Sullivan Engineering Group, LLC
Civil Engineers & Land Development Consultants

December 7, 2015

Town of Reading
Engineering Division
16 Lowell Street
Reading, MA 01867

Re: 186-190 Summer Avenue, Reading
Drainage Design

This drainage study is being conducted at the above property for construction of a parking lot, concrete walkways, and site amenities.

Soil testing was conducted on-site on October 27, 2014 & November 23, 2015 and was witnessed by the Town of Reading Engineering Department. The testholes results showed the site was highly suitable for drainage recharge (Class A soils) at the front of the property with a seasonal groundwater table approximately eight (8) below grade. The testhole to the rear of the property (TH-3) appeared to a Class A Loamy Sand, but as a conservative design approach the soil was identified as a Class B "Sandy Loam". The NRCS soil survey maps for this site identify the entire site as a Class A soil area The Rawls rate method was used as a conservative approach to sizing the drainage BMP's.

The subject property presently drains into two directions. A small portion of the front yard drains towards Summer Avenue. The majority of the site drains overland towards the rear of the property. An effort has been made to match the existing site topography as closely as possible. This was achieved by utilizing porous pavement with a crushed stone base for a portion of the driveway and parking areas. The rear of the site is surfaced with traditional pavement which sheet flows to deep sump catchbasins w/ gas hoods, to a stormceptor unit, and ultimately a subsurface cultec infiltration field.

A HydroCAD model, using TR-20 methodology, was developed to evaluate the pre-development and post-development site conditions. The peak rates of stormwater runoff and volume of stormwater runoff directed towards Summer Avenue is equal in the predevelopment and postdevelopment scenario. The peak rate of stormwater runoff and volume of stormwater runoff was reduced for the 2 yr, 10 yr, 25 yr, and 100 yr storm event for the design point at the rear of the property. The following is a tabular summary of the peak rate of runoff for various storm events to the rear of the property.

	Predevelopment (cfs)	Postdevelopment (cfs)
2 Year	0.02	0.01
10 Year	0.44	0.24
25 Year	0.92	0.51
100 Year	1.69	0.93

Attached are the HydroCAD summaries for the Predevelopment and Postdevelopment scenario. For each analysis a watershed map has been provided to show the subcatchment area(s) evaluated.

Very Truly Yours,

John (Jack) D. Sullivan III, PE

COMMONWEALTH OF MASSACHUSETTS
JOHN D. SULLIVAN III
CIVIL
No. 41536
REGISTERED PROFESSIONAL ENGINEER

PO Box 2004 Woburn, MA 01888 (781) 854-8644 email: jacksull53@comcast.net

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 186 Summer Avenue

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Subsurface Infiltration Structure	**0.80**	**0.75**	**0.60**	**0.15**
Oil Grit Separator	**0.25**	**0.15**	**0.04**	**0.11**
	0.00	**0.11**	**0.00**	**0.11**
	0.00	**0.11**	**0.00**	**0.11**

Total TSS Removal = **89%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:
Prepared By: **JDS**
Date: **12/7/2015**

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

STORMWATER QUALITY WORKSHEET

Stormwater Management Standard #3

Project:	186 Summer Avenue	**Calc By:**	JDS
Date:	7-Dec-15	**Client:**	Criterion

SECTION 1: **Water Quality Volume Calculation:**

REQUIRED:

Impervious Area:

21,701 S.F = 0.50 Acres

Volume Required:

21,701 S.F x 0.5 Inches x $\frac{1 \text{ Ft}}{12 \text{ inches}}$ 904 C.F.

PROPOSED:

Field #1 (Infiltrators) = 937 C.F.

10- Year Storm

SO	937 C.F.	>	904 C.F.

SECTION 2: **Recharge Volume Calculations**

REQUIRED:

Total Impervious Area:

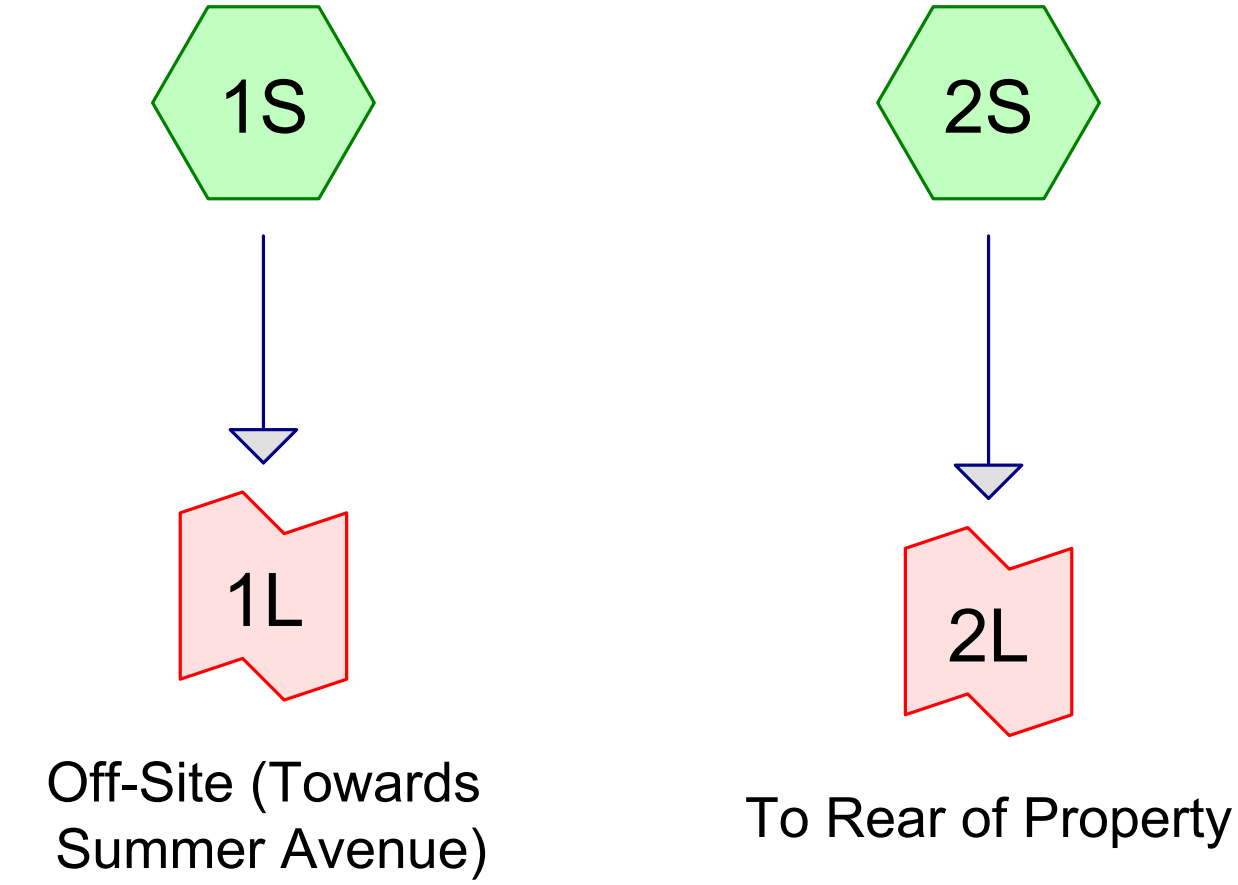
21,701 S.F = 0.50 Acres

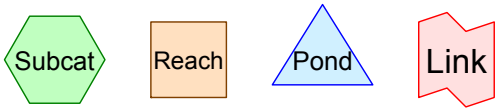
			Vol To Recharge (x Imp. Area)	
21,701	S.F. Over Soil Type "A" material	=	0.60	Inches of Runoff
	S.F. Over Soil Type "B" material	=	0.35	Inches of Runoff
	S.F. Over Soil Type "C" material	=	0.25	Inches of Runoff
	S.F. Over Soil Type "D" material		0.10	Inches of Runoff

Recharge Voulume:

21,701 s.f. x 0.60 x $\frac{1 \text{ Ft}}{12 \text{ inches}}$ (Class A Soil) = 1,085 C.F.

Field #1	2,352 C.F.	>	1,085 C.F.





Drainage Diagram for Predevelopment
Prepared by {enter your company name here} 12/9/2015
HydroCAD® 7.00 s/n 001433 © 1986-2003 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=0.12"
Tc=6.0 min CN=51 Runoff=0.00 cfs 0.001 af

Subcatchment 2S: Runoff Area=68,781 sf Runoff Depth=0.07"
Tc=6.0 min CN=48 Runoff=0.02 cfs 0.009 af

Link 1L: Off-Site (Towards Summer Avenue) Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Link 2L: To Rear of Property Inflow=0.02 cfs 0.009 af
Primary=0.02 cfs 0.009 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.010 af Average Runoff Depth = 0.07"

Subcatchment 1S:

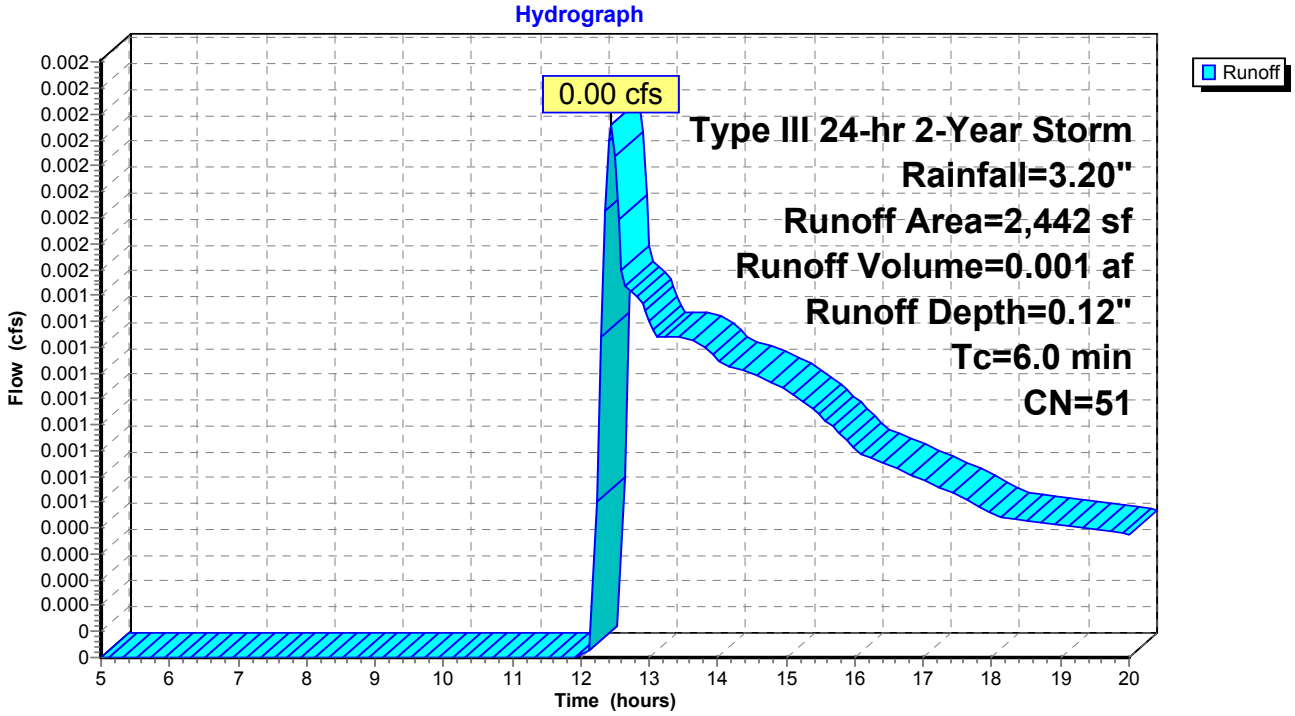
Runoff = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.20"

Area (sf)	CN	Description
107	98	Portion of Front Porch Roof
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

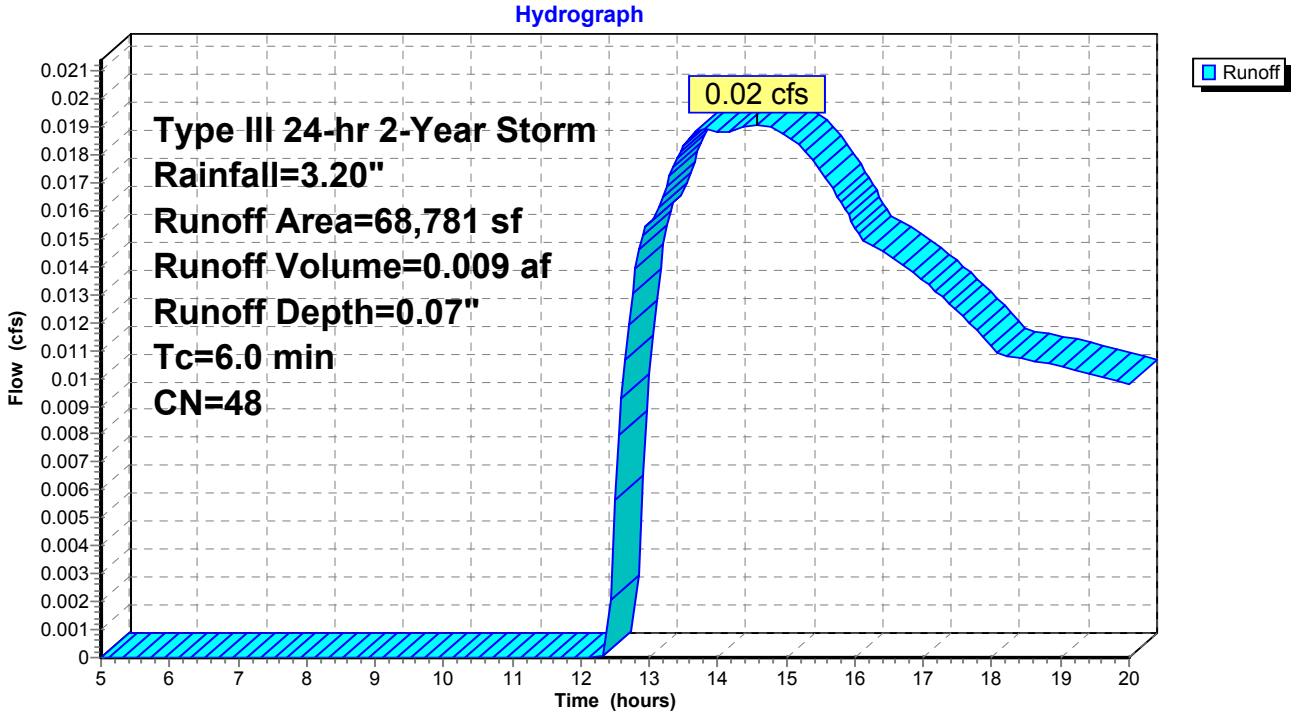
Runoff = 0.02 cfs @ 14.56 hrs, Volume= 0.009 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.20"

Area (sf)	CN	Description
2,287	98	Roof Area of House
399	98	Porch Roof Areas
1,223	98	Barn Roof
3,500	98	Bit. Conc. Driveway
25,625	49	50-75% Grass cover, Fair, HSG A
35,747	36	Woods, Fair, HSG A
68,781	48	Weighted Average

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

Subcatchment 2S:

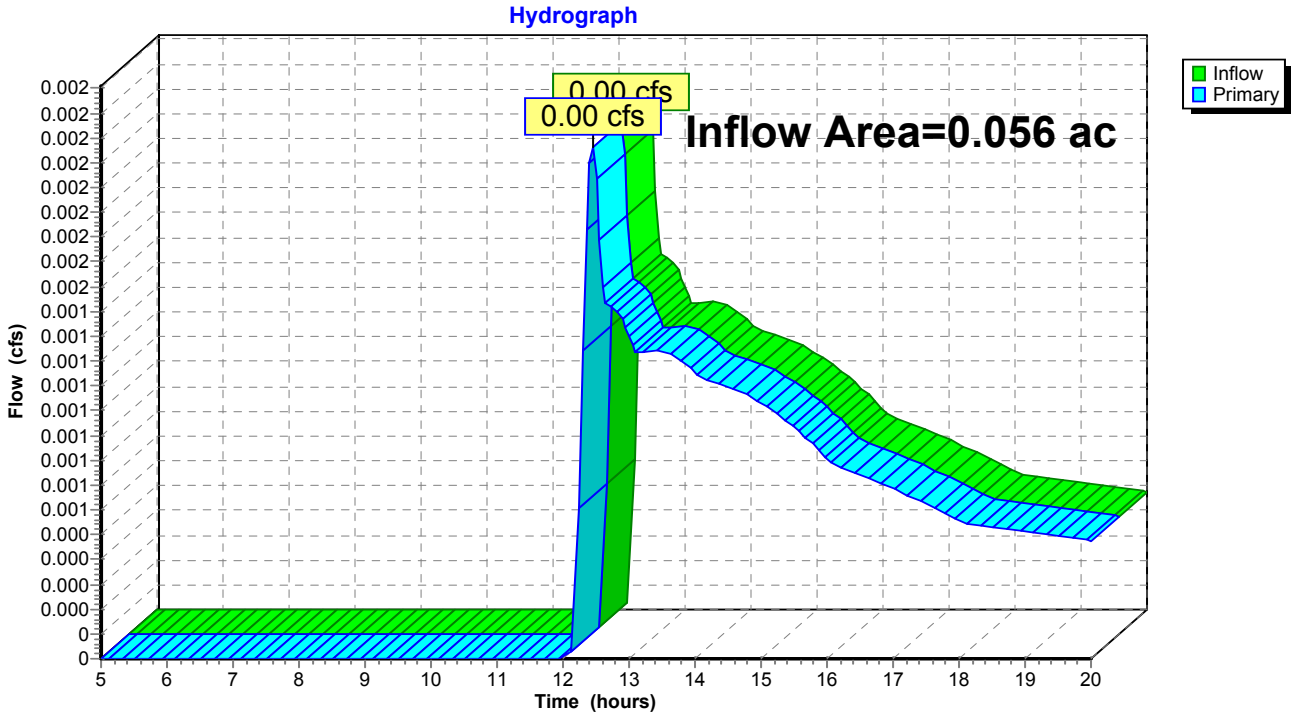


Link 1L: Off-Site (Towards Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 0.12" for 2-Year Storm event
Inflow = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Off-Site (Towards Summer Avenue)

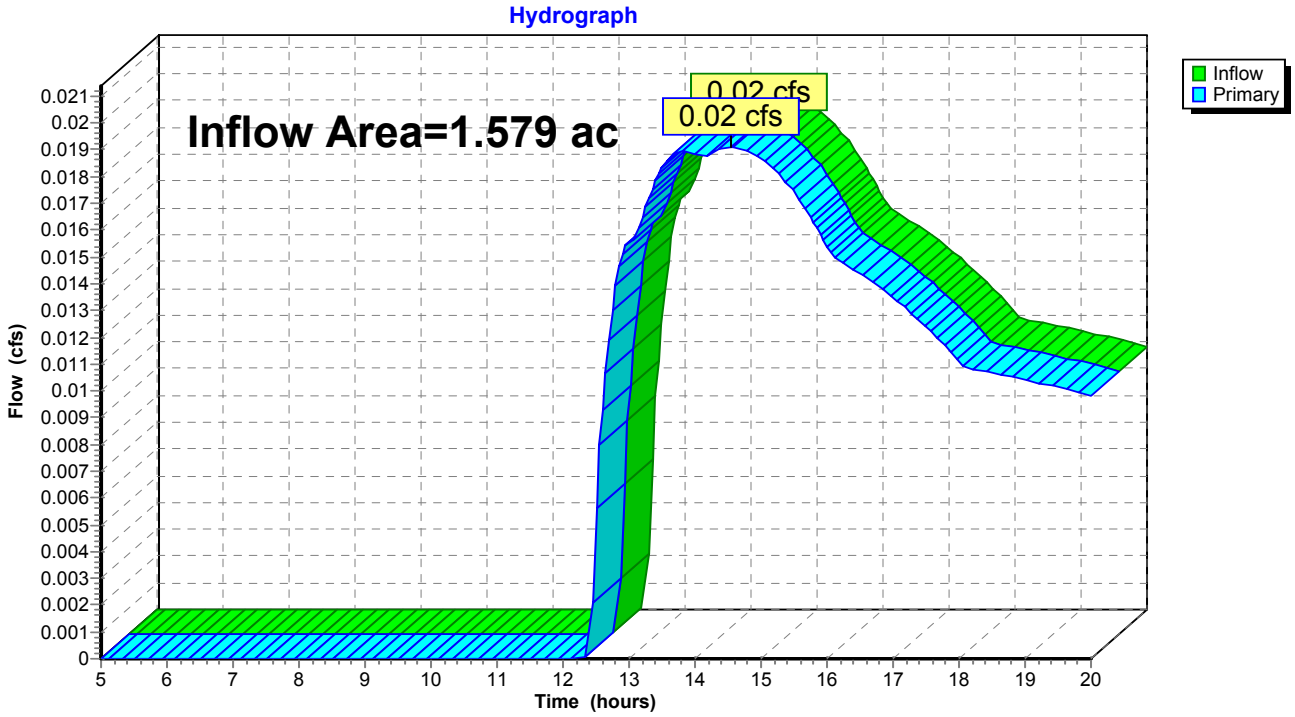


Link 2L: To Rear of Property

Inflow Area = 1.579 ac, Inflow Depth = 0.07" for 2-Year Storm event
Inflow = 0.02 cfs @ 14.56 hrs, Volume= 0.009 af
Primary = 0.02 cfs @ 14.56 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Property



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=0.58"
Tc=6.0 min CN=51 Runoff=0.03 cfs 0.003 af

Subcatchment 2S: Runoff Area=68,781 sf Runoff Depth=0.44"
Tc=6.0 min CN=48 Runoff=0.44 cfs 0.058 af

Link 1L: Off-Site (Towards Summer Avenue) Inflow=0.03 cfs 0.003 af
Primary=0.03 cfs 0.003 af

Link 2L: To Rear of Property Inflow=0.44 cfs 0.058 af
Primary=0.44 cfs 0.058 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.061 af Average Runoff Depth = 0.45"

Subcatchment 1S:

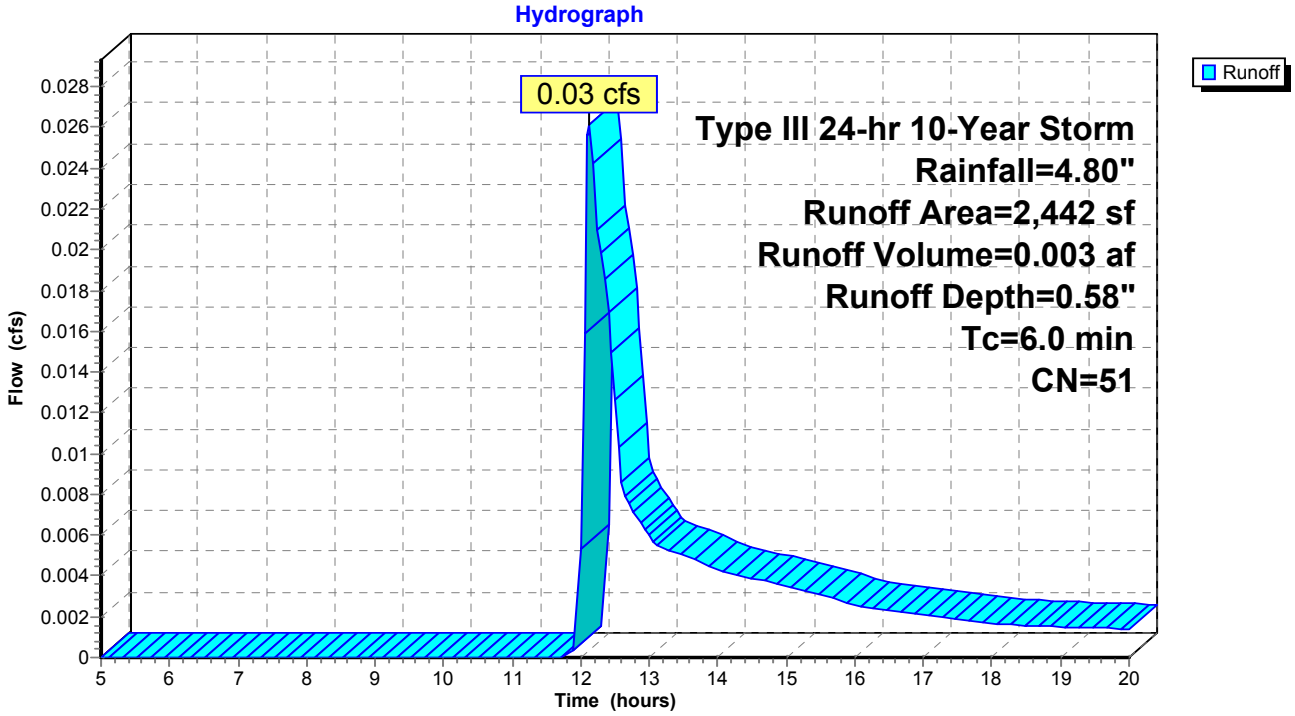
Runoff = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.80"

Area (sf)	CN	Description
107	98	Portion of Front Porch Roof
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

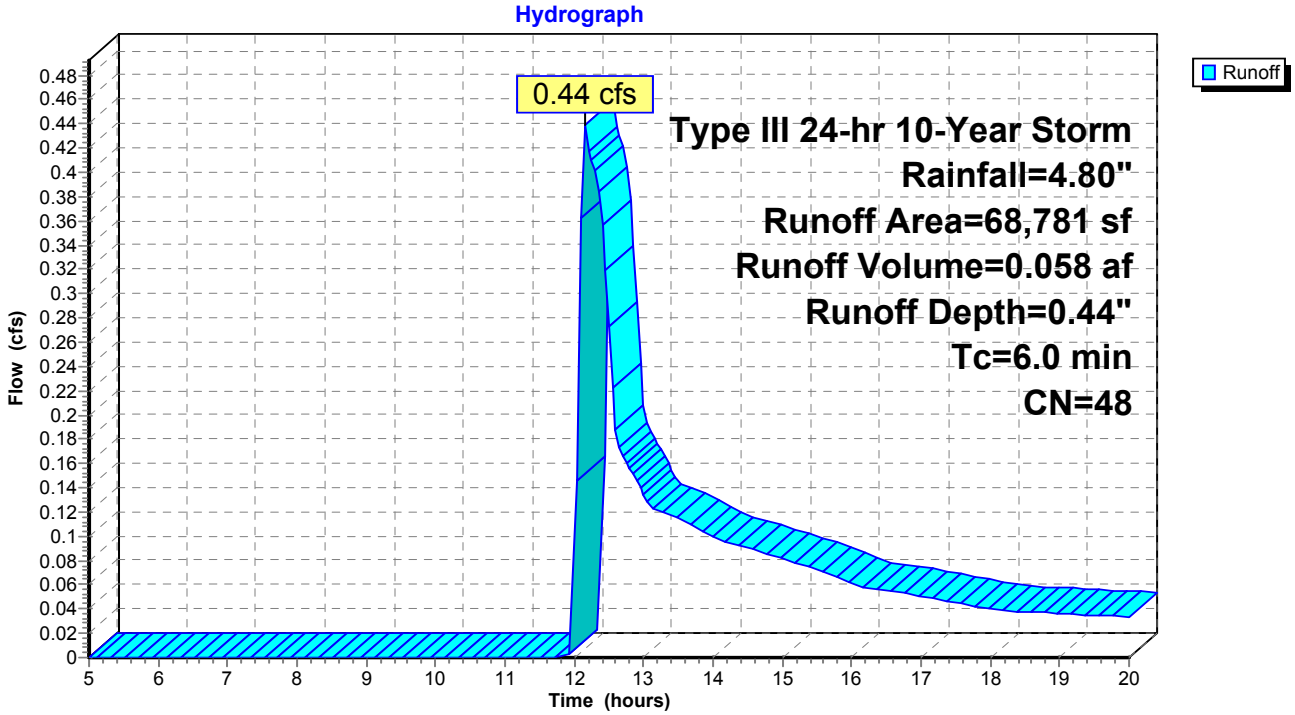
Runoff = 0.44 cfs @ 12.16 hrs, Volume= 0.058 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.80"

