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Engineer's Report

Amherst Central Park
North Forest Road & Sheridan Drive, Amherst, NY

Prepared for:
Town of Amherst
5583 Main Street
Williamsville, NY 14221

July 15, 2026

Table of Contents

Appendices:

1.0 General

Existing Site Conditions

The project site is located at the northwest corner of the intersection of North Forest Road and Sheridan Drive, in the Town of Amherst, New York. (See Location Map in Appendix A). The parcel size is approximately 8.0 +/- acres. The site is currently developed and consists of an existing parking lot with a total of 85 parking space, including 12 HC accessible spaces, an existing tennis court and maintained lawn area.

The soil on site according to the USDA NRCS Soil Survey consists of Claverack loamy fine sand, which is listed as HSG 'C/D'. For soils assigned to a dual hydrologic soil group, the first letter is for drained areas and the second is for undrained areas. Only soils that in their natural condition are in group 'D' are assigned to dual classes.

Upon review of the New York State Historic Preservation Office's GIS for Archeological and National Register online resources tool, no properties, including archaeological and/or historic resources, listed in or eligible for the New York State and National Registers of Historic Places will be impacted by this project.

Proposed Site Conditions

Development will consist of the demolition of the existing tennis court to allow for the construction of an ADA accessible playground, seatwalls, a new parking lot/flexible space for public events and/or vendors, walkways and utility infrastructure (domestic water, sanitary sewer lateral and electric service for a future restroom building). Additionally, a stormwater management system consisting of a bioretention basin, a proprietary stormwater filter and a dry detention basin will be provided for the site.

Upon completion, the proposed project will add 0.55 acres of new impervious cover. The total anticipated ground disturbance during construction of this project will be approximately 2.1 +/- acres. Due to the increase in impervious areas, stormwater detention is required. Additionally, since the construction of this site will disturb greater than one acre, a Stormwater Pollution Prevention Plan (SWPPP), in accordance with the New York State Department of Environmental Conservation (NYSDEC) standards and an eNOI (electronic Notice of Intent) are required.

2.0 Stormwater Management

Stormwater Conveyance

Under existing conditions, there are two (2) main drainage areas, labeled "North Drainage Area" and "South Drainage Area", as shown on the Existing Drainage Analysis Map. The North Drainage Area consists of the existing parking lot, existing access drive and some lawn areas. Stormwater runoff from the North Drainage Area flows overland and is collected in the catch basin within the existing parking lot. Stormwater discharges from this catch basin flow further north within an enclosed drainage system within the golf course facility. The South Drainage Area consists of the existing tennis court and lawn areas along the southern portion of the site. Stormwater runoff from the South Drainage Area flows overland and is conveyed to the catch basin within the existing parking lot in the North Drainage Area. Stormwater discharges from this catch basin flow further north within an enclosed drainage system within the golf course facility.

Stormwater runoff under proposed conditions will continue to follow the same drainage patterns as under existing conditions.

Under proposed conditions, there are two (2) main drainage areas, as shown on the Proposed Drainage Analysis Map. The North Drainage Area consists of the existing parking lot, existing access drive, new concrete sidewalks and lawn areas. Stormwater runoff from the North Drainage Area will continue to flow overland and will be collected in the catch basin within the existing parking lot. Stormwater discharges from this catch basin flow further north within an enclosed drainage system within the golf course facility. The South Drainage Area is broken up into three (3) subareas, labeled "South Drainage Area from Playground", "South Drainage Area to Bioretention" and New Bldg to Filter. The South Drainage Area from Playground consists of the proposed ADA playground area. Stormwater runoff from this area will be collected and piped to the dry detention basin. From the dry detention basin, stormwater discharges will be released at a controlled rate and then piped to the existing catch basin within the existing parking lot in the North Drainage Area. The South Drainage Area to Bioretention consists of the new asphalt paved parking lot/flexible space and lawn areas along the southern portion of the site. Stormwater runoff from this area will be collected and treated within a bioretention basin, prior to be directed to the dry detention basin. From the dry detention basin, stormwater discharges will be released at a controlled rate and then piped to the existing catch basin within the existing parking lot in the North Drainage Area. The New Bldg to Filter consists of the new restroom building. Stormwater runoff from this area will be piped to a proprietary filter and then piped to the dry detention basin. From the dry detention basin, stormwater discharges will be released at a controlled rate and then piped to the existing catch basin within the existing parking lot in the North Drainage Area.

Quantity Control

New York State Department of Environmental Conservation (NYSDEC) regulations require design of stormwater detention facilities to limit the peak discharge produced by the 10-year and 100-year storm events to the pre-developed runoff rates, as well as provide extended detention of the 1-YR, 24-HR storm event (channel protection volume). The proposed stormwater detention system will consist of a dry detention basin and 300 linear feet of 36-inch diameter, perforated, HDPE pipe along with pipe's encasing stone. A minimum 3-inch diameter orifice will be provided within the stormwater control structure to provide the required CPv requirement for the site. A 10-inch diameter outlet pipe and the 10-inch diameter riser piper within the stormwater control structure, will limit both the 10-year and 100-year discharge rates under post-development conditions, to the existing 10-year and 100-year discharge rates under existing conditions.

Stormwater calculations were completed using HYDROCAD, version 10.0 software, which utilizes the SCS unit hydrograph method (See Appendix B). The following is a summary of the pre- and post-development discharge rates, water surface elevations and detention volumes required and provided for the drainage areas:

Channel Protection Volume Required = 0.255 ac-ft = 11,108 cubic feet

Channel Protection Volume Provided = 0.255 ac-ft = 11,108 cubic feet

Discharge from North Drainage Area:

Storm Event	Pre-Development Discharge Rate (cfs)	Post-Development Discharge Rate (cfs)
10-YR	6.92	7.93
100-YR	11.79	13.30

Discharge from South:

Storm Event	Pre-Development Discharge Rate (cfs)	Post-Development Discharge Rate (cfs)	Proposed Water Surface Elevation in Underground Detention (feet)	Detention Volume Provided in Underground Detention (cf)
10-YR	5.34	1.99	602.21	9,369
100-YR	10.73	2.87	603.81	20,635

Total Site Discharge:

Storm Event	Pre-Development Discharge Rate (cfs)	Post-Development Discharge Rate (cf)
10-YR	9.45	8.17
100-YR	18.71	15.08

Quality Control

Chapters 3-5 of the NYSDEC Stormwater Management Design Manual (SMDM) provides a green infrastructure approach to stormwater management to reduce a site's impact on the aquatic ecosystem through the use of site planning techniques, runoff reduction techniques, and standard SMP's. Runoff Reduction Volume (RRv) is the reduction of the total Water Quality Volume (WQv) by application of green infrastructure techniques and SMP's to replicate pre-development hydrology.

The NYSDEC SMDM's intent is for projects to meet 100% of runoff reduction volume through the use of green infrastructure techniques. Projects that do not achieve runoff reduction to pre-construction condition must, at a minimum, provide the minimum RRv as well as provide the remaining WQv in standard SMPs.

One (1) bioretention basin will be used to provide the minimum RRv required and a portion of the water quality volume. Additionally, one (1) proprietary stormwater treatment unit will be used to provide the remainder of the water quality volume.

Below is a summary of the water quality volume and runoff reduction volumes attained on site:

Water Quality Volume Required from New Impervious Area	2,178 cf
Water Quality Volume Required from Redeveloped Impervious Area	1,329 cf
Water Quality Volume Required to be treated with a Standard Practice	**2,510 cf**

= 100% of WQv from new, impervious area + 25% of WQv from redeveloped, impervious area

= 2,178 cf + 0.25(1,329 cf) = **2,510 cf**

Minimum Runoff Reduction Volume Required (RRv, min)	**379 cf**
Bioretention Basin (provided in South Drainage Area to Bioretention):	
WQ_v Required	2,423 cf
Total WQ_v Provided	2,423 cf
RR_v Provided	969 cf
(Filtration Bioretention = 40% of WQv provided)	
WQv provided (Total WQv – RRv Provided)	1,454 cf
Filter #1 (Up-Flo Filter provided for New Restroom Building):	
WQ_v Required	162 cf
WQ_v Provided	162 cf
Water Quality Flowrate	0.07 cfs
WQv Provided	**1,616 cf**
RRv Provided	**969 cf**
Total WQv Provided (WQv Provided = RRv Provided)	**2,585 cf**

Stormwater calculations are included in Appendix B.

3.0 Sanitary Sewer

The proposed building will be serviced by a 6-inch diameter, SDR-35 PVC, private, sanitary sewer lateral. The 6-inch lateral will connect to an existing 8-inch PVC sewer lateral that services the existing Clubhouse building, just to the east of the new building, via a wye connection.

All of the private sanitary work is to be performed per the Town of Amherst standards. Sanitary sewer flow calculations for the proposed building are shown below and are also included in Appendix C.

Design Parameters (Appendix C) –

1) Hydraulic Loading Rate per "Design Standard for Intermediate Sized Wastewater Treatment Works", March 5, 2014 NYSDEC.
2) Table B-3 Typical Per-Unit Hydraulic Loading Rates
   Public Park = 4 gpd/person (reduced by 20% with use of water saving reducing fixtures)
3) An estimate of the expected patrons per day is 300 visitors
4) Average Daily Design Flow = (4 gal/day)(300 people)
   = 1,200 gpd = 0.83 gpm
5) Peak Hourly Flow = (1,200 gpd) (4.41 peak factor)
   = 5,292 gpd = 3.70 gpm

4.0 Water

Currently, there is a 6-inch fire service, tapped off of the existing 8-inch watermain within North Forest Road, that feeds the Willowdale Park (formerly Westwood Country Club) clubhouse building and on-site hydrants. As part of a on-going improvements for the Willowdale Park project, the existing vault for the 6-inch fire service will be replaced with a Hotbox enclosure and inside the enclosure the fire service will be metered with a 6-inch Neptune Protectus III meter and backflow protected with a 6-inch Watts LF957 RPZ. Downstream of the new Hot\box enclosure, a new, 6-inch AWWA C900 PVC private fire service will be tapped off of the existing 6-inch fire service to feed a new private fire hydrant adjacent to the existing parking lot. Additionally, a new, 2-inch Type 'K' copper domestic water service will be tapped off of the proposed 6-inch fire service, to provide domestic water to the new restroom building. Since the existing fire service will be both metered and backflow protected, separate meters and backflow preventors are not required for the new 6-inch fire service or the new 2-inch domestic service.

Design Criteria (Appendix D):

1)	Domestic Peak Operating Demand:	30 gpm
2)	Static Pressure in 8-inch water main on North Forest Road (1^{st} hydrant north of Sheridan Drive):	84 psi
3)	Residual Flow in water main on N. Forest :80 psi at a flow of 500 gpm	
4)	Friction Loss through 2-inch domestic service	1.5 psi
5)	Friction Loss through fittings	1 psi
6)	Friction Loss through elevation	0.4 psi
7)	Friction Loss through 6-inch Watts LF957 RPZ:	12 psi
8)	Friction Loss through 6-inch Neptune Protectus III Meter:	2 psi
9)	Residual Pressure @ building after meter and RPZ:	63 psi

(Static pressure at the main was provided by the Erie County Water Authority, with a test date of 6/17/2026)

Water calculations are included in Appendix D.

5.0 100-YR Floodplain

The proposed building and the proposed playground are not located in the 100-year flood plain. The site is located in "Zone X" per FEMA Firm Panel 36029C0207H, effective date 6/7/2019. See Firmette in Appendix E.

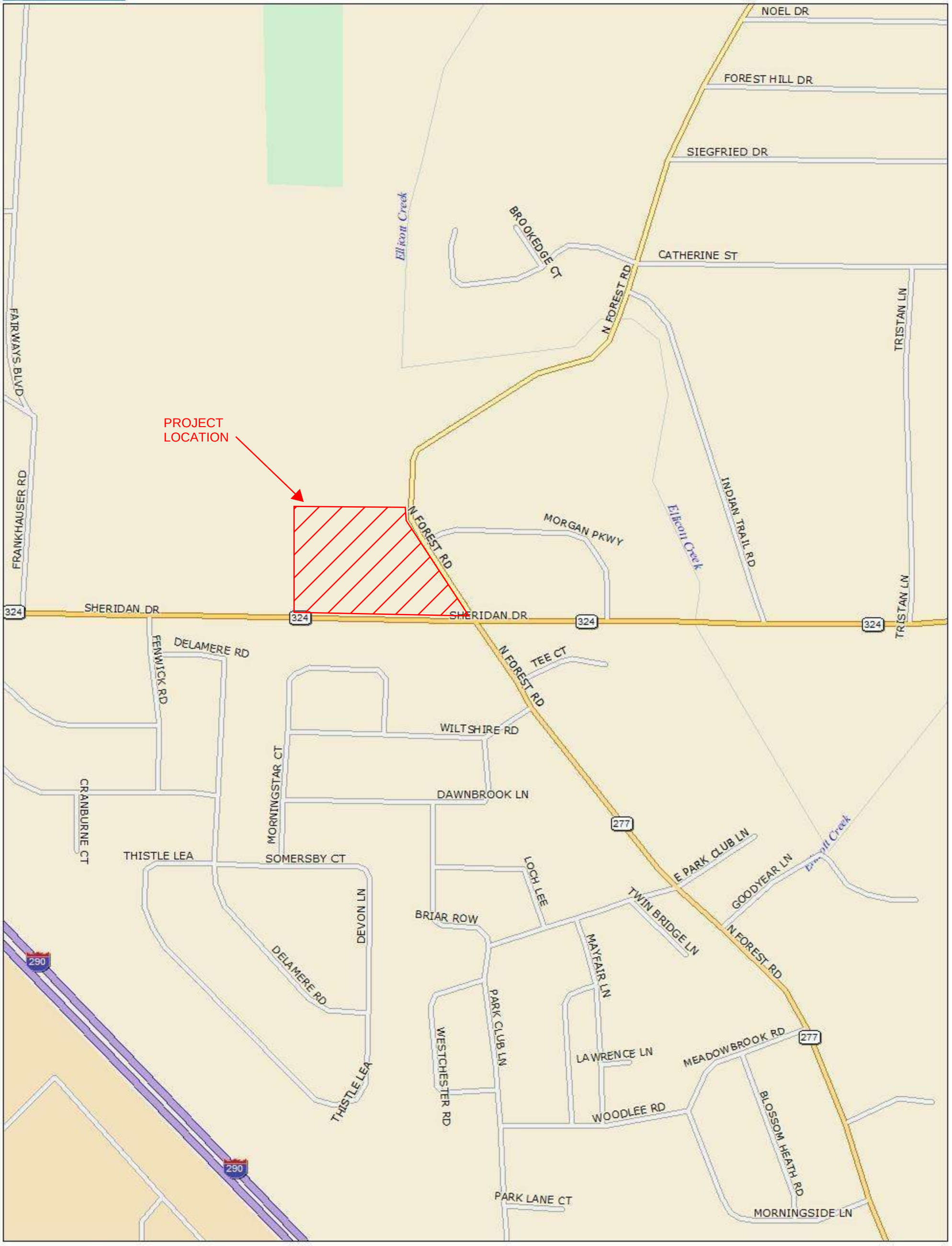
Respectfully Submitted,

C&S ENGINEERS, INC.

Jason P. Utzig, P.E.
Senior Project Engineer

Appendix A – Site Location Map

DeLorme Street Atlas USA® 2011

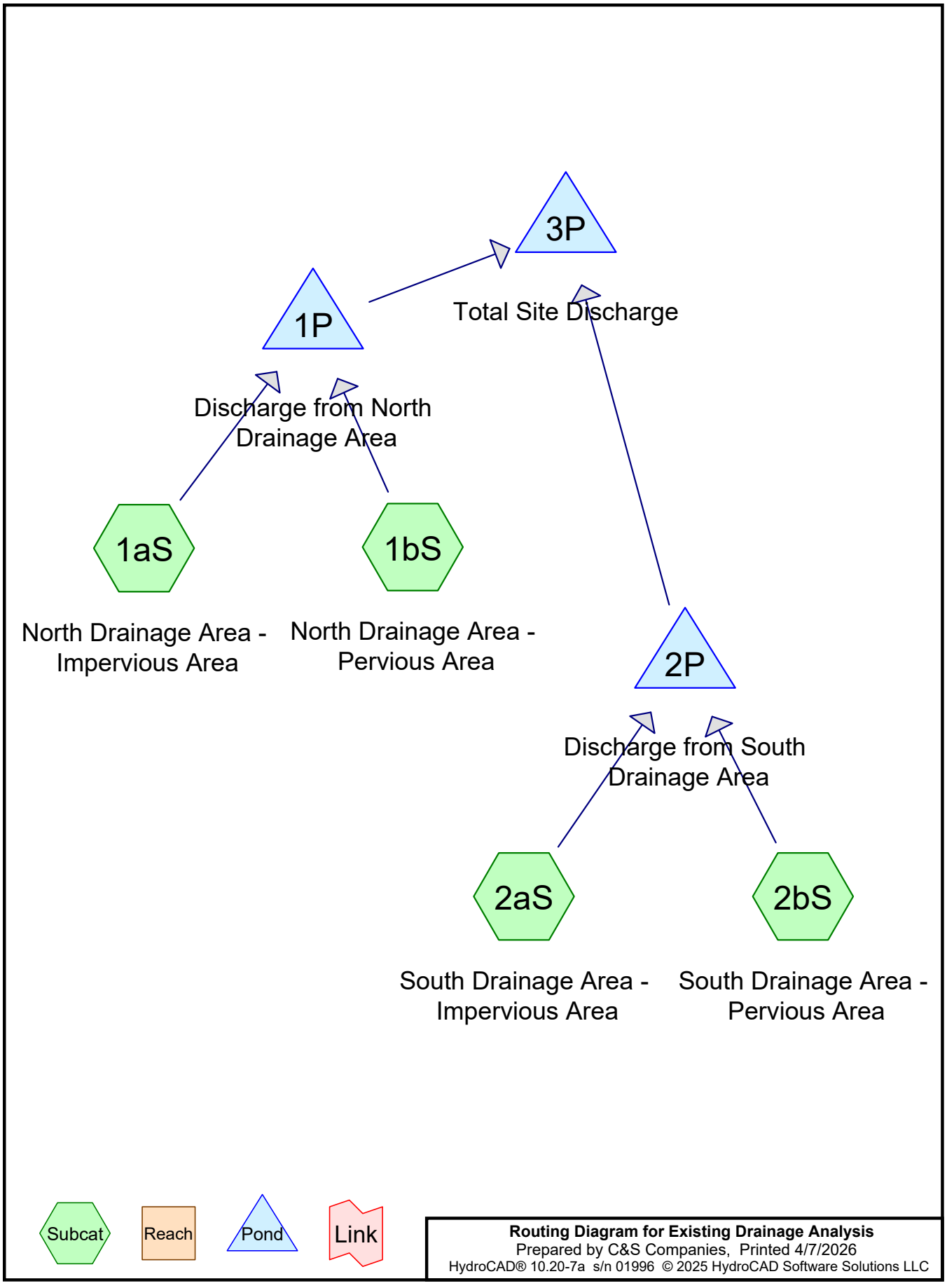


MN (10.8° W)

0 200 400 600 800 1000 1200 ft

Data Zoom 14-6

Appendix B – Drainage Calculations



Routing Diagram for Existing Drainage Analysis
Prepared by C&S Companies, Printed 4/7/2026

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-YR	Type II 24-hr		Default	24.00	1	1.92	2
2	10-YR	Type II 24-hr		Default	24.00	1	3.41	2
3	100-YR	Type II 24-hr		Default	24.00	1	5.17	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1aS: North Drainage Area - Runoff Area=1.100 ac 100.00% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=98 Runoff=2.93 cfs 0.155 af

Subcatchment1bS: North Drainage Area - Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=586' Slope=0.0115 '/' Tc=23.2 min CN=78 Runoff=0.96 cfs 0.092 af

Subcatchment2aS: South Drainage Area - Runoff Area=0.290 ac 100.00% Impervious Runoff Depth=1.70"
Flow Length=353' Slope=0.0084 '/' Tc=16.5 min CN=98 Runoff=0.56 cfs 0.041 af

Subcatchment2bS: South Drainage Area - Runoff Area=4.260 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=809' Slope=0.0084 '/' Tc=32.4 min CN=78 Runoff=1.28 cfs 0.156 af

Pond 1P: Discharge from North Drainage Area Inflow=3.19 cfs 0.247 af
Primary=3.19 cfs 0.247 af

Pond 2P: Discharge from South Drainage Area Inflow=1.51 cfs 0.197 af
Primary=1.51 cfs 0.197 af

Pond 3P: Total Site Discharge Inflow=3.81 cfs 0.444 af
Primary=3.81 cfs 0.444 af

Total Runoff Area = 8.150 ac Runoff Volume = 0.444 af Average Runoff Depth = 0.65"
82.94% Pervious = 6.760 ac 17.06% Impervious = 1.390 ac

Summary for Subcatchment 1aS: North Drainage Area - Impervious Area

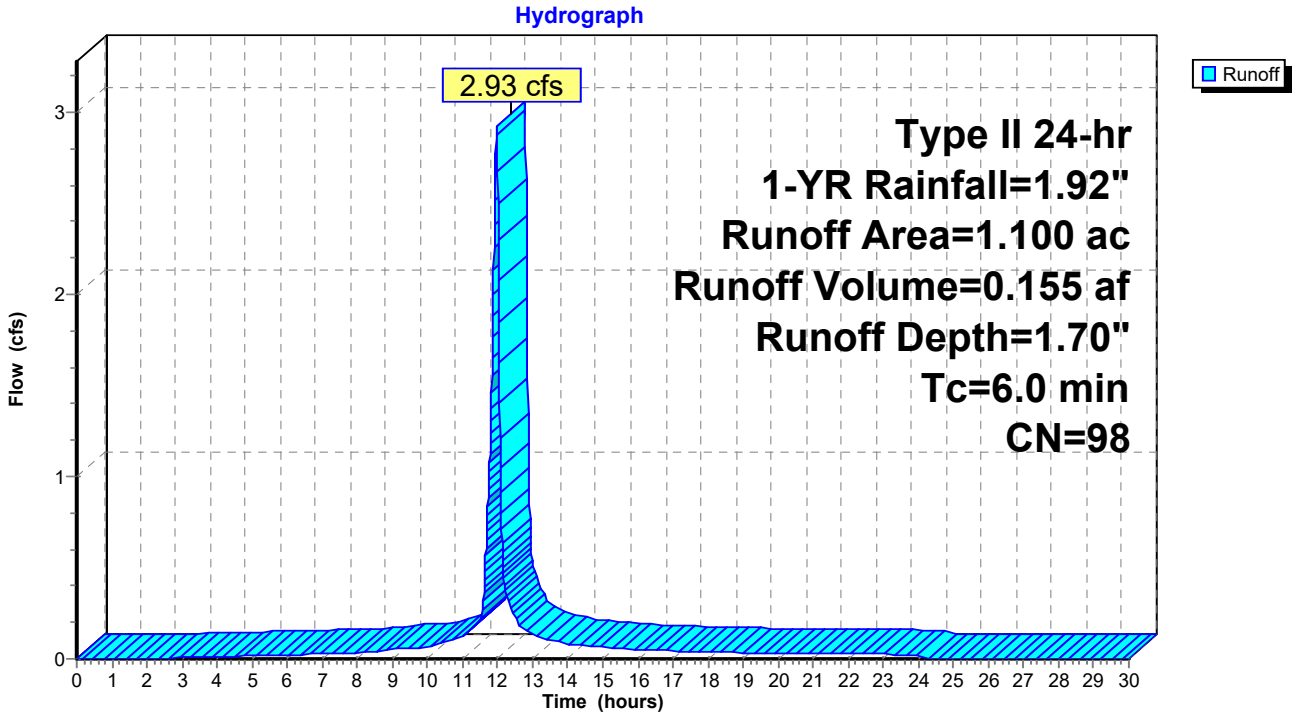
Runoff = 2.93 cfs @ 11.97 hrs, Volume= 0.155 af, Depth= 1.70"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
1.100	98	Paved parking, HSG D
1.100		100.00% Impervious Area

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

Subcatchment 1aS: North Drainage Area - Impervious Area



Summary for Subcatchment 1bS: North Drainage Area - Pervious Area

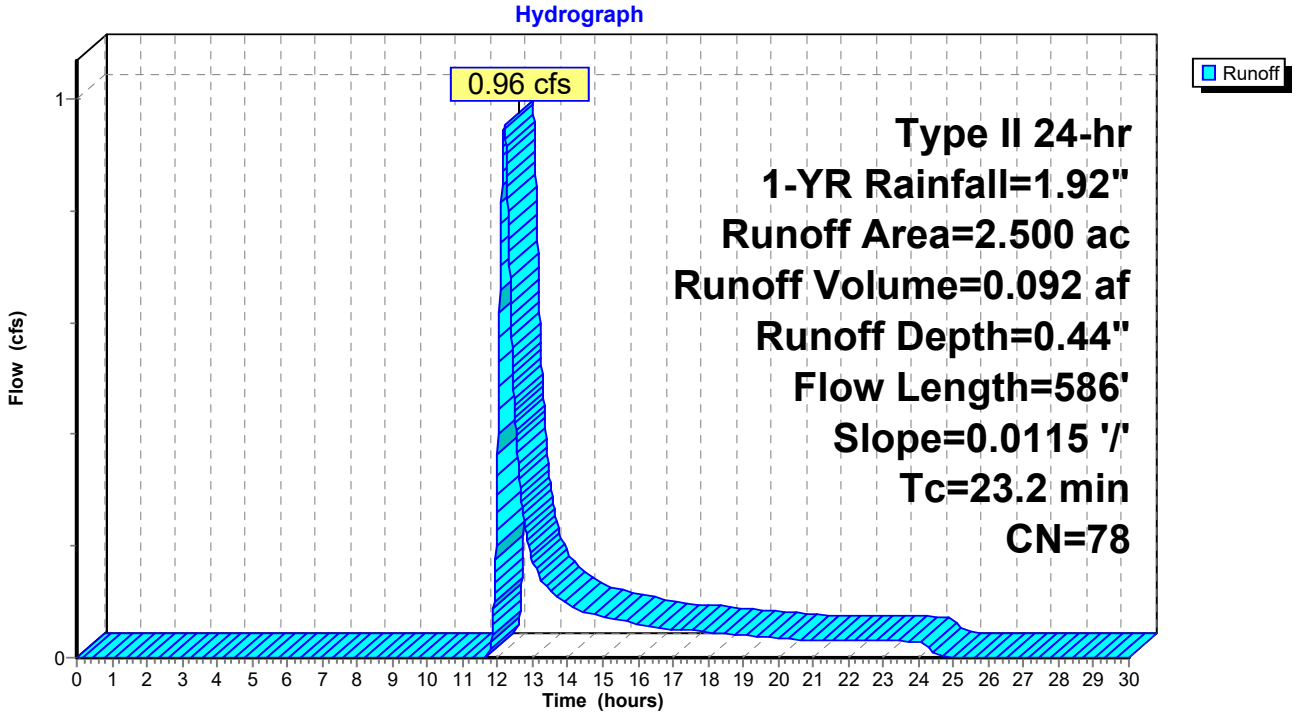
Runoff = 0.96 cfs @ 12.19 hrs, Volume= 0.092 af, Depth= 0.44"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.050	79	Woods/grass comb., Good, HSG D
2.450	78	Meadow, non-grazed, HSG D
2.500	78	Weighted Average
2.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0115	0.13		**Sheet Flow,** Range n= 0.130 P2= 2.29"
10.0	452	0.0115	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0115	2.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
23.2	586	Total			

Subcatchment 1bS: North Drainage Area - Pervious Area



Summary for Subcatchment 2aS: South Drainage Area - Impervious Area

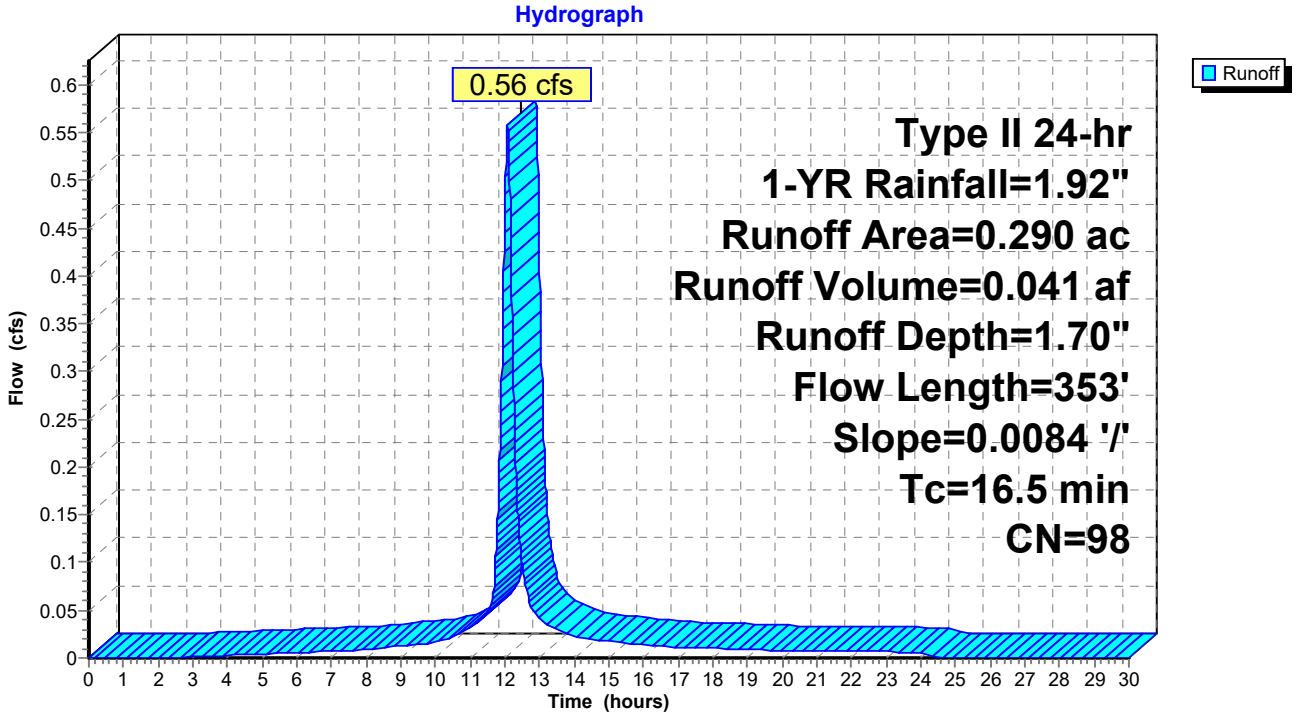
Runoff = 0.56 cfs @ 12.08 hrs, Volume= 0.041 af, Depth= 1.70"
Routed to Pond 2P : Discharge from South Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.290	98	Unconnected pavement, HSG D
0.290		100.00% Impervious Area
0.290		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	30	0.0084	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.29"
11.0	70	0.0084	0.11		**Sheet Flow,** Range n= 0.130 P2= 2.29"
3.8	147	0.0084	0.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	106	0.0084	1.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.5	353	Total			

Subcatchment 2aS: South Drainage Area - Impervious Area



Summary for Subcatchment 2bS: South Drainage Area - Pervious Area

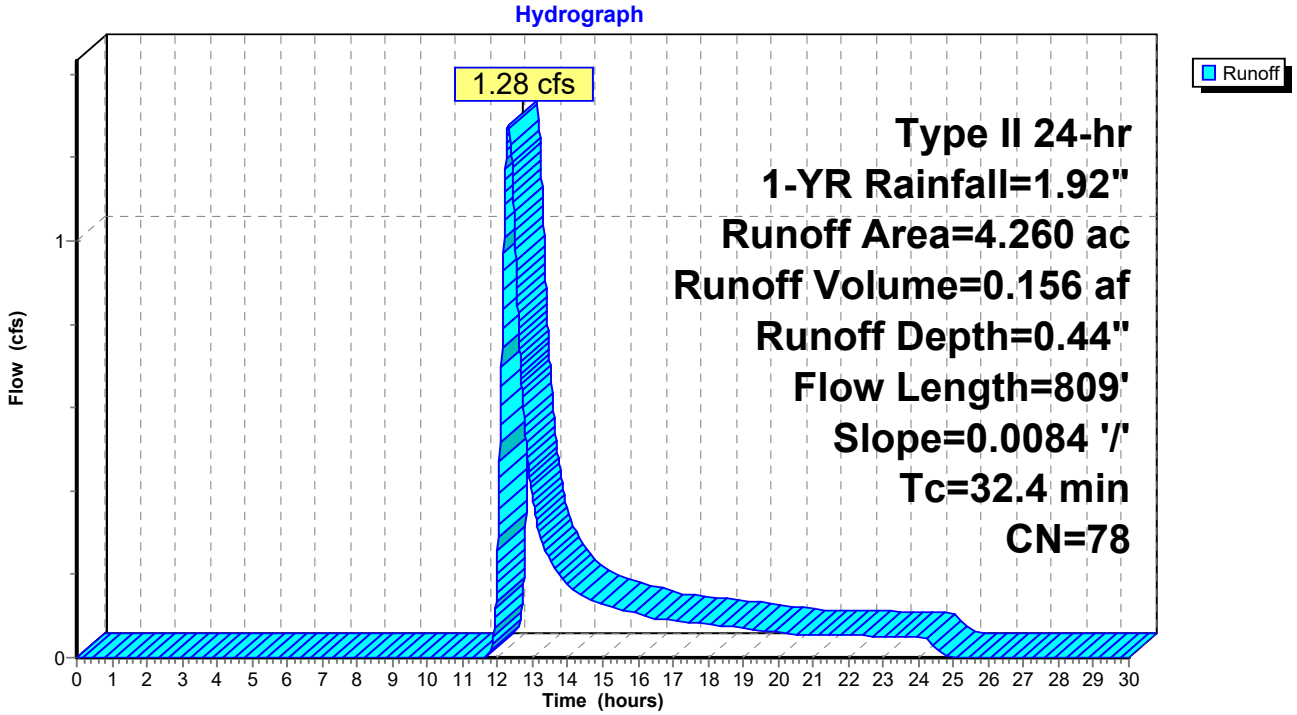
Runoff = 1.28 cfs @ 12.31 hrs, Volume= 0.156 af, Depth= 0.44"
Routed to Pond 2P : Discharge from South Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.330	79	Woods/grass comb., Good, HSG D
3.930	78	Meadow, non-grazed, HSG D
4.260	78	Weighted Average
4.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0084	0.11		**Sheet Flow,** Range n= 0.130 P2= 2.29"
17.4	669	0.0084	0.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0084	1.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
32.4	809	Total			

Subcatchment 2bS: South Drainage Area - Pervious Area



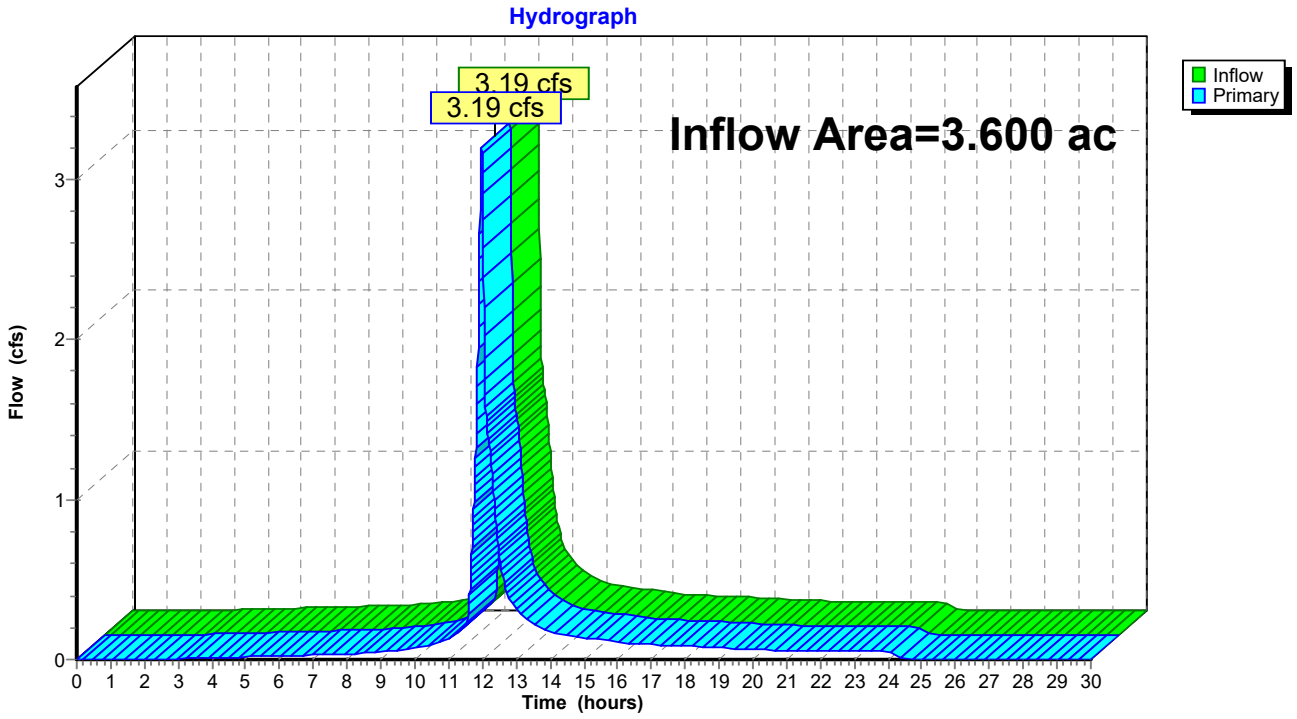
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 3.600 ac, 30.56% Impervious, Inflow Depth = 0.82" for 1-YR event
Inflow = 3.19 cfs @ 11.97 hrs, Volume= 0.247 af
Primary = 3.19 cfs @ 11.97 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



