STORMWATER REPORT
145 WARREN STREET
NEWTON, MASSACHUSETTS

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INTRODUCTION

VTP Associates has performed a stormwater management analysis to evaluate the post-development impacts created by the proposed residential at #145 Warren Street in Newton, Massachusetts. The project will include a new addition to the existing house. The new residence building will include a total of four units, a new surface driveway with parking, landscaped areas, and an associated stormwater management system.

VTP Associates analyzed the hydrology for the drainage areas impacted by the proposed work utilizing the Soil Conservation Service's (SCS) Runoff Curve Number (CN) methodology. VTP Associates used the HydroCAD computer modeling system in conjunction with the SCS's methods to determine the peak rate of runoff for the 2, 10, and 100-year storm events.

VTP Associates proposes the use of best management practices (BMPs) as defined by the Massachusetts Department of Environmental Protection (MA DEP) for stormwater management onsite to protect downstream receiving waters from adverse water quality impacts due to stormwater runoff. Mitigating the rate and quality of stormwater runoff from the project site will also help to lessen the environmental impact of the proposed development.

METHODOLOGY

Hydrology and Hydraulics

VTP Associates analyzed the survey base plan and conducted a site visit to determine the existing drainage flow patterns onsite. The existing conditions survey, in conjunction with aerial photography, and site visits were used to determine existing surface coverage areas for the site. VTP Associates determined that a majority of the pre-developed surface cover for the study area is impervious cover. Initial soil research was determined using the Natural Resources Conservation Service (NRCS) soil survey maps for Middlesex County, Massachusetts via Web Soil Survey 1.1. According to the soil survey, the soil on the site consists of the following:

629C: Canton-Charlton-Urban land complex, 3 to 15 percent slopes

Test pit were conducted and determined that the site consists of a moderately high to high draining loamy sand. Based upon these findings, VTP Associates used a Hydrologic soil group 'A' for its drainage calculations. The test pits information has been included within this report. As per the Mass DEP Stormwater Hydrology Handbook for Conservation Commissions, VTP used a design infiltration rate of 2.41in/hr for 'A' soils.

For each subcatchment area, VTP Associates determined drainage flow path lengths, surface cover type and slopes for sheet and shallow concentrated flow. The information was used to calculate the time of concentration (Tc) for each subcatchment areas. Where applicable, a minimum Tc of 5 minutes was used; the minimum value for highly developed, small catchment areas. SCS Runoff Curve Numbers were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates for the 2, 10 and 100-year storm events were then determined by inputting the weighted CN, Tc, drainage areas, and drainage system information into the HydroCAD storm water modeling system computer program. The storm events were based on the 24-hour duration storm with a SCS Type III storm distribution curve.

Storm Event

VTP Associates used Massachusetts rainfall data maps from Technical Paper 40, Rainfall Frequency Atlas of the United States and the City of Newton's Requirements for On-Site Drainage to estimate the rainfall depth for the 2, 10 and 100-year storms. The rainfall depths for the 24-hour storm events used are as follows:

Storm Event	24-Hour Rainfall Depth (inches)
2-year	3.1
10-year	4.5
100-year	8.78

HYDROLOGICAL ANALYSIS

Pre-Development Conditions

The existing site consists of a one-story wood/brick building, a detached one-story garage, a surface driveway, and landscape areas. Approximately 5,879 square feet (25.1%) of the site is impervious cover. The site is bound by residential building to the east and west, MBTA to the north, and Warren Street to the south.

VTP Associates compiled the existing drainage areas from an existing conditions survey prepared by VTP Associates. Additionally, VTP Associates conducted site visits to evaluate the existing onsite drainage patterns and watershed divides from the existing conditions survey. At present, stormwater runoffs from the existing study area drain to Warren Street to the south (POD1), and to the north abutter (MBTA) (POD2). The pre-development drainage areas are shown on "Figure 1: Pre-Development Drainage Areas."

Post Development Conditions

The proposed project includes a two and one half-story addition to the existing house. The new building will include 4 units, a surface driveway, walkways, landscaped areas, and associated drainage improvements. As a result, approximately 11,255 square feet (48.1%) of the site is impervious. The same overall area was analyzed for the proposed conditions as the pre-development conditions and is shown on "Figure 2: Post-Development Drainage Areas." Similar to pre-development conditions, the stormwater runoff flows in the same direction. The same design points were used as in the pre-development conditions.

The new residence will have approximately 7876 square feet of impervious, or roof, and the driveway will be approximately 2,766 square feet. The roof runoff areas are separated into four drainage areas and discharge to a respective underground infiltration system. The roof runoff area (PR1 and PR5) will be collected by roof leaders and discharge into the onsite infiltration system #1 (INF-1). The roof runoff areas (PR2) will be collected by roof leaders and discharge into the onsite infiltration system #2 (INF-2). The roof runoff area (PR3) will be collected by roof leaders and discharge into the onsite infiltration system #3 (INF-3). The driveway runoff (PD) and roof runoff area (PR4) will be collected by roof leaders and a catch basin and discharge into onsite infiltration system #4 (INF-4). The intent of the proposed stormwater management systems is to infiltrate stormwater runoff of the new building and driveway. The infiltration system was designed to control the 100-year storm with the addition of overflow to the infiltration systems and help mitigate proposed peak rates of runoff to less than existing conditions. The drainage areas can be seen on "Figure 2: Post-Development Drainage Areas."

VTP Associates analyzed the pre- and post-development site conditions to determine the peak rates of runoff at the design points. By incorporating the stormwater management features discussed above, the peak rates of runoff in the post-development condition is to be better than pre-development levels. Pre-development peak runoff rates vs. post-development peak runoff rates for the 2, 10, and 100-year storm events are presented in Table 1 below.

Table 1, Pre-development vs. Post-Development Peak Rate of Runoff

Design Point #1 – (POD1)_Warren Street (South)

STORM EVENT (DESIGN POINT)	*PRE-DEVELOPMENT PEAK RATE OF RUNOFF (CFS)*	*POST-DEVELOPMENT PEAK RATE OF RUNOFF (CFS)*	*PRE-DEVELOPMENT VOLUME OF RUNOFF (AF)*	*POST-DEVELOPMENT VOLUME OF RUNOFF (AF)*
2-YEAR	0.01	0.00	0.001	0.000
10-YEAR	0.05	0.02	0.004	0.002
100-YEAR	0.21	0.12	0.015	0.009

Design Point #2 – (POD2) North Abutter (MBTA)

STORM EVENT (DESIGN POINT)	*PRE-DEVELOPMENT PEAK RATE OF RUNOFF (CFS)*	*POST-DEVELOPMENT PEAK RATE OF RUNOFF (CFS)*	*PRE-DEVELOPMENT VOLUME OF RUNOFF (AF)*	*POST-DEVELOPMENT VOLUME OF RUNOFF (AF)*
2-YEAR	0.01	0.00	0.004	0.000
10-YEAR	0.14	0.13	0.021	0.007
100-YEAR	1.44	0.82	0.113	0.057

CONCLUSION

The post-development peak rate of runoff contributing to Warren Street is expected to be less than or equal to pre-development levels for the 2, 10, and 100-year storm events. Although there is increased impervious coverage on the site as a result of the proposed redevelopment, the addition of the underground infiltration systems controls the post-development runoff to pre-development levels or better.

ENCLOSURES

Test Pit
NRCS Soil Map
Pre-Development Drainage Areas (Figure 1)
Post-Development Drainage Areas (Figure 2)
Pre & Post Development HydroCAD Calculations
Operation and Maintenance Plan

TESTPIT #1 =158.9(JAN 28, 2019)

0-12" TOP SOIL
12"-36" SUBSOIL
36"-114" MEDIUM LOAMY SAND W/GRAVEL

NO WATER
NO REFUSAL
NO MOTTLING

PERC. RATE . <2 mpi

TESTPIT #2 ELEV=148.7(JAN 28, 2019)

0-15" TOP SOIL
15"-30" SUBSOIL
30"-44" SANDY LOAM W/GRAVEL

WATER @ 28"
NO REFUSAL

Hydrologic Soil Group—Middlesex County, Massachusetts
(145 Warren Street Newton, MA)

Map Scale: 1:475 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

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 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 18, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	A	0.5	100.0%
Totals for Area of Interest			**0.5**	**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.

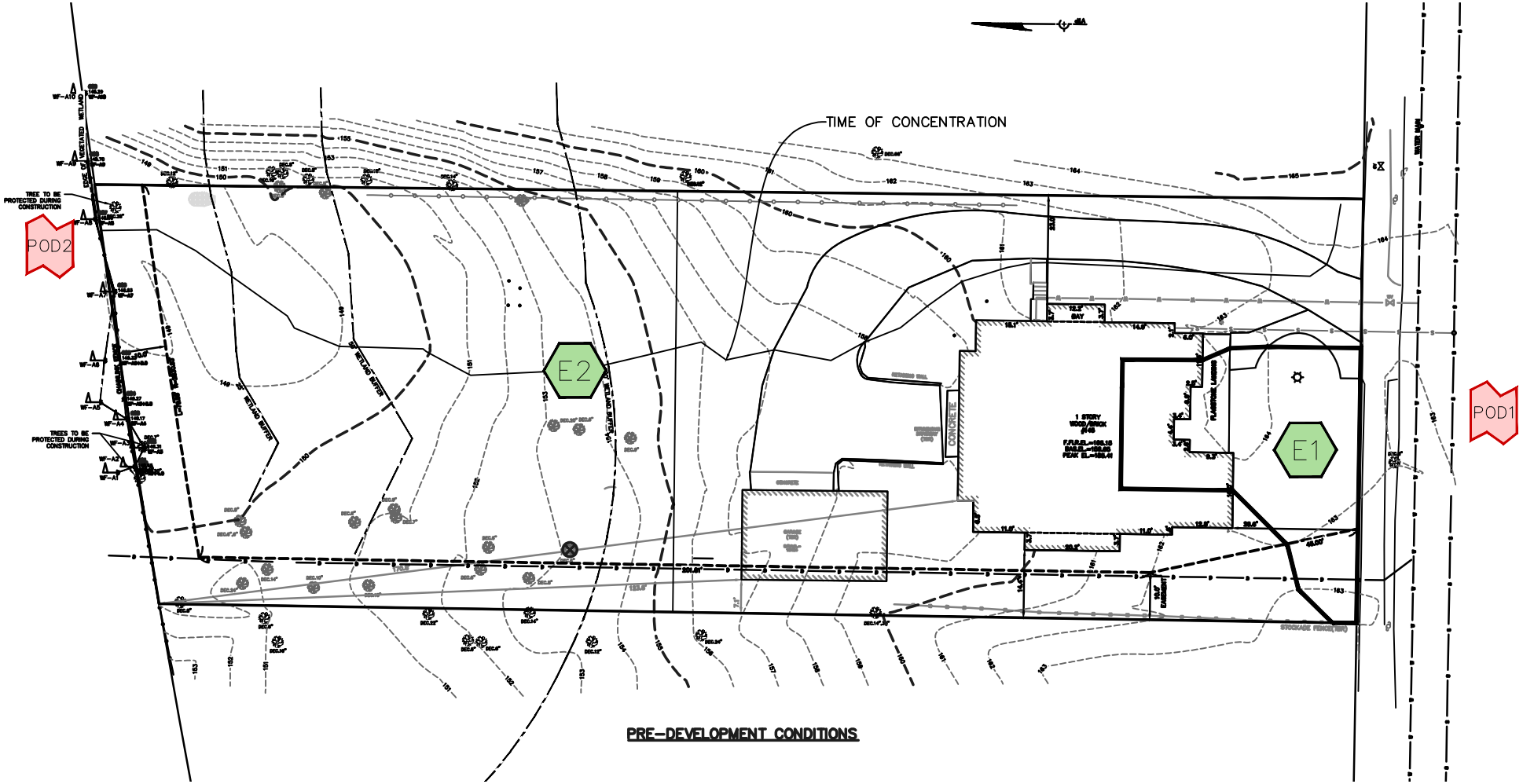
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

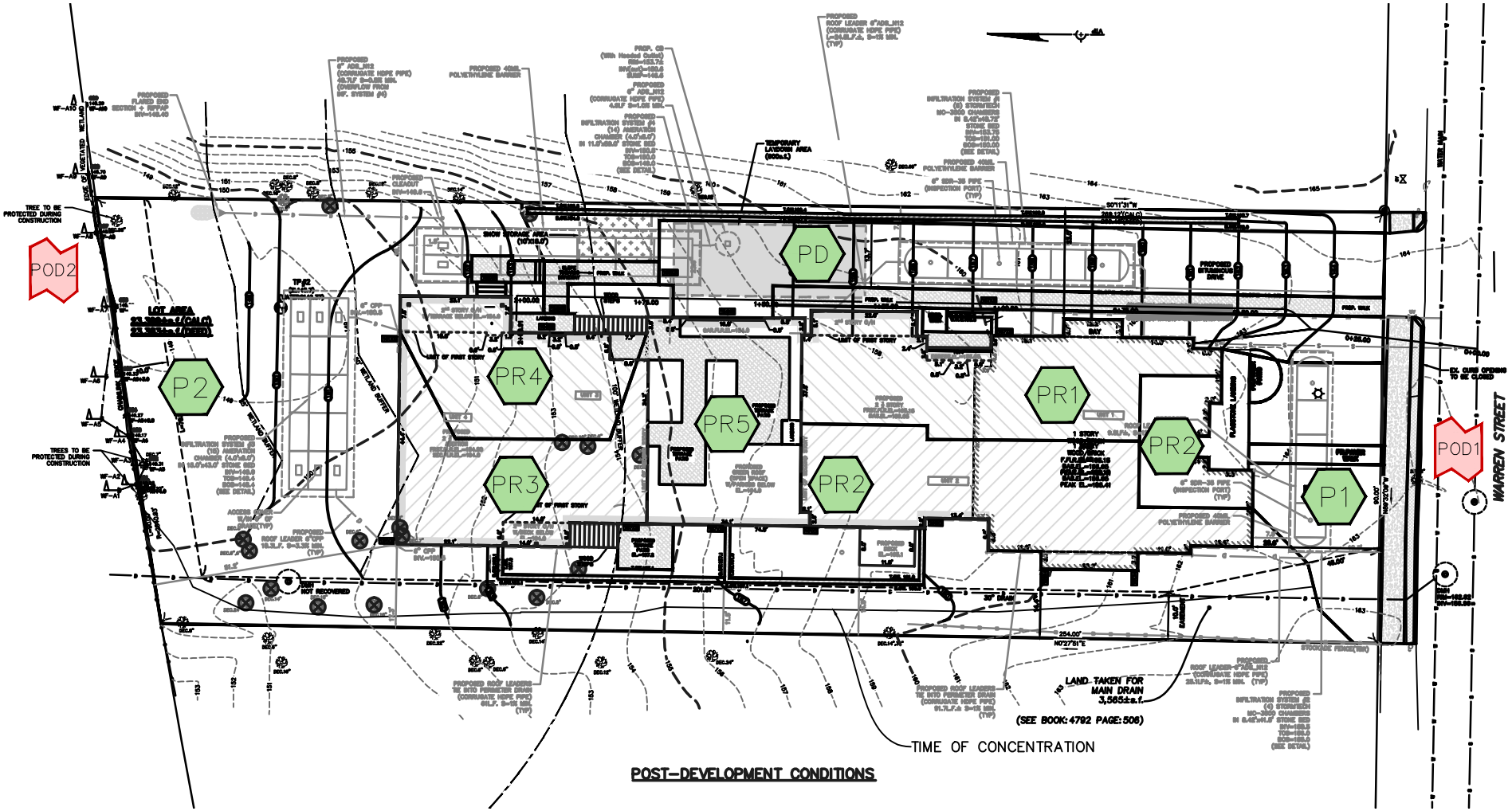
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

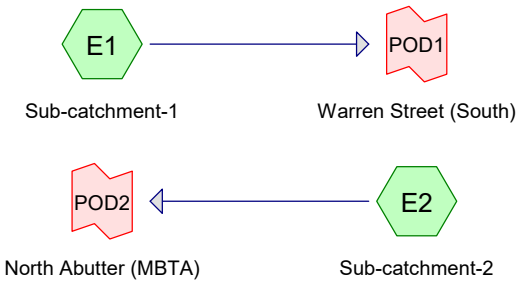
Tie-break Rule: Higher



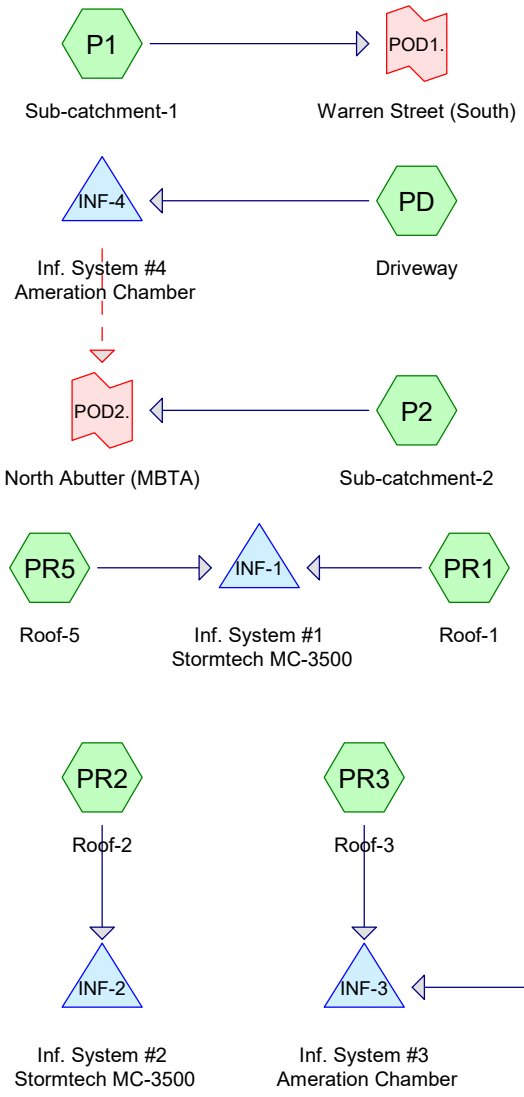
PRE-DEVELOPMENT CONDITIONS

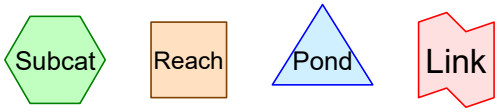

POD2
PD
P2
PR4
PR5
PR1
PR2
PR3
PR2
P1
POD1
WARREN STREET
TREE TO BE PROTECTED DURING CONSTRUCTION
TREE TO BE PROTECTED DURING CONSTRUCTION
LOT AREA
TEMPORARY LAYDOWN AREA (600s.f.)
EX. CURB OPENING TO BE CLOSED
LAND TAKEN FOR MAIN DRAIN 3,565±s.f.
(SEE BOOK: 4792 PAGE: 506)
TIME OF CONCENTRATION
POST-DEVELOPMENT CONDITIONS

PRE-DEVELOPMENT CONDITIONS



POST-DEVELOPMENT CONDITIONS





Routing Diagram for 217115_145 Warren St Newton, MA_REV_21_1_25
Prepared by VTP ASSOCIATES, Printed 1/25/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.451	39	>75% Grass cover, Good, HSG A (E1, E2, P1, P2, PD, PR5)
0.055	98	Bit. Driveway (E2)
0.094	98	Ex. Roof (PR1, PR3, PR4)
0.013	98	Garage (E2)
0.014	98	Landing/Walks (E1, P1)
0.005	98	Landing/Walks/Steps (E2)
0.002	98	Landing/Walks/Steps(UNIT4) (P2)
0.041	98	PR-2&Ex. house-Roofs, HSG A (PR2)
0.011	98	PR-2_Ex_Unconnected roofs, HSG A (PR2)
0.003	98	Patio (P2)
0.050	98	Paved Driveway (PD)
0.003	60	Pavers (P2)
0.007	98	Ret. Wall (E2, P2, PD)
0.056	98	Roof (portion) (E1, E2)
0.020	98	Walks/landing (PD)
0.239	32	Woods/grass comb., Good, HSG A (E2)
0.014	98	wakways (PR5)
1.076	**59**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.741	HSG A	E1, E2, P1, P2, PD, PR2, PR5
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.335	Other	E1, E2, P1, P2, PD, PR1, PR3, PR4, PR5
1.076		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.451	0.000	0.000	0.000	0.000	0.451	>75% Grass cover, Good	E1, E2, P1, P2, PD, PR5
0.000	0.000	0.000	0.000	0.055	0.055	Bit. Driveway	E2
0.000	0.000	0.000	0.000	0.094	0.094	Ex. Roof	PR1, PR3, PR4
0.000	0.000	0.000	0.000	0.013	0.013	Garage	E2
0.000	0.000	0.000	0.000	0.014	0.014	Landing/Walks	E1, P1
0.000	0.000	0.000	0.000	0.005	0.005	Landing/Walks/Steps	E2
0.000	0.000	0.000	0.000	0.002	0.002	Landing/Walks/Steps(UNIT4)	P2
0.041	0.000	0.000	0.000	0.000	0.041	PR-2&Ex. house-Roofs	PR2
0.011	0.000	0.000	0.000	0.000	0.011	PR-2_Ex_Unconnected roofs	PR2
0.000	0.000	0.000	0.000	0.003	0.003	Patio	P2
0.000	0.000	0.000	0.000	0.050	0.050	Paved Driveway	PD
0.000	0.000	0.000	0.000	0.003	0.003	Pavers	P2
0.000	0.000	0.000	0.000	0.007	0.007	Ret. Wall	E2, P2, PD
0.000	0.000	0.000	0.000	0.056	0.056	Roof (portion)	E1, E2
0.000	0.000	0.000	0.000	0.020	0.020	Walks/landing	PD
0.239	0.000	0.000	0.000	0.000	0.239	Woods/grass comb., Good	E2
0.000	0.000	0.000	0.000	0.014	0.014	wakways	PR5
0.741	**0.000**	**0.000**	**0.000**	**0.335**	**1.076**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	INF-4	149.60	149.35	48.7	0.0051	0.012	6.0	0.0	0.0

Time span=0.50-30.00 hrs, dt=0.010 hrs, 2951 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Sub-catchment-1 Runoff Area=1,907 sf 36.97% Impervious Runoff Depth=0.40"
Tc=5.0 min CN=61 Runoff=0.01 cfs 0.001 af

Subcatchment E2: Sub-catchment-2 Runoff Area=21,492 sf 24.07% Impervious Runoff Depth=0.11"
Flow Length=297' Tc=6.9 min CN=50 Runoff=0.01 cfs 0.004 af

Subcatchment P1: Sub-catchment-1 Runoff Area=1,467 sf 24.40% Impervious Runoff Depth=0.17"
Tc=5.0 min CN=53 Runoff=0.00 cfs 0.000 af

Subcatchment P2: Sub-catchment-2 Runoff Area=9,578 sf 3.34% Impervious Runoff Depth=0.00"
Flow Length=255' Tc=7.5 min CN=41 Runoff=0.00 cfs 0.000 af

Subcatchment PD: Driveway Runoff Area=4,693 sf 68.72% Impervious Runoff Depth=1.33"
Tc=5.0 min CN=80 Runoff=0.17 cfs 0.012 af

Subcatchment PR1: Roof-1 Runoff Area=1,686 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment PR2: Roof-2 Runoff Area=2,250 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.16 cfs 0.012 af

Subcatchment PR3: Roof-3 Runoff Area=1,305 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.09 cfs 0.007 af

Subcatchment PR4: Roof-4 Runoff Area=1,103 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.08 cfs 0.006 af

Subcatchment PR5: Roof-5 Runoff Area=1,397 sf 43.31% Impervious Runoff Depth=0.55"
Tc=5.0 min CN=65 Runoff=0.02 cfs 0.001 af

Pond INF-1: Inf. System #1 Stormtech Peak Elev=150.80' Storage=0.003 af Inflow=0.14 cfs 0.011 af
Outflow=0.02 cfs 0.011 af

Pond INF-2: Inf. System #2 Stormtech Peak Elev=156.15' Storage=0.004 af Inflow=0.16 cfs 0.012 af
Outflow=0.02 cfs 0.012 af

Pond INF-3: Inf. System #3 Ameration Peak Elev=148.98' Storage=0.003 af Inflow=0.17 cfs 0.013 af
Outflow=0.04 cfs 0.013 af

Pond INF-4: Inf. System #4 Ameration Peak Elev=149.54' Storage=122 cf Inflow=0.17 cfs 0.012 af
Discarded=0.04 cfs 0.012 af Secondary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.012 af

Link POD1: Warren Street (South) Inflow=0.01 cfs 0.001 af
Primary=0.01 cfs 0.001 af

Link POD1.: Warren Street (South) Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link POD2: North Abutter (MBTA) Inflow=0.01 cfs 0.004 af
Primary=0.01 cfs 0.004 af

Link POD2.: North Abutter (MBTA) Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.076 ac Runoff Volume = 0.055 af Average Runoff Depth = 0.61"
64.31% Pervious = 0.692 ac 35.69% Impervious = 0.384 ac

Summary for Subcatchment E1: Sub-catchment-1

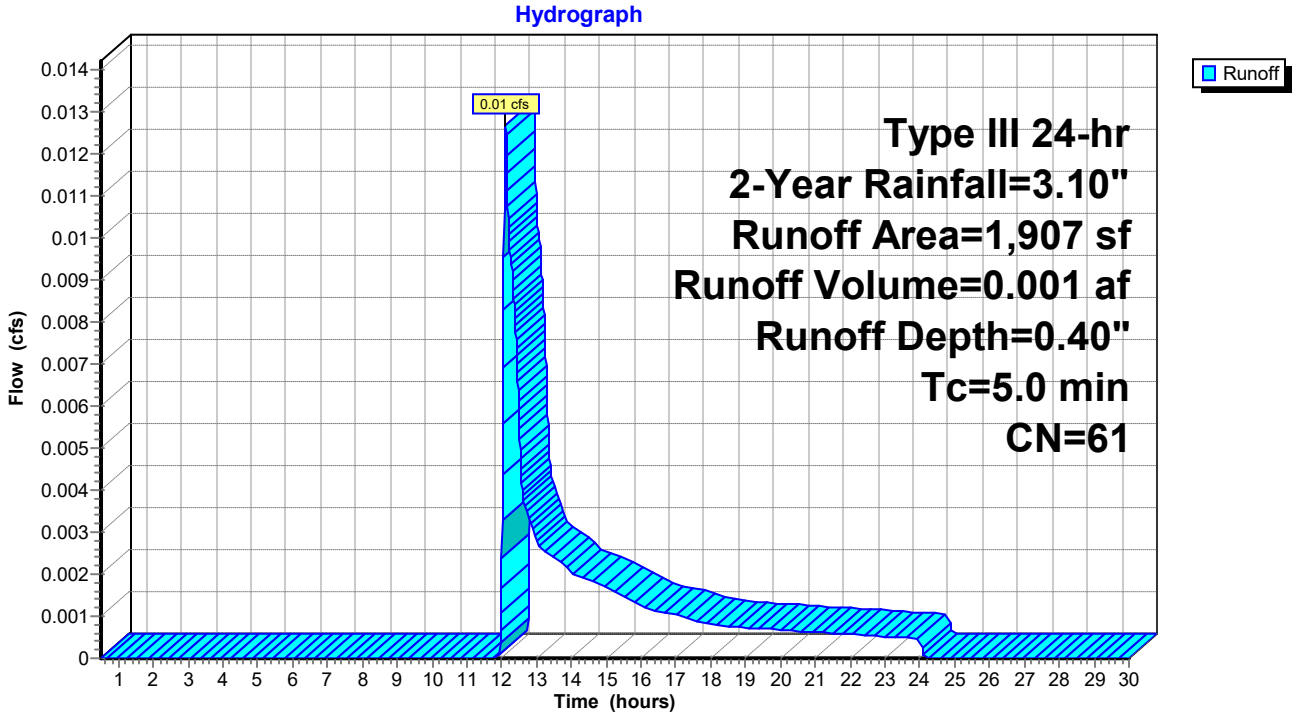
Runoff = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	472	98	Roof (portion)
*	233	98	Landing/Walks
	1,202	39	>75% Grass cover, Good, HSG A
	1,907	61	Weighted Average
	1,202		63.03% Pervious Area
	705		36.97% Impervious Area

