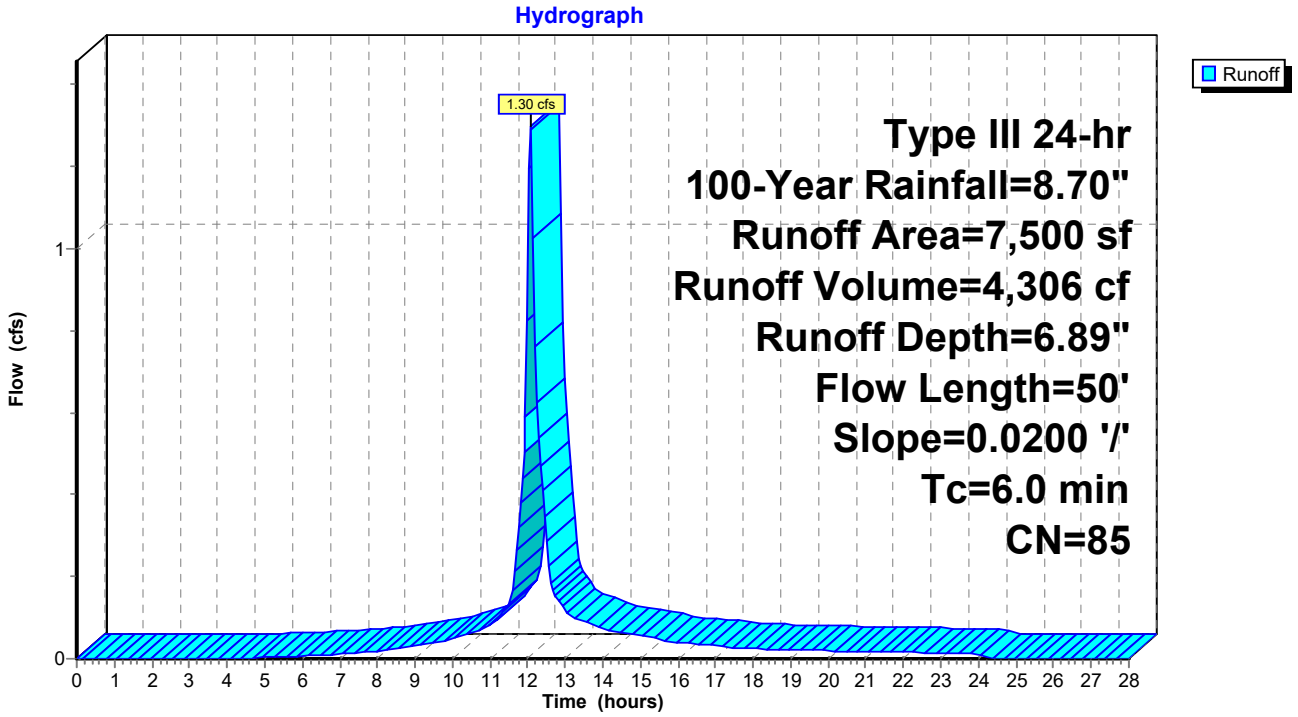
Runoff = 1.30 cfs @ 12.09 hrs, Volume= 4,306 cf, Depth= 6.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	7,500	85	Green Roofs
	7,500	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
5.5	50	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1B: Watershed 1B - Green Roof



