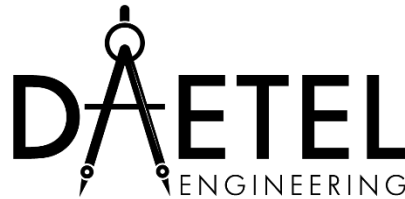


Stormwater Management Report

Prepared For

**Multi-Residential Building
937 Broadway
Block 85, Lot 23
Bayonne, Hudson County,
New Jersey**

Prepared by:



**115 Route 46, STE D29, Mountain Lakes, NJ 07046
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April 22, 2026

A handwritten signature in black ink, appearing to read "Adam B. Kandil".

**Adam B. Kandil, P.E.
New Jersey Professional Engineer
License Number GE05201800**

Stormwater Management Report – Index Page

Project Name: Multi-Residential Building

Project Location: City Of Bayonne, Hudson County, NJ

The following table summarizes typical additional information as required by the New Jersey Department of Environmental Protection Division of Land Use Regulation. Details can be found throughout this Stormwater Management Report, Appendices and Supplemental Reports at the places indicated below.

Drainage Report Information	Location of Information
Total Amount of Land Disturbed on Site – 0.346 Acre	Pages #1 and 2
Acreage of New Impervious Surfaces – 0.258 Acres	Pages #1
Type of Basin Proposed (Detention Tank)	Pages #6 and 7
Proof that Water Quality Standards are met	Page #8
Proof that Runoff Quantity Standards are met	Page #9
Proof that Groundwater Recharge Standards are met	Page 9 - Exempt
Recharge Worksheet	Appendix B - Exempted

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A. Pre- vs. Post-Development Hydrographs

- ♦ 2-Year Storm Event
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C. Maps

- ♦ Soil Map
- ♦ Drainage Area Maps
 - ♦ Existing Drainage Area Map
 - ♦ Proposed Drainage Area Map

Introduction

The intention of this study is to analyze the stormwater drainage conditions that will occur as a result of the construction of a Residential Building. The subject site is more specifically defined as 937 Broadway in City Of Bayonne, Hudson County, New Jersey. Identified on the City of Bayonne Tax Maps as Block 85, Lot 23 with a lot size of 0.258 Acres. The said property shall hereby be referenced as the "Site," and is located on the Soil and various Site Location Map within the Appendix of this report. The subject development will disturb a total area of 0.346 Acres and impervious surfaces will cover 0.258 Acres.

The design of the stormwater collection and detention system for this project is guided by the development regulations set forth by the New Jersey Department of Environmental Protection (NJDEP) for **Major Developments**. The Stormwater management Rules (N.J.A.C 7:8) defines major development as development which:

1. The disturbance of one or more acres of land since February 2, 2004
2. The creation of 1/4 acre or more of regulated impervious surface since February 2, 2004;
3. The creation of 1/4 acre or more of regulated motor vehicle surface since March 2, 2021 or
4. A combination of Subsections (2) and (3) above that totals an area of 1/4 acre or more. The same surface shall not be counted twice when determining if the combination area equals 1/4 acre or more. "Major development" includes all developments that are part of a common plan of development or sale (for example, phased residential development) that collectively or individually meet any one or more of Subsection (1), (2), (3), or (4) above. Projects undertaken by any government agency that otherwise meet the definition of "major development" but which do not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., are also considered major development.

The limit of disturbance of this development containing the property and a portion of the right of way is estimated 15,113.34 SF (0.346 Ac), and thus is a Minor development.

The proposed project does not meet the threshold of major development For both the NJDEP Stormwater Management Rules and the Municipality. Therefore the Project will be designed as a Minor Development in accordance with the Municipal Ordinance. However per the redevelopment there are requirements that there must be reductions in accordance with DEP regarding quantity, In which this project conforms with the requirements

The scope of this study will focus on the stormwater runoff generated by the proposed buildings, driveways, paved parking areas, and landscaped areas (i.e., post-development conditions) within the study

area as compared to the existing conditions of the site (study area). Maps of the existing and proposed conditions are included within the Appendix of the report and are entitled “Existing Drainage Area Map” and “Proposed Drainage Area Map”, respectively. The area of study in this report will be limited to drainage areas tributary to the proposed stormwater management facilities, the proposed developed area, as well as off-site areas tributary to the site.

In summary, the present will be:

- Calculations for pre- and post-development runoff from 2-, 10-, and 100-year frequency events;
- Calculations for the proposed stormwater management facilities, including inflow hydrographs, outflow hydrographs, and a storage volume versus depth table; and,

The design adheres to Rules and Regulations promulgated by the NJDEP and standards set forth by the State Soil Conservation Committee and the Hudson Essex Passaic Soil Conservation District. In particular, the following standards were utilized:

- *New Jersey Stormwater Best Management Practice (BMP) Manual.*
- NJDEP Stormwater Management Regulations (NJAC 7:8).
- NJDEP Flood Hazard Area Control Act Rules (N.J.A.C 7:13-1.1 et seq.

The stormwater management system proposed on the Site has been designed in accordance with the above rules, regulations, guidelines as well as local municipal stormwater requirements.

Existing Site Conditions

The existing site conditions for the subject project are illustrated on the “Existing Drainage Area Map” which is included within Appendix of this report. The “Existing Drainage Area Map” is based on a topographical & boundary & survey, by Behar surveying associates, pc by professional land surveyors by Jeremy a. Klapper, N.J.P.L.S INC NO. 24GAS04331800, L.S. Dated 11/03/2025, Last Revised 03/05/2026. Existing stormwater runoff conditions were analyzed based on the site conditions from the survey, field inspection, and soil conditions as found in the USDA Soil Survey for Hudson County, under original conditions.

Topography

The topography of the site can be described as “mild” with slopes ranging from about one (1) to two (2) percent. The general topography of the site drains towards the Existing Street at Broadway Avenue & West 45th Street

Drainage

Under existing conditions, the site contains one (1) drainage area, labeled as EDA-1 and consists of approximately 0.258 acres (study area) as illustrated on the accompanying “Existing Drainage Area Map” included within Appendix C.

- **Drainage Area EDA-1 (on-site):** This area encompasses approximately 0.258 Acres and includes the entire site that drains towards Broadway Avenue & West 45th Street.

Site Soils

Based on the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey (and as shown on the Soil Survey Map located in Appendix C the soils within the overall drainage area are Urban land, Till Substratum (URTILB), 0 to 8 percent slopes, as shown on the Soil Map for Hudson County and the Hydrologic Soil Group (HSG) is determined to be type “D” (Urban Land).

Proposed Site Conditions

Post Development Conditions

Surface Cover/Development

Under proposed conditions, the developed area will require the disturbance of 0.346 Acres of land; impervious surfaces will cover 0.258 Acres. The runoff from the proposed impervious areas as well as the runoff from the proposed roof area of the building (clean) will be directed the proposed basin. The Site has been designed to maintain existing drainage patterns as the water will continue to drain from North-West to South-East as it does under existing conditions.

Drainage

The stormwater management facilities for the proposed development have been designed to maintain the natural, existing drainage patterns to the fullest extent possible and to meet appropriate regulatory requirements with respect to groundwater recharge, water quality, and peak flow reductions. Under post-development conditions, One (1) main drainage area are proposed as depicted on the accompanying Proposed Drainage Area Plan included in Appendix C and are as follows:

- **Drainage Area PDA-1** This area encompasses approximately 0.258 Acres and includes the Multi-Residential Building which will be directed to the on-site detention tank. This drainage area is mostly developed.

Stormwater Management Facilities

Green Roof

- To meet the various design parameters established by the jurisdictional authorities above, the construction of stormwater management facilities is proposed for this Site. According to the Stormwater Management Rules, A Green Roof is a Green infrastructure BMP that may be used to satisfy the stormwater runoff quantity standards. The Green Roof has been designed to detain the runoff from a portion of the roof (1,799 SF), while infiltrating the water quality storm and reducing the rates of runoff prior to draining to the Underground Stormwater Management Facility. See Green Roof calculation in Appendix B of this report. *Also based on calculations a modified CN value is utilized for modeling the runoff in HydroCAD.*

Detention Stormwater Management Facility

The stormwater management design for this project consists of an detention tank system (18' (L) x 18' (W) x 6.5' (H)), designed to fully collect the roof runoff generated and sized to detain the increase of volume generated by the Proposed development, as per Municipal's stormwater requirements. The design proposes an outlet structure equipped with a 2.5'' orifice, 1' x 1' weir & 2' x 2' grate to control the flow which outlets through a 6'' HDPE pipe which connects to the Municipal Conveyance system in the roadway.

Outlet Control Structure

In order to control the outflow from the Tank outlet structures are proposed. The outlet structure in the small-scale basin (7P) has a 2.5'' inch orifice, set at elevation 92' msl and a 1' x 1' weir is set at elevation 97.79' msl, which ultimately drain to the municipal conveyance system via an 6'' HDPE Pipe Culvert which is set at 92' msl. At the top of the outlet structure the rim is set at elevation 100' msl which is above the routing elevation of the 2-, 10- & 100-year storm event. The proposed outlet pipe will discharge through the 6'' Culvert which is ultimately connects to the Municipal Conveyance system in the roadway.

Methodology

The stormwater management facilities have been designed in accordance with the local, county, and State requirements mentioned above.

Calculation Software

The calculations included within this report were performed using hydrologic software, HydroCAD (Version 10.20) by HydroCAD Software Solutions, LLC. The HydroCAD software was used to develop runoff hydrographs, outlet structure configurations, and detention Tank routings using the SCS TR-20 methodology. Times of concentration calculations for pre-development and post-development calculations were generated utilizing the SCS Method. All storm data for this project was generated using standard NRCS unit hydrographs.

Runoff "CN" Values

As described above, soil classifications for use with runoff curve numbers (CN) were taken from the NRCS Web Soil Survey (see Appendix C). Evaluation of this data indicates that soils within the existing and proposed drainage areas consisted of hydrologic soil groups "D" (Urban Land) as defined within the United States Soil Conservation Service Manual *"Urban Hydrology for Small Watersheds"*, v. 1986 and *within the NRCS NEH Handbook Part 630*.

Runoff CN values for the soil groups were assigned to various surfaces as follows:

Group D

<u>Ground Cover</u>	<u>CN Value</u>
Open Space (good)	80
Green Roof	76-83
Impervious/Building Areas	98

Runoff CN value calculations for pre-developed and post-developed basin were generated using HydroCad software and are included within Appendix A of this report.

Time of Concentration

The time of concentration and travel time (TC) calculations have been completed in accordance with Chapter 15 of the NEH Part 630 Handbook. The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest. Values of the time of concentration were determined for existing and proposed conditions based on land cover and slope of the flow path. A Time of Concentration of 10 minutes was assumed.

Infiltration Rates

Infiltration rates were assumed the soil conditions in that the soils are classified as hydrologic soil groups “D” which are fair drained soils. For the purposes of this design, a safety factor of at least two (2) was utilized in conjunction with the Darcy Equation $Q=KIA$, as set forth in the NJDEP Stormwater BMP Manual. However, conservatively the design was analyzed with NO infiltration for the Stormwater Management Facility, which will be field verified during construction.

Water Quality

Stormwater Quality measures are NOT required since the project site doesn’t create more than ¼ acre of regulated motor vehicle surface. However the Building is covered entirely, hence all runoff is deemed to be clean. Additionally a note has been added to the drawings “All roof drains, gutters, downspouts, and roof leader inlets shall be provided with appropriate screens, strainers, leaf guards, or approved filtering devices to prevent leaves, debris, sediment, and other floatable materials from entering the stormwater management system. roof runoff shall be collected and conveyed as clean roof water only”. Therefore the entire building is being collected by roof leaders and routed directly into the underground stormwater management system as clean runoff.

Stormwater Quality measures are not required since the project site doesn’t creates more than ¼ acre of regulated motor vehicle surface.

Water Quantity Reductions

The 2-, 10- and 100-year storm events will be detained and controlled by an outlet structure, reducing the pre-existing runoff rates substantially and meeting the required reduction rates. In accordance with local ordinance requirements, the stormwater management system has been designed to comply with the water quantity control standards applicable to a Major Development. The quantity reduction for post-construction development, as detailed in the NJDEP Stormwater Management Regulations, includes a 50% reduction for the 2-year storm, a 25% reduction for the 10-year storm, and a 20% reduction for the 100-year storm per N.J.A.C. 7:8-5.6(b)3 (applied when there is a detention Tank proposed).

For areas where the post-development runoff hydrograph is below the pre-development hydrograph, both the proposed site peak runoff rates and runoff volumes will not exceed existing conditions.

The following tables show the comparison between the pre-development and post-development stormwater runoff rates for various discharge points and demonstrate that the site design meets the Peak Flow Rate Reduction Requirements established by NJDEP.