Area (sf)	CN	Description
2,287	98	Roof Area of House
399	98	Porch Roof Areas
1,223	98	Barn Roof
3,500	98	Bit. Conc. Driveway
25,625	49	50-75% Grass cover, Fair, HSG A
35,747	36	Woods, Fair, HSG A
68,781	48	Weighted Average

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

Subcatchment 2S:

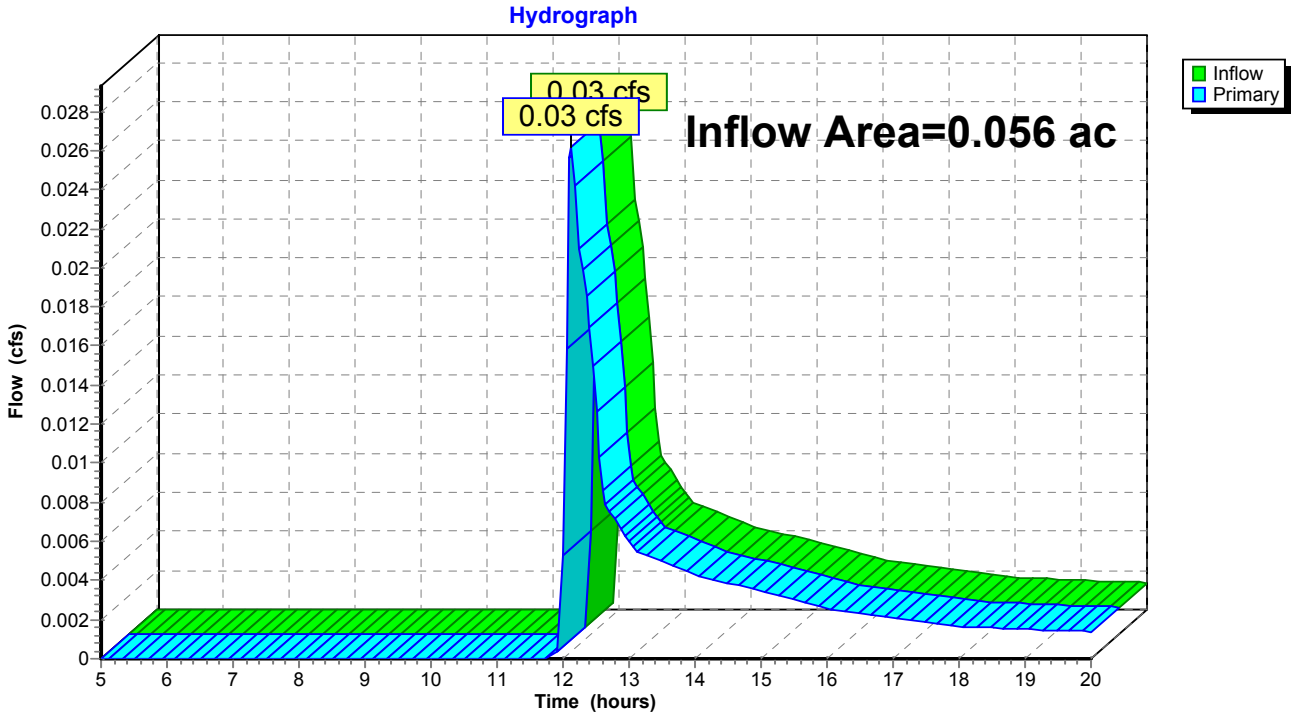


Link 1L: Off-Site (Towards Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 0.58" for 10-Year Storm event
Inflow = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af
Primary = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Off-Site (Towards Summer Avenue)

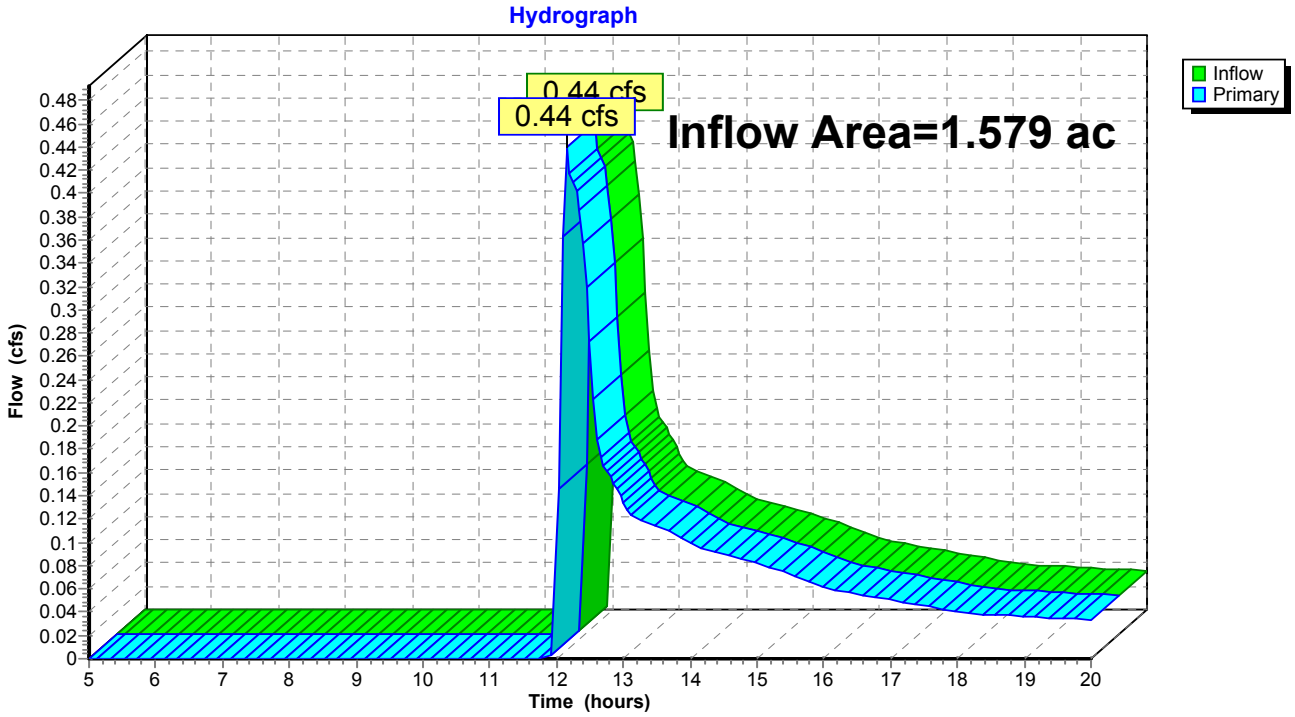


Link 2L: To Rear of Property

Inflow Area = 1.579 ac, Inflow Depth = 0.44" for 10-Year Storm event
Inflow = 0.44 cfs @ 12.16 hrs, Volume= 0.058 af
Primary = 0.44 cfs @ 12.16 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Property



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=0.86"
Tc=6.0 min CN=51 Runoff=0.05 cfs 0.004 af

Subcatchment 2S: Runoff Area=68,781 sf Runoff Depth=0.69"
Tc=6.0 min CN=48 Runoff=0.92 cfs 0.090 af

Link 1L: Off-Site (Towards Summer Avenue) Inflow=0.05 cfs 0.004 af
Primary=0.05 cfs 0.004 af

Link 2L: To Rear of Property Inflow=0.92 cfs 0.090 af
Primary=0.92 cfs 0.090 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.094 af Average Runoff Depth = 0.69"

Subcatchment 1S:

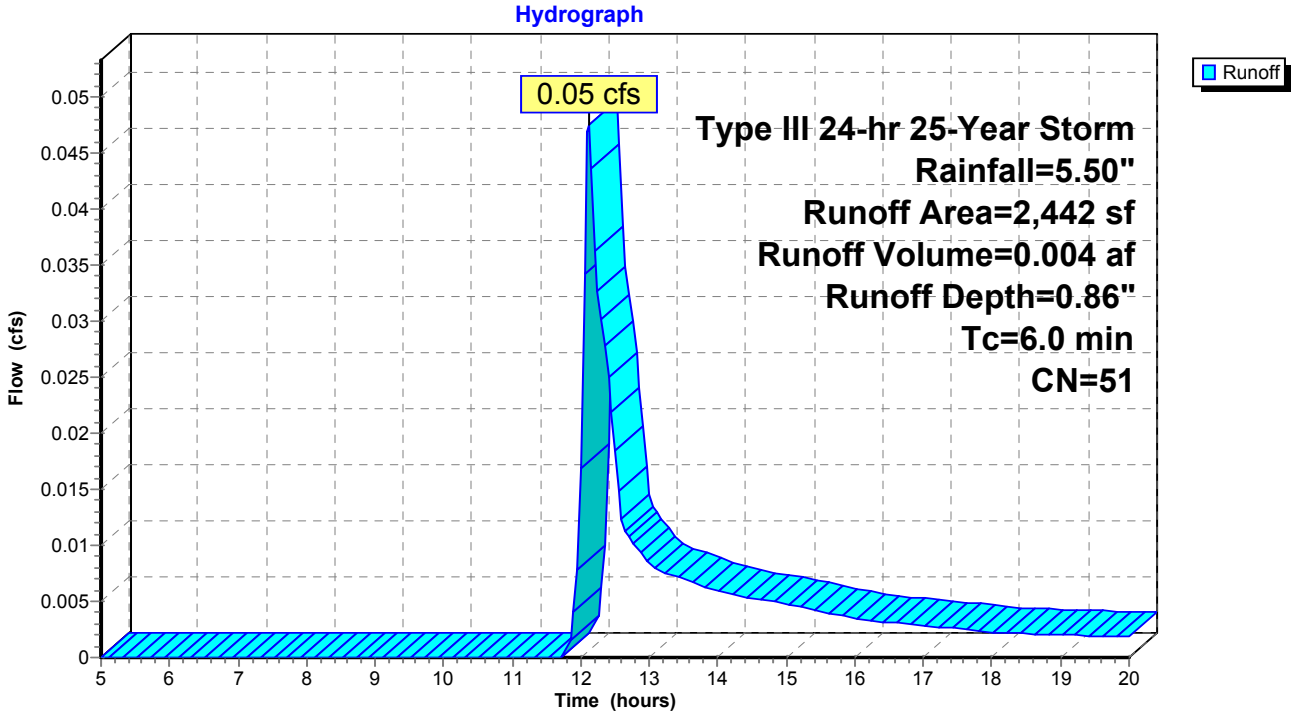
Runoff = 0.05 cfs @ 12.11 hrs, Volume= 0.004 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (sf)	CN	Description
107	98	Portion of Front Porch Roof
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

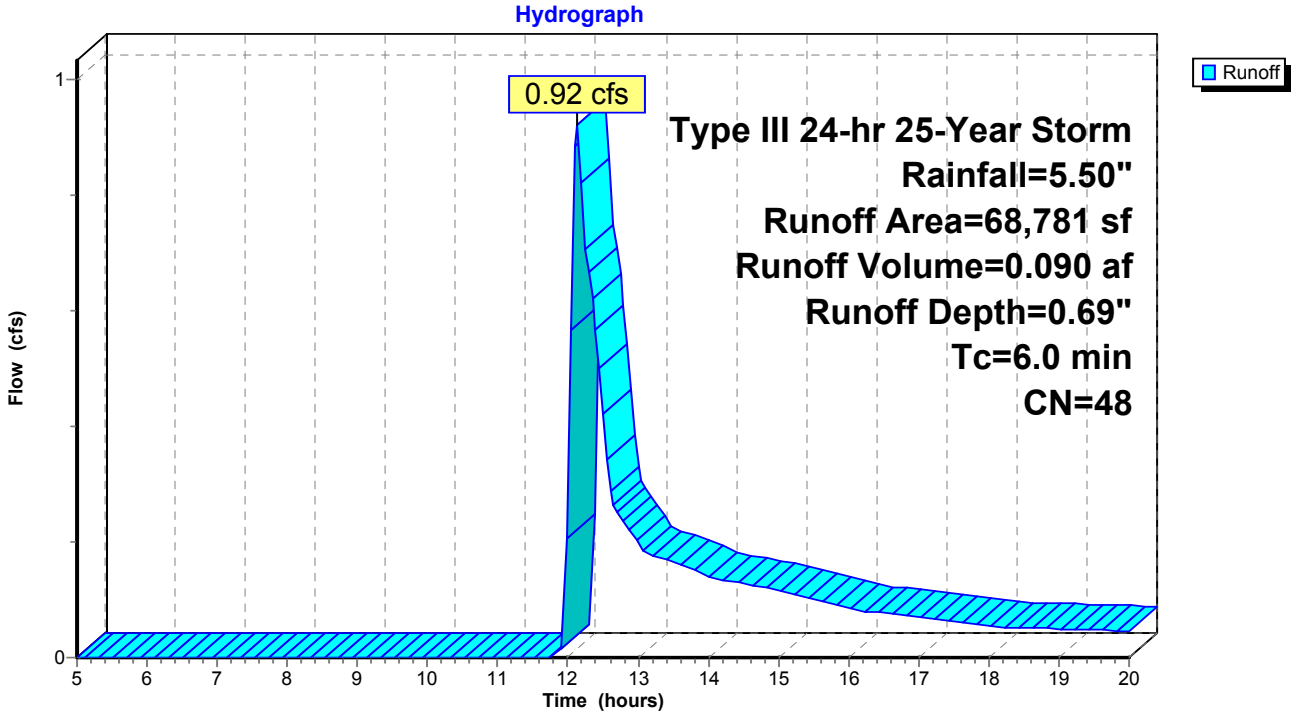
Runoff = 0.92 cfs @ 12.12 hrs, Volume= 0.090 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (sf)	CN	Description
2,287	98	Roof Area of House
399	98	Porch Roof Areas
1,223	98	Barn Roof
3,500	98	Bit. Conc. Driveway
25,625	49	50-75% Grass cover, Fair, HSG A
35,747	36	Woods, Fair, HSG A
68,781	48	Weighted Average

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

Subcatchment 2S:

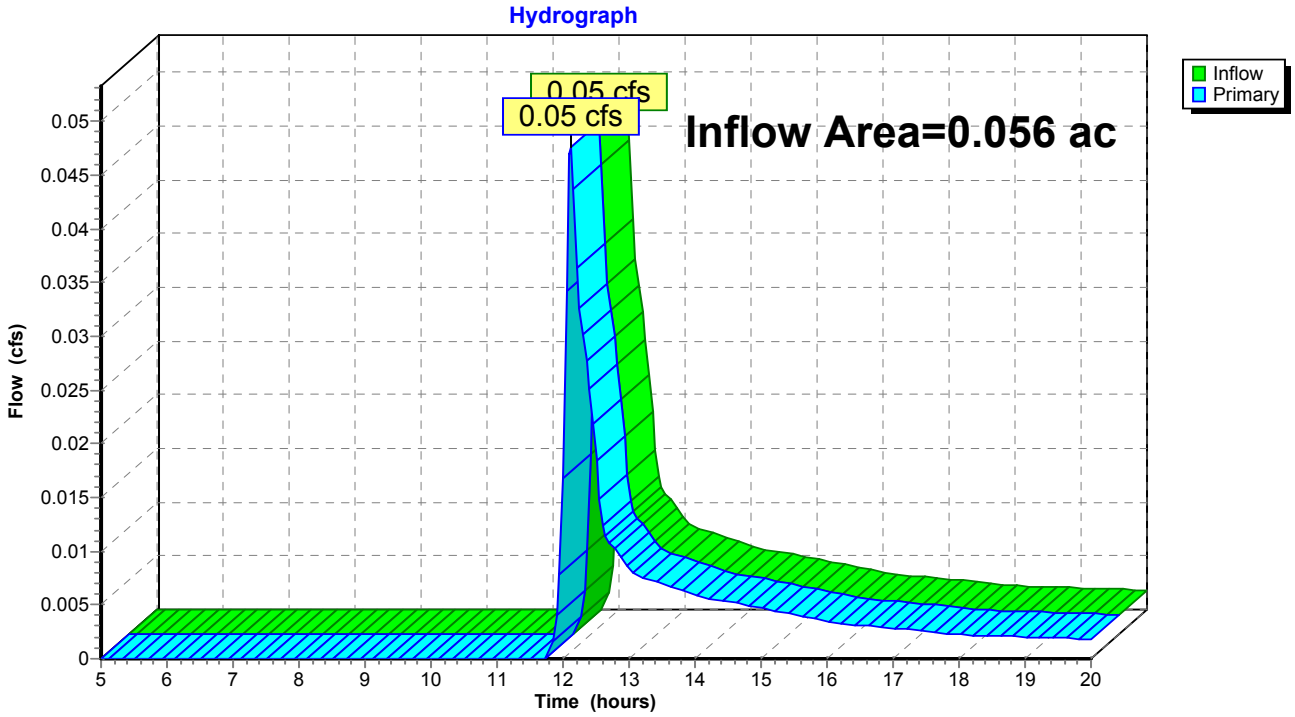


Link 1L: Off-Site (Towards Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 0.86" for 25-Year Storm event
Inflow = 0.05 cfs @ 12.11 hrs, Volume= 0.004 af
Primary = 0.05 cfs @ 12.11 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Off-Site (Towards Summer Avenue)

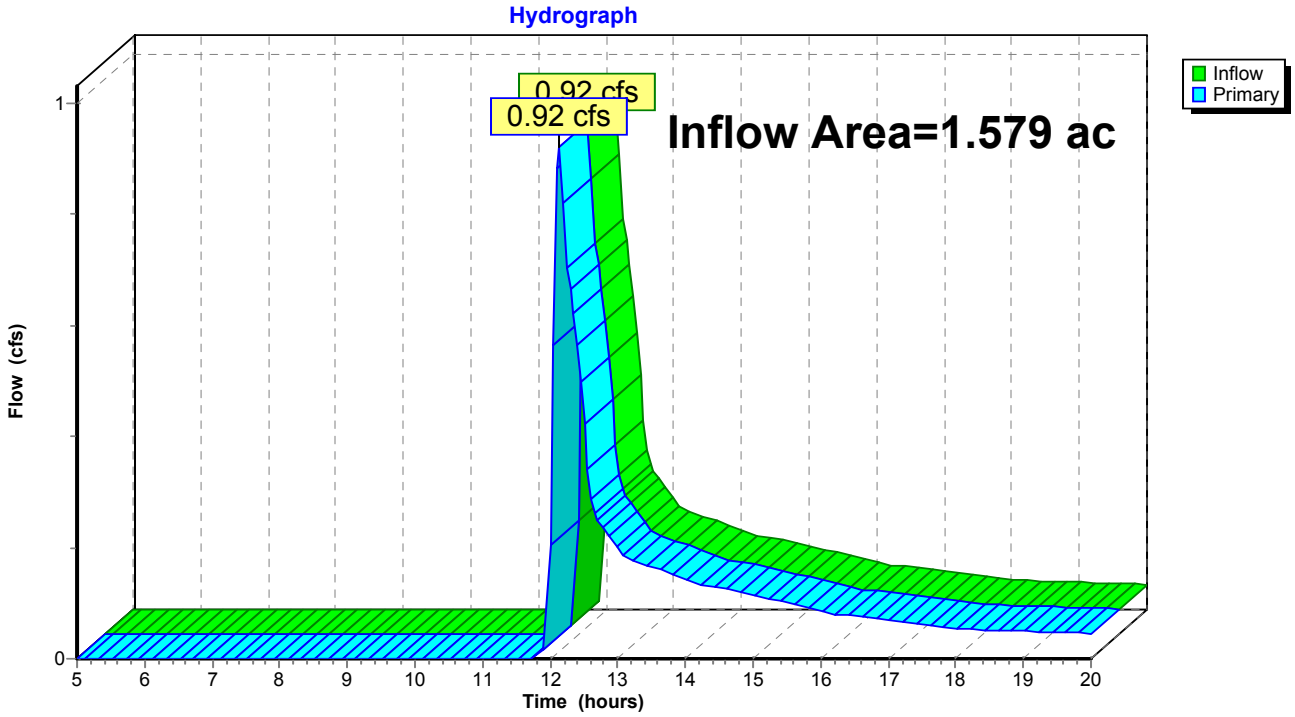


Link 2L: To Rear of Property

Inflow Area = 1.579 ac, Inflow Depth = 0.69" for 25-Year Storm event
Inflow = 0.92 cfs @ 12.12 hrs, Volume= 0.090 af
Primary = 0.92 cfs @ 12.12 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Property



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=1.28"
Tc=6.0 min CN=51 Runoff=0.08 cfs 0.006 af

Subcatchment 2S: Runoff Area=68,781 sf Runoff Depth=1.06"
Tc=6.0 min CN=48 Runoff=1.69 cfs 0.139 af

Link 1L: Off-Site (Towards Summer Avenue) Inflow=0.08 cfs 0.006 af
Primary=0.08 cfs 0.006 af

Link 2L: To Rear of Property Inflow=1.69 cfs 0.139 af
Primary=1.69 cfs 0.139 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.145 af Average Runoff Depth = 1.06"

Subcatchment 1S:

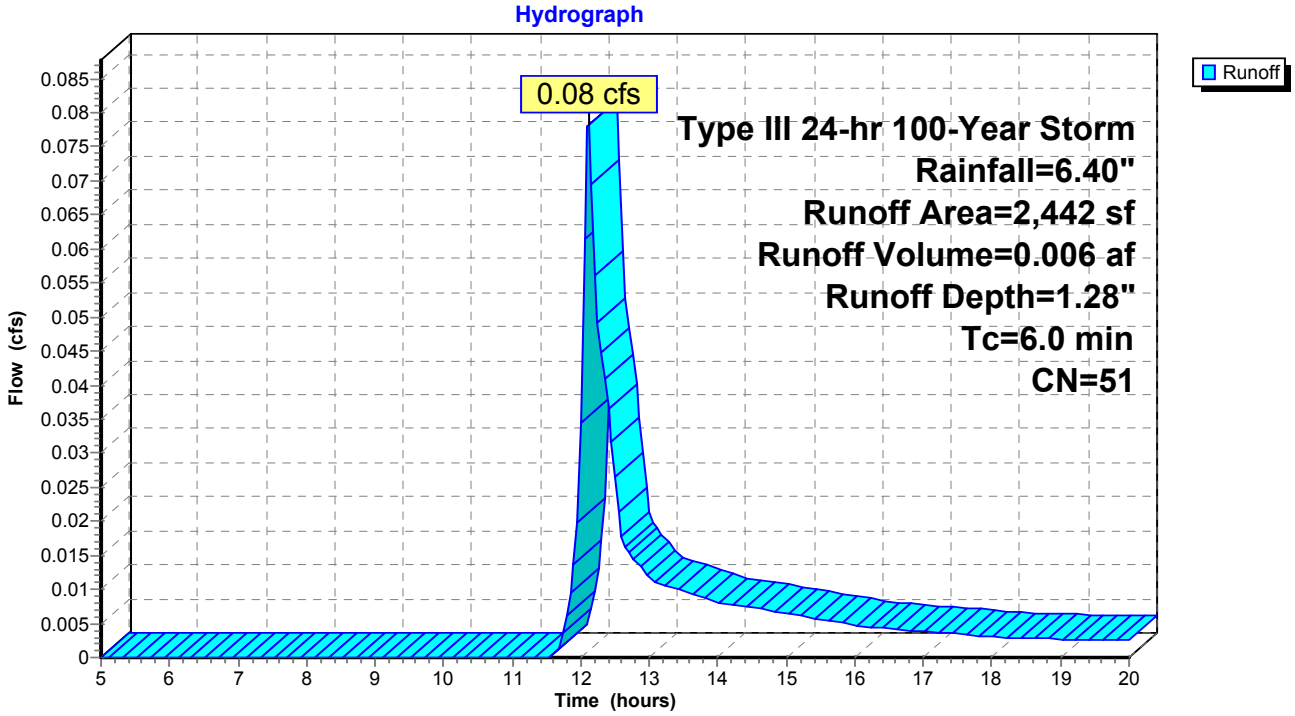
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.40"

Area (sf)	CN	Description
107	98	Portion of Front Porch Roof
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

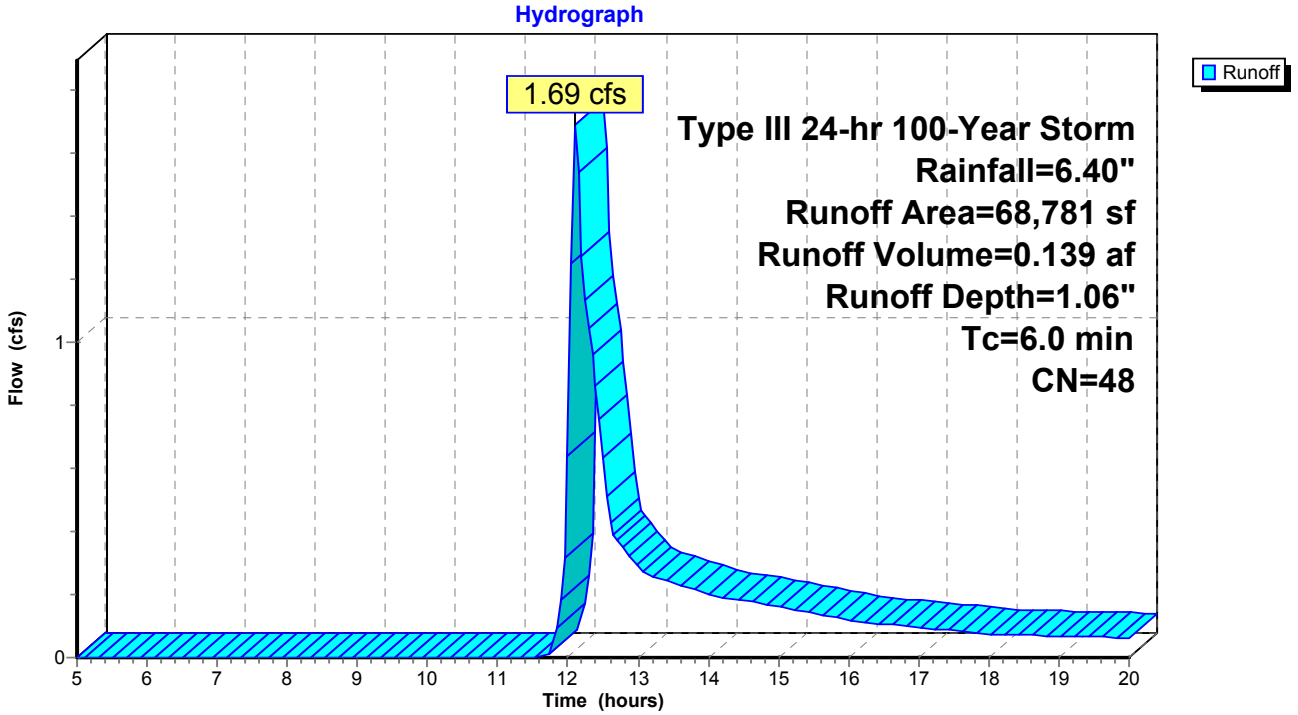
Runoff = 1.69 cfs @ 12.11 hrs, Volume= 0.139 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.40"

Area (sf)	CN	Description
2,287	98	Roof Area of House
399	98	Porch Roof Areas
1,223	98	Barn Roof
3,500	98	Bit. Conc. Driveway
25,625	49	50-75% Grass cover, Fair, HSG A
35,747	36	Woods, Fair, HSG A
68,781	48	Weighted Average

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

Subcatchment 2S:

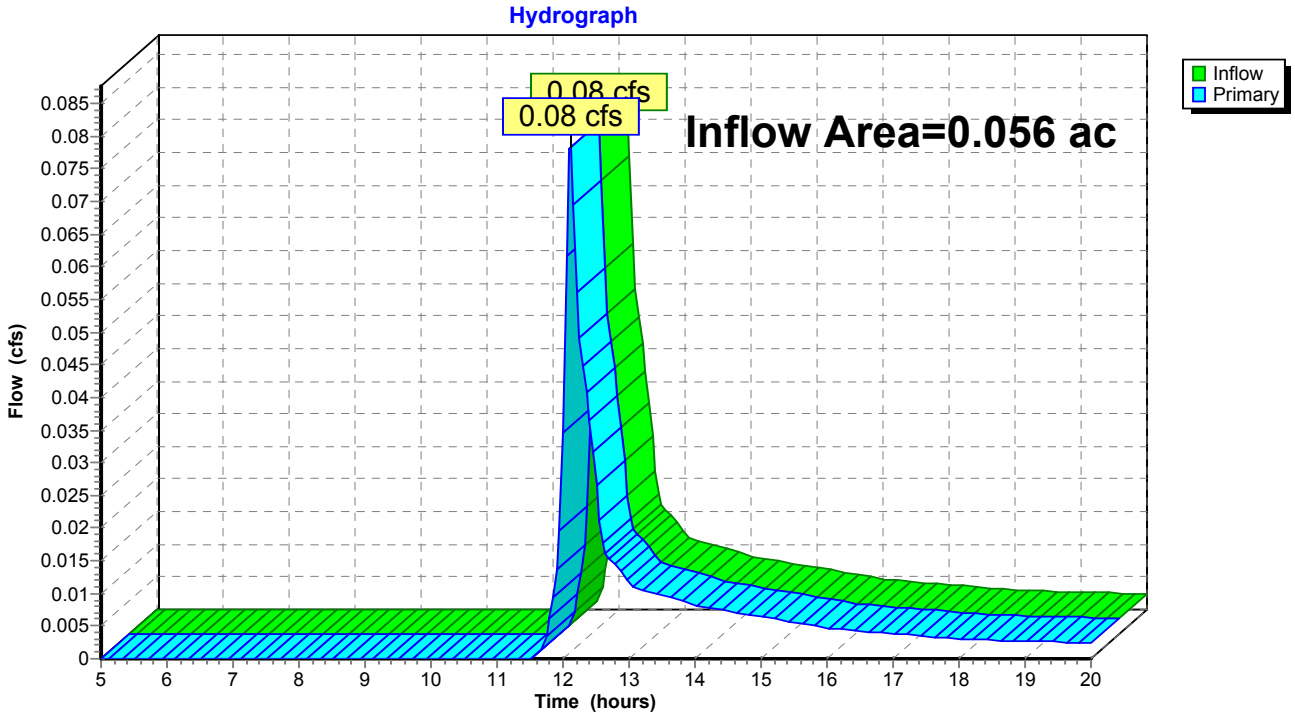


Link 1L: Off-Site (Towards Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 1.28" for 100-Year Storm event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af
Primary = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: Off-Site (Towards Summer Avenue)

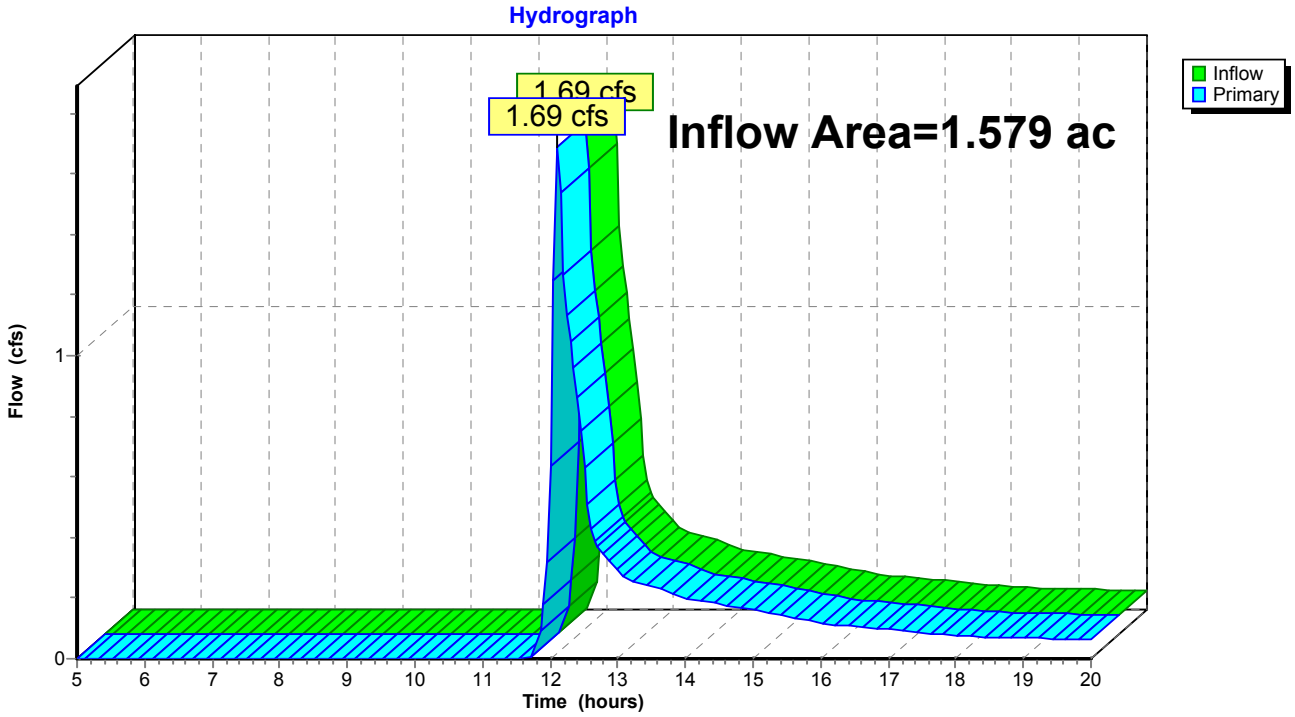


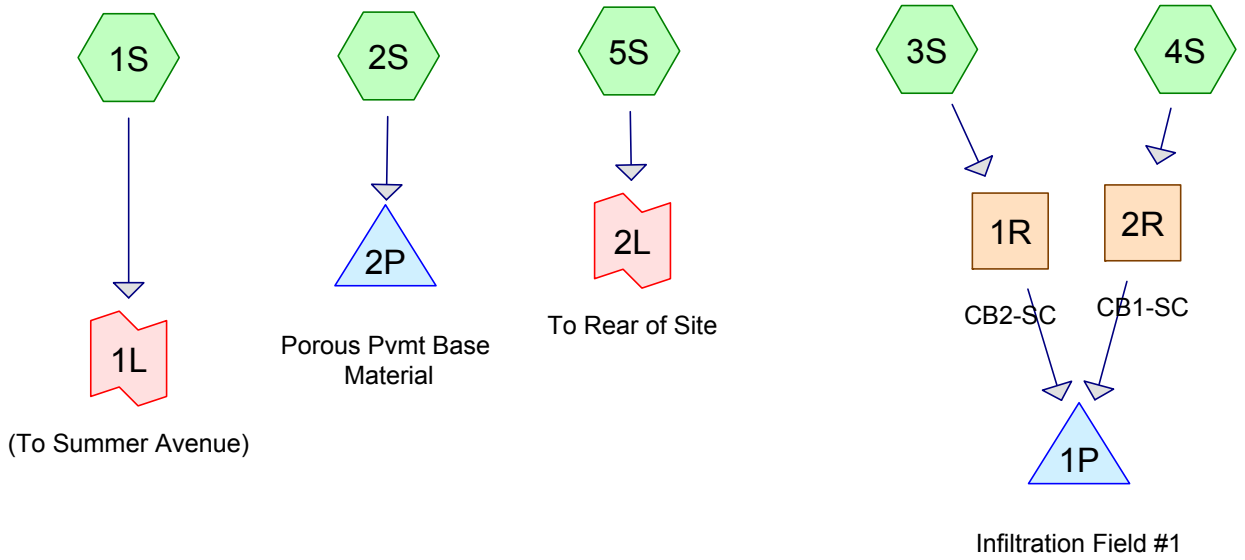
Link 2L: To Rear of Property

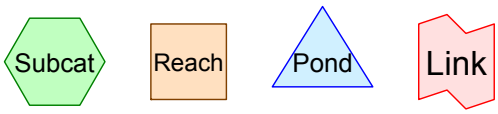
Inflow Area = 1.579 ac, Inflow Depth = 1.06" for 100-Year Storm event
Inflow = 1.69 cfs @ 12.11 hrs, Volume= 0.139 af
Primary = 1.69 cfs @ 12.11 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Property







Drainage Diagram for Postdevelopment_12082015
Prepared by {enter your company name here} 12/9/2015
HydroCAD® 7.00 s/n 001433 © 1986-2003 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=0.12"
Tc=6.0 min CN=51 Runoff=0.00 cfs 0.001 af

Subcatchment 2S: Runoff Area=24,258 sf Runoff Depth=0.51"
Tc=462.0 min CN=75 Runoff=0.06 cfs 0.024 af

Subcatchment 3S: Runoff Area=4,718 sf Runoff Depth=2.77"
Flow Length=86' Tc=0.7 min CN=98 Runoff=0.38 cfs 0.025 af

Subcatchment 4S: Runoff Area=2,130 sf Runoff Depth=2.41"
Flow Length=81' Tc=0.6 min CN=94 Runoff=0.16 cfs 0.010 af

Subcatchment 5S: Runoff Area=37,675 sf Runoff Depth=0.07"
Tc=6.0 min CN=48 Runoff=0.01 cfs 0.005 af

Reach 1R: CB2-SC Peak Depth=0.20' Max Vel=3.3 fps Inflow=0.38 cfs 0.025 af
D=12.0" n=0.011 L=3.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.38 cfs 0.025 af

Reach 2R: CB1-SC Peak Depth=0.13' Max Vel=2.5 fps Inflow=0.16 cfs 0.010 af
D=12.0" n=0.011 L=81.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.15 cfs 0.010 af

Pond 1P: Infiltration Field #1 Peak Elev=86.04' Storage=515 cf Inflow=0.53 cfs 0.035 af
Outflow=0.06 cfs 0.035 af

Pond 2P: Porous Pvmt Base Material Peak Elev=95.51' Storage=0.000 af Inflow=0.06 cfs 0.024 af
Outflow=0.06 cfs 0.023 af

Link 1L: (To Summer Avenue) Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Link 2L: To Rear of Site Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.064 af Average Runoff Depth = 0.47"

Subcatchment 1S:

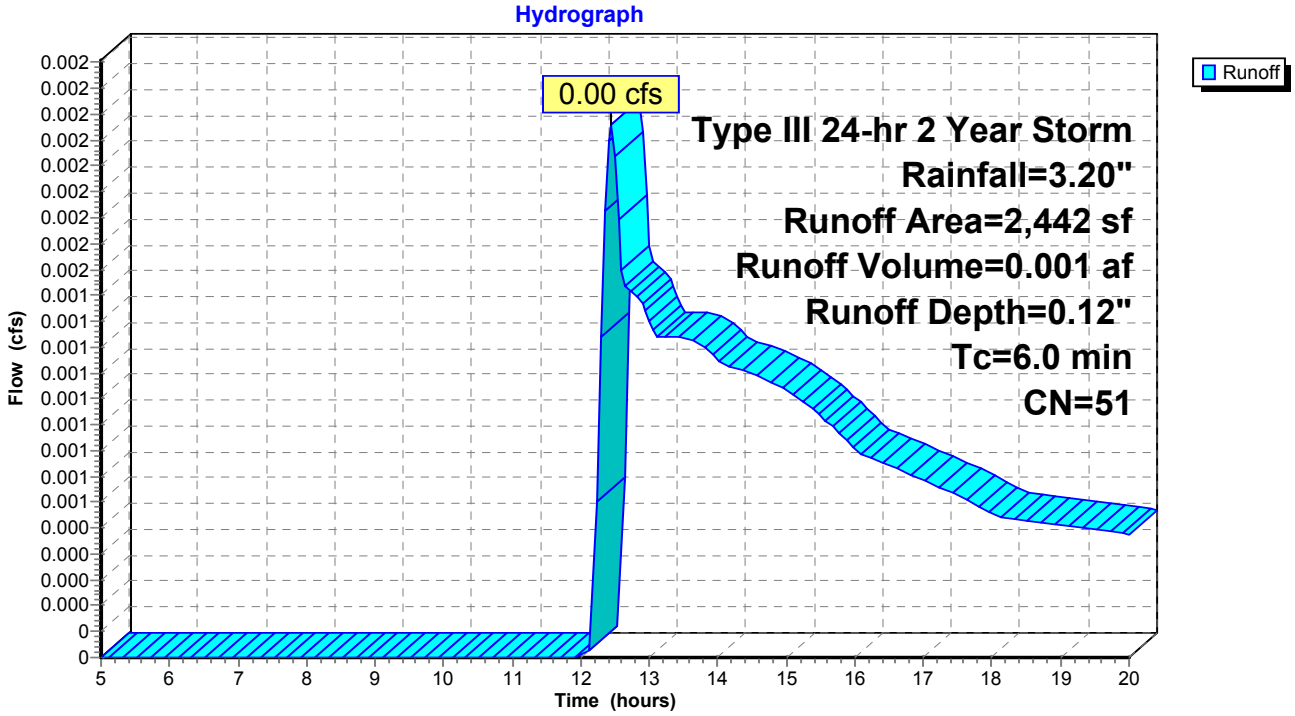
Runoff = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.20"

Area (sf)	CN	Description
107	98	Portion of Front Porch
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

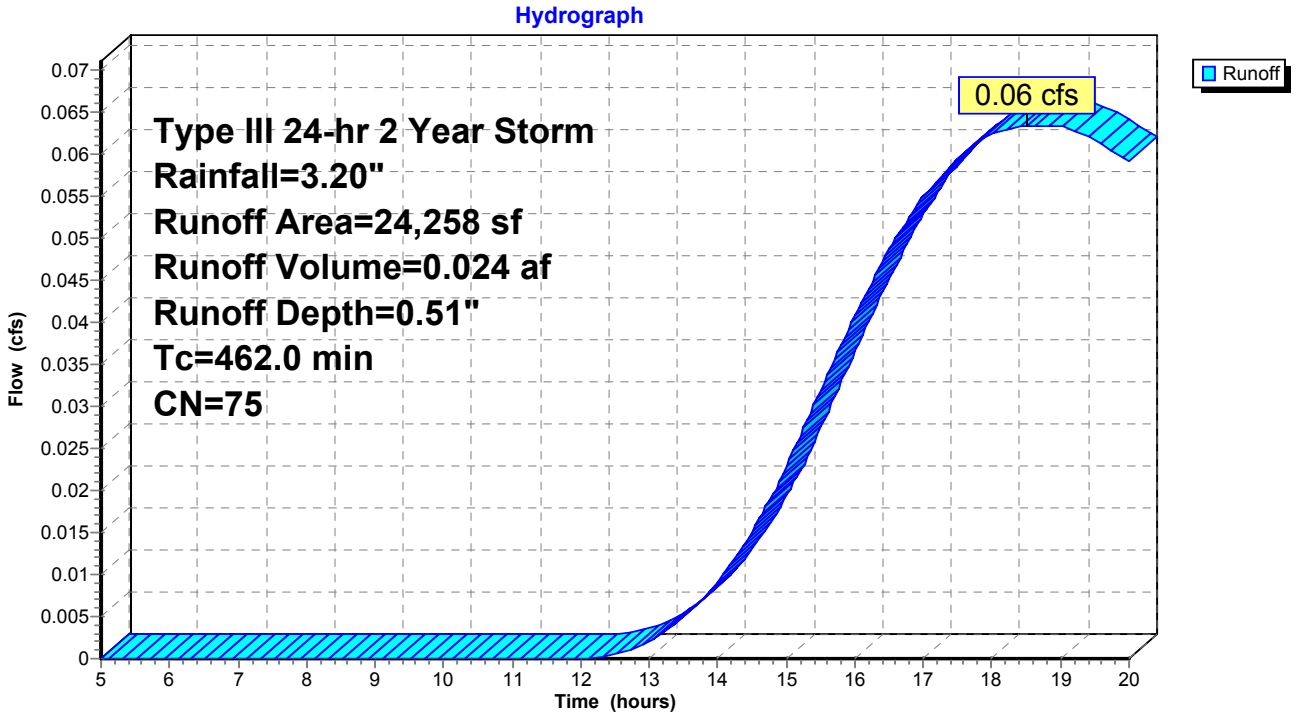
Runoff = 0.06 cfs @ 18.52 hrs, Volume= 0.024 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.20"

Area (sf)	CN	Description
612	98	1/2 of Barn Roof
234	98	Portion of Porch
1,024	98	Portion of House Roof
2,271	98	Portion of Conc. Walkways
50	98	ADA platforms
115	98	vertical granite curb
8,610	98	Porous Pavement
11,342	49	50-75% Grass cover, Fair, HSG A
24,258	75	Weighted Average

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

Subcatchment 2S:



Subcatchment 3S:

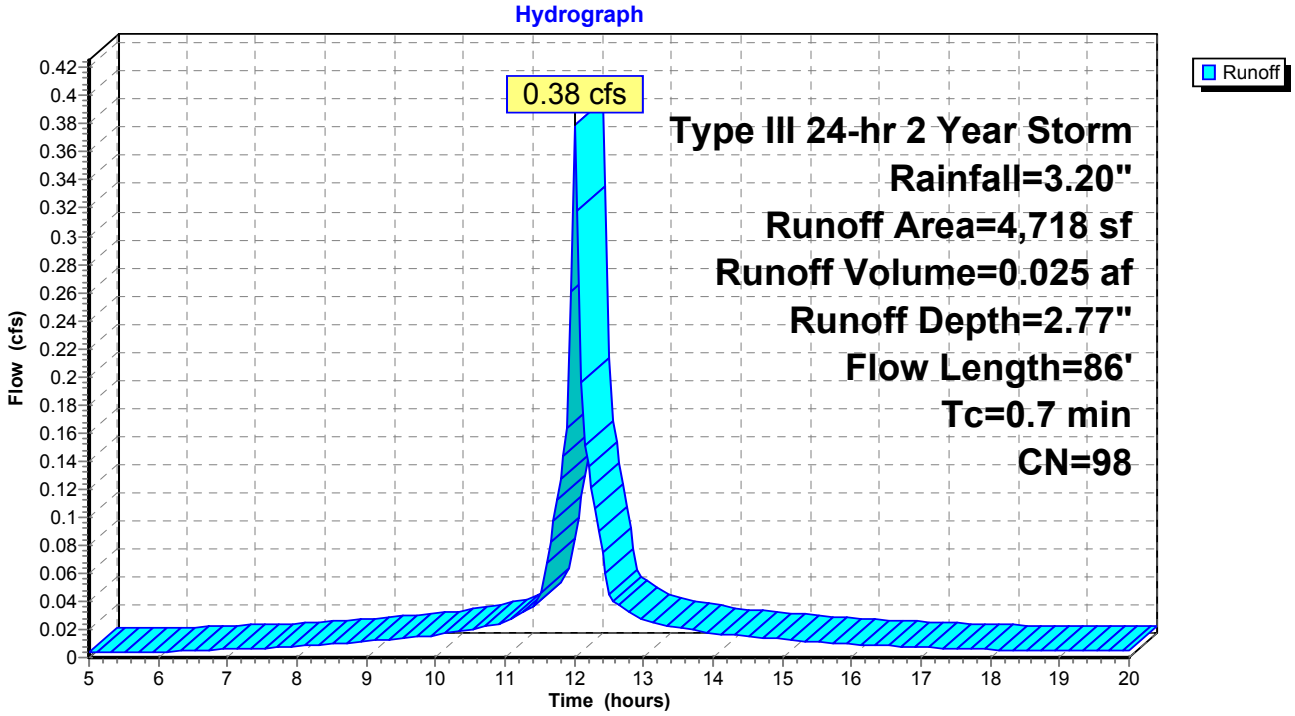
Runoff = 0.38 cfs @ 12.01 hrs, Volume= 0.025 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.20"

Area (sf)	CN	Description
4,718	98	Pavement, curb, and dumpster pad

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.2	36	0.0240	3.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	86	Total			

Subcatchment 3S:



Subcatchment 4S:

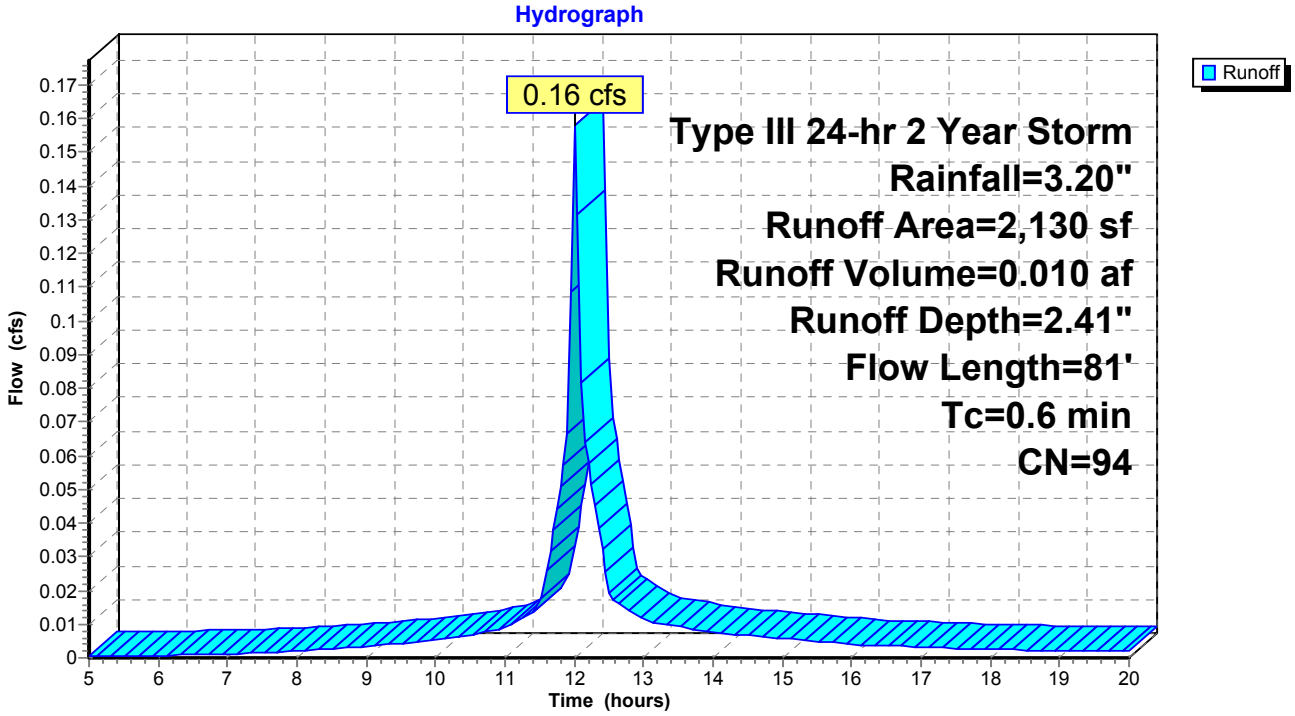
Runoff = 0.16 cfs @ 12.01 hrs, Volume= 0.010 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.20"

Area (sf)	CN	Description
1,945	98	Pavement + Curb
185	49	50-75% Grass cover, Fair, HSG A
2,130	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	31	0.0500	4.5		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	81	Total			

Subcatchment 4S:



Subcatchment 5S:

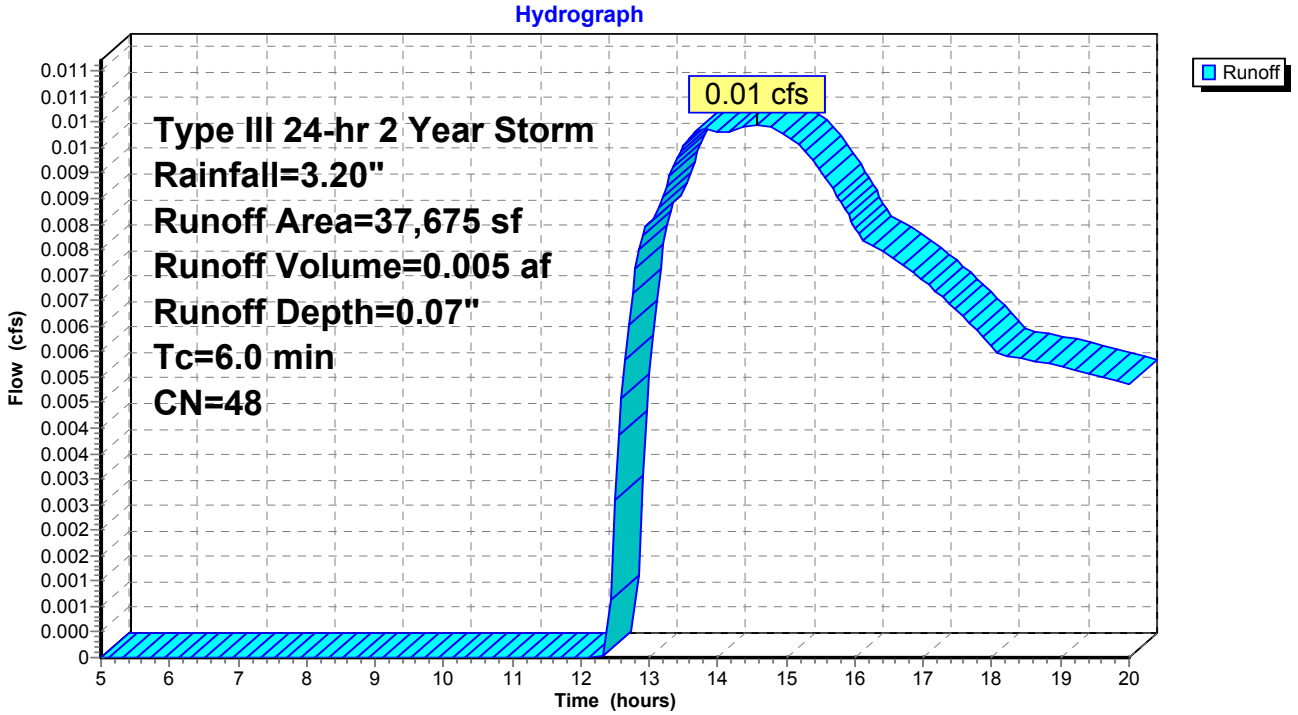
Runoff = 0.01 cfs @ 14.56 hrs, Volume= 0.005 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.20"

Area (sf)	CN	Description
611	98	1/2 Roof Area of Barn
58	98	Portion of Porch Roof
1,263	98	Portion of House Roof Area
83	98	Portion of Conc. walkway
11,530	36	Woods, Fair, HSG A
24,130	49	50-75% Grass cover, Fair, HSG A
37,675	48	Weighted Average

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

Subcatchment 5S:



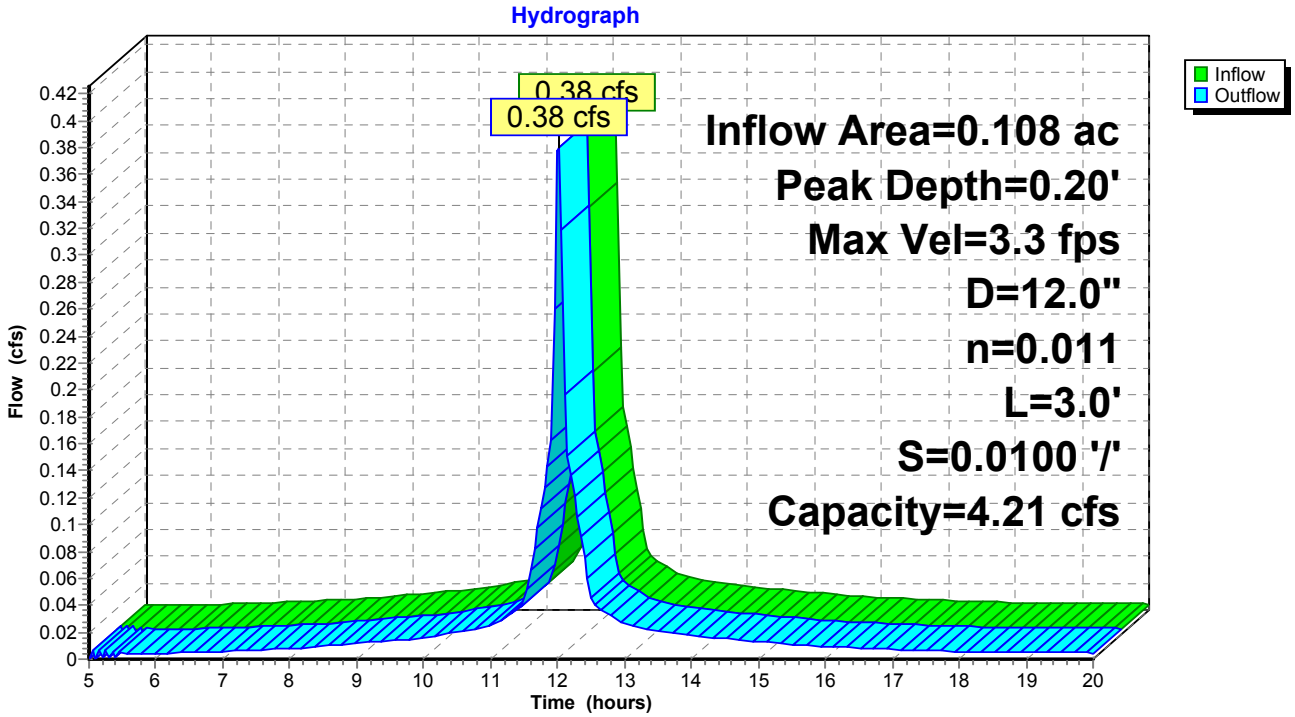
Reach 1R: CB2-SC

Inflow Area = 0.108 ac, Inflow Depth = 2.77" for 2 Year Storm event
Inflow = 0.38 cfs @ 12.01 hrs, Volume= 0.025 af
Outflow = 0.38 cfs @ 12.01 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.3 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 0.0 min

Peak Depth= 0.20' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 86.72', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 3.0' Slope= 0.0100 '/'

Reach 1R: CB2-SC



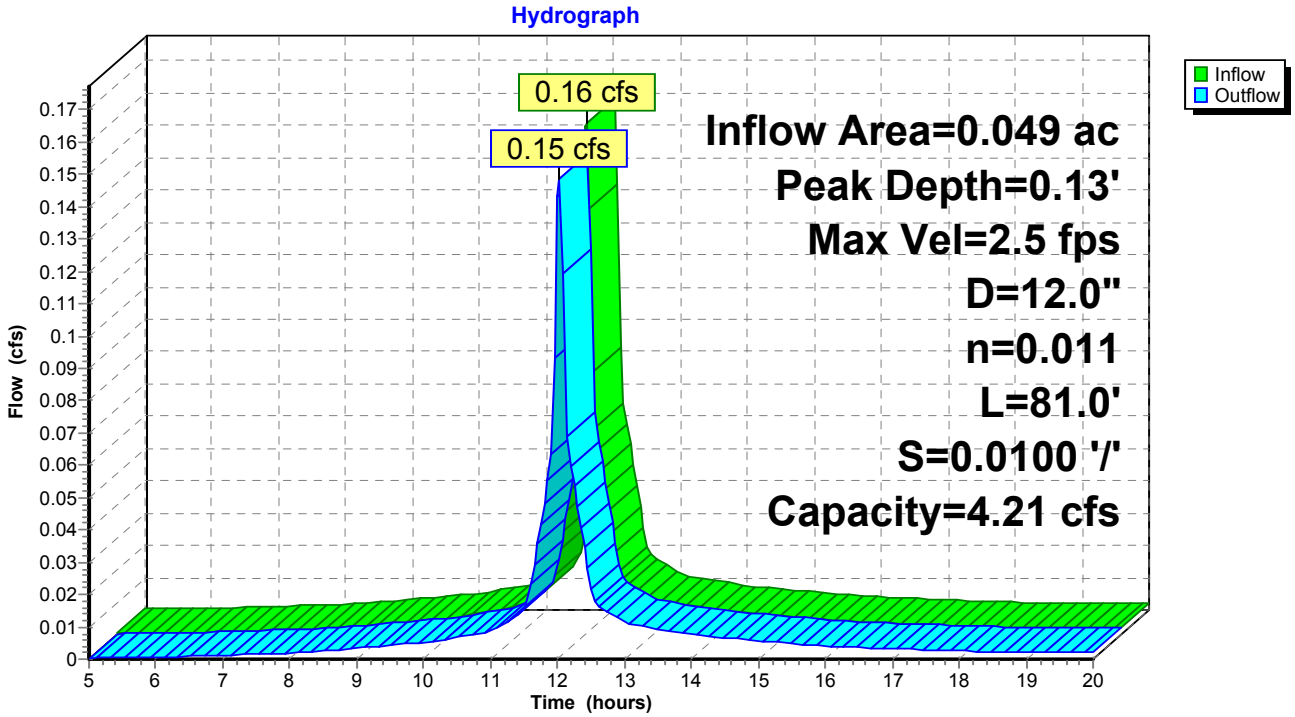
Reach 2R: CB1-SC

Inflow Area = 0.049 ac, Inflow Depth = 2.41" for 2 Year Storm event
Inflow = 0.16 cfs @ 12.01 hrs, Volume= 0.010 af
Outflow = 0.15 cfs @ 12.02 hrs, Volume= 0.010 af, Atten= 6%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.5 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 1.5 min

Peak Depth= 0.13' @ 12.02 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 87.50', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 81.0' Slope= 0.0100 '/'

Reach 2R: CB1-SC



Pond 1P: Infiltration Field #1

Exfiltration based on Class B soil (Sandy Loam) with Design Infiltration Rate of 1.02 in/hr

Inflow Area =	0.157 ac,	Inflow Depth =	2.66"	for	2 Year Storm event
Inflow =	0.53 cfs @	12.01 hrs,	Volume=	0.035 af	
Outflow =	0.06 cfs @	11.60 hrs,	Volume=	0.035 af,	Atten= 89%, Lag= 0.0 min
Discarded =	0.06 cfs @	11.60 hrs,	Volume=	0.035 af	

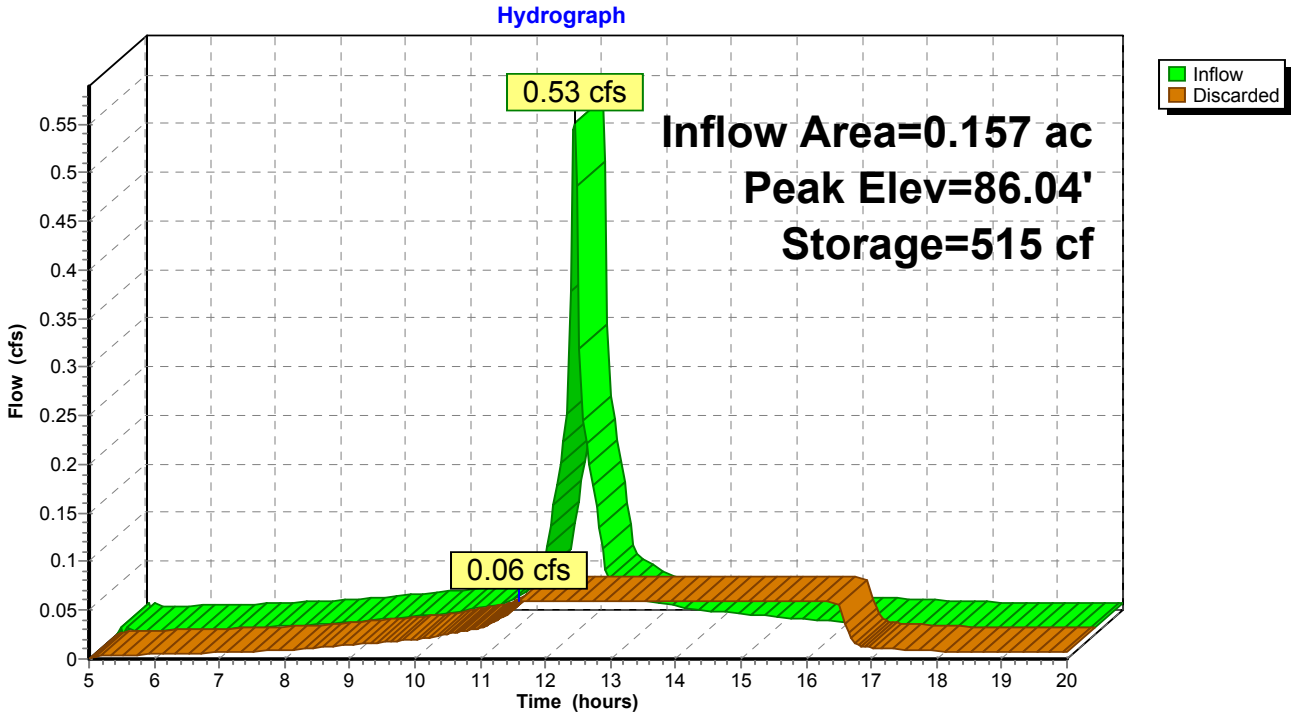
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 86.04' @ 12.56 hrs Surf.Area= 2,480 sf Storage= 515 cf
Plug-Flow detention time= 62.2 min calculated for 0.035 af (100% of inflow)
Center-of-Mass det. time= 61.3 min (801.7 - 740.5)

#	Invert	Avail.Storage	Storage Description
1	85.52'	2,114 cf	**20.00'W x 124.00'L x 2.20'H Prismatoid**
			5,456 cf Overall - 171 cf Embedded = 5,285 cf x 40.0% Voids
2	86.02'	171 cf	**2.7"W x 18.5"H x 10.25'L Cultec 150XLHD** x 72 Inside #1
		2,285 cf	Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001417 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.06 cfs @ 11.60 hrs HW=85.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond 1P: Infiltration Field #1



Pond 2P: Porous Pvmt Base Material

Inflow Area =	0.557 ac,	Inflow Depth =	0.51"	for	2 Year Storm event
Inflow =	0.06 cfs @	18.52 hrs,	Volume=	0.024 af	
Outflow =	0.06 cfs @	18.77 hrs,	Volume=	0.023 af,	Atten= 0%, Lag= 14.8 min
Discarded =	0.06 cfs @	18.77 hrs,	Volume=	0.023 af	

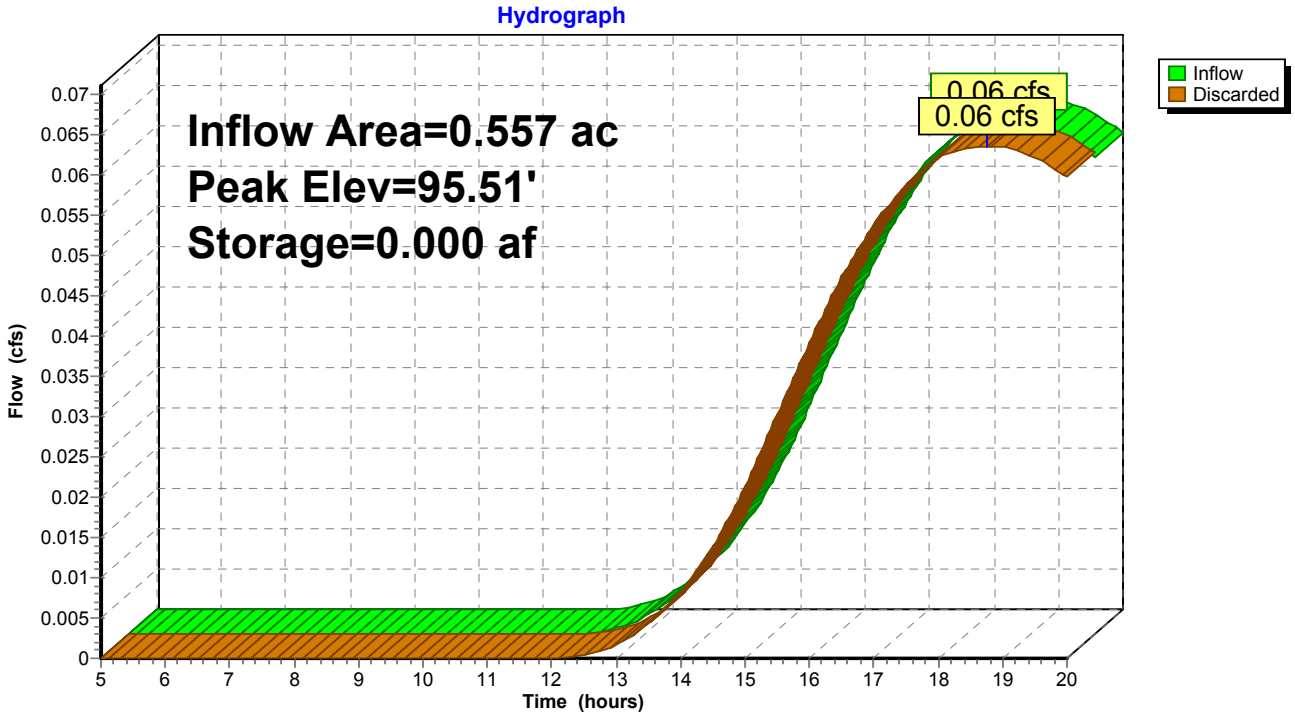
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 95.51' @ 18.77 hrs Surf.Area= 0.197 ac Storage= 0.000 af
Plug-Flow detention time= 5.6 min calculated for 0.023 af (98% of inflow)
Center-of-Mass det. time= 2.7 min (1,055.2 - 1,052.5)

#	Invert	Avail.Storage	Storage Description
1	95.50'	0.158 af	**50.00'W x 172.00'L x 2.00'H Prismatoid** 0.395 af Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001416 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.20 cfs @ 18.77 hrs HW=95.51' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Pond 2P: Porous Pvmt Base Material

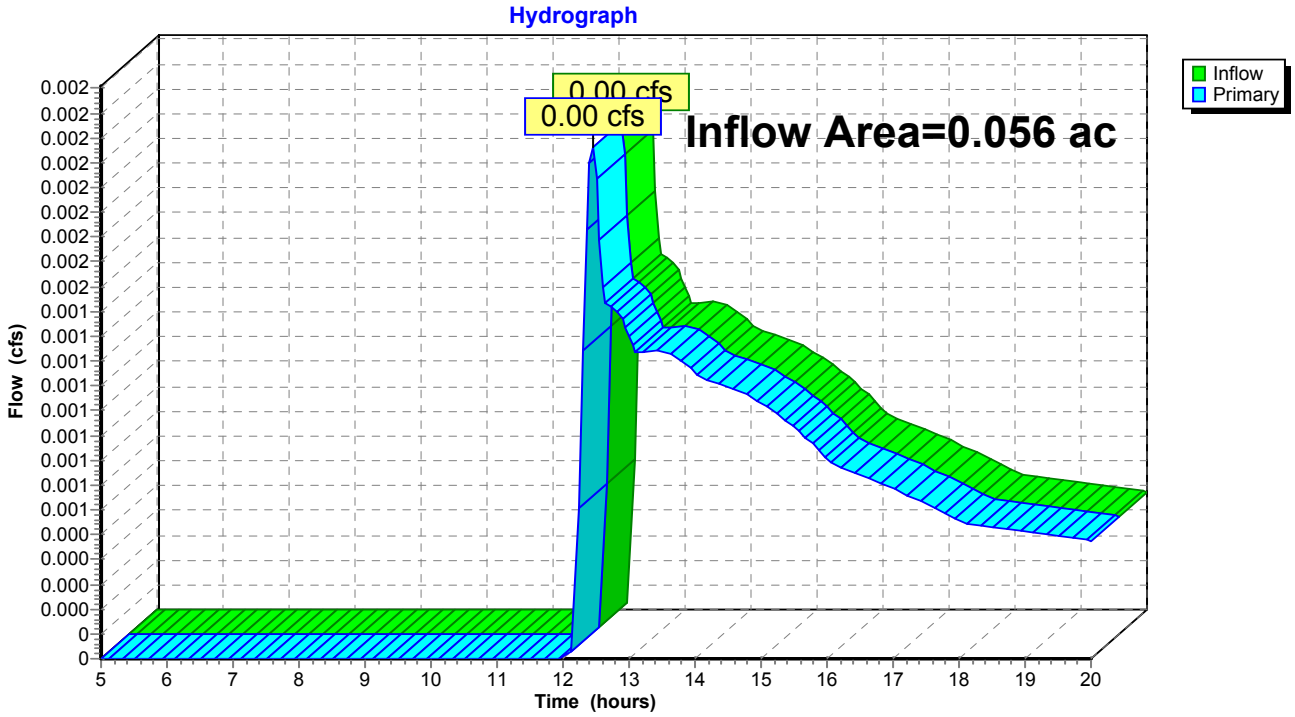


Link 1L: (To Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 0.12" for 2 Year Storm event
Inflow = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: (To Summer Avenue)

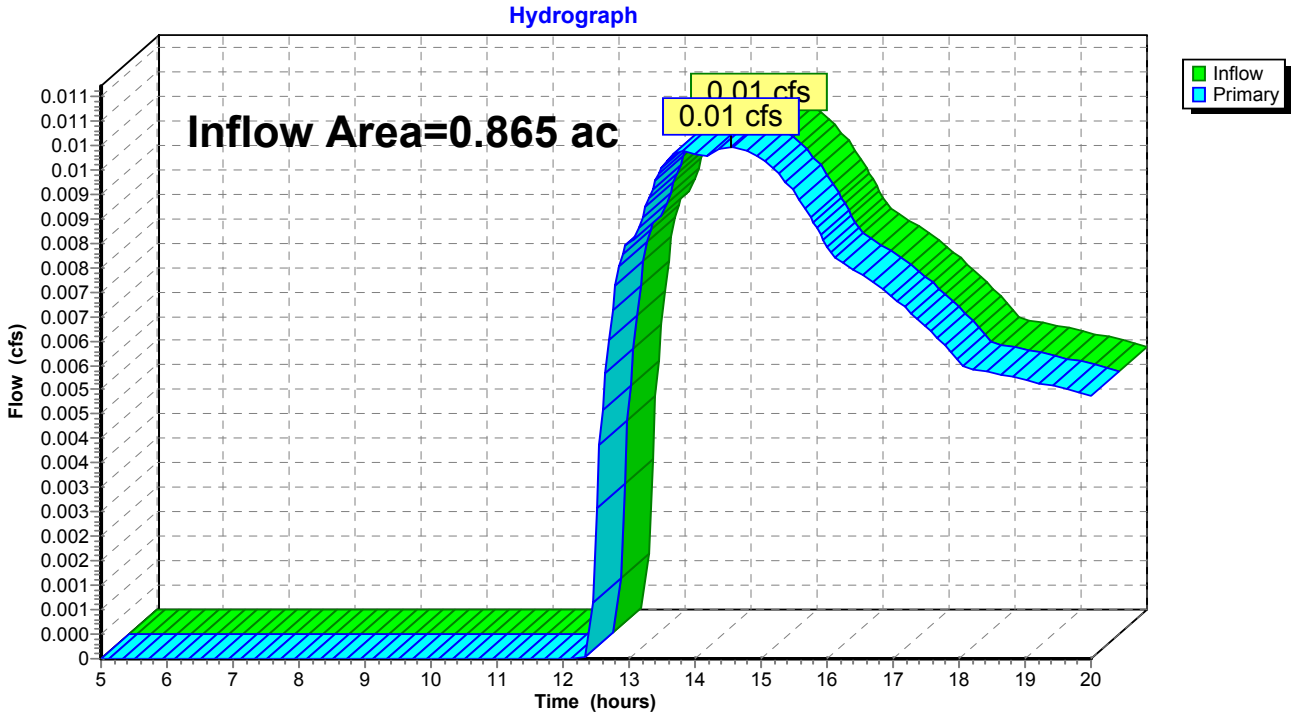


Link 2L: To Rear of Site

Inflow Area = 0.865 ac, Inflow Depth = 0.07" for 2 Year Storm event
Inflow = 0.01 cfs @ 14.56 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 14.56 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Site



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=0.58"
Tc=6.0 min CN=51 Runoff=0.03 cfs 0.003 af

Subcatchment 2S: Runoff Area=24,258 sf Runoff Depth=1.15"
Tc=462.0 min CN=75 Runoff=0.14 cfs 0.053 af

Subcatchment 3S: Runoff Area=4,718 sf Runoff Depth=4.24"
Flow Length=86' Tc=0.7 min CN=98 Runoff=0.57 cfs 0.038 af

Subcatchment 4S: Runoff Area=2,130 sf Runoff Depth=3.88"
Flow Length=81' Tc=0.6 min CN=94 Runoff=0.25 cfs 0.016 af

Subcatchment 5S: Runoff Area=37,675 sf Runoff Depth=0.44"
Tc=6.0 min CN=48 Runoff=0.24 cfs 0.032 af

Reach 1R: CB2-SC Peak Depth=0.25' Max Vel=3.7 fps Inflow=0.57 cfs 0.038 af
D=12.0" n=0.011 L=3.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.57 cfs 0.038 af

Reach 2R: CB1-SC Peak Depth=0.16' Max Vel=2.9 fps Inflow=0.25 cfs 0.016 af
D=12.0" n=0.011 L=81.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.24 cfs 0.016 af

Pond 1P: Infiltration Field #1 Peak Elev=86.43' Storage=937 cf Inflow=0.81 cfs 0.054 af
Outflow=0.06 cfs 0.054 af

Pond 2P: Porous Pvmt Base Material Peak Elev=95.51' Storage=0.001 af Inflow=0.14 cfs 0.053 af
Outflow=0.14 cfs 0.052 af

Link 1L: (To Summer Avenue) Inflow=0.03 cfs 0.003 af
Primary=0.03 cfs 0.003 af

Link 2L: To Rear of Site Inflow=0.24 cfs 0.032 af
Primary=0.24 cfs 0.032 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.142 af Average Runoff Depth = 1.04"

Subcatchment 1S:

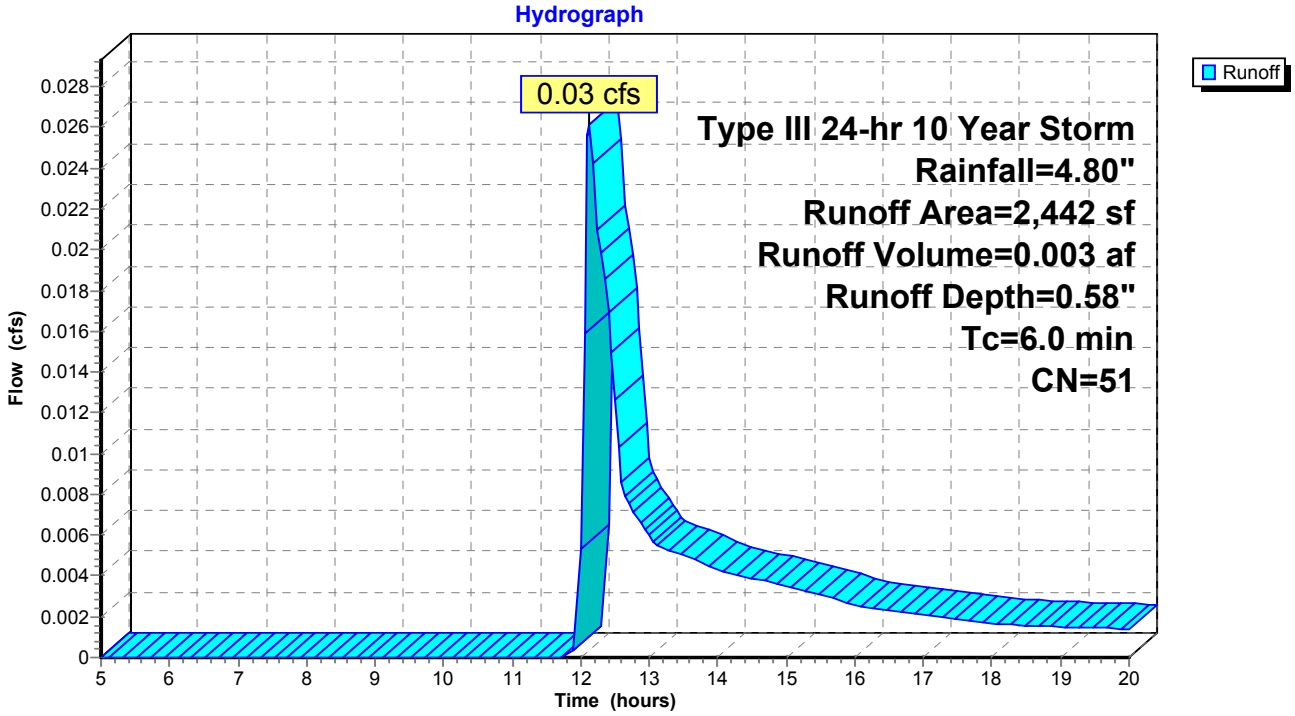
Runoff = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.80"

Area (sf)	CN	Description
107	98	Portion of Front Porch
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

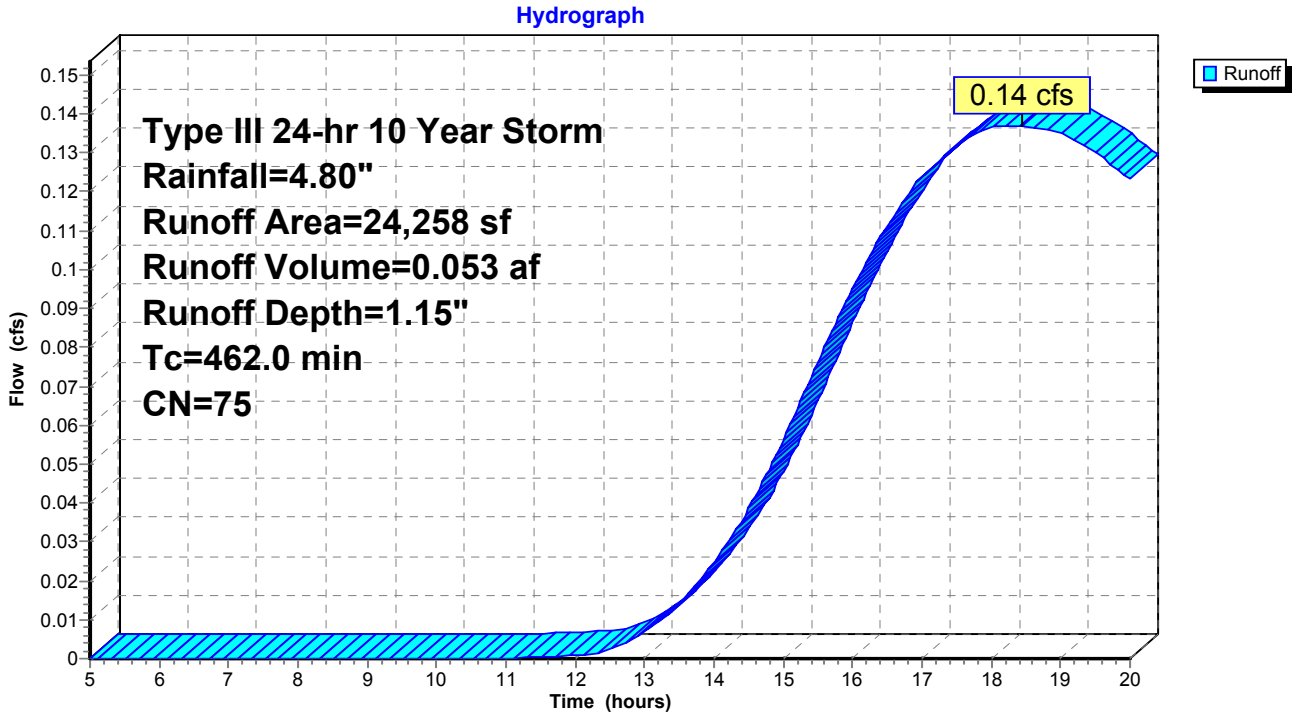
Runoff = 0.14 cfs @ 18.43 hrs, Volume= 0.053 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.80"