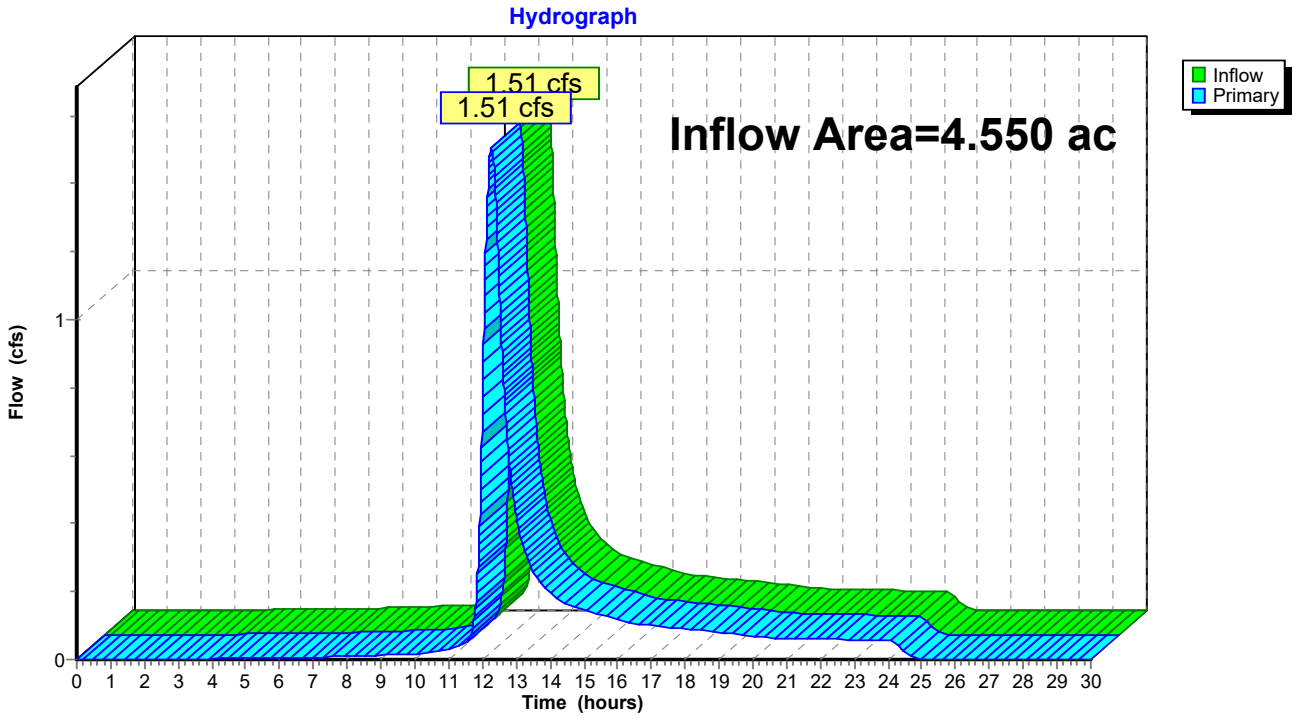
Summary for Pond 2P: Discharge from South Drainage Area

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

Inflow Area = 4.550 ac, 6.37% Impervious, Inflow Depth = 0.52" for 1-YR event
Inflow = 1.51 cfs @ 12.27 hrs, Volume= 0.197 af
Primary = 1.51 cfs @ 12.27 hrs, Volume= 0.197 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 2P: Discharge from South Drainage Area



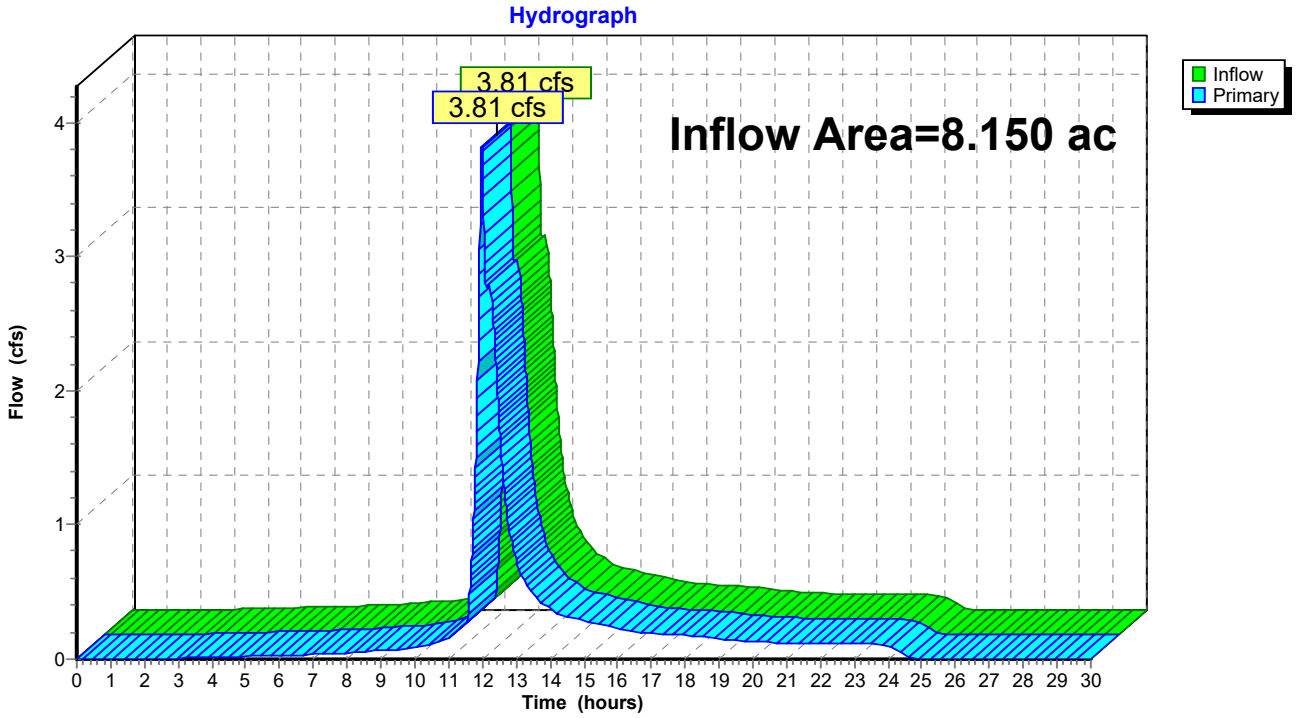
Summary for Pond 3P: Total Site Discharge

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

Inflow Area = 8.150 ac, 17.06% Impervious, Inflow Depth = 0.65" for 1-YR event
Inflow = 3.81 cfs @ 11.98 hrs, Volume= 0.444 af
Primary = 3.81 cfs @ 11.98 hrs, Volume= 0.444 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Total Site Discharge



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1aS: North Drainage Area - Runoff Area=1.100 ac 100.00% Impervious Runoff Depth=3.18"
Tc=6.0 min CN=98 Runoff=5.31 cfs 0.291 af

Subcatchment1bS: North Drainage Area - Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=1.43"
Flow Length=586' Slope=0.0115 '/' Tc=23.2 min CN=78 Runoff=3.57 cfs 0.298 af

Subcatchment2aS: South Drainage Area - Runoff Area=0.290 ac 100.00% Impervious Runoff Depth=3.18"
Flow Length=353' Slope=0.0084 '/' Tc=16.5 min CN=98 Runoff=1.01 cfs 0.077 af

Subcatchment2bS: South Drainage Area - Runoff Area=4.260 ac 0.00% Impervious Runoff Depth=1.43"
Flow Length=809' Slope=0.0084 '/' Tc=32.4 min CN=78 Runoff=4.90 cfs 0.507 af

Pond 1P: Discharge from North Drainage Area Inflow=6.92 cfs 0.589 af
Primary=6.92 cfs 0.589 af

Pond 2P: Discharge from South Drainage Area Inflow=5.34 cfs 0.584 af
Primary=5.34 cfs 0.584 af

Pond 3P: Total Site Discharge Inflow=9.45 cfs 1.173 af
Primary=9.45 cfs 1.173 af

Total Runoff Area = 8.150 ac Runoff Volume = 1.173 af Average Runoff Depth = 1.73"
82.94% Pervious = 6.760 ac 17.06% Impervious = 1.390 ac

Summary for Subcatchment 1aS: North Drainage Area - Impervious Area

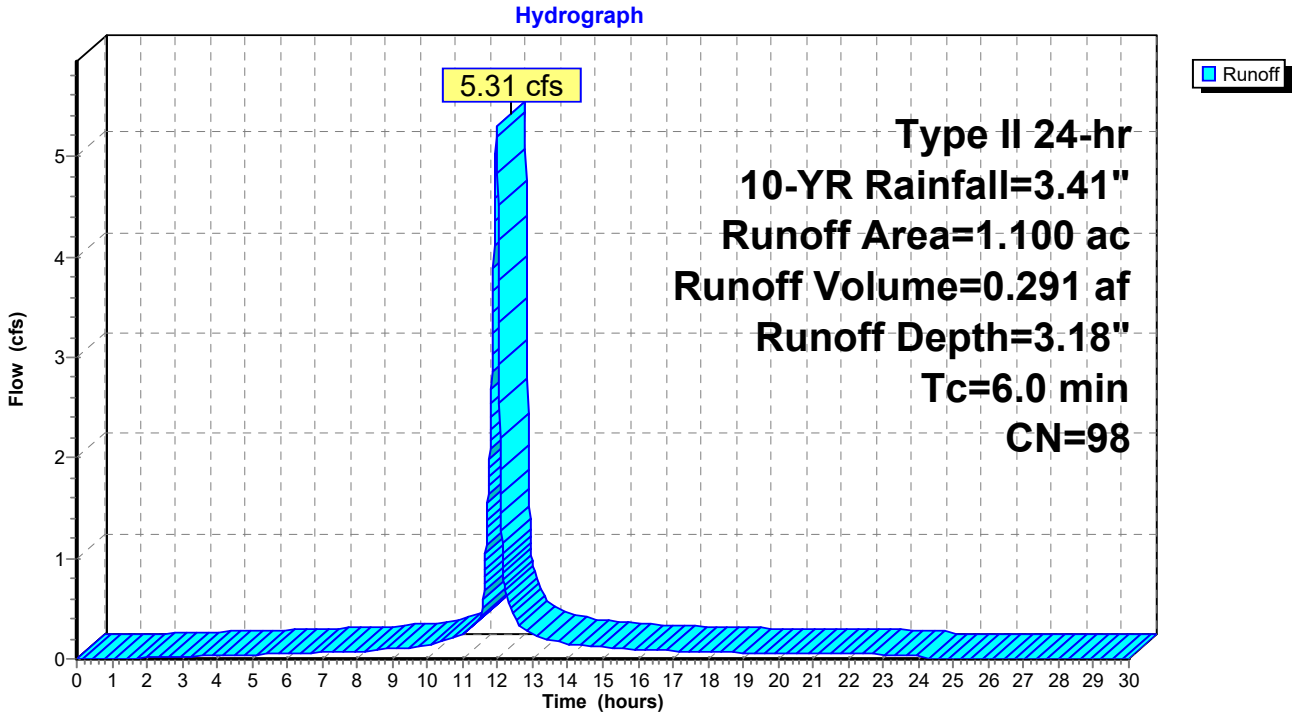
Runoff = 5.31 cfs @ 11.97 hrs, Volume= 0.291 af, Depth= 3.18"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
1.100	98	Paved parking, HSG D
1.100		100.00% Impervious Area

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

Subcatchment 1aS: North Drainage Area - Impervious Area



Summary for Subcatchment 1bS: North Drainage Area - Pervious Area

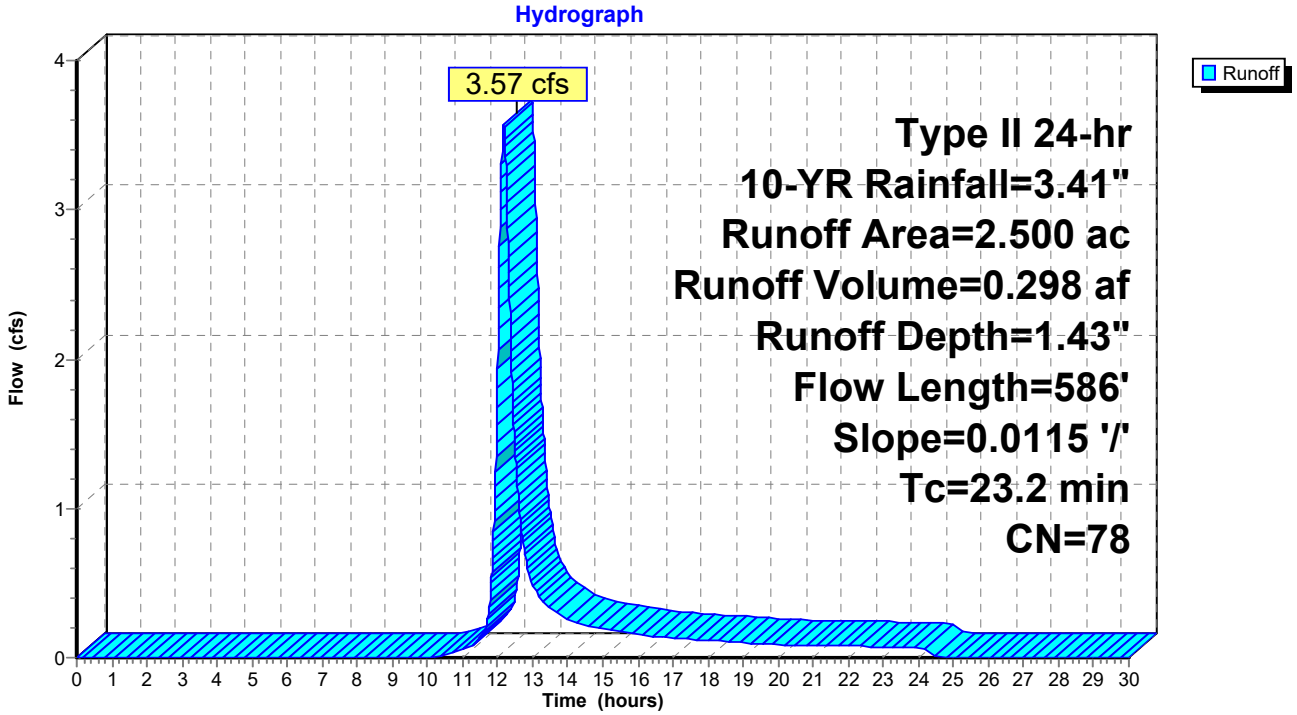
Runoff = 3.57 cfs @ 12.17 hrs, Volume= 0.298 af, Depth= 1.43"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.050	79	Woods/grass comb., Good, HSG D
2.450	78	Meadow, non-grazed, HSG D
2.500	78	Weighted Average
2.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0115	0.13		**Sheet Flow,** Range n= 0.130 P2= 2.29"
10.0	452	0.0115	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0115	2.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
23.2	586	Total			

Subcatchment 1bS: North Drainage Area - Pervious Area



Summary for Subcatchment 2aS: South Drainage Area - Impervious Area

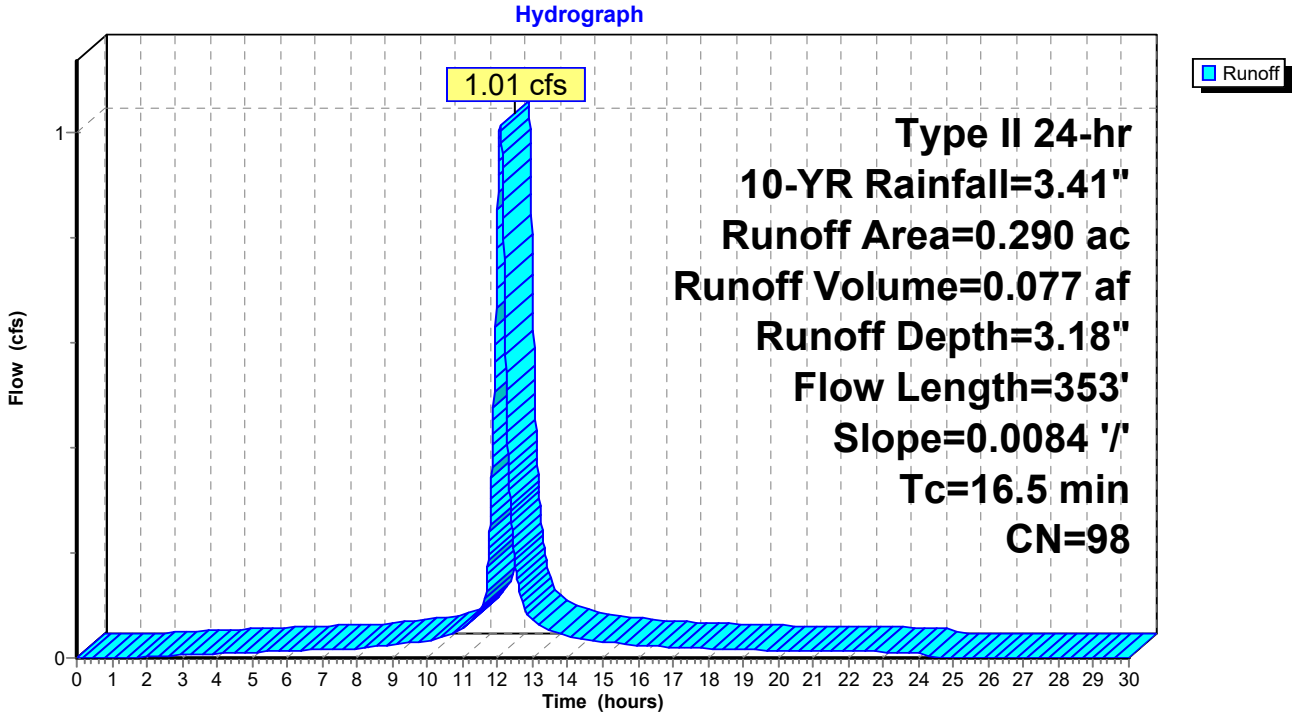
Runoff = 1.01 cfs @ 12.08 hrs, Volume= 0.077 af, Depth= 3.18"
Routed to Pond 2P : Discharge from South Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.290	98	Unconnected pavement, HSG D
0.290		100.00% Impervious Area
0.290		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	30	0.0084	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.29"
11.0	70	0.0084	0.11		**Sheet Flow,** Range n= 0.130 P2= 2.29"
3.8	147	0.0084	0.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	106	0.0084	1.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.5	353	Total			

Subcatchment 2aS: South Drainage Area - Impervious Area



Summary for Subcatchment 2bS: South Drainage Area - Pervious Area

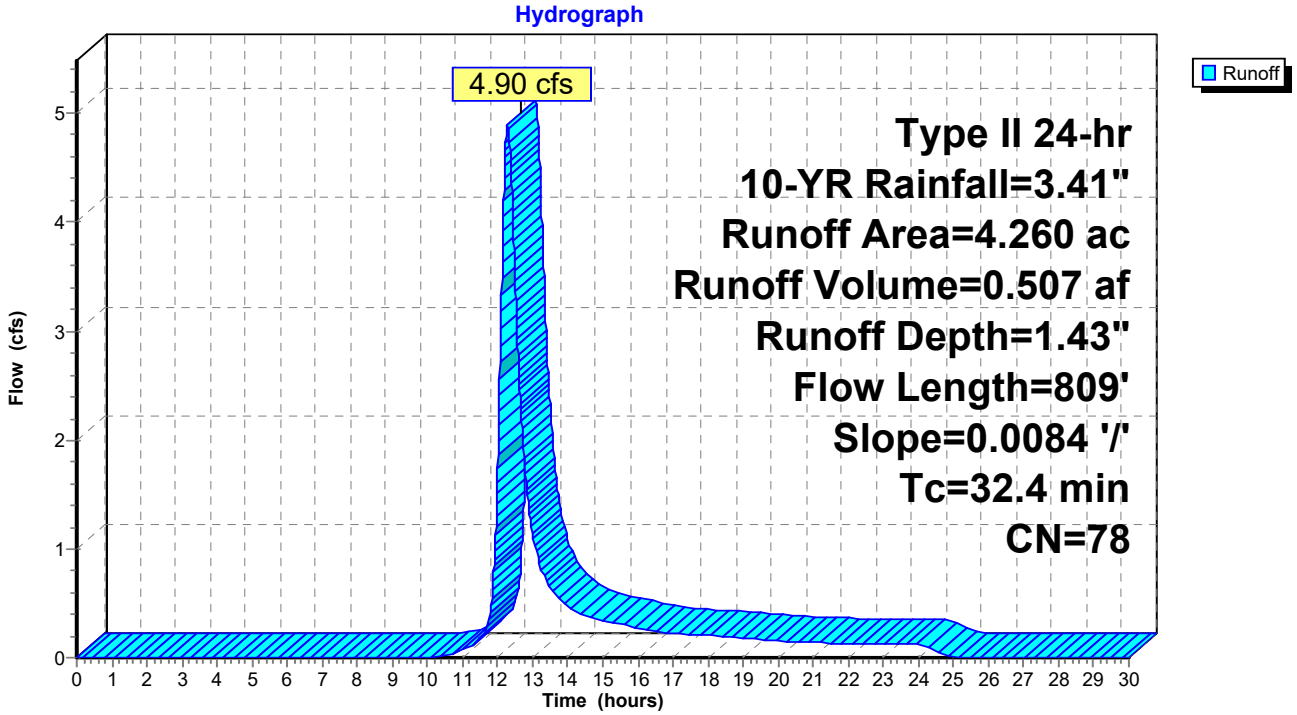
Runoff = 4.90 cfs @ 12.28 hrs, Volume= 0.507 af, Depth= 1.43"
Routed to Pond 2P : Discharge from South Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.330	79	Woods/grass comb., Good, HSG D
3.930	78	Meadow, non-grazed, HSG D
4.260	78	Weighted Average
4.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0084	0.11		**Sheet Flow,** Range n= 0.130 P2= 2.29"
17.4	669	0.0084	0.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0084	1.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
32.4	809	Total			

Subcatchment 2bS: South Drainage Area - Pervious Area



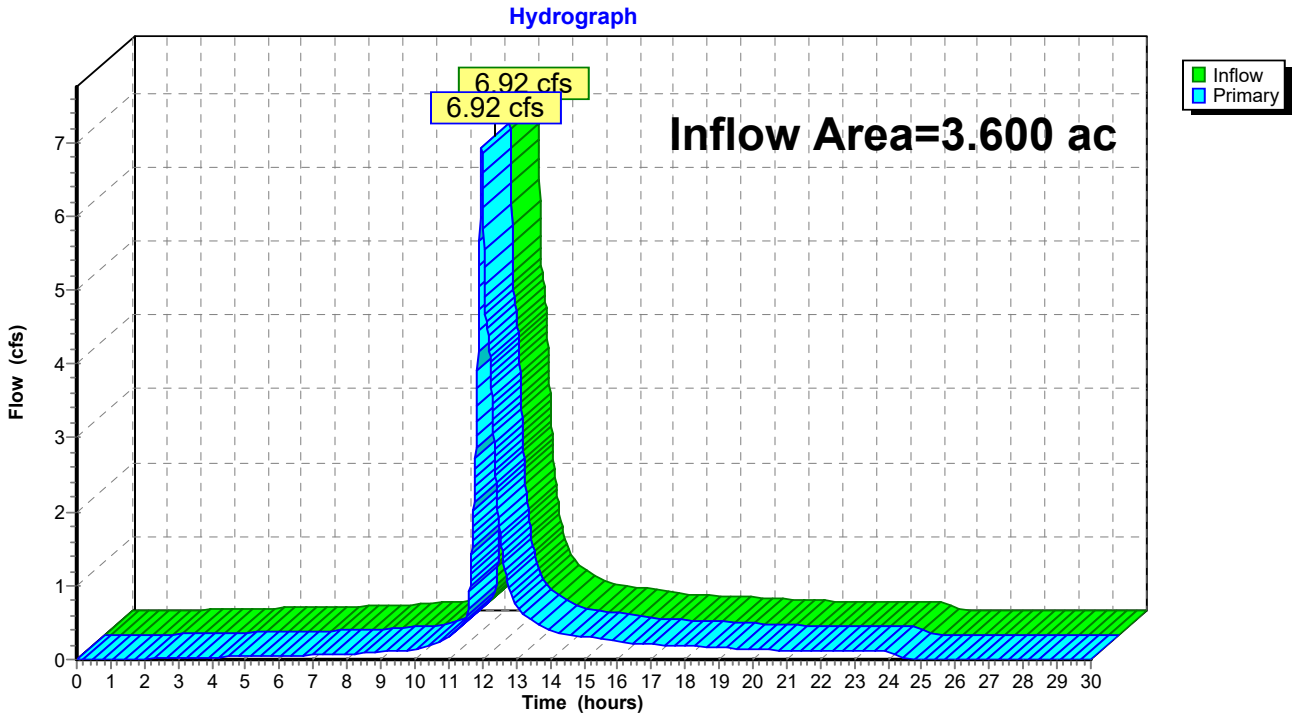
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 3.600 ac, 30.56% Impervious, Inflow Depth = 1.96" for 10-YR event
Inflow = 6.92 cfs @ 11.98 hrs, Volume= 0.589 af
Primary = 6.92 cfs @ 11.98 hrs, Volume= 0.589 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



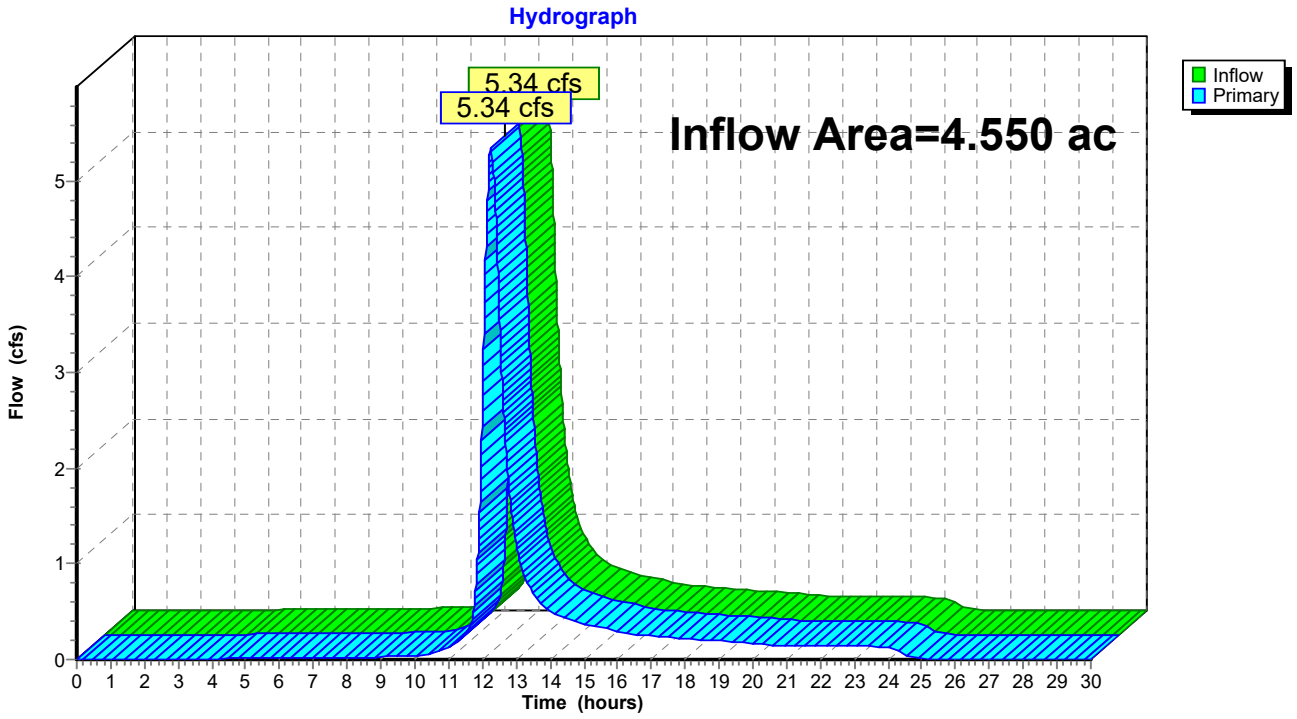
Summary for Pond 2P: Discharge from South Drainage Area

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

Inflow Area = 4.550 ac, 6.37% Impervious, Inflow Depth = 1.54" for 10-YR event
Inflow = 5.34 cfs @ 12.27 hrs, Volume= 0.584 af
Primary = 5.34 cfs @ 12.27 hrs, Volume= 0.584 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 2P: Discharge from South Drainage Area



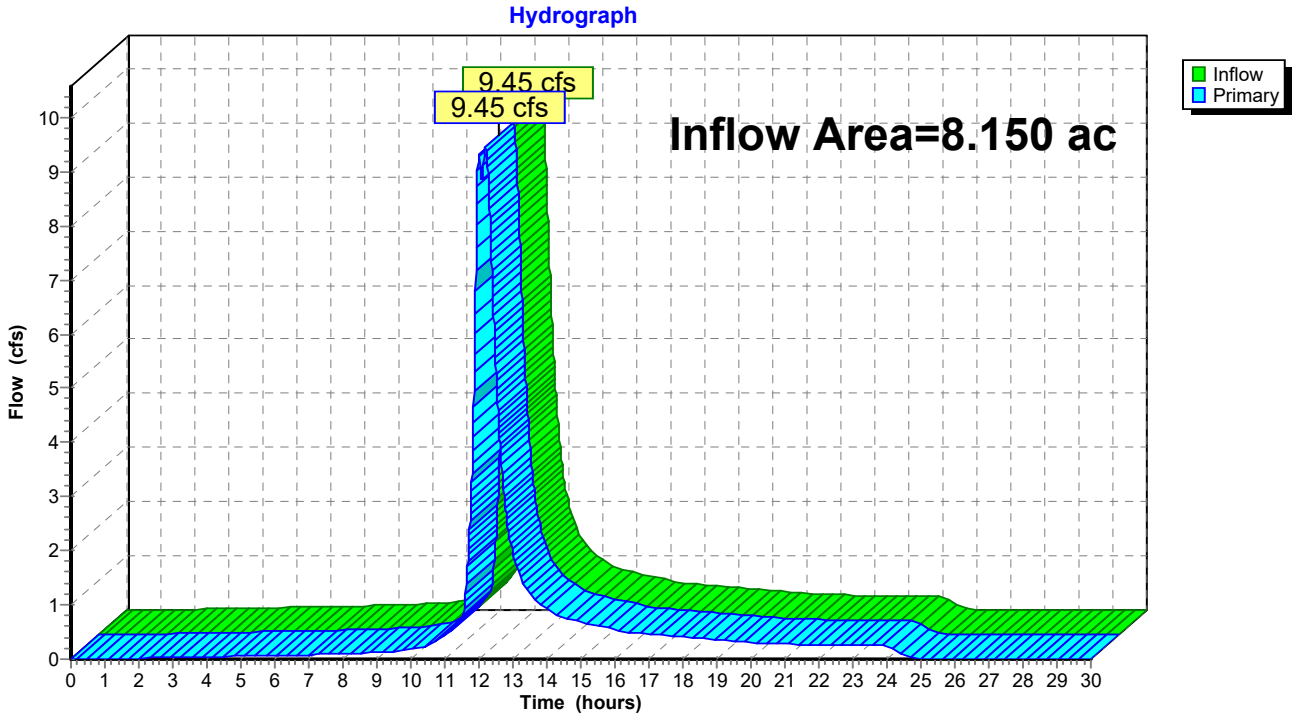
Summary for Pond 3P: Total Site Discharge

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

Inflow Area = 8.150 ac, 17.06% Impervious, Inflow Depth = 1.73" for 10-YR event
Inflow = 9.45 cfs @ 12.20 hrs, Volume= 1.173 af
Primary = 9.45 cfs @ 12.20 hrs, Volume= 1.173 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Total Site Discharge



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1aS: North Drainage Area - Runoff Area=1.100 ac 100.00% Impervious Runoff Depth=4.93"
Tc=6.0 min CN=98 Runoff=8.10 cfs 0.452 af

Subcatchment1bS: North Drainage Area - Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=2.86"
Flow Length=586' Slope=0.0115 '/' Tc=23.2 min CN=78 Runoff=7.27 cfs 0.595 af

Subcatchment2aS: South Drainage Area - Runoff Area=0.290 ac 100.00% Impervious Runoff Depth=4.93"
Flow Length=353' Slope=0.0084 '/' Tc=16.5 min CN=98 Runoff=1.55 cfs 0.119 af

Subcatchment2bS: South Drainage Area - Runoff Area=4.260 ac 0.00% Impervious Runoff Depth=2.86"
Flow Length=809' Slope=0.0084 '/' Tc=32.4 min CN=78 Runoff=10.04 cfs 1.014 af

Pond 1P: Discharge from North Drainage Area Inflow=11.79 cfs 1.047 af
Primary=11.79 cfs 1.047 af

Pond 2P: Discharge from South Drainage Area Inflow=10.73 cfs 1.133 af
Primary=10.73 cfs 1.133 af

Pond 3P: Total Site Discharge Inflow=18.71 cfs 2.181 af
Primary=18.71 cfs 2.181 af

Total Runoff Area = 8.150 ac Runoff Volume = 2.181 af Average Runoff Depth = 3.21"
82.94% Pervious = 6.760 ac 17.06% Impervious = 1.390 ac

Summary for Subcatchment 1aS: North Drainage Area - Impervious Area

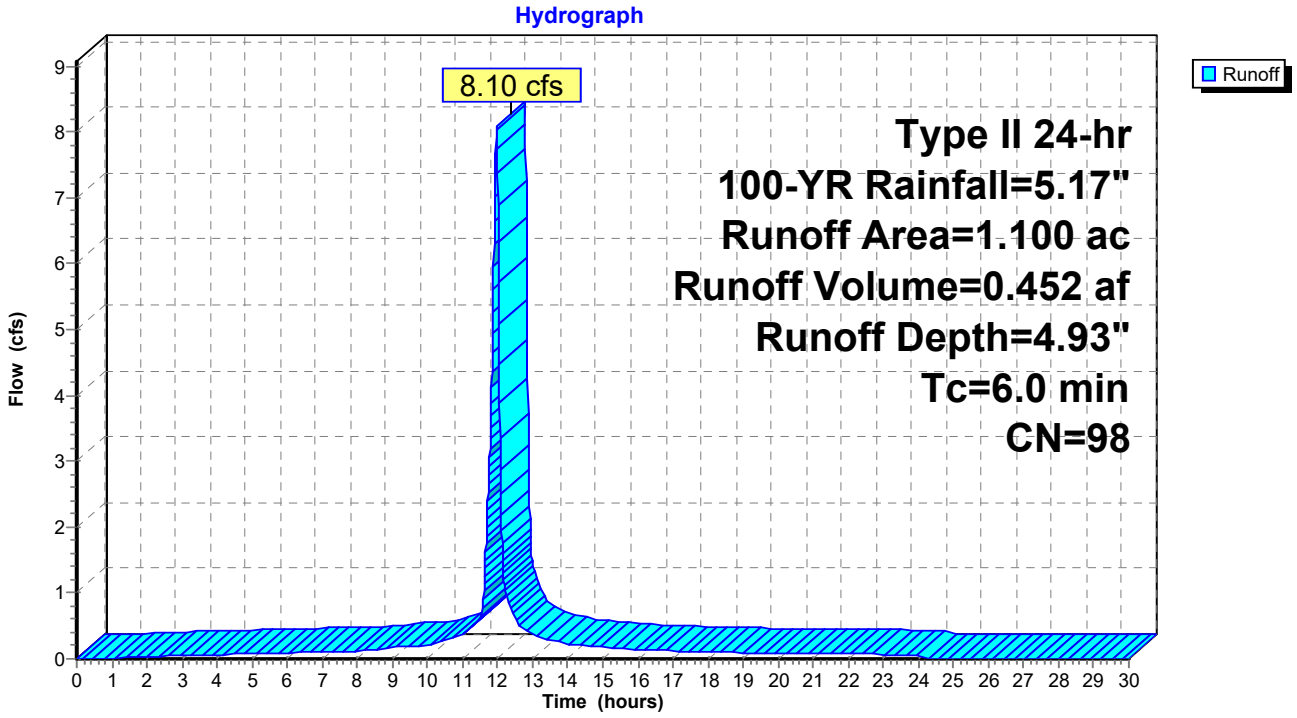
Runoff = 8.10 cfs @ 11.97 hrs, Volume= 0.452 af, Depth= 4.93"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
1.100	98	Paved parking, HSG D
1.100		100.00% Impervious Area

