STORMWATER MANAGEMENT REPORT

For

490 ELIZABETH AVE

BLOCK 514, LOT 34

Located in

TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NEW JERSEY

Prepared by

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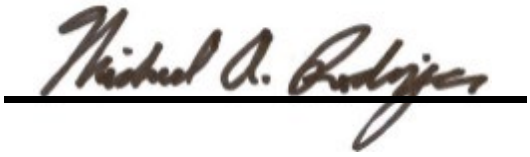

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HLE #19201
JULY 23, 2020
Revised DECEMBER 23, 2020

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A. Introduction

1. Purpose of Report

The purpose of this report is to present the hydrologic criteria and methods used for the stormwater management design for this project. The criteria and methods used in this report are in accordance with the most current Township of Franklin ordinance, New Jersey Department of Environmental Protection (NJDEP) Rules and Regulations, Delaware and Raritan Canal Commission (DRCC) Rules and Regulations, and Standards for Soil Erosion and Sediment Control (SESC) in New Jersey.

2. Project Location

The subject property is approximately 5.50 acres and is known as Block 514, Lot 34 as shown on the tax maps of the Township of Franklin. This project site is bounded by Elizabeth Avenue to the east, Franklin High School property to the south, a residential property to the north and vacant wooded property to the east. A tributary to the Raritan River is located at the northwesterly corner of the site. A USGS map delineating the site location can be found in section 3 of this report.

3. Hydrologic Methodologies

Technical Release No. 55 (TR55) was used to calculate the present and developed runoff from the project site. Hydrographs have been generated for the 2-, 10-, and 100-year storm events. The hydrographs were developed using the New Jersey Region C rainfall distribution and regional rainfall data for Somerset County.

The following parameters were utilized for stormwater management:

1. Reduce the developed peak rate of runoff to 50% of the present peak rate of runoff for the 2-year storm for the area of disturbance

2. Reduce the developed peak rate of runoff to 75% of the present peak rate of runoff for the 10-year storm for the area of disturbance

3. Reduce the developed peak rate of runoff to 80% of the present peak rate of runoff for the 100-year storm for the area of disturbance

4. Provide 80% TSS removal for the proposed development per the BMP Manual

B. Present Land Use and Drainage Patterns

1. Land Use

Presently, the site contains a residential house with an associated parking area near Elizabeth Avenue but is mostly wooded and undeveloped on the remainder of the property

2. Drainage Patterns / Topography and Soils

The site generally drains from south to north contributing runoff toward the tributary to the Raritan River. Portions of the off-site properties located to the south of the site also contribute runoff to this tributary. Additionally, existing inlets along the property frontage (along Elizabeth Avenue) collect runoff from a portion of the site contributing to same tributary to the north. The Soil Survey report, which is found in Section 3 of this report, shows that the existing soils are of hydrologic soil group C on the entire site and contributing off-site drainage area.

A subsurface investigation was performed by Whitestone Associates, Inc. (Whitestone) to evaluate the Seasonal High Groundwater levels and infiltration rates of the site soils. Please refer to the report entitled "Limited Geotechnical Investigation & Stormwater Management Area Evaluation" prepared by Whitestone Associates, Inc. dated March 16, 2020. This report concludes that from test pit data performed within the proposed detention basin area, the elevation of the seasonal high water table ranges between elevations 70.5 and 71.0. Additionally, the infiltration rates were determined to be less than 0.2 inches per hour. This information has been prepared in accordance with Appendix "E" of the NJ BMP Manual.

3. Present Drainage Areas

The present drainage areas are shown on a map entitled "Present Drainage Area Map" found in Section 3 of this report. The contributing drainage area to the tributary (Analysis Point) consists of both on-site and off-site mostly wooded land. These drainage areas are limited to the area of proposed disturbance on-site and all contributing off-site drainage to this area. Hydrographs have been calculated for these areas. Please see the calculations found in Section 2A of this report.

The contributing off-site drainage area was delineated using both field observations and available online topography (Pictometry) which can be found in Section 3 of this report.

Using the data generated by the hydrologic calculations and applying the runoff reductions mentioned above, the following table has been prepared to summarize the Target Peak Flow for the proposed stormwater management design. The following table reduces the peak runoff from the on-site contributing drainage area and adds the contributing off-site peak flow rate to obtain the Target Peak Flow.

TABLE 1. TARGET FLOW CALCULATION					
STORM	EX. PEAK FLOW FROM ON-SITE AREA (CFS)	REDUCTION	REDUCED EX. PEAK FLOW FROM ON-SITE AREA (CFS)	EX PEAK FLOW FROM OFF-SITE AREA (CFS)	AP#1 TARGET PEAK FLOW (CFS)
	A	B	C=A*B	D	E=C+D
2-YR	2.05	50%	1.03	2.22	3.25
10-YR	4.88	75%	3.66	5.03	8.69
100-YR	11.25	80%	9.00	11.19	20.19

Please see Section 2A of this report for the Present Runoff calculations used in the Table above

C. Developed Land Use and Drainage Patterns

1. Land Use

The project proposes to construct a warehouse facility with associated loading docks, car parking, driveways, stormwater management facilities, utilities, landscaping and lighting.

2. Developed Drainage Areas

Once developed, the project will convey the runoff to a combination underground and above-ground detention basin with a single outfall which discharges directly to the tributary. The proposed detention system has been designed to attenuate the required peak flows from the 2-, 10-, and 100-year storm events. The hydrologic calculations can be found in Section 2A of this report.

The following table summarizes the calculations for the developed peak runoff flow rates and compares them to the target peak flow rates from Table 1 above:

Summary of Calculations for Present Runoff and Developed Runoff at the Analysis Point

TABLE 2. TARGET FLOW VS. DEVELOPED FLOW RATES		
STORM	TARGET FLOW (CFS) FROM TABLE 1	DEVELOPED FLOW (CFS)
2-YR	3.25	3.25
10-YR	8.69	5.21
100-YR	20.19	16.85

3. Water Quality

For the proposed development, the Water Quality requirement (minimum runoff treatment to 80% TSS removal from a storm consisting of 1.25-in. of rainfall over 2 hours, or WQ storm event). This requirement is satisfied through the combination of a manufactured treatment devices (ADS BaySaver Barracuda providing 50% TSS Removal), extended detention basins (providing 60% TSS Removal) and vegetative filter strips consisting of existing woodlands (providing 80% TSS Removal).

The runoff from the WQ storm event from a majority of the projectwill be conveyed through the extended detention basin (24hours extended detention for 60% TSS removal) and then to the manufactured treatment device (50% TSS removal) at each detention basin. For water quality calculations (including routing of the water quality storm through the extended detention basin) please see Section 2B of this report.

Additionally, stormwater runoff from a portion of the proposed pavement area along the north side of the building will be discharge uncontrolled and overland via curb cuts to vegetative filter strips consisting of existing woodlands. Per the BMP Manual, this would achieve 80% TSS removal. Calculations on the flow rates at each curb cut have been provided in Section 2F of this report.

4. Storm Sewer

The storm system was designed to accept the 25-year peak runoff. Runoff coefficients of 0.51 for hydrologic soil group 'C' open space and 0.99 for impervious areas were used in the Rational Method calculations. A minimum time of concentration of 10 minutes was used. Local rainfall data provided by the National Oceanic and Atmospheric Administration (NOAA) was utilized to determine the average rainfall intensity. A Manning's "n" value of 0.013 was used for reinforced concrete pipe (RCP) and 0.012 was used for HDPE pipe.

Stormwater pipe conveyance calculations have been provided in Section 2 of this report.

5. Groundwater Recharge

The proposed underground recharge basin will provide adequate groundwater recharge for this project. One hundred percent (100%) of the site's average annual pre-developed groundwater recharge volume will be maintained after development. The following table summarizes the results of the calculations:

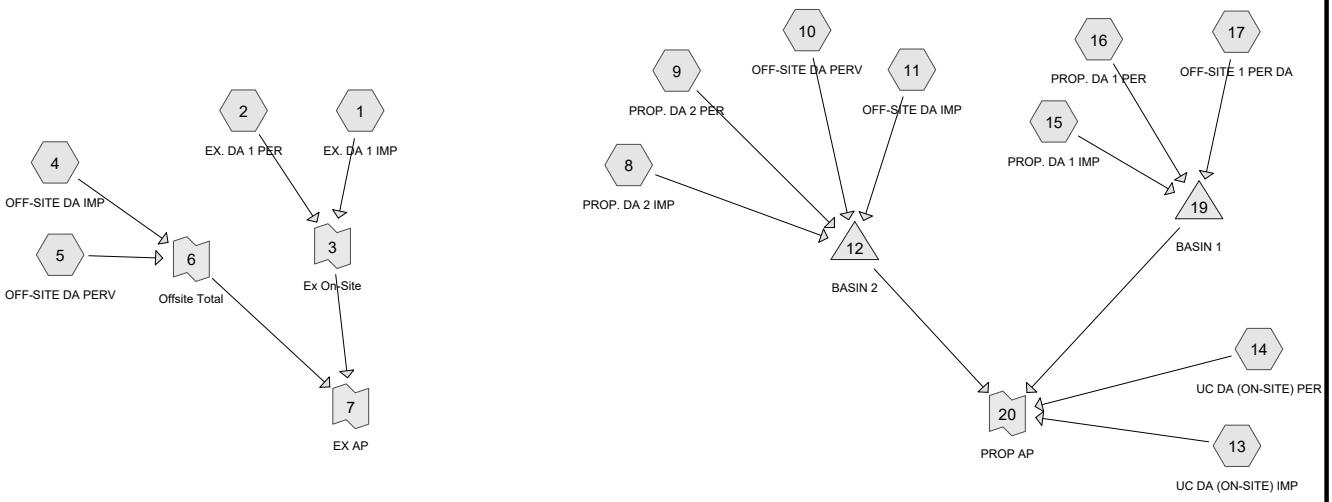
Table No. 5 Summary of Groundwater Recharge	
Groundwater Recharge Deficit	114,000 cubic feet
Groundwater Recharge via Underground Recharge Basin	116,570 cubic feet

Calculations were performed using the New Jersey Groundwater Recharge Spreadsheet (NJGRS) and can be found in Section 2 of this report.

D. Conclusion

The stormwater management design provided will adhere to the most current Township of Franklin development standards, NJDEP Best Management Practices, Delaware and Raritan Canal Commission (DRCC) Rules and Regulations, and the Standards for Soil Erosion and Sediment Control (SESC) in New Jersey. The proposed stormwater management system will provide adequate water quality treatment and runoff flow attenuation. The proposed stormwater management facilities will safely convey all developed runoff from the site and will not have an adverse impact on downstream areas.

SECTION 2A



Subcat Reach Pond Link

Routing Diagram for Drainage Analysis

Prepared by {enter your company name here}, Printed 12/27/2020

HydroCAD® 10.00-25 s/n 09755 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment 1: EX. DA 1 IMP

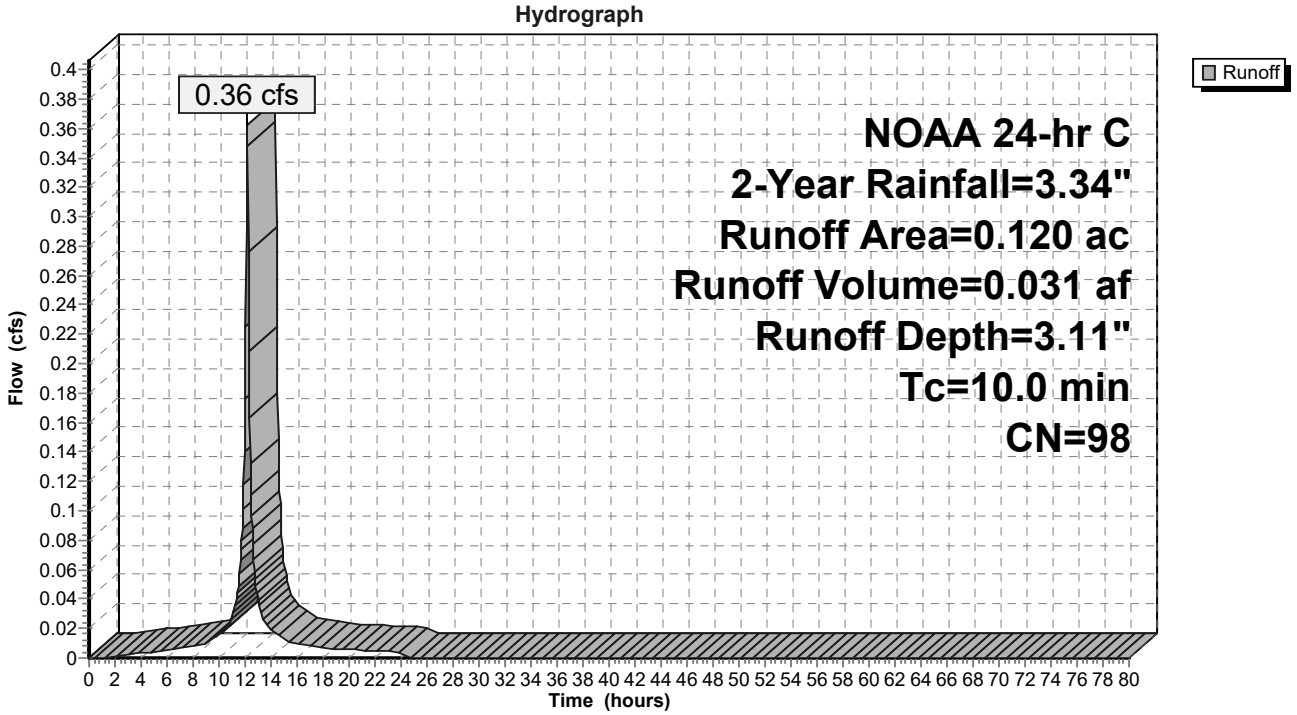
Runoff = 0.36 cfs @ 12.17 hrs, Volume= 0.031 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120		100.00% Impervious Area

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

Subcatchment 1: EX. DA 1 IMP



Summary for Subcatchment 2: EX. DA 1 PER

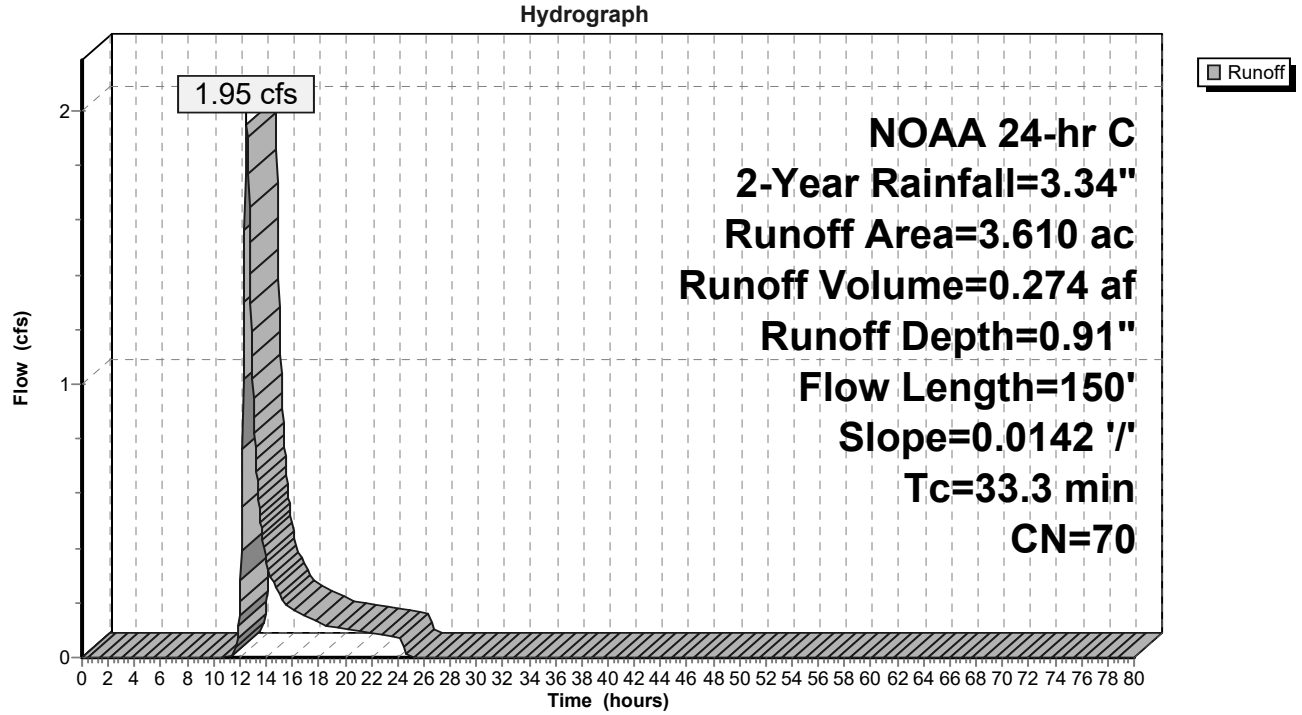
Runoff = 1.95 cfs @ 12.52 hrs, Volume= 0.274 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
3.610	70	Woods, Good, HSG C
3.610		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	150	0.0142	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Subcatchment 2: EX. DA 1 PER



Summary for Subcatchment 4: OFF-SITE DA IMP

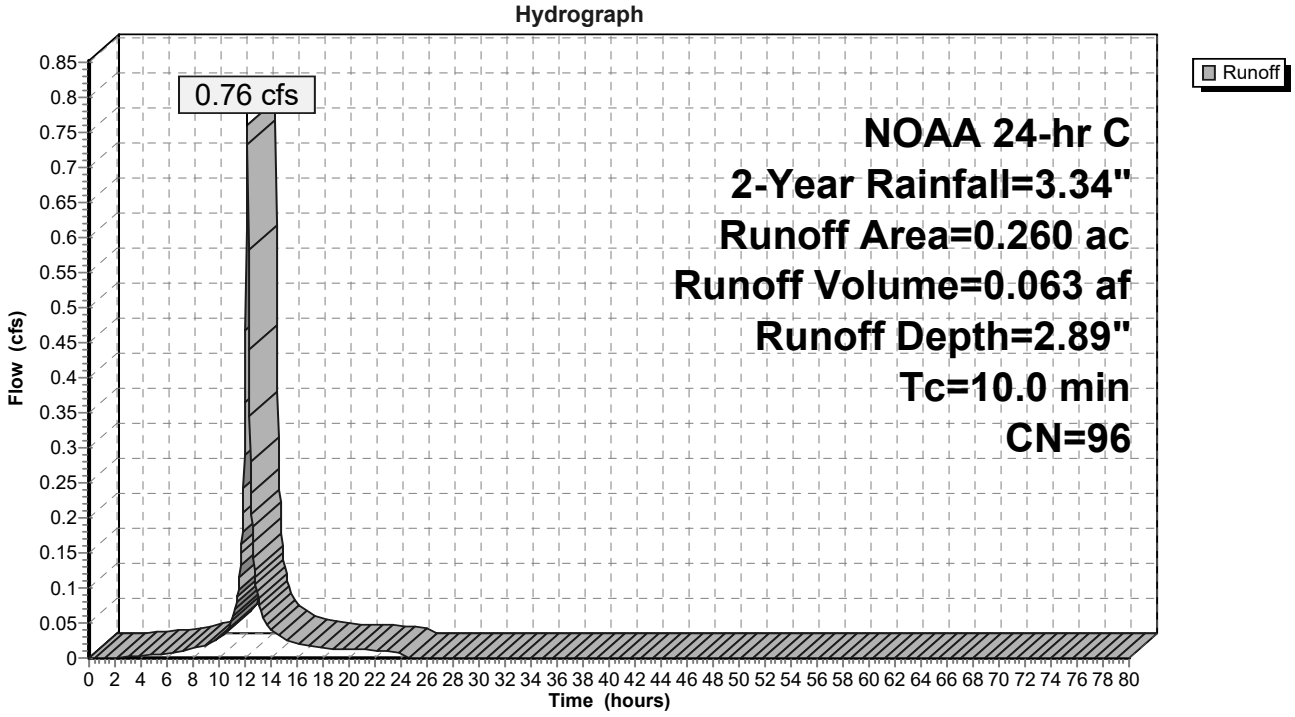
Runoff = 0.76 cfs @ 12.17 hrs, Volume= 0.063 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 4: OFF-SITE DA IMP



Summary for Subcatchment 5: OFF-SITE DA PERV

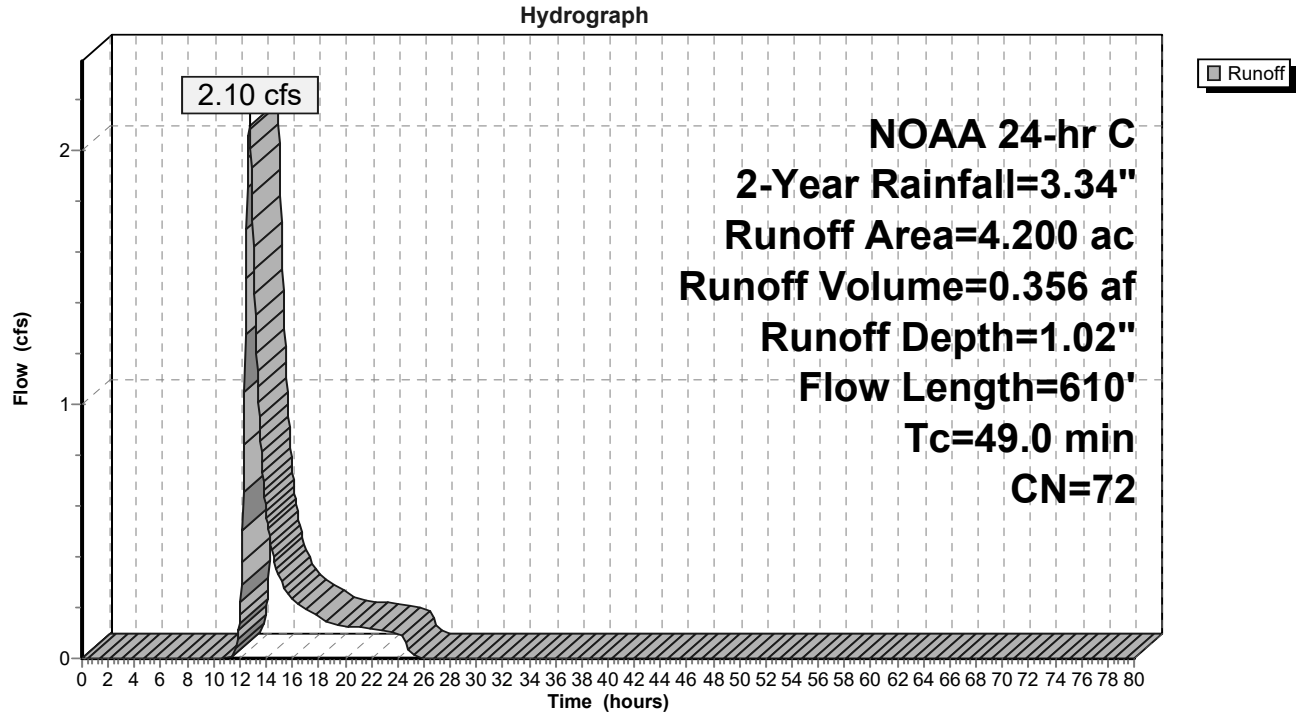
Runoff = 2.10 cfs @ 12.72 hrs, Volume= 0.356 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
2.160	70	Woods, Good, HSG C
2.040	74	>75% Grass cover, Good, HSG C
4.200	72	Weighted Average
4.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 5: OFF-SITE DA PERV



Summary for Subcatchment 8: PROP. DA 2 IMP

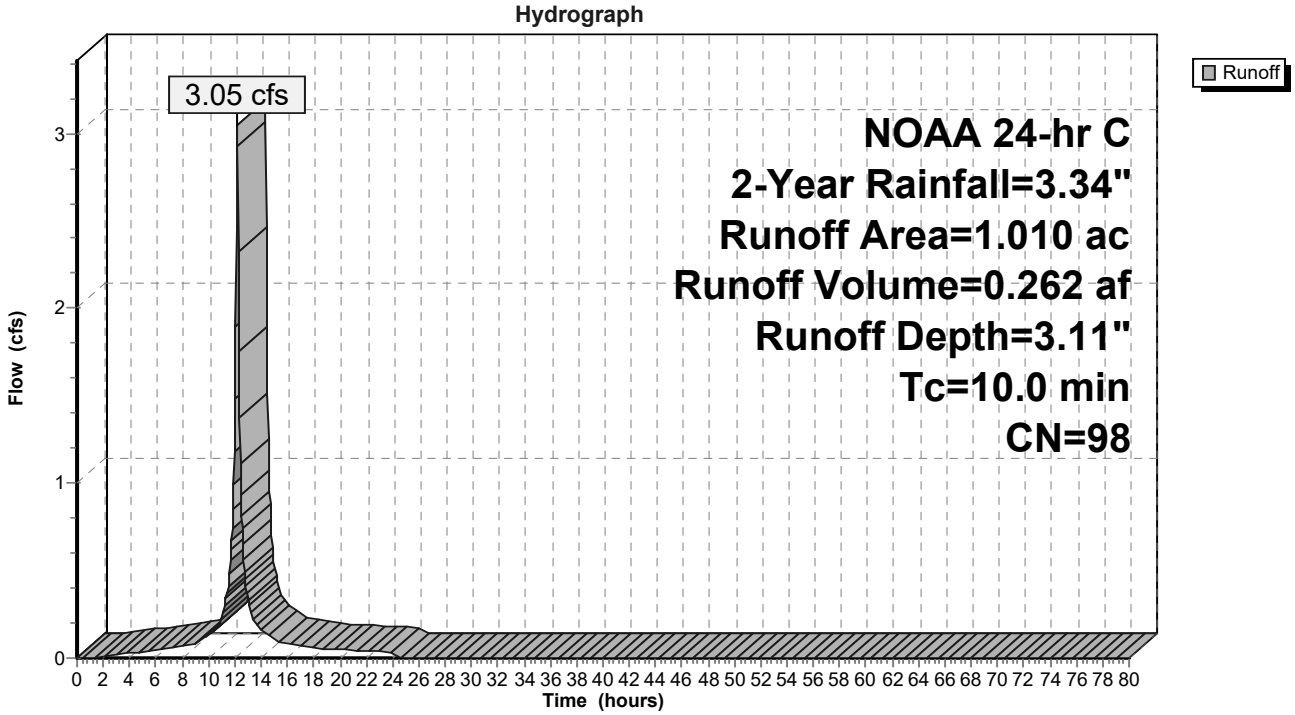
Runoff = 3.05 cfs @ 12.17 hrs, Volume= 0.262 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
*	0.970	98	Impervious
*	0.040	98	1/2 Basin Impervious
	1.010	98	Weighted Average
	1.010		100.00% Impervious Area

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

Subcatchment 8: PROP. DA 2 IMP



Summary for Subcatchment 9: PROP. DA 2 PER

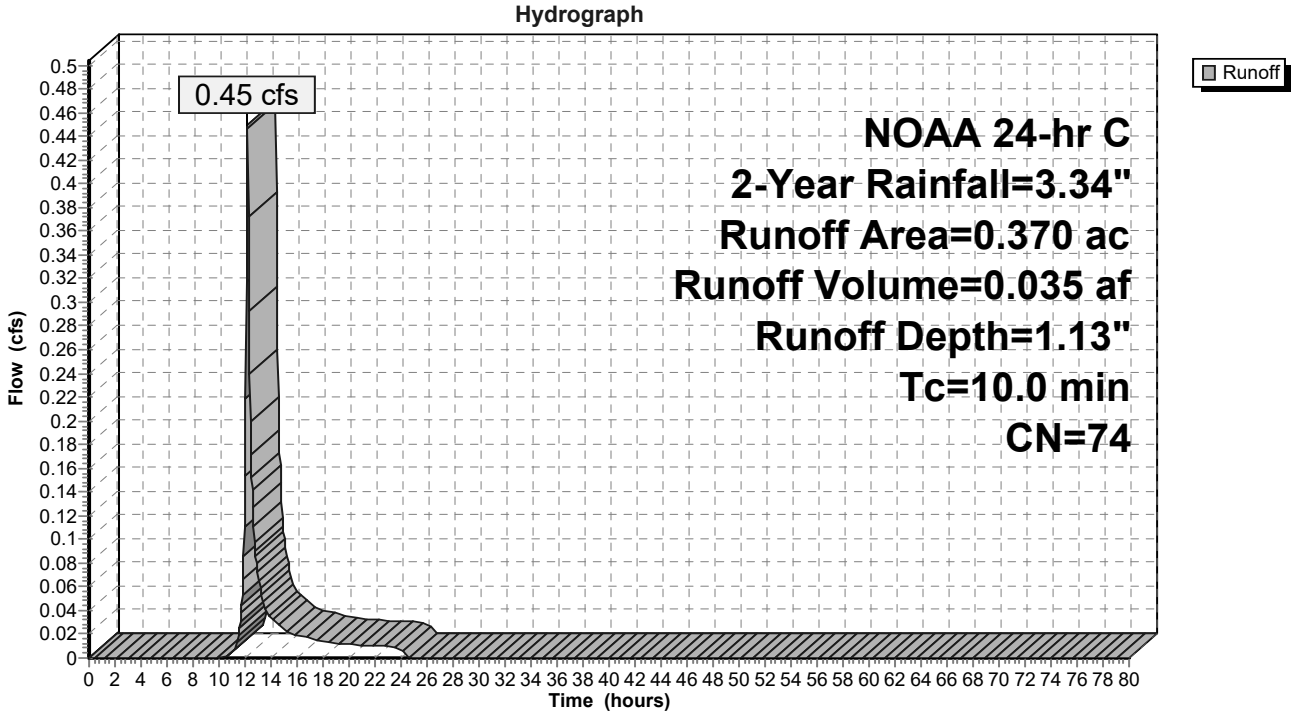
Runoff = 0.45 cfs @ 12.18 hrs, Volume= 0.035 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
	0.330	74	>75% Grass cover, Good, HSG C
*	0.040	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 9: PROP. DA 2 PER



Summary for Subcatchment 10: OFF-SITE DA PERV

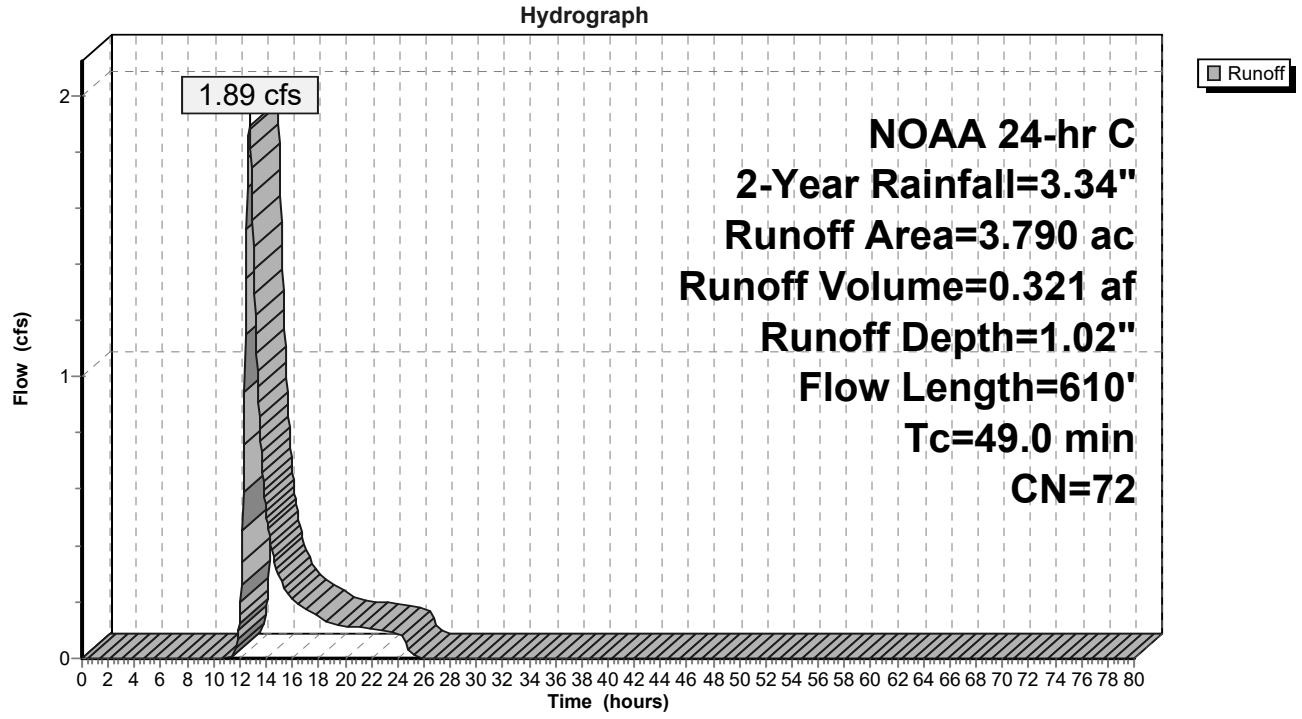
Runoff = 1.89 cfs @ 12.72 hrs, Volume= 0.321 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
1.890	70	Woods, Good, HSG C
1.900	74	>75% Grass cover, Good, HSG C
3.790	72	Weighted Average
3.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 10: OFF-SITE DA PERV



Summary for Subcatchment 11: OFF-SITE DA IMP

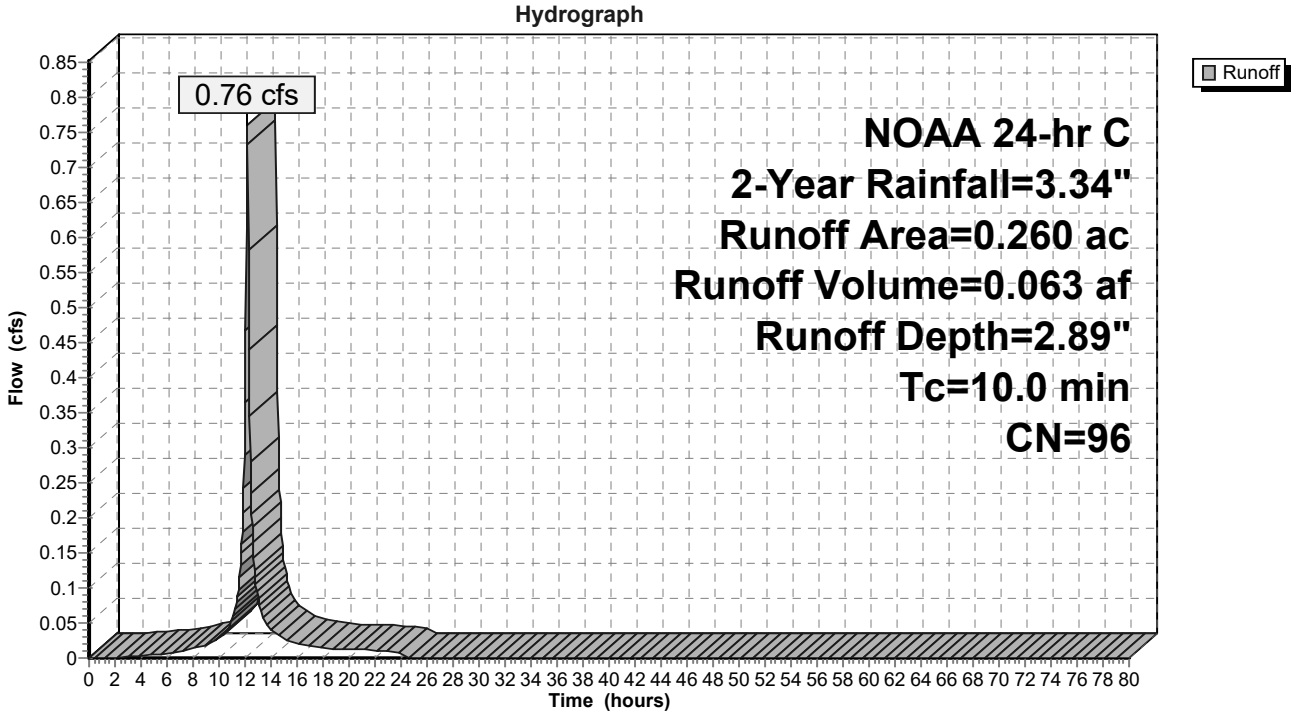
Runoff = 0.76 cfs @ 12.17 hrs, Volume= 0.063 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 11: OFF-SITE DA IMP



Summary for Subcatchment 13: UC DA (ON-SITE) IMP

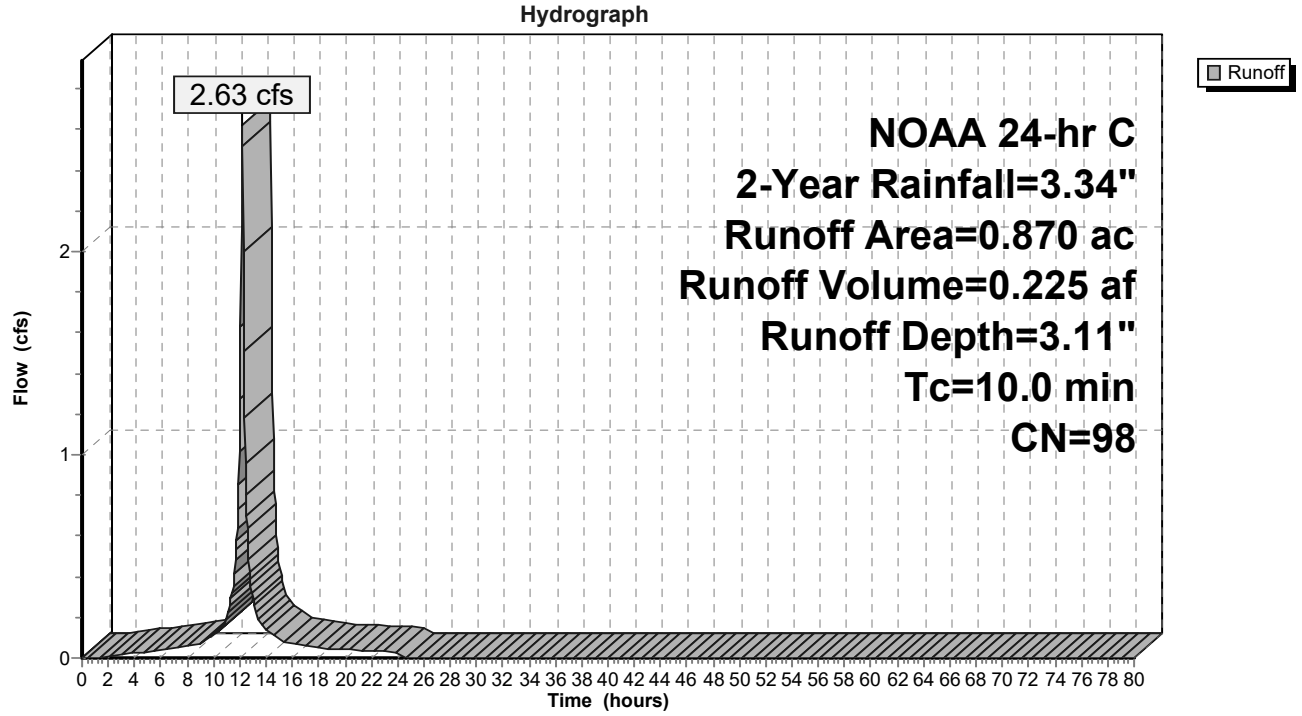
Runoff = 2.63 cfs @ 12.17 hrs, Volume= 0.225 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
*	0.870	98	Impervious
	0.870		100.00% Impervious Area

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

Subcatchment 13: UC DA (ON-SITE) IMP



Summary for Subcatchment 14: UC DA (ON-SITE) PER

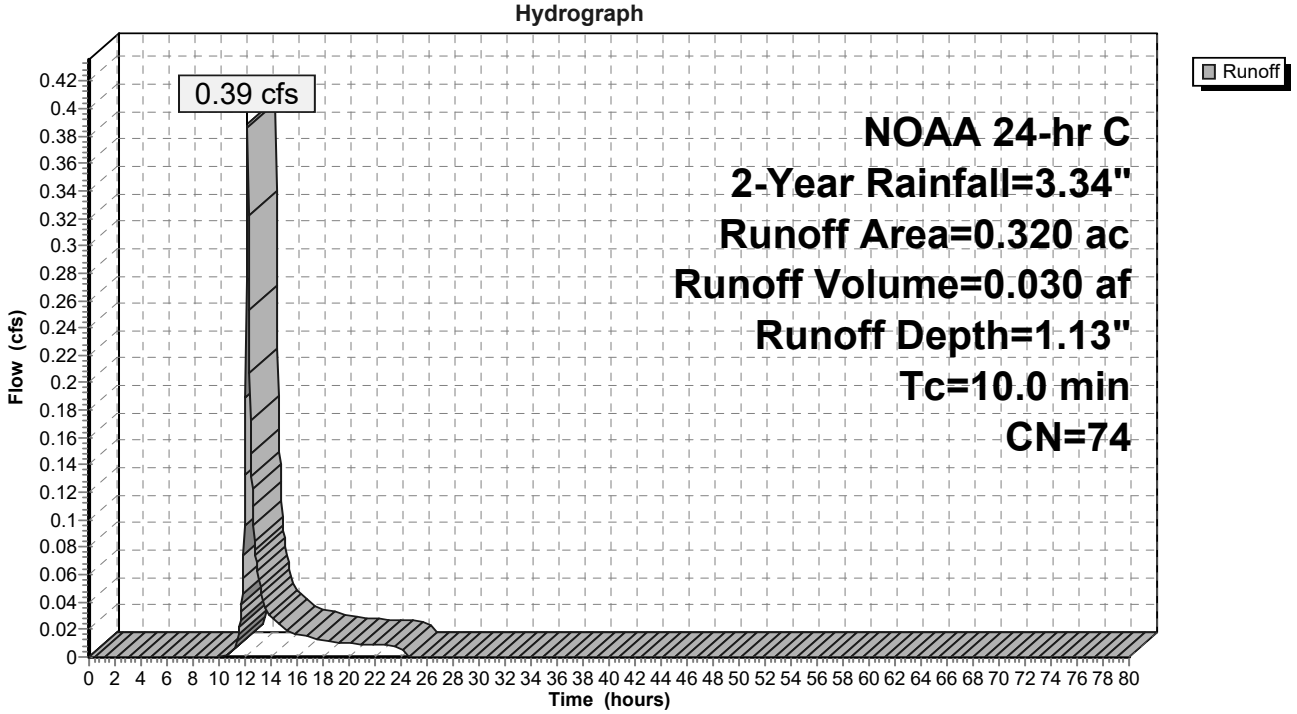
Runoff = 0.39 cfs @ 12.18 hrs, Volume= 0.030 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 14: UC DA (ON-SITE) PER



