

CIVIL AND
ENVIRONMENTAL
CONSULTING

STORMWATER DRAINAGE ANALYSIS

FOR

STAHLMAN OFFICE BUILDING

NEW LONDON, NH

FOR

PROPOSED ADDITIONAL PARKING

prepared by

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Date: July, 2016

Latest Revision:

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1.0 INTRODUCTION

This project involves the construction of 12 parking spaces along with an access road in order to serve the existing office building. These changes will increase the impervious surface at the site by 6,080 sf.

The objectives of the drainage design are to attenuate any increase in the peak stormwater discharge, provide treatment of runoff prior to discharge, and to provide groundwater recharge.

The above objectives will be accomplished with the installation of a stormwater bio-retention basin, or rain garden, adjacent to the parking lot.

2.0 REPORT OBJECTIVES

The purpose of this report is to describe the site's drainage, provide the pre and post-development drainage analysis, and computations for the design of suitable drainage structures for the project. Best management practices are specified during construction to control erosion. A bio-retention basin is proposed for permanent stormwater treatment.

3.0 RESULTS & DISCUSSION:

Stormwater runoff exits the property near the northeast lot corner at an existing culvert adjacent to Pleasant Street. This is considered the point of analysis for this study. The watershed consists of 5.8 acres, and includes the subject property, along with land extending easterly along Gould Road.

Below are the tabulated results for the project.

POINT OF ANALYSIS/NORTHEAST LOT CORNER:

	Q2 (cfs)	Q10	Q25	Q100
PRE-DEV. (5.836 ac.)	5.14	11.04	14.64	22.64
POST-DEV. (5.836 ac.)	5.06	11.00	14.57	22.47

The proposed pond has been designed to attenuate the peak flows, resulting in no net increase in discharge. The basin will additionally treat the water quality volume at the proposed parking lot, and provide a recharge volume of 378 cubic feet.

4.0 METHODOLOGY

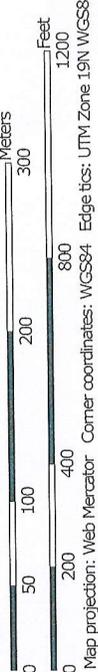
Storm water discharges were estimated using the NRCS TR-20 model.

Computations were performed by software developed by HydroCAD Software Solutions, LLC, Chocorua, NH - HydroCAD v. 10-17.

WEB. Soil Survey



Map Scale: 1:4,450 if printed on A landscape (11" x 8.5") sheet.

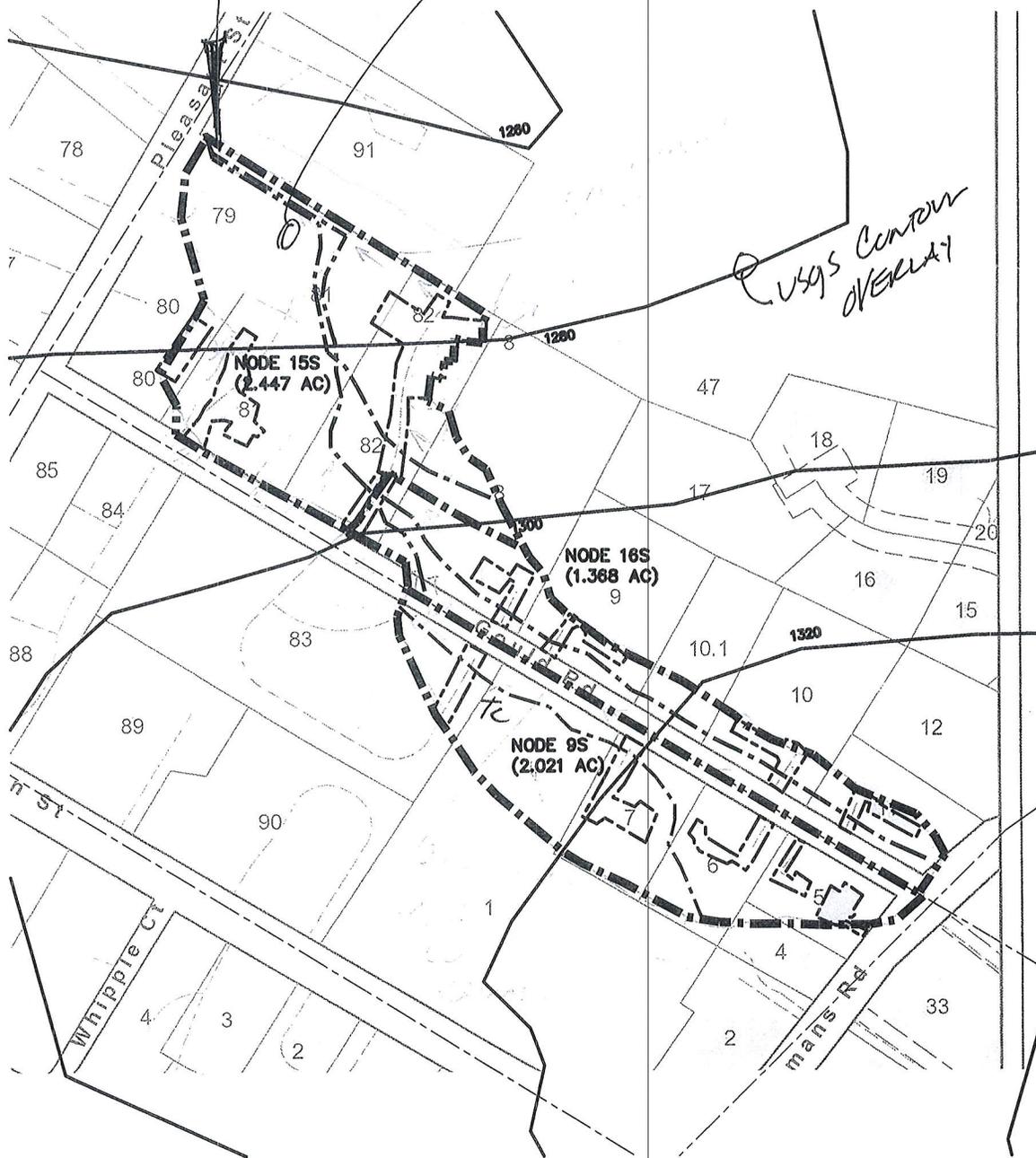


Hydrologic Soil Group—Merrimack and Belknap Counties, New Hampshire

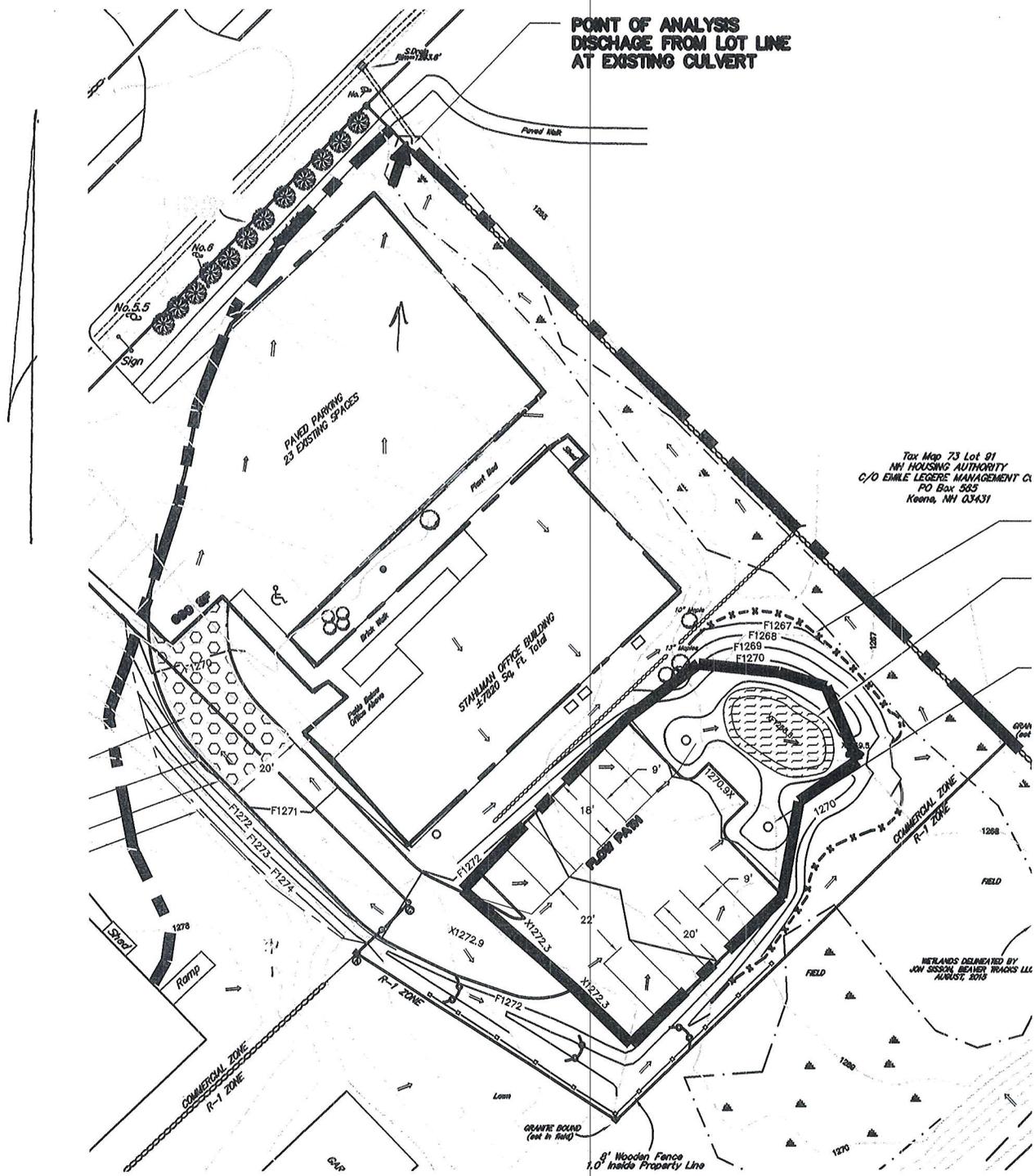
OFF-SITE WATERSHED MAP
(1" = 200' ±)

POINT OF ANALYSIS

SUBJECT LOT



POST-DEVELOPMENT
 WATERSITED MAP (1"=40')
 ON-SITE



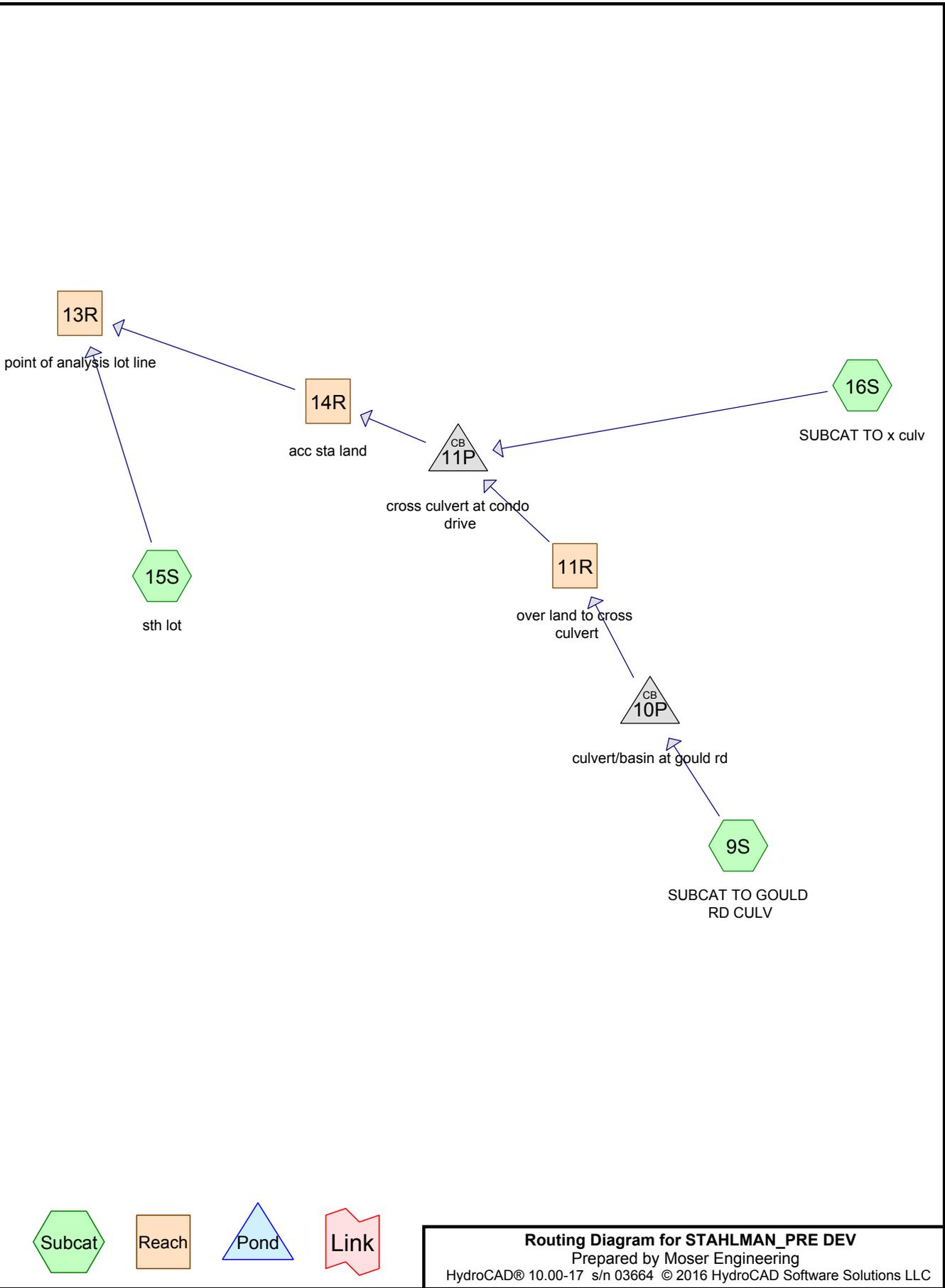
**POINT OF ANALYSIS
 DISCHARGE FROM LOT LINE
 AT EXISTING CULVERT**