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

Subcatchment E1: Sub-catchment-1



Summary for Subcatchment E2: Sub-catchment-2

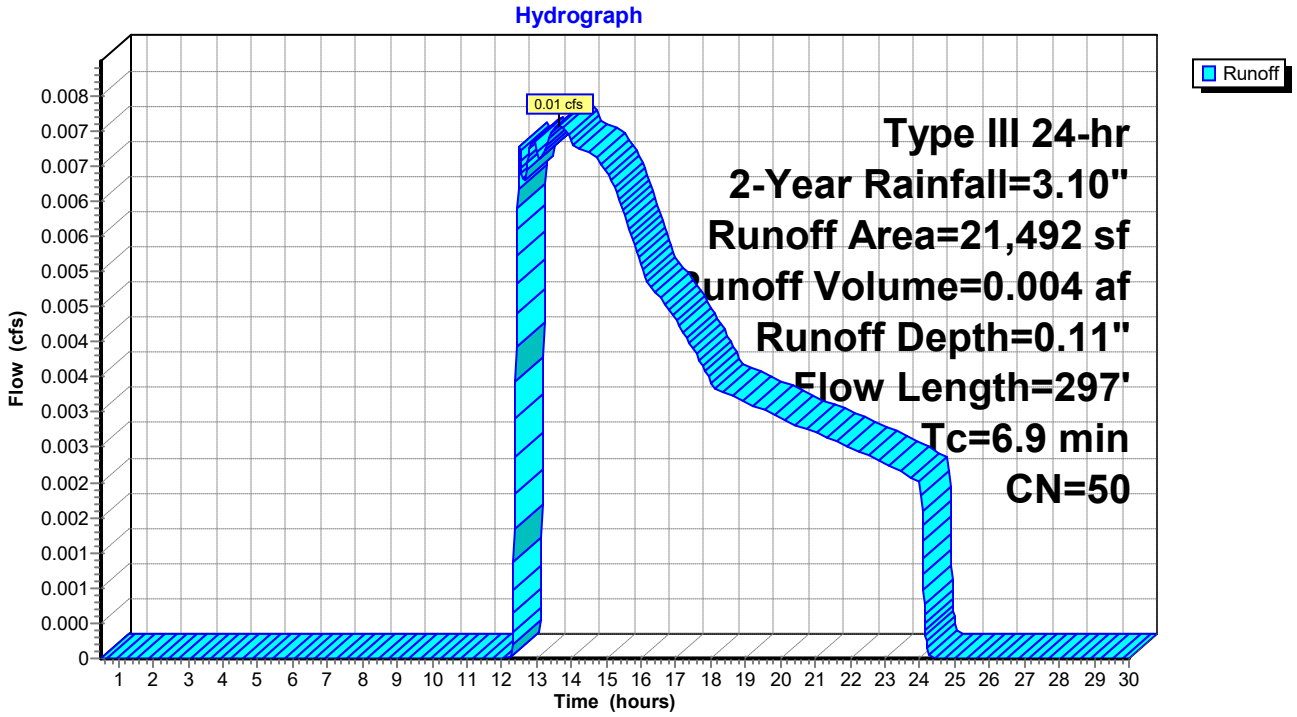
Runoff = 0.01 cfs @ 13.64 hrs, Volume= 0.004 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,954	98	Roof (portion)
*	587	98	Garage
*	2,392	98	Bit. Driveway
*	214	98	Landing/Walks/Steps
*	27	98	Ret. Wall
	10,400	32	Woods/grass comb., Good, HSG A
	5,918	39	>75% Grass cover, Good, HSG A
	21,492	50	Weighted Average
	16,318		75.93% Pervious Area
	5,174		24.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	13	0.0692	0.18		**Sheet Flow, Segment: A - B** Grass: Short n= 0.150 P2= 3.10"
0.3	27	0.0407	1.38		**Sheet Flow, Segmend: B - C** Smooth surfaces n= 0.011 P2= 3.10"
1.3	10	0.0310	0.13		**Sheet Flow, Segment: C - D** Grass: Short n= 0.150 P2= 3.10"
0.4	24	0.0251	1.11		**Shallow Concentrated Flow, Segment: D - E** Short Grass Pasture Kv= 7.0 fps
0.0	3	0.0251	3.22		**Shallow Concentrated Flow, Segment: E - F** Paved Kv= 20.3 fps
0.4	46	0.0720	1.88		**Shallow Concentrated Flow, Segment: F - G** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.0490	4.49		**Shallow Concentrated Flow, Segment: G - H** Paved Kv= 20.3 fps
0.6	77	0.0910	2.11		**Shallow Concentrated Flow, Segment: H - I** Short Grass Pasture Kv= 7.0 fps
0.2	19	0.0520	1.60		**Shallow Concentrated Flow, Segment: I - J** Short Grass Pasture Kv= 7.0 fps
2.4	58	0.0034	0.41		**Shallow Concentrated Flow, Segment: J - K** Short Grass Pasture Kv= 7.0 fps
6.9	297	Total			

Subcatchment E2: Sub-catchment-2



Summary for Subcatchment P1: Sub-catchment-1

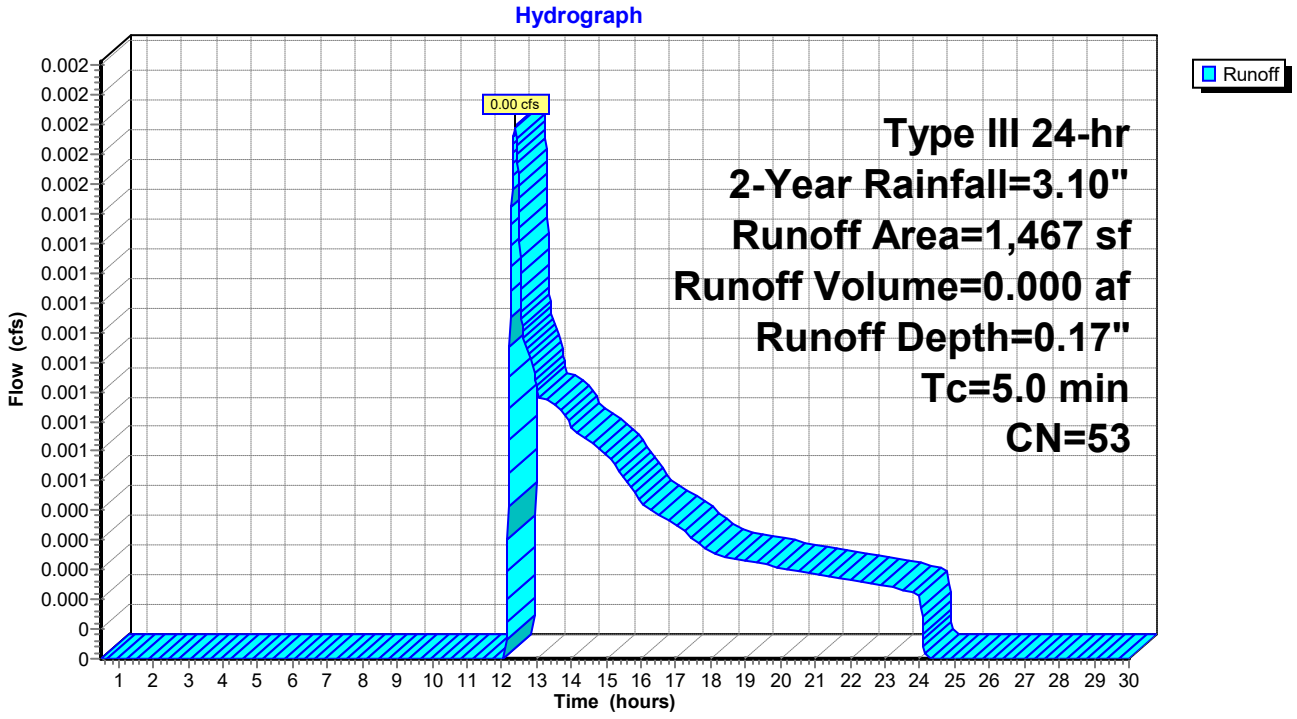
Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	358	98	Landing/Walks
	1,109	39	>75% Grass cover, Good, HSG A
	1,467	53	Weighted Average
	1,109		75.60% Pervious Area
	358		24.40% Impervious Area

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

Subcatchment P1: Sub-catchment-1



Summary for Subcatchment P2: Sub-catchment-2

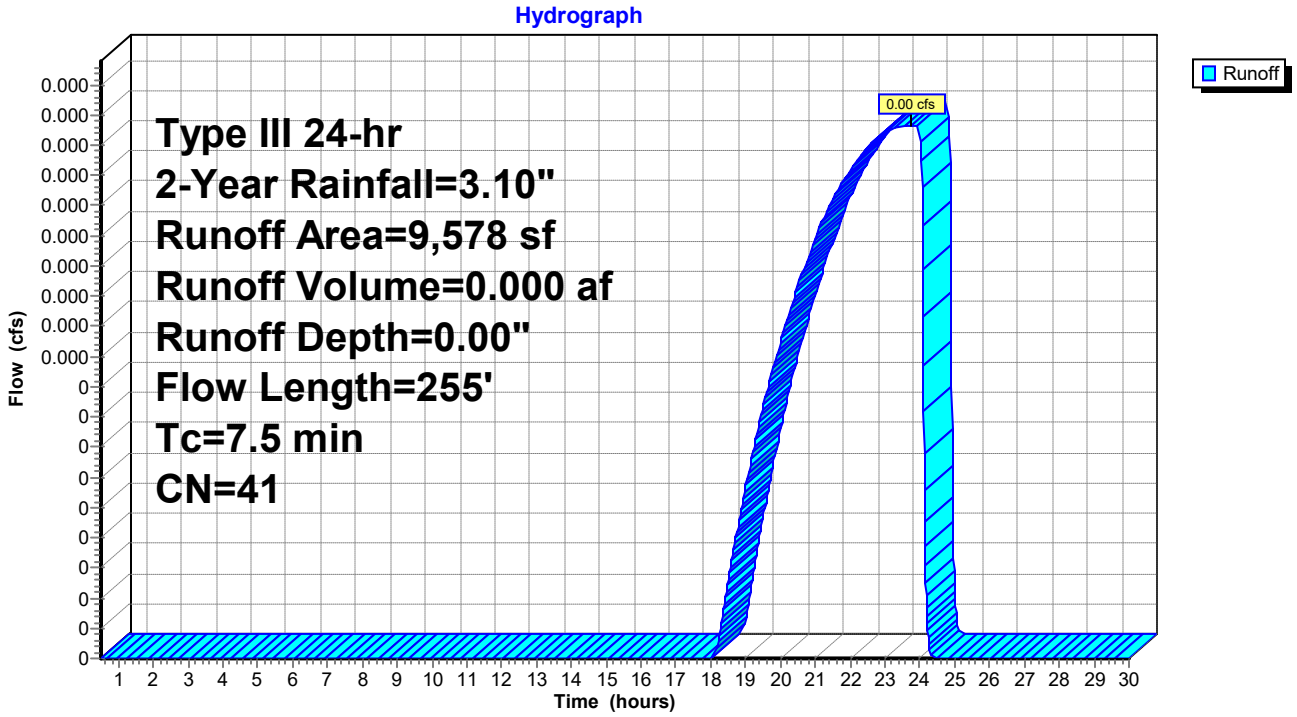
Runoff = 0.00 cfs @ 23.76 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	109	98	Patio
*	95	98	Landing/Walks/Steps(UNIT4)
*	109	60	Pavers
*	116	98	Ret. Wall
	9,149	39	>75% Grass cover, Good, HSG A
	9,578	41	Weighted Average
	9,258		96.66% Pervious Area
	320		3.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, Segment: A - B** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0250	1.11		**Shallow Concentrated Flow, Segment: B - C** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0480	1.53		**Shallow Concentrated Flow, Segment: C -D** Short Grass Pasture Kv= 7.0 fps
0.4	54	0.1000	2.21		**Shallow Concentrated Flow, Segment: D - E** Short Grass Pasture Kv= 7.0 fps
0.3	25	0.0400	1.40		**Shallow Concentrated Flow, Segment: E - F** Short Grass Pasture Kv= 7.0 fps
0.2	28	0.0714	1.87		**Shallow Concentrated Flow, Segment: F - G** Short Grass Pasture Kv= 7.0 fps
0.9	51	0.0196	0.98		**Shallow Concentrated Flow, Segment: G - H** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0500	1.57		**Shallow Concentrated Flow, Segment: H - I** Short Grass Pasture Kv= 7.0 fps
7.5	255	Total			

Subcatchment P2: Sub-catchment-2



Summary for Subcatchment PD: Driveway

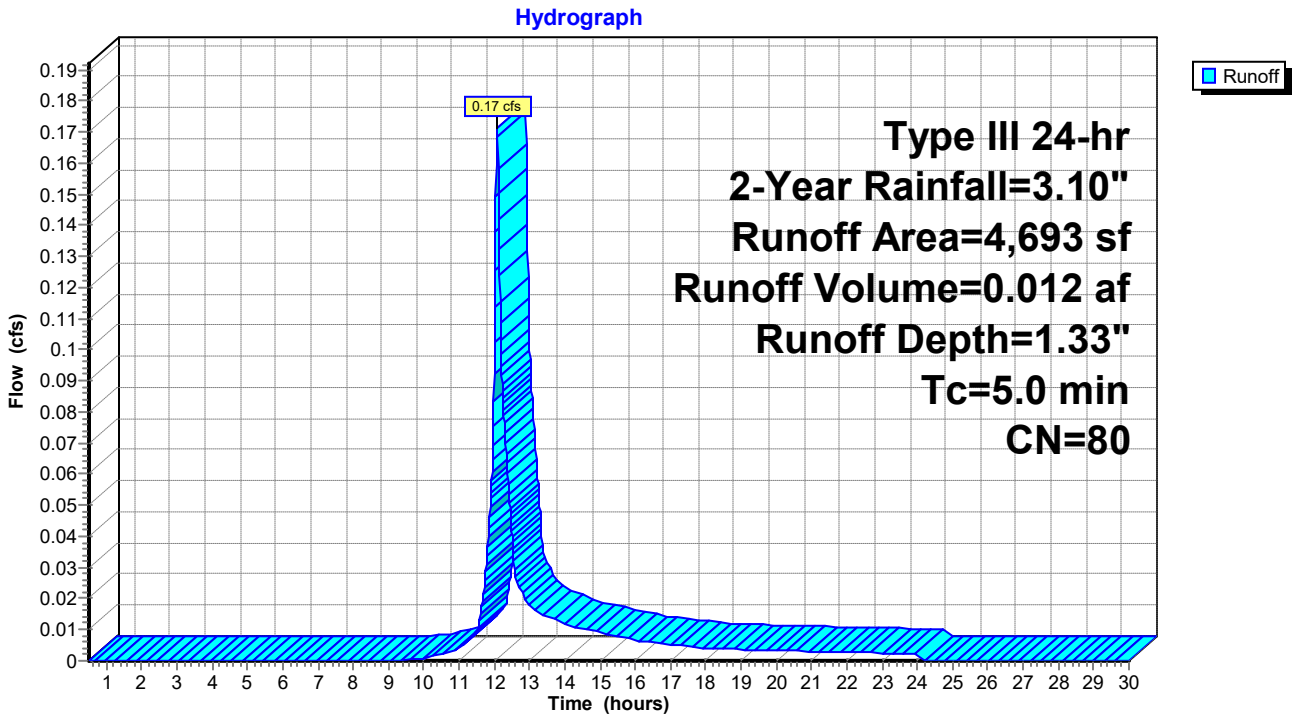
Runoff = 0.17 cfs @ 12.08 hrs, Volume= 0.012 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	2,180	98	Paved Driveway
*	162	98	Ret. Wall
*	883	98	Walks/landing
	1,468	39	>75% Grass cover, Good, HSG A
	4,693	80	Weighted Average
	1,468		31.28% Pervious Area
	3,225		68.72% Impervious Area

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

Subcatchment PD: Driveway



Summary for Subcatchment PR1: Roof-1

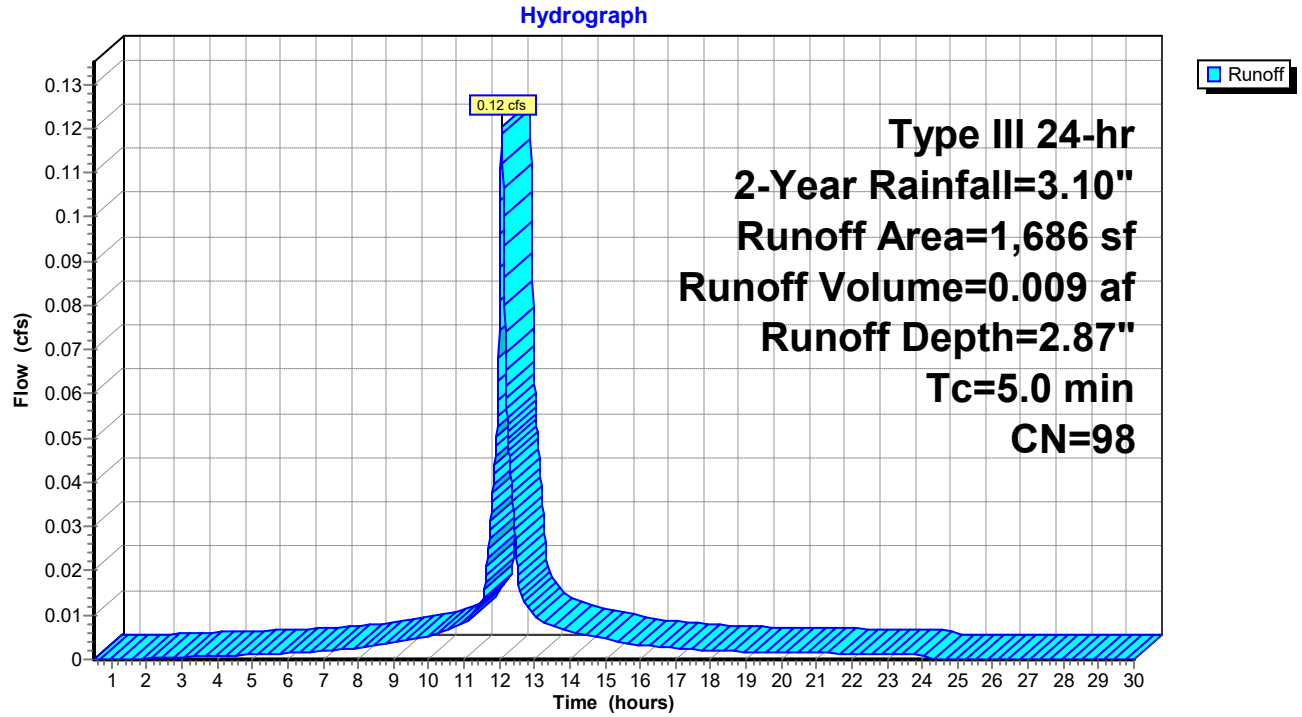
Runoff = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,686	98	Ex. Roof
	1,686		100.00% Impervious Area

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

Subcatchment PR1: Roof-1



Summary for Subcatchment PR2: Roof-2

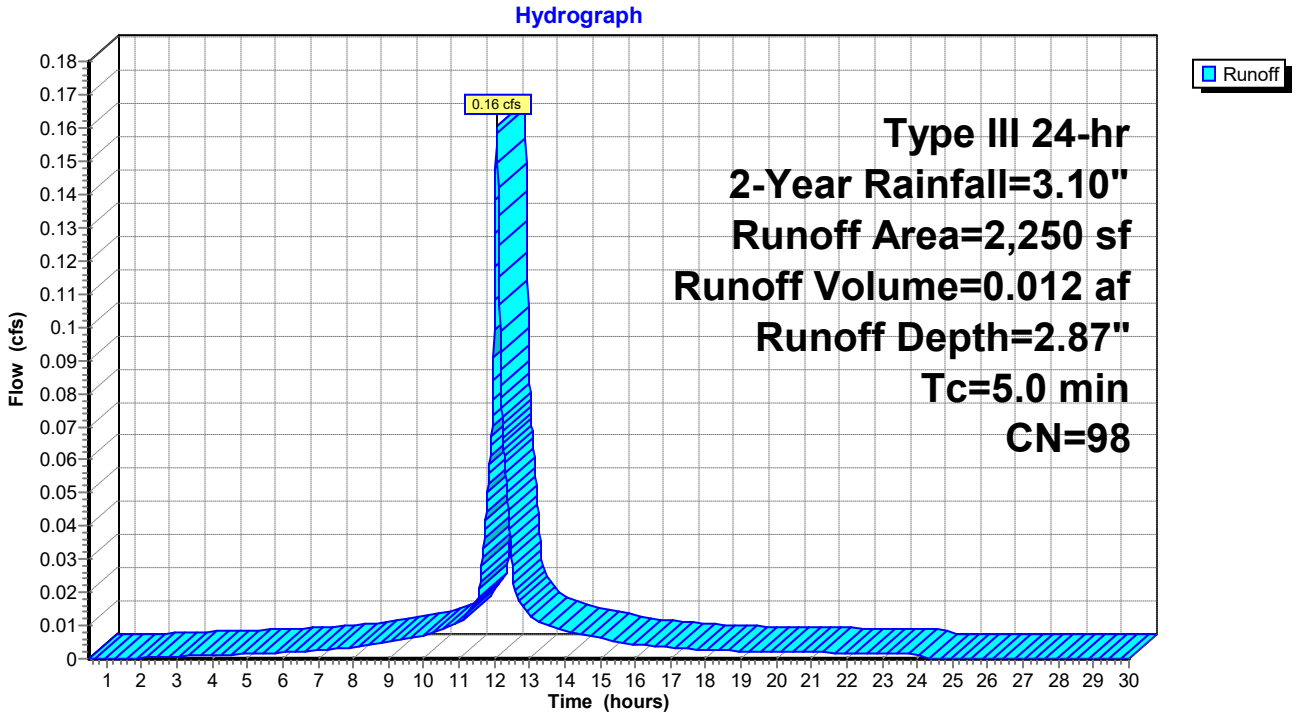
Runoff = 0.16 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,778	98	PR-2&Ex. house-Roofs, HSG A
*	472	98	PR-2_Ex_Unconnected roofs, HSG A
	2,250	98	Weighted Average
	2,250		100.00% Impervious Area
	472		20.98% Unconnected

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

Subcatchment PR2: Roof-2



Summary for Subcatchment PR3: Roof-3

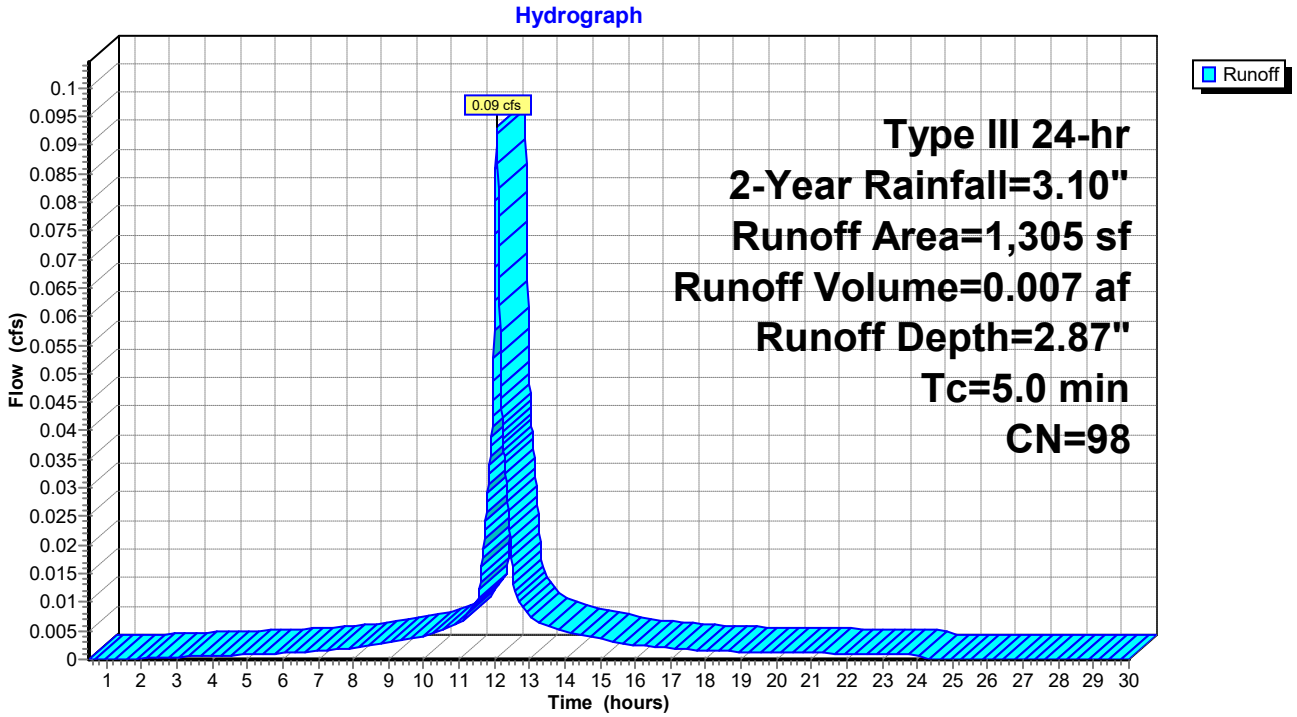
Runoff = 0.09 cfs @ 12.07 hrs, Volume= 0.007 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,305	98	Ex. Roof
	1,305		100.00% Impervious Area

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

Subcatchment PR3: Roof-3



Summary for Subcatchment PR4: Roof-4

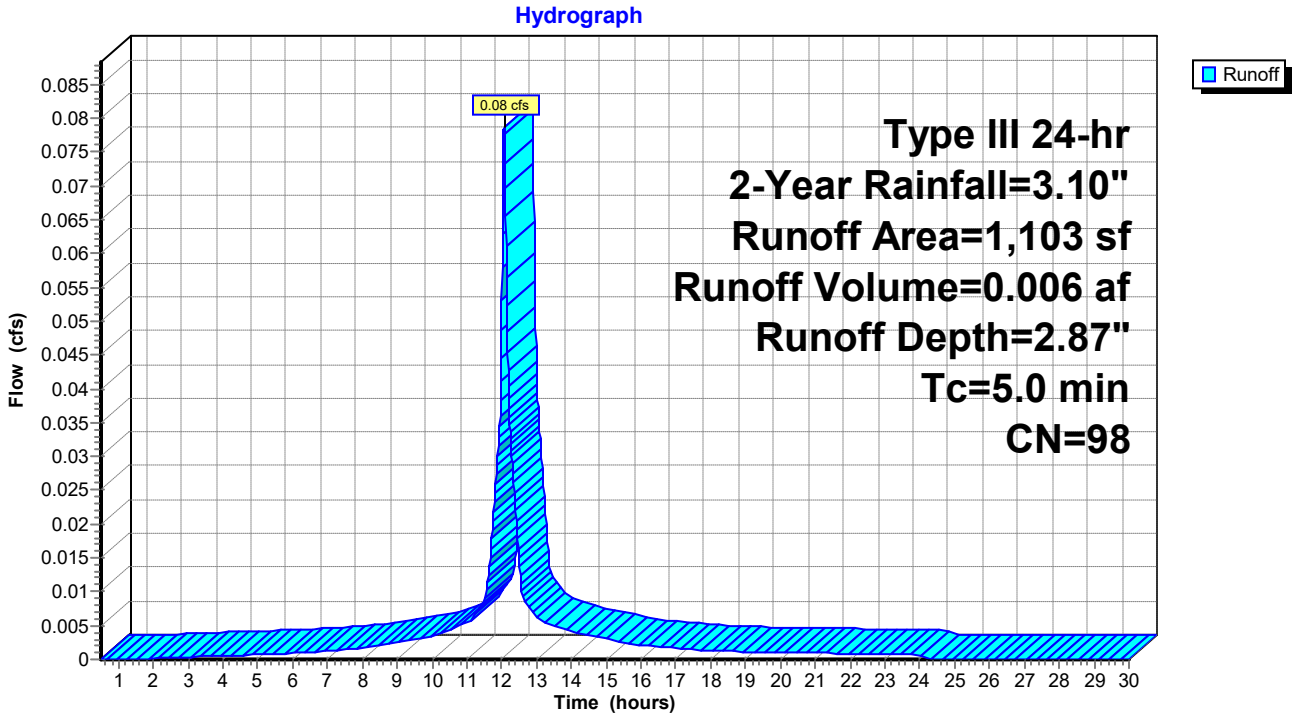
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	1,103	98	Ex. Roof
	1,103		100.00% Impervious Area

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

Subcatchment PR4: Roof-4



Summary for Subcatchment PR5: Roof-5

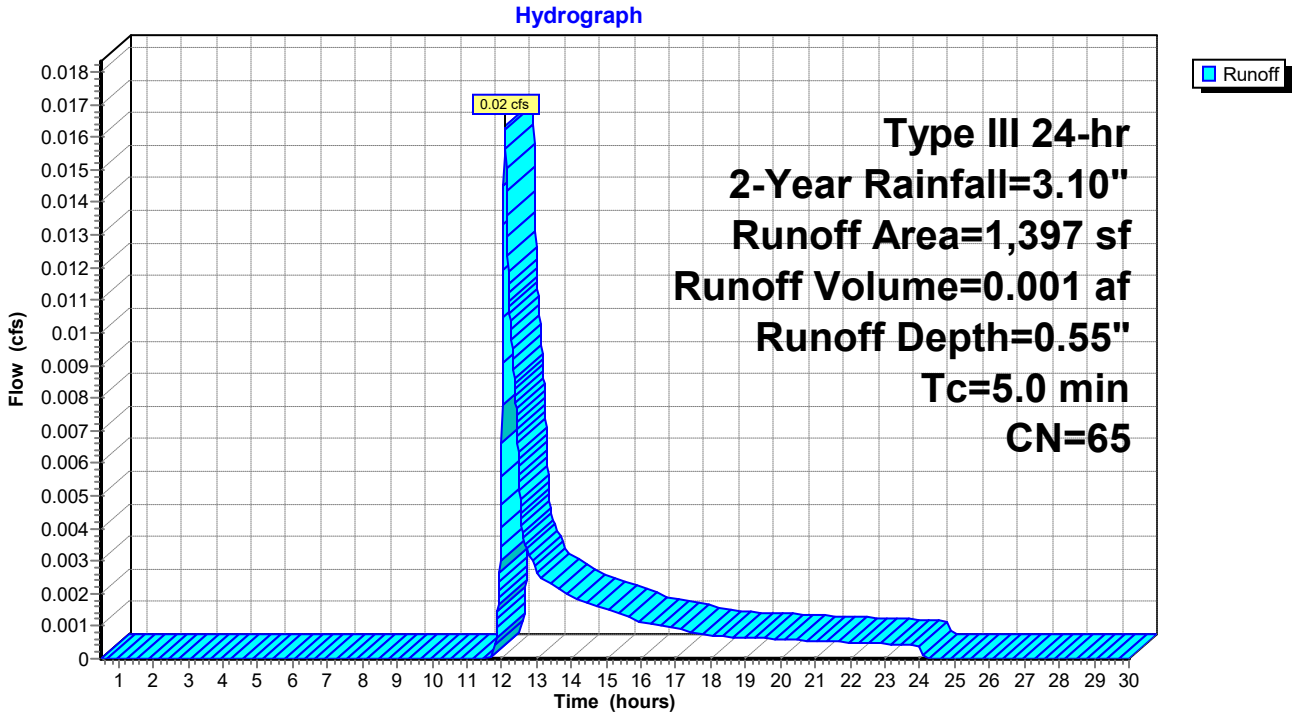
Runoff = 0.02 cfs @ 12.10 hrs, Volume= 0.001 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	605	98	wakways
	792	39	>75% Grass cover, Good, HSG A
	1,397	65	Weighted Average
	792		56.69% Pervious Area
	605		43.31% Impervious Area

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

Subcatchment PR5: Roof-5



Summary for Pond INF-1: Inf. System #1 Stormtech MC-3500

Inflow Area = 0.071 ac, 74.31% Impervious, Inflow Depth = 1.82" for 2-Year event
Inflow = 0.14 cfs @ 12.07 hrs, Volume= 0.011 af
Outflow = 0.02 cfs @ 11.85 hrs, Volume= 0.011 af, Atten= 83%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.85 hrs, Volume= 0.011 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 150.80' @ 12.54 hrs Surf.Area= 0.009 ac Storage= 0.003 af

Plug-Flow detention time= 27.5 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 27.5 min (803.1 - 775.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	150.00'	0.012 af	**8.42'W x 48.72'L x 5.25'H Field A** 0.049 af Overall - 0.016 af Embedded = 0.034 af x 35.0% Voids
#2A	151.00'	0.016 af	**ADS_StormTech MC-3500 d +Cap** x 6 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf
		0.028 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	150.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 11.85 hrs HW=150.06' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond INF-1: Inf. System #1 Stormtech MC-3500 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf

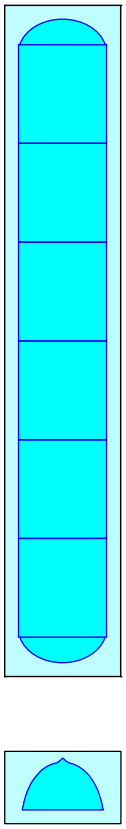
6 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 46.72' Row Length +12.0" End Stone x 2 = 48.72' Base Length
1 Rows x 77.0" Wide + 12.0" Side Stone x 2 = 8.42' Base Width
12.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.25' Field Height

6 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 1 Rows = 689.5 cf Chamber Storage

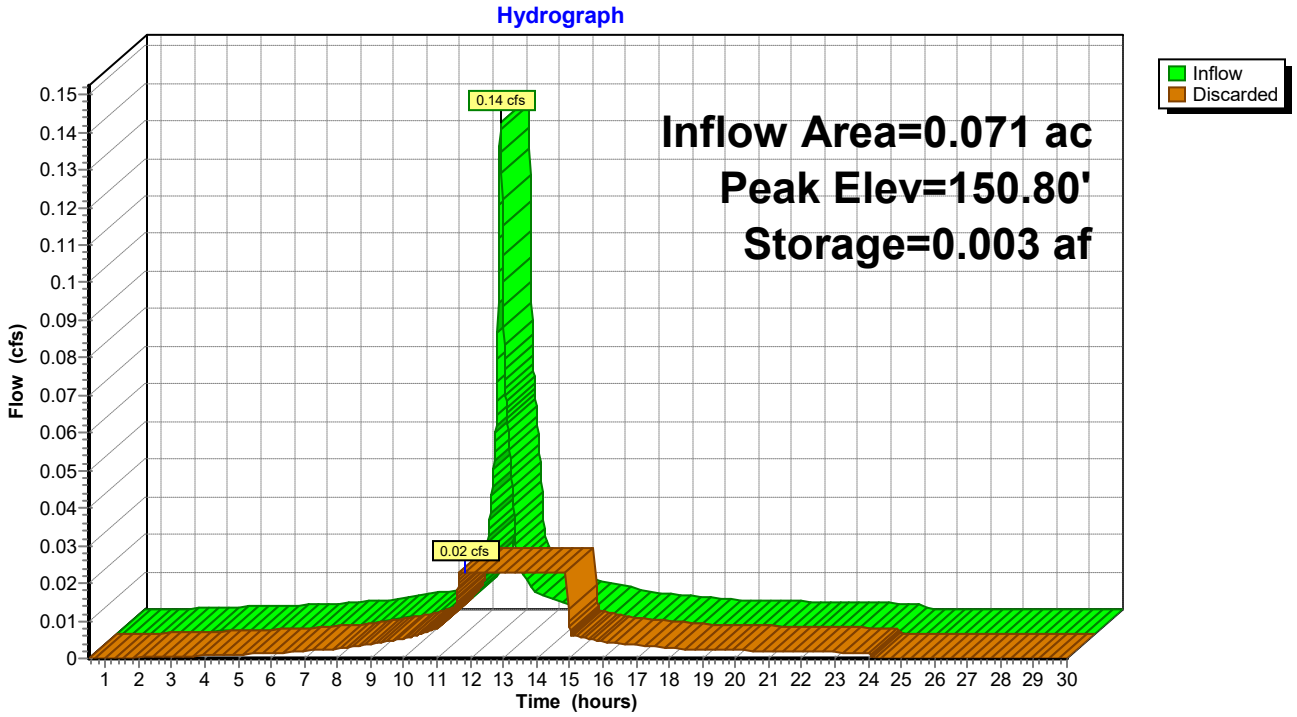
2,152.8 cf Field - 689.5 cf Chambers = 1,463.3 cf Stone x 35.0% Voids = 512.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,201.7 cf = 0.028 af
Overall Storage Efficiency = 55.8%
Overall System Size = 48.72' x 8.42' x 5.25'

6 Chambers
79.7 cy Field
54.2 cy Stone



Pond INF-1: Inf. System #1 Stormtech MC-3500



Summary for Pond INF-2: Inf. System #2 Stormtech MC-3500

Inflow Area = 0.052 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
Inflow = 0.16 cfs @ 12.07 hrs, Volume= 0.012 af
Outflow = 0.02 cfs @ 11.73 hrs, Volume= 0.012 af, Atten= 88%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.73 hrs, Volume= 0.012 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 156.15' @ 12.60 hrs Surf.Area= 0.008 ac Storage= 0.004 af

Plug-Flow detention time= 50.5 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 50.5 min (806.7 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	0.010 af	**8.42'W x 41.55'L x 5.25'H Field A** 0.042 af Overall - 0.013 af Embedded = 0.029 af x 35.0% Voids
#2A	156.00'	0.013 af	**ADS_StormTech MC-3500 d +Cap** x 5 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf
		0.023 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	155.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 11.73 hrs HW=155.05' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond INF-2: Inf. System #2 Stormtech MC-3500 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf

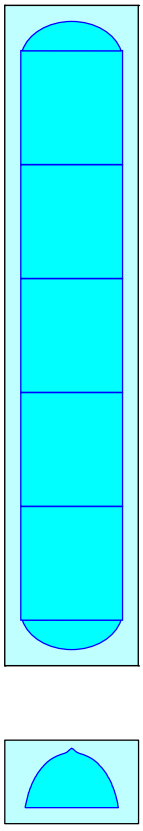
5 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 39.55' Row Length +12.0" End Stone x 2 = 41.55' Base Length
1 Rows x 77.0" Wide + 12.0" Side Stone x 2 = 8.42' Base Width
12.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.25' Field Height

5 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 1 Rows = 579.6 cf Chamber Storage

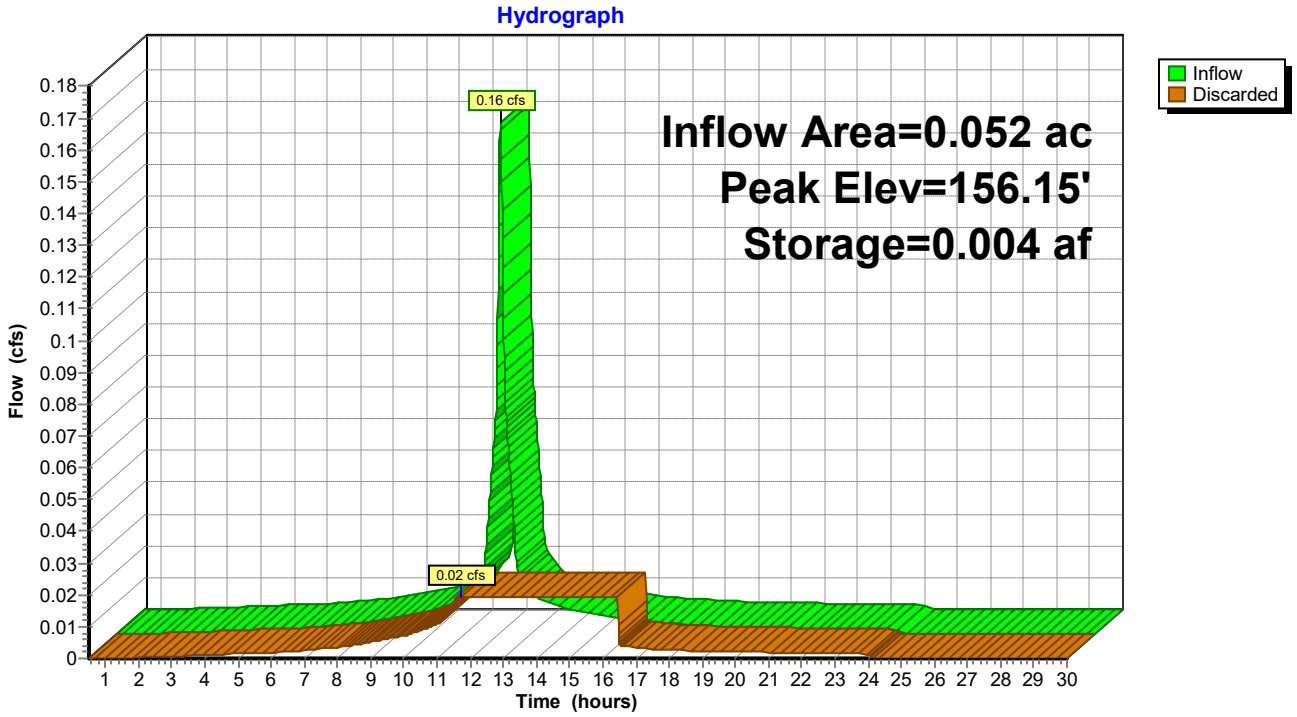
1,836.0 cf Field - 579.6 cf Chambers = 1,256.4 cf Stone x 35.0% Voids = 439.8 cf Stone Storage

Chamber Storage + Stone Storage = 1,019.3 cf = 0.023 af
Overall Storage Efficiency = 55.5%
Overall System Size = 41.55' x 8.42' x 5.25'

5 Chambers
68.0 cy Field
46.5 cy Stone



Pond INF-2: Inf. System #2 Stormtech MC-3500



Summary for Pond INF-3: Inf. System #3 Ameration Chamber

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
Inflow = 0.17 cfs @ 12.07 hrs, Volume= 0.013 af
Outflow = 0.04 cfs @ 11.82 hrs, Volume= 0.013 af, Atten= 80%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.82 hrs, Volume= 0.013 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 148.98' @ 12.48 hrs Surf.Area= 0.014 ac Storage= 0.003 af

Plug-Flow detention time= 18.0 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (774.1 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	148.40'	0.010 af	**15.00'W x 42.00'L x 3.17'H Field A** 0.046 af Overall - 0.018 af Embedded = 0.028 af x 35.0% Voids
#2A	149.40'	0.010 af	**Concrete Galley 4x8x1.7** x 15 Inside #1 Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf 15 Chambers in 3 Rows
		0.020 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.40'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 11.82 hrs HW=148.43' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Pond INF-3: Inf. System #3 Ameration Chamber - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x1.7 (Ameration Chamber, NEPCA LE-AC or equivalent)
Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf
Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf

48.0" Wide + 6.0" Spacing = 54.0" C-C Row Spacing

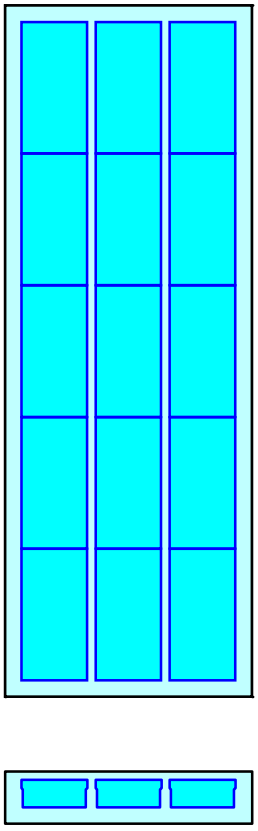
5 Chambers/Row x 8.00' Long = 40.00' Row Length +12.0" End Stone x 2 = 42.00' Base Length
3 Rows x 48.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.00' Base Width
12.0" Base + 20.0" Chamber Height + 6.0" Cover = 3.17' Field Height

15 Chambers x 30.3 cf = 454.3 cf Chamber Storage
15 Chambers x 51.9 cf = 778.6 cf Displacement

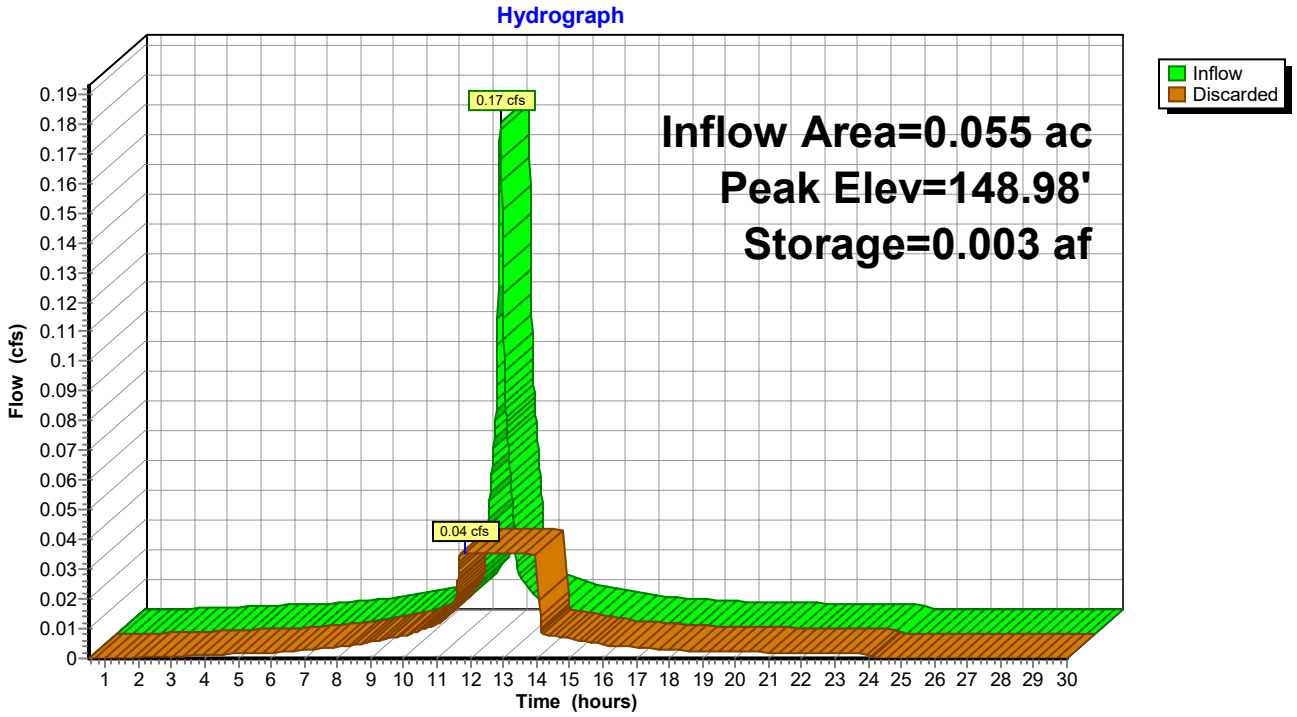
1,997.1 cf Field - 778.6 cf Chambers = 1,218.5 cf Stone x 35.0% Voids = 426.5 cf Stone Storage

Chamber Storage + Stone Storage = 880.7 cf = 0.020 af
Overall Storage Efficiency = 44.1%
Overall System Size = 42.00' x 15.00' x 3.17'

15 Chambers
74.0 cy Field
45.1 cy Stone



Pond INF-3: Inf. System #3 Ameration Chamber



Summary for Pond INF-4: Inf. System #4 Ameration Chamber

Inflow Area = 0.108 ac, 68.72% Impervious, Inflow Depth = 1.33" for 2-Year event
Inflow = 0.17 cfs @ 12.08 hrs, Volume= 0.012 af
Outflow = 0.04 cfs @ 11.92 hrs, Volume= 0.012 af, Atten= 79%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.92 hrs, Volume= 0.012 af
Secondary = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 149.54' @ 12.52 hrs Surf.Area= 649 sf Storage= 122 cf

Plug-Flow detention time= 19.8 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 19.8 min (863.2 - 843.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	149.00'	352 cf	**11.00'W x 59.00'L x 2.67'H Field A** 1,733 cf Overall - 727 cf Embedded = 1,006 cf x 35.0% Voids
#2A	150.00'	424 cf	**Concrete Galley 4x8x1.7** x 14 Inside #1 Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf 14 Chambers in 2 Rows
		776 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	149.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	149.60'	**6.0" Round Overflow** L= 48.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 149.60' / 149.35' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Discarded OutFlow Max=0.04 cfs @ 11.92 hrs HW=149.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.50 hrs HW=149.00' TW=0.00' (Dynamic Tailwater)
2=Overflow (Controls 0.00 cfs)

Pond INF-4: Inf. System #4 Ameration Chamber - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x1.7 (Ameration Chamber, NEPCA LE-AC or equivalent)
Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf
Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf

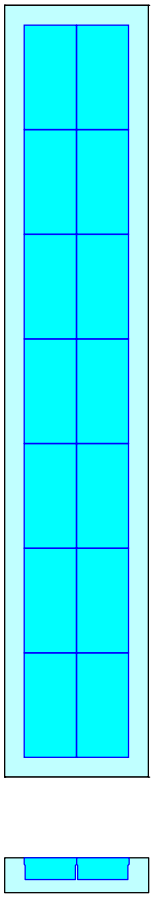
7 Chambers/Row x 8.00' Long = 56.00' Row Length +18.0" End Stone x 2 = 59.00' Base Length
2 Rows x 48.0" Wide + 18.0" Side Stone x 2 = 11.00' Base Width
12.0" Base + 20.0" Chamber Height = 2.67' Field Height

14 Chambers x 30.3 cf = 424.0 cf Chamber Storage
14 Chambers x 51.9 cf = 726.7 cf Displacement

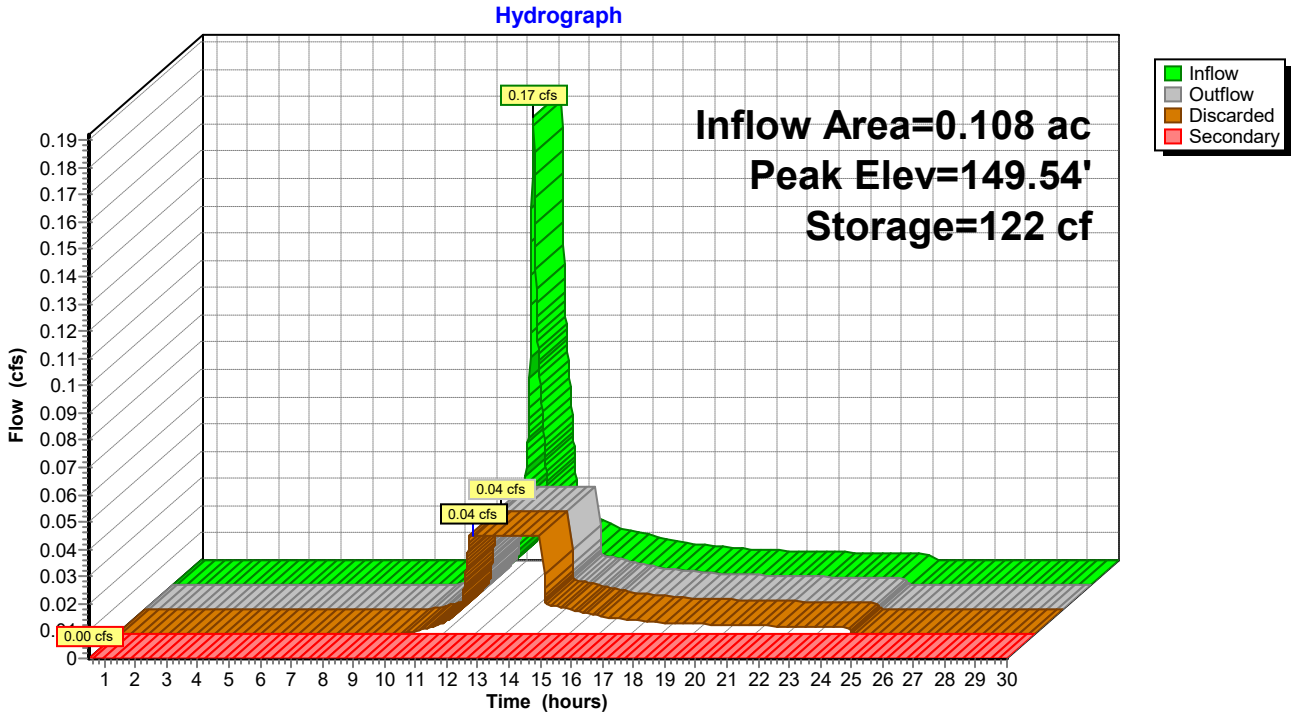
1,732.8 cf Field - 726.7 cf Chambers = 1,006.1 cf Stone x 35.0% Voids = 352.1 cf Stone Storage

Chamber Storage + Stone Storage = 776.1 cf = 0.018 af
Overall Storage Efficiency = 44.8%
Overall System Size = 59.00' x 11.00' x 2.67'

14 Chambers
64.2 cy Field
37.3 cy Stone



Pond INF-4: Inf. System #4 Ameration Chamber

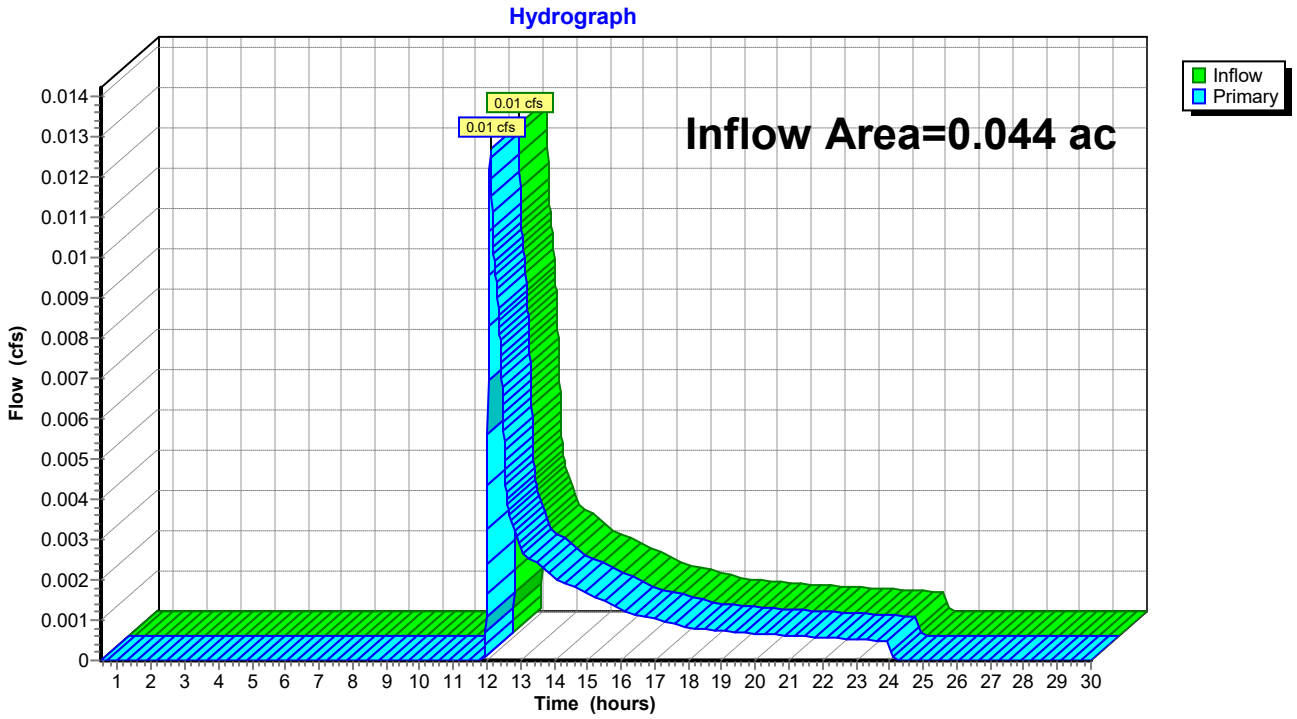


Summary for Link POD1: Warren Street (South)

Inflow Area = 0.044 ac, 36.97% Impervious, Inflow Depth = 0.40" for 2-Year event
Inflow = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af
Primary = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD1: Warren Street (South)

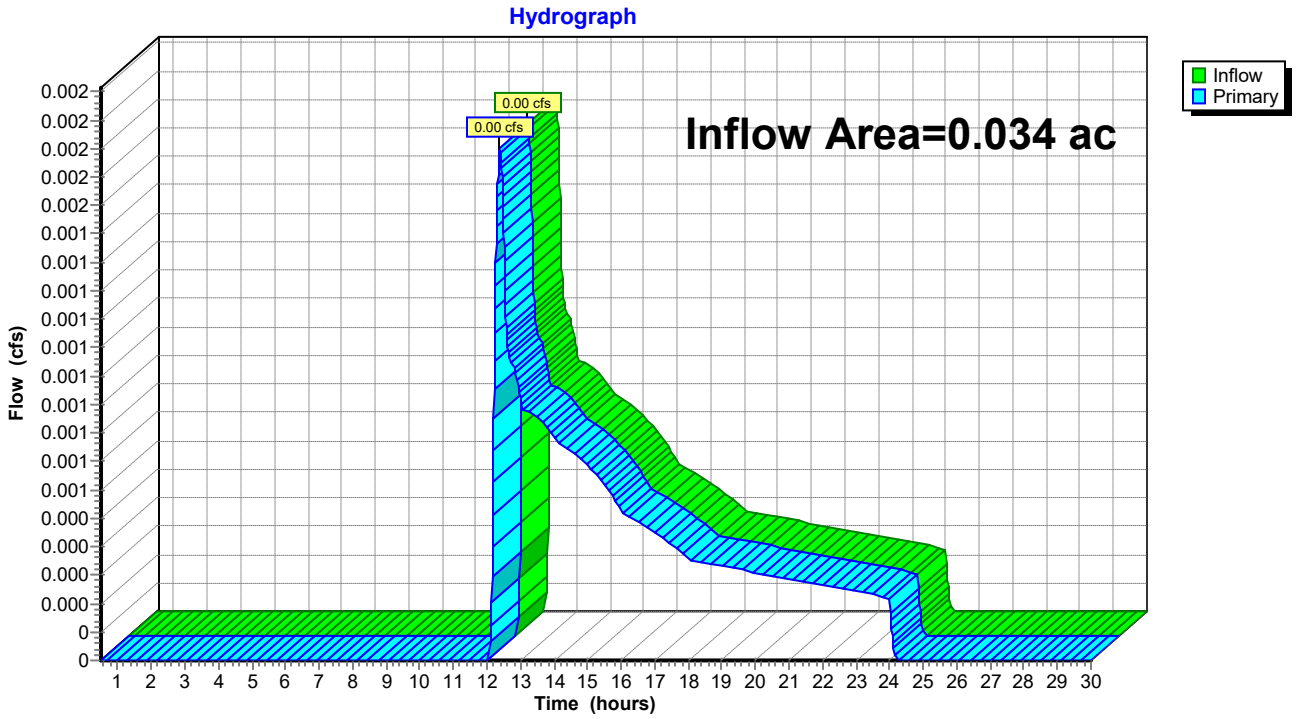


Summary for Link POD1.: Warren Street (South)

Inflow Area = 0.034 ac, 24.40% Impervious, Inflow Depth = 0.17" for 2-Year event
Inflow = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD1.: Warren Street (South)

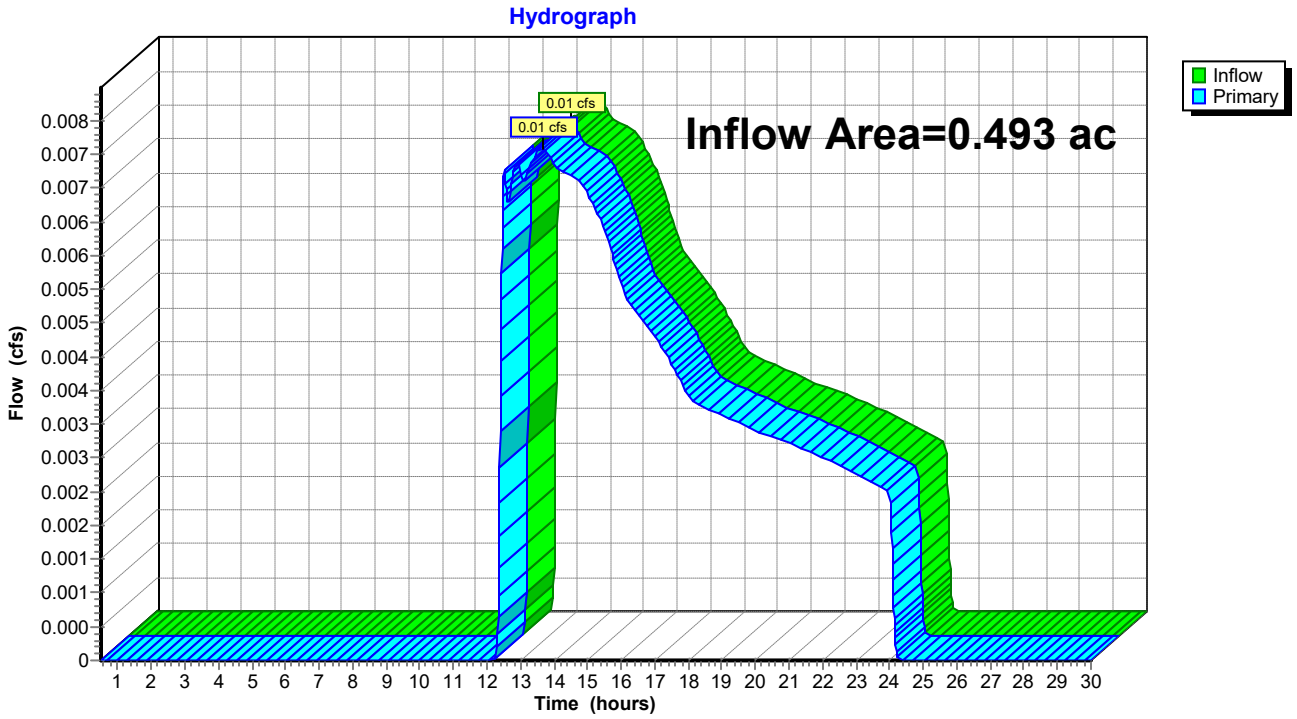


Summary for Link POD2: North Abutter (MBTA)

Inflow Area = 0.493 ac, 24.07% Impervious, Inflow Depth = 0.11" for 2-Year event
Inflow = 0.01 cfs @ 13.64 hrs, Volume= 0.004 af
Primary = 0.01 cfs @ 13.64 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD2: North Abutter (MBTA)

