

Stormwater Management Calculations

Kwik Trip – Bloomington #1794

~~10/20/2025~~

11/12/2025



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Narrative

The Site is currently two separate commercial buildings known as 1000 and 1050 94th St. W in Bloomington with a total area of 1.60 acres. The existing buildings and onsite utilities will be removed and re-developed with a Kwik Trip fueling station. The site is within the Nine Mile Creek Watershed District and will need to meet the stormwater requirements for a re-development where more than 50% of the existing impervious area on site is disturbed.

Information regarding Hydrologic Soil Group type for this site is not available on Web Soil Services. However, the geotechnical report suggests that the HSG is type "B". However, infiltration is not allowed to use for vehicle fueling sites. Therefore, underground wet vault will control flow rates and provide water quality per the NMCWD rules.

There is an overall net decrease in impervious area. The City of Bloomington and NMCWD states, that there shall be no net increase in runoff or volume.

The site is in Nine Mile Creek Watershed District and will be subject to Bloomington and NMCWD rules.

Existing Conditions

Area	Impervious (sf)	Pervious (sf)	Total (sf)
EX	52,631	17,026	69,657
Total	52,631	17,026	69,657

*See attached Existing Conditions Drainage Areas for more information

Proposed Conditions

Area	Impervious (sf)	Pervious (sf)	Total (sf)
1	1,118	68	1,186
2	2,115	456	2,571
3	4,572	881	5,453
4	10	1,861	1,871
5	132	4,200	4,332
6	0	1,337	1,337
8	3,066	916	3,982
10	6,214	357	6,571
11	20,765	4,392	25,157
12	7,315	0	7,315
13	3,797	0	3,797
14	1,256	3,541	4,797
15	440	849	1,289
Total	50,800	18,858	69,658

*See attached Proposed Conditions Drainage Areas for more information

Rate Control

Total Site Peak Runoff Rates

24-HR, Event	Existing Runoff (cfs) [Existing]		Proposed Runoff (cfs) [CA13P]
2-YR	4.75	>	0.68
10-YR	8.01	>	3.75
100-YR	15.59	>	5.86

*See Attached HydroCAD Output for Details

Underground Stormwater Vault

Infiltration is not allowed on vehicle fueling sites, therefore an underground stormwater vault is proposed. The 1.1" of water quality volume for the impervious area will captured and released at a rate not to exceed 5.66 cfs/acre of pond surface required by the State of Minnesota construction stormwater permit. Permanent pool volume exceeds the NPDES standards of 1800cf/acre for the impervious area.

Total Site Area = 69,957 sq. ft.

Existing Impervious Area = 52,631 sq. ft.

Proposed Impervious Area = 50,799 sq. ft.

Contributing Impervious Area = 49,104 sq. ft.

% Impervious = (50,799 sq. ft.) / (69,957 sq. ft.) * 100%

% Impervious = 73%

Permanent Pool Volume East Basin 9P:

Area No.	Total Area Aw (acres)	Impervious Fraction Fi (%)	Pervious Portion CN	Design Storm P (")	Maximum Soil Retention S (")	Runoff R (")	Required Dead Storage Vd (acre-ft)	Required Dead Storage Vd (cu-ft)
1	1.13	77.0	61	2.5	6.3934	1.9701	0.1855	8,081

2.5" of impervious area volume required = 8,081 cubic feet

Provided dead storage volume = 14,413 cubic feet

Basin #9

See NPDES Worksheet for volume calculations below.

STORMWATER MANAGEMENT POND FOR AREA #9 (Wet Pond):



1. Tributary Drainage Area:

Impervious Area = 1.13 Acres = 77%
Pervious Area = 0.33 Acres = 23%

Total Area = 1.46 Acres = 100%

0.5



2. Sediment Storage Required (1800) cf per acres:

Min. Sed. Storage Req'd = 2628 Cu. Ft.



3. Permanent Pool Volume Provided:

Permanent Pool Volume = 0.3247 Acre-Ft = 14143.00 Cu. Ft.



4. Permanent Pool Surface Area Provided:

Permant Pool Surface Area = 0.1235 Acres = 5381.00 Sq. Ft.



5. Permanent Pool Average Depth:

Permant Pool Average Depth = 2.62832 Ft.



6. Hydraulic Storage Required (aka Live Storage):

Minimum Hydraulic Storage = 1.1" of runoff from impervious area

Minimum Hydraulic Storage = 4512 Cu. Ft. = 0.1036 Acre-Ft.



7. Depth of Hydraulic Volume (aka Bounce):

Maximum Depth of Hydraulic Volume = Min. Hydraulic Storage/Permanent Pool Surface Area

Maximum Depth of Hydraulic Volume = 0.8385 Feet



8. Pond Outflow Rate (Outflow Rate must be less than 5.66 cfs per acre of pond surface area):

Orifice Diameter = 5.00 Inches

Orifice Open Area = 0.1364 Sq. Ft.

Outflow Rate ($0.65A\sqrt{2gh}$) = 0.6513 CFS < 0.6991841 CFS ; O.K.



9. Verify 5-micron Removal Efficiency:

Min. Surface Area, $A = Q_o/V_s$; where Q_o = Pond Outflow Rate
 V_s = Terminal Settling Velocity (1.3×10^{-4} ft/sec)

Min. Surface Area, $A = 5010$ Sq. Ft.

5010 Sq. Ft. < 5381 Sq. Ft.; O.K.

Water Quality

The water quality standards are met with the stormwater vault. A P8 model results in the following:

Proposed TP removal = 62.4%, required TP Removal = 60%.

Proposed TSS removal = 90.2%, required TSS Removal = 90%.

STORM SEWER DESIGN

Client: Kwik Trip
Project: Bloomington, MN #1794
Design Basis: 10 year event

Pipe Location		Pipe Flow				Pipe Data					Elevations				
Upstream	Downstream	Area Runoff **		Total Flow		Length	Diameter	Slope	Capacity *	Velocity	Rim Elev. Up	Inv. Elev. Up	Inv. Elev. Down	Cover to Crown	Depth of CB
Structure	Structure	(GPM)	(cfs)	(GPM)	(cfs)	(ft)	(in)	(%)	(cfs)	(ft/s)	(feet)	(feet)	(feet)	(feet)	(feet)
CB11	UG Pond	1,485.63	3.31	1,485.63	3.31	11	12	7.3	9.61	4.21	830.30	825.80	825.00	3.50	4.50
CB10	UG Pond	381.51	0.85	381.51	0.85	12	12	4.17	7.27	1.08	830.07	825.50	825.00	3.57	4.57
CB8	CB7	206.46	0.46	206.46	0.46	32	12	0.59	2.75	0.59	833.00	827.46	827.27	4.54	5.54
CB7	CB6	439.85	0.98	439.85	0.98	15	12	0.60	2.76	1.25	834.00	827.27	827.18	5.73	6.73
CB6	CB5	71.81	0.16	511.67	1.14	85	12	0.60	2.76	1.45	832.90	827.18	826.67	4.72	5.72
CB5	CB4	31.42	0.07	543.08	1.21	53	12	0.60	2.77	1.54	833.10	826.67	826.35	5.43	6.43
CB4	CB3'	26.93	0.06	570.01	1.27	72	12	0.61	2.79	1.62	832.00	826.35	825.91	4.65	5.65
CB3'	CB2	300.72	0.67	870.73	1.94	55	15	0.60	5.00	1.58	832.40	825.91	825.58	5.24	6.49
CB2	CB1	139.14	0.31	1,009.87	2.25	41	15	0.59	4.94	1.83	832.00	825.58	825.34	5.17	6.42
CB1	UG Pond	71.81	0.16	1,081.68	2.41	63	15	0.54	4.75	1.96	832.00	825.34	825.00	5.41	6.66

* Pipe capacity is computed using mannings equation with n = 0.013

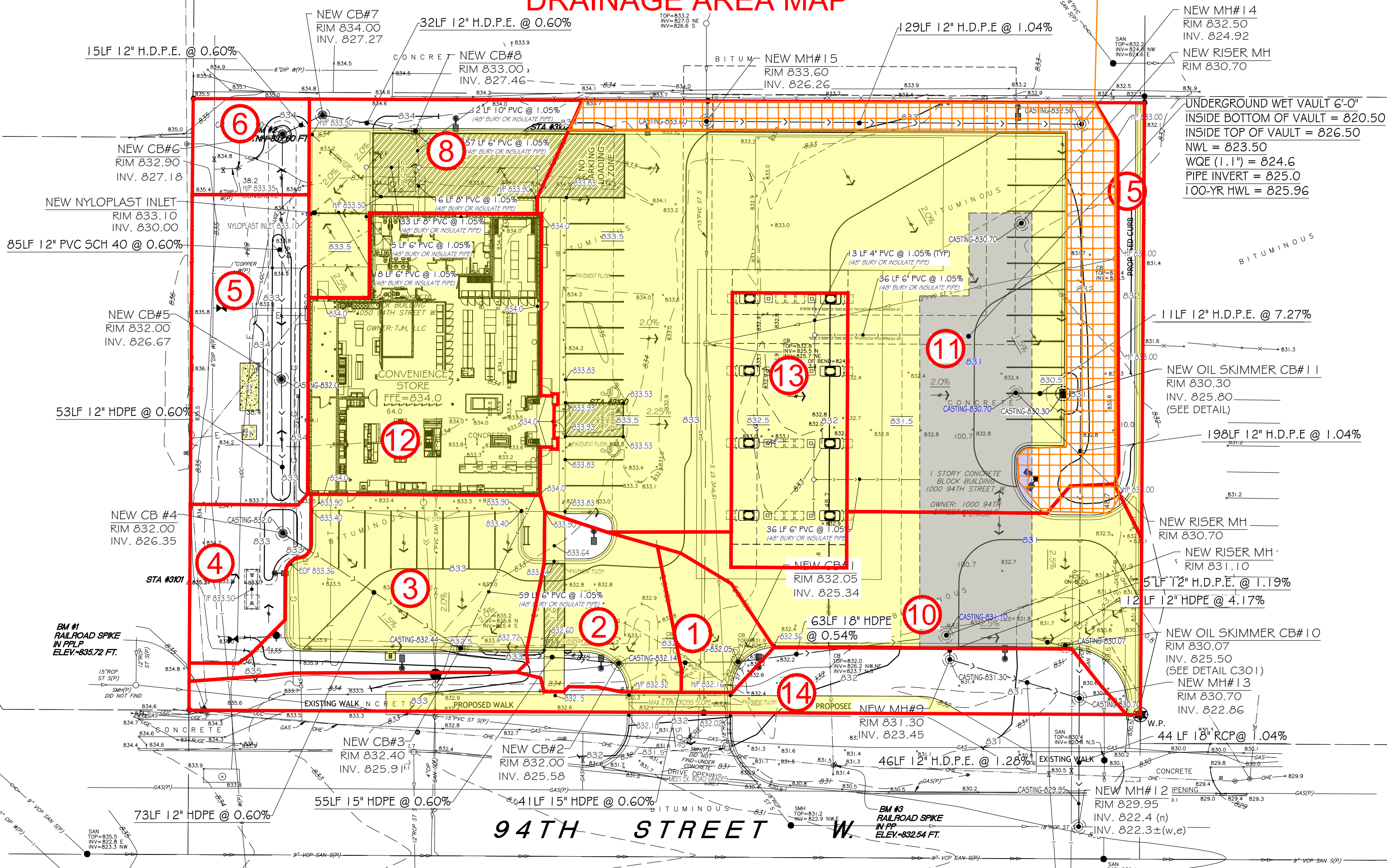
** Runoff values are from HydroCAD output for a 10 year event

