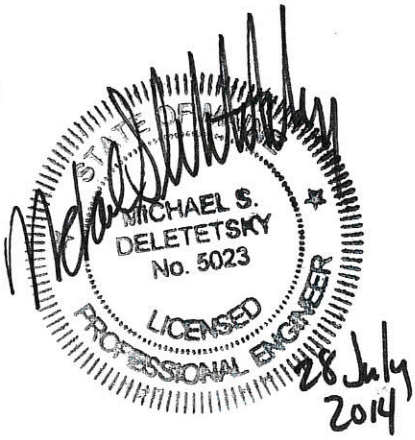
STORMWATER MANAGEMENT REPORT

Boothbay – Ocean Point Road
Boothbay, Maine

Prepared for

MARINER TOWER

Prepared by



amec

511 Congress St.
Portland, Maine 04101

July 18, 2014
Revised July 28, 2014

Boothbay – Ocean Point Road
STORMWATER MANAGEMENT REPORT

AMEC Environment & Infrastructure, Inc. (Amec E&I), has completed the design for a cellular communication tower in the Town of Boothbay, Maine on behalf of Mariner Tower. This project has been designed to minimize the post-development flow rates in an attempt to prevent the transport of sediment due to erosion off site. The HydroCAD calculations in this report are based on rainfall data from the Northeast Regional Climate Center (NRCC). The following table summarizes the pre and post development peak flows for the 2-, 10-, and 25-year Type III 24-hour rainfall event:

24 Hour, Type III Rainfall Event			
	2 Year Pre/Post	**10 Year Pre/Post**	**25 Year Pre/Post**
Analysis Point 1 (AP-1)	0.60 cfs / 0.91 cfs	1.24 cfs / 1.84 cfs	1.55 cfs / 2.29 cfs
Analysis Point 2 (AP-2)	0.06 cfs / 0.20 cfs	0.12 cfs / 0.39 cfs	0.16 cfs / 0.49 cfs
Analysis Point 3 (AP-3)	0.88 cfs / 1.15 cfs	1.86 cfs / 2.29 cfs	2.35 cfs / 2.85 cfs

Conclusion

The results of this report indicate that there is an increase in runoff in post development. The average increase of runoff in the three analysis point areas from pre development to post development during a 25-year rainfall event is 0.52 cubic feet per second. The site currently consists of a heavily wooded area. The drainage analysis incorporates a 2.145 acre area where 0.354 acres of good grass cover and 0.33 acres of gravel road surfaces are now proposed. The remainder of the site will remain heavily wooded. The culvert has been adequately sized, as shown in the attached HydroCAD calculations, to handle a 25-year rainfall event without overtopping the road.

The planning, layout, site drainage, and designs utilized within this project were done keeping in mind the Town's requirements in the development of the proposed telecommunication tower compound and access. The Site was reviewed for any signs of steep slopes, ledge, or wetlands/ vernal pools that may be impacted with this development and it was found that this Site fits with the surrounding area and should not overburden this large parcel.

AMEC Environment & Infrastructure, Inc.
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Tel +1 207.775.5401 • Fax: +1 207.772.4762

References

"Web Soil Survey ." *Web Soil Survey*. USDA National Resources Conservation Service, n.d. Web. 17 July. 2014. <http://websoilsurvey.nrcs.usda.gov/app/wedsoilsurvey.aspx

HydroCAD . Version 10.00. Software. HydroCAD Software Solutions LLC, 2011

Pre Development

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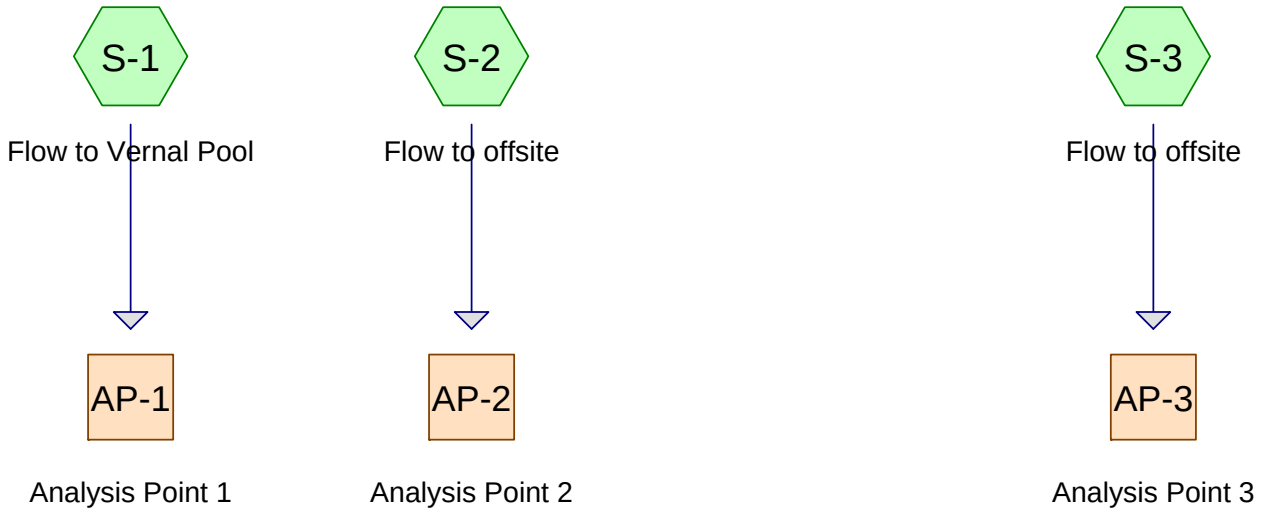
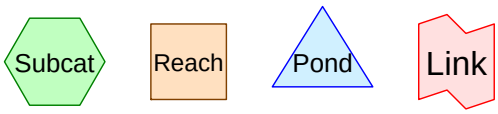




Routing Diagram for Boothbay Pre Development - 072714
Prepared by AMEC, Printed 7/28/2014
HydroCAD® 10.00 s/n 00629 © 2011 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.074	79	Woods, Fair, HSG D (S-1, S-2, S-3)
0.071	98	Water Surface, 0% imp, HSG D (S-1)
2.145	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
2.145	HSG D	S-1, S-2, S-3
0.000	Other	
2.145		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	2.074	0.000	2.074	Woods, Fair	S-1, S-2, S-3
0.000	0.000	0.000	0.071	0.000	0.071	Water Surface, 0% imp	S-1
0.000	**0.000**	**0.000**	**2.145**	**0.000**	**2.145**	**TOTAL AREA**	

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

Subcatchment S-1: Flow to Vernal Pool Runoff Area=41,056 sf 0.00% Impervious Runoff Depth>1.07"
Flow Length=288' Tc=43.3 min CN=80 Runoff=0.60 cfs 0.084 af

Subcatchment S-2: Flow to offsite Runoff Area=3,465 sf 0.00% Impervious Runoff Depth>1.02"
Flow Length=152' Slope=0.0270 '/' Tc=28.0 min CN=79 Runoff=0.06 cfs 0.007 af

Subcatchment S-3: Flow to offsite Runoff Area=48,900 sf 0.00% Impervious Runoff Depth>1.02"
Flow Length=324' Tc=24.4 min CN=79 Runoff=0.88 cfs 0.095 af

Reach AP-1: Analysis Point 1 Inflow=0.60 cfs 0.084 af
Outflow=0.60 cfs 0.084 af

Reach AP-2: Analysis Point 2 Inflow=0.06 cfs 0.007 af
Outflow=0.06 cfs 0.007 af

Reach AP-3: Analysis Point 3 Inflow=0.88 cfs 0.095 af
Outflow=0.88 cfs 0.095 af

Total Runoff Area = 2.145 ac Runoff Volume = 0.186 af Average Runoff Depth = 1.04"
100.00% Pervious = 2.145 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Flow to Vernal Pool

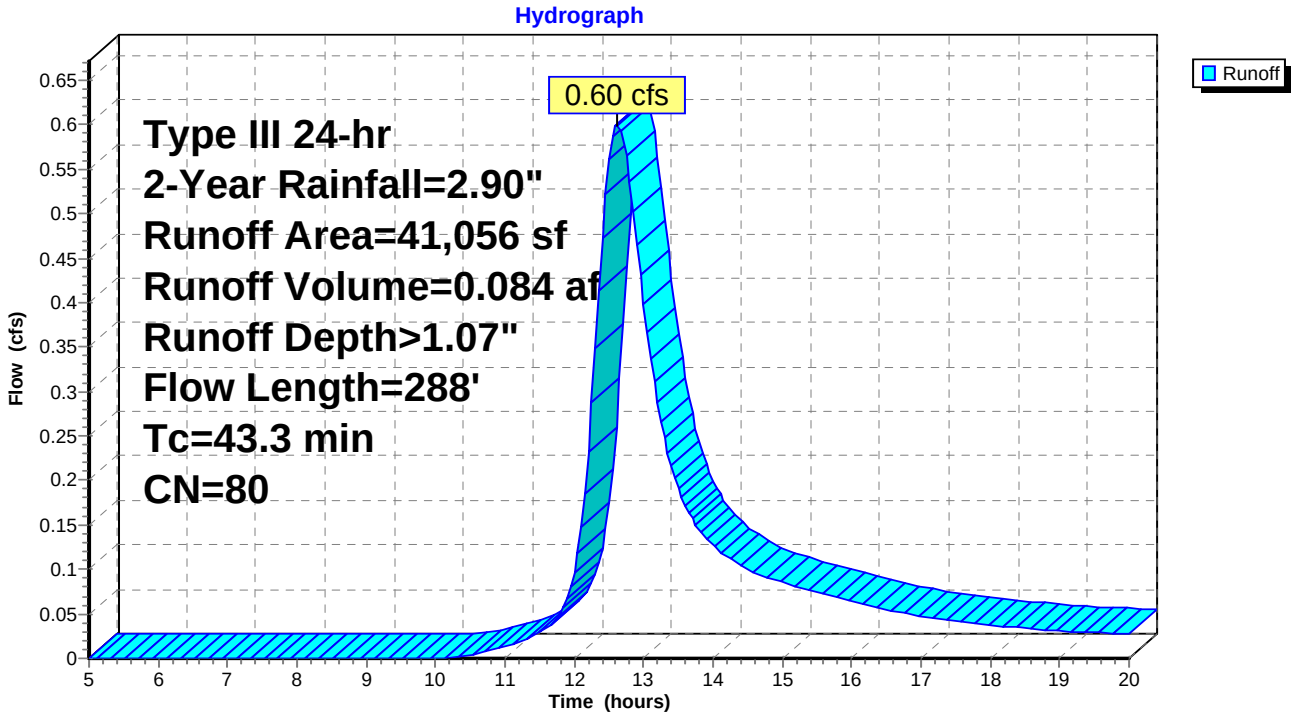
Runoff = 0.60 cfs @ 12.63 hrs, Volume= 0.084 af, Depth> 1.07"

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 Rainfall=2.90"

Area (sf)	CN	Description
37,957	79	Woods, Fair, HSG D
3,099	98	Water Surface, 0% imp, HSG D
41,056	80	Weighted Average
41,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
41.2	150	0.0100	0.06		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
2.1	138	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
43.3	288	Total			

Subcatchment S-1: Flow to Vernal Pool



Summary for Subcatchment S-2: Flow to offsite

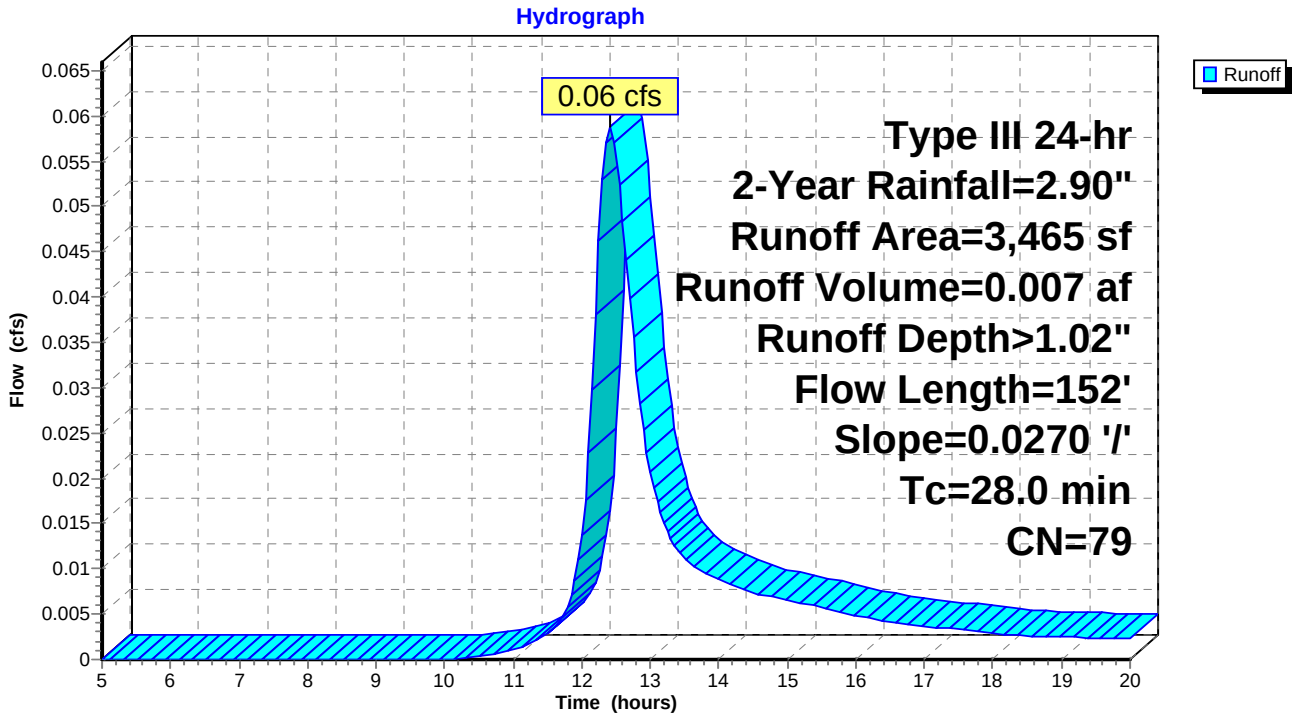
Runoff = 0.06 cfs @ 12.41 hrs, Volume= 0.007 af, Depth> 1.02"

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 Rainfall=2.90"

Area (sf)	CN	Description
3,465	79	Woods, Fair, HSG D
3,465		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.0	152	0.0270	0.09		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"

Subcatchment S-2: Flow to offsite



Summary for Subcatchment S-3: Flow to offsite

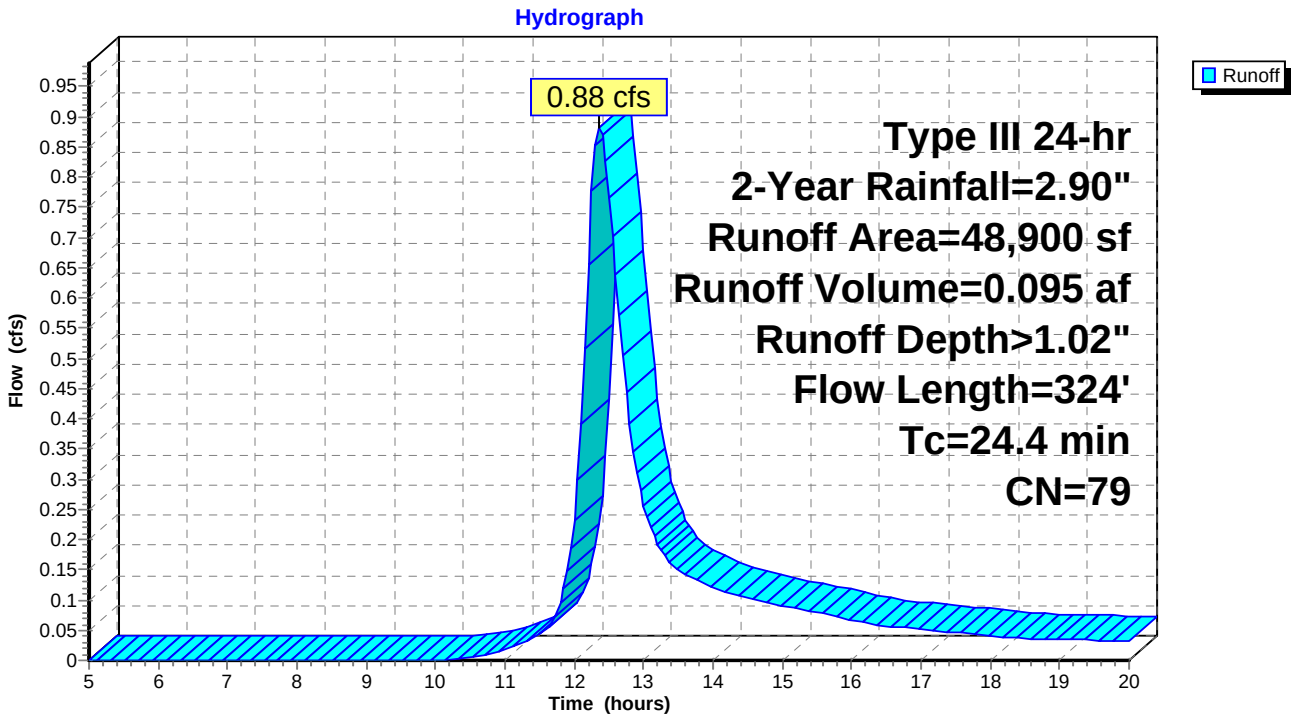
Runoff = 0.88 cfs @ 12.36 hrs, Volume= 0.095 af, Depth> 1.02"

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 Rainfall=2.90"

Area (sf)	CN	Description
48,900	79	Woods, Fair, HSG D
48,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	150	0.0500	0.12		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.6	59	0.1250	1.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	115	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.4	324	Total			

Subcatchment S-3: Flow to offsite



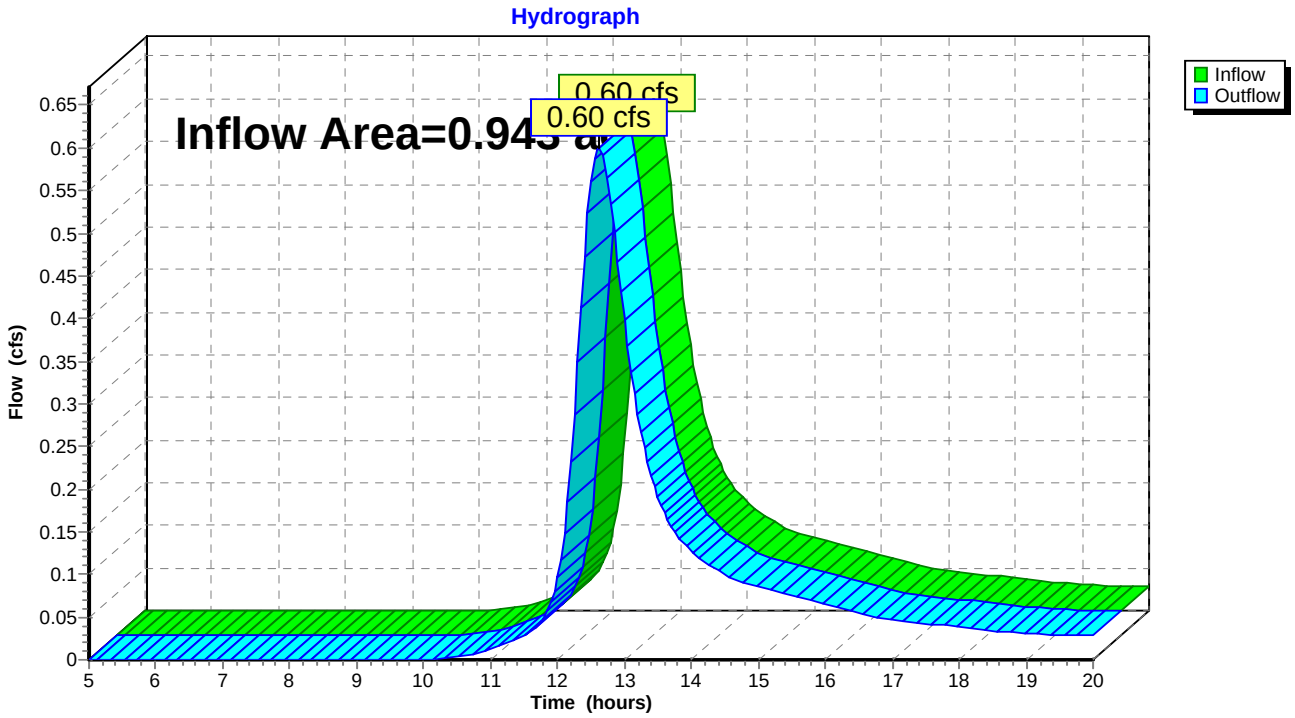
Summary for Reach AP-1: Analysis Point 1

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

Inflow Area =	0.943 ac,	0.00% Impervious,	Inflow Depth >	1.07"	for 2-Year event
Inflow =	0.60 cfs @	12.63 hrs,	Volume=	0.084 af	
Outflow =	0.60 cfs @	12.63 hrs,	Volume=	0.084 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-1: Analysis Point 1



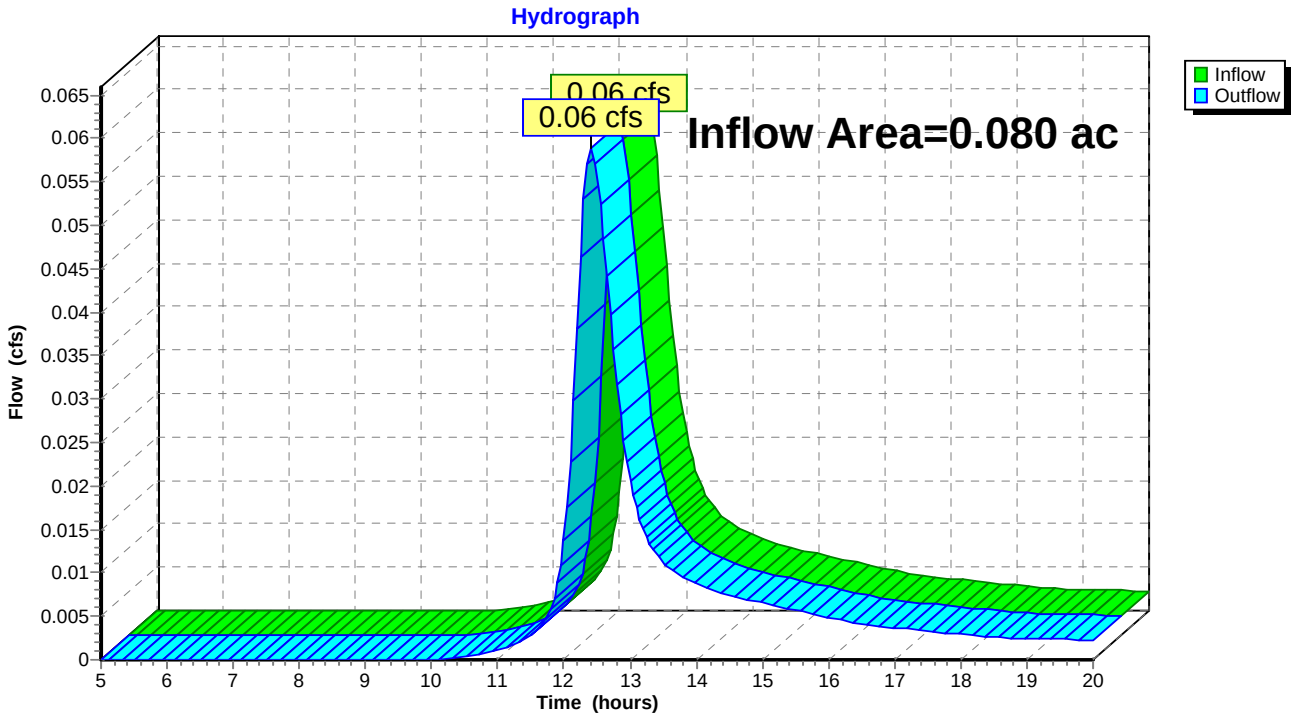
Summary for Reach AP-2: Analysis Point 2

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

Inflow Area =	0.080 ac,	0.00% Impervious,	Inflow Depth >	1.02"	for 2-Year event
Inflow =	0.06 cfs @	12.41 hrs,	Volume=	0.007 af	
Outflow =	0.06 cfs @	12.41 hrs,	Volume=	0.007 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-2: Analysis Point 2



