Northeast Civil Solutions, Inc.

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Memorandum

STATE OF MAINE
Travis A. Letellier
13920
LICENSED
PROFESSIONAL ENGINEER
12-17-15

TO: City of Augusta, Maine

FROM: Travis Letellier, P.E.

DATE: December 16, 2015

RE: Drainage Analysis – Dollar General

Northeast Civil Solutions, INC. (NCS) has completed a drainage analysis for a Dollar General Retail Store development on a parcel identified as Tax map 57 Lot 9 located on Eastern Avenue.

The development will include a new retail building, parking and driveway that will result in roughly 32,000 square feet of new impervious area. Stormwater from the parking lot and roof will be collected in a closed drainage system and directed to a detention pond in the rear of the property. To control peak flows an outlet control structure will be used to gradually discharge stormwater from the 5,000 cubic foot detention area.

In this study, the Soil Conservation Services Urban Hydrology for Small watersheds, Technical Release 20 (also known as SCS-TR20) was utilized to model the surface water drainage patterns for the post development drainage conditions. HydroCAD Stormwater Modeling System Software (Version 10.00) was used for the SCS TR20 calculations. The SCS TR-55 method was used to estimate the Time of Concentration (Tc). This method involves estimating the length of sheet flow, shallow concentrated flow and channel flow that occurs within each sub-catchment. From this information, the time of concentration is determined for the watershed. Modeling was conducted using the 2, 10 and 25-year storm events.

The contours, three watersheds and points of analysis are based on survey completed by NCS in October 2015.

Tables 1, 2 and 3 below outline the peak stormwater discharge, in cubic feet per second (cfs), at each Study Point (SP) for both the existing (pre-development) and proposed (post-development) conditions for all three storm events.

Table 1 – Study Point #1

Storm Event	Existing Conditions (cfs)	Proposed Conditions (cfs)	Change (cfs)
2-year	0.7	0.7	0.0
10-year	1.6	1.2	(0.4)
25-year	2.3	2.3	0.0

Table 2 – Study Point #2

Storm Event	Existing Conditions (cfs)	Proposed Conditions (cfs)	Change (cfs)
2-year	0.5	0.3	(0.2)
10-year	1.1	1.0	(0.1)
25-year	1.6	1.5	(0.1)

Table 3 – Study Point #3

Storm Event	Existing Conditions (cfs)	Proposed Conditions (cfs)	Change (cfs)
2-year	0.2	0.3	+0.1
10-year	0.5	0.6	+0.1
25-year	0.7	0.7	0.0

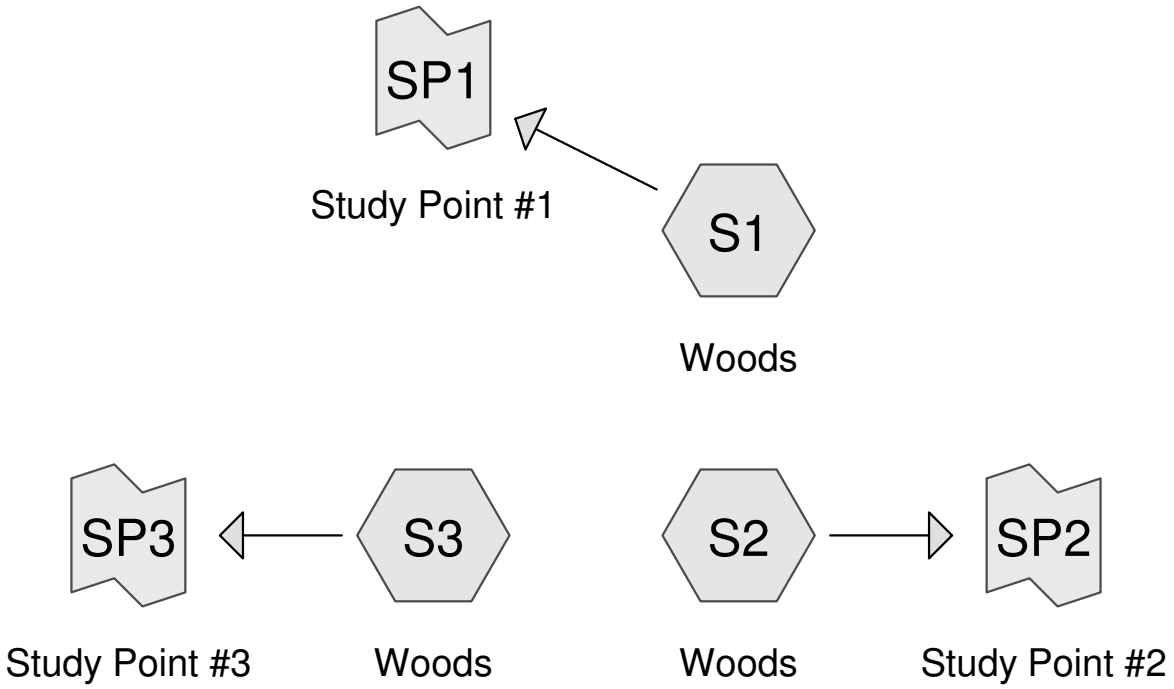
Table 4 summarizes the combination of all three study points.

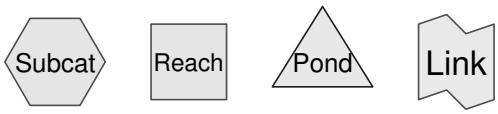
Table 4 – Total

Storm Event	Existing Conditions (cfs)	Proposed Conditions (cfs)	Change (cfs)
2-year	1.4	1.3	(0.1)
10-year	3.2	2.8	(0.4)
25-year	4.6	4.5	(0.1)

By examination of the summary tables above there is no significant increase at any of the three study points, and overall, the detention pond controls peak flows to levels below existing conditions.

The following HydroCAD output and drainage plans (site plan sheets 10 and 11) provide more detail on the analysis of this site.