Tax Map 73 Lot 91
 NH HOUSING AUTHORITY
 C/O EMILE LEGERE MANAGEMENT CO.
 PO Box 585
 Keene, NH 03431

WETLANDS DELINEATED BY
 JON SISSON, BEAVER WADDS LLC
 AUGUST, 2016

APPENDIX A

PRE-DEVELOPMENT ANALYSIS



STAHLMAN_PRE DEV

Prepared by Moser Engineering

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.364	74	>75% Grass cover, Good, HSG C (9S, 15S, 16S)
1.472	98	Paved parking, HSG C (9S, 15S, 16S)
5.836	80	TOTAL AREA

STAHLMAN_PRE DEV

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
5.836	HSG C	9S, 15S, 16S
0.000	HSG D	
0.000	Other	
5.836		TOTAL AREA

STAHLMAN_PRE DEV

Type III 24-hr 2yr Rainfall=2.70"

Prepared by Moser Engineering

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Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=0.97"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=1.74 cfs 0.164 af

Subcatchment15S: sth lot Runoff Area=2.447 ac 27.09% Impervious Runoff Depth=1.09"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=2.41 cfs 0.222 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=1.03"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=1.19 cfs 0.117 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.18' Max Vel=2.88 fps Inflow=1.74 cfs 0.164 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=1.74 cfs 0.164 af

Reach 13R: point of analysis lot line Inflow=5.14 cfs 0.503 af
 Outflow=5.14 cfs 0.503 af

Reach 14R: acc sta land Avg. Flow Depth=0.22' Max Vel=2.95 fps Inflow=2.93 cfs 0.281 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=2.84 cfs 0.281 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,305.74' Inflow=1.74 cfs 0.164 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=1.74 cfs 0.164 af

Pond 11P: cross culvert at condo drive Peak Elev=1,297.02' Inflow=2.93 cfs 0.281 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=2.93 cfs 0.281 af

Total Runoff Area = 5.836 ac Runoff Volume = 0.503 af Average Runoff Depth = 1.03"
74.78% Pervious = 4.364 ac 25.22% Impervious = 1.472 ac

Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=2.04"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=3.79 cfs 0.344 af

Subcatchment15S: sth lot Runoff Area=2.447 ac 27.09% Impervious Runoff Depth=2.21"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=5.01 cfs 0.450 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=2.12"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=2.54 cfs 0.242 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.28' Max Vel=3.76 fps Inflow=3.79 cfs 0.344 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=3.79 cfs 0.344 af

Reach 13R: point of analysis lot line Inflow=11.04 cfs 1.036 af
 Outflow=11.04 cfs 1.036 af

Reach 14R: acc sta land Avg. Flow Depth=0.34' Max Vel=3.86 fps Inflow=6.32 cfs 0.587 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=6.20 cfs 0.587 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,306.29' Inflow=3.79 cfs 0.344 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=3.79 cfs 0.344 af

Pond 11P: cross culvert at condo drive Peak Elev=1,298.46' Inflow=6.32 cfs 0.587 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=6.32 cfs 0.587 af

Total Runoff Area = 5.836 ac Runoff Volume = 1.036 af Average Runoff Depth = 2.13"
74.78% Pervious = 4.364 ac 25.22% Impervious = 1.472 ac

Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=2.72"
Flow Length=560' Tc=13.6 min CN=79 Runoff=5.06 cfs 0.457 af

Subcatchment15S: sth lot Runoff Area=2.447 ac 27.09% Impervious Runoff Depth=2.90"
Flow Length=595' Tc=13.3 min CN=81 Runoff=6.58 cfs 0.591 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=2.81"
Flow Length=780' Tc=15.5 min CN=80 Runoff=3.37 cfs 0.320 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.33' Max Vel=4.13 fps Inflow=5.06 cfs 0.457 af
n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=5.05 cfs 0.457 af

Reach 13R: point of analysis lot line Inflow=14.65 cfs 1.368 af
Outflow=14.65 cfs 1.368 af

Reach 14R: acc sta land Avg. Flow Depth=0.40' Max Vel=4.25 fps Inflow=8.39 cfs 0.777 af
n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=8.26 cfs 0.777 af

Pond 10P: culvert/basinat gould rd Peak Elev=1,306.80' Inflow=5.06 cfs 0.457 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=5.06 cfs 0.457 af

Pond 11P: cross culvert at condo drive Peak Elev=1,299.86' Inflow=8.39 cfs 0.777 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=8.39 cfs 0.777 af

Total Runoff Area = 5.836 ac Runoff Volume = 1.368 af Average Runoff Depth = 2.81"
74.78% Pervious = 4.364 ac 25.22% Impervious = 1.472 ac

Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=3.34"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=6.22 cfs 0.563 af

Subcatchment15S: sth lot Runoff Area=2.447 ac 27.09% Impervious Runoff Depth=3.54"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=8.02 cfs 0.722 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=3.44"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=4.13 cfs 0.392 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.38' Max Vel=4.41 fps Inflow=6.22 cfs 0.563 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=6.22 cfs 0.563 af

Reach 13R: point of analysis lot line Inflow=17.97 cfs 1.677 af
 Outflow=17.97 cfs 1.677 af

Reach 14R: acc sta land Avg. Flow Depth=0.46' Max Vel=4.55 fps Inflow=10.31 cfs 0.955 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=10.16 cfs 0.955 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,307.40' Inflow=6.22 cfs 0.563 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=6.22 cfs 0.563 af

Pond 11P: cross culvert at condo drive Peak Elev=1,301.51' Inflow=10.31 cfs 0.955 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=10.31 cfs 0.955 af

Total Runoff Area = 5.836 ac Runoff Volume = 1.677 af Average Runoff Depth = 3.45"
74.78% Pervious = 4.364 ac 25.22% Impervious = 1.472 ac

Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=4.24"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=7.86 cfs 0.714 af

Subcatchment15S: sth lot Runoff Area=2.447 ac 27.09% Impervious Runoff Depth=4.45"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=10.04 cfs 0.908 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=4.35"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=5.19 cfs 0.495 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.43' Max Vel=4.75 fps Inflow=7.86 cfs 0.714 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=7.86 cfs 0.714 af

Reach 13R: point of analysis lot line Inflow=22.64 cfs 2.117 af
 Outflow=22.64 cfs 2.117 af

Reach 14R: acc sta land Avg. Flow Depth=0.52' Max Vel=4.90 fps Inflow=13.00 cfs 1.209 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=12.84 cfs 1.209 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,308.46' Inflow=7.86 cfs 0.714 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=7.86 cfs 0.714 af

Pond 11P: cross culvert at condo drive Peak Elev=1,304.40' Inflow=13.00 cfs 1.209 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=13.00 cfs 1.209 af

Total Runoff Area = 5.836 ac Runoff Volume = 2.117 af Average Runoff Depth = 4.35"
74.78% Pervious = 4.364 ac 25.22% Impervious = 1.472 ac

Summary for Subcatchment 9S: SUBCAT TO GOULD RD CULV

Runoff = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af, Depth= 2.04"

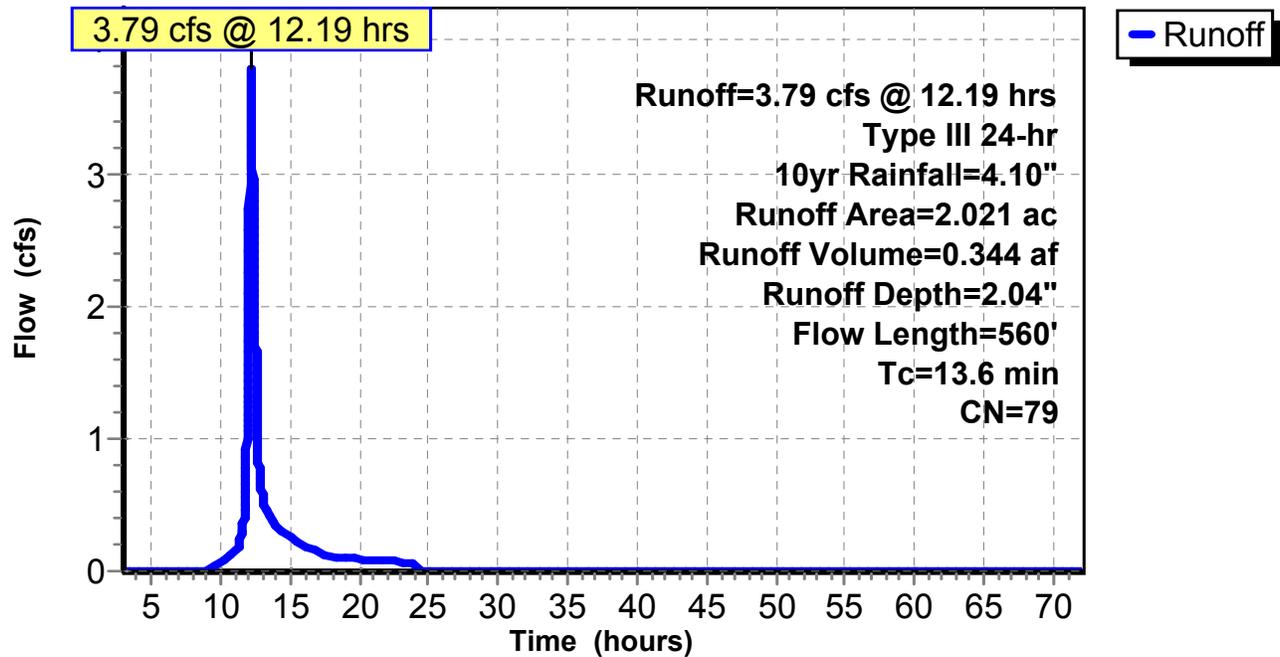
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.443	98	Paved parking, HSG C
1.578	74	>75% Grass cover, Good, HSG C
2.021	79	Weighted Average
1.578		78.08% Pervious Area
0.443		21.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0330	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
5.3	460	0.0430	1.45		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.6	560	Total			

Subcatchment 9S: SUBCAT TO GOULD RD CULV

Hydrograph



Summary for Subcatchment 15S: sth lot

Runoff = 5.01 cfs @ 12.19 hrs, Volume= 0.450 af, Depth= 2.21"

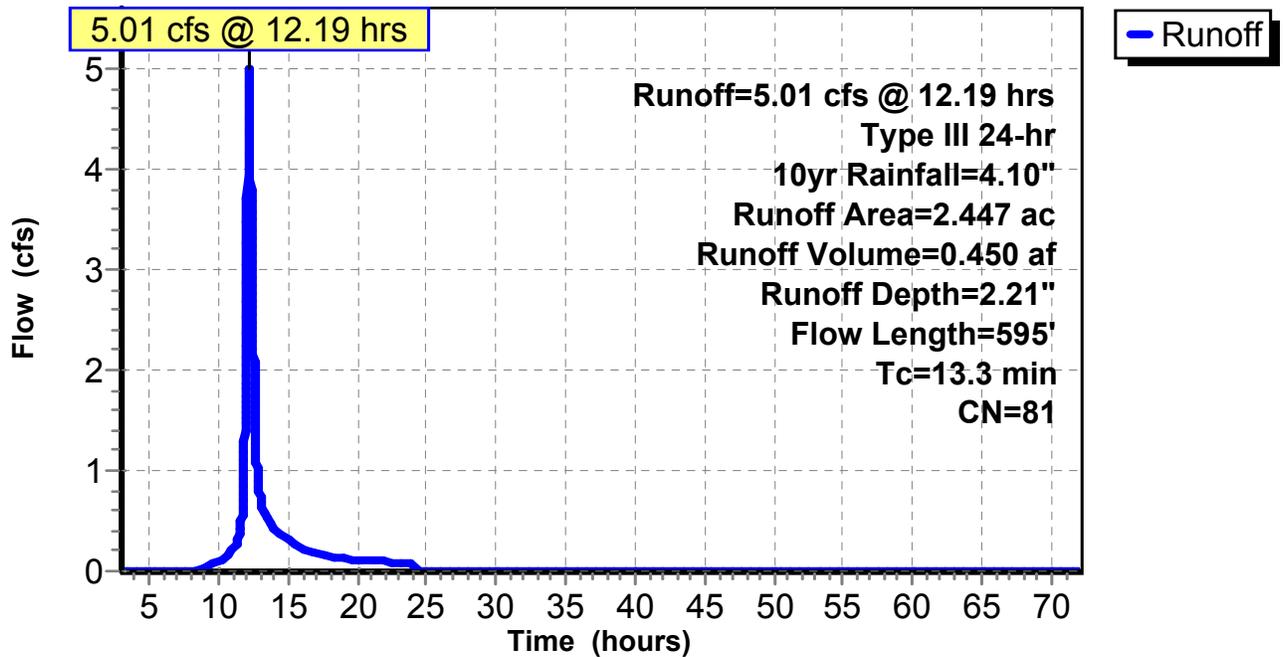
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.663	98	Paved parking, HSG C
1.784	74	>75% Grass cover, Good, HSG C
2.447	81	Weighted Average
1.784		72.91% Pervious Area
0.663		27.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
4.7	495	0.0620	1.74		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.3	595	Total			

