H B H
CONSULTING
ENGINEERS

501 E First Street
Newberg, Oregon 97132
Ph. 503-554-9553 | Fax 503-537-9554

STORMWATER MEMORANDUM

Date: **October 2, 2018**
To: **To Whom It May Concern**
From: **Andrey Chernishov, PE**
RE: **Project Narrative**

Project Number: **2018-011**

Overview

The proposed project is an apartment complex located at 1109 S River St, Newberg, OR 97132 and has an area of 2.15 acres. The existing site area is over 85% pervious and drains to a stream that passes through the northwest corner of the property and is a tributary of Chahalem creek. The proposed project reduces the pervious area of the site to approximately 50%. To treat and detain the increased runoff due to the added impervious area, an extended dry basin stormwater facility will be added to the southwest corner of the property. Under the proposed conditions peak runoff to the stream is reduced by approximately 40% as a result of the detention provided by the extended dry basin.

Existing Conditions

Per USDA NRCS WSS records, the soils underlying the project site are over 90% aloha silt loam and similar soils in hydrologic soil group C/D. Based on a survey and site visits, the existing site is primarily grass and forest with smaller areas of gravel and imperious surface, as shown in Table 1 below. These conditions correspond to a weighted CN of 81 for the entire pre-development area of 93,510. Based on geotechnical soil samples the site has negligible soil infiltration. The entire existing site drains to a stream that is a tributary of Chahalem creek at the northwest corner of the property.

Table 1 – Pre-Development Area (excluding area in the Public ROW)

Surface	CN	Area (SF)	% of Total Area
Grass	79	48299	52%
Forrest	77	30343	32%
Gravel	96	4000	4%
Concrete	98	10868	12%
Total Pervious Surface	79 (weighted average)	82642	88%
Total Impervious Surface	98 (weighted average)	10868	12%

Total	81 (weighted average)	93510	100%

Proposed Conditions

The proposed improvements will significantly reduce the pervious areas and increase the impervious areas onsite such that it is approximately 50% pervious and 50% impervious. Runoff from approximately two thirds of the site drains to the storm catch basin in the parking lot and is then piped to the stormwater facility for detention and treatment. The stormwater facility drains to a flow control manhole then outfalls into the stream basin, as this area currently does. Runoff from the remaining pervious third of the site drains directly to the stream. The areas draining to the stormwater facility and directly to the stream are listed in Table 2 below. These conditions correspond to a weighted CN of 88 for the site. Fill will retain the same soil characteristics as what is currently on site. There is 3,807 SF of work taking place in the Public ROW, 2,707 SF of which is impervious asphalt and concrete.

Table 2 – Post-Development Area (excluding area in the Public ROW)

Surface	CN	Area (SF)	% of Total Area
Areas draining to Stormwater Facility			
Extended Dry Basin	100	4000	4%
Parking Lot	98	23184	25%
Buildings	98	15476	17%
Sidewalk	98	2020	2%
Grass	79	12502	13%
Subtotal	94 (weighted average)	57182	61%
Areas draining directly to stream			
Grass	79	5985	6%
Forrest	77	30343	32%
Subtotal	77 (weighted average)	36328	39%
Total Pervious Surface	78 (weighted average)	48830	52%
Total Impervious Surface	98 (weighted average)	44680	48%
Total	88 (weighted average)	93510	100%

Hydrology

Analysis was performed using the HydroCAD software (inputs and outputs are attached). Subcatchment flows are summarized in Tables 3-5. As shown in Table 3 below, there will be a decrease in peak runoff rates of 0.01 – 0.27 cfs depending on the storm event as a result of this development. This reduction in runoff is due to the addition of the extended dry basin stormwater facility.

Table 3 – Runoff Summary

Development Condition	½ of 2 Year Storm (cfs)	2 Year Storm (cfs)	10 Year Storm (cfs)	25 Year Storm (cfs)
Pre-Development	0.05	0.31	0.62	0.79
Post-Development	0.04	0.19	0.4	0.52

Design Methodology

The Santa Barbara Urban Hydrograph (SBUH) Method was used to analyze stormwater runoff from the area of the site outside of the Public Right-of-Way. This method utilizes the SCS Type 1A 24-hour design storm. HydroCAD 10 computer software was used in the analysis. The HydroCAD model incorporates the Extended Dry Basin into the overall site stormwater system.

The HydroCAD model utilized the 24-hour storm rainfall intensities listed in the City of Newberg Design Standards, shown in Table 4 below:

Table 4 – Storm Event Rainfall Intensities

Recurrence Interval (years)	Total Precipitation Depth (inches)
½ of 2	1.25
2	2.5
10	3.5
25	4.0

Stormwater quality/quantity facilities to treat the area of the site within the Public Right-of-Way were sized using the City of Newberg Low Impact Development Approach (LIDA) Sizing Form (See appendix A).

Water Quantity Treatment

The City of Newberg requires that stormwater runoff be detained onsite such that post-development runoff rates do not exceed pre-development runoff rates from the site, based on 24-hour storm events ranging from the ½ of the 2-year return storm to the 25-year return storm. Stormwater quantity treatment for area outside the Public ROW is provided by an extended dry basin which is approved by the City of Newberg for water quality and quantity treatment. As shown in Table 3, post-development stormwater runoff rates in all storm events is less than pre-development rates, as per code requirements. Stormwater quantity treatment for the area in the Public ROW is provided by a public stormwater flow through planter. Flow through planters are an approved LIDA facility by the City of Newberg for stormwater quality and quantity treatment.

Water Quality Treatment

The City of Newberg requires that owners of new development which create new impervious surfaces or increase the amount of stormwater runoff or pollution leaving the site construct permanent water quality facilities to reduce contaminants entering the storm and surface water system.

The stormwater facility selected, an extended dry basin, is approved by the City of Newberg to treat water quality as well as quantity. The facility collects and holds stormwater runoff, allowing pollutants to filter out and settle into the vegetated bottom of the basin.

The extended dry basin was selected because a LIDA facility/Regional facility is the highest option in the City of Newberg water quality/quantity facility selection hierarchy (Newberg Design Standards section

4.6.8), and per Newberg standard drawing 450 an Extended Dry Basin is most appropriate Regional Facility for the site area.

Stormwater quality treatment for area in the Public ROW is provided by a public stormwater flow through planter. Flow through planters are an approved LIDA facility by the City of Newberg for stormwater quality and quantity treatment.

Conclusion

The proposed development complies with the City of Newberg requirements for stormwater quality and quantity treatment. An extended dry basin stormwater facility is proposed to provide water quality and quantity treatment for area outside the Public ROW, and a public stormwater flow through planter is proposed to treat area in the Public ROW. Post-development peak stormwater runoff is reduced from pre-development, despite a 36% increase in impervious site area.

City of Newberg LIDA Sizing Form

(Include this form with plan submittal)

Project Title: Flats @ Rogers Landing

Project Address: 1109 S River St, Newberg, OR 97132

Project Taxlot/ Taxmap#: 5400

Project Location: 1109 S River St, Newberg, Or 97132

Contact Name/Title/Company: Zack Hartman, Project Designer, HBH Consulting Engineers

Phone/e-mail: 503-554-9553 / zhartman@hbh-consulting.com

STEP 1: Determine Impervious Area Requiring Treatment

Total Gross Site Area (acres):	2.15	Pre. Dev. Impervious Area (ft):	(X)
Proposed Net New Impervious Area (ft): (PA)= (Y) - (X)	2,707 (PA)	Post Dev. Impervious Area (ft):	2,707 (Y)

STEP 2: Deduct Impervious Area LIDA Credits

Porous Pavement (sq. ft.):	0 (P)
Green Roof (sq. ft):	0 (G)
Other Credits as approved (sq. ft.):	0 (O)
Total Credits (sq. ft.): (C)= (P)+(G)+(O)	0 (C)
Impervious Area Requiring Treatment (sq. ft.): (IA)= (PA) - (C)	2,707 (IA)

STEP 3: Size LIDA Facilities for Remaining Impervious Area

	Impervious Area Treated (sq. ft.)	SF, Sizing Factor	LIDA Facility Size (sq. ft.)
Infiltration Planters/ Rain Garden		0.045	
Flow-through Planter		0.060	
Public Flow-through Planter	2,707	0.060	162

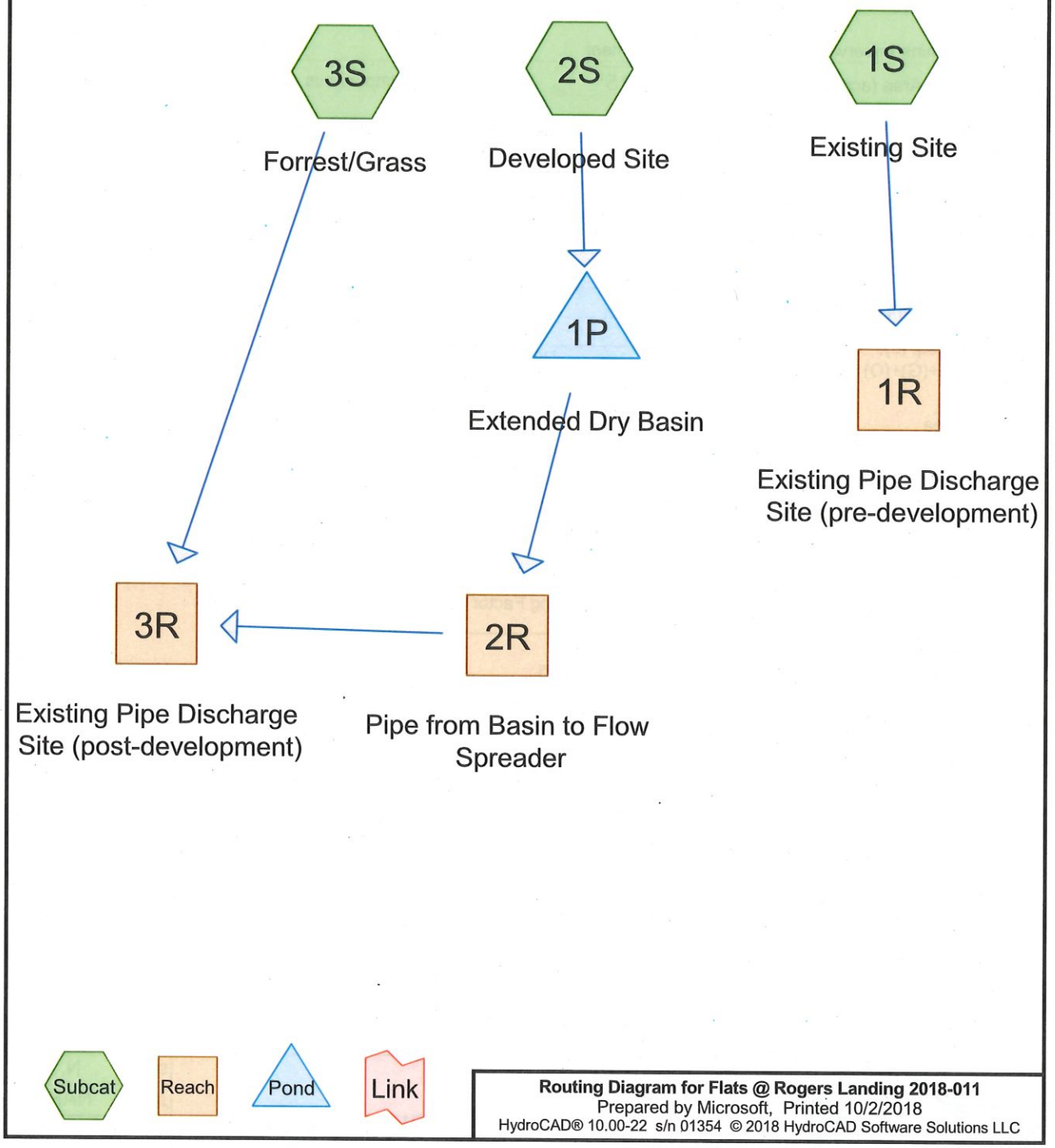
Total Impervious Area Treated (sq. ft.): 2,707 MUST BE EQUAL TO (IA)

City of Newberg
PUBLIC WORKS ENGINEERING DIVISION
414 E. FIRST STREET NEWBERG, OR 97132
PHONE: 503-537-1240
FAX: 503-537-1277

REVISIONS:

LIDA SIZING FORM

SCALE: N.T.S.
DATE: MARCH 2014
APPROVED BY: JAY H.
STANDARD DRAWING 451



Routing Diagram for Flats @ Rogers Landing 2018-011
Prepared by Microsoft, Printed 10/2/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
66,786	79	50-75% Grass cover, Fair, HSG C (1S, 2S, 3S)
4,000	100	Extended Dry Basin (2S)
4,000	96	Gravel surface, HSG C (1S)
2,020	98	Pave sidewalk, HSG C (2S)
34,052	98	Paved parking, HSG C (1S, 2S)
15,476	98	Roofs, HSG C (2S)
60,686	77	Woods, Poor, HSG C (1S, 3S)
187,020	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
183,020	HSG C	1S, 2S, 3S
0	HSG D	
4,000	Other	2S
187,020		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	0	66,786	0	0	66,786	50-75% Grass cover, Fair	
0	0	0	0	4,000	4,000	Extended Dry Basin	
0	0	4,000	0	0	4,000	Gravel surface	
0	0	2,020	0	0	2,020	Pave sidewalk	
0	0	34,052	0	0	34,052	Paved parking	
0	0	15,476	0	0	15,476	Roofs	
0	0	60,686	0	0	60,686	Woods, Poor	
0	**0**	**183,020**	**0**	**4,000**	**187,020**	**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	1R	424.00	422.00	100.0	0.0200	0.020	12.0	0.0	0.0
2	2R	154.00	124.00	176.0	0.1705	0.010	12.0	0.0	0.0
3	3R	124.00	122.00	100.0	0.0200	0.020	12.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=93,510 sf 11.62% Impervious Runoff Depth=0.26"
Flow Length=540' Tc=27.1 min CN=79/98 Runoff=0.05 cfs 1,989 cf

Subcatchment 2S: Developed Site Runoff Area=57,182 sf 78.14% Impervious Runoff Depth=0.84"
Tc=10.0 min CN=79/98 Runoff=0.26 cfs 4,011 cf

Subcatchment 3S: Forrest/Grass Runoff Area=36,328 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=300' Tc=12.3 min CN=77/0 Runoff=0.01 cfs 354 cf