Routing Diagram for 34450 EX
Prepared by Microsoft, Printed 12/17/2015
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.983	77	Woods, Good, HSG D (S1, S2, S3)
1.983	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.983	HSG D	S1, S2, S3
0.000	Other	
1.983		**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	1.983	0.000	1.983	Woods, Good	S1, S2, S3
0.000	**0.000**	**0.000**	**1.983**	**0.000**	**1.983**	**TOTAL AREA**	

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

Subcatchment S1: Woods Runoff Area=43,528 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=220' Tc=18.5 min CN=77 Runoff=0.72 cfs 0.071 af

Subcatchment S2: Woods Runoff Area=31,704 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=238' Tc=19.3 min CN=77 Runoff=0.51 cfs 0.051 af

Subcatchment S3: Woods Runoff Area=11,157 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=176' Tc=10.4 min CN=77 Runoff=0.23 cfs 0.018 af

Link SP1: Study Point #1 Inflow=0.72 cfs 0.071 af
Primary=0.72 cfs 0.071 af

Link SP2: Study Point #2 Inflow=0.51 cfs 0.051 af
Primary=0.51 cfs 0.051 af

Link SP3: Study Point #3 Inflow=0.23 cfs 0.018 af
Primary=0.23 cfs 0.018 af

Total Runoff Area = 1.983 ac Runoff Volume = 0.140 af Average Runoff Depth = 0.85"
100.00% Pervious = 1.983 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S1: Woods

Runoff = 0.72 cfs @ 12.27 hrs, Volume= 0.071 af, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
43,528	77	Woods, Good, HSG D
43,528		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	100	0.0450	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
1.9	120	0.0458	1.07		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
18.5	220	Total			

Summary for Subcatchment S2: Woods

Runoff = 0.51 cfs @ 12.29 hrs, Volume= 0.051 af, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
31,704	77	Woods, Good, HSG D
31,704		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	100	0.0500	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
3.4	138	0.0185	0.68		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
19.3	238	Total			

Summary for Subcatchment S3: Woods

Runoff = 0.23 cfs @ 12.16 hrs, Volume= 0.018 af, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
11,157	77	Woods, Good, HSG D
11,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	73	0.1096	0.13		**Sheet Flow, A-B SHEET**
					Woods: Light underbrush n= 0.400 P2= 2.80"
1.4	103	0.0631	1.26		**Shallow Concentrated Flow, B-C SHALLOW**
					Woodland Kv= 5.0 fps
10.4	176	Total			

Summary for Link SP1: Study Point #1

Inflow Area = 0.999 ac, 0.00% Impervious, Inflow Depth > 0.85" for 2-Year event
Inflow = 0.72 cfs @ 12.27 hrs, Volume= 0.071 af
Primary = 0.72 cfs @ 12.27 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP2: Study Point #2

Inflow Area = 0.728 ac, 0.00% Impervious, Inflow Depth > 0.85" for 2-Year event
Inflow = 0.51 cfs @ 12.29 hrs, Volume= 0.051 af
Primary = 0.51 cfs @ 12.29 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP3: Study Point #3

Inflow Area = 0.256 ac, 0.00% Impervious, Inflow Depth > 0.85" for 2-Year event
Inflow = 0.23 cfs @ 12.16 hrs, Volume= 0.018 af
Primary = 0.23 cfs @ 12.16 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment S1: Woods Runoff Area=43,528 sf 0.00% Impervious Runoff Depth>1.82"
Flow Length=220' Tc=18.5 min CN=77 Runoff=1.59 cfs 0.151 af

Subcatchment S2: Woods Runoff Area=31,704 sf 0.00% Impervious Runoff Depth>1.82"
Flow Length=238' Tc=19.3 min CN=77 Runoff=1.14 cfs 0.110 af

Subcatchment S3: Woods Runoff Area=11,157 sf 0.00% Impervious Runoff Depth>1.82"
Flow Length=176' Tc=10.4 min CN=77 Runoff=0.50 cfs 0.039 af

Link SP1: Study Point #1 Inflow=1.59 cfs 0.151 af
Primary=1.59 cfs 0.151 af

Link SP2: Study Point #2 Inflow=1.14 cfs 0.110 af
Primary=1.14 cfs 0.110 af

Link SP3: Study Point #3 Inflow=0.50 cfs 0.039 af
Primary=0.50 cfs 0.039 af

Total Runoff Area = 1.983 ac Runoff Volume = 0.300 af Average Runoff Depth = 1.82"
100.00% Pervious = 1.983 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S1: Woods

Runoff = 1.59 cfs @ 12.26 hrs, Volume= 0.151 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
43,528	77	Woods, Good, HSG D
43,528		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	100	0.0450	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
1.9	120	0.0458	1.07		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
18.5	220	Total			

Summary for Subcatchment S2: Woods

Runoff = 1.14 cfs @ 12.27 hrs, Volume= 0.110 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
31,704	77	Woods, Good, HSG D
31,704		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	100	0.0500	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
3.4	138	0.0185	0.68		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
19.3	238	Total			

Summary for Subcatchment S3: Woods

Runoff = 0.50 cfs @ 12.15 hrs, Volume= 0.039 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
11,157	77	Woods, Good, HSG D
11,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	73	0.1096	0.13		**Sheet Flow, A-B SHEET**
					Woods: Light underbrush n= 0.400 P2= 2.80"
1.4	103	0.0631	1.26		**Shallow Concentrated Flow, B-C SHALLOW**
					Woodland Kv= 5.0 fps
10.4	176	Total			

Summary for Link SP1: Study Point #1

Inflow Area = 0.999 ac, 0.00% Impervious, Inflow Depth > 1.82" for 10-Year event
Inflow = 1.59 cfs @ 12.26 hrs, Volume= 0.151 af
Primary = 1.59 cfs @ 12.26 hrs, Volume= 0.151 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP2: Study Point #2

Inflow Area = 0.728 ac, 0.00% Impervious, Inflow Depth > 1.82" for 10-Year event
Inflow = 1.14 cfs @ 12.27 hrs, Volume= 0.110 af
Primary = 1.14 cfs @ 12.27 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP3: Study Point #3

Inflow Area = 0.256 ac, 0.00% Impervious, Inflow Depth > 1.82" for 10-Year event
Inflow = 0.50 cfs @ 12.15 hrs, Volume= 0.039 af
Primary = 0.50 cfs @ 12.15 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment S1: Woods Runoff Area=43,528 sf 0.00% Impervious Runoff Depth>2.59"
Flow Length=220' Tc=18.5 min CN=77 Runoff=2.27 cfs 0.216 af

Subcatchment S2: Woods Runoff Area=31,704 sf 0.00% Impervious Runoff Depth>2.59"
Flow Length=238' Tc=19.3 min CN=77 Runoff=1.63 cfs 0.157 af