Summary for Subcatchment 15: PROP. DA 1 IMP

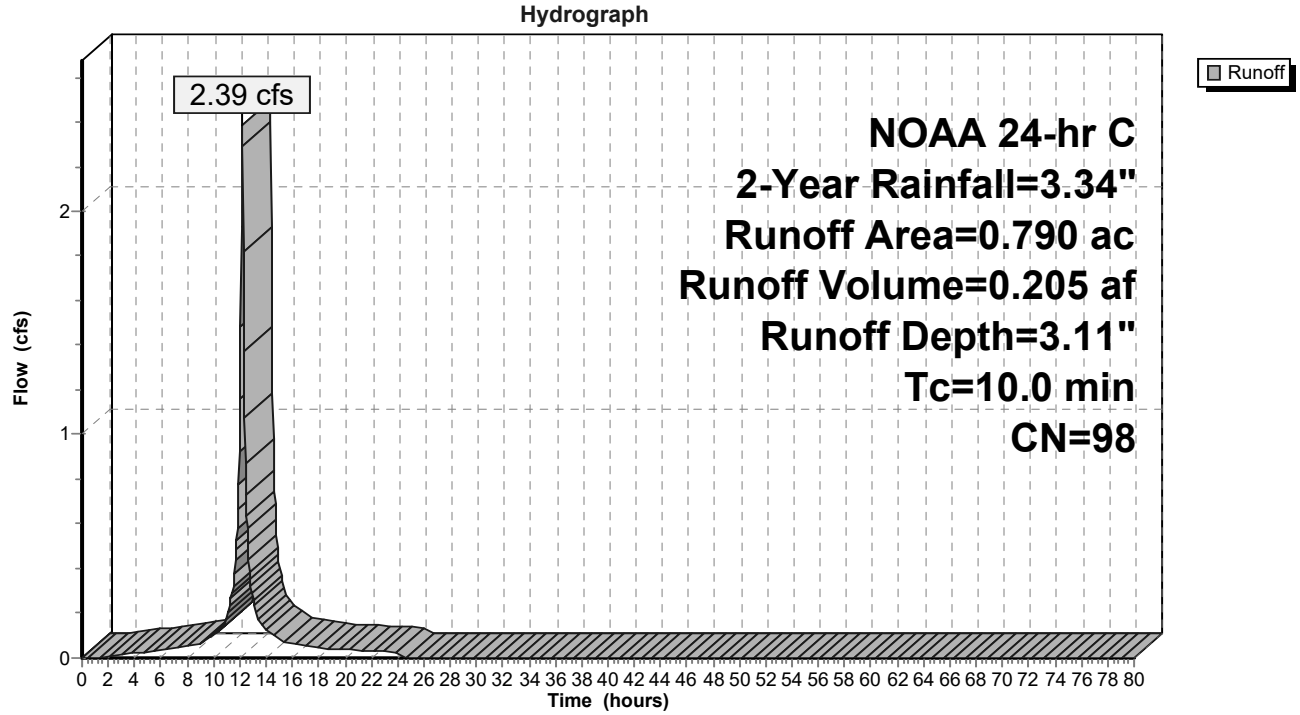
Runoff = 2.39 cfs @ 12.17 hrs, Volume= 0.205 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
*	0.670	98	Impervious
*	0.120	98	1/2 Basin Impervious
	0.790	98	Weighted Average
	0.790		100.00% Impervious Area

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

Subcatchment 15: PROP. DA 1 IMP



Summary for Subcatchment 16: PROP. DA 1 PER

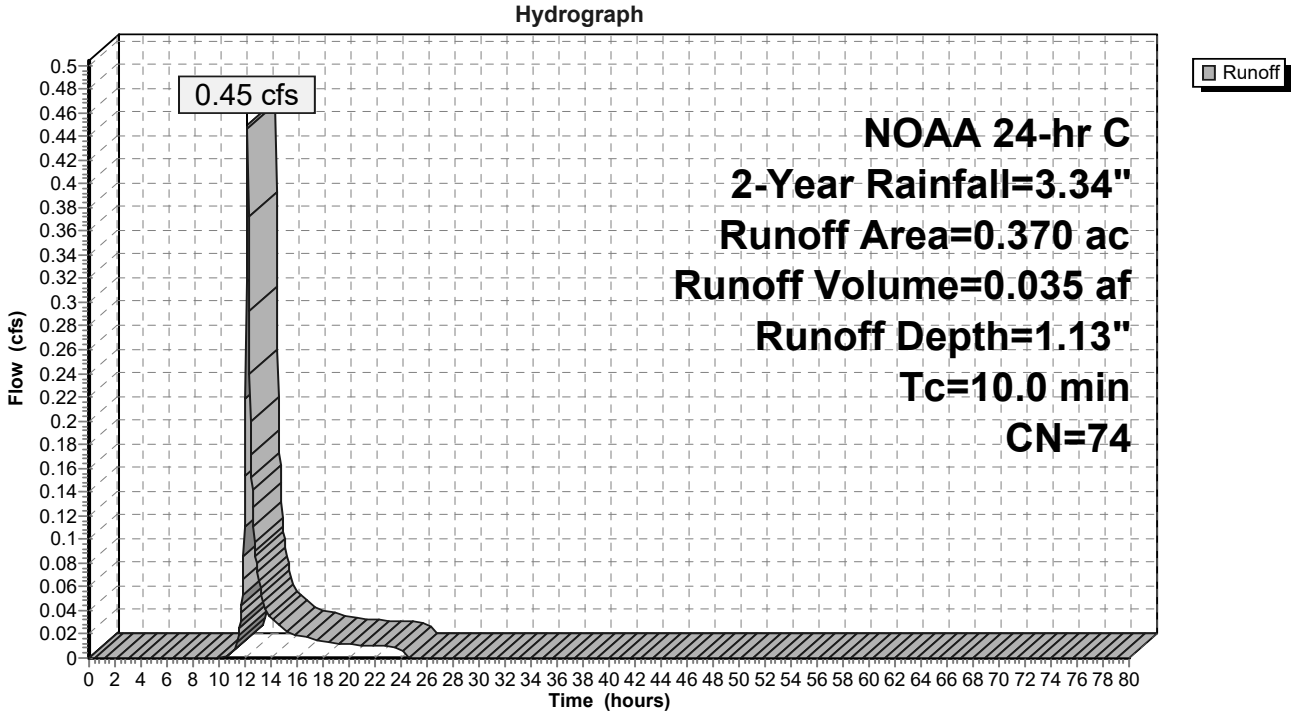
Runoff = 0.45 cfs @ 12.18 hrs, Volume= 0.035 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

	Area (ac)	CN	Description
	0.250	74	>75% Grass cover, Good, HSG C
*	0.120	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 16: PROP. DA 1 PER



Summary for Subcatchment 17: OFF-SITE 1 PER DA

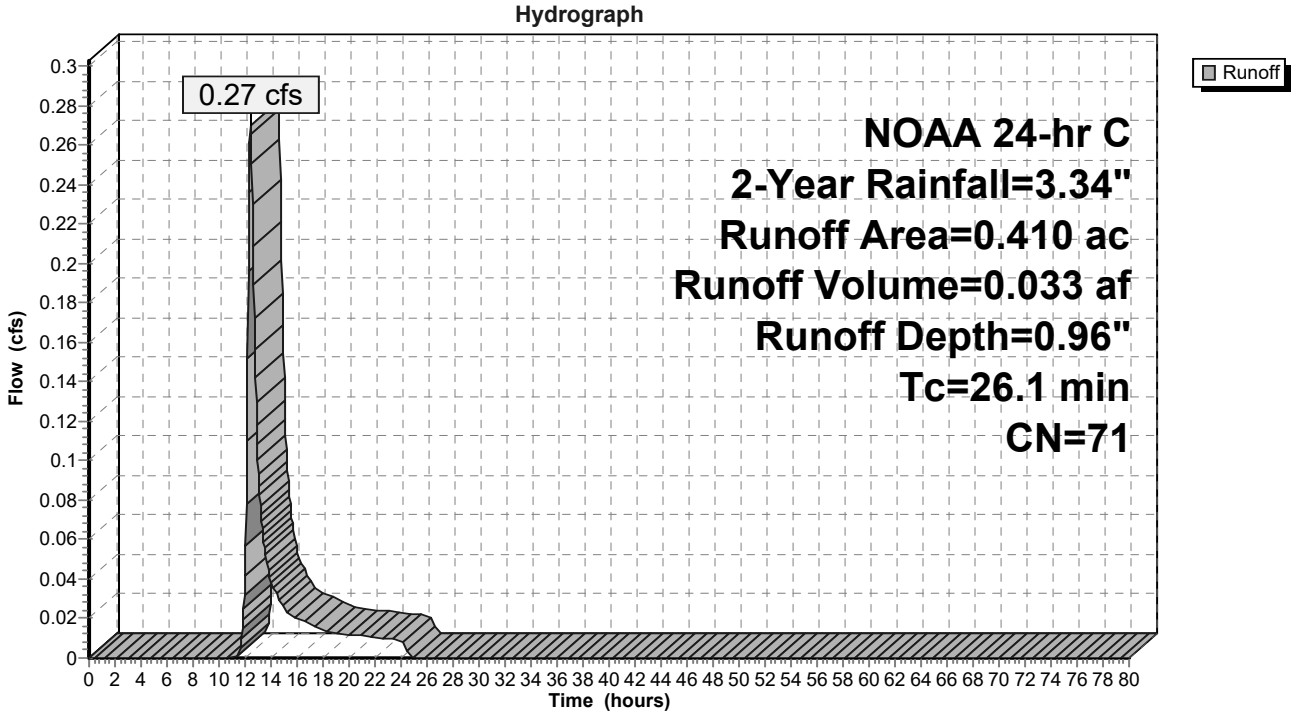
Runoff = 0.27 cfs @ 12.41 hrs, Volume= 0.033 af, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.270	70	Woods, Good, HSG C
0.140	74	>75% Grass cover, Good, HSG C
0.410	71	Weighted Average
0.410		100.00% Pervious Area

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

Subcatchment 17: OFF-SITE 1 PER DA



Summary for Pond 12: BASIN 2

Inflow Area = 5.430 ac, 18.60% Impervious, Inflow Depth = 1.50" for 2-Year event
Inflow = 4.64 cfs @ 12.18 hrs, Volume= 0.680 af
Outflow = 0.55 cfs @ 14.53 hrs, Volume= 0.675 af, Atten= 88%, Lag= 141.4 min
Primary = 0.55 cfs @ 14.53 hrs, Volume= 0.675 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 71.50' Surf.Area= 8,720 sf Storage= 2,616 cf
Peak Elev= 73.55' @ 14.53 hrs Surf.Area= 10,955 sf Storage= 20,444 cf (17,829 cf above start)

Plug-Flow detention time= 1,008.7 min calculated for 0.615 af (90% of inflow)
Center-of-Mass det. time= 862.8 min (1,700.7 - 837.9)

Volume	Invert	Avail.Storage	Storage Description
#1	71.50'	7,051 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	70.75'	12,087 cf	**37.08'W x 235.14'L x 5.50'H Field A** 47,959 cf Overall - 17,741 cf Embedded = 30,217 cf x 40.0% Voids
#3A	71.50'	17,741 cf	**ADS_StormTech MC-3500 d +Cap** x 160 Inside #2 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 160 Chambers in 5 Rows Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		36,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	0	0	0
72.00	1,406	352	352
73.00	1,913	1,660	2,011
74.00	2,501	2,207	4,218
75.00	3,165	2,833	7,051

Device	Routing	Invert	Outlet Devices
#1	Primary	71.50'	**24.0" Round RCP_Round 24"** L= 220.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 71.50' / 70.20' S= 0.0059 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	71.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.40'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.55 cfs @ 14.53 hrs HW=73.55' (Free Discharge)
└**1=RCP_Round 24"** (Passes 0.55 cfs of 15.38 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.23 cfs @ 6.71 fps)
  └**3=Broad-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 1.08 fps)

Pond 12: BASIN 2 - 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

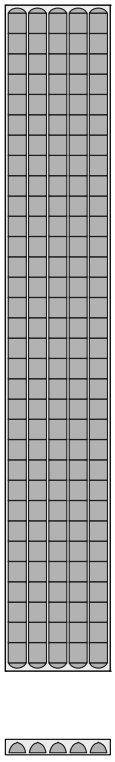
32 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 233.14' Row Length +12.0" End Stone x 2 = 235.14' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

160 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 17,741.3 cf Chamber Storage

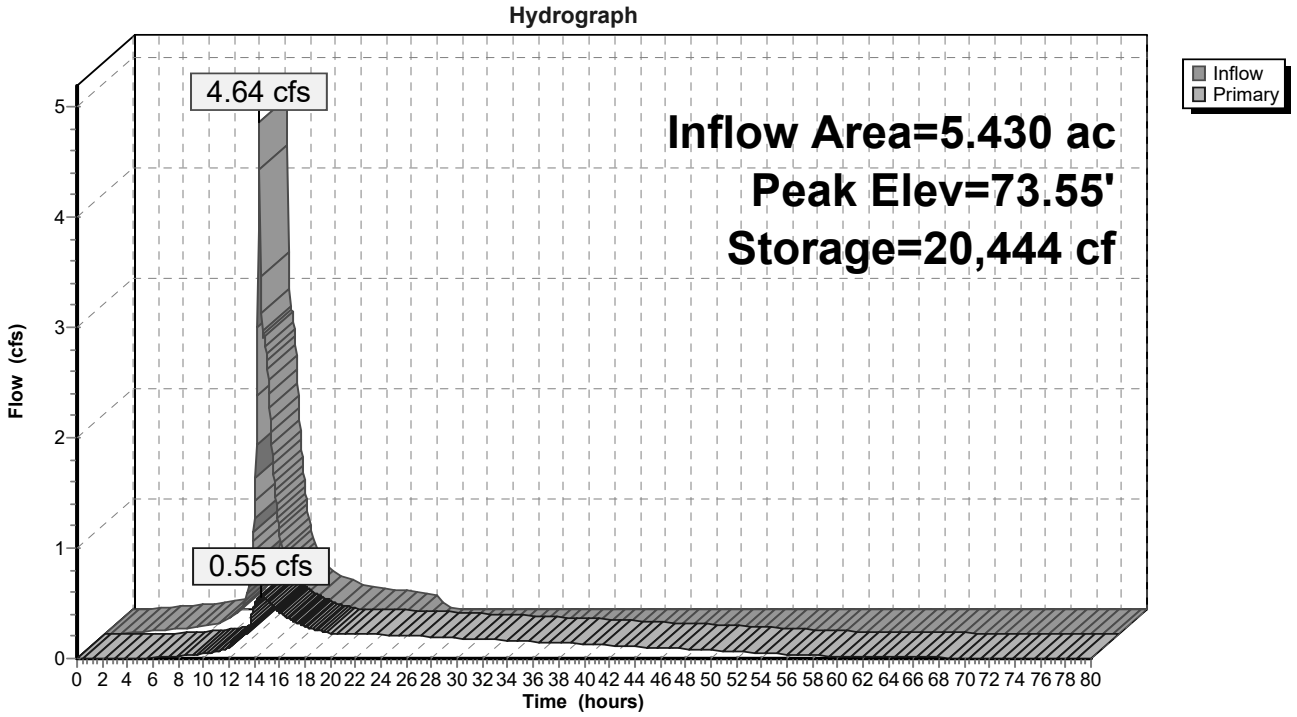
47,958.8 cf Field - 17,741.3 cf Chambers = 30,217.5 cf Stone x 40.0% Voids = 12,087.0 cf Stone Storage

Chamber Storage + Stone Storage = 29,828.3 cf = 0.685 af
Overall Storage Efficiency = 62.2%
Overall System Size = 235.14' x 37.08' x 5.50'

160 Chambers
1,776.3 cy Field
1,119.2 cy Stone



Pond 12: BASIN 2



Summary for Pond 19: BASIN 1

Inflow Area = 1.570 ac, 50.32% Impervious, Inflow Depth = 2.08" for 2-Year event
Inflow = 2.96 cfs @ 12.17 hrs, Volume= 0.272 af
Outflow = 0.14 cfs @ 14.81 hrs, Volume= 0.269 af, Atten= 95%, Lag= 157.9 min
Primary = 0.14 cfs @ 14.81 hrs, Volume= 0.269 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 72.50' Surf.Area= 8,542 sf Storage= 1,708 cf
Peak Elev= 73.38' @ 14.81 hrs Surf.Area= 12,369 sf Storage= 9,241 cf (7,533 cf above start)

Plug-Flow detention time= 886.8 min calculated for 0.230 af (84% of inflow)
Center-of-Mass det. time= 687.9 min (1,477.7 - 789.8)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	13,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	72.00'	7,549 cf	**58.50'W x 146.02'L x 3.50'H Field A** 29,897 cf Overall - 11,026 cf Embedded = 18,871 cf x 40.0% Voids
#3A	72.50'	11,026 cf	**ADS_StormTech SC-740 +Cap** x 240 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 240 Chambers in 12 Rows
		32,376 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.50	0	0	0
73.00	1,451	363	363
74.00	7,756	4,604	4,966
75.00	9,915	8,836	13,802

Device	Routing	Invert	Outlet Devices
#1	Primary	72.50'	**15.0" Round RCP_Round 15"** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 72.50' / 72.20' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	72.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.55'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.14 cfs @ 14.81 hrs HW=73.38' (Free Discharge)
└**1=RCP_Round 15"** (Passes 0.14 cfs of 2.25 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.14 cfs @ 4.23 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 19: BASIN 1 - Chamber Wizard Field A

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

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

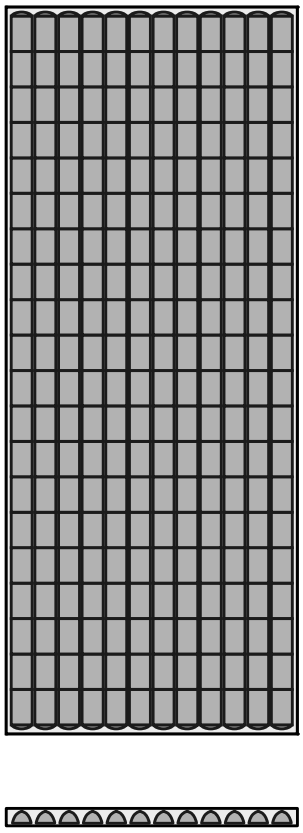
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
12 Rows x 51.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 58.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

240 Chambers x 45.9 cf = 11,025.6 cf Chamber Storage

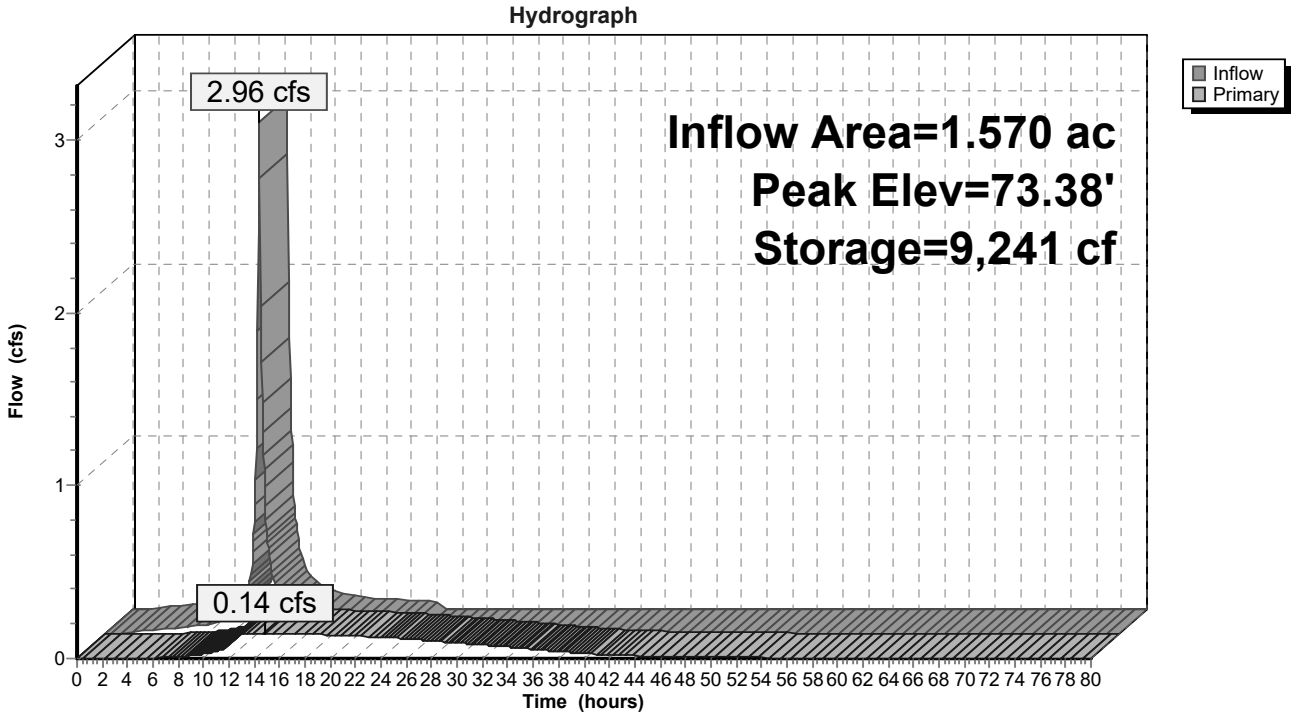
29,896.9 cf Field - 11,025.6 cf Chambers = 18,871.3 cf Stone x 40.0% Voids = 7,548.5 cf Stone Storage

Chamber Storage + Stone Storage = 18,574.1 cf = 0.426 af
Overall Storage Efficiency = 62.1%
Overall System Size = 146.02' x 58.50' x 3.50'

240 Chambers
1,107.3 cy Field
698.9 cy Stone



Pond 19: BASIN 1

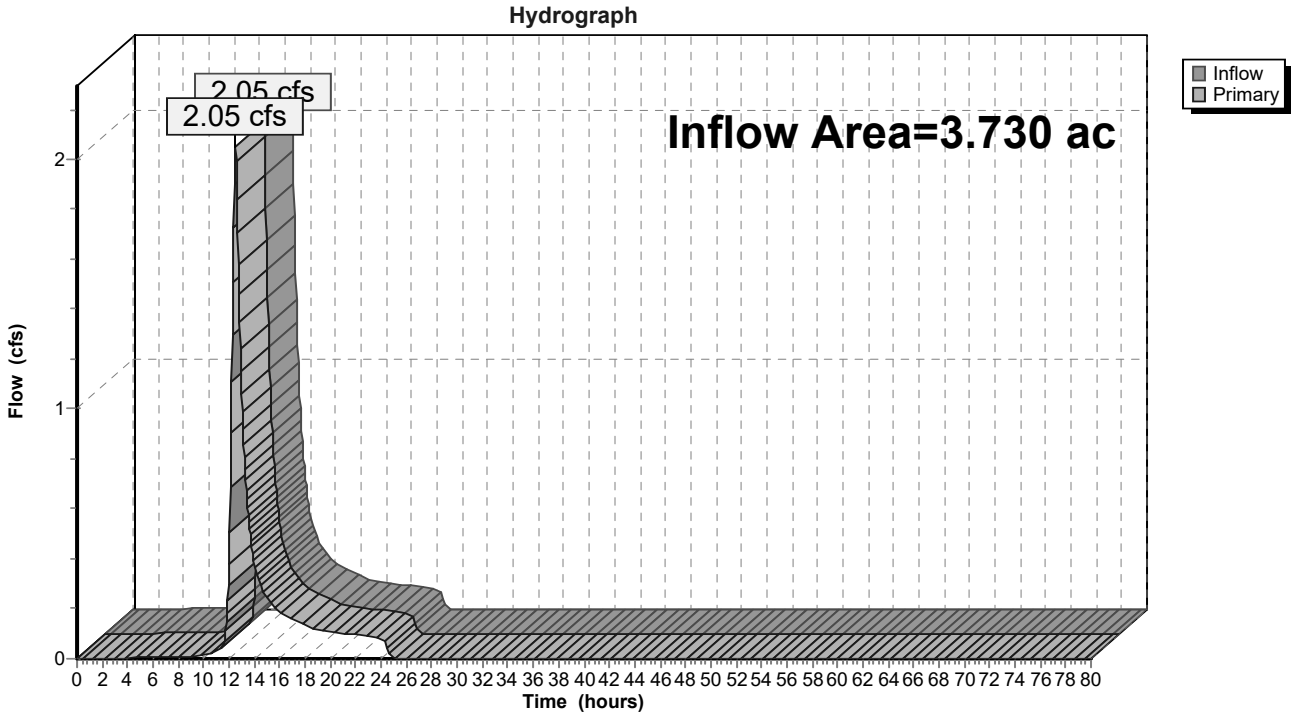


Summary for Link 3: Ex On-Site

Inflow Area = 3.730 ac, 3.22% Impervious, Inflow Depth = 0.98" for 2-Year event
Inflow = 2.05 cfs @ 12.51 hrs, Volume= 0.305 af
Primary = 2.05 cfs @ 12.51 hrs, Volume= 0.305 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 3: Ex On-Site

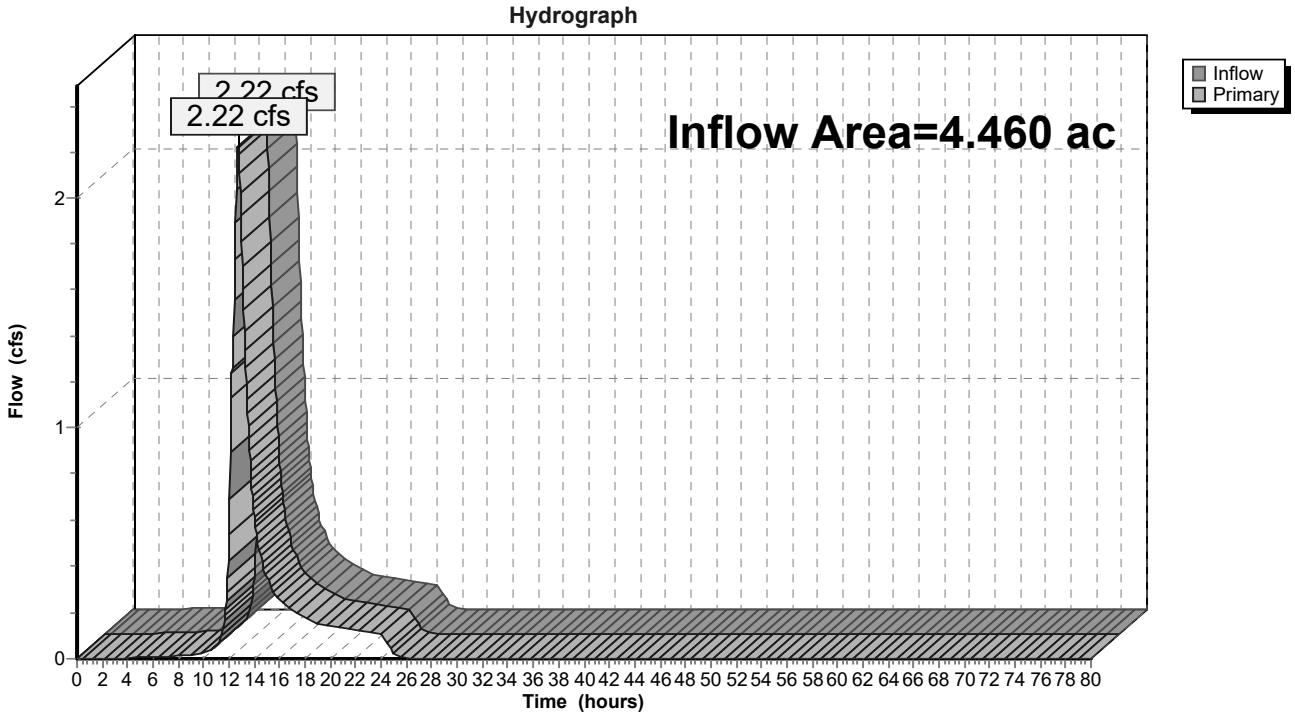


Summary for Link 6: Offsite Total

Inflow Area = 4.460 ac, 0.00% Impervious, Inflow Depth = 1.13" for 2-Year event
Inflow = 2.22 cfs @ 12.71 hrs, Volume= 0.419 af
Primary = 2.22 cfs @ 12.71 hrs, Volume= 0.419 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 6: Offsite Total

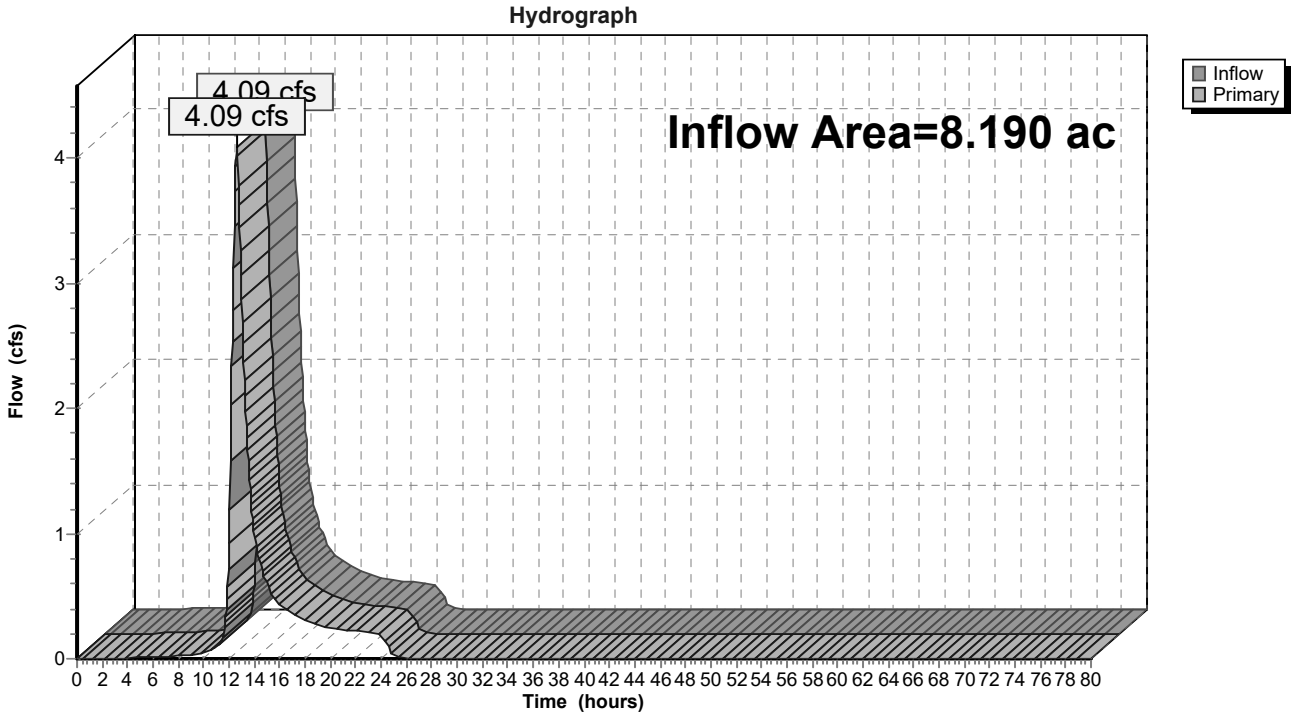


Summary for Link 7: EX AP

Inflow Area = 8.190 ac, 1.47% Impervious, Inflow Depth = 1.06" for 2-Year event
Inflow = 4.09 cfs @ 12.59 hrs, Volume= 0.724 af
Primary = 4.09 cfs @ 12.59 hrs, Volume= 0.724 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 7: EX AP

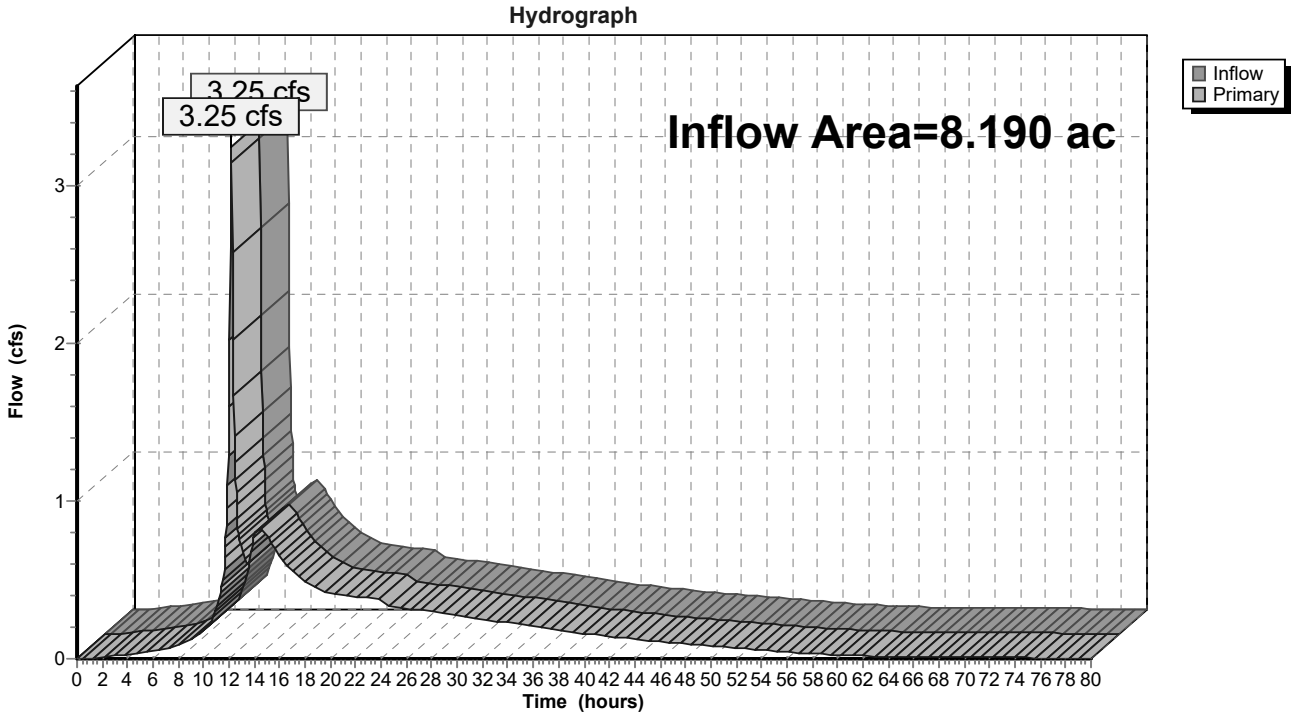


Summary for Link 20: PROP AP

Inflow Area = 8.190 ac, 32.60% Impervious, Inflow Depth > 1.76" for 2-Year event
Inflow = 3.25 cfs @ 12.17 hrs, Volume= 1.199 af
Primary = 3.25 cfs @ 12.17 hrs, Volume= 1.199 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 20: PROP AP



Summary for Subcatchment 1: EX. DA 1 IMP

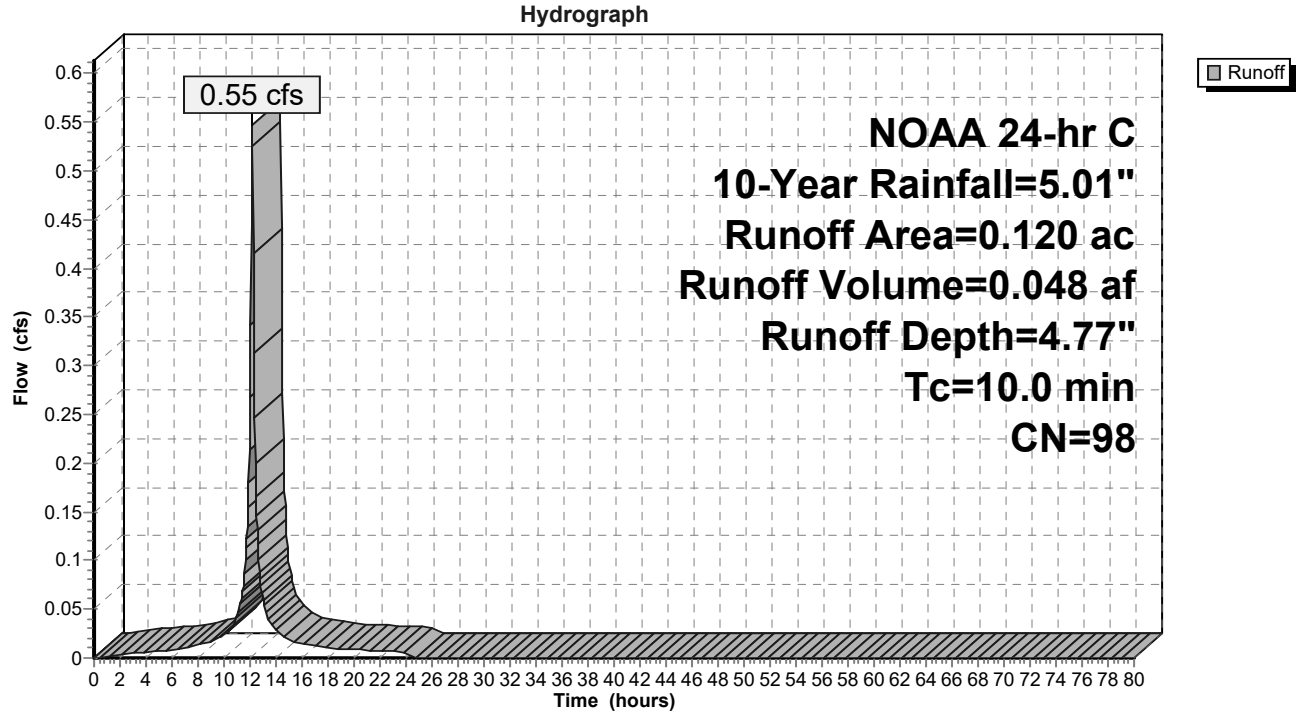
Runoff = 0.55 cfs @ 12.17 hrs, Volume= 0.048 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120		100.00% Impervious Area

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

Subcatchment 1: EX. DA 1 IMP



Summary for Subcatchment 2: EX. DA 1 PER

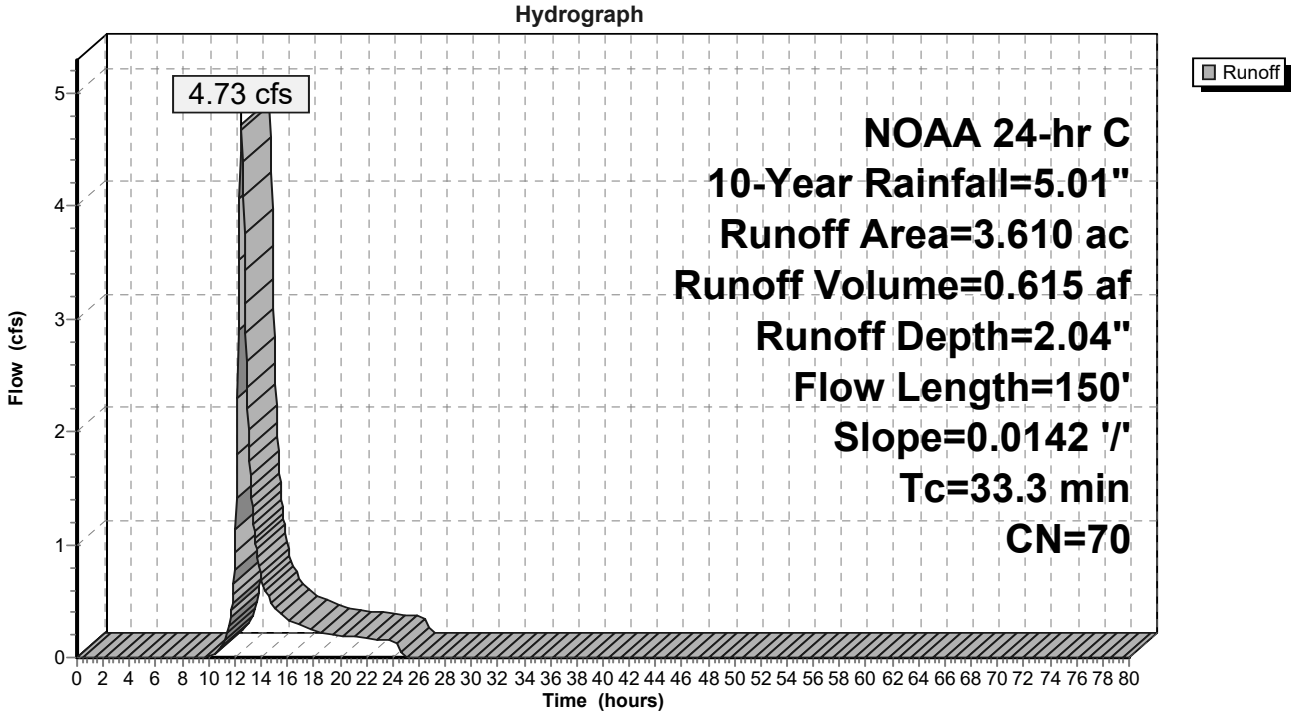
Runoff = 4.73 cfs @ 12.49 hrs, Volume= 0.615 af, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
3.610	70	Woods, Good, HSG C
3.610		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	150	0.0142	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Subcatchment 2: EX. DA 1 PER



Summary for Subcatchment 4: OFF-SITE DA IMP

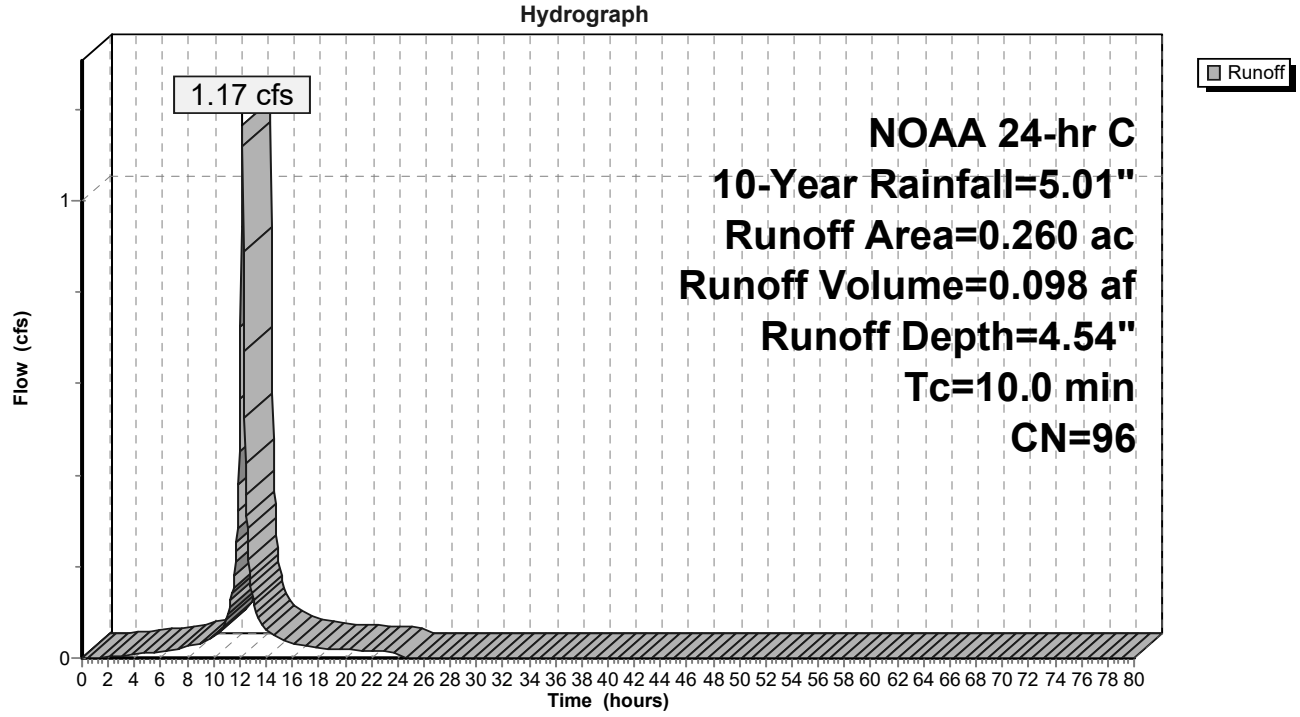
Runoff = 1.17 cfs @ 12.17 hrs, Volume= 0.098 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 4: OFF-SITE DA IMP



