Stormwater Management Plan

Emerald Estates
Minnetonka, MN

Prepared by Loucks

January 15, 2024

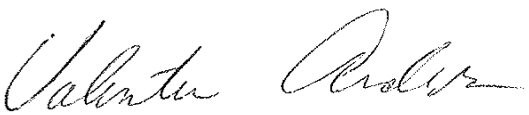
Loucks Project No. 21509.00

Emerald Estates

Minnetonka, MN

Stormwater Management Plan

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.



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Emerald Estates
Minnetonka, Minnesota

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Emerald Estates
Minnetonka, Minnesota

Stormwater Management Plan

Introduction

This stormwater management plan was created for the Emerald Estates project located along Plymouth Road in Minnetonka, Minnesota. The project site encompasses 11.43 acres which is surrounded to the west by Plymouth Road, between Bent Tree Road and Woodbridge Trail and Crescent Ridge Road to the east. The property is surrounded by residential.

The project generally consists of constructing a residential road with residential lots, stormwater pond, and associated utilities.

Included in this plan are calculations for the proposed discharge of stormwater at the Emerald Estate property.

Requirements and Methodology

City of Minnetonka and Minnehaha Creek Watershed District Requirements

1. Rate Control – Runoff rates for the proposed activity shall not exceed existing runoff rates for the 1, 10, and 100-year critical storm events.

2. Volume Control – 1.1-inch abstraction over the impervious surface. Where soils don't allow the full infiltration, alternative methods are used with infiltration used to the greatest extent possible

3. Water Quality – Total Phosphorus (TP) removal equivalent to that achieved from infiltration of 1.1-inch over impervious surface. With alternative design, 90% total suspended solids removal and 60% total phosphorus removal.

Methodology

The stormwater calculations were made utilizing the stormwater-modeling program HydroCAD 10.00. Calculations were performed for the Type II 24-hour Atlas 14 100-year rainfall event of 7.32 inches, 10-year rainfall event of 4.26 inches and 1-year rainfall event of 2.48 inches. For purposes of analyzing the site, a drainage area of about 11.8 acres is included in the hydrologic model to account for all runoff from the site.

Existing Conditions

The existing site is residential with four residences present on the parcels. The property is split into five major drainage areas, with the north split into 2 more drainage areas. Most of the site drains to the north (1S) to a depression within the site with a piped outlet. There are two more drainage areas to the north (10S,11S), there are two small areas to the south (3S, 4S), one to the east (2S) and one to the west (5S).
No treatment is present for the existing impervious surfaces. The depression on site has a HWL of 982.62 in modeling and a floodplain elevation of 982.9 based on City data.

Existing soils are assumed to be type D soils based on the soil borings done. Soil boring data can be found in the Figures section.

The existing site model consists of 11.79 acres with 0.54 acres of impervious surface.

Proposed Conditions

The proposed site consists of a redeveloped residential development with public road and 14 lots with utilities. A proposed pond (1P) is provided for the largest treatment, volume control and rate control prior to discharging to existing storm sewer. Two small infiltration basins (21P and 30P) are located in corners for additional volume control and rate control. The proposed site being analyzed contains 2.41 acres of new impervious surface.

The proposed site is broken up into eleven drainage areas. The five drainage areas (1S, 2S, 4S, 5S and 10S) going directly off site like existing and the five drainage areas going to the basins onsite for treatment before leaving the site and one going to the existing depression that is outlet to the treatment pond. The runoff from the proposed street area is collected by storm sewer and discharged to the treatment pond 1P. This also collects parts of many of the lots that drain to the street. The remainder of the inner back yards drain to the pretreatment pond 110P before overflowing to 1P.

The depression within the site, that is part of the City floodplain areas has a similar HWL to existing at 979.23 and an emergency overflow elevation of 981.50. The drainage area to the depression has been reduced by nearly 95% making the area less of a flood issue. Most of the drainage to the existing floodplain is being captured and redirected to the treatment basin within the remainder of the floodplain area.

The southeast basin captures the backyard of one of the proposed lots. The basins main goal is to control rates leaving the site in smaller storm events. The basin overland overflows with a weir that keeps flow rates and velocities down. The 100-year storm event velocity is 2.1 fps.

The northeast two basins act in series to slow down flow and manage rates in an area that already acts as a swale. The basin overland overflows with a weir that keeps flow rates and velocities down. The 100-year storm event velocity is 2.19 fps.

The proposed site model consists of 11.79 acres with 2.95 acres of impervious surface, 2.41 acres of that being new.

Rate Control

The stormwater runoff rate from the proposed site shall be equal to or less than the runoff rate from the existing conditions for the 1-, 10- and 100-year storm events. The only area that does not meet existing is the drainage to Plymouth Road, as most of the addition flow comes from paving new ROW in Plymouth Road for the turn lane.

Two small infiltration basins, a biofiltration basin where the existing floodplain depression was and a NURP pond with filtration bench are used to treat the site development and provide rate control. Soils maps show soils to be C and D soils mostly. Borings are rough borings currently. With the current boring information, it is assumed large amounts of infiltration cannot be achieved on-site as only type D soils have been found. The site is treated to the extent possible without infiltration while still meeting TSS and TP removals.

Tables 1 and 2 compare the existing and proposed peak runoff rates for the discharge points analyzed.

Table 1 –Existing Peak Runoff Rates

		1-Year Storm		10-Year Storm		100-Year Storm	
Drainage Area	Area acres	Rate cfs	Volume cf	Rate cfs	Volume cf	Rate cfs	Volume cf
11R-North	8.392	8.27	0.728	12.53	1.757	14.37	3.727
2S-East	1.421	1.26	0.098	3.47	0.258	7.71	0.578
3S-Southeast	0.562	0.46	0.039	1.27	0.102	2.82	0.228
4S-South	0.45	0.41	0.033	1.1	0.085	2.4	0.187
5S-West	0.921	1.1	0.071	2.82	0.18	6.06	0.392
Plymouth Road	1.371	1.46	0.104	3.8	0.264	8.19	0.579
Total North Plymouth & North	9.763	9.73	0.832	16.33	2.021	22.56	4.306
Total	11.75	11.05	0.968	19.94	2.381	32.7	5.112

Table 2 – Proposed Peak Runoff Rates

		1-Year Storm		10-Year Storm		100-Year Storm	
Drainage Area	Area acres	Rate cfs	Volume cf	Rate cfs	Volume cf	Rate cfs	Volume cf
1S-North	0.195	0.25	0.014	0.65	0.037	1.41	0.081
2S-East	0.545	0.6	0.042	1.54	0.106	3.3	0.232
3S-Southeast	0.47	0.46	0.035	1.23	0.092	2.62	0.201
4S-South	0.414	0.55	0.036	1.33	0.087	2.74	0.184
5S-West	1.203	1.44	0.104	3.53	0.252	7.33	0.534
10S-Northeast	0.04	0.05	0.003	0.14	0.007	0.3	0.016
11P-Depression	0.183	0.28	0.013	0.72	0.034	1.54	0.076
1P-N Pond	7.955	1.95	0.747	8.5	1.744	10.94	3.629
21P-W2 Basin	0.741	0.73	0.052	1.92	0.139	4.25	0.31
30P-SW Basin	0.47	0.46	0.034	1.23	0.092	2.62	0.201
Plymouth Road	1.617	1.98	0.14	4.82	0.339	10.01	0.718
North	8.373	2.02	0.777	8.86	1.823	12.1	3.803
East	1.286	1.25	0.094	3.31	0.245	7.43	0.541
Southeast	0.47	0.46	0.035	1.23	0.092	2.62	0.201
Total North Plymouth & North	9.99	4	0.917	13.68	2.162	22.11	4.521
Total	11.75	4.02	1.047	18.03	2.499	31.73	5.263

Elevations are evaluated for flooding of the site. All overflows are designed to keep the adjacent buildings from flooding. All flood elevations have at least 2 feet freeboard to the lowest opening elevation.

Volume Control

Based on the soils information we have; most treatment will be by filtration. Soil borings that were taken on site show only D soils, it does not cover the entire site but the natural grade of the site and location of storm sewer to tie into make it unlikely that large amounts of stormwater treatment could take place in another location. Since infiltration cannot be used on this site, alternative methods are being used. With D soils, even meeting the 0.55-inches of infiltration is not feasible on this site without removing all the trees in the woodland area, which is not possible to maintain a Woodland Protection Area that is needed on the site.

Therefore, the site moves to using filtration and sedimentation in treatment trains to reach the total suspended solids and total phosphorus removal requirements. Many of the backyards are disconnected impervious as they will drain through grass and woodland before leaving the site or reaching farther treatment. There are two small basin areas in the back yards in the northeast and southeast corners of the site. These basins allow infiltration and the outlet is set at an elevation to allow drawdown in 48-hours but the main purpose for the basins is to

control rate leaving the site. The delayed outlet in the basins is more likely to aid in sedimentation. The existing depression area has a largely reduced drainage area and has been switched to biofiltration for treatment, this basin is routed to the larger treatment system in the northwest corner of the site. Most of the site and impervious surface is routed to the northwest treatment system. The street drainage has a larger manhole with sump and SAFL baffle to increase sedimentation before entering the sedimentation basin. The woodland and back yards are directed to a swale that routes drainage to the sedimentation basin. The basin has a wider bench area with draintile and biofiltration media to allow biofiltration of at least the first 1.1-inch of rainfall. For purposes of designing the treatment for possible future impervious surface, a minimum of 500 sf was added to each lot for patios in the back yard, which would all be disconnected impervious surface. One additional possible future lot impervious surface is incorporated draining to the pond to make sure the ponds are sized appropriately for a total additional impervious surface of 0.145 acres included in calculations and modeling.

The total impervious surface designed for is 2.95 acres of impervious surface for a volume control of 0.27 ac-ft or 11,779 cf.

The proposed storage volume below the outlet for the filtration bench (1P) is **12,076 cubic-feet**. This volume is filtered through the biofiltration media mix in less than 48 hours.

Depth equivalent proposed: 12,076 cf / 3,110 sf(surface area of bench) = **3.88 ft**
Depth maximum allowed: 1.0 in/hr*48 hours/12in/ft = **4.0 ft**

Quality Control

With no infiltration, removals is the main requirement. The site is required to remove the total phosphorus equivalent to infiltration of the 1-inch over the impervious surface and 90% TSS and 60% TP removal. MIDS is used to model the 1.1-inch in1filtration and proposed TSS and TP for the site. The basins are used in the proposed condition to reduce the TSS and TP particulate loads. Disconnected impervious is only used for the back half of building pads draining directly offsite or to the main pond/filtration system. The pond/filtration bench system is used to capture the remainder of removals. The majority of the impervious surface to the main system is pretreated in a sump manhole. The manhole has a SAFL baffle to aid in additional removals before going to the system. SHSAM is used to determine the modeled removal of the SAFL baffle for MIDS (it is rounded down to the nearest 5%). The pond acts as pretreatment for the filtration bench which is designed with biofiltration media. The pond dead volume is designed to meet a minimum of 1800 sf per acre of drainage to the pond, which is 8.535 acres * 1800 = 15,363 cf. The dead storage in the pond is 16,948 cf.

The table below shows the results for infiltration and proposed loads removed from the site. Model data can be found in the Figures section.

Table 3 – Proposed TSS and TP Removals

	1.1-inch Infiltration Removal lbs/yr	Proposed Removals lbs/yr	% Removals based on yearly load
TSS	875.5	1298.9	91
TP	4.82	4.706	60

Floodplain

There is an existing City floodplain with in the site. The existing flood elevation from the City is 982.9, our modeling shows 982.6, based on a 96-hour 100-year storm event. The difference can be from different modeling platforms or difference in parameters. Our model uses survey data from the site for the drainage area and cover. The drainage area seems similar to the City drainage area and survey data shows that there is an overland overflow below 983. The drainage to the floodplain comes mainly from the site with a small area from outside this site. The proposed condition splits the floodplain into two drainage areas and two depressions. The drainage area north of the proposed berm in the floodplain area is much smaller and the outlet remains the same, the modeled floodplain elevation is 979.23 with an overland overflow elevation of 981.50. Most of the drainage is captured and routed to a main floodplain area, which has a floodplain elevation of 981.62 and an overland overflow of 981.75.

The surveyed floodplain volume for the existing conditions is 57,947 cf. The proposed floodplain in this same area is 73,195 cf of live storage available. This is an increase of 15,248 cf of floodplain storage.

Best Management Practices

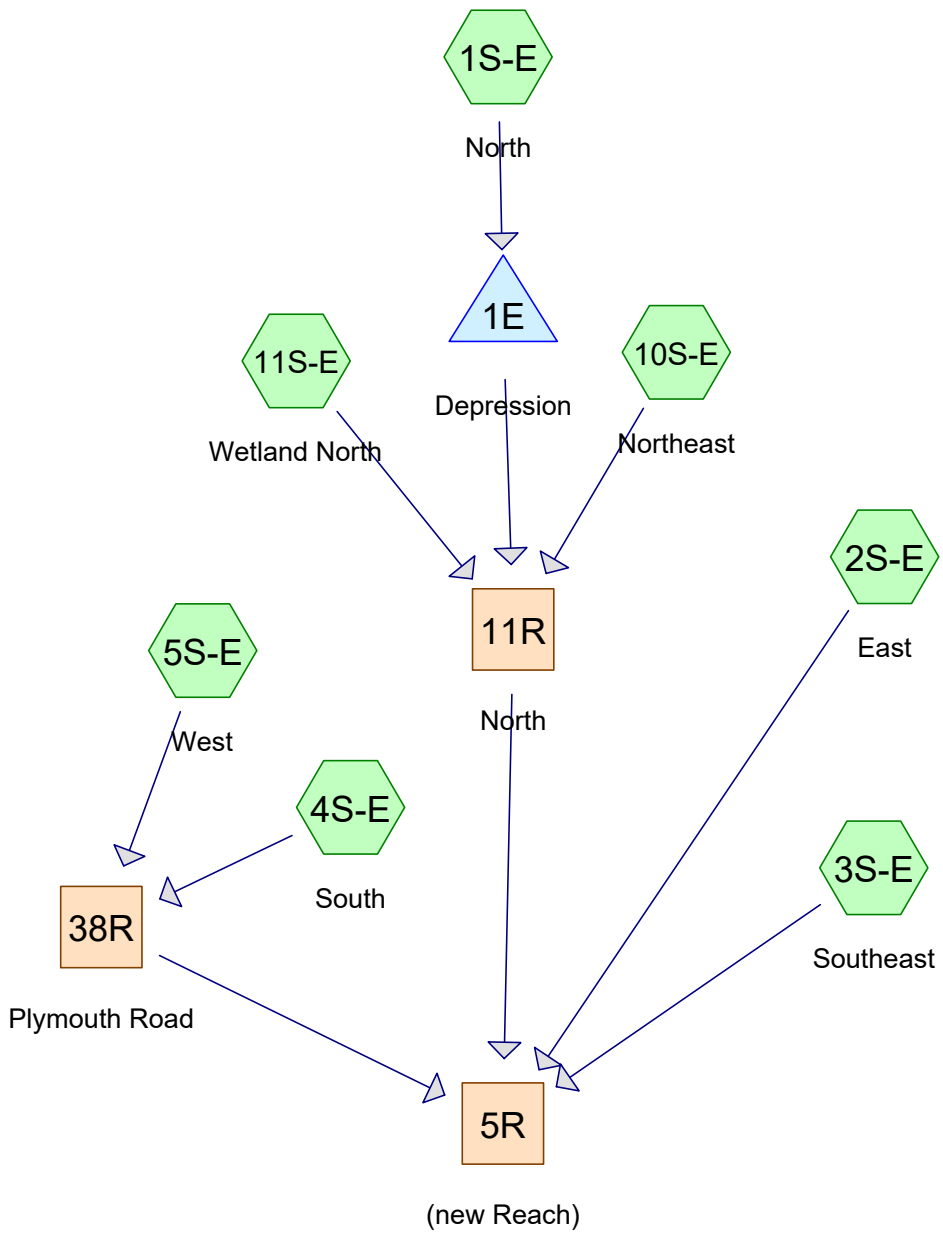
Best management practices (BMP's) will be implemented during construction per the project Stormwater Pollution Prevention Plan. During construction, erosion control measures will include dust control, silt fencing, inlet protection, and a temporary rock construction entrance. Permanent BMP's will include a stormwater pond, a large swale, sump storm sewer structures, surface pavements, and turf establishment (vegetation) of disturbed areas.

Conclusion

The proposed Stormwater Management Plan for the Emerald Estates property project provides an improved solution for the conveyance of stormwater on this site. The stormwater pond will capture runoff and provide additional water quality treatment on the site.