Reach 1R: Existing Pipe Discharge Site Avg. Flow Depth=0.09' Max Vel=1.52 fps Inflow=0.05 cfs 1,989 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.05 cfs 1,989 cf

Reach 2R: Pipe from Basin to Flow Avg. Flow Depth=0.03' Max Vel=4.44 fps Inflow=0.03 cfs 2,725 cf
12.0" Round Pipe n=0.010 L=176.0' S=0.1705 '/' Capacity=19.12 cfs Outflow=0.03 cfs 2,724 cf

Reach 3R: Existing Pipe Discharge Site Avg. Flow Depth=0.07' Max Vel=1.39 fps Inflow=0.04 cfs 3,079 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.04 cfs 3,077 cf

Pond 1P: Extended Dry Basin Peak Elev=158.58' Storage=2,363 cf Inflow=0.26 cfs 4,011 cf
Outflow=0.03 cfs 2,725 cf

Total Runoff Area = 187,020 sf Runoff Volume = 6,355 cf Average Runoff Depth = 0.41"
70.30% Pervious = 131,472 sf 29.70% Impervious = 55,548 sf

Summary for Subcatchment 1S: Existing Site

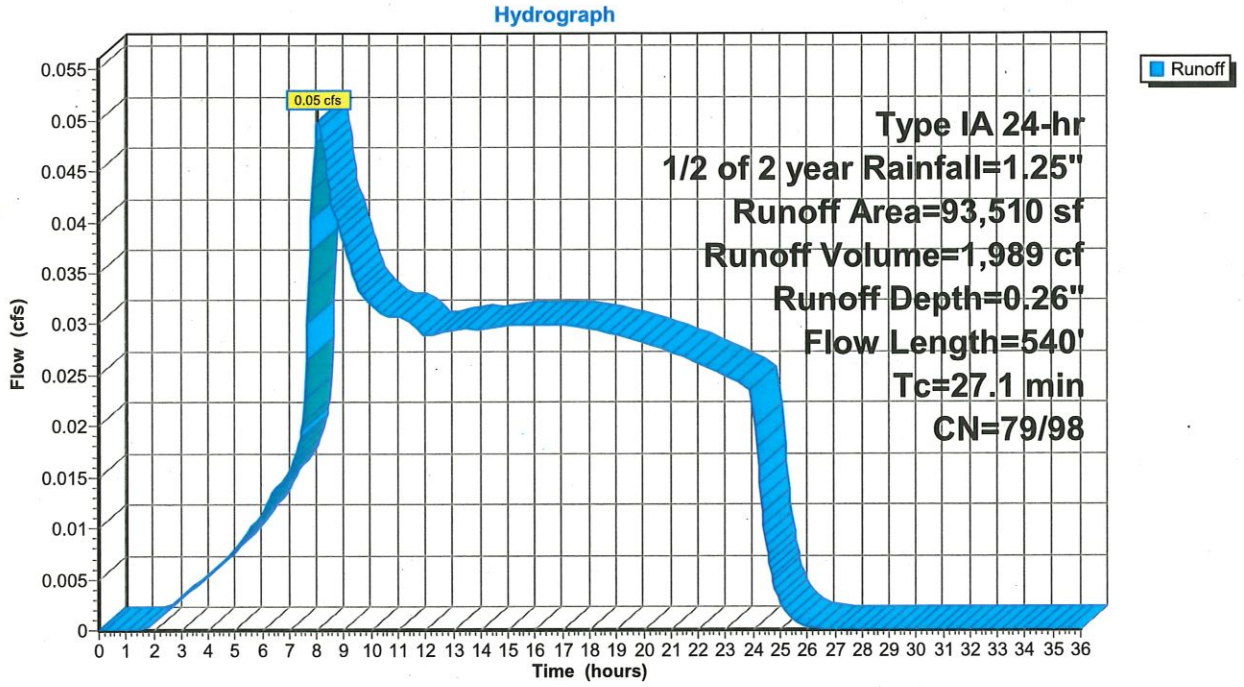
Runoff = 0.05 cfs @ 8.04 hrs, Volume= 1,989 cf, Depth= 0.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.25"

Area (sf)	CN	Description
10,868	98	Paved parking, HSG C
48,299	79	50-75% Grass cover, Fair, HSG C
4,000	96	Gravel surface, HSG C
30,343	77	Woods, Poor, HSG C
93,510	81	Weighted Average
82,642	79	88.38% Pervious Area
10,868	98	11.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	150	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
2.2	150	0.0266	1.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
27.1	540	Total			

Subcatchment 1S: Existing Site



Summary for Subcatchment 2S: Developed Site

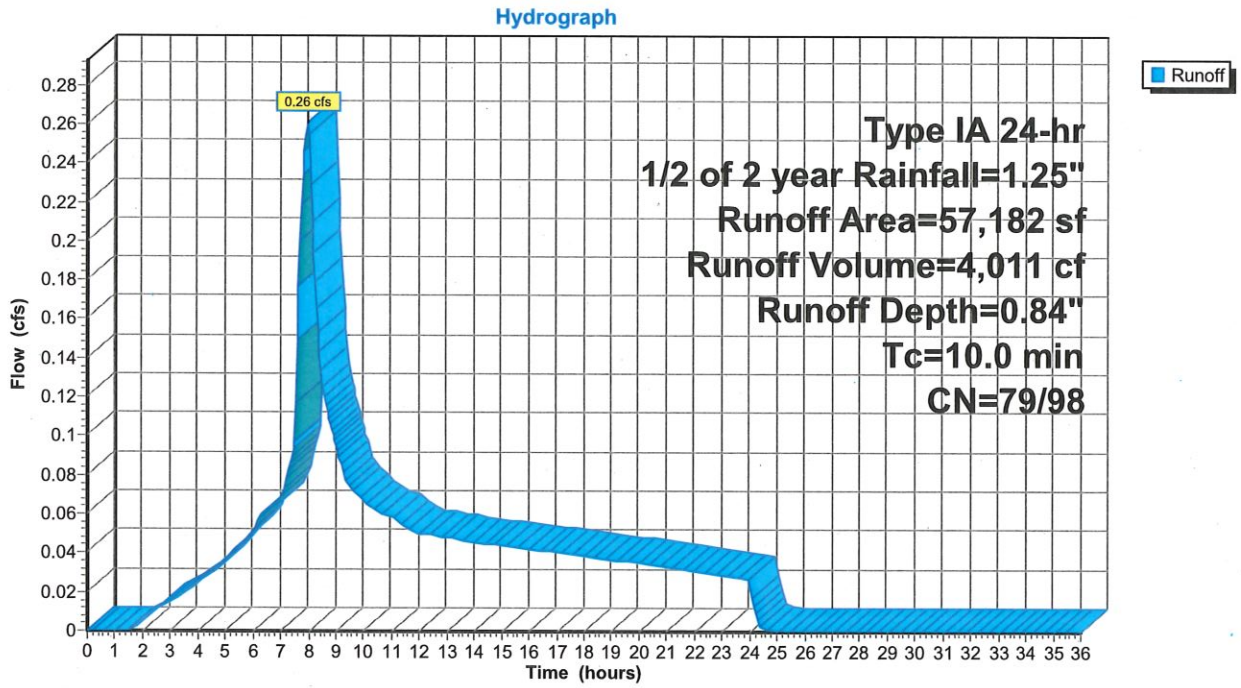
Runoff = 0.26 cfs @ 7.98 hrs, Volume= 4,011 cf, Depth= 0.84"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.25"

	Area (sf)	CN	Description
	12,502	79	50-75% Grass cover, Fair, HSG C
	23,184	98	Paved parking, HSG C
*	2,020	98	Pave sidewalk, HSG C
	15,476	98	Roofs, HSG C
*	4,000	100	Extended Dry Basin
	57,182	94	Weighted Average
	12,502	79	21.86% Pervious Area
	44,680	98	78.14% Impervious Area

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

Subcatchment 2S: Developed Site



Summary for Subcatchment 3S: Forrest/Grass

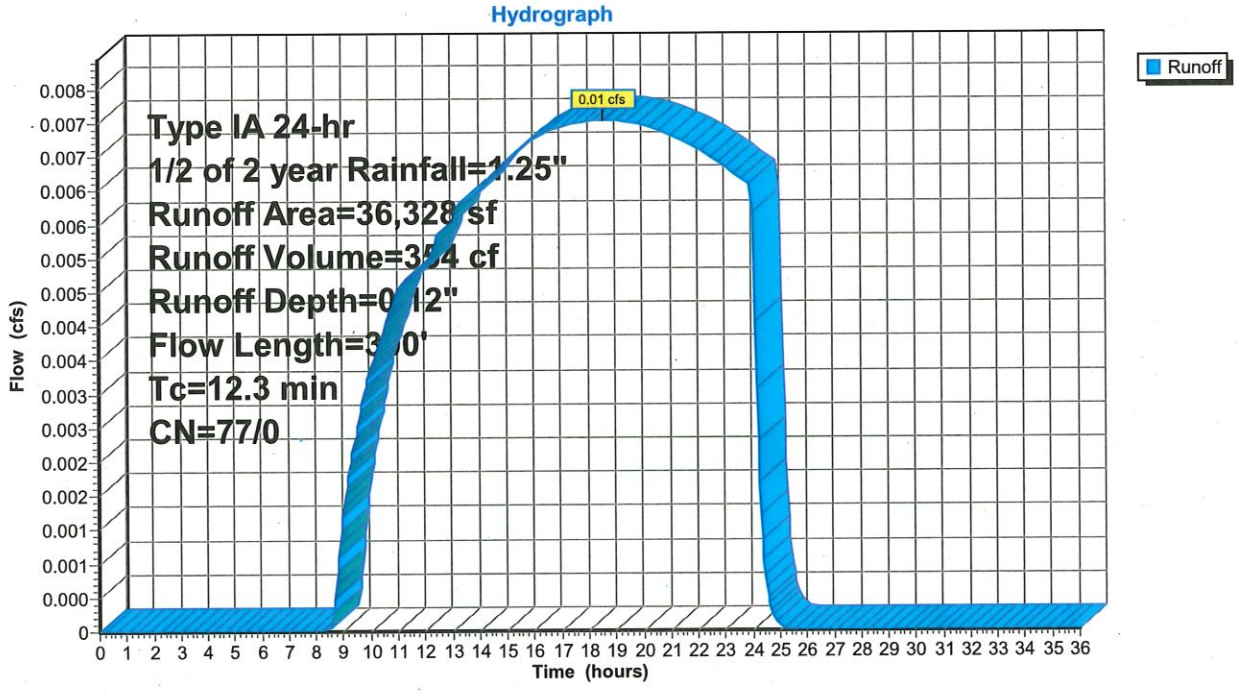
Runoff = 0.01 cfs @ 18.59 hrs, Volume= 354 cf, Depth= 0.12"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.25"

Area (sf)	CN	Description
30,343	77	Woods, Poor, HSG C
5,985	79	50-75% Grass cover, Fair, HSG C
36,328	77	Weighted Average
36,328	77	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	60	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
12.3	300	Total			

Subcatchment 3S: Forrest/Grass



Summary for Reach 1R: Existing Pipe Discharge Site (pre-development)

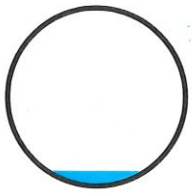
[52] Hint: Inlet/Outlet conditions not evaluated

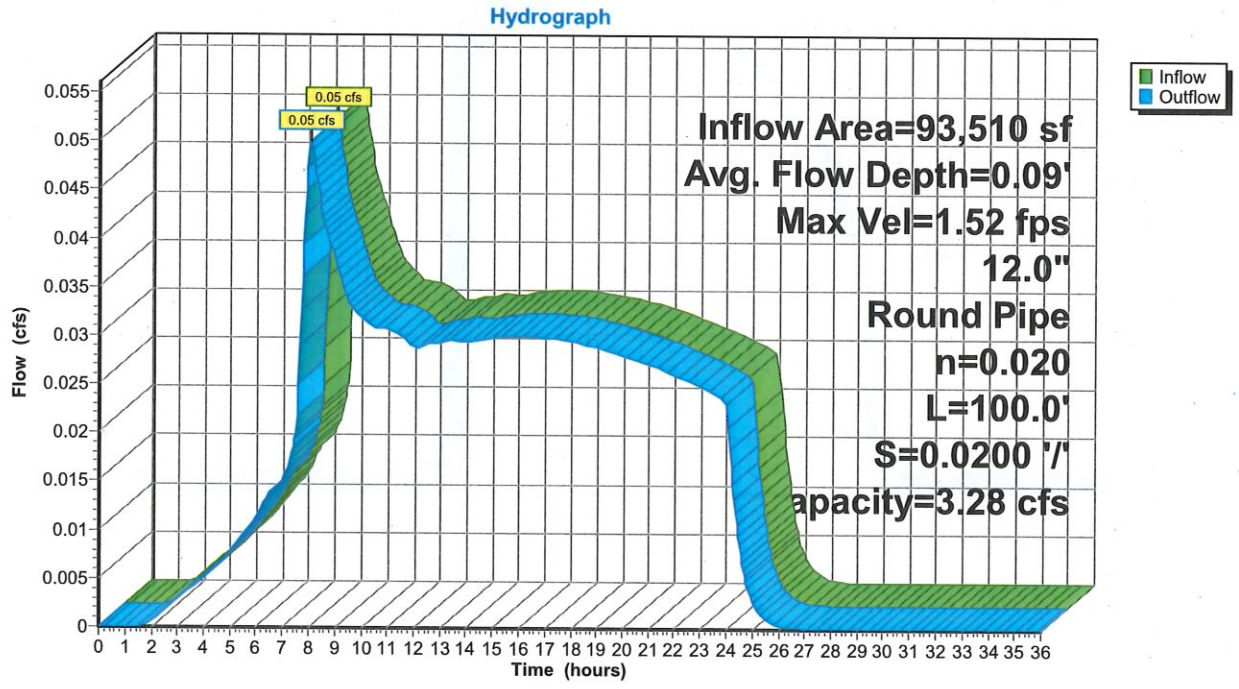
Inflow Area = 93,510 sf, 11.62% Impervious, Inflow Depth = 0.26" for 1/2 of 2 year event
Inflow = 0.05 cfs @ 8.04 hrs, Volume= 1,989 cf
Outflow = 0.05 cfs @ 8.06 hrs, Volume= 1,989 cf, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.52 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 1.5 min

Peak Storage= 3 cf @ 8.06 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 424.00', Outlet Invert= 422.00'





