Stormwater Management Report

Owner:
Chu Vision Institute
9117 Lyndale Ave S
Bloomington, MN 55420

Project:
Chu Vision Institute – Parking Lot Expansion
9117 Lyndale Ave S
Bloomington, MN 55420

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.

Robert A. Latta P.E.

Registration Number: 59612

Date:
08/12/2024

Table of Contents:

Figures:

Appendices:

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 08/12/2024.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 a medical office facility with associated parking and landscape infrastructure.

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
EX1 (TO ADJ. PROPERTIES)	0	98	6942	61	6942	61
EX2 (TO STREET)	48761	98	23862	61	72623	86

Existing Soils:
A geotechnical evaluation has not been completed at this site as of 08/09/2024. Site soils are assumed, for the purposes of this report and the design of the on-site infiltration basin, to have an HSG 'B' designation, with an infiltration rate of 0.45 in/hr.

Groundwater:
Groundwater observations have not been taken at this site as of 08/09/2024.

2.3 Proposed Site Conditions:

Site Description:
The proposed improvements consist of the construction of new parking capacity on-site. The proposed conditions site areas are below.

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1 (TO BASIN)	11158	98	10581	61	21739	80
PR2 (TO STREET)	48140	98	5148	61	53288	94
PR3 (TO ADJ. PROPERTIES)	0	98	4538	61	4538	61

2.4 Stormwater Requirements City (Bloomington):

See Nine Mile Creek Watershed District requirements below.

2.5 Stormwater Requirements Watershed (Nine Mile Creek Watershed District):

Requirement threshold - Projects that disturbs 5,000 sf or more area.
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 – Stormwater BMPs shall remove 90% of the post-development TSS and 60% of the post TP loading for the new/reconstructed impervious and disturbed areas.
Volume Control – Stormwater runoff volume must be reduced by 1.1" 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).
Building Low Floor Elevation - Low-floor elevation. All new and reconstructed buildings must be constructed such that the low floor is:

a. At least two feet above the 100-year high water elevation or one foot above the natural overflow of a waterbody;
b. At least two feet above the 100-year high water elevation of any open stormwater conveyance; and Nine Mile Creek Watershed District Rules Revisions adopted on December 20, 2023 23;
c. At least two feet above the 100-year high water elevation or one foot above the emergency overflow of a constructed facility.

In addition, a stormwater management facility must be constructed at an elevation that ensures that no adjacent habitable building will be brought into noncompliance with a standard in this subsection 4.3.3.

2.6 Stormwater Requirements - Minnesota Pollution Control Agency – NPDES 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).
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).
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.

3.0 Stormwater Calculations:

3.1 Proposed Stormwater Management Strategy & Facilities Description

This project proposes an aboveground infiltration basin to treat and infiltrate runoff from the new and reconstructed impervious surfaces on the site.

3.2 Rate Control

Rate control is provided by the proposed filtration basin. 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	4.95	4.73
10-Year Event	8.22	7.35
100-Year Event	16.09	13.29

3.3 Water Quality

The proposed stormwater BMP is be designed to capture the prescribed water quality volume meeting the watershed requirements, confirmed by the MIDS printout attached to this report as an appendix. Results are also shown below.

Pollutant	TSS Generated (lb/yr)	TSS Removed (lb/yr)	Removal Efficiency
TSS	103.4	99.5	96%
TP	0.5692	0.547	96%

3.4 Volume Control

Water quality and volume control requirements are met by providing infiltration onsite in the amount equal to 1.1 inches of runoff from the new or reconstructed impervious surfaces.

The calculations are shown below:

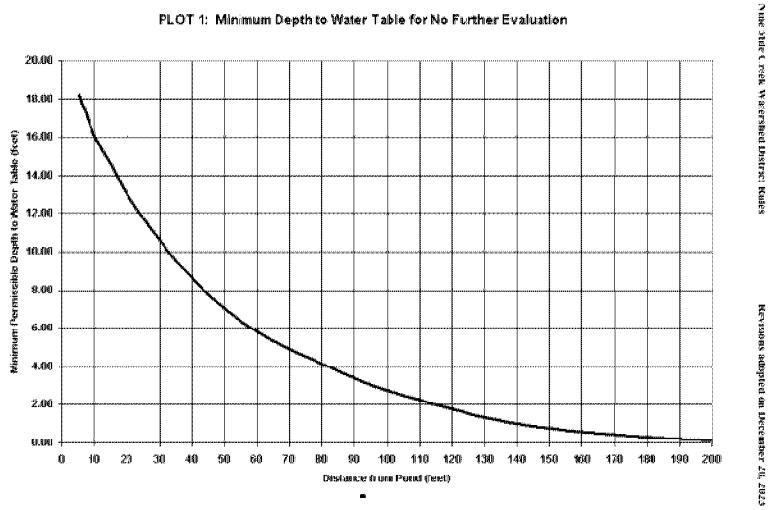
Drainage Area	Required Infiltration Vol. Summary	
	New Impv. Area (sf)	Required Volume (cf)
NEW/RECONSTRUCTED IMPERVIOUS	11665	1069
TOTAL	11665	1069

Infiltration Volume = 1.1"*Dist. Impv. Area

Proposed BMP Area	Provided Vol (cf)
Infiltration Basin 1	13530
TOTAL	13530

3.5 Low Building Floor Elevation

Nine Mile Creek Watershed District rule 4.3.4 requires a stormwater management facility must be constructed such that no adjacent habitable building will be brought into noncompliance with the low floor standards as stated. The proposed infiltration basin onsite will be constructed with a 100-yr flood elevation at or above the existing low floor elevation of the building on the subject site and other adjacent properties. However, the proposed basin has a relatively small contributing drainage area and is, at minimum, 60 feet away from every adjacent building. The proposed HydroCAD simulation of the basins show that in the 100-year and back-to-back events, surface flows would be unable to penetrate any low-opening of any adjacent building. Neither events simulate the basin utilizing the 833.36 EOF in the parking lot, or, let-alone, overflowing the berm to the north, east and south. Further, pending the forthcoming soil boring logs and groundwater observations, a likely low groundwater elevation coupled with the basin's distance from every adjacent building will prevent seepage by groundwater mounding. NMCWD's appendix 4a, plot 1 is shown below. No further evaluation is required (given the nearest building is 60 feet away) provided the water table observed in the forthcoming borings is greater than 6' below the finished floor elevation of that building, roughly 830.0. If groundwater observations show a higher water table at that time, the design will be reassessed.



4.0 Conclusions:

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

Lapham Hickey Steel
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 (TO ADJ. PROPERTIES)	0	98	6942	61	6942	61
EX2 (TO STREET)	48761	98	23862	61	72623	86

Proposed Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1 (TO BASIN)	11158	98	10581	61	21739	80
PR2 (TO STREET)	48140	98	5148	61	53288	94
PR3 (TO ADJ. PROPERTIES)	0	98	4538	61	4538	61

Site Area Summary

	Impervious [SF]	Impervious [AC]	Pervious [SF]	Pervious [AC]	Total [SF]	Total [AC]
Existing Site	48761	1.12	30804	0.71	79565	1.83
Proposed Site	59298	1.36	20267	0.47	79565	1.83

Stormwater Rate Summary

Drainage Area	Existing Rate (cfs)		
	2-YR [2.94"]	10-YR [4.47"]	100-YR [7.81"]
EX1 (TO ADJ. PROPERTIES)	0.06	0.26	0.87
EX2 (TO STREET)	4.90	7.97	15.22
TOTAL (REACH)	4.95	8.22	16.09

Drainage Area	Proposed Conditions Rate (cfs)		
	2-YR [2.94"]	10-YR [4.47"]	100-YR [7.81"]
PR1 (1P)	0.00	0.00	0.00
PR2 (TO STREET)	4.70	7.19	12.72
PR3 (TO ADJ. PROPERTIES)	0.04	0.17	0.57
TOTAL (REACH)	4.73	7.35	13.29

Overall Stormwater Rate Summary

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	4.95	4.73
10-Year Event	8.22	7.35
100-Year Event	16.09	13.29

Stormwater Rate Summary - To Adjacent Property

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	0.06	0.04
10-Year Event	0.26	0.17
100-Year Event	0.87	0.57

Stormwater Water Quality and Volume Summary

Drainage Area	Required Infiltration Vol. Summary	
	New Impv. Area (sf)	Required Volume (cf)
NEW/RECONSTRUCTED IMPERVIOUS	11665	1069
TOTAL	11665	1069

Infiltration Volume = 1.1"*Dist. Impv. Area

Proposed BMP Area	Provided Vol (cf)
Infiltration Basin 1	13530
TOTAL	13530

Stormwater Water Quality Summary

Pollutant	TSS Generated (lb/yr)	TSS Removed (lb/yr)	Removal Efficiency
TSS	103.4	99.5	96%
TP	0.5692	0.547	96%

Project Information

Calculator Version:	Version 4: July 2020
Project Name:	CHU VISION INSTITUTE - PARKING LOT EXPANSION
User Name / Company Name:	CIVIL SITE GROUP
Date:	08/09/2024
Project Description:	PARKING LOT EXPANSION
Construction Permit?:	No

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55420
Annual Rainfall (inches):	31.5
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		0.204			0.204
			Impervious Area (acres)		0.268
				Total Area (acres)	0.472

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		0.204			0.204
			Impervious Area (acres)		0.256
				Total Area (acres)	0.46

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	1070	ft3
Volume removed by BMPs towards performance goal:	1022	ft^3
Percent volume removed towards performance goal	**96**	**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	0.6979	acre-ft
Annual runoff volume removed by BMPs:	0.671	acre-ft
Percent annual runoff volume removed:	**96**	**%**
Post development annual particulate P load:	0.3132	lbs
Annual particulate P removed by BMPs:	0.301	lbs
Post development annual dissolved P load:	0.256	lbs
Annual dissolved P removed by BMPs:	0.246	lbs
Total P removed by BMPs	0.547	lbs
Percent annual total phosphorus removed:	**96**	**%**
Post development annual TSS load:	103.4	lbs
Annual TSS removed by BMPs:	99.5	lbs
Percent annual TSS removed:	**96**	**%**

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	11365	1022	1022	0	100

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.671	0	0.671	0	100

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.3011	0	0.3011	0	100

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.2464	0	0.2464	0	100

Total Phosphorus Summary

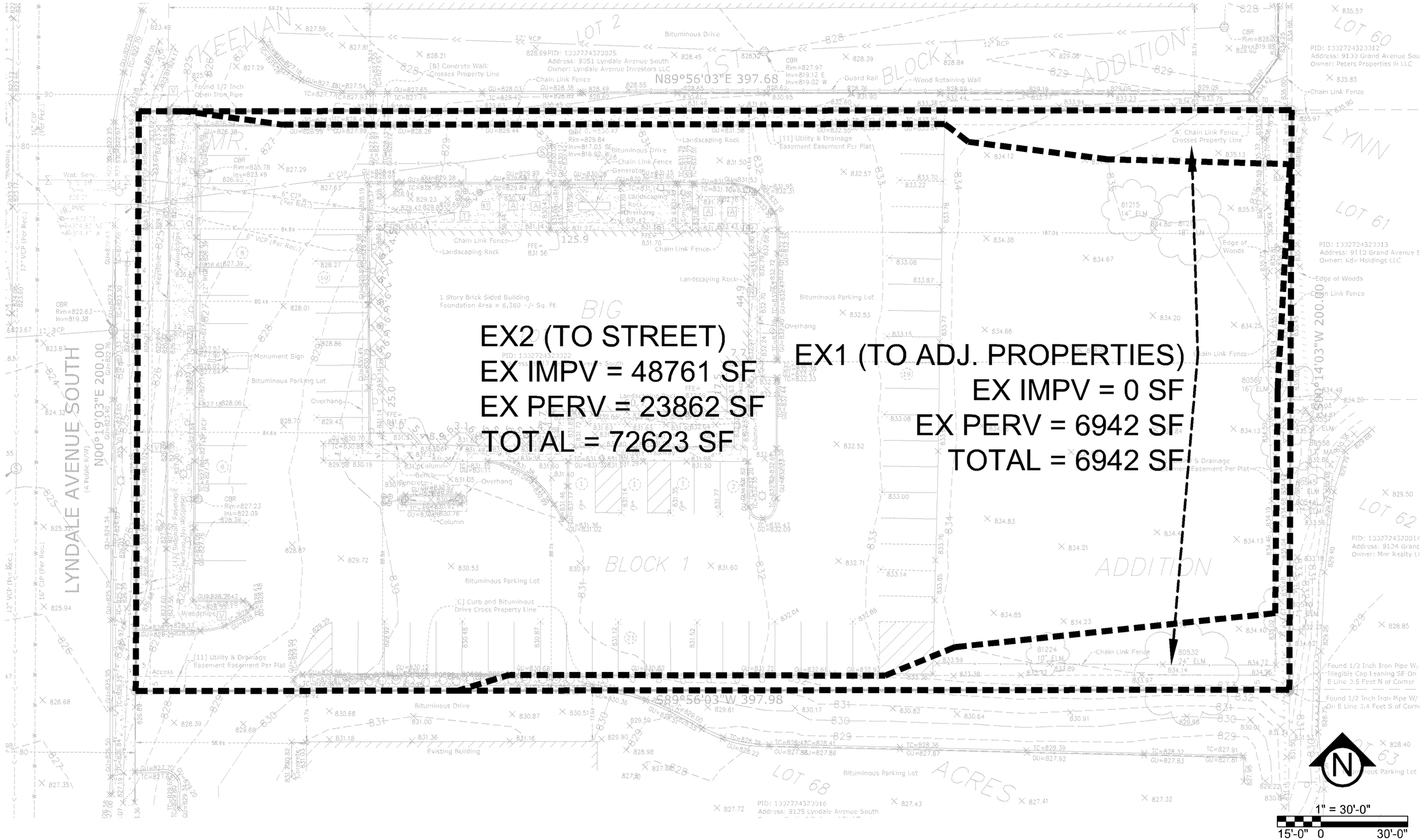
BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.5475	0	0.5475	0	100

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	99.46	0	99.46	0	100

BMP Schematic

1 - Bioretention basin (w/o underdrain)



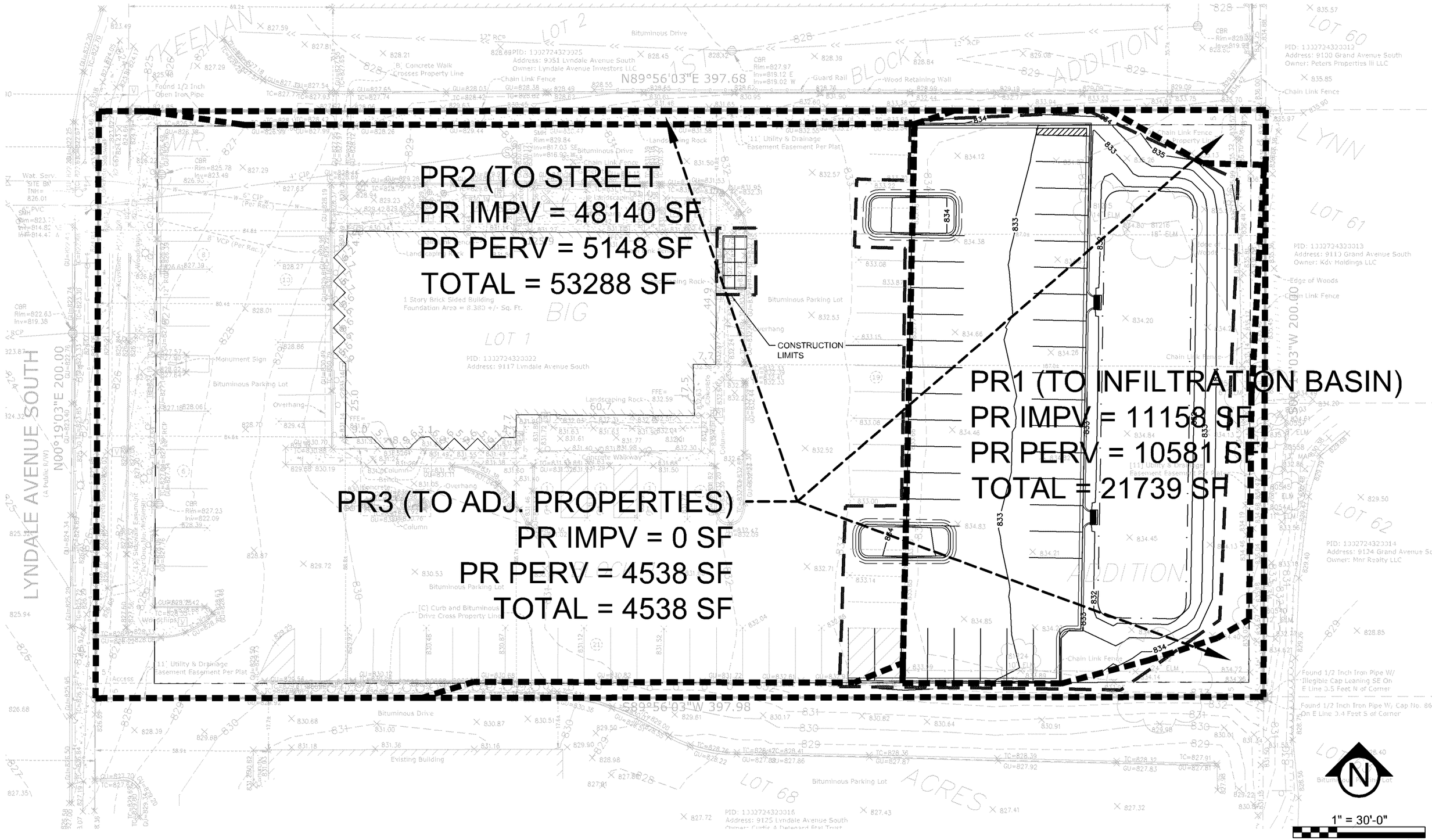
CHU VISION INSTITUTE - PARKING EXPANSION

CivilSite GROUP
5000 Glenwood Avenue
Golden Valley, MN 55422
612-615-0060
www.CivilSiteGroup.com

EXISTING DRAINAGE MAP

Project Number:	24322	Revision Number:	.
Issue Date:	8/9/2024	Revision Date:	.