Appendix A

HydroCAD Report, Existing
(1, 10, 100)



EXISTING
CONDITIONS

Subcat Reach Pond Link

Routing Diagram for Prop-21509-culdesac
Prepared by Loucks & Associates, Printed 1/4/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	MSE 24-hr	3	Default	24.00	1	2.48	2
2	10-Year	MSE 24-hr	3	Default	24.00	1	4.26	2
3	100-Year base	MSE 24-hr	3	Default	24.00	1	7.32	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.532	98	(1S-E, 2S-E, 3S-E, 4S-E, 5S-E, 10S-E, 11S-E)
3.421	79	Woods, Fair, HSG D (2S-E, 3S-E, 4S-E, 5S-E, 10S-E, 11S-E)
7.793	82	Woods/grass comb., Fair, HSG D (1S-E)
11.746	**82**	**TOTAL AREA**

Summary for Subcatchment 1S-E: North

Runoff = 8.64 cfs @ 12.35 hrs, Volume= 0.702 af, Depth= 1.04"
Routed to Pond 1E : Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.304	98	
	7.793	82	Woods/grass comb., Fair, HSG D
	8.097	83	Weighted Average
	7.793	82	96.25% Pervious Area
	0.304	98	3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0570	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.4	100	0.0550	1.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.6	100	0.0085	0.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	500	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.9	800	Total			

Summary for Subcatchment 2S-E: East

Runoff = 1.26 cfs @ 12.31 hrs, Volume= 0.098 af, Depth= 0.82"
Routed to Reach 5R : (new Reach)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.028	98	
	1.393	79	Woods, Fair, HSG D
	1.421	79	Weighted Average
	1.393	79	98.03% Pervious Area
	0.028	98	1.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	100	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.1	100	0.0250	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.7	200	Total			

Summary for Subcatchment 3S-E: Southeast

Runoff = 0.46 cfs @ 12.36 hrs, Volume= 0.039 af, Depth= 0.82"
Routed to Reach 5R : (new Reach)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.004	98	
	0.558	79	Woods, Fair, HSG D
	0.562	79	Weighted Average
	0.558	79	99.29% Pervious Area
	0.004	98	0.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0300	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
3.7	250	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.0	350	Total			

Summary for Subcatchment 4S-E: South

Runoff = 0.41 cfs @ 12.33 hrs, Volume= 0.033 af, Depth= 0.88"
Routed to Reach 38R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.021	98	
	0.429	79	Woods, Fair, HSG D
	0.450	80	Weighted Average
	0.429	79	95.33% Pervious Area
	0.021	98	4.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	100	0.0250	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.5	35	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.3	135	Total			

Summary for Subcatchment 5S-E: West

Runoff = 1.10 cfs @ 12.24 hrs, Volume= 0.071 af, Depth= 0.93"
Routed to Reach 38R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.121	98	
	0.800	79	Woods, Fair, HSG D
	0.921	81	Weighted Average
	0.800	79	86.86% Pervious Area
	0.121	98	13.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0660	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.3	30	0.1100	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.4	130	Total			

Summary for Subcatchment 10S-E: Northeast

Runoff = 0.07 cfs @ 12.17 hrs, Volume= 0.004 af, Depth= 0.98"
Routed to Reach 11R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.007	98	
	0.041	79	Woods, Fair, HSG D
	0.048	82	Weighted Average
	0.041	79	85.42% Pervious Area
	0.007	98	14.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	90	0.1500	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"

Summary for Subcatchment 11S-E: Wetland North

Runoff = 0.35 cfs @ 12.22 hrs, Volume= 0.021 af, Depth= 1.04"
Routed to Reach 11R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.047	98	
	0.200	79	Woods, Fair, HSG D
	0.247	83	Weighted Average
	0.200	79	80.97% Pervious Area
	0.047	98	19.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0300	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"

Summary for Reach 5R: (new Reach)

Inflow Area = 11.746 ac, 4.53% Impervious, Inflow Depth = 0.99" for 1-Year event
Inflow = 11.05 cfs @ 12.35 hrs, Volume= 0.968 af
Outflow = 11.05 cfs @ 12.35 hrs, Volume= 0.968 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 11R: North

Inflow Area = 8.392 ac, 4.27% Impervious, Inflow Depth = 1.04" for 1-Year event
Inflow = 8.27 cfs @ 12.41 hrs, Volume= 0.728 af
Outflow = 8.27 cfs @ 12.41 hrs, Volume= 0.728 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 5R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 38R: Plymouth Road

Inflow Area = 1.371 ac, 10.36% Impervious, Inflow Depth = 0.91" for 1-Year event
Inflow = 1.46 cfs @ 12.26 hrs, Volume= 0.104 af
Outflow = 1.46 cfs @ 12.26 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 5R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Pond 1E: Depression

Inflow Area = 8.097 ac, 3.75% Impervious, Inflow Depth = 1.04" for 1-Year event
Inflow = 8.64 cfs @ 12.35 hrs, Volume= 0.702 af
Outflow = 8.07 cfs @ 12.42 hrs, Volume= 0.702 af, Atten= 7%, Lag= 4.1 min
Primary = 8.07 cfs @ 12.42 hrs, Volume= 0.702 af
Routed to Reach 11R : North

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 980.32' @ 12.42 hrs Surf.Area= 2,529 sf Storage= 562 cf

Plug-Flow detention time= 0.4 min calculated for 0.702 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (832.5 - 832.1)

Volume	Invert	Avail.Storage	Storage Description
#1	978.67'	63,415 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
978.67	10	0	0
979.00	26	6	6
980.00	211	119	124
981.00	7,479	3,845	3,969
982.00	28,736	18,108	22,077
983.00	53,940	41,338	63,415

Device	Routing	Invert	Outlet Devices
#1	Primary	978.35'	**18.0" Round Culvert** L= 275.0' Ke= 0.500 Inlet / Outlet Invert= 978.35' / 975.09' S= 0.0119 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.67'	**18.0" Round Culvert** L= 9.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 978.67' / 978.39' S= 0.0311 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=8.04 cfs @ 12.42 hrs HW=980.31' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 8.04 cfs of 9.37 cfs potential flow)
↑—**2=Culvert** (Inlet Controls 8.04 cfs @ 4.55 fps)

Stage-Area-Storage for Pond 1E: Depression

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
978.67	10	0
978.72	12	1
978.77	15	1
978.82	17	2
978.87	20	3
978.92	22	4
978.97	25	5
979.02	30	6
979.07	39	8
979.12	48	10
979.17	57	13
979.22	67	16
979.27	76	20
979.32	85	24
979.37	94	28
979.42	104	33
979.47	113	39
979.52	122	44
979.57	131	51
979.62	141	58
979.67	150	65
979.72	159	73
979.77	168	81
979.82	178	89
979.87	187	99
979.92	196	108
979.97	205	118
980.02	356	130
980.07	720	157
980.12	1,083	202
980.17	1,447	265
980.22	1,810	347
980.27	2,173	446
980.32	2,537	564
980.37	2,900	700
980.42	3,264	854
980.47	3,627	1,026
980.52	3,990	1,217
980.57	4,354	1,425
980.62	4,717	1,652
980.67	5,081	1,897
980.72	5,444	2,160
980.77	5,807	2,442
980.82	6,171	2,741
980.87	6,534	3,059
980.92	6,898	3,394
980.97	7,261	3,748
981.02	7,904	4,123
981.07	8,967	4,545
981.12	10,030	5,020
981.17	11,093	5,548
981.22	12,156	6,129
981.27	13,218	6,764
981.32	14,281	7,451
981.37	15,344	8,192
981.42	16,407	8,985
981.47	17,470	9,832
981.52	18,533	10,732
981.57	19,595	11,686
981.62	20,658	12,692
981.67	21,721	13,752
981.72	22,784	14,864
981.77	23,847	16,030
981.82	24,910	17,249
981.87	25,973	18,521
981.92	27,035	19,846
981.97	28,098	21,224
982.02	29,240	22,657
982.07	30,500	24,150
982.12	31,760	25,707
982.17	33,021	27,326
982.22	34,281	29,009
982.27	35,541	30,754
982.32	36,801	32,563
982.37	38,061	34,434
982.42	39,322	36,369
982.47	40,582	38,367
982.52	41,842	40,427
982.57	43,102	42,551
982.62	44,362	44,737
982.67	45,623	46,987
982.72	46,883	49,300
982.77	48,143	51,675
982.82	49,403	54,114
982.87	50,663	56,616
982.92	51,924	59,180
982.97	**53,184**	**61,808**

Summary for Subcatchment 1S-E: North

Runoff = 21.13 cfs @ 12.33 hrs, Volume= 1.696 af, Depth= 2.51"
Routed to Pond 1E : Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.304	98	
	7.793	82	Woods/grass comb., Fair, HSG D
	8.097	83	Weighted Average
	7.793	82	96.25% Pervious Area
	0.304	98	3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0570	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.4	100	0.0550	1.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.6	100	0.0085	0.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	500	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.9	800	Total			

Summary for Subcatchment 2S-E: East

Runoff = 3.47 cfs @ 12.30 hrs, Volume= 0.258 af, Depth= 2.18"
Routed to Reach 5R : (new Reach)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.028	98	
	1.393	79	Woods, Fair, HSG D
	1.421	79	Weighted Average
	1.393	79	98.03% Pervious Area
	0.028	98	1.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	100	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.1	100	0.0250	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.7	200	Total			

Summary for Subcatchment 3S-E: Southeast

Runoff = 1.27 cfs @ 12.34 hrs, Volume= 0.102 af, Depth= 2.18"
Routed to Reach 5R : (new Reach)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.004	98	
	0.558	79	Woods, Fair, HSG D
	0.562	79	Weighted Average
	0.558	79	99.29% Pervious Area
	0.004	98	0.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0300	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
3.7	250	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.0	350	Total			

Summary for Subcatchment 4S-E: South

Runoff = 1.10 cfs @ 12.32 hrs, Volume= 0.085 af, Depth= 2.26"
Routed to Reach 38R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.021	98	
	0.429	79	Woods, Fair, HSG D
	0.450	80	Weighted Average
	0.429	79	95.33% Pervious Area
	0.021	98	4.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	100	0.0250	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.5	35	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.3	135	Total			

Summary for Subcatchment 5S-E: West

Runoff = 2.82 cfs @ 12.23 hrs, Volume= 0.180 af, Depth= 2.34"
Routed to Reach 38R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.121	98	
	0.800	79	Woods, Fair, HSG D
	0.921	81	Weighted Average
	0.800	79	86.86% Pervious Area
	0.121	98	13.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0660	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.3	30	0.1100	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.4	130	Total			

Summary for Subcatchment 10S-E: Northeast

Runoff = 0.18 cfs @ 12.17 hrs, Volume= 0.010 af, Depth= 2.43"
Routed to Reach 11R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.007	98	
	0.041	79	Woods, Fair, HSG D
	0.048	82	Weighted Average
	0.041	79	85.42% Pervious Area
	0.007	98	14.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	90	0.1500	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"

Summary for Subcatchment 11S-E: Wetland North

Runoff = 0.86 cfs @ 12.21 hrs, Volume= 0.052 af, Depth= 2.51"
Routed to Reach 11R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.047	98	
	0.200	79	Woods, Fair, HSG D
	0.247	83	Weighted Average
	0.200	79	80.97% Pervious Area
	0.047	98	19.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0300	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"

Summary for Reach 5R: (new Reach)

Inflow Area = 11.746 ac, 4.53% Impervious, Inflow Depth = 2.43" for 10-Year event
Inflow = 19.94 cfs @ 12.31 hrs, Volume= 2.381 af
Outflow = 19.94 cfs @ 12.31 hrs, Volume= 2.381 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 11R: North

Inflow Area = 8.392 ac, 4.27% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 12.54 cfs @ 12.54 hrs, Volume= 1.757 af
Outflow = 12.54 cfs @ 12.54 hrs, Volume= 1.757 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 5R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 38R: Plymouth Road

Inflow Area = 1.371 ac, 10.36% Impervious, Inflow Depth = 2.31" for 10-Year event
Inflow = 3.80 cfs @ 12.25 hrs, Volume= 0.264 af
Outflow = 3.80 cfs @ 12.25 hrs, Volume= 0.264 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 5R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Pond 1E: Depression

Inflow Area = 8.097 ac, 3.75% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 21.13 cfs @ 12.33 hrs, Volume= 1.696 af
Outflow = 12.27 cfs @ 12.58 hrs, Volume= 1.696 af, Atten= 42%, Lag= 14.6 min
Primary = 12.27 cfs @ 12.58 hrs, Volume= 1.696 af
Routed to Reach 11R : North

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 981.50' @ 12.58 hrs Surf.Area= 18,121 sf Storage= 10,378 cf

Plug-Flow detention time= 5.2 min calculated for 1.695 af (100% of inflow)
Center-of-Mass det. time= 5.2 min (819.2 - 814.0)

Volume	Invert	Avail.Storage	Storage Description
#1	978.67'	63,415 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
978.67	10	0	0
979.00	26	6	6
980.00	211	119	124
981.00	7,479	3,845	3,969
982.00	28,736	18,108	22,077
983.00	53,940	41,338	63,415

Device	Routing	Invert	Outlet Devices
#1	Primary	978.35'	**18.0" Round Culvert** L= 275.0' Ke= 0.500 Inlet / Outlet Invert= 978.35' / 975.09' S= 0.0119 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.67'	**18.0" Round Culvert** L= 9.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 978.67' / 978.39' S= 0.0311 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=12.27 cfs @ 12.58 hrs HW=981.50' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 12.27 cfs of 12.30 cfs potential flow)
↑—**2=Culvert** (Inlet Controls 12.27 cfs @ 6.94 fps)

Stage-Area-Storage for Pond 1E: Depression

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
978.67	10	0
978.72	12	1
978.77	15	1
978.82	17	2
978.87	20	3
978.92	22	4
978.97	25	5
979.02	30	6
979.07	39	8
979.12	48	10
979.17	57	13
979.22	67	16
979.27	76	20
979.32	85	24
979.37	94	28
979.42	104	33
979.47	113	39
979.52	122	44
979.57	131	51
979.62	141	58
979.67	150	65
979.72	159	73
979.77	168	81
979.82	178	89
979.87	187	99
979.92	196	108
979.97	205	118
980.02	356	130
980.07	720	157
980.12	1,083	202
980.17	1,447	265
980.22	1,810	347
980.27	2,173	446
980.32	2,537	564
980.37	2,900	700
980.42	3,264	854
980.47	3,627	1,026
980.52	3,990	1,217
980.57	4,354	1,425
980.62	4,717	1,652
980.67	5,081	1,897
980.72	5,444	2,160
980.77	5,807	2,442
980.82	6,171	2,741
980.87	6,534	3,059
980.92	6,898	3,394
980.97	7,261	3,748
981.02	7,904	4,123
981.07	8,967	4,545
981.12	10,030	5,020
981.17	11,093	5,548
981.22	12,156	6,129
981.27	13,218	6,764
981.32	14,281	7,451
981.37	15,344	8,192
981.42	16,407	8,985
981.47	17,470	9,832
981.52	18,533	10,732
981.57	19,595	11,686
981.62	20,658	12,692
981.67	21,721	13,752
981.72	22,784	14,864
981.77	23,847	16,030
981.82	24,910	17,249
981.87	25,973	18,521
981.92	27,035	19,846
981.97	28,098	21,224
982.02	29,240	22,657
982.07	30,500	24,150
982.12	31,760	25,707
982.17	33,021	27,326
982.22	34,281	29,009
982.27	35,541	30,754
982.32	36,801	32,563
982.37	38,061	34,434
982.42	39,322	36,369
982.47	40,582	38,367
982.52	41,842	40,427
982.57	43,102	42,551
982.62	44,362	44,737
982.67	45,623	46,987
982.72	46,883	49,300
982.77	48,143	51,675
982.82	49,403	54,114
982.87	50,663	56,616
982.92	51,924	59,180
982.97	**53,184**	**61,808**

Summary for Subcatchment 1S-E: North

Runoff = 43.98 cfs @ 12.33 hrs, Volume= 3.597 af, Depth= 5.33"
Routed to Pond 1E : Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.304	98	
	7.793	82	Woods/grass comb., Fair, HSG D
	8.097	83	Weighted Average
	7.793	82	96.25% Pervious Area
	0.304	98	3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0570	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.4	100	0.0550	1.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.6	100	0.0085	0.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.0	500	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.9	800	Total			

Summary for Subcatchment 2S-E: East

Runoff = 7.71 cfs @ 12.29 hrs, Volume= 0.578 af, Depth= 4.88"
Routed to Reach 5R : (new Reach)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.028	98	
	1.393	79	Woods, Fair, HSG D
	1.421	79	Weighted Average
	1.393	79	98.03% Pervious Area
	0.028	98	1.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	100	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.1	100	0.0250	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.7	200	Total			

Summary for Subcatchment 3S-E: Southeast

Runoff = 2.82 cfs @ 12.33 hrs, Volume= 0.228 af, Depth= 4.88"
Routed to Reach 5R : (new Reach)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.004	98	
	0.558	79	Woods, Fair, HSG D
	0.562	79	Weighted Average
	0.558	79	99.29% Pervious Area
	0.004	98	0.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0300	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
3.7	250	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.0	350	Total			

Summary for Subcatchment 4S-E: South

Runoff = 2.40 cfs @ 12.31 hrs, Volume= 0.187 af, Depth= 4.99"
Routed to Reach 38R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.021	98	
	0.429	79	Woods, Fair, HSG D
	0.450	80	Weighted Average
	0.429	79	95.33% Pervious Area
	0.021	98	4.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	100	0.0250	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.5	35	0.0650	1.27		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.3	135	Total			

Summary for Subcatchment 5S-E: West

Runoff = 6.06 cfs @ 12.22 hrs, Volume= 0.392 af, Depth= 5.10"
Routed to Reach 38R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.121	98	
	0.800	79	Woods, Fair, HSG D
	0.921	81	Weighted Average
	0.800	79	86.86% Pervious Area
	0.121	98	13.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0660	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.3	30	0.1100	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.4	130	Total			

Summary for Subcatchment 10S-E: Northeast

Runoff = 0.38 cfs @ 12.16 hrs, Volume= 0.021 af, Depth= 5.22"
Routed to Reach 11R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.007	98	
	0.041	79	Woods, Fair, HSG D
	0.048	82	Weighted Average
	0.041	79	85.42% Pervious Area
	0.007	98	14.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	90	0.1500	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"

Summary for Subcatchment 11S-E: Wetland North

Runoff = 1.77 cfs @ 12.21 hrs, Volume= 0.110 af, Depth= 5.33"
Routed to Reach 11R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.047	98	
	0.200	79	Woods, Fair, HSG D
	0.247	83	Weighted Average
	0.200	79	80.97% Pervious Area
	0.047	98	19.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0300	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"

Summary for Reach 5R: (new Reach)

Inflow Area = 11.746 ac, 4.53% Impervious, Inflow Depth = 5.22" for 100-Year base event
Inflow = 32.70 cfs @ 12.27 hrs, Volume= 5.112 af
Outflow = 32.70 cfs @ 12.27 hrs, Volume= 5.112 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 11R: North

Inflow Area = 8.392 ac, 4.27% Impervious, Inflow Depth = 5.33" for 100-Year base event
Inflow = 14.37 cfs @ 12.26 hrs, Volume= 3.727 af
Outflow = 14.37 cfs @ 12.26 hrs, Volume= 3.727 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 5R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 38R: Plymouth Road

Inflow Area = 1.371 ac, 10.36% Impervious, Inflow Depth = 5.07" for 100-Year base event
Inflow = 8.19 cfs @ 12.24 hrs, Volume= 0.579 af
Outflow = 8.19 cfs @ 12.24 hrs, Volume= 0.579 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 5R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Pond 1E: Depression

Inflow Area = 8.097 ac, 3.75% Impervious, Inflow Depth = 5.33" for 100-Year base event
Inflow = 43.98 cfs @ 12.33 hrs, Volume= 3.597 af
Outflow = 13.63 cfs @ 12.77 hrs, Volume= 3.597 af, Atten= 69%, Lag= 26.7 min
Primary = 13.63 cfs @ 12.77 hrs, Volume= 3.597 af
Routed to Reach 11R : North

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 982.62' @ 12.77 hrs Surf.Area= 44,347 sf Storage= 44,711 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 22.8 min (821.8 - 799.0)

Volume	Invert	Avail.Storage	Storage Description
#1	978.67'	63,415 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
978.67	10	0	0
979.00	26	6	6
980.00	211	119	124
981.00	7,479	3,845	3,969
982.00	28,736	18,108	22,077
983.00	53,940	41,338	63,415

Device	Routing	Invert	Outlet Devices
#1	Primary	978.35'	**18.0" Round Culvert** L= 275.0' Ke= 0.500 Inlet / Outlet Invert= 978.35' / 975.09' S= 0.0119 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.67'	**18.0" Round Culvert** L= 9.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 978.67' / 978.39' S= 0.0311 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=13.63 cfs @ 12.77 hrs HW=982.62' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 13.63 cfs @ 7.71 fps)
↑—**2=Culvert** (Passes 13.63 cfs of 15.22 cfs potential flow)