Summary for Subcatchment 5: OFF-SITE DA PERV

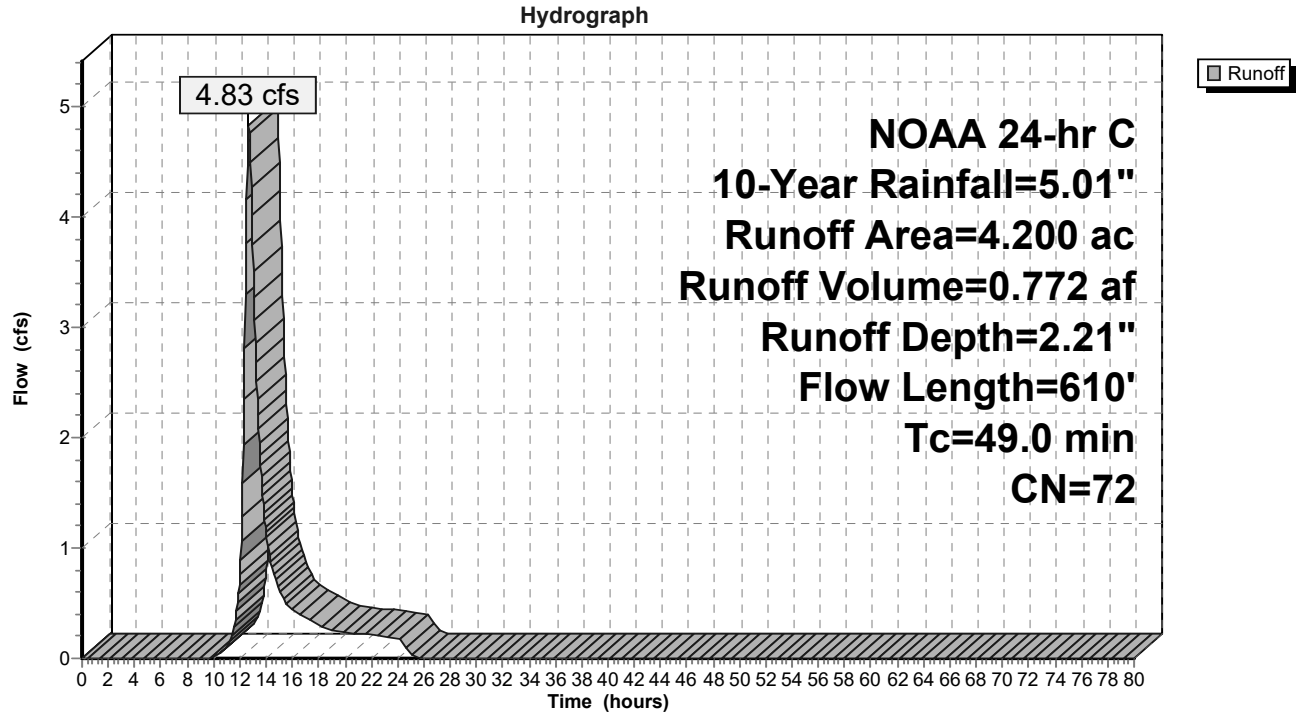
Runoff = 4.83 cfs @ 12.69 hrs, Volume= 0.772 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
2.160	70	Woods, Good, HSG C
2.040	74	>75% Grass cover, Good, HSG C
4.200	72	Weighted Average
4.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 5: OFF-SITE DA PERV



Summary for Subcatchment 8: PROP. DA 2 IMP

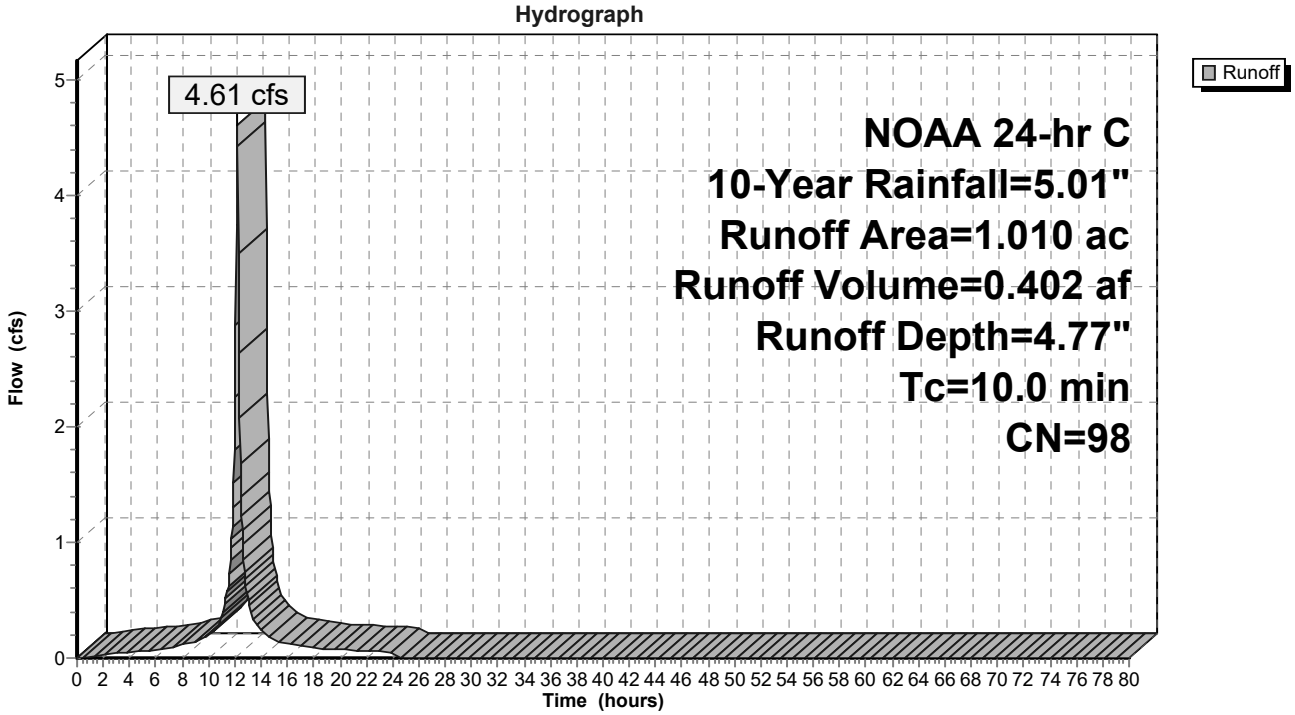
Runoff = 4.61 cfs @ 12.17 hrs, Volume= 0.402 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
*	0.970	98	Impervious
*	0.040	98	1/2 Basin Impervious
	1.010	98	Weighted Average
	1.010		100.00% Impervious Area

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

Subcatchment 8: PROP. DA 2 IMP



Summary for Subcatchment 9: PROP. DA 2 PER

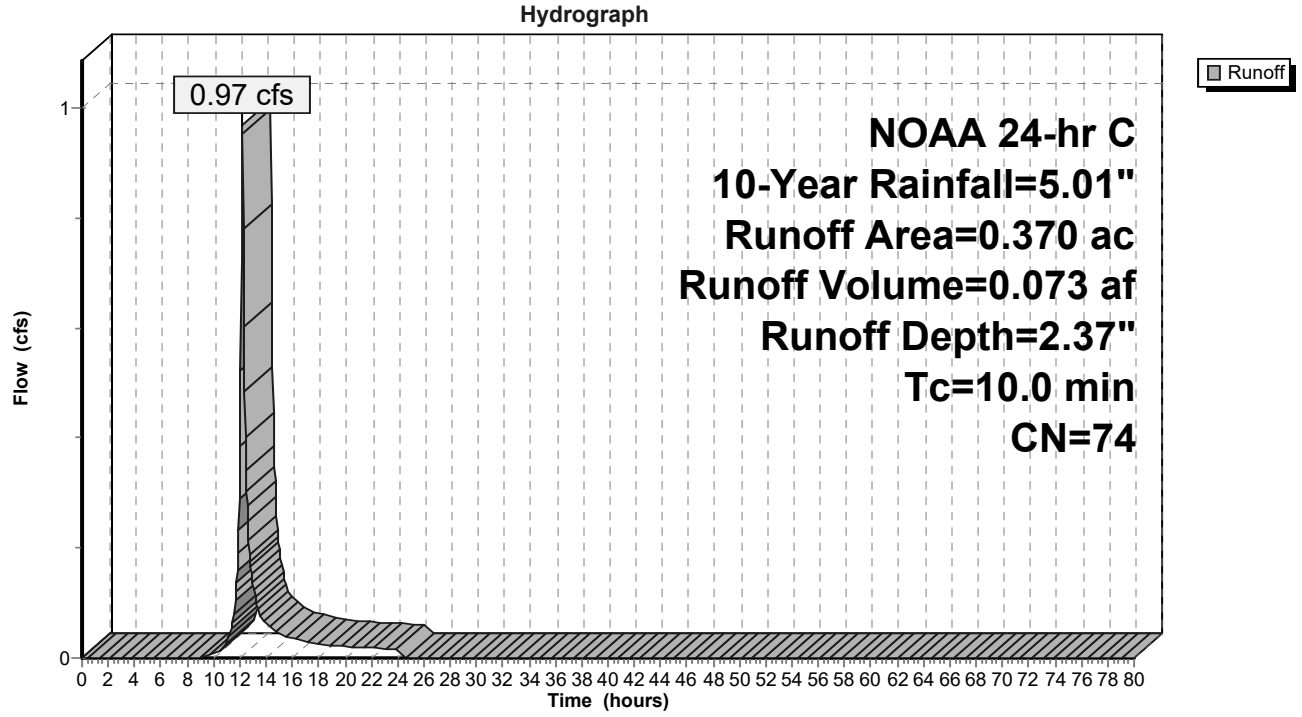
Runoff = 0.97 cfs @ 12.18 hrs, Volume= 0.073 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
	0.330	74	>75% Grass cover, Good, HSG C
*	0.040	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 9: PROP. DA 2 PER



Summary for Subcatchment 10: OFF-SITE DA PERV

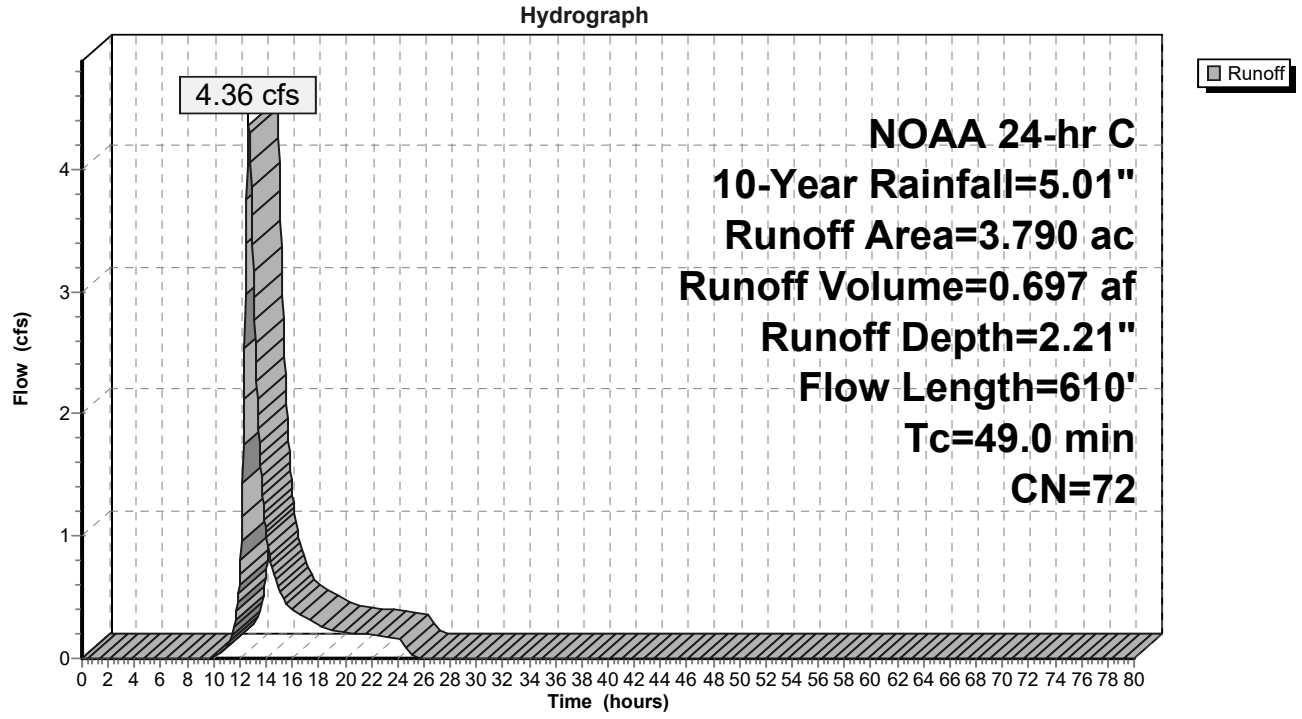
Runoff = 4.36 cfs @ 12.69 hrs, Volume= 0.697 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
1.890	70	Woods, Good, HSG C
1.900	74	>75% Grass cover, Good, HSG C
3.790	72	Weighted Average
3.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 10: OFF-SITE DA PERV



Summary for Subcatchment 11: OFF-SITE DA IMP

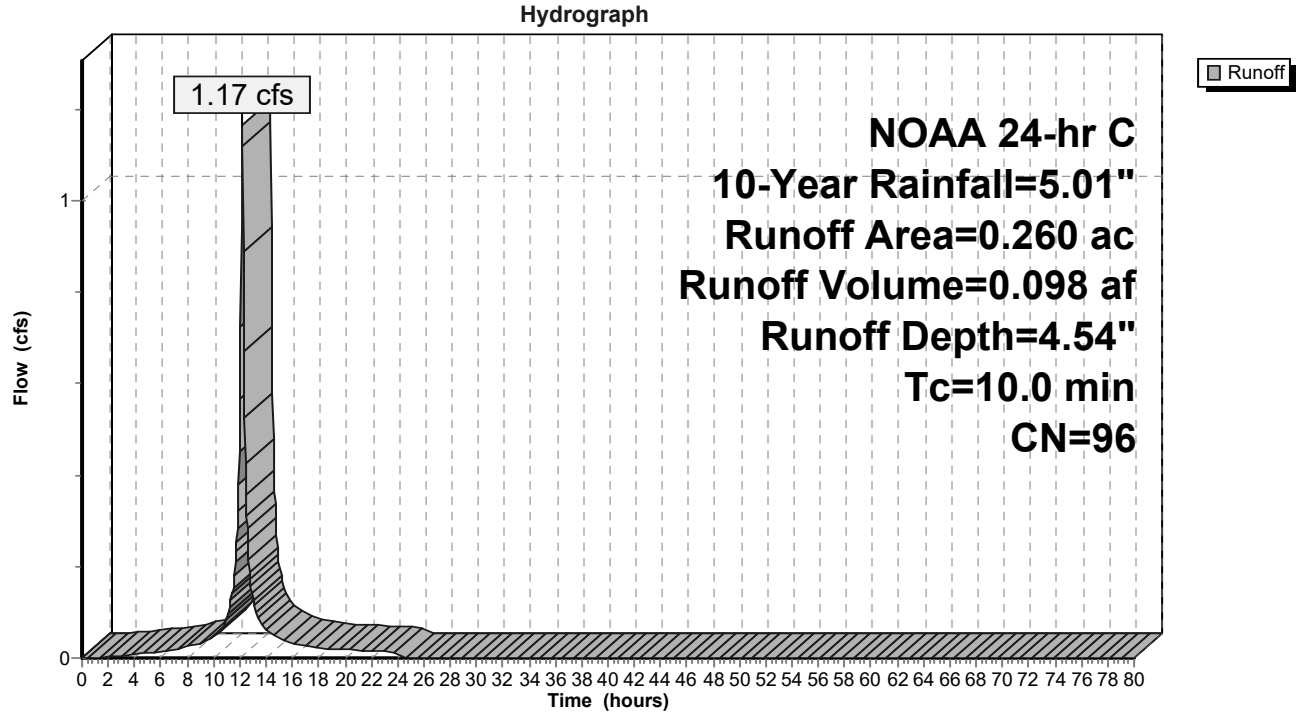
Runoff = 1.17 cfs @ 12.17 hrs, Volume= 0.098 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 11: OFF-SITE DA IMP



Summary for Subcatchment 13: UC DA (ON-SITE) IMP

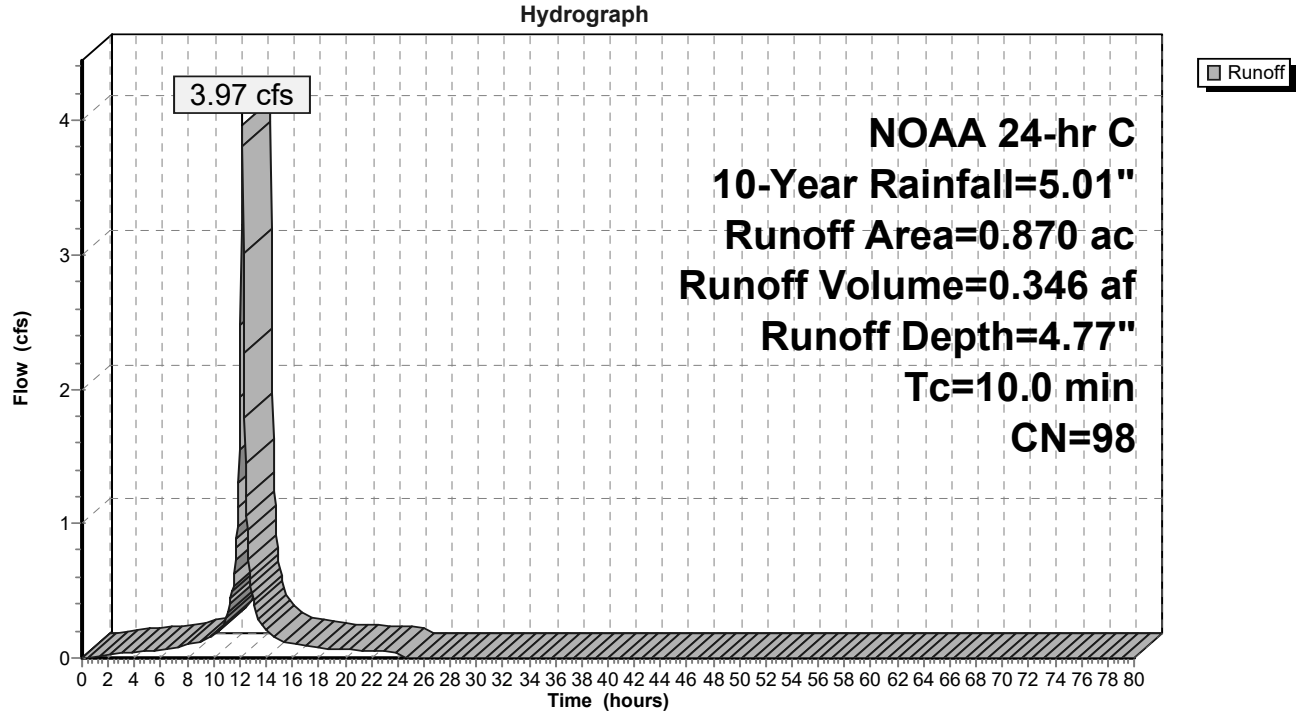
Runoff = 3.97 cfs @ 12.17 hrs, Volume= 0.346 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
*	0.870	98	Impervious
	0.870		100.00% Impervious Area

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

Subcatchment 13: UC DA (ON-SITE) IMP



Summary for Subcatchment 14: UC DA (ON-SITE) PER

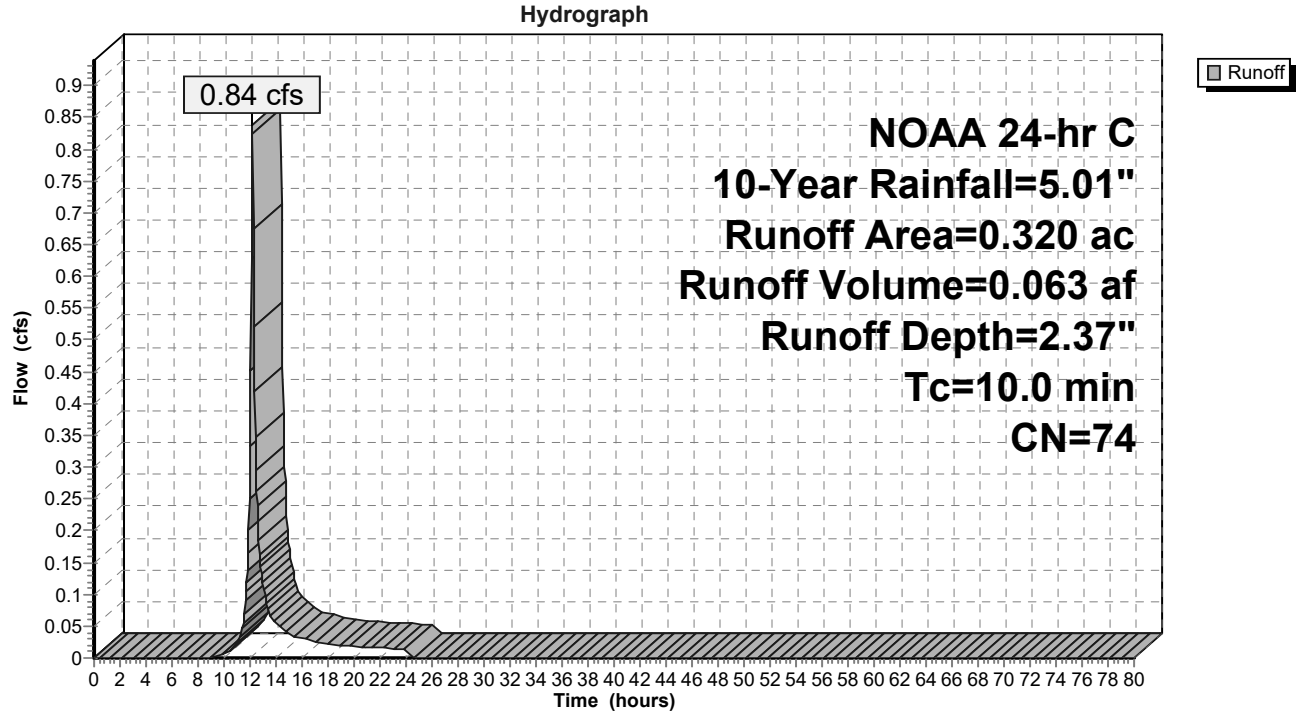
Runoff = 0.84 cfs @ 12.18 hrs, Volume= 0.063 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 14: UC DA (ON-SITE) PER



Summary for Subcatchment 15: PROP. DA 1 IMP

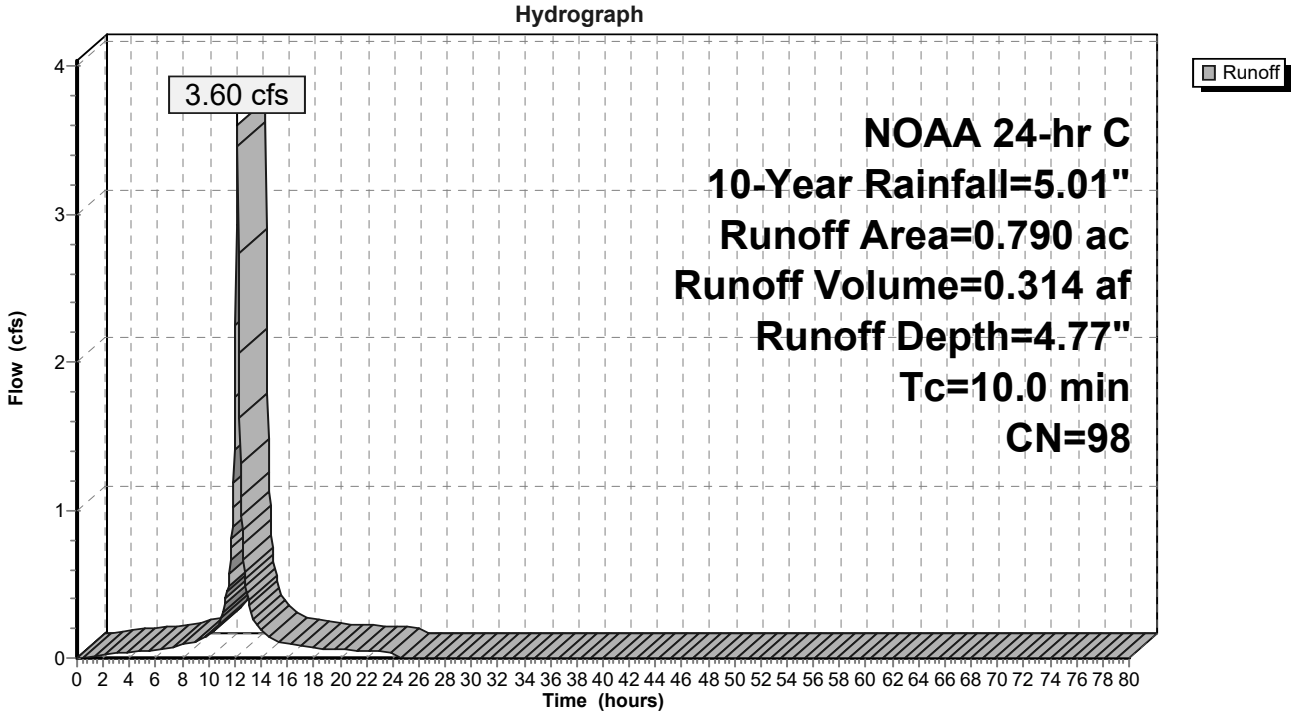
Runoff = 3.60 cfs @ 12.17 hrs, Volume= 0.314 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
*	0.670	98	Impervious
*	0.120	98	1/2 Basin Impervious
	0.790	98	Weighted Average
	0.790		100.00% Impervious Area

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

Subcatchment 15: PROP. DA 1 IMP



Summary for Subcatchment 16: PROP. DA 1 PER

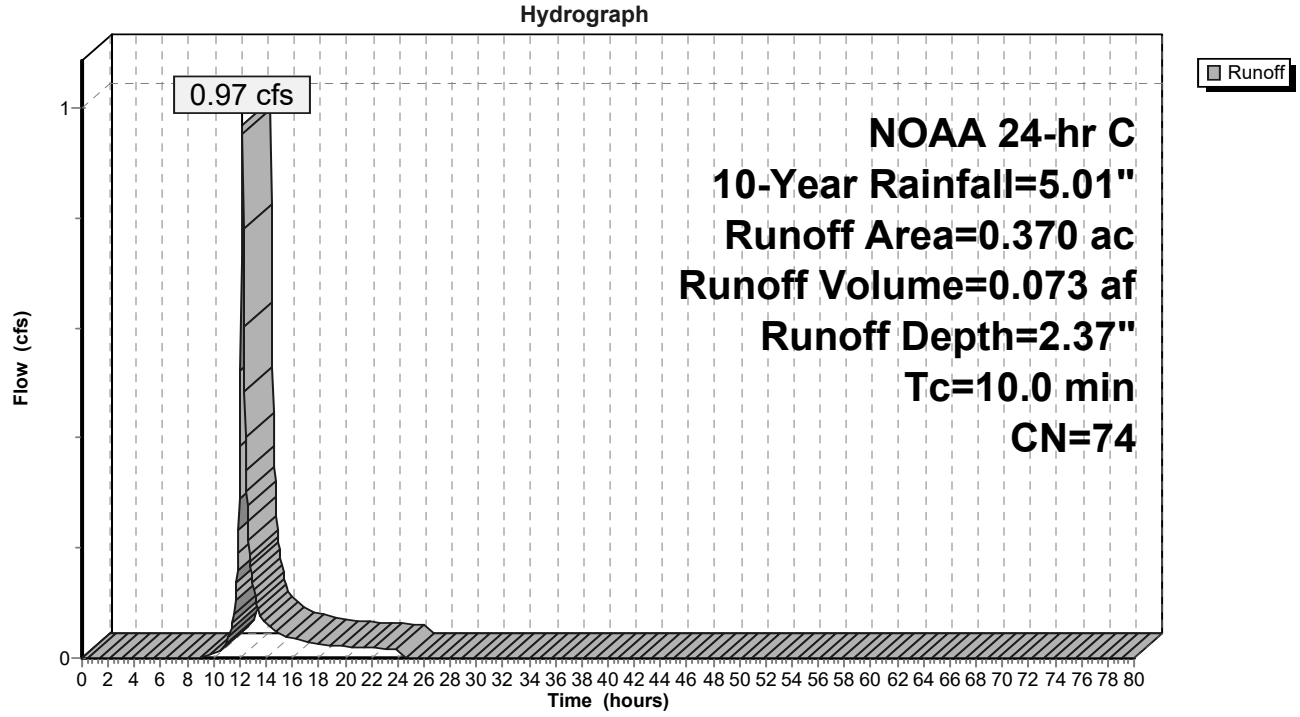
Runoff = 0.97 cfs @ 12.18 hrs, Volume= 0.073 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

	Area (ac)	CN	Description
	0.250	74	>75% Grass cover, Good, HSG C
*	0.120	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 16: PROP. DA 1 PER



Summary for Subcatchment 17: OFF-SITE 1 PER DA

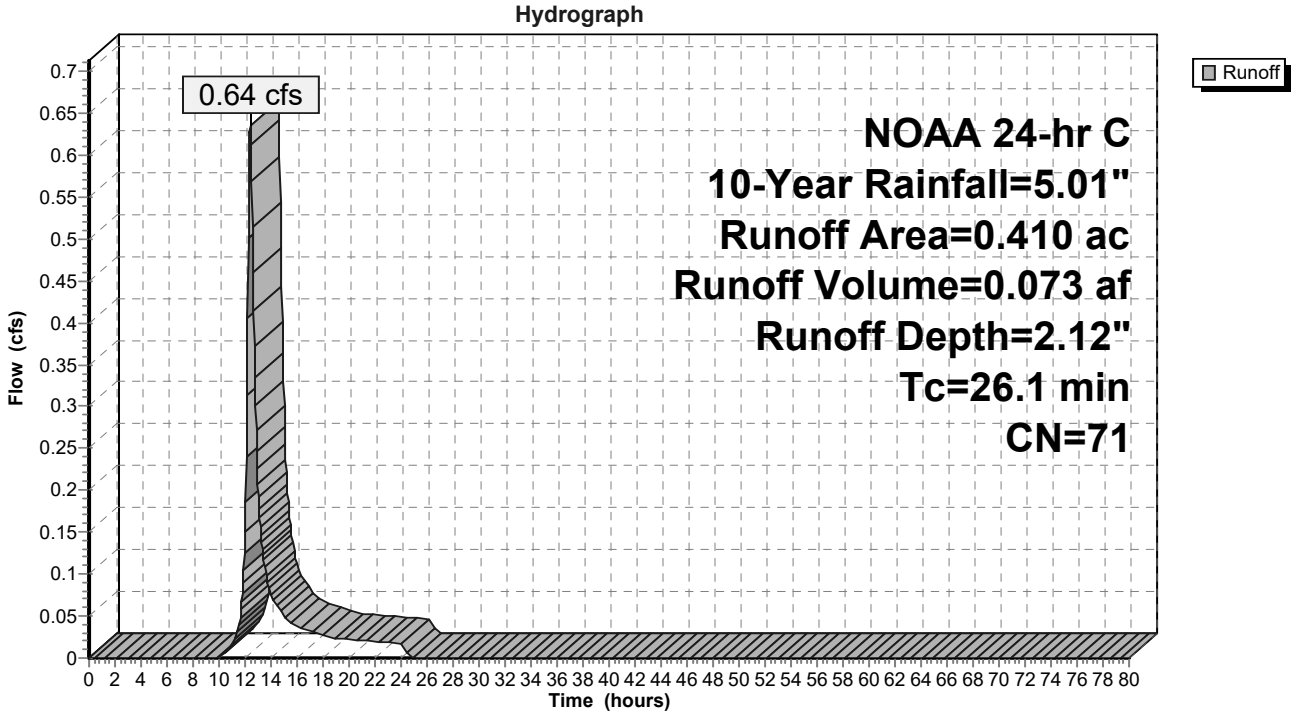
Runoff = 0.64 cfs @ 12.39 hrs, Volume= 0.073 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.270	70	Woods, Good, HSG C
0.140	74	>75% Grass cover, Good, HSG C
0.410	71	Weighted Average
0.410		100.00% Pervious Area

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

Subcatchment 17: OFF-SITE 1 PER DA



Summary for Pond 12: BASIN 2

Inflow Area = 5.430 ac, 18.60% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 8.01 cfs @ 12.18 hrs, Volume= 1.270 af
Outflow = 4.09 cfs @ 13.02 hrs, Volume= 1.264 af, Atten= 49%, Lag= 50.2 min
Primary = 4.09 cfs @ 13.02 hrs, Volume= 1.264 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 71.50' Surf.Area= 8,720 sf Storage= 2,616 cf
Peak Elev= 74.11' @ 13.02 hrs Surf.Area= 11,294 sf Storage= 25,324 cf (22,708 cf above start)

Plug-Flow detention time= 579.0 min calculated for 1.203 af (95% of inflow)
Center-of-Mass det. time= 515.8 min (1,347.8 - 832.0)

Volume	Invert	Avail.Storage	Storage Description
#1	71.50'	7,051 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	70.75'	12,087 cf	**37.08'W x 235.14'L x 5.50'H Field A** 47,959 cf Overall - 17,741 cf Embedded = 30,217 cf x 40.0% Voids
#3A	71.50'	17,741 cf	**ADS_StormTech MC-3500 d +Cap** x 160 Inside #2 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 160 Chambers in 5 Rows Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		36,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	0	0	0
72.00	1,406	352	352
73.00	1,913	1,660	2,011
74.00	2,501	2,207	4,218
75.00	3,165	2,833	7,051

Device	Routing	Invert	Outlet Devices
#1	Primary	71.50'	**24.0" Round RCP_Round 24"** L= 220.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 71.50' / 70.20' S= 0.0059 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	71.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.40'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.08 cfs @ 13.02 hrs HW=74.11' (Free Discharge)
└**1=RCP_Round 24"** (Passes 4.08 cfs of 18.56 cfs potential flow)
└**2=Orifice** (Orifice Controls 0.26 cfs @ 7.62 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 3.82 cfs @ 2.69 fps)

Pond 12: BASIN 2 - 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

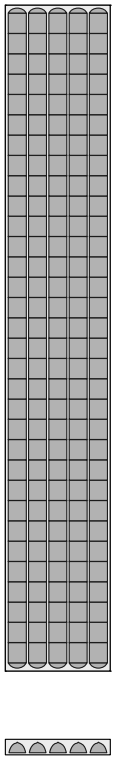
32 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 233.14' Row Length +12.0" End Stone x 2 = 235.14' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

160 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 17,741.3 cf Chamber Storage

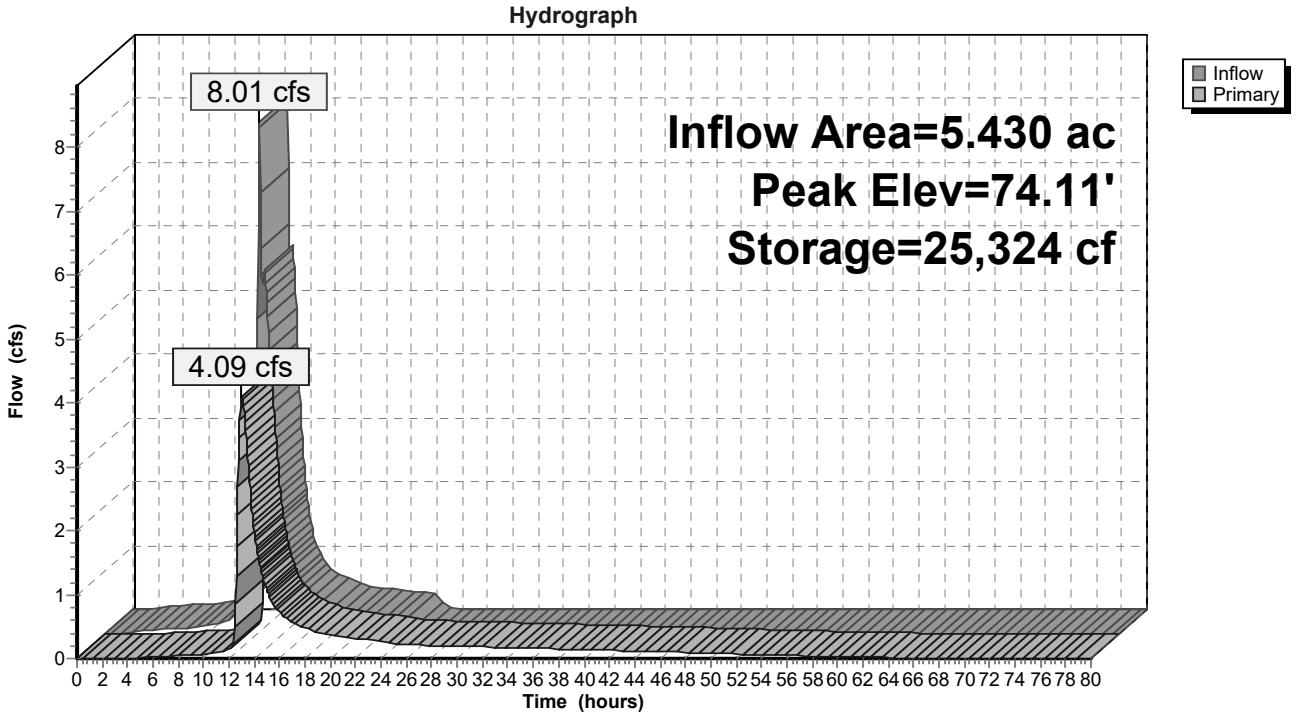
47,958.8 cf Field - 17,741.3 cf Chambers = 30,217.5 cf Stone x 40.0% Voids = 12,087.0 cf Stone Storage

Chamber Storage + Stone Storage = 29,828.3 cf = 0.685 af
Overall Storage Efficiency = 62.2%
Overall System Size = 235.14' x 37.08' x 5.50'

160 Chambers
1,776.3 cy Field
1,119.2 cy Stone



Pond 12: BASIN 2



Summary for Pond 19: BASIN 1

Inflow Area = 1.570 ac, 50.32% Impervious, Inflow Depth = 3.52" for 10-Year event
Inflow = 4.91 cfs @ 12.18 hrs, Volume= 0.460 af
Outflow = 0.58 cfs @ 13.21 hrs, Volume= 0.456 af, Atten= 88%, Lag= 61.9 min
Primary = 0.58 cfs @ 13.21 hrs, Volume= 0.456 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 72.50' Surf.Area= 8,542 sf Storage= 1,708 cf
Peak Elev= 73.72' @ 13.21 hrs Surf.Area= 14,563 sf Storage= 13,252 cf (11,543 cf above start)

Plug-Flow detention time= 764.7 min calculated for 0.417 af (91% of inflow)
Center-of-Mass det. time= 641.7 min (1,426.9 - 785.2)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	13,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	72.00'	7,549 cf	**58.50'W x 146.02'L x 3.50'H Field A** 29,897 cf Overall - 11,026 cf Embedded = 18,871 cf x 40.0% Voids
#3A	72.50'	11,026 cf	**ADS_StormTech SC-740 +Cap** x 240 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 240 Chambers in 12 Rows
		32,376 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.50	0	0	0
73.00	1,451	363	363
74.00	7,756	4,604	4,966
75.00	9,915	8,836	13,802

Device	Routing	Invert	Outlet Devices
#1	Primary	72.50'	**15.0" Round RCP_Round 15"** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 72.50' / 72.20' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	72.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.55'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.58 cfs @ 13.21 hrs HW=73.72' (Free Discharge)
└**1=RCP_Round 15"** (Passes 0.58 cfs of 3.75 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.17 cfs @ 5.10 fps)
  └**3=Broad-Crested Rectangular Weir** (Weir Controls 0.41 cfs @ 1.17 fps)

Pond 19: BASIN 1 - Chamber Wizard Field A

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

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

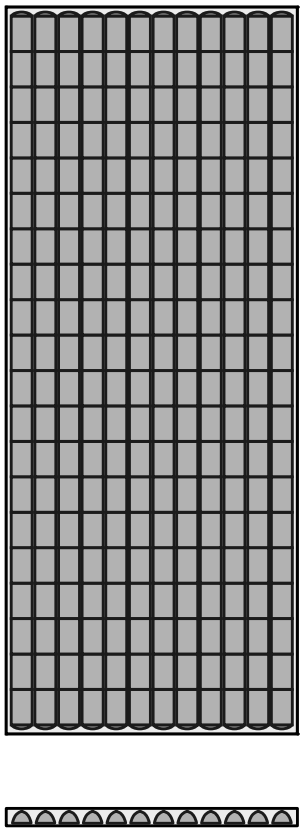
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
12 Rows x 51.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 58.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

240 Chambers x 45.9 cf = 11,025.6 cf Chamber Storage

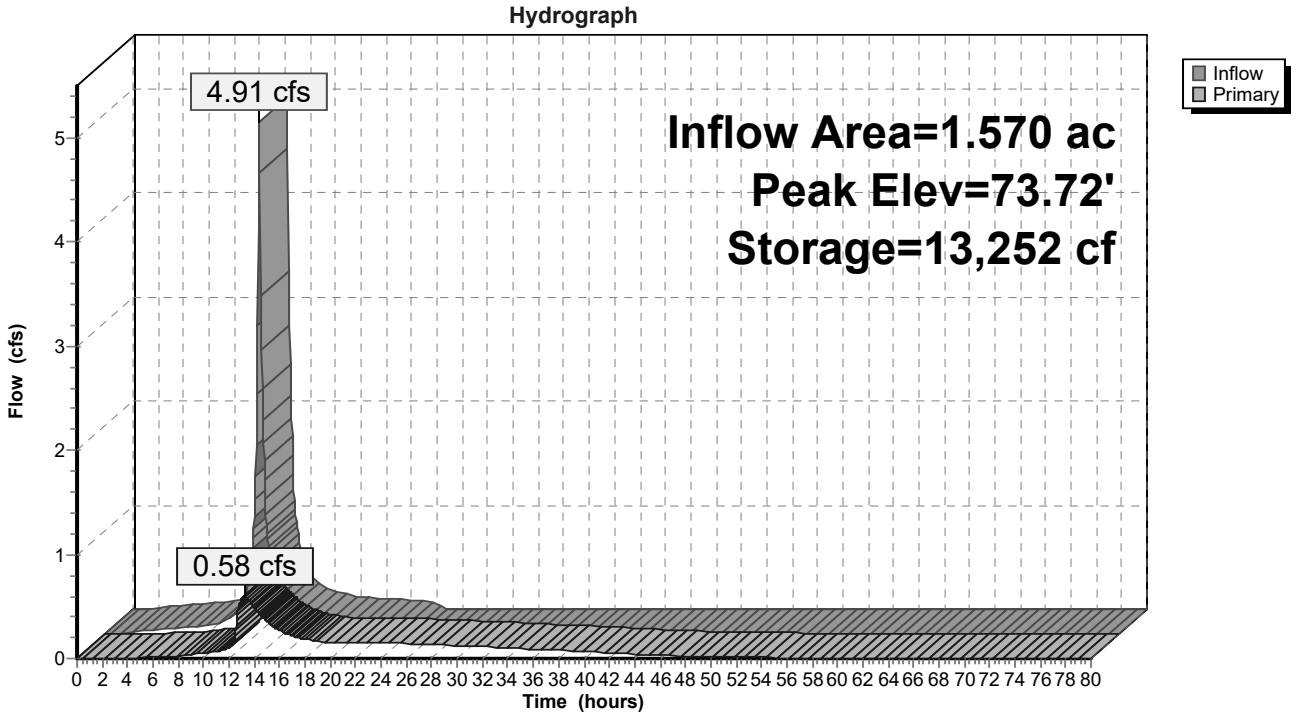
29,896.9 cf Field - 11,025.6 cf Chambers = 18,871.3 cf Stone x 40.0% Voids = 7,548.5 cf Stone Storage