Area (sf)	CN	Description
612	98	1/2 of Barn Roof
234	98	Portion of Porch
1,024	98	Portion of House Roof
2,271	98	Portion of Conc. Walkways
50	98	ADA platforms
115	98	vertical granite curb
8,610	98	Porous Pavement
11,342	49	50-75% Grass cover, Fair, HSG A
24,258	75	Weighted Average

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

Subcatchment 2S:



Subcatchment 3S:

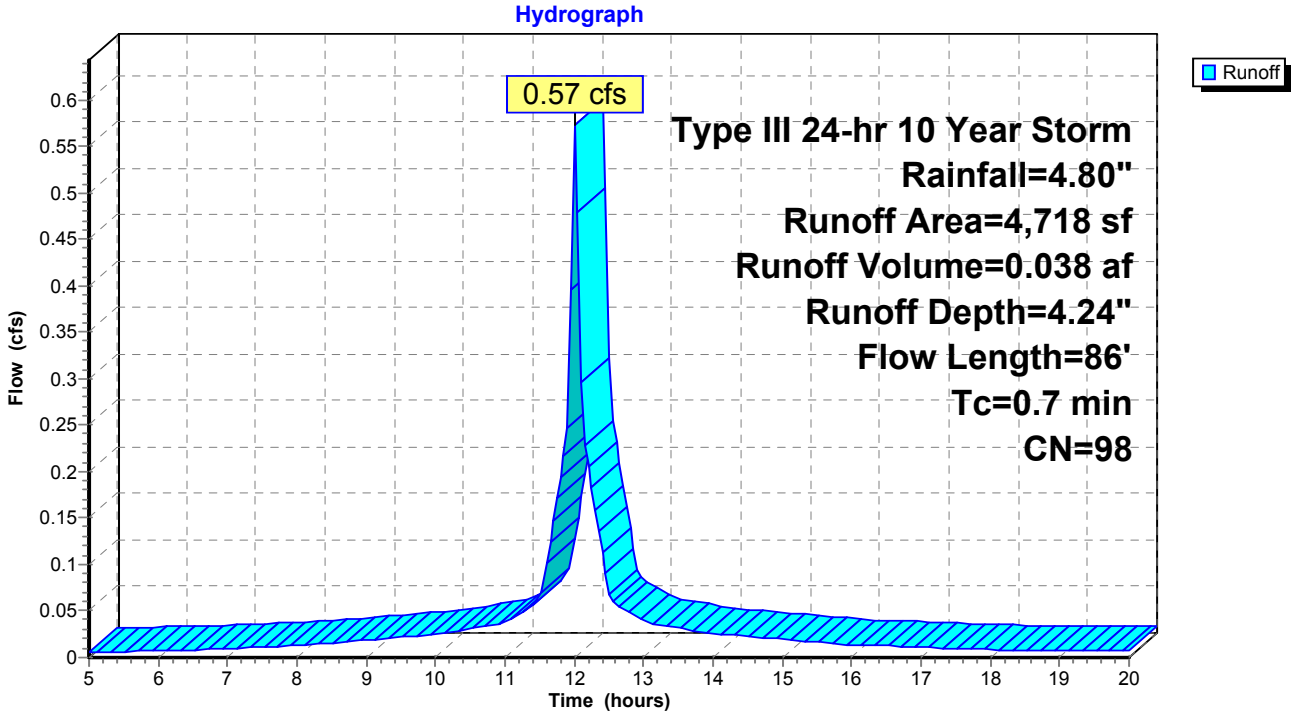
Runoff = 0.57 cfs @ 12.01 hrs, Volume= 0.038 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.80"

Area (sf)	CN	Description
4,718	98	Pavement, curb, and dumpster pad

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.2	36	0.0240	3.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	86	Total			

Subcatchment 3S:



Subcatchment 4S:

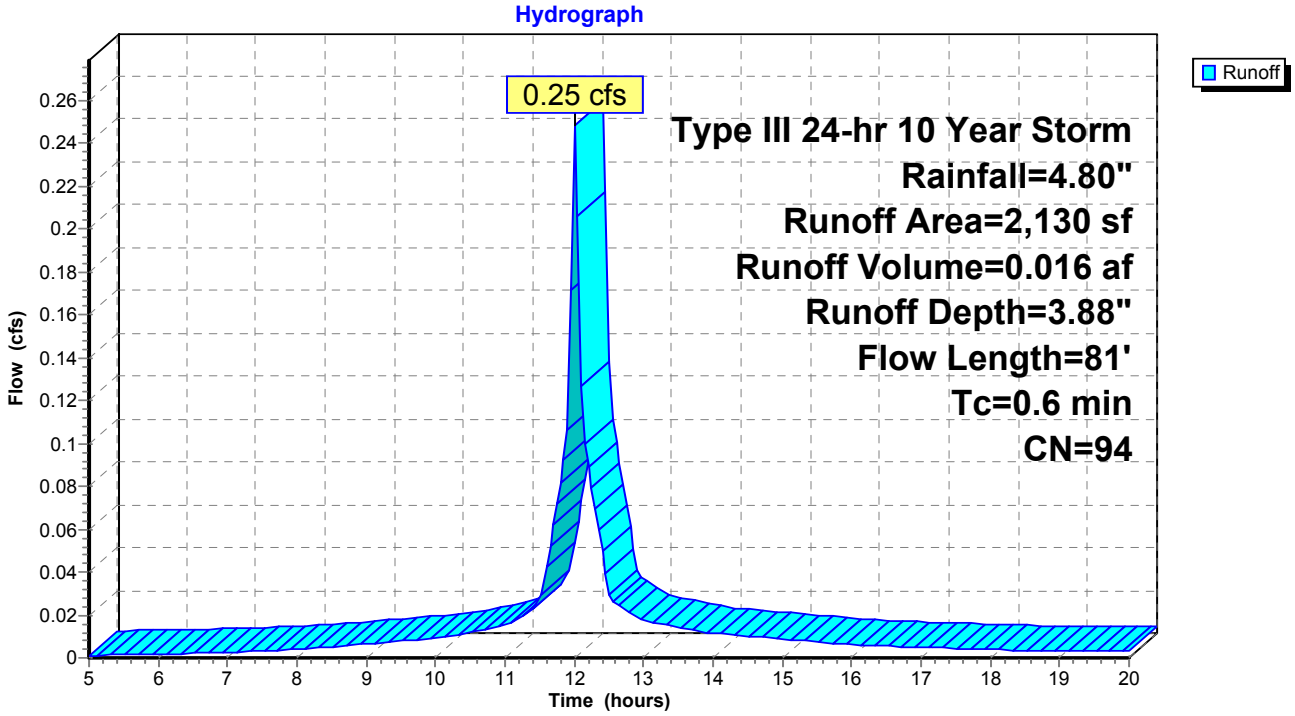
Runoff = 0.25 cfs @ 12.01 hrs, Volume= 0.016 af, Depth= 3.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.80"

Area (sf)	CN	Description
1,945	98	Pavement + Curb
185	49	50-75% Grass cover, Fair, HSG A
2,130	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	31	0.0500	4.5		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	81	Total			

Subcatchment 4S:



Subcatchment 5S:

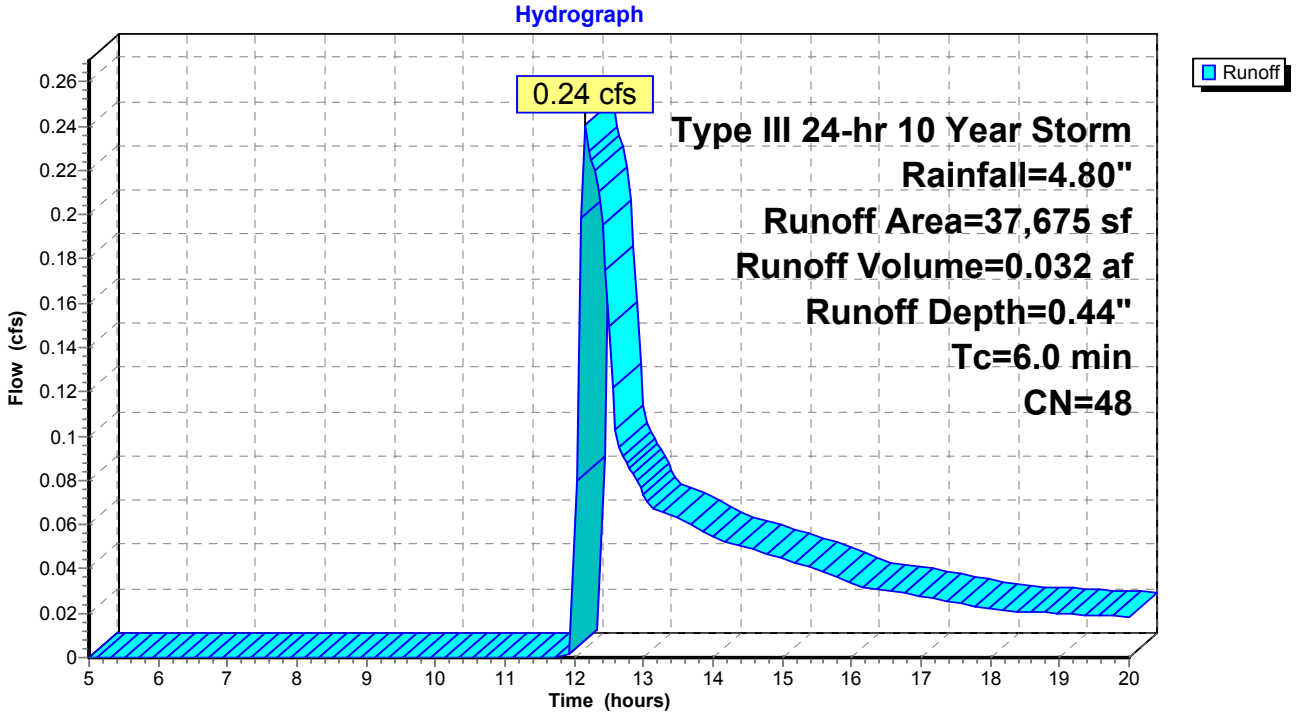
Runoff = 0.24 cfs @ 12.16 hrs, Volume= 0.032 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.80"

Area (sf)	CN	Description
611	98	1/2 Roof Area of Barn
58	98	Portion of Porch Roof
1,263	98	Portion of House Roof Area
83	98	Portion of Conc. walkway
11,530	36	Woods, Fair, HSG A
24,130	49	50-75% Grass cover, Fair, HSG A
37,675	48	Weighted Average

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

Subcatchment 5S:



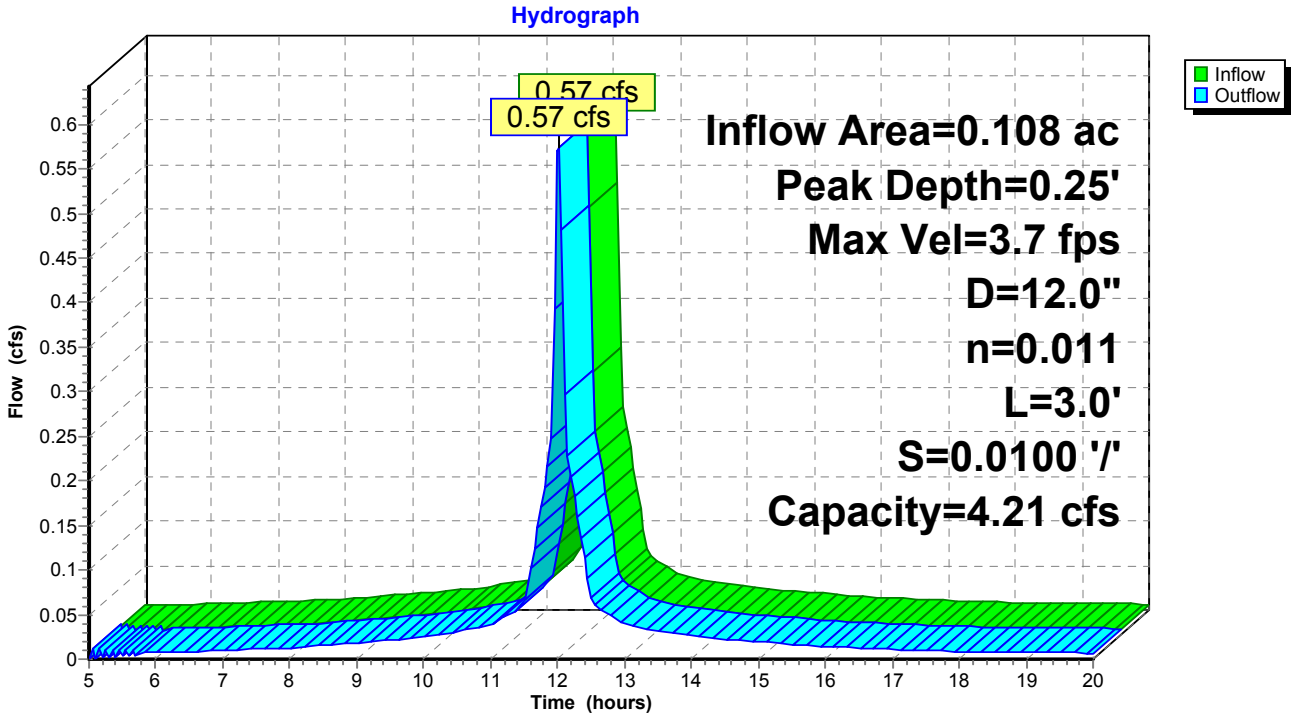
Reach 1R: CB2-SC

Inflow Area = 0.108 ac, Inflow Depth = 4.24" for 10 Year Storm event
Inflow = 0.57 cfs @ 12.01 hrs, Volume= 0.038 af
Outflow = 0.57 cfs @ 12.01 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.7 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 0.0 min

Peak Depth= 0.25' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 86.72', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 3.0' Slope= 0.0100 '/'

Reach 1R: CB2-SC



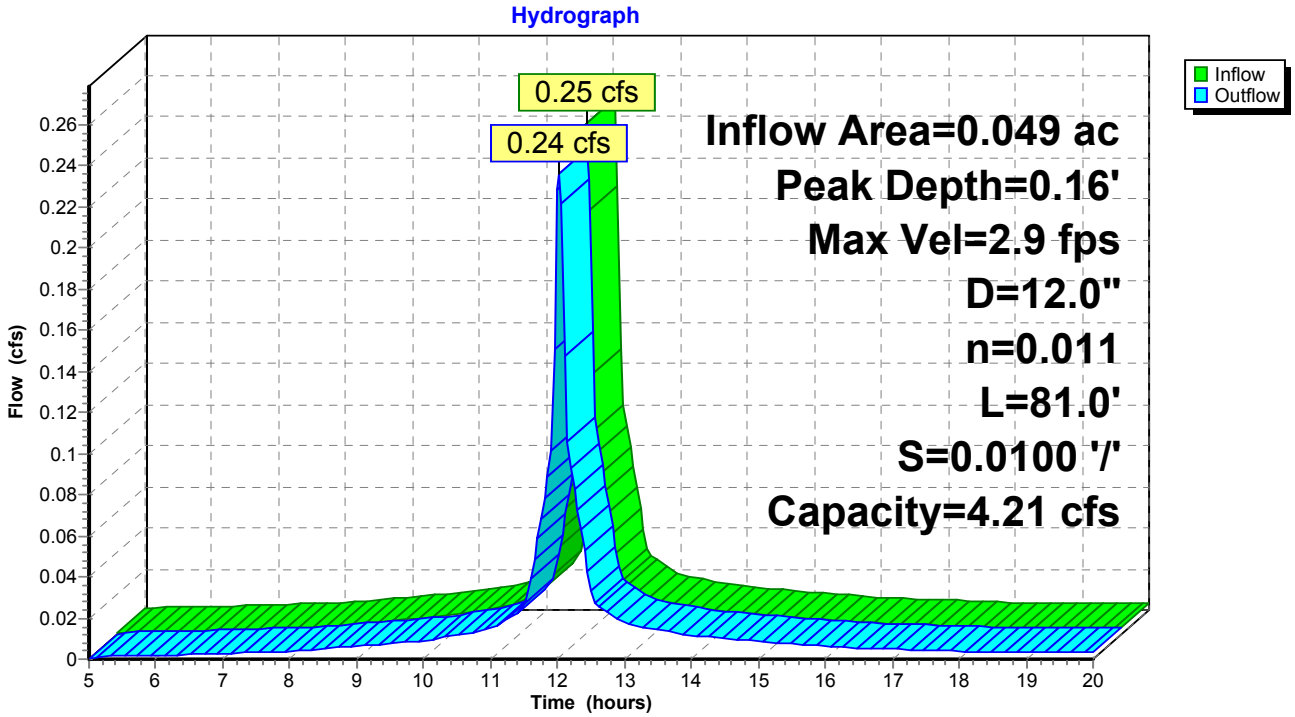
Reach 2R: CB1-SC

Inflow Area = 0.049 ac, Inflow Depth = 3.88" for 10 Year Storm event
Inflow = 0.25 cfs @ 12.01 hrs, Volume= 0.016 af
Outflow = 0.24 cfs @ 12.02 hrs, Volume= 0.016 af, Atten= 5%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.9 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 1.3 min

Peak Depth= 0.16' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 87.50', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 81.0' Slope= 0.0100 '/'

Reach 2R: CB1-SC



Pond 1P: Infiltration Field #1

Exfiltration based on Class B soil (Sandy Loam) with Design Infiltration Rate of 1.02 in/hr

Inflow Area =	0.157 ac,	Inflow Depth =	4.12"	for	10 Year Storm event
Inflow =	0.81 cfs @	12.01 hrs,	Volume=	0.054 af	
Outflow =	0.06 cfs @	11.25 hrs,	Volume=	0.054 af,	Atten= 93%, Lag= 0.0 min
Discarded =	0.06 cfs @	11.25 hrs,	Volume=	0.054 af	

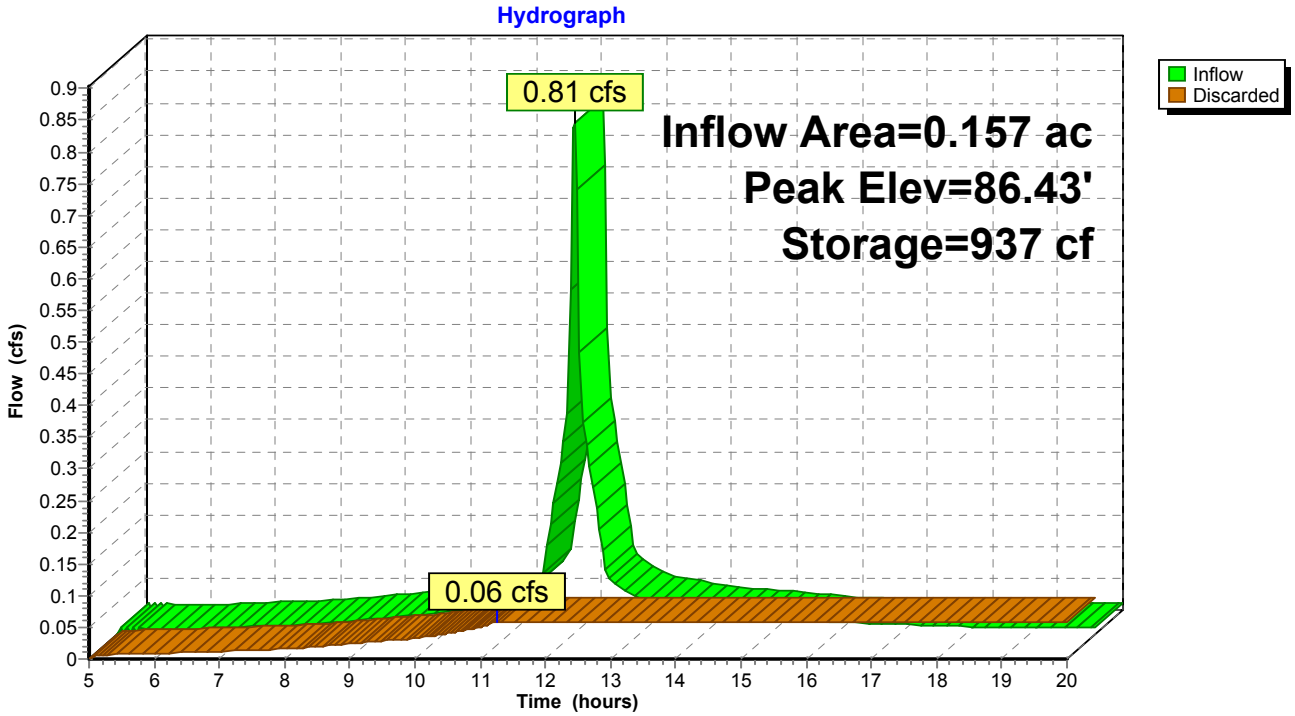
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 86.43' @ 12.97 hrs Surf.Area= 2,480 sf Storage= 937 cf
Plug-Flow detention time= 127.2 min calculated for 0.054 af (99% of inflow)
Center-of-Mass det. time= 122.9 min (858.7 - 735.8)

#	Invert	Avail.Storage	Storage Description
1	85.52'	2,114 cf	**20.00'W x 124.00'L x 2.20'H Prismatoid**
			5,456 cf Overall - 171 cf Embedded = 5,285 cf x 40.0% Voids
2	86.02'	171 cf	**2.7"W x 18.5"H x 10.25'L Cultec 150XLHD** x 72 Inside #1
		2,285 cf	Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001417 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.06 cfs @ 11.25 hrs HW=85.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond 1P: Infiltration Field #1



Pond 2P: Porous Pvmt Base Material

Inflow Area = 0.557 ac, Inflow Depth = 1.15" for 10 Year Storm event
Inflow = 0.14 cfs @ 18.43 hrs, Volume= 0.053 af
Outflow = 0.14 cfs @ 18.48 hrs, Volume= 0.052 af, Atten= 0%, Lag= 2.5 min
Discarded = 0.14 cfs @ 18.48 hrs, Volume= 0.052 af

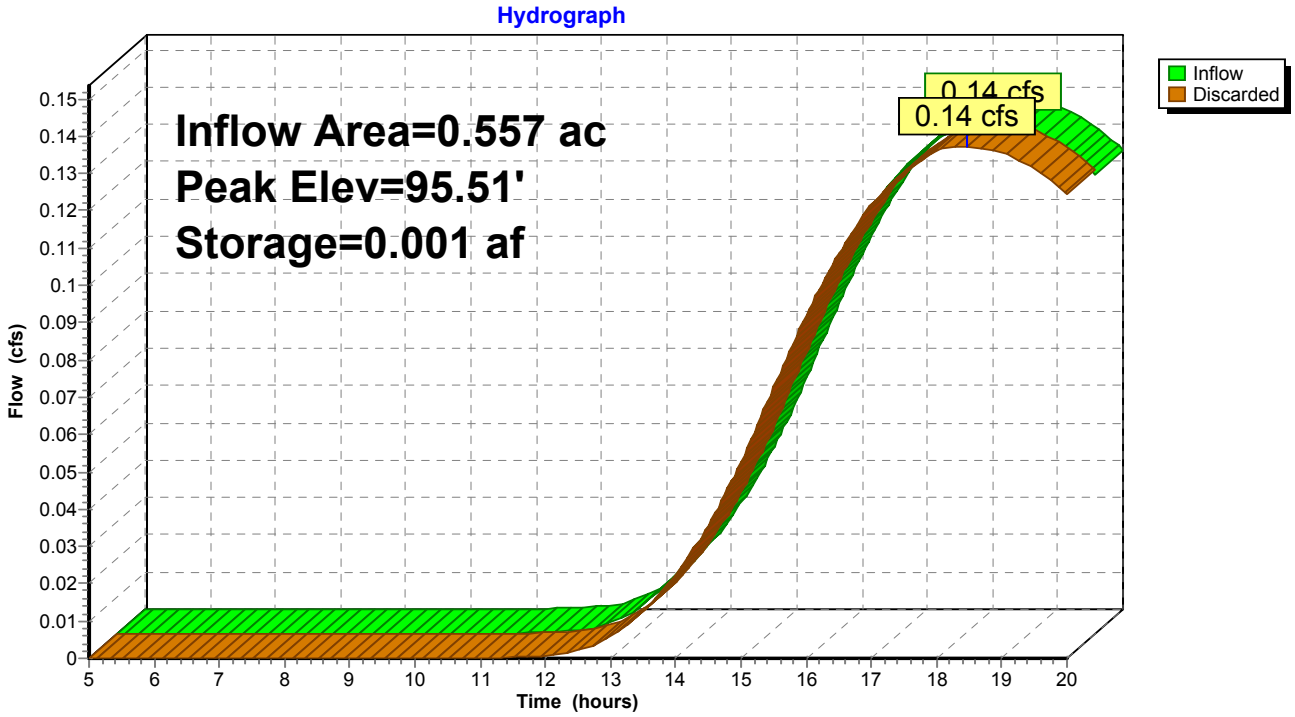
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 95.51' @ 18.48 hrs Surf.Area= 0.197 ac Storage= 0.001 af
Plug-Flow detention time= 5.6 min calculated for 0.052 af (98% of inflow)
Center-of-Mass det. time= 2.8 min (1,048.7 - 1,046.0)

#	Invert	Avail.Storage	Storage Description
1	95.50'	0.158 af	**50.00'W x 172.00'L x 2.00'H Prismatoid** 0.395 af Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001416 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.20 cfs @ 18.48 hrs HW=95.51' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Pond 2P: Porous Pvmt Base Material

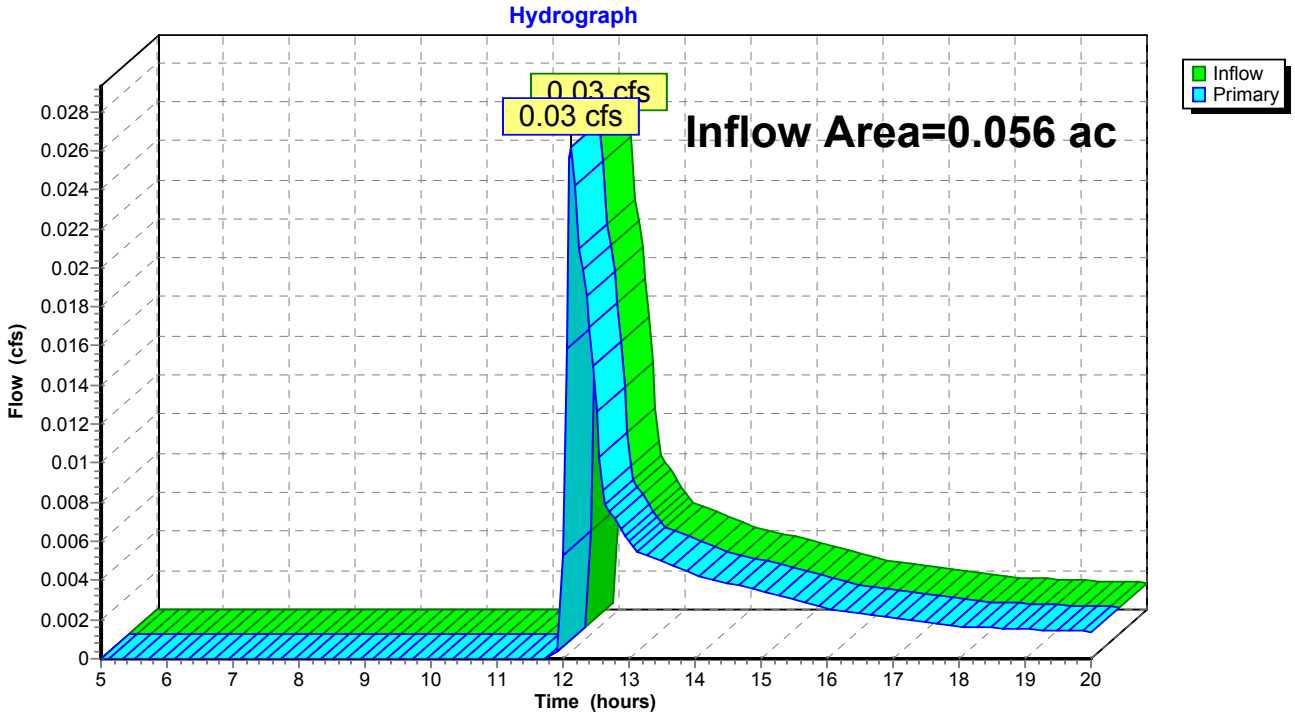


Link 1L: (To Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 0.58" for 10 Year Storm event
Inflow = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af
Primary = 0.03 cfs @ 12.13 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: (To Summer Avenue)