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

Subcatchment 1aS: North Drainage Area - Impervious Area



Summary for Subcatchment 1bS: North Drainage Area - Pervious Area

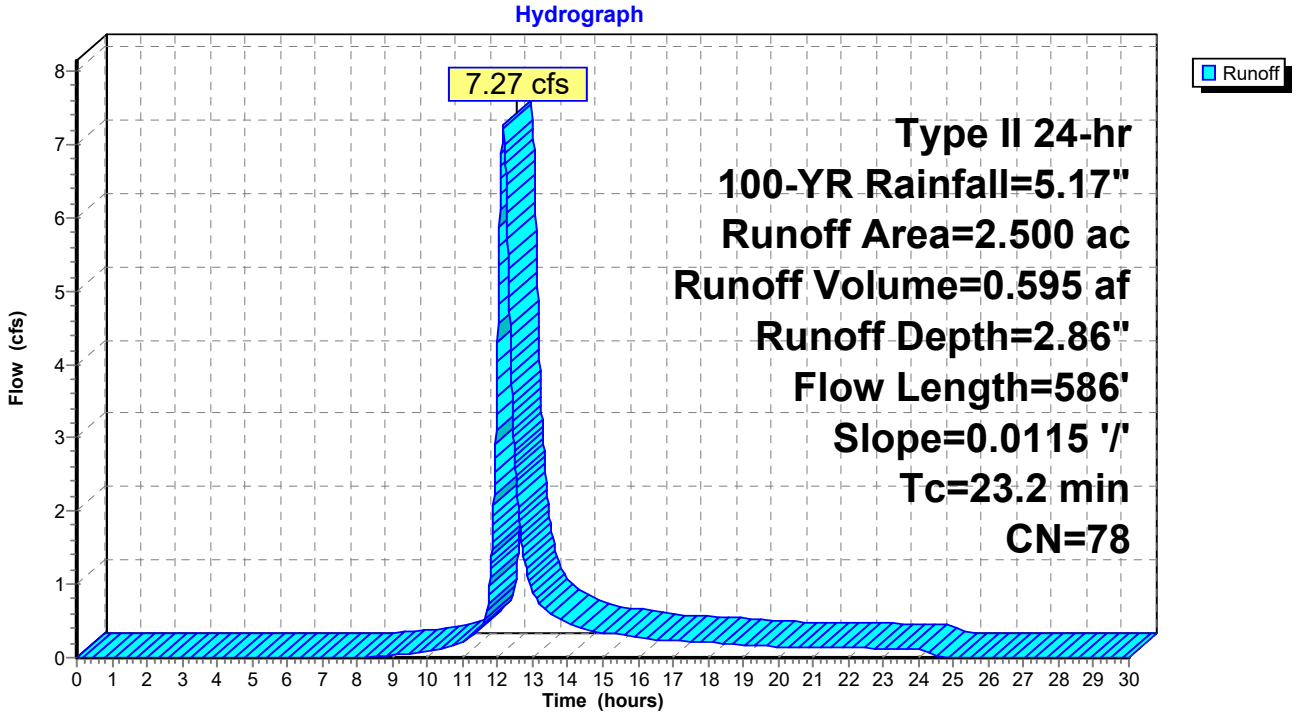
Runoff = 7.27 cfs @ 12.16 hrs, Volume= 0.595 af, Depth= 2.86"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.050	79	Woods/grass comb., Good, HSG D
2.450	78	Meadow, non-grazed, HSG D
2.500	78	Weighted Average
2.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0115	0.13		**Sheet Flow,** Range n= 0.130 P2= 2.29"
10.0	452	0.0115	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0115	2.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
23.2	586	Total			

Subcatchment 1bS: North Drainage Area - Pervious Area



Summary for Subcatchment 2aS: South Drainage Area - Impervious Area

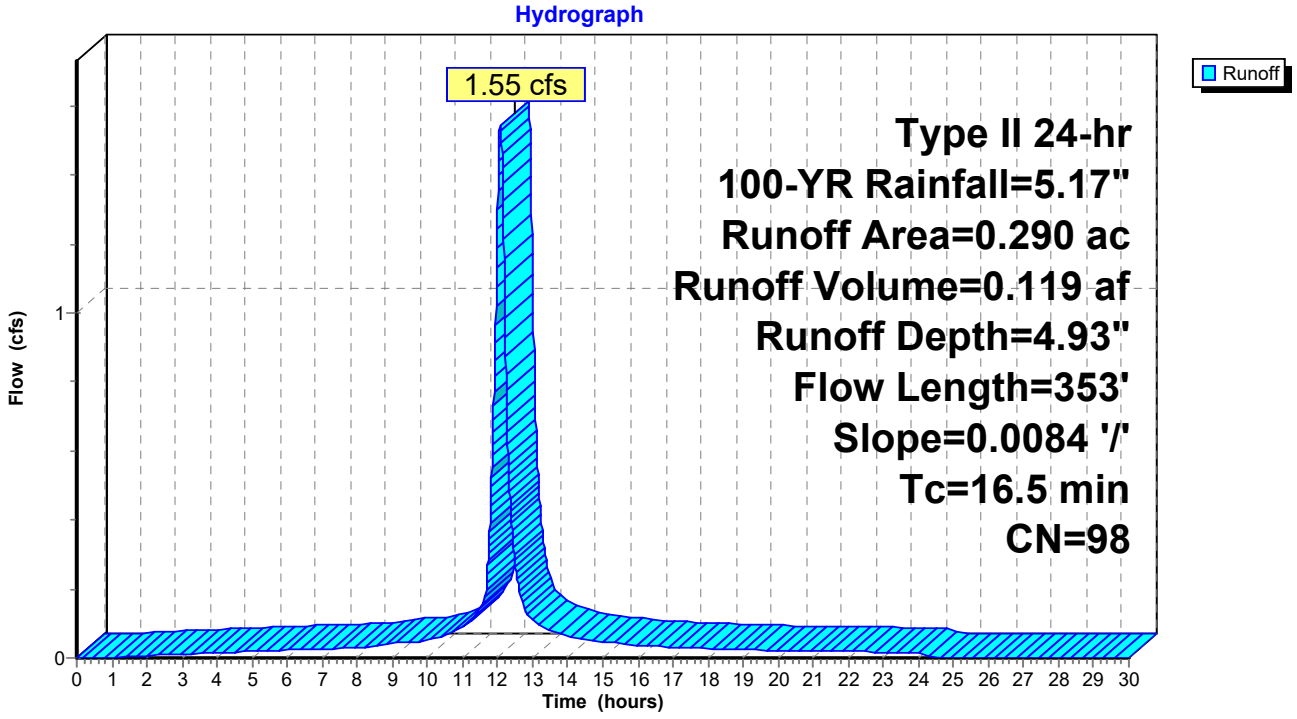
Runoff = 1.55 cfs @ 12.08 hrs, Volume= 0.119 af, Depth= 4.93"
Routed to Pond 2P : Discharge from South Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.290	98	Unconnected pavement, HSG D
0.290		100.00% Impervious Area
0.290		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	30	0.0084	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.29"
11.0	70	0.0084	0.11		**Sheet Flow,** Range n= 0.130 P2= 2.29"
3.8	147	0.0084	0.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	106	0.0084	1.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.5	353	Total			

Subcatchment 2aS: South Drainage Area - Impervious Area



Summary for Subcatchment 2bS: South Drainage Area - Pervious Area

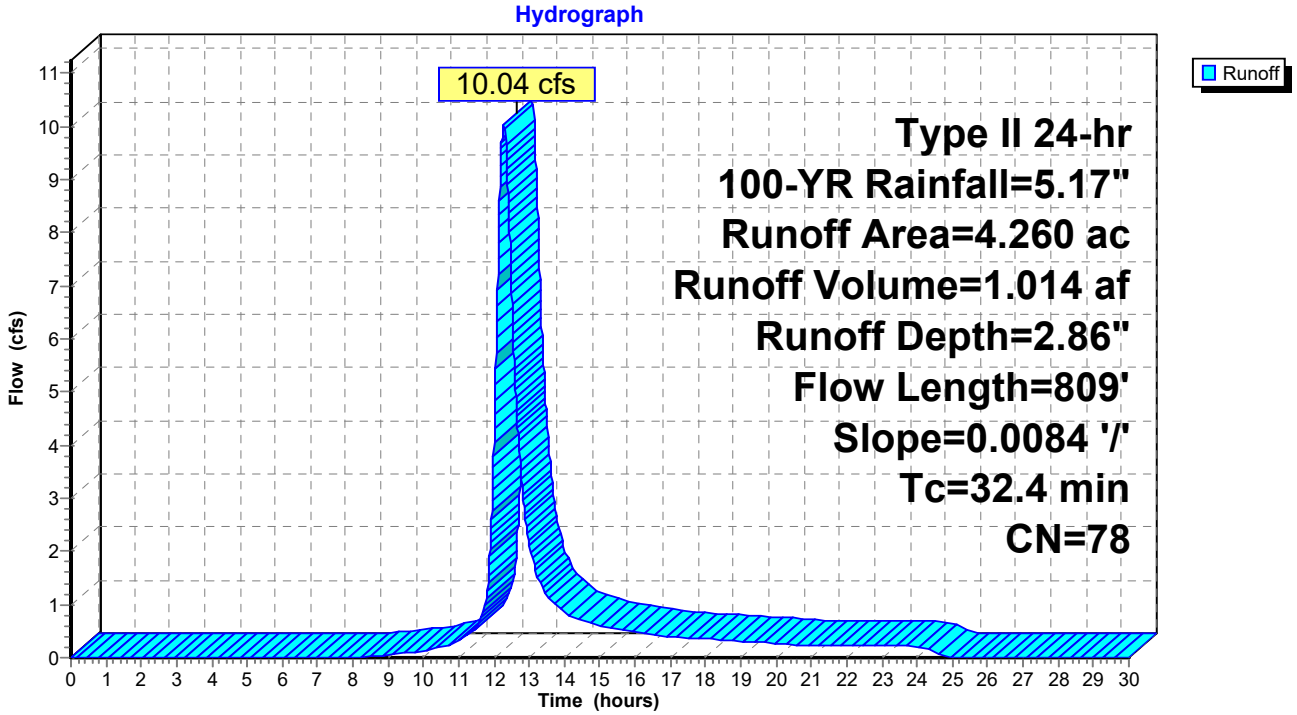
Runoff = 10.04 cfs @ 12.28 hrs, Volume= 1.014 af, Depth= 2.86"
Routed to Pond 2P : Discharge from South Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.330	79	Woods/grass comb., Good, HSG D
3.930	78	Meadow, non-grazed, HSG D
4.260	78	Weighted Average
4.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0084	0.11		**Sheet Flow,** Range n= 0.130 P2= 2.29"
17.4	669	0.0084	0.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0084	1.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
32.4	809	Total			

Subcatchment 2bS: South Drainage Area - Pervious Area



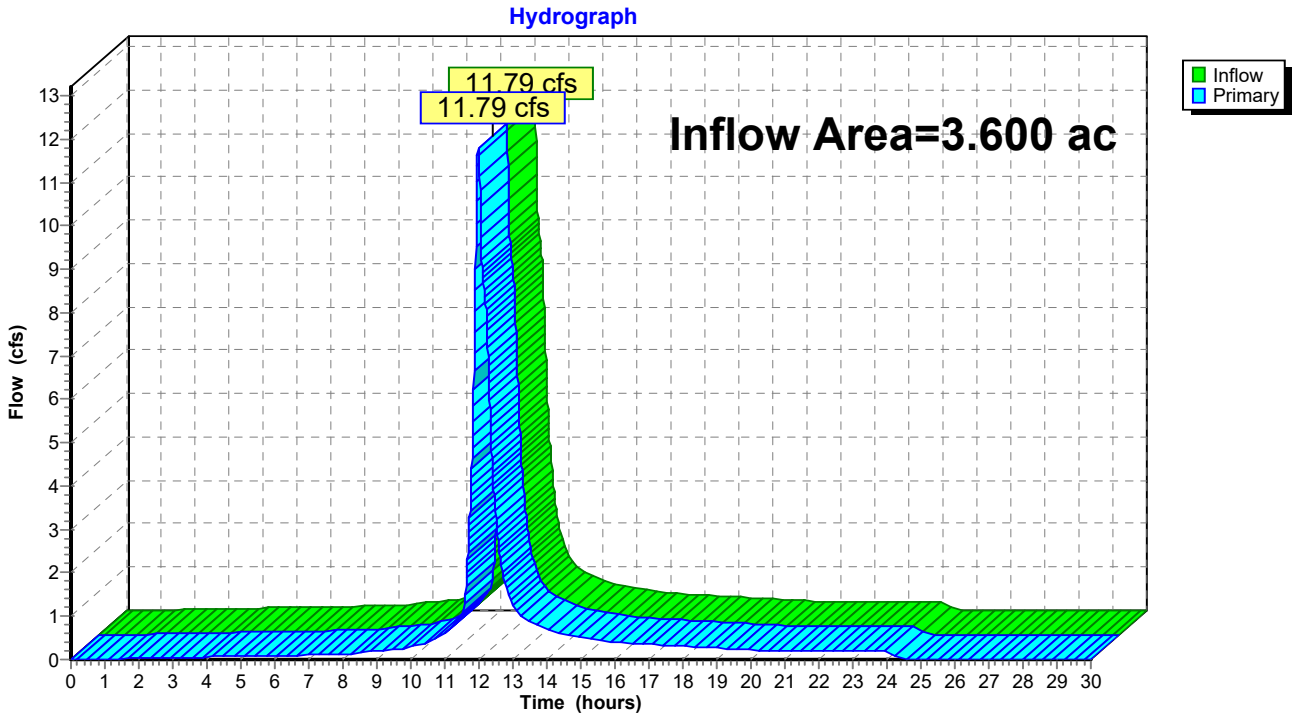
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 3.600 ac, 30.56% Impervious, Inflow Depth = 3.49" for 100-YR event
Inflow = 11.79 cfs @ 11.98 hrs, Volume= 1.047 af
Primary = 11.79 cfs @ 11.98 hrs, Volume= 1.047 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



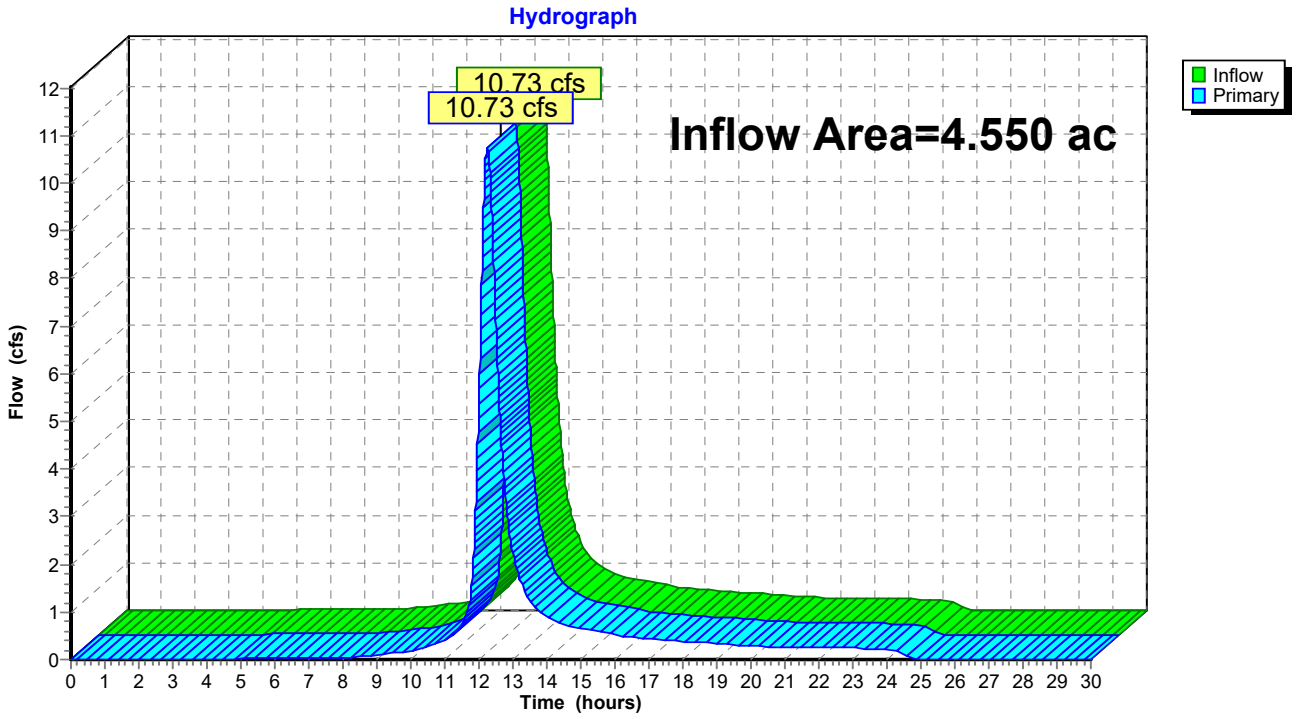
Summary for Pond 2P: Discharge from South Drainage Area

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

Inflow Area = 4.550 ac, 6.37% Impervious, Inflow Depth = 2.99" for 100-YR event
Inflow = 10.73 cfs @ 12.24 hrs, Volume= 1.133 af
Primary = 10.73 cfs @ 12.24 hrs, Volume= 1.133 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 2P: Discharge from South Drainage Area



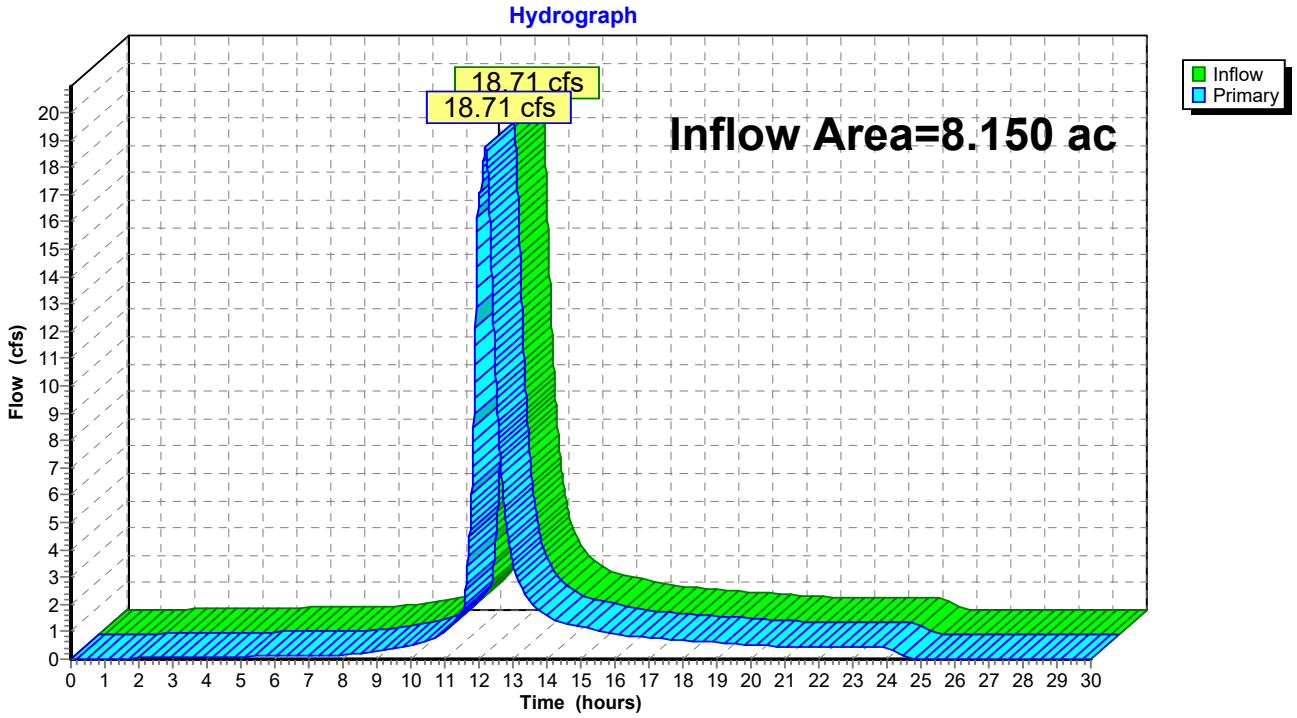
Summary for Pond 3P: Total Site Discharge

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

Inflow Area = 8.150 ac, 17.06% Impervious, Inflow Depth = 3.21" for 100-YR event
Inflow = 18.71 cfs @ 12.20 hrs, Volume= 2.181 af
Primary = 18.71 cfs @ 12.20 hrs, Volume= 2.181 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Total Site Discharge



EXISTING DRAINAGE ANALYSIS MAP

LEGEND

DRAINAGE AREA

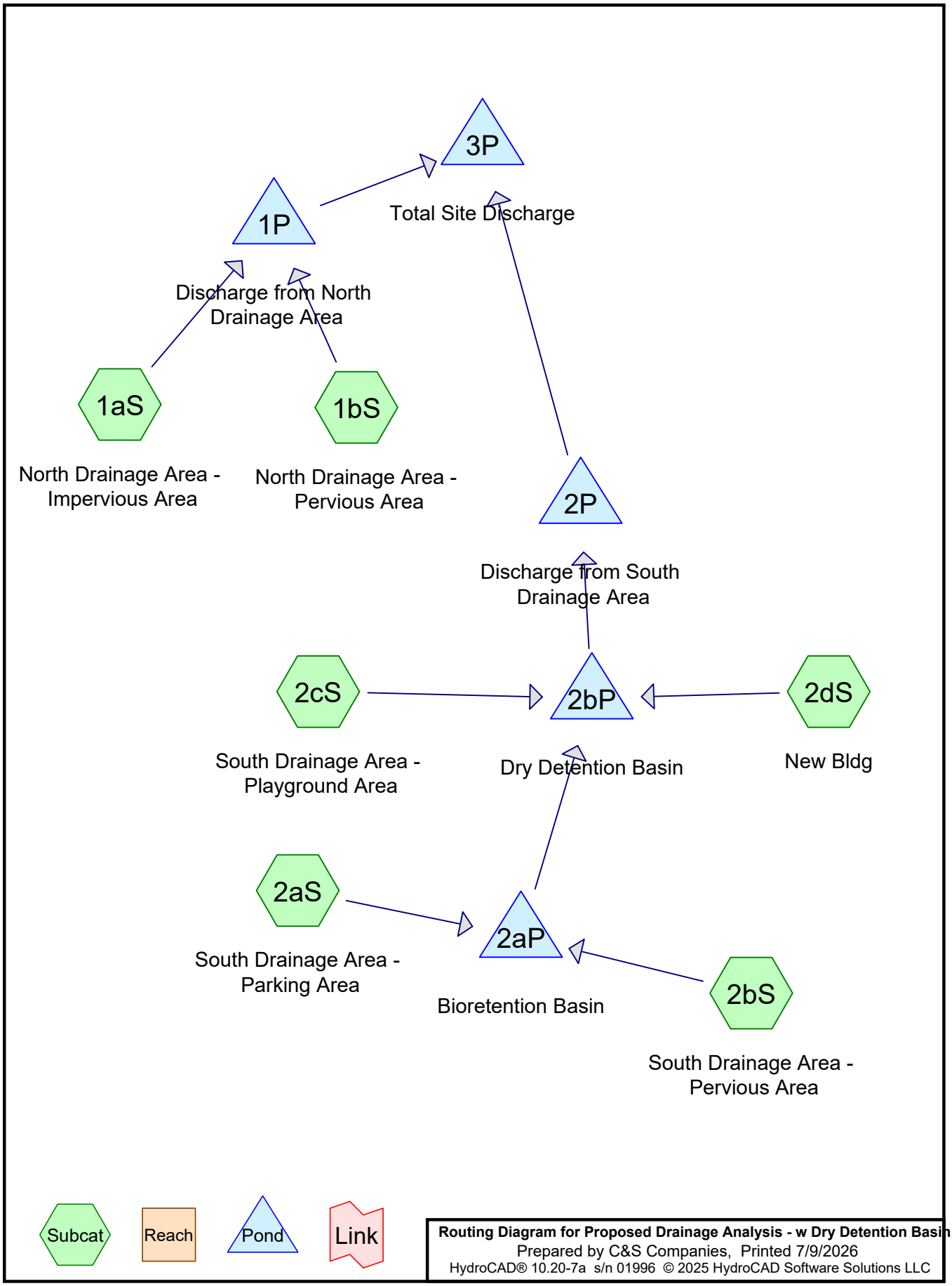
IMPERVIOUS AREA

Tc PATH

PLAN
NORTH

80 0 80 160 Ft.

80'



Routing Diagram for Proposed Drainage Analysis - w Dry Detention Basin
Prepared by C&S Companies, Printed 7/9/2026

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-YR	Type II 24-hr		Default	24.00	1	1.92	2
2	10-YR	Type II 24-hr		Default	24.00	1	3.41	2
3	100-YR	Type II 24-hr		Default	24.00	1	5.17	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1aS: North Drainage Area - Runoff Area=1.317 ac 100.00% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=98 Runoff=3.51 cfs 0.186 af

Subcatchment1bS: North Drainage Area - Runoff Area=2.469 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=586' Slope=0.0115 '/' Tc=23.2 min CN=78 Runoff=0.94 cfs 0.091 af

Subcatchment2aS: South Drainage Area - Runoff Area=0.528 ac 100.00% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=98 Runoff=1.41 cfs 0.075 af

Subcatchment2bS: South Drainage Area - Runoff Area=3.400 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=490' Slope=0.0092 '/' Tc=23.8 min CN=78 Runoff=1.28 cfs 0.125 af

Subcatchment2cS: South Drainage Area - Runoff Area=0.407 ac 82.80% Impervious Runoff Depth=1.41"
Tc=6.0 min CN=95 Runoff=0.97 cfs 0.048 af

Subcatchment2dS: New Bldg Runoff Area=0.047 ac 100.00% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=98 Runoff=0.13 cfs 0.007 af

Pond 1P: Discharge from North Drainage Area Inflow=3.77 cfs 0.277 af
Primary=3.77 cfs 0.277 af

Pond 2aP: Bioretention Basin Peak Elev=603.13' Storage=1,466 cf Inflow=1.77 cfs 0.199 af
Outflow=1.40 cfs 0.199 af

Pond 2bP: Dry Detention Basin Peak Elev=601.29' Storage=3,873 cf Inflow=1.54 cfs 0.254 af
Outflow=0.26 cfs 0.253 af

Pond 2P: Discharge from South Drainage Area Inflow=0.26 cfs 0.253 af
Primary=0.26 cfs 0.253 af

Pond 3P: Total Site Discharge Inflow=3.93 cfs 0.530 af
Primary=3.93 cfs 0.530 af

Total Runoff Area = 8.168 ac Runoff Volume = 0.530 af Average Runoff Depth = 0.78"
72.71% Pervious = 5.939 ac 27.29% Impervious = 2.229 ac

Summary for Subcatchment 1aS: North Drainage Area - Impervious Area

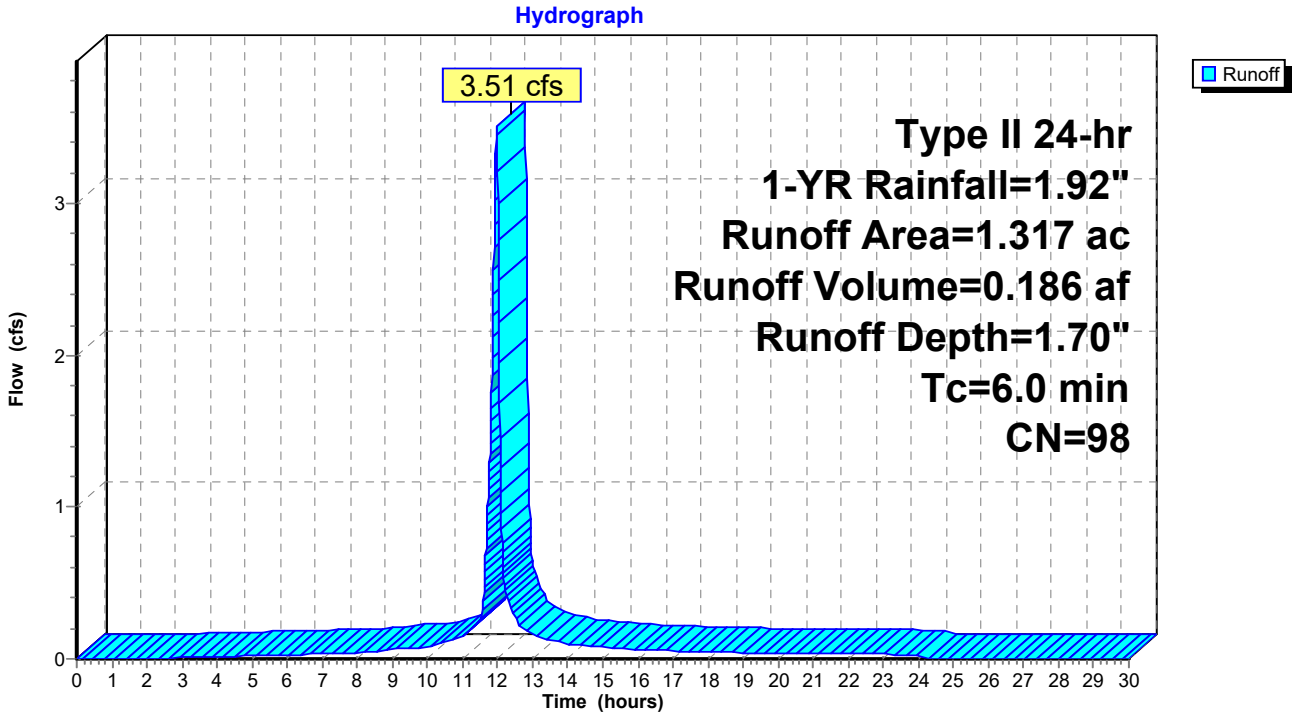
Runoff = 3.51 cfs @ 11.97 hrs, Volume= 0.186 af, Depth= 1.70"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
1.317	98	Paved parking, HSG D
1.317		100.00% Impervious Area

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

Subcatchment 1aS: North Drainage Area - Impervious Area



Summary for Subcatchment 1bS: North Drainage Area - Pervious Area

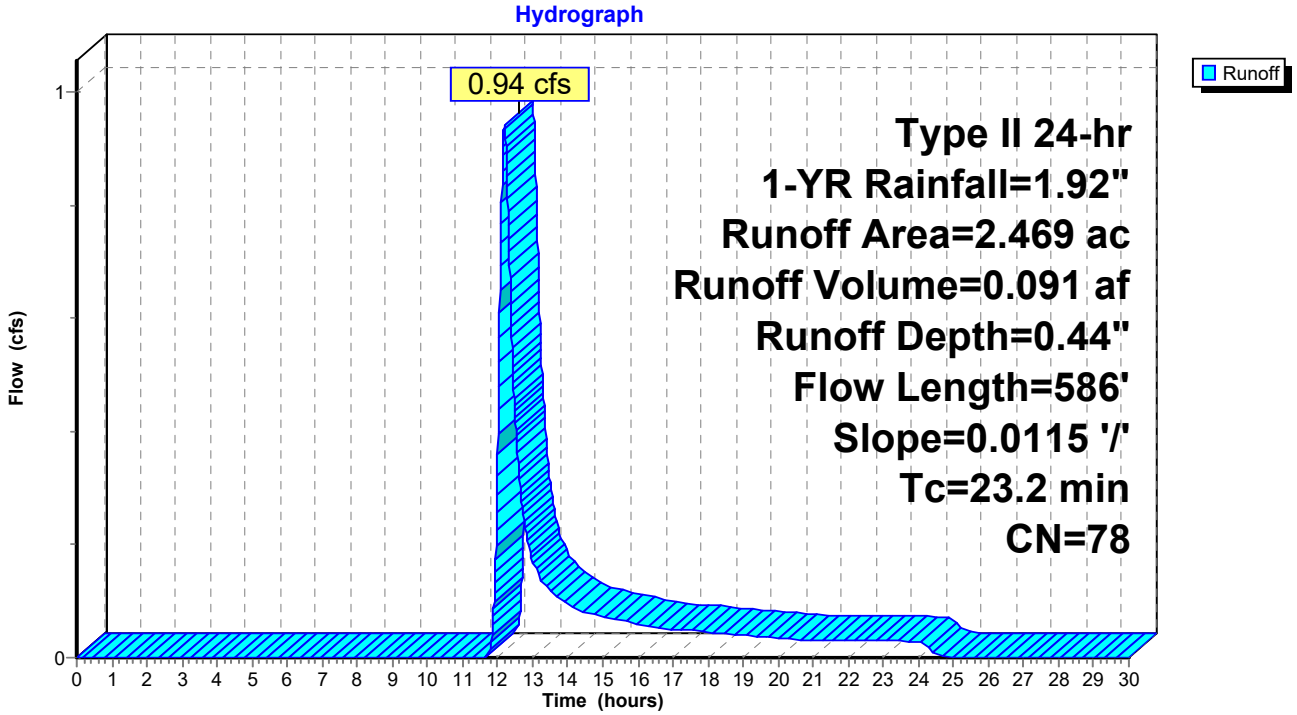
Runoff = 0.94 cfs @ 12.19 hrs, Volume= 0.091 af, Depth= 0.44"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.152	79	Woods/grass comb., Good, HSG D
2.317	78	Meadow, non-grazed, HSG D
2.469	78	Weighted Average
2.469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0115	0.13		**Sheet Flow,** Range n= 0.130 P2= 2.29"
10.0	452	0.0115	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0115	2.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
23.2	586	Total			

Subcatchment 1bS: North Drainage Area - Pervious Area



Summary for Subcatchment 2aS: South Drainage Area - Parking Area

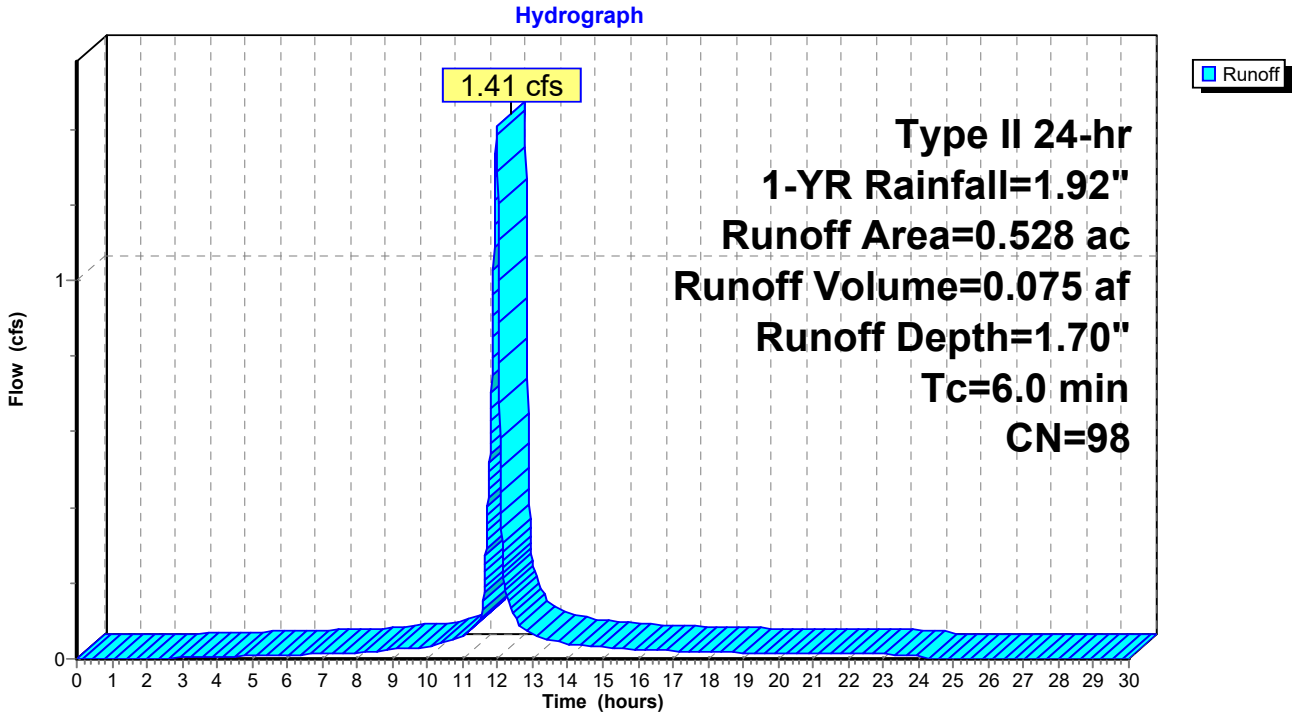
Runoff = 1.41 cfs @ 11.97 hrs, Volume= 0.075 af, Depth= 1.70"
Routed to Pond 2aP : Bioretention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.528	98	Paved parking, HSG D
0.528		100.00% Impervious Area

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

Subcatchment 2aS: South Drainage Area - Parking Area



Summary for Subcatchment 2bS: South Drainage Area - Pervious Area

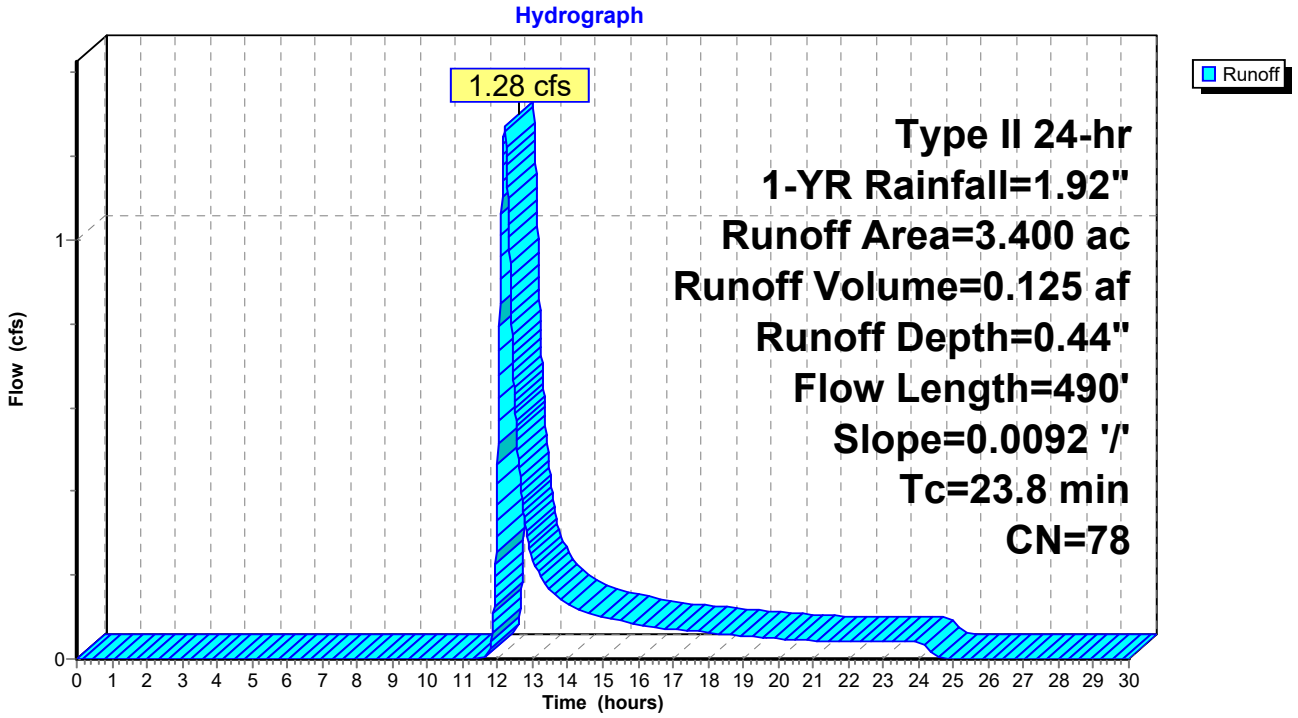
Runoff = 1.28 cfs @ 12.19 hrs, Volume= 0.125 af, Depth= 0.44"
Routed to Pond 2aP : Bioretention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
3.400	78	Meadow, non-grazed, HSG D
3.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0092	0.12		**Sheet Flow,** Range n= 0.130 P2= 2.29"
9.7	390	0.0092	0.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.8	490	Total			