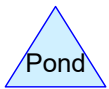
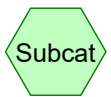
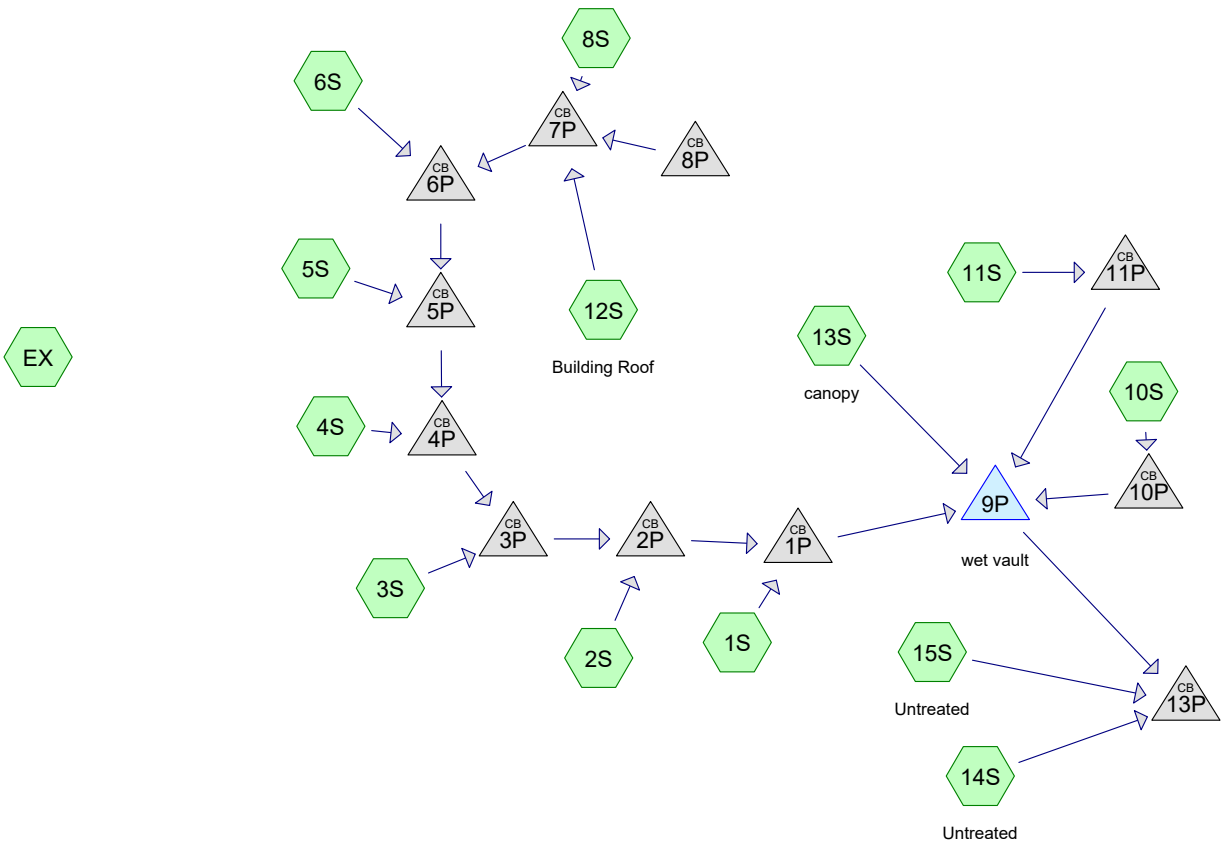
ADDITION/
ADDITION



PROPOSED CONDITIONS DRAINAGE AREA MAP

Review boundary of
drainage area 11 for
inclusion in drainage area 15





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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type II 24-hr		Default	24.00	1	2.84	2
2	10-yr	Type II 24-hr		Default	24.00	1	4.23	2
3	100-yr	Type II 24-hr		Default	24.00	1	7.48	2

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.824	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 8S, 10S, 11S, 14S, 15S, EX)
2.027	98	Paved parking, HSG B (5S, 8S, 10S, 11S, 13S, 14S, 15S, EX)
0.347	98	Paved parking, HSG C (1S, 2S, 3S, 4S, 12S)
3.198	88	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
2.851	HSG B	1S, 2S, 3S, 4S, 5S, 6S, 8S, 10S, 11S, 13S, 14S, 15S, EX
0.347	HSG C	1S, 2S, 3S, 4S, 12S
0.000	HSG D	
0.000	Other	
3.198		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.824	0.000	0.000	0.000	0.824	>75% Grass cover, Good	1S, 2S, 3S, 4S, 5S, 6S, 8S, 10S, 11S, 14S, 15S, EX
0.000	2.027	0.347	0.000	0.000	2.374	Paved parking	1S, 2S, 3S, 4S, 5S, 8S, 10S, 11S, 12S, 13S, 14S, 15S, EX
0.000	2.851	0.347	0.000	0.000	3.198	TOTAL AREA	

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Type II 24-hr 2-yr Rainfall=2.84"

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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

Subcatchment1S:	Runoff Area=1,186 sf 94.27% Impervious Runoff Depth>2.24" Tc=6.0 min CN=96 Runoff=0.10 cfs 0.005 af
Subcatchment2S:	Runoff Area=2,571 sf 82.26% Impervious Runoff Depth>1.79" Tc=6.0 min CN=91 Runoff=0.19 cfs 0.009 af
Subcatchment3S:	Runoff Area=5,453 sf 83.84% Impervious Runoff Depth>1.88" Tc=6.0 min CN=92 Runoff=0.42 cfs 0.020 af
Subcatchment4S:	Runoff Area=1,871 sf 0.53% Impervious Runoff Depth>0.26" Tc=6.0 min CN=61 Runoff=0.02 cfs 0.001 af
Subcatchment5S:	Runoff Area=4,332 sf 3.05% Impervious Runoff Depth>0.29" Tc=6.0 min CN=62 Runoff=0.04 cfs 0.002 af
Subcatchment6S:	Runoff Area=1,337 sf 0.00% Impervious Runoff Depth>0.26" Tc=6.0 min CN=61 Runoff=0.01 cfs 0.001 af
Subcatchment8S:	Runoff Area=3,983 sf 77.00% Impervious Runoff Depth>1.63" Tc=6.0 min CN=89 Runoff=0.27 cfs 0.012 af
Subcatchment10S:	Runoff Area=6,495 sf 95.24% Impervious Runoff Depth>2.24" Tc=6.0 min CN=96 Runoff=0.56 cfs 0.028 af
Subcatchment11S:	Runoff Area=24,642 sf 84.27% Impervious Runoff Depth>1.88" Tc=6.0 min CN=92 Runoff=1.88 cfs 0.089 af
Subcatchment12S: Building Roof	Runoff Area=7,315 sf 100.00% Impervious Runoff Depth>2.42" Tc=6.0 min CN=98 Runoff=0.65 cfs 0.034 af
Subcatchment13S: canopy	Runoff Area=3,797 sf 100.00% Impervious Runoff Depth>2.42" Tc=6.0 min CN=98 Runoff=0.34 cfs 0.018 af
Subcatchment14S: Untreated	Runoff Area=4,797 sf 26.18% Impervious Runoff Depth>0.59" Tc=6.0 min CN=71 Runoff=0.12 cfs 0.005 af
Subcatchment15S: Untreated	Runoff Area=1,880 sf 24.84% Impervious Runoff Depth>0.55" Tc=6.0 min CN=70 Runoff=0.04 cfs 0.002 af
SubcatchmentEX:	Runoff Area=69,657 sf 75.56% Impervious Runoff Depth>1.63" Tc=6.0 min CN=89 Runoff=4.75 cfs 0.217 af
Pond 1P:	Peak Elev=826.06' Inflow=1.69 cfs 0.084 af 15.0" Round Culvert n=0.013 L=59.0' S=0.0058 ' Outflow=1.69 cfs 0.084 af
Pond 2P:	Peak Elev=826.37' Inflow=1.58 cfs 0.079 af 12.0" Round Culvert n=0.013 L=41.0' S=0.0059 ' Outflow=1.58 cfs 0.079 af

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Pond 3P: Peak Elev=826.63' Inflow=1.40 cfs 0.070 af
12.0" Round Culvert n=0.013 L=55.0' S=0.0060 '/' Outflow=1.40 cfs 0.070 af

Pond 4P: Peak Elev=826.93' Inflow=0.98 cfs 0.050 af
12.0" Round Culvert n=0.013 L=73.0' S=0.0060 '/' Outflow=0.98 cfs 0.050 af

Pond 5P: Peak Elev=827.25' Inflow=0.97 cfs 0.049 af
12.0" Round Culvert n=0.013 L=53.0' S=0.0060 '/' Outflow=0.97 cfs 0.049 af

Pond 6P: Peak Elev=827.74' Inflow=0.93 cfs 0.047 af
12.0" Round Culvert n=0.013 L=85.0' S=0.0060 '/' Outflow=0.93 cfs 0.047 af

Pond 7P: Peak Elev=827.86' Inflow=0.92 cfs 0.046 af
12.0" Round Culvert n=0.013 L=15.0' S=0.0060 '/' Outflow=0.92 cfs 0.046 af

Pond 8P: Peak Elev=0.00'
12.0" Round Culvert n=0.013 L=32.0' S=0.0059 '/' Primary=0.00 cfs 0.000 af

Pond 9P: wet vault Peak Elev=824.51' Storage=18,896 cf Inflow=4.47 cfs 0.218 af
Outflow=0.59 cfs 0.200 af

Pond 10P: Peak Elev=825.87' Inflow=0.56 cfs 0.028 af
12.0" Round Culvert n=0.013 L=22.0' S=0.0227 '/' Outflow=0.56 cfs 0.028 af

Pond 11P: Peak Elev=826.55' Inflow=1.88 cfs 0.089 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0444 '/' Outflow=1.88 cfs 0.089 af

Pond 13P: Peak Elev=823.23' Inflow=0.68 cfs 0.208 af
18.0" Round Culvert n=0.013 L=44.0' S=0.0105 '/' Outflow=0.68 cfs 0.208 af

Total Runoff Area = 3.198 ac Runoff Volume = 0.443 af Average Runoff Depth = 1.66"
25.76% Pervious = 0.824 ac 74.24% Impervious = 2.374 ac

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Summary for Subcatchment 1S:

Runoff = 0.10 cfs @ 11.96 hrs, Volume= 0.005 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
1,118	98	Paved parking, HSG C
68	61	>75% Grass cover, Good, HSG B
1,186	96	Weighted Average
68		5.73% Pervious Area
1,118		94.27% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 0.19 cfs @ 11.97 hrs, Volume= 0.009 af, Depth> 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
2,115	98	Paved parking, HSG C
456	61	>75% Grass cover, Good, HSG B
2,571	91	Weighted Average
456		17.74% Pervious Area
2,115		82.26% Impervious Area

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

Summary for Subcatchment 3S:

Runoff = 0.42 cfs @ 11.97 hrs, Volume= 0.020 af, Depth> 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
4,572	98	Paved parking, HSG C
881	61	>75% Grass cover, Good, HSG B
5,453	92	Weighted Average
881		16.16% Pervious Area
4,572		83.84% Impervious Area

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

Summary for Subcatchment 4S:

Runoff = 0.02 cfs @ 12.01 hrs, Volume= 0.001 af, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
10	98	Paved parking, HSG C
1,861	61	>75% Grass cover, Good, HSG B
1,871	61	Weighted Average
1,861		99.47% Pervious Area
10		0.53% Impervious Area

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

Summary for Subcatchment 5S:

Runoff = 0.04 cfs @ 12.00 hrs, Volume= 0.002 af, Depth> 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
132	98	Paved parking, HSG B
4,200	61	>75% Grass cover, Good, HSG B
4,332	62	Weighted Average
4,200		96.95% Pervious Area
132		3.05% Impervious Area

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

Summary for Subcatchment 6S:

Runoff = 0.01 cfs @ 12.01 hrs, Volume= 0.001 af, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

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Area (sf)	CN	Description
0	98	Paved parking, HSG B
1,337	61	>75% Grass cover, Good, HSG B
1,337	61	Weighted Average
1,337		100.00% Pervious Area

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

Summary for Subcatchment 8S:

Runoff = 0.27 cfs @ 11.97 hrs, Volume= 0.012 af, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
3,067	98	Paved parking, HSG B
916	61	>75% Grass cover, Good, HSG B
3,983	89	Weighted Average
916		23.00% Pervious Area
3,067		77.00% Impervious Area

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

Summary for Subcatchment 10S:

Runoff = 0.56 cfs @ 11.96 hrs, Volume= 0.028 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
6,186	98	Paved parking, HSG B
309	61	>75% Grass cover, Good, HSG B
6,495	96	Weighted Average
309		4.76% Pervious Area
6,186		95.24% Impervious Area

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

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Type II 24-hr 2-yr Rainfall=2.84"

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Summary for Subcatchment 11S:

Runoff = 1.88 cfs @ 11.97 hrs, Volume= 0.089 af, Depth> 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
20,765	98	Paved parking, HSG B
3,877	61	>75% Grass cover, Good, HSG B
24,642	92	Weighted Average
3,877		15.73% Pervious Area
20,765		84.27% Impervious Area

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

Summary for Subcatchment 12S: Building Roof

Runoff = 0.65 cfs @ 11.96 hrs, Volume= 0.034 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
7,315	98	Paved parking, HSG C
0	61	>75% Grass cover, Good, HSG B
7,315	98	Weighted Average
7,315		100.00% Impervious Area

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

Summary for Subcatchment 13S: canopy

Runoff = 0.34 cfs @ 11.96 hrs, Volume= 0.018 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
3,797	98	Paved parking, HSG B
0	61	>75% Grass cover, Good, HSG B
3,797	98	Weighted Average
3,797		100.00% Impervious Area

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

Summary for Subcatchment 14S: Untreated

Runoff = 0.12 cfs @ 11.99 hrs, Volume= 0.005 af, Depth> 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
1,256	98	Paved parking, HSG B
3,541	61	>75% Grass cover, Good, HSG B
4,797	71	Weighted Average
3,541		73.82% Pervious Area
1,256		26.18% Impervious Area

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

Summary for Subcatchment 15S: Untreated

Runoff = 0.04 cfs @ 11.99 hrs, Volume= 0.002 af, Depth> 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

Area (sf)	CN	Description
467	98	Paved parking, HSG B
1,413	61	>75% Grass cover, Good, HSG B
1,880	70	Weighted Average
1,413		75.16% Pervious Area
467		24.84% Impervious Area

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

Summary for Subcatchment EX:

Runoff = 4.75 cfs @ 11.97 hrs, Volume= 0.217 af, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.84"

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Area (sf)	CN	Description
52,631	98	Paved parking, HSG B
17,026	61	>75% Grass cover, Good, HSG B
69,657	89	Weighted Average
17,026		24.44% Pervious Area
52,631		75.56% Impervious Area

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

Summary for Pond 1P:

Inflow Area = 0.644 ac, 65.35% Impervious, Inflow Depth > 1.56" for 2-yr event
 Inflow = 1.69 cfs @ 11.97 hrs, Volume= 0.084 af
 Outflow = 1.69 cfs @ 11.97 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.69 cfs @ 11.97 hrs, Volume= 0.084 af

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

Peak Elev= 826.06' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.34'	15.0" Round Culvert L= 59.0' Ke= 0.500 Inlet / Outlet Invert= 825.34' / 825.00' S= 0.0058 ' / ' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.64 cfs @ 11.97 hrs HW=826.05' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.64 cfs @ 3.28 fps)**Summary for Pond 2P:**

Inflow Area = 0.617 ac, 64.07% Impervious, Inflow Depth > 1.53" for 2-yr event
 Inflow = 1.58 cfs @ 11.97 hrs, Volume= 0.079 af
 Outflow = 1.58 cfs @ 11.97 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.58 cfs @ 11.97 hrs, Volume= 0.079 af

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

Peak Elev= 826.37' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.58'	12.0" Round Culvert L= 41.0' Ke= 0.500 Inlet / Outlet Invert= 825.58' / 825.34' S= 0.0059 ' / ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.54 cfs @ 11.97 hrs HW=826.35' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.54 cfs @ 3.25 fps)

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Summary for Pond 3P:

Inflow Area = 0.558 ac, 62.15% Impervious, Inflow Depth > 1.50" for 2-yr event
Inflow = 1.40 cfs @ 11.97 hrs, Volume= 0.070 af
Outflow = 1.40 cfs @ 11.97 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min
Primary = 1.40 cfs @ 11.97 hrs, Volume= 0.070 af

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

Peak Elev= 826.63' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.91'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 825.91' / 825.58' S= 0.0060 '/ Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.35 cfs @ 11.97 hrs HW=826.61' (Free Discharge)

↑**1=Culvert** (Barrel Controls 1.35 cfs @ 3.22 fps)

Summary for Pond 4P:

Inflow Area = 0.432 ac, 55.87% Impervious, Inflow Depth > 1.39" for 2-yr event
Inflow = 0.98 cfs @ 11.97 hrs, Volume= 0.050 af
Outflow = 0.98 cfs @ 11.97 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 11.97 hrs, Volume= 0.050 af

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

Peak Elev= 826.93' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	826.35'	12.0" Round Culvert L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 826.35' / 825.91' S= 0.0060 '/ Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.95 cfs @ 11.97 hrs HW=826.91' (Free Discharge)

↑**1=Culvert** (Barrel Controls 0.95 cfs @ 3.00 fps)

Summary for Pond 5P:

Inflow Area = 0.390 ac, 61.97% Impervious, Inflow Depth > 1.52" for 2-yr event
Inflow = 0.97 cfs @ 11.97 hrs, Volume= 0.049 af
Outflow = 0.97 cfs @ 11.97 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min
Primary = 0.97 cfs @ 11.97 hrs, Volume= 0.049 af

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

Peak Elev= 827.25' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	826.67'	12.0" Round Culvert L= 53.0' Ke= 0.500 Inlet / Outlet Invert= 826.67' / 826.35' S= 0.0060 '/ Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=0.94 cfs @ 11.97 hrs HW=827.24' (Free Discharge)↑**1=Culvert** (Barrel Controls 0.94 cfs @ 2.95 fps)**Summary for Pond 6P:**

Inflow Area = 0.290 ac, 82.17% Impervious, Inflow Depth > 1.94" for 2-yr event
 Inflow = 0.93 cfs @ 11.96 hrs, Volume= 0.047 af
 Outflow = 0.93 cfs @ 11.96 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.93 cfs @ 11.96 hrs, Volume= 0.047 af

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

Peak Elev= 827.74' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	827.18'	12.0" Round Culvert L= 85.0' Ke= 0.500 Inlet / Outlet Invert= 827.18' / 826.67' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.91 cfs @ 11.96 hrs HW=827.73' (Free Discharge)↑**1=Culvert** (Barrel Controls 0.91 cfs @ 2.98 fps)**Summary for Pond 7P:**

Inflow Area = 0.259 ac, 91.89% Impervious, Inflow Depth > 2.14" for 2-yr event
 Inflow = 0.92 cfs @ 11.96 hrs, Volume= 0.046 af
 Outflow = 0.92 cfs @ 11.96 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.92 cfs @ 11.96 hrs, Volume= 0.046 af

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

Peak Elev= 827.86' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	827.27'	12.0" Round Culvert L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 827.27' / 827.18' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.90 cfs @ 11.96 hrs HW=827.85' (Free Discharge)↑**1=Culvert** (Barrel Controls 0.90 cfs @ 2.73 fps)**Summary for Pond 8P:**

Device	Routing	Invert	Outlet Devices
#1	Primary	827.46'	12.0" Round Culvert L= 32.0' Ke= 0.500 Inlet / Outlet Invert= 827.46' / 827.27' S= 0.0059 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)↑**1=Culvert** (Controls 0.00 cfs)

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Summary for Pond 9P: wet vault

Inflow Area = 1.446 ac, 77.92% Impervious, Inflow Depth > 1.81" for 2-yr event
 Inflow = 4.47 cfs @ 11.97 hrs, Volume= 0.218 af
 Outflow = 0.59 cfs @ 12.25 hrs, Volume= 0.200 af, Atten= 87%, Lag= 17.1 min
 Primary = 0.59 cfs @ 12.25 hrs, Volume= 0.200 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Starting Elev= 823.50' Surf.Area= 5,318 sf Storage= 14,143 cf
 Peak Elev= 824.51' @ 12.25 hrs Surf.Area= 5,318 sf Storage= 18,896 cf (4,753 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= 94.2 min (850.2 - 756.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	820.00'	0 cf	38.75'W x 121.08'L x 7.00'H Field A 32,844 cf Overall - 32,844 cf Embedded = 0 cf x 40.0% Voids
#2A	820.00'	25,005 cf	StormTrap DoubleTrap 6-0 x 21 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
#3B	820.00'	0 cf	21.79'W x 28.71'L x 7.00'H Field B 4,379 cf Overall - 4,379 cf Embedded = 0 cf x 40.0% Voids
#4B	820.00'	3,281 cf	StormTrap DoubleTrap 6-0 Inside #3 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 15.40' Core + 6.66' Border = 21.79' x 28.71' System
		28,286 cf	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	823.50'	12.0" Round Culvert L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 823.50' / 822.86' S= 0.0119 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	823.50'	5.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.60'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.59 cfs @ 12.25 hrs HW=824.51' (Free Discharge)

- 1=Culvert (Passes 0.59 cfs of 2.70 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.59 cfs @ 4.31 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

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Summary for Pond 10P:

Inflow Area = 0.149 ac, 95.24% Impervious, Inflow Depth > 2.24" for 2-yr event
 Inflow = 0.56 cfs @ 11.96 hrs, Volume= 0.028 af
 Outflow = 0.56 cfs @ 11.96 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.56 cfs @ 11.96 hrs, Volume= 0.028 af

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

Peak Elev= 825.87' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.50'	12.0" Round Culvert L= 22.0' Ke= 0.500 Inlet / Outlet Invert= 825.50' / 825.00' S= 0.0227 ' / ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.54 cfs @ 11.96 hrs HW=825.87' (Free Discharge)↑**1=Culvert** (Inlet Controls 0.54 cfs @ 2.07 fps)**Summary for Pond 11P:**

Inflow Area = 0.566 ac, 84.27% Impervious, Inflow Depth > 1.88" for 2-yr event
 Inflow = 1.88 cfs @ 11.97 hrs, Volume= 0.089 af
 Outflow = 1.88 cfs @ 11.97 hrs, Volume= 0.089 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.88 cfs @ 11.97 hrs, Volume= 0.089 af

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

Peak Elev= 826.55' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.80'	12.0" Round Culvert L= 18.0' Ke= 0.500 Inlet / Outlet Invert= 825.80' / 825.00' S= 0.0444 ' / ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.83 cfs @ 11.97 hrs HW=826.54' (Free Discharge)↑**1=Culvert** (Inlet Controls 1.83 cfs @ 2.93 fps)**Summary for Pond 13P:**

Inflow Area = 1.599 ac, 72.93% Impervious, Inflow Depth > 1.56" for 2-yr event
 Inflow = 0.68 cfs @ 12.02 hrs, Volume= 0.208 af
 Outflow = 0.68 cfs @ 12.02 hrs, Volume= 0.208 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.68 cfs @ 12.02 hrs, Volume= 0.208 af

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

Peak Elev= 823.23' @ 12.02 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	822.86'	18.0" Round Culvert L= 44.0' Ke= 0.500 Inlet / Outlet Invert= 822.86' / 822.40' S= 0.0105 ' / ' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

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Primary OutFlow Max=0.67 cfs @ 12.02 hrs HW=823.23' (Free Discharge)

↑**1=Culvert** (Barrel Controls 0.67 cfs @ 3.03 fps)

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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

