



HYDROLOGY FOR
Ridge Periodontics
Maplewood, Minnesota
November 23, 2021

EXISTING SITE DESCRIPTION

The total existing project site is approximately 1.90 acres, of which 0 acres are impervious. The site mostly consists of open green space with two transmission towers. Approximately half of the existing site being analyzed sheet flows northeast to existing storm sewer in Hazelwood Street. The other portion of the site sheet flows west to County Road D, East. It is assumed that all the stormwater from the site eventually flows north to the receiving water body of Kohlman Lake. There are no known stormwater management features on site.

EXISTING SITE DRAINAGE CHARACTERISTICS

Detail 1/C600 of the Stormwater Summary Plan shows the existing delineated site drainage areas. Table 1 briefly summarizes the ground cover characteristics and drainage routing of each numbered drainage area. Most of the site drainage to each respective drainage point is via overland sheet flow and shallow concentrated flow.

Table 1: Existing Site Drainage Descriptions (Refer to Detail 1/C600)		
Drainage Area No.	Description	Drainage Routes to:
1	Green space	Sheet flows northeast to existing storm sewer in Hazelwood Street.
2	Green space.	Sheet flows west to County Road D, East.

EXISTING SITE DRAINAGE FLOW RATES

HydroCAD was used to model the existing site hydrology. The NRCS Method of Abstractions was used in the model with Type-II rainfall events from the NOAA Atlas 14 precipitation frequency estimates (refer to Table 3). NRCS curve numbers were derived based on topographic survey information (completed by Advance Survey and Engineering) and information on cover and underlying soil types from geotechnical information from Braun Intertec. Table 2 lists the derived curve runoff numbers for each cover type.

Table 2: NRCS Hydrologic Soil Group and Runoff Curve Numbers		
Ground Cover Type	Hydrologic Soil Group	Curve Number (CN)
Existing Pervious Area	D	80
Proposed Pervious Area	D	80
Paving/Buildings	NA	98

Peak runoff computations were performed for the 2-year, 10-year, and 100-year/24-hour return period rainfall events, listed in Table 3. The weighted curve number for each drainage area is based on a weighted average of each area of ground cover type as listed in Table 2. Peak HydroCAD runoff and total volume computations are summarized in Table 4 and Table 5 and included as an appendix to this report.

Table 3: NOAA Atlas 14 24-hour Duration Storm Events for Each Return Period (inches)		
2-year	10-year	100-year
2.90"	4.30"	7.50"

Table 4: Summary of Peak Runoff Rates: Existing Drainage Areas (Detail 1/C600)				
Drainage Area No.	Time of Concentration (minutes)	24-hour Storm Events Peak Runoff Rates		
		2-year (cfs)	10-year (cfs)	100-year (cfs)
1	5	1.60	3.18	7.06
2	5	1.10	2.17	4.78
Total		2.70	5.35	11.84

PROPOSED DEVELOPMENT DESCRIPTION

The proposed site improvements include a new building, small parking lot, sidewalk, and associated utilities. These new site improvements will include 0.39 acres (16,998 sf) of new and reconstructed impervious. In order to provide stormwater management for the site a surface filtration system will be constructed north of the proposed building.

PROPOSED SITE DRAINAGE ROUTING

Detail 2/C600 of the Stormwater Summary Plan shows the proposed delineated site drainage areas. Table 5 gives a brief summary and routing of the proposed drainage patterns on site.

Table 5: Proposed Site Drainage Descriptions (Refer to Detail 2/C600)		
Drainage Area No.	Description	Drainage Routes to:
1	Green space	Sheet flows west to County Road D, East.
2	Green space.	Sheet flows east to existing storm sewer in Hazelwood Street.
3	Green space and partial building overhang.	Sheet flows east to existing storm sewer in Hazelwood Street.
4	Green space, bituminous parking lot, building, and sidewalks.	Sheet flows to proposed storm sewer where it is piped to the proposed filtration basin.
5	Green space and partial building overhang.	Sheet flows to the proposed filtration basin.