Summary for Subcatchment W1C: Watershed 1C - Ground level

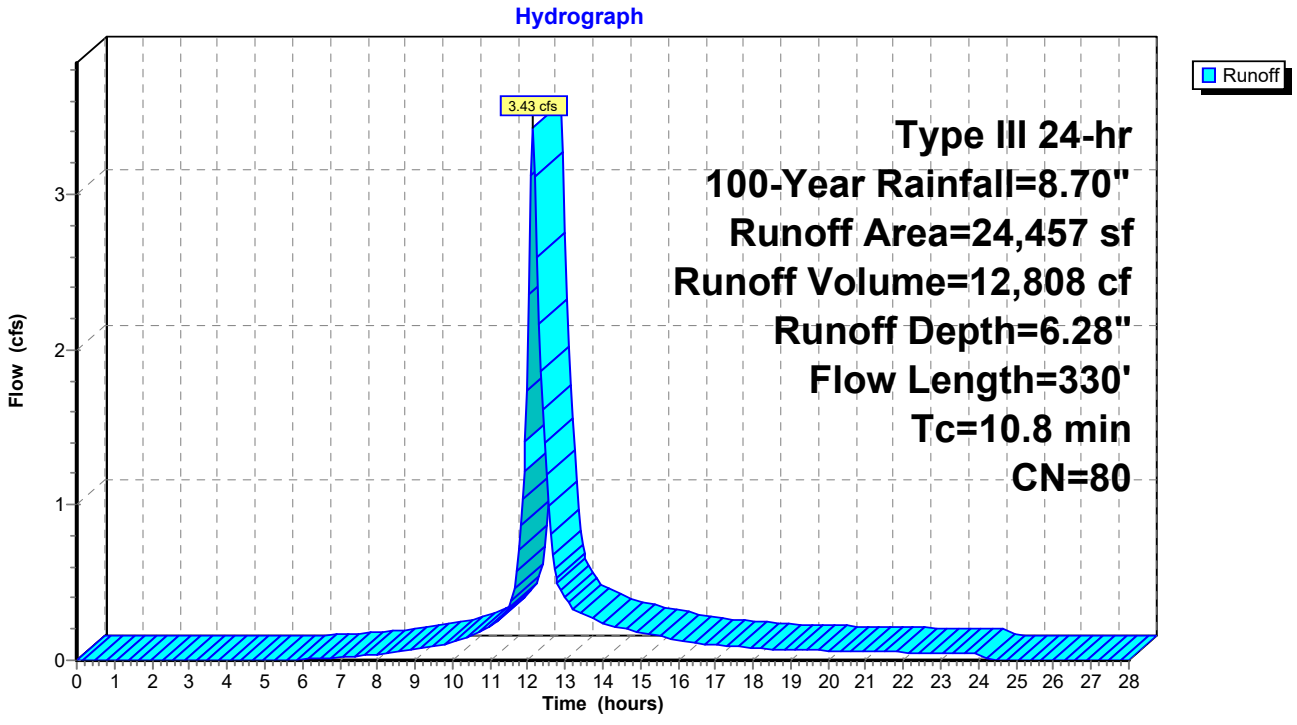
Runoff = 3.43 cfs @ 12.15 hrs, Volume= 12,808 cf, Depth= 6.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
	18,778	74	>75% Grass cover, Good, HSG C
*	5,341	98	Paved parking + Roof, HSG C
*	338	98	Concrete Pads, HSG C
	24,457	80	Weighted Average
	18,778	74	76.78% Pervious Area
	5,679	98	23.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
1.2	230	0.0430	3.11		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
10.8	330	Total			

Subcatchment W1C: Watershed 1C - Ground level



Summary for Subcatchment W1D: Watershed 1B - Roof

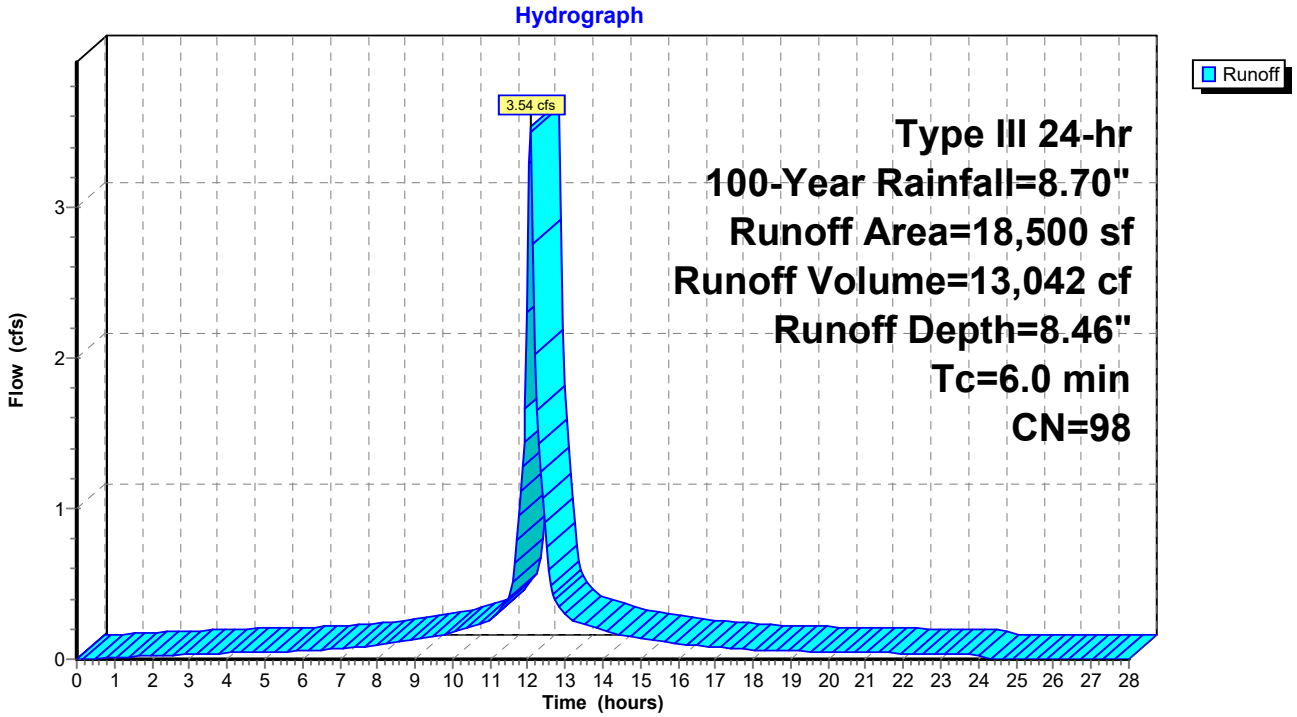
Runoff = 3.54 cfs @ 12.09 hrs, Volume= 13,042 cf, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
18,500	98	Roofs, HSG C
18,500	98	100.00% Impervious Area