Subcatchment1S:	Runoff Area=1,186 sf 94.27% Impervious Runoff Depth>3.51" Tc=6.0 min CN=96 Runoff=0.16 cfs 0.008 af
Subcatchment2S:	Runoff Area=2,571 sf 82.26% Impervious Runoff Depth>3.04" Tc=6.0 min CN=91 Runoff=0.31 cfs 0.015 af
Subcatchment3S:	Runoff Area=5,453 sf 83.84% Impervious Runoff Depth>3.13" Tc=6.0 min CN=92 Runoff=0.67 cfs 0.033 af
Subcatchment4S:	Runoff Area=1,871 sf 0.53% Impervious Runoff Depth>0.82" Tc=6.0 min CN=61 Runoff=0.07 cfs 0.003 af
Subcatchment5S:	Runoff Area=4,332 sf 3.05% Impervious Runoff Depth>0.88" Tc=6.0 min CN=62 Runoff=0.16 cfs 0.007 af
Subcatchment6S:	Runoff Area=1,337 sf 0.00% Impervious Runoff Depth>0.82" Tc=6.0 min CN=61 Runoff=0.05 cfs 0.002 af
Subcatchment8S:	Runoff Area=3,983 sf 77.00% Impervious Runoff Depth>2.84" Tc=6.0 min CN=89 Runoff=0.46 cfs 0.022 af
Subcatchment10S:	Runoff Area=6,495 sf 95.24% Impervious Runoff Depth>3.51" Tc=6.0 min CN=96 Runoff=0.85 cfs 0.044 af
Subcatchment11S:	Runoff Area=24,642 sf 84.27% Impervious Runoff Depth>3.13" Tc=6.0 min CN=92 Runoff=3.03 cfs 0.148 af
Subcatchment12S: Building Roof	Runoff Area=7,315 sf 100.00% Impervious Runoff Depth>3.68" Tc=6.0 min CN=98 Runoff=0.98 cfs 0.051 af
Subcatchment13S: canopy	Runoff Area=3,797 sf 100.00% Impervious Runoff Depth>3.68" Tc=6.0 min CN=98 Runoff=0.51 cfs 0.027 af
Subcatchment14S: Untreated	Runoff Area=4,797 sf 26.18% Impervious Runoff Depth>1.41" Tc=6.0 min CN=71 Runoff=0.30 cfs 0.013 af
Subcatchment15S: Untreated	Runoff Area=1,880 sf 24.84% Impervious Runoff Depth>1.35" Tc=6.0 min CN=70 Runoff=0.11 cfs 0.005 af
SubcatchmentEX:	Runoff Area=69,657 sf 75.56% Impervious Runoff Depth>2.84" Tc=6.0 min CN=89 Runoff=8.01 cfs 0.379 af
Pond 1P:	Peak Elev=826.33' Inflow=2.84 cfs 0.141 af 15.0" Round Culvert n=0.013 L=59.0' S=0.0058 ' Outflow=2.84 cfs 0.141 af
Pond 2P:	Peak Elev=826.74' Inflow=2.68 cfs 0.133 af 12.0" Round Culvert n=0.013 L=41.0' S=0.0059 ' Outflow=2.68 cfs 0.133 af

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Pond 3P: Peak Elev=826.94' Inflow=2.37 cfs 0.118 af
12.0" Round Culvert n=0.013 L=55.0' S=0.0060 '/' Outflow=2.37 cfs 0.118 af

Pond 4P: Peak Elev=827.15' Inflow=1.70 cfs 0.085 af
12.0" Round Culvert n=0.013 L=73.0' S=0.0060 '/' Outflow=1.70 cfs 0.085 af

Pond 5P: Peak Elev=827.46' Inflow=1.64 cfs 0.082 af
12.0" Round Culvert n=0.013 L=53.0' S=0.0060 '/' Outflow=1.64 cfs 0.082 af

Pond 6P: Peak Elev=827.91' Inflow=1.48 cfs 0.075 af
12.0" Round Culvert n=0.013 L=85.0' S=0.0060 '/' Outflow=1.48 cfs 0.075 af

Pond 7P: Peak Elev=828.04' Inflow=1.44 cfs 0.073 af
12.0" Round Culvert n=0.013 L=15.0' S=0.0060 '/' Outflow=1.44 cfs 0.073 af

Pond 8P: Peak Elev=0.00'
12.0" Round Culvert n=0.013 L=32.0' S=0.0059 '/' Primary=0.00 cfs 0.000 af

Pond 9P: wet vault Peak Elev=824.92' Storage=20,824 cf Inflow=7.23 cfs 0.359 af
Outflow=3.54 cfs 0.337 af

Pond 10P: Peak Elev=825.97' Inflow=0.85 cfs 0.044 af
12.0" Round Culvert n=0.013 L=22.0' S=0.0227 '/' Outflow=0.85 cfs 0.044 af

Pond 11P: Peak Elev=826.94' Inflow=3.03 cfs 0.148 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0444 '/' Outflow=3.03 cfs 0.148 af

Pond 13P: Peak Elev=823.83' Inflow=3.75 cfs 0.354 af
18.0" Round Culvert n=0.013 L=44.0' S=0.0105 '/' Outflow=3.75 cfs 0.354 af

Total Runoff Area = 3.198 ac Runoff Volume = 0.756 af Average Runoff Depth = 2.84"
25.76% Pervious = 0.824 ac 74.24% Impervious = 2.374 ac

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Summary for Subcatchment 1S:

Runoff = 0.16 cfs @ 11.96 hrs, Volume= 0.008 af, Depth> 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
1,118	98	Paved parking, HSG C
68	61	>75% Grass cover, Good, HSG B
1,186	96	Weighted Average
68		5.73% Pervious Area
1,118		94.27% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 0.31 cfs @ 11.96 hrs, Volume= 0.015 af, Depth> 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
2,115	98	Paved parking, HSG C
456	61	>75% Grass cover, Good, HSG B
2,571	91	Weighted Average
456		17.74% Pervious Area
2,115		82.26% Impervious Area

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

Summary for Subcatchment 3S:

Runoff = 0.67 cfs @ 11.96 hrs, Volume= 0.033 af, Depth> 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
4,572	98	Paved parking, HSG C
881	61	>75% Grass cover, Good, HSG B
5,453	92	Weighted Average
881		16.16% Pervious Area
4,572		83.84% Impervious Area

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

Summary for Subcatchment 4S:

Runoff = 0.07 cfs @ 11.99 hrs, Volume= 0.003 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
10	98	Paved parking, HSG C
1,861	61	>75% Grass cover, Good, HSG B
1,871	61	Weighted Average
1,861		99.47% Pervious Area
10		0.53% Impervious Area

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

Summary for Subcatchment 5S:

Runoff = 0.16 cfs @ 11.99 hrs, Volume= 0.007 af, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
132	98	Paved parking, HSG B
4,200	61	>75% Grass cover, Good, HSG B
4,332	62	Weighted Average
4,200		96.95% Pervious Area
132		3.05% Impervious Area

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

Summary for Subcatchment 6S:

Runoff = 0.05 cfs @ 11.99 hrs, Volume= 0.002 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

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Area (sf)	CN	Description
0	98	Paved parking, HSG B
1,337	61	>75% Grass cover, Good, HSG B
1,337	61	Weighted Average
1,337		100.00% Pervious Area

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

Summary for Subcatchment 8S:

Runoff = 0.46 cfs @ 11.97 hrs, Volume= 0.022 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
3,067	98	Paved parking, HSG B
916	61	>75% Grass cover, Good, HSG B
3,983	89	Weighted Average
916		23.00% Pervious Area
3,067		77.00% Impervious Area

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

Summary for Subcatchment 10S:

Runoff = 0.85 cfs @ 11.96 hrs, Volume= 0.044 af, Depth> 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
6,186	98	Paved parking, HSG B
309	61	>75% Grass cover, Good, HSG B
6,495	96	Weighted Average
309		4.76% Pervious Area
6,186		95.24% Impervious Area

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

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Type II 24-hr 10-yr Rainfall=4.23"

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Summary for Subcatchment 11S:

Runoff = 3.03 cfs @ 11.96 hrs, Volume= 0.148 af, Depth> 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
20,765	98	Paved parking, HSG B
3,877	61	>75% Grass cover, Good, HSG B
24,642	92	Weighted Average
3,877		15.73% Pervious Area
20,765		84.27% Impervious Area

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

Summary for Subcatchment 12S: Building Roof

Runoff = 0.98 cfs @ 11.96 hrs, Volume= 0.051 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
7,315	98	Paved parking, HSG C
0	61	>75% Grass cover, Good, HSG B
7,315	98	Weighted Average
7,315		100.00% Impervious Area

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

Summary for Subcatchment 13S: canopy

Runoff = 0.51 cfs @ 11.96 hrs, Volume= 0.027 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
3,797	98	Paved parking, HSG B
0	61	>75% Grass cover, Good, HSG B
3,797	98	Weighted Average
3,797		100.00% Impervious Area

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

Summary for Subcatchment 14S: Untreated

Runoff = 0.30 cfs @ 11.98 hrs, Volume= 0.013 af, Depth> 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
1,256	98	Paved parking, HSG B
3,541	61	>75% Grass cover, Good, HSG B
4,797	71	Weighted Average
3,541		73.82% Pervious Area
1,256		26.18% Impervious Area

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

Summary for Subcatchment 15S: Untreated

Runoff = 0.11 cfs @ 11.98 hrs, Volume= 0.005 af, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

Area (sf)	CN	Description
467	98	Paved parking, HSG B
1,413	61	>75% Grass cover, Good, HSG B
1,880	70	Weighted Average
1,413		75.16% Pervious Area
467		24.84% Impervious Area

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

Summary for Subcatchment EX:

Runoff = 8.01 cfs @ 11.97 hrs, Volume= 0.379 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.23"

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Area (sf)	CN	Description
52,631	98	Paved parking, HSG B
17,026	61	>75% Grass cover, Good, HSG B
69,657	89	Weighted Average
17,026		24.44% Pervious Area
52,631		75.56% Impervious Area

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

Summary for Pond 1P:

Inflow Area = 0.644 ac, 65.35% Impervious, Inflow Depth > 2.63" for 10-yr event
 Inflow = 2.84 cfs @ 11.97 hrs, Volume= 0.141 af
 Outflow = 2.84 cfs @ 11.97 hrs, Volume= 0.141 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.84 cfs @ 11.97 hrs, Volume= 0.141 af

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

Peak Elev= 826.33' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.34'	15.0" Round Culvert L= 59.0' Ke= 0.500 Inlet / Outlet Invert= 825.34' / 825.00' S= 0.0058 ' / Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.75 cfs @ 11.97 hrs HW=826.31' (Free Discharge)↑**1=Culvert** (Barrel Controls 2.75 cfs @ 3.71 fps)**Summary for Pond 2P:**

Inflow Area = 0.617 ac, 64.07% Impervious, Inflow Depth > 2.59" for 10-yr event
 Inflow = 2.68 cfs @ 11.97 hrs, Volume= 0.133 af
 Outflow = 2.68 cfs @ 11.97 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.68 cfs @ 11.97 hrs, Volume= 0.133 af

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

Peak Elev= 826.74' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.58'	12.0" Round Culvert L= 41.0' Ke= 0.500 Inlet / Outlet Invert= 825.58' / 825.34' S= 0.0059 ' / Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.60 cfs @ 11.97 hrs HW=826.71' (Free Discharge)↑**1=Culvert** (Barrel Controls 2.60 cfs @ 3.67 fps)

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Summary for Pond 3P:

Inflow Area = 0.558 ac, 62.15% Impervious, Inflow Depth > 2.54" for 10-yr event
 Inflow = 2.37 cfs @ 11.97 hrs, Volume= 0.118 af
 Outflow = 2.37 cfs @ 11.97 hrs, Volume= 0.118 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.37 cfs @ 11.97 hrs, Volume= 0.118 af

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

Peak Elev= 826.94' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.91'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 825.91' / 825.58' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.30 cfs @ 11.97 hrs HW=826.91' (Free Discharge)↑**1=Culvert** (Barrel Controls 2.30 cfs @ 3.63 fps)**Summary for Pond 4P:**

Inflow Area = 0.432 ac, 55.87% Impervious, Inflow Depth > 2.37" for 10-yr event
 Inflow = 1.70 cfs @ 11.97 hrs, Volume= 0.085 af
 Outflow = 1.70 cfs @ 11.97 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.70 cfs @ 11.97 hrs, Volume= 0.085 af

