

Stormwater Management Report

Owner:

Monarch Development Partners, LLC.
441 Second Street
Excelsior, MN 55331

Project:

Lake Minnetonka Flats
2400-2420 Commerce Blvd
Mound, MN 55364

Engineer's Certification:

All plans and supporting Documentation contained in this report have been reviewed by me and it is hereby certified that to the best of my knowledge the plans comply with the requirements of the ordinance.

I hereby certify that this 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.



Matthew R. Pavsek P.E.

Registration Number: 44263

Date:

7-31-24
9-6-24
9-25-24

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2.0 Summary Analysis / Narrative:

2.1 Introduction:

This stormwater management report accompanies the Civil Engineering Plans prepared by Civil Site Group for the subject project dated 9/25/2024. This report includes a summary of the existing and proposed site conditions, the stormwater requirements of relevant regulatory agencies, and proposed design calculations and data to meet the requirements.

2.2 Existing Site Conditions:

Site Description:

The existing site is currently a vacated lot with a garage and driveway. The existing site surface coverage areas are shown in the table below:

Existing Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
EX1	3046	98	56454	74	59500	75
EX2	42143	98	2232	74	44375	97
EX3	31086	98	21978	74	53064	88

Existing Soils:

A geotechnical evaluation report was completed by Haugo Geotechnical Services dated May 15, 2024. This report determined the soils on site consist of clayey sand, silty clayey sand, sandy lean clay, silty clay, sandy clayey silt, silty sand, and poorly graded sand with silt. For the purposes of this report, soils have been assumed to have a hydrologic soil group "C" designation.

Groundwater:

Groundwater encountered in the soil borings at elevations ranging from 918.50 to 932.50.

2.3 Proposed Site Conditions:

Site Description:

The proposed site is a development of the parcel into 3 new townhouse buildings with underground parking, landscaping, and aboveground/underground stormwater management. The proposed site surface coverage areas are shown in the table below:

Proposed Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1	289	98	33021	61	33310	61
PR2	21079	98	5111	61	26190	91
PR3	42677	98	1698	61	44375	97
PR4	31086	98	21978	61	53064	83

2.4 Stormwater Requirements City (Mound):

The City of Mound defers to the Minnehaha Creek Watershed District requirements.

2.5 Stormwater Requirements Watershed (Minnehaha Creek Watershed District):

Requirement threshold – Site size, over 1 acre, site disturbance 67% (over 40%)

Rate Control – Runoff rate may not exceed existing conditions for the 2, 10, and 100-yr storm events. Utilize Atlas-14 rainfall data.

Water Quality – Water quality is provided by filtration (2" over impervious surfaces, double the required volume for infiltration).

Volume Control – Stormwater runoff volume must be reduced by 1.0” over all new and reconstructed impervious surfaces (includes all newly constructed impervious surfaces, i.e. all impervious disturbed and reconstructed as well as new impervious). Volume Control alternative is **FILTRATION** since site has clay soils and infiltration is not feasible. Site to provide filtration volume (2” over impervious surfaces, double the required volume for infiltration).

2.6 Stormwater Requirements - Minnesota Pollution Control Agency – NPPDES permit (MPCA):

Requirement threshold - A permit is required for projects with a disturbed area over 1 acre in size, Stormwater management is required for a project adding 1-acre of more of NEW impervious surface (reconstructed impervious is not included). **This project does not trigger MPCA stormwater management requirements since proposed site impervious surface is less than 1 acre)**

Rate Control – No specific regulation, may not degrade downstream facilities.

Water Quality – Stormwater water quality treatment volume must be provided equal to 1.0” over all new impervious surfaces (includes all newly constructed impervious surfaces only, re-constructed impervious surfaces are not included). **This project does not trigger MPCA stormwater management requirements since proposed site impervious surface is less than 1 acre)**

Volume Control – Must consider volume reduction if feasible and not prohibited on site. The required infiltration volume is equal to the water quality volume described above. **This project does not trigger MPCA stormwater management requirements since proposed site impervious surface is less than 1 acre)**

3.0 Stormwater Calculations:

3.1 Proposed Stormwater Management Strategy & Facilities Description

This project is disturbing approximately 0.9 acres of land. The project will be constructing 0.61 acres of new/reconstructed impervious surfaces. This land disturbance and creation of impervious surfaces will trigger stormwater management requirements from the Minnehaha Creek Watershed District. The proposed stormwater strategy for this project is directing both the adjacent off site public street and the site’s stormwater runoff via surface drainage and storm sewer piping to a rate control chamber system and a cartridge stormwater filtration device. The chamber system will discharge into a proposed jellyfish filter then into the existing wetland/lake. This stormwater system has been designed to provide filtration for the volume requirement and the required water quality and rate control.

In addition (over and above requirements): This site is required to treat 2” of water from the proposed on-site impervious surface, however the site stormwater system has been oversized to also include 0.5” of stormwater from the off-site public street impervious surface that currently drains to the lake untreated. This is the maximum off site stormwater treatment volume that could be accomplished with the site’s limited land area.

3.2 Rate Control

Peak runoff rate may not exceed existing conditions for the 2-YR, 10- YR, 25-YR, and 100- YR 24-hour rainfall events, utilize Atlas 14 rainfall data.

Rate control is provided by live storage within the proposed underground stormwater chamber. This information was derived using HydroCAD stormwater modeling software. The existing and proposed runoff rates are shown in the summary table below.

Overall Stormwater Rate Summary

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	8.54	4.97
10-Year Event	14.61	14.56
100-Year Event	28.76	27.78

The proposed runoff rates are less than the existing peak runoff rates – REQUIREMENT SATISFIED

3.3 Water Quality

The proposed stormwater BMP's have been designed to capture the prescribed water quality volume meeting the watershed requirements (2" over impervious surface on site) as well as off-site oversizing (0.5" over offsite impervious).

MIDS modeling shows the "before and after" TSS and TP removal efficiencies and quantities for both on-site (required) and off-site (additional benefit) pollutant removals.

MIDS demonstrates that due to the project stormwater oversizing an additional 243.8 lbs (80%) TSS and 0.839 lbs TP (50%) is removed by the project that would otherwise not be required.

Water quality treatment is provided by the proposed stormwater system meeting the watershed's water quality requirements. See attached MIDS modeling – REQUIREMENT SATISFIED

3.4 Volume Control

Stormwater runoff volume must be reduced by 1.0" over all new and reconstructed impervious surfaces (includes all newly constructed impervious surfaces, i.e. all impervious disturbed and reconstructed as well as new impervious). If volume reduction is not feasible due to poor soils, then 2.0" of filtration is an acceptable alternative.

Water quality and volume control requirements are met by providing filtration onsite in the amount equal to 2.0 inches of runoff from the new or reconstructed impervious surfaces. The proposed chamber and filtration system will be utilized to meet these requirements.

The system is also oversized to include off-site stormwater treatment equivalent to 0.5" of runoff over the adjacent contributing public street impervious surface area.

Stormwater Water Quality and Volume Summary

Drainage Area	Required Infiltration Vol. Summary		Filtration Volume = 2x1.0"*Dist. Impv. 2" 2" 0.5" N/A
	New Impv. Area (sf)	Required Volume (cf)	
PR1	289	48	
PR2	21079	3513	
PR3	42677	1778	
PR4	0		
TOTAL	21368	5340	

Proposed BMP Area	Provided Vol (cf) (elev=934.70)	Drawdown Time Calculations (0.8"/Hour)		
		Volume (cf)	Treatment rate (cfs)	Drawdown Time (h)
Underground Rate Control Basin	5827	5340	0.89	1.67
TOTAL	5827			

As shown in the tables above, the proposed volume of 5,827 CF is larger than the required volume of 5,340 CF (3,561 is actual requirement) – REQUIREMENT SATISFIED, AND OVERSIZED FOR OFF-SITE AREA

4.0 Conclusions:

To the best of our knowledge, this project meets all State, City, and Watershed stormwater management requirements.

**Lake Minnetonka Flats
Civil Site Group - Stormwater Calculations**

Existing Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
EX1	3046	98	56454	74	59500	75
EX2	42143	98	2232	74	44375	97
EX3	31086	98	21978	74	53064	88

Proposed Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1	289	98	33021	61	33310	61
PR2	21079	98	5111	61	26190	91
PR3	42677	98	1698	61	44375	97
PR4	31086	98	21978	61	53064	83

Site Area Summary

	Impervious [SF]	Impervious [AC]	Pervious [SF]	Pervious [AC]	Total [SF]	Total [AC]
Existing Site	76275	1.75	80664	1.85	156939	3.60
Proposed Site	95131	2.18	61808	1.42	156939	3.60

Stormwater Rate Summary

Drainage Area	Existing Rate (cfs)		
	2-YR [2.86"]	10-YR [4.26"]	100-YR [7.32"]
EX1	1.83	3.97	9.33
EX2	3.55	5.38	9.39
EX3	3.18	5.26	10.05
TOTAL (REACH)	8.54	14.61	28.76

Drainage Area	Proposed Conditions Rate (cfs)		
	2-YR [2.86"]	10-YR [4.26"]	100-YR [7.32"]
PR1	0.95	2.14	5.13
1P (PR2, 3, 4)	4.40	12.52	22.82
TOTAL (REACH)	4.97	14.56	27.78

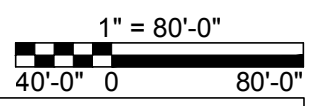
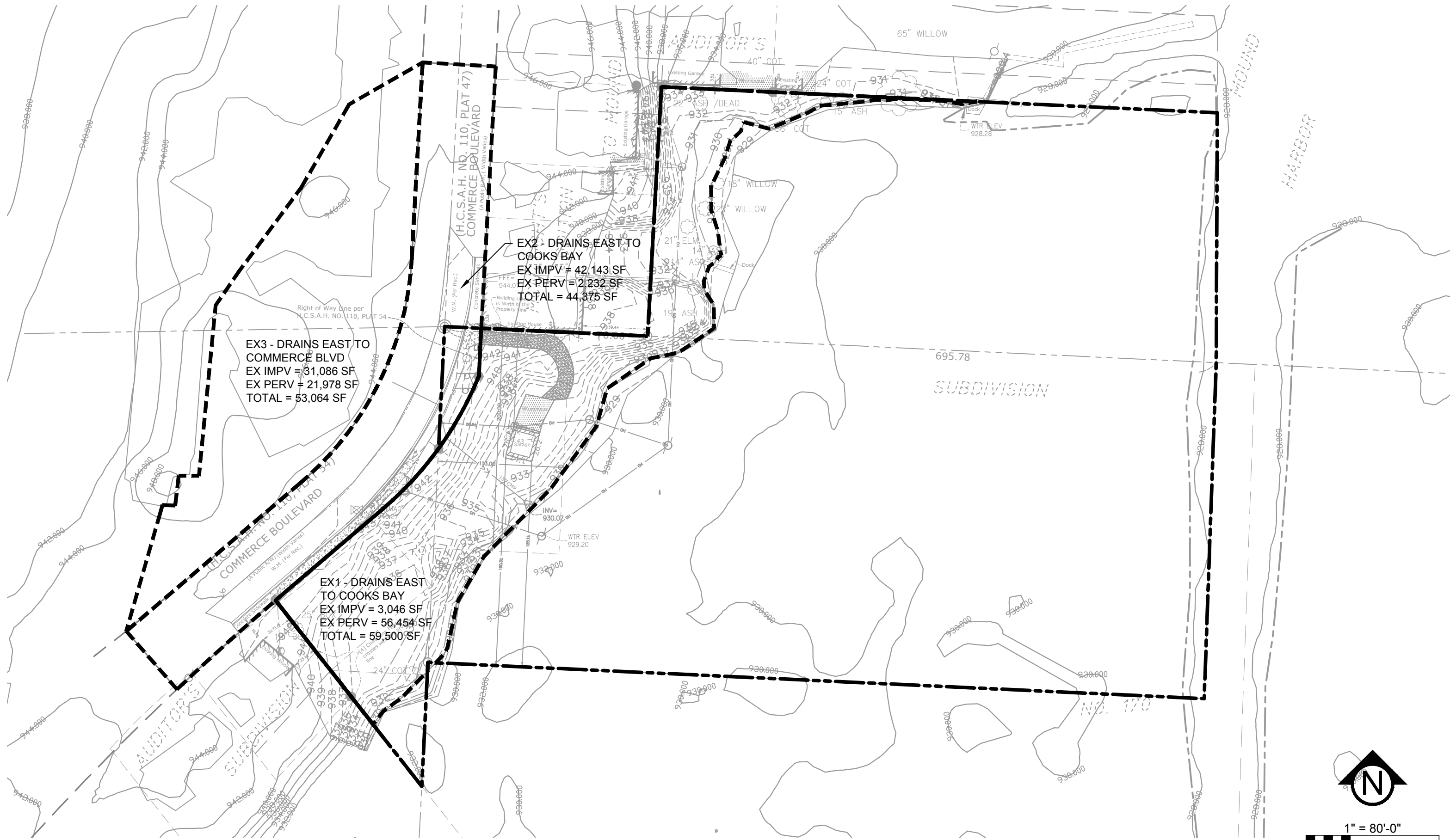
Overall Stormwater Rate Summary

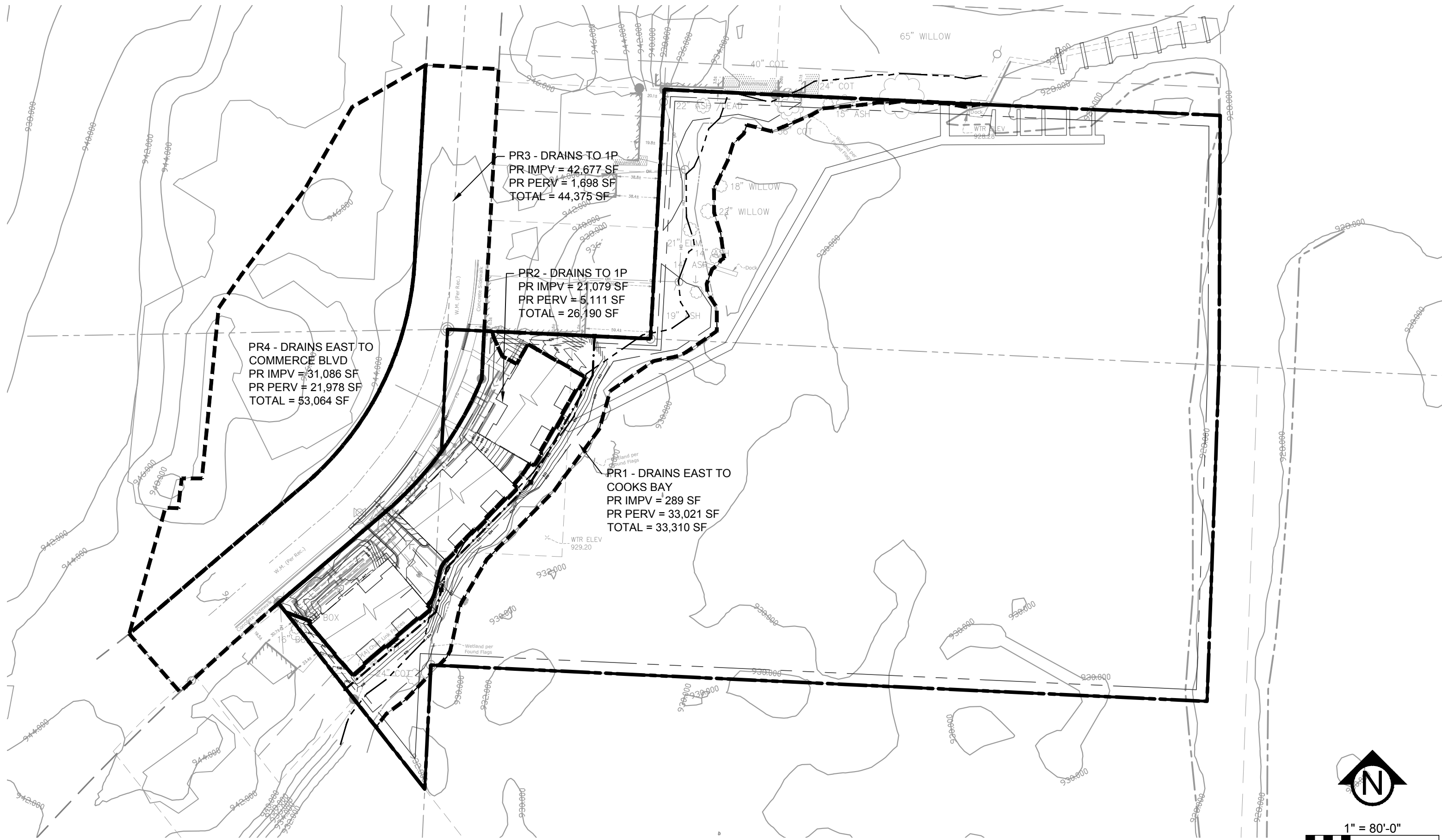
	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	8.54	4.97
10-Year Event	14.61	14.56
100-Year Event	28.76	27.78

Stormwater Water Quality and Volume Summary

Drainage Area	Required Infiltration Vol. Summary		Filtration Volume = 2x1.0**Dist. Impv. Area
	New Impv. Area (sf)	Required Volume (cf)	
PR1	289	48	2"
PR2	21079	3513	2"
PR3	42677	1778	0.5"
PR4	0		N/A
TOTAL	21368	5340	

Proposed BMP Area	Provided Vol (cf) (elev=934.70)	Drawdown Time Calculations (0.8"/Hour)		
		Volume (cf)	Treatment rate (cfs)	Drawdown Time (h)
Underground Rate Control Basin	5827	5340	0.89	1.67
TOTAL	5827			



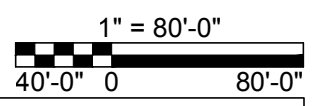


PR4 - DRAINS EAST TO
COMMERCE BLVD
PR IMPV = 31,086 SF
PR PERV = 21,978 SF
TOTAL = 53,064 SF

PR3 - DRAINS TO 1P
PR IMPV = 42,677 SF
PR PERV = 1,698 SF
TOTAL = 44,375 SF

PR2 - DRAINS TO 1P
PR IMPV = 21,079 SF
PR PERV = 5,111 SF
TOTAL = 26,190 SF

PR1 - DRAINS EAST TO
COOKS BAY
PR IMPV = 289 SF
PR PERV = 33,021 SF
TOTAL = 33,310 SF

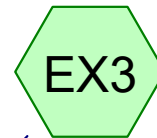




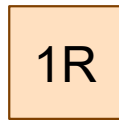
EX 1 - DRAINS EAST TO COOKS BAY



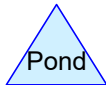
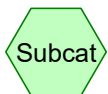
EX 2 - DRAINS EAST TO COOKS BAY



EX 3 - DRAINS EAST TO COMMERCE BLVD



TOTAL TO COOKS BAY



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Project Notes

Rainfall events imported from "Atlas-14-Rain.txt" for 543 MN Hennepin

Rainfall events imported from "Atlas-14-Rain.txt" for 543 MN Hennepin

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year 24-Hour	MSE 24-hr	3	Default	24.00	1	2.86	2
2	10-Year 24-Hour	MSE 24-hr	3	Default	24.00	1	4.26	2
3	100-Year 24-Hour	MSE 24-hr	3	Default	24.00	1	7.32	2

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.852	74	>75% Grass cover, Good, HSG C (EX1, EX2, EX3)
1.751	98	Paved parking, HSG C (EX1, EX2, EX3)
3.603	86	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.603	HSG C	EX1, EX2, EX3
0.000	HSG D	
0.000	Other	
3.603		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.852	0.000	0.000	1.852	>75% Grass cover, Good	EX1, EX2, EX3
0.000	0.000	1.751	0.000	0.000	1.751	Paved parking	EX1, EX2, EX3
0.000	0.000	3.603	0.000	0.000	3.603	TOTAL AREA	

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX 1 - DRAINS EAST Runoff Area=59,500 sf 5.12% Impervious Runoff Depth=0.91"
Tc=10.0 min CN=WQ Runoff=1.83 cfs 0.104 af

SubcatchmentEX2: EX 2 - DRAINS EAST Runoff Area=44,375 sf 94.97% Impervious Runoff Depth=2.54"
Tc=10.0 min CN=WQ Runoff=3.55 cfs 0.215 af

SubcatchmentEX3: EX 3 - DRAINS EAST Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=1.88"
Tc=10.0 min CN=WQ Runoff=3.18 cfs 0.191 af

Reach 1R: TOTAL TO COOKS BAY Inflow=8.54 cfs 0.510 af
Outflow=8.54 cfs 0.510 af

Total Runoff Area = 3.603 ac Runoff Volume = 0.510 af Average Runoff Depth = 1.70"
51.40% Pervious = 1.852 ac 48.60% Impervious = 1.751 ac

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment EX1: EX 1 - DRAINS EAST TO COOKS BAY

Runoff = 1.83 cfs @ 12.18 hrs, Volume= 0.104 af, Depth= 0.91"
Routed to Reach 1R : TOTAL TO COOKS BAY

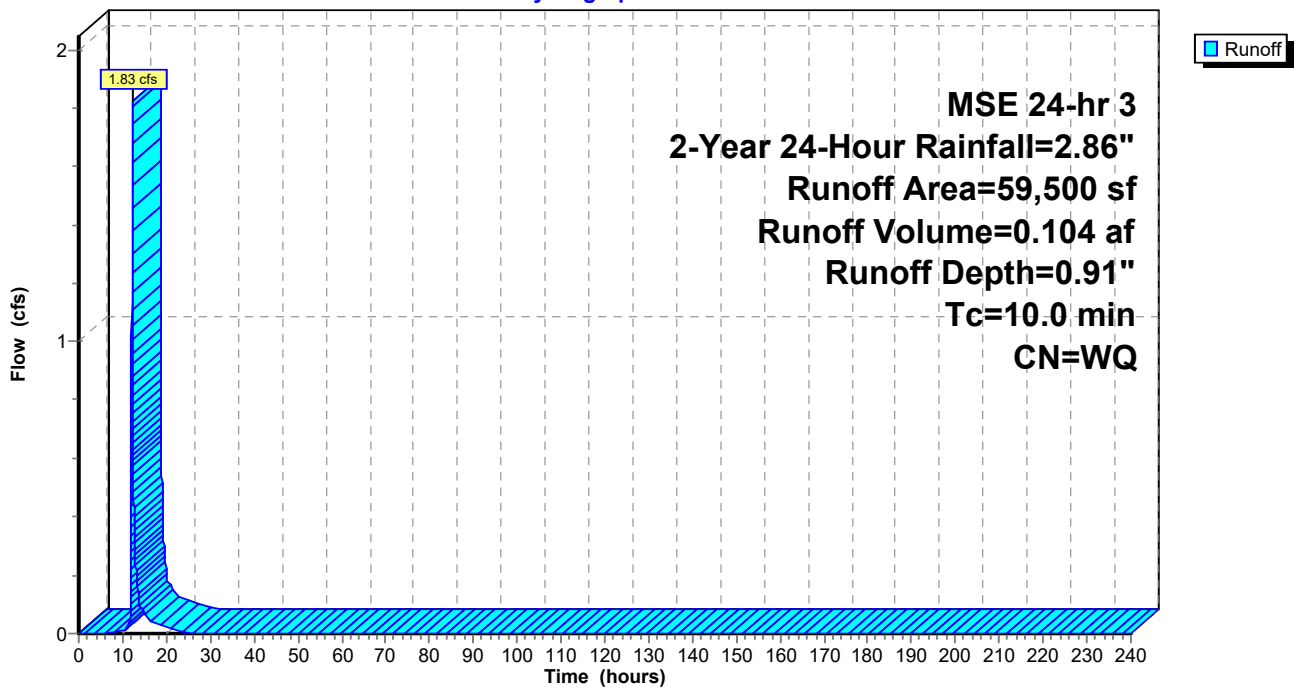
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
3,046	98	Paved parking, HSG C
56,454	74	>75% Grass cover, Good, HSG C
59,500		Weighted Average
56,454		94.88% Pervious Area
3,046		5.12% Impervious Area

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

Subcatchment EX1: EX 1 - DRAINS EAST TO COOKS BAY

Hydrograph



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EXISTING

MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment EX2: EX 2 - DRAINS EAST TO COOKS BAY

Runoff = 3.55 cfs @ 12.17 hrs, Volume= 0.215 af, Depth= 2.54"
Routed to Reach 1R : TOTAL TO COOKS BAY

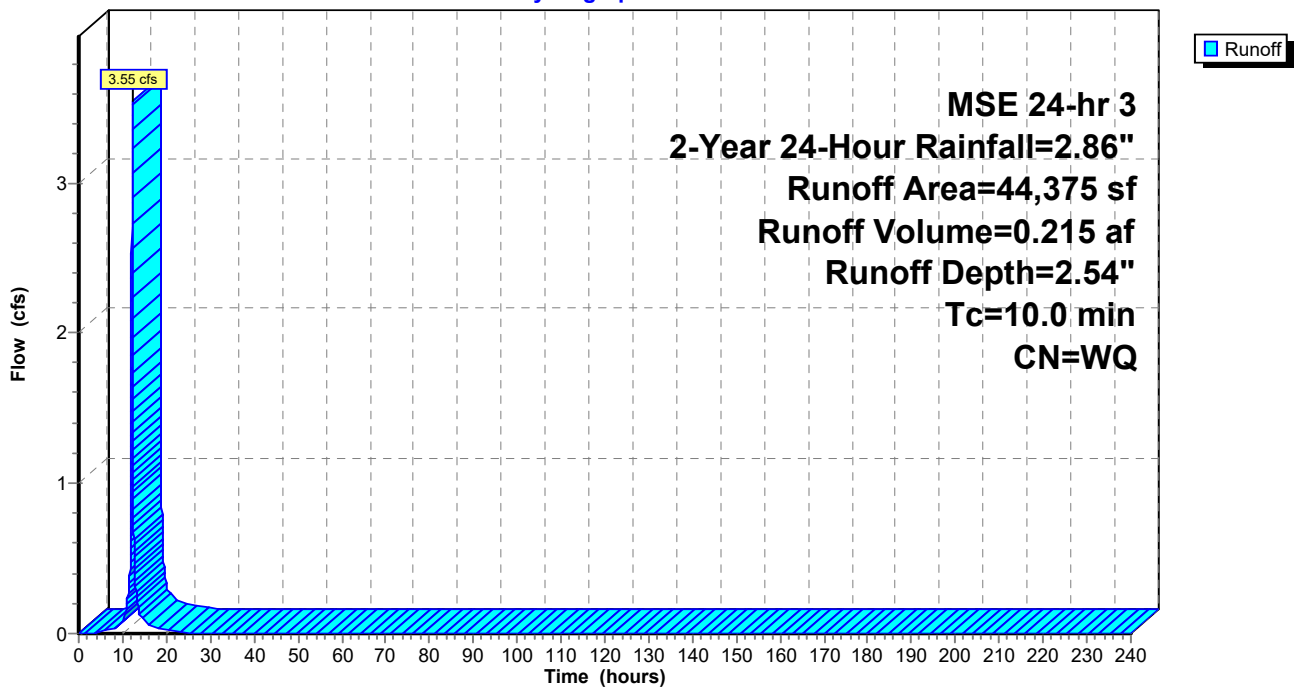
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
42,143	98	Paved parking, HSG C
2,232	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
2,232		5.03% Pervious Area
42,143		94.97% Impervious Area

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

Subcatchment EX2: EX 2 - DRAINS EAST TO COOKS BAY

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment EX3: EX 3 - DRAINS EAST TO COMMERCE BLVD

Runoff = 3.18 cfs @ 12.17 hrs, Volume= 0.191 af, Depth= 1.88"
Routed to Reach 1R : TOTAL TO COOKS BAY

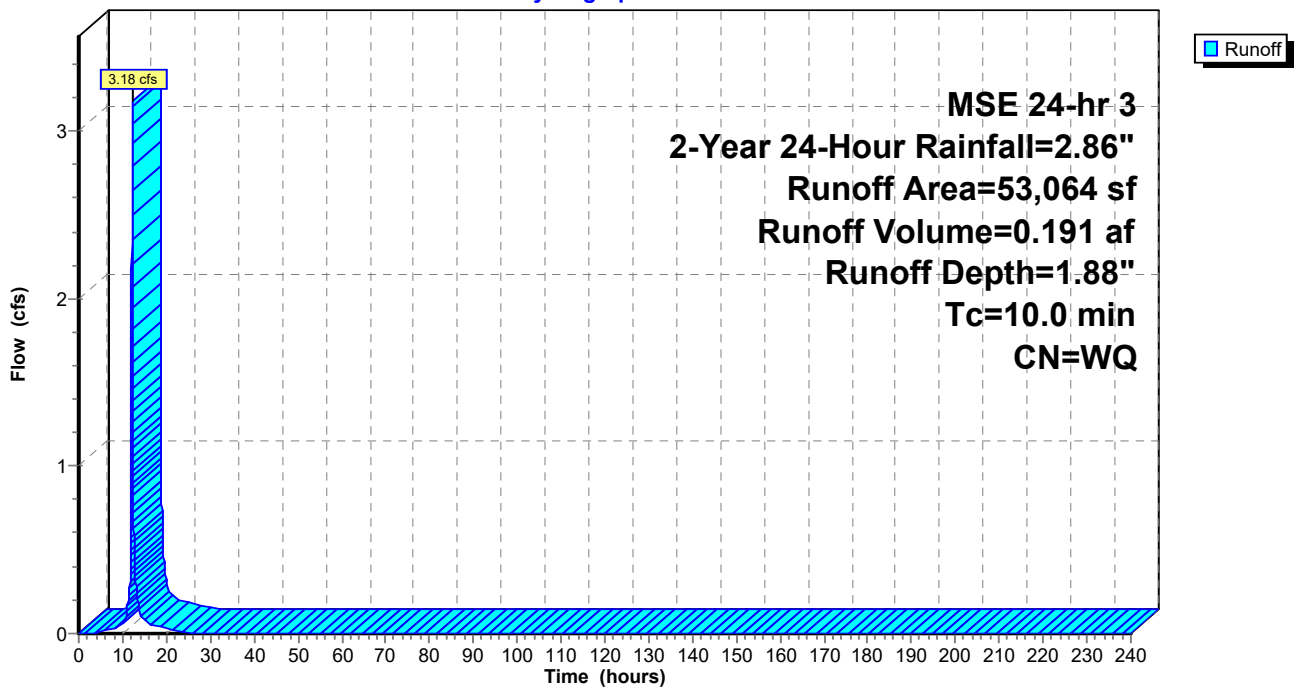
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment EX3: EX 3 - DRAINS EAST TO COMMERCE BLVD

Hydrograph



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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Reach 1R: TOTAL TO COOKS BAY

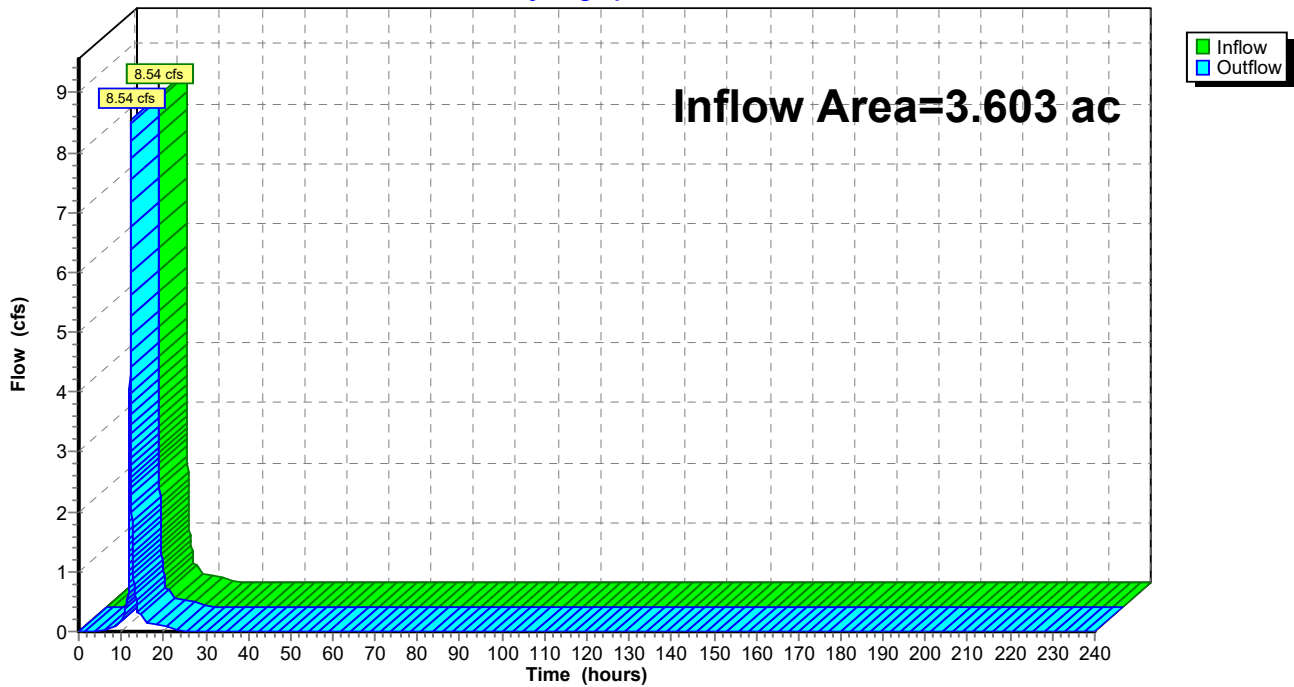
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 48.60% Impervious, Inflow Depth = 1.70" for 2-Year 24-Hour event
Inflow = 8.54 cfs @ 12.17 hrs, Volume= 0.510 af
Outflow = 8.54 cfs @ 12.17 hrs, Volume= 0.510 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

Hydrograph



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EXISTING
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX 1 - DRAINS EAST Runoff Area=59,500 sf 5.12% Impervious Runoff Depth=1.90"
Tc=10.0 min CN=WQ Runoff=3.97 cfs 0.217 af

SubcatchmentEX2: EX 2 - DRAINS EAST Runoff Area=44,375 sf 94.97% Impervious Runoff Depth=3.91"
Tc=10.0 min CN=WQ Runoff=5.38 cfs 0.332 af

SubcatchmentEX3: EX 3 - DRAINS EAST Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=3.10"
Tc=10.0 min CN=WQ Runoff=5.26 cfs 0.315 af

Reach 1R: TOTAL TO COOKS BAY

Inflow=14.61 cfs 0.863 af
Outflow=14.61 cfs 0.863 af

Total Runoff Area = 3.603 ac Runoff Volume = 0.863 af Average Runoff Depth = 2.88"
51.40% Pervious = 1.852 ac 48.60% Impervious = 1.751 ac

23360 - EXISTING

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EXISTING
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment EX1: EX 1 - DRAINS EAST TO COOKS BAY

Runoff = 3.97 cfs @ 12.18 hrs, Volume= 0.217 af, Depth= 1.90"
Routed to Reach 1R : TOTAL TO COOKS BAY