Stage-Area-Storage for Pond 1E: Depression

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
978.67	10	0
978.72	12	1
978.77	15	1
978.82	17	2
978.87	20	3
978.92	22	4
978.97	25	5
979.02	30	6
979.07	39	8
979.12	48	10
979.17	57	13
979.22	67	16
979.27	76	20
979.32	85	24
979.37	94	28
979.42	104	33
979.47	113	39
979.52	122	44
979.57	131	51
979.62	141	58
979.67	150	65
979.72	159	73
979.77	168	81
979.82	178	89
979.87	187	99
979.92	196	108
979.97	205	118
980.02	356	130
980.07	720	157
980.12	1,083	202
980.17	1,447	265
980.22	1,810	347
980.27	2,173	446
980.32	2,537	564
980.37	2,900	700
980.42	3,264	854
980.47	3,627	1,026
980.52	3,990	1,217
980.57	4,354	1,425
980.62	4,717	1,652
980.67	5,081	1,897
980.72	5,444	2,160
980.77	5,807	2,442
980.82	6,171	2,741
980.87	6,534	3,059
980.92	6,898	3,394
980.97	7,261	3,748
981.02	7,904	4,123
981.07	8,967	4,545
981.12	10,030	5,020
981.17	11,093	5,548
981.22	12,156	6,129
981.27	13,218	6,764
981.32	14,281	7,451
981.37	15,344	8,192
981.42	16,407	8,985
981.47	17,470	9,832
981.52	18,533	10,732
981.57	19,595	11,686
981.62	20,658	12,692
981.67	21,721	13,752
981.72	22,784	14,864
981.77	23,847	16,030
981.82	24,910	17,249
981.87	25,973	18,521
981.92	27,035	19,846
981.97	28,098	21,224
982.02	29,240	22,657
982.07	30,500	24,150
982.12	31,760	25,707
982.17	33,021	27,326
982.22	34,281	29,009
982.27	35,541	30,754
982.32	36,801	32,563
982.37	38,061	34,434
982.42	39,322	36,369
982.47	40,582	38,367
982.52	41,842	40,427
982.57	43,102	42,551
982.62	44,362	44,737
982.67	45,623	46,987
982.72	46,883	49,300
982.77	48,143	51,675
982.82	49,403	54,114
982.87	50,663	56,616
982.92	51,924	59,180
982.97	**53,184**	**61,808**

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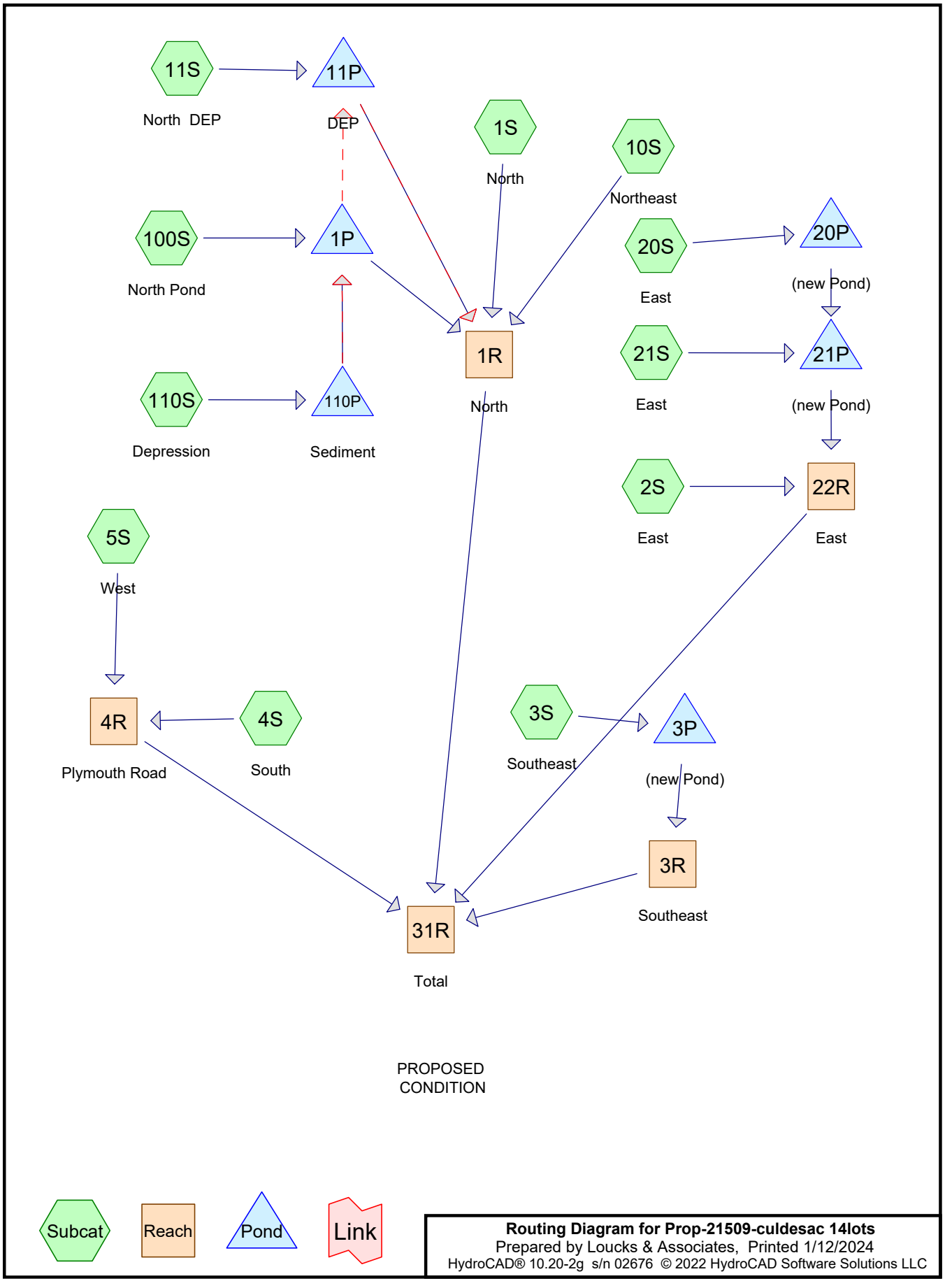
Appendix B

HydroCAD Report, Proposed
(1, 10, 100)



Routing Diagram for Prop-21509-culdesac 14lots
Prepared by Loucks & Associates, Printed 1/12/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	MSE 24-hr	3	Default	24.00	1	2.48	2
2	10-Year	MSE 24-hr	3	Default	24.00	1	4.26	2
3	100-Year base	MSE 24-hr	3	Default	24.00	1	7.32	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.008	98	(4S, 5S, 100S)
5.405	80	>75% Grass cover, Good, HSG D (1S, 2S, 3S, 4S, 5S, 11S, 20S, 21S, 100S, 110S)
0.252	98	Unconnected pavement, HSG D (3S, 110S)
0.694	98	Unconnected roofs, HSG D (2S, 20S, 21S, 110S)
0.966	79	Woods, Fair, HSG D (3S, 4S, 5S, 10S)
2.421	79	Woods/grass comb., Good, HSG D (2S, 20S, 21S, 100S, 110S)
11.746	**84**	**TOTAL AREA**

Summary for Subcatchment 1S: North

Runoff = 0.25 cfs @ 12.20 hrs, Volume= 0.014 af, Depth= 0.88"
Routed to Reach 1R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.000	98	
	0.195	80	>75% Grass cover, Good, HSG D
	0.000	77	Woods, Good, HSG D
	0.195	80	Weighted Average
	0.195	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.6	110	0.2000	3.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.0	160	Total			

Summary for Subcatchment 2S: East

Runoff = 0.60 cfs @ 12.27 hrs, Volume= 0.042 af, Depth= 0.93"
Routed to Reach 22R : East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

Area (ac)	CN	Adj	Description
0.086	98		Unconnected roofs, HSG D
0.276	80		>75% Grass cover, Good, HSG D
0.183	79		Woods/grass comb., Good, HSG D
0.545	83	81	Weighted Average, UI Adjusted
0.459	80	80	84.22% Pervious Area
0.086	98	98	15.78% Impervious Area
0.086			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.4	60	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
17.1	160	Total			

Summary for Subcatchment 3S: Southeast

Runoff = 0.49 cfs @ 12.32 hrs, Volume= 0.039 af, Depth= 0.98"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

Area (ac)	CN	Adj	Description
0.117	98		Unconnected pavement, HSG D
0.120	79		Woods, Fair, HSG D
0.233	80		>75% Grass cover, Good, HSG D
0.470	84	82	Weighted Average, UI Adjusted
0.353	80	80	75.11% Pervious Area
0.117	98	98	24.89% Impervious Area
0.117			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	100	0.0280	0.09		**Sheet Flow,** n= 0.380 P2= 2.86"
1.8	155	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.9	255	Total			

Summary for Subcatchment 4S: South

Runoff = 0.55 cfs @ 12.25 hrs, Volume= 0.036 af, Depth= 1.04"
Routed to Reach 4R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.086	98	
	0.218	80	>75% Grass cover, Good, HSG D
	0.110	79	Woods, Fair, HSG D
	0.414	83	Weighted Average
	0.328	80	79.23% Pervious Area
	0.086	98	20.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	85	0.0420	0.09		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 2.86"

Summary for Subcatchment 5S: West

Runoff = 1.44 cfs @ 12.29 hrs, Volume= 0.104 af, Depth= 1.04"
Routed to Reach 4R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.252	98	
	0.255	80	>75% Grass cover, Good, HSG D
	0.696	79	Woods, Fair, HSG D
	1.203	83	Weighted Average
	0.951	79	79.05% Pervious Area
	0.252	98	20.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0300	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
14.4	80	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.5	45	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.4	145	Total			

Summary for Subcatchment 10S: Northeast

Runoff = 0.05 cfs @ 12.18 hrs, Volume= 0.003 af, Depth= 0.82"
Routed to Reach 1R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.000	98	
	0.040	79	Woods, Fair, HSG D
	0.040	79	Weighted Average
	0.040	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	90	0.1500	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"

Summary for Subcatchment 11S: North DEP

Runoff = 0.28 cfs @ 12.15 hrs, Volume= 0.013 af, Depth= 0.88"
Routed to Pond 11P : DEP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	0.000	98	
	0.183	80	>75% Grass cover, Good, HSG D
	0.000	79	Woods/grass comb., Good, HSG D
	0.183	80	Weighted Average
	0.183	80	100.00% Pervious Area

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

Summary for Subcatchment 20S: East

Runoff = 0.66 cfs @ 12.30 hrs, Volume= 0.049 af, Depth= 0.93"
Routed to Pond 20P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

Area (ac)	CN	Adj	Description
0.120	98		Unconnected roofs, HSG D
0.378	80		>75% Grass cover, Good, HSG D
0.140	79		Woods/grass comb., Good, HSG D
0.638	83	81	Weighted Average, UI Adjusted
0.518	80	80	81.19% Pervious Area
0.120	98	98	18.81% Impervious Area
0.120			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0480	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.9	122	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.9	222	Total			

Summary for Subcatchment 21S: East

Runoff = 0.11 cfs @ 12.30 hrs, Volume= 0.008 af, Depth= 0.98"
Routed to Pond 21P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

Area (ac)	CN	Adj	Description
0.023	98		Unconnected roofs, HSG D
0.060	80		>75% Grass cover, Good, HSG D
0.020	79		Woods/grass comb., Good, HSG D
0.103	84	82	Weighted Average, UI Adjusted
0.080	80	80	77.67% Pervious Area
0.023	98	98	22.33% Impervious Area
0.023			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0480	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.9	122	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.9	222	Total			

Summary for Subcatchment 100S: North Pond

Runoff = 6.92 cfs @ 12.25 hrs, Volume= 0.465 af, Depth= 1.29"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

	Area (ac)	CN	Description
*	1.670	98	
	2.390	80	>75% Grass cover, Good, HSG D
	0.250	79	Woods/grass comb., Good, HSG D
*	0.000	98	
*	0.000	80	
	4.310	87	Weighted Average
	2.640	80	61.25% Pervious Area
	1.670	98	38.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	110	0.0350	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
0.3	81	0.0600	4.97		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.0	641	0.0060	3.51	2.76	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
16.3	832	Total			

Summary for Subcatchment 110S: Depression

Runoff = 4.24 cfs @ 12.25 hrs, Volume= 0.282 af, Depth= 0.93"
Routed to Pond 110P : Sediment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.48"

Area (ac)	CN	Adj	Description
0.465	98		Unconnected roofs, HSG D
1.217	80		>75% Grass cover, Good, HSG D
1.828	79		Woods/grass comb., Good, HSG D
0.135	98		Unconnected pavement, HSG D
3.645	82	81	Weighted Average, UI Adjusted
3.045	79	79	83.54% Pervious Area
0.600	98	98	16.46% Impervious Area
0.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
5.8	50	0.1500	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.3	150	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	130	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	380	Total			

Summary for Reach 1R: North

Inflow Area = 8.373 ac, 27.11% Impervious, Inflow Depth = 1.11" for 1-Year event
Inflow = 2.02 cfs @ 12.81 hrs, Volume= 0.777 af
Outflow = 2.02 cfs @ 12.81 hrs, Volume= 0.777 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 3R: Southeast

Inflow Area = 0.470 ac, 24.89% Impervious, Inflow Depth = 0.90" for 1-Year event
Inflow = 0.46 cfs @ 12.39 hrs, Volume= 0.035 af
Outflow = 0.46 cfs @ 12.39 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Plymouth Road

Inflow Area = 1.617 ac, 20.90% Impervious, Inflow Depth = 1.04" for 1-Year event
Inflow = 1.98 cfs @ 12.27 hrs, Volume= 0.140 af
Outflow = 1.98 cfs @ 12.27 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 22R: East

Inflow Area = 1.286 ac, 17.81% Impervious, Inflow Depth = 0.88" for 1-Year event
Inflow = 1.25 cfs @ 12.34 hrs, Volume= 0.094 af
Outflow = 1.25 cfs @ 12.34 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 31R: Total

Inflow Area = 11.746 ac, 25.15% Impervious, Inflow Depth = 1.07" for 1-Year event
Inflow = 4.02 cfs @ 12.30 hrs, Volume= 1.047 af
Outflow = 4.02 cfs @ 12.30 hrs, Volume= 1.047 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 7.955 ac, 28.54% Impervious, Inflow Depth = 1.13" for 1-Year event
Inflow = 8.78 cfs @ 12.28 hrs, Volume= 0.747 af
Outflow = 1.95 cfs @ 12.83 hrs, Volume= 0.747 af, Atten= 78%, Lag= 33.0 min
Primary = 1.95 cfs @ 12.83 hrs, Volume= 0.747 af
Routed to Reach 1R : North
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 11P : DEP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Starting Elev= 978.00' Surf.Area= 6,020 sf Storage= 22,715 cf
Peak Elev= 979.46' @ 12.83 hrs Surf.Area= 11,415 sf Storage= 36,165 cf (13,450 cf above start)

Plug-Flow detention time= 1,583.6 min calculated for 0.225 af (30% of inflow)
Center-of-Mass det. time= 504.3 min (1,377.5 - 873.2)

Volume	Invert	Avail.Storage	Storage Description
#1	971.00'	79,375 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
971.00	735	0	0
977.00	5,000	17,205	17,205
978.00	6,020	5,510	22,715
979.00	10,650	8,335	31,050
980.00	12,300	11,475	42,525
981.00	18,200	15,250	57,775
982.00	25,000	21,600	79,375

Device	Routing	Invert	Outlet Devices
#1	Primary	977.11'	**15.0" Round Culvert** L= 59.0' Ke= 0.500 Inlet / Outlet Invert= 977.11' / 976.82' S= 0.0049 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	979.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	980.25'	**48.0" Horiz. Orifice/Grate X 0.60** C= 0.600 Limited to weir flow at low heads
#4	Device 1	977.25'	**6.0" Round Culvert X 2.00** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 977.25' / 977.25' S= 0.0000 '/' Cc= 0.900 n= 0.020, Flow Area= 0.20 sf
#5	Device 4	978.00'	**1.600 in/hr Exfiltration over Surface area above 978.00'** Excluded Surface area = 6,020 sf
#6	Secondary	981.75'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=1.94 cfs @ 12.83 hrs HW=979.46' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.94 cfs of 6.86 cfs potential flow)
  ├─**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.75 cfs @ 1.68 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Culvert** (Passes 0.20 cfs of 0.92 cfs potential flow)
    └─**5=Exfiltration** (Exfiltration Controls 0.20 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=978.00' TW=978.67' (Dynamic Tailwater)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 1P:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
971.00	735	0
971.20	877	161
971.40	1,019	351
971.60	1,162	569
971.80	1,304	815
972.00	1,446	1,090
972.20	1,588	1,394
972.40	1,730	1,726
972.60	1,872	2,086
972.80	2,014	2,475
973.00	2,157	2,892
973.20	2,299	3,337
973.40	2,441	3,811
973.60	2,583	4,314
973.80	2,725	4,844
974.00	2,868	5,404
974.20	3,010	5,991
974.40	3,152	6,608
974.60	3,294	7,252
974.80	3,436	7,925
975.00	3,578	8,627
975.20	3,721	9,357
975.40	3,863	10,115
975.60	4,005	10,902
975.80	4,147	11,717
976.00	4,289	12,560
976.20	4,431	13,432
976.40	4,573	14,333
976.60	4,716	15,262
976.80	4,858	16,219
977.00	5,000	17,205
977.20	5,204	18,225
977.40	5,408	19,287
977.60	5,612	20,389
977.80	5,816	21,531
978.00	6,020	22,715
978.20	6,946	24,012
978.40	7,872	25,493
978.60	8,798	27,160
978.80	9,724	29,013
979.00	10,650	31,050
979.20	10,980	33,213
979.40	11,310	35,442
979.60	11,640	37,737
979.80	11,970	40,098
980.00	12,300	42,525
980.20	13,480	45,103
980.40	14,660	47,917
980.60	15,840	50,967
980.80	17,020	54,253
981.00	18,200	57,775
981.20	19,560	61,551
981.40	20,920	65,599
981.60	22,280	69,919
981.80	23,640	74,511
982.00	**25,000**	**79,375**

Summary for Pond 3P: (new Pond)

Inflow Area = 0.470 ac, 24.89% Impervious, Inflow Depth = 0.98" for 1-Year event
Inflow = 0.49 cfs @ 12.32 hrs, Volume= 0.039 af
Outflow = 0.46 cfs @ 12.39 hrs, Volume= 0.039 af, Atten= 7%, Lag= 4.4 min
Discarded = 0.00 cfs @ 12.39 hrs, Volume= 0.003 af
Primary = 0.46 cfs @ 12.39 hrs, Volume= 0.035 af
Routed to Reach 3R : Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 1,015.31' @ 12.39 hrs Surf.Area= 504 sf Storage= 243 cf

Plug-Flow detention time= 163.8 min calculated for 0.038 af (100% of inflow)
Center-of-Mass det. time= 165.4 min (998.3 - 832.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.70'	685 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,014.70	300	0	0
1,015.00	400	105	105
1,015.50	570	243	347
1,016.00	780	338	685