Table 1: Pre-Development vs. Post-Development Runoff Rate Comparison
Point of Analysis (Link 3L vs. Link 6L)
Per NJAC 7:8-5.6 (b) (1)

Design Storm	Pre-Development Runoff Rate (cfs)	Allowable (cfs)	Post-Development Runoff Rate (cfs)	Reduction Achieved
2-year	0.62	0.31	0.24	Y
10-year	1.00	0.75	0.32	Y
100-year	1.73	1.38	1.30	Y

Groundwater Recharge

The Project is Exempted from Recharge as the Project has been previously develop and is located within the Urban Redevelopment Area (Metropolitan Planning Area (PA1) as Defined by the State Planning Area. ***Therefore, Groundwater Recharge Standards DO NOT apply to this project.***

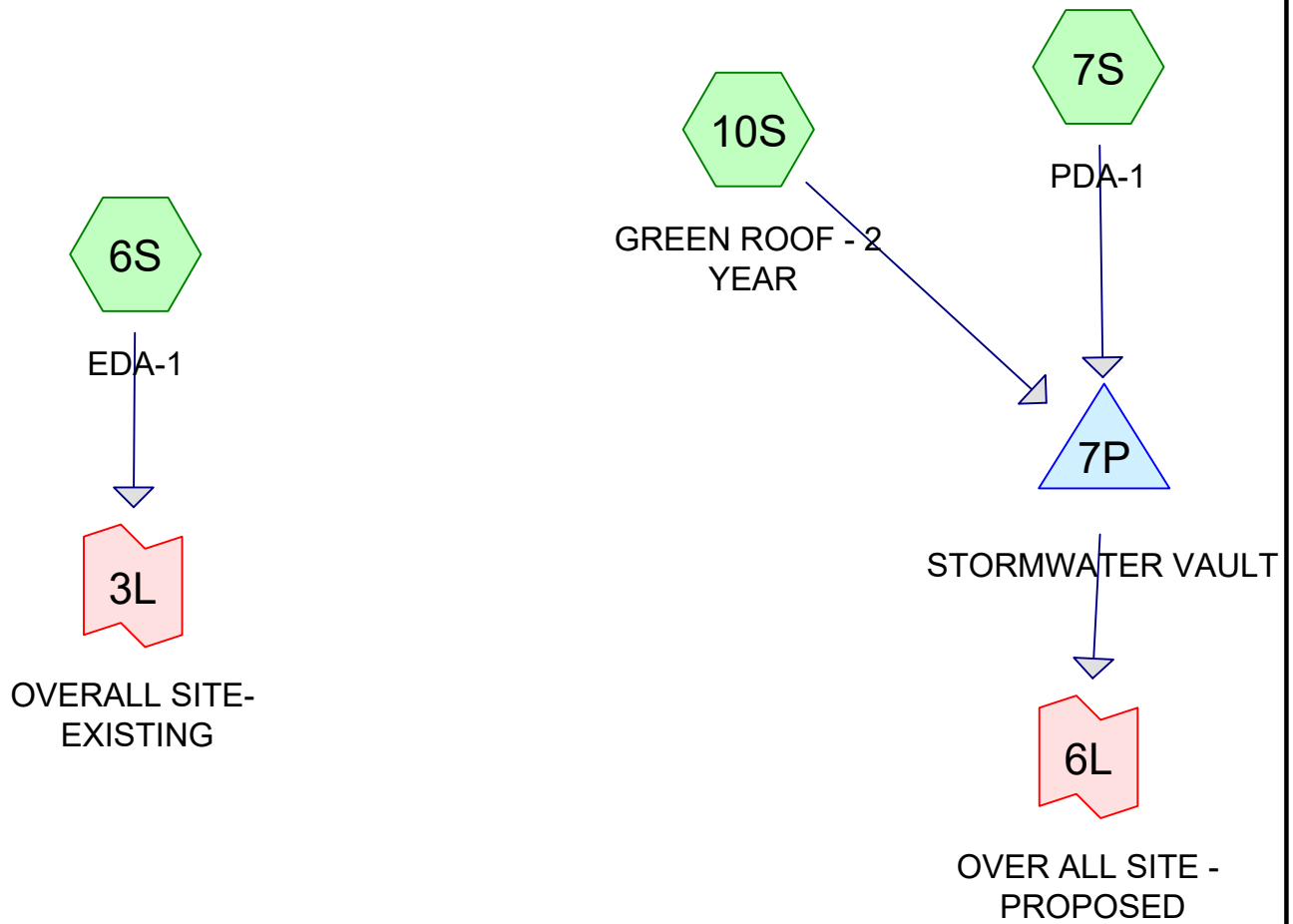
Conclusion

In summary, the proposed development and stormwater management system illustrated on the drawings prepared DaeTel Engineering, Inc. meets the requirements set forth by the current NJDEP Stormwater Management Regulations. The storm water management system for the project is designed to minimize the impacts of the developed areas on the downstream discharge points in accordance with the Municipal, County and NJDEP regulations. The proposed development has been designed with provisions for safe and efficient control of stormwater runoff in a manner which will not adversely affect the existing drainage patterns found in the surrounding areas. The proposed development satisfies the NJDEP and municipal criteria for peak runoff rates for the, 2, 10, & 100-year design storm frequencies and meets NJDEP criteria for water quality, groundwater recharge and water quality. It is evident that the proposed development will not adversely impact on the existing drainage system.

A. PRE- vs. POST-DEVELOPMENT HYDROGRAPHS

- ♦ **2-Year Storm Event**
- ♦ **10-Year Storm Event**
- ♦ **100-Year Storm Event**

2-Year Storm Event



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Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year	NOAA 24-hr	D	Default	24.00	1	3.31	2

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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
3,615	80	>75% Grass cover, Good, HSG D (6S)
1,799	76	Green Roof (10S)
18,861	98	Paved parking & roofs (6S, 7S)
24,276	94	TOTAL AREA

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Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
3,615	HSG D	6S
20,660	Other	6S, 7S, 10S
24,276		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	3,615	0	3,615	>75% Grass cover, Good
0	0	0	0	1,799	1,799	Green Roof
0	0	0	0	18,861	18,861	Paved parking & roofs
0	0	0	3,615	20,660	24,276	TOTAL AREA

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	7P	92.00	91.72	51.0	0.0055	0.011	0.0	6.0	0.0	

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NOAA 24-hr D 2 Year Rainfall=3.31"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 9
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: EDA-1

Runoff Area=0.258 ac 67.83% Impervious Runoff Depth=2.46"
Flow Length=170' Tc=10.0 min CN=92 Runoff=0.62 cfs 2,299 cf

Subcatchment7S: PDA-1

Runoff Area=0.258 ac 100.00% Impervious Runoff Depth=3.08"
Tc=10.0 min CN=98 Runoff=0.70 cfs 2,882 cf

Subcatchment10S: GREEN ROOF - 2 YEAR

Runoff Area=1,799 sf 0.00% Impervious Runoff Depth=1.23"
Tc=0.0 min CN=76 Runoff=0.07 cfs 184 cf

Pond 7P: STORMWATERVAULT

Peak Elev=94.21' Storage=717 cf Inflow=0.73 cfs 3,066 cf
Outflow=0.24 cfs 3,066 cf

Link 3L: OVERALL SITE- EXISTING

Inflow=0.62 cfs 2,299 cf
Primary=0.62 cfs 2,299 cf

Link 6L: OVER ALL SITE - PROPOSED

Inflow=0.24 cfs 3,066 cf
Primary=0.24 cfs 3,066 cf

Total Runoff Area = 24,276 sf Runoff Volume = 5,366 cf Average Runoff Depth = 2.65"
22.30% Pervious = 5,414 sf 77.70% Impervious = 18,861 sf

Summary for Subcatchment 6S: EDA-1

Runoff = 0.62 cfs @ 12.17 hrs, Volume= 2,299 cf, Depth= 2.46"
Routed to Link 3L : OVERALL SITE- EXISTING

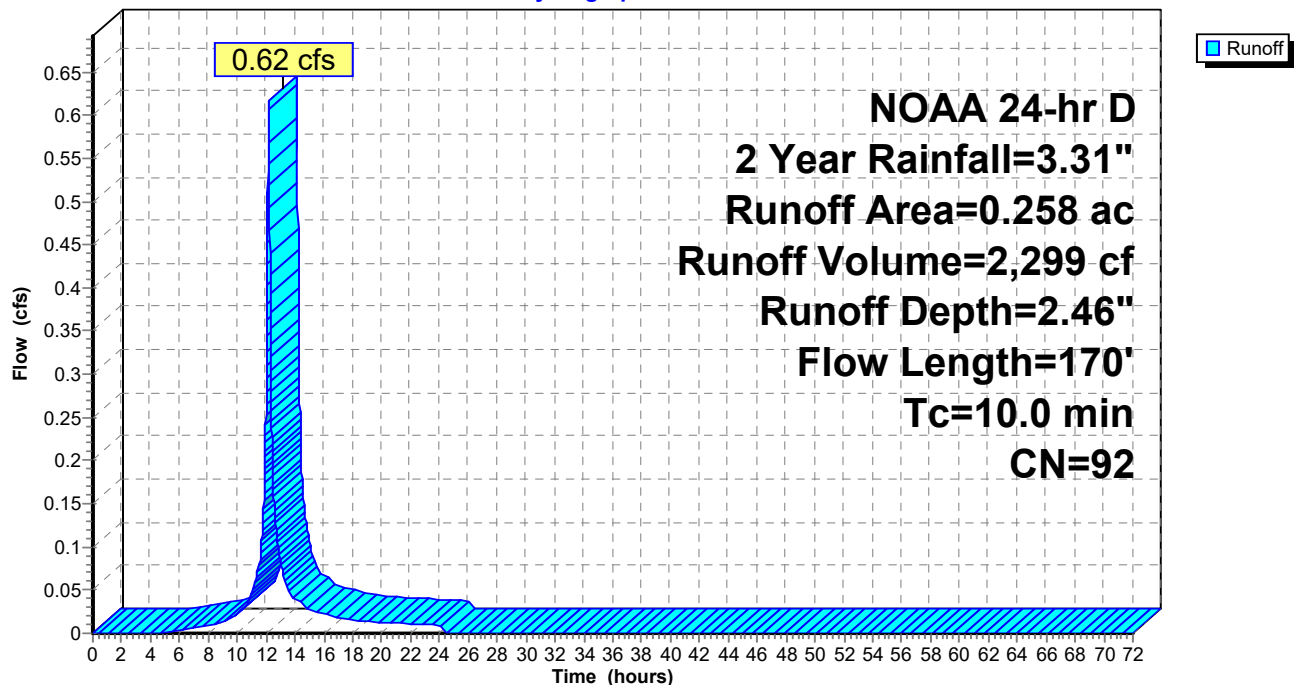
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 Year Rainfall=3.31"

Area (ac)	CN	Description
0.083	80	>75% Grass cover, Good, HSG D
0.175	98	Paved parking & roofs
0.258	92	Weighted Average
0.083		32.17% Pervious Area
0.175		67.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.06		Sheet Flow, A-B
					Smooth surfaces n= 0.011 P2= 3.31"
0.3	70	0.0320	3.63		Shallow Concentrated Flow, B-C
					Paved Kv= 20.3 fps
1.9	170	Total, Increased to minimum Tc = 10.0 min			

Subcatchment 6S: EDA-1

Hydrograph



Summary for Subcatchment 7S: PDA-1

Runoff = 0.70 cfs @ 12.17 hrs, Volume= 2,882 cf, Depth= 3.08"
 Routed to Pond 7P : STORMWATER VAULT

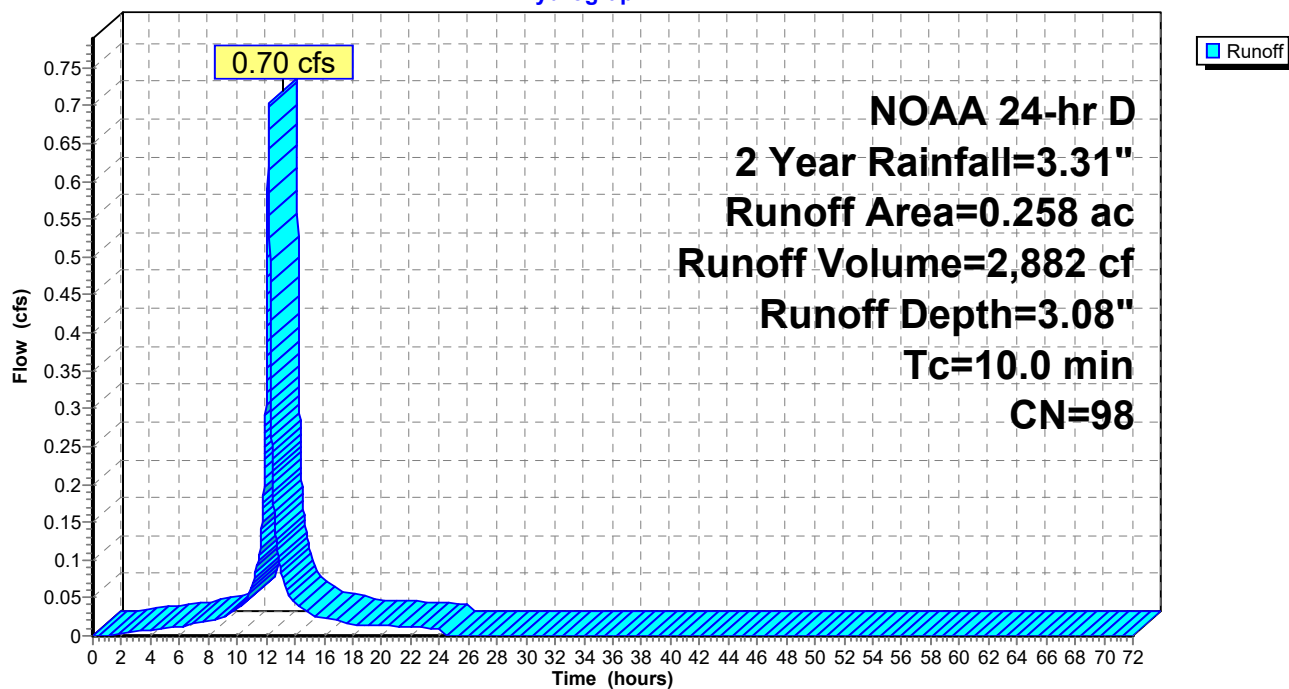
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2 Year Rainfall=3.31"

Area (ac)	CN	Description
0.258	98	Paved parking & roofs
0.258		100.00% Impervious Area