Subcatchment S3: Woods Runoff Area=11,157 sf 0.00% Impervious Runoff Depth>2.60"
Flow Length=176' Tc=10.4 min CN=77 Runoff=0.72 cfs 0.055 af

Link SP1: Study Point #1 Inflow=2.27 cfs 0.216 af
Primary=2.27 cfs 0.216 af

Link SP2: Study Point #2 Inflow=1.63 cfs 0.157 af
Primary=1.63 cfs 0.157 af

Link SP3: Study Point #3 Inflow=0.72 cfs 0.055 af
Primary=0.72 cfs 0.055 af

Total Runoff Area = 1.983 ac Runoff Volume = 0.428 af Average Runoff Depth = 2.59"
100.00% Pervious = 1.983 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S1: Woods

Runoff = 2.27 cfs @ 12.26 hrs, Volume= 0.216 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
43,528	77	Woods, Good, HSG D
43,528		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6	100	0.0450	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
1.9	120	0.0458	1.07		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
18.5	220	Total			

Summary for Subcatchment S2: Woods

Runoff = 1.63 cfs @ 12.27 hrs, Volume= 0.157 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
31,704	77	Woods, Good, HSG D
31,704		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	100	0.0500	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
3.4	138	0.0185	0.68		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
19.3	238	Total			

Summary for Subcatchment S3: Woods

Runoff = 0.72 cfs @ 12.15 hrs, Volume= 0.055 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
11,157	77	Woods, Good, HSG D
11,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	73	0.1096	0.13		**Sheet Flow, A-B SHEET**
					Woods: Light underbrush n= 0.400 P2= 2.80"
1.4	103	0.0631	1.26		**Shallow Concentrated Flow, B-C SHALLOW**
					Woodland Kv= 5.0 fps
10.4	176	Total			

Summary for Link SP1: Study Point #1

Inflow Area = 0.999 ac, 0.00% Impervious, Inflow Depth > 2.59" for 25-Year event
Inflow = 2.27 cfs @ 12.26 hrs, Volume= 0.216 af
Primary = 2.27 cfs @ 12.26 hrs, Volume= 0.216 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP2: Study Point #2

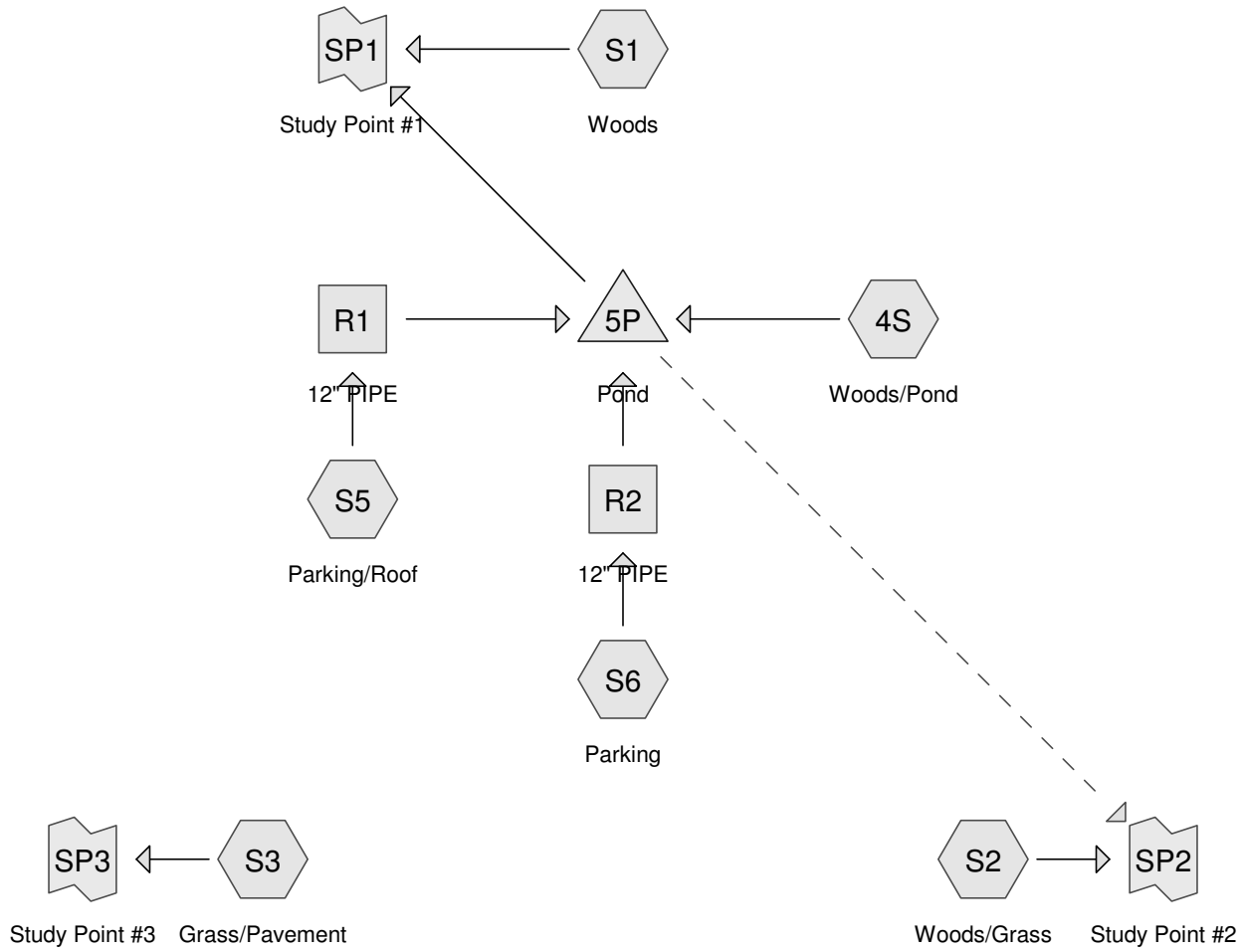
Inflow Area = 0.728 ac, 0.00% Impervious, Inflow Depth > 2.59" for 25-Year event
Inflow = 1.63 cfs @ 12.27 hrs, Volume= 0.157 af
Primary = 1.63 cfs @ 12.27 hrs, Volume= 0.157 af, Atten= 0%, Lag= 0.0 min