Subcatchment 2bS: South Drainage Area - Pervious Area



Summary for Subcatchment 2cS: South Drainage Area - Playground Area

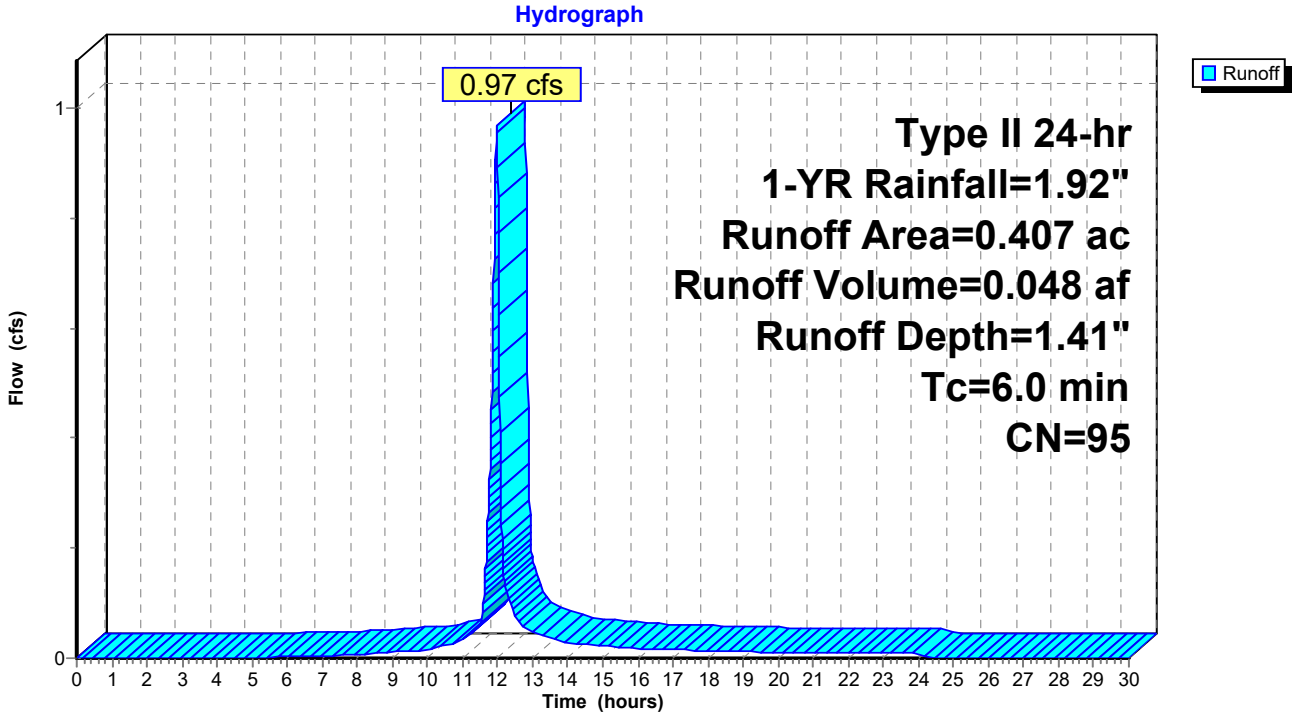
Runoff = 0.97 cfs @ 11.97 hrs, Volume= 0.048 af, Depth= 1.41"
Routed to Pond 2bP : Dry Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.337	98	Roofs, HSG D
0.070	80	>75% Grass cover, Good, HSG D
0.407	95	Weighted Average
0.070		17.20% Pervious Area
0.337		82.80% Impervious Area

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

Subcatchment 2cS: South Drainage Area - Playground Area



Summary for Subcatchment 2dS: New Bldg

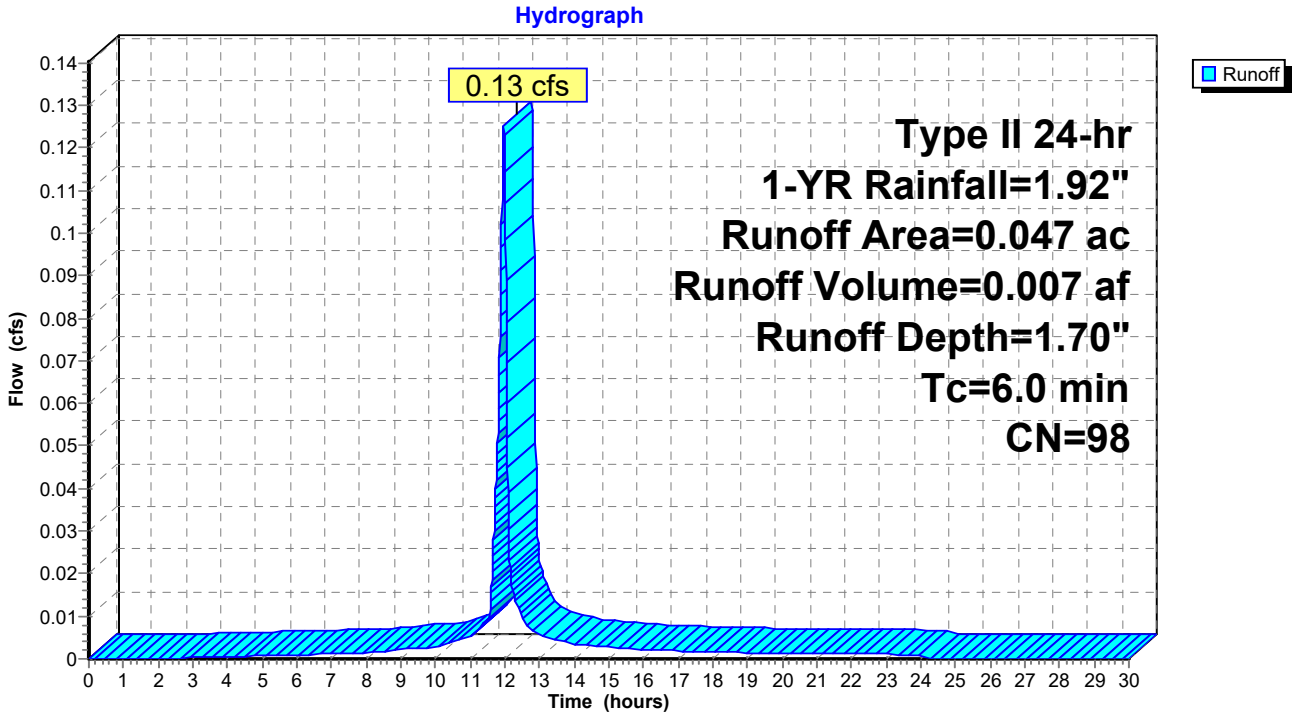
Runoff = 0.13 cfs @ 11.97 hrs, Volume= 0.007 af, Depth= 1.70"
Routed to Pond 2bP : Dry Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.92"

Area (ac)	CN	Description
0.047	98	Roofs, HSG D
0.047		100.00% Impervious Area

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

Subcatchment 2dS: New Bldg



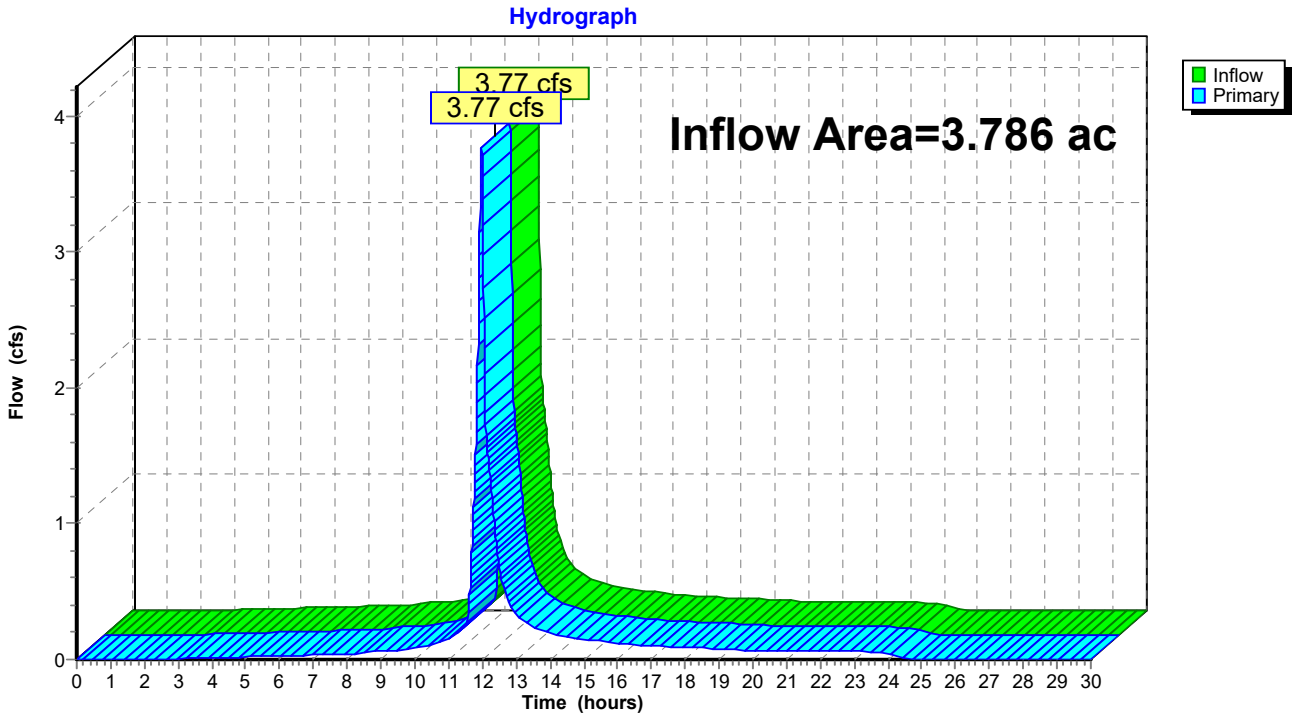
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 3.786 ac, 34.79% Impervious, Inflow Depth = 0.88" for 1-YR event
Inflow = 3.77 cfs @ 11.97 hrs, Volume= 0.277 af
Primary = 3.77 cfs @ 11.97 hrs, Volume= 0.277 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



Summary for Pond 2aP: Bioretention Basin

Inflow Area = 3.928 ac, 13.44% Impervious, Inflow Depth = 0.61" for 1-YR event
Inflow = 1.77 cfs @ 11.99 hrs, Volume= 0.199 af
Outflow = 1.40 cfs @ 12.25 hrs, Volume= 0.199 af, Atten= 21%, Lag= 15.5 min
Primary = 1.40 cfs @ 12.25 hrs, Volume= 0.199 af
Routed to Pond 2bP : Dry Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 603.13' @ 12.25 hrs Surf.Area= 3,662 sf Storage= 1,466 cf

Plug-Flow detention time= 64.4 min calculated for 0.199 af (100% of inflow)
Center-of-Mass det. time= 64.4 min (911.8 - 847.3)

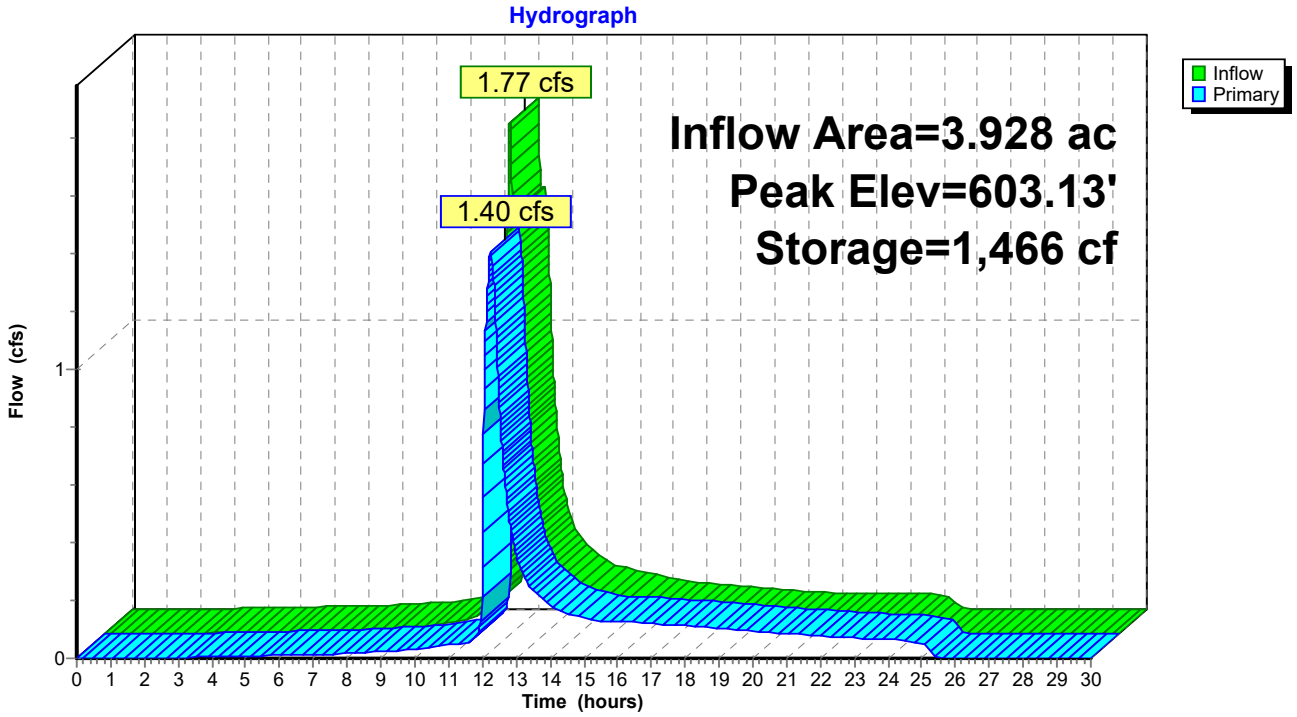
Volume	Invert	Avail.Storage	Storage Description
#1	602.50'	6,205 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
602.50	1,050	230.0	0	0	1,050
603.00	3,200	432.0	1,014	1,014	11,693
604.00	7,480	724.0	5,191	6,205	38,560

Device	Routing	Invert	Outlet Devices
#1	Primary	600.00'	**18.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 600.00' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	600.00'	**8.0" Round Underdrain Pipe** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 600.00' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	602.50'	**1.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 500.00'
#4	Device 1	603.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.40 cfs @ 12.25 hrs HW=603.13' (Free Discharge)
- **1=Culvert** (Passes 1.40 cfs of 10.37 cfs potential flow)
  - **2=Underdrain Pipe** (Passes 0.15 cfs of 1.63 cfs potential flow)
    - **3=Exfiltration** (Controls 0.15 cfs)
  - **4=Orifice/Grate** (Weir Controls 1.25 cfs @ 1.19 fps)

Pond 2aP: Bioretention Basin



Summary for Pond 2bP: Dry Detention Basin

[79] Warning: Submerged Pond 2aP Primary device # 1 by 1.29'

Inflow Area = 4.382 ac, 20.81% Impervious, Inflow Depth = 0.69" for 1-YR event
Inflow = 1.54 cfs @ 12.24 hrs, Volume= 0.254 af
Outflow = 0.26 cfs @ 13.66 hrs, Volume= 0.253 af, Atten= 83%, Lag= 85.3 min
Primary = 0.26 cfs @ 13.66 hrs, Volume= 0.253 af
Routed to Pond 2P : Discharge from South Drainage Area

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 601.29' @ 13.66 hrs Surf.Area= 5,852 sf Storage= 3,873 cf

Plug-Flow detention time= 165.3 min calculated for 0.253 af (100% of inflow)
Center-of-Mass det. time= 164.0 min (1,049.9 - 885.9)

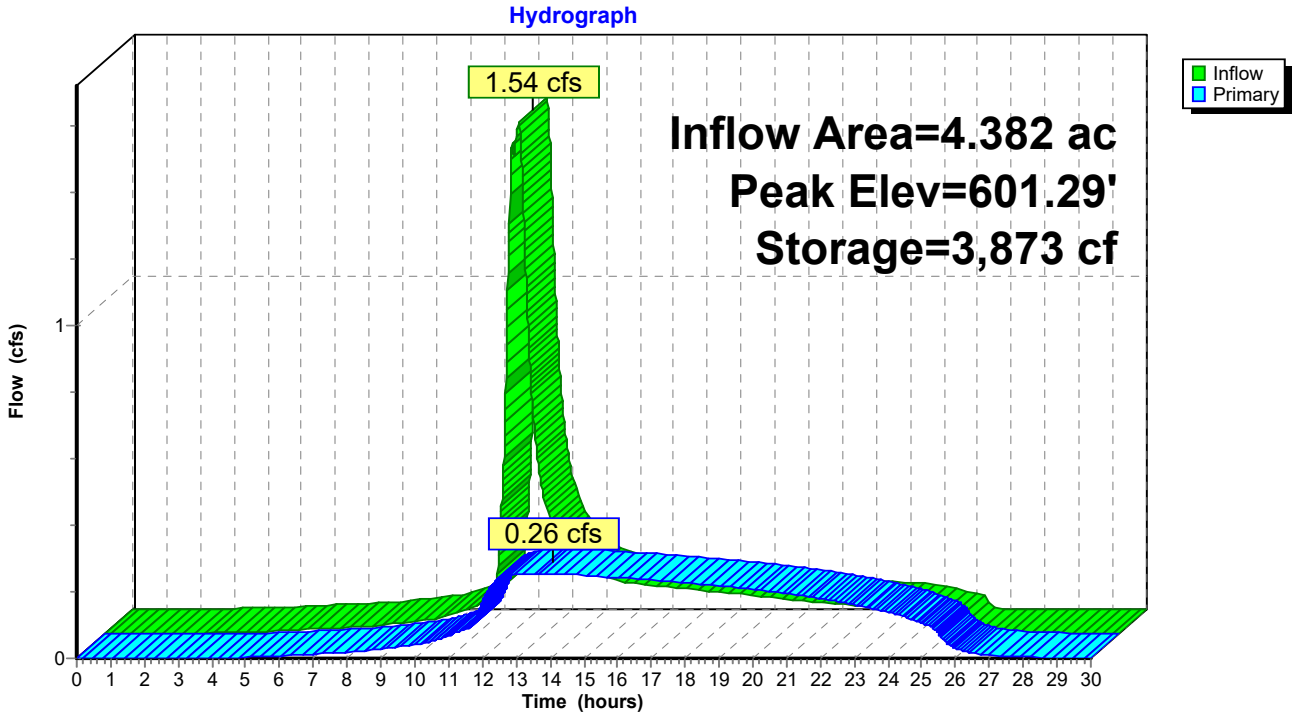
Volume	Invert	Avail.Storage	Storage Description
#1	600.00'	1,568 cf	**5.00'W x 302.00'L x 4.00'H Stone Encasement** 6,040 cf Overall - 2,121 cf Embedded = 3,919 cf x 40.0% Voids
#2	600.00'	2,121 cf	**36.0" Round 36" Pipe** Inside #1 L= 300.0'
#3	600.00'	26,477 cf	**Dry Detention Basin (Irregular)** Listed below (Recalc)
		30,165 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
600.00	0	0.0	0	0	0
601.00	4,041	349.0	1,347	1,347	9,694
602.00	5,117	368.0	4,568	5,915	10,836
603.00	6,249	387.0	5,674	11,589	12,038
604.00	7,438	405.0	6,835	18,424	13,240
605.00	8,684	424.0	8,053	26,477	14,560

Device	Routing	Invert	Outlet Devices
#1	Primary	600.00'	**10.0" Round Culvert** L= 133.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 599.88' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Device 1	600.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	601.30'	**10.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.26 cfs @ 13.66 hrs HW=601.29' (Free Discharge)
└**1=Culvert** (Passes 0.26 cfs of 1.24 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 0.26 cfs @ 5.20 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 2bP: Dry Detention Basin



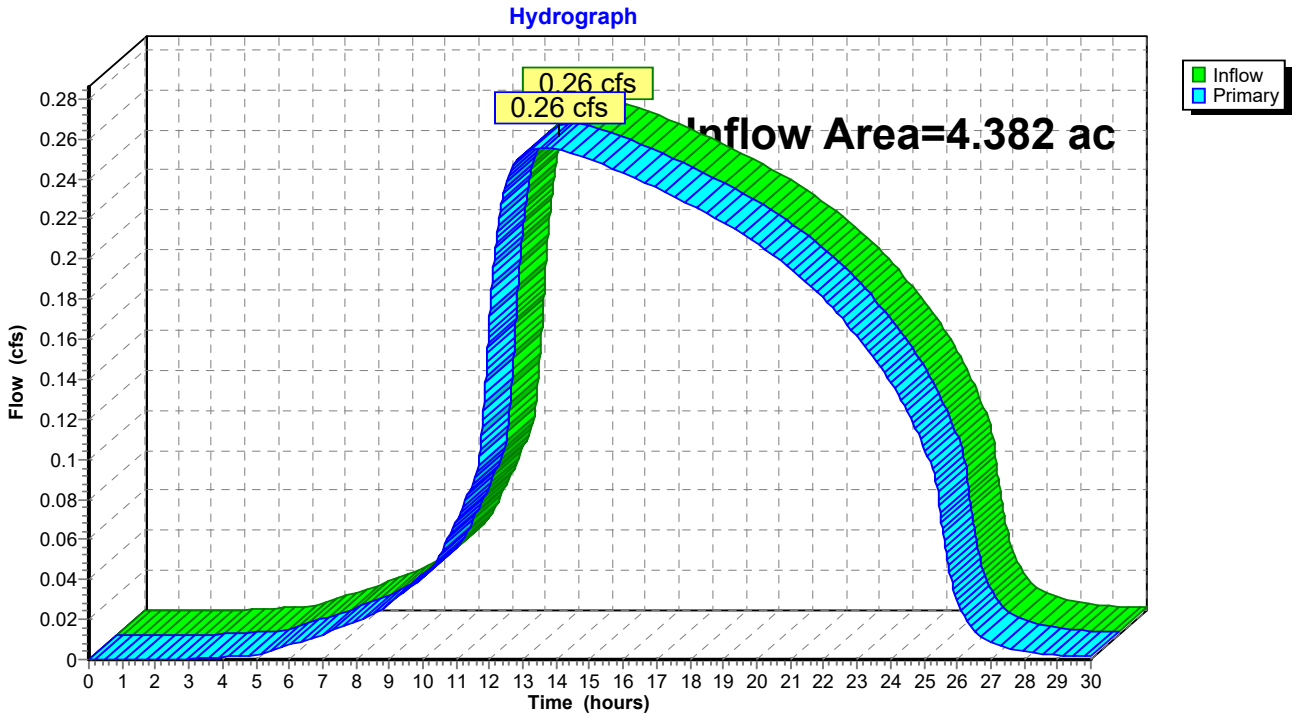
Summary for Pond 2P: Discharge from South Drainage Area

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

Inflow Area = 4.382 ac, 20.81% Impervious, Inflow Depth > 0.69" for 1-YR event
Inflow = 0.26 cfs @ 13.66 hrs, Volume= 0.253 af
Primary = 0.26 cfs @ 13.66 hrs, Volume= 0.253 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 2P: Discharge from South Drainage Area



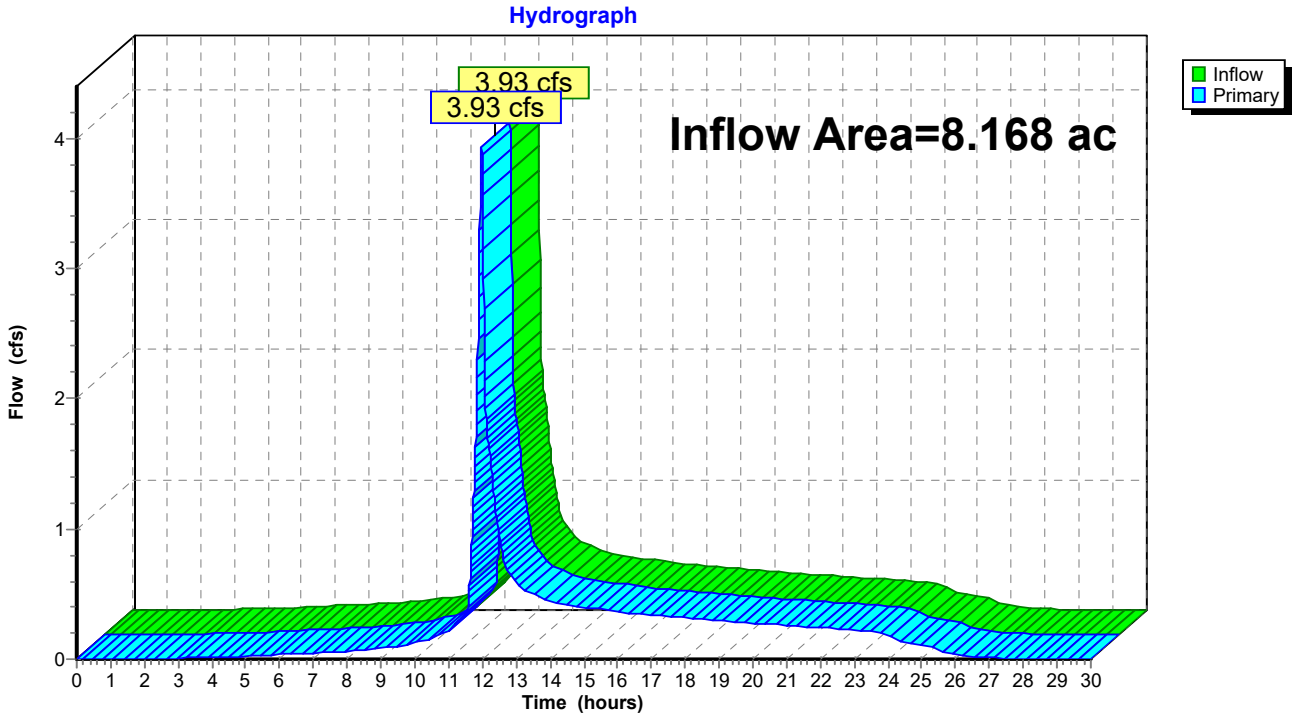
Summary for Pond 3P: Total Site Discharge

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

Inflow Area = 8.168 ac, 27.29% Impervious, Inflow Depth > 0.78" for 1-YR event
Inflow = 3.93 cfs @ 11.97 hrs, Volume= 0.530 af
Primary = 3.93 cfs @ 11.97 hrs, Volume= 0.530 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Total Site Discharge



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1aS: North Drainage Area - Runoff Area=1.317 ac 100.00% Impervious Runoff Depth=3.18"
Tc=6.0 min CN=98 Runoff=6.36 cfs 0.349 af

Subcatchment1bS: North Drainage Area - Runoff Area=2.469 ac 0.00% Impervious Runoff Depth=1.43"
Flow Length=586' Slope=0.0115 '/' Tc=23.2 min CN=78 Runoff=3.53 cfs 0.294 af

Subcatchment2aS: South Drainage Area - Runoff Area=0.528 ac 100.00% Impervious Runoff Depth=3.18"
Tc=6.0 min CN=98 Runoff=2.55 cfs 0.140 af

Subcatchment2bS: South Drainage Area - Runoff Area=3.400 ac 0.00% Impervious Runoff Depth=1.43"
Flow Length=490' Slope=0.0092 '/' Tc=23.8 min CN=78 Runoff=4.79 cfs 0.405 af

Subcatchment2cS: South Drainage Area - Runoff Area=0.407 ac 82.80% Impervious Runoff Depth=2.85"
Tc=6.0 min CN=95 Runoff=1.88 cfs 0.097 af

Subcatchment2dS: New Bldg Runoff Area=0.047 ac 100.00% Impervious Runoff Depth=3.18"
Tc=6.0 min CN=98 Runoff=0.23 cfs 0.012 af

Pond 1P: Discharge from North Drainage Area Inflow=7.93 cfs 0.643 af
Primary=7.93 cfs 0.643 af

Pond 2aP: Bioretention Basin Peak Elev=603.33' Storage=2,249 cf Inflow=5.17 cfs 0.545 af
Outflow=5.06 cfs 0.545 af

Pond 2bP: Dry Detention Basin Peak Elev=602.21' Storage=9,369 cf Inflow=5.91 cfs 0.654 af
Outflow=1.99 cfs 0.652 af

Pond 2P: Discharge from South Drainage Area Inflow=1.99 cfs 0.652 af
Primary=1.99 cfs 0.652 af

Pond 3P: Total Site Discharge Inflow=8.17 cfs 1.295 af
Primary=8.17 cfs 1.295 af

Total Runoff Area = 8.168 ac Runoff Volume = 1.297 af Average Runoff Depth = 1.90"
72.71% Pervious = 5.939 ac 27.29% Impervious = 2.229 ac

Summary for Subcatchment 1aS: North Drainage Area - Impervious Area

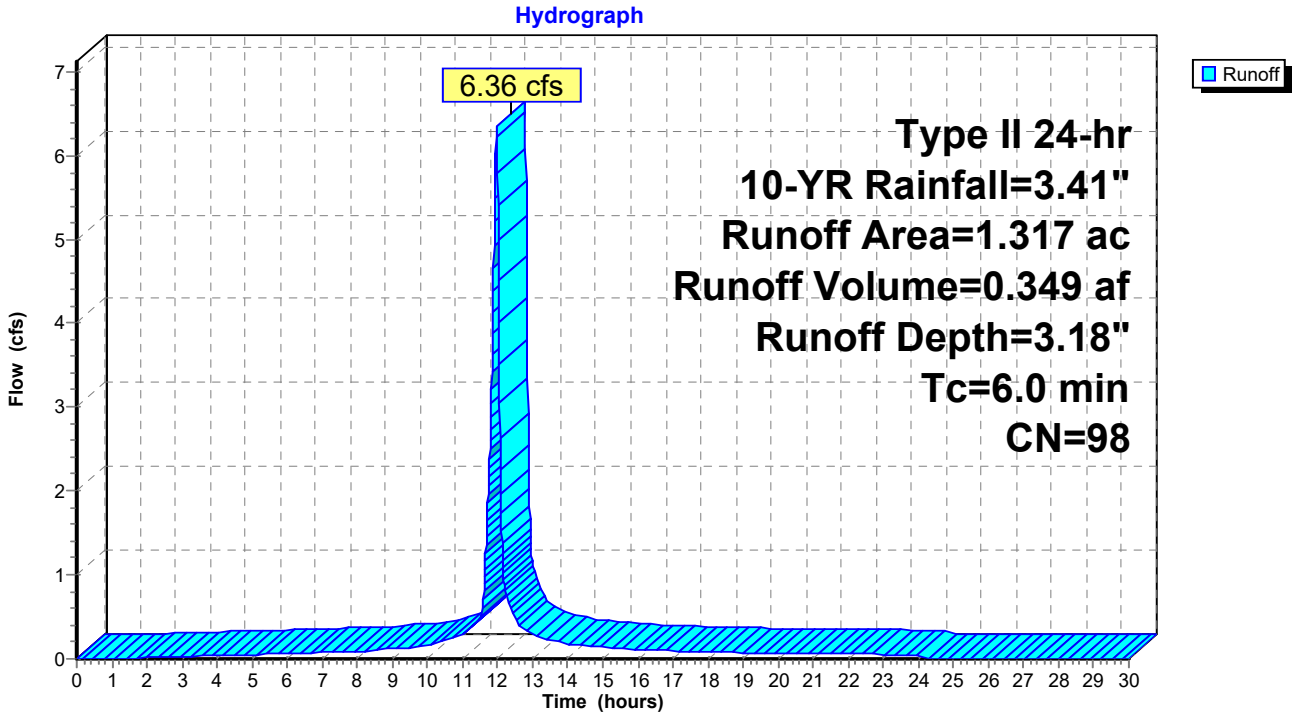
Runoff = 6.36 cfs @ 11.97 hrs, Volume= 0.349 af, Depth= 3.18"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
1.317	98	Paved parking, HSG D
1.317		100.00% Impervious Area

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

Subcatchment 1aS: North Drainage Area - Impervious Area



Summary for Subcatchment 1bS: North Drainage Area - Pervious Area

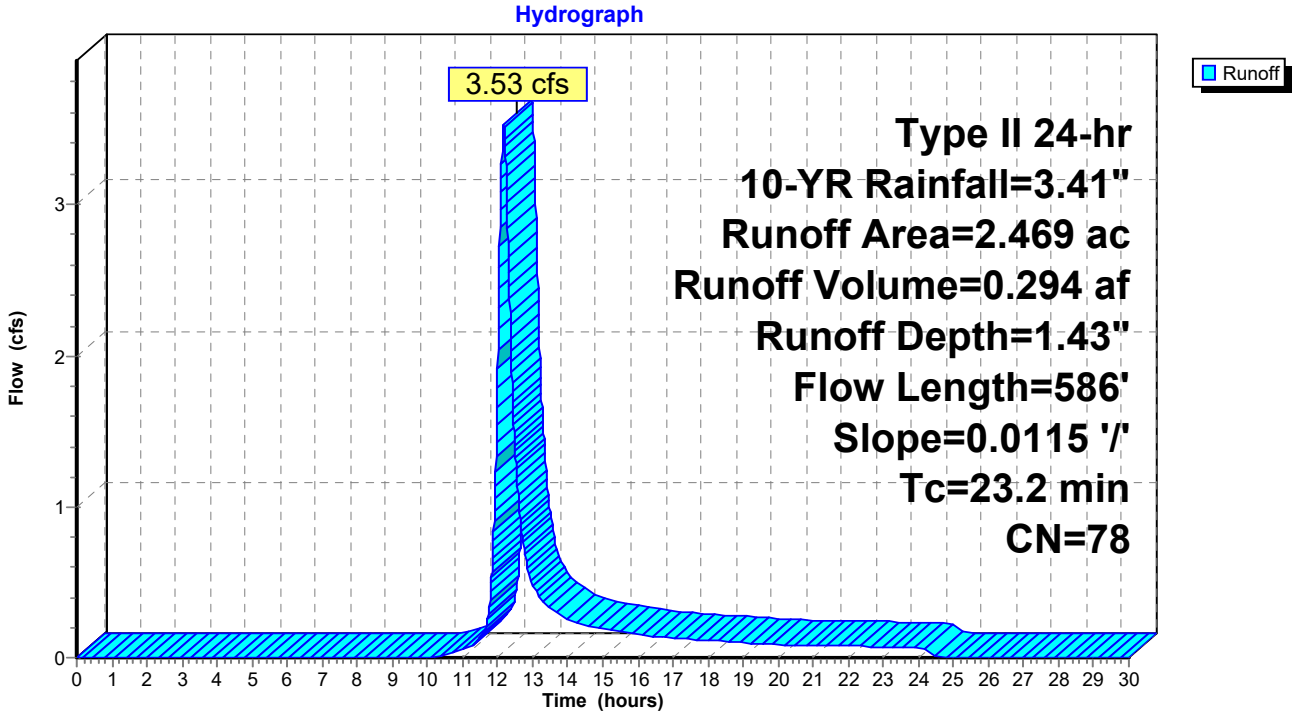
Runoff = 3.53 cfs @ 12.17 hrs, Volume= 0.294 af, Depth= 1.43"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.152	79	Woods/grass comb., Good, HSG D
2.317	78	Meadow, non-grazed, HSG D
2.469	78	Weighted Average
2.469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0115	0.13		**Sheet Flow,** Range n= 0.130 P2= 2.29"
10.0	452	0.0115	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0115	2.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
23.2	586	Total			