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

Subcatchment 7S: PDA-1

Hydrograph

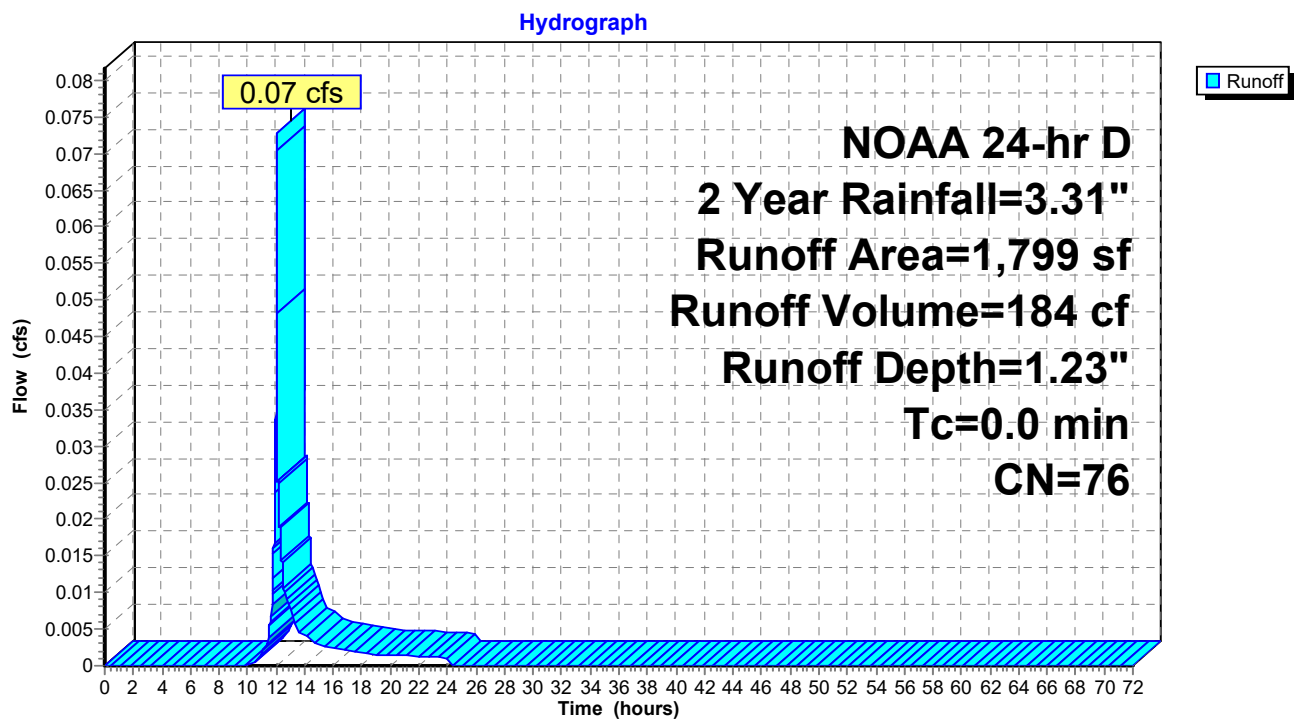


Summary for Subcatchment 10S: GREEN ROOF - 2 YEAR

Runoff = 0.07 cfs @ 12.09 hrs, Volume= 184 cf, Depth= 1.23"
 Routed to Pond 7P : STORMWATER VAULT

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 2 Year Rainfall=3.31"

	Area (sf)	CN	Description
*	1,799	76	Green Roof
	1,799		100.00% Pervious Area

Subcatchment 10S: GREEN ROOF - 2 YEAR

Summary for Pond 7P: STORMWATER VAULT

Inflow Area = 13,037 sf, 86.20% Impervious, Inflow Depth = 2.82" for 2 Year event
 Inflow = 0.73 cfs @ 12.17 hrs, Volume= 3,066 cf
 Outflow = 0.24 cfs @ 12.43 hrs, Volume= 3,066 cf, Atten= 67%, Lag= 15.6 min
 Primary = 0.24 cfs @ 12.43 hrs, Volume= 3,066 cf
 Routed to Link 6L : OVER ALL SITE - PROPOSED

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 9
 Peak Elev= 94.21' @ 12.43 hrs Surf.Area= 324 sf Storage= 717 cf

Plug-Flow detention time= 35.1 min calculated for 3,065 cf (100% of inflow)
 Center-of-Mass det. time= 35.2 min (802.5 - 767.2)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,106 cf	18.00'W x 18.00'L x 6.50'H Prismatic

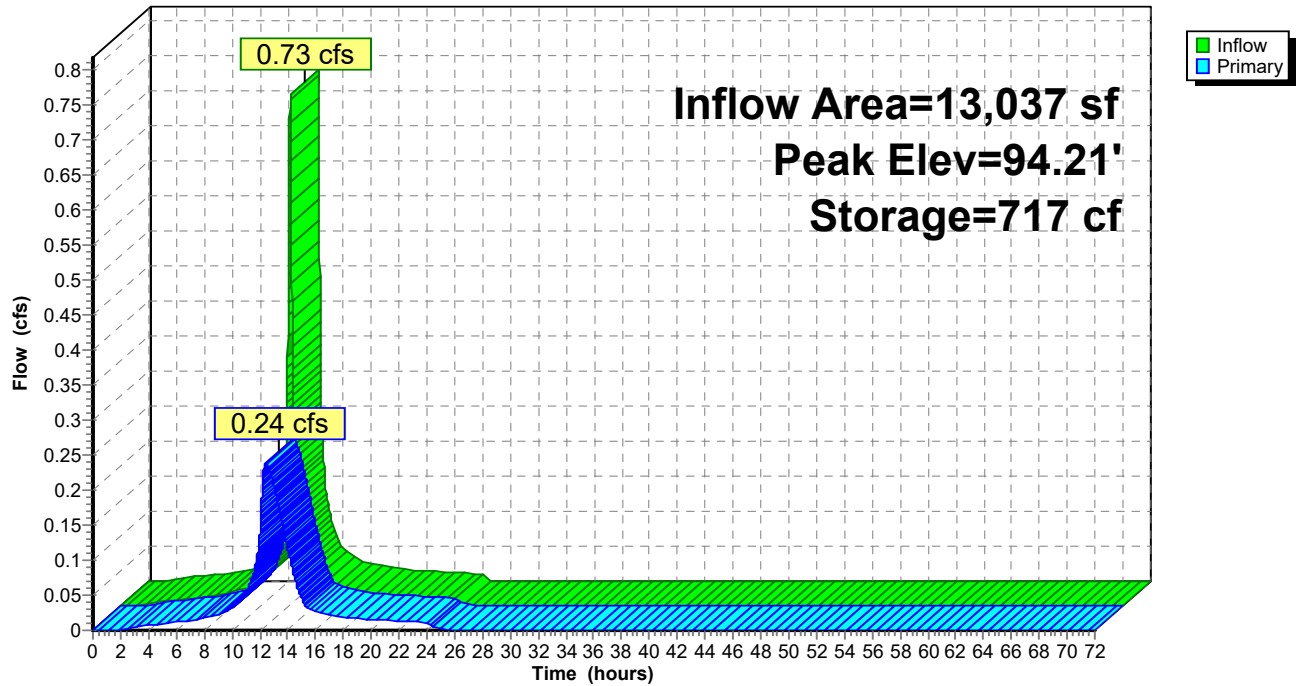
Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	6.0" Round Culvert L= 51.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 92.00' / 91.72' S= 0.0055 ' / Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	92.00'	2.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	97.79'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.0' Crest Height
#4	Device 1	100.00'	2.0" x 2.0" Horiz. Orifice/Grate C= 0.600 in 2.0" x 2.0" Grate (100% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.24 cfs @ 12.43 hrs HW=94.21' TW=0.00' (Dynamic Tailwater)

1=Culvert (Passes 0.24 cfs of 1.11 cfs potential flow)
 2=Orifice/Grate (Orifice Controls 0.24 cfs @ 6.99 fps)
 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
 4=Orifice/Grate (Controls 0.00 cfs)

Pond 7P: STORMWATER VAULT

Hydrograph



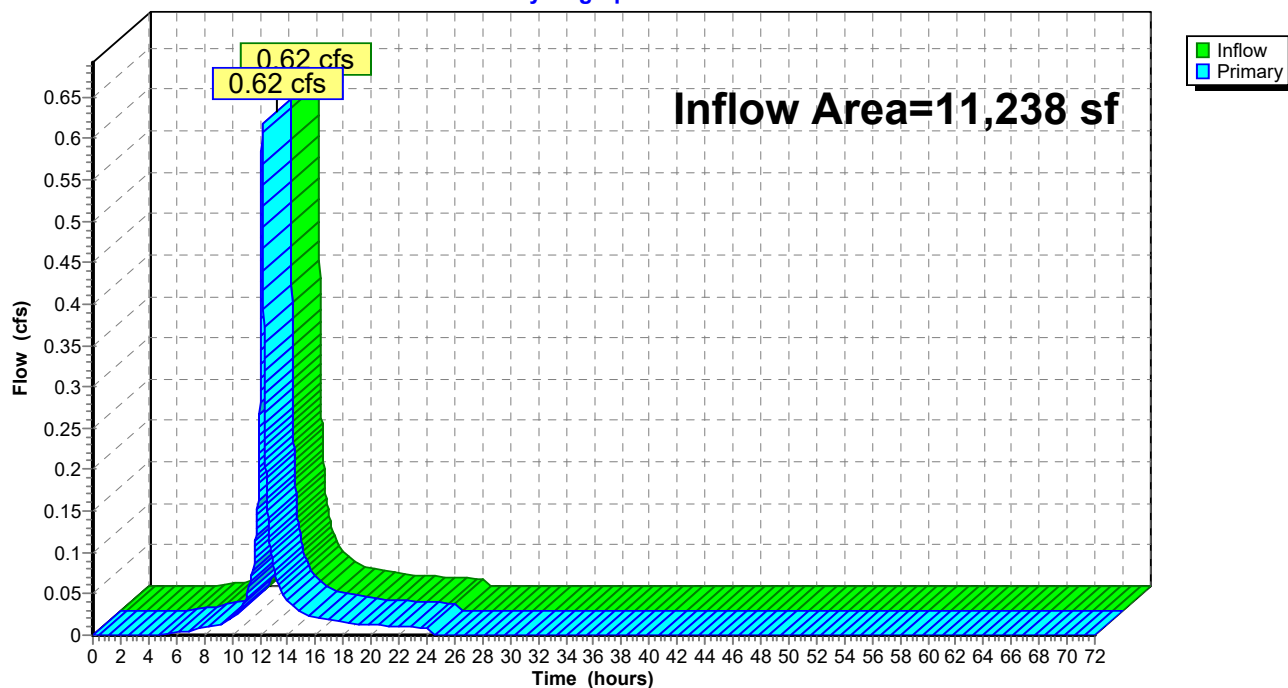
Summary for Link 3L: OVERALL SITE- EXISTING

Inflow Area = 11,238 sf, 67.83% Impervious, Inflow Depth = 2.46" for 2 Year event
Inflow = 0.62 cfs @ 12.17 hrs, Volume= 2,299 cf
Primary = 0.62 cfs @ 12.17 hrs, Volume= 2,299 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: OVERALL SITE- EXISTING

