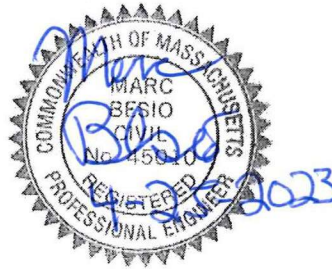


DRAINAGE REPORT
280 Nevada Street
Newton, Massachusetts



Date: April 25, 2023

Prepared by:
Natalie Doyle

Reviewed by:
Marc Besio, PE, SIT

VTP Associates, Inc.
132 Adams Street
2nd Floor, Suite 3
Newton, Massachusetts 02465
1-617-332-8271
Job # 222183

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INTRODUCTION

VTP Associates has performed a stormwater management analysis to evaluate the post-development impacts created by the proposed residential development at #280 Nevada Street, Newton, Massachusetts. The project will include the demolition of the existing and rebuilding a new house. The new residence building will include a total of two 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, 25 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:

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Test pits were conducted and determined that the site consists of a moderately 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 8.27in/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, 25, 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	3.10
10-year	4.50
25-year	5.30
100-year	8.78

HYDROLOGICAL ANALYSIS

PRE-DEVELOPMENT	Design point A1			
	POD1			
Building	3,289.2 s.f.			
Driveway	6,646.0 s.f.			
Other	5,736.0 s.f.			
Grass	13,878.8 s.f.			
Wooded				
Total impervious areas	15,671.2 s.f.			
Total pervious areas	13,878.8 s.f.			
Total areas	29,550.0 s.f.			

POST-DEVELOPMENT	Design point A1			
	POD1	IS #1	IS #2	IS #3
Building		2,259.8 s.f.	3,360.0 s.f.	1,120.0 s.f.
Driveway		2,237.9 s.f.		4,038.4 s.f.
Other	452.0 s.f.	38.3 s.f.		
Grass	16,043.7			
Wooded				
Total impervious areas	13,506.3 s.f.	4,536.0 s.f.	3,360.0 s.f.	5,158.4 s.f.
Total pervious areas	16,043.7 s.f.	0.0 s.f.	0.0 s.f.	0.0 s.f.
Total areas	29,550.0 s.f.			

Pre-Development Conditions

The existing site consists of a three-story wood building, driveway, walkway, patio and landscape areas.

Approximately 15,671.2 s.f.(53.0%) of the site is impervious cover.

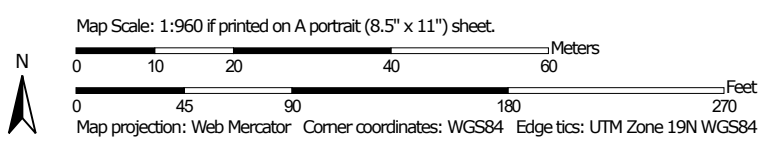
The site is bound by residential buildings and by Albemarle Road.

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 the south-west (POD1). These areas are shown on the table above.

Soil Map—Middlesex County, Massachusetts
(VTP Associates, Inc.)



Soil Map may not be valid at this scale.



Middlesex County, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9

Elevation: 0 to 820 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 250 days

Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent

Urban land: 40 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames

Landform position (two-dimensional): Summit, shoulder, backslope, footslope

Landform position (three-dimensional): Crest, side slope, riser, tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam

Bw1 - 10 to 22 inches: fine sandy loam

Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand

2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water

(Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

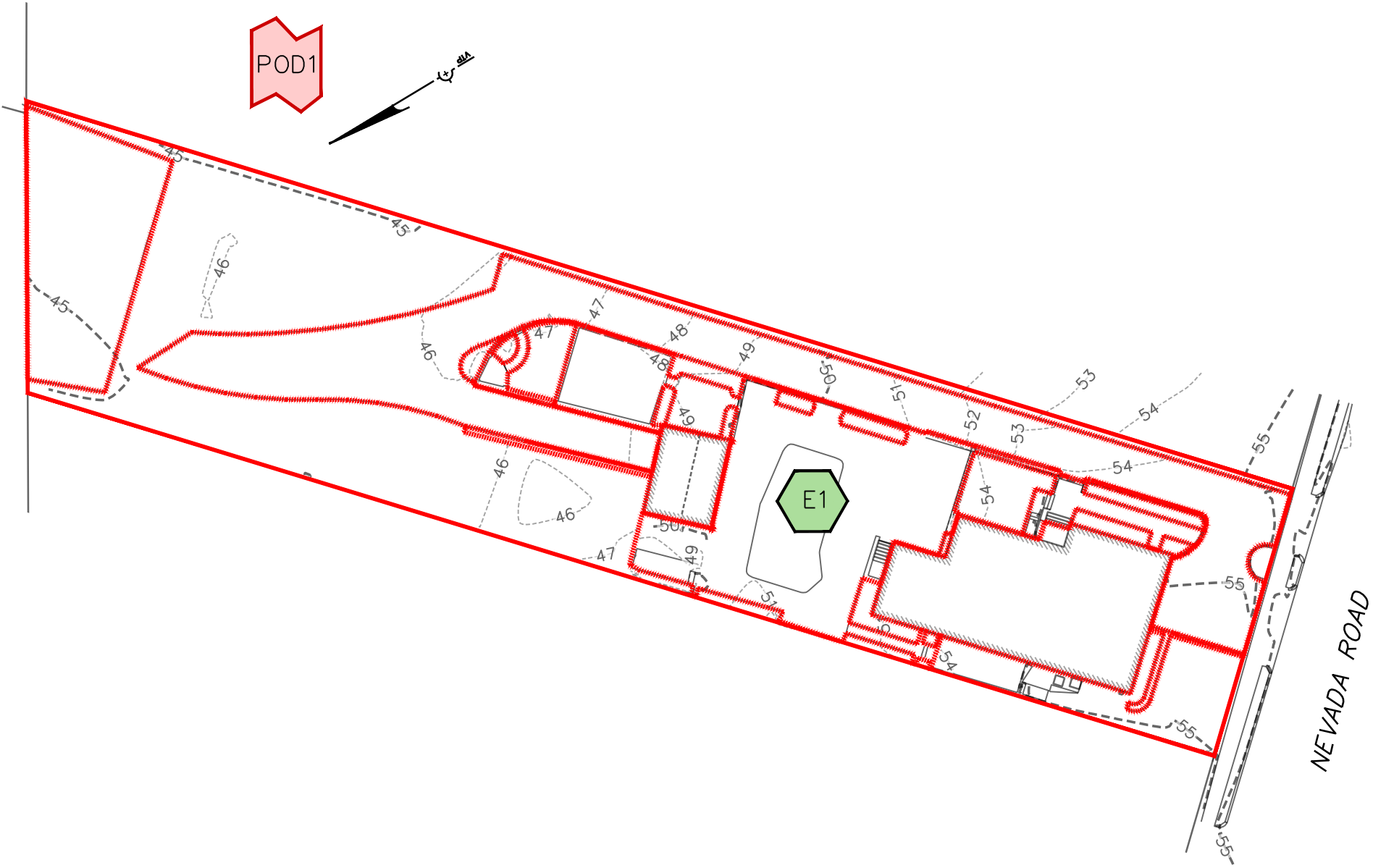
Frequency of flooding: None

Frequency of ponding: None

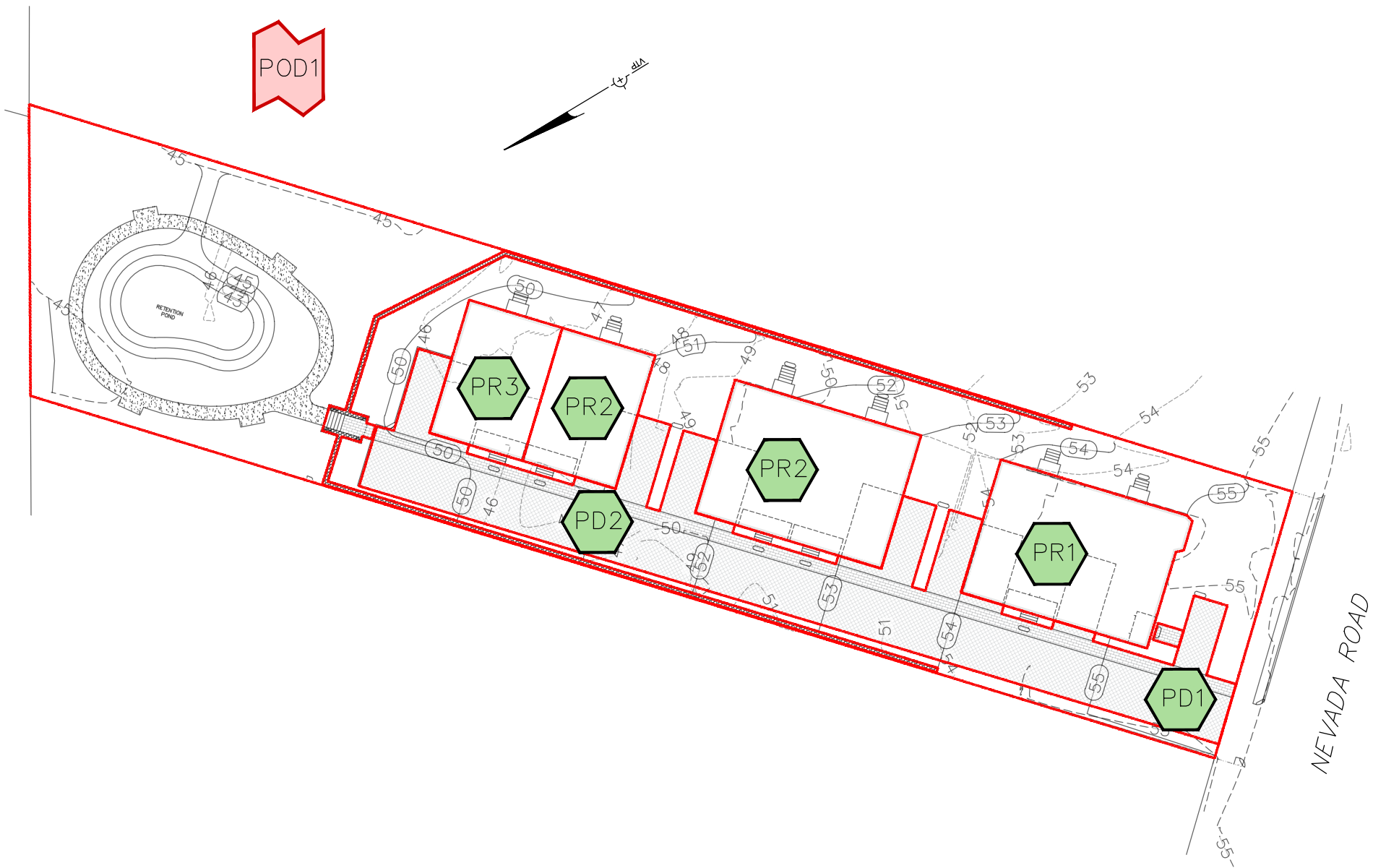
Calcium carbonate, maximum content: 2 percent

Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)

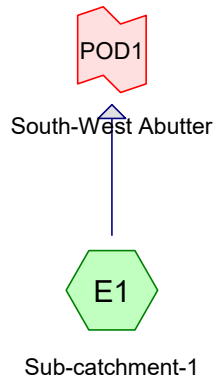
PRE-DEVELOPMENT



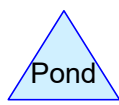
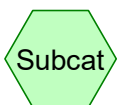
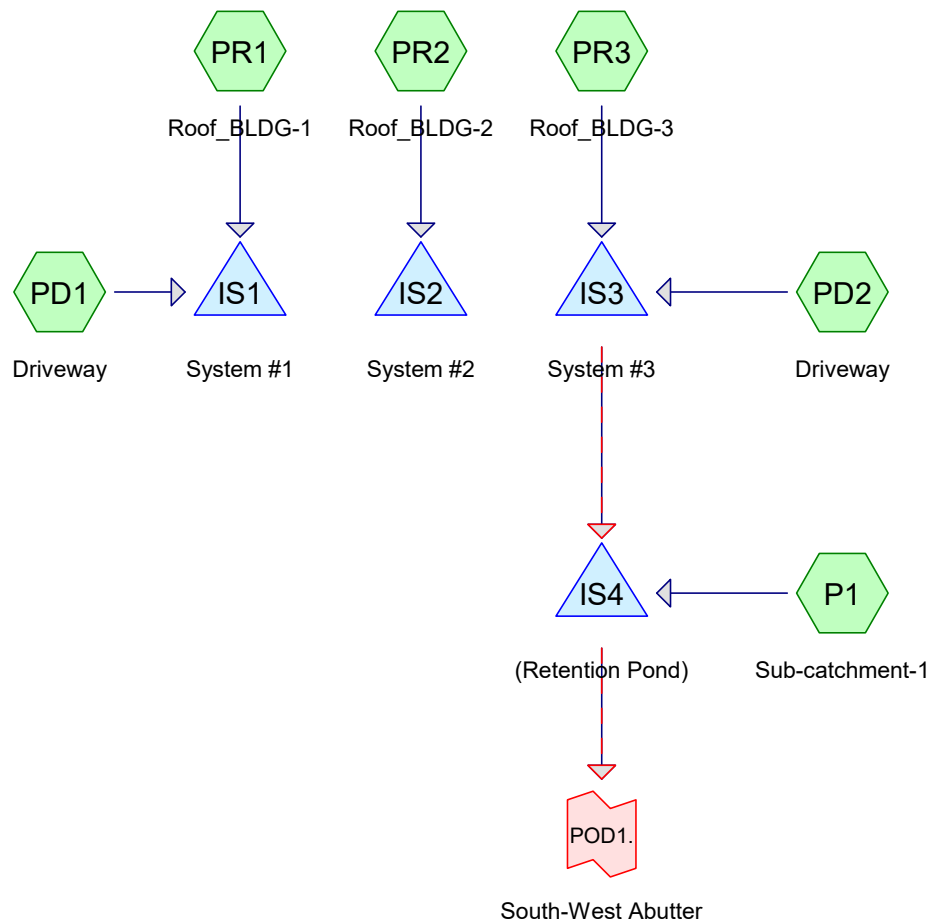
POST-DEVELOPMENT



**PRE-DEVELOPMENT
CONDITIONS**



**POST-DEVELOPMENT
CONDITIONS**



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.678	68	<50% Grass cover, Poor, HSG A (E1)
0.060	39	>75% Grass cover, Good, HSG A (P1)
0.020	76	Gravel roads, HSG A (P1)
0.144	98	Paved parking, HSG A (PD1, PD2)
0.001	65	Paver walkway (PD1)
0.155	98	Roofs, HSG A (PR1, PR2, PR3)
0.085	36	Woods, Fair, HSG A (P1)
1.143	72	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.142	HSG A	E1, P1, PD1, PD2, PR1, PR2, PR3
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.001	Other	PD1
1.143		TOTAL AREA

222183-hydrocad

Prepared by VTP ASSOCIATES

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Printed 4/24/2023

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.678	0.000	0.000	0.000	0.000	0.678	<50% Grass cover, Poor	E1
0.060	0.000	0.000	0.000	0.000	0.060	>75% Grass cover, Good	P1
0.020	0.000	0.000	0.000	0.000	0.020	Gravel roads	P1
0.144	0.000	0.000	0.000	0.000	0.144	Paved parking	PD1, PD2
0.000	0.000	0.000	0.000	0.001	0.001	Paver walkway	PD1
0.155	0.000	0.000	0.000	0.000	0.155	Roofs	PR1, PR2, PR3
0.085	0.000	0.000	0.000	0.000	0.085	Woods, Fair	P1
1.142	0.000	0.000	0.000	0.001	1.143	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	IS3	46.80	45.00	72.0	0.0250	0.012	8.0	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=29,550 sf 0.00% Impervious Runoff Depth=0.68" Tc=5.0 min CN=68 Runoff=0.47 cfs 0.038 af
Subcatchment P1: Sub-catchment-1	Runoff Area=7,199 sf 0.00% Impervious Runoff Depth=0.01" Tc=5.0 min CN=42 Runoff=0.00 cfs 0.000 af
Subcatchment PD1: Driveway	Runoff Area=2,276 sf 98.33% Impervious Runoff Depth=2.76" Tc=5.0 min CN=97 Runoff=0.16 cfs 0.012 af
Subcatchment PD2: Driveway	Runoff Area=4,038 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.29 cfs 0.022 af
Subcatchment PR1: Roof_BLDG-1	Runoff Area=2,260 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.16 cfs 0.012 af
Subcatchment PR2: Roof_BLDG-2	Runoff Area=3,360 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.24 cfs 0.018 af
Subcatchment PR3: Roof_BLDG-3	Runoff Area=1,120 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.08 cfs 0.006 af
Pond IS1: System #1	Peak Elev=48.01' Storage=198 cf Inflow=0.32 cfs 0.024 af Outflow=0.08 cfs 0.024 af
Pond IS2: System #2	Peak Elev=46.46' Storage=147 cf Inflow=0.24 cfs 0.018 af Outflow=0.06 cfs 0.018 af
Pond IS3: System #3	Peak Elev=44.24' Storage=286 cf Inflow=0.37 cfs 0.028 af Discarded=0.07 cfs 0.028 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.028 af
Pond IS4: (Retention Pond)	Peak Elev=43.01' Storage=5 cf Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Link POD1: South-West Abutter	Inflow=0.47 cfs 0.038 af Primary=0.47 cfs 0.038 af
Link POD1.: South-West Abutter	Inflow=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.143 ac Runoff Volume = 0.110 af Average Runoff Depth = 1.15"
73.87% Pervious = 0.845 ac 26.13% Impervious = 0.299 ac

Summary for Subcatchment E1: Sub-catchment-1

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 0.038 af, Depth= 0.68"

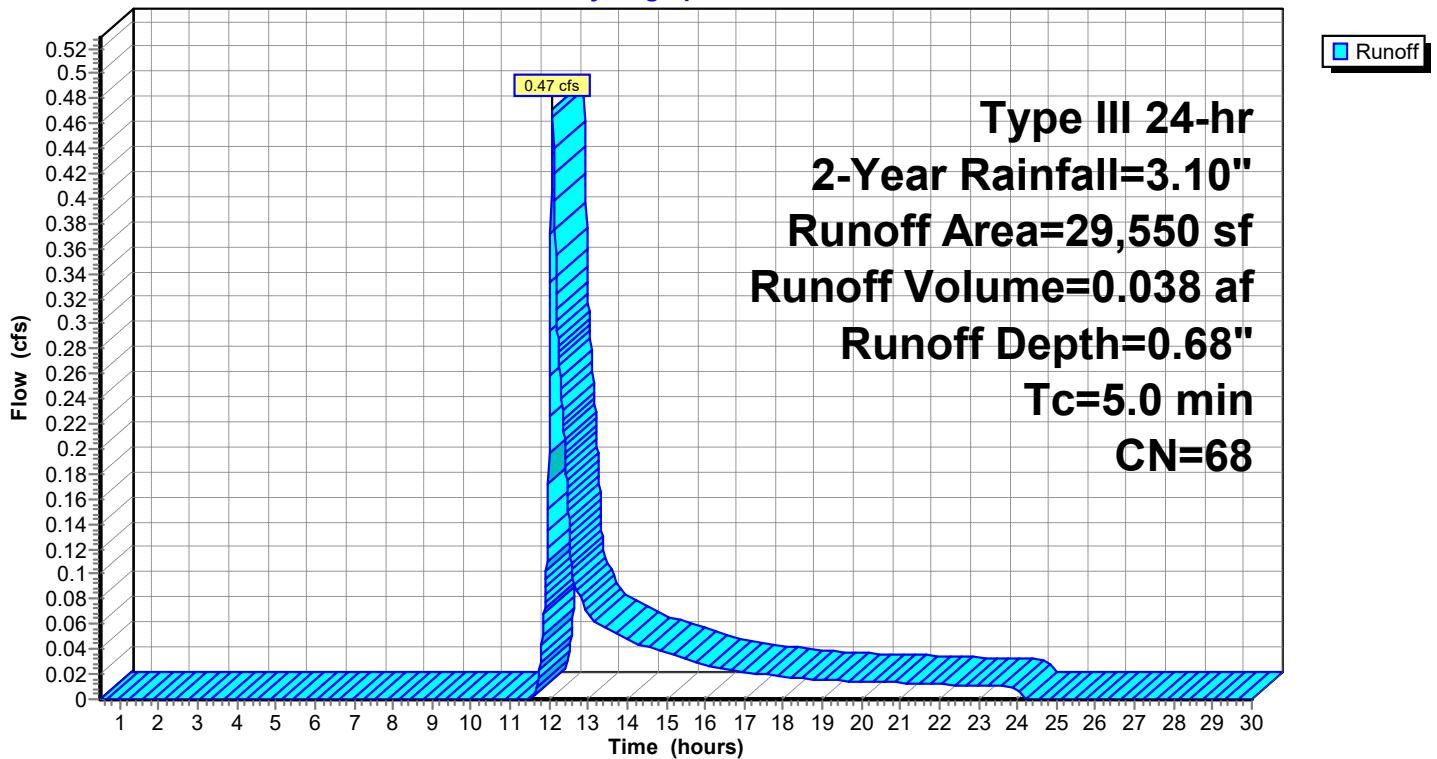
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
29,550	68	<50% Grass cover, Poor, HSG A
29,550		100.00% Pervious Area

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

Subcatchment E1: Sub-catchment-1

Hydrograph



Summary for Subcatchment P1: Sub-catchment-1

Runoff = 0.00 cfs @ 22.35 hrs, Volume= 0.000 af, Depth= 0.01"

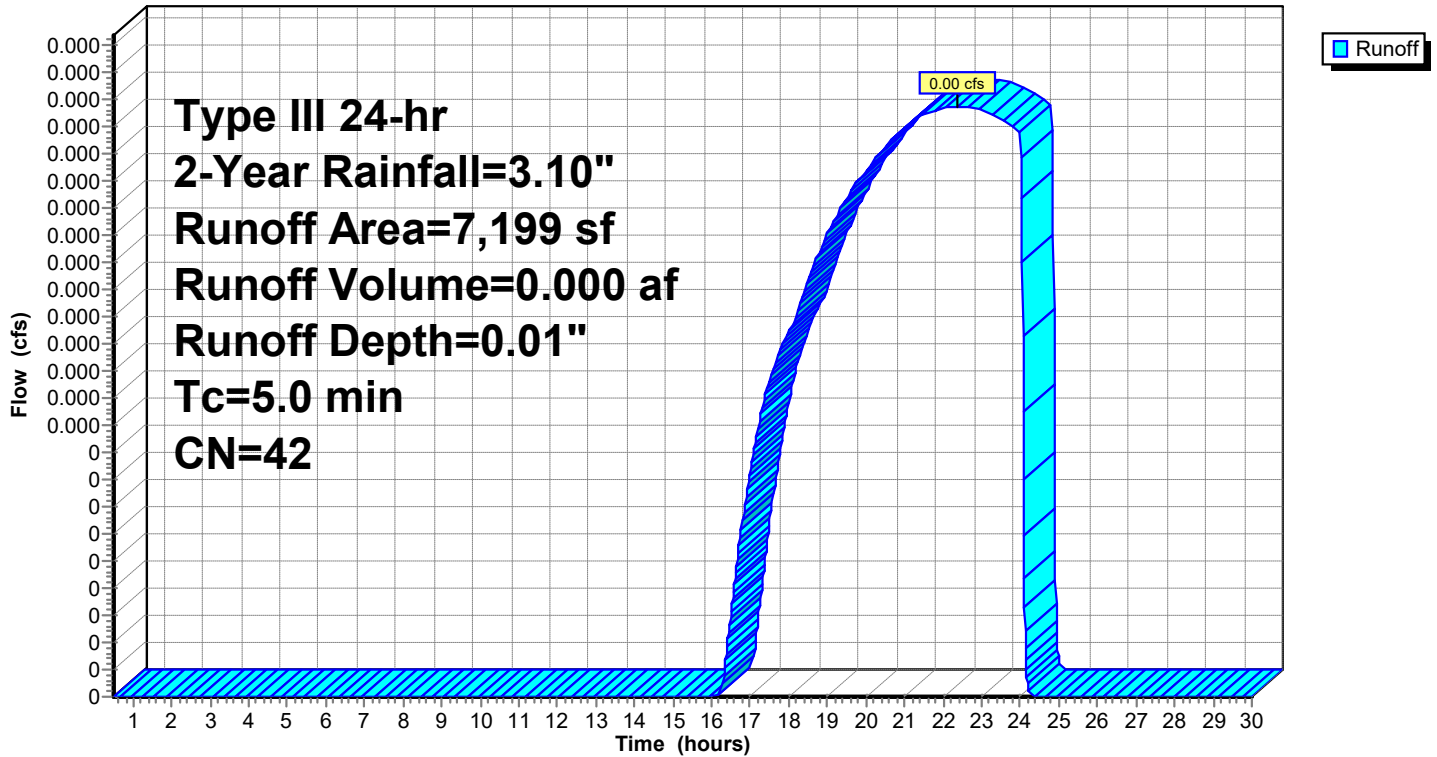
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,623	39	>75% Grass cover, Good, HSG A
3,705	36	Woods, Fair, HSG A
871	76	Gravel roads, HSG A
7,199	42	Weighted Average
7,199		100.00% Pervious Area

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

Subcatchment P1: Sub-catchment-1

Hydrograph



Summary for Subcatchment PD1: Driveway

Runoff = 0.16 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 2.76"

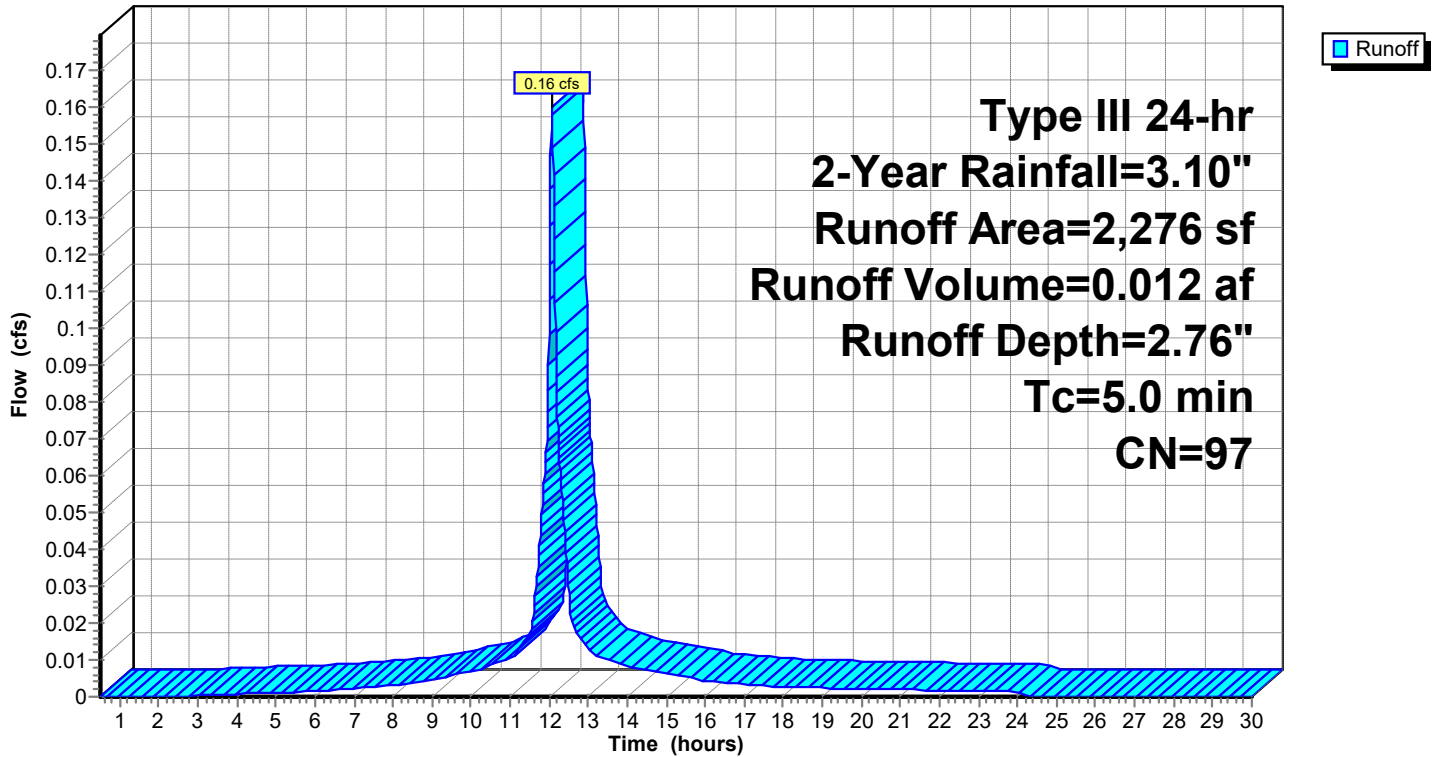
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,238	98	Paved parking, HSG A
* 38	65	Paver walkway
2,276	97	Weighted Average
38		1.67% Pervious Area
2,238		98.33% Impervious Area

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

Subcatchment PD1: Driveway

Hydrograph



Summary for Subcatchment PD2: Driveway

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 0.022 af, Depth= 2.87"

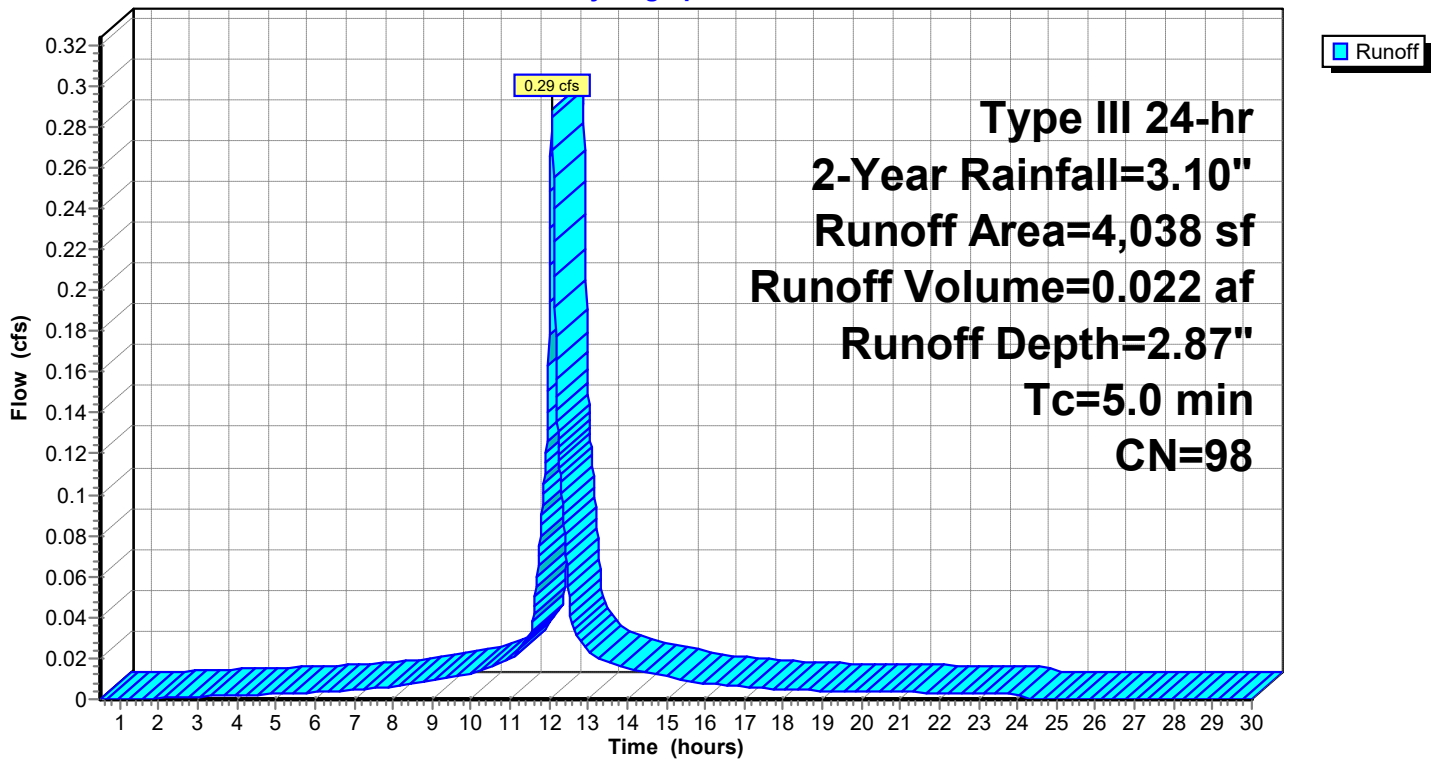
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
4,038	98	Paved parking, HSG A
4,038		100.00% Impervious Area

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

Subcatchment PD2: Driveway

Hydrograph



Summary for Subcatchment PR1: Roof_BLDG-1

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

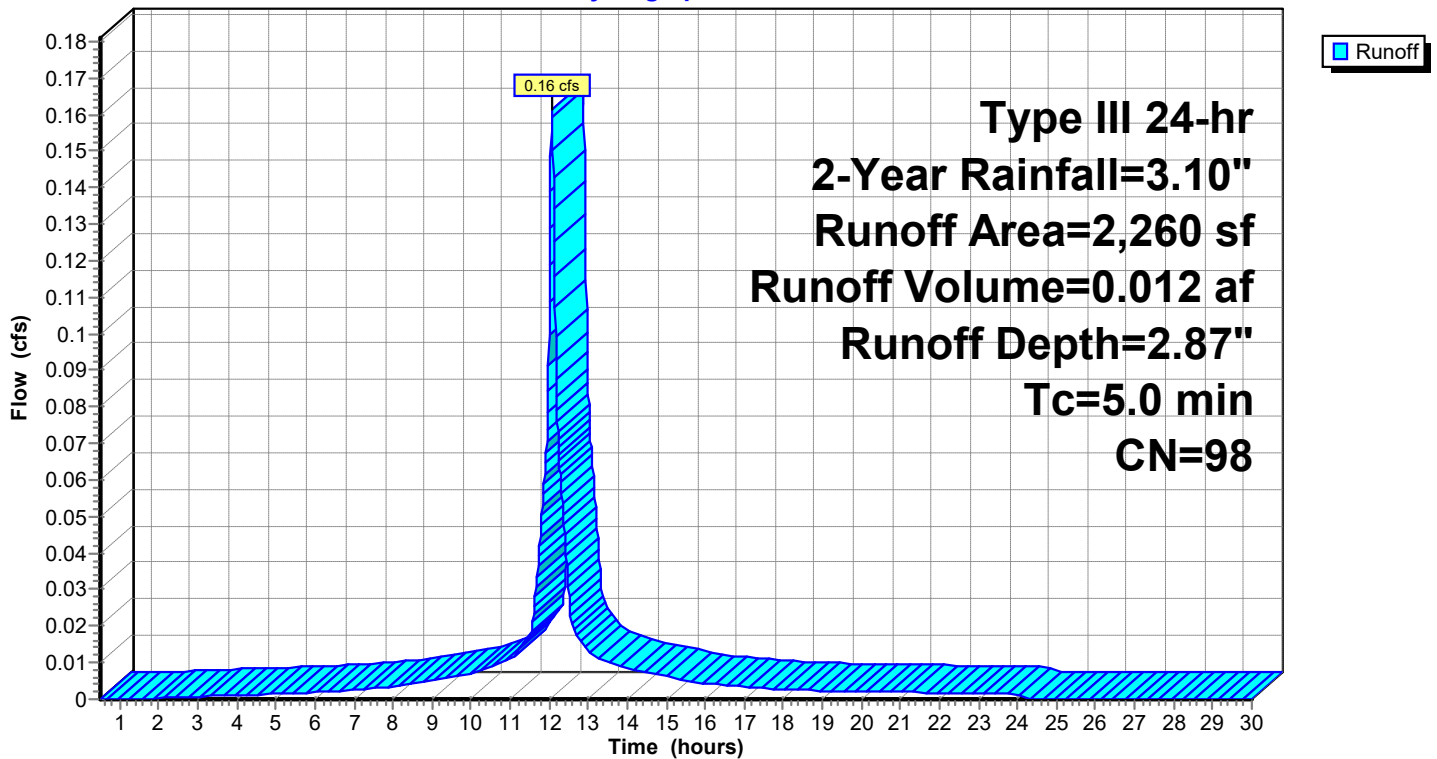
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
* 2,260	98	Roofs, HSG A
2,260		100.00% Impervious Area

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

Subcatchment PR1: Roof_BLDG-1

Hydrograph



Summary for Subcatchment PR2: Roof_BLDG-2

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af, Depth= 2.87"

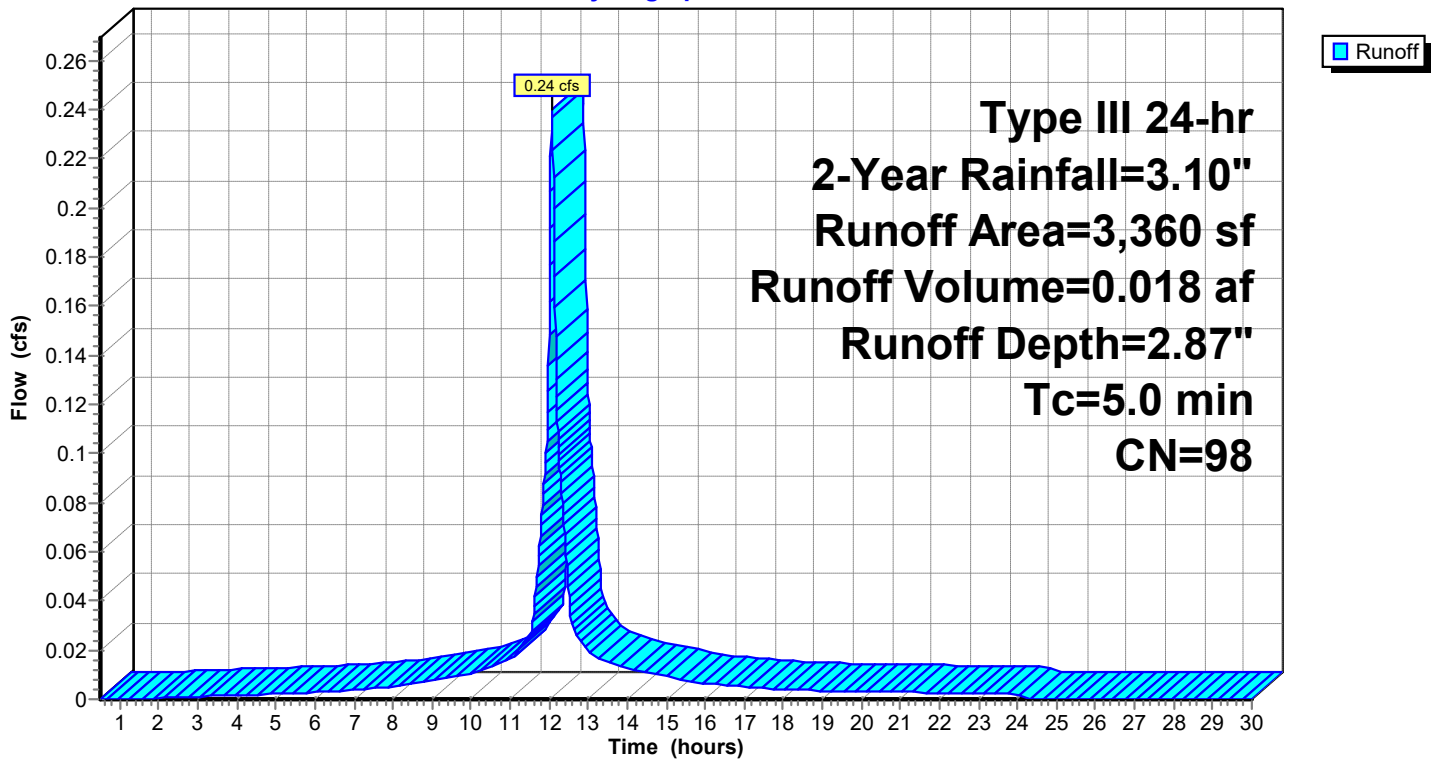
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
* 3,360	98	Roofs, HSG A
3,360		100.00% Impervious Area

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

Subcatchment PR2: Roof_BLDG-2

Hydrograph



Summary for Subcatchment PR3: Roof_BLDG-3

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

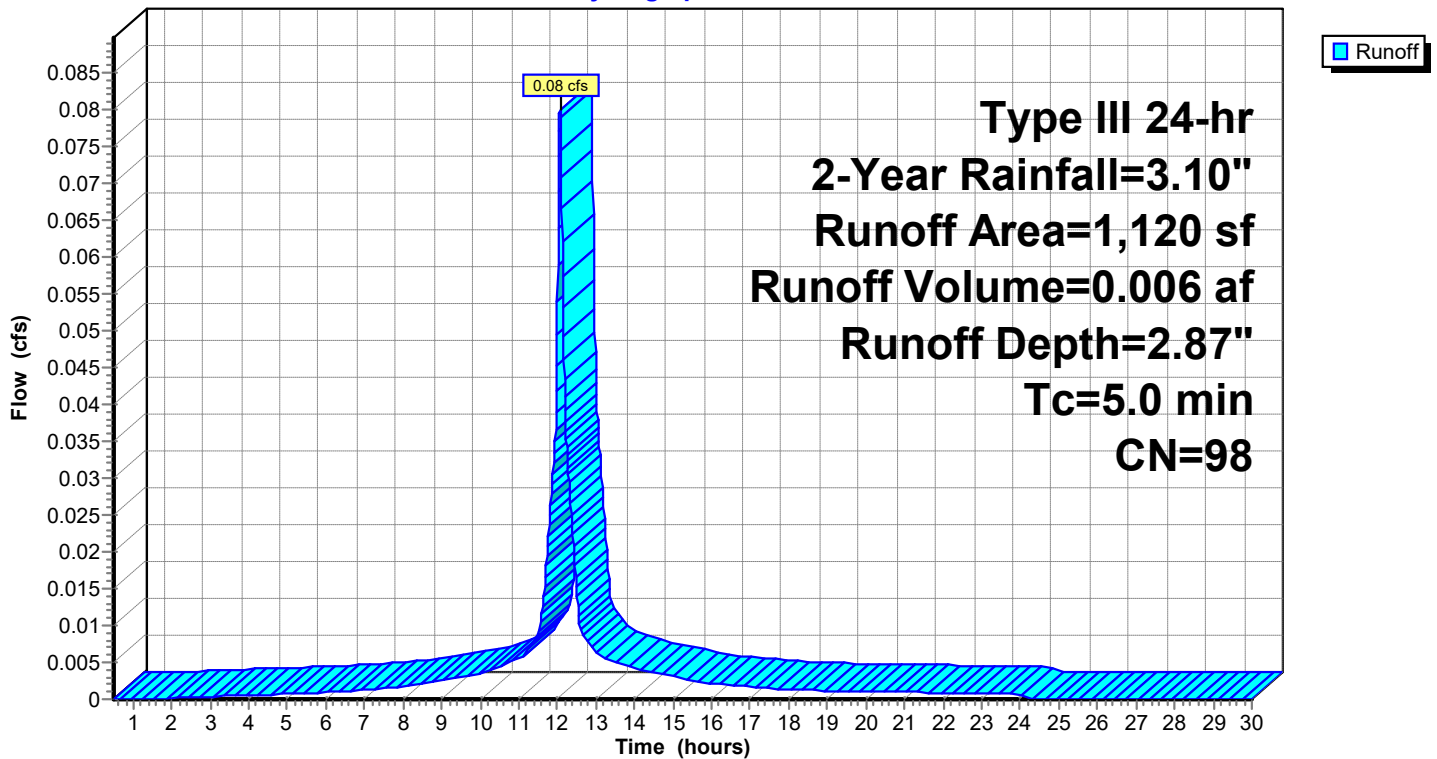
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
* 1,120	98	Roofs, HSG A
1,120		100.00% Impervious Area

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

Subcatchment PR3: Roof_BLDG-3

Hydrograph



Summary for Pond IS1: System #1

Inflow Area = 0.104 ac, 99.16% Impervious, Inflow Depth = 2.81" for 2-Year event
 Inflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af
 Outflow = 0.08 cfs @ 11.85 hrs, Volume= 0.024 af, Atten= 75%, Lag= 0.0 min
 Discarded = 0.08 cfs @ 11.85 hrs, Volume= 0.024 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 48.01' @ 12.43 hrs Surf.Area= 416 sf Storage= 198 cf

Plug-Flow detention time= 11.2 min calculated for 0.024 af (100% of inflow)
 Center-of-Mass det. time= 11.2 min (772.1 - 761.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	46.80'	459 cf	13.00'W x 32.00'L x 5.25'H Field A 2,184 cf Overall - 873 cf Embedded = 1,311 cf x 35.0% Voids
#2A	47.80'	649 cf	Concrete Galley 4x4x4.25 x 14 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 14 Chambers in 2 Rows
		1,108 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.80'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.08 cfs @ 11.85 hrs HW=46.86' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Pond IS1: System #1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

7 Chambers/Row x 4.00' Long = 28.00' Row Length +24.0" End Stone x 2 = 32.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

14 Chambers x 46.4 cf = 649.3 cf Chamber Storage

14 Chambers x 62.3 cf = 872.6 cf Displacement

2,184.0 cf Field - 872.6 cf Chambers = 1,311.4 cf Stone x 35.0% Voids = 459.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,108.3 cf = 0.025 af

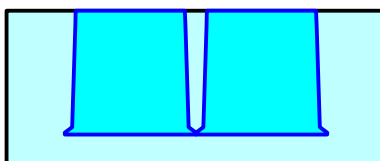
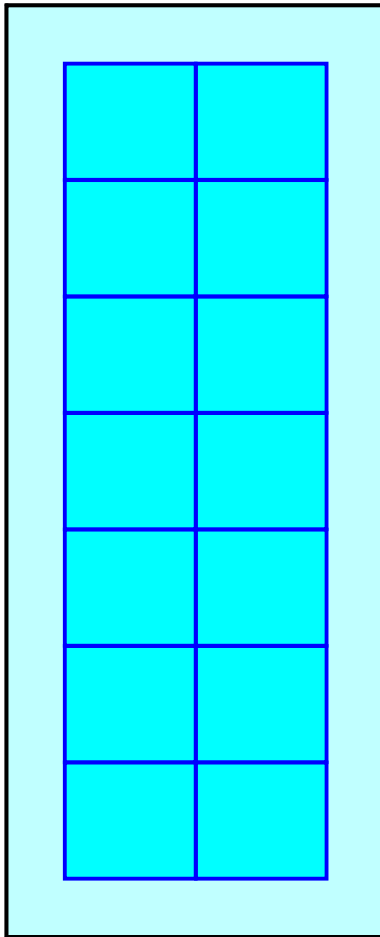
Overall Storage Efficiency = 50.7%

Overall System Size = 32.00' x 13.00' x 5.25'