PROPOSED SITE STORMWATER TREATMENT

HydroCAD was used to model the proposed site hydrology. The NRCS Method of Abstractions was used with Type-II rainfall events from the NOAA Atlas 14 precipitation frequency estimates (refer to Table 3). NRCS curve numbers were derived based on a weighted average of each area of ground cover type. Refer to Table 2 for runoff curve numbers used in the proposed computations.

The project is located within the Ramsey-Washington Metro Watershed District, however since the site disturbs under 1 acre, a watershed permit is not required for this project. Total site disturbance for the project will be 0.98 acres (42,812 square feet). Since the project disturbs more than 0.5 acres, the project will be required to meet the City of Maplewood Stormwater Requirements. Current treatment and runoff standards for the City are the following:

Volume Control – Stormwater runoff shall be retained onsite in the amount equivalent to 1.1 inches of runoff over the new and reconstructed impervious surfaces of the development. Since the site has predominantly D soils (see attached geotechnical report) a surface filtration basin is proposed for this project. The filtration basin will drawdown within 48 hours and is calculated below.

Distance from the bottom of the filtration basin to the outlet = 2.50 feet, or 30 inches
 Drawdown rate = 1 inches/hour.

Drawdown time = 30 inches / 1 inch/hour = **30 hours**

The required treatment volume for this site shall be calculated as follows:

$$\text{Reconstructed/New Impervious Area} \times 1.1'' / 12 \text{ inches/foot} = \text{Required Treatment Volume}$$

$$16,248 \text{ square feet} \times 1.1''/12 = 1,490 \text{ cubic feet}$$

Peak Stormwater Runoff Control – Runoff rates for the proposed activity shall not exceed existing runoff rates for the 2-year, 10-year, and 100-year critical storm events using Atlas 14 precipitation depths and Type-II storm distributions.

In order to meet the above standard a filtration basin is proposed in the north of the proposed building. Filtration practices receive a 55% volume credit per the city rules. The total treatment volume provided by this filtration basin 4,396 cubic feet. Credit received for this practice is 4,396 cubic feet x 55% = 2,418 cubic feet. This exceeds the required volume of 1,490 cubic feet.

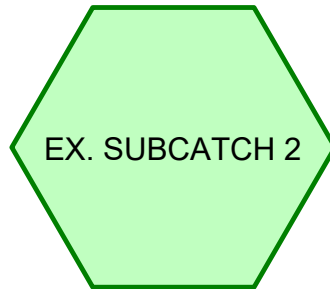
The filtration basin also rate controls the site to below existing conditions. Table 6 shows a summary of the peak runoff rates for the proposed conditions. Table 7 compares the existing site runoff rates and the proposed site runoff rates.

Water Quality – If the development meets the volume control requirements for the site, the pollutant removal requirements are considered to be met.

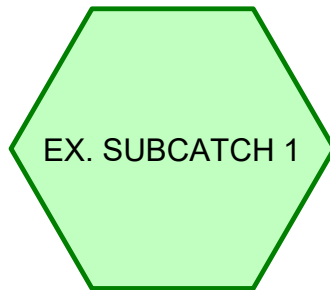
Table 6: Summary of Peak Runoff Rates: Proposed Drainage Areas (Detail 2/C600)				
Drainage Area No.	Time of Concentration (minutes)	24-hour Storm Events Peak Runoff Rates		
		2-year (cfs)	10-year (cfs)	100-year (cfs)
1	5	1.10	2.20	4.90
2	5	0.19	0.36	0.79
3	5	0.50	0.93	1.99
4	5	-	-	-
5	5	-	-	-
Proposed Filtration Basin	-	0.05	0.14	4.14
Total		1.84	3.63	11.82

Table 7: Comparison of Peak Runoff Rates: Existing vs. Proposed (cfs)			
Condition	2-year/ 24-hr	10-year/ 24-hr	100-year/ 24-hr
Existing	2.70	5.35	11.84
Proposed	1.84	3.63	11.82

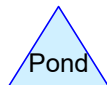
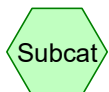
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Subcat EX. SUBCATCH 2