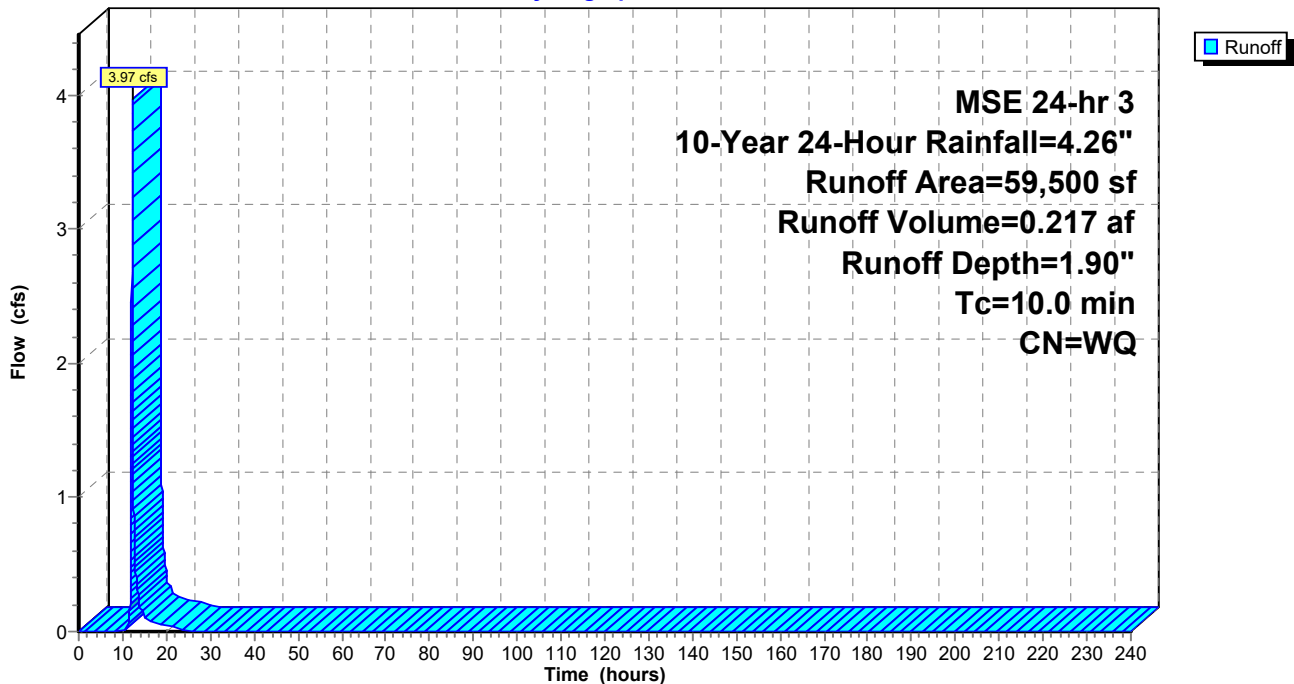
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
3,046	98	Paved parking, HSG C
56,454	74	>75% Grass cover, Good, HSG C
59,500		Weighted Average
56,454		94.88% Pervious Area
3,046		5.12% Impervious Area

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

Subcatchment EX1: EX 1 - DRAINS EAST TO COOKS BAY

Hydrograph



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EXISTING
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment EX2: EX 2 - DRAINS EAST TO COOKS BAY

Runoff = 5.38 cfs @ 12.17 hrs, Volume= 0.332 af, Depth= 3.91"
Routed to Reach 1R : TOTAL TO COOKS BAY

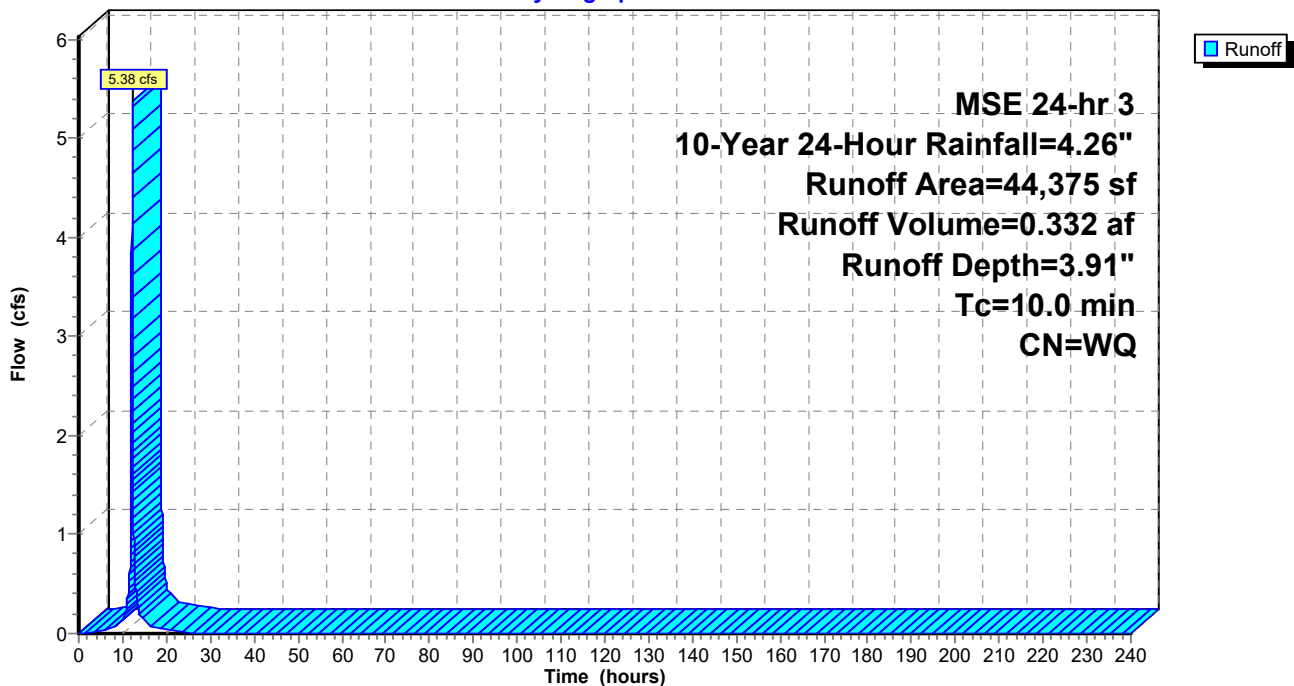
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
42,143	98	Paved parking, HSG C
2,232	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
2,232		5.03% Pervious Area
42,143		94.97% Impervious Area

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

Subcatchment EX2: EX 2 - DRAINS EAST TO COOKS BAY

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EXISTING
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment EX3: EX 3 - DRAINS EAST TO COMMERCE BLVD

Runoff = 5.26 cfs @ 12.17 hrs, Volume= 0.315 af, Depth= 3.10"
Routed to Reach 1R : TOTAL TO COOKS BAY

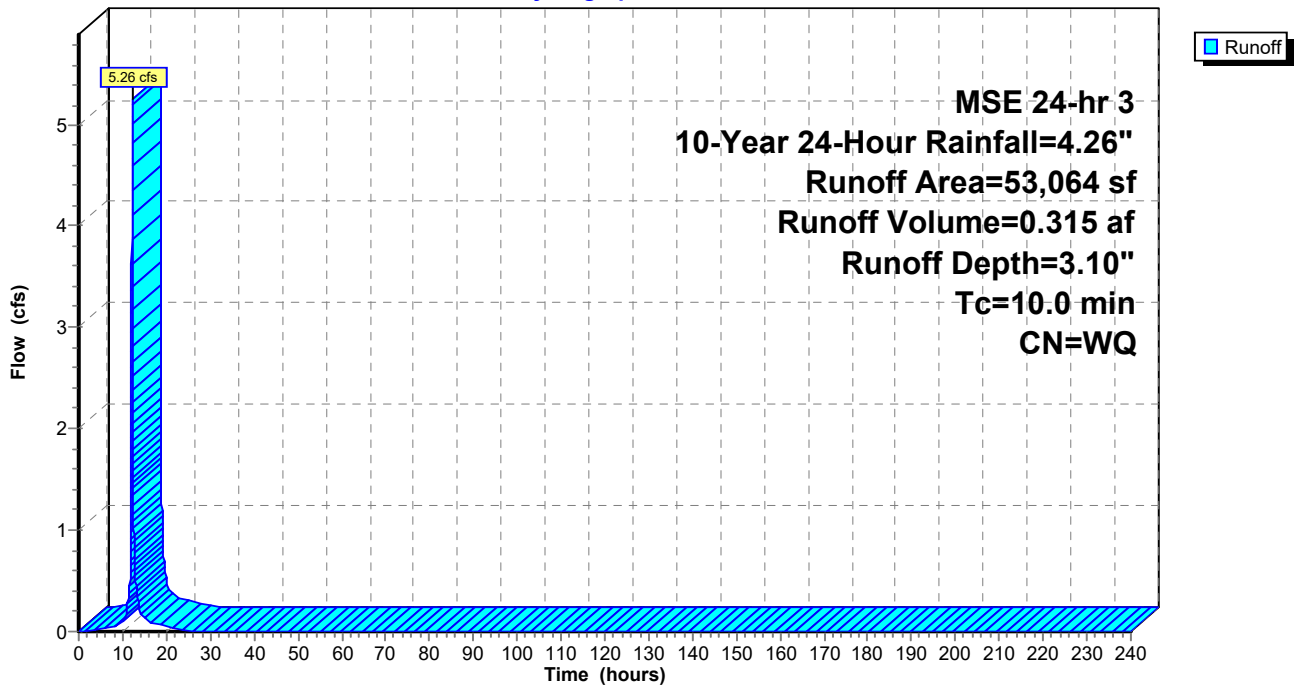
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment EX3: EX 3 - DRAINS EAST TO COMMERCE BLVD

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EXISTING
MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Reach 1R: TOTAL TO COOKS BAY

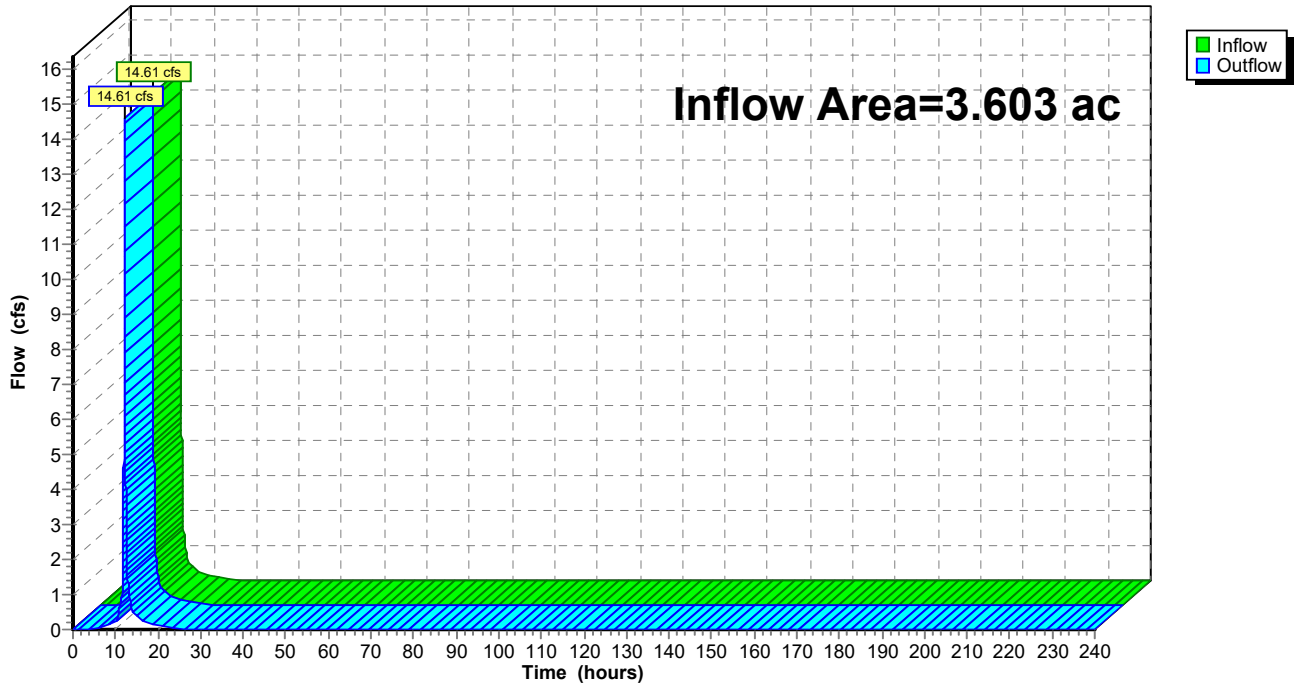
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 48.60% Impervious, Inflow Depth = 2.88" for 10-Year 24-Hour event
Inflow = 14.61 cfs @ 12.17 hrs, Volume= 0.863 af
Outflow = 14.61 cfs @ 12.17 hrs, Volume= 0.863 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

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EXISTING
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX 1 - DRAINS EAST Runoff Area=59,500 sf 5.12% Impervious Runoff Depth=4.46"
Tc=10.0 min CN=WQ Runoff=9.33 cfs 0.508 af

SubcatchmentEX2: EX 2 - DRAINS EAST Runoff Area=44,375 sf 94.97% Impervious Runoff Depth=6.94"
Tc=10.0 min CN=WQ Runoff=9.39 cfs 0.589 af

SubcatchmentEX3: EX 3 - DRAINS EAST Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=5.94"
Tc=10.0 min CN=WQ Runoff=10.05 cfs 0.603 af

Reach 1R: TOTAL TO COOKS BAY

Inflow=28.76 cfs 1.700 af
Outflow=28.76 cfs 1.700 af

Total Runoff Area = 3.603 ac Runoff Volume = 1.700 af Average Runoff Depth = 5.66"
51.40% Pervious = 1.852 ac 48.60% Impervious = 1.751 ac

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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment EX1: EX 1 - DRAINS EAST TO COOKS BAY

Runoff = 9.33 cfs @ 12.18 hrs, Volume= 0.508 af, Depth= 4.46"
Routed to Reach 1R : TOTAL TO COOKS BAY

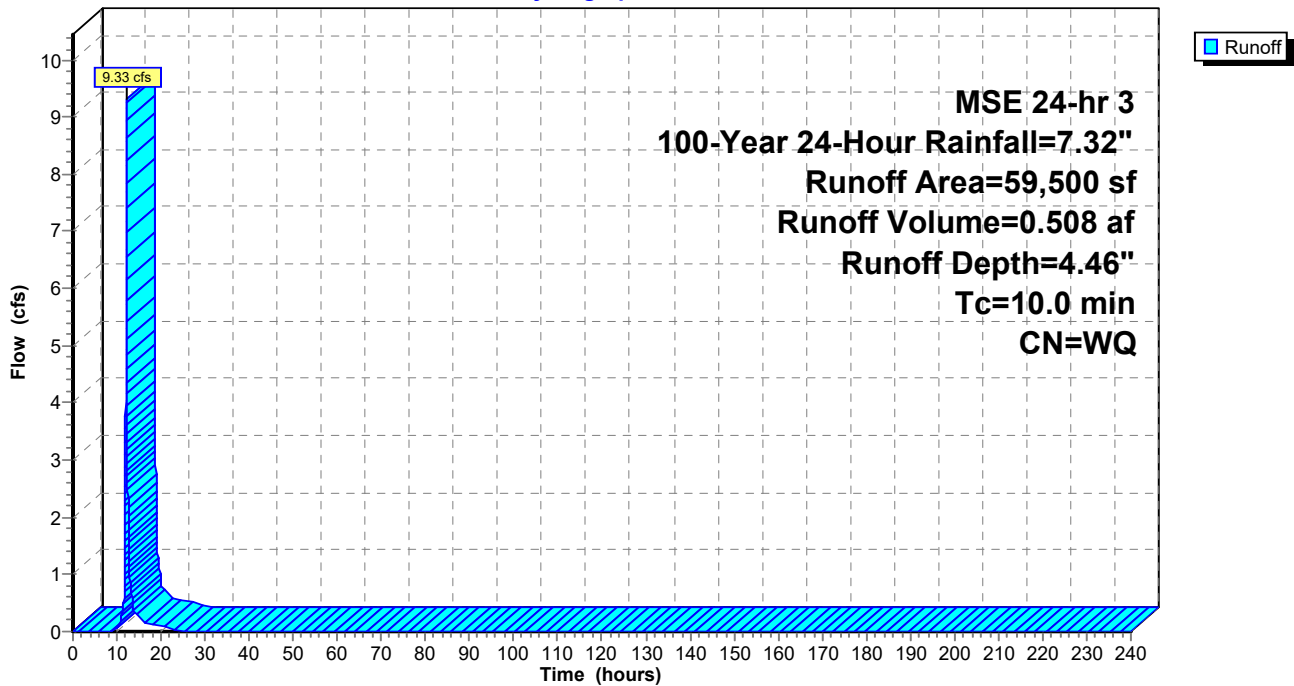
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
3,046	98	Paved parking, HSG C
56,454	74	>75% Grass cover, Good, HSG C
59,500		Weighted Average
56,454		94.88% Pervious Area
3,046		5.12% Impervious Area

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

Subcatchment EX1: EX 1 - DRAINS EAST TO COOKS BAY

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EXISTING
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment EX2: EX 2 - DRAINS EAST TO COOKS BAY

Runoff = 9.39 cfs @ 12.17 hrs, Volume= 0.589 af, Depth= 6.94"
Routed to Reach 1R : TOTAL TO COOKS BAY

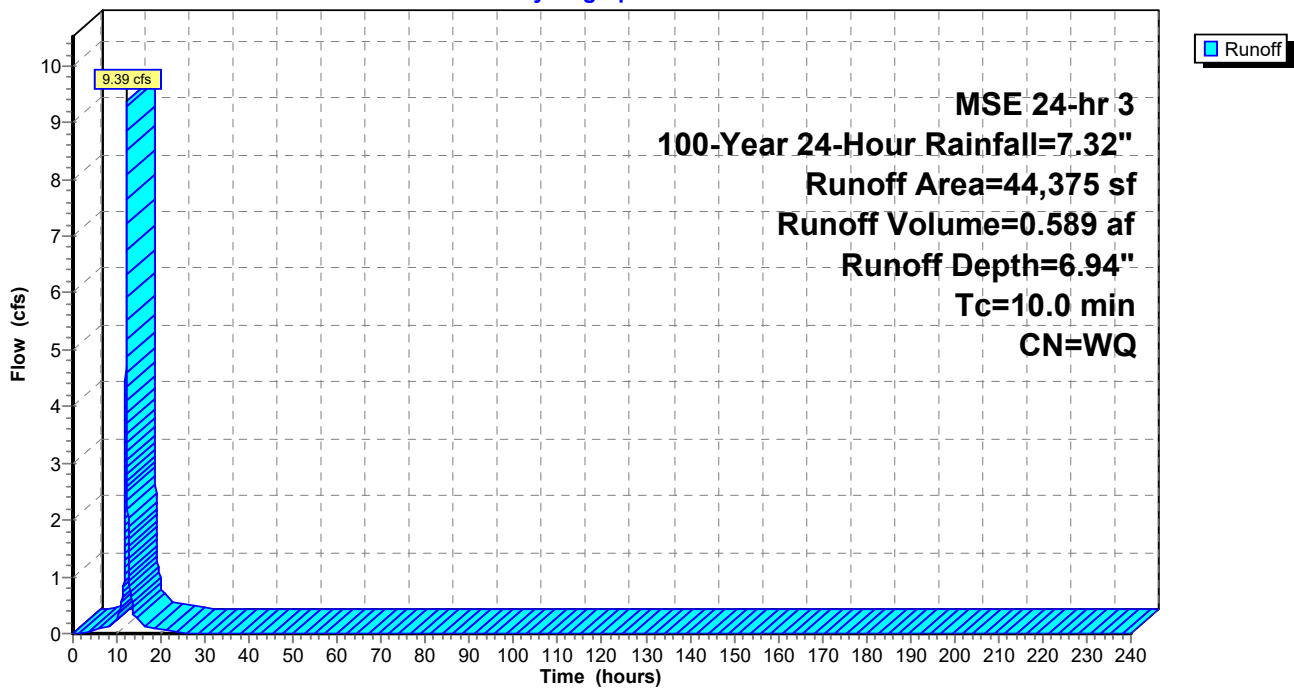
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
42,143	98	Paved parking, HSG C
2,232	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
2,232		5.03% Pervious Area
42,143		94.97% Impervious Area

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

Subcatchment EX2: EX 2 - DRAINS EAST TO COOKS BAY

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EXISTING
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment EX3: EX 3 - DRAINS EAST TO COMMERCE BLVD

Runoff = 10.05 cfs @ 12.17 hrs, Volume= 0.603 af, Depth= 5.94"
Routed to Reach 1R : TOTAL TO COOKS BAY

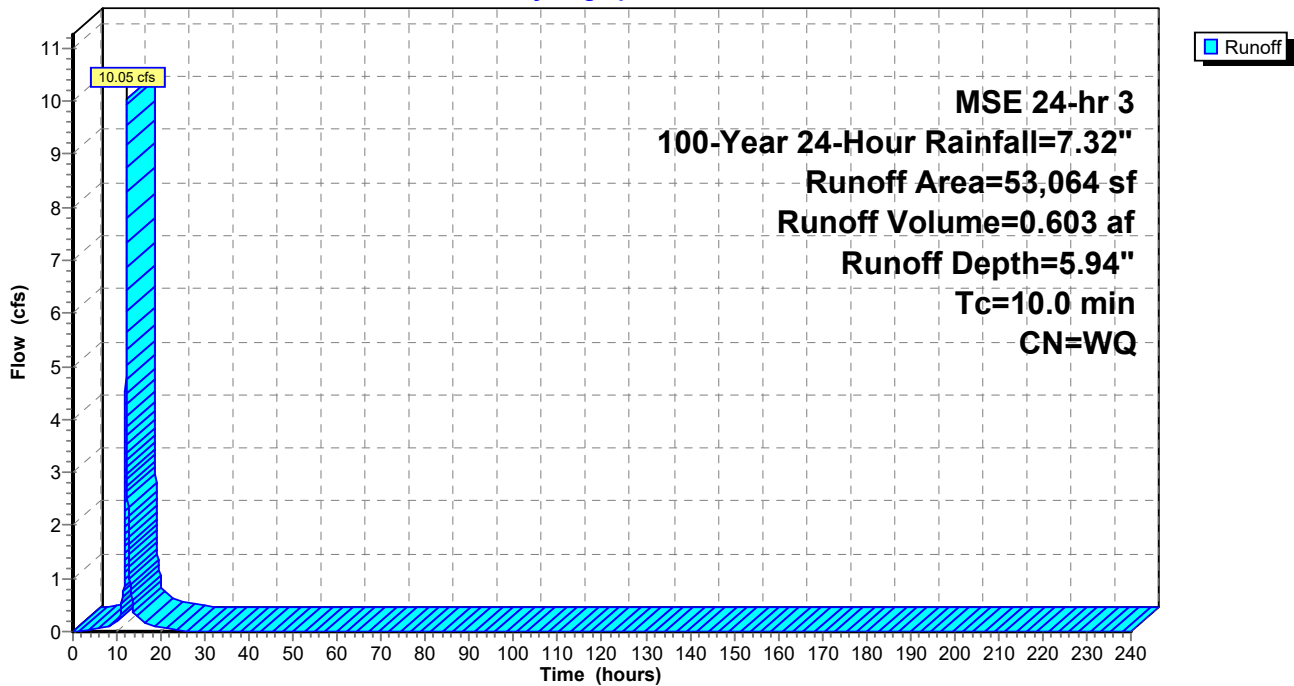
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment EX3: EX 3 - DRAINS EAST TO COMMERCE BLVD

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EXISTING
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Reach 1R: TOTAL TO COOKS BAY

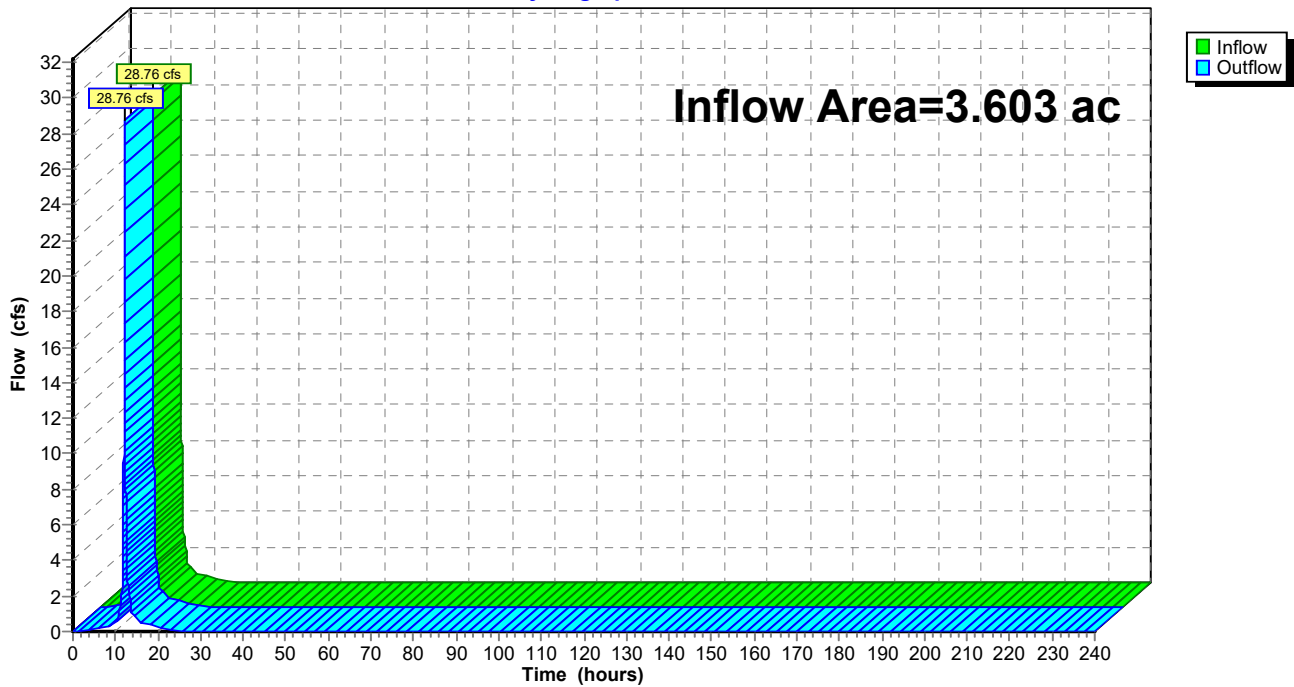
[40] Hint: Not Described (Outflow=Inflow)

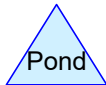
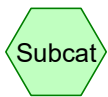
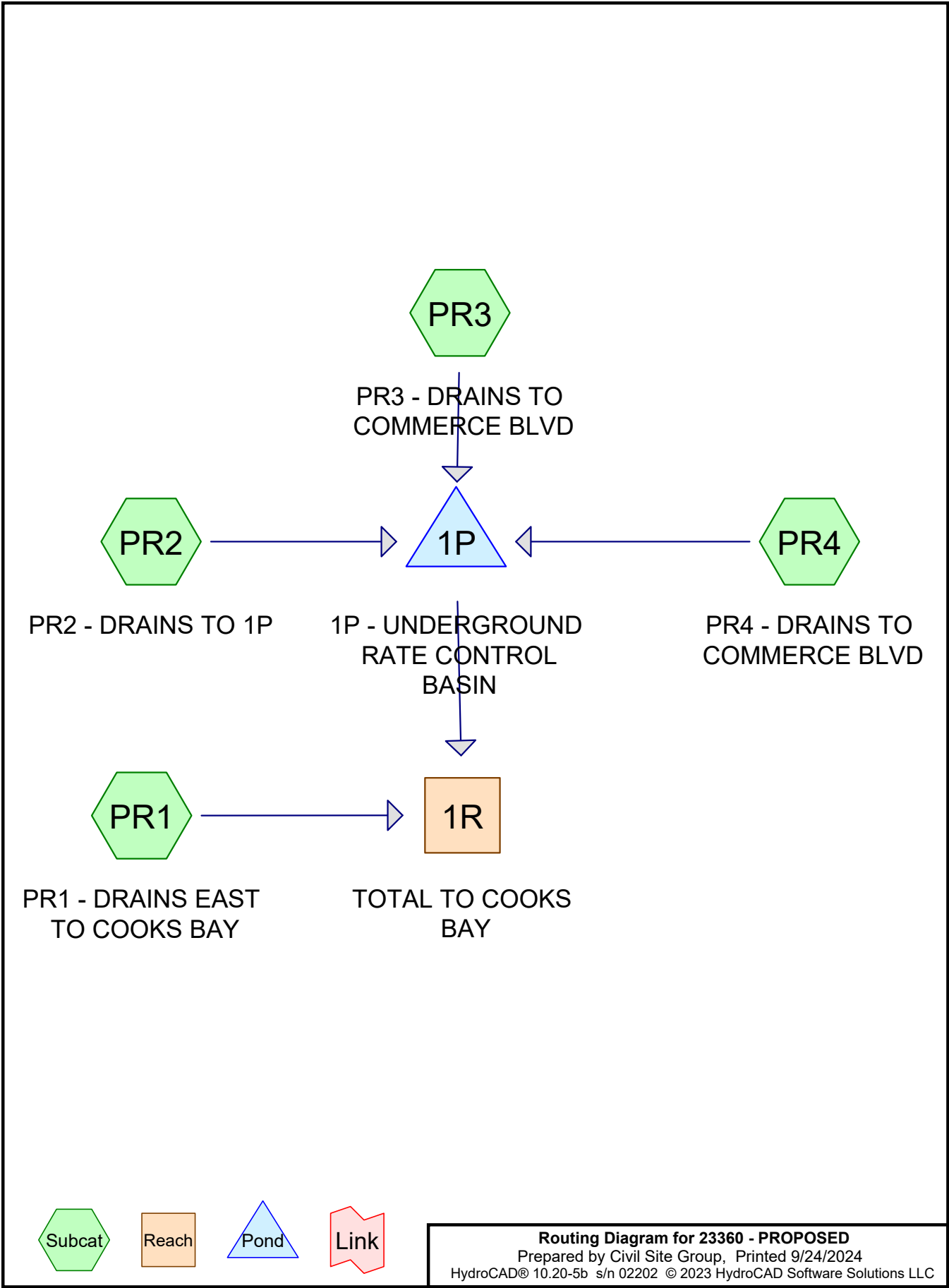
Inflow Area = 3.603 ac, 48.60% Impervious, Inflow Depth = 5.66" for 100-Year 24-Hour event
Inflow = 28.76 cfs @ 12.17 hrs, Volume= 1.700 af
Outflow = 28.76 cfs @ 12.17 hrs, Volume= 1.700 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

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Routing Diagram for 23360 - PROPOSED
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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year 24-Hour	MSE 24-hr	3	Default	24.00	1	2.86	2
2	10-Year 24-Hour	MSE 24-hr	3	Default	24.00	1	4.26	2
3	100-Year 24-Hour	MSE 24-hr	3	Default	24.00	1	7.32	2
4	2" WQ	MSE 24-hr	3	Default	24.00	1	2.00	2
5	1" WQ	MSE 24-hr	3	Default	24.00	1	1.00	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.419	74	>75% Grass cover, Good, HSG C (PR1, PR2, PR3, PR4)
2.184	98	Paved parking, HSG C (PR1, PR2, PR3, PR4)
3.603	89	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.603	HSG C	PR1, PR2, PR3, PR4
0.000	HSG D	
0.000	Other	
3.603		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.419	0.000	0.000	1.419	>75% Grass cover, Good	PR1, PR2, PR3, PR4
0.000	0.000	2.184	0.000	0.000	2.184	Paved parking	PR1, PR2, PR3, PR4
0.000	0.000	3.603	0.000	0.000	3.603	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1P	929.86	929.50	56.0	0.0064	0.012	0.0	21.0	0.0	

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentPR1: PR1 - DRAINS EAST Runoff Area=33,310 sf 0.87% Impervious Runoff Depth=0.84"
Tc=10.0 min CN=WQ Runoff=0.95 cfs 0.053 af

SubcatchmentPR2: PR2 - DRAINS TO 1P Runoff Area=26,190 sf 80.48% Impervious Runoff Depth=2.28"
Tc=10.0 min CN=WQ Runoff=1.89 cfs 0.114 af

SubcatchmentPR3: PR3 - DRAINS TO Runoff Area=44,375 sf 96.17% Impervious Runoff Depth=2.56"
Tc=10.0 min CN=WQ Runoff=3.58 cfs 0.217 af

SubcatchmentPR4: PR4 - DRAINS TO Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=1.88"
Tc=10.0 min CN=WQ Runoff=3.18 cfs 0.191 af

Reach 1R: TOTAL TO COOKS BAY Inflow=4.97 cfs 0.575 af
Outflow=4.97 cfs 0.575 af

Pond 1P: 1P - UNDERGROUND RATE Peak Elev=935.22' Storage=6,556 cf Inflow=8.64 cfs 0.522 af
Outflow=4.40 cfs 0.522 af

Total Runoff Area = 3.603 ac Runoff Volume = 0.575 af Average Runoff Depth = 1.92"
39.38% Pervious = 1.419 ac 60.62% Impervious = 2.184 ac

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Runoff = 0.95 cfs @ 12.19 hrs, Volume= 0.053 af, Depth= 0.84"
 Routed to Reach 1R : TOTAL TO COOKS BAY

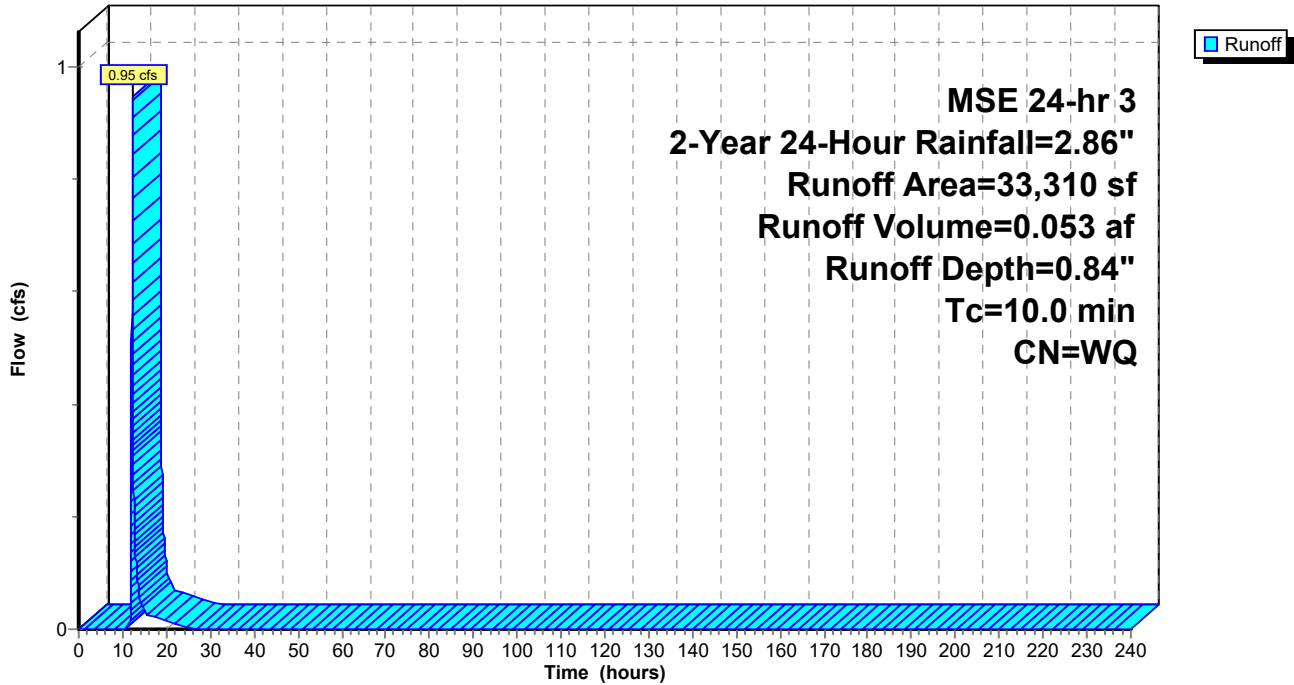
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
289	98	Paved parking, HSG C
33,021	74	>75% Grass cover, Good, HSG C
33,310		Weighted Average
33,021		99.13% Pervious Area
289		0.87% Impervious Area

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

Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Hydrograph



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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment PR2: PR2 - DRAINS TO 1P

Runoff = 1.89 cfs @ 12.17 hrs, Volume= 0.114 af, Depth= 2.28"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

