Ministers Estates

39 Sunset Rock Road
Andover, Massachusetts

PROJECT REPORT

on
Drainage & Sedimentation Control
&
Project Stormwater Report

Prepared For:

MINSTERS LANE, LLC
42 School Street
Andover, MA 01810

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Date: April 14, 2025
Revised:

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Ministers Estates

Andover, Massachusetts

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II. Project Narrative

i. Introduction

Ministers Estates is a proposed five (5) lot single-family residential subdivision, located on the west side of Sunset Rock Road in Andover, Massachusetts. The subject property consists of approximately 4.7± acres of wooded vegetation. The topography slopes from a high point near the northerly boundary of the property to a low point along the southerly property boundary. The elevations range from a high of 238 to a low of 202, a general vertical elevation difference of approximately thirty-six (36) feet.

The soils within the project consist mainly of the Canton series with a small area of the Woodbridge series along Sunset Rock Road. The Canton series is classified as being within the SCS-Hydrological Soils Group (HSG) A & B; ranked first & second on a scale of four (A, B, C, D) in terms of infiltration capacity and the Woodbridge series is classified as being within the HSG C/D.

These calculations determine Pre-Development and Post-Development peak flow rates (Q) using the SCS-TR20 Runoff Method with HydroCAD. Proposed mitigation of the increase in runoff is being obtained primarily through the proposed detention/infiltration facilities within the property. The results for each drainage area, which experiences an increase in impervious area and therefore an apparent increase in peak runoff, will be tabulated. The objective is to mitigate the storm drainage flows such that there will be no increase in the peak rate of runoff at any point along the parcel's boundary. The calculations will be performed for the 2, 10, 25 and 100-year storm events.

Applicable regulations of the Town of Andover and the State of Massachusetts are incorporated herein.

ii. Summary & Results

As indicated in the Introduction, the objective is to mitigate the storm drainage flows such that there will be no increase in the peak rate of runoff at any point at the parcel's boundary. The following table summarizes the pre-development vs. the post-development peak runoff flow rates for the 2, 10, 25 and 100-year storm event. As indicated, due to the detention/infiltration mitigation facilities located within the project, the peak rates of runoff from the site are not increased under any design storm conditions, therefore, no downstream properties should be adversely affected by this project.

Pre-Development vs. Post-Development Drainage Summary Tables

Point #1 (A)

Design Storm	Peak Flow Rate		
	Pre-Dev. (cfs)	Post-Dev. (cfs)	Δ (cfs)
2	0.0	0.0	0.0
10	0.0	0.0	0.0
25	0.1	0.1	0.0
100	0.6	0.6	0.0

Point #2 (B)

Design Storm	Peak Flow Rate		
	Pre-Dev. (cfs)	Post-Dev. (cfs)	Δ (cfs)
2	0.5	0.4	(0.1)
10	2.9	2.9	0.0
25	5.0	4.9	0.1[1]
100	8.5	8.3	(0.2)

[1] Increase in the flow rate of this magnitude is minimal and considered negligible.

Point #3 (C)

Design Storm	Peak Flow Rate		
	Pre-Dev. (cfs)	Post-Dev. (cfs)	Δ (cfs)
2	0.0	0.0	0.0
10	0.0	0.0	0.0
25	0.0	0.0	0.0
100	0.2	0.2	0.0

Point #4 (D)

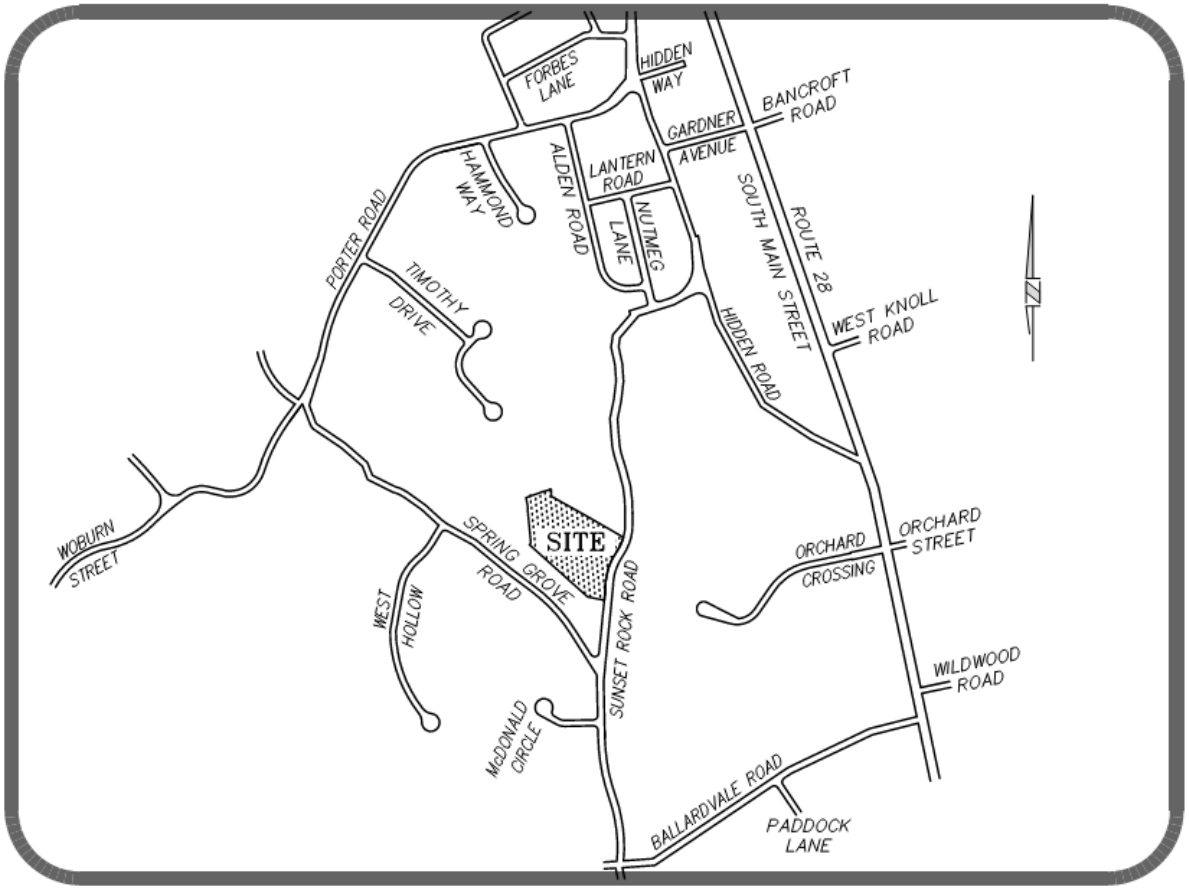
Design Storm	Peak Flow Rate		
	Pre-Dev. (cfs)	Post-Dev. (cfs)	Δ (cfs)
2	0.0	0.0	0.0
10	0.1	0.0	(0.1)
25	0.2	0.1	(0.1)
100	1.0	1.0	0.0

Point #5 (E)

Design Storm	Peak Flow Rate		
	Pre-Dev. (cfs)	Post-Dev. (cfs)	Δ (cfs)
2	0.0	0.0	0.0
10	0.1	0.1	0.0
25	0.4	0.3	(0.1)
100	1.3	0.7	(0.6)

These Storm Drainage calculations were prepared in accordance with the applicable Town of Andover Regulations and the Massachusetts DEP Stormwater Handbook. Drainage structures and pipes were designed according to generally accepted engineering principles and in accordance with the stated regulations.

III. Locus Map, USGS Map & FIRMette Map



LOCUS MAP

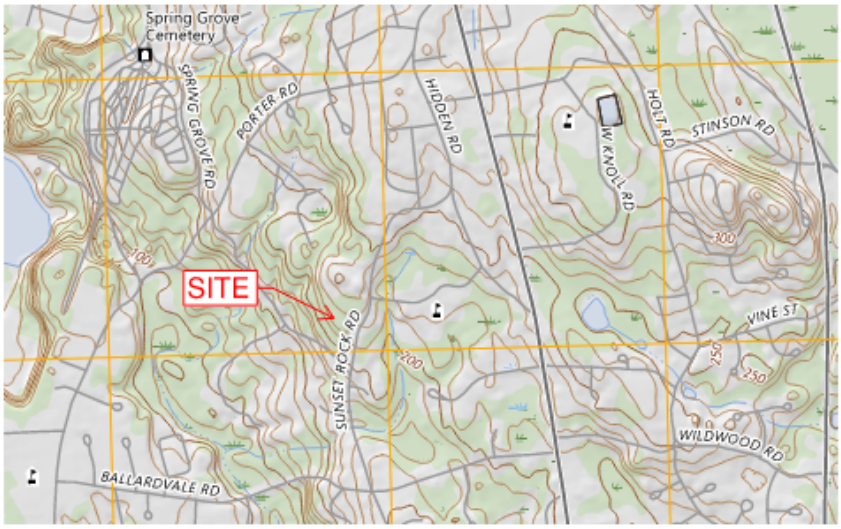
SCALE: 1" = 800'

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

7.5-MINUTE TOPO QUADRANGLE
Custom Extent
7.5-MINUTE TOPO

The National Map
OnDemand Topo



SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
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1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR SMOOTHNESS = Medium

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 19T

Data is provided by The National Map (TNM), is the best available at the time of map generation, and includes data content from supporting themes of Elevation, Hydrography, Geographic Names, Boundaries, Transportation, Structures, Land Cover, and Orthoimagery. Refer to associated Federal Geographic Data Committee (FGDC) Metadata for additional source data information.

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands. Temporal changes may have occurred since these data were collected and some data may no longer represent actual surface conditions.

Learn About The National Map: https://nationalmap.gov

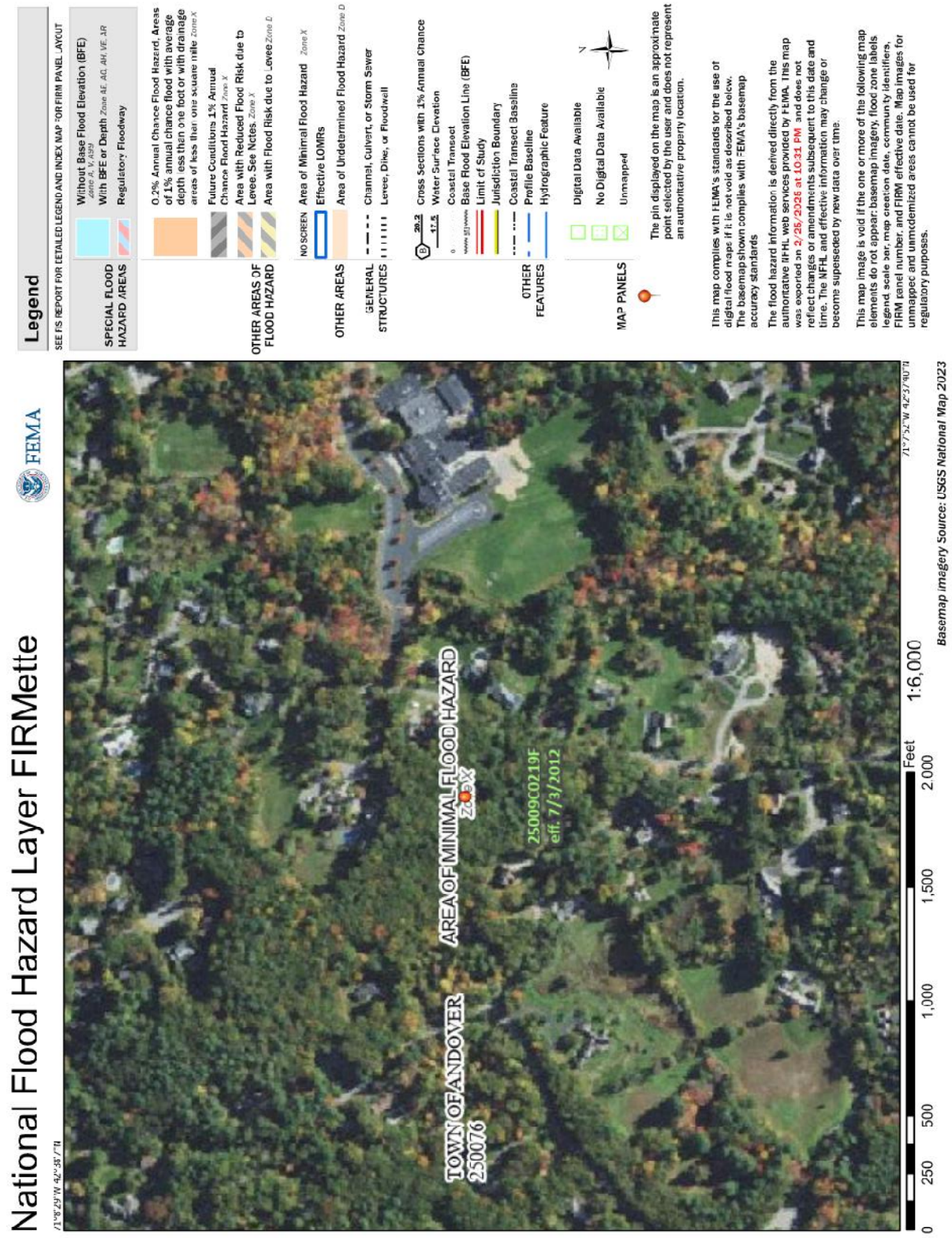
ROAD CLASSIFICATION

Expressway	Local Connector
Secondary Hwy	Local Road
Ramp	4WD

Interstate Route US Route State Route

Ministers Estates

Andover, Massachusetts



IV. Storm Drain Calculations

i. Description of Drainage System

The proposed drainage system is a combination closed and open system. Decreases in the peak flow rates of runoff will be obtained primarily through use of the proposed detention/infiltration facilities. Catch basins will be constructed to collect the runoff and transport it to the closed drainage system and discharge to the detention basin. The basin will serve to detain and store the runoff while discharging a flow rate equal to or less than the calculated pre-development peak flow rate. The difference will be stored in the basin.

Pre- and Post-Development Drainage Area Maps accompany these calculations. The following table summarizes the pre vs. post development drainage areas for the entire site.

Drainage Area	Pre-Dev. (s.f)	Post-Dev. (s.f)
A	42,502	
A-1		43,022
A-2		63,162
B	95,631	
B-1		50,757
B-2		23,604
C	21,188	31,505
D	39,824	17,189
E	40,179	10,085
Total	**239,234**	**241,466**

NOAA Atlas 14, Volume 10, Version 3
Location name: Andover, Massachusetts, USA*
Latitude: 42.6315°, Longitude: -71.1363°
Elevation: 227 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

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)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.311** (0.244-0.386)	**0.372** (0.291-0.462)	**0.472** (0.368-0.588)	**0.555** (0.430-0.695)	**0.669** (0.502-0.876)	**0.755** (0.554-1.01)	**0.845** (0.602-1.17)	**0.946** (0.638-1.34)	**1.09** (0.708-1.61)	**1.21** (0.766-1.82)
10-min	**0.441** (0.345-0.546)	**0.527** (0.413-0.654)	**0.668** (0.521-0.832)	**0.786** (0.609-0.984)	**0.948** (0.711-1.24)	**1.07** (0.785-1.43)	**1.20** (0.853-1.66)	**1.34** (0.905-1.90)	**1.55** (1.00-2.28)	**1.72** (1.09-2.58)
15-min	**0.519** (0.406-0.643)	**0.620** (0.485-0.770)	**0.786** (0.612-0.979)	**0.925** (0.717-1.16)	**1.12** (0.836-1.46)	**1.26** (0.923-1.68)	**1.41** (1.00-1.96)	**1.58** (1.06-2.24)	**1.82** (1.18-2.68)	**2.02** (1.28-3.03)
30-min	**0.713** (0.558-0.883)	**0.853** (0.667-1.06)	**1.08** (0.844-1.35)	**1.27** (0.986-1.59)	**1.54** (1.15-2.01)	**1.73** (1.27-2.32)	**1.94** (1.38-2.69)	**2.17** (1.46-3.09)	**2.51** (1.63-3.69)	**2.78** (1.76-4.18)
60-min	**0.907** (0.710-1.12)	**1.08** (0.849-1.35)	**1.38** (1.07-1.71)	**1.62** (1.26-2.03)	**1.95** (1.47-2.56)	**2.20** (1.62-2.95)	**2.47** (1.76-3.43)	**2.77** (1.87-3.93)	**3.20** (2.07-4.70)	**3.55** (2.24-5.33)
2-hr	**1.17** (0.922-1.44)	**1.41** (1.11-1.74)	**1.80** (1.42-2.23)	**2.13** (1.66-2.65)	**2.58** (1.95-3.36)	**2.91** (2.16-3.89)	**3.27** (2.36-4.56)	**3.70** (2.50-5.23)	**4.36** (2.83-6.37)	**4.92** (3.12-7.34)
3-hr	**1.35** (1.07-1.66)	**1.64** (1.30-2.01)	**2.10** (1.66-2.59)	**2.49** (1.95-3.08)	**3.02** (2.30-3.93)	**3.41** (2.54-4.55)	**3.84** (2.79-5.35)	**4.36** (2.96-6.14)	**5.17** (3.37-7.54)	**5.87** (3.74-8.73)
6-hr	**1.73** (1.38-2.10)	**2.10** (1.68-2.56)	**2.71** (2.16-3.32)	**3.22** (2.55-3.96)	**3.92** (3.01-5.08)	**4.43** (3.34-5.89)	**5.00** (3.66-6.94)	**5.70** (3.88-7.97)	**6.80** (4.44-9.84)	**7.75** (4.94-11.4)
12-hr	**2.17** (1.75-2.63)	**2.66** (2.14-3.22)	**3.45** (2.77-4.20)	**4.11** (3.28-5.02)	**5.02** (3.87-6.45)	**5.68** (4.30-7.49)	**6.41** (4.72-8.83)	**7.32** (5.01-10.2)	**8.72** (5.72-12.5)	**9.94** (6.36-14.6)
24-hr	**2.58** (2.10-3.10)	**3.20** (2.60-3.85)	**4.22** (3.42-5.09)	**5.06** (4.07-6.15)	**6.23** (4.85-7.98)	**7.08** (5.40-9.30)	**8.02** (5.96-11.0)	**9.21** (6.33-12.7)	**11.1** (7.29-15.8)	**12.7** (8.16-18.5)
2-day	**2.90** (2.38-3.46)	**3.67** (3.01-4.39)	**4.94** (4.03-5.92)	**5.99** (4.85-7.22)	**7.43** (5.84-9.49)	**8.49** (6.54-11.1)	**9.66** (7.26-13.3)	**11.2** (7.72-15.4)	**13.7** (9.03-19.4)	**15.9** (10.2-23.0)
3-day	**3.18** (2.62-3.78)	**4.01** (3.30-4.77)	**5.37** (4.40-6.41)	**6.50** (5.29-7.80)	**8.05** (6.35-10.2)	**9.18** (7.10-12.0)	**10.4** (7.88-14.3)	**12.1** (8.37-16.5)	**14.8** (9.80-20.9)	**17.2** (11.1-24.8)
4-day	**3.45** (2.86-4.09)	**4.31** (3.56-5.11)	**5.71** (4.70-6.80)	**6.87** (5.62-8.23)	**8.47** (6.70-10.7)	**9.63** (7.47-12.5)	**10.9** (8.27-14.9)	**12.6** (8.76-17.2)	**15.4** (10.2-21.8)	**17.9** (11.6-25.7)
7-day	**4.20** (3.50-4.95)	**5.09** (4.23-6.00)	**6.53** (5.42-7.74)	**7.74** (6.37-9.21)	**9.39** (7.47-11.8)	**10.6** (8.26-13.7)	**11.9** (9.06-16.2)	**13.7** (9.53-18.5)	**16.6** (11.0-23.2)	**19.1** (12.4-27.3)
10-day	**4.88** (4.08-5.73)	**5.79** (4.84-6.81)	**7.27** (6.05-8.58)	**8.50** (7.03-10.1)	**10.2** (8.14-12.7)	**11.4** (8.93-14.7)	**12.8** (9.71-17.2)	**14.6** (10.2-19.6)	**17.4** (11.6-24.3)	**19.9** (12.9-28.3)
20-day	**6.80** (5.74-7.94)	**7.80** (6.58-9.12)	**9.44** (7.93-11.1)	**10.8** (9.00-12.7)	**12.7** (10.2-15.6)	**14.1** (11.0-17.7)	**15.6** (11.7-20.3)	**17.3** (12.1-23.1)	**19.8** (13.3-27.4)	**21.9** (14.2-30.9)
30-day	**8.42** (7.14-9.78)	**9.50** (8.05-11.0)	**11.3** (9.50-13.1)	**12.7** (10.7-14.9)	**14.7** (11.8-18.0)	**16.3** (12.7-20.3)	**17.8** (13.4-23.0)	**19.5** (13.8-25.9)	**21.8** (14.7-30.0)	**23.6** (15.4-33.2)
45-day	**10.5** (8.94-12.1)	**11.6** (9.92-13.5)	**13.6** (11.5-15.8)	**15.1** (12.7-17.7)	**17.3** (13.9-21.0)	**19.0** (14.9-23.4)	**20.7** (15.4-26.3)	**22.3** (15.8-29.5)	**24.4** (16.5-33.4)	**26.0** (17.0-36.4)
60-day	**12.3** (10.5-14.1)	**13.5** (11.5-15.6)	**15.5** (13.2-18.0)	**17.2** (14.5-20.0)	**19.5** (15.7-23.5)	**21.3** (16.7-26.1)	**23.0** (17.2-29.1)	**24.6** (17.5-32.4)	**26.7** (18.0-36.4)	**28.1** (18.4-39.2)