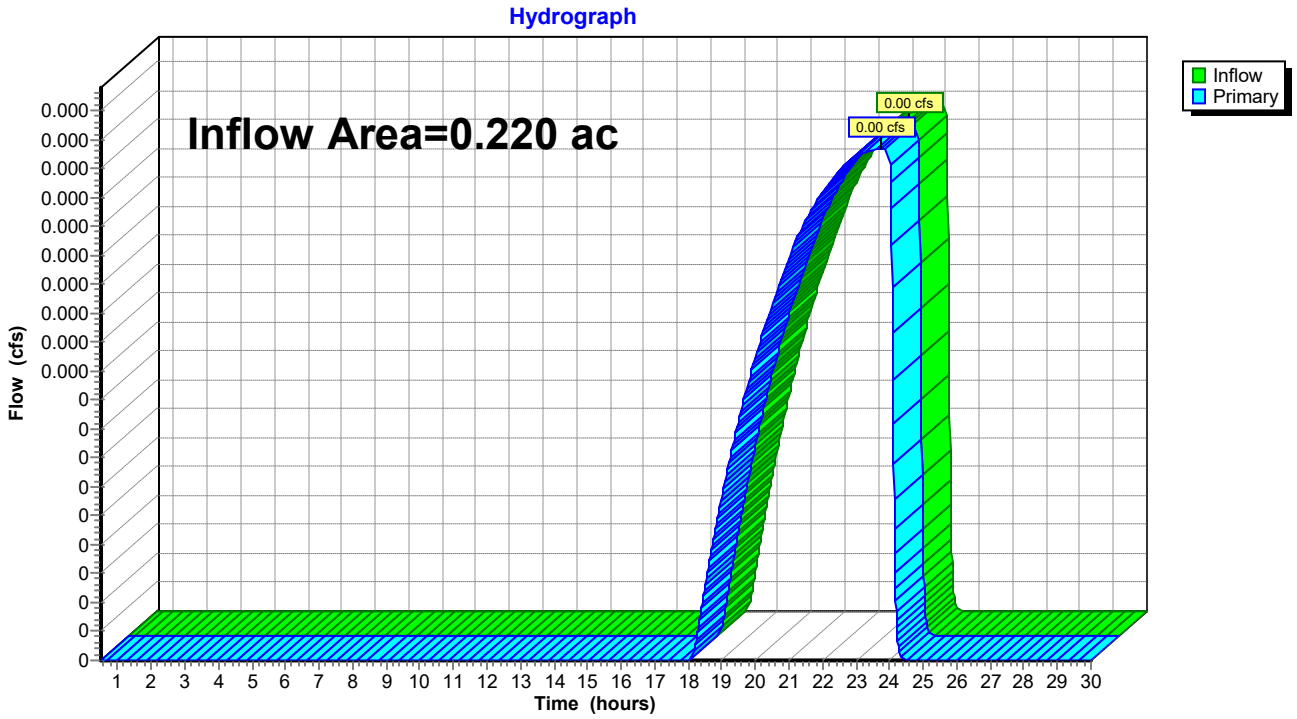


Summary for Link POD2.: North Abutter (MBTA)

Inflow Area = 0.220 ac, 3.34% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 23.76 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.76 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD2.: North Abutter (MBTA)



Time span=0.50-30.00 hrs, dt=0.010 hrs, 2951 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Sub-catchment-1 Runoff Area=1,907 sf 36.97% Impervious Runoff Depth=1.08"
Tc=5.0 min CN=61 Runoff=0.05 cfs 0.004 af

Subcatchment E2: Sub-catchment-2 Runoff Area=21,492 sf 24.07% Impervious Runoff Depth=0.50"
Flow Length=297' Tc=6.9 min CN=50 Runoff=0.14 cfs 0.021 af

Subcatchment P1: Sub-catchment-1 Runoff Area=1,467 sf 24.40% Impervious Runoff Depth=0.64"
Tc=5.0 min CN=53 Runoff=0.02 cfs 0.002 af

Subcatchment P2: Sub-catchment-2 Runoff Area=9,578 sf 3.34% Impervious Runoff Depth=0.16"
Flow Length=255' Tc=7.5 min CN=41 Runoff=0.01 cfs 0.003 af

Subcatchment PD: Driveway Runoff Area=4,693 sf 68.72% Impervious Runoff Depth=2.46"
Tc=5.0 min CN=80 Runoff=0.32 cfs 0.022 af

Subcatchment PR1: Roof-1 Runoff Area=1,686 sf 100.00% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=98 Runoff=0.18 cfs 0.014 af

Subcatchment PR2: Roof-2 Runoff Area=2,250 sf 100.00% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=98 Runoff=0.24 cfs 0.018 af

Subcatchment PR3: Roof-3 Runoff Area=1,305 sf 100.00% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=98 Runoff=0.14 cfs 0.011 af

Subcatchment PR4: Roof-4 Runoff Area=1,103 sf 100.00% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment PR5: Roof-5 Runoff Area=1,397 sf 43.31% Impervious Runoff Depth=1.33"
Tc=5.0 min CN=65 Runoff=0.05 cfs 0.004 af

Pond INF-1: Inf. System #1 Stormtech Peak Elev=151.31' Storage=0.006 af Inflow=0.22 cfs 0.017 af
Outflow=0.02 cfs 0.017 af

Pond INF-2: Inf. System #2 Stormtech Peak Elev=156.60' Storage=0.006 af Inflow=0.24 cfs 0.018 af
Outflow=0.02 cfs 0.018 af

Pond INF-3: Inf. System #3 Ameration Peak Elev=149.44' Storage=0.005 af Inflow=0.25 cfs 0.020 af
Outflow=0.04 cfs 0.020 af

Pond INF-4: Inf. System #4 Ameration Peak Elev=149.86' Storage=195 cf Inflow=0.32 cfs 0.022 af
Discarded=0.04 cfs 0.018 af Secondary=0.13 cfs 0.004 af Outflow=0.17 cfs 0.022 af

Link POD1: Warren Street (South) Inflow=0.05 cfs 0.004 af
Primary=0.05 cfs 0.004 af

Link POD1.: Warren Street (South) Inflow=0.02 cfs 0.002 af
Primary=0.02 cfs 0.002 af

Link POD2: North Abutter (MBTA) Inflow=0.14 cfs 0.021 af
Primary=0.14 cfs 0.021 af

Link POD2.: North Abutter (MBTA) Inflow=0.13 cfs 0.007 af
Primary=0.13 cfs 0.007 af

Total Runoff Area = 1.076 ac Runoff Volume = 0.107 af Average Runoff Depth = 1.19"
64.31% Pervious = 0.692 ac 35.69% Impervious = 0.384 ac

Summary for Subcatchment E1: Sub-catchment-1

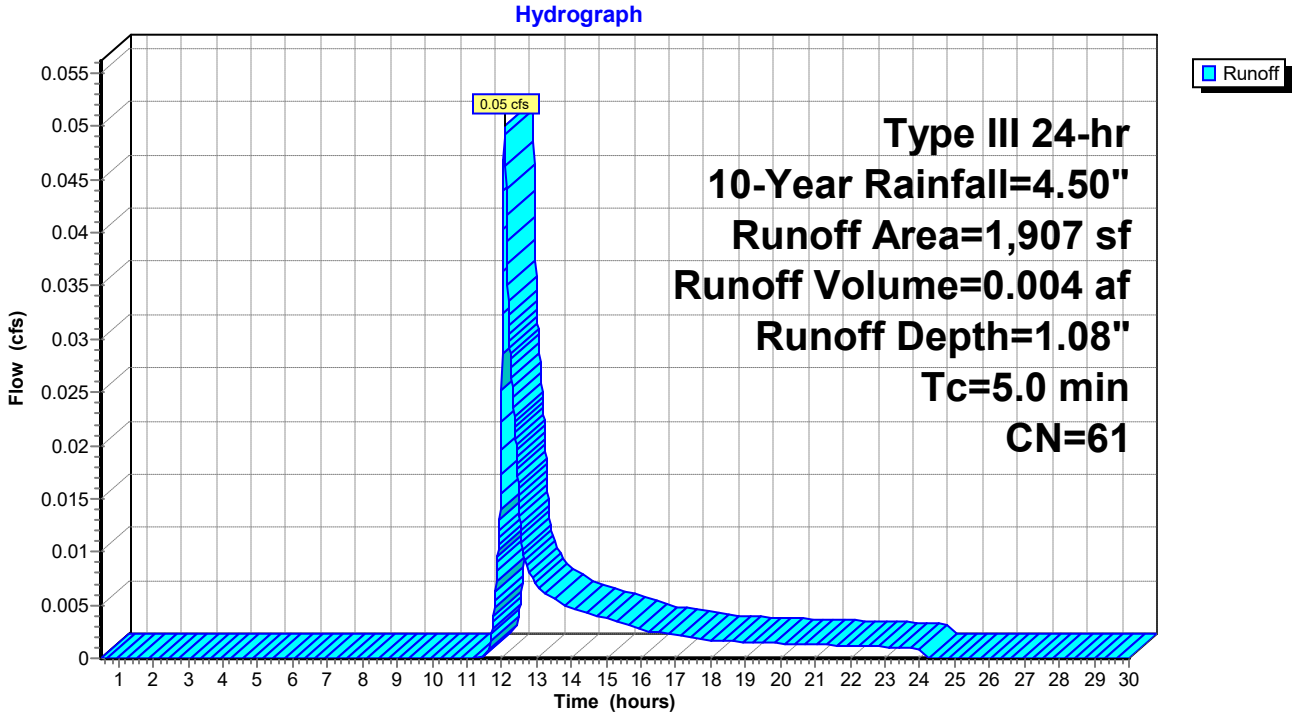
Runoff = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	472	98	Roof (portion)
*	233	98	Landing/Walks
	1,202	39	>75% Grass cover, Good, HSG A
	1,907	61	Weighted Average
	1,202		63.03% Pervious Area
	705		36.97% Impervious Area

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

Subcatchment E1: Sub-catchment-1



Summary for Subcatchment E2: Sub-catchment-2

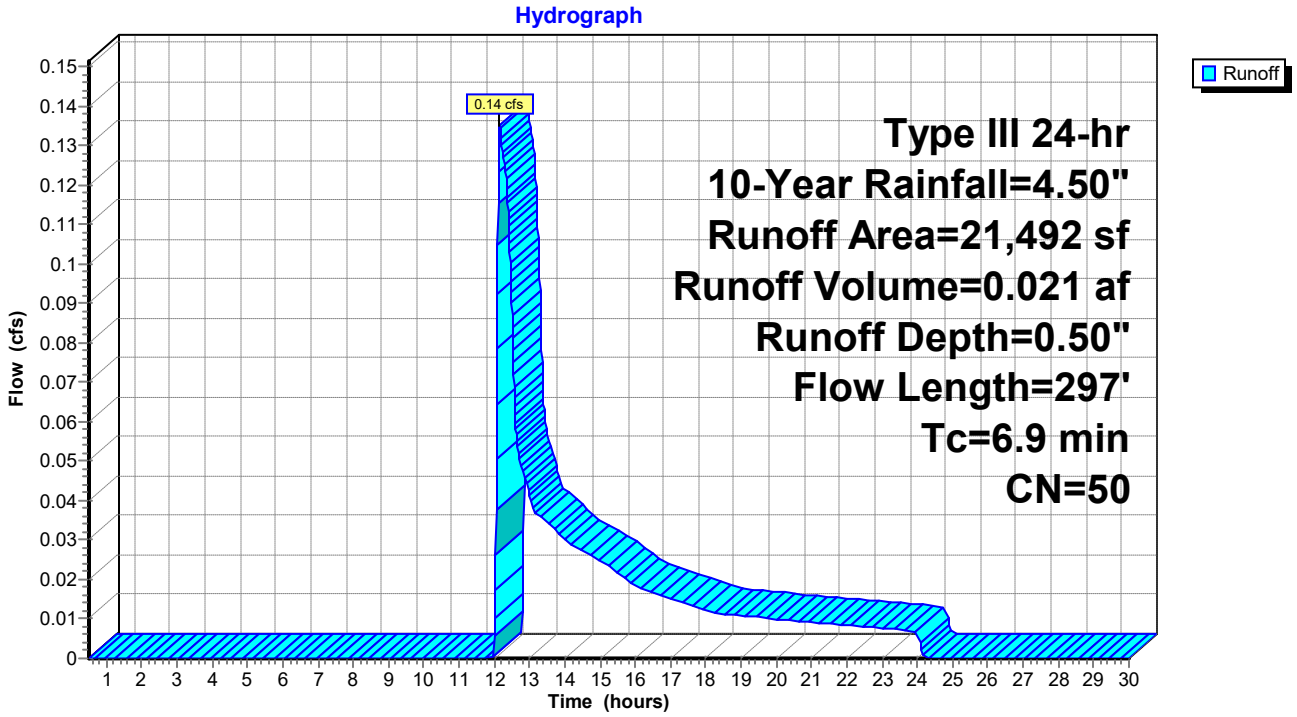
Runoff = 0.14 cfs @ 12.16 hrs, Volume= 0.021 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,954	98	Roof (portion)
*	587	98	Garage
*	2,392	98	Bit. Driveway
*	214	98	Landing/Walks/Steps
*	27	98	Ret. Wall
	10,400	32	Woods/grass comb., Good, HSG A
	5,918	39	>75% Grass cover, Good, HSG A
	21,492	50	Weighted Average
	16,318		75.93% Pervious Area
	5,174		24.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	13	0.0692	0.18		**Sheet Flow, Segment: A - B** Grass: Short n= 0.150 P2= 3.10"
0.3	27	0.0407	1.38		**Sheet Flow, Segmend: B - C** Smooth surfaces n= 0.011 P2= 3.10"
1.3	10	0.0310	0.13		**Sheet Flow, Segment: C - D** Grass: Short n= 0.150 P2= 3.10"
0.4	24	0.0251	1.11		**Shallow Concentrated Flow, Segment: D - E** Short Grass Pasture Kv= 7.0 fps
0.0	3	0.0251	3.22		**Shallow Concentrated Flow, Segment: E - F** Paved Kv= 20.3 fps
0.4	46	0.0720	1.88		**Shallow Concentrated Flow, Segment: F - G** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.0490	4.49		**Shallow Concentrated Flow, Segment: G - H** Paved Kv= 20.3 fps
0.6	77	0.0910	2.11		**Shallow Concentrated Flow, Segment: H - I** Short Grass Pasture Kv= 7.0 fps
0.2	19	0.0520	1.60		**Shallow Concentrated Flow, Segment: I - J** Short Grass Pasture Kv= 7.0 fps
2.4	58	0.0034	0.41		**Shallow Concentrated Flow, Segment: J - K** Short Grass Pasture Kv= 7.0 fps
6.9	297	Total			

Subcatchment E2: Sub-catchment-2



Summary for Subcatchment P1: Sub-catchment-1

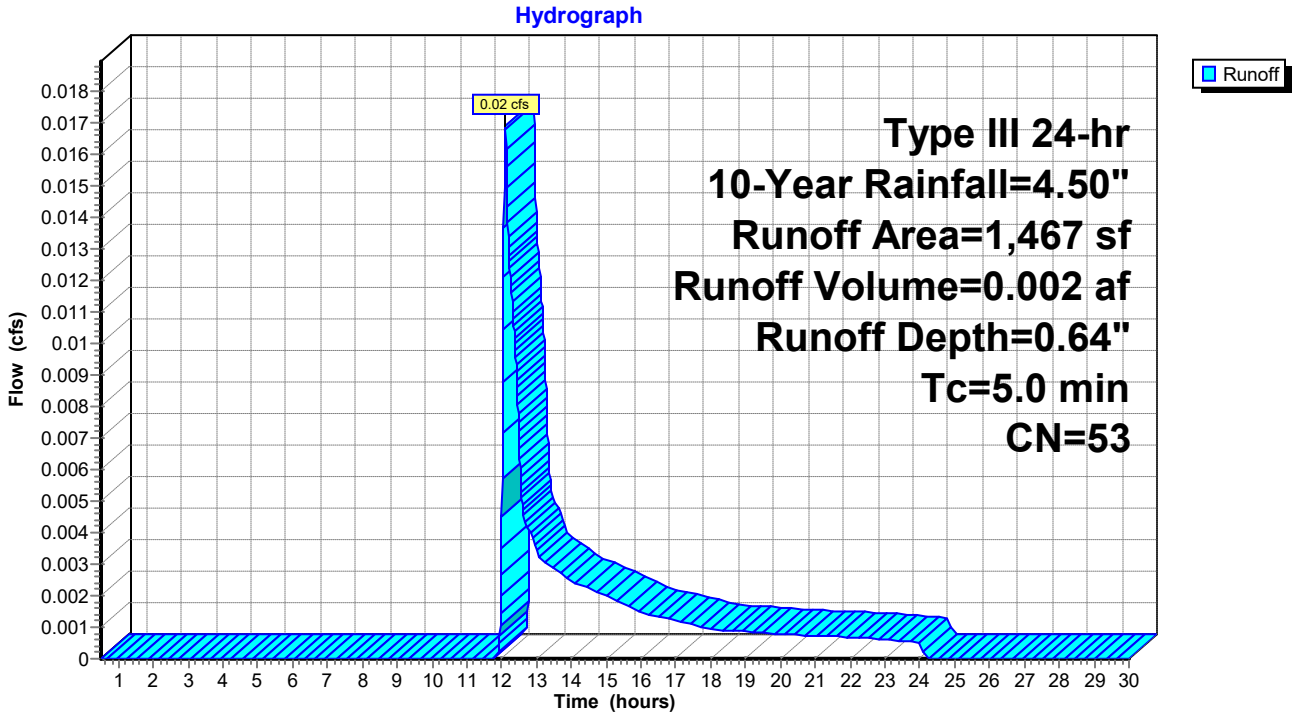
Runoff = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	358	98	Landing/Walks
	1,109	39	>75% Grass cover, Good, HSG A
	1,467	53	Weighted Average
	1,109		75.60% Pervious Area
	358		24.40% Impervious Area

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

Subcatchment P1: Sub-catchment-1



Summary for Subcatchment P2: Sub-catchment-2

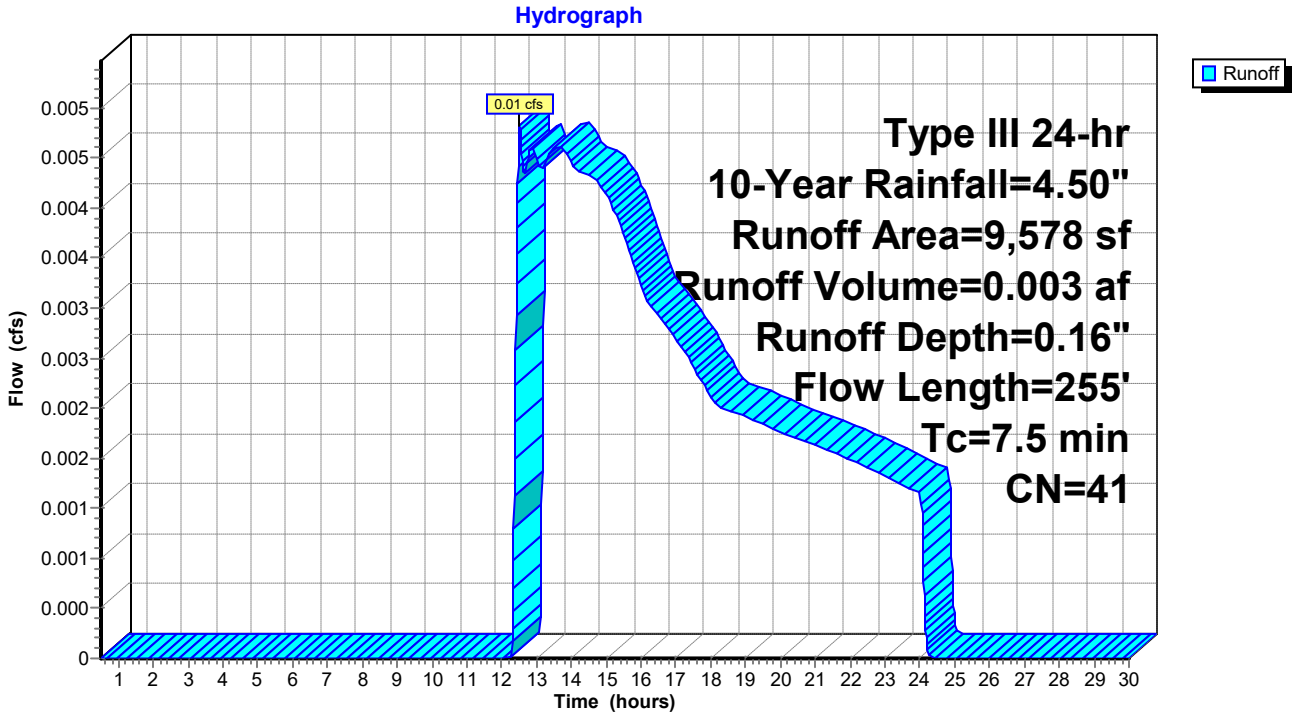
Runoff = 0.01 cfs @ 12.52 hrs, Volume= 0.003 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	109	98	Patio
*	95	98	Landing/Walks/Steps(UNIT4)
*	109	60	Pavers
*	116	98	Ret. Wall
	9,149	39	>75% Grass cover, Good, HSG A
	9,578	41	Weighted Average
	9,258		96.66% Pervious Area
	320		3.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, Segment: A - B** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0250	1.11		**Shallow Concentrated Flow, Segment: B - C** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0480	1.53		**Shallow Concentrated Flow, Segment: C -D** Short Grass Pasture Kv= 7.0 fps
0.4	54	0.1000	2.21		**Shallow Concentrated Flow, Segment: D - E** Short Grass Pasture Kv= 7.0 fps
0.3	25	0.0400	1.40		**Shallow Concentrated Flow, Segment: E - F** Short Grass Pasture Kv= 7.0 fps
0.2	28	0.0714	1.87		**Shallow Concentrated Flow, Segment: F - G** Short Grass Pasture Kv= 7.0 fps
0.9	51	0.0196	0.98		**Shallow Concentrated Flow, Segment: G - H** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0500	1.57		**Shallow Concentrated Flow, Segment: H - I** Short Grass Pasture Kv= 7.0 fps
7.5	255	Total			

Subcatchment P2: Sub-catchment-2



Summary for Subcatchment PD: Driveway

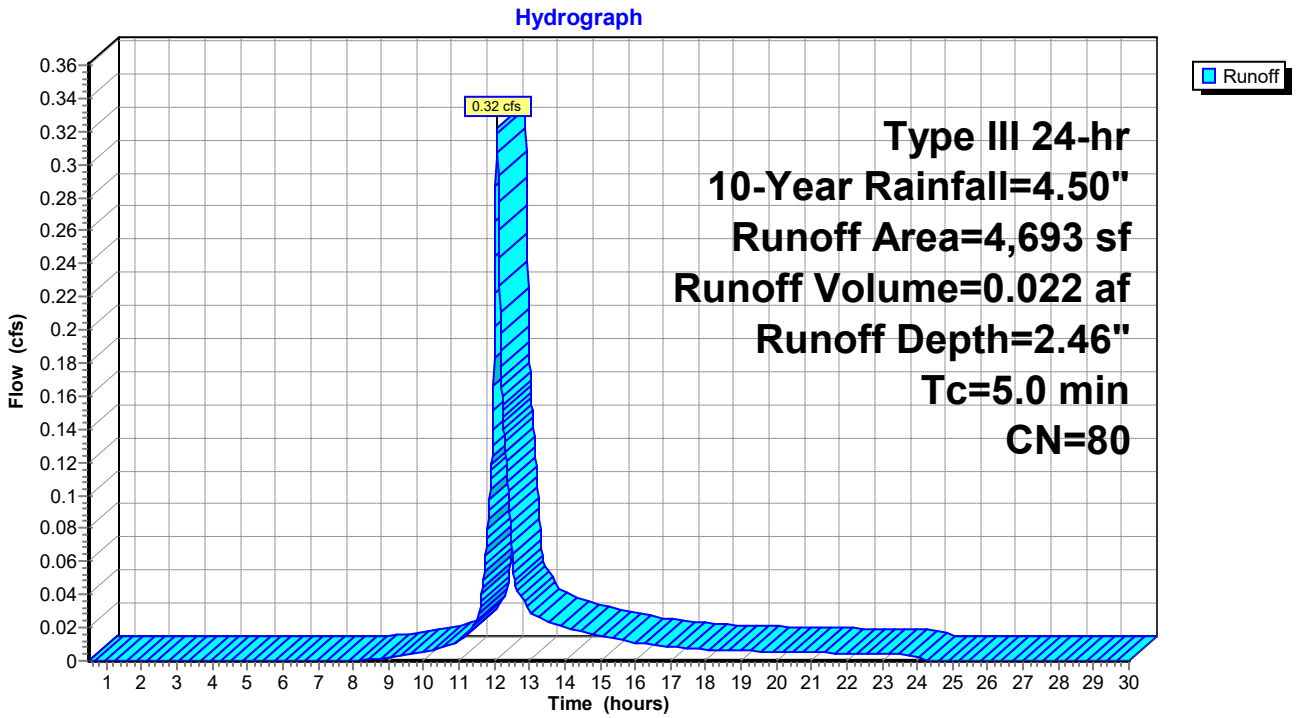
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.022 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	2,180	98	Paved Driveway
*	162	98	Ret. Wall
*	883	98	Walks/landing
	1,468	39	>75% Grass cover, Good, HSG A
	4,693	80	Weighted Average
	1,468		31.28% Pervious Area
	3,225		68.72% Impervious Area

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

Subcatchment PD: Driveway



Summary for Subcatchment PR1: Roof-1

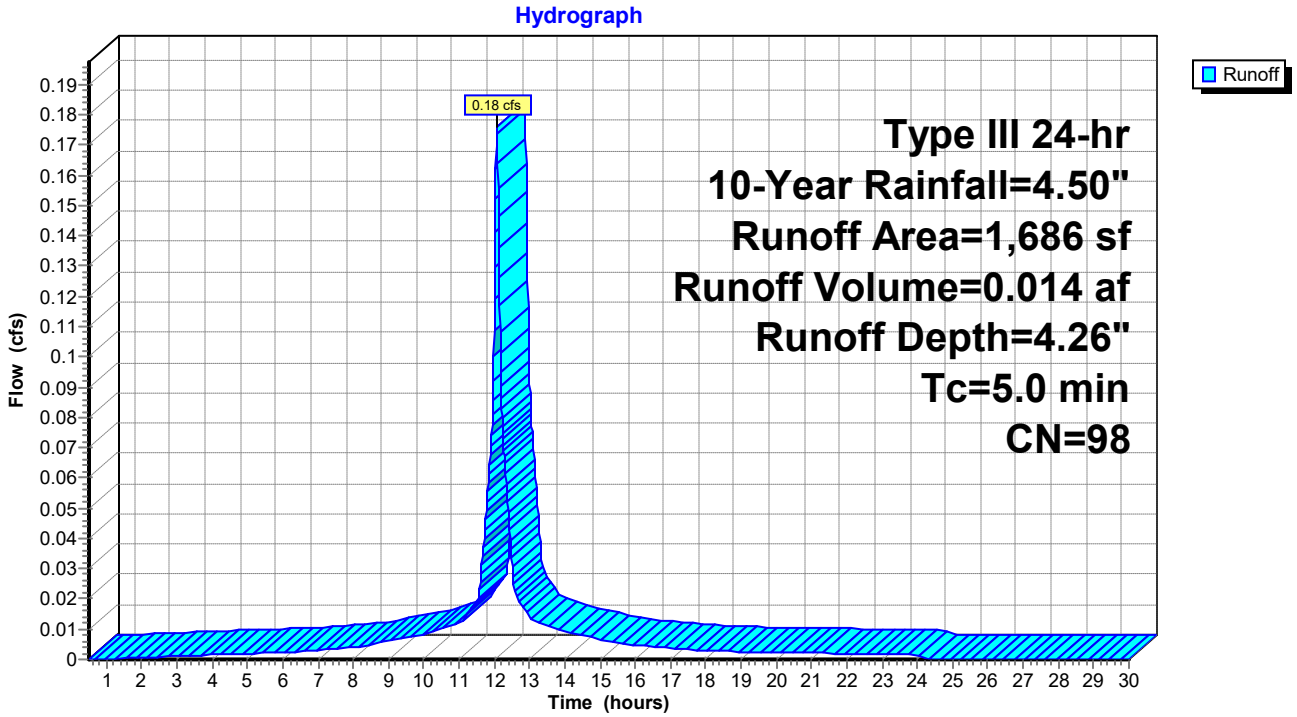
Runoff = 0.18 cfs @ 12.07 hrs, Volume= 0.014 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,686	98	Ex. Roof
	1,686		100.00% Impervious Area

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

Subcatchment PR1: Roof-1



Summary for Subcatchment PR2: Roof-2

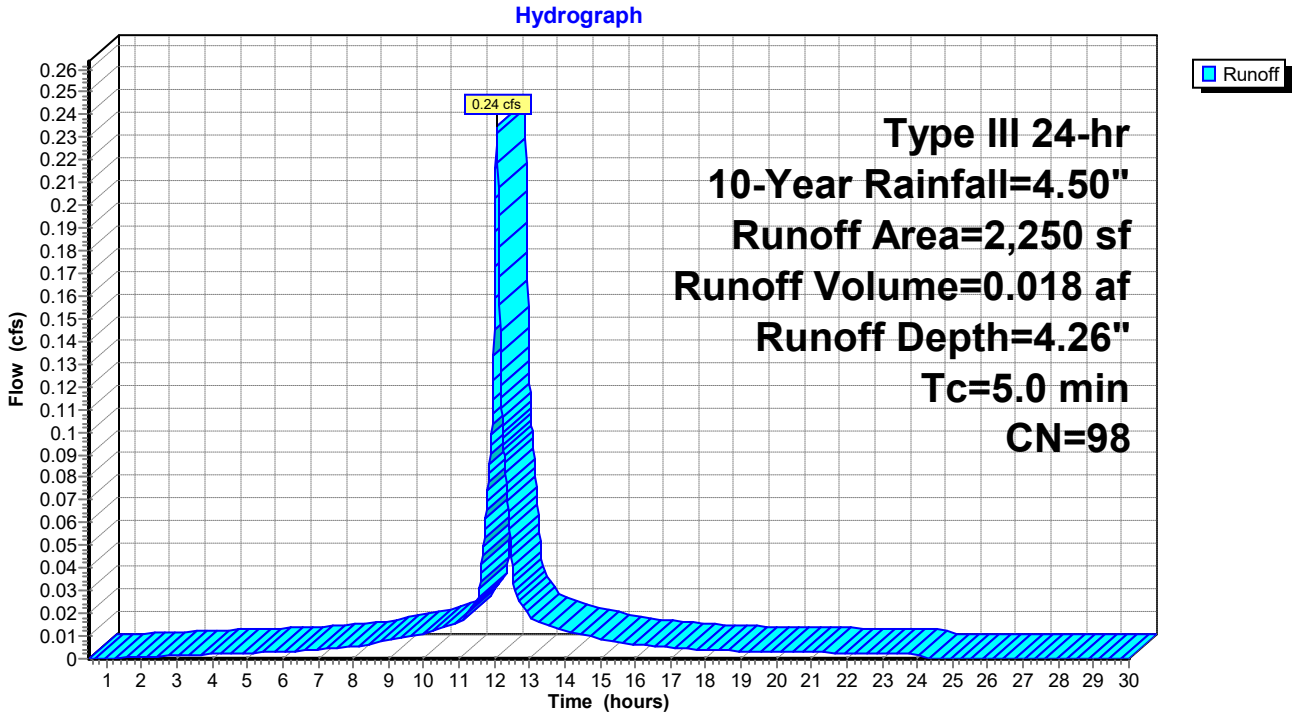
Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,778	98	PR-2&Ex. house-Roofs, HSG A
*	472	98	PR-2_Ex_Unconnected roofs, HSG A
	2,250	98	Weighted Average
	2,250		100.00% Impervious Area
	472		20.98% Unconnected