DA 1



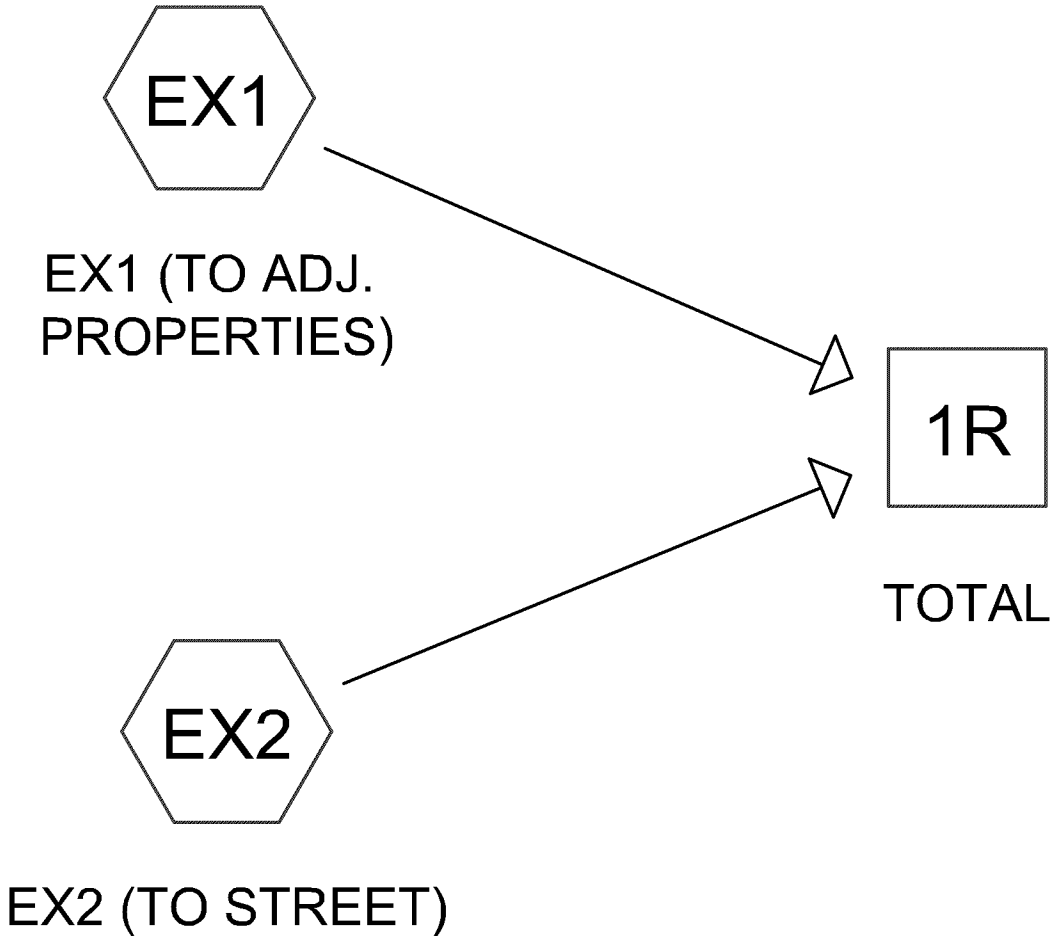
CHU VISION INSTITUTE - PARKING EXPANSION

CivilSite GROUP
5000 Glenwood Avenue
Golden Valley, MN 55422
612-615-0060
www.CivilSiteGroup.com

PROPOSED DRAINAGE MAP

Project Number:	24322	Revision Number:	.
Issue Date:	8/9/2024	Revision Date:	.

DA 2



Subcat Reach Pond Link

Routing Diagram for 24322 EXISTING
Prepared by Civil Site Group, Printed 8/9/2024

Project Notes

Rainfall events imported from "24322 PROPOSED.hcp"
Rainfall events imported from "24322 PROPOSED.hcp"

Rainfall Events Listing

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

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.707	61	>75% Grass cover, Good, HSG B (EX1, EX2)
1.119	98	Paved parking, HSG B (EX2)
1.827	**84**	**TOTAL AREA**

Soil Listing (all nodes)

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

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	0.707	0.000	0.000	0.000	0.707	>75% Grass cover, Good	EX1, EX2
0.000	1.119	0.000	0.000	0.000	1.119	Paved parking	EX2
0.000	**1.827**	**0.000**	**0.000**	**0.000**	**1.827**	**TOTAL AREA**	

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: EX1 (TO ADJ. Runoff Area=6,942 sf 0.00% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=61 Runoff=0.06 cfs 0.004 af

SubcatchmentEX2: EX2 (TO STREET) Runoff Area=72,623 sf 67.14% Impervious Runoff Depth=1.87"
Tc=6.0 min CN=WQ Runoff=4.90 cfs 0.260 af

Reach 1R: TOTAL Inflow=4.95 cfs 0.264 af
Outflow=4.95 cfs 0.264 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.264 af Average Runoff Depth = 1.73"
38.72% Pervious = 0.707 ac 61.28% Impervious = 1.119 ac

Summary for Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

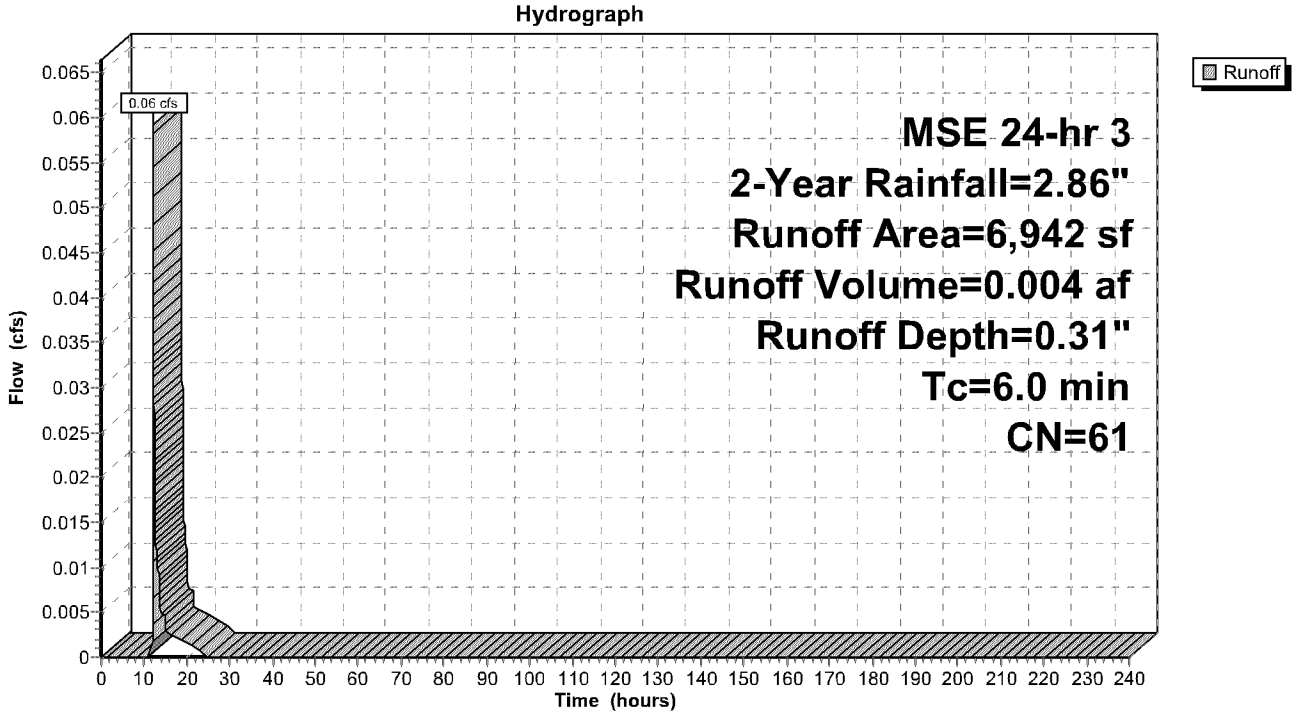
Runoff = 0.06 cfs @ 12.16 hrs, Volume= 0.004 af, Depth= 0.31"
Routed to Reach 1R : TOTAL

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 Rainfall=2.86"

Area (sf)	CN	Description
6,942	61	>75% Grass cover, Good, HSG B
6,942		100.00% Pervious Area

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

Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)



Summary for Subcatchment EX2: EX2 (TO STREET)

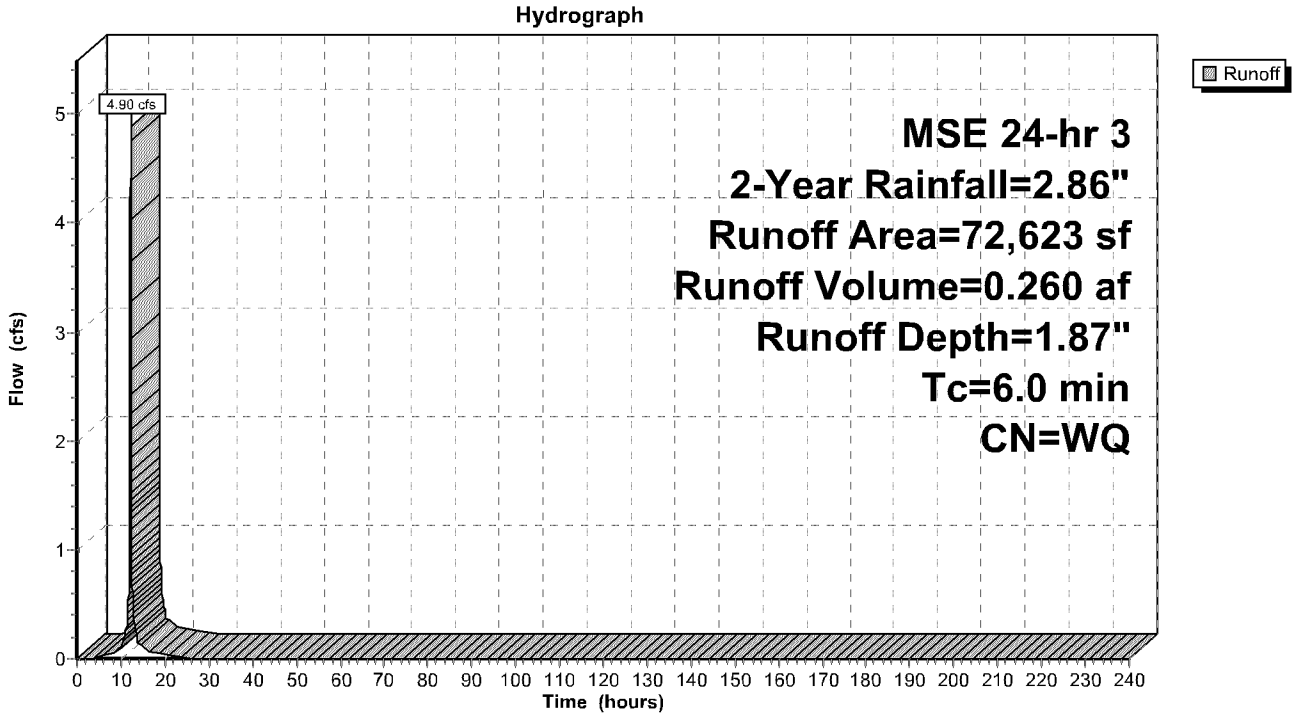
Runoff = 4.90 cfs @ 12.13 hrs, Volume= 0.260 af, Depth= 1.87"
Routed to Reach 1R : TOTAL

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 Rainfall=2.86"

Area (sf)	CN	Description
48,761	98	Paved parking, HSG B
23,862	61	>75% Grass cover, Good, HSG B
72,623		Weighted Average
23,862		32.86% Pervious Area
48,761		67.14% Impervious Area

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

Subcatchment EX2: EX2 (TO STREET)



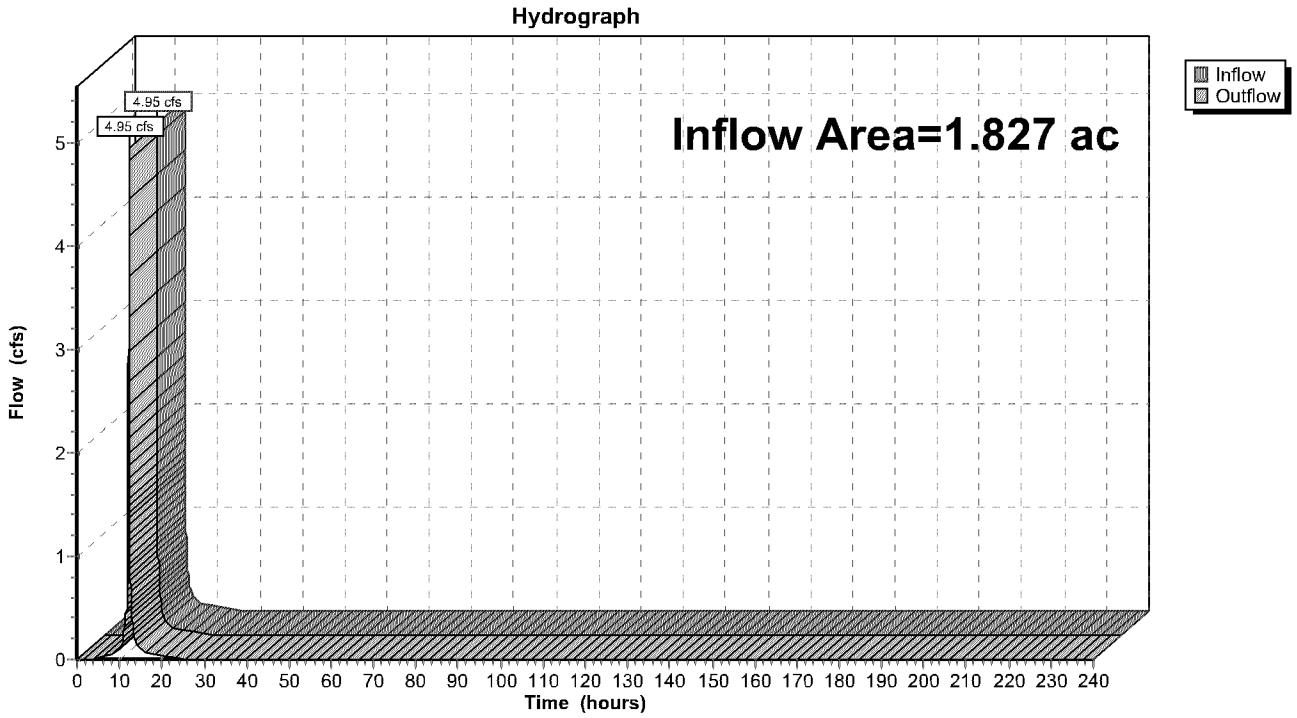
Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 61.28% Impervious, Inflow Depth = 1.73" for 2-Year event
Inflow = 4.95 cfs @ 12.13 hrs, Volume= 0.264 af
Outflow = 4.95 cfs @ 12.13 hrs, Volume= 0.264 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



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: EX1 (TO ADJ. Runoff Area=6,942 sf 0.00% Impervious Runoff Depth=0.95"
Tc=6.0 min CN=61 Runoff=0.26 cfs 0.013 af

SubcatchmentEX2: EX2 (TO STREET) Runoff Area=72,623 sf 67.14% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=WQ Runoff=7.97 cfs 0.419 af

Reach 1R: TOTAL Inflow=8.22 cfs 0.431 af
Outflow=8.22 cfs 0.431 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.431 af Average Runoff Depth = 2.83"
38.72% Pervious = 0.707 ac 61.28% Impervious = 1.119 ac

