



Engineering
& Design

Stormwater Management Report

October 18, 2024

Revised December 20, 2024

Proposed Residential Improvements

Block 106, Lot 24.01

Town of West Orange, Essex County, New Jersey

Prepared for:

The Waymaker, LLC
40 Eagle Ridge Way
West Orange, NJ 07052

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Project No. 24006174A

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Limitation

The sole purpose of this report and the associated services performed by Colliers Engineering & Design, Inc., is to undertake a hydrologic assessment for the proposed residential development in accordance with the scope of services set out in the contract between Colliers Engineering & Design and The Waymaker, LLC.

Colliers Engineering & Design derived the data in this report from a variety of sources. The sources are identified at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations, and conclusions expressed in this report. Colliers Engineering & Design has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose of the project and by reference to applicable standards, procedures, and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report.

This report should be read in full, and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Colliers Engineering & Design for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of The Waymaker, LLC and is subject to, and issued in connection with, the provisions of the agreement between Colliers Engineering & Design and The Waymaker, LLC.

Introduction

This Stormwater Management Report for the proposed project has been prepared by Colliers Engineering & Design for The Waymaker, LLC. Colliers Engineering & Design performed a hydrological assessment for the property located at 42 Eagle Ridge Way, West Orange, New Jersey, also defined as Block 106, Lot 24.01. The site is currently ± 3.09 -acres in size and was previously occupied by a single-family home and associated driveways and site improvements. The house was recently demolished and the property was cleared, and is currently occupied by stockpiles of gravel and other materials. The proposed development consists of the construction of a single-family home and a barn and indoor arena for the keeping of horses. There will also be an outdoor arena, grass paddocks, and associated driveways and pathways. The proposed development results in a total disturbance of approximately 3.13 acres and a total impervious area of approximately 0.40 acres (0.19-acre increase) within the proposed development area.

Purpose

This report assesses the hydrologic aspects, and the stormwater drainage conditions as a result of the proposed construction, including the house, barn, arenas, paddocks, landscaping areas, stormwater management facilities, associated utilities, and related site improvements.

The focus of the study is the identification of the existing drainage characteristics prior to the demolition of the house in comparison to post-development conditions. Calculations documenting the design of the stormwater management system are illustrated on the Site Plan drawing documents, prepared by Colliers Engineering & Design.

Method

Generally, stormwater runoff from the site flows overland from west to east and discharges to an existing drainage channel located at the northeastern corner of the site (Design Point 1). The remainder of the site drains overland to the south (Design Point 2). The area, curve number, and time of concentration for each existing watershed can be seen on the Existing Drainage Area Map included in the appendix. For the purposes of this analysis the existing conditions include the previously demolished house and site improvements.

Under proposed conditions, the site will generally mimic the existing drainage pattern; however, the majority of the proposed development will be captured and routed through a subsurface infiltration basin to attenuate peak flows. New inlets and pipes will be installed to convey the stormwater runoff from certain areas to the infiltration basins. Tributary areas to the infiltration basin are outlined on the Proposed Drainage Area Map and include the house, barn, arenas, and the majority of the proposed pathways and paddocks. The area, curve number, and time of concentration for each proposed watershed can be found on the Proposed Drainage Area Map and HydroCAD output included in the appendix.

Stormwater Quantity

1.1 Stormwater Management

As mentioned above, a subsurface infiltration basin has been designed to provide water quantity mitigation for the runoff discharging to the existing drainage channel. As the site is located in HSG 'C' soils, infiltration is anticipated to be the minimum allowable 1 in/hr. Soil testing, including groundwater elevation determination, will be performed prior to construction. Full HydroCAD output calculations are provided in the appendix. The results are summarized in the table below.

1.2 Summary Table

<i>Description</i>	<i>2 Year Storm</i>	<i>10 Year Storm</i>	<i>100 Year Storm</i>
A. Existing Conditions			
Design Point 1	2.85 cfs	5.99 cfs	12.64 cfs
Required Reductions (50%, 75%, 80%)	1.43 cfs	4.49 cfs	10.11 cfs
Design Point 2	0.55 cfs	1.19 cfs	2.54 cfs
Required Reductions (50%, 75%, 80%)	0.28 cfs	0.89 cfs	2.03 cfs
B. Proposed Conditions			
Design Point 1	1.40 cfs	4.42 cfs	9.91 cfs
Design Point 2	0.26 cfs	0.55 cfs	1.14 cfs

According to §25-29.4.r of the Township of West Orange, stormwater management measures shall be designed so that the post-construction peak runoff rates for the 2-, 10-, and 100-year storm events are 50%, 75%, and 80%, respectively, of the preconstruction peak runoff rates. As can be seen in the Summary Table above, the post-construction peak runoff rates for the 2-, 10-, and 100-year storm events have been reduced below the required peak runoff rates.

1.3 Stormwater Management Facility Operations and Maintenance

The long-term operations and maintenance of the proposed stormwater management facilities shall be performed in accordance with the Stormwater Management Facility Operations & Maintenance Manual prepared by Colliers Engineering & Design (under separate cover). This Manual explains how often maintenance should be performed and how long it should take for the proposed on-site stormwater management systems (porous pavement) to drain to ensure proper operation. Tables showing the data to support the listed drain times are included in the appendix of this report.

1.4 Conveyance System

Pipe sizing calculations will be provided prior to final approval. Pipe sizing calculations will be performed using the Rational Method and 25-year design storm for capacity verification.

Stormwater Quality

As per NJDEP Regulations, stormwater management measures shall only be required for water quality control if an additional $\frac{1}{4}$ acre of regulated motor vehicle surface is being proposed on a development site. For this project, the existing motor vehicle surface area totals approximately 0.19 acres and the proposed motor vehicle surface area totals approximately 0.40 acres, which results in an increase of 0.21 acres. Therefore, as the proposed improvements result in less than $\frac{1}{4}$ acre of new regulated motor vehicle surfaces, water quality treatment is not required.

Groundwater Recharge (N.J.A.C. 7:8-5.4)

To meet Township and NJDEP requirements for groundwater recharge, the proposed development is designed to maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site. As the entire subject property falls within one (1) HUC-14 sub-watershed, compliance with the groundwater recharge standard is met by analyzing the site as a whole. The site is within the Passaic River Lower (Nwk Bay to Saddle) HUC-14 drainage area.

The New Jersey Groundwater Recharge Spreadsheet, Version 2.0, November 2003 is utilized to calculate the post-development annual recharge deficit for the project site and annual recharge volume for each proposed BMP. The following table provides a summary of the post-development deficit and proposed recharge volume. Full calculation spreadsheets and a summary of the proposed recharge volume for each BMP are provided in the Appendix.

Groundwater Recharge Summary

HUC-14 Drainage Area	Pre-Development Total Annual Recharge (cubic feet)	Proposed Annual Recharge Volume (cubic feet)	Percentage of Average Annual Pre-Construction Groundwater Recharge Volume
Passaic River Lower (Nwk Bay to Saddle)	150,467	156,306	103.88%

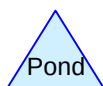
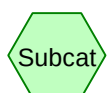
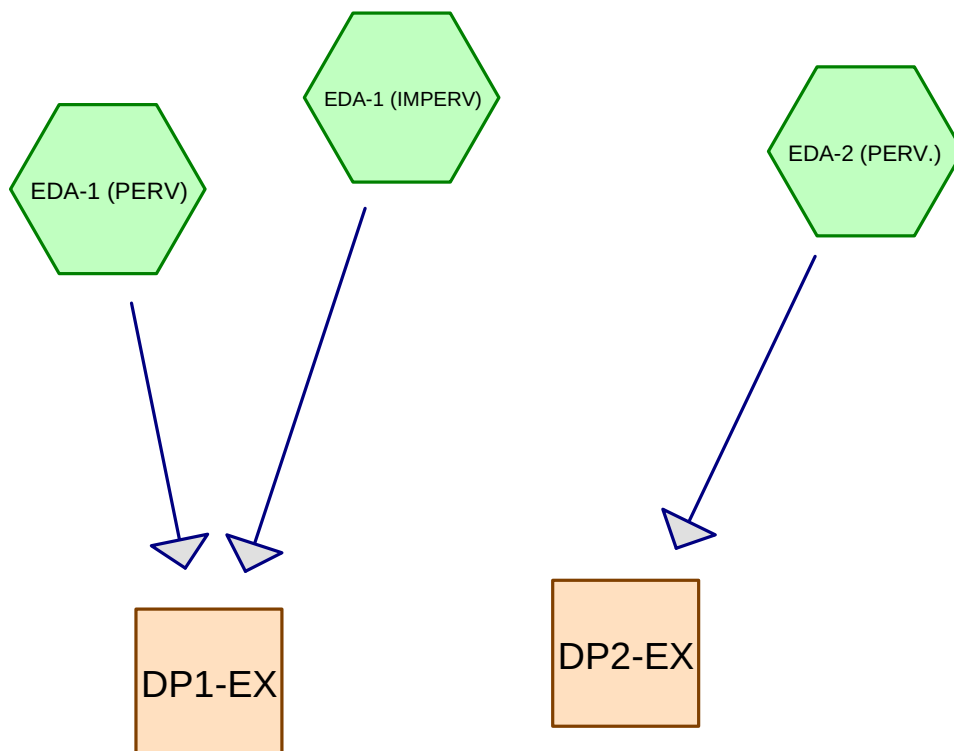
As shown in the above table, the proposed development is designed to maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site.

Conclusion

As discussed above, water quantity mitigation is provided for all watersheds for all storm events studied in accordance with NJDEP and Township of West Orange regulations. A subsurface infiltration basin was utilized to achieve the required reductions for all Design Points. Furthermore, water quality treatment is not required for this project site. As such, there should be no adverse impacts due to stormwater, on-site or off-site, as a result of the proposed development. Included in the appendix of this report is the HydroCAD output for back-up on both the existing and proposed conditions. Additionally, the aforementioned Existing and Proposed Drainage Area Maps, an Inlet Area Map and a Pipe Capacity Report are provided in the appendix of this report.

Appendix A

HydroCAD Output



Routing Diagram for 240924_42 ERW Waymaker
Prepared by Colliers Engineering & Design, Printed 10/17/2024
HydroCAD® 10.20-4b s/n 04431 © 2023 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS2-Rain.txt" for 1167 NJ Essex-D

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	3.44	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.22	2
3	100-Year	NOAA 24-hr	D	Default	24.00	1	8.66	2
4	WQ	NJ DEP 2-hr		Default	2.00	1	1.25	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.773	74	>75% Grass cover, Good, HSG C (EDA-1 (PERV), EDA-2 (PERV.))
0.319	98	Paved parking, HSG C (EDA-1 (IMPERV))
3.092	76	TOTAL AREA

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.092	HSG C	EDA-1 (IMPERV), EDA-1 (PERV), EDA-2 (PERV.)
0.000	HSG D	
0.000	Other	
3.092		TOTAL AREA

240924_42 ERW Waymaker

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	2.773	0.000	0.000	2.773	>75% Grass cover, Good	EDA-1 (PERV), EDA-2 (PERV.)
0.000	0.000	0.319	0.000	0.000	0.319	Paved parking	EDA-1 (IMPERV)
0.000	0.000	3.092	0.000	0.000	3.092	TOTAL AREA	

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

Subcatchment EDA-1 (IMPERV): Runoff Area=13,913 sf 100.00% Impervious Runoff Depth=3.21"
Flow Length=275' Tc=2.8 min CN=98 Runoff=1.14 cfs 0.085 af

Subcatchment EDA-1 (PERV): Runoff Area=102,351 sf 0.00% Impervious Runoff Depth=1.20"
Flow Length=501' Tc=13.1 min CN=74 Runoff=2.46 cfs 0.235 af

Subcatchment EDA-2 (PERV.): Runoff Area=18,430 sf 0.00% Impervious Runoff Depth=1.20"
Flow Length=121' Tc=7.2 min CN=74 Runoff=0.55 cfs 0.042 af

Reach DP1-EX: Inflow=2.85 cfs 0.320 af
Outflow=2.85 cfs 0.320 af

Reach DP2-EX: Inflow=0.55 cfs 0.042 af
Outflow=0.55 cfs 0.042 af

Total Runoff Area = 3.092 ac Runoff Volume = 0.362 af Average Runoff Depth = 1.41"
89.67% Pervious = 2.773 ac 10.33% Impervious = 0.319 ac

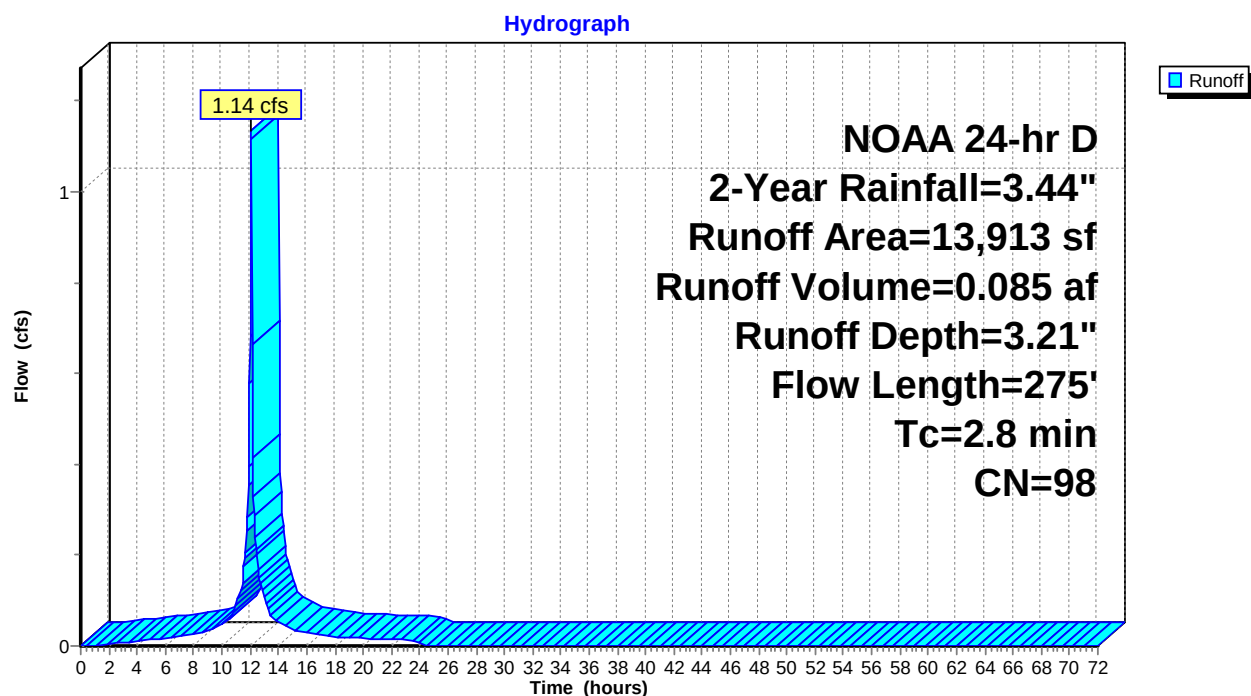
Summary for Subcatchment EDA-1 (IMPERV):[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.085 af, Depth= 3.21"
 Routed to Reach DP1-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt= 0.05$ hrs
 NOAA 24-hr D 2-Year Rainfall=3.44"

Area (sf)	CN	Description
13,913	98	Paved parking, HSG C
13,913		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0150	1.21		Sheet Flow, Smooth surfaces $n= 0.011$ $P2= 3.44"$
1.0	12	0.0800	0.20		Sheet Flow, Grass: Short $n= 0.150$ $P2= 3.44"$
0.7	185	0.0830	4.64		Shallow Concentrated Flow, Unpaved $K_v= 16.1$ fps
2.8	275	Total			

Subcatchment EDA-1 (IMPERV):

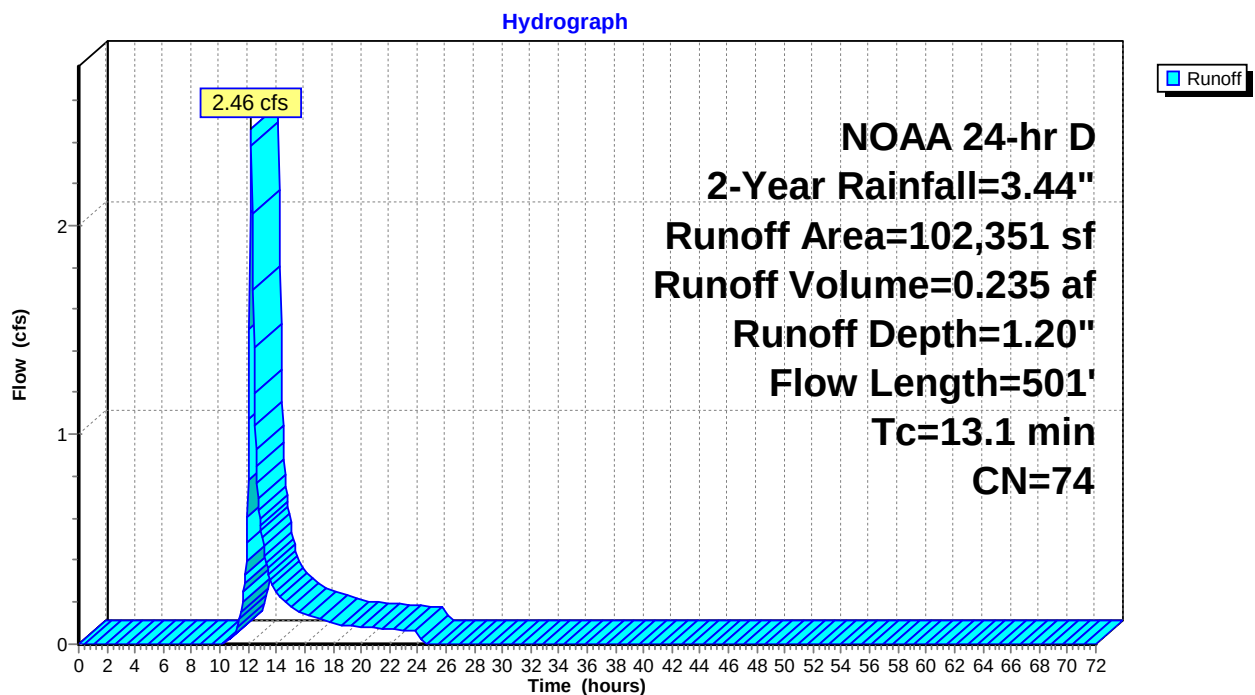
Summary for Subcatchment EDA-1 (PERV):

Runoff = 2.46 cfs @ 12.22 hrs, Volume= 0.235 af, Depth= 1.20"
 Routed to Reach DP1-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-Year Rainfall=3.44"

Area (sf)	CN	Description
102,351	74	>75% Grass cover, Good, HSG C
102,351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0140	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
2.2	401	0.0350	3.01		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	501	Total			

Subcatchment EDA-1 (PERV):

Summary for Subcatchment EDA-2 (PERV.):

Runoff = 0.55 cfs @ 12.15 hrs, Volume= 0.042 af, Depth= 1.20"
 Routed to Reach DP2-EX :

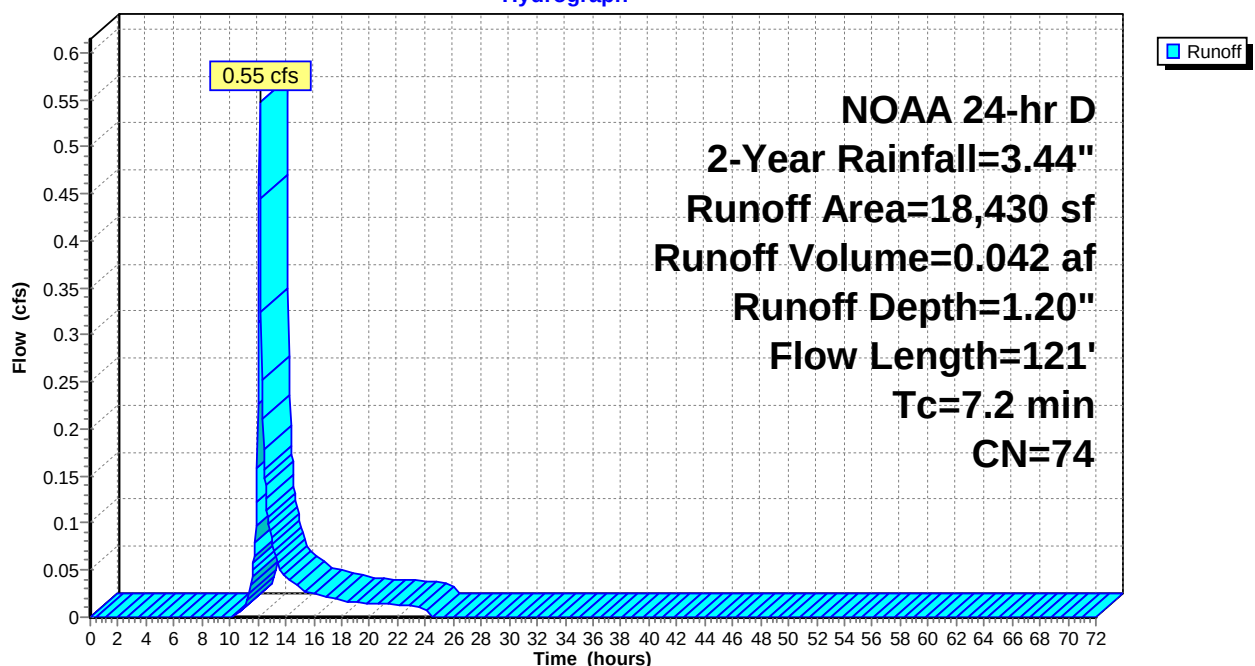
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-Year Rainfall=3.44"

Area (sf)	CN	Description
18,430	74	>75% Grass cover, Good, HSG C
18,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0410	0.24		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
0.1	21	0.1050	5.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.2	121	Total			

Subcatchment EDA-2 (PERV.):

Hydrograph

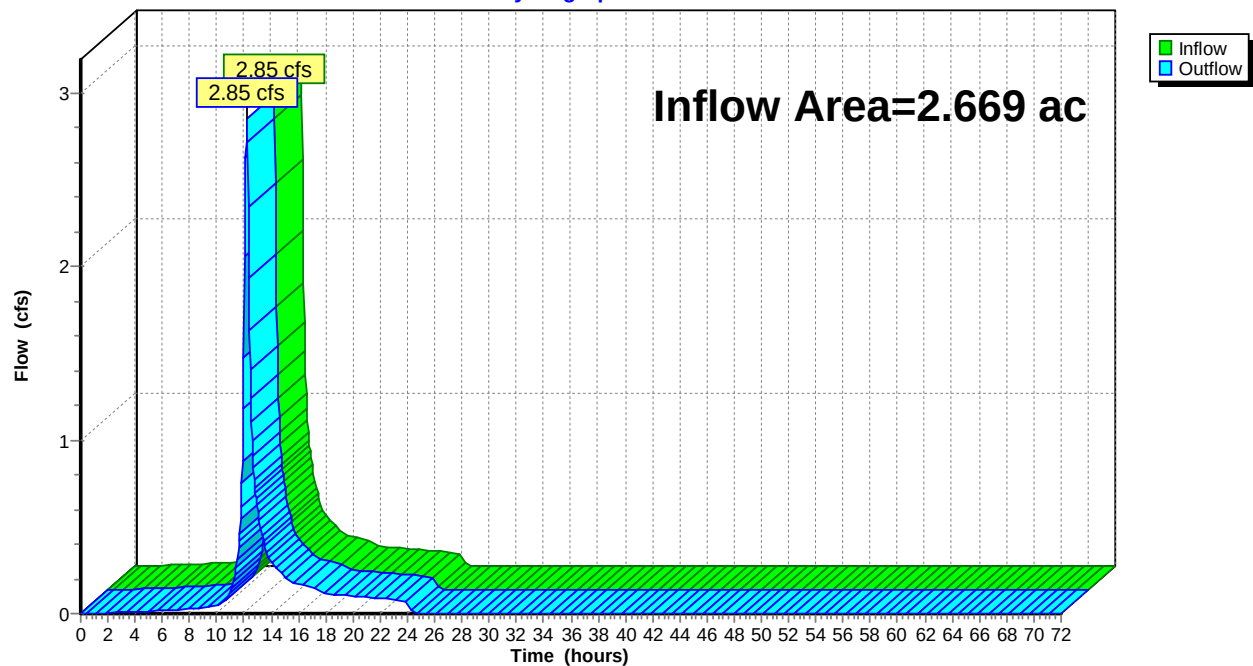


Summary for Reach DP1-EX:

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

Inflow Area = 2.669 ac, 11.97% Impervious, Inflow Depth = 1.44" for 2-Year event
Inflow = 2.85 cfs @ 12.20 hrs, Volume= 0.320 af
Outflow = 2.85 cfs @ 12.20 hrs, Volume= 0.320 af, Atten= 0%, Lag= 0.0 min

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

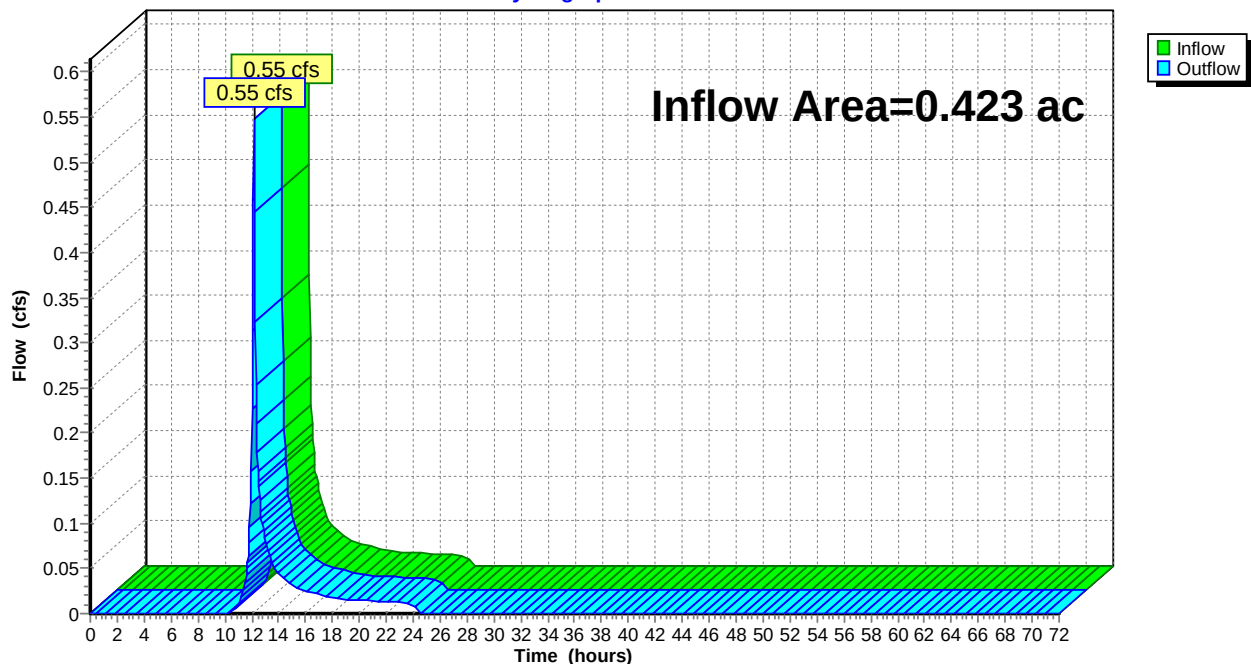
Reach DP1-EX:**Hydrograph**

Summary for Reach DP2-EX:

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

Inflow Area = 0.423 ac, 0.00% Impervious, Inflow Depth = 1.20" for 2-Year event
Inflow = 0.55 cfs @ 12.15 hrs, Volume= 0.042 af
Outflow = 0.55 cfs @ 12.15 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2-EX:**Hydrograph**

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

Subcatchment EDA-1 (IMPERV): Runoff Area=13,913 sf 100.00% Impervious Runoff Depth=4.98"
Flow Length=275' Tc=2.8 min CN=98 Runoff=1.74 cfs 0.133 af

Subcatchment EDA-1 (PERV): Runoff Area=102,351 sf 0.00% Impervious Runoff Depth=2.54"
Flow Length=501' Tc=13.1 min CN=74 Runoff=5.39 cfs 0.498 af

Subcatchment EDA-2 (PERV.): Runoff Area=18,430 sf 0.00% Impervious Runoff Depth=2.54"
Flow Length=121' Tc=7.2 min CN=74 Runoff=1.19 cfs 0.090 af

Reach DP1-EX: Inflow=5.99 cfs 0.630 af
Outflow=5.99 cfs 0.630 af

Reach DP2-EX: Inflow=1.19 cfs 0.090 af
Outflow=1.19 cfs 0.090 af

Total Runoff Area = 3.092 ac Runoff Volume = 0.720 af Average Runoff Depth = 2.79"
89.67% Pervious = 2.773 ac 10.33% Impervious = 0.319 ac

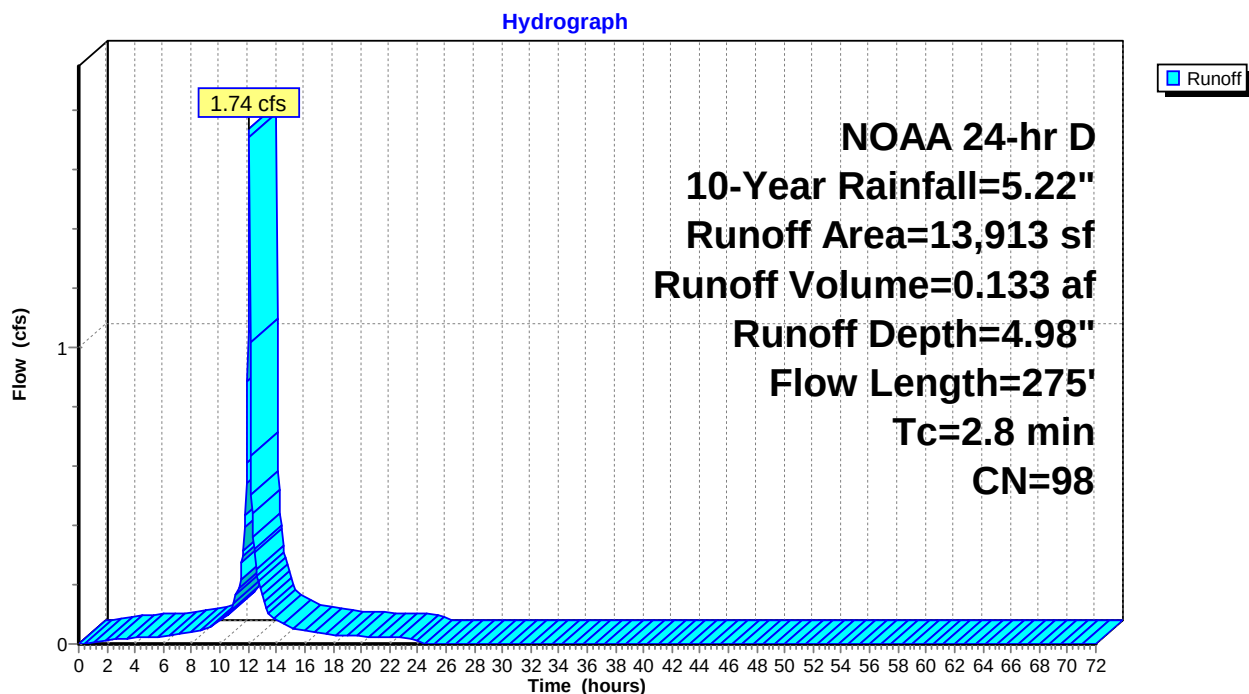
Summary for Subcatchment EDA-1 (IMPERV):[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 1.74 cfs @ 12.09 hrs, Volume= 0.133 af, Depth= 4.98"
 Routed to Reach DP1-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
 NOAA 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
13,913	98	Paved parking, HSG C
13,913		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0150	1.21		Sheet Flow, Smooth surfaces $n=0.011$ $P2=3.44"$
1.0	12	0.0800	0.20		Sheet Flow, Grass: Short $n=0.150$ $P2=3.44"$
0.7	185	0.0830	4.64		Shallow Concentrated Flow, Unpaved $K_v=16.1$ fps
2.8	275	Total			

Subcatchment EDA-1 (IMPERV):

Summary for Subcatchment EDA-1 (PERV):

Runoff = 5.39 cfs @ 12.21 hrs, Volume= 0.498 af, Depth= 2.54"
 Routed to Reach DP1-EX :

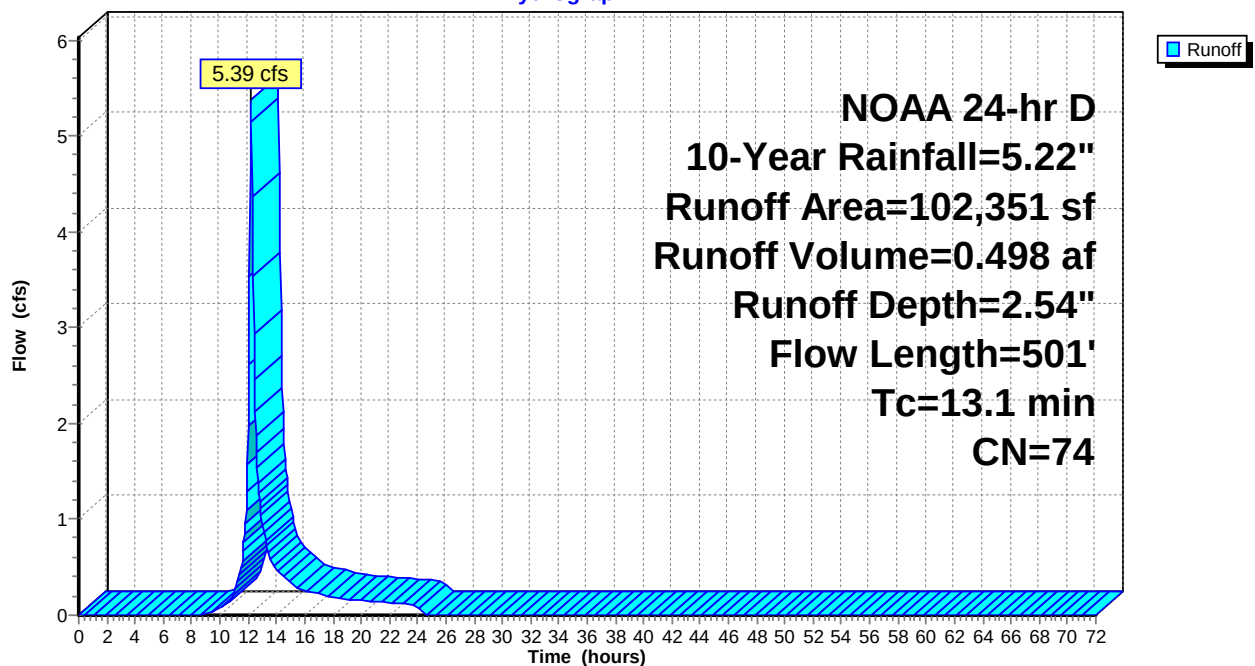
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
102,351	74	>75% Grass cover, Good, HSG C
102,351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0140	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
2.2	401	0.0350	3.01		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	501	Total			

Subcatchment EDA-1 (PERV):

Hydrograph



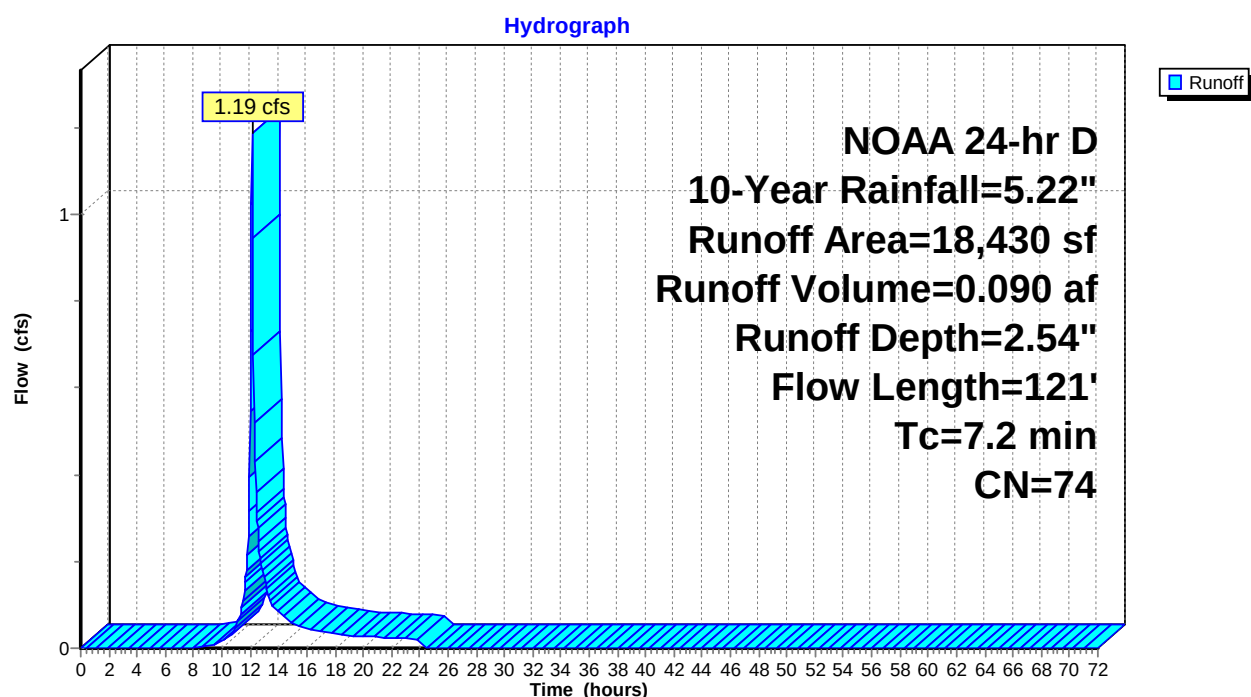
Summary for Subcatchment EDA-2 (PERV.):

Runoff = 1.19 cfs @ 12.15 hrs, Volume= 0.090 af, Depth= 2.54"
 Routed to Reach DP2-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
18,430	74	>75% Grass cover, Good, HSG C
18,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0410	0.24		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
0.1	21	0.1050	5.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.2	121	Total			

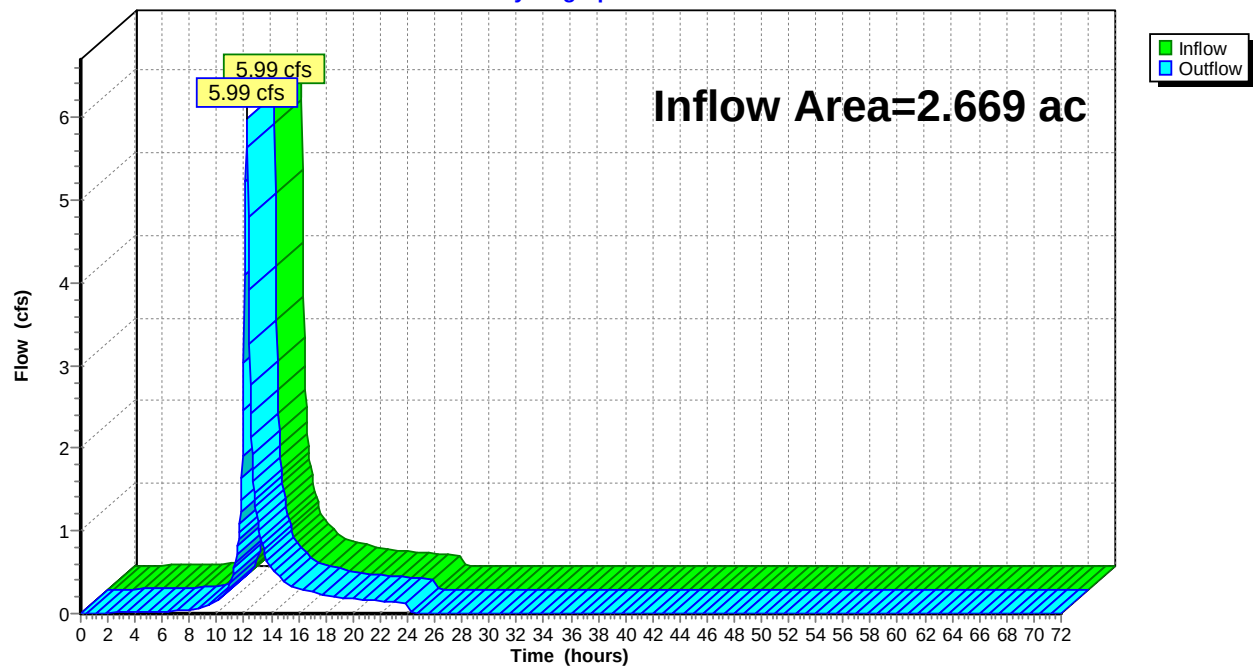
Subcatchment EDA-2 (PERV.):

Summary for Reach DP1-EX:

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

Inflow Area = 2.669 ac, 11.97% Impervious, Inflow Depth = 2.83" for 10-Year event
Inflow = 5.99 cfs @ 12.20 hrs, Volume= 0.630 af
Outflow = 5.99 cfs @ 12.20 hrs, Volume= 0.630 af, Atten= 0%, Lag= 0.0 min

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

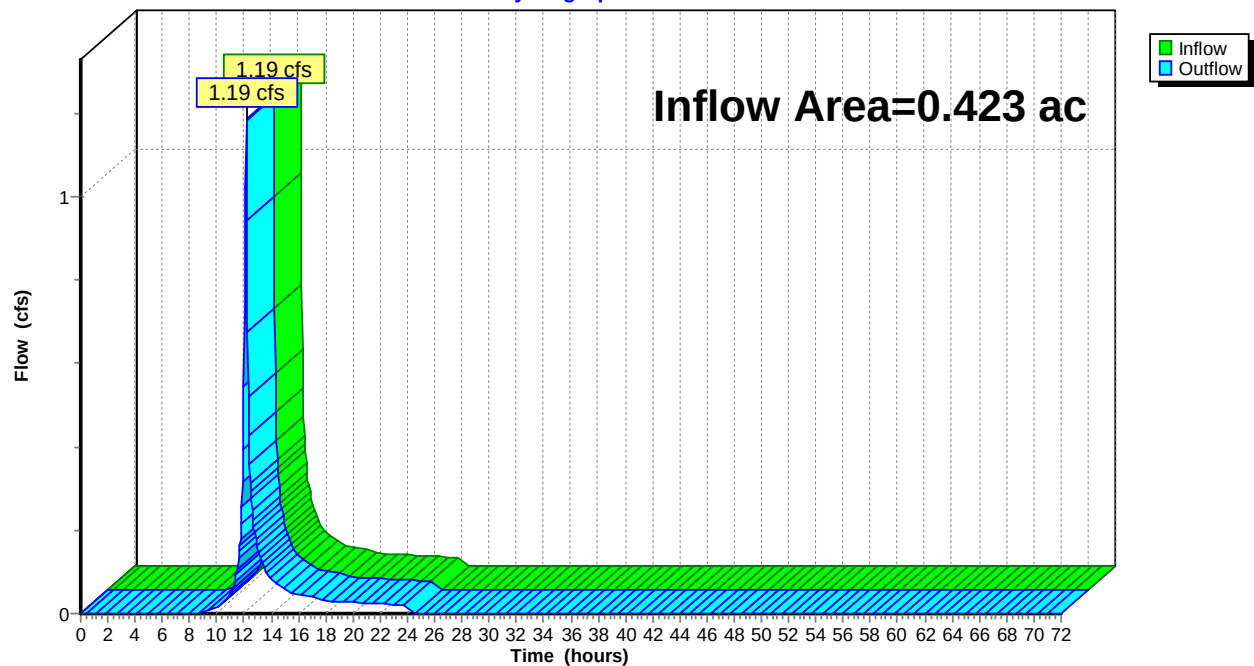
Reach DP1-EX:**Hydrograph**

Summary for Reach DP2-EX:

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

Inflow Area = 0.423 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 1.19 cfs @ 12.15 hrs, Volume= 0.090 af
Outflow = 1.19 cfs @ 12.15 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2-EX:**Hydrograph**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-1 (IMPERV):Runoff Area=13,913 sf 100.00% Impervious Runoff Depth=8.42"
Flow Length=275' Tc=2.8 min CN=98 Runoff=2.89 cfs 0.224 af**Subcatchment EDA-1 (PERV):**Runoff Area=102,351 sf 0.00% Impervious Runoff Depth=5.52"
Flow Length=501' Tc=13.1 min CN=74 Runoff=11.62 cfs 1.081 af**Subcatchment EDA-2 (PERV.):**Runoff Area=18,430 sf 0.00% Impervious Runoff Depth=5.52"
Flow Length=121' Tc=7.2 min CN=74 Runoff=2.54 cfs 0.195 af**Reach DP1-EX:**Inflow=12.64 cfs 1.305 af
Outflow=12.64 cfs 1.305 af**Reach DP2-EX:**Inflow=2.54 cfs 0.195 af
Outflow=2.54 cfs 0.195 af**Total Runoff Area = 3.092 ac Runoff Volume = 1.500 af Average Runoff Depth = 5.82"**
89.67% Pervious = 2.773 ac 10.33% Impervious = 0.319 ac

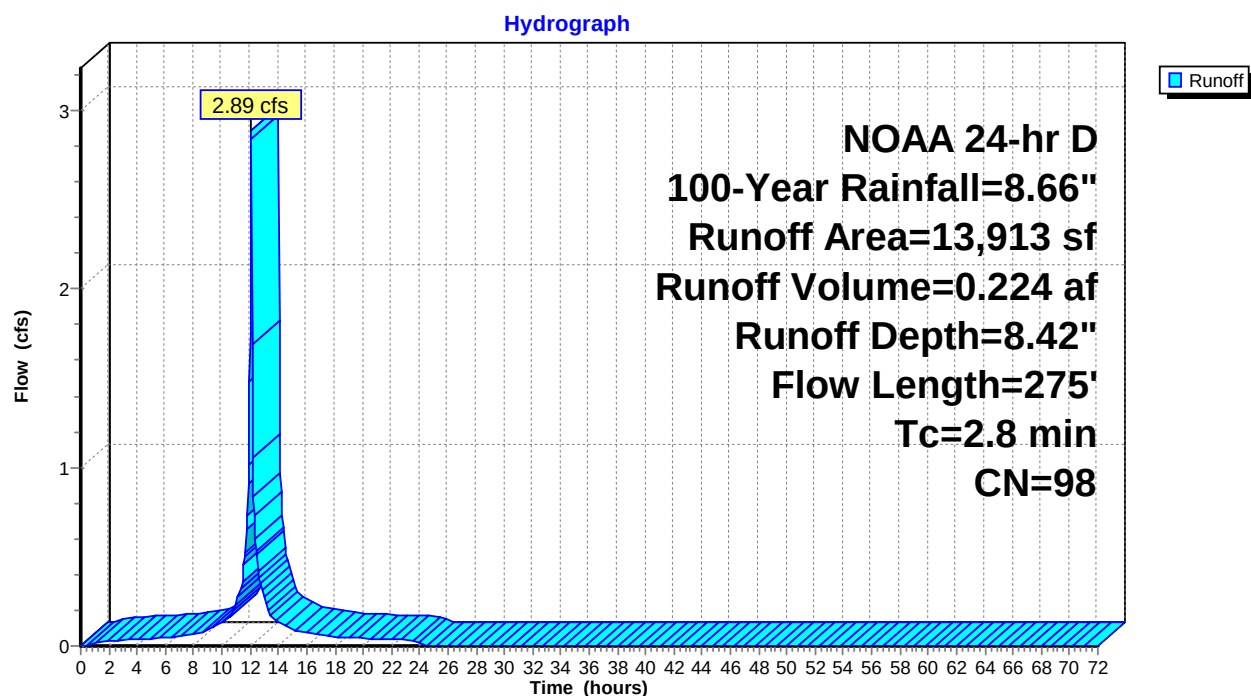
Summary for Subcatchment EDA-1 (IMPERV):[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 2.89 cfs @ 12.09 hrs, Volume= 0.224 af, Depth= 8.42"
 Routed to Reach DP1-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
 NOAA 24-hr D 100-Year Rainfall=8.66"

Area (sf)	CN	Description
13,913	98	Paved parking, HSG C
13,913		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0150	1.21		Sheet Flow, Smooth surfaces $n=0.011$ $P2=3.44"$
1.0	12	0.0800	0.20		Sheet Flow, Grass: Short $n=0.150$ $P2=3.44"$
0.7	185	0.0830	4.64		Shallow Concentrated Flow, Unpaved $K_v=16.1$ fps
2.8	275	Total			

Subcatchment EDA-1 (IMPERV):

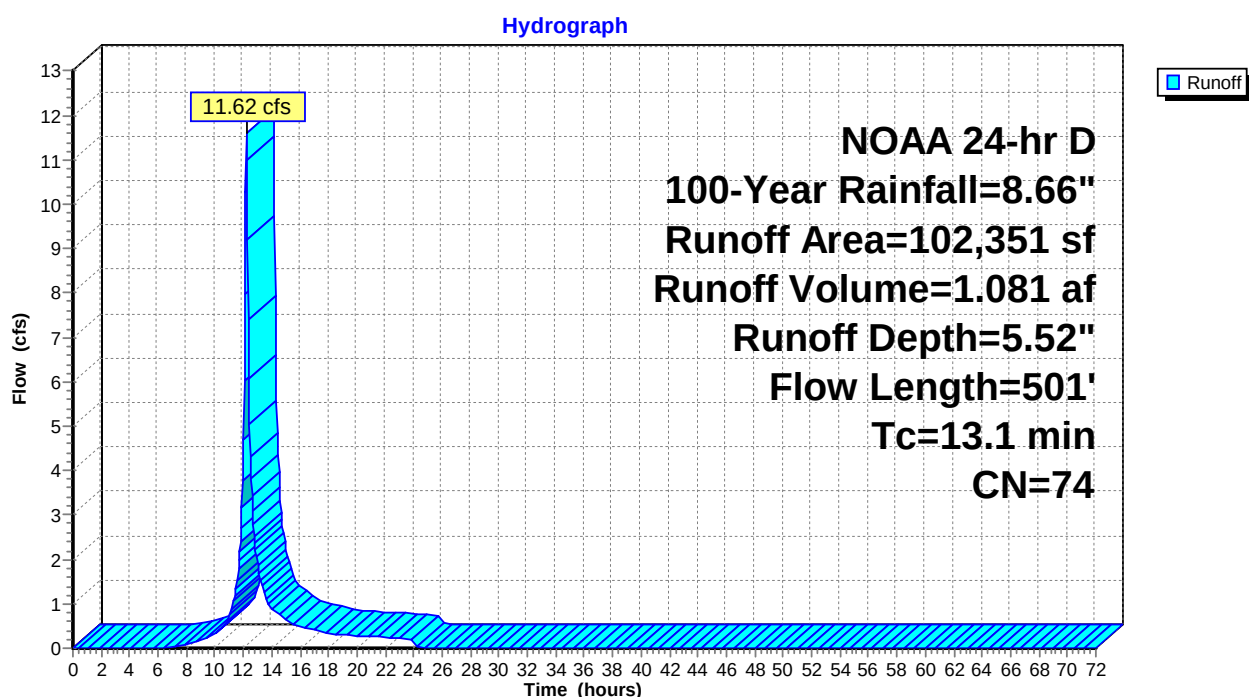
Summary for Subcatchment EDA-1 (PERV):

Runoff = 11.62 cfs @ 12.21 hrs, Volume= 1.081 af, Depth= 5.52"
 Routed to Reach DP1-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-Year Rainfall=8.66"

Area (sf)	CN	Description
102,351	74	>75% Grass cover, Good, HSG C
102,351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0140	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
2.2	401	0.0350	3.01		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	501	Total			

Subcatchment EDA-1 (PERV):

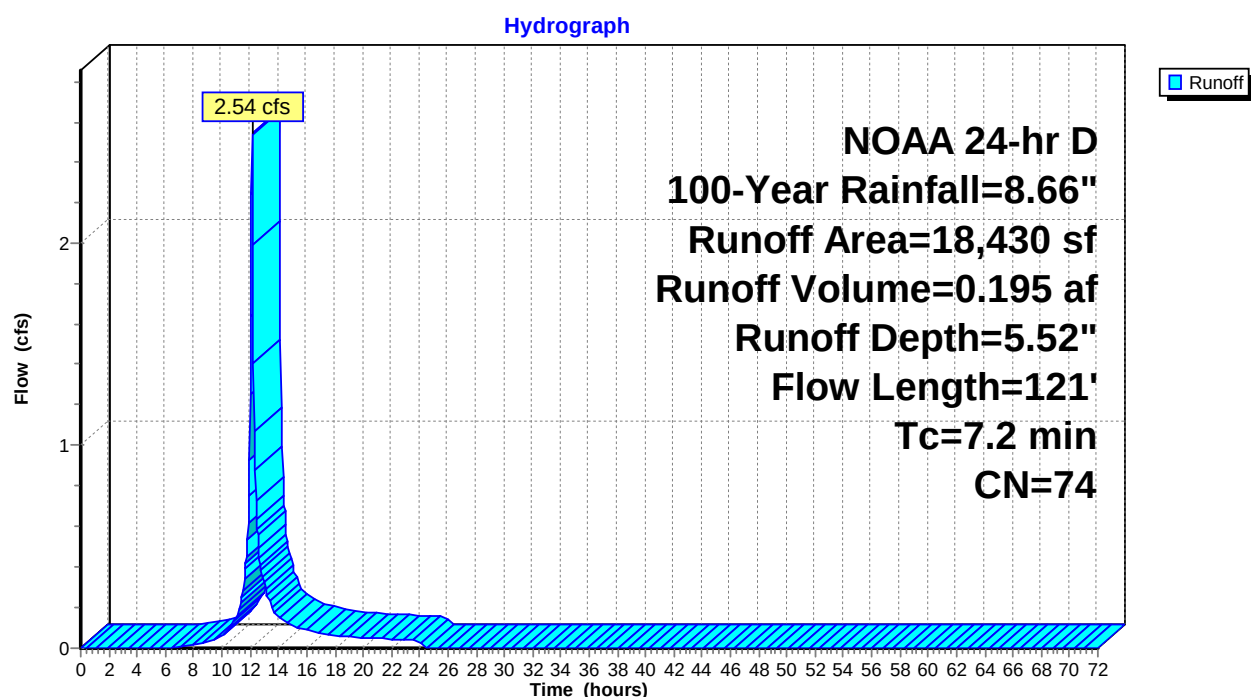
Summary for Subcatchment EDA-2 (PERV.):

Runoff = 2.54 cfs @ 12.14 hrs, Volume= 0.195 af, Depth= 5.52"
 Routed to Reach DP2-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-Year Rainfall=8.66"