Subcatchment 15S: sth lot

Hydrograph



Summary for Subcatchment 16S: SUBCAT TO x culv

Runoff = 2.54 cfs @ 12.21 hrs, Volume= 0.242 af, Depth= 2.12"

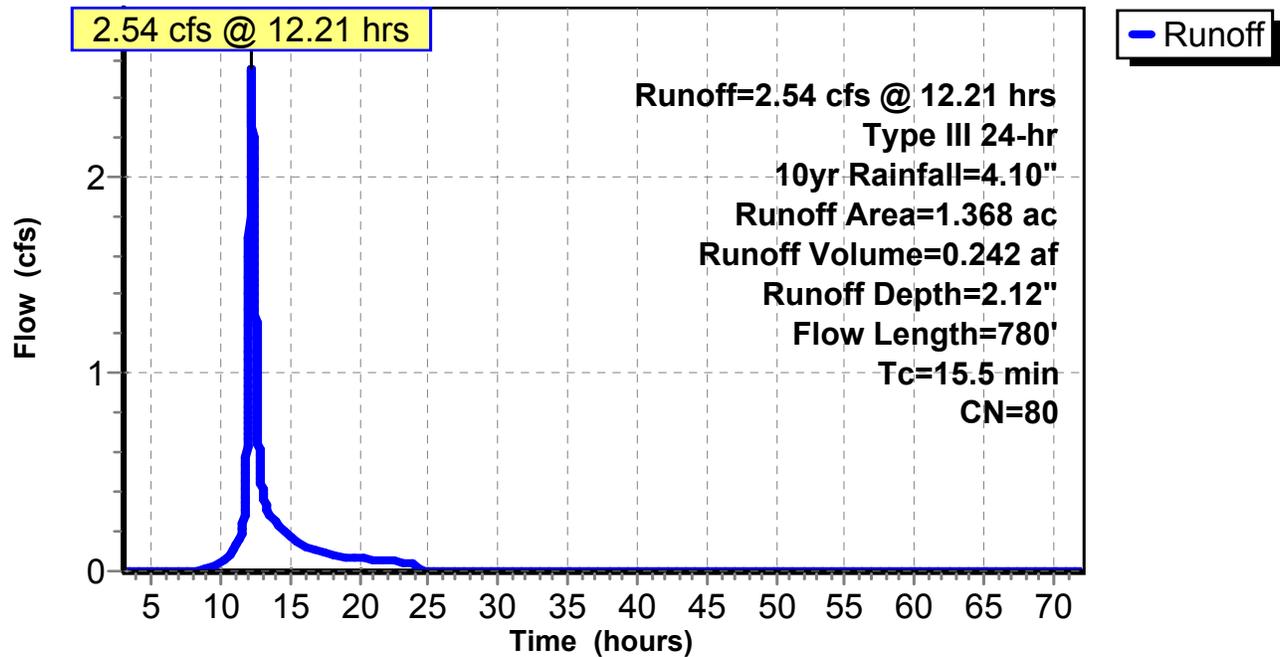
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.366	98	Paved parking, HSG C
1.002	74	>75% Grass cover, Good, HSG C
1.368	80	Weighted Average
1.002		73.25% Pervious Area
0.366		26.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0330	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
7.2	680	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
15.5	780	Total			

Subcatchment 16S: SUBCAT TO x culv

Hydrograph



Summary for Reach 11R: over land to cross culvert

Inflow Area = 2.021 ac, 21.92% Impervious, Inflow Depth = 2.04" for 10yr event
 Inflow = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af
 Outflow = 3.79 cfs @ 12.20 hrs, Volume= 0.344 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Max. Velocity= 3.76 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 1.18 fps, Avg. Travel Time= 1.4 min

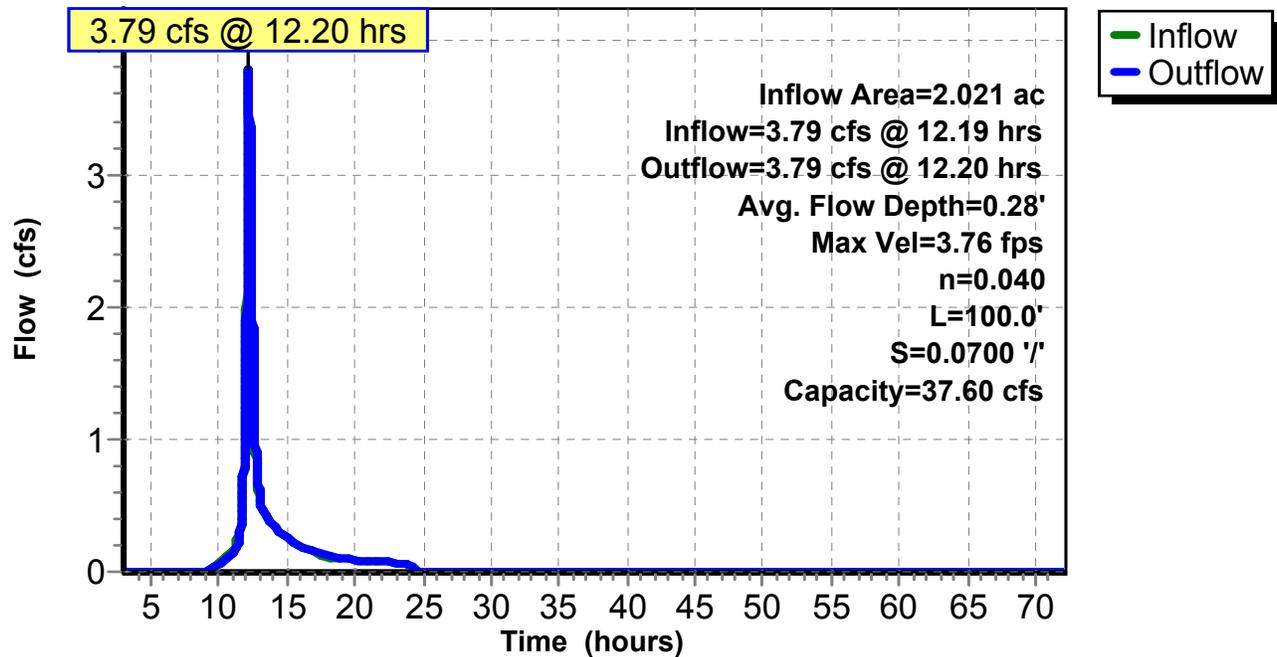
Peak Storage= 101 cf @ 12.20 hrs
 Average Depth at Peak Storage= 0.28'
 Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 37.60 cfs

3.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
 Side Slope Z-value= 2.0 ' ' Top Width= 7.00'
 Length= 100.0' Slope= 0.0700 ' '
 Inlet Invert= 1,303.00', Outlet Invert= 1,296.00'



Reach 11R: over land to cross culvert

Hydrograph



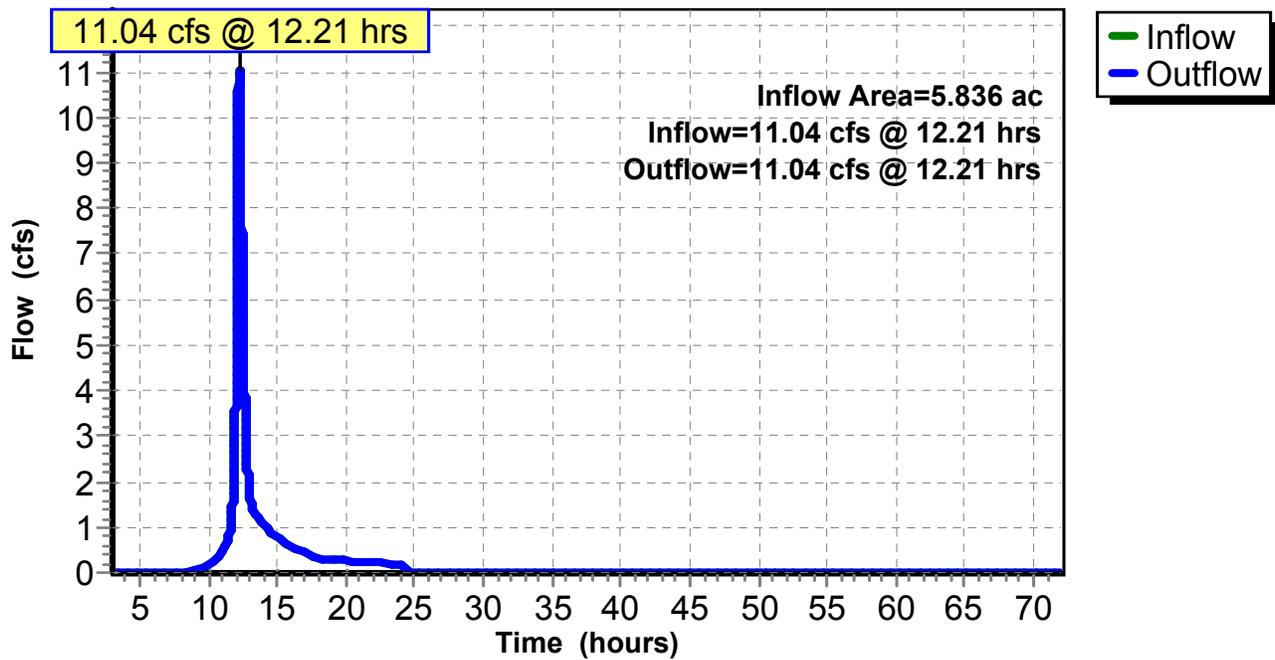
Summary for Reach 13R: point of analysis lot line

Inflow Area = 5.836 ac, 25.22% Impervious, Inflow Depth = 2.13" for 10yr event
Inflow = 11.04 cfs @ 12.21 hrs, Volume= 1.036 af
Outflow = 11.04 cfs @ 12.21 hrs, Volume= 1.036 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7

Reach 13R: point of analysis lot line

Hydrograph



Summary for Reach 14R: acc sta land

Inflow Area = 3.389 ac, 23.87% Impervious, Inflow Depth = 2.08" for 10yr event
 Inflow = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af
 Outflow = 6.20 cfs @ 12.23 hrs, Volume= 0.587 af, Atten= 2%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Max. Velocity= 3.86 fps, Min. Travel Time= 2.4 min
 Avg. Velocity = 1.12 fps, Avg. Travel Time= 8.2 min

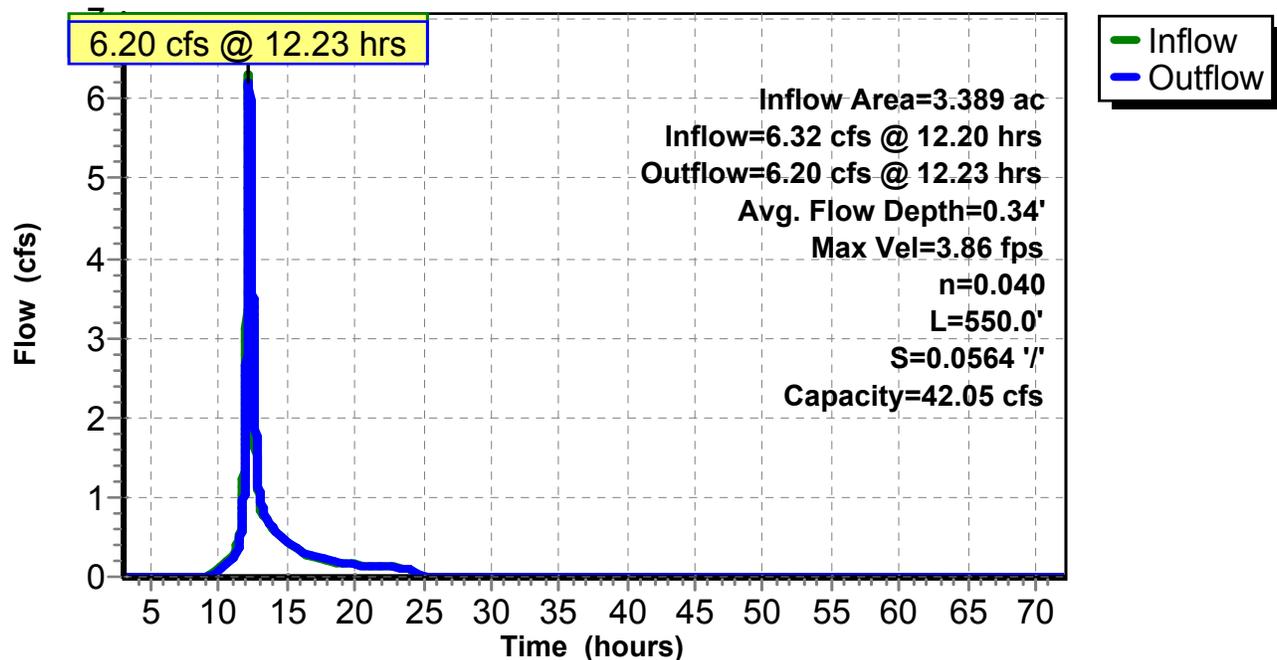
Peak Storage= 882 cf @ 12.23 hrs
 Average Depth at Peak Storage= 0.34'
 Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 42.05 cfs