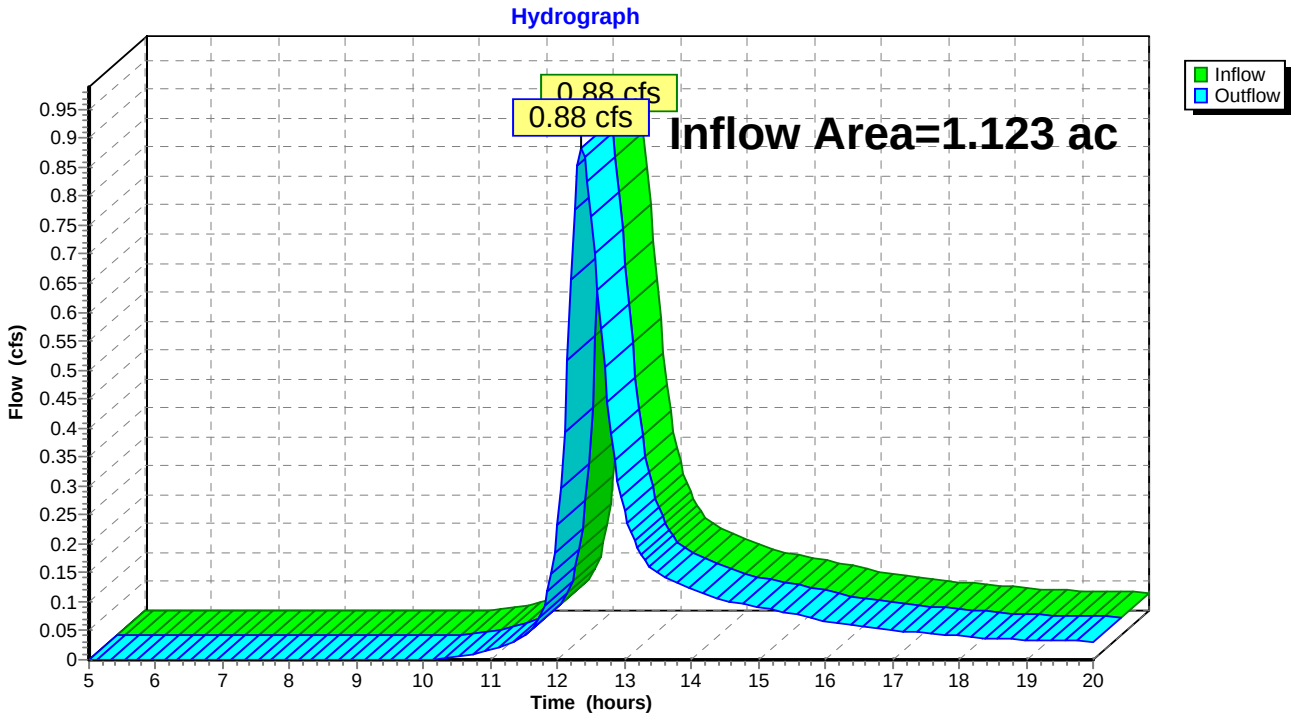
Summary for Reach AP-3: Analysis Point 3

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

Inflow Area =	1.123 ac,	0.00% Impervious,	Inflow Depth >	1.02"	for 2-Year event
Inflow =	0.88 cfs @	12.36 hrs,	Volume=	0.095 af	
Outflow =	0.88 cfs @	12.36 hrs,	Volume=	0.095 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-3: Analysis Point 3



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

Subcatchment S-1: Flow to Vernal Pool Runoff Area=41,056 sf 0.00% Impervious Runoff Depth>2.18"
Flow Length=288' Tc=43.3 min CN=80 Runoff=1.24 cfs 0.172 af

Subcatchment S-2: Flow to offsite Runoff Area=3,465 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=152' Slope=0.0270 '/' Tc=28.0 min CN=79 Runoff=0.12 cfs 0.014 af

Subcatchment S-3: Flow to offsite Runoff Area=48,900 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=324' Tc=24.4 min CN=79 Runoff=1.86 cfs 0.198 af

Reach AP-1: Analysis Point 1 Inflow=1.24 cfs 0.172 af
Outflow=1.24 cfs 0.172 af

Reach AP-2: Analysis Point 2 Inflow=0.12 cfs 0.014 af
Outflow=0.12 cfs 0.014 af

Reach AP-3: Analysis Point 3 Inflow=1.86 cfs 0.198 af
Outflow=1.86 cfs 0.198 af

Total Runoff Area = 2.145 ac Runoff Volume = 0.384 af Average Runoff Depth = 2.15"
100.00% Pervious = 2.145 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Flow to Vernal Pool

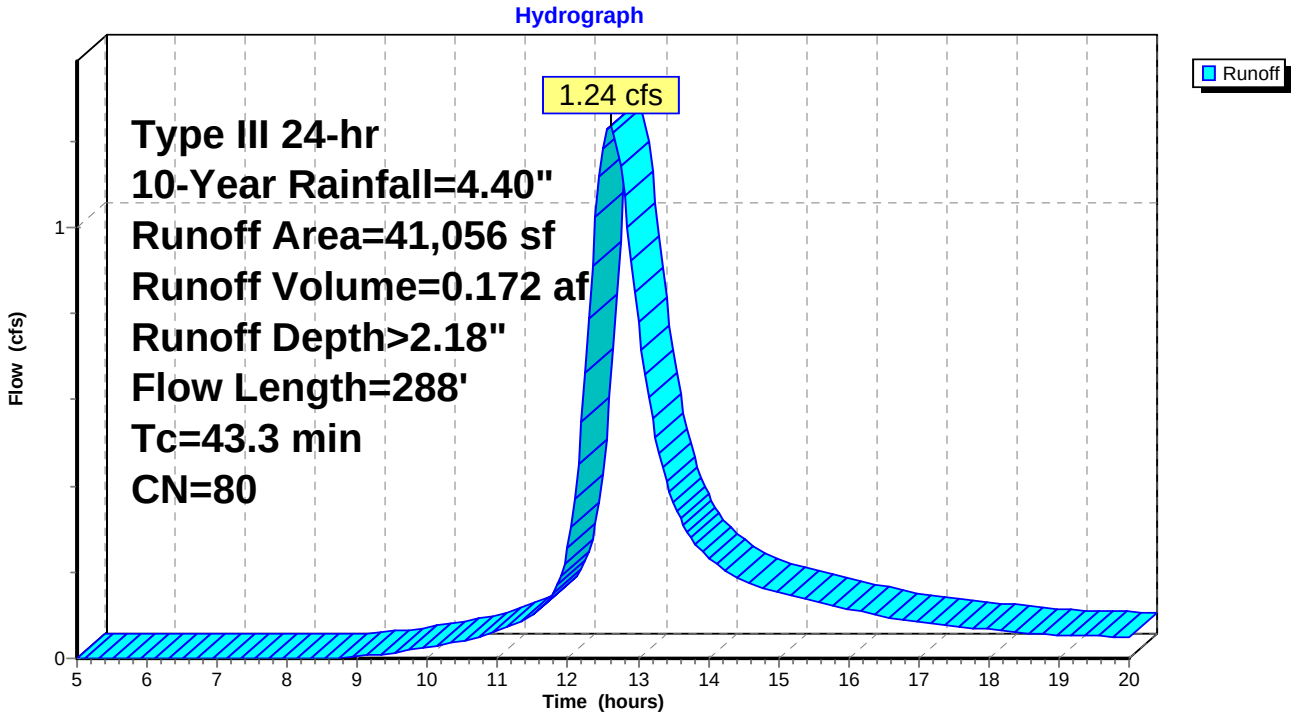
Runoff = 1.24 cfs @ 12.60 hrs, Volume= 0.172 af, Depth> 2.18"

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 Rainfall=4.40"

Area (sf)	CN	Description
37,957	79	Woods, Fair, HSG D
3,099	98	Water Surface, 0% imp, HSG D
41,056	80	Weighted Average
41,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
41.2	150	0.0100	0.06		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
2.1	138	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
43.3	288	Total			

Subcatchment S-1: Flow to Vernal Pool



Summary for Subcatchment S-2: Flow to offsite

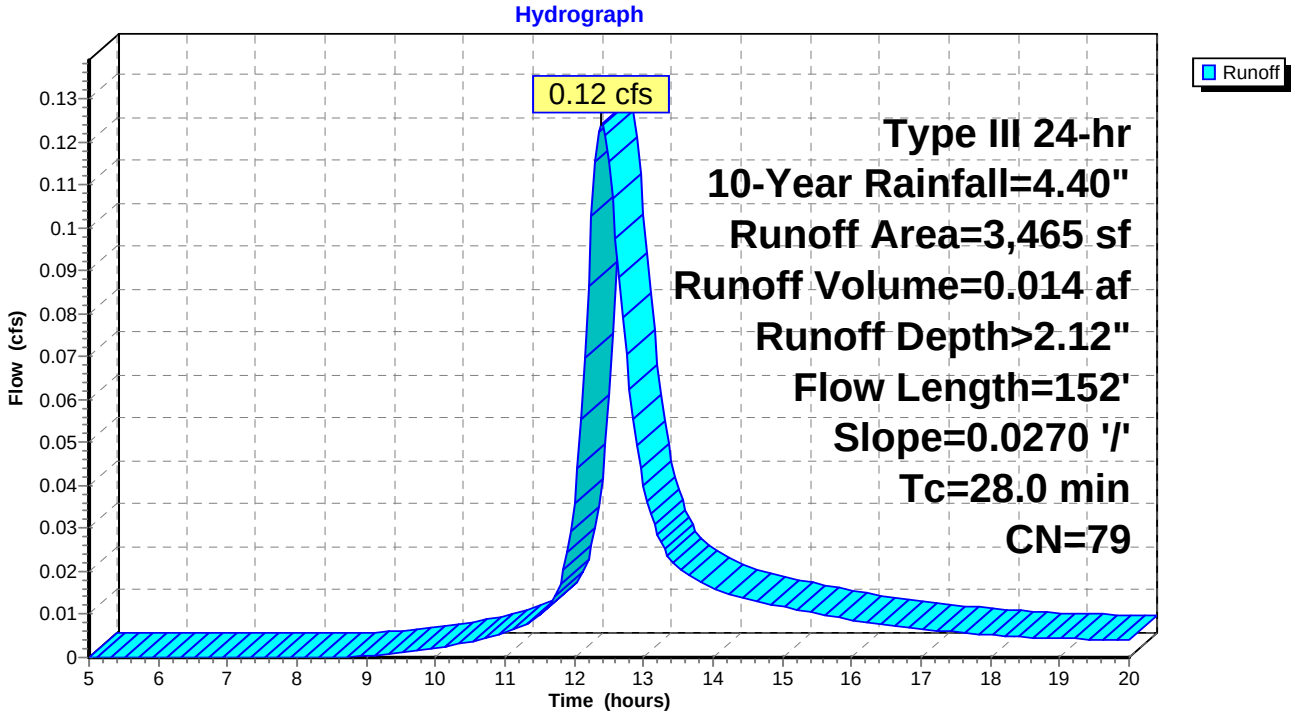
Runoff = 0.12 cfs @ 12.40 hrs, Volume= 0.014 af, Depth> 2.12"

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 Rainfall=4.40"

Area (sf)	CN	Description
3,465	79	Woods, Fair, HSG D
3,465		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.0	152	0.0270	0.09		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"

Subcatchment S-2: Flow to offsite



Summary for Subcatchment S-3: Flow to offsite

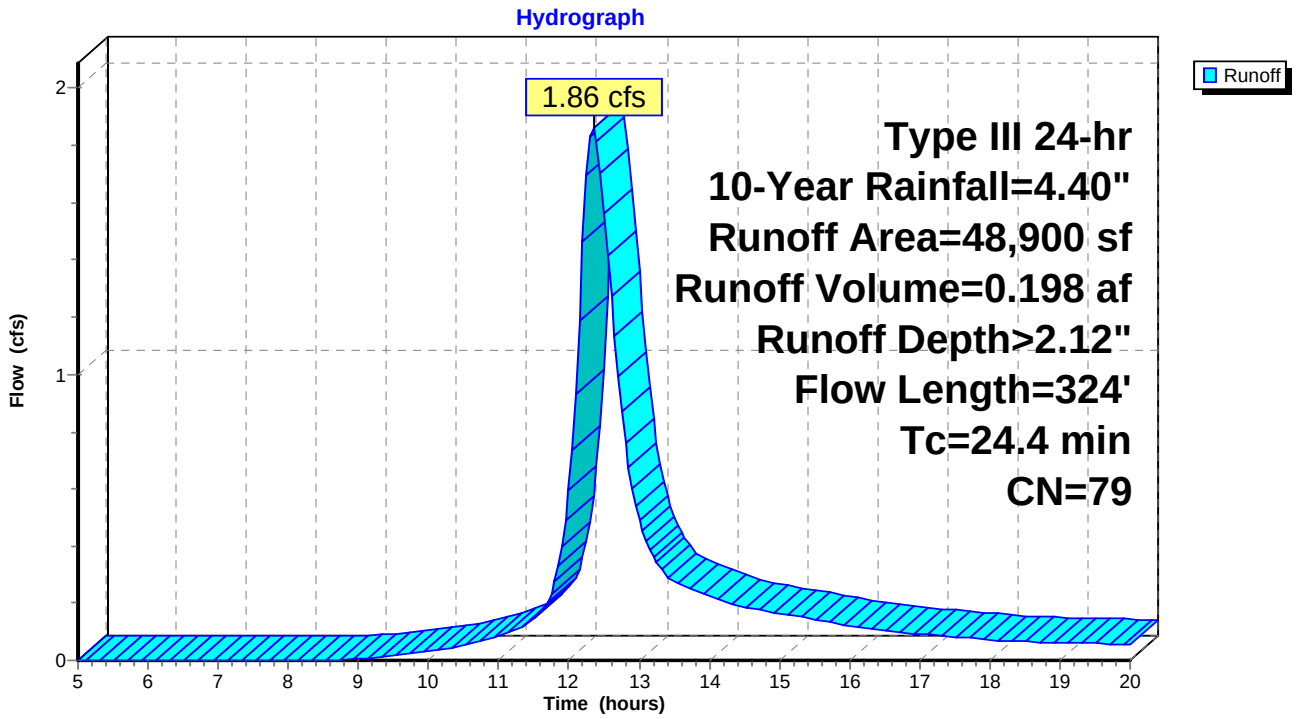
Runoff = 1.86 cfs @ 12.34 hrs, Volume= 0.198 af, Depth> 2.12"

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 Rainfall=4.40"

Area (sf)	CN	Description
48,900	79	Woods, Fair, HSG D
48,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	150	0.0500	0.12		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.6	59	0.1250	1.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	115	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.4	324	Total			

Subcatchment S-3: Flow to offsite



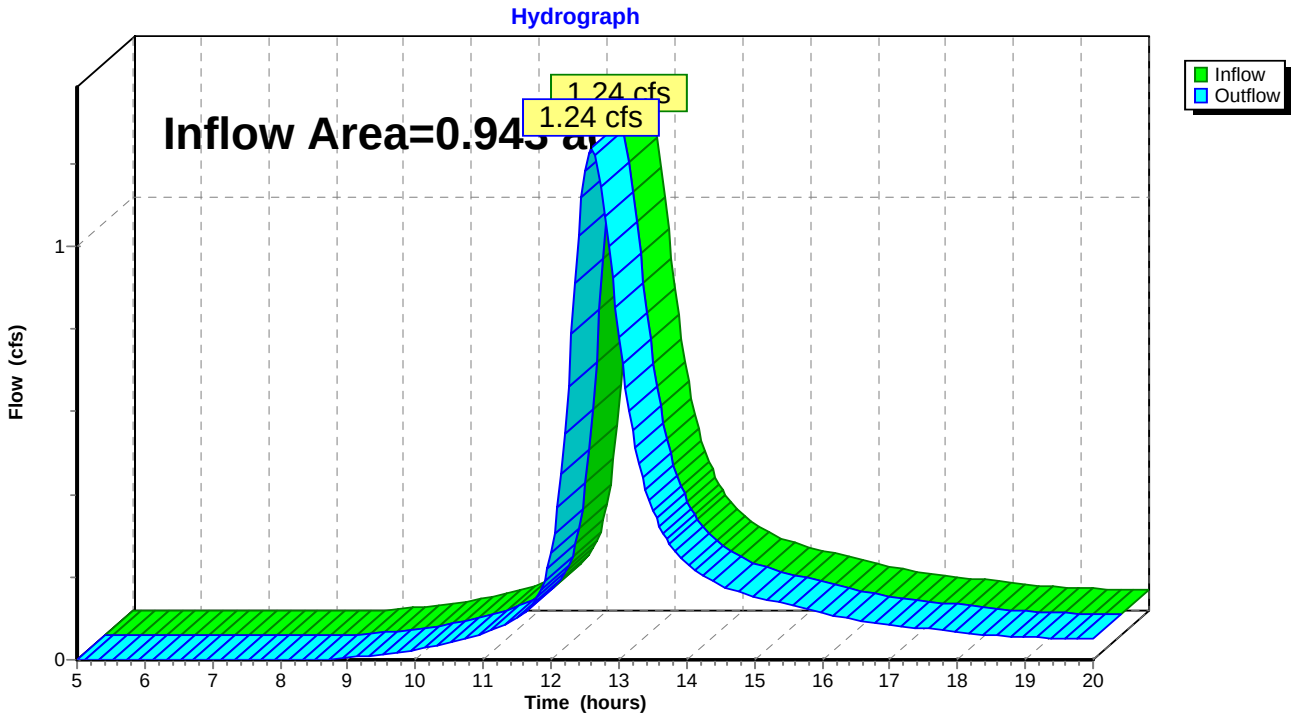
Summary for Reach AP-1: Analysis Point 1

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

Inflow Area =	0.943 ac,	0.00% Impervious,	Inflow Depth >	2.18"	for 10-Year event
Inflow =	1.24 cfs @	12.60 hrs,	Volume=	0.172 af	
Outflow =	1.24 cfs @	12.60 hrs,	Volume=	0.172 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-1: Analysis Point 1



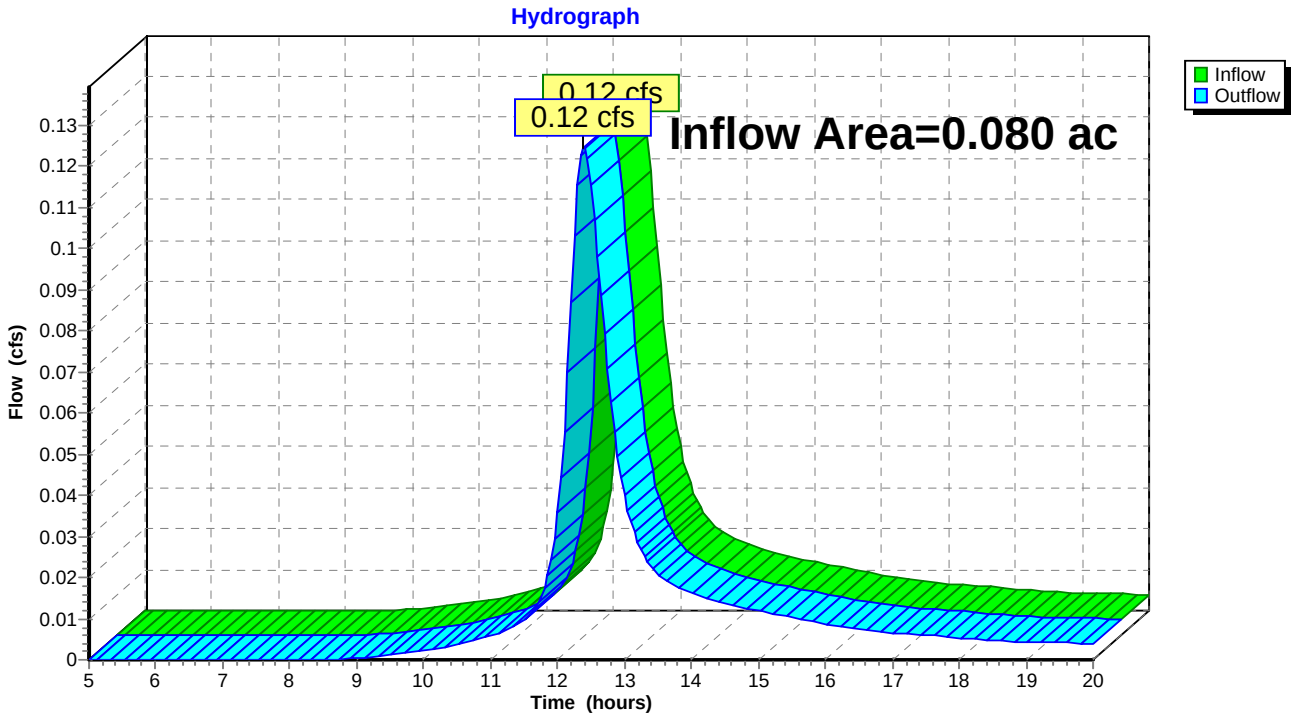
Summary for Reach AP-2: Analysis Point 2

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

Inflow Area = 0.080 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-Year event
Inflow = 0.12 cfs @ 12.40 hrs, Volume= 0.014 af
Outflow = 0.12 cfs @ 12.40 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-2: Analysis Point 2



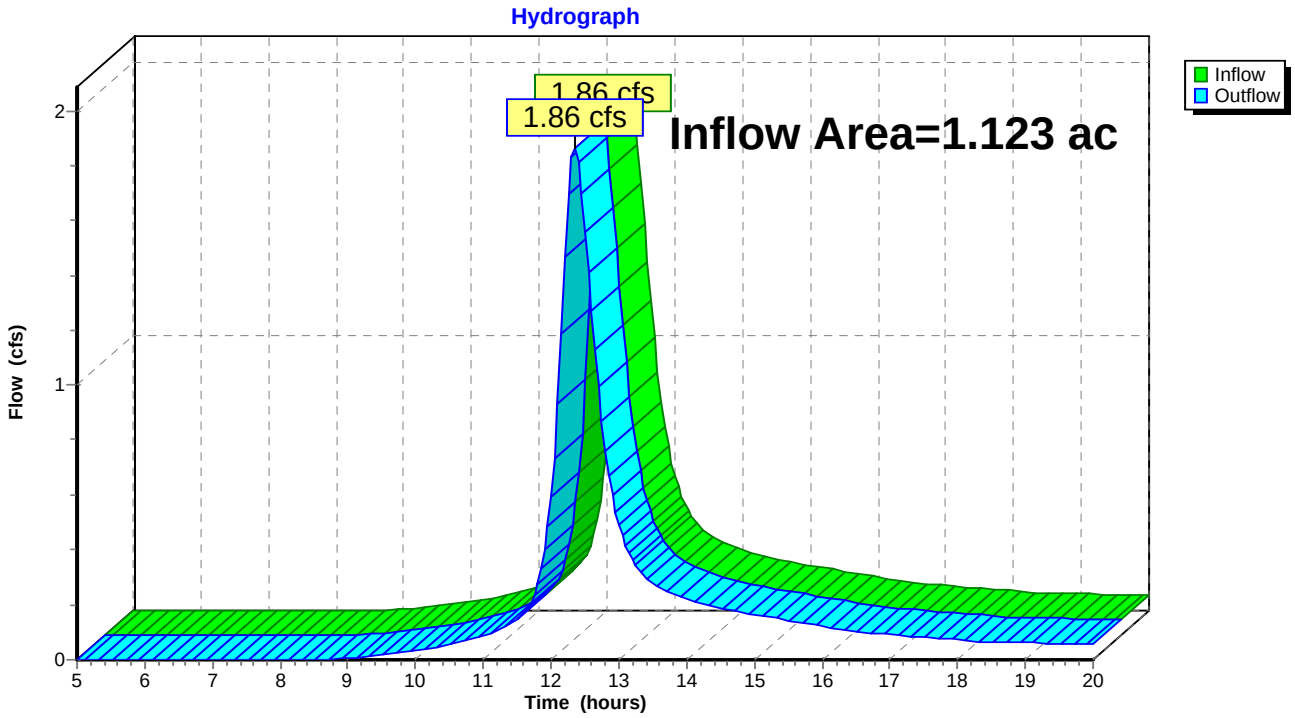
Summary for Reach AP-3: Analysis Point 3