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.00'	**1.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,014.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	1,015.35'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.39 hrs HW=1,015.31' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.46 cfs @ 12.39 hrs HW=1,015.31' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.46 cfs @ 1.50 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 3P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,014.70	300	0
1,014.72	307	6
1,014.74	313	12
1,014.76	320	19
1,014.78	327	25
1,014.80	333	32
1,014.82	340	38
1,014.84	347	45
1,014.86	353	52
1,014.88	360	59
1,014.90	367	67
1,014.92	373	74
1,014.94	380	82
1,014.96	387	89
1,014.98	393	97
1,015.00	400	105
1,015.02	407	113
1,015.04	414	121
1,015.06	420	130
1,015.08	427	138
1,015.10	434	147
1,015.12	441	155
1,015.14	448	164
1,015.16	454	173
1,015.18	461	183
1,015.20	468	192
1,015.22	475	201
1,015.24	482	211
1,015.26	488	220
1,015.28	495	230
1,015.30	502	240
1,015.32	509	250
1,015.34	516	261
1,015.36	522	271
1,015.38	529	282
1,015.40	536	292
1,015.42	543	303
1,015.44	550	314
1,015.46	556	325
1,015.48	563	336
1,015.50	570	347
1,015.52	578	359
1,015.54	587	371
1,015.56	595	382
1,015.58	604	394
1,015.60	612	407
1,015.62	620	419
1,015.64	629	431
1,015.66	637	444
1,015.68	646	457
1,015.70	654	470
1,015.72	662	483
1,015.74	671	496
1,015.76	679	510
1,015.78	688	524
1,015.80	696	537
1,015.82	704	551
1,015.84	713	566
1,015.86	721	580
1,015.88	730	594
1,015.90	738	609
1,015.92	746	624
1,015.94	755	639
1,015.96	763	654
1,015.98	772	669
1,016.00	**780**	**685**

Summary for Pond 11P: DEP

Inflow Area = 0.183 ac, 0.00% Impervious, Inflow Depth = 0.88" for 1-Year event
Inflow = 0.28 cfs @ 12.15 hrs, Volume= 0.013 af
Outflow = 0.28 cfs @ 12.15 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.1 min
Primary = 0.28 cfs @ 12.15 hrs, Volume= 0.013 af
Routed to Reach 1R : North
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : North

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 978.90' @ 12.15 hrs Surf.Area= 15 sf Storage= 3 cf

Plug-Flow detention time= 1.7 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (826.0 - 825.4)

Volume	Invert	Avail.Storage	Storage Description
#1	978.67'	2,228 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
978.67	10	0	0
980.00	40	33	33
981.00	770	405	438
982.00	2,810	1,790	2,228

Device	Routing	Invert	Outlet Devices
#1	Primary	978.67'	**18.0" Round Culvert** L= 9.0' Ke= 0.500 Inlet / Outlet Invert= 978.67' / 978.39' S= 0.0311 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Secondary	981.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.28 cfs @ 12.15 hrs HW=978.90' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.28 cfs @ 1.63 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=978.67' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 11P: DEP

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
978.67	10	0
978.72	11	1
978.77	12	1
978.82	13	2
978.87	15	2
978.92	16	3
978.97	17	4
979.02	18	5
979.07	19	6
979.12	20	7
979.17	21	8
979.22	22	9
979.27	24	10
979.32	25	11
979.37	26	13
979.42	27	14
979.47	28	15
979.52	29	17
979.57	30	18
979.62	31	20
979.67	33	21
979.72	34	23
979.77	35	25
979.82	36	26
979.87	37	28
979.92	38	30
979.97	39	32
980.02	55	34
980.07	91	38
980.12	128	43
980.17	164	51
980.22	201	60
980.27	237	71
980.32	274	83
980.37	310	98
980.42	347	114
980.47	383	133
980.52	420	153
980.57	456	175
980.62	493	198
980.67	529	224
980.72	566	251
980.77	602	280
980.82	639	311
980.87	675	344
980.92	712	379
980.97	748	415
981.02	811	454
981.07	913	497
981.12	1,015	545
981.17	1,117	599
981.22	1,219	657
981.27	1,321	721
981.32	1,423	789
981.37	1,525	863
981.42	1,627	942
981.47	1,729	1,025
981.52	1,831	1,114
981.57	1,933	1,209
981.62	2,035	1,308
981.67	2,137	1,412
981.72	2,239	1,521
981.77	2,341	1,636
981.82	2,443	1,755
981.87	2,545	1,880
981.92	2,647	2,010
981.97	**2,749**	**2,145**

Summary for Pond 20P: (new Pond)

Inflow Area = 0.638 ac, 18.81% Impervious, Inflow Depth = 0.93" for 1-Year event
Inflow = 0.66 cfs @ 12.30 hrs, Volume= 0.049 af
Outflow = 0.64 cfs @ 12.34 hrs, Volume= 0.049 af, Atten= 3%, Lag= 2.5 min
Discarded = 0.00 cfs @ 12.34 hrs, Volume= 0.003 af
Primary = 0.64 cfs @ 12.34 hrs, Volume= 0.046 af
Routed to Pond 21P : (new Pond)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 993.25' @ 12.34 hrs Surf.Area= 528 sf Storage= 212 cf

Plug-Flow detention time= 116.9 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 118.5 min (952.3 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	992.70'	756 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.70	275	0	0
993.00	380	98	98
993.50	675	264	362
994.00	900	394	756

Device	Routing	Invert	Outlet Devices
#1	Primary	993.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	992.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	993.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.34 hrs HW=993.25' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.64 cfs @ 12.34 hrs HW=993.25' TW=992.26' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.64 cfs @ 1.28 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 20P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
992.70	275	0
992.72	282	6
992.74	289	11
992.76	296	17
992.78	303	23
992.80	310	29
992.82	317	36
992.84	324	42
992.86	331	48
992.88	338	55
992.90	345	62
992.92	352	69
992.94	359	76
992.96	366	83
992.98	373	91
993.00	380	98
993.02	392	106
993.04	404	114
993.06	415	122
993.08	427	131
993.10	439	139
993.12	451	148
993.14	463	157
993.16	474	167
993.18	486	176
993.20	498	186
993.22	510	196
993.24	522	206
993.26	533	217
993.28	545	228
993.30	557	239
993.32	569	250
993.34	581	262
993.36	592	273
993.38	604	285
993.40	616	297
993.42	628	310
993.44	640	323
993.46	651	335
993.48	663	349
993.50	675	362
993.52	684	376
993.54	693	389
993.56	702	403
993.58	711	417
993.60	720	432
993.62	729	446
993.64	738	461
993.66	747	476
993.68	756	491
993.70	765	506
993.72	774	521
993.74	783	537
993.76	792	553
993.78	801	569
993.80	810	585
993.82	819	601
993.84	828	618
993.86	837	634
993.88	846	651
993.90	855	668
993.92	864	685
993.94	873	703
993.96	882	720
993.98	891	738
994.00	**900**	**756**

Summary for Pond 21P: (new Pond)

Inflow Area = 0.741 ac, 19.30% Impervious, Inflow Depth = 0.89" for 1-Year event
Inflow = 0.75 cfs @ 12.33 hrs, Volume= 0.055 af
Outflow = 0.73 cfs @ 12.38 hrs, Volume= 0.055 af, Atten= 3%, Lag= 2.7 min
Discarded = 0.00 cfs @ 12.38 hrs, Volume= 0.003 af
Primary = 0.73 cfs @ 12.38 hrs, Volume= 0.052 af
Routed to Reach 22R : East

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 992.27' @ 12.38 hrs Surf.Area= 563 sf Storage= 240 cf

Plug-Flow detention time= 117.8 min calculated for 0.055 af (100% of inflow)
Center-of-Mass det. time= 119.4 min (959.2 - 839.8)

Volume	Invert	Avail.Storage	Storage Description
#1	991.70'	784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
991.70	325	0	0
992.00	400	109	109
992.50	700	275	384
993.00	900	400	784

Device	Routing	Invert	Outlet Devices
#1	Primary	992.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	991.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	992.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.38 hrs HW=992.27' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.72 cfs @ 12.38 hrs HW=992.27' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.72 cfs @ 1.33 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 21P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
991.70	325	0
991.72	330	7
991.74	335	13
991.76	340	20
991.78	345	27
991.80	350	34
991.82	355	41
991.84	360	48
991.86	365	55
991.88	370	63
991.90	375	70
991.92	380	78
991.94	385	85
991.96	390	93
991.98	395	101
992.00	400	109
992.02	412	117
992.04	424	125
992.06	436	134
992.08	448	143
992.10	460	152
992.12	472	161
992.14	484	171
992.16	496	180
992.18	508	190
992.20	520	201
992.22	532	211
992.24	544	222
992.26	556	233
992.28	568	244
992.30	580	256
992.32	592	267
992.34	604	279
992.36	616	292
992.38	628	304
992.40	640	317
992.42	652	330
992.44	664	343
992.46	676	356
992.48	688	370
992.50	700	384
992.52	708	398
992.54	716	412
992.56	724	426
992.58	732	441
992.60	740	456
992.62	748	471
992.64	756	486
992.66	764	501
992.68	772	516
992.70	780	532
992.72	788	547
992.74	796	563
992.76	804	579
992.78	812	595
992.80	820	612
992.82	828	628
992.84	836	645
992.86	844	662
992.88	852	679
992.90	860	696
992.92	868	713
992.94	876	730
992.96	884	748
992.98	892	766
993.00	**900**	**784**

Summary for Pond 110P: Sediment

Inflow Area = 3.645 ac, 16.46% Impervious, Inflow Depth = 0.93" for 1-Year event
Inflow = 4.24 cfs @ 12.25 hrs, Volume= 0.282 af
Outflow = 2.56 cfs @ 12.37 hrs, Volume= 0.282 af, Atten= 40%, Lag= 7.2 min
Secondary = 2.56 cfs @ 12.37 hrs, Volume= 0.282 af
Routed to Pond 1P :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Starting Elev= 979.00' Surf.Area= 7,745 sf Storage= 19,593 cf
Peak Elev= 979.47' @ 12.87 hrs Surf.Area= 8,422 sf Storage= 23,368 cf (3,775 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 138.9 min (969.4 - 830.4)

Volume	Invert	Avail.Storage	Storage Description
#1	973.00'	53,395 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
973.00	1,020	0	0
978.00	4,390	13,525	13,525
979.00	7,745	6,068	19,593
979.50	8,470	4,054	23,646
980.00	9,375	4,461	28,108
981.00	12,800	11,088	39,195
982.00	15,600	14,200	53,395

Device	Routing	Invert	Outlet Devices
#1	Secondary	979.00'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Secondary OutFlow Max=2.26 cfs @ 12.37 hrs HW=979.35' TW=979.15' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 2.26 cfs @ 1.31 fps)

Stage-Area-Storage for Pond 110P: Sediment

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
973.00	1,020	0
973.10	1,087	105
973.20	1,155	217
973.30	1,222	336
973.40	1,290	462
973.50	1,357	594
973.60	1,424	733
973.70	1,492	879
973.80	1,559	1,032
973.90	1,627	1,191
974.00	1,694	1,357
974.10	1,761	1,530
974.20	1,829	1,709
974.30	1,896	1,896
974.40	1,964	2,089
974.50	2,031	2,288
974.60	2,098	2,495
974.70	2,166	2,708
974.80	2,233	2,928
974.90	2,301	3,155
975.00	2,368	3,388
975.10	2,435	3,628
975.20	2,503	3,875
975.30	2,570	4,129
975.40	2,638	4,389
975.50	2,705	4,656
975.60	2,772	4,930
975.70	2,840	5,211
975.80	2,907	5,498
975.90	2,975	5,792
976.00	3,042	6,093
976.10	3,109	6,401
976.20	3,177	6,715
976.30	3,244	7,036
976.40	3,312	7,364
976.50	3,379	7,698
976.60	3,446	8,040
976.70	3,514	8,388
976.80	3,581	8,742
976.90	3,649	9,104
977.00	3,716	9,472
977.10	3,783	9,847
977.20	3,851	10,229
977.30	3,918	10,617
977.40	3,986	11,012
977.50	4,053	11,414
977.60	4,120	11,823
977.70	4,188	12,238
977.80	4,255	12,660
977.90	4,323	13,089
978.00	4,390	13,525
978.10	4,726	13,981
978.20	5,061	14,470
978.30	5,396	14,993
978.40	5,732	15,549
978.50	6,068	16,139
978.60	6,403	16,763
978.70	6,739	17,420
978.80	7,074	18,111
978.90	7,409	18,835
979.00	7,745	19,593
979.10	7,890	20,374
979.20	8,035	21,171
979.30	8,180	21,981
979.40	8,325	22,806
979.50	8,470	23,646
979.60	8,651	24,502
979.70	8,832	25,376
979.80	9,013	26,269
979.90	9,194	27,179
980.00	9,375	28,108
980.10	9,718	29,062
980.20	10,060	30,051
980.30	10,402	31,074
980.40	10,745	32,131
980.50	11,088	33,223
980.60	11,430	34,349
980.70	11,773	35,509
980.80	12,115	36,703
980.90	12,457	37,932
981.00	12,800	39,195
981.10	13,080	40,489
981.20	13,360	41,811
981.30	13,640	43,161
981.40	13,920	44,539
981.50	14,200	45,945
981.60	14,480	47,379
981.70	14,760	48,841
981.80	15,040	50,331
981.90	15,320	51,849
982.00	**15,600**	**53,395**

Summary for Subcatchment 1S: North

Runoff = 0.65 cfs @ 12.19 hrs, Volume= 0.037 af, Depth= 2.26"
Routed to Reach 1R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	98	
	0.195	80	>75% Grass cover, Good, HSG D
	0.000	77	Woods, Good, HSG D
	0.195	80	Weighted Average
	0.195	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.6	110	0.2000	3.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.0	160	Total			

Summary for Subcatchment 2S: East

Runoff = 1.54 cfs @ 12.26 hrs, Volume= 0.106 af, Depth= 2.34"
Routed to Reach 22R : East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Adj	Description
0.086	98		Unconnected roofs, HSG D
0.276	80		>75% Grass cover, Good, HSG D
0.183	79		Woods/grass comb., Good, HSG D
0.545	83	81	Weighted Average, UI Adjusted
0.459	80	80	84.22% Pervious Area
0.086	98	98	15.78% Impervious Area
0.086			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.4	60	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
17.1	160	Total			

Summary for Subcatchment 3S: Southeast

Runoff = 1.24 cfs @ 12.31 hrs, Volume= 0.095 af, Depth= 2.43"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Adj	Description
0.117	98		Unconnected pavement, HSG D
0.120	79		Woods, Fair, HSG D
0.233	80		>75% Grass cover, Good, HSG D
0.470	84	82	Weighted Average, UI Adjusted
0.353	80	80	75.11% Pervious Area
0.117	98	98	24.89% Impervious Area
0.117			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	100	0.0280	0.09		**Sheet Flow,** n= 0.380 P2= 2.86"
1.8	155	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.9	255	Total			

Summary for Subcatchment 4S: South

Runoff = 1.33 cfs @ 12.24 hrs, Volume= 0.087 af, Depth= 2.51"
Routed to Reach 4R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.086	98	
	0.218	80	>75% Grass cover, Good, HSG D
	0.110	79	Woods, Fair, HSG D
	0.414	83	Weighted Average
	0.328	80	79.23% Pervious Area
	0.086	98	20.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	85	0.0420	0.09		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 2.86"

Summary for Subcatchment 5S: West

Runoff = 3.53 cfs @ 12.27 hrs, Volume= 0.252 af, Depth= 2.51"
Routed to Reach 4R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.252	98	
	0.255	80	>75% Grass cover, Good, HSG D
	0.696	79	Woods, Fair, HSG D
	1.203	83	Weighted Average
	0.951	79	79.05% Pervious Area
	0.252	98	20.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0300	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
14.4	80	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.5	45	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.4	145	Total			

Summary for Subcatchment 10S: Northeast

Runoff = 0.14 cfs @ 12.17 hrs, Volume= 0.007 af, Depth= 2.18"
Routed to Reach 1R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	98	
	0.040	79	Woods, Fair, HSG D
	0.040	79	Weighted Average
	0.040	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	90	0.1500	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"

Summary for Subcatchment 11S: North DEP

Runoff = 0.72 cfs @ 12.14 hrs, Volume= 0.034 af, Depth= 2.26"
Routed to Pond 11P : DEP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	98	
	0.183	80	>75% Grass cover, Good, HSG D
	0.000	79	Woods/grass comb., Good, HSG D
	0.183	80	Weighted Average
	0.183	80	100.00% Pervious Area

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

Summary for Subcatchment 20S: East

Runoff = 1.71 cfs @ 12.28 hrs, Volume= 0.125 af, Depth= 2.34"
Routed to Pond 20P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Adj	Description
0.120	98		Unconnected roofs, HSG D
0.378	80		>75% Grass cover, Good, HSG D
0.140	79		Woods/grass comb., Good, HSG D
0.638	83	81	Weighted Average, UI Adjusted
0.518	80	80	81.19% Pervious Area
0.120	98	98	18.81% Impervious Area
0.120			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0480	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.9	122	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.9	222	Total			

Summary for Subcatchment 21S: East

Runoff = 0.29 cfs @ 12.28 hrs, Volume= 0.021 af, Depth= 2.43"
Routed to Pond 21P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Adj	Description
0.023	98		Unconnected roofs, HSG D
0.060	80		>75% Grass cover, Good, HSG D
0.020	79		Woods/grass comb., Good, HSG D
0.103	84	82	Weighted Average, UI Adjusted
0.080	80	80	77.67% Pervious Area
0.023	98	98	22.33% Impervious Area
0.023			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0480	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.9	122	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.9	222	Total			

Summary for Subcatchment 100S: North Pond

Runoff = 15.17 cfs @ 12.25 hrs, Volume= 1.033 af, Depth= 2.88"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (ac)	CN	Description
*	1.670	98	
	2.390	80	>75% Grass cover, Good, HSG D
	0.250	79	Woods/grass comb., Good, HSG D
*	0.000	98	
*	0.000	80	
	4.310	87	Weighted Average
	2.640	80	61.25% Pervious Area
	1.670	98	38.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	110	0.0350	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
0.3	81	0.0600	4.97		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.0	641	0.0060	3.51	2.76	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
16.3	832	Total			

Summary for Subcatchment 110S: Depression

Runoff = 10.90 cfs @ 12.24 hrs, Volume= 0.711 af, Depth= 2.34"
Routed to Pond 110P : Sediment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Adj	Description
0.465	98		Unconnected roofs, HSG D
1.217	80		>75% Grass cover, Good, HSG D
1.828	79		Woods/grass comb., Good, HSG D
0.135	98		Unconnected pavement, HSG D
3.645	82	81	Weighted Average, UI Adjusted
3.045	79	79	83.54% Pervious Area
0.600	98	98	16.46% Impervious Area
0.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
5.8	50	0.1500	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.3	150	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	130	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	380	Total			

Summary for Reach 1R: North

Inflow Area = 8.373 ac, 27.11% Impervious, Inflow Depth = 2.61" for 10-Year event
Inflow = 8.86 cfs @ 12.44 hrs, Volume= 1.823 af
Outflow = 8.86 cfs @ 12.44 hrs, Volume= 1.823 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 3R: Southeast

Inflow Area = 0.470 ac, 24.89% Impervious, Inflow Depth = 2.35" for 10-Year event
Inflow = 1.23 cfs @ 12.33 hrs, Volume= 0.092 af
Outflow = 1.23 cfs @ 12.33 hrs, Volume= 0.092 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Plymouth Road