[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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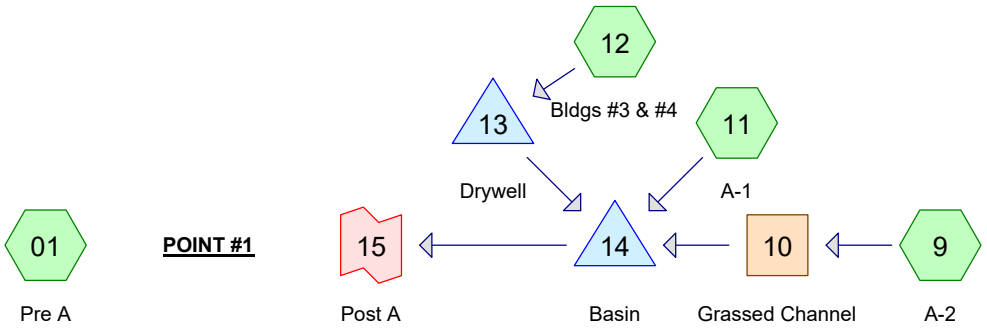
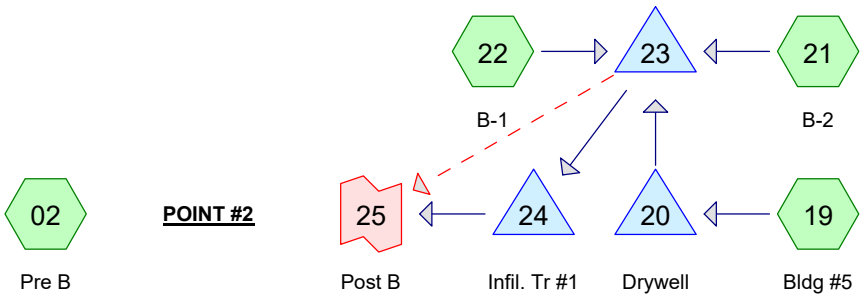
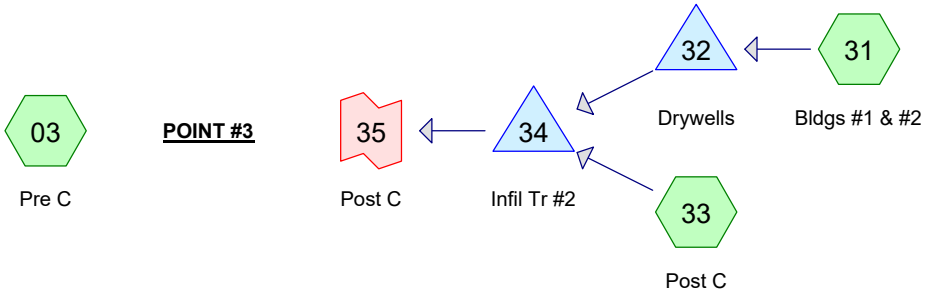
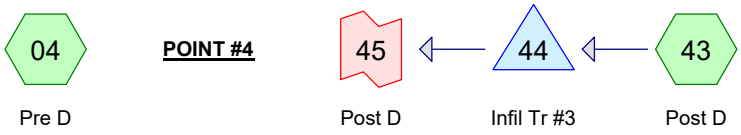
PF graphical

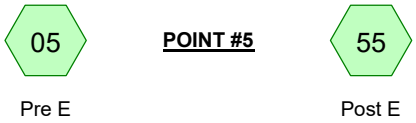
Pre-Development **Post-Development**

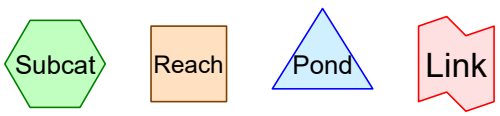












Routing Diagram for 42305 Original 2025-04-08
Prepared by DK Engineering LLC, Printed 4/8/2025

ii. Runoff and Mitigation Design Calculations

25-Year Design Storm Event – Detail

See Following Pages

Summary for Subcatchment 01: Pre A

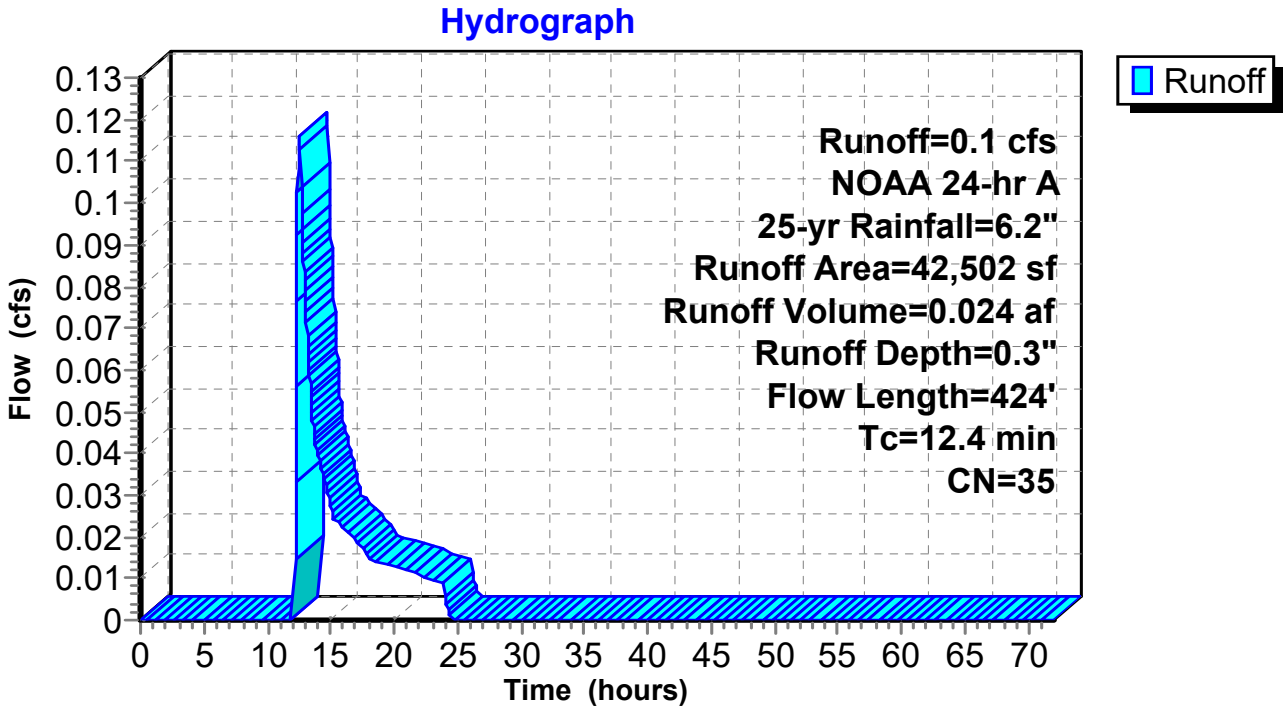
Runoff = 0.1 cfs @ 12.57 hrs, Volume= 0.024 af, Depth= 0.3"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
33,802	30	Woods, Good, HSG A
8,700	55	Woods, Good, HSG B
42,502	35	Weighted Average
42,502		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
2.2	181	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	73	0.1900	2.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	120	0.0750	1.37		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.4	424	Total			

Subcatchment 01: Pre A



Summary for Subcatchment 02: Pre B

Runoff = 4.9 cfs @ 12.23 hrs, Volume= 0.332 af, Depth= 1.8"

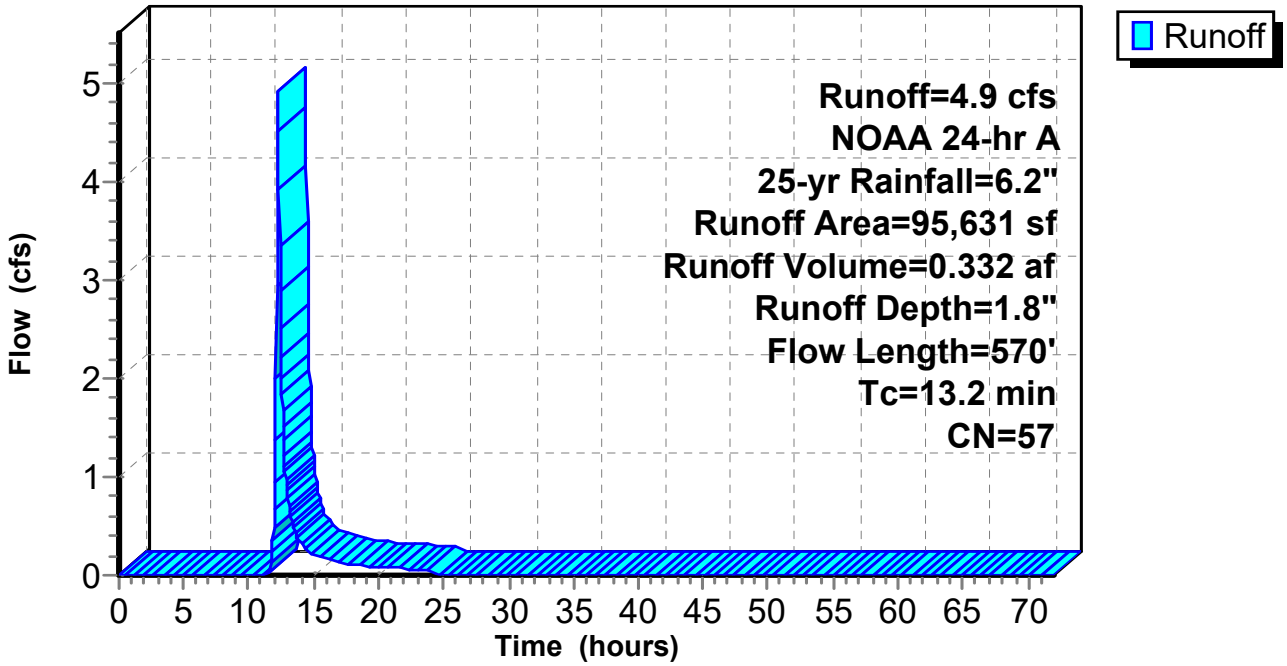
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

	Area (sf)	CN	Description
	448	98	Roofs, HSG A
	242	98	Paved parking, HSG B
	2,752	98	Paved parking, HSG A
*	995	98	Paved parking, HSG B
	589	98	Paved parking, HSG C
	26,841	30	Woods, Good, HSG A
	23,696	55	Woods, Good, HSG B
	19,693	70	Woods, Good, HSG C
	20,375	70	1/2 acre lots, 25% imp, HSG B
	95,631	57	Weighted Average
	85,511		89.42% Pervious Area
	10,120		10.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.1"
2.3	132	0.0380	0.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.2	388	0.0620	1.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.2	570	Total			

Subcatchment 02: Pre B

Hydrograph



Summary for Subcatchment 03: Pre C

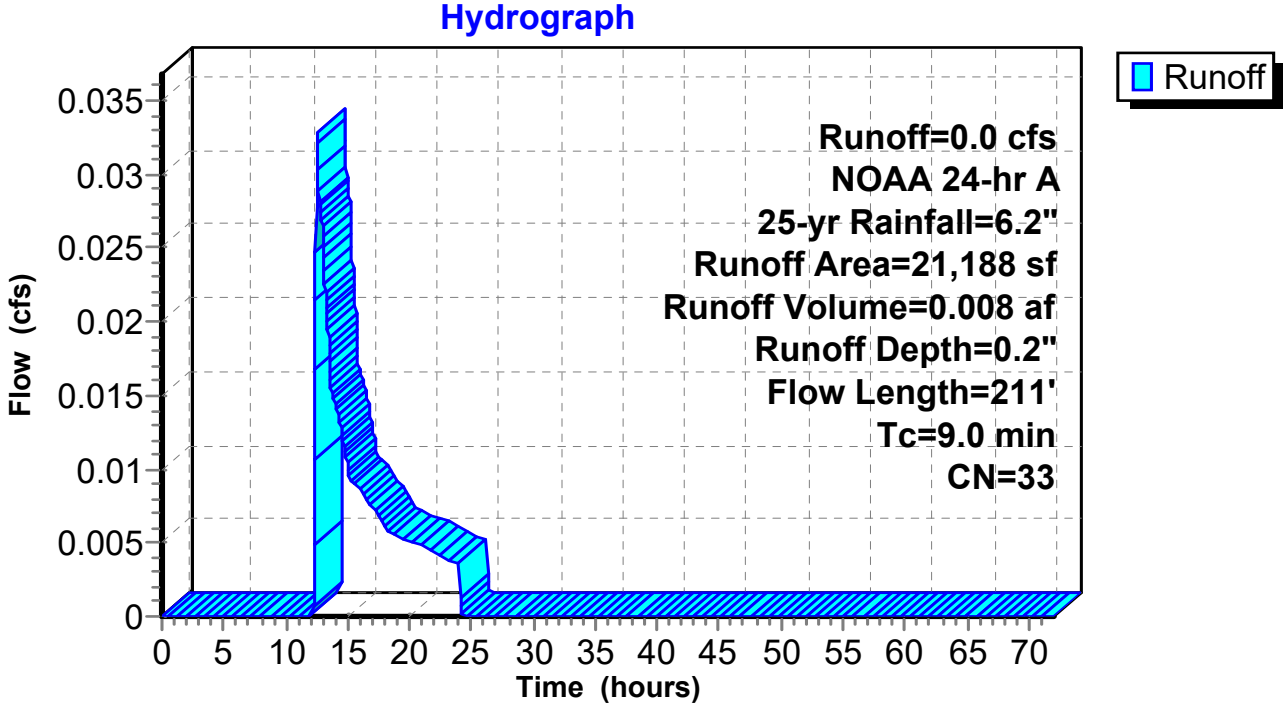
Runoff = 0.0 cfs @ 12.57 hrs, Volume= 0.008 af, Depth= 0.2"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
806	98	Roofs, HSG A
20,382	30	Woods, Good, HSG A
21,188	33	Weighted Average
20,382		96.20% Pervious Area
806		3.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.8	161	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.0	211	Total			

Subcatchment 03: Pre C



Summary for Subcatchment 04: Pre D

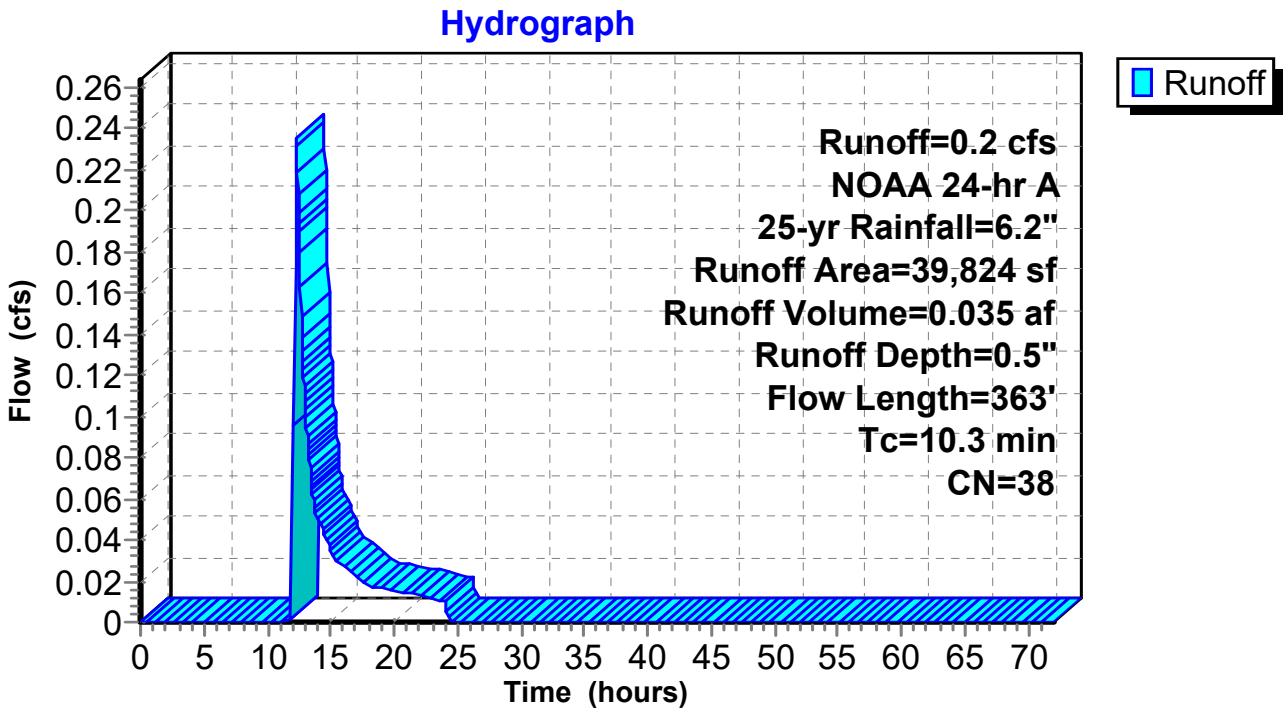
Runoff = 0.2 cfs @ 12.30 hrs, Volume= 0.035 af, Depth= 0.5"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
278	98	Roofs, HSG A
574	98	Roofs, HSG B
27,837	30	Woods, Good, HSG A
11,135	55	Woods, Good, HSG B
39,824	38	Weighted Average
38,972		97.86% Pervious Area
852		2.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
2.1	142	0.0490	1.11		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	171	0.1290	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.3	363	Total			

Subcatchment 04: Pre D



Summary for Subcatchment 05: Pre E

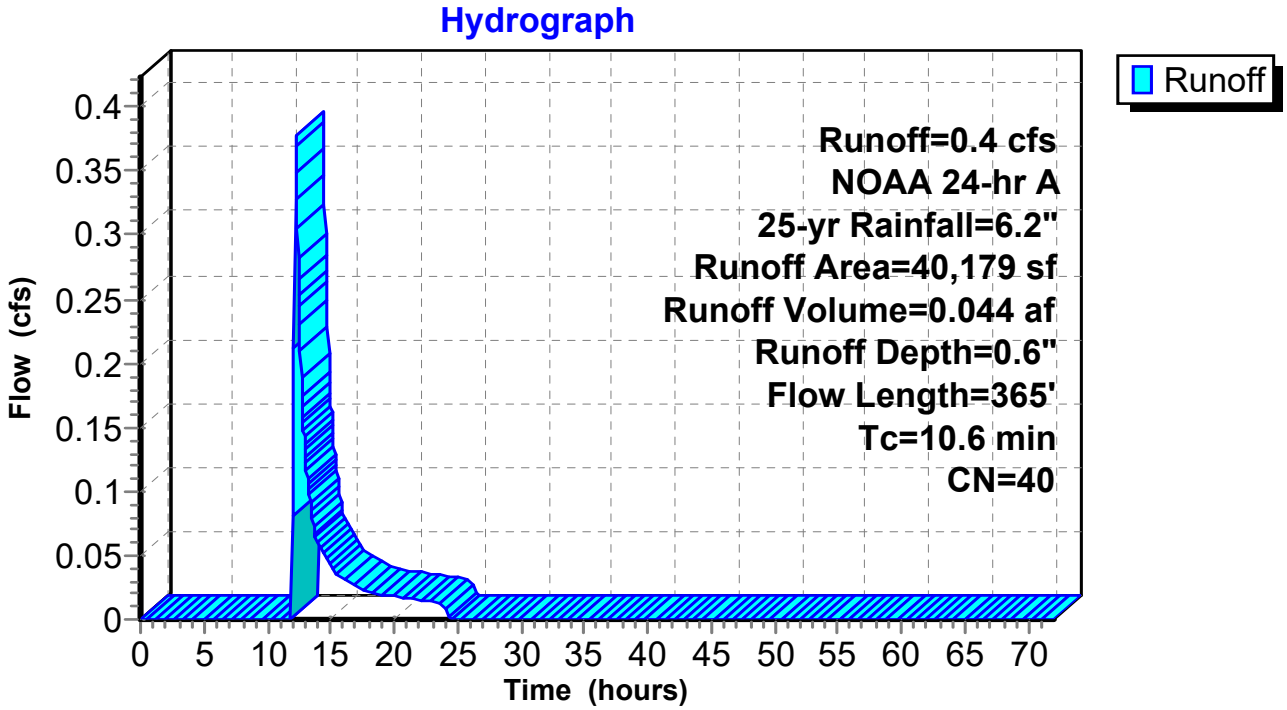
Runoff = 0.4 cfs @ 12.26 hrs, Volume= 0.044 af, Depth= 0.6"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
24,091	30	Woods, Good, HSG A
16,088	55	Woods, Good, HSG B
40,179	40	Weighted Average
40,179		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.5	109	0.0550	1.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.9	206	0.1260	1.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	365	Total			