Subcat EX. SUBCATCH 1



2021-11-09 Existing 22126 Ridge Per

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type II 24-hr		Default	24.00	1	2.90	2
2	10-yr	Type II 24-hr		Default	24.00	1	4.30	2
3	100-yr	Type II 24-hr		Default	24.00	1	7.50	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.903	80	>75% Grass cover, Good, HSG D (EX. SUBCATCH 1, EX. SUBCATCH 2)
1.903	80	TOTAL AREA

2021-11-09 Existing 22126 Ridge Per

Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment EX. SUBCATCH 1: Subcat EX. SUBCATCH 1

Runoff = 1.60 cfs @ 12.12 hrs, Volume= 0.119 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
1.212	80	>75% Grass cover, Good, HSG D
1.212	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0150	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 2.90"
2.3	120	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.1	220	Total			

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Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment EX. SUBCATCH 2: Subcat EX. SUBCATCH 2

Runoff = 1.10 cfs @ 12.06 hrs, Volume= 0.068 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
0.691	80	>75% Grass cover, Good, HSG D
0.691	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 2.90"
1.4	110	0.0350	1.31		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.4	210	Total			

2021-11-09 Existing 22126 Ridge Per

Type II 24-hr 10-yr Rainfall=4.30"

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Summary for Subcatchment EX. SUBCATCH 1: Subcat EX. SUBCATCH 1

Runoff = 3.18 cfs @ 12.12 hrs, Volume= 0.232 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
1.212	80	>75% Grass cover, Good, HSG D
1.212	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0150	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 2.90"
2.3	120	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.1	220	Total			

2021-11-09 Existing 22126 Ridge Per

Type II 24-hr 10-yr Rainfall=4.30"

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Summary for Subcatchment EX. SUBCATCH 2: Subcat EX. SUBCATCH 2

Runoff = 2.17 cfs @ 12.05 hrs, Volume= 0.132 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.691	80	>75% Grass cover, Good, HSG D
0.691	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 2.90"
1.4	110	0.0350	1.31		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.4	210	Total			

2021-11-09 Existing 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment EX. SUBCATCH 1: Subcat EX. SUBCATCH 1

Runoff = 7.06 cfs @ 12.11 hrs, Volume= 0.521 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
1.212	80	>75% Grass cover, Good, HSG D
1.212	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0150	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 2.90"
2.3	120	0.0150	0.86		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.1	220	Total			

2021-11-09 Existing 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment EX. SUBCATCH 2: Subcat EX. SUBCATCH 2

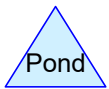
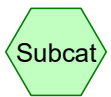
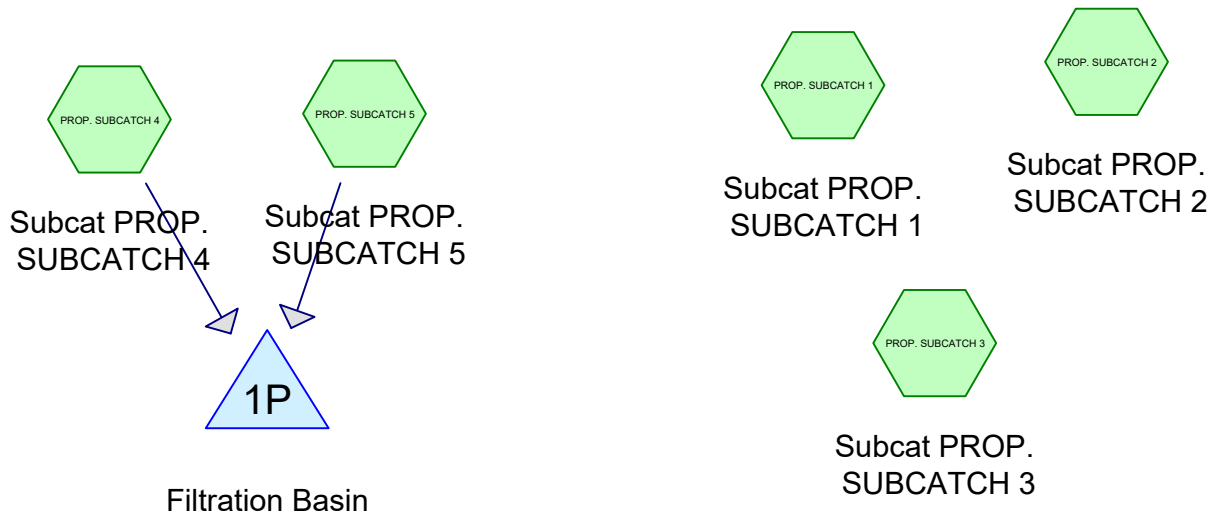
Runoff = 4.78 cfs @ 12.05 hrs, Volume= 0.297 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
0.691	80	>75% Grass cover, Good, HSG D
0.691	80	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 2.90"
1.4	110	0.0350	1.31		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
13.4	210	Total			