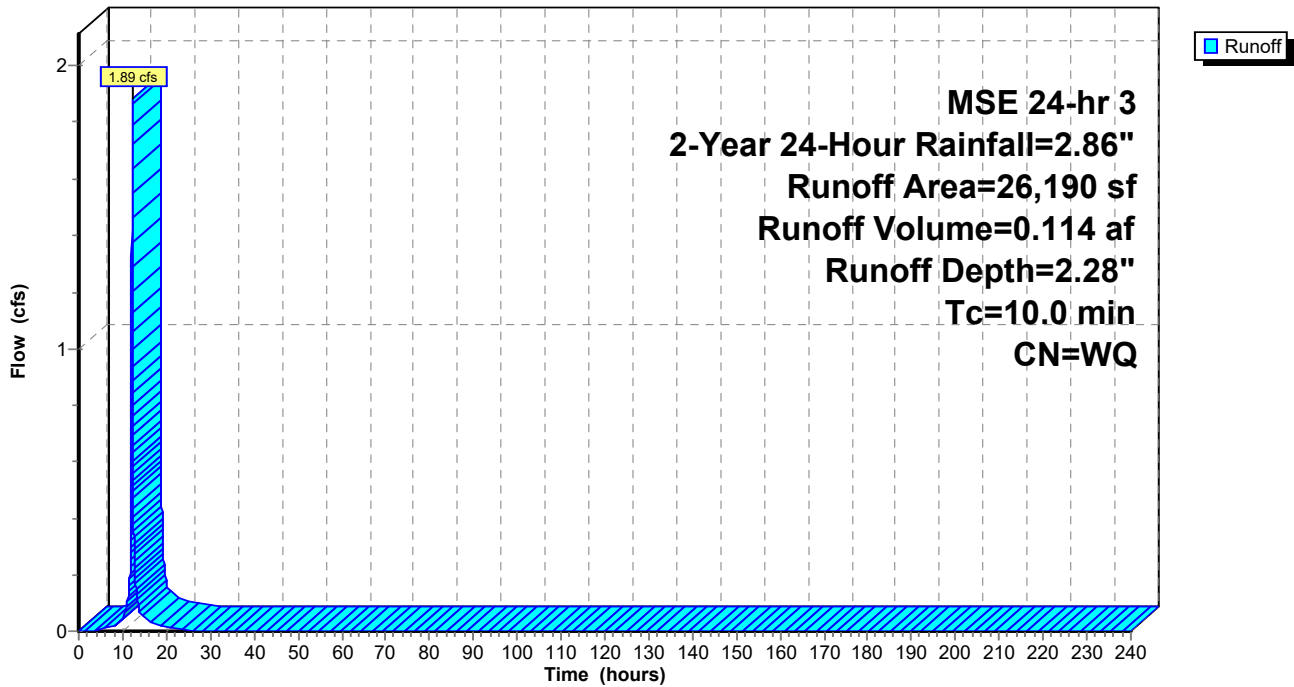
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
21,079	98	Paved parking, HSG C
5,111	74	>75% Grass cover, Good, HSG C
26,190		Weighted Average
5,111		19.52% Pervious Area
21,079		80.48% Impervious Area

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

Subcatchment PR2: PR2 - DRAINS TO 1P

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Runoff = 3.58 cfs @ 12.17 hrs, Volume= 0.217 af, Depth= 2.56"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

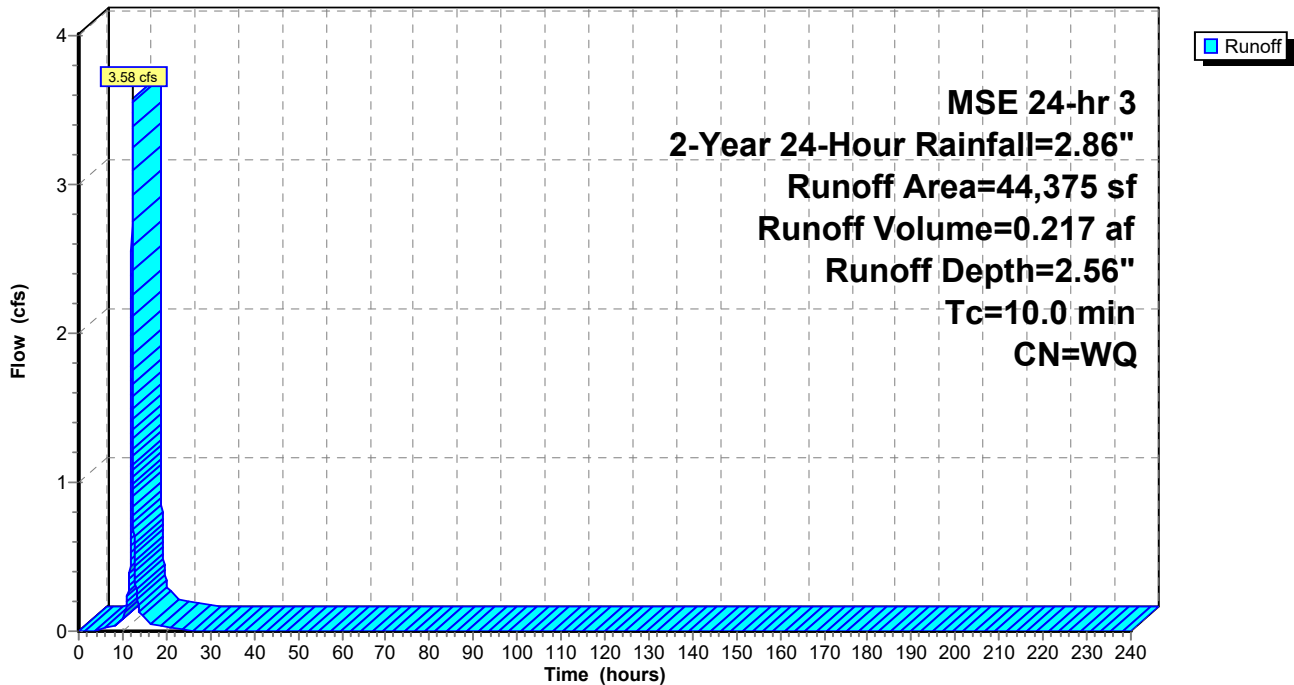
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
42,677	98	Paved parking, HSG C
1,698	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
1,698		3.83% Pervious Area
42,677		96.17% Impervious Area

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

Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Runoff = 3.18 cfs @ 12.17 hrs, Volume= 0.191 af, Depth= 1.88"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

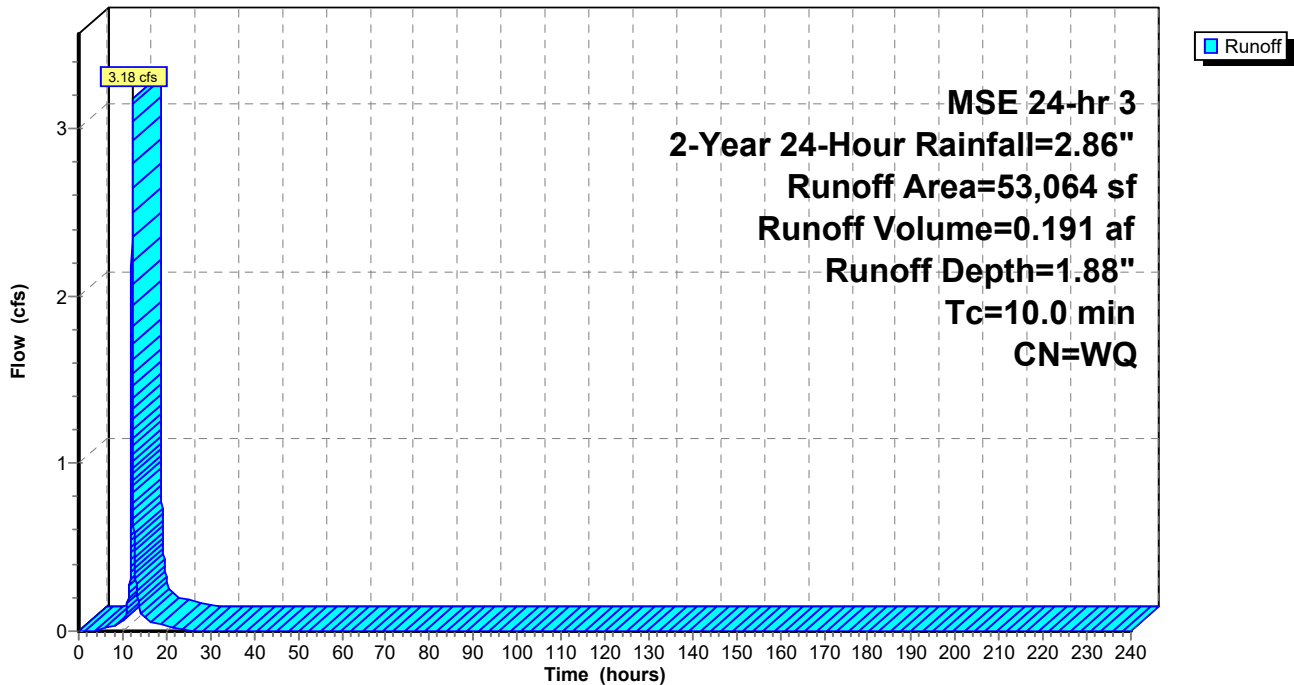
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Hydrograph



Summary for Reach 1R: TOTAL TO COOKS BAY

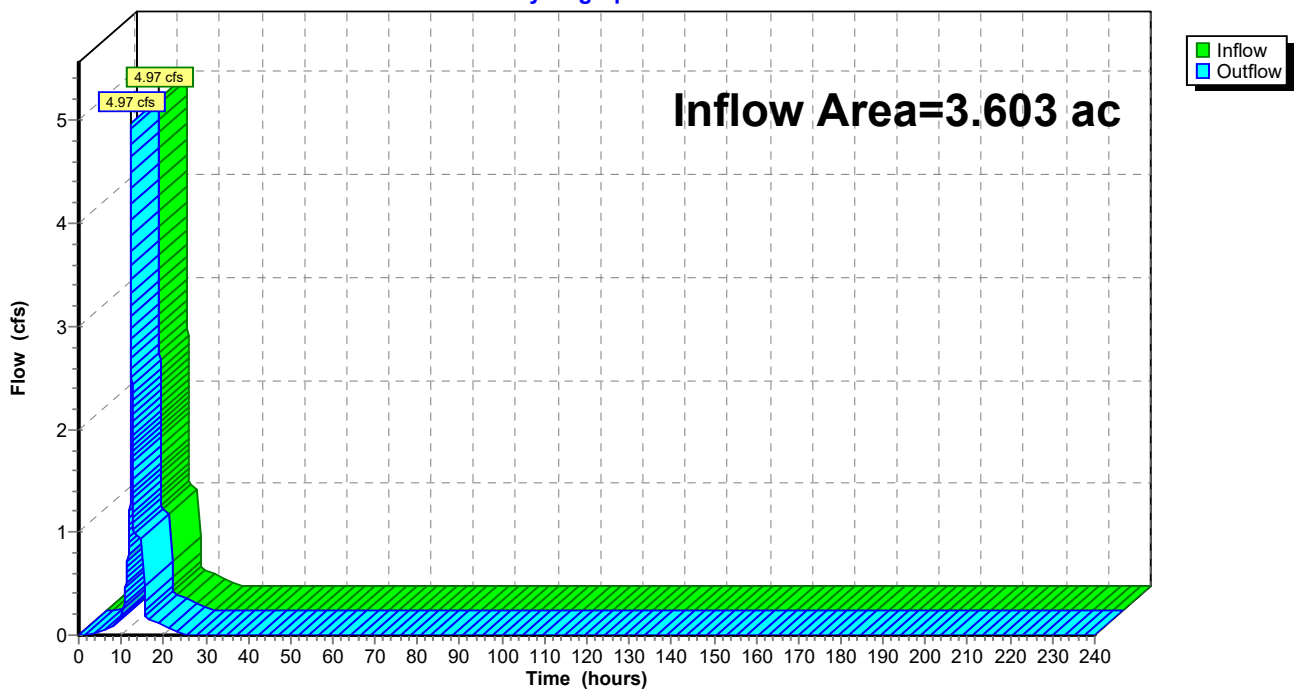
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 60.62% Impervious, Inflow Depth = 1.92" for 2-Year 24-Hour event
Inflow = 4.97 cfs @ 12.30 hrs, Volume= 0.575 af
Outflow = 4.97 cfs @ 12.30 hrs, Volume= 0.575 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

Hydrograph



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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Summary for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Inflow Area = 2.838 ac, 76.72% Impervious, Inflow Depth = 2.21" for 2-Year 24-Hour event
 Inflow = 8.64 cfs @ 12.17 hrs, Volume= 0.522 af
 Outflow = 4.40 cfs @ 12.31 hrs, Volume= 0.522 af, Atten= 49%, Lag= 8.1 min
 Primary = 4.40 cfs @ 12.31 hrs, Volume= 0.522 af
 Routed to Reach 1R : TOTAL TO COOKS BAY

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 935.22' @ 12.31 hrs Surf.Area= 1,853 sf Storage= 6,556 cf

Plug-Flow detention time= 39.2 min calculated for 0.522 af (100% of inflow)
 Center-of-Mass det. time= 39.2 min (803.6 - 764.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	930.50'	3,015 cf	17.00'W x 109.00'L x 7.33'H Field A 13,589 cf Overall - 6,051 cf Embedded = 7,538 cf x 40.0% Voids
#2A	930.50'	6,051 cf	CMP Round 72 x 10 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +7.00' x 28.27 sf x 2 rows
		9,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	930.50'	0.890 cfs Constant Flow/Skimmer
#2	Primary	929.86'	21.0" Round Culvert L= 56.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 929.86' / 929.50' S= 0.0064 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 2.41 sf
#3	Device 4	934.70'	3.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 2	929.86'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.39 cfs @ 12.31 hrs HW=935.22' (Free Discharge)

- ↑ **2=Culvert** (Passes 4.39 cfs of 21.63 cfs potential flow)
- ↑ **4=Orifice/Grate** (Passes 4.39 cfs of 19.69 cfs potential flow)
- ↑ **1=Constant Flow/Skimmer** (Constant Controls 0.89 cfs)
- ↑ **3=Sharp-Crested Rectangular Weir** (Weir Controls 3.50 cfs @ 2.35 fps)

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN - Chamber Wizard Field A

Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +7.00' x 28.27 sf x 2 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

5 Chambers/Row x 20.00' Long +7.00' Row Adjustment = 107.00' Row Length +12.0" End Stone x 2 = 109.00' Base Length

2 Rows x 72.0" Wide + 36.0" Spacing x 1 + 12.0" Side Stone x 2 = 17.00' Base Width

72.0" Chamber Height + 16.0" Stone Cover = 7.33' Field Height

10 Chambers x 565.5 cf +7.00' Row Adjustment x 28.27 sf x 2 Rows = 6,050.7 cf Chamber Storage

13,588.7 cf Field - 6,050.7 cf Chambers = 7,538.0 cf Stone x 40.0% Voids = 3,015.2 cf Stone Storage

Chamber Storage + Stone Storage = 9,065.9 cf = 0.208 af

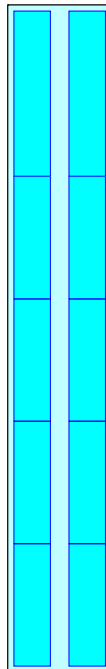
Overall Storage Efficiency = 66.7%

Overall System Size = 109.00' x 17.00' x 7.33'

10 Chambers

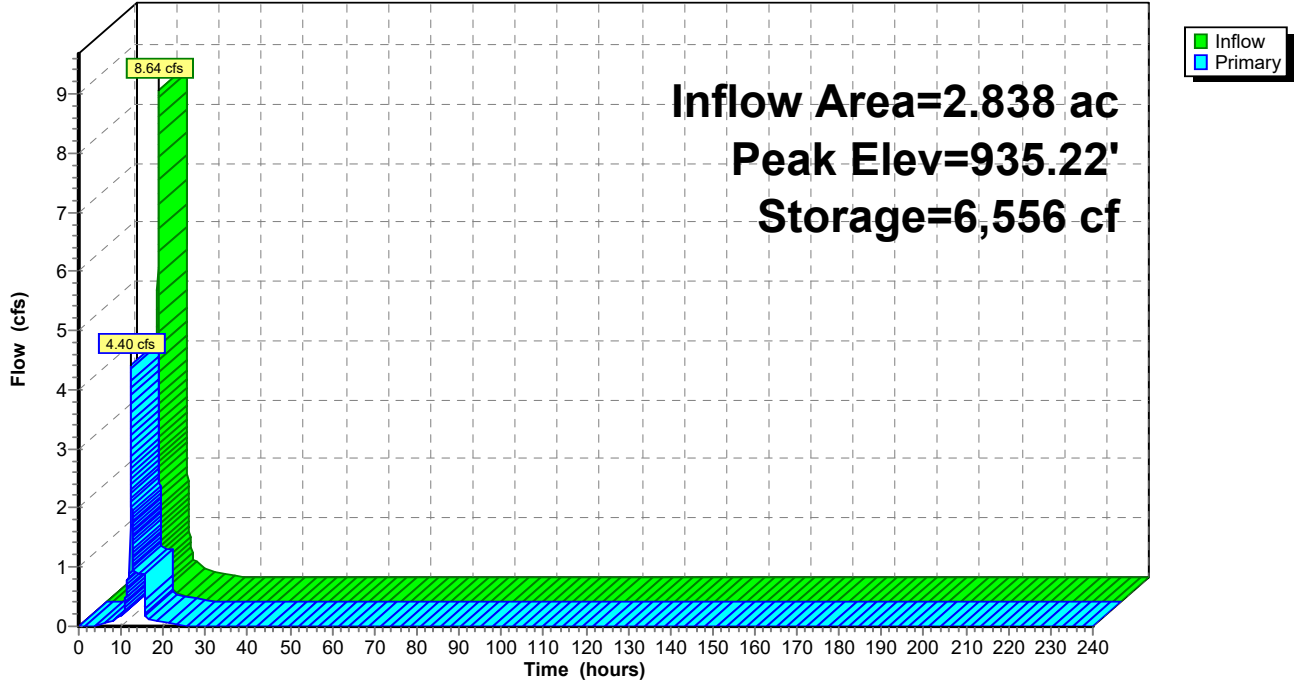
503.3 cy Field

279.2 cy Stone



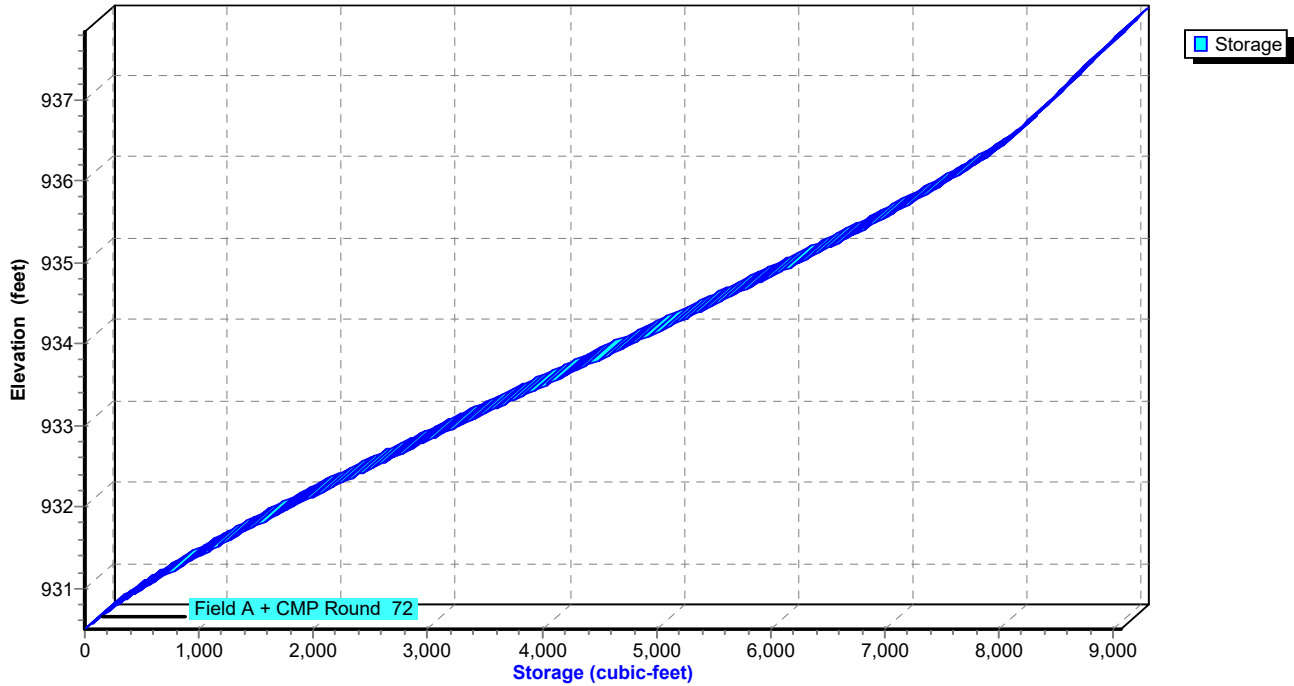
Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Hydrograph



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Stage-Area-Storage



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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Stage-Discharge for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
930.50	0.00	933.10	0.89	935.70	10.05
930.55	0.89	933.15	0.89	935.75	10.71
930.60	0.89	933.20	0.89	935.80	11.38
930.65	0.89	933.25	0.89	935.85	12.06
930.70	0.89	933.30	0.89	935.90	12.75
930.75	0.89	933.35	0.89	935.95	13.46
930.80	0.89	933.40	0.89	936.00	14.17
930.85	0.89	933.45	0.89	936.05	14.89
930.90	0.89	933.50	0.89	936.10	15.62
930.95	0.89	933.55	0.89	936.15	16.36
931.00	0.89	933.60	0.89	936.20	17.11
931.05	0.89	933.65	0.89	936.25	17.86
931.10	0.89	933.70	0.89	936.30	18.63
931.15	0.89	933.75	0.89	936.35	19.39
931.20	0.89	933.80	0.89	936.40	20.17
931.25	0.89	933.85	0.89	936.45	20.95
931.30	0.89	933.90	0.89	936.50	21.74
931.35	0.89	933.95	0.89	936.55	22.01
931.40	0.89	934.00	0.89	936.60	22.09
931.45	0.89	934.05	0.89	936.65	22.17
931.50	0.89	934.10	0.89	936.70	22.25
931.55	0.89	934.15	0.89	936.75	22.33
931.60	0.89	934.20	0.89	936.80	22.42
931.65	0.89	934.25	0.89	936.85	22.50
931.70	0.89	934.30	0.89	936.90	22.58
931.75	0.89	934.35	0.89	936.95	22.66
931.80	0.89	934.40	0.89	937.00	22.74
931.85	0.89	934.45	0.89	937.05	22.82
931.90	0.89	934.50	0.89	937.10	22.89
931.95	0.89	934.55	0.89	937.15	22.97
932.00	0.89	934.60	0.89	937.20	23.05
932.05	0.89	934.65	0.89	937.25	23.13
932.10	0.89	934.70	0.89	937.30	23.21
932.15	0.89	934.75	1.00	937.35	23.29
932.20	0.89	934.80	1.20	937.40	23.36
932.25	0.89	934.85	1.45	937.45	23.44
932.30	0.89	934.90	1.76	937.50	23.52
932.35	0.89	934.95	2.10	937.55	23.60
932.40	0.89	935.00	2.47	937.60	23.67
932.45	0.89	935.05	2.87	937.65	23.75
932.50	0.89	935.10	3.31	937.70	23.82
932.55	0.89	935.15	3.76	937.75	23.90
932.60	0.89	935.20	4.24	937.80	23.98
932.65	0.89	935.25	4.74		
932.70	0.89	935.30	5.27		
932.75	0.89	935.35	5.81		
932.80	0.89	935.40	6.37		
932.85	0.89	935.45	6.94		
932.90	0.89	935.50	7.54		
932.95	0.89	935.55	8.14		
933.00	0.89	935.60	8.76		
933.05	0.89	935.65	9.40		

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MSE 24-hr 3 2-Year 24-Hour Rainfall=2.86"

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Stage-Area-Storage for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
930.50	0	933.10	3,435	935.70	7,197
930.55	40	933.15	3,510	935.75	7,260
930.60	87	933.20	3,586	935.80	7,322
930.65	135	933.25	3,661	935.85	7,383
930.70	185	933.30	3,737	935.90	7,444
930.75	237	933.35	3,812	935.95	7,504
930.80	290	933.40	3,888	936.00	7,563
930.85	345	933.45	3,963	936.05	7,620
930.90	400	933.50	4,039	936.10	7,677
930.95	457	933.55	4,114	936.15	7,733
931.00	515	933.60	4,190	936.20	7,787
931.05	574	933.65	4,266	936.25	7,841
931.10	634	933.70	4,341	936.30	7,892
931.15	694	933.75	4,416	936.35	7,942
931.20	756	933.80	4,492	936.40	7,990
931.25	818	933.85	4,567	936.45	8,036
931.30	881	933.90	4,643	936.50	8,078
931.35	944	933.95	4,718	936.55	8,115
931.40	1,009	934.00	4,793	936.60	8,152
931.45	1,073	934.05	4,868	936.65	8,189
931.50	1,139	934.10	4,943	936.70	8,226
931.55	1,205	934.15	5,017	936.75	8,263
931.60	1,272	934.20	5,092	936.80	8,300
931.65	1,339	934.25	5,166	936.85	8,337
931.70	1,406	934.30	5,241	936.90	8,374
931.75	1,474	934.35	5,315	936.95	8,411
931.80	1,543	934.40	5,389	937.00	8,448
931.85	1,612	934.45	5,462	937.05	8,485
931.90	1,681	934.50	5,536	937.10	8,522
931.95	1,751	934.55	5,609	937.15	8,559
932.00	1,822	934.60	5,682	937.20	8,596
932.05	1,892	934.65	5,755	937.25	8,634
932.10	1,963	934.70	5,827	937.30	8,671
932.15	2,034	934.75	5,900	937.35	8,708
932.20	2,106	934.80	5,972	937.40	8,745
932.25	2,178	934.85	6,043	937.45	8,782
932.30	2,250	934.90	6,115	937.50	8,819
932.35	2,323	934.95	6,185	937.55	8,856
932.40	2,395	935.00	6,256	937.60	8,893
932.45	2,468	935.05	6,326	937.65	8,930
932.50	2,542	935.10	6,396	937.70	8,967
932.55	2,615	935.15	6,466	937.75	9,004
932.60	2,689	935.20	6,535	937.80	9,041
932.65	2,763	935.25	6,603		
932.70	2,837	935.30	6,671		
932.75	2,911	935.35	6,739		
932.80	2,986	935.40	6,806		
932.85	3,060	935.45	6,873		
932.90	3,135	935.50	6,939		
932.95	3,210	935.55	7,004		
933.00	3,285	935.60	7,069		
933.05	3,360	935.65	7,133		

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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Runoff = 2.14 cfs @ 12.18 hrs, Volume= 0.115 af, Depth= 1.81"
 Routed to Reach 1R : TOTAL TO COOKS BAY

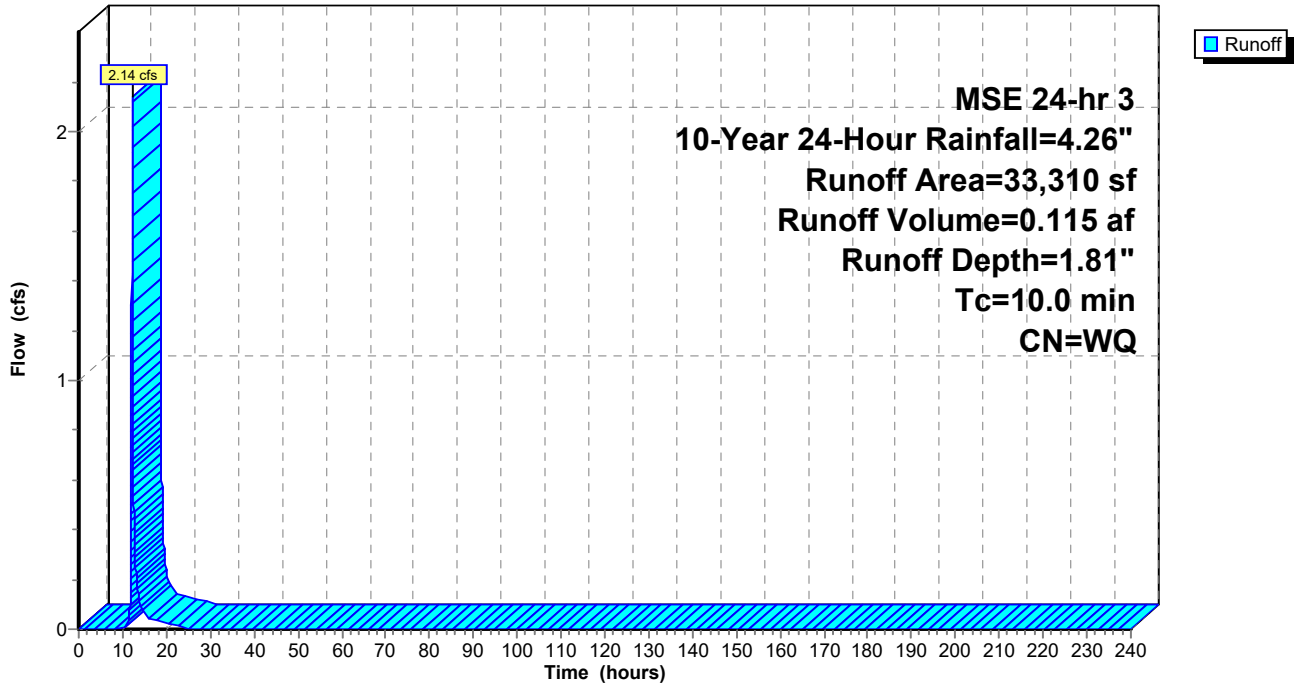
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
289	98	Paved parking, HSG C
33,021	74	>75% Grass cover, Good, HSG C
33,310		Weighted Average
33,021		99.13% Pervious Area
289		0.87% Impervious Area

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

Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Hydrograph



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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment PR2: PR2 - DRAINS TO 1P

Runoff = 2.95 cfs @ 12.17 hrs, Volume= 0.180 af, Depth= 3.59"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

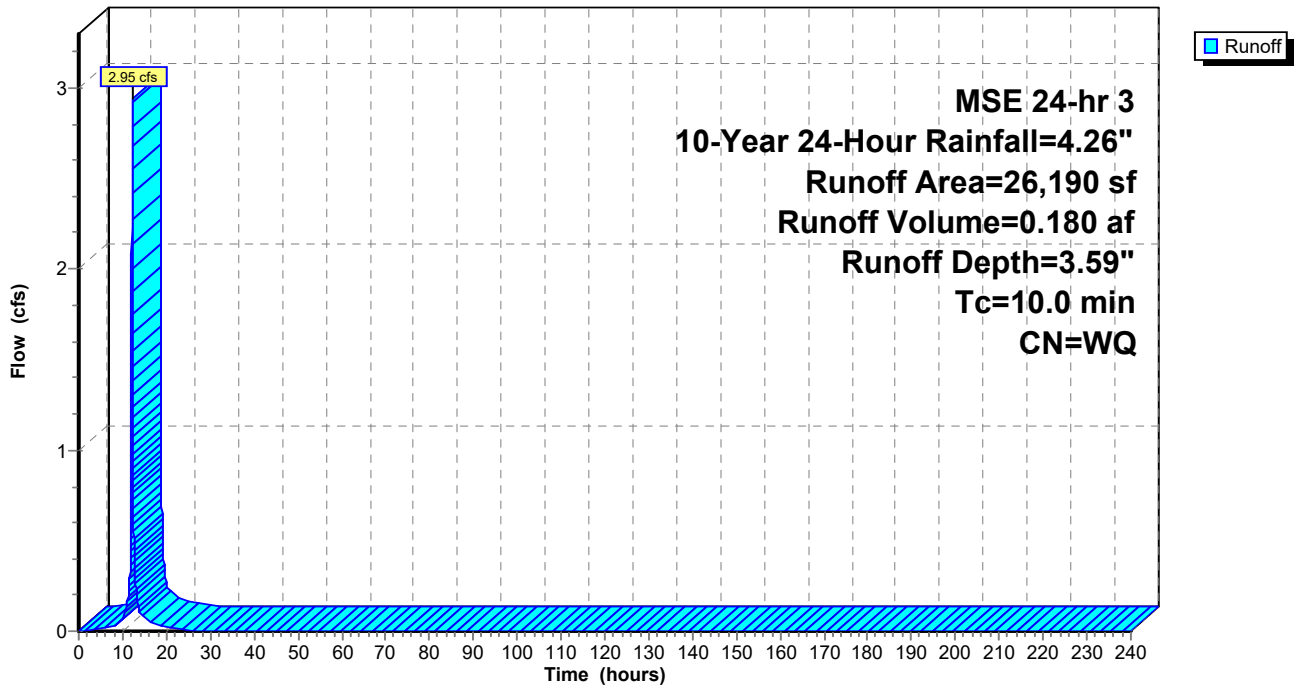
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
21,079	98	Paved parking, HSG C
5,111	74	>75% Grass cover, Good, HSG C
26,190		Weighted Average
5,111		19.52% Pervious Area
21,079		80.48% Impervious Area

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

Subcatchment PR2: PR2 - DRAINS TO 1P

Hydrograph



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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Runoff = 5.41 cfs @ 12.17 hrs, Volume= 0.334 af, Depth= 3.94"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

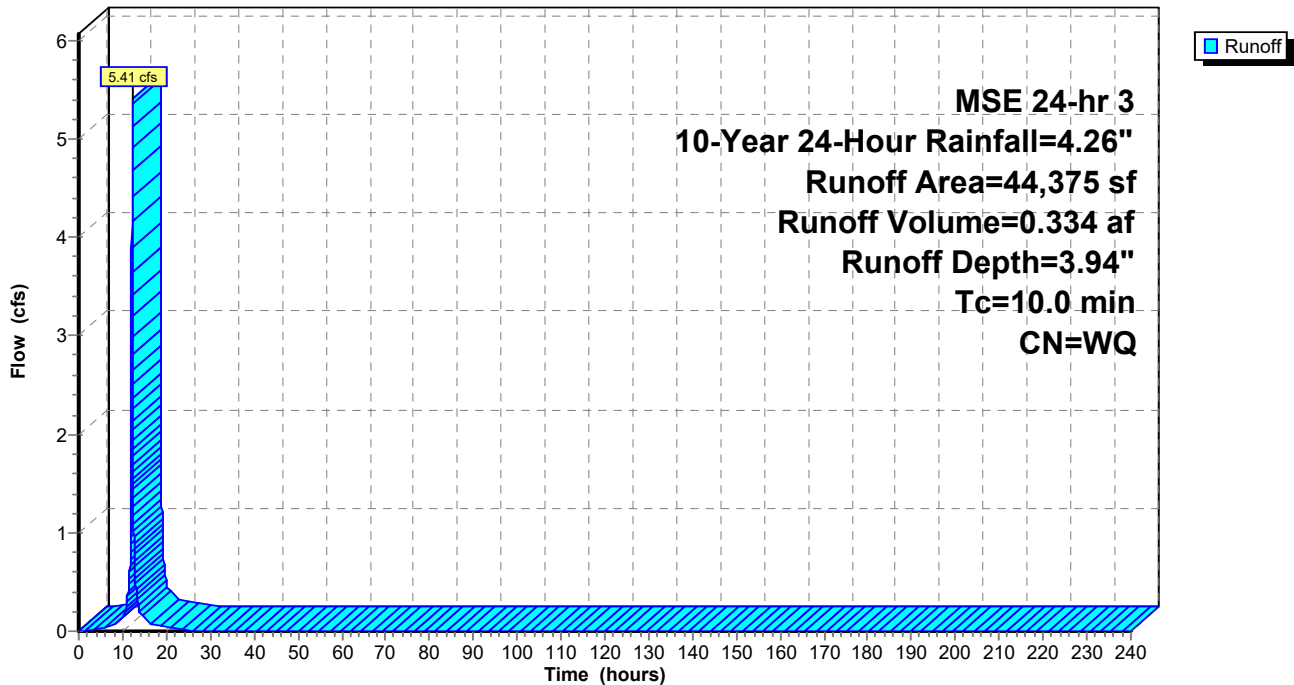
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
42,677	98	Paved parking, HSG C
1,698	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
1,698		3.83% Pervious Area
42,677		96.17% Impervious Area