Summary for Reach 2R: Pipe from Basin to Flow Spreader

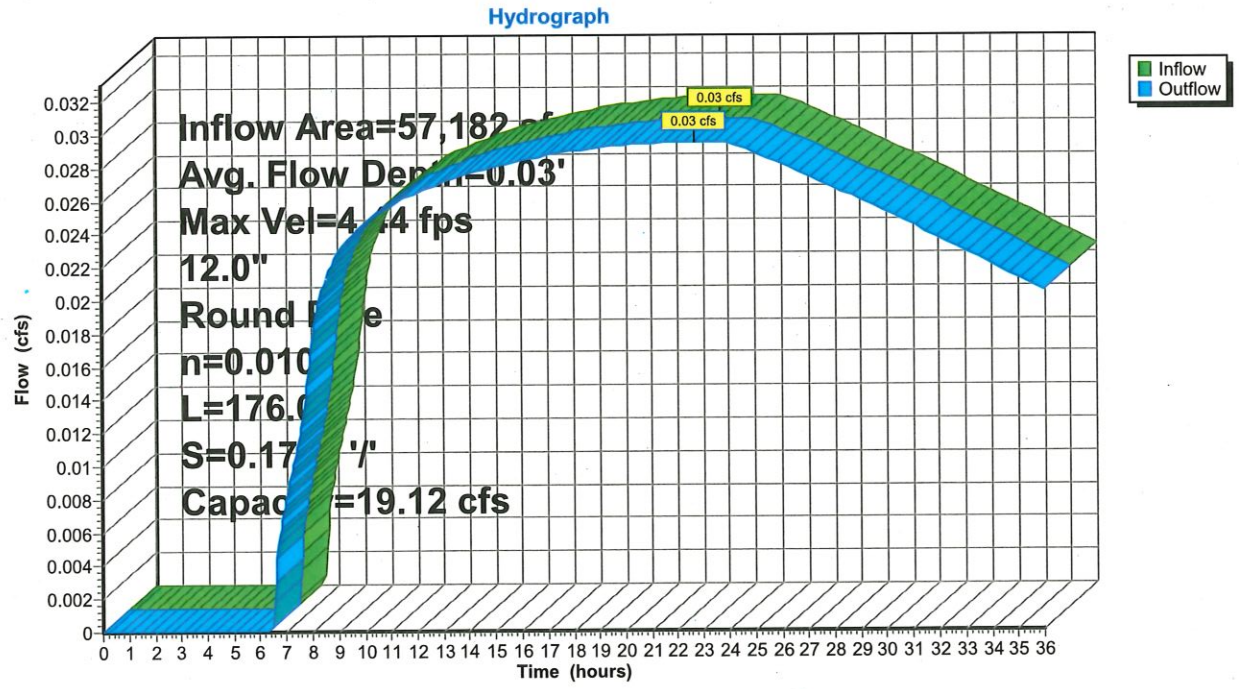
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth > 0.57" for 1/2 of 2 year event
Inflow = 0.03 cfs @ 22.67 hrs, Volume= 2,725 cf
Outflow = 0.03 cfs @ 22.68 hrs, Volume= 2,724 cf, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.44 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 4.26 fps, Avg. Travel Time= 0.7 min

Peak Storage= 1 cf @ 22.68 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 19.12 cfs

12.0" Round Pipe
n= 0.010
Length= 176.0' Slope= 0.1705 '/'
Inlet Invert= 154.00', Outlet Invert= 124.00'



Summary for Reach 3R: Existing Pipe Discharge Site (post-development)

[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 2R OUTLET depth by 0.05' @ 19.40 hrs

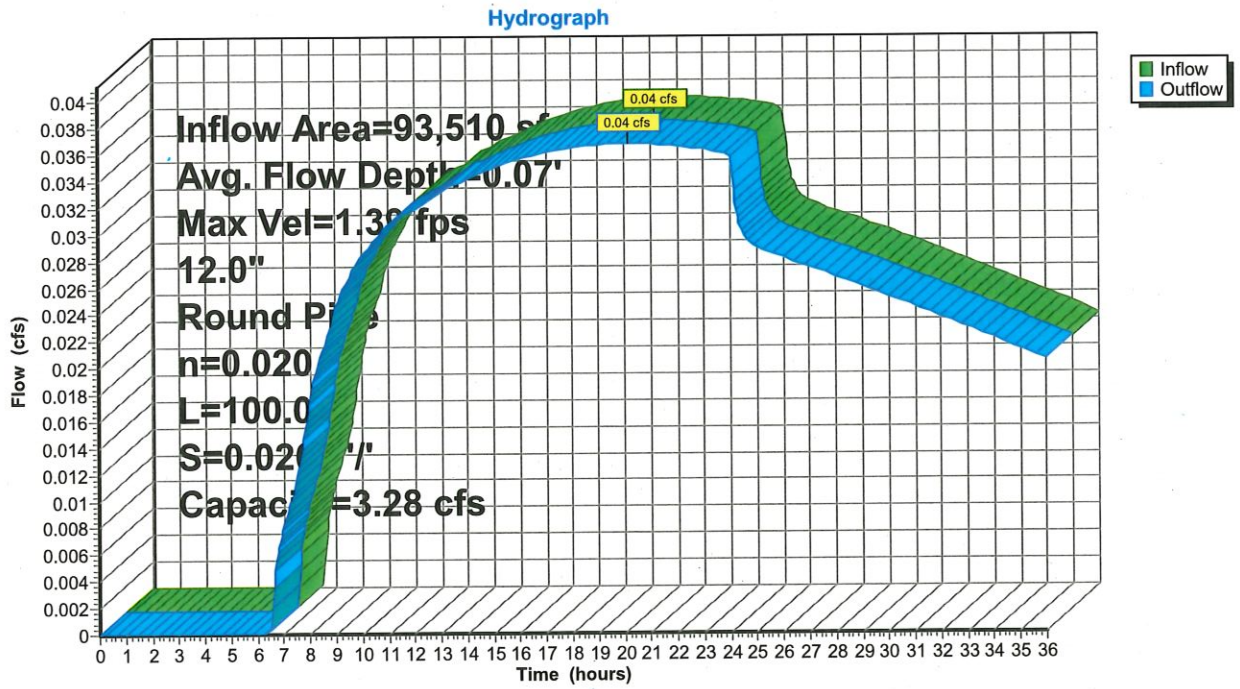
Inflow Area = 93,510 sf, 47.78% Impervious, Inflow Depth > 0.40" for 1/2 of 2 year event
Inflow = 0.04 cfs @ 20.17 hrs, Volume= 3,079 cf
Outflow = 0.04 cfs @ 20.18 hrs, Volume= 3,077 cf, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.39 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 1.3 min

Peak Storage= 3 cf @ 20.18 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 124.00', Outlet Invert= 122.00'

Reach 3R: Existing Pipe Discharge Site (post-development)



Summary for Pond 1P: Extended Dry Basin

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth = 0.84" for 1/2 of 2 year event
Inflow = 0.26 cfs @ 7.98 hrs, Volume= 4,011 cf
Outflow = 0.03 cfs @ 22.67 hrs, Volume= 2,725 cf, Atten= 89%, Lag= 881.3 min
Primary = 0.03 cfs @ 22.67 hrs, Volume= 2,725 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 158.58' @ 22.67 hrs Surf.Area= 1,934 sf Storage= 2,363 cf

Plug-Flow detention time= 764.4 min calculated for 2,725 cf (68% of inflow)
Center-of-Mass det. time= 571.0 min (1,289.6 - 718.6)

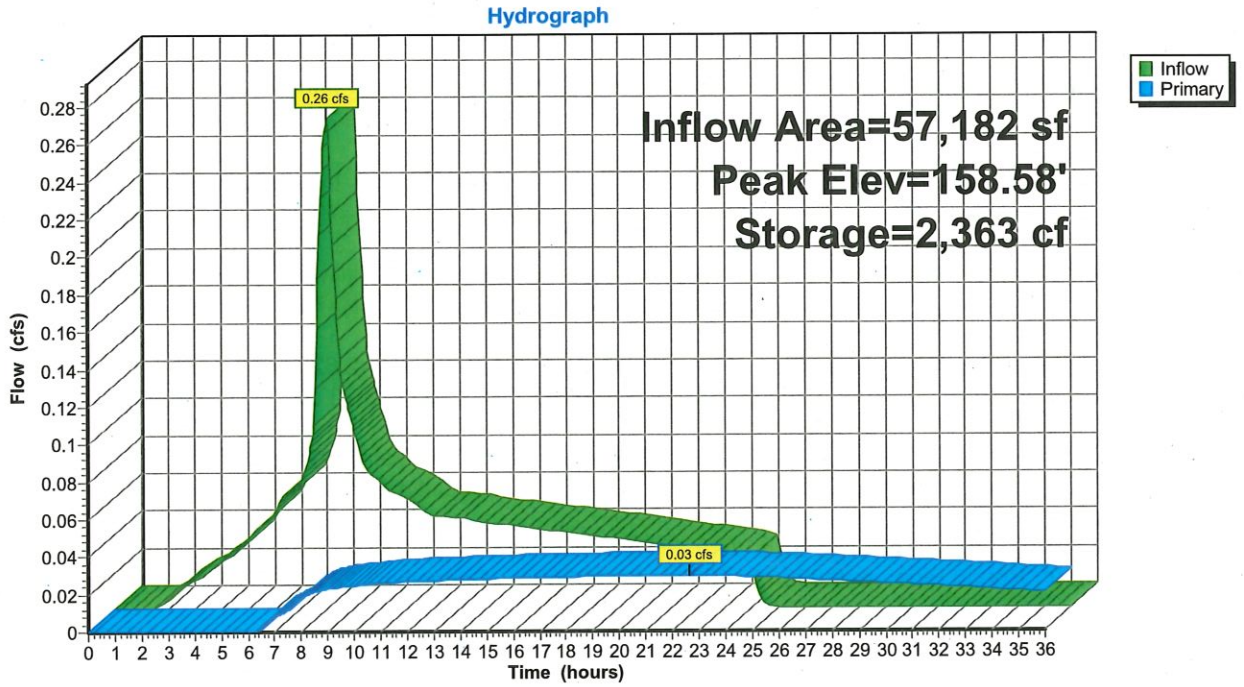
Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	8,923 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
157.00	1,080	0	0
158.00	1,595	1,338	1,338
159.00	2,179	1,887	3,225
160.00	2,832	2,506	5,730
161.00	3,554	3,193	8,923

Device	Routing	Invert	Outlet Devices
#1	Primary	157.40'	**1.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#2	Primary	159.00'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	160.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.03 cfs @ 22.67 hrs HW=158.58' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.41 fps)
- **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Extended Dry Basin



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=93,510 sf 11.62% Impervious Runoff Depth=1.00"
Flow Length=540' Tc=27.1 min CN=79/98 Runoff=0.31 cfs 7,824 cf

Subcatchment 2S: Developed Site Runoff Area=57,182 sf 78.14% Impervious Runoff Depth=1.96"
Tc=10.0 min CN=79/98 Runoff=0.60 cfs 9,327 cf

Subcatchment 3S: Forrest/Grass Runoff Area=36,328 sf 0.00% Impervious Runoff Depth=0.74"
Flow Length=300' Tc=12.3 min CN=77/0 Runoff=0.09 cfs 2,241 cf

Reach 1R: Existing Pipe Discharge Site Avg. Flow Depth=0.21' Max Vel=2.62 fps Inflow=0.31 cfs 7,824 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.31 cfs 7,824 cf

Reach 2R: Pipe from Basin to Flow Avg. Flow Depth=0.06' Max Vel=7.20 fps Inflow=0.14 cfs 7,341 cf
12.0" Round Pipe n=0.010 L=176.0' S=0.1705 '/' Capacity=19.12 cfs Outflow=0.14 cfs 7,340 cf

Reach 3R: Existing Pipe Discharge Site Avg. Flow Depth=0.16' Max Vel=2.26 fps Inflow=0.19 cfs 9,582 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.19 cfs 9,579 cf

Pond 1P: Extended Dry Basin Peak Elev=159.21' Storage=3,696 cf Inflow=0.60 cfs 9,327 cf
Outflow=0.14 cfs 7,341 cf

Total Runoff Area = 187,020 sf Runoff Volume = 19,392 cf Average Runoff Depth = 1.24"
70.30% Pervious = 131,472 sf 29.70% Impervious = 55,548 sf

Summary for Subcatchment 1S: Existing Site

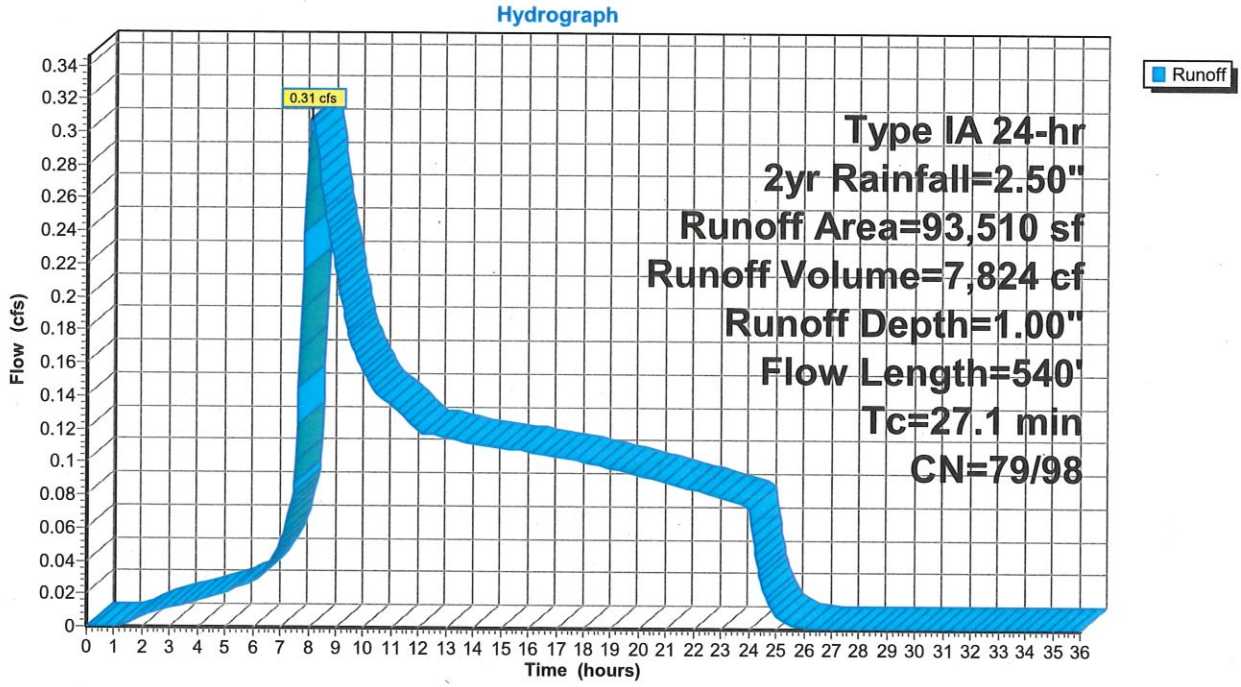
Runoff = 0.31 cfs @ 8.07 hrs, Volume= 7,824 cf, Depth= 1.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2yr Rainfall=2.50"