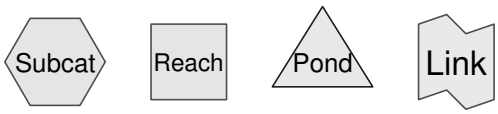
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link SP3: Study Point #3

Inflow Area = 0.256 ac, 0.00% Impervious, Inflow Depth > 2.60" for 25-Year event
Inflow = 0.72 cfs @ 12.15 hrs, Volume= 0.055 af
Primary = 0.72 cfs @ 12.15 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min

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





Routing Diagram for 34450 PR
Prepared by Microsoft, Printed 12/17/2015
HydroCAD® 10.00-13 s/n 02173 © 2014 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.683	80	>75% Grass cover, Good, HSG D (4S, S1, S2, S3)
0.459	98	Paved parking, HSG D (S5, S6)
0.209	98	Roofs, HSG D (S5)
0.063	98	Unconnected pavement, HSG D (S3)
0.569	77	Woods, Good, HSG D (4S, S1, S2)
1.983	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.983	HSG D	4S, S1, S2, S3, S5, S6
0.000	Other	
1.983		**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	0.683	0.000	0.683	>75% Grass cover, Good	4S, S1, S2, S3
0.000	0.000	0.000	0.459	0.000	0.459	Paved parking	S5, S6
0.000	0.000	0.000	0.209	0.000	0.209	Roofs	S5
0.000	0.000	0.000	0.063	0.000	0.063	Unconnected pavement	S3
0.000	0.000	0.000	0.569	0.000	0.569	Woods, Good	4S, S1, S2
0.000	**0.000**	**0.000**	**1.983**	**0.000**	**1.983**	**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	R1	216.70	215.00	270.0	0.0063	0.011	12.0	0.0	0.0
2	R2	216.88	215.00	91.0	0.0207	0.011	12.0	0.0	0.0
3	5P	212.50	212.00	50.0	0.0100	0.011	12.0	0.0	0.0
4	5P	214.00	213.80	50.0	0.0040	0.011	6.0	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, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4S: Woods/Pond Runoff Area=9,812 sf 0.00% Impervious Runoff Depth>0.96"
Flow Length=83' Tc=9.9 min CN=79 Runoff=0.23 cfs 0.018 af

Subcatchment S1: Woods Runoff Area=23,173 sf 0.00% Impervious Runoff Depth>0.90"
Flow Length=149' Tc=17.7 min CN=78 Runoff=0.42 cfs 0.040 af

Subcatchment S2: Woods/Grass Runoff Area=17,560 sf 0.00% Impervious Runoff Depth>0.90"
Flow Length=184' Tc=16.9 min CN=78 Runoff=0.32 cfs 0.030 af

Subcatchment S3: Grass/Pavement Runoff Area=6,736 sf 40.78% Impervious Runoff Depth>1.46"
Flow Length=69' Tc=2.1 min CN=87 Runoff=0.31 cfs 0.019 af

Subcatchment S5: Parking/Roof Runoff Area=18,231 sf 100.00% Impervious Runoff Depth>2.41"
Flow Length=120' Slope=0.0150 '/' Tc=1.7 min CN=98 Runoff=1.23 cfs 0.084 af

Subcatchment S6: Parking Runoff Area=10,875 sf 100.00% Impervious Runoff Depth>2.41"
Flow Length=168' Tc=2.1 min CN=98 Runoff=0.73 cfs 0.050 af

Reach R1: 12" PIPE Avg. Flow Depth=0.42' Max Vel=3.92 fps Inflow=1.23 cfs 0.084 af
12.0" Round Pipe n=0.011 L=270.0' S=0.0063 '/' Capacity=3.34 cfs Outflow=1.15 cfs 0.084 af

Reach R2: 12" PIPE Avg. Flow Depth=0.24' Max Vel=5.21 fps Inflow=0.73 cfs 0.050 af
12.0" Round Pipe n=0.011 L=91.0' S=0.0207 '/' Capacity=6.05 cfs Outflow=0.73 cfs 0.050 af

Pond 5P: Pond Peak Elev=214.03' Storage=2,786 cf Inflow=2.02 cfs 0.152 af
Primary=0.28 cfs 0.147 af Secondary=0.00 cfs 0.000 af Outflow=0.28 cfs 0.148 af

Link SP1: Study Point #1 Inflow=0.68 cfs 0.187 af
Primary=0.68 cfs 0.187 af

Link SP2: Study Point #2 Inflow=0.32 cfs 0.030 af
Primary=0.32 cfs 0.030 af

Link SP3: Study Point #3 Inflow=0.31 cfs 0.019 af
Primary=0.31 cfs 0.019 af

Total Runoff Area = 1.983 ac Runoff Volume = 0.241 af Average Runoff Depth = 1.46"
63.13% Pervious = 1.252 ac 36.87% Impervious = 0.731 ac

Summary for Subcatchment 4S: Woods/Pond

Runoff = 0.23 cfs @ 12.15 hrs, Volume= 0.018 af, Depth> 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
3,208	77	Woods, Good, HSG D
6,604	80	>75% Grass cover, Good, HSG D
9,812	79	Weighted Average
9,812		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	53	0.0472	0.09		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
0.1	30	0.2500	3.50		**Shallow Concentrated Flow, B-C SHALLOW** Short Grass Pasture Kv= 7.0 fps
9.9	83	Total			

Summary for Subcatchment S1: Woods

Runoff = 0.42 cfs @ 12.26 hrs, Volume= 0.040 af, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
12,434	77	Woods, Good, HSG D
10,739	80	>75% Grass cover, Good, HSG D
23,173	78	Weighted Average
23,173		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0425	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	49	0.0600	1.22		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
17.7	149	Total			

Summary for Subcatchment S2: Woods/Grass

Runoff = 0.32 cfs @ 12.25 hrs, Volume= 0.030 af, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
9,129	77	Woods, Good, HSG D
8,431	80	>75% Grass cover, Good, HSG D
17,560	78	Weighted Average
17,560		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0600	0.11		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
2.1	84	0.0178	0.67		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
16.9	184	Total			