Subcatchment 05: Pre E



Summary for Subcatchment 9: A-2

Runoff = 7.1 cfs @ 12.22 hrs, Volume= 0.464 af, Depth= 4.2"
Routed to Reach 10 : Grassed Channel

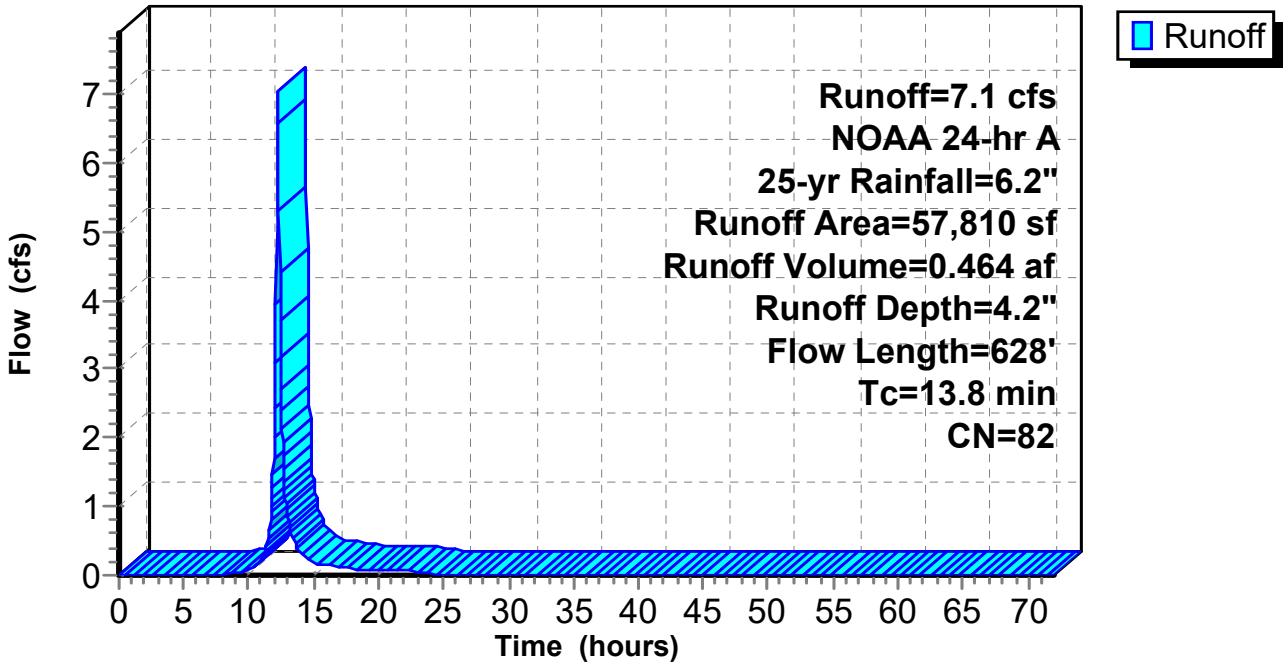
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

	Area (sf)	CN	Description
	11,254	98	Paved parking, HSG A
	7,293	98	Paved parking, HSG B
*	176	98	Paved parking, HSG A (Sidewalk)
*	887	98	Paved parking, HSG B (Sidewalk)
	7,131	68	<50% Grass cover, Poor, HSG A
	25,481	79	<50% Grass cover, Poor, HSG B
	5,588	55	Woods, Good, HSG B
	57,810	82	Weighted Average
	38,200		66.08% Pervious Area
	19,610		33.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.9	197	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	339	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	42	0.0450	12.51	9.8	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010
13.8	628	Total			

Subcatchment 9: A-2

Hydrograph



Summary for Reach 10: Grassed Channel

Inflow Area = 1.327 ac, 33.92% Impervious, Inflow Depth = 4.2" for 25-yr event
Inflow = 7.1 cfs @ 12.22 hrs, Volume= 0.464 af
Outflow = 6.9 cfs @ 12.26 hrs, Volume= 0.464 af, Atten= 2%, Lag= 2.5 min
Routed to Pond 14 : Basin

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Max. Velocity= 1.55 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.36 fps, Avg. Travel Time= 6.2 min

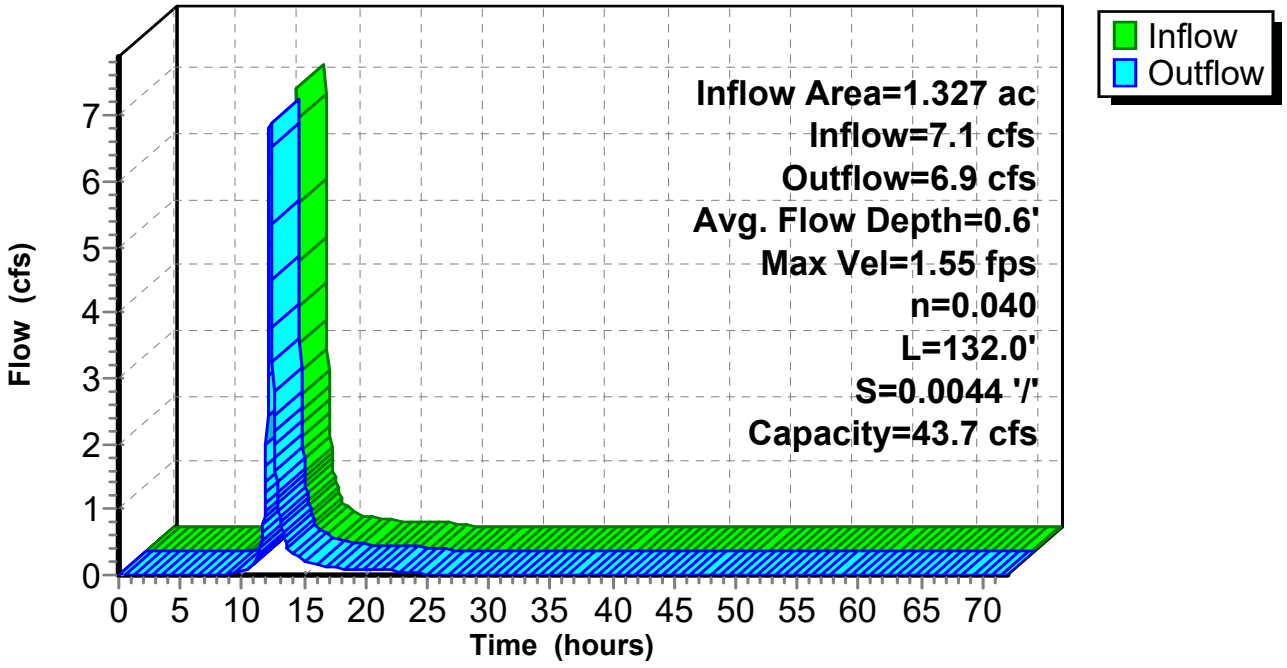
Peak Storage= 596 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.6' , Surface Width= 8.7'
Bank-Full Depth= 1.6' Flow Area= 15.6 sf, Capacity= 43.7 cfs

7.00' x 1.65' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.5 '/' Top Width= 11.95'
Length= 132.0' Slope= 0.0044 '/'
Inlet Invert= 208.00', Outlet Invert= 207.42'

‡

Reach 10: Grassed Channel

Hydrograph



Summary for Subcatchment 11: A-1

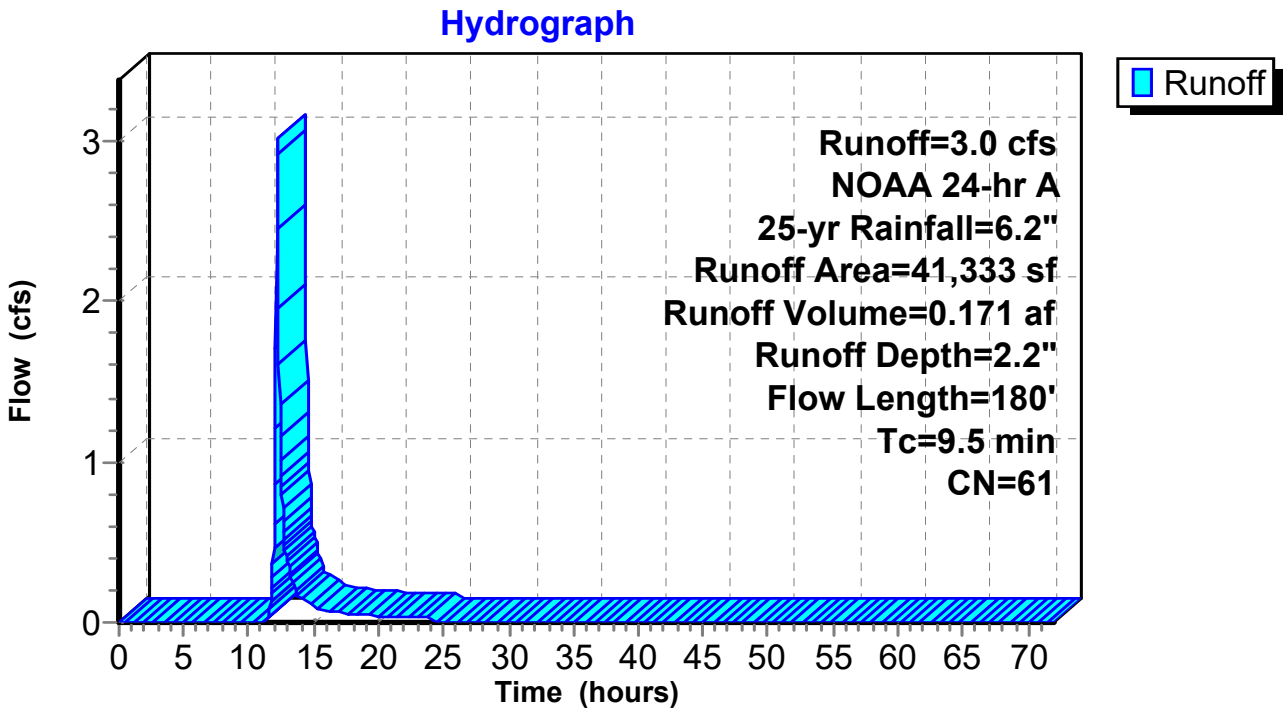
Runoff = 3.0 cfs @ 12.18 hrs, Volume= 0.171 af, Depth= 2.2"
Routed to Pond 14 : Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
28,537	68	<50% Grass cover, Poor, HSG A
2,292	79	<50% Grass cover, Poor, HSG B
7,464	30	Woods, Good, HSG A
3,040	55	Woods, Good, HSG B
41,333	61	Weighted Average
41,333		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.4	130	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.5	180	Total			

Subcatchment 11: A-1



Summary for Subcatchment 12: Bldgs #3 & #4

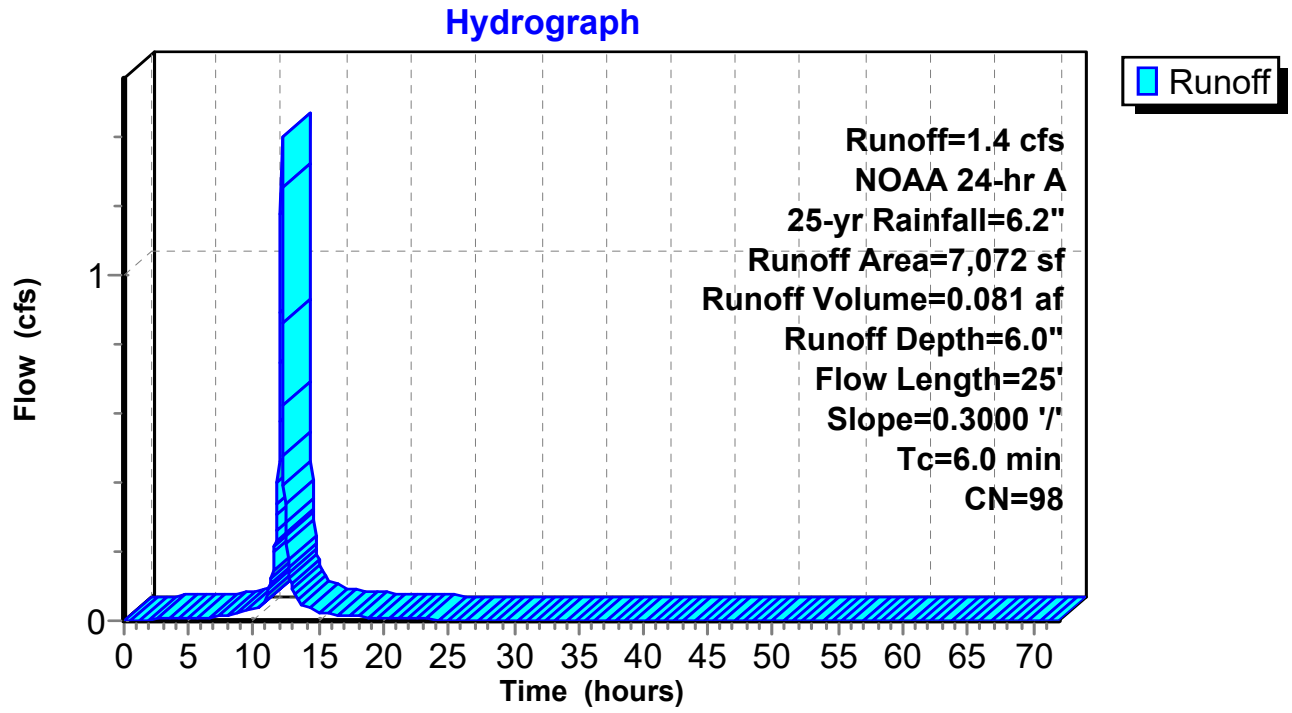
Runoff = 1.4 cfs @ 12.12 hrs, Volume= 0.081 af, Depth= 6.0"
Routed to Pond 13 : Drywell

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
7,072	98	Roofs, HSG C
7,072		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	25	0.3000	3.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.1"
0.1	25	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 12: Bldgs #3 & #4



Summary for Pond 13: Drywell

Inflow Area = 0.162 ac,100.00% Impervious, Inflow Depth = 6.0" for 25-yr event
Inflow = 1.4 cfs @ 12.12 hrs, Volume= 0.081 af
Outflow = 0.1 cfs @ 11.08 hrs, Volume= 0.081 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.1 cfs @ 11.08 hrs, Volume= 0.081 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 14 : Basin

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 3.71' @ 13.33 hrs Surf.Area= 1,200 sf Storage= 1,835 cf

Plug-Flow detention time= 219.1 min calculated for 0.081 af (100% of inflow)
Center-of-Mass det. time= 219.0 min (962.3 - 743.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,242 cf	**20.00'W x 30.00'L x 5.25'H Prismatoid** 3,150 cf Overall - 44 cf Embedded = 3,106 cf x 40.0% Voids
#2	0.50'	44 cf	**12.0" Round Pipe Storage** x 2 Inside #1 L= 28.0' S= 0.0050 '/'
		1,286 cf	x 2.00 = 2,573 cf Total Available Storage

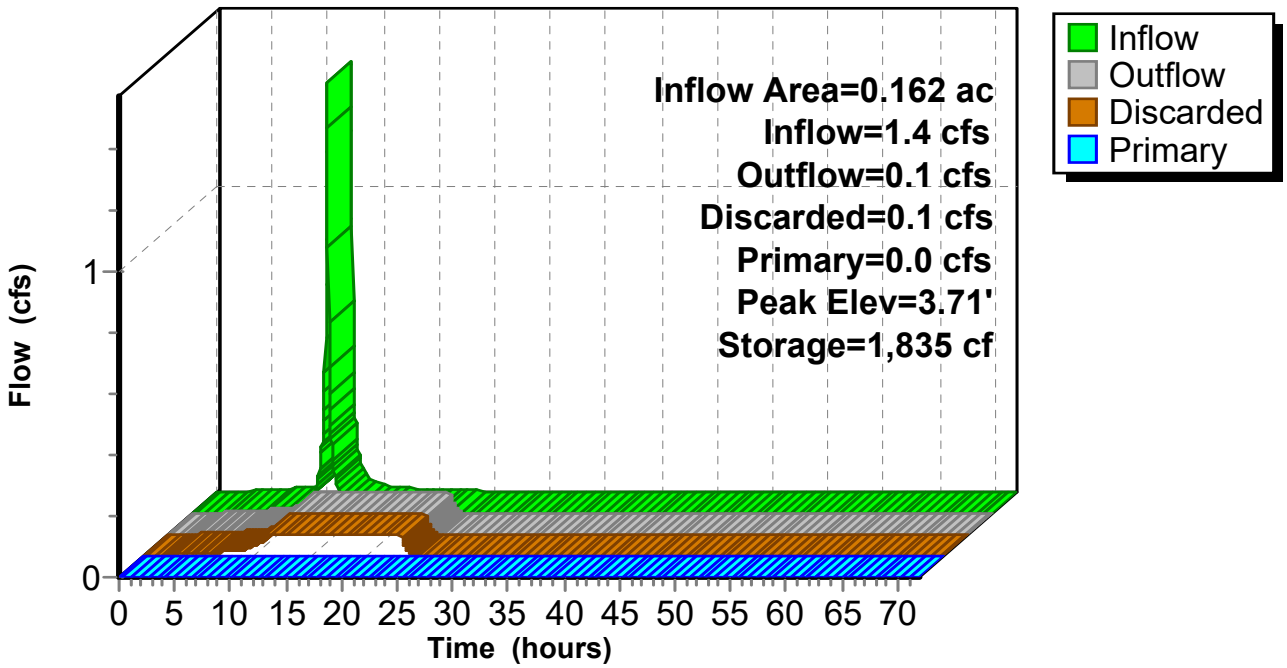
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.400 in/hr Exfiltration over Surface area**
#2	Primary	5.25'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.1 cfs @ 11.08 hrs HW=0.11' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 13: Drywell

Hydrograph



Summary for Pond 14: Basin

Inflow Area = 2.438 ac, 25.12% Impervious, Inflow Depth = 3.1" for 25-yr event
Inflow = 9.3 cfs @ 12.23 hrs, Volume= 0.635 af
Outflow = 0.5 cfs @ 14.08 hrs, Volume= 0.635 af, Atten= 95%, Lag= 110.8 min
Discarded = 0.4 cfs @ 14.08 hrs, Volume= 0.579 af
Primary = 0.1 cfs @ 14.08 hrs, Volume= 0.056 af
Routed to Link 15 : Post A

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 205.53' @ 14.08 hrs Surf.Area= 6,437 sf Storage= 17,723 cf

Plug-Flow detention time= 496.1 min calculated for 0.635 af (100% of inflow)
Center-of-Mass det. time= 496.1 min (1,307.8 - 811.7)

Volume	Invert	Avail.Storage	Storage Description
#1	201.50'	28,327 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
201.50	1,060	0	0	1,060
202.00	3,160	1,008	1,008	3,161
204.00	4,935	8,029	9,038	4,992
206.00	6,935	11,813	20,851	7,065
207.00	8,030	7,476	28,327	8,202