14 Chambers

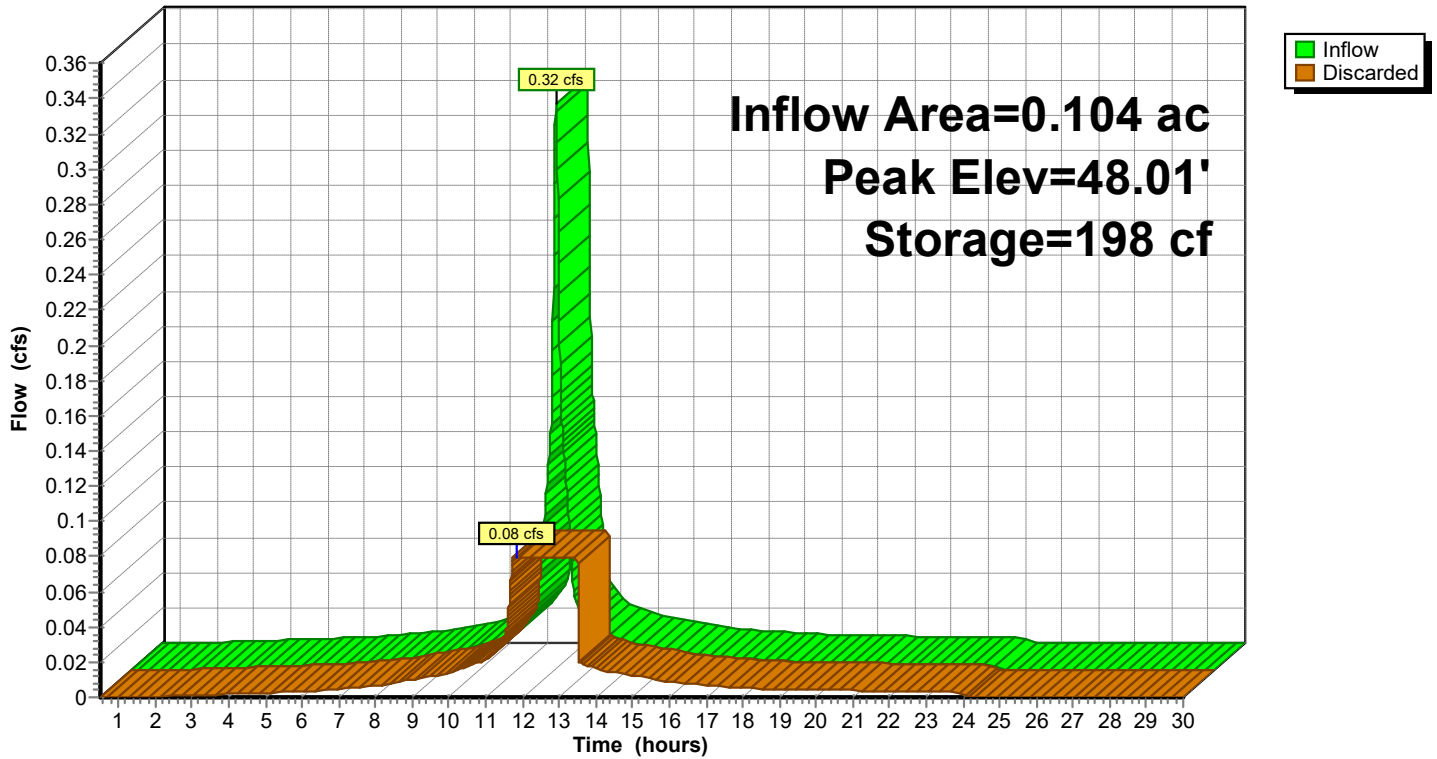
80.9 cy Field

48.6 cy Stone



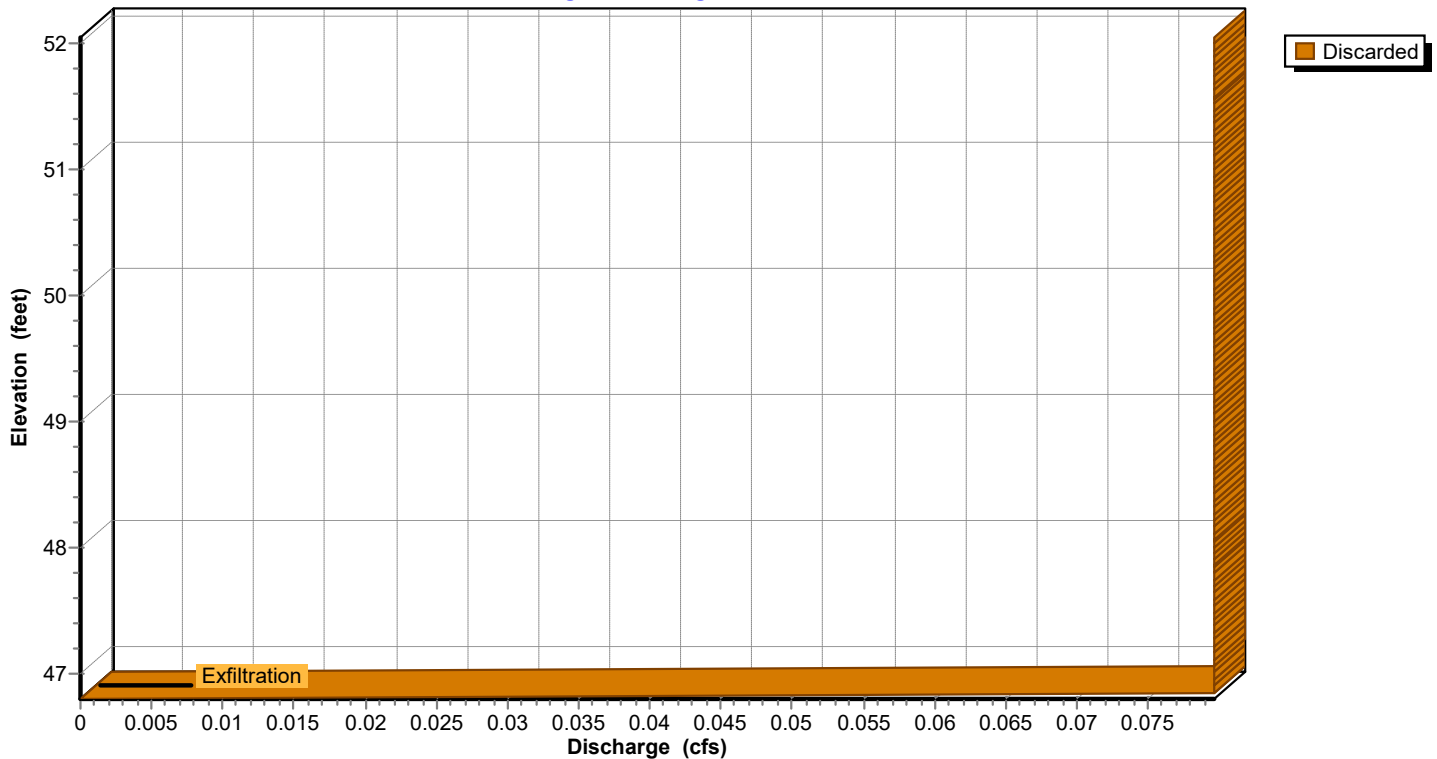
Pond IS1: System #1

Hydrograph



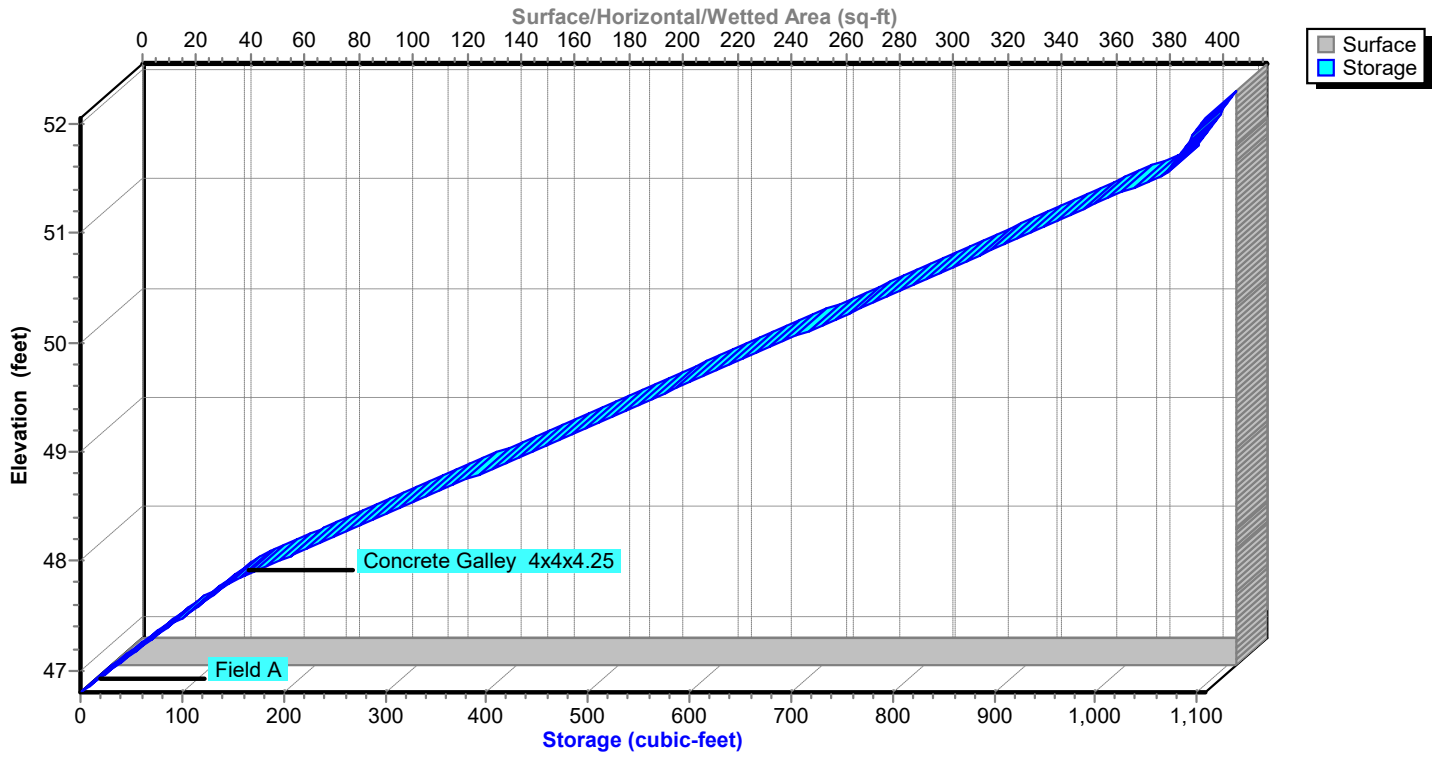
Pond IS1: System #1

Stage-Discharge



Pond IS1: System #1

Stage-Area-Storage



Summary for Pond IS2: System #2

Inflow Area = 0.077 ac, 100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
 Inflow = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af
 Outflow = 0.06 cfs @ 11.85 hrs, Volume= 0.018 af, Atten= 75%, Lag= 0.0 min
 Discarded = 0.06 cfs @ 11.85 hrs, Volume= 0.018 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 46.46' @ 12.43 hrs Surf.Area= 312 sf Storage= 147 cf

Plug-Flow detention time= 11.0 min calculated for 0.018 af (100% of inflow)
 Center-of-Mass det. time= 11.0 min (767.1 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	45.25'	355 cf	13.00'W x 24.00'L x 5.25'H Field A 1,638 cf Overall - 623 cf Embedded = 1,015 cf x 35.0% Voids
#2A	46.25'	464 cf	Concrete Galley 4x4x4.25 x 10 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 10 Chambers in 2 Rows
		819 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.25'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 11.85 hrs HW=45.31' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IS2: System #2 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

5 Chambers/Row x 4.00' Long = 20.00' Row Length +24.0" End Stone x 2 = 24.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

10 Chambers x 46.4 cf = 463.8 cf Chamber Storage

10 Chambers x 62.3 cf = 623.3 cf Displacement

1,638.0 cf Field - 623.3 cf Chambers = 1,014.7 cf Stone x 35.0% Voids = 355.1 cf Stone Storage

Chamber Storage + Stone Storage = 818.9 cf = 0.019 af

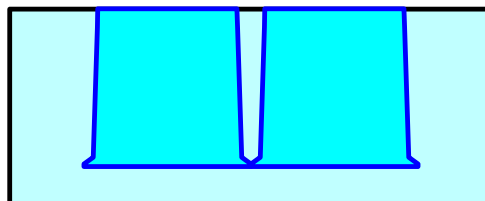
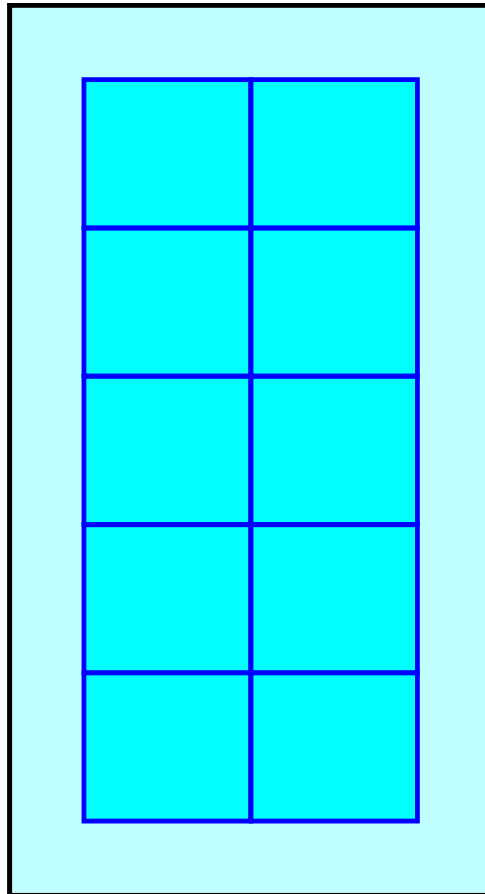
Overall Storage Efficiency = 50.0%

Overall System Size = 24.00' x 13.00' x 5.25'

10 Chambers

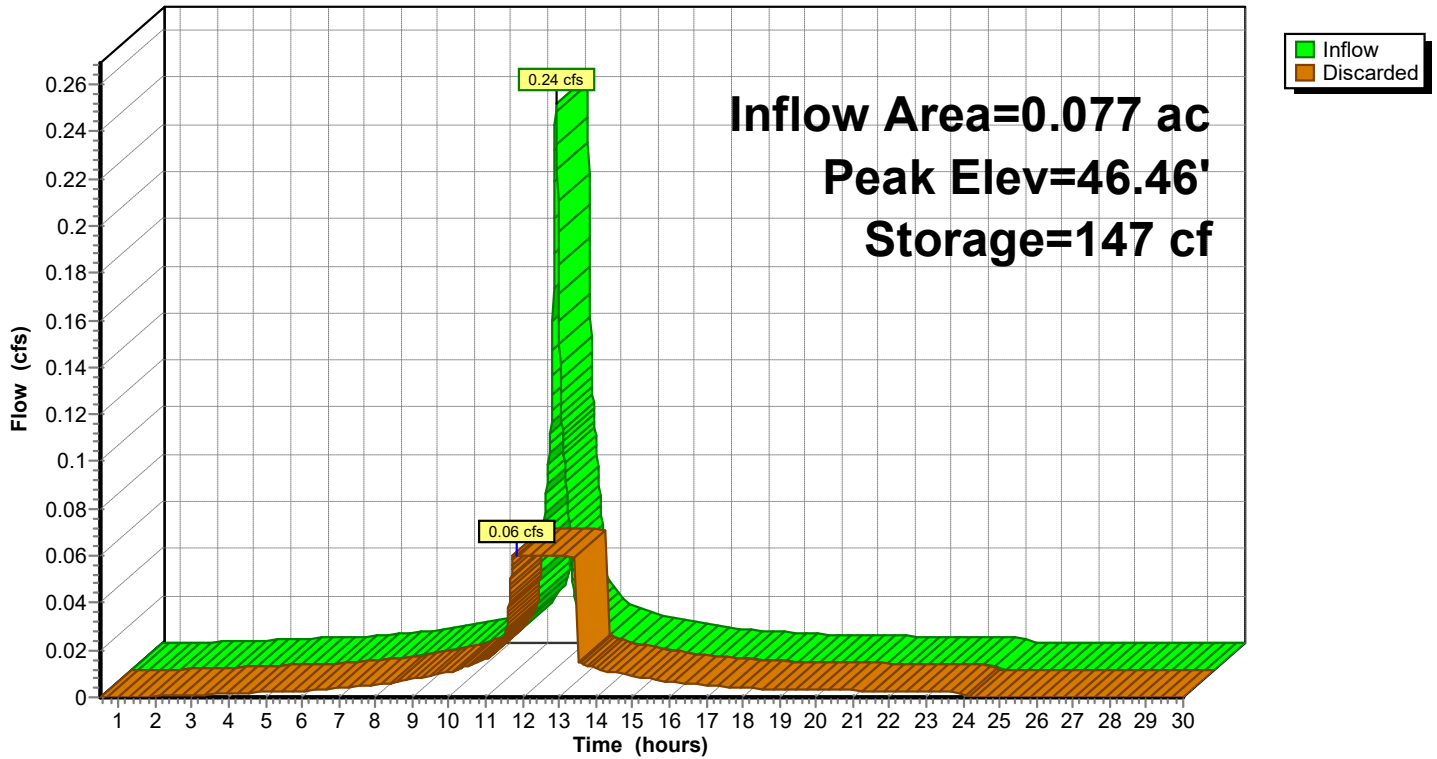
60.7 cy Field

37.6 cy Stone



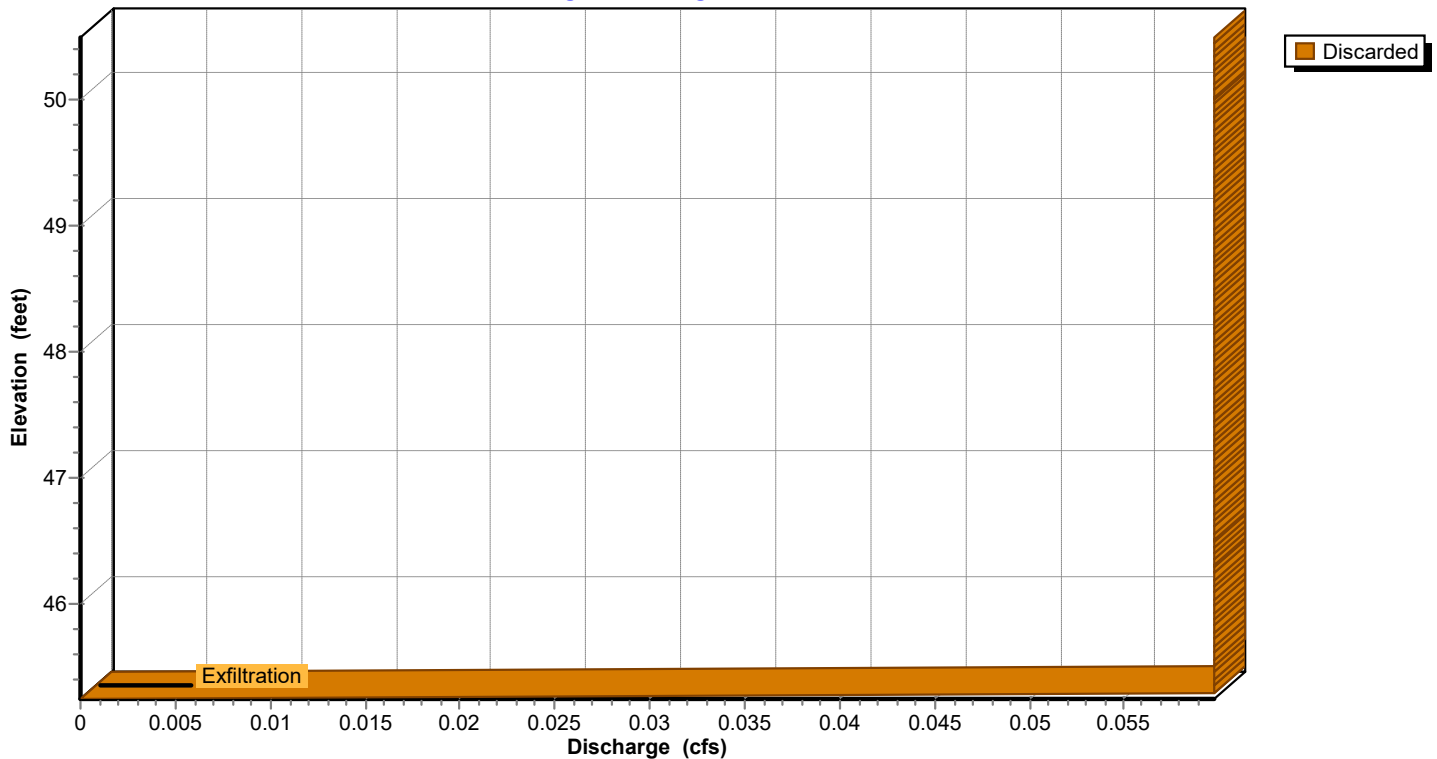
Pond IS2: System #2

Hydrograph



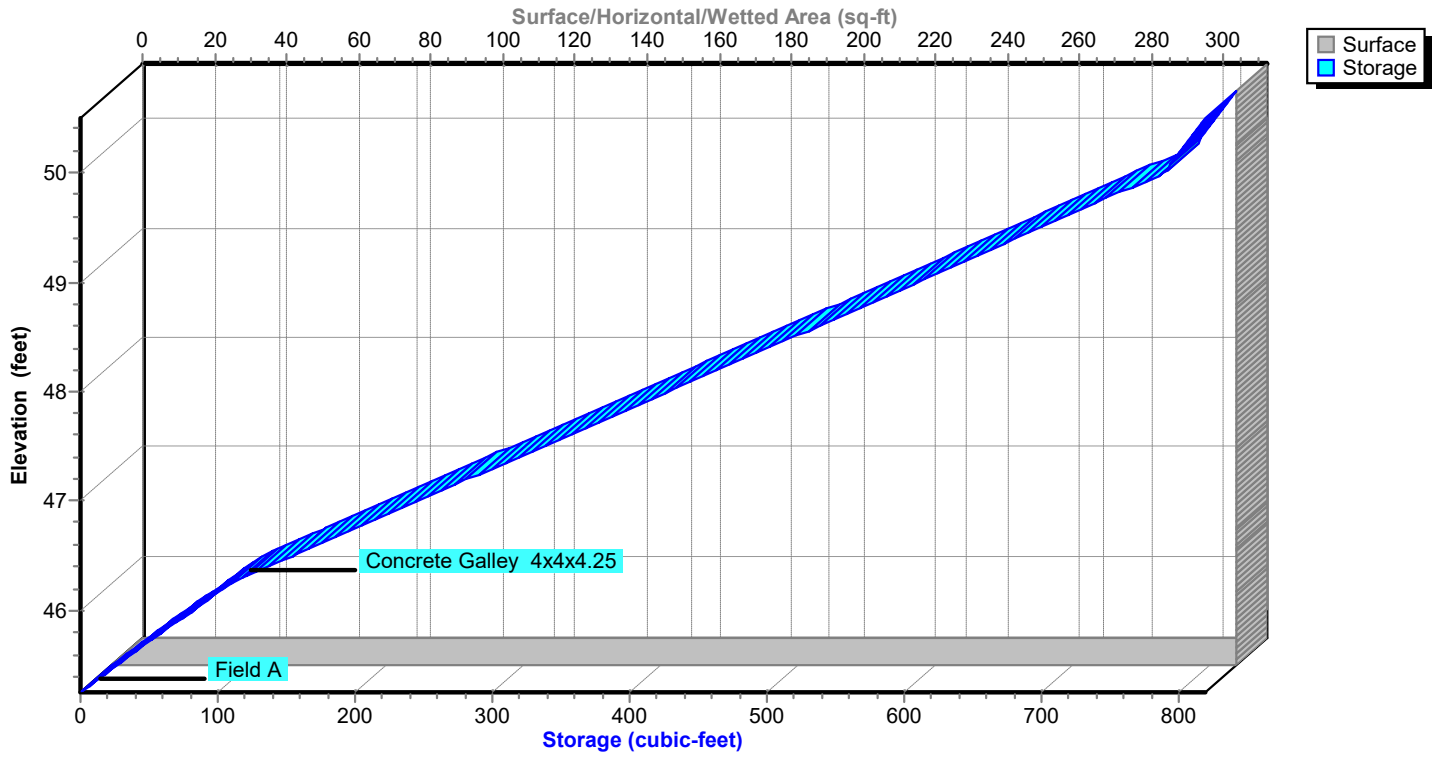
Pond IS2: System #2

Stage-Discharge



Pond IS2: System #2

Stage-Area-Storage



Summary for Pond IS3: System #3

Inflow Area = 0.118 ac, 100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
 Inflow = 0.37 cfs @ 12.07 hrs, Volume= 0.028 af
 Outflow = 0.07 cfs @ 11.77 hrs, Volume= 0.028 af, Atten= 81%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.77 hrs, Volume= 0.028 af
 Primary = 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= 44.24' @ 12.50 hrs Surf.Area= 364 sf Storage= 286 cf

Plug-Flow detention time= 20.4 min calculated for 0.028 af (100% of inflow)
 Center-of-Mass det. time= 20.4 min (776.6 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	42.50'	407 cf	13.00'W x 28.00'L x 5.25'H Field A 1,911 cf Overall - 748 cf Embedded = 1,163 cf x 35.0% Voids
#2A	43.50'	557 cf	Concrete Galley 4x4x4.25 x 12 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 12 Chambers in 2 Rows
		964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	42.50'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	46.80'	8.0" Round Culvert L= 72.0' Ke= 0.090 Inlet / Outlet Invert= 46.80' / 45.00' S= 0.0250 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 11.77 hrs HW=42.56' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.50 hrs HW=42.50' TW=43.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Controls 0.00 cfs)

Pond IS3: System #3 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

6 Chambers/Row x 4.00' Long = 24.00' Row Length +24.0" End Stone x 2 = 28.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

12 Chambers x 46.4 cf = 556.6 cf Chamber Storage

12 Chambers x 62.3 cf = 748.0 cf Displacement

1,911.0 cf Field - 748.0 cf Chambers = 1,163.0 cf Stone x 35.0% Voids = 407.1 cf Stone Storage

Chamber Storage + Stone Storage = 963.6 cf = 0.022 af

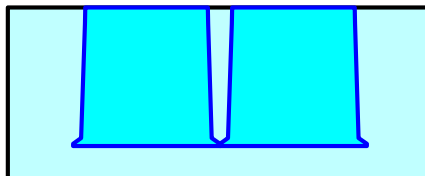
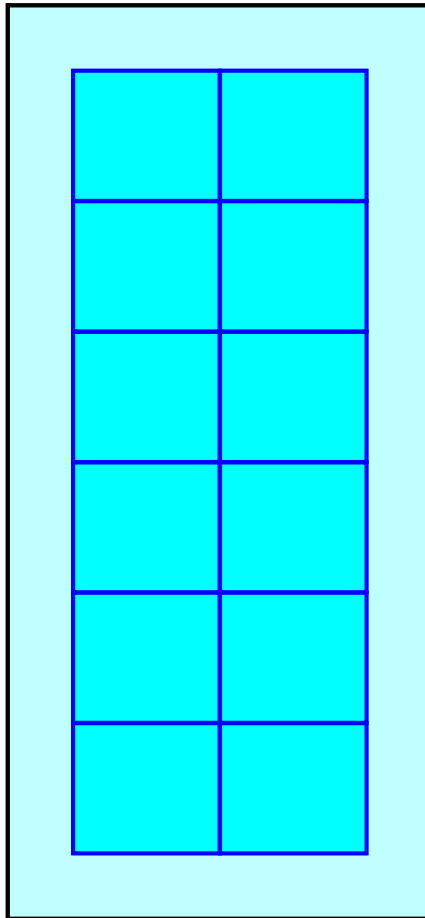
Overall Storage Efficiency = 50.4%

Overall System Size = 28.00' x 13.00' x 5.25'

12 Chambers

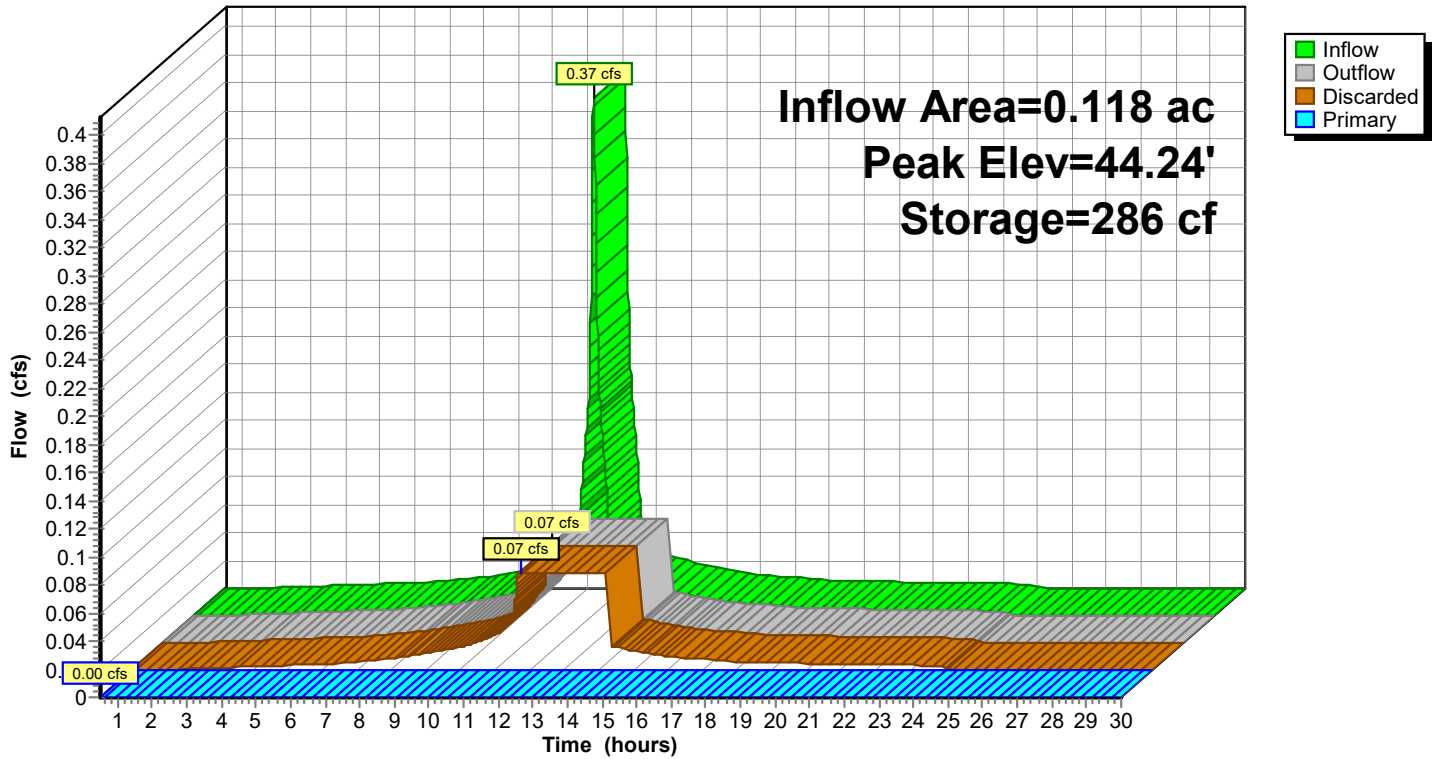
70.8 cy Field

43.1 cy Stone



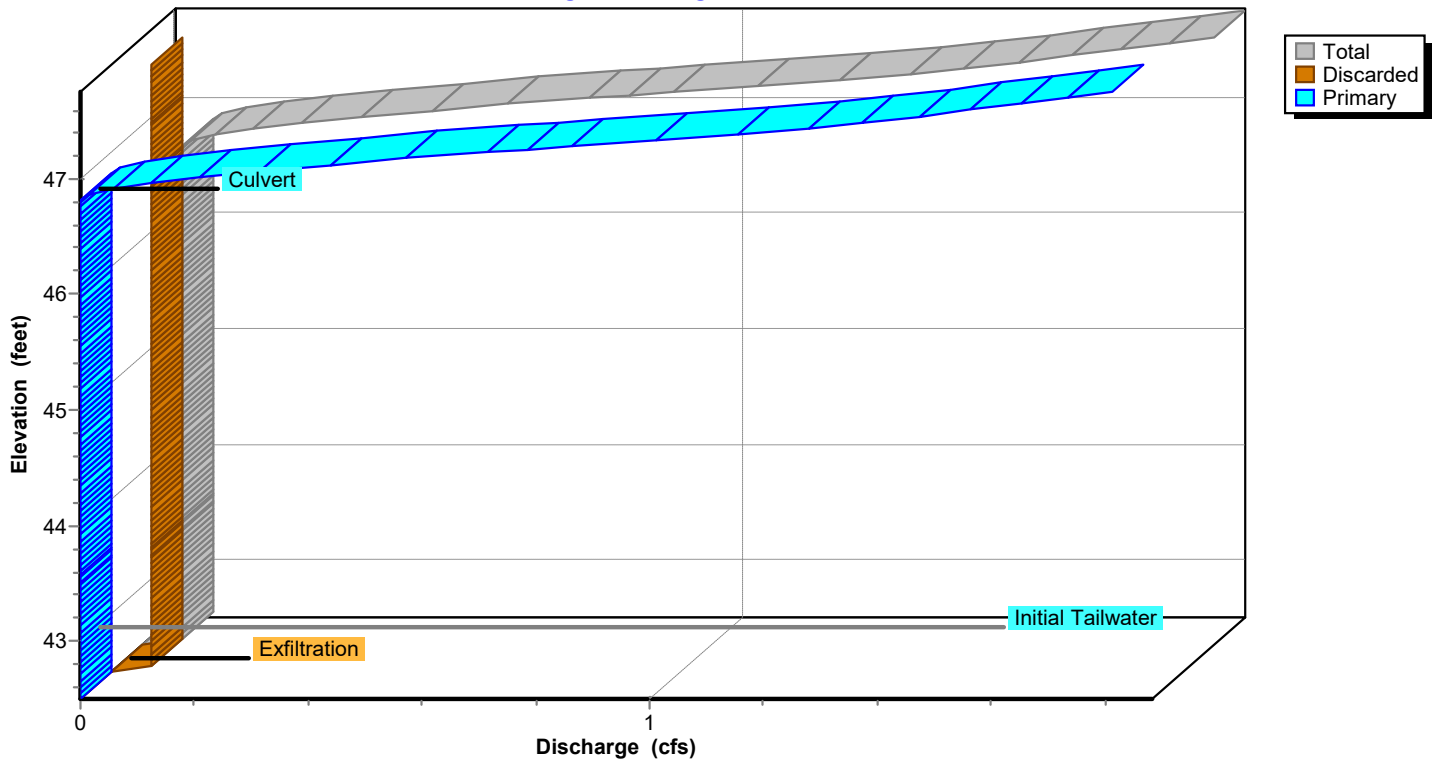
Pond IS3: System #3

Hydrograph



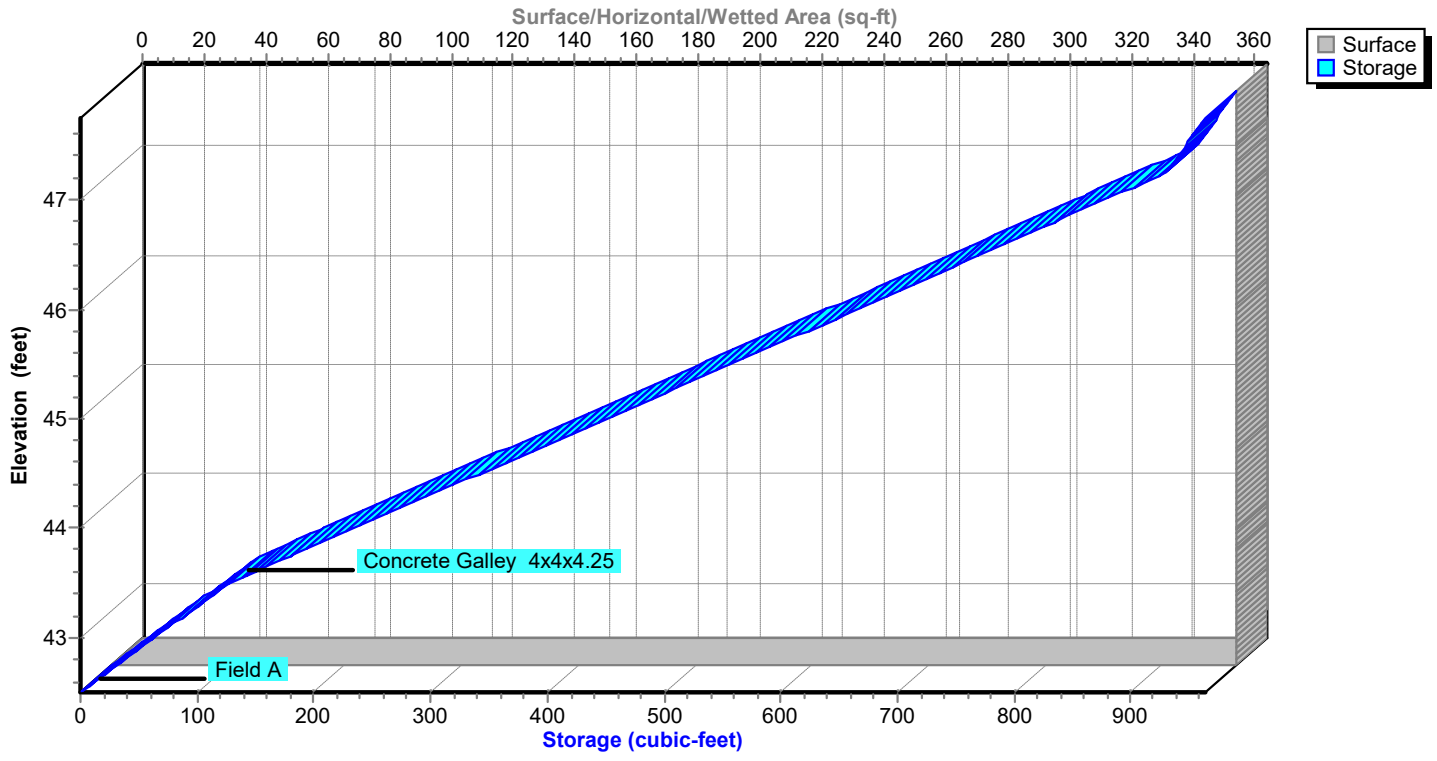
Pond IS3: System #3

Stage-Discharge



Pond IS3: System #3

Stage-Area-Storage



Summary for Pond IS4: (Retention Pond)

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 0.00" for 2-Year event
 Inflow = 0.00 cfs @ 22.35 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 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= 43.01' @ 24.29 hrs Surf.Area= 639 sf Storage= 5 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume #1	Invert 43.00'	Avail.Storage 1,949 cf	Storage Description
Custom Stage Data (Irregular) Listed below (Recalc)			

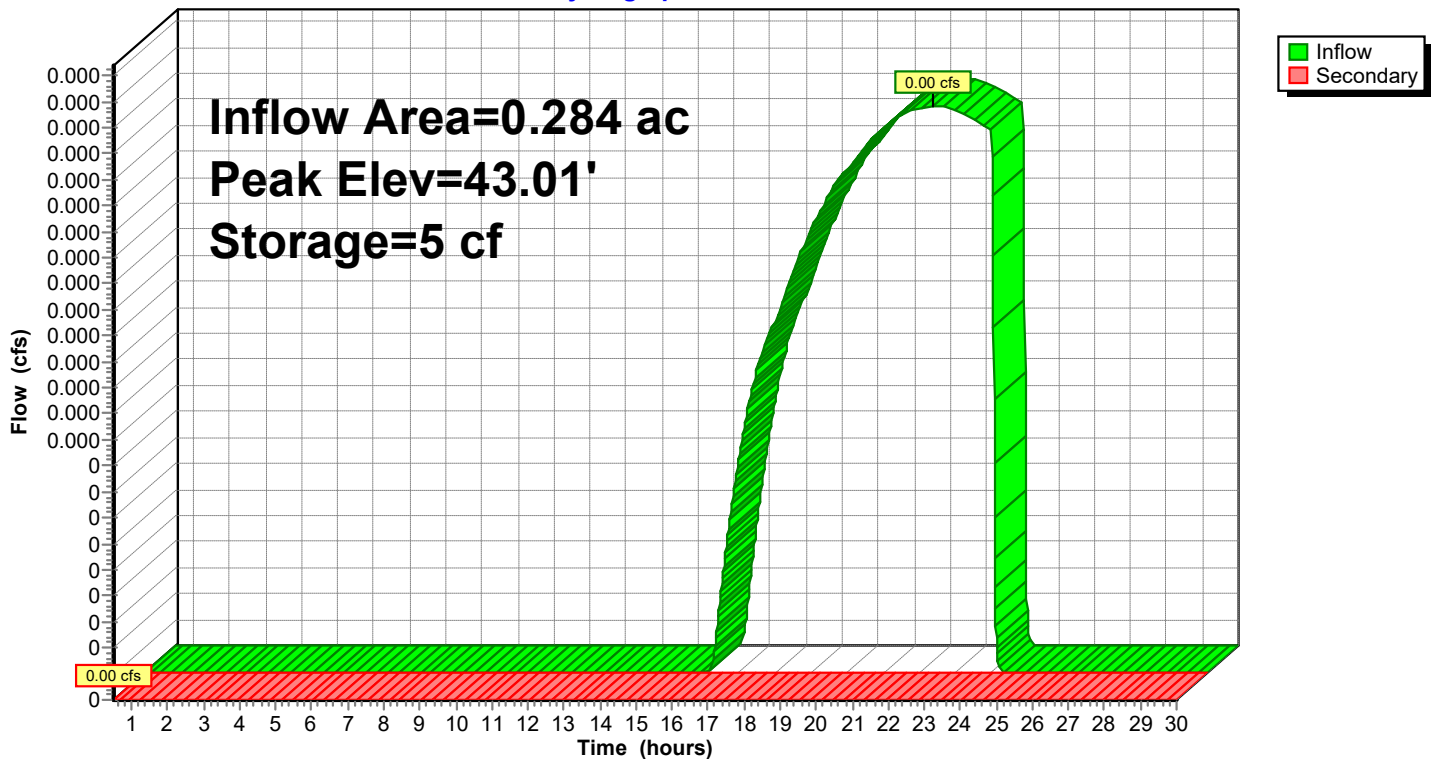
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.00	637	100.0	0	0	637
44.00	966	119.0	796	796	986
45.00	1,351	137.0	1,153	1,949	1,374

Device #1	Routing Secondary	Invert 44.50'	Outlet Devices
45.0 deg x 3.0' wide x 0.50' high Dam Breach C= 2.56			
Top of breach = 45.00' Bottom of breach = 44.50'			
Breach starts at 44.50' WSE and develops over 1.000 hrs			

Secondary OutFlow Max=0.00 cfs @ 0.50 hrs HW=43.00' TW=0.00' (Dynamic Tailwater)
 ←1=Dam Breach (Controls 0.00 cfs)

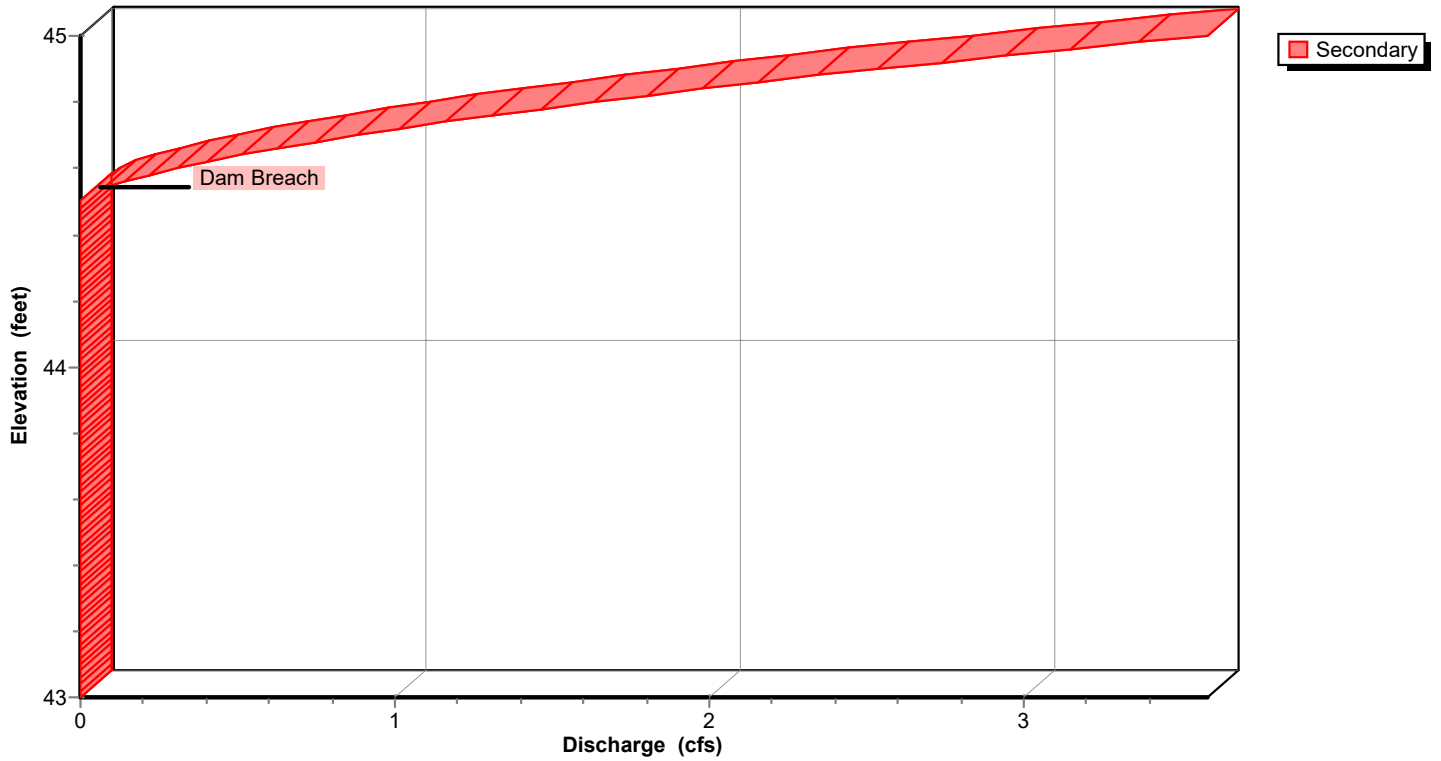
Pond IS4: (Retention Pond)