Subcatchment 1bS: North Drainage Area - Pervious Area



Summary for Subcatchment 2aS: South Drainage Area - Parking Area

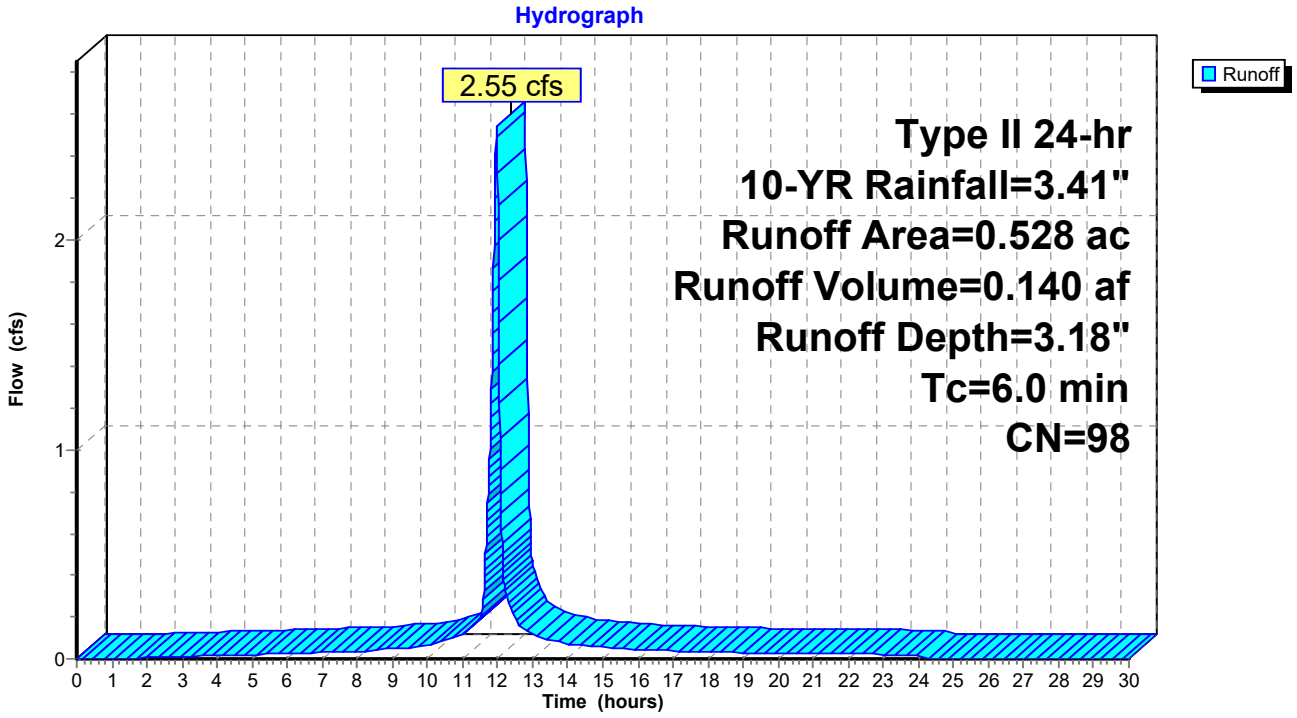
Runoff = 2.55 cfs @ 11.97 hrs, Volume= 0.140 af, Depth= 3.18"
Routed to Pond 2aP : Bioretention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.528	98	Paved parking, HSG D
0.528		100.00% Impervious Area

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

Subcatchment 2aS: South Drainage Area - Parking Area



Summary for Subcatchment 2bS: South Drainage Area - Pervious Area

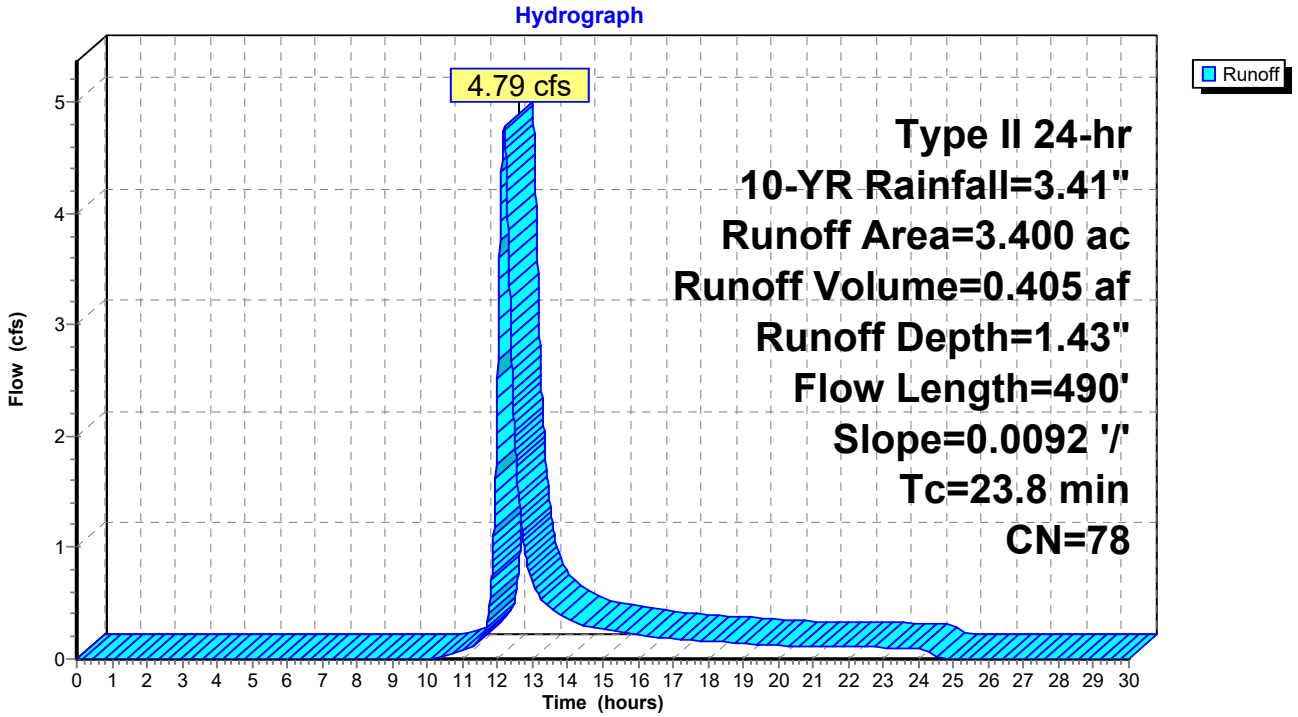
Runoff = 4.79 cfs @ 12.19 hrs, Volume= 0.405 af, Depth= 1.43"
Routed to Pond 2aP : Bioretention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
3.400	78	Meadow, non-grazed, HSG D
3.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0092	0.12		**Sheet Flow,** Range n= 0.130 P2= 2.29"
9.7	390	0.0092	0.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.8	490	Total			

Subcatchment 2bS: South Drainage Area - Pervious Area



Summary for Subcatchment 2cS: South Drainage Area - Playground Area

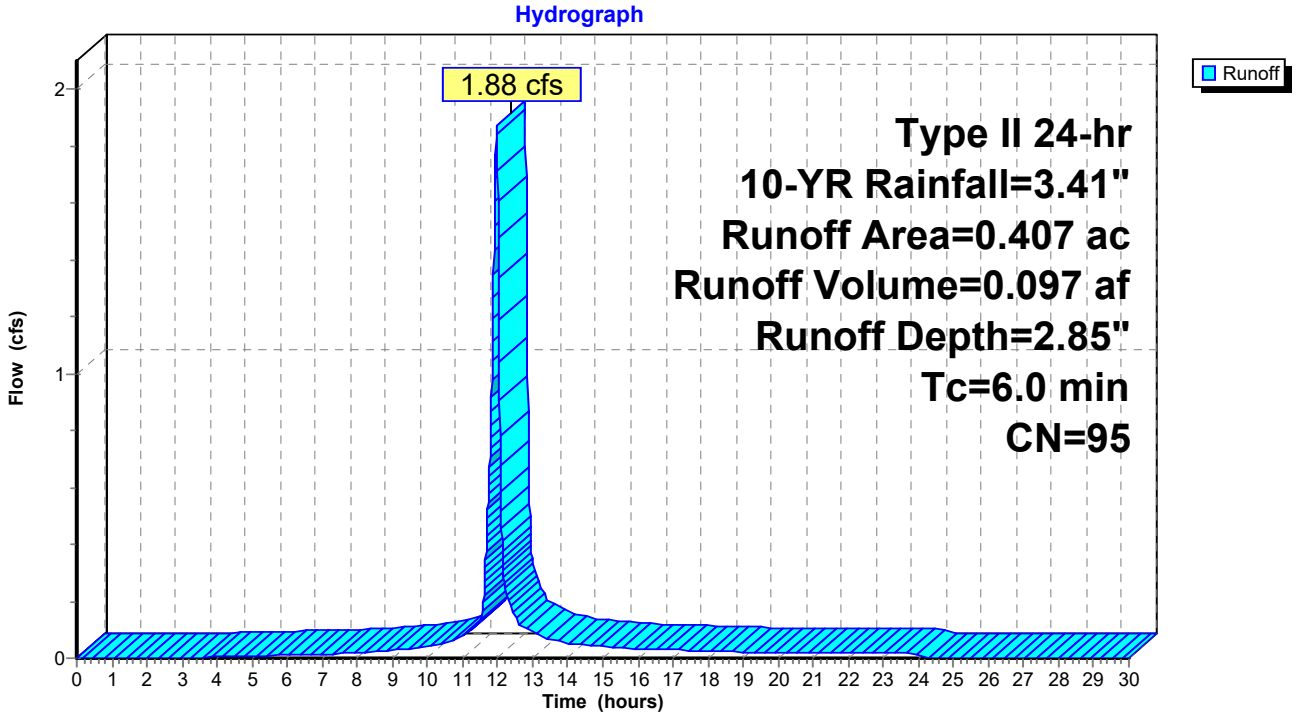
Runoff = 1.88 cfs @ 11.97 hrs, Volume= 0.097 af, Depth= 2.85"
Routed to Pond 2bP : Dry Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.337	98	Roofs, HSG D
0.070	80	>75% Grass cover, Good, HSG D
0.407	95	Weighted Average
0.070		17.20% Pervious Area
0.337		82.80% Impervious Area

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

Subcatchment 2cS: South Drainage Area - Playground Area



Summary for Subcatchment 2dS: New Bldg

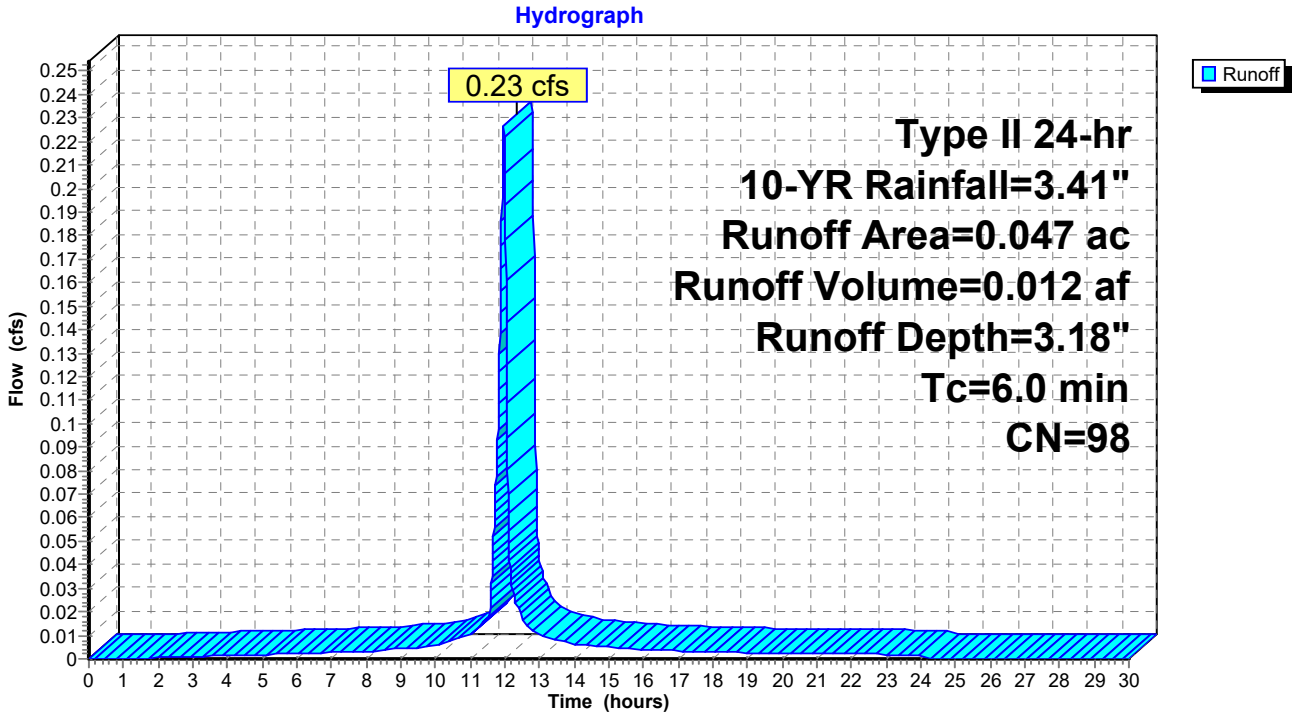
Runoff = 0.23 cfs @ 11.97 hrs, Volume= 0.012 af, Depth= 3.18"
Routed to Pond 2bP : Dry Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.41"

Area (ac)	CN	Description
0.047	98	Roofs, HSG D
0.047		100.00% Impervious Area

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

Subcatchment 2dS: New Bldg



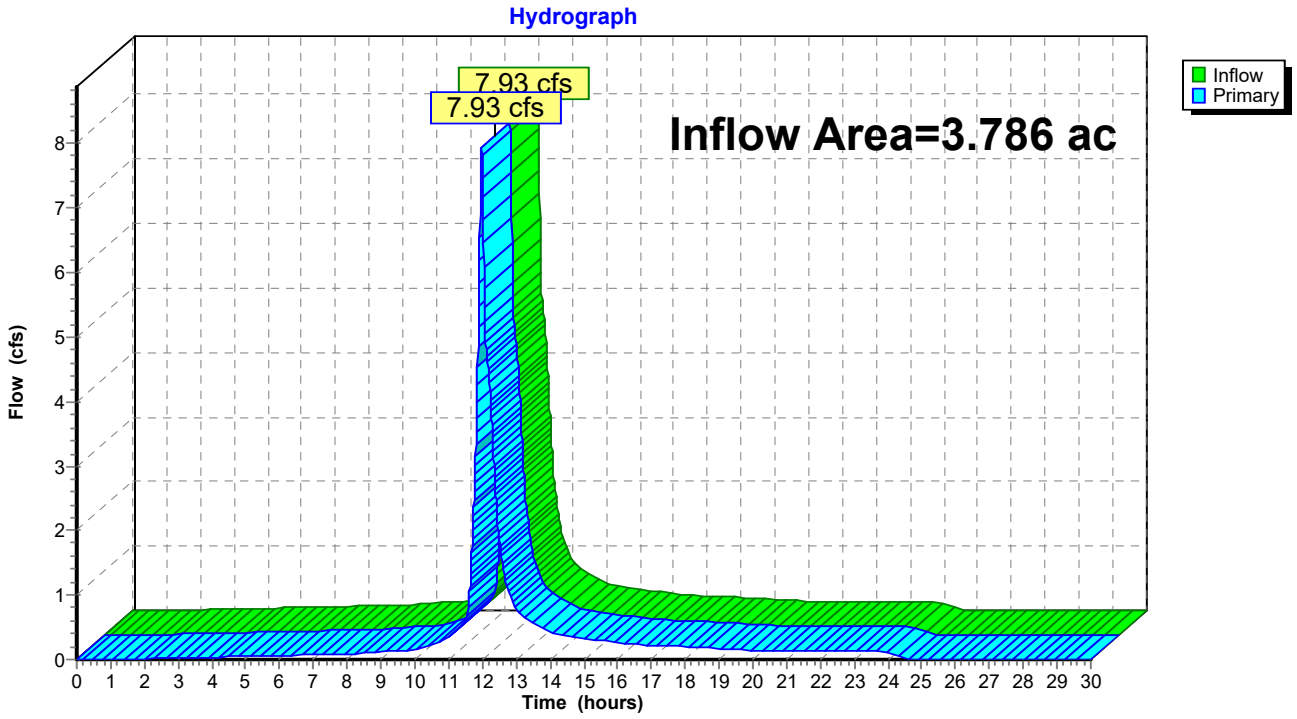
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 3.786 ac, 34.79% Impervious, Inflow Depth = 2.04" for 10-YR event
Inflow = 7.93 cfs @ 11.98 hrs, Volume= 0.643 af
Primary = 7.93 cfs @ 11.98 hrs, Volume= 0.643 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



Summary for Pond 2aP: Bioretention Basin

Inflow Area = 3.928 ac, 13.44% Impervious, Inflow Depth = 1.66" for 10-YR event
Inflow = 5.17 cfs @ 12.17 hrs, Volume= 0.545 af
Outflow = 5.06 cfs @ 12.21 hrs, Volume= 0.545 af, Atten= 2%, Lag= 2.3 min
Primary = 5.06 cfs @ 12.21 hrs, Volume= 0.545 af
Routed to Pond 2bP : Dry Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 603.33' @ 12.21 hrs Surf.Area= 4,400 sf Storage= 2,249 cf

Plug-Flow detention time= 41.1 min calculated for 0.545 af (100% of inflow)
Center-of-Mass det. time= 41.1 min (872.4 - 831.3)

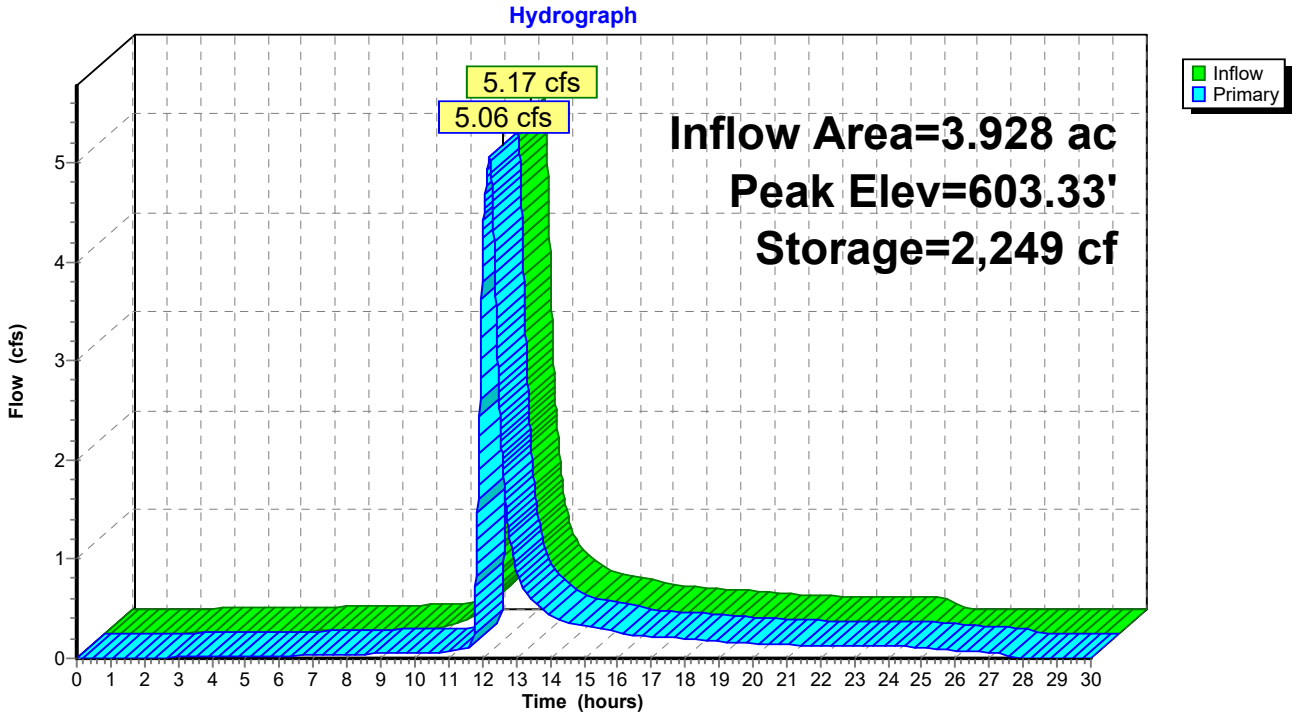
Volume	Invert	Avail.Storage	Storage Description
#1	602.50'	6,205 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
602.50	1,050	230.0	0	0	1,050
603.00	3,200	432.0	1,014	1,014	11,693
604.00	7,480	724.0	5,191	6,205	38,560

Device	Routing	Invert	Outlet Devices
#1	Primary	600.00'	**18.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 600.00' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	600.00'	**8.0" Round Underdrain Pipe** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 600.00' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	602.50'	**1.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 500.00'
#4	Device 1	603.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.06 cfs @ 12.21 hrs HW=603.33' (Free Discharge)
- **1=Culvert** (Passes 5.06 cfs of 10.78 cfs potential flow)
  - **2=Underdrain Pipe** (Passes 0.18 cfs of 1.69 cfs potential flow)
    - **3=Exfiltration** (Controls 0.18 cfs)
  - **4=Orifice/Grate** (Weir Controls 4.88 cfs @ 1.87 fps)

Pond 2aP: Bioretention Basin



Summary for Pond 2bP: Dry Detention Basin

[79] Warning: Submerged Pond 2aP Primary device # 1 by 2.21'

Inflow Area = 4.382 ac, 20.81% Impervious, Inflow Depth = 1.79" for 10-YR event
Inflow = 5.91 cfs @ 12.01 hrs, Volume= 0.654 af
Outflow = 1.99 cfs @ 12.62 hrs, Volume= 0.652 af, Atten= 66%, Lag= 36.6 min
Primary = 1.99 cfs @ 12.62 hrs, Volume= 0.652 af
Routed to Pond 2P : Discharge from South Drainage Area

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 602.21' @ 12.62 hrs Surf.Area= 6,858 sf Storage= 9,369 cf

Plug-Flow detention time= 124.9 min calculated for 0.652 af (100% of inflow)
Center-of-Mass det. time= 122.6 min (978.4 - 855.8)

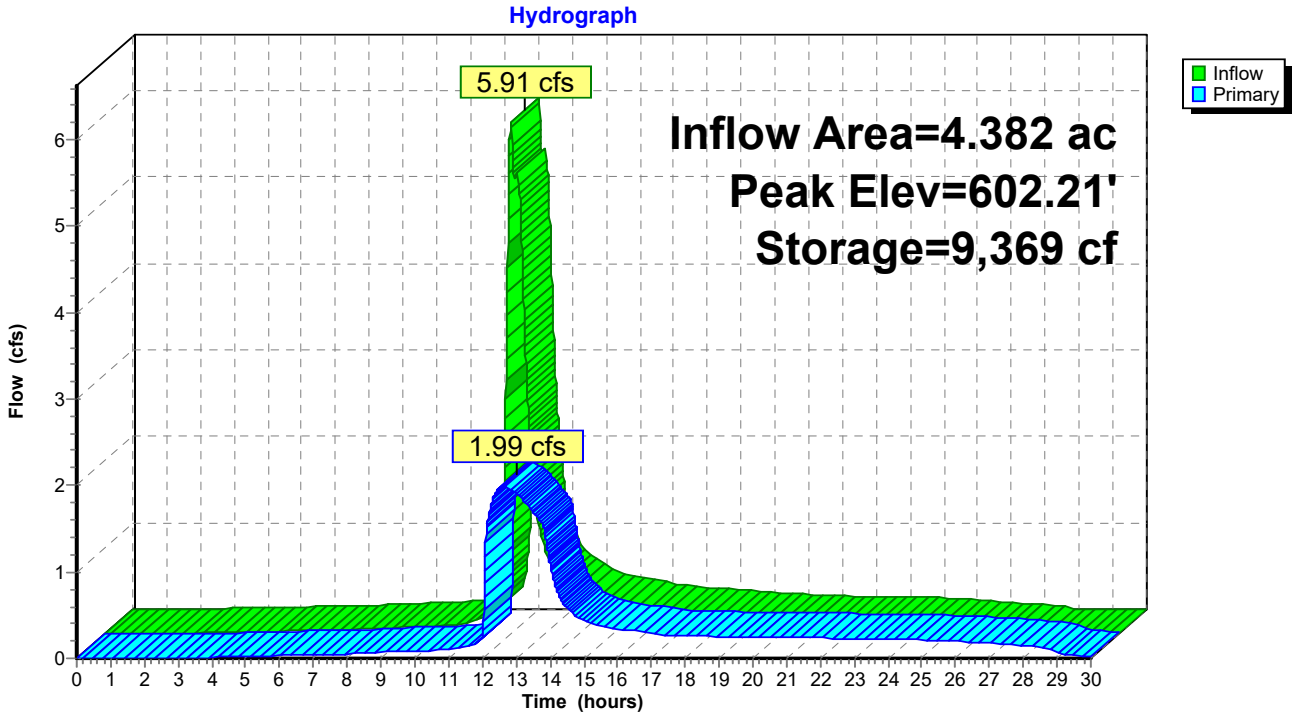
Volume	Invert	Avail.Storage	Storage Description
#1	600.00'	1,568 cf	**5.00'W x 302.00'L x 4.00'H Stone Encasement** 6,040 cf Overall - 2,121 cf Embedded = 3,919 cf x 40.0% Voids
#2	600.00'	2,121 cf	**36.0" Round 36" Pipe** Inside #1 L= 300.0'
#3	600.00'	26,477 cf	**Dry Detention Basin (Irregular)** Listed below (Recalc)
		30,165 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
600.00	0	0.0	0	0	0
601.00	4,041	349.0	1,347	1,347	9,694
602.00	5,117	368.0	4,568	5,915	10,836
603.00	6,249	387.0	5,674	11,589	12,038
604.00	7,438	405.0	6,835	18,424	13,240
605.00	8,684	424.0	8,053	26,477	14,560

Device	Routing	Invert	Outlet Devices
#1	Primary	600.00'	**10.0" Round Culvert** L= 133.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 599.88' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Device 1	600.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	601.30'	**10.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.99 cfs @ 12.62 hrs HW=602.21' (Free Discharge)
└─**1=Culvert** (Barrel Controls 1.99 cfs @ 3.66 fps)
  └─**2=Orifice/Grate** (Passes < 0.34 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 2.51 cfs potential flow)

Pond 2bP: Dry Detention Basin



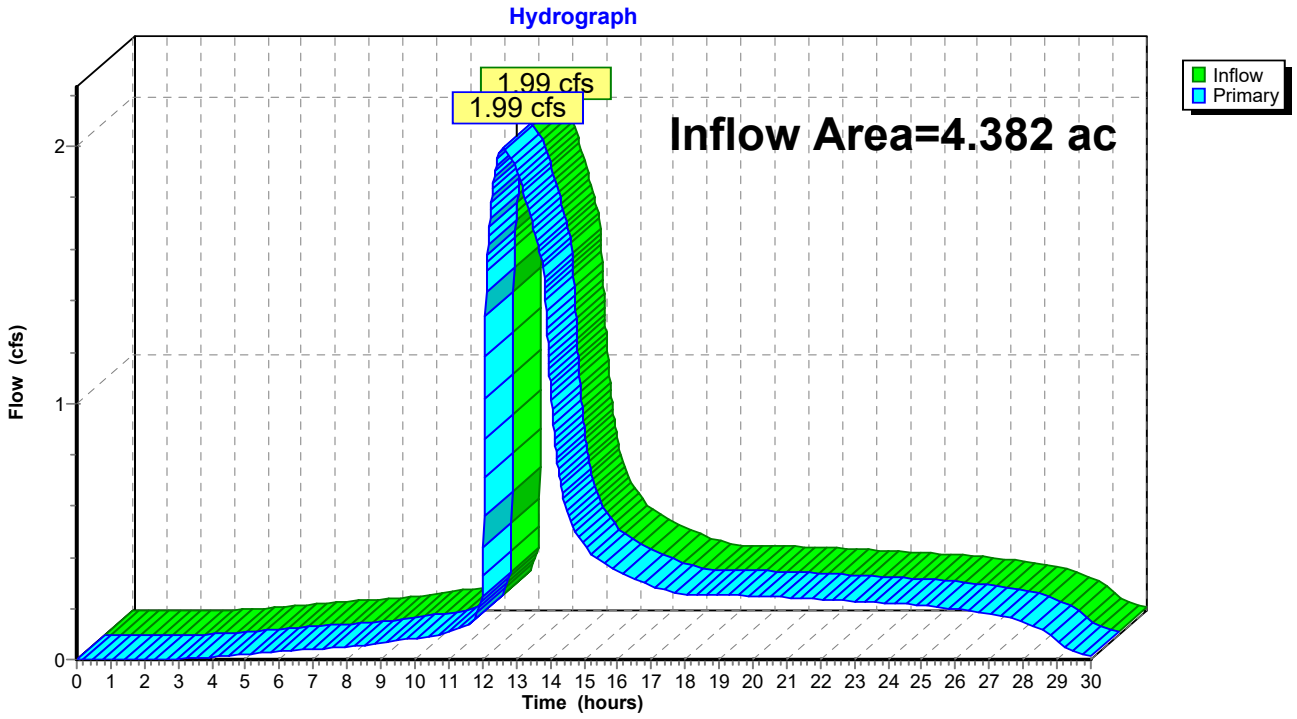
Summary for Pond 2P: Discharge from South Drainage Area

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

Inflow Area = 4.382 ac, 20.81% Impervious, Inflow Depth > 1.79" for 10-YR event
Inflow = 1.99 cfs @ 12.62 hrs, Volume= 0.652 af
Primary = 1.99 cfs @ 12.62 hrs, Volume= 0.652 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 2P: Discharge from South Drainage Area



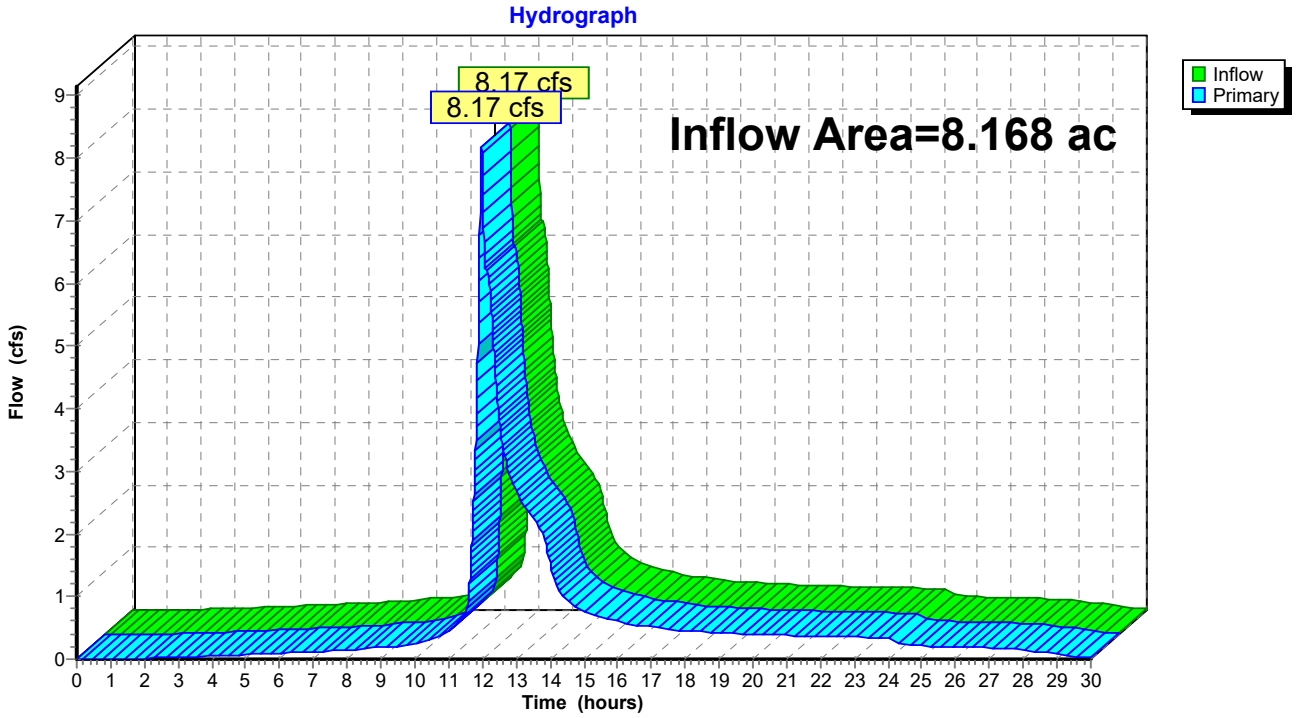
Summary for Pond 3P: Total Site Discharge

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

Inflow Area = 8.168 ac, 27.29% Impervious, Inflow Depth > 1.90" for 10-YR event
Inflow = 8.17 cfs @ 11.98 hrs, Volume= 1.295 af
Primary = 8.17 cfs @ 11.98 hrs, Volume= 1.295 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Total Site Discharge



Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1aS: North Drainage Area - Runoff Area=1.317 ac 100.00% Impervious Runoff Depth=4.93"
Tc=6.0 min CN=98 Runoff=9.69 cfs 0.541 af

Subcatchment1bS: North Drainage Area - Runoff Area=2.469 ac 0.00% Impervious Runoff Depth=2.86"
Flow Length=586' Slope=0.0115 '/' Tc=23.2 min CN=78 Runoff=7.18 cfs 0.588 af

Subcatchment2aS: South Drainage Area - Runoff Area=0.528 ac 100.00% Impervious Runoff Depth=4.93"
Tc=6.0 min CN=98 Runoff=3.89 cfs 0.217 af

Subcatchment2bS: South Drainage Area - Runoff Area=3.400 ac 0.00% Impervious Runoff Depth=2.86"
Flow Length=490' Slope=0.0092 '/' Tc=23.8 min CN=78 Runoff=9.74 cfs 0.809 af

Subcatchment2cS: South Drainage Area - Runoff Area=0.407 ac 82.80% Impervious Runoff Depth=4.59"
Tc=6.0 min CN=95 Runoff=2.93 cfs 0.156 af

Subcatchment2dS: New Bldg Runoff Area=0.047 ac 100.00% Impervious Runoff Depth=4.93"
Tc=6.0 min CN=98 Runoff=0.35 cfs 0.019 af

Pond 1P: Discharge from North Drainage Area Inflow=13.30 cfs 1.129 af
Primary=13.30 cfs 1.129 af

Pond 2aP: Bioretention Basin Peak Elev=603.52' Storage=3,197 cf Inflow=10.35 cfs 1.026 af
Outflow=10.13 cfs 1.026 af

Pond 2bP: Dry Detention Basin Peak Elev=603.81' Storage=20,635 cf Inflow=10.74 cfs 1.201 af
Outflow=2.87 cfs 1.190 af

Pond 2P: Discharge from South Drainage Area Inflow=2.87 cfs 1.190 af
Primary=2.87 cfs 1.190 af

Pond 3P: Total Site Discharge Inflow=15.08 cfs 2.319 af
Primary=15.08 cfs 2.319 af

Total Runoff Area = 8.168 ac Runoff Volume = 2.330 af Average Runoff Depth = 3.42"
72.71% Pervious = 5.939 ac 27.29% Impervious = 2.229 ac

Summary for Subcatchment 1aS: North Drainage Area - Impervious Area

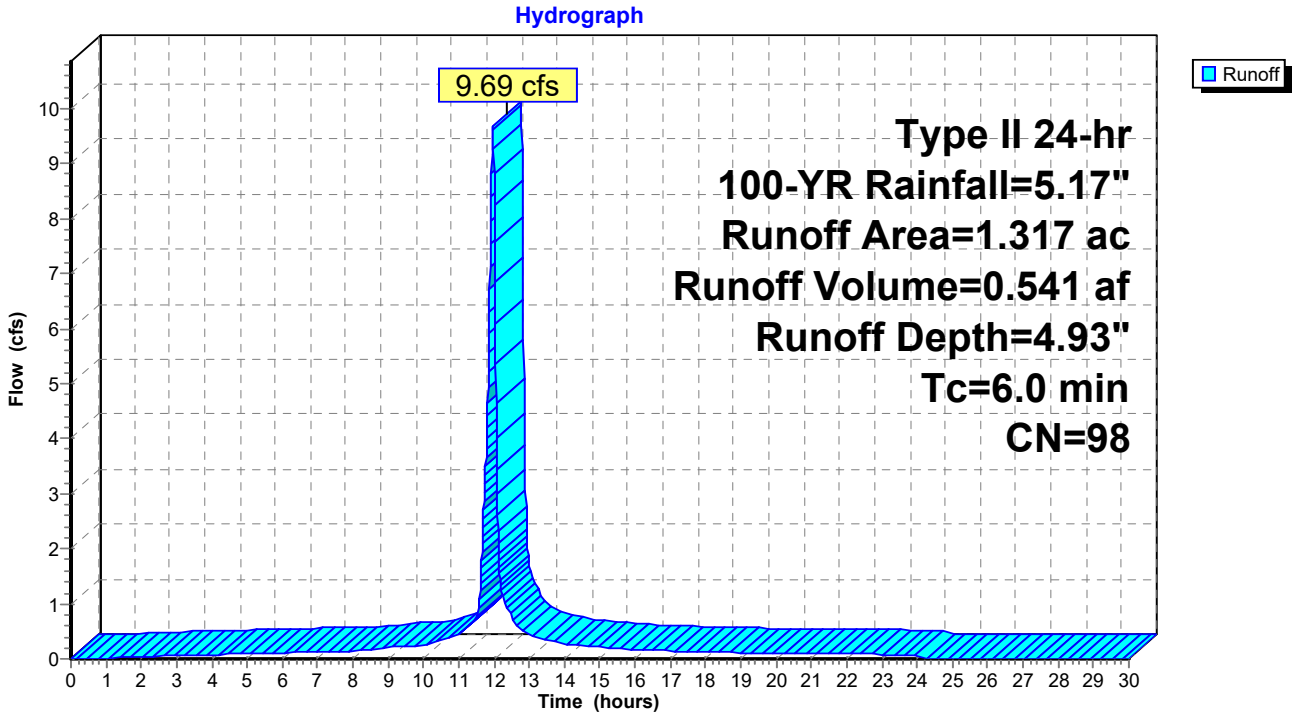
Runoff = 9.69 cfs @ 11.97 hrs, Volume= 0.541 af, Depth= 4.93"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
1.317	98	Paved parking, HSG D
1.317		100.00% Impervious Area