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

Peak Elev= 827.15' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	826.35'	12.0" Round Culvert L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 826.35' / 825.91' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.65 cfs @ 11.97 hrs HW=827.14' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.65 cfs @ 3.42 fps)**Summary for Pond 5P:**

Inflow Area = 0.390 ac, 61.97% Impervious, Inflow Depth > 2.54" for 10-yr event
 Inflow = 1.64 cfs @ 11.97 hrs, Volume= 0.082 af
 Outflow = 1.64 cfs @ 11.97 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.64 cfs @ 11.97 hrs, Volume= 0.082 af

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

Peak Elev= 827.46' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	826.67'	12.0" Round Culvert L= 53.0' Ke= 0.500 Inlet / Outlet Invert= 826.67' / 826.35' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=1.59 cfs @ 11.97 hrs HW=827.45' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.59 cfs @ 3.34 fps)**Summary for Pond 6P:**

Inflow Area = 0.290 ac, 82.17% Impervious, Inflow Depth > 3.11" for 10-yr event
 Inflow = 1.48 cfs @ 11.96 hrs, Volume= 0.075 af
 Outflow = 1.48 cfs @ 11.96 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.48 cfs @ 11.96 hrs, Volume= 0.075 af

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

Peak Elev= 827.91' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	827.18'	12.0" Round Culvert L= 85.0' Ke= 0.500 Inlet / Outlet Invert= 827.18' / 826.67' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.44 cfs @ 11.96 hrs HW=827.90' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.44 cfs @ 3.33 fps)**Summary for Pond 7P:**

Inflow Area = 0.259 ac, 91.89% Impervious, Inflow Depth > 3.38" for 10-yr event
 Inflow = 1.44 cfs @ 11.96 hrs, Volume= 0.073 af
 Outflow = 1.44 cfs @ 11.96 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 11.96 hrs, Volume= 0.073 af

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

Peak Elev= 828.04' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	827.27'	12.0" Round Culvert L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 827.27' / 827.18' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.40 cfs @ 11.96 hrs HW=828.03' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.40 cfs @ 3.05 fps)**Summary for Pond 8P:**

Device	Routing	Invert	Outlet Devices
#1	Primary	827.46'	12.0" Round Culvert L= 32.0' Ke= 0.500 Inlet / Outlet Invert= 827.46' / 827.27' S= 0.0059 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)↑**1=Culvert** (Controls 0.00 cfs)

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Summary for Pond 9P: wet vault

Inflow Area = 1.446 ac, 77.92% Impervious, Inflow Depth > 2.98" for 10-yr event
 Inflow = 7.23 cfs @ 11.96 hrs, Volume= 0.359 af
 Outflow = 3.54 cfs @ 12.07 hrs, Volume= 0.337 af, Atten= 51%, Lag= 6.5 min
 Primary = 3.54 cfs @ 12.07 hrs, Volume= 0.337 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Starting Elev= 823.50' Surf.Area= 5,318 sf Storage= 14,143 cf
 Peak Elev= 824.92' @ 12.07 hrs Surf.Area= 5,318 sf Storage= 20,824 cf (6,681 cf above start)

Plug-Flow detention time= 760.9 min calculated for 0.012 af (3% of inflow)
 Center-of-Mass det. time= 79.1 min (827.6 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	820.00'	0 cf	38.75'W x 121.08'L x 7.00'H Field A 32,844 cf Overall - 32,844 cf Embedded = 0 cf x 40.0% Voids
#2A	820.00'	25,005 cf	StormTrap DoubleTrap 6-0 x 21 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
#3B	820.00'	0 cf	21.79'W x 28.71'L x 7.00'H Field B 4,379 cf Overall - 4,379 cf Embedded = 0 cf x 40.0% Voids
#4B	820.00'	3,281 cf	StormTrap DoubleTrap 6-0 Inside #3 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 15.40' Core + 6.66' Border = 21.79' x 28.71' System
		28,286 cf	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	823.50'	12.0" Round Culvert L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 823.50' / 822.86' S= 0.0119 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	823.50'	5.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.60'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=3.42 cfs @ 12.07 hrs HW=824.90' (Free Discharge)

1=Culvert (Passes 3.42 cfs of 3.59 cfs potential flow)

2=Orifice/Grate (Orifice Controls 0.72 cfs @ 5.26 fps)

3=Sharp-Crested Rectangular Weir (Weir Controls 2.70 cfs @ 1.80 fps)

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Summary for Pond 10P:

Inflow Area = 0.149 ac, 95.24% Impervious, Inflow Depth > 3.51" for 10-yr event
 Inflow = 0.85 cfs @ 11.96 hrs, Volume= 0.044 af
 Outflow = 0.85 cfs @ 11.96 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.85 cfs @ 11.96 hrs, Volume= 0.044 af

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

Peak Elev= 825.97' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.50'	12.0" Round Culvert L= 22.0' Ke= 0.500 Inlet / Outlet Invert= 825.50' / 825.00' S= 0.0227 ' /' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.83 cfs @ 11.96 hrs HW=825.97' (Free Discharge)↑**1=Culvert** (Inlet Controls 0.83 cfs @ 2.32 fps)**Summary for Pond 11P:**

Inflow Area = 0.566 ac, 84.27% Impervious, Inflow Depth > 3.13" for 10-yr event
 Inflow = 3.03 cfs @ 11.96 hrs, Volume= 0.148 af
 Outflow = 3.03 cfs @ 11.96 hrs, Volume= 0.148 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.03 cfs @ 11.96 hrs, Volume= 0.148 af

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

Peak Elev= 826.94' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.80'	12.0" Round Culvert L= 18.0' Ke= 0.500 Inlet / Outlet Invert= 825.80' / 825.00' S= 0.0444 ' /' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.95 cfs @ 11.96 hrs HW=826.91' (Free Discharge)↑**1=Culvert** (Inlet Controls 2.95 cfs @ 3.76 fps)**Summary for Pond 13P:**

Inflow Area = 1.599 ac, 72.93% Impervious, Inflow Depth > 2.66" for 10-yr event
 Inflow = 3.75 cfs @ 12.07 hrs, Volume= 0.354 af
 Outflow = 3.75 cfs @ 12.07 hrs, Volume= 0.354 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.75 cfs @ 12.07 hrs, Volume= 0.354 af

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

Peak Elev= 823.83' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	822.86'	18.0" Round Culvert L= 44.0' Ke= 0.500 Inlet / Outlet Invert= 822.86' / 822.40' S= 0.0105 ' /' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

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Primary OutFlow Max=3.60 cfs @ 12.07 hrs HW=823.81' (Free Discharge)

↑**1=Culvert** (Barrel Controls 3.60 cfs @ 4.37 fps)

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Type II 24-hr 100-yr Rainfall=7.48"

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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

Subcatchment1S:	Runoff Area=1,186 sf 94.27% Impervious Runoff Depth>6.46" Tc=6.0 min CN=96 Runoff=0.28 cfs 0.015 af
Subcatchment2S:	Runoff Area=2,571 sf 82.26% Impervious Runoff Depth>6.00" Tc=6.0 min CN=91 Runoff=0.59 cfs 0.029 af
Subcatchment3S:	Runoff Area=5,453 sf 83.84% Impervious Runoff Depth>6.10" Tc=6.0 min CN=92 Runoff=1.26 cfs 0.064 af
Subcatchment4S:	Runoff Area=1,871 sf 0.53% Impervious Runoff Depth>2.78" Tc=6.0 min CN=61 Runoff=0.23 cfs 0.010 af
Subcatchment5S:	Runoff Area=4,332 sf 3.05% Impervious Runoff Depth>2.89" Tc=6.0 min CN=62 Runoff=0.55 cfs 0.024 af
Subcatchment6S:	Runoff Area=1,337 sf 0.00% Impervious Runoff Depth>2.78" Tc=6.0 min CN=61 Runoff=0.16 cfs 0.007 af
Subcatchment8S:	Runoff Area=3,983 sf 77.00% Impervious Runoff Depth>5.79" Tc=6.0 min CN=89 Runoff=0.89 cfs 0.044 af
Subcatchment10S:	Runoff Area=6,495 sf 95.24% Impervious Runoff Depth>6.46" Tc=6.0 min CN=96 Runoff=1.54 cfs 0.080 af
Subcatchment11S:	Runoff Area=24,642 sf 84.27% Impervious Runoff Depth>6.10" Tc=6.0 min CN=92 Runoff=5.68 cfs 0.287 af
Subcatchment12S: Building Roof	Runoff Area=7,315 sf 100.00% Impervious Runoff Depth>6.60" Tc=6.0 min CN=98 Runoff=1.74 cfs 0.092 af
Subcatchment13S: canopy	Runoff Area=3,797 sf 100.00% Impervious Runoff Depth>6.60" Tc=6.0 min CN=98 Runoff=0.91 cfs 0.048 af
Subcatchment14S: Untreated	Runoff Area=4,797 sf 26.18% Impervious Runoff Depth>3.82" Tc=6.0 min CN=71 Runoff=0.78 cfs 0.035 af
Subcatchment15S: Untreated	Runoff Area=1,880 sf 24.84% Impervious Runoff Depth>3.71" Tc=6.0 min CN=70 Runoff=0.30 cfs 0.013 af
SubcatchmentEX:	Runoff Area=69,657 sf 75.56% Impervious Runoff Depth>5.79" Tc=6.0 min CN=89 Runoff=15.59 cfs 0.771 af
Pond 1P:	Peak Elev=827.22' Inflow=5.68 cfs 0.285 af 15.0" Round Culvert n=0.013 L=59.0' S=0.0058 ' Outflow=5.68 cfs 0.285 af
Pond 2P:	Peak Elev=828.38' Inflow=5.40 cfs 0.271 af 12.0" Round Culvert n=0.013 L=41.0' S=0.0059 ' Outflow=5.40 cfs 0.271 af

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Pond 3P:	Peak Elev=828.45' Inflow=4.81 cfs 0.241 af 12.0" Round Culvert n=0.013 L=55.0' S=0.0060 '/' Outflow=4.81 cfs 0.241 af
Pond 4P:	Peak Elev=828.12' Inflow=3.56 cfs 0.177 af 12.0" Round Culvert n=0.013 L=73.0' S=0.0060 '/' Outflow=3.56 cfs 0.177 af
Pond 5P:	Peak Elev=828.24' Inflow=3.33 cfs 0.167 af 12.0" Round Culvert n=0.013 L=53.0' S=0.0060 '/' Outflow=3.33 cfs 0.167 af
Pond 6P:	Peak Elev=828.36' Inflow=2.79 cfs 0.144 af 12.0" Round Culvert n=0.013 L=85.0' S=0.0060 '/' Outflow=2.79 cfs 0.144 af
Pond 7P:	Peak Elev=828.43' Inflow=2.63 cfs 0.136 af 12.0" Round Culvert n=0.013 L=15.0' S=0.0060 '/' Outflow=2.63 cfs 0.136 af
Pond 8P:	Peak Elev=0.00' 12.0" Round Culvert n=0.013 L=32.0' S=0.0059 '/' Primary=0.00 cfs 0.000 af
Pond 9P: wet vault	Peak Elev=825.96' Storage=25,752 cf Inflow=13.80 cfs 0.701 af Outflow=5.11 cfs 0.668 af
Pond 10P:	Peak Elev=826.16' Inflow=1.54 cfs 0.080 af 12.0" Round Culvert n=0.013 L=22.0' S=0.0227 '/' Outflow=1.54 cfs 0.080 af
Pond 11P:	Peak Elev=828.55' Inflow=5.68 cfs 0.287 af 12.0" Round Culvert n=0.013 L=18.0' S=0.0444 '/' Outflow=5.68 cfs 0.287 af
Pond 13P:	Peak Elev=824.16' Inflow=5.86 cfs 0.716 af 18.0" Round Culvert n=0.013 L=44.0' S=0.0105 '/' Outflow=5.86 cfs 0.716 af