Hydrograph



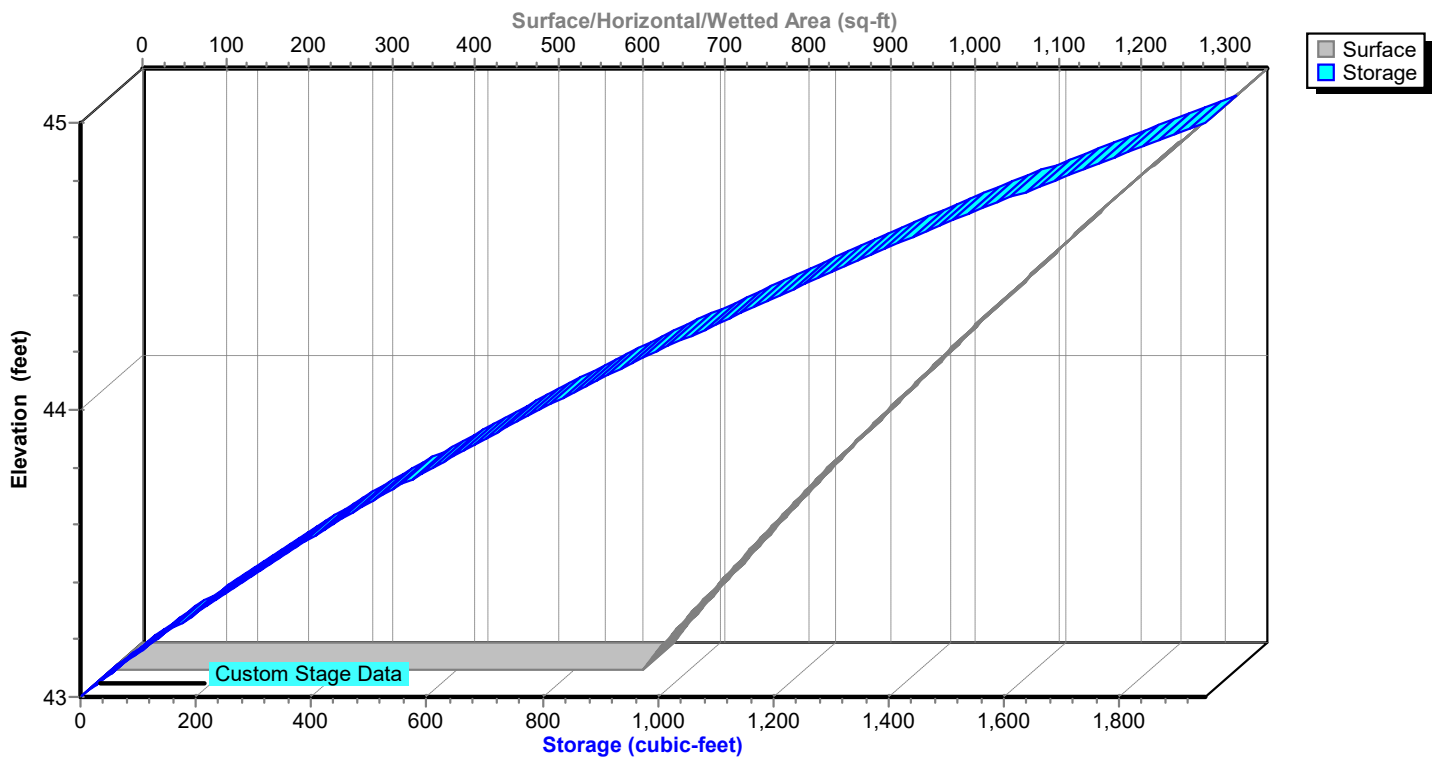
Pond IS4: (Retention Pond)

Stage-Discharge



Pond IS4: (Retention Pond)

Stage-Area-Storage



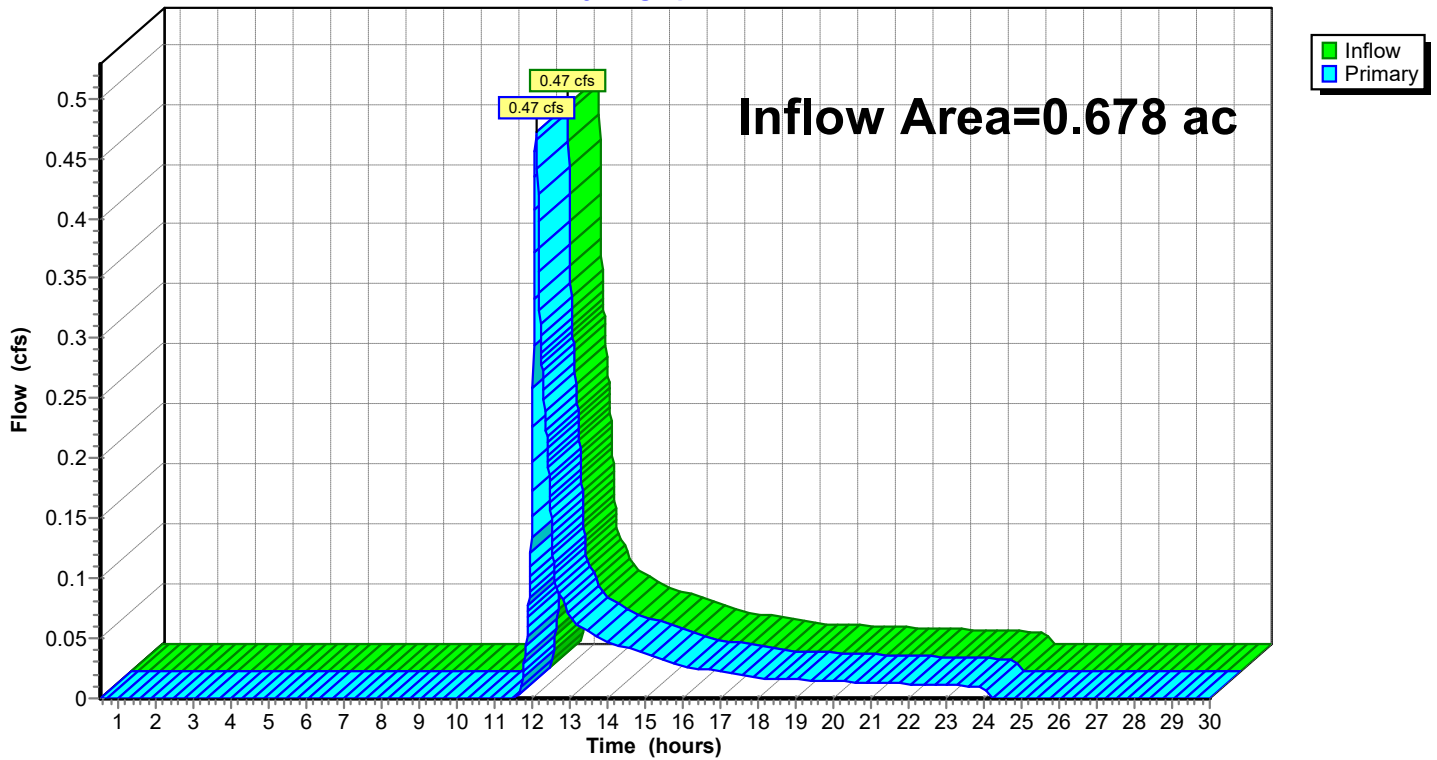
Summary for Link POD1: South-West Abutter

Inflow Area = 0.678 ac, 0.00% Impervious, Inflow Depth = 0.68" for 2-Year event
Inflow = 0.47 cfs @ 12.09 hrs, Volume= 0.038 af
Primary = 0.47 cfs @ 12.09 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

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

Link POD1: South-West Abutter

Hydrograph



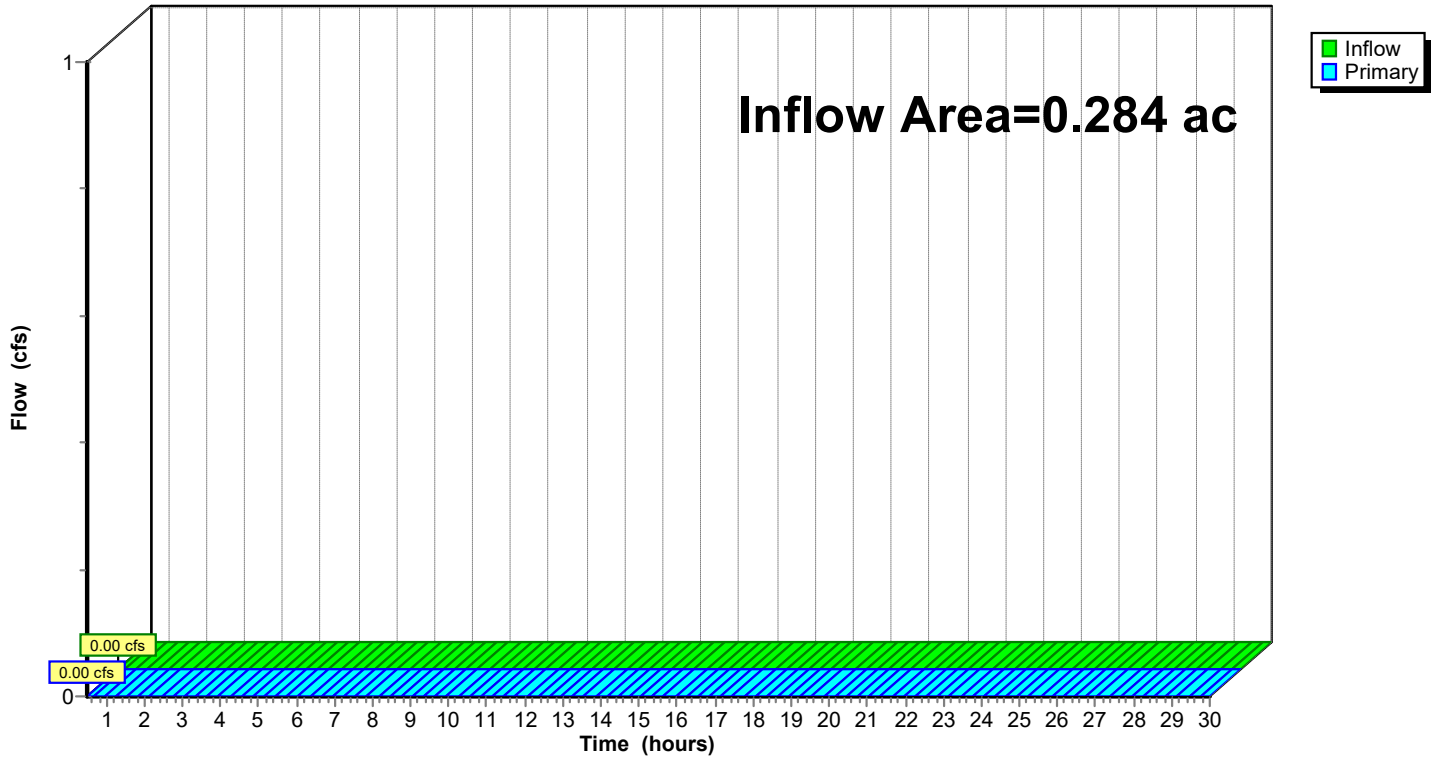
Summary for Link POD1.: South-West Abutter

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.50 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.: South-West Abutter

Hydrograph



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=29,550 sf 0.00% Impervious Runoff Depth=1.53" Tc=5.0 min CN=68 Runoff=1.21 cfs 0.087 af
Subcatchment P1: Sub-catchment-1	Runoff Area=7,199 sf 0.00% Impervious Runoff Depth=0.19" Tc=5.0 min CN=42 Runoff=0.01 cfs 0.003 af
Subcatchment PD1: Driveway	Runoff Area=2,276 sf 98.33% Impervious Runoff Depth=4.15" Tc=5.0 min CN=97 Runoff=0.24 cfs 0.018 af
Subcatchment PD2: Driveway	Runoff Area=4,038 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.42 cfs 0.033 af
Subcatchment PR1: Roof_BLDG-1	Runoff Area=2,260 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.24 cfs 0.018 af
Subcatchment PR2: Roof_BLDG-2	Runoff Area=3,360 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.35 cfs 0.027 af
Subcatchment PR3: Roof_BLDG-3	Runoff Area=1,120 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.12 cfs 0.009 af
Pond IS1: System #1	Peak Elev=48.81' Storage=396 cf Inflow=0.47 cfs 0.037 af Outflow=0.08 cfs 0.037 af
Pond IS2: System #2	Peak Elev=47.26' Storage=293 cf Inflow=0.35 cfs 0.027 af Outflow=0.06 cfs 0.027 af
Pond IS3: System #3	Peak Elev=45.34' Storage=524 cf Inflow=0.54 cfs 0.042 af Discarded=0.07 cfs 0.042 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.042 af
Pond IS4: (Retention Pond)	Peak Elev=43.18' Storage=117 cf Inflow=0.01 cfs 0.003 af Outflow=0.00 cfs 0.000 af
Link POD1: South-West Abutter	Inflow=1.21 cfs 0.087 af Primary=1.21 cfs 0.087 af
Link POD1.: South-West Abutter	Inflow=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.143 ac Runoff Volume = 0.195 af Average Runoff Depth = 2.05"
73.87% Pervious = 0.845 ac 26.13% Impervious = 0.299 ac

Summary for Subcatchment E1: Sub-catchment-1

Runoff = 1.21 cfs @ 12.08 hrs, Volume= 0.087 af, Depth= 1.53"

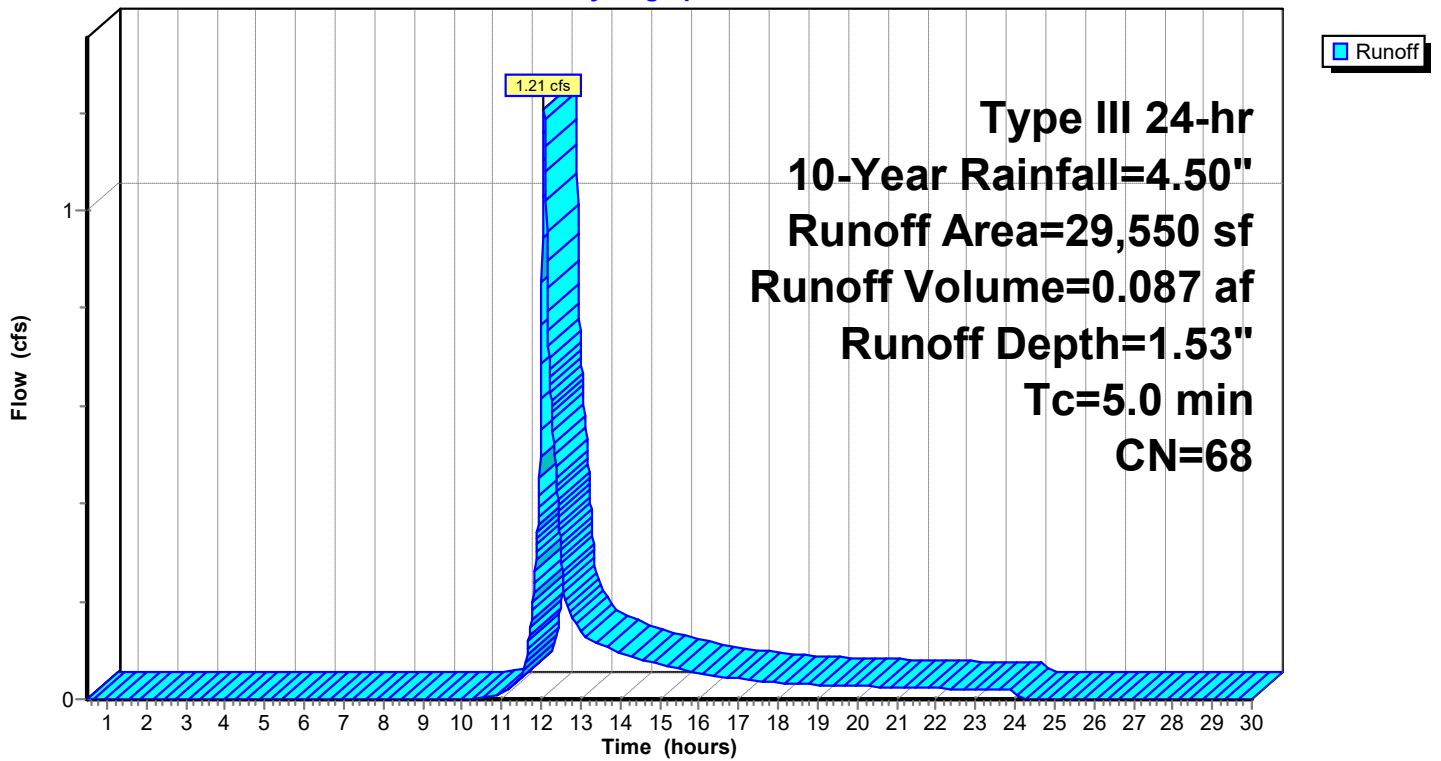
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
29,550	68	<50% Grass cover, Poor, HSG A
29,550		100.00% Pervious Area

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

Subcatchment E1: Sub-catchment-1

Hydrograph



Summary for Subcatchment P1: Sub-catchment-1

Runoff = 0.01 cfs @ 12.44 hrs, Volume= 0.003 af, Depth= 0.19"

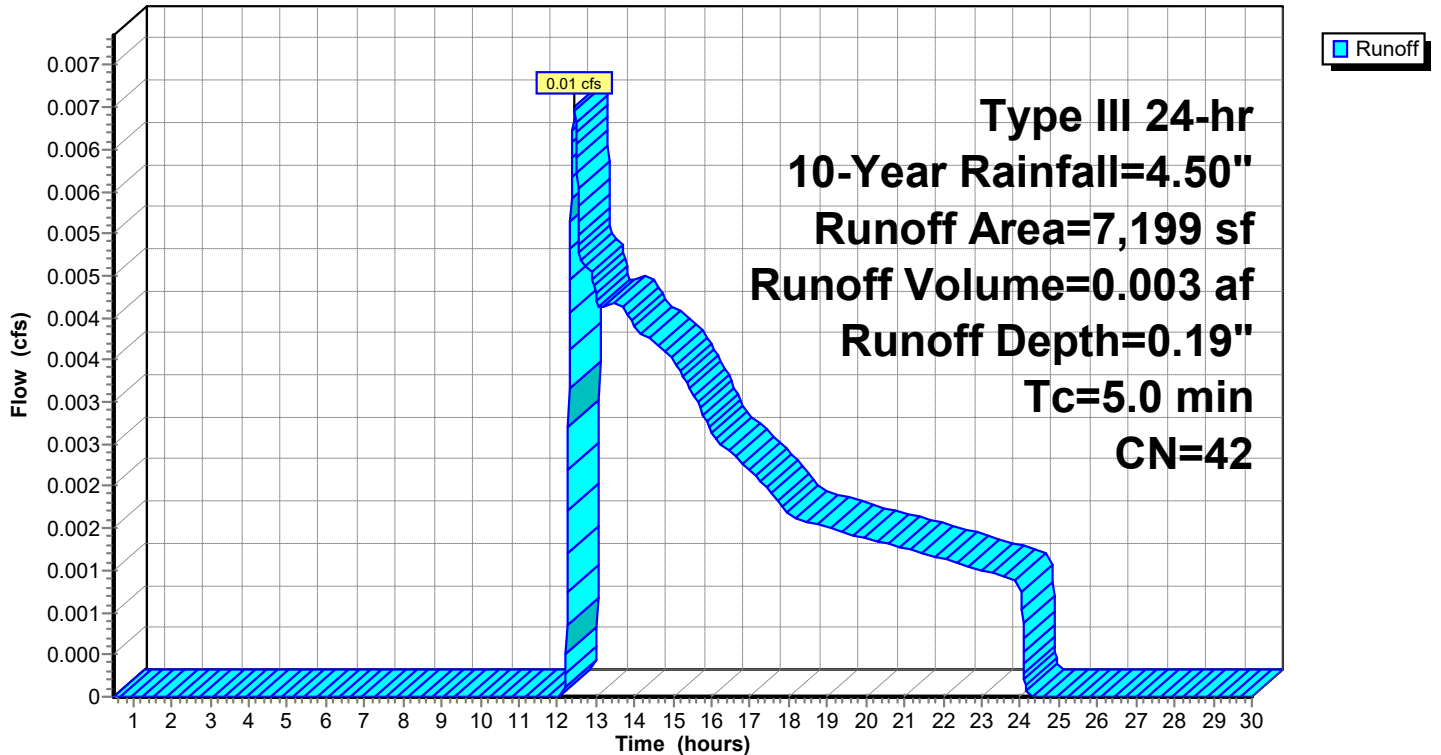
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,623	39	>75% Grass cover, Good, HSG A
3,705	36	Woods, Fair, HSG A
871	76	Gravel roads, HSG A
7,199	42	Weighted Average
7,199		100.00% Pervious Area

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

Subcatchment P1: Sub-catchment-1

Hydrograph



Summary for Subcatchment PD1: Driveway

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.018 af, Depth= 4.15"

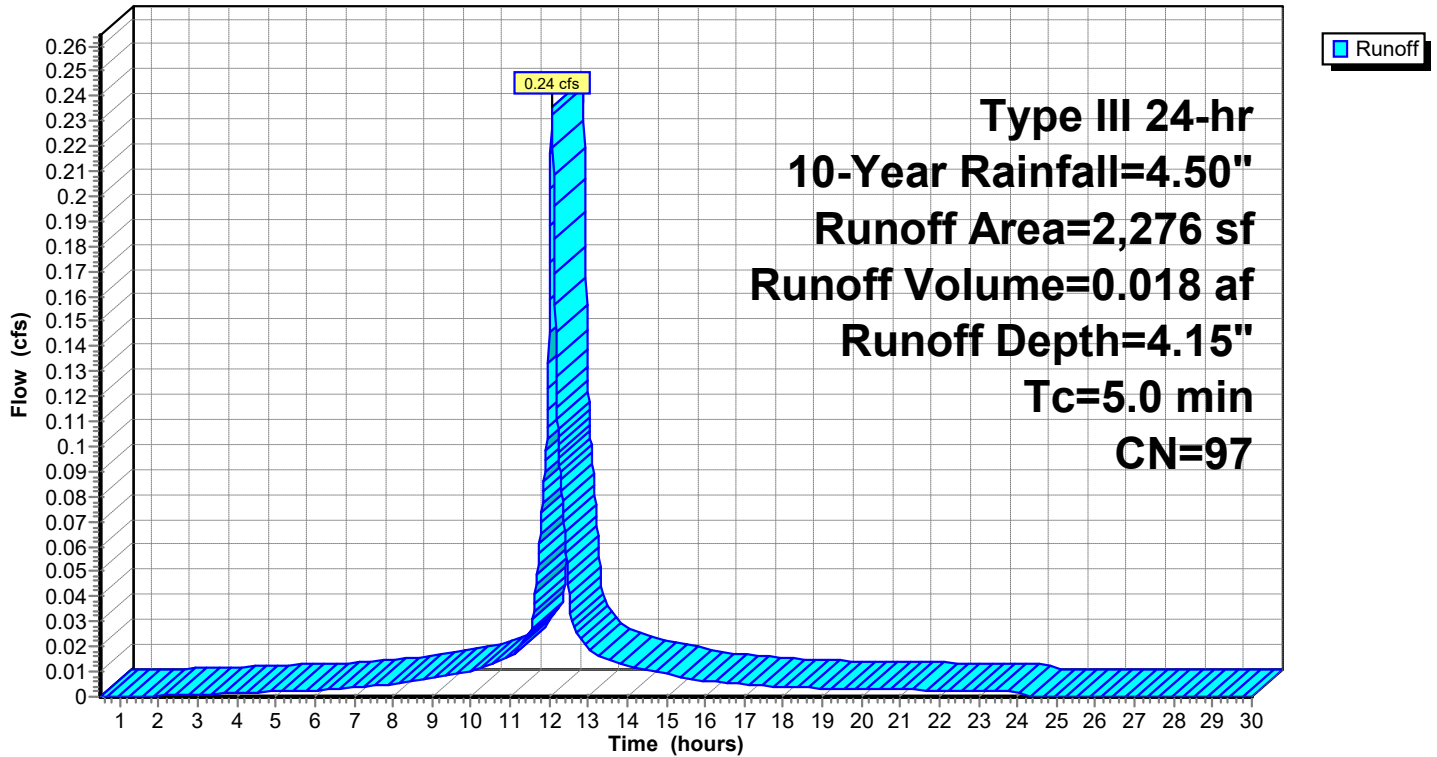
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,238	98	Paved parking, HSG A
* 38	65	Paver walkway
2,276	97	Weighted Average
38		1.67% Pervious Area
2,238		98.33% Impervious Area

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

Subcatchment PD1: Driveway

Hydrograph



Summary for Subcatchment PD2: Driveway

Runoff = 0.42 cfs @ 12.07 hrs, Volume= 0.033 af, Depth= 4.26"

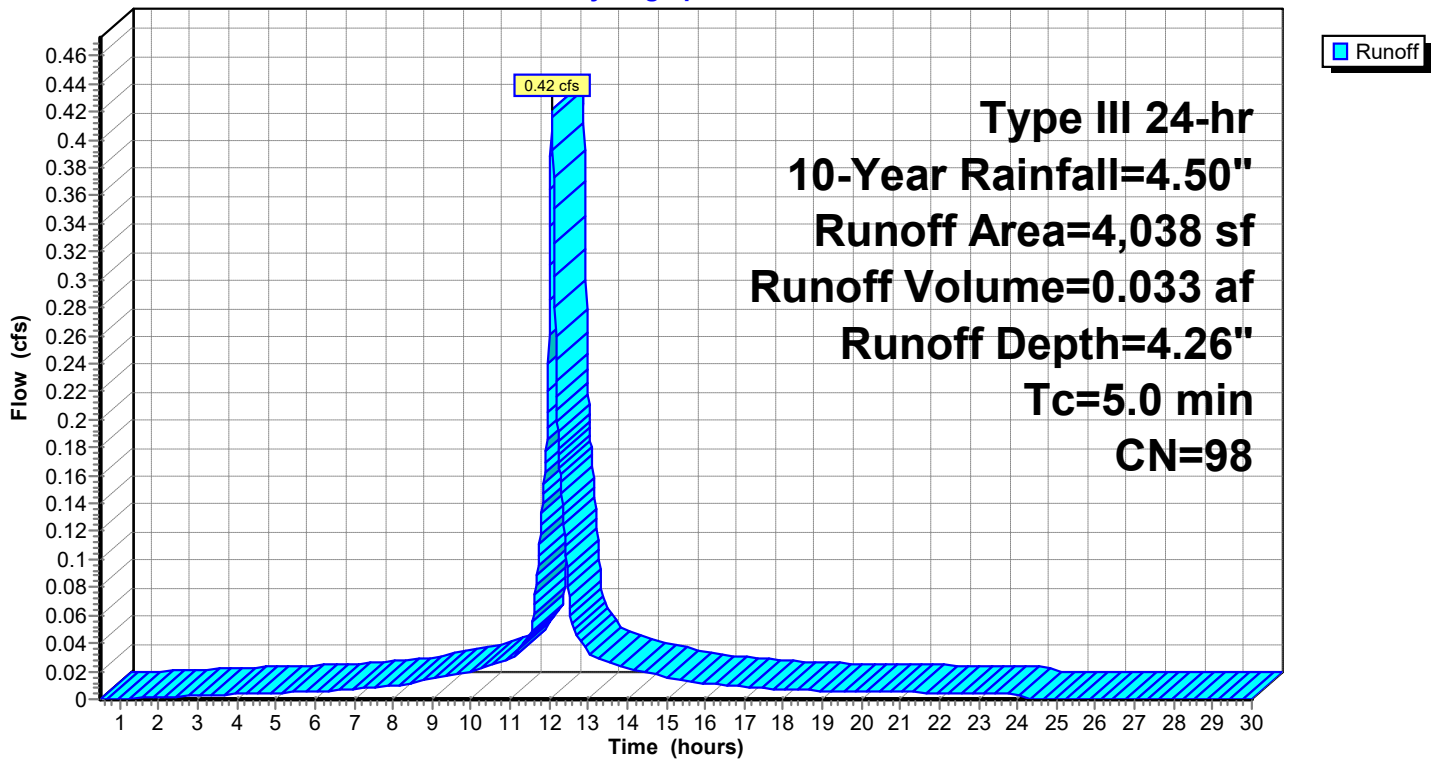
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,038	98	Paved parking, HSG A
4,038		100.00% Impervious Area

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

Subcatchment PD2: Driveway

Hydrograph



Summary for Subcatchment PR1: Roof_BLDG-1

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

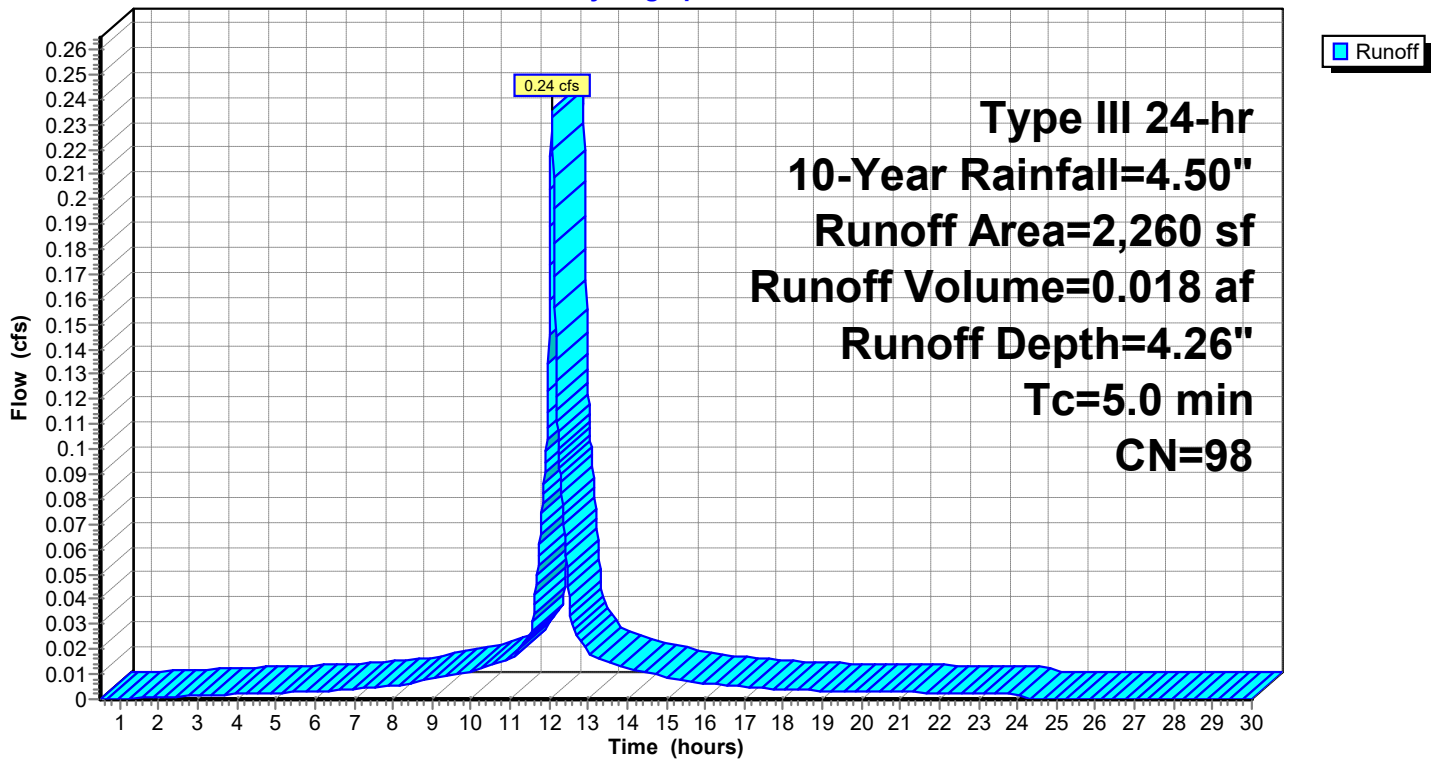
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
* 2,260	98	Roofs, HSG A
2,260		100.00% Impervious Area

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

Subcatchment PR1: Roof_BLDG-1

Hydrograph



Summary for Subcatchment PR2: Roof_BLDG-2

Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.027 af, Depth= 4.26"

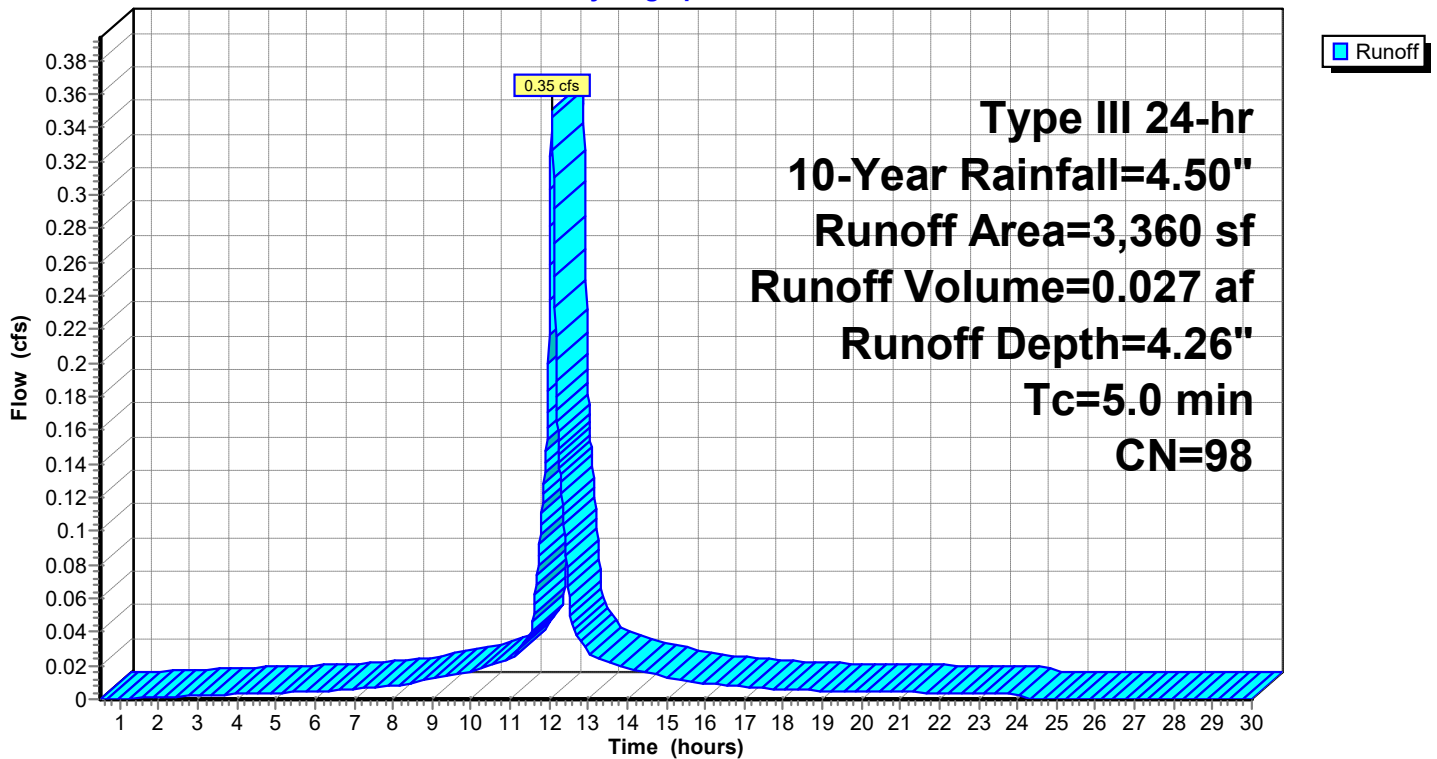
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
* 3,360	98	Roofs, HSG A
3,360		100.00% Impervious Area

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

Subcatchment PR2: Roof_BLDG-2

Hydrograph



Summary for Subcatchment PR3: Roof_BLDG-3

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

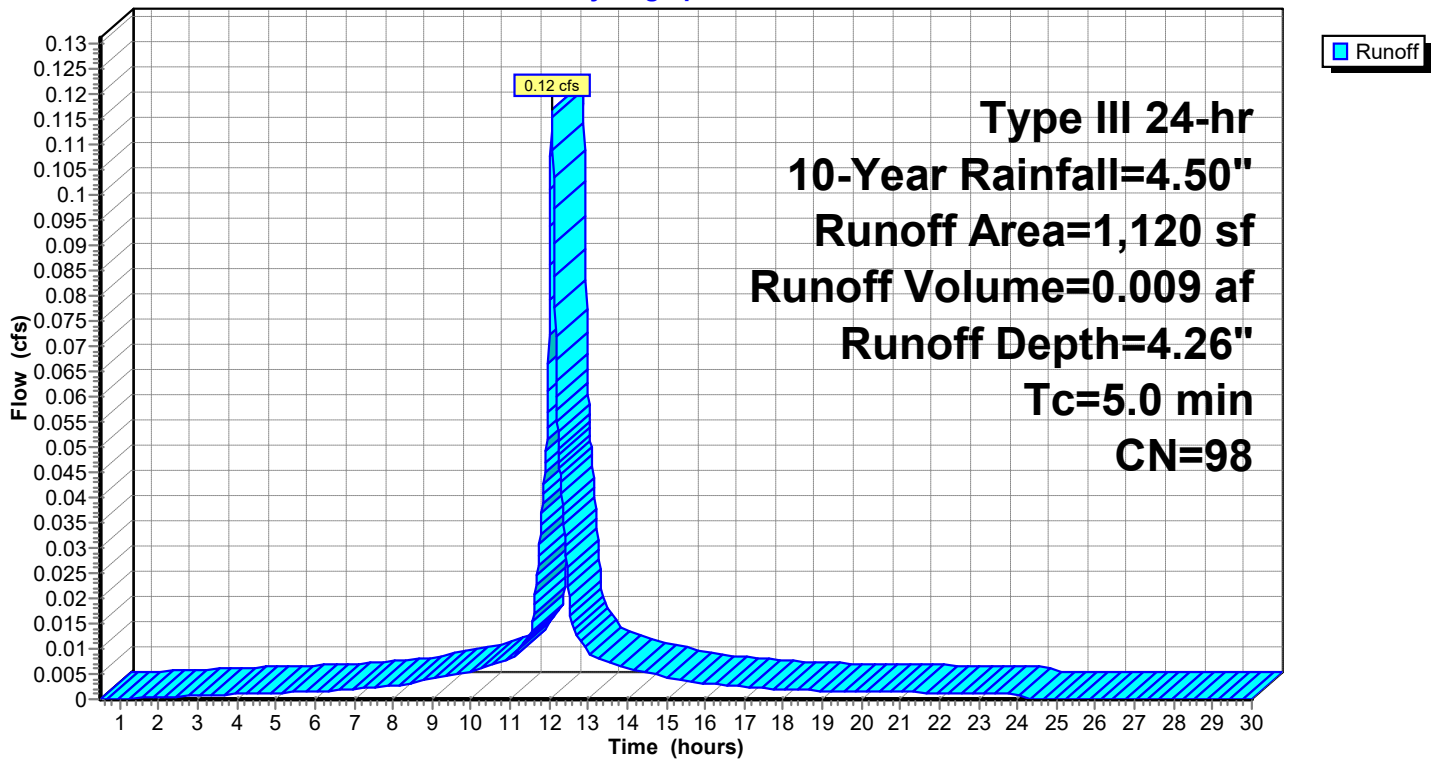
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
* 1,120	98	Roofs, HSG A
1,120		100.00% Impervious Area

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

Subcatchment PR3: Roof_BLDG-3

Hydrograph



Summary for Pond IS1: System #1

Inflow Area = 0.104 ac, 99.16% Impervious, Inflow Depth = 4.21" for 10-Year event
 Inflow = 0.47 cfs @ 12.07 hrs, Volume= 0.037 af
 Outflow = 0.08 cfs @ 11.74 hrs, Volume= 0.037 af, Atten= 83%, Lag= 0.0 min
 Discarded = 0.08 cfs @ 11.74 hrs, Volume= 0.037 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 48.81' @ 12.52 hrs Surf.Area= 416 sf Storage= 396 cf

Plug-Flow detention time= 25.8 min calculated for 0.037 af (100% of inflow)
 Center-of-Mass det. time= 25.8 min (778.7 - 752.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	46.80'	459 cf	13.00'W x 32.00'L x 5.25'H Field A 2,184 cf Overall - 873 cf Embedded = 1,311 cf x 35.0% Voids
#2A	47.80'	649 cf	Concrete Galley 4x4x4.25 x 14 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 14 Chambers in 2 Rows
		1,108 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.80'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.08 cfs @ 11.74 hrs HW=46.86' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Pond IS1: System #1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

7 Chambers/Row x 4.00' Long = 28.00' Row Length +24.0" End Stone x 2 = 32.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

14 Chambers x 46.4 cf = 649.3 cf Chamber Storage

14 Chambers x 62.3 cf = 872.6 cf Displacement

2,184.0 cf Field - 872.6 cf Chambers = 1,311.4 cf Stone x 35.0% Voids = 459.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,108.3 cf = 0.025 af

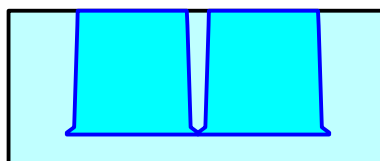
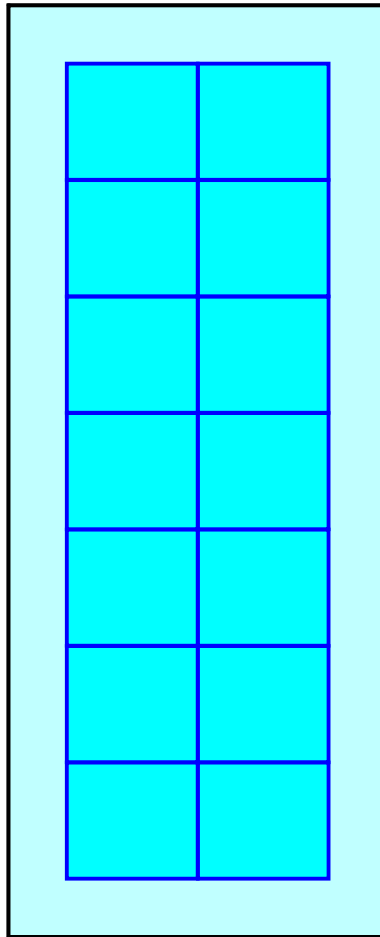
Overall Storage Efficiency = 50.7%

Overall System Size = 32.00' x 13.00' x 5.25'

14 Chambers

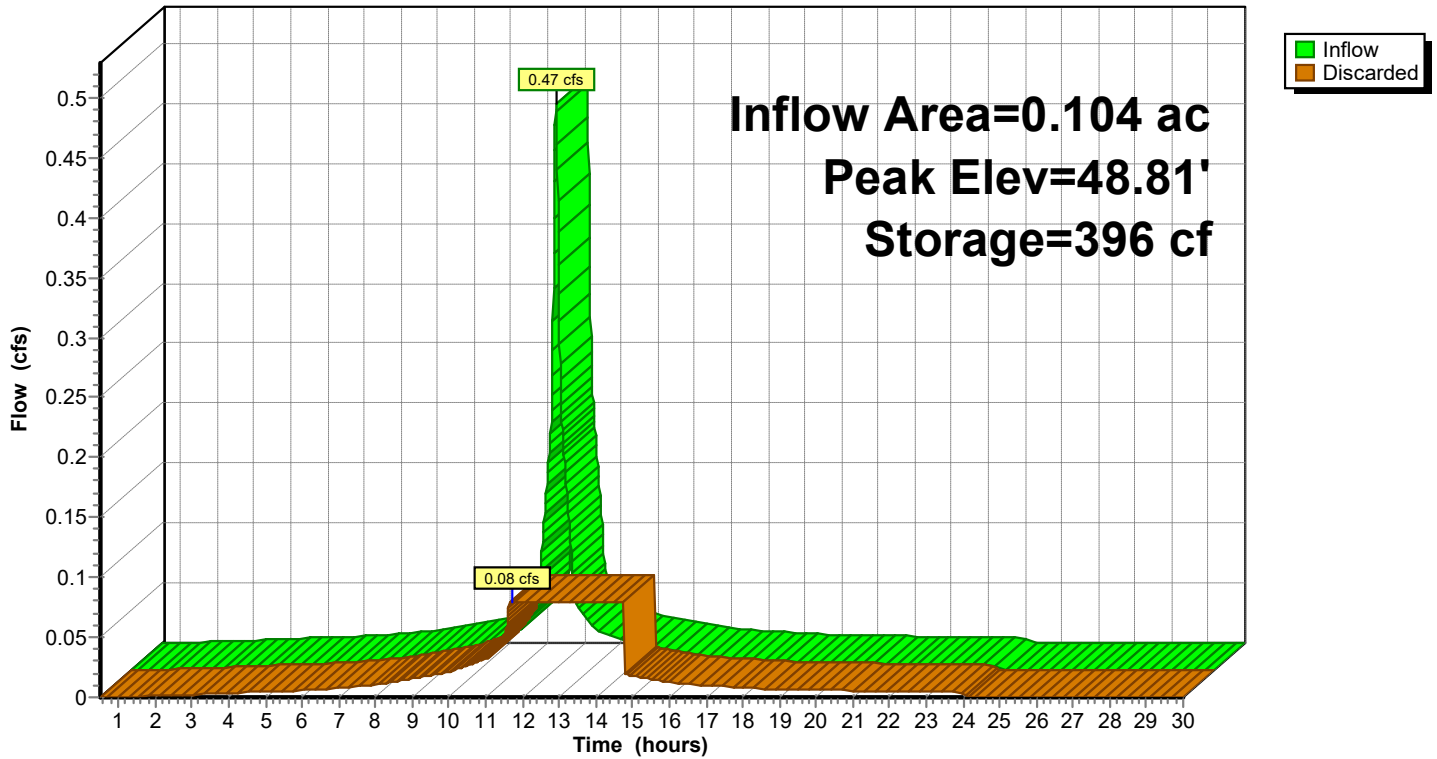
80.9 cy Field

48.6 cy Stone



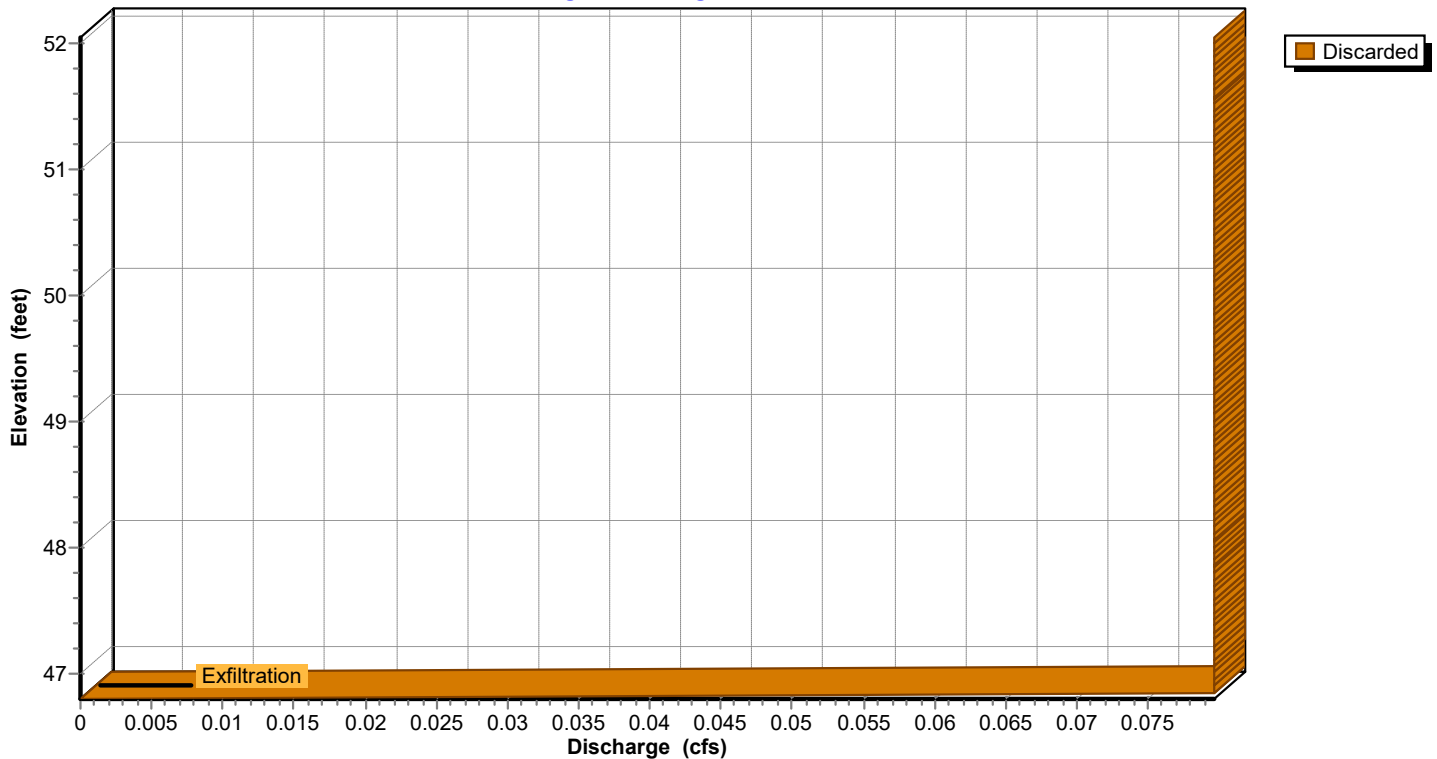
Pond IS1: System #1

Hydrograph



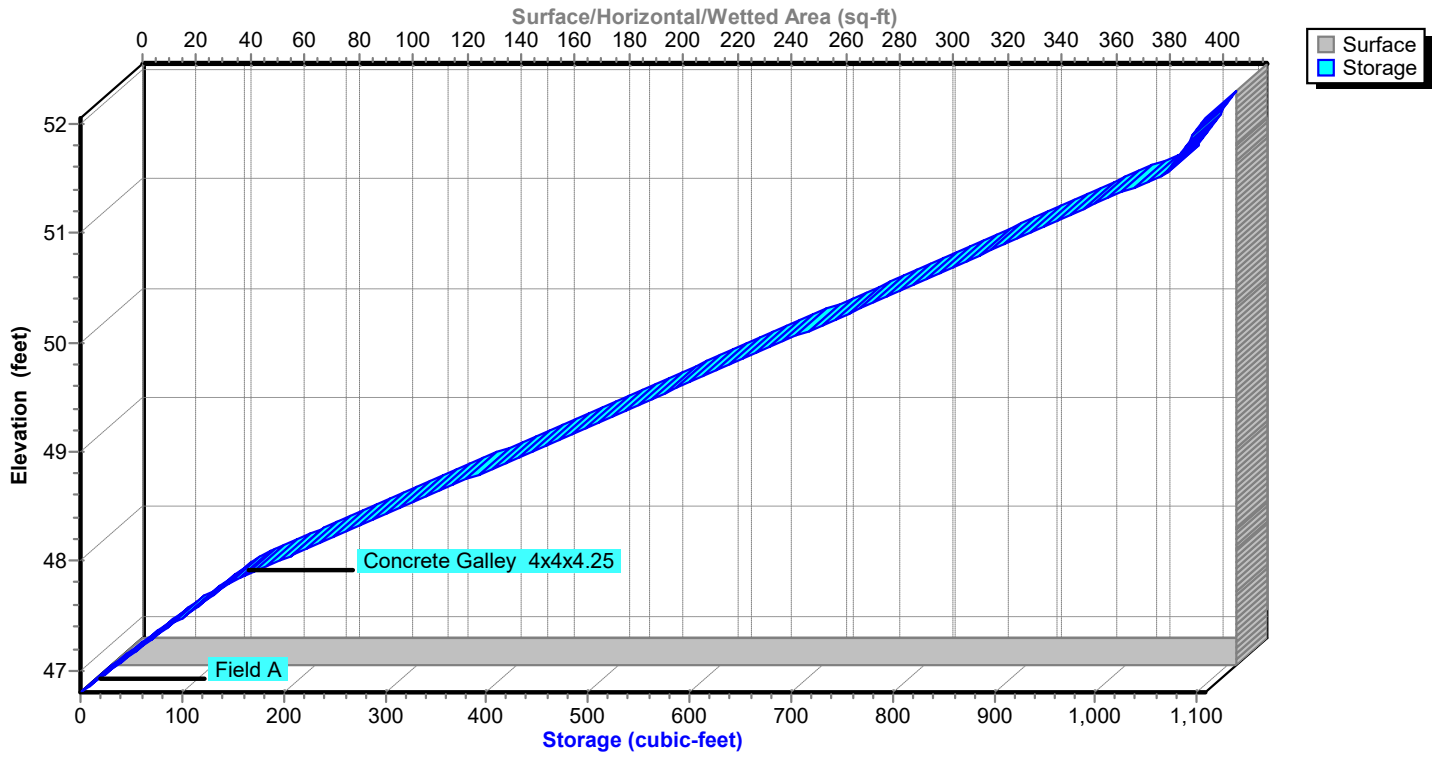
Pond IS1: System #1

Stage-Discharge



Pond IS1: System #1

Stage-Area-Storage



Summary for Pond IS2: System #2

Inflow Area = 0.077 ac, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.35 cfs @ 12.07 hrs, Volume= 0.027 af
 Outflow = 0.06 cfs @ 11.74 hrs, Volume= 0.027 af, Atten= 83%, Lag= 0.0 min
 Discarded = 0.06 cfs @ 11.74 hrs, Volume= 0.027 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 47.26' @ 12.52 hrs Surf.Area= 312 sf Storage= 293 cf