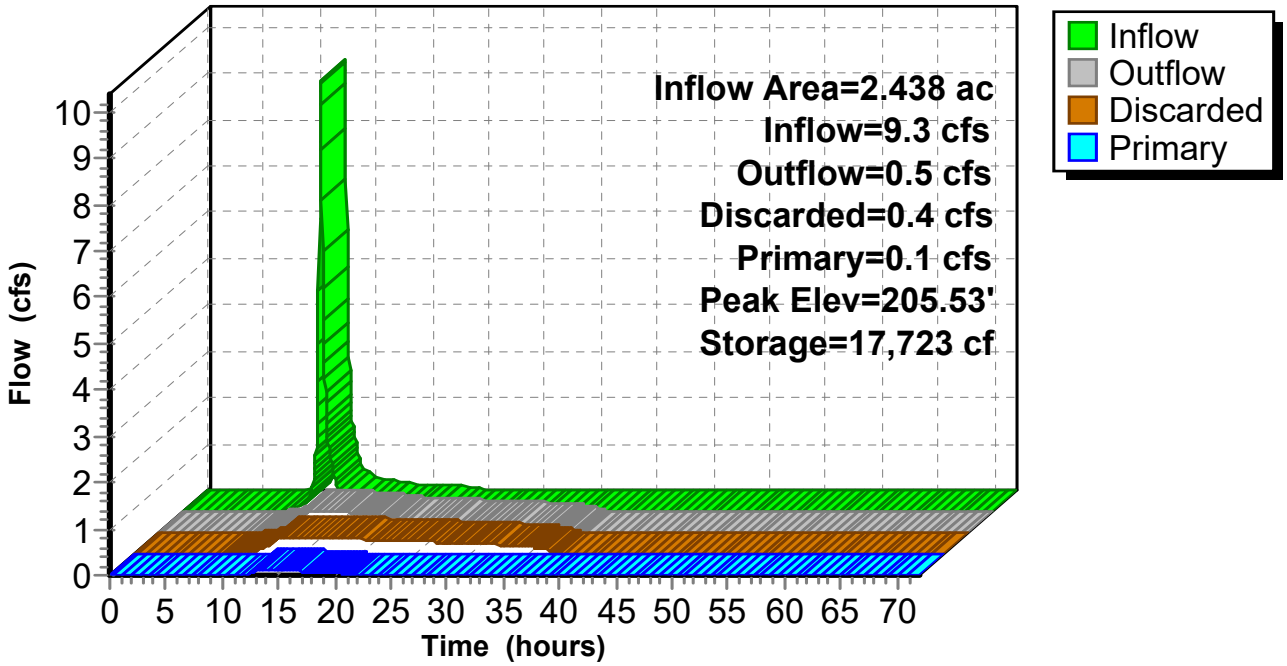
Device	Routing	Invert	Outlet Devices
#1	Discarded	201.50'	**2.400 in/hr Exfiltration over Wetted area**
#2	Primary	204.50'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	206.55'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.4 cfs @ 14.08 hrs HW=205.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.4 cfs)

Primary OutFlow Max=0.1 cfs @ 14.08 hrs HW=205.53' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.1 cfs @ 4.69 fps)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 14: Basin

Hydrograph

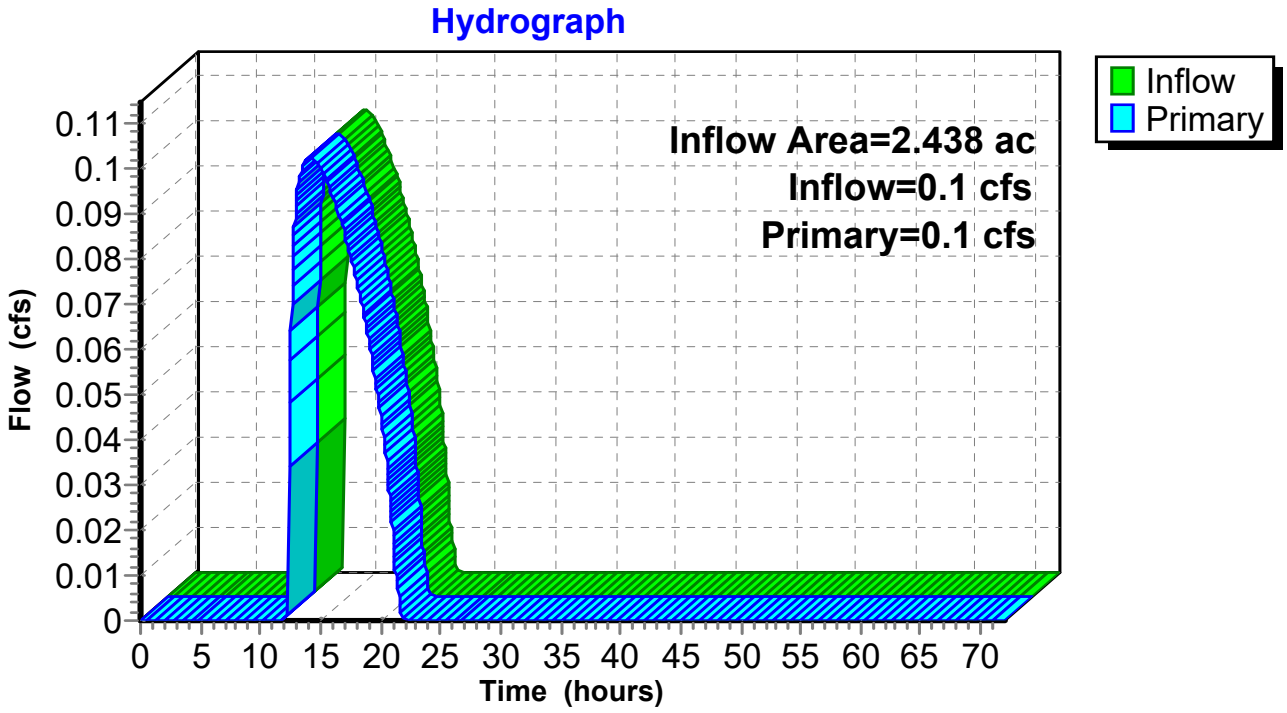


Summary for Link 15: Post A

Inflow Area = 2.438 ac, 25.12% Impervious, Inflow Depth = 0.3" for 25-yr event
Inflow = 0.1 cfs @ 14.08 hrs, Volume= 0.056 af
Primary = 0.1 cfs @ 14.08 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs

Link 15: Post A



Summary for Subcatchment 19: Bldg #5

Runoff = 0.7 cfs @ 12.12 hrs, Volume= 0.041 af, Depth= 6.0"
Routed to Pond 20 : Drywell

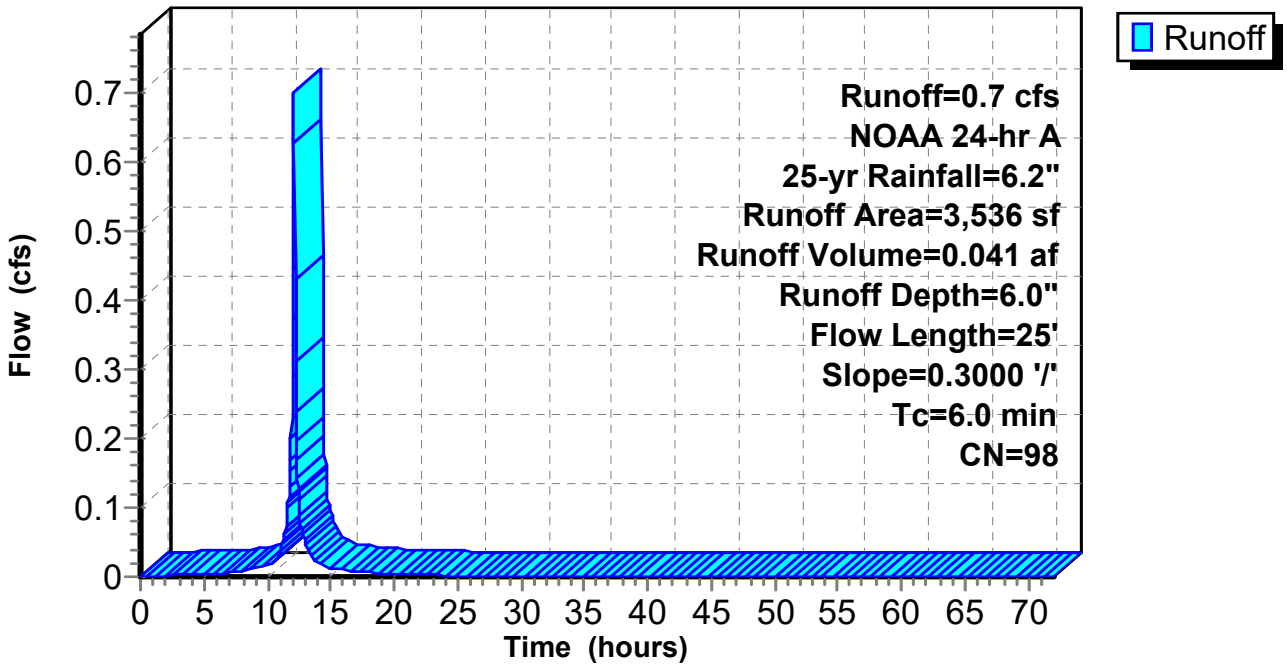
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
3,536	98	Unconnected roofs, HSG C
3,536		100.00% Impervious Area
3,536		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	25	0.3000	3.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.1"
0.1	25	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 19: Bldg #5

Hydrograph



Summary for Pond 20: Drywell

Inflow Area = 0.081 ac,100.00% Impervious, Inflow Depth = 6.0" for 25-yr event
Inflow = 0.7 cfs @ 12.12 hrs, Volume= 0.041 af
Outflow = 0.0 cfs @ 11.08 hrs, Volume= 0.041 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.0 cfs @ 11.08 hrs, Volume= 0.041 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 23 :

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 3.71' @ 13.33 hrs Surf.Area= 600 sf Storage= 917 cf

Plug-Flow detention time= 219.1 min calculated for 0.041 af (100% of inflow)
Center-of-Mass det. time= 219.0 min (962.3 - 743.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,242 cf	**20.00'W x 30.00'L x 5.25'H Prismatoid** 3,150 cf Overall - 44 cf Embedded = 3,106 cf x 40.0% Voids
#2	0.50'	44 cf	**12.0" Round Pipe Storage** x 2 Inside #1 L= 28.0' S= 0.0050 '/'
		1,286 cf	Total Available Storage

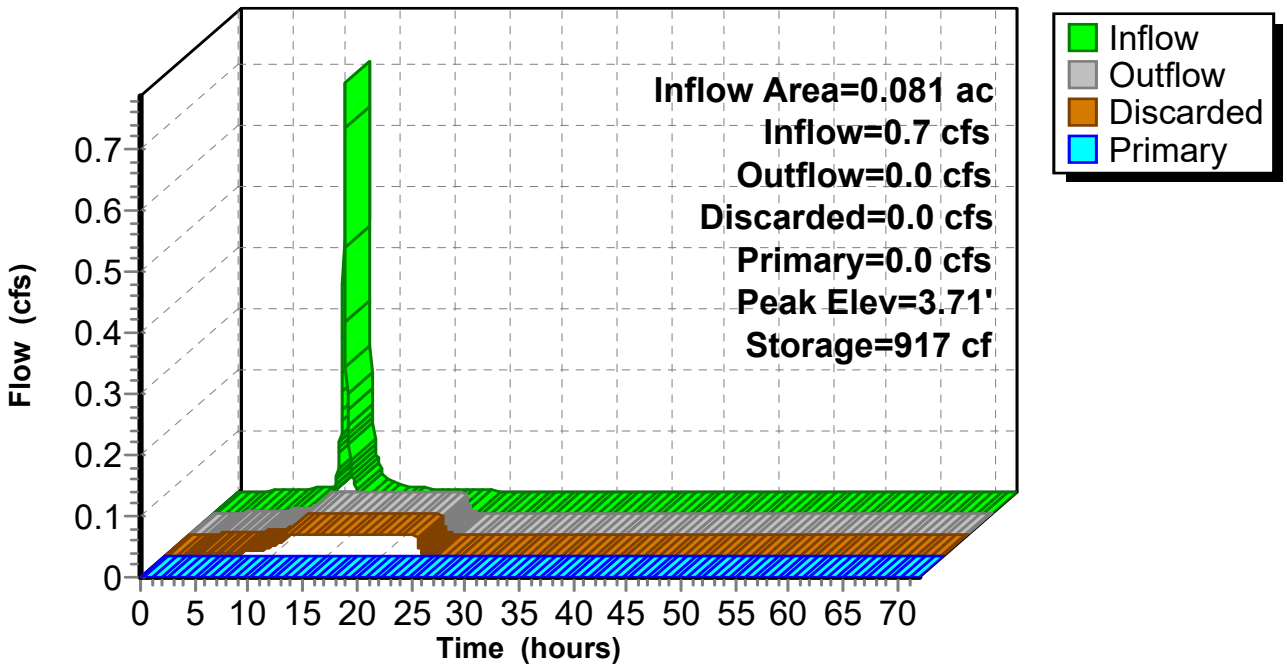
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.400 in/hr Exfiltration over Surface area**
#2	Primary	5.25'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 11.08 hrs HW=0.11' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 20: Drywell

Hydrograph



Summary for Subcatchment 21: B-2

Runoff = 2.6 cfs @ 12.19 hrs, Volume= 0.157 af, Depth= 3.5"
Routed to Pond 23 :

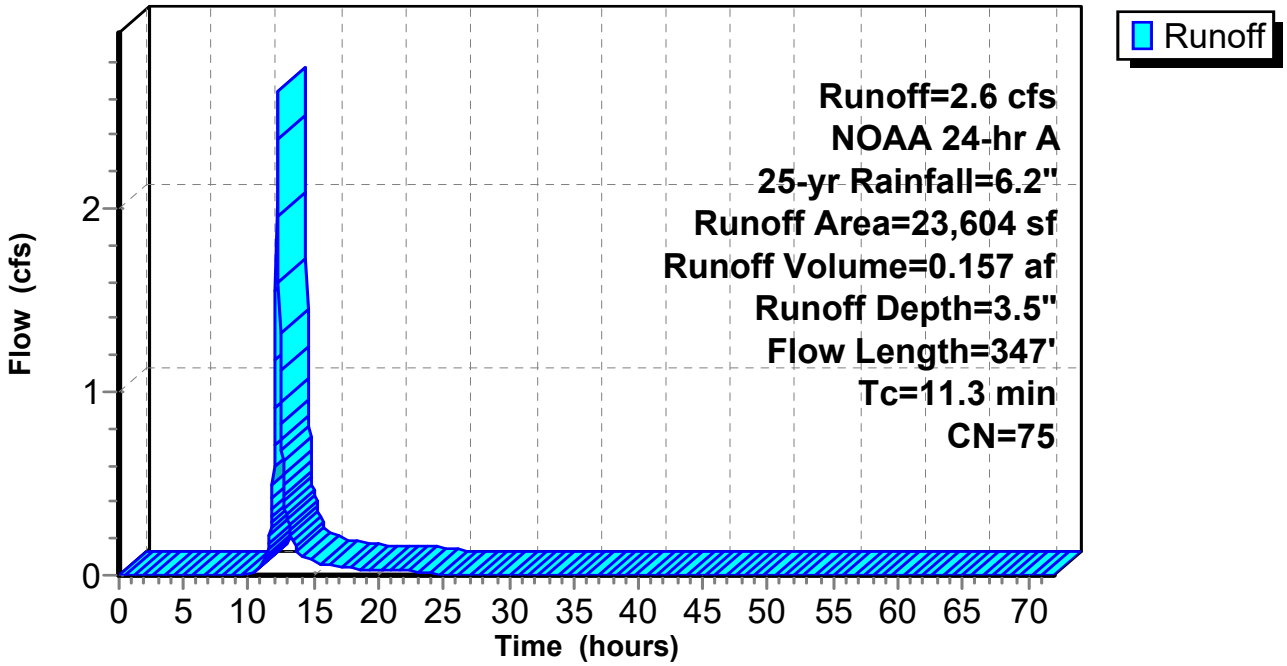
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

	Area (sf)	CN	Description
*	1,074	98	Paved parking, HSG C (Pvmt.)
*	188	98	Paved parking, HSG C (Sdwk.)
	3,849	68	<50% Grass cover, Poor, HSG A
	10,272	86	<50% Grass cover, Poor, HSG C
	1,818	30	Woods, Good, HSG A
	478	55	Woods, Good, HSG B
	5,925	70	Woods, Good, HSG C
	23,604	75	Weighted Average
	22,342		94.65% Pervious Area
	1,262		5.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.9	142	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	35	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.9	120	0.0460	1.07		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.3	347	Total			

Subcatchment 21: B-2

Hydrograph



Summary for Subcatchment 22: B-1

Runoff = 3.8 cfs @ 12.25 hrs, Volume= 0.261 af, Depth= 2.9"
Routed to Pond 23 :

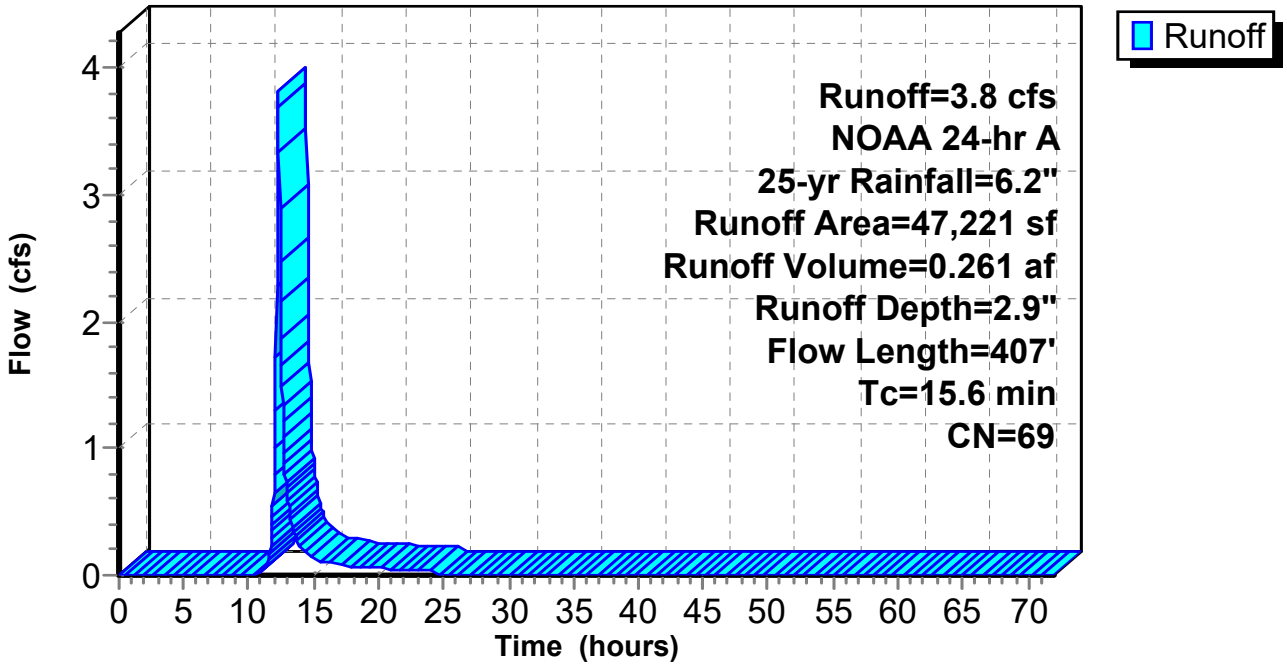
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

	Area (sf)	CN	Description
	3,889	98	Paved parking, HSG A
	501	98	Paved parking, HSG C
*	454	98	Paved parking, HSG A Sdwk
*	107	98	Paved parking, HSG C Sdwk
	9,131	68	<50% Grass cover, Poor, HSG A
	1,410	79	<50% Grass cover, Poor, HSG B
	975	86	<50% Grass cover, Poor, HSG C
	1,010	30	Woods, Good, HSG A
	9,369	55	Woods, Good, HSG B
	20,375	70	1/2 acre lots, 25% imp, HSG B
	47,221	69	Weighted Average
	37,176		78.73% Pervious Area
	10,045		21.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
2.7	242	0.0460	1.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	115	0.0520	4.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
15.6	407	Total			

Subcatchment 22: B-1

Hydrograph



Summary for Pond 23:

Inflow Area = 1.707 ac, 19.96% Impervious, Inflow Depth = 2.9" for 25-yr event
Inflow = 6.3 cfs @ 12.22 hrs, Volume= 0.418 af
Outflow = 6.2 cfs @ 12.23 hrs, Volume= 0.418 af, Atten= 1%, Lag= 0.7 min
Discarded = 0.0 cfs @ 12.23 hrs, Volume= 0.028 af
Primary = 3.9 cfs @ 12.23 hrs, Volume= 0.356 af
Routed to Pond 24 : Infil. Tr #1
Secondary = 2.3 cfs @ 12.23 hrs, Volume= 0.034 af
Routed to Link 25 : Post B