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Routing Diagram for 2021-11-09 Proposed 22126 Ridge Per
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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type II 24-hr		Default	24.00	1	2.90	2
2	10-yr	Type II 24-hr		Default	24.00	1	4.30	2
3	100-yr	Type II 24-hr		Default	24.00	1	7.50	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.530	80	>75% Grass cover, Good, HSG D (PROP. SUBCATCH 1, PROP. SUBCATCH 2, PROP. SUBCATCH 3, PROP. SUBCATCH 4, PROP. SUBCATCH 5)
0.373	98	Roofs, HSG D (PROP. SUBCATCH 1, PROP. SUBCATCH 2, PROP. SUBCATCH 3, PROP. SUBCATCH 4, PROP. SUBCATCH 5)
1.903	84	TOTAL AREA

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment PROP. SUBCATCH 1: Subcat PROP. SUBCATCH 1

Runoff = 1.10 cfs @ 12.18 hrs, Volume= 0.094 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
0.961	80	>75% Grass cover, Good, HSG D
0.000	98	Roofs, HSG D
0.961	80	Weighted Average
0.961	80	99.99% Pervious Area
0.000	98	0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,
16.8	100	0.0150	0.10		Sheet Flow,
					Grass: Dense n= 0.240 P2= 2.90"
2.3	120	0.0150	0.86		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
24.1	220	Total			

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Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment PROP. SUBCATCH 2: Subcat PROP. SUBCATCH 2

Runoff = 0.19 cfs @ 11.96 hrs, Volume= 0.008 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
0.086	80	>75% Grass cover, Good, HSG D
0.000	98	Roofs, HSG D
0.086	80	Weighted Average
0.086	80	100.00% Pervious Area
0.000	98	0.00% Impervious Area

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

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Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment PROP. SUBCATCH 3: Subcat PROP. SUBCATCH 3

Runoff = 0.50 cfs @ 11.96 hrs, Volume= 0.023 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
0.200	80	>75% Grass cover, Good, HSG D
0.014	98	Roofs, HSG D
0.214	81	Weighted Average
0.200	80	93.60% Pervious Area
0.014	98	6.40% Impervious Area

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

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Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment PROP. SUBCATCH 4: Subcat PROP. SUBCATCH 4

Runoff = 1.90 cfs @ 11.96 hrs, Volume= 0.097 af, Depth= 2.17"
Routed to Pond 1P : Filtration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
0.179	80	>75% Grass cover, Good, HSG D
0.358	98	Roofs, HSG D
0.537	92	Weighted Average
0.179	80	33.33% Pervious Area
0.358	98	66.67% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 2-yr Rainfall=2.90"

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Summary for Subcatchment PROP. SUBCATCH 5: Subcat PROP. SUBCATCH 5

Runoff = 0.23 cfs @ 11.96 hrs, Volume= 0.010 af, Depth= 1.19"

Routed to Pond 1P : Filtration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (ac)	CN	Description
0.103	80	>75% Grass cover, Good, HSG D
0.001	98	Roofs, HSG D
0.104	80	Weighted Average
0.103	80	98.73% Pervious Area
0.001	98	1.27% Impervious Area