4.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
 Side Slope Z-value= 2.0 ' / ' Top Width= 8.00'
 Length= 550.0' Slope= 0.0564 ' / '
 Inlet Invert= 1,295.00', Outlet Invert= 1,264.00'



Reach 14R: acc sta land

Hydrograph



Summary for Pond 10P: culvert/basin at gould rd

Inflow Area = 2.021 ac, 21.92% Impervious, Inflow Depth = 2.04" for 10yr event
 Inflow = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af
 Outflow = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af

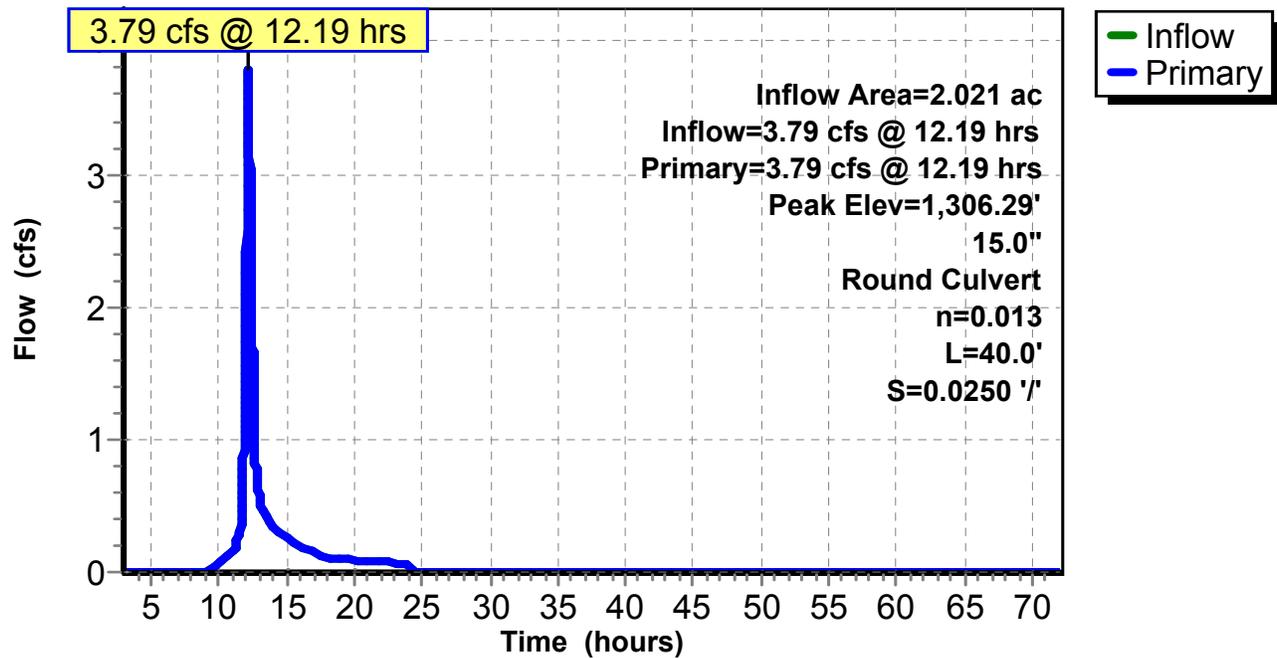
Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Peak Elev= 1,306.29' @ 12.19 hrs

Device #	Routing	Invert	Outlet Devices
#1	Primary	1,305.00'	15.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,305.00' / 1,304.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.79 cfs @ 12.19 hrs HW=1,306.29' TW=1,303.28' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 3.79 cfs @ 3.09 fps)

Pond 10P: culvert/basin at gould rd

Hydrograph



Summary for Pond 11P: cross culvert at condo drive

Inflow Area = 3.389 ac, 23.87% Impervious, Inflow Depth = 2.08" for 10yr event
 Inflow = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af
 Outflow = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af, Atten= 0%, Lag= 0.0 min
 Primary = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af

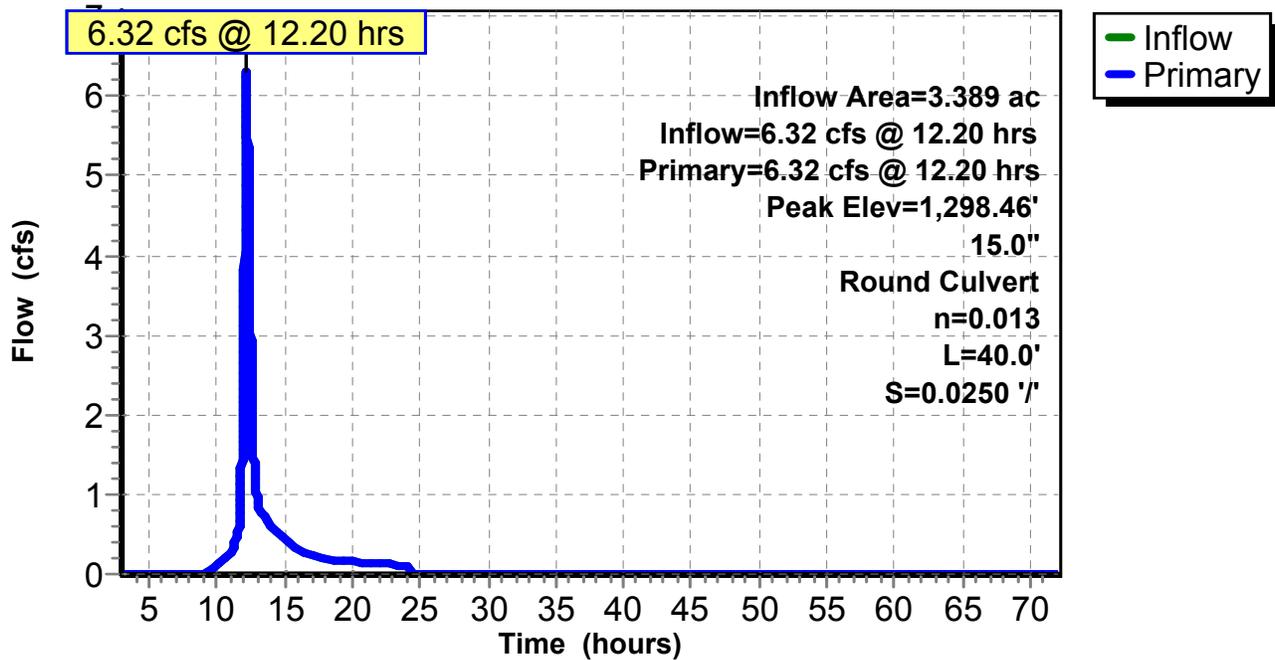
Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Peak Elev= 1,298.46' @ 12.20 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,296.00'	15.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,296.00' / 1,295.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

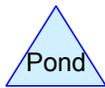
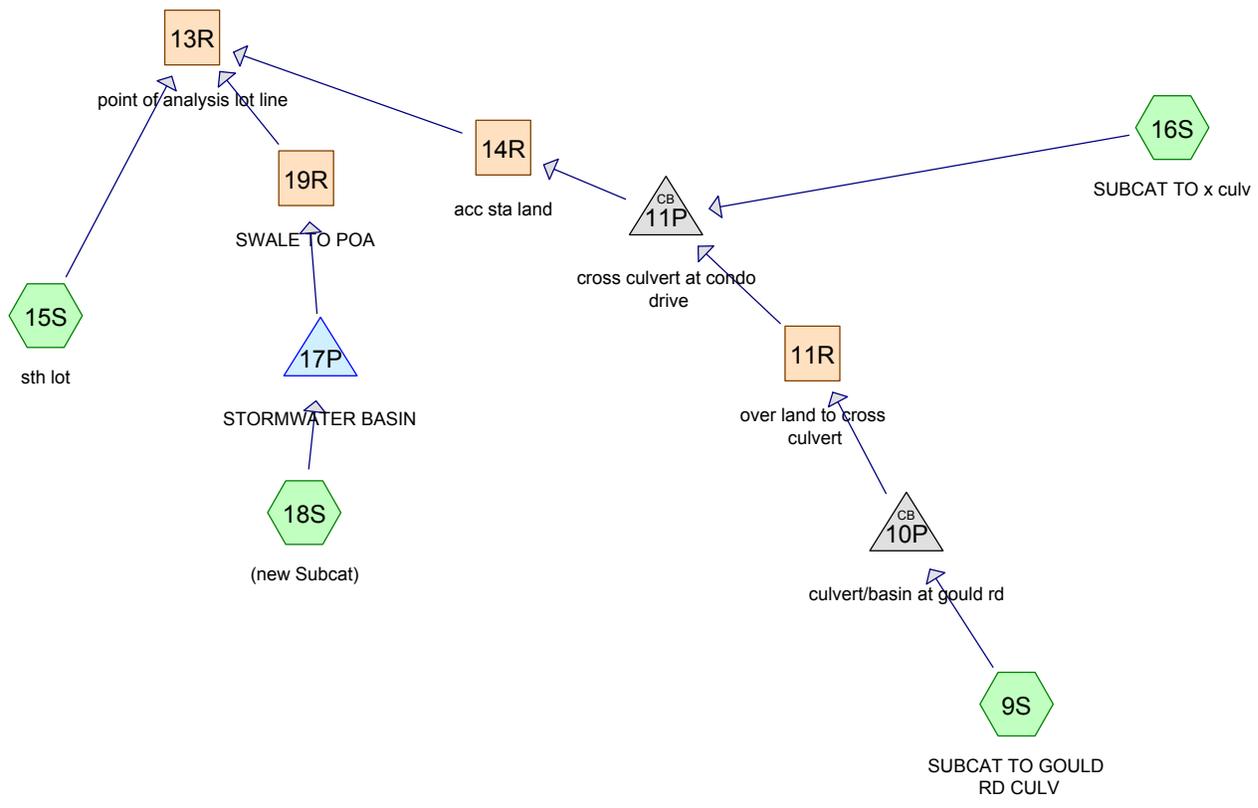
Primary OutFlow Max=6.31 cfs @ 12.20 hrs HW=1,298.46' TW=1,295.34' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 6.31 cfs @ 5.14 fps)

Pond 11P: cross culvert at condo drive

Hydrograph



APPENDIX B:
POST-DEVELOPMENT ANALYSIS



Routing Diagram for STAHLMAN_POST DEV_W BASIN
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STAHLMAN_POST DEV_W BASIN

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.219	74	>75% Grass cover, Good, HSG C (9S, 15S, 16S, 18S)
1.617	98	Paved parking, HSG C (9S, 15S, 16S, 18S)
5.836	81	TOTAL AREA

STAHLMAN_POST DEV_W BASIN

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
5.836	HSG C	9S, 15S, 16S, 18S
0.000	HSG D	
0.000	Other	
5.836		TOTAL AREA

STAHLMAN_POST DEV_W BASIN

Type III 24-hr 2yr Rainfall=2.70"

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Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=0.97"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=1.74 cfs 0.164 af

Subcatchment15S: sth lot Runoff Area=2.297 ac 31.21% Impervious Runoff Depth=1.09"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=2.27 cfs 0.208 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=1.03"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=1.19 cfs 0.117 af

Subcatchment18S: (new Subcat) Runoff Area=0.150 ac 60.67% Impervious Runoff Depth=1.63"
 Flow Length=100' Slope=0.0200 '/' Tc=0.8 min CN=89 Runoff=0.34 cfs 0.020 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.18' Max Vel=2.88 fps Inflow=1.74 cfs 0.164 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=1.74 cfs 0.164 af

Reach 13R: point of analysis lot line Inflow=5.05 cfs 0.501 af
 Outflow=5.05 cfs 0.501 af

Reach 14R: acc sta land Avg. Flow Depth=0.22' Max Vel=2.95 fps Inflow=2.93 cfs 0.281 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=2.84 cfs 0.281 af

Reach 19R: SWALE TO POA Avg. Flow Depth=0.04' Max Vel=0.56 fps Inflow=0.12 cfs 0.012 af
 n=0.040 L=195.0' S=0.0154 '/' Capacity=21.97 cfs Outflow=0.10 cfs 0.012 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,305.74' Inflow=1.74 cfs 0.164 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=1.74 cfs 0.164 af