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

Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Hydrograph



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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Runoff = 5.26 cfs @ 12.17 hrs, Volume= 0.315 af, Depth= 3.10"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

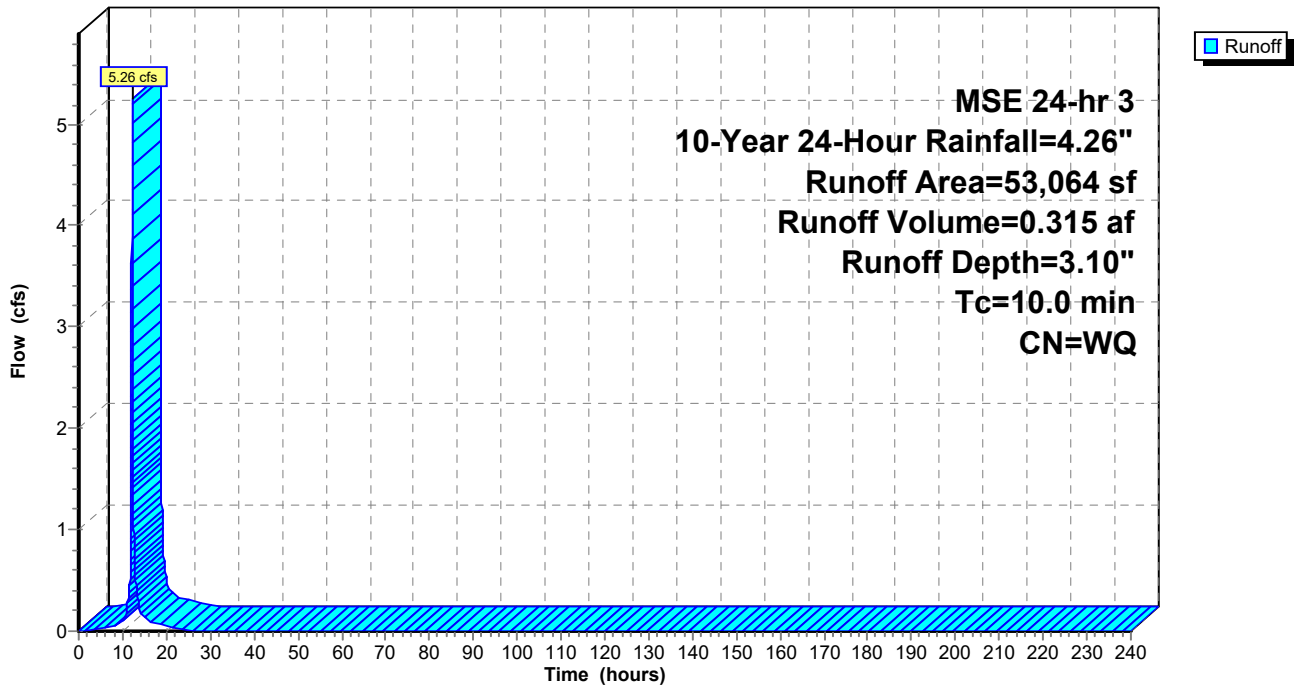
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Hydrograph



Summary for Reach 1R: TOTAL TO COOKS BAY

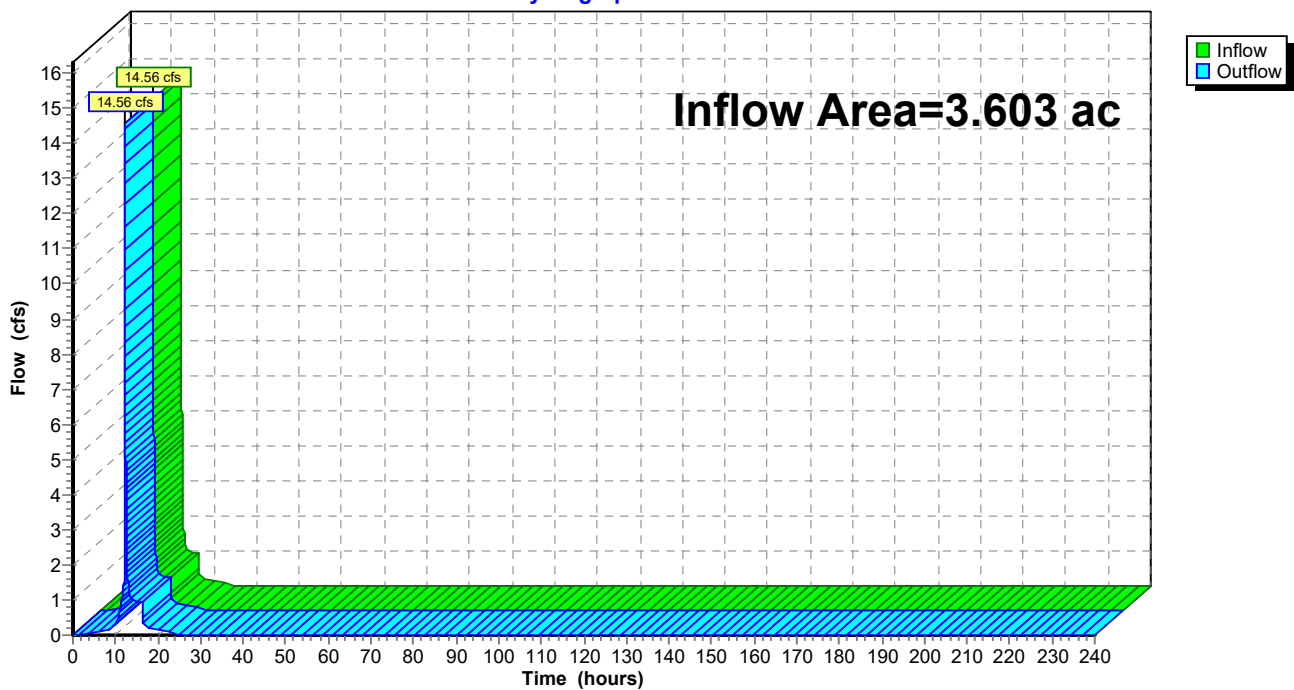
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 60.62% Impervious, Inflow Depth = 3.14" for 10-Year 24-Hour event
Inflow = 14.56 cfs @ 12.21 hrs, Volume= 0.944 af
Outflow = 14.56 cfs @ 12.21 hrs, Volume= 0.944 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

Hydrograph



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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Summary for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Inflow Area = 2.838 ac, 76.72% Impervious, Inflow Depth = 3.50" for 10-Year 24-Hour event
 Inflow = 13.62 cfs @ 12.17 hrs, Volume= 0.829 af
 Outflow = 12.52 cfs @ 12.21 hrs, Volume= 0.829 af, Atten= 8%, Lag= 2.2 min
 Primary = 12.52 cfs @ 12.21 hrs, Volume= 0.829 af
 Routed to Reach 1R : TOTAL TO COOKS BAY

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 935.88' @ 12.21 hrs Surf.Area= 1,853 sf Storage= 7,424 cf

Plug-Flow detention time= 32.0 min calculated for 0.829 af (100% of inflow)
 Center-of-Mass det. time= 32.0 min (791.3 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	930.50'	3,015 cf	17.00'W x 109.00'L x 7.33'H Field A 13,589 cf Overall - 6,051 cf Embedded = 7,538 cf x 40.0% Voids
#2A	930.50'	6,051 cf	CMP Round 72 x 10 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +7.00' x 28.27 sf x 2 rows
		9,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	930.50'	0.890 cfs Constant Flow/Skimmer
#2	Primary	929.86'	21.0" Round Culvert L= 56.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 929.86' / 929.50' S= 0.0064 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 2.41 sf
#3	Device 4	934.70'	3.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 2	929.86'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=12.51 cfs @ 12.21 hrs HW=935.88' (Free Discharge)
 ↑ **2=Culvert** (Passes 12.51 cfs of 23.18 cfs potential flow)
 ↑ **4=Orifice/Grate** (Passes 12.51 cfs of 20.88 cfs potential flow)
 ↑ **1=Constant Flow/Skimmer** (Constant Controls 0.89 cfs)
 ↑ **3=Sharp-Crested Rectangular Weir** (Weir Controls 11.62 cfs @ 3.56 fps)

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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN - Chamber Wizard Field A

Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +7.00' x 28.27 sf x 2 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

5 Chambers/Row x 20.00' Long +7.00' Row Adjustment = 107.00' Row Length +12.0" End Stone x 2 = 109.00' Base Length

2 Rows x 72.0" Wide + 36.0" Spacing x 1 + 12.0" Side Stone x 2 = 17.00' Base Width

72.0" Chamber Height + 16.0" Stone Cover = 7.33' Field Height

10 Chambers x 565.5 cf +7.00' Row Adjustment x 28.27 sf x 2 Rows = 6,050.7 cf Chamber Storage

13,588.7 cf Field - 6,050.7 cf Chambers = 7,538.0 cf Stone x 40.0% Voids = 3,015.2 cf Stone Storage

Chamber Storage + Stone Storage = 9,065.9 cf = 0.208 af

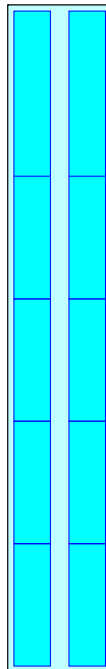
Overall Storage Efficiency = 66.7%

Overall System Size = 109.00' x 17.00' x 7.33'

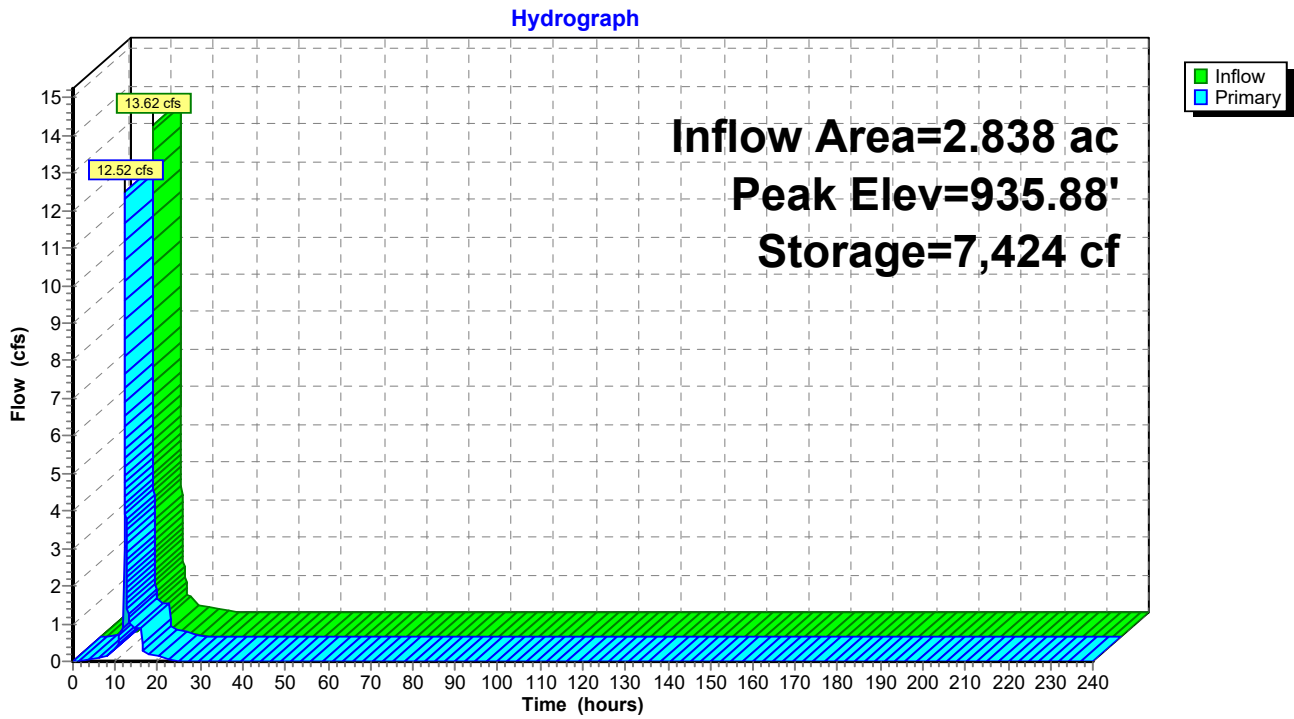
10 Chambers

503.3 cy Field

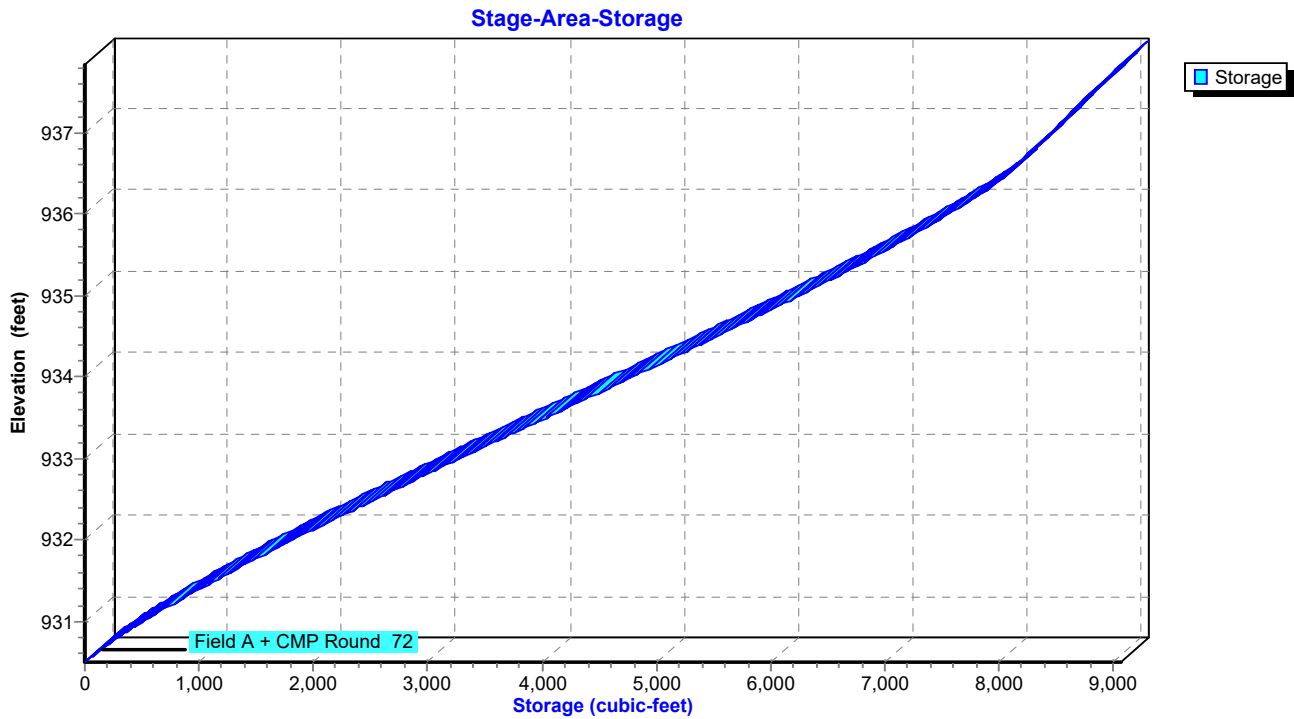
279.2 cy Stone



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Stage-Discharge for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
930.50	0.00	933.10	0.89	935.70	10.05
930.55	0.89	933.15	0.89	935.75	10.71
930.60	0.89	933.20	0.89	935.80	11.38
930.65	0.89	933.25	0.89	935.85	12.06
930.70	0.89	933.30	0.89	935.90	12.75
930.75	0.89	933.35	0.89	935.95	13.46
930.80	0.89	933.40	0.89	936.00	14.17
930.85	0.89	933.45	0.89	936.05	14.89
930.90	0.89	933.50	0.89	936.10	15.62
930.95	0.89	933.55	0.89	936.15	16.36
931.00	0.89	933.60	0.89	936.20	17.11
931.05	0.89	933.65	0.89	936.25	17.86
931.10	0.89	933.70	0.89	936.30	18.63
931.15	0.89	933.75	0.89	936.35	19.39
931.20	0.89	933.80	0.89	936.40	20.17
931.25	0.89	933.85	0.89	936.45	20.95
931.30	0.89	933.90	0.89	936.50	21.74
931.35	0.89	933.95	0.89	936.55	22.01
931.40	0.89	934.00	0.89	936.60	22.09
931.45	0.89	934.05	0.89	936.65	22.17
931.50	0.89	934.10	0.89	936.70	22.25
931.55	0.89	934.15	0.89	936.75	22.33
931.60	0.89	934.20	0.89	936.80	22.42
931.65	0.89	934.25	0.89	936.85	22.50
931.70	0.89	934.30	0.89	936.90	22.58
931.75	0.89	934.35	0.89	936.95	22.66
931.80	0.89	934.40	0.89	937.00	22.74
931.85	0.89	934.45	0.89	937.05	22.82
931.90	0.89	934.50	0.89	937.10	22.89
931.95	0.89	934.55	0.89	937.15	22.97
932.00	0.89	934.60	0.89	937.20	23.05
932.05	0.89	934.65	0.89	937.25	23.13
932.10	0.89	934.70	0.89	937.30	23.21
932.15	0.89	934.75	1.00	937.35	23.29
932.20	0.89	934.80	1.20	937.40	23.36
932.25	0.89	934.85	1.45	937.45	23.44
932.30	0.89	934.90	1.76	937.50	23.52
932.35	0.89	934.95	2.10	937.55	23.60
932.40	0.89	935.00	2.47	937.60	23.67
932.45	0.89	935.05	2.87	937.65	23.75
932.50	0.89	935.10	3.31	937.70	23.82
932.55	0.89	935.15	3.76	937.75	23.90
932.60	0.89	935.20	4.24	937.80	23.98
932.65	0.89	935.25	4.74		
932.70	0.89	935.30	5.27		
932.75	0.89	935.35	5.81		
932.80	0.89	935.40	6.37		
932.85	0.89	935.45	6.94		
932.90	0.89	935.50	7.54		
932.95	0.89	935.55	8.14		
933.00	0.89	935.60	8.76		
933.05	0.89	935.65	9.40		

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MSE 24-hr 3 10-Year 24-Hour Rainfall=4.26"

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Stage-Area-Storage for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
930.50	0	933.10	3,435	935.70	7,197
930.55	40	933.15	3,510	935.75	7,260
930.60	87	933.20	3,586	935.80	7,322
930.65	135	933.25	3,661	935.85	7,383
930.70	185	933.30	3,737	935.90	7,444
930.75	237	933.35	3,812	935.95	7,504
930.80	290	933.40	3,888	936.00	7,563
930.85	345	933.45	3,963	936.05	7,620
930.90	400	933.50	4,039	936.10	7,677
930.95	457	933.55	4,114	936.15	7,733
931.00	515	933.60	4,190	936.20	7,787
931.05	574	933.65	4,266	936.25	7,841
931.10	634	933.70	4,341	936.30	7,892
931.15	694	933.75	4,416	936.35	7,942
931.20	756	933.80	4,492	936.40	7,990
931.25	818	933.85	4,567	936.45	8,036
931.30	881	933.90	4,643	936.50	8,078
931.35	944	933.95	4,718	936.55	8,115
931.40	1,009	934.00	4,793	936.60	8,152
931.45	1,073	934.05	4,868	936.65	8,189
931.50	1,139	934.10	4,943	936.70	8,226
931.55	1,205	934.15	5,017	936.75	8,263
931.60	1,272	934.20	5,092	936.80	8,300
931.65	1,339	934.25	5,166	936.85	8,337
931.70	1,406	934.30	5,241	936.90	8,374
931.75	1,474	934.35	5,315	936.95	8,411
931.80	1,543	934.40	5,389	937.00	8,448
931.85	1,612	934.45	5,462	937.05	8,485
931.90	1,681	934.50	5,536	937.10	8,522
931.95	1,751	934.55	5,609	937.15	8,559
932.00	1,822	934.60	5,682	937.20	8,596
932.05	1,892	934.65	5,755	937.25	8,634
932.10	1,963	934.70	5,827	937.30	8,671
932.15	2,034	934.75	5,900	937.35	8,708
932.20	2,106	934.80	5,972	937.40	8,745
932.25	2,178	934.85	6,043	937.45	8,782
932.30	2,250	934.90	6,115	937.50	8,819
932.35	2,323	934.95	6,185	937.55	8,856
932.40	2,395	935.00	6,256	937.60	8,893
932.45	2,468	935.05	6,326	937.65	8,930
932.50	2,542	935.10	6,396	937.70	8,967
932.55	2,615	935.15	6,466	937.75	9,004
932.60	2,689	935.20	6,535	937.80	9,041
932.65	2,763	935.25	6,603		
932.70	2,837	935.30	6,671		
932.75	2,911	935.35	6,739		
932.80	2,986	935.40	6,806		
932.85	3,060	935.45	6,873		
932.90	3,135	935.50	6,939		
932.95	3,210	935.55	7,004		
933.00	3,285	935.60	7,069		
933.05	3,360	935.65	7,133		

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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentPR1: PR1 - DRAINS EAST Runoff Area=33,310 sf 0.87% Impervious Runoff Depth=4.35"
Tc=10.0 min CN=WQ Runoff=5.13 cfs 0.277 af

SubcatchmentPR2: PR2 - DRAINS TO 1P Runoff Area=26,190 sf 80.48% Impervious Runoff Depth=6.54"
Tc=10.0 min CN=WQ Runoff=5.31 cfs 0.328 af

SubcatchmentPR3: PR3 - DRAINS TO Runoff Area=44,375 sf 96.17% Impervious Runoff Depth=6.98"
Tc=10.0 min CN=WQ Runoff=9.42 cfs 0.592 af

SubcatchmentPR4: PR4 - DRAINS TO Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=5.94"
Tc=10.0 min CN=WQ Runoff=10.05 cfs 0.603 af

Reach 1R: TOTAL TO COOKS BAY Inflow=27.78 cfs 1.800 af
Outflow=27.78 cfs 1.800 af

Pond 1P: 1P - UNDERGROUND RATE Peak Elev=937.05' Storage=8,485 cf Inflow=24.78 cfs 1.523 af
Outflow=22.82 cfs 1.523 af

Total Runoff Area = 3.603 ac Runoff Volume = 1.800 af Average Runoff Depth = 5.99"
39.38% Pervious = 1.419 ac 60.62% Impervious = 2.184 ac

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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Runoff = 5.13 cfs @ 12.18 hrs, Volume= 0.277 af, Depth= 4.35"
 Routed to Reach 1R : TOTAL TO COOKS BAY

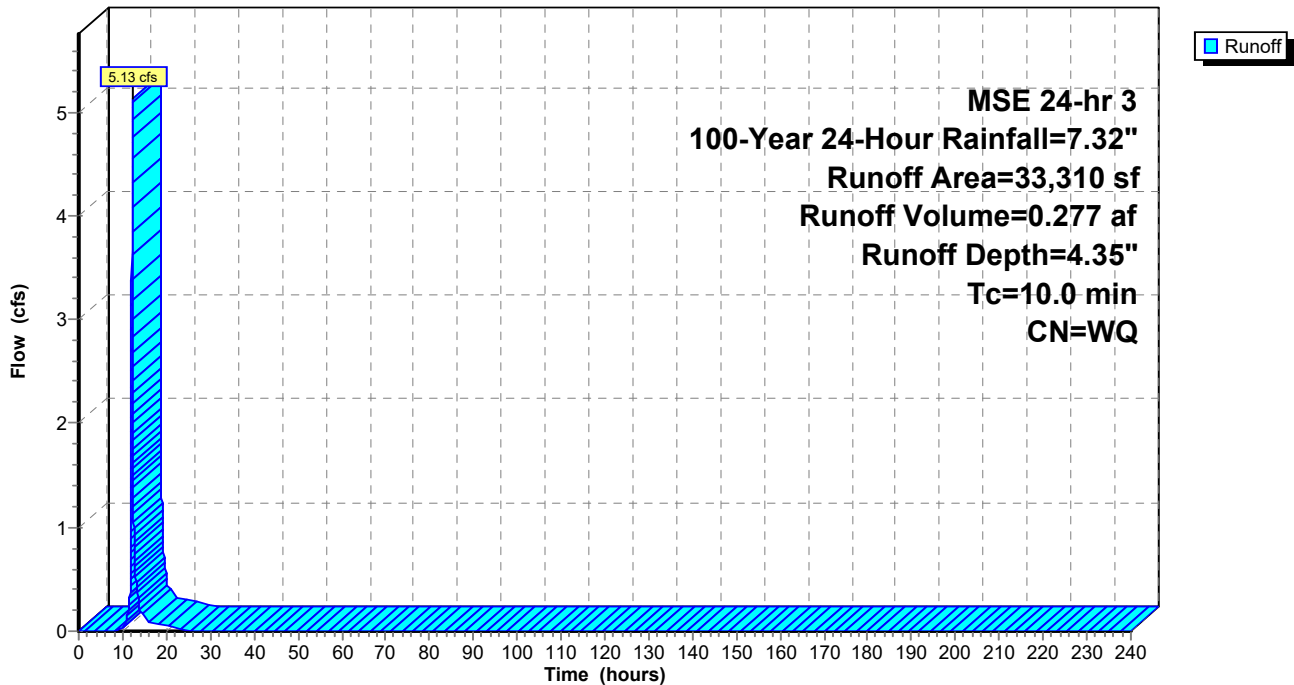
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
289	98	Paved parking, HSG C
33,021	74	>75% Grass cover, Good, HSG C
33,310		Weighted Average
33,021		99.13% Pervious Area
289		0.87% Impervious Area

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

Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Hydrograph



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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment PR2: PR2 - DRAINS TO 1P

Runoff = 5.31 cfs @ 12.17 hrs, Volume= 0.328 af, Depth= 6.54"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

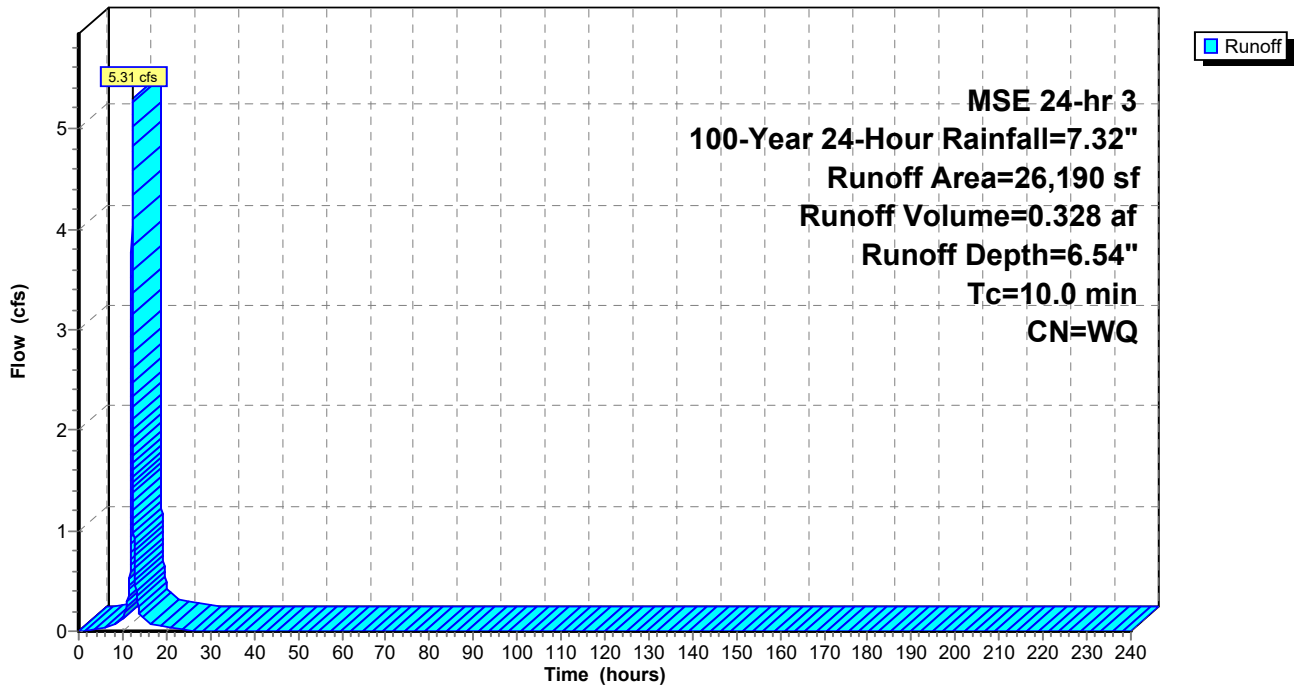
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
21,079	98	Paved parking, HSG C
5,111	74	>75% Grass cover, Good, HSG C
26,190		Weighted Average
5,111		19.52% Pervious Area
21,079		80.48% Impervious Area

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

Subcatchment PR2: PR2 - DRAINS TO 1P

Hydrograph



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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Runoff = 9.42 cfs @ 12.17 hrs, Volume= 0.592 af, Depth= 6.98"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

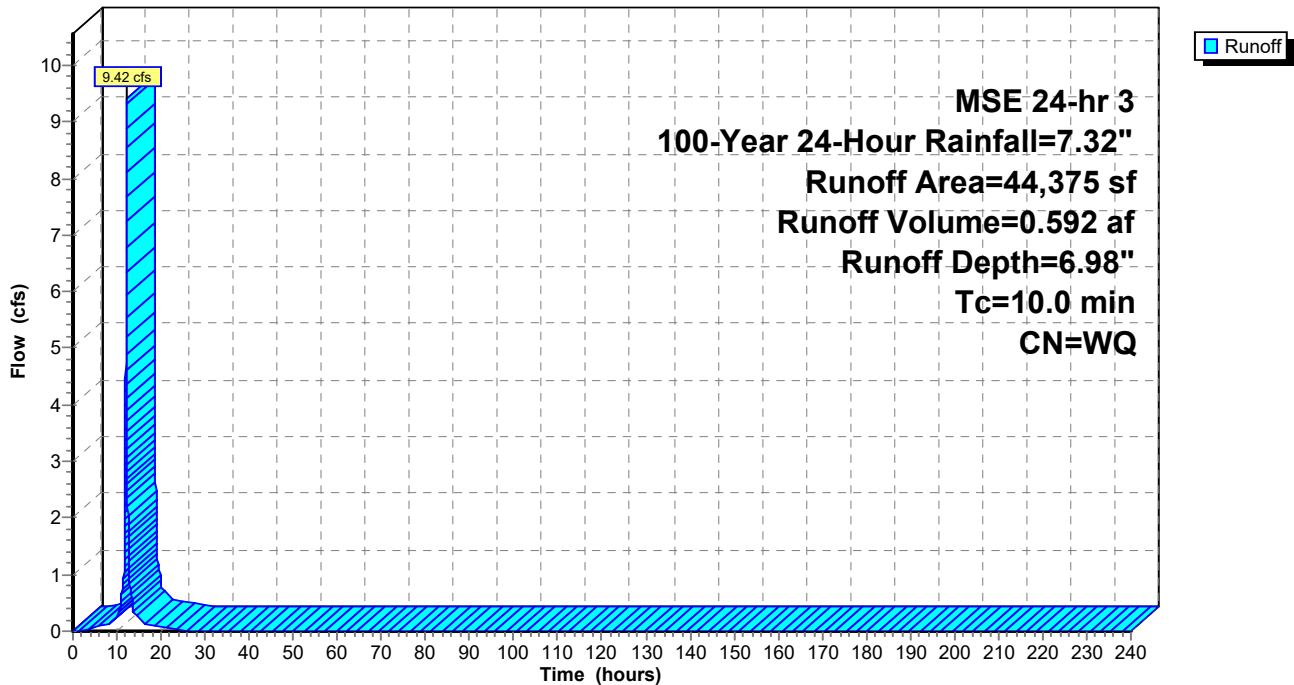
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
42,677	98	Paved parking, HSG C
1,698	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
1,698		3.83% Pervious Area
42,677		96.17% Impervious Area

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

Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Hydrograph



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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Runoff = 10.05 cfs @ 12.17 hrs, Volume= 0.603 af, Depth= 5.94"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

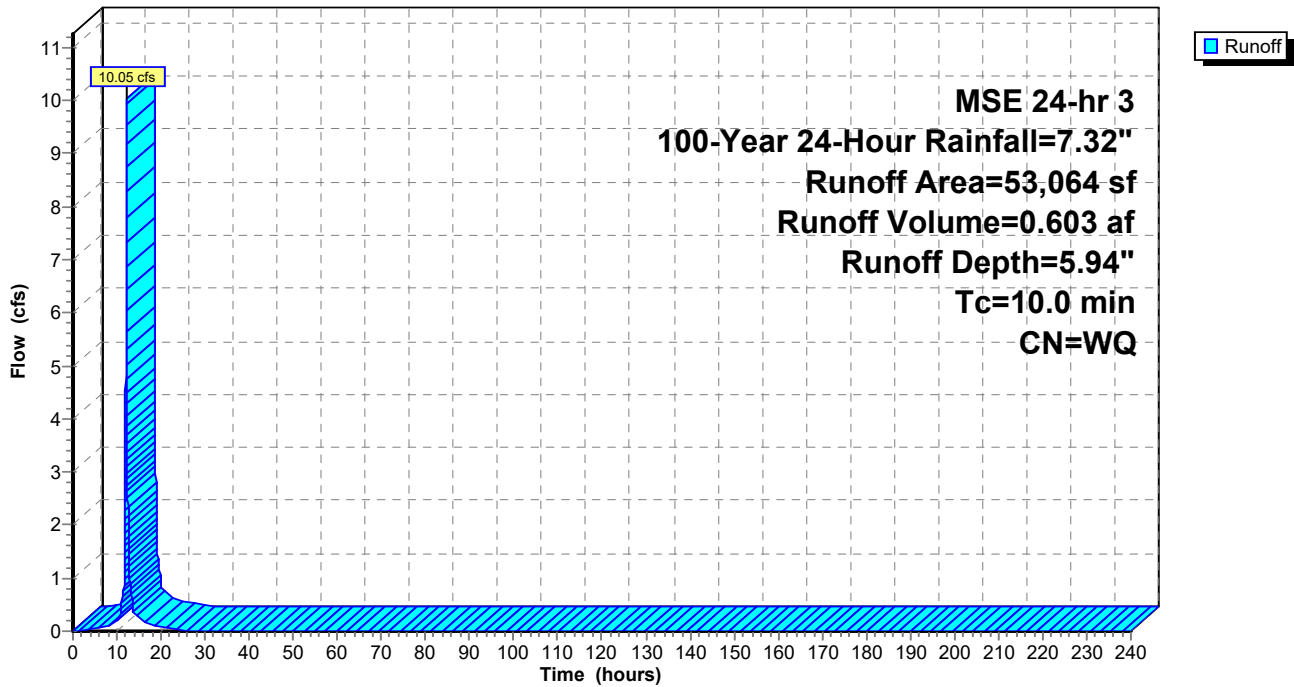
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Hydrograph