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

Subcatchment 1aS: North Drainage Area - Impervious Area



Summary for Subcatchment 1bS: North Drainage Area - Pervious Area

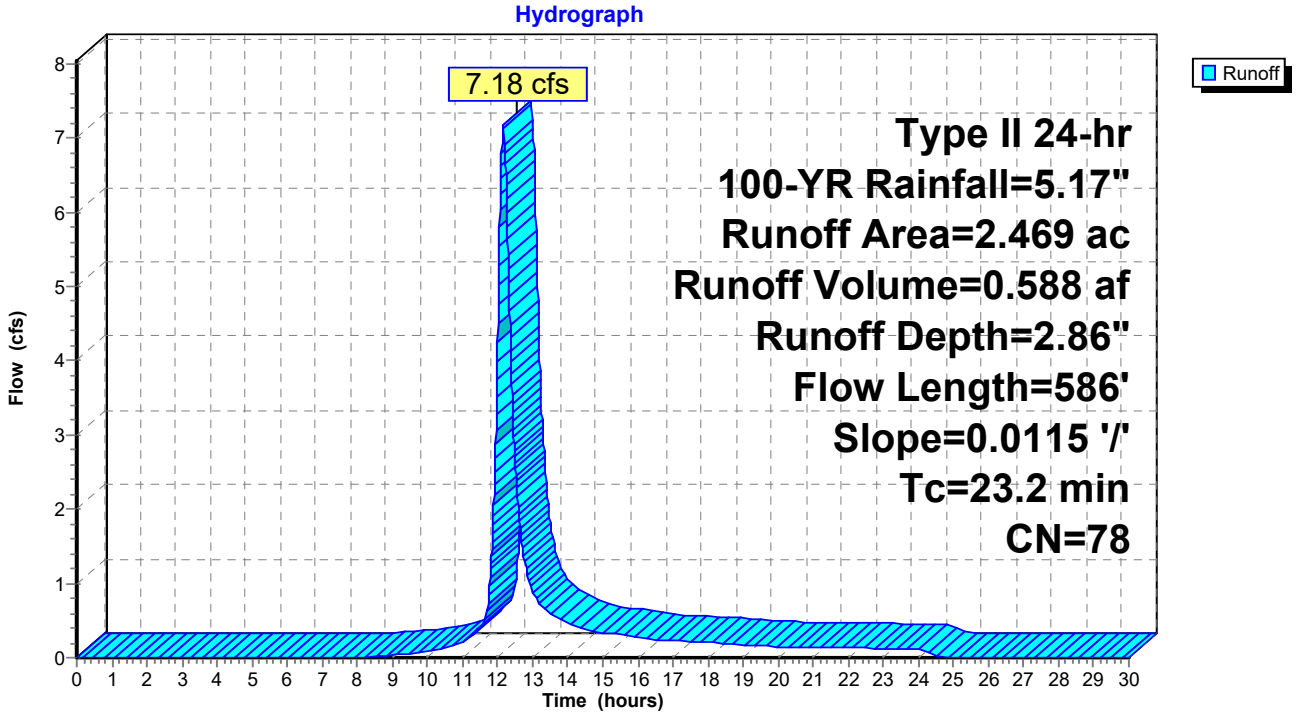
Runoff = 7.18 cfs @ 12.16 hrs, Volume= 0.588 af, Depth= 2.86"
Routed to Pond 1P : Discharge from North Drainage Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.152	79	Woods/grass comb., Good, HSG D
2.317	78	Meadow, non-grazed, HSG D
2.469	78	Weighted Average
2.469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0115	0.13		**Sheet Flow,** Range n= 0.130 P2= 2.29"
10.0	452	0.0115	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0115	2.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
23.2	586	Total			

Subcatchment 1bS: North Drainage Area - Pervious Area



Summary for Subcatchment 2aS: South Drainage Area - Parking Area

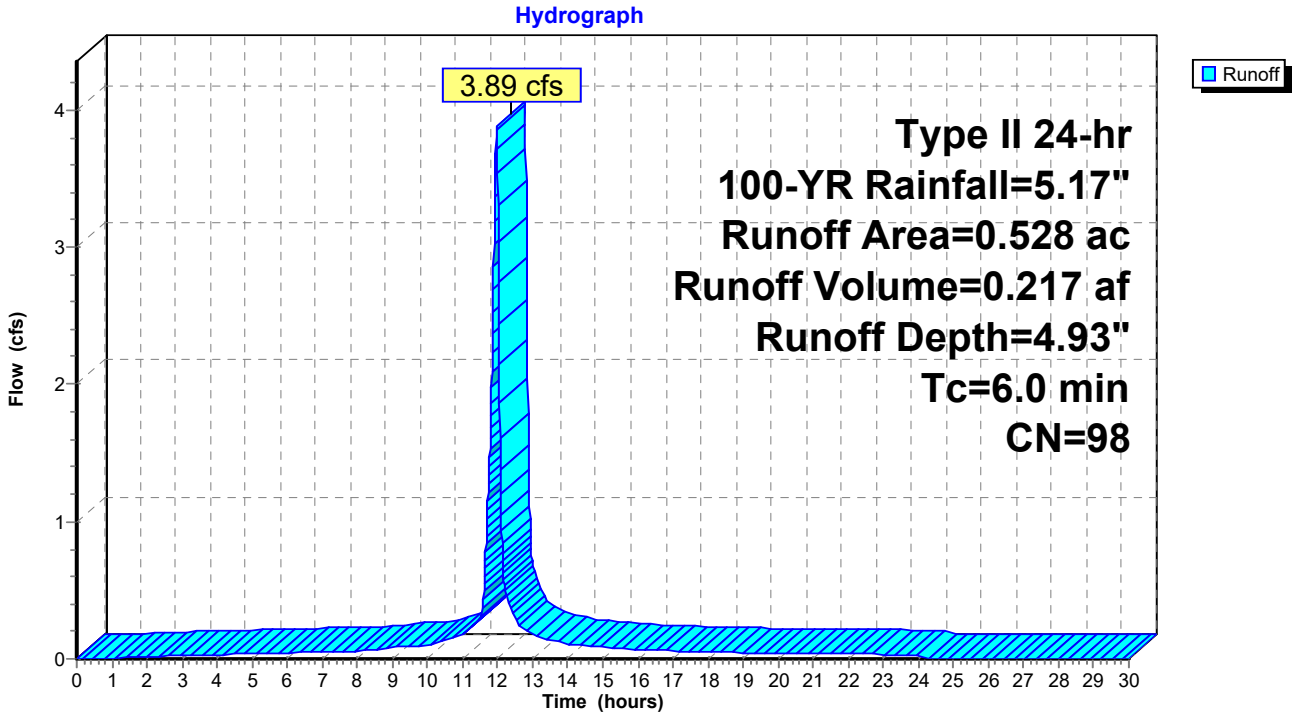
Runoff = 3.89 cfs @ 11.97 hrs, Volume= 0.217 af, Depth= 4.93"
Routed to Pond 2aP : Bioretention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.528	98	Paved parking, HSG D
0.528		100.00% Impervious Area

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

Subcatchment 2aS: South Drainage Area - Parking Area



Summary for Subcatchment 2bS: South Drainage Area - Pervious Area

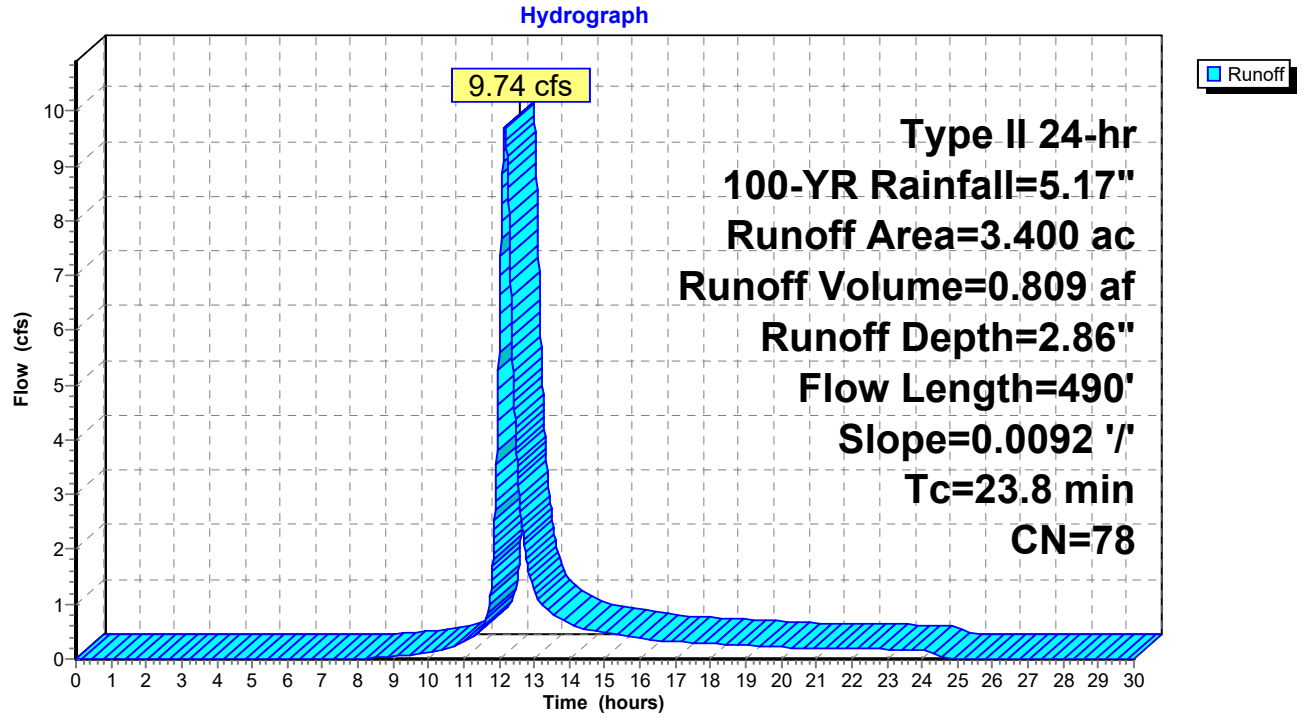
Runoff = 9.74 cfs @ 12.17 hrs, Volume= 0.809 af, Depth= 2.86"
Routed to Pond 2aP : Bioretention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
3.400	78	Meadow, non-grazed, HSG D
3.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0092	0.12		**Sheet Flow,** Range n= 0.130 P2= 2.29"
9.7	390	0.0092	0.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
23.8	490	Total			

Subcatchment 2bS: South Drainage Area - Pervious Area



Summary for Subcatchment 2cS: South Drainage Area - Playground Area

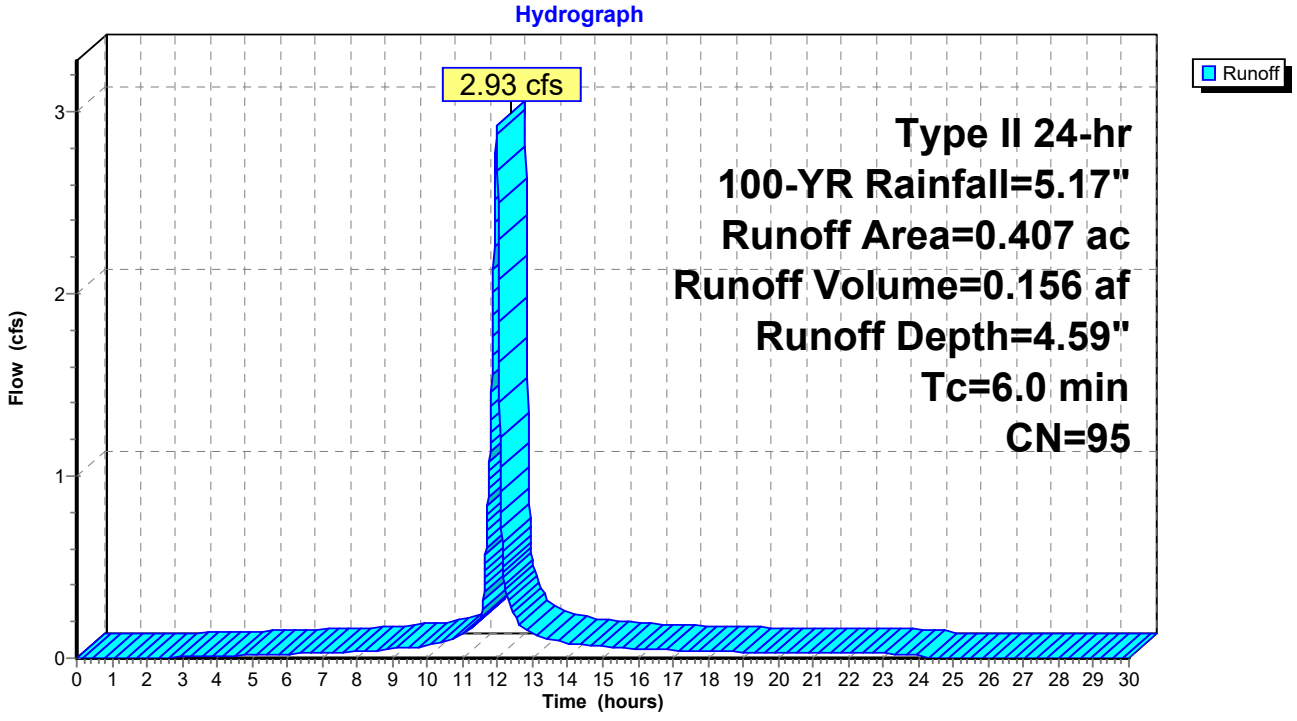
Runoff = 2.93 cfs @ 11.97 hrs, Volume= 0.156 af, Depth= 4.59"
Routed to Pond 2bP : Dry Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.337	98	Roofs, HSG D
0.070	80	>75% Grass cover, Good, HSG D
0.407	95	Weighted Average
0.070		17.20% Pervious Area
0.337		82.80% Impervious Area

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

Subcatchment 2cS: South Drainage Area - Playground Area



Summary for Subcatchment 2dS: New Bldg

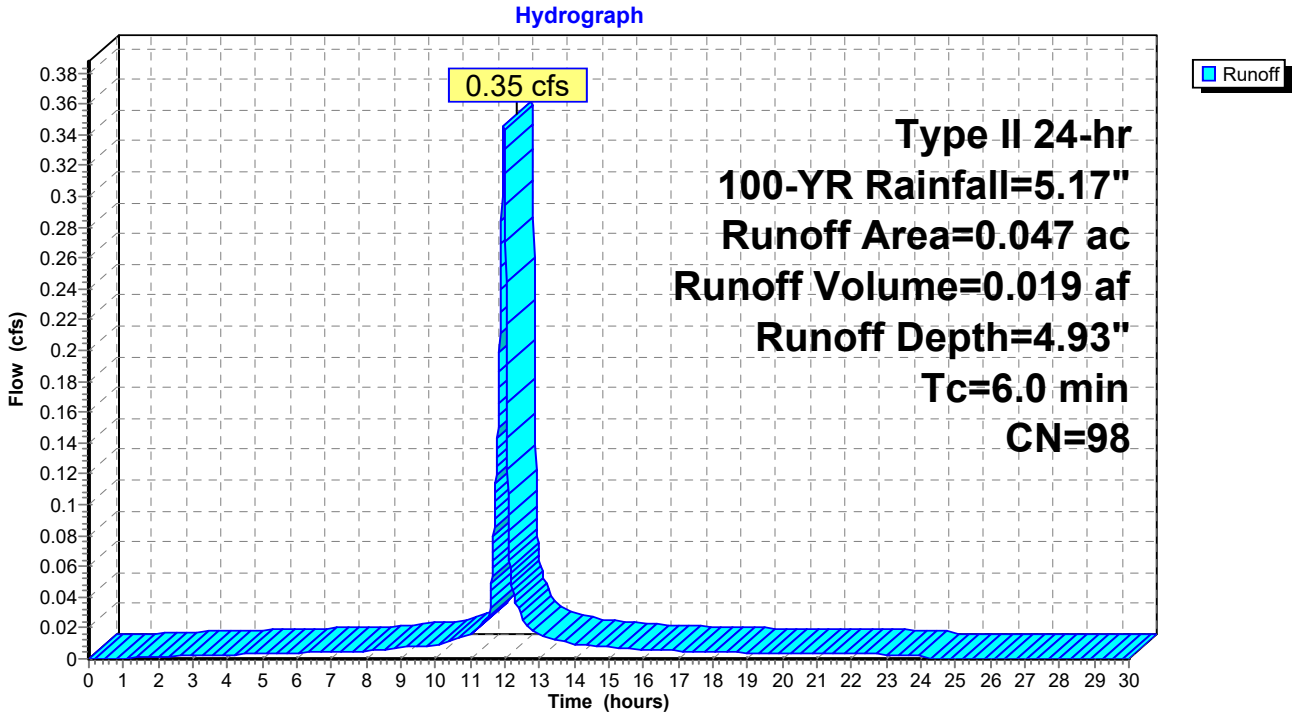
Runoff = 0.35 cfs @ 11.97 hrs, Volume= 0.019 af, Depth= 4.93"
Routed to Pond 2bP : Dry Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.17"

Area (ac)	CN	Description
0.047	98	Roofs, HSG D
0.047		100.00% Impervious Area

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

Subcatchment 2dS: New Bldg



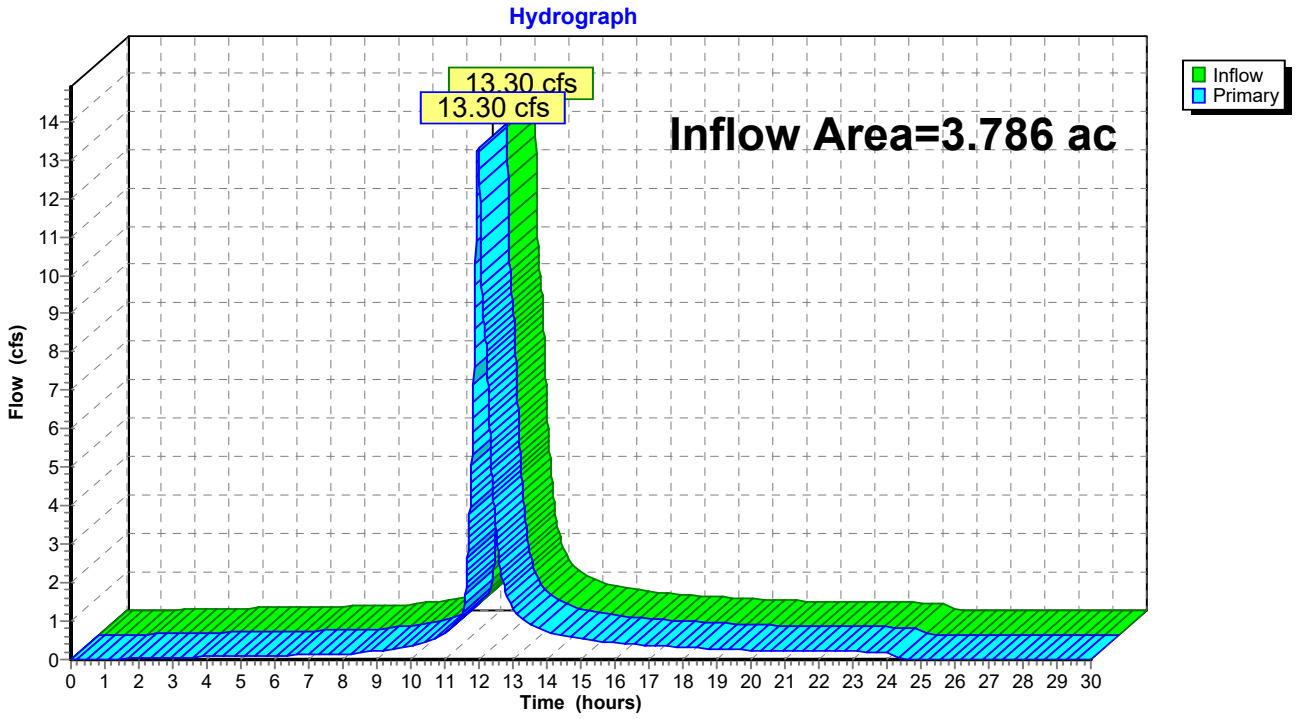
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 3.786 ac, 34.79% Impervious, Inflow Depth = 3.58" for 100-YR event
Inflow = 13.30 cfs @ 11.98 hrs, Volume= 1.129 af
Primary = 13.30 cfs @ 11.98 hrs, Volume= 1.129 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



Summary for Pond 2aP: Bioretention Basin

Inflow Area = 3.928 ac, 13.44% Impervious, Inflow Depth = 3.14" for 100-YR event
Inflow = 10.35 cfs @ 12.16 hrs, Volume= 1.026 af
Outflow = 10.13 cfs @ 12.20 hrs, Volume= 1.026 af, Atten= 2%, Lag= 2.4 min
Primary = 10.13 cfs @ 12.20 hrs, Volume= 1.026 af
Routed to Pond 2bP : Dry Detention Basin

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 603.52' @ 12.20 hrs Surf.Area= 5,218 sf Storage= 3,197 cf

Plug-Flow detention time= 26.6 min calculated for 1.026 af (100% of inflow)
Center-of-Mass det. time= 26.5 min (845.3 - 818.8)

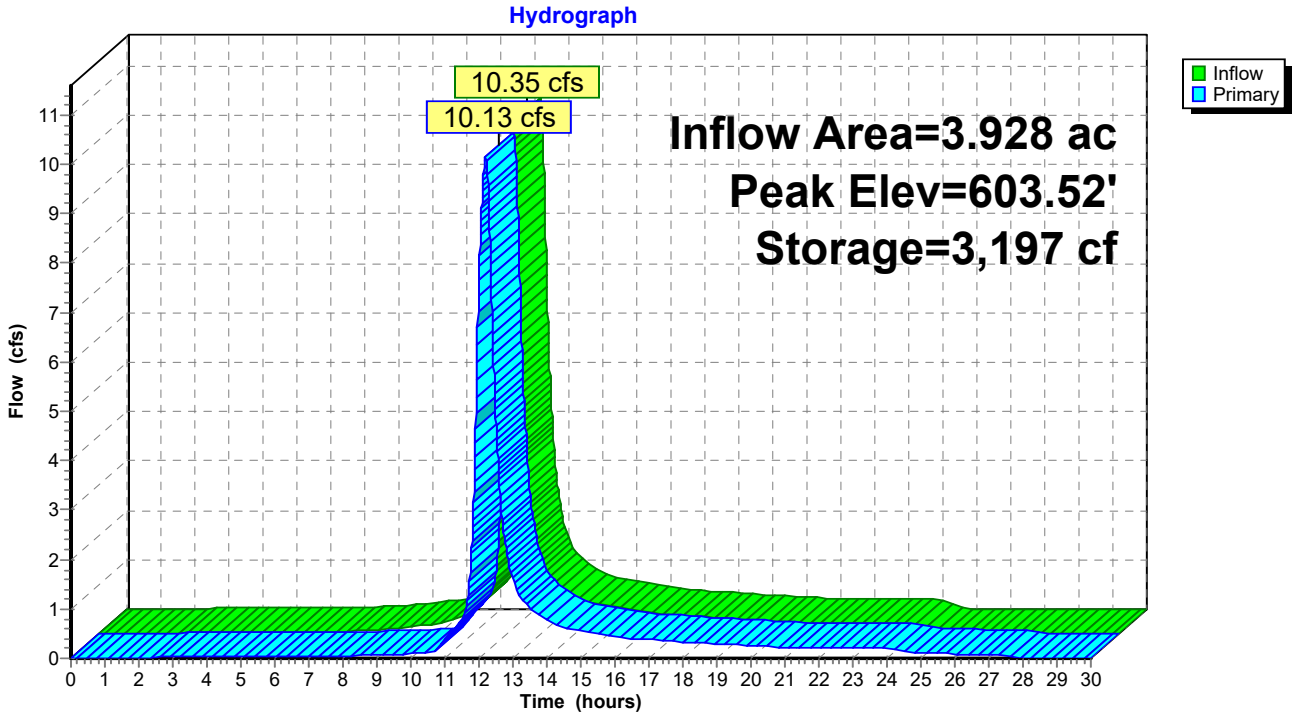
Volume	Invert	Avail.Storage	Storage Description
#1	602.50'	6,205 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
602.50	1,050	230.0	0	0	1,050
603.00	3,200	432.0	1,014	1,014	11,693
604.00	7,480	724.0	5,191	6,205	38,560

Device	Routing	Invert	Outlet Devices
#1	Primary	600.00'	**18.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 600.00' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	600.00'	**8.0" Round Underdrain Pipe** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 600.00' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	602.50'	**1.750 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 500.00'
#4	Device 1	603.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=10.13 cfs @ 12.20 hrs HW=603.52' (Free Discharge)
- **1=Culvert** (Passes 10.13 cfs of 11.19 cfs potential flow)
  - **2=Underdrain Pipe** (Passes 0.21 cfs of 1.75 cfs potential flow)
    - **3=Exfiltration** (Controls 0.21 cfs)
  - **4=Orifice/Grate** (Weir Controls 9.91 cfs @ 2.37 fps)

Pond 2aP: Bioretention Basin



Summary for Pond 2bP: Dry Detention Basin

[81] Warning: Exceeded Pond 2aP by 0.62' @ 12.82 hrs

Inflow Area = 4.382 ac, 20.81% Impervious, Inflow Depth = 3.29" for 100-YR event
Inflow = 10.74 cfs @ 12.02 hrs, Volume= 1.201 af
Outflow = 2.87 cfs @ 12.72 hrs, Volume= 1.190 af, Atten= 73%, Lag= 41.8 min
Primary = 2.87 cfs @ 12.72 hrs, Volume= 1.190 af
Routed to Pond 2P : Discharge from South Drainage Area

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 603.81' @ 12.72 hrs Surf.Area= 8,719 sf Storage= 20,635 cf

Plug-Flow detention time= 119.8 min calculated for 1.190 af (99% of inflow)
Center-of-Mass det. time= 112.5 min (945.6 - 833.1)

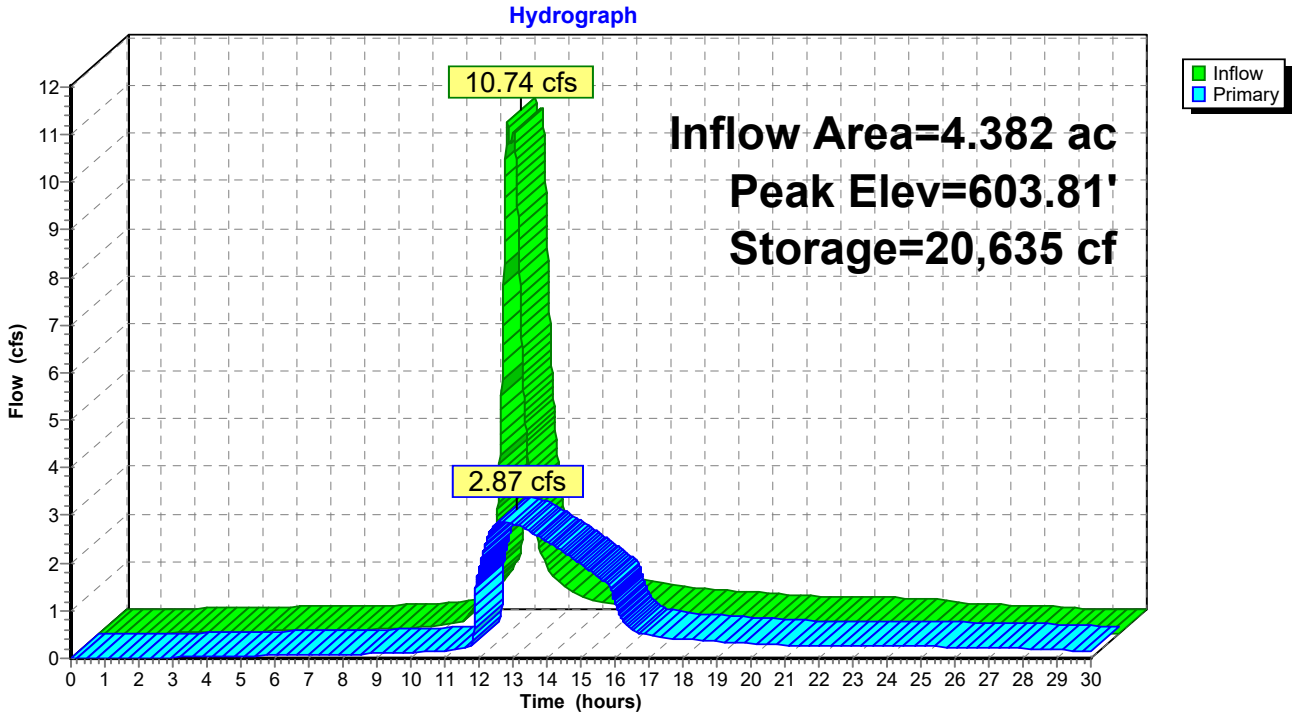
Volume	Invert	Avail.Storage	Storage Description
#1	600.00'	1,568 cf	**5.00'W x 302.00'L x 4.00'H Stone Encasement** 6,040 cf Overall - 2,121 cf Embedded = 3,919 cf x 40.0% Voids
#2	600.00'	2,121 cf	**36.0" Round 36" Pipe** Inside #1 L= 300.0'
#3	600.00'	26,477 cf	**Dry Detention Basin (Irregular)** Listed below (Recalc)
		30,165 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
600.00	0	0.0	0	0	0
601.00	4,041	349.0	1,347	1,347	9,694
602.00	5,117	368.0	4,568	5,915	10,836
603.00	6,249	387.0	5,674	11,589	12,038
604.00	7,438	405.0	6,835	18,424	13,240
605.00	8,684	424.0	8,053	26,477	14,560

Device	Routing	Invert	Outlet Devices
#1	Primary	600.00'	**10.0" Round Culvert** L= 133.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 600.00' / 599.88' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Device 1	600.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	601.30'	**10.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.87 cfs @ 12.72 hrs HW=603.81' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.87 cfs @ 5.26 fps)
└**2=Orifice/Grate** (Passes < 0.45 cfs potential flow)
└**3=Orifice/Grate** (Passes < 4.16 cfs potential flow)

Pond 2bP: Dry Detention Basin



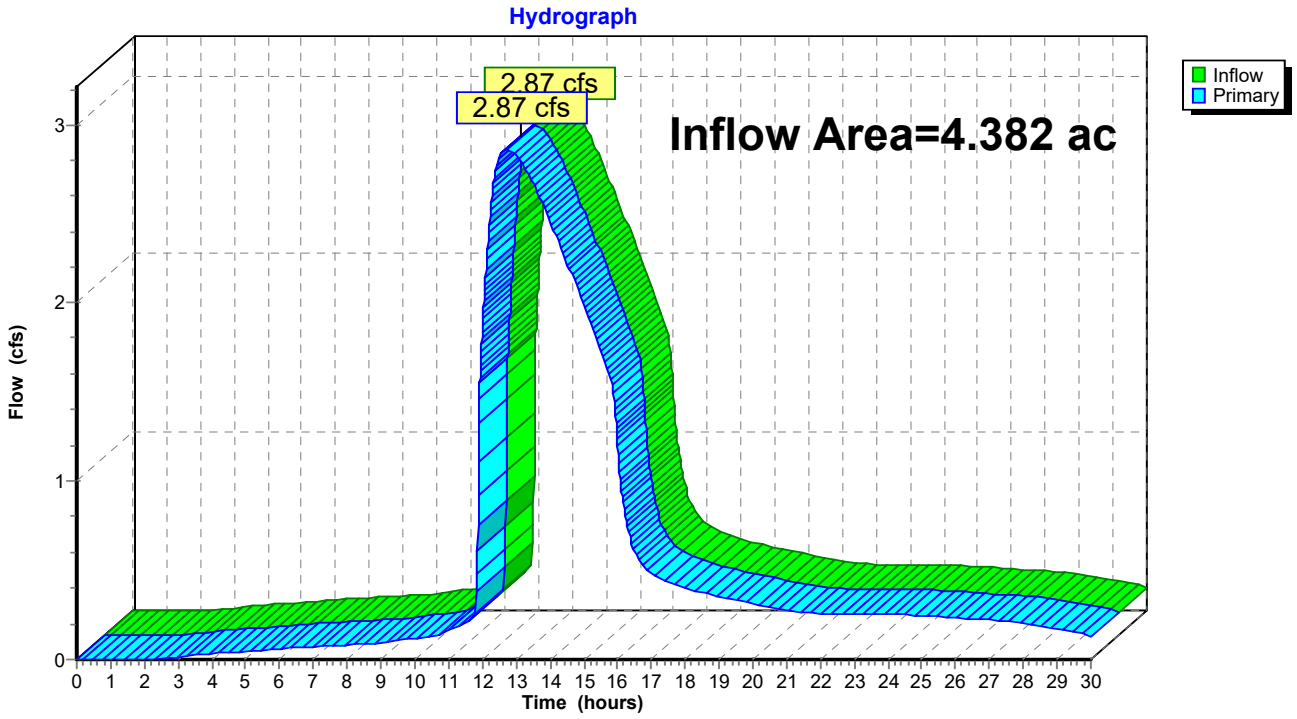
Summary for Pond 2P: Discharge from South Drainage Area

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

Inflow Area = 4.382 ac, 20.81% Impervious, Inflow Depth > 3.26" for 100-YR event
Inflow = 2.87 cfs @ 12.72 hrs, Volume= 1.190 af
Primary = 2.87 cfs @ 12.72 hrs, Volume= 1.190 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Total Site Discharge

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 2P: Discharge from South Drainage Area



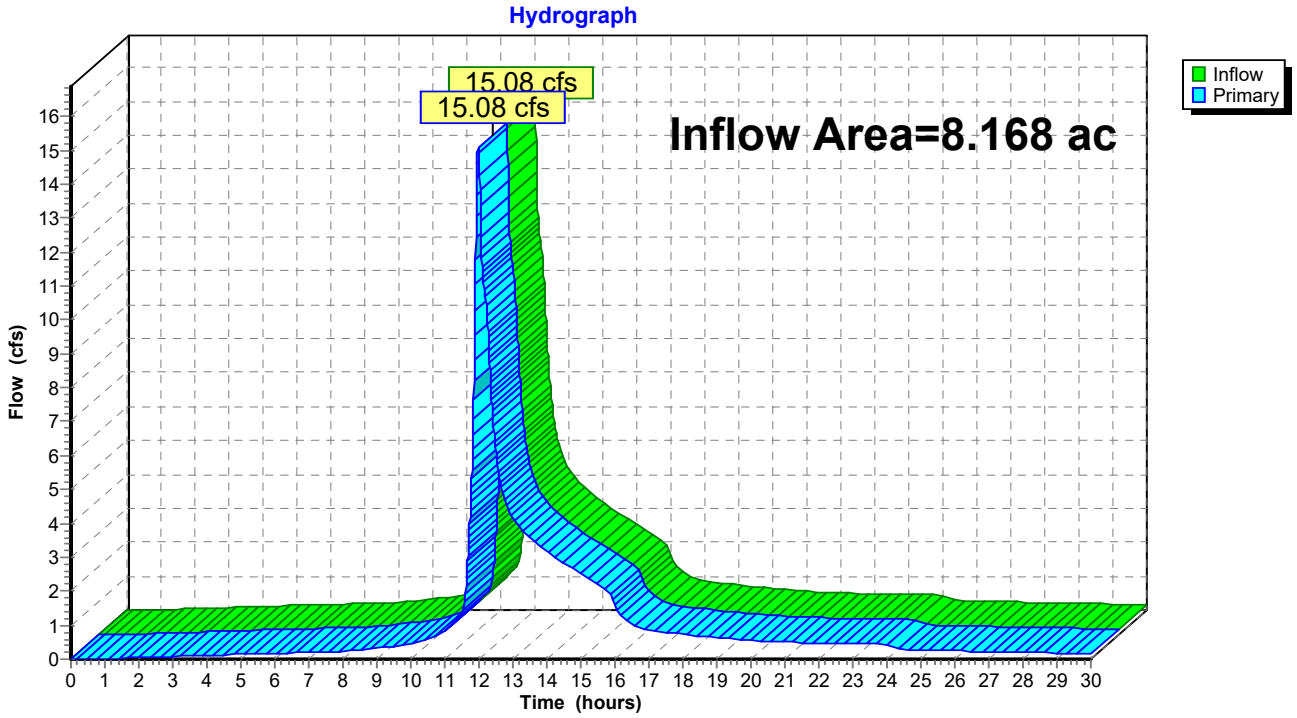
Summary for Pond 3P: Total Site Discharge

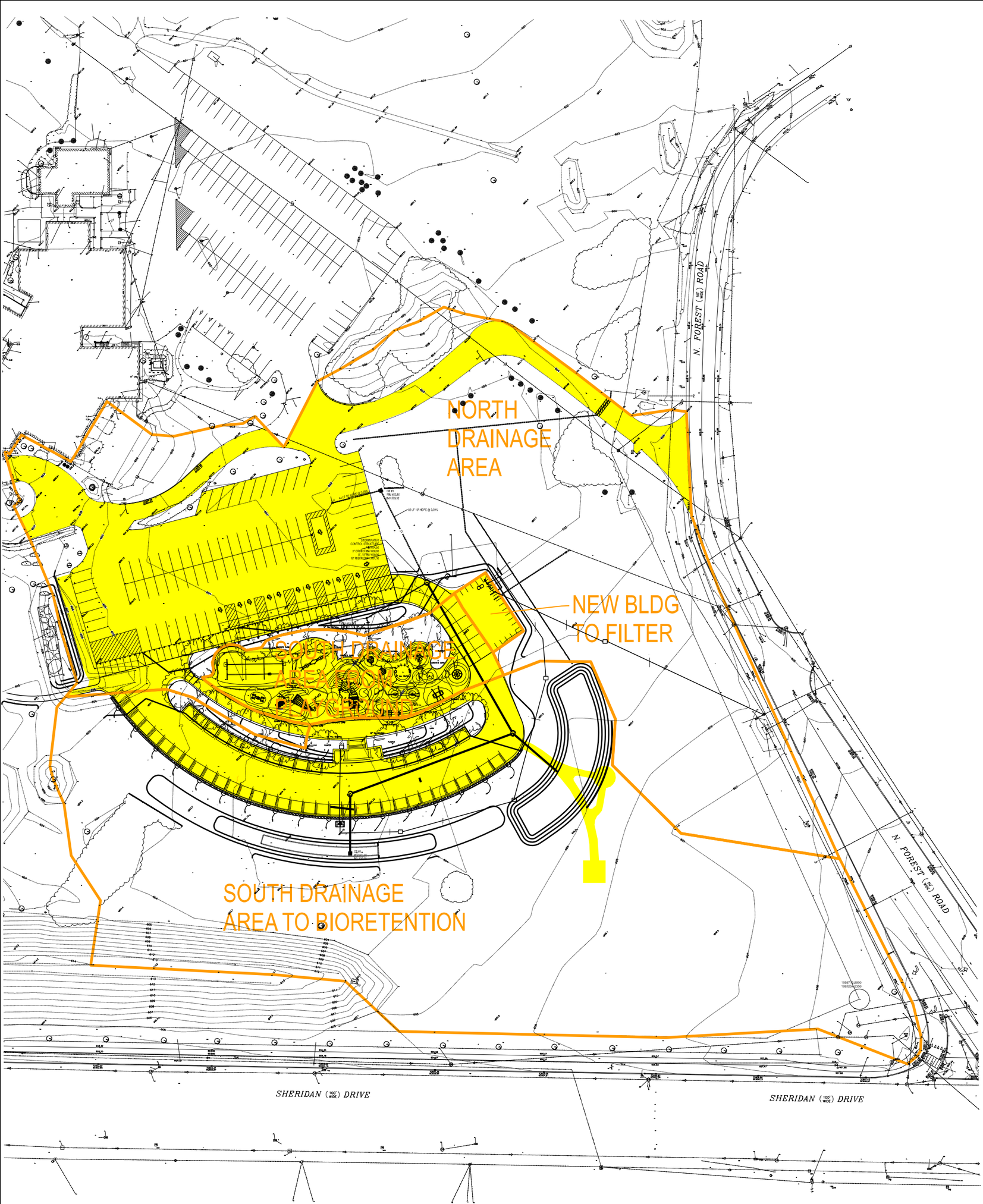
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.168 ac, 27.29% Impervious, Inflow Depth > 3.41" for 100-YR event
Inflow = 15.08 cfs @ 11.98 hrs, Volume= 2.319 af
Primary = 15.08 cfs @ 11.98 hrs, Volume= 2.319 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Total Site Discharge





PROPOSED DRAINAGE ANALYSIS MAP

LEGEND

DRAINAGE AREA

IMPERVIOUS AREA

Tc PATH

PLAN
NORTH

80 0 80 160 Ft.