Chamber Storage + Stone Storage = 18,574.1 cf = 0.426 af
Overall Storage Efficiency = 62.1%
Overall System Size = 146.02' x 58.50' x 3.50'

240 Chambers
1,107.3 cy Field
698.9 cy Stone



Pond 19: BASIN 1

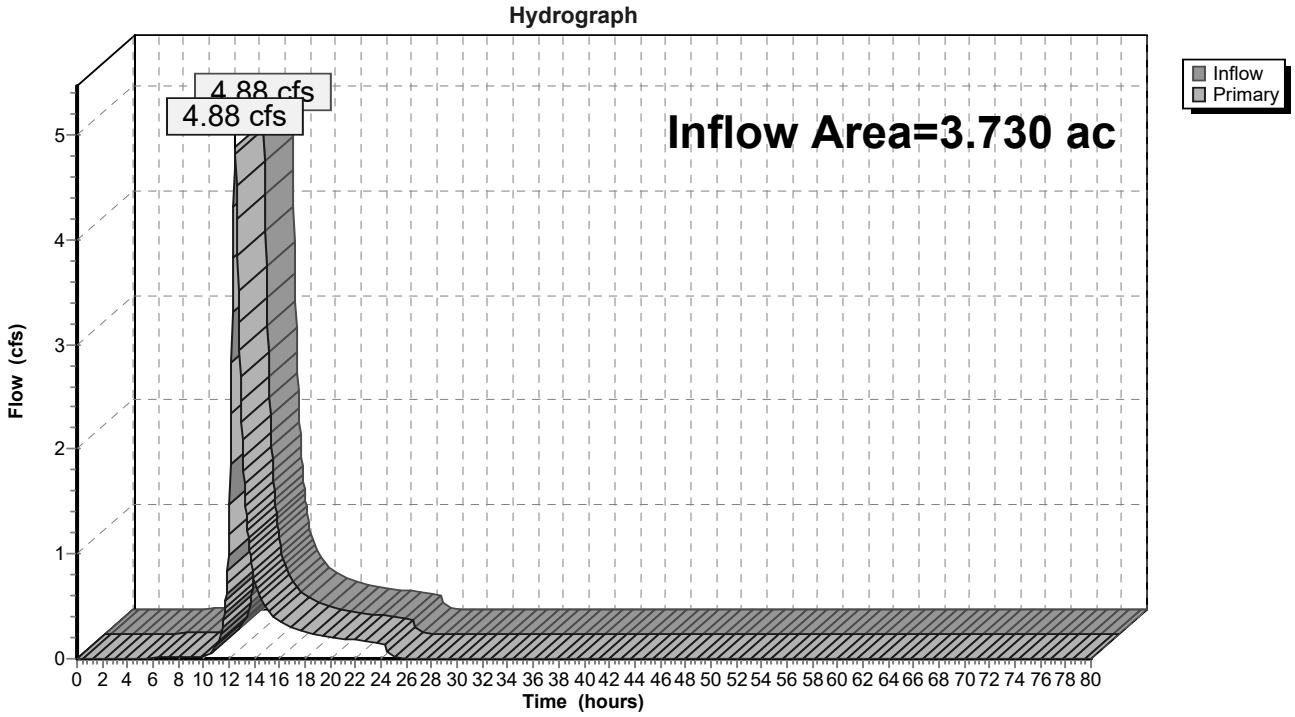


Summary for Link 3: Ex On-Site

Inflow Area = 3.730 ac, 3.22% Impervious, Inflow Depth = 2.13" for 10-Year event
Inflow = 4.88 cfs @ 12.48 hrs, Volume= 0.663 af
Primary = 4.88 cfs @ 12.48 hrs, Volume= 0.663 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 3: Ex On-Site

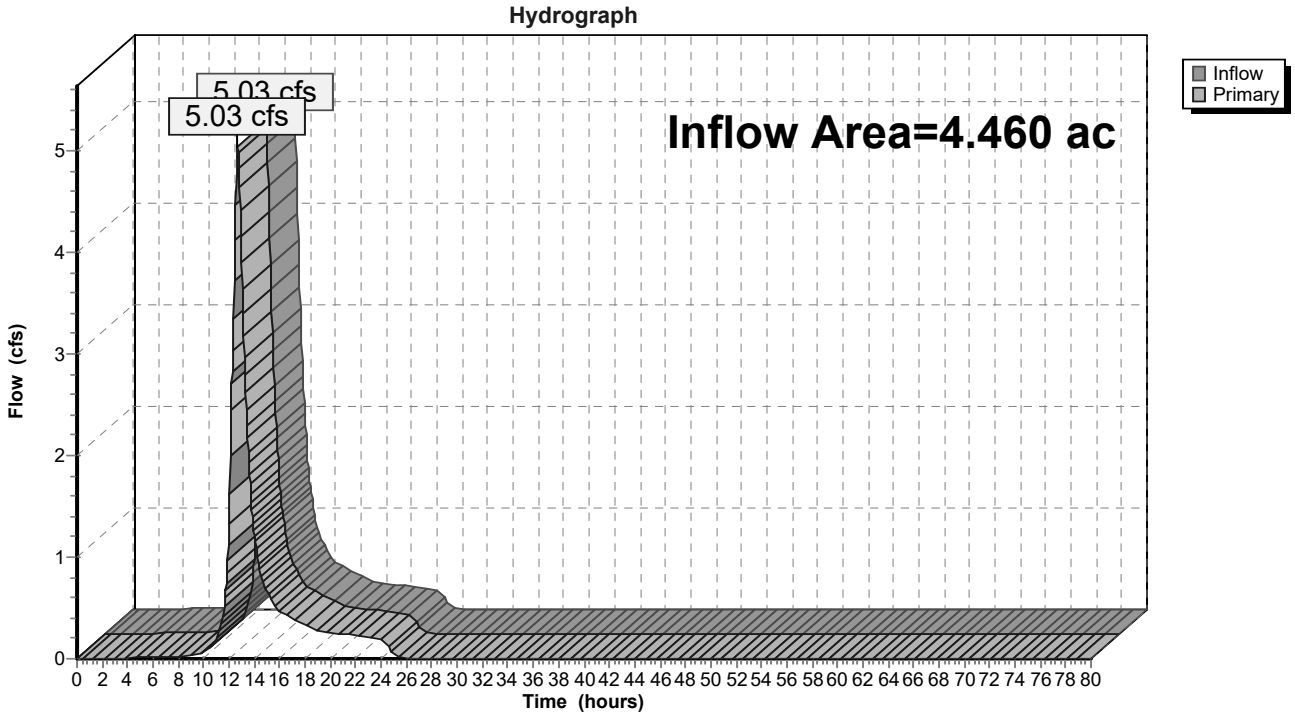


Summary for Link 6: Offsite Total

Inflow Area = 4.460 ac, 0.00% Impervious, Inflow Depth = 2.34" for 10-Year event
Inflow = 5.03 cfs @ 12.68 hrs, Volume= 0.870 af
Primary = 5.03 cfs @ 12.68 hrs, Volume= 0.870 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 6: Offsite Total

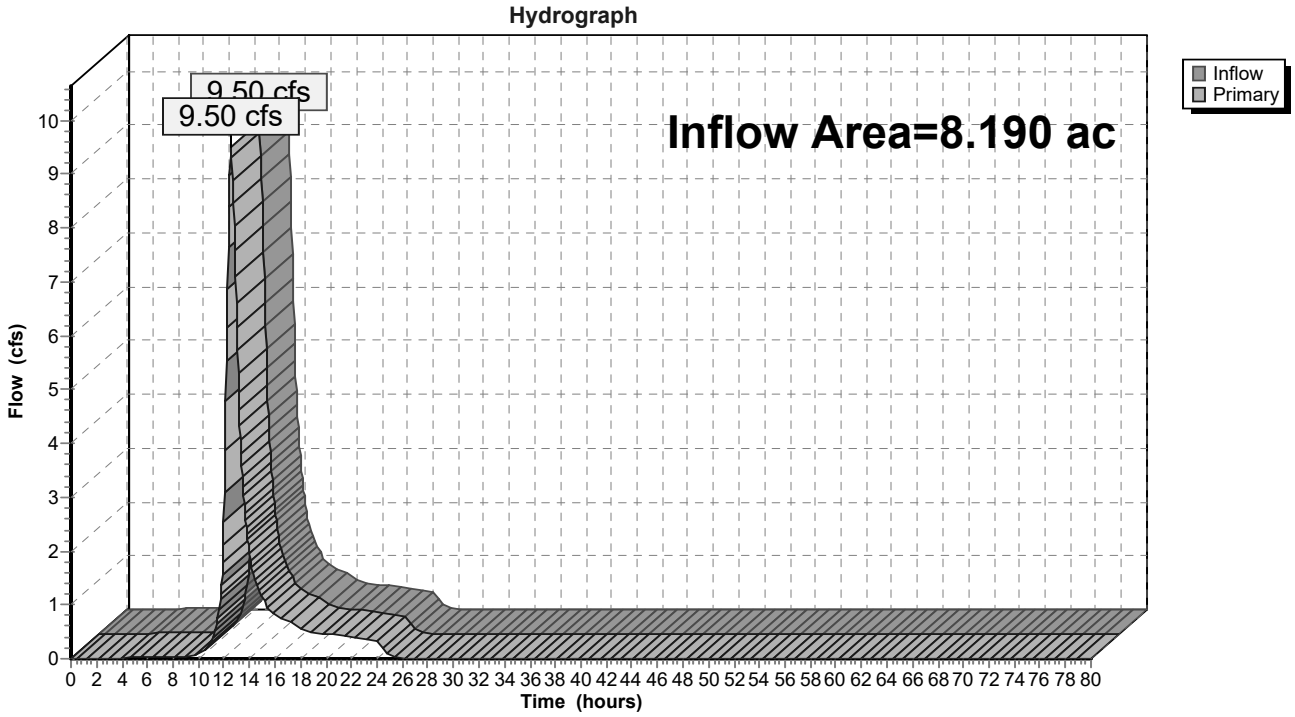


Summary for Link 7: EX AP

Inflow Area = 8.190 ac, 1.47% Impervious, Inflow Depth = 2.25" for 10-Year event
Inflow = 9.50 cfs @ 12.56 hrs, Volume= 1.533 af
Primary = 9.50 cfs @ 12.56 hrs, Volume= 1.533 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 7: EX AP

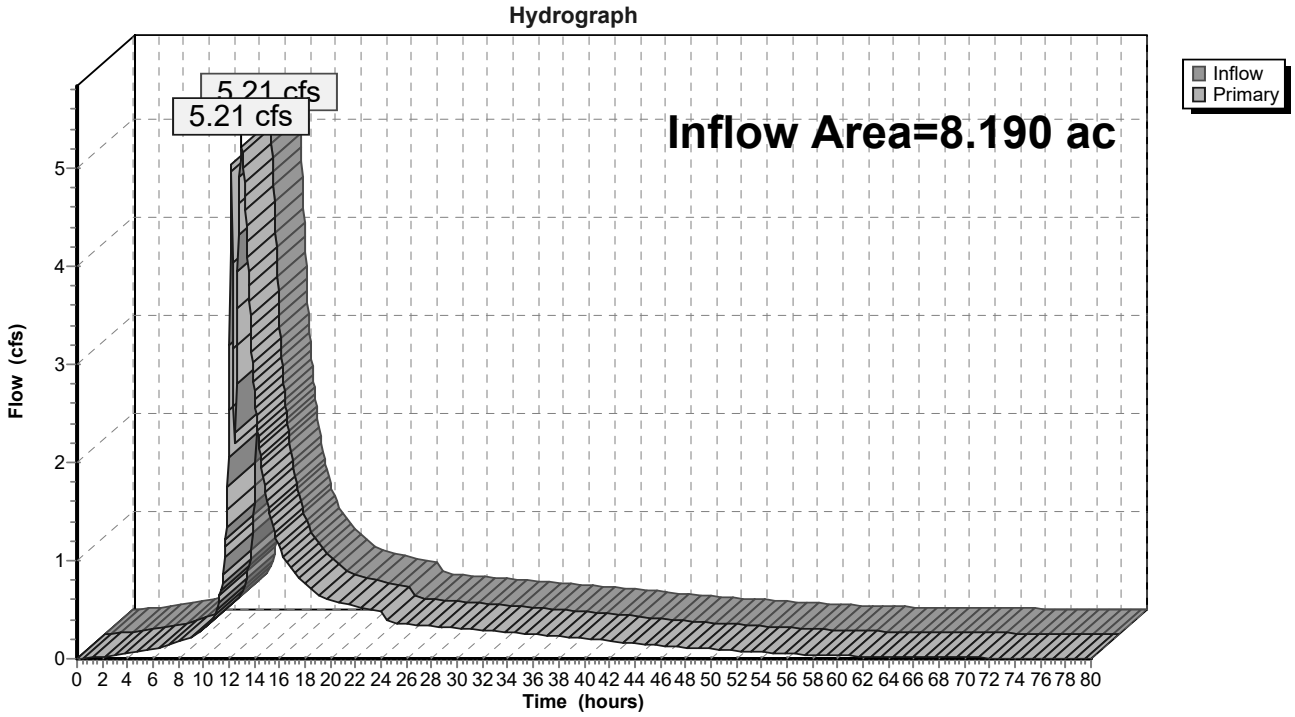


Summary for Link 20: PROP AP

Inflow Area = 8.190 ac, 32.60% Impervious, Inflow Depth > 3.12" for 10-Year event
Inflow = 5.21 cfs @ 13.00 hrs, Volume= 2.129 af
Primary = 5.21 cfs @ 13.00 hrs, Volume= 2.129 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 20: PROP AP



Summary for Subcatchment 1: EX. DA 1 IMP

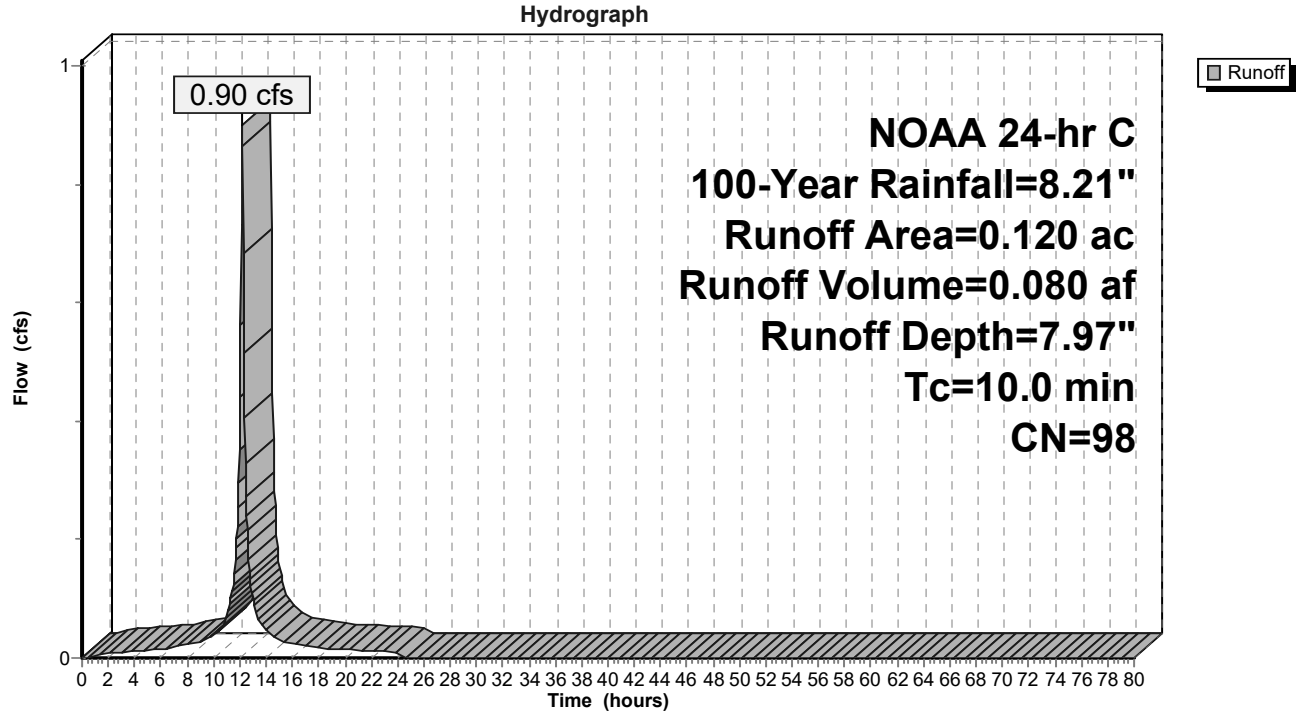
Runoff = 0.90 cfs @ 12.17 hrs, Volume= 0.080 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120		100.00% Impervious Area

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

Subcatchment 1: EX. DA 1 IMP



Summary for Subcatchment 2: EX. DA 1 PER

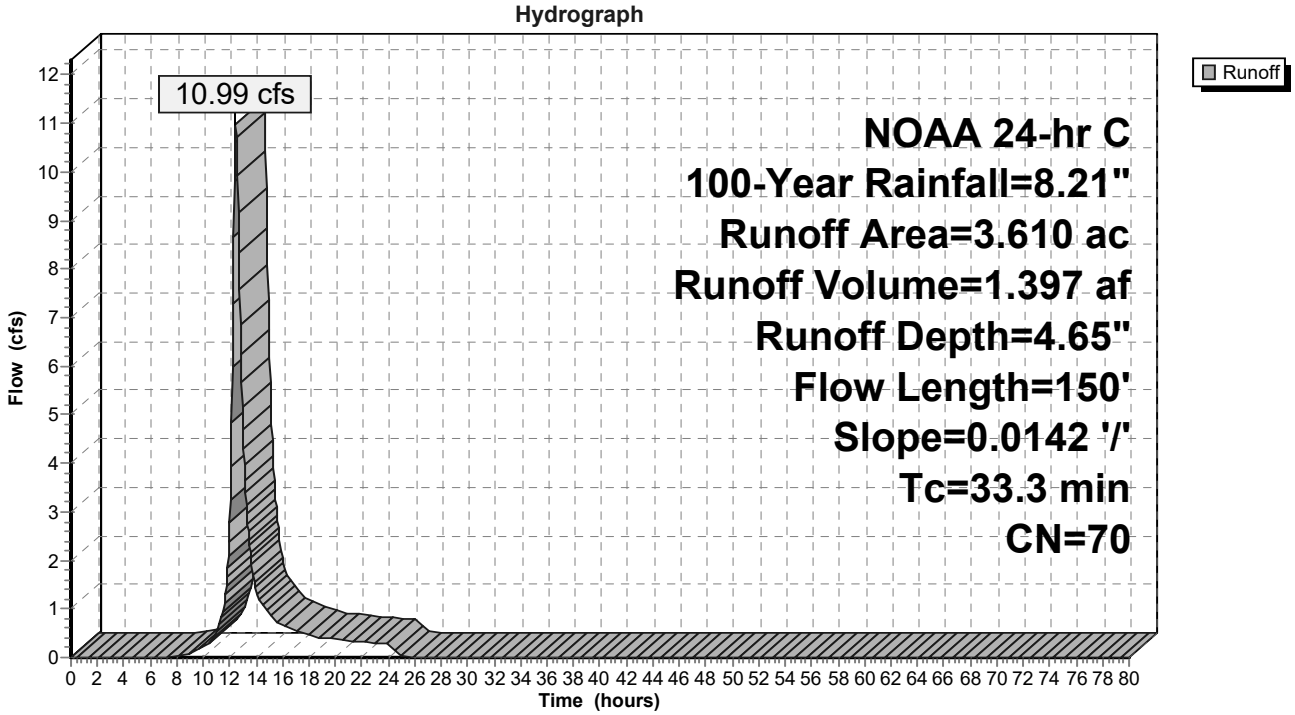
Runoff = 10.99 cfs @ 12.47 hrs, Volume= 1.397 af, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
3.610	70	Woods, Good, HSG C
3.610		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	150	0.0142	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Subcatchment 2: EX. DA 1 PER



Summary for Subcatchment 4: OFF-SITE DA IMP

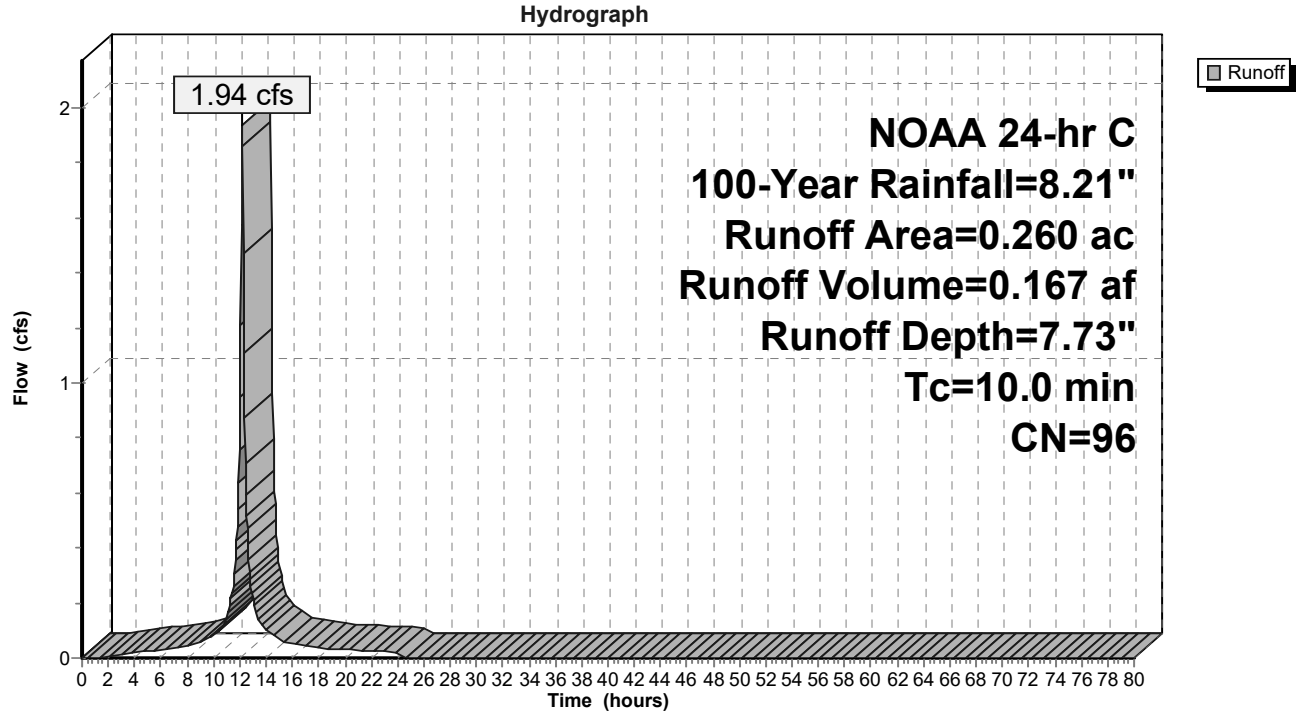
Runoff = 1.94 cfs @ 12.17 hrs, Volume= 0.167 af, Depth= 7.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 4: OFF-SITE DA IMP



Summary for Subcatchment 5: OFF-SITE DA PERV

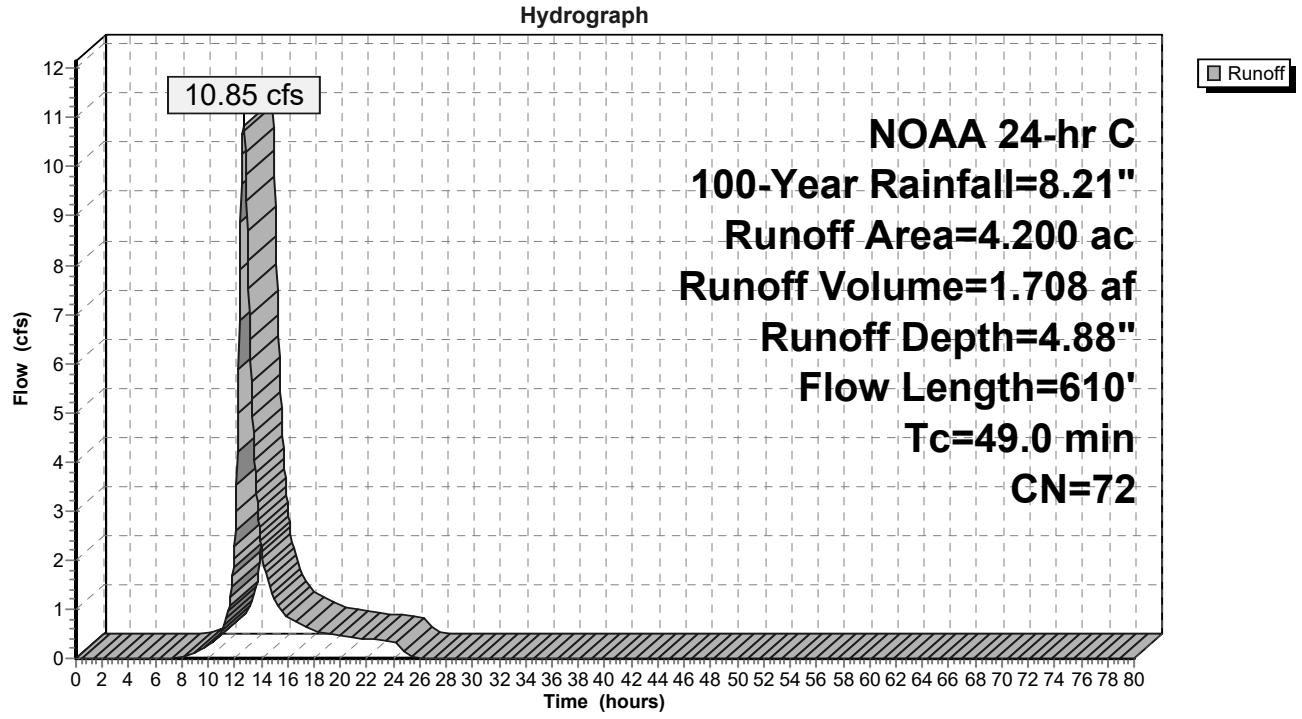
Runoff = 10.85 cfs @ 12.67 hrs, Volume= 1.708 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
2.160	70	Woods, Good, HSG C
2.040	74	>75% Grass cover, Good, HSG C
4.200	72	Weighted Average
4.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 5: OFF-SITE DA PERV



Summary for Subcatchment 8: PROP. DA 2 IMP

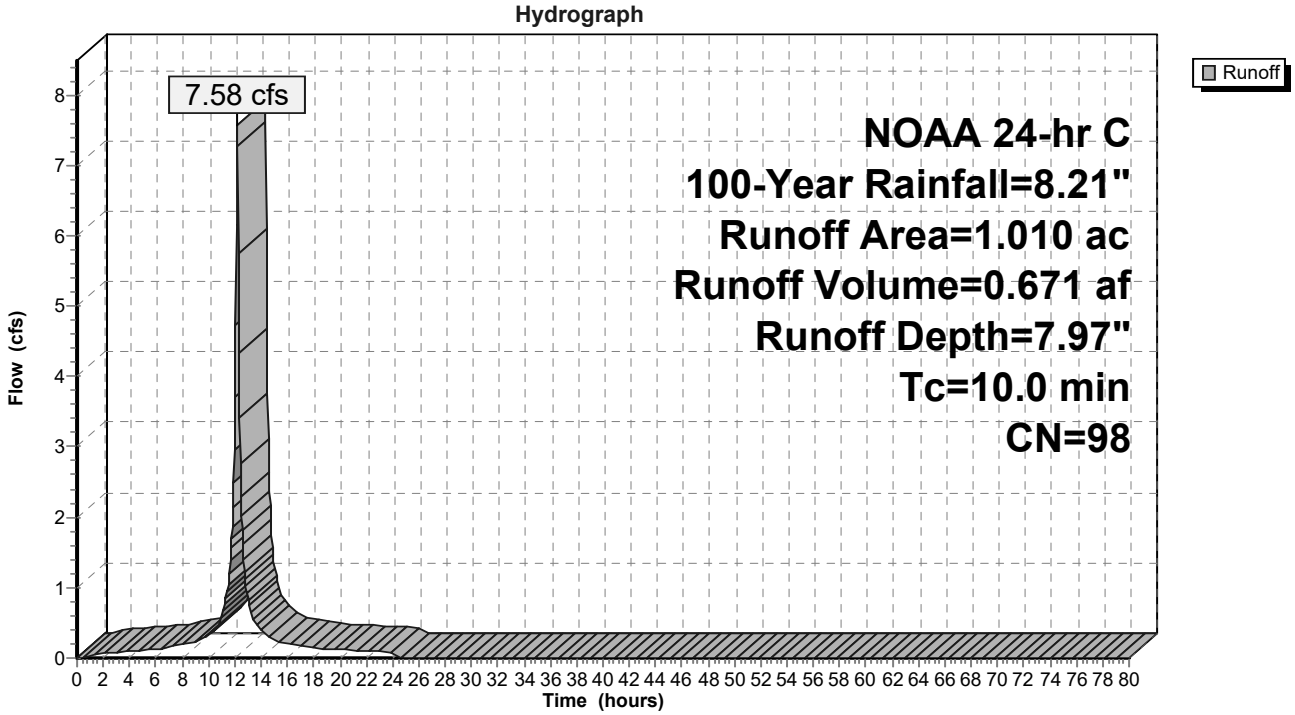
Runoff = 7.58 cfs @ 12.17 hrs, Volume= 0.671 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
*	0.970	98	Impervious
*	0.040	98	1/2 Basin Impervious
	1.010	98	Weighted Average
	1.010		100.00% Impervious Area

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

Subcatchment 8: PROP. DA 2 IMP



Summary for Subcatchment 9: PROP. DA 2 PER

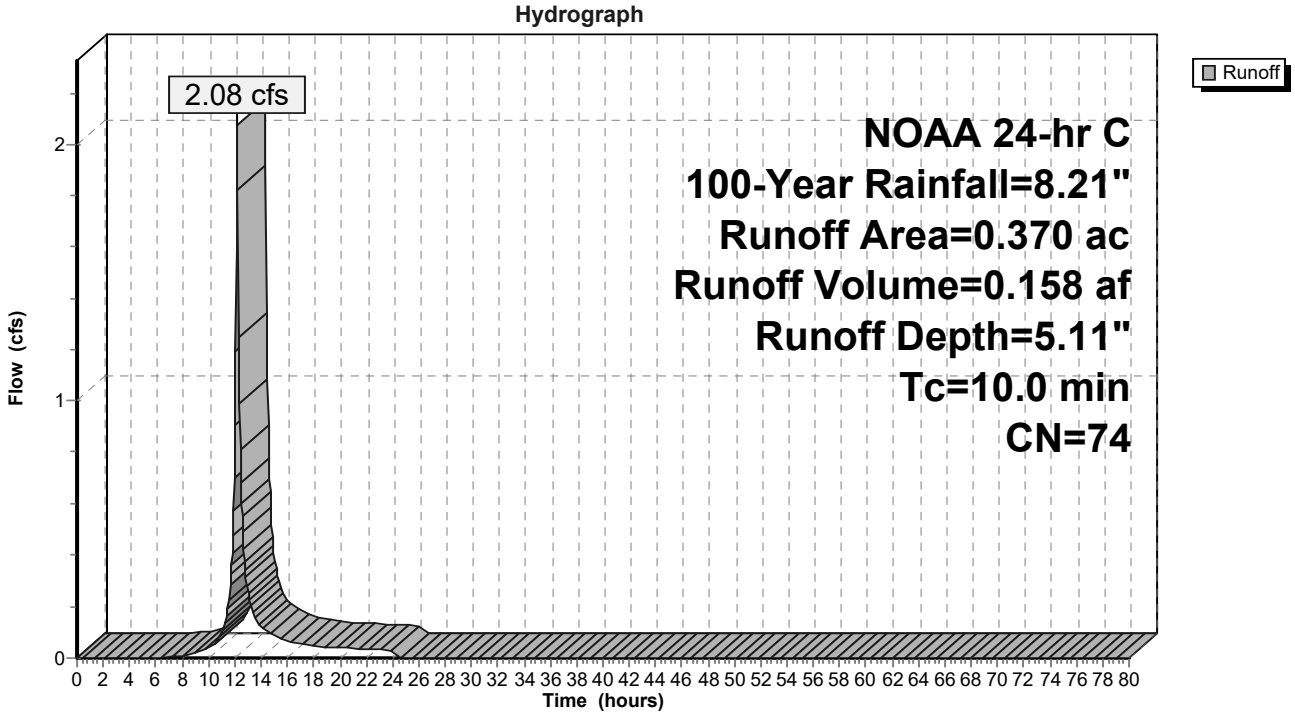
Runoff = 2.08 cfs @ 12.17 hrs, Volume= 0.158 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
	0.330	74	>75% Grass cover, Good, HSG C
*	0.040	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 9: PROP. DA 2 PER



Summary for Subcatchment 10: OFF-SITE DA PERV

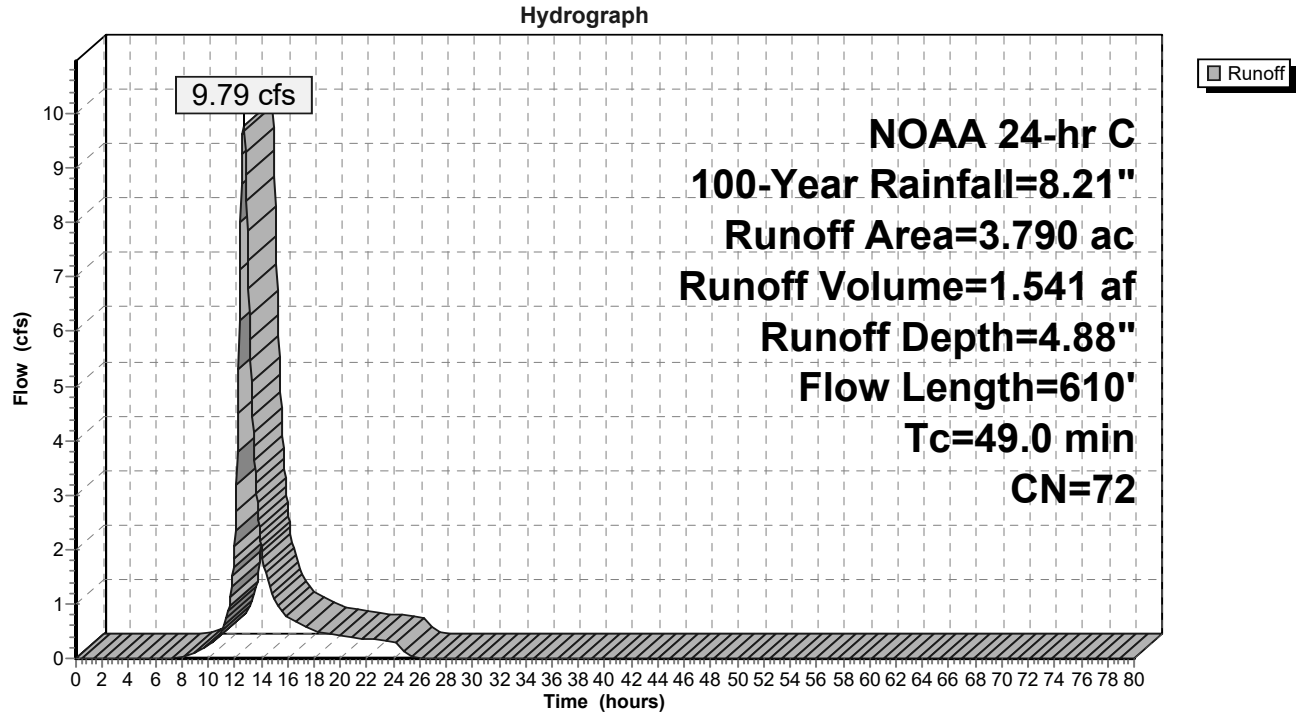
Runoff = 9.79 cfs @ 12.67 hrs, Volume= 1.541 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
1.890	70	Woods, Good, HSG C
1.900	74	>75% Grass cover, Good, HSG C
3.790	72	Weighted Average
3.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 10: OFF-SITE DA PERV



Summary for Subcatchment 11: OFF-SITE DA IMP

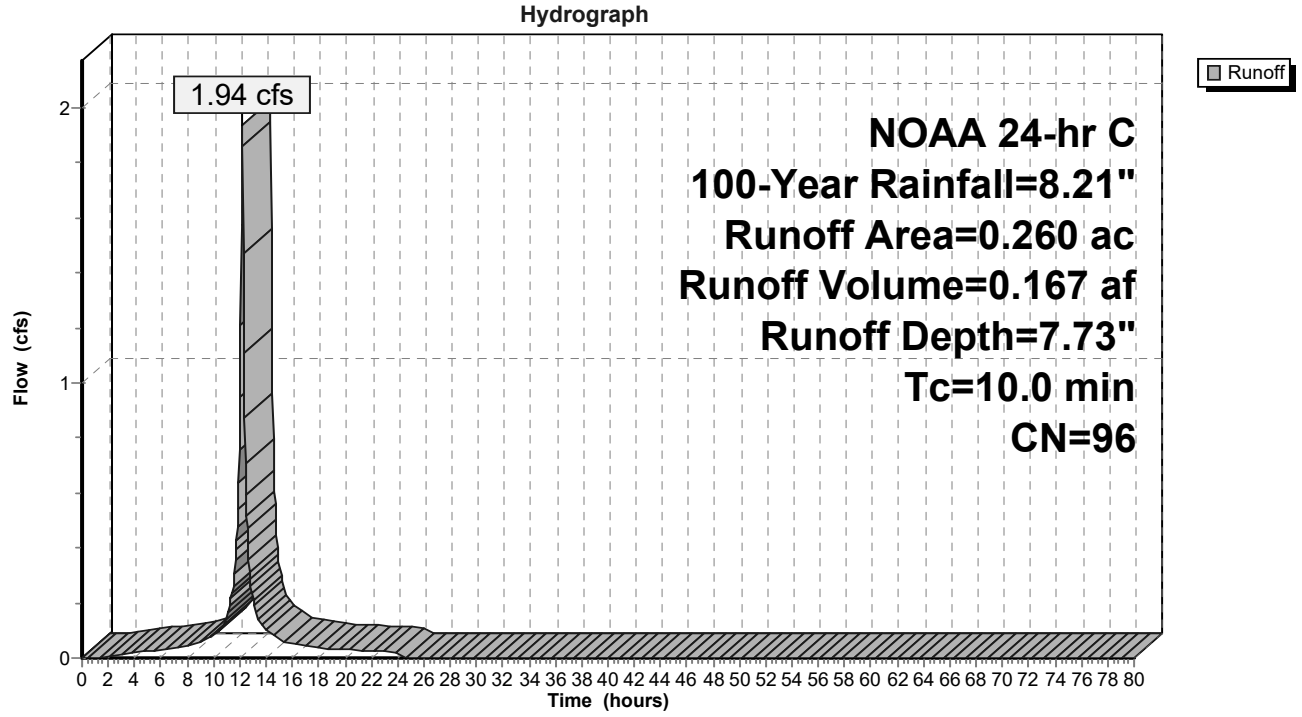
Runoff = 1.94 cfs @ 12.17 hrs, Volume= 0.167 af, Depth= 7.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 11: OFF-SITE DA IMP



Summary for Subcatchment 13: UC DA (ON-SITE) IMP

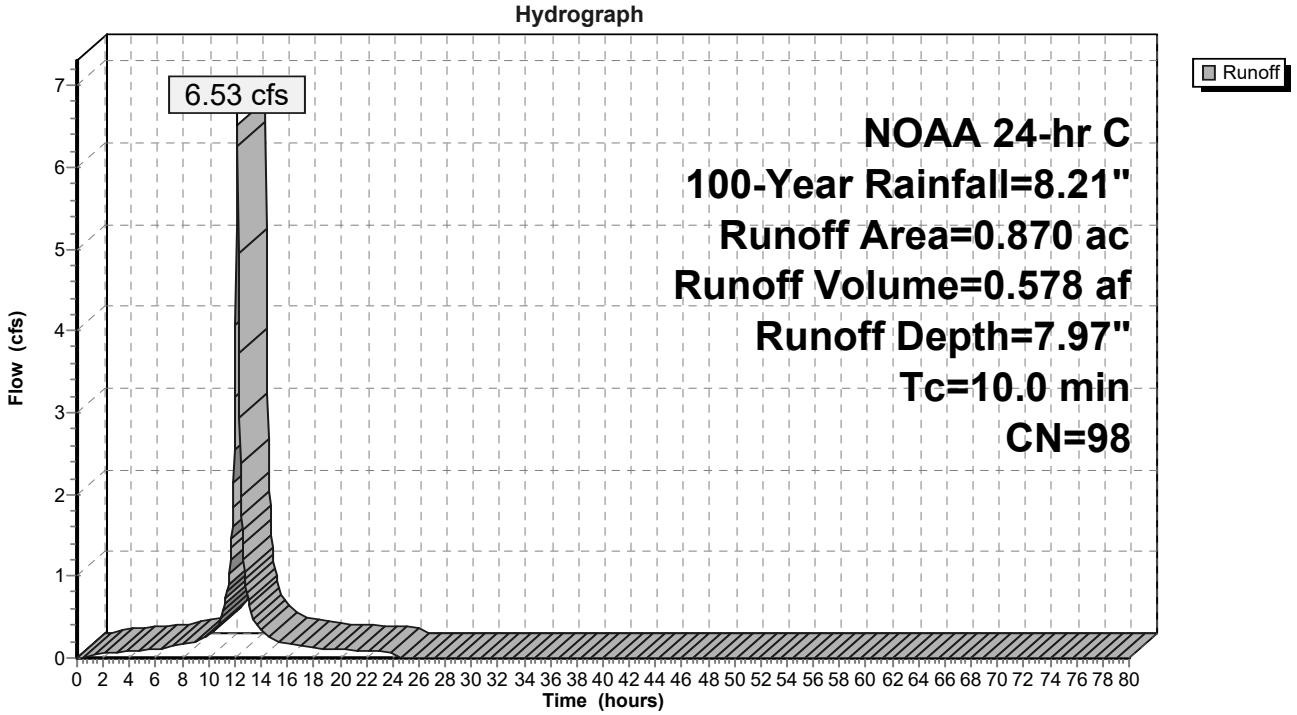
Runoff = 6.53 cfs @ 12.17 hrs, Volume= 0.578 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
*	0.870	98	Impervious
	0.870		100.00% Impervious Area