Summary for Reach 1R: TOTAL TO COOKS BAY

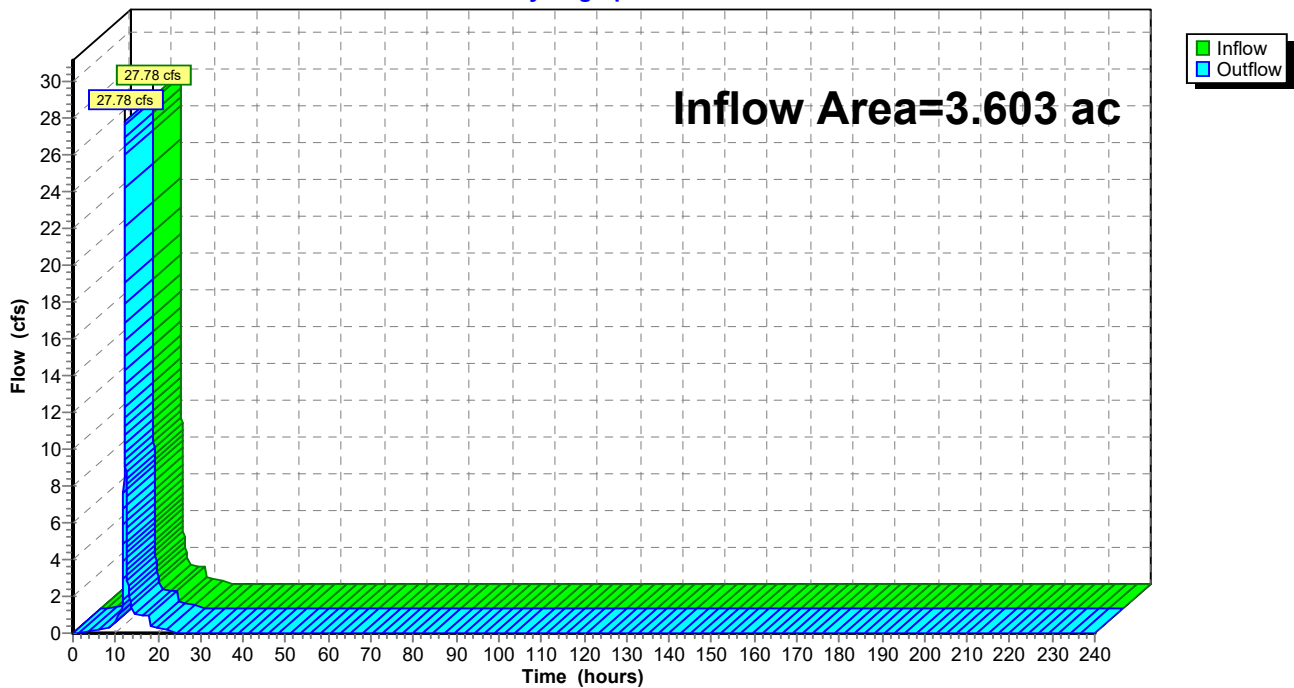
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 60.62% Impervious, Inflow Depth = 5.99" for 100-Year 24-Hour event
Inflow = 27.78 cfs @ 12.19 hrs, Volume= 1.800 af
Outflow = 27.78 cfs @ 12.19 hrs, Volume= 1.800 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

Hydrograph



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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Summary for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Inflow Area = 2.838 ac, 76.72% Impervious, Inflow Depth = 6.44" for 100-Year 24-Hour event
 Inflow = 24.78 cfs @ 12.17 hrs, Volume= 1.523 af
 Outflow = 22.82 cfs @ 12.21 hrs, Volume= 1.523 af, Atten= 8%, Lag= 2.1 min
 Primary = 22.82 cfs @ 12.21 hrs, Volume= 1.523 af
 Routed to Reach 1R : TOTAL TO COOKS BAY

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 937.05' @ 12.21 hrs Surf.Area= 1,853 sf Storage= 8,485 cf

Plug-Flow detention time= 25.9 min calculated for 1.523 af (100% of inflow)
 Center-of-Mass det. time= 25.9 min (779.2 - 753.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	930.50'	3,015 cf	17.00'W x 109.00'L x 7.33'H Field A 13,589 cf Overall - 6,051 cf Embedded = 7,538 cf x 40.0% Voids
#2A	930.50'	6,051 cf	CMP Round 72 x 10 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +7.00' x 28.27 sf x 2 rows
		9,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	930.50'	0.890 cfs Constant Flow/Skimmer
#2	Primary	929.86'	21.0" Round Culvert L= 56.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 929.86' / 929.50' S= 0.0064 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 2.41 sf
#3	Device 4	934.70'	3.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 2	929.86'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=22.81 cfs @ 12.21 hrs HW=937.05' (Free Discharge)
 ↳ **2=Culvert** (Passes 22.81 cfs of 25.67 cfs potential flow)
 ↳ ↳ **4=Orifice/Grate** (Orifice Controls 22.81 cfs @ 12.91 fps)
 ↳ ↳ ↳ **1=Constant Flow/Skimmer** (Passes < 0.89 cfs potential flow)
 ↳ ↳ ↳ **3=Sharp-Crested Rectangular Weir** (Passes < 29.72 cfs potential flow)

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Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN - Chamber Wizard Field A

Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +7.00' x 28.27 sf x 2 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

5 Chambers/Row x 20.00' Long +7.00' Row Adjustment = 107.00' Row Length +12.0" End Stone x 2 = 109.00' Base Length

2 Rows x 72.0" Wide + 36.0" Spacing x 1 + 12.0" Side Stone x 2 = 17.00' Base Width

72.0" Chamber Height + 16.0" Stone Cover = 7.33' Field Height

10 Chambers x 565.5 cf +7.00' Row Adjustment x 28.27 sf x 2 Rows = 6,050.7 cf Chamber Storage

13,588.7 cf Field - 6,050.7 cf Chambers = 7,538.0 cf Stone x 40.0% Voids = 3,015.2 cf Stone Storage

Chamber Storage + Stone Storage = 9,065.9 cf = 0.208 af

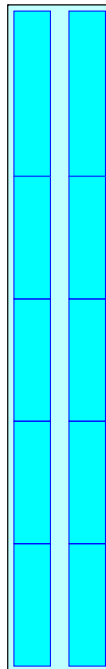
Overall Storage Efficiency = 66.7%

Overall System Size = 109.00' x 17.00' x 7.33'

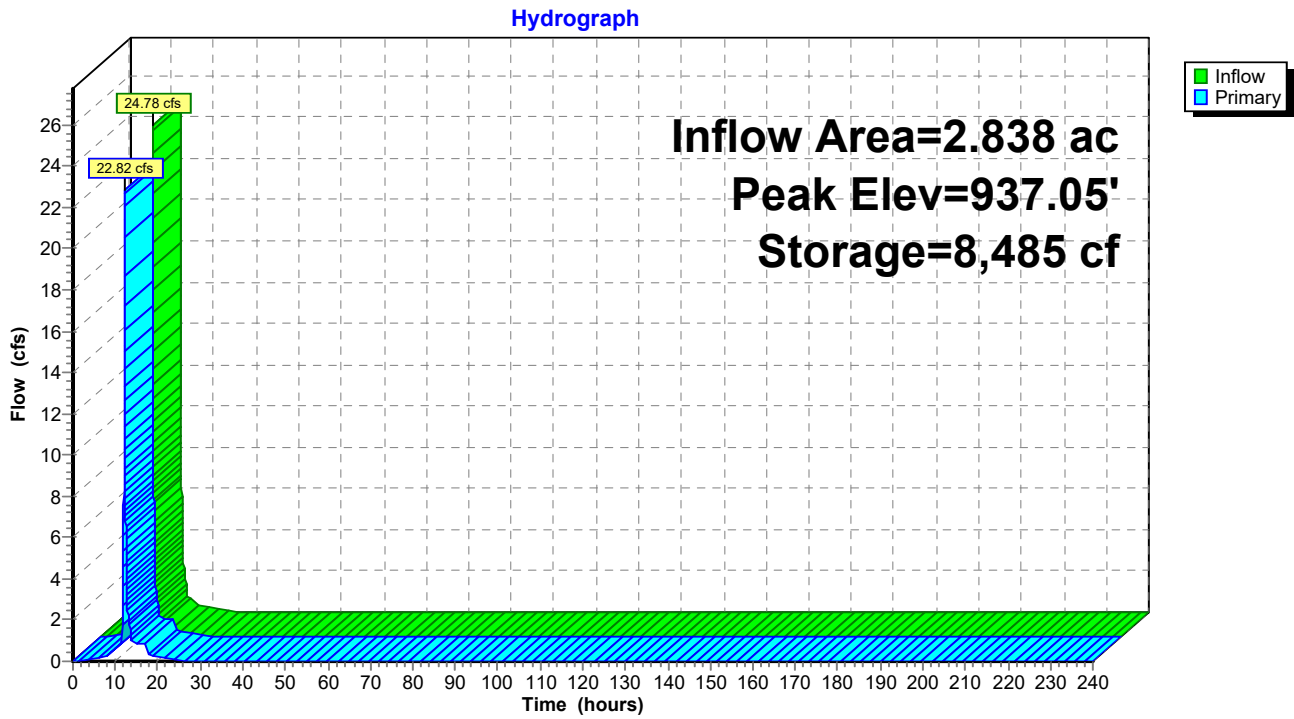
10 Chambers

503.3 cy Field

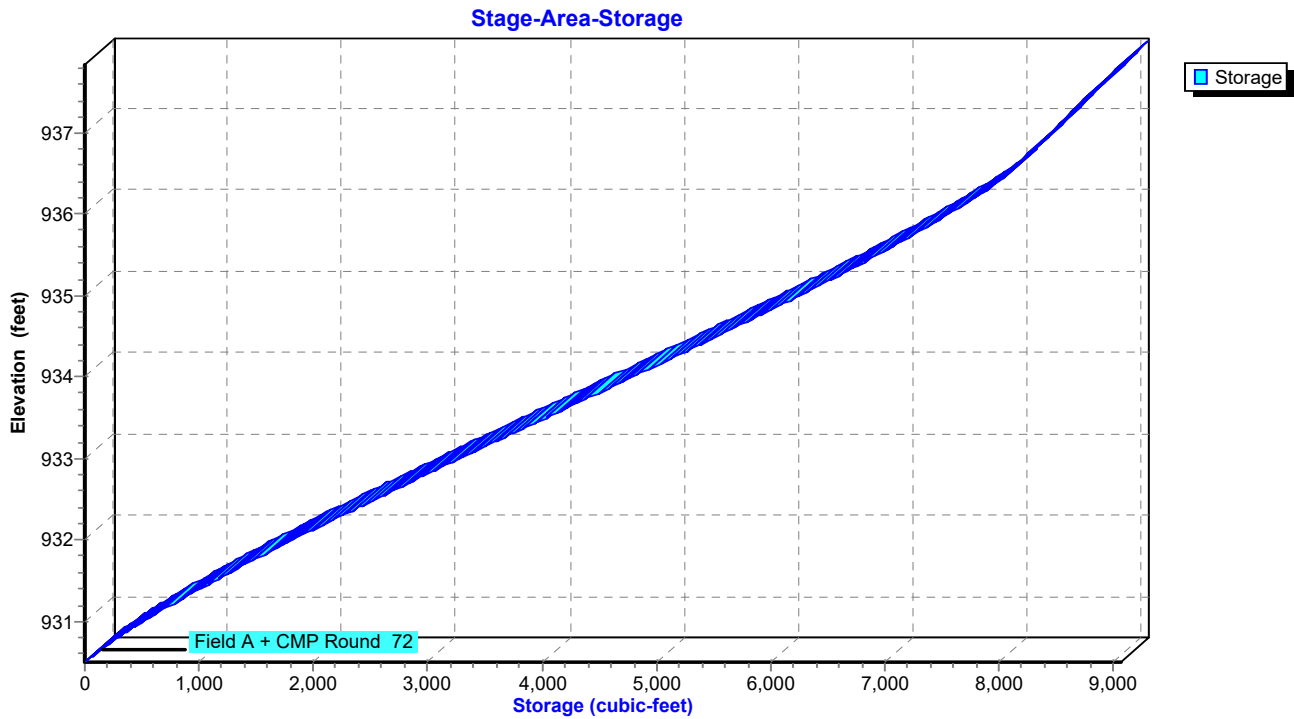
279.2 cy Stone



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Stage-Discharge for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
930.50	0.00	933.10	0.89	935.70	10.05
930.55	0.89	933.15	0.89	935.75	10.71
930.60	0.89	933.20	0.89	935.80	11.38
930.65	0.89	933.25	0.89	935.85	12.06
930.70	0.89	933.30	0.89	935.90	12.75
930.75	0.89	933.35	0.89	935.95	13.46
930.80	0.89	933.40	0.89	936.00	14.17
930.85	0.89	933.45	0.89	936.05	14.89
930.90	0.89	933.50	0.89	936.10	15.62
930.95	0.89	933.55	0.89	936.15	16.36
931.00	0.89	933.60	0.89	936.20	17.11
931.05	0.89	933.65	0.89	936.25	17.86
931.10	0.89	933.70	0.89	936.30	18.63
931.15	0.89	933.75	0.89	936.35	19.39
931.20	0.89	933.80	0.89	936.40	20.17
931.25	0.89	933.85	0.89	936.45	20.95
931.30	0.89	933.90	0.89	936.50	21.74
931.35	0.89	933.95	0.89	936.55	22.01
931.40	0.89	934.00	0.89	936.60	22.09
931.45	0.89	934.05	0.89	936.65	22.17
931.50	0.89	934.10	0.89	936.70	22.25
931.55	0.89	934.15	0.89	936.75	22.33
931.60	0.89	934.20	0.89	936.80	22.42
931.65	0.89	934.25	0.89	936.85	22.50
931.70	0.89	934.30	0.89	936.90	22.58
931.75	0.89	934.35	0.89	936.95	22.66
931.80	0.89	934.40	0.89	937.00	22.74
931.85	0.89	934.45	0.89	937.05	22.82
931.90	0.89	934.50	0.89	937.10	22.89
931.95	0.89	934.55	0.89	937.15	22.97
932.00	0.89	934.60	0.89	937.20	23.05
932.05	0.89	934.65	0.89	937.25	23.13
932.10	0.89	934.70	0.89	937.30	23.21
932.15	0.89	934.75	1.00	937.35	23.29
932.20	0.89	934.80	1.20	937.40	23.36
932.25	0.89	934.85	1.45	937.45	23.44
932.30	0.89	934.90	1.76	937.50	23.52
932.35	0.89	934.95	2.10	937.55	23.60
932.40	0.89	935.00	2.47	937.60	23.67
932.45	0.89	935.05	2.87	937.65	23.75
932.50	0.89	935.10	3.31	937.70	23.82
932.55	0.89	935.15	3.76	937.75	23.90
932.60	0.89	935.20	4.24	937.80	23.98
932.65	0.89	935.25	4.74		
932.70	0.89	935.30	5.27		
932.75	0.89	935.35	5.81		
932.80	0.89	935.40	6.37		
932.85	0.89	935.45	6.94		
932.90	0.89	935.50	7.54		
932.95	0.89	935.55	8.14		
933.00	0.89	935.60	8.76		
933.05	0.89	935.65	9.40		

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MSE 24-hr 3 100-Year 24-Hour Rainfall=7.32"

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Stage-Area-Storage for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
930.50	0	933.10	3,435	935.70	7,197
930.55	40	933.15	3,510	935.75	7,260
930.60	87	933.20	3,586	935.80	7,322
930.65	135	933.25	3,661	935.85	7,383
930.70	185	933.30	3,737	935.90	7,444
930.75	237	933.35	3,812	935.95	7,504
930.80	290	933.40	3,888	936.00	7,563
930.85	345	933.45	3,963	936.05	7,620
930.90	400	933.50	4,039	936.10	7,677
930.95	457	933.55	4,114	936.15	7,733
931.00	515	933.60	4,190	936.20	7,787
931.05	574	933.65	4,266	936.25	7,841
931.10	634	933.70	4,341	936.30	7,892
931.15	694	933.75	4,416	936.35	7,942
931.20	756	933.80	4,492	936.40	7,990
931.25	818	933.85	4,567	936.45	8,036
931.30	881	933.90	4,643	936.50	8,078
931.35	944	933.95	4,718	936.55	8,115
931.40	1,009	934.00	4,793	936.60	8,152
931.45	1,073	934.05	4,868	936.65	8,189
931.50	1,139	934.10	4,943	936.70	8,226
931.55	1,205	934.15	5,017	936.75	8,263
931.60	1,272	934.20	5,092	936.80	8,300
931.65	1,339	934.25	5,166	936.85	8,337
931.70	1,406	934.30	5,241	936.90	8,374
931.75	1,474	934.35	5,315	936.95	8,411
931.80	1,543	934.40	5,389	937.00	8,448
931.85	1,612	934.45	5,462	937.05	8,485
931.90	1,681	934.50	5,536	937.10	8,522
931.95	1,751	934.55	5,609	937.15	8,559
932.00	1,822	934.60	5,682	937.20	8,596
932.05	1,892	934.65	5,755	937.25	8,634
932.10	1,963	934.70	5,827	937.30	8,671
932.15	2,034	934.75	5,900	937.35	8,708
932.20	2,106	934.80	5,972	937.40	8,745
932.25	2,178	934.85	6,043	937.45	8,782
932.30	2,250	934.90	6,115	937.50	8,819
932.35	2,323	934.95	6,185	937.55	8,856
932.40	2,395	935.00	6,256	937.60	8,893
932.45	2,468	935.05	6,326	937.65	8,930
932.50	2,542	935.10	6,396	937.70	8,967
932.55	2,615	935.15	6,466	937.75	9,004
932.60	2,689	935.20	6,535	937.80	9,041
932.65	2,763	935.25	6,603		
932.70	2,837	935.30	6,671		
932.75	2,911	935.35	6,739		
932.80	2,986	935.40	6,806		
932.85	3,060	935.45	6,873		
932.90	3,135	935.50	6,939		
932.95	3,210	935.55	7,004		
933.00	3,285	935.60	7,069		
933.05	3,360	935.65	7,133		

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MSE 24-hr 3 2" WQ Rainfall=2.00"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentPR1: PR1 - DRAINS EAST Runoff Area=33,310 sf 0.87% Impervious Runoff Depth=0.36"
Tc=10.0 min CN=WQ Runoff=0.35 cfs 0.023 af

SubcatchmentPR2: PR2 - DRAINS TO 1P Runoff Area=26,190 sf 80.48% Impervious Runoff Depth=1.50"
Tc=10.0 min CN=WQ Runoff=1.25 cfs 0.075 af

SubcatchmentPR3: PR3 - DRAINS TO Runoff Area=44,375 sf 96.17% Impervious Runoff Depth=1.72"
Tc=10.0 min CN=WQ Runoff=2.45 cfs 0.146 af

SubcatchmentPR4: PR4 - DRAINS TO Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=1.18"
Tc=10.0 min CN=WQ Runoff=1.99 cfs 0.120 af

Reach 1R: TOTAL TO COOKS BAY Inflow=1.24 cfs 0.364 af
Outflow=1.24 cfs 0.364 af

Pond 1P: 1P - UNDERGROUND RATE Peak Elev=934.05' Storage=4,870 cf Inflow=5.69 cfs 0.341 af
Outflow=0.89 cfs 0.341 af

Total Runoff Area = 3.603 ac Runoff Volume = 0.364 af Average Runoff Depth = 1.21"
39.38% Pervious = 1.419 ac 60.62% Impervious = 2.184 ac

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MSE 24-hr 3 2" WQ Rainfall=2.00"

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Summary for Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Runoff = 0.35 cfs @ 12.19 hrs, Volume= 0.023 af, Depth= 0.36"
 Routed to Reach 1R : TOTAL TO COOKS BAY

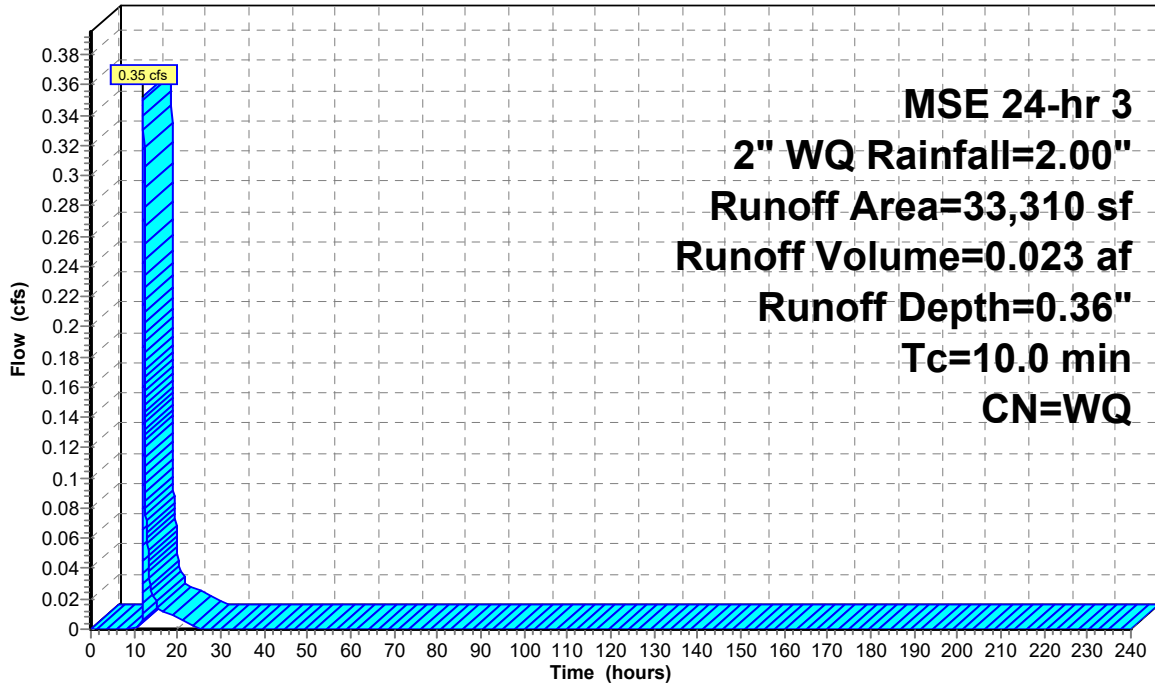
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2" WQ Rainfall=2.00"

Area (sf)	CN	Description
289	98	Paved parking, HSG C
33,021	74	>75% Grass cover, Good, HSG C
33,310		Weighted Average
33,021		99.13% Pervious Area
289		0.87% Impervious Area

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

Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Hydrograph



Runoff

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MSE 24-hr 3 2" WQ Rainfall=2.00"

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Summary for Subcatchment PR2: PR2 - DRAINS TO 1P

Runoff = 1.25 cfs @ 12.17 hrs, Volume= 0.075 af, Depth= 1.50"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

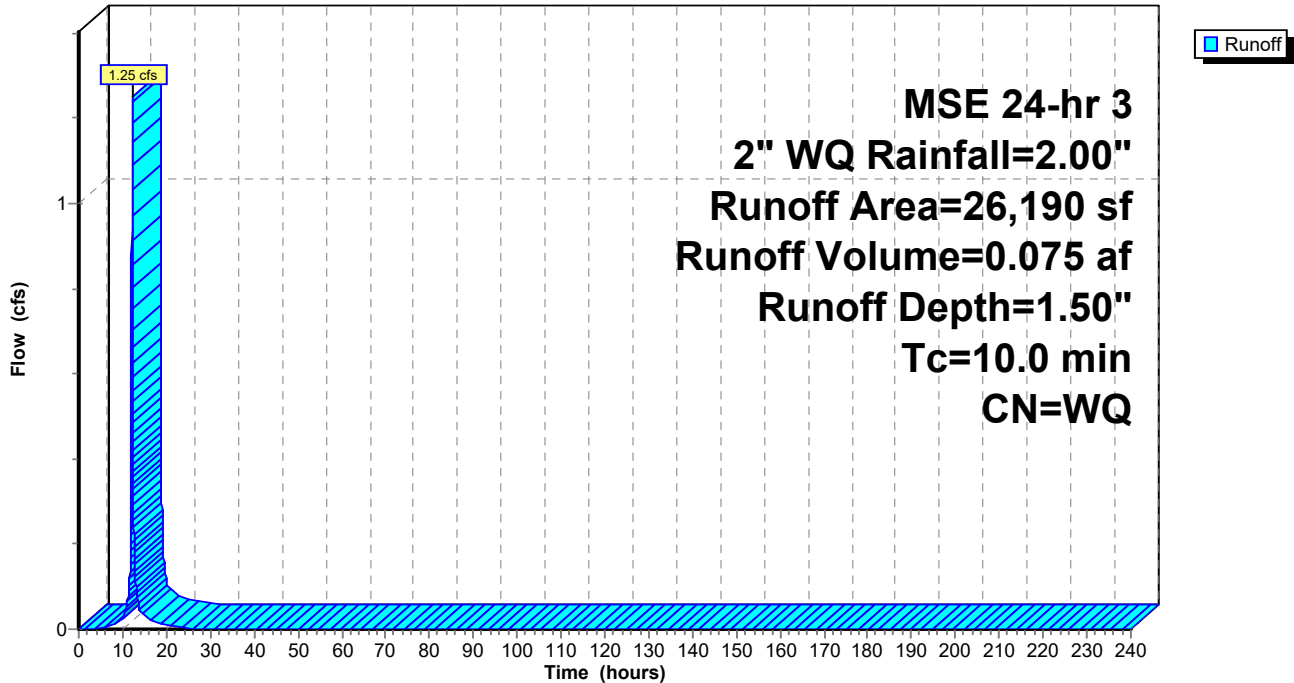
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2" WQ Rainfall=2.00"

Area (sf)	CN	Description
21,079	98	Paved parking, HSG C
5,111	74	>75% Grass cover, Good, HSG C
26,190		Weighted Average
5,111		19.52% Pervious Area
21,079		80.48% Impervious Area

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

Subcatchment PR2: PR2 - DRAINS TO 1P

Hydrograph



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MSE 24-hr 3 2" WQ Rainfall=2.00"

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Summary for Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Runoff = 2.45 cfs @ 12.17 hrs, Volume= 0.146 af, Depth= 1.72"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

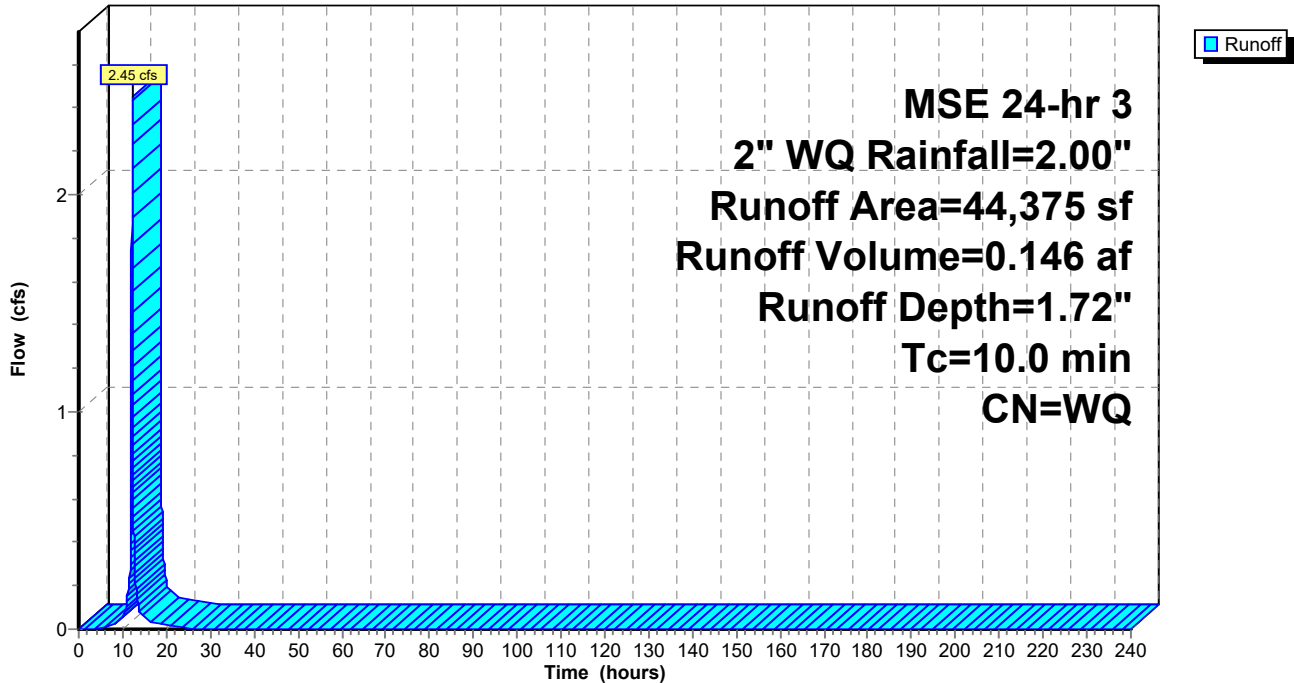
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2" WQ Rainfall=2.00"

Area (sf)	CN	Description
42,677	98	Paved parking, HSG C
1,698	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
1,698		3.83% Pervious Area
42,677		96.17% Impervious Area

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

Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Hydrograph



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MSE 24-hr 3 2" WQ Rainfall=2.00"

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Summary for Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Runoff = 1.99 cfs @ 12.17 hrs, Volume= 0.120 af, Depth= 1.18"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

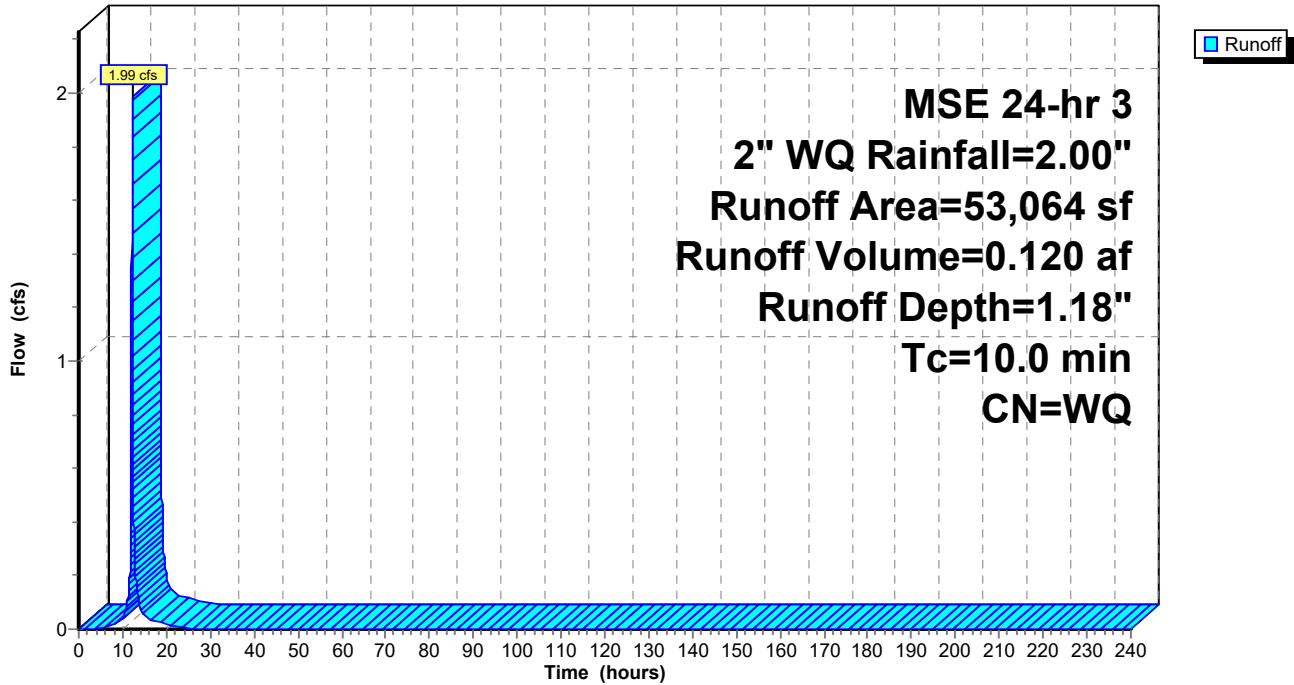
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2" WQ Rainfall=2.00"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Hydrograph



Summary for Reach 1R: TOTAL TO COOKS BAY

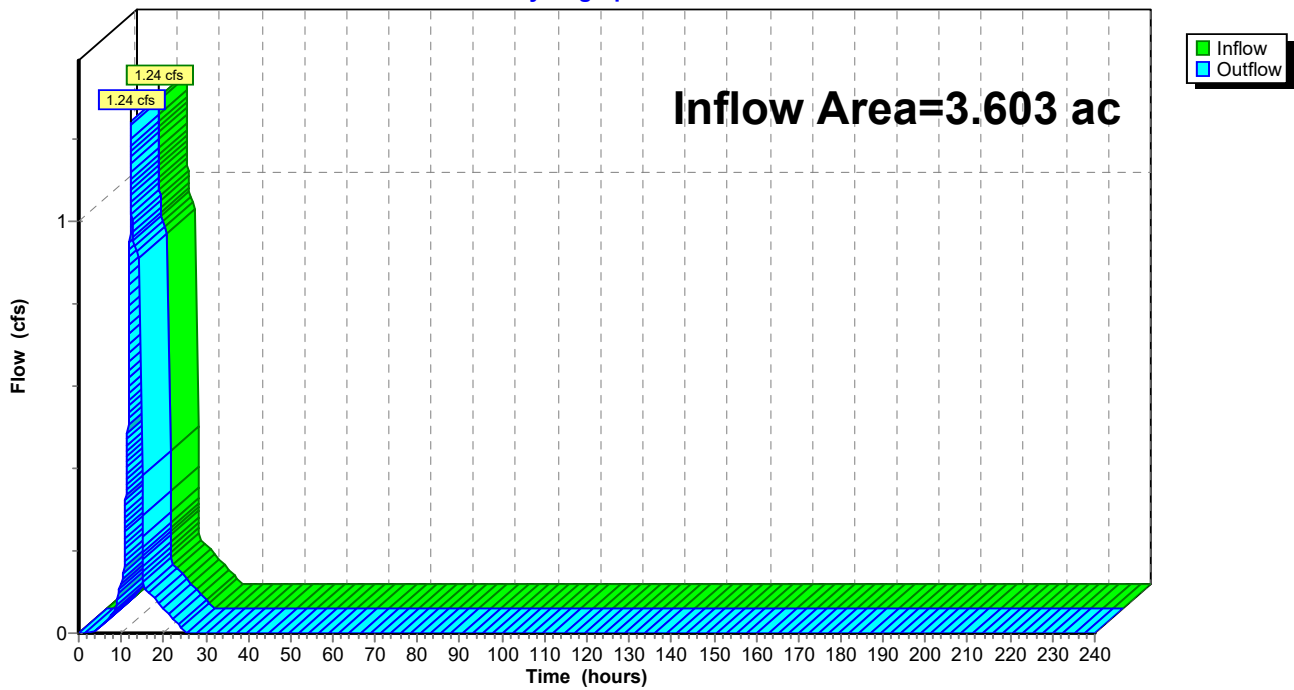
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 60.62% Impervious, Inflow Depth = 1.21" for 2" WQ event
Inflow = 1.24 cfs @ 12.19 hrs, Volume= 0.364 af
Outflow = 1.24 cfs @ 12.19 hrs, Volume= 0.364 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

Hydrograph



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MSE 24-hr 3 2" WQ Rainfall=2.00"

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Summary for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Inflow Area = 2.838 ac, 76.72% Impervious, Inflow Depth = 1.44" for 2" WQ event
 Inflow = 5.69 cfs @ 12.17 hrs, Volume= 0.341 af
 Outflow = 0.89 cfs @ 11.78 hrs, Volume= 0.341 af, Atten= 84%, Lag= 0.0 min
 Primary = 0.89 cfs @ 11.78 hrs, Volume= 0.341 af
 Routed to Reach 1R : TOTAL TO COOKS BAY

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 934.05' @ 12.60 hrs Surf.Area= 1,853 sf Storage= 4,870 cf