Summary for Subcatchment S3: Grass/Pavement

Runoff = 0.31 cfs @ 12.04 hrs, Volume= 0.019 af, Depth> 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
3,989	80	>75% Grass cover, Good, HSG D
2,747	98	Unconnected pavement, HSG D
6,736	87	Weighted Average
3,989		59.22% Pervious Area
2,747		40.78% Impervious Area
2,747		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	28	0.2500	0.23		**Sheet Flow, A-B SHEET** Grass: Dense n= 0.240 P2= 2.80"
0.1	41	0.1000	4.74		**Shallow Concentrated Flow, B-C SHALLOW** Grassed Waterway Kv= 15.0 fps
2.1	69	Total			

Summary for Subcatchment S5: Parking/Roof

Runoff = 1.23 cfs @ 12.03 hrs, Volume= 0.084 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
9,100	98	Roofs, HSG D
9,131	98	Paved parking, HSG D
18,231	98	Weighted Average
18,231		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.0150	1.19		**Sheet Flow, A-B SHEET** Smooth surfaces n= 0.011 P2= 2.80"

Summary for Subcatchment S6: Parking

Runoff = 0.73 cfs @ 12.03 hrs, Volume= 0.050 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
10,875	98	Paved parking, HSG D
10,875		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	78	0.0100	0.93		**Sheet Flow, A-B SHEET** Smooth surfaces n= 0.011 P2= 2.80"
0.7	90	0.0120	2.22		**Shallow Concentrated Flow, B-C SHALLOW** Paved Kv= 20.3 fps
2.1	168	Total			

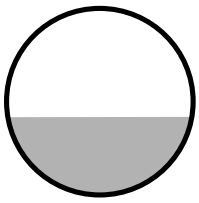
Summary for Reach R1: 12" PIPE

Inflow Area = 0.419 ac,100.00% Impervious, Inflow Depth > 2.41" for 2-Year event
Inflow = 1.23 cfs @ 12.03 hrs, Volume= 0.084 af
Outflow = 1.15 cfs @ 12.06 hrs, Volume= 0.084 af, Atten= 6%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.92 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.47 fps, Avg. Travel Time= 3.1 min

Peak Storage= 84 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.34 cfs

12.0" Round Pipe
n= 0.011
Length= 270.0' Slope= 0.0063 '/'
Inlet Invert= 216.70', Outlet Invert= 215.00'



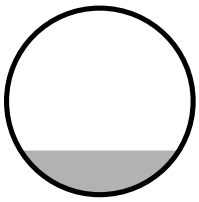
Summary for Reach R2: 12" PIPE

Inflow Area = 0.250 ac,100.00% Impervious, Inflow Depth > 2.41" for 2-Year event
Inflow = 0.73 cfs @ 12.03 hrs, Volume= 0.050 af
Outflow = 0.73 cfs @ 12.04 hrs, Volume= 0.050 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.21 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.91 fps, Avg. Travel Time= 0.8 min

Peak Storage= 13 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.05 cfs

12.0" Round Pipe
n= 0.011
Length= 91.0' Slope= 0.0207 '/'
Inlet Invert= 216.88', Outlet Invert= 215.00'



Summary for Pond 5P: Pond

Inflow Area = 0.893 ac, 74.79% Impervious, Inflow Depth > 2.04" for 2-Year event
Inflow = 2.02 cfs @ 12.06 hrs, Volume= 0.152 af
Outflow = 0.28 cfs @ 12.61 hrs, Volume= 0.148 af, Atten= 86%, Lag= 33.1 min
Primary = 0.28 cfs @ 12.61 hrs, Volume= 0.147 af
Secondary = 0.00 cfs @ 12.61 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.03' @ 12.61 hrs Surf.Area= 2,506 sf Storage= 2,786 cf

Plug-Flow detention time= 112.6 min calculated for 0.147 af (97% of inflow)
Center-of-Mass det. time= 100.8 min (848.7 - 748.0)

Volume	Invert	Avail.Storage	Storage Description
#1	212.50'	9,433 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
212.50	1,174	0	0
213.00	1,564	685	685
214.00	2,471	2,018	2,702
215.00	3,495	2,983	5,685
216.00	4,000	3,748	9,433

Device	Routing	Invert	Outlet Devices
#1	Primary	212.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.50' / 212.00' S= 0.0100 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Device 1	212.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	214.00'	**6.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.80' S= 0.0040 '/' Cc= 0.900 n= 0.011, Flow Area= 0.20 sf
#4	Device 1	214.55'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.28 cfs @ 12.61 hrs HW=214.03' (Free Discharge)
└─**1=Culvert** (Passes 0.28 cfs of 3.04 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.28 cfs @ 5.71 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 12.61 hrs HW=214.03' (Free Discharge)
└─**3=Culvert** (Barrel Controls 0.00 cfs @ 0.55 fps)

Summary for Link SP1: Study Point #1

Inflow Area = 1.425 ac, 46.88% Impervious, Inflow Depth > 1.58" for 2-Year event
Inflow = 0.68 cfs @ 12.27 hrs, Volume= 0.187 af
Primary = 0.68 cfs @ 12.27 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP2: Study Point #2

Inflow Area = 0.403 ac, 0.00% Impervious, Inflow Depth > 0.90" for 2-Year event
Inflow = 0.32 cfs @ 12.25 hrs, Volume= 0.030 af
Primary = 0.32 cfs @ 12.25 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP3: Study Point #3

Inflow Area = 0.155 ac, 40.78% Impervious, Inflow Depth > 1.46" for 2-Year event
Inflow = 0.31 cfs @ 12.04 hrs, Volume= 0.019 af
Primary = 0.31 cfs @ 12.04 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment 4S: Woods/Pond Runoff Area=9,812 sf 0.00% Impervious Runoff Depth>1.97"
Flow Length=83' Tc=9.9 min CN=79 Runoff=0.49 cfs 0.037 af

Subcatchment S1: Woods Runoff Area=23,173 sf 0.00% Impervious Runoff Depth>1.89"
Flow Length=149' Tc=17.7 min CN=78 Runoff=0.90 cfs 0.084 af

Subcatchment S2: Woods/Grass Runoff Area=17,560 sf 0.00% Impervious Runoff Depth>1.89"
Flow Length=184' Tc=16.9 min CN=78 Runoff=0.69 cfs 0.064 af

Subcatchment S3: Grass/Pavement Runoff Area=6,736 sf 40.78% Impervious Runoff Depth>2.65"
Flow Length=69' Tc=2.1 min CN=87 Runoff=0.55 cfs 0.034 af