Area (sf)	CN	Description
18,430	74	>75% Grass cover, Good, HSG C
18,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0410	0.24		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
0.1	21	0.1050	5.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.2	121	Total			

Subcatchment EDA-2 (PERV.):

Summary for Reach DP1-EX:

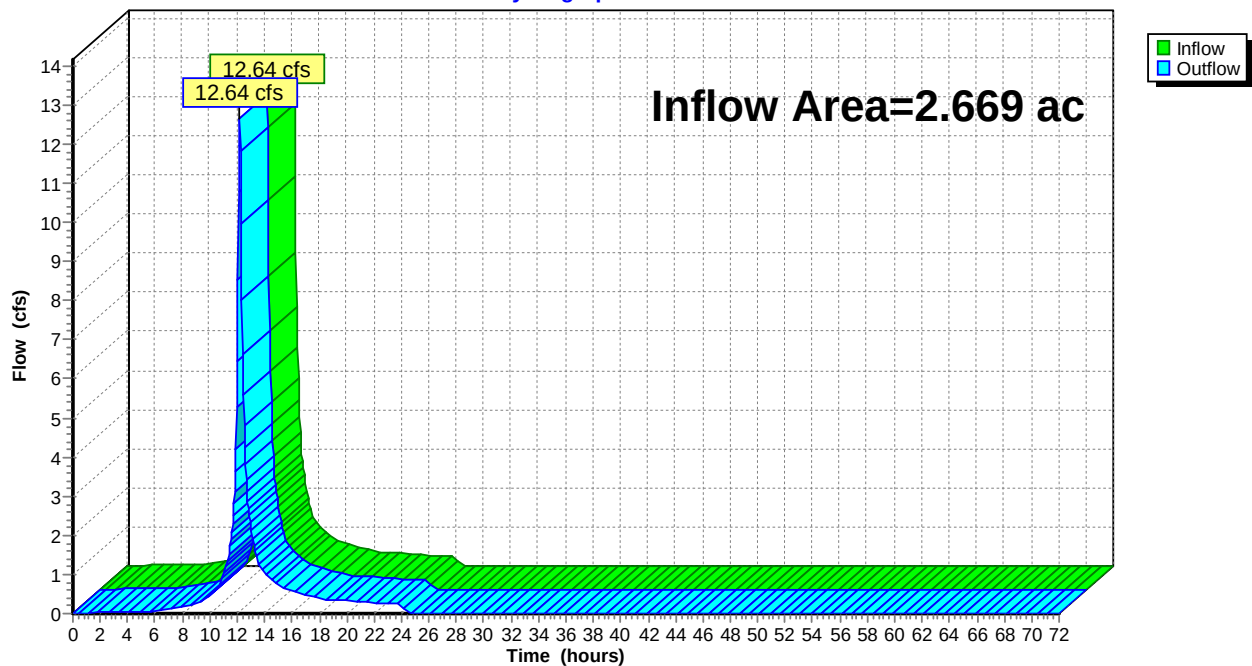
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.669 ac, 11.97% Impervious, Inflow Depth = 5.87" for 100-Year event

Inflow = 12.64 cfs @ 12.20 hrs, Volume= 1.305 af

Outflow = 12.64 cfs @ 12.20 hrs, Volume= 1.305 af, Atten= 0%, Lag= 0.0 min

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

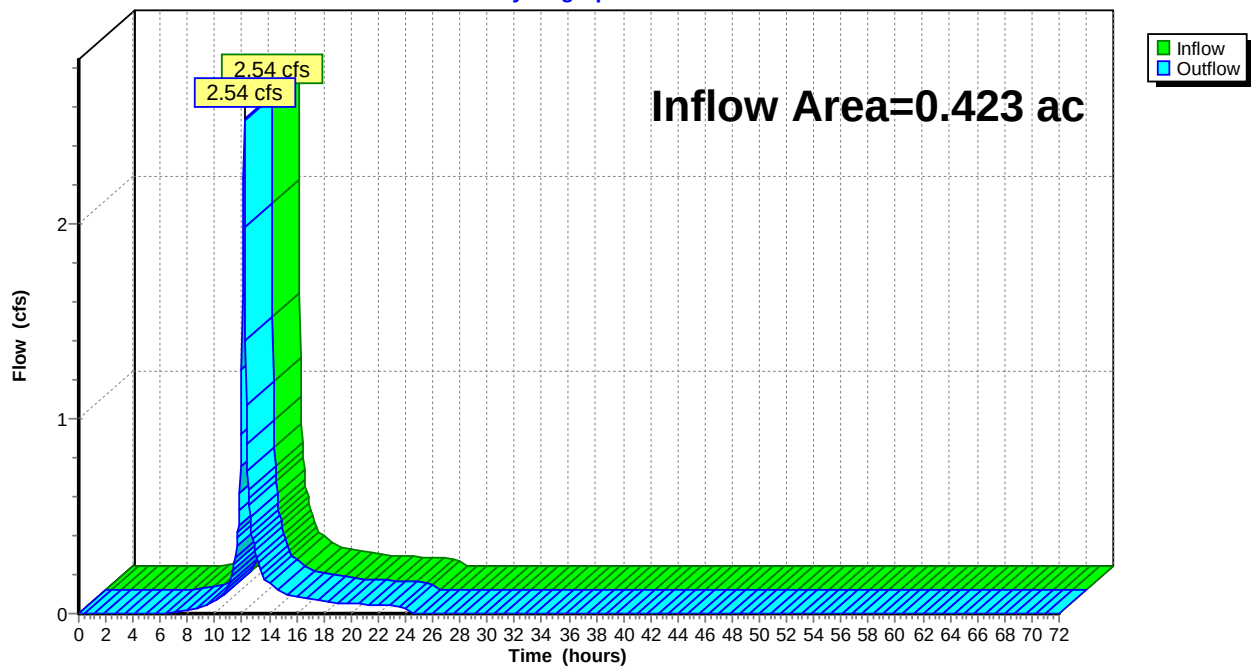
Reach DP1-EX:**Hydrograph**

Summary for Reach DP2-EX:

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

Inflow Area = 0.423 ac, 0.00% Impervious, Inflow Depth = 5.52" for 100-Year event
Inflow = 2.54 cfs @ 12.14 hrs, Volume= 0.195 af
Outflow = 2.54 cfs @ 12.14 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2-EX:**Hydrograph**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-1 (IMPERV):Runoff Area=13,913 sf 100.00% Impervious Runoff Depth=1.03"
Flow Length=275' Tc=2.8 min CN=98 Runoff=0.96 cfs 0.028 af**Subcatchment EDA-1 (PERV):**Runoff Area=102,351 sf 0.00% Impervious Runoff Depth=0.07"
Flow Length=501' Tc=13.1 min CN=74 Runoff=0.28 cfs 0.014 af**Subcatchment EDA-2 (PERV.):**Runoff Area=18,430 sf 0.00% Impervious Runoff Depth=0.07"
Flow Length=121' Tc=7.2 min CN=74 Runoff=0.06 cfs 0.003 af**Reach DP1-EX:**Inflow=0.96 cfs 0.042 af
Outflow=0.96 cfs 0.042 af**Reach DP2-EX:**Inflow=0.06 cfs 0.003 af
Outflow=0.06 cfs 0.003 af**Total Runoff Area = 3.092 ac Runoff Volume = 0.045 af Average Runoff Depth = 0.17"**
89.67% Pervious = 2.773 ac 10.33% Impervious = 0.319 ac

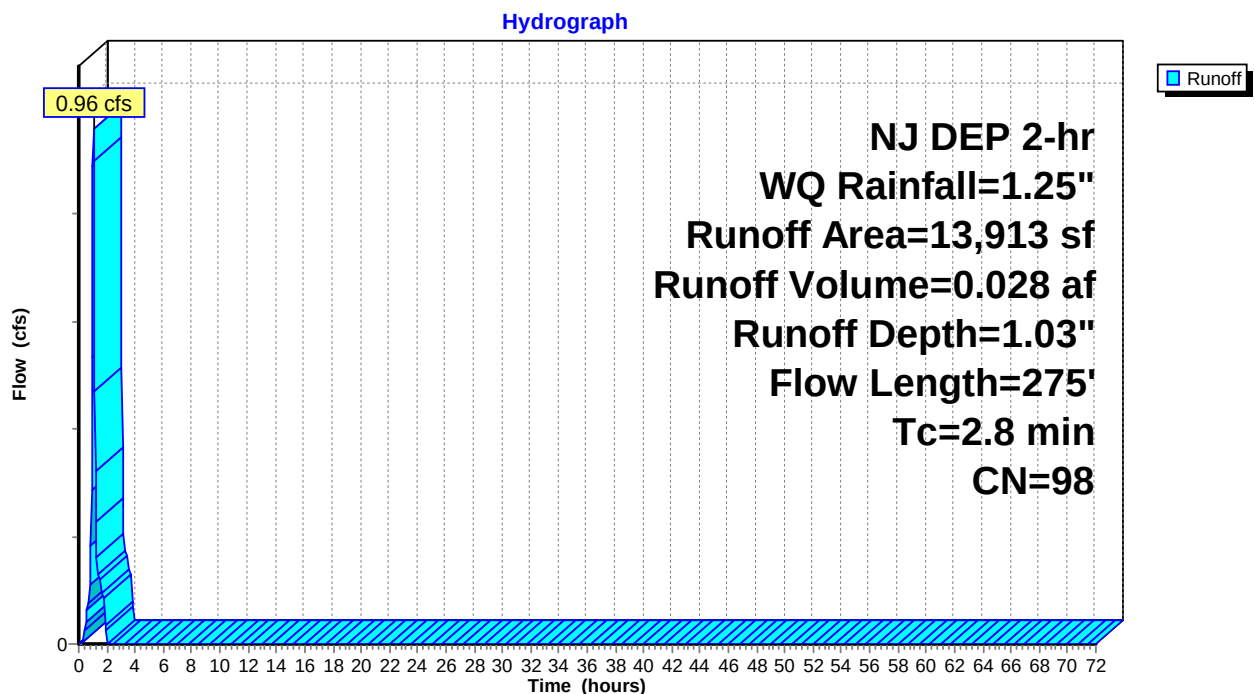
Summary for Subcatchment EDA-1 (IMPERV):[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.96 cfs @ 1.05 hrs, Volume= 0.028 af, Depth= 1.03"
 Routed to Reach DP1-EX :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt= 0.05$ hrs
 NJ DEP 2-hr WQ Rainfall=1.25"

Area (sf)	CN	Description
13,913	98	Paved parking, HSG C
13,913		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	78	0.0150	1.21		Sheet Flow, Smooth surfaces $n= 0.011$ $P2= 3.44"$
1.0	12	0.0800	0.20		Sheet Flow, Grass: Short $n= 0.150$ $P2= 3.44"$
0.7	185	0.0830	4.64		Shallow Concentrated Flow, Unpaved $K_v= 16.1$ fps
2.8	275	Total			

Subcatchment EDA-1 (IMPERV):

Summary for Subcatchment EDA-1 (PERV):

Runoff = 0.28 cfs @ 1.32 hrs, Volume= 0.014 af, Depth= 0.07"
 Routed to Reach DP1-EX :

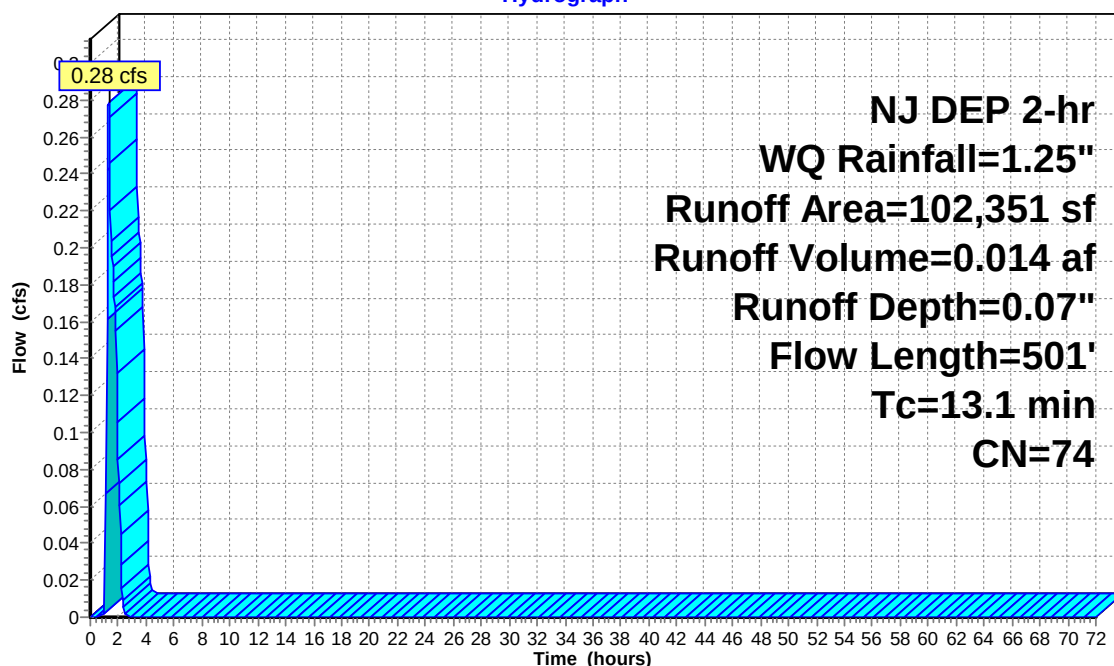
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NJ DEP 2-hr WQ Rainfall=1.25"

Area (sf)	CN	Description
102,351	74	>75% Grass cover, Good, HSG C
102,351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0140	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
2.2	401	0.0350	3.01		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	501	Total			

Subcatchment EDA-1 (PERV):

Hydrograph



Summary for Subcatchment EDA-2 (PERV.):

Runoff = 0.06 cfs @ 1.22 hrs, Volume= 0.003 af, Depth= 0.07"
 Routed to Reach DP2-EX :

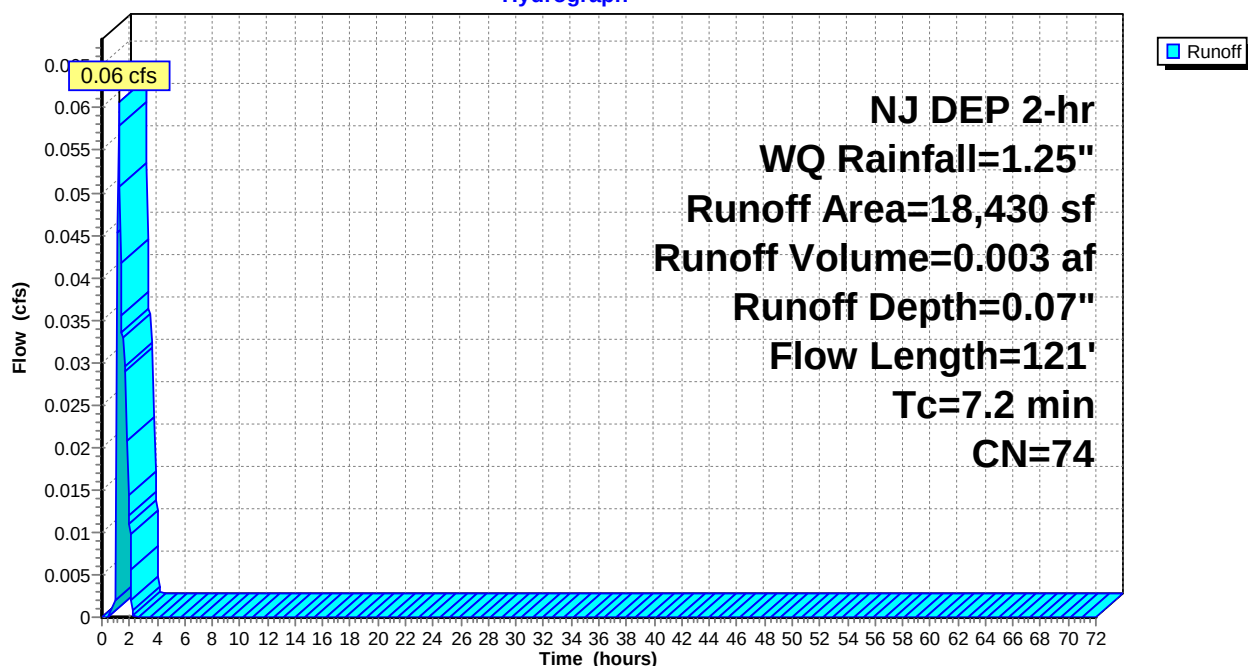
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NJ DEP 2-hr WQ Rainfall=1.25"

Area (sf)	CN	Description
18,430	74	>75% Grass cover, Good, HSG C
18,430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0410	0.24		Sheet Flow, Grass: Short n= 0.150 P2= 3.44"
0.1	21	0.1050	5.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.2	121	Total			

Subcatchment EDA-2 (PERV.):

Hydrograph

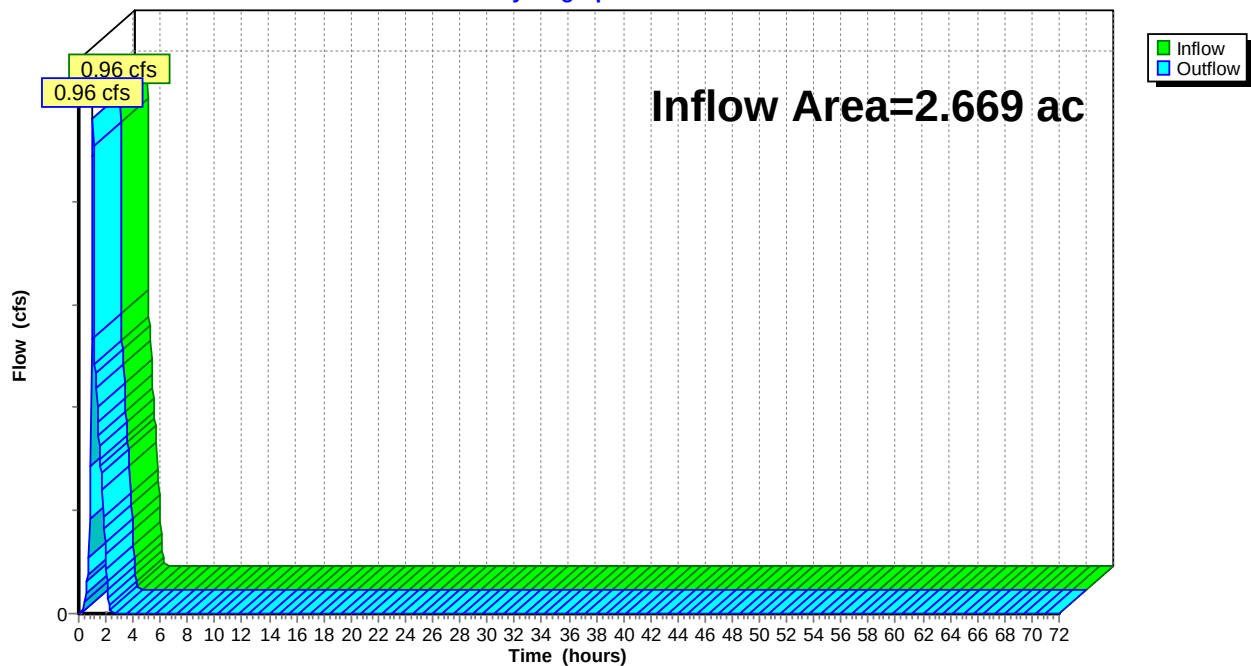


Summary for Reach DP1-EX:

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

Inflow Area = 2.669 ac, 11.97% Impervious, Inflow Depth = 0.19" for WQ event
Inflow = 0.96 cfs @ 1.05 hrs, Volume= 0.042 af
Outflow = 0.96 cfs @ 1.05 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

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

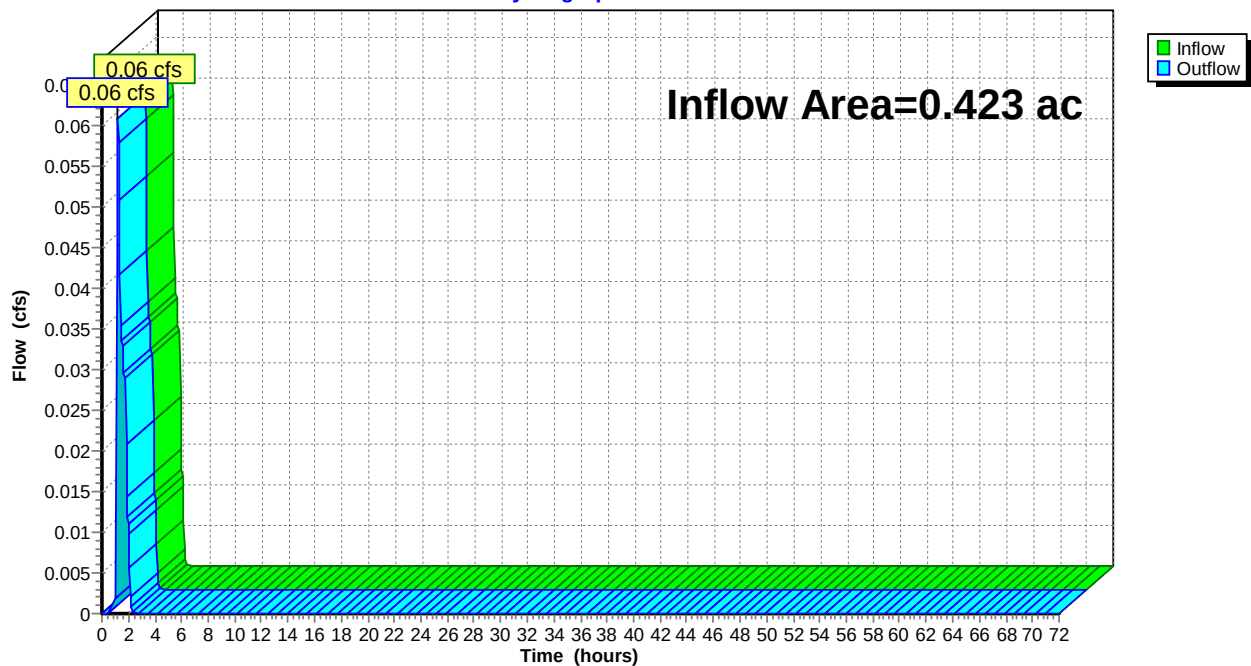
Reach DP1-EX:**Hydrograph**

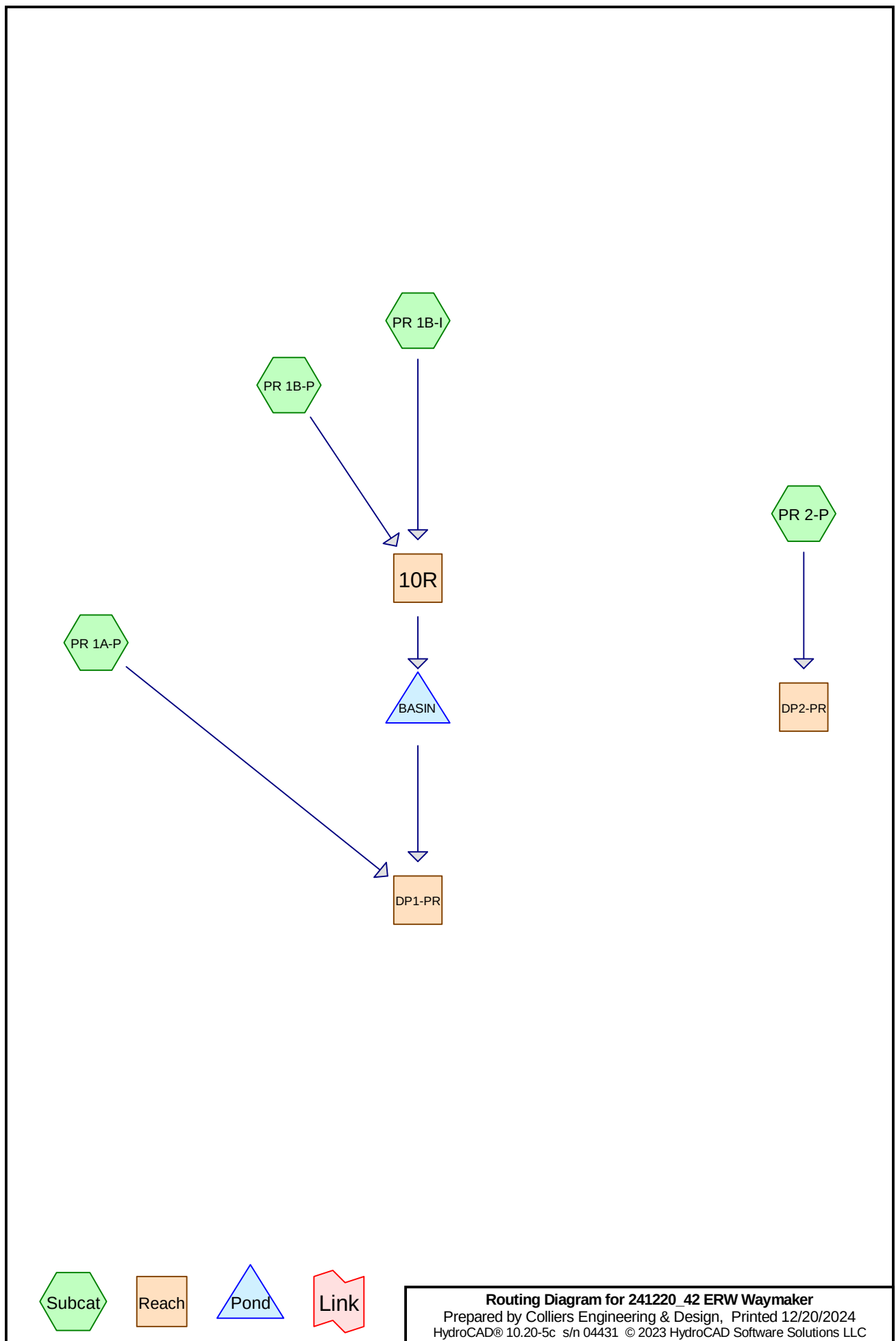
Summary for Reach DP2-EX:

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

Inflow Area = 0.423 ac, 0.00% Impervious, Inflow Depth = 0.07" for WQ event
Inflow = 0.06 cfs @ 1.22 hrs, Volume= 0.003 af
Outflow = 0.06 cfs @ 1.22 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2-EX:**Hydrograph**



Project Notes

Rainfall events imported from "NRCS2-Rain.txt" for 1167 NJ Essex-D

241220_42 ERW Waymaker

Prepared by Colliers Engineering & Design

Printed 12/20/2024

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Rainfall Events Listing

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	3.44	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.22	2
3	25-Year	NOAA 24-hr	D	Default	24.00	1	6.44	2
4	100-Year	NOAA 24-hr	D	Default	24.00	1	8.66	2
5	WQ	NJ DEP 2-hr		Default	2.00	1	1.25	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.601	74	>75% Grass cover, Good, HSG C (PR 1A-P, PR 1B-P, PR 2-P)
0.643	89	Gravel roads, HSG C (PR 1A-P, PR 1B-P, PR 2-P)
0.355	98	Paved parking, HSG C (PR 1B-I)
0.492	98	Roofs, HSG C (PR 1B-I)
3.092	84	TOTAL AREA

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.092	HSG C	PR 1A-P, PR 1B-I, PR 1B-P, PR 2-P
0.000	HSG D	
0.000	Other	
3.092		TOTAL AREA