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

Inflow Area =	1.123 ac,	0.00% Impervious,	Inflow Depth >	2.12"	for 10-Year event
Inflow =	1.86 cfs @	12.34 hrs,	Volume=	0.198 af	
Outflow =	1.86 cfs @	12.34 hrs,	Volume=	0.198 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-3: Analysis Point 3



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

Subcatchment S-1: Flow to Vernal Pool Runoff Area=41,056 sf 0.00% Impervious Runoff Depth>2.75"
Flow Length=288' Tc=43.3 min CN=80 Runoff=1.55 cfs 0.216 af

Subcatchment S-2: Flow to offsite Runoff Area=3,465 sf 0.00% Impervious Runoff Depth>2.68"
Flow Length=152' Slope=0.0270 '/' Tc=28.0 min CN=79 Runoff=0.16 cfs 0.018 af

Subcatchment S-3: Flow to offsite Runoff Area=48,900 sf 0.00% Impervious Runoff Depth>2.68"
Flow Length=324' Tc=24.4 min CN=79 Runoff=2.35 cfs 0.251 af

Reach AP-1: Analysis Point 1 Inflow=1.55 cfs 0.216 af
Outflow=1.55 cfs 0.216 af

Reach AP-2: Analysis Point 2 Inflow=0.16 cfs 0.018 af
Outflow=0.16 cfs 0.018 af

Reach AP-3: Analysis Point 3 Inflow=2.35 cfs 0.251 af
Outflow=2.35 cfs 0.251 af

Total Runoff Area = 2.145 ac Runoff Volume = 0.484 af Average Runoff Depth = 2.71"
100.00% Pervious = 2.145 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Flow to Vernal Pool

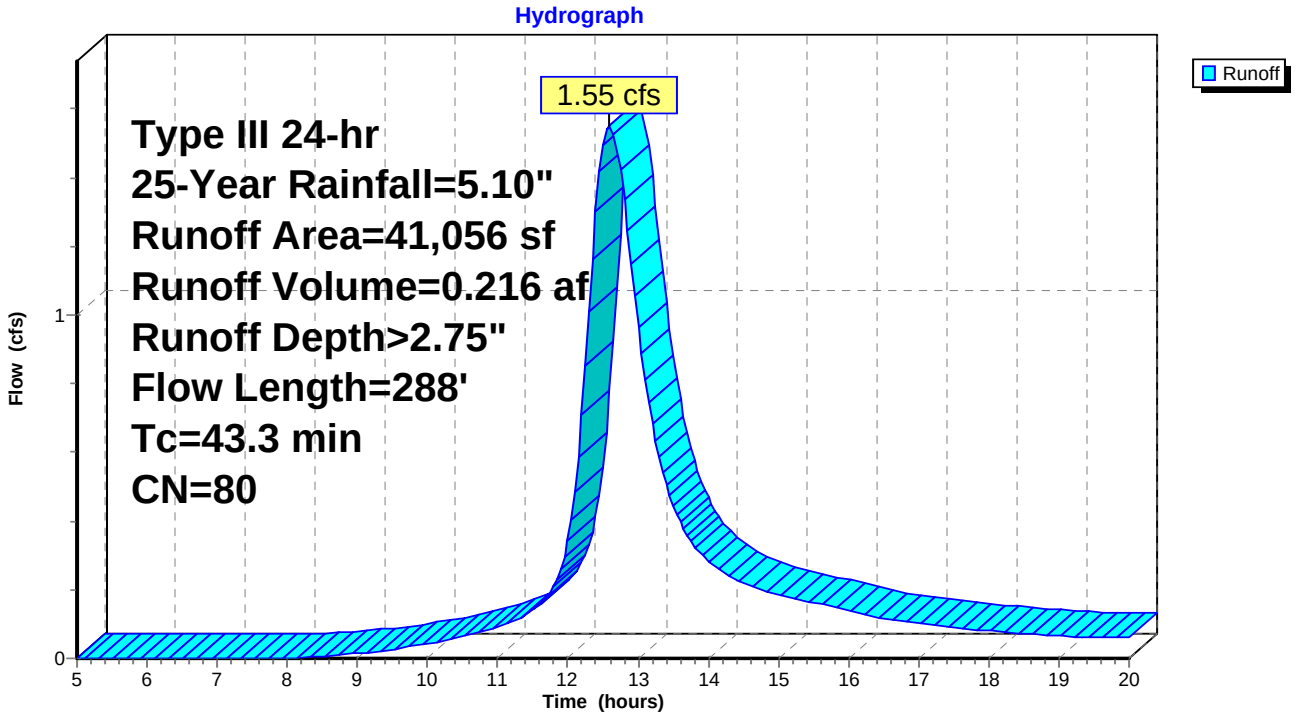
Runoff = 1.55 cfs @ 12.59 hrs, Volume= 0.216 af, Depth> 2.75"

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 Rainfall=5.10"

Area (sf)	CN	Description
37,957	79	Woods, Fair, HSG D
3,099	98	Water Surface, 0% imp, HSG D
41,056	80	Weighted Average
41,056		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
41.2	150	0.0100	0.06		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
2.1	138	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
43.3	288	Total			

Subcatchment S-1: Flow to Vernal Pool



Summary for Subcatchment S-2: Flow to offsite

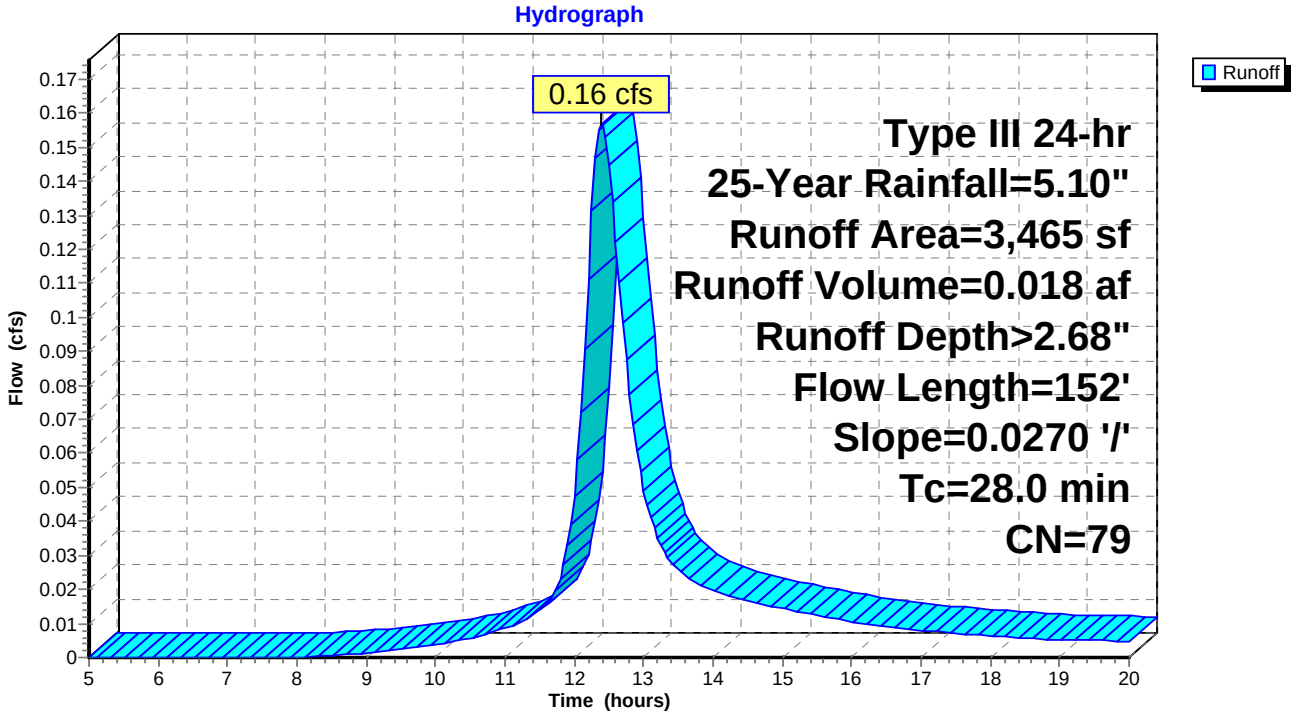
Runoff = 0.16 cfs @ 12.39 hrs, Volume= 0.018 af, Depth> 2.68"

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 Rainfall=5.10"

Area (sf)	CN	Description
3,465	79	Woods, Fair, HSG D
3,465		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.0	152	0.0270	0.09		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"

Subcatchment S-2: Flow to offsite



Summary for Subcatchment S-3: Flow to offsite

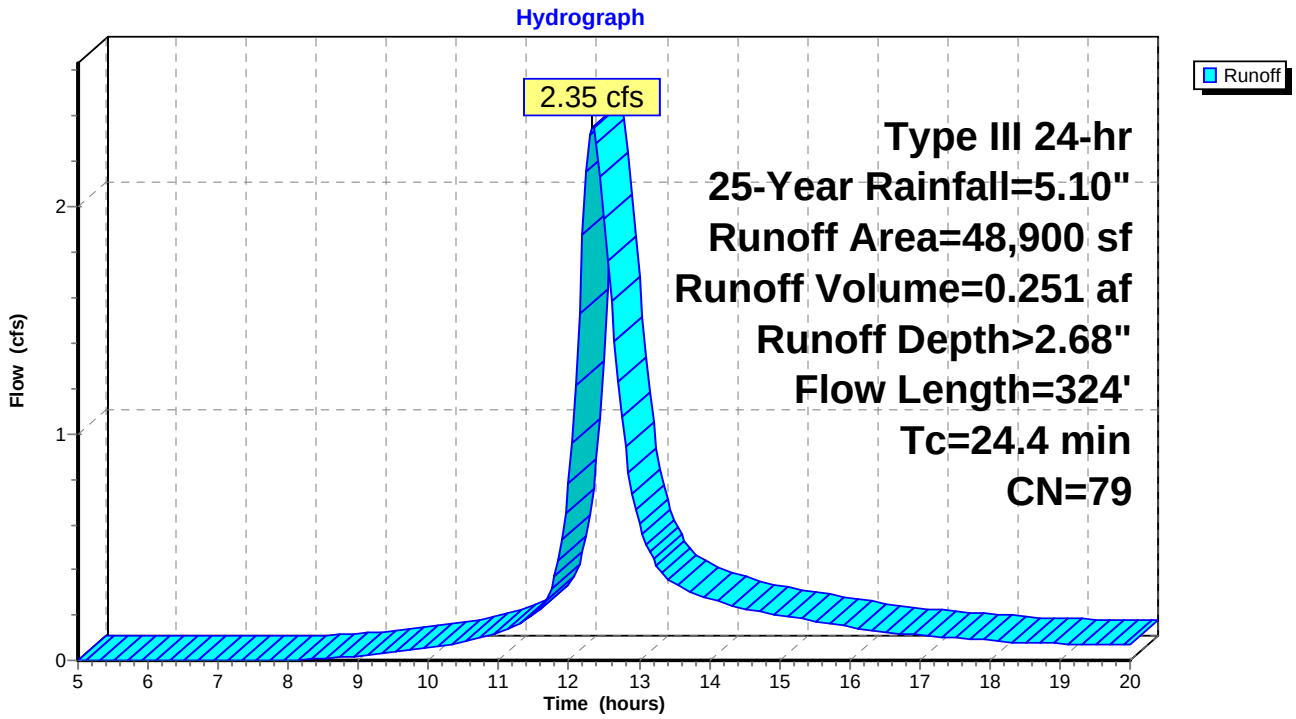
Runoff = 2.35 cfs @ 12.34 hrs, Volume= 0.251 af, Depth> 2.68"

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 Rainfall=5.10"

Area (sf)	CN	Description
48,900	79	Woods, Fair, HSG D
48,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	150	0.0500	0.12		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.6	59	0.1250	1.77		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	115	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.4	324	Total			

Subcatchment S-3: Flow to offsite



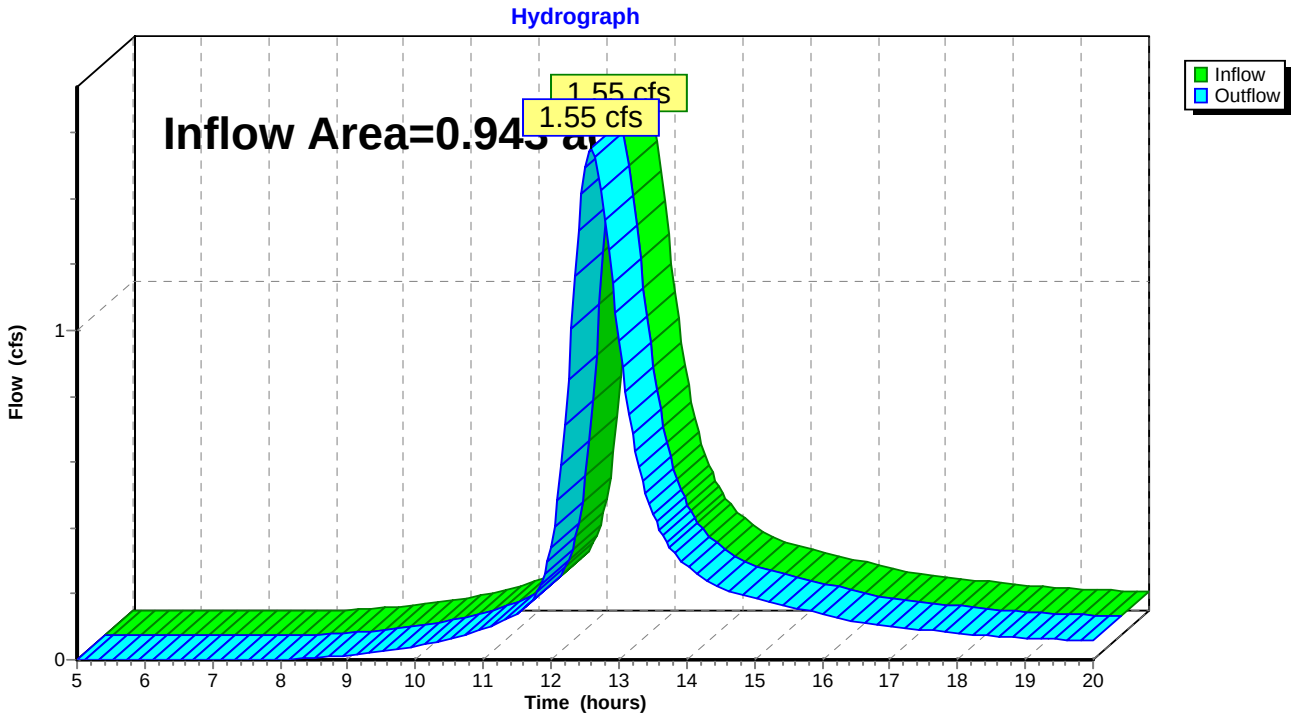
Summary for Reach AP-1: Analysis Point 1

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

Inflow Area =	0.943 ac,	0.00% Impervious,	Inflow Depth >	2.75"	for 25-Year event
Inflow =	1.55 cfs @	12.59 hrs,	Volume=	0.216 af	
Outflow =	1.55 cfs @	12.59 hrs,	Volume=	0.216 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-1: Analysis Point 1



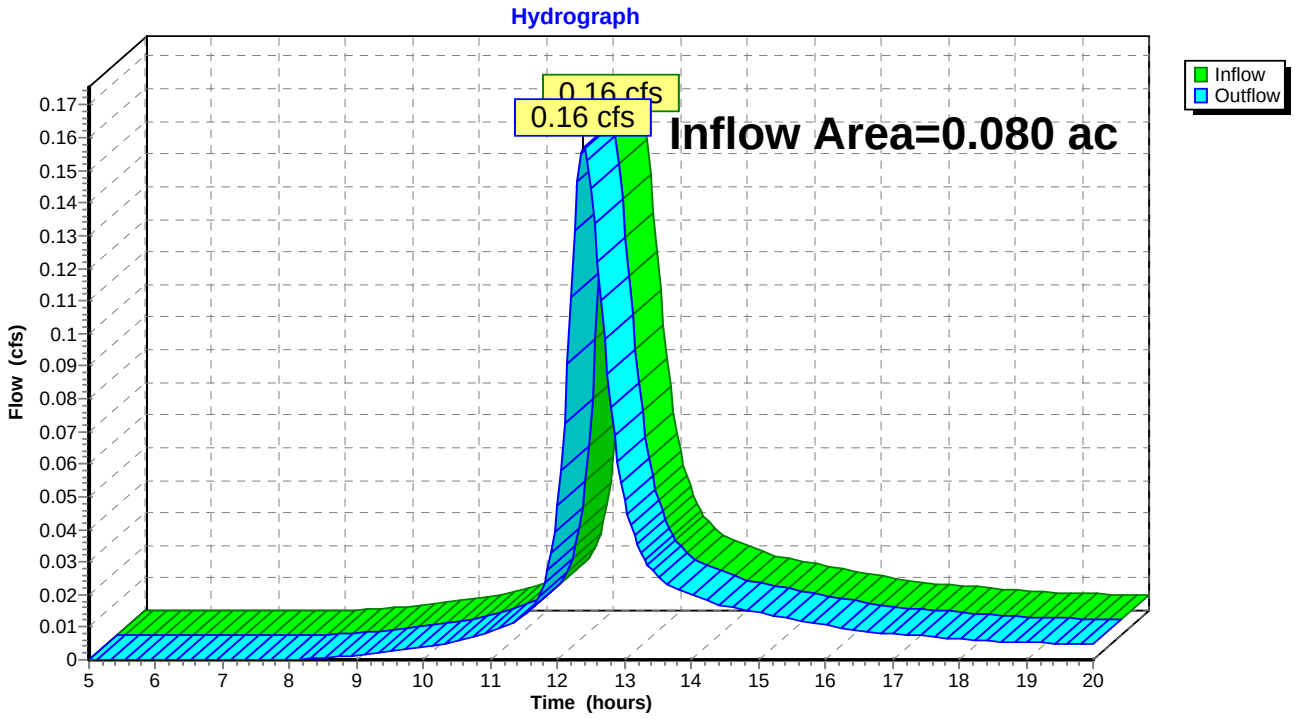
Summary for Reach AP-2: Analysis Point 2

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

Inflow Area = 0.080 ac, 0.00% Impervious, Inflow Depth > 2.68" for 25-Year event
Inflow = 0.16 cfs @ 12.39 hrs, Volume= 0.018 af
Outflow = 0.16 cfs @ 12.39 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-2: Analysis Point 2



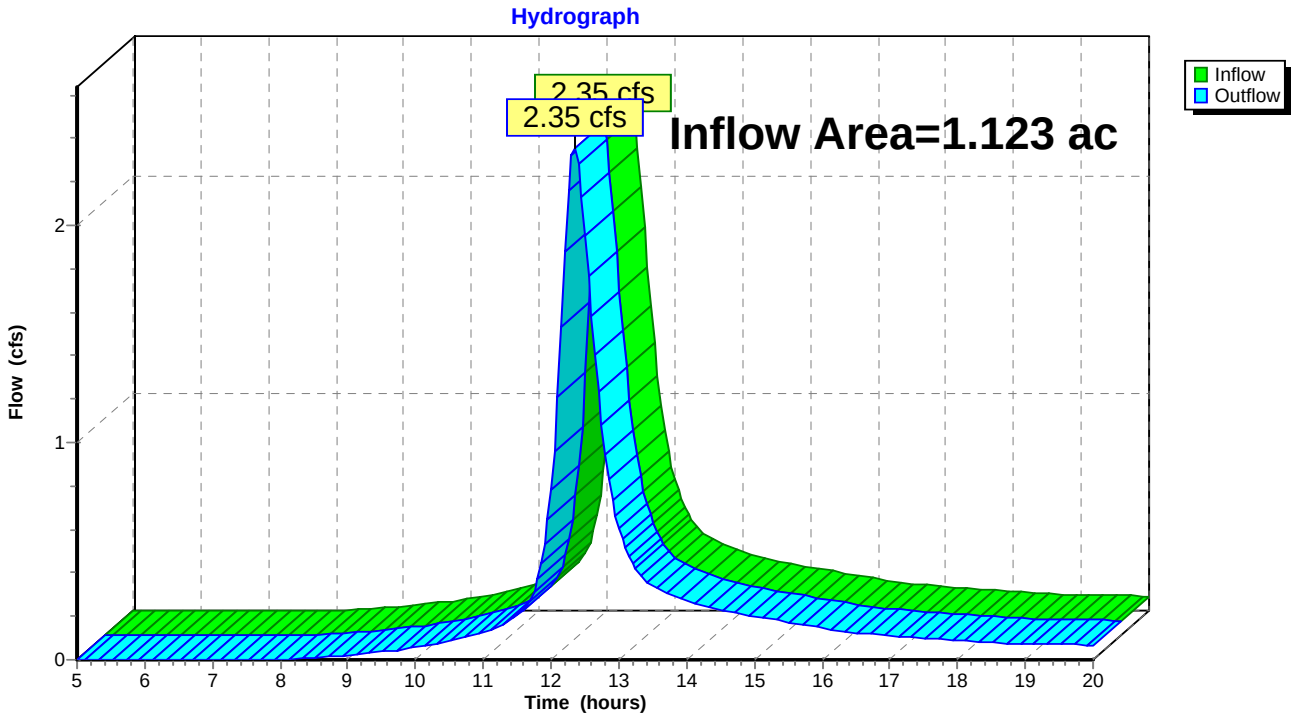
Summary for Reach AP-3: Analysis Point 3

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

Inflow Area =	1.123 ac,	0.00% Impervious,	Inflow Depth >	2.68"	for 25-Year event
Inflow =	2.35 cfs @	12.34 hrs,	Volume=	0.251 af	
Outflow =	2.35 cfs @	12.34 hrs,	Volume=	0.251 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-3: Analysis Point 3



Post Development

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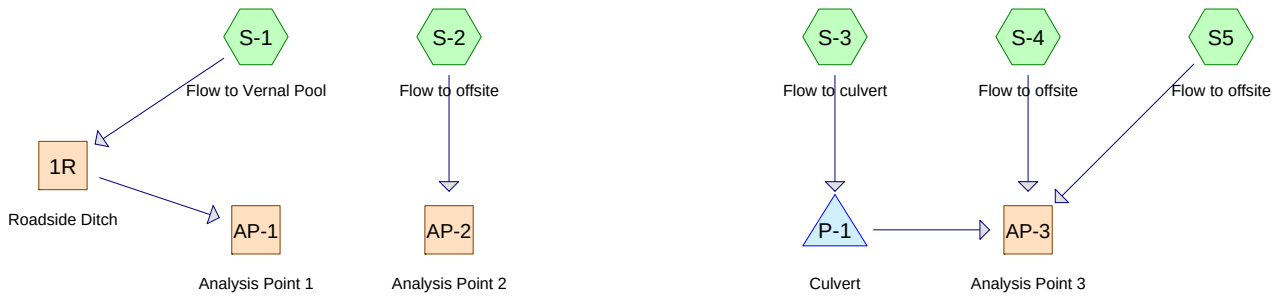

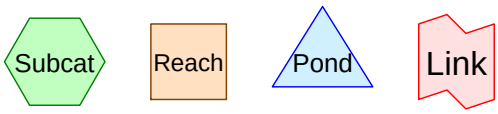

Routing Diagram for Boothbay PostDevelopment 072714
Prepared by AMEC, Printed 7/28/2014
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.388	79	Woods, Fair, HSG D (S-1, S-2, S-3, S-4)
0.354	80	>75% Grass cover, Good, HSG D (S-1, S-2, S-3, S-4)
0.144	91	Gravel roads, HSG D (S-1, S-2, S-4)
0.187	96	Gravel surface, HSG D (S5)
0.071	98	Water Surface, 0% imp, HSG D (S-1)
2.145	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
2.145	HSG D	S-1, S-2, S-3, S-4, S5
0.000	Other	
2.145		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.354	0.000	0.354	>75% Grass cover, Good	S-1, S-2, S-3, S-4
0.000	0.000	0.000	0.144	0.000	0.144	Gravel roads	S-1, S-2, S-4
0.000	0.000	0.000	0.187	0.000	0.187	Gravel surface	S5
0.000	0.000	0.000	1.388	0.000	1.388	Woods, Fair	S-1, S-2, S-3, S-4
0.000	0.000	0.000	0.071	0.000	0.071	Water Surface, 0% imp	S-1
0.000	**0.000**	**0.000**	**2.145**	**0.000**	**2.145**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	P-1	91.00	90.70	28.0	0.0107	0.013	15.0	0.0	0.0