Subcatchment S5: Parking/Roof Runoff Area=18,231 sf 100.00% Impervious Runoff Depth>3.69"
Flow Length=120' Slope=0.0150 '/' Tc=1.7 min CN=98 Runoff=1.86 cfs 0.129 af

Subcatchment S6: Parking Runoff Area=10,875 sf 100.00% Impervious Runoff Depth>3.69"
Flow Length=168' Tc=2.1 min CN=98 Runoff=1.11 cfs 0.077 af

Reach R1: 12" PIPE Avg. Flow Depth=0.53' Max Vel=4.36 fps Inflow=1.86 cfs 0.129 af
12.0" Round Pipe n=0.011 L=270.0' S=0.0063 '/' Capacity=3.34 cfs Outflow=1.76 cfs 0.128 af

Reach R2: 12" PIPE Avg. Flow Depth=0.29' Max Vel=5.86 fps Inflow=1.11 cfs 0.077 af
12.0" Round Pipe n=0.011 L=91.0' S=0.0207 '/' Capacity=6.05 cfs Outflow=1.10 cfs 0.077 af

Pond 5P: Pond Peak Elev=214.56' Storage=4,258 cf Inflow=3.18 cfs 0.242 af
Primary=0.34 cfs 0.197 af Secondary=0.41 cfs 0.036 af Outflow=0.75 cfs 0.233 af

Link SP1: Study Point #1 Inflow=1.22 cfs 0.281 af
Primary=1.22 cfs 0.281 af

Link SP2: Study Point #2 Inflow=1.03 cfs 0.099 af
Primary=1.03 cfs 0.099 af

Link SP3: Study Point #3 Inflow=0.55 cfs 0.034 af
Primary=0.55 cfs 0.034 af

Total Runoff Area = 1.983 ac Runoff Volume = 0.424 af Average Runoff Depth = 2.57"
63.13% Pervious = 1.252 ac 36.87% Impervious = 0.731 ac

Summary for Subcatchment 4S: Woods/Pond

Runoff = 0.49 cfs @ 12.14 hrs, Volume= 0.037 af, Depth> 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
3,208	77	Woods, Good, HSG D
6,604	80	>75% Grass cover, Good, HSG D
9,812	79	Weighted Average
9,812		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	53	0.0472	0.09		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
0.1	30	0.2500	3.50		**Shallow Concentrated Flow, B-C SHALLOW** Short Grass Pasture Kv= 7.0 fps
9.9	83	Total			

Summary for Subcatchment S1: Woods

Runoff = 0.90 cfs @ 12.25 hrs, Volume= 0.084 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
12,434	77	Woods, Good, HSG D
10,739	80	>75% Grass cover, Good, HSG D
23,173	78	Weighted Average
23,173		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0425	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	49	0.0600	1.22		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
17.7	149	Total			

Summary for Subcatchment S2: Woods/Grass

Runoff = 0.69 cfs @ 12.24 hrs, Volume= 0.064 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
9,129	77	Woods, Good, HSG D
8,431	80	>75% Grass cover, Good, HSG D
17,560	78	Weighted Average
17,560		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0600	0.11		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
2.1	84	0.0178	0.67		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
16.9	184	Total			

Summary for Subcatchment S3: Grass/Pavement

Runoff = 0.55 cfs @ 12.04 hrs, Volume= 0.034 af, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
3,989	80	>75% Grass cover, Good, HSG D
2,747	98	Unconnected pavement, HSG D
6,736	87	Weighted Average
3,989		59.22% Pervious Area
2,747		40.78% Impervious Area
2,747		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	28	0.2500	0.23		**Sheet Flow, A-B SHEET** Grass: Dense n= 0.240 P2= 2.80"
0.1	41	0.1000	4.74		**Shallow Concentrated Flow, B-C SHALLOW** Grassed Waterway Kv= 15.0 fps
2.1	69	Total			

Summary for Subcatchment S5: Parking/Roof

Runoff = 1.86 cfs @ 12.03 hrs, Volume= 0.129 af, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
9,100	98	Roofs, HSG D
9,131	98	Paved parking, HSG D
18,231	98	Weighted Average
18,231		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.0150	1.19		**Sheet Flow, A-B SHEET** Smooth surfaces n= 0.011 P2= 2.80"

Summary for Subcatchment S6: Parking

Runoff = 1.11 cfs @ 12.03 hrs, Volume= 0.077 af, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.20"

Area (sf)	CN	Description
10,875	98	Paved parking, HSG D
10,875		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	78	0.0100	0.93		**Sheet Flow, A-B SHEET** Smooth surfaces n= 0.011 P2= 2.80"
0.7	90	0.0120	2.22		**Shallow Concentrated Flow, B-C SHALLOW** Paved Kv= 20.3 fps
2.1	168	Total			

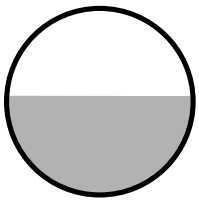
Summary for Reach R1: 12" PIPE

Inflow Area = 0.419 ac,100.00% Impervious, Inflow Depth > 3.69" for 10-Year event
Inflow = 1.86 cfs @ 12.03 hrs, Volume= 0.129 af
Outflow = 1.76 cfs @ 12.06 hrs, Volume= 0.128 af, Atten= 5%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.36 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 2.7 min

Peak Storage= 114 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.34 cfs

12.0" Round Pipe
n= 0.011
Length= 270.0' Slope= 0.0063 '/'
Inlet Invert= 216.70', Outlet Invert= 215.00'



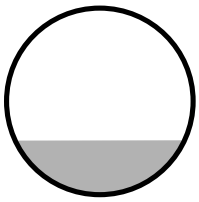
Summary for Reach R2: 12" PIPE

Inflow Area = 0.250 ac,100.00% Impervious, Inflow Depth > 3.69" for 10-Year event
Inflow = 1.11 cfs @ 12.03 hrs, Volume= 0.077 af
Outflow = 1.10 cfs @ 12.04 hrs, Volume= 0.077 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.86 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.18 fps, Avg. Travel Time= 0.7 min

Peak Storage= 17 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.05 cfs

12.0" Round Pipe
n= 0.011
Length= 91.0' Slope= 0.0207 '/'
Inlet Invert= 216.88', Outlet Invert= 215.00'