Plug-Flow detention time= 25.1 min calculated for 0.027 af (100% of inflow)
 Center-of-Mass det. time= 25.1 min (774.0 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	45.25'	355 cf	13.00'W x 24.00'L x 5.25'H Field A 1,638 cf Overall - 623 cf Embedded = 1,015 cf x 35.0% Voids
#2A	46.25'	464 cf	Concrete Galley 4x4x4.25 x 10 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 10 Chambers in 2 Rows
		819 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.25'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 11.74 hrs HW=45.31' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IS2: System #2 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

5 Chambers/Row x 4.00' Long = 20.00' Row Length +24.0" End Stone x 2 = 24.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

10 Chambers x 46.4 cf = 463.8 cf Chamber Storage

10 Chambers x 62.3 cf = 623.3 cf Displacement

1,638.0 cf Field - 623.3 cf Chambers = 1,014.7 cf Stone x 35.0% Voids = 355.1 cf Stone Storage

Chamber Storage + Stone Storage = 818.9 cf = 0.019 af

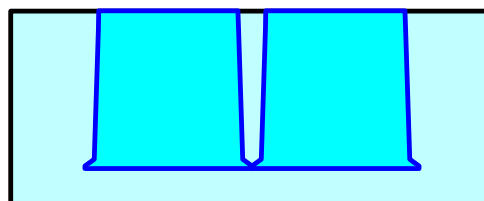
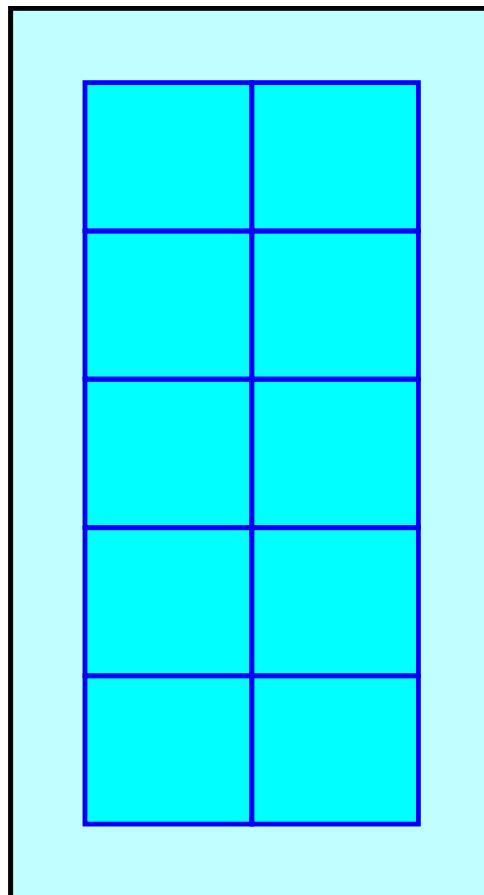
Overall Storage Efficiency = 50.0%

Overall System Size = 24.00' x 13.00' x 5.25'

10 Chambers

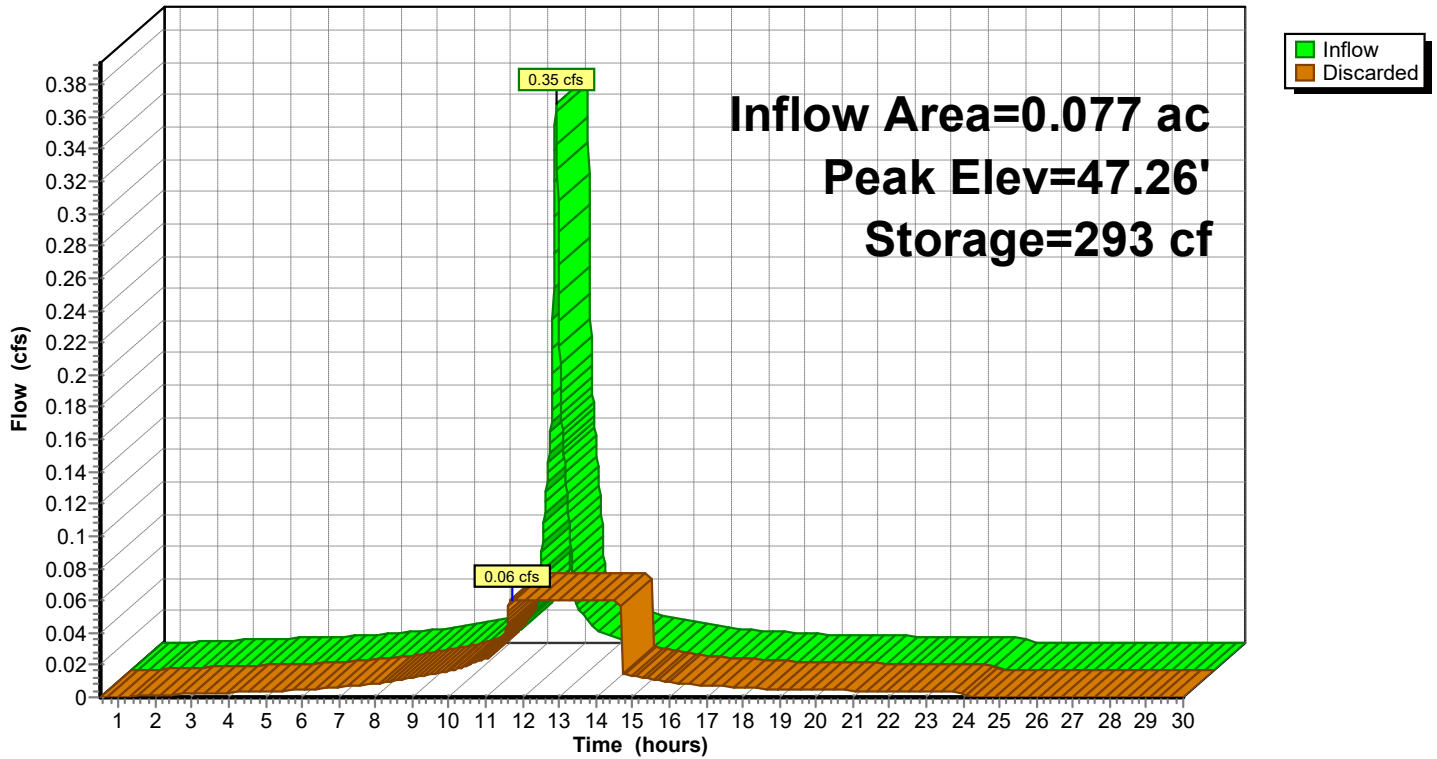
60.7 cy Field

37.6 cy Stone



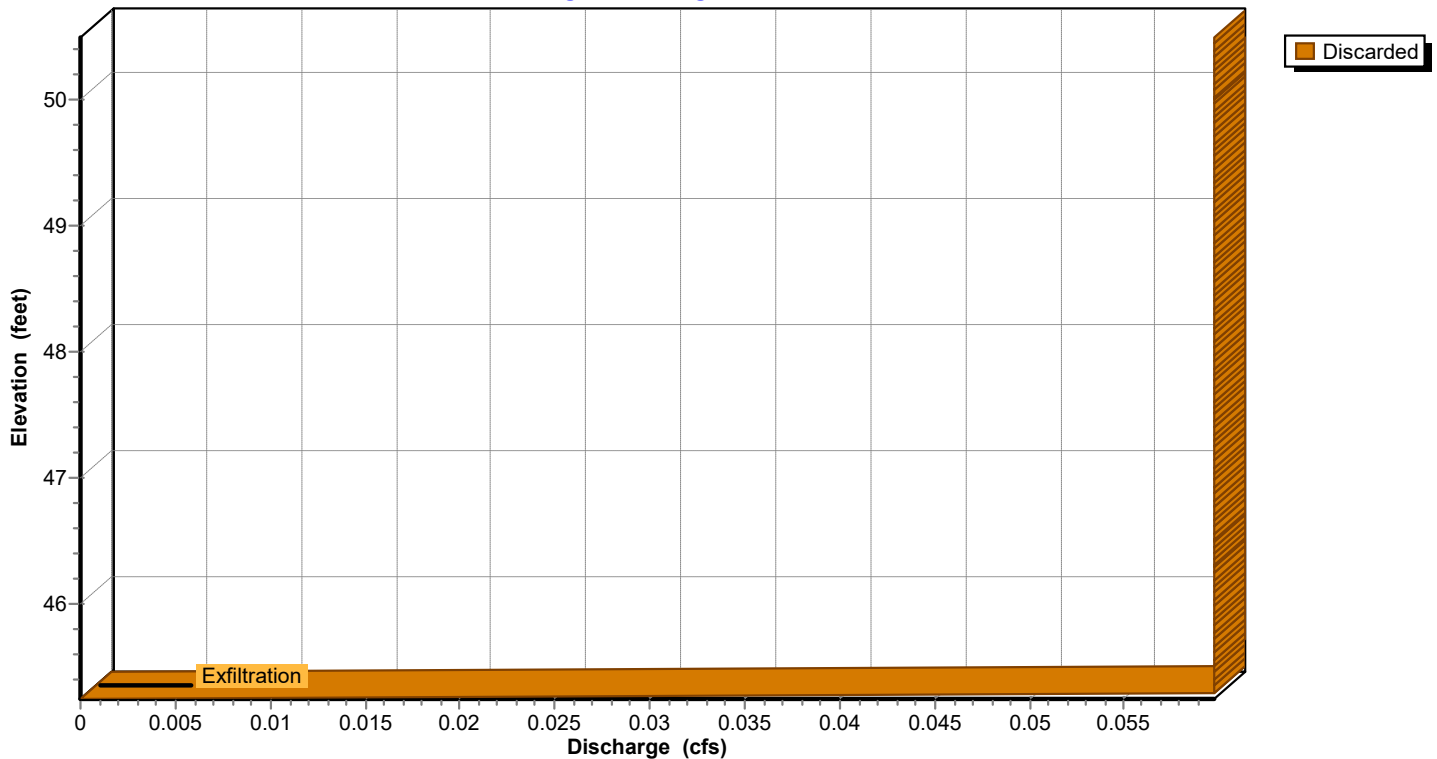
Pond IS2: System #2

Hydrograph



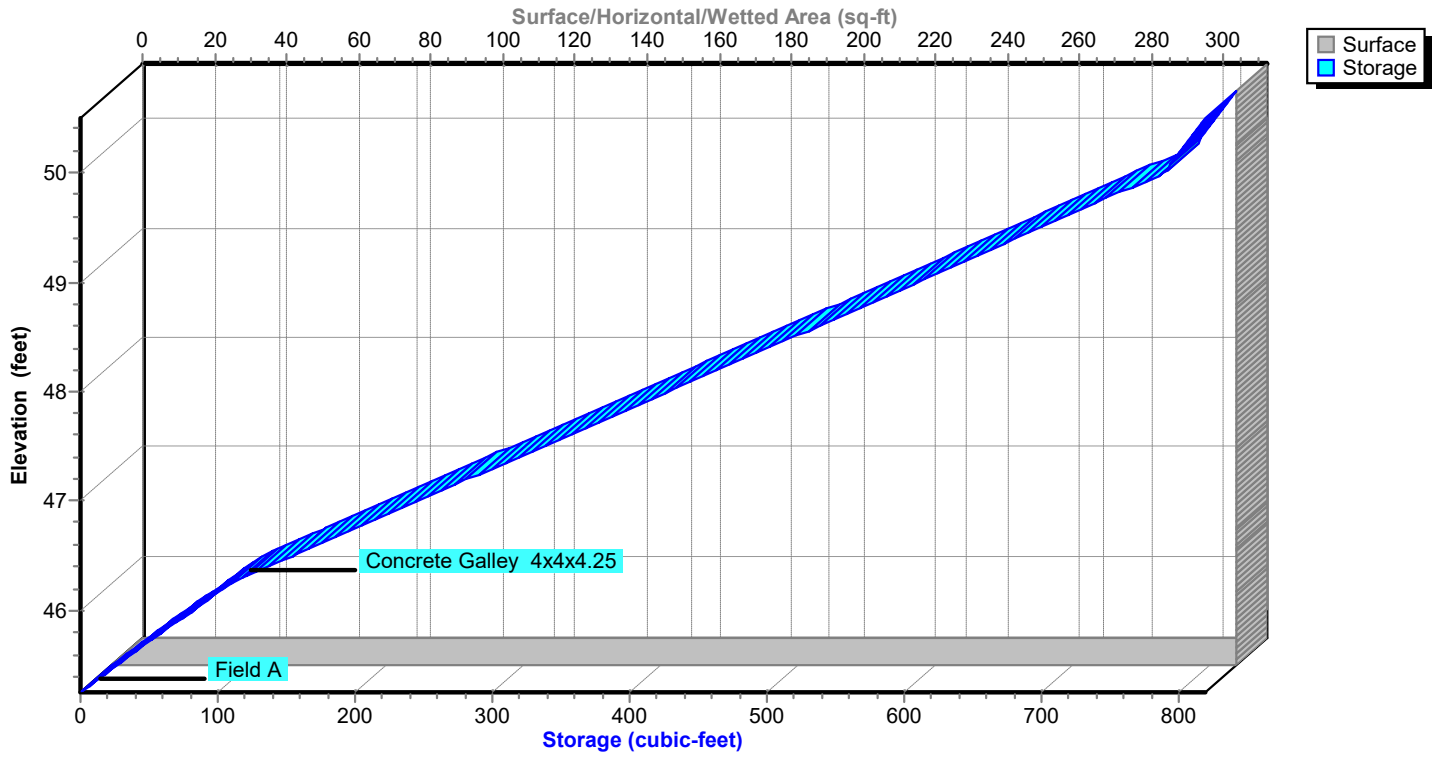
Pond IS2: System #2

Stage-Discharge



Pond IS2: System #2

Stage-Area-Storage



Summary for Pond IS3: System #3

Inflow Area = 0.118 ac, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.54 cfs @ 12.07 hrs, Volume= 0.042 af
 Outflow = 0.07 cfs @ 11.67 hrs, Volume= 0.042 af, Atten= 87%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.67 hrs, Volume= 0.042 af
 Primary = 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= 45.34' @ 12.58 hrs Surf.Area= 364 sf Storage= 524 cf

Plug-Flow detention time= 43.4 min calculated for 0.042 af (100% of inflow)
 Center-of-Mass det. time= 43.4 min (792.3 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	42.50'	407 cf	13.00'W x 28.00'L x 5.25'H Field A 1,911 cf Overall - 748 cf Embedded = 1,163 cf x 35.0% Voids
#2A	43.50'	557 cf	Concrete Galley 4x4x4.25 x 12 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 12 Chambers in 2 Rows
		964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	42.50'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	46.80'	8.0" Round Culvert L= 72.0' Ke= 0.090 Inlet / Outlet Invert= 46.80' / 45.00' S= 0.0250 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 11.67 hrs HW=42.55' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.50 hrs HW=42.50' TW=43.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Controls 0.00 cfs)

Pond IS3: System #3 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

6 Chambers/Row x 4.00' Long = 24.00' Row Length +24.0" End Stone x 2 = 28.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

12 Chambers x 46.4 cf = 556.6 cf Chamber Storage

12 Chambers x 62.3 cf = 748.0 cf Displacement

1,911.0 cf Field - 748.0 cf Chambers = 1,163.0 cf Stone x 35.0% Voids = 407.1 cf Stone Storage

Chamber Storage + Stone Storage = 963.6 cf = 0.022 af

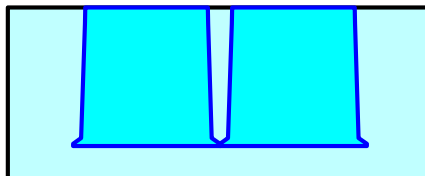
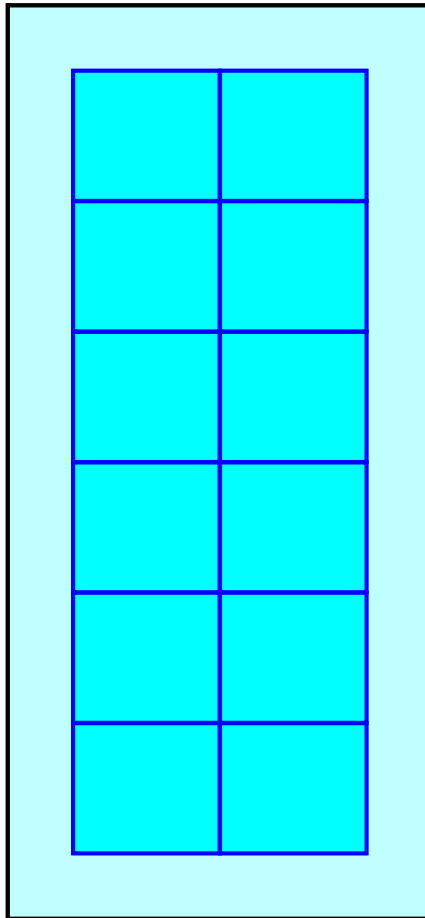
Overall Storage Efficiency = 50.4%

Overall System Size = 28.00' x 13.00' x 5.25'

12 Chambers

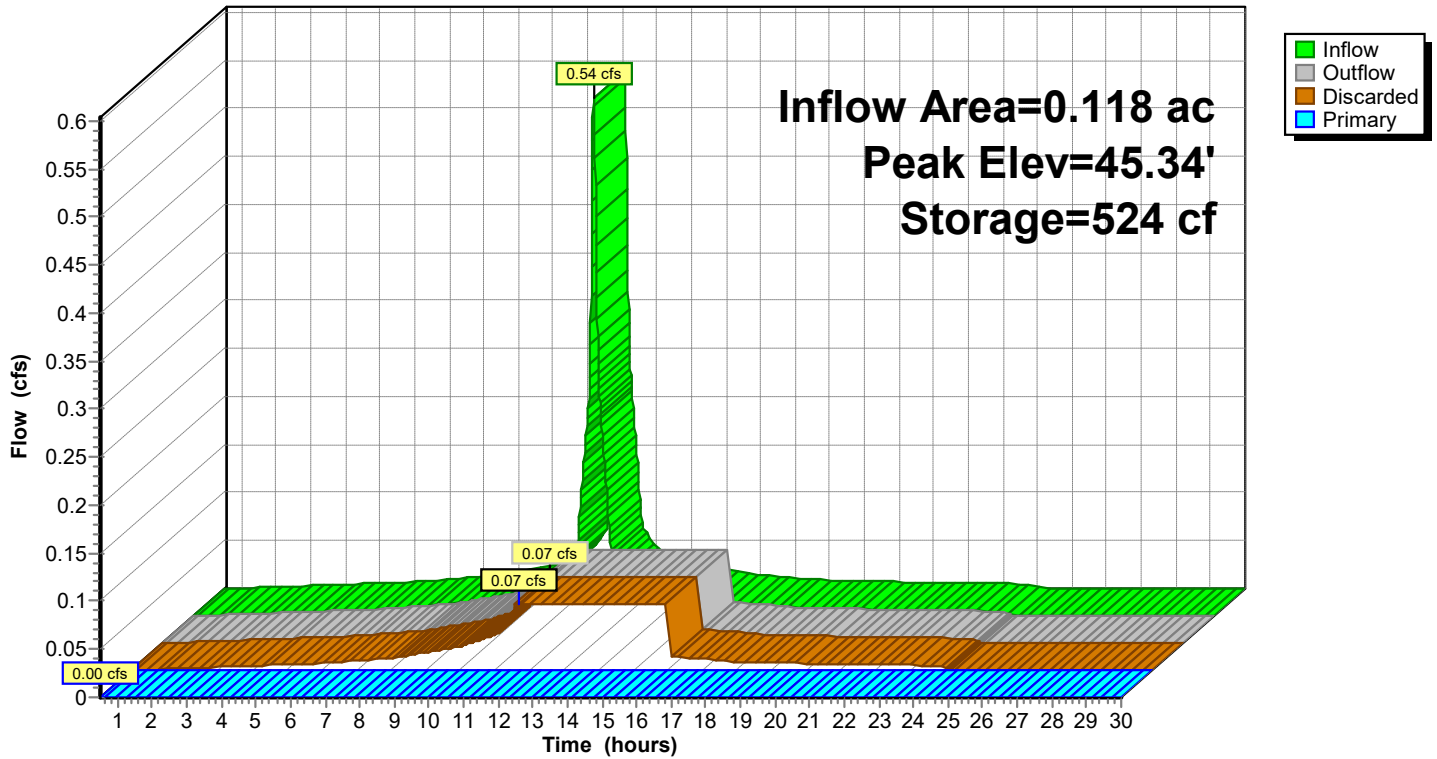
70.8 cy Field

43.1 cy Stone



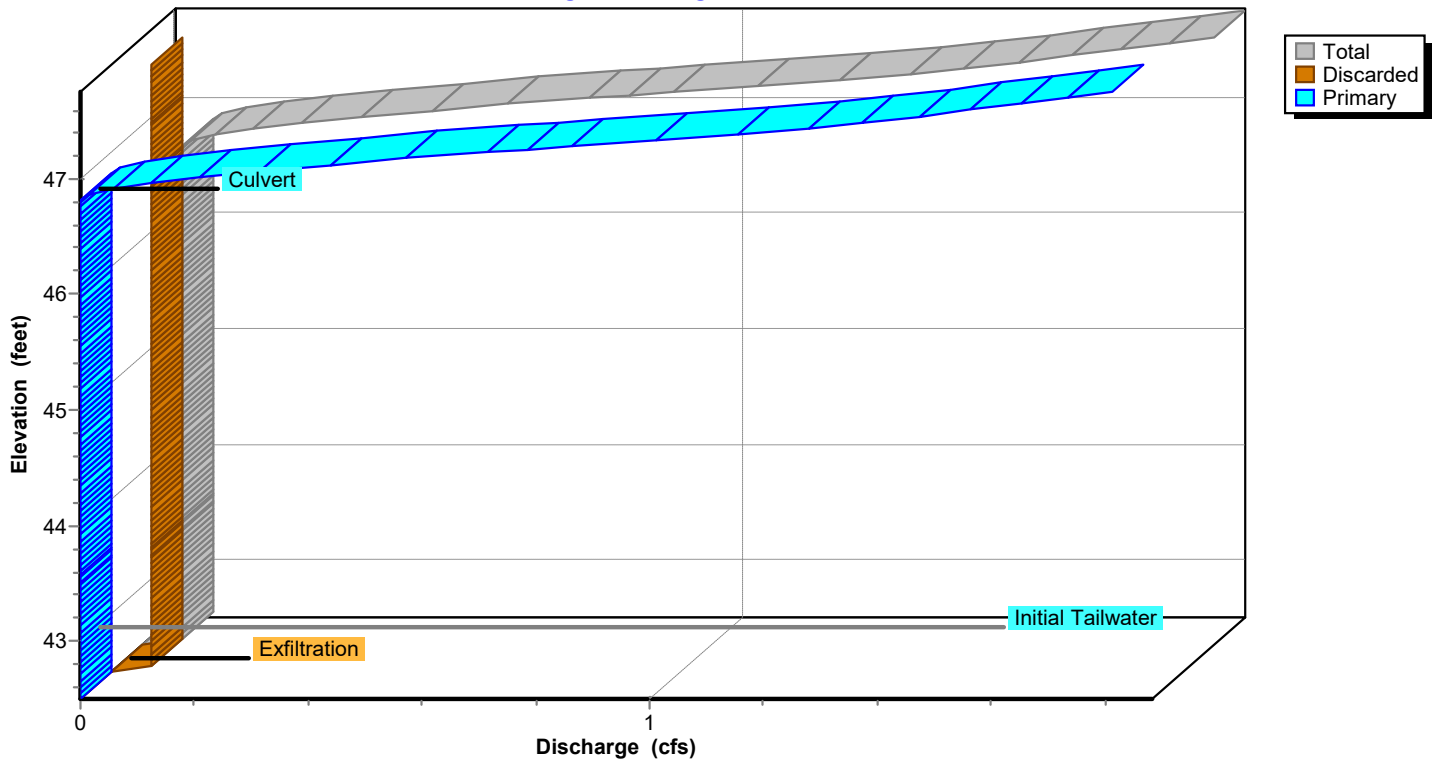
Pond IS3: System #3

Hydrograph



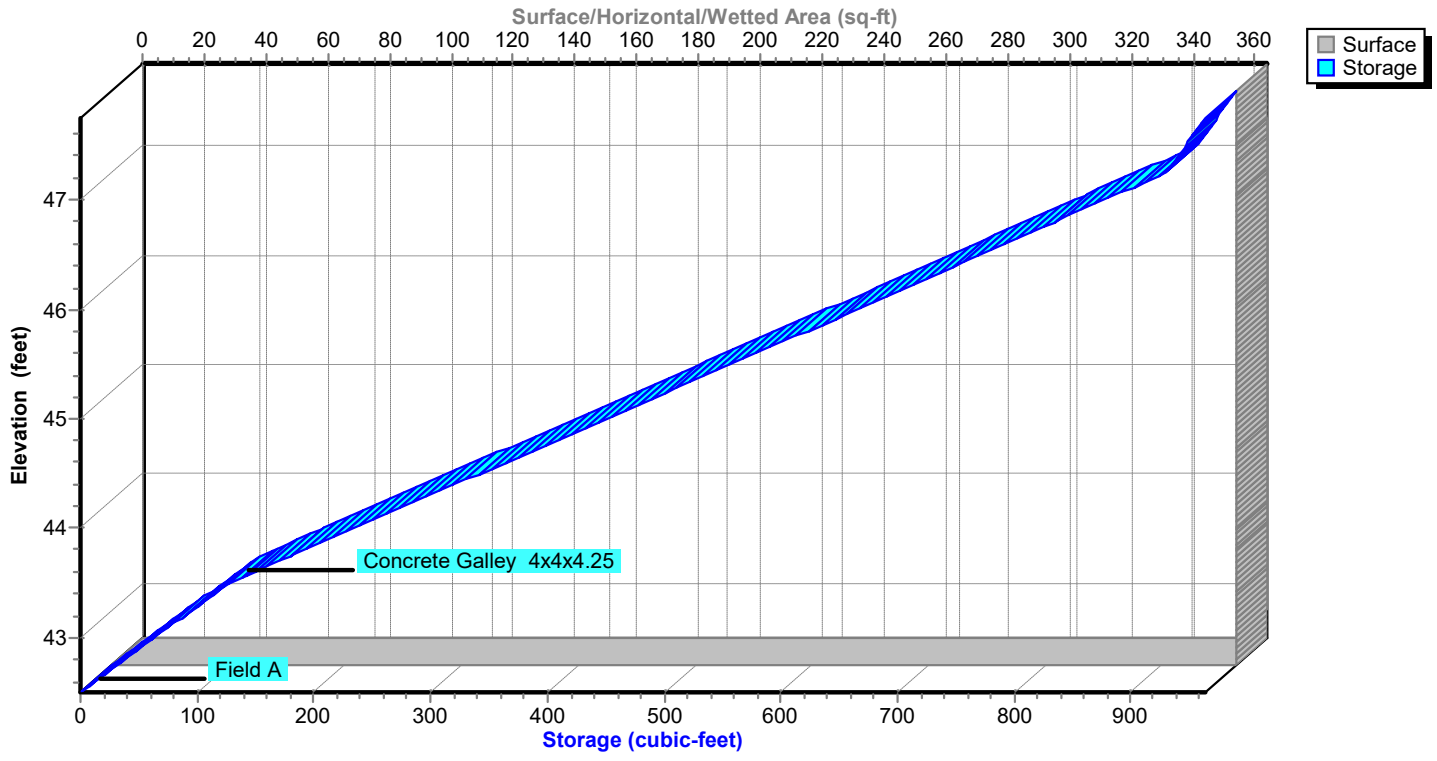
Pond IS3: System #3

Stage-Discharge



Pond IS3: System #3

Stage-Area-Storage



Summary for Pond IS4: (Retention Pond)

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 0.11" for 10-Year event
 Inflow = 0.01 cfs @ 12.44 hrs, Volume= 0.003 af
 Outflow = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 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= 43.18' @ 24.29 hrs Surf.Area= 690 sf Storage= 117 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	43.00'	1,949 cf	Custom Stage Data (Irregular) Listed below (Recalc)

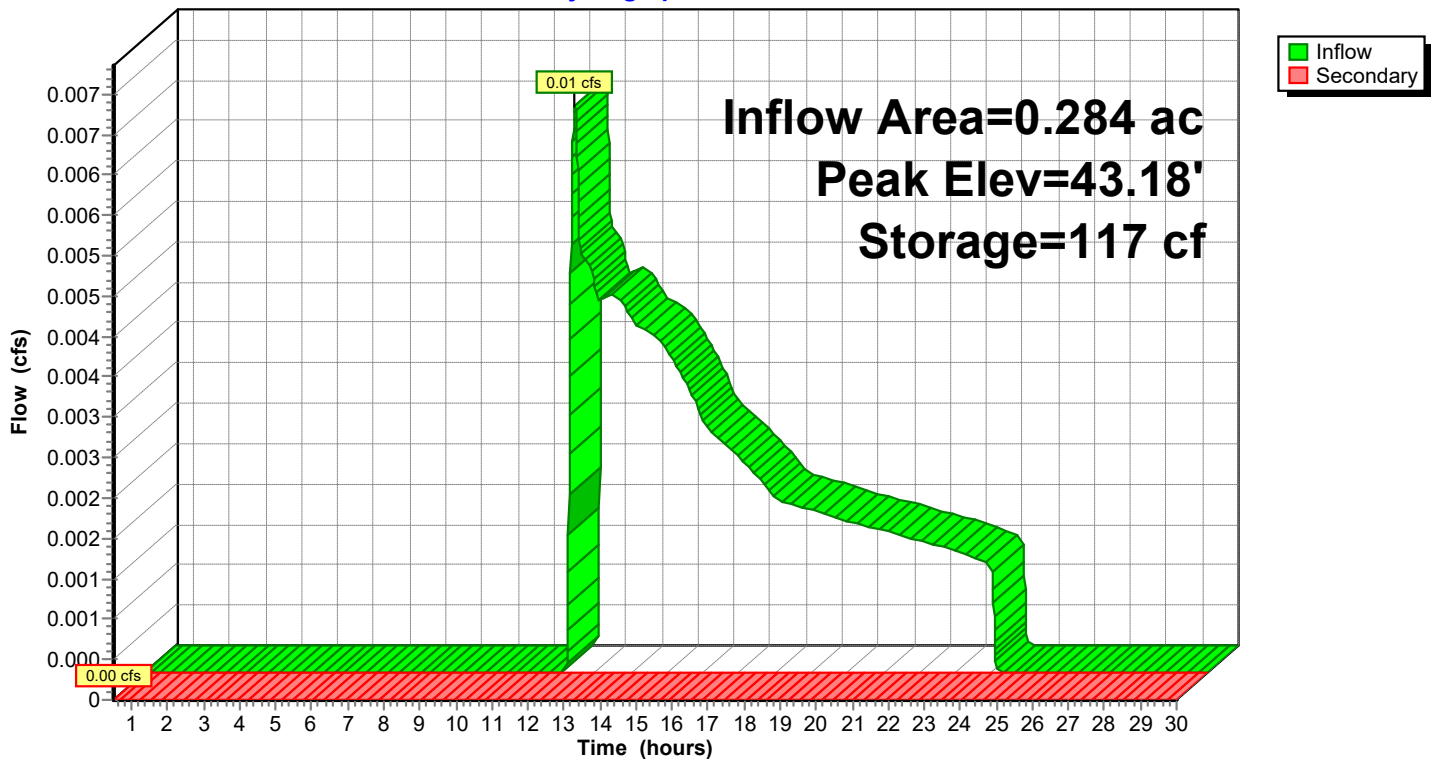
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.00	637	100.0	0	0	637
44.00	966	119.0	796	796	986
45.00	1,351	137.0	1,153	1,949	1,374

Device	Routing	Invert	Outlet Devices
#1	Secondary	44.50'	45.0 deg x 3.0' wide x 0.50' high Dam Breach C= 2.56 Top of breach = 45.00' Bottom of breach = 44.50' Breach starts at 44.50' WSE and develops over 1.000 hrs

Secondary OutFlow Max=0.00 cfs @ 0.50 hrs HW=43.00' TW=0.00' (Dynamic Tailwater)
 1=Dam Breach (Controls 0.00 cfs)

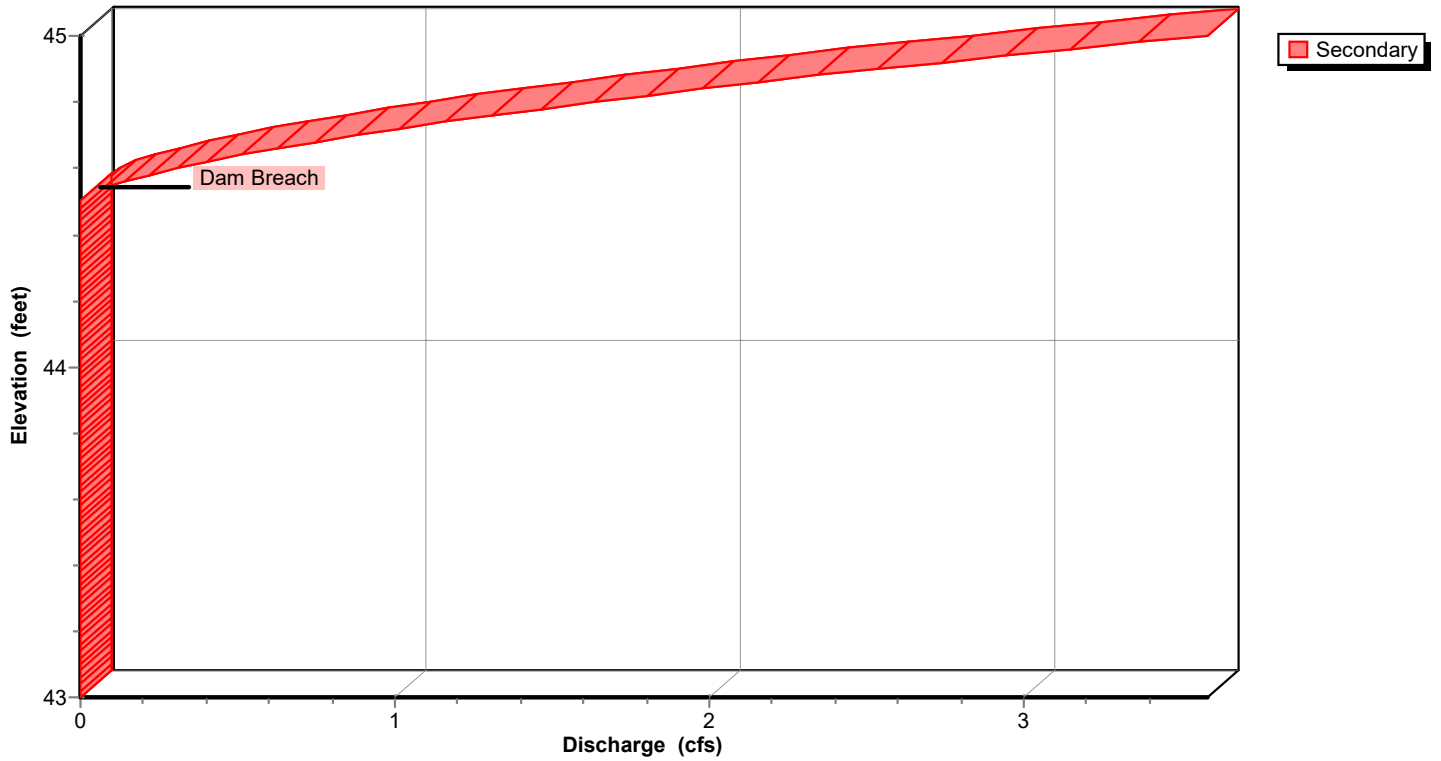
Pond IS4: (Retention Pond)

Hydrograph



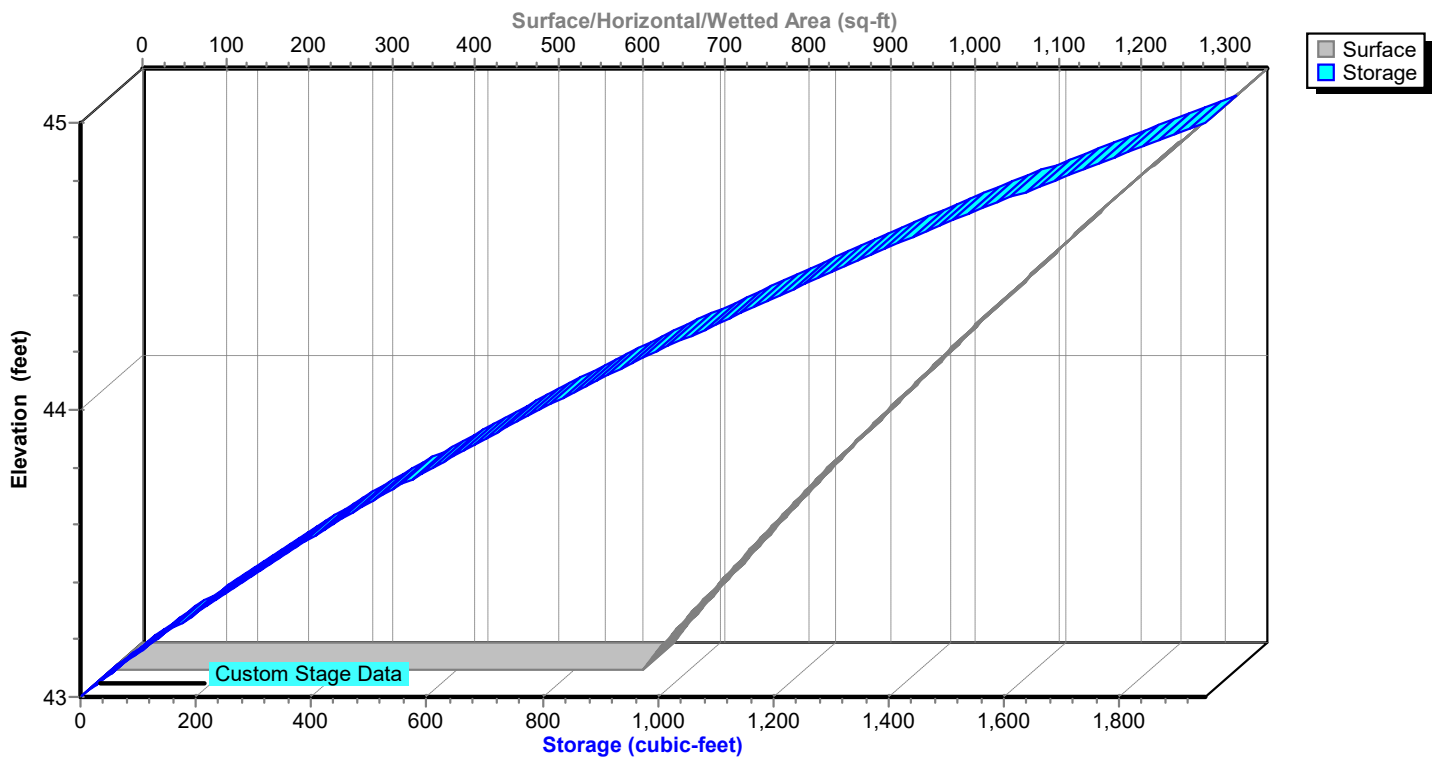
Pond IS4: (Retention Pond)

Stage-Discharge



Pond IS4: (Retention Pond)

Stage-Area-Storage



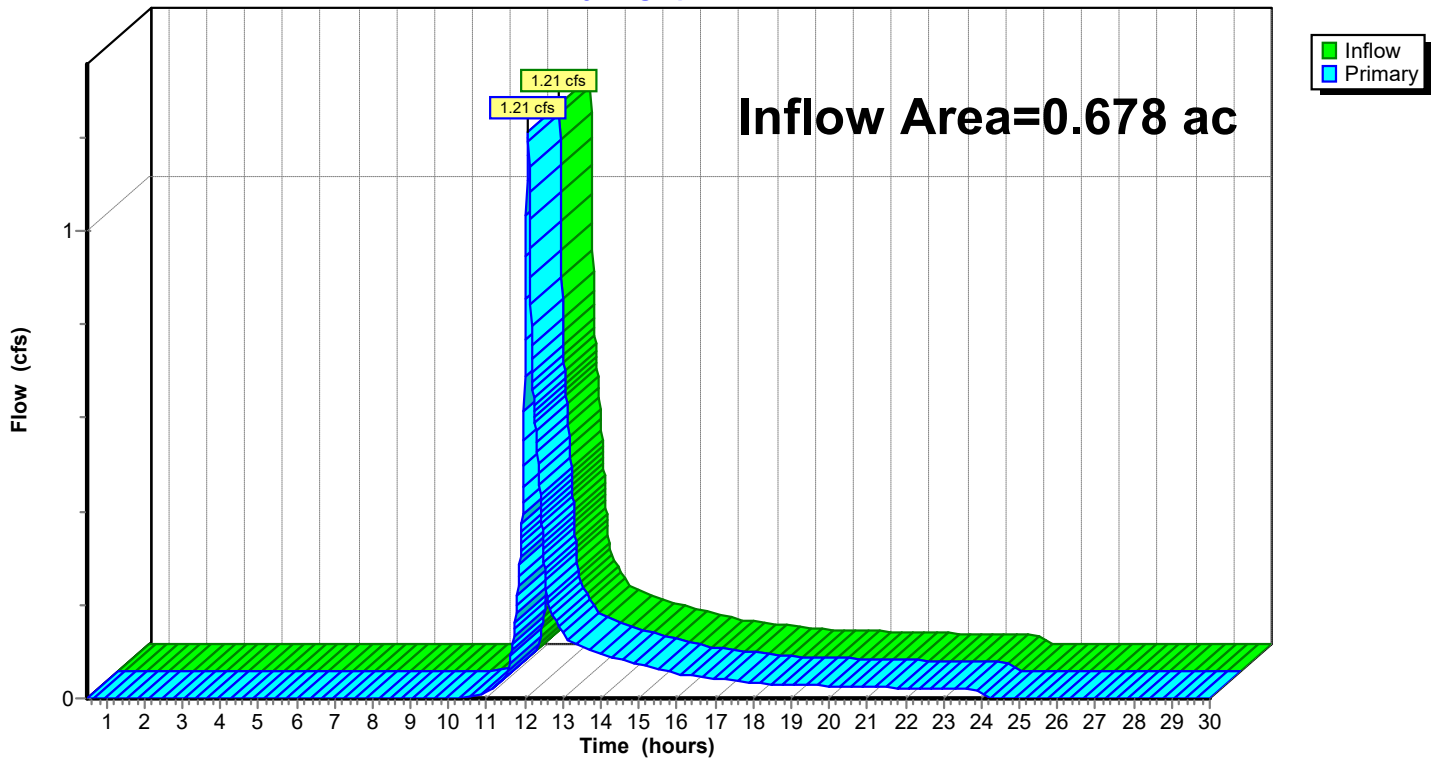
Summary for Link POD1: South-West Abutter

Inflow Area = 0.678 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10-Year event
Inflow = 1.21 cfs @ 12.08 hrs, Volume= 0.087 af
Primary = 1.21 cfs @ 12.08 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min