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

Subcatchment PR2: Roof-2



Summary for Subcatchment PR3: Roof-3

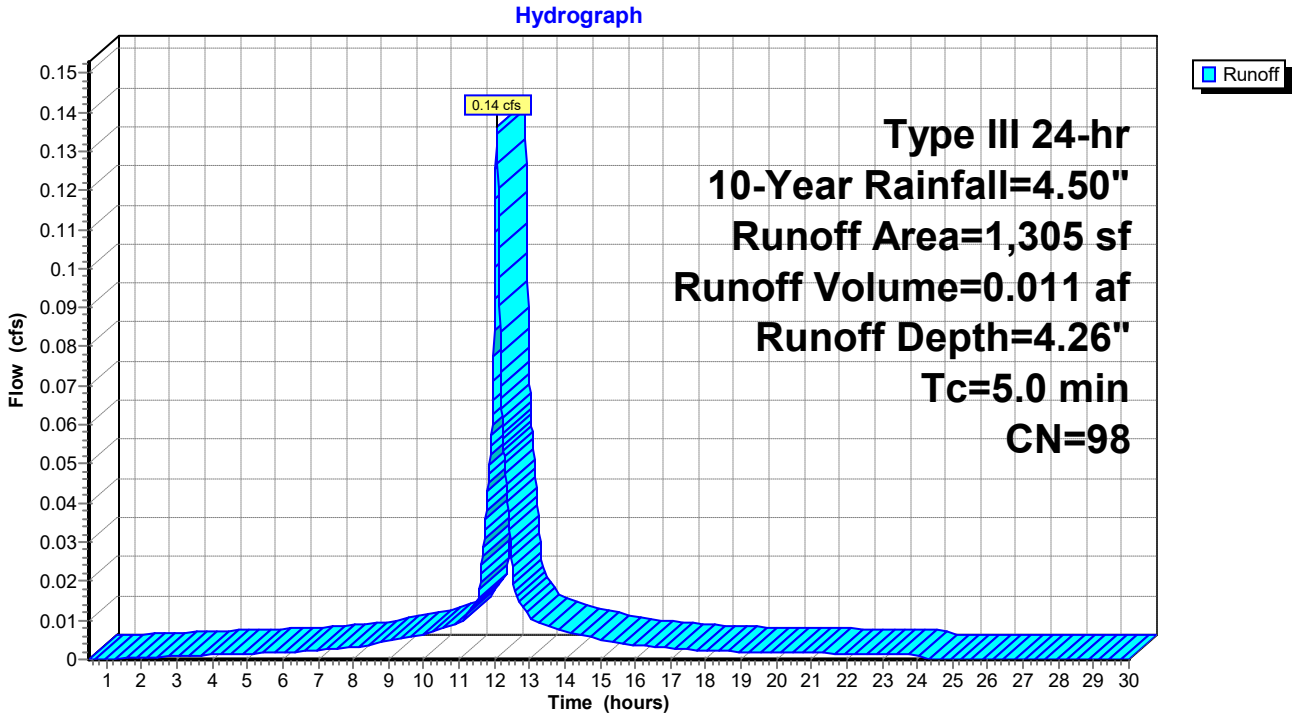
Runoff = 0.14 cfs @ 12.07 hrs, Volume= 0.011 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,305	98	Ex. Roof
	1,305		100.00% Impervious Area

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

Subcatchment PR3: Roof-3



Summary for Subcatchment PR4: Roof-4

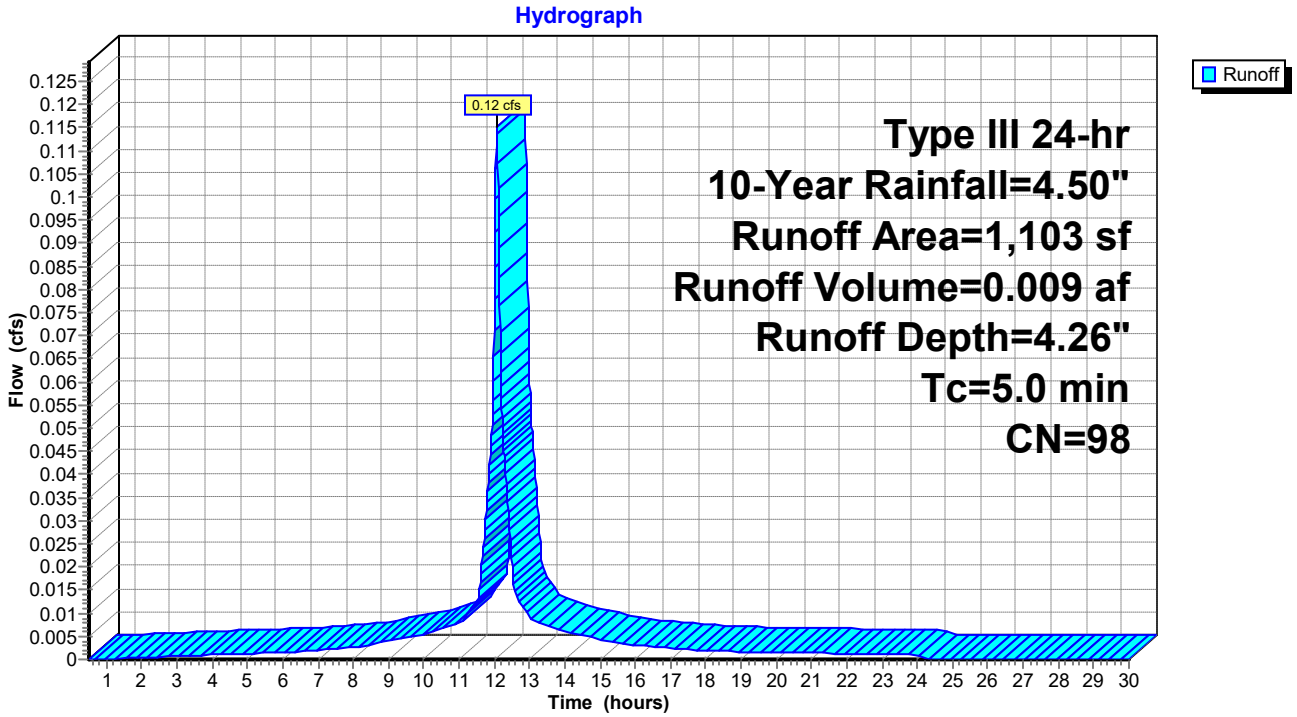
Runoff = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	1,103	98	Ex. Roof
	1,103		100.00% Impervious Area

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

Subcatchment PR4: Roof-4



Summary for Subcatchment PR5: Roof-5

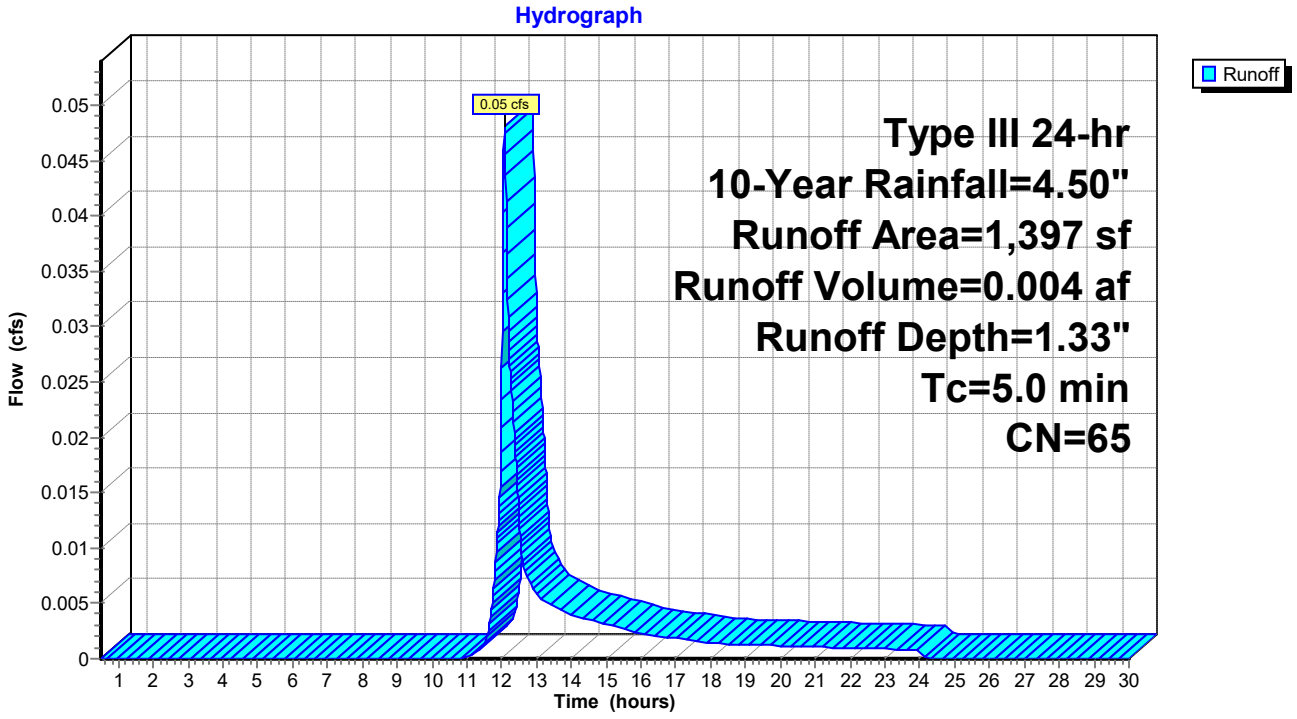
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	605	98	wakways
	792	39	>75% Grass cover, Good, HSG A
	1,397	65	Weighted Average
	792		56.69% Pervious Area
	605		43.31% Impervious Area

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

Subcatchment PR5: Roof-5



Summary for Pond INF-1: Inf. System #1 Stormtech MC-3500

Inflow Area = 0.071 ac, 74.31% Impervious, Inflow Depth = 2.93" for 10-Year event
Inflow = 0.22 cfs @ 12.07 hrs, Volume= 0.017 af
Outflow = 0.02 cfs @ 11.72 hrs, Volume= 0.017 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.72 hrs, Volume= 0.017 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 151.31' @ 12.87 hrs Surf.Area= 0.009 ac Storage= 0.006 af

Plug-Flow detention time= 73.0 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 73.0 min (846.1 - 773.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	150.00'	0.012 af	**8.42'W x 48.72'L x 5.25'H Field A** 0.049 af Overall - 0.016 af Embedded = 0.034 af x 35.0% Voids
#2A	151.00'	0.016 af	**ADS_StormTech MC-3500 d +Cap** x 6 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf
		0.028 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	150.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 11.72 hrs HW=150.05' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond INF-1: Inf. System #1 Stormtech MC-3500 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf

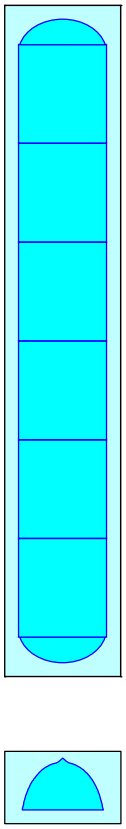
6 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 46.72' Row Length +12.0" End Stone x 2 = 48.72' Base Length
1 Rows x 77.0" Wide + 12.0" Side Stone x 2 = 8.42' Base Width
12.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.25' Field Height

6 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 1 Rows = 689.5 cf Chamber Storage

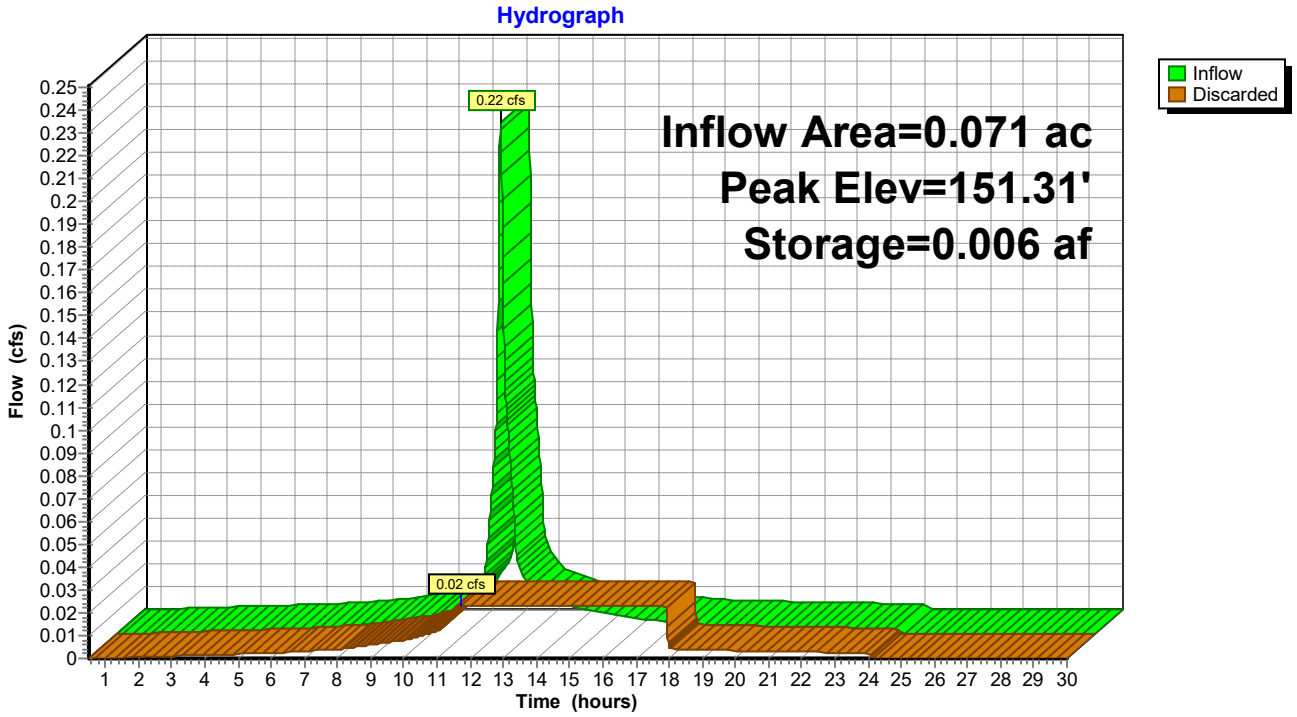
2,152.8 cf Field - 689.5 cf Chambers = 1,463.3 cf Stone x 35.0% Voids = 512.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,201.7 cf = 0.028 af
Overall Storage Efficiency = 55.8%
Overall System Size = 48.72' x 8.42' x 5.25'

6 Chambers
79.7 cy Field
54.2 cy Stone



Pond INF-1: Inf. System #1 Stormtech MC-3500



Summary for Pond INF-2: Inf. System #2 Stormtech MC-3500

Inflow Area = 0.052 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af
Outflow = 0.02 cfs @ 11.58 hrs, Volume= 0.018 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.58 hrs, Volume= 0.018 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 156.60' @ 12.96 hrs Surf.Area= 0.008 ac Storage= 0.006 af

Plug-Flow detention time= 99.3 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 99.3 min (848.2 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	0.010 af	**8.42'W x 41.55'L x 5.25'H Field A** 0.042 af Overall - 0.013 af Embedded = 0.029 af x 35.0% Voids
#2A	156.00'	0.013 af	**ADS_StormTech MC-3500 d +Cap** x 5 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf
		0.023 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	155.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 11.58 hrs HW=155.05' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond INF-2: Inf. System #2 Stormtech MC-3500 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf

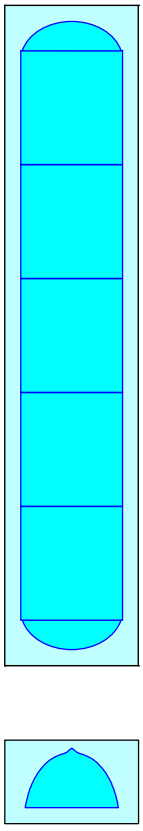
5 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 39.55' Row Length +12.0" End Stone x 2 = 41.55' Base Length
1 Rows x 77.0" Wide + 12.0" Side Stone x 2 = 8.42' Base Width
12.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.25' Field Height

5 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 1 Rows = 579.6 cf Chamber Storage

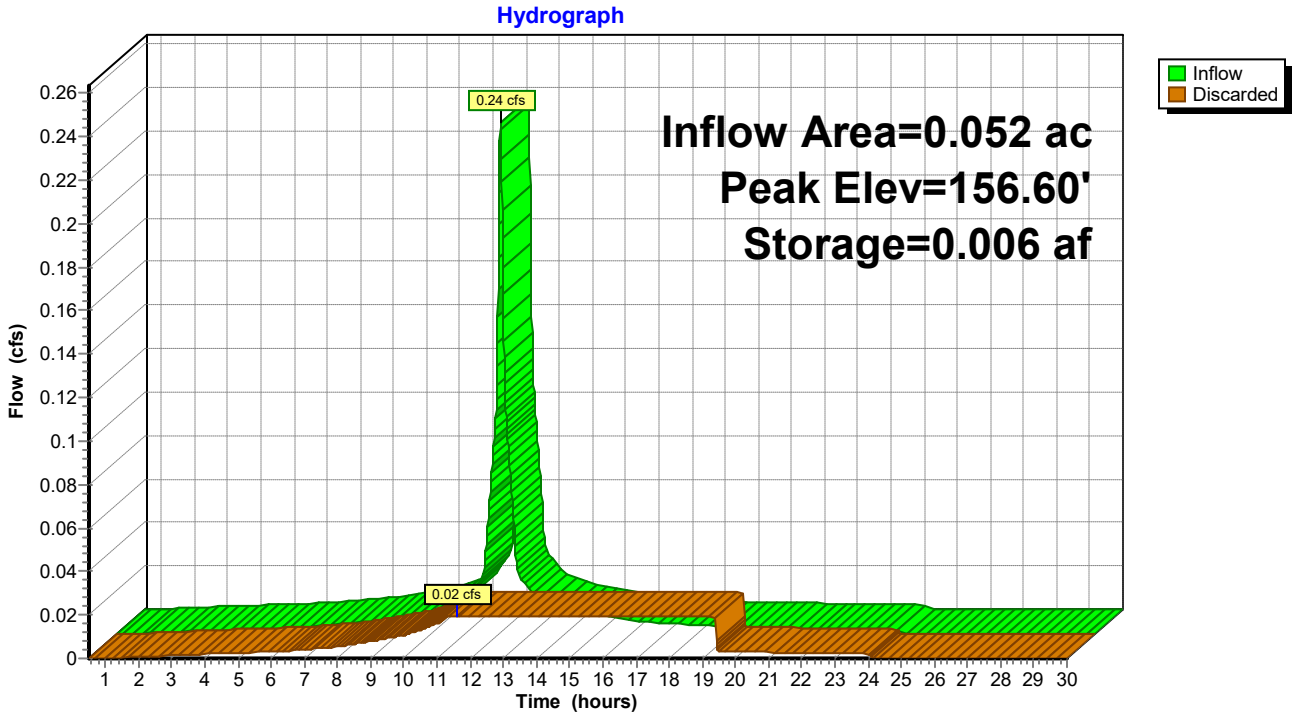
1,836.0 cf Field - 579.6 cf Chambers = 1,256.4 cf Stone x 35.0% Voids = 439.8 cf Stone Storage

Chamber Storage + Stone Storage = 1,019.3 cf = 0.023 af
Overall Storage Efficiency = 55.5%
Overall System Size = 41.55' x 8.42' x 5.25'

5 Chambers
68.0 cy Field
46.5 cy Stone



Pond INF-2: Inf. System #2 Stormtech MC-3500



Summary for Pond INF-3: Inf. System #3 Ameration Chamber

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.25 cfs @ 12.07 hrs, Volume= 0.020 af
Outflow = 0.04 cfs @ 11.72 hrs, Volume= 0.020 af, Atten= 86%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.72 hrs, Volume= 0.020 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 149.44' @ 12.56 hrs Surf.Area= 0.014 ac Storage= 0.005 af

Plug-Flow detention time= 38.1 min calculated for 0.020 af (100% of inflow)
Center-of-Mass det. time= 38.1 min (787.0 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	148.40'	0.010 af	**15.00'W x 42.00'L x 3.17'H Field A** 0.046 af Overall - 0.018 af Embedded = 0.028 af x 35.0% Voids
#2A	149.40'	0.010 af	**Concrete Galley 4x8x1.7** x 15 Inside #1 Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf 15 Chambers in 3 Rows
		0.020 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.40'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 11.72 hrs HW=148.43' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Pond INF-3: Inf. System #3 Ameration Chamber - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x1.7 (Ameration Chamber, NEPCA LE-AC or equivalent)
Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf
Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf

48.0" Wide + 6.0" Spacing = 54.0" C-C Row Spacing

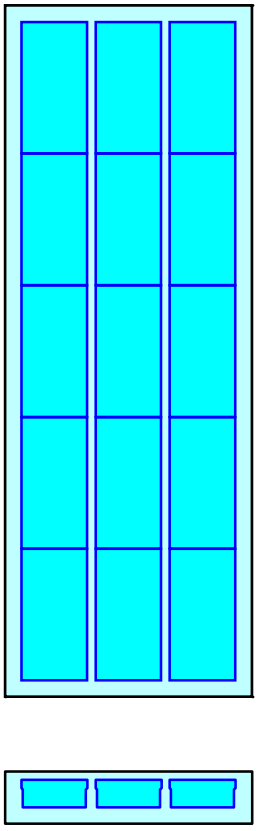
5 Chambers/Row x 8.00' Long = 40.00' Row Length +12.0" End Stone x 2 = 42.00' Base Length
3 Rows x 48.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.00' Base Width
12.0" Base + 20.0" Chamber Height + 6.0" Cover = 3.17' Field Height

15 Chambers x 30.3 cf = 454.3 cf Chamber Storage
15 Chambers x 51.9 cf = 778.6 cf Displacement

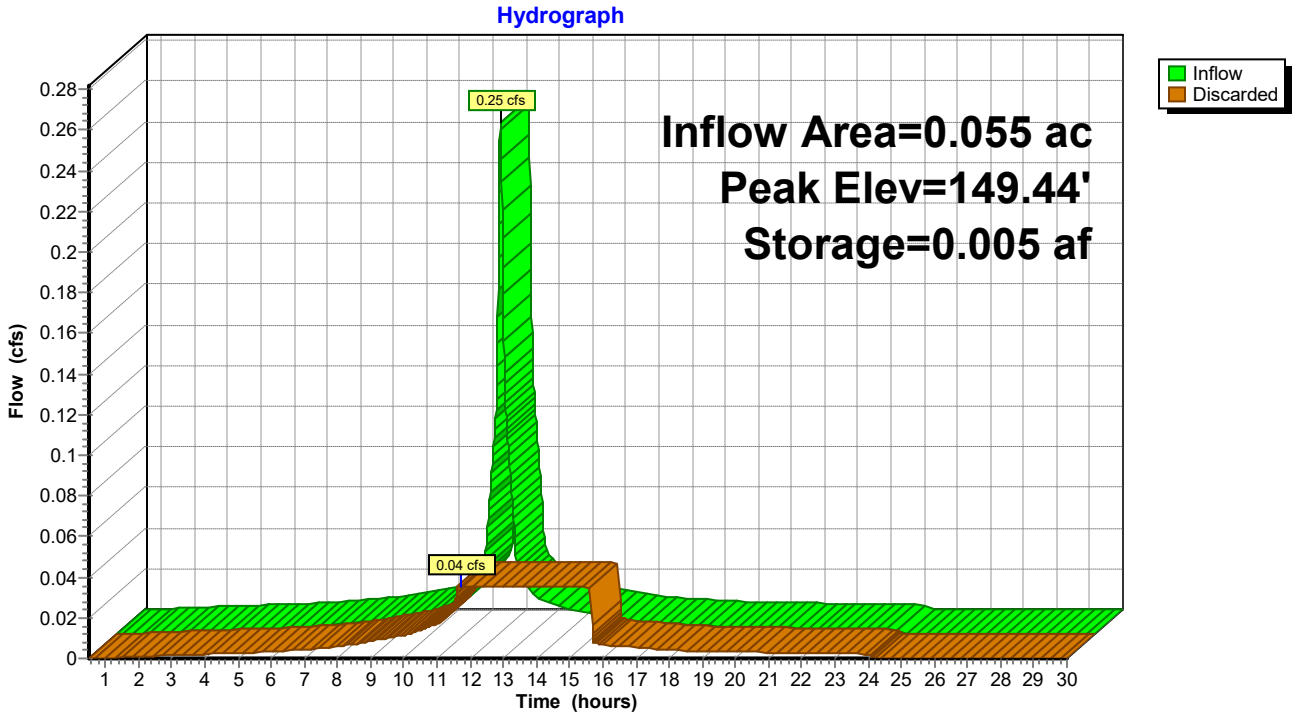
1,997.1 cf Field - 778.6 cf Chambers = 1,218.5 cf Stone x 35.0% Voids = 426.5 cf Stone Storage

Chamber Storage + Stone Storage = 880.7 cf = 0.020 af
Overall Storage Efficiency = 44.1%
Overall System Size = 42.00' x 15.00' x 3.17'

15 Chambers
74.0 cy Field
45.1 cy Stone



Pond INF-3: Inf. System #3 Ameration Chamber



Summary for Pond INF-4: Inf. System #4 Ameration Chamber

Inflow Area = 0.108 ac, 68.72% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 0.32 cfs @ 12.08 hrs, Volume= 0.022 af
Outflow = 0.17 cfs @ 12.20 hrs, Volume= 0.022 af, Atten= 47%, Lag= 7.6 min
Discarded = 0.04 cfs @ 11.73 hrs, Volume= 0.018 af
Secondary = 0.13 cfs @ 12.20 hrs, Volume= 0.004 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 149.86' @ 12.20 hrs Surf.Area= 649 sf Storage= 195 cf

Plug-Flow detention time= 23.9 min calculated for 0.022 af (100% of inflow)
Center-of-Mass det. time= 23.9 min (849.4 - 825.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	149.00'	352 cf	**11.00'W x 59.00'L x 2.67'H Field A** 1,733 cf Overall - 727 cf Embedded = 1,006 cf x 35.0% Voids
#2A	150.00'	424 cf	**Concrete Galley 4x8x1.7** x 14 Inside #1 Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf 14 Chambers in 2 Rows
		776 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	149.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	149.60'	**6.0" Round Overflow** L= 48.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 149.60' / 149.35' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Discarded OutFlow Max=0.04 cfs @ 11.73 hrs HW=149.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Secondary OutFlow Max=0.13 cfs @ 12.20 hrs HW=149.86' TW=0.00' (Dynamic Tailwater)
2=Overflow (Barrel Controls 0.13 cfs @ 1.90 fps)

Pond INF-4: Inf. System #4 Ameration Chamber - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x1.7 (Ameration Chamber, NEPCA LE-AC or equivalent)
Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf
Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf

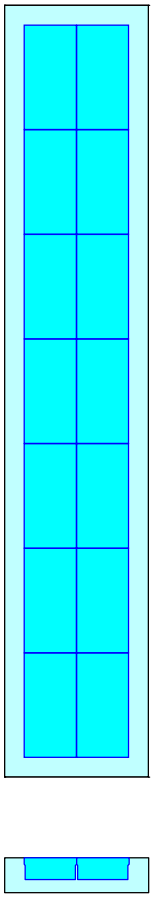
7 Chambers/Row x 8.00' Long = 56.00' Row Length +18.0" End Stone x 2 = 59.00' Base Length
2 Rows x 48.0" Wide + 18.0" Side Stone x 2 = 11.00' Base Width
12.0" Base + 20.0" Chamber Height = 2.67' Field Height

14 Chambers x 30.3 cf = 424.0 cf Chamber Storage
14 Chambers x 51.9 cf = 726.7 cf Displacement

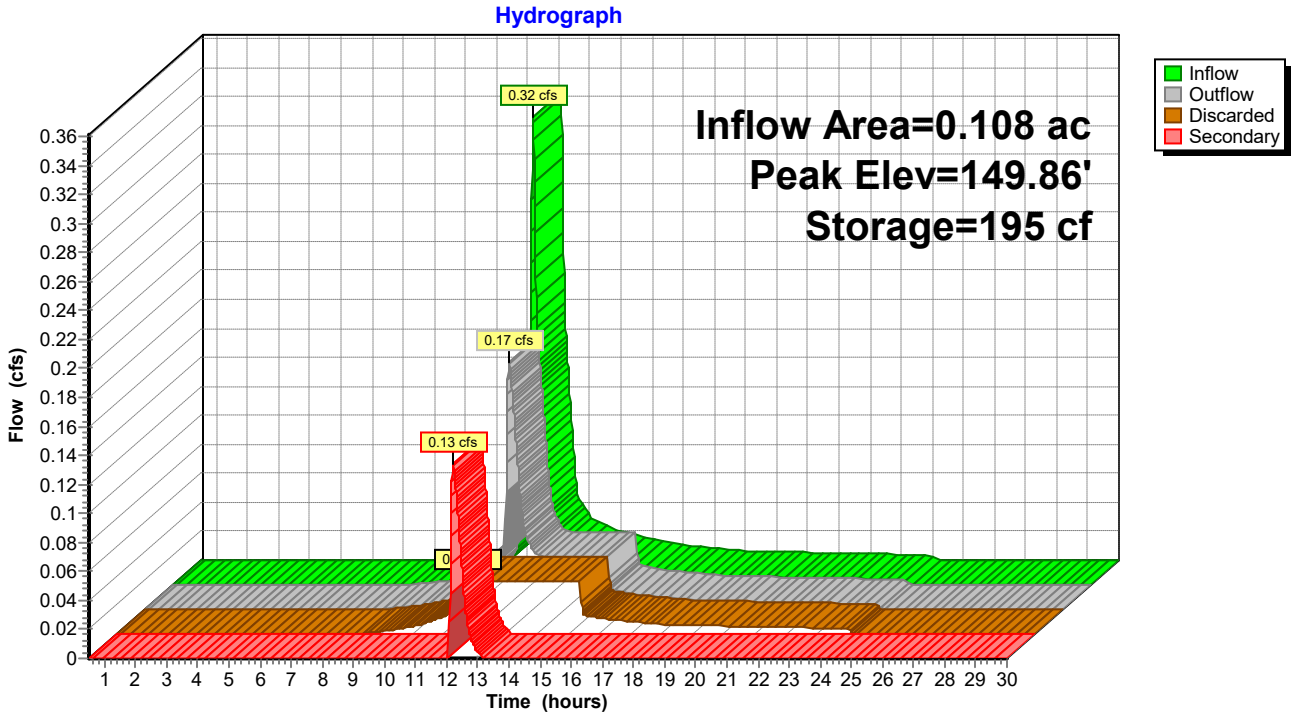
1,732.8 cf Field - 726.7 cf Chambers = 1,006.1 cf Stone x 35.0% Voids = 352.1 cf Stone Storage