Pond 11P: cross culvert at condo drive Peak Elev=1,297.02' Inflow=2.93 cfs 0.281 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=2.93 cfs 0.281 af

Pond 17P: STORMWATERBASIN Peak Elev=1,269.54' Storage=401 cf Inflow=0.34 cfs 0.020 af
 Outflow=0.12 cfs 0.012 af

Total Runoff Area = 5.836 ac Runoff Volume = 0.510 af Average Runoff Depth = 1.05"
72.29% Pervious = 4.219 ac 27.71% Impervious = 1.617 ac

STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=2.04"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=3.79 cfs 0.344 af

Subcatchment15S: sth lot Runoff Area=2.297 ac 31.21% Impervious Runoff Depth=2.21"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=4.70 cfs 0.422 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=2.12"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=2.54 cfs 0.242 af

Subcatchment18S: (new Subcat) Runoff Area=0.150 ac 60.67% Impervious Runoff Depth=2.92"
 Flow Length=100' Slope=0.0200 '/' Tc=0.8 min CN=89 Runoff=0.61 cfs 0.036 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.28' Max Vel=3.76 fps Inflow=3.79 cfs 0.344 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=3.79 cfs 0.344 af

Reach 13R: point of analysis lot line Inflow=11.00 cfs 1.037 af
 Outflow=11.00 cfs 1.037 af

Reach 14R: acc sta land Avg. Flow Depth=0.34' Max Vel=3.86 fps Inflow=6.32 cfs 0.587 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=6.20 cfs 0.587 af

Reach 19R: SWALE TO POA Avg. Flow Depth=0.11' Max Vel=1.04 fps Inflow=0.56 cfs 0.028 af
 n=0.040 L=195.0' S=0.0154 '/' Capacity=21.97 cfs Outflow=0.50 cfs 0.028 af

Pond 10P: culvert/basinat gould rd Peak Elev=1,306.29' Inflow=3.79 cfs 0.344 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=3.79 cfs 0.344 af

Pond 11P: cross culvert at condo drive Peak Elev=1,298.46' Inflow=6.32 cfs 0.587 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=6.32 cfs 0.587 af

Pond 17P: STORMWATERBASIN Peak Elev=1,269.60' Storage=445 cf Inflow=0.61 cfs 0.036 af
 Outflow=0.56 cfs 0.028 af

Total Runoff Area = 5.836 ac Runoff Volume = 1.045 af Average Runoff Depth = 2.15"
72.29% Pervious = 4.219 ac 27.71% Impervious = 1.617 ac

STAHLMAN_POST DEV_W BASIN

Type III 24-hr 25yr Rainfall=4.90"

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Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=2.72"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=5.06 cfs 0.457 af

Subcatchment15S: sth lot Runoff Area=2.297 ac 31.21% Impervious Runoff Depth=2.90"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=6.18 cfs 0.555 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=2.81"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=3.37 cfs 0.320 af

Subcatchment18S: (new Subcat) Runoff Area=0.150 ac 60.67% Impervious Runoff Depth=3.68"
 Flow Length=100' Slope=0.0200 '/' Tc=0.8 min CN=89 Runoff=0.76 cfs 0.046 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.33' Max Vel=4.13 fps Inflow=5.06 cfs 0.457 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=5.05 cfs 0.457 af

Reach 13R: point of analysis lot line Inflow=14.58 cfs 1.369 af
 Outflow=14.58 cfs 1.369 af

Reach 14R: acc sta land Avg. Flow Depth=0.40' Max Vel=4.25 fps Inflow=8.39 cfs 0.777 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=8.26 cfs 0.777 af

Reach 19R: SWALE TO POA Avg. Flow Depth=0.13' Max Vel=1.14 fps Inflow=0.70 cfs 0.037 af
 n=0.040 L=195.0' S=0.0154 '/' Capacity=21.97 cfs Outflow=0.64 cfs 0.037 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,306.80' Inflow=5.06 cfs 0.457 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=5.06 cfs 0.457 af

Pond 11P: cross culvert at condo drive Peak Elev=1,299.86' Inflow=8.39 cfs 0.777 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=8.39 cfs 0.777 af

Pond 17P: STORMWATERBASIN Peak Elev=1,269.62' Storage=456 cf Inflow=0.76 cfs 0.046 af
 Outflow=0.70 cfs 0.037 af

Total Runoff Area = 5.836 ac Runoff Volume = 1.378 af Average Runoff Depth = 2.83"
72.29% Pervious = 4.219 ac 27.71% Impervious = 1.617 ac

STAHLMAN_POST DEV_W BASIN

Type III 24-hr 50ry Rainfall=5.62"

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Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=3.34"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=6.22 cfs 0.563 af

Subcatchment15S: sth lot Runoff Area=2.297 ac 31.21% Impervious Runoff Depth=3.54"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=7.53 cfs 0.677 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=3.44"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=4.13 cfs 0.392 af

Subcatchment18S: (new Subcat) Runoff Area=0.150 ac 60.67% Impervious Runoff Depth=4.37"
 Flow Length=100' Slope=0.0200 '/' Tc=0.8 min CN=89 Runoff=0.89 cfs 0.055 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.38' Max Vel=4.41 fps Inflow=6.22 cfs 0.563 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=6.22 cfs 0.563 af

Reach 13R: point of analysis lot line Inflow=17.86 cfs 1.678 af
 Outflow=17.86 cfs 1.678 af

Reach 14R: acc sta land Avg. Flow Depth=0.46' Max Vel=4.55 fps Inflow=10.31 cfs 0.955 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=10.16 cfs 0.955 af

Reach 19R: SWALE TO POA Avg. Flow Depth=0.15' Max Vel=1.21 fps Inflow=0.83 cfs 0.046 af
 n=0.040 L=195.0' S=0.0154 '/' Capacity=21.97 cfs Outflow=0.76 cfs 0.046 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,307.40' Inflow=6.22 cfs 0.563 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=6.22 cfs 0.563 af

Pond 11P: cross culvert at condo drive Peak Elev=1,301.51' Inflow=10.31 cfs 0.955 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=10.31 cfs 0.955 af

Pond 17P: STORMWATERBASIN Peak Elev=1,269.63' Storage=465 cf Inflow=0.89 cfs 0.055 af
 Outflow=0.83 cfs 0.046 af

Total Runoff Area = 5.836 ac Runoff Volume = 1.687 af Average Runoff Depth = 3.47"
72.29% Pervious = 4.219 ac 27.71% Impervious = 1.617 ac

STAHLMAN_POST DEV_W BASIN

Type III 24-hr 100yr Rainfall=6.62"

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Time span=3.00-72.00 hrs, dt=0.01 hrs, 6901 points x 7
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment9S: SUBCATTO GOULD RD Runoff Area=2.021 ac 21.92% Impervious Runoff Depth=4.24"
 Flow Length=560' Tc=13.6 min CN=79 Runoff=7.86 cfs 0.714 af

Subcatchment15S: sth lot Runoff Area=2.297 ac 31.21% Impervious Runoff Depth=4.45"
 Flow Length=595' Tc=13.3 min CN=81 Runoff=9.42 cfs 0.852 af

Subcatchment16S: SUBCATTO x culv Runoff Area=1.368 ac 26.75% Impervious Runoff Depth=4.35"
 Flow Length=780' Tc=15.5 min CN=80 Runoff=5.19 cfs 0.495 af

Subcatchment18S: (new Subcat) Runoff Area=0.150 ac 60.67% Impervious Runoff Depth=5.34"
 Flow Length=100' Slope=0.0200 '/' Tc=0.8 min CN=89 Runoff=1.08 cfs 0.067 af

Reach 11R: over land to cross culvert Avg. Flow Depth=0.43' Max Vel=4.75 fps Inflow=7.86 cfs 0.714 af
 n=0.040 L=100.0' S=0.0700 '/' Capacity=37.60 cfs Outflow=7.86 cfs 0.714 af

Reach 13R: point of analysis lot line Inflow=22.48 cfs 2.119 af
 Outflow=22.48 cfs 2.119 af

Reach 14R: acc sta land Avg. Flow Depth=0.52' Max Vel=4.90 fps Inflow=13.00 cfs 1.209 af
 n=0.040 L=550.0' S=0.0564 '/' Capacity=42.05 cfs Outflow=12.84 cfs 1.209 af

Reach 19R: SWALE TO POA Avg. Flow Depth=0.17' Max Vel=1.31 fps Inflow=1.01 cfs 0.058 af
 n=0.040 L=195.0' S=0.0154 '/' Capacity=21.97 cfs Outflow=0.94 cfs 0.058 af

Pond 10P: culvert/basin at gould rd Peak Elev=1,308.46' Inflow=7.86 cfs 0.714 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=7.86 cfs 0.714 af

Pond 11P: cross culvert at condo drive Peak Elev=1,304.40' Inflow=13.00 cfs 1.209 af
 15.0" Round Culvert n=0.013 L=40.0' S=0.0250 '/' Outflow=13.00 cfs 1.209 af

Pond 17P: STORMWATERBASIN Peak Elev=1,269.65' Storage=477 cf Inflow=1.08 cfs 0.067 af
 Outflow=1.01 cfs 0.058 af

Total Runoff Area = 5.836 ac Runoff Volume = 2.128 af Average Runoff Depth = 4.38"
72.29% Pervious = 4.219 ac 27.71% Impervious = 1.617 ac

STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Summary for Subcatchment 9S: SUBCAT TO GOULD RD CULV

Runoff = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af, Depth= 2.04"

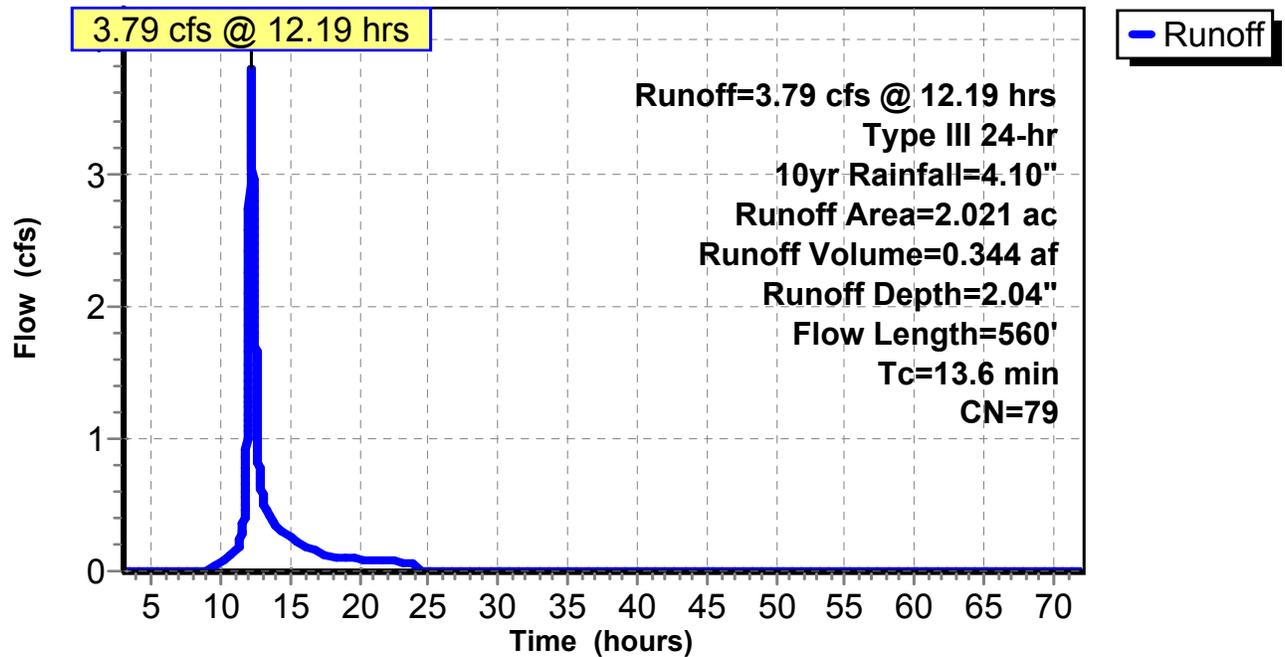
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.443	98	Paved parking, HSG C
1.578	74	>75% Grass cover, Good, HSG C
2.021	79	Weighted Average
1.578		78.08% Pervious Area
0.443		21.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0330	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
5.3	460	0.0430	1.45		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.6	560	Total			

Subcatchment 9S: SUBCAT TO GOULD RD CULV

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Summary for Subcatchment 15S: sth lot

Runoff = 4.70 cfs @ 12.19 hrs, Volume= 0.422 af, Depth= 2.21"