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

Subcatchment 13: UC DA (ON-SITE) IMP



Summary for Subcatchment 14: UC DA (ON-SITE) PER

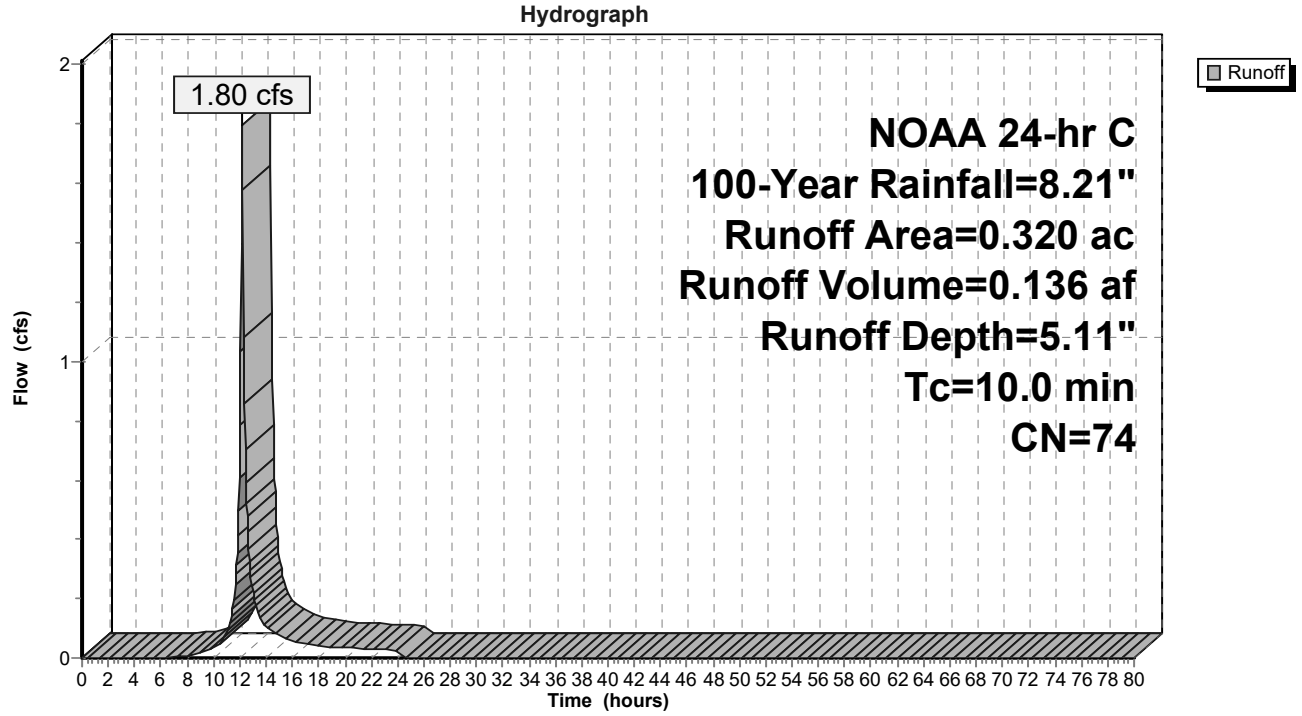
Runoff = 1.80 cfs @ 12.17 hrs, Volume= 0.136 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 14: UC DA (ON-SITE) PER



Summary for Subcatchment 15: PROP. DA 1 IMP

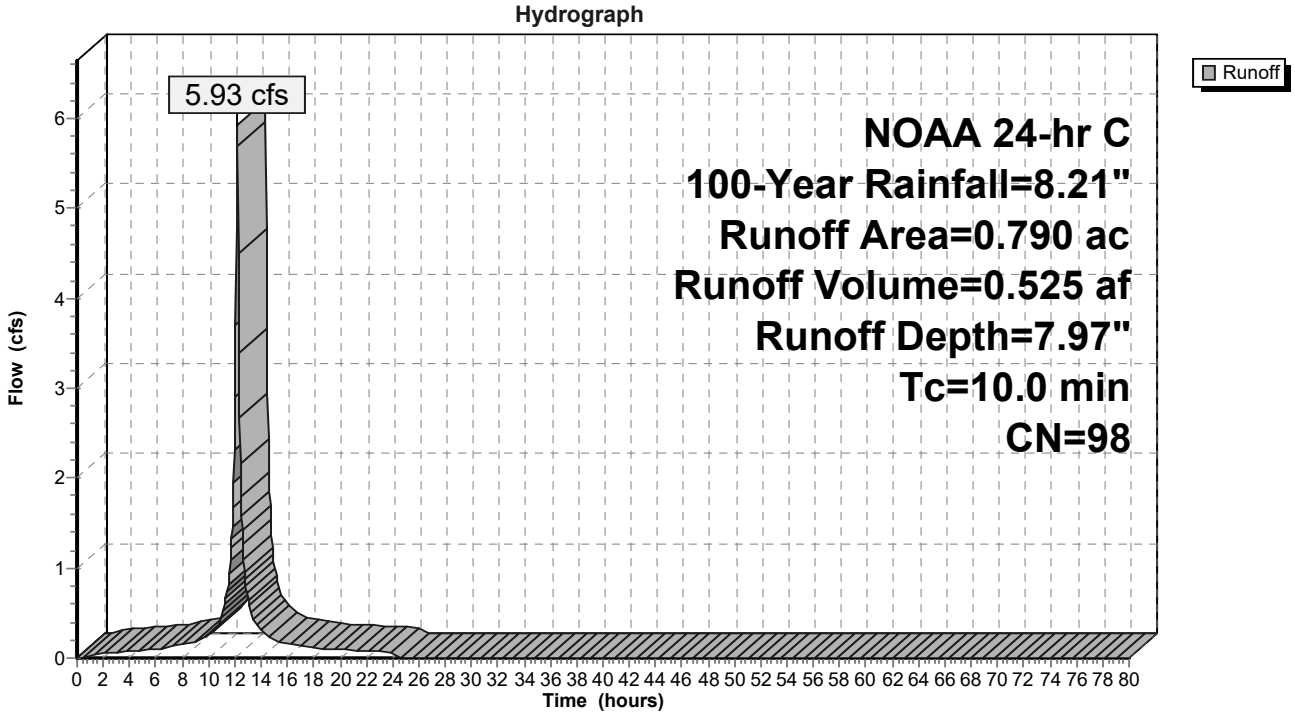
Runoff = 5.93 cfs @ 12.17 hrs, Volume= 0.525 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
*	0.670	98	Impervious
*	0.120	98	1/2 Basin Impervious
	0.790	98	Weighted Average
	0.790		100.00% Impervious Area

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

Subcatchment 15: PROP. DA 1 IMP



Summary for Subcatchment 16: PROP. DA 1 PER

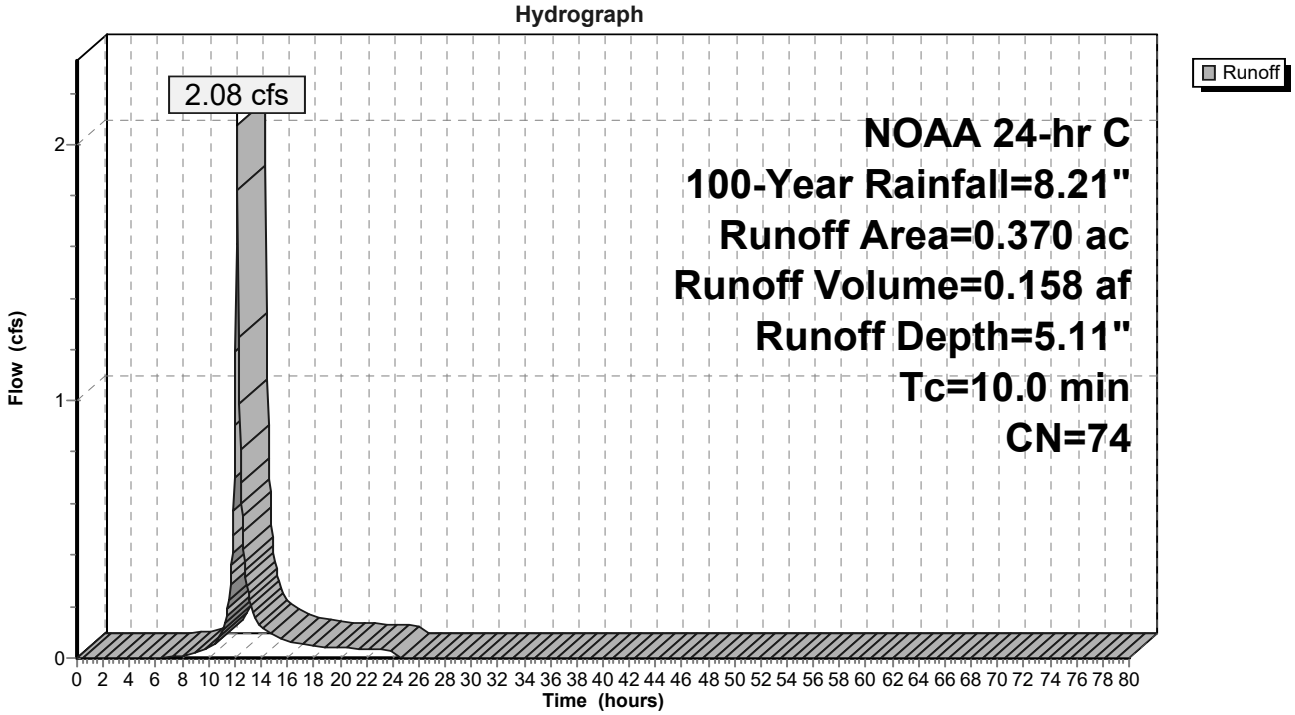
Runoff = 2.08 cfs @ 12.17 hrs, Volume= 0.158 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (ac)	CN	Description
	0.250	74	>75% Grass cover, Good, HSG C
*	0.120	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 16: PROP. DA 1 PER



Summary for Subcatchment 17: OFF-SITE 1 PER DA

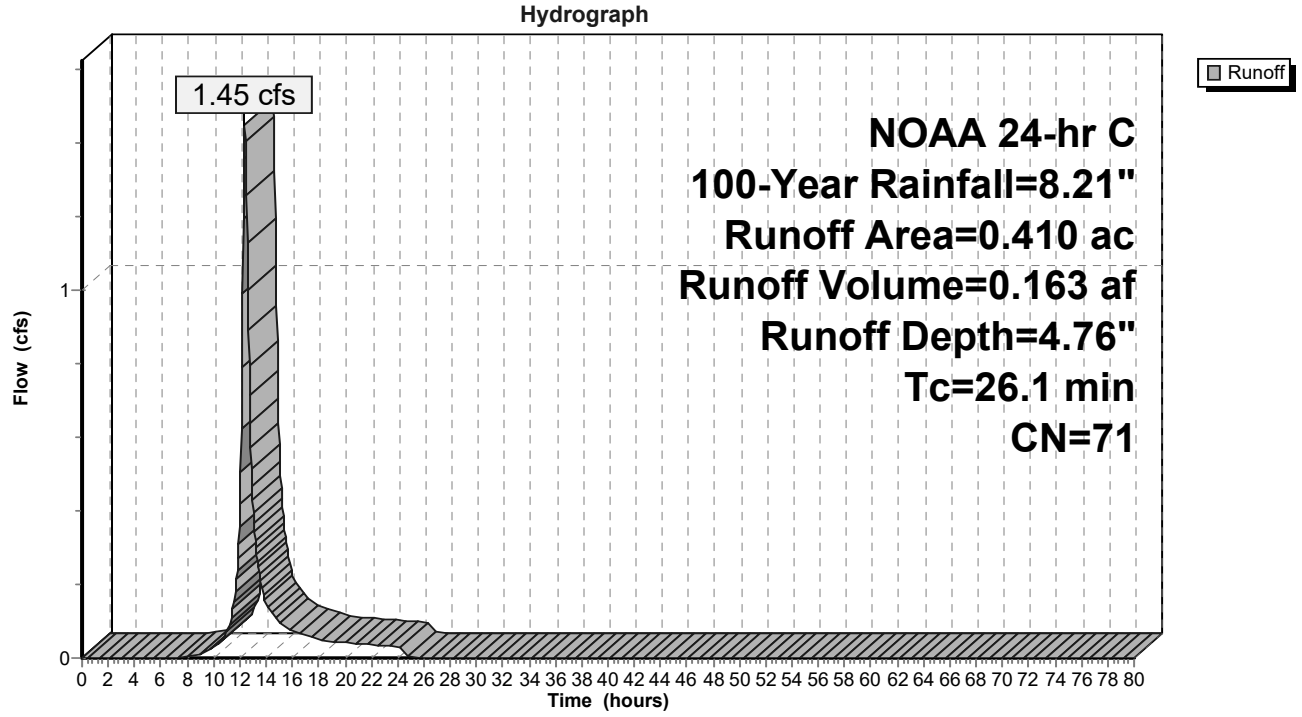
Runoff = 1.45 cfs @ 12.37 hrs, Volume= 0.163 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.270	70	Woods, Good, HSG C
0.140	74	>75% Grass cover, Good, HSG C
0.410	71	Weighted Average
0.410		100.00% Pervious Area

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

Subcatchment 17: OFF-SITE 1 PER DA



Summary for Pond 12: BASIN 2

Inflow Area = 5.430 ac, 18.60% Impervious, Inflow Depth = 5.61" for 100-Year event
Inflow = 15.03 cfs @ 12.18 hrs, Volume= 2.537 af
Outflow = 11.63 cfs @ 12.71 hrs, Volume= 2.239 af, Atten= 23%, Lag= 31.4 min
Primary = 11.63 cfs @ 12.71 hrs, Volume= 2.239 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 71.50' Surf.Area= 8,720 sf Storage= 2,616 cf
Peak Elev= 74.83' @ 12.71 hrs Surf.Area= 11,775 sf Storage= 31,262 cf (28,646 cf above start)

Plug-Flow detention time= 183.1 min calculated for 2.179 af (86% of inflow)
Center-of-Mass det. time= 110.3 min (932.2 - 822.0)

Volume	Invert	Avail.Storage	Storage Description
#1	71.50'	7,051 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	70.75'	12,087 cf	**37.08'W x 235.14'L x 5.50'H Field A** 47,959 cf Overall - 17,741 cf Embedded = 30,217 cf x 40.0% Voids
#3A	71.50'	17,741 cf	**ADS_StormTech MC-3500 d +Cap** x 160 Inside #2 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 160 Chambers in 5 Rows Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		36,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	0	0	0
72.00	1,406	352	352
73.00	1,913	1,660	2,011
74.00	2,501	2,207	4,218
75.00	3,165	2,833	7,051

Device	Routing	Invert	Outlet Devices
#1	Primary	71.50'	**24.0" Round RCP_Round 24"** L= 220.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 71.50' / 70.20' S= 0.0059 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	71.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.40'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=11.62 cfs @ 12.71 hrs HW=74.83' TW=73.00' (Fixed TW Elev= 73.00')
└─**1=RCP_Round 24"** (Passes 11.62 cfs of 17.43 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.22 cfs @ 6.52 fps)
  └─**3=Broad-Crested Rectangular Weir** (Weir Controls 11.40 cfs @ 3.98 fps)

Pond 12: BASIN 2 - 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

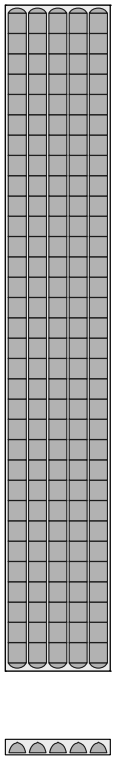
32 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 233.14' Row Length +12.0" End Stone x 2 = 235.14' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

160 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 17,741.3 cf Chamber Storage

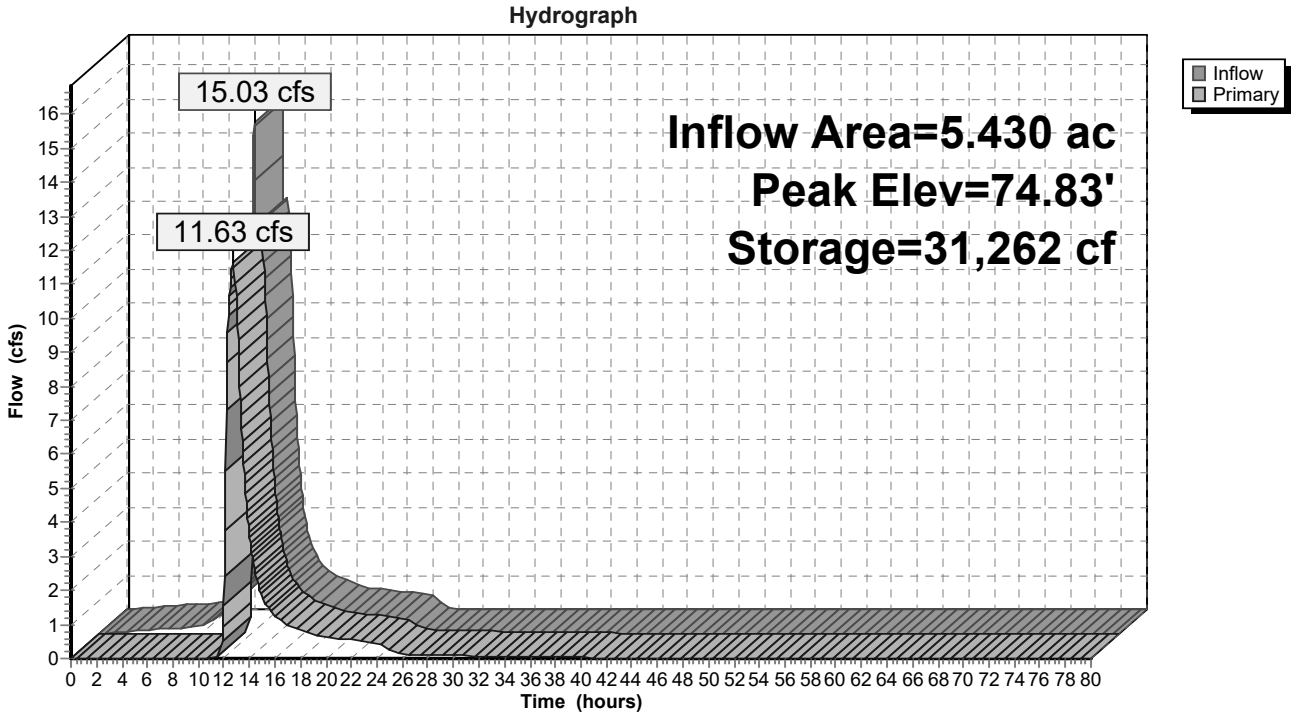
47,958.8 cf Field - 17,741.3 cf Chambers = 30,217.5 cf Stone x 40.0% Voids = 12,087.0 cf Stone Storage

Chamber Storage + Stone Storage = 29,828.3 cf = 0.685 af
Overall Storage Efficiency = 62.2%
Overall System Size = 235.14' x 37.08' x 5.50'

160 Chambers
1,776.3 cy Field
1,119.2 cy Stone



Pond 12: BASIN 2



Summary for Pond 18: BASIN 1

Inflow Area = 1.570 ac, 50.32% Impervious, Inflow Depth = 6.46" for 100-Year event
Inflow = 8.85 cfs @ 12.18 hrs, Volume= 0.845 af
Outflow = 2.92 cfs @ 12.58 hrs, Volume= 0.841 af, Atten= 67%, Lag= 24.1 min
Primary = 2.92 cfs @ 12.58 hrs, Volume= 0.841 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 72.50' Surf.Area= 8,542 sf Storage= 1,708 cf
Peak Elev= 74.13' @ 12.58 hrs Surf.Area= 16,582 sf Storage= 18,701 cf (16,993 cf above start)

Plug-Flow detention time= 483.0 min calculated for 0.802 af (95% of inflow)
Center-of-Mass det. time= 420.3 min (1,198.7 - 778.4)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	13,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	72.00'	7,549 cf	**58.50'W x 146.02'L x 3.50'H Field A** 29,897 cf Overall - 11,026 cf Embedded = 18,871 cf x 40.0% Voids
#3A	72.50'	11,026 cf	**ADS_StormTech SC-740 +Cap** x 240 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 240 Chambers in 12 Rows
		32,376 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.50	0	0	0
73.00	1,451	363	363
74.00	7,756	4,604	4,966
75.00	9,915	8,836	13,802

Device	Routing	Invert	Outlet Devices
#1	Primary	72.50'	**15.0" Round RCP_Round 15"** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 72.50' / 72.20' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	72.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.55'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.92 cfs @ 12.58 hrs HW=74.13' TW=70.70' (Fixed TW Elev= 70.70')
└─**1=RCP_Round 15"** (Passes 2.92 cfs of 4.99 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.20 cfs @ 5.95 fps)
  └─**3=Broad-Crested Rectangular Weir** (Weir Controls 2.71 cfs @ 2.34 fps)

Pond 18: BASIN 1 - Chamber Wizard Field A

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

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

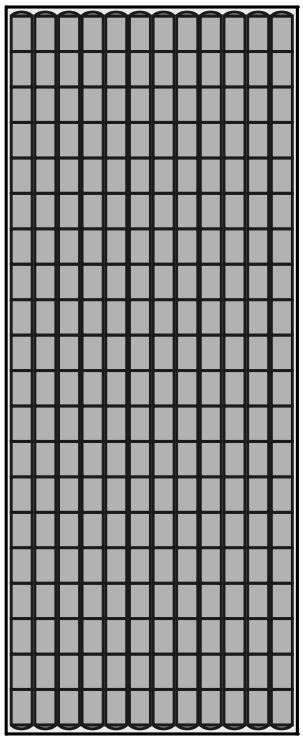
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
12 Rows x 51.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 58.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

240 Chambers x 45.9 cf = 11,025.6 cf Chamber Storage

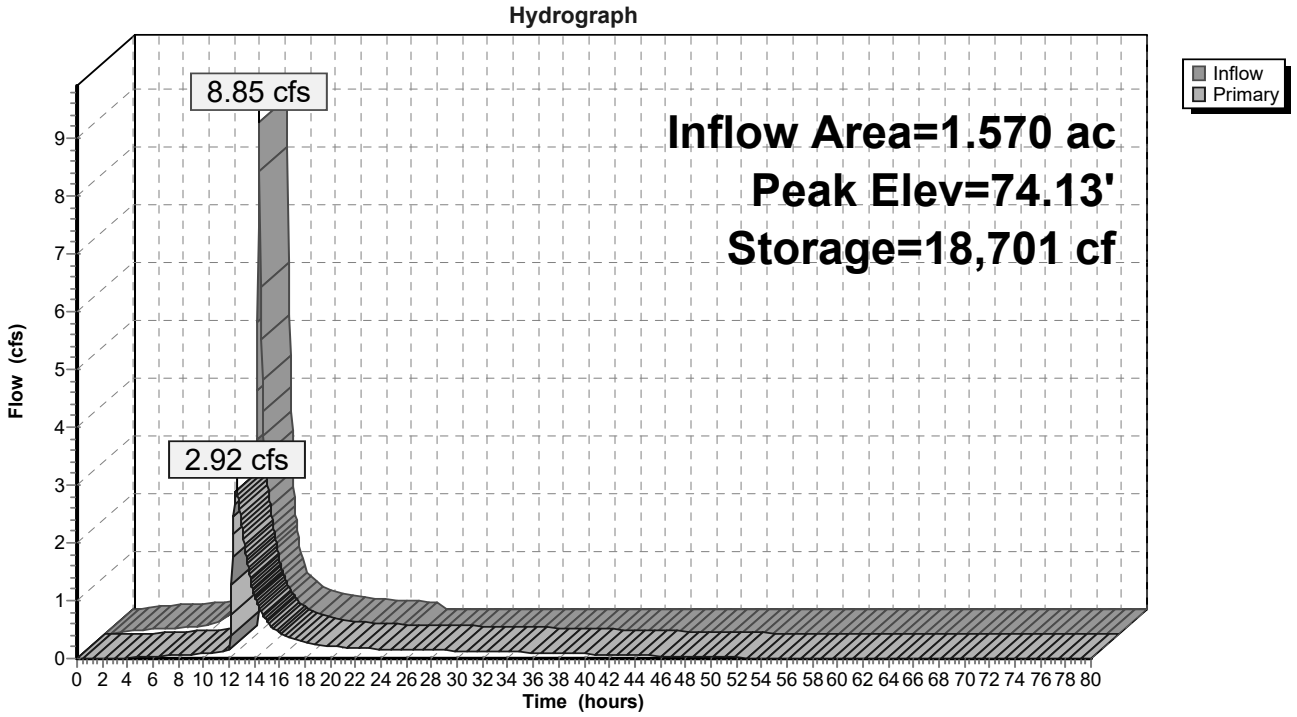
29,896.9 cf Field - 11,025.6 cf Chambers = 18,871.3 cf Stone x 40.0% Voids = 7,548.5 cf Stone Storage

Chamber Storage + Stone Storage = 18,574.1 cf = 0.426 af
Overall Storage Efficiency = 62.1%
Overall System Size = 146.02' x 58.50' x 3.50'

240 Chambers
1,107.3 cy Field
698.9 cy Stone



Pond 18: BASIN 1

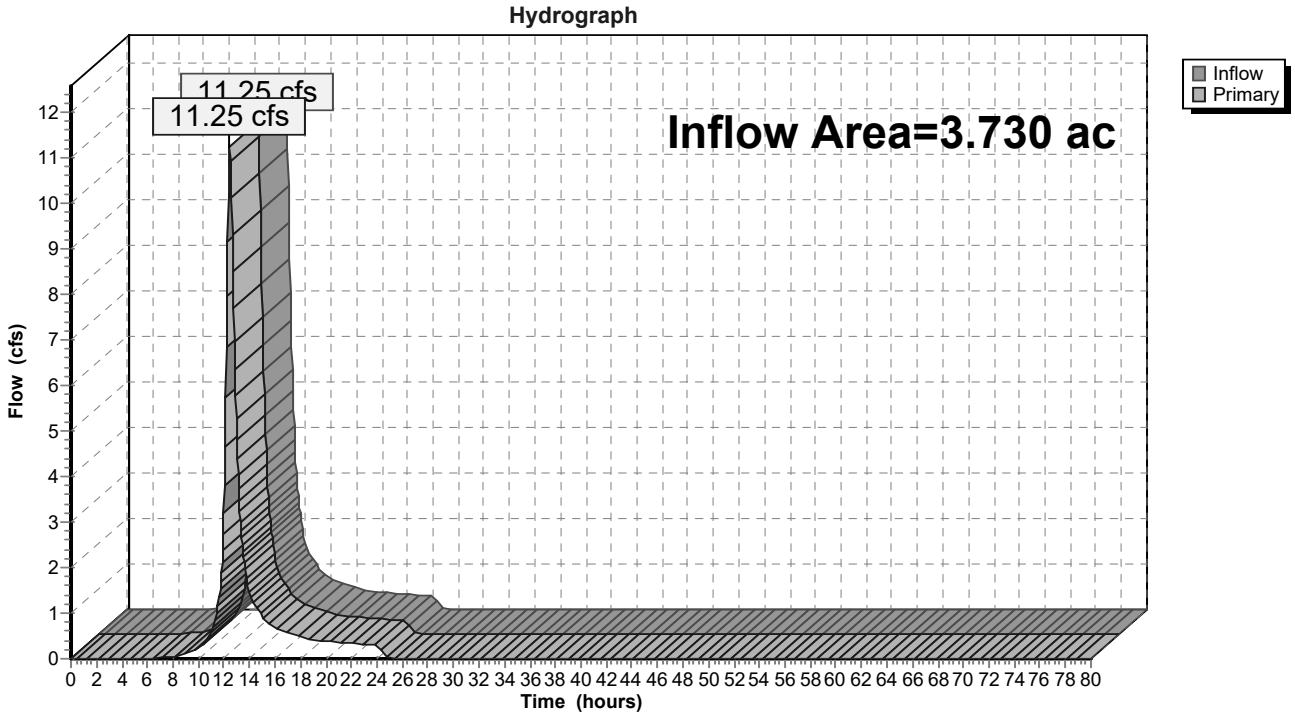


Summary for Link 3: Ex On-Site

Inflow Area = 3.730 ac, 3.22% Impervious, Inflow Depth = 4.75" for 100-Year event
Inflow = 11.25 cfs @ 12.46 hrs, Volume= 1.477 af
Primary = 11.25 cfs @ 12.46 hrs, Volume= 1.477 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 3: Ex On-Site

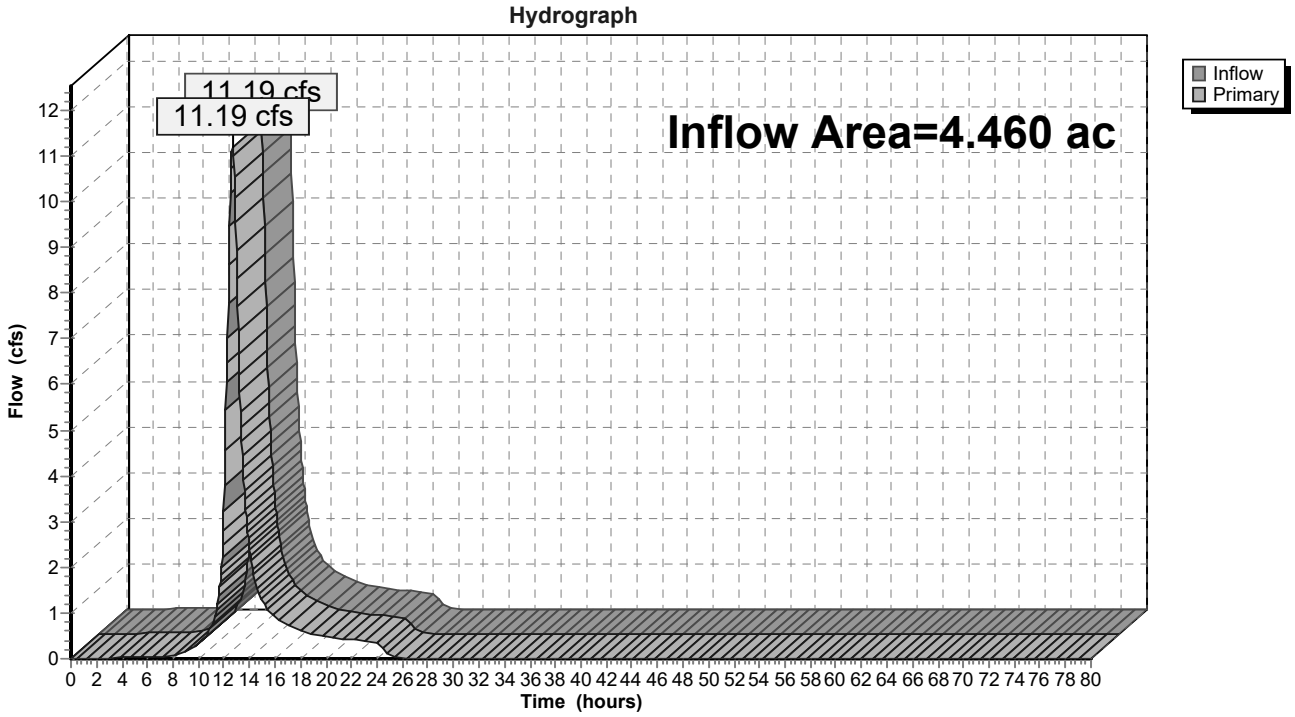


Summary for Link 6: Offsite Total

Inflow Area = 4.460 ac, 0.00% Impervious, Inflow Depth = 5.05" for 100-Year event
Inflow = 11.19 cfs @ 12.66 hrs, Volume= 1.875 af
Primary = 11.19 cfs @ 12.66 hrs, Volume= 1.875 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 6: Offsite Total

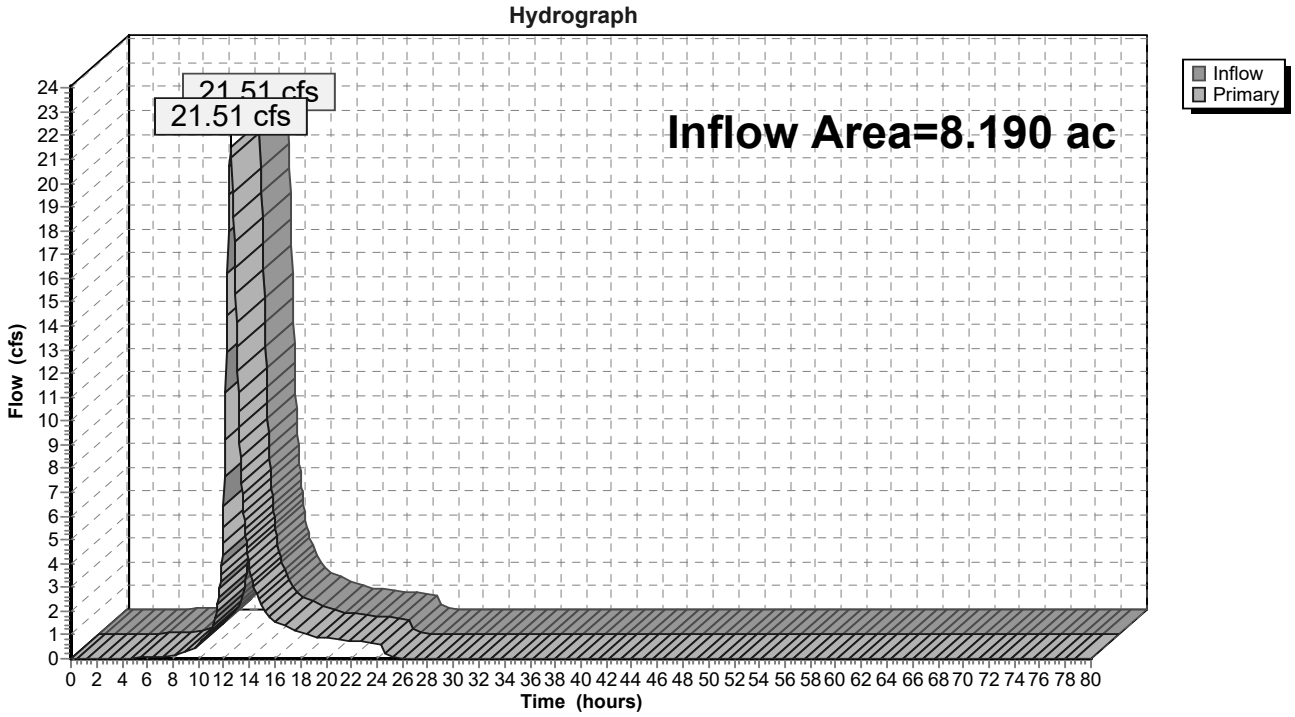


Summary for Link 7: EX AP

Inflow Area = 8.190 ac, 1.47% Impervious, Inflow Depth = 4.91" for 100-Year event
Inflow = 21.51 cfs @ 12.54 hrs, Volume= 3.352 af
Primary = 21.51 cfs @ 12.54 hrs, Volume= 3.352 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 7: EX AP

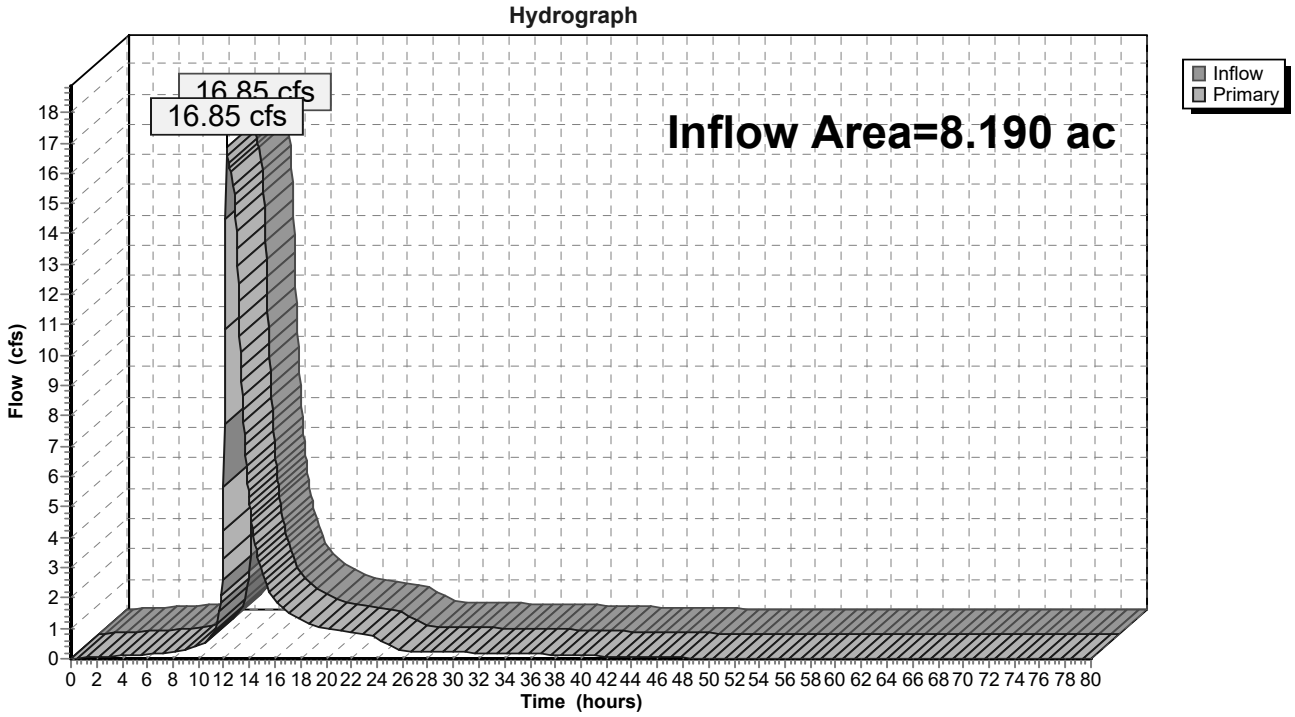


Summary for Link 19: PROP AP

Inflow Area = 8.190 ac, 32.60% Impervious, Inflow Depth = 5.56" for 100-Year event
Inflow = 16.85 cfs @ 12.25 hrs, Volume= 3.794 af
Primary = 16.85 cfs @ 12.25 hrs, Volume= 3.794 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs

Link 19: PROP AP



SECTION 2B

Proposed TSS Removal Rate

Design Criteria:

Treat all proposed pavement to 80% TSS removal (roof runoff is mixed with runoff from pavement and will need to be treated as well).

Proposed BMPs:

Proposed runoff from the site including proposed pavement will contribute to the extended detention basin which provides 24-hours extended detention and provides 60% TSS Removal per the BMP Manual. The BaySaver Barracuda manufactured treatment device will be located downstream of the extended detention basin and will treat the basin discharge rates to 50% TSS Removal.

Proposed Weighted TSS Removal Rate

R = A + B – [(A X B) / 100] (Equation 4-1)

Where: R = Total TSS Removal Rate ; A = TSS Removal Rate of the First or Upstream BMP; B = TSS Removal Rate of the Second or Downstream BMP

TSS Removal Rate = 60% + 50% - [(60% X 50%) / 100]

TSS Removal Rate = 80%

KIM GUADAGNO

CHRIS CHRISTIE
Governor

Lt. Governor

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
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Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

BOB MARTIN
Commissioner

September 18, 2017

Daniel J. Figola, P.E.
General Manager
BaySaver Technologies, LLC
1030 Deer Hollow Drive
Mt. Airy, MD 21771

Re: MTD Lab Certification
BaySaver Barracuda™ Hydrodynamic Separator by BaySaver Technologies, LLC
Online Installation

TSS Removal Rate 50%

Dear Mr. Figola:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). BaySaver Technologies, LLC has requested an MTD Laboratory Certification for the BaySaver Barracuda™ Hydrodynamic Separator (BaySaver Barracuda).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated September 2017) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

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The NJDEP certifies the use of the BaySaver Barracuda by BaySaver Technologies, LLC at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The BaySaver Barracuda shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This BaySaver Barracuda cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the BaySaver Barracuda. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.ads-pipe.com/pdf/en/Barracuda_Maintenance_07_17.pdf for any changes to the maintenance requirements.

6. Sizing Requirement:

   The example below demonstrates the sizing procedure for the BaySaver Barracuda:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a BaySaver Barracuda. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c = 0.99 (curve number for impervious)
   Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the Barracuda Model S4 with a MTFR of 1.25 cfs could be used for this site to remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1.

Table 1 BaySaver Barracuda Sizing Information

Barracuda Model	NJDEP 50% TSS Maximum Treatment Flow Rate (cfs)	Treatment Area (ft^2)	Hydraulic Loading Rate (gpm/ft^2)	50% Maximum Sediment Storage (ft^3)
S3	0.70	7.07	44.6	5.89
S4	1.25	12.57	44.6	10.47
S5	1.95	19.63	44.6	16.36
S6	2.80	28.27	44.6	23.56
S8	5.00	50.27	44.6	41.89
S10	7.80	78.54	44.6	65.45

A detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Mr. Shashi Nayak of my office at (609) 633-7021.