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

Subcatchment S-1: Flow to Vernal Pool Runoff Area=33,347 sf 0.00% Impervious Runoff Depth>1.14"
Flow Length=288' Tc=11.4 min CN=81 Runoff=0.91 cfs 0.073 af

Subcatchment S-2: Flow to offsite Runoff Area=7,368 sf 0.00% Impervious Runoff Depth>1.26"
Flow Length=191' Tc=15.0 min CN=83 Runoff=0.20 cfs 0.018 af

Subcatchment S-3: Flow to culvert Runoff Area=25,964 sf 0.00% Impervious Runoff Depth>1.02"
Flow Length=219' Slope=0.0900 '/' Tc=17.2 min CN=79 Runoff=0.54 cfs 0.051 af

Subcatchment S-4: Flow to offsite Runoff Area=18,586 sf 0.00% Impervious Runoff Depth>1.14"
Flow Length=321' Tc=18.5 min CN=81 Runoff=0.42 cfs 0.040 af

Subcatchment S5: Flow to offsite Runoff Area=8,160 sf 0.00% Impervious Runoff Depth>2.32"
Flow Length=102' Slope=0.0250 '/' Tc=1.2 min CN=96 Runoff=0.56 cfs 0.036 af

Reach 1R: Roadside Ditch Avg. Flow Depth=0.16' Max Vel=2.31 fps Inflow=0.91 cfs 0.073 af
n=0.030 L=10.0' S=0.0330 '/' Capacity=32.03 cfs Outflow=0.91 cfs 0.073 af

Reach AP-1: Analysis Point 1 Inflow=0.91 cfs 0.073 af
Outflow=0.91 cfs 0.073 af

Reach AP-2: Analysis Point 2 Inflow=0.20 cfs 0.018 af
Outflow=0.20 cfs 0.018 af

Reach AP-3: Analysis Point 3 Inflow=1.15 cfs 0.127 af
Outflow=1.15 cfs 0.127 af

Pond P-1: Culvert Peak Elev=91.39' Storage=33 cf Inflow=0.54 cfs 0.051 af
15.0" Round Culvert n=0.013 L=28.0' S=0.0107 '/' Outflow=0.54 cfs 0.051 af

Total Runoff Area = 2.145 ac Runoff Volume = 0.218 af Average Runoff Depth = 1.22"
100.00% Pervious = 2.145 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Flow to Vernal Pool

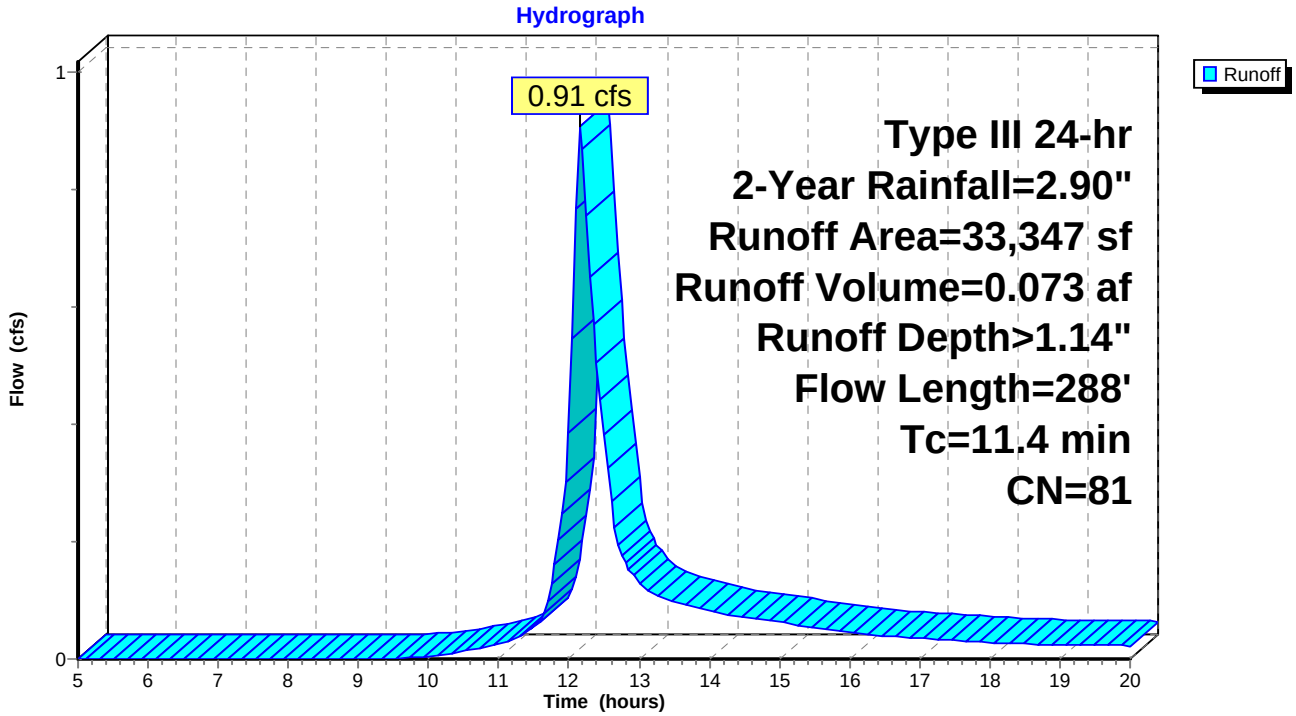
Runoff = 0.91 cfs @ 12.17 hrs, Volume= 0.073 af, Depth> 1.14"

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 Rainfall=2.90"

Area (sf)	CN	Description
26,635	79	Woods, Fair, HSG D
1,171	91	Gravel roads, HSG D
2,442	80	>75% Grass cover, Good, HSG D
3,099	98	Water Surface, 0% imp, HSG D
33,347	81	Weighted Average
33,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	150	0.0500	0.25		**Sheet Flow, Woods** Grass: Short n= 0.150 P2= 2.90"
0.1	70	0.0500	7.88	39.42	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
1.4	68	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	288	Total			

Subcatchment S-1: Flow to Vernal Pool



Summary for Subcatchment S-2: Flow to offsite

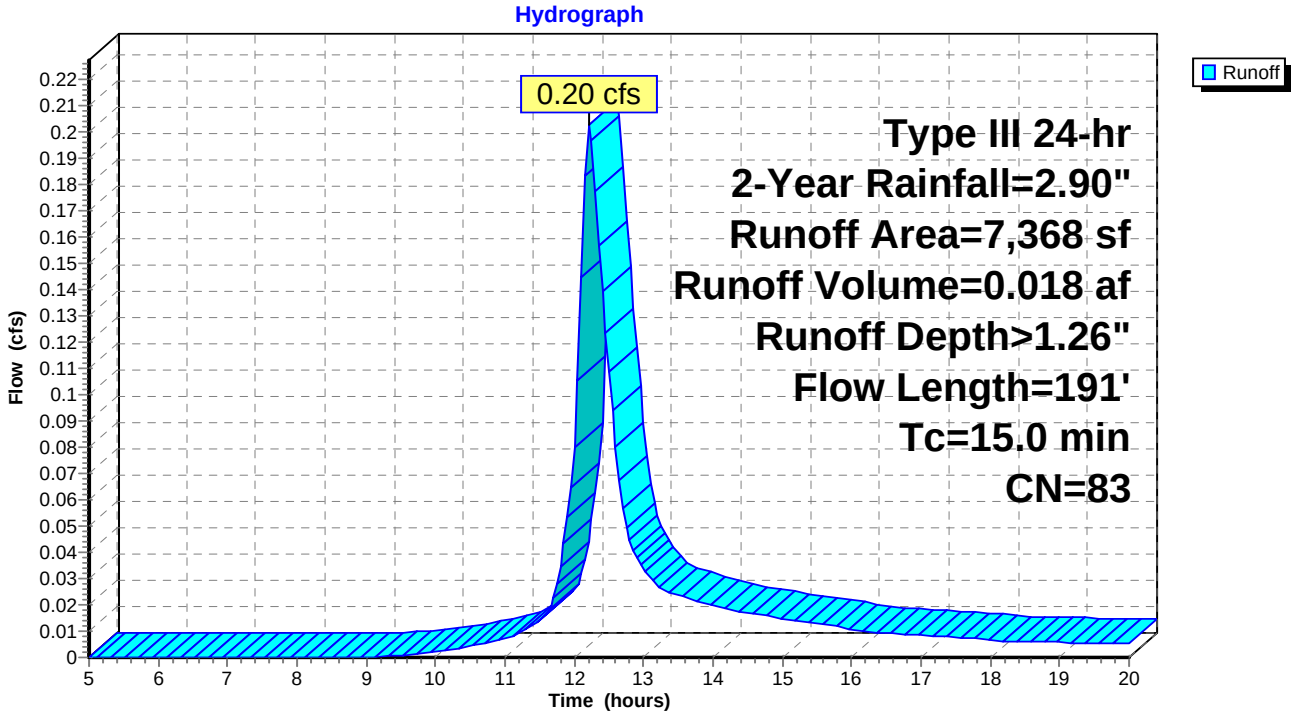
Runoff = 0.20 cfs @ 12.21 hrs, Volume= 0.018 af, Depth> 1.26"

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 Rainfall=2.90"

Area (sf)	CN	Description
2,261	91	Gravel roads, HSG D
2,623	80	>75% Grass cover, Good, HSG D
2,484	79	Woods, Fair, HSG D
7,368	83	Weighted Average
7,368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	58	0.0200	0.07		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.4	133	0.0230	5.35	26.74	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
15.0	191	Total			

Subcatchment S-2: Flow to offsite



Summary for Subcatchment S-3: Flow to culvert

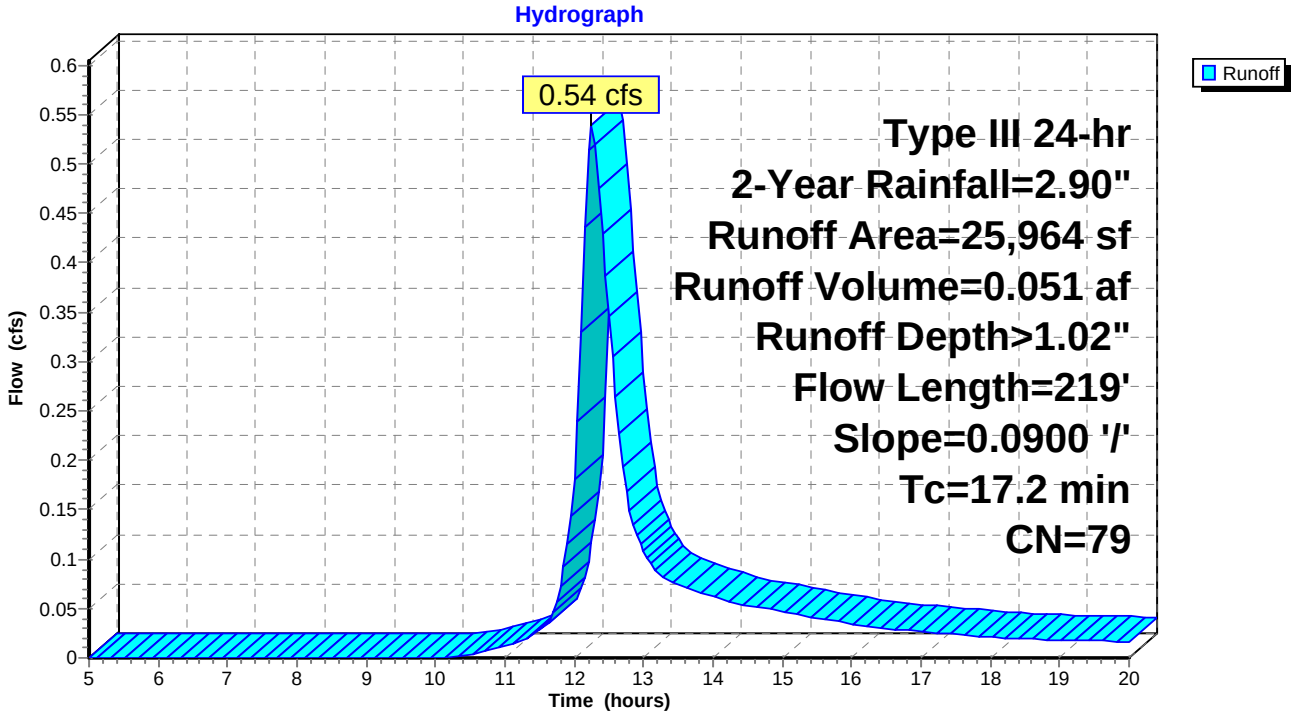
Runoff = 0.54 cfs @ 12.25 hrs, Volume= 0.051 af, Depth> 1.02"

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 Rainfall=2.90"

Area (sf)	CN	Description
3,670	80	>75% Grass cover, Good, HSG D
22,294	79	Woods, Fair, HSG D
25,964	79	Weighted Average
25,964		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	150	0.0900	0.15		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.1	69	0.0900	10.58	52.89	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
17.2	219	Total			

Subcatchment S-3: Flow to culvert



Summary for Subcatchment S-4: Flow to offsite

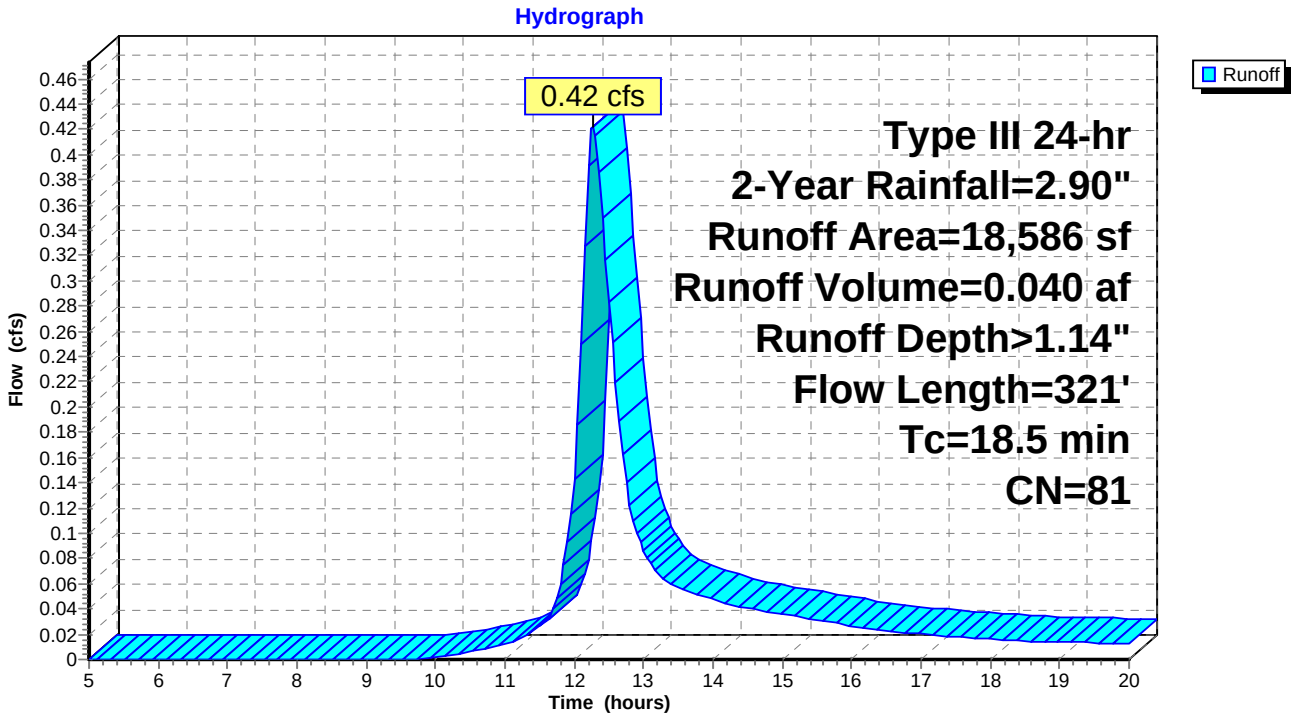
Runoff = 0.42 cfs @ 12.27 hrs, Volume= 0.040 af, Depth> 1.14"

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 Rainfall=2.90"

Area (sf)	CN	Description
6,702	80	>75% Grass cover, Good, HSG D
9,044	79	Woods, Fair, HSG D
2,840	91	Gravel roads, HSG D
18,586	81	Weighted Average
18,586		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	150	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.90"
0.1	13	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	158	0.0200	4.99	24.93	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
18.5	321	Total			

Subcatchment S-4: Flow to offsite



Summary for Subcatchment S5: Flow to offsite

[49] Hint: Tc<2dt may require smaller dt

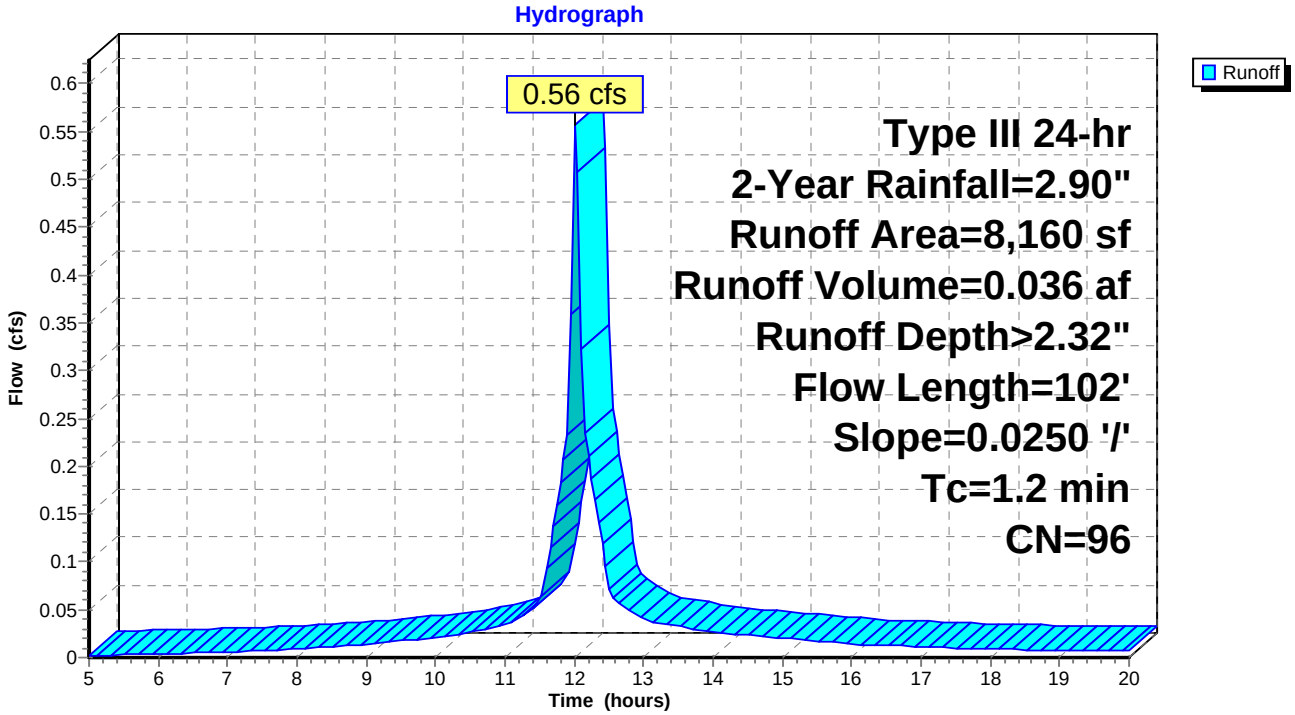
Runoff = 0.56 cfs @ 12.02 hrs, Volume= 0.036 af, Depth> 2.32"

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 Rainfall=2.90"

Area (sf)	CN	Description
8,160	96	Gravel surface, HSG D
8,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	102	0.0250	1.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.90"

Subcatchment S5: Flow to offsite



Summary for Reach 1R: Roadside Ditch

Inflow Area = 0.766 ac, 0.00% Impervious, Inflow Depth > 1.14" for 2-Year event
Inflow = 0.91 cfs @ 12.17 hrs, Volume= 0.073 af
Outflow = 0.91 cfs @ 12.17 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

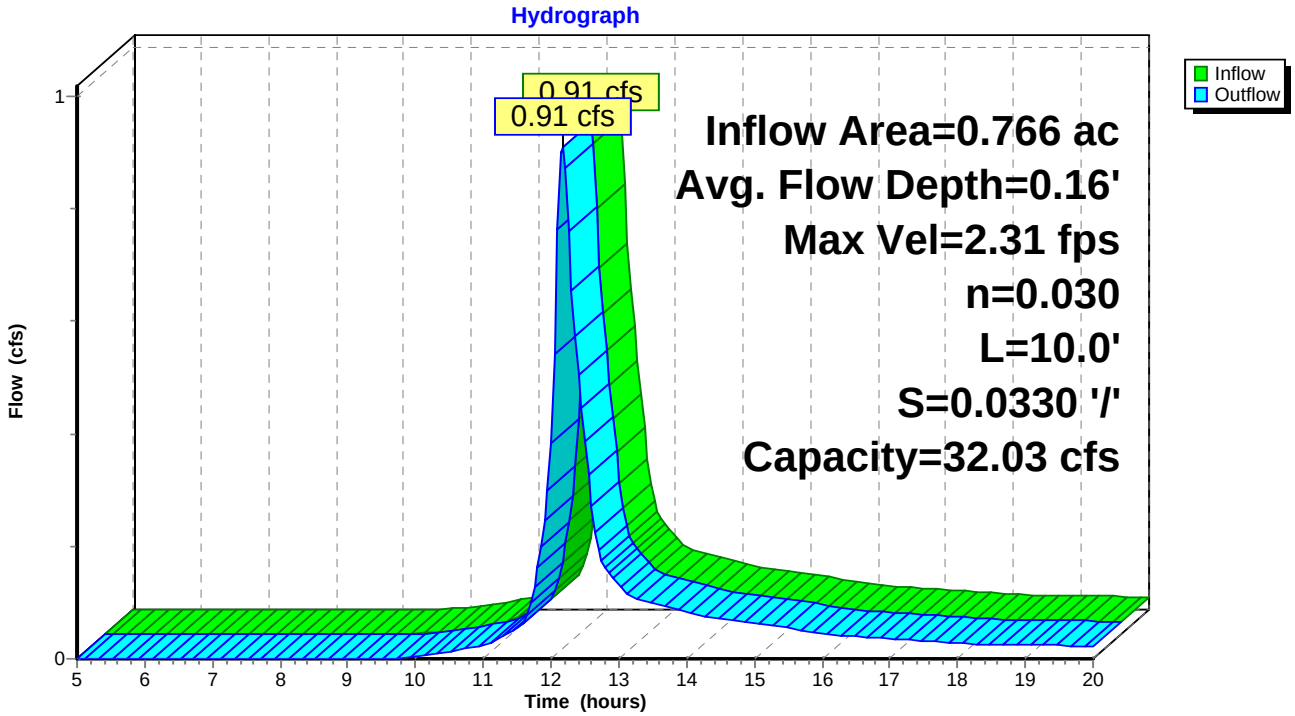
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.31 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 0.2 min

Peak Storage= 4 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 32.03 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 8.00'
Length= 10.0' Slope= 0.0330 '/'
Inlet Invert= 101.00', Outlet Invert= 100.67'