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 210.06' @ 12.23 hrs Surf.Area= 497 sf Storage= 700 cf

Plug-Flow detention time= 14.6 min calculated for 0.418 af (100% of inflow)
Center-of-Mass det. time= 14.8 min (833.1 - 818.4)

Volume	Invert	Avail.Storage	Storage Description
#1	208.00'	1,250 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.00	185	0	0
210.00	485	670	670
211.00	675	580	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	208.00'	**2.400 in/hr Exfiltration over Surface area**
#2	Primary	209.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 in 18.0" x 18.0" Grate (35% open area) Limited to weir flow at low heads
#3	Secondary	209.75'	**5.0' long + 2.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

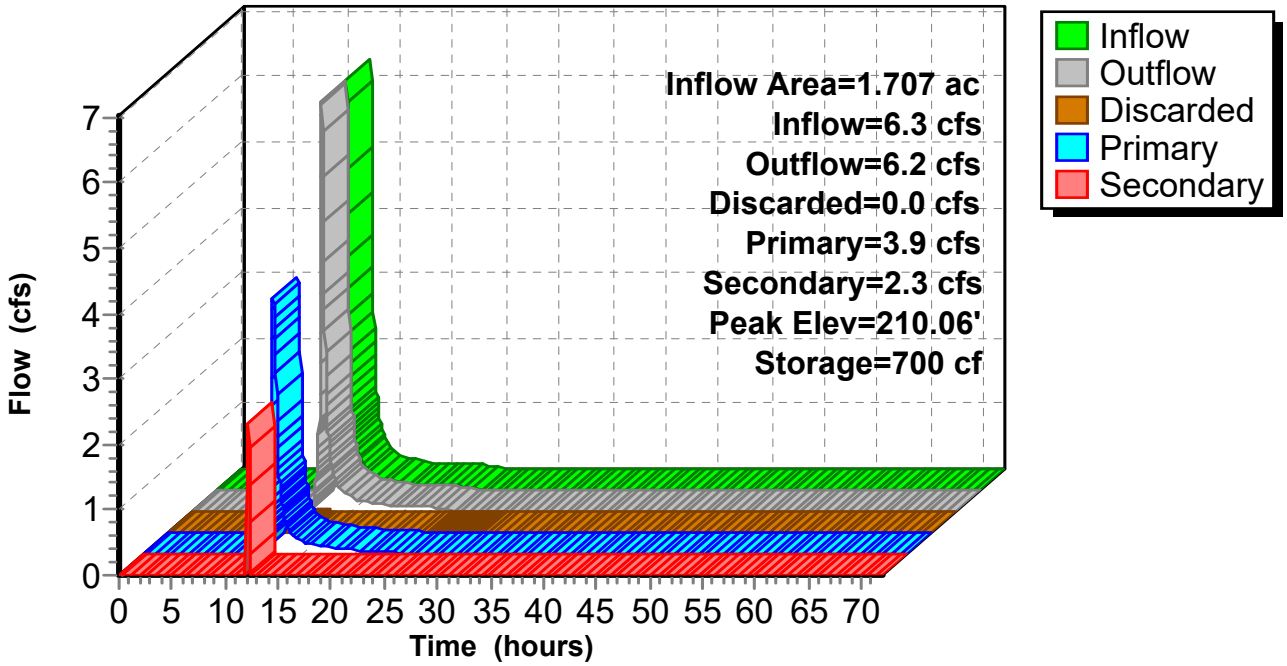
Discarded OutFlow Max=0.0 cfs @ 12.23 hrs HW=210.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.9 cfs @ 12.23 hrs HW=210.06' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 3.9 cfs @ 4.95 fps)

Secondary OutFlow Max=2.3 cfs @ 12.23 hrs HW=210.06' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Weir Controls 2.3 cfs @ 1.32 fps)

Pond 23:

Hydrograph



Summary for Pond 24: Infil. Tr #1

Inflow Area = 1.707 ac, 19.96% Impervious, Inflow Depth = 2.5" for 25-yr event
Inflow = 3.9 cfs @ 12.23 hrs, Volume= 0.356 af
Outflow = 3.3 cfs @ 12.44 hrs, Volume= 0.356 af, Atten= 15%, Lag= 12.3 min
Discarded = 0.1 cfs @ 11.48 hrs, Volume= 0.064 af
Primary = 3.2 cfs @ 12.44 hrs, Volume= 0.292 af
Routed to Link 25 : Post B

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 209.19' @ 12.44 hrs Surf.Area= 1,400 sf Storage= 2,664 cf

Plug-Flow detention time= 21.2 min calculated for 0.356 af (100% of inflow)
Center-of-Mass det. time= 21.2 min (838.2 - 817.0)

Volume	Invert	Avail.Storage	Storage Description
#1	204.80'	2,440 cf	**14.00'W x 50.00'L x 4.60'H Prismatoid** x 2 6,440 cf Overall - 339 cf Embedded = 6,101 cf x 40.0% Voids
#2	206.50'	339 cf	**24.0" Round Pipe Storage** x 2 Inside #1 L= 54.0' S= 0.0050 '/'
		2,780 cf	Total Available Storage

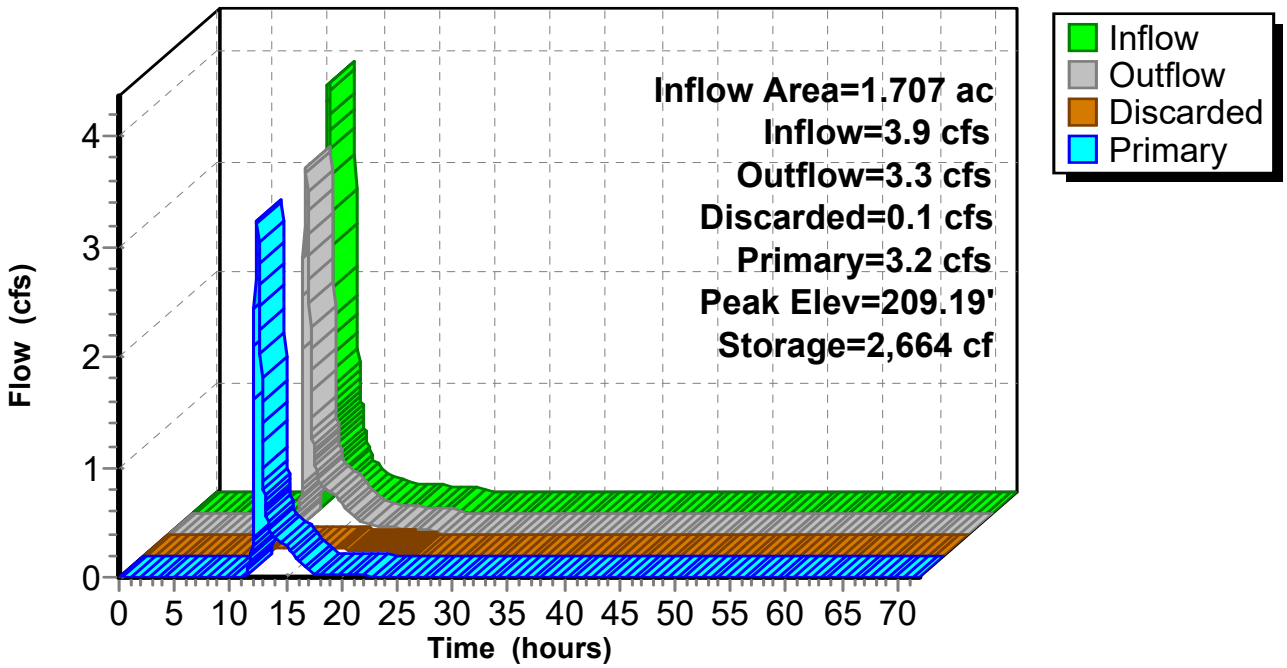
Device	Routing	Invert	Outlet Devices
#1	Discarded	204.80'	**2.400 in/hr Exfiltration over Surface area**
#2	Primary	204.80'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	207.25'	**5.0" Horiz. Orifice/Grate** X 3 rows C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 11.48 hrs HW=204.86' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=3.2 cfs @ 12.44 hrs HW=209.19' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.5 cfs @ 10.09 fps)
└**3=Orifice/Grate** (Orifice Controls 2.7 cfs @ 6.71 fps)

Pond 24: Infil. Tr #1

Hydrograph

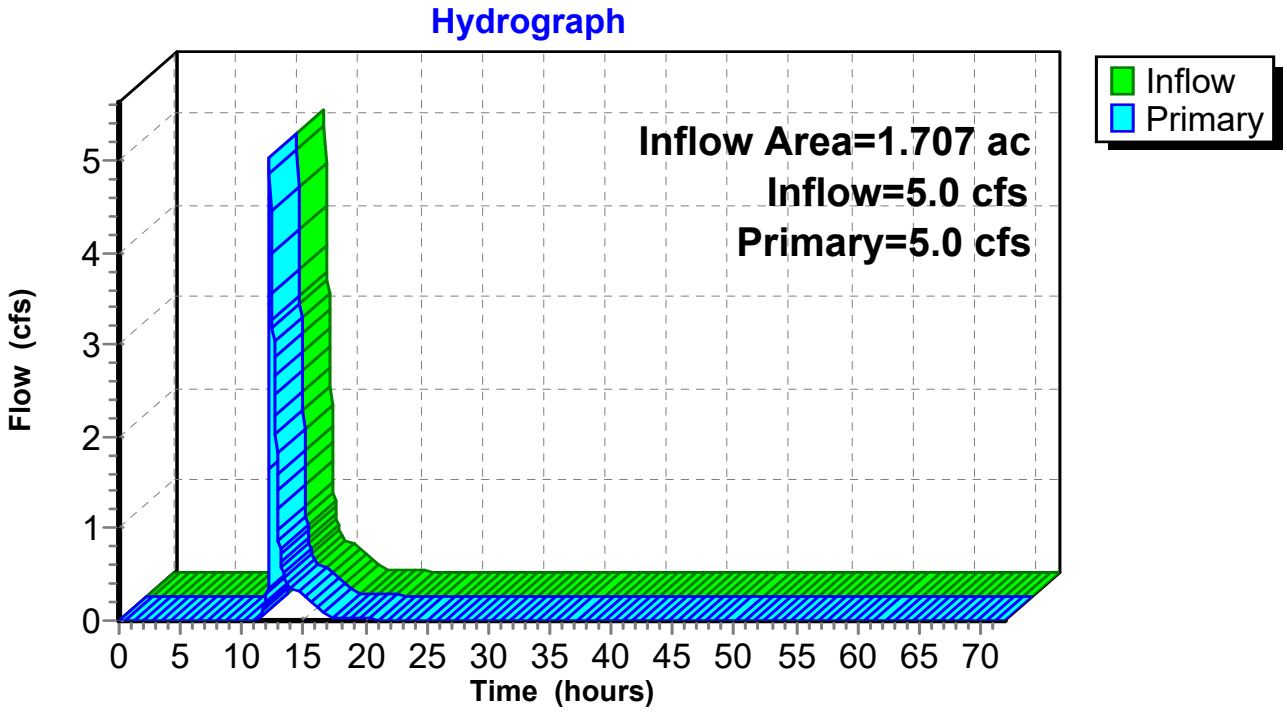


Summary for Link 25: Post B

Inflow Area = 1.707 ac, 19.96% Impervious, Inflow Depth = 2.3" for 25-yr event
Inflow = 5.0 cfs @ 12.25 hrs, Volume= 0.326 af
Primary = 5.0 cfs @ 12.25 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs

Link 25: Post B



Summary for Subcatchment 31: Bldgs #1 & #2

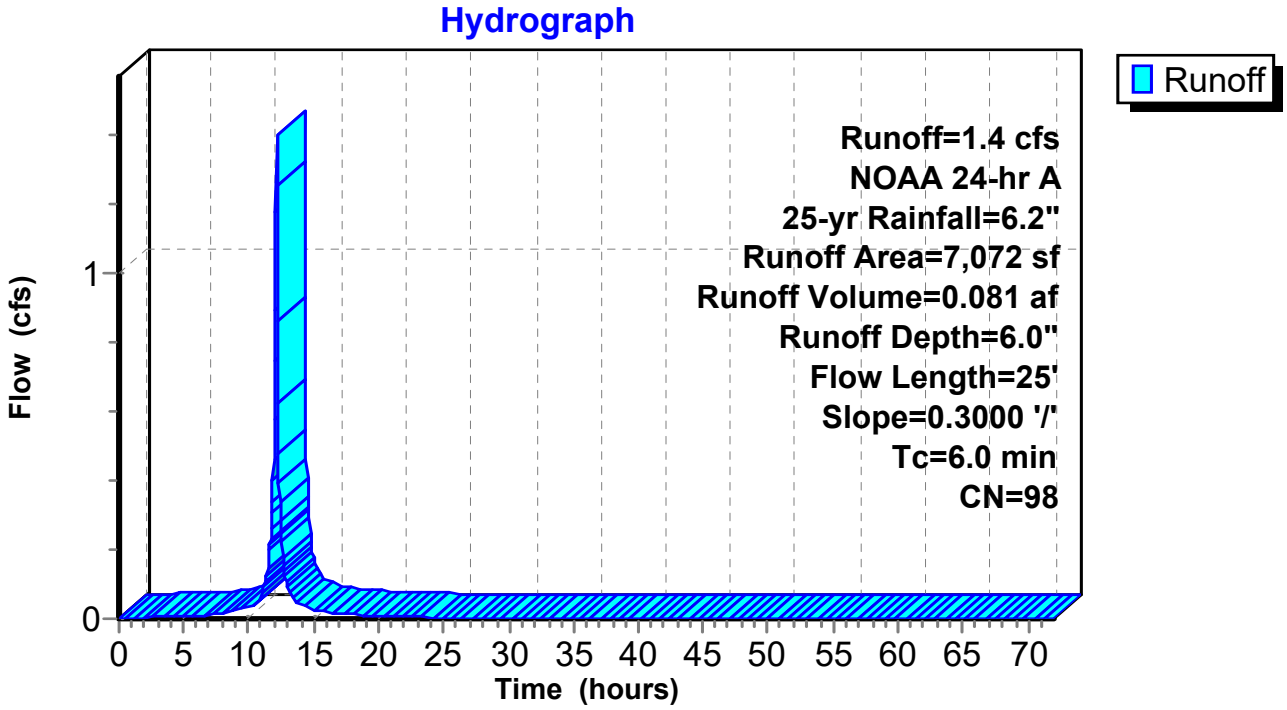
Runoff = 1.4 cfs @ 12.12 hrs, Volume= 0.081 af, Depth= 6.0"
Routed to Pond 32 : Drywells

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
7,072	98	Unconnected roofs, HSG C
7,072		100.00% Impervious Area
7,072		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	25	0.3000	3.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.1"
0.1	25	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 31: Bldgs #1 & #2



Summary for Pond 32: Drywells

Inflow Area = 0.162 ac,100.00% Impervious, Inflow Depth = 6.0" for 25-yr event
Inflow = 1.4 cfs @ 12.12 hrs, Volume= 0.081 af
Outflow = 0.1 cfs @ 12.94 hrs, Volume= 0.081 af, Atten= 92%, Lag= 48.8 min
Discarded = 0.1 cfs @ 10.80 hrs, Volume= 0.080 af
Primary = 0.1 cfs @ 12.94 hrs, Volume= 0.001 af
Routed to Pond 34 : Infil Tr #2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 5.27' @ 12.94 hrs Surf.Area= 900 sf Storage= 1,924 cf

Plug-Flow detention time= 312.9 min calculated for 0.081 af (100% of inflow)
Center-of-Mass det. time= 312.9 min (1,056.2 - 743.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	934 cf	**15.00'W x 30.00'L x 5.25'H Prismatoid** 2,363 cf Overall - 28 cf Embedded = 2,334 cf x 40.0% Voids
#2	0.50'	28 cf	**12.0" Round Pipe Storage** x 2 Inside #1 L= 18.0' S= 0.0050 '/'
		962 cf	x 2.00 = 1,924 cf Total Available Storage

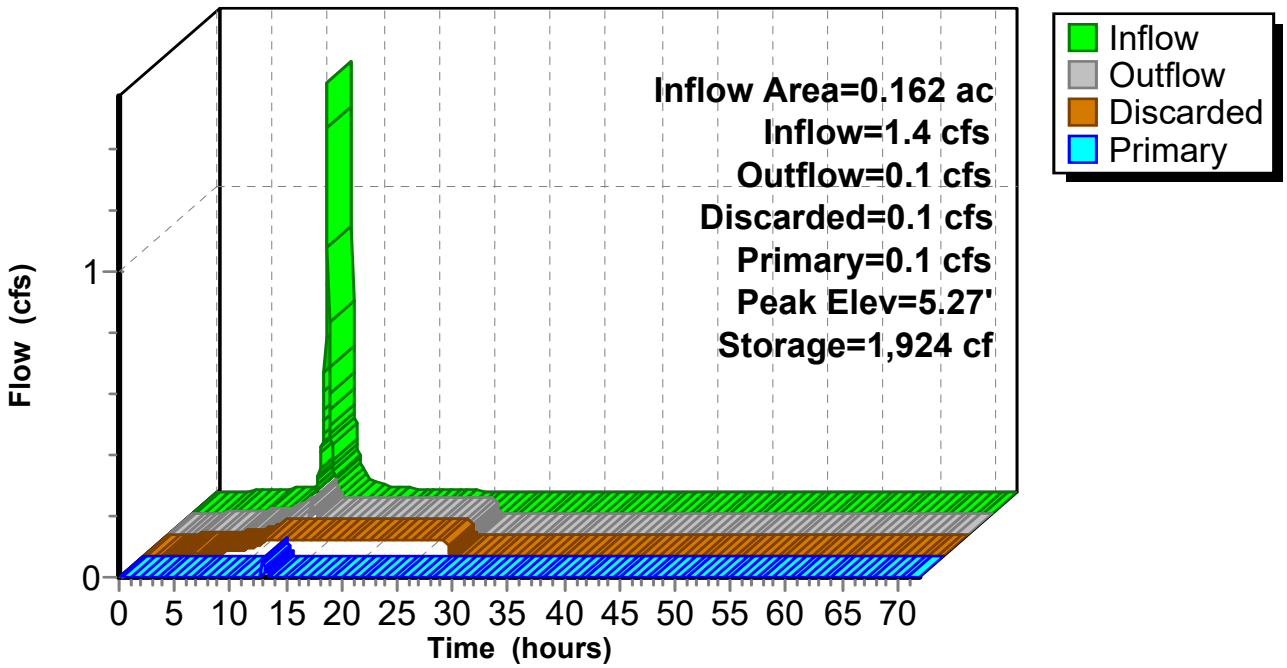
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.400 in/hr Exfiltration over Surface area**
#2	Primary	5.25'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.1 cfs @ 10.80 hrs HW=0.11' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 12.94 hrs HW=5.26' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.0 cfs @ 0.29 fps)

Pond 32: Drywells

Hydrograph



Summary for Subcatchment 33: Post C

Runoff = 2.2 cfs @ 12.16 hrs, Volume= 0.114 af, Depth= 2.4"
Routed to Pond 34 : Infil Tr #2