241220_42 ERW Waymaker

Prepared by Colliers Engineering & Design

Printed 12/20/2024

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.601	0.000	0.000	1.601	>75% Grass cover, Good	PR 1A-P, PR 1B-P, PR 2-P
0.000	0.000	0.643	0.000	0.000	0.643	Gravel roads	PR 1A-P, PR 1B-P, PR 2-P
0.000	0.000	0.355	0.000	0.000	0.355	Paved parking	PR 1B-I
0.000	0.000	0.492	0.000	0.000	0.492	Roofs	PR 1B-I
0.000	0.000	3.092	0.000	0.000	3.092	TOTAL AREA	

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

Subcatchment PR 1A-P: Runoff Area=13,167 sf 0.00% Impervious Runoff Depth=1.45"
Flow Length=203' Tc=5.9 min CN=78 Runoff=0.50 cfs 0.037 af

Subcatchment PR 1B-I: Runoff Area=36,906 sf 100.00% Impervious Runoff Depth=3.21"
Flow Length=136' Tc=1.5 min CN=98 Runoff=3.04 cfs 0.226 af

Subcatchment PR 1B-P: Runoff Area=77,195 sf 0.00% Impervious Runoff Depth=1.52"
Flow Length=180' Tc=7.5 min CN=79 Runoff=2.95 cfs 0.224 af

Subcatchment PR 2-P: Runoff Area=7,405 sf 0.00% Impervious Runoff Depth=1.32"
Flow Length=84' Slope=0.0833 '/' Tc=4.6 min CN=76 Runoff=0.26 cfs 0.019 af

Reach 10R: Inflow=5.32 cfs 0.451 af
Outflow=5.32 cfs 0.451 af

Reach DP1-PR: Inflow=1.40 cfs 0.256 af
Outflow=1.40 cfs 0.256 af

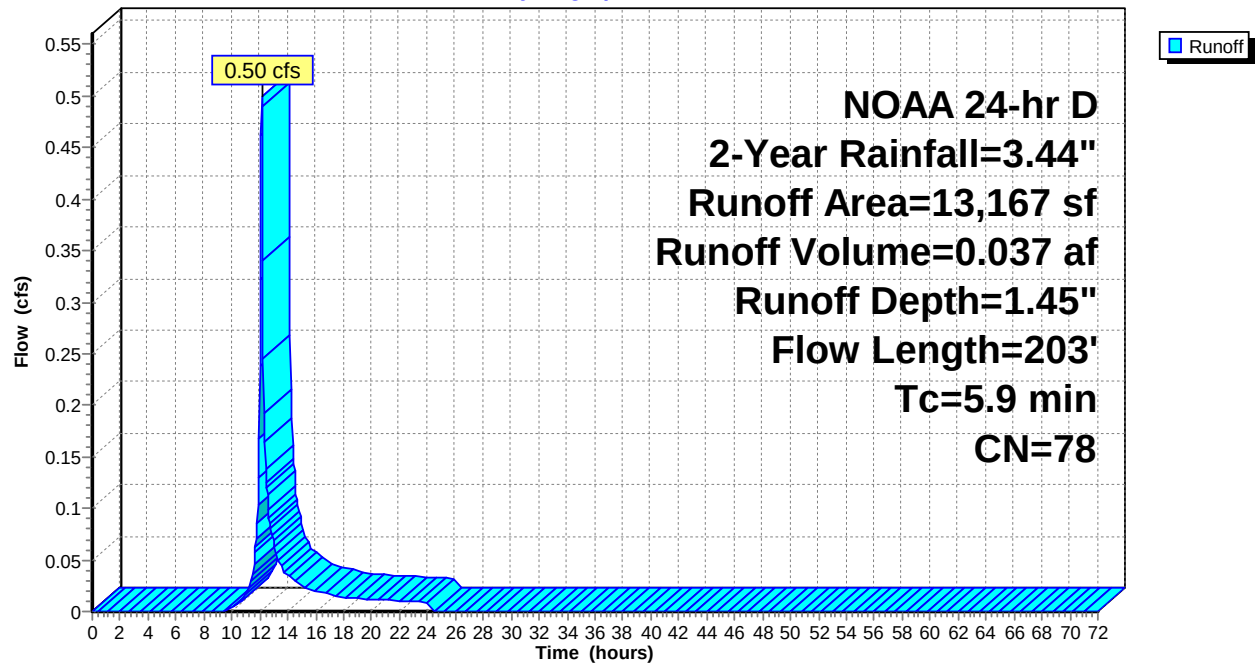
Reach DP2-PR: Inflow=0.26 cfs 0.019 af
Outflow=0.26 cfs 0.019 af

Pond BASIN: Peak Elev=14.76' Storage=0.167 af Inflow=5.32 cfs 0.451 af
Discarded=0.13 cfs 0.232 af Primary=1.20 cfs 0.219 af Outflow=1.33 cfs 0.451 af

Total Runoff Area = 3.092 ac Runoff Volume = 0.506 af Average Runoff Depth = 1.96"
72.60% Pervious = 2.244 ac 27.40% Impervious = 0.847 ac

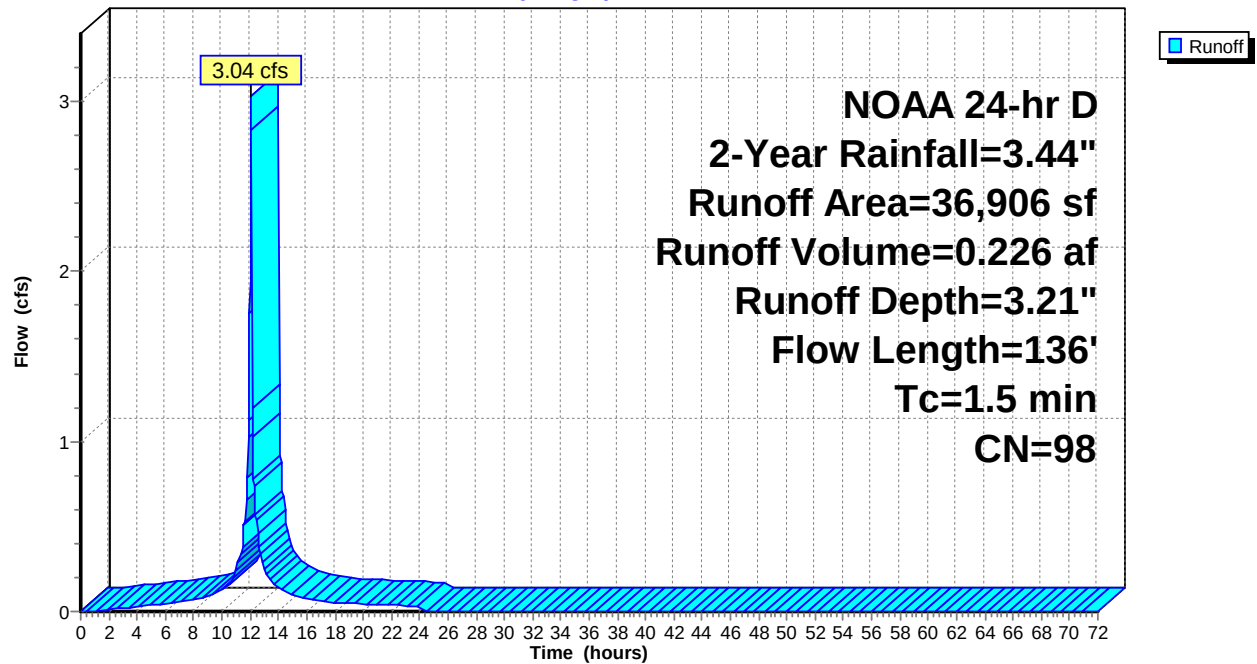
Subcatchment PR 1A-P:

Hydrograph

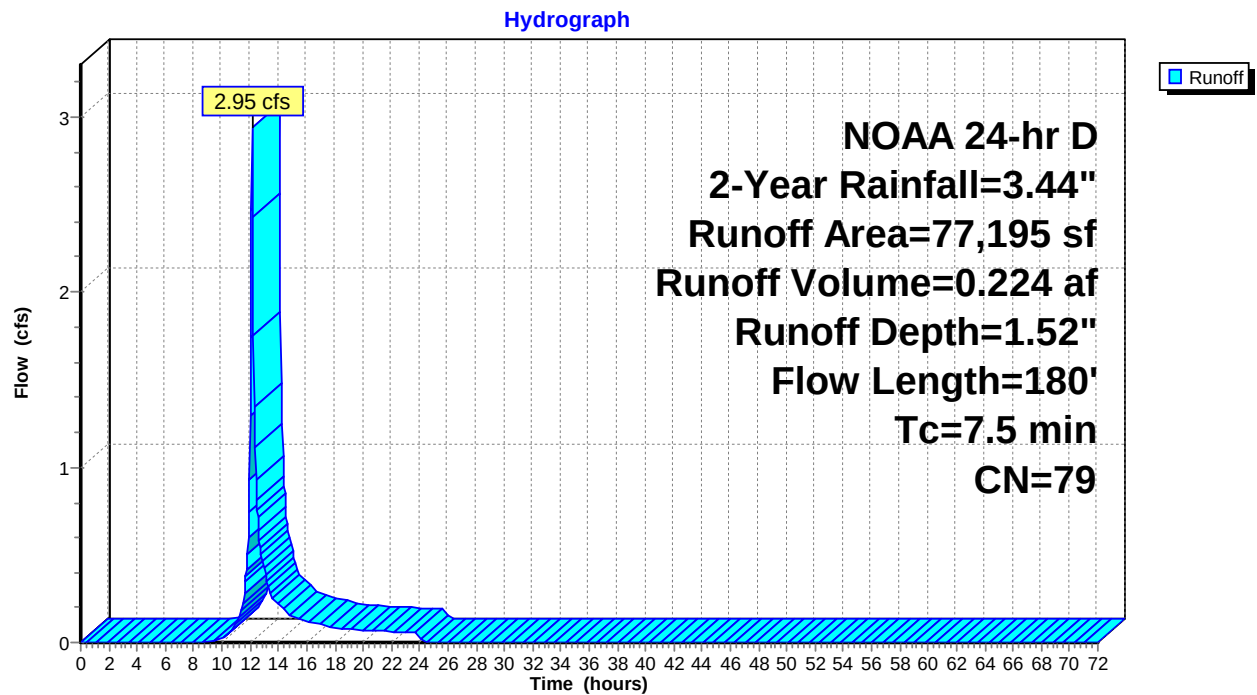


Subcatchment PR 1B-I:

Hydrograph

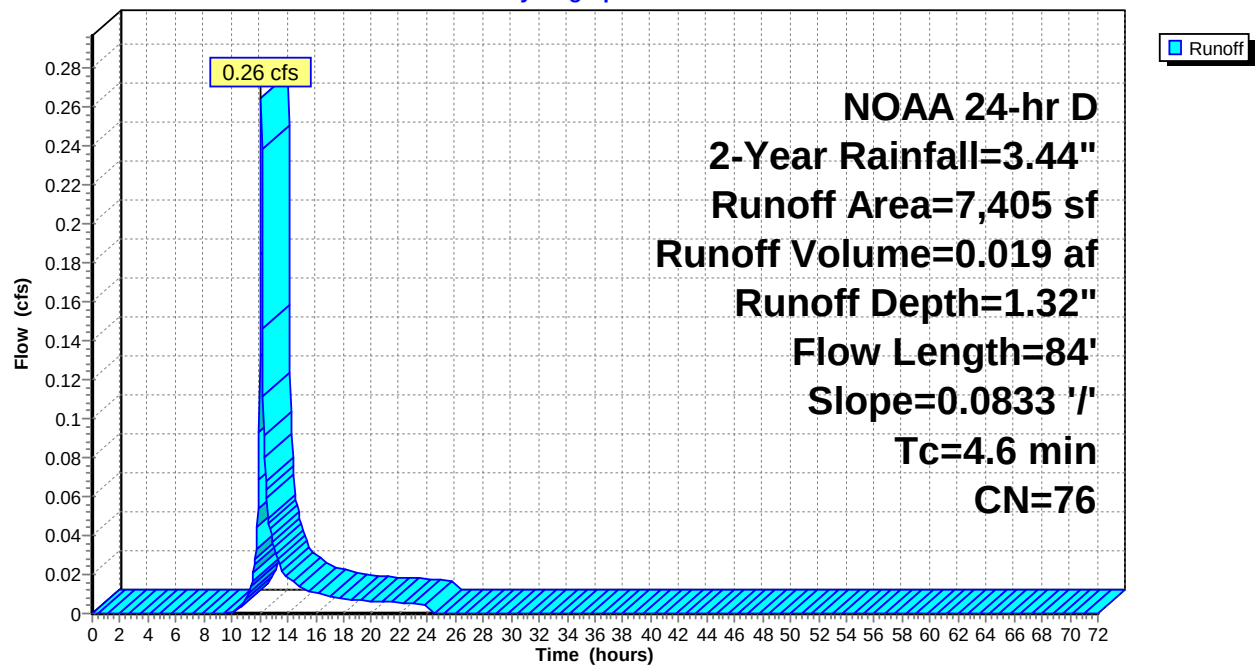


Subcatchment PR 1B-P:



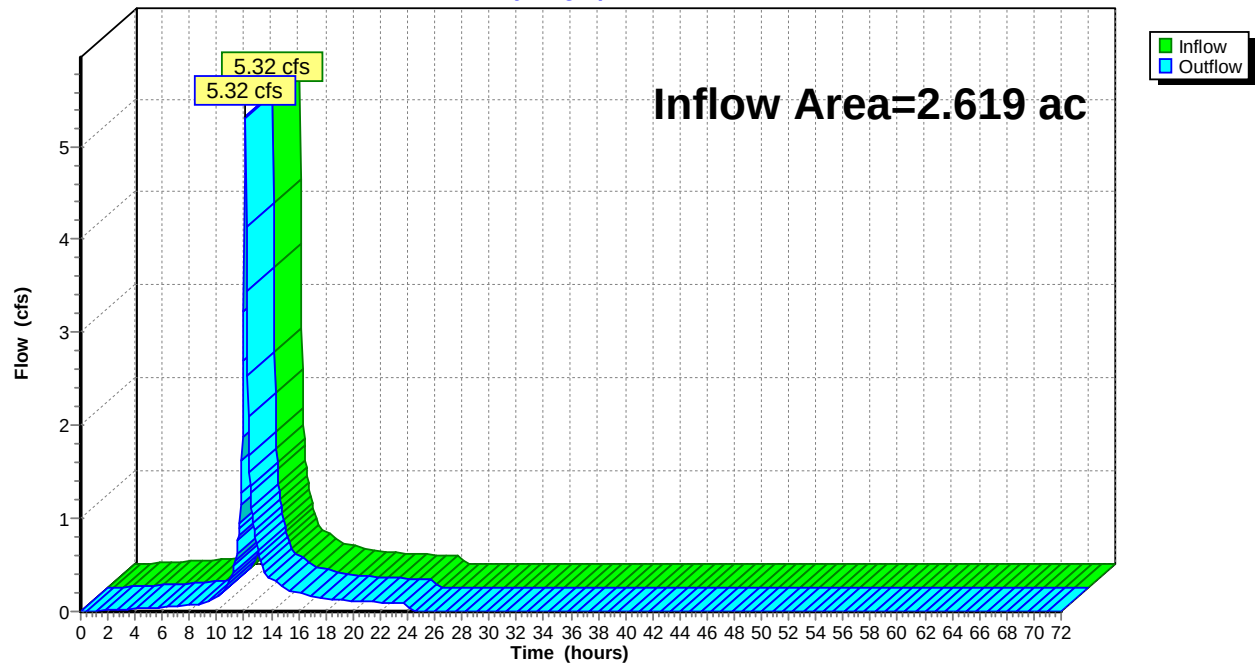
Subcatchment PR 2-P:

Hydrograph



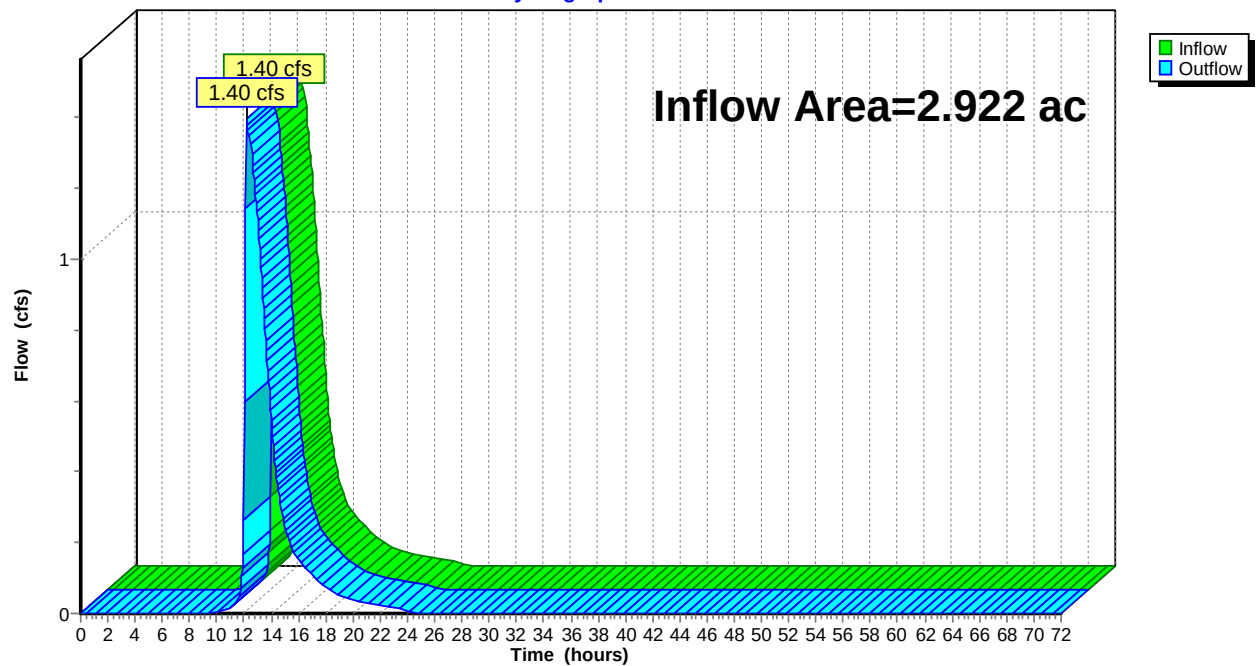
Reach 10R:

Hydrograph



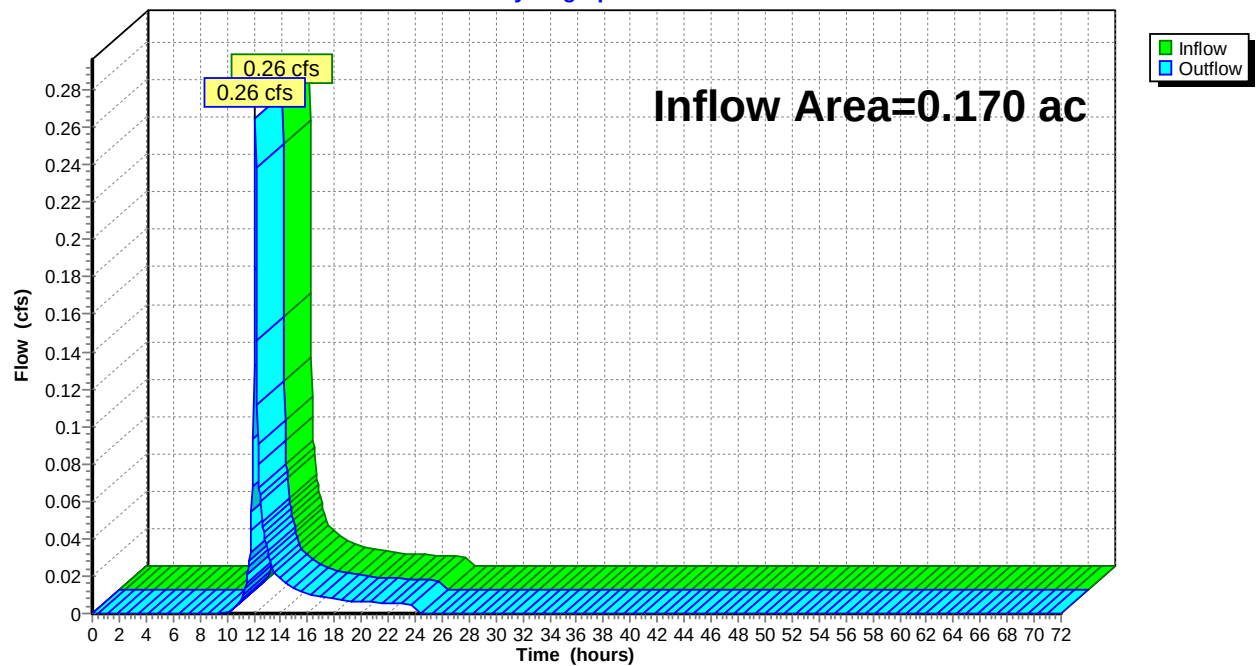
Reach DP1-PR:

Hydrograph



Reach DP2-PR:

Hydrograph



Pond BASIN: - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)

Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf

Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap

Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length

5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 18.0" Side Stone x 2 = 38.08' Base Width

9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

95 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 10,594.4 cf Chamber Storage

29,728.4 cf Field - 10,594.4 cf Chambers = 19,134.0 cf Stone x 40.0% Voids = 7,653.6 cf Stone Storage

Chamber Storage + Stone Storage = 18,248.0 cf = 0.419 af

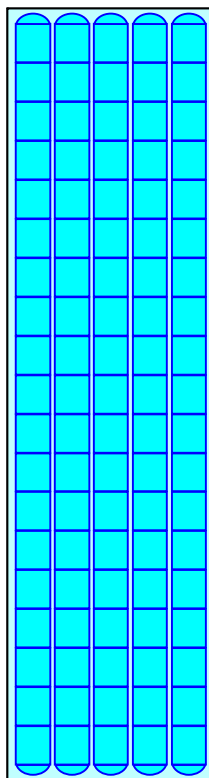
Overall Storage Efficiency = 61.4%

Overall System Size = 141.93' x 38.08' x 5.50'

95 Chambers

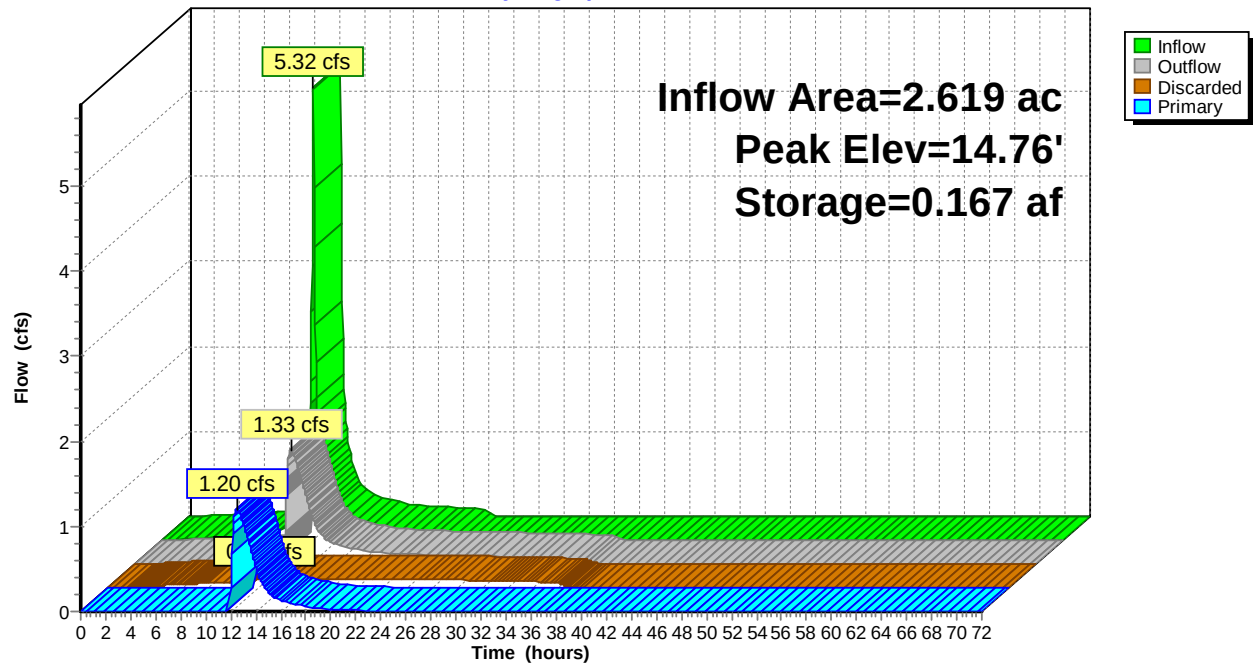
1,101.1 cy Field

708.7 cy Stone



Pond BASIN:

Hydrograph



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

Subcatchment PR 1A-P: Runoff Area=13,167 sf 0.00% Impervious Runoff Depth=2.90"
Flow Length=203' Tc=5.9 min CN=78 Runoff=1.00 cfs 0.073 af

Subcatchment PR 1B-I: Runoff Area=36,906 sf 100.00% Impervious Runoff Depth=4.98"
Flow Length=136' Tc=1.5 min CN=98 Runoff=4.63 cfs 0.352 af

Subcatchment PR 1B-P: Runoff Area=77,195 sf 0.00% Impervious Runoff Depth=2.99"
Flow Length=180' Tc=7.5 min CN=79 Runoff=5.79 cfs 0.442 af

Subcatchment PR 2-P: Runoff Area=7,405 sf 0.00% Impervious Runoff Depth=2.72"
Flow Length=84' Slope=0.0833 '/' Tc=4.6 min CN=76 Runoff=0.55 cfs 0.039 af

Reach 10R: Inflow=9.28 cfs 0.794 af
Outflow=9.28 cfs 0.794 af

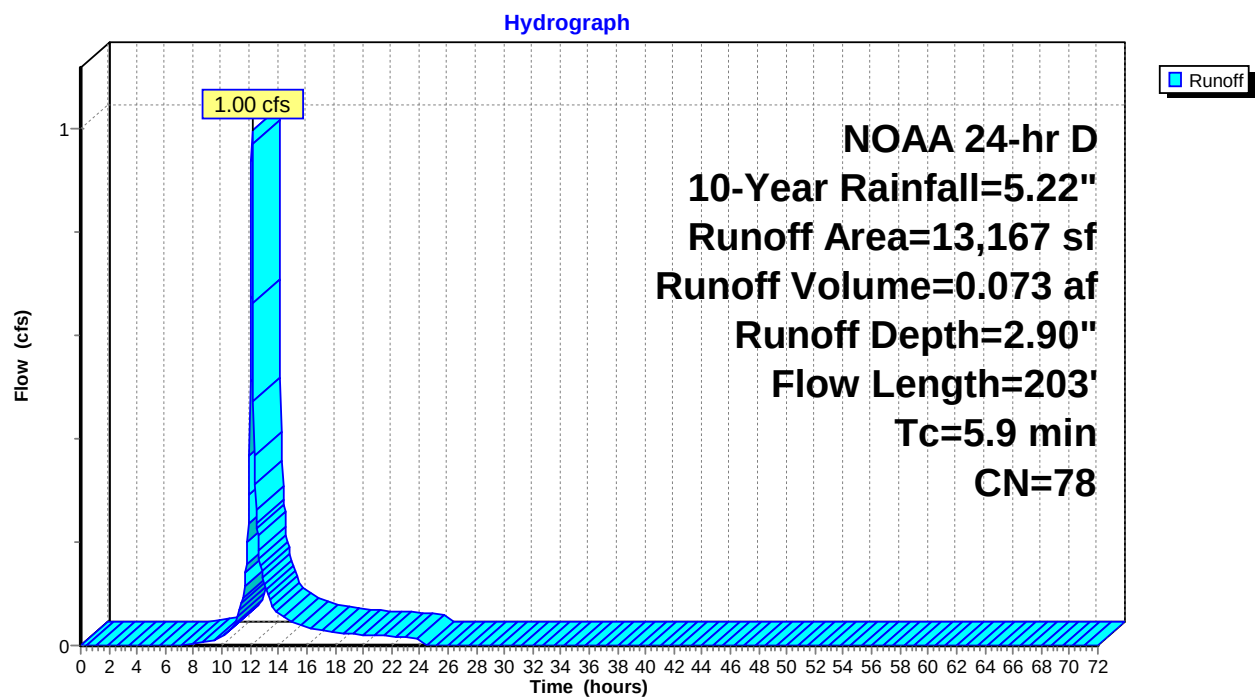
Reach DP1-PR: Inflow=4.42 cfs 0.610 af
Outflow=4.42 cfs 0.610 af