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

Summary for Pond 1P: Filtration Basin

Inflow Area = 0.642 ac, 56.04% Impervious, Inflow Depth = 2.01" for 2-yr event
 Inflow = 2.13 cfs @ 11.96 hrs, Volume= 0.108 af
 Outflow = 0.05 cfs @ 15.24 hrs, Volume= 0.108 af, Atten= 98%, Lag= 196.9 min
 Primary = 0.05 cfs @ 15.24 hrs, Volume= 0.108 af
 Secondary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
 Peak Elev= 904.24' @ 15.24 hrs Surf.Area= 2,013 sf Storage= 2,704 cf
 Flood Elev= 905.00' Surf.Area= 2,448 sf Storage= 4,396 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 604.4 min (1,381.2 - 776.8)

Volume	Invert	Avail.Storage	Storage Description
#1	902.50'	7,159 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
902.50	1,117	0	0
903.00	1,358	619	619
904.00	1,874	1,616	2,235
905.00	2,448	2,161	4,396
906.00	3,079	2,764	7,159

Device	Routing	Invert	Outlet Devices
#1	Device 2	902.50'	1.000 in/hr Exfiltration over Surface area
#2	Primary	899.20'	12.0" Round Culvert L= 42.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 899.20' / 897.60' S= 0.0373 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	905.00'	14.2" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Secondary	905.80'	10.0' 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=0.05 cfs @ 15.24 hrs HW=904.24' (Free Discharge)

↑ **2=Culvert** (Passes 0.05 cfs of 9.57 cfs potential flow)

↑ **1=Exfiltration** (Exfiltration Controls 0.05 cfs)

↑ **3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.01 hrs HW=902.50' (Free Discharge)

↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 2-yr Rainfall=2.90"

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Stage-Area-Storage for Pond 1P: Filtration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
902.50	1,117	0	905.10	2,511	4,644
902.55	1,141	56	905.15	2,543	4,770
902.60	1,165	114	905.20	2,574	4,898
902.65	1,189	173	905.25	2,606	5,027
902.70	1,213	233	905.30	2,637	5,159
902.75	1,238	294	905.35	2,669	5,291
902.80	1,262	357	905.40	2,700	5,425
902.85	1,286	420	905.45	2,732	5,561
902.90	1,310	485	905.50	2,764	5,699
902.95	1,334	551	905.55	2,795	5,838
903.00	1,358	619	905.60	2,827	5,978
903.05	1,384	687	905.65	2,858	6,120
903.10	1,410	757	905.70	2,890	6,264
903.15	1,435	828	905.75	2,921	6,409
903.20	1,461	901	905.80	2,953	6,556
903.25	1,487	974	905.85	2,984	6,704
903.30	1,513	1,049	905.90	3,016	6,855
903.35	1,539	1,126	905.95	3,047	7,006
903.40	1,564	1,203	906.00	3,079	7,159
903.45	1,590	1,282			
903.50	1,616	1,362			
903.55	1,642	1,444			
903.60	1,668	1,526			
903.65	1,693	1,610			
903.70	1,719	1,696			
903.75	1,745	1,782			
903.80	1,771	1,870			
903.85	1,797	1,959			
903.90	1,822	2,050			
903.95	1,848	2,142			
904.00	1,874	2,235			
904.05	1,903	2,329			
904.10	1,931	2,425			
904.15	1,960	2,522			
904.20	1,989	2,621			
904.25	2,018	2,721			
904.30	2,046	2,823			
904.35	2,075	2,926			
904.40	2,104	3,030			
904.45	2,132	3,136			
904.50	2,161	3,244			
904.55	2,190	3,352			
904.60	2,218	3,462			
904.65	2,247	3,574			
904.70	2,276	3,687			
904.75	2,305	3,802			
904.80	2,333	3,918			
904.85	2,362	4,035			
904.90	2,391	4,154			
904.95	2,419	4,274			
905.00	2,448	4,396			
905.05	2,480	4,519			

Summary for Subcatchment PROP. SUBCATCH 1: Subcat PROP. SUBCATCH 1

Runoff = 2.20 cfs @ 12.18 hrs, Volume= 0.184 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.961	80	>75% Grass cover, Good, HSG D
0.000	98	Roofs, HSG D
0.961	80	Weighted Average
0.961	80	99.99% Pervious Area
0.000	98	0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,
16.8	100	0.0150	0.10		Sheet Flow,
					Grass: Dense n= 0.240 P2= 2.90"
2.3	120	0.0150	0.86		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
24.1	220	Total			