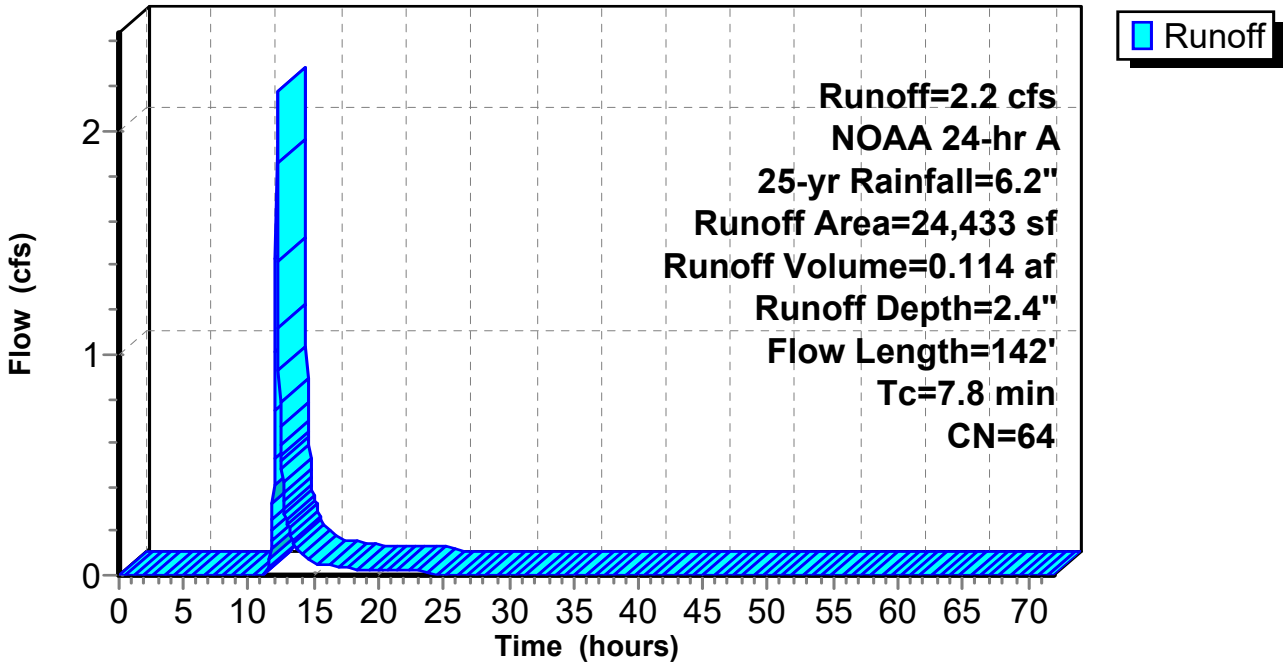
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
3,010	98	Paved parking, HSG A
16,313	68	<50% Grass cover, Poor, HSG A
5,056	30	Woods, Good, HSG A
54	55	Woods, Good, HSG B
24,433	64	Weighted Average
21,423		87.68% Pervious Area
3,010		12.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.1"
0.3	41	0.1200	2.42		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	51	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.8	142	Total			

Subcatchment 33: Post C

Hydrograph



Summary for Pond 34: Infil Tr #2

Inflow Area = 0.723 ac, 32.00% Impervious, Inflow Depth = 1.9" for 25-yr event
Inflow = 2.2 cfs @ 12.16 hrs, Volume= 0.115 af
Outflow = 0.1 cfs @ 24.69 hrs, Volume= 0.115 af, Atten= 97%, Lag= 751.9 min
Discarded = 0.1 cfs @ 24.69 hrs, Volume= 0.115 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 35 : Post C

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 207.63' @ 14.76 hrs Surf.Area= 2,880 sf Storage= 3,155 cf

Plug-Flow detention time= 456.6 min calculated for 0.115 af (100% of inflow)
Center-of-Mass det. time= 456.6 min (1,281.4 - 824.7)

Volume	Invert	Avail.Storage	Storage Description
#1	205.00'	5,472 cf	**18.00'W x 160.00'L x 4.75'H Prismatoid** 13,680 cf Overall x 40.0% Voids
#2	205.50'	123 cf	**12.0" Round Pipe Storage** L= 156.0' S= 0.0050 '/'
		5,595 cf	Total Available Storage

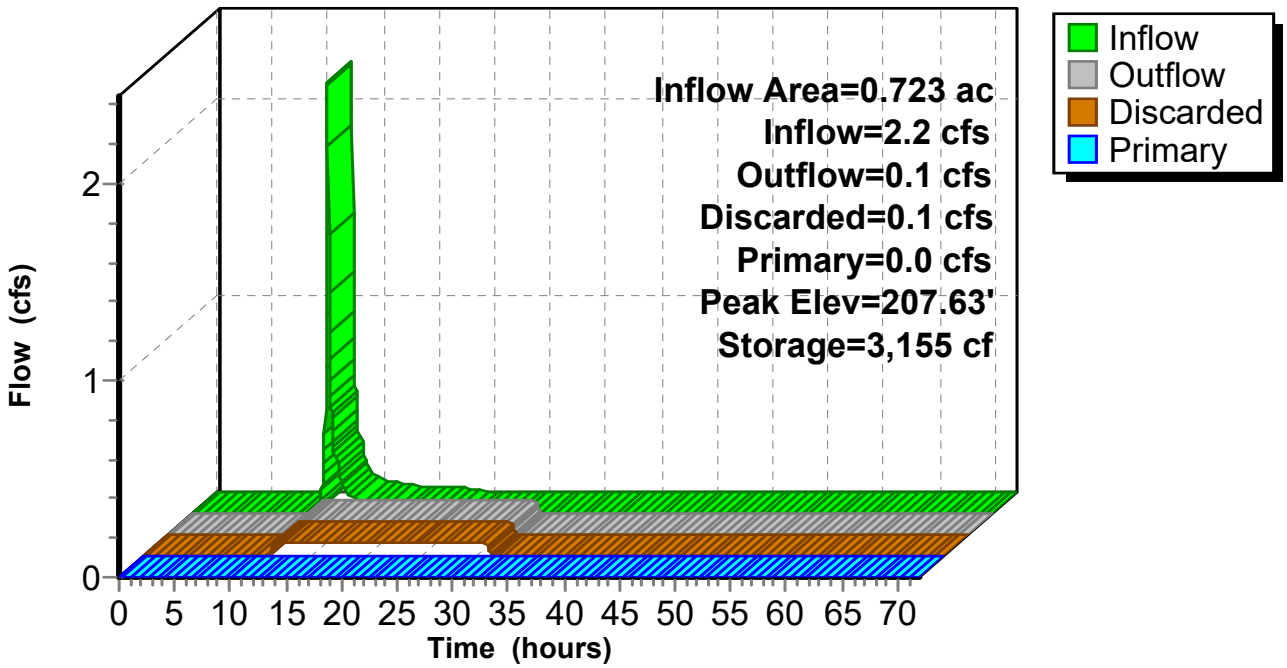
Device	Routing	Invert	Outlet Devices
#1	Discarded	205.00'	**1.050 in/hr Exfiltration over Surface area**
#2	Primary	209.50'	**3.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 24.69 hrs HW=206.38' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=205.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.0 cfs)

Pond 34: Infil Tr #2

Hydrograph

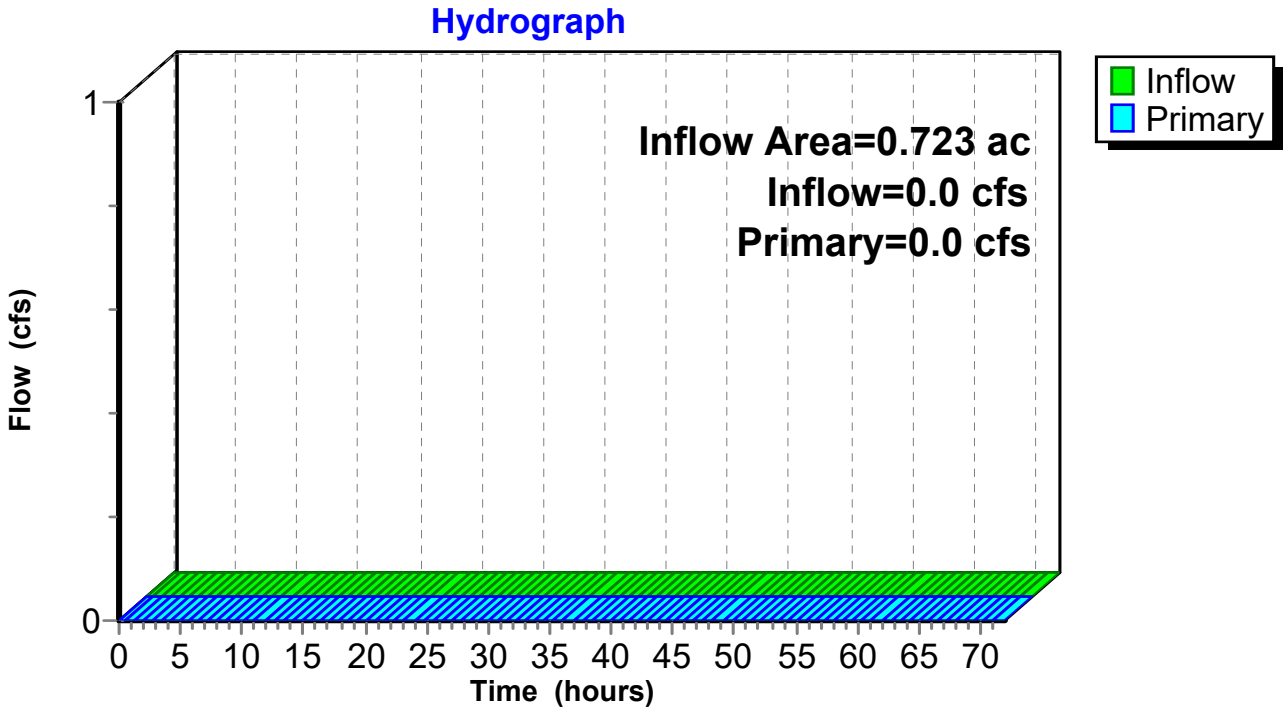


Summary for Link 35: Post C

Inflow Area = 0.723 ac, 32.00% Impervious, Inflow Depth = 0.0" for 25-yr event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs

Link 35: Post C



Summary for Subcatchment 43: Post D

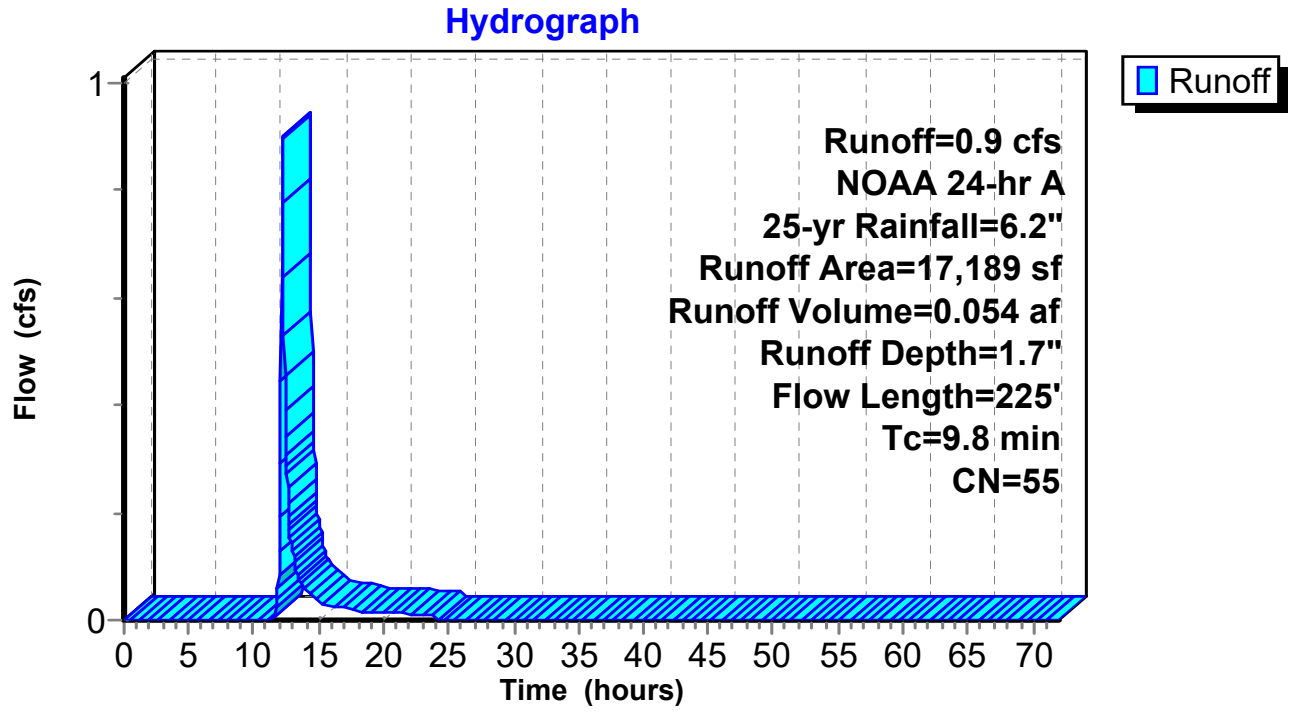
Runoff = 0.9 cfs @ 12.19 hrs, Volume= 0.054 af, Depth= 1.7"
Routed to Pond 44 : Infil Tr #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
11,160	68	<50% Grass cover, Poor, HSG A
46	79	<50% Grass cover, Poor, HSG B
5,983	30	Woods, Good, HSG A
17,189	55	Weighted Average
17,189		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.1"
0.9	75	0.0430	1.45		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	100	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.8	225	Total			

Subcatchment 43: Post D



Summary for Pond 44: Infil Tr #3

Inflow Area = 0.395 ac, 0.00% Impervious, Inflow Depth = 1.7" for 25-yr event
Inflow = 0.9 cfs @ 12.19 hrs, Volume= 0.054 af
Outflow = 0.1 cfs @ 11.96 hrs, Volume= 0.054 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.1 cfs @ 11.96 hrs, Volume= 0.054 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 45 : Post D

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Peak Elev= 206.15' @ 14.02 hrs Surf.Area= 960 sf Storage= 1,240 cf

Plug-Flow detention time= 235.6 min calculated for 0.054 af (100% of inflow)
Center-of-Mass det. time= 235.5 min (1,080.9 - 845.4)

Volume	Invert	Avail.Storage	Storage Description
#1	203.50'	1,345 cf	**12.00'W x 80.00'L x 4.00'H Prismatoid** 3,840 cf Overall - 478 cf Embedded = 3,362 cf x 40.0% Voids
#2	204.50'	478 cf	**24.0" Round Pipe Storage** x 2 Inside #1 L= 76.0' S= 0.0050 '/'
		1,823 cf	Total Available Storage

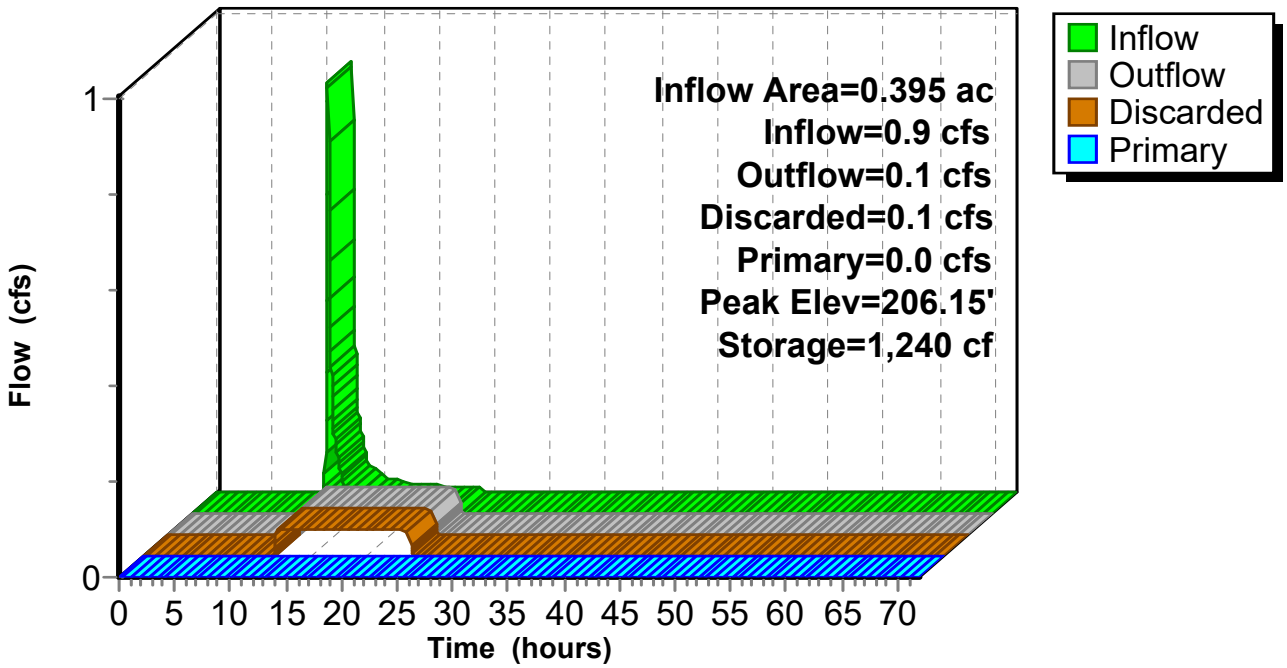
Device	Routing	Invert	Outlet Devices
#1	Discarded	203.50'	**2.400 in/hr Exfiltration over Surface area**
#2	Primary	207.00'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 11.96 hrs HW=203.56' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=203.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.0 cfs)

Pond 44: Infil Tr #3

Hydrograph

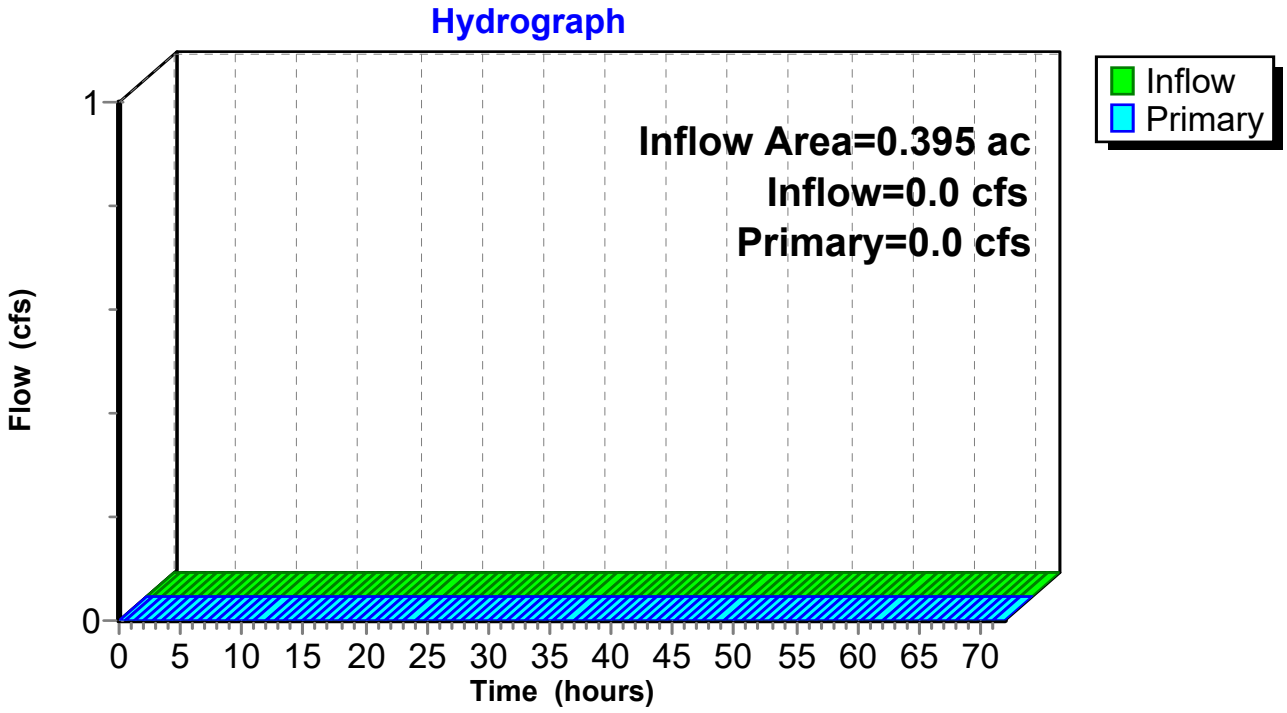


Summary for Link 45: Post D

Inflow Area = 0.395 ac, 0.00% Impervious, Inflow Depth = 0.0" for 25-yr event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs

Link 45: Post D



Summary for Subcatchment 55: Post E

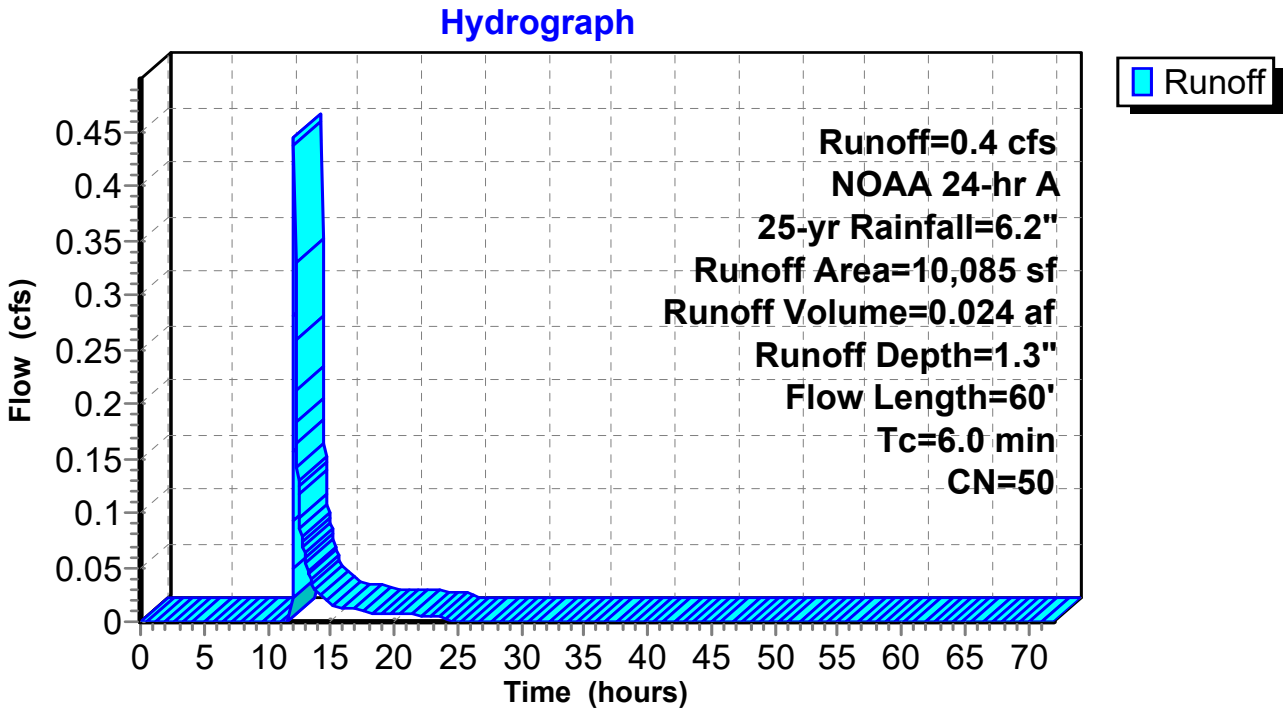
Runoff = 0.4 cfs @ 12.15 hrs, Volume= 0.024 af, Depth= 1.3"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 25-yr Rainfall=6.2"

Area (sf)	CN	Description
5,342	68	<50% Grass cover, Poor, HSG A
4,743	30	Woods, Good, HSG A
10,085	50	Weighted Average
10,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1400	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
0.1	10	0.0900	1.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.9	60	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 55: Post E



iii. Runoff and Mitigation Design Summary Calculations

2, 10, 25 & 100-Year Design Storm Events Summary Calculations

See Following Pages

Time span=0.00-72.00 hrs, dt=0.04 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment01: Pre A Runoff Area=42,502 sf 0.00% Impervious Runoff Depth=0.0"
Flow Length=424' Tc=12.4 min CN=35 Runoff=0.0 cfs 0.000 af

Subcatchment02: Pre B Runoff Area=95,631 sf 10.58% Impervious Runoff Depth=0.3"
Flow Length=570' Tc=13.2 min CN=57 Runoff=0.5 cfs 0.057 af

Subcatchment03: Pre C Runoff Area=21,188 sf 3.80% Impervious Runoff Depth=0.0"
Flow Length=211' Tc=9.0 min CN=33 Runoff=0.0 cfs 0.000 af

Subcatchment04: Pre D Runoff Area=39,824 sf 2.14% Impervious Runoff Depth=0.0"
Flow Length=363' Tc=10.3 min CN=38 Runoff=0.0 cfs 0.000 af

Subcatchment05: Pre E Runoff Area=40,179 sf 0.00% Impervious Runoff Depth=0.0"
Flow Length=365' Tc=10.6 min CN=40 Runoff=0.0 cfs 0.000 af

Subcatchment9: A-2 Runoff Area=57,810 sf 33.92% Impervious Runoff Depth=1.5"
Flow Length=628' Tc=13.8 min CN=82 Runoff=2.6 cfs 0.170 af

Reach 10: Grassed Channel Avg. Flow Depth=0.3' Max Vel=1.08 fps Inflow=2.6 cfs 0.170 af
n=0.040 L=132.0' S=0.0044 '/' Capacity=43.7 cfs Outflow=2.6 cfs 0.170 af

Subcatchment11: A-1 Runoff Area=41,333 sf 0.00% Impervious Runoff Depth=0.4"
Flow Length=180' Tc=9.5 min CN=61 Runoff=0.5 cfs 0.035 af

Subcatchment12: Bldgs #3 & #4 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=3.0"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=0.7 cfs 0.040 af

Pond 13: Drywell Peak Elev=1.44' Storage=739 cf Inflow=0.7 cfs 0.040 af
Discarded=0.1 cfs 0.040 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.040 af

Pond 14: Basin Peak Elev=203.07' Storage=4,849 cf Inflow=2.9 cfs 0.205 af
Discarded=0.2 cfs 0.205 af Primary=0.0 cfs 0.000 af Outflow=0.2 cfs 0.205 af

Link 15: Post A Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment19: Bldg #5 Runoff Area=3,536 sf 100.00% Impervious Runoff Depth=3.0"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=0.4 cfs 0.020 af

Pond 20: Drywell Peak Elev=1.44' Storage=369 cf Inflow=0.4 cfs 0.020 af
Discarded=0.0 cfs 0.020 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.020 af

Subcatchment21: B-2 Runoff Area=23,604 sf 5.35% Impervious Runoff Depth=1.1"
Flow Length=347' Tc=11.3 min CN=75 Runoff=0.8 cfs 0.049 af

Subcatchment22: B-1 Runoff Area=47,221 sf 21.27% Impervious Runoff Depth=0.8"
Flow Length=407' Tc=15.6 min CN=69 Runoff=0.9 cfs 0.070 af

Pond 23: Peak Elev=209.29' Storage=365 cf Inflow=1.7 cfs 0.120 af
Discarded=0.0 cfs 0.025 af Primary=1.6 cfs 0.094 af Secondary=0.0 cfs 0.000 af Outflow=1.7 cfs 0.120 af

Pond 24: Infil. Tr #1 Peak Elev=207.26' Storage=1,430 cf Inflow=1.6 cfs 0.094 af
Discarded=0.1 cfs 0.030 af Primary=0.4 cfs 0.065 af Outflow=0.5 cfs 0.094 af

Link 25: Post B Inflow=0.4 cfs 0.065 af
Primary=0.4 cfs 0.065 af

Subcatchment31: Bldgs #1 & #2 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=3.0"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=0.7 cfs 0.040 af

Pond 32: Drywells Peak Elev=2.18' Storage=820 cf Inflow=0.7 cfs 0.040 af
Discarded=0.1 cfs 0.040 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.040 af

Subcatchment33: Post C Runoff Area=24,433 sf 12.32% Impervious Runoff Depth=0.6"
Flow Length=142' Tc=7.8 min CN=64 Runoff=0.4 cfs 0.026 af

Pond 34: Infil Tr #2 Peak Elev=205.31' Storage=354 cf Inflow=0.4 cfs 0.026 af
Discarded=0.1 cfs 0.026 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.026 af

Link 35: Post C Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment43: Post D Runoff Area=17,189 sf 0.00% Impervious Runoff Depth=0.3"
Flow Length=225' Tc=9.8 min CN=55 Runoff=0.1 cfs 0.008 af

Pond 44: Infil Tr #3 Peak Elev=203.54' Storage=16 cf Inflow=0.1 cfs 0.008 af
Discarded=0.1 cfs 0.008 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.008 af

Link 45: Post D Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment55: Post E Runoff Area=10,085 sf 0.00% Impervious Runoff Depth=0.1"
Flow Length=60' Tc=6.0 min CN=50 Runoff=0.0 cfs 0.002 af

Total Runoff Area = 10.989 ac Runoff Volume = 0.519 af Average Runoff Depth = 0.6"
86.76% Pervious = 9.534 ac 13.24% Impervious = 1.455 ac

Time span=0.00-72.00 hrs, dt=0.04 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment01: Pre A Runoff Area=42,502 sf 0.00% Impervious Runoff Depth=0.1"
Flow Length=424' Tc=12.4 min CN=35 Runoff=0.0 cfs 0.007 af

Subcatchment02: Pre B Runoff Area=95,631 sf 10.58% Impervious Runoff Depth=1.1"
Flow Length=570' Tc=13.2 min CN=57 Runoff=2.9 cfs 0.208 af

Subcatchment03: Pre C Runoff Area=21,188 sf 3.80% Impervious Runoff Depth=0.0"
Flow Length=211' Tc=9.0 min CN=33 Runoff=0.0 cfs 0.002 af

Subcatchment04: Pre D Runoff Area=39,824 sf 2.14% Impervious Runoff Depth=0.2"
Flow Length=363' Tc=10.3 min CN=38 Runoff=0.1 cfs 0.014 af

Subcatchment05: Pre E Runoff Area=40,179 sf 0.00% Impervious Runoff Depth=0.2"
Flow Length=365' Tc=10.6 min CN=40 Runoff=0.1 cfs 0.019 af

Subcatchment9: A-2 Runoff Area=57,810 sf 33.92% Impervious Runoff Depth=3.1"
Flow Length=628' Tc=13.8 min CN=82 Runoff=5.3 cfs 0.346 af

Reach 10: Grassed Channel Avg. Flow Depth=0.5' Max Vel=1.40 fps Inflow=5.3 cfs 0.346 af
n=0.040 L=132.0' S=0.0044 '/' Capacity=43.7 cfs Outflow=5.2 cfs 0.346 af

Subcatchment11: A-1 Runoff Area=41,333 sf 0.00% Impervious Runoff Depth=1.4"
Flow Length=180' Tc=9.5 min CN=61 Runoff=1.9 cfs 0.111 af

Subcatchment12: Bldgs #3 & #4 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=4.8"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=1.1 cfs 0.065 af

Pond 13: Drywell Peak Elev=2.79' Storage=1,393 cf Inflow=1.1 cfs 0.065 af
Discarded=0.1 cfs 0.065 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.065 af

Pond 14: Basin Peak Elev=204.66' Storage=12,522 cf Inflow=6.7 cfs 0.458 af
Discarded=0.3 cfs 0.452 af Primary=0.0 cfs 0.005 af Outflow=0.3 cfs 0.458 af

Link 15: Post A Inflow=0.0 cfs 0.005 af
Primary=0.0 cfs 0.005 af

Subcatchment19: Bldg #5 Runoff Area=3,536 sf 100.00% Impervious Runoff Depth=4.8"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=0.6 cfs 0.033 af

Pond 20: Drywell Peak Elev=2.79' Storage=696 cf Inflow=0.6 cfs 0.033 af
Discarded=0.0 cfs 0.033 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.033 af

Subcatchment21: B-2 Runoff Area=23,604 sf 5.35% Impervious Runoff Depth=2.5"
Flow Length=347' Tc=11.3 min CN=75 Runoff=1.9 cfs 0.113 af

Subcatchment22: B-1 Runoff Area=47,221 sf 21.27% Impervious Runoff Depth=2.0"
Flow Length=407' Tc=15.6 min CN=69 Runoff=2.6 cfs 0.181 af

Pond 23: Peak Elev=209.91' Storage=626 cf Inflow=4.4 cfs 0.294 af
Discarded=0.0 cfs 0.027 af Primary=3.6 cfs 0.260 af Secondary=0.8 cfs 0.006 af Outflow=4.4 cfs 0.294 af

Pond 24: Infil. Tr #1 Peak Elev=208.63' Storage=2,349 cf Inflow=3.6 cfs 0.260 af
Discarded=0.1 cfs 0.053 af Primary=2.8 cfs 0.208 af Outflow=2.9 cfs 0.260 af

Link 25: Post B Inflow=2.9 cfs 0.214 af
Primary=2.9 cfs 0.214 af

Subcatchment31: Bldgs #1 & #2 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=4.8"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=1.1 cfs 0.065 af

Pond 32: Drywells Peak Elev=4.13' Storage=1,519 cf Inflow=1.1 cfs 0.065 af
Discarded=0.1 cfs 0.065 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.065 af

Subcatchment33: Post C Runoff Area=24,433 sf 12.32% Impervious Runoff Depth=1.6"
Flow Length=142' Tc=7.8 min CN=64 Runoff=1.4 cfs 0.076 af

Pond 34: Infil Tr #2 Peak Elev=206.50' Storage=1,802 cf Inflow=1.4 cfs 0.076 af
Discarded=0.1 cfs 0.076 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.076 af

Link 35: Post C Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment43: Post D Runoff Area=17,189 sf 0.00% Impervious Runoff Depth=1.0"
Flow Length=225' Tc=9.8 min CN=55 Runoff=0.5 cfs 0.033 af

Pond 44: Infil Tr #3 Peak Elev=204.99' Storage=598 cf Inflow=0.5 cfs 0.033 af
Discarded=0.1 cfs 0.033 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.033 af

Link 45: Post D Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment55: Post E Runoff Area=10,085 sf 0.00% Impervious Runoff Depth=0.7"
Flow Length=60' Tc=6.0 min CN=50 Runoff=0.2 cfs 0.014 af

Total Runoff Area = 10.989 ac Runoff Volume = 1.287 af Average Runoff Depth = 1.4"
86.76% Pervious = 9.534 ac 13.24% Impervious = 1.455 ac

Time span=0.00-72.00 hrs, dt=0.04 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment01: Pre A Runoff Area=42,502 sf 0.00% Impervious Runoff Depth=0.3"
Flow Length=424' Tc=12.4 min CN=35 Runoff=0.1 cfs 0.024 af

Subcatchment02: Pre B Runoff Area=95,631 sf 10.58% Impervious Runoff Depth=1.8"
Flow Length=570' Tc=13.2 min CN=57 Runoff=4.9 cfs 0.332 af

Subcatchment03: Pre C Runoff Area=21,188 sf 3.80% Impervious Runoff Depth=0.2"
Flow Length=211' Tc=9.0 min CN=33 Runoff=0.0 cfs 0.008 af

Subcatchment04: Pre D Runoff Area=39,824 sf 2.14% Impervious Runoff Depth=0.5"
Flow Length=363' Tc=10.3 min CN=38 Runoff=0.2 cfs 0.035 af

Subcatchment05: Pre E Runoff Area=40,179 sf 0.00% Impervious Runoff Depth=0.6"
Flow Length=365' Tc=10.6 min CN=40 Runoff=0.4 cfs 0.044 af

Subcatchment9: A-2 Runoff Area=57,810 sf 33.92% Impervious Runoff Depth=4.2"
Flow Length=628' Tc=13.8 min CN=82 Runoff=7.1 cfs 0.464 af

Reach 10: Grassed Channel Avg. Flow Depth=0.6' Max Vel=1.55 fps Inflow=7.1 cfs 0.464 af
n=0.040 L=132.0' S=0.0044 '/' Capacity=43.7 cfs Outflow=6.9 cfs 0.464 af

Subcatchment11: A-1 Runoff Area=41,333 sf 0.00% Impervious Runoff Depth=2.2"
Flow Length=180' Tc=9.5 min CN=61 Runoff=3.0 cfs 0.171 af

Subcatchment12: Bldgs #3 & #4 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=6.0"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=1.4 cfs 0.081 af

Pond 13: Drywell Peak Elev=3.71' Storage=1,835 cf Inflow=1.4 cfs 0.081 af
Discarded=0.1 cfs 0.081 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.081 af

Pond 14: Basin Peak Elev=205.53' Storage=17,723 cf Inflow=9.3 cfs 0.635 af
Discarded=0.4 cfs 0.579 af Primary=0.1 cfs 0.056 af Outflow=0.5 cfs 0.635 af

Link 15: Post A Inflow=0.1 cfs 0.056 af
Primary=0.1 cfs 0.056 af

Subcatchment19: Bldg #5 Runoff Area=3,536 sf 100.00% Impervious Runoff Depth=6.0"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=0.7 cfs 0.041 af

Pond 20: Drywell Peak Elev=3.71' Storage=917 cf Inflow=0.7 cfs 0.041 af
Discarded=0.0 cfs 0.041 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.041 af

Subcatchment21: B-2 Runoff Area=23,604 sf 5.35% Impervious Runoff Depth=3.5"
Flow Length=347' Tc=11.3 min CN=75 Runoff=2.6 cfs 0.157 af

Subcatchment22: B-1 Runoff Area=47,221 sf 21.27% Impervious Runoff Depth=2.9"
Flow Length=407' Tc=15.6 min CN=69 Runoff=3.8 cfs 0.261 af

Pond 23: Peak Elev=210.06' Storage=700 cf Inflow=6.3 cfs 0.418 af
Discarded=0.0 cfs 0.028 af Primary=3.9 cfs 0.356 af Secondary=2.3 cfs 0.034 af Outflow=6.2 cfs 0.418 af

Pond 24: Infil. Tr #1 Peak Elev=209.19' Storage=2,664 cf Inflow=3.9 cfs 0.356 af
Discarded=0.1 cfs 0.064 af Primary=3.2 cfs 0.292 af Outflow=3.3 cfs 0.356 af

Link 25: Post B Inflow=5.0 cfs 0.326 af
Primary=5.0 cfs 0.326 af

Subcatchment31: Bldgs #1 & #2 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=6.0"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=1.4 cfs 0.081 af

Pond 32: Drywells Peak Elev=5.27' Storage=1,924 cf Inflow=1.4 cfs 0.081 af
Discarded=0.1 cfs 0.080 af Primary=0.1 cfs 0.001 af Outflow=0.1 cfs 0.081 af

Subcatchment33: Post C Runoff Area=24,433 sf 12.32% Impervious Runoff Depth=2.4"
Flow Length=142' Tc=7.8 min CN=64 Runoff=2.2 cfs 0.114 af

Pond 34: Infil Tr #2 Peak Elev=207.63' Storage=3,155 cf Inflow=2.2 cfs 0.115 af
Discarded=0.1 cfs 0.115 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.115 af

Link 35: Post C Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment43: Post D Runoff Area=17,189 sf 0.00% Impervious Runoff Depth=1.7"
Flow Length=225' Tc=9.8 min CN=55 Runoff=0.9 cfs 0.054 af

Pond 44: Infil Tr #3 Peak Elev=206.15' Storage=1,240 cf Inflow=0.9 cfs 0.054 af
Discarded=0.1 cfs 0.054 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.054 af

Link 45: Post D Inflow=0.0 cfs 0.000 af
Primary=0.0 cfs 0.000 af

Subcatchment55: Post E Runoff Area=10,085 sf 0.00% Impervious Runoff Depth=1.3"
Flow Length=60' Tc=6.0 min CN=50 Runoff=0.4 cfs 0.024 af

Total Runoff Area = 10.989 ac Runoff Volume = 1.893 af Average Runoff Depth = 2.1"
86.76% Pervious = 9.534 ac 13.24% Impervious = 1.455 ac

Time span=0.00-72.00 hrs, dt=0.04 hrs, 1801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment01: Pre A Runoff Area=42,502 sf 0.00% Impervious Runoff Depth=0.8"
Flow Length=424' Tc=12.4 min CN=35 Runoff=0.6 cfs 0.066 af

Subcatchment02: Pre B Runoff Area=95,631 sf 10.58% Impervious Runoff Depth=3.0"
Flow Length=570' Tc=13.2 min CN=57 Runoff=8.5 cfs 0.552 af

Subcatchment03: Pre C Runoff Area=21,188 sf 3.80% Impervious Runoff Depth=0.6"
Flow Length=211' Tc=9.0 min CN=33 Runoff=0.2 cfs 0.026 af

Subcatchment04: Pre D Runoff Area=39,824 sf 2.14% Impervious Runoff Depth=1.1"
Flow Length=363' Tc=10.3 min CN=38 Runoff=1.0 cfs 0.082 af

Subcatchment05: Pre E Runoff Area=40,179 sf 0.00% Impervious Runoff Depth=1.3"
Flow Length=365' Tc=10.6 min CN=40 Runoff=1.3 cfs 0.097 af

Subcatchment9: A-2 Runoff Area=57,810 sf 33.92% Impervious Runoff Depth=5.9"
Flow Length=628' Tc=13.8 min CN=82 Runoff=9.7 cfs 0.650 af

Reach 10: Grassed Channel Avg. Flow Depth=0.7' Max Vel=1.73 fps Inflow=9.7 cfs 0.650 af
n=0.040 L=132.0' S=0.0044 '/' Capacity=43.7 cfs Outflow=9.5 cfs 0.650 af

Subcatchment11: A-1 Runoff Area=41,333 sf 0.00% Impervious Runoff Depth=3.5"
Flow Length=180' Tc=9.5 min CN=61 Runoff=4.9 cfs 0.274 af