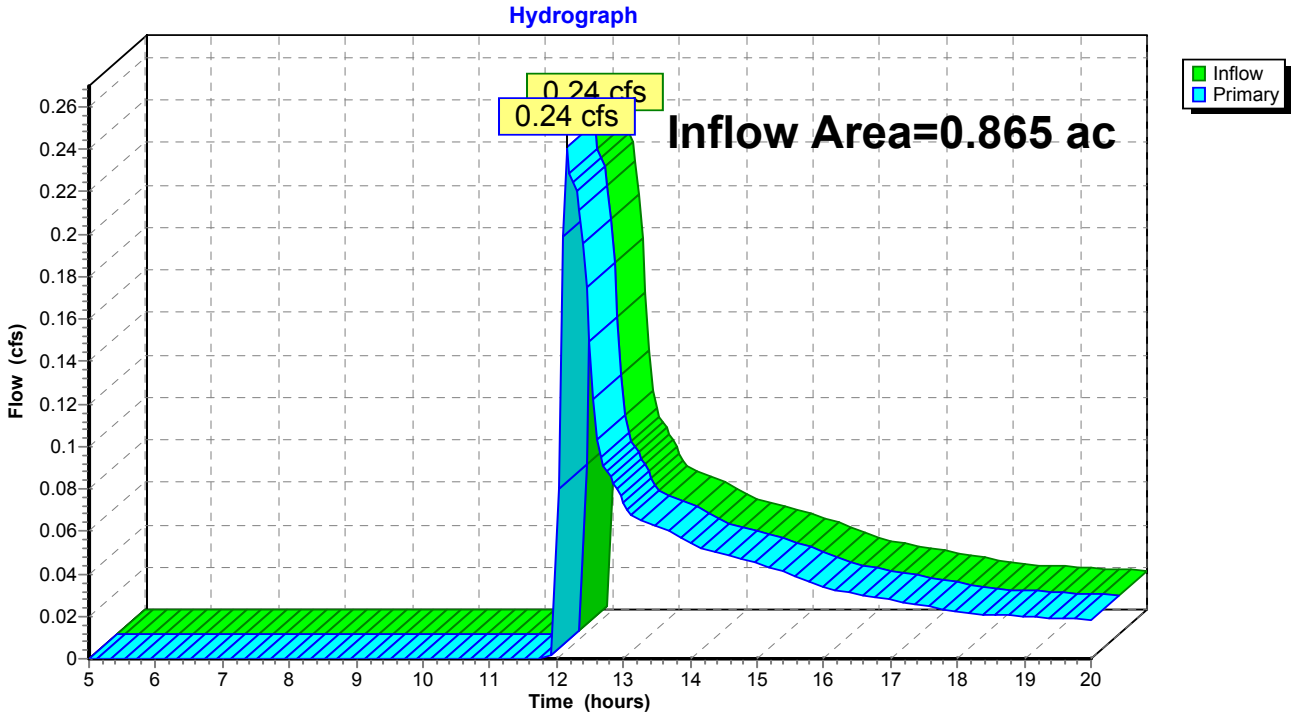


Link 2L: To Rear of Site

Inflow Area = 0.865 ac, Inflow Depth = 0.44" for 10 Year Storm event
Inflow = 0.24 cfs @ 12.16 hrs, Volume= 0.032 af
Primary = 0.24 cfs @ 12.16 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Site



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=0.86"
Tc=6.0 min CN=51 Runoff=0.05 cfs 0.004 af

Subcatchment 2S: Runoff Area=24,258 sf Runoff Depth=1.46"
Tc=462.0 min CN=75 Runoff=0.17 cfs 0.068 af

Subcatchment 3S: Runoff Area=4,718 sf Runoff Depth=4.87"
Flow Length=86' Tc=0.7 min CN=98 Runoff=0.66 cfs 0.044 af

Subcatchment 4S: Runoff Area=2,130 sf Runoff Depth=4.53"
Flow Length=81' Tc=0.6 min CN=94 Runoff=0.29 cfs 0.018 af

Subcatchment 5S: Runoff Area=37,675 sf Runoff Depth=0.69"
Tc=6.0 min CN=48 Runoff=0.51 cfs 0.049 af

Reach 1R: CB2-SC Peak Depth=0.27' Max Vel=3.9 fps Inflow=0.66 cfs 0.044 af
D=12.0" n=0.011 L=3.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.66 cfs 0.044 af

Reach 2R: CB1-SC Peak Depth=0.18' Max Vel=3.0 fps Inflow=0.29 cfs 0.018 af
D=12.0" n=0.011 L=81.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.27 cfs 0.018 af

Pond 1P: Infiltration Field #1 Peak Elev=86.62' Storage=1,142 cf Inflow=0.93 cfs 0.062 af
Outflow=0.06 cfs 0.055 af

Pond 2P: Porous Pvmt Base Material Peak Elev=95.52' Storage=0.001 af Inflow=0.17 cfs 0.068 af
Outflow=0.17 cfs 0.067 af

Link 1L: (To Summer Avenue) Inflow=0.05 cfs 0.004 af
Primary=0.05 cfs 0.004 af

Link 2L: To Rear of Site Inflow=0.51 cfs 0.049 af
Primary=0.51 cfs 0.049 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.184 af Average Runoff Depth = 1.35"

Subcatchment 1S:

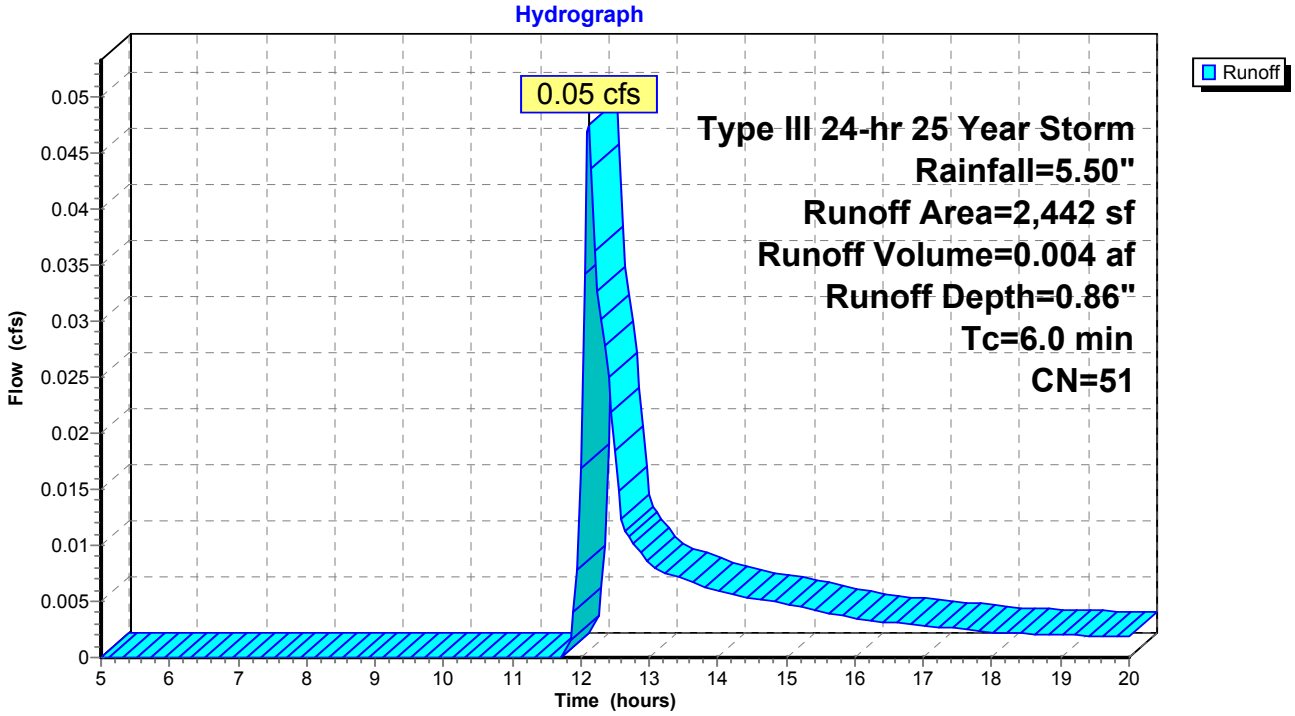
Runoff = 0.05 cfs @ 12.11 hrs, Volume= 0.004 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=5.50"

Area (sf)	CN	Description
107	98	Portion of Front Porch
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

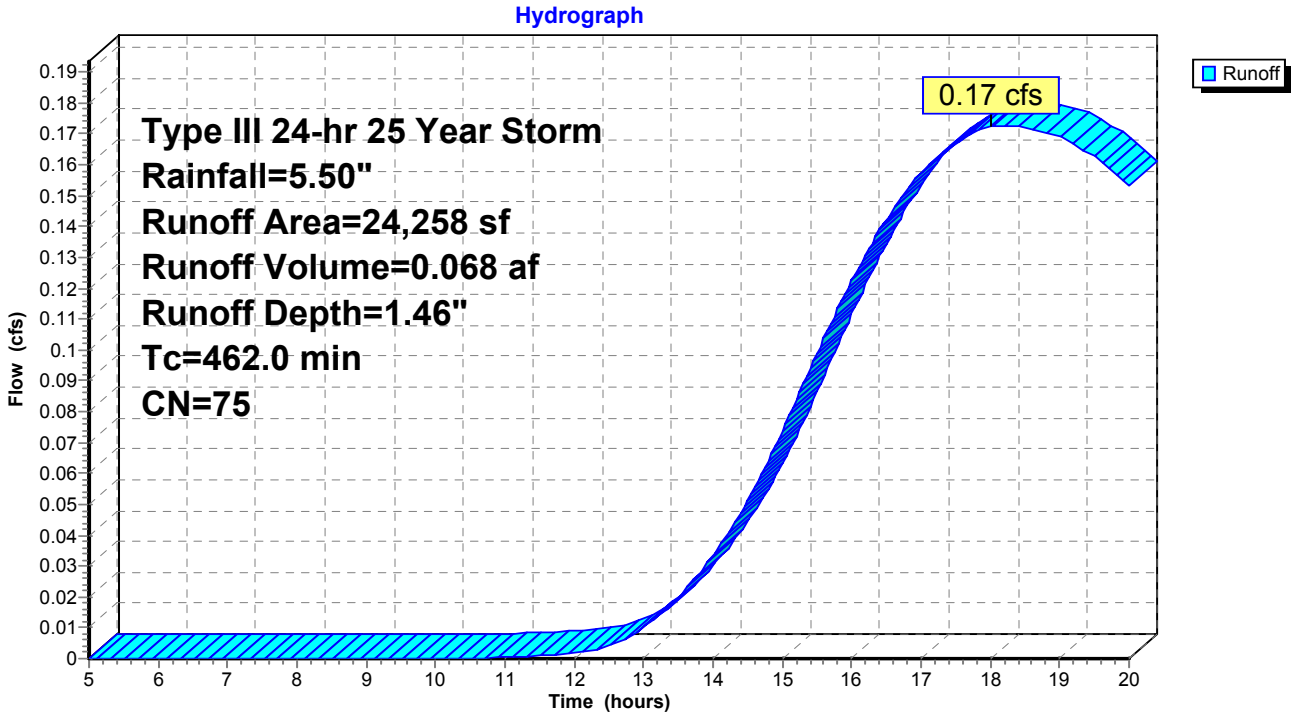
Runoff = 0.17 cfs @ 18.02 hrs, Volume= 0.068 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=5.50"

Area (sf)	CN	Description
612	98	1/2 of Barn Roof
234	98	Portion of Porch
1,024	98	Portion of House Roof
2,271	98	Portion of Conc. Walkways
50	98	ADA platforms
115	98	vertical granite curb
8,610	98	Porous Pavement
11,342	49	50-75% Grass cover, Fair, HSG A
24,258	75	Weighted Average

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

Subcatchment 2S:



Subcatchment 3S:

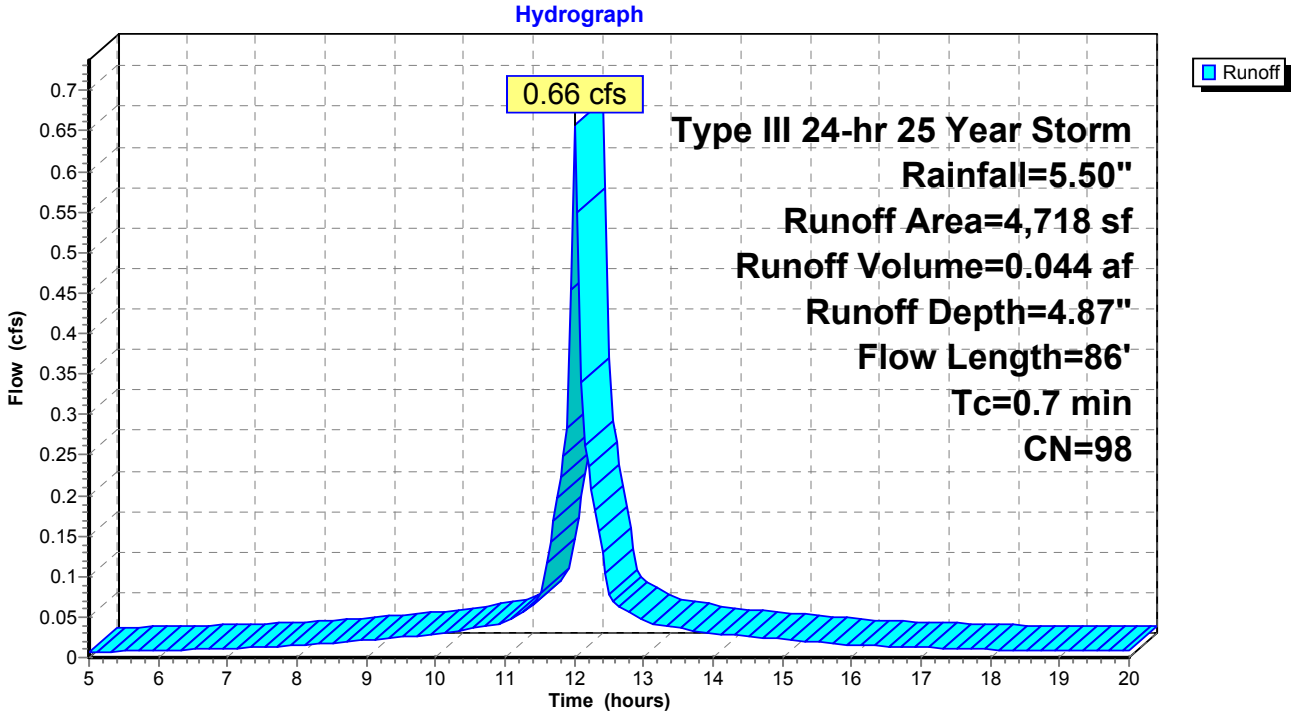
Runoff = 0.66 cfs @ 12.01 hrs, Volume= 0.044 af, Depth= 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=5.50"

Area (sf)	CN	Description
4,718	98	Pavement, curb, and dumpster pad

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.2	36	0.0240	3.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	86	Total			

Subcatchment 3S:



Subcatchment 4S:

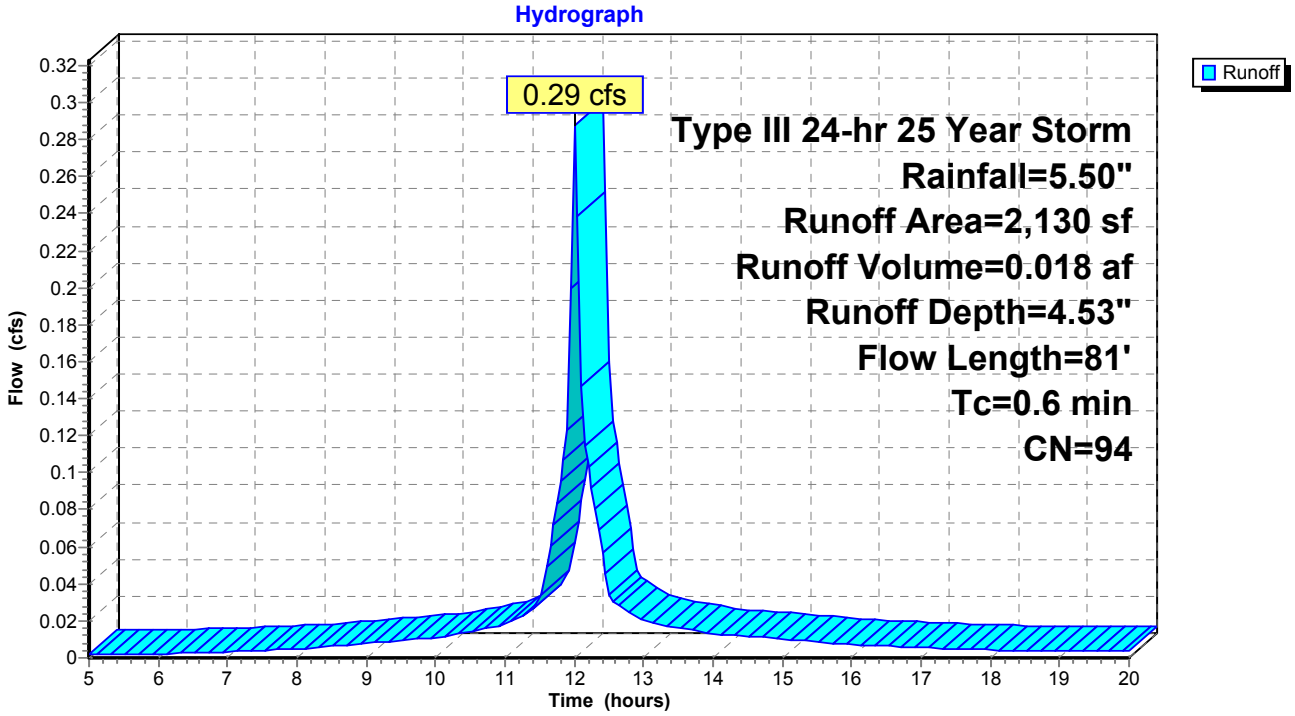
Runoff = 0.29 cfs @ 12.01 hrs, Volume= 0.018 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=5.50"

Area (sf)	CN	Description
1,945	98	Pavement + Curb
185	49	50-75% Grass cover, Fair, HSG A
2,130	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	31	0.0500	4.5		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	81	Total			

Subcatchment 4S:



Subcatchment 5S:

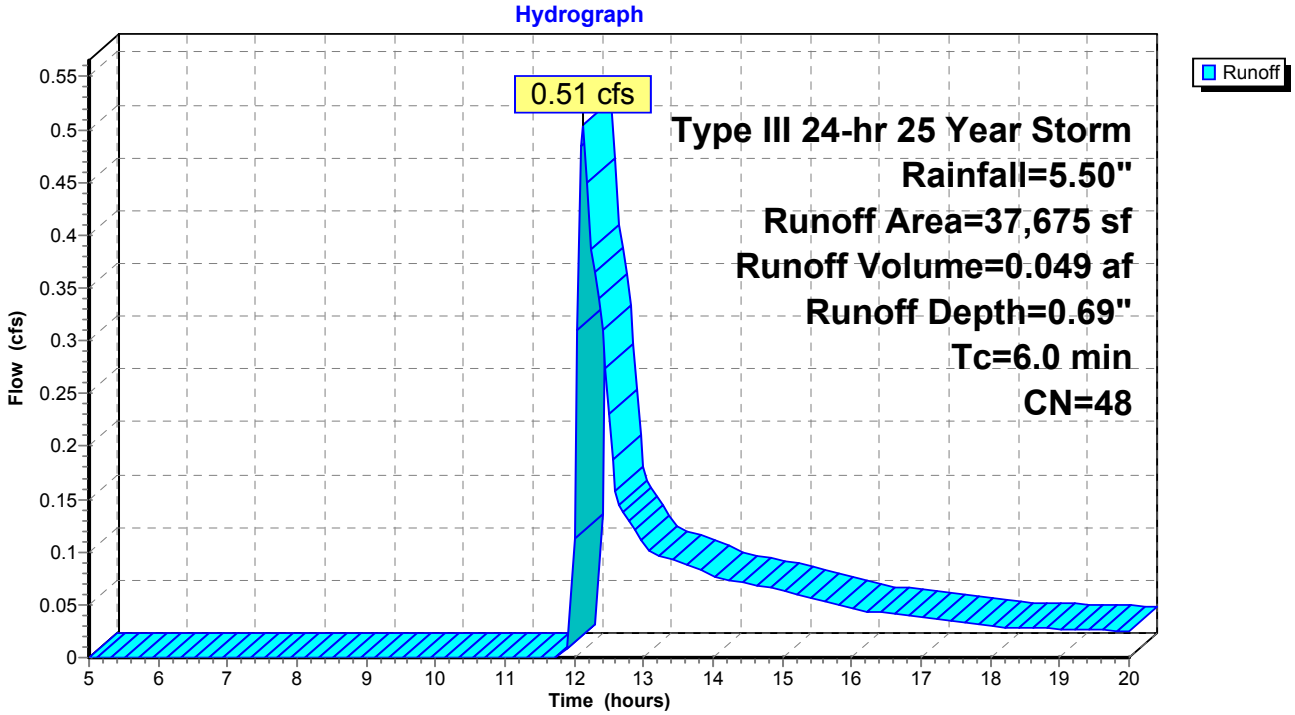
Runoff = 0.51 cfs @ 12.12 hrs, Volume= 0.049 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=5.50"

Area (sf)	CN	Description
611	98	1/2 Roof Area of Barn
58	98	Portion of Porch Roof
1,263	98	Portion of House Roof Area
83	98	Portion of Conc. walkway
11,530	36	Woods, Fair, HSG A
24,130	49	50-75% Grass cover, Fair, HSG A
37,675	48	Weighted Average

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

Subcatchment 5S:



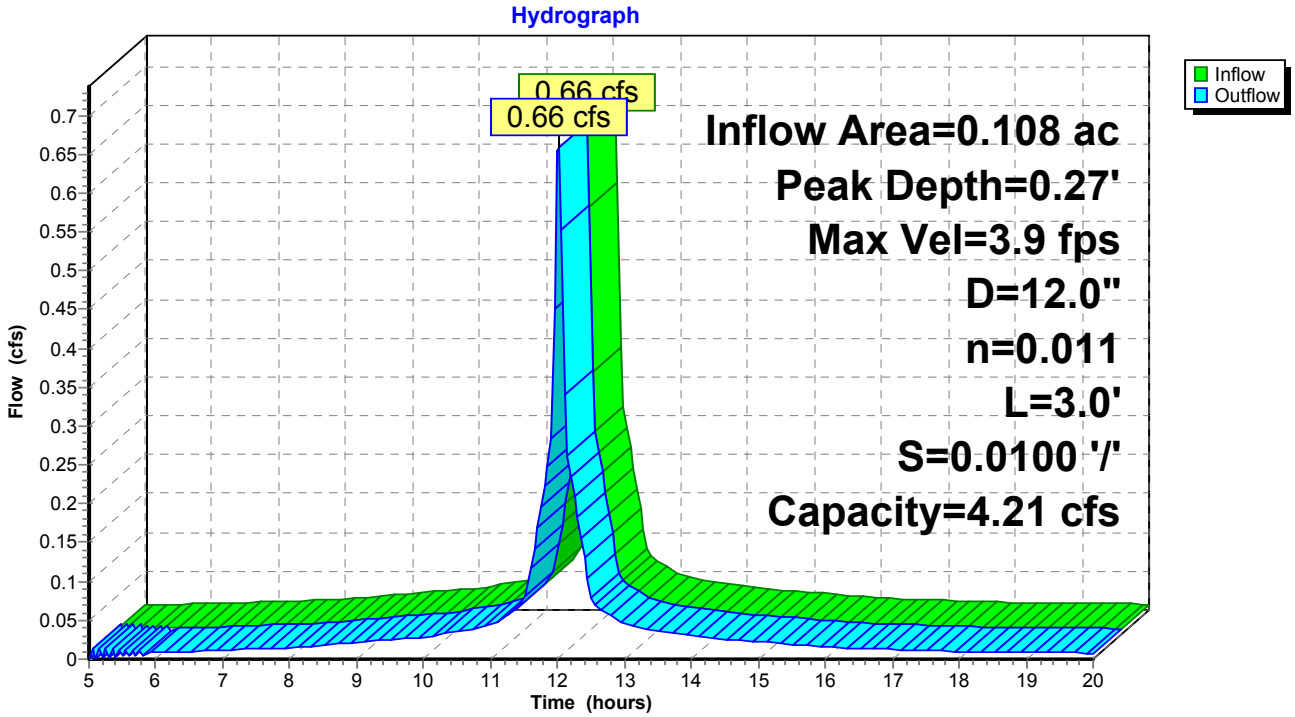
Reach 1R: CB2-SC

Inflow Area = 0.108 ac, Inflow Depth = 4.87" for 25 Year Storm event
Inflow = 0.66 cfs @ 12.01 hrs, Volume= 0.044 af
Outflow = 0.66 cfs @ 12.01 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.9 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 0.0 min

Peak Depth= 0.27' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 86.72', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 3.0' Slope= 0.0100 '/'

Reach 1R: CB2-SC



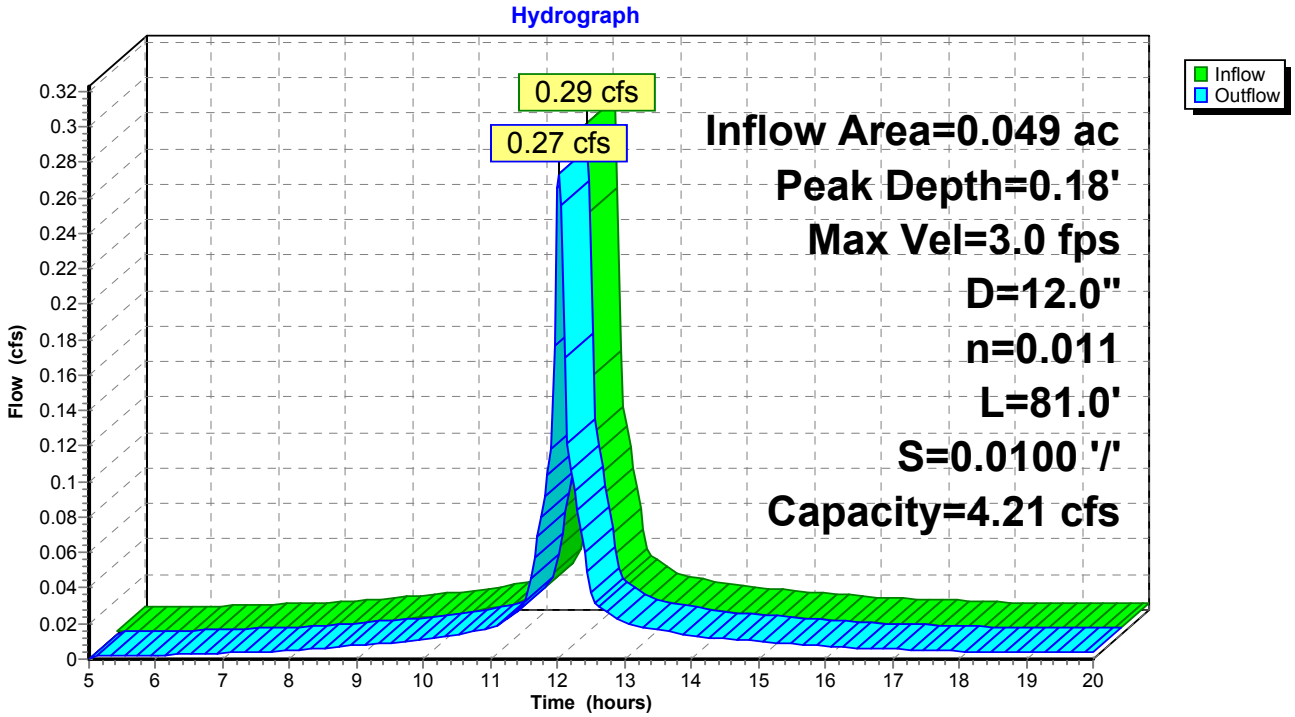
Reach 2R: CB1-SC

Inflow Area = 0.049 ac, Inflow Depth = 4.53" for 25 Year Storm event
Inflow = 0.29 cfs @ 12.01 hrs, Volume= 0.018 af
Outflow = 0.27 cfs @ 12.02 hrs, Volume= 0.018 af, Atten= 5%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.0 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.1 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.18' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 87.50', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 81.0' Slope= 0.0100 '/'