Plug-Flow detention time= 35.1 min calculated for 0.341 af (100% of inflow)
 Center-of-Mass det. time= 35.1 min (804.6 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	930.50'	3,015 cf	17.00'W x 109.00'L x 7.33'H Field A 13,589 cf Overall - 6,051 cf Embedded = 7,538 cf x 40.0% Voids
#2A	930.50'	6,051 cf	CMP Round 72 x 10 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +7.00' x 28.27 sf x 2 rows
		9,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	930.50'	0.890 cfs Constant Flow/Skimmer
#2	Primary	929.86'	21.0" Round Culvert L= 56.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 929.86' / 929.50' S= 0.0064 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 2.41 sf
#3	Device 4	934.70'	3.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 2	929.86'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.89 cfs @ 11.78 hrs HW=930.56' (Free Discharge)

- ↑ **2=Culvert** (Passes 0.89 cfs of 2.10 cfs potential flow)
- ↑ **4=Orifice/Grate** (Passes 0.89 cfs of 7.12 cfs potential flow)
- ↑ **1=Constant Flow/Skimmer** (Constant Controls 0.89 cfs)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

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Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN - Chamber Wizard Field A

Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +7.00' x 28.27 sf x 2 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

5 Chambers/Row x 20.00' Long +7.00' Row Adjustment = 107.00' Row Length +12.0" End Stone x 2 = 109.00' Base Length

2 Rows x 72.0" Wide + 36.0" Spacing x 1 + 12.0" Side Stone x 2 = 17.00' Base Width

72.0" Chamber Height + 16.0" Stone Cover = 7.33' Field Height

10 Chambers x 565.5 cf +7.00' Row Adjustment x 28.27 sf x 2 Rows = 6,050.7 cf Chamber Storage

13,588.7 cf Field - 6,050.7 cf Chambers = 7,538.0 cf Stone x 40.0% Voids = 3,015.2 cf Stone Storage

Chamber Storage + Stone Storage = 9,065.9 cf = 0.208 af

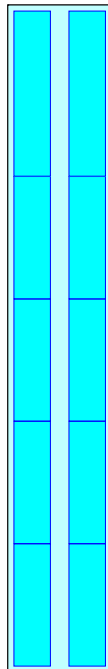
Overall Storage Efficiency = 66.7%

Overall System Size = 109.00' x 17.00' x 7.33'

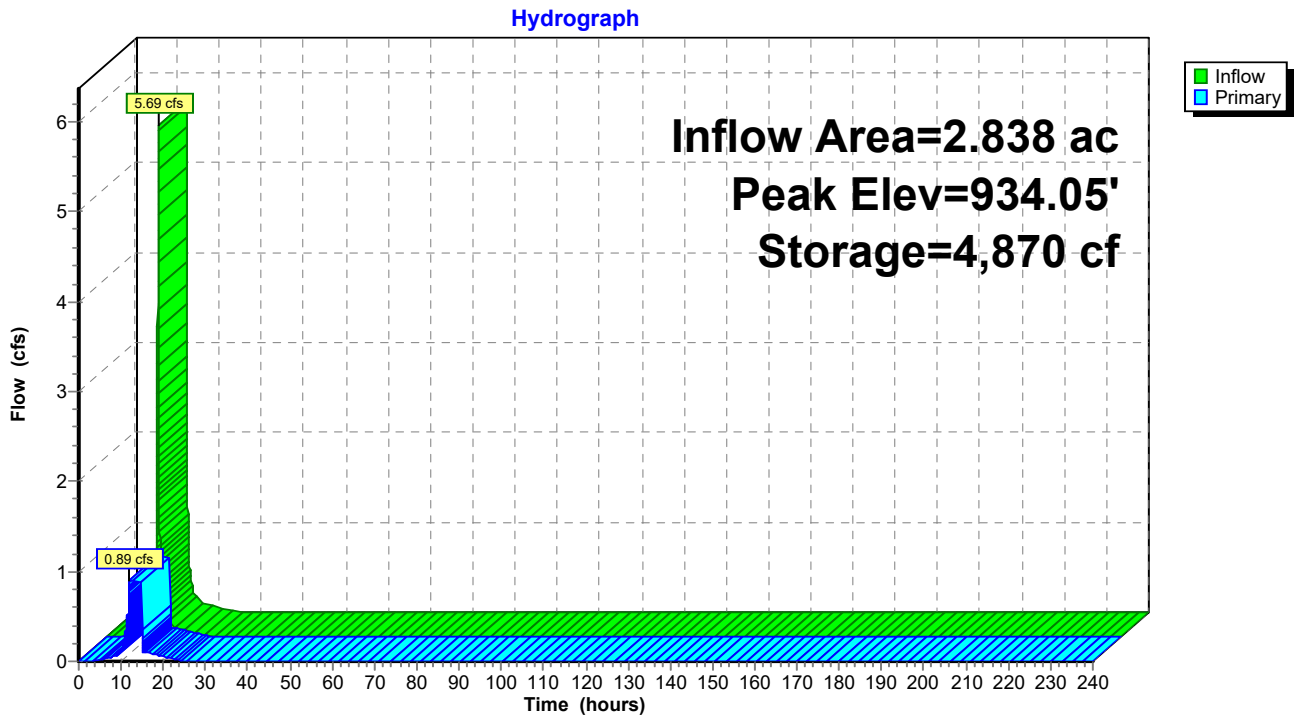
10 Chambers

503.3 cy Field

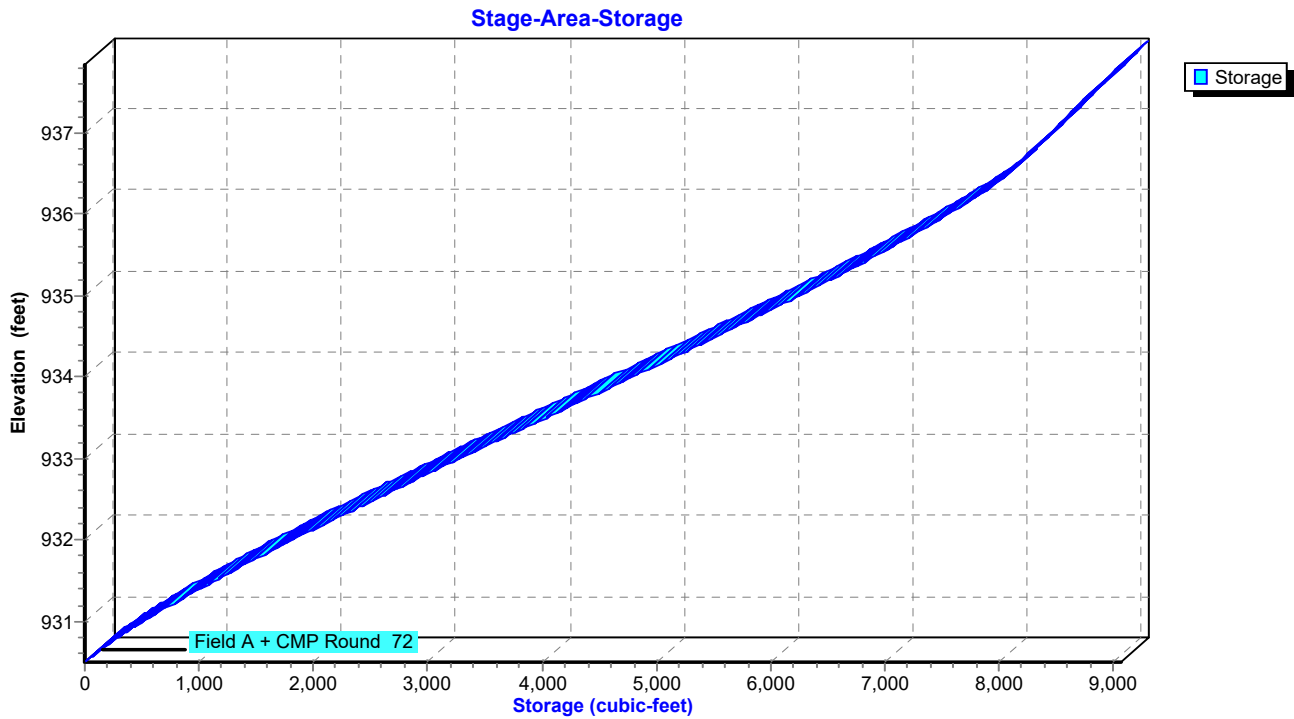
279.2 cy Stone



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



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Stage-Discharge for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
930.50	0.00	933.10	0.89	935.70	10.05
930.55	0.89	933.15	0.89	935.75	10.71
930.60	0.89	933.20	0.89	935.80	11.38
930.65	0.89	933.25	0.89	935.85	12.06
930.70	0.89	933.30	0.89	935.90	12.75
930.75	0.89	933.35	0.89	935.95	13.46
930.80	0.89	933.40	0.89	936.00	14.17
930.85	0.89	933.45	0.89	936.05	14.89
930.90	0.89	933.50	0.89	936.10	15.62
930.95	0.89	933.55	0.89	936.15	16.36
931.00	0.89	933.60	0.89	936.20	17.11
931.05	0.89	933.65	0.89	936.25	17.86
931.10	0.89	933.70	0.89	936.30	18.63
931.15	0.89	933.75	0.89	936.35	19.39
931.20	0.89	933.80	0.89	936.40	20.17
931.25	0.89	933.85	0.89	936.45	20.95
931.30	0.89	933.90	0.89	936.50	21.74
931.35	0.89	933.95	0.89	936.55	22.01
931.40	0.89	934.00	0.89	936.60	22.09
931.45	0.89	934.05	0.89	936.65	22.17
931.50	0.89	934.10	0.89	936.70	22.25
931.55	0.89	934.15	0.89	936.75	22.33
931.60	0.89	934.20	0.89	936.80	22.42
931.65	0.89	934.25	0.89	936.85	22.50
931.70	0.89	934.30	0.89	936.90	22.58
931.75	0.89	934.35	0.89	936.95	22.66
931.80	0.89	934.40	0.89	937.00	22.74
931.85	0.89	934.45	0.89	937.05	22.82
931.90	0.89	934.50	0.89	937.10	22.89
931.95	0.89	934.55	0.89	937.15	22.97
932.00	0.89	934.60	0.89	937.20	23.05
932.05	0.89	934.65	0.89	937.25	23.13
932.10	0.89	934.70	0.89	937.30	23.21
932.15	0.89	934.75	1.00	937.35	23.29
932.20	0.89	934.80	1.20	937.40	23.36
932.25	0.89	934.85	1.45	937.45	23.44
932.30	0.89	934.90	1.76	937.50	23.52
932.35	0.89	934.95	2.10	937.55	23.60
932.40	0.89	935.00	2.47	937.60	23.67
932.45	0.89	935.05	2.87	937.65	23.75
932.50	0.89	935.10	3.31	937.70	23.82
932.55	0.89	935.15	3.76	937.75	23.90
932.60	0.89	935.20	4.24	937.80	23.98
932.65	0.89	935.25	4.74		
932.70	0.89	935.30	5.27		
932.75	0.89	935.35	5.81		
932.80	0.89	935.40	6.37		
932.85	0.89	935.45	6.94		
932.90	0.89	935.50	7.54		
932.95	0.89	935.55	8.14		
933.00	0.89	935.60	8.76		
933.05	0.89	935.65	9.40		

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Stage-Area-Storage for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
930.50	0	933.10	3,435	935.70	7,197
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930.70	185	933.30	3,737	935.90	7,444
930.75	237	933.35	3,812	935.95	7,504
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930.90	400	933.50	4,039	936.10	7,677
930.95	457	933.55	4,114	936.15	7,733
931.00	515	933.60	4,190	936.20	7,787
931.05	574	933.65	4,266	936.25	7,841
931.10	634	933.70	4,341	936.30	7,892
931.15	694	933.75	4,416	936.35	7,942
931.20	756	933.80	4,492	936.40	7,990
931.25	818	933.85	4,567	936.45	8,036
931.30	881	933.90	4,643	936.50	8,078
931.35	944	933.95	4,718	936.55	8,115
931.40	1,009	934.00	4,793	936.60	8,152
931.45	1,073	934.05	4,868	936.65	8,189
931.50	1,139	934.10	4,943	936.70	8,226
931.55	1,205	934.15	5,017	936.75	8,263
931.60	1,272	934.20	5,092	936.80	8,300
931.65	1,339	934.25	5,166	936.85	8,337
931.70	1,406	934.30	5,241	936.90	8,374
931.75	1,474	934.35	5,315	936.95	8,411
931.80	1,543	934.40	5,389	937.00	8,448
931.85	1,612	934.45	5,462	937.05	8,485
931.90	1,681	934.50	5,536	937.10	8,522
931.95	1,751	934.55	5,609	937.15	8,559
932.00	1,822	934.60	5,682	937.20	8,596
932.05	1,892	934.65	5,755	937.25	8,634
932.10	1,963	934.70	5,827	937.30	8,671
932.15	2,034	934.75	5,900	937.35	8,708
932.20	2,106	934.80	5,972	937.40	8,745
932.25	2,178	934.85	6,043	937.45	8,782
932.30	2,250	934.90	6,115	937.50	8,819
932.35	2,323	934.95	6,185	937.55	8,856
932.40	2,395	935.00	6,256	937.60	8,893
932.45	2,468	935.05	6,326	937.65	8,930
932.50	2,542	935.10	6,396	937.70	8,967
932.55	2,615	935.15	6,466	937.75	9,004
932.60	2,689	935.20	6,535	937.80	9,041
932.65	2,763	935.25	6,603		
932.70	2,837	935.30	6,671		
932.75	2,911	935.35	6,739		
932.80	2,986	935.40	6,806		
932.85	3,060	935.45	6,873		
932.90	3,135	935.50	6,939		
932.95	3,210	935.55	7,004		
933.00	3,285	935.60	7,069		
933.05	3,360	935.65	7,133		

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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentPR1: PR1 - DRAINS EAST Runoff Area=33,310 sf 0.87% Impervious Runoff Depth=0.03"
Tc=10.0 min CN=WQ Runoff=0.01 cfs 0.002 af

SubcatchmentPR2: PR2 - DRAINS TO 1P Runoff Area=26,190 sf 80.48% Impervious Runoff Depth=0.64"
Tc=10.0 min CN=WQ Runoff=0.56 cfs 0.032 af

SubcatchmentPR3: PR3 - DRAINS TO Runoff Area=44,375 sf 96.17% Impervious Runoff Depth=0.76"
Tc=10.0 min CN=WQ Runoff=1.14 cfs 0.065 af

SubcatchmentPR4: PR4 - DRAINS TO Runoff Area=53,064 sf 58.58% Impervious Runoff Depth=0.47"
Tc=10.0 min CN=WQ Runoff=0.83 cfs 0.048 af

Reach 1R: TOTAL TO COOKS BAY Inflow=0.90 cfs 0.147 af
Outflow=0.90 cfs 0.147 af

Pond 1P: 1P - UNDERGROUND RATE Peak Elev=931.52' Storage=1,161 cf Inflow=2.53 cfs 0.145 af
Outflow=0.89 cfs 0.145 af

Total Runoff Area = 3.603 ac Runoff Volume = 0.147 af Average Runoff Depth = 0.49"
39.38% Pervious = 1.419 ac 60.62% Impervious = 2.184 ac

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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Summary for Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Runoff = 0.01 cfs @ 12.17 hrs, Volume= 0.002 af, Depth= 0.03"
 Routed to Reach 1R : TOTAL TO COOKS BAY

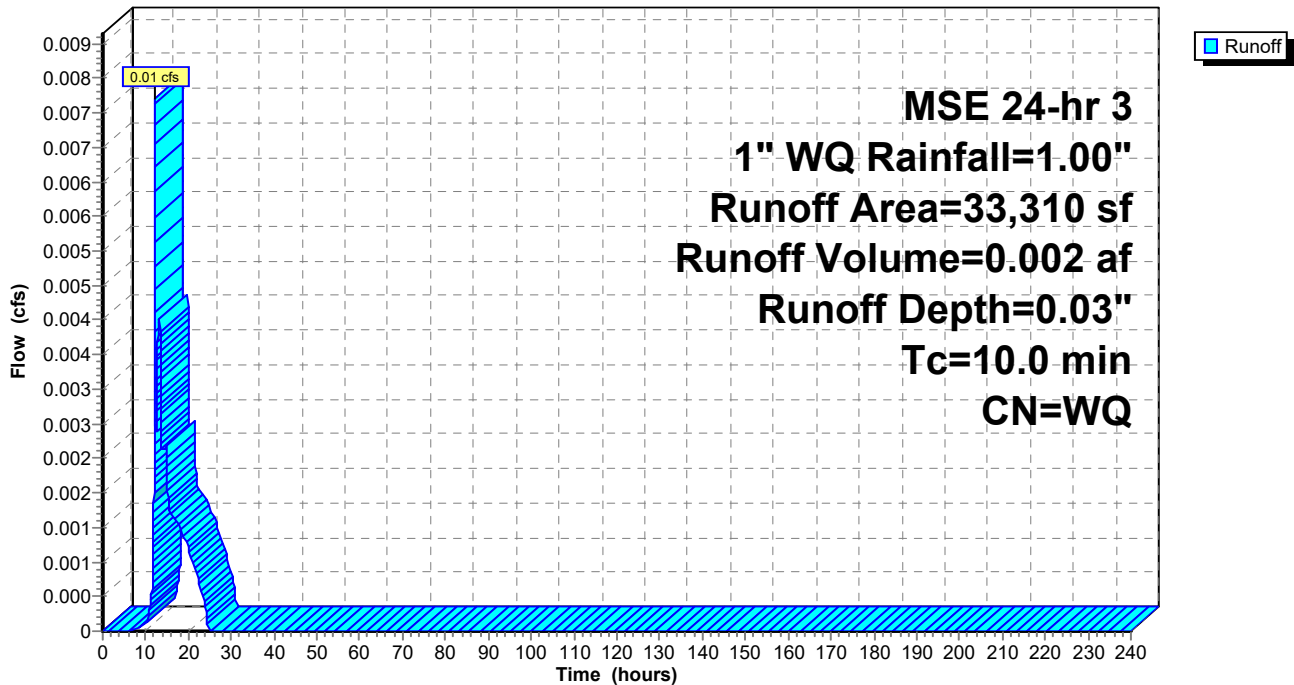
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1" WQ Rainfall=1.00"

Area (sf)	CN	Description
289	98	Paved parking, HSG C
33,021	74	>75% Grass cover, Good, HSG C
33,310		Weighted Average
33,021		99.13% Pervious Area
289		0.87% Impervious Area

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

Subcatchment PR1: PR1 - DRAINS EAST TO COOKS BAY

Hydrograph



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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Summary for Subcatchment PR2: PR2 - DRAINS TO 1P

Runoff = 0.56 cfs @ 12.17 hrs, Volume= 0.032 af, Depth= 0.64"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

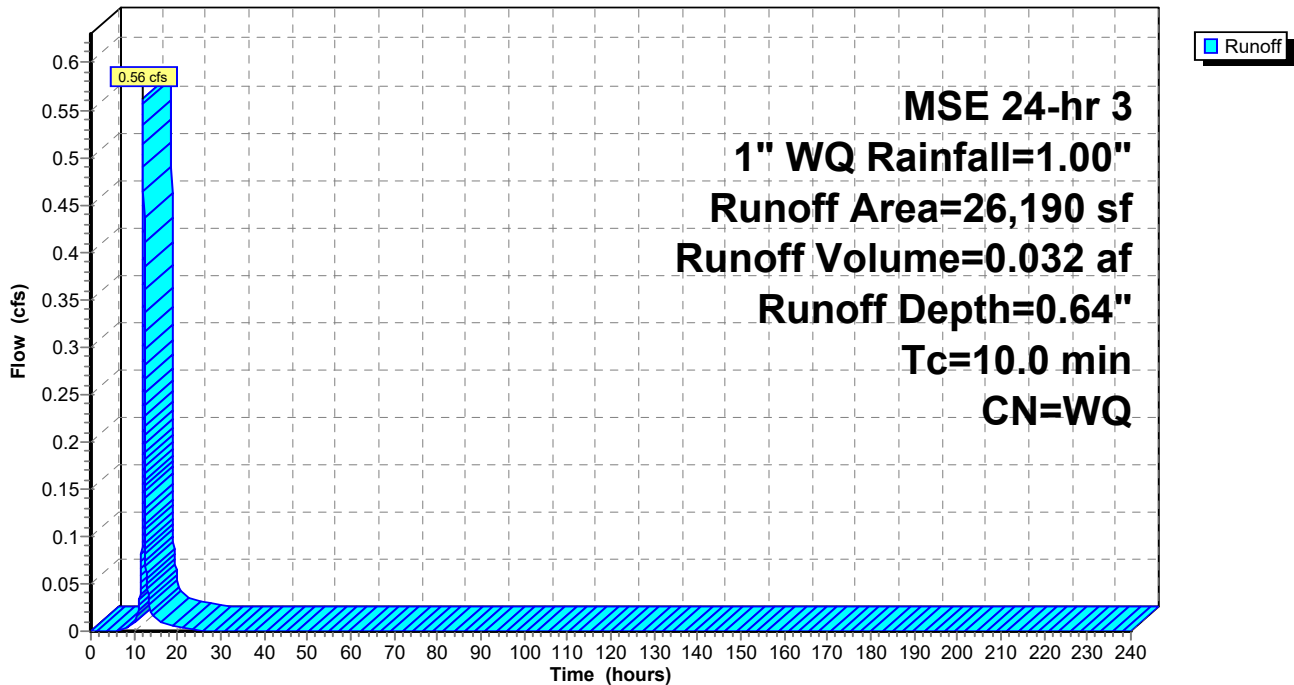
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1" WQ Rainfall=1.00"

Area (sf)	CN	Description
21,079	98	Paved parking, HSG C
5,111	74	>75% Grass cover, Good, HSG C
26,190		Weighted Average
5,111		19.52% Pervious Area
21,079		80.48% Impervious Area

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

Subcatchment PR2: PR2 - DRAINS TO 1P

Hydrograph



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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Summary for Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Runoff = 1.14 cfs @ 12.17 hrs, Volume= 0.065 af, Depth= 0.76"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

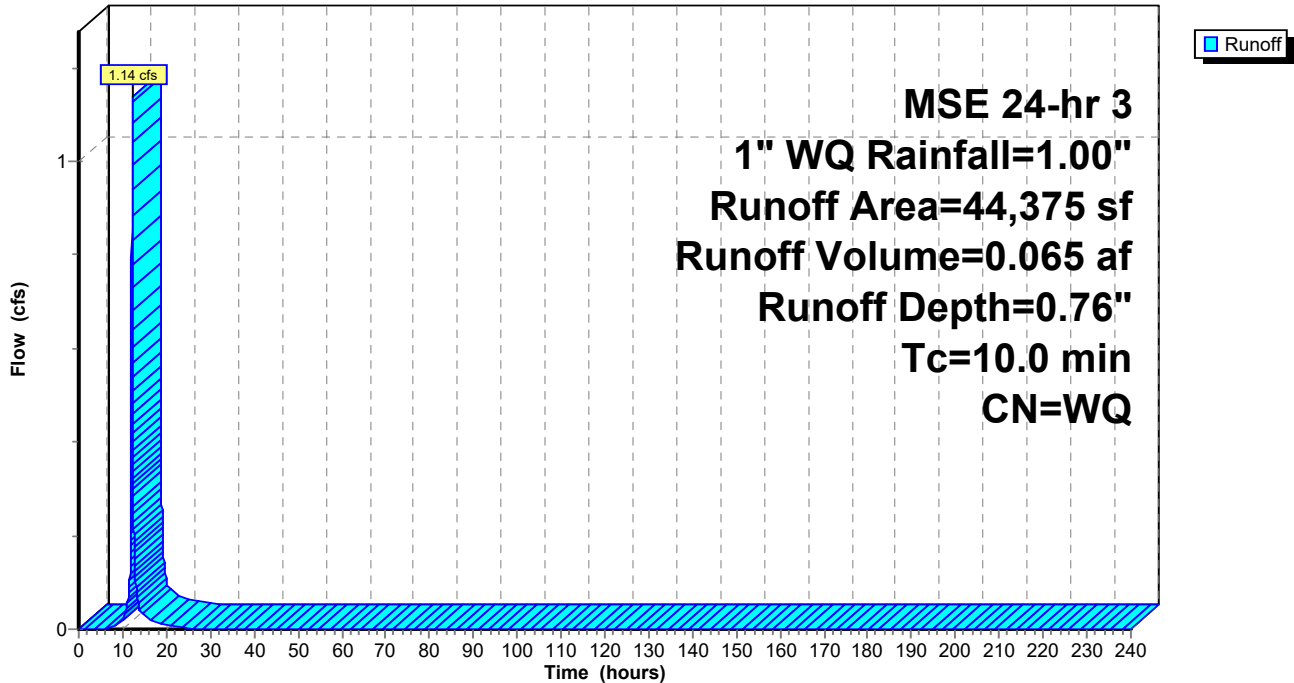
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1" WQ Rainfall=1.00"

Area (sf)	CN	Description
42,677	98	Paved parking, HSG C
1,698	74	>75% Grass cover, Good, HSG C
44,375		Weighted Average
1,698		3.83% Pervious Area
42,677		96.17% Impervious Area

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

Subcatchment PR3: PR3 - DRAINS TO COMMERCE BLVD

Hydrograph



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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Summary for Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Runoff = 0.83 cfs @ 12.17 hrs, Volume= 0.048 af, Depth= 0.47"

Routed to Pond 1P : 1P - UNDERGROUND RATE CONTROL BASIN

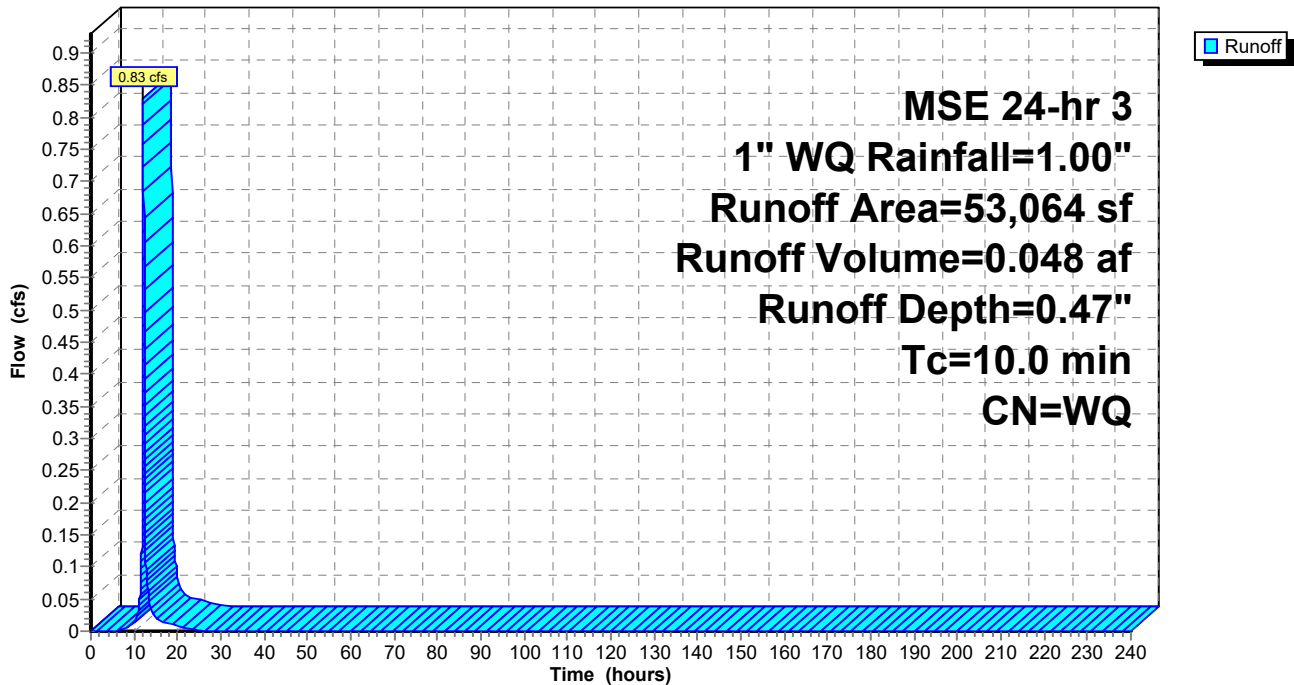
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1" WQ Rainfall=1.00"

Area (sf)	CN	Description
31,086	98	Paved parking, HSG C
21,978	74	>75% Grass cover, Good, HSG C
53,064		Weighted Average
21,978		41.42% Pervious Area
31,086		58.58% Impervious Area

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

Subcatchment PR4: PR4 - DRAINS TO COMMERCE BLVD

Hydrograph



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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Summary for Reach 1R: TOTAL TO COOKS BAY

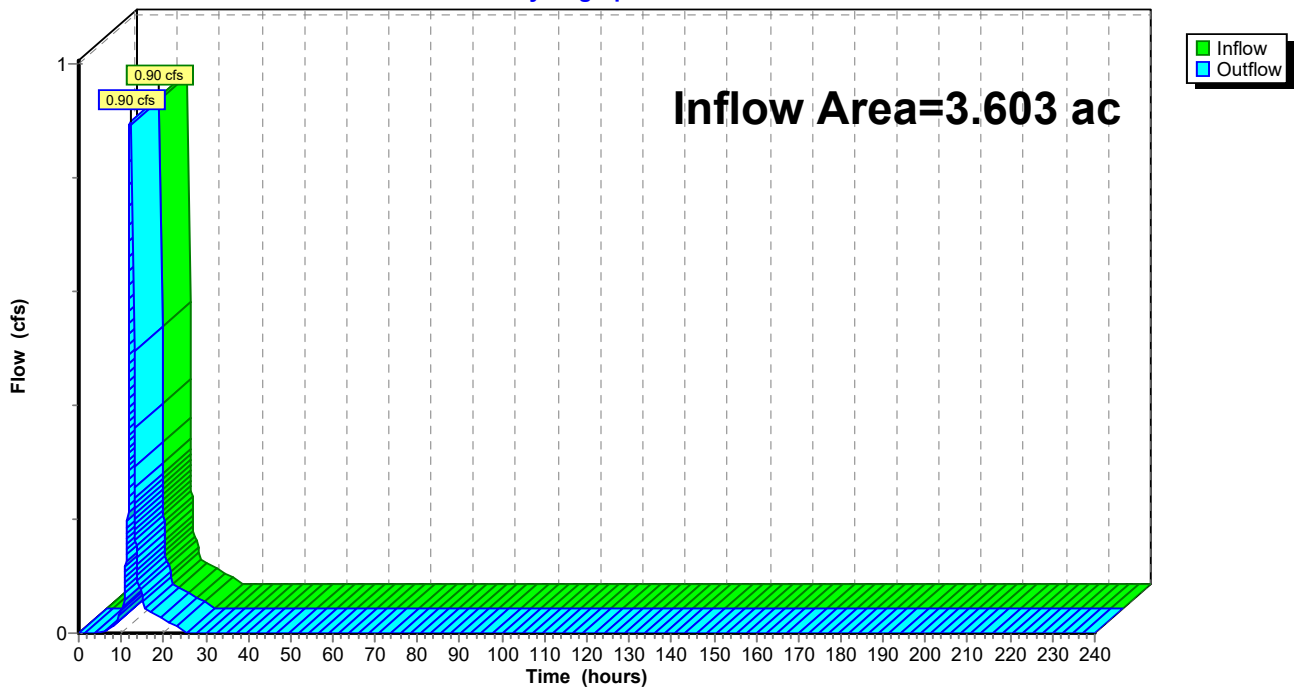
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.603 ac, 60.62% Impervious, Inflow Depth = 0.49" for 1" WQ event
Inflow = 0.90 cfs @ 12.17 hrs, Volume= 0.147 af
Outflow = 0.90 cfs @ 12.17 hrs, Volume= 0.147 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL TO COOKS BAY

Hydrograph



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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Summary for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Inflow Area = 2.838 ac, 76.72% Impervious, Inflow Depth = 0.61" for 1" WQ event
 Inflow = 2.53 cfs @ 12.17 hrs, Volume= 0.145 af
 Outflow = 0.89 cfs @ 12.00 hrs, Volume= 0.145 af, Atten= 65%, Lag= 0.0 min
 Primary = 0.89 cfs @ 12.00 hrs, Volume= 0.145 af
 Routed to Reach 1R : TOTAL TO COOKS BAY

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 931.52' @ 12.38 hrs Surf.Area= 1,853 sf Storage= 1,161 cf

Plug-Flow detention time= 7.0 min calculated for 0.145 af (100% of inflow)
 Center-of-Mass det. time= 7.0 min (788.0 - 781.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	930.50'	3,015 cf	17.00'W x 109.00'L x 7.33'H Field A 13,589 cf Overall - 6,051 cf Embedded = 7,538 cf x 40.0% Voids
#2A	930.50'	6,051 cf	CMP Round 72 x 10 Inside #1 Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf Overall Size= 72.0"W x 72.0"H x 20.00'L Row Length Adjustment= +7.00' x 28.27 sf x 2 rows
		9,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	930.50'	0.890 cfs Constant Flow/Skimmer
#2	Primary	929.86'	21.0" Round Culvert L= 56.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 929.86' / 929.50' S= 0.0064 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 2.41 sf
#3	Device 4	934.70'	3.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 2	929.86'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.89 cfs @ 12.00 hrs HW=930.56' (Free Discharge)

- ↑ **2=Culvert** (Passes 0.89 cfs of 2.11 cfs potential flow)
- ↑ **4=Orifice/Grate** (Passes 0.89 cfs of 7.13 cfs potential flow)
- ↑ **1=Constant Flow/Skimmer** (Constant Controls 0.89 cfs)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

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MSE 24-hr 3 1" WQ Rainfall=1.00"

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Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN - Chamber Wizard Field A

Chamber Model = CMP Round 72 (Round Corrugated Metal Pipe)

Effective Size= 72.0"W x 72.0"H => 28.27 sf x 20.00'L = 565.5 cf

Overall Size= 72.0"W x 72.0"H x 20.00'L

Row Length Adjustment= +7.00' x 28.27 sf x 2 rows

72.0" Wide + 36.0" Spacing = 108.0" C-C Row Spacing

5 Chambers/Row x 20.00' Long +7.00' Row Adjustment = 107.00' Row Length +12.0" End Stone x 2 = 109.00' Base Length

2 Rows x 72.0" Wide + 36.0" Spacing x 1 + 12.0" Side Stone x 2 = 17.00' Base Width

72.0" Chamber Height + 16.0" Stone Cover = 7.33' Field Height

10 Chambers x 565.5 cf +7.00' Row Adjustment x 28.27 sf x 2 Rows = 6,050.7 cf Chamber Storage

13,588.7 cf Field - 6,050.7 cf Chambers = 7,538.0 cf Stone x 40.0% Voids = 3,015.2 cf Stone Storage

Chamber Storage + Stone Storage = 9,065.9 cf = 0.208 af

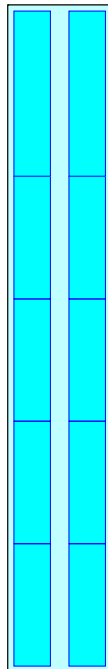
Overall Storage Efficiency = 66.7%

Overall System Size = 109.00' x 17.00' x 7.33'