Summary for Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

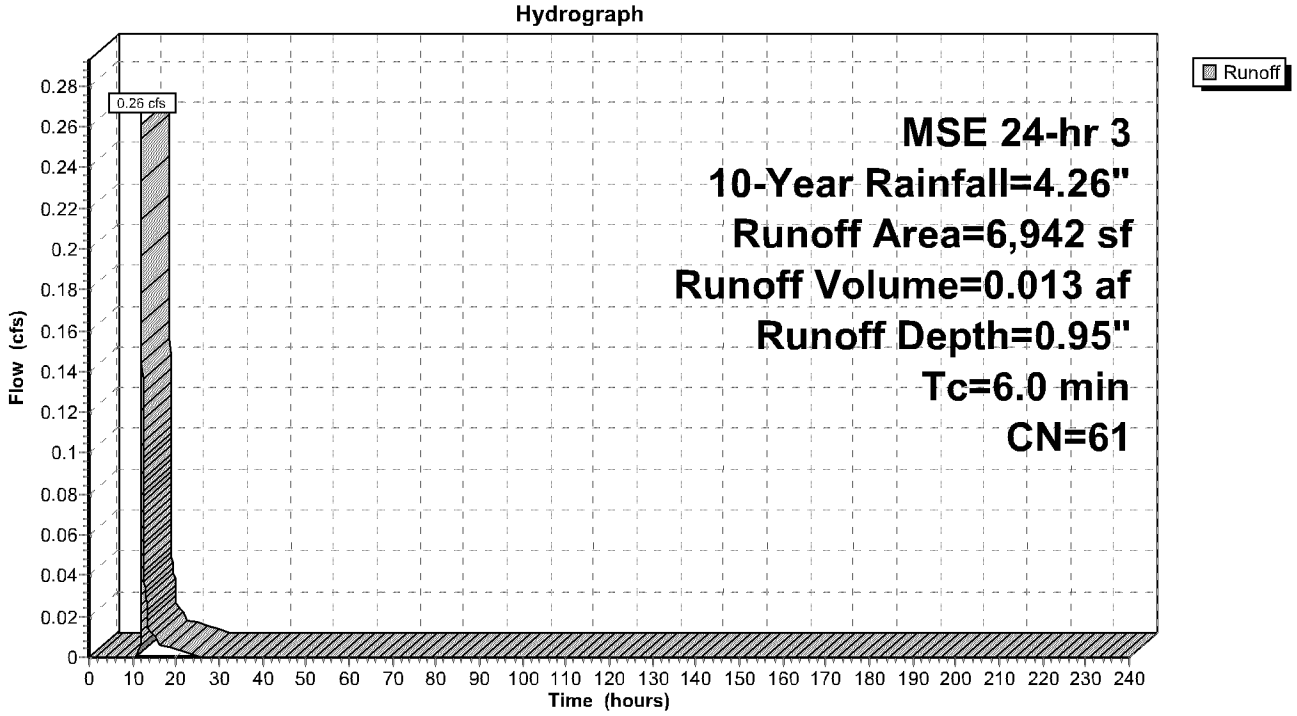
Runoff = 0.26 cfs @ 12.14 hrs, Volume= 0.013 af, Depth= 0.95"
Routed to Reach 1R : TOTAL

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 Rainfall=4.26"

Area (sf)	CN	Description
6,942	61	>75% Grass cover, Good, HSG B
6,942		100.00% Pervious Area

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

Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)



Summary for Subcatchment EX2: EX2 (TO STREET)

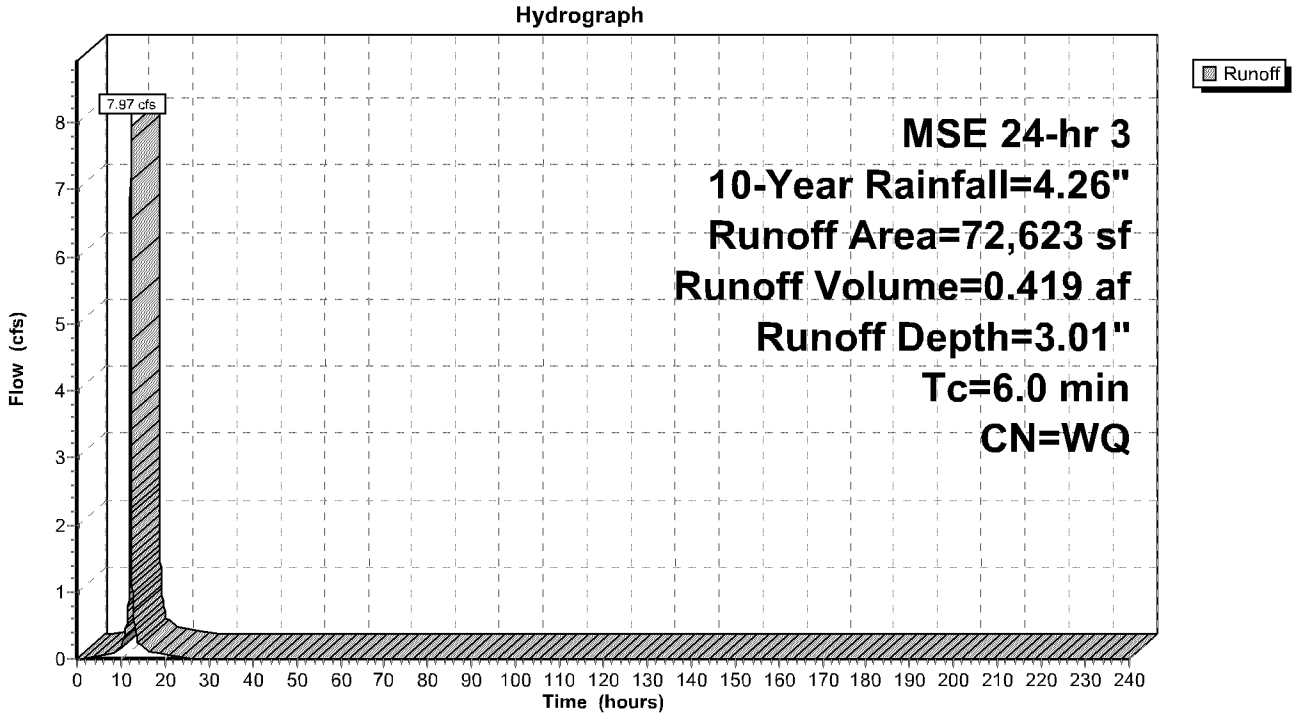
Runoff = 7.97 cfs @ 12.13 hrs, Volume= 0.419 af, Depth= 3.01"
Routed to Reach 1R : TOTAL

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 Rainfall=4.26"

Area (sf)	CN	Description
48,761	98	Paved parking, HSG B
23,862	61	>75% Grass cover, Good, HSG B
72,623		Weighted Average
23,862		32.86% Pervious Area
48,761		67.14% Impervious Area

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

Subcatchment EX2: EX2 (TO STREET)



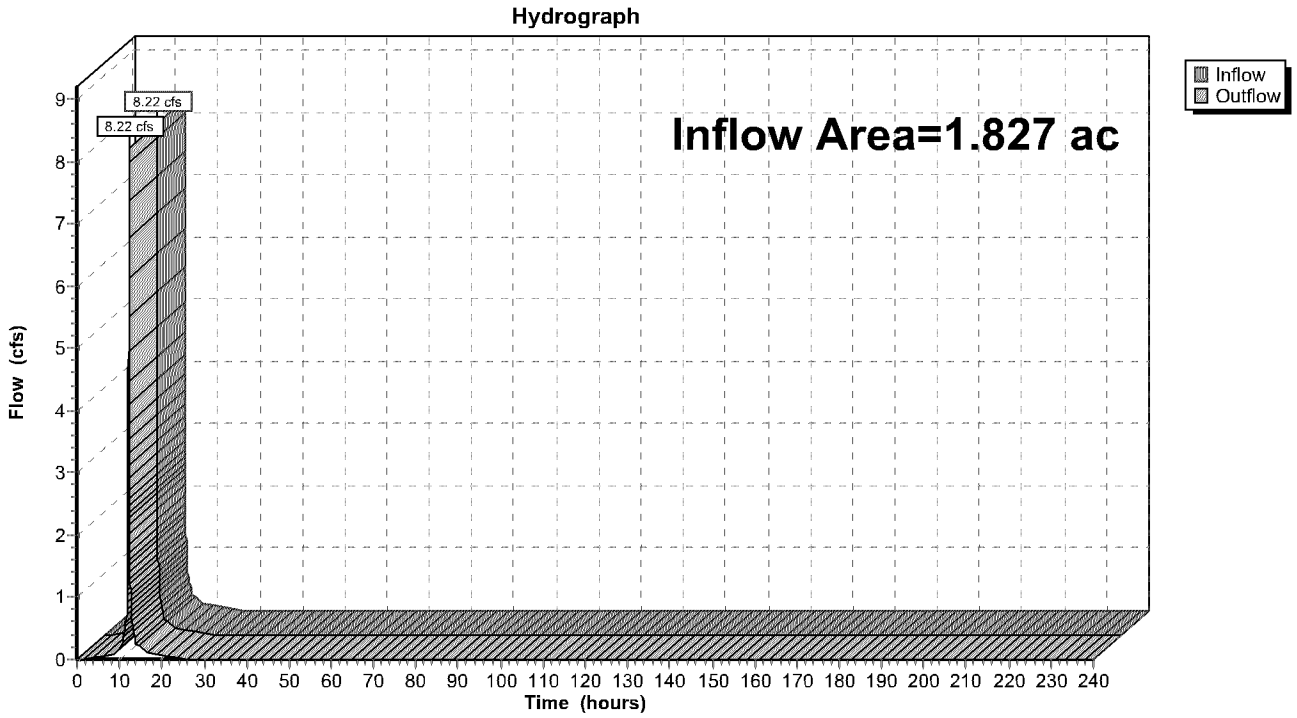
Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 61.28% Impervious, Inflow Depth = 2.83" for 10-Year event
Inflow = 8.22 cfs @ 12.13 hrs, Volume= 0.431 af
Outflow = 8.22 cfs @ 12.13 hrs, Volume= 0.431 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



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: EX1 (TO ADJ. Runoff Area=6,942 sf 0.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=61 Runoff=0.87 cfs 0.039 af

SubcatchmentEX2: EX2 (TO STREET) Runoff Area=72,623 sf 67.14% Impervious Runoff Depth=5.72"
Tc=6.0 min CN=WQ Runoff=15.22 cfs 0.794 af

Reach 1R: TOTAL Inflow=16.09 cfs 0.833 af
Outflow=16.09 cfs 0.833 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.833 af Average Runoff Depth = 5.48"
38.72% Pervious = 0.707 ac 61.28% Impervious = 1.119 ac

Summary for Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

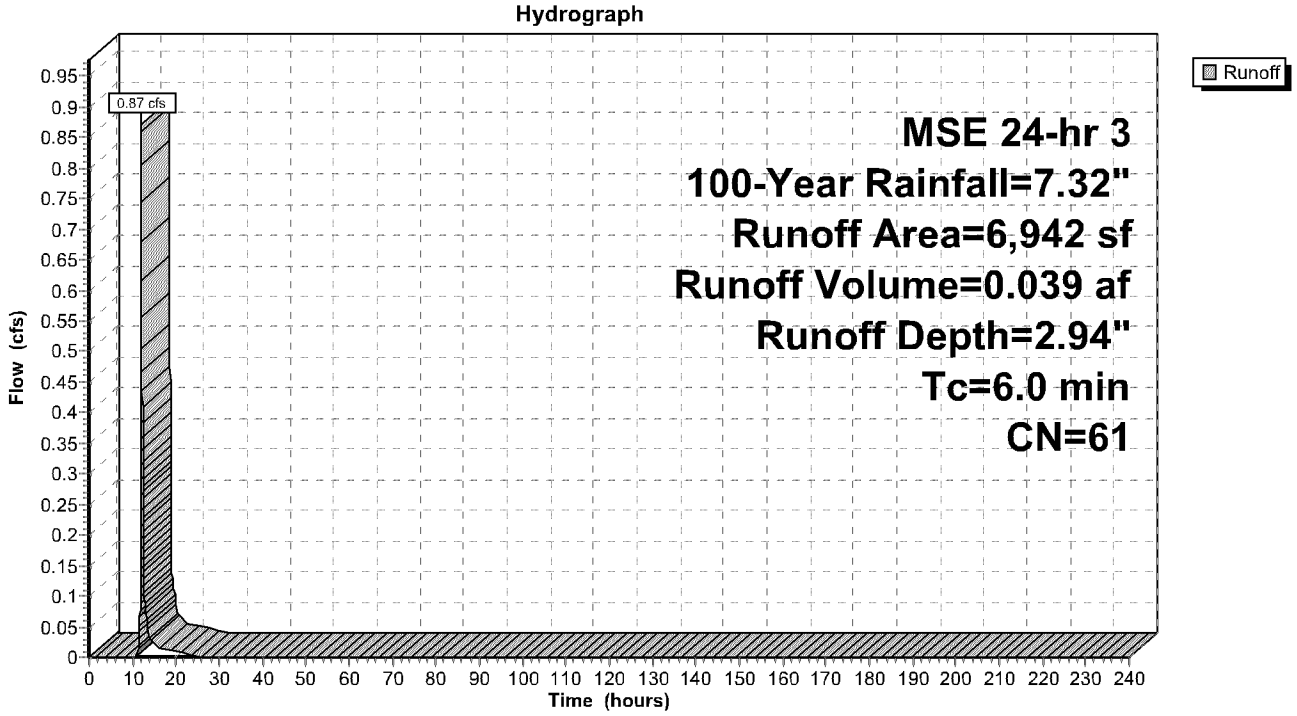
Runoff = 0.87 cfs @ 12.14 hrs, Volume= 0.039 af, Depth= 2.94"
Routed to Reach 1R : TOTAL

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 Rainfall=7.32"

Area (sf)	CN	Description
6,942	61	>75% Grass cover, Good, HSG B
6,942		100.00% Pervious Area

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

Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)



Summary for Subcatchment EX2: EX2 (TO STREET)

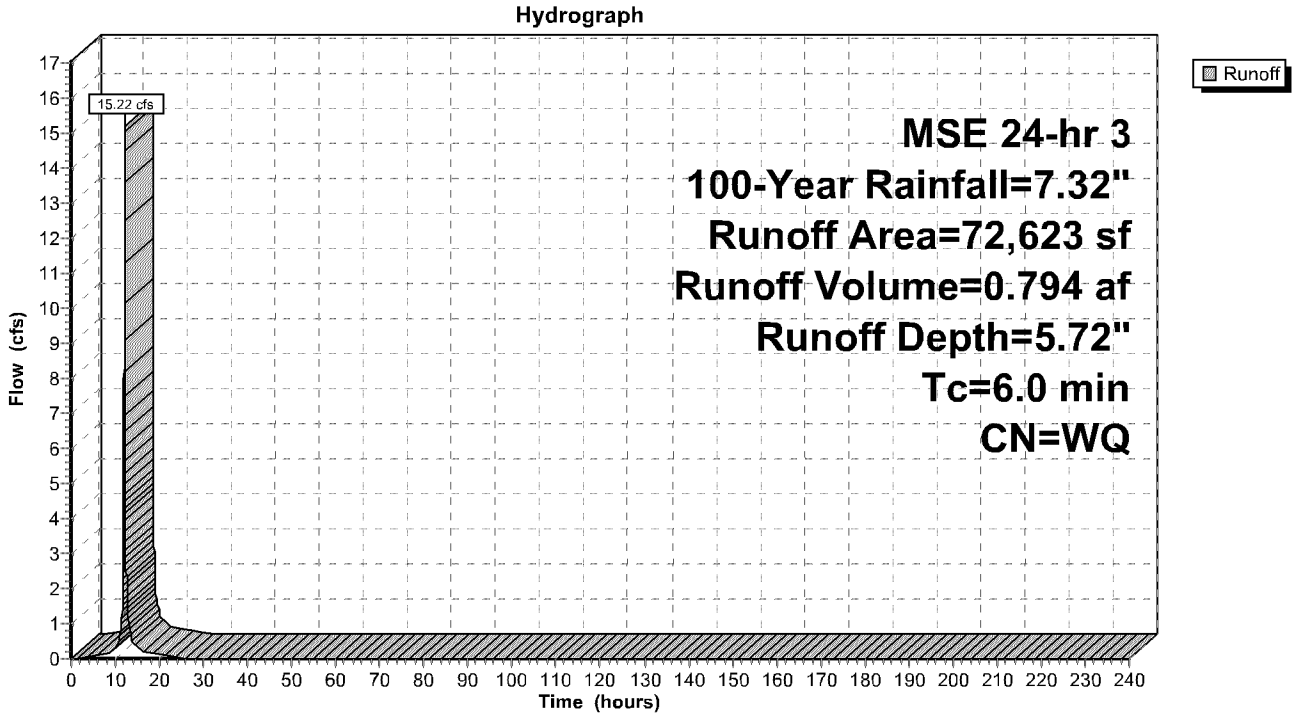
Runoff = 15.22 cfs @ 12.13 hrs, Volume= 0.794 af, Depth= 5.72"
Routed to Reach 1R : TOTAL

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 Rainfall=7.32"

Area (sf)	CN	Description
48,761	98	Paved parking, HSG B
23,862	61	>75% Grass cover, Good, HSG B
72,623		Weighted Average
23,862		32.86% Pervious Area
48,761		67.14% Impervious Area

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

Subcatchment EX2: EX2 (TO STREET)