80'

DATE: July 9, 2026
PROJECT NAME: Amherst Central Park

Stormwater Quality Calculations

Impervious Areas (refer to Existing & Proposed Drainage Analysis Maps)

$I_{Existing} := 0.29$ — **I Existing = Existing Impervious Area (acres) within South Drainage Area**

$I_{Proposed} := 0.84$ — **I Proposed = Proposed Impervious Area (acres) within South Drainage Area**

$I_{New} := I_{Proposed} - I_{Existing}$

$I_{New} = 0.55$ — **I New = New Impervious Area (acres) per Disturbance Area Map**

$I_{Redeveloped} := I_{Existing}$

$I_{Redeveloped} = 0.29$ — **I Redeveloped = Redeveloped Impervious Area (acres) per Disturbance Area Map**

$A_{Disturbance} := 2.1$ — **A Disturbance = Site Disturbance Area (acres)**

Minimum Runoff Reduction Volume (RRv Min)

The minimum RRv is calculated by applying a reduction factor (S) (based on the HSG on site) to the area of new impervious coverage.

$P := 1.0$ — ***90% Rainfall Event (inches)***

$Rv := 0.95$ — **0.05 + 0.009(I) where I is 100% impervious**

$Aic := I_{New}$ — ***Total Area of New Impervious Area (acres)***

$Aic = 0.55$

$S := 0.20$ — ***Hydrologic Soil Group (HSG) Specific Reduction Factor (S).*** **Web Soil Survey indicates the site is 100% HSG D. Therefore, S =0.20.**

$RR_{vmin} := \left(\frac{(P \cdot Rv \cdot Aic \cdot S)}{12} \right) = 0.009$ — ***Runoff Reduction Volume Minimum (acre-feet)***

$RR_{vmin} \cdot 43560 = 379$ — ***Runoff Reduction Volume Minimum (cubic-feet)***

{p}{f}

Water Quality Volume Required from New Impervious Area (to be treated with a standard practice)

$P = 1.0$ — *90% Rainfall Event (inches)*

$A_{Disturbance} = 2.1$ — *Area to be developed (acres)*

$I_1 := \frac{I_{New}}{A_{Disturbance}} \cdot 100$ — *Percent impervious cover (100%)*

$I_1 = 26.190$

$R_{v1} := 0.05 + 0.009 \cdot I_1$ — **0.05 + 0.009(I) where I is 100% impervious**

$R_{v1} = 0.286$

$WQ_{vRequiredNew} := \frac{P \cdot R_{v1} \cdot A_{Disturbance}}{12}$

$WQ_{vRequiredNew} = 0.050$ — *Water Quality Volume Required from New Impervious Area (acre-feet)*

$WQ_{vRequiredNew} \cdot 43560 = 2178$ — *Water Quality Volume Required from New Impervious Area(cubic feet)*

Water Quality Volume Required from Redeveloped Impervious Area (to be treated with a standard practice)

$P = 1.0$ — *90% Rainfall Event (inches)*

$A_{Disturbance} = 2.1$ — *Area to be developed (acres)*

$I_2 := \frac{I_{Redeveloped}}{A_{Disturbance}} \cdot 100$ — *Percent impervious cover (100%)*

$I_2 = 13.810$

$R_{v2} := 0.05 + 0.009 \cdot I_2$ — **0.05 + 0.009(I) where I is 100% impervious**

$R_{v2} = 0.174$

$WQ_{vRequiredRedev} := \frac{P \cdot R_{v2} \cdot A_{Disturbance}}{12}$

$WQ_{vRequiredRedev} = 0.031$ — *Water Quality Volume Required from Redeveloped Impervious Area (acre-feet)*

$WQ_{vRequiredRedev} \cdot 43560 = 1329$ — *Water Quality Volume Required from Redeveloped Impervious Area(cubic feet)*

{p}{f}

Total Water Quality Volume Required to be treated with a standard practice

$WQ_{vRequired} := WQ_{vRequiredNew} + 0.25 \cdot WQ_{vRequiredRedev}$

$WQ_{vRequired} = 0.058$ **Total Water Quality Volume Required with a Standard Practice (acre-feet)**

$WQ_{vRequired} \cdot 43560 = 2510$ **Total Water Quality Volume Required with a Standard Practice (cubic feet)**

Water Quality Volume Provided (WQv Provided) in a Standard Practice

Bioretention Basin

$P = 1.0$ ***90% Rainfall Event (inches)***

$A_1 := 3.848$ ***Area Draining to BMP = 3.848 acres***

$Impervious_1 := 0.528$ ***Impervious Area = 0.528 acres***

$I_3 := \frac{Impervious_1}{A_1} \cdot 100$ ***Percent impervious cover***

$I_3 = 13.721$

$R_{v3} := 0.05 + 0.009 \cdot I_3$ **0.05 + 0.009(I) where I is percent impervious**

$R_{v3} = 0.173$

$WQ_{vProvidedTotal1} := \frac{P \cdot R_{v3} \cdot A_1}{12}$

$WQ_{vProvidedTotal1} = 0.056$ ***Water Quality Volume Provided in BMP (acre-feet)***

$WQ_{vProvidedTotal1} \cdot 43560 = 2423$ ***Water Quality Volume Provided in BMP (cubic feet)***

In accordance with the NYSDEC SMDM, for a filtration bioretention basin , 40% of the water quality volume can count towards the Runoff Reduction Volume.

$RR_{v1} := 0.40 \cdot WQ_{vProvidedTotal1}$

$RR_{v1} = 0.022$ **Runoff Reduction Volume Provided in BMP (acre-feet)**

$RR_{v1} \cdot 43560 = 969$ **Runoff Reduction Volume Provided in BMP (cubic-feet)**

$WQ_{vProvided1} := WQ_{vProvidedTotal1} - RR_{v1}$

$WQ_{vProvided1} = 0.033$ **Water Quality Volume Provided in BMP (acre-feet)**

$WQ_{vProvided1} \cdot 43560 = 1454$ **Water Quality Volume Provided in BMP (cubic-feet)**

{p}{f}

Size Filter Area of Bioretention Basin

$WQ_{vProvidedTotal1} \cdot 43560 = 2423$ — ***Water Quality Volume Provided in BMP (cubic feet)***

$d_{f1} := 2.5$ — **Filter Bed Depth = 2.5 feet**

$k := 1.0$ — **Coefficient of permeability of filter media = 1.0 ft/day (for bioretention soil)**

$h_f := 0.50$ — **Average height of water above filter bed (feet)**

$t_f := 2$ — **Design filter bed drain time = 2 day for bioretention**

$$A_{f2} := \frac{WQ_{vProvidedTotal1} \cdot 43560 \cdot d_{f1}}{k \cdot (h_f + d_{f1}) \cdot t_f}$$

$A_{f2} = 1010$ — **Required Surface Area of filter bed (square feet)**

Af provided is 10' x 105' = 1,050 square feet

Filter #1

$P = 1.0$ — ***90% Rainfall Event (inches)***

$A_2 := 0.047$ — ***Area Draining to BMP = New Restroom Bldg = 0.047 acres***

$Impervious_2 := 0.047$ — ***Impervious Area = 0.047 acres***

$$I_4 := \frac{Impervious_2}{A_2} \cdot 100$$ — ***Percent impervious cover***

$I_4 = 100.000$

$R_{v4} := 0.05 + 0.009 \cdot I_4$ — **0.05 + 0.009(I) where I is percent impervious**

$R_{v4} = 0.950$

$$WQ_{vProvidedTotal2} := \frac{P \cdot R_{v4} \cdot A_2}{12}$$

$WQ_{vProvidedTotal2} = 0.004$ — ***Water Quality Volume Provided in BMP (acre-feet)***

$WQ_{vProvidedTotal2} \cdot 43560 = 162$ — ***Water Quality Volume Provided in BMP (cubic feet)***

{p}{f}

WQv & RRv Summary

$WQ_{vRequired} = 0.058$ — **Total Water Quality Volume Required with a Standard Practice (acre-feet)**

$WQ_{vRequired} \cdot 43560 = 2510$ — **Total Water Quality Volume Required with a Standard Practice (cubic feet)**

$RR_{vmin} := \left(\frac{(P \cdot Rv \cdot Aic \cdot S)}{12} \right) = 0.009$ — ***Runoff Reduction Volume Minimum (acre-feet)***

$RR_{vmin} \cdot 43560 = 379$ — ***Runoff Reduction Volume Minimum (cubic-feet)***

$WQ_{vProvidedTotal} := WQ_{vProvidedTotal1} + WQ_{vProvidedTotal2}$ — **Total Water Quality Volume Provided with a Standard Practice (acre-feet)**

$WQ_{vProvidedTotal} = 0.059$

$WQ_{vProvidedTotal} \cdot 43560 = 2585$ — **Total Water Quality Volume Provided with a Standard Practice (cubic feet)**

$RR_{vProvided} := RR_{v1}$

$RR_{vProvided} = 0.022$

$RR_{vProvided} \cdot 43560 = 969$ — **Total Runoff Reduction Volume Provided (cubic feet)**

Channel Protection Volume (CPv)

Size Orifice for Outlet Structure:

1-yr Runoff Volume = 0.255 ac-ft = 11,108cf

Estimate Orifice size for Extended Detention of Chanel Protection Volume (CPv).

$CP_v := 11108\ ft^3$

$g = 32.174\ \frac{ft}{s^2}$

$h := 1 \cdot ft$

$Q := \frac{CP_v}{24 \cdot hr}$

$Q = 0.129\ \frac{ft^3}{sec}$

$A_{orifice} := \frac{Q}{.6 \cdot \sqrt{2 \cdot g \cdot h}}$

{p}{f}

$A_{orifice} = 0.027\ ft^2$

$$d := \sqrt{4 \cdot \frac{A_{orifice}}{\pi}}$$

$d = 0.2\ ft$

In accordance with Section 4.6 of the NYSDEC Stormwater Management Design Manual, the minimum CPv control orifice shall be 3-inches.

Accordingly, use a 3-inch orifice.

Project: **Amherst Central Park**
Location: **North Forest Road & Sheridan Drive, Amherst, NY**
Prepared By: **C & S Engineers Inc**

Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 1.00" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	A (acres)	A ($miles^2$)	Runoff Coefficient	Percent Imp. (%)*	t_c (min)	t_c (hr)
WQS	0.05	0.00007	0.90	100.00	6.0	0.100

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure: The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method.

1. Compute WQV in watershed inches using the following equation:

$$WQV = P * R$$

where: WQV = water quality volume (watershed inches)
P = design precipitation (inches) = (1.0" for water quality storm)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

Structure Name	Percent Imp. (%)	R	P (in)	WQV (in)
WQS	100.00	0.950	1.0	0.950

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$CN = 1000 / [10+5P+10Q-10(Q^2+1.25QP)^{1/2}]$$

where: CN = Runoff Curve Number
P = design precipitation (inches) = (1.0" for water quality storm)
Q = runoff depth (watershed inches)

Structure Name	Q (in)	CN
WQS	0.950	99.57

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P, interpolating when appropriate.

Structure Name	I_a (in)	I_a/P
WQS	0.041	0.041

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles. A minimum t_c of 0.167 hours (10 minutes) should be used.

Structure Name	t_c (hr)	A (miles^2)
WQS	0.167	0.00007

5. Read the unit peak discharge (q_u) from Exhibit 4-II in Chapter 4 of TR-55 for appropriate t_c for type II rainfall distribution.

Structure Name	t_c (hr)	I_a/P	q_u (csm/in)
WQS	0.167	0.041	950

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$$\mathbf{WQF = (q_u)*(A)*(Q)}$$

where: WQF = water quality flow (cfs)
q_u = unit peak discharge (cfs/mi^2/inch)
A = drainage area (mi^2)
Q = runoff depth (watershed inches)

Structure Name	q_u (csm/in)	A (miles^2)	Q (in)	WQF (cfs)
WQS	950	0.00007	0.950	0.07

NOAA Atlas 14, Volume 10, Version 3
Location name: Buffalo, New York, USA*
Latitude: 42.9792°, Longitude: -78.77°
Elevation: 604 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.277** (0.220-0.349)	**0.336** (0.267-0.424)	**0.433** (0.342-0.547)	**0.513** (0.403-0.652)	**0.623** (0.473-0.827)	**0.705** (0.525-0.955)	**0.793** (0.573-1.11)	**0.897** (0.607-1.27)	**1.05** (0.682-1.54)	**1.18** (0.748-1.76)
10-min	**0.392** (0.312-0.495)	**0.476** (0.378-0.601)	**0.613** (0.484-0.776)	**0.727** (0.572-0.925)	**0.883** (0.670-1.17)	**0.999** (0.744-1.35)	**1.12** (0.811-1.58)	**1.27** (0.860-1.80)	**1.49** (0.967-2.18)	**1.67** (1.06-2.49)
15-min	**0.461** (0.367-0.582)	**0.560** (0.444-0.707)	**0.721** (0.570-0.913)	**0.854** (0.671-1.09)	**1.04** (0.789-1.38)	**1.18** (0.874-1.59)	**1.32** (0.954-1.86)	**1.50** (1.01-2.12)	**1.75** (1.14-2.56)	**1.97** (1.25-2.93)
30-min	**0.636** (0.505-0.802)	**0.773** (0.614-0.976)	**0.997** (0.788-1.26)	**1.18** (0.930-1.50)	**1.44** (1.09-1.91)	**1.63** (1.21-2.21)	**1.83** (1.32-2.57)	**2.07** (1.40-2.94)	**2.43** (1.58-3.56)	**2.73** (1.73-4.07)
60-min	**0.811** (0.644-1.02)	**0.986** (0.783-1.24)	**1.27** (1.01-1.61)	**1.51** (1.19-1.92)	**1.84** (1.40-2.44)	**2.08** (1.55-2.82)	**2.35** (1.69-3.29)	**2.65** (1.80-3.77)	**3.11** (2.02-4.55)	**3.50** (2.21-5.21)
2-hr	**1.01** (0.810-1.27)	**1.23** (0.983-1.54)	**1.59** (1.26-2.00)	**1.88** (1.49-2.38)	**2.29** (1.75-3.02)	**2.60** (1.94-3.49)	**2.92** (2.12-4.07)	**3.30** (2.24-4.65)	**3.87** (2.52-5.62)	**4.35** (2.76-6.43)
3-hr	**1.14** (0.914-1.42)	**1.38** (1.11-1.73)	**1.79** (1.42-2.24)	**2.12** (1.68-2.67)	**2.58** (1.97-3.38)	**2.92** (2.18-3.90)	**3.28** (2.38-4.55)	**3.71** (2.52-5.20)	**4.35** (2.84-6.29)	**4.88** (3.10-7.18)
6-hr	**1.37** (1.10-1.70)	**1.66** (1.34-2.06)	**2.14** (1.72-2.67)	**2.54** (2.02-3.18)	**3.09** (2.38-4.03)	**3.50** (2.63-4.65)	**3.94** (2.87-5.42)	**4.45** (3.04-6.20)	**5.21** (3.41-7.48)	**5.86** (3.74-8.55)
12-hr	**1.62** (1.31-1.99)	**1.96** (1.59-2.42)	**2.52** (2.04-3.12)	**2.99** (2.39-3.71)	**3.63** (2.81-4.70)	**4.11** (3.10-5.42)	**4.62** (3.38-6.32)	**5.22** (3.58-7.22)	**6.12** (4.02-8.72)	**6.87** (4.40-9.96)
24-hr	**1.92** (1.56-2.35)	**2.29** (1.87-2.81)	**2.90** (2.35-3.56)	**3.41** (2.74-4.20)	**4.10** (3.19-5.27)	**4.62** (3.51-6.06)	**5.17** (3.81-7.03)	**5.84** (4.02-8.01)	**6.84** (4.51-9.67)	**7.69** (4.94-11.1)
2-day	**2.31** (1.89-2.80)	**2.68** (2.19-3.26)	**3.28** (2.68-4.00)	**3.79** (3.07-4.64)	**4.48** (3.51-5.72)	**4.99** (3.82-6.51)	**5.55** (4.12-7.50)	**6.23** (4.31-8.49)	**7.27** (4.81-10.2)	**8.17** (5.26-11.7)
3-day	**2.58** (2.12-3.12)	**2.96** (2.43-3.58)	**3.57** (2.92-4.34)	**4.08** (3.32-4.98)	**4.78** (3.75-6.06)	**5.30** (4.06-6.86)	**5.86** (4.35-7.86)	**6.54** (4.53-8.86)	**7.57** (5.02-10.6)	**8.45** (5.45-12.0)
4-day	**2.81** (2.32-3.39)	**3.20** (2.63-3.86)	**3.82** (3.13-4.63)	**4.34** (3.54-5.28)	**5.06** (3.97-6.39)	**5.59** (4.29-7.20)	**6.16** (4.57-8.21)	**6.84** (4.75-9.24)	**7.85** (5.21-10.9)	**8.70** (5.62-12.3)
7-day	**3.39** (2.80-4.06)	**3.80** (3.15-4.57)	**4.49** (3.70-5.40)	**5.05** (4.13-6.11)	**5.83** (4.59-7.29)	**6.42** (4.93-8.17)	**7.03** (5.19-9.22)	**7.70** (5.37-10.3)	**8.63** (5.75-11.9)	**9.38** (6.07-13.2)
10-day	**3.91** (3.25-4.68)	**4.37** (3.62-5.22)	**5.11** (4.22-6.13)	**5.73** (4.70-6.91)	**6.58** (5.18-8.18)	**7.23** (5.55-9.14)	**7.89** (5.81-10.2)	**8.57** (6.00-11.4)	**9.49** (6.34-13.1)	**10.2** (6.61-14.3)
20-day	**5.48** (4.58-6.51)	**6.06** (5.05-7.20)	**6.99** (5.81-8.33)	**7.76** (6.41-9.29)	**8.83** (6.99-10.9)	**9.66** (7.44-12.1)	**10.5** (7.73-13.4)	**11.3** (7.93-14.9)	**12.3** (8.27-16.8)	**13.1** (8.52-18.2)
30-day	**6.84** (5.73-8.08)	**7.50** (6.28-8.87)	**8.58** (7.15-10.2)	**9.48** (7.85-11.3)	**10.7** (8.51-13.1)	**11.7** (9.02-14.5)	**12.6** (9.33-16.1)	**13.5** (9.54-17.8)	**14.7** (9.90-20.0)	**15.6** (10.2-21.6)
45-day	**8.57** (7.21-10.1)	**9.34** (7.84-11.0)	**10.6** (8.86-12.5)	**11.6** (9.66-13.8)	**13.1** (10.4-15.9)	**14.2** (11.0-17.6)	**15.3** (11.3-19.4)	**16.3** (11.5-21.4)	**17.6** (11.9-23.8)	**18.6** (12.1-25.6)
60-day	**10.1** (8.49-11.8)	**10.9** (9.19-12.8)	**12.3** (10.3-14.5)	**13.5** (11.2-15.9)	**15.0** (12.0-18.3)	**16.3** (12.6-20.1)	**17.5** (13.0-22.1)	**18.6** (13.2-24.3)	**20.0** (13.5-27.0)	**21.0** (13.7-28.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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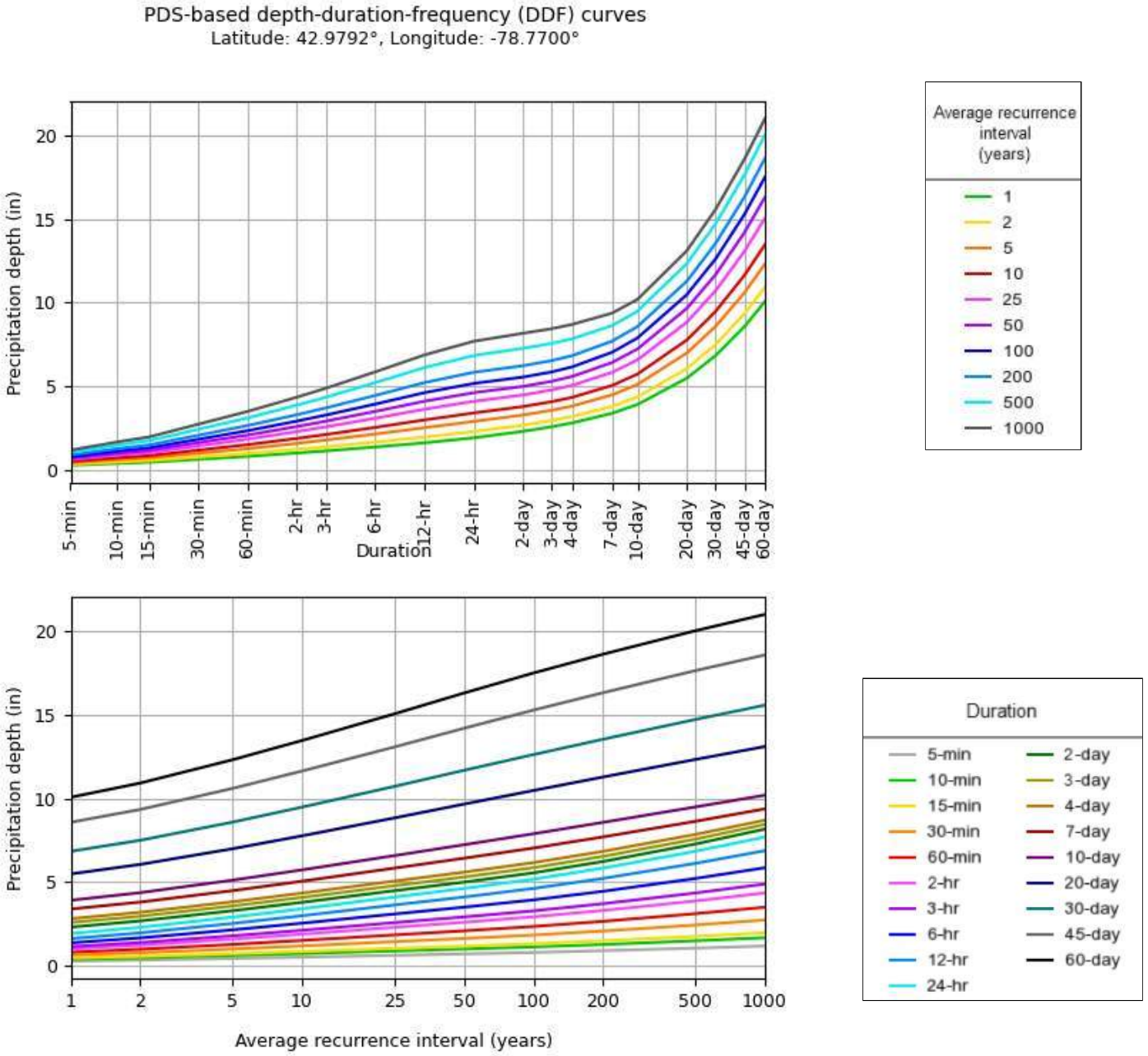
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Wed Jan 21 16:14:30 2026

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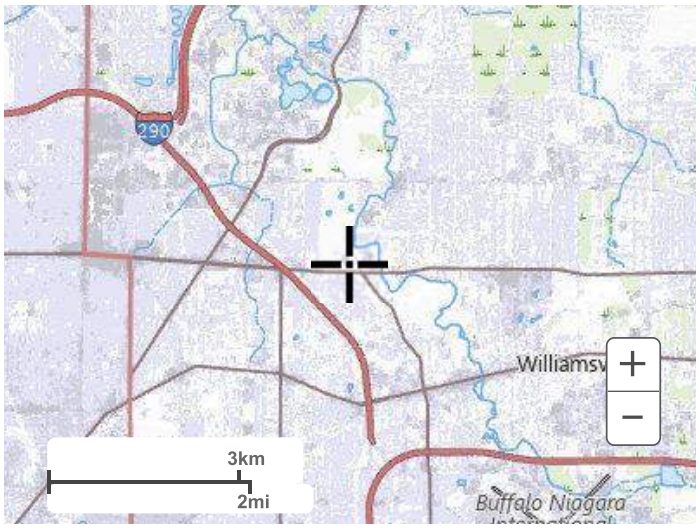
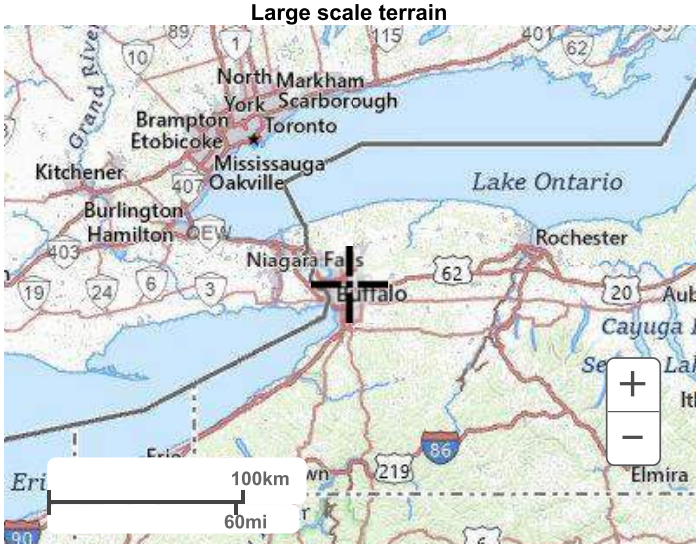
Maps & aerials

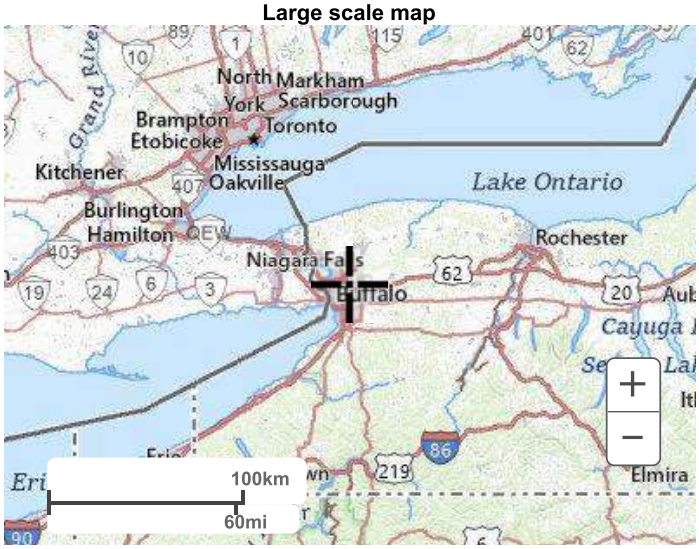
Small scale terrain



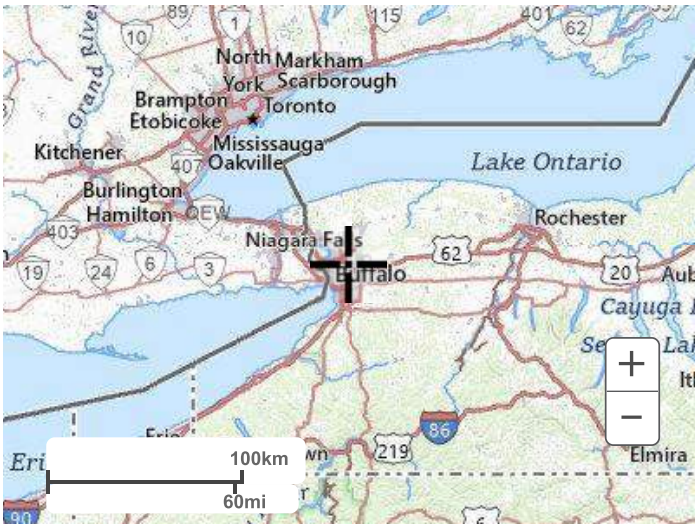
Large scale terrain



Large scale map



Large scale aerial



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

Hydrologic Soil Group—Erie County, New York
(Amherst Central Park, Sheridan Drive & North Forest Road, Amherst, NY)

Map Scale: 1:1,550 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Erie County, New York
Survey Area Data: Version 25, Sep 4, 2025

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

Date(s) aerial images were photographed: May 13, 2023—May 27, 2023

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CrA	Claverack loamy fine sand, 0 to 3 percent slopes	C/D	8.4	100.0%
Totals for Area of Interest			**8.4**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C – Sanitary Sewer Calculations

DATE: April 10, 2026,
PROJECT NAME: Amherst Central Park

Sanitary Calculations

Loading Rates taken from NYSDEC Design Standards for Intermediate Sized Wastewater Treatment Systems (2014) - Table B-3: Typical Per-Unit Hydraulic Loading Rates

Public Park = 4 gpd/person - toilet use only (5 gpd/person reduced by 20% with use of water saving reducing plumbing fixtures)

$LR_{person} := 4 \cdot \frac{gal}{day}$ ***Hydraulic Loading Rate (gal/day per person)***

It is conservatively estimated that the park will be used by 300 people per day at the worst case scenario of a winter market or a busy summer day.

Building Use/Matrix

$N_{people} := 300$ ***300 park visitors***

Average Daily Design Flow

$Q_{avgdaily} := N_{people} \cdot LR_{person}$

$Q_{avgdaily} = 1200 \ \frac{gal}{day}$

$Q_{avgdailygpm} := Q_{avgdaily} \cdot \frac{1 \cdot day}{24 \cdot hr} \cdot \frac{1 \cdot hr}{60 \cdot min}$

$Q_{avgdailygpm} = 0.83 \ gpm$

Average Daily Flowrate = 1,200 gpd = 0.83 gpm

Since the Average Daily Flow of 1,200 gpd is under 2,500 gpd, a Downstream Sanitary Capacity Analysis study is not required.

Peak Hourly Flow

Per Ten States Standards (2014 Edition), Figure 1:

Q Peak Hourly $= ?$ 18 + P1/2 $= ?$ Peak Factor

Q Daily Average 4 + P1/2

where P = population in thousands

$Population := \frac{1200}{100}$ gpd

gpd per person

$Population = 12 \ persons$

{p}{f}

$$P := \frac{Population}{1000}$$

$$P = 0.012$$

PF = Peak factor

$$PF := \frac{18 + P^{\frac{1}{2}}}{4 + P^{\frac{1}{2}}}$$

$$PF = 4.41$$

Q Peak Hourly = (Q Daily Average)(Peak Factor)

$$Q_{peakhourly} := Q_{avgdaily} \cdot PF$$

$$Q_{peakhourly} = 5288 \ \frac{gal}{day}$$

$$Q_{peakhourlygpm} := Q_{peakhourly} \cdot \frac{1 \cdot day}{24 \cdot hr} \cdot \frac{1 \cdot hr}{60 \cdot min}$$

$$Q_{peakhourlygpm} = 3.7 \ gpm$$

Q Peak Hourly = 5,288 gpd = 3.70 gpm

{p}{f}

Appendix D – Water Calculations

DATE: July 9, 2026
PROJECT NAME: Amherst Central Park

Water Demand

Domestic Service

Domestic water demand approximately equal to peak sewer flow = 3.7 gpm

To be conservative, use a peak domestic flow of 30 gpm

$Q_{DomesticPeak} := 30 \quad gpm$

Hydrant Flow Test information provided by the Erie County Water Authority dated 6/17/2026 for 1st hydrant north of Sheridan Drive, on North Forest Road.

Static Pressure = 84 psi

Residual Pressure = 80 psi with total flow of 500 gpm

$Pressure_{static} := 84 \quad psi$

$Pressure_{residual} := 80 \quad psi$

Determine headloss in proposed domestic service:

Length of 2 inch Type 'K' copper domestic service from tap location to the building = 165 ft

$L_D := 165 \quad feet$

$D_D := 2 \quad inches$

$C_D := 140$

$$h_L := \frac{10.44 \cdot L_D \cdot Q_{DomesticPeak}^{1.85}}{C_D^{1.85} \cdot D_D^{4.87}}$$

$h_L = 3.408 \quad feet$

$h_{Lpsi} := 0.433 \cdot h_L$

$h_{Lpsi} = 1.5 \quad psi$

Determine headloss due to fittings:

$h_{Lfittings} := 1 \quad psi$

Determine headloss due to elevation:

Elevation Change = 606.0 - 605.00 = 1.0 foot

$h_{lelevation.ft} := 1.0 \quad foot$

$h_{lelevation} := 0.433 \cdot h_{lelevation.ft}$

$h_{lelevation} = 0.4 \quad psi$

{p}{f}

Determine headloss through 6-inch Watts LF957 RPZ:
- refer to attached cut sheet w/ 30 gpm domestic flow

$h_{LRPZ} := 12 \quad psi$

Determine headloss through 6-inch Neptune Protectus III meter:
- refer to attached cut sheet w/ 30 gpm domestic flow

$h_{LMeter} := 2 \quad psi$

Calculate Residual Pressure at building:

Residual Pressure = Residual in watermain - Sum of headloss

$Pressure_{residualbldg} := Pressure_{residual} - \left(h_{Lpsi} + h_{Lfittings} + h_{lelevation} + h_{LRPZ} + h_{LMeter}\right)$

$Pressure_{residualbldg} = 63 \quad psi$

A 2-inch Type 'K' copper domestic water service lateral has capacity for the proposed domestic water demand with a residual pressure of 63 psi at the building.

{p}{f}

A PRODUCT SHEET OF NEPTUNE TECHNOLOGY GROUP

High Performance PROTECTUS® III Stainless Steel (S) Fire Service Meter

SIZES: 4", 6", 8", and 10"

The Neptune® HP PROTECTUS® III Stainless Steel (S) fire service meter measures extremely wide flow ranges at 100% ± 1.5% accuracy. All HP fire service meters meet or exceed AWWA C703 Standard, are certified to NSF/ANSI 61 and 372 requirements, and are Underwriters Laboratory (UL) Listed and Factory Manual (FM) Approved for fire service use.

Application

The HP PROTECTUS III S fire service meter is designed to measure both domestic and fire service water usage through a single water line. A typical application would be in a warehouse, hotel, or hospital where one water line may supply any number of faucets or bathrooms as well as an automatic sprinkler system.

Operation

At low flow rates, all flow is through the bypass meter. As flow increases, pressure loss through the bypass meter increases and the detector check valve automatically opens. This condition occurs, for example, when a fire sprinkler system goes into operation. This permits flow through the mainline turbine meter. As flow decreases, reduced pressure loss closes the detector check valve and flow is again directed through the bypass meter.

Construction

The combined readings of the mainline turbine and the bypass meter indicate total consumption through the HP PROTECTUS III S meter.