Summary for Pond 5P: Pond

Inflow Area = 0.893 ac, 74.79% Impervious, Inflow Depth > 3.25" for 10-Year event
Inflow = 3.18 cfs @ 12.06 hrs, Volume= 0.242 af
Outflow = 0.75 cfs @ 12.47 hrs, Volume= 0.233 af, Atten= 76%, Lag= 24.6 min
Primary = 0.34 cfs @ 12.47 hrs, Volume= 0.197 af
Secondary = 0.41 cfs @ 12.47 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.56' @ 12.47 hrs Surf.Area= 3,048 sf Storage= 4,258 cf

Plug-Flow detention time= 110.9 min calculated for 0.233 af (96% of inflow)
Center-of-Mass det. time= 95.6 min (840.4 - 744.8)

Volume	Invert	Avail.Storage	Storage Description
#1	212.50'	9,433 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
212.50	1,174	0	0
213.00	1,564	685	685
214.00	2,471	2,018	2,702
215.00	3,495	2,983	5,685
216.00	4,000	3,748	9,433

Device	Routing	Invert	Outlet Devices
#1	Primary	212.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.50' / 212.00' S= 0.0100 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Device 1	212.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	214.00'	**6.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.80' S= 0.0040 '/' Cc= 0.900 n= 0.011, Flow Area= 0.20 sf
#4	Device 1	214.55'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.34 cfs @ 12.47 hrs HW=214.56' (Free Discharge)
└─**1=Culvert** (Passes 0.34 cfs of 3.73 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.33 cfs @ 6.70 fps)
  └─**4=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.36 fps)

Secondary OutFlow Max=0.41 cfs @ 12.47 hrs HW=214.56' (Free Discharge)
└─**3=Culvert** (Barrel Controls 0.41 cfs @ 2.32 fps)

Summary for Link SP1: Study Point #1

Inflow Area = 1.425 ac, 46.88% Impervious, Inflow Depth > 2.37" for 10-Year event
Inflow = 1.22 cfs @ 12.25 hrs, Volume= 0.281 af
Primary = 1.22 cfs @ 12.25 hrs, Volume= 0.281 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP2: Study Point #2

Inflow Area = 0.403 ac, 0.00% Impervious, Inflow Depth > 2.95" for 10-Year event
Inflow = 1.03 cfs @ 12.27 hrs, Volume= 0.099 af
Primary = 1.03 cfs @ 12.27 hrs, Volume= 0.099 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP3: Study Point #3

Inflow Area = 0.155 ac, 40.78% Impervious, Inflow Depth > 2.65" for 10-Year event
Inflow = 0.55 cfs @ 12.04 hrs, Volume= 0.034 af
Primary = 0.55 cfs @ 12.04 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment 4S: Woods/Pond Runoff Area=9,812 sf 0.00% Impervious Runoff Depth>2.77"
Flow Length=83' Tc=9.9 min CN=79 Runoff=0.68 cfs 0.052 af

Subcatchment S1: Woods Runoff Area=23,173 sf 0.00% Impervious Runoff Depth>2.68"
Flow Length=149' Tc=17.7 min CN=78 Runoff=1.27 cfs 0.119 af

Subcatchment S2: Woods/Grass Runoff Area=17,560 sf 0.00% Impervious Runoff Depth>2.68"
Flow Length=184' Tc=16.9 min CN=78 Runoff=0.98 cfs 0.090 af

Subcatchment S3: Grass/Pavement Runoff Area=6,736 sf 40.78% Impervious Runoff Depth>3.54"
Flow Length=69' Tc=2.1 min CN=87 Runoff=0.73 cfs 0.046 af

Subcatchment S5: Parking/Roof Runoff Area=18,231 sf 100.00% Impervious Runoff Depth>4.60"
Flow Length=120' Slope=0.0150 '/' Tc=1.7 min CN=98 Runoff=2.31 cfs 0.160 af

Subcatchment S6: Parking Runoff Area=10,875 sf 100.00% Impervious Runoff Depth>4.60"
Flow Length=168' Tc=2.1 min CN=98 Runoff=1.38 cfs 0.096 af

Reach R1: 12" PIPE Avg. Flow Depth=0.61' Max Vel=4.58 fps Inflow=2.31 cfs 0.160 af
12.0" Round Pipe n=0.011 L=270.0' S=0.0063 '/' Capacity=3.34 cfs Outflow=2.19 cfs 0.160 af

Reach R2: 12" PIPE Avg. Flow Depth=0.33' Max Vel=6.23 fps Inflow=1.38 cfs 0.096 af
12.0" Round Pipe n=0.011 L=91.0' S=0.0207 '/' Capacity=6.05 cfs Outflow=1.37 cfs 0.096 af

Pond 5P: Pond Peak Elev=214.77' Storage=4,922 cf Inflow=4.02 cfs 0.308 af
Primary=1.03 cfs 0.240 af Secondary=0.50 cfs 0.054 af Outflow=1.53 cfs 0.294 af

Link SP1: Study Point #1 Inflow=2.26 cfs 0.359 af
Primary=2.26 cfs 0.359 af

Link SP2: Study Point #2 Inflow=1.47 cfs 0.144 af
Primary=1.47 cfs 0.144 af

Link SP3: Study Point #3 Inflow=0.73 cfs 0.046 af
Primary=0.73 cfs 0.046 af

Total Runoff Area = 1.983 ac Runoff Volume = 0.563 af Average Runoff Depth = 3.40"
63.13% Pervious = 1.252 ac 36.87% Impervious = 0.731 ac

Summary for Subcatchment 4S: Woods/Pond

Runoff = 0.68 cfs @ 12.14 hrs, Volume= 0.052 af, Depth> 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
3,208	77	Woods, Good, HSG D
6,604	80	>75% Grass cover, Good, HSG D
9,812	79	Weighted Average
9,812		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	53	0.0472	0.09		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
0.1	30	0.2500	3.50		**Shallow Concentrated Flow, B-C SHALLOW** Short Grass Pasture Kv= 7.0 fps
9.9	83	Total			

Summary for Subcatchment S1: Woods

Runoff = 1.27 cfs @ 12.25 hrs, Volume= 0.119 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
12,434	77	Woods, Good, HSG D
10,739	80	>75% Grass cover, Good, HSG D
23,173	78	Weighted Average
23,173		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0425	0.10		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
0.7	49	0.0600	1.22		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
17.7	149	Total			