Total Runoff Area = 3.198 ac Runoff Volume = 1.521 af Average Runoff Depth = 5.71"
25.76% Pervious = 0.824 ac 74.24% Impervious = 2.374 ac

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Summary for Subcatchment 1S:

Runoff = 0.28 cfs @ 11.96 hrs, Volume= 0.015 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
1,118	98	Paved parking, HSG C
68	61	>75% Grass cover, Good, HSG B
1,186	96	Weighted Average
68		5.73% Pervious Area
1,118		94.27% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 0.59 cfs @ 11.96 hrs, Volume= 0.029 af, Depth> 6.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
2,115	98	Paved parking, HSG C
456	61	>75% Grass cover, Good, HSG B
2,571	91	Weighted Average
456		17.74% Pervious Area
2,115		82.26% Impervious Area

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

Summary for Subcatchment 3S:

Runoff = 1.26 cfs @ 11.96 hrs, Volume= 0.064 af, Depth> 6.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
4,572	98	Paved parking, HSG C
881	61	>75% Grass cover, Good, HSG B
5,453	92	Weighted Average
881		16.16% Pervious Area
4,572		83.84% Impervious Area

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

Summary for Subcatchment 4S:

Runoff = 0.23 cfs @ 11.98 hrs, Volume= 0.010 af, Depth> 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
10	98	Paved parking, HSG C
1,861	61	>75% Grass cover, Good, HSG B
1,871	61	Weighted Average
1,861		99.47% Pervious Area
10		0.53% Impervious Area

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

Summary for Subcatchment 5S:

Runoff = 0.55 cfs @ 11.98 hrs, Volume= 0.024 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
132	98	Paved parking, HSG B
4,200	61	>75% Grass cover, Good, HSG B
4,332	62	Weighted Average
4,200		96.95% Pervious Area
132		3.05% Impervious Area

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

Summary for Subcatchment 6S:

Runoff = 0.16 cfs @ 11.98 hrs, Volume= 0.007 af, Depth> 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

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Area (sf)	CN	Description
0	98	Paved parking, HSG B
1,337	61	>75% Grass cover, Good, HSG B
1,337	61	Weighted Average
1,337		100.00% Pervious Area

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

Summary for Subcatchment 8S:

Runoff = 0.89 cfs @ 11.96 hrs, Volume= 0.044 af, Depth> 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
3,067	98	Paved parking, HSG B
916	61	>75% Grass cover, Good, HSG B
3,983	89	Weighted Average
916		23.00% Pervious Area
3,067		77.00% Impervious Area

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

Summary for Subcatchment 10S:

Runoff = 1.54 cfs @ 11.96 hrs, Volume= 0.080 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
6,186	98	Paved parking, HSG B
309	61	>75% Grass cover, Good, HSG B
6,495	96	Weighted Average
309		4.76% Pervious Area
6,186		95.24% Impervious Area

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

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Summary for Subcatchment 11S:

Runoff = 5.68 cfs @ 11.96 hrs, Volume= 0.287 af, Depth> 6.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
20,765	98	Paved parking, HSG B
3,877	61	>75% Grass cover, Good, HSG B
24,642	92	Weighted Average
3,877		15.73% Pervious Area
20,765		84.27% Impervious Area

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

Summary for Subcatchment 12S: Building Roof

Runoff = 1.74 cfs @ 11.96 hrs, Volume= 0.092 af, Depth> 6.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
7,315	98	Paved parking, HSG C
0	61	>75% Grass cover, Good, HSG B
7,315	98	Weighted Average
7,315		100.00% Impervious Area

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

Summary for Subcatchment 13S: canopy

Runoff = 0.91 cfs @ 11.96 hrs, Volume= 0.048 af, Depth> 6.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
3,797	98	Paved parking, HSG B
0	61	>75% Grass cover, Good, HSG B
3,797	98	Weighted Average
3,797		100.00% Impervious Area

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

Summary for Subcatchment 14S: Untreated

Runoff = 0.78 cfs @ 11.97 hrs, Volume= 0.035 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
1,256	98	Paved parking, HSG B
3,541	61	>75% Grass cover, Good, HSG B
4,797	71	Weighted Average
3,541		73.82% Pervious Area
1,256		26.18% Impervious Area

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

Summary for Subcatchment 15S: Untreated

Runoff = 0.30 cfs @ 11.97 hrs, Volume= 0.013 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

Area (sf)	CN	Description
467	98	Paved parking, HSG B
1,413	61	>75% Grass cover, Good, HSG B
1,880	70	Weighted Average
1,413		75.16% Pervious Area
467		24.84% Impervious Area

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

Summary for Subcatchment EX:

Runoff = 15.59 cfs @ 11.96 hrs, Volume= 0.771 af, Depth> 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.48"

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Area (sf)	CN	Description
52,631	98	Paved parking, HSG B
17,026	61	>75% Grass cover, Good, HSG B
69,657	89	Weighted Average
17,026		24.44% Pervious Area
52,631		75.56% Impervious Area

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

Summary for Pond 1P:

Inflow Area = 0.644 ac, 65.35% Impervious, Inflow Depth > 5.31" for 100-yr event
 Inflow = 5.68 cfs @ 11.96 hrs, Volume= 0.285 af
 Outflow = 5.68 cfs @ 11.96 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.68 cfs @ 11.96 hrs, Volume= 0.285 af

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

Peak Elev= 827.22' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.34'	15.0" Round Culvert L= 59.0' Ke= 0.500 Inlet / Outlet Invert= 825.34' / 825.00' S= 0.0058 ' / Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=5.53 cfs @ 11.96 hrs HW=827.16' (Free Discharge)**1=Culvert** (Barrel Controls 5.53 cfs @ 4.50 fps)**Summary for Pond 2P:**

Inflow Area = 0.617 ac, 64.07% Impervious, Inflow Depth > 5.26" for 100-yr event
 Inflow = 5.40 cfs @ 11.96 hrs, Volume= 0.271 af
 Outflow = 5.40 cfs @ 11.96 hrs, Volume= 0.271 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.40 cfs @ 11.96 hrs, Volume= 0.271 af

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

Peak Elev= 828.38' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.58'	12.0" Round Culvert L= 41.0' Ke= 0.500 Inlet / Outlet Invert= 825.58' / 825.34' S= 0.0059 ' / Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=5.25 cfs @ 11.96 hrs HW=828.28' (Free Discharge)**1=Culvert** (Barrel Controls 5.25 cfs @ 6.69 fps)

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Summary for Pond 3P:

Inflow Area = 0.558 ac, 62.15% Impervious, Inflow Depth > 5.19" for 100-yr event
 Inflow = 4.81 cfs @ 11.96 hrs, Volume= 0.241 af
 Outflow = 4.81 cfs @ 11.96 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.0 min
 Primary = 4.81 cfs @ 11.96 hrs, Volume= 0.241 af

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

Peak Elev= 828.45' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.91'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 825.91' / 825.58' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=4.68 cfs @ 11.96 hrs HW=828.36' (Free Discharge)↑**1=Culvert** (Barrel Controls 4.68 cfs @ 5.96 fps)**Summary for Pond 4P:**

Inflow Area = 0.432 ac, 55.87% Impervious, Inflow Depth > 4.92" for 100-yr event
 Inflow = 3.56 cfs @ 11.97 hrs, Volume= 0.177 af
 Outflow = 3.56 cfs @ 11.97 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.56 cfs @ 11.97 hrs, Volume= 0.177 af

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

Peak Elev= 828.12' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	826.35'	12.0" Round Culvert L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 826.35' / 825.91' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=3.46 cfs @ 11.97 hrs HW=828.05' (Free Discharge)↑**1=Culvert** (Barrel Controls 3.46 cfs @ 4.40 fps)**Summary for Pond 5P:**

Inflow Area = 0.390 ac, 61.97% Impervious, Inflow Depth > 5.16" for 100-yr event
 Inflow = 3.33 cfs @ 11.97 hrs, Volume= 0.167 af
 Outflow = 3.33 cfs @ 11.97 hrs, Volume= 0.167 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.33 cfs @ 11.97 hrs, Volume= 0.167 af

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

Peak Elev= 828.24' @ 11.97 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	826.67'	12.0" Round Culvert L= 53.0' Ke= 0.500 Inlet / Outlet Invert= 826.67' / 826.35' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

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Primary OutFlow Max=3.24 cfs @ 11.97 hrs HW=828.19' (Free Discharge)↑**1=Culvert** (Barrel Controls 3.24 cfs @ 4.13 fps)**Summary for Pond 6P:**

Inflow Area = 0.290 ac, 82.17% Impervious, Inflow Depth > 5.94" for 100-yr event
 Inflow = 2.79 cfs @ 11.96 hrs, Volume= 0.144 af
 Outflow = 2.79 cfs @ 11.96 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.79 cfs @ 11.96 hrs, Volume= 0.144 af

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

Peak Elev= 828.36' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	827.18'	12.0" Round Culvert L= 85.0' Ke= 0.500 Inlet / Outlet Invert= 827.18' / 826.67' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.73 cfs @ 11.96 hrs HW=828.33' (Free Discharge)↑**1=Culvert** (Barrel Controls 2.73 cfs @ 3.79 fps)**Summary for Pond 7P:**

Inflow Area = 0.259 ac, 91.89% Impervious, Inflow Depth > 6.31" for 100-yr event
 Inflow = 2.63 cfs @ 11.96 hrs, Volume= 0.136 af
 Outflow = 2.63 cfs @ 11.96 hrs, Volume= 0.136 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.63 cfs @ 11.96 hrs, Volume= 0.136 af

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

Peak Elev= 828.43' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	827.27'	12.0" Round Culvert L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 827.27' / 827.18' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.57 cfs @ 11.96 hrs HW=828.41' (Free Discharge)↑**1=Culvert** (Barrel Controls 2.57 cfs @ 3.60 fps)**Summary for Pond 8P:**

Device	Routing	Invert	Outlet Devices
#1	Primary	827.46'	12.0" Round Culvert L= 32.0' Ke= 0.500 Inlet / Outlet Invert= 827.46' / 827.27' S= 0.0059 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)↑**1=Culvert** (Controls 0.00 cfs)

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Summary for Pond 9P: wet vault

Inflow Area = 1.446 ac, 77.92% Impervious, Inflow Depth > 5.82" for 100-yr event
 Inflow = 13.80 cfs @ 11.96 hrs, Volume= 0.701 af
 Outflow = 5.11 cfs @ 12.09 hrs, Volume= 0.668 af, Atten= 63%, Lag= 7.7 min
 Primary = 5.11 cfs @ 12.09 hrs, Volume= 0.668 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Starting Elev= 823.50' Surf.Area= 5,318 sf Storage= 14,143 cf
 Peak Elev= 825.96' @ 12.09 hrs Surf.Area= 5,318 sf Storage= 25,752 cf (11,609 cf above start)

Plug-Flow detention time= 246.0 min calculated for 0.343 af (49% of inflow)
 Center-of-Mass det. time= 59.6 min (800.4 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	820.00'	0 cf	38.75'W x 121.08'L x 7.00'H Field A 32,844 cf Overall - 32,844 cf Embedded = 0 cf x 40.0% Voids
#2A	820.00'	25,005 cf	StormTrap DoubleTrap 6-0 x 21 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
#3B	820.00'	0 cf	21.79'W x 28.71'L x 7.00'H Field B 4,379 cf Overall - 4,379 cf Embedded = 0 cf x 40.0% Voids
#4B	820.00'	3,281 cf	StormTrap DoubleTrap 6-0 Inside #3 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 15.40' Core + 6.66' Border = 21.79' x 28.71' System
		28,286 cf	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	823.50'	12.0" Round Culvert L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 823.50' / 822.86' S= 0.0119 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	823.50'	5.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.60'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=5.10 cfs @ 12.09 hrs HW=825.96' (Free Discharge)