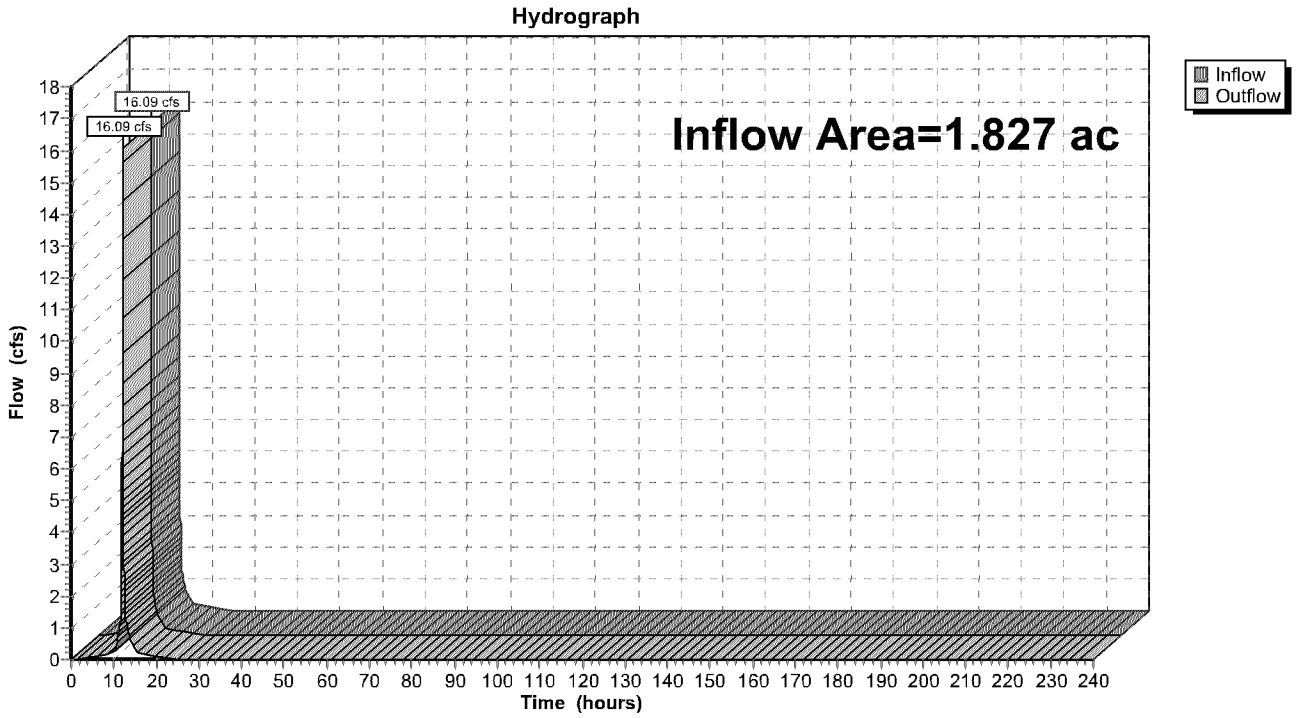
Summary for Reach 1R: TOTAL

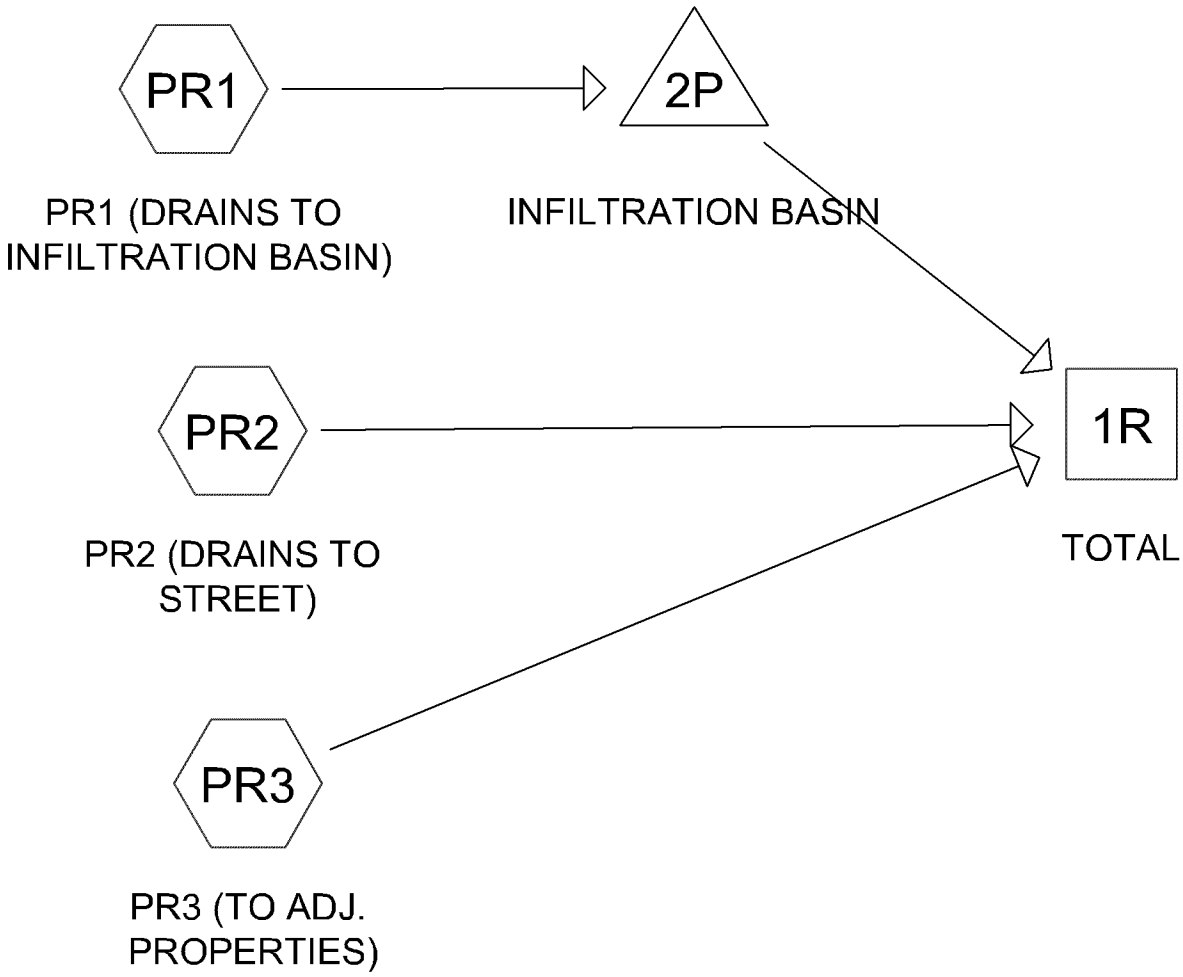
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 61.28% Impervious, Inflow Depth = 5.48" for 100-Year event
Inflow = 16.09 cfs @ 12.13 hrs, Volume= 0.833 af
Outflow = 16.09 cfs @ 12.13 hrs, Volume= 0.833 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





Subcat Reach Pond Link

Routing Diagram for 24322 PROPOSED
Prepared by Civil Site Group, Printed 8/12/2024

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

Rainfall Events Listing

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

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.465	61	>75% Grass cover, Good, HSG B (PR1, PR2, PR3)
1.361	98	Paved parking, HSG B (PR1, PR2)
1.827	**89**	**TOTAL AREA**

Soil Listing (all nodes)

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

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	0.465	0.000	0.000	0.000	0.465	>75% Grass cover, Good	PR1, PR2, PR3
0.000	1.361	0.000	0.000	0.000	1.361	Paved parking	PR1, PR2
0.000	**1.827**	**0.000**	**0.000**	**0.000**	**1.827**	**TOTAL AREA**	

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

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=1.50"
Tc=6.0 min CN=WQ Runoff=1.16 cfs 0.062 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=WQ Runoff=4.70 cfs 0.245 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=61 Runoff=0.04 cfs 0.003 af

Reach 1R: TOTAL Inflow=4.73 cfs 0.248 af
Outflow=4.73 cfs 0.248 af

Pond 2P: INFILTRATION BASIN Peak Elev=831.92' Storage=1,483 cf Inflow=1.16 cfs 0.062 af
Discarded=0.05 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.062 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.310 af Average Runoff Depth = 2.04"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

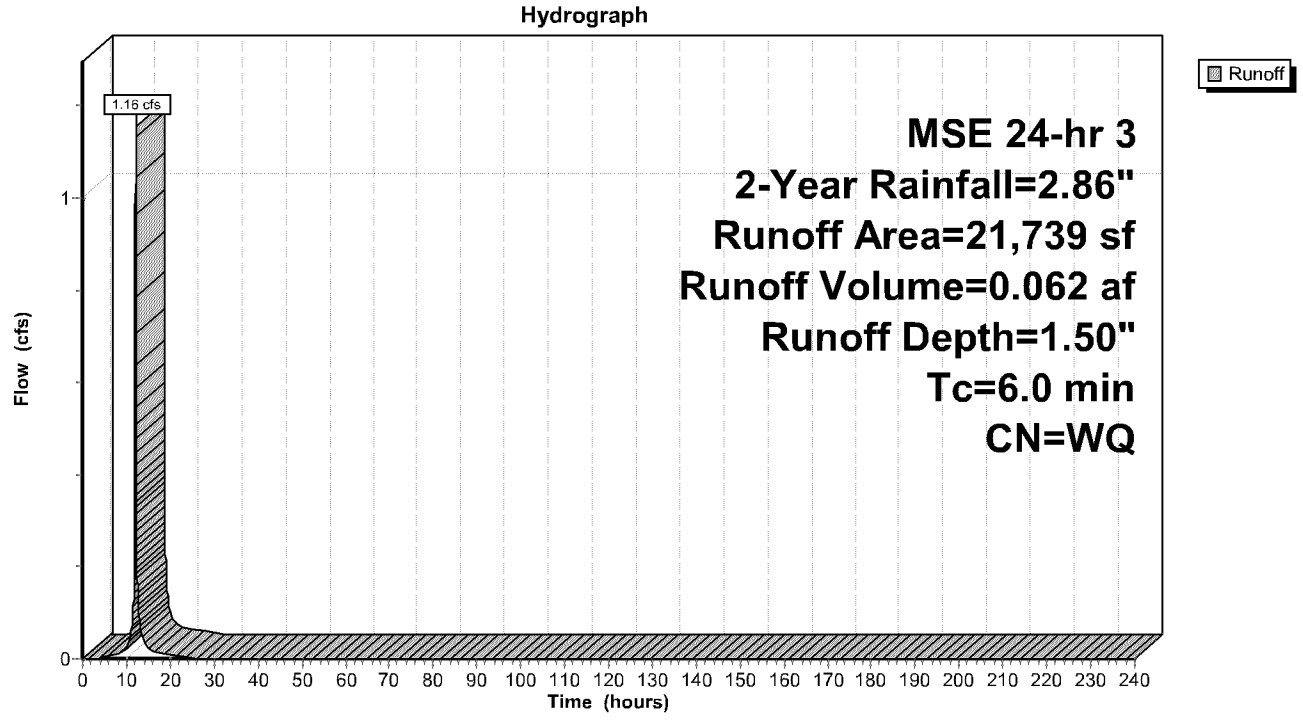
Runoff = 1.16 cfs @ 12.13 hrs, Volume= 0.062 af, Depth= 1.50"
Routed to Pond 2P : INFILTRATION BASIN

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 Rainfall=2.86"

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)



Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

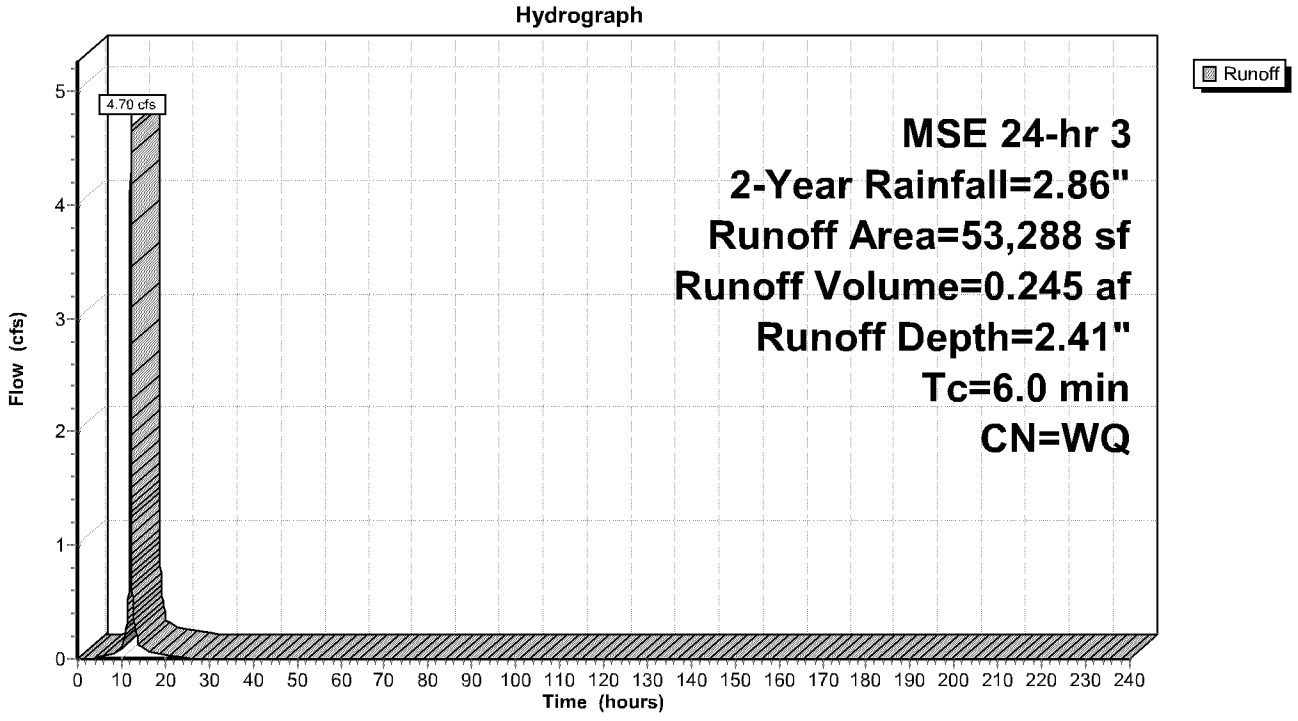
Runoff = 4.70 cfs @ 12.13 hrs, Volume= 0.245 af, Depth= 2.41"
Routed to Reach 1R : TOTAL

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 Rainfall=2.86"

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)



Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

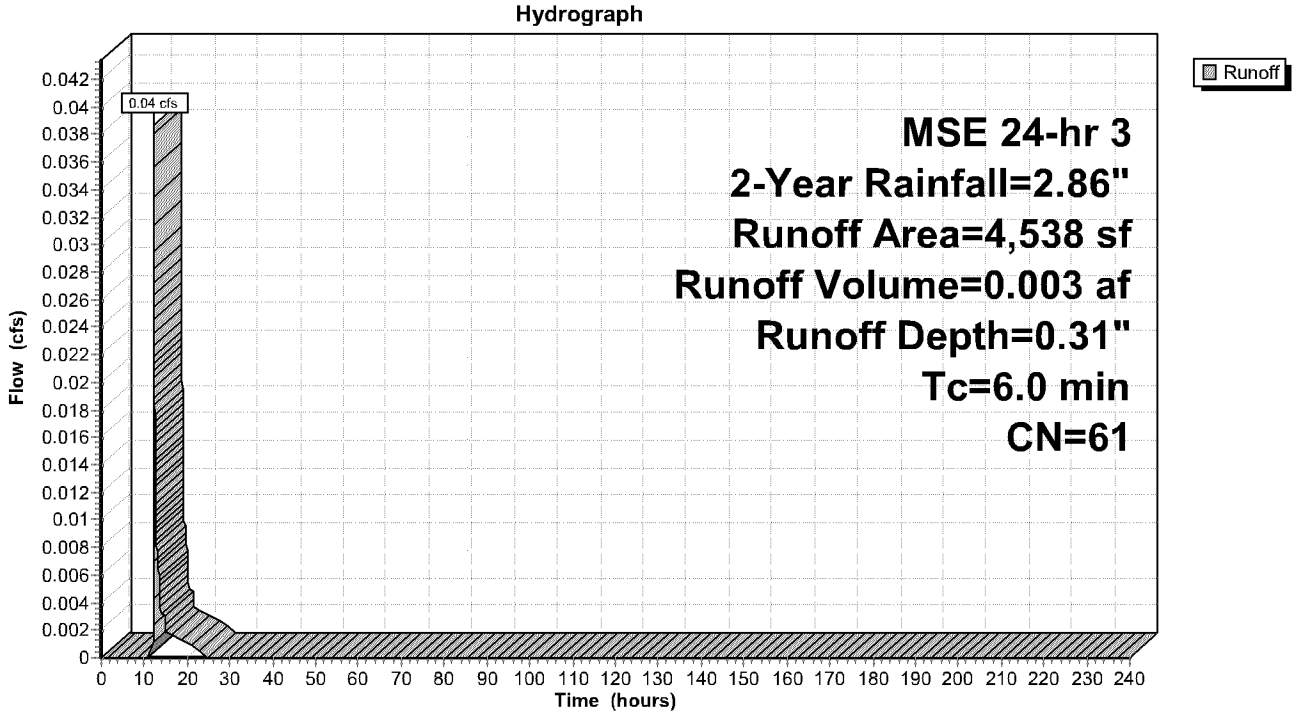
Runoff = 0.04 cfs @ 12.16 hrs, Volume= 0.003 af, Depth= 0.31"
Routed to Reach 1R : TOTAL

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 Rainfall=2.86"

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)