Chamber Storage + Stone Storage = 776.1 cf = 0.018 af
Overall Storage Efficiency = 44.8%
Overall System Size = 59.00' x 11.00' x 2.67'

14 Chambers
64.2 cy Field
37.3 cy Stone



Pond INF-4: Inf. System #4 Ameration Chamber

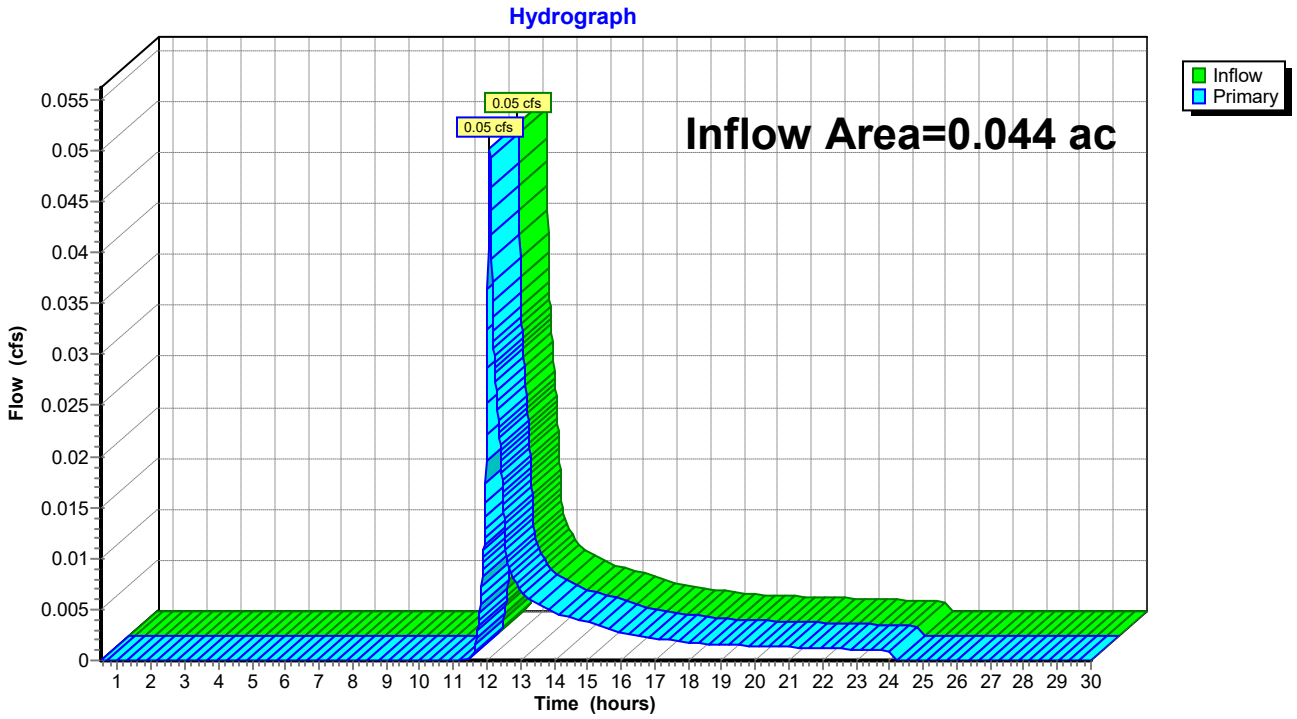


Summary for Link POD1: Warren Street (South)

Inflow Area = 0.044 ac, 36.97% Impervious, Inflow Depth = 1.08" for 10-Year event
Inflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af
Primary = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD1: Warren Street (South)

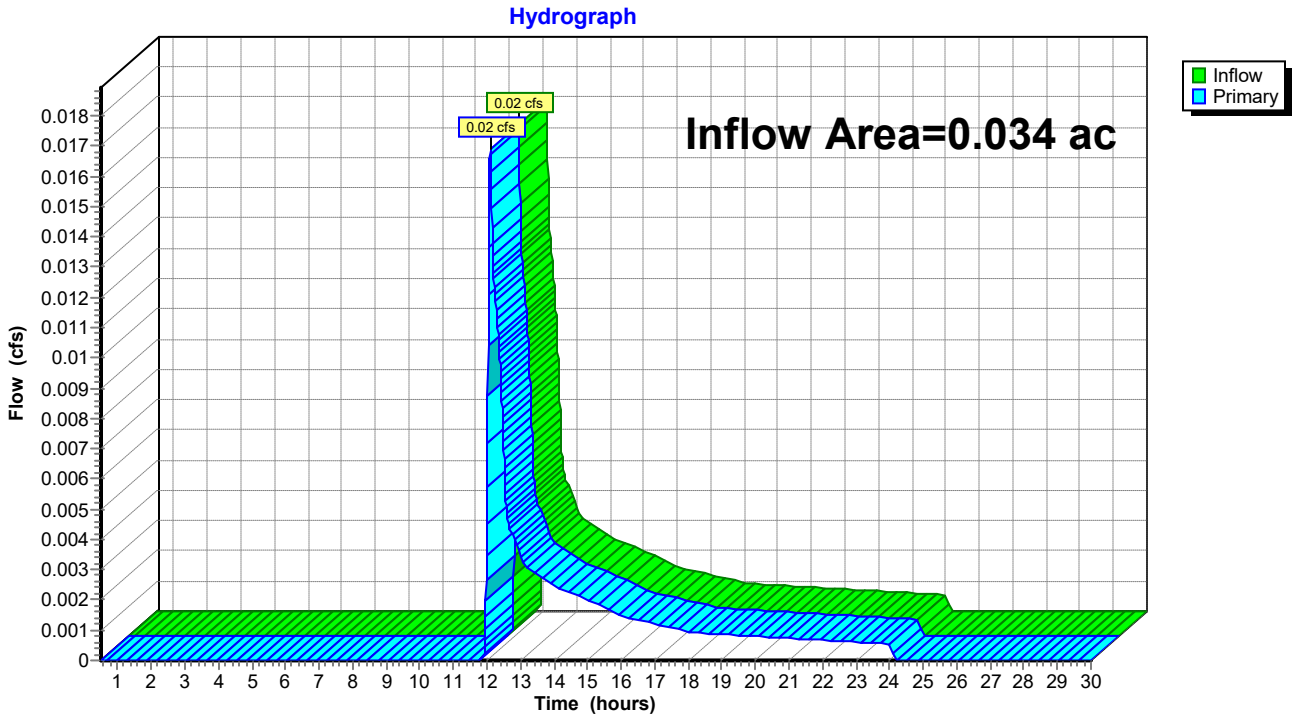


Summary for Link POD1.: Warren Street (South)

Inflow Area = 0.034 ac, 24.40% Impervious, Inflow Depth = 0.64" for 10-Year event
Inflow = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af
Primary = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD1.: Warren Street (South)

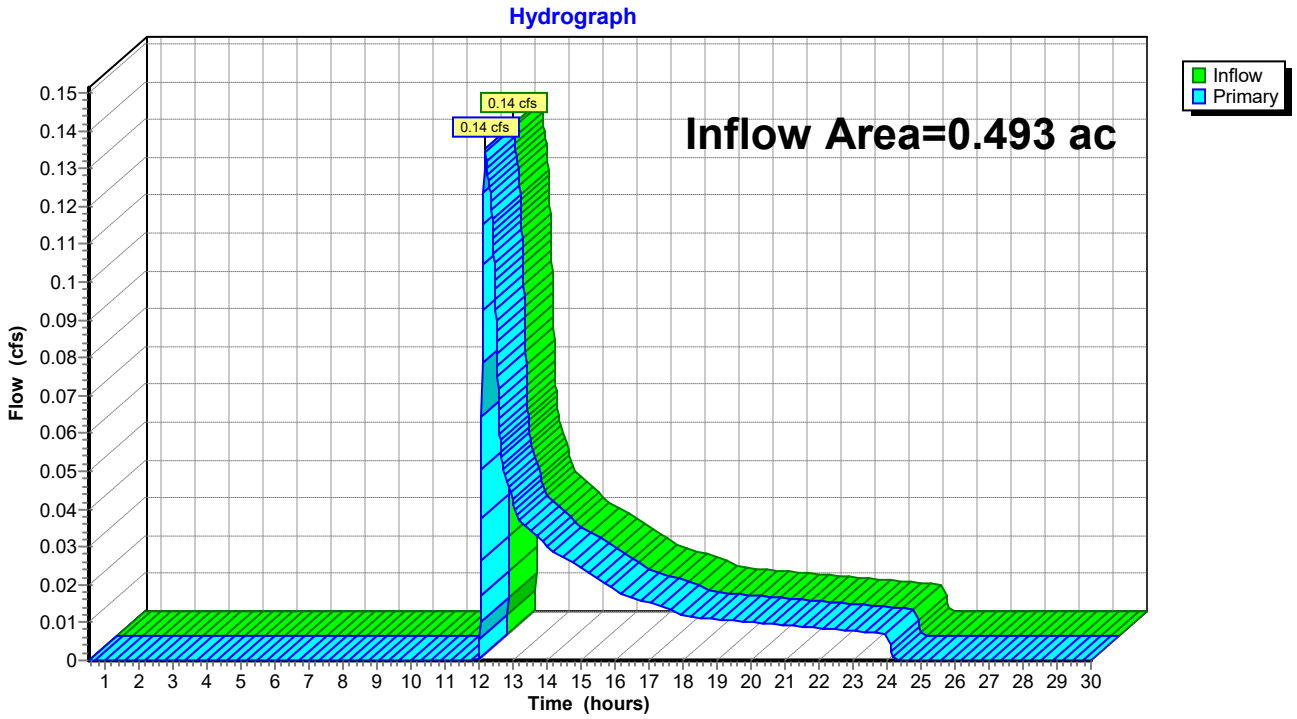


Summary for Link POD2: North Abutter (MBTA)

Inflow Area = 0.493 ac, 24.07% Impervious, Inflow Depth = 0.50" for 10-Year event
Inflow = 0.14 cfs @ 12.16 hrs, Volume= 0.021 af
Primary = 0.14 cfs @ 12.16 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD2: North Abutter (MBTA)

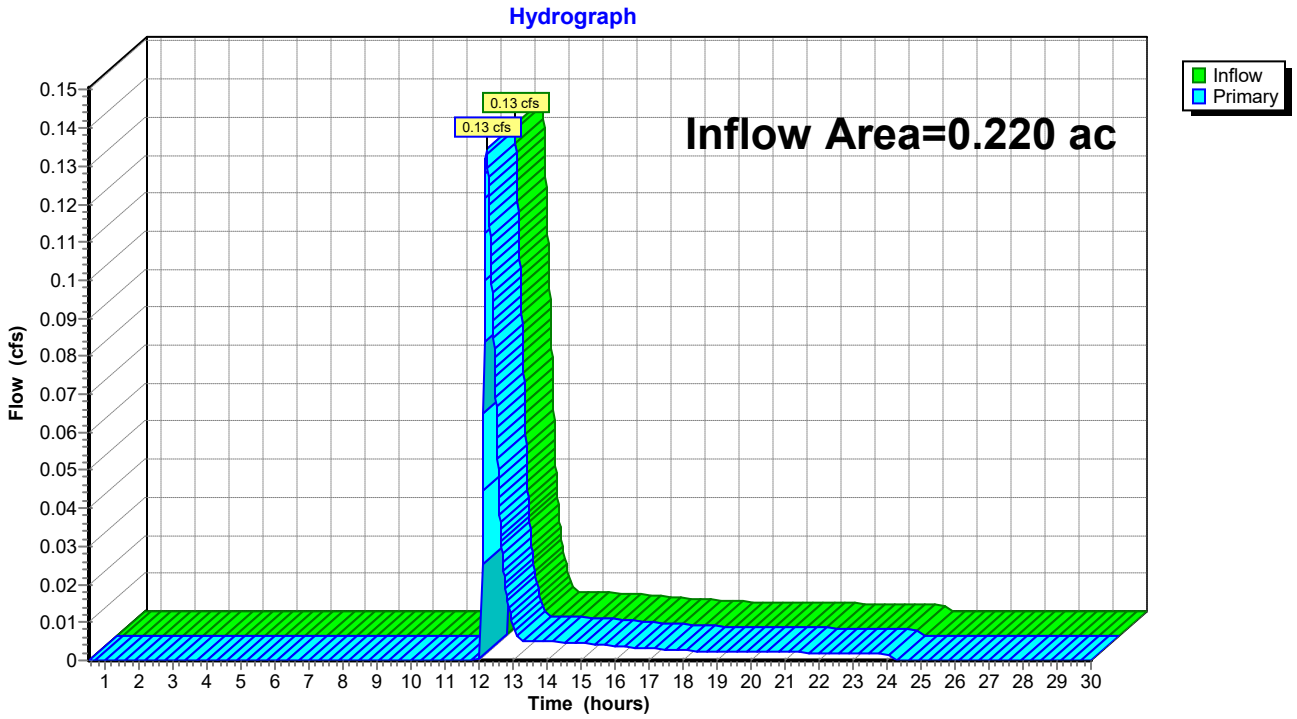


Summary for Link POD2.: North Abutter (MBTA)

Inflow Area = 0.220 ac, 3.34% Impervious, Inflow Depth = 0.39" for 10-Year event
Inflow = 0.13 cfs @ 12.20 hrs, Volume= 0.007 af
Primary = 0.13 cfs @ 12.20 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD2.: North Abutter (MBTA)



Time span=0.50-30.00 hrs, dt=0.010 hrs, 2951 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: Sub-catchment-1 Runoff Area=1,907 sf 36.97% Impervious Runoff Depth=4.05"
Tc=5.0 min CN=61 Runoff=0.21 cfs 0.015 af

Subcatchment E2: Sub-catchment-2 Runoff Area=21,492 sf 24.07% Impervious Runoff Depth=2.74"
Flow Length=297' Tc=6.9 min CN=50 Runoff=1.44 cfs 0.113 af

Subcatchment P1: Sub-catchment-1 Runoff Area=1,467 sf 24.40% Impervious Runoff Depth=3.09"
Tc=5.0 min CN=53 Runoff=0.12 cfs 0.009 af

Subcatchment P2: Sub-catchment-2 Runoff Area=9,578 sf 3.34% Impervious Runoff Depth=1.72"
Flow Length=255' Tc=7.5 min CN=41 Runoff=0.33 cfs 0.031 af

Subcatchment PD: Driveway Runoff Area=4,693 sf 68.72% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=80 Runoff=0.82 cfs 0.057 af

Subcatchment PR1: Roof-1 Runoff Area=1,686 sf 100.00% Impervious Runoff Depth=8.54"
Tc=5.0 min CN=98 Runoff=0.35 cfs 0.028 af

Subcatchment PR2: Roof-2 Runoff Area=2,250 sf 100.00% Impervious Runoff Depth=8.54"
Tc=5.0 min CN=98 Runoff=0.46 cfs 0.037 af

Subcatchment PR3: Roof-3 Runoff Area=1,305 sf 100.00% Impervious Runoff Depth=8.54"
Tc=5.0 min CN=98 Runoff=0.27 cfs 0.021 af

Subcatchment PR4: Roof-4 Runoff Area=1,103 sf 100.00% Impervious Runoff Depth=8.54"
Tc=5.0 min CN=98 Runoff=0.23 cfs 0.018 af

Subcatchment PR5: Roof-5 Runoff Area=1,397 sf 43.31% Impervious Runoff Depth=4.53"
Tc=5.0 min CN=65 Runoff=0.18 cfs 0.012 af

Pond INF-1: Inf. System #1 Stormtech Peak Elev=153.26' Storage=0.019 af Inflow=0.52 cfs 0.040 af
Outflow=0.02 cfs 0.040 af

Pond INF-2: Inf. System #2 Stormtech Peak Elev=158.52' Storage=0.017 af Inflow=0.46 cfs 0.037 af
Outflow=0.02 cfs 0.037 af

Pond INF-3: Inf. System #3 Ameration Peak Elev=150.31' Storage=0.014 af Inflow=0.49 cfs 0.039 af
Outflow=0.04 cfs 0.039 af

Pond INF-4: Inf. System #4 Ameration Peak Elev=150.32' Storage=368 cf Inflow=0.82 cfs 0.057 af
Discarded=0.04 cfs 0.032 af Secondary=0.49 cfs 0.025 af Outflow=0.53 cfs 0.057 af

Link POD1: Warren Street (South) Inflow=0.21 cfs 0.015 af
Primary=0.21 cfs 0.015 af

Link POD1.: Warren Street (South) Inflow=0.12 cfs 0.009 af
Primary=0.12 cfs 0.009 af

Link POD2: North Abutter (MBTA) Inflow=1.44 cfs 0.113 af
Primary=1.44 cfs 0.113 af

Link POD2.: North Abutter (MBTA) Inflow=0.82 cfs 0.057 af
Primary=0.82 cfs 0.057 af

Total Runoff Area = 1.076 ac Runoff Volume = 0.340 af Average Runoff Depth = 3.80"
64.31% Pervious = 0.692 ac 35.69% Impervious = 0.384 ac

Summary for Subcatchment E1: Sub-catchment-1

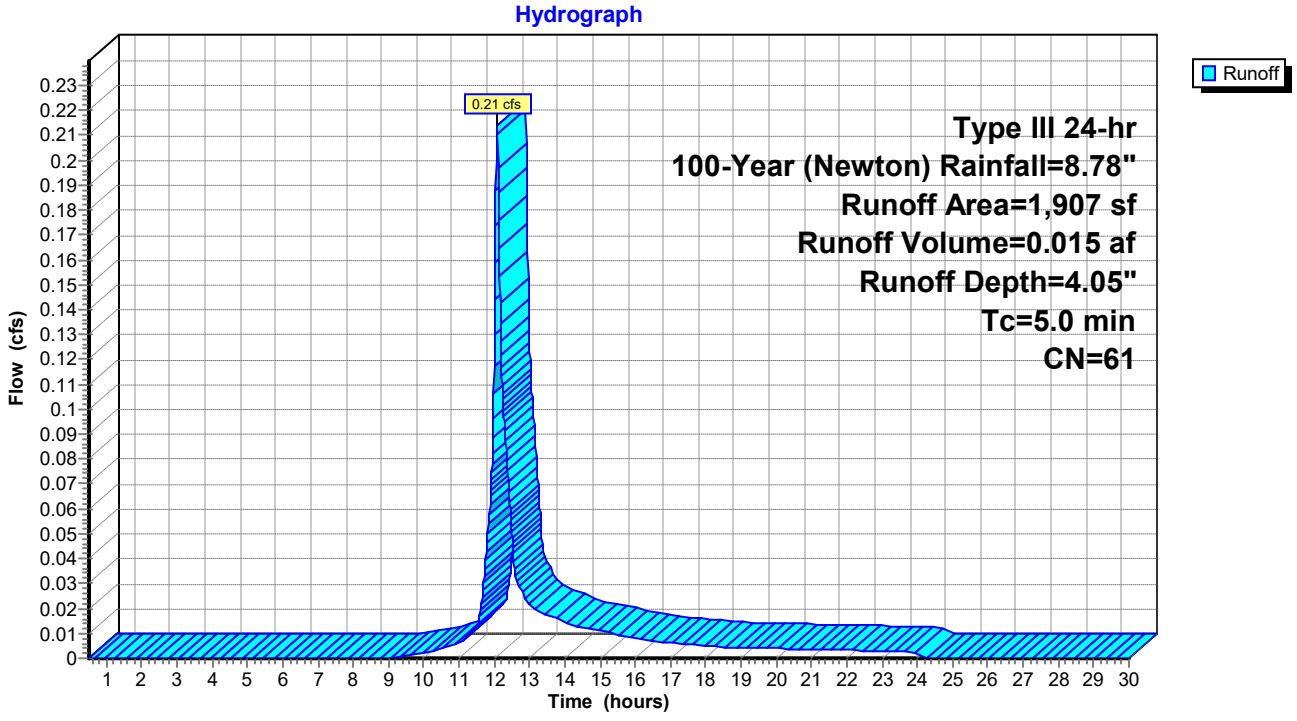
Runoff = 0.21 cfs @ 12.08 hrs, Volume= 0.015 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	472	98	Roof (portion)
*	233	98	Landing/Walks
	1,202	39	>75% Grass cover, Good, HSG A
	1,907	61	Weighted Average
	1,202		63.03% Pervious Area
	705		36.97% Impervious Area

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

Subcatchment E1: Sub-catchment-1



Summary for Subcatchment E2: Sub-catchment-2

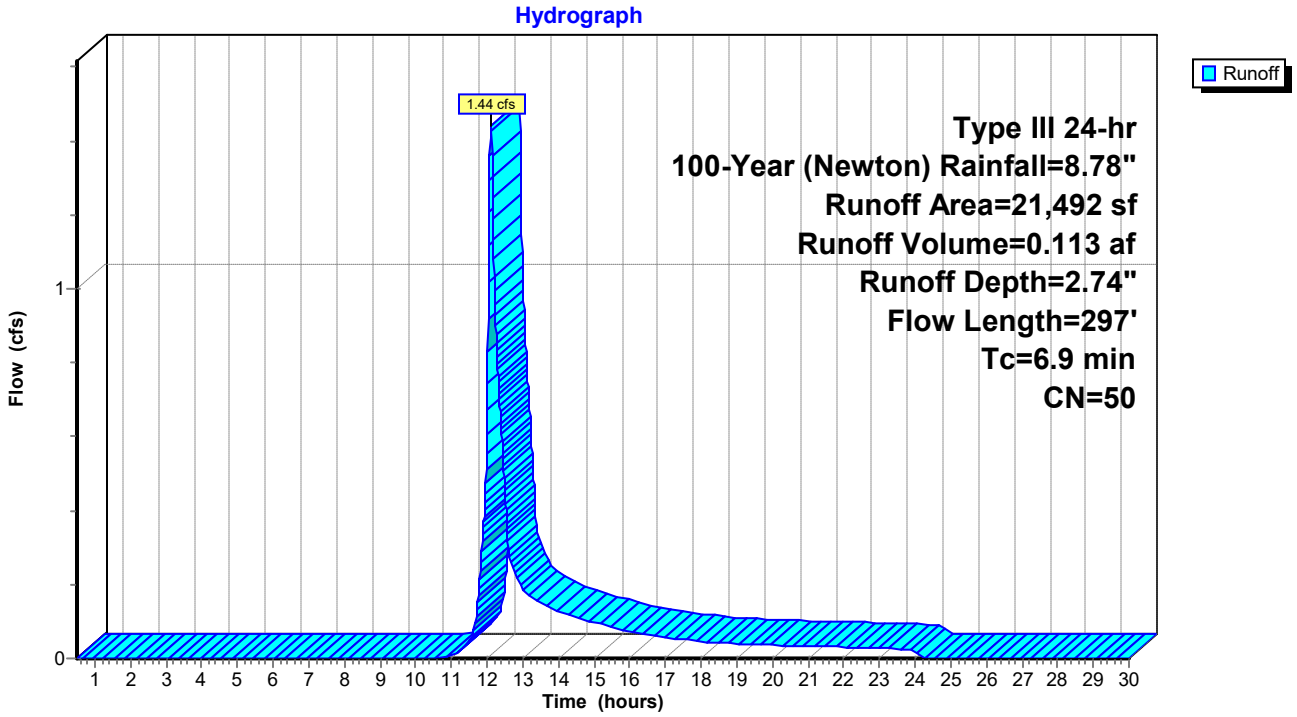
Runoff = 1.44 cfs @ 12.11 hrs, Volume= 0.113 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	1,954	98	Roof (portion)
*	587	98	Garage
*	2,392	98	Bit. Driveway
*	214	98	Landing/Walks/Steps
*	27	98	Ret. Wall
	10,400	32	Woods/grass comb., Good, HSG A
	5,918	39	>75% Grass cover, Good, HSG A
	21,492	50	Weighted Average
	16,318		75.93% Pervious Area
	5,174		24.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	13	0.0692	0.18		**Sheet Flow, Segment: A - B** Grass: Short n= 0.150 P2= 3.10"
0.3	27	0.0407	1.38		**Sheet Flow, Segmend: B - C** Smooth surfaces n= 0.011 P2= 3.10"
1.3	10	0.0310	0.13		**Sheet Flow, Segment: C - D** Grass: Short n= 0.150 P2= 3.10"
0.4	24	0.0251	1.11		**Shallow Concentrated Flow, Segment: D - E** Short Grass Pasture Kv= 7.0 fps
0.0	3	0.0251	3.22		**Shallow Concentrated Flow, Segment: E - F** Paved Kv= 20.3 fps
0.4	46	0.0720	1.88		**Shallow Concentrated Flow, Segment: F - G** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.0490	4.49		**Shallow Concentrated Flow, Segment: G - H** Paved Kv= 20.3 fps
0.6	77	0.0910	2.11		**Shallow Concentrated Flow, Segment: H - I** Short Grass Pasture Kv= 7.0 fps
0.2	19	0.0520	1.60		**Shallow Concentrated Flow, Segment: I - J** Short Grass Pasture Kv= 7.0 fps
2.4	58	0.0034	0.41		**Shallow Concentrated Flow, Segment: J - K** Short Grass Pasture Kv= 7.0 fps
6.9	297	Total			

Subcatchment E2: Sub-catchment-2



Summary for Subcatchment P1: Sub-catchment-1

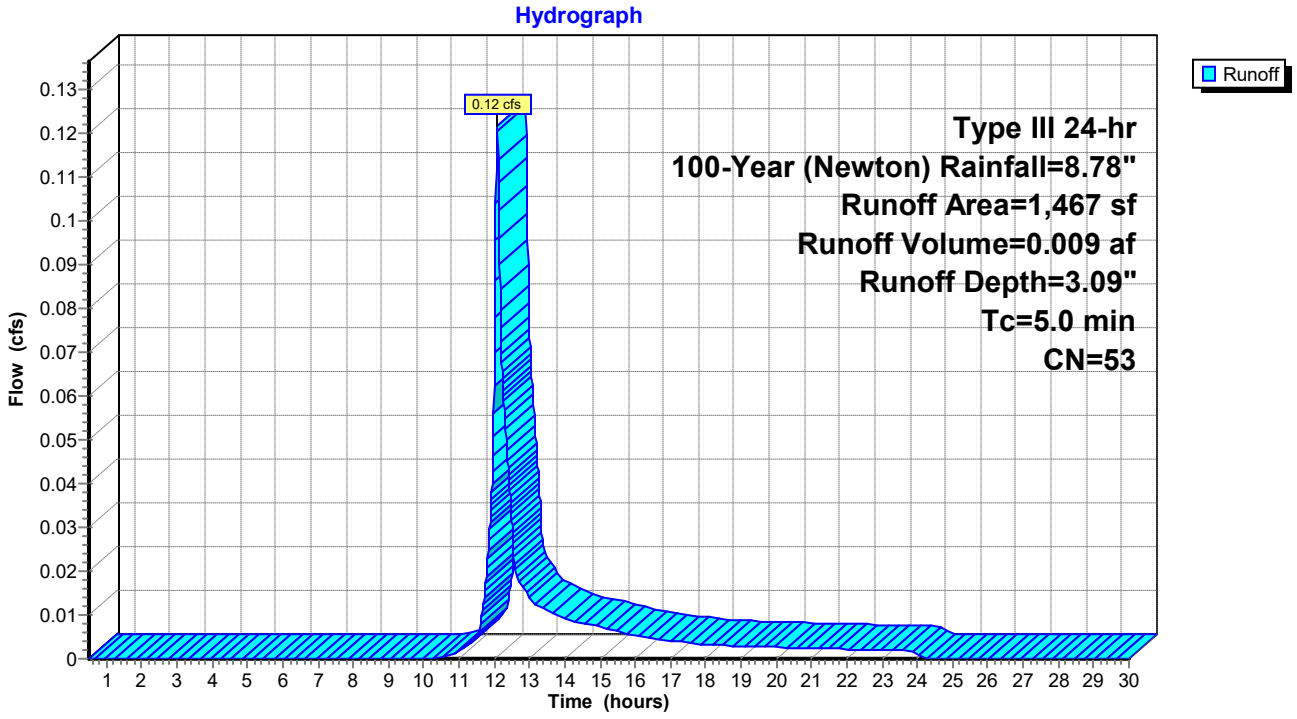
Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	358	98	Landing/Walks
	1,109	39	>75% Grass cover, Good, HSG A
	1,467	53	Weighted Average
	1,109		75.60% Pervious Area
	358		24.40% Impervious Area