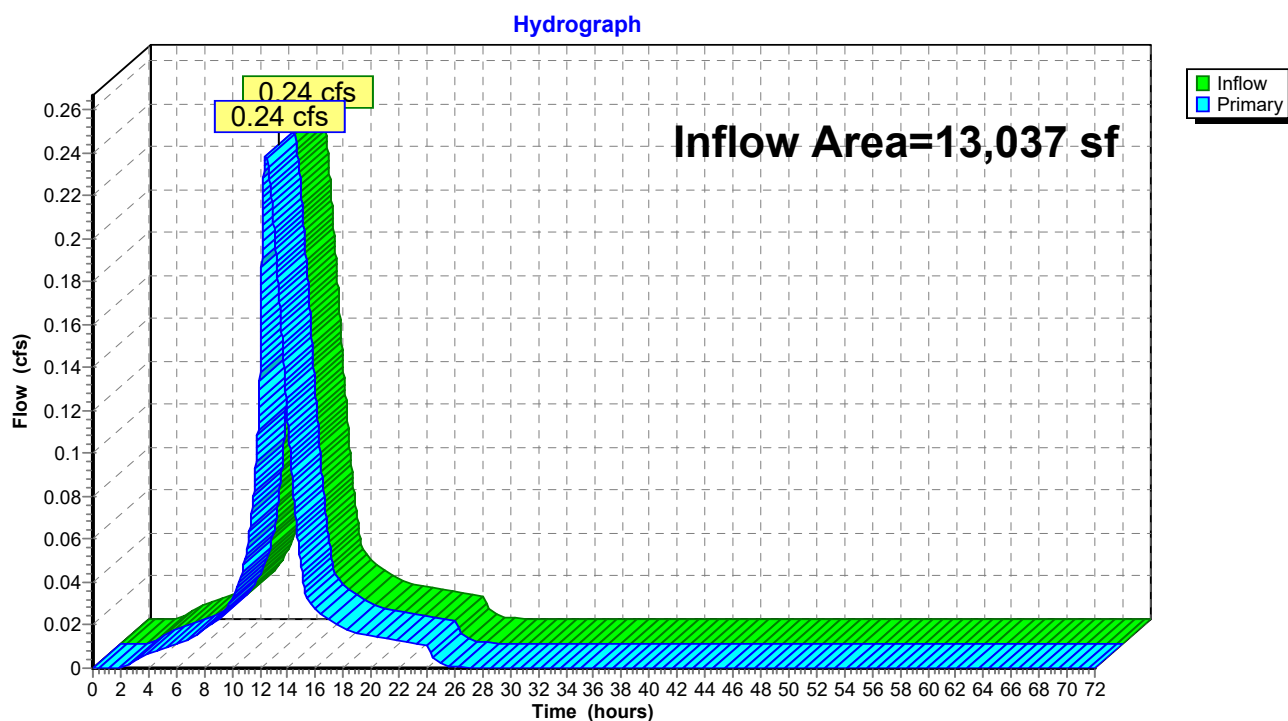
Hydrograph



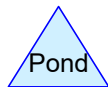
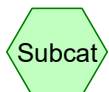
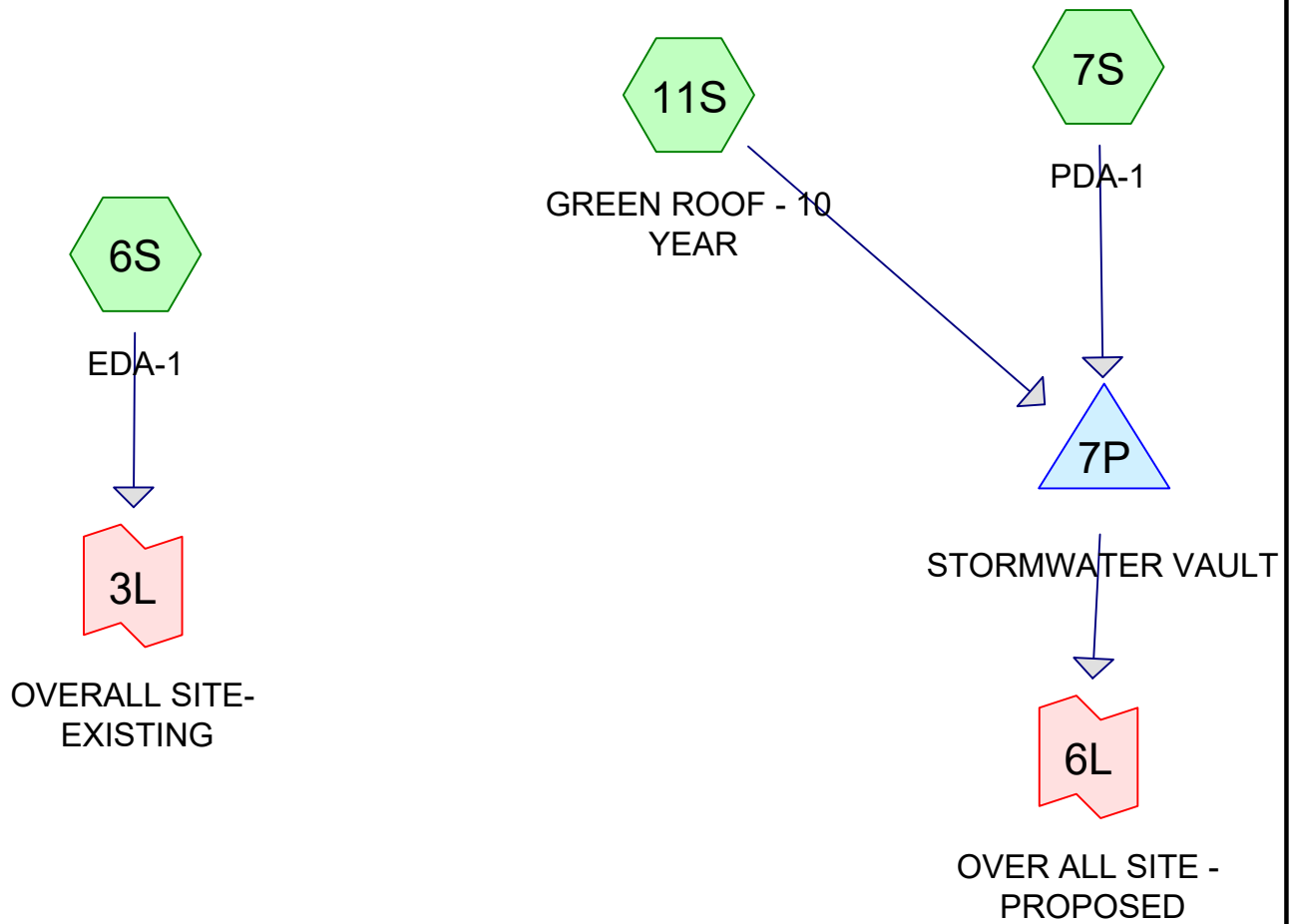
Summary for Link 6L: OVER ALL SITE - PROPOSED

Inflow Area = 13,037 sf, 86.20% Impervious, Inflow Depth = 2.82" for 2 Year event
Inflow = 0.24 cfs @ 12.43 hrs, Volume= 3,066 cf
Primary = 0.24 cfs @ 12.43 hrs, Volume= 3,066 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 6L: OVER ALL SITE - PROPOSED

10-Year Storm Event



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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10 Year	NOAA 24-hr	D	Default	24.00	1	5.02	2

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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
3,615	80	>75% Grass cover, Good, HSG D (6S)
1,799	80	Green Roof (11S)
18,861	98	Paved parking & roofs (6S, 7S)
24,276	94	TOTAL AREA

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Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
3,615	HSG D	6S
20,660	Other	6S, 7S, 11S
24,276		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	3,615	0	3,615	>75% Grass cover, Good
0	0	0	0	1,799	1,799	Green Roof
0	0	0	0	18,861	18,861	Paved parking & roofs
0	0	0	3,615	20,660	24,276	TOTAL AREA

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	7P	92.00	91.72	51.0	0.0055	0.011	0.0	6.0	0.0	

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NOAA 24-hr D 10 Year Rainfall=5.02"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 9
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: EDA-1

Runoff Area=0.258 ac 67.83% Impervious Runoff Depth=4.11"
Flow Length=170' Tc=10.0 min CN=92 Runoff=1.00 cfs 3,848 cf

Subcatchment7S: PDA-1

Runoff Area=0.258 ac 100.00% Impervious Runoff Depth=4.78"
Tc=10.0 min CN=98 Runoff=1.07 cfs 4,480 cf

Subcatchment11S: GREEN ROOF - 10 YEAR Runoff Area=1,799 sf 0.00% Impervious Runoff Depth=2.91"
Tc=0.0 min CN=80 Runoff=0.16 cfs 436 cf

Pond 7P: STORMWATERVAULT

Peak Elev=95.92' Storage=1,271 cf Inflow=1.13 cfs 4,916 cf
Outflow=0.32 cfs 4,915 cf

Link 3L: OVERALL SITE- EXISTING

Inflow=1.00 cfs 3,848 cf
Primary=1.00 cfs 3,848 cf

Link 6L: OVER ALL SITE - PROPOSED

Inflow=0.32 cfs 4,915 cf
Primary=0.32 cfs 4,915 cf

Total Runoff Area = 24,276 sf Runoff Volume = 8,764 cf Average Runoff Depth = 4.33"
22.30% Pervious = 5,414 sf 77.70% Impervious = 18,861 sf

Summary for Subcatchment 6S: EDA-1

Runoff = 1.00 cfs @ 12.17 hrs, Volume= 3,848 cf, Depth= 4.11"
 Routed to Link 3L : OVERALL SITE- EXISTING

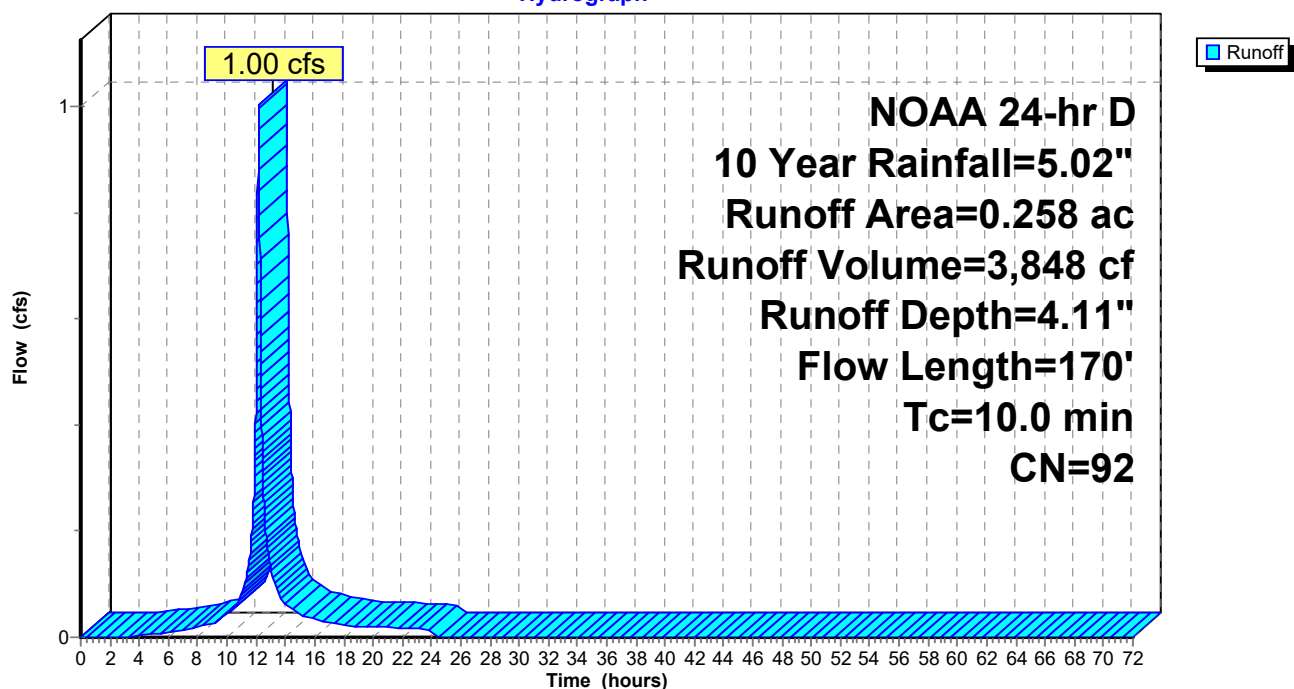
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10 Year Rainfall=5.02"

Area (ac)	CN	Description
0.083	80	>75% Grass cover, Good, HSG D
0.175	98	Paved parking & roofs
0.258	92	Weighted Average
0.083		32.17% Pervious Area
0.175		67.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.06		Sheet Flow, A-B
					Smooth surfaces n= 0.011 P2= 3.31"
0.3	70	0.0320	3.63		Shallow Concentrated Flow, B-C
					Paved Kv= 20.3 fps
1.9	170	Total, Increased to minimum Tc = 10.0 min			

Subcatchment 6S: EDA-1

Hydrograph



Summary for Subcatchment 7S: PDA-1

Runoff = 1.07 cfs @ 12.17 hrs, Volume= 4,480 cf, Depth= 4.78"
 Routed to Pond 7P : STORMWATER VAULT

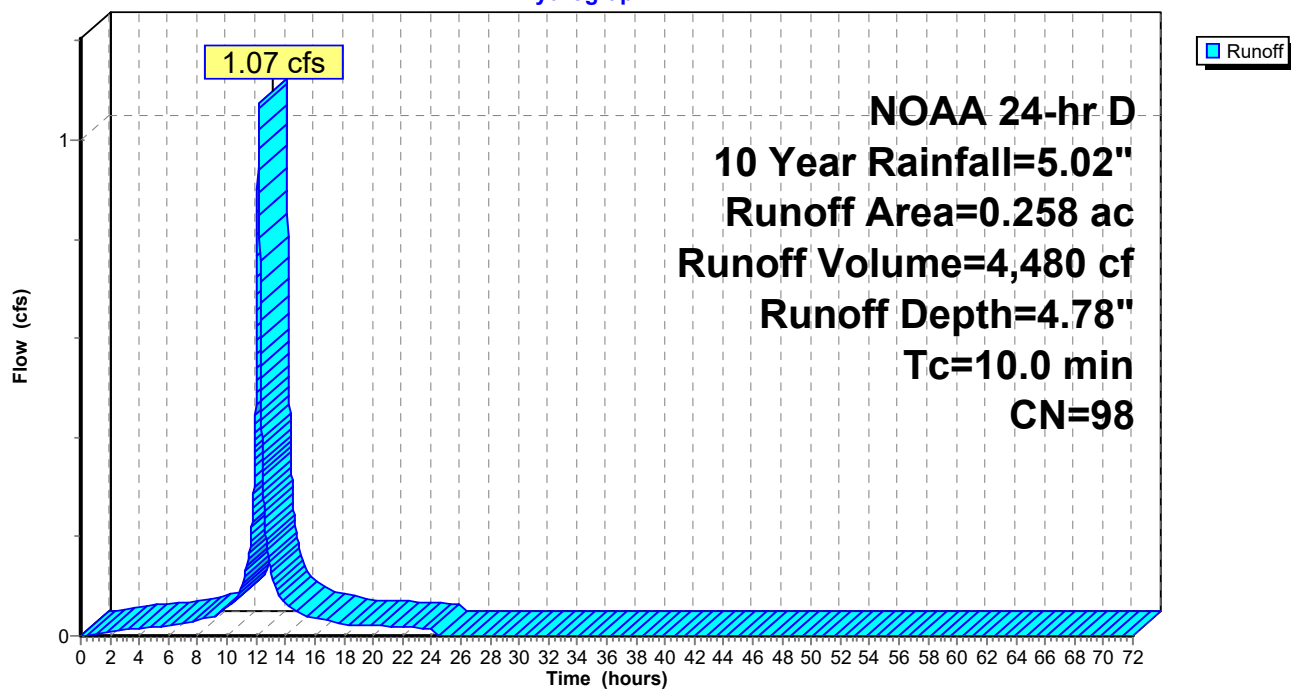
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10 Year Rainfall=5.02"

Area (ac)	CN	Description
0.258	98	Paved parking & roofs
0.258		100.00% Impervious Area