Subcatchment12: Bldgs #3 & #4 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=7.8"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=1.8 cfs 0.105 af

Pond 13: Drywell Peak Elev=5.19' Storage=2,542 cf Inflow=1.8 cfs 0.105 af
Discarded=0.1 cfs 0.105 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.105 af

Pond 14: Basin Peak Elev=206.67' Storage=25,756 cf Inflow=13.5 cfs 0.924 af
Discarded=0.4 cfs 0.756 af Primary=0.6 cfs 0.168 af Outflow=1.0 cfs 0.924 af

Link 15: Post A Inflow=0.6 cfs 0.168 af
Primary=0.6 cfs 0.168 af

Subcatchment19: Bldg #5 Runoff Area=3,536 sf 100.00% Impervious Runoff Depth=7.8"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=0.9 cfs 0.053 af

Pond 20: Drywell Peak Elev=5.19' Storage=1,271 cf Inflow=0.9 cfs 0.053 af
Discarded=0.0 cfs 0.053 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.053 af

Subcatchment21: B-2 Runoff Area=23,604 sf 5.35% Impervious Runoff Depth=5.1"
Flow Length=347' Tc=11.3 min CN=75 Runoff=3.8 cfs 0.228 af

Subcatchment22: B-1 Runoff Area=47,221 sf 21.27% Impervious Runoff Depth=4.4"
Flow Length=407' Tc=15.6 min CN=69 Runoff=5.8 cfs 0.394 af

Pond 23: Peak Elev=210.24' Storage=790 cf Inflow=9.3 cfs 0.623 af
Discarded=0.0 cfs 0.030 af Primary=4.2 cfs 0.492 af Secondary=5.1 cfs 0.101 af Outflow=9.3 cfs 0.623 af

Pond 24: Infil. Tr #1 Peak Elev=211.40' Storage=2,780 cf Inflow=4.2 cfs 0.492 af
Discarded=0.1 cfs 0.078 af Primary=4.6 cfs 0.414 af Outflow=4.7 cfs 0.492 af

Link 25: Post B Inflow=8.3 cfs 0.515 af
Primary=8.3 cfs 0.515 af

Subcatchment31: Bldgs #1 & #2 Runoff Area=7,072 sf 100.00% Impervious Runoff Depth=7.8"
Flow Length=25' Slope=0.3000 '/' Tc=6.0 min CN=98 Runoff=1.8 cfs 0.105 af

Pond 32: Drywells Peak Elev=5.46' Storage=1,924 cf Inflow=1.8 cfs 0.105 af
Discarded=0.1 cfs 0.087 af Primary=1.1 cfs 0.019 af Outflow=1.2 cfs 0.105 af

Subcatchment33: Post C Runoff Area=24,433 sf 12.32% Impervious Runoff Depth=3.8"
Flow Length=142' Tc=7.8 min CN=64 Runoff=3.4 cfs 0.177 af

Pond 34: Infil Tr #2 Peak Elev=209.67' Storage=5,498 cf Inflow=3.4 cfs 0.196 af
Discarded=0.1 cfs 0.176 af Primary=0.2 cfs 0.020 af Outflow=0.3 cfs 0.196 af

Link 35: Post C Inflow=0.2 cfs 0.020 af
Primary=0.2 cfs 0.020 af

Subcatchment43: Post D Runoff Area=17,189 sf 0.00% Impervious Runoff Depth=2.8"
Flow Length=225' Tc=9.8 min CN=55 Runoff=1.6 cfs 0.092 af

Pond 44: Infil Tr #3 Peak Elev=207.16' Storage=1,690 cf Inflow=1.6 cfs 0.092 af
Discarded=0.1 cfs 0.072 af Primary=0.4 cfs 0.020 af Outflow=0.5 cfs 0.092 af

Link 45: Post D Inflow=0.4 cfs 0.020 af
Primary=0.4 cfs 0.020 af

Subcatchment55: Post E Runoff Area=10,085 sf 0.00% Impervious Runoff Depth=2.3"
Flow Length=60' Tc=6.0 min CN=50 Runoff=0.9 cfs 0.044 af

Total Runoff Area = 10.989 ac Runoff Volume = 2.945 af Average Runoff Depth = 3.2"
86.76% Pervious = 9.534 ac 13.24% Impervious = 1.455 ac

iv. Grass Channel [Biofilter Swale] Design

1" Rainfall Design
2 & 10 Year Design Storm Analysis

See Following Pages

Summary for Subcatchment x09: A-2

Runoff = 1.8 cfs @ 12.23 hrs, Volume= 0.117 af, Depth= 1.1"
Routed to Reach x10 : Grassed Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 1-yr Rainfall=2.6"

	Area (sf)	CN	Description
	11,254	98	Paved parking, HSG A
	7,293	98	Paved parking, HSG B
*	176	98	Paved parking, HSG A (Sidewalk)
*	887	98	Paved parking, HSG B (Sidewalk)
	7,131	68	<50% Grass cover, Poor, HSG A
	25,481	79	<50% Grass cover, Poor, HSG B
	5,588	55	Woods, Good, HSG B
	57,810	82	Weighted Average
	38,200		66.08% Pervious Area
	19,610		33.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.9	197	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	339	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	42	0.0450	12.51	9.8	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010
13.8	628	Total			

Summary for Reach x10: Grassed Channel

Inflow Area = 1.327 ac, 33.92% Impervious, Inflow Depth = 1.1" for 1-yr event
Inflow = 1.8 cfs @ 12.23 hrs, Volume= 0.117 af
Outflow = 1.7 cfs @ 12.29 hrs, Volume= 0.117 af, Atten= 2%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Max. Velocity= 0.62 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 0.16 fps, Avg. Travel Time= 9.0 min

Peak Storage= 240 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.3' , Surface Width= 9.1'
Bank-Full Depth= 1.6' Flow Area= 17.4 sf, Capacity= 27.5 cfs

8.10' x 1.65' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 1.5 '/' Top Width= 13.05'
Length= 85.0' Slope= 0.0054 '/'
Inlet Invert= 207.30', Outlet Invert= 206.84'

‡

Summary for Subcatchment x09: A-2

Runoff = 1.8 cfs @ 12.23 hrs, Volume= 0.117 af, Depth= 1.1"
Routed to Reach x10 : Grassed Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 1-yr Rainfall=2.6"

	Area (sf)	CN	Description
	11,254	98	Paved parking, HSG A
	7,293	98	Paved parking, HSG B
*	176	98	Paved parking, HSG A (Sidewalk)
*	887	98	Paved parking, HSG B (Sidewalk)
	7,131	68	<50% Grass cover, Poor, HSG A
	25,481	79	<50% Grass cover, Poor, HSG B
	5,588	55	Woods, Good, HSG B
	57,810	82	Weighted Average
	38,200		66.08% Pervious Area
	19,610		33.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.9	197	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	339	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	42	0.0450	12.51	9.8	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010
13.8	628	Total			

Summary for Reach x10: Grassed Channel

Inflow Area = 1.327 ac, 33.92% Impervious, Inflow Depth = 1.1" for 1-yr event
Inflow = 1.8 cfs @ 12.23 hrs, Volume= 0.117 af
Outflow = 1.7 cfs @ 12.29 hrs, Volume= 0.117 af, Atten= 2%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Max. Velocity= 0.62 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 0.16 fps, Avg. Travel Time= 9.0 min

Peak Storage= 240 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.3' , Surface Width= 9.1'
Bank-Full Depth= 1.6' Flow Area= 17.4 sf, Capacity= 27.5 cfs

8.10' x 1.65' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 1.5 '/' Top Width= 13.05'
Length= 85.0' Slope= 0.0054 '/'
Inlet Invert= 207.30', Outlet Invert= 206.84'

‡

Summary for Subcatchment x09: A-2

Runoff = 2.6 cfs @ 12.23 hrs, Volume= 0.170 af, Depth= 1.5"
Routed to Reach x10 : Grassed Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 2-yr Rainfall=3.2"

	Area (sf)	CN	Description
	11,254	98	Paved parking, HSG A
	7,293	98	Paved parking, HSG B
*	176	98	Paved parking, HSG A (Sidewalk)
*	887	98	Paved parking, HSG B (Sidewalk)
	7,131	68	<50% Grass cover, Poor, HSG A
	25,481	79	<50% Grass cover, Poor, HSG B
	5,588	55	Woods, Good, HSG B
	57,810	82	Weighted Average
	38,200		66.08% Pervious Area
	19,610		33.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.9	197	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	339	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	42	0.0450	12.51	9.8	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010
13.8	628	Total			

Summary for Reach x10: Grassed Channel

Inflow Area = 1.327 ac, 33.92% Impervious, Inflow Depth = 1.5" for 2-yr event
Inflow = 2.6 cfs @ 12.23 hrs, Volume= 0.170 af
Outflow = 2.6 cfs @ 12.28 hrs, Volume= 0.170 af, Atten= 2%, Lag= 3.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Max. Velocity= 0.71 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.18 fps, Avg. Travel Time= 8.1 min

Peak Storage= 307 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.4' , Surface Width= 9.3'
Bank-Full Depth= 1.6' Flow Area= 17.4 sf, Capacity= 27.5 cfs

8.10' x 1.65' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 1.5 '/' Top Width= 13.05'
Length= 85.0' Slope= 0.0054 '/'
Inlet Invert= 207.30', Outlet Invert= 206.84'

‡

Summary for Subcatchment x09: A-2

Runoff = 5.3 cfs @ 12.22 hrs, Volume= 0.346 af, Depth= 3.1"
Routed to Reach x10 : Grassed Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
NOAA 24-hr A 10-yr Rainfall=5.1"

	Area (sf)	CN	Description
	11,254	98	Paved parking, HSG A
	7,293	98	Paved parking, HSG B
*	176	98	Paved parking, HSG A (Sidewalk)
*	887	98	Paved parking, HSG B (Sidewalk)
	7,131	68	<50% Grass cover, Poor, HSG A
	25,481	79	<50% Grass cover, Poor, HSG B
	5,588	55	Woods, Good, HSG B
	57,810	82	Weighted Average
	38,200		66.08% Pervious Area
	19,610		33.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.1"
1.9	197	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	339	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	42	0.0450	12.51	9.8	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010
13.8	628	Total			

Summary for Reach x10: Grassed Channel

Inflow Area = 1.327 ac, 33.92% Impervious, Inflow Depth = 3.1" for 10-yr event
Inflow = 5.3 cfs @ 12.22 hrs, Volume= 0.346 af
Outflow = 5.2 cfs @ 12.27 hrs, Volume= 0.346 af, Atten= 2%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.04 hrs
Max. Velocity= 0.92 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 6.7 min

Peak Storage= 486 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.6' , Surface Width= 10.0'
Bank-Full Depth= 1.6' Flow Area= 17.4 sf, Capacity= 27.5 cfs

8.10' x 1.65' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 1.5 '/' Top Width= 13.05'
Length= 85.0' Slope= 0.0054 '/'
Inlet Invert= 207.30', Outlet Invert= 206.84'

‡

V. Erosion And Sedimentation Control Maintenance Plan

i. Soil Erosion & Sediment Control Narrative

In general, the erosion control methodology to be employed on the site involves the installation of straw wattles (Compost Filter Soxx) as shown on the plans to protect abutting properties. These devices will remain in place until the earth disturbing activity is stabilized with loam and seed and grass is growing. Loam and seeding, are permanent methods of site stabilization while the straw wattles placement is considered temporary erosion control methods. If a significant amount of soil is tracked onto the roadway from the lot construction, then, at the direction of the Town Inspector, street sweeping will be performed.

The disturbed portions of the entire site will be hydroseeded if construction including loaming and seeding has not been completed prior to October 1st of a season. This will provide approximately three (3) or four (4) weeks growing season for the grass, which will serve to stabilize the site to accommodate spring runoff periods. No other methods to stabilize the site for winter construction are necessary.

During construction, and upon completion of construction, the project will require some maintenance of erosion control devices. During construction, straw wattles must be checked every couple of weeks and after rainstorms, repaired and replaced as necessary due to sediment buildup behind it or on the device. After large storm events, the cleaning of sediment may be necessary. If storm events occur after the slopes and other areas, which are stabilized, have been planted but prior to seed germination, then replanting and re-grading of those areas might be necessary. This work will be performed by the developer on an as-needed basis, during the construction phase.

The plan set contains the erosion control layout, while the storm drainage calculations attached hereto describe the soils which are present on the site, as well as the methodology for handling storm water flow on the property.

ii. Operation and Maintenance Procedures

Compost Filter Sock

Installation

1. Perimeter control used for control of sediment in storm runoff shall meet Filtrexx Soxx Mesh Material and Filtrexx Certified FilterMedia specifications or equal.
2. Perimeter control will be placed at locations indicated on plans and in a manner as directed by the Engineer or Manufacturer.
3. Perimeter control should be installed parallel to the base of the slope or other disturbed area.
4. Effective Soxx height in the field for 12" diameter Soxx should be = 9.5" high.
5. Stakes should be installed through the middle of the perimeter control on 10 ft centers, using nominal 2 in by 2 in by 3 ft wooden stakes.
6. Staking depth for sand and silt loam soils shall be 12 in.
7. Loose compost may be backfilled along the upslope side of the perimeter control, filling the seam between the soil surface and the device, improving filtration and sediment retention.

Inspection & maintenance

Routine inspection should be conducted within 24 hours of a runoff event or as designated by the regulating authority. Perimeter control should be regularly inspected to make sure they maintain their shape and are producing adequate hydraulic flow-through. If ponding becomes excessive, additional perimeter control may be required to reduce effective slope length or sediment removal may be necessary. Perimeter control shall be inspected until area above has been permanently stabilized and construction activity has ceased.

1. The contractor shall maintain the perimeter control in a functional condition at all times and it shall be routinely inspected.
2. If the perimeter control has been damaged, it shall be repaired or replaced if beyond repair.
3. The contractor shall remove sediment at the base of the upslope side of the perimeter control when accumulation has reached 1/2 of the effective height of the Soxx, or as directed by the Engineer. Alternatively, a new perimeter control can be placed on top of and slightly behind the original one creating more sediment storage capacity without soil disturbance.

4. Perimeter control shall be maintained until the disturbed area above the device has been permanently stabilized and construction activity has ceased.
5. The FilterMedia will be dispersed on site once the disturbed area has been permanently stabilized, construction activity has ceased, or as determined by the engineer.
6. For long-term sediment and pollution control applications, perimeter control can be seeded at the time of installation to create a vegetative filtering system for prolonged and increased filtration of sediment (contained vegetative filter strip). The appropriate seed mix shall be determined by the engineer.

Stabilized Construction Entrance - Developing Areas

Definition

A stabilized pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area shall be provided.

Purpose

The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets.

Conditions Where Practice Applies

A stabilized construction entrance shall be used at all points of construction ingress and egress.

Design Criteria

1. Aggregate Size - Use 2-inch stone or reclaimed or recycled concrete equivalent.
2. Thickness - Not less than 6 inches.
3. Width - 10-foot minimum but not less than the full width of points where ingress or egress occurs.
4. Length - As required, but not less than 50 feet (except on a single residence lot where a 30-foot minimum would apply).
5. Filter cloth - To be placed over the entire area to be covered with aggregate. Filter cloth will not be required on a single-family residence lot.
6. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

Maintenance

The entrance shall be maintained in a condition which will prevent tracking of sediment onto public rights-of-way or streets. This may require periodic topdressing with additional aggregate. All sediment spilled, dropped, or washed onto public rights-of-way must be removed immediately.

When necessary, wheels must be cleaned to remove sediment prior to entrance into public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.

Criteria for Filter Cloth

The filter cloth shall be a woven or non-woven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew, rot resistant, and conform to the properties of the following table:

Roads	Haul Roads Test	Light Duty 1-/ Heavy Duty 2-/ Fabric Properties 3/ Grade Subgrade Rough Graded	Method
Grab Tensile Strength (lbs.)	200	220	ASTM D1682
Elongation at Failure (%)	50	60	ASTM D1682
Mullen Burst Strength (lbs.)	190	430	ASTM D3786
Puncture Strength (lbs.)	40	125	ASTM D751 modified
Equivalent Opening Size	40-80	40-80	US Std Sieve CW-02215
Aggregate Depth (in.)	6	10	--

1-/ Light Duty Road: Sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

2-/ Heavy Duty Road: Sites with only rough grading, and where most travel would be multi-axle vehicles. Trevira Spunbond 1135, Mirafi 600X, or equivalent.

3-/ Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

VI. Appendix – Norse Environmental Services ~ Soil Logs

See Following Pages

VII. Appendix – NRCS Soils Information

See Following Pages

Hydrologic Soil Group—Essex County, Massachusetts, Northern Part
(39 Sunset Rock Road)

Map Scale: 1:1,930 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N 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 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	0.6	9.4%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	B	1.7	25.3%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	4.4	65.3%
Totals for Area of Interest			**6.7**	**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

Map Unit Description

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

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

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Essex County, Massachusetts, Northern Part

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet

Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

421B—Canton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w81l
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton, very stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Very Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 9 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Gloucester, very stony

Percent of map unit: 4 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 2 percent

Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

421D—Canton fine sandy loam, 15 to 25 percent slopes, very stony

Map Unit Setting

National map unit symbol: vj5c
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Canton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over friable sandy and gravelly basal till derived from granite and gneiss

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 33 inches: fine sandy loam
H3 - 33 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate
Percent of map unit: 10 percent
Hydric soil rating: No

Charlton
Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 9, 2022

VIII. Appendix – Drainage Area Maps

See Following Pages

SOILS LEGEND

Series	HSG
(310B) Woodbridge fine sandy loam, 3 to 8% slopes	C/D
(421B) Canton, fine sandy loam, 0 to 8% slopes	B
(421D) Canton, fine sandy loam, 8 to 25% slopes	A

SCALE: 1" = 60'

0 60 120

"B" Soils

NRCS BOUNDARY LINE (TYP.)

"A" Soils

"B" Soils

"A"
"A" Soils
42,502± s.f.

"B"
95,631± s.f.

421B CANTON

PAVED DRIVE

EXISTING GARAGE

EXISTING DWELLING #39

STONE PATIO

EXISTING STRUCTURES (TO BE REMOVED)

"E"
40,179± s.f.

"C"
21,188± s.f.

WOODBRIDGE 310B
"C" Soils

"D"
39,824± s.f.

421D CANTON
"A" Soils

EXISTING GAZEBO

Pt-1 Pt-2 Pt-3 Pt-4 Pt-5

MINISTERS ESTATES

DK Engineering LLC
59 Granite Lane, Chester, NH 03036
Tel. Number:: (603) 505-5226
E-mail Address: dan@dke.llc

Assessor's Map & Lot: Map 59 / Lot 30	
Project No.: 42305	Drawing Scale:
Plan Date: 04/14/25	Revised Date:

Sheet Title: PRE-DEV. DRAINAGE AREA MAP

Sheet No.: 1

No. of Shts.: 2

Drawing name: D:_dk data\Projects\42305 ~ ADC - 39 Sunset Rock Rd - Andover_dwg\42305 ~ DSP 39 SSR 2025-04-14.dwg

Plotted on Apr 09, 2025 - 12:39pm

SOILS LEGEND

Series	HSG
(310B) Woodbridge fine sandy loam, 3 to 8% slopes	C/D
(421B) Canton, fine sandy loam, 0 to 8% slopes	B
(421D) Canton, fine sandy loam, 8 to 25% slopes	A

SCALE: 1" = 60'

0 60 120

"A-1" 43,022± s.f. "A" Soils

"A-2" 63,163± s.f. 421B CANTON

"B-1" 50,756± s.f. NRCS BOUNDARY LINE (TYP.) "B" Soils "A" Soils

"B-2" 23,604± s.f. WOODBRIDGE 310B "C" Soils

"C" 31,808± s.f. 421D CANTON "A" Soils

"D" 17,190± s.f.

"E" 10,379± s.f.

Pt-1 Pt-2 Pt-3 Pt-4 Pt-5

MINISTERS ESTATES

DK Engineering LLC
59 Granite Lane, Chester, NH 03036
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Assessor's Map & Lot: Map 59 / Lot 30	
Project No.: 42305	Drawing Scale:
Plan Date: 04/14/25	Revised Date:

Sheet Title: POST-DEV. DRAINAGE AREA MAP

Sheet No.: 2

No. of Shts.: 2

Plotted on Apr 09, 2025 – 12:46pm

Drawing name: D:_dk data\Projects\42305 ~ ADC – 39 Sunset Rock Rd – Andover_dwg\42305 ~ DSP 39 SSR 2025-04-14.dwg