Inflow Area = 1.617 ac, 20.90% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 4.82 cfs @ 12.26 hrs, Volume= 0.339 af
Outflow = 4.82 cfs @ 12.26 hrs, Volume= 0.339 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 22R: East

Inflow Area = 1.286 ac, 17.81% Impervious, Inflow Depth = 2.29" for 10-Year event
Inflow = 3.31 cfs @ 12.31 hrs, Volume= 0.245 af
Outflow = 3.31 cfs @ 12.31 hrs, Volume= 0.245 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 31R: Total

Inflow Area = 11.746 ac, 25.15% Impervious, Inflow Depth = 2.55" for 10-Year event
Inflow = 18.03 cfs @ 12.31 hrs, Volume= 2.499 af
Outflow = 18.03 cfs @ 12.31 hrs, Volume= 2.499 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 7.955 ac, 28.54% Impervious, Inflow Depth = 2.63" for 10-Year event
Inflow = 19.07 cfs @ 12.24 hrs, Volume= 1.744 af
Outflow = 8.50 cfs @ 12.56 hrs, Volume= 1.744 af, Atten= 55%, Lag= 19.3 min
Primary = 8.50 cfs @ 12.56 hrs, Volume= 1.744 af
Routed to Reach 1R : North
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 11P : DEP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Starting Elev= 978.00' Surf.Area= 6,020 sf Storage= 22,715 cf
Peak Elev= 980.21' @ 12.56 hrs Surf.Area= 13,562 sf Storage= 45,292 cf (22,577 cf above start)

Plug-Flow detention time= 481.7 min calculated for 1.223 af (70% of inflow)
Center-of-Mass det. time= 246.0 min (1,084.6 - 838.6)

Volume	Invert	Avail.Storage	Storage Description
#1	971.00'	79,375 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
971.00	735	0	0
977.00	5,000	17,205	17,205
978.00	6,020	5,510	22,715
979.00	10,650	8,335	31,050
980.00	12,300	11,475	42,525
981.00	18,200	15,250	57,775
982.00	25,000	21,600	79,375

Device	Routing	Invert	Outlet Devices
#1	Primary	977.11'	**15.0" Round Culvert** L= 59.0' Ke= 0.500 Inlet / Outlet Invert= 977.11' / 976.82' S= 0.0049 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	979.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	980.25'	**48.0" Horiz. Orifice/Grate X 0.60** C= 0.600 Limited to weir flow at low heads
#4	Device 1	977.25'	**6.0" Round Culvert X 2.00** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 977.25' / 977.25' S= 0.0000 '/' Cc= 0.900 n= 0.020, Flow Area= 0.20 sf
#5	Device 4	978.00'	**1.600 in/hr Exfiltration over Surface area above 978.00'** Excluded Surface area = 6,020 sf
#6	Secondary	981.75'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=8.50 cfs @ 12.56 hrs HW=980.21' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 8.50 cfs @ 6.93 fps)
  ├─**2=Sharp-Crested Rectangular Weir** (Passes < 12.66 cfs potential flow)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Culvert** (Passes < 1.10 cfs potential flow)
    └─**5=Exfiltration** (Passes < 0.28 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=978.00' TW=978.67' (Dynamic Tailwater)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 1P:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
971.00	735	0
971.20	877	161
971.40	1,019	351
971.60	1,162	569
971.80	1,304	815
972.00	1,446	1,090
972.20	1,588	1,394
972.40	1,730	1,726
972.60	1,872	2,086
972.80	2,014	2,475
973.00	2,157	2,892
973.20	2,299	3,337
973.40	2,441	3,811
973.60	2,583	4,314
973.80	2,725	4,844
974.00	2,868	5,404
974.20	3,010	5,991
974.40	3,152	6,608
974.60	3,294	7,252
974.80	3,436	7,925
975.00	3,578	8,627
975.20	3,721	9,357
975.40	3,863	10,115
975.60	4,005	10,902
975.80	4,147	11,717
976.00	4,289	12,560
976.20	4,431	13,432
976.40	4,573	14,333
976.60	4,716	15,262
976.80	4,858	16,219
977.00	5,000	17,205
977.20	5,204	18,225
977.40	5,408	19,287
977.60	5,612	20,389
977.80	5,816	21,531
978.00	6,020	22,715
978.20	6,946	24,012
978.40	7,872	25,493
978.60	8,798	27,160
978.80	9,724	29,013
979.00	10,650	31,050
979.20	10,980	33,213
979.40	11,310	35,442
979.60	11,640	37,737
979.80	11,970	40,098
980.00	12,300	42,525
980.20	13,480	45,103
980.40	14,660	47,917
980.60	15,840	50,967
980.80	17,020	54,253
981.00	18,200	57,775
981.20	19,560	61,551
981.40	20,920	65,599
981.60	22,280	69,919
981.80	23,640	74,511
982.00	**25,000**	**79,375**

Summary for Pond 3P: (new Pond)

Inflow Area = 0.470 ac, 24.89% Impervious, Inflow Depth = 2.43" for 10-Year event
Inflow = 1.24 cfs @ 12.31 hrs, Volume= 0.095 af
Outflow = 1.23 cfs @ 12.33 hrs, Volume= 0.095 af, Atten= 1%, Lag= 1.2 min
Discarded = 0.00 cfs @ 12.33 hrs, Volume= 0.003 af
Primary = 1.23 cfs @ 12.33 hrs, Volume= 0.092 af
Routed to Reach 3R : Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 1,015.45' @ 12.33 hrs Surf.Area= 555 sf Storage= 322 cf

Plug-Flow detention time= 70.1 min calculated for 0.095 af (100% of inflow)
Center-of-Mass det. time= 71.7 min (886.0 - 814.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.70'	685 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,014.70	300	0	0
1,015.00	400	105	105
1,015.50	570	243	347
1,016.00	780	338	685

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.00'	**1.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,014.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	1,015.35'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.33 hrs HW=1,015.45' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.22 cfs @ 12.33 hrs HW=1,015.45' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 0.83 cfs @ 1.84 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.39 cfs @ 0.75 fps)

Stage-Area-Storage for Pond 3P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,014.70	300	0
1,014.72	307	6
1,014.74	313	12
1,014.76	320	19
1,014.78	327	25
1,014.80	333	32
1,014.82	340	38
1,014.84	347	45
1,014.86	353	52
1,014.88	360	59
1,014.90	367	67
1,014.92	373	74
1,014.94	380	82
1,014.96	387	89
1,014.98	393	97
1,015.00	400	105
1,015.02	407	113
1,015.04	414	121
1,015.06	420	130
1,015.08	427	138
1,015.10	434	147
1,015.12	441	155
1,015.14	448	164
1,015.16	454	173
1,015.18	461	183
1,015.20	468	192
1,015.22	475	201
1,015.24	482	211
1,015.26	488	220
1,015.28	495	230
1,015.30	502	240
1,015.32	509	250
1,015.34	516	261
1,015.36	522	271
1,015.38	529	282
1,015.40	536	292
1,015.42	543	303
1,015.44	550	314
1,015.46	556	325
1,015.48	563	336
1,015.50	570	347
1,015.52	578	359
1,015.54	587	371
1,015.56	595	382
1,015.58	604	394
1,015.60	612	407
1,015.62	620	419
1,015.64	629	431
1,015.66	637	444
1,015.68	646	457
1,015.70	654	470
1,015.72	662	483
1,015.74	671	496
1,015.76	679	510
1,015.78	688	524
1,015.80	696	537
1,015.82	704	551
1,015.84	713	566
1,015.86	721	580
1,015.88	730	594
1,015.90	738	609
1,015.92	746	624
1,015.94	755	639
1,015.96	763	654
1,015.98	772	669
1,016.00	**780**	**685**

Summary for Pond 11P: DEP

Inflow Area = 0.183 ac, 0.00% Impervious, Inflow Depth = 2.26" for 10-Year event
Inflow = 0.72 cfs @ 12.14 hrs, Volume= 0.034 af
Outflow = 0.72 cfs @ 12.15 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.1 min
Primary = 0.72 cfs @ 12.15 hrs, Volume= 0.034 af
Routed to Reach 1R : North
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : North

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 979.04' @ 12.15 hrs Surf.Area= 18 sf Storage= 5 cf

Plug-Flow detention time= 1.5 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (805.8 - 805.4)

Volume	Invert	Avail.Storage	Storage Description
#1	978.67'	2,228 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
978.67	10	0	0
980.00	40	33	33
981.00	770	405	438
982.00	2,810	1,790	2,228

Device	Routing	Invert	Outlet Devices
#1	Primary	978.67'	**18.0" Round Culvert** L= 9.0' Ke= 0.500 Inlet / Outlet Invert= 978.67' / 978.39' S= 0.0311 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Secondary	981.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.71 cfs @ 12.15 hrs HW=979.04' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.71 cfs @ 2.07 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=978.67' TW=0.00' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Stage-Area-Storage for Pond 11P: DEP

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
978.67	10	0
978.72	11	1
978.77	12	1
978.82	13	2
978.87	15	2
978.92	16	3
978.97	17	4
979.02	18	5
979.07	19	6
979.12	20	7
979.17	21	8
979.22	22	9
979.27	24	10
979.32	25	11
979.37	26	13
979.42	27	14
979.47	28	15
979.52	29	17
979.57	30	18
979.62	31	20
979.67	33	21
979.72	34	23
979.77	35	25
979.82	36	26
979.87	37	28
979.92	38	30
979.97	39	32
980.02	55	34
980.07	91	38
980.12	128	43
980.17	164	51
980.22	201	60
980.27	237	71
980.32	274	83
980.37	310	98
980.42	347	114
980.47	383	133
980.52	420	153
980.57	456	175
980.62	493	198
980.67	529	224
980.72	566	251
980.77	602	280
980.82	639	311
980.87	675	344
980.92	712	379
980.97	748	415
981.02	811	454
981.07	913	497
981.12	1,015	545
981.17	1,117	599
981.22	1,219	657
981.27	1,321	721
981.32	1,423	789
981.37	1,525	863
981.42	1,627	942
981.47	1,729	1,025
981.52	1,831	1,114
981.57	1,933	1,209
981.62	2,035	1,308
981.67	2,137	1,412
981.72	2,239	1,521
981.77	2,341	1,636
981.82	2,443	1,755
981.87	2,545	1,880
981.92	2,647	2,010
981.97	**2,749**	**2,145**

Summary for Pond 20P: (new Pond)

Inflow Area = 0.638 ac, 18.81% Impervious, Inflow Depth = 2.34" for 10-Year event
Inflow = 1.71 cfs @ 12.28 hrs, Volume= 0.125 af
Outflow = 1.68 cfs @ 12.32 hrs, Volume= 0.125 af, Atten= 2%, Lag= 2.1 min
Discarded = 0.00 cfs @ 12.32 hrs, Volume= 0.003 af
Primary = 1.68 cfs @ 12.32 hrs, Volume= 0.122 af
Routed to Pond 21P : (new Pond)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 993.47' @ 12.32 hrs Surf.Area= 657 sf Storage= 341 cf

Plug-Flow detention time= 48.6 min calculated for 0.124 af (100% of inflow)
Center-of-Mass det. time= 50.2 min (864.6 - 814.4)

Volume	Invert	Avail.Storage	Storage Description
#1	992.70'	756 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.70	275	0	0
993.00	380	98	98
993.50	675	264	362
994.00	900	394	756

Device	Routing	Invert	Outlet Devices
#1	Primary	993.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	992.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	993.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.32 hrs HW=993.47' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.66 cfs @ 12.32 hrs HW=993.47' TW=992.50' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 1.66 cfs @ 1.78 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 20P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
992.70	275	0
992.72	282	6
992.74	289	11
992.76	296	17
992.78	303	23
992.80	310	29
992.82	317	36
992.84	324	42
992.86	331	48
992.88	338	55
992.90	345	62
992.92	352	69
992.94	359	76
992.96	366	83
992.98	373	91
993.00	380	98
993.02	392	106
993.04	404	114
993.06	415	122
993.08	427	131
993.10	439	139
993.12	451	148
993.14	463	157
993.16	474	167
993.18	486	176
993.20	498	186
993.22	510	196
993.24	522	206
993.26	533	217
993.28	545	228
993.30	557	239
993.32	569	250
993.34	581	262
993.36	592	273
993.38	604	285
993.40	616	297
993.42	628	310
993.44	640	323
993.46	651	335
993.48	663	349
993.50	675	362
993.52	684	376
993.54	693	389
993.56	702	403
993.58	711	417
993.60	720	432
993.62	729	446
993.64	738	461
993.66	747	476
993.68	756	491
993.70	765	506
993.72	774	521
993.74	783	537
993.76	792	553
993.78	801	569
993.80	810	585
993.82	819	601
993.84	828	618
993.86	837	634
993.88	846	651
993.90	855	668
993.92	864	685
993.94	873	703
993.96	882	720
993.98	891	738
994.00	**900**	**756**

Summary for Pond 21P: (new Pond)

Inflow Area = 0.741 ac, 19.30% Impervious, Inflow Depth = 2.31" for 10-Year event
Inflow = 1.96 cfs @ 12.32 hrs, Volume= 0.142 af
Outflow = 1.92 cfs @ 12.35 hrs, Volume= 0.142 af, Atten= 2%, Lag= 2.2 min
Discarded = 0.00 cfs @ 12.35 hrs, Volume= 0.003 af
Primary = 1.92 cfs @ 12.35 hrs, Volume= 0.139 af
Routed to Reach 22R : East

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 992.51' @ 12.35 hrs Surf.Area= 704 sf Storage= 391 cf

Plug-Flow detention time= 47.3 min calculated for 0.142 af (100% of inflow)
Center-of-Mass det. time= 48.9 min (867.9 - 819.0)

Volume	Invert	Avail.Storage	Storage Description
#1	991.70'	784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
991.70	325	0	0
992.00	400	109	109
992.50	700	275	384
993.00	900	400	784

Device	Routing	Invert	Outlet Devices
#1	Primary	992.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	991.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	992.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.35 hrs HW=992.51' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.91 cfs @ 12.35 hrs HW=992.51' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 1.90 cfs @ 1.86 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.23 fps)

Stage-Area-Storage for Pond 21P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
991.70	325	0
991.72	330	7
991.74	335	13
991.76	340	20
991.78	345	27
991.80	350	34
991.82	355	41
991.84	360	48
991.86	365	55
991.88	370	63
991.90	375	70
991.92	380	78
991.94	385	85
991.96	390	93
991.98	395	101
992.00	400	109
992.02	412	117
992.04	424	125
992.06	436	134
992.08	448	143
992.10	460	152
992.12	472	161
992.14	484	171
992.16	496	180
992.18	508	190
992.20	520	201
992.22	532	211
992.24	544	222
992.26	556	233
992.28	568	244
992.30	580	256
992.32	592	267
992.34	604	279
992.36	616	292
992.38	628	304
992.40	640	317
992.42	652	330
992.44	664	343
992.46	676	356
992.48	688	370
992.50	700	384
992.52	708	398
992.54	716	412
992.56	724	426
992.58	732	441
992.60	740	456
992.62	748	471
992.64	756	486
992.66	764	501
992.68	772	516
992.70	780	532
992.72	788	547
992.74	796	563
992.76	804	579
992.78	812	595
992.80	820	612
992.82	828	628
992.84	836	645
992.86	844	662
992.88	852	679
992.90	860	696
992.92	868	713
992.94	876	730
992.96	884	748
992.98	892	766
993.00	**900**	**784**

Summary for Pond 110P: Sediment

Inflow Area = 3.645 ac, 16.46% Impervious, Inflow Depth = 2.34" for 10-Year event
Inflow = 10.90 cfs @ 12.24 hrs, Volume= 0.711 af
Outflow = 3.97 cfs @ 12.23 hrs, Volume= 0.711 af, Atten= 64%, Lag= 0.0 min
Secondary = 3.97 cfs @ 12.23 hrs, Volume= 0.711 af
Routed to Pond 1P :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Starting Elev= 979.00' Surf.Area= 7,745 sf Storage= 19,593 cf
Peak Elev= 980.22' @ 12.61 hrs Surf.Area= 10,138 sf Storage= 30,282 cf (10,689 cf above start)

Plug-Flow detention time= 396.8 min calculated for 0.261 af (37% of inflow)
Center-of-Mass det. time= 85.2 min (896.3 - 811.1)

Volume	Invert	Avail.Storage	Storage Description
#1	973.00'	53,395 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
973.00	1,020	0	0
978.00	4,390	13,525	13,525
979.00	7,745	6,068	19,593
979.50	8,470	4,054	23,646
980.00	9,375	4,461	28,108
981.00	12,800	11,088	39,195
982.00	15,600	14,200	53,395

Device	Routing	Invert	Outlet Devices
#1	Secondary	979.00'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Secondary OutFlow Max=0.00 cfs @ 12.23 hrs HW=979.63' TW=979.73' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 110P: Sediment

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
973.00	1,020	0
973.10	1,087	105
973.20	1,155	217
973.30	1,222	336
973.40	1,290	462
973.50	1,357	594
973.60	1,424	733
973.70	1,492	879
973.80	1,559	1,032
973.90	1,627	1,191
974.00	1,694	1,357
974.10	1,761	1,530
974.20	1,829	1,709
974.30	1,896	1,896
974.40	1,964	2,089
974.50	2,031	2,288
974.60	2,098	2,495
974.70	2,166	2,708
974.80	2,233	2,928
974.90	2,301	3,155
975.00	2,368	3,388
975.10	2,435	3,628
975.20	2,503	3,875
975.30	2,570	4,129
975.40	2,638	4,389
975.50	2,705	4,656
975.60	2,772	4,930
975.70	2,840	5,211
975.80	2,907	5,498
975.90	2,975	5,792
976.00	3,042	6,093
976.10	3,109	6,401
976.20	3,177	6,715
976.30	3,244	7,036
976.40	3,312	7,364
976.50	3,379	7,698
976.60	3,446	8,040
976.70	3,514	8,388
976.80	3,581	8,742
976.90	3,649	9,104
977.00	3,716	9,472
977.10	3,783	9,847
977.20	3,851	10,229
977.30	3,918	10,617
977.40	3,986	11,012
977.50	4,053	11,414
977.60	4,120	11,823
977.70	4,188	12,238
977.80	4,255	12,660
977.90	4,323	13,089
978.00	4,390	13,525
978.10	4,726	13,981
978.20	5,061	14,470
978.30	5,396	14,993
978.40	5,732	15,549
978.50	6,068	16,139
978.60	6,403	16,763
978.70	6,739	17,420
978.80	7,074	18,111
978.90	7,409	18,835
979.00	7,745	19,593
979.10	7,890	20,374
979.20	8,035	21,171
979.30	8,180	21,981
979.40	8,325	22,806
979.50	8,470	23,646
979.60	8,651	24,502
979.70	8,832	25,376
979.80	9,013	26,269
979.90	9,194	27,179
980.00	9,375	28,108
980.10	9,718	29,062
980.20	10,060	30,051
980.30	10,402	31,074
980.40	10,745	32,131
980.50	11,088	33,223
980.60	11,430	34,349
980.70	11,773	35,509
980.80	12,115	36,703
980.90	12,457	37,932
981.00	12,800	39,195
981.10	13,080	40,489
981.20	13,360	41,811
981.30	13,640	43,161
981.40	13,920	44,539
981.50	14,200	45,945
981.60	14,480	47,379
981.70	14,760	48,841
981.80	15,040	50,331
981.90	15,320	51,849
982.00	**15,600**	**53,395**