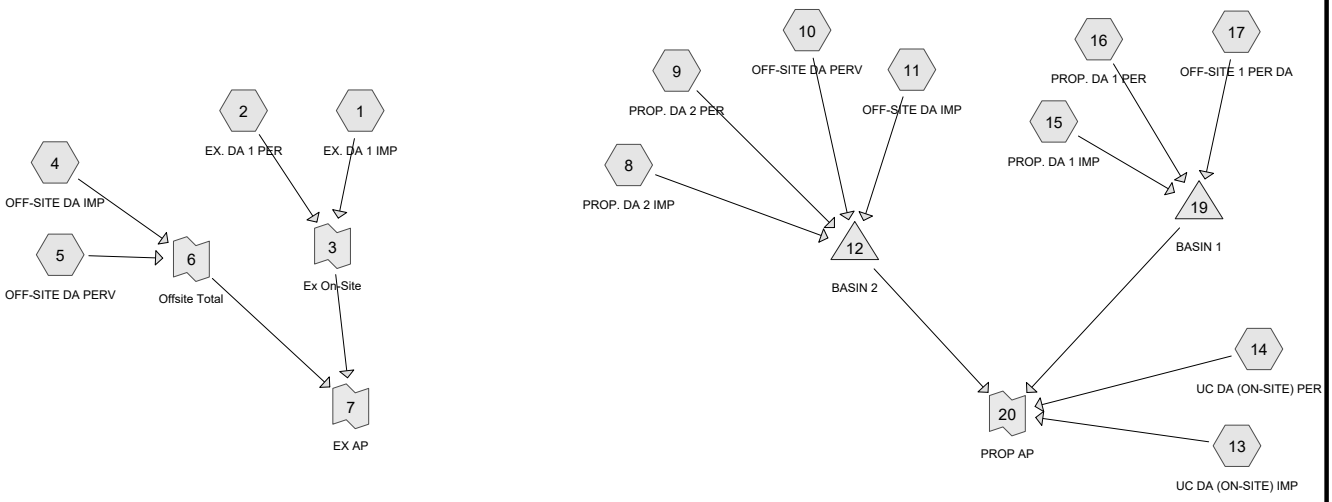
DETENTION BASIN WQ FLOW IS
0.08 CFS FOR BASIN #1
0.11 CFS FOR BASIN #2
S3 MODEL REQUIRED FOR 50% TSS REMOVAL

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC



Subcat Reach Pond Link

Routing Diagram for Drainage Analysis

Prepared by {enter your company name here}, Printed 12/27/2020

HydroCAD® 10.00-25 s/n 09755 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment 1: EX. DA 1 IMP

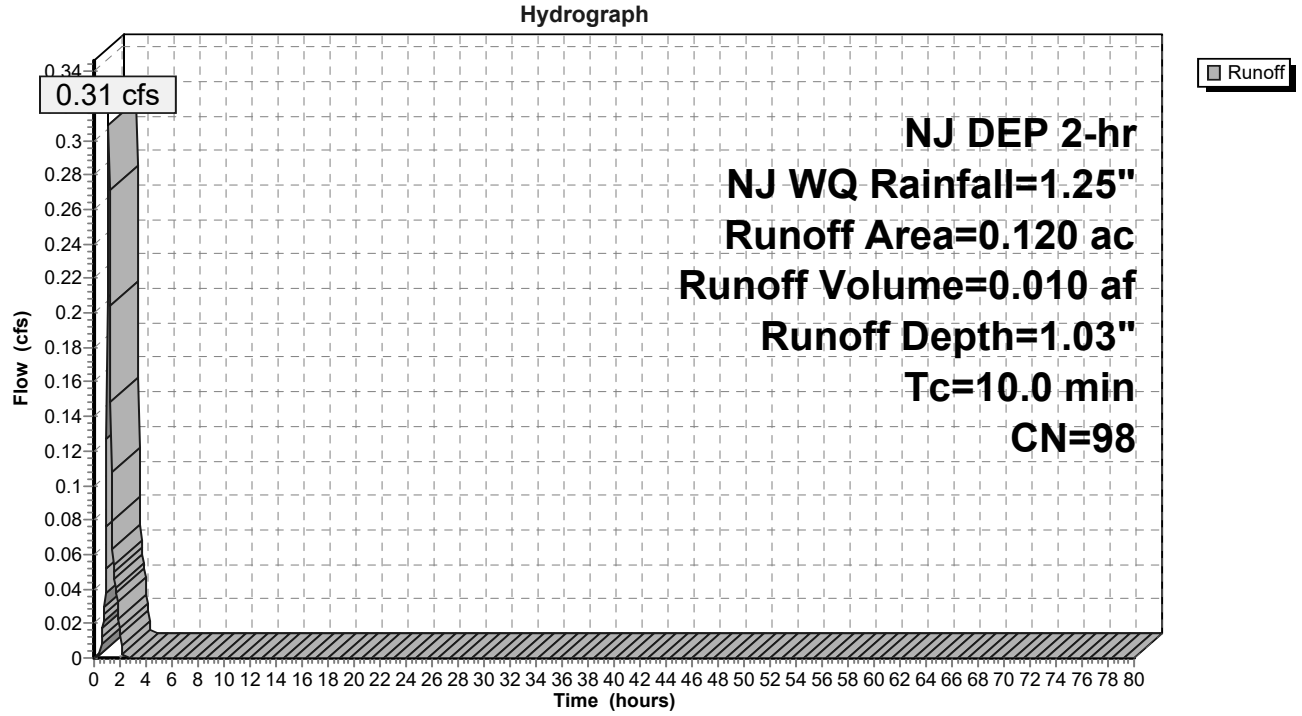
Runoff = 0.31 cfs @ 1.15 hrs, Volume= 0.010 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120		100.00% Impervious Area

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

Subcatchment 1: EX. DA 1 IMP



Summary for Subcatchment 2: EX. DA 1 PER

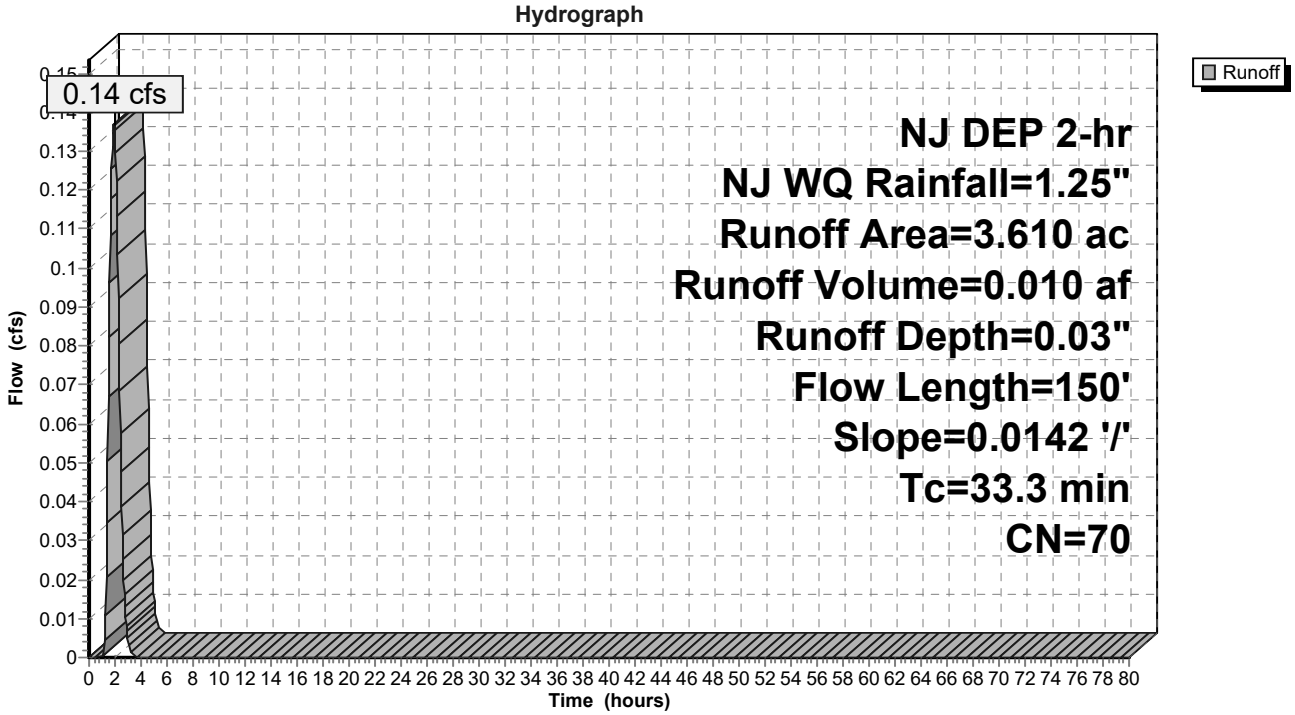
Runoff = 0.14 cfs @ 1.93 hrs, Volume= 0.010 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

Area (ac)	CN	Description
3.610	70	Woods, Good, HSG C
3.610		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	150	0.0142	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"

Subcatchment 2: EX. DA 1 PER



Summary for Subcatchment 4: OFF-SITE DA IMP

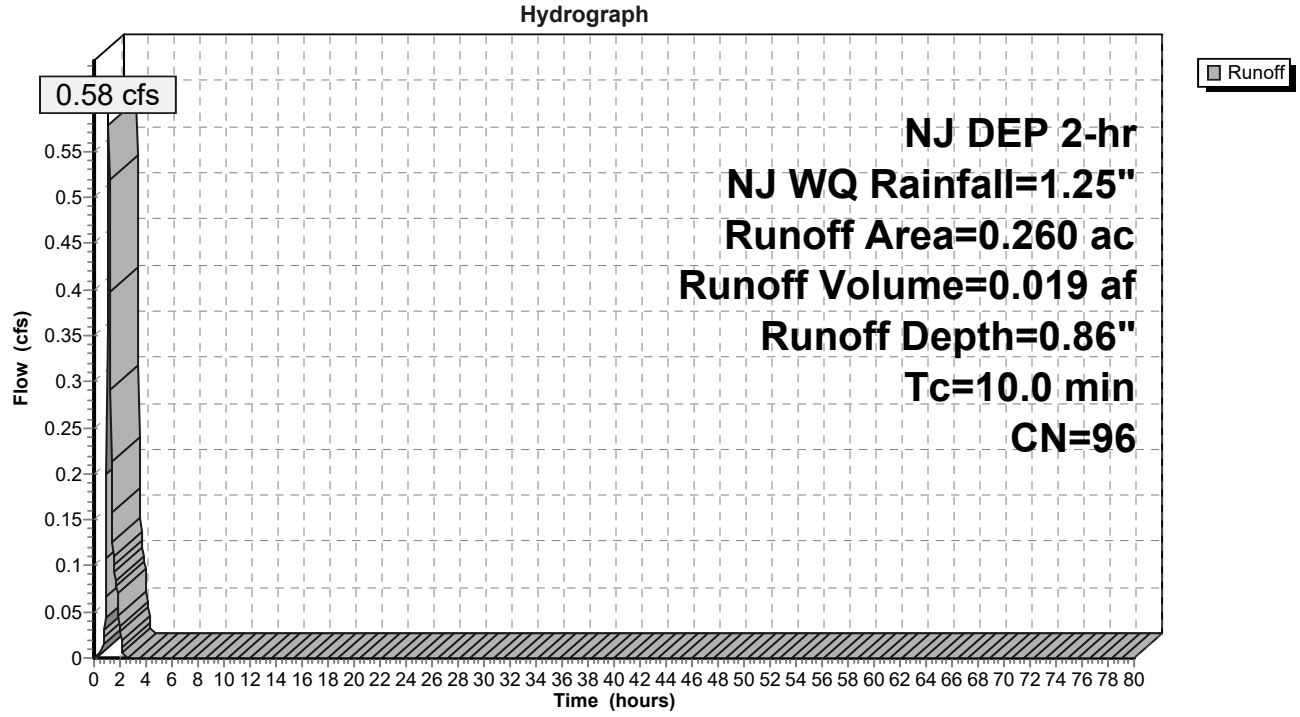
Runoff = 0.58 cfs @ 1.15 hrs, Volume= 0.019 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 4: OFF-SITE DA IMP



Summary for Subcatchment 5: OFF-SITE DA PERV

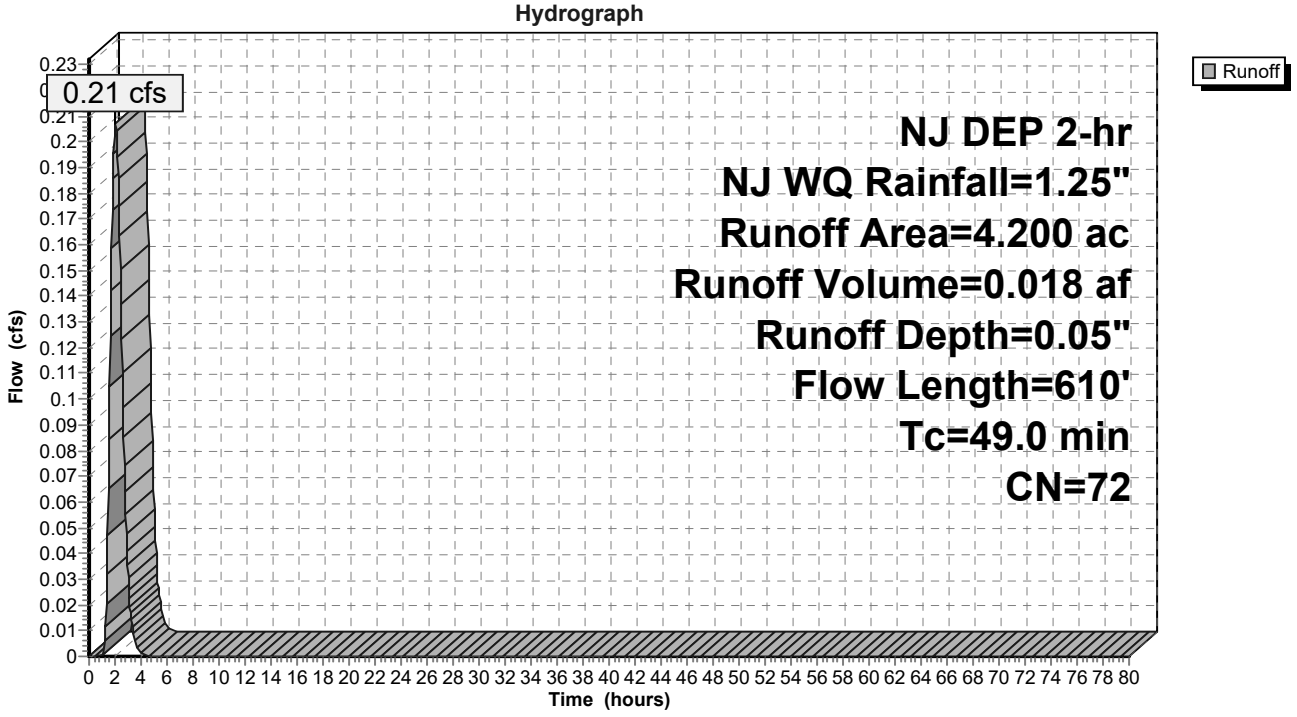
Runoff = 0.21 cfs @ 2.04 hrs, Volume= 0.018 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

Area (ac)	CN	Description
2.160	70	Woods, Good, HSG C
2.040	74	>75% Grass cover, Good, HSG C
4.200	72	Weighted Average
4.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 5: OFF-SITE DA PERV



Summary for Subcatchment 8: PROP. DA 2 IMP

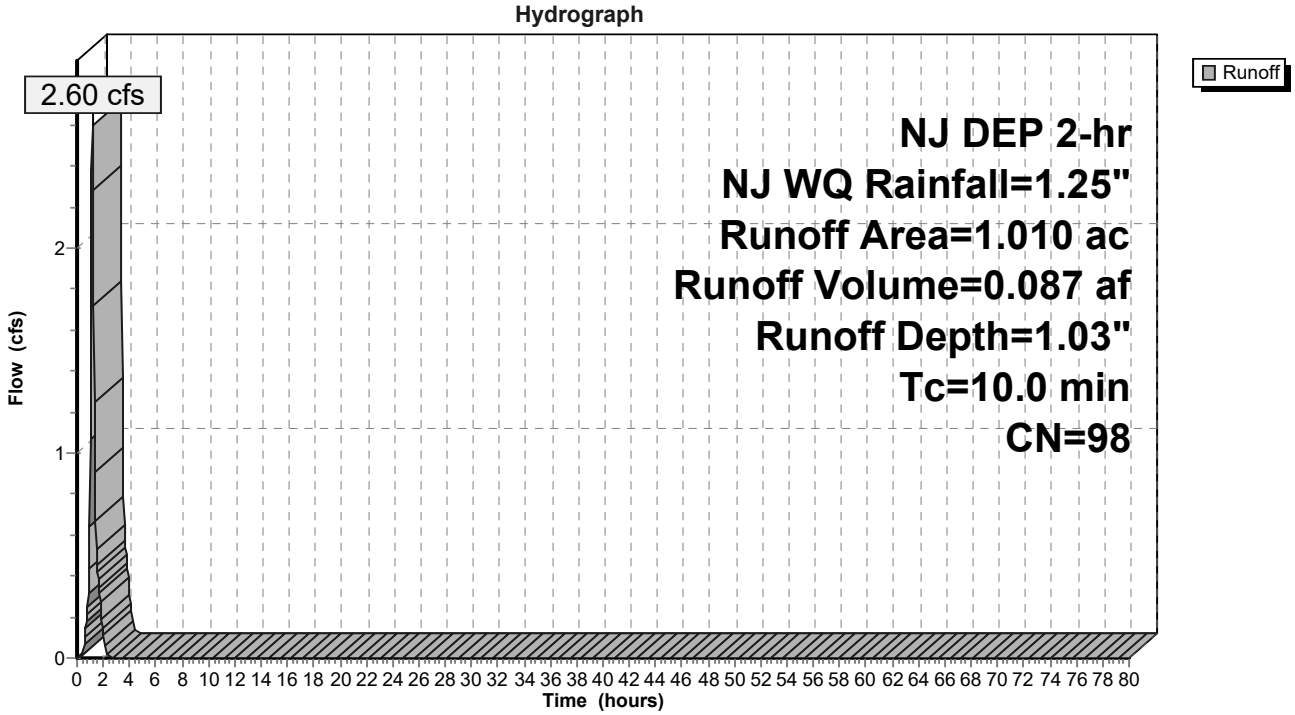
Runoff = 2.60 cfs @ 1.15 hrs, Volume= 0.087 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.970	98	Impervious
*	0.040	98	1/2 Basin Impervious
	1.010	98	Weighted Average
	1.010		100.00% Impervious Area

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

Subcatchment 8: PROP. DA 2 IMP



Summary for Subcatchment 9: PROP. DA 2 PER

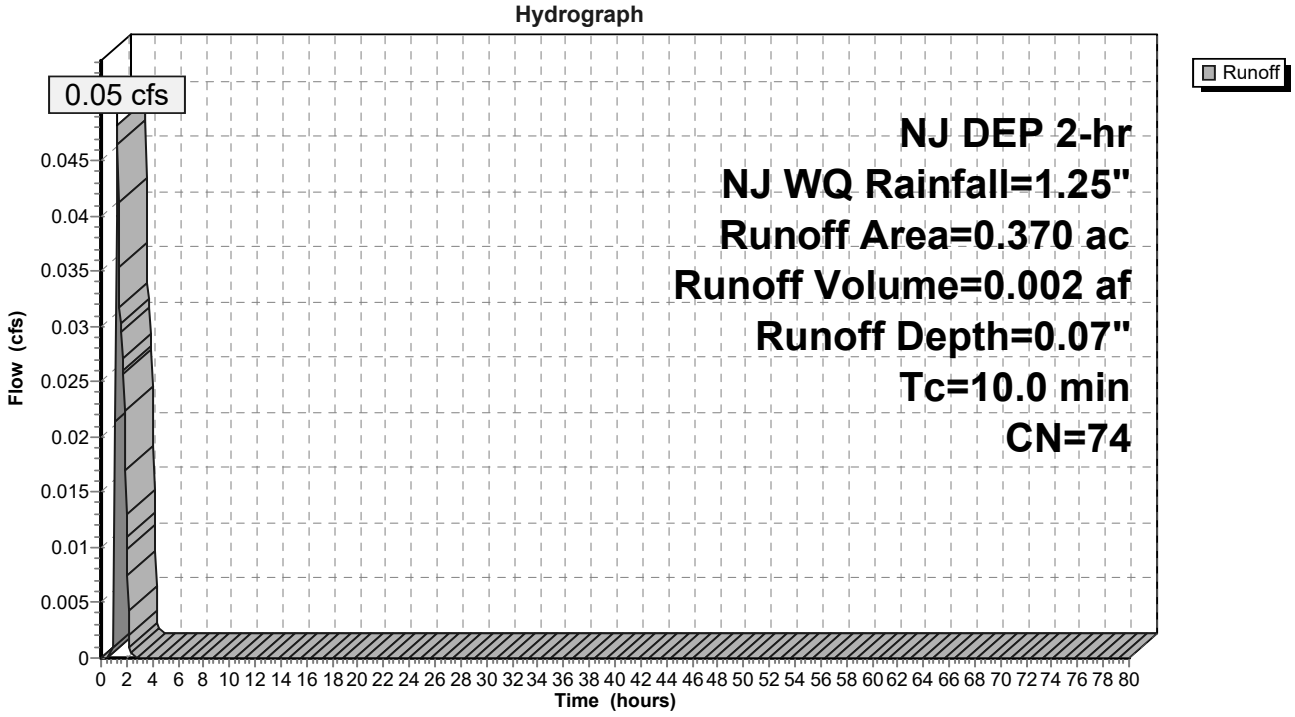
Runoff = 0.05 cfs @ 1.27 hrs, Volume= 0.002 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
	0.330	74	>75% Grass cover, Good, HSG C
*	0.040	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 9: PROP. DA 2 PER



Summary for Subcatchment 10: OFF-SITE DA PERV

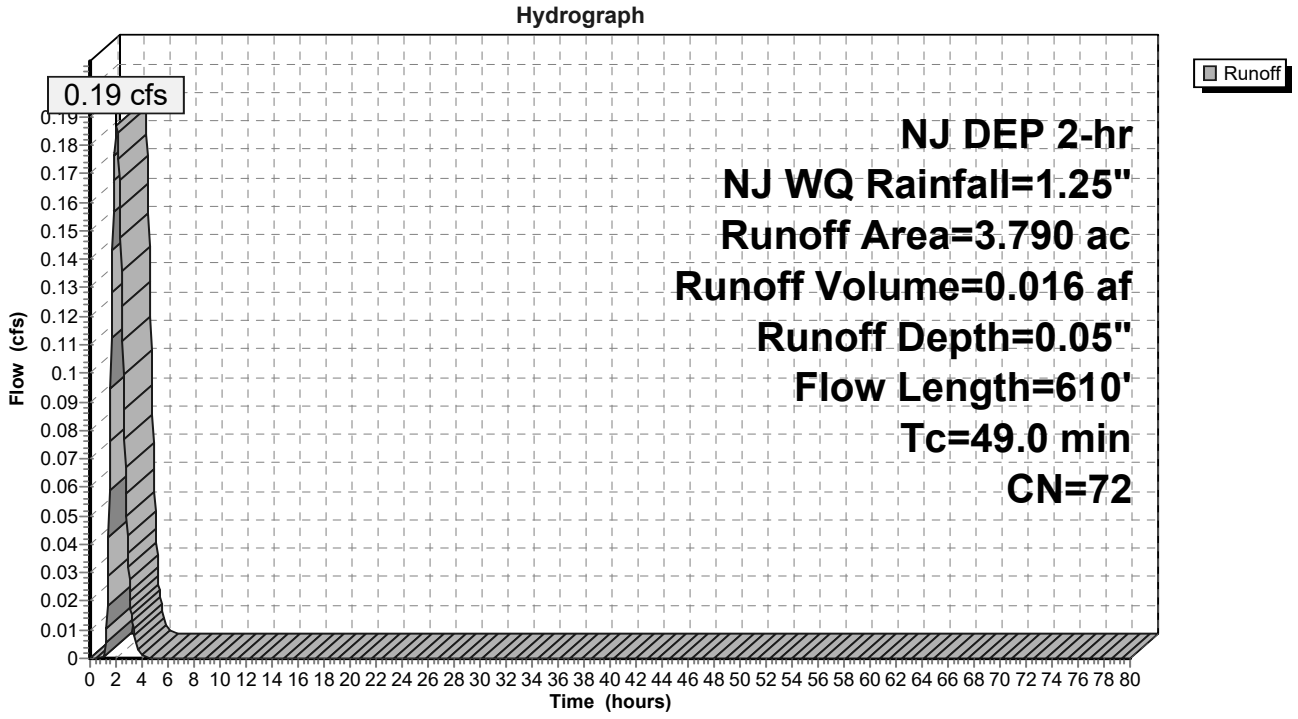
Runoff = 0.19 cfs @ 2.04 hrs, Volume= 0.016 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

Area (ac)	CN	Description
1.890	70	Woods, Good, HSG C
1.900	74	>75% Grass cover, Good, HSG C
3.790	72	Weighted Average
3.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	100	0.0070	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.34"
17.0	510	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
49.0	610	Total			

Subcatchment 10: OFF-SITE DA PERV



Summary for Subcatchment 11: OFF-SITE DA IMP

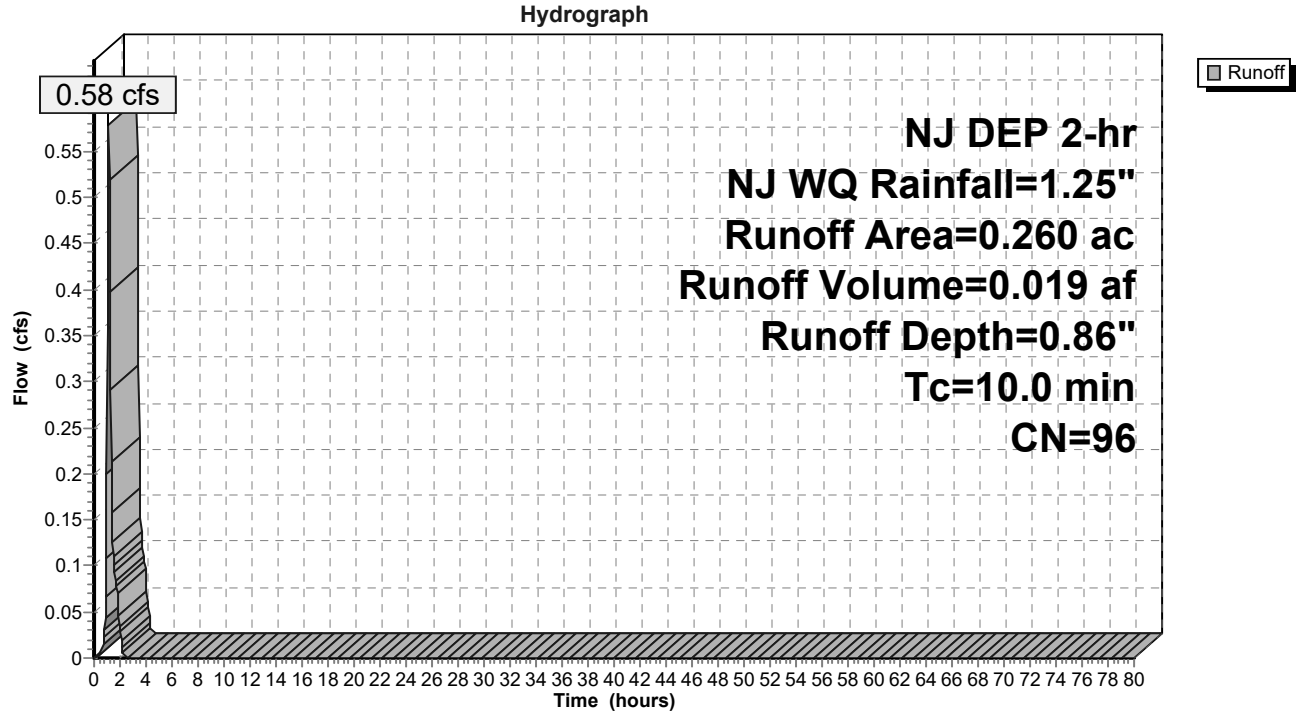
Runoff = 0.58 cfs @ 1.15 hrs, Volume= 0.019 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.000	98	Impervious
*	0.260	96	Gravel
	0.260	96	Weighted Average
	0.260		100.00% Pervious Area

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

Subcatchment 11: OFF-SITE DA IMP



Summary for Subcatchment 13: UC DA (ON-SITE) IMP

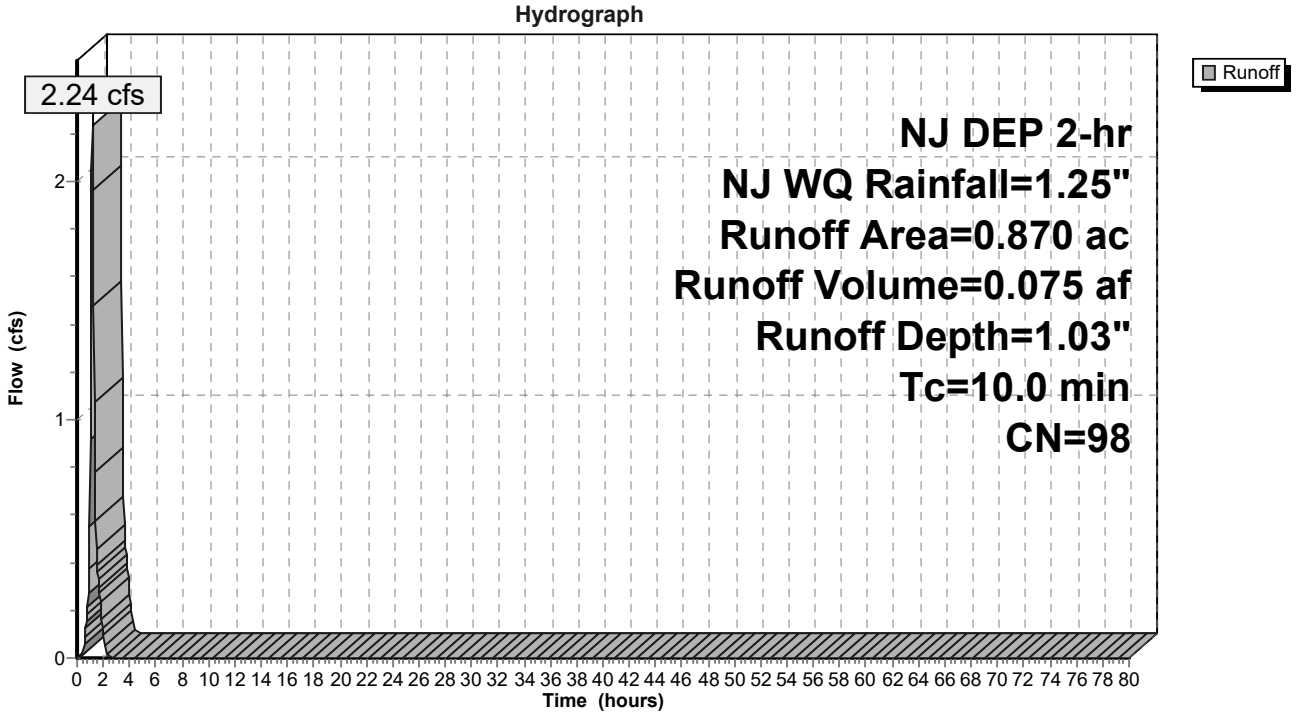
Runoff = 2.24 cfs @ 1.15 hrs, Volume= 0.075 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.870	98	Impervious
	0.870		100.00% Impervious Area

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

Subcatchment 13: UC DA (ON-SITE) IMP



Summary for Subcatchment 14: UC DA (ON-SITE) PER

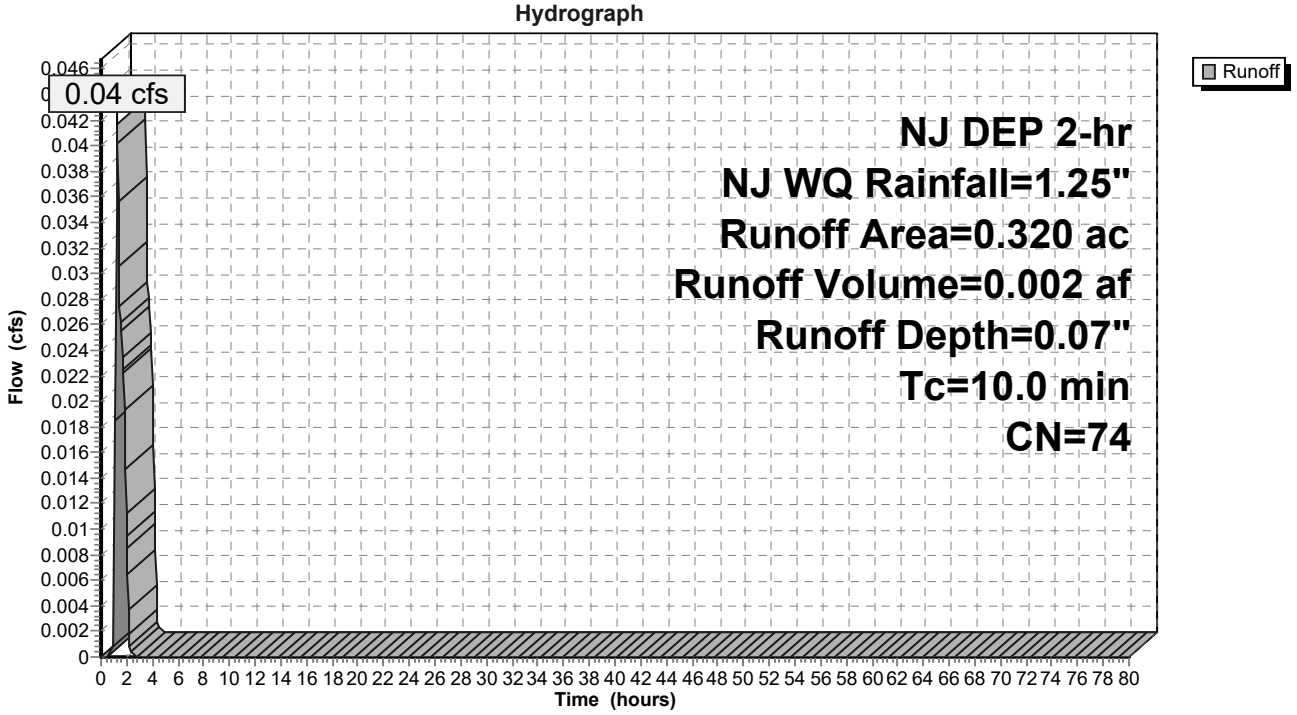
Runoff = 0.04 cfs @ 1.27 hrs, Volume= 0.002 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 14: UC DA (ON-SITE) PER



Summary for Subcatchment 15: PROP. DA 1 IMP

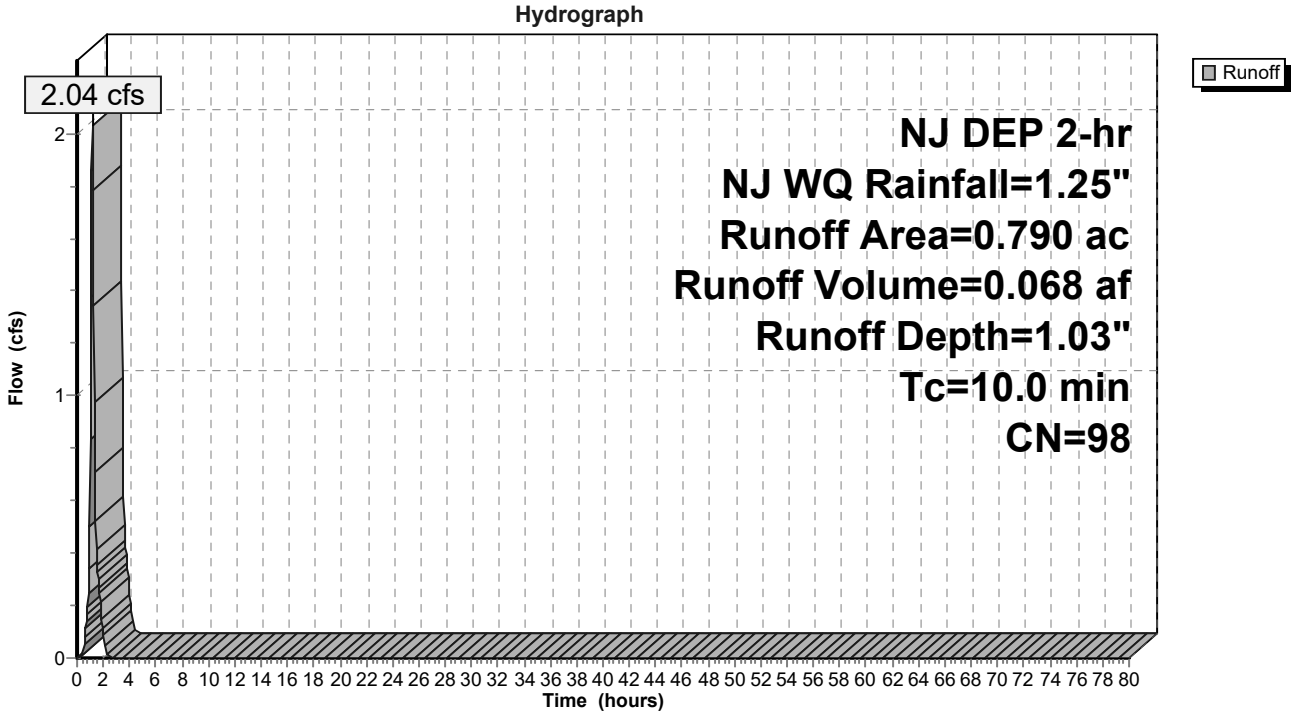
Runoff = 2.04 cfs @ 1.15 hrs, Volume= 0.068 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
*	0.670	98	Impervious
*	0.120	98	1/2 Basin Impervious
	0.790	98	Weighted Average
	0.790		100.00% Impervious Area

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

Subcatchment 15: PROP. DA 1 IMP



Summary for Subcatchment 16: PROP. DA 1 PER

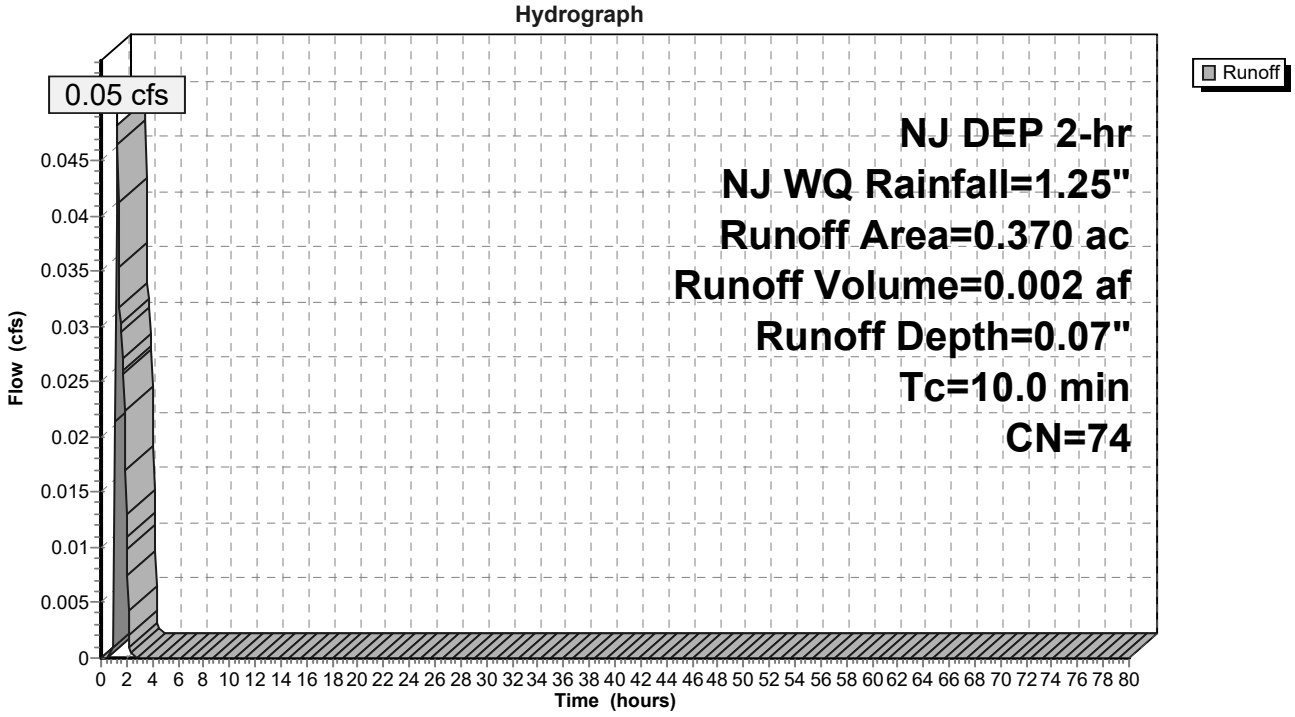
Runoff = 0.05 cfs @ 1.27 hrs, Volume= 0.002 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

	Area (ac)	CN	Description
	0.250	74	>75% Grass cover, Good, HSG C
*	0.120	74	1/2 Basin Pervious
	0.370	74	Weighted Average
	0.370		100.00% Pervious Area

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

Subcatchment 16: PROP. DA 1 PER



Summary for Subcatchment 17: OFF-SITE 1 PER DA

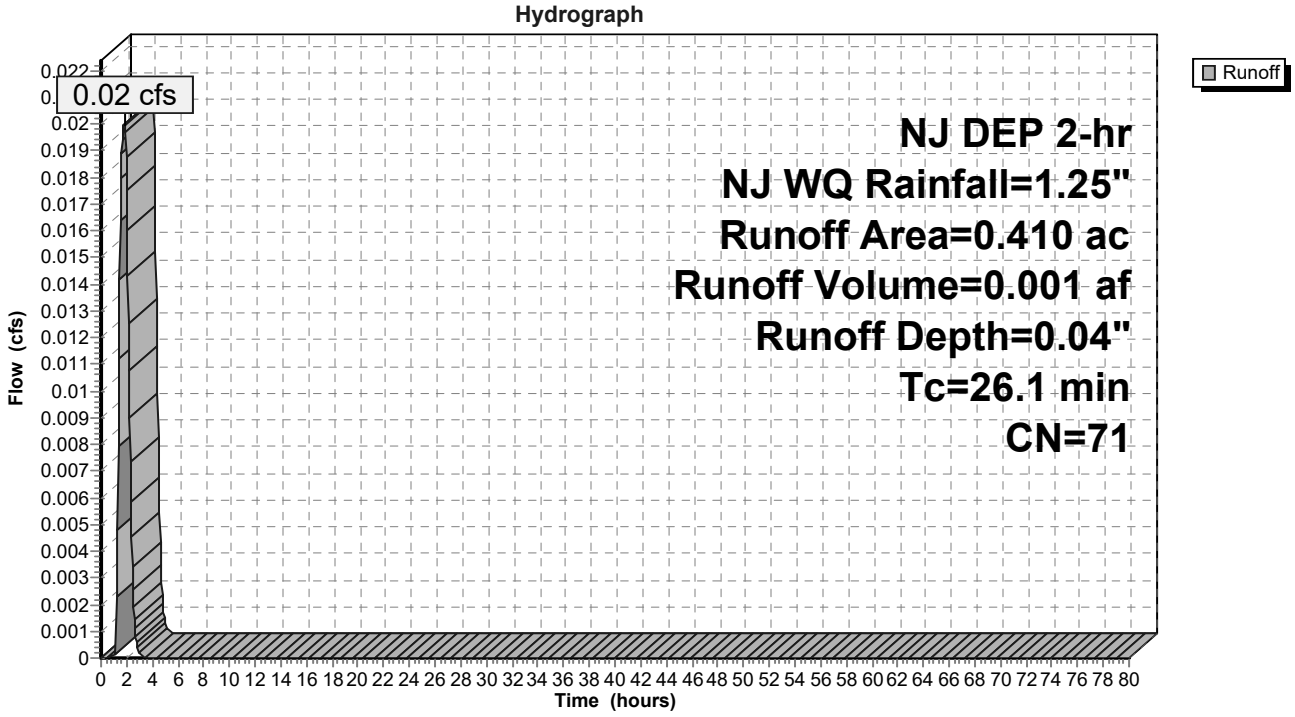
Runoff = 0.02 cfs @ 1.80 hrs, Volume= 0.001 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJ WQ Rainfall=1.25"

Area (ac)	CN	Description
0.270	70	Woods, Good, HSG C
0.140	74	>75% Grass cover, Good, HSG C
0.410	71	Weighted Average
0.410		100.00% Pervious Area

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

Subcatchment 17: OFF-SITE 1 PER DA



Summary for Pond 12: BASIN 2

Inflow Area = 5.430 ac, 18.60% Impervious, Inflow Depth = 0.27" for NJ WQ event
Inflow = 3.20 cfs @ 1.15 hrs, Volume= 0.124 af
Outflow = 0.11 cfs @ 2.50 hrs, Volume= 0.122 af, Atten= 96%, Lag= 81.0 min
Primary = 0.11 cfs @ 2.50 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 71.50' Surf.Area= 8,720 sf Storage= 2,616 cf
Peak Elev= 72.07' @ 2.50 hrs Surf.Area= 10,163 sf Storage= 7,357 cf (4,741 cf above start)

Plug-Flow detention time= 1,026.7 min calculated for 0.062 af (50% of inflow)
Center-of-Mass det. time= 607.8 min (689.7 - 82.0)

Volume	Invert	Avail.Storage	Storage Description
#1	71.50'	7,051 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	70.75'	12,087 cf	**37.08'W x 235.14'L x 5.50'H Field A** 47,959 cf Overall - 17,741 cf Embedded = 30,217 cf x 40.0% Voids
#3A	71.50'	17,741 cf	**ADS_StormTech MC-3500 d +Cap** x 160 Inside #2 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 160 Chambers in 5 Rows Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		36,879 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
71.50	0	0	0
72.00	1,406	352	352
73.00	1,913	1,660	2,011
74.00	2,501	2,207	4,218
75.00	3,165	2,833	7,051

Device	Routing	Invert	Outlet Devices
#1	Primary	71.50'	**24.0" Round RCP_Round 24"** L= 220.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 71.50' / 70.20' S= 0.0059 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	71.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.40'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.11 cfs @ 2.50 hrs HW=72.07' (Free Discharge)
└**1=RCP_Round 24"** (Passes 0.11 cfs of 1.78 cfs potential flow)
└**2=Orifice** (Orifice Controls 0.11 cfs @ 3.30 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 12: BASIN 2 - 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

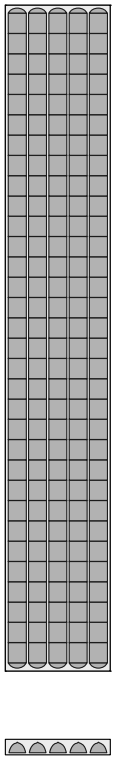
32 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 233.14' Row Length +12.0" End Stone x 2 = 235.14' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

160 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 17,741.3 cf Chamber Storage

47,958.8 cf Field - 17,741.3 cf Chambers = 30,217.5 cf Stone x 40.0% Voids = 12,087.0 cf Stone Storage