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

Link POD1: South-West Abutter

Hydrograph



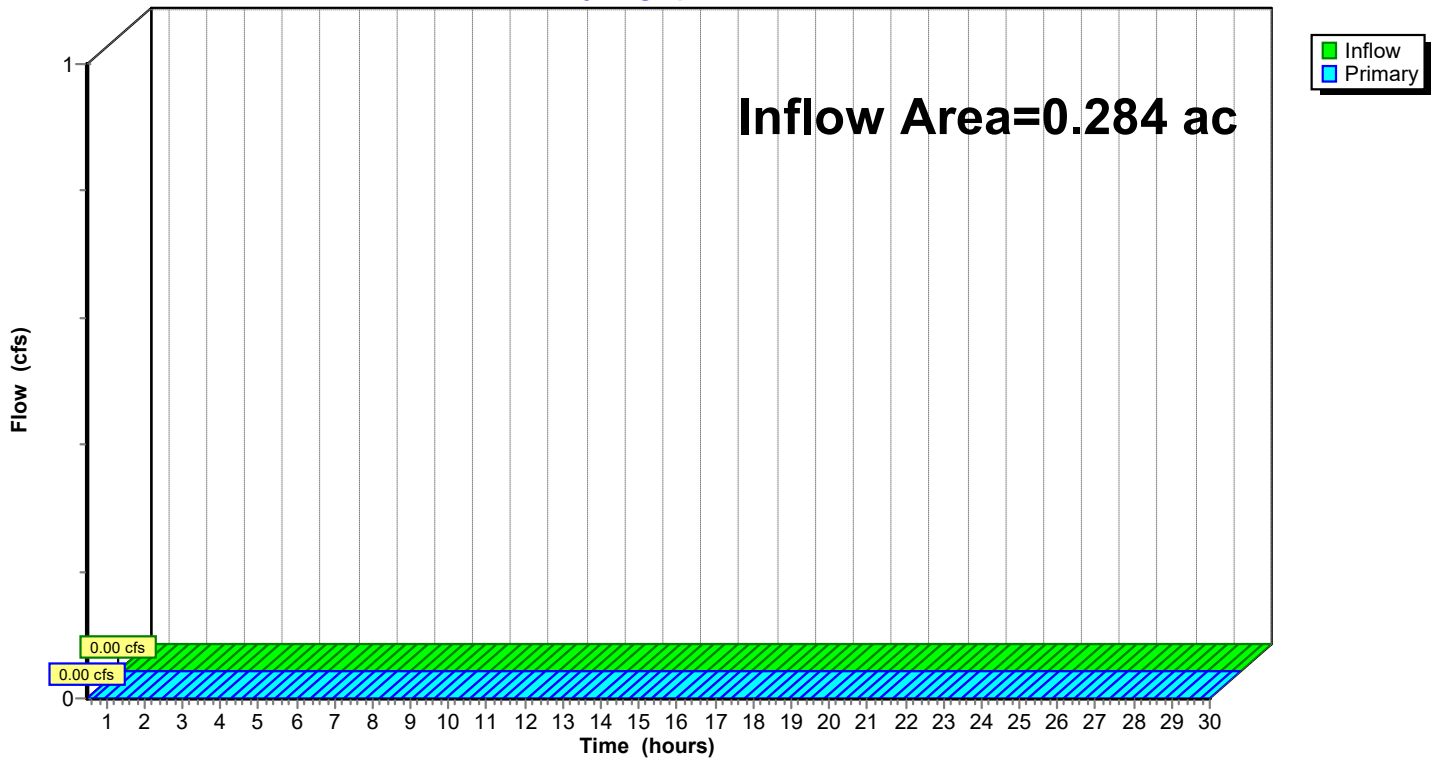
Summary for Link POD1.: South-West Abutter

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.50 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.: South-West Abutter

Hydrograph



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=29,550 sf 0.00% Impervious Runoff Depth=2.10" Tc=5.0 min CN=68 Runoff=1.69 cfs 0.118 af
Subcatchment P1: Sub-catchment-1	Runoff Area=7,199 sf 0.00% Impervious Runoff Depth=0.39" Tc=5.0 min CN=42 Runoff=0.03 cfs 0.005 af
Subcatchment PD1: Driveway	Runoff Area=2,276 sf 98.33% Impervious Runoff Depth=4.95" Tc=5.0 min CN=97 Runoff=0.28 cfs 0.022 af
Subcatchment PD2: Driveway	Runoff Area=4,038 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.50 cfs 0.039 af
Subcatchment PR1: Roof_BLDG-1	Runoff Area=2,260 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.28 cfs 0.022 af
Subcatchment PR2: Roof_BLDG-2	Runoff Area=3,360 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.41 cfs 0.033 af
Subcatchment PR3: Roof_BLDG-3	Runoff Area=1,120 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.14 cfs 0.011 af
Pond IS1: System #1	Peak Elev=49.29' Storage=516 cf Inflow=0.56 cfs 0.043 af Outflow=0.08 cfs 0.043 af
Pond IS2: System #2	Peak Elev=47.74' Storage=382 cf Inflow=0.41 cfs 0.033 af Outflow=0.06 cfs 0.033 af
Pond IS3: System #3	Peak Elev=46.01' Storage=666 cf Inflow=0.64 cfs 0.050 af Discarded=0.07 cfs 0.050 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.050 af
Pond IS4: (Retention Pond)	Peak Elev=43.34' Storage=236 cf Inflow=0.03 cfs 0.005 af Outflow=0.00 cfs 0.000 af
Link POD1: South-West Abutter	Inflow=1.69 cfs 0.118 af Primary=1.69 cfs 0.118 af
Link POD1.: South-West Abutter	Inflow=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.143 ac Runoff Volume = 0.250 af Average Runoff Depth = 2.62"
73.87% Pervious = 0.845 ac 26.13% Impervious = 0.299 ac

Summary for Subcatchment E1: Sub-catchment-1

Runoff = 1.69 cfs @ 12.08 hrs, Volume= 0.118 af, Depth= 2.10"

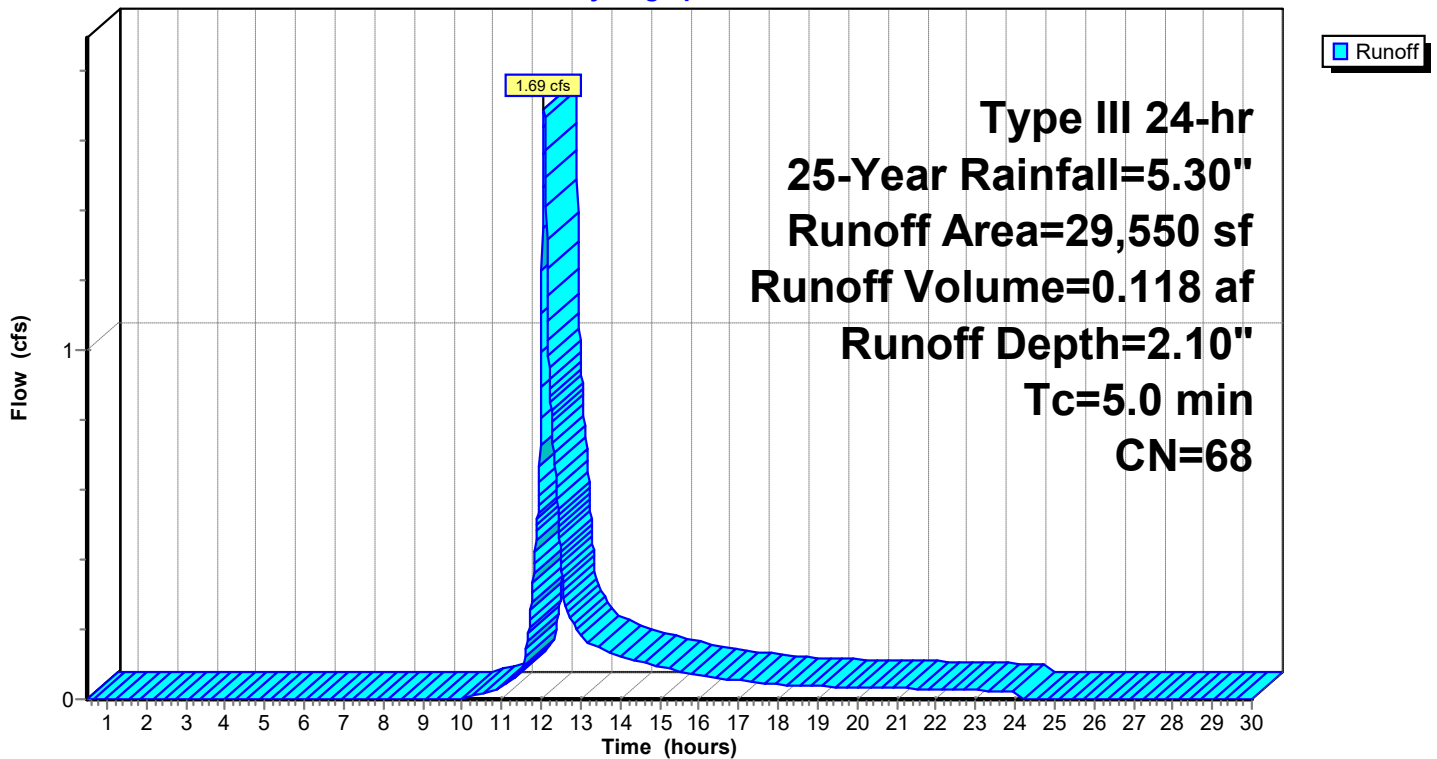
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
29,550	68	<50% Grass cover, Poor, HSG A
29,550		100.00% Pervious Area

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

Subcatchment E1: Sub-catchment-1

Hydrograph



Summary for Subcatchment P1: Sub-catchment-1

Runoff = 0.03 cfs @ 12.33 hrs, Volume= 0.005 af, Depth= 0.39"

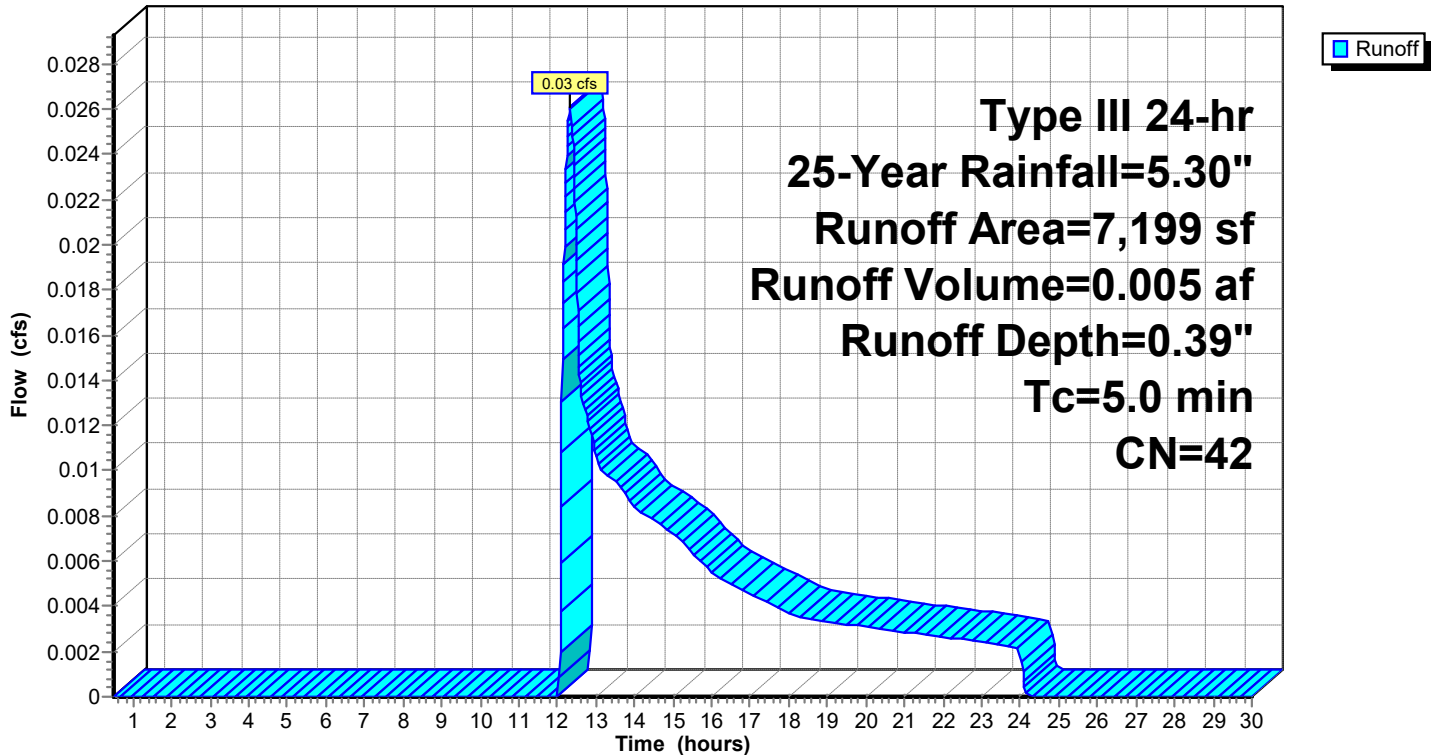
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
2,623	39	>75% Grass cover, Good, HSG A
3,705	36	Woods, Fair, HSG A
871	76	Gravel roads, HSG A
7,199	42	Weighted Average
7,199		100.00% Pervious Area

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

Subcatchment P1: Sub-catchment-1

Hydrograph



Summary for Subcatchment PD1: Driveway

Runoff = 0.28 cfs @ 12.07 hrs, Volume= 0.022 af, Depth= 4.95"

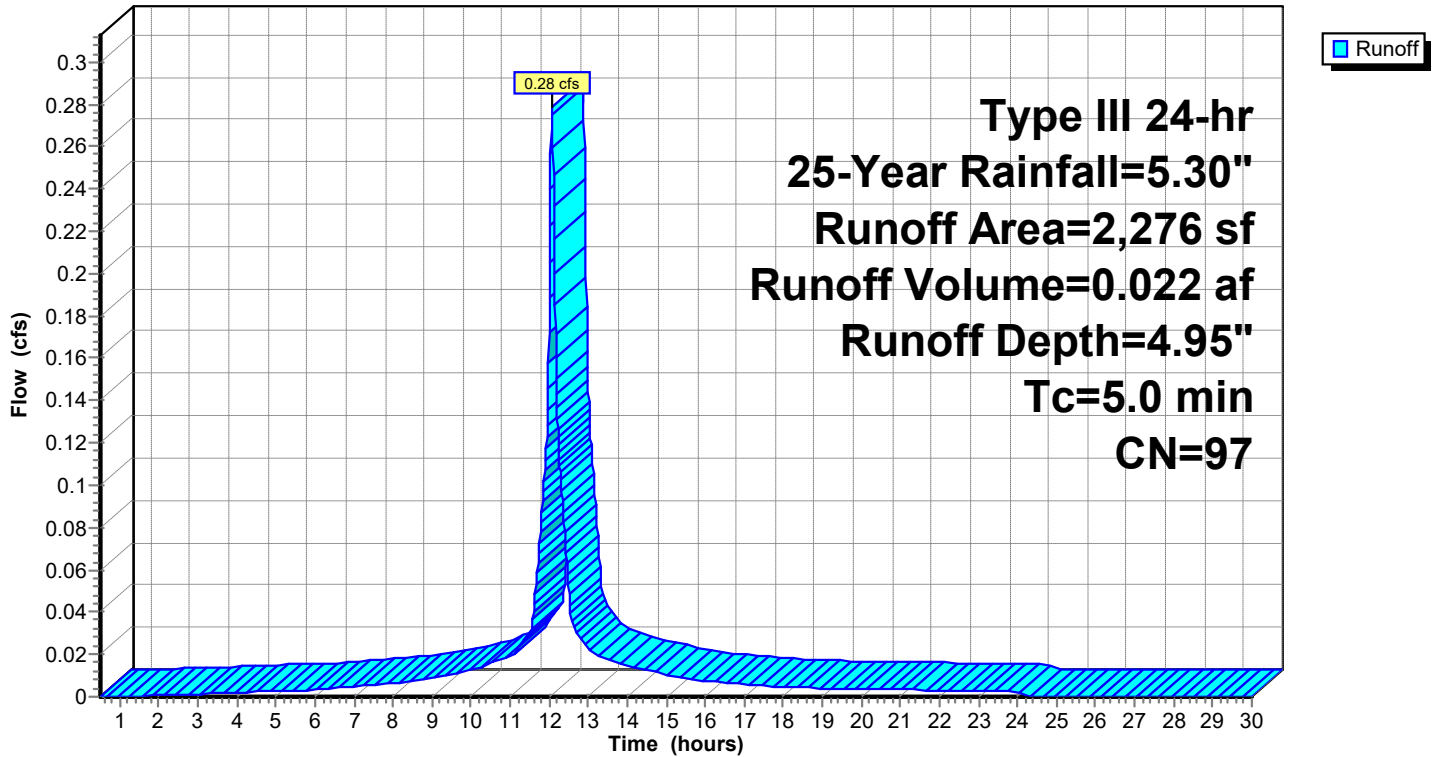
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
2,238	98	Paved parking, HSG A
* 38	65	Paver walkway
2,276	97	Weighted Average
38		1.67% Pervious Area
2,238		98.33% Impervious Area

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

Subcatchment PD1: Driveway

Hydrograph



Summary for Subcatchment PD2: Driveway

Runoff = 0.50 cfs @ 12.07 hrs, Volume= 0.039 af, Depth= 5.06"

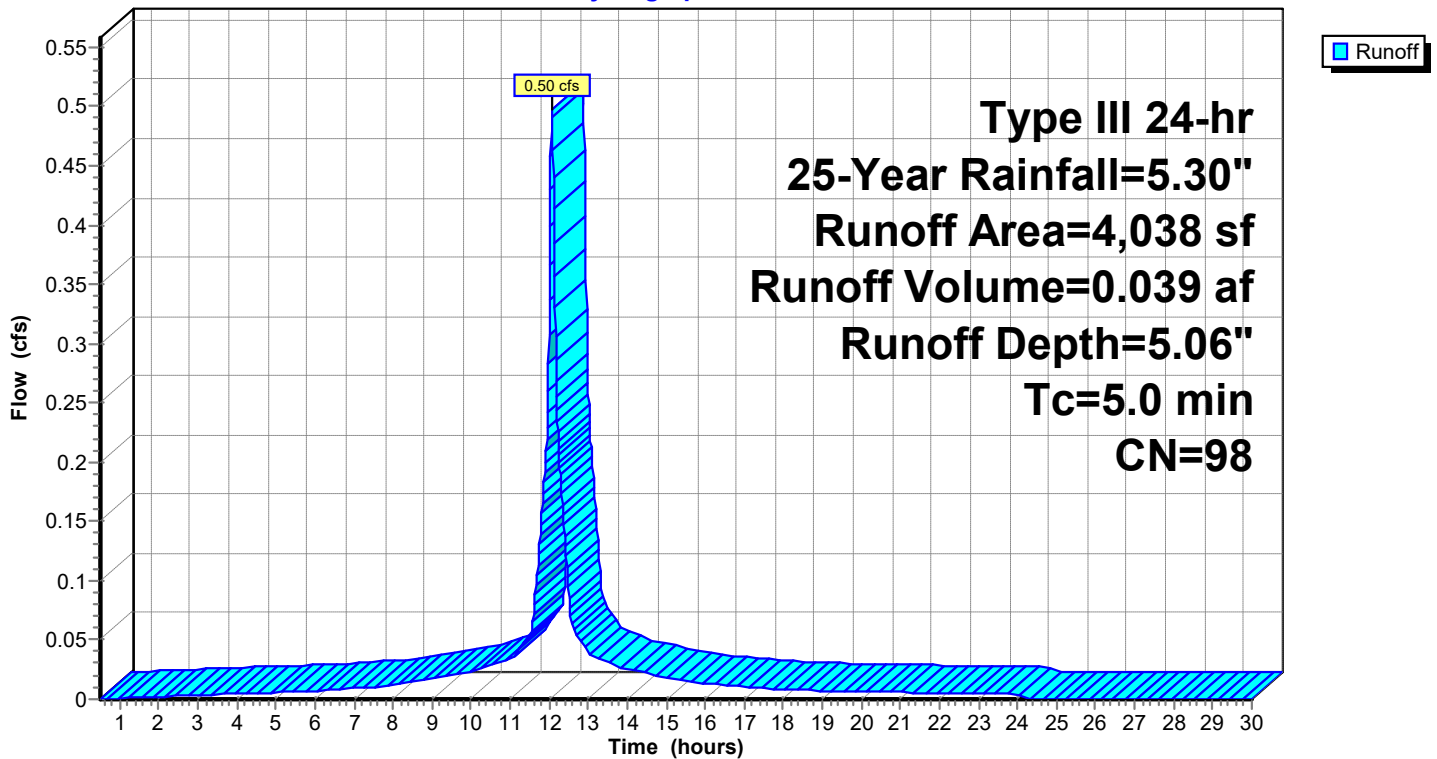
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
4,038	98	Paved parking, HSG A
4,038		100.00% Impervious Area

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

Subcatchment PD2: Driveway

Hydrograph



Summary for Subcatchment PR1: Roof_BLDG-1

Runoff = 0.28 cfs @ 12.07 hrs, Volume= 0.022 af, Depth= 5.06"

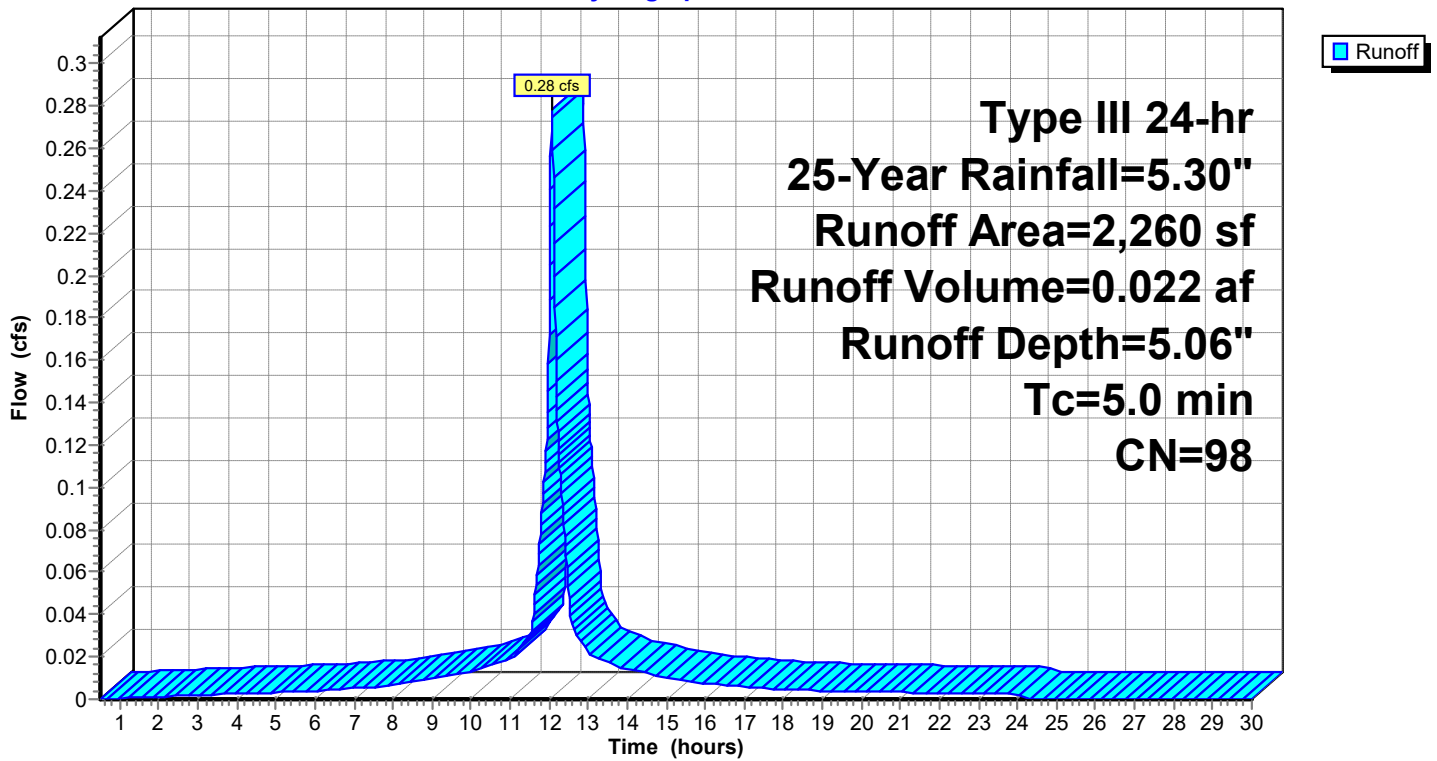
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
* 2,260	98	Roofs, HSG A
2,260		100.00% Impervious Area

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

Subcatchment PR1: Roof_BLDG-1

Hydrograph



Summary for Subcatchment PR2: Roof_BLDG-2

Runoff = 0.41 cfs @ 12.07 hrs, Volume= 0.033 af, Depth= 5.06"

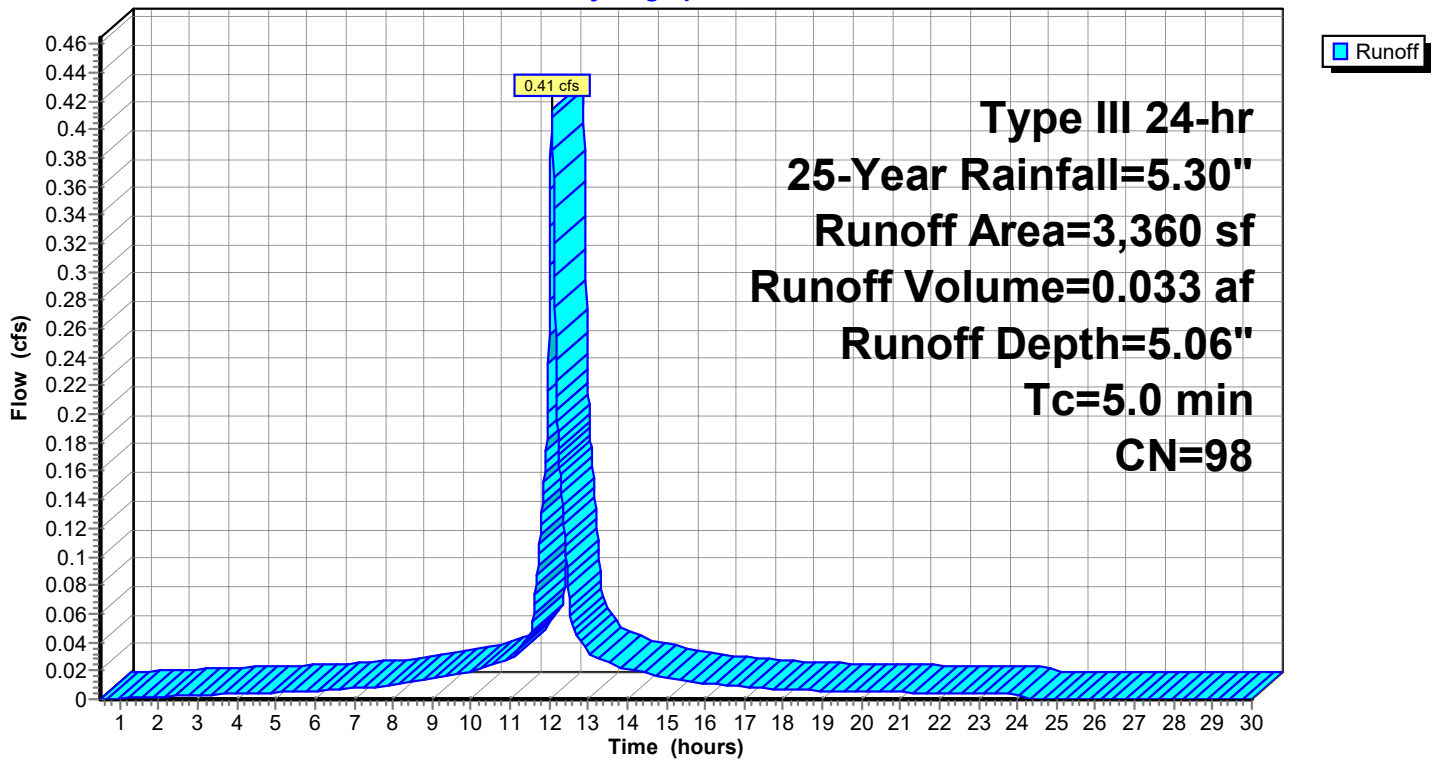
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
* 3,360	98	Roofs, HSG A
3,360		100.00% Impervious Area

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

Subcatchment PR2: Roof_BLDG-2

Hydrograph



Summary for Subcatchment PR3: Roof_BLDG-3

Runoff = 0.14 cfs @ 12.07 hrs, Volume= 0.011 af, Depth= 5.06"

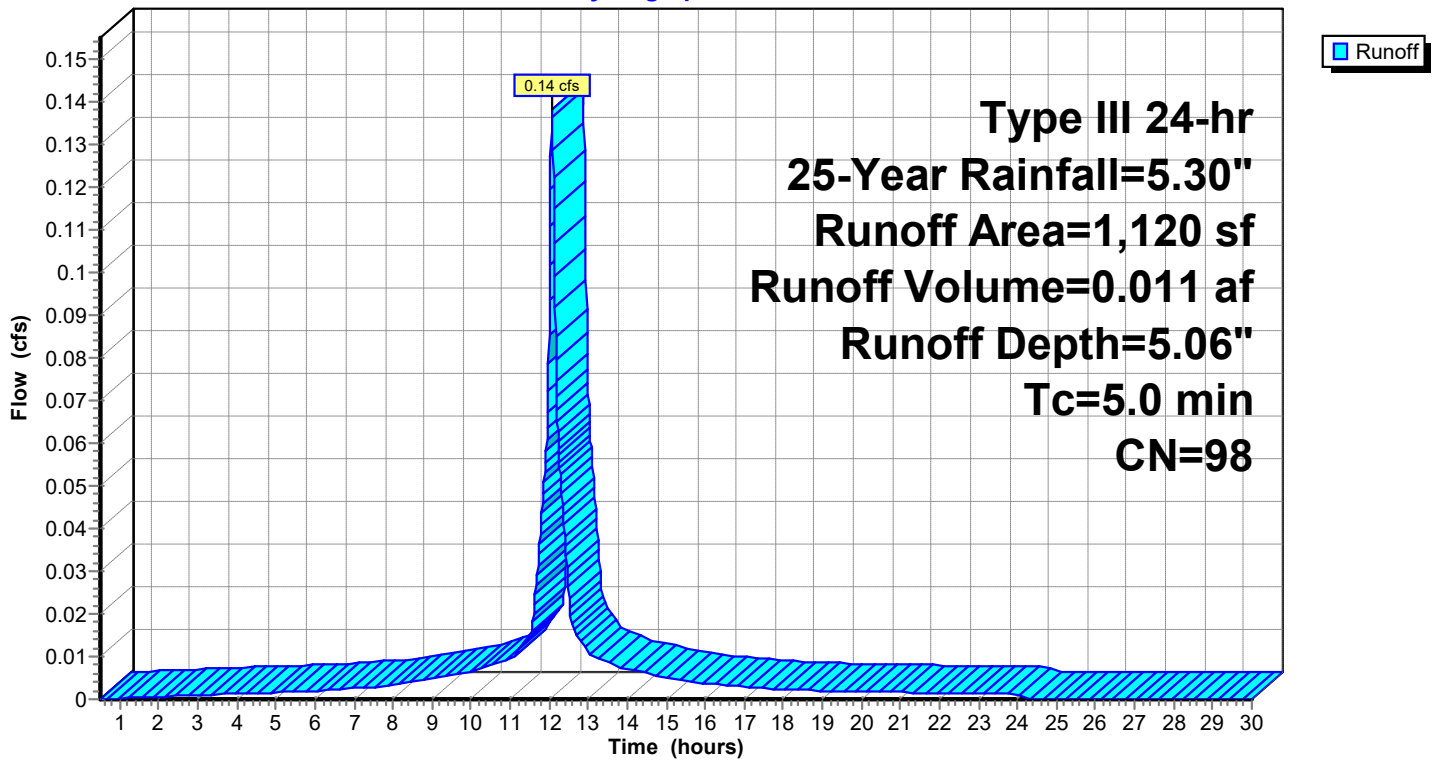
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
* 1,120	98	Roofs, HSG A
1,120		100.00% Impervious Area

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

Subcatchment PR3: Roof_BLDG-3

Hydrograph



Summary for Pond IS1: System #1

Inflow Area = 0.104 ac, 99.16% Impervious, Inflow Depth = 5.00" for 25-Year event
 Inflow = 0.56 cfs @ 12.07 hrs, Volume= 0.043 af
 Outflow = 0.08 cfs @ 11.70 hrs, Volume= 0.043 af, Atten= 86%, Lag= 0.0 min
 Discarded = 0.08 cfs @ 11.70 hrs, Volume= 0.043 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 49.29' @ 12.55 hrs Surf.Area= 416 sf Storage= 516 cf

Plug-Flow detention time= 35.9 min calculated for 0.043 af (100% of inflow)
 Center-of-Mass det. time= 35.8 min (785.7 - 749.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	46.80'	459 cf	13.00'W x 32.00'L x 5.25'H Field A 2,184 cf Overall - 873 cf Embedded = 1,311 cf x 35.0% Voids
#2A	47.80'	649 cf	Concrete Galley 4x4x4.25 x 14 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 14 Chambers in 2 Rows
		1,108 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.80'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.08 cfs @ 11.70 hrs HW=46.86' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Pond IS1: System #1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

7 Chambers/Row x 4.00' Long = 28.00' Row Length +24.0" End Stone x 2 = 32.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

14 Chambers x 46.4 cf = 649.3 cf Chamber Storage

14 Chambers x 62.3 cf = 872.6 cf Displacement

2,184.0 cf Field - 872.6 cf Chambers = 1,311.4 cf Stone x 35.0% Voids = 459.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,108.3 cf = 0.025 af

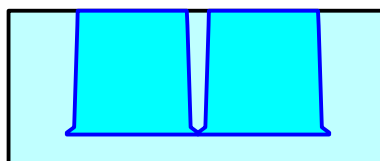
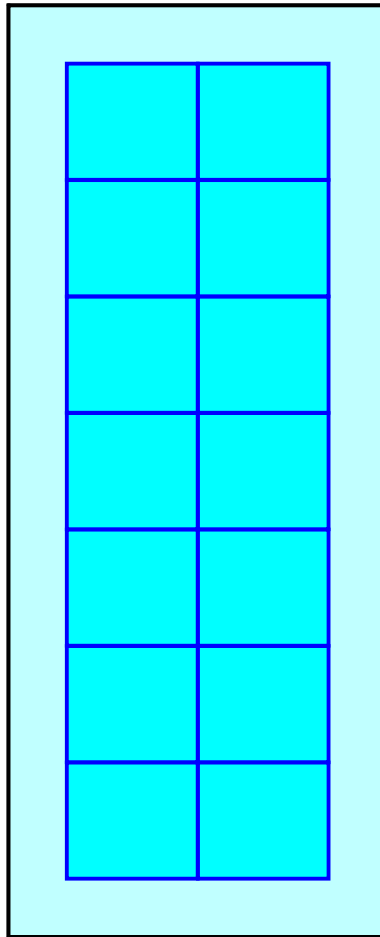
Overall Storage Efficiency = 50.7%

Overall System Size = 32.00' x 13.00' x 5.25'

14 Chambers

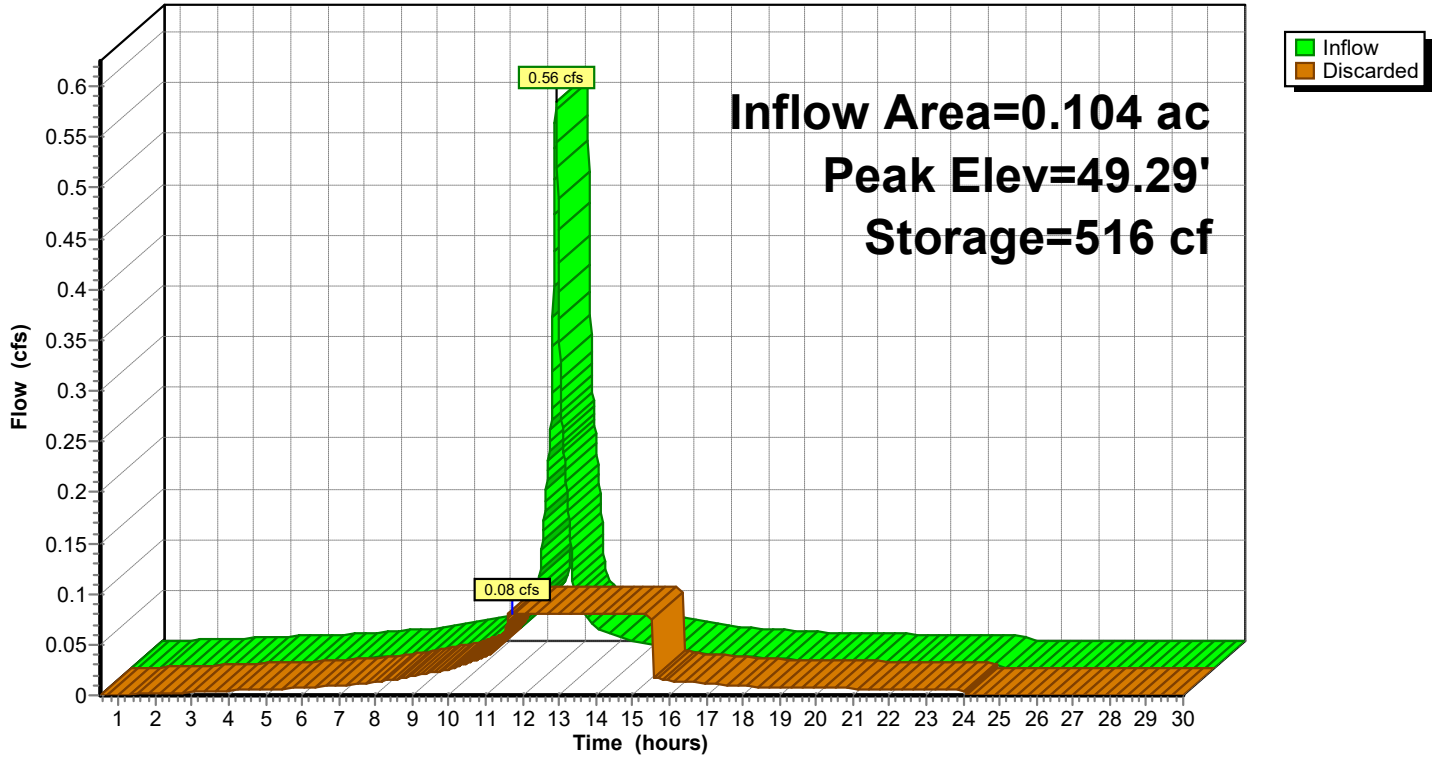
80.9 cy Field

48.6 cy Stone



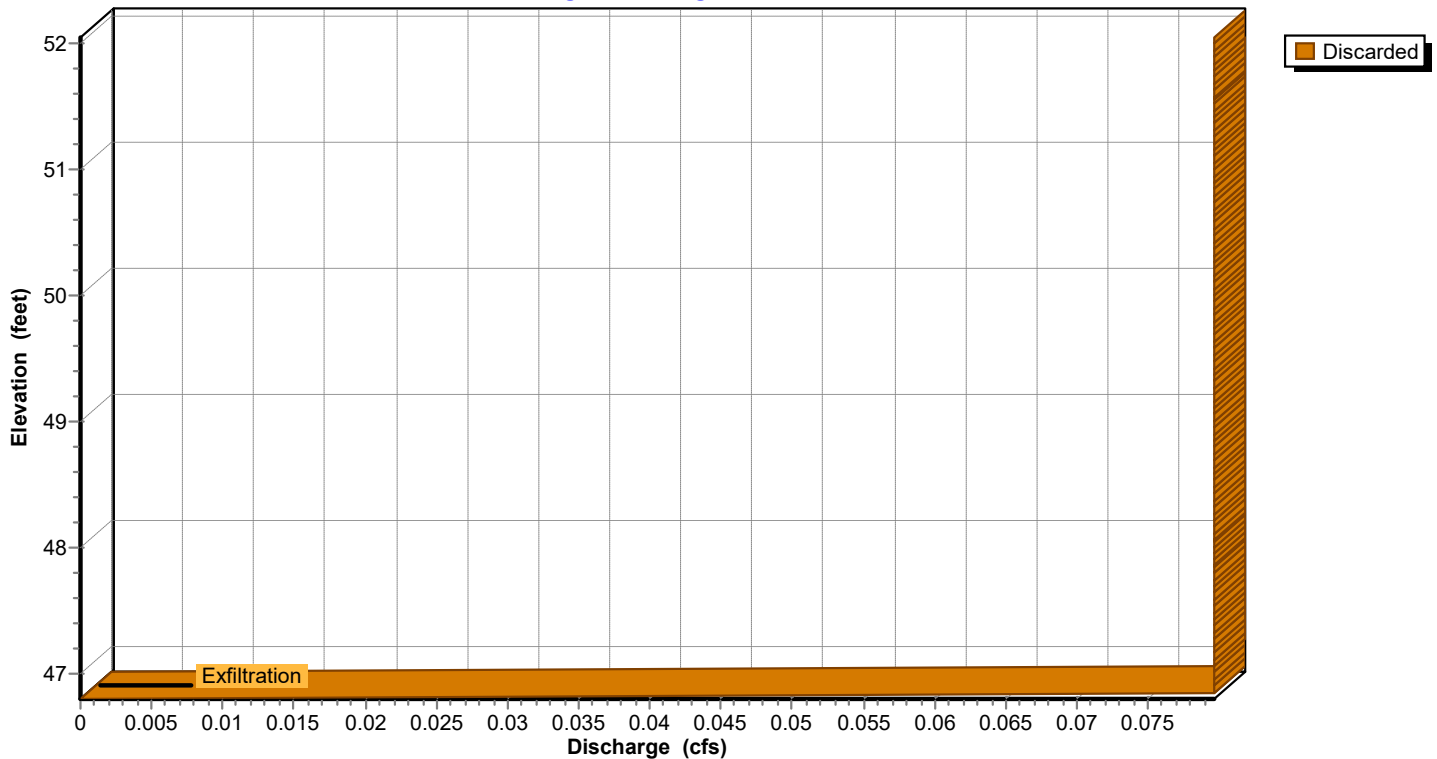
Pond IS1: System #1

Hydrograph



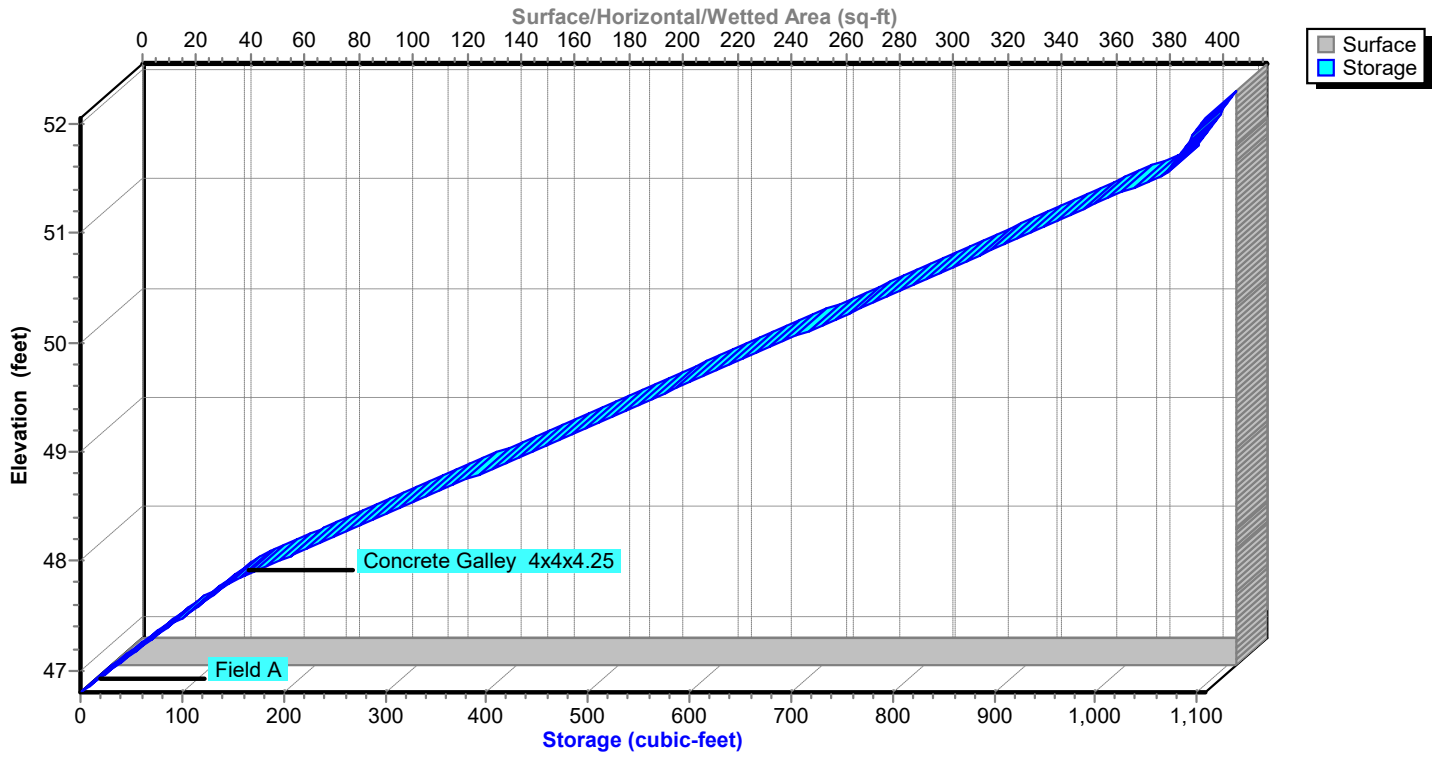
Pond IS1: System #1

Stage-Discharge



Pond IS1: System #1

Stage-Area-Storage



Summary for Pond IS2: System #2

Inflow Area = 0.077 ac, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.41 cfs @ 12.07 hrs, Volume= 0.033 af
 Outflow = 0.06 cfs @ 11.70 hrs, Volume= 0.033 af, Atten= 86%, Lag= 0.0 min
 Discarded = 0.06 cfs @ 11.70 hrs, Volume= 0.033 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 47.74' @ 12.55 hrs Surf.Area= 312 sf Storage= 382 cf

Plug-Flow detention time= 34.9 min calculated for 0.033 af (100% of inflow)
 Center-of-Mass det. time= 34.9 min (781.1 - 746.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	45.25'	355 cf	13.00'W x 24.00'L x 5.25'H Field A 1,638 cf Overall - 623 cf Embedded = 1,015 cf x 35.0% Voids
#2A	46.25'	464 cf	Concrete Galley 4x4x4.25 x 10 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 10 Chambers in 2 Rows
		819 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.25'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 11.70 hrs HW=45.31' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IS2: System #2 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

5 Chambers/Row x 4.00' Long = 20.00' Row Length +24.0" End Stone x 2 = 24.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

10 Chambers x 46.4 cf = 463.8 cf Chamber Storage

10 Chambers x 62.3 cf = 623.3 cf Displacement

1,638.0 cf Field - 623.3 cf Chambers = 1,014.7 cf Stone x 35.0% Voids = 355.1 cf Stone Storage