- 1=Culvert (Barrel Controls 5.10 cfs @ 6.50 fps)
- 2=Orifice/Grate (Passes < 0.98 cfs potential flow)
- 3=Sharp-Crested Rectangular Weir (Passes < 24.40 cfs potential flow)

KT - Bloomington, MN

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Kwik Trip - Bloomington, MN #1794

Type II 24-hr 100-yr Rainfall=7.48"

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Summary for Pond 10P:

Inflow Area = 0.149 ac, 95.24% Impervious, Inflow Depth > 6.46" for 100-yr event
 Inflow = 1.54 cfs @ 11.96 hrs, Volume= 0.080 af
 Outflow = 1.54 cfs @ 11.96 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.54 cfs @ 11.96 hrs, Volume= 0.080 af

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

Peak Elev= 826.16' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.50'	12.0" Round Culvert L= 22.0' Ke= 0.500 Inlet / Outlet Invert= 825.50' / 825.00' S= 0.0227 ' /' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.50 cfs @ 11.96 hrs HW=826.15' (Free Discharge)↑**1=Culvert** (Inlet Controls 1.50 cfs @ 2.75 fps)**Summary for Pond 11P:**

Inflow Area = 0.566 ac, 84.27% Impervious, Inflow Depth > 6.10" for 100-yr event
 Inflow = 5.68 cfs @ 11.96 hrs, Volume= 0.287 af
 Outflow = 5.68 cfs @ 11.96 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.68 cfs @ 11.96 hrs, Volume= 0.287 af

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

Peak Elev= 828.55' @ 11.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	825.80'	12.0" Round Culvert L= 18.0' Ke= 0.500 Inlet / Outlet Invert= 825.80' / 825.00' S= 0.0444 ' /' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=5.54 cfs @ 11.96 hrs HW=828.45' (Free Discharge)↑**1=Culvert** (Inlet Controls 5.54 cfs @ 7.05 fps)**Summary for Pond 13P:**

Inflow Area = 1.599 ac, 72.93% Impervious, Inflow Depth > 5.38" for 100-yr event
 Inflow = 5.86 cfs @ 12.01 hrs, Volume= 0.716 af
 Outflow = 5.86 cfs @ 12.01 hrs, Volume= 0.716 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.86 cfs @ 12.01 hrs, Volume= 0.716 af

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

Peak Elev= 824.16' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	822.86'	18.0" Round Culvert L= 44.0' Ke= 0.500 Inlet / Outlet Invert= 822.86' / 822.40' S= 0.0105 ' /' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

KT - Bloomington, MN

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Kwik Trip - Bloomington, MN #1794

Type II 24-hr 100-yr Rainfall=7.48"

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Primary OutFlow Max=5.80 cfs @ 12.01 hrs HW=824.15' (Free Discharge)

↑**1=Culvert** (Barrel Controls 5.80 cfs @ 4.82 fps)

P8 INPUT

P8 Urban Catchment Model, Version 3.5

Run Date 11/05/25

Case	KT-Bloomington P8.p8c	FirstDate	01/01/71	Precip(in)	50.4
Title	Kwik Trip - Bloomington	LastDate	12/31/72	Rain(in)	40.76
PrecFile	Msp5095.pcp	Events	134	Snow(in)	9.67
PartFile	nurp50.p8p	TotalHrs	16440	TotalYrs	1.88

Case Title Kwik Trip - Bloomington

Case Data File KT-Bloomington P8.p8c

Path P:\INSITES\Kwik Trip\Kwik Trip-Bloomington, MN #1794\Hydro\2025-11-03\P8\

Case Notes: simple startup case

one device (wet pond)

one watershed

Storm Data File Msp5095.pcp

Particle File nurp50.p8p

Air Temp File File msp_4889.tem

Time Steps Per Hour 4

Minimum Inter-Event Time (hrs) 10

Maximum Continuity Error % 2

Rainfall Breakpoint (inches) 0.8

Precipitation Scale Factor 1

Air Temp Offset (deg-F) 0

Loops Thru Storm File 1

Simulation Dates

Start 6/1/1970

Keep 1/1/1971

Stop 12/31/1972

Max Snowfall Temperature (deg-f) 32.0

SnowMelt Temperature (deg-f) 32.0

Snowmelt Coef (in/degF-Day) 0.06

Soil Freeze Temp (deg-F) 32.0

Snowmelt Abstraction Factor	1.00
Evapo-Trans. Calibration Factor	1.00
Growing Season Start Month	5
Growing Season End Month	10

5-Day Antecedent Rainfall + Runoff (inches)

CN Antecedent Moisture Condition	AMC-II	AMC-III
Growing Season	1.40	2.10
NonGrowing Season	0.50	1.10

Watershed Data

Watershed Name	to Wet Ponto Offsite	
Runoff to Device	WET_POND Untreated	
Infiltration to Device		
Watershed Area	1.459	0.14
SCS Curve Number (Pervious)	61	61
Scale Factor for Pervious Runoff	1	1
Indirectly Connected Imperv Frac	0	0
UnSwept Impervious Fraction	0.71	0.279
UnSwept Depression Storage (inch	0.02	0.02
UnSwept Imperv. Runoff Coefficie	1	1
UnSwept Scale Factor for Particl	1	1
Swept Impervious Fraction	0	0
Swept Depression Storage (inches	0.02	0.02
Swept Imperv. Runoff Coefficient	1	1
Swept Scale Factor for Particle	1	1
Sweeping Frequency	0	0
Sweeping Efficiency	1	1
Sweeping Start Date (MMDD)	101	101
Sweeping Stop Date (MMDD)	1231	1231

Device Data

Device Name	WET_POND Untreated	
Device Type	POND	PIPE
Infiltration Outlet		
Normal Outlet		

Spillway Outlet

Particle Removal Scale Factor	1
Bottom Elevation (ft)	820.5
Bottom Area (acres)	0.119
Permanent Pool Area (acres)	0.119
Permanent Pool Volume (ac-ft)	0.325
Perm Pool Infilt Rate (in/hr)	0
Flood Pool Area (acres)	0.119
Flood Pool Volume (ac-ft)	0.649
Flood Pool Infilt Rate (in/hr)	0

Infilt Basin Void Fraction (%)

Detention Pond Outlet Parameters

Outlet Type	ORIFICE
Outlet Orifice Diameter (in)	5
Orifice Discharge Coef	1
Outlet Weir Length (ft)	
Weir Discharge Coef	
Perforated Riser Height (ft)	
Number of Holes in Riser	
Holes Diameter	
Flood Pool Drain Time (hrs)	
Swale Parameters	
Length of Flow Path (ft)	
Slope of Flow Path %	
Bottom Width (ft)	
Side Slope (ft-v/ft-h)	
Maximum Depth of Flow (ft)	
Mannings n Constant	
Hydraulic Model	
Pipe, Splitter, Aquifer Parameter	
Hydraulic Res. Time (hrs)	0

Particle Data

Particle File	nurp50.p8p				
Particle Class	P0%	P10%	P30%	P50%	P80%
Filtration Efficiency	90	100	100	100	100

Settling Velocity (ft/	0	0.03	0.3	1.5	15
First Order Decay Rate	0	0	0	0	0
2nd Order Decay (1/day	0	0	0	0	0
Impervious Runoff Conc	1	0	0	0	0
Pervious Runoff Conc (	1	100	100	100	200
Pervious Conc Exponent	0	1	1	1	1
Accum. Rate (lbs-ac-da	0	1.75	1.75	1.75	3.5
Particle Removal Rate	0	0.25	0.25	0.25	0.25
Washoff Coefficient	0	20	20	20	20
Washoff Exponent	0	2	2	2	2
Sweeper Efficiency	0	0	0	5	15

Water Quality Component Data

Component Name	TSS	TP	TKN	CU	PB	ZN	HC
----------------	-----	----	-----	----	----	----	----

Water Quality Criteria (ppm)

Level 1	5	0.025	2	2	0.02	5	0.1
Level 2	10	0.05	1	0.0048	0.014	0.0362	0.5
Level 3	20	0.1	0.5	0.02	0.15	0.38	1

Content Scale Factor	1	1	1	1	1	1	1
----------------------	---	---	---	---	---	---	---

Particle Composition (mg/kg)

P0%	0	99000	600000	13600	2000	64000	250000
P10%	1000000	3850	15000	340	180	1600	22500
P30%	1000000	3850	15000	340	180	1600	22500
P50%	1000000	3850	15000	340	180	1600	22500
P80%	1000000	0	0	340	180	0	22500