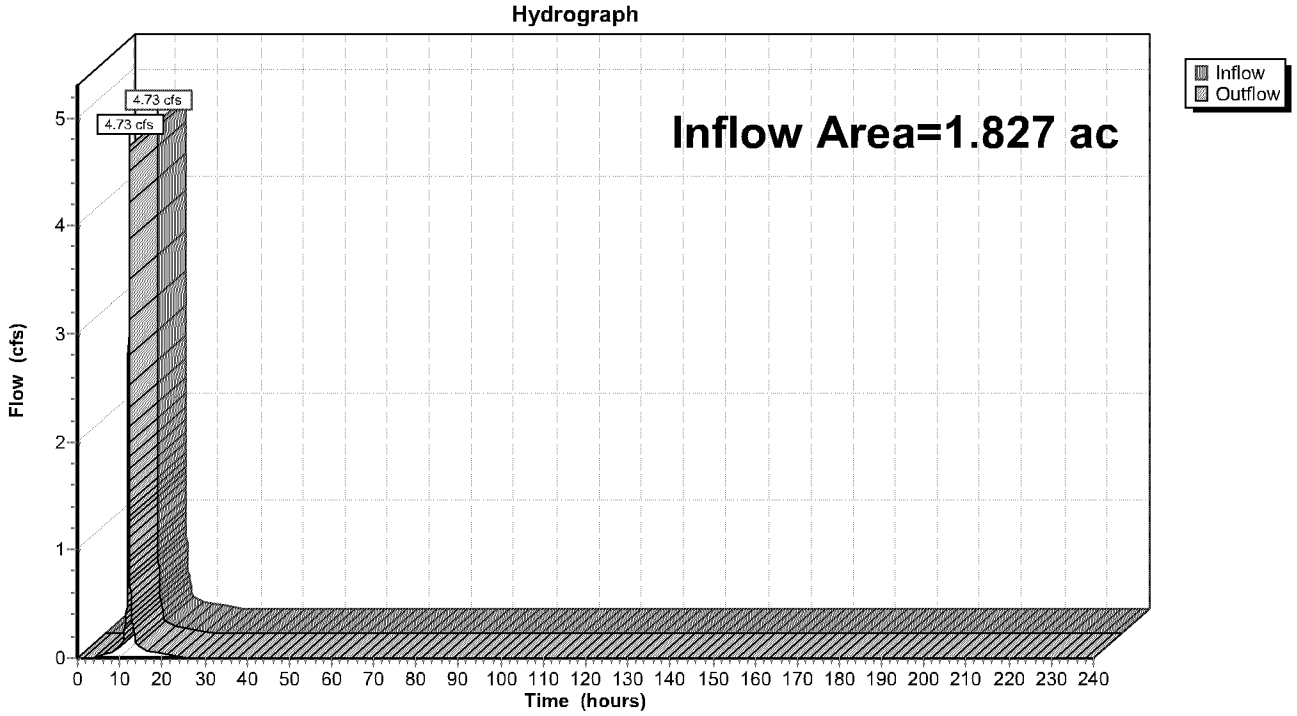
Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 1.63" for 2-Year event
Inflow = 4.73 cfs @ 12.13 hrs, Volume= 0.248 af
Outflow = 4.73 cfs @ 12.13 hrs, Volume= 0.248 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



Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 1.50" for 2-Year event
Inflow = 1.16 cfs @ 12.13 hrs, Volume= 0.062 af
Outflow = 0.05 cfs @ 13.56 hrs, Volume= 0.062 af, Atten= 96%, Lag= 85.6 min
Discarded = 0.05 cfs @ 13.56 hrs, Volume= 0.062 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 831.92' @ 13.56 hrs Surf.Area= 4,807 sf Storage= 1,483 cf

Plug-Flow detention time= 267.4 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 267.4 min (1,034.1 - 766.7)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

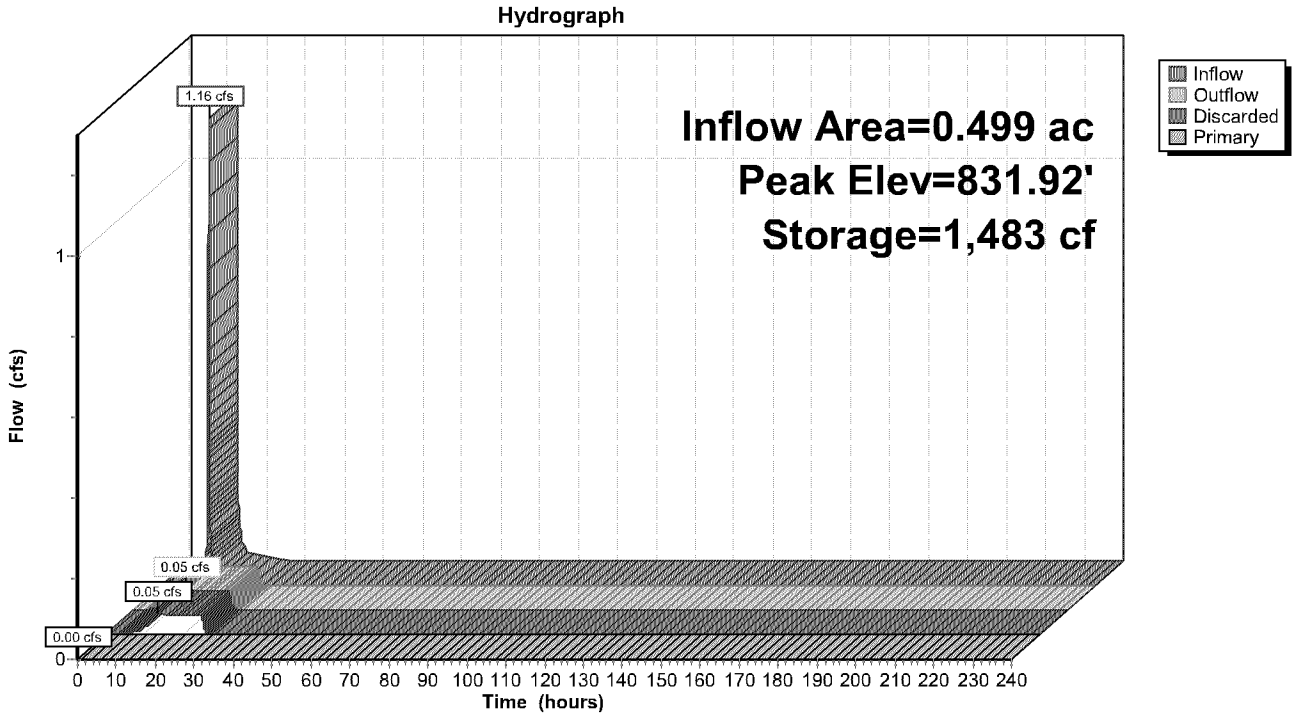
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	**0.450 in/hr Exfiltration over Surface area**
#2	Primary	833.36'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.05 cfs @ 13.56 hrs HW=831.92' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN



Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0
831.62	4,373	87
831.64	4,401	175
831.66	4,430	263
831.68	4,458	352
831.70	4,487	442
831.72	4,516	532
831.74	4,544	622
831.76	4,573	713
831.78	4,601	805
831.80	4,630	897
831.82	4,659	990
831.84	4,687	1,084
831.86	4,716	1,178
831.88	4,744	1,272
831.90	4,773	1,368
831.92	4,802	1,463
831.94	4,830	1,560
831.96	4,859	1,657
831.98	4,887	1,754
832.00	4,916	1,852
832.02	4,962	1,951
832.04	5,009	2,050
832.06	5,055	2,151
832.08	5,101	2,253
832.10	5,148	2,355
832.12	5,194	2,459
832.14	5,240	2,563
832.16	5,287	2,668
832.18	5,333	2,774
832.20	5,379	2,882
832.22	5,426	2,990
832.24	5,472	3,099
832.26	5,518	3,208
832.28	5,564	3,319
832.30	5,611	3,431
832.32	5,657	3,544
832.34	5,703	3,657
832.36	5,750	3,772
832.38	5,796	3,887
832.40	5,842	4,004
832.42	5,889	4,121
832.44	5,935	4,239
832.46	5,981	4,358
832.48	6,028	4,478
832.50	6,074	4,599
832.52	6,273	4,723
832.54	6,471	4,850
832.56	6,670	4,982
832.58	6,869	5,117
832.60	7,068	5,257
832.62	7,266	5,400
832.64	7,465	5,547
832.66	7,664	5,699
832.68	7,862	5,854
832.70	8,061	6,013
832.72	8,260	6,176
832.74	8,459	6,343
832.76	8,657	6,515
832.78	8,856	6,690
832.80	9,055	6,869
832.82	9,254	7,052
832.84	9,452	7,239
832.86	9,651	7,430
832.88	9,850	7,625
832.90	10,048	7,824
832.92	10,247	8,027
832.94	10,446	8,234
832.96	10,645	8,445
832.98	10,843	8,660
833.00	11,042	8,878
833.02	11,251	9,101
833.04	11,460	9,329
833.06	11,669	9,560
833.08	11,877	9,795
833.10	12,086	10,035
833.12	12,295	10,279
833.14	12,504	10,527
833.16	12,713	10,779
833.18	12,922	11,035
833.20	13,130	11,296
833.22	13,339	11,560
833.24	13,548	11,829
833.26	13,757	12,102
833.28	13,966	12,380
833.30	14,175	12,661
833.32	14,383	12,947
833.34	14,592	13,236
833.36	14,801	13,530
833.38	15,010	13,828
833.40	15,219	14,131
833.42	15,428	14,437
833.44	15,636	14,748
833.46	15,845	15,063
833.48	16,054	15,382
833.50	**16,263**	**15,705**

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

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=2.53"
Tc=6.0 min CN=WQ Runoff=2.01 cfs 0.105 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=3.73"
Tc=6.0 min CN=WQ Runoff=7.19 cfs 0.380 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=0.95"
Tc=6.0 min CN=61 Runoff=0.17 cfs 0.008 af

Reach 1R: TOTAL Inflow=7.35 cfs 0.388 af
Outflow=7.35 cfs 0.388 af

Pond 2P: INFILTRATION BASIN Peak Elev=832.18' Storage=2,767 cf Inflow=2.01 cfs 0.105 af
Discarded=0.06 cfs 0.105 af Primary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.105 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.493 af Average Runoff Depth = 3.24"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

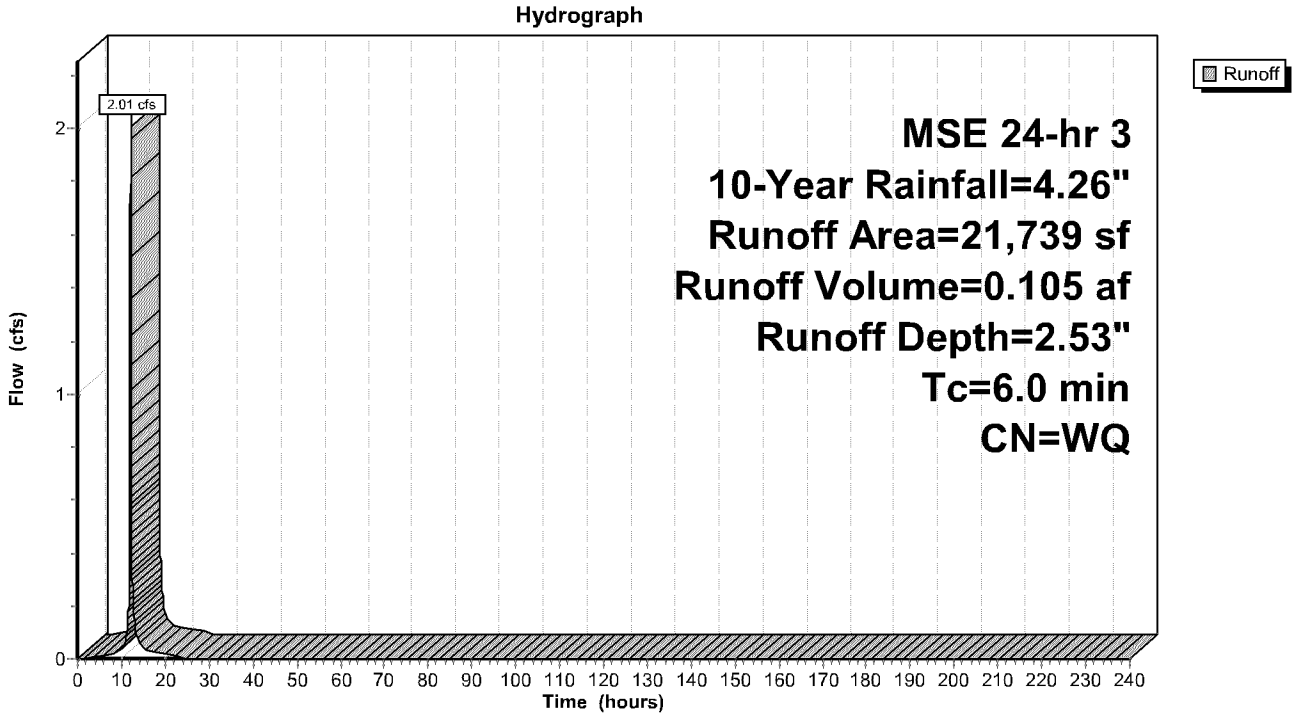
Runoff = 2.01 cfs @ 12.13 hrs, Volume= 0.105 af, Depth= 2.53"
Routed to Pond 2P : INFILTRATION BASIN

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 Rainfall=4.26"

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)



Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

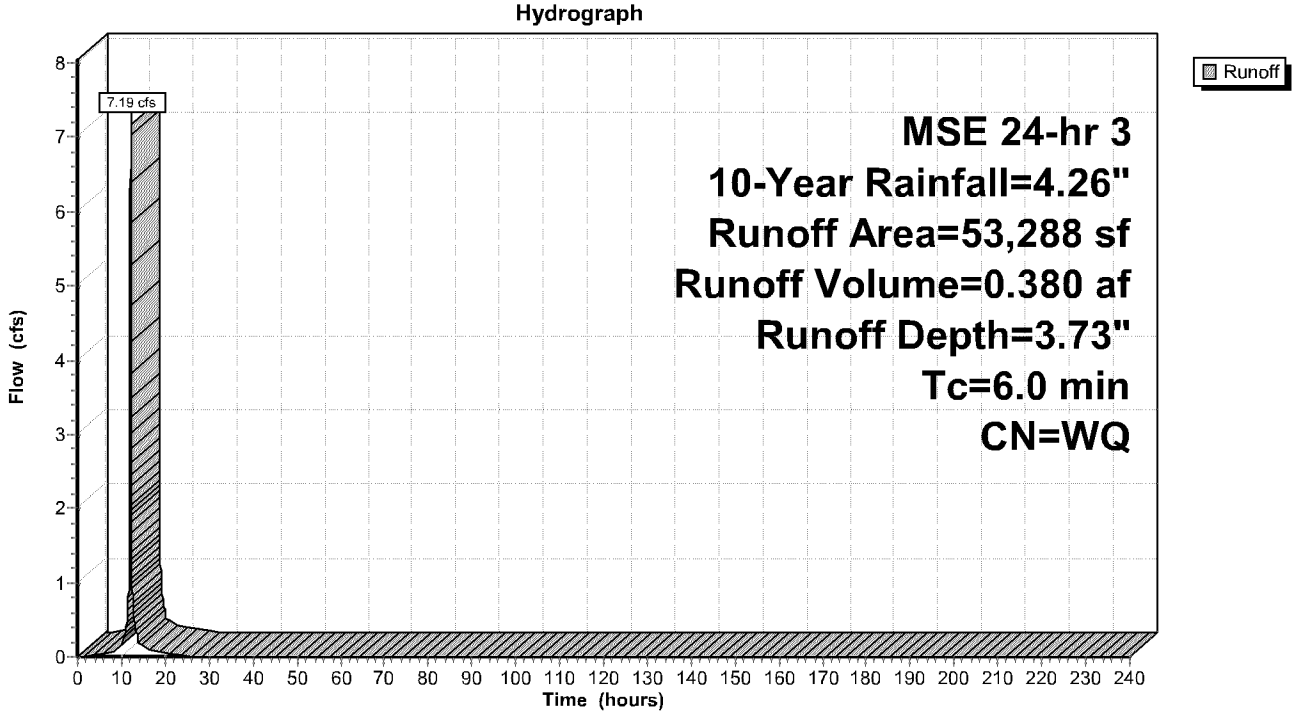
Runoff = 7.19 cfs @ 12.13 hrs, Volume= 0.380 af, Depth= 3.73"
Routed to Reach 1R : TOTAL

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 Rainfall=4.26"

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)



Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

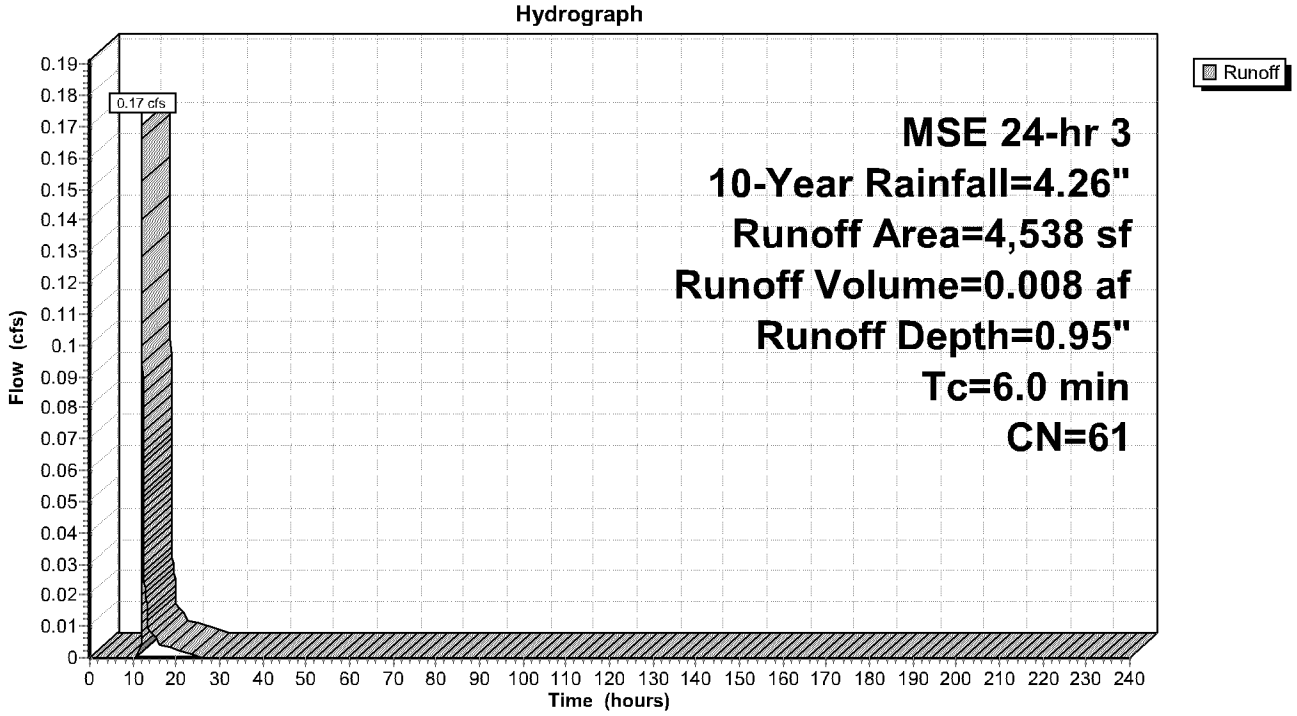
Runoff = 0.17 cfs @ 12.14 hrs, Volume= 0.008 af, Depth= 0.95"
Routed to Reach 1R : TOTAL

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 Rainfall=4.26"

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)



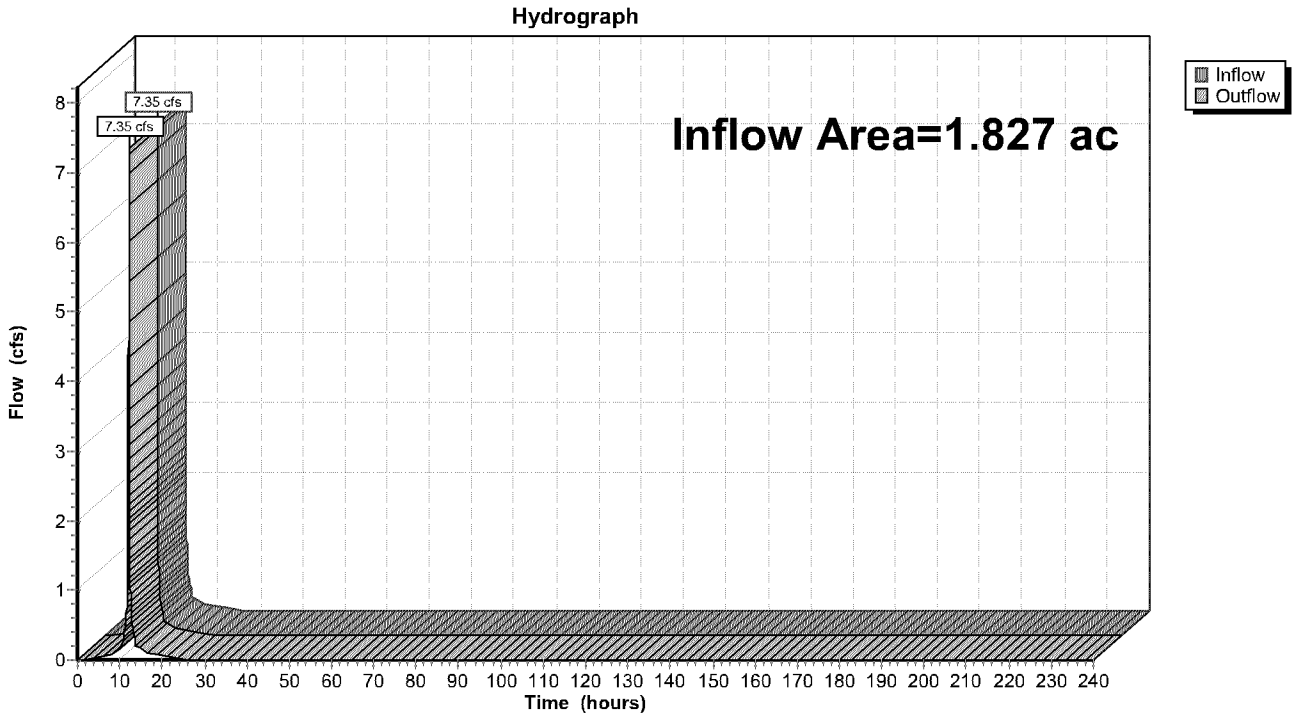
Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 2.55" for 10-Year event
Inflow = 7.35 cfs @ 12.13 hrs, Volume= 0.388 af
Outflow = 7.35 cfs @ 12.13 hrs, Volume= 0.388 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



Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 2.53" for 10-Year event
Inflow = 2.01 cfs @ 12.13 hrs, Volume= 0.105 af
Outflow = 0.06 cfs @ 14.52 hrs, Volume= 0.105 af, Atten= 97%, Lag= 143.1 min
Discarded = 0.06 cfs @ 14.52 hrs, Volume= 0.105 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 832.18' @ 14.52 hrs Surf.Area= 5,330 sf Storage= 2,767 cf

Plug-Flow detention time= 478.5 min calculated for 0.105 af (100% of inflow)
Center-of-Mass det. time= 478.5 min (1,243.9 - 765.3)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

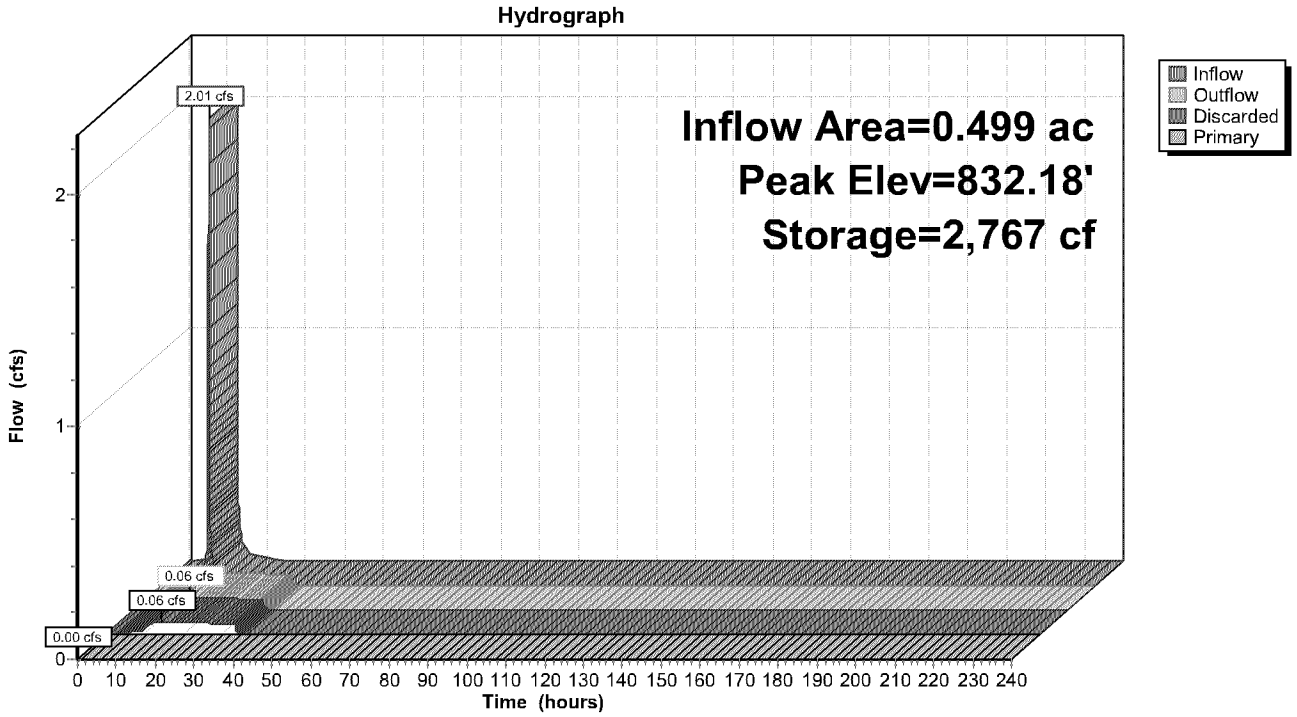
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	**0.450 in/hr Exfiltration over Surface area**
#2	Primary	833.36'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.06 cfs @ 14.52 hrs HW=832.18' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN



Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0
831.62	4,373	87
831.64	4,401	175
831.66	4,430	263
831.68	4,458	352
831.70	4,487	442
831.72	4,516	532
831.74	4,544	622
831.76	4,573	713
831.78	4,601	805
831.80	4,630	897
831.82	4,659	990
831.84	4,687	1,084
831.86	4,716	1,178
831.88	4,744	1,272
831.90	4,773	1,368
831.92	4,802	1,463
831.94	4,830	1,560
831.96	4,859	1,657
831.98	4,887	1,754
832.00	4,916	1,852
832.02	4,962	1,951
832.04	5,009	2,050
832.06	5,055	2,151
832.08	5,101	2,253
832.10	5,148	2,355
832.12	5,194	2,459
832.14	5,240	2,563
832.16	5,287	2,668
832.18	5,333	2,774
832.20	5,379	2,882
832.22	5,426	2,990
832.24	5,472	3,099
832.26	5,518	3,208
832.28	5,564	3,319
832.30	5,611	3,431
832.32	5,657	3,544
832.34	5,703	3,657
832.36	5,750	3,772
832.38	5,796	3,887
832.40	5,842	4,004
832.42	5,889	4,121
832.44	5,935	4,239
832.46	5,981	4,358
832.48	6,028	4,478
832.50	6,074	4,599
832.52	6,273	4,723
832.54	6,471	4,850
832.56	6,670	4,982
832.58	6,869	5,117
832.60	7,068	5,257
832.62	7,266	5,400
832.64	7,465	5,547
832.66	7,664	5,699
832.68	7,862	5,854
832.70	8,061	6,013
832.72	8,260	6,176
832.74	8,459	6,343
832.76	8,657	6,515
832.78	8,856	6,690
832.80	9,055	6,869
832.82	9,254	7,052
832.84	9,452	7,239
832.86	9,651	7,430
832.88	9,850	7,625
832.90	10,048	7,824
832.92	10,247	8,027
832.94	10,446	8,234
832.96	10,645	8,445
832.98	10,843	8,660
833.00	11,042	8,878
833.02	11,251	9,101
833.04	11,460	9,329
833.06	11,669	9,560
833.08	11,877	9,795
833.10	12,086	10,035
833.12	12,295	10,279
833.14	12,504	10,527
833.16	12,713	10,779
833.18	12,922	11,035
833.20	13,130	11,296
833.22	13,339	11,560
833.24	13,548	11,829
833.26	13,757	12,102
833.28	13,966	12,380
833.30	14,175	12,661
833.32	14,383	12,947
833.34	14,592	13,236
833.36	14,801	13,530
833.38	15,010	13,828
833.40	15,219	14,131
833.42	15,428	14,437
833.44	15,636	14,748
833.46	15,845	15,063
833.48	16,054	15,382
833.50	**16,263**	**15,705**

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

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=WQ Runoff=4.12 cfs 0.211 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=6.68"
Tc=6.0 min CN=WQ Runoff=12.72 cfs 0.681 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=61 Runoff=0.57 cfs 0.025 af

Reach 1R: TOTAL Inflow=13.29 cfs 0.706 af
Outflow=13.29 cfs 0.706 af

Pond 2P: INFILTRATION BASIN Peak Elev=832.72' Storage=6,173 cf Inflow=4.12 cfs 0.211 af
Discarded=0.09 cfs 0.211 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.211 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.917 af Average Runoff Depth = 6.02"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

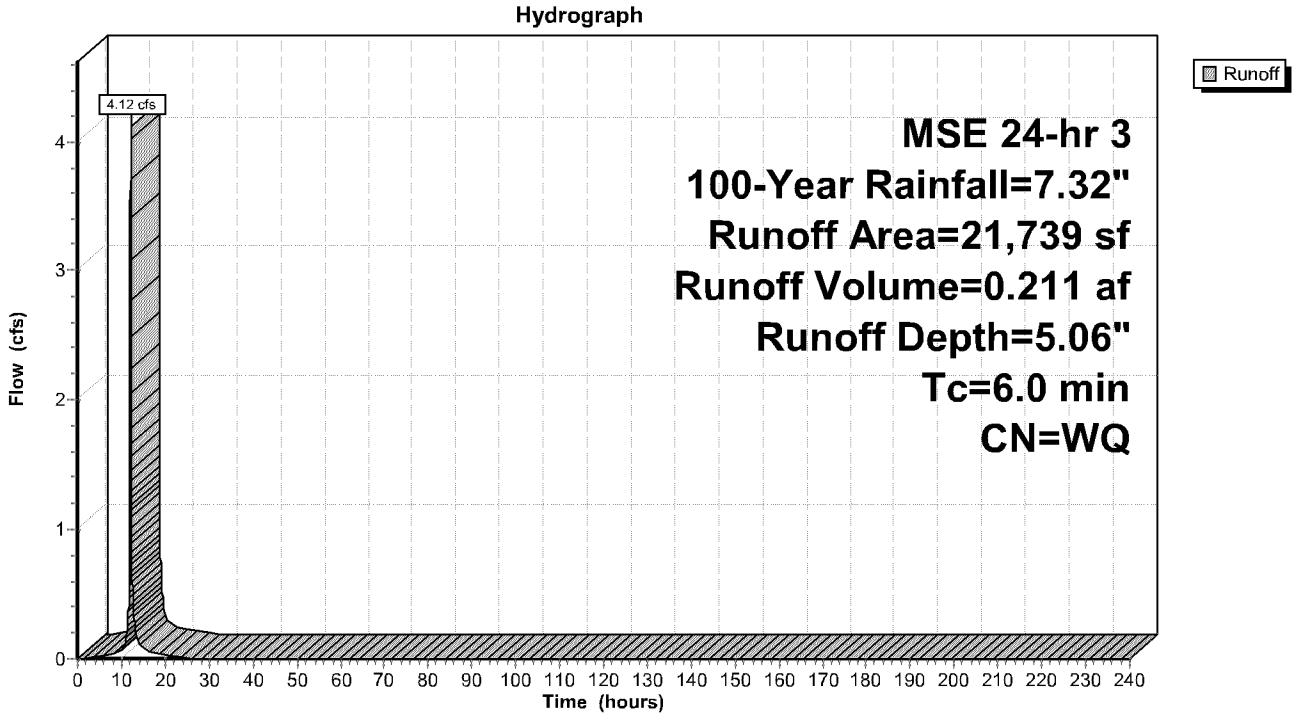
Runoff = 4.12 cfs @ 12.13 hrs, Volume= 0.211 af, Depth= 5.06"
Routed to Pond 2P : INFILTRATION BASIN

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 Rainfall=7.32"

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)



Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

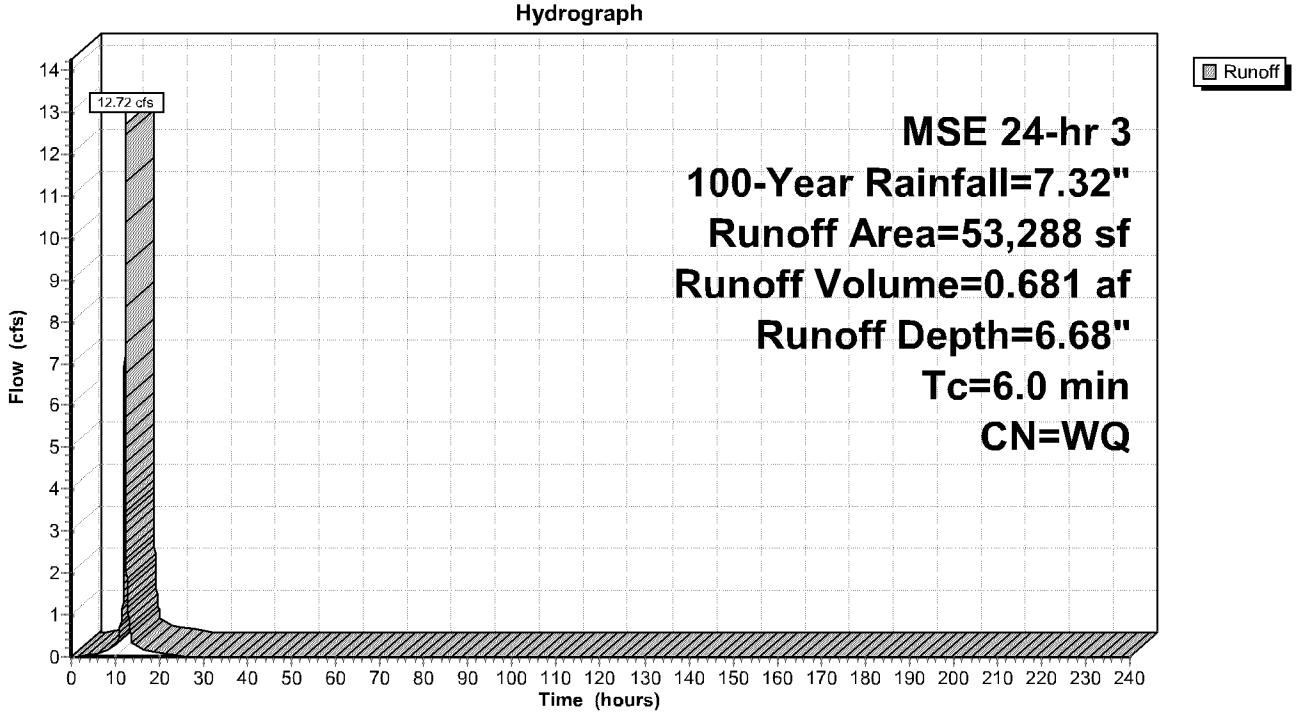
Runoff = 12.72 cfs @ 12.13 hrs, Volume= 0.681 af, Depth= 6.68"
Routed to Reach 1R : TOTAL

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 Rainfall=7.32"

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)



Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

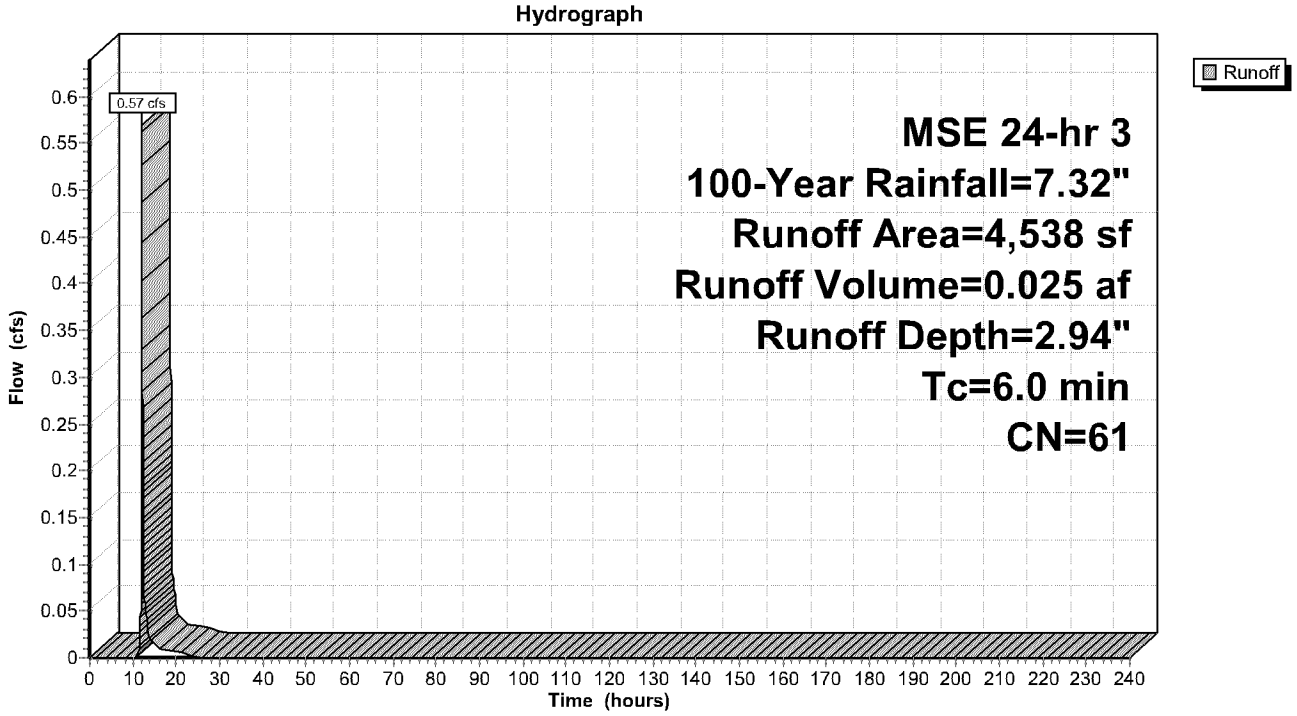
Runoff = 0.57 cfs @ 12.14 hrs, Volume= 0.025 af, Depth= 2.94"
Routed to Reach 1R : TOTAL

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 Rainfall=7.32"

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)



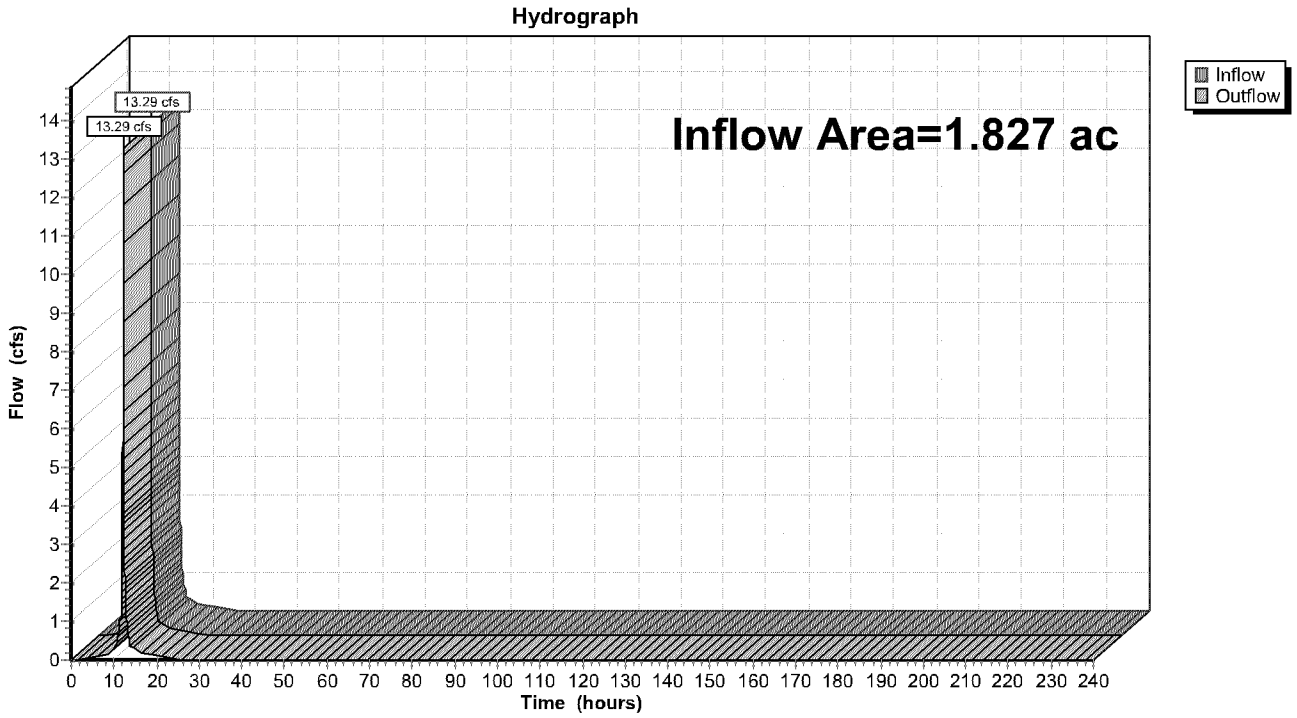
Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 4.64" for 100-Year event
Inflow = 13.29 cfs @ 12.13 hrs, Volume= 0.706 af
Outflow = 13.29 cfs @ 12.13 hrs, Volume= 0.706 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



Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 5.06" for 100-Year event
Inflow = 4.12 cfs @ 12.13 hrs, Volume= 0.211 af
Outflow = 0.09 cfs @ 15.08 hrs, Volume= 0.211 af, Atten= 98%, Lag= 176.7 min
Discarded = 0.09 cfs @ 15.08 hrs, Volume= 0.211 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 832.72' @ 15.08 hrs Surf.Area= 8,256 sf Storage= 6,173 cf

Plug-Flow detention time= 820.1 min calculated for 0.211 af (100% of inflow)
Center-of-Mass det. time= 820.2 min (1,582.7 - 762.6)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

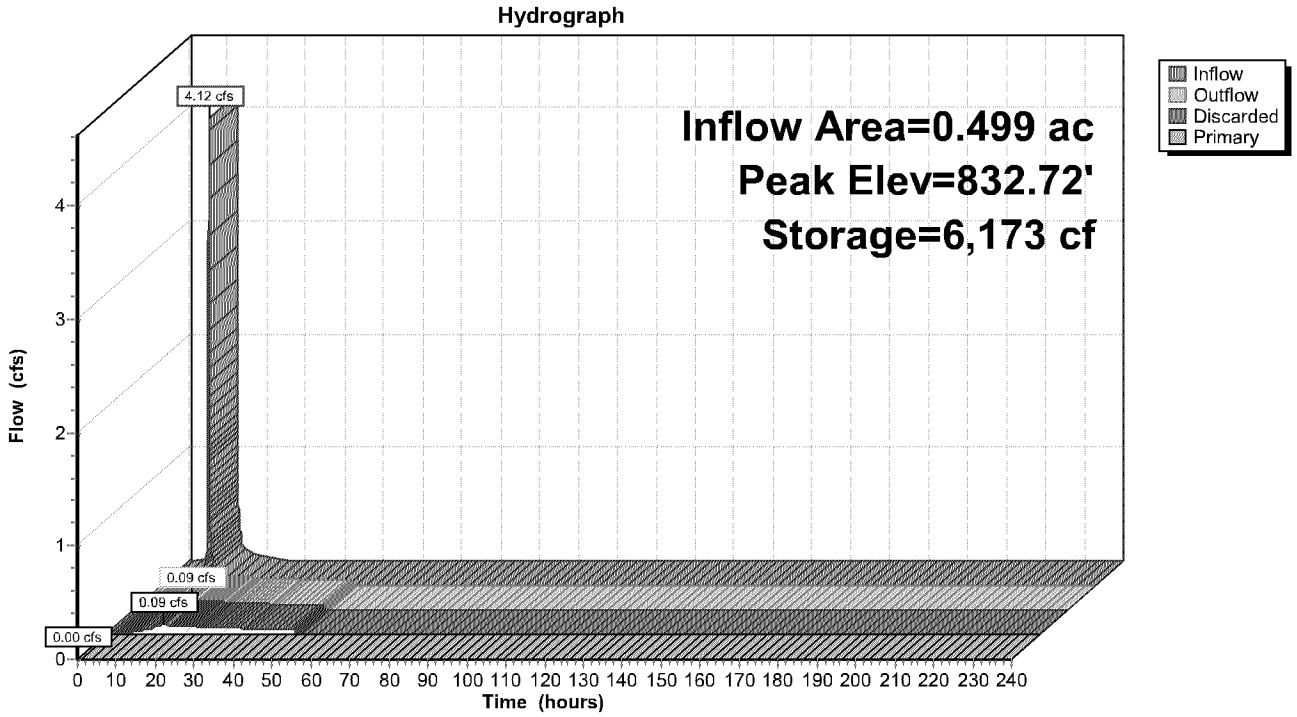
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	**0.450 in/hr Exfiltration over Surface area**
#2	Primary	833.36'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.09 cfs @ 15.08 hrs HW=832.72' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN



Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0
831.62	4,373	87
831.64	4,401	175
831.66	4,430	263
831.68	4,458	352
831.70	4,487	442
831.72	4,516	532
831.74	4,544	622
831.76	4,573	713
831.78	4,601	805
831.80	4,630	897
831.82	4,659	990
831.84	4,687	1,084
831.86	4,716	1,178
831.88	4,744	1,272
831.90	4,773	1,368
831.92	4,802	1,463
831.94	4,830	1,560
831.96	4,859	1,657
831.98	4,887	1,754
832.00	4,916	1,852
832.02	4,962	1,951
832.04	5,009	2,050
832.06	5,055	2,151
832.08	5,101	2,253
832.10	5,148	2,355
832.12	5,194	2,459
832.14	5,240	2,563
832.16	5,287	2,668
832.18	5,333	2,774
832.20	5,379	2,882
832.22	5,426	2,990
832.24	5,472	3,099
832.26	5,518	3,208
832.28	5,564	3,319
832.30	5,611	3,431
832.32	5,657	3,544
832.34	5,703	3,657
832.36	5,750	3,772
832.38	5,796	3,887
832.40	5,842	4,004
832.42	5,889	4,121
832.44	5,935	4,239
832.46	5,981	4,358
832.48	6,028	4,478
832.50	6,074	4,599
832.52	6,273	4,723
832.54	6,471	4,850
832.56	6,670	4,982
832.58	6,869	5,117
832.60	7,068	5,257
832.62	7,266	5,400
832.64	7,465	5,547
832.66	7,664	5,699
832.68	7,862	5,854
832.70	8,061	6,013
832.72	8,260	6,176
832.74	8,459	6,343
832.76	8,657	6,515
832.78	8,856	6,690
832.80	9,055	6,869
832.82	9,254	7,052
832.84	9,452	7,239
832.86	9,651	7,430
832.88	9,850	7,625
832.90	10,048	7,824
832.92	10,247	8,027
832.94	10,446	8,234
832.96	10,645	8,445
832.98	10,843	8,660
833.00	11,042	8,878
833.02	11,251	9,101
833.04	11,460	9,329
833.06	11,669	9,560
833.08	11,877	9,795
833.10	12,086	10,035
833.12	12,295	10,279
833.14	12,504	10,527
833.16	12,713	10,779
833.18	12,922	11,035
833.20	13,130	11,296
833.22	13,339	11,560
833.24	13,548	11,829
833.26	13,757	12,102
833.28	13,966	12,380
833.30	14,175	12,661
833.32	14,383	12,947
833.34	14,592	13,236
833.36	14,801	13,530
833.38	15,010	13,828
833.40	15,219	14,131
833.42	15,428	14,437
833.44	15,636	14,748
833.46	15,845	15,063
833.48	16,054	15,382
833.50	**16,263**	**15,705**

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

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=11.79"
Tc=6.0 min CN=WQ Runoff=5.06 cfs 0.490 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=13.88"
Tc=6.0 min CN=WQ Runoff=13.21 cfs 1.415 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=9.04"
Tc=6.0 min CN=61 Runoff=0.97 cfs 0.078 af

Reach 1R: TOTAL Inflow=14.17 cfs 1.493 af
Outflow=14.17 cfs 1.493 af

Pond 2P: INFILTRATION BASIN Peak Elev=833.22' Storage=11,593 cf Inflow=5.06 cfs 0.490 af
Discarded=0.14 cfs 0.490 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.490 af

Total Runoff Area = 1.827 ac Runoff Volume = 1.984 af Average Runoff Depth = 13.03"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

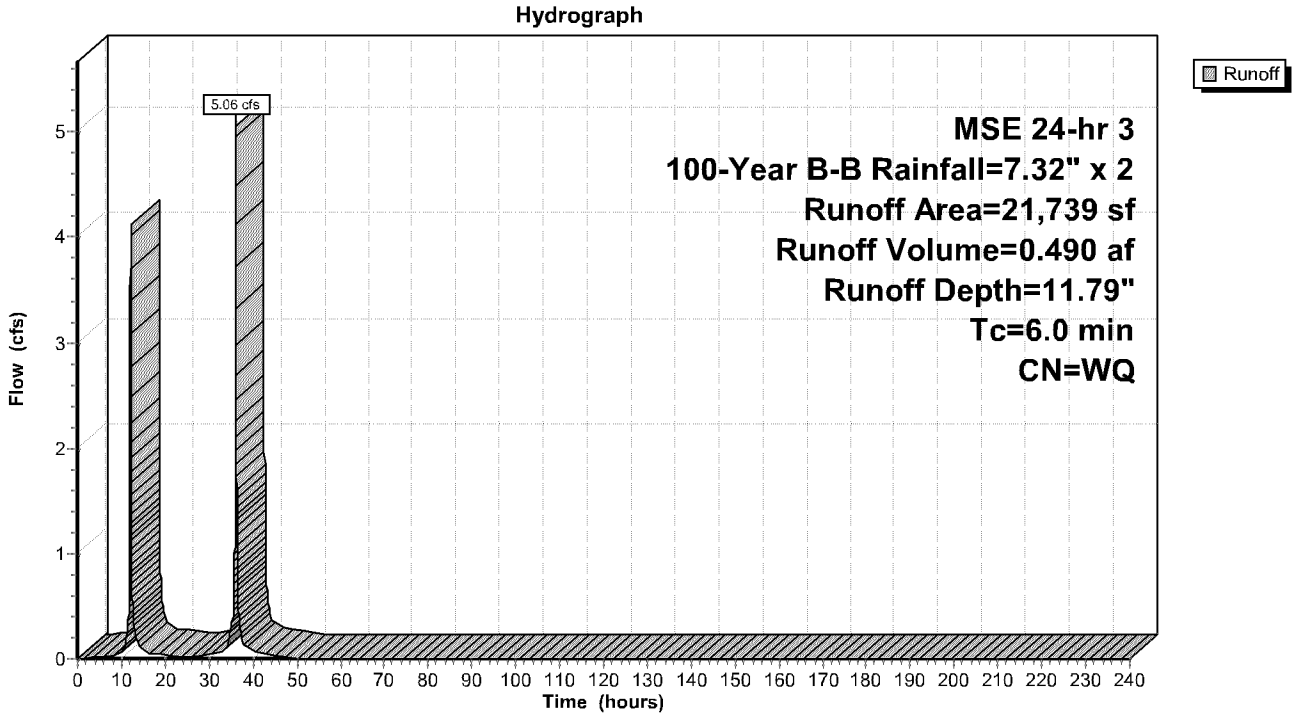
Runoff = 5.06 cfs @ 36.13 hrs, Volume= 0.490 af, Depth=11.79"
Routed to Pond 2P : INFILTRATION BASIN