Chamber Storage + Stone Storage = 29,828.3 cf = 0.685 af
Overall Storage Efficiency = 62.2%
Overall System Size = 235.14' x 37.08' x 5.50'

160 Chambers
1,776.3 cy Field
1,119.2 cy Stone



Hydrograph for Pond 12: BASIN 2

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	2,616	71.50	0.00
2.50	**0.11**	**7,357**	**72.07**	**0.11**
5.00	0.00	6,536	71.98	0.10
7.50	0.00	5,694	71.88	0.09
10.00	0.00	4,979	71.80	0.07
12.50	0.00	4,397	71.73	0.06
15.00	0.00	3,948	71.67	0.04
17.50	0.00	3,636	71.63	0.03
20.00	0.00	3,424	71.60	0.02
22.50	0.00	3,278	71.59	0.01
25.00	0.00	3,175	71.57	0.01
27.50	0.00	3,094	71.56	0.01
30.00	0.00	3,027	71.55	0.01
32.50	0.00	2,973	71.55	0.01
35.00	0.00	2,929	71.54	0.00
37.50	0.00	2,893	71.54	0.00
40.00	0.00	2,864	71.53	0.00
42.50	0.00	2,839	71.53	0.00
45.00	0.00	2,820	71.53	0.00
47.50	0.00	2,804	71.52	0.00
50.00	0.00	2,790	71.52	0.00
52.50	0.00	2,780	71.52	0.00
55.00	0.00	2,771	71.52	0.00
57.50	0.00	2,764	71.52	0.00
60.00	0.00	2,757	71.52	0.00
62.50	0.00	2,750	71.52	0.00
65.00	0.00	2,744	71.52	0.00
67.50	0.00	2,738	71.52	0.00
70.00	0.00	2,732	71.52	0.00
72.50	0.00	2,727	71.51	0.00
75.00	0.00	2,722	71.51	0.00
77.50	0.00	2,717	71.51	0.00
80.00	0.00	2,712	71.51	0.00

PEAK WQ STORAGE VOLUME
@2.5 HRS.
7357 - 2616 = 4,741 CF

GREATER THAN 10% OF PEAK
WQ STORAGE VOLUME
@27.5 HRS.
3094 - 2616 = 478 CF

Summary for Pond 19: BASIN 1

Inflow Area = 1.570 ac, 50.32% Impervious, Inflow Depth = 0.55" for NJ WQ event
Inflow = 2.06 cfs @ 1.15 hrs, Volume= 0.072 af
Outflow = 0.08 cfs @ 2.10 hrs, Volume= 0.070 af, Atten= 96%, Lag= 57.1 min
Primary = 0.08 cfs @ 2.10 hrs, Volume= 0.070 af

Routing by Stor-Ind method, Time Span= 0.00-80.00 hrs, dt= 0.05 hrs
Starting Elev= 72.50' Surf.Area= 8,542 sf Storage= 1,708 cf
Peak Elev= 72.87' @ 2.10 hrs Surf.Area= 9,604 sf Storage= 4,531 cf (2,822 cf above start)

Plug-Flow detention time= 1,122.4 min calculated for 0.031 af (43% of inflow)
Center-of-Mass det. time= 592.0 min (667.3 - 75.3)

Volume	Invert	Avail.Storage	Storage Description
#1	72.50'	13,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	72.00'	7,549 cf	**58.50'W x 146.02'L x 3.50'H Field A** 29,897 cf Overall - 11,026 cf Embedded = 18,871 cf x 40.0% Voids
#3A	72.50'	11,026 cf	**ADS_StormTech SC-740 +Cap** x 240 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 240 Chambers in 12 Rows
		32,376 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.50	0	0	0
73.00	1,451	363	363
74.00	7,756	4,604	4,966
75.00	9,915	8,836	13,802

Device	Routing	Invert	Outlet Devices
#1	Primary	72.50'	**15.0" Round RCP_Round 15"** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 72.50' / 72.20' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	72.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	73.55'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.08 cfs @ 2.10 hrs HW=72.87' (Free Discharge)
└**1=RCP_Round 15"** (Passes 0.08 cfs of 0.46 cfs potential flow)
└**2=Orifice** (Orifice Controls 0.08 cfs @ 2.46 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 19: BASIN 1 - Chamber Wizard Field A

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

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

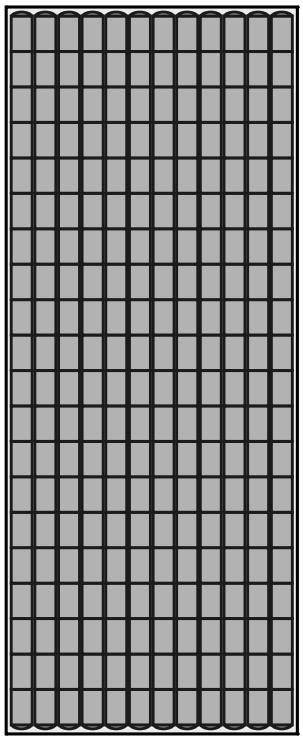
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
12 Rows x 51.0" Wide + 6.0" Spacing x 11 + 12.0" Side Stone x 2 = 58.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

240 Chambers x 45.9 cf = 11,025.6 cf Chamber Storage

29,896.9 cf Field - 11,025.6 cf Chambers = 18,871.3 cf Stone x 40.0% Voids = 7,548.5 cf Stone Storage

Chamber Storage + Stone Storage = 18,574.1 cf = 0.426 af
Overall Storage Efficiency = 62.1%
Overall System Size = 146.02' x 58.50' x 3.50'

240 Chambers
1,107.3 cy Field
698.9 cy Stone



Hydrograph for Pond 19: BASIN 1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**1,708**	**72.50**	**0.00**
2.50	**0.00**	**4,442**	**72.85**	**0.08**
5.00	0.00	3,772	72.77	0.07
7.50	0.00	3,236	72.70	0.05
10.00	0.00	2,844	72.65	0.04
12.50	0.00	2,582	72.62	0.02
15.00	0.00	2,407	72.59	0.02
17.50	0.00	2,287	72.58	0.01
20.00	0.00	2,198	72.57	0.01
22.50	0.00	2,132	72.56	0.01
25.00	0.00	2,079	72.55	0.01
27.50	0.00	2,036	72.54	0.00
30.00	0.00	2,000	72.54	0.00
32.50	0.00	1,970	72.54	0.00
35.00	0.00	1,946	72.53	0.00
37.50	0.00	1,926	72.53	0.00
40.00	0.00	1,909	72.53	0.00
42.50	0.00	1,896	72.53	0.00
45.00	0.00	1,884	72.52	0.00
47.50	0.00	1,874	72.52	0.00
50.00	0.00	1,864	72.52	0.00
52.50	0.00	1,855	72.52	0.00
55.00	0.00	1,846	72.52	0.00
57.50	0.00	1,838	72.52	0.00
60.00	0.00	1,830	72.52	0.00
62.50	0.00	1,823	72.52	0.00
65.00	0.00	1,816	72.51	0.00
67.50	0.00	1,809	72.51	0.00
70.00	0.00	1,803	72.51	0.00
72.50	0.00	1,798	72.51	0.00
75.00	0.00	1,792	72.51	0.00
77.50	0.00	1,787	72.51	0.00
80.00	0.00	1,783	72.51	0.00

PEAK WQ STORAGE VOLUME
@2.5 HRS.
4442 - 1708 = 2,734 CF

GREATER THAN 10% OF PEAK
WQ STORAGE VOLUME
@27.5 HRS.
2036 - 1708 = 328 CF

SECTION 2C

NJDEP Nonstructural Strategies Points System (NSPS)

Version: January 31, 2006

Note: Input Values in Yellow Cells Only

Project:	490 Elizabeth Ave
Date:	December 23, 2020
User:	Hammer Land Engineering
Notes:	

Step 1 - Provide Basic Major Development Site Information

A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 = 5.5 **Acres**

B. Specify by Percent the Various Planning Areas Located within the Development Site:

State Plan Planning Area:	PA-1	PA-2	PA-3	PA-4	PA-4B	PA-5	Total % Area
Percent of Each Planning Area within Site:		61.0%			39.0%		100.0%

Note: See User's Guide for Equivalent Zones within Designated Centers and the NJ Meadowlands, Pinelands, and Highlands Districts

Step 2 - Describe Existing or Pre-Developed Site Conditions

A. Specify Existing Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers			1.8		1.8		132
2	Lawn and Open Space					0.0		0
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous					0.0		0
8	Woods - Planted					0.0		0
9	Woods and Grass Combination			3.6		3.6		182
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt					0.0		0
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious			0.1		0.1		0
14	Unconnected Impervious with Small D/S Pervious					0.0		0
15	Unconnected Impervious with Large D/S Pervious					0.0		0
	HSG Subtotals (Acres):	0.0	0.0	5.5	0.0		**Total Area:**	5.5
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		**Total % Area:**	100.0%

Points Subtotal: **313**

Total Existing Site Points: **313**

Step 3 - Describe Proposed or Post-Developed Site Conditions

A. Specify Proposed Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers			1.8		1.8		132
2	Lawn and Open Space			1.2		1.2		51
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous					0.0		0
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt					0.0		0
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious			0.8		0.8		0
14	Unconnected Impervious with Small D/S Pervious			0.9		0.9		11
15	Unconnected Impervious with Large D/S Pervious			0.8		0.8		28
	HSG Subtotals (Acres):	0.0	0.0	5.5	0.0		**Total Area:**	5.5
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		**Total % Area:**	100.0%
							Points Subtotal:	**222**

B. Compare Proposed Impervious Coverage with Maximum Allowable Impervious Coverage:

Total Directly Connected Impervious Coverage =	15%	% of Site
Total Unconnected Impervious Coverage with Small D/S Pervious =	16%	% of Site
Total Unconnected Impervious Coverage with Large D/S Pervious =	15%	% of Site
Total Site Impervious Coverage =	46%	% of Site
Effective Site Impervious Coverage =	36%	% of Site
Specify Source of Maximum Allowable Impervious Coverage:	Table	(None or Table)
Allowable Site Impervious Cover from Maximum Impervious Cover Table:	49%	

Note: See Maximum Impervious Cover Table Worksheet for Details

Points Subtotal: 12

C. Compare Proposed Site Disturbance with Maximum Allowable Site Disturbance:

Total Proposed Site Disturbance =	68%	% of Site
Maximum Allowable Site Disturbance by Municipal Ordinance =	100%	% of Site

Points Subtotal: 15

D. Describe Proposed Runoff Conveyance System:

Total Length of Runoff Conveyance System =	1377	Feet
Length of Vegetated Runoff Conveyance System =	888	Feet
% of Total Runoff Conveyance System That is Vegetated =	64%	

Points Subtotal: 59

E. Residential Lot Clustering:

Percent of Total Site Area that will be Clustered =		% of Site
Minimum Standard Lot Size as Per Zoning (Note: 1/2 Acre or Greater) =		Acres
Maximum Proposed Cluster Lot Size (Note:1/4 Acre or Less) =		Acres
Percent of Clustered Portion of Site to be Preserved as Vegetated Open Space =		% of Clustered Site Portion

Points Subtotal: 0

F. Will the Following be Utilized to Minimize Soil Compaction?

Proposed Lawn Areas will be Graded with Lightweight Construction Equipment:	Yes	(Yes or No)
Percent of Proposed Lawn Areas to be Graded with Such Equipment:	100%	% of Lawn Areas

Points Subtotal: 23

G. Are Any of the Following Stormwater Management Standards Met Using Only Nonstructural Strategies and Measures?

Groundwater Recharge Standards (NJAC 7:8-5.4-a-2):	No	(Yes or No)
Stormwater Runoff Quality Standards (NJAC 7:8-5.5):	No	(Yes or No)
Stormwater Runoff Quantity Standards (NJAC 7:8-5.4-a-3):	No	(Yes or No)

Points Subtotal: 0

Note: If the Answers to All Three Questions at G Above are "Yes", Adequate Nonstructural Measures have been Utilized.

Total Proposed Site Points: 332

Ratio of Proposed to Existing Site Points: 106%

Required Site Points Ratio: 91%

Nonstructural Point System Results: Proposed Nonstructural Measures are Adequate

SECTION 2D

New Jersey Stormwater Best Management Practices Manual

February 2004

A P P E N D I X A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: Township of Franklin

County: Somerset Date: 12/22/20

Review board or agency: Township of Franklin/DRCC

Proposed land development name: 490 Elizabeth Ave

Lot(s): 34 Block(s): 514

Project or application number: _____

Applicant's name: ALPHA Finance Corp.

Applicant's address: 53 Knightsbridge Rd, Suite 200

Piscataway, NJ 08854

Telephone: (908) 429-4334 Fax: N/A

Email address: patelh@hotmail.com

Designer's name: Michael A. Rodrigues, Hammer Land Engineering

Designer's address: 663 Raritan Rd, Suite E

Cranford, NJ 07016

Telephone: 732-899-0898 Fax: 888-712-4519

Email address: mike@hammerengineering.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

The existing land cover for the site within the limit of disturbance is predominantly woods and open space. A geotechnical investigation was performed and it was determined that the existing soils have an infiltration rate less than 0.2 inches per hour, therefore the development does not provide any groundwater recharge. The site will utilize an aboveground stormwater basin in conjunction with a below ground detention basin to provide storage of the 2, 10, and 100-year storm events. Stormwater conveyance is provided mostly through curb cuts and vegetated swales on all sides of the property where practicable. The site has been designed to limit the increase in impervious coverage (approximately 46%) and land disturbance (approximately 68%). Wooded areas and areas with native vegetation will be preserved to the furthest extents possible. Regular inspection and maintenance of the proposed stormwater system will be required as indicated in the Operations and Maintenance Manual. Fertilizers if required, will be applied in accordance with the Standards of the Soil Erosion and Sediment Control Act.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

2004 BMP Manual, revised through 2020

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: Local ordinance references NJAC 7:8.

List LID-BMPs prohibited by local regulations: N/A

Pre-design meeting held? Yes: _____ Date: _____ No: X

Meeting held with: _____

Pre-design site walk held? Yes: _____ Date: _____ No: X

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: Township of Franklin

Required approval: Site Plan Approval

Name: Somerset-Union County Soil Conservation District

Required approval: Soil Erosion and Sediment Contraol Plan Certification

Name: Somerset County Planning Board

Required approval: Site Plan Approval

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No: _____

If yes, was this inventory a factor in the site's layout and design? Yes: X No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: _____ If yes, specify % of site: 32%

Native ground cover? Yes: X No: _____ If yes, specify % of site: 32%

Vegetated buffers? Yes: X No: _____ If yes, specify % of site: 15%

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: X If yes, specify % of site: _____

Native ground cover? Yes: _____ No: X If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: X If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: X No: _____

Reduce runoff pollutant loads through runoff treatment: Yes: X No: _____

Maintain groundwater recharge by preserving natural areas: Yes: _____ No: X

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X No: _____

If yes, were these inventories factors in the site's layout and design? Yes: X No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: X No: _____

If yes, how: Township of Franklin requires a conservation easement

_____

Restrict temporary site disturbance during construction? Yes: X No: _____

If yes, how: Tree protection, silt fencing and limiting land disturbance around perimeter of site.

_____

Consider soils and slopes in selecting disturbance limits? Yes: _____ No: X

If yes, how: _____

_____

C. Specify percentage of site to be cleared: 68% Regraded: 68%

D. Specify percentage of cleared areas done so for buildings: 20%

For driveways and parking: 41% For roadways: N/A

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: 0% HSG B: 0% HSG C: 100% HSG D: 0%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: N/A HSG B: N/A HSG C: 68% HSG D: N/A

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

All of site is located within HSG 'C' soil types.

I. Does the site include Karst topography? Yes: _____ No: X

If yes, discuss measures taken to limit Karst impacts:

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 0.12 Ac. Proposed: 2.52 Ac.

B. Specify maximum site impervious coverage allowed by regulations: 60%

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity	N/A	N/A
Residential access – medium intensity	N/A	N/A
Residential access – high intensity with parking	N/A	N/A
Residential access – high intensity without parking	N/A	N/A
Neighborhood	N/A	N/A
Minor collector – low intensity without parking	N/A	N/A
Minor collector – with one parking lane	N/A	N/A
Minor collector – with two parking lanes	N/A	N/A
Minor collector – without parking	N/A	N/A
Major collector	N/A	N/A

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9'X 18' Regulations: 9'X 18'

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 30 Regulations: 36

F. Specify percentage of total site impervious cover created by buildings: 20%

By driveways and parking: 41% By roadways: N/A

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

Reducing the number of parking spaces however note that parking provided meets what is required by the ordinance.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 68% Buildings: 18% Driveways and parking: 50% Roads: N/A

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: N/A

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 0%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 36% Vegetated swale: 64% Natural channel: 0%

Stormwater management facility: 0% Other: N/A

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

Additional swales, however due to the narrow nature of the site, it is not possible.Also based on infiltration testing, the site does not have suitable infiltration rates. Water quality will be addressed through the use of manufactured treatment devices and extended detention.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: _____

Increase overland flow roughness: Grass areas are already at a minimum slope.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: Trash Enclosure

Specify the spacing between the trash receptacles: N/A

Compare trash receptacles proposed with those required by regulations:

Proposed: N/A Regulations: N/A

B. Pet Waste Stations

Specify the number of pet waste stations provided: 0

Specify the spacing between the pet waste stations: N/A

Compare pet waste stations proposed with those required by regulations:

Proposed: _____ Regulations: N/A

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: TBD Regulations: N/A

Litter collection: Proposed: TBD Regulations: N/A

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

Operations and maintenance manual

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: N/A

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.	X	
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.	X	
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

The site layout design makes a concerted effort to disconnect runoff from impervious surfaces along with preserving existing natural areas. Stormwater runoff quality and attenuation will be provided. Groundwater recharge is not required since the site soils have an infiltration rate of less than 1 inch per hour.

SECTION 2E

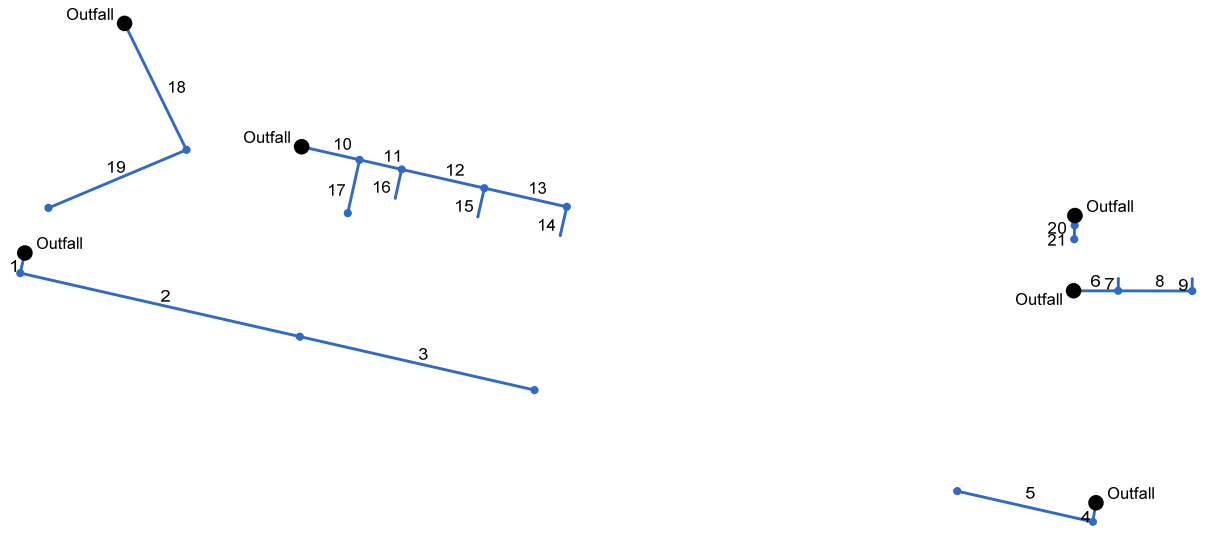
Job #:	**19201**
Job Description:	**Alpha 490 Elizabeth Ave**
Designed By:	**MDS**
Checked By:	**MAR**
Date:	**December 27, 2020**
Location:	**Franklin, NJ**
Design Storm:	**25**

Surface	"C"
Impervious	0.99
Grassed Area 'C'	0.51
Grassed Area 'D'	0.65
Woods 'C'	0.45
Woods 'D'	0.59
Runoff Coefficient Adjustment Factor =	**1.00**

INLET AREA #	TOTAL AREA (AC)	Impervious Area (Ac) C = 0.99	Grassed Area 'C' Area (Ac) ADJ. C = 0.51	Grassed Area 'D' Area (Ac) ADJ. C = 0.65	Woods 'C' Area (Ac) ADJ. C = 0.45	Woods 'D' Area (Ac) ADJ. C = 0.59	ADJUSTED WEIGHTED C (*)	A X C	TC
111	0.09	0.07	0.02				0.88	0.08	10.0
112	0.61	0.11	0.22		0.28		0.57	0.35	10.0
107 RL	0.12	0.12					0.99	0.12	10.0
108 RL	0.12	0.12					0.99	0.12	10.0
206	1.63	0.05	0.81		0.77		0.50	0.81	10.0
207	2.19	0.42	1.08		0.69		0.58	1.28	10.0
213	0.05	0.04	0.01				0.89	0.04	10.0
213 RL	0.04	0.04					0.99	0.04	10.0
214 RL	0.10	0.10					0.99	0.10	10.0
215 RL	0.12	0.12					0.99	0.12	10.0
216 RL	0.15	0.15					0.99	0.15	10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
									10.0
BASIN 1									10.0
BASIN 2									10.0
BASIN 3									10.0
Totals	5.22	1.34	**2.14**	**0.00**		0.00	0.46	**2.42**	

Percent Impervious **25.7%** **Total Composite 'C'**

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 2020-12-23 STM.stm	Number of lines: 21	Date: 12/27/2020

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	15.680	0.00	3.82	0.00	0.00	2.09	0.0	11.3	5.5	11.48	8.13	6.80	18	0.51	71.75	71.83	73.04	73.31	74.25	78.00	205
2	1	217.093	1.63	3.82	0.50	0.82	2.09	10.0	10.7	5.6	11.69	8.06	6.62	18	0.50	72.00	73.09	73.97	76.27	78.00	77.50	206
3	2	182.167	2.19	2.19	0.58	1.27	1.27	10.0	10.0	5.8	7.31	8.04	4.14	18	0.50	73.09	74.00	76.61	77.36	77.50	77.50	207
4	End	14.698	0.09	0.70	0.88	0.08	0.43	10.0	11.1	5.5	2.37	5.77	3.22	15	0.68	72.70	72.80	73.60	73.41	77.60	75.50	111
5	4	105.253	0.61	0.61	0.57	0.35	0.35	10.0	10.0	5.8	2.00	4.31	3.43	15	0.38	72.80	73.20	73.41	73.79	75.50	75.50	112
6	End	33.790	0.00	0.24	0.00	0.00	0.24	0.0	11.8	5.4	1.29	4.66	3.24	15	0.44	72.55	72.70	73.00	73.15	77.55	76.81	107
7	6	9.161	0.12	0.12	0.99	0.12	0.12	10.0	10.0	5.8	0.68	1.37	3.12	8	1.09	72.90	73.00	73.31	73.39	76.81	80.00	107 RL
8	6	56.004	0.00	0.12	0.00	0.00	0.12	0.0	10.1	5.7	0.68	4.18	1.47	15	0.36	72.70	72.90	73.31	73.33	76.81	76.12	108
9	8	9.161	0.12	0.12	0.99	0.12	0.12	10.0	10.0	5.8	0.68	1.37	2.87	8	1.09	72.90	73.00	73.38	73.39	76.12	80.00	108 RL
10	End	44.990	0.00	0.46	0.00	0.00	0.45	0.0	14.1	5.0	2.27	6.35	3.40	18	0.31	72.12	72.26	72.69	72.91	80.25	76.72	213
11	10	32.727	0.00	0.37	0.00	0.00	0.37	0.0	13.6	5.1	1.87	6.60	2.13	18	0.34	72.26	72.37	73.06	73.07	76.72	76.83	214
12	11	64.106	0.00	0.27	0.00	0.00	0.27	0.0	12.4	5.3	1.42	6.51	1.84	18	0.33	72.37	72.58	73.16	73.18	76.83	77.03	215
13	12	64.000	0.00	0.15	0.00	0.00	0.15	0.0	10.2	5.7	0.85	6.36	1.40	18	0.31	72.58	72.78	73.25	73.27	77.03	86.60	216
14	13	22.384	0.15	0.15	0.99	0.15	0.15	10.0	10.0	5.8	0.85	1.30	3.18	8	0.98	72.78	73.00	73.31	73.44	86.60	80.00	216 RL
15	12	22.383	0.12	0.12	0.99	0.12	0.12	10.0	10.0	5.8	0.68	1.30	2.91	8	0.98	72.78	73.00	73.25	73.39	77.03	80.00	215 RL
16	11	22.382	0.10	0.10	0.99	0.10	0.10	10.0	10.0	5.8	0.57	1.30	2.92	8	0.98	72.78	73.00	73.16	73.35	76.83	80.00	214 RL
17	10	41.465	0.09	0.09	0.94	0.08	0.08	10.0	10.0	5.8	0.49	5.32	1.53	15	0.58	72.26	72.50	73.06	72.77	76.72	75.80	213A
18	End	106.907	0.00	0.00	0.00	0.00	0.00	0.0	0.5	0.0	11.25	18.81	5.71	24	0.59	70.20	70.83	71.40	72.03	73.20	76.50	202
19	18	113.421	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	11.25	18.83	5.70	24	0.59	70.83	71.50	72.03	72.70	76.50	74.50	203
20	End	7.455	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	5.28	5.73	5.33	15	0.67	72.13	72.18	73.06	73.13	0.94	75.00	102
21	20	10.583	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	5.28	5.69	5.26	15	0.66	72.43	72.50	73.38	73.45	75.00	73.00	103

Project File: 2020-12-23 STM.stm

Number of lines: 21

Run Date: 12/27/2020

NOTES:Intensity = 54.48 / (Inlet time + 11.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box

SECTION 2F

12/23/2020

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, July 1999

Structure: SCOUR HOLE 1

Job # 19201
Job Name: Alpha 490 Elizabeth
Designed by: MDS
Checked by: MAR

HAMMER LAND ENGINEERING

Q =	5.28 c.f.s.	W_o=	1.25 Ft.
D_o=	1.25 Ft.	q=Q/W_o=	4.22 c.f.s.
TW=	0.25 Ft.		

(For areas where Tw cannot be computed, use Tw = 0.2D_o)

d_{50} Stone size formula — **When Y = 1/2 D_o**

$d_{50} = \frac{0.0125 * q^{1.33}}{TW}$ = 0.34 Ft. = 5 " Stone Calculated

5 " Stone Used for Construction

0.63 ' = Y

d_{50} Stone size formula — **When Y = D_o**

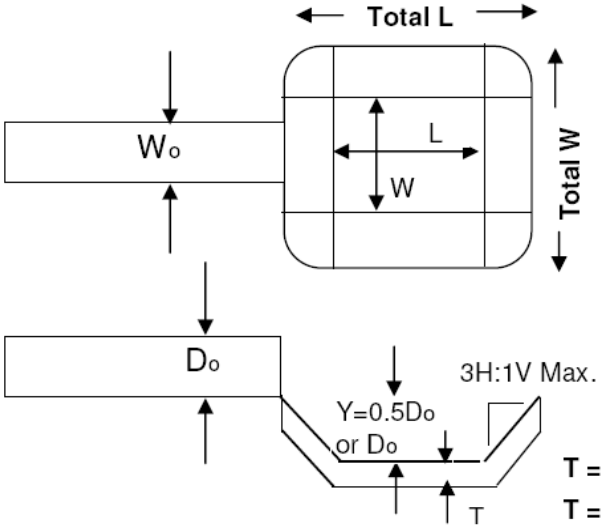
$d_{50} = \frac{0.0082 * q^{1.33}}{TW}$ = 0.22 Ft. = 3 " Stone Calculated

3 " Stone Used for Construction

1.25 ' = Y

NJ Standards require d_{50}=3" min, NJDOT requires d_{50}=6" min

Y = Depth of scour hole below culvert invert



L = 3 D_o = 3.75 '
W = 2 W_o = 2.50 '

If Y = 1/2D_o
Total L = 7.50 , Total W = 6.25

If Y = D_o
Total L = 11.25 , Total W = 10.00

T = d_{50} Stone size x 2 if filter fabric is used
T = d_{50} Stone size x 3 if *no* filter fabric is used

Structure SCOUR HOLE 1 Design Summary

Select Scour Hole Design	Total L = 7.5 '	L =	3.75 '
	Total W = 6.25 '	W =	2.5 '
	Depth of scour hole (Y) =		0.625 '
Y = 1/2 Do Use Filter Fabric	d_{50} stone size =		5 "
	Thickness of riprap (T) =		10 "
	Volume of riprap (V) =		1.45 CY

Notes:

12/23/2020

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, July 1999

Structure: SCOUR HOLE 2

Job # 19201
Job Name: Alpha 490 Elizabeth
Designed by: MDS
Checked by: MAR

HAMMER LAND ENGINEERING

Q =	11.25 c.f.s.	W_o=	2.00 Ft.
D_o=	2.00 Ft.	q=Q/W_o=	5.63 c.f.s.
TW=	0.40 Ft.		

(For areas where Tw cannot be computed, use Tw = 0.2D_o)

d_{50} Stone size formula — **When Y = 1/2 D_o**

$d_{50} = \frac{0.0125 * q^{1.33}}{TW}$ = 0.31 Ft. = 4 " Stone Calculated

4 " Stone Used for Construction

1.00 ' = Y

d_{50} Stone size formula — **When Y = D_o**

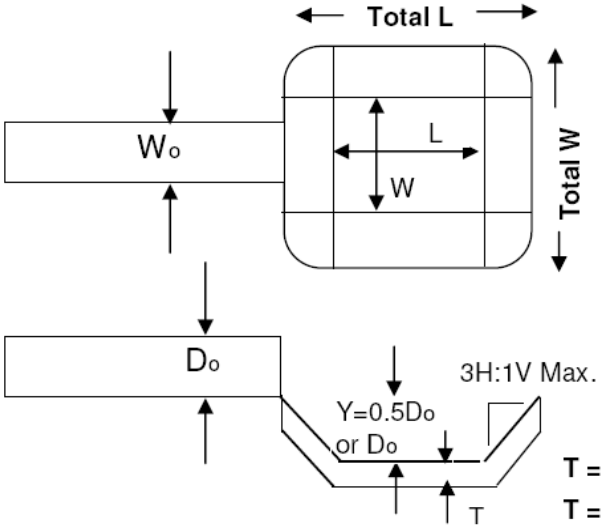
$d_{50} = \frac{0.0082 * q^{1.33}}{TW}$ = 0.20 Ft. = 3 " Stone Calculated

3 " Stone Used for Construction

2.00 ' = Y

NJ Standards require d_{50}=3" min, NJDOT requires d_{50}=6" min

Y = Depth of scour hole below culvert invert



L = 3 D_o = 6.00 '
W = 2 W_o = 4.00 '

If Y = 1/2D_o
Total L = 12.00 , Total W = 10.00

If Y = D_o
Total L = 18.00 , Total W = 16.00

T = d_{50} Stone size x 2 if filter fabric is used
T = d_{50} Stone size x 3 if *no* filter fabric is used

Structure SCOUR HOLE 2 Design Summary

Select Scour Hole Design	Total L = 12 '	L =	6 '
	Total W = 10 '	W =	4 '
	Depth of scour hole (Y) =		1 '
Y = 1/2 Do Use Filter Fabric	d_{50} stone size =		4 "
	Thickness of riprap (T) =		8 "
	Volume of riprap (V) =		2.96 CY

Notes:

RIPRAP CALCULATIONS

TW > 0.5Do

NJ Standards for SESC, Ch. 12, July 1999

Job # 19201
Job Name: Alpha 490 Elizabeth
Designed by: MDS
Checked by: MAR

Structure: RIP RAP APRON 204
Select TW Conditions: TW > 0.5Do

HAMMER LAND ENGINEERING

Q =	**6.60 c.f.s.**	W_o=	**1.50 Ft.**
D_o=	**1.50 Ft.**	q=Q/W_o=	**4.40 c.f.s.**
		TW =	**1.32 Ft.**

Length of apron (La)

$La = \frac{3q}{D_o^{1/2}}$ = **10.8 Ft.** **11 Ft. Provided**

Width of apron (W_1) (downstream end)

W1 = 3Wo + 0.4La = **8.8 Ft.** **9 Ft. Provided**

Width of apron (W_2) (outlet end)

$W_2 = 3W_o$ = **4.5 Ft.** **5 Ft. Provided**

d_{50} Stone size

$d_{50} = \frac{0.016 * q^{1.33}}{TW}$ = **0.09 Ft.**

2 " Stone Calculated

3 " Stone Used for Construction

NJ Standards require d_{50}=3" min, NJDOT requires d_{50}=6" min

Apron Thickness (T)

T = d_{50} Stone size x 2 if filter fabric is used

T = d_{50} Stone size x 3 if no filter fabric is used

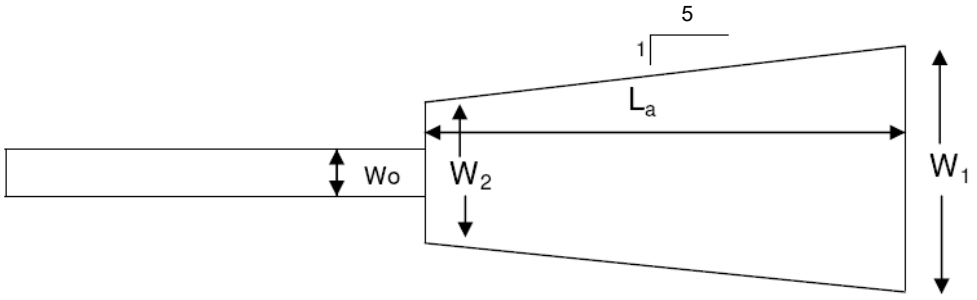
Select Apron Design

Use Filter Fabric

T = 6 " Thick with fabric

Volume of riprap = 1.43 CY

Structure RIP RAP APRON 204 Detail



W2 = 5' **La = 11'** **W1 = 9'**

Notes:

Job #:	**19201**
Job Description:	**Alpha 490 Elizabeth Ave**
Designed By:	**MDS**
Checked By:	**MAR**
Date:	**December 22, 2020**
Location:	**Franklin, NJ**
Design Storm:	**25**

Surface	"C"
Impervious	0.99
Grassed Area 'C'	0.51
Grassed Area 'D'	0.65
Woods 'C'	0.45
Woods 'D'	0.59
Runoff Coefficient Adjustment Factor =	**1.00**

RIP RAP #	TOTAL AREA (AC)	Impervious Area (Ac) C = 0.99	Grassed Area 'C' Area (Ac) ADJ. C = 0.51	Grassed Area 'D' Area (Ac) ADJ. C = 0.65	Woods 'C' Area (Ac) ADJ. C = 0.45	Woods 'D' Area (Ac) ADJ. C = 0.59	ADJUSTED WEIGHTED C (*)	A X C	TC
1	0.07	0.06	0.01				0.92	0.06	10.0
2	0.05	0.04	0.01				0.89	0.04	10.0
3	0.05	0.05					0.99	0.05	10.0
4	0.05	0.05					0.99	0.05	10.0
5	0.06	0.06					0.99	0.06	10.0
6	0.06	0.06					0.99	0.06	10.0
7	0.11	0.11					0.99	0.11	10.0
8	0.11	0.11					0.99	0.11	10.0
9	0.11	0.11					0.99	0.11	10.0
10	0.06	0.06					0.99	0.06	10.0
11	0.16	0.16					0.99	0.16	10.0
12	0.08	0.07	0.01				0.93	0.07	10.0
13	0.04	0.04					0.99	0.04	10.0
14	0.02	0.02					0.99	0.02	10.0
15	0.03	0.03					0.99	0.03	10.0
16	0.03	0.03					0.99	0.03	10.0
17	0.03	0.03					0.99	0.03	10.0
18	0.04	0.04					0.99	0.04	10.0
19	0.03	0.03					0.99	0.03	10.0
20	0.17	0.17					0.99	0.17	10.0
21	0.17	0.16	0.01				0.96	0.16	10.0
22	0.34	0.33	0.01				0.98	0.33	10.0
									10.0
									10.0
									10.0
									10.0
									10.0
Totals	1.87	1.82	**0.05**	**0.00**		0.00	0.98	**1.83**	

Percent Impervious **97.3%** **Total Composite 'C'**

FLOW CALCULATIONS FOR BIORETENTION BASIN INFLOW RIP RAP AREAS

RIP RAP AREA	Q(cfs)	c	I(in/hr)	A(ac)
1	0.36	0.92	5.62	0.07
2	0.25	0.89	5.62	0.05
3	0.28	0.99	5.62	0.05
4	0.28	0.99	5.62	0.05
5	0.33	0.99	5.62	0.06
6	0.33	0.99	5.62	0.06
7	0.61	0.99	5.62	0.11
8	0.61	0.99	5.62	0.11
9	0.61	0.99	5.62	0.11
10	0.33	0.99	5.62	0.06
11	0.33	0.99	5.62	0.06
12	0.42	0.93	5.62	0.08
13	0.22	0.99	5.62	0.04
14	0.11	0.99	5.62	0.02
15	0.17	0.99	5.62	0.03
16	0.17	0.99	5.62	0.03
17	0.17	0.99	5.62	0.03
18	0.22	0.99	5.62	0.04
19	0.17	0.99	5.62	0.03
20	0.95	0.99	5.62	0.17
21	0.92	0.96	5.62	0.17
22	1.87	0.98	5.62	0.34

RIPRAP CALCULATIONS Job # 19201

TW = 0.2Do Job Name: 490 Elizabeth Ave

NJ Standards for SESC, Ch. 12, January 2014 Designed by: MAR

Checked by: MAR

Structure: Rip Rap Area #22

Select TW Conditions: TW = 0.2Do

HAMMER LAND ENGINEERING

Q =	**1.87**	**c.f.s.**	W_o=	**4.00** **Ft.**
D_o=	**0.50**	**Ft.**	q=Q/W_o=	**0.47** **c.f.s.**
TW= 0.2Do =	**0.10**	**Ft.**		

Length of apron (La)

$La = \frac{1.8q + 7Do}{Do^{1/2}}$ = **4.7 Ft.** **5 Ft. Provided**

Width of apron (W_1) (downstream end)

W1 = 3Wo + La = **16.7 Ft.** **17 Ft. Provided**

Width of apron (W_2) (outlet end)

$W_2 = 3W_o$ = **12.0 Ft.** **12 Ft. Provided**

d_{50} Stone size

$d_{50} = \frac{0.016 * q^{1.33}}{TW}$ = **0.06 Ft.** **1 " Stone Calculated**

3 " Stone Used for Construction

NJ Standards require d_{50}=3" min, NJDOT requires d_{50}=6" min

Apron Thickness (T)

T = d_{50} Stone size x 2 if filter fabric is used

T = d_{50} Stone size x 3 if no filter fabric is used

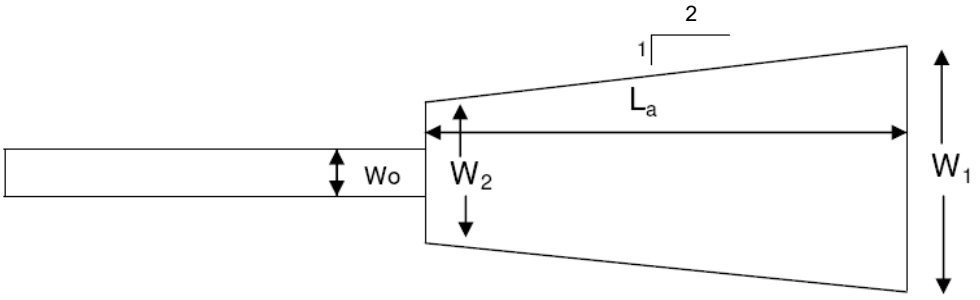
Select Apron Design

Use Filter Fabric

T = 6 " Thick with fabric

Volume of riprap = 1.34 CY

Structure Rip Rap Area #22 Detail



W2 = 12' **La = 5'** **W1 = 17'**

Notes:

SECTION 2G

New Jersey Groundwater Recharge Spreadsheet Version 2.0 November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
SOMERSET CO., FRANKLIN TWP	45.7	1.48

Project Name:	490 ELIZABETH AVE.
Description:	OFFICE/WAREHOUSE DEV.
Analysis Date:	12/23/20

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	3.61	Woods	Penn	12.9	168,506
2	0.12	Impervious areas	Udorthents	0.0	-
3					
4					
5					
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	3.7			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				12.4	168,506

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	1.22	Open space	Penn	12.3	54,505
2	2.51	Impervious areas	Udorthents	0.0	-
3					
4					
5					
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	3.7			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				4.0	54,505

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft) 109,336
Post-Development Annual Recharge Deficit=	*114,000*	(cubic feet)

Recharge Efficiency Parameters Calculations (area averages)

RWC=	#N/A	(in)	DRWC=	#N/A	(in)
ERWC =	#N/A	(in)	EDRWC=	#N/A	(in)

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.

Project Name	Description	Analysis Date	BMP or LID Type
490 ELIZABETH AVE.	OFFICE/WAREHOUSE DEV.	12/23/20	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	8099.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	2.4	in
Upper level of the BMP surface (negative if above ground)	dBMPu	78.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	84.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	2	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	1.49	in
Inches of Rainfall to capture	Pdesign	1.71	in
Recharge Provided Avg. over Imp. Area		33.0	in
Runoff Captured Avg. over imp. Area		33.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.77	unitless
BMP Volume	VBMP	1,620	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	114,000	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	10,454	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.48	no units
Average Annual P	Pavg	45.7	in
Recharge Requirement over Imp. Area	dr	12.5	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		59,121	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.9%	%
%Runoff Infiltrated		190.6%	%
%Runoff Recharged		18.2%	%
%Rainfall Recharged		14.2%	%

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 sensetive 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.

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 clik the "Default Vdef & Aimp" button.