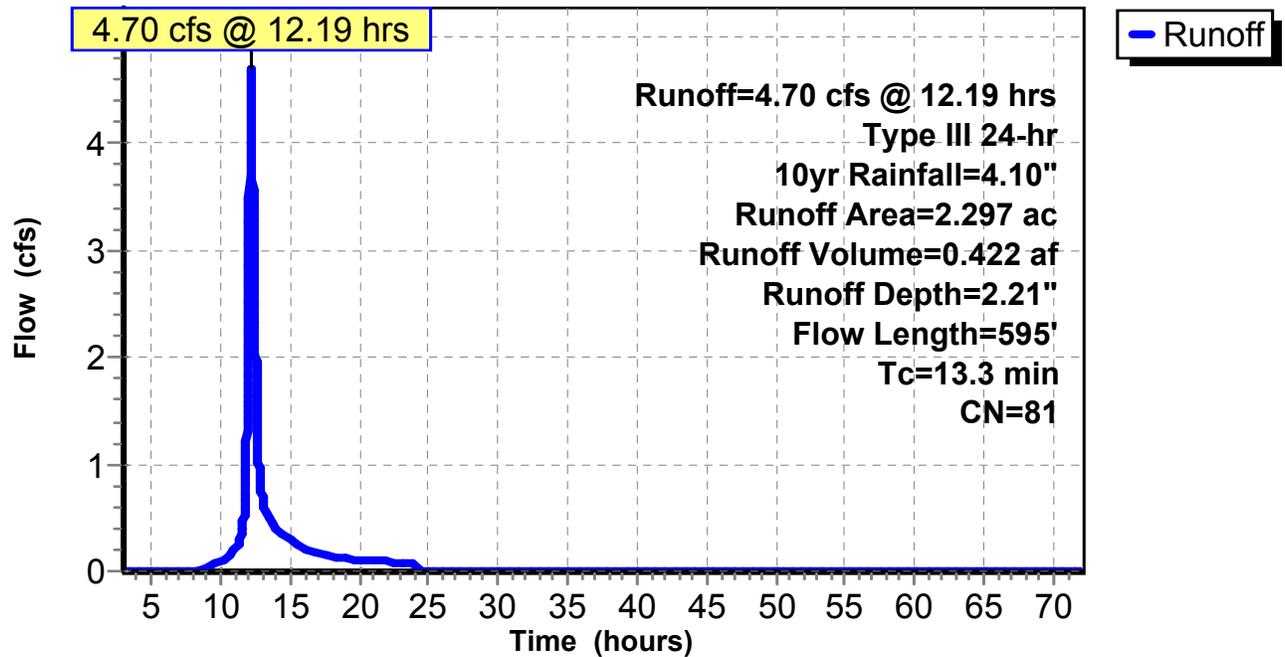
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.717	98	Paved parking, HSG C
1.580	74	>75% Grass cover, Good, HSG C
2.297	81	Weighted Average
1.580		68.79% Pervious Area
0.717		31.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0300	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
4.7	495	0.0620	1.74		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.3	595	Total			

Subcatchment 15S: sth lot

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Summary for Subcatchment 16S: SUBCAT TO x culv

Runoff = 2.54 cfs @ 12.21 hrs, Volume= 0.242 af, Depth= 2.12"

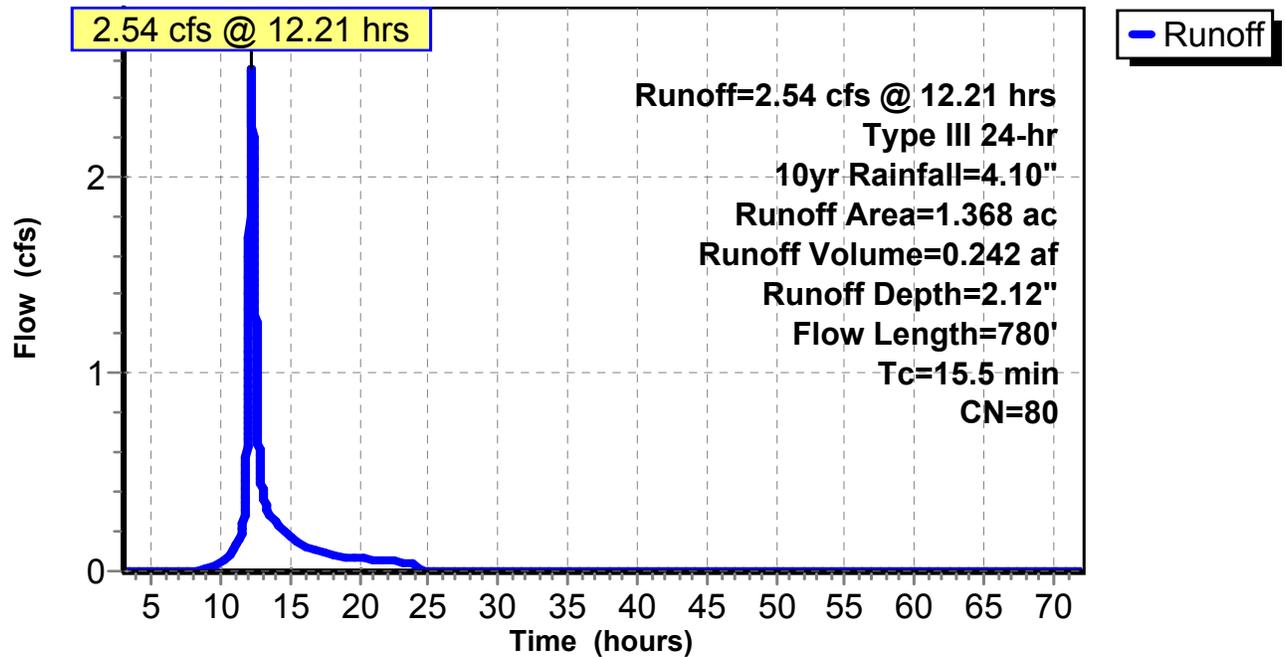
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.366	98	Paved parking, HSG C
1.002	74	>75% Grass cover, Good, HSG C
1.368	80	Weighted Average
1.002		73.25% Pervious Area
0.366		26.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0330	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
7.2	680	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
15.5	780	Total			

Subcatchment 16S: SUBCAT TO x culv

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Summary for Subcatchment 18S: (new Subcat)

Runoff = 0.61 cfs @ 12.01 hrs, Volume= 0.036 af, Depth= 2.92"

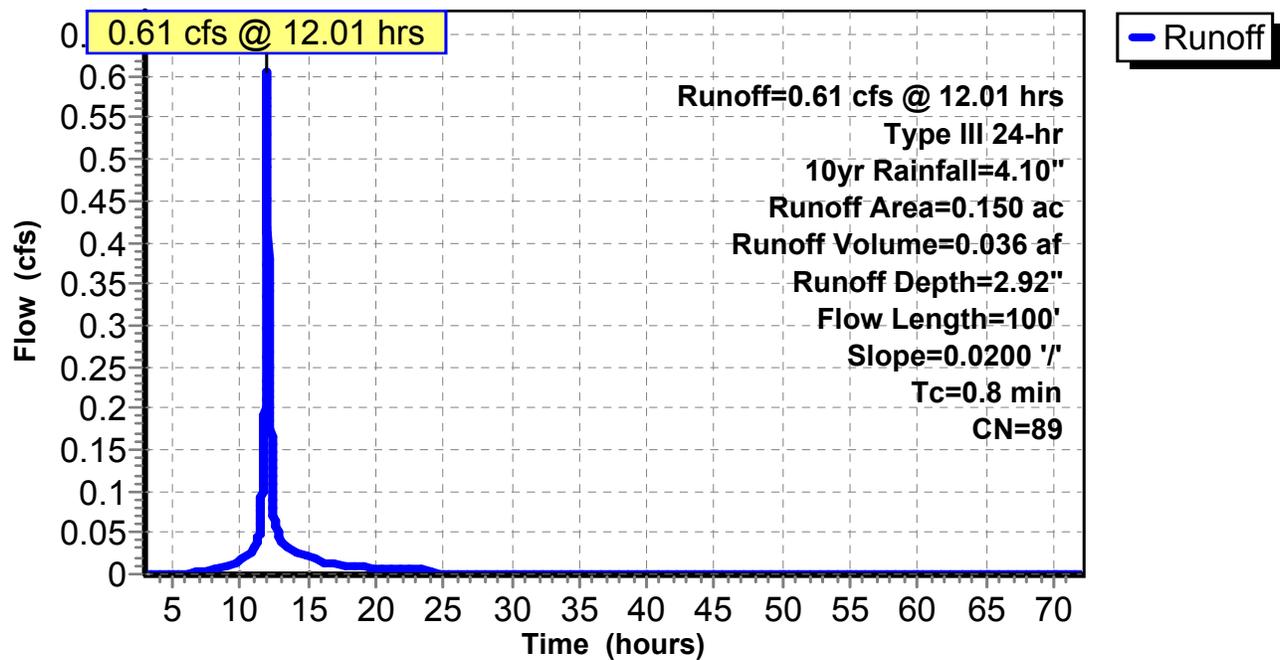
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10yr Rainfall=4.10"

Area (ac)	CN	Description
0.091	98	Paved parking, HSG C
0.059	74	>75% Grass cover, Good, HSG C
0.150	89	Weighted Average
0.059		39.33% Pervious Area
0.091		60.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0200	0.97		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.00"
0.5	80	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.8	100	Total			

Subcatchment 18S: (new Subcat)

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Summary for Reach 11R: over land to cross culvert

Inflow Area = 2.021 ac, 21.92% Impervious, Inflow Depth = 2.04" for 10yr event
Inflow = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af
Outflow = 3.79 cfs @ 12.20 hrs, Volume= 0.344 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
Max. Velocity= 3.76 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 1.4 min

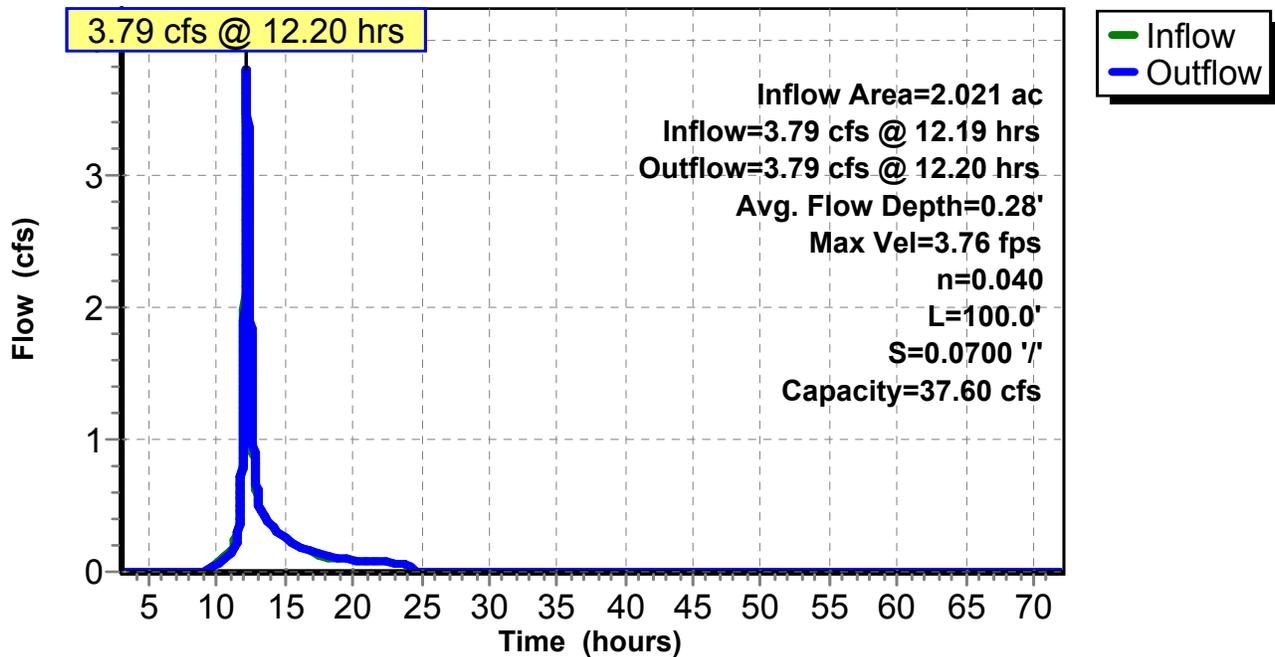
Peak Storage= 101 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 37.60 cfs

3.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 ' ' Top Width= 7.00'
Length= 100.0' Slope= 0.0700 ' '
Inlet Invert= 1,303.00', Outlet Invert= 1,296.00'