Area (sf)	CN	Description
10,868	98	Paved parking, HSG C
48,299	79	50-75% Grass cover, Fair, HSG C
4,000	96	Gravel surface, HSG C
30,343	77	Woods, Poor, HSG C
93,510	81	Weighted Average
82,642	79	88.38% Pervious Area
10,868	98	11.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	150	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
2.2	150	0.0266	1.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
27.1	540	Total			

Subcatchment 1S: Existing Site



Summary for Subcatchment 2S: Developed Site

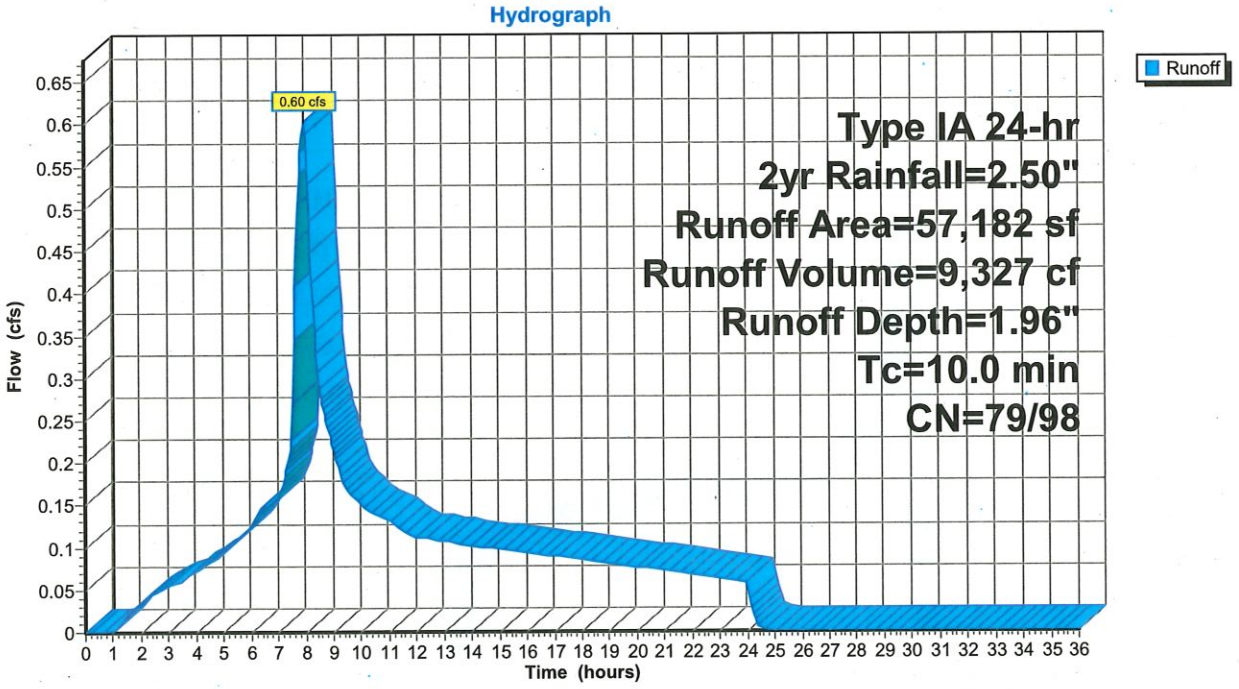
Runoff = 0.60 cfs @ 7.98 hrs, Volume= 9,327 cf, Depth= 1.96"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2yr Rainfall=2.50"

	Area (sf)	CN	Description
	12,502	79	50-75% Grass cover, Fair, HSG C
	23,184	98	Paved parking, HSG C
*	2,020	98	Pave sidewalk, HSG C
	15,476	98	Roofs, HSG C
*	4,000	100	Extended Dry Basin
	57,182	94	Weighted Average
	12,502	79	21.86% Pervious Area
	44,680	98	78.14% Impervious Area

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

Subcatchment 2S: Developed Site



Summary for Subcatchment 3S: Forrest/Grass

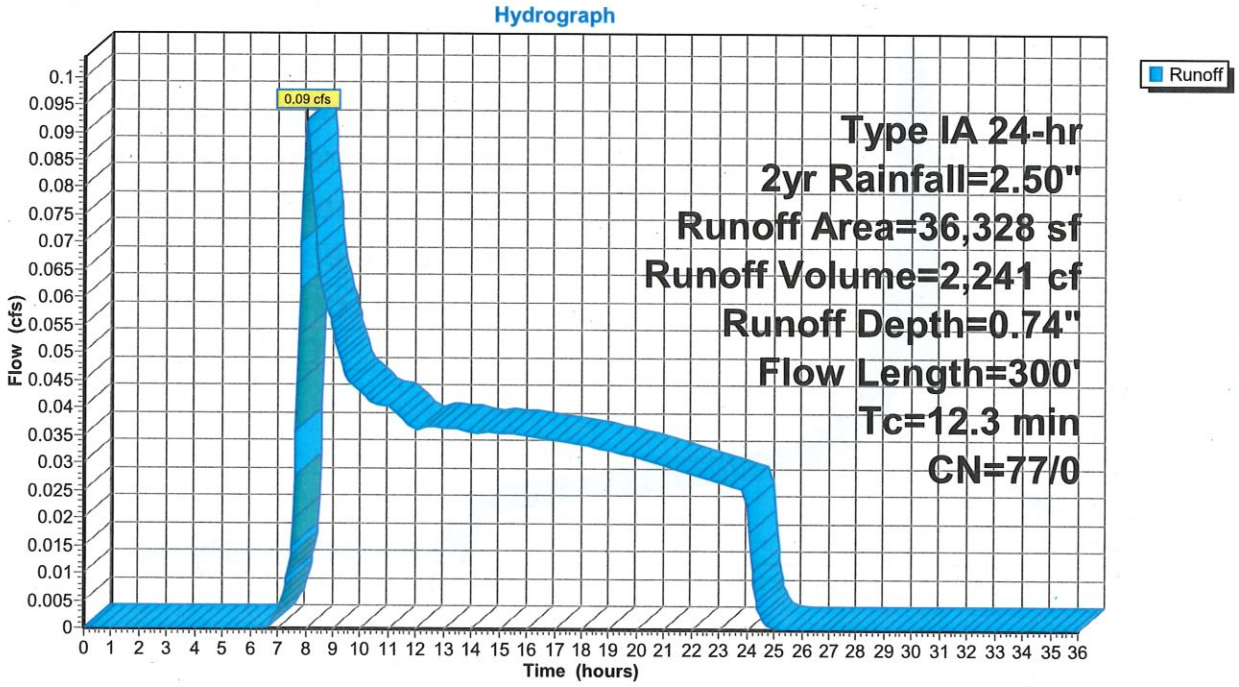
Runoff = 0.09 cfs @ 8.04 hrs, Volume= 2,241 cf, Depth= 0.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2yr Rainfall=2.50"

Area (sf)	CN	Description
30,343	77	Woods, Poor, HSG C
5,985	79	50-75% Grass cover, Fair, HSG C
36,328	77	Weighted Average
36,328	77	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	60	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
12.3	300	Total			

Subcatchment 3S: Forrest/Grass



Summary for Reach 1R: Existing Pipe Discharge Site (pre-development)

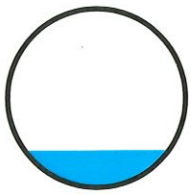
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 93,510 sf, 11.62% Impervious, Inflow Depth = 1.00" for 2yr event
Inflow = 0.31 cfs @ 8.07 hrs, Volume= 7,824 cf
Outflow = 0.31 cfs @ 8.08 hrs, Volume= 7,824 cf, Atten= 0%, Lag= 0.7 min

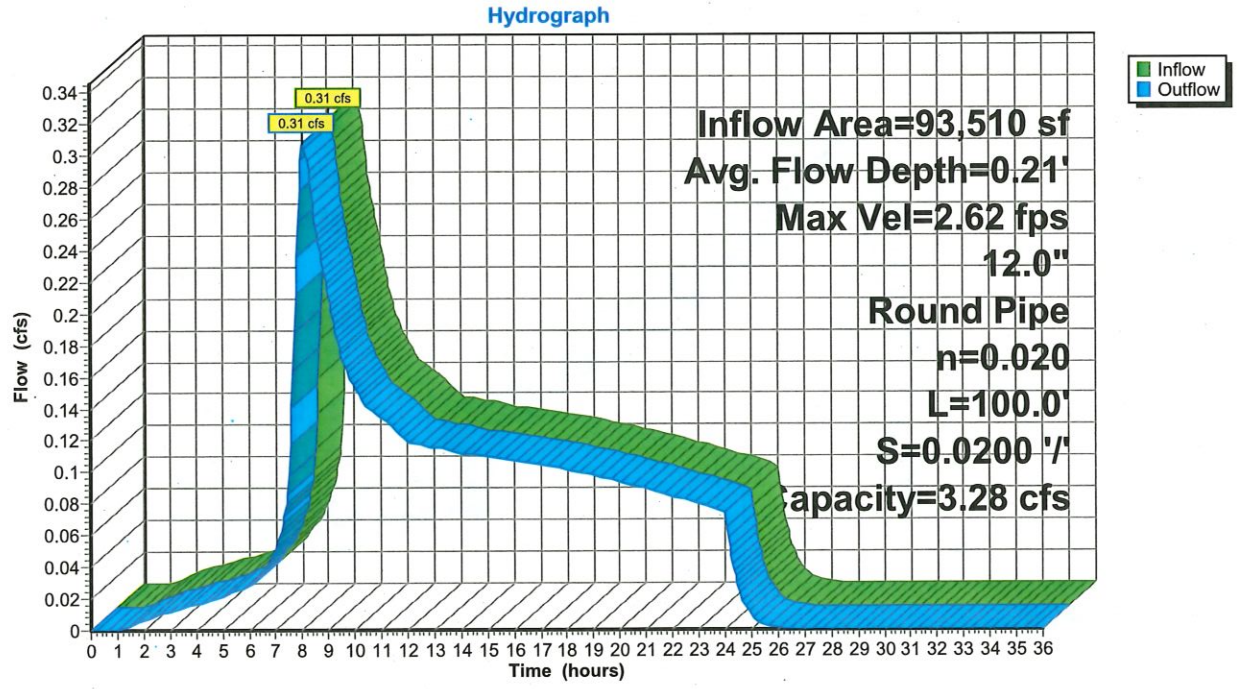
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.58 fps, Avg. Travel Time= 1.1 min

Peak Storage= 12 cf @ 8.08 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 424.00', Outlet Invert= 422.00'



Reach 1R: Existing Pipe Discharge Site (pre-development)



Summary for Reach 2R: Pipe from Basin to Flow Spreader

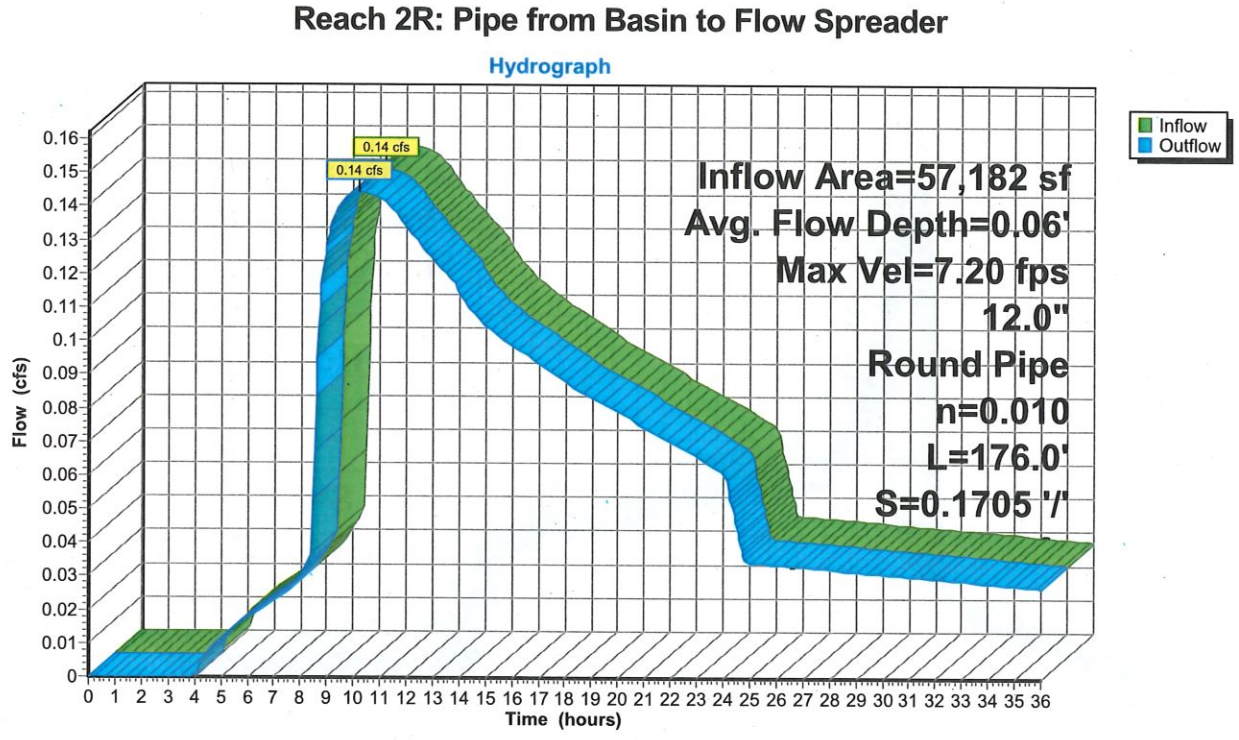
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth > 1.54" for 2yr event
Inflow = 0.14 cfs @ 10.21 hrs, Volume= 7,341 cf
Outflow = 0.14 cfs @ 10.21 hrs, Volume= 7,340 cf, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.20 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 5.35 fps, Avg. Travel Time= 0.5 min