- 300 series stainless steel mainline body
- Integral detector check valve (stainless steel spring-loaded type)
- 300 series stainless steel strainer body with stainless steel basket
- Epoxy-coated steel strainer and valve cover
- HP Turbine measuring element
- Lockable ball valves used on bypass
- Check valve used on bypass
- 1" T-10® meter (on 4" size)
- 1½" T-10 or 1½" HP Turbine meter (on 6" size)
- 2" T-10 or 2" HP Turbine meter (on 8" and 10" sizes)

KEY FEATURES

Compact Size

- Standard laying length fits existing installations
- Lowers new installation and replacement costs

Wide Operating Range

- Measures extremely wide flow ranges at 98.5%–101.5% accuracy
- Combines low-flow sensitivity of disc meter with high-flow capacity of turbine meter
- Registers leaks or unauthorized use of water from fire service lines

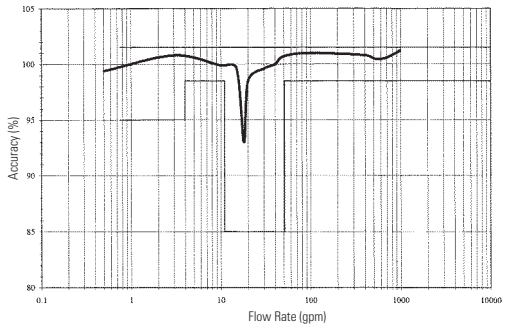
Component Repair and Maintenance

- Owner maintenance easily accomplished by replacement of major components
- Calibration vane allows in-field calibration of unitized measuring element (UME)

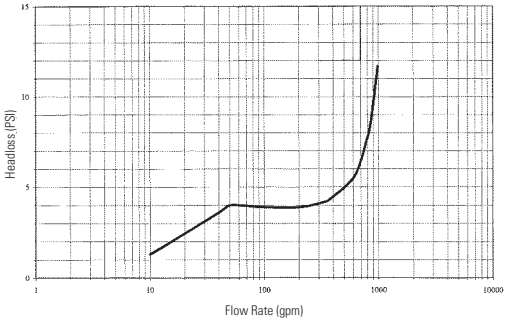
Roll-Sealed Registers

- Eliminates leaking and fogging
- In-line serviceability
- Magnetic driven, low-torque registration
- Tamperproof seal design

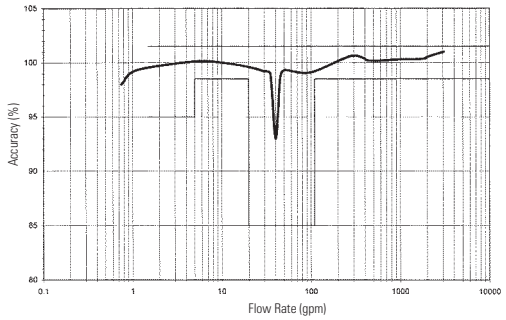
4" Accuracy



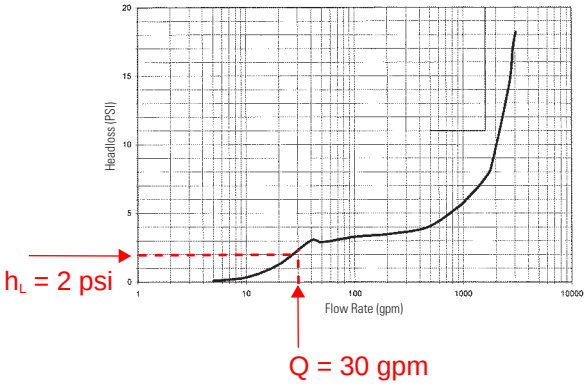
4" Headloss



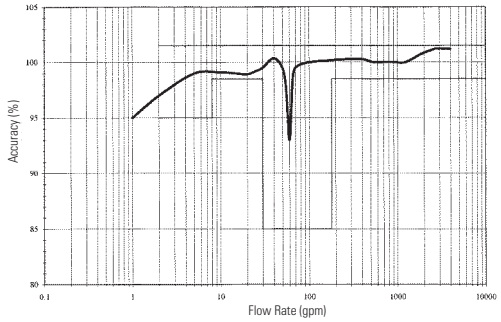
6" Accuracy



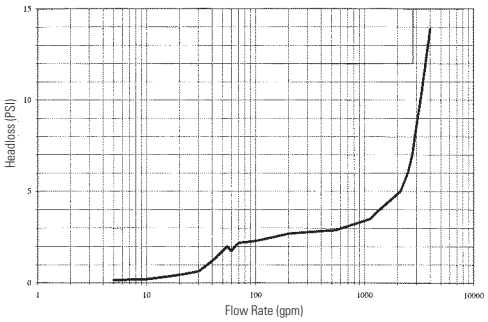
6" Headloss



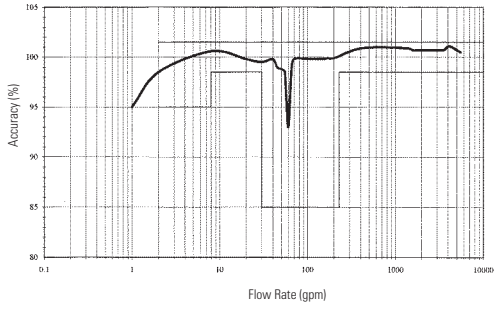
8" Accuracy



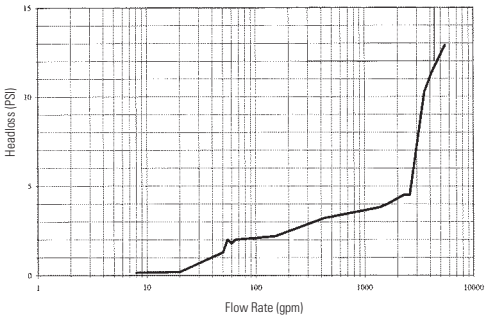
8" Headloss



10" Accuracy



10" Headloss



These charts show typical meter performance. Individual results may vary.

Operating Characteristics

Meter Size	Normal Operating Range @ 100% Accuracy (+/- 1.5%)	AWWA Standard	Low Flow @ 95% - 101% Accuracy	Maximum Intermittent Flow Rate
4"	¾ to 1200 US gpm 0.171 to 272.55 m³/h	4 to 700 US gpm 0.91 to 159 m³/h	⅜ US gpm 0.09 m³/h	1500 US gpm 340.7 m³/h
6"	1½ to 2500 US gpm 0.34 to 567.81 m³/h	5 to 1600 US gpm 1.14 to 363 m³/h	¾ US gpm 0.17 m³/h	3100 US gpm 704.1 m³/h
8"	2 to 4000 US gpm 0.45 to 908.5 m³/h	8 to 2800 US gpm 1.8 to 636 m³/h	1 US gpm 0.23 m³/h	5000 US gpm 1135.6 m³/h
10"	2 to 6500 US gpm 0.45 to 1476.31 m³/h	8 to 4400 US gpm 1.8 to 999 m³/h	1 US gpm 0.23 m³/h	8000 US gpm 1817 m³/h

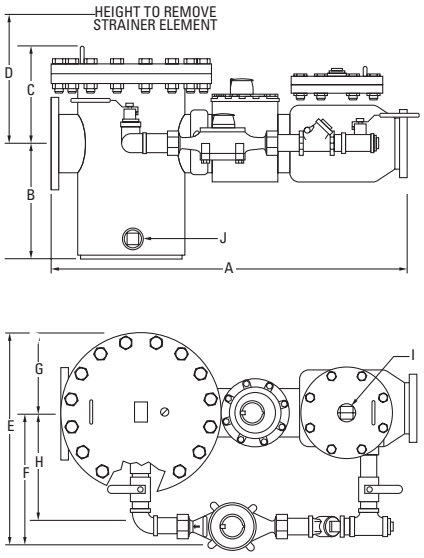
Dimensions

Meter Size	A in/mm	B in/mm	C in/mm	D in/mm	E in/mm	F in/mm	G in/mm	H in/mm	I in/mm	J in/mm	Weight lbs/kg
4"	33 838	10 254	10 ¾ 273	17 ½ 445	22 559	15 ¼ 387	6 ¾ 171	12 305	2 51	2 51	215 98
6"	45 1143	11 1/16 281	11 ⅜ 289	21 ¼ 540	29 737	19 ½ 495	9 ½ 241	16 406	2 51	3 76	570 258
8"	53 1346	11 13/16 300	13 29/64 342	25 ⅞ 657	34 ¼ 870	21 ¾ 552	12 ½ 318	17 432	3 76	3 76	765 347
10"	68 1727	14 13/16 376	15 381	30 1/16 764	36 ¼ 921	22 ½ 572	13 ¾ 349	18 457	3 76	3 76	900 408

Registration

Registration (per sweep hand revolution)	Disc Side			Turbine Side		
	1"	1½"	2"	4"	6"	8" & 10"
1,000 US Gallons					✓	✓
100 Gallons		✓	✓	✓		
100 Cubic Feet					✓	✓
10 US Gallons	✓					
10 Cubic Feet		✓	✓	✓		
1 Cubic Foot	✓					
10 Cubic Metres					✓	✓
1 Cubic Metre			✓	✓		
0.1 Cubic Metre	✓	✓				

Register Capacity (6 active wheel odometer)	Disc Side			Turbine Side		
	1"	1½"	2"	4"	6"	8" & 10"
1,000,000,000 Gallons					✓	✓
100,000,000 Gallons		✓	✓	✓		
100,000,000 Cubic Feet					✓	✓
10,000,000 Gallons	✓					
10,000,000 Cubic Feet		✓	✓	✓		
10,000,000 Cubic Metres					✓	✓
1,000,000 Cubic Metres			✓	✓		
1,000,000 Cubic Feet	✓					
100,000 Cubic Metres	✓	✓				



Specifications

Application

- Cold water measurement of flow in one direction

Maximum Operating Pressure

- 175 psi (1206 kPa)

Register

- Direct reading, center sweep, roll-sealed magnetic drive with low-flow indicator

Measuring Element

- AWWA Class II Turbine, hydrodynamically-balanced rotor, nutating disc

Flanges

- Round flanged ends per AWWA C207, Class D

Approvals

- NSF/ANSI 61
- NSF/ANSI 372
- UL Listed
- FM Approved

Options

Sizes

- 4", 6", 8", and 10"

300 Series Stainless Steel Strainer Cover and Valve Cover

300 Series Stainless Steel Bolts

Left Side Bypass

Units Of Measure

- U.S. gallons, Imperial gallons, cubic feet, cubic metres

Register types

- Remote reading systems*: ProRead™, ProCoder™, E-CODER®, E-CODER®)R900*i*™, E-CODER®)R450*i*™, TRICON®/S, TRICON/E®3
- Reclaim

Companion Flanges

- Cast iron
- Bronze (4" only)

Special Meter Flanges**

- 12" (for 10" meter size)

**Consult factory for meter performance specifications when fitted with ARB.*

***Non-UL/FM approved.*

Guaranteed Systems Compatibility

All HP PROTECTUS III S fire service meters are guaranteed adaptable to our ProRead, ProCoder, E-CODER, E-CODER)R900*i*, E-CODER)R450*i*, TRICON/S, TRICON/E3, and Neptune meter reading systems without removing the meter from service.

Warranty

Neptune provides a limited warranty with respect to its HP PROTECTUS III S fire service meter for performance, materials, and workmanship.

When desired, owner maintenance is easily accomplished by in-line replacement of the UME.

NEPTUNE TECHNOLOGY GROUP

#winyourday
neptunetg.com

Neptune Technology Group
1600 Alabama Highway 229
Tallassee, AL 36078
800-633-8754 f 334-283-7293

Engineering Specification

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

LEAD FREE*

Series 957

Reduced Pressure Zone Assembly

2½" – 10"

Series 957 Reduced Pressure Zone assembly provides protection to the potable water system from contamination in accordance with national plumbing codes. The assemblies are normally used in health hazard applications for protection against backsiphonage or backpressure.

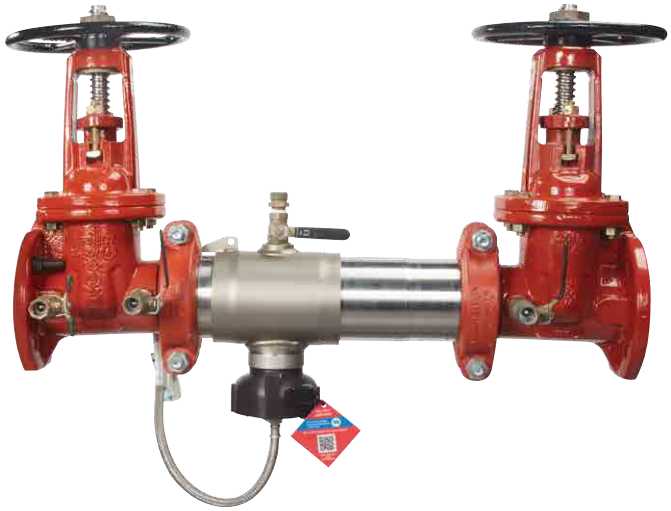
The series includes a flood sensor to detect excessive water discharges from the relief valve. The sensor is installed on the assembly exterior and does not alter assembly functions or certifications. The sensor relays a signal that triggers notification to facility personnel for corrective action, thus limiting flooding and costly damage.

NOTICE

An add-on connection kit is required to activate the flood sensor. Without the connection kit, the sensor is a passive component that has no communication with any other device. (For more information download RP/IS-957/957DCDA.)

Features

- Sizes 2½", 3", and 4" available with quarter-turn ball valve shutoffs
- Replaceable check disc rubber
- Extremely compact design
- 70% Lighter than traditional designs
- 304 (Schedule 40) stainless steel housing and sleeve
- Groove fittings allow integral pipeline adjustment
- Patented torsion spring checks provide lowest pressure loss
- Unmatched ease of serviceability
- Bottom mounted cast stainless steel relief valve
- Available with grooved butterfly valve shutoffs
- Sensor on relief valve for flood detection
- Flood alerts feature activated with add-on sensor connection kit, compatible with BMS and cellular network communication



957-OSY with Flood Sensor

NOTICE

Use of the flood sensor does not replace the need to comply with all required instructions, codes, and regulations related to installation, operation, and maintenance of this product, including the need to provide proper drainage in the event of a discharge.

Watts is not responsible for the failure of alerts due to connectivity issues, power outages, or improper installation.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

Inquire with governing authorities for local installation requirements.

*The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.

WATTS®

Specification

The Reduced Pressure Zone assembly shall consist of two independent torsion spring check modules, a differential pressure relief valve located between and below the two modules, two drip tight shutoff valves, and required torsion spring check modules and relief valve shall be contained with a sleeve accessible single housing constructed from 304 (Schedule 40) stainless steel pipe with groove end connections. Torsion spring checks shall have replaceable elastomer discs and in operation produce drip tight closure against the reverse flow of liquid caused by backpressure or backsiphonage. The assembly shall be a Watts Series 957, and shall include a flood sensor on the relief valve for flood detection.

Model/Option

FS	Flood sensor on relief valve for flood detection
NRS	Non-rising stem, resilient seated gate valves
OSY	UL Classified and FM Approved outside stem and yoke resilient seated gate valves
N	N-pattern orientation
Z	Z-pattern orientation
BFG	UL Classified and FM Approved grooved gear operated butterfly valves with tamper switch
QT	2½" - 4" quarter-turn ball valves
OSY FxG**	Flanged inlet gate connection and grooved outlet gate connection
OSY GxF**	Grooved inlet gate connection and flanged outlet gate connection
OSY GxG**	Grooved inlet gate connection and grooved outlet gate connection

Materials

Housing & Sleeve	304 (Schedule 40) stainless steel
Elastomers	EPDM, silicone, and Buna-N
Torsion Spring Checks	Noryl®, stainless steel
Check Discs	Reversible silicone or EPDM
Test Cocks	Lead Free* bronze body
Pins & Fasteners	300 Series stainless steel
Springs	Stainless steel

Pressure — Temperature

Temperature Range	33°F – 140°F (0.5°C – 60°C)
Maximum Working Pressure	175 psi (12.1 bar)

Approvals

- Approved by the Foundation for Cross-Connection Control and Hydraulic Research at The University of Southern California (FCCCHR-USC), excluding 10" N-pattern installation as well as 6" and 10" Z-pattern installations
- AWWA C511-97

1013 B64.4 (**BFG & OSY Only)

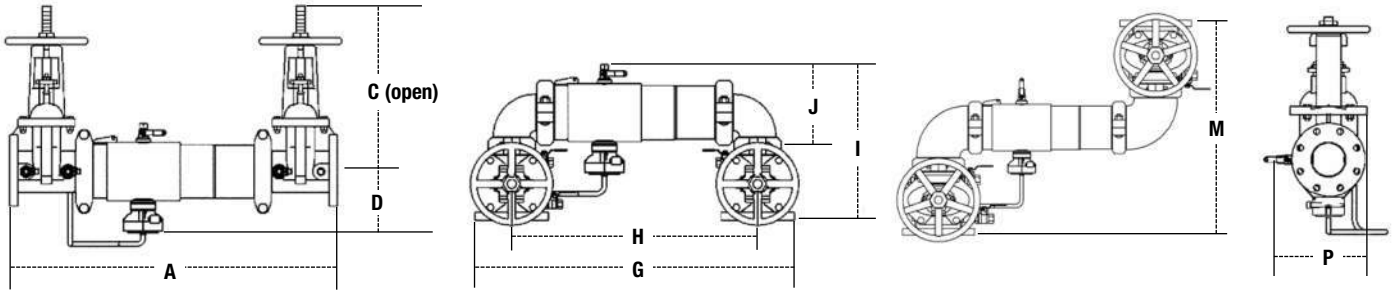
For additional approval information, contact the factory or visit watts.com.

NOTICE

When installing a drain line on Series 957 backflow preventers, use 957AG air gaps. Attach the air gap brackets directly onto the flood sensor. For additional information, refer to ES-AG/EL/TC at watts.com

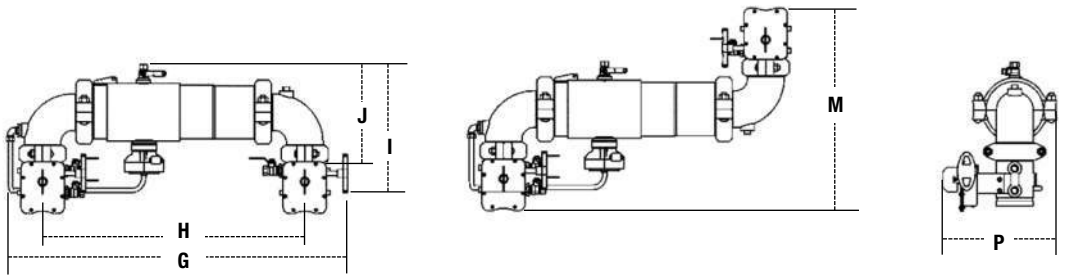
**Options for the gate valve:
– Consult factory for dimensions.
– Available with grooved NRS gate valves; consult factory.
– Post indicator plate and operating nut available; consult factory.

Dimensions - Weight



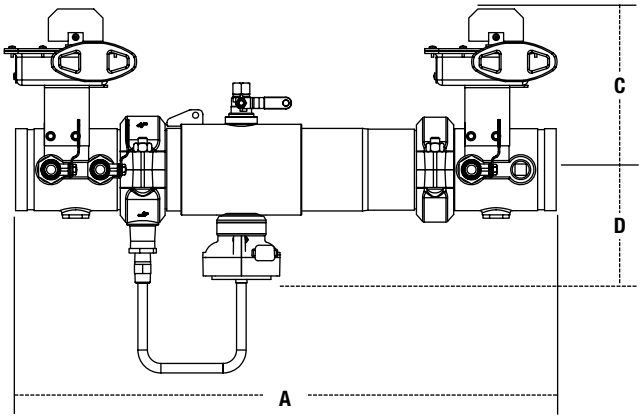
957, 957N, 957Z

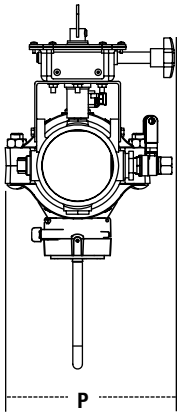
SIZE	DIMENSIONS																		WEIGHT					
	A		C (OSY)		C (NRS)		D		G		H		I		J		M		P		957NRS		957OSY		957N NRS		957N OSY	
in.	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lb*	*kg*	*lb*	*kg*	*lb*	*kg*	*lb*	*kg*
2½	30¾	781	16⅜	416	9⅜	238	6½	165	29 1/16	738	21½	546	15½	393	8 13/16	223	21¼	540	9 3/16	234	118	54	128	58	126	57	136	62
3	31¾	806	18⅞	479	10¼	260	6 11/16	170	30¼	768	22¼	565	17⅛	435	9 3/16	233	23	584	10½	267	134	61	148	67	147	67	161	73
4	33¾	857	22¾	578	12 3/16	310	7	178	33	838	23½	597	18½	470	9 15/16	252	26¼	667	11 3/16	284	164	74	164	74	187	85	187	85
6	43½	1105	30⅛	765	16	406	8½	216	44¾	1137	33½	851	23 3/16	589	13 1/16	332	34¼	870	15	381	276	125	298	135	317	144	339	154
8	49¾	1264	37¾	959	19 15/16	506	9 11/16	246	54⅛	1375	40⅛	1019	27 7/16	697	15 11/16	399	36⅞	937	17 3/16	437	441	200	483	219	516	234	558	253
10	57¾	1467	45¾	1162	23 13/16	605	11 3/16	285	66	1676	49½	1257	32½	826	17 5/16	440	44½	1124	20	508	723	328	783	355	893	405	950	431



957NBFG, 957ZBFG

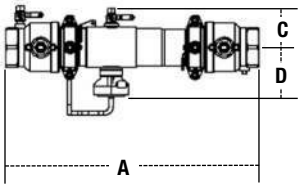
SIZE	DIMENSIONS												WEIGHT	
	G		H		I		J		M		P		957N/957Z	
in.	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lb*	*kg*
2½	32½	826	23	584	15½	394	9½	241	19¾	502	11 13/16	300	67	30
3	34	864	24	610	16 5/16	414	10 1/16	256	21¼	540	12⅛	308	70	32
4	35⅝	905	25½	648	17 3/16	437	10 15/16	279	23½	597	12⅝	321	87	39
6	46½	1181	35¼	895	20½	521	13½	343	27¼	692	15	382	160	73

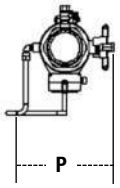


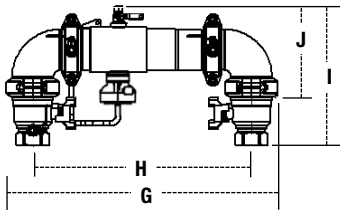


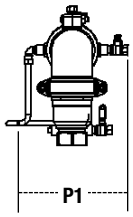
957 BFG

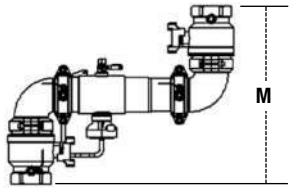
SIZE	DIMENSIONS								WEIGHT	
	A		C		D		P			
in.	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lb*	*kg*
4	29	737	7¾	197	6⅜	162	9½	241	66	30
6	36½	927	9 11⁄16	246	7 7⁄16	189	14¼	362	122	55











957QT

SIZE	DIMENSIONS																		WEIGHT	
	A		C		D		G		H		I		J		M		P		P1		QT		QTN	
in.	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lb*	*kg*	*lb*	*kg*
2 1⁄2	27 1⁄2	698	4 7⁄8	124	6 7⁄8	175	30¼	768	21½	546	16 1⁄16	407	11⅜	289	19 7⁄8	505	11 5⁄16	287	11 5⁄16	287	46	21	57	26
3	28	711	4 7⁄8	124	6 7⁄8	175	30¼	768	22¼	565	16 9⁄16	420	11⅜	289	20 7⁄8	531	11 5⁄16	287	11 5⁄16	287	56	25	67	30
4	28 3⁄4	730	4 7⁄8	124	6 7⁄8	175	30¼	768	23½	597	18 5⁄16	465	11⅜	289	24 3⁄8	619	11 5⁄16	287	11 5⁄16	287	76	34	87	39

Capacity

Flow curves as tested by Underwriters Laboratories.

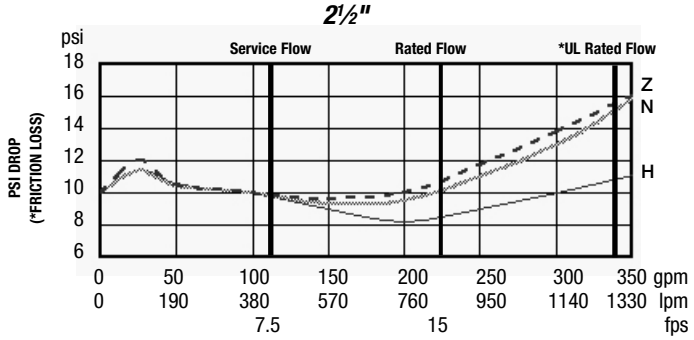
Flow capacity chart identifies valve performance based upon rated water velocity up to 25 fps.

- Service Flow is typically determined by a rated velocity of 7.5 fps based upon schedule 40 pipe.
- Rated Flow identifies maximum continuous duty performance determined by AWWA.
- UL Flow Rate is 150% of Rated Flow and is not recommended for continuous duty.
- AWWA Manual M22 (Appendix C) recommends that the maximum water velocity in services be not more than 10 fps.

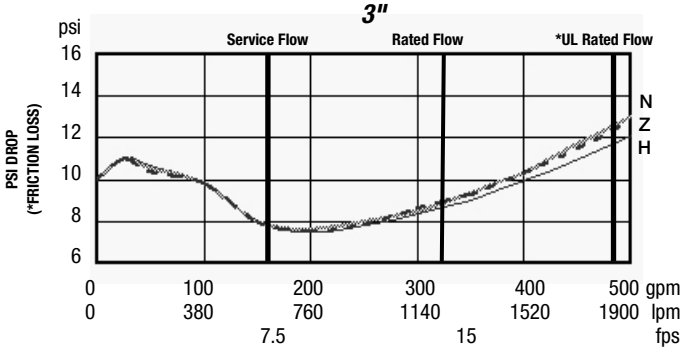
Flow characteristics collected using butterfly shutoff valves.

Horizontal N-pattern Z-pattern

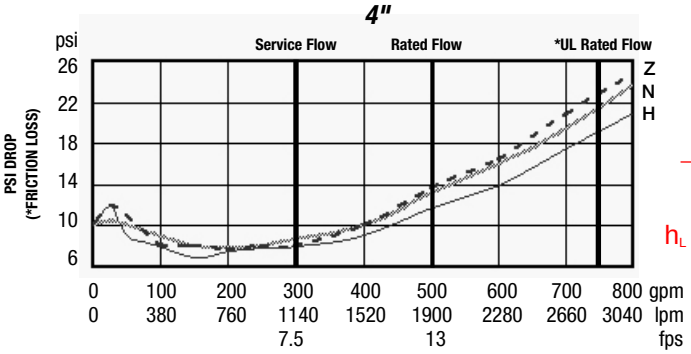
2½"



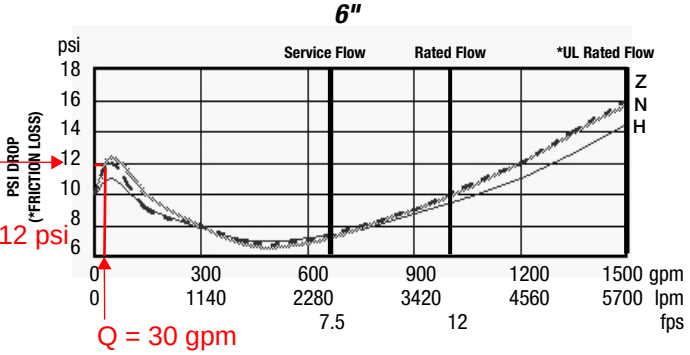
3"



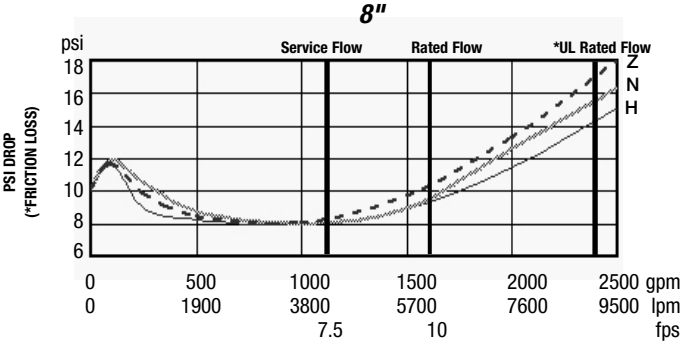
4"



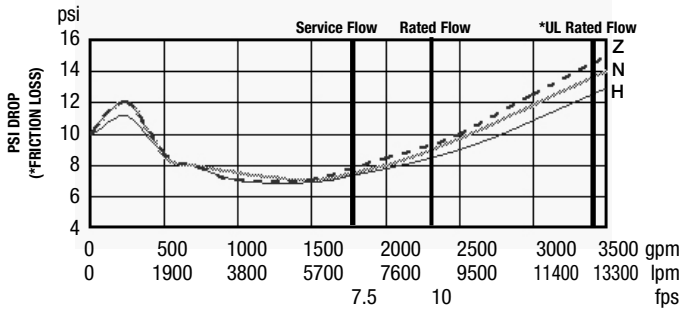
6"



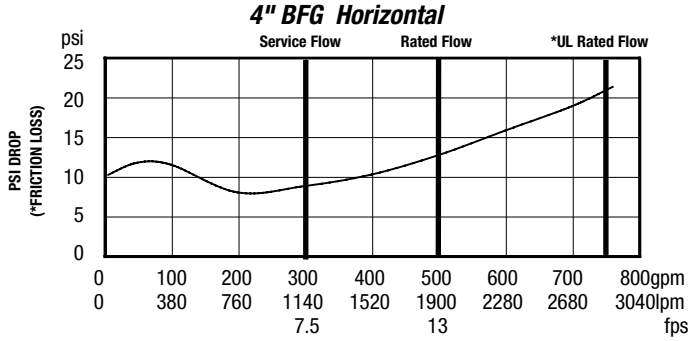
8"



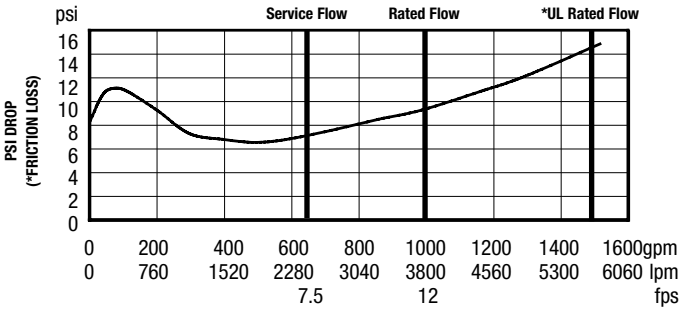
10"



4" BFG Horizontal



6" BFG Horizontal



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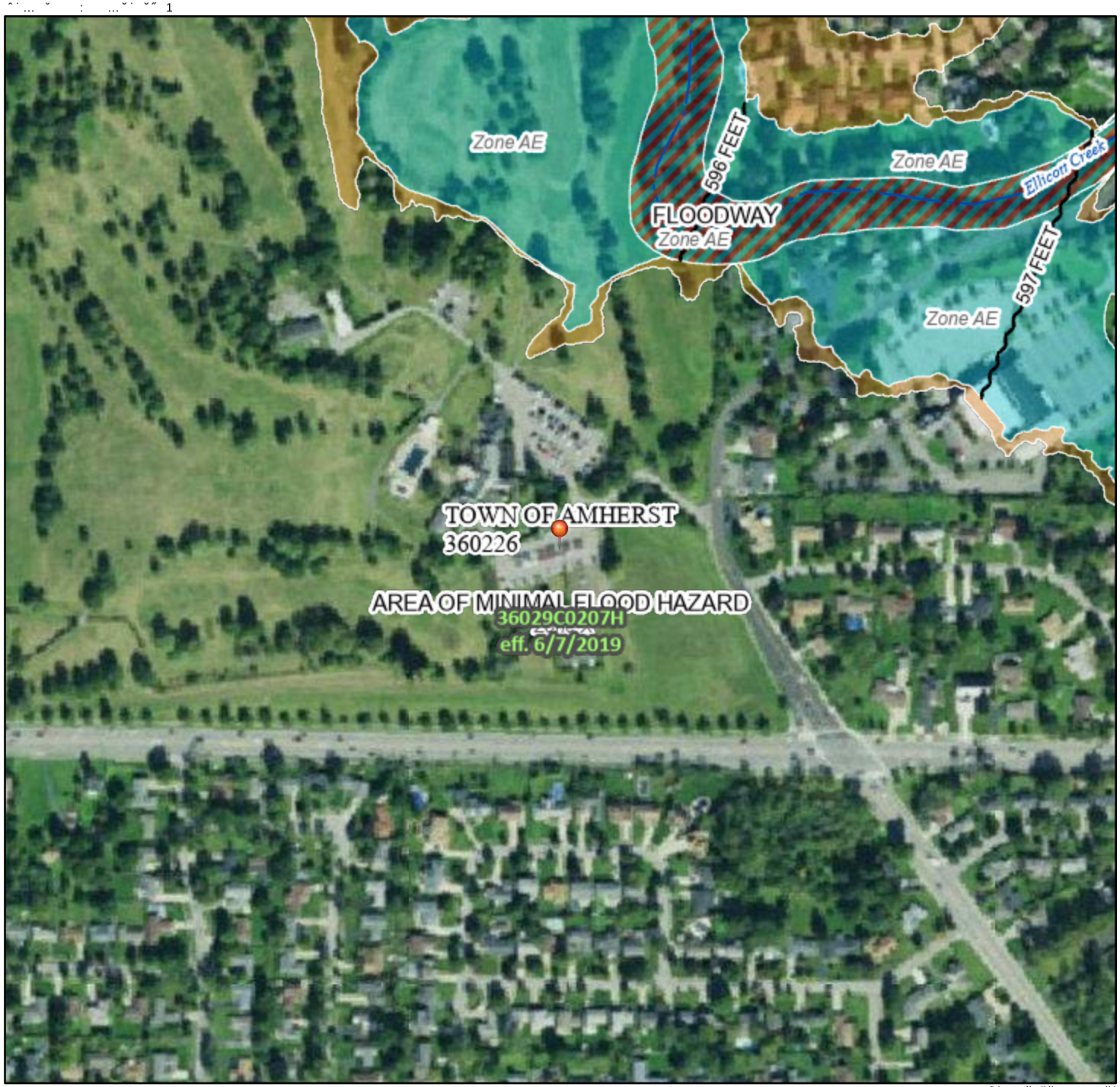
Appendix E – FEMA Firmette – Part of Panel 36029C0207H

1DWLRQDO)ORRG +D]DUG / FEMA



)HHW

/HJHQG

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63(&,$/)/2
+$=$5' $5(
:LWKRXW %DVH)ORRG (O
=RQH $ 9 $
:LWK %)(RU +HSWK
5HJXODWRU\ )ORRGZD\

$QQXDO &KDQFH)ORR
RI DQQXDO FKDQFH IO
GHSWK OHVV WKDQ RQH
DUHDV RI OHVV WKDQ RQ
)XWXUH &RQGLWLRQV
&KDQFH)ORRG +D]DUG
$UHD ZLWK 5HGXFHG)OR
/HYHH 6HH 1RWHV
27+(5 $5($6 2)
)/22' +$=$5'
$UHD ZLWK)ORRG 5LVN

12 6&5((
$UHD RI 0LQLPDO)ORRG
(IIHFWLYH /205V
27+(5 $5($6
$UHD RI 8QGHWHUPLQHG

*(1(5$/
6758&785(6
&KDQQHO &XOYHUW RU
/HYHH 'LNH RU)ORRGZD

&URVV 6HFWLRQV ZLWK
:DWHU 6XUIDFH (OHYDWL
&RDVWDO 7UDQVHFW
%DVH)ORRG (OHYDWLRQ
/LPLW RI 6WXG\
-XULVGLFWLRQ %RXQGDU
&RDVWDO 7UDQVHFW %DV
27+(5
)($785(6
3URILOH %DVHOLQH
+\GURJUDSKLF)HDWXUH

'LJLWDO 'DWD $YDLODEO
1R 'LJLWDO 'DWD $YDLOD
0$3 3$1(/6
8QPDSSHG

7KH SLQ GLVSOD\HG RQ WKH
SRLQW VHOHFWHG E\ WKH XV
DQ DXWKRULWDWLYH SURSHU

7KLV PDS FRPSOLHV ZLWK)(0$ V VWDQ
GLJLWDO IORRG PDSV LI LW LV QRW YR
7KH EDVHPDS VKRZQ FRPSOLHV ZLWK)(
DFFXUDF\ VWDQGDUGV

7KH IORRG KD]DUG LQIRUPDWLRQ LV GH
DXWKRULWDWLYH 1)+/ ZHE VHUYLFHV S
ZDV H[SRUWHG RQ ; DQG GHV QRW
UHIOHFW FKDQJHV RU DPHQGPHQWV VX
WLPH 7KH 1)+/ DQG HIIHFWLYH LQIRUP
EHFRPH VXSHUVHGHG E\ QHZ GDWD RYH

7KLV PDS LPDJH LV YRLG LI WKH RQH R
HOHPHQWV GR QRW DSSHDU EDVHPDS
OHJHQG VFDOH EDU PDS FUHDWLRQ G
),50 SDQHO QXPEHU DQG),50 HIIHFWLY
XQPDSSHG DQG XQPRGHUQL]HG DUHDV
UHJXODWRU\ SXUSRVHV

%DVHPDS ,PDJHU\ 6RXUFH¸ 86*6 1DWLRQDO 0DS

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