Summary for Subcatchment S2: Woods/Grass

Runoff = 0.98 cfs @ 12.24 hrs, Volume= 0.090 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
9,129	77	Woods, Good, HSG D
8,431	80	>75% Grass cover, Good, HSG D
17,560	78	Weighted Average
17,560		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0600	0.11		**Sheet Flow, A-B SHEET** Woods: Light underbrush n= 0.400 P2= 2.80"
2.1	84	0.0178	0.67		**Shallow Concentrated Flow, B-C SHALLOW** Woodland Kv= 5.0 fps
16.9	184	Total			

Summary for Subcatchment S3: Grass/Pavement

Runoff = 0.73 cfs @ 12.04 hrs, Volume= 0.046 af, Depth> 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
3,989	80	>75% Grass cover, Good, HSG D
2,747	98	Unconnected pavement, HSG D
6,736	87	Weighted Average
3,989		59.22% Pervious Area
2,747		40.78% Impervious Area
2,747		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	28	0.2500	0.23		**Sheet Flow, A-B SHEET** Grass: Dense n= 0.240 P2= 2.80"
0.1	41	0.1000	4.74		**Shallow Concentrated Flow, B-C SHALLOW** Grassed Waterway Kv= 15.0 fps
2.1	69	Total			

Summary for Subcatchment S5: Parking/Roof

Runoff = 2.31 cfs @ 12.03 hrs, Volume= 0.160 af, Depth> 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
9,100	98	Roofs, HSG D
9,131	98	Paved parking, HSG D
18,231	98	Weighted Average
18,231		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.0150	1.19		**Sheet Flow, A-B SHEET** Smooth surfaces n= 0.011 P2= 2.80"

Summary for Subcatchment S6: Parking

Runoff = 1.38 cfs @ 12.03 hrs, Volume= 0.096 af, Depth> 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.20"

Area (sf)	CN	Description
10,875	98	Paved parking, HSG D
10,875		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	78	0.0100	0.93		**Sheet Flow, A-B SHEET** Smooth surfaces n= 0.011 P2= 2.80"
0.7	90	0.0120	2.22		**Shallow Concentrated Flow, B-C SHALLOW** Paved Kv= 20.3 fps
2.1	168	Total			

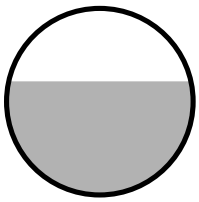
Summary for Reach R1: 12" PIPE

Inflow Area = 0.419 ac,100.00% Impervious, Inflow Depth > 4.60" for 25-Year event
Inflow = 2.31 cfs @ 12.03 hrs, Volume= 0.160 af
Outflow = 2.19 cfs @ 12.05 hrs, Volume= 0.160 af, Atten= 5%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.58 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 2.5 min

Peak Storage= 135 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.34 cfs

12.0" Round Pipe
n= 0.011
Length= 270.0' Slope= 0.0063 '/'
Inlet Invert= 216.70', Outlet Invert= 215.00'



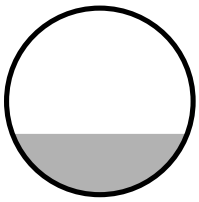
Summary for Reach R2: 12" PIPE

Inflow Area = 0.250 ac,100.00% Impervious, Inflow Depth > 4.60" for 25-Year event
Inflow = 1.38 cfs @ 12.03 hrs, Volume= 0.096 af
Outflow = 1.37 cfs @ 12.04 hrs, Volume= 0.096 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.23 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 0.6 min

Peak Storage= 20 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.05 cfs

12.0" Round Pipe
n= 0.011
Length= 91.0' Slope= 0.0207 '/'
Inlet Invert= 216.88', Outlet Invert= 215.00'



Summary for Pond 5P: Pond

Inflow Area = 0.893 ac, 74.79% Impervious, Inflow Depth > 4.14" for 25-Year event
Inflow = 4.02 cfs @ 12.06 hrs, Volume= 0.308 af
Outflow = 1.53 cfs @ 12.32 hrs, Volume= 0.294 af, Atten= 62%, Lag= 16.0 min
Primary = 1.03 cfs @ 12.32 hrs, Volume= 0.240 af
Secondary = 0.50 cfs @ 12.32 hrs, Volume= 0.054 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.77' @ 12.32 hrs Surf.Area= 3,264 sf Storage= 4,922 cf

Plug-Flow detention time= 101.1 min calculated for 0.293 af (95% of inflow)
Center-of-Mass det. time= 83.7 min (827.1 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1	212.50'	9,433 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
212.50	1,174	0	0
213.00	1,564	685	685
214.00	2,471	2,018	2,702
215.00	3,495	2,983	5,685
216.00	4,000	3,748	9,433

Device	Routing	Invert	Outlet Devices
#1	Primary	212.50'	**12.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.50' / 212.00' S= 0.0100 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Device 1	212.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	214.00'	**6.0" Round Culvert** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.80' S= 0.0040 '/' Cc= 0.900 n= 0.011, Flow Area= 0.20 sf
#4	Device 1	214.55'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.02 cfs @ 12.32 hrs HW=214.77' (Free Discharge)
└─**1=Culvert** (Passes 1.02 cfs of 3.97 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.35 cfs @ 7.06 fps)
  └─**4=Orifice/Grate** (Orifice Controls 0.67 cfs @ 1.51 fps)

Secondary OutFlow Max=0.50 cfs @ 12.32 hrs HW=214.77' (Free Discharge)
└─**3=Culvert** (Barrel Controls 0.50 cfs @ 2.54 fps)

Summary for Link SP1: Study Point #1

Inflow Area = 1.425 ac, 46.88% Impervious, Inflow Depth > 3.02" for 25-Year event
Inflow = 2.26 cfs @ 12.27 hrs, Volume= 0.359 af
Primary = 2.26 cfs @ 12.27 hrs, Volume= 0.359 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP2: Study Point #2

Inflow Area = 0.403 ac, 0.00% Impervious, Inflow Depth > 4.29" for 25-Year event
Inflow = 1.47 cfs @ 12.24 hrs, Volume= 0.144 af
Primary = 1.47 cfs @ 12.24 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link SP3: Study Point #3

Inflow Area = 0.155 ac, 40.78% Impervious, Inflow Depth > 3.54" for 25-Year event
Inflow = 0.73 cfs @ 12.04 hrs, Volume= 0.046 af
Primary = 0.73 cfs @ 12.04 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

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