Proposed Recharge Volume Underground Basin 1
Contributing Impervious Drainage Area is 10,454 SF
Available Volume for Recharge is the 6" thick stone base beneath the system invert (8,099 SF system, 40% Void Ratio)

Project Name	Description	Analysis Date	BMP or LID Type
490 ELIZABETH AVE.	OFFICE/WAREHOUSE DEV.	12/23/20	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	7870.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	3.6	in
Upper level of the BMP surface (negative if above ground)	dBMPu	87.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	96.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	2	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.00	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	1.49	in
Inches of Rainfall to capture	Pdesign	1.71	in
Recharge Provided Avg. over Imp. Area		33.0	in
Runoff Captured Avg. over imp. Area		33.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.38	unitless
BMP Volume	VBMP	2,361	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	114,000	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	20,909	sq.ft
Root Zone Water Capacity	RWC	0.00	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.48	no units
Average Annual P	Pavg	45.7	in
Recharge Requirement over Imp. Area	dr	12.5	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		57,449	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.9%	%
%Runoff Infiltrated		92.6%	%
%Runoff Recharged		17.7%	%
%Rainfall Recharged		13.8%	%

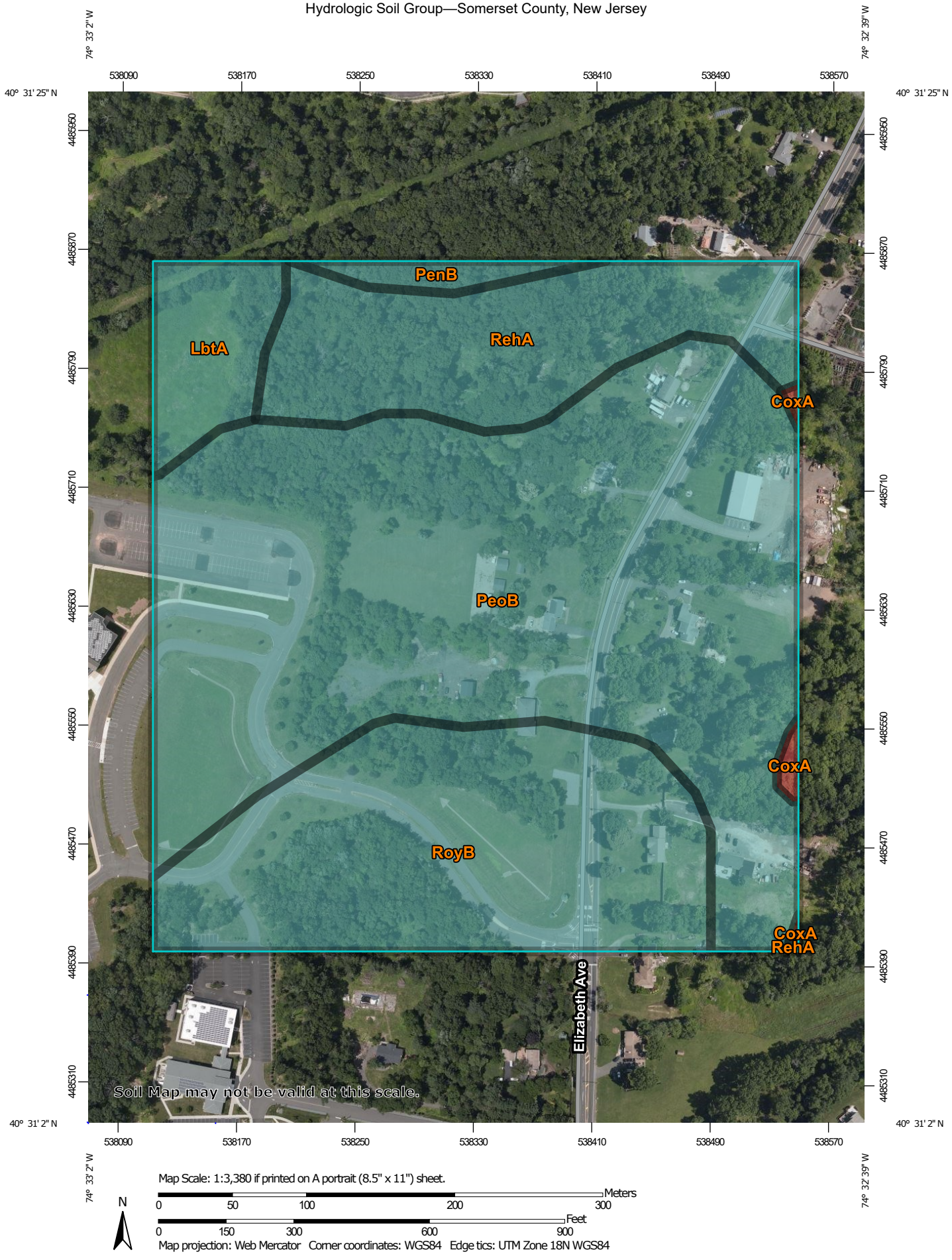
OTHER NOTES

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 sensetive 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.

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 clik the "Default Vdef & Aimp" button.

Proposed Recharge Volume Underground Basin 2
Contributing Impervious Drainage Area is 20,909 SF
Available Volume for Recharge is the 9" thick stone base beneath the system invert (7,870 SF system, 40% Void Ratio)

SECTION 3



Map Scale: 1:3,380 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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 1:24,000.

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: Somerset County, New Jersey
Survey Area Data: Version 17, Sep 16, 2019

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

Date(s) aerial images were photographed: Jun 22, 2019—Jul 13, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CoxA	Croton silt loam, 0 to 2 percent slopes	D	0.2	0.4%
LbtA	Lansdowne silt loam, 0 to 2 percent slopes	C	2.4	4.8%
PenB	Penn silt loam, 2 to 6 percent slopes	C	0.7	1.4%
PeoB	Penn channery silt loam, 2 to 6 percent slopes	C	27.6	54.9%
RehA	Reaville silt loam, 0 to 2 percent slopes	C	7.3	14.6%
RoyB	Royce silt loam, 2 to 6 percent slopes	C	12.1	24.0%
Totals for Area of Interest			**50.2**	**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

NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

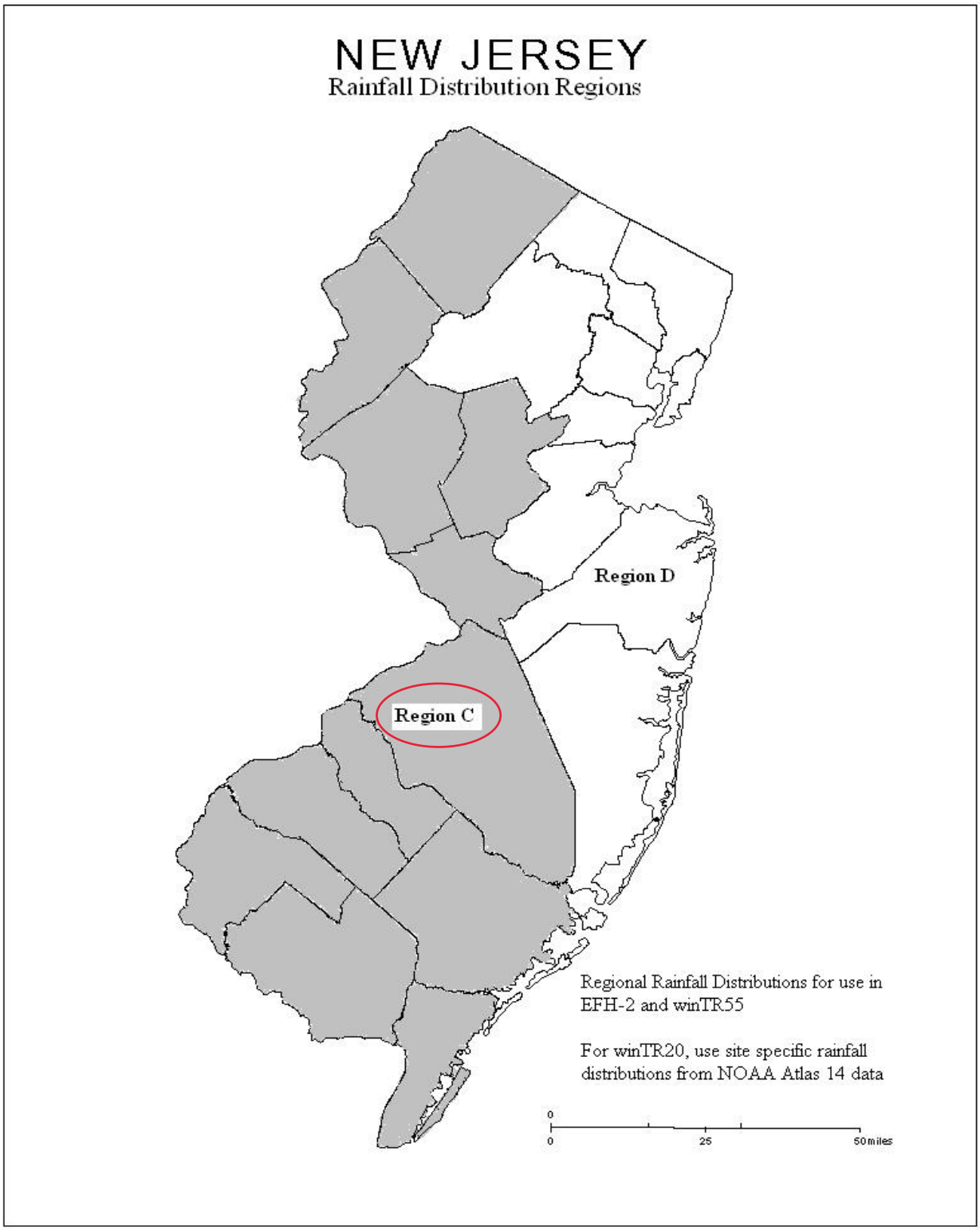
Rainfall amounts in Inches

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.


NEW JERSEY
Rainfall Distribution Regions
Region D
Region C
Regional Rainfall Distributions for use in EFH-2 and winTR55
For winTR20, use site specific rainfall distributions from NOAA Atlas 14 data
0
0
25
50 miles

NOAA Atlas 14, Volume 2, Version 3
Location name: Somerset, New Jersey, USA*
Latitude: 40.5213°, Longitude: -74.5465°
Elevation: 75.95 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.98** (3.61-4.40)	**4.75** (4.30-5.24)	**5.63** (5.08-6.22)	**6.26** (5.65-6.92)	**7.04** (6.32-7.76)	**7.60** (6.78-8.36)	**8.14** (7.24-8.98)	**8.63** (7.63-9.52)	**9.24** (8.10-10.2)	**9.68** (8.44-10.7)
10-min	**3.19** (2.88-3.52)	**3.80** (3.43-4.19)	**4.51** (4.07-4.97)	**5.01** (4.52-5.53)	**5.62** (5.04-6.19)	**6.05** (5.40-6.66)	**6.47** (5.75-7.13)	**6.84** (6.05-7.55)	**7.30** (6.40-8.08)	**7.63** (6.64-8.46)
15-min	**2.65** (2.40-2.94)	**3.18** (2.88-3.52)	**3.80** (3.43-4.20)	**4.22** (3.81-4.67)	**4.74** (4.26-5.23)	**5.10** (4.56-5.62)	**5.45** (4.84-6.01)	**5.75** (5.09-6.35)	**6.13** (5.37-6.78)	**6.38** (5.56-7.08)
30-min	**1.82** (1.65-2.01)	**2.20** (1.99-2.43)	**2.70** (2.44-2.98)	**3.06** (2.76-3.38)	**3.51** (3.15-3.87)	**3.84** (3.43-4.23)	**4.17** (3.71-4.60)	**4.48** (3.96-4.94)	**4.88** (4.28-5.40)	**5.17** (4.50-5.73)
60-min	**1.13** (1.03-1.25)	**1.38** (1.25-1.52)	**1.73** (1.56-1.91)	**1.99** (1.80-2.20)	**2.34** (2.10-2.58)	**2.60** (2.33-2.87)	**2.87** (2.56-3.17)	**3.14** (2.78-3.47)	**3.50** (3.07-3.87)	**3.77** (3.29-4.18)
2-hr	**0.692** (0.622-0.770)	**0.844** (0.759-0.937)	**1.07** (0.962-1.19)	**1.25** (1.12-1.38)	**1.49** (1.33-1.65)	**1.69** (1.50-1.87)	**1.89** (1.67-2.10)	**2.11** (1.85-2.33)	**2.40** (2.08-2.67)	**2.64** (2.26-2.94)
3-hr	**0.513** (0.462-0.572)	**0.624** (0.563-0.697)	**0.793** (0.714-0.885)	**0.925** (0.830-1.03)	**1.11** (0.988-1.23)	**1.26** (1.12-1.40)	**1.41** (1.24-1.57)	**1.57** (1.38-1.75)	**1.80** (1.55-2.00)	**1.98** (1.69-2.20)
6-hr	**0.329** (0.296-0.368)	**0.399** (0.359-0.445)	**0.506** (0.454-0.563)	**0.594** (0.531-0.659)	**0.719** (0.637-0.796)	**0.824** (0.725-0.910)	**0.936** (0.816-1.03)	**1.06** (0.913-1.17)	**1.23** (1.05-1.36)	**1.38** (1.16-1.52)
12-hr	**0.198** (0.178-0.223)	**0.240** (0.215-0.270)	**0.307** (0.274-0.343)	**0.363** (0.323-0.405)	**0.446** (0.393-0.496)	**0.517** (0.453-0.575)	**0.595** (0.516-0.660)	**0.682** (0.583-0.757)	**0.811** (0.681-0.901)	**0.921** (0.761-1.02)
24-hr	**0.113** (0.105-0.123)	**0.137** (0.127-0.149)	**0.175** (0.162-0.191)	**0.208** (0.192-0.226)	**0.257** (0.236-0.279)	**0.300** (0.272-0.325)	**0.347** (0.312-0.376)	**0.400** (0.356-0.434)	**0.478** (0.419-0.521)	**0.545** (0.471-0.596)
2-day	**0.066** (0.060-0.072)	**0.079** (0.073-0.087)	**0.101** (0.092-0.111)	**0.120** (0.109-0.131)	**0.146** (0.132-0.161)	**0.169** (0.152-0.185)	**0.194** (0.173-0.213)	**0.221** (0.195-0.243)	**0.260** (0.226-0.288)	**0.293** (0.252-0.326)
3-day	**0.046** (0.043-0.051)	**0.056** (0.051-0.062)	**0.071** (0.065-0.078)	**0.084** (0.076-0.092)	**0.102** (0.093-0.112)	**0.118** (0.106-0.129)	**0.134** (0.120-0.147)	**0.152** (0.135-0.167)	**0.178** (0.156-0.197)	**0.200** (0.172-0.221)
4-day	**0.037** (0.034-0.040)	**0.045** (0.041-0.049)	**0.056** (0.052-0.062)	**0.066** (0.060-0.072)	**0.080** (0.073-0.088)	**0.092** (0.083-0.100)	**0.104** (0.093-0.114)	**0.118** (0.105-0.129)	**0.137** (0.120-0.151)	**0.153** (0.133-0.169)
7-day	**0.025** (0.023-0.027)	**0.030** (0.027-0.032)	**0.037** (0.034-0.040)	**0.043** (0.039-0.046)	**0.051** (0.047-0.056)	**0.058** (0.053-0.063)	**0.066** (0.059-0.071)	**0.074** (0.066-0.080)	**0.085** (0.075-0.093)	**0.094** (0.082-0.104)
10-day	**0.020** (0.018-0.021)	**0.023** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.036)	**0.039** (0.036-0.042)	**0.044** (0.040-0.047)	**0.049** (0.045-0.053)	**0.055** (0.049-0.059)	**0.062** (0.056-0.068)	**0.068** (0.060-0.075)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.027-0.031)	**0.032** (0.030-0.034)	**0.035** (0.032-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.021-0.024)	**0.024** (0.022-0.025)	**0.026** (0.024-0.028)	**0.027** (0.025-0.029)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.012)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.020** (0.019-0.022)	**0.021** (0.020-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.014-0.015)	**0.015** (0.015-0.016)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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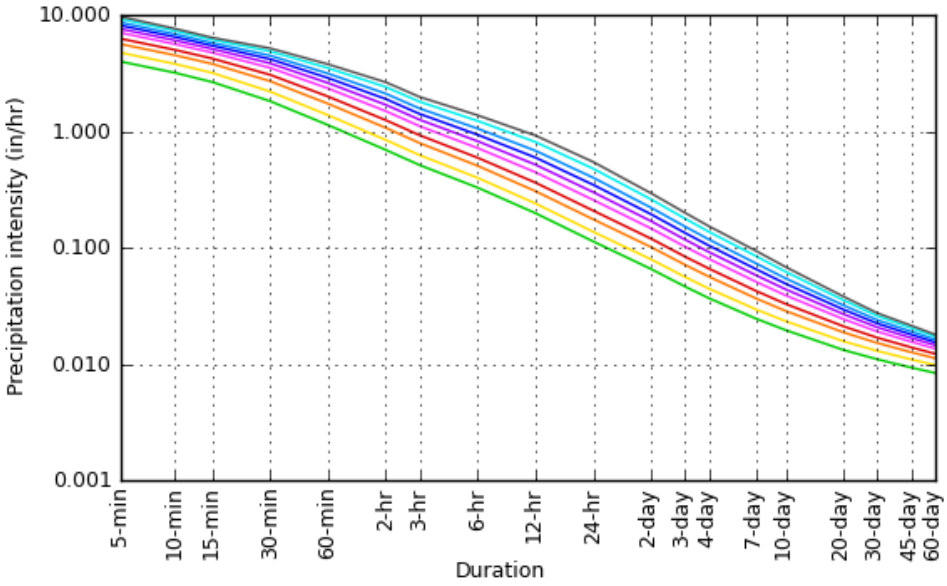
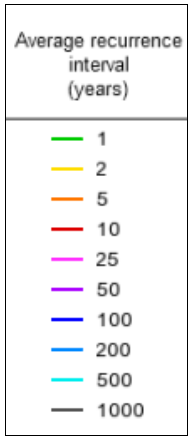
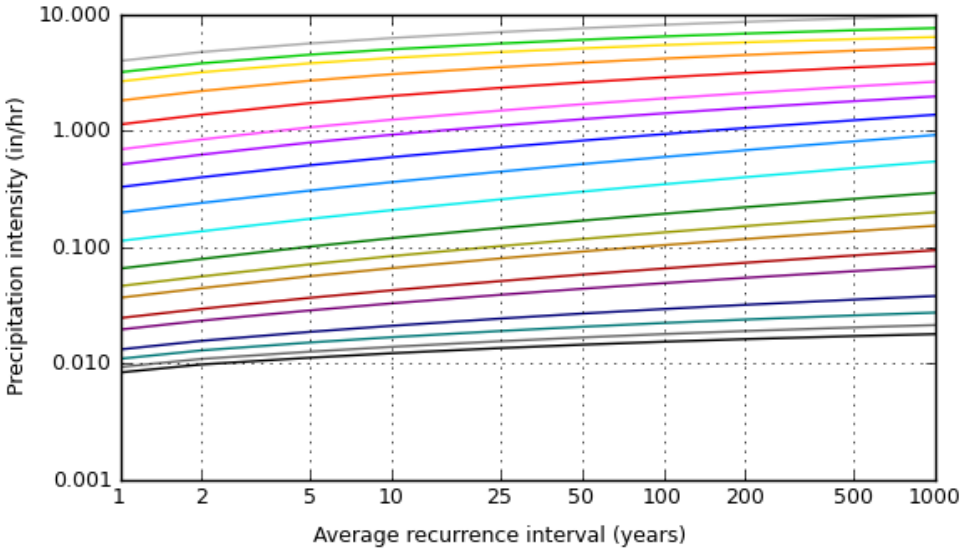
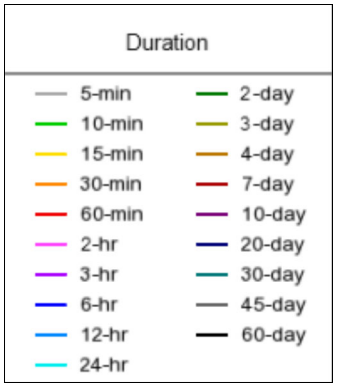
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 40.5213°, Longitude: -74.5465°









NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Mon Apr 20 13:19:18 2020

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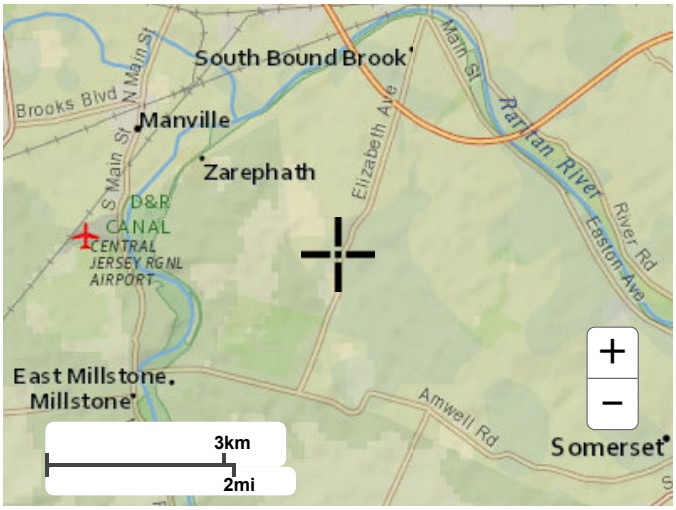
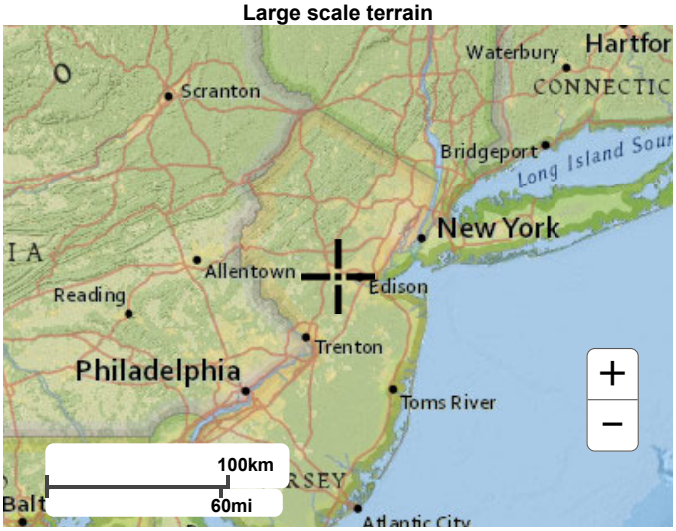
Maps & aerials

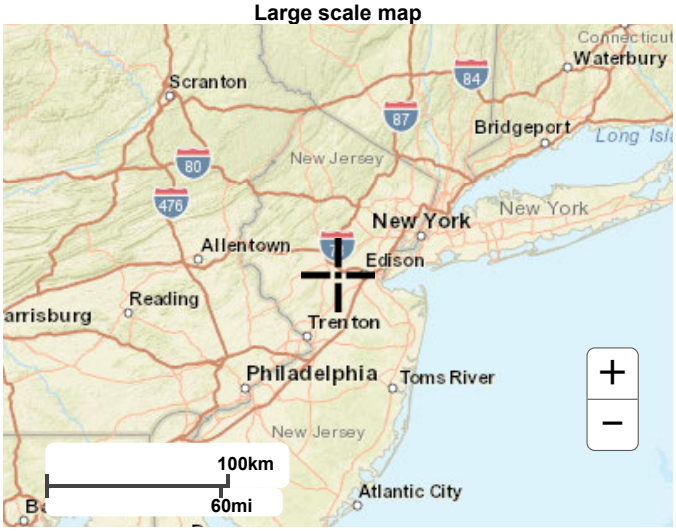
Small scale terrain



Large scale terrain



Large scale map

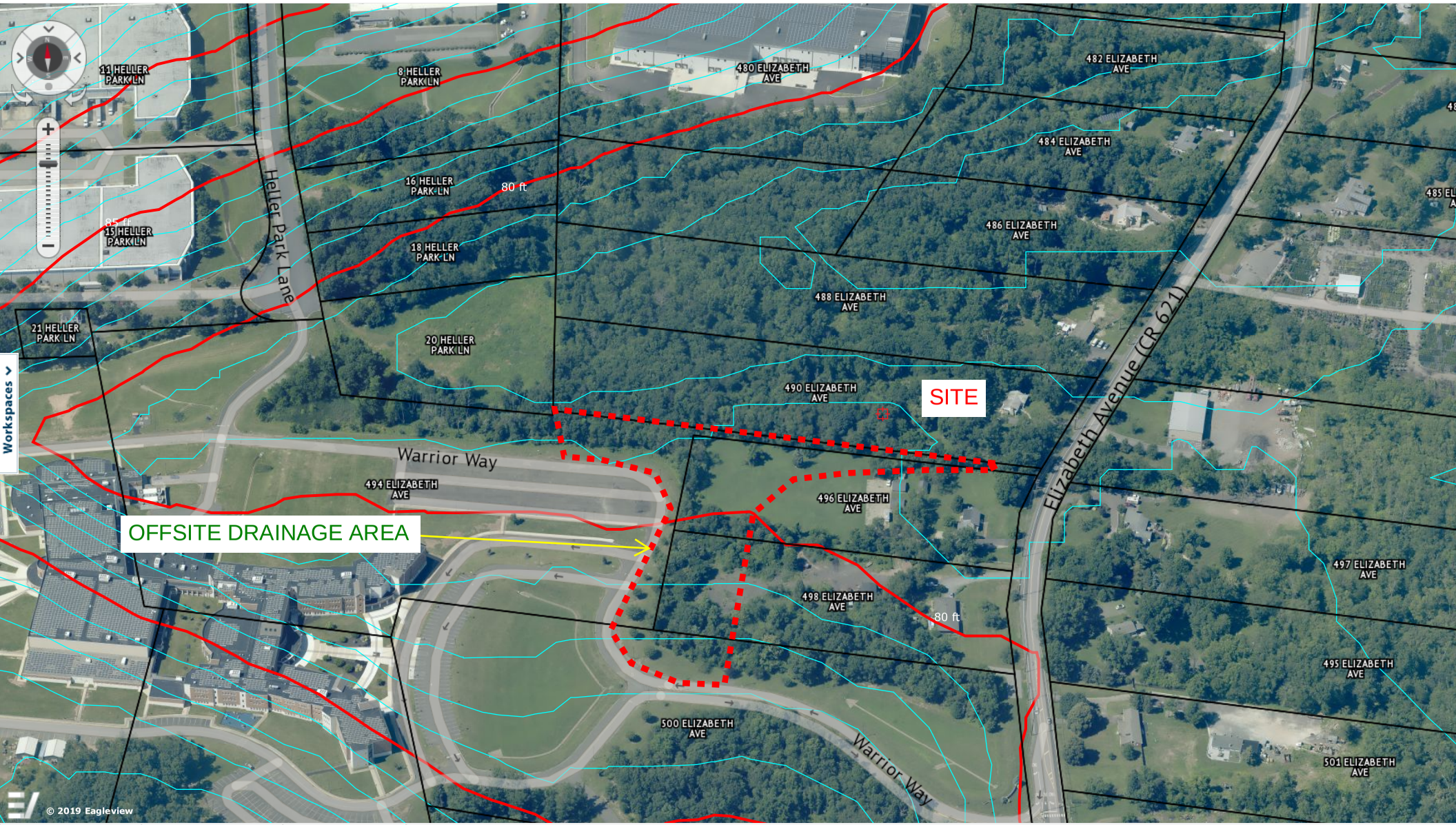


Large scale aerial

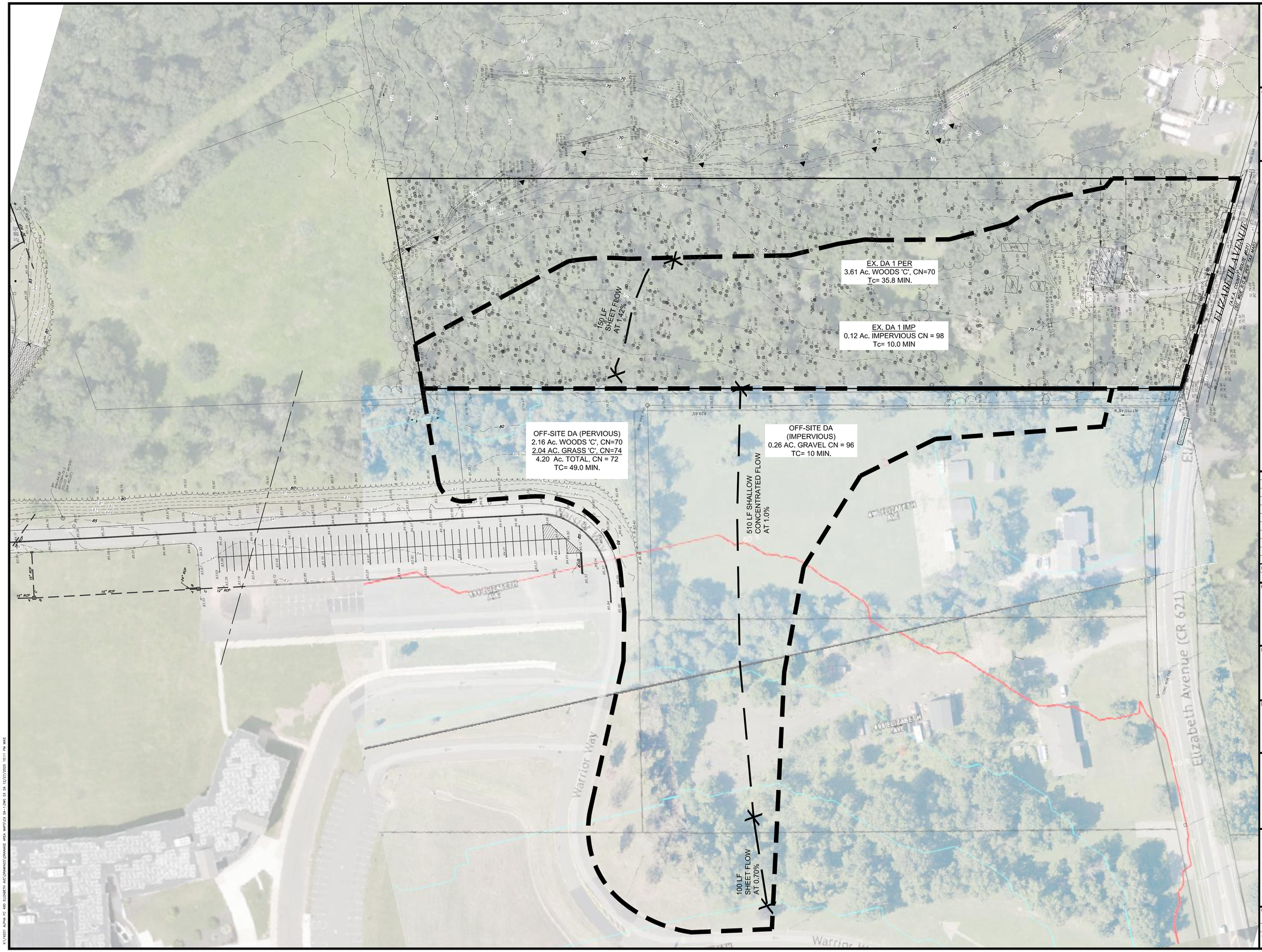
Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer



NOTE:
The contributing offsite drainage area was established utilizing both field observations and the aerial topography shown hereon sourced from the Pictometry website.



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LAND ENGINEERING

"THE WAY TO ENTITLEMENT"
GROUNDBREAKING RESULTS

APPLICANT:

ALPHA FINANCE CORP
53 KNIGHTSBRIDGE ROAD
SUITE 200
PISCATAWAY, NJ 08854
T: 908.429.4334

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NO.	DATE	ISSUE OR REVISION	BY
1	12/23/20	DRCC STREAM CORRIDOR	MAR

REVISIONS

PROJECT:

490 ELIZABETH AVENUE

LOCATION:

BLOCK 514, LOT 34
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NJ

DRAWING TITLE:

EXISTING DRAINAGE AREA MAP

HAMMER
LAND ENGINEERING
663 RARITAN ROAD, SUITE E
CRANFORD, NJ 07016
(TEL) 732.899.0898 (FAX) 888.712.4519
CERTIFICATE OF AUTHORIZATION #24GA28176300
HAMMERENGINEERING.COM

MICHAEL A. RODRIGUES
PROFESSIONAL ENGINEER
NJ LICENSE NUMBER 48141

DRAWN BY:	CHECKED BY:	DRAWING NUMBER:
MDS	MAR	DA-01
SCALE: 1" = 50'		
JOB NUMBER: 19201	DATE: 07.23.20	SHEET 1 OF 1

N:\19201 ACPA FC 490 ELIZABETH AVE\DRAWINGS\DRAINAGE AREA MAP\EX DA-1.DWG EX DA 12/23/2020 10:11 PM MRS

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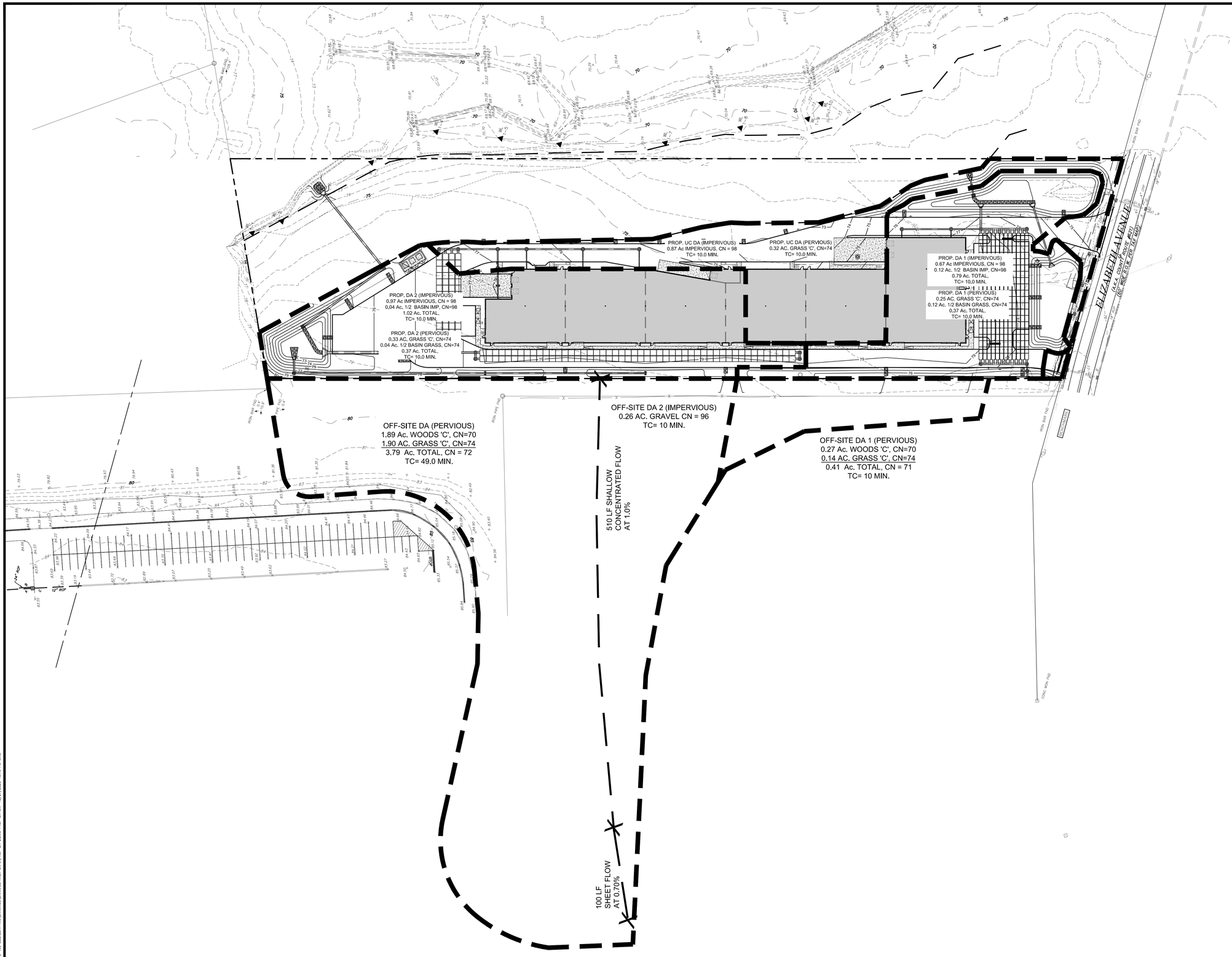

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1	12/23/20	DRCC STREAM CORRIDOR	MAR

REVISIONS

PROJECT:

490 ELIZABETH AVENUE

LOCATION:

BLOCK 514, LOT 34
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NJ

DRAWING TITLE:

PROPOSED DRAINAGE AREA MAP

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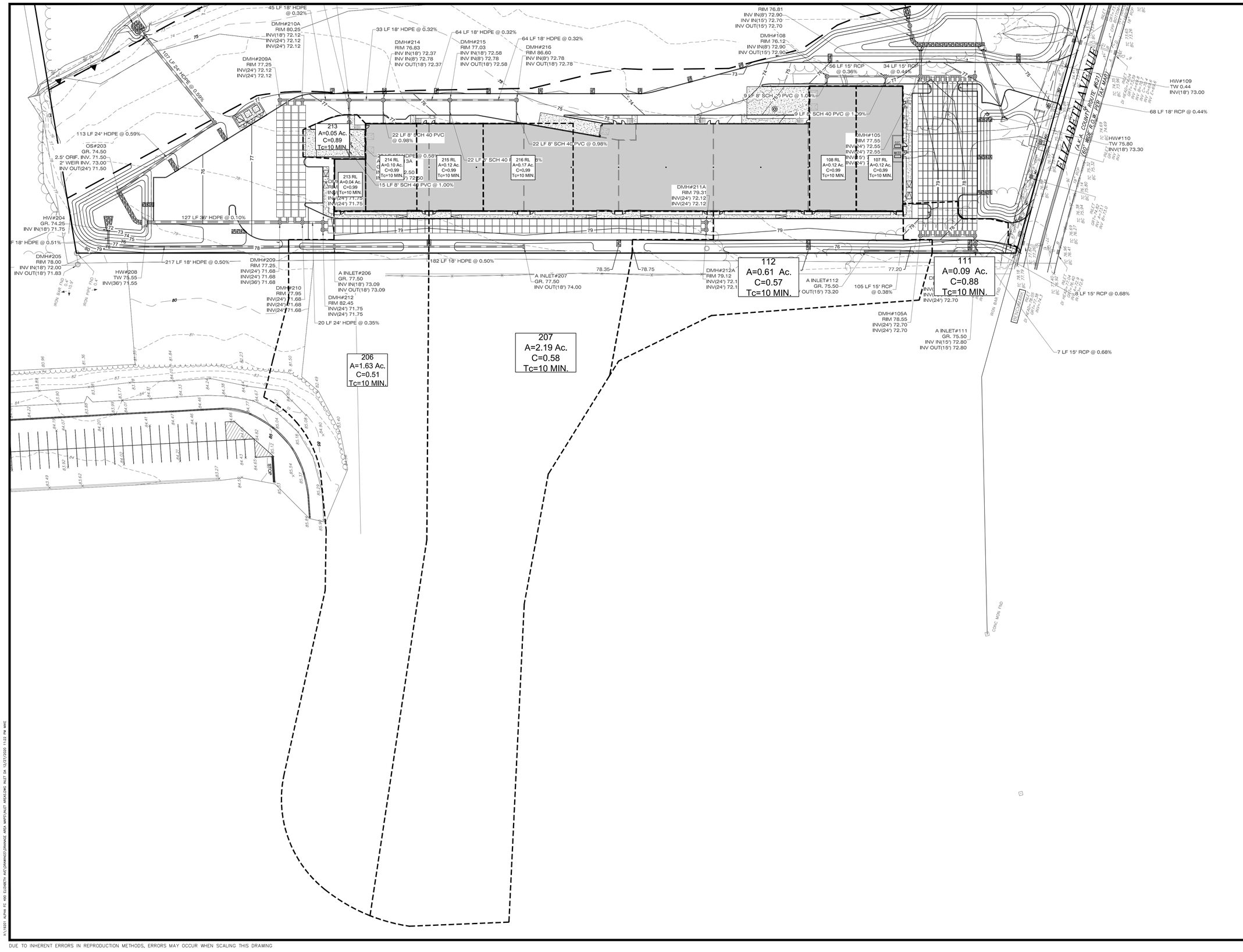

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NO.	DATE	ISSUE OR REVISION	BY
1	12/23/20	DRCC STREAM CORRIDOR	MAR

REVISIONS

PROJECT:

490 ELIZABETH AVENUE

LOCATION:

BLOCK 514, LOT 34
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NJ

DRAWING TITLE:

INLET DRAINAGE AREA MAP

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SCALE: 1" = 40'		
JOB NUMBER: 19201	DATE: 07.23.20	SHEET 1 OF 1

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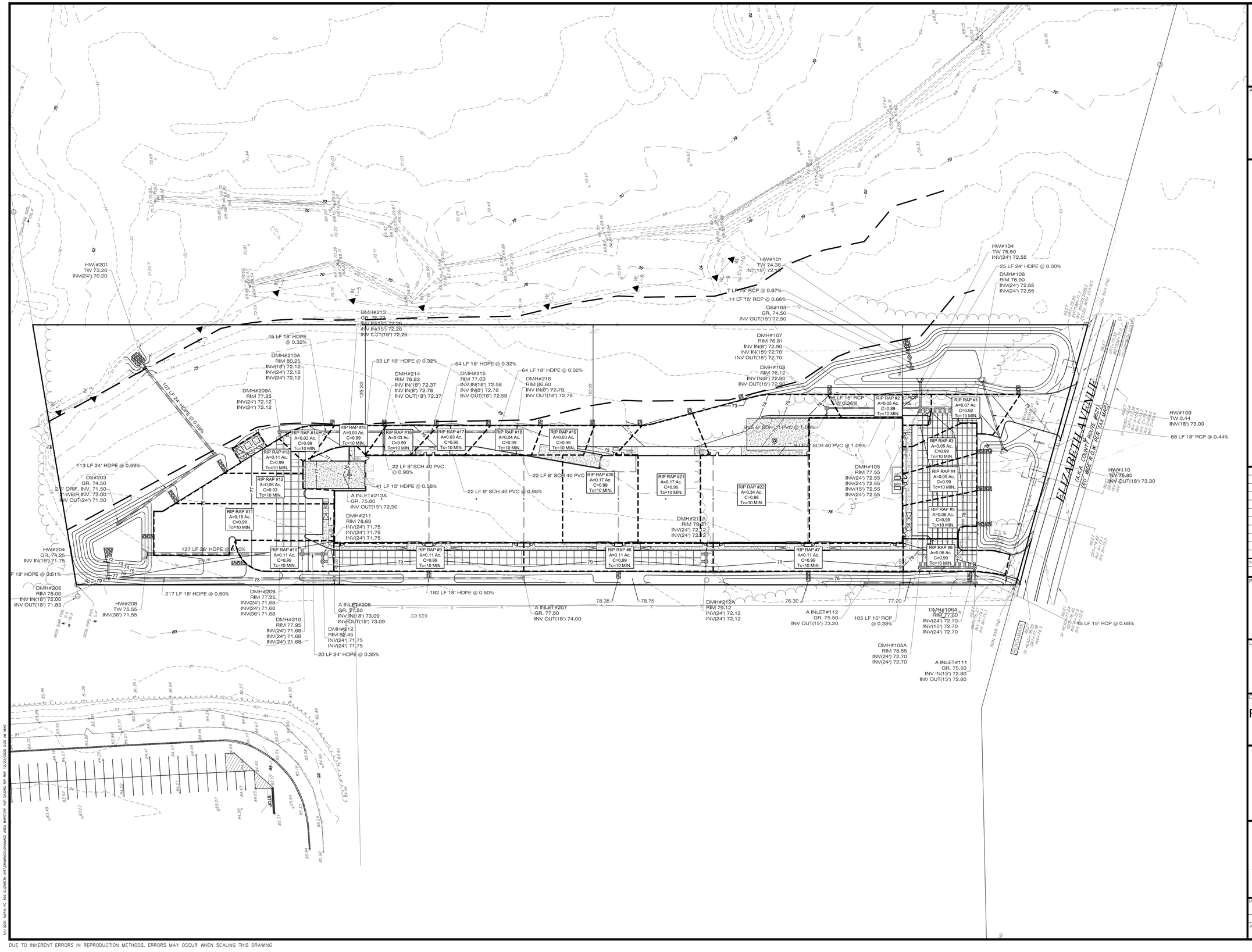

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REVISIONS

PROJECT:

490 ELIZABETH AVENUE

LOCATION:

BLOCK 514, LOT 34
TOWNSHIP OF FRANKLIN
SOMERSET COUNTY, NJ

DRAWING TITLE:

RIP RAP DRAINAGE AREA MAP

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(TEL) 732.899.0898 (FAX) 888.712.4519
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SCALE: 1" = 40'		
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I:\19201 ALPHA FIN. AVE ELIZABETH, AVE\DRAWINGS\DRAINAGE AREA MAPS\RIP RAP DRAINAGE RIP RAP 12/23/2020 2:25 AM MDS