Reach DP2-PR: Inflow=0.55 cfs 0.039 af
Outflow=0.55 cfs 0.039 af

Pond BASIN: Peak Elev=15.72' Storage=0.258 af Inflow=9.28 cfs 0.794 af
Discarded=0.16 cfs 0.257 af Primary=3.90 cfs 0.537 af Outflow=4.05 cfs 0.794 af

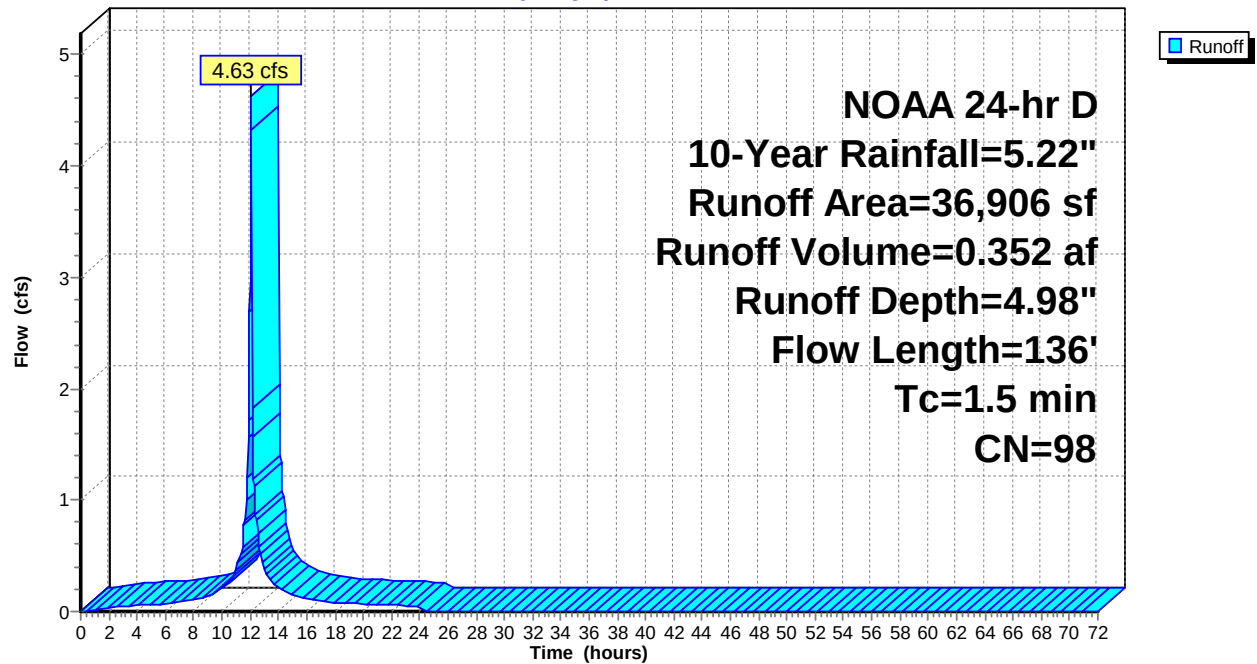
Total Runoff Area = 3.092 ac Runoff Volume = 0.905 af Average Runoff Depth = 3.51"
72.60% Pervious = 2.244 ac 27.40% Impervious = 0.847 ac

Subcatchment PR 1A-P:



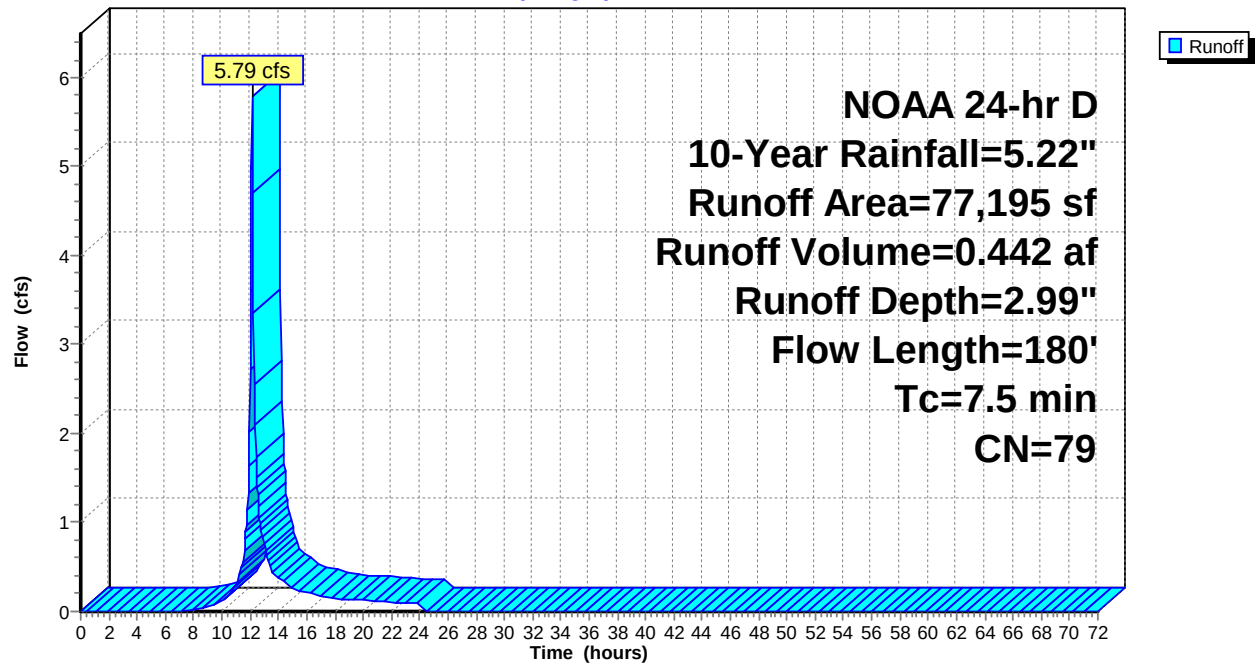
Subcatchment PR 1B-I:

Hydrograph



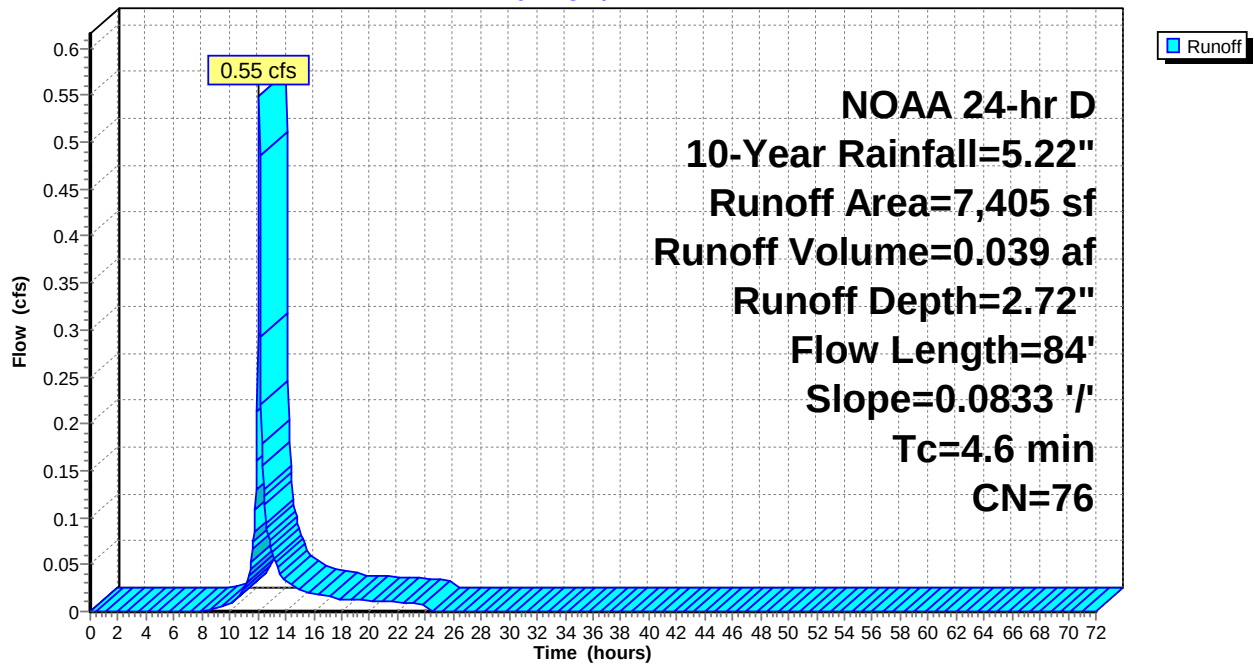
Subcatchment PR 1B-P:

Hydrograph



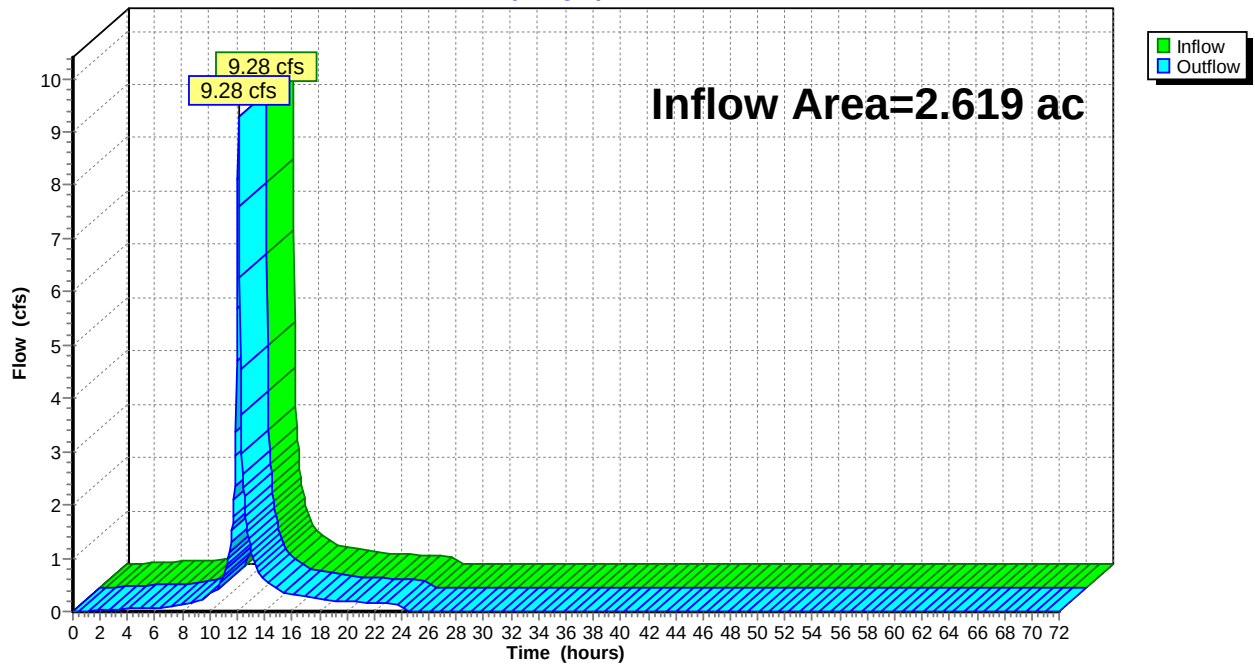
Subcatchment PR 2-P:

Hydrograph



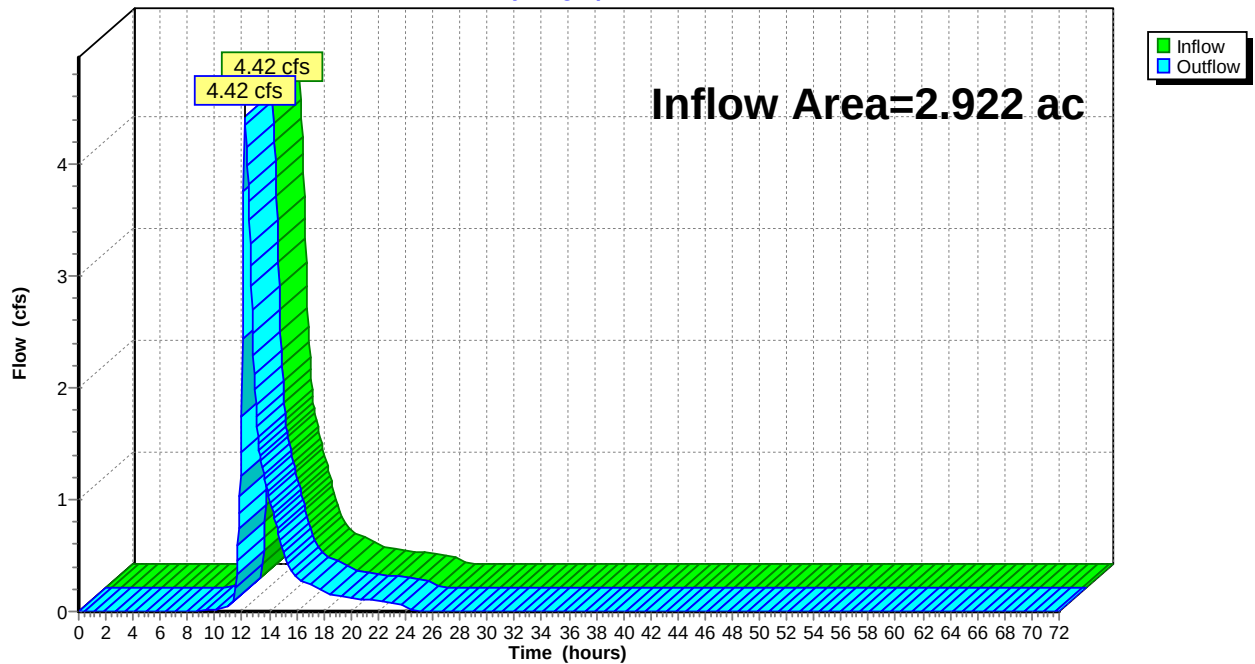
Reach 10R:

Hydrograph



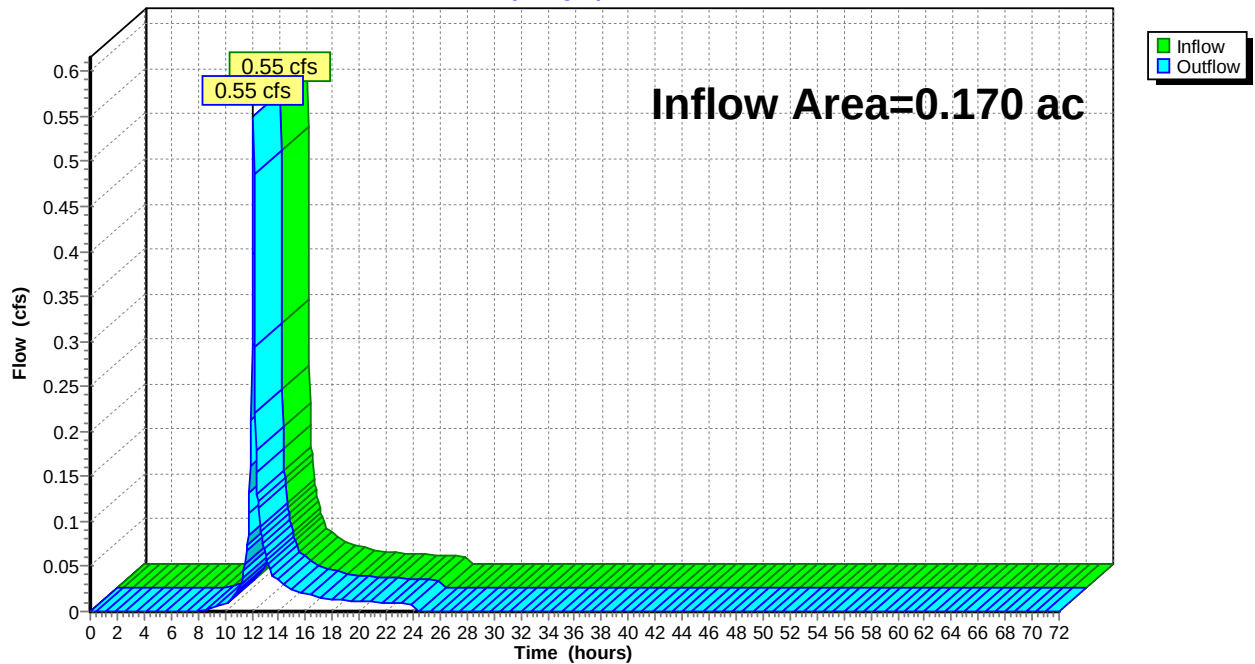
Reach DP1-PR:

Hydrograph



Reach DP2-PR:

Hydrograph



Pond BASIN: - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)

Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf

Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap

Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length

5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 18.0" Side Stone x 2 = 38.08' Base Width

9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

95 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 10,594.4 cf Chamber Storage

29,728.4 cf Field - 10,594.4 cf Chambers = 19,134.0 cf Stone x 40.0% Voids = 7,653.6 cf Stone Storage

Chamber Storage + Stone Storage = 18,248.0 cf = 0.419 af

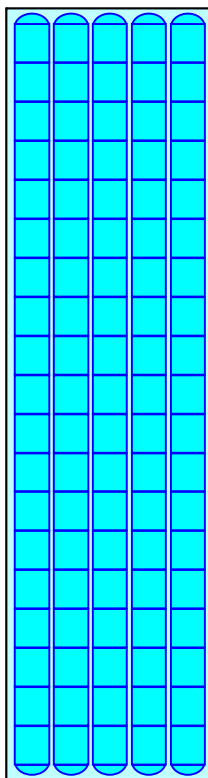
Overall Storage Efficiency = 61.4%

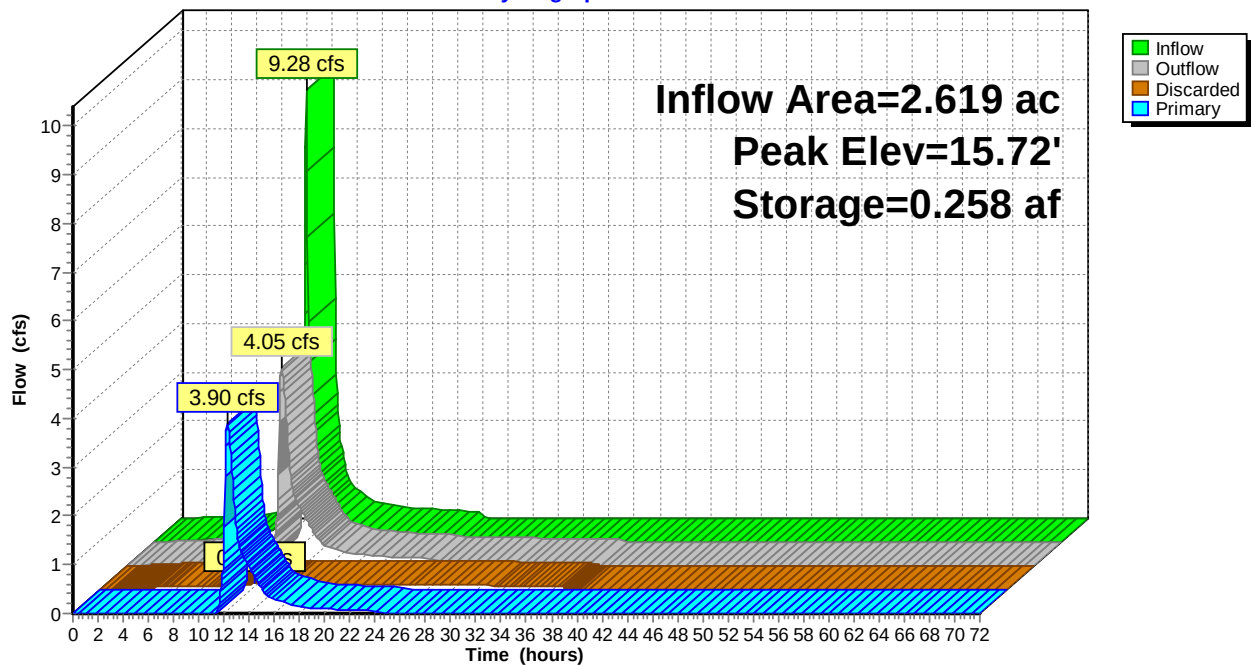
Overall System Size = 141.93' x 38.08' x 5.50'

95 Chambers

1,101.1 cy Field

708.7 cy Stone



Pond BASIN:**Hydrograph**

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

Subcatchment PR 1A-P: Runoff Area=13,167 sf 0.00% Impervious Runoff Depth=3.97"
Flow Length=203' Tc=5.9 min CN=78 Runoff=1.36 cfs 0.100 af

Subcatchment PR 1B-I: Runoff Area=36,906 sf 100.00% Impervious Runoff Depth=6.20"
Flow Length=136' Tc=1.5 min CN=98 Runoff=5.73 cfs 0.438 af

Subcatchment PR 1B-P: Runoff Area=77,195 sf 0.00% Impervious Runoff Depth=4.07"
Flow Length=180' Tc=7.5 min CN=79 Runoff=7.82 cfs 0.602 af

Subcatchment PR 2-P: Runoff Area=7,405 sf 0.00% Impervious Runoff Depth=3.76"
Flow Length=84' Slope=0.0833 '/' Tc=4.6 min CN=76 Runoff=0.76 cfs 0.053 af

Reach 10R: Inflow=12.08 cfs 1.040 af
Outflow=12.08 cfs 1.040 af

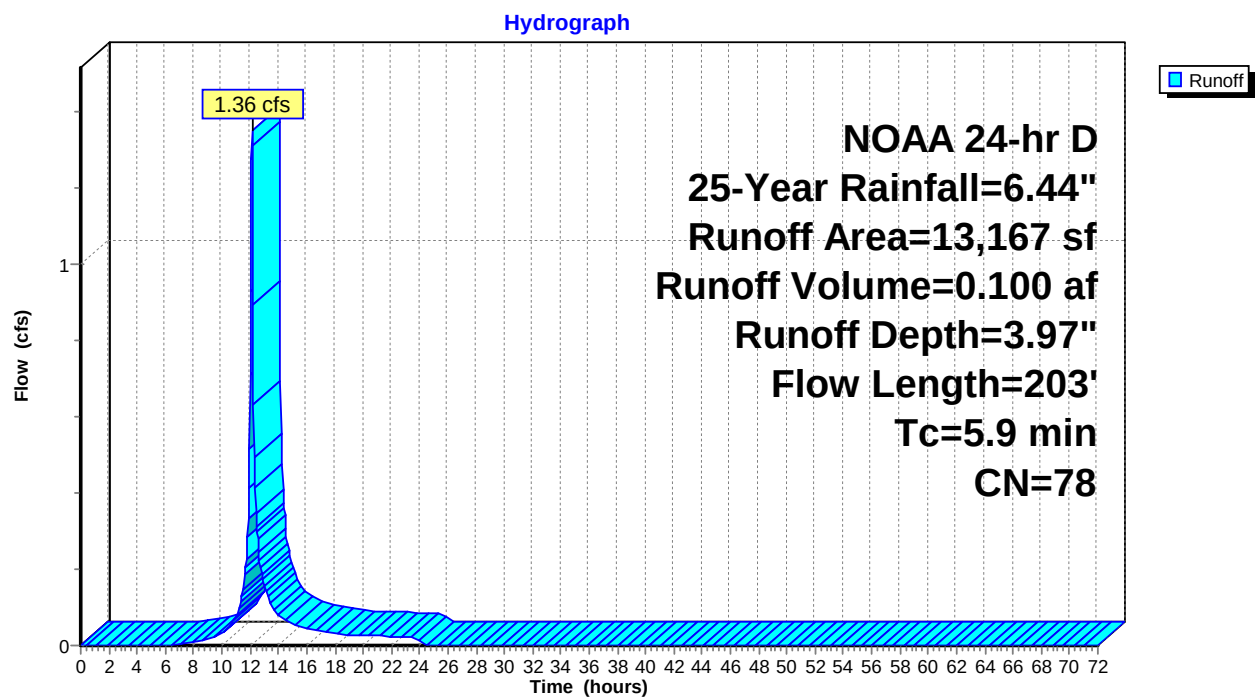
Reach DP1-PR: Inflow=6.00 cfs 0.870 af
Outflow=6.00 cfs 0.870 af

Reach DP2-PR: Inflow=0.76 cfs 0.053 af
Outflow=0.76 cfs 0.053 af

Pond BASIN: Peak Elev=16.44' Storage=0.318 af Inflow=12.08 cfs 1.040 af
Discarded=0.18 cfs 0.270 af Primary=5.14 cfs 0.770 af Outflow=5.32 cfs 1.040 af

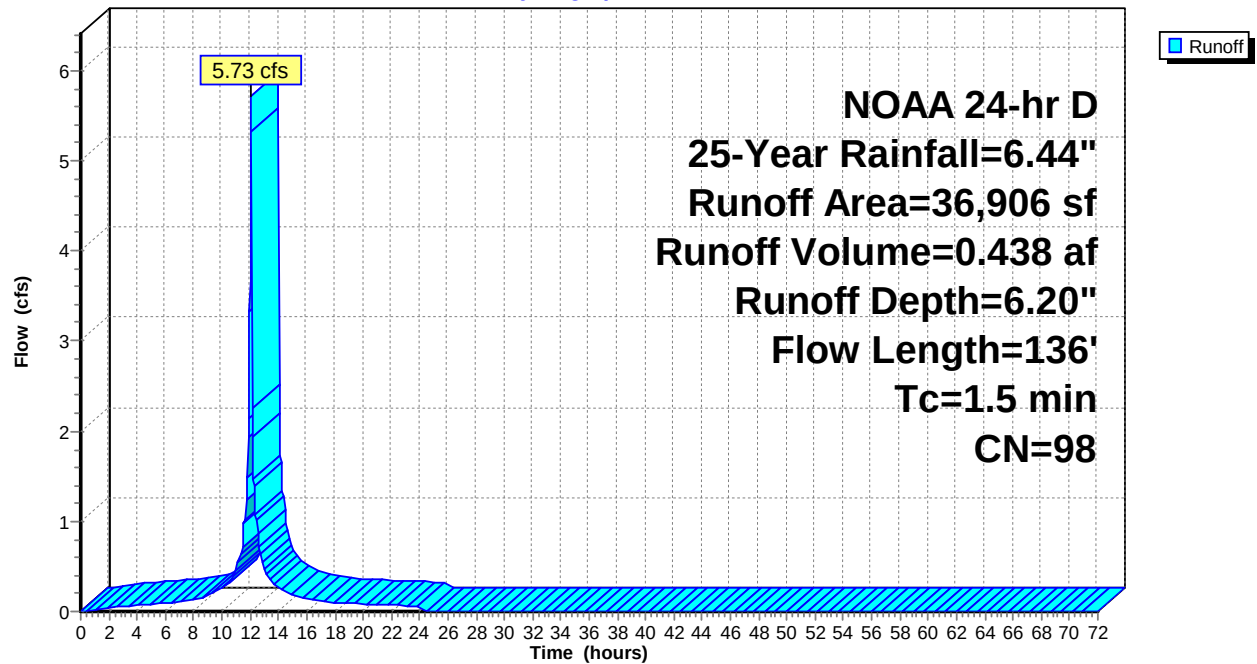
Total Runoff Area = 3.092 ac Runoff Volume = 1.193 af Average Runoff Depth = 4.63"
72.60% Pervious = 2.244 ac 27.40% Impervious = 0.847 ac