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 B-B Rainfall=7.32" x 2

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)



Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

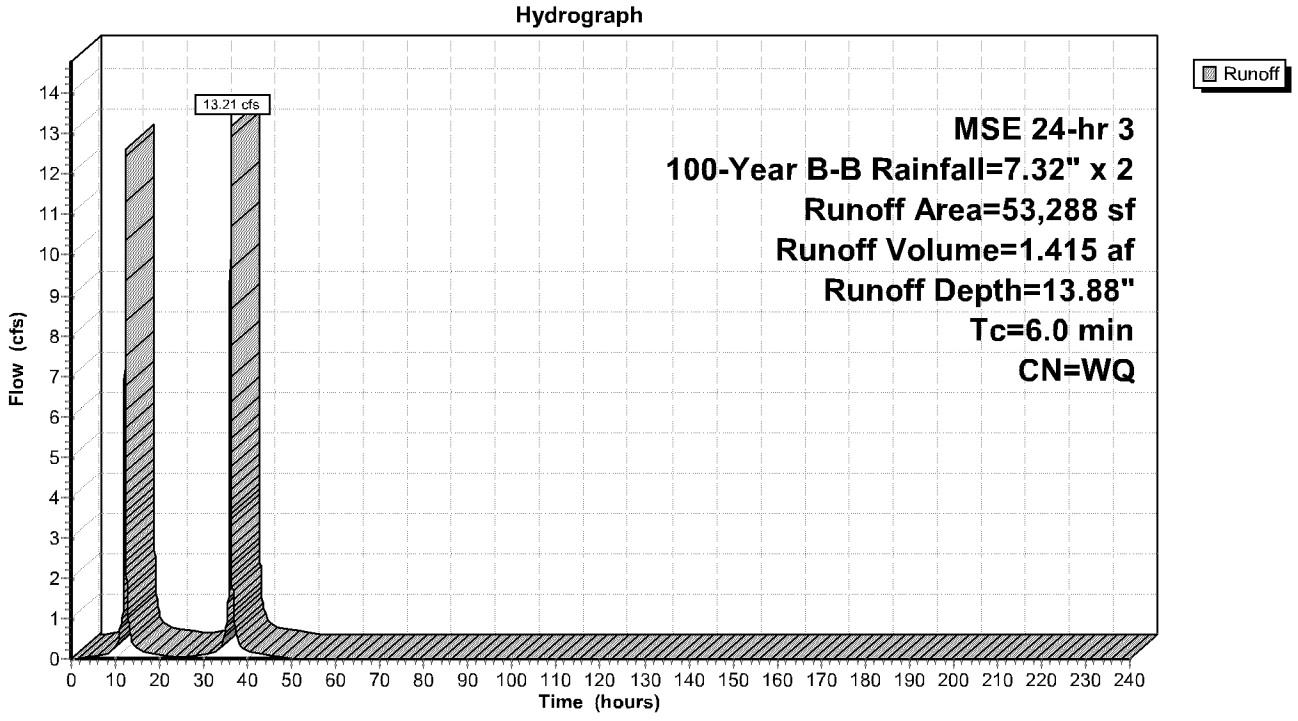
Runoff = 13.21 cfs @ 36.13 hrs, Volume= 1.415 af, Depth=13.88"
Routed to Reach 1R : TOTAL

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 B-B Rainfall=7.32" x 2

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)



Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

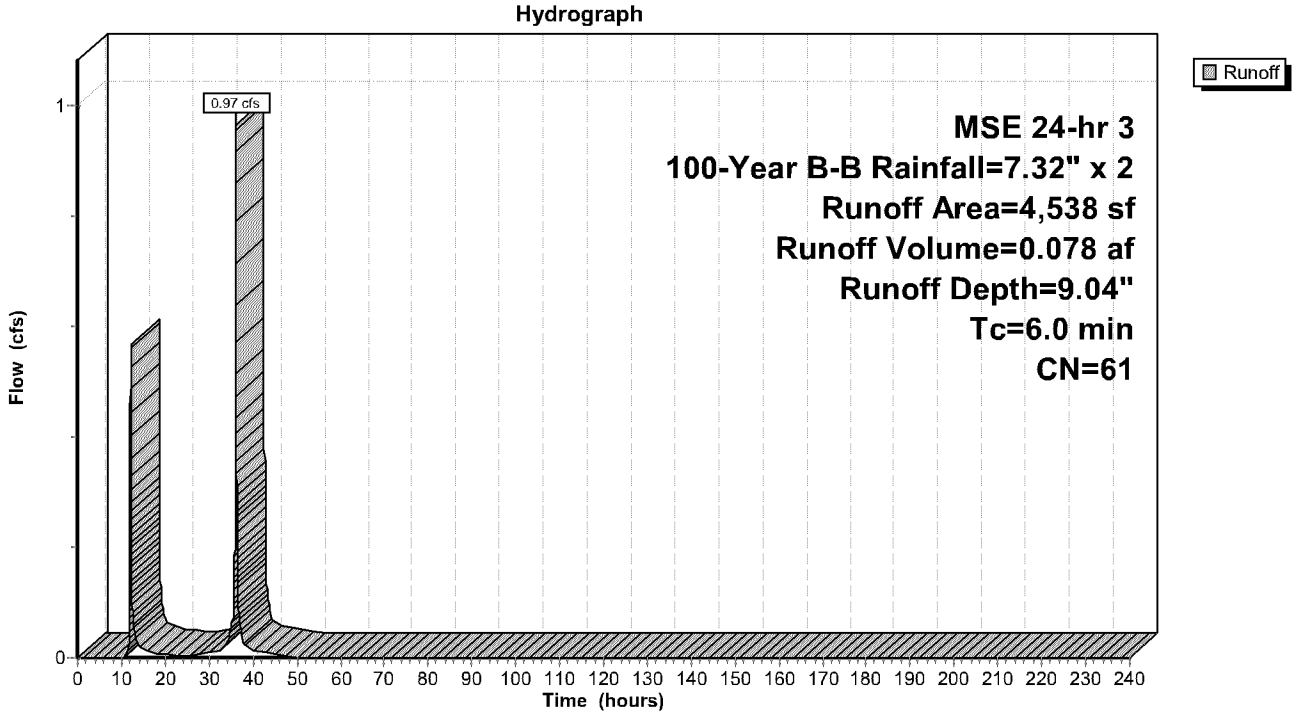
Runoff = 0.97 cfs @ 36.13 hrs, Volume= 0.078 af, Depth= 9.04"
Routed to Reach 1R : TOTAL

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 B-B Rainfall=7.32" x 2

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)



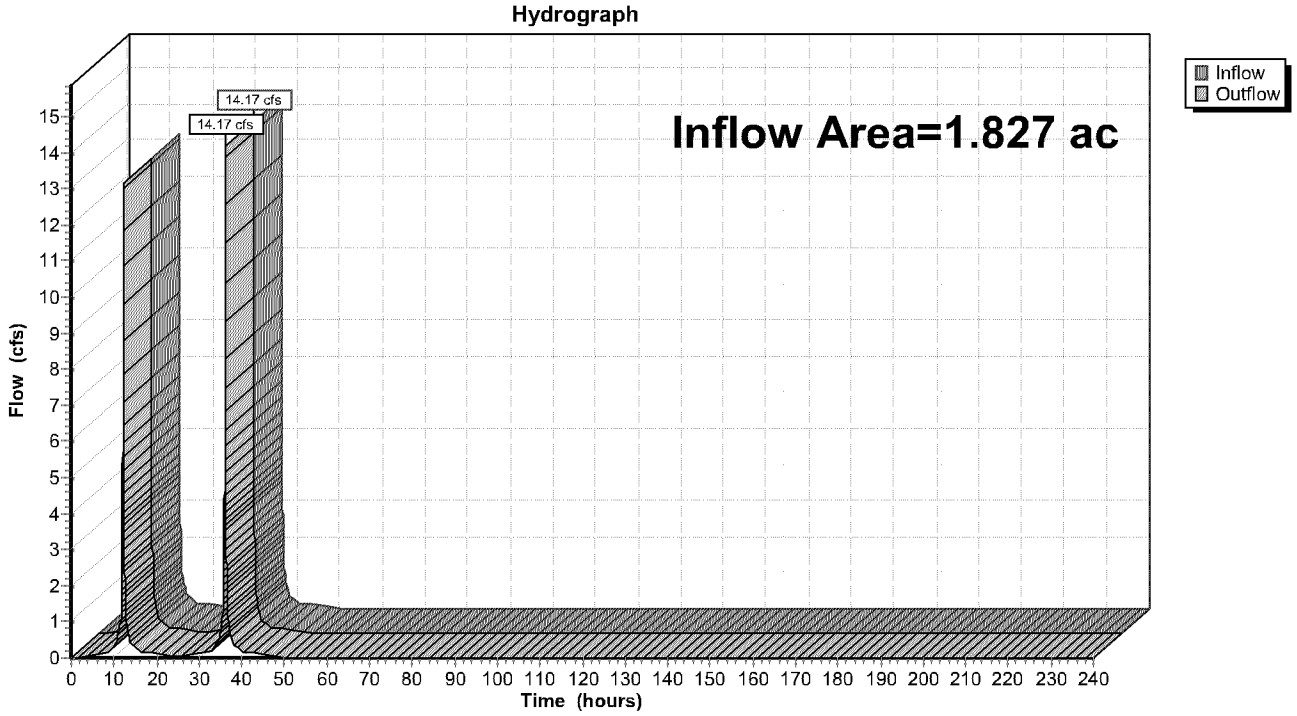
Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 9.81" for 100-Year B-B event
Inflow = 14.17 cfs @ 36.13 hrs, Volume= 1.493 af
Outflow = 14.17 cfs @ 36.13 hrs, Volume= 1.493 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



Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 11.79" for 100-Year B-B event
Inflow = 5.06 cfs @ 36.13 hrs, Volume= 0.490 af
Outflow = 0.14 cfs @ 37.66 hrs, Volume= 0.490 af, Atten= 97%, Lag= 92.0 min
Discarded = 0.14 cfs @ 37.66 hrs, Volume= 0.490 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 833.22' @ 37.66 hrs Surf.Area= 13,365 sf Storage= 11,593 cf

Plug-Flow detention time= 1,072.0 min calculated for 0.490 af (100% of inflow)
Center-of-Mass det. time= 1,072.0 min (2,637.3 - 1,565.3)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

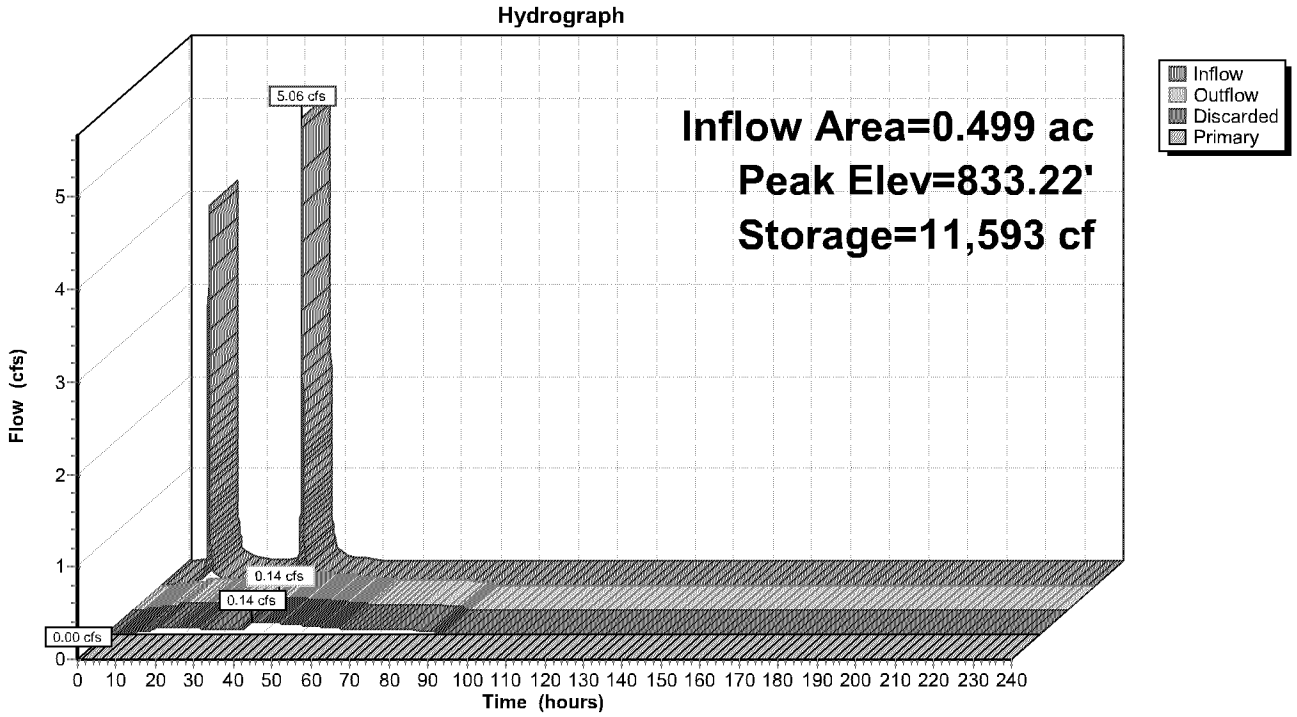
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	**0.450 in/hr Exfiltration over Surface area**
#2	Primary	833.36'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.14 cfs @ 37.66 hrs HW=833.22' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN



Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0
831.62	4,373	87
831.64	4,401	175
831.66	4,430	263
831.68	4,458	352
831.70	4,487	442
831.72	4,516	532
831.74	4,544	622
831.76	4,573	713
831.78	4,601	805
831.80	4,630	897
831.82	4,659	990
831.84	4,687	1,084
831.86	4,716	1,178
831.88	4,744	1,272
831.90	4,773	1,368
831.92	4,802	1,463
831.94	4,830	1,560
831.96	4,859	1,657
831.98	4,887	1,754
832.00	4,916	1,852
832.02	4,962	1,951
832.04	5,009	2,050
832.06	5,055	2,151
832.08	5,101	2,253
832.10	5,148	2,355
832.12	5,194	2,459
832.14	5,240	2,563
832.16	5,287	2,668
832.18	5,333	2,774
832.20	5,379	2,882
832.22	5,426	2,990
832.24	5,472	3,099
832.26	5,518	3,208
832.28	5,564	3,319
832.30	5,611	3,431
832.32	5,657	3,544
832.34	5,703	3,657
832.36	5,750	3,772
832.38	5,796	3,887
832.40	5,842	4,004
832.42	5,889	4,121
832.44	5,935	4,239
832.46	5,981	4,358
832.48	6,028	4,478
832.50	6,074	4,599
832.52	6,273	4,723
832.54	6,471	4,850
832.56	6,670	4,982
832.58	6,869	5,117
832.60	7,068	5,257
832.62	7,266	5,400
832.64	7,465	5,547
832.66	7,664	5,699
832.68	7,862	5,854
832.70	8,061	6,013
832.72	8,260	6,176
832.74	8,459	6,343
832.76	8,657	6,515
832.78	8,856	6,690
832.80	9,055	6,869
832.82	9,254	7,052
832.84	9,452	7,239
832.86	9,651	7,430
832.88	9,850	7,625
832.90	10,048	7,824
832.92	10,247	8,027
832.94	10,446	8,234
832.96	10,645	8,445
832.98	10,843	8,660
833.00	11,042	8,878
833.02	11,251	9,101
833.04	11,460	9,329
833.06	11,669	9,560
833.08	11,877	9,795
833.10	12,086	10,035
833.12	12,295	10,279
833.14	12,504	10,527
833.16	12,713	10,779
833.18	12,922	11,035
833.20	13,130	11,296
833.22	13,339	11,560
833.24	13,548	11,829
833.26	13,757	12,102
833.28	13,966	12,380
833.30	14,175	12,661
833.32	14,383	12,947
833.34	14,592	13,236
833.36	14,801	13,530
833.38	15,010	13,828
833.40	15,219	14,131
833.42	15,428	14,437
833.44	15,636	14,748
833.46	15,845	15,063
833.48	16,054	15,382
833.50	**16,263**	**15,705**