Reach 11R: over land to cross culvert

Hydrograph



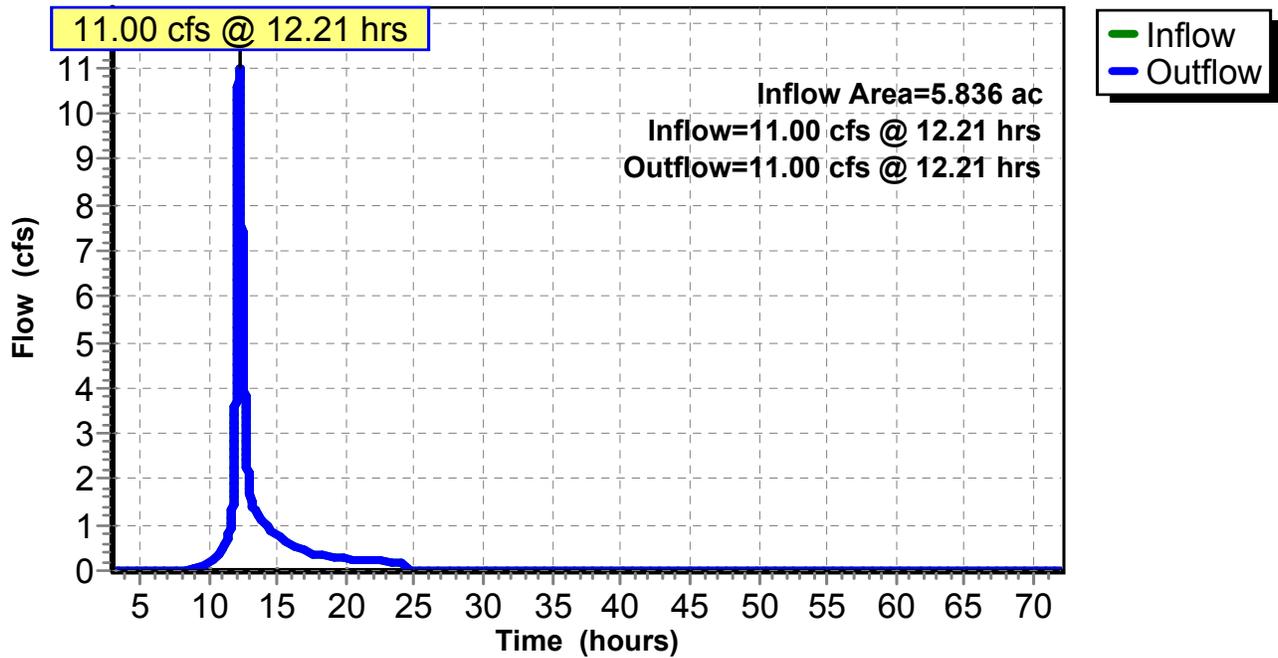
Summary for Reach 13R: point of analysis lot line

Inflow Area = 5.836 ac, 27.71% Impervious, Inflow Depth = 2.13" for 10yr event
Inflow = 11.00 cfs @ 12.21 hrs, Volume= 1.037 af
Outflow = 11.00 cfs @ 12.21 hrs, Volume= 1.037 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7

Reach 13R: point of analysis lot line

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

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Summary for Reach 14R: acc sta land

Inflow Area = 3.389 ac, 23.87% Impervious, Inflow Depth = 2.08" for 10yr event
Inflow = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af
Outflow = 6.20 cfs @ 12.23 hrs, Volume= 0.587 af, Atten= 2%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
Max. Velocity= 3.86 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.12 fps, Avg. Travel Time= 8.2 min

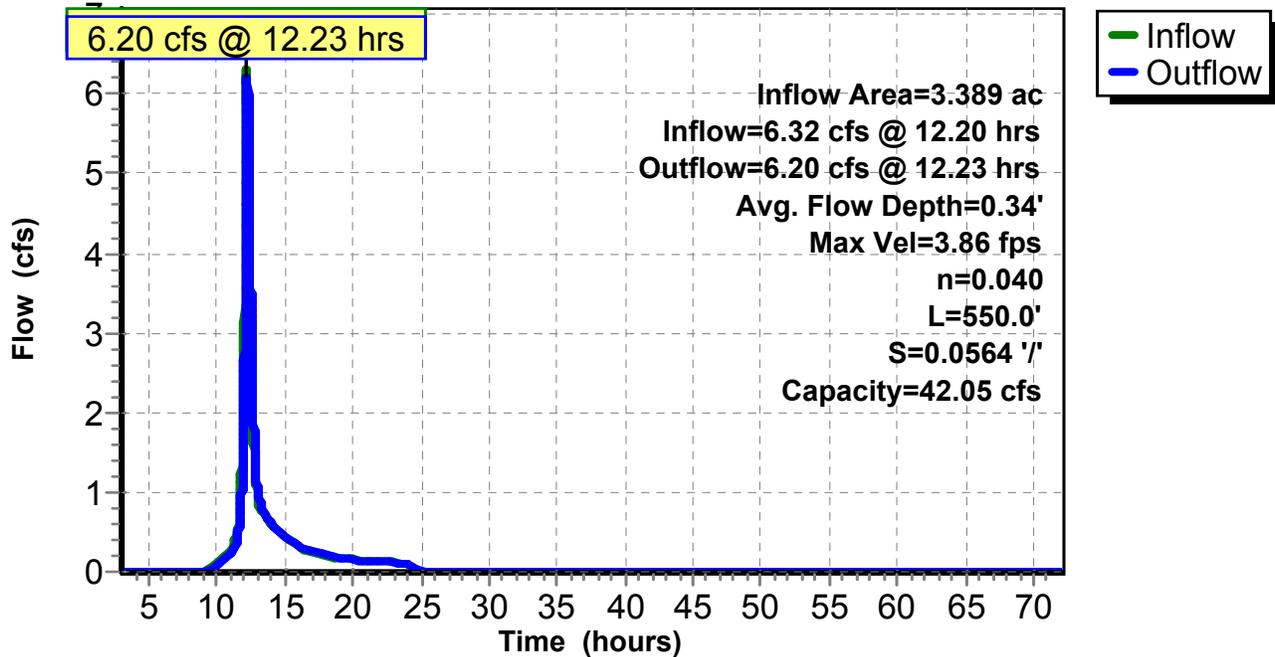
Peak Storage= 882 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 42.05 cfs

4.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 ' / ' Top Width= 8.00'
Length= 550.0' Slope= 0.0564 ' / '
Inlet Invert= 1,295.00', Outlet Invert= 1,264.00'



Reach 14R: acc sta land

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

Prepared by Moser Engineering

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Summary for Reach 19R: SWALE TO POA

Inflow Area = 0.150 ac, 60.67% Impervious, Inflow Depth = 2.22" for 10yr event
Inflow = 0.56 cfs @ 12.03 hrs, Volume= 0.028 af
Outflow = 0.50 cfs @ 12.07 hrs, Volume= 0.028 af, Atten= 11%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
Max. Velocity= 1.04 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 11.6 min

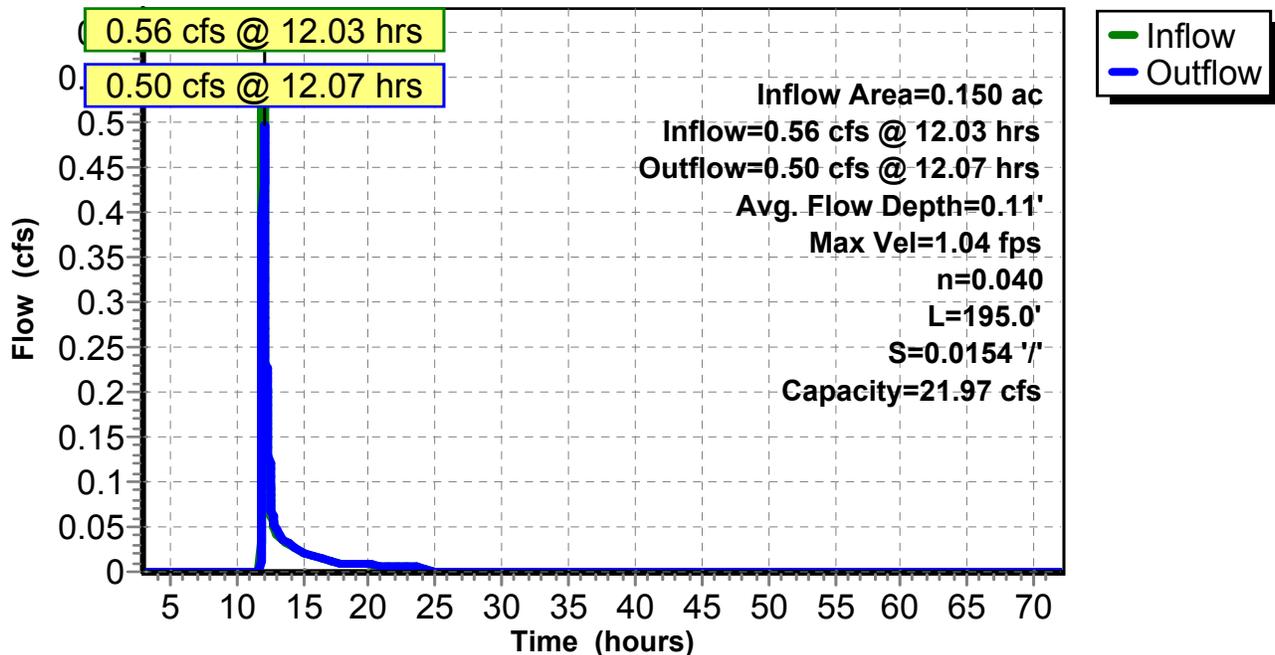
Peak Storage= 94 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 21.97 cfs

4.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 ' / ' Top Width= 8.00'
Length= 195.0' Slope= 0.0154 ' / '
Inlet Invert= 1,267.00', Outlet Invert= 1,264.00'



Reach 19R: SWALE TO POA

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

Prepared by Moser Engineering

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Summary for Pond 10P: culvert/basin at gould rd

Inflow Area = 2.021 ac, 21.92% Impervious, Inflow Depth = 2.04" for 10yr event
 Inflow = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af
 Outflow = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.79 cfs @ 12.19 hrs, Volume= 0.344 af

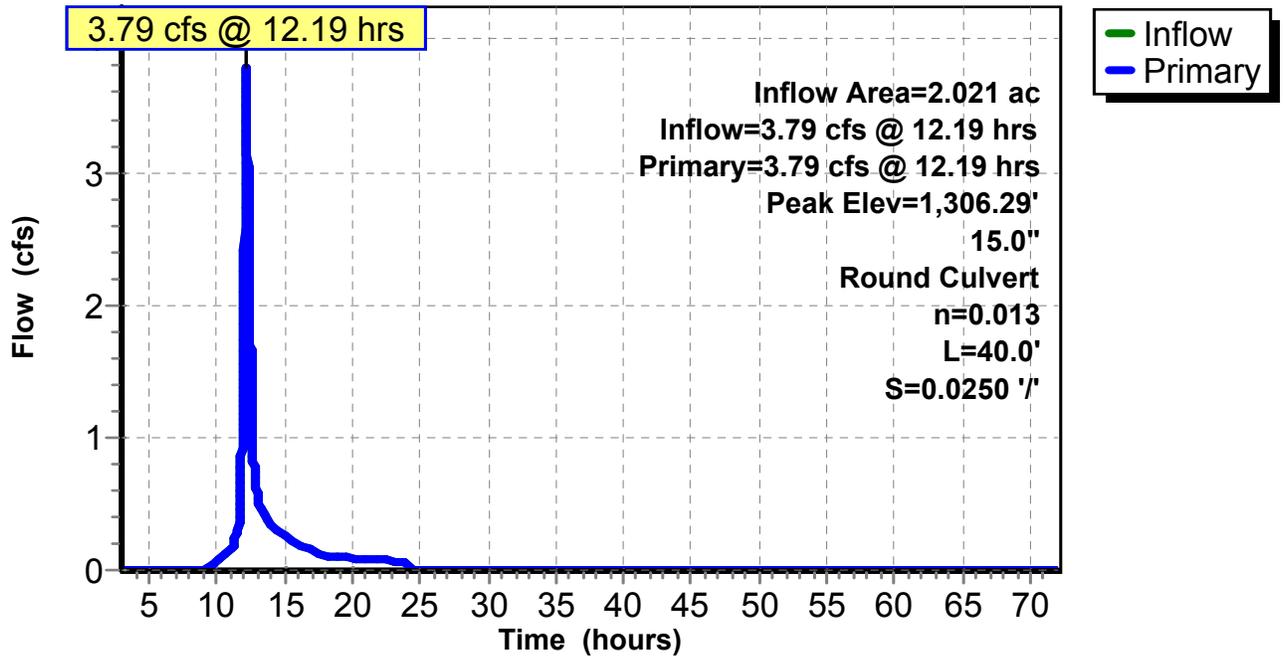
Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Peak Elev= 1,306.29' @ 12.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,305.00'	15.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,305.00' / 1,304.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.79 cfs @ 12.19 hrs HW=1,306.29' TW=1,303.28' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 3.79 cfs @ 3.09 fps)

Pond 10P: culvert/basin at gould rd

Hydrograph



Summary for Pond 11P: cross culvert at condo drive

Inflow Area = 3.389 ac, 23.87% Impervious, Inflow Depth = 2.08" for 10yr event
 Inflow = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af
 Outflow = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af, Atten= 0%, Lag= 0.0 min
 Primary = 6.32 cfs @ 12.20 hrs, Volume= 0.587 af