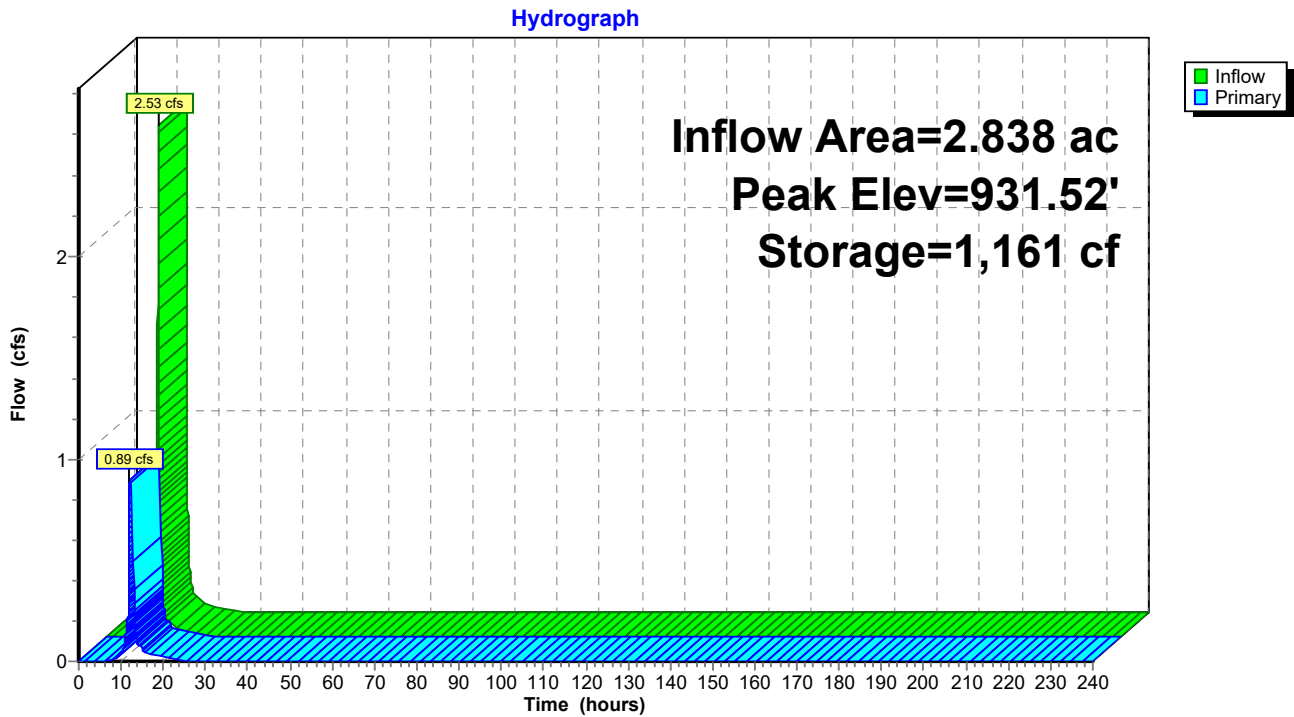
10 Chambers

503.3 cy Field

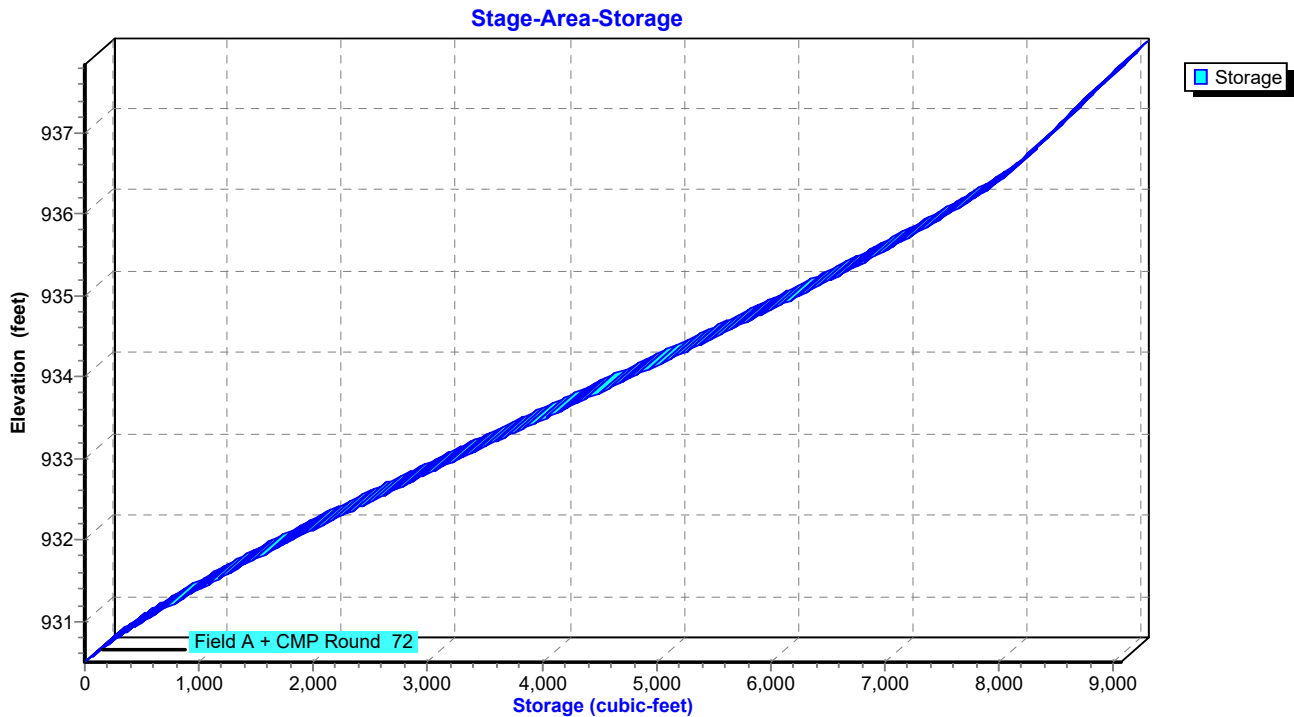
279.2 cy Stone



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN



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Stage-Discharge for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
930.50	0.00	933.10	0.89	935.70	10.05
930.55	0.89	933.15	0.89	935.75	10.71
930.60	0.89	933.20	0.89	935.80	11.38
930.65	0.89	933.25	0.89	935.85	12.06
930.70	0.89	933.30	0.89	935.90	12.75
930.75	0.89	933.35	0.89	935.95	13.46
930.80	0.89	933.40	0.89	936.00	14.17
930.85	0.89	933.45	0.89	936.05	14.89
930.90	0.89	933.50	0.89	936.10	15.62
930.95	0.89	933.55	0.89	936.15	16.36
931.00	0.89	933.60	0.89	936.20	17.11
931.05	0.89	933.65	0.89	936.25	17.86
931.10	0.89	933.70	0.89	936.30	18.63
931.15	0.89	933.75	0.89	936.35	19.39
931.20	0.89	933.80	0.89	936.40	20.17
931.25	0.89	933.85	0.89	936.45	20.95
931.30	0.89	933.90	0.89	936.50	21.74
931.35	0.89	933.95	0.89	936.55	22.01
931.40	0.89	934.00	0.89	936.60	22.09
931.45	0.89	934.05	0.89	936.65	22.17
931.50	0.89	934.10	0.89	936.70	22.25
931.55	0.89	934.15	0.89	936.75	22.33
931.60	0.89	934.20	0.89	936.80	22.42
931.65	0.89	934.25	0.89	936.85	22.50
931.70	0.89	934.30	0.89	936.90	22.58
931.75	0.89	934.35	0.89	936.95	22.66
931.80	0.89	934.40	0.89	937.00	22.74
931.85	0.89	934.45	0.89	937.05	22.82
931.90	0.89	934.50	0.89	937.10	22.89
931.95	0.89	934.55	0.89	937.15	22.97
932.00	0.89	934.60	0.89	937.20	23.05
932.05	0.89	934.65	0.89	937.25	23.13
932.10	0.89	934.70	0.89	937.30	23.21
932.15	0.89	934.75	1.00	937.35	23.29
932.20	0.89	934.80	1.20	937.40	23.36
932.25	0.89	934.85	1.45	937.45	23.44
932.30	0.89	934.90	1.76	937.50	23.52
932.35	0.89	934.95	2.10	937.55	23.60
932.40	0.89	935.00	2.47	937.60	23.67
932.45	0.89	935.05	2.87	937.65	23.75
932.50	0.89	935.10	3.31	937.70	23.82
932.55	0.89	935.15	3.76	937.75	23.90
932.60	0.89	935.20	4.24	937.80	23.98
932.65	0.89	935.25	4.74		
932.70	0.89	935.30	5.27		
932.75	0.89	935.35	5.81		
932.80	0.89	935.40	6.37		
932.85	0.89	935.45	6.94		
932.90	0.89	935.50	7.54		
932.95	0.89	935.55	8.14		
933.00	0.89	935.60	8.76		
933.05	0.89	935.65	9.40		

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Stage-Area-Storage for Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
930.50	0	933.10	3,435	935.70	7,197
930.55	40	933.15	3,510	935.75	7,260
930.60	87	933.20	3,586	935.80	7,322
930.65	135	933.25	3,661	935.85	7,383
930.70	185	933.30	3,737	935.90	7,444
930.75	237	933.35	3,812	935.95	7,504
930.80	290	933.40	3,888	936.00	7,563
930.85	345	933.45	3,963	936.05	7,620
930.90	400	933.50	4,039	936.10	7,677
930.95	457	933.55	4,114	936.15	7,733
931.00	515	933.60	4,190	936.20	7,787
931.05	574	933.65	4,266	936.25	7,841
931.10	634	933.70	4,341	936.30	7,892
931.15	694	933.75	4,416	936.35	7,942
931.20	756	933.80	4,492	936.40	7,990
931.25	818	933.85	4,567	936.45	8,036
931.30	881	933.90	4,643	936.50	8,078
931.35	944	933.95	4,718	936.55	8,115
931.40	1,009	934.00	4,793	936.60	8,152
931.45	1,073	934.05	4,868	936.65	8,189
931.50	1,139	934.10	4,943	936.70	8,226
931.55	1,205	934.15	5,017	936.75	8,263
931.60	1,272	934.20	5,092	936.80	8,300
931.65	1,339	934.25	5,166	936.85	8,337
931.70	1,406	934.30	5,241	936.90	8,374
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932.05	1,892	934.65	5,755	937.25	8,634
932.10	1,963	934.70	5,827	937.30	8,671
932.15	2,034	934.75	5,900	937.35	8,708
932.20	2,106	934.80	5,972	937.40	8,745
932.25	2,178	934.85	6,043	937.45	8,782
932.30	2,250	934.90	6,115	937.50	8,819
932.35	2,323	934.95	6,185	937.55	8,856
932.40	2,395	935.00	6,256	937.60	8,893
932.45	2,468	935.05	6,326	937.65	8,930
932.50	2,542	935.10	6,396	937.70	8,967
932.55	2,615	935.15	6,466	937.75	9,004
932.60	2,689	935.20	6,535	937.80	9,041
932.65	2,763	935.25	6,603		
932.70	2,837	935.30	6,671		
932.75	2,911	935.35	6,739		
932.80	2,986	935.40	6,806		
932.85	3,060	935.45	6,873		
932.90	3,135	935.50	6,939		
932.95	3,210	935.55	7,004		
933.00	3,285	935.60	7,069		
933.05	3,360	935.65	7,133		

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2-Year 24-Hour Event

- 7 Node Listing
- 8 Subcat PR1: PR1 - DRAINS EAST TO COOKS BAY
- 9 Subcat PR2: PR2 - DRAINS TO 1P
- 10 Subcat PR3: PR3 - DRAINS TO COMMERCE BLVD
- 11 Subcat PR4: PR4 - DRAINS TO COMMERCE BLVD
- 12 Reach 1R: TOTAL TO COOKS BAY
- 13 Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

10-Year 24-Hour Event

- 18 Node Listing
- 19 Subcat PR1: PR1 - DRAINS EAST TO COOKS BAY
- 20 Subcat PR2: PR2 - DRAINS TO 1P
- 21 Subcat PR3: PR3 - DRAINS TO COMMERCE BLVD
- 22 Subcat PR4: PR4 - DRAINS TO COMMERCE BLVD
- 23 Reach 1R: TOTAL TO COOKS BAY
- 24 Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

100-Year 24-Hour Event

- 29 Node Listing
- 30 Subcat PR1: PR1 - DRAINS EAST TO COOKS BAY
- 31 Subcat PR2: PR2 - DRAINS TO 1P
- 32 Subcat PR3: PR3 - DRAINS TO COMMERCE BLVD
- 33 Subcat PR4: PR4 - DRAINS TO COMMERCE BLVD
- 34 Reach 1R: TOTAL TO COOKS BAY
- 35 Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

2" WQ Event

- 40 Node Listing
- 41 Subcat PR1: PR1 - DRAINS EAST TO COOKS BAY
- 42 Subcat PR2: PR2 - DRAINS TO 1P
- 43 Subcat PR3: PR3 - DRAINS TO COMMERCE BLVD
- 44 Subcat PR4: PR4 - DRAINS TO COMMERCE BLVD
- 45 Reach 1R: TOTAL TO COOKS BAY
- 46 Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

1" WQ Event

- 51 Node Listing

23360 - PROPOSED

Prepared by Civil Site Group

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- 53 Subcat PR2: PR2 - DRAINS TO 1P
- 54 Subcat PR3: PR3 - DRAINS TO COMMERCE BLVD
- 55 Subcat PR4: PR4 - DRAINS TO COMMERCE BLVD
- 56 Reach 1R: TOTAL TO COOKS BAY
- 57 Pond 1P: 1P - UNDERGROUND RATE CONTROL BASIN

Project Information

Calculator Version: Version 4: July 2020
Project Name: Lake Minnetonka Flats - Existing Conditions Site
User Name / Company Name: Madison Darling - Civil Site Group
Date: 09/06/2024
Project Description:
Construction Permit?: Yes

Site Information

Retention Requirement (inches): 2
Site's Zip Code: 55364
Annual Rainfall (inches): 29.4
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			1.3		1.3
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0
				Impervious Area (acres)	0.07
				Total Area (acres)	1.37

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)	
				Total Area (acres)	0

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	508	ft ³
Volume removed by BMPs towards performance goal:		ft ³
Percent volume removed towards performance goal		%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	0.2613	acre-ft
Annual runoff volume removed by BMPs:		acre-ft
Percent annual runoff volume removed:		%

Post development annual particulate P load:	0.1173	lbs
Annual particulate P removed by BMPs:		lbs
Post development annual dissolved P load:	0.096	lbs
Annual dissolved P removed by BMPs:	0	lbs
Total P removed by BMPs	0	lbs
Percent annual total phosphorus removed:		%

Post development annual TSS load:	38.7	lbs
Annual TSS removed by BMPs:		lbs
Percent annual TSS removed:		%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)

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 (%)

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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BMP Schematic

Project Information

Calculator Version: Version 4: July 2020
Project Name: Lake Minnetonka Flats - Existing Conditions Street
User Name / Company Name: Madison Darling - Civil Site Group
Date: 09/06/2024
Project Description:
Construction Permit?: Yes

Site Information

Retention Requirement (inches): 0.5
Site's Zip Code: 55364
Annual Rainfall (inches): 29.4
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			0.05		0.05
			Impervious Area (acres)		0.97
			Total Area (acres)		1.02

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)		
			Total Area (acres)		0

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	1761	ft ³
Volume removed by BMPs towards performance goal:		ft ³
Percent volume removed towards performance goal		%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	2.0562	acre-ft
Annual runoff volume removed by BMPs:		acre-ft
Percent annual runoff volume removed:		%

Post development annual particulate P load:	0.9228	lbs
Annual particulate P removed by BMPs:		lbs
Post development annual dissolved P load:	0.755	lbs
Annual dissolved P removed by BMPs:	0	lbs
Total P removed by BMPs	0	lbs
Percent annual total phosphorus removed:		%

Post development annual TSS load:	304.8	lbs
Annual TSS removed by BMPs:		lbs
Percent annual TSS removed:		%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)

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 (%)

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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BMP Schematic

Project Information

Calculator Version: Version 4: July 2020
Project Name: Lake Minnetonka Flats - Proposed Conditions Site
User Name / Company Name: Madison Darling - Civil Site Group
Date: 09/06/2024
Project Description:
Construction Permit?: Yes

Site Information

Retention Requirement (inches): 2
Site's Zip Code: 55364
Annual Rainfall (inches): 29.4
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			0.53		0.53
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			0.35		0.35
			Impervious Area (acres)		0.49
			Total Area (acres)		1.37

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			0.12		0.12
			Impervious Area (acres)		0.48
			Total Area (acres)		0.6

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	3557	ft ³
Volume removed by BMPs towards performance goal:		ft ³
Percent volume removed towards performance goal		%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	1.243	acre-ft
Annual runoff volume removed by BMPs:	0	acre-ft
Percent annual runoff volume removed:	0	%

Post development annual particulate P load:	0.5578	lbs
Annual particulate P removed by BMPs:	0.239	lbs
Post development annual dissolved P load:	0.456	lbs
Annual dissolved P removed by BMPs:	0.195	lbs
Total P removed by BMPs	0.434	lbs
Percent annual total phosphorus removed:	43	%

Post development annual TSS load:	184.3	lbs
Annual TSS removed by BMPs:	126.1	lbs
Percent annual TSS removed:	68	%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)
Jellyfish Filter	0	3485	0	3485	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 (%)
Jellyfish Filter	1.0637	0	0	1.0637	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	0.4774	0	0.2387	0.2387	50

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	0.3906	0	0.1953	0.1953	50

Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	0.868	0	0.434	0.434	50

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	157.68	0	126.14	31.54	80

BMP Schematic

Project Information

Calculator Version: Version 4: July 2020
Project Name: Lake Minnetonka Flats - Proposed Conditions Street
User Name / Company Name: Madison Darling - Civil Site Group
Date: 09/06/2024
Project Description:
Construction Permit?: Yes

Site Information

Retention Requirement (inches): 0.5
Site's Zip Code: 55364
Annual Rainfall (inches): 29.4
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			.05		0.05
				Impervious Area (acres)	.97
				Total Area (acres)	1.02

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			0.05		0.05
				Impervious Area (acres)	0.97
				Total Area (acres)	1.02

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	1761	ft ³
Volume removed by BMPs towards performance goal:		ft ³
Percent volume removed towards performance goal		%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	2.0562	acre-ft
Annual runoff volume removed by BMPs:	0	acre-ft
Percent annual runoff volume removed:	0	%

Post development annual particulate P load:	0.9228	lbs
Annual particulate P removed by BMPs:	0.461	lbs
Post development annual dissolved P load:	0.755	lbs
Annual dissolved P removed by BMPs:	0.378	lbs
Total P removed by BMPs	0.839	lbs
Percent annual total phosphorus removed:	50	%

Post development annual TSS load:	304.8	lbs
Annual TSS removed by BMPs:	243.8	lbs
Percent annual TSS removed:	80	%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)
Jellyfish Filter	0	1761	0	1761	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 (%)
Jellyfish Filter	2.0562	0	0	2.0562	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	0.9228	0	0.4614	0.4614	50

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	0.755	0	0.3775	0.3775	50

Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	1.6778	0	0.8389	0.8389	50

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Jellyfish Filter	304.81	0	243.85	60.96	80

BMP Schematic

Other
Jellyfish Filter

May 15, 2024

HGTS Project Number: 24-0274

Mr. Dan Schaefer
Schaeferco Builders LLC
305 Minnetonka Ave S, Suite 100
Wayzata MN 55391

Re: Geotechnical Exploration Report, Proposed Lost Lake Townhomes, Commerce Boulevard, Mound, Minnesota

Dear Mr. Schaefer:

We have completed the geotechnical exploration report for the proposed Lost Lake Townhomes in Mound, Minnesota. A brief summary of our results and recommendations is presented below. Specific details regarding our procedures, results and recommendations follow in the attached geotechnical exploration report.

Six (6) soil borings were completed for this project that encountered about 2 to 7 feet of topsoil and/or Fill underlain by native clayey glacial till soils that extended to the termination depths of the borings. Groundwater was encountered in the soil borings at depths ranging from about 2 ½ to 20 feet below the ground surface.

The vegetation, topsoil/Fill are not suitable for foundation support and will need to be removed from within the proposed building and oversize areas and replaced, as needed, with suitable compacted engineered fill. Portions of the underlying clayey glacial till soils had a soft consistency and are likewise not suitable for foundation support so that some soil corrections will also be needed to remove any soft clayey soils. It is our opinion that the stiffer underlying native glacial till soils are suitable for foundation support.

Thank you for the opportunity to assist you on this project. If you have any questions or need additional information, please contact Paul Gionfriddo at 612-729-2959.

Sincerely,

Haugo GeoTechnical Services



Nic Alfonso, G.I.T.
Project Geologist



Paul Gionfriddo, P.E.
Senior Engineer

GEOTECHNICAL EXPLORATION REPORT

PROJECT:

Proposed Lost Lake Townhomes
2400 Block of Commerce Boulevard
Mound, Minnesota

PREPARED FOR:

Schaefco Builders LLC
305 Minnetonka Ave S, Suite 100
Wayzata MN 55391

PREPARED BY:

Haugo GeoTechnical Services
2825 Cedar Avenue South
Minneapolis, Minnesota 55407

Haugo GeoTechnical Services Project: 24-0274

May 15, 2024

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 Professional Engineer under the laws of the State of Minnesota.



Paul Gionfriddo, P.E.
Senior Engineer
License Number: 23093



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APPENDIX

Boring Location Sketch, Figure 1
Soil Boring Logs, SB-1 thru SB-6
Descriptive Terminology

1.0 INTRODUCTION

1.1 Project Description

Schaeferco Builders, LLC (Schaeferco) is preparing for construction of the Lost Lake Townhomes on the approximate 2400 block of Commerce Boulevard in Mound, Minnesota. Schaeferco retained Haugo GeoTechnical Services (HGTS) to perform a geotechnical exploration to evaluate the suitability of site soil conditions to support the proposed townhome development.

1.2 Purpose

The purpose of this geotechnical exploration was to characterize subsurface soil and groundwater conditions and provide recommendations for foundation design and construction.

1.3 Site Description

The project site is located on the east side of Commerce Boulevard between the addresses of 2388 and 2426 Commerce Boulevard in Mound, Minnesota. At the time of this assessment, the project site was composed of multiple parcels that totaled about 8 ¼ acres. The overall project site mostly consisted of lowlands/wetland lands associated with Lost Lake. The “buildable” area of the project site was generally located along Commerce Boulevard.

Based on a brief review of historical aerial photographs available on Google Earth it appears that structures existed on the property that were removed sometime between May, 2006 and May, 2008. These structures appeared to homes/residential in nature and were located on the approximate north and south ends of the site (near borings SB-1, SB-2 and SB-6).

The site topography varied with the ground surface ranging from about elevation 942 feet along Commerce Boulevard to about elevation 930 along Lost Lake. Ground surface elevations at the boring locations ranging from about 935 to 938 ½ feet above mean sea level (MSL).

1.4 Scope of Services

Our services were performed as requested and authorized by Schaeferco and under the terms of our General Conditions. Our services were limited to the following tasks:

- Completing six (6) standard penetration test soil borings each extending to nominal depths of 20 feet.
- Sealing the boring in accordance with Minnesota Department of Health requirements.
- Obtaining GPS coordinates and ground surface elevations at the soil boring location.
- Visually/manually classifying samples recovered from the soil boring.
- Performing laboratory tests on selected samples.
- Preparing soil boring logs describing the materials encountered and the results of groundwater level measurements.
- Preparing an engineering report describing soil and groundwater conditions and providing recommendations for foundation design and construction.

1.5 Documents Provided

We were provided with the following documents, in no particular order;

- Plan Sheet V1.0, ALTA/NSPS Land Title Survey prepared by Civil Site Group and dated November 12, 2023.
- Plan Sheet "EX1-Schematic Site Plan" that was prepared by Civil site Group and dated March 5, 2024. The Schematic Site Plan appeared to consist of a layout of the town homes onto the ALTA/NSPS Land Title Survey.
- A 5-page Power Point Presentation which included but was not limited to; an outline of the project site, aerial photographs edited to identify nearby features, and a Development Vision.
- 3-plan sheets prepared by Whitten Associated Inc, that were dated April 16, 2024 which showed the proposed townhomes overlain onto a survey of the site and floor plans of the proposed townhomes.
- A1-page sheet showing a plan of the Main Floor of the townhomes. The plan was not dated and did not identify the preparer.

Except as described above, specific architectural, structural and civil engineering plans were not provided.

1.6 Locations and Elevations

The soil boring locations were selected by Schaefco and/or their civil engineering consultants. The approximate locations of the soil borings are shown on Figure 1, "Soil Boring Location Sketch," in the Appendix. The sketch was prepared by HGTS using an aerial image from Google Earth as a base.

HGTS obtained the GPS coordinates and ground surface elevations at the soil boring locations using GPS technology based on the US State Plane Coordinate System. GPS coordinates and ground surface elevations are shown on Figure 2 in the Appendix.

2.0 FIELD PROCEDURES

The standard penetration test borings were advanced on April 30, 2024 by HGTS with a rotary drilling rig, using continuous flight augers to advance the boreholes. Representative samples were obtained from the borings, using the split-barrel sampling procedures in general accordance with ASTM Specification D-1586. In the split-barrel sampling procedure, a 2-inch O.D. split-barrel spoon is driven into the ground with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampling spoon the last 12 inches of an 18-inch penetration is recorded as the standard penetration resistance value, or "N" value. The results of the standard penetration tests are indicated on the boring logs. The samples were sealed in containers and provided to HGTS for testing and soil classification.

A field log of each boring was prepared by HGTS. The logs contain visual classifications of the soil materials encountered during drilling, as well as the driller's interpretation of the subsurface conditions between samples and water observation notes. The final boring logs

included with this report represent an interpretation of the field logs and include modifications based on visual/manual method observation of the samples.

The soil boring logs, general terminology for soil description and identification, and classification of soils for engineering purposes are also included in the appendix. The soil boring logs identify and describe the materials encountered, the relative density or consistency based on the Standard Penetration resistance (N-value, "blows per foot") and groundwater observations.

The strata changes were inferred from the changes in the samples and auger cuttings. The depths shown as changes between strata are only approximate. The changes are likely transitions, variations can occur beyond the location of the borings.

3.0 RESULTS

3.1 Soil Conditions

At the surface, the soil borings encountered about 2 to 7 feet of topsoil or Fill consisting of clayey sand or sandy lean clay that was black in color and contained some grass and roots. The topsoil was judged to be slightly organic to organic.

Below the topsoil soil borings SB-3 encountered about 2 ½ feet of Possible Fill that was composed of silty clayey sand that was dark grey to grey in color. Due to its darker coloration, it was difficult to determine its origin and therefore was identified a Possible Fill.

Below the topsoil or Possible Fill, the soil borings encountered native glacial till soils that extended to the termination depths of the borings. The glacial till soils consisted of; sandy lean clay, sandy clayey silt, silty sand, silty clayey sand, silty clay and poorly graded sand with silt. These soils were brown and grey in color but were mostly grey.

Penetration resistance values (N-Values), shown as blows per foot (bpf) on the boring logs, within the clayey glacial till (sandy lean clay, silty clay, clayey sand and sandy clayey silt) ranged from 3 to 28 bpf indicating a soft to very stiff consistency.

N-Values within the sandy or sandier soil (silty sand, silty clayey sand and poorly graded sand with silt) ranged from 4 to 25 bpf indicating a loose to medium dense relative density.

3.2 Groundwater

Groundwater was encountered in 5 of the 6 soil borings while drilling and sampling at depths ranging from about 2 ½ to 20 feet below the ground surface. The observed water levels are summarized in Table 1.

Table 1. Summary of Groundwater Levels Tests

Boring Number	Surface Elevation (feet)	Approximate Depths to Groundwater (feet)*	Approximate Groundwater Elevation (feet)*
SB-1	936.1	5	931
SB-2	934.8	2 ½	932 ½
SB-3	936.1	14 ½	921 ½
SB-4	938.7	20	918 ½
SB-5	937.0	10	927
SB-6	938.4	NE	-

* = Depths and elevations were rounded to the nearest ½ foot.

Water levels were measured on the date as noted on the boring logs and the period of water level observations was relatively short. Due to the cohesive nature of the soil encountered in the borings, it is possible that insufficient time was available for groundwater to seep into the boring(s) and rise to its hydrostatic level. Seasonal and annual fluctuations in the groundwater levels should be expected. Groundwater monitoring wells or piezometers in conjunction with deeper soil boring(s) would be required to more accurately determine water levels.

Information included on the ALTA/NSPS Land Title Survey indicates that the Ordinary High-Water Level of Lost Lake is 929.4 (NCVD 1929). The highest and lowest recorded levels were reported to be 931.1 and 921.78, respectively. Further the flood elevation was reported to be 931 feet.

3.3 Laboratory Testing

Laboratory moisture content tests were performed on selected samples recovered from the soil borings. Laboratory soil moisture contents ranged from about 16 to 32 ½ percent indicating that the soils were likely above their assumed optimum moisture content based on the standard Proctor test. Laboratory tests results are summarized in Table 2 and are shown on the boring logs adjacent to the samples tested.

Table 2. Summary of Laboratory Tests

Boring Number	Sample Number	Depth (feet)	Moisture Content (%) *
SB-1	SS-3	5	23
SB-2	SS-5	10	20 ½
SB-2	SS-11	5	27
SB-2	SS-13	10	25
SB-3	SS-43	5	16
SB-3	SS-44	7 ½	31
SB-4	SS-20	7 ½	32 ½
SB-5	SS-23	15	24
SB-5	SS-27	5	28
SB-6	SS-34	2 ½	20
SB-6	SS-36	7 ½	18 ½

*Moisture content values rounded to the nearest ½ percent.

3.4 OSHA Soil Classification

The soils encountered in the borings consisted of; clayey sand, silty clayey sand, sandy lean clay, silty clay, sandy clayey silt, silty sand, and poorly graded sand with silt. The sandy lean clay, silty clay and sandy clayey silt correspond to the ASTM Classification of CL and are typically a Type B soil Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. The clayey sand, silty clayey sand, silty sand and poorly graded sand with silt correspond to the ASTM classifications; SC, SC-SM, SM and SP-SM and will generally be Type C soils under OSHA guidelines.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Proposed Construction

We understand the project will consist of constructing 4-townhome buildings with each building containing 3 or 4 townhome units for a total of up to 14 townhome units. Based on the provided documents each building will have a basement level with 2 stories above grade. The basement floor slabs will be set at elevation 933.5 feet, or higher, and the main floor or sidewalk/street level will be set at elevation 943, or higher.

We anticipate below grade construction consisting of cast-in-place concrete foundation walls supported on concrete spread footings. The above grade construction is assumed to consist of wood framing, a pitched roof and asphalt shingles.

Based on the assumed construction we estimate wall loadings will range from about 2 to 3 kips (2,000 to 3,000 pounds) per lineal foot and column loads, if any, will be on the order of 75 kips (75,000 pounds).

We have attempted to describe our understanding of the project. If the proposed loads exceed these values, the proposed grades differ by more than 2 feet from the assumed values or if the design or location of the proposed building changes, we should be informed. Additional analyses and revised recommendations may be necessary.

4.2 Discussion

Structure(s) existed on the project site at the time of our exploration and structures formerly existed on the site which were removed sometime between May, 2006 and May 2008. Former structures appeared to have been located near borings SB-1, SB-2 and SB-6. Although our borings did not appear to encounter remnants of any former structures there is that potential. We recommend that all remnants of any current and former structures including footings, floor slabs, foundation walls, exterior flatwork and underground utilities, if encountered, be removed from within the proposed building, utility and oversize areas and be properly disposed of off-site.

The vegetation and topsoil/ Fill and possible Fill are not suitable for foundation support and will need to be removed from within the proposed building, pavement, utility and oversize areas and replaced with suitable compacted engineered fill to attain site grades.

It is our opinion that the underlying native glacial till soils are generally suitable for foundation support however portions of the clayey soil had a soft consistency and some corrections to remove the soft clay will be required. Since the homes will have a basement level removal of some or all the topsoil and any soft clay could be incidental to construction.

Groundwater was encountered in 5 of the 6 soil borings while drilling and sampling at depths ranging from about 2 ½ to 20 feet below the ground surface corresponding to elevations ranging from about 918 ½ to 932 ½ feet. With excavations for soil corrections and/or foundation construction anticipated to extend about 7 feet below the ground surface groundwater will likely be encountered and dewatering could be required.

The following sections provide recommendations for foundation design and construction.

4.3 Site Grading Recommendations

Excavation We recommend that all vegetation, topsoil, Fill and any soft or otherwise unsuitable soils, if encountered, be removed from below the proposed building and oversize areas. Likewise, we recommend that all remnants of any existing and former structure(s) including footings, floor slabs, foundation walls, exterior flatwork and underground utilities, if encountered, be removed from within the proposed building, utility and oversize areas and be properly disposed of off-site. Table 3 summarizes the anticipated excavation depths at the soil boring locations. Excavation depths may vary and could be deeper.

Table 3. Anticipated Excavation Depths

Boring Number	Measured Surface Elevation (feet)	Anticipated Excavation Depth (feet)*	Anticipated Excavation Elevation (feet)*	Approximate Groundwater Elevation(feet)*
SB-1	936.1	7	929	931
SB-2	934.8	4 ½	930 ½	932 ½
SB-3	936.1	4 ½ - 7	931 ½ - 929	921 ½
SB-4	938.7	7	931 ½	918 ½
SB-5	937.0	7	931	927
SB-6	938.4	2	936 ½	NE

* = Excavation depths and elevations were rounded to nearest ½ foot.

Oversizing In areas where the excavations for soil corrections extend below the proposed footing elevations, the excavations require oversizing. We recommend the perimeter of the excavation be extended a foot outside the proposed footprint for every foot below footing grade (1H:1V oversizing). The purpose of the oversizing is to provide lateral support of the foundation.

Fill Material Additional fill required to attain design grades can consist of any mineral soil provided it is free of debris, organic soil and any soft or otherwise unsuitable materials. Except we recommend that fill or backfill placed in wet excavations or within 2 feet of the groundwater table consist of granular soil (sand) with less than 5 percent passing the number 200 sieve and at least 50 percent retained on the number 40 sieve. Alternately “clear rock” can be used in wet excavations.

The on-site native glacial till soils appear to be suitable for reuse as structural fill or backfill provided it is free of debris, organic soils or other unsuitable materials. Laboratory soil moisture contents ranged from about 16 to 32 ½ percent indicating that the soils were likely above their assumed optimum moisture content based on the standard Proctor test. Soils that will be excavated and reused as fill and backfill will likely require some moisture conditioning (drying) to achieve the recommended compaction levels. Summer months are typically more favorable for drying wet soils.

Topsoil or other soils that are black in color are not suitable for reuse as structural fill or backfill.

Backfilling We recommend that backfill placed to attain site grades be compacted to a minimum of 95 percent of its standard Proctor density (ASTM D 698). Granular fill classified as SP or SP-SM should be placed within 65 percent to 105 percent of its optimum moisture content as determined by the standard Proctor. Other fill soils should be placed within 3 percentage points above and 1 percentage point below its optimum moisture content as determined by the standard Proctor. All fill should be placed in thin lifts and be compacted with a large self-propelled vibratory compactor operating in vibratory mode.

Foundations We recommend the perimeter footings bear a minimum of 42 inches below the exterior grade for frost protection. Interior footings may be placed immediately below the slab provided construction does not occur during below freezing weather conditions. Foundation elements in unheated areas should bear at least 5 feet below exterior grade for frost protection.

We anticipate the foundations and floor slabs will bear on compacted engineered fill or native glacial till soils. With the building pad prepared as recommended, it is our opinion the footings can be designed for a net allowable bearing pressure up to 2,000 pounds per square foot (psf).

We anticipate total and differential settlement of the foundations will be less than 1 inch and ½ inch, respectively, across a 30-foot span.

4.4 Dewatering

Groundwater was encountered in 5 of the 6 soil borings while drilling and sampling at depths ranging from about 2 ½ to 20 feet below the ground surface corresponding to elevations ranging from about 918 ½ to 932 ½ feet. With excavations for soil corrections and/or foundation construction anticipated to extend about 7 feet (about elevation 929) below the ground surface groundwater will likely be encountered and dewatering could be required.

In the event dewatering is required, we recommend the groundwater level be temporarily lowered to a minimum of 2 feet below the lowest anticipated excavation elevation to allow for construction. In sand soils, we do not recommend attempting to dewater from within the excavation. Upward seepage will loosen and disturb the excavation, resulting in a “quick condition.” Rather, we recommend groundwater to be drawn down below the anticipated excavation bottom.

If dewatering is required, it may be appropriate for a dewatering contractor to review the soil boring logs, develop a dewatering plan and evaluate the impact of dewatering on adjacent structures.