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 10-yr Rainfall=4.30"

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Summary for Subcatchment PROP. SUBCATCH 2: Subcat PROP. SUBCATCH 2

Runoff = 0.36 cfs @ 11.96 hrs, Volume= 0.016 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.086	80	>75% Grass cover, Good, HSG D
0.000	98	Roofs, HSG D
0.086	80	Weighted Average
0.086	80	100.00% Pervious Area
0.000	98	0.00% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 10-yr Rainfall=4.30"

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Summary for Subcatchment PROP. SUBCATCH 3: Subcat PROP. SUBCATCH 3

Runoff = 0.93 cfs @ 11.96 hrs, Volume= 0.043 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.200	80	>75% Grass cover, Good, HSG D
0.014	98	Roofs, HSG D
0.214	81	Weighted Average
0.200	80	93.60% Pervious Area
0.014	98	6.40% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 10-yr Rainfall=4.30"

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Summary for Subcatchment PROP. SUBCATCH 4: Subcat PROP. SUBCATCH 4

Runoff = 3.01 cfs @ 11.96 hrs, Volume= 0.156 af, Depth= 3.47"
Routed to Pond 1P : Filtration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.179	80	>75% Grass cover, Good, HSG D
0.358	98	Roofs, HSG D
0.537	92	Weighted Average
0.179	80	33.33% Pervious Area
0.358	98	66.67% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 10-yr Rainfall=4.30"

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Summary for Subcatchment PROP. SUBCATCH 5: Subcat PROP. SUBCATCH 5

Runoff = 0.44 cfs @ 11.96 hrs, Volume= 0.020 af, Depth= 2.31"
Routed to Pond 1P : Filtration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.30"

Area (ac)	CN	Description
0.103	80	>75% Grass cover, Good, HSG D
0.001	98	Roofs, HSG D
0.104	80	Weighted Average
0.103	80	98.73% Pervious Area
0.001	98	1.27% Impervious Area

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

Summary for Pond 1P: Filtration Basin

Inflow Area = 0.642 ac, 56.04% Impervious, Inflow Depth = 3.29" for 10-yr event
 Inflow = 3.46 cfs @ 11.96 hrs, Volume= 0.176 af
 Outflow = 0.14 cfs @ 13.28 hrs, Volume= 0.176 af, Atten= 96%, Lag= 79.5 min
 Primary = 0.14 cfs @ 13.28 hrs, Volume= 0.176 af
 Secondary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
 Peak Elev= 905.04' @ 13.28 hrs Surf.Area= 2,470 sf Storage= 4,483 cf
 Flood Elev= 905.00' Surf.Area= 2,448 sf Storage= 4,396 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 787.1 min (1,556.9 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1	902.50'	7,159 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
902.50	1,117	0	0
903.00	1,358	619	619
904.00	1,874	1,616	2,235
905.00	2,448	2,161	4,396
906.00	3,079	2,764	7,159

Device	Routing	Invert	Outlet Devices
#1	Device 2	902.50'	1.000 in/hr Exfiltration over Surface area
#2	Primary	899.20'	12.0" Round Culvert L= 42.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 899.20' / 897.60' S= 0.0373 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	905.00'	14.2" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Secondary	905.80'	10.0' 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=0.14 cfs @ 13.28 hrs HW=905.04' (Free Discharge)
 ↑ **2=Culvert** (Passes 0.14 cfs of 10.22 cfs potential flow)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)
 ↑ **3=Orifice/Grate** (Weir Controls 0.08 cfs @ 0.62 fps)