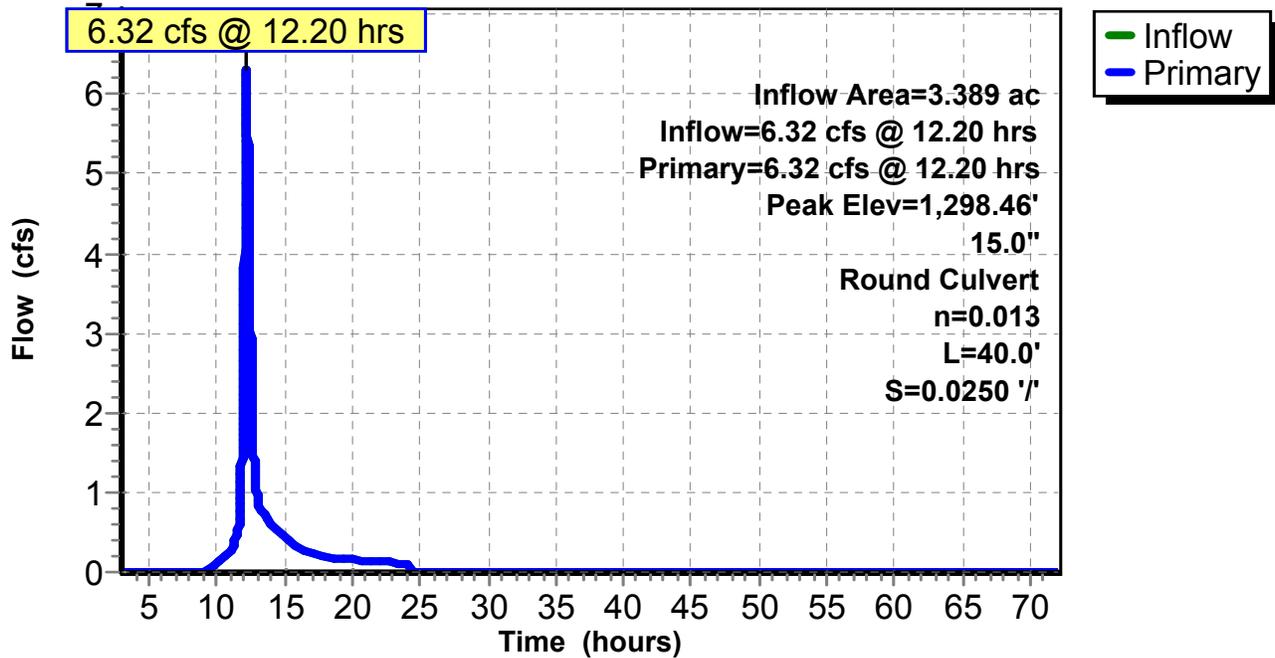
Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Peak Elev= 1,298.46' @ 12.20 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,296.00'	15.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,296.00' / 1,295.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=6.31 cfs @ 12.20 hrs HW=1,298.46' TW=1,295.34' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 6.31 cfs @ 5.14 fps)

Pond 11P: cross culvert at condo drive

Hydrograph



STAHLMAN_POST DEV_W BASIN

Type III 24-hr 10yr Rainfall=4.10"

Prepared by Moser Engineering

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Summary for Pond 17P: STORMWATER BASIN

Inflow Area = 0.150 ac, 60.67% Impervious, Inflow Depth = 2.92" for 10yr event
 Inflow = 0.61 cfs @ 12.01 hrs, Volume= 0.036 af
 Outflow = 0.56 cfs @ 12.03 hrs, Volume= 0.028 af, Atten= 8%, Lag= 1.2 min
 Primary = 0.56 cfs @ 12.03 hrs, Volume= 0.028 af

Routing by Dyn-Stor-Ind method, Time Span= 3.00-72.00 hrs, dt= 0.01 hrs / 7
 Peak Elev= 1,269.60' @ 12.03 hrs Surf.Area= 679 sf Storage= 445 cf

Plug-Flow detention time= 135.5 min calculated for 0.028 af (76% of inflow)
 Center-of-Mass det. time= 52.2 min (848.9 - 796.7)

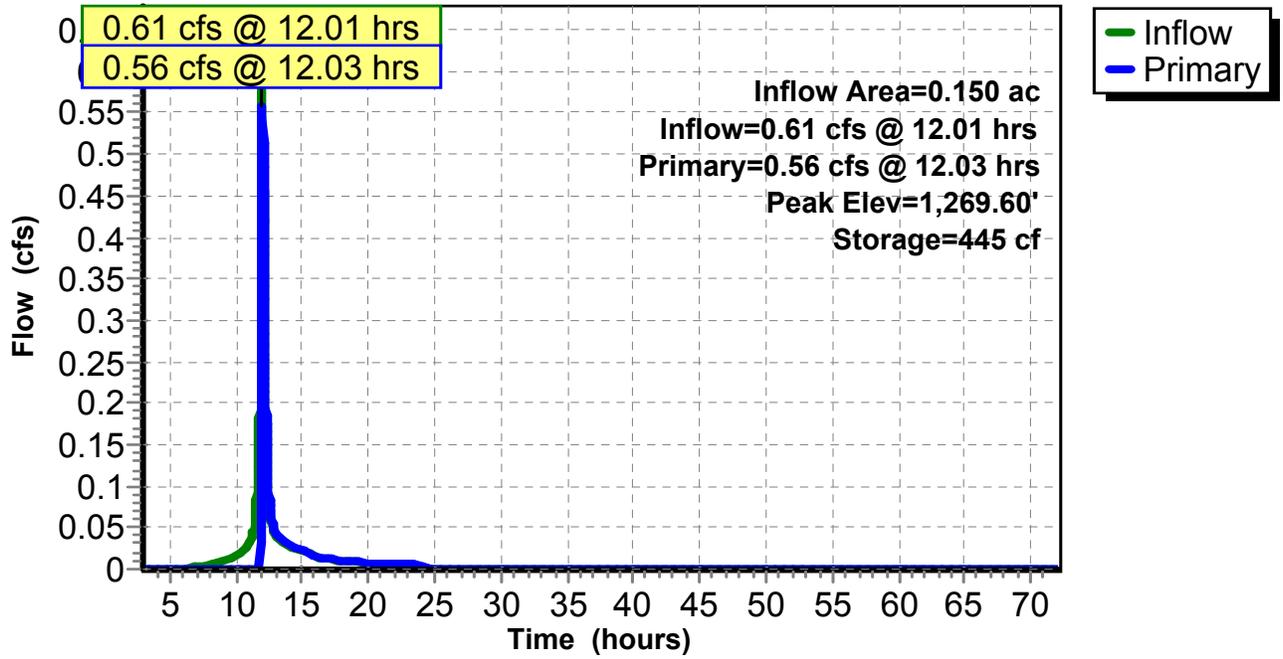
Volume	Invert	Avail.Storage	Storage Description
#1	1,268.80'	753 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,268.80	450	0	0
1,269.50	630	378	378
1,270.00	870	375	753

Device	Routing	Invert	Outlet Devices
#1	Primary	1,269.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.50 Width (feet) 5.00 8.00

Primary OutFlow Max=0.56 cfs @ 12.03 hrs HW=1,269.60' TW=1,267.11' (Dynamic Tailwater)
 ↑1=Custom Weir/Orifice (Weir Controls 0.56 cfs @ 1.03 fps)

Pond 17P: STORMWATER BASIN

Hydrograph



APPENDIX C:

BIO-RETENTION BASIN WORKSHEET

FILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.06)

Type/Node Name: _____

Node #17P, BIO-RETENTION, FOR PARKING

Enter the type of filtration practice (e.g., bioretention system) and the node name in the drainage analysis, if applicable

	yes	Have you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.06(b)?	
0.12	ac	$A = \text{Area draining to the practice}^1$	
0.09	ac	$A_1 = \text{Impervious area draining to the practice}$	
0.72	decimal	$I = \text{percent impervious area draining to the practice, in decimal form}$	
0.69	unitless	$R_v = \text{Runoff coefficient} = 0.05 + (0.9 \times I)$	
0.08	ac-in	$WQV = 1'' \times R_v \times A$	
300	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
75	cf	25% x WQV (check calc for sediment forebay volume)	
225	cf	75% x WQV (check calc for surface sand filter volume)	
SEDIMENT FOREBAY Method of Pretreatment? (not required for clean or roof runoff)			
NA	cf	$V_{SED} = \text{sediment forebay volume, if used for pretreatment}$	← ≥ 25%WQV
675	sf	$A_{SA} = \text{surface area of the practice}$	
0.30	iph	$I_{DESIGN} = \text{design infiltration rate}^2$	
N/A	Yes/No	If I_{DESIGN} is < 0.50 iph, has an underdrain been provided?	
17.8	hours	$T_{DRAIN} = \text{drain time} = V / (A_{SA} * I_{DESIGN})$	← ≤ 72-hrs
1,267.10	feet	$E_{FC} = \text{elevation of the bottom of the filter course material}$	
	feet	$E_{UD} = \text{invert elevation of the underdrain (UD), if applicable}$	
1,267.10	feet	$E_{BTM} = \text{elevation of the bottom of the practice (i.e., bottom of the stone reservoir).}$	
1,266.80	feet	$E_{SHWT} = \text{elevation of SHWT (if none found, enter the lowest elevation of the test pit)}$	
	feet	$E_{ROCK} = \text{elevation of bedrock (if none found, enter the lowest elevation of the test pit)}$	
1,267.10	feet	$D_{FC \text{ to } UD} = \text{depth to UD from the bottom of the filter course}^3$	← ≥ 1'
1,267.10	feet	$D_{FC \text{ to } ROCK} = \text{depth to bedrock from the bottom of the filter course}^3$	← ≥ 1'
0.30	feet	$D_{FC \text{ to } SHWT} = \text{depth to SHWT from the bottom of the filter course}^3$	← ≥ 1'
0.30	feet	$D_{BTM \text{ to } SHWT} = \text{depth to SHWT from the bottom of the practice}^3$	← ≥ 2'
1,269.60	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
1,270.50	ft	Elevation of the top of the practice	
YES		10 peak elevation ≤ Elevation of the top of the practice	← yes

If a surface sand filter is proposed:

YES	ac	Drainage Area check.	← < 10 ac
	cf	$V = \text{volume of storage}^{4,5}$ (attach a stage-storage table)	← ≥ 75%WQV
	inches	$D_{FC} = \text{filter course thickness}$	← 18"
Sheet		Note what sheet in the plan set contains the filter course specification	
	Yes/No	Access grate provided?	← yes
		The filter shall not be covered in grass. What is covering the filter?	

If an underground sand filter is proposed:

YES	ac	Drainage Area check.	← < 10 ac
	cf	$V = \text{volume of storage}^{4,5}$ (attach a stage-storage table)	← ≥ 75%WQV
	inches	$D_{FC} = \text{filter course thickness}$	← 24"
Sheet		Note what sheet in the plan set contains the filter course specification	
	Yes/No	Access grate provided?	← yes

Stage-Area-Storage for Pond 17P: STORMWATER BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,268.80	450	0	1,269.32	584	269
1,268.81	453	5	1,269.33	586	275
1,268.82	455	9	1,269.34	589	280
1,268.83	458	14	1,269.35	591	286
1,268.84	460	18	1,269.36	594	292
1,268.85	463	23	1,269.37	597	298
1,268.86	465	27	1,269.38	599	304
1,268.87	468	32	1,269.39	602	310
1,268.88	471	37	1,269.40	604	316
1,268.89	473	42	1,269.41	607	322
1,268.90	476	46	1,269.42	609	328
1,268.91	478	51	1,269.43	612	335
1,268.92	481	56	1,269.44	615	341
1,268.93	483	61	1,269.45	617	347
1,268.94	486	66	1,269.46	620	353
1,268.95	489	70	1,269.47	622	359
1,268.96	491	75	1,269.48	625	365
1,268.97	494	80	1,269.49	627	372
1,268.98	496	85	1,269.50	630	378
1,268.99	499	90	1,269.51	635	384
1,269.00	501	95	1,269.52	640	391
1,269.01	504	100	1,269.53	644	397
1,269.02	507	105	1,269.54	649	404
1,269.03	509	110	1,269.55	654	410
1,269.04	512	115	1,269.56	659	417
1,269.05	514	121	1,269.57	664	423
1,269.06	517	126	1,269.58	668	430
1,269.07	519	131	1,269.59	673	437
1,269.08	522	136	1,269.60	678	443
1,269.09	525	141	1,269.61	683	450
1,269.10	527	147	1,269.62	688	457
1,269.11	530	152	1,269.63	692	464
1,269.12	532	157	1,269.64	697	471
1,269.13	535	163	1,269.65	702	478
1,269.14	537	168	1,269.66	707	485
1,269.15	540	173	1,269.67	712	492
1,269.16	543	179	1,269.68	716	499
1,269.17	545	184	1,269.69	721	506
1,269.18	548	190	1,269.70	726	514
1,269.19	550	195	1,269.71	731	521
1,269.20	553	201	1,269.72	736	528
1,269.21	555	206	1,269.73	740	536
1,269.22	558	212	1,269.74	745	543
1,269.23	561	217	1,269.75	750	551
1,269.24	563	223	1,269.76	755	558
1,269.25	566	229	1,269.77	760	566
1,269.26	568	234	1,269.78	764	573
1,269.27	571	240	1,269.79	769	581
1,269.28	573	246	1,269.80	774	589
1,269.29	576	251	1,269.81	779	596
1,269.30	579	257	1,269.82	784	604
1,269.31	581	263	1,269.83	788	612