Reach 2R: CB1-SC



Pond 1P: Infiltration Field #1

Exfiltration based on Class B soil (Sandy Loam) with Design Infiltration Rate of 1.02 in/hr

Inflow Area =	0.157 ac,	Inflow Depth =	4.77"	for	25 Year Storm event
Inflow =	0.93 cfs @	12.01 hrs,	Volume=	0.062 af	
Outflow =	0.06 cfs @	11.05 hrs,	Volume=	0.055 af,	Atten= 94%, Lag= 0.0 min
Discarded =	0.06 cfs @	11.05 hrs,	Volume=	0.055 af	

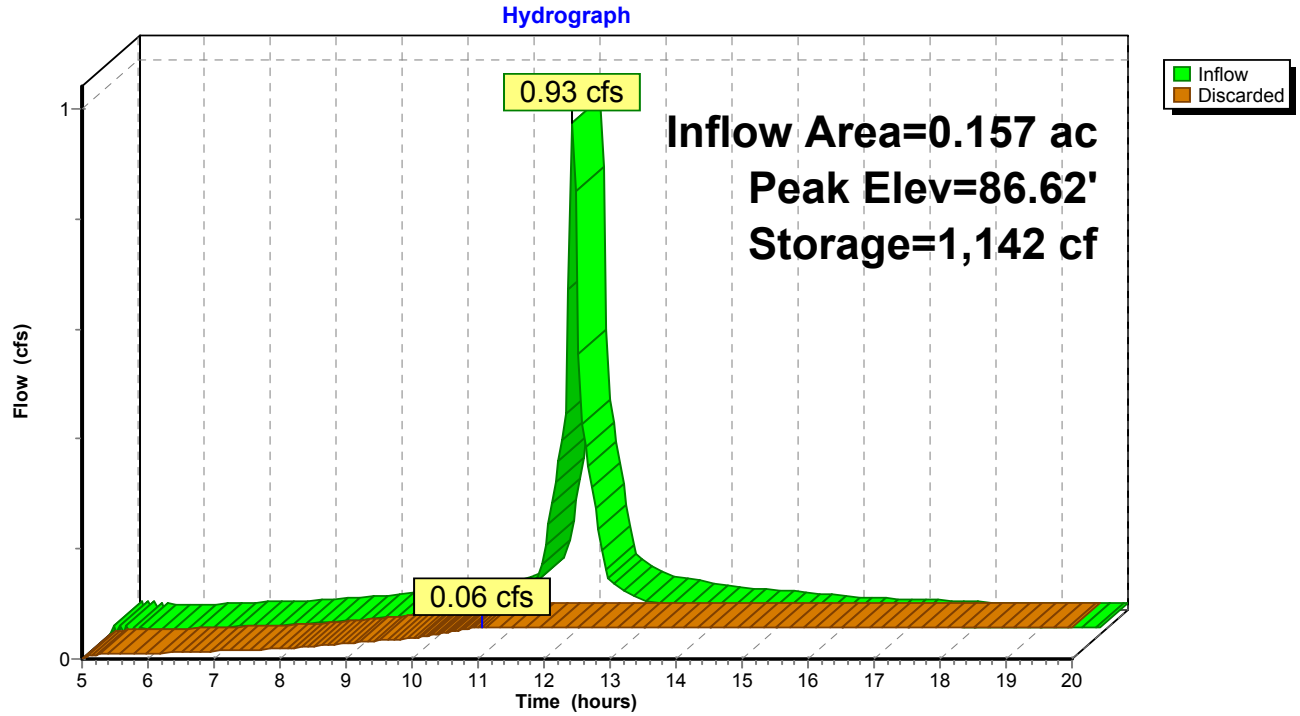
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 86.62' @ 13.24 hrs Surf.Area= 2,480 sf Storage= 1,142 cf
Plug-Flow detention time= 151.1 min calculated for 0.055 af (89% of inflow)
Center-of-Mass det. time= 113.5 min (848.1 - 734.6)

#	Invert	Avail.Storage	Storage Description
1	85.52'	2,114 cf	**20.00'W x 124.00'L x 2.20'H Prismatoid**
			5,456 cf Overall - 171 cf Embedded = 5,285 cf x 40.0% Voids
2	86.02'	171 cf	**2.7"W x 18.5"H x 10.25'L Cultec 150XLHD** x 72 Inside #1
		2,285 cf	Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001417 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.06 cfs @ 11.05 hrs HW=85.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond 1P: Infiltration Field #1



Pond 2P: Porous Pvmt Base Material

Inflow Area =	0.557 ac,	Inflow Depth =	1.46"	for	25 Year Storm event
Inflow =	0.17 cfs @	18.02 hrs,	Volume=	0.068 af	
Outflow =	0.17 cfs @	18.23 hrs,	Volume=	0.067 af,	Atten= 0%, Lag= 12.9 min
Discarded =	0.17 cfs @	18.23 hrs,	Volume=	0.067 af	

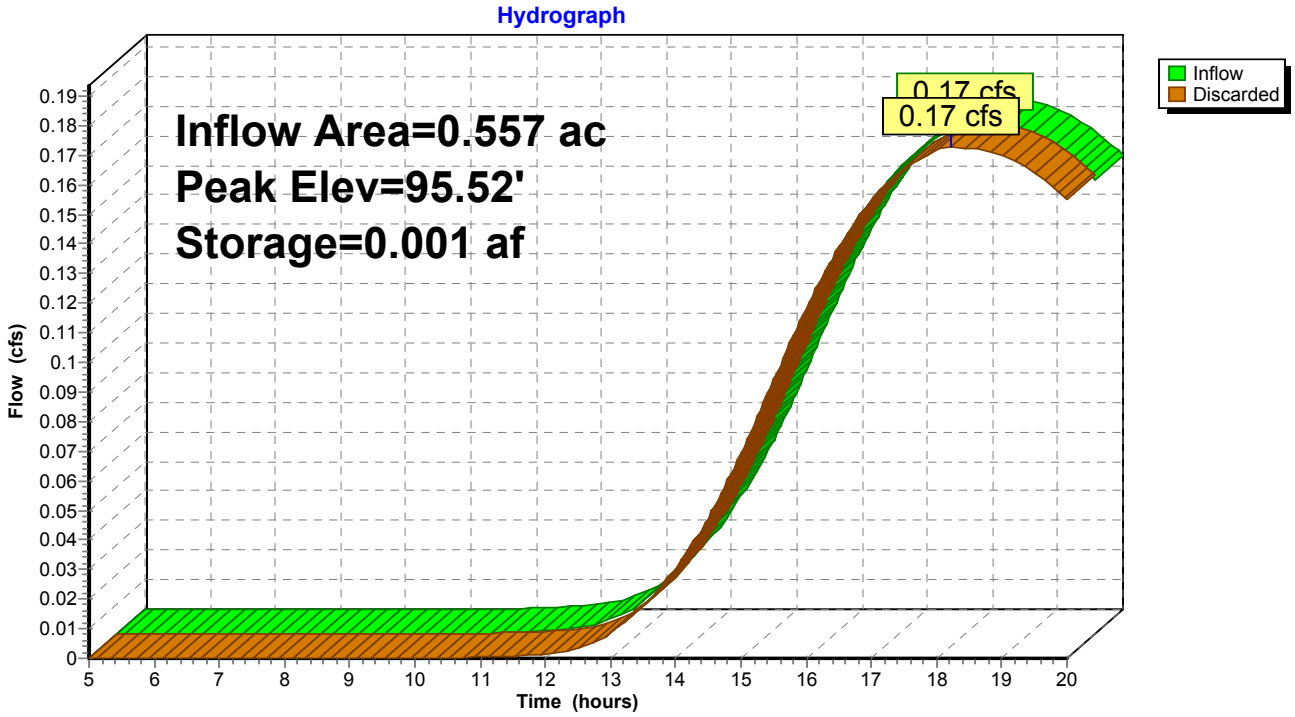
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 95.52' @ 18.23 hrs Surf.Area= 0.197 ac Storage= 0.001 af
Plug-Flow detention time= 5.6 min calculated for 0.067 af (98% of inflow)
Center-of-Mass det. time= 2.8 min (1,046.3 - 1,043.5)

#	Invert	Avail.Storage	Storage Description
1	95.50'	0.158 af	**50.00'W x 172.00'L x 2.00'H Prismatoid** 0.395 af Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001416 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.20 cfs @ 18.23 hrs HW=95.52' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Pond 2P: Porous Pvmt Base Material

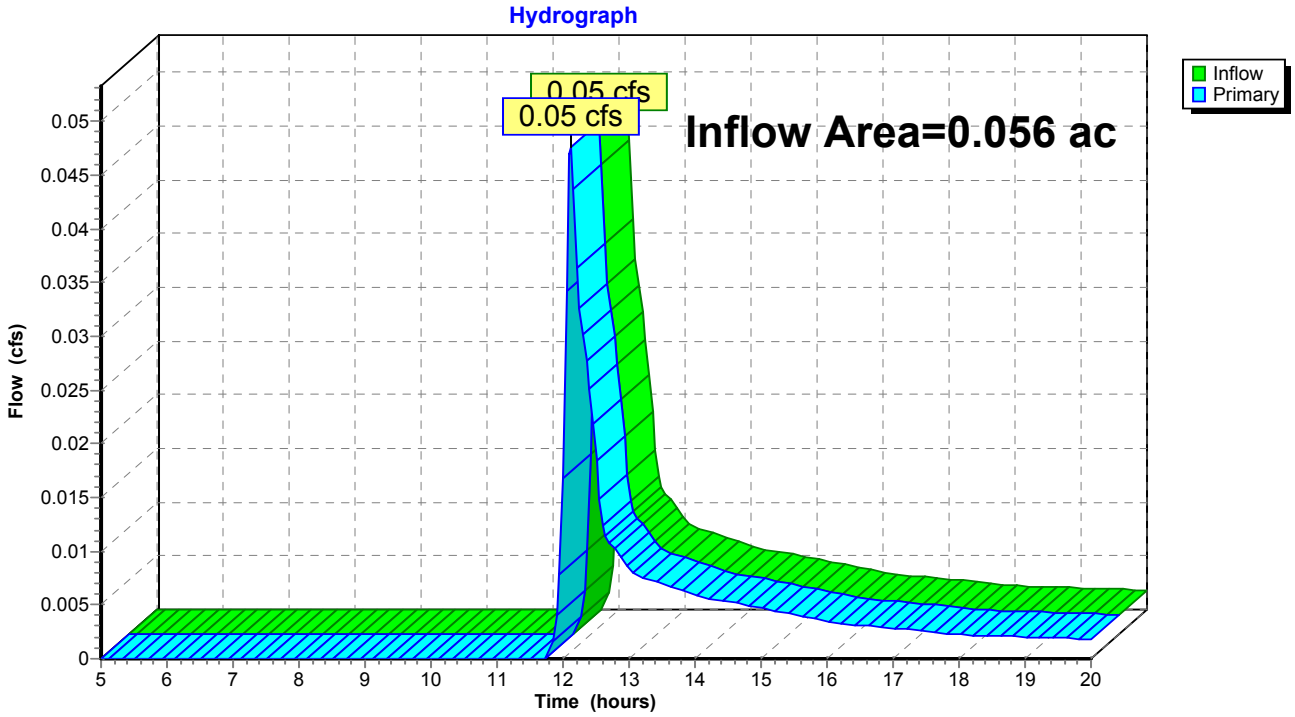


Link 1L: (To Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 0.86" for 25 Year Storm event
Inflow = 0.05 cfs @ 12.11 hrs, Volume= 0.004 af
Primary = 0.05 cfs @ 12.11 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: (To Summer Avenue)

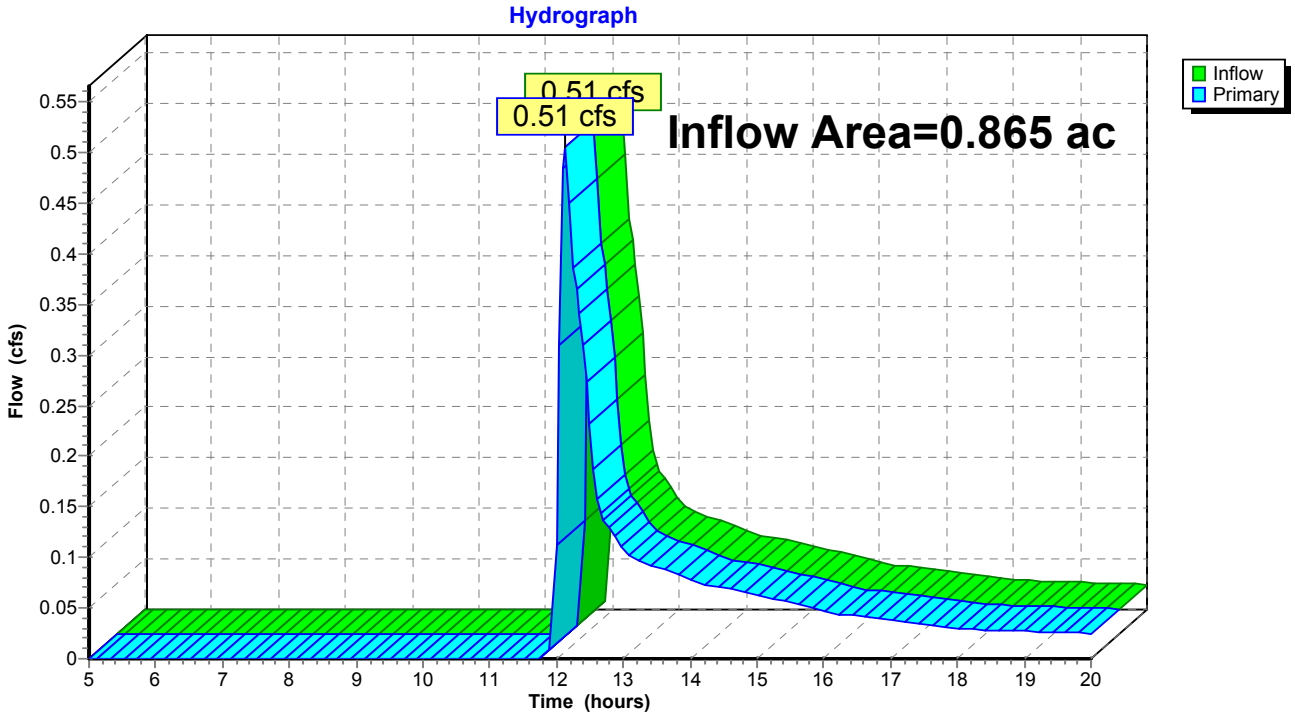


Link 2L: To Rear of Site

Inflow Area = 0.865 ac, Inflow Depth = 0.69" for 25 Year Storm event
Inflow = 0.51 cfs @ 12.12 hrs, Volume= 0.049 af
Primary = 0.51 cfs @ 12.12 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Site



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=2,442 sf Runoff Depth=1.28"
Tc=6.0 min CN=51 Runoff=0.08 cfs 0.006 af

Subcatchment 2S: Runoff Area=24,258 sf Runoff Depth=1.89"
Tc=462.0 min CN=75 Runoff=0.22 cfs 0.088 af

Subcatchment 3S: Runoff Area=4,718 sf Runoff Depth=5.69"
Flow Length=86' Tc=0.7 min CN=98 Runoff=0.77 cfs 0.051 af

Subcatchment 4S: Runoff Area=2,130 sf Runoff Depth=5.36"
Flow Length=81' Tc=0.6 min CN=94 Runoff=0.34 cfs 0.022 af

Subcatchment 5S: Runoff Area=37,675 sf Runoff Depth=1.06"
Tc=6.0 min CN=48 Runoff=0.93 cfs 0.076 af

Reach 1R: CB2-SC Peak Depth=0.29' Max Vel=4.1 fps Inflow=0.77 cfs 0.051 af
D=12.0" n=0.011 L=3.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.77 cfs 0.051 af

Reach 2R: CB1-SC Peak Depth=0.19' Max Vel=3.2 fps Inflow=0.34 cfs 0.022 af
D=12.0" n=0.011 L=81.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=0.32 cfs 0.022 af

Pond 1P: Infiltration Field #1 Peak Elev=86.89' Storage=1,428 cf Inflow=1.09 cfs 0.073 af
Outflow=0.06 cfs 0.057 af

Pond 2P: Porous Pvmt Base Material Peak Elev=95.55' Storage=0.004 af Inflow=0.22 cfs 0.088 af
Outflow=0.20 cfs 0.084 af

Link 1L: (To Summer Avenue) Inflow=0.08 cfs 0.006 af
Primary=0.08 cfs 0.006 af

Link 2L: To Rear of Site Inflow=0.93 cfs 0.076 af
Primary=0.93 cfs 0.076 af

Total Runoff Area = 1.635 ac Runoff Volume = 0.243 af Average Runoff Depth = 1.78"

Subcatchment 1S:

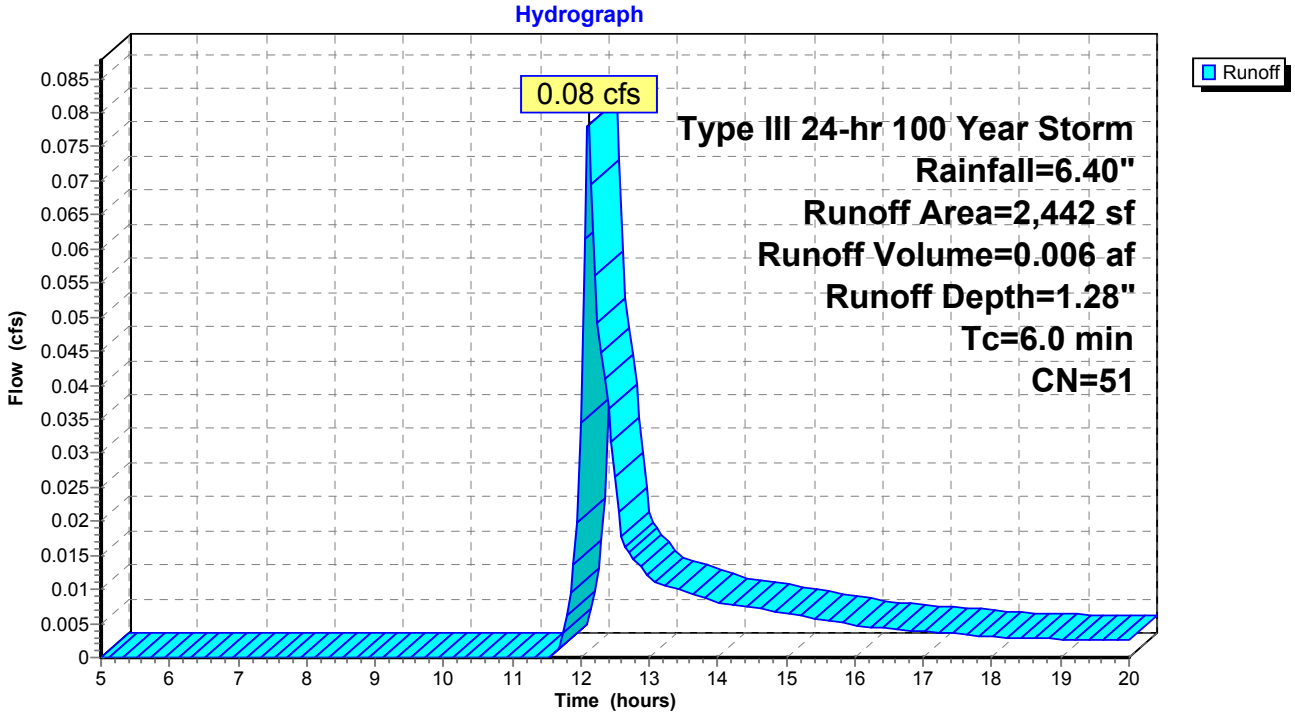
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=6.40"

Area (sf)	CN	Description
107	98	Portion of Front Porch
2,335	49	50-75% Grass cover, Fair, HSG A
2,442	51	Weighted Average

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

Subcatchment 1S:



Subcatchment 2S:

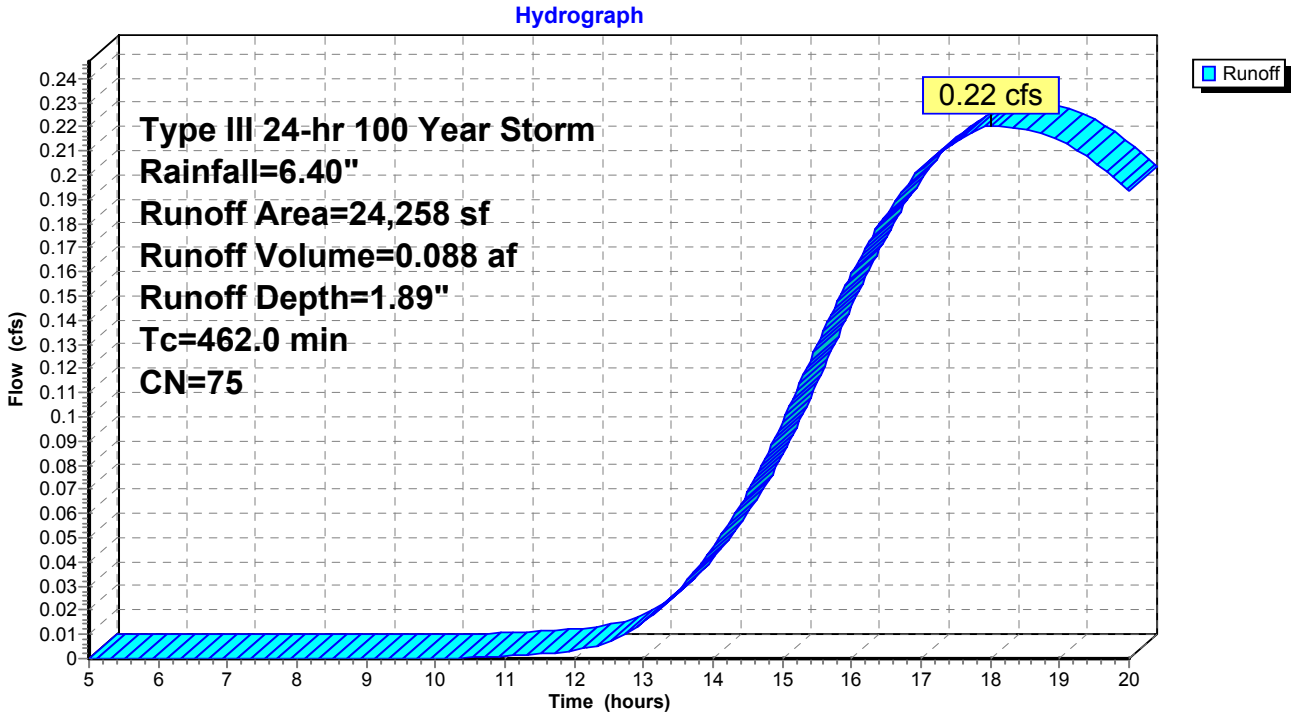
Runoff = 0.22 cfs @ 18.00 hrs, Volume= 0.088 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=6.40"

Area (sf)	CN	Description
612	98	1/2 of Barn Roof
234	98	Portion of Porch
1,024	98	Portion of House Roof
2,271	98	Portion of Conc. Walkways
50	98	ADA platforms
115	98	vertical granite curb
8,610	98	Porous Pavement
11,342	49	50-75% Grass cover, Fair, HSG A
24,258	75	Weighted Average

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

Subcatchment 2S:



Subcatchment 3S:

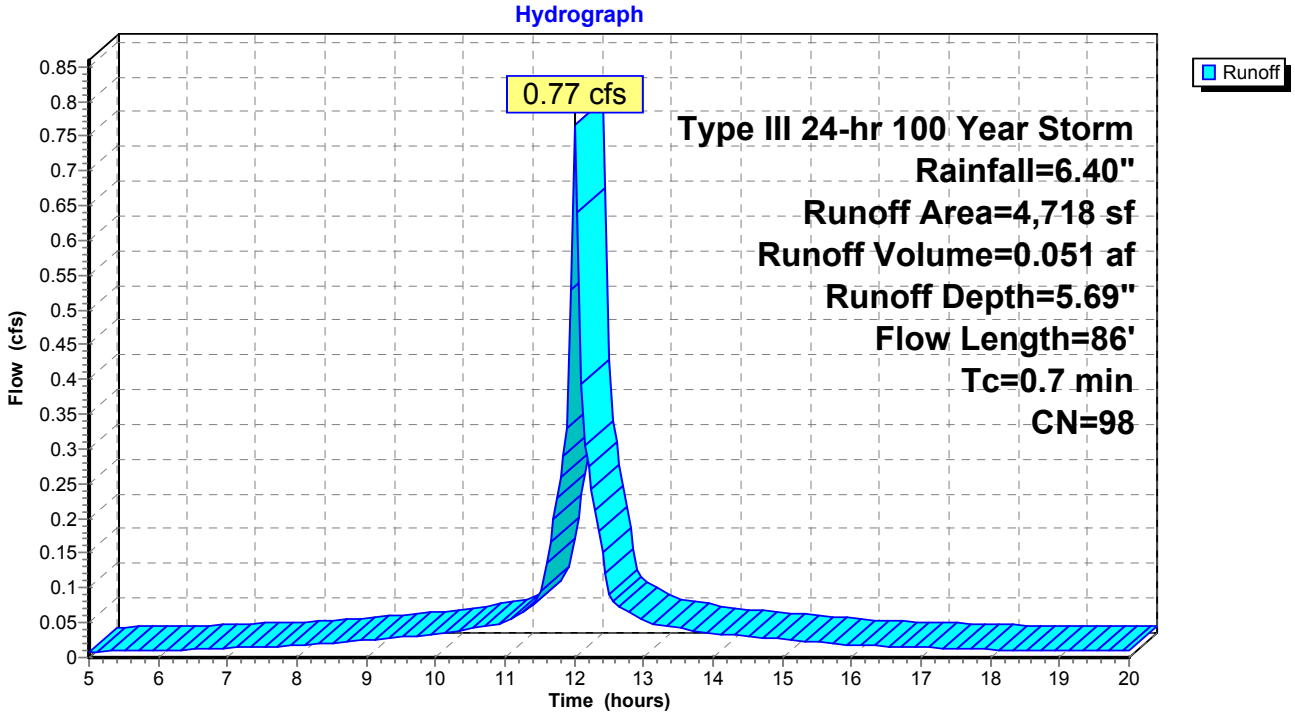
Runoff = 0.77 cfs @ 12.01 hrs, Volume= 0.051 af, Depth= 5.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=6.40"

Area (sf)	CN	Description
4,718	98	Pavement, curb, and dumpster pad

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.2	36	0.0240	3.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	86	Total			

Subcatchment 3S:



Subcatchment 4S:

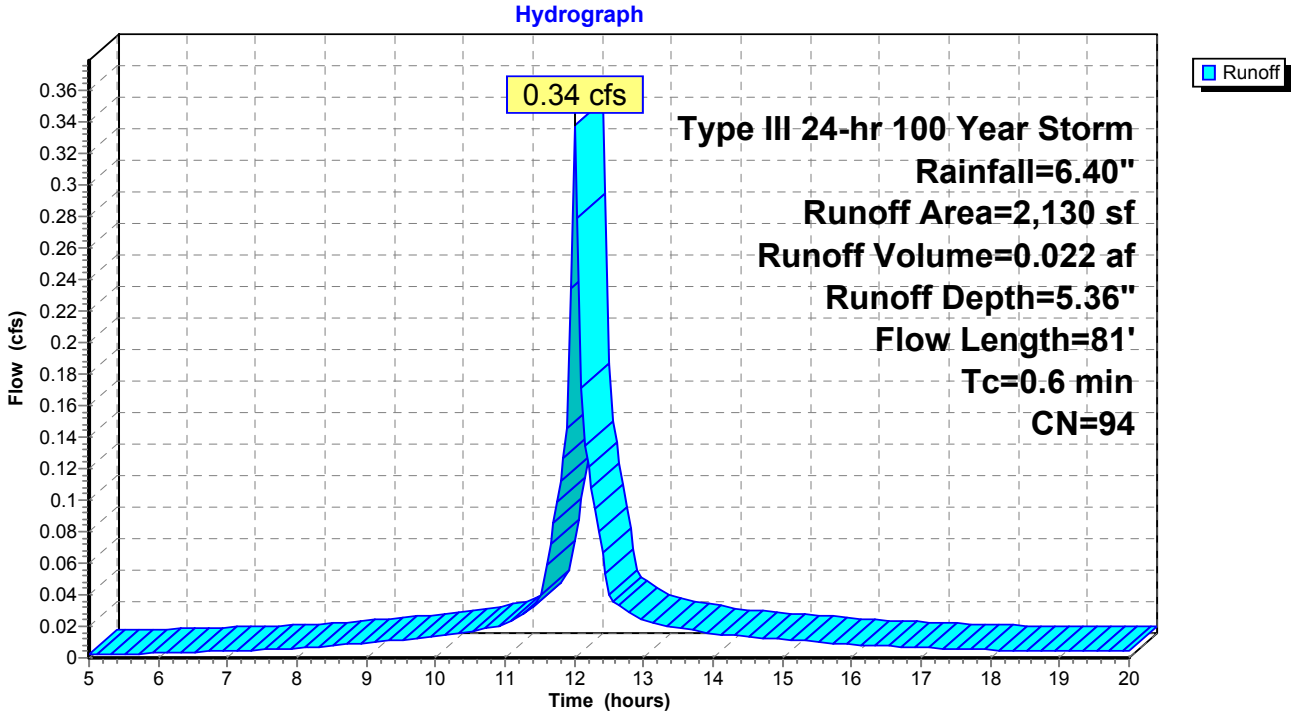
Runoff = 0.34 cfs @ 12.01 hrs, Volume= 0.022 af, Depth= 5.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=6.40"

Area (sf)	CN	Description
1,945	98	Pavement + Curb
185	49	50-75% Grass cover, Fair, HSG A
2,130	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0500	1.7		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	31	0.0500	4.5		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	81	Total			

Subcatchment 4S:



Subcatchment 5S:

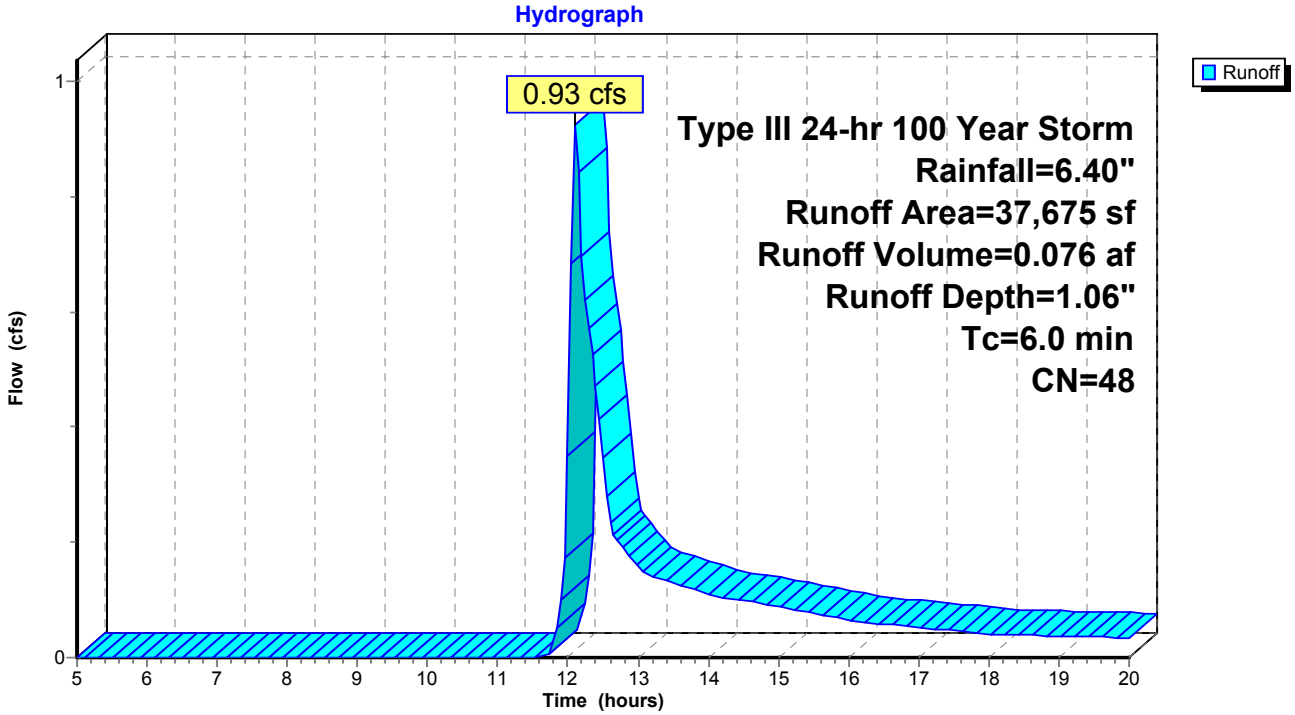
Runoff = 0.93 cfs @ 12.11 hrs, Volume= 0.076 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=6.40"

Area (sf)	CN	Description
611	98	1/2 Roof Area of Barn
58	98	Portion of Porch Roof
1,263	98	Portion of House Roof Area
83	98	Portion of Conc. walkway
11,530	36	Woods, Fair, HSG A
24,130	49	50-75% Grass cover, Fair, HSG A
37,675	48	Weighted Average

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

Subcatchment 5S:



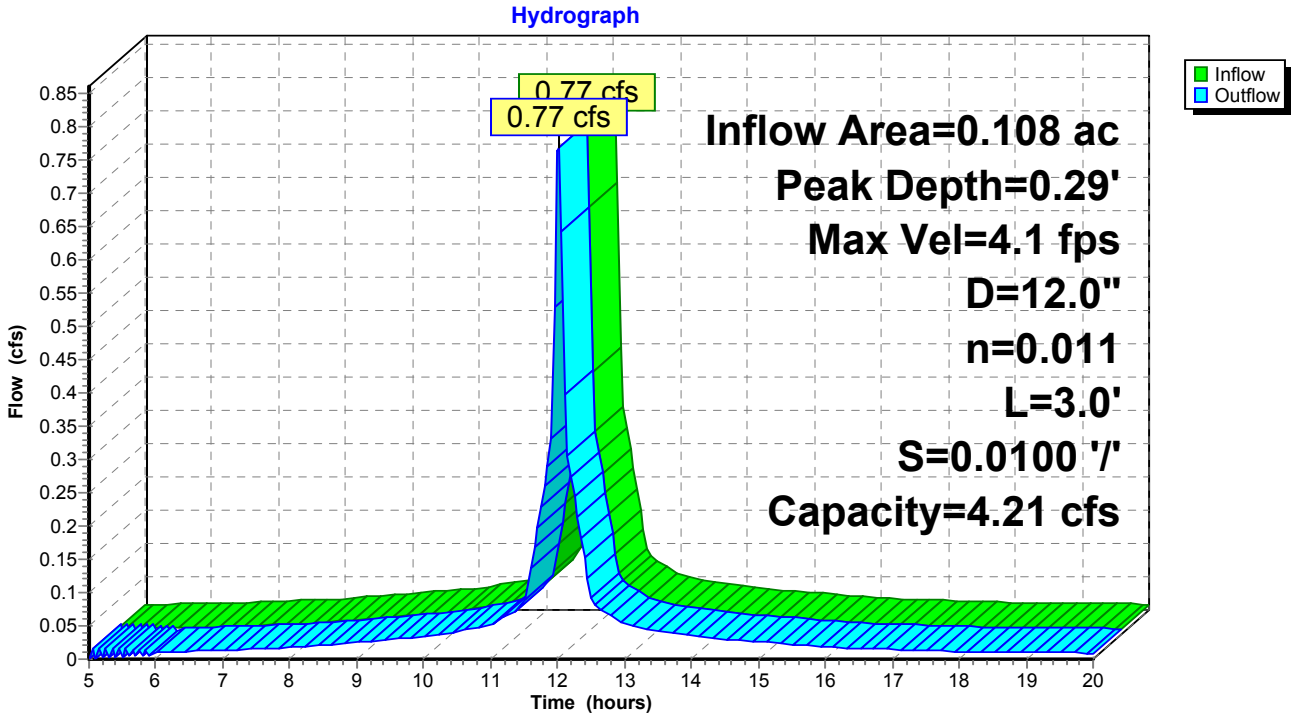
Reach 1R: CB2-SC

Inflow Area = 0.108 ac, Inflow Depth = 5.69" for 100 Year Storm event
Inflow = 0.77 cfs @ 12.01 hrs, Volume= 0.051 af
Outflow = 0.77 cfs @ 12.01 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.1 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 0.0 min

Peak Depth= 0.29' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 86.72', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 3.0' Slope= 0.0100 '/'

Reach 1R: CB2-SC



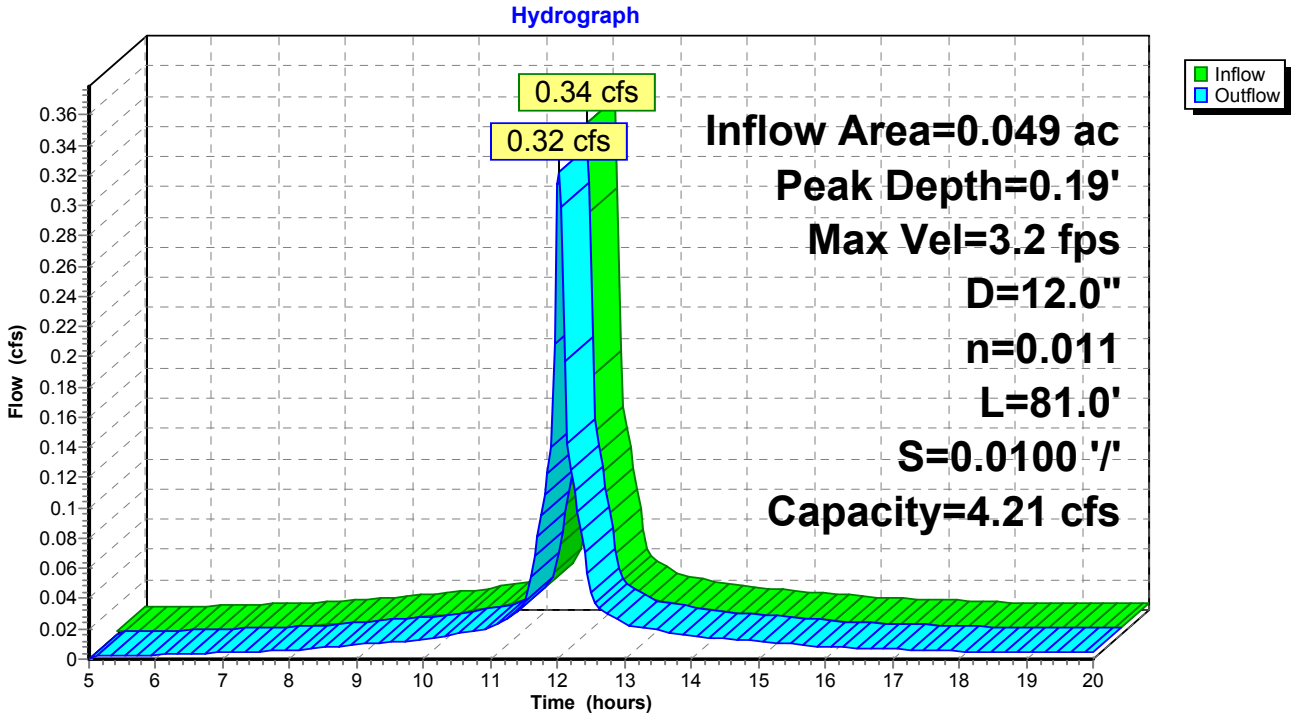
Reach 2R: CB1-SC

Inflow Area = 0.049 ac, Inflow Depth = 5.36" for 100 Year Storm event
Inflow = 0.34 cfs @ 12.01 hrs, Volume= 0.022 af
Outflow = 0.32 cfs @ 12.02 hrs, Volume= 0.022 af, Atten= 5%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.2 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.19' @ 12.01 hrs
Capacity at bank full= 4.21 cfs
Inlet Invert= 87.50', Outlet Invert= 86.69'
12.0" Diameter Pipe n= 0.011 Length= 81.0' Slope= 0.0100 '/'

Reach 2R: CB1-SC



Pond 1P: Infiltration Field #1

Exfiltration based on Class B soil (Sandy Loam) with Design Infiltration Rate of 1.02 in/hr

Inflow Area =	0.157 ac,	Inflow Depth =	5.59"	for	100 Year Storm event
Inflow =	1.09 cfs @	12.01 hrs,	Volume=	0.073 af	
Outflow =	0.06 cfs @	10.65 hrs,	Volume=	0.057 af,	Atten= 95%, Lag= 0.0 min
Discarded =	0.06 cfs @	10.65 hrs,	Volume=	0.057 af	

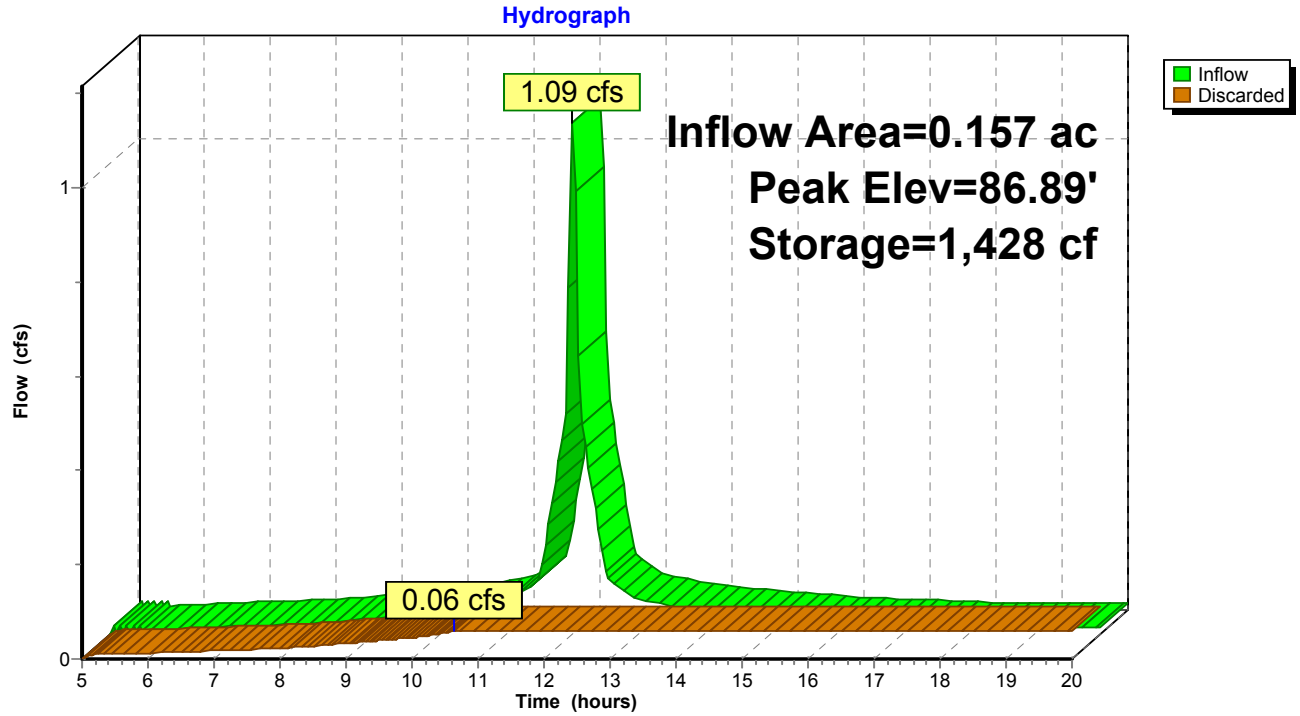
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 86.89' @ 13.64 hrs Surf.Area= 2,480 sf Storage= 1,428 cf
Plug-Flow detention time= 160.0 min calculated for 0.057 af (78% of inflow)
Center-of-Mass det. time= 102.8 min (836.2 - 733.4)

#	Invert	Avail.Storage	Storage Description
1	85.52'	2,114 cf	**20.00'W x 124.00'L x 2.20'H Prismatoid**
			5,456 cf Overall - 171 cf Embedded = 5,285 cf x 40.0% Voids
2	86.02'	171 cf	**2.7"W x 18.5"H x 10.25'L Cultec 150XLHD** x 72 Inside #1
		2,285 cf	Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001417 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.06 cfs @ 10.65 hrs HW=85.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond 1P: Infiltration Field #1



Pond 2P: Porous Pvmt Base Material

Inflow Area =	0.557 ac,	Inflow Depth =	1.89"	for	100 Year Storm event
Inflow =	0.22 cfs @	18.00 hrs,	Volume=	0.088 af	
Outflow =	0.20 cfs @	17.15 hrs,	Volume=	0.084 af,	Atten= 8%, Lag= 0.0 min
Discarded =	0.20 cfs @	17.15 hrs,	Volume=	0.084 af	

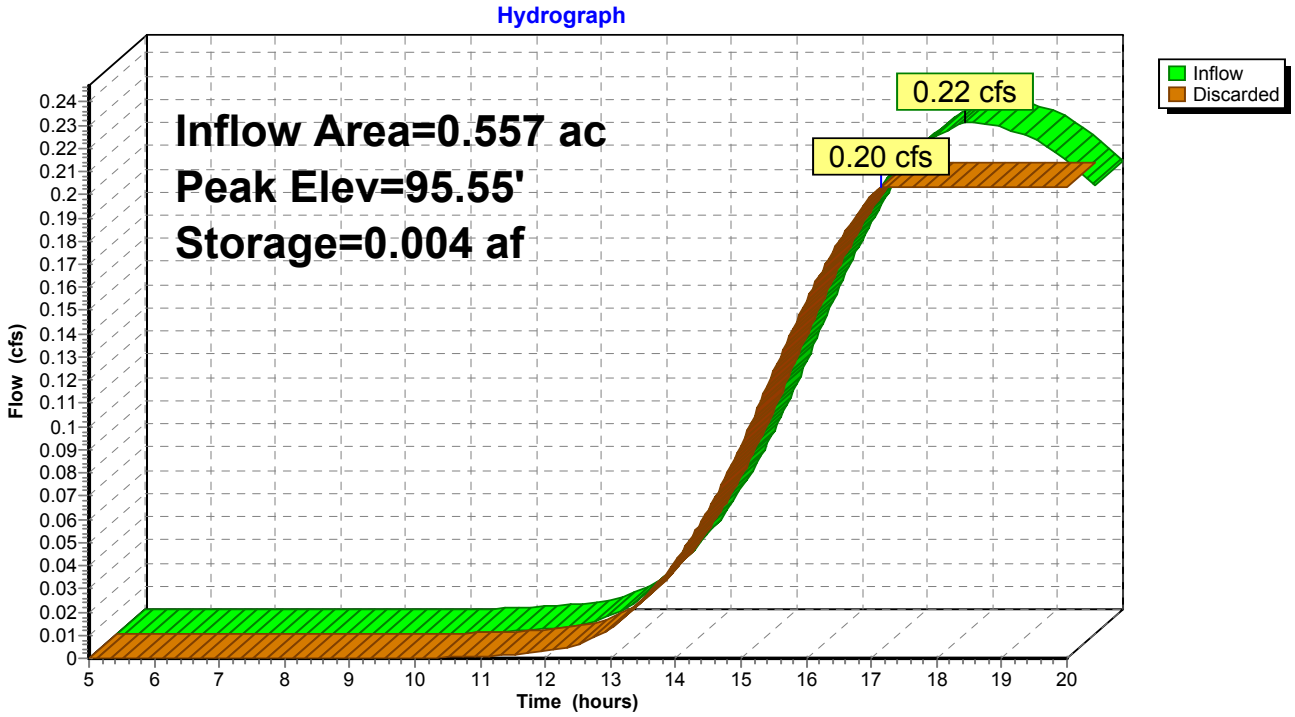
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 95.55' @ 19.62 hrs Surf.Area= 0.197 ac Storage= 0.004 af
Plug-Flow detention time= 8.3 min calculated for 0.084 af (96% of inflow)
Center-of-Mass det. time= 1.3 min (1,042.0 - 1,040.7)

#	Invert	Avail.Storage	Storage Description
1	95.50'	0.158 af	**50.00'W x 172.00'L x 2.00'H Prismatoid** 0.395 af Overall x 40.0% Voids

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001416 fpm Exfiltration over entire Surface area**

Discarded OutFlow Max=0.20 cfs @ 17.15 hrs HW=95.52' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Pond 2P: Porous Pvmt Base Material

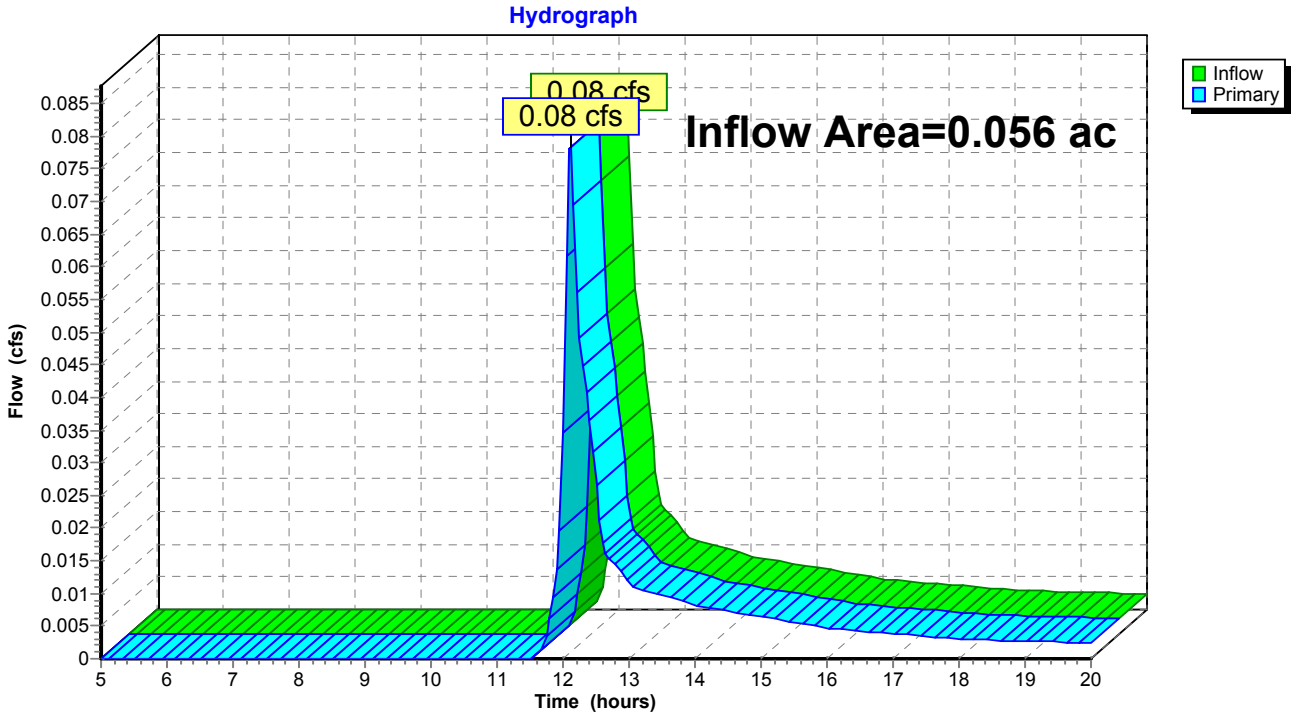


Link 1L: (To Summer Avenue)

Inflow Area = 0.056 ac, Inflow Depth = 1.28" for 100 Year Storm event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af
Primary = 0.08 cfs @ 12.11 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

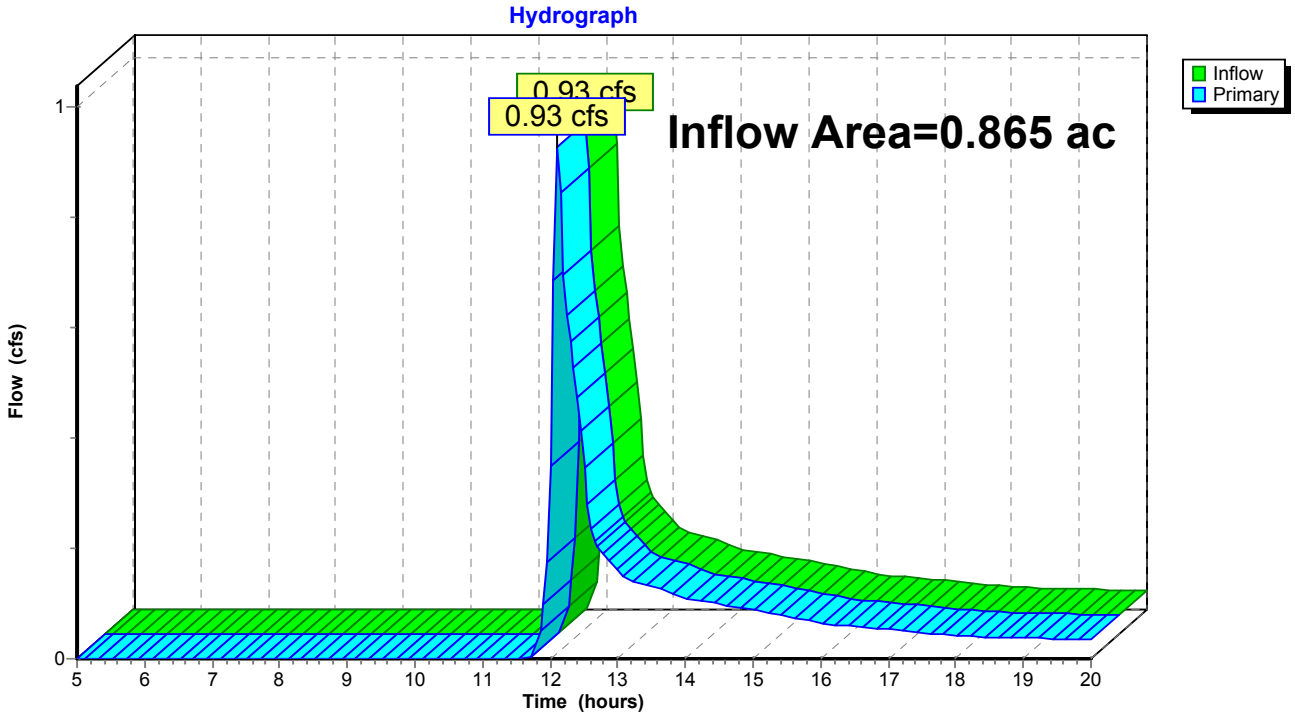
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 1L: (To Summer Avenue)



Link 2L: To Rear of Site

Inflow Area = 0.865 ac, Inflow Depth = 1.06" for 100 Year Storm event
Inflow = 0.93 cfs @ 12.11 hrs, Volume= 0.076 af
Primary = 0.93 cfs @ 12.11 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2L: To Rear of Site