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

Subcatchment W1D: Watershed 1B - Roof



Summary for Pond 1P: Green Roof

Inflow Area = 7,500 sf, 0.00% Impervious, Inflow Depth = 6.89" for 100-Year event
Inflow = 1.30 cfs @ 12.09 hrs, Volume= 4,306 cf
Outflow = 1.28 cfs @ 12.10 hrs, Volume= 3,147 cf, Atten= 2%, Lag= 0.4 min
Primary = 1.28 cfs @ 12.10 hrs, Volume= 3,147 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 141.49' @ 12.09 hrs Surf.Area= 7,500 sf Storage= 1,216 cf

Plug-Flow detention time= 146.3 min calculated for 3,147 cf (73% of inflow)
Center-of-Mass det. time= 59.0 min (846.7 - 787.7)

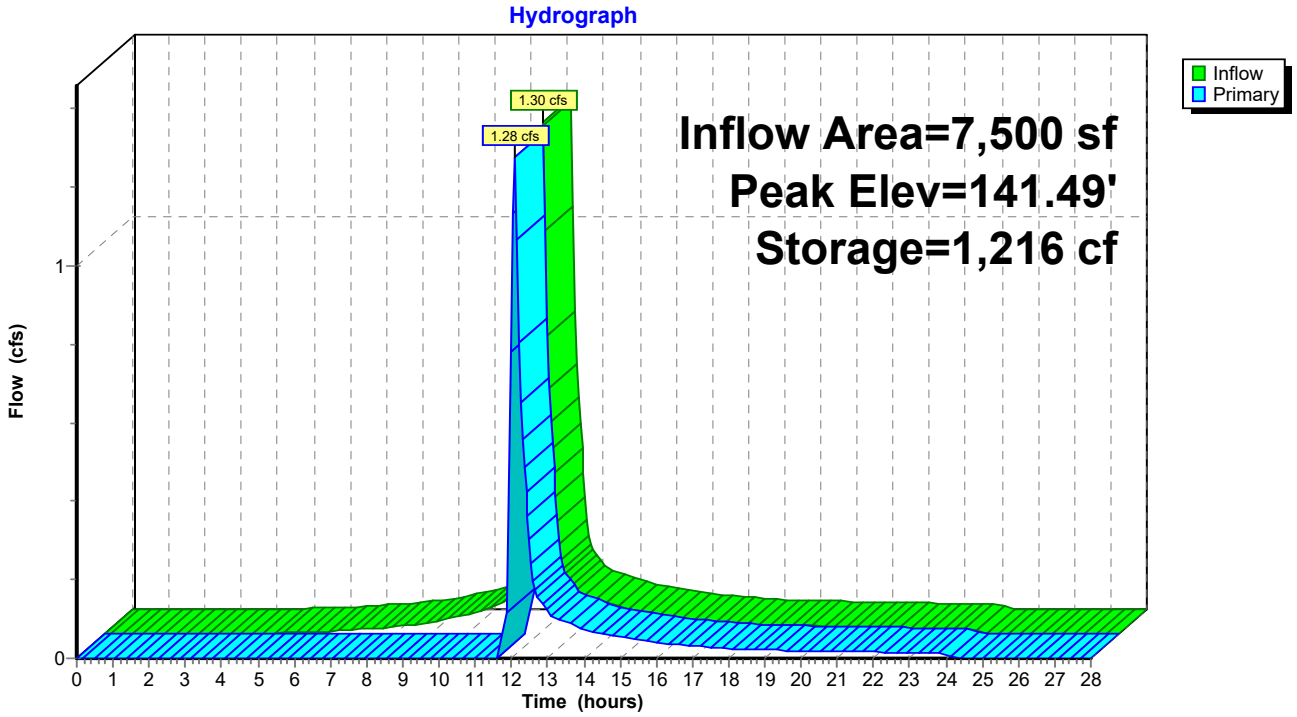
Volume	Invert	Avail.Storage	Storage Description
#1	141.00'	309 cf	**Green Roof (Prismatic)**Listed below (Recalc) 938 cf Overall x 33.0% Voids
		309 cf	x 4.00 = 1,238 cf Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
141.00	1,875	0	0
141.50	1,875	938	938