Secondary OutFlow Max=0.00 cfs @ 0.01 hrs HW=902.50' (Free Discharge)
 ↑ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Stage-Area-Storage for Pond 1P: Filtration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
902.50	1,117	0	905.10	2,511	4,644
902.55	1,141	56	905.15	2,543	4,770
902.60	1,165	114	905.20	2,574	4,898
902.65	1,189	173	905.25	2,606	5,027
902.70	1,213	233	905.30	2,637	5,159
902.75	1,238	294	905.35	2,669	5,291
902.80	1,262	357	905.40	2,700	5,425
902.85	1,286	420	905.45	2,732	5,561
902.90	1,310	485	905.50	2,764	5,699
902.95	1,334	551	905.55	2,795	5,838
903.00	1,358	619	905.60	2,827	5,978
903.05	1,384	687	905.65	2,858	6,120
903.10	1,410	757	905.70	2,890	6,264
903.15	1,435	828	905.75	2,921	6,409
903.20	1,461	901	905.80	2,953	6,556
903.25	1,487	974	905.85	2,984	6,704
903.30	1,513	1,049	905.90	3,016	6,855
903.35	1,539	1,126	905.95	3,047	7,006
903.40	1,564	1,203	906.00	3,079	7,159
903.45	1,590	1,282			
903.50	1,616	1,362			
903.55	1,642	1,444			
903.60	1,668	1,526			
903.65	1,693	1,610			
903.70	1,719	1,696			
903.75	1,745	1,782			
903.80	1,771	1,870			
903.85	1,797	1,959			
903.90	1,822	2,050			
903.95	1,848	2,142			
904.00	1,874	2,235			
904.05	1,903	2,329			
904.10	1,931	2,425			
904.15	1,960	2,522			
904.20	1,989	2,621			
904.25	2,018	2,721			
904.30	2,046	2,823			
904.35	2,075	2,926			
904.40	2,104	3,030			
904.45	2,132	3,136			
904.50	2,161	3,244			
904.55	2,190	3,352			
904.60	2,218	3,462			
904.65	2,247	3,574			
904.70	2,276	3,687			
904.75	2,305	3,802			
904.80	2,333	3,918			
904.85	2,362	4,035			
904.90	2,391	4,154			
904.95	2,419	4,274			
905.00	2,448	4,396			
905.05	2,480	4,519			

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment PROP. SUBCATCH 1: Subcat PROP. SUBCATCH 1

Runoff = 4.90 cfs @ 12.18 hrs, Volume= 0.413 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
0.961	80	>75% Grass cover, Good, HSG D
0.000	98	Roofs, HSG D
0.961	80	Weighted Average
0.961	80	99.99% Pervious Area
0.000	98	0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,
16.8	100	0.0150	0.10		Sheet Flow,
					Grass: Dense n= 0.240 P2= 2.90"
2.3	120	0.0150	0.86		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
24.1	220	Total			

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment PROP. SUBCATCH 2: Subcat PROP. SUBCATCH 2

Runoff = 0.79 cfs @ 11.96 hrs, Volume= 0.037 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
0.086	80	>75% Grass cover, Good, HSG D
0.000	98	Roofs, HSG D
0.086	80	Weighted Average
0.086	80	100.00% Pervious Area
0.000	98	0.00% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment PROP. SUBCATCH 3: Subcat PROP. SUBCATCH 3

Runoff = 1.99 cfs @ 11.96 hrs, Volume= 0.094 af, Depth= 5.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
0.200	80	>75% Grass cover, Good, HSG D
0.014	98	Roofs, HSG D
0.214	81	Weighted Average
0.200	80	93.60% Pervious Area
0.014	98	6.40% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment PROP. SUBCATCH 4: Subcat PROP. SUBCATCH 4

Runoff = 5.60 cfs @ 11.96 hrs, Volume= 0.294 af, Depth= 6.56"
Routed to Pond 1P : Filtration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
0.179	80	>75% Grass cover, Good, HSG D
0.358	98	Roofs, HSG D
0.537	92	Weighted Average
0.179	80	33.33% Pervious Area
0.358	98	66.67% Impervious Area

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

2021-11-09 Proposed 22126 Ridge Per

Type II 24-hr 100-yr Rainfall=7.50"

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Summary for Subcatchment PROP. SUBCATCH 5: Subcat PROP. SUBCATCH 5

Runoff = 0.96 cfs @ 11.96 hrs, Volume= 0.045 af, Depth= 5.18"
Routed to Pond 1P : Filtration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.50"

Area (ac)	CN	Description
0.103	80	>75% Grass cover, Good, HSG D
0.001	98	Roofs, HSG D
0.104	80	Weighted Average
0.103	80	98.73% Pervious Area
0.001	98	1.27% Impervious Area