Peak Storage= 4 cf @ 10.21 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 19.12 cfs

12.0" Round Pipe
n= 0.010
Length= 176.0' Slope= 0.1705 '/'
Inlet Invert= 154.00', Outlet Invert= 124.00'



Summary for Reach 3R: Existing Pipe Discharge Site (post-development)

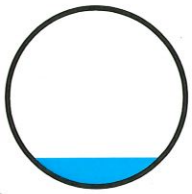
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 2R OUTLET depth by 0.10' @ 8.05 hrs

Inflow Area = 93,510 sf, 47.78% Impervious, Inflow Depth > 1.23" for 2yr event
Inflow = 0.19 cfs @ 9.93 hrs, Volume= 9,582 cf
Outflow = 0.19 cfs @ 9.94 hrs, Volume= 9,579 cf, Atten= 0%, Lag= 0.5 min

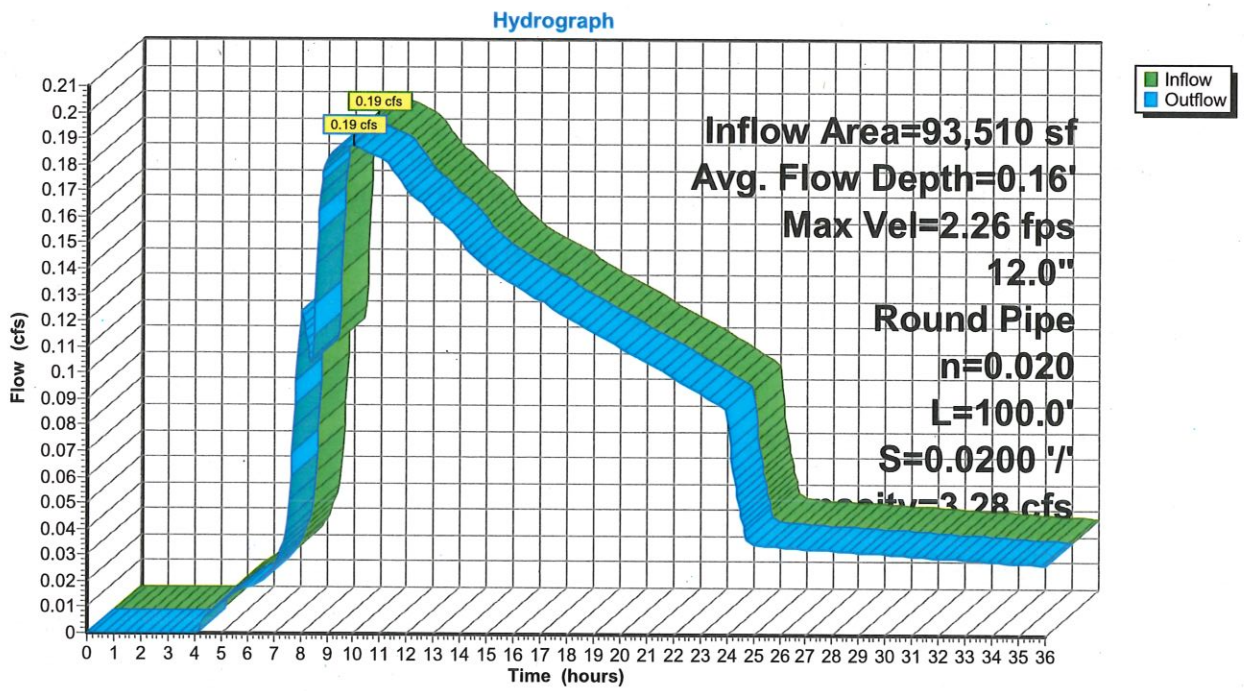
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.26 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 1.0 min

Peak Storage= 8 cf @ 9.94 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 124.00', Outlet Invert= 122.00'



Reach 3R: Existing Pipe Discharge Site (post-development)



Summary for Pond 1P: Extended Dry Basin

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth = 1.96" for 2yr event
Inflow = 0.60 cfs @ 7.98 hrs, Volume= 9,327 cf
Outflow = 0.14 cfs @ 10.21 hrs, Volume= 7,341 cf, Atten= 76%, Lag= 133.5 min
Primary = 0.14 cfs @ 10.21 hrs, Volume= 7,341 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 159.21' @ 10.21 hrs Surf.Area= 2,316 sf Storage= 3,696 cf

Plug-Flow detention time= 494.2 min calculated for 7,341 cf (79% of inflow)
Center-of-Mass det. time= 354.9 min (1,051.1 - 696.2)

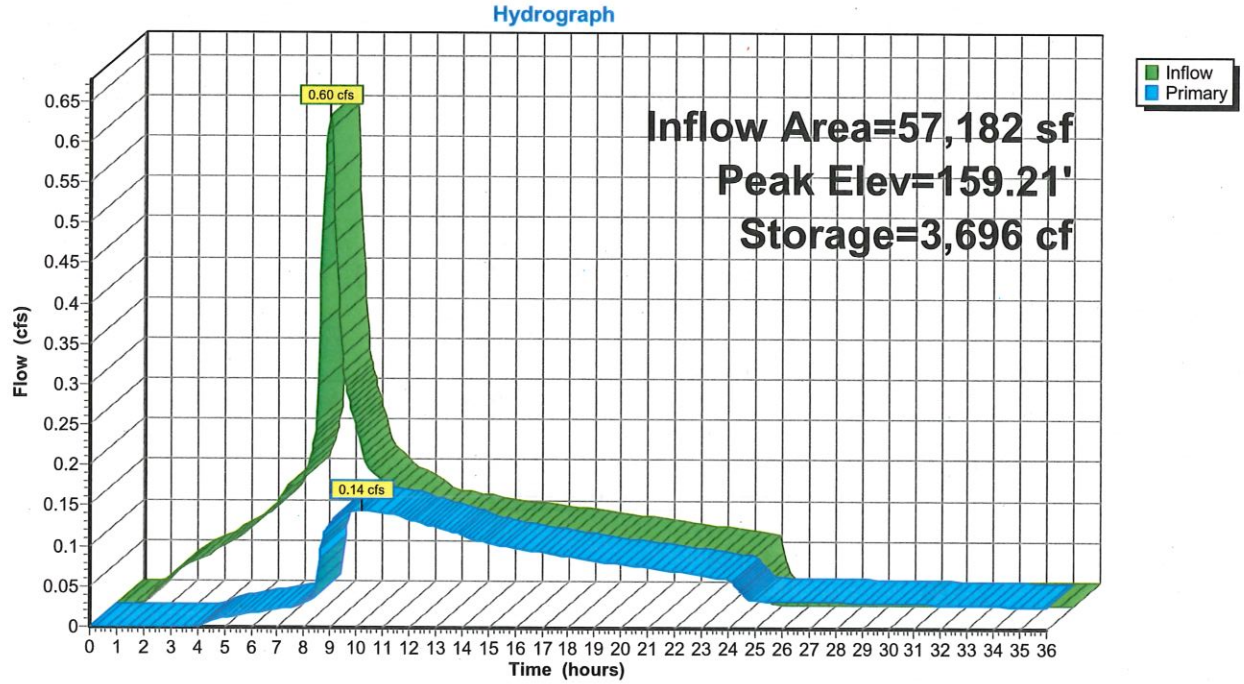
Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	8,923 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
157.00	1,080	0	0
158.00	1,595	1,338	1,338
159.00	2,179	1,887	3,225
160.00	2,832	2,506	5,730
161.00	3,554	3,193	8,923

Device	Routing	Invert	Outlet Devices
#1	Primary	157.40'	**1.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#2	Primary	159.00'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	160.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 10.21 hrs HW=159.21' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 6.69 fps)
- **2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 2.20 fps)
- **3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Extended Dry Basin



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=93,510 sf 11.62% Impervious Runoff Depth=1.76"
Flow Length=540' Tc=27.1 min CN=79/98 Runoff=0.62 cfs 13,743 cf

Subcatchment 2S: Developed Site Runoff Area=57,182 sf 78.14% Impervious Runoff Depth=2.89"
Tc=10.0 min CN=79/98 Runoff=0.89 cfs 13,794 cf

Subcatchment 3S: Forrest/Grass Runoff Area=36,328 sf 0.00% Impervious Runoff Depth=1.43"
Flow Length=300' Tc=12.3 min CN=77/0 Runoff=0.23 cfs 4,331 cf

Reach 1R: Existing Pipe Discharge Site Avg. Flow Depth=0.29' Max Vel=3.20 fps Inflow=0.62 cfs 13,743 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.62 cfs 13,743 cf

Reach 2R: Pipe from Basin to Flow Avg. Flow Depth=0.08' Max Vel=8.41 fps Inflow=0.24 cfs 11,783 cf
12.0" Round Pipe n=0.010 L=176.0' S=0.1705 '/' Capacity=19.12 cfs Outflow=0.24 cfs 11,782 cf

Reach 3R: Existing Pipe Discharge Site Avg. Flow Depth=0.24' Max Vel=2.83 fps Inflow=0.40 cfs 16,113 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.40 cfs 16,111 cf

Pond 1P: Extended Dry Basin Peak Elev=159.73' Storage=4,983 cf Inflow=0.89 cfs 13,794 cf
Outflow=0.24 cfs 11,783 cf

Total Runoff Area = 187,020 sf Runoff Volume = 31,867 cf Average Runoff Depth = 2.04"
70.30% Pervious = 131,472 sf 29.70% Impervious = 55,548 sf

Summary for Subcatchment 1S: Existing Site

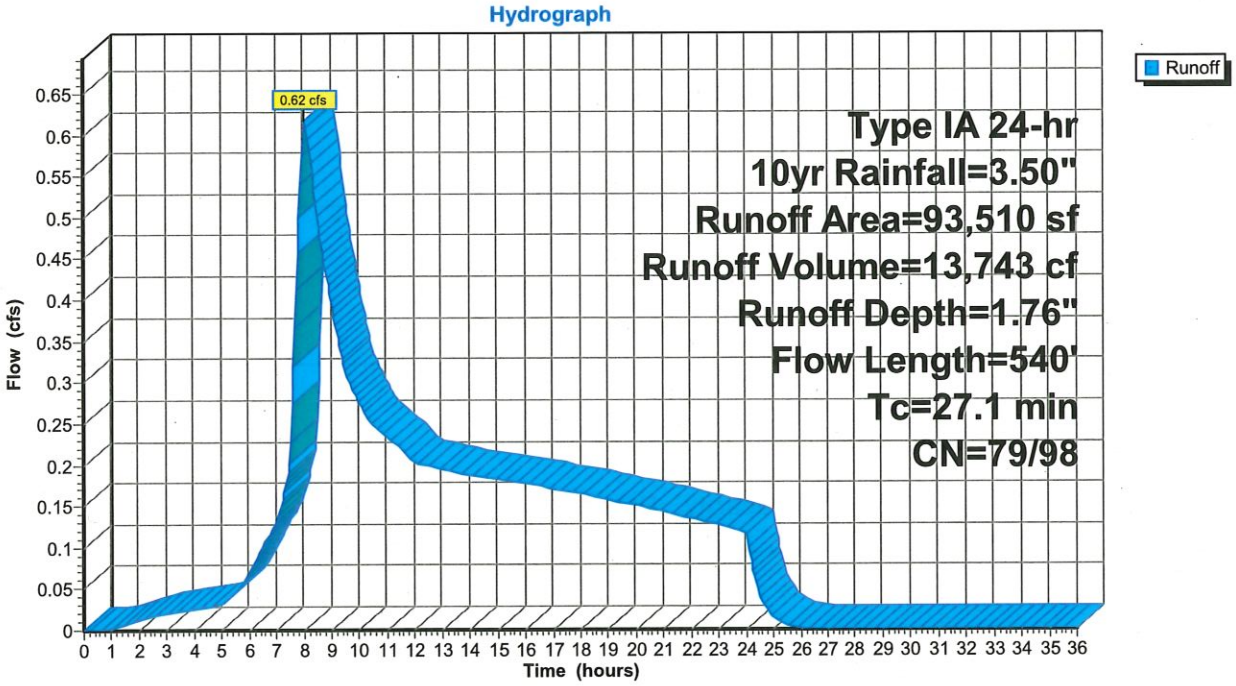
Runoff = 0.62 cfs @ 8.06 hrs, Volume= 13,743 cf, Depth= 1.76"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10yr Rainfall=3.50"

Area (sf)	CN	Description
10,868	98	Paved parking, HSG C
48,299	79	50-75% Grass cover, Fair, HSG C
4,000	96	Gravel surface, HSG C
30,343	77	Woods, Poor, HSG C
93,510	81	Weighted Average
82,642	79	88.38% Pervious Area
10,868	98	11.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	150	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
2.2	150	0.0266	1.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
27.1	540	Total			

Subcatchment 1S: Existing Site



Summary for Subcatchment 2S: Developed Site

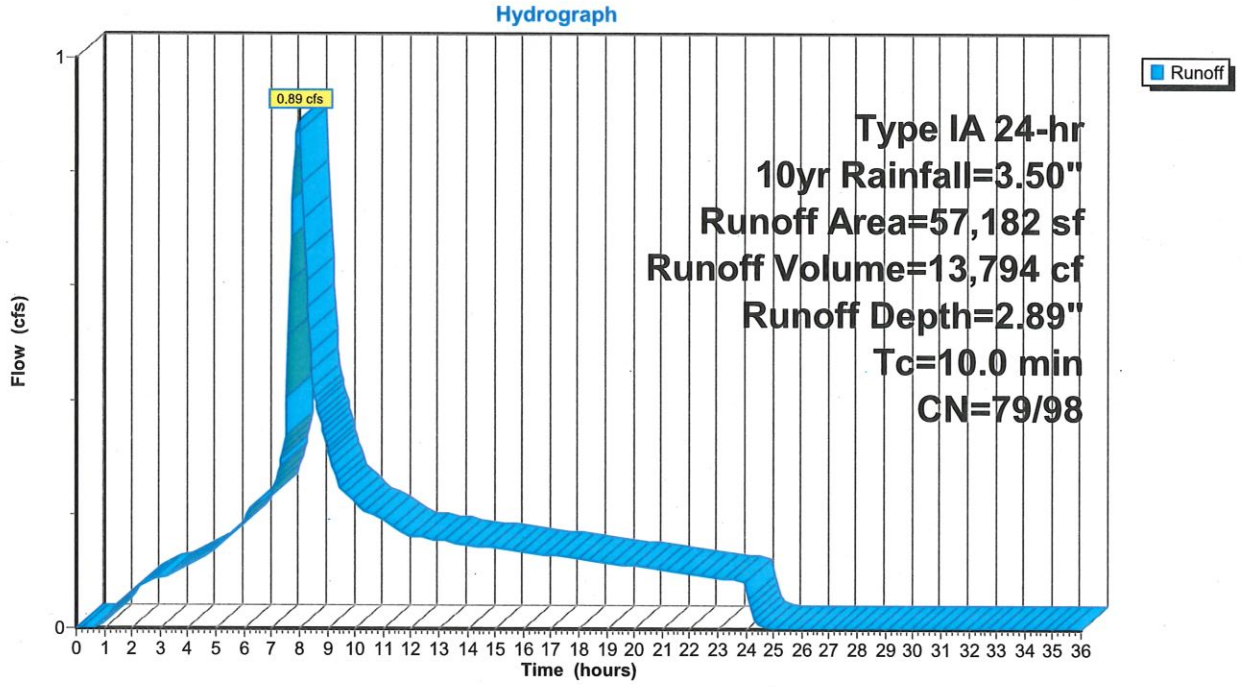
Runoff = 0.89 cfs @ 7.98 hrs, Volume= 13,794 cf, Depth= 2.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10yr Rainfall=3.50"

	Area (sf)	CN	Description
	12,502	79	50-75% Grass cover, Fair, HSG C
	23,184	98	Paved parking, HSG C
*	2,020	98	Pave sidewalk, HSG C
	15,476	98	Roofs, HSG C
*	4,000	100	Extended Dry Basin
	57,182	94	Weighted Average
	12,502	79	21.86% Pervious Area
	44,680	98	78.14% Impervious Area

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

Subcatchment 2S: Developed Site



Summary for Subcatchment 3S: Forrest/Grass

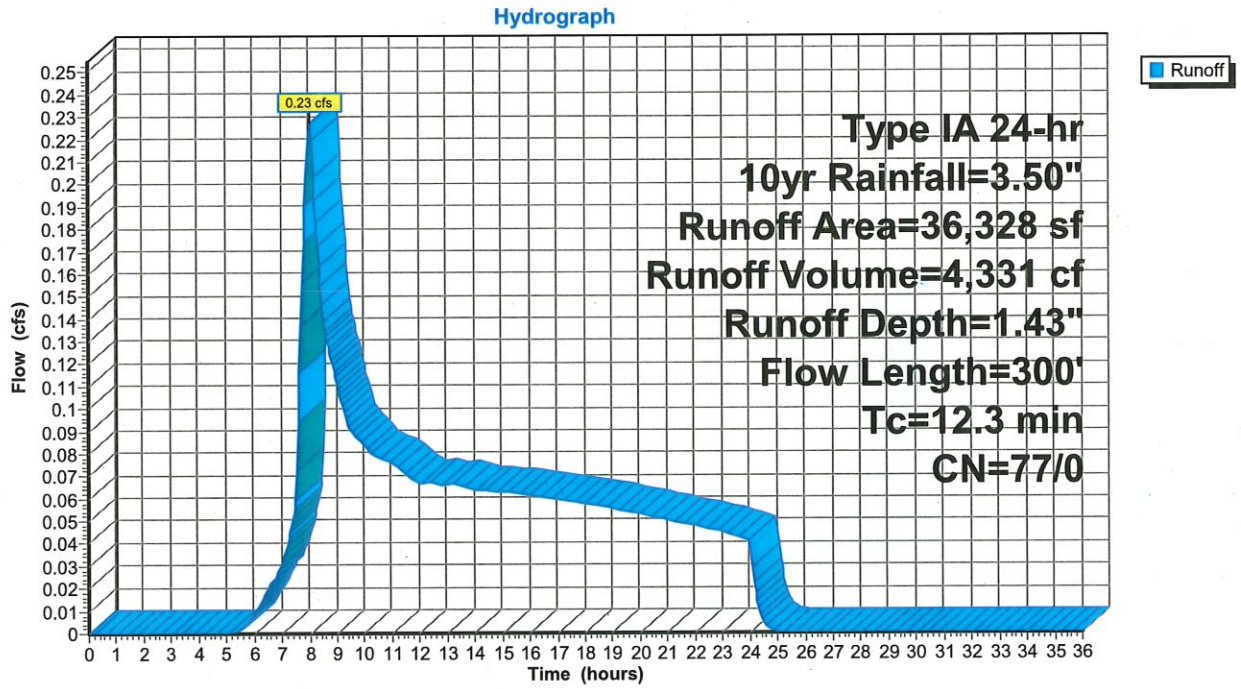
Runoff = 0.23 cfs @ 8.02 hrs, Volume= 4,331 cf, Depth= 1.43"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10yr Rainfall=3.50"

Area (sf)	CN	Description
30,343	77	Woods, Poor, HSG C
5,985	79	50-75% Grass cover, Fair, HSG C
36,328	77	Weighted Average
36,328	77	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	60	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
12.3	300	Total			

Subcatchment 3S: Forrest/Grass



Summary for Reach 1R: Existing Pipe Discharge Site (pre-development)

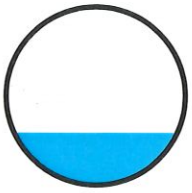
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 93,510 sf, 11.62% Impervious, Inflow Depth = 1.76" for 10yr event
Inflow = 0.62 cfs @ 8.06 hrs, Volume= 13,743 cf
Outflow = 0.62 cfs @ 8.07 hrs, Volume= 13,743 cf, Atten= 0%, Lag= 0.3 min

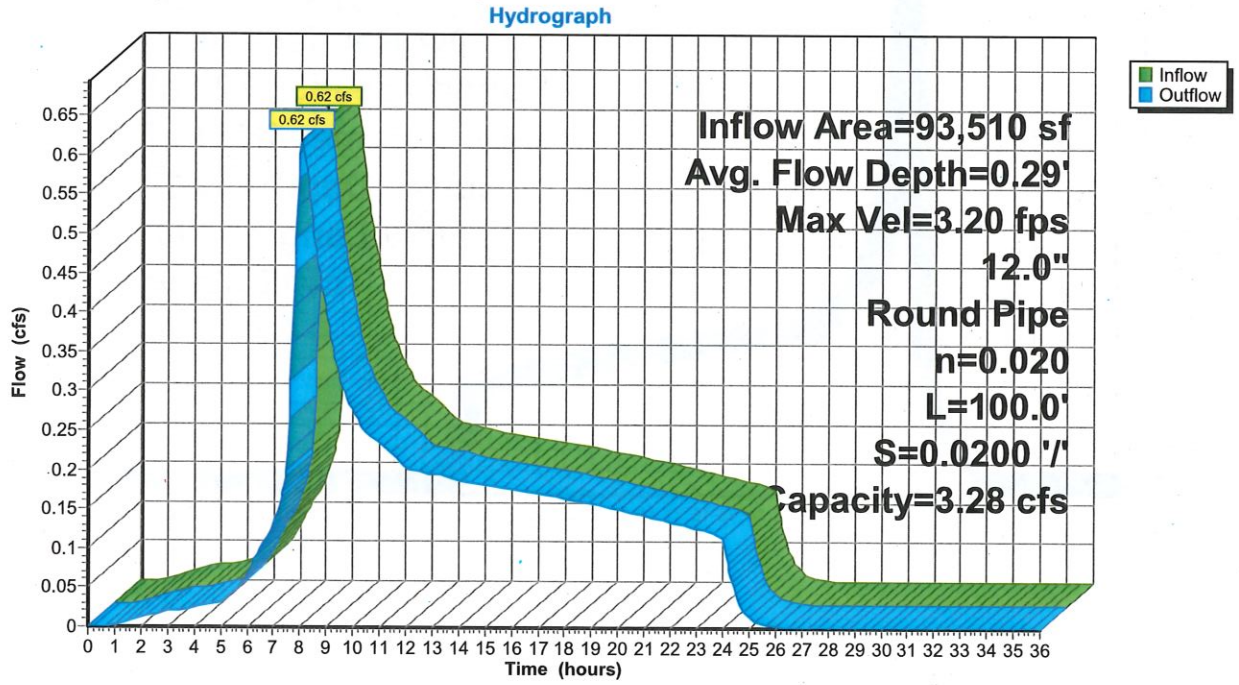
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.20 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 0.9 min

Peak Storage= 19 cf @ 8.07 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 424.00', Outlet Invert= 422.00'



Reach 1R: Existing Pipe Discharge Site (pre-development)



Summary for Reach 2R: Pipe from Basin to Flow Spreader

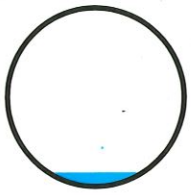
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth > 2.47" for 10yr event
Inflow = 0.24 cfs @ 9.52 hrs, Volume= 11,783 cf
Outflow = 0.24 cfs @ 9.52 hrs, Volume= 11,782 cf, Atten= 0%, Lag= 0.2 min

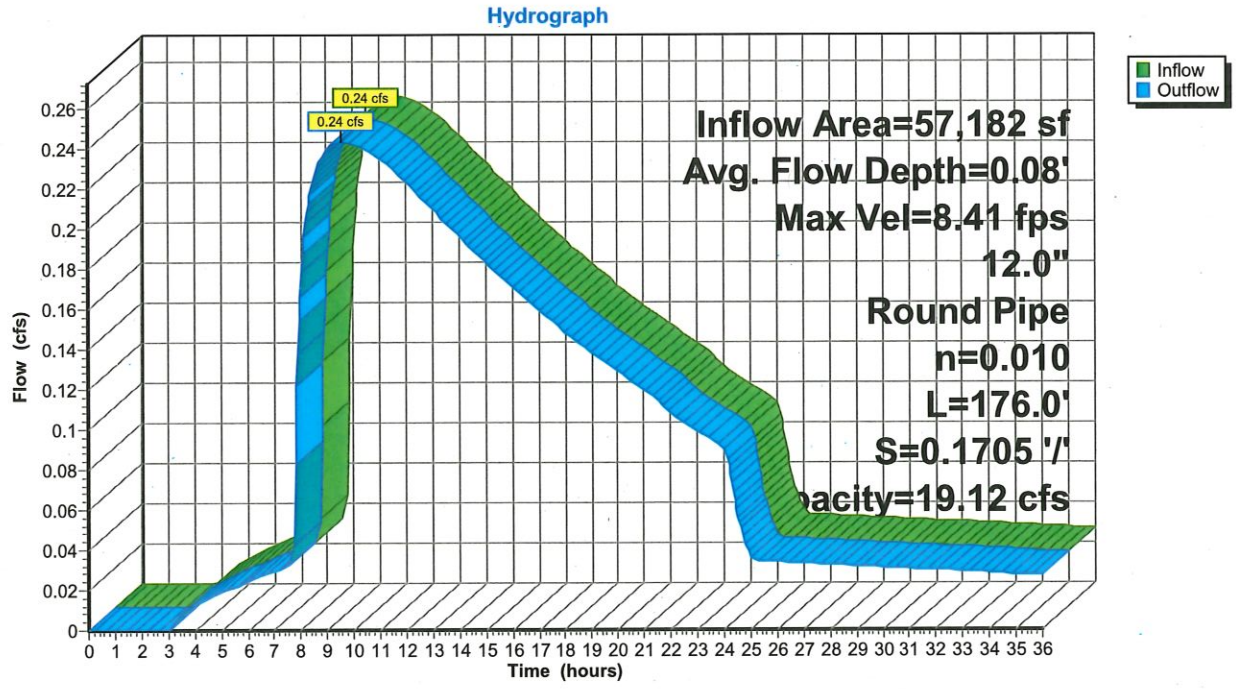
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.41 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 5.93 fps, Avg. Travel Time= 0.5 min

Peak Storage= 5 cf @ 9.52 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 19.12 cfs

12.0" Round Pipe
n= 0.010
Length= 176.0' Slope= 0.1705 '/'
Inlet Invert= 154.00', Outlet Invert= 124.00'



Reach 2R: Pipe from Basin to Flow Spreader



Summary for Reach 3R: Existing Pipe Discharge Site (post-development)

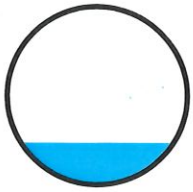
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 2R OUTLET depth by 0.17' @ 8.05 hrs

Inflow Area =	93,510 sf,	47.78% Impervious,	Inflow Depth >	2.07"	for 10yr event
Inflow =	0.40 cfs @	8.07 hrs, Volume=	16,113 cf		
Outflow =	0.40 cfs @	8.08 hrs, Volume=	16,111 cf,	Atten= 0%,	Lag= 0.8 min

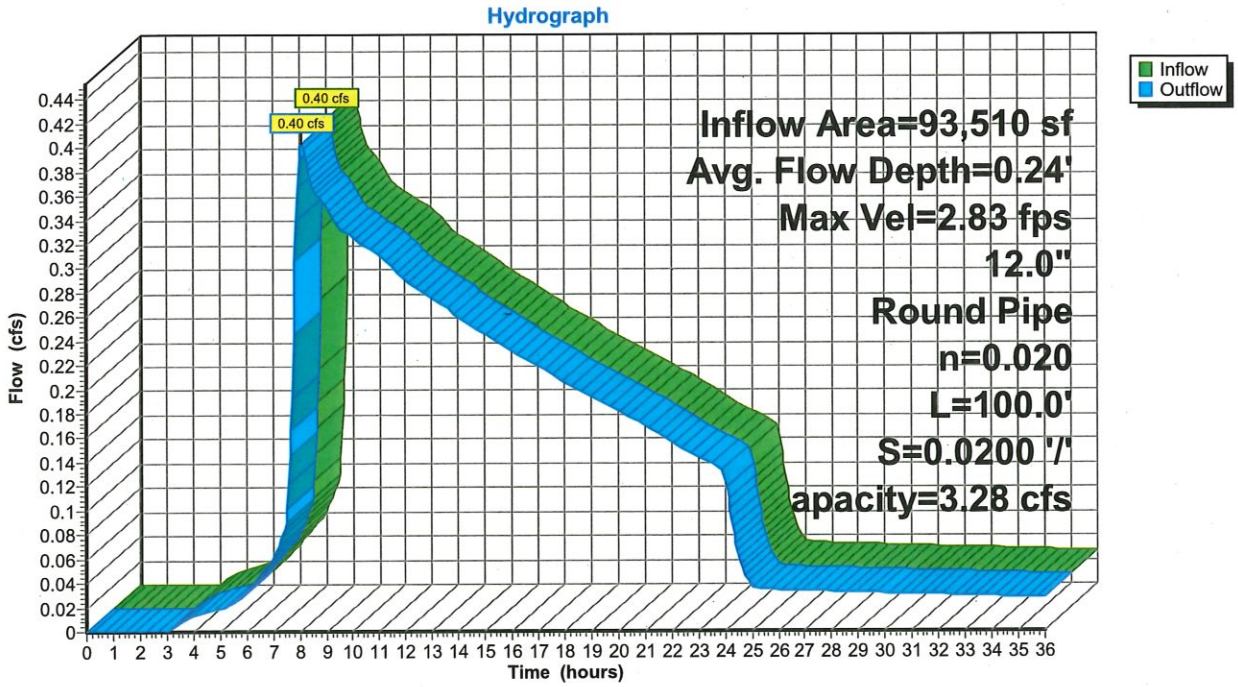
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.83 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.86 fps, Avg. Travel Time= 0.9 min