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

Subcatchment P1: Sub-catchment-1



Summary for Subcatchment P2: Sub-catchment-2

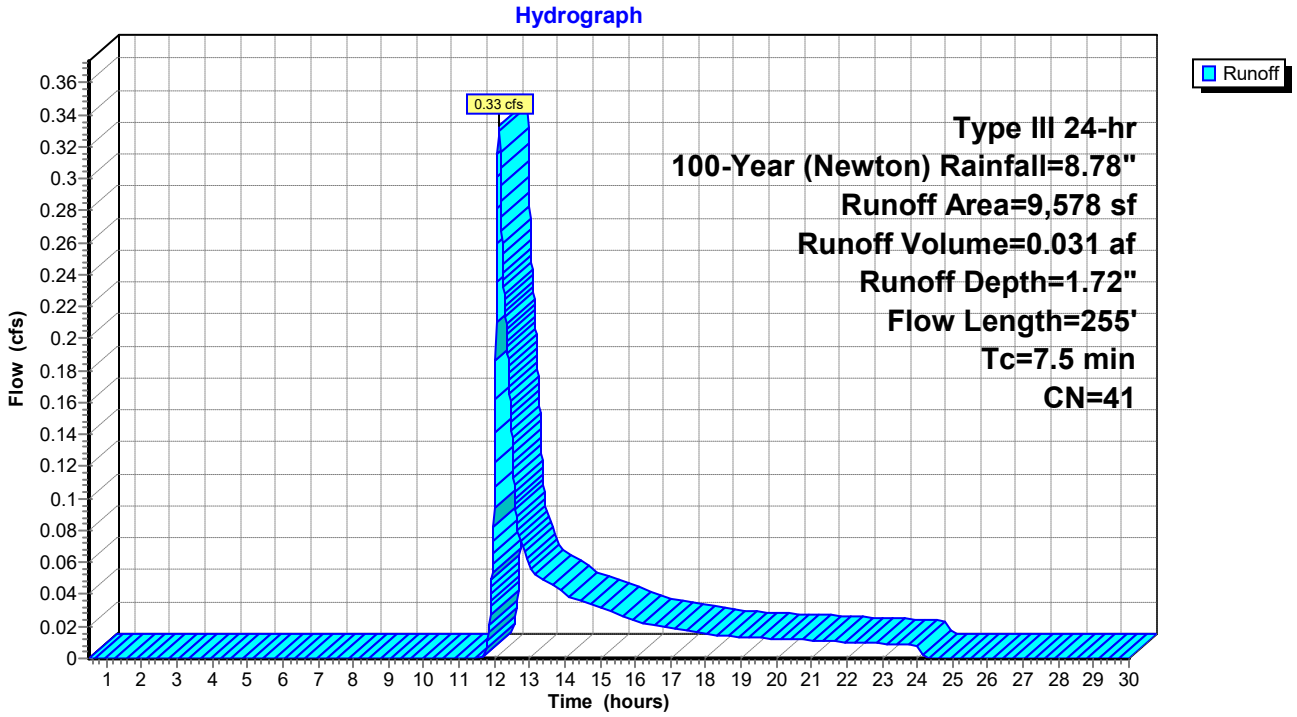
Runoff = 0.33 cfs @ 12.13 hrs, Volume= 0.031 af, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	109	98	Patio
*	95	98	Landing/Walks/Steps(UNIT4)
*	109	60	Pavers
*	116	98	Ret. Wall
	9,149	39	>75% Grass cover, Good, HSG A
	9,578	41	Weighted Average
	9,258		96.66% Pervious Area
	320		3.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, Segment: A - B** Grass: Short n= 0.150 P2= 3.10"
0.2	16	0.0250	1.11		**Shallow Concentrated Flow, Segment: B - C** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0480	1.53		**Shallow Concentrated Flow, Segment: C -D** Short Grass Pasture Kv= 7.0 fps
0.4	54	0.1000	2.21		**Shallow Concentrated Flow, Segment: D - E** Short Grass Pasture Kv= 7.0 fps
0.3	25	0.0400	1.40		**Shallow Concentrated Flow, Segment: E - F** Short Grass Pasture Kv= 7.0 fps
0.2	28	0.0714	1.87		**Shallow Concentrated Flow, Segment: F - G** Short Grass Pasture Kv= 7.0 fps
0.9	51	0.0196	0.98		**Shallow Concentrated Flow, Segment: G - H** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0500	1.57		**Shallow Concentrated Flow, Segment: H - I** Short Grass Pasture Kv= 7.0 fps
7.5	255	Total			

Subcatchment P2: Sub-catchment-2



Summary for Subcatchment PD: Driveway

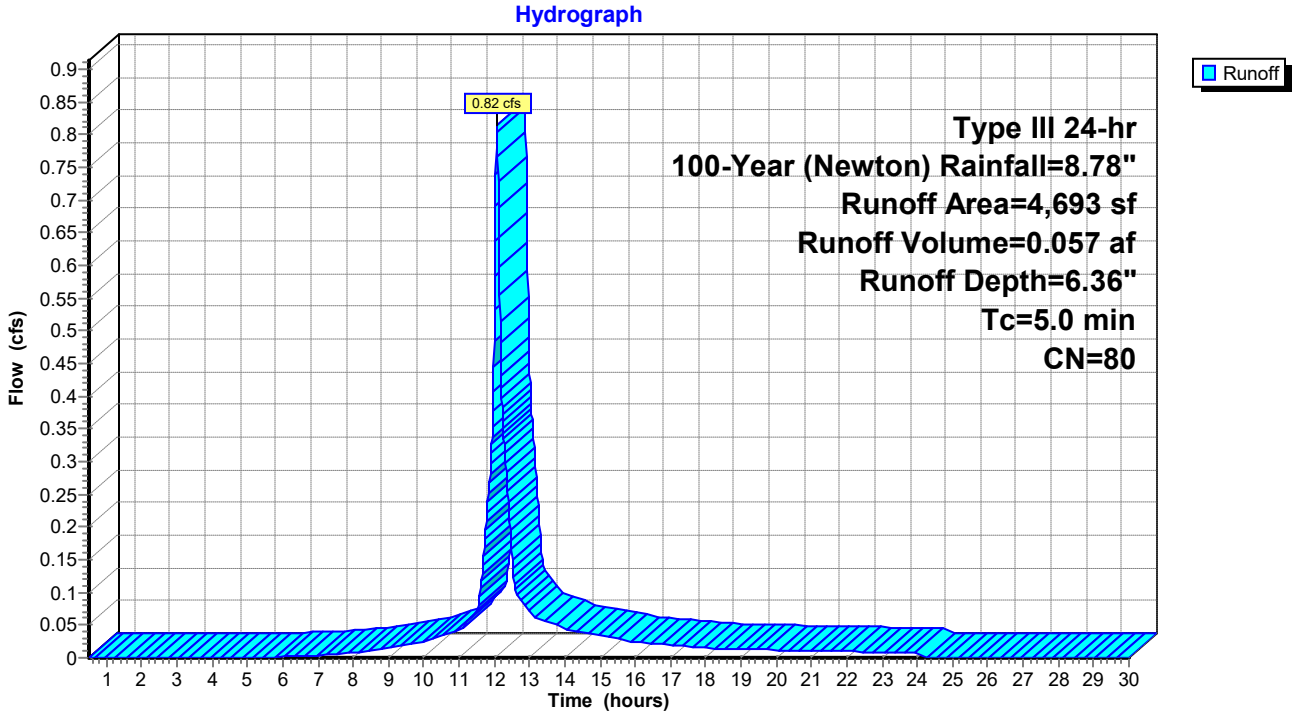
Runoff = 0.82 cfs @ 12.07 hrs, Volume= 0.057 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	2,180	98	Paved Driveway
*	162	98	Ret. Wall
*	883	98	Walks/landing
	1,468	39	>75% Grass cover, Good, HSG A
	4,693	80	Weighted Average
	1,468		31.28% Pervious Area
	3,225		68.72% Impervious Area

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

Subcatchment PD: Driveway



Summary for Subcatchment PR1: Roof-1

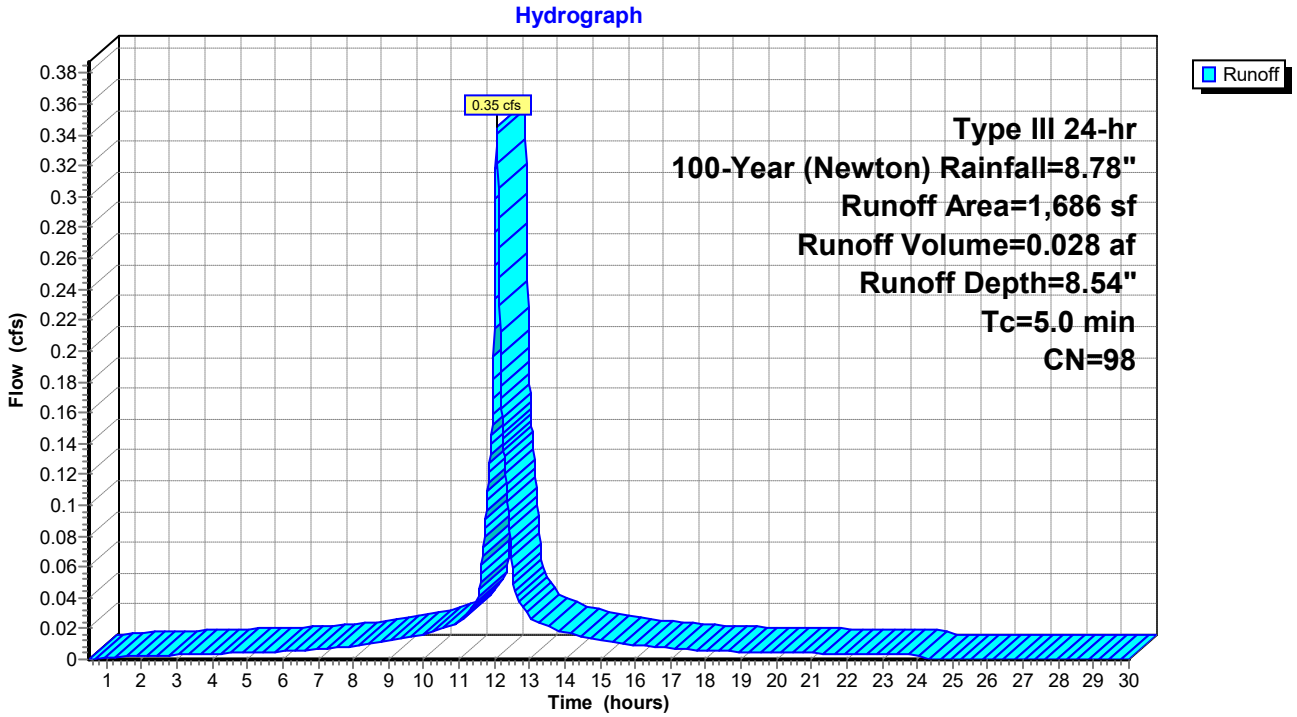
Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.028 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	1,686	98	Ex. Roof
	1,686		100.00% Impervious Area

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

Subcatchment PR1: Roof-1



Summary for Subcatchment PR2: Roof-2

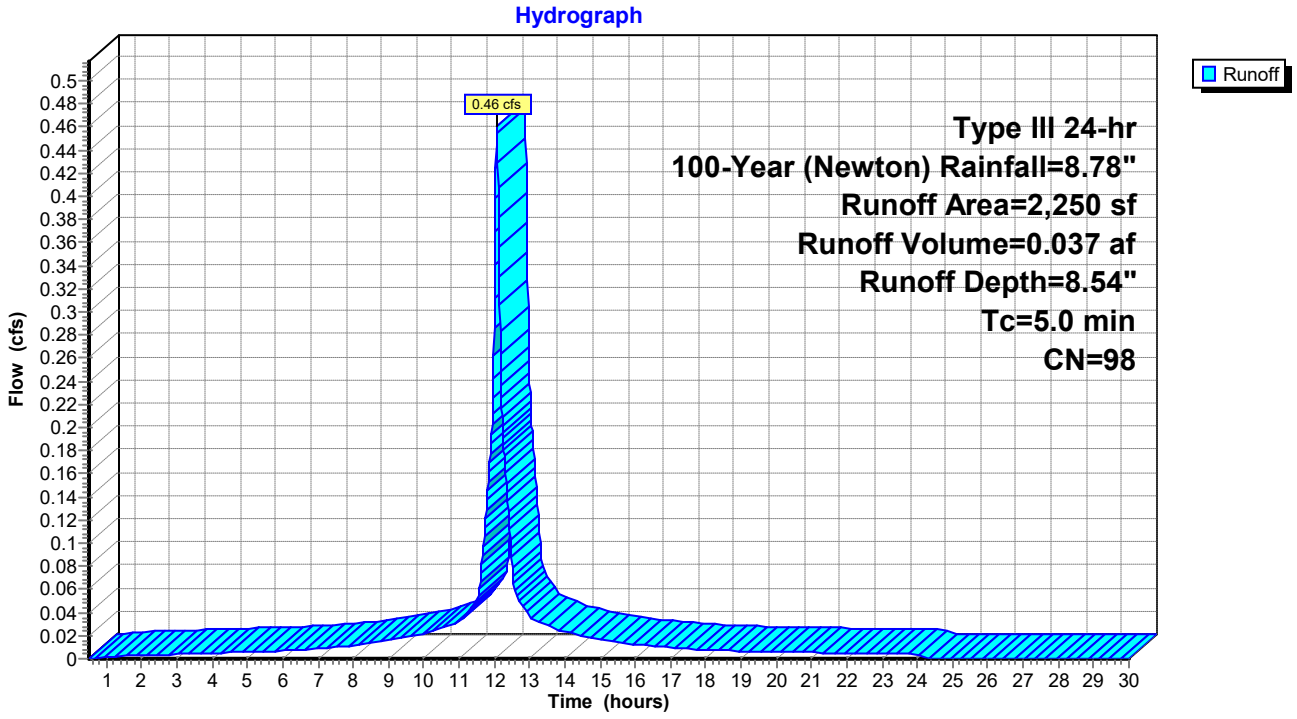
Runoff = 0.46 cfs @ 12.07 hrs, Volume= 0.037 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	1,778	98	PR-2&Ex. house-Roofs, HSG A
*	472	98	PR-2_Ex_Unconnected roofs, HSG A
	2,250	98	Weighted Average
	2,250		100.00% Impervious Area
	472		20.98% Unconnected

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

Subcatchment PR2: Roof-2



Summary for Subcatchment PR3: Roof-3

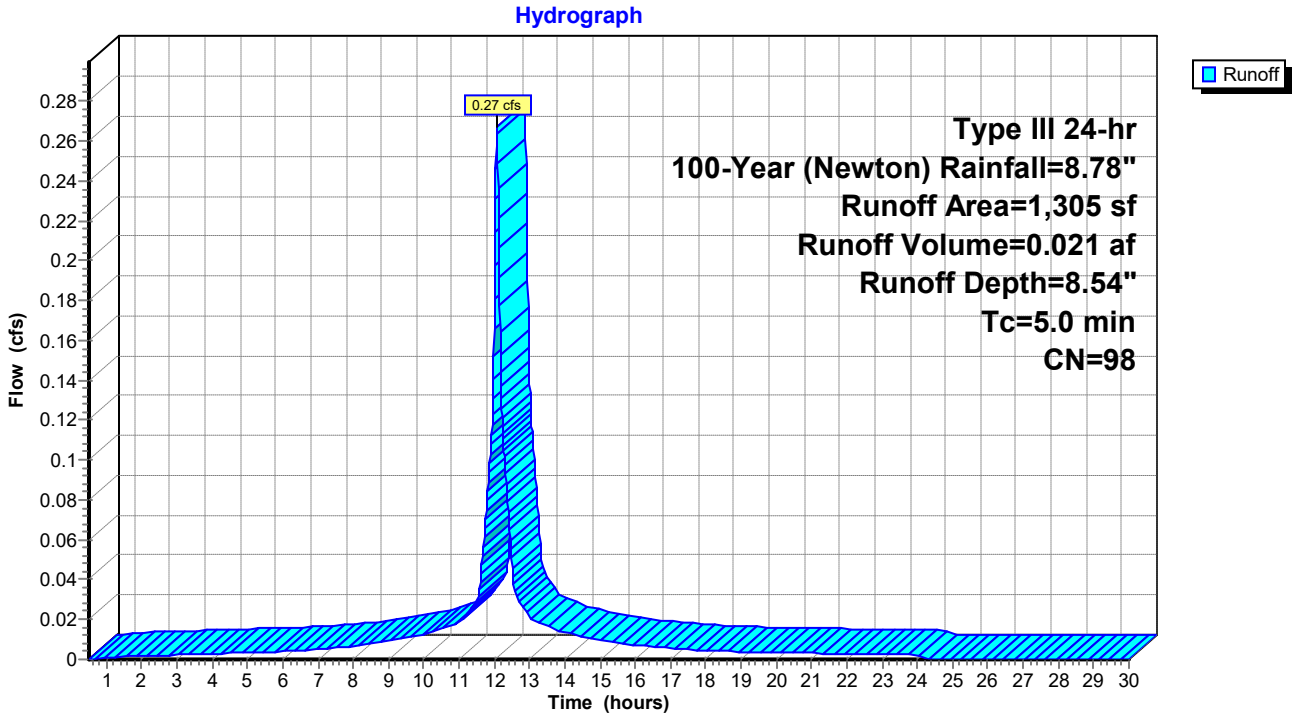
Runoff = 0.27 cfs @ 12.07 hrs, Volume= 0.021 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	1,305	98	Ex. Roof
	1,305		100.00% Impervious Area

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

Subcatchment PR3: Roof-3



Summary for Subcatchment PR4: Roof-4

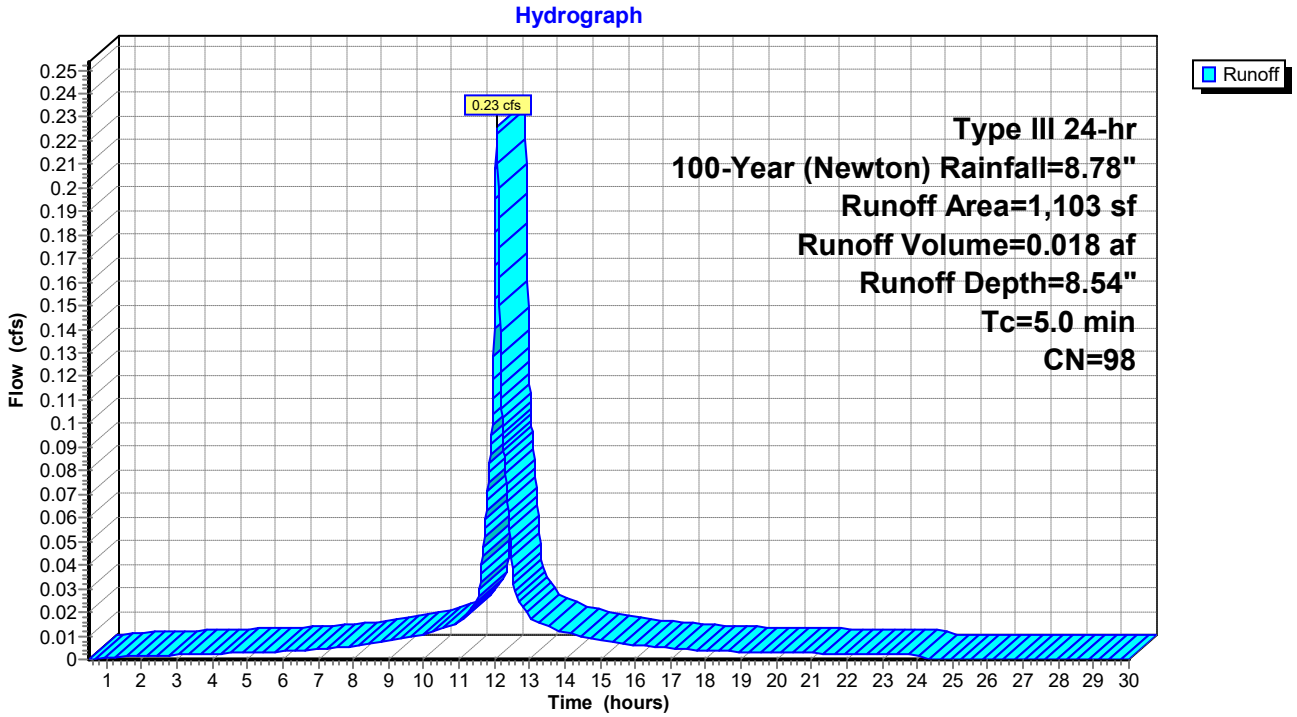
Runoff = 0.23 cfs @ 12.07 hrs, Volume= 0.018 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	1,103	98	Ex. Roof
	1,103		100.00% Impervious Area

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

Subcatchment PR4: Roof-4



Summary for Subcatchment PR5: Roof-5

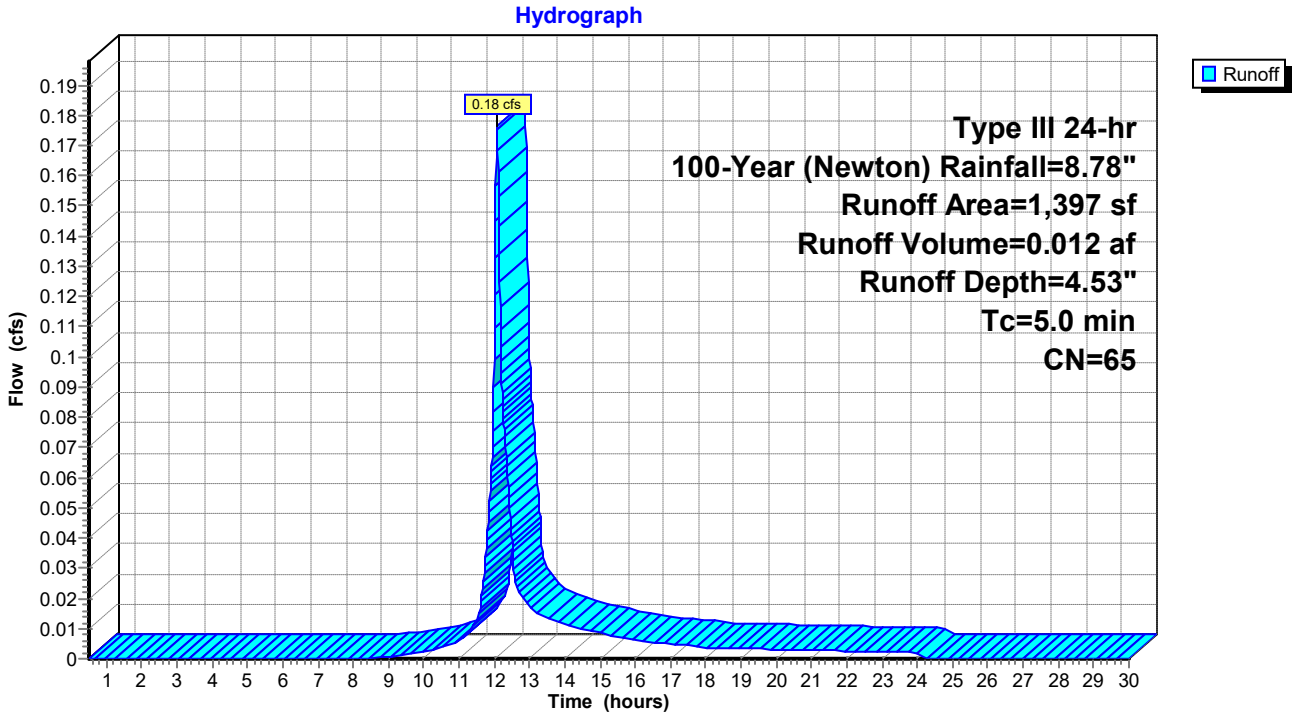
Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.012 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 100-Year (Newton) Rainfall=8.78"

	Area (sf)	CN	Description
*	605	98	wakways
	792	39	>75% Grass cover, Good, HSG A
	1,397	65	Weighted Average
	792		56.69% Pervious Area
	605		43.31% Impervious Area

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

Subcatchment PR5: Roof-5



Summary for Pond INF-1: Inf. System #1 Stormtech MC-3500

Inflow Area = 0.071 ac, 74.31% Impervious, Inflow Depth = 6.72" for 100-Year (Newton) event
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 0.040 af
Outflow = 0.02 cfs @ 10.93 hrs, Volume= 0.040 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.02 cfs @ 10.93 hrs, Volume= 0.040 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 153.26' @ 14.83 hrs Surf.Area= 0.009 ac Storage= 0.019 af

Plug-Flow detention time= 305.7 min calculated for 0.040 af (100% of inflow)
Center-of-Mass det. time= 305.7 min (1,072.6 - 766.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	150.00'	0.012 af	**8.42'W x 48.72'L x 5.25'H Field A** 0.049 af Overall - 0.016 af Embedded = 0.034 af x 35.0% Voids
#2A	151.00'	0.016 af	**ADS_StormTech MC-3500 d +Cap** x 6 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf
		0.028 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	150.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 10.93 hrs HW=150.05' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond INF-1: Inf. System #1 Stormtech MC-3500 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf

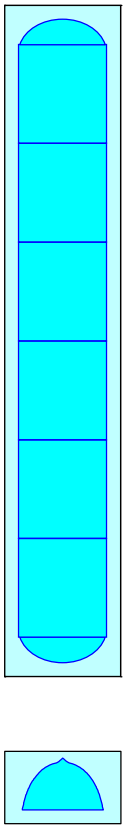
6 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 46.72' Row Length +12.0" End Stone x 2 = 48.72' Base Length
1 Rows x 77.0" Wide + 12.0" Side Stone x 2 = 8.42' Base Width
12.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.25' Field Height

6 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 1 Rows = 689.5 cf Chamber Storage

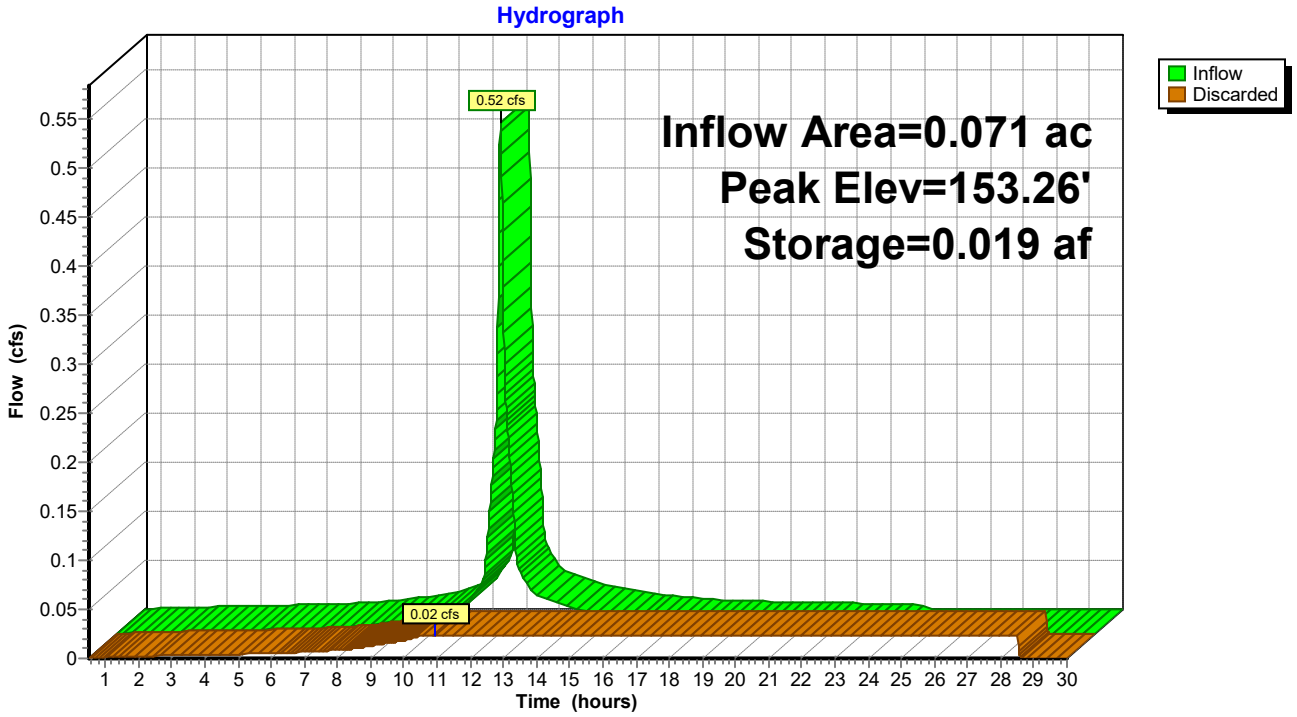
2,152.8 cf Field - 689.5 cf Chambers = 1,463.3 cf Stone x 35.0% Voids = 512.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,201.7 cf = 0.028 af
Overall Storage Efficiency = 55.8%
Overall System Size = 48.72' x 8.42' x 5.25'

6 Chambers
79.7 cy Field
54.2 cy Stone



Pond INF-1: Inf. System #1 Stormtech MC-3500



Summary for Pond INF-2: Inf. System #2 Stormtech MC-3500

Inflow Area = 0.052 ac,100.00% Impervious, Inflow Depth = 8.54" for 100-Year (Newton) event
Inflow = 0.46 cfs @ 12.07 hrs, Volume= 0.037 af
Outflow = 0.02 cfs @ 10.29 hrs, Volume= 0.037 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.02 cfs @ 10.29 hrs, Volume= 0.037 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 158.52' @ 14.63 hrs Surf.Area= 0.008 ac Storage= 0.017 af

Plug-Flow detention time= 311.2 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 311.2 min (1,050.3 - 739.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	0.010 af	**8.42'W x 41.55'L x 5.25'H Field A** 0.042 af Overall - 0.013 af Embedded = 0.029 af x 35.0% Voids
#2A	156.00'	0.013 af	**ADS_StormTech MC-3500 d +Cap** x 5 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf
		0.023 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	155.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 10.29 hrs HW=155.05' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond INF-2: Inf. System #2 Stormtech MC-3500 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 1 rows = 29.8 cf

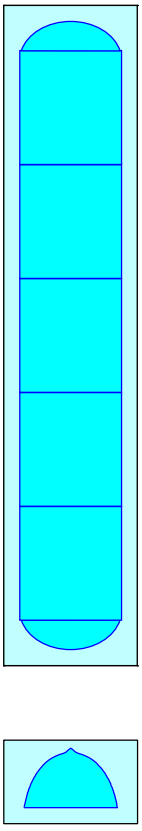
5 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 39.55' Row Length +12.0" End Stone x 2 = 41.55' Base Length
1 Rows x 77.0" Wide + 12.0" Side Stone x 2 = 8.42' Base Width
12.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.25' Field Height

5 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 1 Rows = 579.6 cf Chamber Storage