‡

Reach 1R: Roadside Ditch



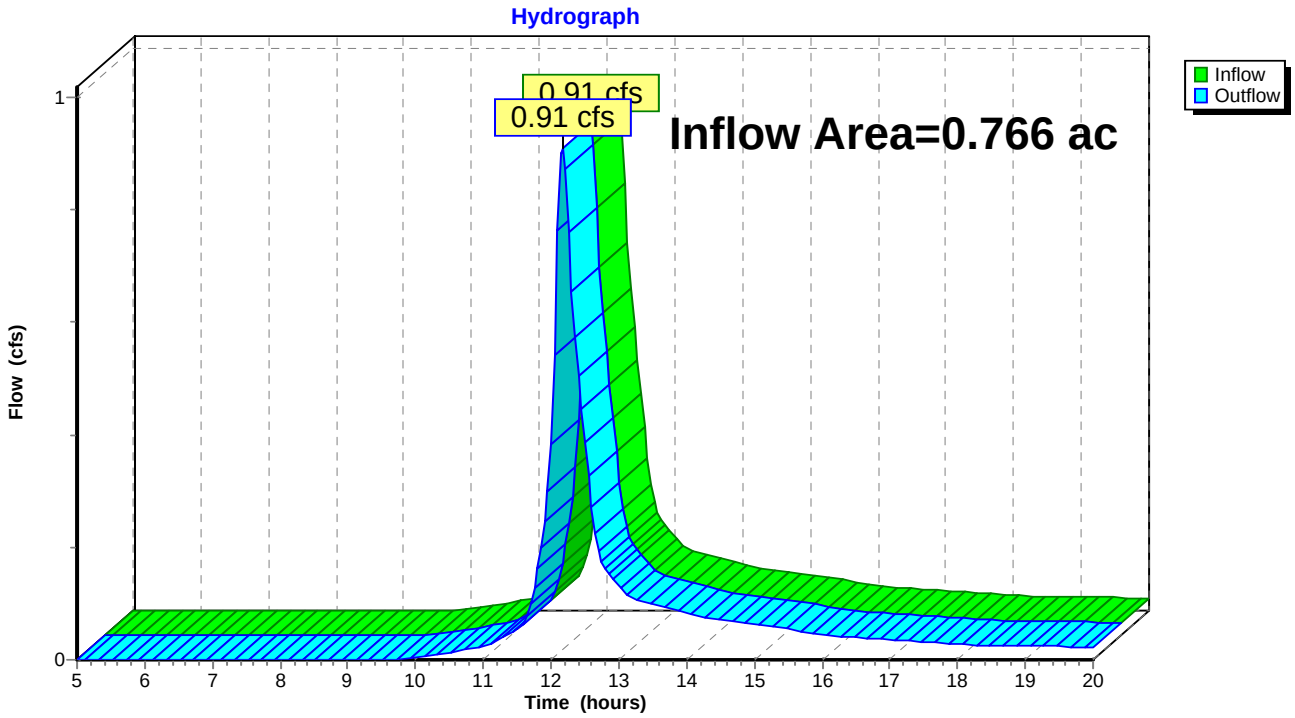
Summary for Reach AP-1: Analysis Point 1

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

Inflow Area =	0.766 ac,	0.00% Impervious,	Inflow Depth >	1.14"	for 2-Year event
Inflow =	0.91 cfs @	12.17 hrs,	Volume=	0.073 af	
Outflow =	0.91 cfs @	12.17 hrs,	Volume=	0.073 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-1: Analysis Point 1



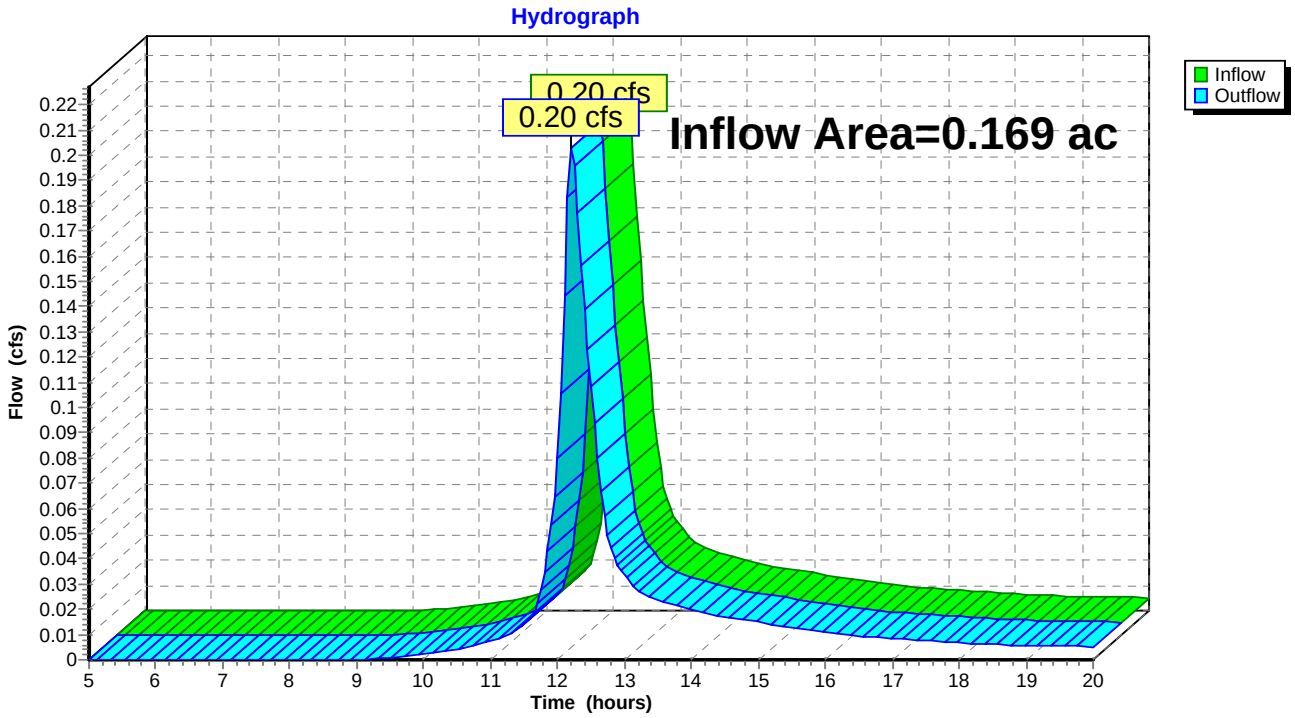
Summary for Reach AP-2: Analysis Point 2

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

Inflow Area = 0.169 ac, 0.00% Impervious, Inflow Depth > 1.26" for 2-Year event
Inflow = 0.20 cfs @ 12.21 hrs, Volume= 0.018 af
Outflow = 0.20 cfs @ 12.21 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-2: Analysis Point 2



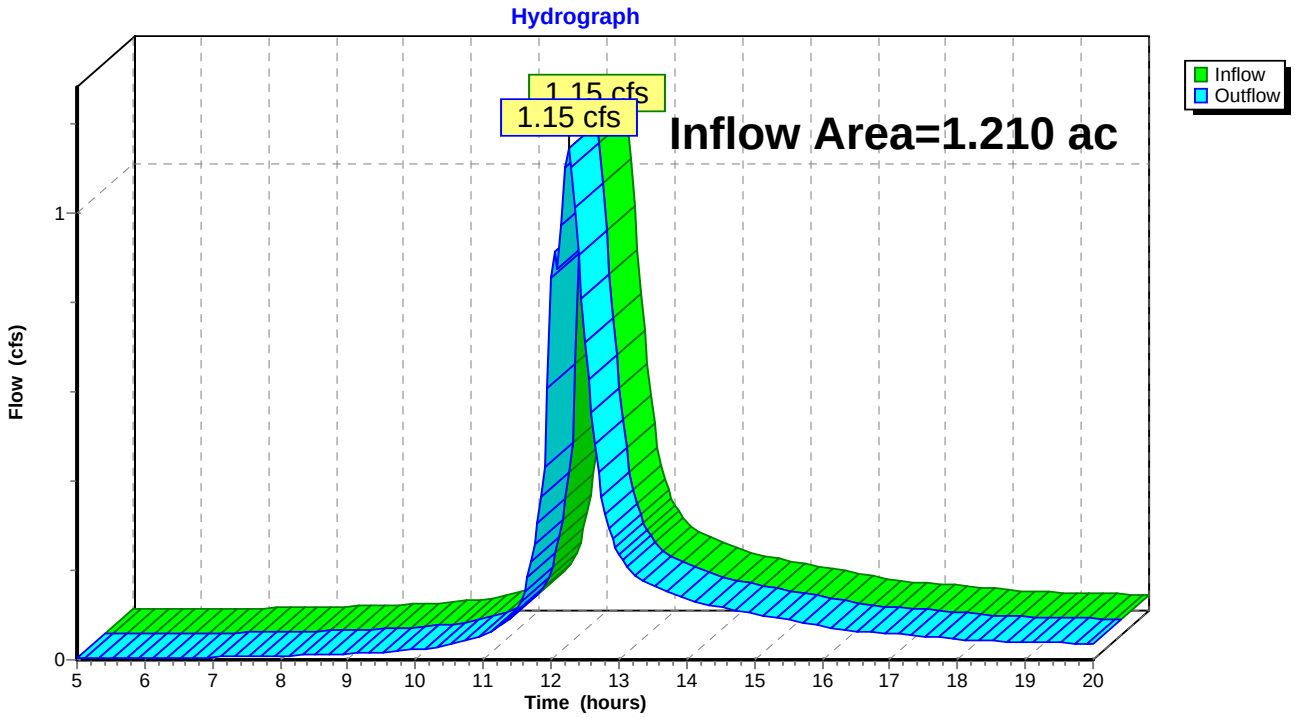
Summary for Reach AP-3: Analysis Point 3

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

Inflow Area =	1.210 ac,	0.00% Impervious,	Inflow Depth >	1.26"	for 2-Year event
Inflow =	1.15 cfs @	12.25 hrs,	Volume=	0.127 af	
Outflow =	1.15 cfs @	12.25 hrs,	Volume=	0.127 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-3: Analysis Point 3



Summary for Pond P-1: Culvert

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth > 1.02" for 2-Year event
Inflow = 0.54 cfs @ 12.25 hrs, Volume= 0.051 af
Outflow = 0.54 cfs @ 12.26 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.6 min
Primary = 0.54 cfs @ 12.26 hrs, Volume= 0.051 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 91.39' @ 12.26 hrs Surf.Area= 99 sf Storage= 33 cf
Flood Elev= 93.10' Surf.Area= 450 sf Storage= 406 cf

Plug-Flow detention time= 2.2 min calculated for 0.051 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (820.2 - 818.9)

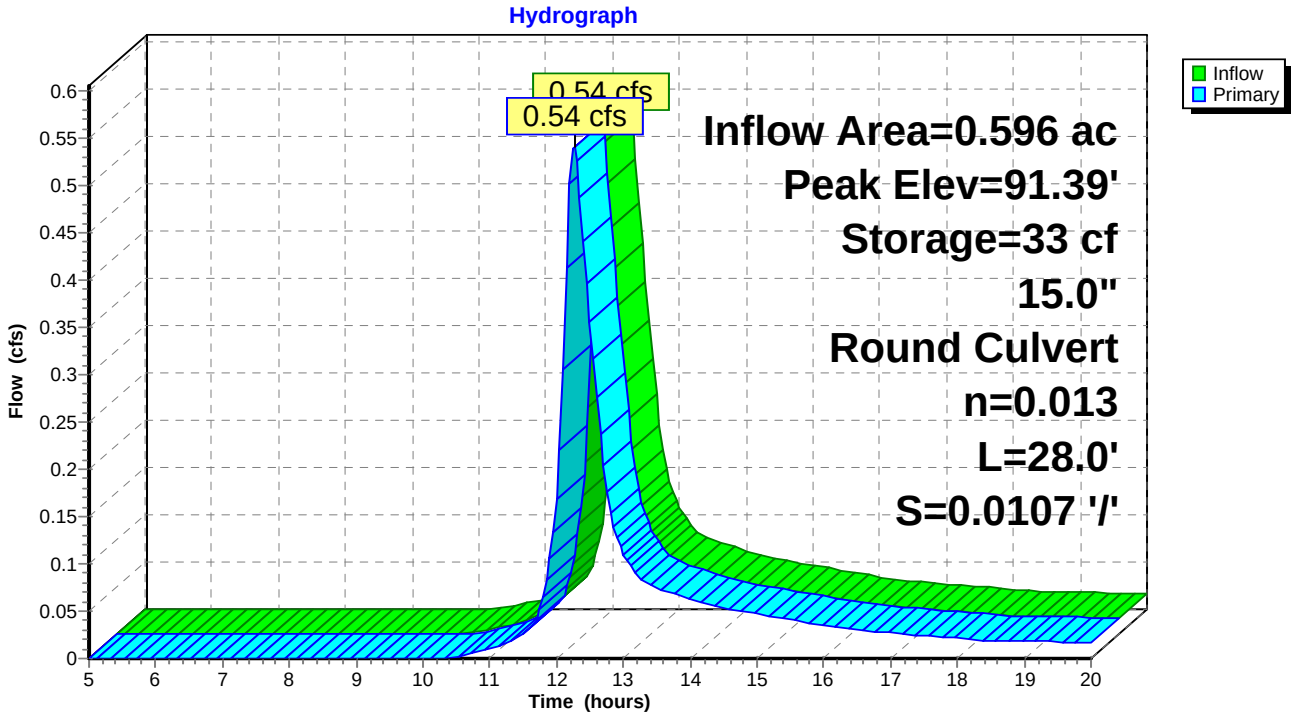
Volume	Invert	Avail.Storage	Storage Description
#1	91.00'	406 cf	**Culvert Inlet (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	70	0	0
92.00	146	108	108
93.00	450	298	406

Device	Routing	Invert	Outlet Devices
#1	Primary	91.00'	**15.0" Round Culvert** L= 28.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.00' / 90.70' S= 0.0107 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.54 cfs @ 12.26 hrs HW=91.38' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.54 cfs @ 1.67 fps)

Pond P-1: Culvert



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

Subcatchment S-1: Flow to Vernal Pool Runoff Area=33,347 sf 0.00% Impervious Runoff Depth>2.29"
Flow Length=288' Tc=11.4 min CN=81 Runoff=1.84 cfs 0.146 af

Subcatchment S-2: Flow to offsite Runoff Area=7,368 sf 0.00% Impervious Runoff Depth>2.46"
Flow Length=191' Tc=15.0 min CN=83 Runoff=0.39 cfs 0.035 af

Subcatchment S-3: Flow to culvert Runoff Area=25,964 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=219' Slope=0.0900 '/' Tc=17.2 min CN=79 Runoff=1.14 cfs 0.106 af

Subcatchment S-4: Flow to offsite Runoff Area=18,586 sf 0.00% Impervious Runoff Depth>2.29"
Flow Length=321' Tc=18.5 min CN=81 Runoff=0.86 cfs 0.081 af

Subcatchment S5: Flow to offsite Runoff Area=8,160 sf 0.00% Impervious Runoff Depth>3.70"
Flow Length=102' Slope=0.0250 '/' Tc=1.2 min CN=96 Runoff=0.87 cfs 0.058 af

Reach 1R: Roadside Ditch Avg. Flow Depth=0.23' Max Vel=2.89 fps Inflow=1.84 cfs 0.146 af
n=0.030 L=10.0' S=0.0330 '/' Capacity=32.03 cfs Outflow=1.84 cfs 0.146 af

Reach AP-1: Analysis Point 1 Inflow=1.84 cfs 0.146 af
Outflow=1.84 cfs 0.146 af

Reach AP-2: Analysis Point 2 Inflow=0.39 cfs 0.035 af
Outflow=0.39 cfs 0.035 af

Reach AP-3: Analysis Point 3 Inflow=2.29 cfs 0.244 af
Outflow=2.29 cfs 0.244 af

Pond P-1: Culvert Peak Elev=91.58' Storage=53 cf Inflow=1.14 cfs 0.106 af
15.0" Round Culvert n=0.013 L=28.0' S=0.0107 '/' Outflow=1.14 cfs 0.105 af

Total Runoff Area = 2.145 ac Runoff Volume = 0.426 af Average Runoff Depth = 2.38"
100.00% Pervious = 2.145 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Flow to Vernal Pool

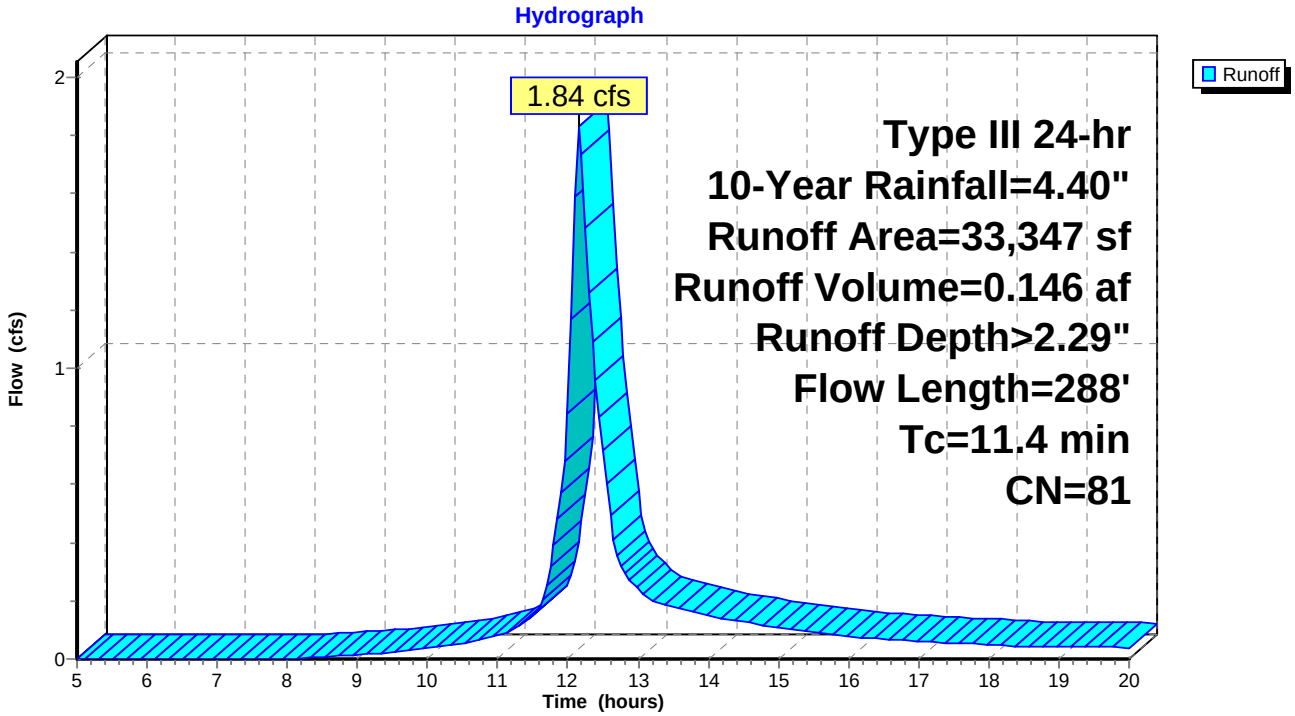
Runoff = 1.84 cfs @ 12.16 hrs, Volume= 0.146 af, Depth> 2.29"

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 Rainfall=4.40"

Area (sf)	CN	Description
26,635	79	Woods, Fair, HSG D
1,171	91	Gravel roads, HSG D
2,442	80	>75% Grass cover, Good, HSG D
3,099	98	Water Surface, 0% imp, HSG D
33,347	81	Weighted Average
33,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	150	0.0500	0.25		**Sheet Flow, Woods** Grass: Short n= 0.150 P2= 2.90"
0.1	70	0.0500	7.88	39.42	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
1.4	68	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	288	Total			

Subcatchment S-1: Flow to Vernal Pool



Summary for Subcatchment S-2: Flow to offsite

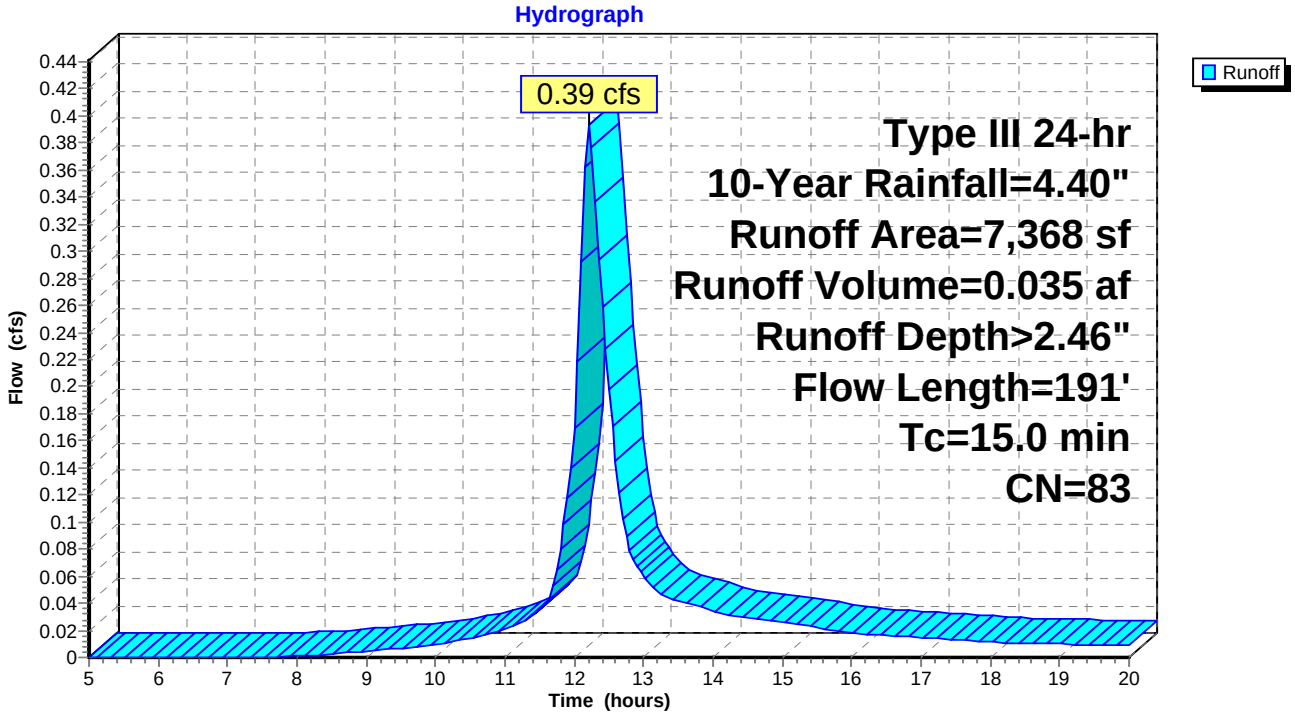
Runoff = 0.39 cfs @ 12.21 hrs, Volume= 0.035 af, Depth> 2.46"

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 Rainfall=4.40"

Area (sf)	CN	Description
2,261	91	Gravel roads, HSG D
2,623	80	>75% Grass cover, Good, HSG D
2,484	79	Woods, Fair, HSG D
7,368	83	Weighted Average
7,368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	58	0.0200	0.07		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.4	133	0.0230	5.35	26.74	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
15.0	191	Total			

Subcatchment S-2: Flow to offsite



Summary for Subcatchment S-3: Flow to culvert

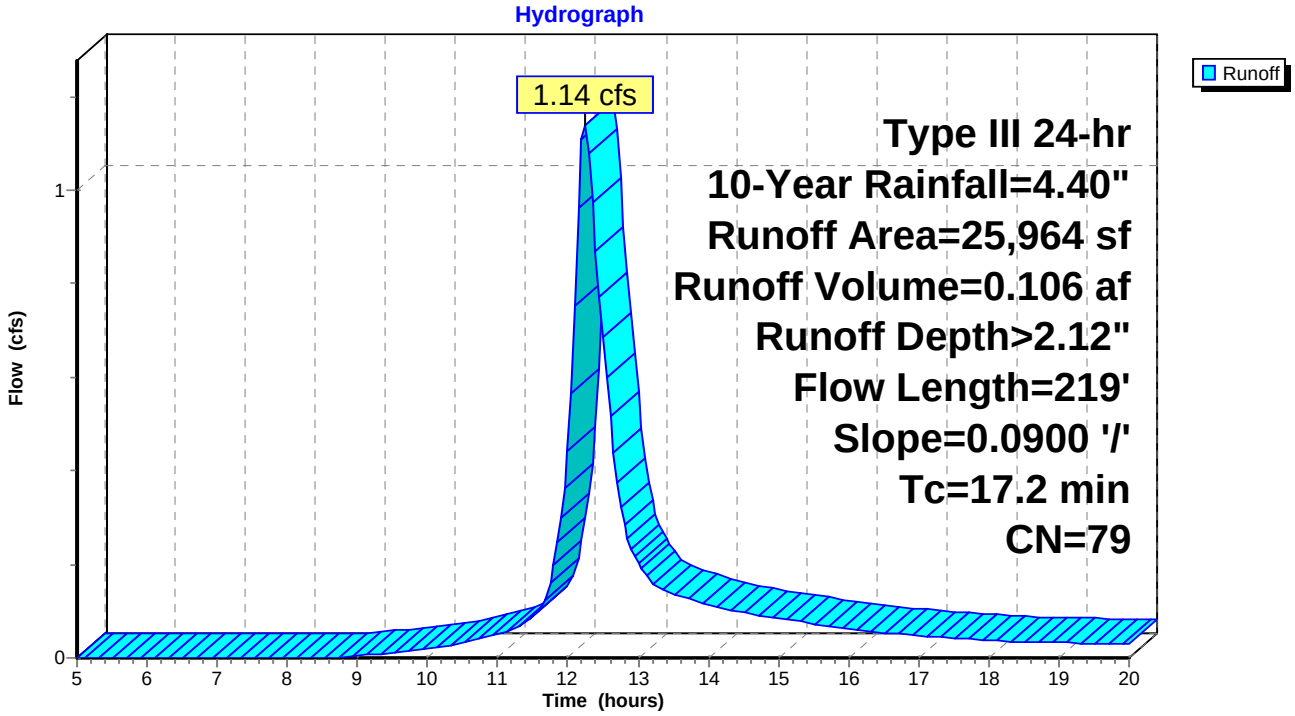
Runoff = 1.14 cfs @ 12.24 hrs, Volume= 0.106 af, Depth> 2.12"