Peak Storage= 14 cf @ 8.08 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 124.00', Outlet Invert= 122.00'



Reach 3R: Existing Pipe Discharge Site (post-development)



Summary for Pond 1P: Extended Dry Basin

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth = 2.89" for 10yr event
Inflow = 0.89 cfs @ 7.98 hrs, Volume= 13,794 cf
Outflow = 0.24 cfs @ 9.52 hrs, Volume= 11,783 cf, Atten= 73%, Lag= 92.3 min
Primary = 0.24 cfs @ 9.52 hrs, Volume= 11,783 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 159.73' @ 9.52 hrs Surf.Area= 2,654 sf Storage= 4,983 cf

Plug-Flow detention time= 384.1 min calculated for 11,767 cf (85% of inflow)
Center-of-Mass det. time= 284.7 min (972.1 - 687.3)

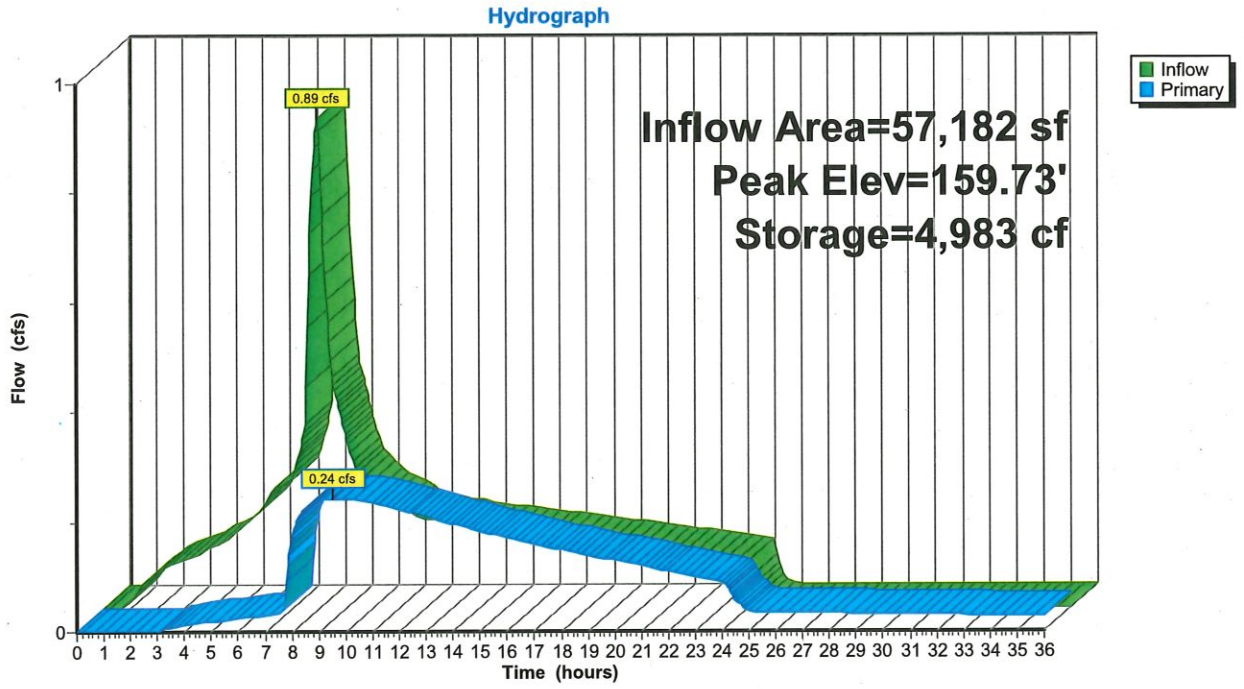
Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	8,923 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
157.00	1,080	0	0
158.00	1,595	1,338	1,338
159.00	2,179	1,887	3,225
160.00	2,832	2,506	5,730
161.00	3,554	3,193	8,923

Device	Routing	Invert	Outlet Devices
#1	Primary	157.40'	**1.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#2	Primary	159.00'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	160.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.24 cfs @ 9.52 hrs HW=159.73' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.59 fps)
- **2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 4.11 fps)
- **3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Extended Dry Basin



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=93,510 sf 11.62% Impervious Runoff Depth=2.17"
Flow Length=540' Tc=27.1 min CN=79/98 Runoff=0.79 cfs 16,932 cf

Subcatchment 2S: Developed Site Runoff Area=57,182 sf 78.14% Impervious Runoff Depth=3.37"
Tc=10.0 min CN=79/98 Runoff=1.04 cfs 16,064 cf

Subcatchment 3S: Forrest/Grass Runoff Area=36,328 sf 0.00% Impervious Runoff Depth=1.81"
Flow Length=300' Tc=12.3 min CN=77/0 Runoff=0.30 cfs 5,485 cf

Reach 1R: Existing Pipe Discharge Site Avg. Flow Depth=0.33' Max Vel=3.43 fps Inflow=0.79 cfs 16,932 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.79 cfs 16,932 cf

Reach 2R: Pipe from Basin to Flow Avg. Flow Depth=0.09' Max Vel=8.91 fps Inflow=0.29 cfs 14,035 cf
12.0" Round Pipe n=0.010 L=176.0' S=0.1705 '/' Capacity=19.12 cfs Outflow=0.29 cfs 14,033 cf

Reach 3R: Existing Pipe Discharge Site Avg. Flow Depth=0.27' Max Vel=3.06 fps Inflow=0.52 cfs 19,519 cf
12.0" Round Pipe n=0.020 L=100.0' S=0.0200 '/' Capacity=3.28 cfs Outflow=0.52 cfs 19,517 cf

Pond 1P: Extended Dry Basin Peak Elev=160.00' Storage=5,737 cf Inflow=1.04 cfs 16,064 cf
Outflow=0.29 cfs 14,035 cf

Total Runoff Area = 187,020 sf Runoff Volume = 38,482 cf Average Runoff Depth = 2.47"
70.30% Pervious = 131,472 sf 29.70% Impervious = 55,548 sf

Summary for Subcatchment 1S: Existing Site

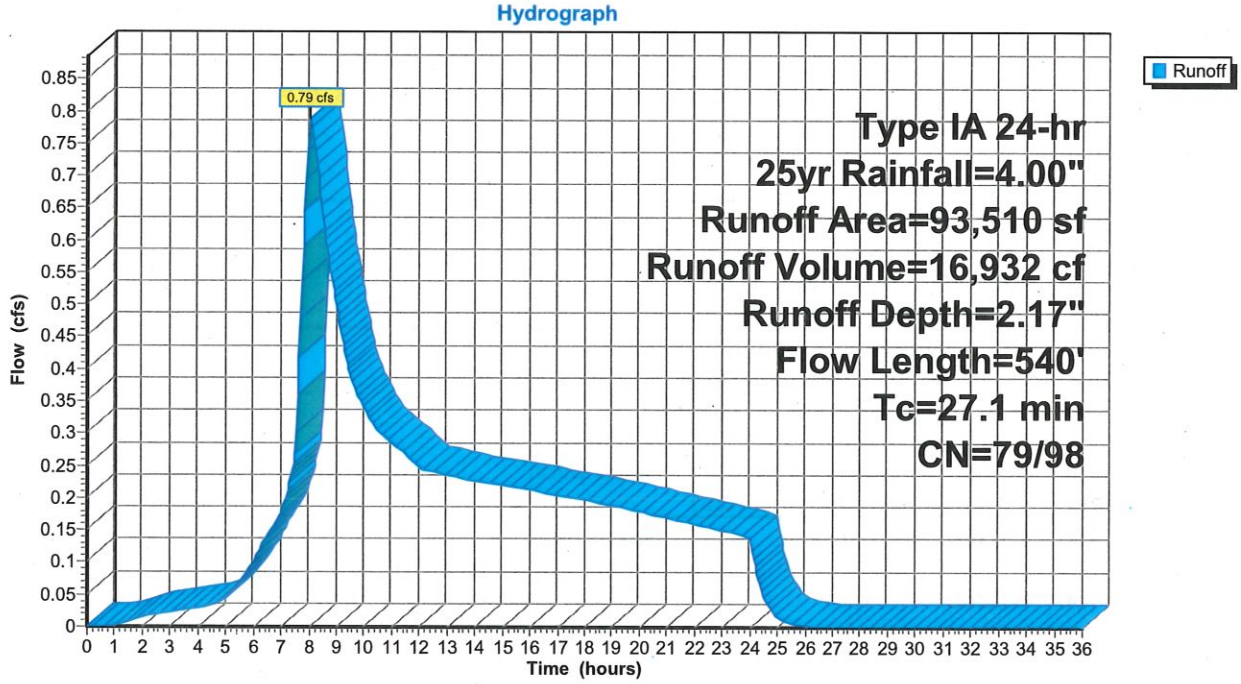
Runoff = 0.79 cfs @ 8.06 hrs, Volume= 16,932 cf, Depth= 2.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25yr Rainfall=4.00"

Area (sf)	CN	Description
10,868	98	Paved parking, HSG C
48,299	79	50-75% Grass cover, Fair, HSG C
4,000	96	Gravel surface, HSG C
30,343	77	Woods, Poor, HSG C
93,510	81	Weighted Average
82,642	79	88.38% Pervious Area
10,868	98	11.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	150	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
2.2	150	0.0266	1.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
27.1	540	Total			

Subcatchment 1S: Existing Site



Summary for Subcatchment 2S: Developed Site

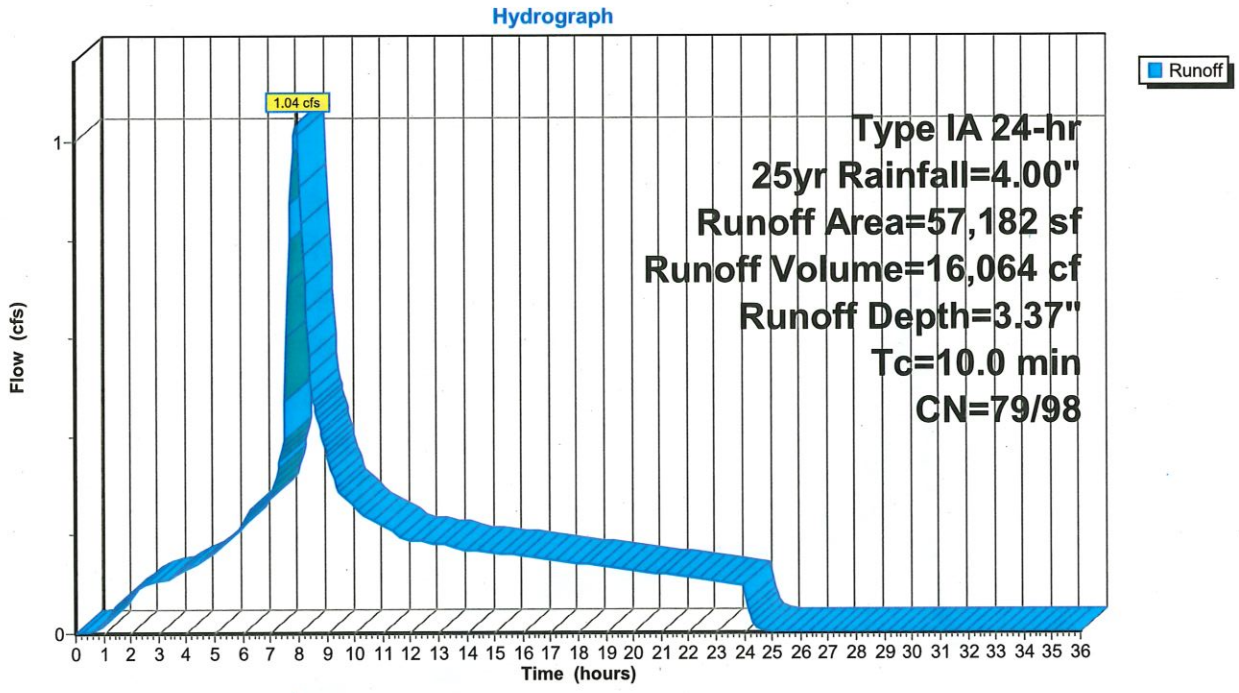
Runoff = 1.04 cfs @ 7.98 hrs, Volume= 16,064 cf, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25yr Rainfall=4.00"

	Area (sf)	CN	Description
	12,502	79	50-75% Grass cover, Fair, HSG C
	23,184	98	Paved parking, HSG C
*	2,020	98	Pave sidewalk, HSG C
	15,476	98	Roofs, HSG C
*	4,000	100	Extended Dry Basin
	57,182	94	Weighted Average
	12,502	79	21.86% Pervious Area
	44,680	98	78.14% Impervious Area