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

Subcatchment 7S: PDA-1

Hydrograph



Summary for Subcatchment 11S: GREEN ROOF - 10 YEAR

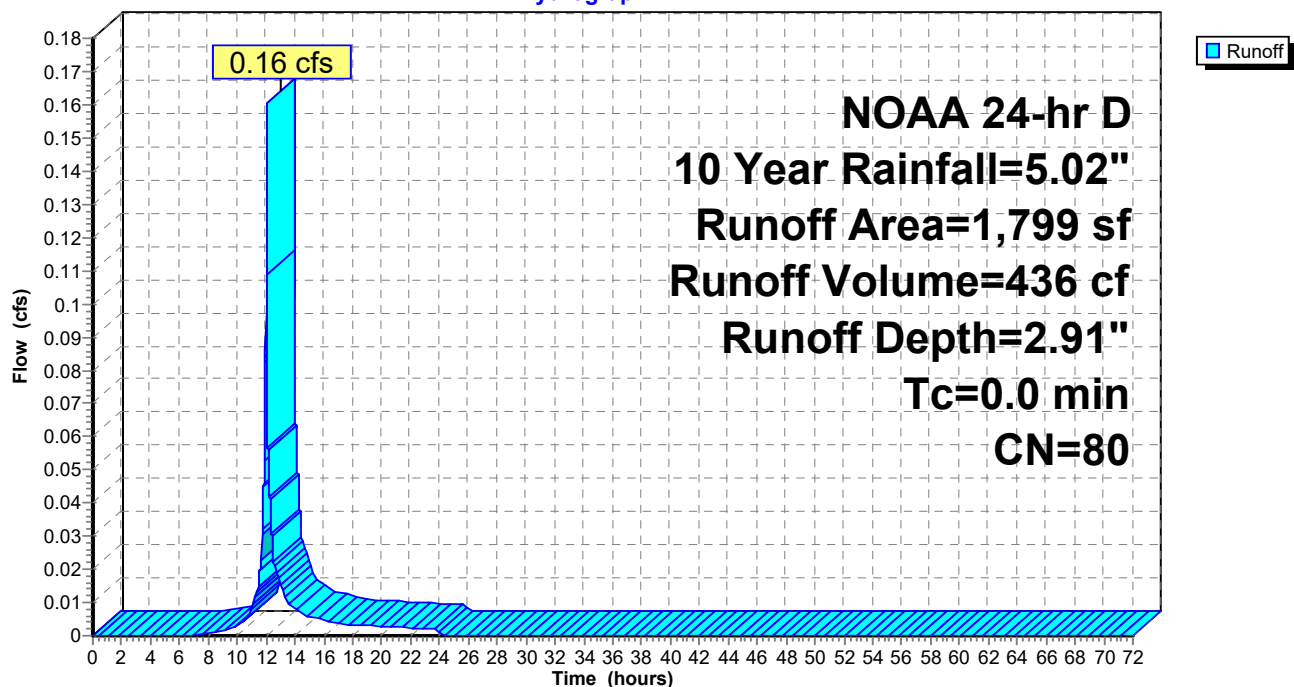
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 436 cf, Depth= 2.91"
 Routed to Pond 7P : STORMWATER VAULT

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10 Year Rainfall=5.02"

	Area (sf)	CN	Description
*	1,799	80	Green Roof
	1,799		100.00% Pervious Area

Subcatchment 11S: GREEN ROOF - 10 YEAR

Hydrograph



Summary for Pond 7P: STORMWATER VAULT

Inflow Area = 13,037 sf, 86.20% Impervious, Inflow Depth = 4.52" for 10 Year event
 Inflow = 1.13 cfs @ 12.17 hrs, Volume= 4,916 cf
 Outflow = 0.32 cfs @ 12.48 hrs, Volume= 4,915 cf, Atten= 72%, Lag= 18.8 min
 Primary = 0.32 cfs @ 12.48 hrs, Volume= 4,915 cf
 Routed to Link 6L : OVER ALL SITE - PROPOSED

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 9
 Peak Elev= 95.92' @ 12.48 hrs Surf.Area= 324 sf Storage= 1,271 cf

Plug-Flow detention time= 40.9 min calculated for 4,915 cf (100% of inflow)
 Center-of-Mass det. time= 40.8 min (800.1 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,106 cf	18.00'W x 18.00'L x 6.50'H Prisma

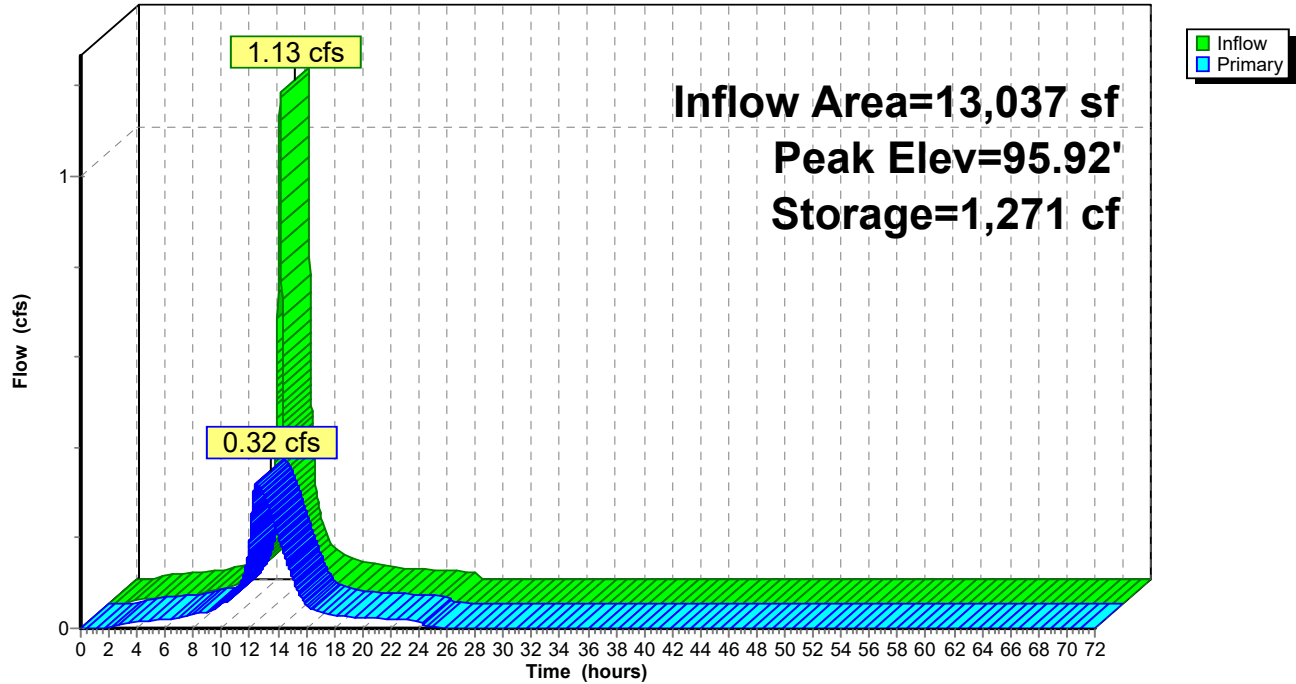
Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	6.0" Round Culvert L= 51.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 92.00' / 91.72' S= 0.0055 ' / Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	92.00'	2.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	97.79'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.0' Crest Height
#4	Device 1	100.00'	2.0" x 2.0" Horiz. Orifice/Grate C= 0.600 in 2.0" x 2.0" Grate (100% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.32 cfs @ 12.48 hrs HW=95.92' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.32 cfs of 1.52 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.32 cfs @ 9.41 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Orifice/Grate (Controls 0.00 cfs)

Pond 7P: STORMWATER VAULT

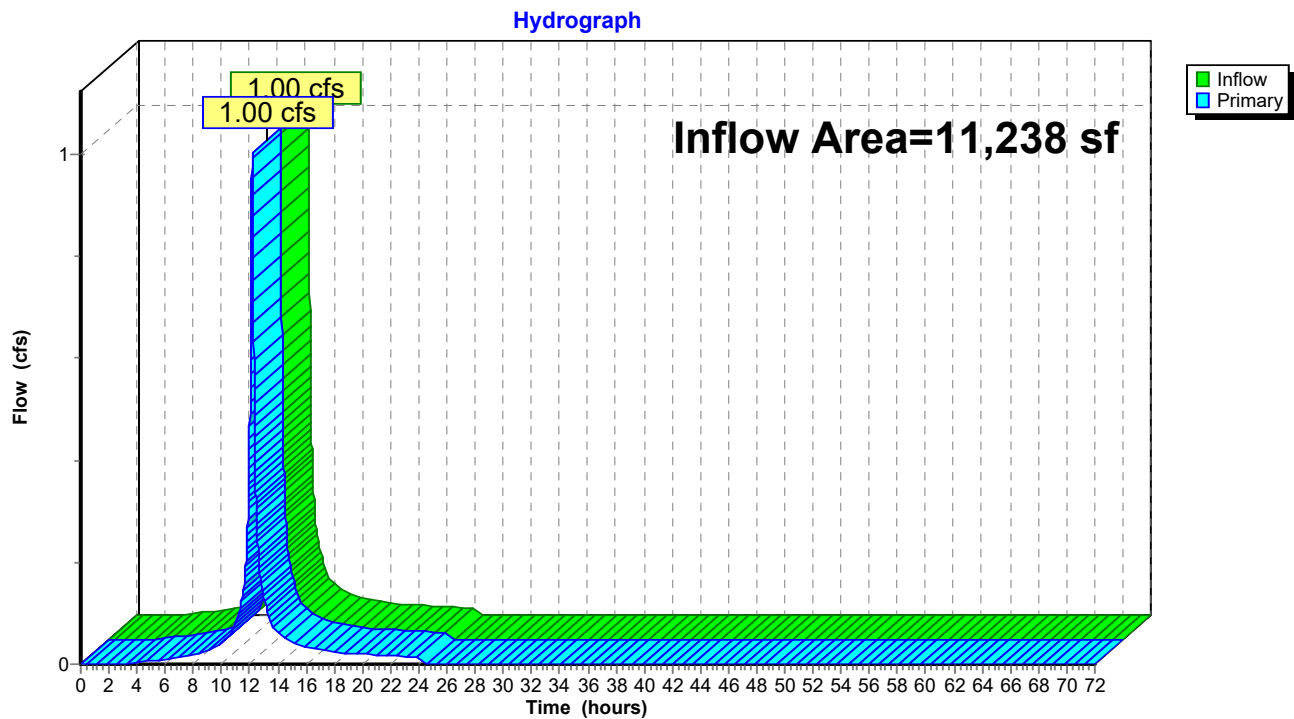
Hydrograph



Summary for Link 3L: OVERALL SITE- EXISTING

Inflow Area = 11,238 sf, 67.83% Impervious, Inflow Depth = 4.11" for 10 Year event
Inflow = 1.00 cfs @ 12.17 hrs, Volume= 3,848 cf
Primary = 1.00 cfs @ 12.17 hrs, Volume= 3,848 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: OVERALL SITE- EXISTING

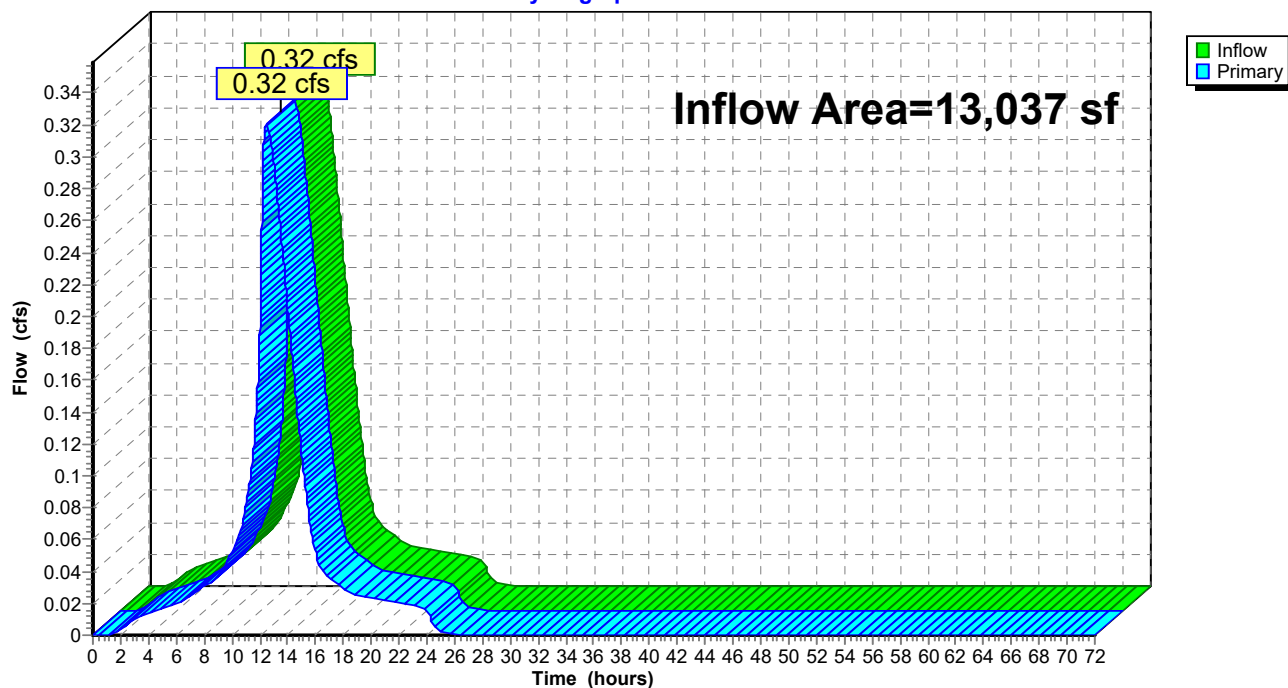
Summary for Link 6L: OVER ALL SITE - PROPOSED

Inflow Area = 13,037 sf, 86.20% Impervious, Inflow Depth = 4.52" for 10 Year event
Inflow = 0.32 cfs @ 12.48 hrs, Volume= 4,915 cf
Primary = 0.32 cfs @ 12.48 hrs, Volume= 4,915 cf, Atten= 0%, Lag= 0.0 min