Summary for Subcatchment 1S: North

Runoff = 1.41 cfs @ 12.19 hrs, Volume= 0.081 af, Depth= 4.99"
Routed to Reach 1R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.000	98	
	0.195	80	>75% Grass cover, Good, HSG D
	0.000	77	Woods, Good, HSG D
	0.195	80	Weighted Average
	0.195	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.6	110	0.2000	3.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.0	160	Total			

Summary for Subcatchment 2S: East

Runoff = 3.30 cfs @ 12.26 hrs, Volume= 0.232 af, Depth= 5.10"
Routed to Reach 22R : East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

Area (ac)	CN	Adj	Description
0.086	98		Unconnected roofs, HSG D
0.276	80		>75% Grass cover, Good, HSG D
0.183	79		Woods/grass comb., Good, HSG D
0.545	83	81	Weighted Average, UI Adjusted
0.459	80	80	84.22% Pervious Area
0.086	98	98	15.78% Impervious Area
0.086			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.4	60	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
17.1	160	Total			

Summary for Subcatchment 3S: Southeast

Runoff = 2.63 cfs @ 12.30 hrs, Volume= 0.204 af, Depth= 5.22"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

Area (ac)	CN	Adj	Description
0.117	98		Unconnected pavement, HSG D
0.120	79		Woods, Fair, HSG D
0.233	80		>75% Grass cover, Good, HSG D
0.470	84	82	Weighted Average, UI Adjusted
0.353	80	80	75.11% Pervious Area
0.117	98	98	24.89% Impervious Area
0.117			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.1	100	0.0280	0.09		**Sheet Flow,** n= 0.380 P2= 2.86"
1.8	155	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
20.9	255	Total			

Summary for Subcatchment 4S: South

Runoff = 2.74 cfs @ 12.23 hrs, Volume= 0.184 af, Depth= 5.33"
Routed to Reach 4R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.086	98	
	0.218	80	>75% Grass cover, Good, HSG D
	0.110	79	Woods, Fair, HSG D
	0.414	83	Weighted Average
	0.328	80	79.23% Pervious Area
	0.086	98	20.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	85	0.0420	0.09		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 2.86"

Summary for Subcatchment 5S: West

Runoff = 7.33 cfs @ 12.27 hrs, Volume= 0.534 af, Depth= 5.33"
Routed to Reach 4R : Plymouth Road

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.252	98	
	0.255	80	>75% Grass cover, Good, HSG D
	0.696	79	Woods, Fair, HSG D
	1.203	83	Weighted Average
	0.951	79	79.05% Pervious Area
	0.252	98	20.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0300	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
14.4	80	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
0.5	45	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.4	145	Total			

Summary for Subcatchment 10S: Northeast

Runoff = 0.30 cfs @ 12.17 hrs, Volume= 0.016 af, Depth= 4.88"
Routed to Reach 1R : North

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.000	98	
	0.040	79	Woods, Fair, HSG D
	0.040	79	Weighted Average
	0.040	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	90	0.1500	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"

Summary for Subcatchment 11S: North DEP

Runoff = 1.54 cfs @ 12.14 hrs, Volume= 0.076 af, Depth= 4.99"
Routed to Pond 11P : DEP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	0.000	98	
	0.183	80	>75% Grass cover, Good, HSG D
	0.000	79	Woods/grass comb., Good, HSG D
	0.183	80	Weighted Average
	0.183	80	100.00% Pervious Area

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

Summary for Subcatchment 20S: East

Runoff = 3.68 cfs @ 12.28 hrs, Volume= 0.271 af, Depth= 5.10"
Routed to Pond 20P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

Area (ac)	CN	Adj	Description
0.120	98		Unconnected roofs, HSG D
0.378	80		>75% Grass cover, Good, HSG D
0.140	79		Woods/grass comb., Good, HSG D
0.638	83	81	Weighted Average, UI Adjusted
0.518	80	80	81.19% Pervious Area
0.120	98	98	18.81% Impervious Area
0.120			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0480	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.9	122	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.9	222	Total			

Summary for Subcatchment 21S: East

Runoff = 0.61 cfs @ 12.28 hrs, Volume= 0.045 af, Depth= 5.22"
Routed to Pond 21P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

Area (ac)	CN	Adj	Description
0.023	98		Unconnected roofs, HSG D
0.060	80		>75% Grass cover, Good, HSG D
0.020	79		Woods/grass comb., Good, HSG D
0.103	84	82	Weighted Average, UI Adjusted
0.080	80	80	77.67% Pervious Area
0.023	98	98	22.33% Impervious Area
0.023			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0480	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
2.9	122	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.9	222	Total			

Summary for Subcatchment 100S: North Pond

Runoff = 29.58 cfs @ 12.24 hrs, Volume= 2.079 af, Depth= 5.79"
Routed to Pond 1P :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

	Area (ac)	CN	Description
*	1.670	98	
	2.390	80	>75% Grass cover, Good, HSG D
	0.250	79	Woods/grass comb., Good, HSG D
*	0.000	98	
*	0.000	80	
	4.310	87	Weighted Average
	2.640	80	61.25% Pervious Area
	1.670	98	38.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	110	0.0350	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
0.3	81	0.0600	4.97		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.0	641	0.0060	3.51	2.76	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
16.3	832	Total			

Summary for Subcatchment 110S: Depression

Runoff = 23.30 cfs @ 12.24 hrs, Volume= 1.550 af, Depth= 5.10"
Routed to Pond 110P : Sediment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year base Rainfall=7.32"

Area (ac)	CN	Adj	Description
0.465	98		Unconnected roofs, HSG D
1.217	80		>75% Grass cover, Good, HSG D
1.828	79		Woods/grass comb., Good, HSG D
0.135	98		Unconnected pavement, HSG D
3.645	82	81	Weighted Average, UI Adjusted
3.045	79	79	83.54% Pervious Area
0.600	98	98	16.46% Impervious Area
0.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.86"
5.8	50	0.1500	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.86"
1.3	150	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.2	130	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.3	380	Total			

Summary for Reach 1R: North

Inflow Area = 8.373 ac, 27.11% Impervious, Inflow Depth = 5.45" for 100-Year base event
Inflow = 12.10 cfs @ 12.20 hrs, Volume= 3.803 af
Outflow = 12.10 cfs @ 12.20 hrs, Volume= 3.803 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 3R: Southeast

Inflow Area = 0.470 ac, 24.89% Impervious, Inflow Depth = 5.13" for 100-Year base event
Inflow = 2.62 cfs @ 12.32 hrs, Volume= 0.201 af
Outflow = 2.62 cfs @ 12.32 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Plymouth Road

Inflow Area = 1.617 ac, 20.90% Impervious, Inflow Depth = 5.33" for 100-Year base event
Inflow = 10.01 cfs @ 12.26 hrs, Volume= 0.718 af
Outflow = 10.01 cfs @ 12.26 hrs, Volume= 0.718 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 22R: East

Inflow Area = 1.286 ac, 17.81% Impervious, Inflow Depth = 5.05" for 100-Year base event
Inflow = 7.43 cfs @ 12.29 hrs, Volume= 0.541 af
Outflow = 7.43 cfs @ 12.29 hrs, Volume= 0.541 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 31R : Total

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Reach 31R: Total

Inflow Area = 11.746 ac, 25.15% Impervious, Inflow Depth = 5.38" for 100-Year base event
Inflow = 31.73 cfs @ 12.27 hrs, Volume= 5.263 af
Outflow = 31.73 cfs @ 12.27 hrs, Volume= 5.263 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 7.955 ac, 28.54% Impervious, Inflow Depth = 5.47" for 100-Year base event
Inflow = 37.17 cfs @ 12.23 hrs, Volume= 3.629 af
Outflow = 10.94 cfs @ 12.68 hrs, Volume= 3.629 af, Atten= 71%, Lag= 27.1 min
Primary = 10.94 cfs @ 12.68 hrs, Volume= 3.629 af
Routed to Reach 1R : North
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 11P : DEP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Starting Elev= 978.00' Surf.Area= 6,020 sf Storage= 22,715 cf
Peak Elev= 981.62' @ 12.68 hrs Surf.Area= 22,418 sf Storage= 70,374 cf (47,659 cf above start)

Plug-Flow detention time= 252.3 min calculated for 3.108 af (86% of inflow)
Center-of-Mass det. time= 150.9 min (976.0 - 825.1)

Volume	Invert	Avail.Storage	Storage Description
#1	971.00'	79,375 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
971.00	735	0	0
977.00	5,000	17,205	17,205
978.00	6,020	5,510	22,715
979.00	10,650	8,335	31,050
980.00	12,300	11,475	42,525
981.00	18,200	15,250	57,775
982.00	25,000	21,600	79,375

Device	Routing	Invert	Outlet Devices
#1	Primary	977.11'	**15.0" Round Culvert** L= 59.0' Ke= 0.500 Inlet / Outlet Invert= 977.11' / 976.82' S= 0.0049 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	979.20'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	980.25'	**48.0" Horiz. Orifice/Grate X 0.60** C= 0.600 Limited to weir flow at low heads
#4	Device 1	977.25'	**6.0" Round Culvert X 2.00** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 977.25' / 977.25' S= 0.0000 '/' Cc= 0.900 n= 0.020, Flow Area= 0.20 sf
#5	Device 4	978.00'	**1.600 in/hr Exfiltration over Surface area above 978.00'** Excluded Surface area = 6,020 sf
#6	Secondary	981.75'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=10.94 cfs @ 12.68 hrs HW=981.62' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 10.94 cfs @ 8.92 fps)
  ├─**2=Sharp-Crested Rectangular Weir** (Passes < 43.27 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 39.51 cfs potential flow)
  └─**4=Culvert** (Passes < 1.38 cfs potential flow)
    └─**5=Exfiltration** (Passes < 0.61 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=978.00' TW=978.67' (Dynamic Tailwater)
└─**6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 1P:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
971.00	735	0
971.20	877	161
971.40	1,019	351
971.60	1,162	569
971.80	1,304	815
972.00	1,446	1,090
972.20	1,588	1,394
972.40	1,730	1,726
972.60	1,872	2,086
972.80	2,014	2,475
973.00	2,157	2,892
973.20	2,299	3,337
973.40	2,441	3,811
973.60	2,583	4,314
973.80	2,725	4,844
974.00	2,868	5,404
974.20	3,010	5,991
974.40	3,152	6,608
974.60	3,294	7,252
974.80	3,436	7,925
975.00	3,578	8,627
975.20	3,721	9,357
975.40	3,863	10,115
975.60	4,005	10,902
975.80	4,147	11,717
976.00	4,289	12,560
976.20	4,431	13,432
976.40	4,573	14,333
976.60	4,716	15,262
976.80	4,858	16,219
977.00	5,000	17,205
977.20	5,204	18,225
977.40	5,408	19,287
977.60	5,612	20,389
977.80	5,816	21,531
978.00	6,020	22,715
978.20	6,946	24,012
978.40	7,872	25,493
978.60	8,798	27,160
978.80	9,724	29,013
979.00	10,650	31,050
979.20	10,980	33,213
979.40	11,310	35,442
979.60	11,640	37,737
979.80	11,970	40,098
980.00	12,300	42,525
980.20	13,480	45,103
980.40	14,660	47,917
980.60	15,840	50,967
980.80	17,020	54,253
981.00	18,200	57,775
981.20	19,560	61,551
981.40	20,920	65,599
981.60	22,280	69,919
981.80	23,640	74,511
982.00	**25,000**	**79,375**

Summary for Pond 3P: (new Pond)

Inflow Area = 0.470 ac, 24.89% Impervious, Inflow Depth = 5.22" for 100-Year base event
Inflow = 2.63 cfs @ 12.30 hrs, Volume= 0.204 af
Outflow = 2.62 cfs @ 12.32 hrs, Volume= 0.204 af, Atten= 0%, Lag= 0.8 min
Discarded = 0.00 cfs @ 12.32 hrs, Volume= 0.003 af
Primary = 2.62 cfs @ 12.32 hrs, Volume= 0.201 af
Routed to Reach 3R : Southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 1,015.59' @ 12.32 hrs Surf.Area= 607 sf Storage= 399 cf

Plug-Flow detention time= 35.2 min calculated for 0.204 af (100% of inflow)
Center-of-Mass det. time= 36.8 min (835.7 - 799.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.70'	685 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,014.70	300	0	0
1,015.00	400	105	105
1,015.50	570	243	347
1,016.00	780	338	685

Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.00'	**1.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,014.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	1,015.35'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.32 hrs HW=1,015.59' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.59 cfs @ 12.32 hrs HW=1,015.59' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 1.23 cfs @ 2.10 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.36 cfs @ 1.15 fps)

Stage-Area-Storage for Pond 3P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,014.70	300	0
1,014.72	307	6
1,014.74	313	12
1,014.76	320	19
1,014.78	327	25
1,014.80	333	32
1,014.82	340	38
1,014.84	347	45
1,014.86	353	52
1,014.88	360	59
1,014.90	367	67
1,014.92	373	74
1,014.94	380	82
1,014.96	387	89
1,014.98	393	97
1,015.00	400	105
1,015.02	407	113
1,015.04	414	121
1,015.06	420	130
1,015.08	427	138
1,015.10	434	147
1,015.12	441	155
1,015.14	448	164
1,015.16	454	173
1,015.18	461	183
1,015.20	468	192
1,015.22	475	201
1,015.24	482	211
1,015.26	488	220
1,015.28	495	230
1,015.30	502	240
1,015.32	509	250
1,015.34	516	261
1,015.36	522	271
1,015.38	529	282
1,015.40	536	292
1,015.42	543	303
1,015.44	550	314
1,015.46	556	325
1,015.48	563	336
1,015.50	570	347
1,015.52	578	359
1,015.54	587	371
1,015.56	595	382
1,015.58	604	394
1,015.60	612	407
1,015.62	620	419
1,015.64	629	431
1,015.66	637	444
1,015.68	646	457
1,015.70	654	470
1,015.72	662	483
1,015.74	671	496
1,015.76	679	510
1,015.78	688	524
1,015.80	696	537
1,015.82	704	551
1,015.84	713	566
1,015.86	721	580
1,015.88	730	594
1,015.90	738	609
1,015.92	746	624
1,015.94	755	639
1,015.96	763	654
1,015.98	772	669
1,016.00	**780**	**685**

Summary for Pond 11P: DEP

Inflow Area = 0.183 ac, 0.00% Impervious, Inflow Depth = 4.99" for 100-Year base event
Inflow = 1.54 cfs @ 12.14 hrs, Volume= 0.076 af
Outflow = 1.54 cfs @ 12.14 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.1 min
Primary = 1.54 cfs @ 12.14 hrs, Volume= 0.076 af
Routed to Reach 1R : North
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : North

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 979.23' @ 12.14 hrs Surf.Area= 23 sf Storage= 9 cf

Plug-Flow detention time= 1.4 min calculated for 0.076 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (789.8 - 789.5)

Volume	Invert	Avail.Storage	Storage Description
#1	978.67'	2,228 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
978.67	10	0	0
980.00	40	33	33
981.00	770	405	438
982.00	2,810	1,790	2,228

Device	Routing	Invert	Outlet Devices
#1	Primary	978.67'	**18.0" Round Culvert** L= 9.0' Ke= 0.500 Inlet / Outlet Invert= 978.67' / 978.39' S= 0.0311 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Secondary	981.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.51 cfs @ 12.14 hrs HW=979.22' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.51 cfs @ 2.54 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=978.67' TW=0.00' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Stage-Area-Storage for Pond 11P: DEP

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
978.67	10	0
978.72	11	1
978.77	12	1
978.82	13	2
978.87	15	2
978.92	16	3
978.97	17	4
979.02	18	5
979.07	19	6
979.12	20	7
979.17	21	8
979.22	22	9
979.27	24	10
979.32	25	11
979.37	26	13
979.42	27	14
979.47	28	15
979.52	29	17
979.57	30	18
979.62	31	20
979.67	33	21
979.72	34	23
979.77	35	25
979.82	36	26
979.87	37	28
979.92	38	30
979.97	39	32
980.02	55	34
980.07	91	38
980.12	128	43
980.17	164	51
980.22	201	60
980.27	237	71
980.32	274	83
980.37	310	98
980.42	347	114
980.47	383	133
980.52	420	153
980.57	456	175
980.62	493	198
980.67	529	224
980.72	566	251
980.77	602	280
980.82	639	311
980.87	675	344
980.92	712	379
980.97	748	415
981.02	811	454
981.07	913	497
981.12	1,015	545
981.17	1,117	599
981.22	1,219	657
981.27	1,321	721
981.32	1,423	789
981.37	1,525	863
981.42	1,627	942
981.47	1,729	1,025
981.52	1,831	1,114
981.57	1,933	1,209
981.62	2,035	1,308
981.67	2,137	1,412
981.72	2,239	1,521
981.77	2,341	1,636
981.82	2,443	1,755
981.87	2,545	1,880
981.92	2,647	2,010
981.97	**2,749**	**2,145**

Summary for Pond 20P: (new Pond)

Inflow Area = 0.638 ac, 18.81% Impervious, Inflow Depth = 5.10" for 100-Year base event
Inflow = 3.68 cfs @ 12.28 hrs, Volume= 0.271 af
Outflow = 3.67 cfs @ 12.30 hrs, Volume= 0.271 af, Atten= 0%, Lag= 1.1 min
Discarded = 0.00 cfs @ 12.30 hrs, Volume= 0.003 af
Primary = 3.67 cfs @ 12.30 hrs, Volume= 0.268 af
Routed to Pond 21P : (new Pond)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 993.67' @ 12.30 hrs Surf.Area= 751 sf Storage= 483 cf

Plug-Flow detention time= 23.9 min calculated for 0.271 af (100% of inflow)
Center-of-Mass det. time= 25.4 min (824.3 - 798.9)

Volume	Invert	Avail.Storage	Storage Description
#1	992.70'	756 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.70	275	0	0
993.00	380	98	98
993.50	675	264	362
994.00	900	394	756

Device	Routing	Invert	Outlet Devices
#1	Primary	993.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	992.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	993.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.30 hrs HW=993.67' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=3.65 cfs @ 12.30 hrs HW=993.67' TW=992.71' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 2.85 cfs @ 2.13 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.81 cfs @ 0.96 fps)

Stage-Area-Storage for Pond 20P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
992.70	275	0
992.72	282	6
992.74	289	11
992.76	296	17
992.78	303	23
992.80	310	29
992.82	317	36
992.84	324	42
992.86	331	48
992.88	338	55
992.90	345	62
992.92	352	69
992.94	359	76
992.96	366	83
992.98	373	91
993.00	380	98
993.02	392	106
993.04	404	114
993.06	415	122
993.08	427	131
993.10	439	139
993.12	451	148
993.14	463	157
993.16	474	167
993.18	486	176
993.20	498	186
993.22	510	196
993.24	522	206
993.26	533	217
993.28	545	228
993.30	557	239
993.32	569	250
993.34	581	262
993.36	592	273
993.38	604	285
993.40	616	297
993.42	628	310
993.44	640	323
993.46	651	335
993.48	663	349
993.50	675	362
993.52	684	376
993.54	693	389
993.56	702	403
993.58	711	417
993.60	720	432
993.62	729	446
993.64	738	461
993.66	747	476
993.68	756	491
993.70	765	506
993.72	774	521
993.74	783	537
993.76	792	553
993.78	801	569
993.80	810	585
993.82	819	601
993.84	828	618
993.86	837	634
993.88	846	651
993.90	855	668
993.92	864	685
993.94	873	703
993.96	882	720
993.98	891	738
994.00	**900**	**756**

Summary for Pond 21P: (new Pond)

Inflow Area = 0.741 ac, 19.30% Impervious, Inflow Depth = 5.07" for 100-Year base event
Inflow = 4.27 cfs @ 12.29 hrs, Volume= 0.313 af
Outflow = 4.26 cfs @ 12.31 hrs, Volume= 0.313 af, Atten= 0%, Lag= 0.9 min
Discarded = 0.00 cfs @ 12.31 hrs, Volume= 0.003 af
Primary = 4.25 cfs @ 12.31 hrs, Volume= 0.310 af
Routed to Reach 22R : East

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Peak Elev= 992.71' @ 12.31 hrs Surf.Area= 784 sf Storage= 540 cf

Plug-Flow detention time= 22.9 min calculated for 0.313 af (100% of inflow)
Center-of-Mass det. time= 24.5 min (827.3 - 802.8)

Volume	Invert	Avail.Storage	Storage Description
#1	991.70'	784 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
991.70	325	0	0
992.00	400	109	109
992.50	700	275	384
993.00	900	400	784

Device	Routing	Invert	Outlet Devices
#1	Primary	992.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	991.70'	**0.060 in/hr Exfiltration over Surface area**
#3	Primary	992.50'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 12.31 hrs HW=992.71' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=4.22 cfs @ 12.31 hrs HW=992.71' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 3.11 cfs @ 2.19 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.12 cfs @ 1.07 fps)

Stage-Area-Storage for Pond 21P: (new Pond)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
991.70	325	0
991.72	330	7
991.74	335	13
991.76	340	20
991.78	345	27
991.80	350	34
991.82	355	41
991.84	360	48
991.86	365	55
991.88	370	63
991.90	375	70
991.92	380	78
991.94	385	85
991.96	390	93
991.98	395	101
992.00	400	109
992.02	412	117
992.04	424	125
992.06	436	134
992.08	448	143
992.10	460	152
992.12	472	161
992.14	484	171
992.16	496	180
992.18	508	190
992.20	520	201
992.22	532	211
992.24	544	222
992.26	556	233
992.28	568	244
992.30	580	256
992.32	592	267
992.34	604	279
992.36	616	292
992.38	628	304
992.40	640	317
992.42	652	330
992.44	664	343
992.46	676	356
992.48	688	370
992.50	700	384
992.52	708	398
992.54	716	412
992.56	724	426
992.58	732	441
992.60	740	456
992.62	748	471
992.64	756	486
992.66	764	501
992.68	772	516
992.70	780	532
992.72	788	547
992.74	796	563
992.76	804	579
992.78	812	595
992.80	820	612
992.82	828	628
992.84	836	645
992.86	844	662
992.88	852	679
992.90	860	696
992.92	868	713
992.94	876	730
992.96	884	748
992.98	892	766
993.00	**900**	**784**

Summary for Pond 110P: Sediment

Inflow Area = 3.645 ac, 16.46% Impervious, Inflow Depth = 5.10" for 100-Year base event
Inflow = 23.30 cfs @ 12.24 hrs, Volume= 1.550 af
Outflow = 8.01 cfs @ 12.20 hrs, Volume= 1.550 af, Atten= 66%, Lag= 0.0 min
Secondary = 8.01 cfs @ 12.20 hrs, Volume= 1.550 af
Routed to Pond 1P :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-110.00 hrs, dt= 0.05 hrs
Starting Elev= 979.00' Surf.Area= 7,745 sf Storage= 19,593 cf
Peak Elev= 981.62' @ 12.73 hrs Surf.Area= 14,543 sf Storage= 47,707 cf (28,115 cf above start)

Plug-Flow detention time= 216.0 min calculated for 1.100 af (71% of inflow)
Center-of-Mass det. time= 83.3 min (878.8 - 795.5)

Volume	Invert	Avail.Storage	Storage Description
#1	973.00'	53,395 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
973.00	1,020	0	0
978.00	4,390	13,525	13,525
979.00	7,745	6,068	19,593
979.50	8,470	4,054	23,646
980.00	9,375	4,461	28,108
981.00	12,800	11,088	39,195
982.00	15,600	14,200	53,395

Device	Routing	Invert	Outlet Devices
#1	Secondary	979.00'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Secondary OutFlow Max=0.00 cfs @ 12.20 hrs HW=980.39' TW=980.61' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 110P: Sediment

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
973.00	1,020	0
973.10	1,087	105
973.20	1,155	217
973.30	1,222	336
973.40	1,290	462
973.50	1,357	594
973.60	1,424	733
973.70	1,492	879
973.80	1,559	1,032
973.90	1,627	1,191
974.00	1,694	1,357
974.10	1,761	1,530
974.20	1,829	1,709
974.30	1,896	1,896
974.40	1,964	2,089
974.50	2,031	2,288
974.60	2,098	2,495
974.70	2,166	2,708
974.80	2,233	2,928
974.90	2,301	3,155
975.00	2,368	3,388
975.10	2,435	3,628
975.20	2,503	3,875
975.30	2,570	4,129
975.40	2,638	4,389
975.50	2,705	4,656
975.60	2,772	4,930
975.70	2,840	5,211
975.80	2,907	5,498
975.90	2,975	5,792
976.00	3,042	6,093
976.10	3,109	6,401
976.20	3,177	6,715
976.30	3,244	7,036
976.40	3,312	7,364
976.50	3,379	7,698
976.60	3,446	8,040
976.70	3,514	8,388
976.80	3,581	8,742
976.90	3,649	9,104
977.00	3,716	9,472
977.10	3,783	9,847
977.20	3,851	10,229
977.30	3,918	10,617
977.40	3,986	11,012
977.50	4,053	11,414
977.60	4,120	11,823
977.70	4,188	12,238
977.80	4,255	12,660
977.90	4,323	13,089
978.00	4,390	13,525
978.10	4,726	13,981
978.20	5,061	14,470
978.30	5,396	14,993
978.40	5,732	15,549
978.50	6,068	16,139
978.60	6,403	16,763
978.70	6,739	17,420
978.80	7,074	18,111
978.90	7,409	18,835
979.00	7,745	19,593
979.10	7,890	20,374
979.20	8,035	21,171
979.30	8,180	21,981
979.40	8,325	22,806
979.50	8,470	23,646
979.60	8,651	24,502
979.70	8,832	25,376
979.80	9,013	26,269
979.90	9,194	27,179
980.00	9,375	28,108
980.10	9,718	29,062
980.20	10,060	30,051
980.30	10,402	31,074
980.40	10,745	32,131
980.50	11,088	33,223
980.60	11,430	34,349
980.70	11,773	35,509
980.80	12,115	36,703
980.90	12,457	37,932
981.00	12,800	39,195
981.10	13,080	40,489
981.20	13,360	41,811
981.30	13,640	43,161
981.40	13,920	44,539
981.50	14,200	45,945
981.60	14,480	47,379
981.70	14,760	48,841
981.80	15,040	50,331
981.90	15,320	51,849
982.00	**15,600**	**53,395**

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70 Subcat 21S: East
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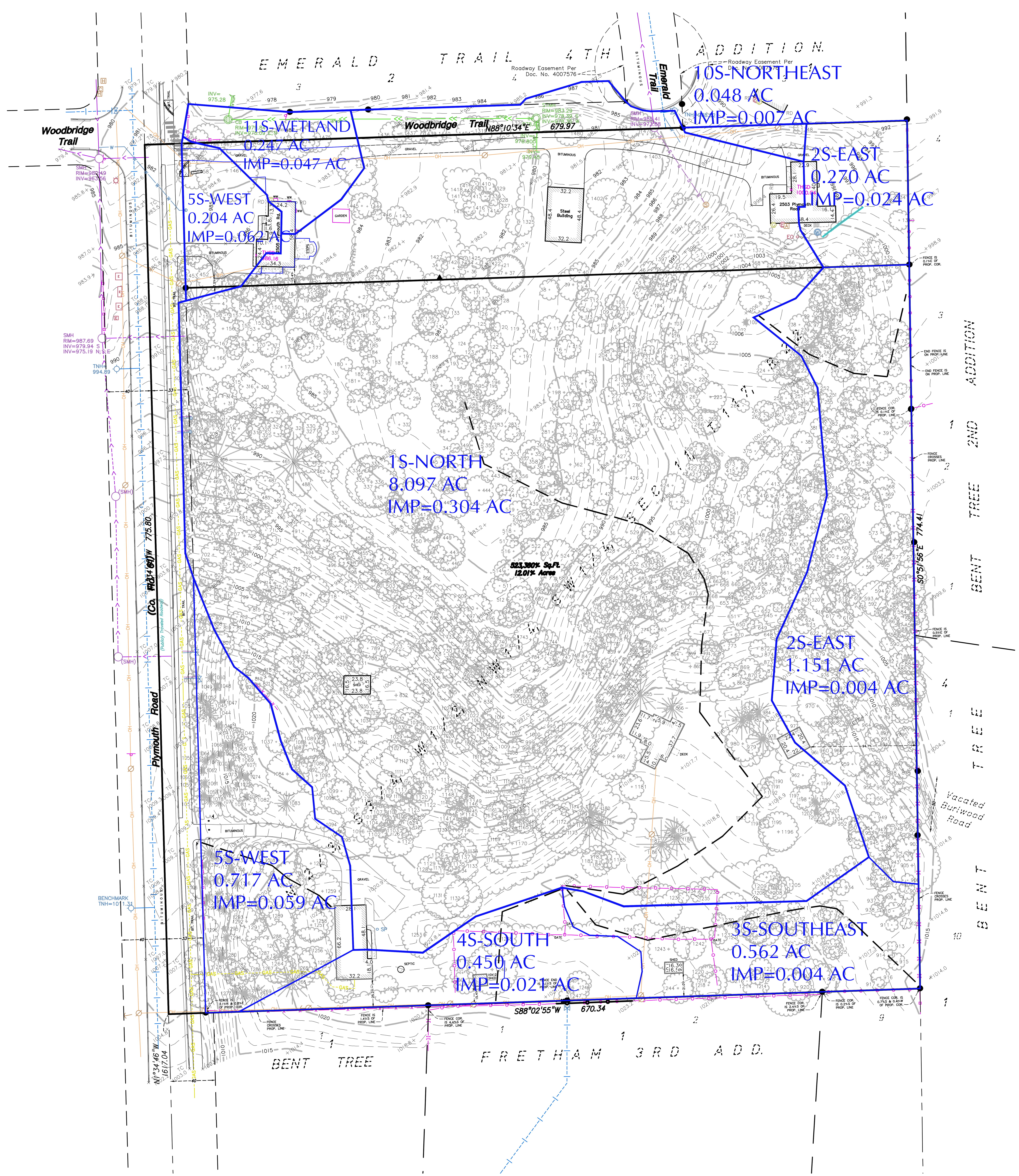

Plotted: 10 /26 / 2023 1:17 PM W:\2021\21509\HYDROLOGY\CAD\H1-1

DUDYCHA PROPERTY

2511 & 2615 Plymouth Road
Minnetonka, MN 55305

LAKE WEST DEVELOPMENT, LLC

14525 Highway 7, Suite 265
Minnetonka, MN 55345

LOUCKS

PLANNING
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LANDSCAPE ARCHITECTURE
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7200 Hemlock Lane, Suite 300
Maple Grove, MN 55369
763.424.5505
www.loucksinc.com

CADD QUALIFICATION

SUBMITTAL/REVISIONS

PROFESSIONAL SIGNATURE

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed Landscape Architect under the laws of the State of Minnesota.

Chad E. Feigum - LA

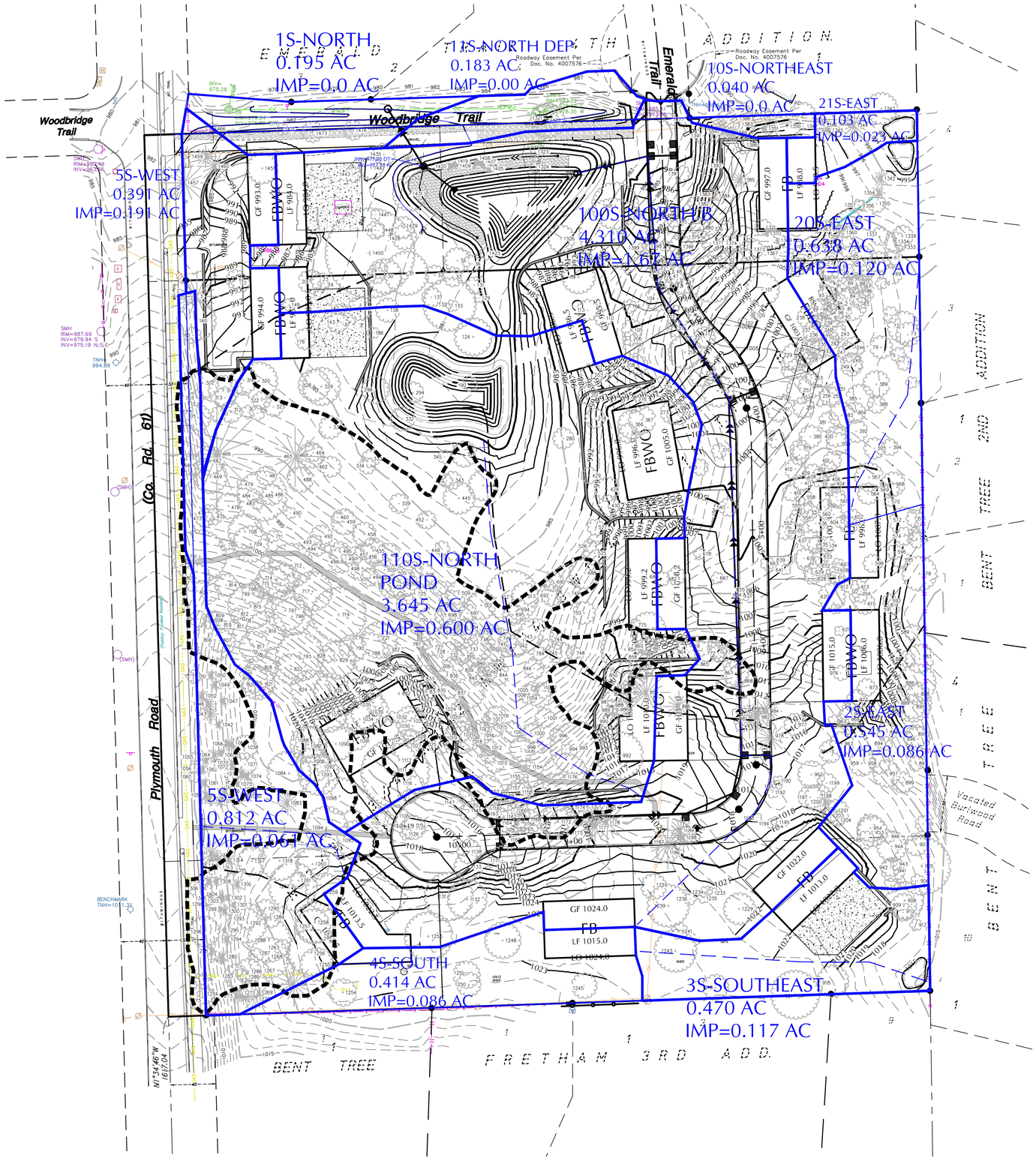
License No. 46508
Date

QUALITY CONTROL

Loucks Project No.	21509.0
Project Lead	CEF
Drawn By	CEF
Checked By	TJG/CEF
Review Date	

EXISTING DRAINAGE PLAN

H1-1



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SUBMITTAL/REVISIONS

.

PROFESSIONAL SIGNATURE

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed Landscape Architect under the laws of the State of Minnesota.

Chad E. Feigum - LA

License No. 46508
Date

QUALITY CONTROL

Loucks Project No.	21509.0
Project Lead	CEF
Drawn By	CEF
Checked By	TJG/CEF
Review Date	

SHEET INDEX

.

PROPOSED DRAINAGE PLAN

H2-1

Plotted: 01/12/2024 2:3 PM W:\2021\21509\HYDROLOGY\CADH2-1-14 Lot

Project Information

Calculator Version:	Version 4: July 2020
Project Name:	
User Name / Company Name:	
Date:	
Project Description:	
Construction Permit?:	No

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55305
Annual Rainfall (inches):	30.4
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			6.953	8.47	15.423
				Impervious Area (acres)	2.95
				Total Area (acres)	18.373

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0
				Impervious Area (acres)	2.95
				Total Area (acres)	2.95

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	11779	ft3
Volume removed by BMPs towards performance goal:	11779	ft^3
Percent volume removed towards performance goal	**100**	**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	14.7052	acre-ft
Annual runoff volume removed by BMPs:	5.906	acre-ft
Percent annual runoff volume removed:	**40**	**%**
Post development annual particulate P load:	6.5997	lbs
Annual particulate P removed by BMPs:	2.651	lbs
Post development annual dissolved P load:	5.4	lbs
Annual dissolved P removed by BMPs:	2.169	lbs
Total P removed by BMPs	4.82	lbs
Percent annual total phosphorus removed:	**40**	**%**
Post development annual TSS load:	2179.9	lbs
Annual TSS removed by BMPs:	875.5	lbs
Percent annual TSS removed:	**40**	**%**

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	Percent Retained (%)
1 - Infiltration basin/Infiltration trench (abc	11779	11779	11779	0	100

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
1 - Infiltration basin/Infiltration trench (abc	6.3897	0	5.906	0.4837000000	92

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Infiltration basin/Infiltration trench (abc	2.8677	0	2.6506	0.2171	92

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Infiltration basin/Infiltration trench (abc	2.3463	0	2.1687	0.1776	92

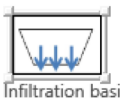
Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Infiltration basin/Infiltration trench (abc	5.214	0	4.8193	0.3947	92

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Infiltration basin/Infiltration trench (abc	947.21	0	875.51	71.7	92

BMP Schematic



1 - Infiltration basin/
Infiltration trench

Project Information

Calculator Version:	Version 4: July 2020
Project Name:	
User Name / Company Name:	
Date:	
Project Description:	
Construction Permit?:	No

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55305
Annual Rainfall (inches):	30.4
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				3.5	3.5
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			0	4.94	4.94
				Impervious Area (acres)	2.95
				Total Area (acres)	11.39

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				3.5	3.5
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed				4.936	4.936
				Impervious Area (acres)	2.95
				Total Area (acres)	11.386

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	11779	ft3
Volume removed by BMPs towards performance goal:	4701	ft^3
Percent volume removed towards performance goal	**40**	**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	9.6045	acre-ft
Annual runoff volume removed by BMPs:	1.8379	acre-ft
Percent annual runoff volume removed:	**19**	**%**
Post development annual particulate P load:	4.3105	lbs
Annual particulate P removed by BMPs:	3.551	lbs
Post development annual dissolved P load:	3.527	lbs
Annual dissolved P removed by BMPs:	1.155	lbs
Total P removed by BMPs	4.706	lbs
Percent annual total phosphorus removed:	**60**	**%**
Post development annual TSS load:	1423.8	lbs
Annual TSS removed by BMPs:	1298.9	lbs
Percent annual TSS removed:	**91**	**%**

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	2821	7961	2821	5140	35
1 - Stormwater disconnection (Impervious	777	1677	777	900	46
0 - Stormwater disconnection (Impervious	1103	2396	1103	1293	46
1 - Constructed stormwater pond	0	7961	0	7961	0
2 - Constructed stormwater pond	0	571	0	571	0
3 - Constructed stormwater pond	0	467	0	467	0
4 - Constructed stormwater pond	0	1293	0	1293	0
SAFL Baffle	0	6668	0	6668	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	6.9441	1.3923	5.5518	20
1 - Stormwater disconnection (Impervious	1.4341	0	0.19	1.2441	13
0 - Stormwater disconnection (Impervious	1.9294	0	0.2556	1.6738	13
1 - Constructed stormwater pond	0	6.9441	0	6.9441	0
2 - Constructed stormwater pond	0.5594	0	0	0.5594	0
3 - Constructed stormwater pond	0.409	0	0	0.409	0
4 - Constructed stormwater pond	0.285	1.6739	0	1.9589	0
SAFL Baffle	4.9852	0	0	4.9852	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	0.1657	0.1392	0.0265	84
1 - Stormwater disconnection (Impervious	0.6436	0	0.0853	0.5583	13
0 - Stormwater disconnection (Impervious	0.8659	0	0.1147	0.7512	13
1 - Constructed stormwater pond	0	1.0357	0.87	0.1657	84
2 - Constructed stormwater pond	0.2511	0	0.1507	0.1004	60
3 - Constructed stormwater pond	0.1836	0	0.1102	0.0734	60
4 - Constructed stormwater pond	0.1279	0.7512	0.7384	0.1407	84
SAFL Baffle	2.2374	0	1.3424	0.895	60

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	2.293	0.7347	1.5583	32
1 - Stormwater disconnection (Impervious	0.5266	0	0.0698	0.4568	13
0 - Stormwater disconnection (Impervious	0.7085	0	0.0938	0.6147	13
1 - Constructed stormwater pond	0	2.4924	0.1994	2.293	8
2 - Constructed stormwater pond	0.2054	0	0	0.2054	0
3 - Constructed stormwater pond	0.1502	0	0	0.1502	0
4 - Constructed stormwater pond	0.1047	0.6147	0.0576	0.6618	8
SAFL Baffle	1.8306	0	0	1.8306	0

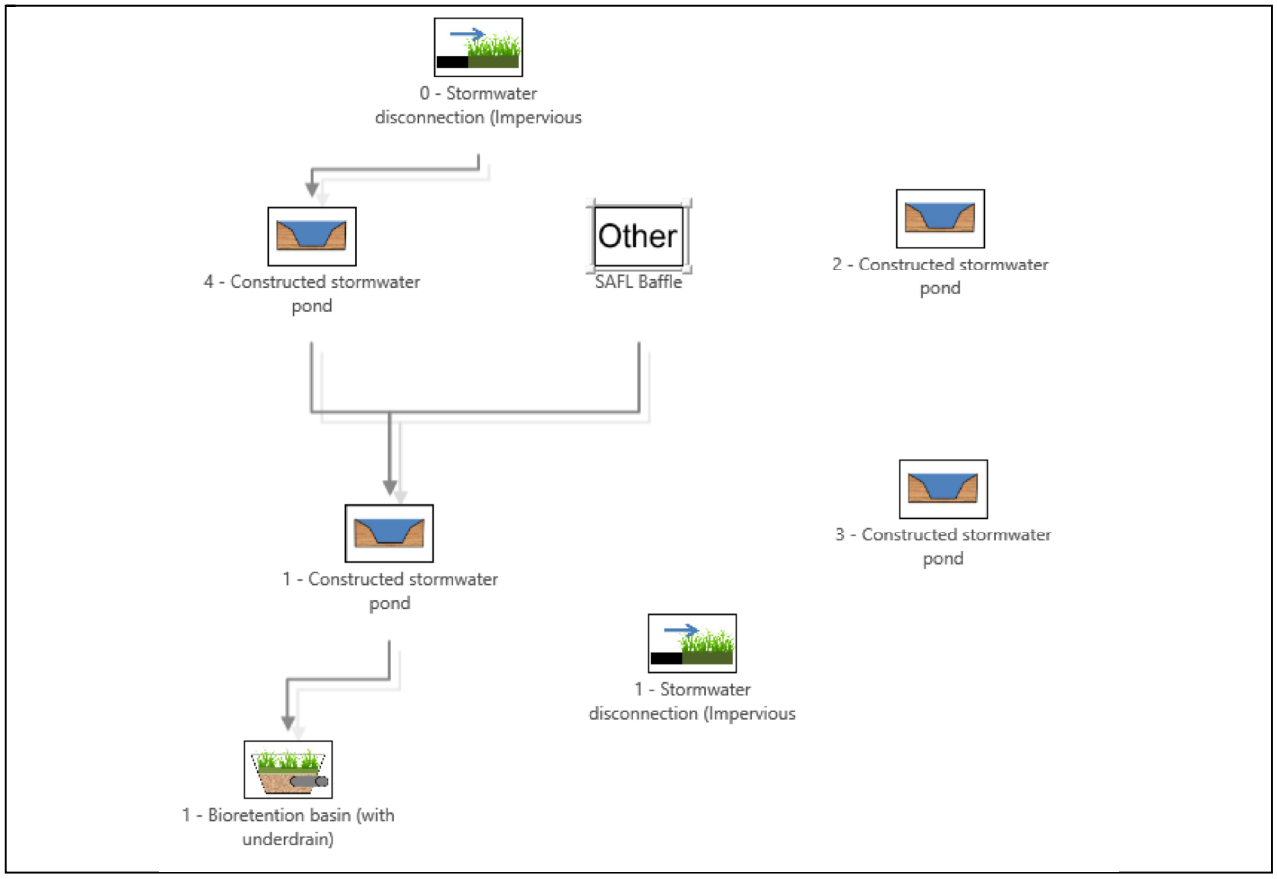
Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	2.4587	0.8739	1.5848	58
1 - Stormwater disconnection (Impervious	1.1702	0	0.1551	1.0151	13
0 - Stormwater disconnection (Impervious	1.5744	0	0.2085	1.3659	13
1 - Constructed stormwater pond	0	3.5281	1.0694	2.4587	46
2 - Constructed stormwater pond	0.4565	0	0.1507	0.3058	30
3 - Constructed stormwater pond	0.3338	0	0.1102	0.2236	30
4 - Constructed stormwater pond	0.2326	1.3659	0.796	0.8025	46
SAFL Baffle	4.068	0	1.3424	2.7256	30

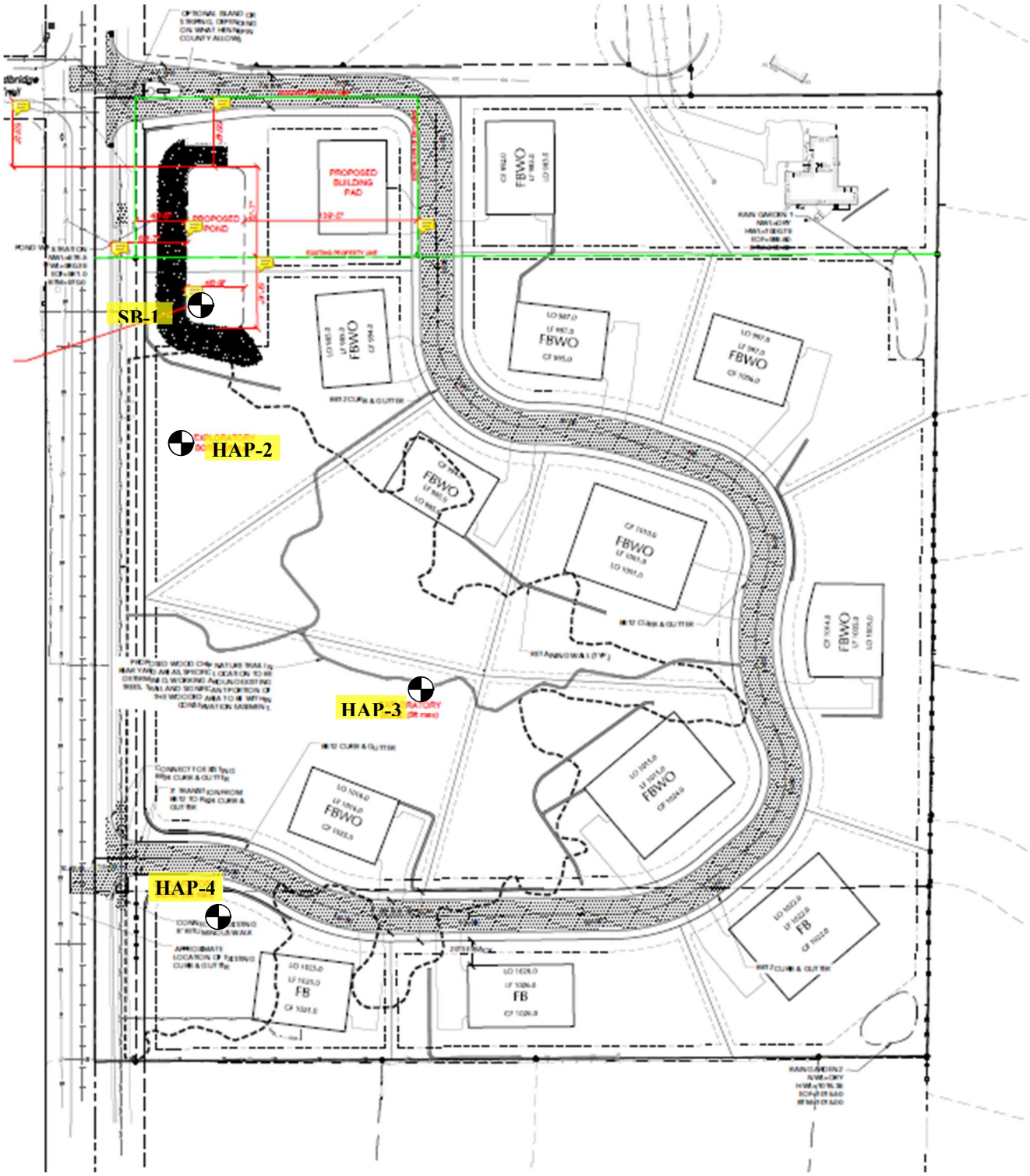
TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	50.41	42.35	8.0599999999	84
1 - Stormwater disconnection (Impervious	212.59	0	153.57	59.02	72
0 - Stormwater disconnection (Impervious	286.02	0	206.62	79.4	72
1 - Constructed stormwater pond	0	315.06	264.65	50.41	84
2 - Constructed stormwater pond	82.93	0	49.76	33.17	60
3 - Constructed stormwater pond	60.63	0	36.38	24.25	60
4 - Constructed stormwater pond	42.25	79.4	102.19	19.46	84
SAFL Baffle	739.01	0	443.41	295.6	60

BMP Schematic


0 - Stormwater disconnection (Impervious
4 - Constructed stormwater pond
Other
SAFL Baffle
2 - Constructed stormwater pond
3 - Constructed stormwater pond
1 - Constructed stormwater pond
1 - Stormwater disconnection (Impervious
1 - Bioretention basin (with underdrain)

Name	Model	Total Load (lbs)	Total Load Removed (lbs)	Removal Efficiency (%)	Model Height (ft)	Model Diameter (ft)	Pipe Diameter (inches)
SAFLBaffle	42	10852	1772	16.3	2	4	15
SAFLBaffle	44	10852	3703	34.1	4	4	15
SAFLBaffle	55	10852	6322	58.3	5	5	18
SAFLBaffle	63	10852	7045	64.9	3	6	24
SAFLBaffle	66	10852	8205	75.6	6	6	24
SAFLBaffle	86	10852	9180	84.6	6	8	30
SAFLBaffle	106	10852	9797	90.3	6	10	36



Legend

Approximate Soil Boring Location

Disclaimer: Map and parcel data are believed to be accurate, but accuracy is not guaranteed.
This is not a legal document and should not be substituted for a title search, appraisal, survey, or for zoning verification.

N W E S

Haugo GeoTechnical Services, LLC 2825 Cedar Avenue S. Minneapolis, MN 55407	Soil Boring Location Sketch Fretham 31st Addition Minnetonka, Minnesota	Figure #: 1 Drawn By: AH Date: 10-25-2023 Scale: None Project #: 23-0817

Haugo GeoTechnical Services
2825 Cedar Ave South
Minneapolis, MN, 55407
Telephone: 612-729-2959
Fax: 763-445-2238

BORING NUMBER SB-1

CLIENT Lake West Deveopment
PROJECT NAME Fretham 31st Addition
PROJECT NUMBER 23-0817
PROJECT LOCATION Minnetonka, MN
DATE STARTED 10/25/23 **COMPLETED** 10/25/23
GROUND ELEVATION _____ **HOLE SIZE** 3 1/4 inches
DRILLING CONTRACTOR HGTS- 45
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger/Split Spoon
AT TIME OF DRILLING --- Not Encountered
LOGGED BY NC **CHECKED BY** PG
AT END OF DRILLING --- Not Encountered
NOTES
AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)
0		Clayey Sand, trace Roots, dark brown to black, moist (Topsoil)				
		(CL) Lean Clay, brown w/ Rust Staining, dry to about 10 ft then moist, rather stiff to very stiff (Glacial Till)	AU 1			
			SS 2		2-4-9 (13)	
5			SS 3		7-20-14 (34)	
			SS 4		7-10-13 (23)	
10			SS 5		5-10-14 (24)	
			SS 6		4-6-9 (15)	
15			SS 7		3-5-7 (12)	
20			SS 8		4-7-8 (15)	

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

Bottom of borehole at 21.0 feet.

Haugo GeoTechnical Services
2825 Cedar Ave South
Minneapolis, MN, 55407
Telephone: 612-729-2959
Fax: 763-445-2238

BORING NUMBER HAP-2

CLIENT Lake West Deveopment
PROJECT NAME Fretham 31st Addition
PROJECT NUMBER 23-0817
PROJECT LOCATION Minnetonka, MN
DATE STARTED 10/25/23 **COMPLETED** 10/25/23
GROUND ELEVATION _____ **HOLE SIZE** 3 1/4 inches
DRILLING CONTRACTOR HGTS- 45
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger
AT TIME OF DRILLING --- Not Encountered
LOGGED BY NC **CHECKED BY** PG
AT END OF DRILLING --- Not Encountered
NOTES
AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)
0		Lean Clay, trace Roots, dark brown to black, wet (Topsoil)	AU 6			
		(CL) Lean Clay, dark brown to brown, wet (Glacial Till)	AU 7			
			AU 8			

Bottom of borehole at 4.3 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

Haugo GeoTechnical Services
2825 Cedar Ave South
Minneapolis, MN, 55407
Telephone: 612-729-2959
Fax: 763-445-2238

BORING NUMBER HAP-3

CLIENT Lake West Deveopment
PROJECT NAME Fretham 31st Addition
PROJECT NUMBER 23-0817
PROJECT LOCATION Minnetonka, MN
DATE STARTED 10/25/23 **COMPLETED** 10/25/23
GROUND ELEVATION _____ **HOLE SIZE** 3 1/4 inches
DRILLING CONTRACTOR HGTS- 45
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger
AT TIME OF DRILLING --- Not Encountered
LOGGED BY NC **CHECKED BY** PG
AT END OF DRILLING --- Not Encountered
NOTES _____
AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)
0		Lean Clay w/ Sand, trace Roots, black, wet (Topsoil)	AU 4			
		(CL) Lean Clay w/ Sand, dark brown to brown, wet (Glacial Till)	AU 5			

Bottom of borehole at 4.3 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

Haugo GeoTechnical Services
2825 Cedar Ave South
Minneapolis, MN, 55407
Telephone: 612-729-2959
Fax: 763-445-2238

BORING NUMBER HAP-4

CLIENT Lake West Deveopment
PROJECT NAME Fretham 31st Addition
PROJECT NUMBER 23-0817
PROJECT LOCATION Minnetonka, MN
DATE STARTED 10/25/23 **COMPLETED** 10/25/23
GROUND ELEVATION _____ **HOLE SIZE** 3 1/4 inches
DRILLING CONTRACTOR HGTS- 45
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger
AT TIME OF DRILLING --- Not Encountered
LOGGED BY NC **CHECKED BY** PG
AT END OF DRILLING --- Not Encountered
NOTES
AFTER DRILLING --- Not Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)
0		Lean Clay w/ Sand, trace Roots, dark brown to black, wet (Topsoil)	AU 1			
		(SC) Clayey Sand, trace Gravel, brown, moist to wet (Glacial Till)	AU 2			
		(CL) Sandy Lean Clay, trace Gravel, brown, moist to wet (Glacial Till)	AU 3			

Bottom of borehole at 4.7 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

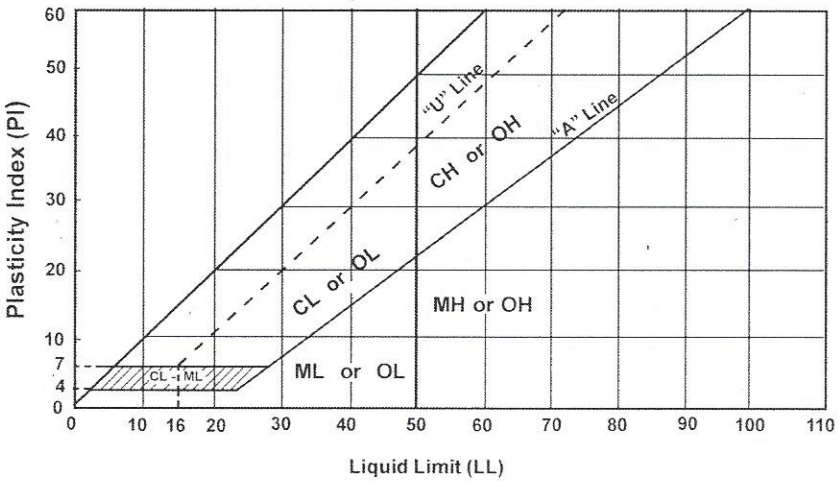
HAUGO GEOTECHNICAL SERVICES

Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.