Chamber Storage + Stone Storage = 818.9 cf = 0.019 af

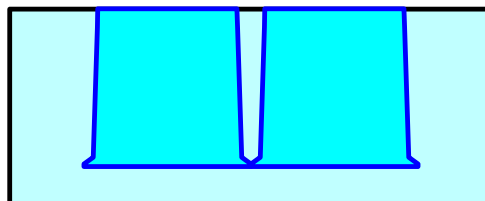
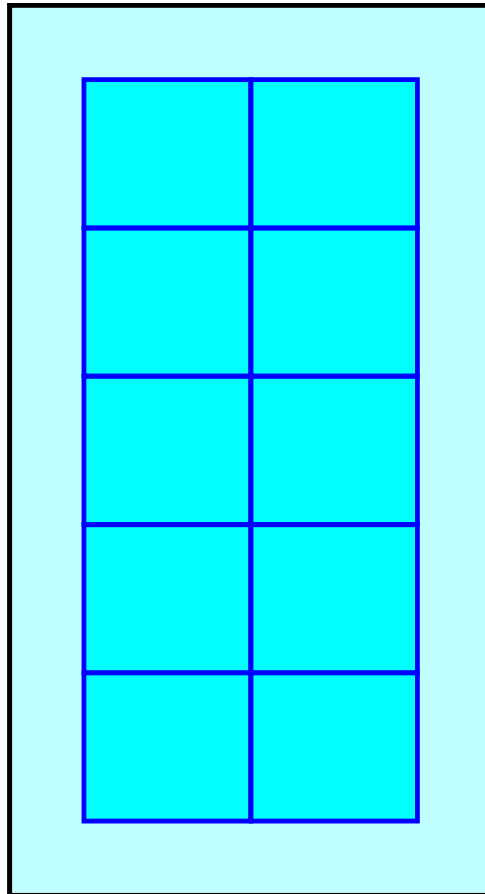
Overall Storage Efficiency = 50.0%

Overall System Size = 24.00' x 13.00' x 5.25'

10 Chambers

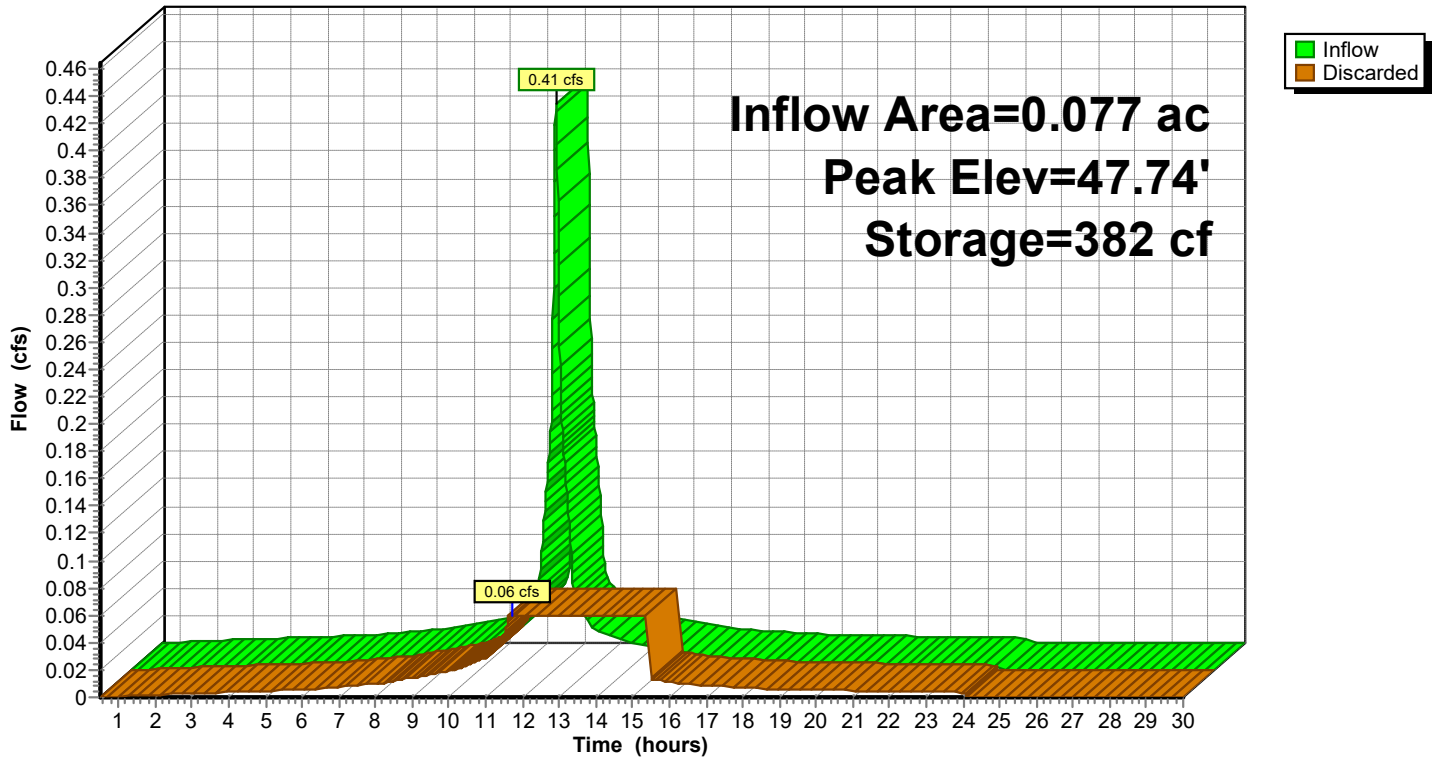
60.7 cy Field

37.6 cy Stone



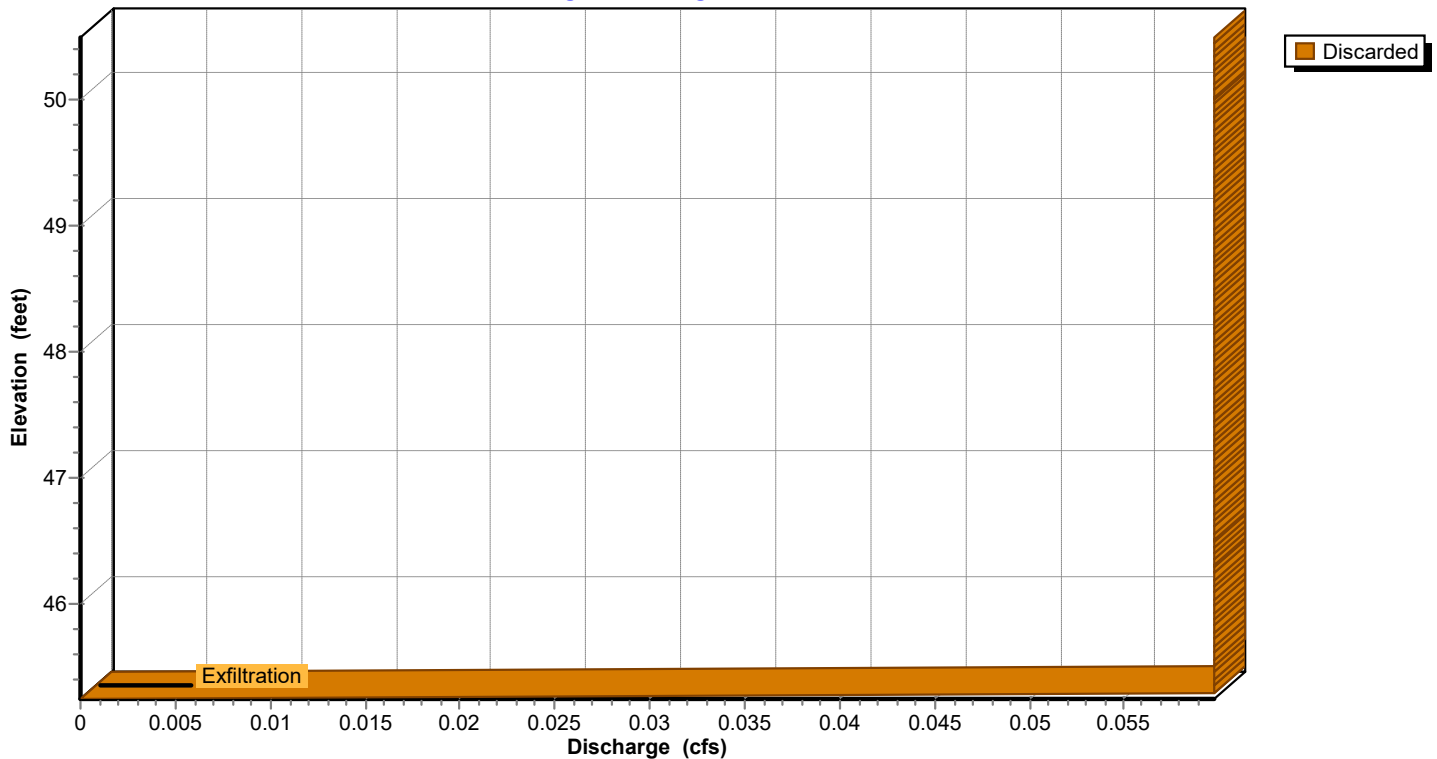
Pond IS2: System #2

Hydrograph



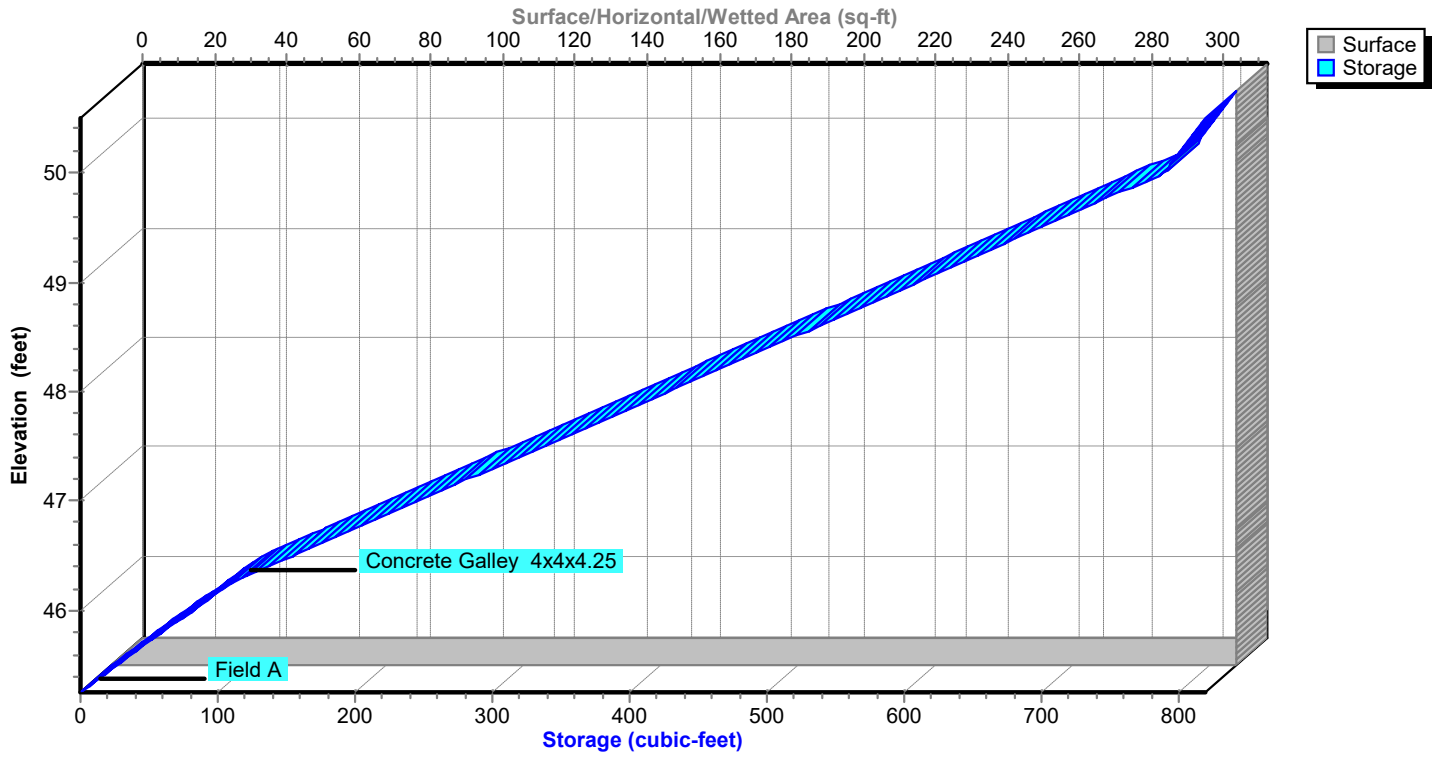
Pond IS2: System #2

Stage-Discharge



Pond IS2: System #2

Stage-Area-Storage



Summary for Pond IS3: System #3

Inflow Area = 0.118 ac, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.64 cfs @ 12.07 hrs, Volume= 0.050 af
 Outflow = 0.07 cfs @ 11.64 hrs, Volume= 0.050 af, Atten= 89%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.64 hrs, Volume= 0.050 af
 Primary = 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= 46.01' @ 12.68 hrs Surf.Area= 364 sf Storage= 666 cf

Plug-Flow detention time= 58.9 min calculated for 0.050 af (100% of inflow)
 Center-of-Mass det. time= 58.8 min (805.0 - 746.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	42.50'	407 cf	13.00'W x 28.00'L x 5.25'H Field A 1,911 cf Overall - 748 cf Embedded = 1,163 cf x 35.0% Voids
#2A	43.50'	557 cf	Concrete Galley 4x4x4.25 x 12 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 12 Chambers in 2 Rows
		964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	42.50'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	46.80'	8.0" Round Culvert L= 72.0' Ke= 0.090 Inlet / Outlet Invert= 46.80' / 45.00' S= 0.0250 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 11.64 hrs HW=42.56' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.50 hrs HW=42.50' TW=43.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Controls 0.00 cfs)

Pond IS3: System #3 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

6 Chambers/Row x 4.00' Long = 24.00' Row Length +24.0" End Stone x 2 = 28.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

12 Chambers x 46.4 cf = 556.6 cf Chamber Storage

12 Chambers x 62.3 cf = 748.0 cf Displacement

1,911.0 cf Field - 748.0 cf Chambers = 1,163.0 cf Stone x 35.0% Voids = 407.1 cf Stone Storage

Chamber Storage + Stone Storage = 963.6 cf = 0.022 af

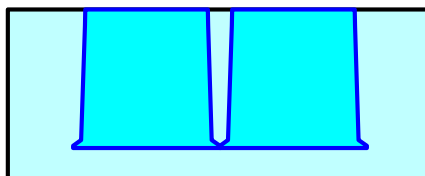
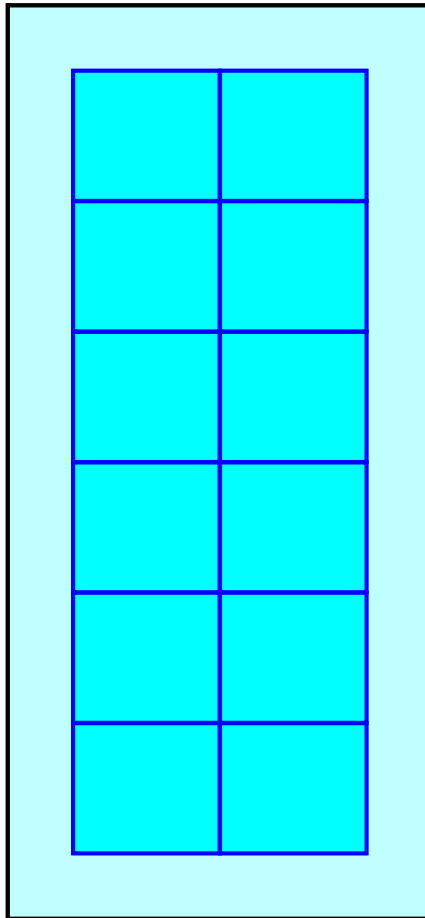
Overall Storage Efficiency = 50.4%

Overall System Size = 28.00' x 13.00' x 5.25'

12 Chambers

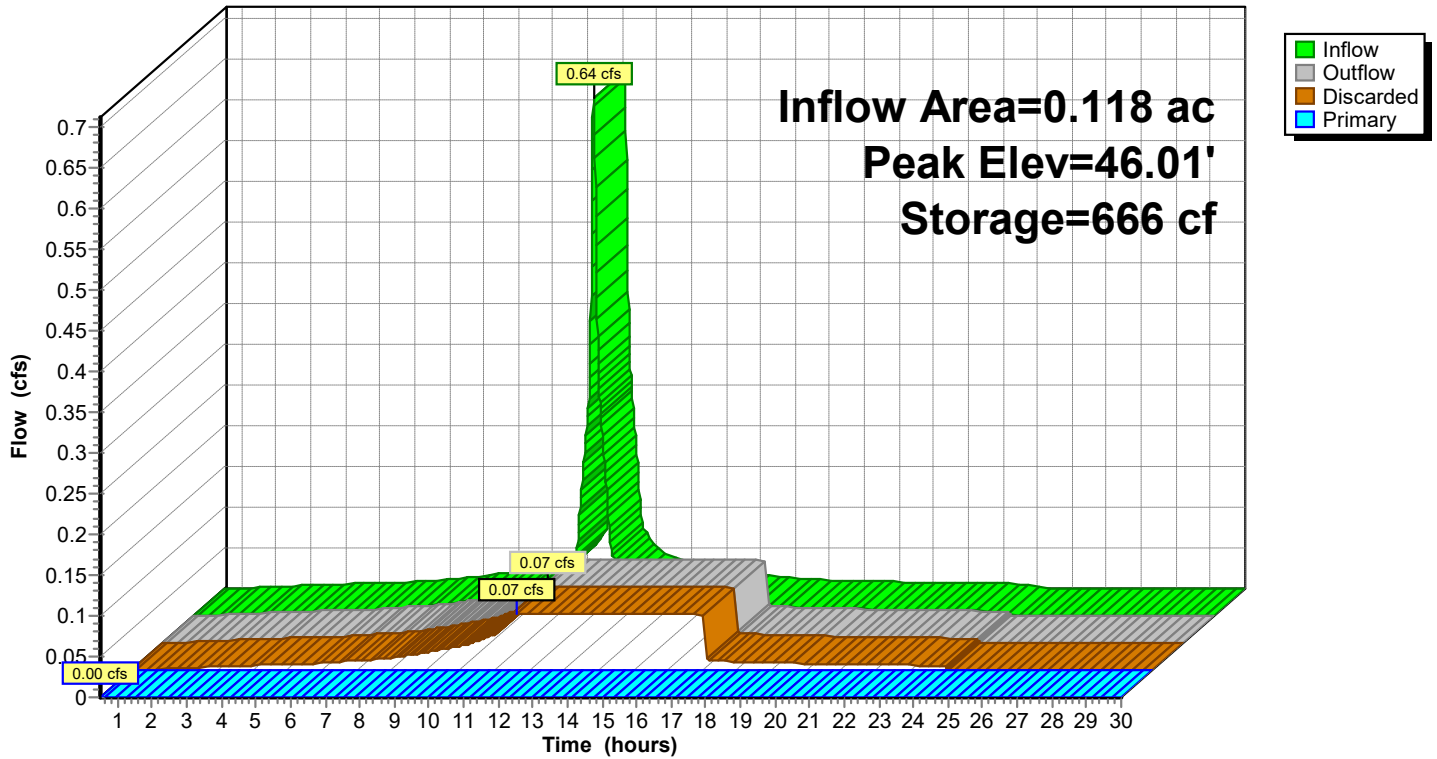
70.8 cy Field

43.1 cy Stone



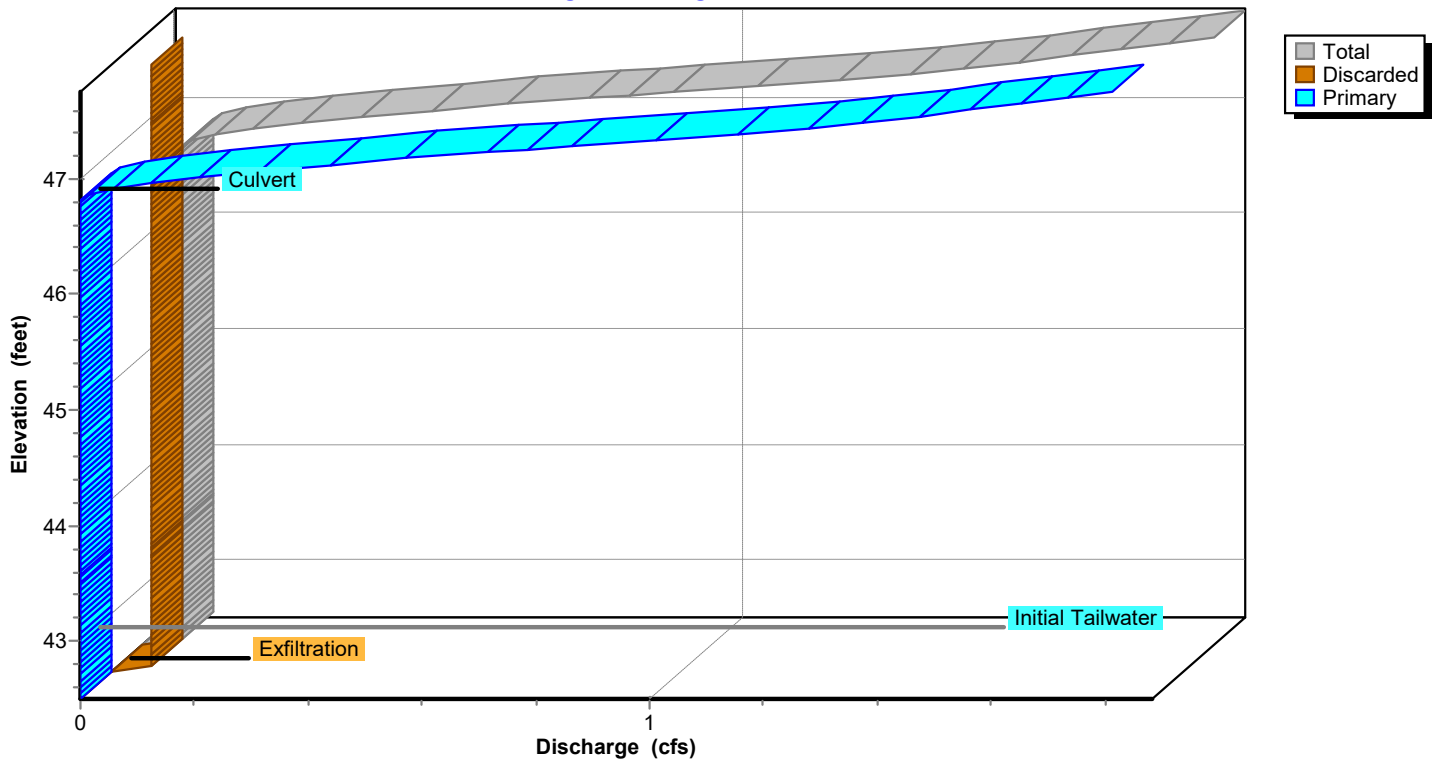
Pond IS3: System #3

Hydrograph



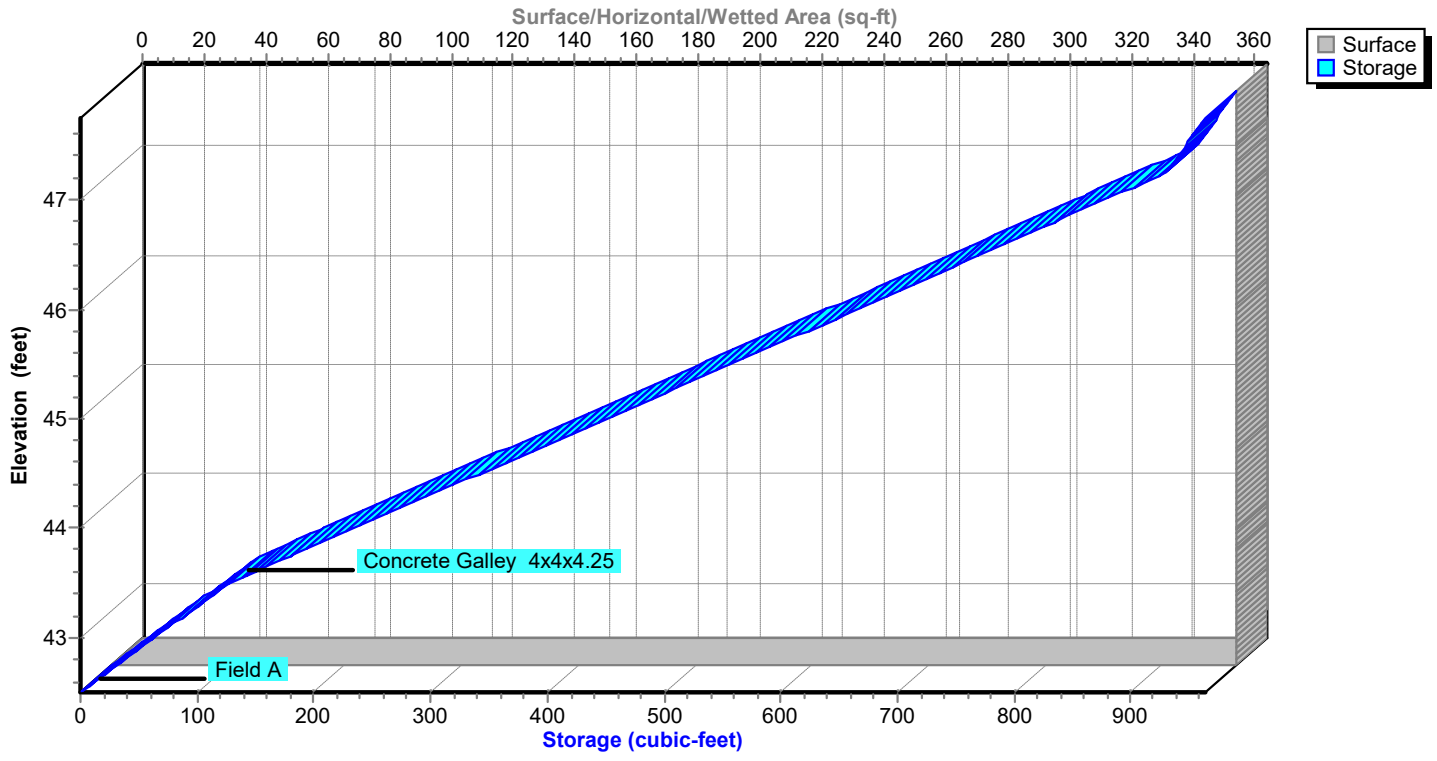
Pond IS3: System #3

Stage-Discharge



Pond IS3: System #3

Stage-Area-Storage



Summary for Pond IS4: (Retention Pond)

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 0.23" for 25-Year event
 Inflow = 0.03 cfs @ 12.33 hrs, Volume= 0.005 af
 Outflow = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 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= 43.34' @ 24.29 hrs Surf.Area= 742 sf Storage= 236 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	43.00'	1,949 cf	Custom Stage Data (Irregular) Listed below (Recalc)

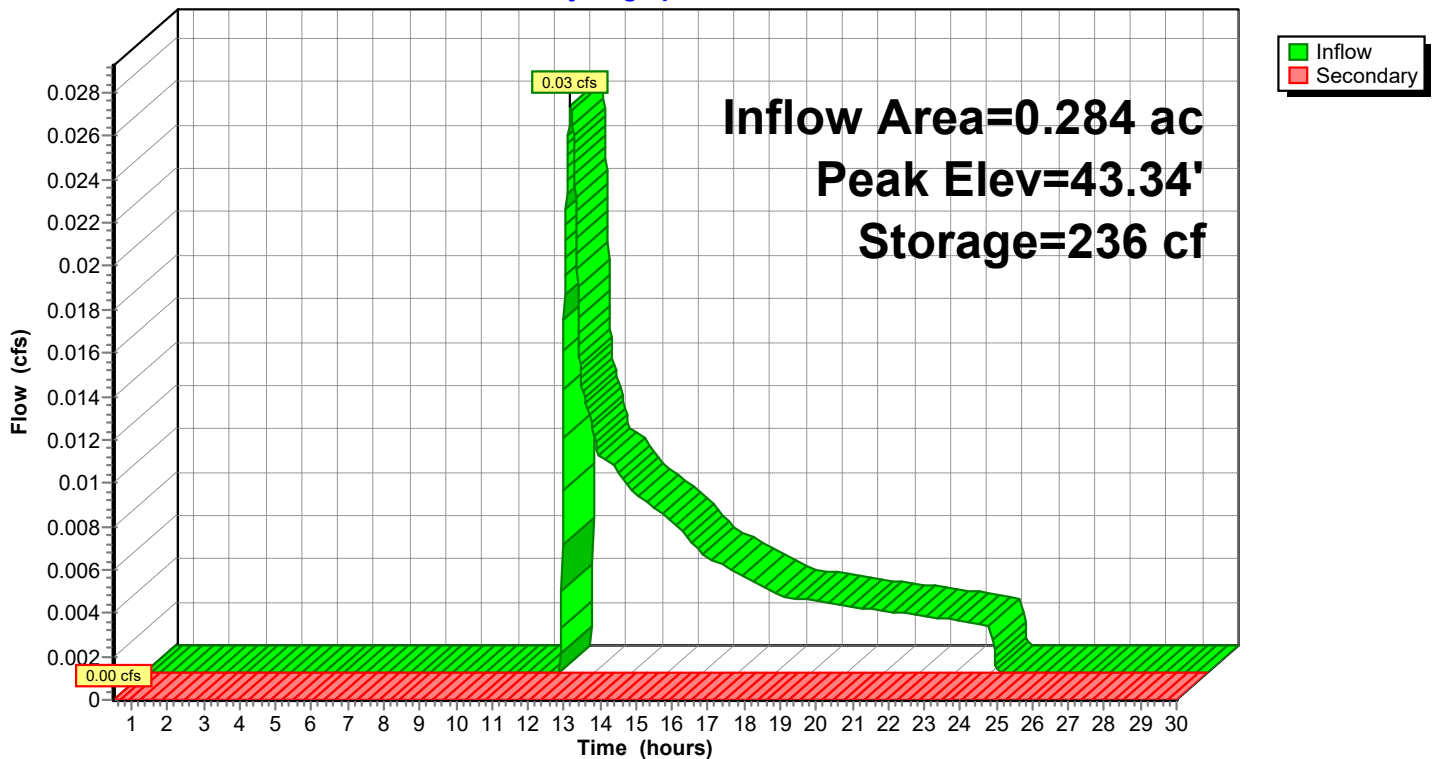
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.00	637	100.0	0	0	637
44.00	966	119.0	796	796	986
45.00	1,351	137.0	1,153	1,949	1,374

Device	Routing	Invert	Outlet Devices
#1	Secondary	44.50'	45.0 deg x 3.0' wide x 0.50' high Dam Breach C= 2.56 Top of breach = 45.00' Bottom of breach = 44.50' Breach starts at 44.50' WSE and develops over 1.000 hrs

Secondary OutFlow Max=0.00 cfs @ 0.50 hrs HW=43.00' TW=0.00' (Dynamic Tailwater)
 1=Dam Breach (Controls 0.00 cfs)

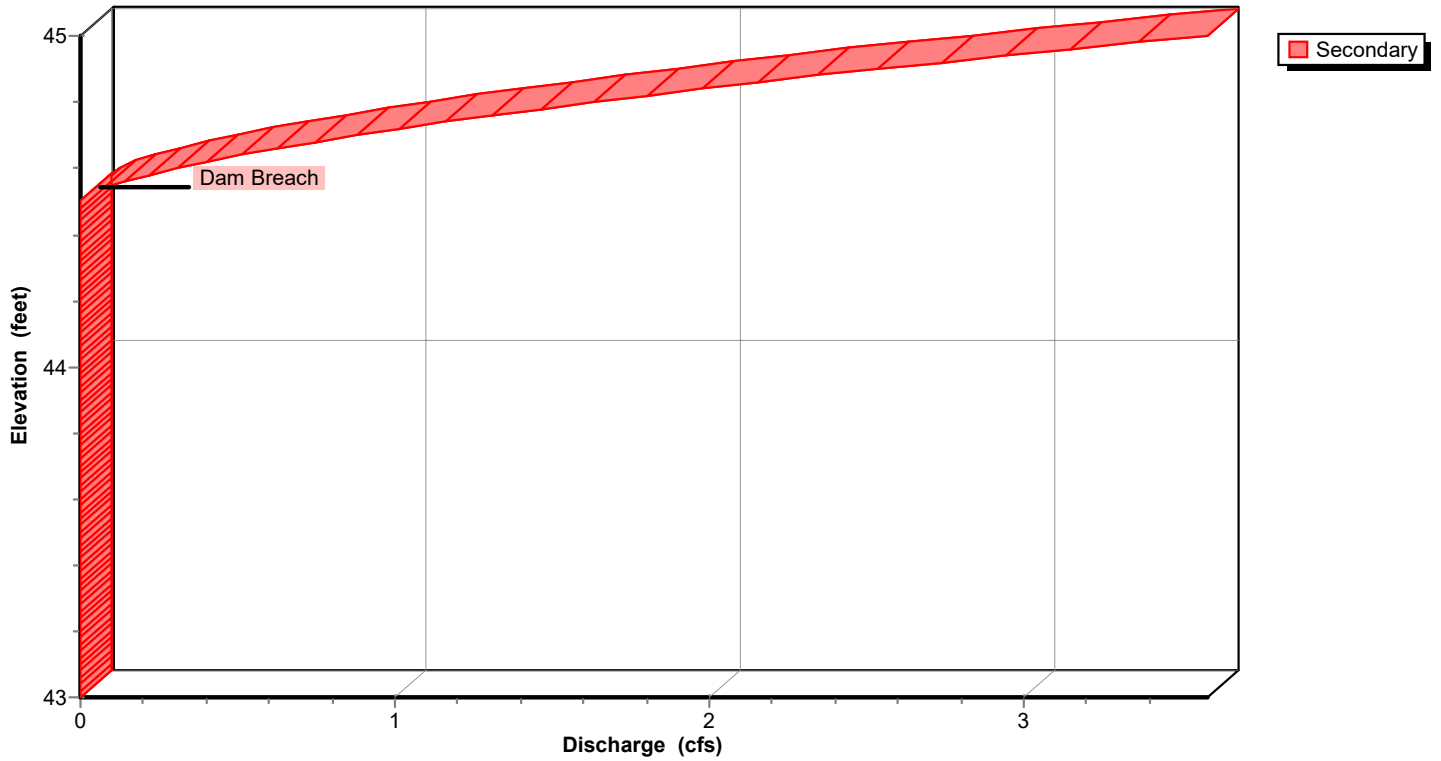
Pond IS4: (Retention Pond)

Hydrograph



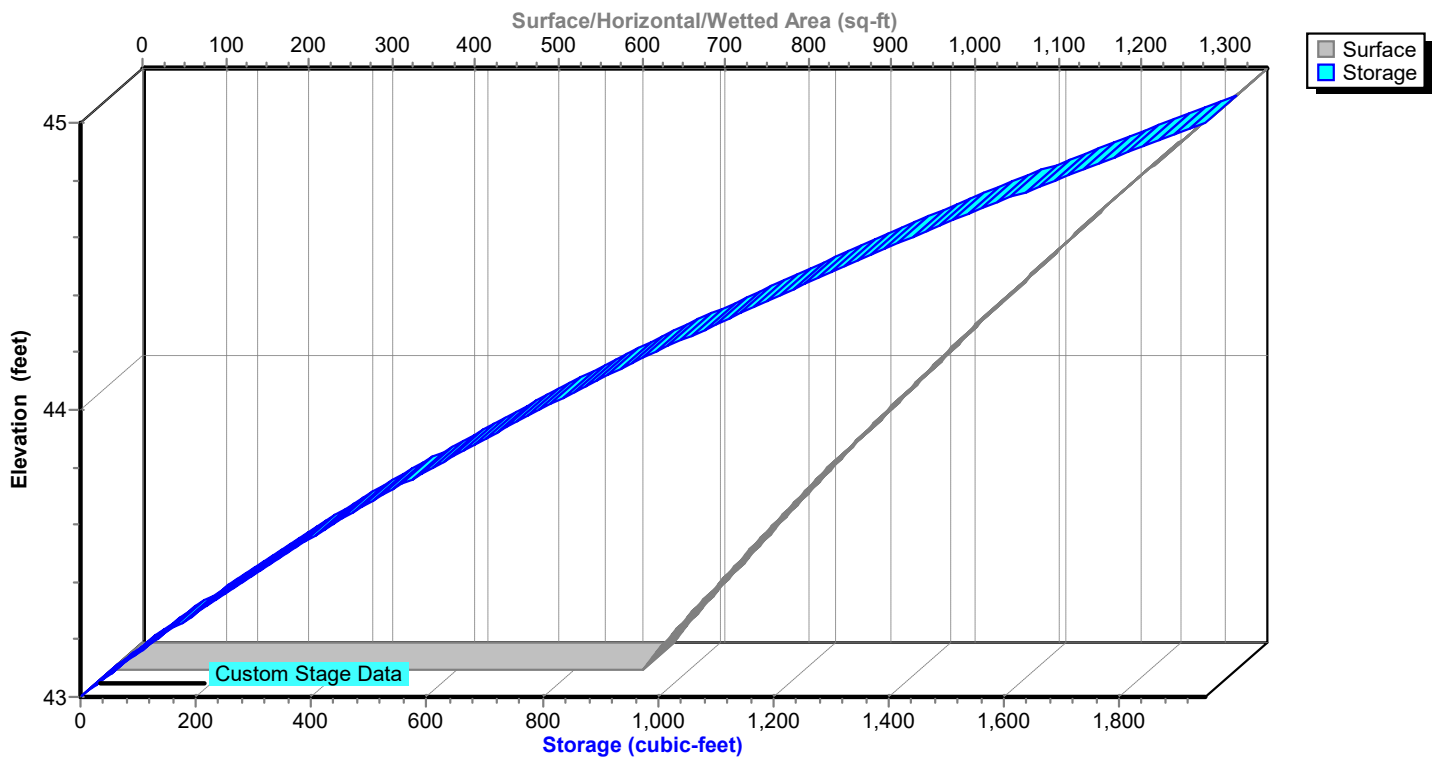
Pond IS4: (Retention Pond)

Stage-Discharge



Pond IS4: (Retention Pond)

Stage-Area-Storage



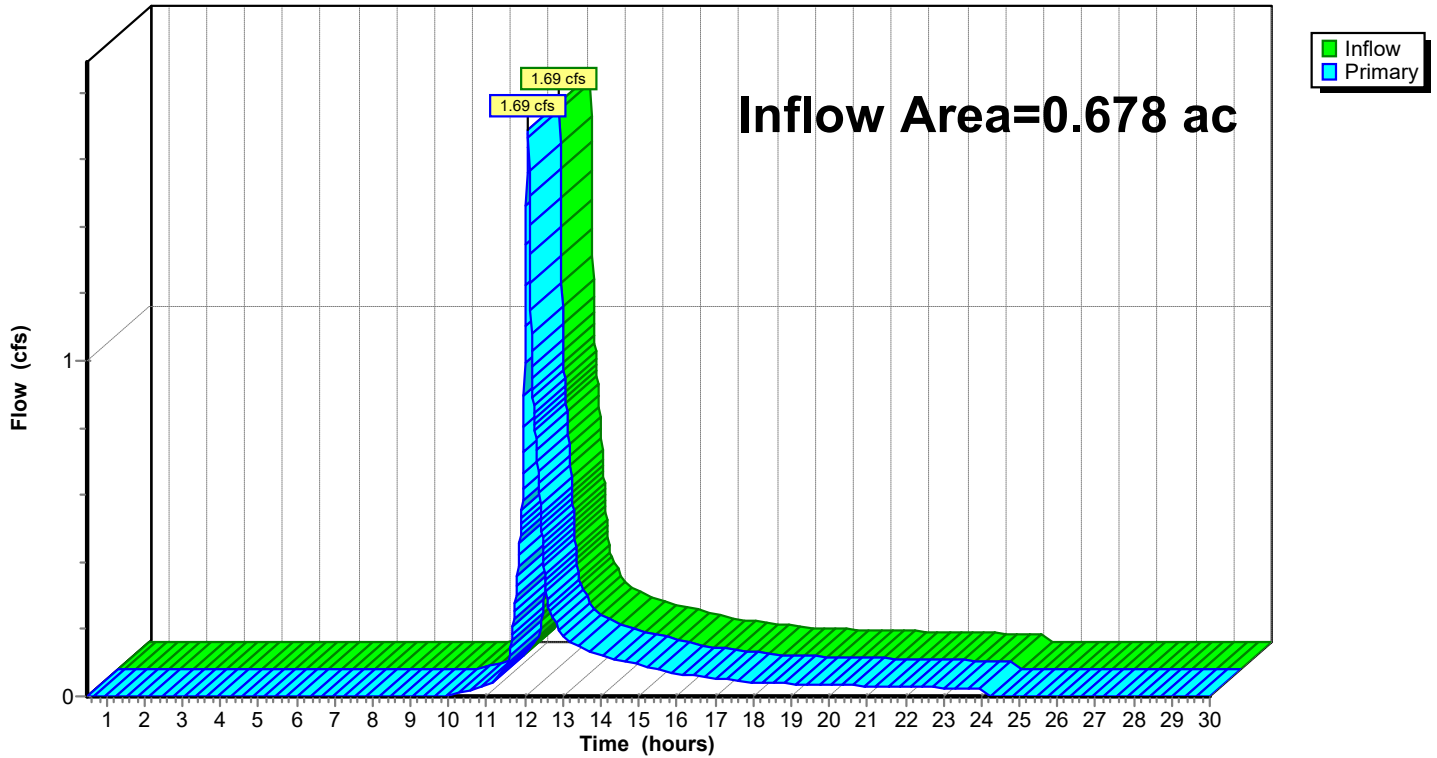
Summary for Link POD1: South-West Abutter

Inflow Area = 0.678 ac, 0.00% Impervious, Inflow Depth = 2.10" for 25-Year event
Inflow = 1.69 cfs @ 12.08 hrs, Volume= 0.118 af
Primary = 1.69 cfs @ 12.08 hrs, Volume= 0.118 af, Atten= 0%, Lag= 0.0 min

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

Link POD1: South-West Abutter

Hydrograph



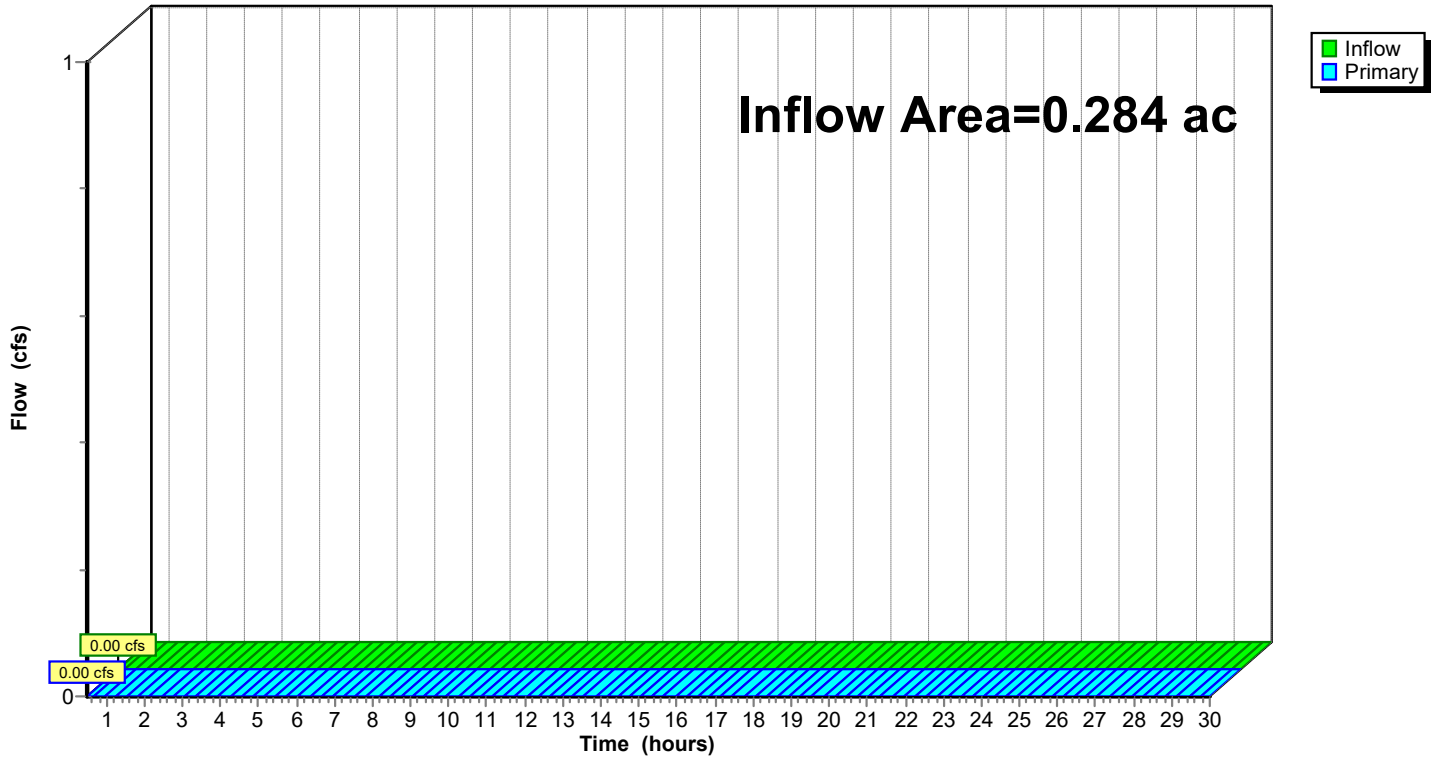
Summary for Link POD1.: South-West Abutter

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 0.00" for 25-Year event
Inflow = 0.00 cfs @ 0.50 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.50 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.: South-West Abutter

Hydrograph



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=29,550 sf 0.00% Impervious Runoff Depth=4.90" Tc=5.0 min CN=68 Runoff=4.04 cfs 0.277 af
Subcatchment P1: Sub-catchment-1	Runoff Area=7,199 sf 0.00% Impervious Runoff Depth=1.83" Tc=5.0 min CN=42 Runoff=0.30 cfs 0.025 af
Subcatchment PD1: Driveway	Runoff Area=2,276 sf 98.33% Impervious Runoff Depth=8.42" Tc=5.0 min CN=97 Runoff=0.47 cfs 0.037 af
Subcatchment PD2: Driveway	Runoff Area=4,038 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.83 cfs 0.066 af
Subcatchment PR1: Roof_BLDG-1	Runoff Area=2,260 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.46 cfs 0.037 af
Subcatchment PR2: Roof_BLDG-2	Runoff Area=3,360 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.69 cfs 0.055 af
Subcatchment PR3: Roof_BLDG-3	Runoff Area=1,120 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.23 cfs 0.018 af
Pond IS1: System #1	Peak Elev=51.77' Storage=1,087 cf Inflow=0.93 cfs 0.074 af Outflow=0.08 cfs 0.074 af
Pond IS2: System #2	Peak Elev=50.23' Storage=803 cf Inflow=0.69 cfs 0.055 af Outflow=0.06 cfs 0.055 af
Pond IS3: System #3	Peak Elev=47.14' Storage=907 cf Inflow=1.06 cfs 0.084 af Discarded=0.07 cfs 0.072 af Primary=0.50 cfs 0.013 af Outflow=0.57 cfs 0.084 af
Pond IS4: (Retention Pond)	Peak Elev=44.55' Storage=1,383 cf Inflow=0.71 cfs 0.038 af Outflow=0.09 cfs 0.007 af
Link POD1: South-West Abutter	Inflow=4.04 cfs 0.277 af Primary=4.04 cfs 0.277 af
Link POD1.: South-West Abutter	Inflow=0.09 cfs 0.007 af Primary=0.09 cfs 0.007 af