Device	Routing	Invert	Outlet Devices
#1	Primary	141.47'	**124.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.26 cfs @ 12.10 hrs HW=141.49' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 1.26 cfs @ 0.48 fps)

Pond 1P: Green Roof

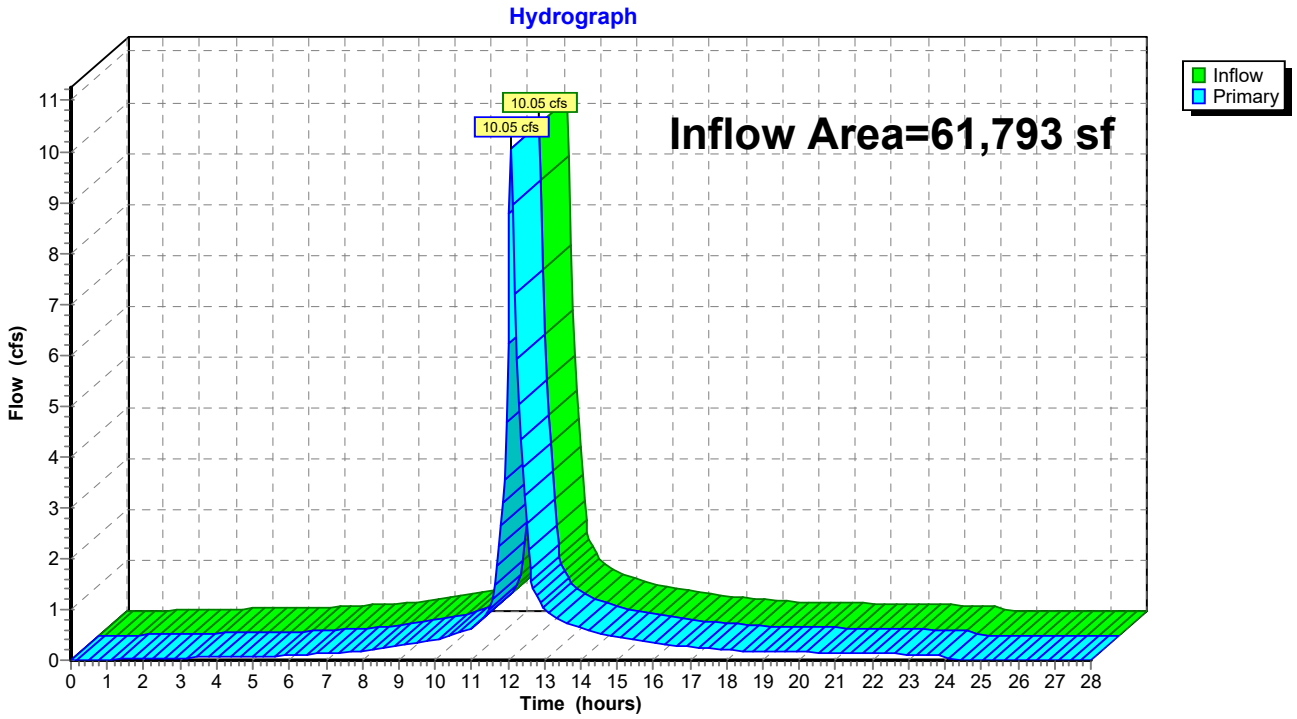


Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 56.53% Impervious, Inflow Depth = 7.16" for 100-Year event
Inflow = 10.05 cfs @ 12.10 hrs, Volume= 36,875 cf
Primary = 10.05 cfs @ 12.10 hrs, Volume= 36,875 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=11,336 sf 94.87% Impervious Runoff Depth=0.89"
Flow Length=225' Tc=6.0 min CN=97 Runoff=0.26 cfs 845 cf

SubcatchmentW1B: Watershed 1B - Green Runoff Area=7,500 sf 0.00% Impervious Runoff Depth=0.27"
Flow Length=50' Slope=0.0200 '/' Tc=6.0 min CN=85 Runoff=0.05 cfs 172 cf

SubcatchmentW1C: Watershed 1C - Runoff Area=24,457 sf 23.22% Impervious Runoff Depth=0.15"
Flow Length=330' Tc=10.8 min CN=80 Runoff=0.05 cfs 312 cf

SubcatchmentW1D: Watershed 1B - Roof Runoff Area=18,500 sf 100.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=98 Runoff=0.45 cfs 1,520 cf