Subcatchment PR 1A-P:



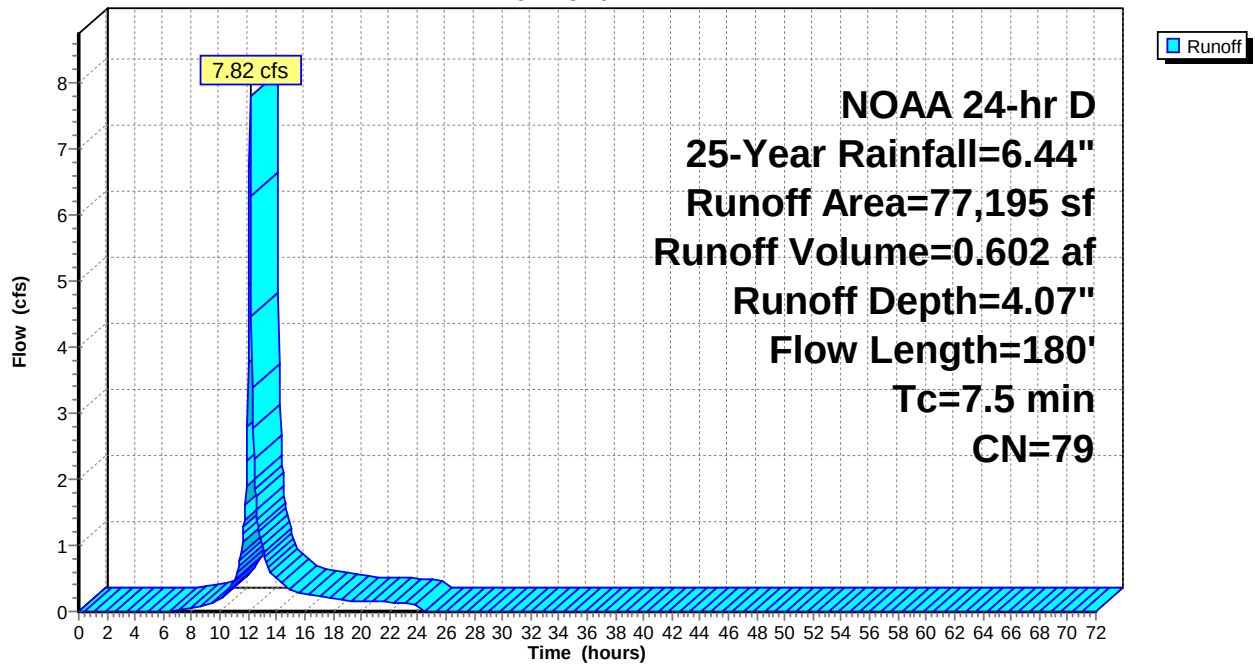
Subcatchment PR 1B-I:

Hydrograph



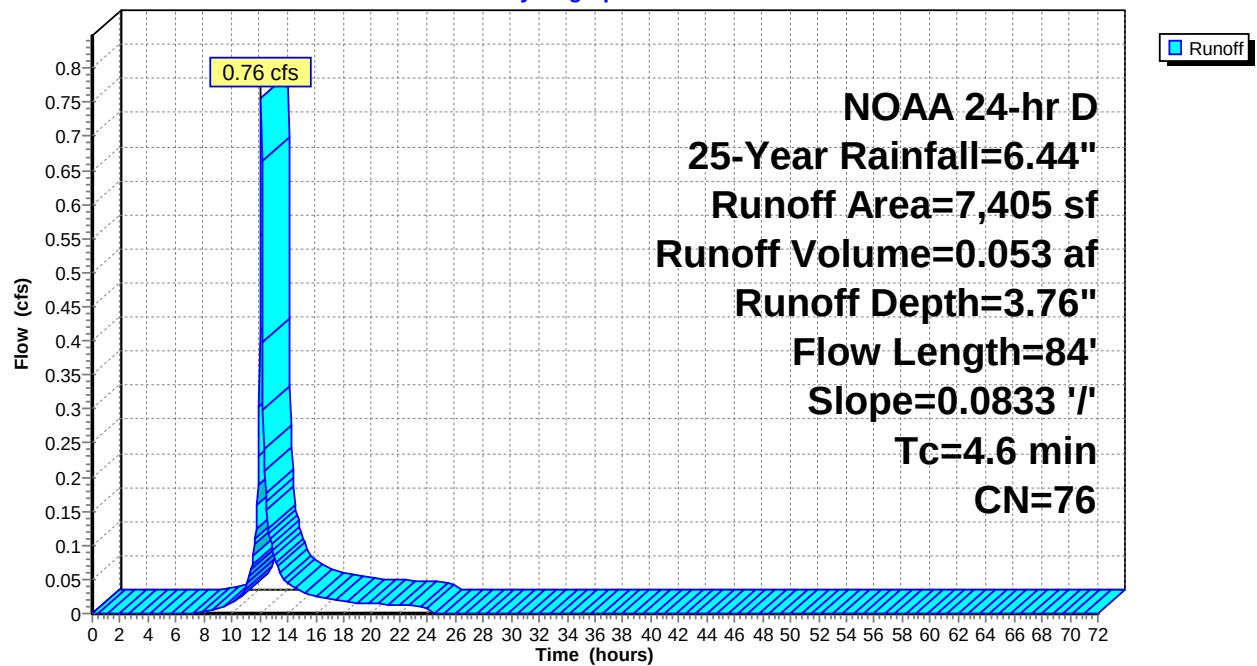
Subcatchment PR 1B-P:

Hydrograph



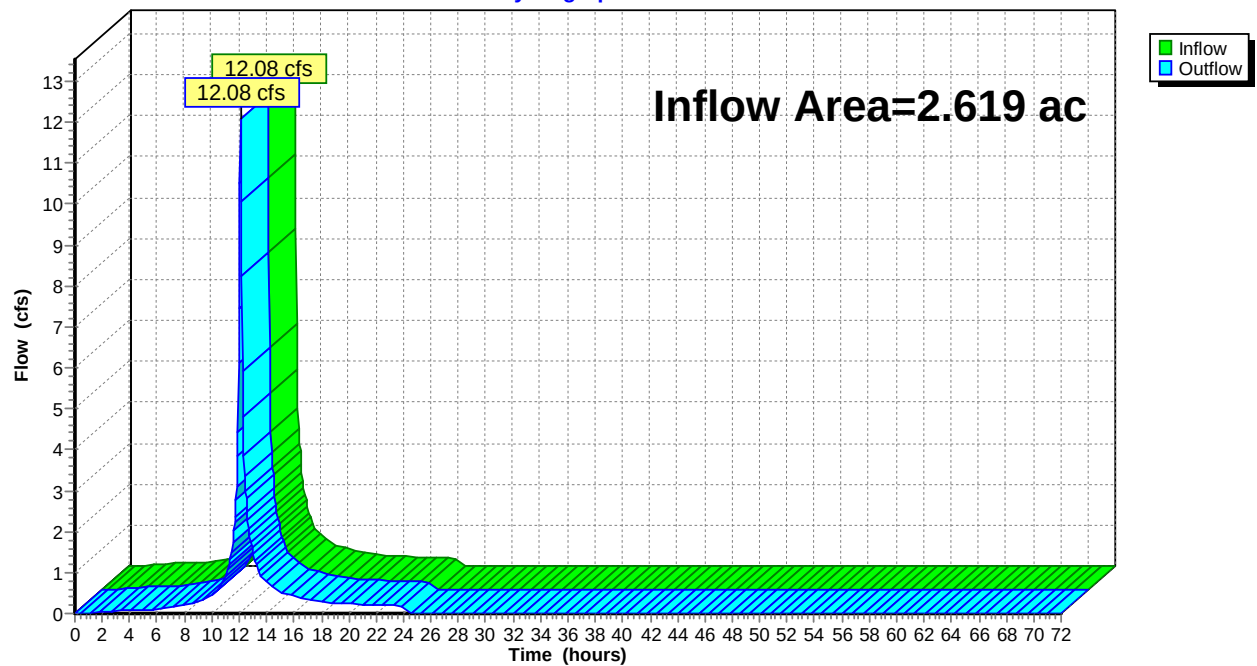
Subcatchment PR 2-P:

Hydrograph



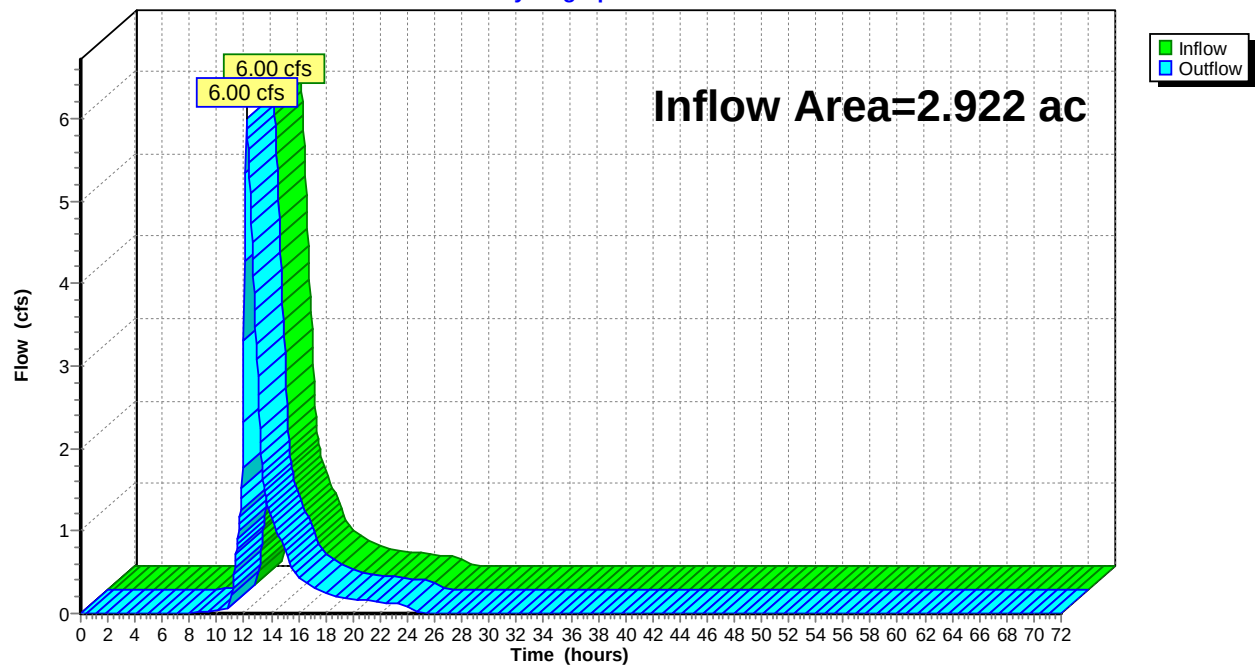
Reach 10R:

Hydrograph



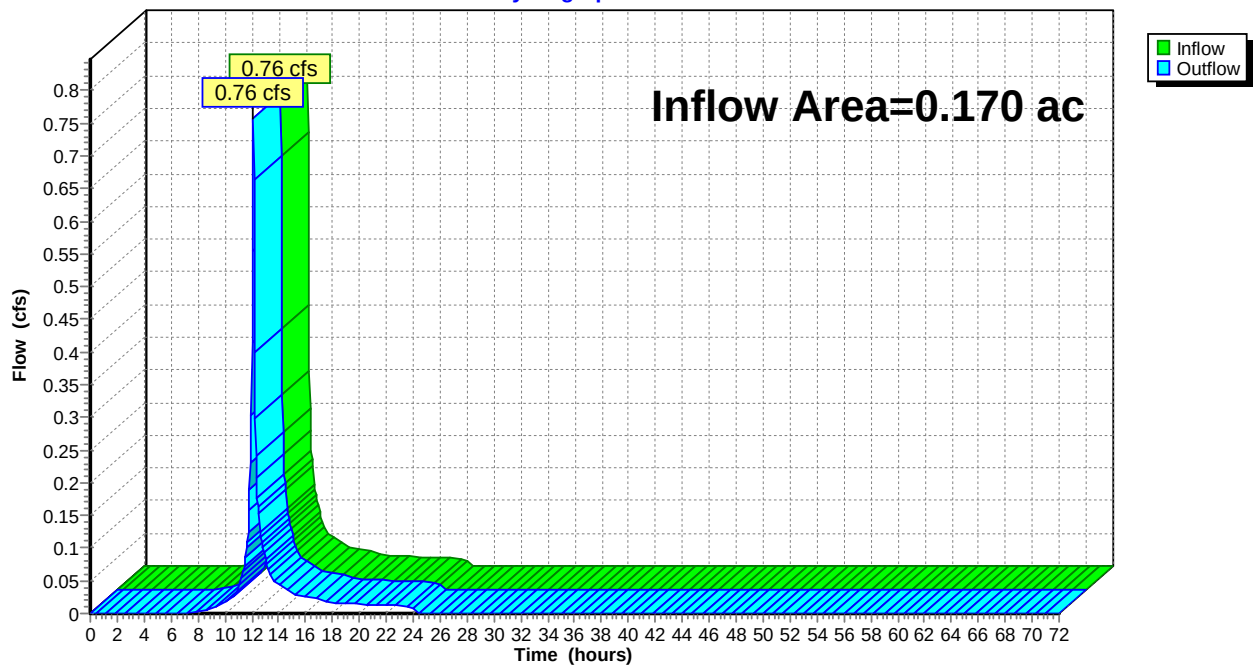
Reach DP1-PR:

Hydrograph



Reach DP2-PR:

Hydrograph



Pond BASIN: - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)

Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf

Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap

Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length

5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 18.0" Side Stone x 2 = 38.08' Base Width

9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

95 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 10,594.4 cf Chamber Storage

29,728.4 cf Field - 10,594.4 cf Chambers = 19,134.0 cf Stone x 40.0% Voids = 7,653.6 cf Stone Storage

Chamber Storage + Stone Storage = 18,248.0 cf = 0.419 af

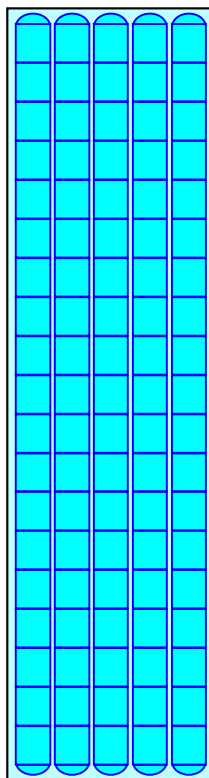
Overall Storage Efficiency = 61.4%

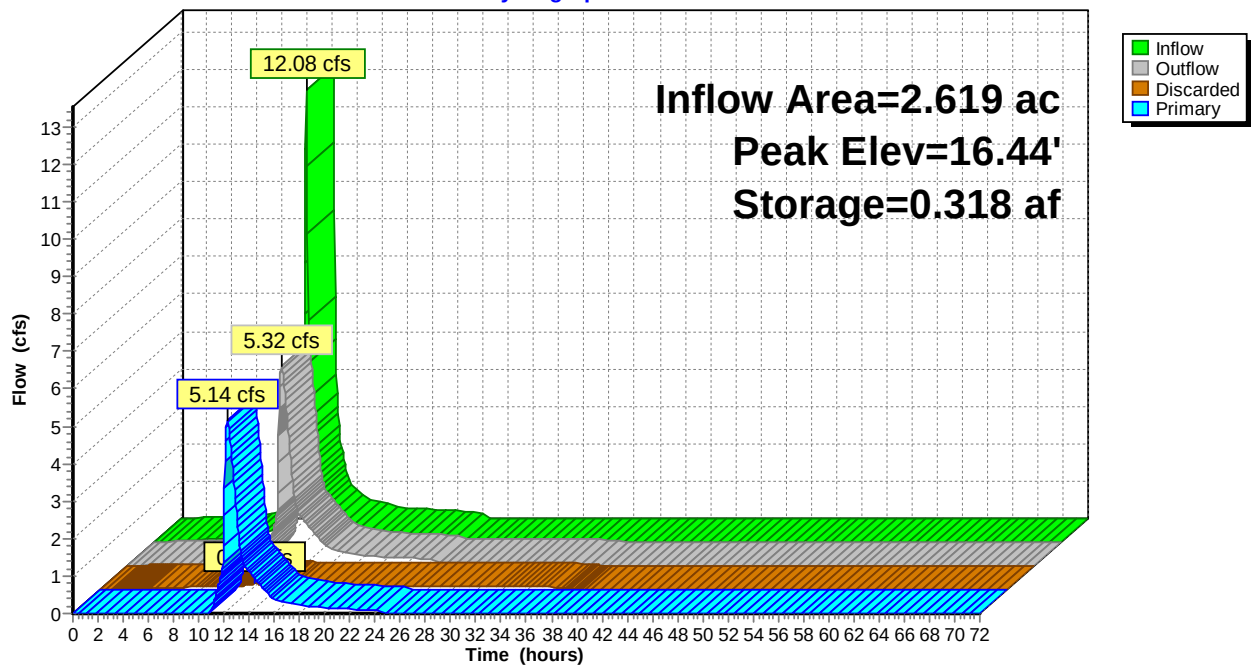
Overall System Size = 141.93' x 38.08' x 5.50'

95 Chambers

1,101.1 cy Field

708.7 cy Stone



Pond BASIN:**Hydrograph**

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

Subcatchment PR 1A-P: Runoff Area=13,167 sf 0.00% Impervious Runoff Depth=6.00"
Flow Length=203' Tc=5.9 min CN=78 Runoff=2.01 cfs 0.151 af

Subcatchment PR 1B-I: Runoff Area=36,906 sf 100.00% Impervious Runoff Depth=8.42"
Flow Length=136' Tc=1.5 min CN=98 Runoff=7.71 cfs 0.594 af

Subcatchment PR 1B-P: Runoff Area=77,195 sf 0.00% Impervious Runoff Depth=6.13"
Flow Length=180' Tc=7.5 min CN=79 Runoff=11.55 cfs 0.905 af

Subcatchment PR 2-P: Runoff Area=7,405 sf 0.00% Impervious Runoff Depth=5.76"
Flow Length=84' Slope=0.0833 '/' Tc=4.6 min CN=76 Runoff=1.14 cfs 0.082 af

Reach 10R: Inflow=17.23 cfs 1.499 af
Outflow=17.23 cfs 1.499 af

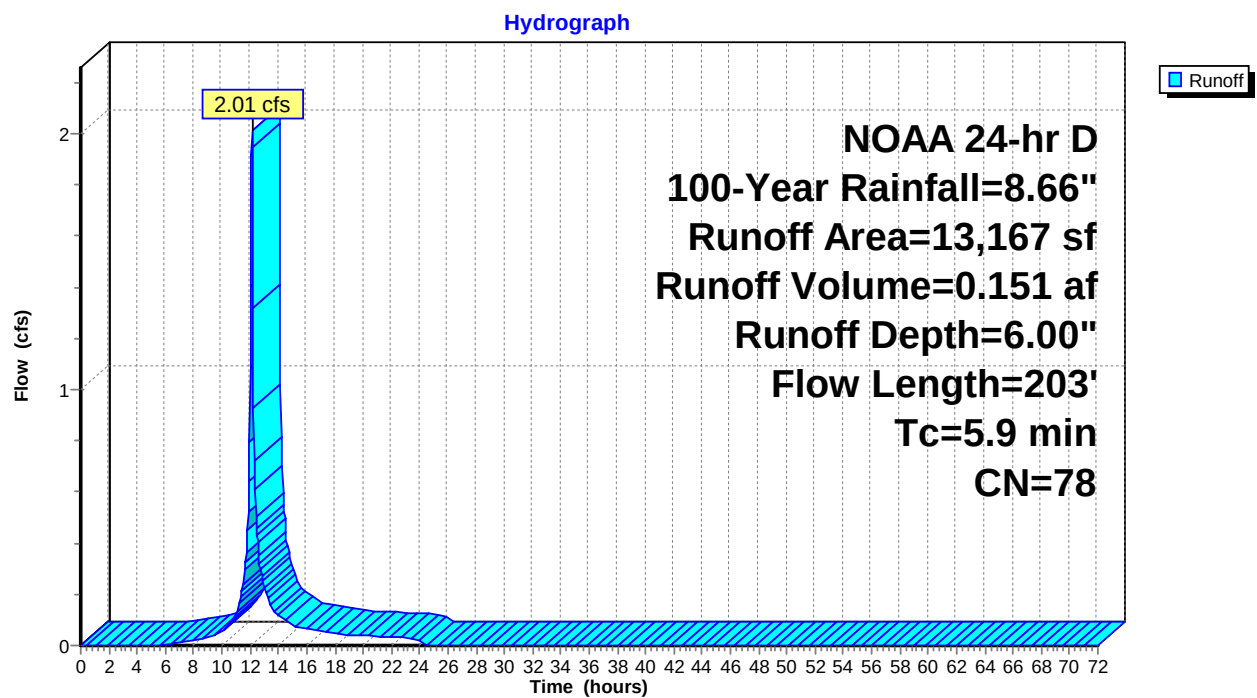
Reach DP1-PR: Inflow=9.92 cfs 1.363 af
Outflow=9.92 cfs 1.363 af

Reach DP2-PR: Inflow=1.14 cfs 0.082 af
Outflow=1.14 cfs 0.082 af

Pond BASIN: Peak Elev=18.12' Storage=0.413 af Inflow=17.23 cfs 1.499 af
Discarded=0.23 cfs 0.287 af Primary=8.95 cfs 1.212 af Outflow=9.19 cfs 1.499 af

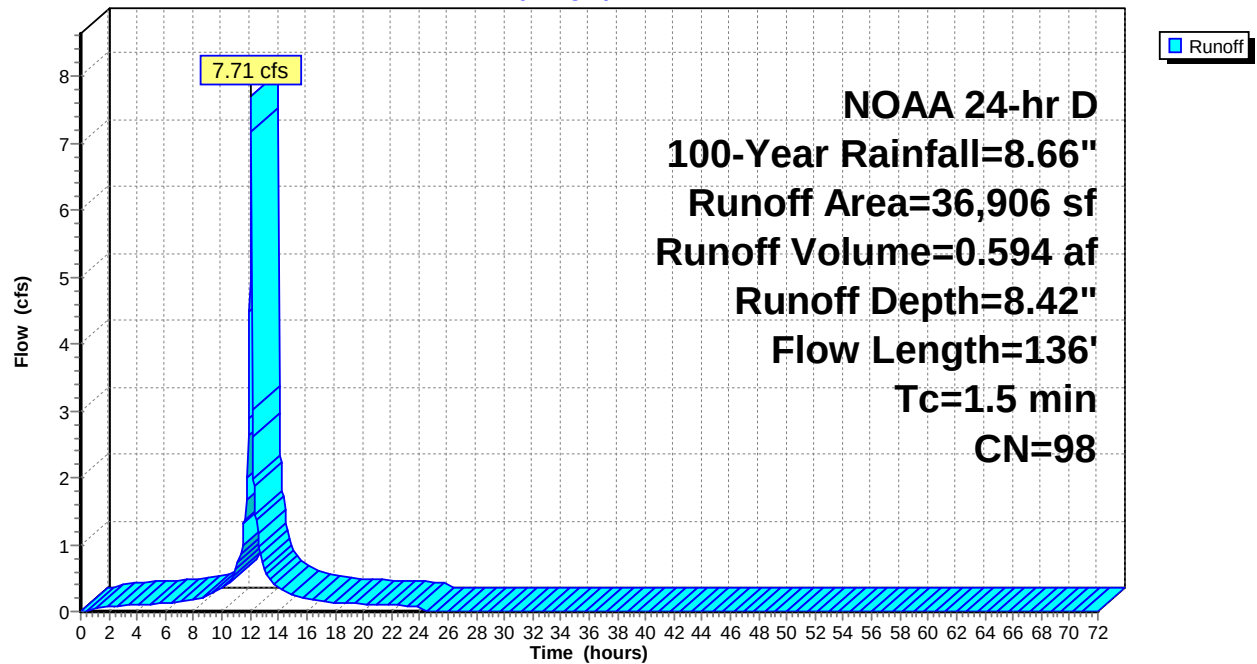
Total Runoff Area = 3.092 ac Runoff Volume = 1.732 af Average Runoff Depth = 6.72"
72.60% Pervious = 2.244 ac 27.40% Impervious = 0.847 ac

Subcatchment PR 1A-P:



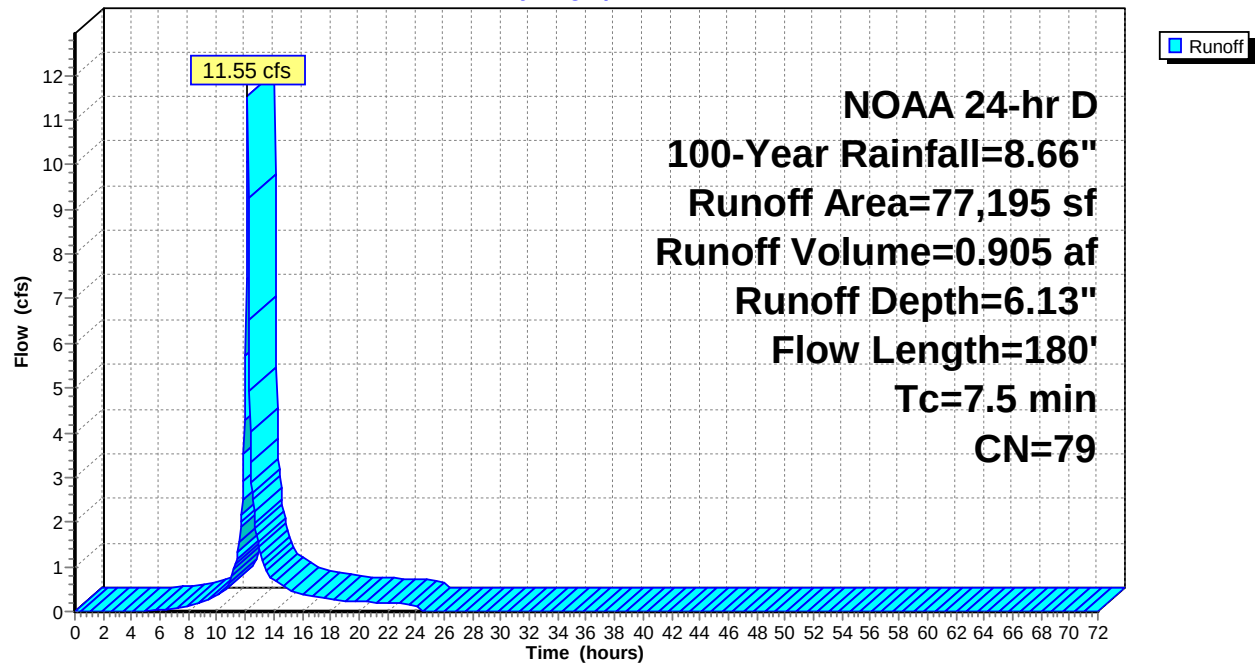
Subcatchment PR 1B-I:

Hydrograph

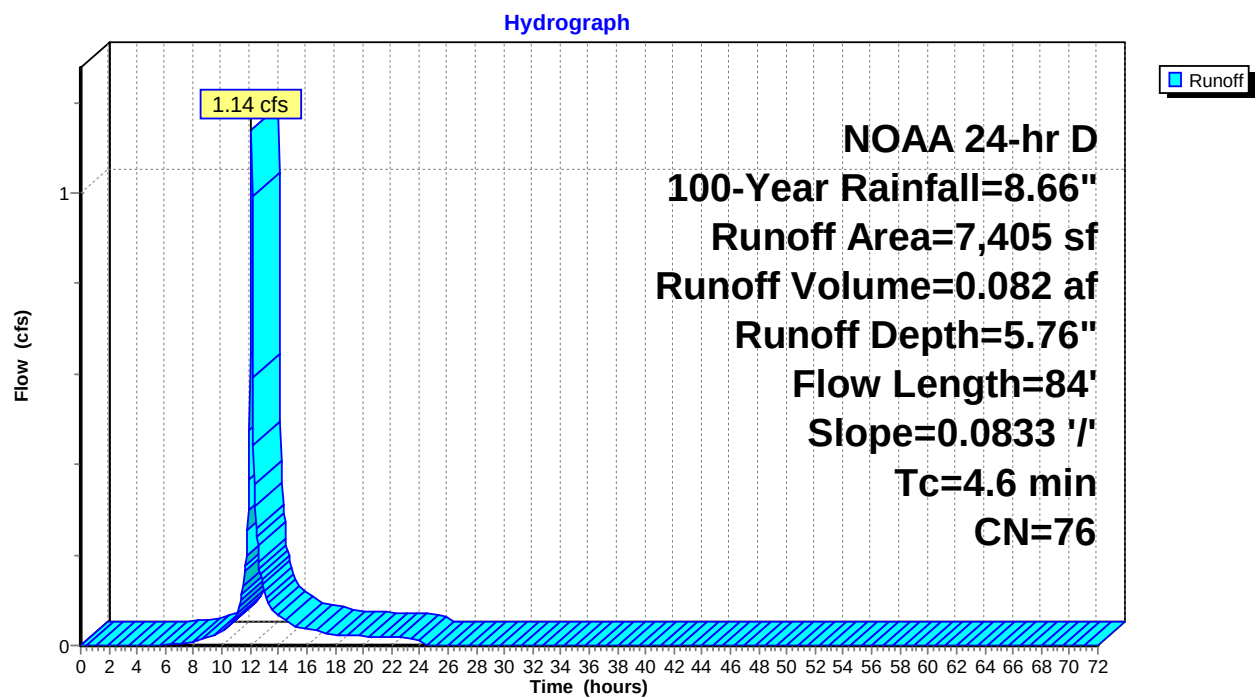


Subcatchment PR 1B-P:

Hydrograph

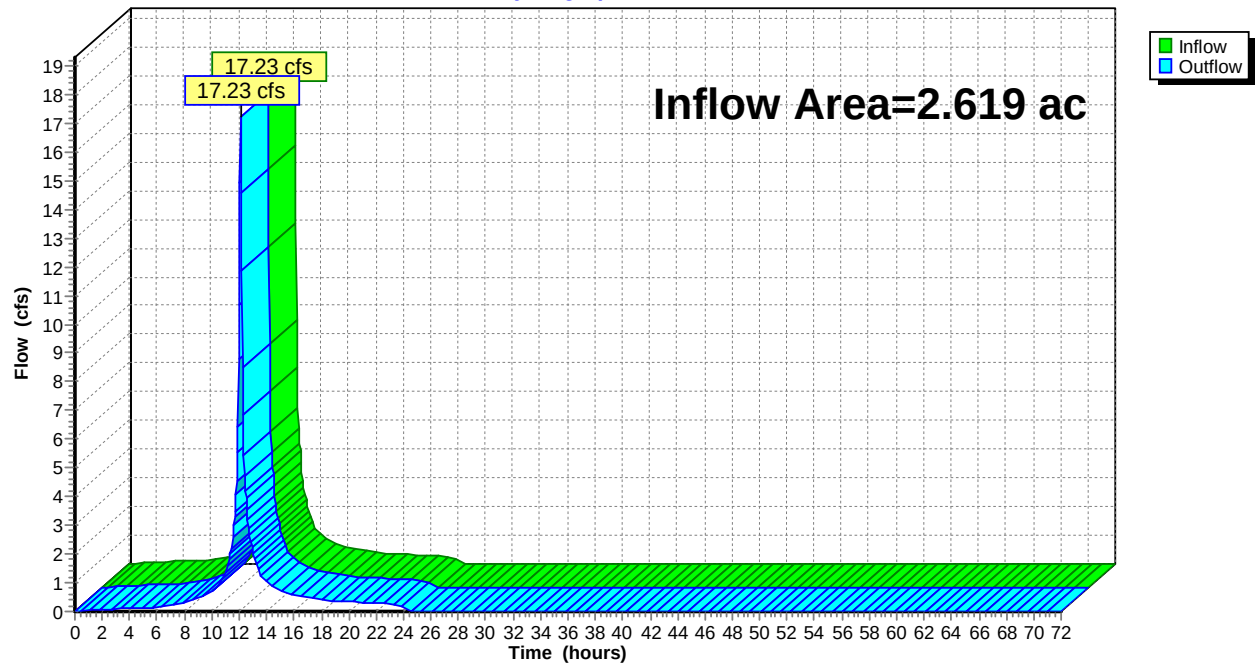


Subcatchment PR 2-P:



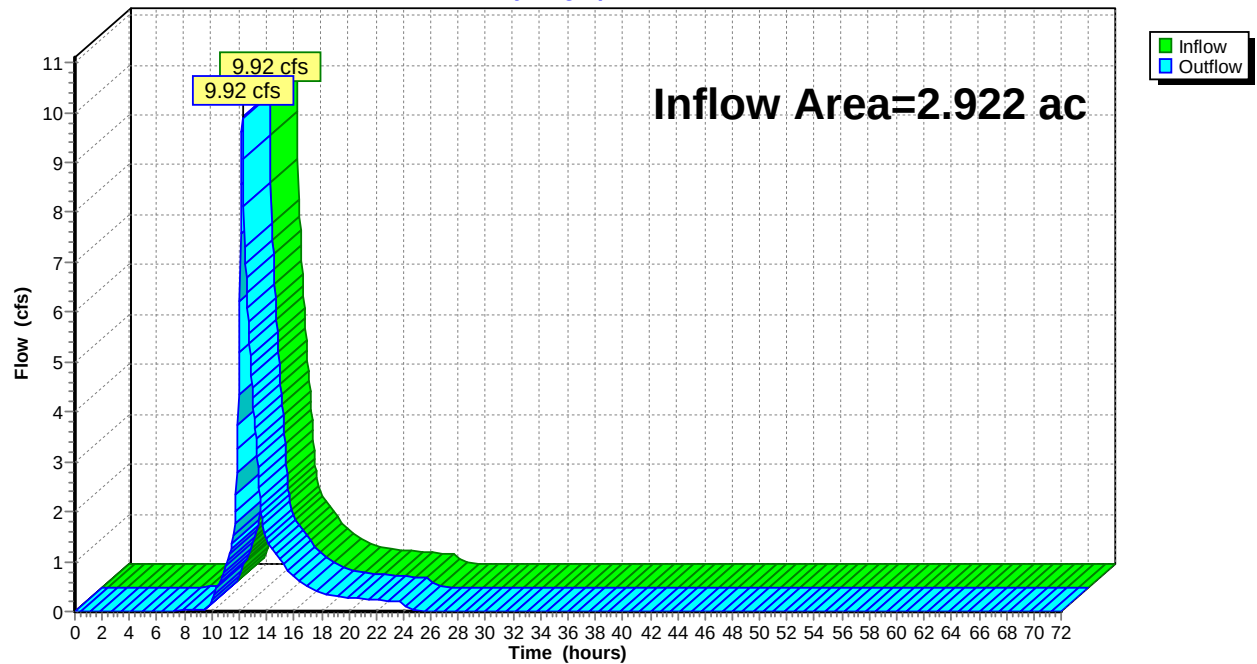
Reach 10R:

Hydrograph



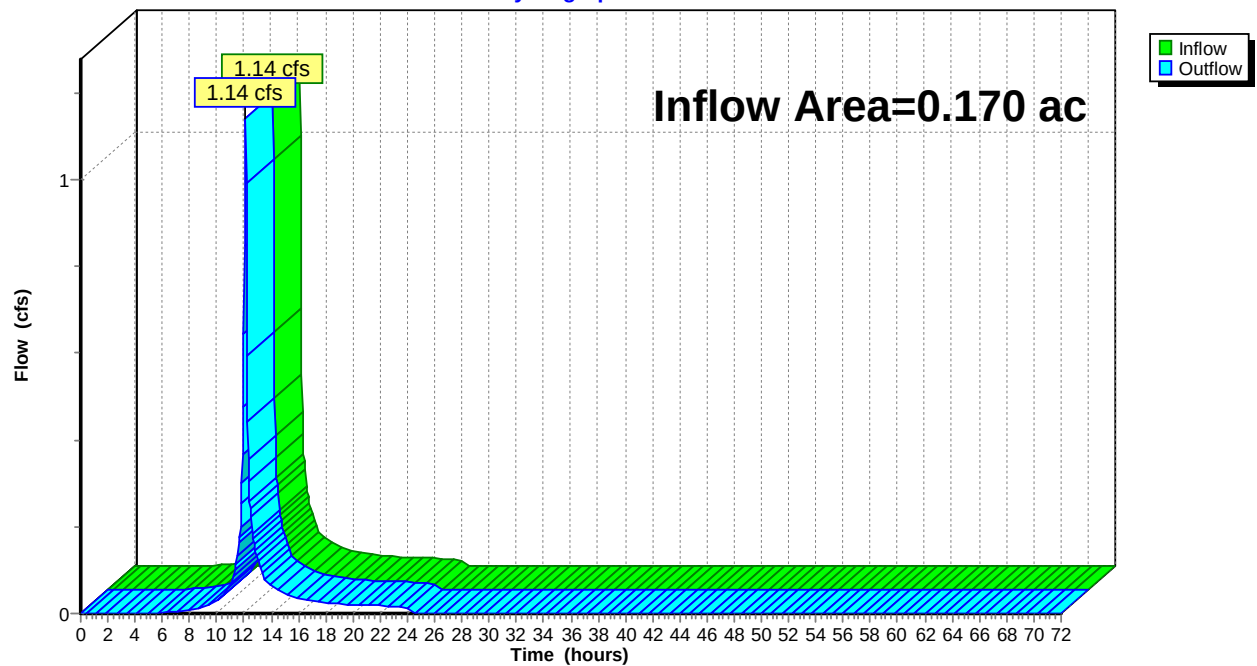
Reach DP1-PR:

Hydrograph



Reach DP2-PR:

Hydrograph



Pond BASIN: - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)

Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf

Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap

Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length

5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 18.0" Side Stone x 2 = 38.08' Base Width

9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

95 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 10,594.4 cf Chamber Storage

29,728.4 cf Field - 10,594.4 cf Chambers = 19,134.0 cf Stone x 40.0% Voids = 7,653.6 cf Stone Storage

Chamber Storage + Stone Storage = 18,248.0 cf = 0.419 af

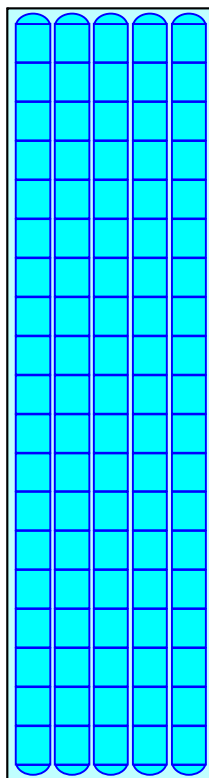
Overall Storage Efficiency = 61.4%

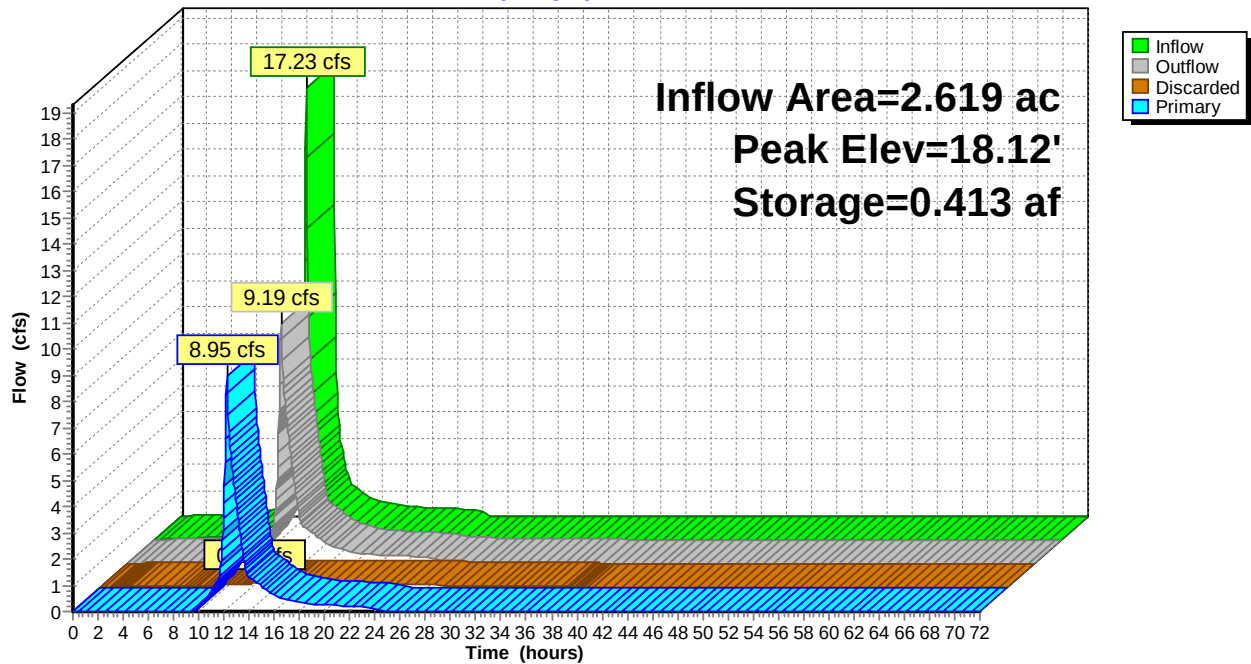
Overall System Size = 141.93' x 38.08' x 5.50'

95 Chambers

1,101.1 cy Field

708.7 cy Stone



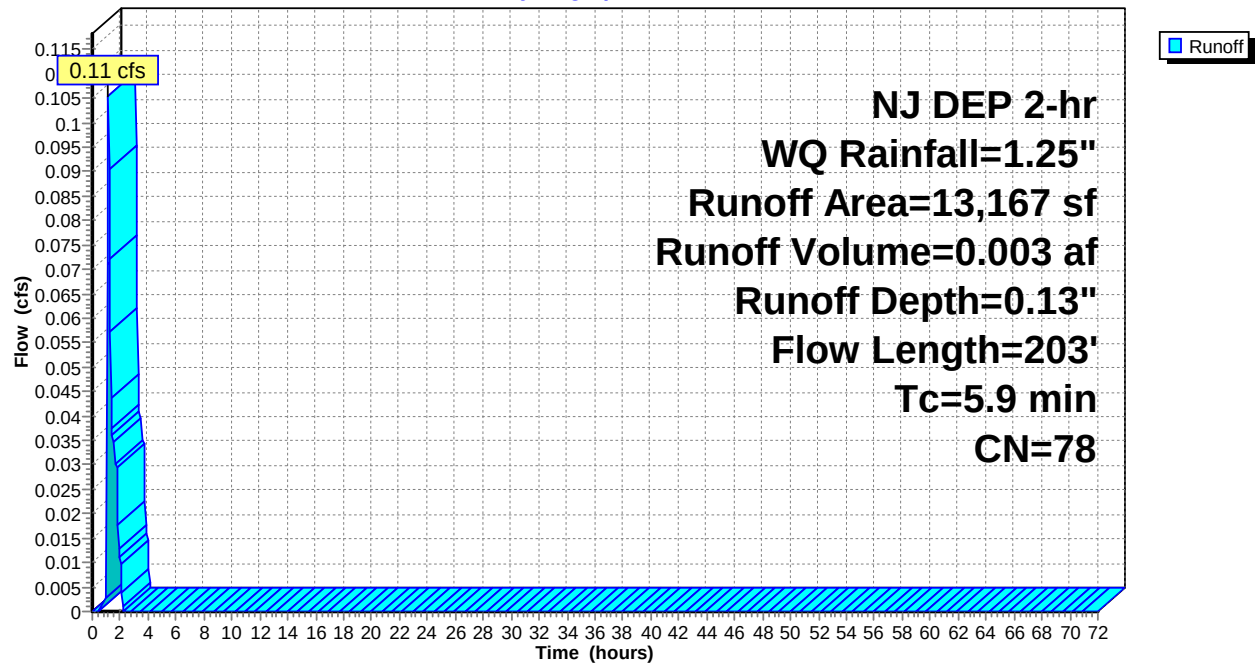
Pond BASIN:**Hydrograph**

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

Subcatchment PR 1A-P:	Runoff Area=13,167 sf 0.00% Impervious Runoff Depth=0.13" Flow Length=203' Tc=5.9 min CN=78 Runoff=0.11 cfs 0.003 af
Subcatchment PR 1B-I:	Runoff Area=36,906 sf 100.00% Impervious Runoff Depth=1.03" Flow Length=136' Tc=1.5 min CN=98 Runoff=2.63 cfs 0.073 af
Subcatchment PR 1B-P:	Runoff Area=77,195 sf 0.00% Impervious Runoff Depth=0.15" Flow Length=180' Tc=7.5 min CN=79 Runoff=0.68 cfs 0.023 af
Subcatchment PR 2-P:	Runoff Area=7,405 sf 0.00% Impervious Runoff Depth=0.10" Flow Length=84' Slope=0.0833 '/' Tc=4.6 min CN=76 Runoff=0.04 cfs 0.001 af
Reach 10R:	Inflow=2.67 cfs 0.096 af Outflow=2.67 cfs 0.096 af
Reach DP1-PR:	Inflow=0.11 cfs 0.003 af Outflow=0.11 cfs 0.003 af
Reach DP2-PR:	Inflow=0.04 cfs 0.001 af Outflow=0.04 cfs 0.001 af
Pond BASIN:	Peak Elev=13.95' Storage=0.085 af Inflow=2.67 cfs 0.096 af Discarded=0.10 cfs 0.096 af Primary=0.00 cfs 0.000 af Outflow=0.10 cfs 0.096 af
Total Runoff Area = 3.092 ac Runoff Volume = 0.100 af Average Runoff Depth = 0.39" 72.60% Pervious = 2.244 ac 27.40% Impervious = 0.847 ac	

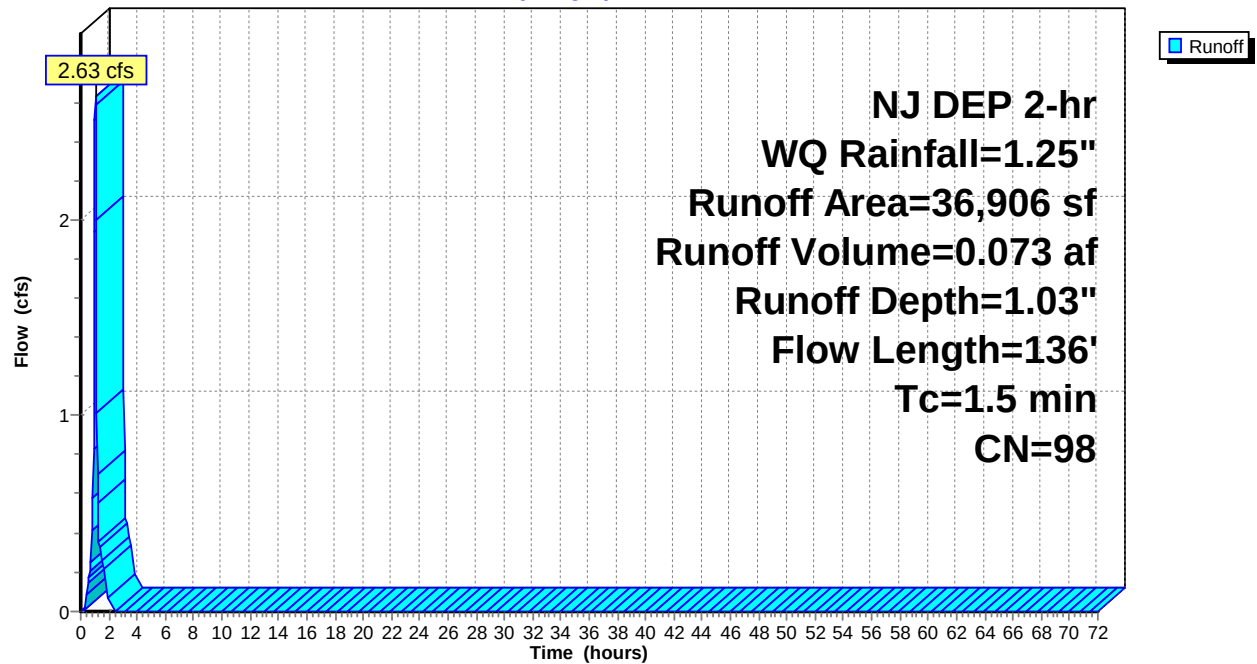
Subcatchment PR 1A-P:

Hydrograph



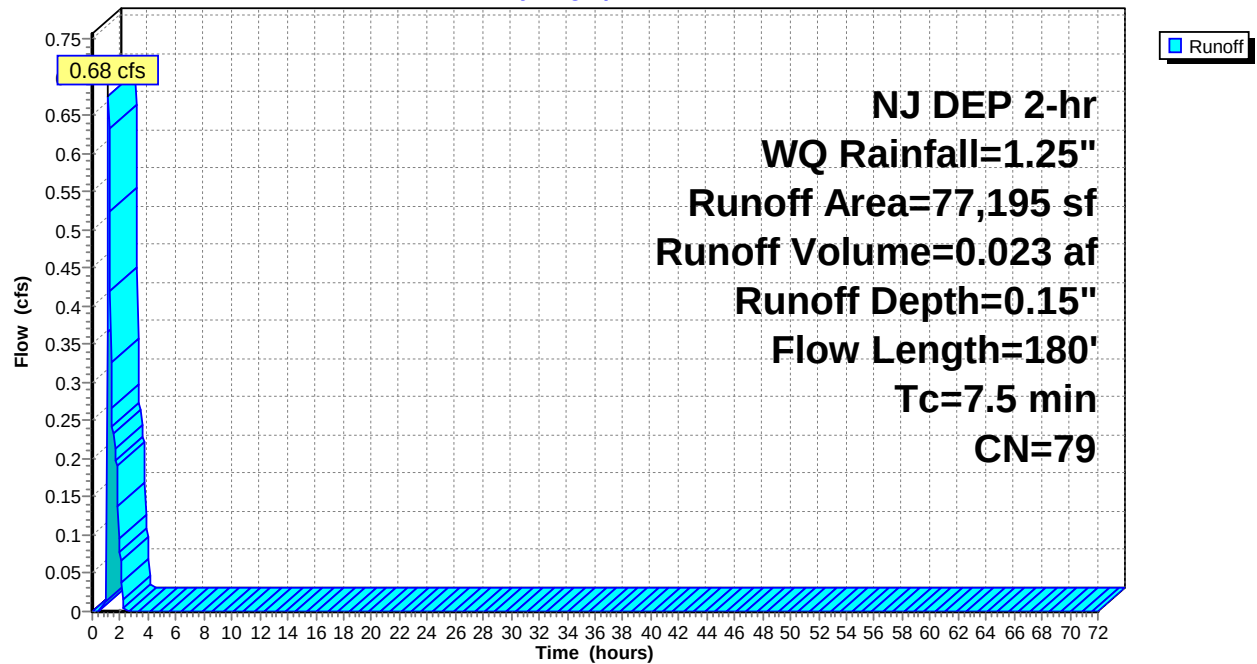
Subcatchment PR 1B-I:

Hydrograph



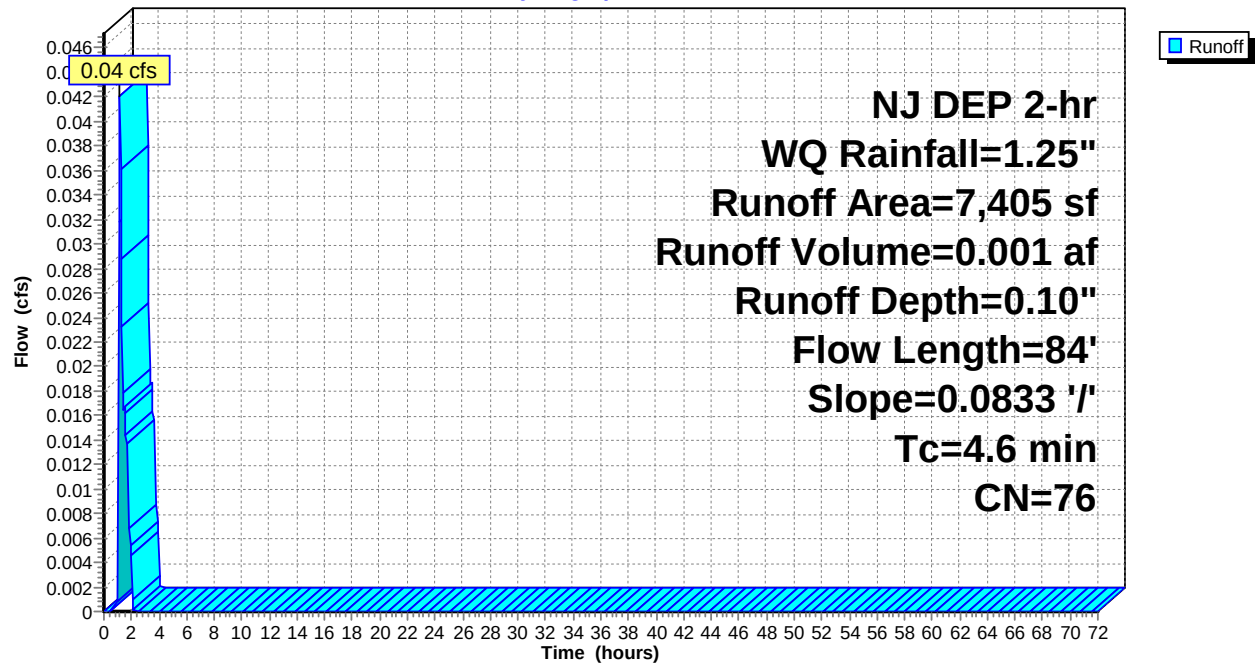
Subcatchment PR 1B-P:

Hydrograph



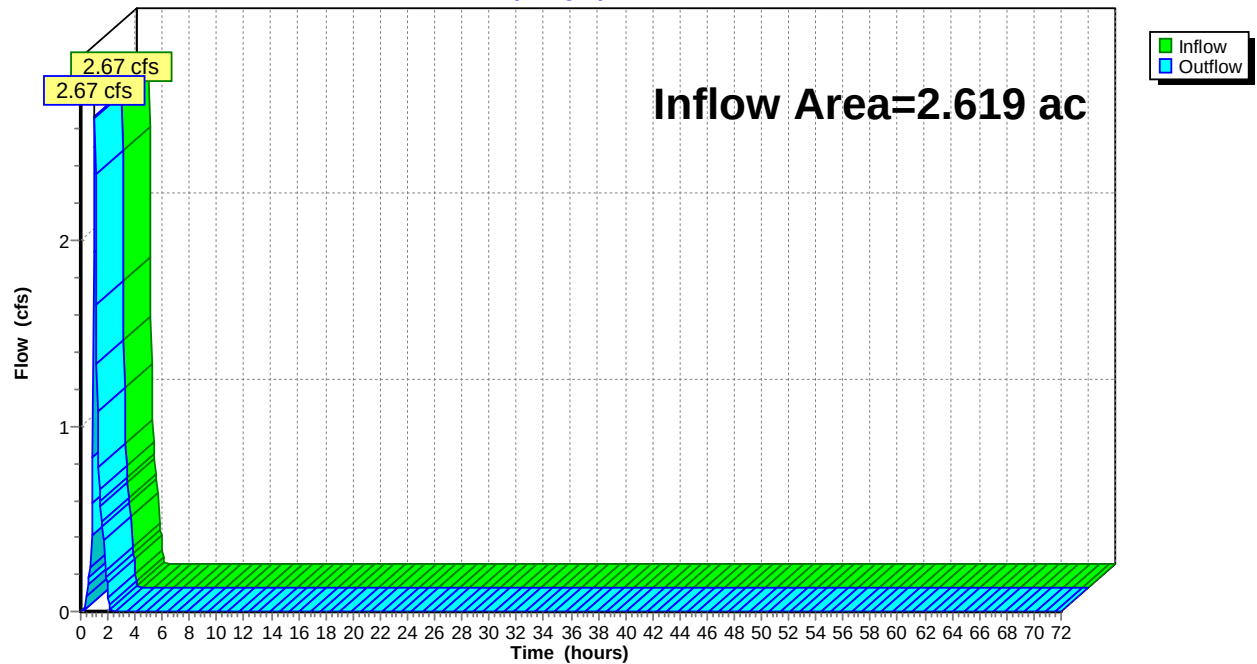
Subcatchment PR 2-P:

Hydrograph



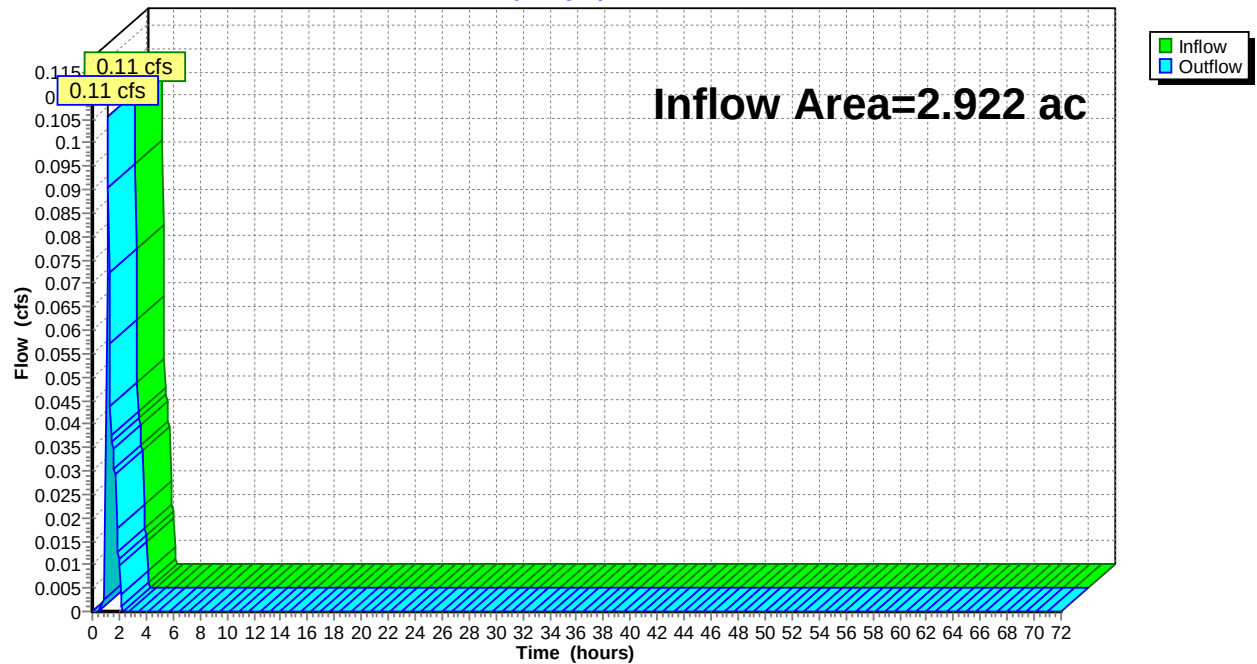
Reach 10R:

Hydrograph



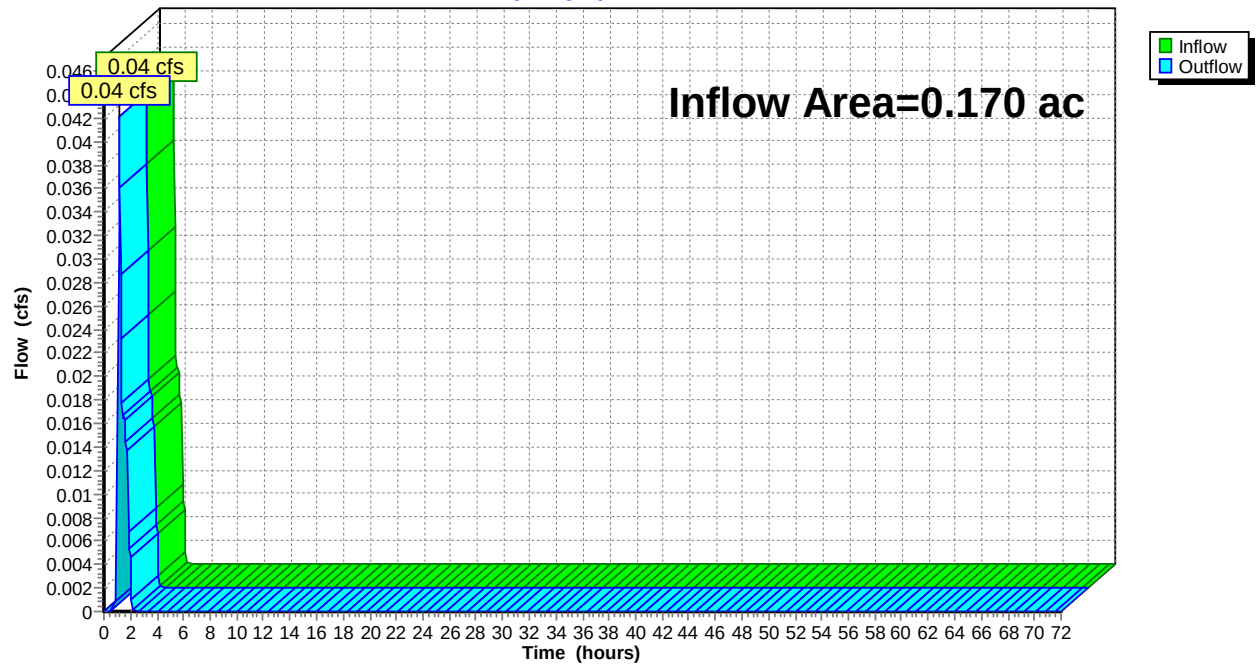
Reach DP1-PR:

Hydrograph



Reach DP2-PR:

Hydrograph



Pond BASIN: - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)

Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf

Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap

Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length

5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 18.0" Side Stone x 2 = 38.08' Base Width

9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

95 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 10,594.4 cf Chamber Storage

29,728.4 cf Field - 10,594.4 cf Chambers = 19,134.0 cf Stone x 40.0% Voids = 7,653.6 cf Stone Storage

Chamber Storage + Stone Storage = 18,248.0 cf = 0.419 af

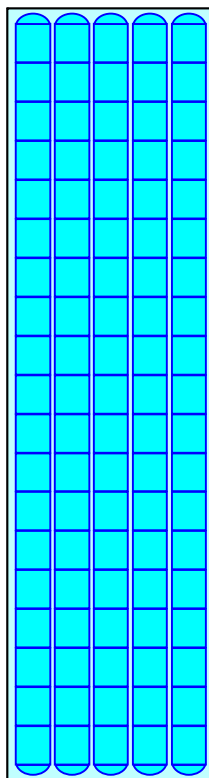
Overall Storage Efficiency = 61.4%

Overall System Size = 141.93' x 38.08' x 5.50'

95 Chambers

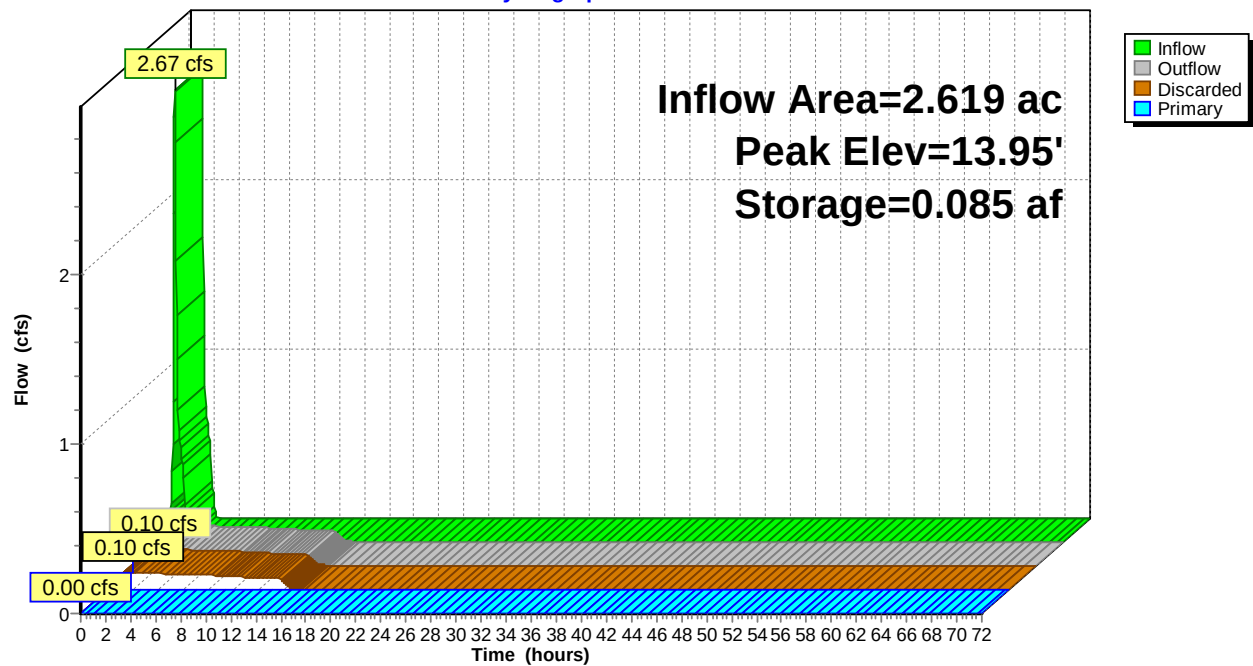
1,101.1 cy Field

708.7 cy Stone



Pond BASIN:

Hydrograph



Appendix B

Recharge Worksheet



Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
ESSEX CO., WEST ORANGE TOWN	49.0	1.67

Project Name:	Waymaker
Description:	Proposed Site Improvements
Analysis Date:	11/18/24

Pre-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.319	Impervious areas	Boonton	0.0	-
2	2.773	Open space	Boonton	14.9	150,467
3					
4					
5					
6					
7					
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	3.1			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				13.4	150,467

Post-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.847	Impervious areas	Boonton	0.0	-
2	2.245	Open space	Boonton	14.9	121,817
3					
4					
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	3.1			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
Annual Recharge Requirements Calculation ↓				10.9	121,817

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Annual Recharge Requirements Calculation ↓			10.9	121,817
% of Pre-Developed Annual Recharge to Preserve =		100%	Total Impervious Area (sq.ft)	36,895
Post-Development Annual Recharge Deficit=		28,650	(cubic feet)	
Recharge Efficiency Parameters Calculations (area averages)				
RWC=	3.59	(in)	DRWC=	0.00 (in)
ERWC=	0.59	(in)	EDRWC=	0.00 (in)

Project Name		Description		Analysis Date		BMP or LID Type					
Waymaker		Proposed Site Improvements		11/18/24		Subsurface Infiltration Basin					
Recharge BMP Input Parameters				Root Zone Water capacity Calculated Parameters				Recharge Design Parameters			
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
BMP Area	ABMP	5404.7	sq.ft	Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.61	in	Inches of Runoff to capture	Qdesign	1.84	in
BMP Effective Depth, this is the design variable	dBMP	3.6	in	ERWC Modified to consider dEXC	EDRWC	0.00	in	Inches of Rainfall to capture	Pdesign	2.07	in
Upper level of the BMP surface (negative if above ground)	dBMPu	108.0	in	Empty Portion of RWC under Infiltr. BMP	RERWC	0.00	in	Recharge Provided Avg. over Imp. Area		36.5	in
Depth of lower surface of BMP, must be >= dBMPu	dEXC	117.0	in					Runoff Captured Avg. over imp. Area		36.5	in
Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined	SegBMP	2	unitless								
				BMP Calculated Size Parameters				CALCULATION CHECK MESSAGES			
				ABMP/Aimp	Aratio	0.48	unitless	Volume Balance-> Solve Problem to satisfy Annual Recharge dBMP Check----> OK dEXC Check----> OK BMP Location----> OK			
				BMP Volume	VBMP	1,621	cu.ft				
Parameters from Annual Recharge Worksheet				System Performance Calculated Parameters							
Post-D Deficit Recharge (or desired recharge volume)	Vdef	28,650	cu.ft	Annual BMP Recharge Volume		34,489	cu.ft	OTHER NOTES Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses			
Post-D Impervious Area (or target Impervious Area)	Aimp	11,326	sq.ft	Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged				
Root Zone Water Capacity	RWC	3.69	in	%Rainfall became Runoff		78.5%	%				
RWC Modified to consider dEXC	DRWC	0.00	in	%Runoff Infiltrated		95.0%	%				
Climatic Factor	C-factor	1.67	no units	%Runoff Recharged		29.2%	%				
Average Annual P	Pavg	49.0	in	%Rainfall Recharged		22.9%	%				
Recharge Requirement over Imp. Area	dr	9.3	in								
How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP. To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.											

Input Values

0.50	R	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
0.50	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
71.000	x	1/2 length of basin (x direction, in feet)
17.000	y	1/2 width of basin (y direction, in feet)
18.60	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

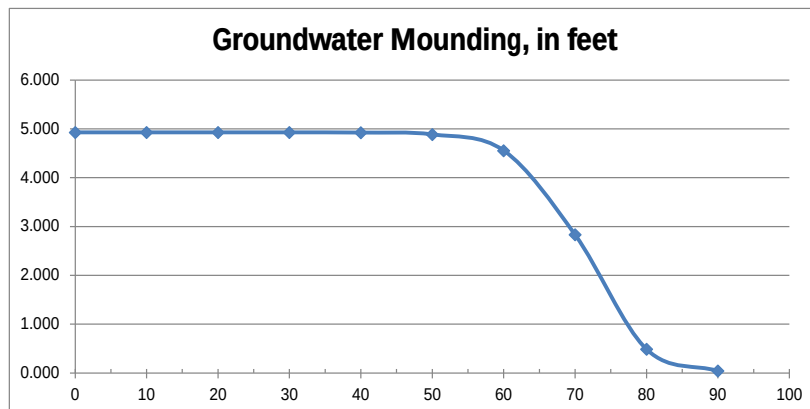
14.929	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
4.929	$\Delta h(\max)$	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Distance from
Ground-water center of basin in x
Mounding, in feet direction, in feet

4.929	0
4.929	10
4.929	20
4.929	30
4.927	40
4.889	50
4.556	60
2.833	70
0.487	80
0.043	90



Re-Calculate Now

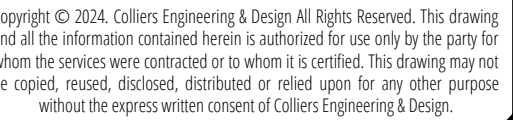


Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Appendix C

Existing and Proposed Drainage Area Map



PROTECT YOURSELF

OR STATE SPECIFIC DIRECT PHONE NUMBERS
VISIT: WWW.CALL811.COM

REV	DATE	DRAWN BY	DESCRIPTION
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
11		11	
12		12	
13		13	
14		14	
15		15	
16		16	
17		17	
18		18	
19		19	
20		20	
21		21	
22		22	
23		23	
24		24	
25		25	
26		26	
27		27	
28		28	
29		29	
30		30	
31		31	
32		32	
33		33	
34		34	
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Jesse Cokeley
W JERSEY LICENSED PROFESSIONAL ENGINEER
LICENSE NUMBER: GE54006
COLLIERS ENGINEERING & DESIGN, INC.
N.J. C.O.A. #: 24GA27986500

PRELIMINARY & FINAL MAJOR SITE PLAN

FOR
THE WAYMAKER LLC
PROPOSED
RESIDENTIAL
IMPROVEMENTS

BLOCK 106
LOT 24.01

TOWNSHIP OF WEST
ORANGE
ESSEX COUNTY
NEW JERSEY



WOODCLIFF LAKE
300 Tice Boulevard
Suite 101
Woodcliff Lake, NJ 07677
Phone: 845.352.0411
JERS ENGINEERING & DESIGN, INC. DOING
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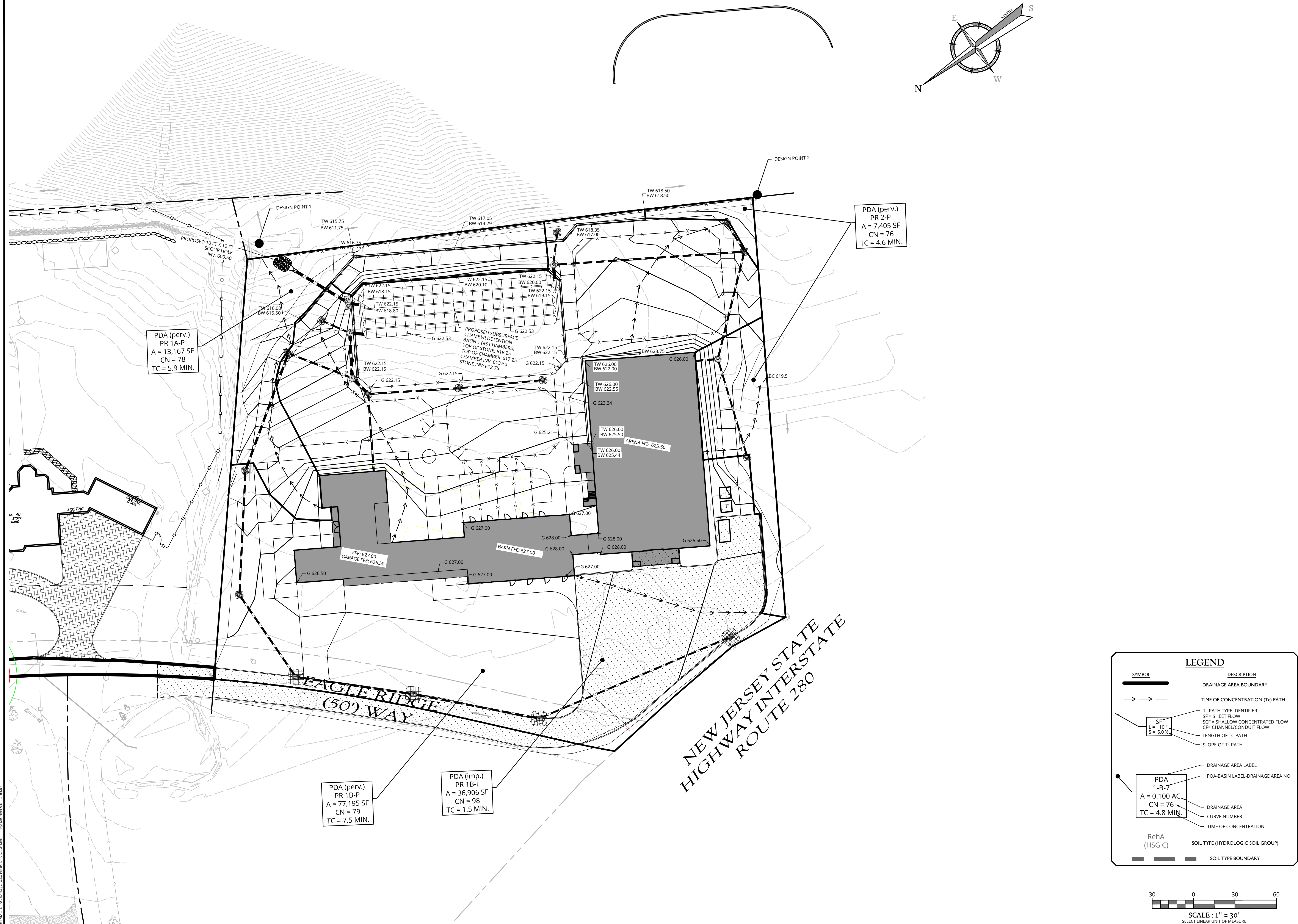
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PROPOSED
DRAINAGE MAP

SHEET NUMBER:

2 OF 2

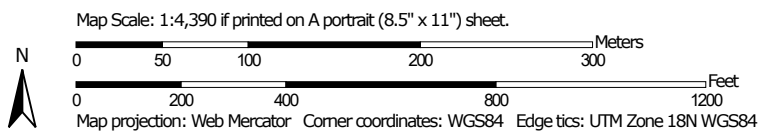
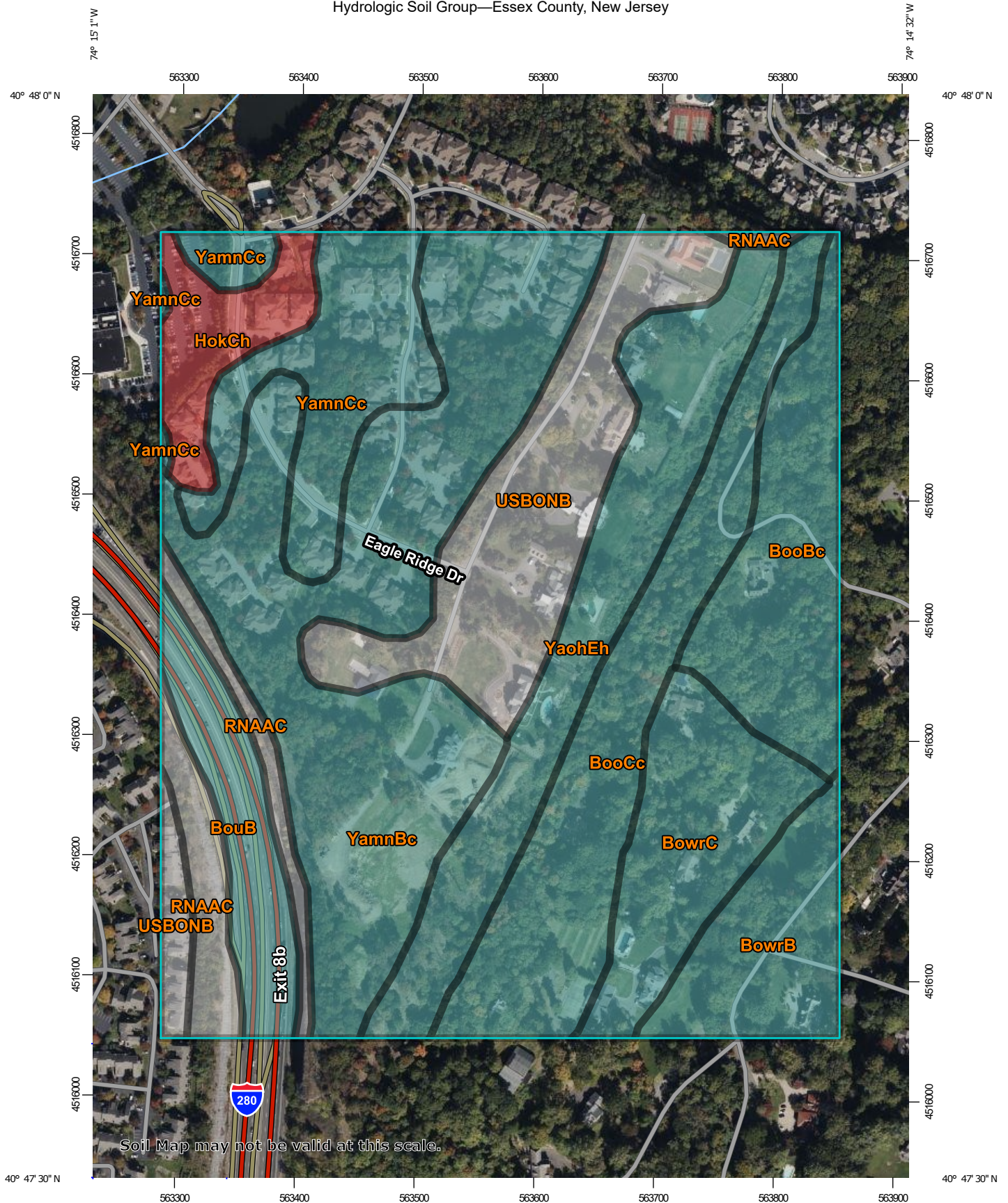


NOTE: DO NOT SCALE DRAWINGS FOR CONSTRUCTION.

Appendix D

USGS HUC-11 Soil Survey Location Map

Hydrologic Soil Group—Essex County, New Jersey



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

6/28/2024
Page 1 of 4

MAP LEGEND**Area of Interest (AOI)**
 Area of Interest (AOI)
Soils**Soil Rating Polygons**

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

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: Essex County, New Jersey
Survey Area Data: Version 19, Aug 29, 2023

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

Date(s) aerial images were photographed: Oct 10, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BooBc	Boonton silt loam, red sandstone lowland, 0 to 8 percent slopes, extremely stony	C	7.7	8.1%
BooCc	Boonton silt loam, red sandstone lowland, 8 to 15 percent slopes, extremely stony	C	11.0	11.6%
BouB	Boonton - Urban land, Boonton substratum complex, 0 to 8 percent slopes	C	4.3	4.5%
BowrB	Boonton - Urban land, Boonton substratum complex, red sandstone lowland, 0 to 8 percent slopes	C	5.2	5.5%
BowrC	Boonton - Urban land, Boonton substratum complex, red sandstone lowland, 8 to 15 percent slopes	C	6.8	7.2%
HokCh	Holyoke silt loam, 0 to 15 percent slopes, very rocky	D	3.4	3.6%
RNAAC	Rock outcrop		3.9	4.2%
USBONB	Urban land, Boonton substratum - Boonton complex, 0 to 8 percent slopes		11.7	12.4%
YamnBc	Yalesville loam, 0 to 8 percent slopes, extremely stony	C	22.5	23.9%
YamnCc	Yalesville loam, 8 to 15 percent slopes, extremely stony	C	7.5	8.0%
YaohEh	Yalesville - Holyoke complex, 35 to 60 percent slopes, very rocky	C	10.4	11.0%
Totals for Area of Interest			94.3	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix E - Not Included in this Submission

Low Impact Development

Appendix F - Not Included in this Submission

Stormwater Conveyance System



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