Total Runoff Area = 1.143 ac Runoff Volume = 0.515 af Average Runoff Depth = 5.40"
73.87% Pervious = 0.845 ac 26.13% Impervious = 0.299 ac

Summary for Subcatchment E1: Sub-catchment-1

Runoff = 4.04 cfs @ 12.07 hrs, Volume= 0.277 af, Depth= 4.90"

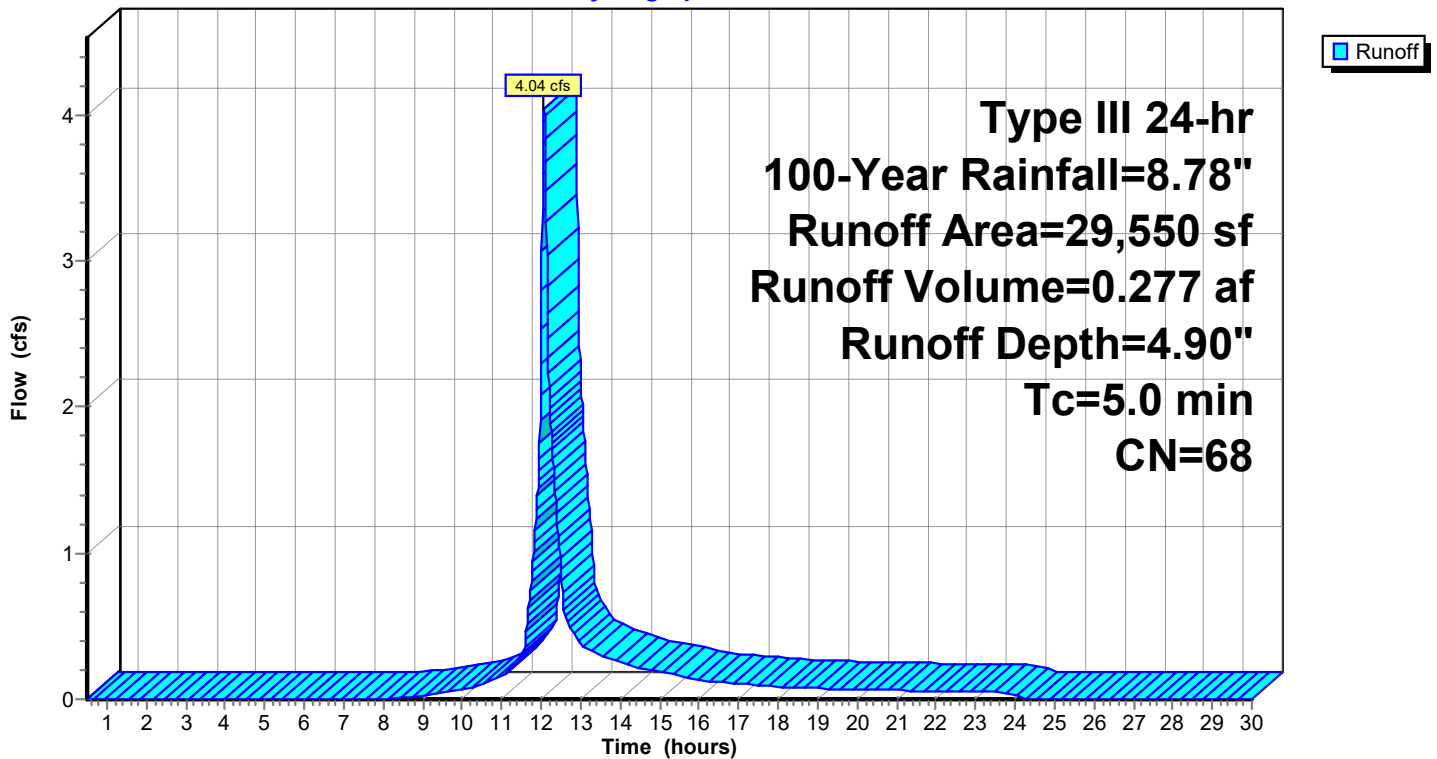
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
29,550	68	<50% Grass cover, Poor, HSG A
29,550		100.00% Pervious Area

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

Subcatchment E1: Sub-catchment-1

Hydrograph



Summary for Subcatchment P1: Sub-catchment-1

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.025 af, Depth= 1.83"

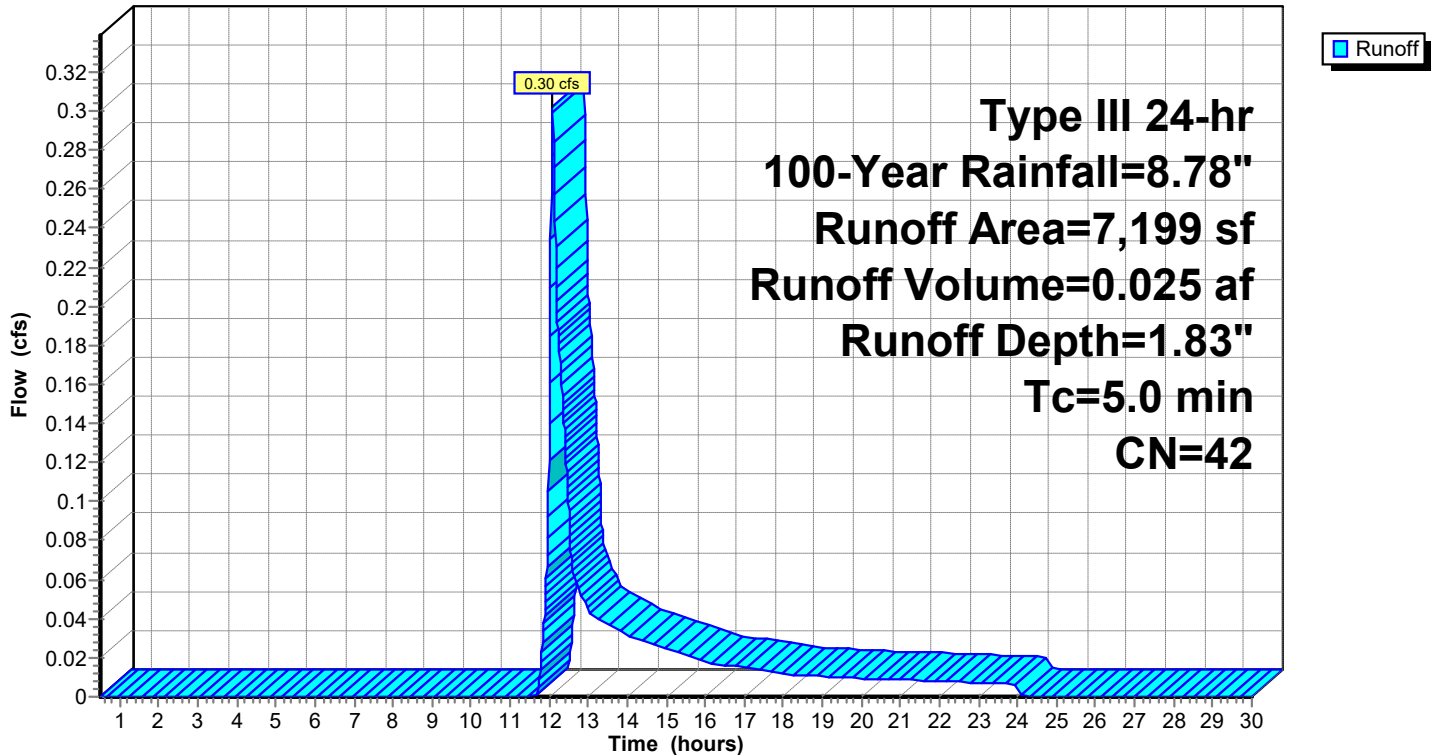
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
2,623	39	>75% Grass cover, Good, HSG A
3,705	36	Woods, Fair, HSG A
871	76	Gravel roads, HSG A
7,199	42	Weighted Average
7,199		100.00% Pervious Area

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

Subcatchment P1: Sub-catchment-1

Hydrograph



Summary for Subcatchment PD1: Driveway

Runoff = 0.47 cfs @ 12.07 hrs, Volume= 0.037 af, Depth= 8.42"

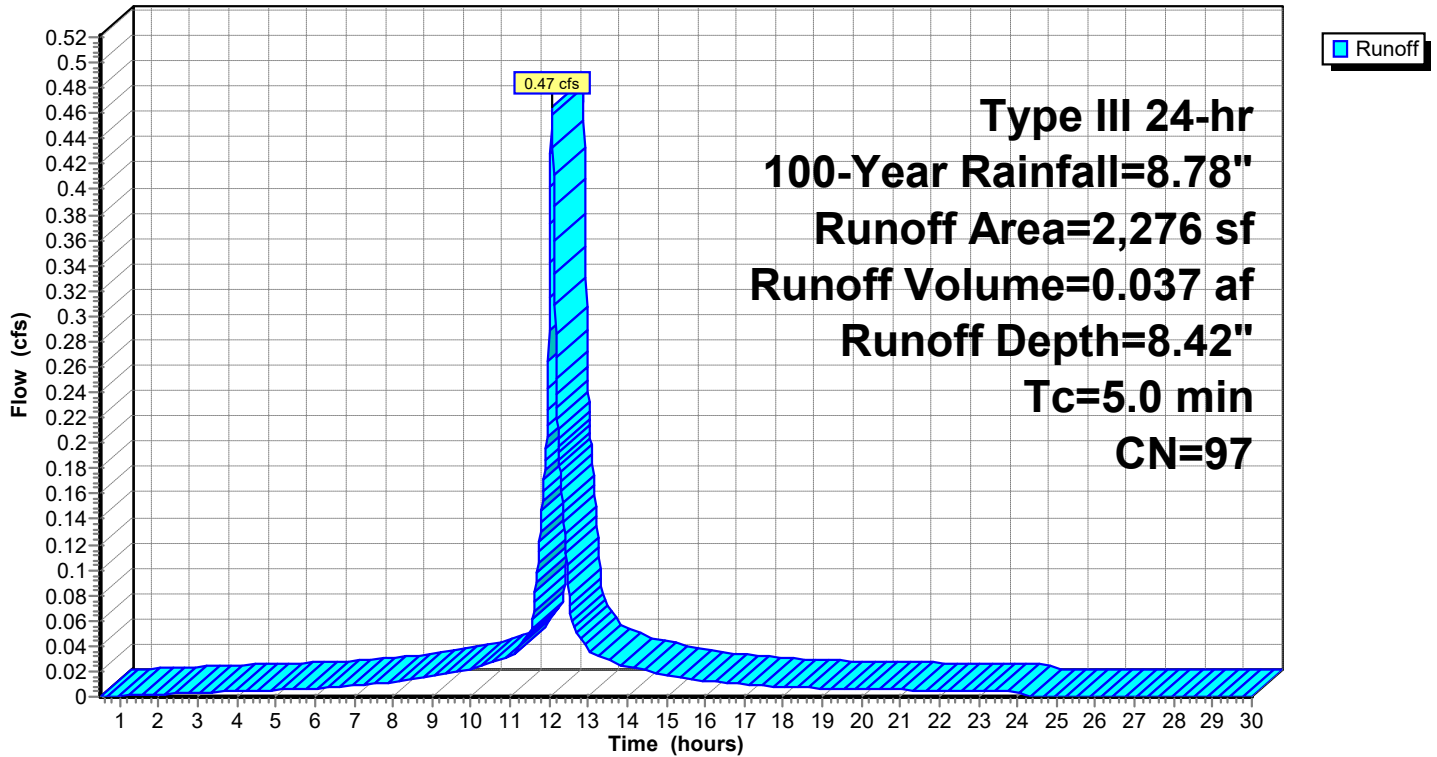
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
2,238	98	Paved parking, HSG A
* 38	65	Paver walkway
2,276	97	Weighted Average
38		1.67% Pervious Area
2,238		98.33% Impervious Area

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

Subcatchment PD1: Driveway

Hydrograph



Summary for Subcatchment PD2: Driveway

Runoff = 0.83 cfs @ 12.07 hrs, Volume= 0.066 af, Depth= 8.54"

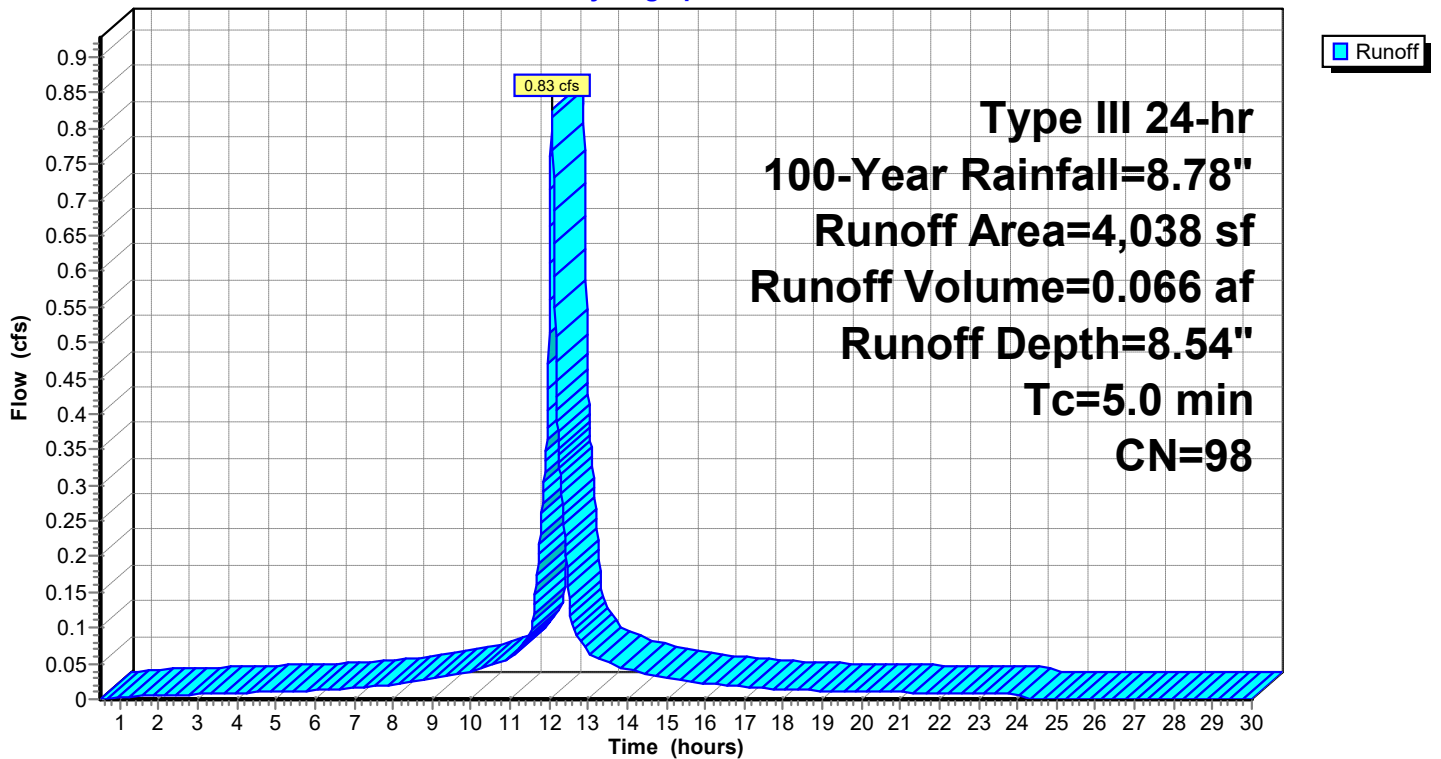
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
4,038	98	Paved parking, HSG A
4,038		100.00% Impervious Area

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

Subcatchment PD2: Driveway

Hydrograph



Summary for Subcatchment PR1: Roof_BLDG-1

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

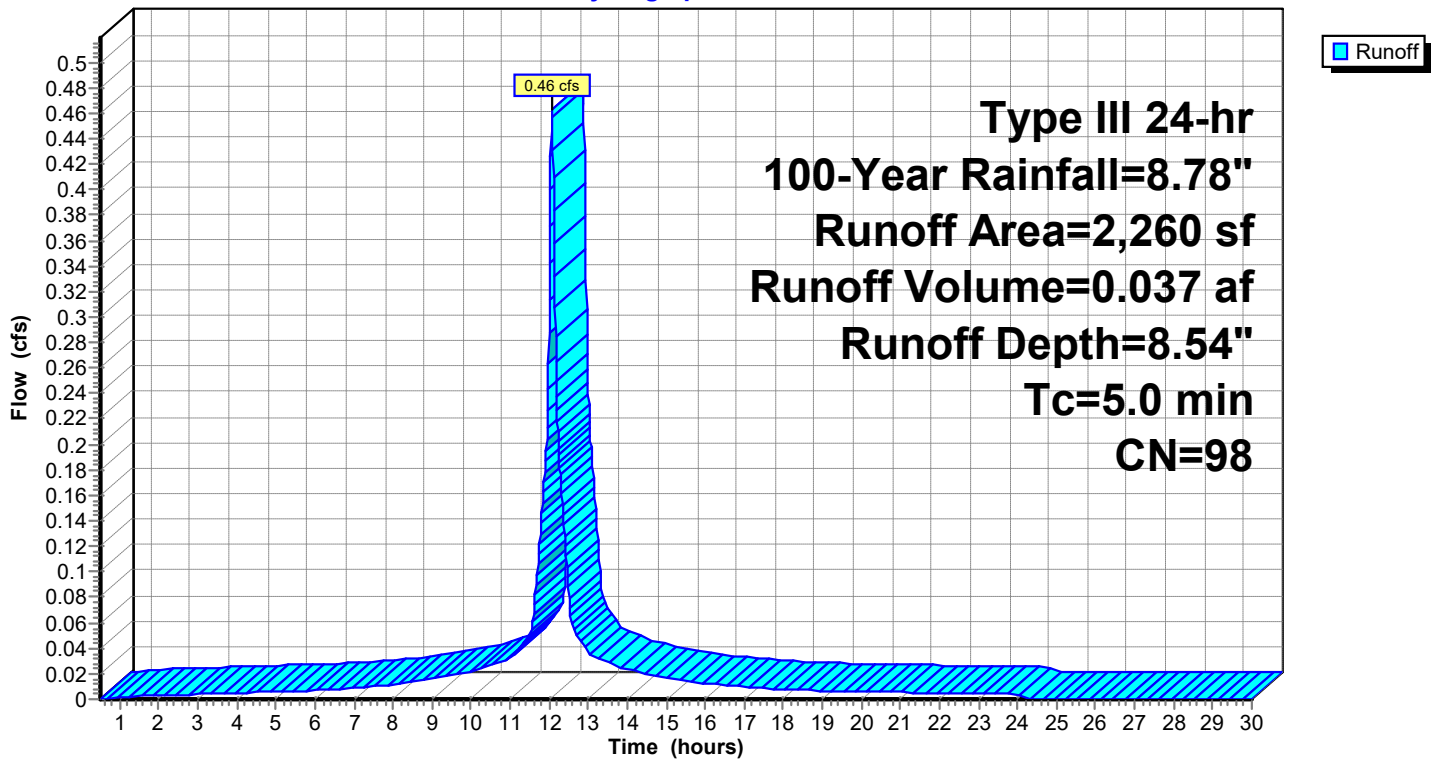
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
* 2,260	98	Roofs, HSG A
2,260		100.00% Impervious Area

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

Subcatchment PR1: Roof_BLDG-1

Hydrograph



Summary for Subcatchment PR2: Roof_BLDG-2

Runoff = 0.69 cfs @ 12.07 hrs, Volume= 0.055 af, Depth= 8.54"

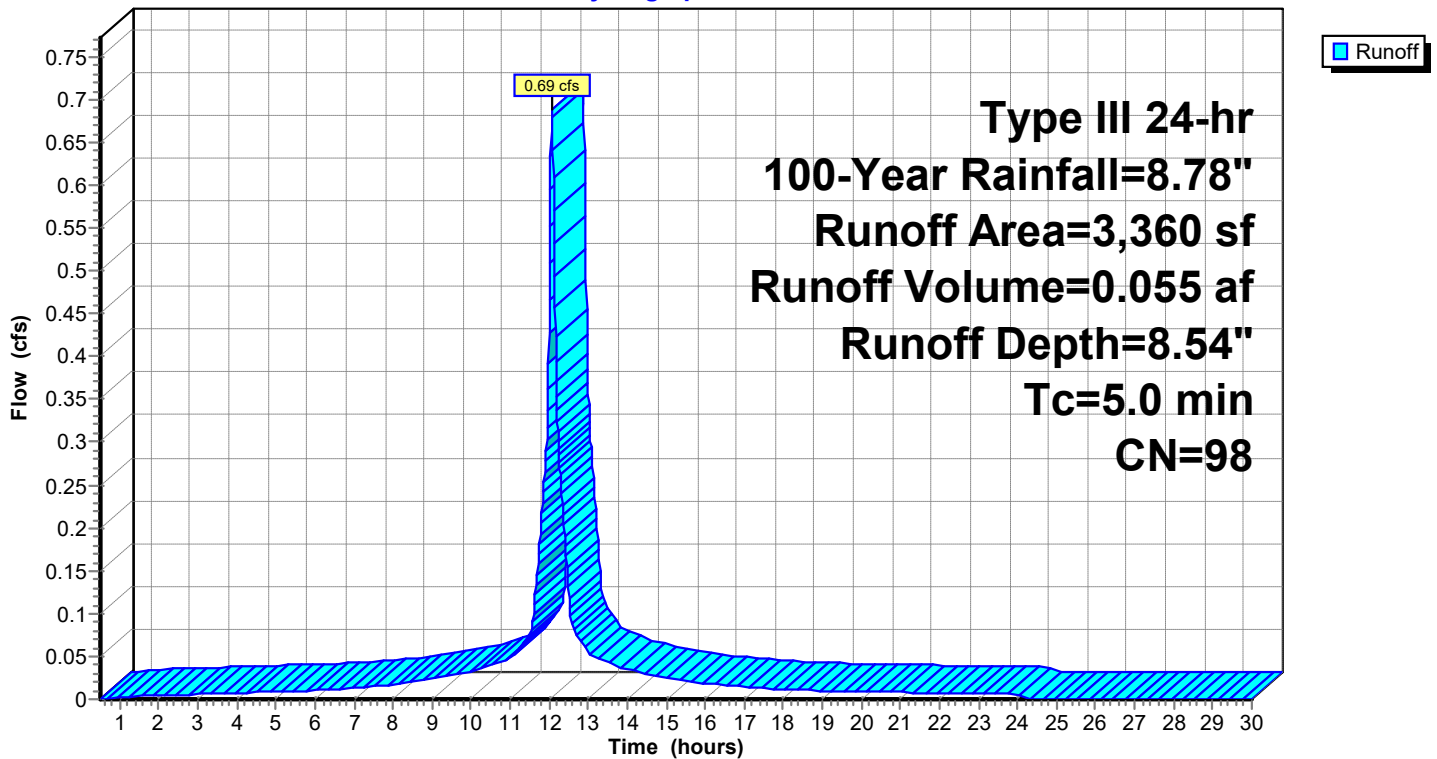
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
* 3,360	98	Roofs, HSG A
3,360		100.00% Impervious Area

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

Subcatchment PR2: Roof_BLDG-2

Hydrograph



Summary for Subcatchment PR3: Roof_BLDG-3

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

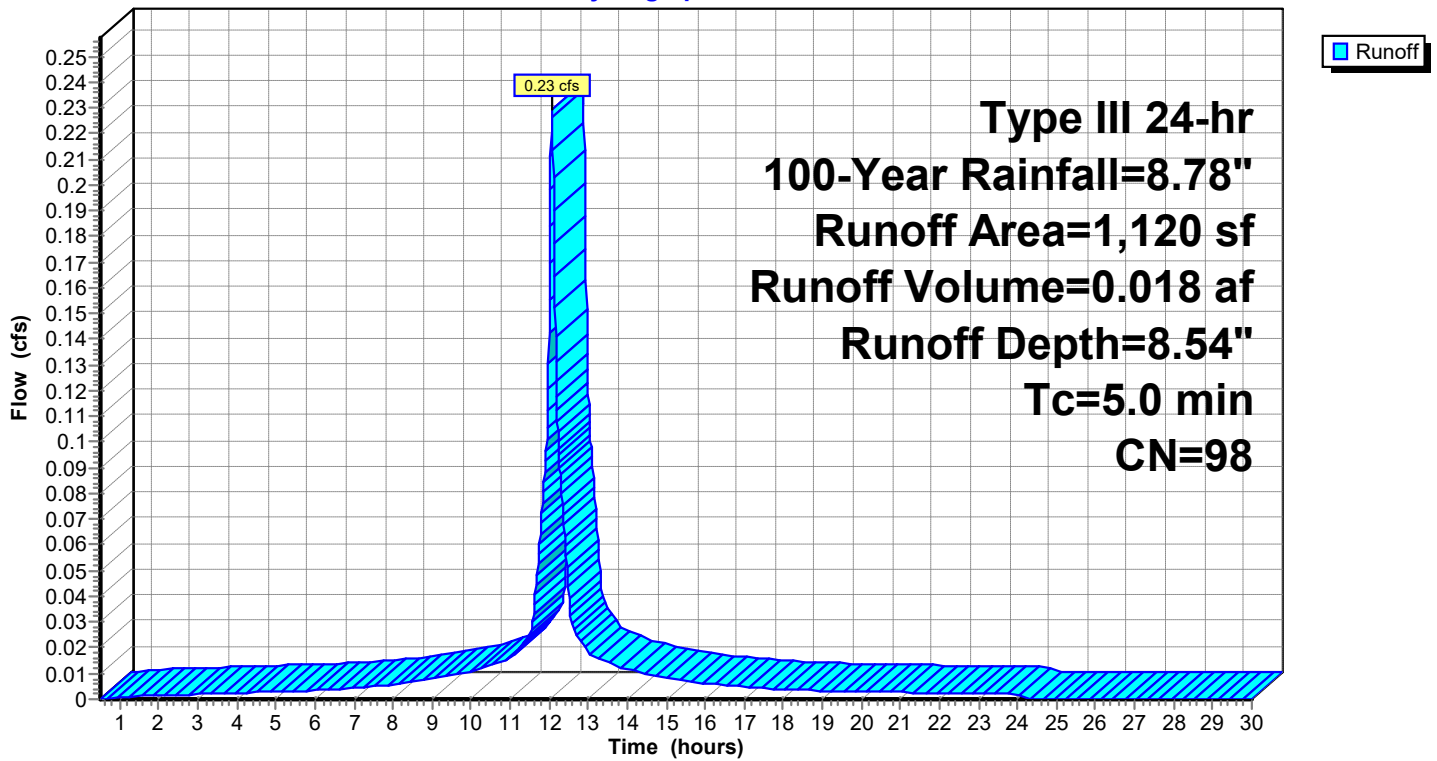
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
* 1,120	98	Roofs, HSG A
1,120		100.00% Impervious Area

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

Subcatchment PR3: Roof_BLDG-3

Hydrograph



Summary for Pond IS1: System #1

Inflow Area = 0.104 ac, 99.16% Impervious, Inflow Depth = 8.48" for 100-Year event
 Inflow = 0.93 cfs @ 12.07 hrs, Volume= 0.074 af
 Outflow = 0.08 cfs @ 11.44 hrs, Volume= 0.074 af, Atten= 91%, Lag= 0.0 min
 Discarded = 0.08 cfs @ 11.44 hrs, Volume= 0.074 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 51.77' @ 12.93 hrs Surf.Area= 416 sf Storage= 1,087 cf

Plug-Flow detention time= 91.5 min calculated for 0.074 af (100% of inflow)
 Center-of-Mass det. time= 91.5 min (833.5 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	46.80'	459 cf	13.00'W x 32.00'L x 5.25'H Field A 2,184 cf Overall - 873 cf Embedded = 1,311 cf x 35.0% Voids
#2A	47.80'	649 cf	Concrete Galley 4x4x4.25 x 14 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 14 Chambers in 2 Rows
		1,108 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.80'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.08 cfs @ 11.44 hrs HW=46.85' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Pond IS1: System #1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

7 Chambers/Row x 4.00' Long = 28.00' Row Length +24.0" End Stone x 2 = 32.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

14 Chambers x 46.4 cf = 649.3 cf Chamber Storage

14 Chambers x 62.3 cf = 872.6 cf Displacement

2,184.0 cf Field - 872.6 cf Chambers = 1,311.4 cf Stone x 35.0% Voids = 459.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,108.3 cf = 0.025 af

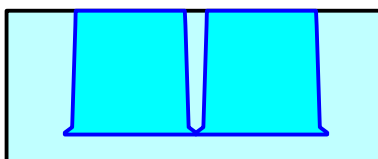
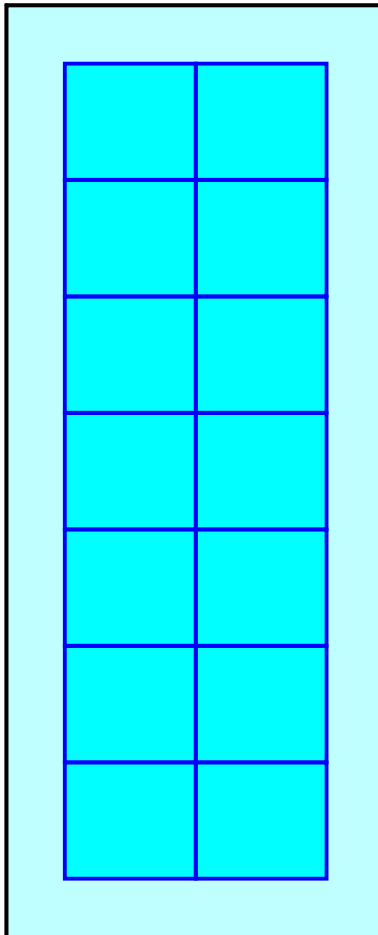
Overall Storage Efficiency = 50.7%

Overall System Size = 32.00' x 13.00' x 5.25'

14 Chambers

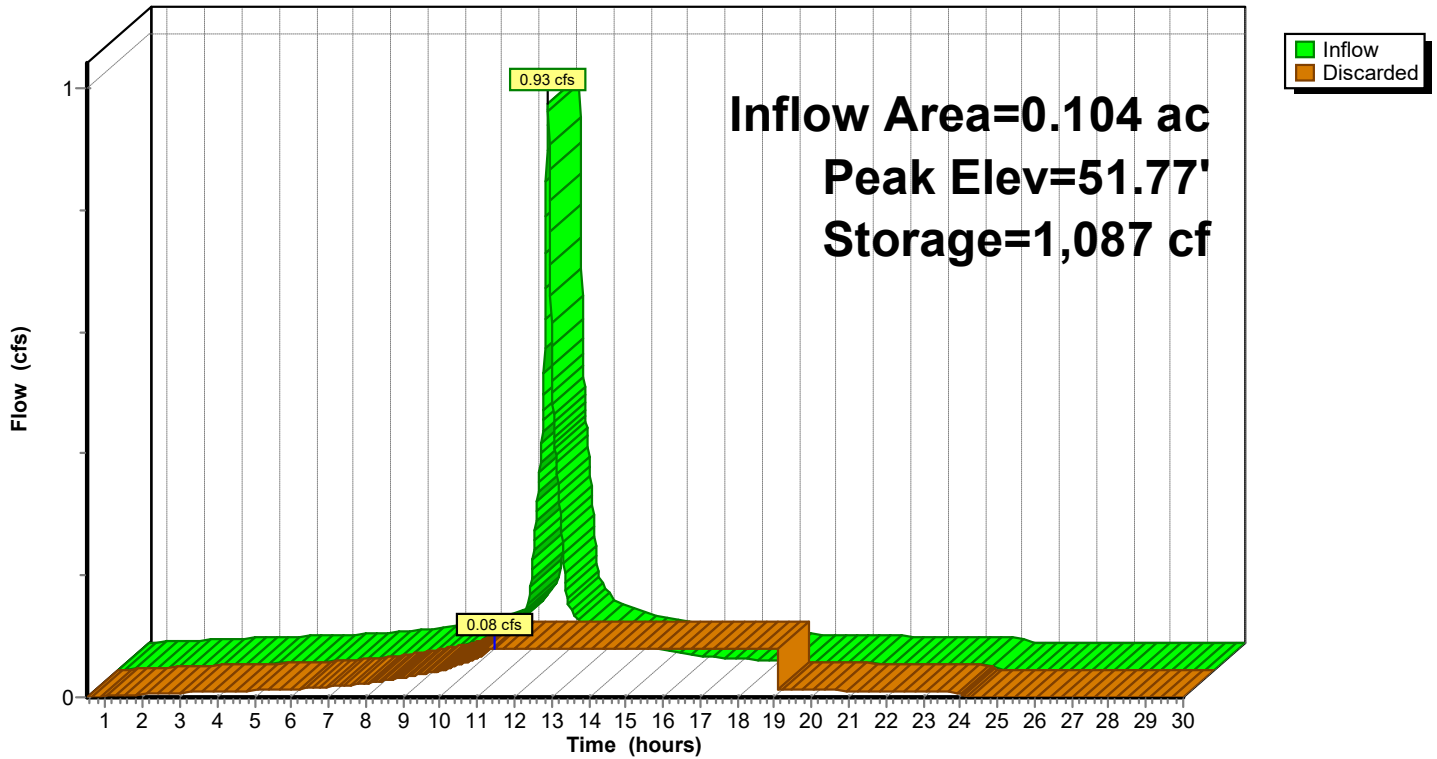
80.9 cy Field

48.6 cy Stone



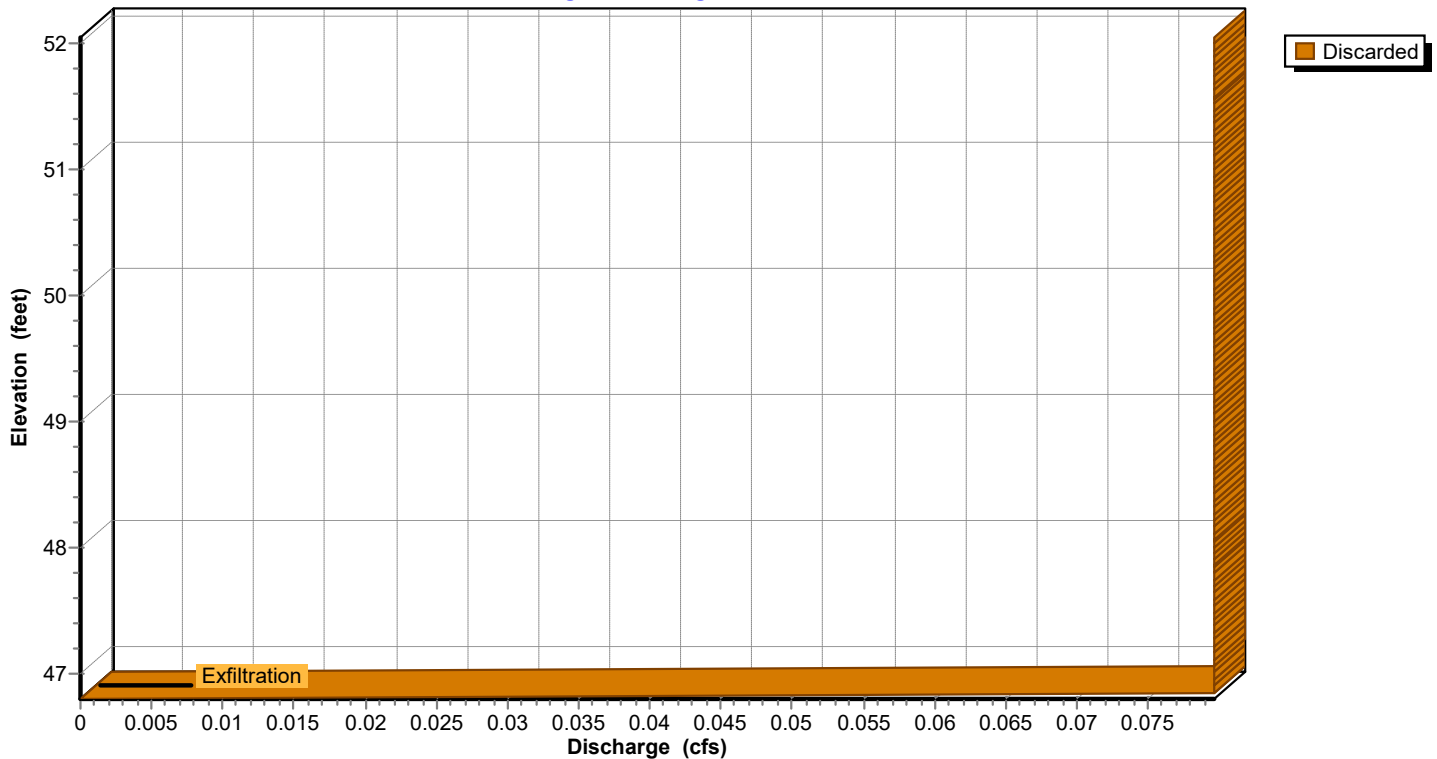
Pond IS1: System #1

Hydrograph



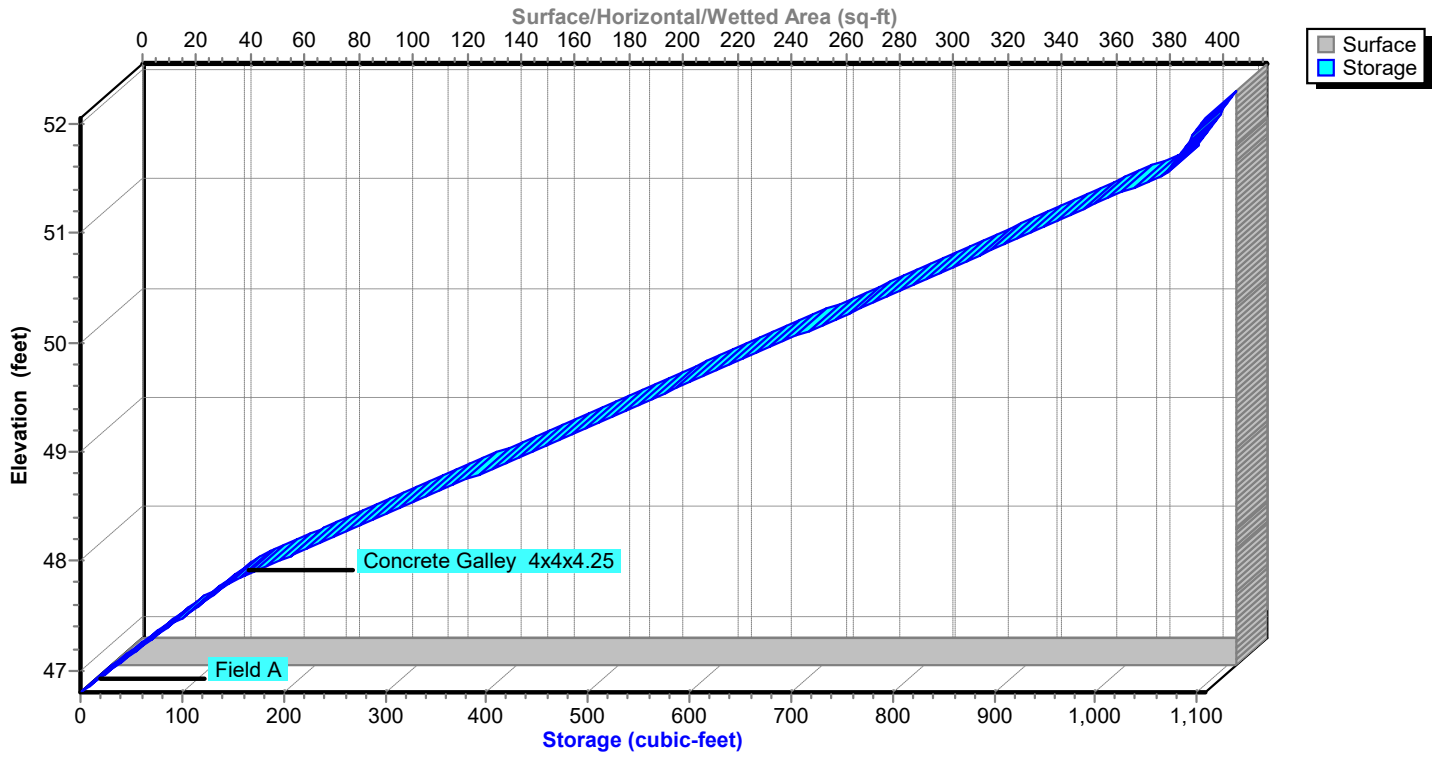
Pond IS1: System #1

Stage-Discharge



Pond IS1: System #1

Stage-Area-Storage



Summary for Pond IS2: System #2

Inflow Area = 0.077 ac, 100.00% Impervious, Inflow Depth = 8.54" for 100-Year event
 Inflow = 0.69 cfs @ 12.07 hrs, Volume= 0.055 af
 Outflow = 0.06 cfs @ 11.45 hrs, Volume= 0.055 af, Atten= 91%, Lag= 0.0 min
 Discarded = 0.06 cfs @ 11.45 hrs, Volume= 0.055 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 50.23' @ 12.92 hrs Surf.Area= 312 sf Storage= 803 cf

Plug-Flow detention time= 89.2 min calculated for 0.055 af (100% of inflow)
 Center-of-Mass det. time= 89.2 min (828.4 - 739.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	45.25'	355 cf	13.00'W x 24.00'L x 5.25'H Field A 1,638 cf Overall - 623 cf Embedded = 1,015 cf x 35.0% Voids
#2A	46.25'	464 cf	Concrete Galley 4x4x4.25 x 10 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 10 Chambers in 2 Rows
		819 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.25'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 11.45 hrs HW=45.31' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IS2: System #2 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

5 Chambers/Row x 4.00' Long = 20.00' Row Length +24.0" End Stone x 2 = 24.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

10 Chambers x 46.4 cf = 463.8 cf Chamber Storage

10 Chambers x 62.3 cf = 623.3 cf Displacement

1,638.0 cf Field - 623.3 cf Chambers = 1,014.7 cf Stone x 35.0% Voids = 355.1 cf Stone Storage

Chamber Storage + Stone Storage = 818.9 cf = 0.019 af

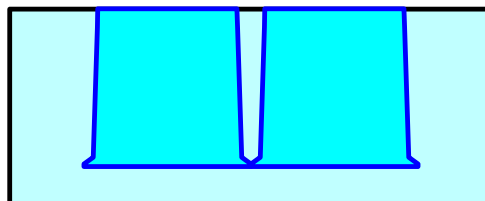
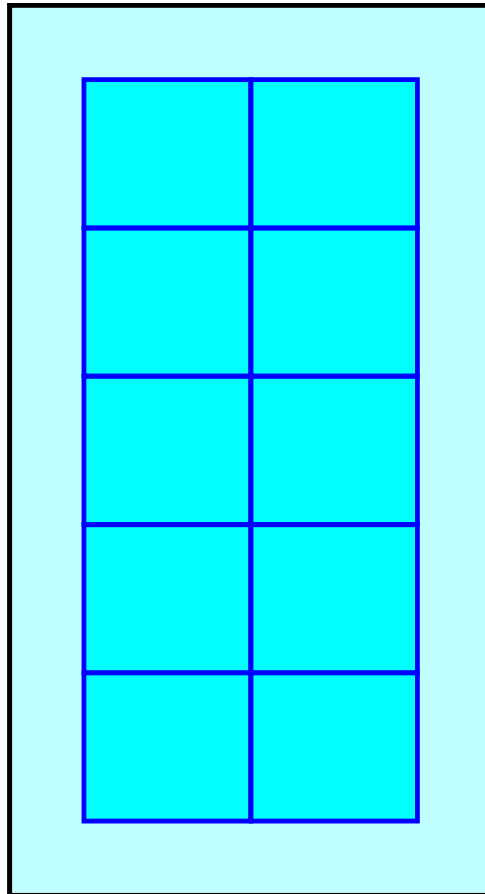
Overall Storage Efficiency = 50.0%

Overall System Size = 24.00' x 13.00' x 5.25'