Pond 1P: Green Roof Peak Elev=141.07' Storage=172 cf Inflow=0.05 cfs 172 cf
Outflow=0.00 cfs 0 cf

Link DP-1: Lower Gradient - Seekonk River Inflow=0.74 cfs 2,677 cf
Primary=0.74 cfs 2,677 cf

Total Runoff Area = 61,793 sf Runoff Volume = 2,849 cf Average Runoff Depth = 0.55"
43.47% Pervious = 26,859 sf 56.53% Impervious = 34,934 sf

Summary for Subcatchment W1A: Watershed 1A

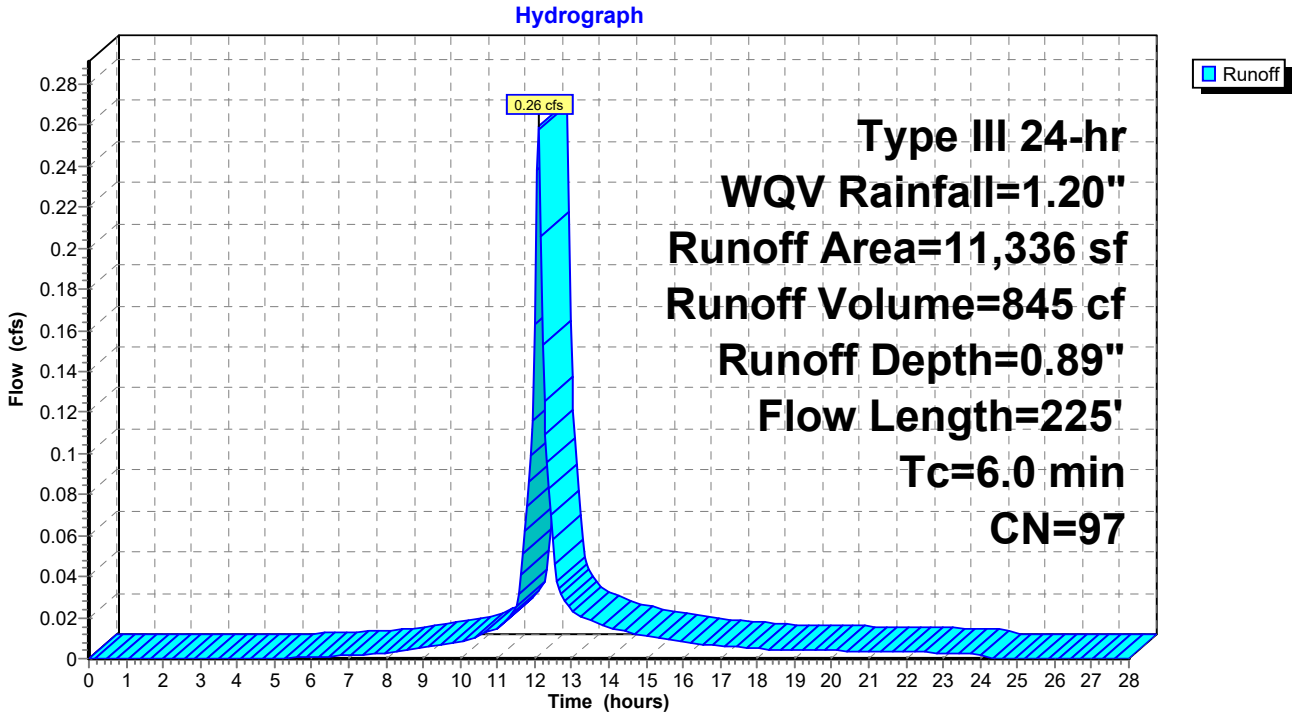
Runoff = 0.26 cfs @ 12.09 hrs, Volume= 845 cf, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
*	10,755	98	Roofs & Parking Lot, HSG C
	581	74	>75% Grass cover, Good, HSG C
	11,336	97	Weighted Average
	581	74	5.13% Pervious Area
	10,755	98	94.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.75		**Sheet Flow, SEG A** Smooth surfaces n= 0.011 P2= 3.30"
0.5	125	0.0400	4.06		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.5	225	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1A: Watershed 1A