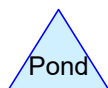
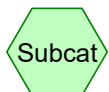
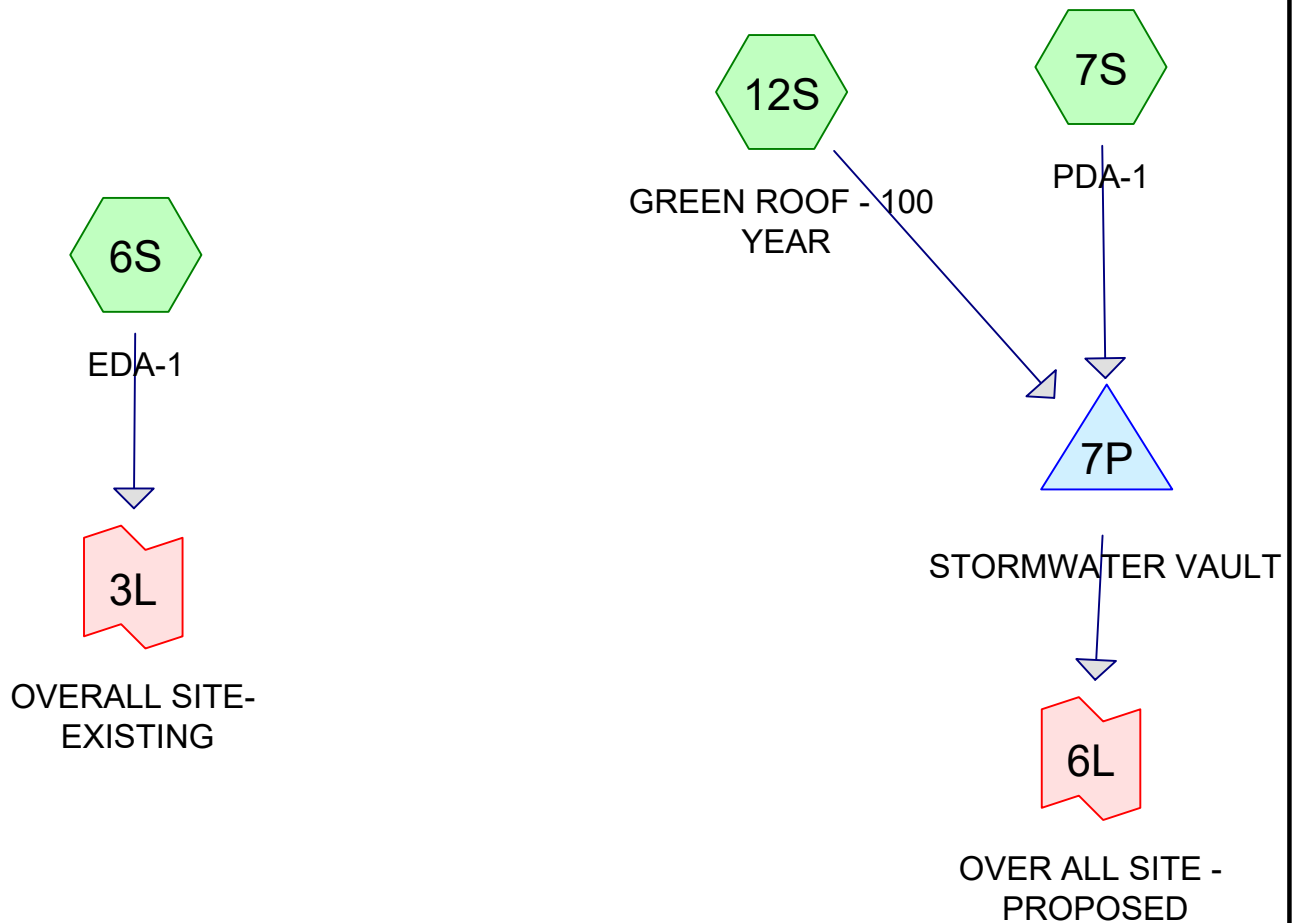
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 6L: OVER ALL SITE - PROPOSED

Hydrograph



100-Year Storm Event



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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100 Year	NOAA 24-hr	D	Default	24.00	1	8.31	2

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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
3,615	80	>75% Grass cover, Good, HSG D (6S)
1,799	83	Green Roof (12S)
18,861	98	Paved parking & roofs (6S, 7S)
24,276	94	TOTAL AREA

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Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
3,615	HSG D	6S
20,660	Other	6S, 7S, 12S
24,276		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	3,615	0	3,615	>75% Grass cover, Good
0	0	0	0	1,799	1,799	Green Roof
0	0	0	0	18,861	18,861	Paved parking & roofs
0	0	0	3,615	20,660	24,276	TOTAL AREA

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	7P	92.00	91.72	51.0	0.0055	0.011	0.0	6.0	0.0	

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NOAA 24-hr D 100 Year Rainfall=8.31"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 9
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment6S: EDA-1

Runoff Area=0.258 ac 67.83% Impervious Runoff Depth=7.35"
Flow Length=170' Tc=10.0 min CN=92 Runoff=1.73 cfs 6,884 cf

Subcatchment7S: PDA-1

Runoff Area=0.258 ac 100.00% Impervious Runoff Depth=8.07"
Tc=10.0 min CN=98 Runoff=1.79 cfs 7,558 cf

Subcatchment12S: GREEN ROOF - 100

Runoff Area=1,799 sf 0.00% Impervious Runoff Depth=6.27"
Tc=0.0 min CN=83 Runoff=0.32 cfs 941 cf

Pond 7P: STORMWATERVAULT

Peak Elev=98.22' Storage=2,016 cf Inflow=1.90 cfs 8,498 cf
Outflow=1.30 cfs 8,498 cf

Link 3L: OVERALL SITE- EXISTING

Inflow=1.73 cfs 6,884 cf
Primary=1.73 cfs 6,884 cf

Link 6L: OVER ALL SITE - PROPOSED

Inflow=1.30 cfs 8,498 cf
Primary=1.30 cfs 8,498 cf

Total Runoff Area = 24,276 sf Runoff Volume = 15,382 cf Average Runoff Depth = 7.60"
22.30% Pervious = 5,414 sf 77.70% Impervious = 18,861 sf

Summary for Subcatchment 6S: EDA-1

Runoff = 1.73 cfs @ 12.17 hrs, Volume= 6,884 cf, Depth= 7.35"
Routed to Link 3L : OVERALL SITE- EXISTING

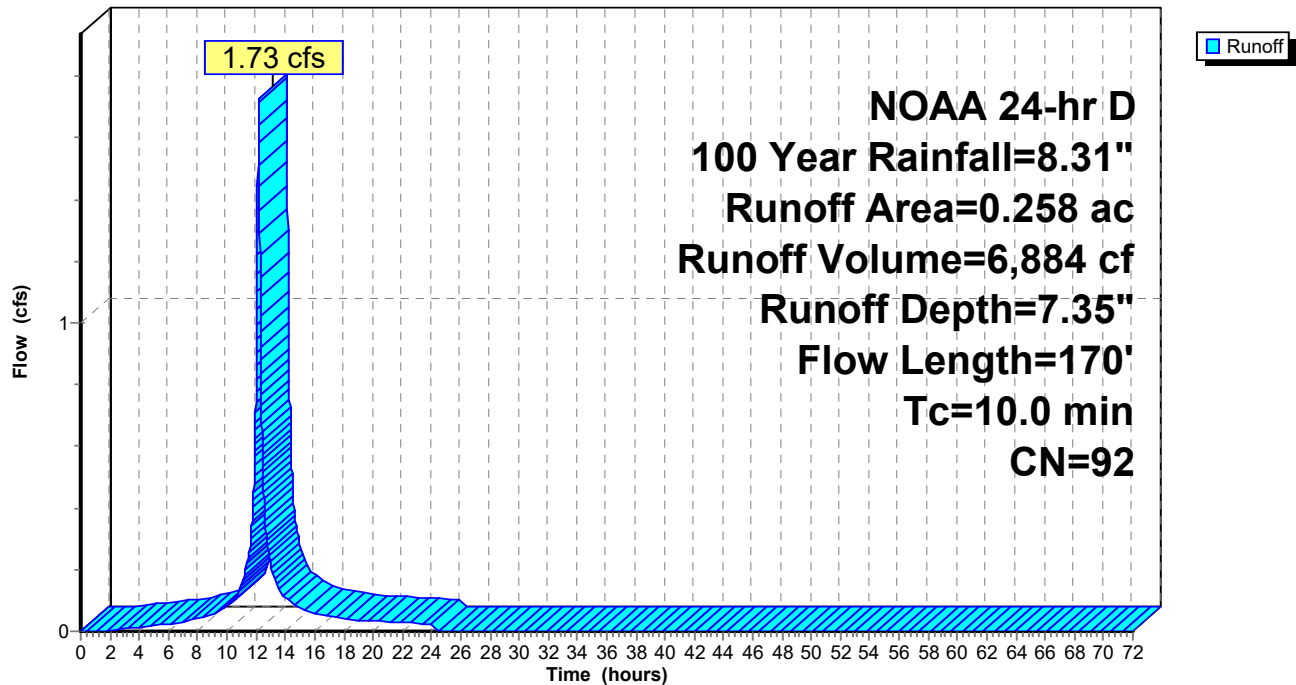
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 Year Rainfall=8.31"

Area (ac)	CN	Description
0.083	80	>75% Grass cover, Good, HSG D
0.175	98	Paved parking & roofs
0.258	92	Weighted Average
0.083		32.17% Pervious Area
0.175		67.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.06		Sheet Flow, A-B
					Smooth surfaces n= 0.011 P2= 3.31"
0.3	70	0.0320	3.63		Shallow Concentrated Flow, B-C
					Paved Kv= 20.3 fps
1.9	170	Total, Increased to minimum Tc = 10.0 min			

Subcatchment 6S: EDA-1

Hydrograph



Summary for Subcatchment 7S: PDA-1

Runoff = 1.79 cfs @ 12.17 hrs, Volume= 7,558 cf, Depth= 8.07"
 Routed to Pond 7P : STORMWATER VAULT

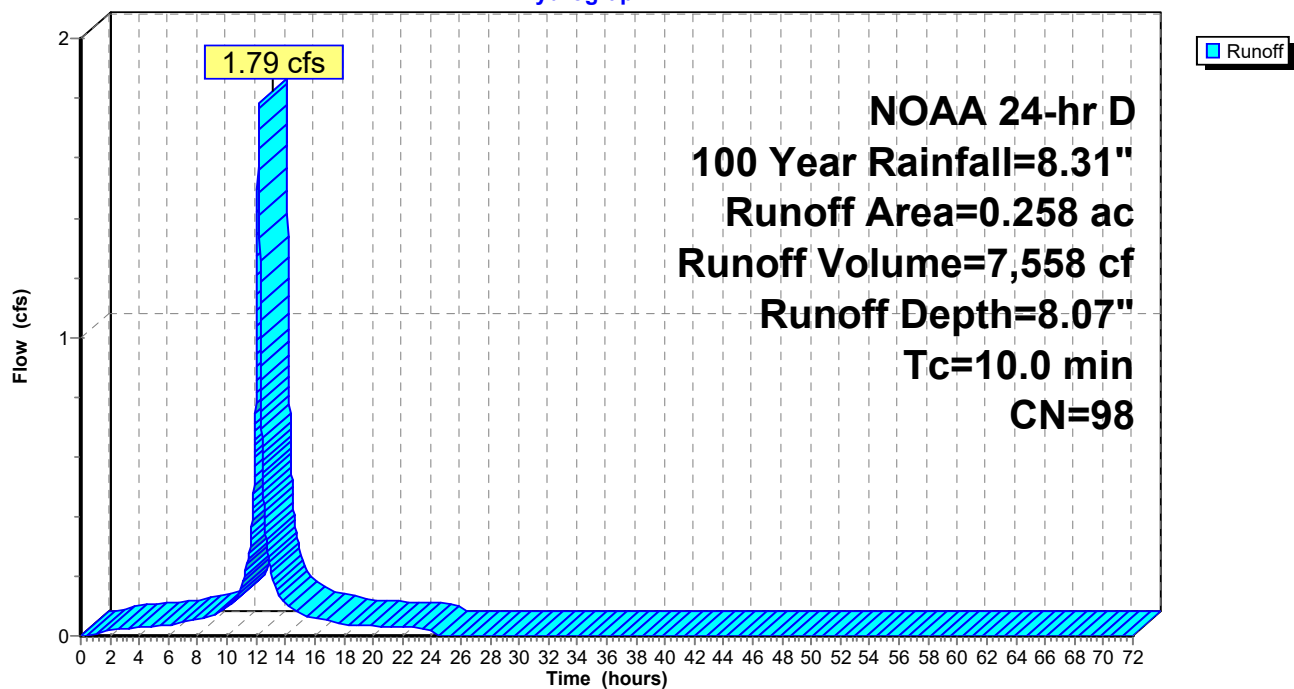
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100 Year Rainfall=8.31"

Area (ac)	CN	Description
0.258	98	Paved parking & roofs
0.258		100.00% Impervious Area

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

Subcatchment 7S: PDA-1

Hydrograph



Summary for Subcatchment 12S: GREEN ROOF - 100 YEAR

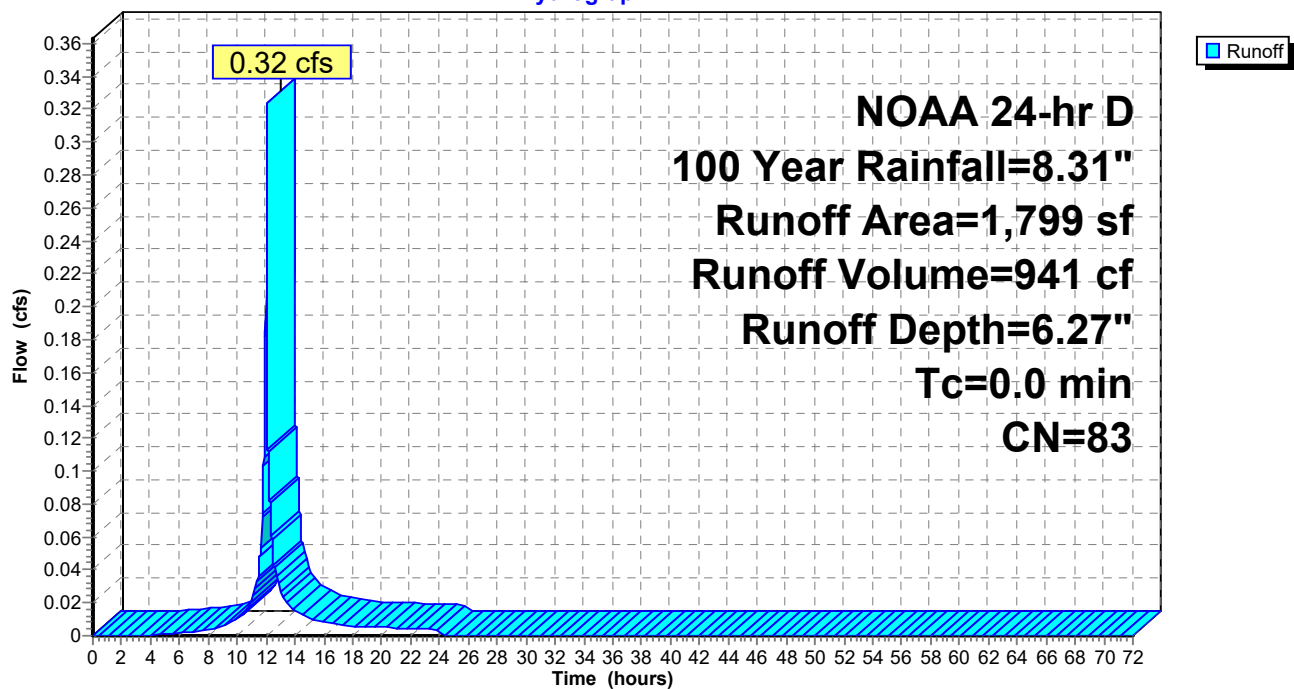
Runoff = 0.32 cfs @ 12.09 hrs, Volume= 941 cf, Depth= 6.27"
 Routed to Pond 7P : STORMWATER VAULT