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

Subcatchment 2S: Developed Site



Summary for Subcatchment 3S: Forrest/Grass

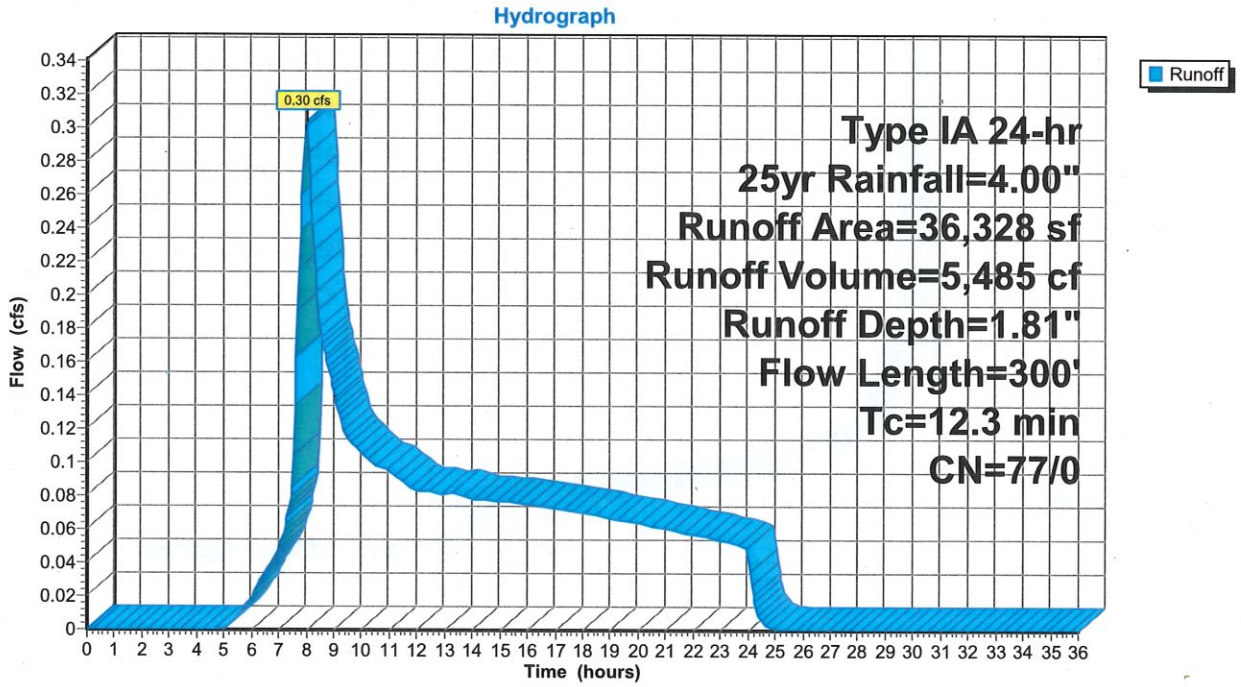
Runoff = 0.30 cfs @ 8.01 hrs, Volume= 5,485 cf, Depth= 1.81"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25yr Rainfall=4.00"

Area (sf)	CN	Description
30,343	77	Woods, Poor, HSG C
5,985	79	50-75% Grass cover, Fair, HSG C
36,328	77	Weighted Average
36,328	77	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	60	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.60"
0.4	40	0.5000	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.7	200	0.0800	0.71		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
12.3	300	Total			

Subcatchment 3S: Forrest/Grass



Summary for Reach 1R: Existing Pipe Discharge Site (pre-development)

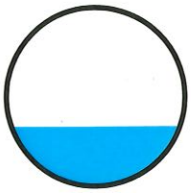
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 93,510 sf, 11.62% Impervious, Inflow Depth = 2.17" for 25yr event
Inflow = 0.79 cfs @ 8.06 hrs, Volume= 16,932 cf
Outflow = 0.79 cfs @ 8.06 hrs, Volume= 16,932 cf, Atten= 0%, Lag= 0.3 min

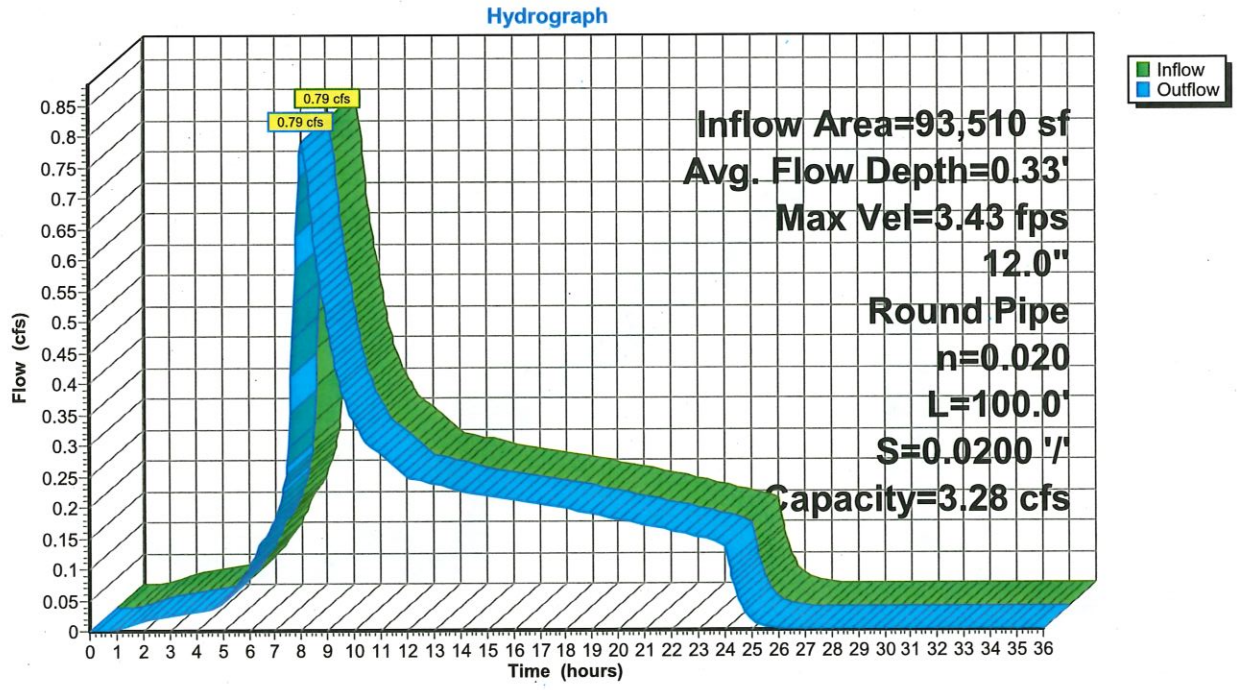
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.43 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 0.9 min

Peak Storage= 23 cf @ 8.06 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 424.00', Outlet Invert= 422.00'



Reach 1R: Existing Pipe Discharge Site (pre-development)



Summary for Reach 2R: Pipe from Basin to Flow Spreader

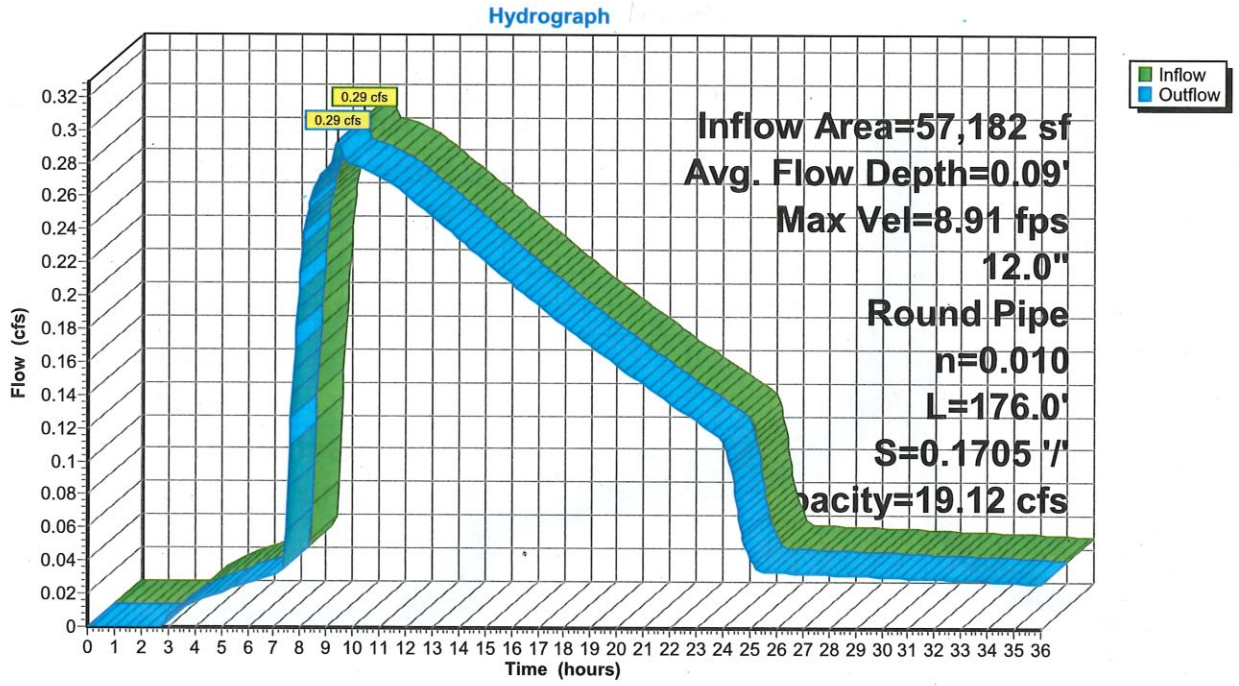
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth > 2.95" for 25yr event
Inflow = 0.29 cfs @ 9.42 hrs, Volume= 14,035 cf
Outflow = 0.29 cfs @ 9.42 hrs, Volume= 14,033 cf, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.91 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 6.18 fps, Avg. Travel Time= 0.5 min

Peak Storage= 6 cf @ 9.42 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 19.12 cfs

12.0" Round Pipe
n= 0.010
Length= 176.0' Slope= 0.1705 '/'
Inlet Invert= 154.00', Outlet Invert= 124.00'



Summary for Reach 3R: Existing Pipe Discharge Site (post-development)

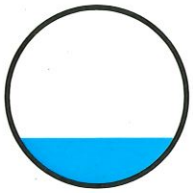
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 2R OUTLET depth by 0.19' @ 8.05 hrs

Inflow Area = 93,510 sf, 47.78% Impervious, Inflow Depth > 2.50" for 25yr event
Inflow = 0.52 cfs @ 8.05 hrs, Volume= 19,519 cf
Outflow = 0.52 cfs @ 8.05 hrs, Volume= 19,517 cf, Atten= 0%, Lag= 0.4 min

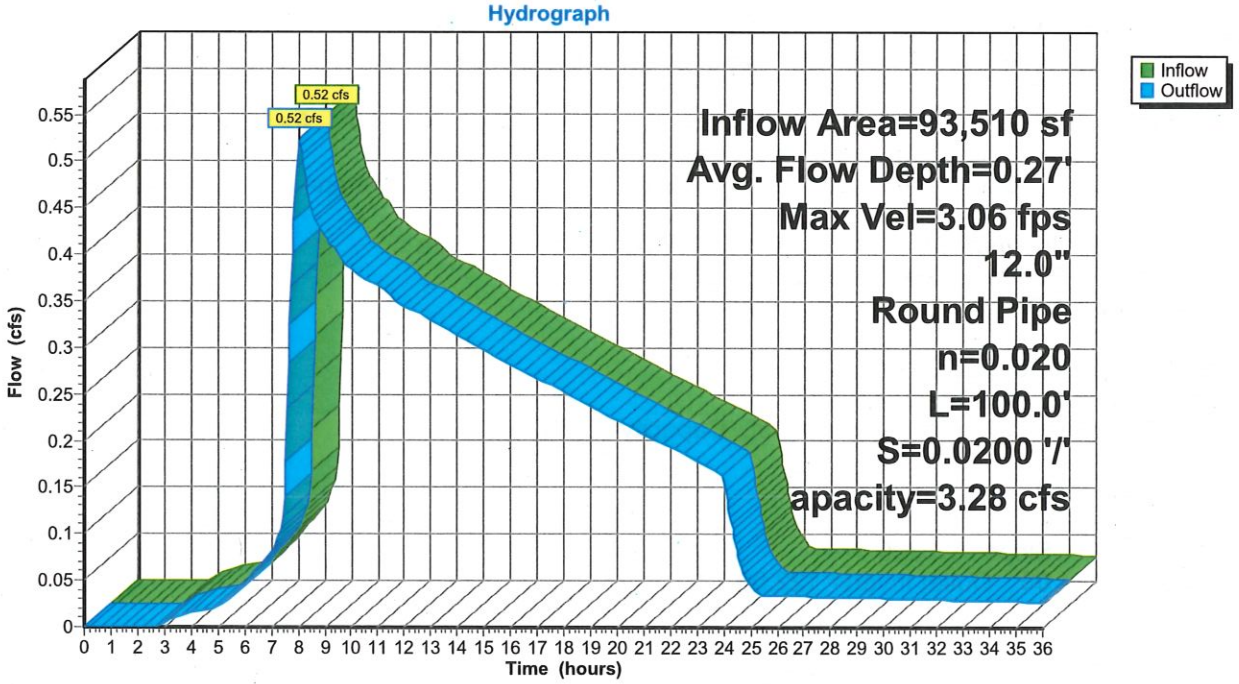
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.06 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 0.9 min

Peak Storage= 17 cf @ 8.05 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.28 cfs

12.0" Round Pipe
n= 0.020
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 124.00', Outlet Invert= 122.00'



Reach 3R: Existing Pipe Discharge Site (post-development)



Summary for Pond 1P: Extended Dry Basin

Inflow Area = 57,182 sf, 78.14% Impervious, Inflow Depth = 3.37" for 25yr event
Inflow = 1.04 cfs @ 7.98 hrs, Volume= 16,064 cf
Outflow = 0.29 cfs @ 9.42 hrs, Volume= 14,035 cf, Atten= 72%, Lag= 86.1 min
Primary = 0.29 cfs @ 9.42 hrs, Volume= 14,035 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 160.00' @ 9.42 hrs Surf.Area= 2,834 sf Storage= 5,737 cf

Plug-Flow detention time= 363.4 min calculated for 14,015 cf (87% of inflow)
Center-of-Mass det. time= 276.0 min (960.1 - 684.1)

Volume	Invert	Avail.Storage	Storage Description
#1	157.00'	8,923 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
157.00	1,080	0	0
158.00	1,595	1,338	1,338
159.00	2,179	1,887	3,225
160.00	2,832	2,506	5,730
161.00	3,554	3,193	8,923

Device	Routing	Invert	Outlet Devices
#1	Primary	157.40'	**1.0" Horiz. Orifice/Grate** C= 0.620 Limited to weir flow at low heads
#2	Primary	159.00'	**3.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	160.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.28 cfs @ 9.42 hrs HW=160.00' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 8.03 fps)
- **2=Orifice/Grate** (Orifice Controls 0.24 cfs @ 4.82 fps)
- **3=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.16 fps)

Pond 1P: Extended Dry Basin