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 Rainfall=4.40"

Area (sf)	CN	Description
3,670	80	>75% Grass cover, Good, HSG D
22,294	79	Woods, Fair, HSG D
25,964	79	Weighted Average
25,964		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	150	0.0900	0.15		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.1	69	0.0900	10.58	52.89	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
17.2	219	Total			

Subcatchment S-3: Flow to culvert



Summary for Subcatchment S-4: Flow to offsite

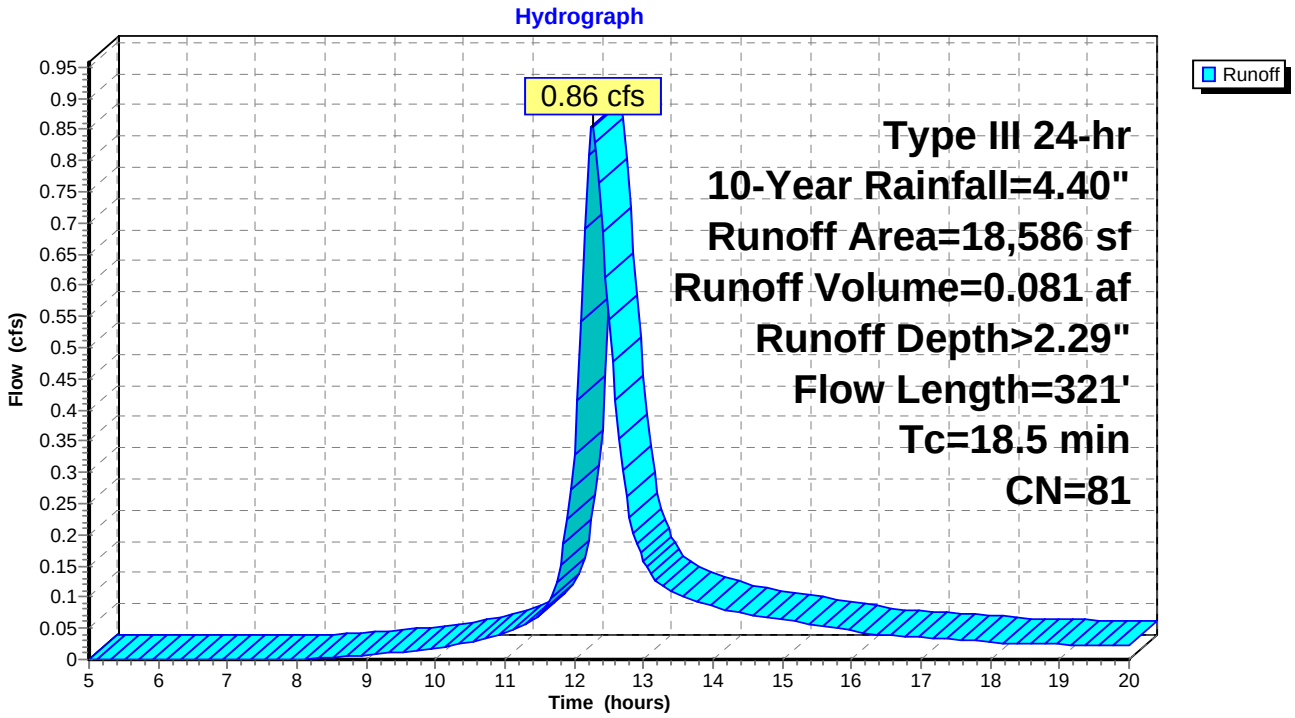
Runoff = 0.86 cfs @ 12.26 hrs, Volume= 0.081 af, Depth> 2.29"

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 Rainfall=4.40"

Area (sf)	CN	Description
6,702	80	>75% Grass cover, Good, HSG D
9,044	79	Woods, Fair, HSG D
2,840	91	Gravel roads, HSG D
18,586	81	Weighted Average
18,586		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	150	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.90"
0.1	13	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	158	0.0200	4.99	24.93	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
18.5	321	Total			

Subcatchment S-4: Flow to offsite



Summary for Subcatchment S5: Flow to offsite

[49] Hint: Tc<2dt may require smaller dt

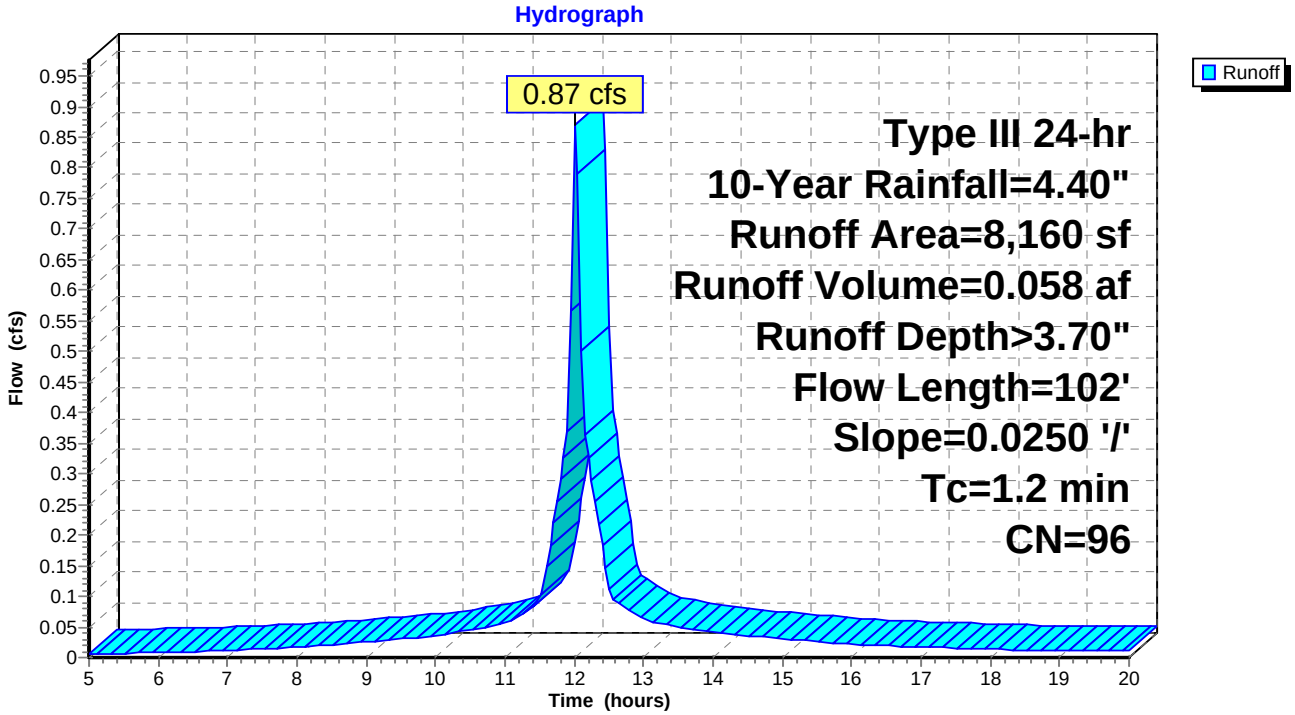
Runoff = 0.87 cfs @ 12.02 hrs, Volume= 0.058 af, Depth> 3.70"

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 Rainfall=4.40"

Area (sf)	CN	Description
8,160	96	Gravel surface, HSG D
8,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	102	0.0250	1.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.90"

Subcatchment S5: Flow to offsite



Summary for Reach 1R: Roadside Ditch

Inflow Area = 0.766 ac, 0.00% Impervious, Inflow Depth > 2.29" for 10-Year event
Inflow = 1.84 cfs @ 12.16 hrs, Volume= 0.146 af
Outflow = 1.84 cfs @ 12.16 hrs, Volume= 0.146 af, Atten= 0%, Lag= 0.0 min

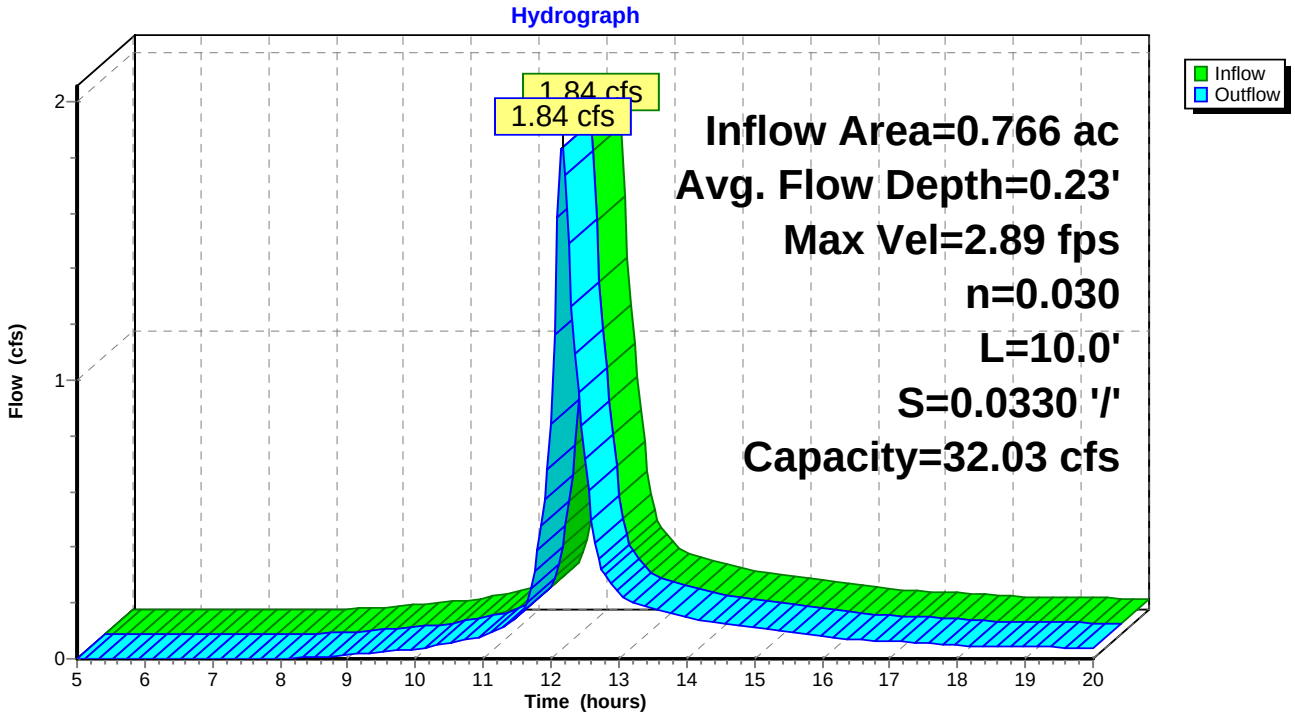
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.89 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 0.2 min

Peak Storage= 6 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 32.03 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 8.00'
Length= 10.0' Slope= 0.0330 '/'
Inlet Invert= 101.00', Outlet Invert= 100.67'

‡

Reach 1R: Roadside Ditch



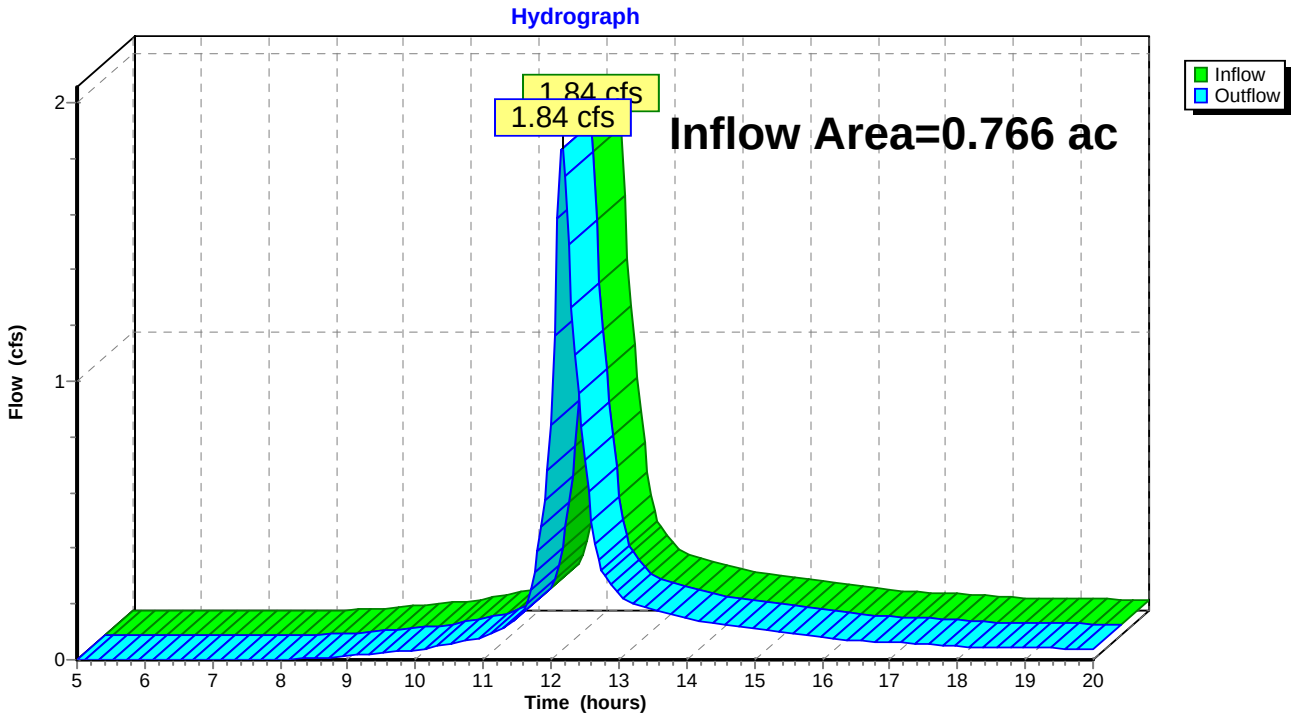
Summary for Reach AP-1: Analysis Point 1

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

Inflow Area =	0.766 ac,	0.00% Impervious,	Inflow Depth >	2.29"	for 10-Year event
Inflow =	1.84 cfs @	12.16 hrs,	Volume=	0.146 af	
Outflow =	1.84 cfs @	12.16 hrs,	Volume=	0.146 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-1: Analysis Point 1



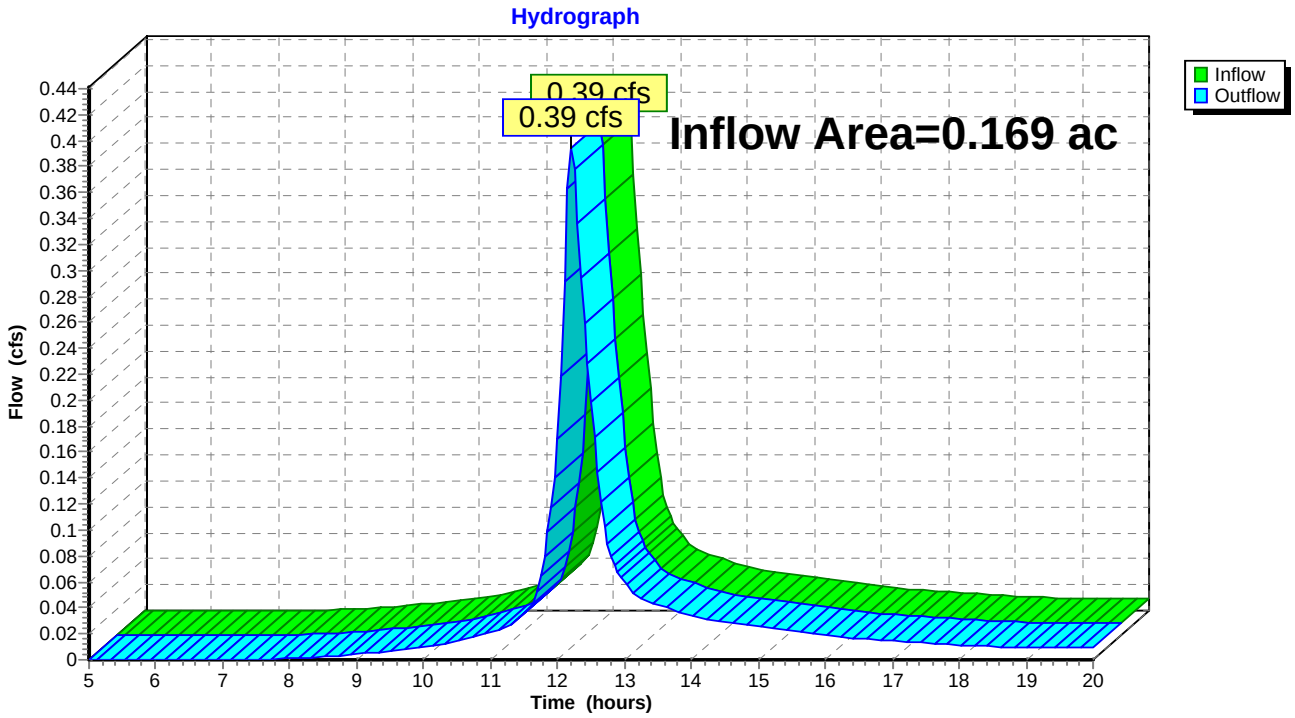
Summary for Reach AP-2: Analysis Point 2

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

Inflow Area = 0.169 ac, 0.00% Impervious, Inflow Depth > 2.46" for 10-Year event
Inflow = 0.39 cfs @ 12.21 hrs, Volume= 0.035 af
Outflow = 0.39 cfs @ 12.21 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-2: Analysis Point 2



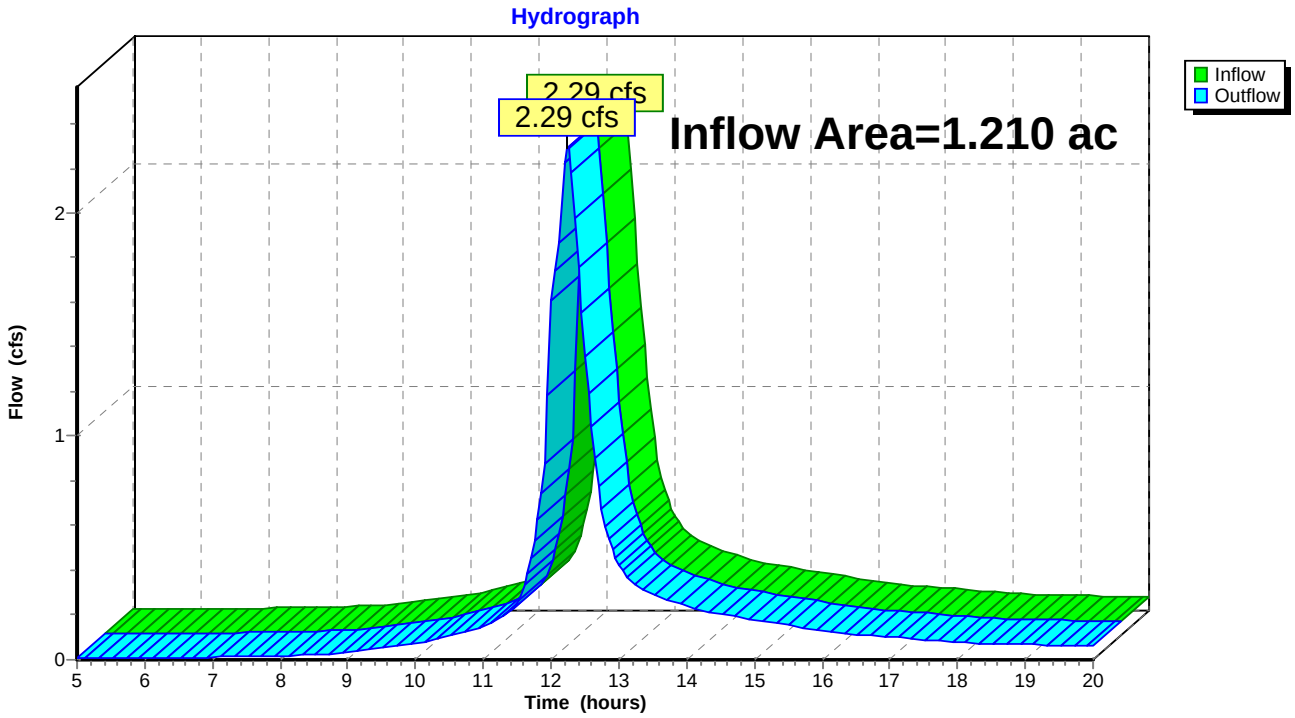
Summary for Reach AP-3: Analysis Point 3

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

Inflow Area =	1.210 ac,	0.00% Impervious,	Inflow Depth >	2.42"	for 10-Year event
Inflow =	2.29 cfs @	12.24 hrs,	Volume=	0.244 af	
Outflow =	2.29 cfs @	12.24 hrs,	Volume=	0.244 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-3: Analysis Point 3



Summary for Pond P-1: Culvert

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-Year event
Inflow = 1.14 cfs @ 12.24 hrs, Volume= 0.106 af
Outflow = 1.14 cfs @ 12.25 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.6 min
Primary = 1.14 cfs @ 12.25 hrs, Volume= 0.105 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 91.58' @ 12.25 hrs Surf.Area= 114 sf Storage= 53 cf
Flood Elev= 93.10' Surf.Area= 450 sf Storage= 406 cf

Plug-Flow detention time= 1.6 min calculated for 0.105 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (803.7 - 802.6)

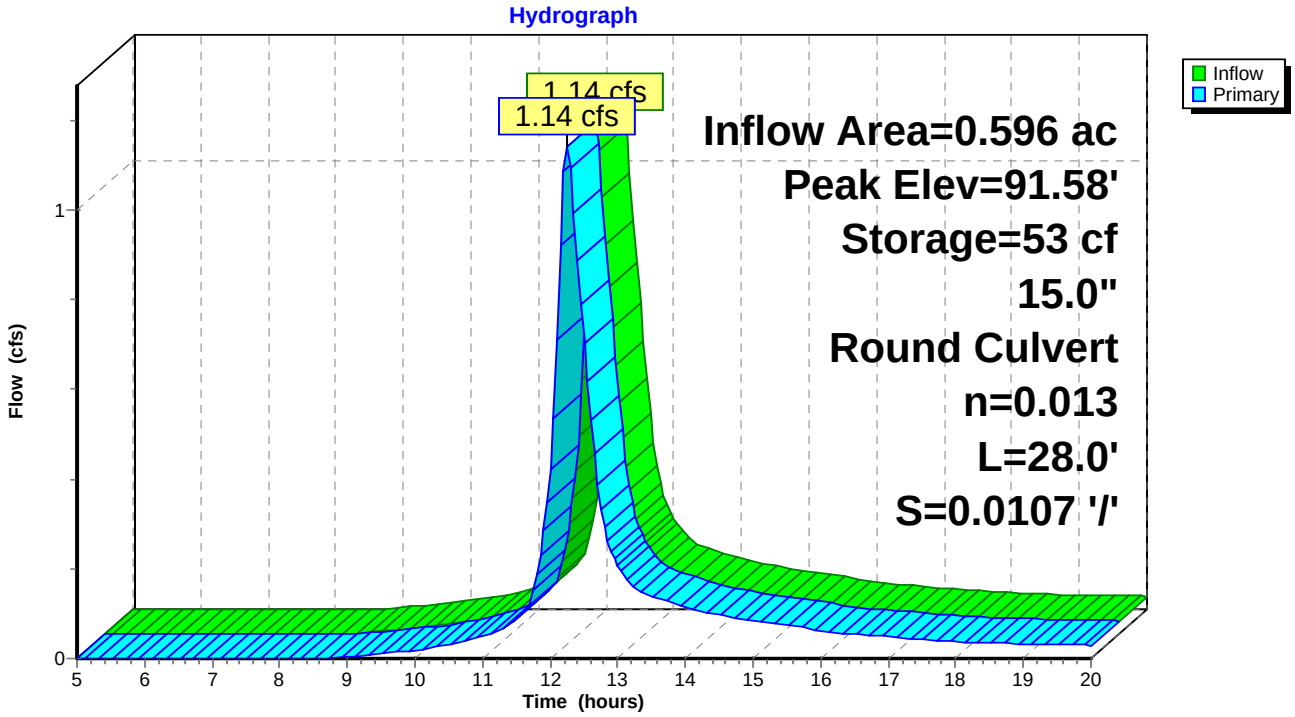
Volume	Invert	Avail.Storage	Storage Description
#1	91.00'	406 cf	**Culvert Inlet (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	70	0	0
92.00	146	108	108
93.00	450	298	406

Device	Routing	Invert	Outlet Devices
#1	Primary	91.00'	**15.0" Round Culvert** L= 28.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.00' / 90.70' S= 0.0107 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.14 cfs @ 12.25 hrs HW=91.58' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.14 cfs @ 2.05 fps)

Pond P-1: Culvert



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

Subcatchment S-1: Flow to Vernal Pool Runoff Area=33,347 sf 0.00% Impervious Runoff Depth>2.87"
Flow Length=288' Tc=11.4 min CN=81 Runoff=2.29 cfs 0.183 af

Subcatchment S-2: Flow to offsite Runoff Area=7,368 sf 0.00% Impervious Runoff Depth>3.05"
Flow Length=191' Tc=15.0 min CN=83 Runoff=0.49 cfs 0.043 af

Subcatchment S-3: Flow to culvert Runoff Area=25,964 sf 0.00% Impervious Runoff Depth>2.69"
Flow Length=219' Slope=0.0900 '/' Tc=17.2 min CN=79 Runoff=1.44 cfs 0.133 af

Subcatchment S-4: Flow to offsite Runoff Area=18,586 sf 0.00% Impervious Runoff Depth>2.86"
Flow Length=321' Tc=18.5 min CN=81 Runoff=1.07 cfs 0.102 af

Subcatchment S5: Flow to offsite Runoff Area=8,160 sf 0.00% Impervious Runoff Depth>4.35"
Flow Length=102' Slope=0.0250 '/' Tc=1.2 min CN=96 Runoff=1.02 cfs 0.068 af

Reach 1R: Roadside Ditch Avg. Flow Depth=0.27' Max Vel=3.09 fps Inflow=2.29 cfs 0.183 af
n=0.030 L=10.0' S=0.0330 '/' Capacity=32.03 cfs Outflow=2.29 cfs 0.183 af

Reach AP-1: Analysis Point 1 Inflow=2.29 cfs 0.183 af
Outflow=2.29 cfs 0.183 af

Reach AP-2: Analysis Point 2 Inflow=0.49 cfs 0.043 af
Outflow=0.49 cfs 0.043 af

Reach AP-3: Analysis Point 3 Inflow=2.85 cfs 0.303 af
Outflow=2.85 cfs 0.303 af

Pond P-1: Culvert Peak Elev=91.66' Storage=63 cf Inflow=1.44 cfs 0.133 af
15.0" Round Culvert n=0.013 L=28.0' S=0.0107 '/' Outflow=1.44 cfs 0.133 af

Total Runoff Area = 2.145 ac Runoff Volume = 0.529 af Average Runoff Depth = 2.96"
100.00% Pervious = 2.145 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Flow to Vernal Pool

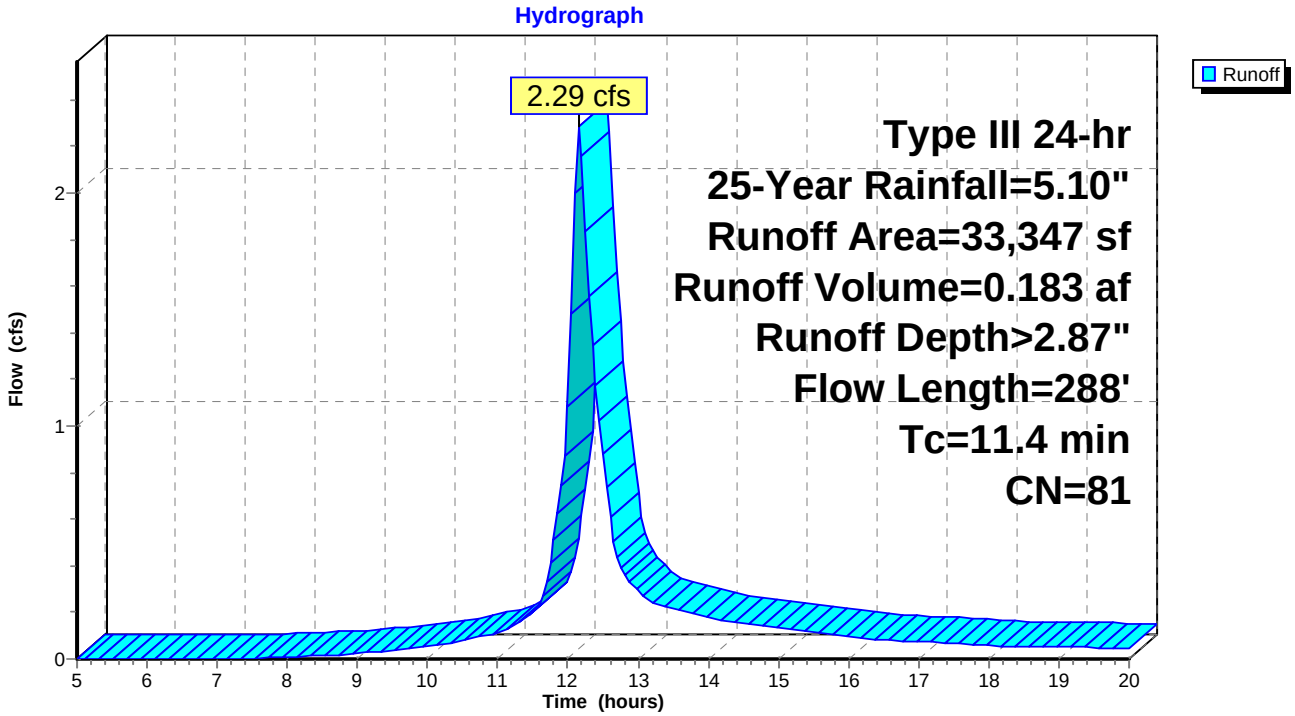
Runoff = 2.29 cfs @ 12.16 hrs, Volume= 0.183 af, Depth> 2.87"

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 Rainfall=5.10"

Area (sf)	CN	Description
26,635	79	Woods, Fair, HSG D
1,171	91	Gravel roads, HSG D
2,442	80	>75% Grass cover, Good, HSG D
3,099	98	Water Surface, 0% imp, HSG D
33,347	81	Weighted Average
33,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	150	0.0500	0.25		**Sheet Flow, Woods** Grass: Short n= 0.150 P2= 2.90"
0.1	70	0.0500	7.88	39.42	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
1.4	68	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	288	Total			

Subcatchment S-1: Flow to Vernal Pool



Summary for Subcatchment S-2: Flow to offsite

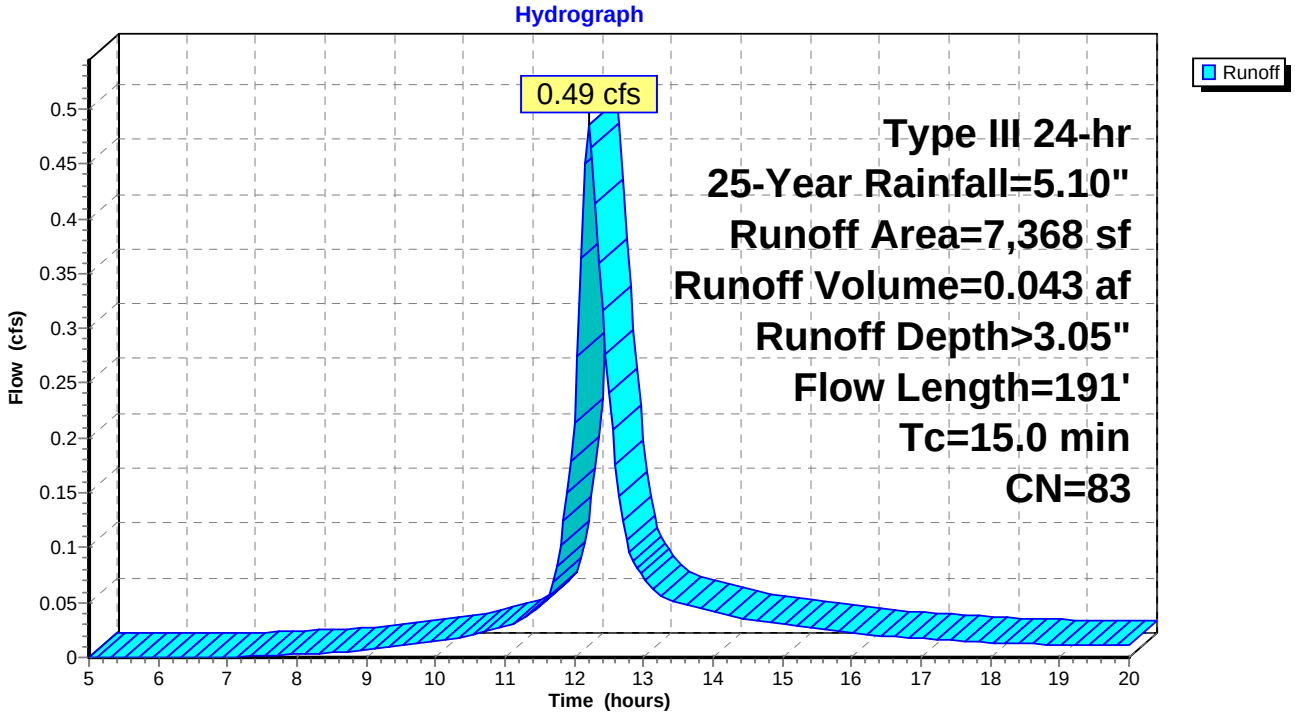
Runoff = 0.49 cfs @ 12.21 hrs, Volume= 0.043 af, Depth> 3.05"

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 Rainfall=5.10"

Area (sf)	CN	Description
2,261	91	Gravel roads, HSG D
2,623	80	>75% Grass cover, Good, HSG D
2,484	79	Woods, Fair, HSG D
7,368	83	Weighted Average
7,368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	58	0.0200	0.07		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.4	133	0.0230	5.35	26.74	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
15.0	191	Total			

Subcatchment S-2: Flow to offsite



Summary for Subcatchment S-3: Flow to culvert

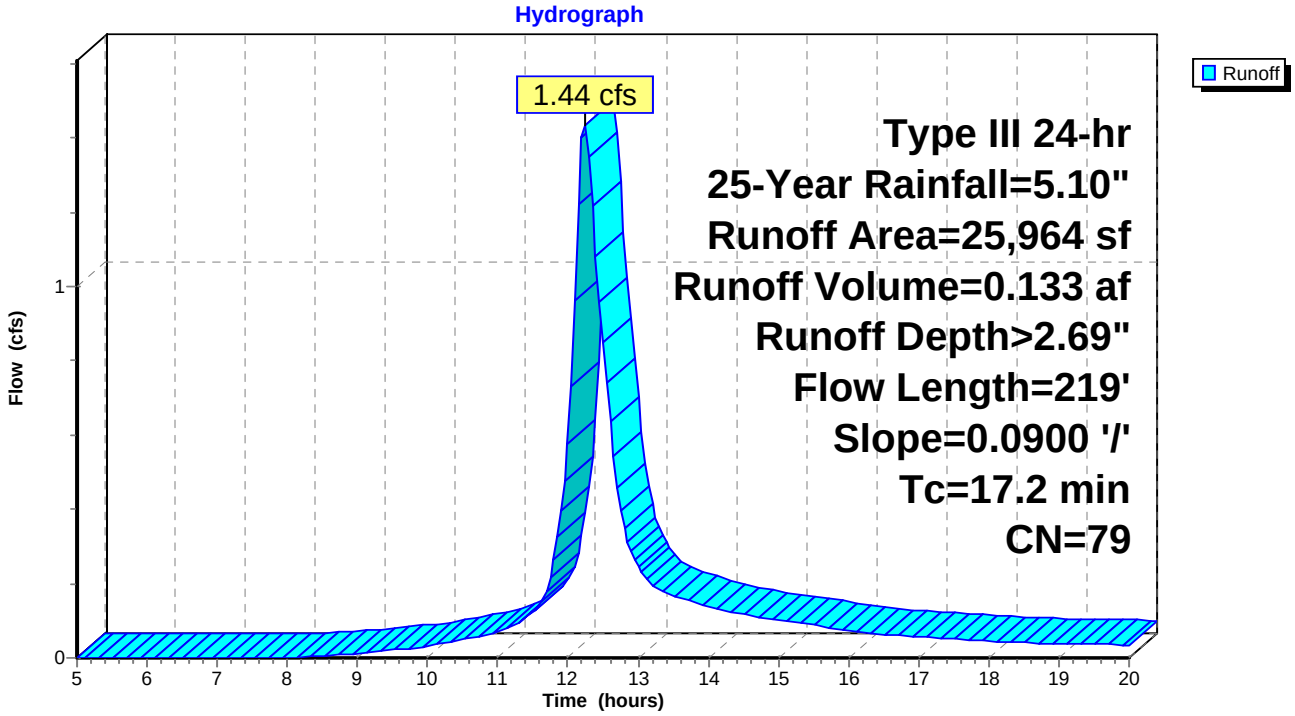
Runoff = 1.44 cfs @ 12.24 hrs, Volume= 0.133 af, Depth> 2.69"

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 Rainfall=5.10"

Area (sf)	CN	Description
3,670	80	>75% Grass cover, Good, HSG D
22,294	79	Woods, Fair, HSG D
25,964	79	Weighted Average
25,964		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	150	0.0900	0.15		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 2.90"
0.1	69	0.0900	10.58	52.89	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
17.2	219	Total			

Subcatchment S-3: Flow to culvert



Summary for Subcatchment S-4: Flow to offsite

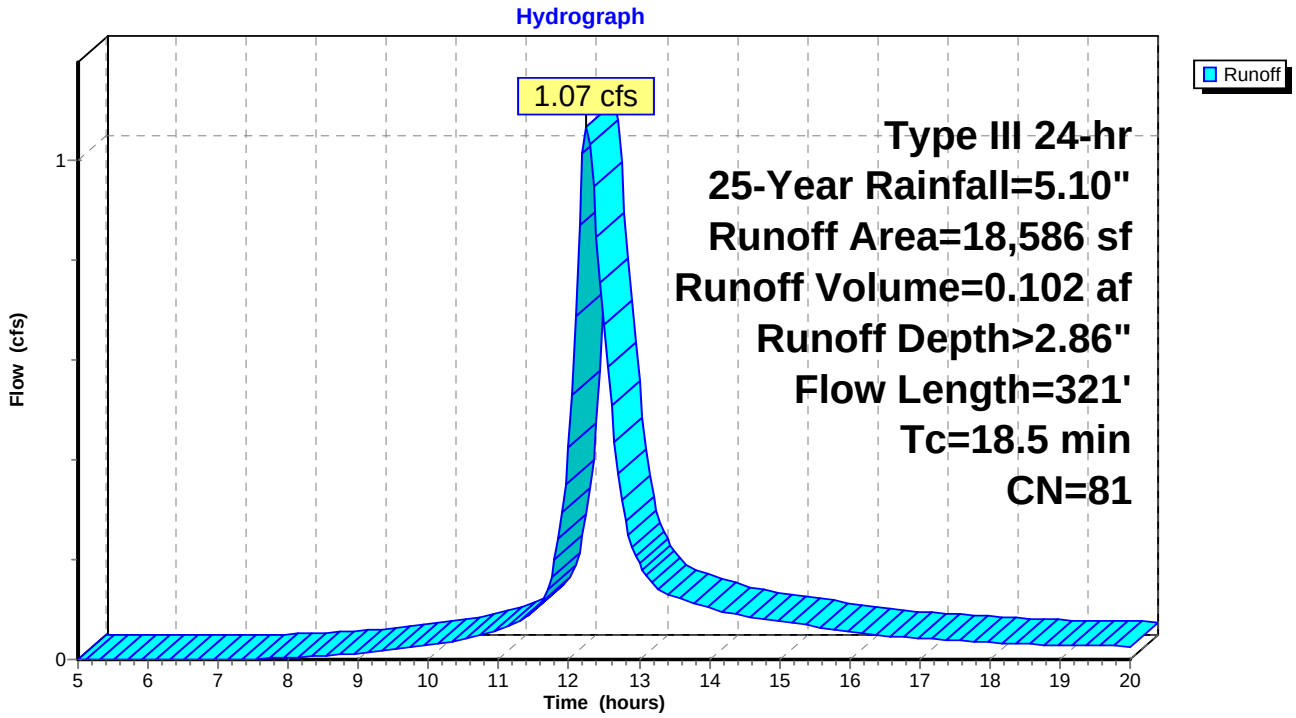
Runoff = 1.07 cfs @ 12.26 hrs, Volume= 0.102 af, Depth> 2.86"

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 Rainfall=5.10"

Area (sf)	CN	Description
6,702	80	>75% Grass cover, Good, HSG D
9,044	79	Woods, Fair, HSG D
2,840	91	Gravel roads, HSG D
18,586	81	Weighted Average
18,586		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	150	0.0800	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.90"
0.1	13	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	158	0.0200	4.99	24.93	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.030 Earth, grassed & winding
18.5	321	Total			

Subcatchment S-4: Flow to offsite



Summary for Subcatchment S5: Flow to offsite

[49] Hint: Tc<2dt may require smaller dt

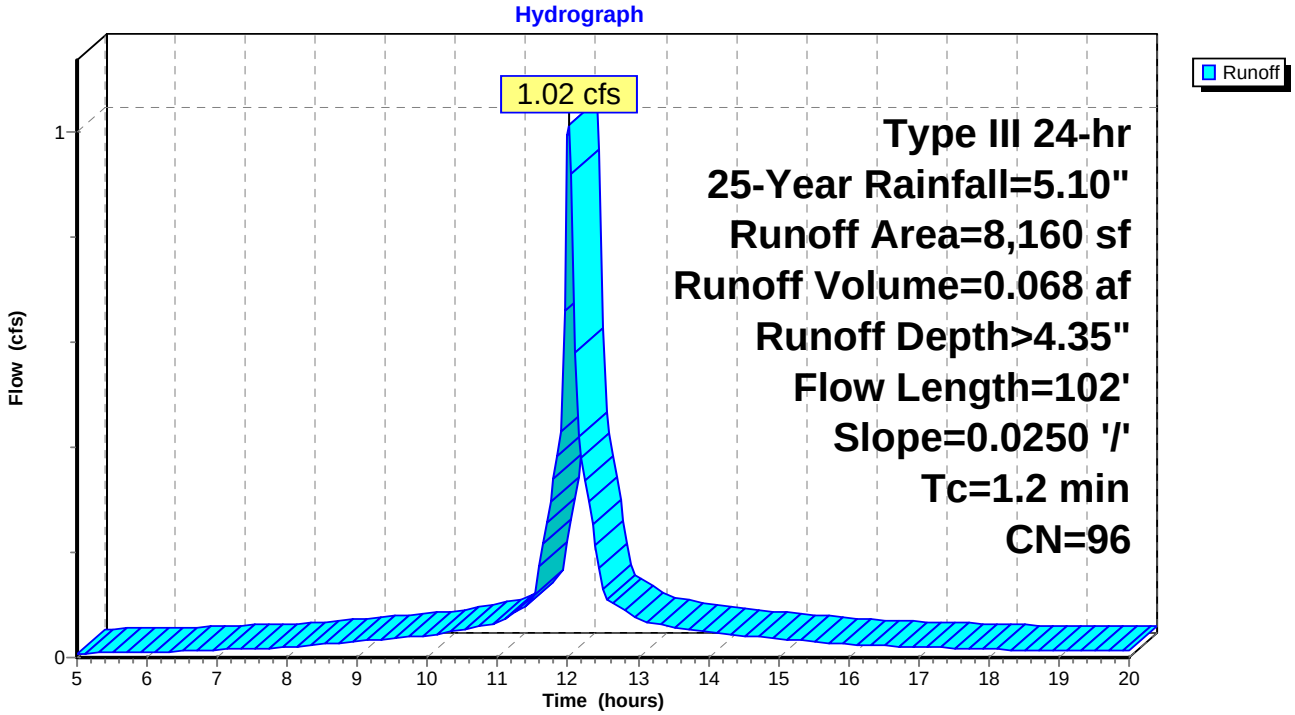
Runoff = 1.02 cfs @ 12.02 hrs, Volume= 0.068 af, Depth> 4.35"

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 Rainfall=5.10"

Area (sf)	CN	Description
8,160	96	Gravel surface, HSG D
8,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	102	0.0250	1.44		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.90"

Subcatchment S5: Flow to offsite



Summary for Reach 1R: Roadside Ditch

Inflow Area = 0.766 ac, 0.00% Impervious, Inflow Depth > 2.87" for 25-Year event
Inflow = 2.29 cfs @ 12.16 hrs, Volume= 0.183 af
Outflow = 2.29 cfs @ 12.16 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min

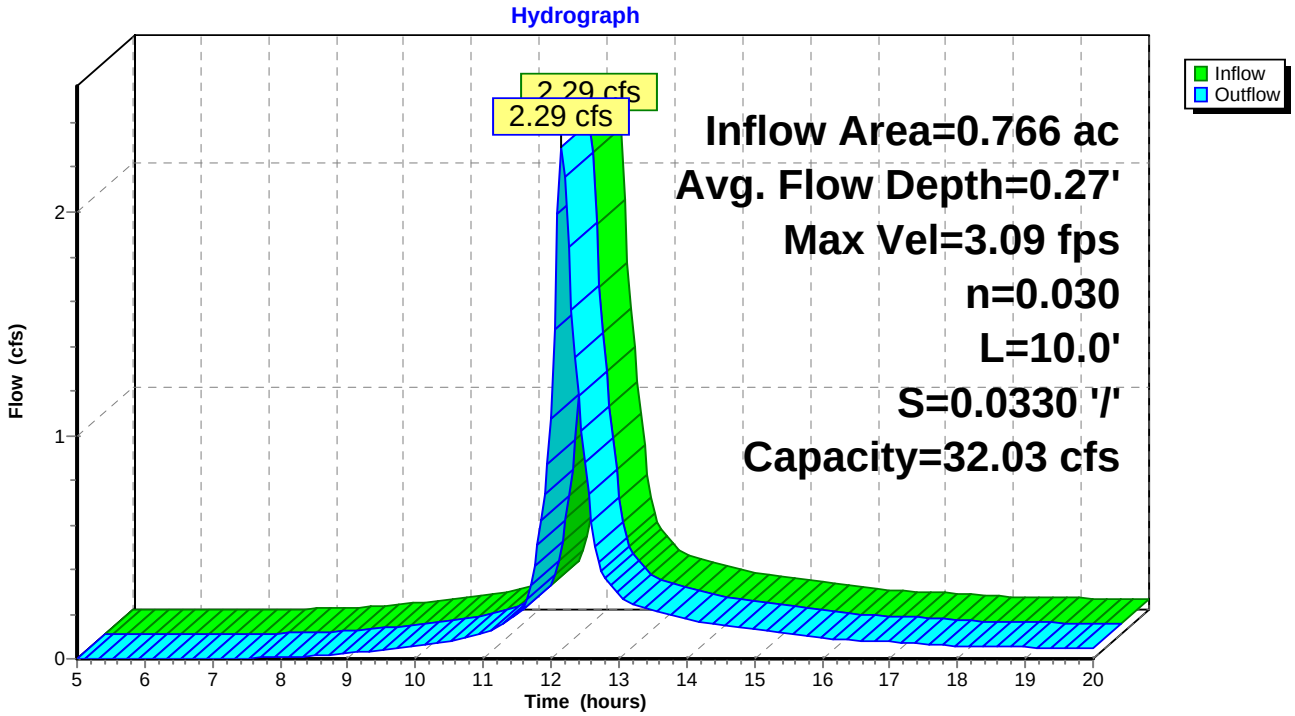
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.09 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 32.03 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 8.00'
Length= 10.0' Slope= 0.0330 '/'
Inlet Invert= 101.00', Outlet Invert= 100.67'