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100 Year Rainfall=8.31"

	Area (sf)	CN	Description
*	1,799	83	Green Roof
	1,799		100.00% Pervious Area

Subcatchment 12S: GREEN ROOF - 100 YEAR

Hydrograph



Summary for Pond 7P: STORMWATER VAULT

Inflow Area = 13,037 sf, 86.20% Impervious, Inflow Depth = 7.82" for 100 Year event
 Inflow = 1.90 cfs @ 12.17 hrs, Volume= 8,498 cf
 Outflow = 1.30 cfs @ 12.27 hrs, Volume= 8,498 cf, Atten= 31%, Lag= 5.7 min
 Primary = 1.30 cfs @ 12.27 hrs, Volume= 8,498 cf
 Routed to Link 6L : OVER ALL SITE - PROPOSED

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 9
 Peak Elev= 98.22' @ 12.27 hrs Surf.Area= 324 sf Storage= 2,016 cf

Plug-Flow detention time= 44.2 min calculated for 8,498 cf (100% of inflow)
 Center-of-Mass det. time= 44.0 min (794.8 - 750.7)

Volume	Invert	Avail.Storage	Storage Description
#1	92.00'	2,106 cf	18.00'W x 18.00'L x 6.50'H Prismatic

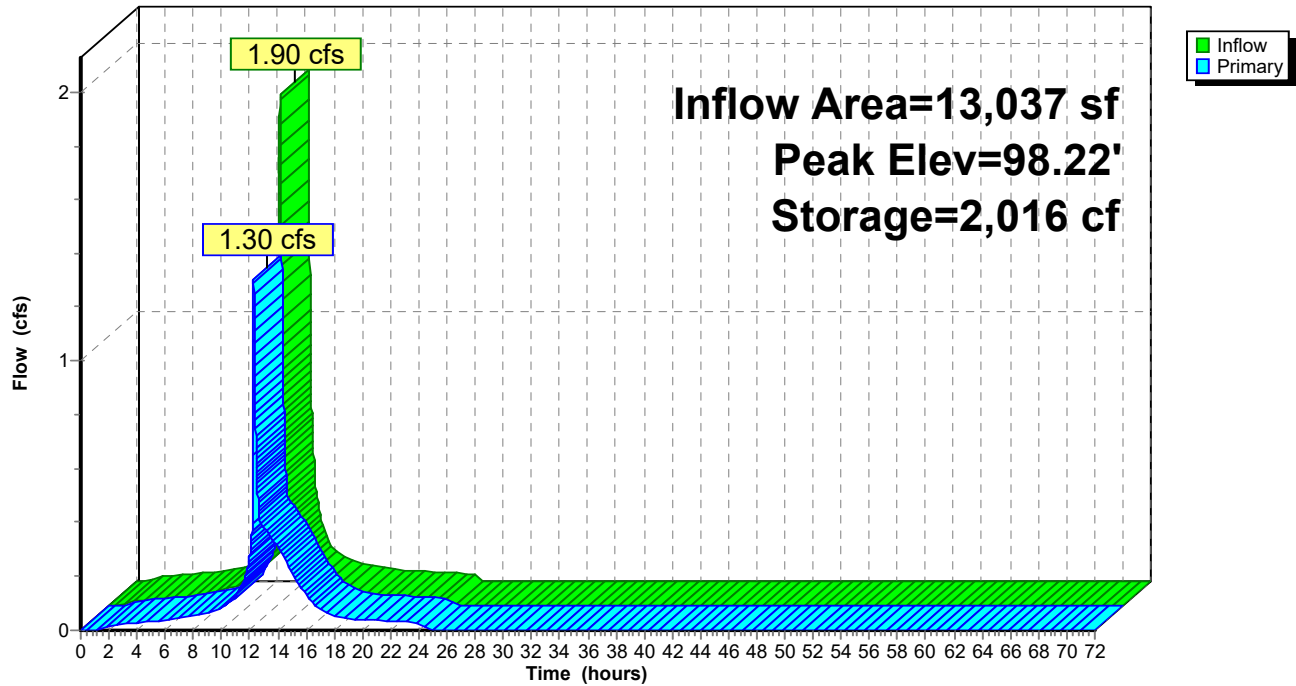
Device	Routing	Invert	Outlet Devices
#1	Primary	92.00'	6.0" Round Culvert L= 51.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 92.00' / 91.72' S= 0.0055 ' / Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	92.00'	2.5" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	97.79'	1.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.0' Crest Height
#4	Device 1	100.00'	2.0" x 2.0" Horiz. Orifice/Grate C= 0.600 in 2.0" x 2.0" Grate (100% open area) Limited to weir flow at low heads

Primary OutFlow Max=1.30 cfs @ 12.27 hrs HW=98.22' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.30 cfs of 1.93 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.41 cfs @ 11.91 fps)
- 3=Sharp-Crested Rectangular Weir (Weir Controls 0.89 cfs @ 2.26 fps)
- 4=Orifice/Grate (Controls 0.00 cfs)

Pond 7P: STORMWATER VAULT

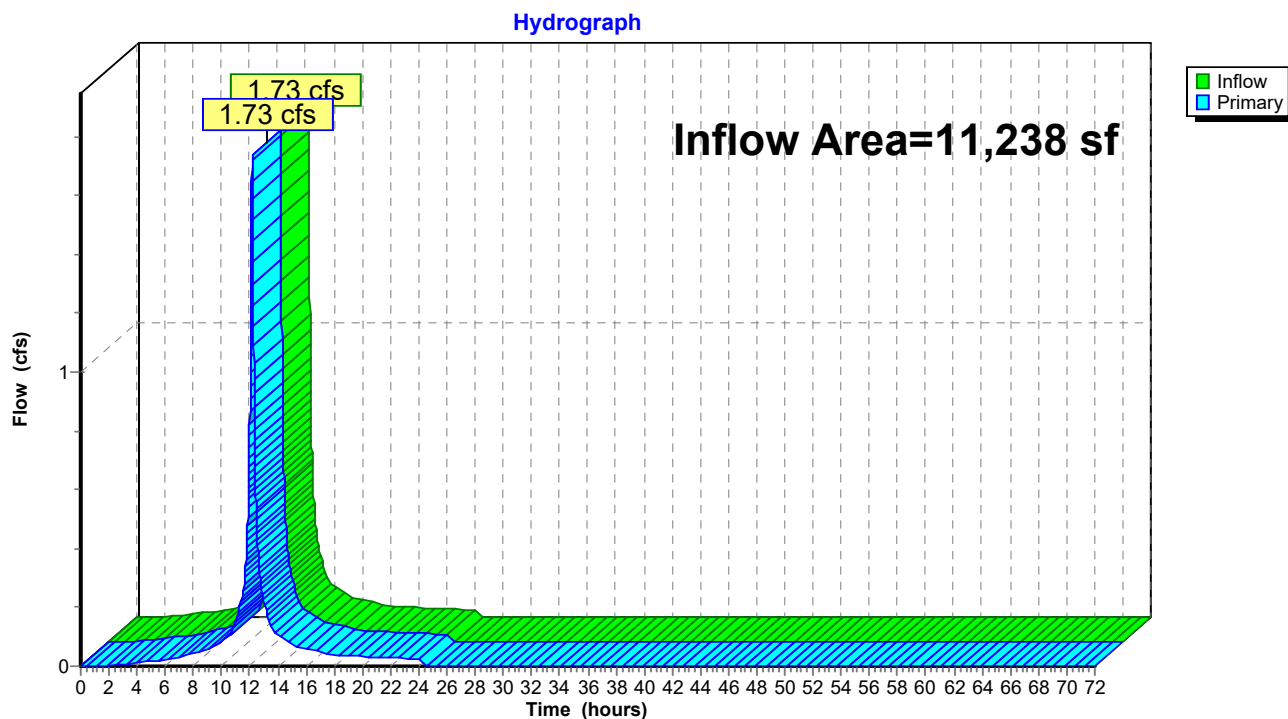
Hydrograph



Summary for Link 3L: OVERALL SITE- EXISTING

Inflow Area = 11,238 sf, 67.83% Impervious, Inflow Depth = 7.35" for 100 Year event
Inflow = 1.73 cfs @ 12.17 hrs, Volume= 6,884 cf
Primary = 1.73 cfs @ 12.17 hrs, Volume= 6,884 cf, Atten= 0%, Lag= 0.0 min

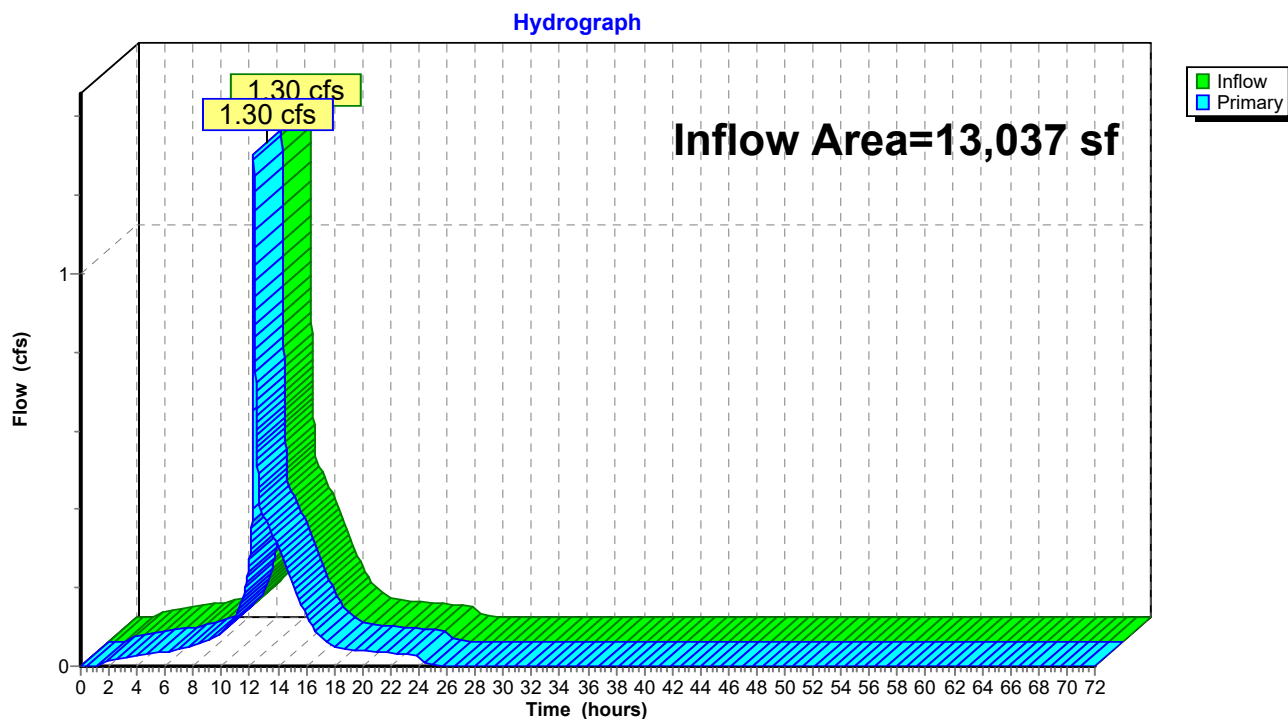
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: OVERALL SITE- EXISTING

Summary for Link 6L: OVER ALL SITE - PROPOSED

Inflow Area = 13,037 sf, 86.20% Impervious, Inflow Depth = 7.82" for 100 Year event
Inflow = 1.30 cfs @ 12.27 hrs, Volume= 8,498 cf
Primary = 1.30 cfs @ 12.27 hrs, Volume= 8,498 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 6L: OVER ALL SITE - PROPOSED

B. DESIGN CALCULATIONS

- ◆ **NOAA Rainfall Intensities**
- ◆ **Basin Drain Time Calculations**
- ◆ **Green Roof Calculations**