Summary for Subcatchment W1B: Watershed 1B - Green Roof

Per RISDISM

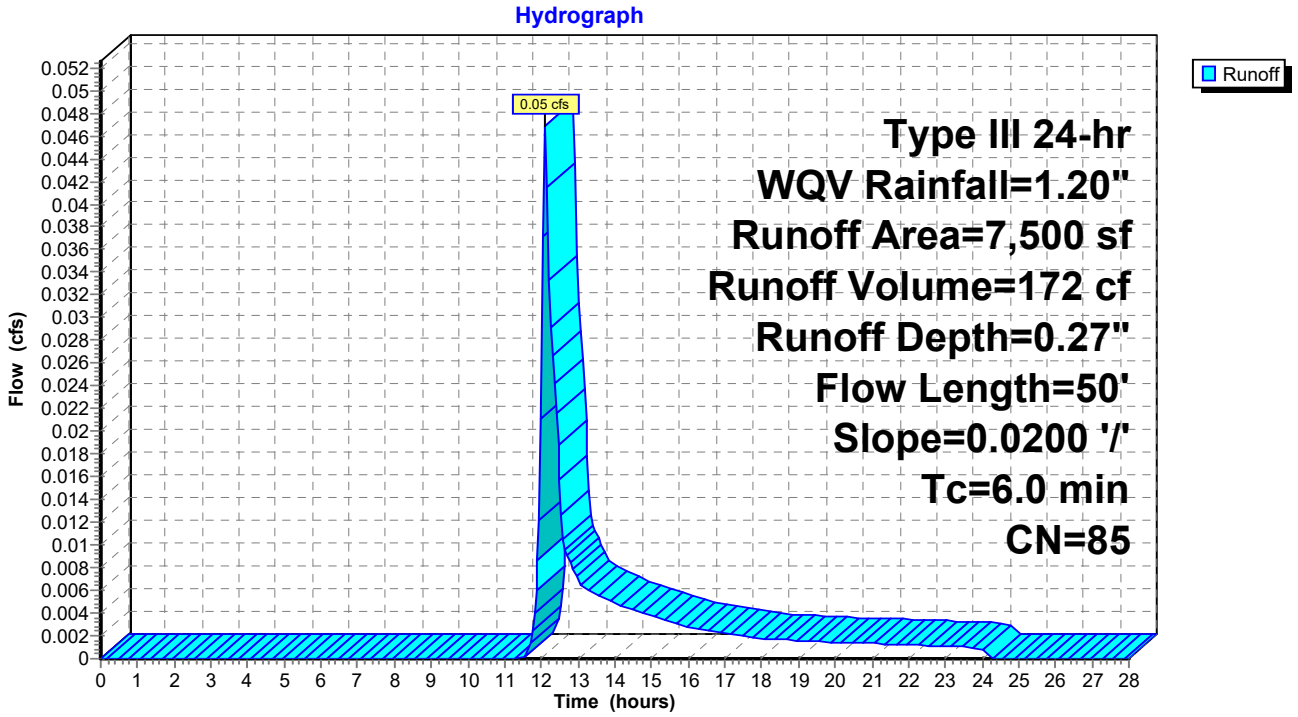
Runoff = 0.05 cfs @ 12.11 hrs, Volume= 172 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
*	7,500	85	Green Roofs
	7,500	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
5.5	50	Total, Increased to minimum Tc = 6.0 min			

Subcatchment W1B: Watershed 1B - Green Roof



Summary for Subcatchment W1C: Watershed 1C - Ground level

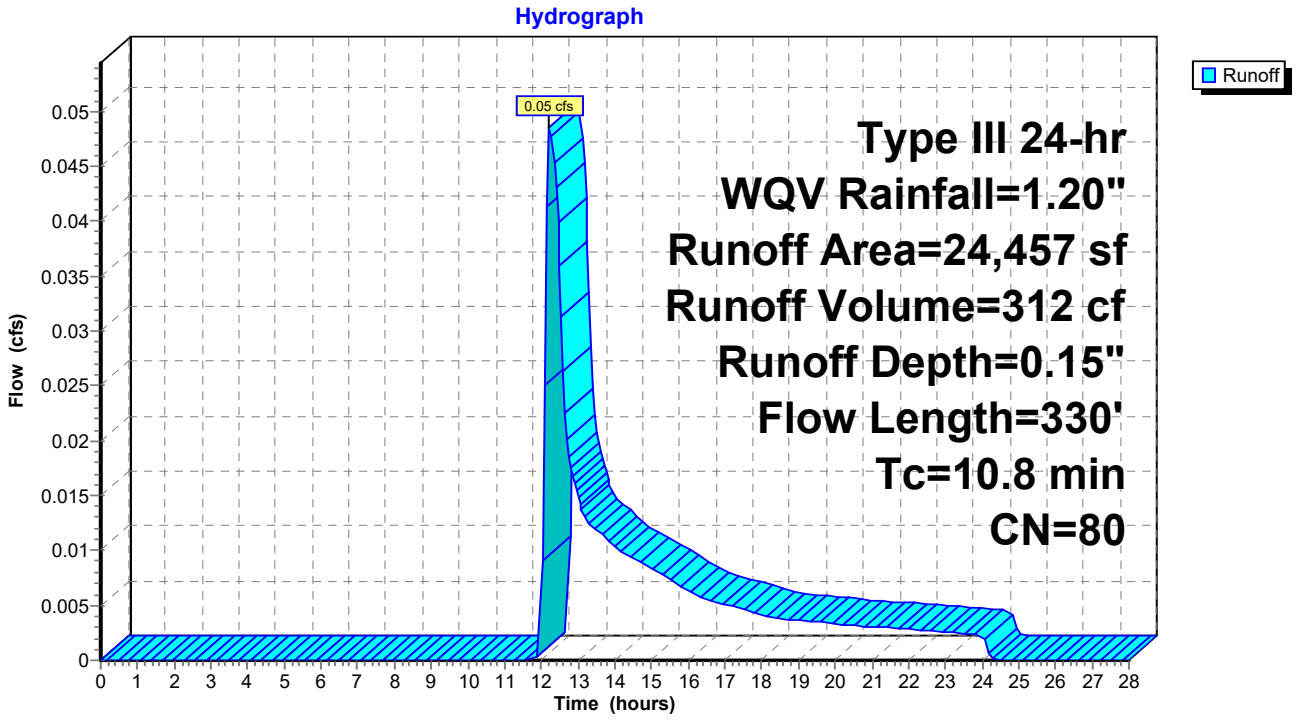
Runoff = 0.05 cfs @ 12.23 hrs, Volume= 312 cf, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
	18,778	74	>75% Grass cover, Good, HSG C
*	5,341	98	Paved parking + Roof, HSG C
*	338	98	Concrete Pads, HSG C
	24,457	80	Weighted Average
	18,778	74	76.78% Pervious Area
	5,679	98	23.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
1.2	230	0.0430	3.11		**Shallow Concentrated Flow, Grass** Grassed Waterway Kv= 15.0 fps
10.8	330	Total			