‡

Reach 1R: Roadside Ditch



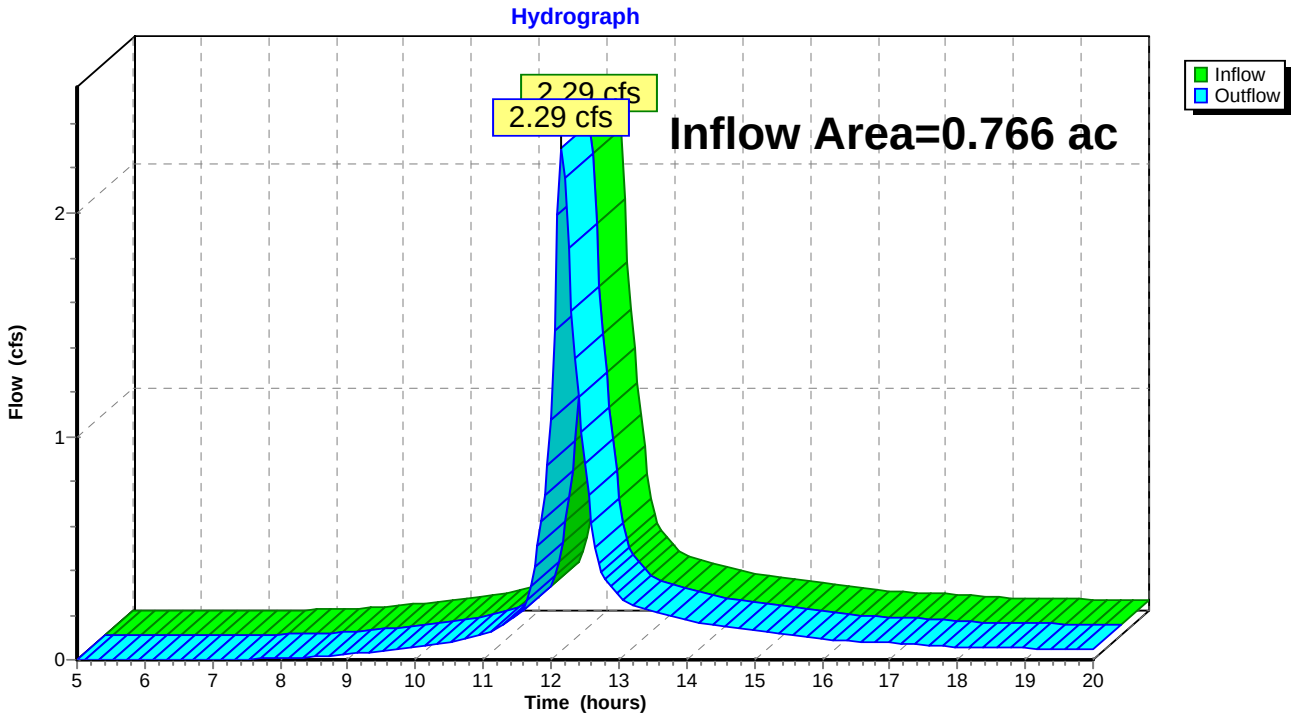
Summary for Reach AP-1: Analysis Point 1

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

Inflow Area =	0.766 ac,	0.00% Impervious,	Inflow Depth >	2.87"	for 25-Year event
Inflow =	2.29 cfs @	12.16 hrs,	Volume=	0.183 af	
Outflow =	2.29 cfs @	12.16 hrs,	Volume=	0.183 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-1: Analysis Point 1



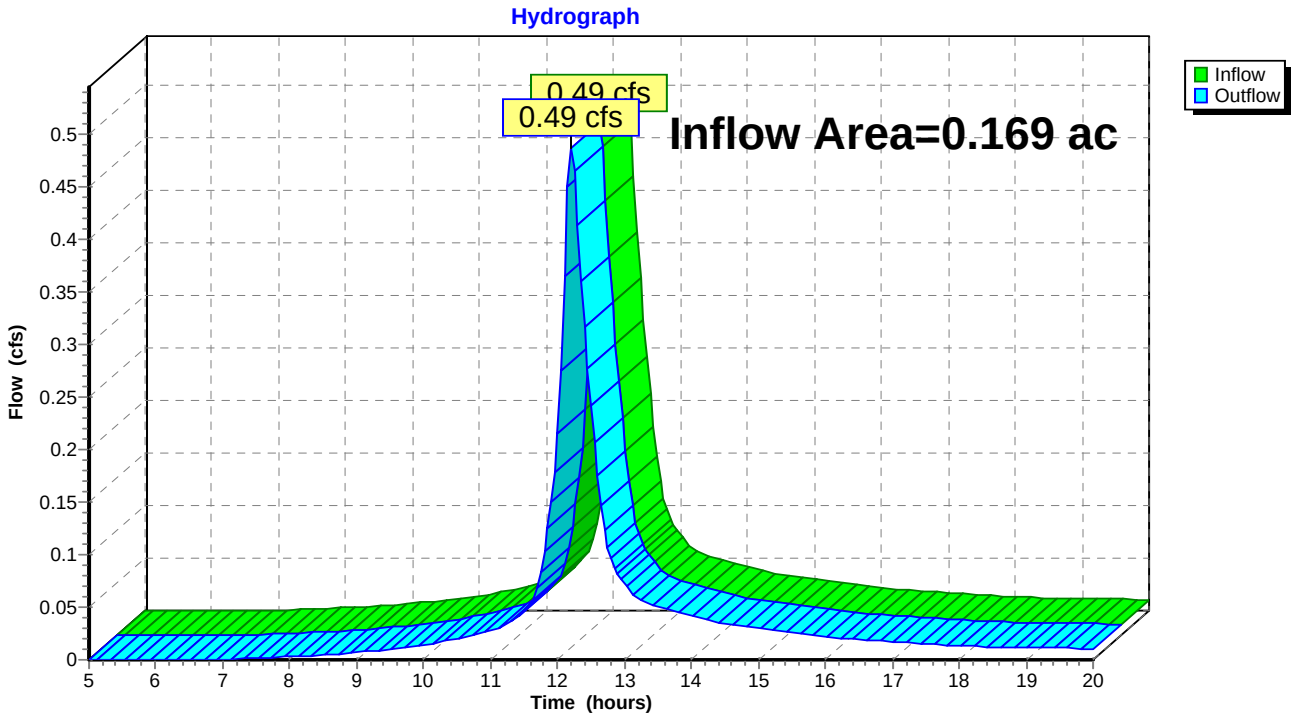
Summary for Reach AP-2: Analysis Point 2

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

Inflow Area = 0.169 ac, 0.00% Impervious, Inflow Depth > 3.05" for 25-Year event
Inflow = 0.49 cfs @ 12.21 hrs, Volume= 0.043 af
Outflow = 0.49 cfs @ 12.21 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-2: Analysis Point 2



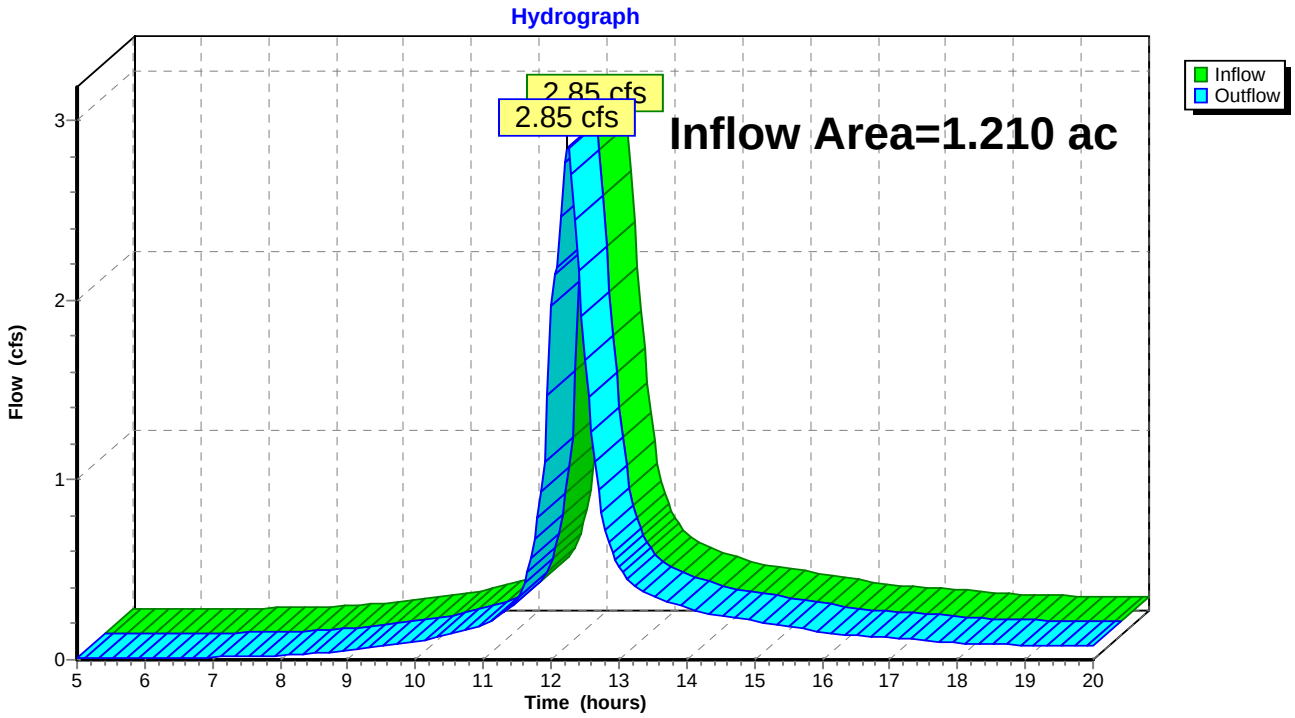
Summary for Reach AP-3: Analysis Point 3

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

Inflow Area =	1.210 ac,	0.00% Impervious,	Inflow Depth >	3.00"	for 25-Year event
Inflow =	2.85 cfs @	12.24 hrs,	Volume=	0.303 af	
Outflow =	2.85 cfs @	12.24 hrs,	Volume=	0.303 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach AP-3: Analysis Point 3



Summary for Pond P-1: Culvert

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth > 2.69" for 25-Year event
Inflow = 1.44 cfs @ 12.24 hrs, Volume= 0.133 af
Outflow = 1.44 cfs @ 12.25 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.6 min
Primary = 1.44 cfs @ 12.25 hrs, Volume= 0.133 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 91.66' @ 12.25 hrs Surf.Area= 120 sf Storage= 63 cf
Flood Elev= 93.10' Surf.Area= 450 sf Storage= 406 cf

Plug-Flow detention time= 1.5 min calculated for 0.133 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (798.4 - 797.3)

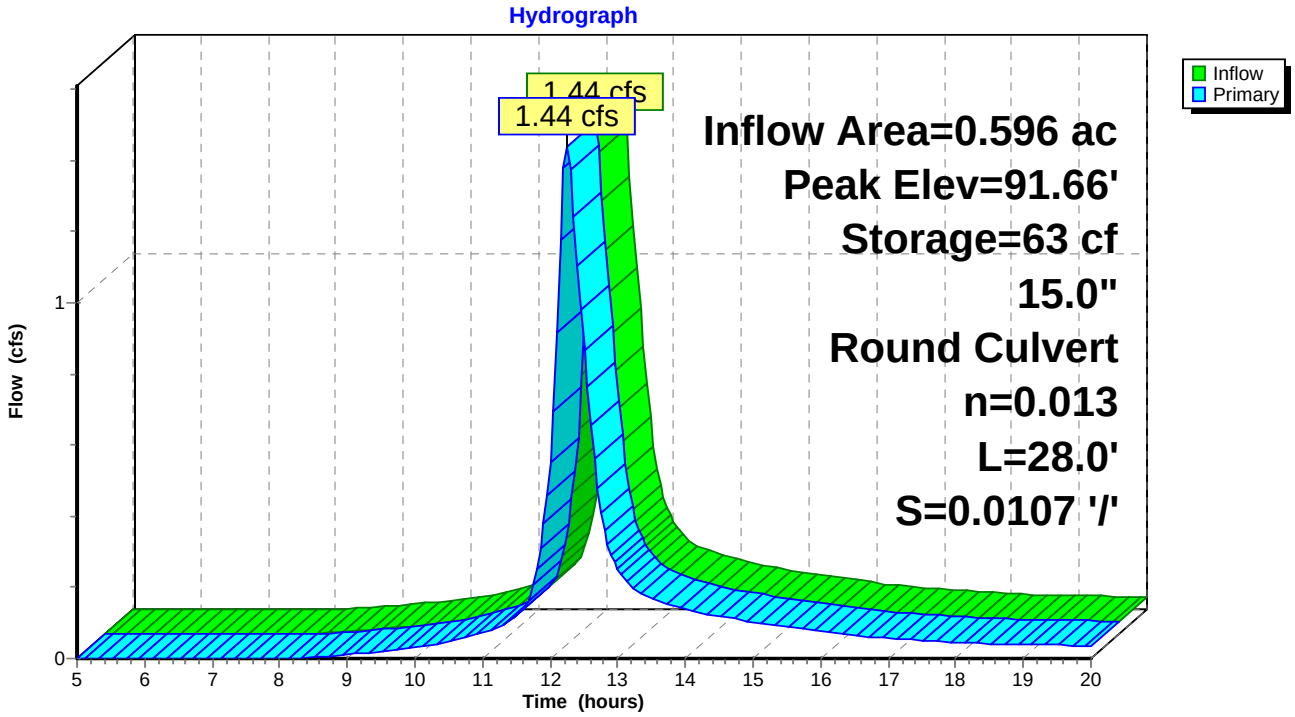
Volume	Invert	Avail.Storage	Storage Description
#1	91.00'	406 cf	**Culvert Inlet (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	70	0	0
92.00	146	108	108
93.00	450	298	406

Device	Routing	Invert	Outlet Devices
#1	Primary	91.00'	**15.0" Round Culvert** L= 28.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 91.00' / 90.70' S= 0.0107 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.44 cfs @ 12.25 hrs HW=91.66' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.44 cfs @ 2.19 fps)

Pond P-1: Culvert



Pre Development Drainage Plan/
Post Development Drainage Plan

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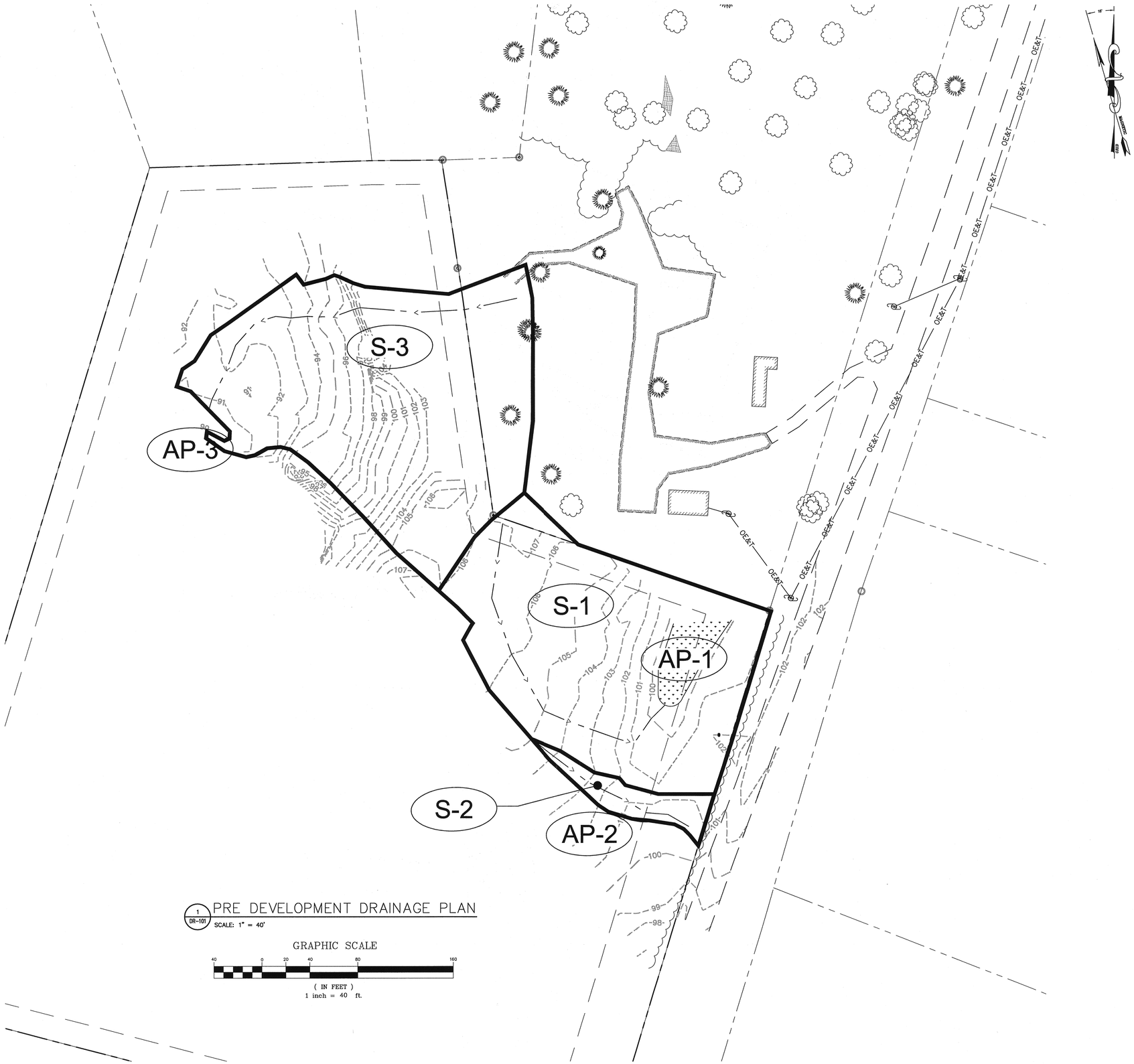

1 DR-101 PRE DEVELOPMENT DRAINAGE PLAN

SCALE: 1" = 40'

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

LEGEND

- PROPERTY LINE
- ABUTTING PROPERTY LINE
- IRON PIN FOUND (AS NOTED)
- UTILITY POLE
- 766 EXISTING CONTOUR
- STONE WALL
- EXISTING TREE LINE
- TIME OF CONCENTRATION
- SUBCATCHMENT
- S-1 SUBCATCHMENT ID
- AP-3 ANALYSIS POINT

MARINER TOWER
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amec
511 Congress St., Portland ME 04101
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PROJECT COORDINATION BY:

SURVEYOR

STATE OF MAINE
MICHAEL S. DELETETSKY
No. 5023
LICENSED
PROFESSIONAL ENGINEER
28 July 2014

PROJECT NO:	3618148350
DRAWN BY:	CBM
RELEASED BY:	MSD

SUBMITTALS

1	07/28/14	FOR TOWN SUBMISSION
0	07/18/14	FOR TOWN SUBMISSION

BOOTHBAY

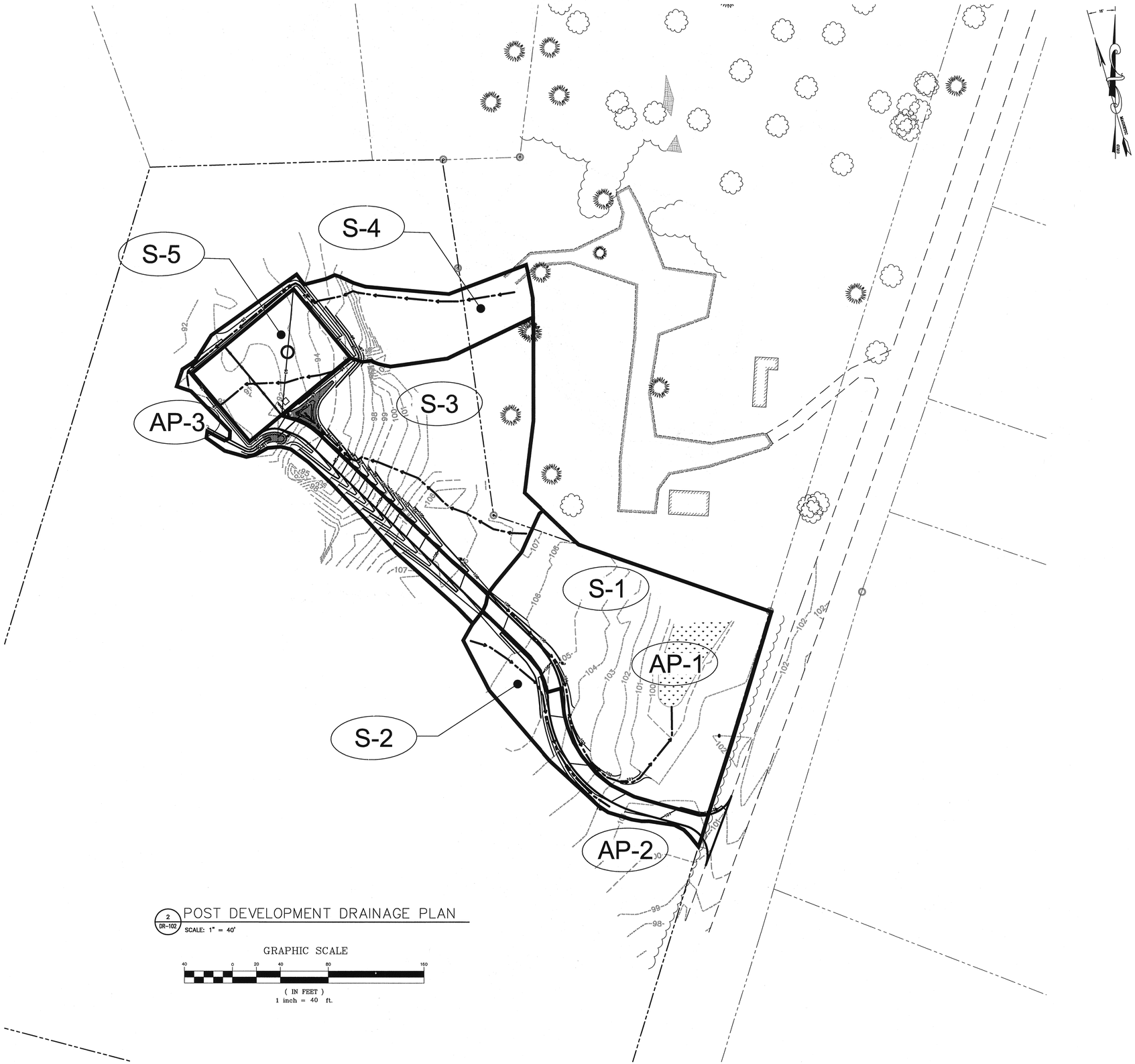
OCEAN POINT ROAD
BOOTHBAY, ME 04537
LINCOLN COUNTY

SHEET TITLE

PRE DEVELOPMENT DRAINAGE PLAN

SHEET NUMBER

DR-101



2 DR-102 POST DEVELOPMENT DRAINAGE PLAN

SCALE: 1" = 40'

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

LEGEND

	PROPERTY LINE
	ABUTTING PROPERTY LINE
	IRON PIN FOUND (AS NOTED)
	UTILITY POLE
766	EXISTING CONTOUR
	STONE WALL
	EXISTING TREE LINE
	TIME OF CONCENTRATION
	SUBCATCHMENT
S-1	SUBCATCHMENT ID
AP-3	ANALYSIS POINT

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BOOTHBAY, ME 04537
LINCOLN COUNTY

SHEET TITLE

POST DEVELOPMENT DRAINAGE PLAN

SHEET NUMBER

DR-102