10 Chambers

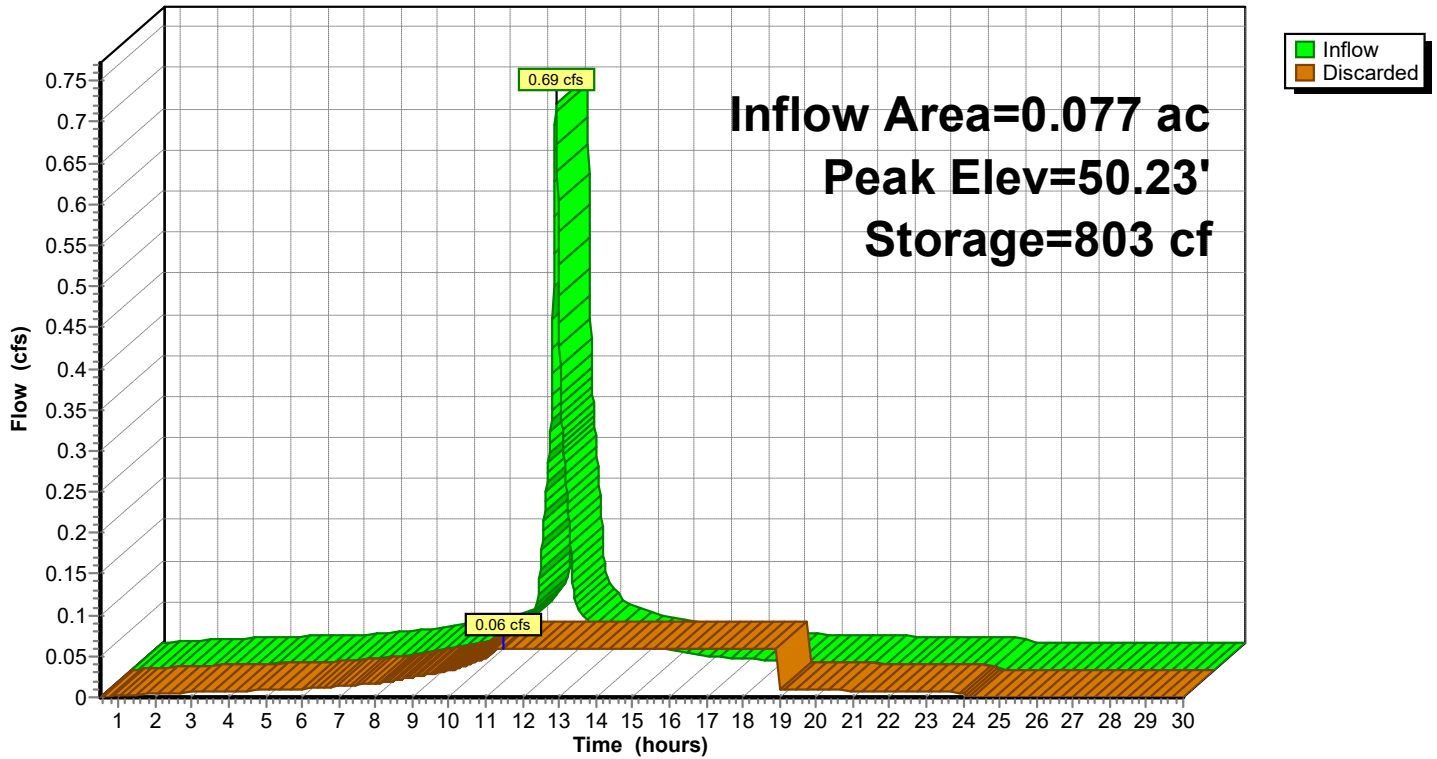
60.7 cy Field

37.6 cy Stone



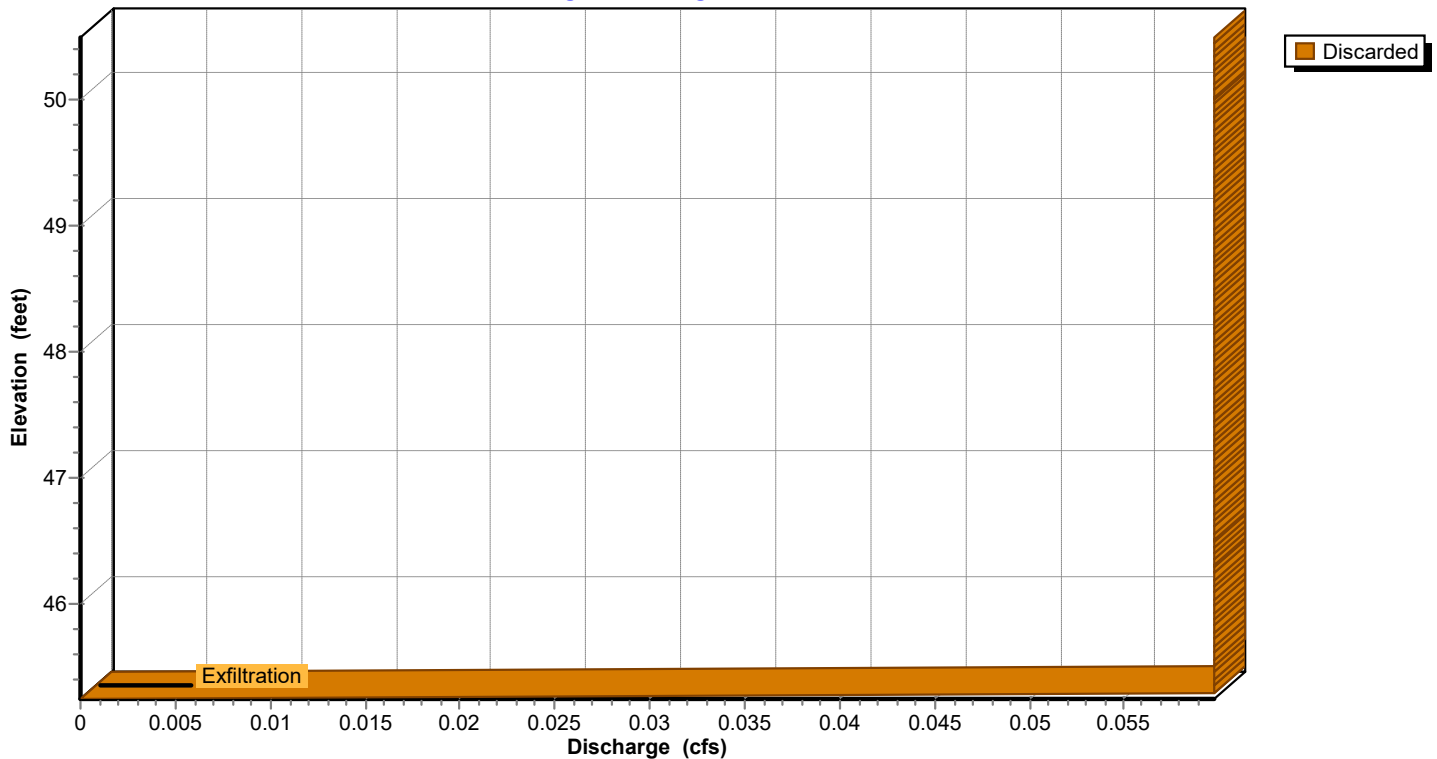
Pond IS2: System #2

Hydrograph



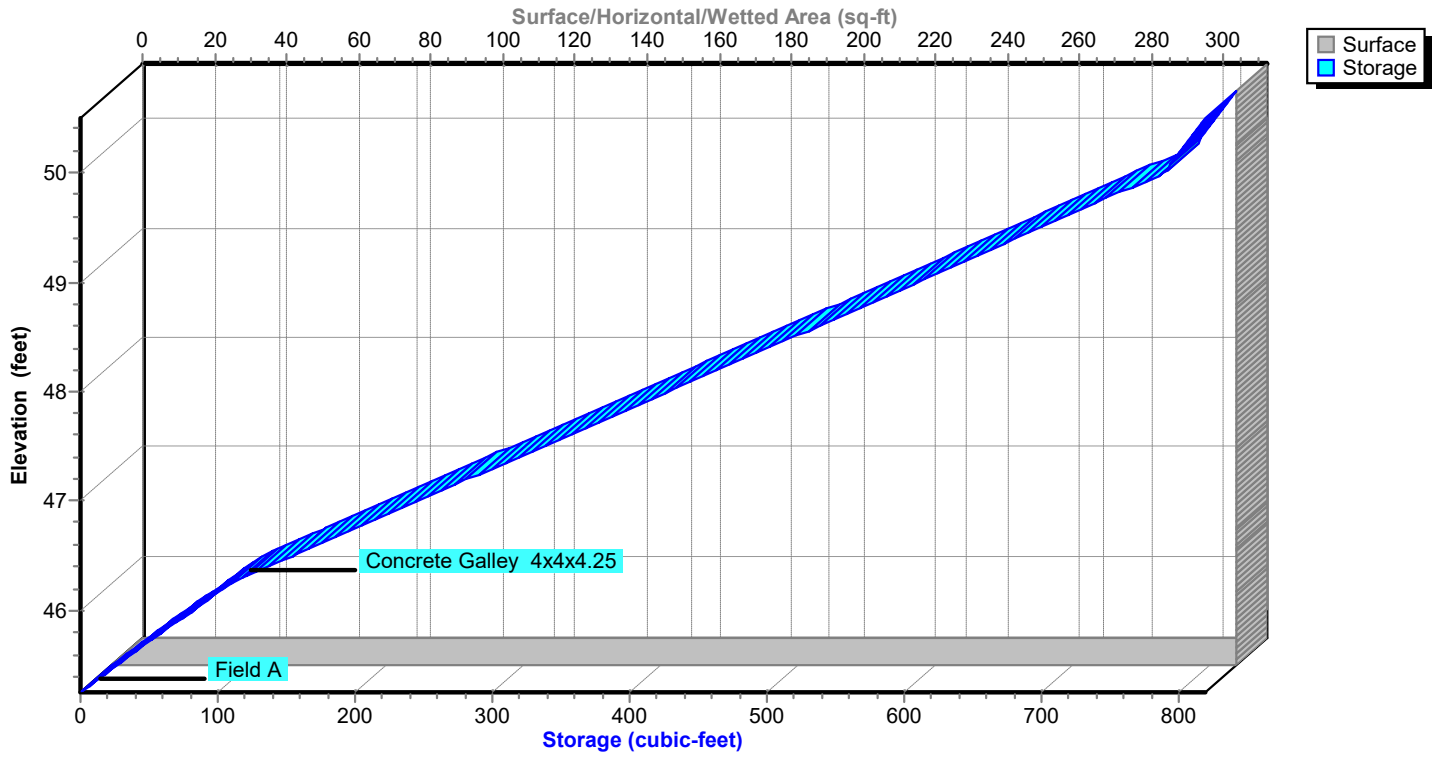
Pond IS2: System #2

Stage-Discharge



Pond IS2: System #2

Stage-Area-Storage



Summary for Pond IS3: System #3

Inflow Area = 0.118 ac, 100.00% Impervious, Inflow Depth = 8.54" for 100-Year event
 Inflow = 1.06 cfs @ 12.07 hrs, Volume= 0.084 af
 Outflow = 0.57 cfs @ 12.18 hrs, Volume= 0.084 af, Atten= 46%, Lag= 6.7 min
 Discarded = 0.07 cfs @ 11.15 hrs, Volume= 0.072 af
 Primary = 0.50 cfs @ 12.18 hrs, Volume= 0.013 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 47.14' @ 12.18 hrs Surf.Area= 364 sf Storage= 907 cf

Plug-Flow detention time= 70.5 min calculated for 0.084 af (100% of inflow)
 Center-of-Mass det. time= 70.5 min (809.7 - 739.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	42.50'	407 cf	13.00'W x 28.00'L x 5.25'H Field A 1,911 cf Overall - 748 cf Embedded = 1,163 cf x 35.0% Voids
#2A	43.50'	557 cf	Concrete Galley 4x4x4.25 x 12 Inside #1 Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf 12 Chambers in 2 Rows
		964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	42.50'	8.270 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	46.80'	8.0" Round Culvert L= 72.0' Ke= 0.090 Inlet / Outlet Invert= 46.80' / 45.00' S= 0.0250 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 11.15 hrs HW=42.55' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.50 cfs @ 12.18 hrs HW=47.14' TW=43.40' (Dynamic Tailwater)
 ↑ **2=Culvert** (Inlet Controls 0.50 cfs @ 2.75 fps)

Pond IS3: System #3 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4.25 (Concrete Galley, Shea LE-EGH, LE-CGH or equivalent)

Inside= 42.2"W x 45.0"H => 13.25 sf x 3.50'L = 46.4 cf

Outside= 54.0"W x 51.0"H => 15.58 sf x 4.00'L = 62.3 cf

6 Chambers/Row x 4.00' Long = 24.00' Row Length +24.0" End Stone x 2 = 28.00' Base Length

2 Rows x 54.0" Wide + 24.0" Side Stone x 2 = 13.00' Base Width

12.0" Base + 51.0" Chamber Height = 5.25' Field Height

12 Chambers x 46.4 cf = 556.6 cf Chamber Storage

12 Chambers x 62.3 cf = 748.0 cf Displacement

1,911.0 cf Field - 748.0 cf Chambers = 1,163.0 cf Stone x 35.0% Voids = 407.1 cf Stone Storage

Chamber Storage + Stone Storage = 963.6 cf = 0.022 af

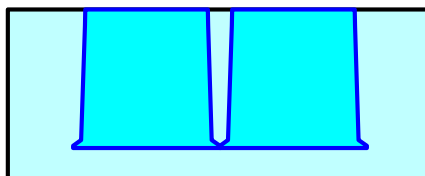
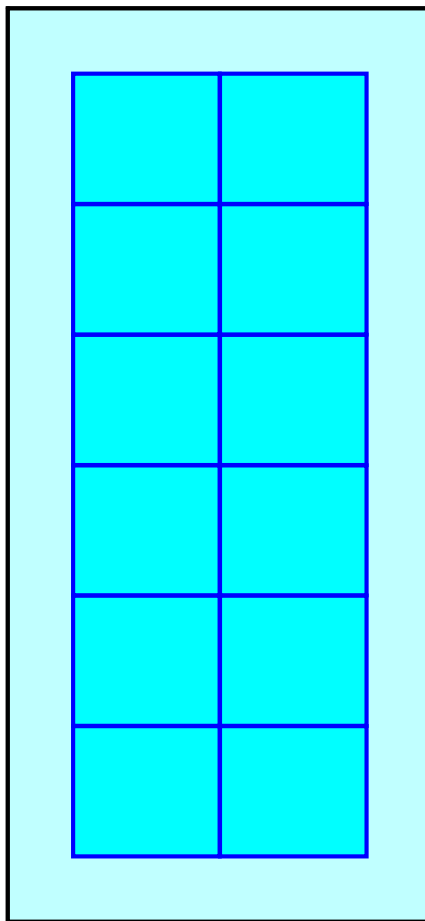
Overall Storage Efficiency = 50.4%

Overall System Size = 28.00' x 13.00' x 5.25'

12 Chambers

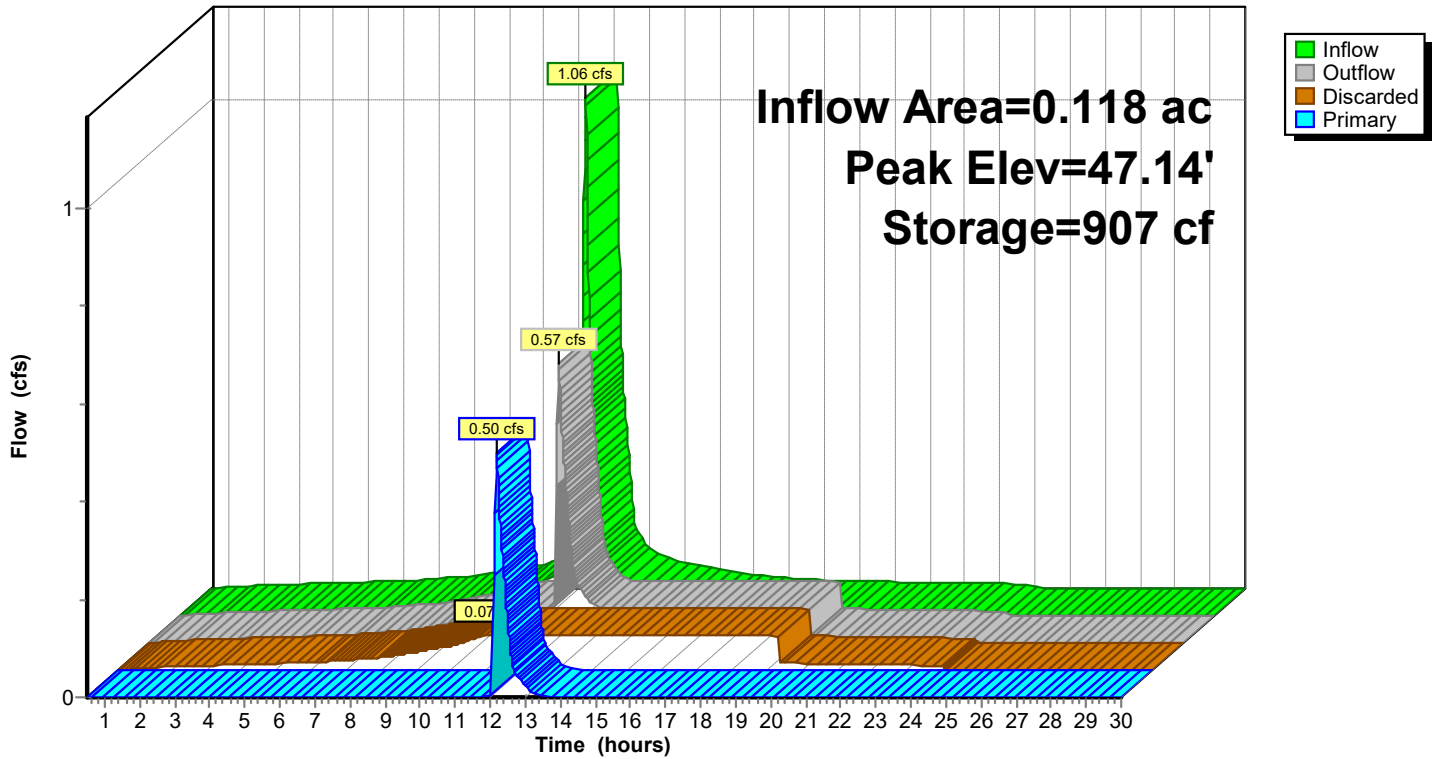
70.8 cy Field

43.1 cy Stone



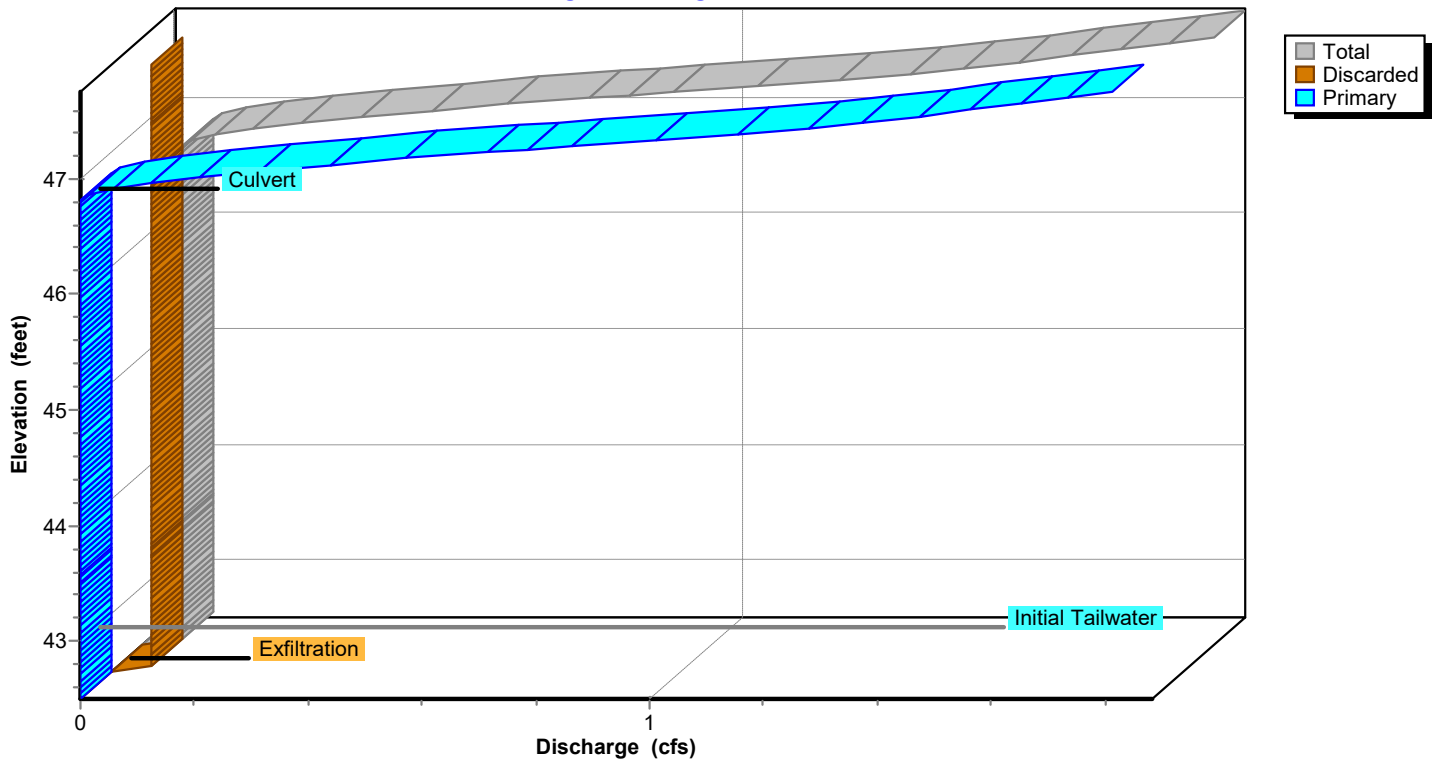
Pond IS3: System #3

Hydrograph



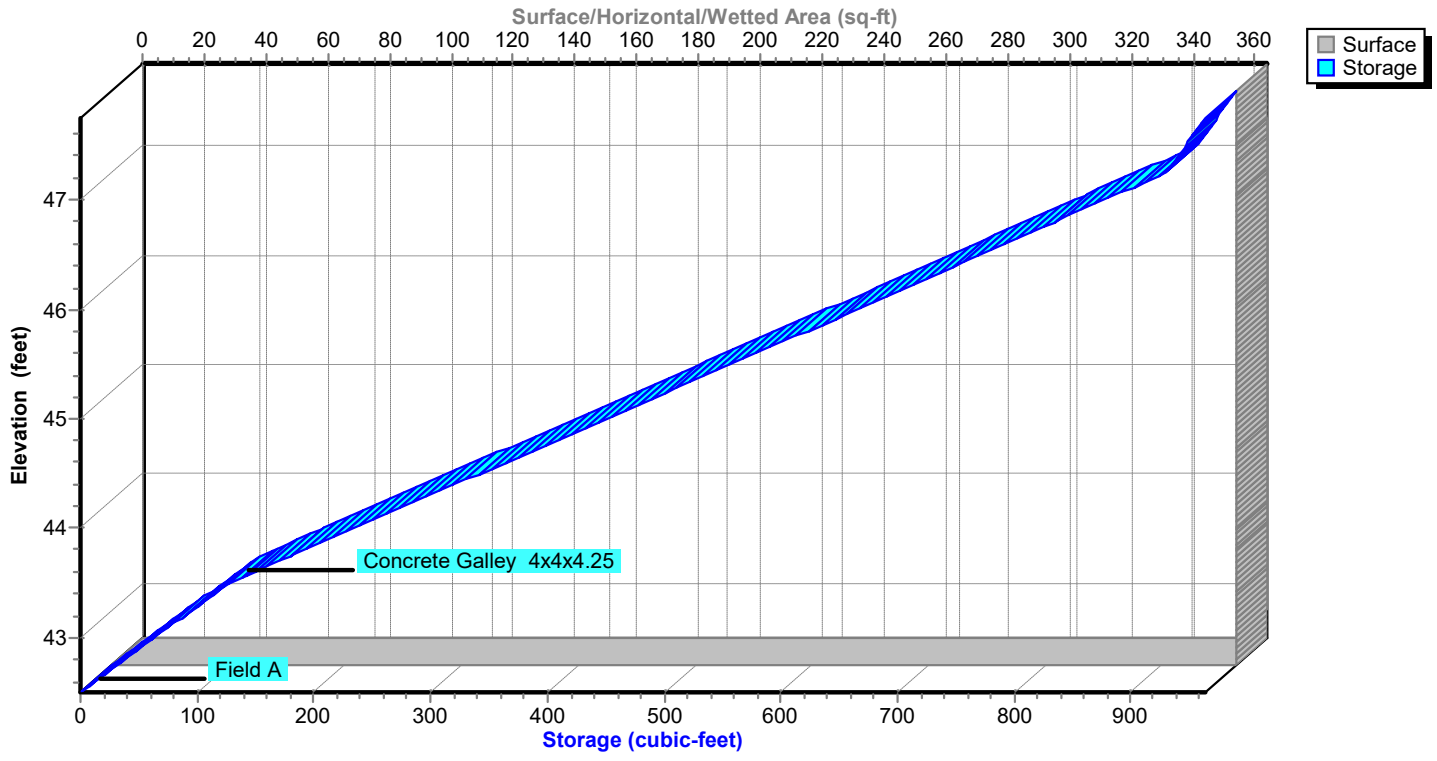
Pond IS3: System #3

Stage-Discharge



Pond IS3: System #3

Stage-Area-Storage



Summary for Pond IS4: (Retention Pond)

[56] Hint: Dam Breach started at 15.70 hrs WSE=44.50'

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth = 1.60" for 100-Year event
 Inflow = 0.71 cfs @ 12.18 hrs, Volume= 0.038 af
 Outflow = 0.09 cfs @ 16.70 hrs, Volume= 0.007 af, Atten= 88%, Lag= 271.5 min
 Secondary = 0.09 cfs @ 16.70 hrs, Volume= 0.007 af

Routing by Dyn-Stor-Ind method, Time Span= 0.50-30.00 hrs, dt= 0.010 hrs
 Peak Elev= 44.55' @ 16.63 hrs Surf.Area= 1,170 sf Storage= 1,383 cf

Plug-Flow detention time= 448.0 min calculated for 0.007 af (19% of inflow)
 Center-of-Mass det. time= 334.1 min (1,173.8 - 839.7)

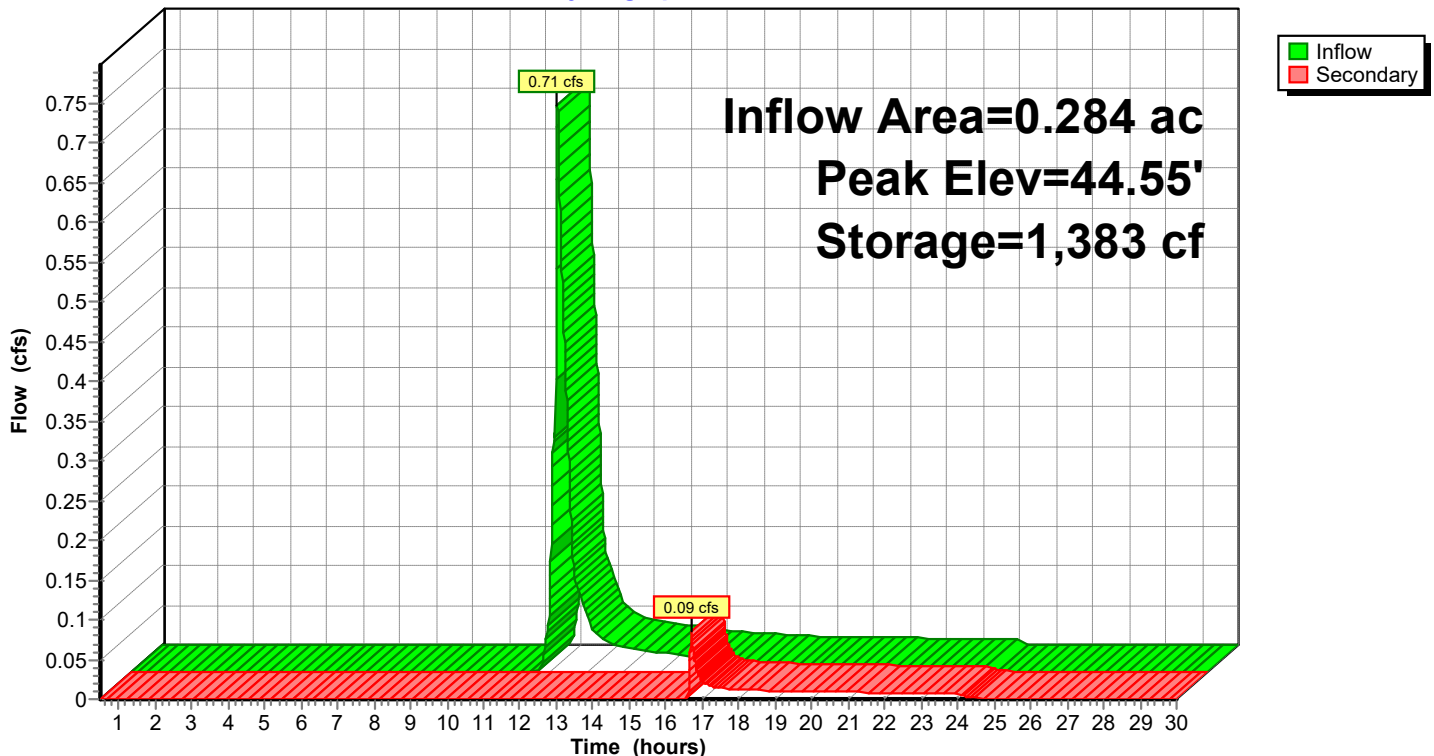
Volume	Invert	Avail.Storage	Storage Description			
#1	43.00'	1,949 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
43.00	637	100.0	0	0	637	
44.00	966	119.0	796	796	986	
45.00	1,351	137.0	1,153	1,949	1,374	

Device	Routing	Invert	Outlet Devices (Turned on 1 times)	
#1	Secondary	44.50'	45.0 deg x 3.0' wide x 0.50' high Dam Breach C= 2.56 Top of breach = 45.00' Bottom of breach = 44.50' Breach starts at 44.50' WSE and develops over 1.000 hrs	

Secondary OutFlow Max=0.08 cfs @ 16.70 hrs HW=44.54' TW=0.00' (Dynamic Tailwater)
 ↑-1=Dam Breach (Weir Controls 0.08 cfs @ 0.66 fps)

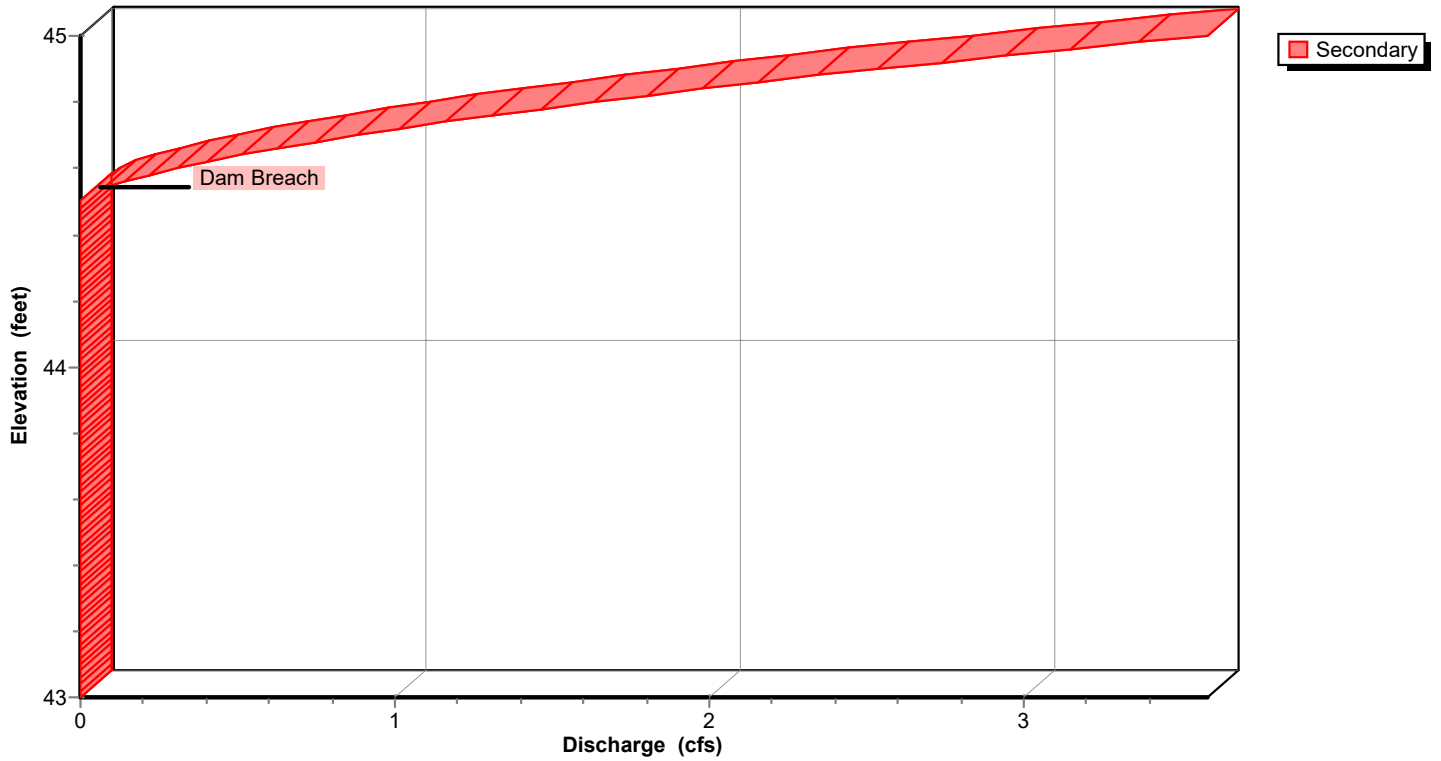
Pond IS4: (Retention Pond)

Hydrograph



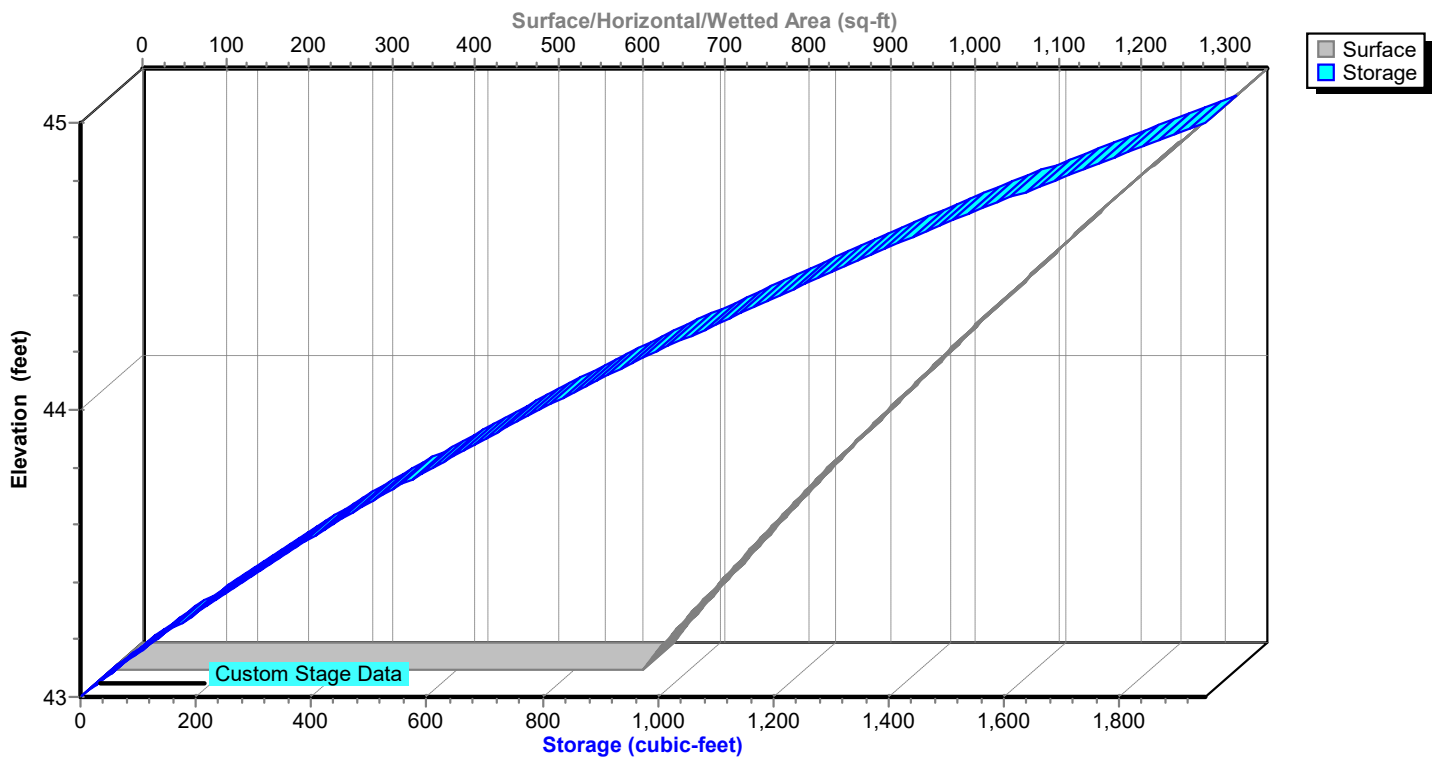
Pond IS4: (Retention Pond)

Stage-Discharge



Pond IS4: (Retention Pond)

Stage-Area-Storage



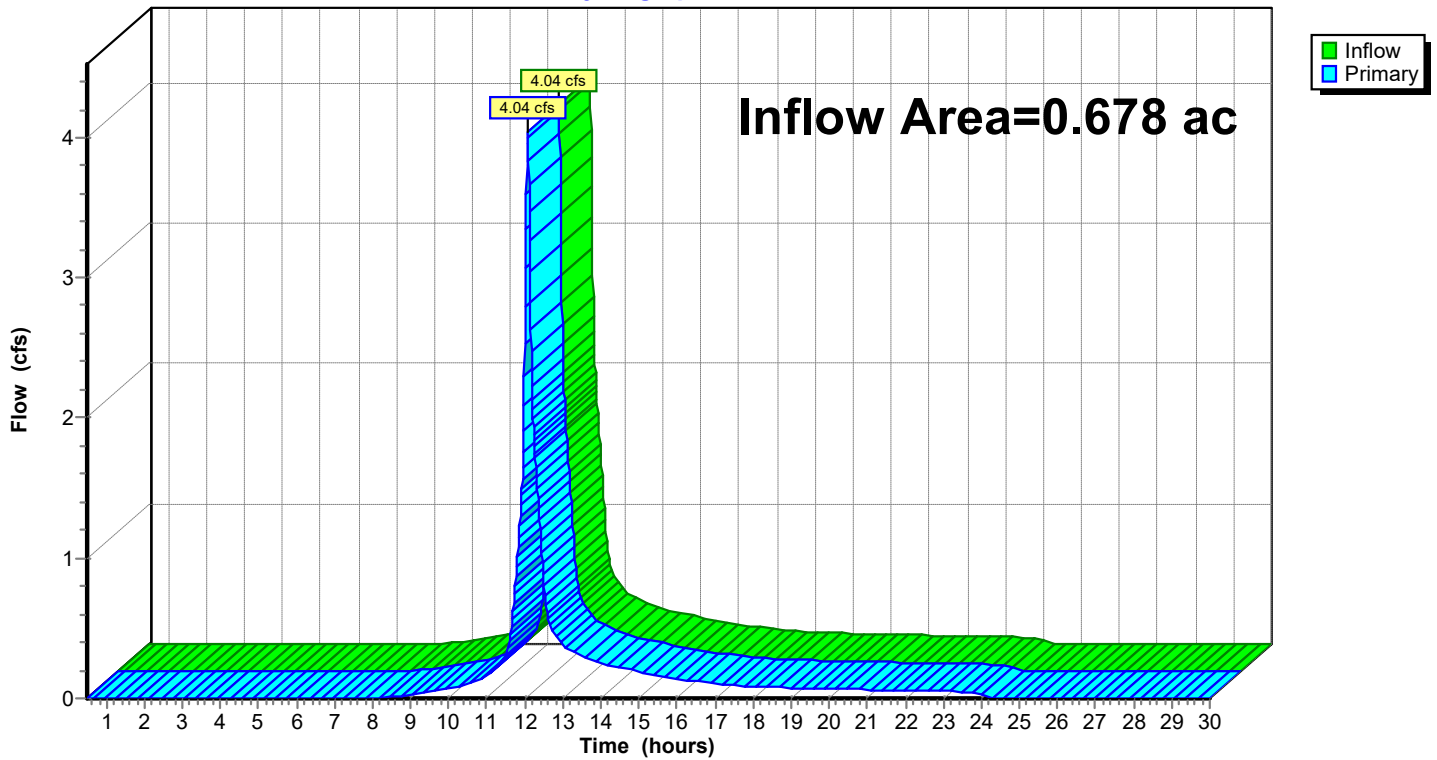
Summary for Link POD1: South-West Abutter

Inflow Area = 0.678 ac, 0.00% Impervious, Inflow Depth = 4.90" for 100-Year event
Inflow = 4.04 cfs @ 12.07 hrs, Volume= 0.277 af
Primary = 4.04 cfs @ 12.07 hrs, Volume= 0.277 af, Atten= 0%, Lag= 0.0 min

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

Link POD1: South-West Abutter

Hydrograph



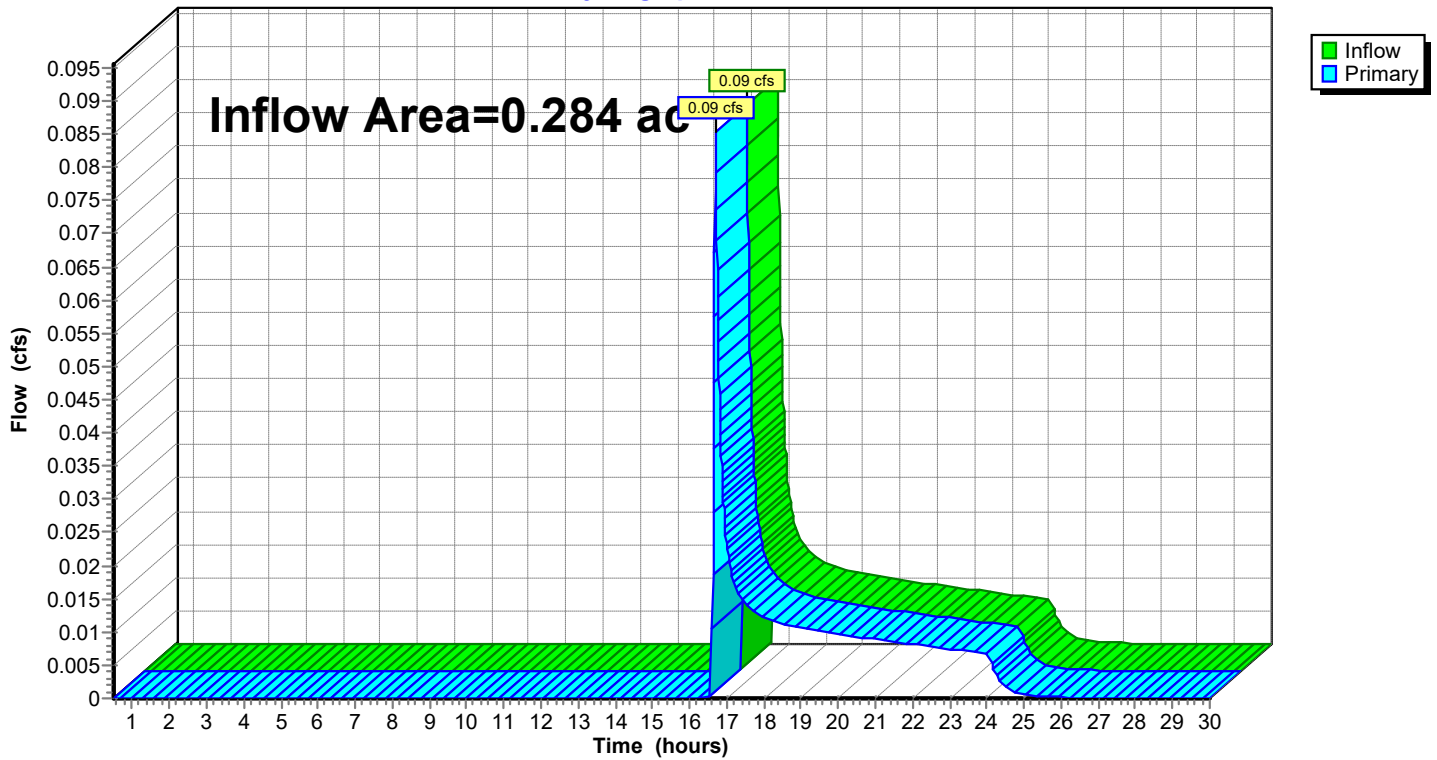
Summary for Link POD1.: South-West Abutter

Inflow Area = 0.284 ac, 41.74% Impervious, Inflow Depth > 0.31" for 100-Year event
Inflow = 0.09 cfs @ 16.70 hrs, Volume= 0.007 af
Primary = 0.09 cfs @ 16.70 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 POD1.: South-West Abutter

Hydrograph



Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex


Across-slope shape: Convex, linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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 22, Sep 9, 2022

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	1.5	100.0%
Totals for Area of Interest		1.5	100.0%

Post Development Conditions

The proposed project consists of the demolition of the existing building, three new 2-1/2 story buildings, driveway, walkways and a retention pond.

Approximately 26,560.7 s.f. (89.9%) of the site will be impervious areas.

The same overall area was analyzed for the proposed conditions as in the pre-development conditions and is shown on the previous table. 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 roofs and driveway runoff areas will be collected by roof leaders and catch basing and connected to three infiltration systems.

The intent of the proposed stormwater management systems is to infiltrate stormwater runoff of the new building roof and driveway. The infiltration system was designed to control the 100-year storm event and help mitigate the proposed peak rates of runoff to less than existing conditions.

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 equal or better than pre-development levels. Pre-development peak runoff rates vs. post-development peak runoff rates for the 2, 10, 25 and 100-year storm events are presented in the table below.

	Design Point #1			
	Peak Rate of Runoff (CFS)		Volume of Runoff (AF)	
	PRE	POST	PRE	POST
2-year	0.47	0.00	0.038	0.000
10-year	1.21	0.00	0.087	0.000
25-year	1.69	0.00	0.118	0.000
100-year	4.04	0.09	0.277	0.007

CONCLUSION

The post-development peak rate of runoff contributing to James Street is expected to be less than or equal to pre-development levels for the 2, 10, 25 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.

HYDROCAD AREAS

Design Point POD1 29,550.0 s.f.
 Total Lot Area 29,550.0 s.f.


PRE-DEVELOPMENT	Design point A1
	POD1
Building	3,289.2 s.f.
Driveway	6,646.0 s.f.
Other	0.0 s.f.
Grass	19,614.8 s.f.
Wooded	
Total impervious areas	9,935.2 s.f.
Total pervious areas	19,614.8 s.f.
Total areas	29,550.0 s.f.

POST-DEVELOPMENT	Design point A1			
	POD1	IS #1	IS #2	IS #3
Building		2,260.0 s.f.	3,360.0 s.f.	1,120.0 s.f.
Driveway		2,096.0 s.f.		
Other	452.0 s.f.	193.0 s.f.		
Grass	20,069.0			
Wooded				
Total impervious areas	9,481.0 s.f.	4,549.0 s.f.	3,360.0 s.f.	1,120.0 s.f.
Total pervious areas	20,069.0 s.f.	0.0 s.f.	0.0 s.f.	0.0 s.f.
Total areas		29,550.0 s.f.		


DRAWDOWN TIME CALCULATIONS

Time=Rv/(k*Ab) *Rv=recharge voluyme of the system. See HydroCad report*
Ab=bottom area of the infiltration system. See HydroCad report
k=infiltration rate


Infiltration System #1

Rv = **1,108.30 cu-ft**
K = 8.27 in/hr
= **0.69 ft/hr**
Ab = **416.0 sq. ft.**
Time = 3.86 Hr < 72 Hr 

Infiltration System #1

Rv = **818.90 cu-ft**
K = 8.27 in/hr
= **0.69 ft/hr**
Ab = **0.0 sq. ft.**
Time = 312.00 Hr < 72 Hr 

Infiltration System #1

Rv = **936.60 cu-ft**
K = 8.27 in/hr
= **0.69 ft/hr**
Ab = **364.0 sq. ft.**
Time = 3.73 Hr < 72 Hr 

BMP PERFORMANCE

Location: Infiltration system #1

<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Infiltration Basin	0.80	1.00	0.80	0.20
Infiltration Basin	0.80	0.20	0.16	0.04
	0.00	0.04	0.00	0.04
	0.00	0.04	0.00	0.04
	0.00	0.04	0.00	0.04

Total TSS Removal =

96%

Equals remaining load from previous BMP (E) which enters the BMP

Location: Infiltration system #2

<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Infiltration Basin	0.80	1.00	0.80	0.20
Infiltration Basin	0.80	0.20	0.16	0.04
	0.00	0.04	0.00	0.04
	0.00	0.04	0.00	0.04
	0.00	0.04	0.00	0.04

Total TSS Removal =

96%

Equals remaining load from previous BMP (E) which enters the BMP

PHOSPHORUS REMOVAL CALCULATION

For 2" (0.1667 ft.) of rain multiplied by the impervious surfaces

Infiltration System #1

2,259.0 s.f. x 2/12 ft./in. = 376.50 cu-ft

Infiltration System #2

2,240.0 s.f. x 2/12 ft./in. = 373.33 cu-ft

Infiltration System #2

2,240.0 s.f. x 2/12 ft./in. = 373.33 cu-ft

Volume Provided *	>	Volume Required
2,863.80 cu-ft		1,123.16 cu-ft ✓

* See HydroCad report for provided volume calculations

Load Factor	1.96 lb-year	
Existing Impervious Area	9,935.2 sq.ft	0.2281 ac
Proposed Impervious Area	9,481.0 sq.ft	0.2177 ac
Infiltrated Area	9,029.0 sq.ft	0.2073 ac

Existing Phosphorus Load	0.4471 lb-year	
Proposed Phosphorus Load	0.4267 lb-year	✓
Phosphorus Load Reduction	0.4063 lb-year	-----> 95.2%

Existing Cumulative Load Reduction Infiltration Trench

Infiltration rate (in/hr.)	Imp. areas Runoff Depth (in.)	Phosphorus	Runoff Volume
2.41	0.10	33%	34.00%
	0.20	55%	55.00%
	0.40	81%	78.00%
	0.60	91%	88.00%
	0.80	96%	93.00%
	1.00	98%	96.00%
	1.50	100%	99.00%
	2.00	100%	100.00%

Proposed Cumulative Load Reduction Infiltration Trench

Infiltration rate (in/hr.)	Imp. areas Runoff Depth	Phosphorus	Runoff Volume
2.41	0.10	33%	34.00%
	0.20	55%	55.00%
	0.40	81%	78.00%
	0.60	91%	88.00%
	0.80	96%	93.00%
	1.00	98%	96.00%
	1.50	100%	99.00%
	2.00	100%	100.00%