Subcatchment W1C: Watershed 1C - Ground level



Summary for Subcatchment W1D: Watershed 1B - Roof

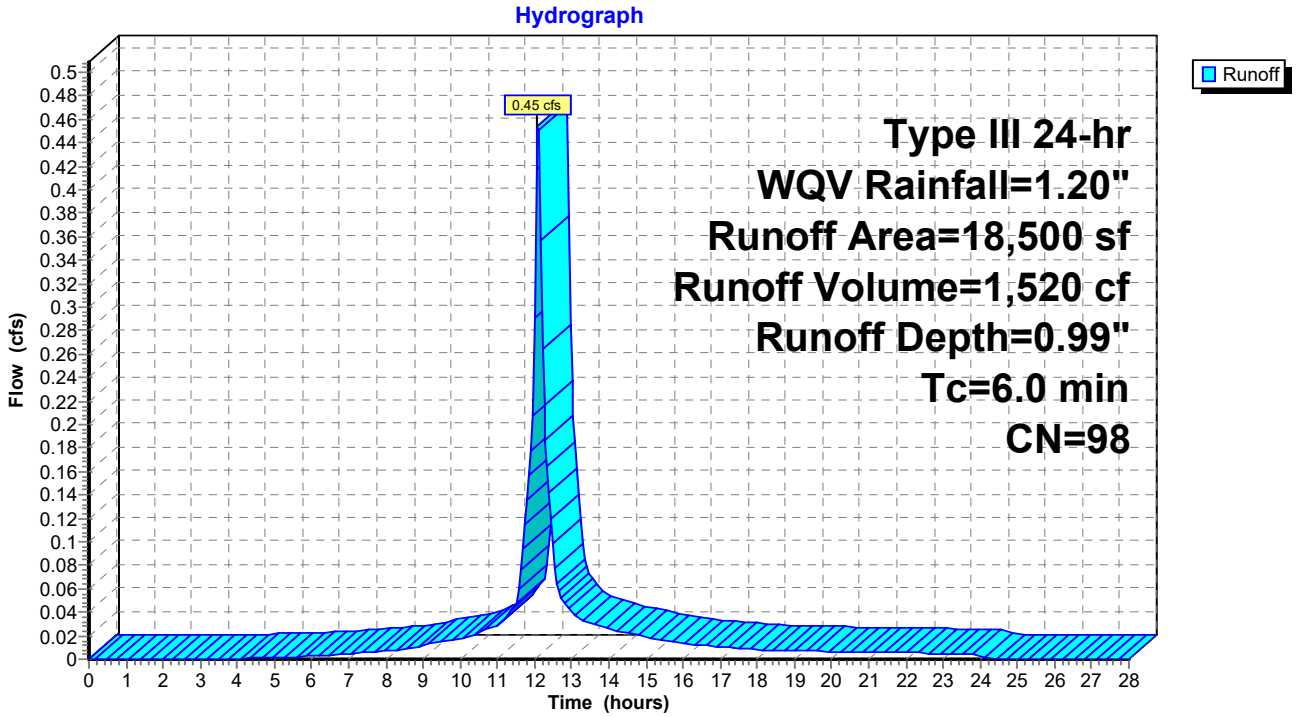
Runoff = 0.45 cfs @ 12.09 hrs, Volume= 1,520 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