NOAA Rainfall Intensities

NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

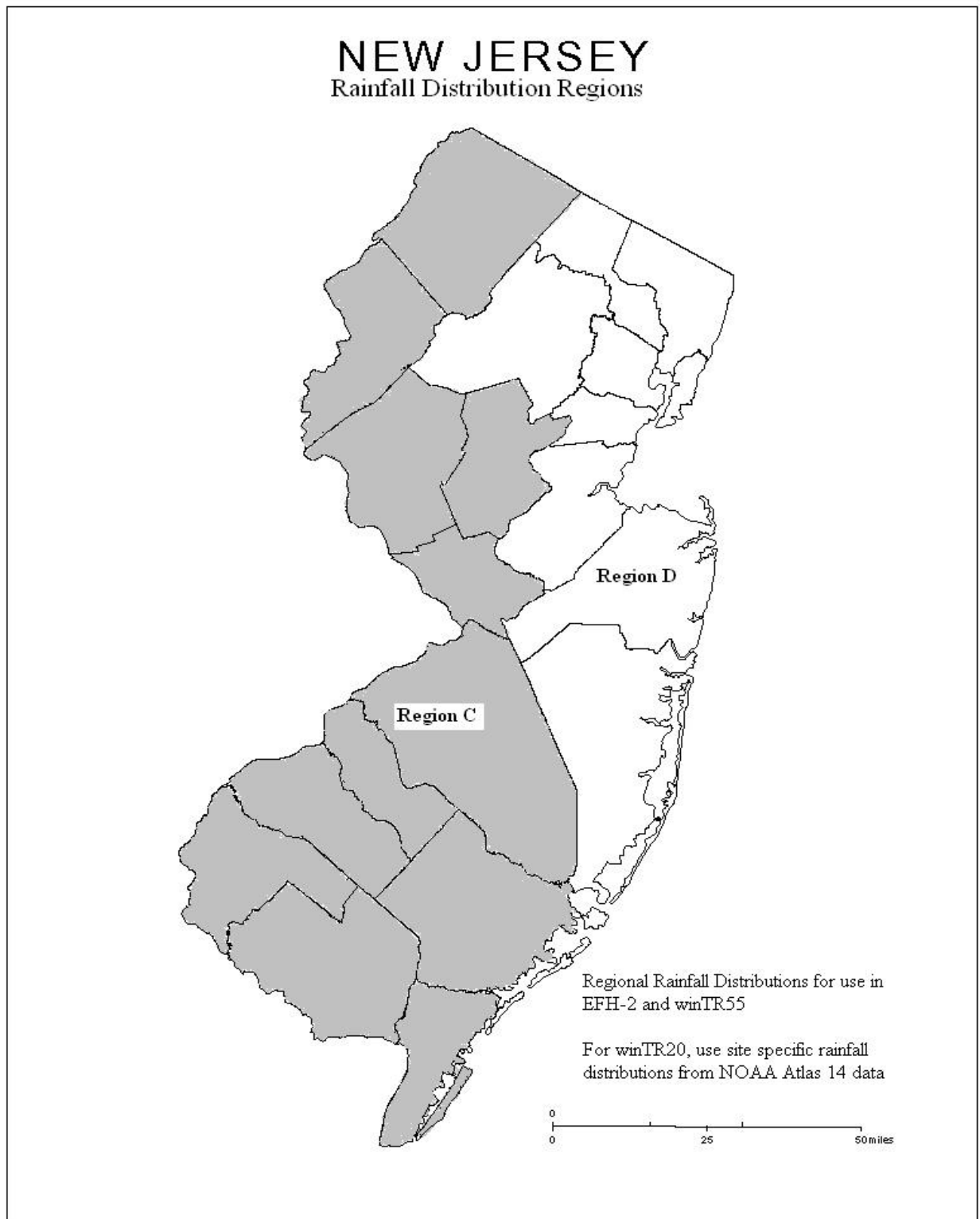
Rainfall amounts in Inches

County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

Notes: The average point rainfall amounts listed above were developed from data contained in NOAA Atlas 14 Volume 2.

Point rainfall estimates for specific locations may be obtained from the Precipitation Frequency Data Server located at <http://www.nws.noaa.gov/ohd/hdsc/>

For most hydrologic design procedures, the rainfall amounts listed above may be rounded to the nearest tenth of an inch.



Basin Drain Time Calculations

Hydrograph for Pond 7P: STORMWATER VAULT

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	92.00	0.00
2.00	0.02	29	92.09	0.01
4.00	0.03	42	92.13	0.03
6.00	0.04	50	92.15	0.04
8.00	0.06	69	92.21	0.05
10.00	0.11	128	92.39	0.09
12.00	1.11	976	95.01	0.28
14.00	0.12	1,149	95.55	0.30
16.00	0.07	239	92.74	0.13
18.00	0.05	65	92.20	0.05
20.00	0.04	53	92.16	0.04
22.00	0.03	48	92.15	0.03
24.00	0.03	43	92.13	0.03
26.00	0.00	7	92.02	0.00
28.00	0.00	4	92.01	0.00
30.00	0.00	3	92.01	0.00
32.00	0.00	2	92.01	0.00
34.00	0.00	2	92.00	0.00
36.00	0.00	1	92.00	0.00
38.00	0.00	1	92.00	0.00
40.00	0.00	1	92.00	0.00
42.00	0.00	1	92.00	0.00
44.00	0.00	1	92.00	0.00
46.00	0.00	1	92.00	0.00
48.00	0.00	1	92.00	0.00
50.00	0.00	1	92.00	0.00
52.00	0.00	1	92.00	0.00
54.00	0.00	1	92.00	0.00
56.00	0.00	1	92.00	0.00
58.00	0.00	1	92.00	0.00
60.00	0.00	1	92.00	0.00
62.00	0.00	1	92.00	0.00
64.00	0.00	0	92.00	0.00
66.00	0.00	0	92.00	0.00
68.00	0.00	0	92.00	0.00
70.00	0.00	0	92.00	0.00
72.00	0.00	0	92.00	0.00

Basin fully Drains
in 26 hrs <72
hours
CONFORMS

Green Roof Calculations

GREEN ROOF DESIGN CALCULATION SHEET (N.J.A.C. 7:8-9.4(a)(2))

STEP 1: Calculate the stormwater runoff retention by the green roof:

(THE NUMBERS YOU PUT HERE WILL ALL NEED TO CHANGE - THE ONLY NUMBERS THAT REMAIN THE SAME WILL BE HIGHLIGHTED IN BLUE)

SA = Roof Area (SF): 1,799

WQDS Rainfall, Pwq: 1.25

2-year storm rainfall, P2: 3.31

10-year storm rainfall, P10: 5.02

100-year storm rainfall, P100: 8.31

DL = Drainage Layer Depth (in): 1

η₂ = Drainage Field Capacity (% by vol): 0.020

Slope (%): 2.50%

Vegetation: Dense Native Grass

d = Growing Medium Depth (in): 8

Field Capacity (% by volume): 0.349

Wilting Point (% by volume): 0.118

η₁ = Runoff Retention(% by volume): 0.231

Step 1: Calculate the runoff retention of the green roof

$$S_v = \frac{SA \times [(d \times \eta_1) + (DL \times \eta_2)]}{12 \text{ in/ft}}, \text{ where:}$$

S_v = storage volume (cf)

SA = green roof area (sf)

d = media depth (in)

η_1 = available water capacity for runoff retention

DL = drainage layer depth (in)

η_2 = drainage layer field capacity

SV= 280.04 CF

STEP 2: Calculate the discharged runoff volume:

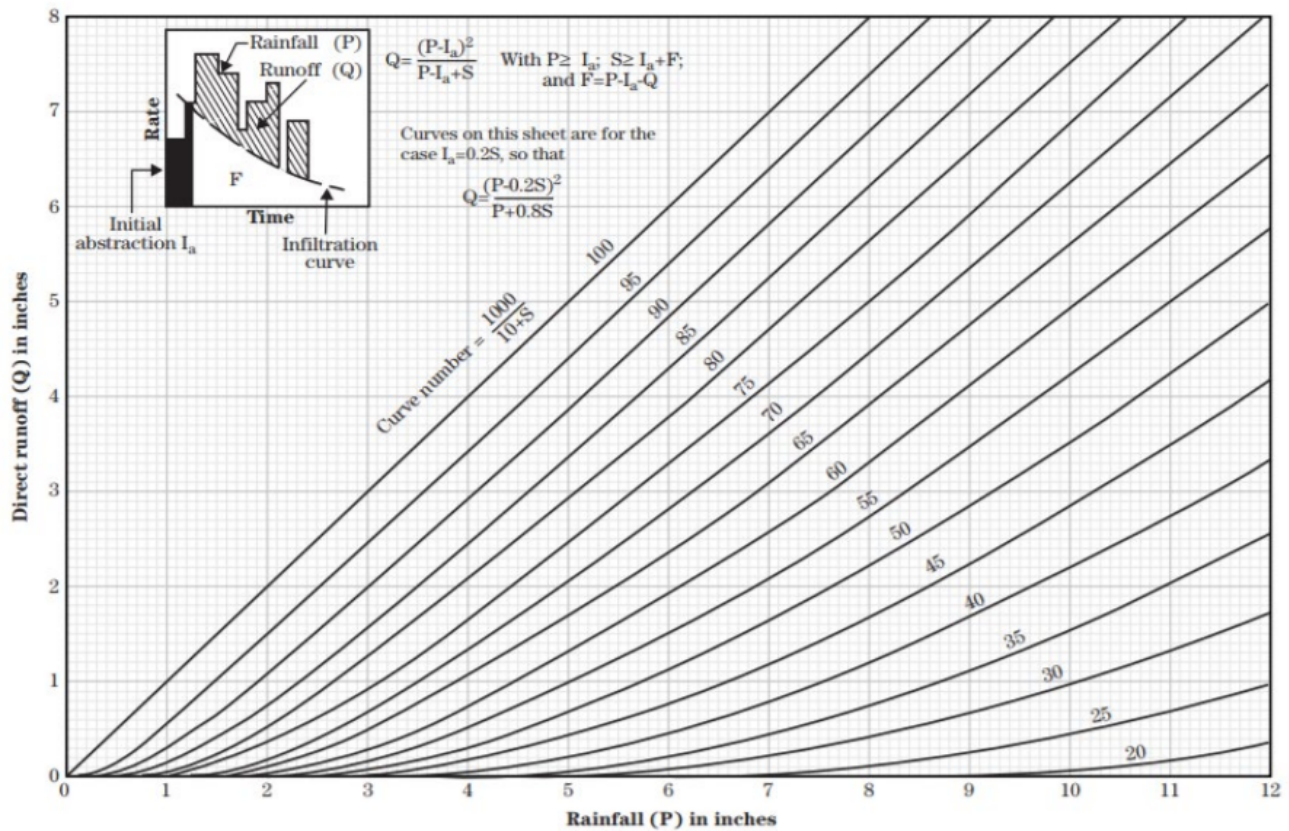
Storm Event	(A) Runoff Volume (cf) (Imperio us Surface - HydroCA D)	(B) Storage Volume (cf) - SV	(A)-(B) Discharged Runoff Volume (cf) (Green Roof)
WQDS	146	280.0443333	0
2-Year	433	280.0443333	153
10-Year	673	280.0443333	393
100-Year	1,135	280.0443333	855

STEP 3: Calculate the direct runoff depth:

Storm Event	Discharged Runoff Volume (cf) (Green Roof)		
	Green Roof	Green Roof Area (sf)	Direct Runoff Depth (in)
WQDS	0	1,799	0.00
2-Year	153	1,799	1.02
10-Year	393	1,799	2.62
100-Year	855	1,799	5.70

STEP 4: Determine the Adjusted Curve Number:

Figure 10-2 ES-1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$



Storm Event	Rainfall	Adjusted Curve Number (To be	
	Depth (in)	Direct Runoff Depth (in)	Utilized in Modeling)
WQDS	1.25	0.00	61
2-Year	3.31	1.02	76
10-Year	5.02	2.62	80
100-Year	8.31	5.70	83

C. MAPS

- ◆ **Soil Map**
- ◆ **Drainage Area Maps**
 - **Existing Drainage Area Map**
 - **Proposed Drainage Area Map**

Soil Map



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Hudson County, New Jersey



March 18, 2026

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

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 1:12,000.

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: Hudson County, New Jersey
Survey Area Data: Version 15, Aug 28, 2025

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

Date(s) aerial images were photographed: Oct 9, 2022—Oct 16, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
URTILB	Urban land, till substratum, 0 to 8 percent slopes	0.2	100.0%
Totals for Area of Interest		0.2	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Custom Soil Resource Report

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Hudson County, New Jersey

URTILB—Urban land, till substratum, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2qjwr
Landscape: Uplands
Elevation: 0 to 520 feet
Mean annual precipitation: 30 to 56 inches
Mean annual air temperature: 47 to 63 degrees F
Frost-free period: 179 to 217 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land, till substratum: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land, Till Substratum

Setting

Landscape: Uplands
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Anthropogenic Feature: Urban land
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Asphalt over human-transported material

Typical profile

M - 0 to 15 inches: material
2^C - 15 to 79 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Greenbelt

Percent of map unit: 10 percent
Landscape: Uplands
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope, base slope, talf
Anthropogenic features: Fills
Down-slope shape: Linear, convex

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Across-slope shape: Linear, convex
Hydric soil rating: No

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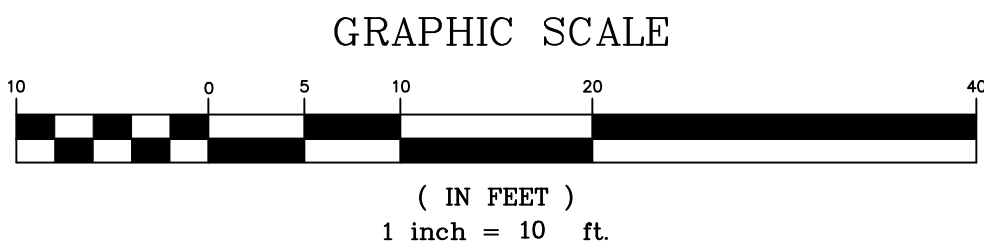
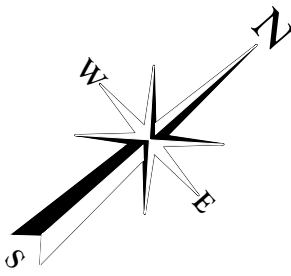
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Drainage Area Maps

Existing Drainage Area Map

Proposed Drainage Area Map



TBR - TO BE REMOVED



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O	03/19/26	INITIAL SUBMISSION	MTY	ABK
REV	DATE	DESCRIPTION	DRAWN BY	CHECKE BY

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HUDSON COUNTY

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