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

Summary for Pond 1P: Filtration Basin

Inflow Area = 0.642 ac, 56.04% Impervious, Inflow Depth = 6.34" for 100-yr event
 Inflow = 6.56 cfs @ 11.96 hrs, Volume= 0.339 af
 Outflow = 4.14 cfs @ 12.03 hrs, Volume= 0.339 af, Atten= 37%, Lag= 4.1 min
 Primary = 4.14 cfs @ 12.03 hrs, Volume= 0.339 af
 Secondary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.01-80.00 hrs, dt= 0.01 hrs
 Peak Elev= 905.59' @ 12.03 hrs Surf.Area= 2,821 sf Storage= 5,955 cf
 Flood Elev= 905.00' Surf.Area= 2,448 sf Storage= 4,396 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 473.9 min (1,233.8 - 759.9)

Volume	Invert	Avail.Storage	Storage Description
#1	902.50'	7,159 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
902.50	1,117	0	0
903.00	1,358	619	619
904.00	1,874	1,616	2,235
905.00	2,448	2,161	4,396
906.00	3,079	2,764	7,159

Device	Routing	Invert	Outlet Devices
#1	Device 2	902.50'	1.000 in/hr Exfiltration over Surface area
#2	Primary	899.20'	12.0" Round Culvert L= 42.9' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 899.20' / 897.60' S= 0.0373 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	905.00'	14.2" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Secondary	905.80'	10.0' 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=4.14 cfs @ 12.03 hrs HW=905.59' (Free Discharge)

- ↑ 2=Culvert (Passes 4.14 cfs of 10.65 cfs potential flow)
- ↑ 1=Exfiltration (Exfiltration Controls 0.07 cfs)
- ↑ 3=Orifice/Grate (Orifice Controls 4.07 cfs @ 3.70 fps)

Secondary OutFlow Max=0.00 cfs @ 0.01 hrs HW=902.50' (Free Discharge)

- ↑ 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Stage-Area-Storage for Pond 1P: Filtration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
902.50	1,117	0	905.10	2,511	4,644
902.55	1,141	56	905.15	2,543	4,770
902.60	1,165	114	905.20	2,574	4,898
902.65	1,189	173	905.25	2,606	5,027
902.70	1,213	233	905.30	2,637	5,159
902.75	1,238	294	905.35	2,669	5,291
902.80	1,262	357	905.40	2,700	5,425
902.85	1,286	420	905.45	2,732	5,561
902.90	1,310	485	905.50	2,764	5,699
902.95	1,334	551	905.55	2,795	5,838
903.00	1,358	619	905.60	2,827	5,978
903.05	1,384	687	905.65	2,858	6,120
903.10	1,410	757	905.70	2,890	6,264
903.15	1,435	828	905.75	2,921	6,409
903.20	1,461	901	905.80	2,953	6,556
903.25	1,487	974	905.85	2,984	6,704
903.30	1,513	1,049	905.90	3,016	6,855
903.35	1,539	1,126	905.95	3,047	7,006
903.40	1,564	1,203	906.00	3,079	7,159
903.45	1,590	1,282			
903.50	1,616	1,362			
903.55	1,642	1,444			
903.60	1,668	1,526			
903.65	1,693	1,610			
903.70	1,719	1,696			
903.75	1,745	1,782			
903.80	1,771	1,870			
903.85	1,797	1,959			
903.90	1,822	2,050			
903.95	1,848	2,142			
904.00	1,874	2,235			
904.05	1,903	2,329			
904.10	1,931	2,425			
904.15	1,960	2,522			
904.20	1,989	2,621			
904.25	2,018	2,721			
904.30	2,046	2,823			
904.35	2,075	2,926			
904.40	2,104	3,030			
904.45	2,132	3,136			
904.50	2,161	3,244			
904.55	2,190	3,352			
904.60	2,218	3,462			
904.65	2,247	3,574			
904.70	2,276	3,687			
904.75	2,305	3,802			
904.80	2,333	3,918			
904.85	2,362	4,035			
904.90	2,391	4,154			
904.95	2,419	4,274			
905.00	2,448	4,396			
905.05	2,480	4,519			