Area (sf)	CN	Description
18,500	98	Roofs, HSG C
18,500	98	100.00% Impervious Area

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

Subcatchment W1D: Watershed 1B - Roof



Summary for Pond 1P: Green Roof

Inflow Area = 7,500 sf, 0.00% Impervious, Inflow Depth = 0.27" for WQV event
Inflow = 0.05 cfs @ 12.11 hrs, Volume= 172 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 141.07' @ 24.40 hrs Surf.Area= 7,500 sf Storage= 172 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

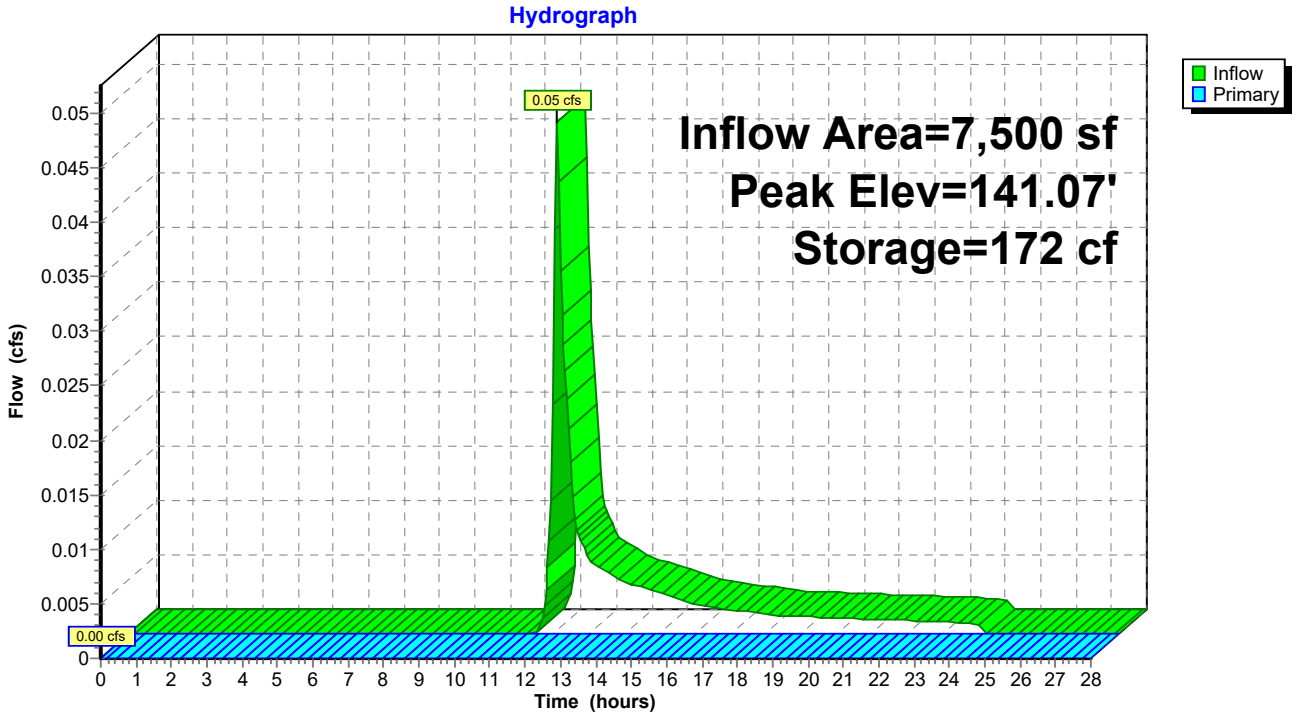
Volume	Invert	Avail.Storage	Storage Description
#1	141.00'	309 cf	**Green Roof (Prismatic)**Listed below (Recalc) 938 cf Overall x 33.0% Voids
		309 cf	x 4.00 = 1,238 cf Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
141.00	1,875	0	0
141.50	1,875	938	938

Device	Routing	Invert	Outlet Devices
#1	Primary	141.47'	**124.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=141.00' (Free Discharge)
↑—**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Green Roof



Summary for Link DP-1: Lower Gradient - Seekonk River

Inflow Area = 61,793 sf, 56.53% Impervious, Inflow Depth = 0.52" for WQV event
Inflow = 0.74 cfs @ 12.09 hrs, Volume= 2,677 cf
Primary = 0.74 cfs @ 12.09 hrs, Volume= 2,677 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: Lower Gradient - Seekonk River