P8 OUTPUT

Variable OVERALL WET_POND Untreated

P0%

P10%	79.1	82.2
------	------	------

P30%	87.8	91.2
------	------	------

P50%	92.5	96.0
------	------	------

P80%	95.9	99.6
------	------	------

TSS	90.2	93.7
-----	------	------

TP	62.4	64.9
----	------	------

TKN	54.0	56.2
-----	------	------

CU	66.3	69.0
----	------	------

PB	82.0	85.2
----	------	------

ZN	54.0	56.2
----	------	------

HC	82.0	85.2
----	------	------



NOAA Atlas 14, Volume 8, Version 2
Location name: Minneapolis, Minnesota, USA*
Latitude: 44.8338°, Longitude: -93.2934°
Elevation: 833 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.353 (0.282-0.445)	0.420 (0.335-0.530)	0.535 (0.426-0.677)	0.636 (0.503-0.809)	0.783 (0.601-1.04)	0.903 (0.674-1.22)	1.03 (0.740-1.42)	1.16 (0.799-1.65)	1.34 (0.889-1.97)	1.49 (0.956-2.21)
10-min	0.516 (0.413-0.652)	0.615 (0.491-0.776)	0.783 (0.624-0.992)	0.931 (0.737-1.18)	1.15 (0.880-1.52)	1.32 (0.987-1.78)	1.50 (1.08-2.08)	1.70 (1.17-2.42)	1.97 (1.30-2.88)	2.18 (1.40-3.23)
15-min	0.630 (0.504-0.795)	0.750 (0.599-0.946)	0.955 (0.761-1.21)	1.14 (0.899-1.44)	1.40 (1.07-1.86)	1.61 (1.20-2.17)	1.84 (1.32-2.54)	2.07 (1.43-2.95)	2.40 (1.59-3.51)	2.66 (1.71-3.94)
30-min	0.886 (0.709-1.12)	1.06 (0.846-1.34)	1.36 (1.08-1.72)	1.62 (1.28-2.06)	2.01 (1.54-2.67)	2.32 (1.73-3.12)	2.65 (1.91-3.66)	3.00 (2.07-4.27)	3.49 (2.30-5.10)	3.87 (2.48-5.74)
60-min	1.16 (0.925-1.46)	1.38 (1.10-1.74)	1.78 (1.42-2.25)	2.15 (1.70-2.74)	2.72 (2.10-3.66)	3.21 (2.41-4.35)	3.73 (2.70-5.20)	4.31 (2.98-6.16)	5.13 (3.40-7.54)	5.80 (3.72-8.59)
2-hr	1.43 (1.15-1.78)	1.69 (1.36-2.12)	2.20 (1.76-2.76)	2.68 (2.14-3.38)	3.44 (2.69-4.61)	4.10 (3.10-5.54)	4.82 (3.52-6.67)	5.61 (3.92-7.99)	6.77 (4.53-9.90)	7.72 (5.00-11.3)
3-hr	1.60 (1.29-1.98)	1.88 (1.52-2.35)	2.45 (1.97-3.06)	3.01 (2.41-3.78)	3.91 (3.08-5.24)	4.70 (3.59-6.35)	5.59 (4.11-7.73)	6.58 (4.62-9.34)	8.02 (5.41-11.7)	9.23 (6.01-13.5)
6-hr	1.88 (1.53-2.32)	2.20 (1.79-2.72)	2.86 (2.32-3.54)	3.51 (2.83-4.37)	4.59 (3.66-6.13)	5.55 (4.28-7.46)	6.64 (4.93-9.13)	7.86 (5.58-11.1)	9.66 (6.58-14.0)	11.2 (7.33-16.2)
12-hr	2.14 (1.75-2.62)	2.51 (2.06-3.08)	3.23 (2.64-3.98)	3.93 (3.20-4.86)	5.05 (4.04-6.64)	6.02 (4.67-7.98)	7.10 (5.31-9.65)	8.31 (5.94-11.6)	10.1 (6.90-14.4)	11.5 (7.63-16.5)
24-hr	2.48 (2.06-3.02)	2.84 (2.34-3.45)	3.54 (2.91-4.31)	4.23 (3.46-5.18)	5.36 (4.32-6.99)	6.36 (4.98-8.37)	7.48 (5.64-10.1)	8.73 (6.31-12.1)	10.6 (7.33-15.0)	12.1 (8.11-17.3)
2-day	2.88 (2.40-3.47)	3.22 (2.68-3.88)	3.90 (3.23-4.71)	4.58 (3.78-5.56)	5.71 (4.65-7.39)	6.72 (5.31-8.77)	7.86 (5.98-10.5)	9.15 (6.67-12.6)	11.0 (7.73-15.6)	12.6 (8.53-17.8)
3-day	3.15 (2.64-3.77)	3.49 (2.92-4.19)	4.19 (3.49-5.04)	4.89 (4.05-5.90)	6.03 (4.93-7.74)	7.05 (5.59-9.14)	8.20 (6.27-10.9)	9.49 (6.96-13.0)	11.4 (8.02-16.0)	13.0 (8.83-18.3)
4-day	3.36 (2.82-4.01)	3.73 (3.13-4.46)	4.46 (3.73-5.35)	5.19 (4.31-6.24)	6.35 (5.19-8.10)	7.38 (5.86-9.50)	8.52 (6.53-11.3)	9.80 (7.20-13.3)	11.7 (8.24-16.3)	13.2 (9.02-18.5)
7-day	3.87 (3.27-4.58)	4.36 (3.68-5.17)	5.24 (4.41-6.24)	6.05 (5.06-7.23)	7.27 (5.94-9.11)	8.30 (6.61-10.5)	9.41 (7.23-12.2)	10.6 (7.82-14.2)	12.3 (8.73-17.0)	13.7 (9.42-19.1)
10-day	4.36 (3.70-5.14)	4.93 (4.18-5.83)	5.93 (5.01-7.02)	6.80 (5.71-8.09)	8.07 (6.59-9.99)	9.10 (7.25-11.4)	10.2 (7.84-13.1)	11.3 (8.37-15.0)	12.9 (9.18-17.7)	14.2 (9.80-19.6)
20-day	5.93 (5.08-6.94)	6.66 (5.69-7.80)	7.85 (6.69-9.22)	8.85 (7.49-10.4)	10.2 (8.38-12.5)	11.3 (9.06-14.0)	12.4 (9.60-15.7)	13.5 (10.0-17.6)	15.0 (10.7-20.2)	16.1 (11.2-22.1)
30-day	7.33 (6.30-8.53)	8.18 (7.02-9.53)	9.56 (8.17-11.2)	10.7 (9.08-12.5)	12.2 (10.0-14.7)	13.3 (10.7-16.3)	14.4 (11.2-18.2)	15.5 (11.6-20.2)	17.0 (12.2-22.7)	18.0 (12.7-24.6)
45-day	9.14 (7.89-10.6)	10.2 (8.79-11.8)	11.9 (10.2-13.8)	13.2 (11.3-15.4)	14.9 (12.3-17.8)	16.1 (13.0-19.6)	17.3 (13.5-21.6)	18.4 (13.8-23.7)	19.8 (14.3-26.3)	20.8 (14.7-28.2)
60-day	10.7 (9.26-12.3)	12.0 (10.4-13.8)	13.9 (12.0-16.1)	15.4 (13.2-18.0)	17.4 (14.3-20.6)	18.7 (15.1-22.6)	20.0 (15.6-24.8)	21.1 (15.9-27.0)	22.5 (16.2-29.6)	23.3 (16.5-31.6)

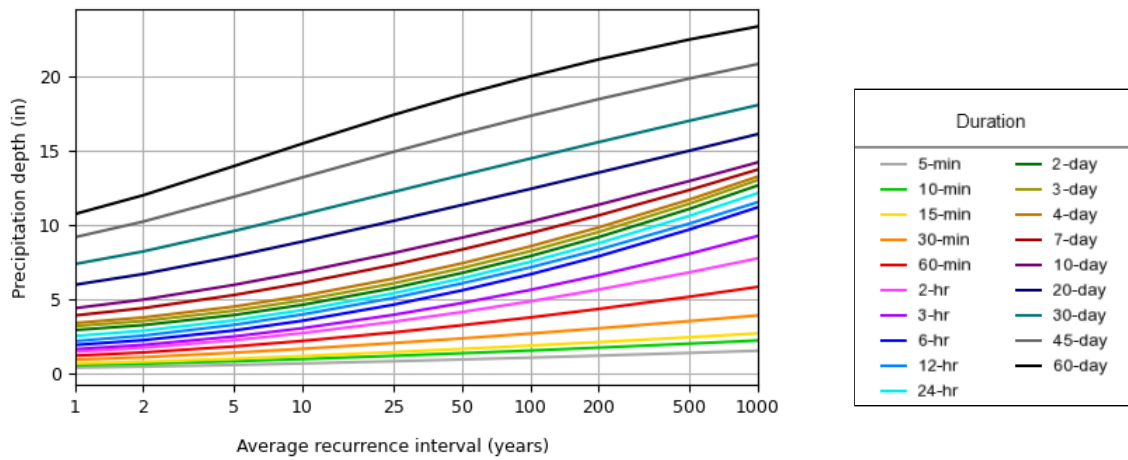
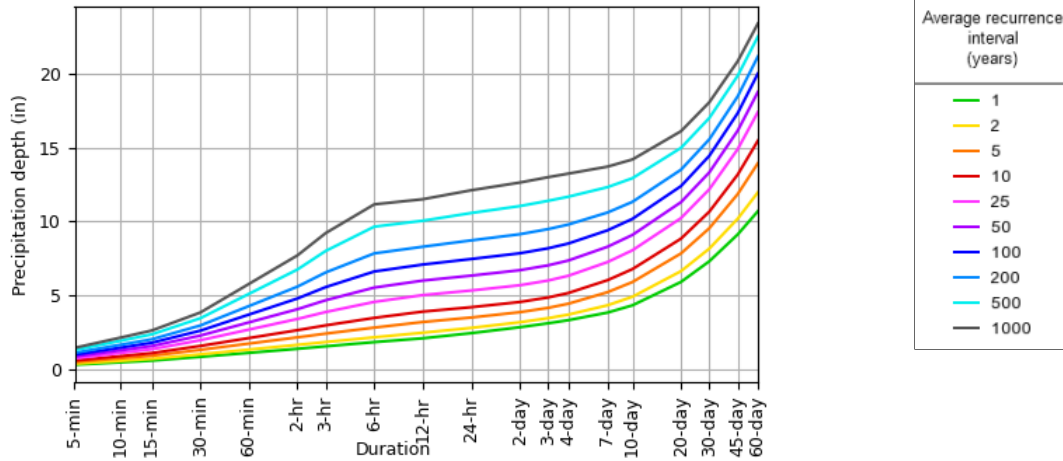
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 44.8338°, Longitude: -93.2934°



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Sep 29 17:21:21 2025

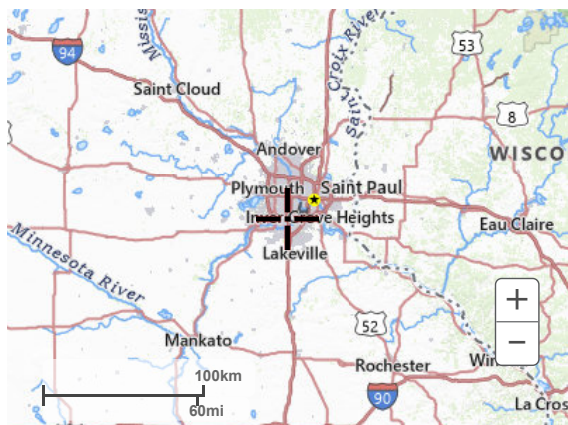
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Maps & aerals

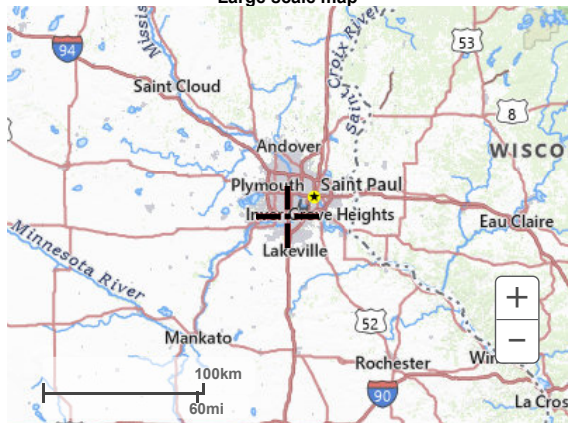
Small scale terrain



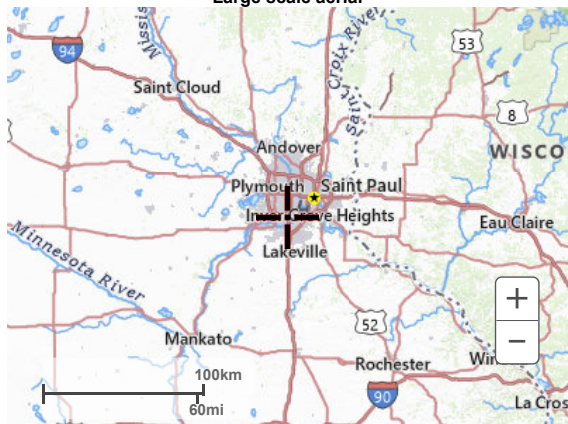
Large scale terrain



Large scale map



Large scale aerial

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C.8.c. Backfill

Utility trench backfill should adhere to the recommendations in Section C.2 above.

C.9. Storm Water

We estimated infiltration rates for some of the soils we encountered in Boring ST-4 for the proposed storm water pond, as summarized in Table 9 below. These infiltration rates represent the long-term infiltration capacity of a practice and not the capacity of the soils in their natural state. Field testing, such as with a double-ring infiltrometer (ASTM D3385), may justify the use of higher infiltration rates. However, we recommend adjusting field test rates by the appropriate correction factor, as provided for in the Minnesota Stormwater Manual or as allowed by the local watershed. We recommend consulting the Minnesota Stormwater Manual for stormwater design.

Table 9. Estimated Design Infiltration Rates Based on Soil Classification

Boring Location	Depth (feet)	Elevation (feet)	Soil Type – USCS Soil Classification	Infiltration Rate* (inches/hour)
ST-4	0 – 1	833 ½ – 832 ½	FILL: Pavement Materials	---
	1 – 2	832 ½ – 831 ½	FILL: Silty Sand (SM)	0.45**
	2 – 4	831 ½ – 829 ½	Poorly Graded Sand with Silt (SP-SM)	0.80
	4 – 20	829 ½ – 813 ½	Poorly Graded Sand (SP)	0.80

*From Minnesota Stormwater Manual. Rates may differ at individual sites.

**Discontinuities in fill materials should be anticipated. The infiltration value provided is based on natural soil. Infiltration in fill may be higher or lower based on compactive effort placed on the fill.

In general, the location of the proposed storm water pond is well suited for infiltration of storm water. However, lower infiltration rates should be anticipated in the sandy fill soils encountered near the surface at the proposed storm water pond.

Fine-grained soils (silts and clays), topsoil or organic matter that mixes into or washes onto the soil will lower the permeability. The contractor should maintain and protect infiltration areas during construction. Furthermore, organic matter and silt washed into the system after construction can fill the soil pores and reduce permeability over time. Proper maintenance is important for long-term performance of infiltration systems.

This geotechnical evaluation does not constitute a review of site suitability for storm water infiltration or evaluate the potential impacts, if any, from infiltration of large amounts of storm water.