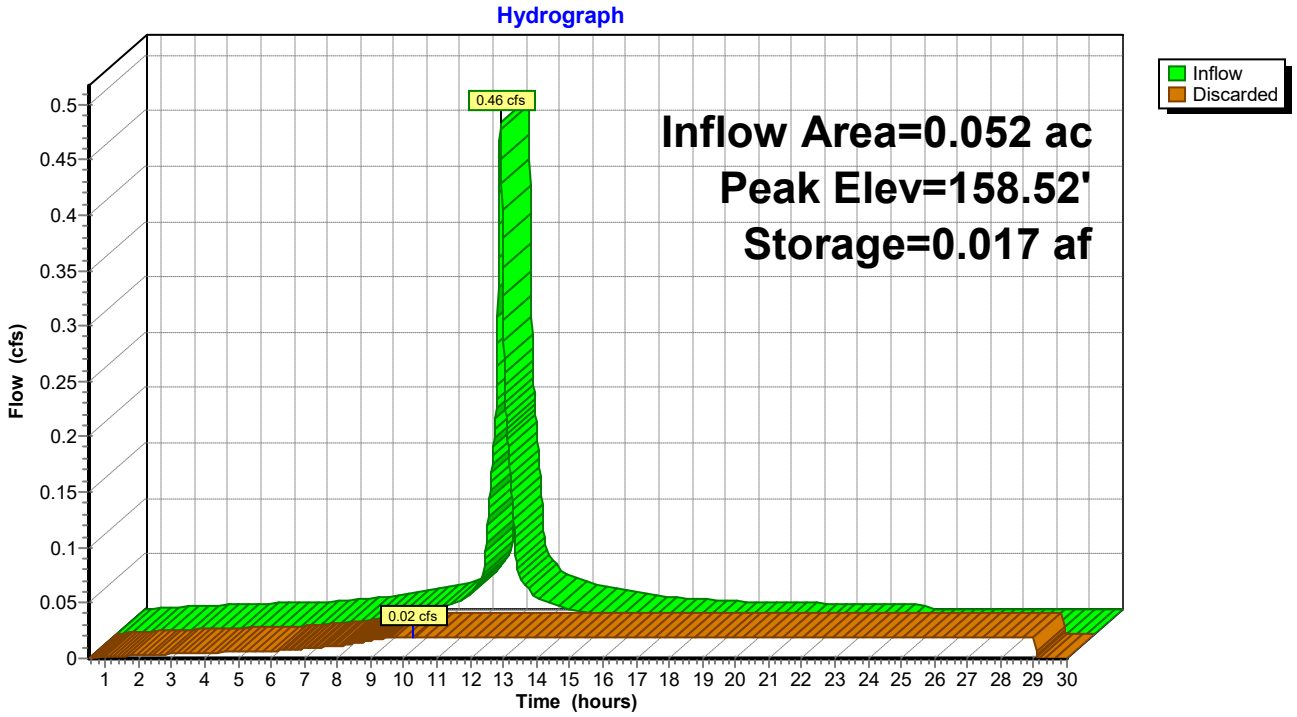
1,836.0 cf Field - 579.6 cf Chambers = 1,256.4 cf Stone x 35.0% Voids = 439.8 cf Stone Storage

Chamber Storage + Stone Storage = 1,019.3 cf = 0.023 af
Overall Storage Efficiency = 55.5%
Overall System Size = 41.55' x 8.42' x 5.25'

5 Chambers
68.0 cy Field
46.5 cy Stone



Pond INF-2: Inf. System #2 Stormtech MC-3500



Summary for Pond INF-3: Inf. System #3 Ameration Chamber

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth = 8.54" for 100-Year (Newton) event
Inflow = 0.49 cfs @ 12.07 hrs, Volume= 0.039 af
Outflow = 0.04 cfs @ 11.32 hrs, Volume= 0.039 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.32 hrs, Volume= 0.039 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 150.31' @ 13.13 hrs Surf.Area= 0.014 ac Storage= 0.014 af

Plug-Flow detention time= 127.5 min calculated for 0.039 af (100% of inflow)
Center-of-Mass det. time= 127.5 min (866.7 - 739.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	148.40'	0.010 af	**15.00'W x 42.00'L x 3.17'H Field A** 0.046 af Overall - 0.018 af Embedded = 0.028 af x 35.0% Voids
#2A	149.40'	0.010 af	**Concrete Galley 4x8x1.7** x 15 Inside #1 Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf 15 Chambers in 3 Rows
		0.020 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.40'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 11.32 hrs HW=148.43' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Pond INF-3: Inf. System #3 Ameration Chamber - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x1.7 (Ameration Chamber, NEPCA LE-AC or equivalent)
Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf
Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf

48.0" Wide + 6.0" Spacing = 54.0" C-C Row Spacing

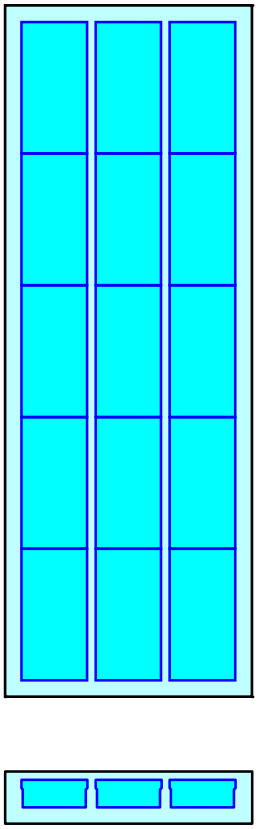
5 Chambers/Row x 8.00' Long = 40.00' Row Length +12.0" End Stone x 2 = 42.00' Base Length
3 Rows x 48.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.00' Base Width
12.0" Base + 20.0" Chamber Height + 6.0" Cover = 3.17' Field Height

15 Chambers x 30.3 cf = 454.3 cf Chamber Storage
15 Chambers x 51.9 cf = 778.6 cf Displacement

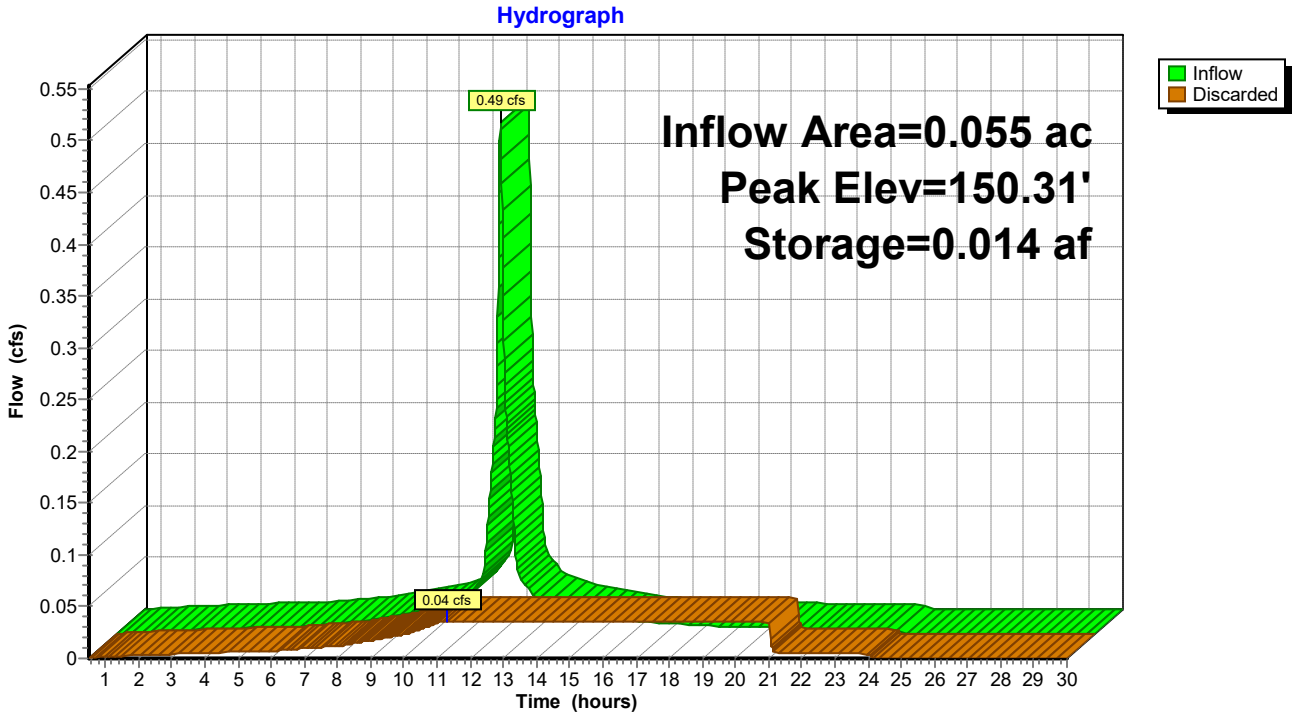
1,997.1 cf Field - 778.6 cf Chambers = 1,218.5 cf Stone x 35.0% Voids = 426.5 cf Stone Storage

Chamber Storage + Stone Storage = 880.7 cf = 0.020 af
Overall Storage Efficiency = 44.1%
Overall System Size = 42.00' x 15.00' x 3.17'

15 Chambers
74.0 cy Field
45.1 cy Stone



Pond INF-3: Inf. System #3 Ameration Chamber



Summary for Pond INF-4: Inf. System #4 Ameration Chamber

Inflow Area = 0.108 ac, 68.72% Impervious, Inflow Depth = 6.36" for 100-Year (Newton) event
Inflow = 0.82 cfs @ 12.07 hrs, Volume= 0.057 af
Outflow = 0.53 cfs @ 12.16 hrs, Volume= 0.057 af, Atten= 35%, Lag= 5.0 min
Discarded = 0.04 cfs @ 10.99 hrs, Volume= 0.032 af
Secondary = 0.49 cfs @ 12.16 hrs, Volume= 0.025 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Peak Elev= 150.32' @ 12.16 hrs Surf.Area= 649 sf Storage= 368 cf

Plug-Flow detention time= 21.3 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 21.3 min (819.8 - 798.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	149.00'	352 cf	**11.00'W x 59.00'L x 2.67'H Field A** 1,733 cf Overall - 727 cf Embedded = 1,006 cf x 35.0% Voids
#2A	150.00'	424 cf	**Concrete Galley 4x8x1.7** x 14 Inside #1 Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf 14 Chambers in 2 Rows
		776 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	149.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Secondary	149.60'	**6.0" Round Overflow** L= 48.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 149.60' / 149.35' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Discarded OutFlow Max=0.04 cfs @ 10.99 hrs HW=149.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Secondary OutFlow Max=0.49 cfs @ 12.16 hrs HW=150.32' TW=0.00' (Dynamic Tailwater)
↑**2=Overflow** (Barrel Controls 0.49 cfs @ 2.51 fps)

Pond INF-4: Inf. System #4 Ameration Chamber - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x1.7 (Ameration Chamber, NEPCA LE-AC or equivalent)
Inside= 41.0"W x 14.0"H => 4.08 sf x 7.42'L = 30.3 cf
Outside= 48.0"W x 20.0"H => 6.49 sf x 8.00'L = 51.9 cf

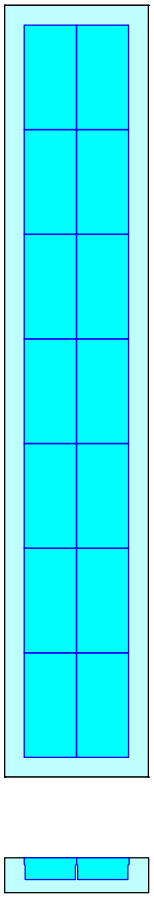
7 Chambers/Row x 8.00' Long = 56.00' Row Length +18.0" End Stone x 2 = 59.00' Base Length
2 Rows x 48.0" Wide + 18.0" Side Stone x 2 = 11.00' Base Width
12.0" Base + 20.0" Chamber Height = 2.67' Field Height

14 Chambers x 30.3 cf = 424.0 cf Chamber Storage
14 Chambers x 51.9 cf = 726.7 cf Displacement

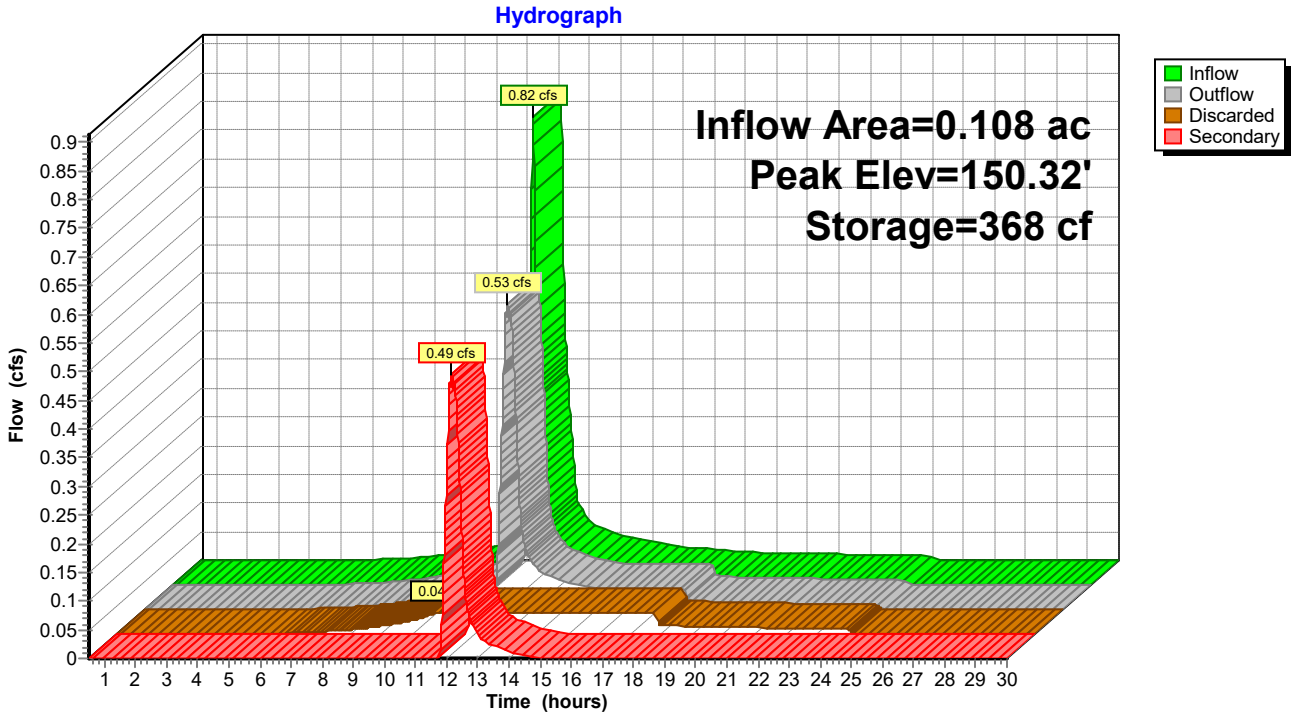
1,732.8 cf Field - 726.7 cf Chambers = 1,006.1 cf Stone x 35.0% Voids = 352.1 cf Stone Storage

Chamber Storage + Stone Storage = 776.1 cf = 0.018 af
Overall Storage Efficiency = 44.8%
Overall System Size = 59.00' x 11.00' x 2.67'

14 Chambers
64.2 cy Field
37.3 cy Stone



Pond INF-4: Inf. System #4 Ameration Chamber

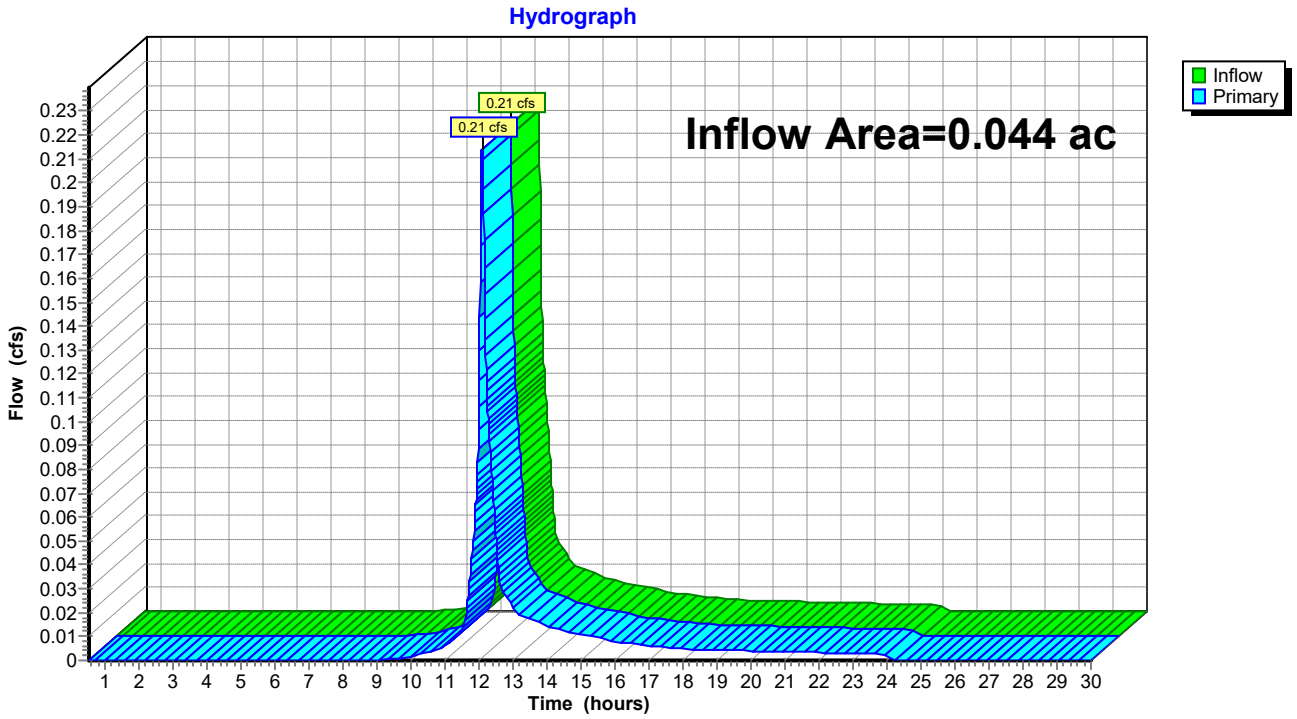


Summary for Link POD1: Warren Street (South)

Inflow Area = 0.044 ac, 36.97% Impervious, Inflow Depth = 4.05" for 100-Year (Newton) event
Inflow = 0.21 cfs @ 12.08 hrs, Volume= 0.015 af
Primary = 0.21 cfs @ 12.08 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD1: Warren Street (South)

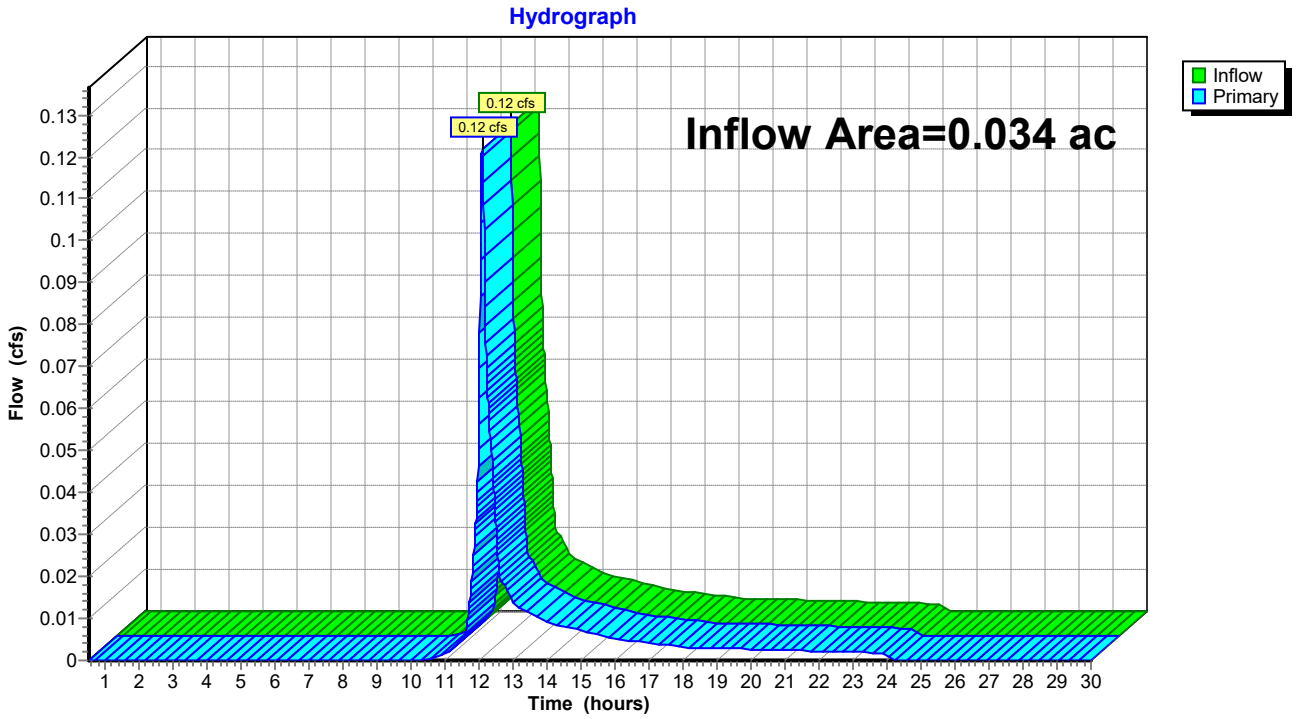


Summary for Link POD1.: Warren Street (South)

Inflow Area = 0.034 ac, 24.40% Impervious, Inflow Depth = 3.09" for 100-Year (Newton) event
Inflow = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af
Primary = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD1.: Warren Street (South)

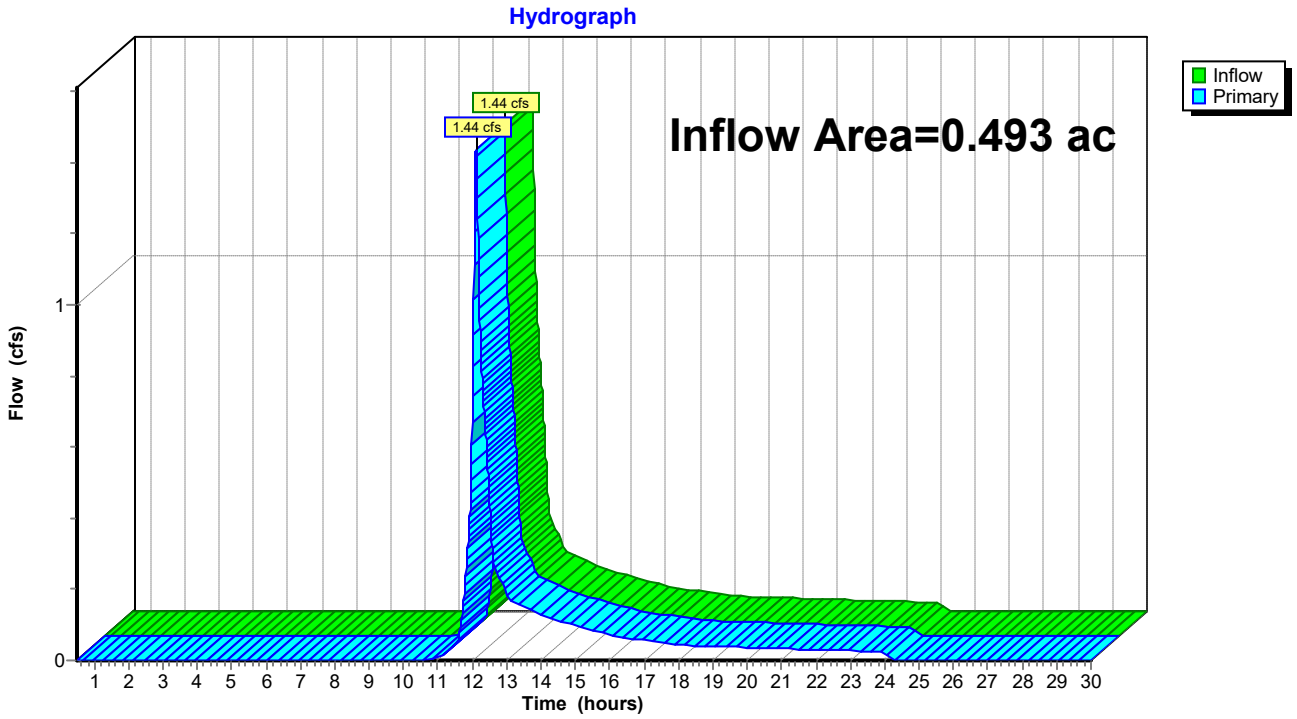


Summary for Link POD2: North Abutter (MBTA)

Inflow Area = 0.493 ac, 24.07% Impervious, Inflow Depth = 2.74" for 100-Year (Newton) event
Inflow = 1.44 cfs @ 12.11 hrs, Volume= 0.113 af
Primary = 1.44 cfs @ 12.11 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD2: North Abutter (MBTA)

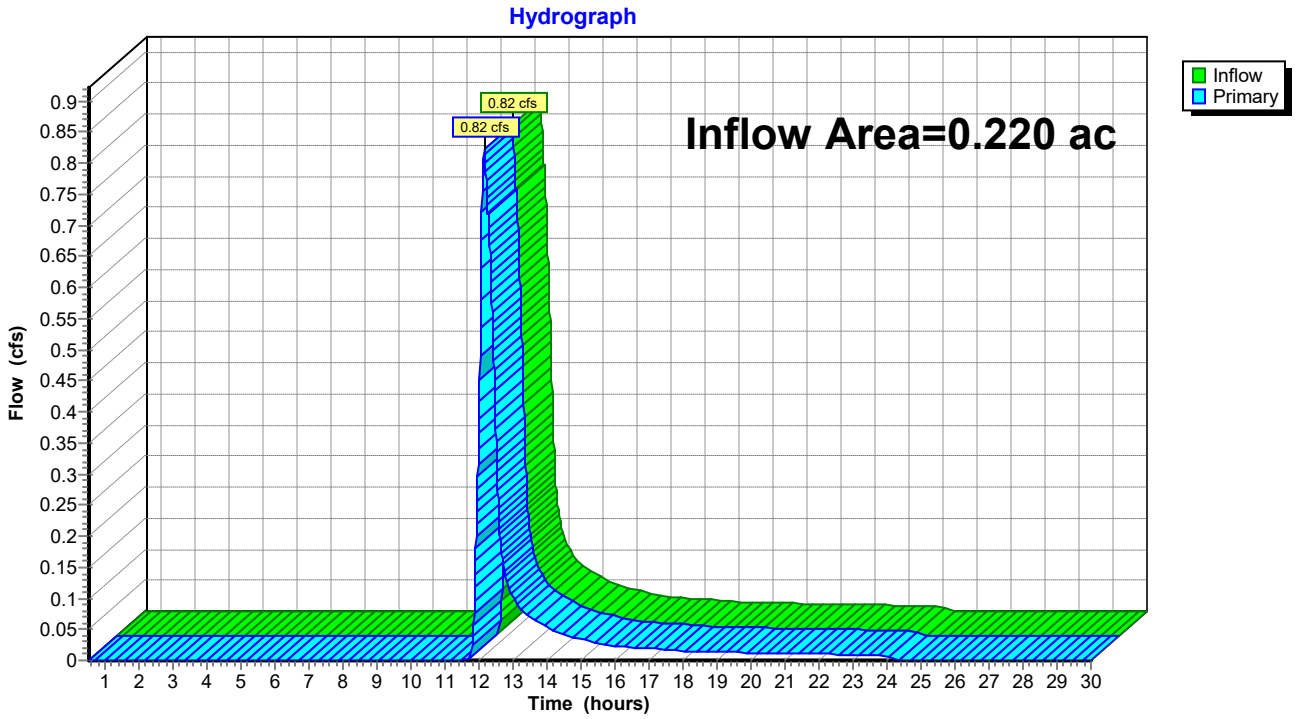


Summary for Link POD2.: North Abutter (MBTA)

Inflow Area = 0.220 ac, 3.34% Impervious, Inflow Depth = 3.09" for 100-Year (Newton) event
Inflow = 0.82 cfs @ 12.14 hrs, Volume= 0.057 af
Primary = 0.82 cfs @ 12.14 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs

Link POD2.: North Abutter (MBTA)



OPERATION & MAINTENANCE PLAN
145 WARREN STREET
NEWTON, MASSACHUSETTS

January 25, 2021

VTP Associates, Inc.
132 Adams Street
2nd Floor, Suite 3
Newton Massachusetts 02465
1-617-332-8271
Job # 217115

OPERATION & MAINTENANCE PLAN
145 WARREN STREET
NEWTON, MASSACHUSETTS

The proposed project includes stormwater runoff controls associated with the redevelopment of the existing site into a new residential development that will require continued maintenance by the property owner. The major components associated with maintenance needs are the catch basins and infiltration systems. These will need to be cleaned periodically as noted below. Cleaning of these structures shall be done by the developer & property owners via a specialty contractor with hydraulic cleaning ability. In addition to the facilities noted below, the property owner should maintain any roof gutters/drains on a regular basis to prevent clogging and carry over of debris into the driveway system. The property owner should also provide for the periodic cleaning of the driveway areas to remove large debris, grass cuttings and sand particles prior to discharge through the catch basin units. The following outlines the major maintenance issues associated with the project:

Catch basin Cleaning:

The catch basin structures should be inspected after completion of construction to assure that all debris was removed and no construction material will be cause the system to clog. This inspection should also include the drain lines within the system.

The catch basin sumps should be inspect quarterly; if depth of sediment in sumps exceeds 50% capacity, sediment must be removed. The catch basin should be cleaned with a hydraulic vacuum system two (2) times per year (spring and fall season) to remove accumulated solids and debris. At the same time, the drain lines should be inspected and cleaned if needed. Assuming the catch basins, and drain lines are maintained and cleaning is in accordance with normal standards, the solids removal efficiency should be as required to prevent carry over of large solids to the infiltration systems.

Storage / Infiltration System

The storage/infiltration system should be inspected after completion of construction to assure that all debris was removed and no construction material will be cause the system to clog.

The storage/infiltration system should be inspected over the first year of operation on a quarterly basis to determine the level of required maintenance. This inspection should be performed by the Owner's Engineer and a report issued to the City as to any cleaning / maintenance needs of that system. At the same time, the inspection of the catch basins and piping should be performed to determine any flushing / cleaning needs. As a preliminary schedule, the system piping should be cleaned once a year to remove accumulated sediments and sediments in the infiltration chambers should be removed when they reach two (2) inches in depth.

Maintenance Responsibilities

The maintenance of the Drainage System is the responsibility of the Property Owner(s), via their owners association. The actual work should be subcontracted to a company that specializes in the cleaning of storm drainage facilities. Inspections should be performed by independent individual such as the design engineer or other experienced individual in the field.

OPERATION & MAINTENANCE PLAN
145 WARREN STREET
NEWTON, MASSACHUSETTS

INSPECTION REPORT:

Inspection Firm: _____

Inspectors Name: _____ Date: _____

Components Inspected: _____
_____

Signed: _____

SYSTEM MAINTENANCE:

Maintenance Firm: _____ Date: _____

Catch basins Cleaned: Yes ____ No ____ Comments _____
_____
_____

Drain lines Inspected: Yes ____ No ____ Comments: _____
_____
_____

Infiltration System(s) Cleaned: Yes ____ No ____ Comments: _____
_____
_____

Estimate of Material Removed: _____

Other Comments: _____
_____

Signed: _____