4.5 Interior Slabs

The anticipated floor subgrade will consist of compacted clayey engineered fill or clayey native glacial till soils. It is our opinion that a modulus of subgrade reaction, k , of 50 pounds per square inch per inch of deflection may be used to design the floor.

If floor coverings or coatings less permeable than the concrete slab will be used, we recommend that a vapor retarder or vapor barrier be placed immediately beneath the slab. Some contractors prefer to bury the vapor barrier or vapor retarder beneath a layer of sand to reduce curling and shrinkage, but this practice often traps water between the slab and vapor retarder or barrier. Regardless of where the vapor retarder or vapor barrier is placed, we recommend consulting the floor covering manufacturer regarding the appropriate type, use and installation of the vapor retarder or vapor barrier to preserve the warranty.

We recommend following all state and local building codes with regards to a radon mitigation plan beneath interior slabs.

4.6 Below Grade Walls

We recommend general waterproofing of the below grade walls. We recommend either placing drainage composite against the backs of the exterior walls or backfilling adjacent to the walls with sand having less than 50 percent of the particles by weight passing the #40 sieve and less than 5 percent of the particles by weight passing the #200 sieve. The sand backfill should be placed within 2 feet horizontally of the wall. We recommend the balance of the backfill for the walls consist of sand however the sand may contain up to 20 percent of the particles by weight passing the #200 sieve.

We recommend installing drain tile behind the below grade walls, adjacent to the wall footing and below the slab elevation. Preferably the drain tile should consist of perforated pipe embedded in gravel. A geotextile filter fabric should encase the pipe and gravel. The drain tile should be routed to a storm sewer, sump pump or other suitable disposal site.

Foundation walls or below grade walls will have lateral loads from the surrounding soil transmitted to them. Active earth pressures can be used to design the below grade walls if the walls are allowed to rotate slightly. If wall rotation cannot be tolerated, then below grade wall design should be based on at-rest earth pressures. It is our opinion that the estimated soil parameters presented in Table 4 can be used for below grade wall design. These estimated

soil parameters are based on the assumptions that the walls are drained, there are no surcharge loads within a horizontal distance equal to the height of the wall and the backfill is level.

Table 4. Estimated Soil Parameters

Soil Type	Estimated Unit Weight (pcf)	Estimated Friction Angle (degrees)	At-Rest Pressure (pcf)	Active Soil Pressure (pcf)	Passive Soil Pressure (pcf)
Sand (SP & SP-SM)	115	32	55	35	375
Other Soils (CL, CL-ML, SC, SC-SM SM)	135	28	70	50	375

Resistance to lateral earth pressures will be provided by passive resistance against the wall footings and by sliding resistance along the bottom of the wall footings. We recommend a sliding coefficient of 0.35. This value does not include a factor of safety.

4.8 Exterior Slabs

Exterior slabs will likely be underlain by clayey soils which are considered to be moderately to highly frost susceptible. If these soils become saturated and freeze, frost heave may occur. This heave can be a nuisance in front of doors and at other critical grade areas. One way to help reduce the potential for heaving is to remove the frost-susceptible soils below the slabs down to bottom of footing grades and replace them with non-frost-susceptible backfill consisting of sand having less than 5 percent of the particles by weight passing the number 200 sieve.

If this approach is used and the excavation bottoms terminate in non-free draining granular soil, we recommend a drain tile be installed along the bottom outer edges of the excavation to collect and remove any water that may accumulate within the sand. The bottom of the excavation should be graded away from the building.

If the banks of the excavations to remove the frost-susceptible soils are not sloped, abrupt transitions between the frost-susceptible and non-frost-susceptible backfill will exist along which unfavorable amounts of differential heaving may occur. Such transitions could exist between exterior slabs and sidewalks, between exterior slabs and pavements and along the slabs themselves if the excavations are confined to only the building entrances. To address this issue, we recommend sloping the excavations to remove frost-susceptible soils at a minimum 3:1 (horizontal:vertical) gradient.

Another alternative for reducing frost heave is to support the slabs on frost depth footings. A void space of at least 4 inches should be provided between the slab and the underlying soil to allow the soil to heave without affecting the slabs.

4.9 Site Grading and Drainage

We recommend the site be graded to provide positive run-off away from the proposed buildings. We recommend landscaped areas be sloped a minimum of 6 inches within 10 feet of the building and slabs be sloped a minimum of 2 inches. In addition, we recommend downspouts with long splash blocks or extensions.

We recommend the lowest floor grades be constructed to meet City of Mound requirement with respect to groundwater separation distances. In the absence of city requirements, we recommend maintaining at least a 2-foot separation between the lowest floor slab and the 100-year flood level of nearby wetlands, storm water ponds or other surface water features.

4.10 Utilities

We anticipate that new utilities will be installed as part of this project. We further anticipate that new utilities will bear at depths ranging from about 7 to 10 feet below the ground surface. At these depths, we anticipate that the pipes will bear on compacted engineered fill or native glacial till soils, which in our opinion are suitable for pipe support. We recommend removing all vegetation, topsoil and any soft or otherwise unsuitable soils, if any, beneath utilities prior to placement.

We recommend bedding material be thoroughly compacted around the pipes. We recommend trench backfill above the pipes be compacted to a minimum of 95 percent beneath slabs and pavements, the exception being within 3 feet of the proposed pavement subgrade, where 100 percent of standard Proctor density is required. In landscaped areas, we recommend a minimum compaction of 90 percent.

We anticipate that groundwater will be encountered during construction and that dewatering will likely be required. See section 4.4 for dewatering considerations.

4.11 Bituminous Pavements

General We were not provided any information regarding traffic volumes or vehicle distribution. We anticipate the parking and drive lanes will be used mostly by automobiles and light trucks with weekly use by heavier vehicles such as garbage trucks. Based on the number of townhome units we estimate the pavements will be subjected to Equivalent Single Axle Loads (ESAL's) significantly less than 50,000 over a 20-year design life. This does not account for any future growth.

Subgrade Preparation We recommend removing all vegetation, topsoil and any soft or otherwise unsuitable soils, if any, be removed from below the pavement and oversize areas. Prior to placing the aggregate base (Class 5) we recommend compacting the subgrade and/or performing a proof-roll of the subgrade to identify soft, weak, loose, or unstable areas that may require additional subcuts. Backfill to attain pavement subgrade elevation can consist of any mineral soil provided it is free of organic material or other deleterious materials.

Granular fill classified as SP or SP-SM should be placed within 65 percent to 105 percent of its optimum moisture content as determined by the standard Proctor. Remaining fill soils should be placed within 3 percentage points above and 1 percentage point below its optimum

moisture content as determined by the standard Proctor. All fill should be placed in thin lifts and be compacted to a minimum of 95 percent of its standard Proctor maximum dry density with a large self-propelled vibratory compactor operating in vibratory mode. The upper 3 feet of fill and backfill should be compacted to a minimum of 100 percent of its standard Proctor maximum dry density.

R-Value R-Value testing was beyond the scope of this project. The soil borings predominantly encountered clayey soils near the surface corresponding to the ASTM Classification CL. We recommend using an R-Value of 10 for pavement design.

Pavement Section We anticipate that both heavy duty and light duty pavements will be constructed. Based on an estimated R-value of 10 and a maximum of 50,000 ESAL's we recommend a light-duty pavement section consisting of a minimum of 3 ½ inches of bituminous underlain by a minimum of 8 inches of aggregate base. If a heavy-duty section is required, we recommend a pavement section consisting of a minimum of 4 inches of bituminous underlain by a minimum of 9 inches of aggregate base.

4.12 Pavement Materials

We recommend aggregate base meeting MN/DOT specification 3138 for Class 5 aggregate base. We recommend the aggregate base be compacted to 100 percent of its maximum standard Proctor dry density.

We recommend that the bituminous wear and base courses meet the requirement of MN/DOT specification 2360. We recommend the bituminous pavements be compacted to at least 92% of the maximum theoretical density.

We recommend specifying concrete that has a minimum 28-day compressive strength of 3,900 psi. We recommend specifying 5 to 8 percent entrained air for exposed concrete to provide resistance to freeze-thaw deterioration. We recommend slump, air content and compressive strength test of Portland cement concrete.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Excavation

The soils encountered in the borings consisted of; clayey sand, silty clayey sand, sandy lean clay, silty clay, sandy clayey silt, silty sand, and poorly graded sand with silt. The sandy lean clay, silty clay and sandy clayey silt correspond to the ASTM Classification of CL and are typically a Type B soil Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. The clayey sand, silty clayey sand, silty sand and poorly graded sand with silt correspond to the ASTM classifications; SC, SC-SM, SM and SP-SM and will generally be Type C soils under OSHA guidelines.

Temporary excavations in Type C soils should be constructed at a minimum of 1 ½ foot horizontal to every 1 foot vertical within excavations. Temporary excavations in Type B soils should be constructed at a minimum of 1 foot horizontal to every 1 foot vertical within excavations. Slopes constructed in this manner may still exhibit surface sloughing. If site

constraints do not allow the construction of slopes with these dimensions, then temporary shoring may be required.

5.2 Observations

A geotechnical engineer or a qualified engineering technician should observe the excavation subgrade to evaluate if the subgrade soils are similar to those encountered in the borings and adequate to support the proposed construction.

5.3 Backfill and Fills

The on-site soils appear to be above their assumed optimum soil moisture content. If these soils will be used or reused as structural fill or backfill, some drying of the soils will likely be required to meet the recommend compaction levels. We recommend moisture conditioning all soils that will be used as fill or backfill in accordance with Section 4.3 above. We recommend that fill and backfill be placed in lifts not exceeding 4 to 12 inches, depending on the size of the compactor and materials used.

5.4 Testing

We recommend density tests of backfill and fills placed for the proposed foundations. Samples of the proposed materials should be submitted to our laboratory prior to placement for evaluation of their suitability and to determine their optimum moisture content and maximum dry density (Standard Proctor).

5.5 Winter Construction

If site grading and construction is anticipated to proceed during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading and placement of fill. No fill should be placed on frozen soil and no frozen soil should be used as fill or backfill.

Concrete delivered to the site should meet the temperature requirements of ASTM and/or ACI. Concrete should not be placed on frozen soil. Concrete should be protected from freezing until the necessary strength is obtained. Frost should not be permitted to penetrate below the footings.

6.0 PROCEDURES

6.1 Soil Classification

The drill crew chief visually and manually classified the soils encountered in the borings in general accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedure)." Soil terminology notes are included in the Appendix. The samples were returned to our laboratory for review of the field classification by a soils engineer. Samples will be retained for a period of 30 days.

6.2 Groundwater Observations

Immediately after taking the final samples in the bottom of the boring, the hole was checked for the presence of groundwater. Immediately after removing the augers from the borehole the hole was once again checked and the depth to water and cave-in depths were noted.

7.0 GENERAL

7.1 Subsurface Variations

The analyses and recommendations presented in this report are based on data obtained from a limited number of soil borings. Variations can occur away from the boring, the nature of which may not become apparent until additional exploration work is completed, or construction is conducted. A reevaluation of the recommendations in this report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional foundation costs and it is suggested that a contingency be provided for this purpose.

It is recommended that we be retained to perform the observation and testing program during construction to evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs, specifications and construction methods. This will allow correlation of the soil conditions encountered during construction to the soil borings and will provide continuity of professional responsibility.

7.2 Review of Design

This report is based on the design of the proposed structures as related to us for preparation of this report. It is recommended that we be retained to review the geotechnical aspects of the design and specifications. With the review, we will evaluate whether any changes have affected the validity of the recommendations and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

7.3 Groundwater Fluctuations

We made water level measurements in the borings at the times and under the conditions stated on the boring log. The data was interpreted in the text of this report. The period of observation was relatively short and fluctuations in the groundwater level may occur due to rainfall, flooding, irrigation, spring thaw, drainage, and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations.

7.4 Use of Report

This report is for the exclusive use of Schaefco Builders LLC and their design team to use to design the proposed structures and prepare construction documents. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. The data, analysis and recommendations may not be appropriate for

other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

7.5 Level of Care

Haugo GeoTechnical Services has used the degree of skill and care ordinarily exercised under similar circumstance by members of the profession currently practicing in this locality. No warranty expressed or implied is made.

APPENDIX



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.

Haugo GeoTechnical
Services, LLC
2825 Cedar Avenue S.
Minneapolis, MN 55407

Soil Boring Location Sketch
Lost Lake Townhomes
Mound, Minnesota

Figure #: 1
Drawn By: NA
Date: 5/14/2024
Scale: None
Project #: 24-0274

Figure 2: GPS Boring Locations

Boring Number	Elevation (US Feet)	Northing Coordinate	Easting Coordinate
SB-1	936.1	1033587.63932281	2711142.33217227
SB-2	934.8	1033534.55676074	2711076.88327216
SB-3	936.1	1033489.78792384	2711039.08736328
SB-4	938.7	1033458.19691256	2711004.4629201
SB-5	937.0	1033416.96176939	2710981.85506609
SB-6	938.4	1033364.38942191	2710929.30791112

Referencing US State Plane Coordinate System



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 Minneapolis, MN, 55407
 Telephone: 612-729-2959
 Fax: 763-445-2238

BORING NUMBER SB-1

CLIENT Schaefer Builders, LLC
PROJECT NUMBER 24-0274
DATE STARTED 4/30/24 **COMPLETED** 4/30/24
DRILLING CONTRACTOR HGTS- 45
DRILLING METHOD Hollow Stem Auger/Split Spoon
LOGGED BY NC/MS **CHECKED BY** PG
NOTES _____

PROJECT NAME Lost Lake Townhomes
PROJECT LOCATION Mound, MN
GROUND ELEVATION 936.1 ft **HOLE SIZE** 3 1/4 inches
GROUND WATER LEVELS:
 ▽ **AT TIME OF DRILLING** 5.00 ft / Elev 931.10 ft
AT END OF DRILLING ---
AFTER DRILLING ---

GEOTECH BH PLOTS - GINT STD US LAB.GDT - 5/15/24 11:52 - C:\USERS\ALICE HAUGO\HGTS DROPBOX\LAB HAUGO\HAUGO GEOTECHNICAL SERVICES\GINT PROJECT BACKUP\PROJECTS\24-0274 BORING LOG DRAFT.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)	▲ SPT N VALUE ▲		
							20	40	60
0		Clayey Sand with Grass and Roots, black, slightly organic to organic, moist (Topsoil)	AU 1						
			SS 2		2-2-1 (3)				
5		▽ (SC-SM) Silty Clayey Sand, grey with trace black, wet to waterbearing, very loose (Glacial Till)	SS 3		2-2-2 (4)	23			
		(CL-ML) Sandy Clayey Silt, brown to greyish brown, wet, loose (Glacial Till)	SS 4		4-5-5 (10)				
10		(CL) Sandy Lean Clay, trace Gravel, brown, wet, rather stiff to stiff (Glacial Till) Sand Seam at about 10 Feet	SS 5		3-4-6 (10)	20.5			
			SS 6		4-7-9 (16)				
15		(CL) Sandy Lean Clay, trace Gravel, grey, wet, stiff to very stiff (Glacial Till)	SS 7		4-5-9 (14)				
20			SS 8		4-6-11 (17)				

Bottom of borehole at 21.0 feet.



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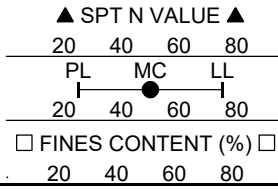
BORING NUMBER SB-2

CLIENT Schaefco Builders, LLC
PROJECT NUMBER 24-0274
DATE STARTED 4/30/24 **COMPLETED** 4/30/24
DRILLING CONTRACTOR HGTS- 45
DRILLING METHOD Hollow Stem Auger/Split Spoon
LOGGED BY NC/MS **CHECKED BY** PG
NOTES _____

PROJECT NAME Lost Lake Townhomes
PROJECT LOCATION Mound, MN
GROUND ELEVATION 934.8 ft **HOLE SIZE** 3 1/4 inches
GROUND WATER LEVELS:
 ▽ **AT TIME OF DRILLING** 2.50 ft / Elev 932.30 ft
AT END OF DRILLING ---
AFTER DRILLING ---

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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)	▲ SPT N VALUE ▲		
							20	40	60
0		Sandy Lean Clay with Grass and Roots, black, moist to wet (Topsoil)	AU 9						
5		(SM) Silty Sand, fine grained, greyish brown, moist to waterbearing, loose to medium dense (Glacial Till)	SS 10		3-2-3 (5)				
			SS 11		1-3-3 (6)	27			
			SS 12		3-5-7 (12)				
10		(CL) Silty Clay with Sand, grey, wet, rather stiff (Glacial Till)	SS 13		5-4-5 (9)	25			
			SS 14		7-7-10 (17)				
			SS 15		4-6-8 (14)				
15		(CL) Sandy Lean Clay, trace Gravel, grey, wet, stiff to very stiff (Glacial Till)	SS 16		8-10-16 (26)				
20									



Bottom of borehole at 21.0 feet.



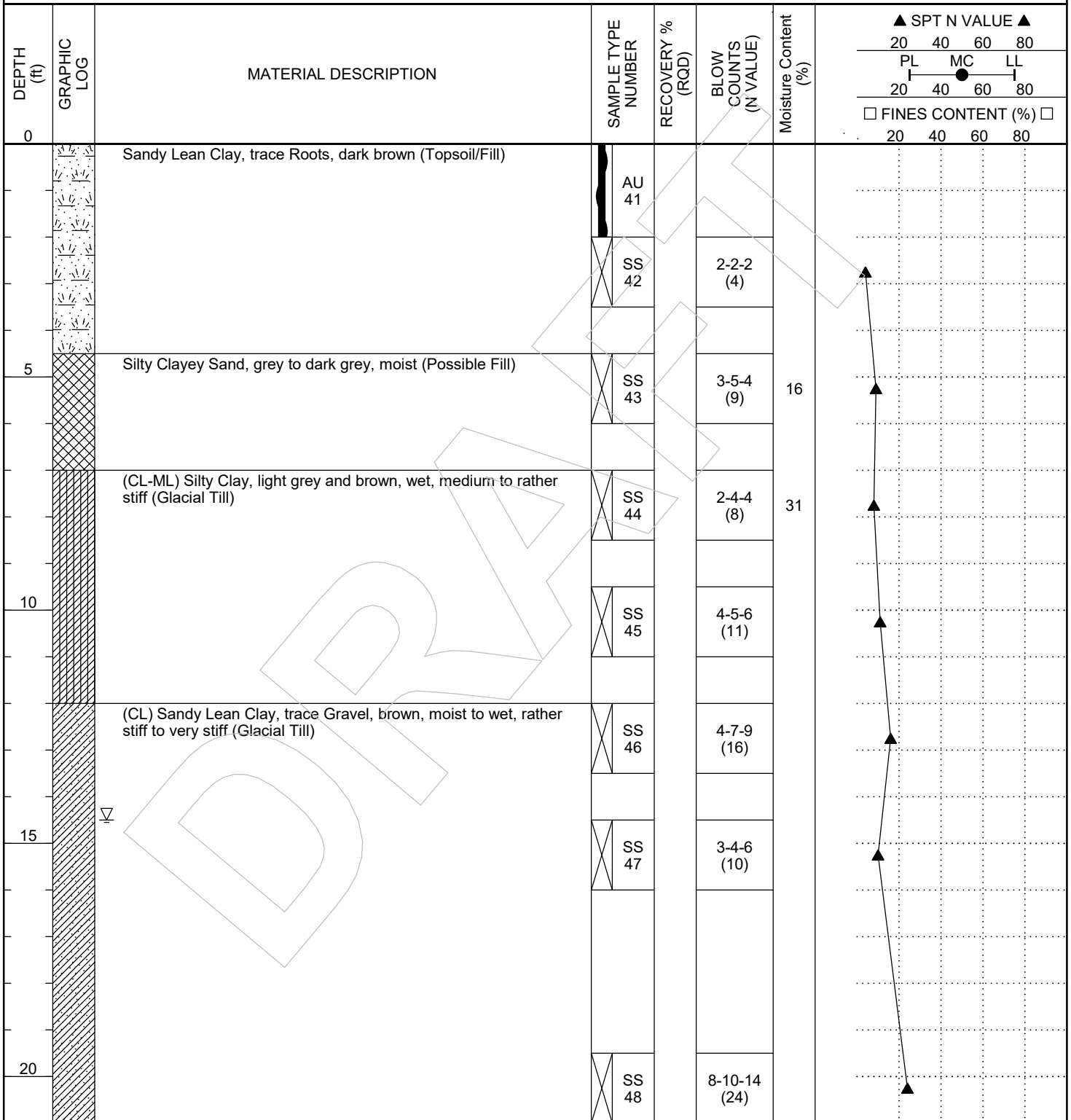
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 Fax: 763-445-2238

BORING NUMBER SB-3

CLIENT Schaefer Builders, LLC
PROJECT NUMBER 24-0274
DATE STARTED 4/30/24 **COMPLETED** 4/30/24
DRILLING CONTRACTOR HGTS- 45
DRILLING METHOD Hollow Stem Auger/Split Spoon
LOGGED BY NC/MS **CHECKED BY** PG
NOTES _____

PROJECT NAME Lost Lake Townhomes
PROJECT LOCATION Mound, MN
GROUND ELEVATION 936.1 ft **HOLE SIZE** 3 1/4 inches
GROUND WATER LEVELS:
 ▽ **AT TIME OF DRILLING** 14.50 ft / Elev 921.60 ft
AT END OF DRILLING ---
AFTER DRILLING ---

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Bottom of borehole at 21.0 feet.



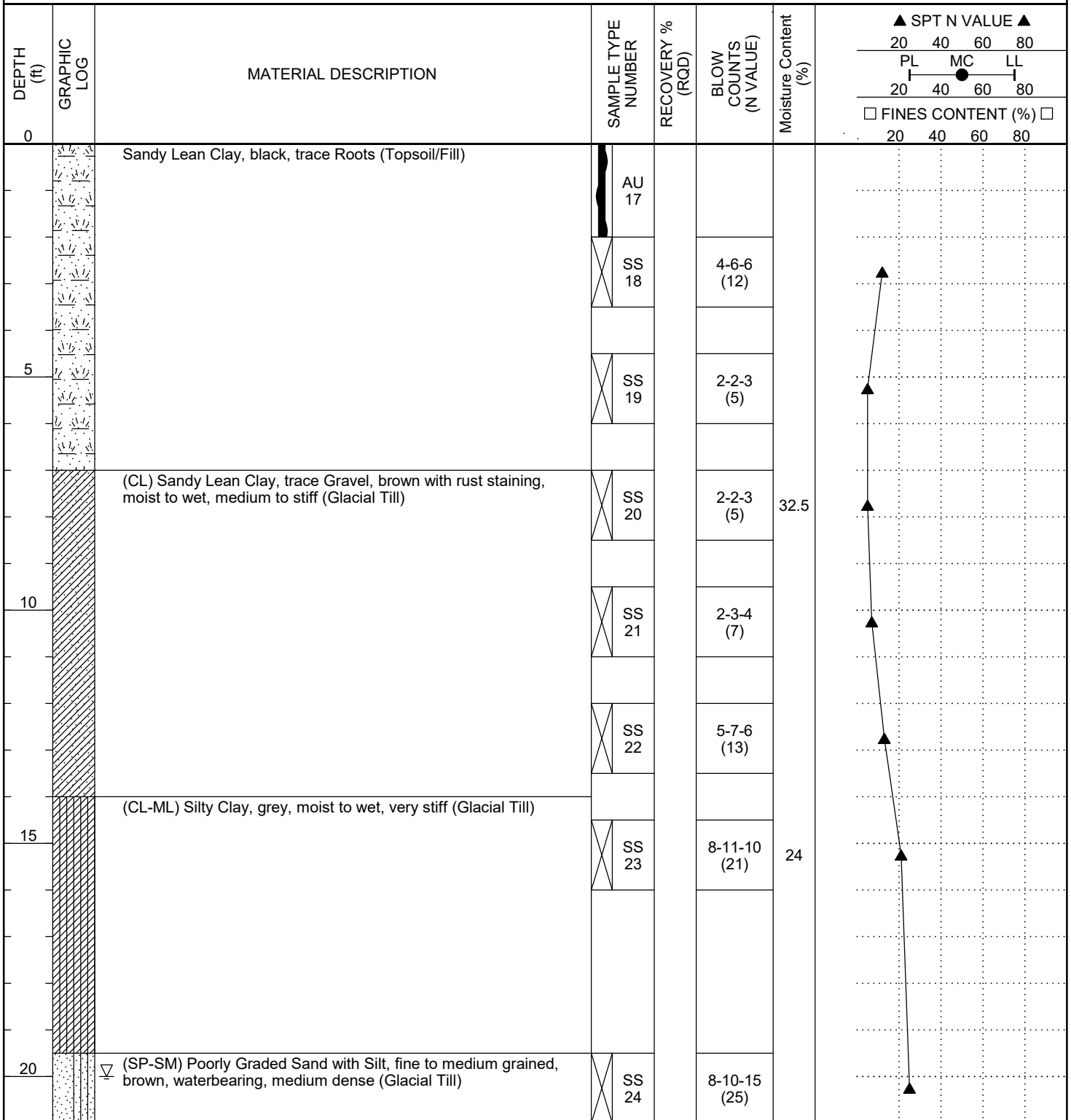
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BORING NUMBER SB-4

CLIENT Schaefer Builders, LLC
PROJECT NUMBER 24-0274
DATE STARTED 4/30/24 **COMPLETED** 4/30/24
DRILLING CONTRACTOR HGTS- 45
DRILLING METHOD Hollow Stem Auger/Split Spoon
LOGGED BY NC/MS **CHECKED BY** PG
NOTES _____

PROJECT NAME Lost Lake Townhomes
PROJECT LOCATION Mound, MN
GROUND ELEVATION 938.7 ft **HOLE SIZE** 3 1/4 inches
GROUND WATER LEVELS:
 ▽ **AT TIME OF DRILLING** 20.00 ft / Elev 918.70 ft
AT END OF DRILLING ---
AFTER DRILLING ---

GEOTECH BH PLOTS - GINT STD US LAB.GDT - 5/15/24 11:52 - C:\USERS\ALICE HAUGO\HGTS DROPBOX\LAB HAUGO\HAUGO GEOTECHNICAL SERVICES\GINT PROJECT BACKUP\PROJECTS\24-0274 BORING LOG DRAFT.GPJ



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 SB-5

CLIENT Schaefco Builders, LLC
PROJECT NUMBER 24-0274
DATE STARTED 4/30/24 **COMPLETED** 4/30/24
DRILLING CONTRACTOR HGTS- 45
DRILLING METHOD Hollow Stem Auger/Split Spoon
LOGGED BY NC/MS **CHECKED BY** PG
NOTES _____

PROJECT NAME Lost Lake Townhomes
PROJECT LOCATION Mound, MN
GROUND ELEVATION 937 ft **HOLE SIZE** 3 1/4 inches
GROUND WATER LEVELS:
 ▽ **AT TIME OF DRILLING** 10.00 ft / Elev 927.00 ft
AT END OF DRILLING ---
AFTER DRILLING ---

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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	Moisture Content (%)	▲ SPT N VALUE ▲			
							PL	MC	LL	
							20	40	60	80
							20	40	60	80
							□ FINES CONTENT (%) □			
							20	40	60	80
0		Sandy Lean Clay with Grass and Roots, black to dark brown, moist (Topsoil/Fill)	AU 25							
			SS 26		1-2-2 (4)					
5		(CL) Sandy Lean Clay, trace Gravel, brown, wet, soft to rather stiff (Glacial Till)	SS 27		1-2-1 (3)	28				
			SS 28		4-5-6 (11)					
10		(SM) Silty Sand, fine grained, brown, wet to waterbearing, medium dense (Glacial Till)	SS 29		2-5-10 (15)					
		(CL) Sandy Lean Clay, trace Gravel, grey, wet, rather stiff (Glacial Till)	SS 30		5-5-5 (10)					
		Sand Seam at about 12 Feet	SS 31		3-4-8 (12)					
15			SS 32		4-6-9 (15)					
20		(CL) Sandy Lean Clay, trace Gravel, brown, moist to wet, stiff (Glacial Till)								

Bottom of borehole at 21.0 feet.



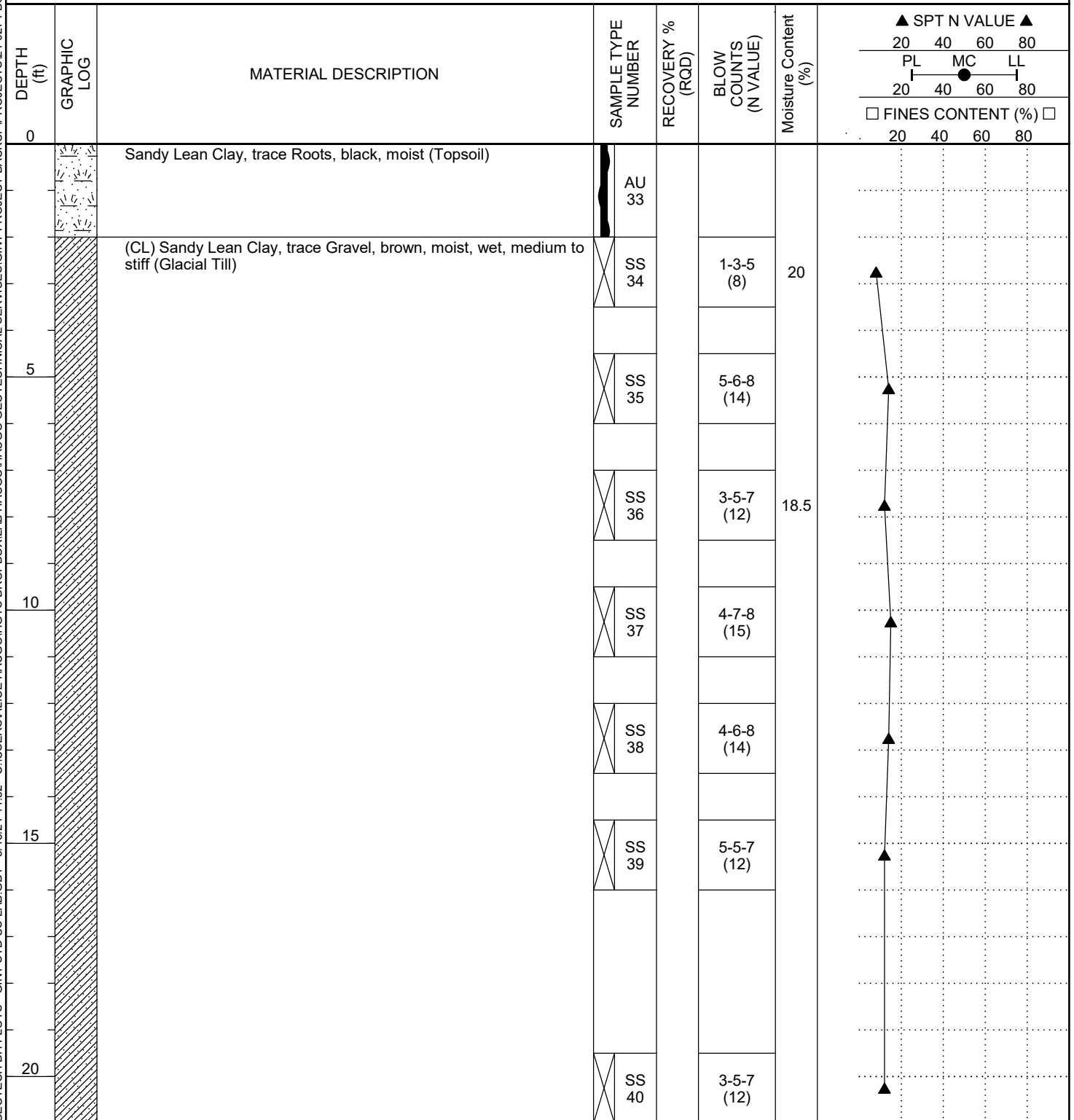
Haugo GeoTechnical Services
 2825 Cedar Ave South
 Minneapolis, MN, 55407
 Telephone: 612-729-2959
 Fax: 763-445-2238

BORING NUMBER SB-6

CLIENT Schaefer Builders, LLC
PROJECT NUMBER 24-0274
DATE STARTED 4/30/24 **COMPLETED** 4/30/24
DRILLING CONTRACTOR HGTS- 45
DRILLING METHOD Hollow Stem Auger/Split Spoon
LOGGED BY NC/MS **CHECKED BY** PG
NOTES _____

PROJECT NAME Lost Lake Townhomes
PROJECT LOCATION Mound, MN
GROUND ELEVATION 938.4 ft **HOLE SIZE** 3 1/4 inches
GROUND WATER LEVELS:
AT TIME OF DRILLING --- Not Encountered
AT END OF DRILLING --- Not Encountered
AFTER DRILLING --- Not Encountered

GEOTECH BH PLOTS - GINT STD US LAB.GDT - 5/15/24 11:52 - C:\USERS\ALICE HAUGO\HGTS DROPBOX\LAB HAUGO\HAUGO GEOTECHNICAL SERVICES\GINT PROJECT BACKUP\PROJECTS\24-0274 BORING LOG DRAFT.GPJ



Bottom of borehole at 21.0 feet.



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
		Gravels with Fines More than 12% fines ^e	$C_u < 4$ and/or $1 > C_c > 3$ ^c	GP	Poorly graded gravel ^d
			Fines classify as ML or MH	GM	Silty 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
	Sands with Fines More than 12% ⁱ		$C_u < 6$ and/or $1 > C_c > 3$ ^c	SP	Poorly graded sand ^h
			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
PI < 4 or plots below "A" line ^j				ML	Silt ^{k i m}
Organic			Liquid limit - oven dried < 0.75	OL	Organic clay ^{k i m n}
			Liquid limit - not dried < 0.75	OL	Organic silt ^{k i m o}
Silts and clays Liquid limit 50 or more		Inorganic	PI plots on or above "A" line	CH	Fat clay ^{k i m}
			PI plots below "A" line	MH	Elastic silt ^{k i m}
		Organic	Liquid limit - oven dried < 0.75	OH	Organic clay ^{k i m p}
			Liquid limit - not dried < 0.75	OH	Organic silt ^{k i m q}
Highly Organic Soils	Primarily organic matter, dark in color and organic odor			PT	Peat

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 $< \text{No. 200}$, PI < 4 or below "A" line
Clay $< \text{No. 200}$, 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

- 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 $\geq 15\%$ 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 $\geq 15\%$ 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 $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
- m. If soil contains $\geq 30\%$ 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.

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."

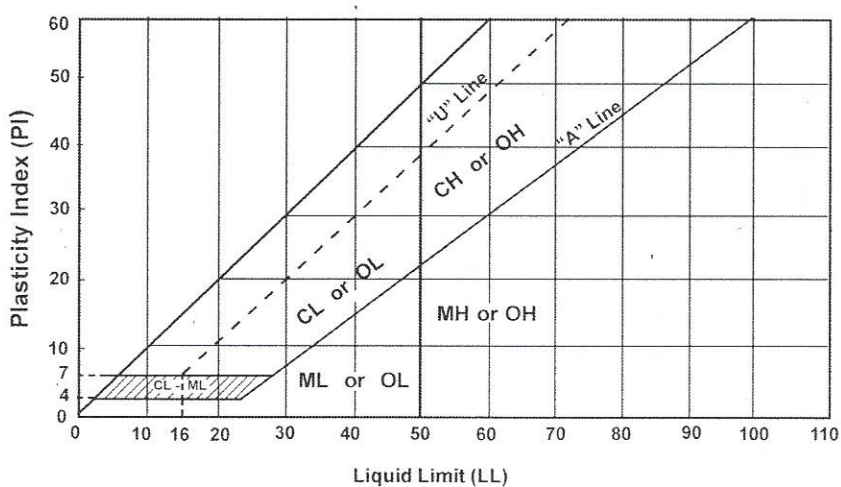
BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly,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



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, %	ϕ	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf