Stormwater Management Report

Owner:
Stuart Development Corporation
1000 W 80th Street
Minneapolis, MN 55420

Project:
Knox & American II
8000 Knox Ave S,
Bloomington, MN 55431

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. Pavek P.E.

Registration Number: 44263

Date:
5/15/23

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 05/17/2023. 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 an empty lot. Historically the site was a small office building with an associated parking lot. Below is the existing surface area tabulation.

Existing Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
EX1	56927	98	11599	61	68526	92
EX2	8155	98	2009	61	10164	91

Existing Soils:
A geotechnical exploration has been completed for the site by Braun Intertec in 2007, 2017, and 2023. The geotechnical evaluation shows that soils on the site are primarily poorly graded sand with some silt. There exists some swamp deposits and organic silt on the eastern portion of the site. Hydrologic soil group A has been assumed for the purposes of this report.

Groundwater:
Groundwater observations range from an elevation of 796.5 to 808.5 feet although this may be due to regional drought conditions. Actual groundwater is estimated to be in the range of 810 to 813 feet. This is more than 3 feet below the bottom of infiltration media of 822.17.

2.3 Proposed Site Conditions:

Site Description:
The proposed site is a multi-family residential building with associated above ground and underground parking. Landscaping, utility, and stormwater improvements will occur.

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	5012	98	10738	61	15750	73
PR2	3437	98	1241	61	4678	88
PR2A	54623	98	3639	61	58262	96

2.4 Stormwater Requirements City (Bloomington):

Rate Control – Surface-water discharge rates from redevelopments that disturb land area greater than 50 cubic yards or 5,000 square feet must, at a minimum, achieve a net reduction of preproject discharge rates for the 50-percent, 10- percent, and 1-percent annual-chance event using the 24-hour Atlas 14 rainfall event values shown in Table 4-1 and a nested distribution.

Water Quality
Total Phosphorus (TP): 60% annual removal efficiency of total phosphorus.
Total Suspended Solids (TSS): 90% annual removal efficiency of total suspended solids.

Volume Control – Sites that disturb land area more than 50 cubic yards or 5,000 square feet of new and/or fully reconstructed impervious surface shall capture and retain on-site a volume equivalent to 1.1 inches of runoff from the new and/or fully reconstructed impervious area.

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

Requirement threshold – A permit is required for projects which disturb 50 cubic yards or more of earth or disturb 5,000 sf of surface area or vegetation.

Rate Control – Limit peak runoff flow rates to existing conditions for two-, 10-, and 100-year frequency storms (nested 24-hour rainfall distribution).

Water Quality – Remove at least 60% of total phosphorus and 90 percent of total suspended solids annually from site runoff.

Volume Retention – Retain 1.1 inches of runoff on-site from applicable impervious surface.
Provide pretreatment of runoff for infiltration or filtration systems
Draw down water levels in infiltration or filtration systems within 48 hours
If site conditions limit or prohibit infiltration, see the volume retention compliance sequencing approach.

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).
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 is disturbing approximately 1.8 acres of land. The project will be constructing approximately 1.3 acres of new/reconstructed impervious surfaces.

This land disturbance and creation of impervious surfaces will trigger stormwater management requirements from the Nine Mile Creek Watershed District, the City of Bloomington, and the Minnesota Pollution Control Agency. The stormwater management requirements of the Nine Mile Creek Watershed District are the most stringent and will be used as a basis for the design requirements for this project. The proposed stormwater strategy for this project is to direct the site's stormwater runoff via surface drainage and storm sewer piping to a below ground infiltration basin underneath the parking lot before discharging into the city's existing storm sewer system. The underground basin is designed to meet rate control, water quality, and volume control requirements.

3.2 Rate Control

Rate control is provided by live storage within the proposed underground 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	5.37	0.70
10-Year Event	8.07	1.05
100-Year Event	14.58	6.23

Runoff rates have been reduced in the 2-year, 10-year, and 100-year storm event. – REQUIREMENT SATISFIED

3.3 Water Quality

Water quality requirements are met using pretreatment solid sections of the underground infiltration system as well as sump catch basins prior to discharging into the underground infiltration system. A total of more than 95 % of the new/reconstructed impervious surfaces onsite are routed to the underground system. The remainder of the impervious surfaces flow directly to Knox Ave S and American Blvd W.

The water quality requirement which is achieving 90% TSS removal and 60% TP removal is met using the underground infiltration system. MIDS calculations are attached to this report in the appendix.

The proposed water quality achieves greater than 90% total phosphorus (TP) and 90% total suspended solids (TSS) removal. – REQUIREMENT SATISFIED

3.4 Volume Control

The required infiltration volume is the post construction runoff volume for 1.1" of runoff from all new/reconstructed impervious surfaces on the site. These calculations are shown in the table below.

Stormwater Water Quality and Volume Summary

Drainage Area	Required Infiltration Vol. Summary	
	New Impv. Area (sf)	Required Volume (cf)
PR1	1027	94
PR2	1271	117
PR2A	54623	5007
TOTAL	56921	5218

Infiltration Volume = 1.1"*Dist. Impv. Area

Proposed BMP Area	Provided Vol (cf)	Drawdown Time Calculations (0.8"/Hour)		
		Inf. Area (sf)	Assoc. Inf. Height (ft)	Drawdown Time (h)
Infiltration Basin 1	10223	3959	2.58	38.73
TOTAL	10223			

Provided Vol (cf) is calculated from the volume of the BMP which is below the outlet elevation.

4.0 Conclusions:

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

PL202300068

Knox & American II
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	56927	98	11599	61	68526	92
EX2	8155	98	2009	61	10164	91

Proposed Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1	5012	98	10738	61	15750	73
PR2	3437	98	1241	61	4678	88
PR2A	54523	98	3539	61	58252	96

Site Area Summary

	Impervious [SF]	Impervious [AC]	Pervious [SF]	Pervious [AC]	Total [SF]	Total [AC]
Existing Site	65082	1.49	13608	0.31	78690	1.81
Proposed Site	63072	1.45	15618	0.36	78690	1.81

Stormwater Rate Summary

Drainage Area	Existing Rate (cfs)		
	2-YR [2.85"]	10-YR [4.25"]	100-YR [7.48"]
EX1	4.70	7.06	12.74
EX2	0.67	1.01	1.83
TOTAL (REACH)	5.37	8.07	14.58

Drainage Area	Proposed Conditions Rate (cfs)		
	2-YR [2.85"]	10-YR [4.25"]	100-YR [7.48"]
PR1	0.41	0.62	1.32
PR2	0.28	0.43	0.78
PR2A	4.51	6.78	12.08
Und. Sys.	0.00	0.50	5.03
TOTAL (REACH)	0.70	1.05	6.23

Overall Stormwater Rate Summary

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	5.37	0.70
10-Year Event	8.07	1.05
100-Year Event	14.58	6.23

Stormwater Rate Summary - American Blvd W

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	0.67	0.28
10-Year Event	1.01	0.93
100-Year Event	1.83	5.81

Stormwater Rate Summary - Knox Ave S

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	4.70	0.41
10-Year Event	7.06	0.62
100-Year Event	12.74	1.32

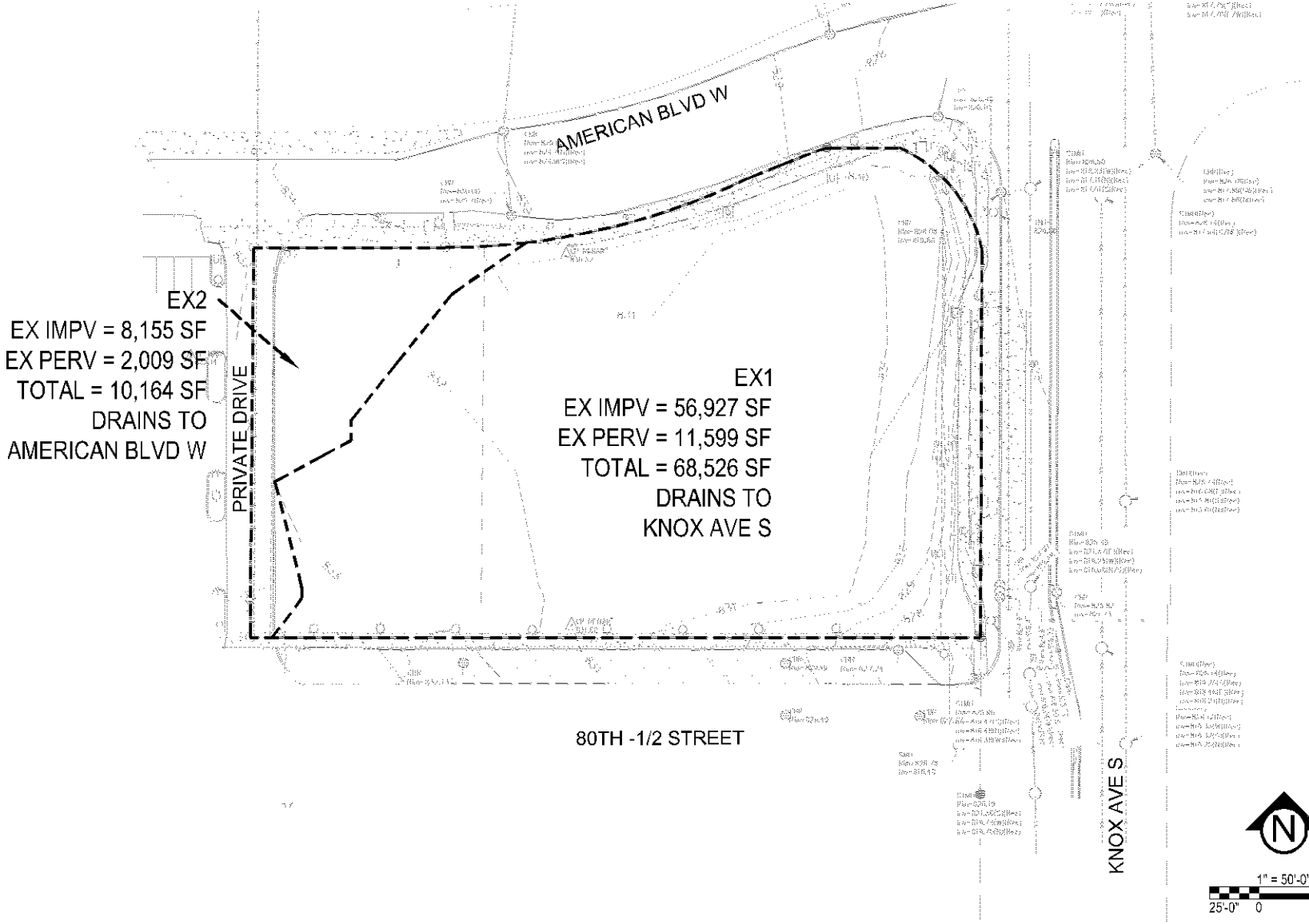
Stormwater Water Quality and Volume Summary

Drainage Area	Required Infiltration Vol. Summary	
	New Impv. Area (sf)	Required Volume (cf)
PR1	1027	94
PR2	1271	117
PR2A	54523	5007
TOTAL	56921	5218

Infiltration Volume = 1.1"*Dist. Impv. Area

Proposed BMP Area	Provided Vol (cf)	Drawdown Time Calculations (0.8"/Hour)		
		Inf. Area (sf)	Assoc. Inf. Height (ft)	Drawdown Time (h)
Infiltration Basin 1	10223	3959	2.58	38.73
TOTAL	10223			

Provided Vol (cf) is calculated from the volume of the BMP which is below the outlet elevation.



PL20230068

Knox & American II

CivilSite GROUP
5000 GLENWOOD AVENUE
GOLDEN VALLEY, MN 55422
612-615-0060
www.CivilSiteGroup.com

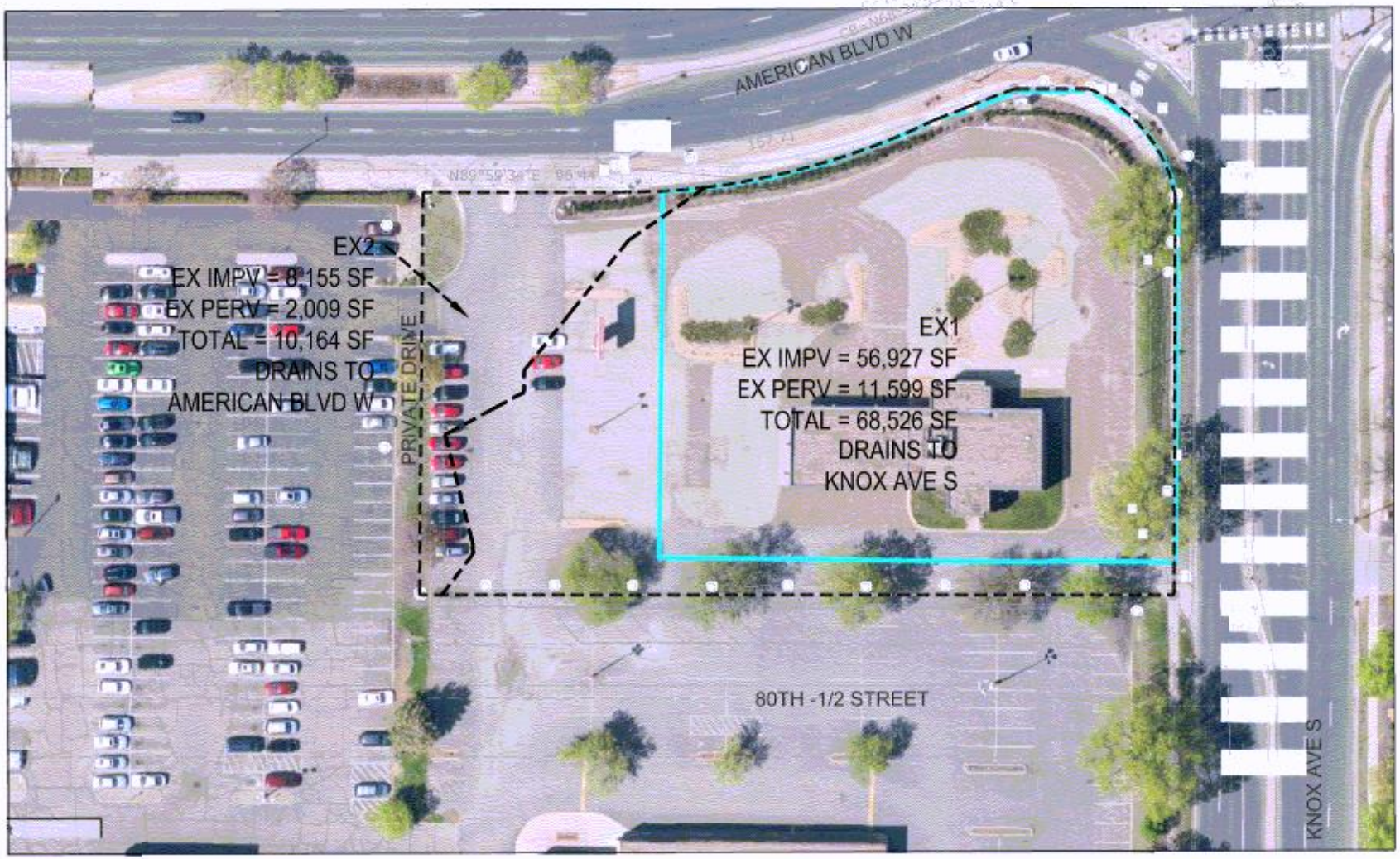
EXISTING DRAINAGE MAP

8000 Knox Ave S, Bloomington, MN 55431

Project Number:	23027	Revision Number:	.
Issue Date:	5/15/23	Revision Date:	.

DA1

PL202300068



CivilSite GROUP

Knox & American II

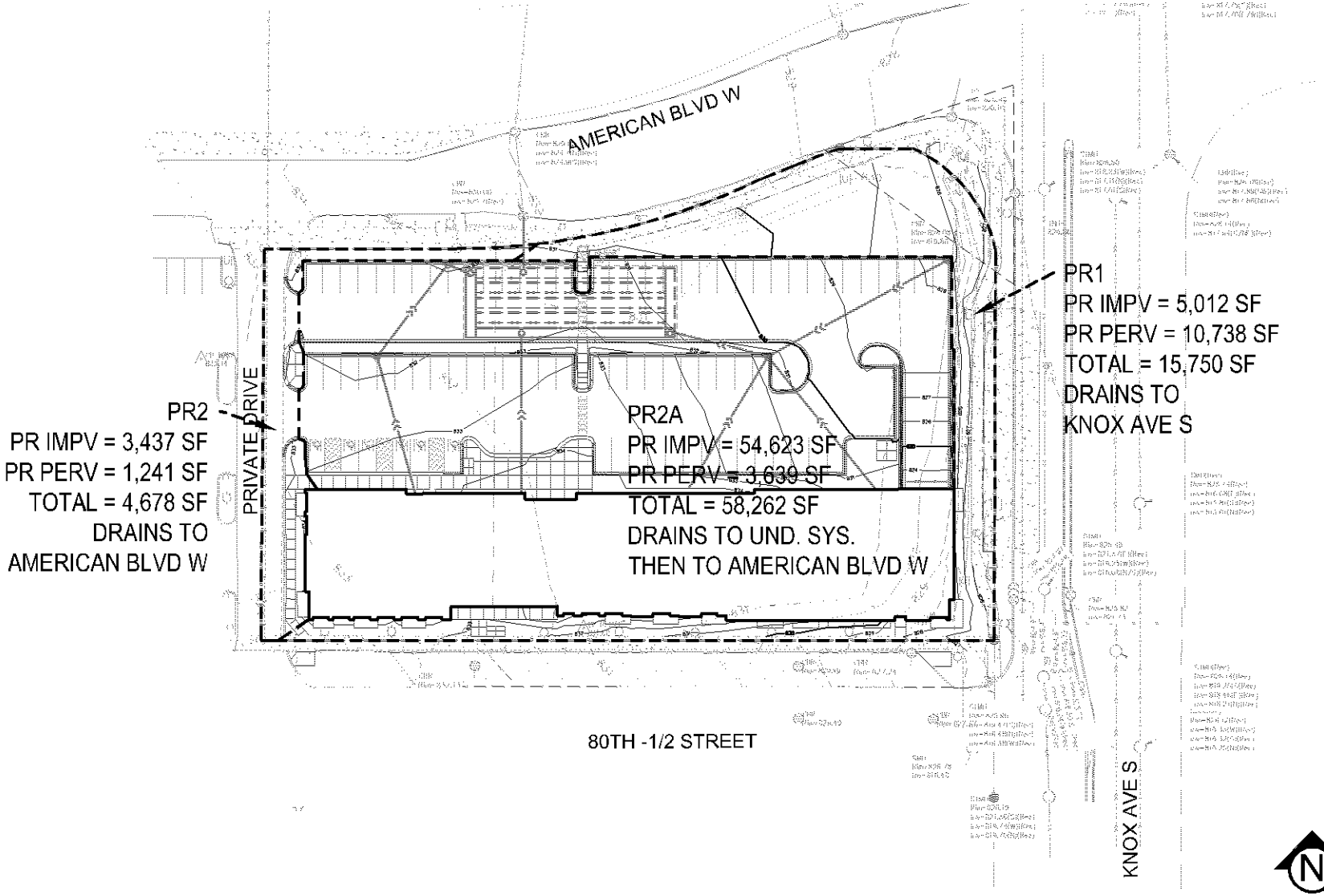
8000 Knox Ave S, Bloomington, MN 55431

HISTORIC CONDITION MAP

Project Number: 23027

Issue Date: 5/15/23

DA1



PL20230068

CivilSite GROUP 5000 GLENWOOD AVENUE GOLDEN VALLEY, MN 55422 612-615-0060 www.CivilSiteGroup.com	PROPOSED DRAINAGE MAP	Knox & American II 8000 Knox Ave S, Bloomington, MN 55431 Project Number: 23027 Revision Number: . Issue Date: 5/15/23 Revision Date: . DA2

PL202300068

Project Information

Calculator Version:	Version 3: January 2017
Project Name:	Knox & American II
User Name / Company Name:	Civil Site Group - Joseph Rief
Date:	05/15/2023
Project Description:	Apartment Building. Grading and landscape improvements will occur.
Construction Permit?:	No

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55431
Annual Rainfall (inches):	31.3
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				0
				Impervious Area (acres)	1.3067
				Total Area (acres)	1.3067

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)	1.254
				Total Area (acres)	1.254

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	5218	ft3
Volume removed by BMPs towards performance goal:	5007	ft^3
Percent volume removed towards performance goal	**96**	**%**

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	2.9141	acre-ft
Annual runoff volume removed by BMPs:	2.7966	acre-ft
Percent annual runoff volume removed:	**96**	**%**
Post development annual particulate P load:	1.308	lbs
Annual particulate P removed by BMPs:	1.255	lbs
Post development annual dissolved P load:	1.07	lbs
Annual dissolved P removed by BMPs:	1.027	lbs
Percent annual total phosphorus removed:	**96**	**%**
Post development annual TSS load:	432	lbs
Annual TSS removed by BMPs:	414.6	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 (%)
Underground Infiltration - 1P	11015	5007	5007	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 (%)
Underground Infiltration - 1P	2.7966	0	2.7966	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 (%)
Underground Infiltration - 1P	1.2551	0	1.2551	0	100

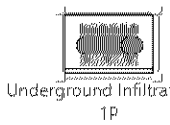
Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Underground Infiltration - 1P	1.0269	0	1.0269	0	100

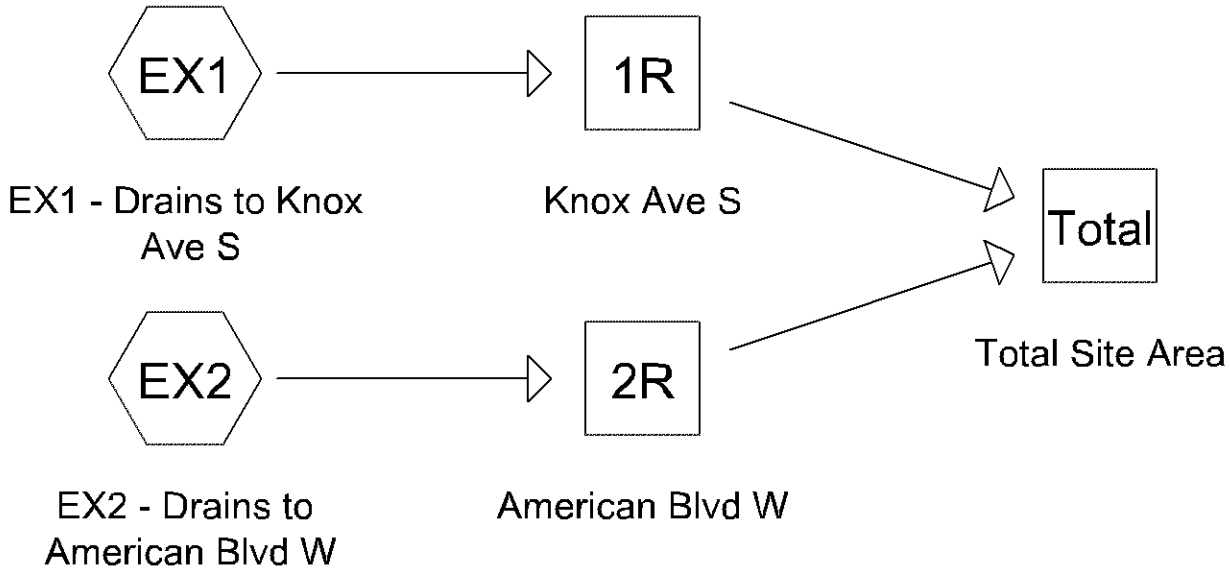
TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
Underground Infiltration - 1P	414.56	0	414.56	0	100

BMP Schematic



EXISTING CONDITIONS



Subcat Reach Pond Link

Routing Diagram for 23027 EXISTING
Prepared by Civil Site Group, Printed 5/15/2023

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2y 24hr AT-14	MSE 24-hr	3	Default	24.00	1	2.85	2
2	10y 24hr AT-14	MSE 24-hr	3	Default	24.00	1	4.25	2
3	100y 24hr AT-14	MSE 24-hr	3	Default	24.00	1	7.49	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.312	39	>75% Grass cover, Good, HSG A (EX1, EX2)
1.494	98	Paved parking, HSG A (EX1, EX2)
1.806	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.806	HSG A	EX1, EX2
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.806		**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
0.312	0.000	0.000	0.000	0.000	0.312	>75% Grass cover, Good	EX1, EX2
1.494	0.000	0.000	0.000	0.000	1.494	Paved parking	EX1, EX2
1.806	**0.000**	**0.000**	**0.000**	**0.000**	**1.806**	**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 - Drains to Knox Runoff Area=68,526 sf 83.07% Impervious Runoff Depth=2.18"
Tc=10.0 min CN=WQ Runoff=4.70 cfs 0.285 af

SubcatchmentEX2: EX2 - Drains to Runoff Area=10,164 sf 80.23% Impervious Runoff Depth=2.10"
Tc=10.0 min CN=WQ Runoff=0.67 cfs 0.041 af

Reach 1R: Knox Ave S Inflow=4.70 cfs 0.285 af
Outflow=4.70 cfs 0.285 af

Reach 2R: American Blvd W Inflow=0.67 cfs 0.041 af
Outflow=0.67 cfs 0.041 af

Reach Total: Total Site Area Inflow=5.37 cfs 0.326 af
Outflow=5.37 cfs 0.326 af

Total Runoff Area = 1.806 ac Runoff Volume = 0.326 af Average Runoff Depth = 2.17"
17.29% Pervious = 0.312 ac 82.71% Impervious = 1.494 ac

Summary for Subcatchment EX1: EX1 - Drains to Knox Ave S

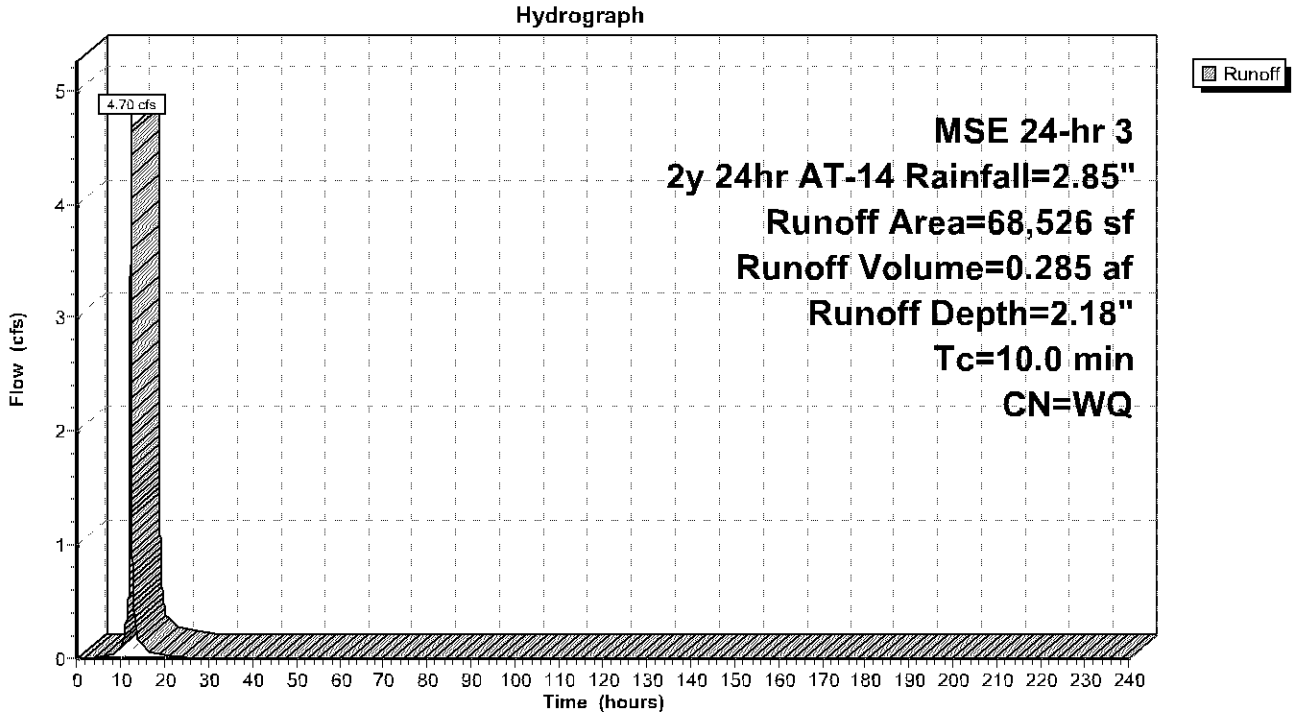
Runoff = 4.70 cfs @ 12.17 hrs, Volume= 0.285 af, Depth= 2.18"
Routed to Reach 1R : Knox Ave S

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 2y 24hr AT-14 Rainfall=2.85"

Area (sf)	CN	Description
56,927	98	Paved parking, HSG A
11,599	39	>75% Grass cover, Good, HSG A
68,526		Weighted Average
11,599		16.93% Pervious Area
56,927		83.07% Impervious Area

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

Subcatchment EX1: EX1 - Drains to Knox Ave S



Summary for Subcatchment EX2: EX2 - Drains to American Blvd W

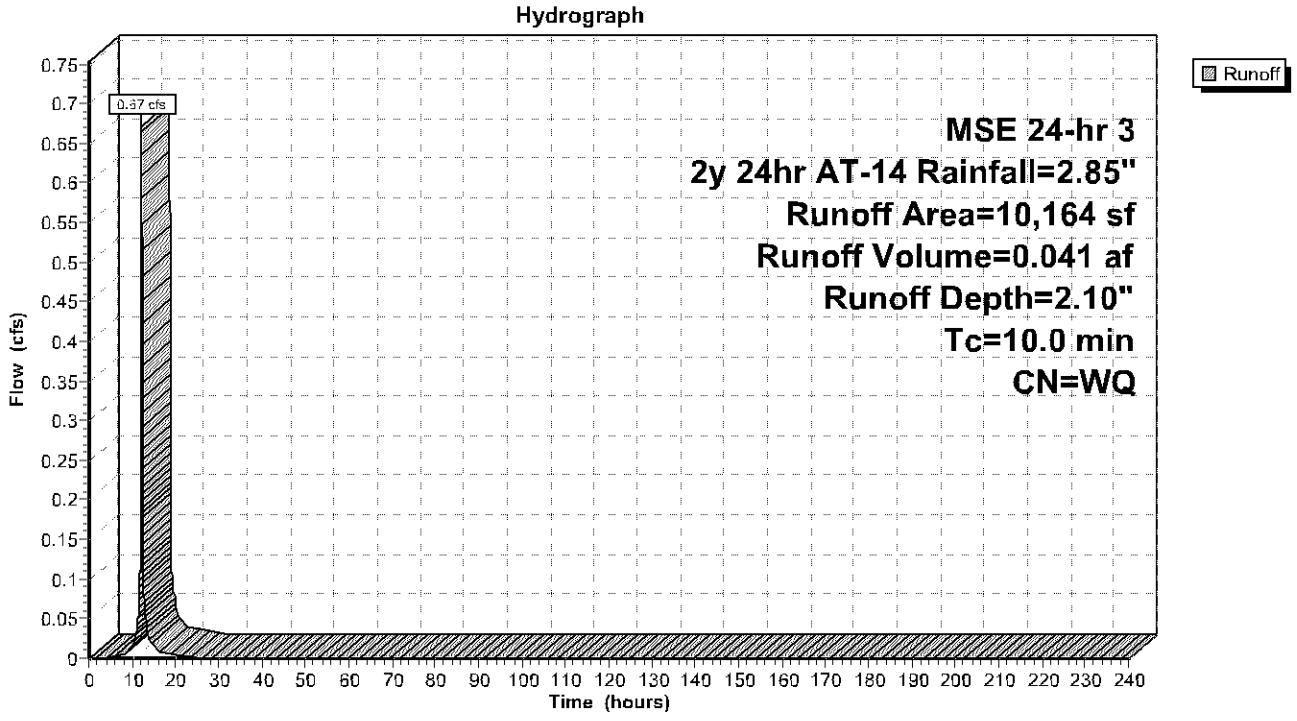
Runoff = 0.67 cfs @ 12.17 hrs, Volume= 0.041 af, Depth= 2.10"
Routed to Reach 2R : American Blvd W

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 2y 24hr AT-14 Rainfall=2.85"

Area (sf)	CN	Description
8,155	98	Paved parking, HSG A
2,009	39	>75% Grass cover, Good, HSG A
10,164		Weighted Average
2,009		19.77% Pervious Area
8,155		80.23% Impervious Area

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

Subcatchment EX2: EX2 - Drains to American Blvd W



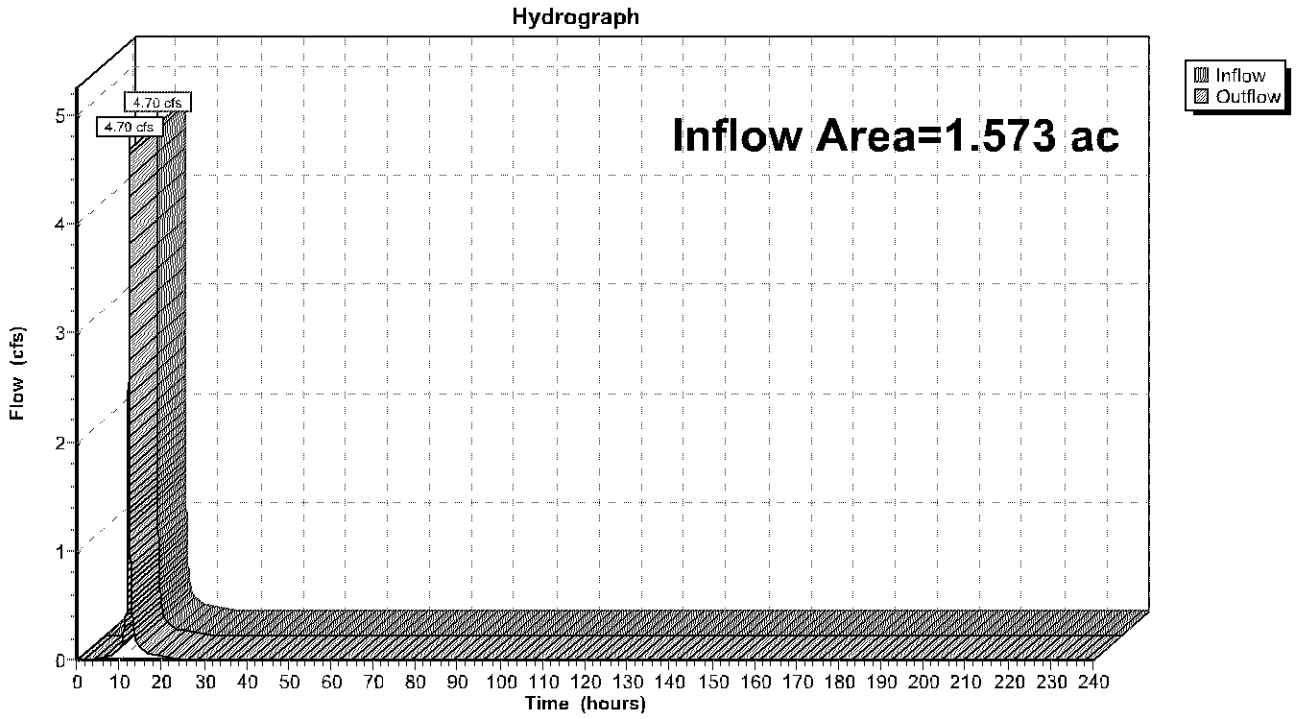
Summary for Reach 1R: Knox Ave S

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

Inflow Area = 1.573 ac, 83.07% Impervious, Inflow Depth = 2.18" for 2y 24hr AT-14 event
Inflow = 4.70 cfs @ 12.17 hrs, Volume= 0.285 af
Outflow = 4.70 cfs @ 12.17 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 1R: Knox Ave S



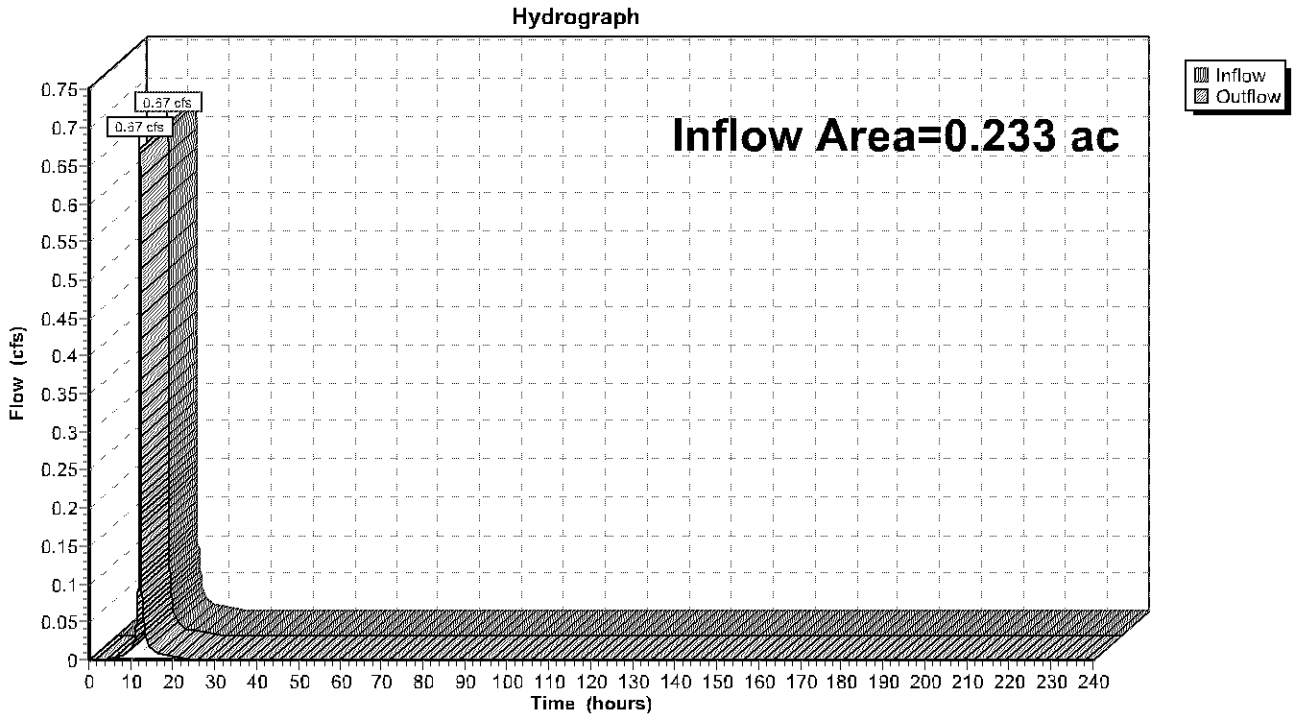
Summary for Reach 2R: American Blvd W

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

Inflow Area = 0.233 ac, 80.23% Impervious, Inflow Depth = 2.10" for 2y 24hr AT-14 event
Inflow = 0.67 cfs @ 12.17 hrs, Volume= 0.041 af
Outflow = 0.67 cfs @ 12.17 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 2R: American Blvd W



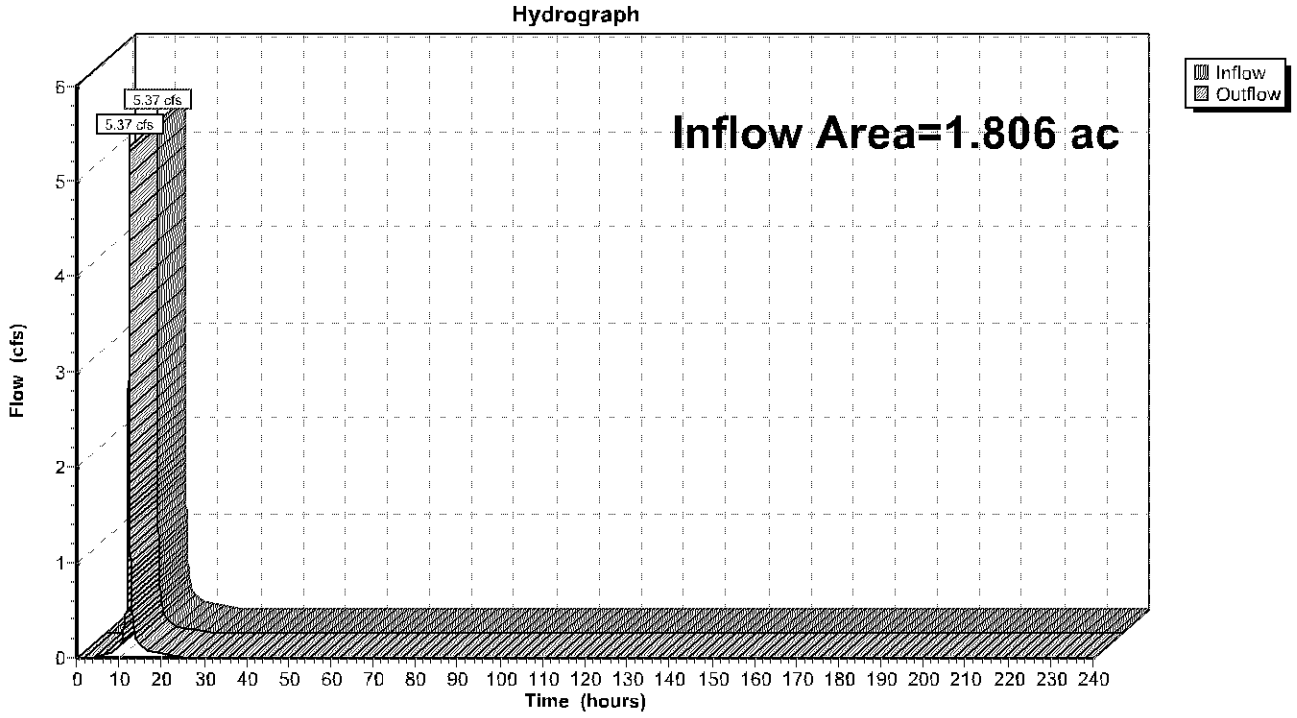
Summary for Reach Total: Total Site Area

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

Inflow Area = 1.806 ac, 82.71% Impervious, Inflow Depth = 2.17" for 2y 24hr AT-14 event
Inflow = 5.37 cfs @ 12.17 hrs, Volume= 0.326 af
Outflow = 5.37 cfs @ 12.17 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.0 min

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

Reach Total: Total Site 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 - Drains to Knox Runoff Area=68,526 sf 83.07% Impervious Runoff Depth=3.35"
Tc=10.0 min CN=WQ Runoff=7.06 cfs 0.439 af

SubcatchmentEX2: EX2 - Drains to Runoff Area=10,164 sf 80.23% Impervious Runoff Depth=3.24"
Tc=10.0 min CN=WQ Runoff=1.01 cfs 0.063 af

Reach 1R: Knox Ave S Inflow=7.06 cfs 0.439 af
Outflow=7.06 cfs 0.439 af

Reach 2R: American Blvd W Inflow=1.01 cfs 0.063 af
Outflow=1.01 cfs 0.063 af

Reach Total: Total Site Area Inflow=8.07 cfs 0.502 af
Outflow=8.07 cfs 0.502 af

Total Runoff Area = 1.806 ac Runoff Volume = 0.502 af Average Runoff Depth = 3.33"
17.29% Pervious = 0.312 ac 82.71% Impervious = 1.494 ac

Summary for Subcatchment EX1: EX1 - Drains to Knox Ave S

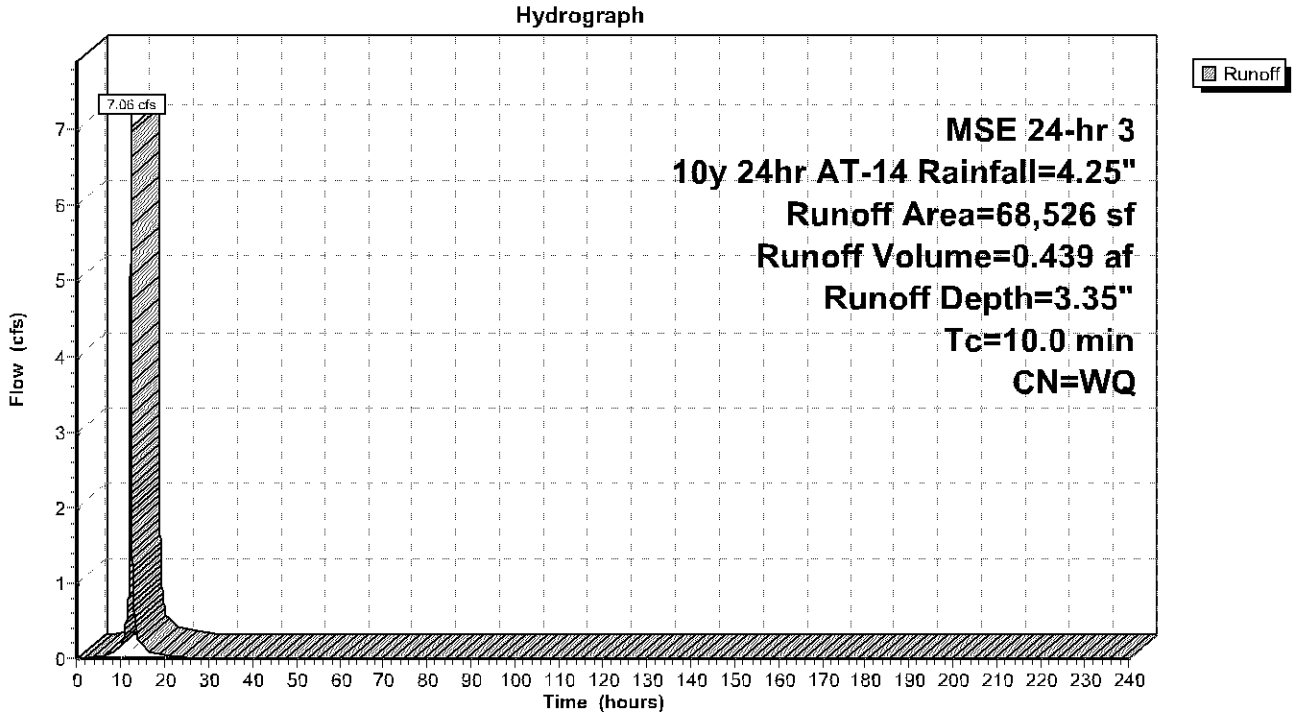
Runoff = 7.06 cfs @ 12.17 hrs, Volume= 0.439 af, Depth= 3.35"
Routed to Reach 1R : Knox Ave S

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 10y 24hr AT-14 Rainfall=4.25"

Area (sf)	CN	Description
56,927	98	Paved parking, HSG A
11,599	39	>75% Grass cover, Good, HSG A
68,526		Weighted Average
11,599		16.93% Pervious Area
56,927		83.07% Impervious Area

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

Subcatchment EX1: EX1 - Drains to Knox Ave S



Summary for Subcatchment EX2: EX2 - Drains to American Blvd W

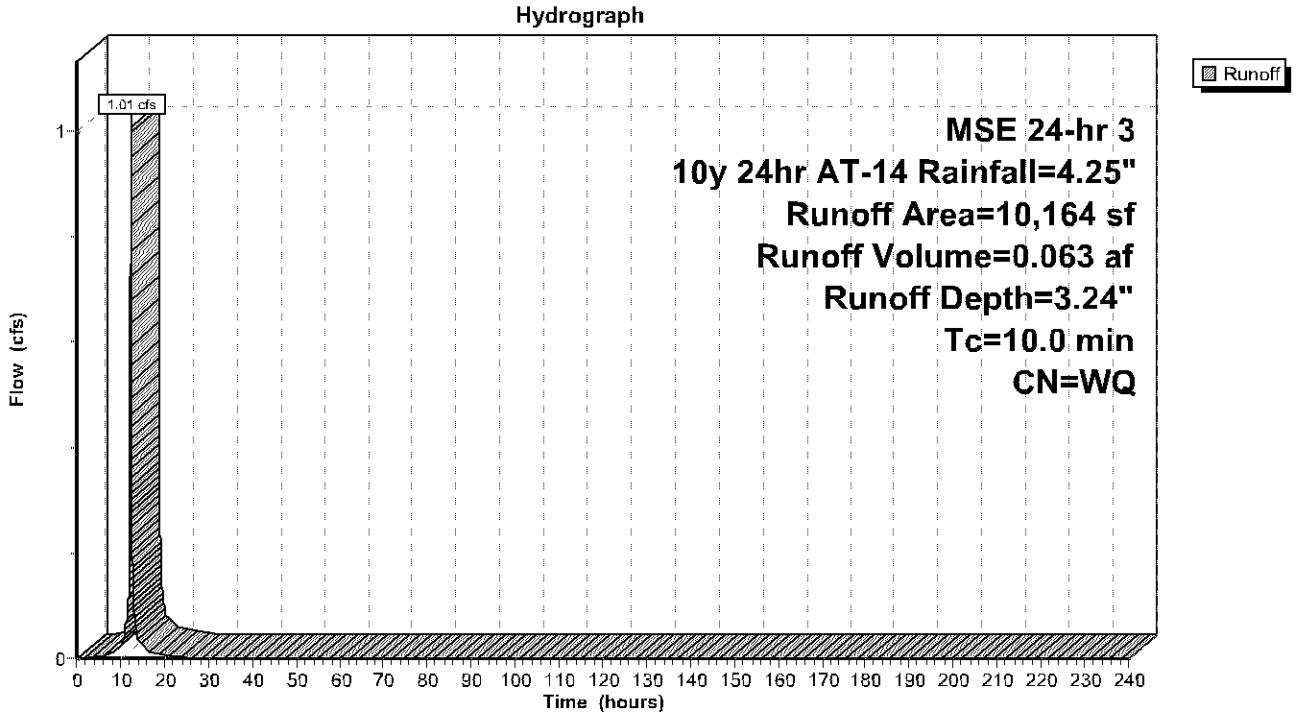
Runoff = 1.01 cfs @ 12.17 hrs, Volume= 0.063 af, Depth= 3.24"
Routed to Reach 2R : American Blvd W

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 10y 24hr AT-14 Rainfall=4.25"

Area (sf)	CN	Description
8,155	98	Paved parking, HSG A
2,009	39	>75% Grass cover, Good, HSG A
10,164		Weighted Average
2,009		19.77% Pervious Area
8,155		80.23% Impervious Area

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

Subcatchment EX2: EX2 - Drains to American Blvd W



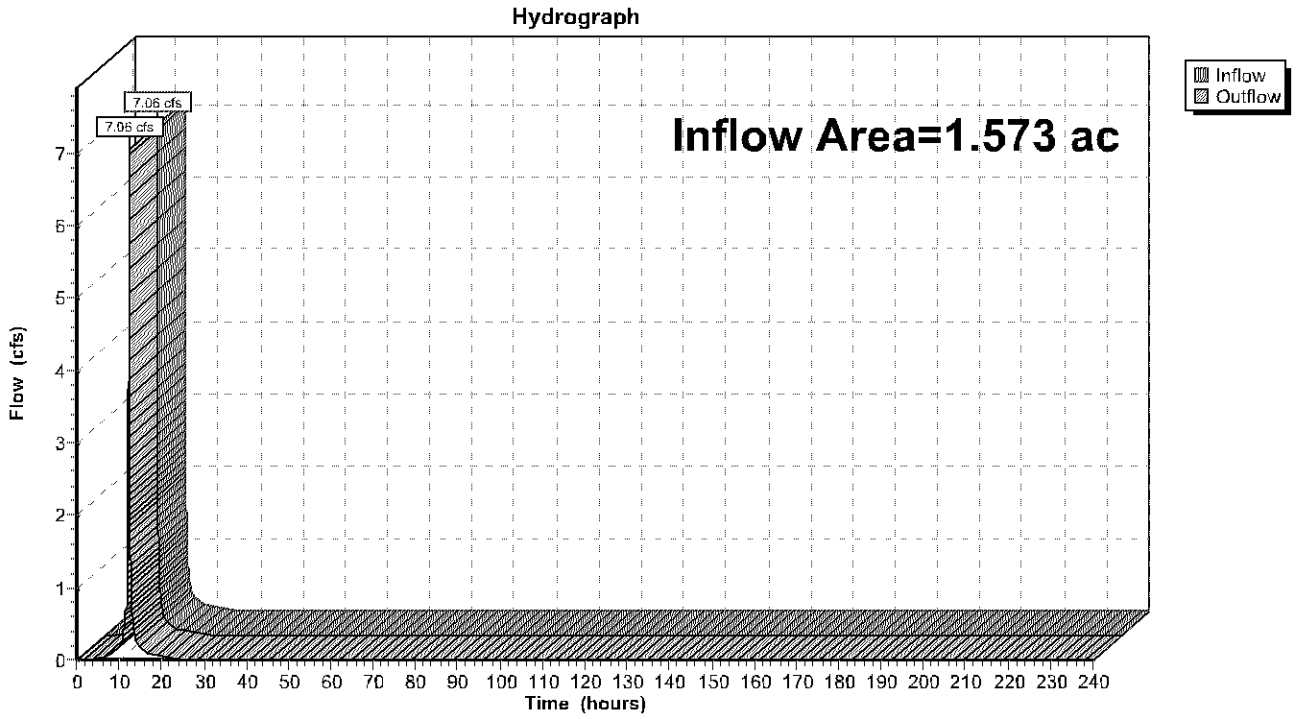
Summary for Reach 1R: Knox Ave S

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

Inflow Area = 1.573 ac, 83.07% Impervious, Inflow Depth = 3.35" for 10y 24hr AT-14 event
Inflow = 7.06 cfs @ 12.17 hrs, Volume= 0.439 af
Outflow = 7.06 cfs @ 12.17 hrs, Volume= 0.439 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 1R: Knox Ave S



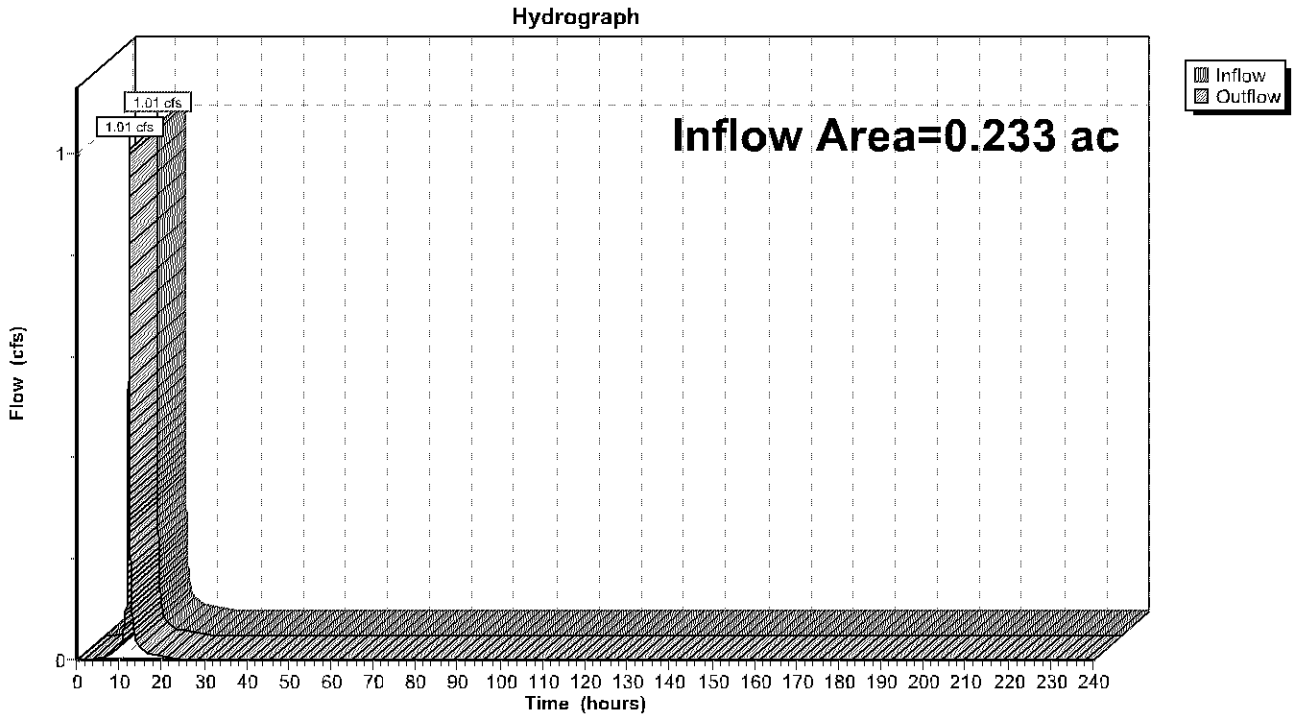
Summary for Reach 2R: American Blvd W

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

Inflow Area = 0.233 ac, 80.23% Impervious, Inflow Depth = 3.24" for 10y 24hr AT-14 event
Inflow = 1.01 cfs @ 12.17 hrs, Volume= 0.063 af
Outflow = 1.01 cfs @ 12.17 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 2R: American Blvd W



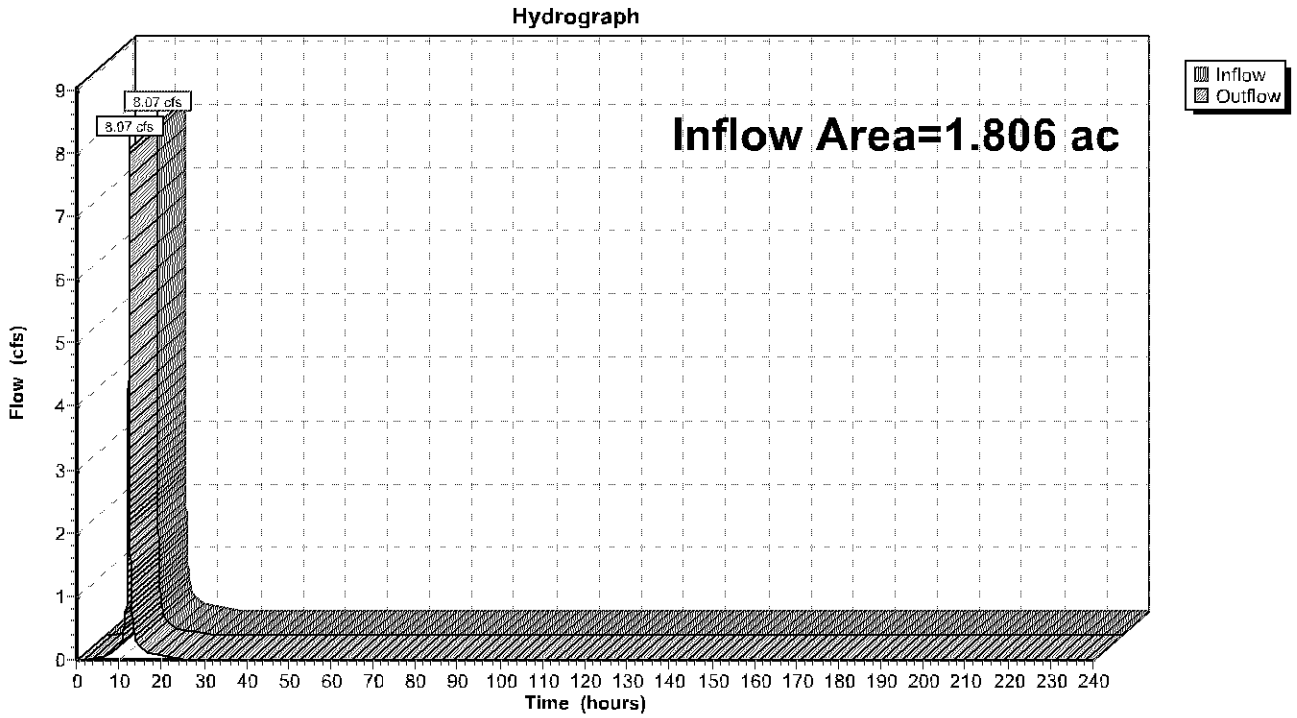
Summary for Reach Total: Total Site Area

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

Inflow Area = 1.806 ac, 82.71% Impervious, Inflow Depth = 3.33" for 10y 24hr AT-14 event
Inflow = 8.07 cfs @ 12.17 hrs, Volume= 0.502 af
Outflow = 8.07 cfs @ 12.17 hrs, Volume= 0.502 af, Atten= 0%, Lag= 0.0 min

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

Reach Total: Total Site 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 - Drains to Knox Runoff Area=68,526 sf 83.07% Impervious Runoff Depth=6.18"
Tc=10.0 min CN=WQ Runoff=12.74 cfs 0.811 af

SubcatchmentEX2: EX2 - Drains to Runoff Area=10,164 sf 80.23% Impervious Runoff Depth=6.01"
Tc=10.0 min CN=WQ Runoff=1.83 cfs 0.117 af

Reach 1R: Knox Ave S Inflow=12.74 cfs 0.811 af
Outflow=12.74 cfs 0.811 af

Reach 2R: American Blvd W Inflow=1.83 cfs 0.117 af
Outflow=1.83 cfs 0.117 af

Reach Total: Total Site Area Inflow=14.58 cfs 0.928 af
Outflow=14.58 cfs 0.928 af

Total Runoff Area = 1.806 ac Runoff Volume = 0.928 af Average Runoff Depth = 6.16"
17.29% Pervious = 0.312 ac 82.71% Impervious = 1.494 ac

Summary for Subcatchment EX1: EX1 - Drains to Knox Ave S

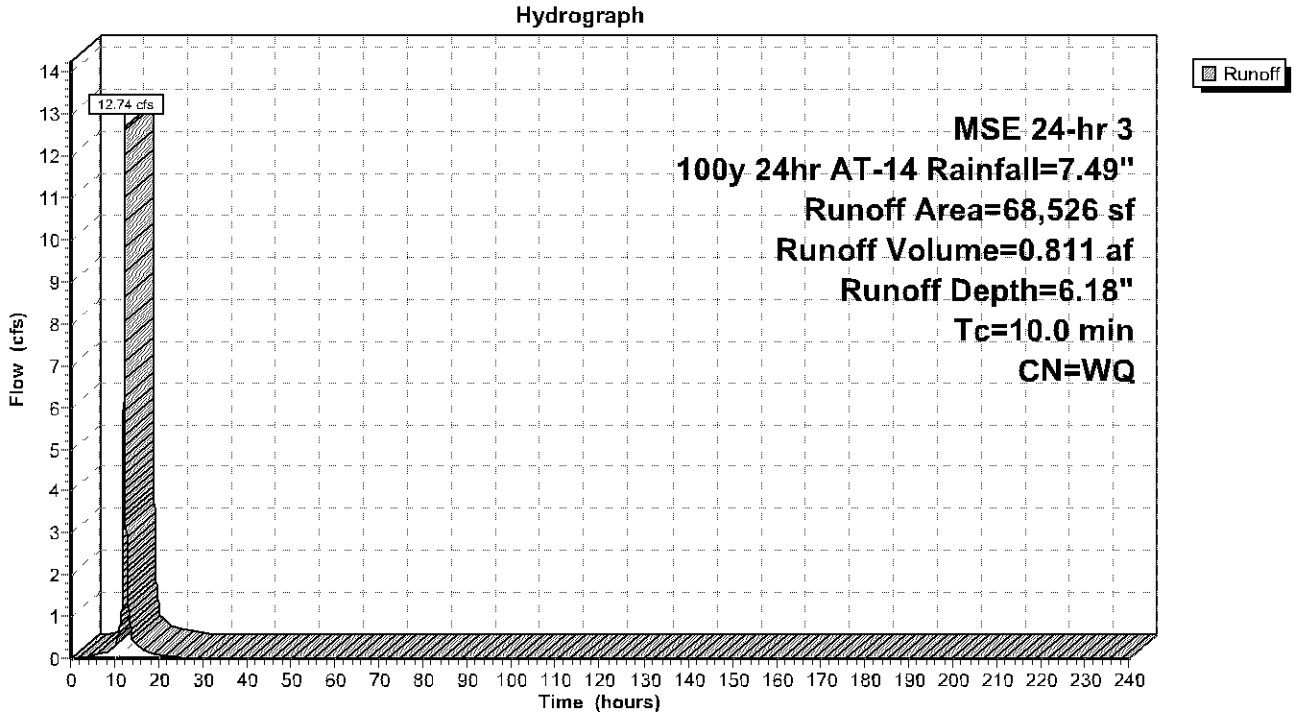
Runoff = 12.74 cfs @ 12.17 hrs, Volume= 0.811 af, Depth= 6.18"
Routed to Reach 1R : Knox Ave S

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 100y 24hr AT-14 Rainfall=7.49"

Area (sf)	CN	Description
56,927	98	Paved parking, HSG A
11,599	39	>75% Grass cover, Good, HSG A
68,526		Weighted Average
11,599		16.93% Pervious Area
56,927		83.07% Impervious Area

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

Subcatchment EX1: EX1 - Drains to Knox Ave S



Summary for Subcatchment EX2: EX2 - Drains to American Blvd W

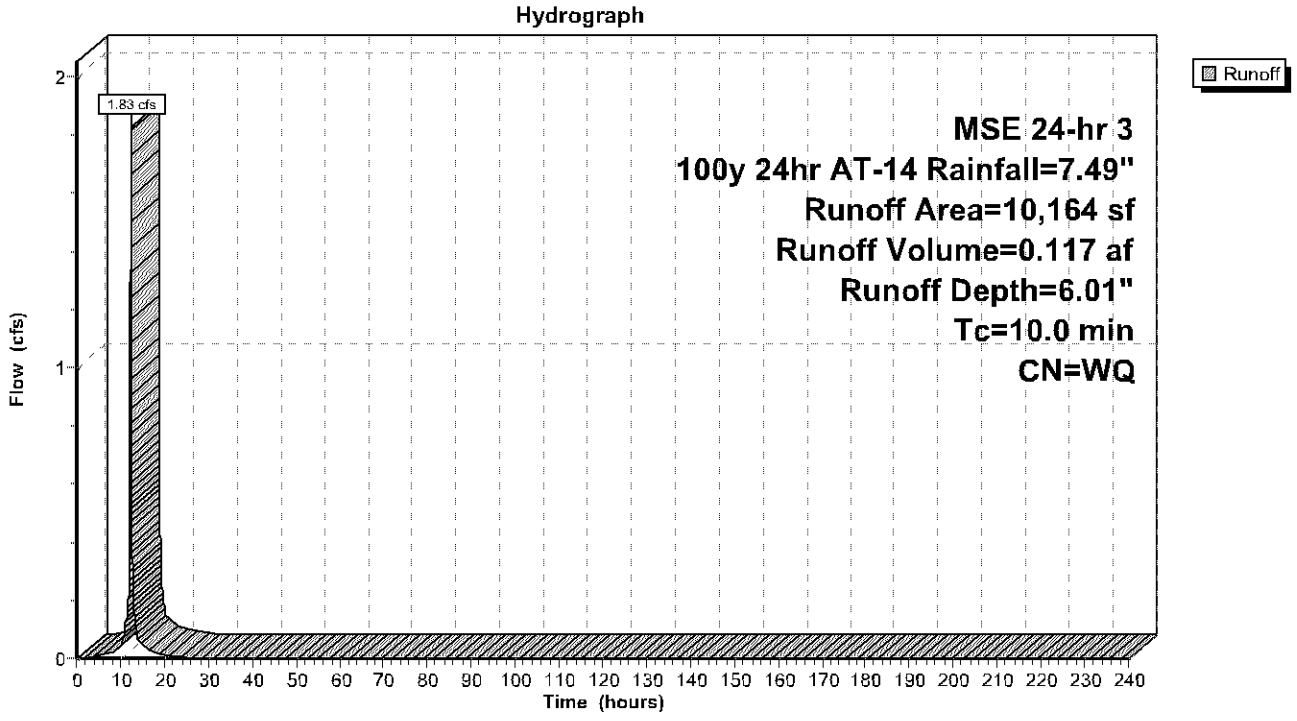
Runoff = 1.83 cfs @ 12.17 hrs, Volume= 0.117 af, Depth= 6.01"
Routed to Reach 2R : American Blvd W

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 100y 24hr AT-14 Rainfall=7.49"

Area (sf)	CN	Description
8,155	98	Paved parking, HSG A
2,009	39	>75% Grass cover, Good, HSG A
10,164		Weighted Average
2,009		19.77% Pervious Area
8,155		80.23% Impervious Area

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

Subcatchment EX2: EX2 - Drains to American Blvd W



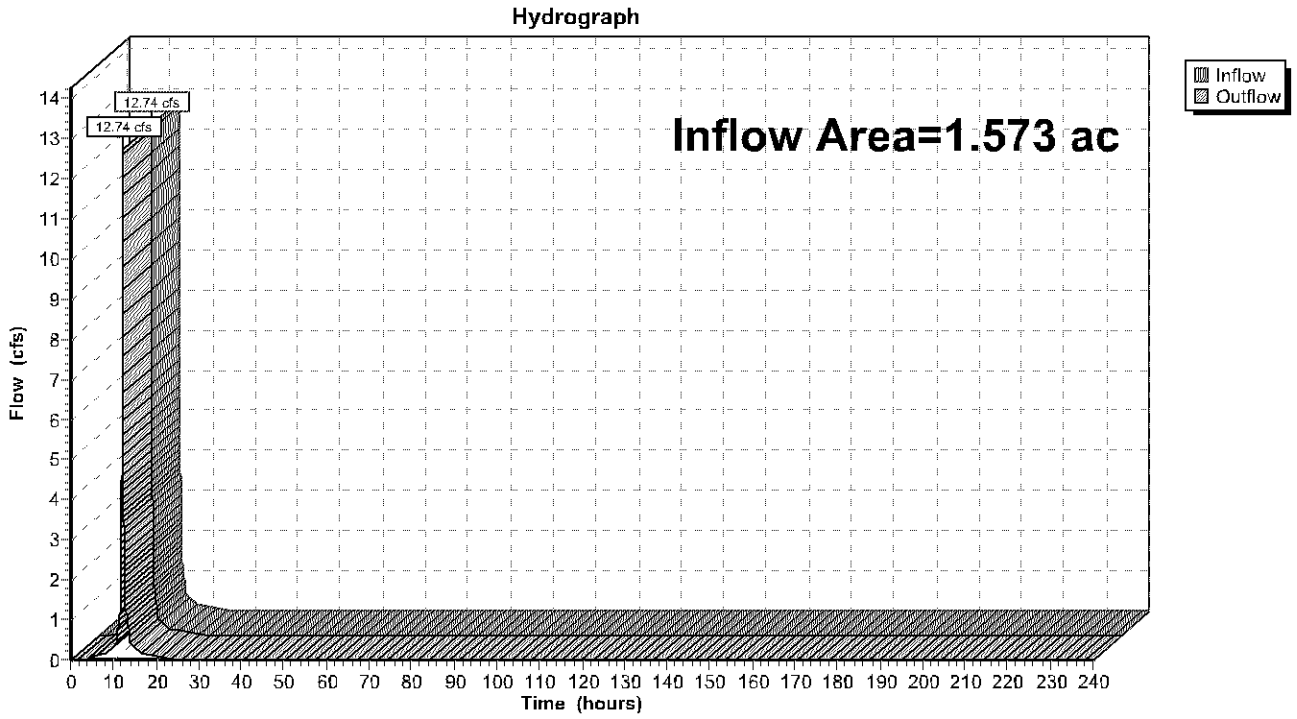
Summary for Reach 1R: Knox Ave S

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

Inflow Area = 1.573 ac, 83.07% Impervious, Inflow Depth = 6.18" for 100y 24hr AT-14 event
Inflow = 12.74 cfs @ 12.17 hrs, Volume= 0.811 af
Outflow = 12.74 cfs @ 12.17 hrs, Volume= 0.811 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 1R: Knox Ave S



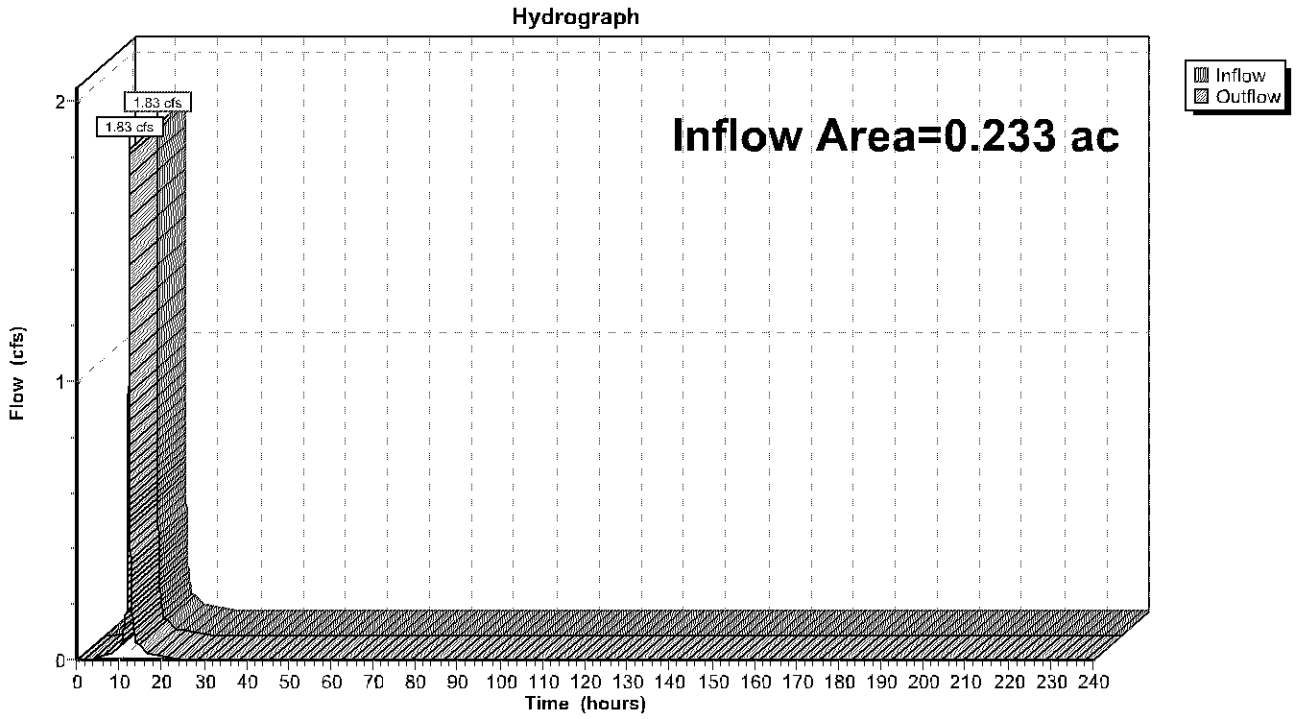
Summary for Reach 2R: American Blvd W

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

Inflow Area = 0.233 ac, 80.23% Impervious, Inflow Depth = 6.01" for 100y 24hr AT-14 event
Inflow = 1.83 cfs @ 12.17 hrs, Volume= 0.117 af
Outflow = 1.83 cfs @ 12.17 hrs, Volume= 0.117 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 2R: American Blvd W



Summary for Reach Total: Total Site Area

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

Inflow Area = 1.806 ac, 82.71% Impervious, Inflow Depth = 6.16" for 100y 24hr AT-14 event
Inflow = 14.58 cfs @ 12.17 hrs, Volume= 0.928 af
Outflow = 14.58 cfs @ 12.17 hrs, Volume= 0.928 af, Atten= 0%, Lag= 0.0 min

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

Reach Total: Total Site Area

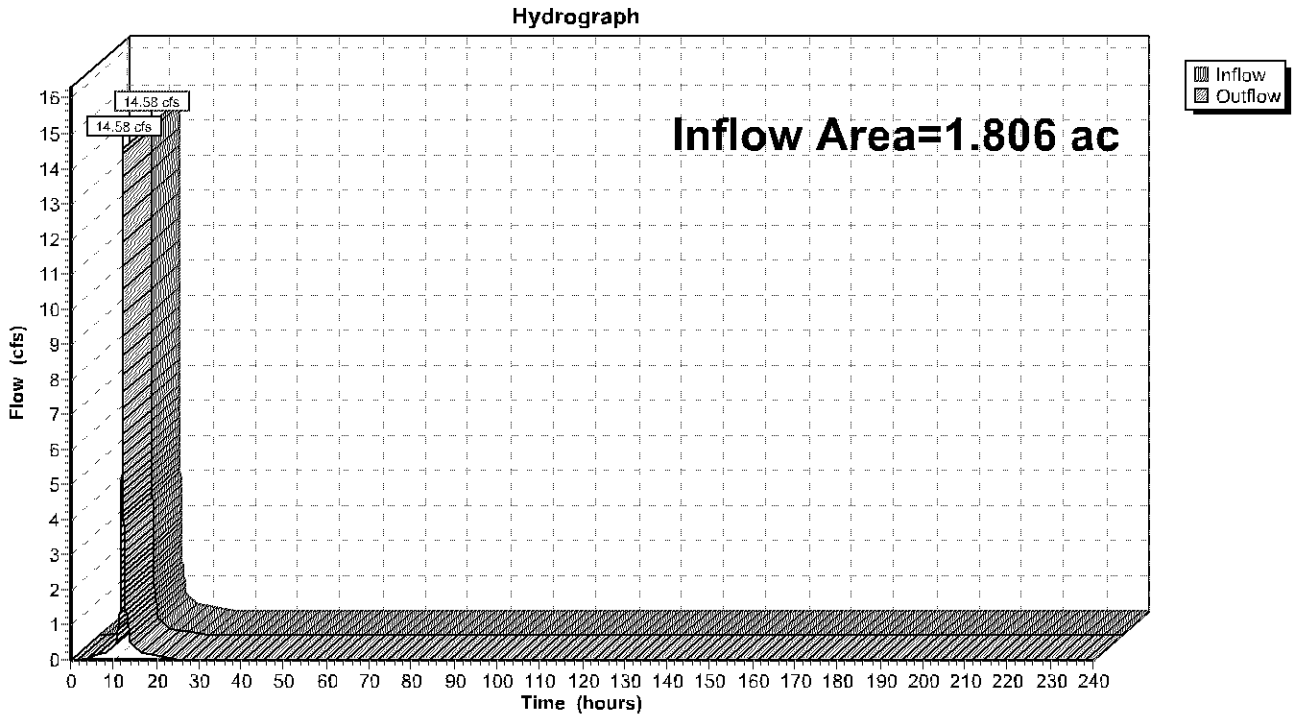
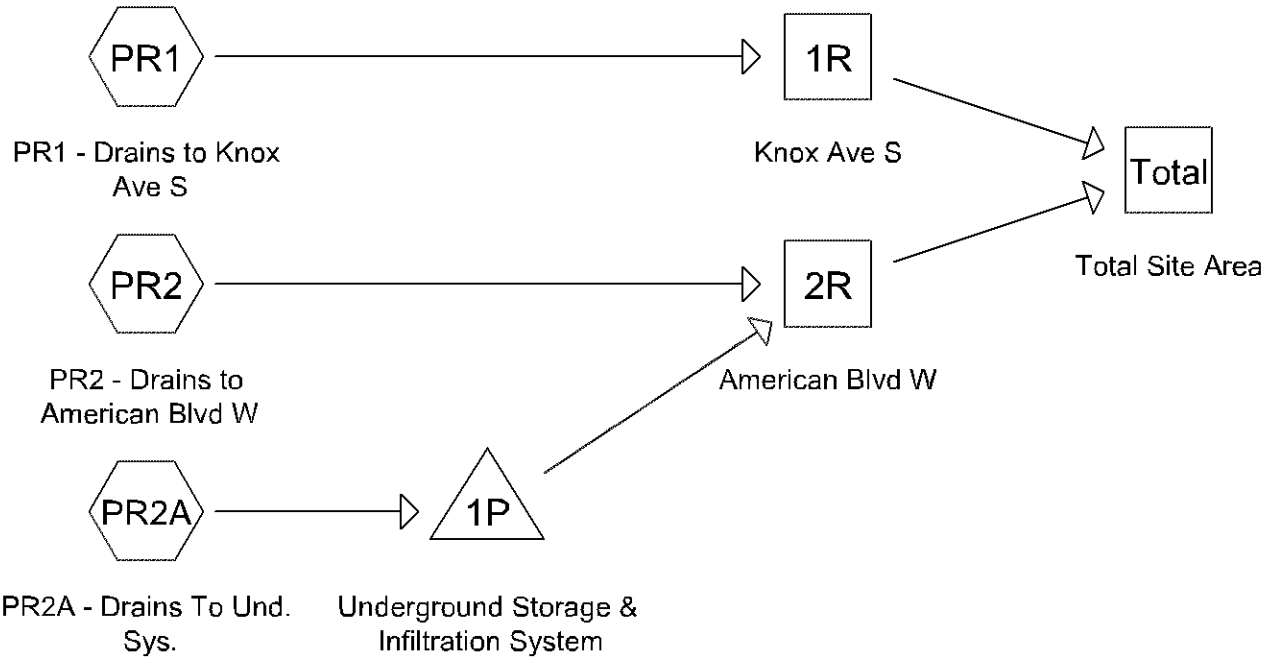


TABLE OF CONTENTS

PROPOSED CONDITIONS



Subcat Reach Pond Link

Routing Diagram for 23027 PROPOSED
Prepared by Civil Site Group, Printed 5/15/2023

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2y 24hr AT-14	MSE 24-hr	3	Default	24.00	1	2.85	2
2	10y 24hr AT-14	MSE 24-hr	3	Default	24.00	1	4.25	2
3	100y 24hr AT-14	MSE 24-hr	3	Default	24.00	1	7.49	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.359	39	>75% Grass cover, Good, HSG A (PR1, PR2, PR2A)
1.448	98	Paved parking, HSG A (PR1, PR2, PR2A)
1.806	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.806	HSG A	PR1, PR2, PR2A
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.806		**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
0.359	0.000	0.000	0.000	0.000	0.359	>75% Grass cover, Good	PR1, PR2, PR2A
1.448	0.000	0.000	0.000	0.000	1.448	Paved parking	PR1, PR2, PR2A
1.806	**0.000**	**0.000**	**0.000**	**0.000**	**1.806**	**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

SubcatchmentPR1: PR1 - Drains to Knox Runoff Area=15,750 sf 31.82% Impervious Runoff Depth=0.83"
Tc=10.0 min CN=WQ Runoff=0.41 cfs 0.025 af

SubcatchmentPR2: PR2 - Drains to Runoff Area=4,678 sf 73.47% Impervious Runoff Depth=1.92"
Tc=10.0 min CN=WQ Runoff=0.28 cfs 0.017 af

SubcatchmentPR2A: PR2A - Drains To Runoff Area=58,262 sf 93.75% Impervious Runoff Depth=2.46"
Tc=10.0 min CN=WQ Runoff=4.51 cfs 0.274 af

Reach 1R: Knox Ave S Inflow=0.41 cfs 0.025 af
Outflow=0.41 cfs 0.025 af

Reach 2R: American Blvd W Inflow=0.28 cfs 0.017 af
Outflow=0.28 cfs 0.017 af

Reach Total: Total Site Area Inflow=0.70 cfs 0.042 af
Outflow=0.70 cfs 0.042 af

Pond 1P: Underground Storage & Infiltration Peak Elev=825.32' Storage=8,457 cf Inflow=4.51 cfs 0.274 af
Discarded=0.07 cfs 0.274 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.274 af

Total Runoff Area = 1.806 ac Runoff Volume = 0.316 af Average Runoff Depth = 2.10"
19.85% Pervious = 0.359 ac 80.15% Impervious = 1.448 ac

Summary for Subcatchment PR1: PR1 - Drains to Knox Ave S

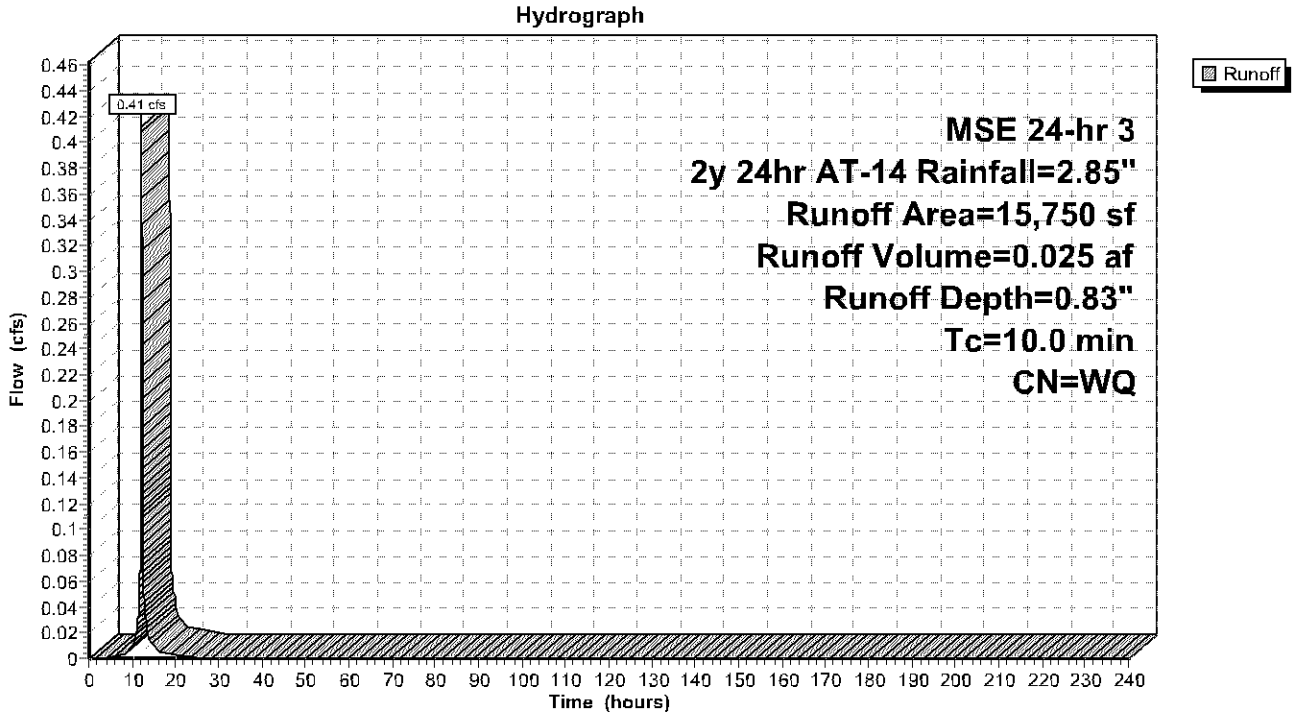
Runoff = 0.41 cfs @ 12.17 hrs, Volume= 0.025 af, Depth= 0.83"
Routed to Reach 1R : Knox Ave S

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 2y 24hr AT-14 Rainfall=2.85"

Area (sf)	CN	Description
5,012	98	Paved parking, HSG A
10,738	39	>75% Grass cover, Good, HSG A
15,750		Weighted Average
10,738		68.18% Pervious Area
5,012		31.82% Impervious Area

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

Subcatchment PR1: PR1 - Drains to Knox Ave S



Summary for Subcatchment PR2: PR2 - Drains to American Blvd W

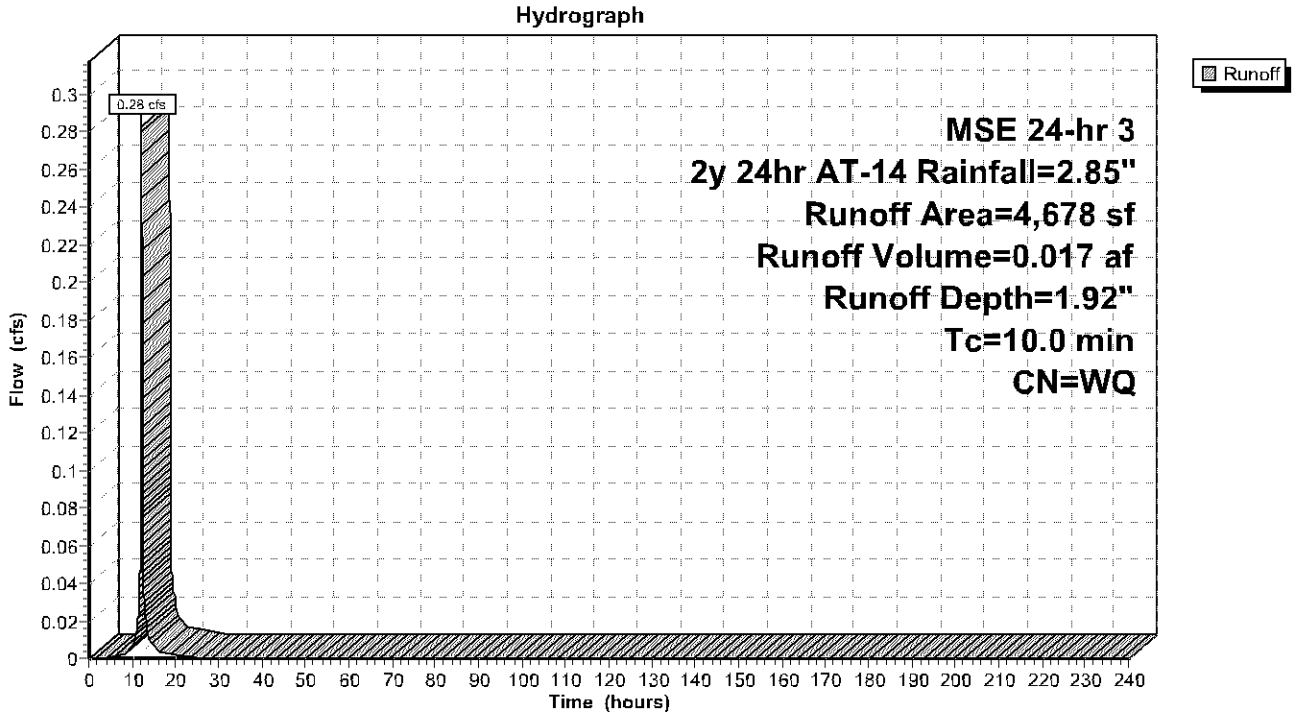
Runoff = 0.28 cfs @ 12.17 hrs, Volume= 0.017 af, Depth= 1.92"
Routed to Reach 2R : American Blvd W

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 2y 24hr AT-14 Rainfall=2.85"

Area (sf)	CN	Description
3,437	98	Paved parking, HSG A
1,241	39	>75% Grass cover, Good, HSG A
4,678		Weighted Average
1,241		26.53% Pervious Area
3,437		73.47% Impervious Area

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

Subcatchment PR2: PR2 - Drains to American Blvd W



Summary for Subcatchment PR2A: PR2A - Drains To Und. Sys.

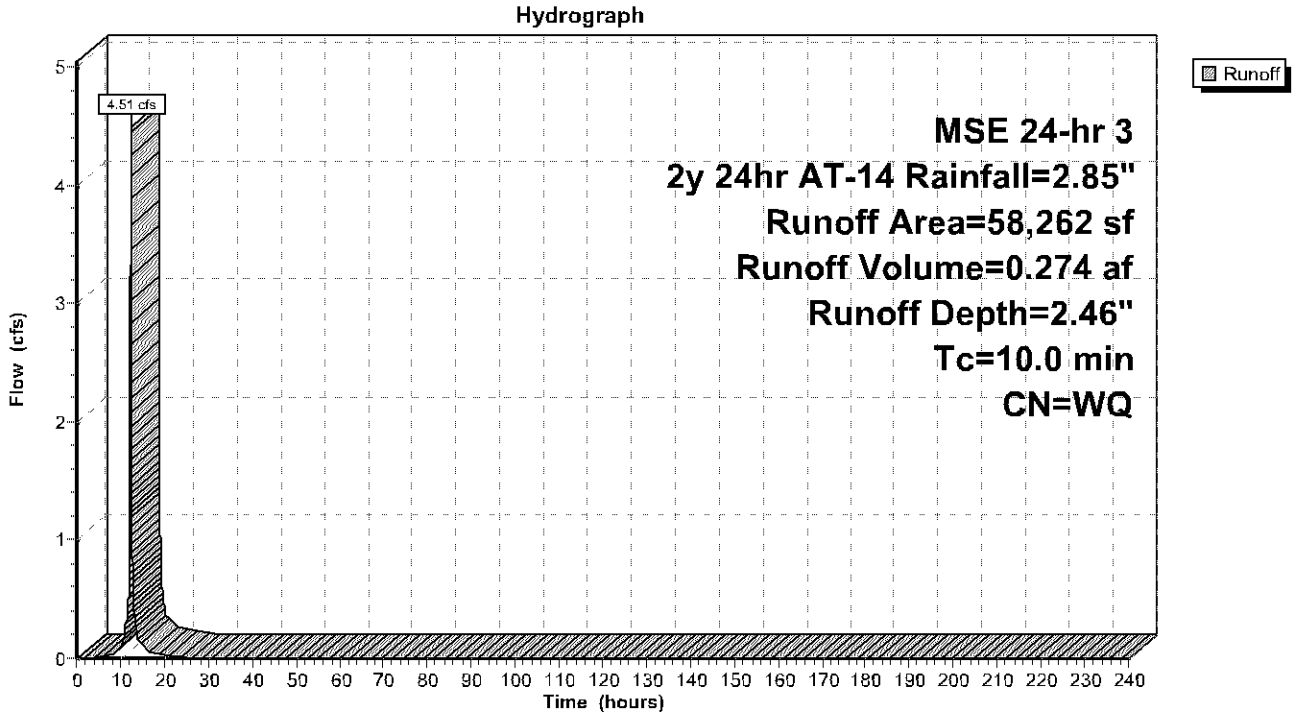
Runoff = 4.51 cfs @ 12.17 hrs, Volume= 0.274 af, Depth= 2.46"
Routed to Pond 1P : Underground Storage & Infiltration System

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 2y 24hr AT-14 Rainfall=2.85"

Area (sf)	CN	Description
54,623	98	Paved parking, HSG A
3,639	39	>75% Grass cover, Good, HSG A
58,262		Weighted Average
3,639		6.25% Pervious Area
54,623		93.75% Impervious Area

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

Subcatchment PR2A: PR2A - Drains To Und. Sys.



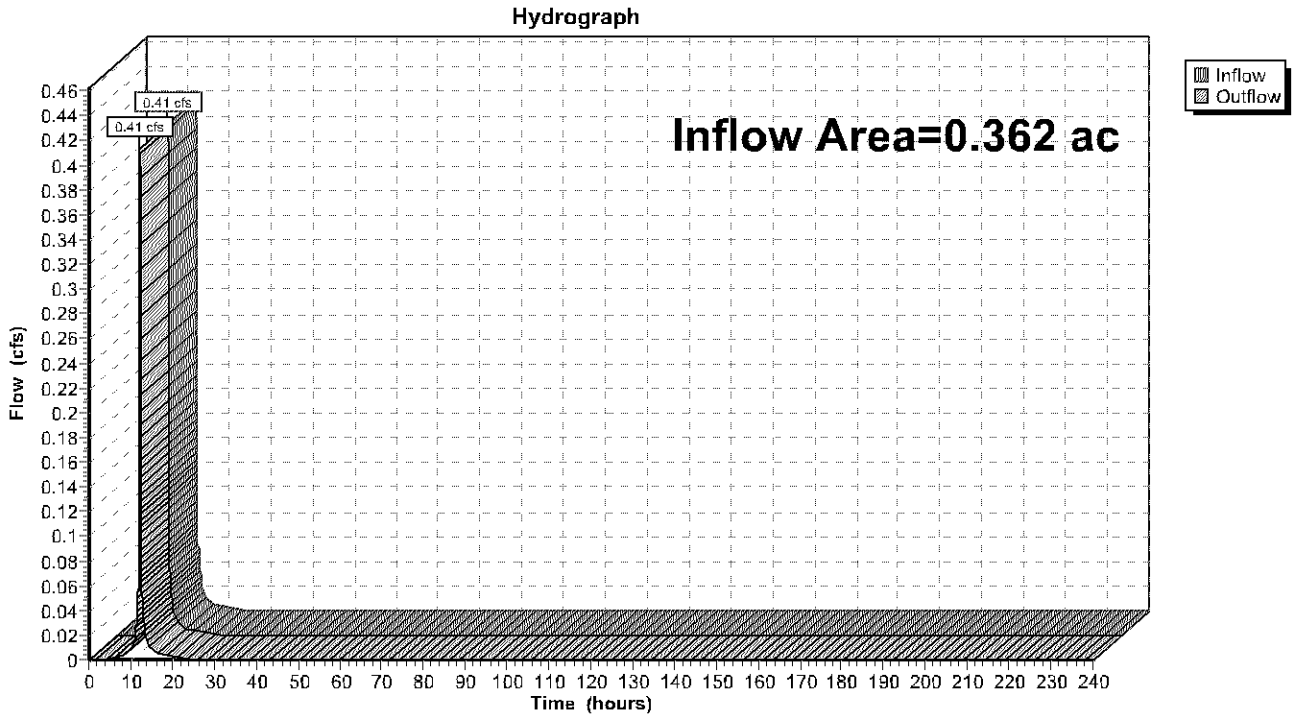
Summary for Reach 1R: Knox Ave S

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

Inflow Area = 0.362 ac, 31.82% Impervious, Inflow Depth = 0.83" for 2y 24hr AT-14 event
Inflow = 0.41 cfs @ 12.17 hrs, Volume= 0.025 af
Outflow = 0.41 cfs @ 12.17 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 1R: Knox Ave S



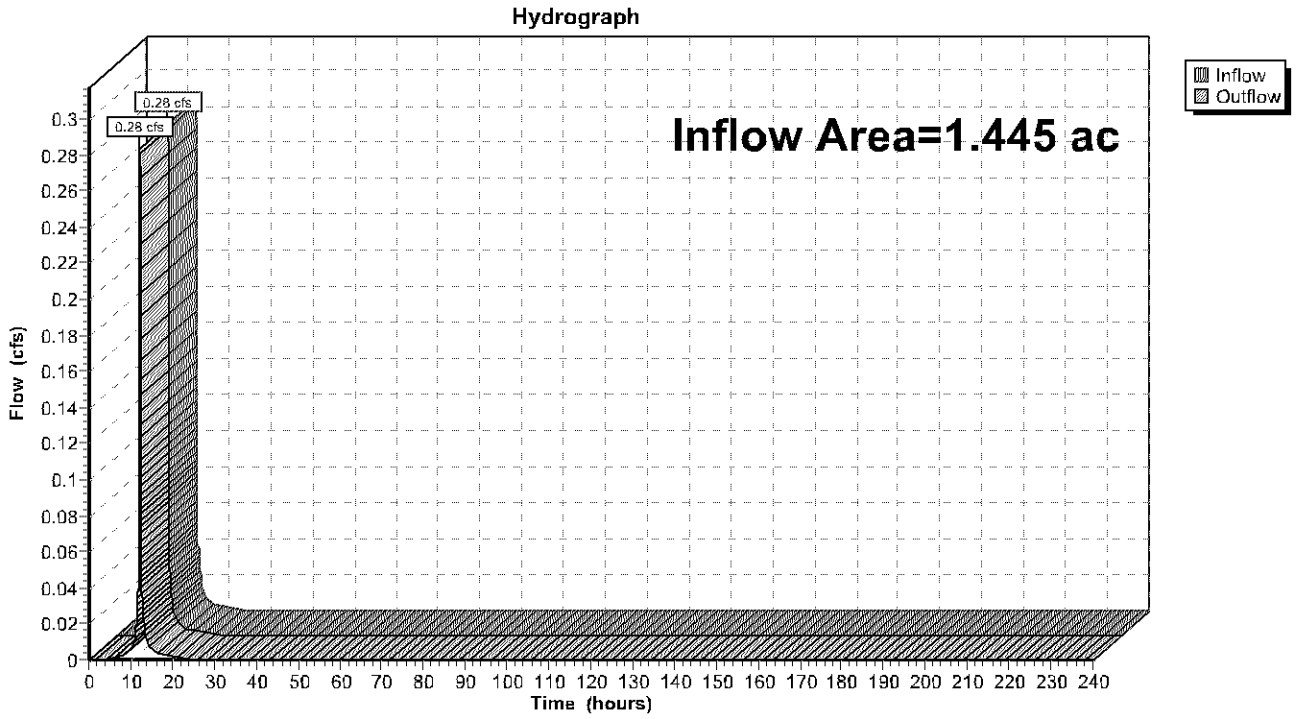
Summary for Reach 2R: American Blvd W

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

Inflow Area = 1.445 ac, 92.25% Impervious, Inflow Depth = 0.14" for 2y 24hr AT-14 event
Inflow = 0.28 cfs @ 12.17 hrs, Volume= 0.017 af
Outflow = 0.28 cfs @ 12.17 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 2R: American Blvd W



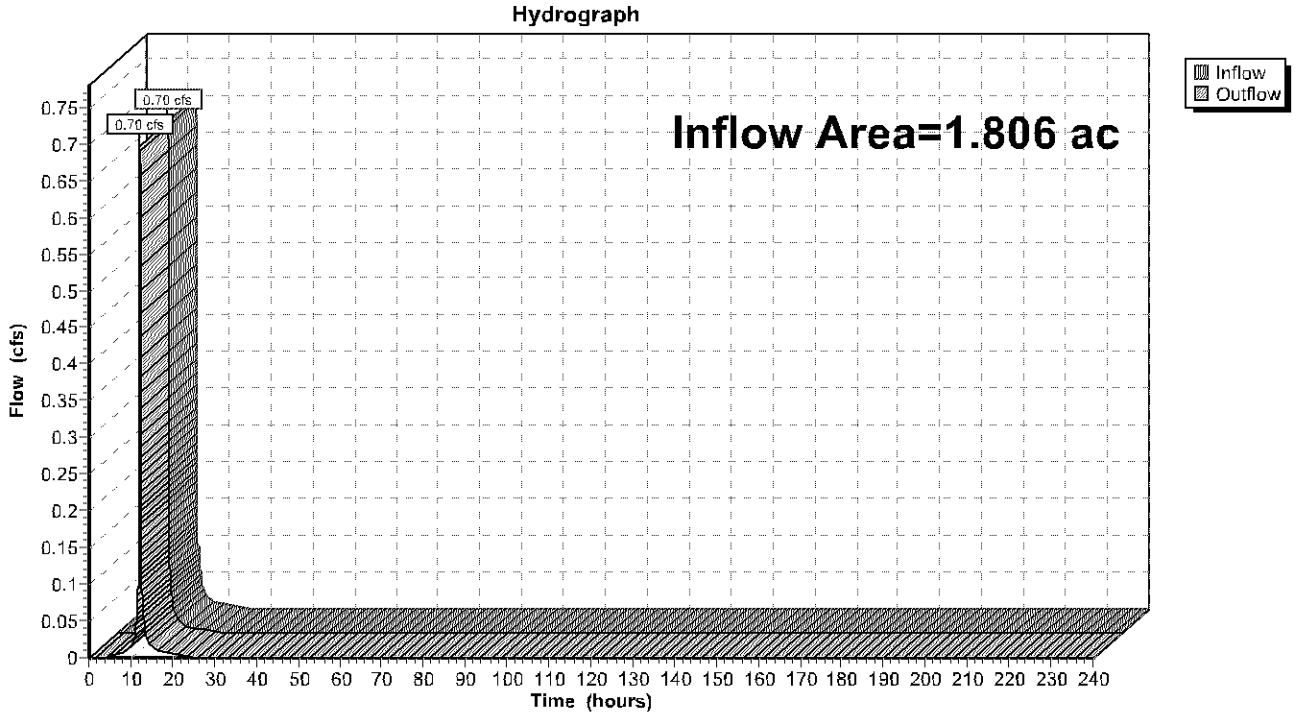
Summary for Reach Total: Total Site Area

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

Inflow Area = 1.806 ac, 80.15% Impervious, Inflow Depth = 0.28" for 2y 24hr AT-14 event
Inflow = 0.70 cfs @ 12.17 hrs, Volume= 0.042 af
Outflow = 0.70 cfs @ 12.17 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

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

Reach Total: Total Site Area



Summary for Pond 1P: Underground Storage & Infiltration System

Inflow Area = 1.338 ac, 93.75% Impervious, Inflow Depth = 2.46" for 2y 24hr AT-14 event
Inflow = 4.51 cfs @ 12.17 hrs, Volume= 0.274 af
Outflow = 0.07 cfs @ 9.41 hrs, Volume= 0.274 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.07 cfs @ 9.41 hrs, Volume= 0.274 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : American Blvd W
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : American Blvd W

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 825.32' @ 15.32 hrs Surf.Area= 3,959 sf Storage= 8,457 cf

Plug-Flow detention time= 1,019.6 min calculated for 0.274 af (100% of inflow)
Center-of-Mass det. time= 1,019.6 min (1,777.1 - 757.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.17'	5,221 cf	**37.00'W x 107.00'L x 6.00'H Field A** 23,754 cf Overall - 10,701 cf Embedded = 13,053 cf x 40.0% Voids
#2A	822.67'	10,701 cf	**CMP Round 60** x 20 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L Row Length Adjustment= +15.00' x 19.63 sf x 5 rows 35.00' Header x 19.63 sf x 2 = 1,374.4 cf Inside
#3	824.00'	41,883 cf	**CBMH 4 & EOF (Prismatic)**Listed below (Recalc) -Impervious
		57,806 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
824.00	13	0	0
827.67	13	48	48
828.17	500	128	176
829.00	100,000	41,708	41,883

Device	Routing	Invert	Outlet Devices
#1	Discarded	822.17'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	825.87'	**12.0" Round 12" RCP Out of Sys** L= 26.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 825.87' / 825.70' S= 0.0065 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Secondary	828.17'	**4.0' long (Profile 1) EOF** Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59

Discarded OutFlow Max=0.07 cfs @ 9.41 hrs HW=822.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=822.17' (Free Discharge)
↑—**2=12" RCP Out of Sys** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=822.17' (Free Discharge)
↑—**3=EOF** (Controls 0.00 cfs)

Pond 1P: Underground Storage & Infiltration System - Chamber Wizard Field A

Chamber Model = CMP Round 60 (Round Corrugated Metal Pipe)
Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf
Overall Size= 60.0"W x 60.0"H x 20.00'L
Row Length Adjustment= +15.00' x 19.63 sf x 5 rows

60.0" Wide + 30.0" Spacing = 90.0" C-C Row Spacing

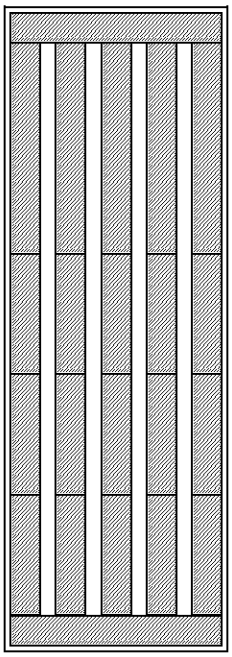
4 Chambers/Row x 20.00' Long +15.00' Row Adjustment +5.00' Header x 2 = 105.00' Row Length +12.0" End Stone x 2 = 107.00' Base Length
5 Rows x 60.0" Wide + 30.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.00' Base Width
6.0" Stone Base + 60.0" Chamber Height + 6.0" Stone Cover = 6.00' Field Height

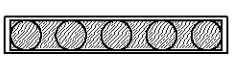
20 Chambers x 392.7 cf +15.00' Row Adjustment x 19.63 sf x 5 Rows + 35.00' Header x 19.63 sf x 2 = 10,701.0 cf Chamber Storage

23,754.0 cf Field - 10,701.0 cf Chambers = 13,053.0 cf Stone x 40.0% Voids = 5,221.2 cf Stone Storage

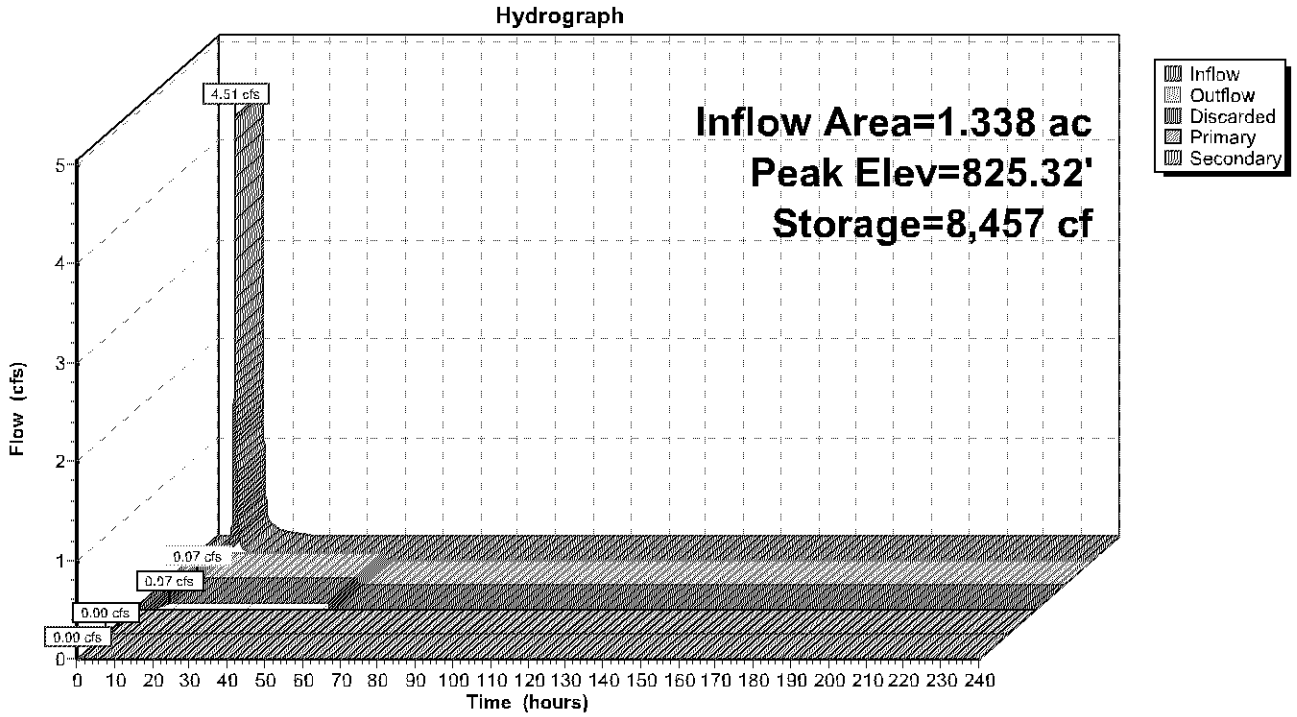
Chamber Storage + Stone Storage = 15,922.2 cf = 0.366 af
Overall Storage Efficiency = 67.0%
Overall System Size = 107.00' x 37.00' x 6.00'

20 Chambers
879.8 cy Field
483.4 cy Stone

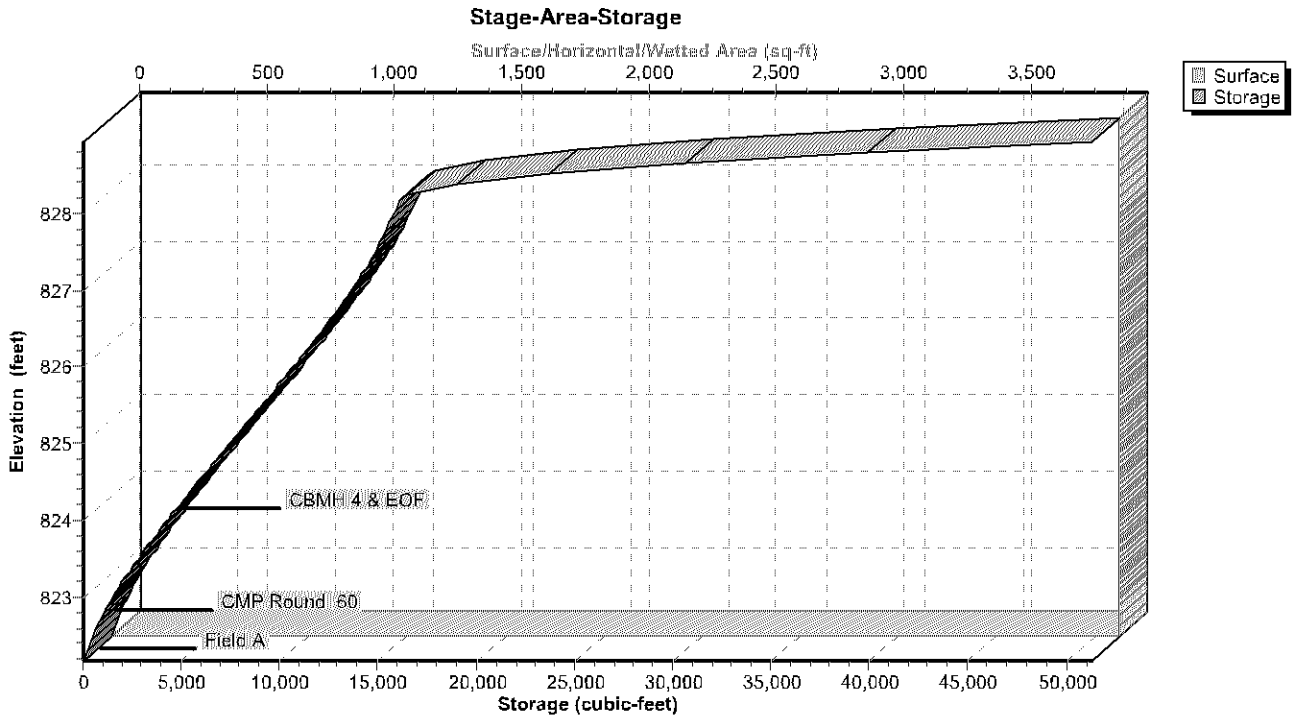




Pond 1P: Underground Storage & Infiltration System



Pond 1P: Underground Storage & Infiltration System



Stage-Area-Storage for Pond 1P: Underground Storage & Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
822.17	**3,959**	0
822.27	3,959	158
822.37	3,959	317
822.47	3,959	475
822.57	3,959	633
822.67	3,959	792
822.77	3,959	981
822.87	3,959	1,195
822.97	3,959	1,424
823.07	3,959	1,666
823.17	3,959	1,918
823.27	3,959	2,178
823.37	3,959	2,447
823.47	3,959	2,722
823.57	3,959	3,003
823.67	3,959	3,290
823.77	3,959	3,581
823.87	3,959	3,877
823.97	3,959	4,177
824.07	3,959	4,481
824.17	3,959	4,789
824.27	3,959	5,100
824.37	3,959	5,414
824.47	3,959	5,729
824.57	3,959	6,047
824.67	3,959	6,366
824.77	3,959	6,686
824.87	3,959	7,008
824.97	3,959	7,330
825.07	3,959	7,653
825.17	3,959	7,976
825.27	3,959	8,299
825.37	3,959	8,622
825.47	3,959	8,945
825.57	3,959	9,266
825.67	3,959	9,587
825.77	3,959	9,906
825.87	3,959	10,223
825.97	3,959	10,539
826.07	3,959	10,852
826.17	3,959	11,163
826.27	3,959	11,471
826.37	3,959	11,776
826.47	3,959	12,077
826.57	3,959	12,375
826.67	3,959	12,667
826.77	3,959	12,955
826.87	3,959	13,238
826.97	3,959	13,514
827.07	3,959	13,784
827.17	3,959	14,046
827.27	3,959	14,299
827.37	3,959	14,542
827.47	3,959	14,773
827.57	3,959	14,988
827.67	3,959	15,178
827.77	3,959	15,343
827.87	3,959	15,517
827.97	3,959	15,701
828.07	3,959	15,895
828.17	3,959	16,098
828.27	3,959	16,748
828.37	3,959	18,596
828.47	3,959	21,643
828.57	3,959	25,889
828.67	3,959	31,333
828.77	3,959	37,977
828.87	3,959	45,819
828.97	3,959	**54,860**

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 to Knox Runoff Area=15,750 sf 31.82% Impervious Runoff Depth=1.33"
Tc=10.0 min CN=WQ Runoff=0.62 cfs 0.040 af

SubcatchmentPR2: PR2 - Drains to Runoff Area=4,678 sf 73.47% Impervious Runoff Depth=2.97"
Tc=10.0 min CN=WQ Runoff=0.43 cfs 0.027 af

SubcatchmentPR2A: PR2A - Drains To Runoff Area=58,262 sf 93.75% Impervious Runoff Depth=3.77"
Tc=10.0 min CN=WQ Runoff=6.78 cfs 0.420 af

Reach 1R: Knox Ave S Inflow=0.62 cfs 0.040 af
Outflow=0.62 cfs 0.040 af

Reach 2R: American Blvd W Inflow=0.54 cfs 0.108 af
Outflow=0.54 cfs 0.108 af

Reach Total: Total Site Area Inflow=1.05 cfs 0.148 af
Outflow=1.05 cfs 0.148 af

Pond 1P: Underground Storage & Peak Elev=826.26' Storage=11,438 cf Inflow=6.78 cfs 0.420 af
Discarded=0.07 cfs 0.339 af Primary=0.50 cfs 0.082 af Secondary=0.00 cfs 0.000 af Outflow=0.57 cfs 0.420 af

Total Runoff Area = 1.806 ac Runoff Volume = 0.487 af Average Runoff Depth = 3.23"
19.85% Pervious = 0.359 ac 80.15% Impervious = 1.448 ac

Summary for Subcatchment PR1: PR1 - Drains to Knox Ave S

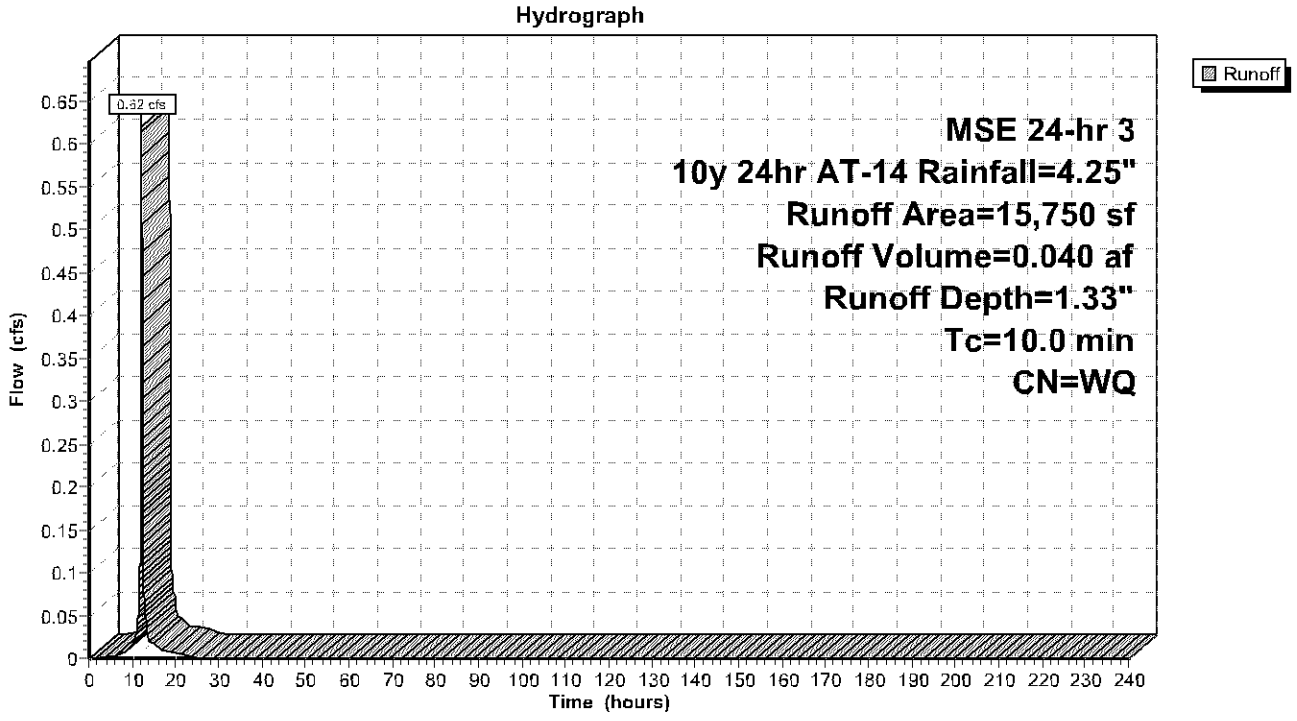
Runoff = 0.62 cfs @ 12.17 hrs, Volume= 0.040 af, Depth= 1.33"
Routed to Reach 1R : Knox Ave S

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 10y 24hr AT-14 Rainfall=4.25"

Area (sf)	CN	Description
5,012	98	Paved parking, HSG A
10,738	39	>75% Grass cover, Good, HSG A
15,750		Weighted Average
10,738		68.18% Pervious Area
5,012		31.82% Impervious Area

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

Subcatchment PR1: PR1 - Drains to Knox Ave S



Summary for Subcatchment PR2: PR2 - Drains to American Blvd W

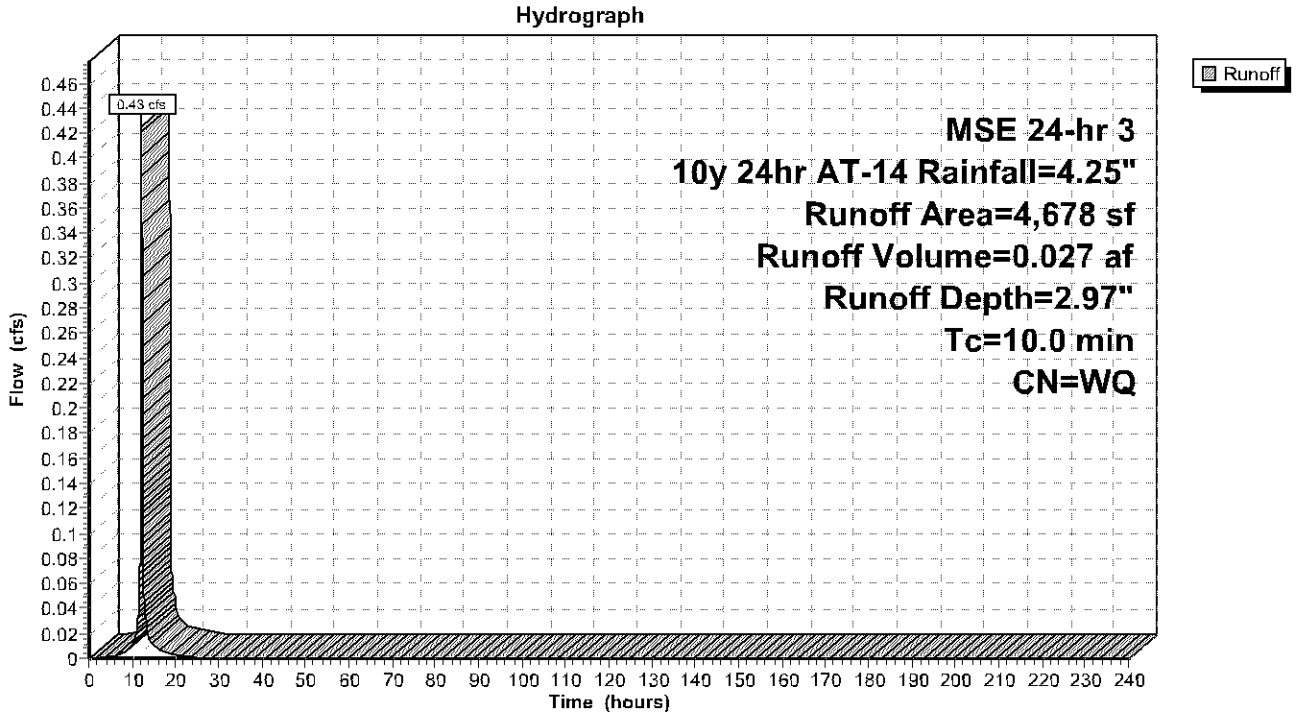
Runoff = 0.43 cfs @ 12.17 hrs, Volume= 0.027 af, Depth= 2.97"
Routed to Reach 2R : American Blvd W

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 10y 24hr AT-14 Rainfall=4.25"

Area (sf)	CN	Description
3,437	98	Paved parking, HSG A
1,241	39	>75% Grass cover, Good, HSG A
4,678		Weighted Average
1,241		26.53% Pervious Area
3,437		73.47% Impervious Area

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

Subcatchment PR2: PR2 - Drains to American Blvd W



Summary for Subcatchment PR2A: PR2A - Drains To Und. Sys.

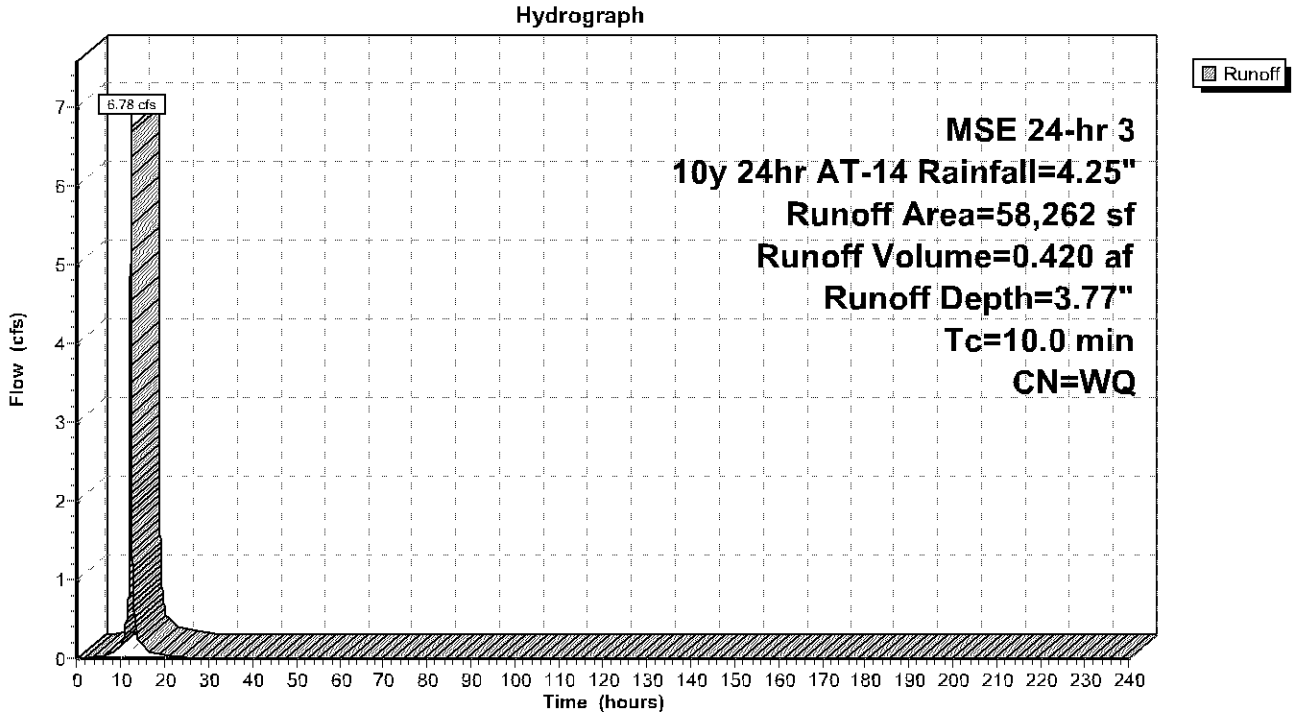
Runoff = 6.78 cfs @ 12.17 hrs, Volume= 0.420 af, Depth= 3.77"
Routed to Pond 1P : Underground Storage & Infiltration System

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 10y 24hr AT-14 Rainfall=4.25"

Area (sf)	CN	Description
54,623	98	Paved parking, HSG A
3,639	39	>75% Grass cover, Good, HSG A
58,262		Weighted Average
3,639		6.25% Pervious Area
54,623		93.75% Impervious Area

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

Subcatchment PR2A: PR2A - Drains To Und. Sys.



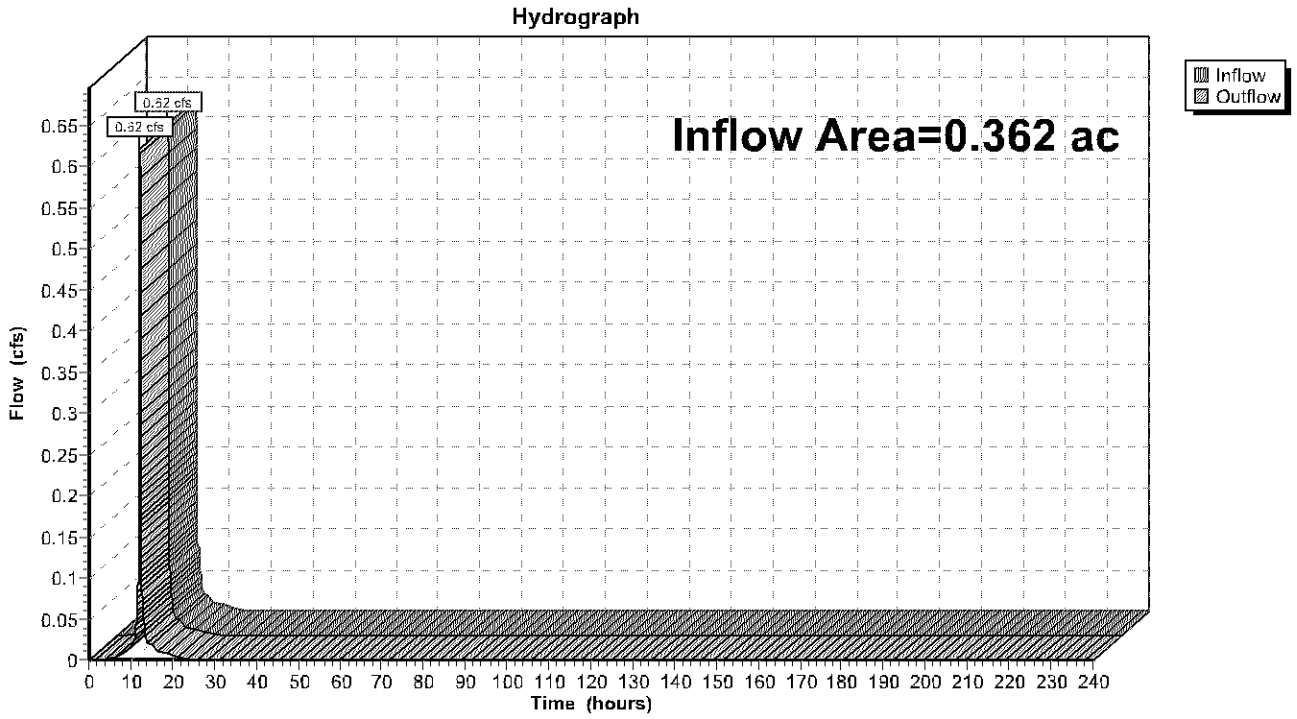
Summary for Reach 1R: Knox Ave S

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

Inflow Area = 0.362 ac, 31.82% Impervious, Inflow Depth = 1.33" for 10y 24hr AT-14 event
Inflow = 0.62 cfs @ 12.17 hrs, Volume= 0.040 af
Outflow = 0.62 cfs @ 12.17 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 1R: Knox Ave S



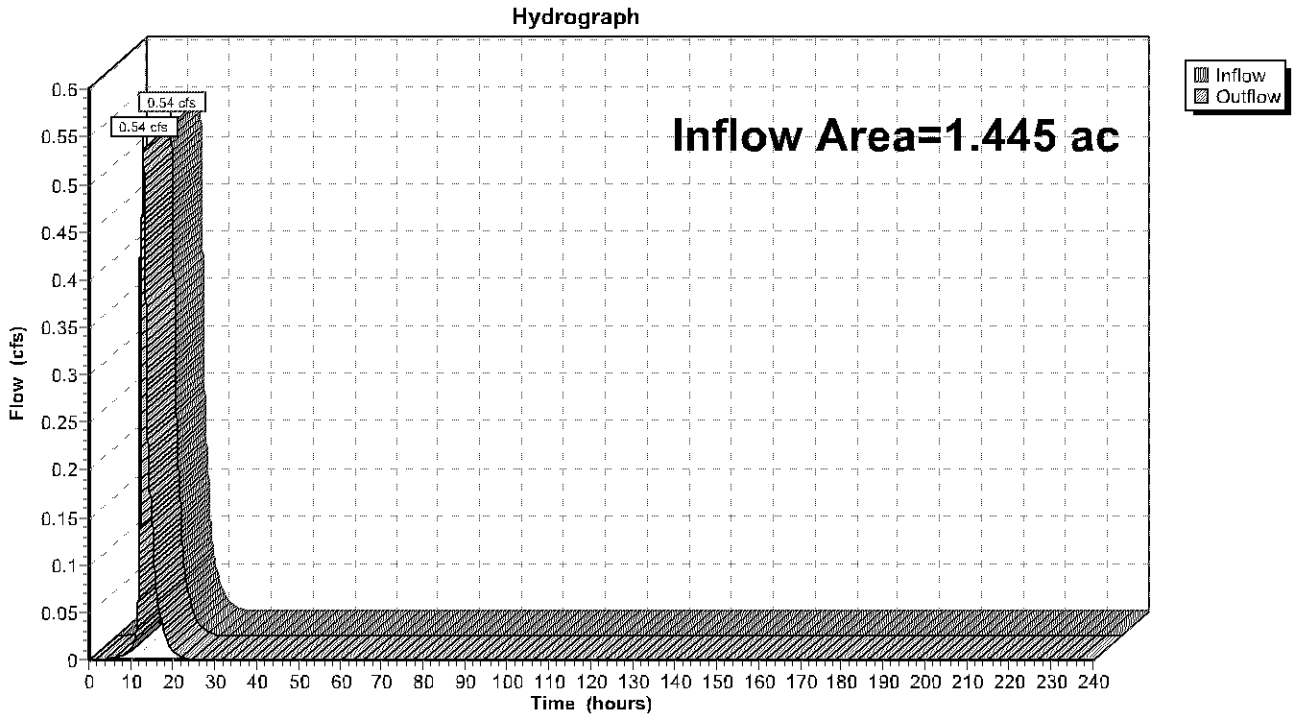
Summary for Reach 2R: American Blvd W

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

Inflow Area = 1.445 ac, 92.25% Impervious, Inflow Depth = 0.90" for 10y 24hr AT-14 event
Inflow = 0.54 cfs @ 12.93 hrs, Volume= 0.108 af
Outflow = 0.54 cfs @ 12.93 hrs, Volume= 0.108 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 2R: American Blvd W



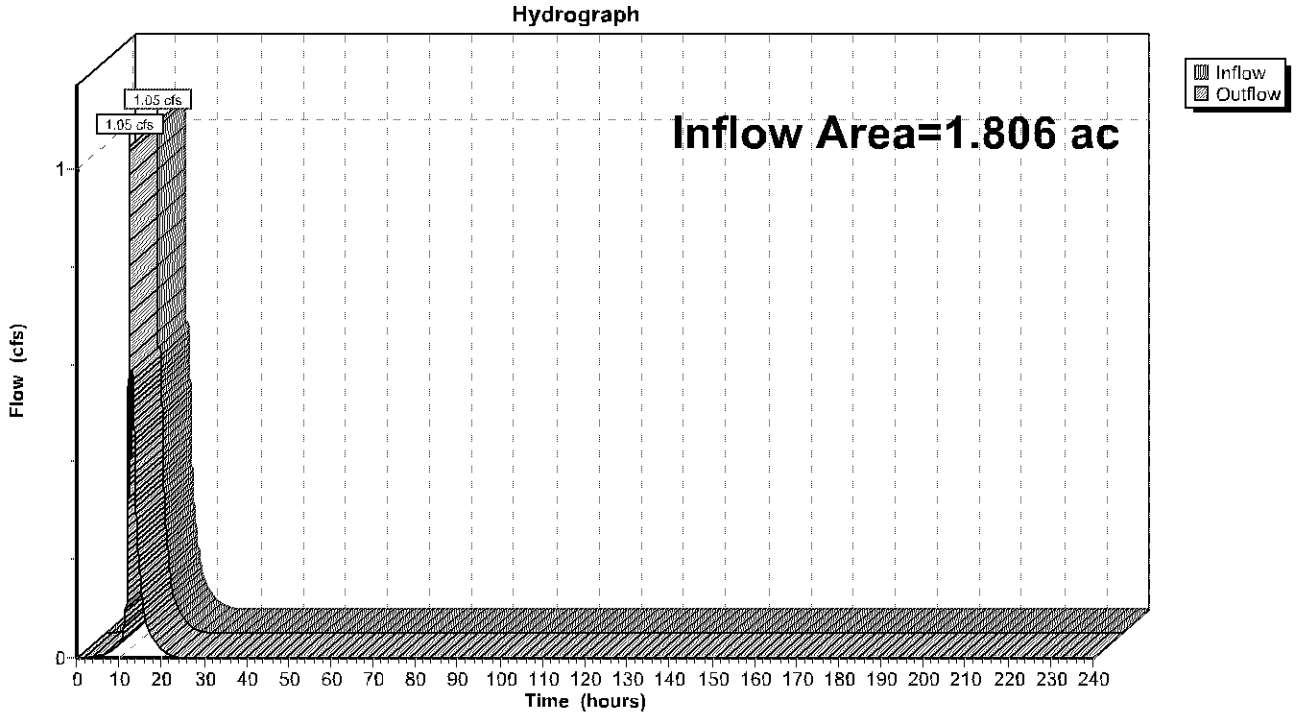
Summary for Reach Total: Total Site Area

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

Inflow Area = 1.806 ac, 80.15% Impervious, Inflow Depth = 0.98" for 10y 24hr AT-14 event
Inflow = 1.05 cfs @ 12.17 hrs, Volume= 0.148 af
Outflow = 1.05 cfs @ 12.17 hrs, Volume= 0.148 af, Atten= 0%, Lag= 0.0 min

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

Reach Total: Total Site Area



Summary for Pond 1P: Underground Storage & Infiltration System

Inflow Area = 1.338 ac, 93.75% Impervious, Inflow Depth = 3.77" for 10y 24hr AT-14 event
Inflow = 6.78 cfs @ 12.17 hrs, Volume= 0.420 af
Outflow = 0.57 cfs @ 12.95 hrs, Volume= 0.420 af, Atten= 92%, Lag= 47.0 min
Discarded = 0.07 cfs @ 7.84 hrs, Volume= 0.339 af
Primary = 0.50 cfs @ 12.95 hrs, Volume= 0.082 af
Routed to Reach 2R : American Blvd W
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : American Blvd W

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 826.26' @ 12.95 hrs Surf.Area= 3,959 sf Storage= 11,438 cf

Plug-Flow detention time= 1,019.0 min calculated for 0.420 af (100% of inflow)
Center-of-Mass det. time= 1,019.0 min (1,770.5 - 751.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.17'	5,221 cf	**37.00'W x 107.00'L x 6.00'H Field A** 23,754 cf Overall - 10,701 cf Embedded = 13,053 cf x 40.0% Voids
#2A	822.67'	10,701 cf	**CMP Round 60** x 20 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L Row Length Adjustment= +15.00' x 19.63 sf x 5 rows 35.00' Header x 19.63 sf x 2 = 1,374.4 cf Inside
#3	824.00'	41,883 cf	**CBMH 4 & EOF (Prismatic)**Listed below (Recalc) -Impervious
		57,806 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
824.00	13	0	0
827.67	13	48	48
828.17	500	128	176
829.00	100,000	41,708	41,883

Device	Routing	Invert	Outlet Devices
#1	Discarded	822.17'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	825.87'	**12.0" Round 12" RCP Out of Sys** L= 26.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 825.87' / 825.70' S= 0.0065 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Secondary	828.17'	**4.0' long (Profile 1) EOF** Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59

Discarded OutFlow Max=0.07 cfs @ 7.84 hrs HW=822.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.50 cfs @ 12.95 hrs HW=826.26' (Free Discharge)
↑—**2=12" RCP Out of Sys** (Barrel Controls 0.50 cfs @ 2.62 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=822.17' (Free Discharge)
↑—**3=EOF** (Controls 0.00 cfs)

Pond 1P: Underground Storage & Infiltration System - Chamber Wizard Field A

Chamber Model = CMP Round 60 (Round Corrugated Metal Pipe)
Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf
Overall Size= 60.0"W x 60.0"H x 20.00'L
Row Length Adjustment= +15.00' x 19.63 sf x 5 rows

60.0" Wide + 30.0" Spacing = 90.0" C-C Row Spacing

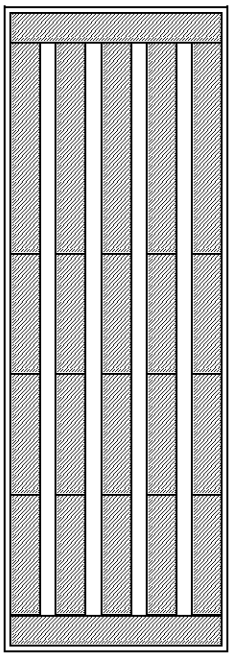
4 Chambers/Row x 20.00' Long +15.00' Row Adjustment +5.00' Header x 2 = 105.00' Row Length +12.0" End Stone x 2 = 107.00' Base Length
5 Rows x 60.0" Wide + 30.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.00' Base Width
6.0" Stone Base + 60.0" Chamber Height + 6.0" Stone Cover = 6.00' Field Height

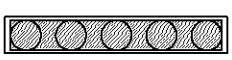
20 Chambers x 392.7 cf +15.00' Row Adjustment x 19.63 sf x 5 Rows + 35.00' Header x 19.63 sf x 2 = 10,701.0 cf Chamber Storage

23,754.0 cf Field - 10,701.0 cf Chambers = 13,053.0 cf Stone x 40.0% Voids = 5,221.2 cf Stone Storage

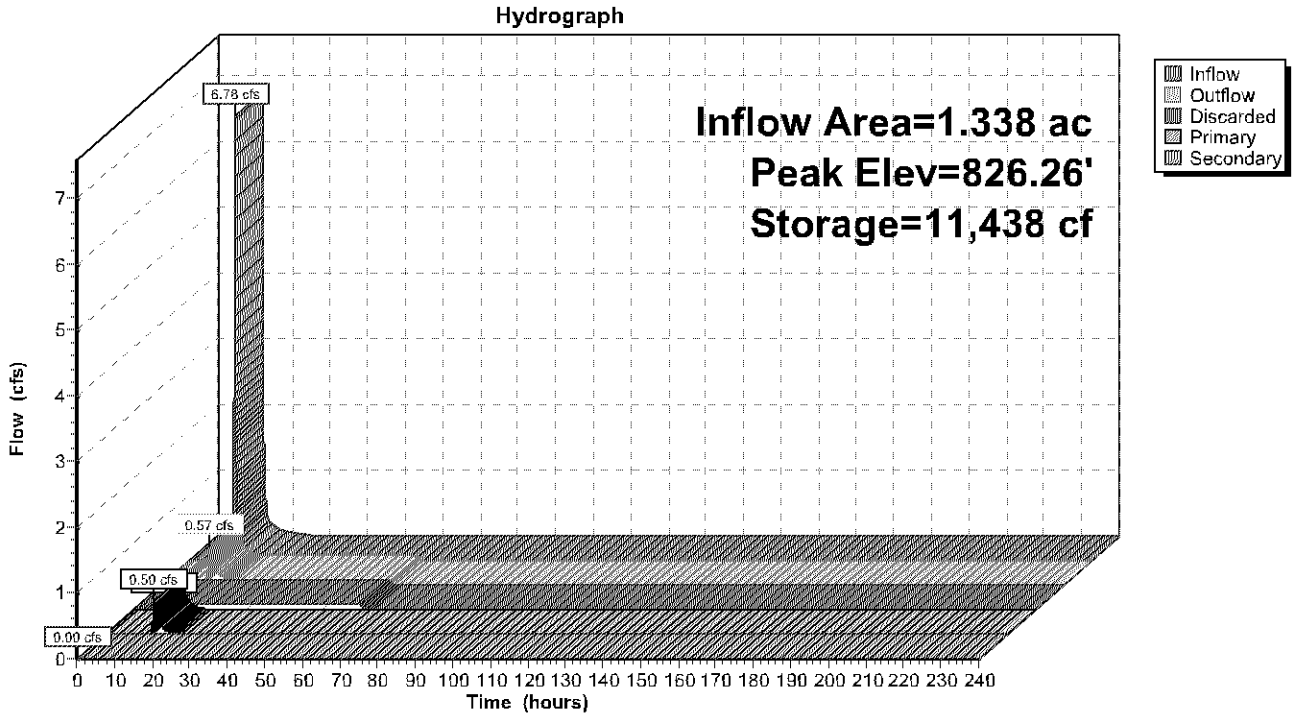
Chamber Storage + Stone Storage = 15,922.2 cf = 0.366 af
Overall Storage Efficiency = 67.0%
Overall System Size = 107.00' x 37.00' x 6.00'

20 Chambers
879.8 cy Field
483.4 cy Stone

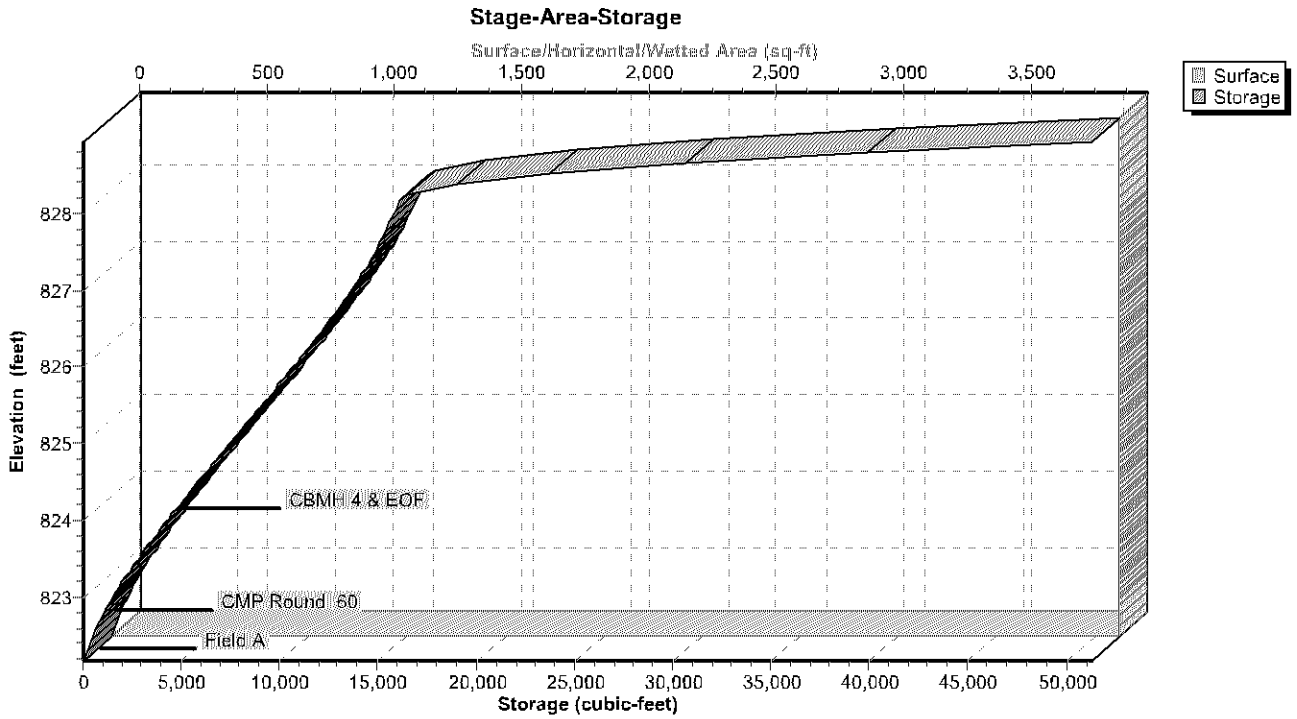




Pond 1P: Underground Storage & Infiltration System



Pond 1P: Underground Storage & Infiltration System



Stage-Area-Storage for Pond 1P: Underground Storage & Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
822.17	**3,959**	0
822.27	3,959	158
822.37	3,959	317
822.47	3,959	475
822.57	3,959	633
822.67	3,959	792
822.77	3,959	981
822.87	3,959	1,195
822.97	3,959	1,424
823.07	3,959	1,666
823.17	3,959	1,918
823.27	3,959	2,178
823.37	3,959	2,447
823.47	3,959	2,722
823.57	3,959	3,003
823.67	3,959	3,290
823.77	3,959	3,581
823.87	3,959	3,877
823.97	3,959	4,177
824.07	3,959	4,481
824.17	3,959	4,789
824.27	3,959	5,100
824.37	3,959	5,414
824.47	3,959	5,729
824.57	3,959	6,047
824.67	3,959	6,366
824.77	3,959	6,686
824.87	3,959	7,008
824.97	3,959	7,330
825.07	3,959	7,653
825.17	3,959	7,976
825.27	3,959	8,299
825.37	3,959	8,622
825.47	3,959	8,945
825.57	3,959	9,266
825.67	3,959	9,587
825.77	3,959	9,906
825.87	3,959	10,223
825.97	3,959	10,539
826.07	3,959	10,852
826.17	3,959	11,163
826.27	3,959	11,471
826.37	3,959	11,776
826.47	3,959	12,077
826.57	3,959	12,375
826.67	3,959	12,667
826.77	3,959	12,955
826.87	3,959	13,238
826.97	3,959	13,514
827.07	3,959	13,784
827.17	3,959	14,046
827.27	3,959	14,299
827.37	3,959	14,542
827.47	3,959	14,773
827.57	3,959	14,988
827.67	3,959	15,178
827.77	3,959	15,343
827.87	3,959	15,517
827.97	3,959	15,701
828.07	3,959	15,895
828.17	3,959	16,098
828.27	3,959	16,748
828.37	3,959	18,596
828.47	3,959	21,643
828.57	3,959	25,889
828.67	3,959	31,333
828.77	3,959	37,977
828.87	3,959	45,819
828.97	3,959	**54,860**

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 to Knox Runoff Area=15,750 sf 31.82% Impervious Runoff Depth=2.96"
Tc=10.0 min CN=WQ Runoff=1.32 cfs 0.089 af

SubcatchmentPR2: PR2 - Drains to Runoff Area=4,678 sf 73.47% Impervious Runoff Depth=5.58"
Tc=10.0 min CN=WQ Runoff=0.78 cfs 0.050 af

SubcatchmentPR2A: PR2A - Drains To Runoff Area=58,262 sf 93.75% Impervious Runoff Depth=6.86"
Tc=10.0 min CN=WQ Runoff=12.08 cfs 0.764 af

Reach 1R: Knox Ave S Inflow=1.32 cfs 0.089 af
Outflow=1.32 cfs 0.089 af

Reach 2R: American Blvd W Inflow=5.39 cfs 0.455 af
Outflow=5.39 cfs 0.455 af

Reach Total: Total Site Area Inflow=6.23 cfs 0.544 af
Outflow=6.23 cfs 0.544 af

Pond 1P: Underground Storage & Peak Elev=828.14' Storage=16,037 cf Inflow=12.08 cfs 0.764 af
Discarded=0.07 cfs 0.359 af Primary=5.03 cfs 0.405 af Secondary=0.00 cfs 0.000 af Outflow=5.11 cfs 0.764 af

Total Runoff Area = 1.806 ac Runoff Volume = 0.903 af Average Runoff Depth = 6.00"
19.85% Pervious = 0.359 ac 80.15% Impervious = 1.448 ac

Summary for Subcatchment PR1: PR1 - Drains to Knox Ave S

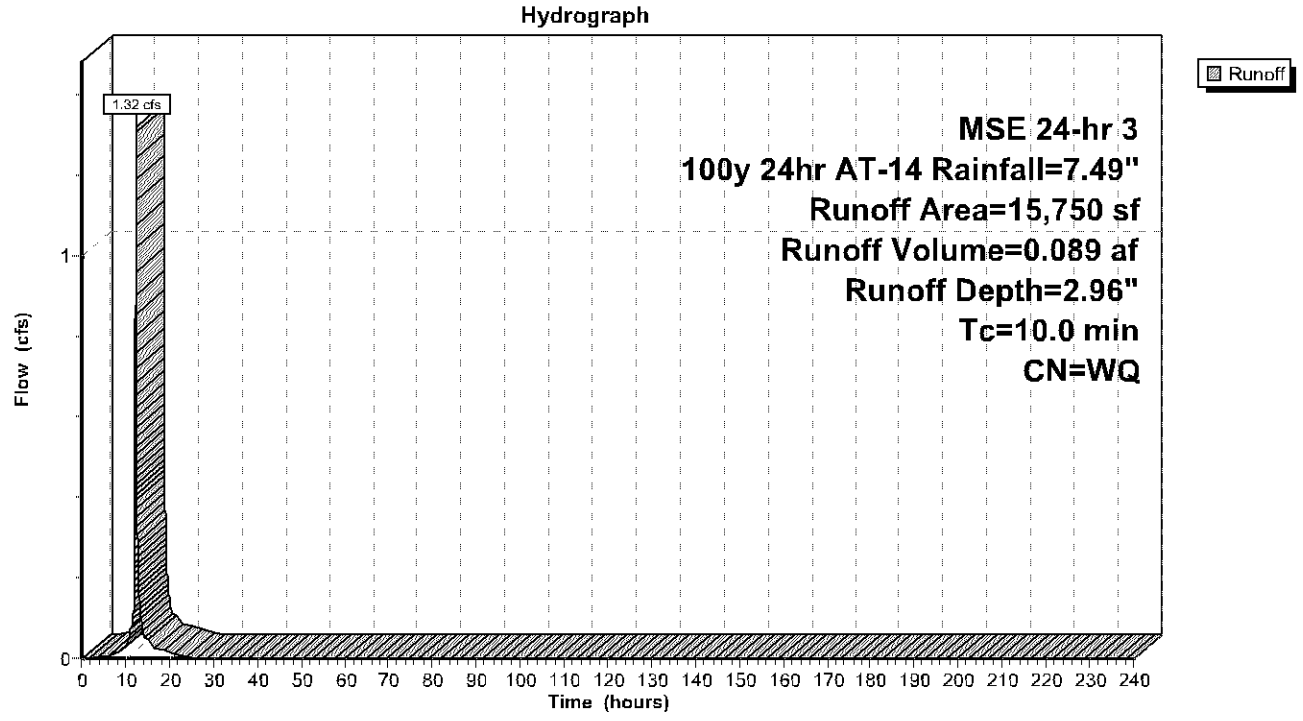
Runoff = 1.32 cfs @ 12.18 hrs, Volume= 0.089 af, Depth= 2.96"
Routed to Reach 1R : Knox Ave S

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 100y 24hr AT-14 Rainfall=7.49"

Area (sf)	CN	Description
5,012	98	Paved parking, HSG A
10,738	39	>75% Grass cover, Good, HSG A
15,750		Weighted Average
10,738		68.18% Pervious Area
5,012		31.82% Impervious Area

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

Subcatchment PR1: PR1 - Drains to Knox Ave S



Summary for Subcatchment PR2: PR2 - Drains to American Blvd W

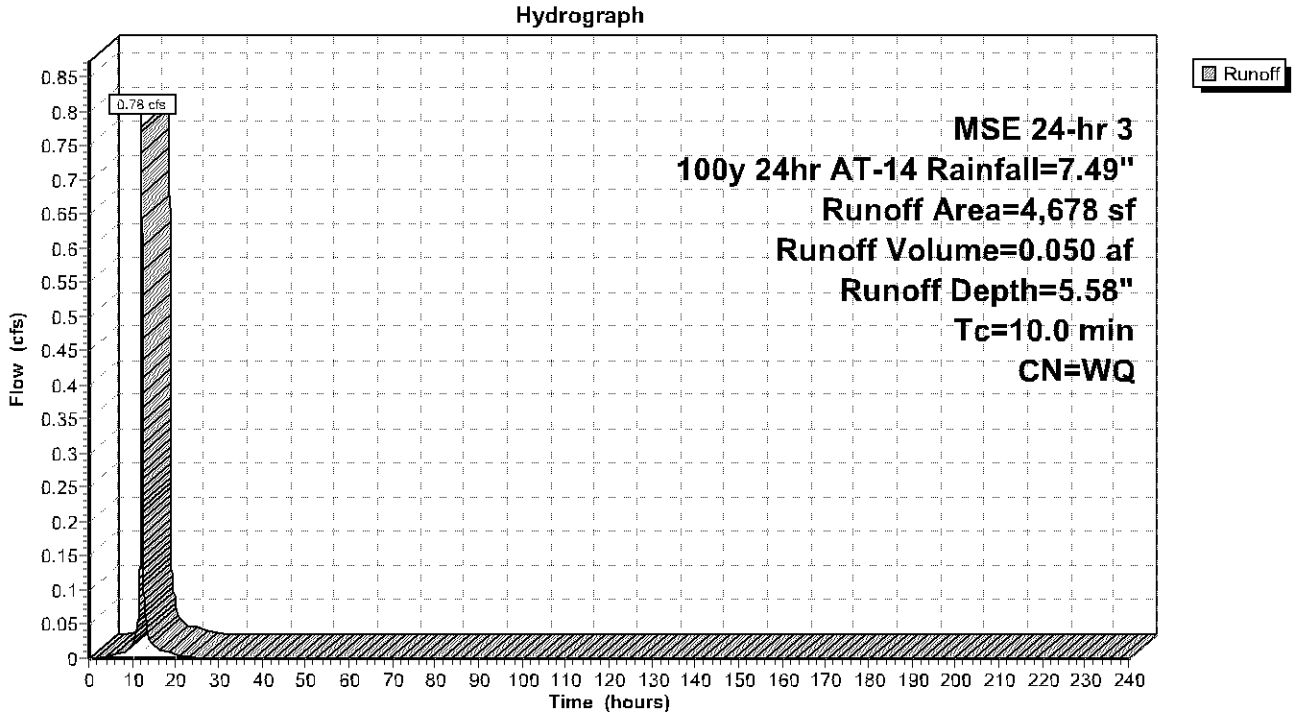
Runoff = 0.78 cfs @ 12.17 hrs, Volume= 0.050 af, Depth= 5.58"
Routed to Reach 2R : American Blvd W

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 100y 24hr AT-14 Rainfall=7.49"

Area (sf)	CN	Description
3,437	98	Paved parking, HSG A
1,241	39	>75% Grass cover, Good, HSG A
4,678		Weighted Average
1,241		26.53% Pervious Area
3,437		73.47% Impervious Area

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

Subcatchment PR2: PR2 - Drains to American Blvd W



Summary for Subcatchment PR2A: PR2A - Drains To Und. Sys.

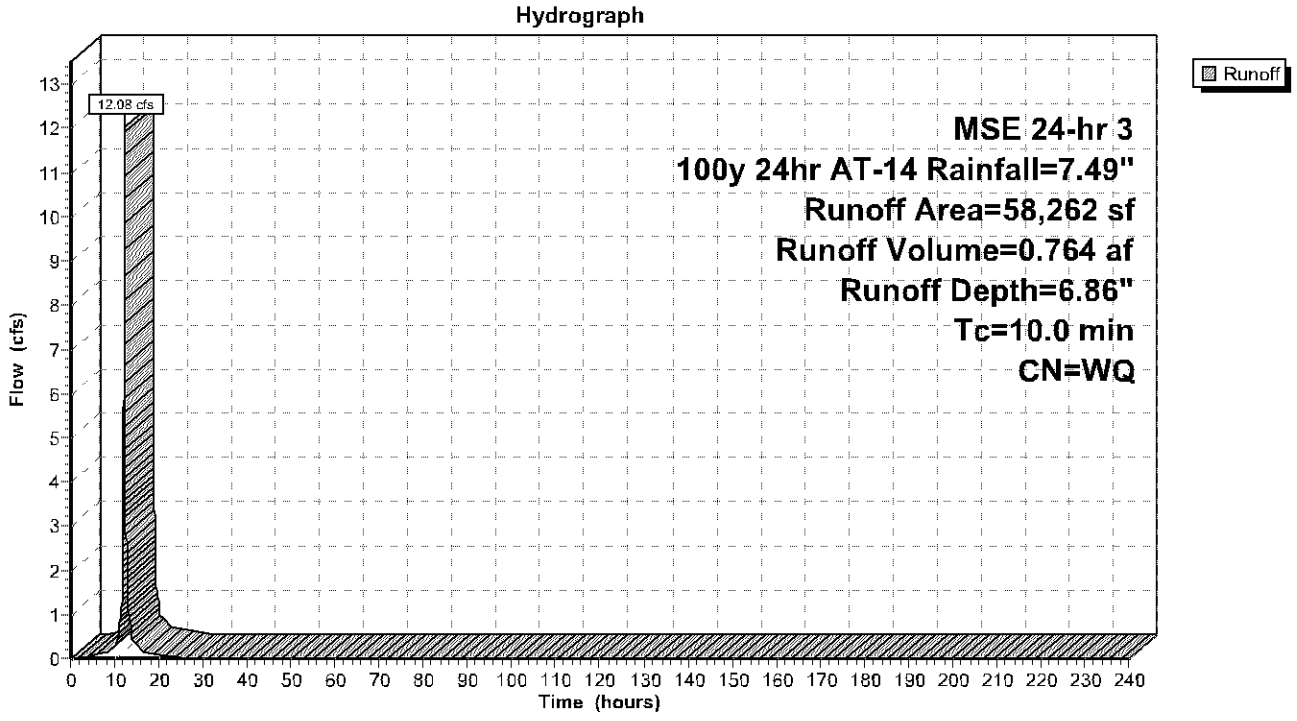
Runoff = 12.08 cfs @ 12.17 hrs, Volume= 0.764 af, Depth= 6.86"
Routed to Pond 1P : Underground Storage & Infiltration System

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 100y 24hr AT-14 Rainfall=7.49"

Area (sf)	CN	Description
54,623	98	Paved parking, HSG A
3,639	39	>75% Grass cover, Good, HSG A
58,262		Weighted Average
3,639		6.25% Pervious Area
54,623		93.75% Impervious Area

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

Subcatchment PR2A: PR2A - Drains To Und. Sys.



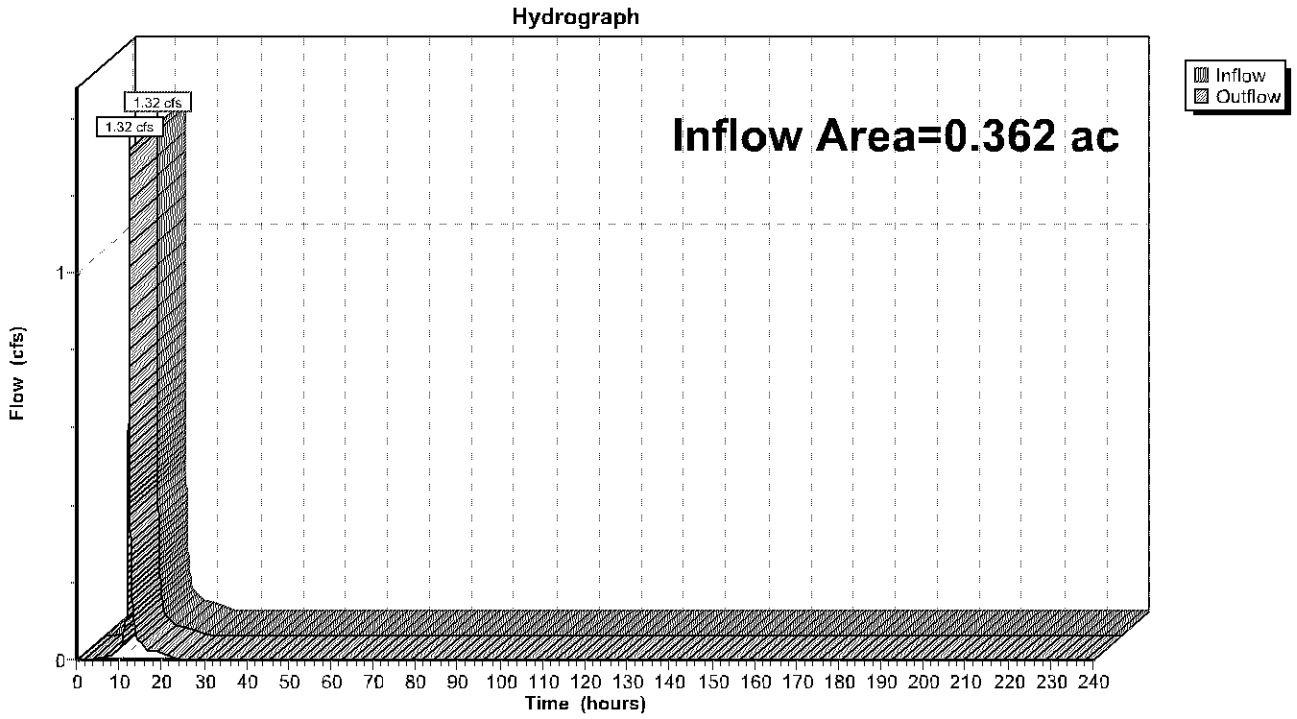
Summary for Reach 1R: Knox Ave S

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

Inflow Area = 0.362 ac, 31.82% Impervious, Inflow Depth = 2.96" for 100y 24hr AT-14 event
Inflow = 1.32 cfs @ 12.18 hrs, Volume= 0.089 af
Outflow = 1.32 cfs @ 12.18 hrs, Volume= 0.089 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 1R: Knox Ave S



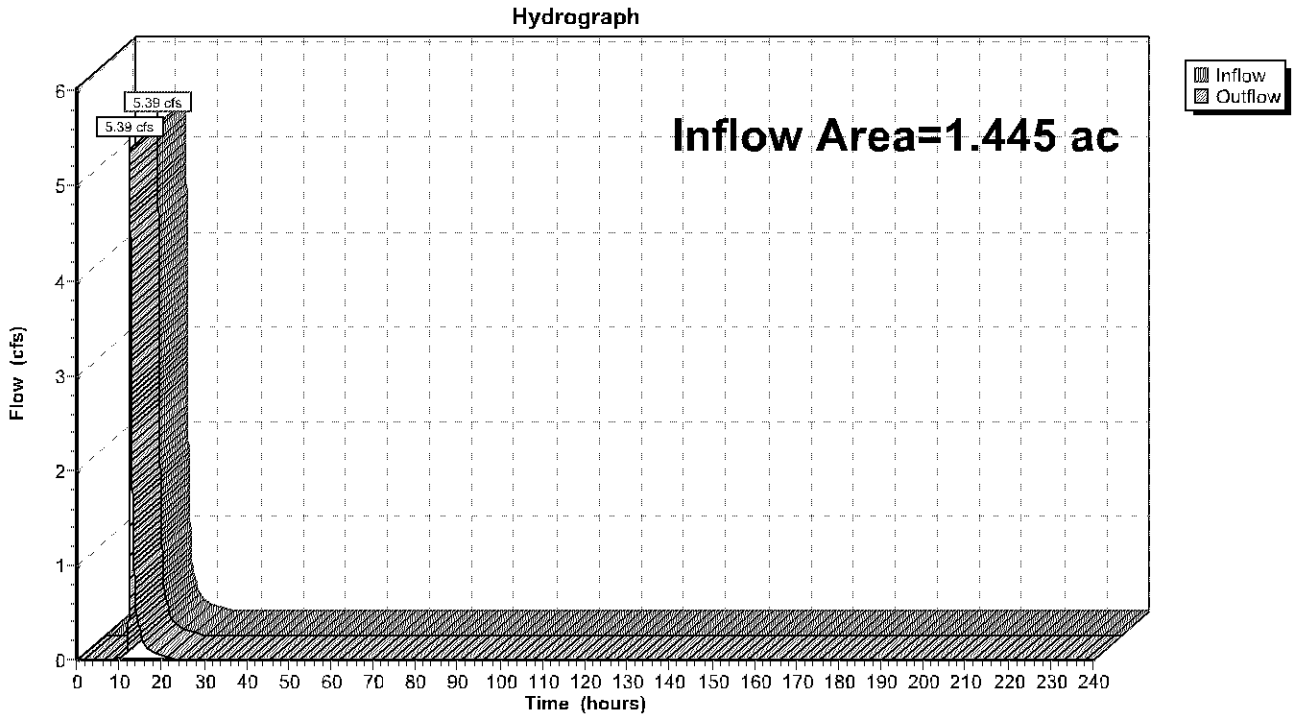
Summary for Reach 2R: American Blvd W

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

Inflow Area = 1.445 ac, 92.25% Impervious, Inflow Depth = 3.78" for 100y 24hr AT-14 event
Inflow = 5.39 cfs @ 12.31 hrs, Volume= 0.455 af
Outflow = 5.39 cfs @ 12.31 hrs, Volume= 0.455 af, Atten= 0%, Lag= 0.0 min
Routed to Reach Total : Total Site Area

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

Reach 2R: American Blvd W



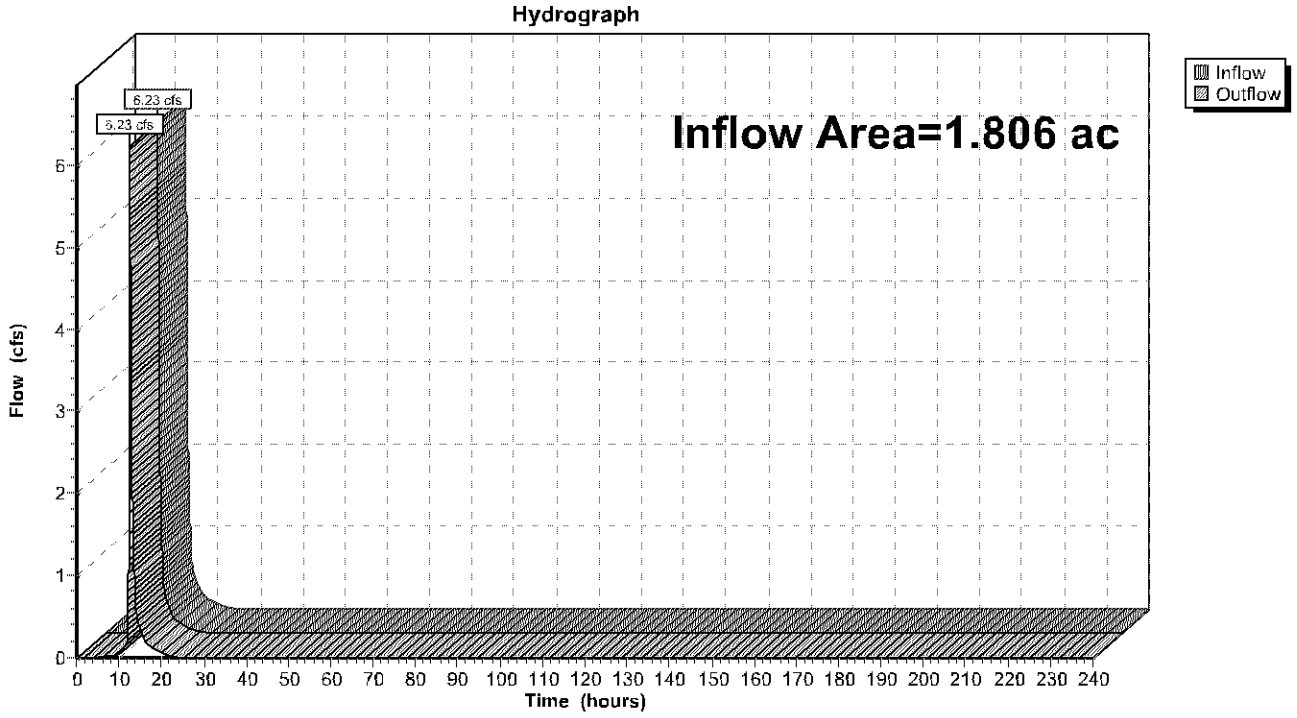
Summary for Reach Total: Total Site Area

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

Inflow Area = 1.806 ac, 80.15% Impervious, Inflow Depth = 3.61" for 100y 24hr AT-14 event
Inflow = 6.23 cfs @ 12.26 hrs, Volume= 0.544 af
Outflow = 6.23 cfs @ 12.26 hrs, Volume= 0.544 af, Atten= 0%, Lag= 0.0 min

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

Reach Total: Total Site Area



Summary for Pond 1P: Underground Storage & Infiltration System

Inflow Area = 1.338 ac, 93.75% Impervious, Inflow Depth = 6.86" for 100y 24hr AT-14 event
Inflow = 12.08 cfs @ 12.17 hrs, Volume= 0.764 af
Outflow = 5.11 cfs @ 12.34 hrs, Volume= 0.764 af, Atten= 58%, Lag= 10.0 min
Discarded = 0.07 cfs @ 4.81 hrs, Volume= 0.359 af
Primary = 5.03 cfs @ 12.34 hrs, Volume= 0.405 af
Routed to Reach 2R : American Blvd W
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : American Blvd W

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
Peak Elev= 828.14' @ 12.34 hrs Surf.Area= 3,959 sf Storage= 16,037 cf

Plug-Flow detention time= 614.2 min calculated for 0.764 af (100% of inflow)
Center-of-Mass det. time= 614.2 min (1,359.3 - 745.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.17'	5,221 cf	**37.00'W x 107.00'L x 6.00'H Field A** 23,754 cf Overall - 10,701 cf Embedded = 13,053 cf x 40.0% Voids
#2A	822.67'	10,701 cf	**CMP Round 60** x 20 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L Row Length Adjustment= +15.00' x 19.63 sf x 5 rows 35.00' Header x 19.63 sf x 2 = 1,374.4 cf Inside
#3	824.00'	41,883 cf	**CBMH 4 & EOF (Prismatic)**Listed below (Recalc) -Impervious
		57,806 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
824.00	13	0	0
827.67	13	48	48
828.17	500	128	176
829.00	100,000	41,708	41,883

Device	Routing	Invert	Outlet Devices
#1	Discarded	822.17'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	825.87'	**12.0" Round 12" RCP Out of Sys** L= 26.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 825.87' / 825.70' S= 0.0065 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Secondary	828.17'	**4.0' long (Profile 1) EOF** Head (feet) 0.49 0.98 1.48 Coef. (English) 2.92 3.37 3.59

Discarded OutFlow Max=0.07 cfs @ 4.81 hrs HW=822.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=5.03 cfs @ 12.34 hrs HW=828.14' (Free Discharge)
↑—**2=12" RCP Out of Sys** (Inlet Controls 5.03 cfs @ 6.41 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=822.17' (Free Discharge)
↑—**3=EOF** (Controls 0.00 cfs)

Pond 1P: Underground Storage & Infiltration System - Chamber Wizard Field A

Chamber Model = CMP Round 60 (Round Corrugated Metal Pipe)
Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf
Overall Size= 60.0"W x 60.0"H x 20.00'L
Row Length Adjustment= +15.00' x 19.63 sf x 5 rows

60.0" Wide + 30.0" Spacing = 90.0" C-C Row Spacing

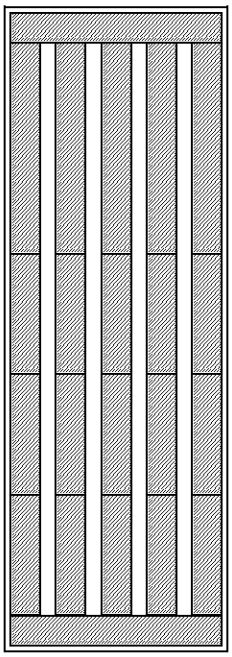
4 Chambers/Row x 20.00' Long +15.00' Row Adjustment +5.00' Header x 2 = 105.00' Row Length +12.0" End Stone x 2 = 107.00' Base Length
5 Rows x 60.0" Wide + 30.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.00' Base Width
6.0" Stone Base + 60.0" Chamber Height + 6.0" Stone Cover = 6.00' Field Height

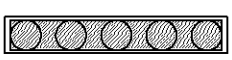
20 Chambers x 392.7 cf +15.00' Row Adjustment x 19.63 sf x 5 Rows + 35.00' Header x 19.63 sf x 2 = 10,701.0 cf Chamber Storage

23,754.0 cf Field - 10,701.0 cf Chambers = 13,053.0 cf Stone x 40.0% Voids = 5,221.2 cf Stone Storage

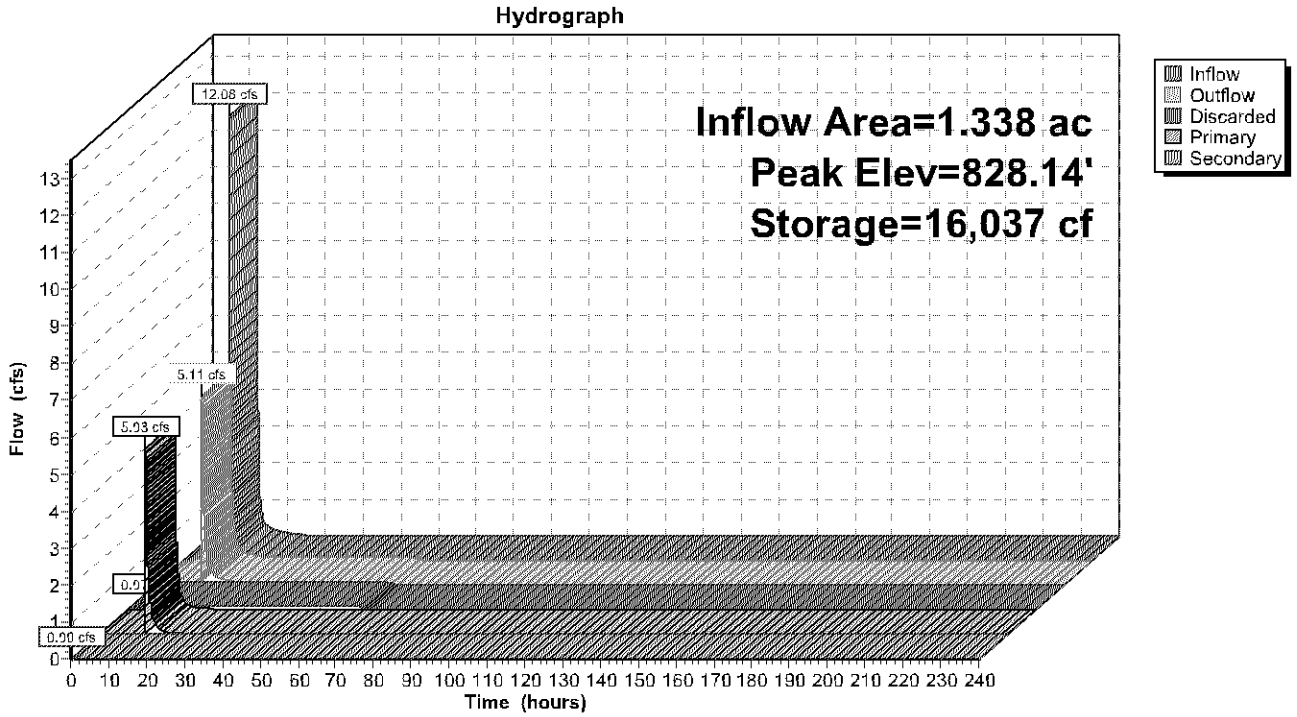
Chamber Storage + Stone Storage = 15,922.2 cf = 0.366 af
Overall Storage Efficiency = 67.0%
Overall System Size = 107.00' x 37.00' x 6.00'

20 Chambers
879.8 cy Field
483.4 cy Stone

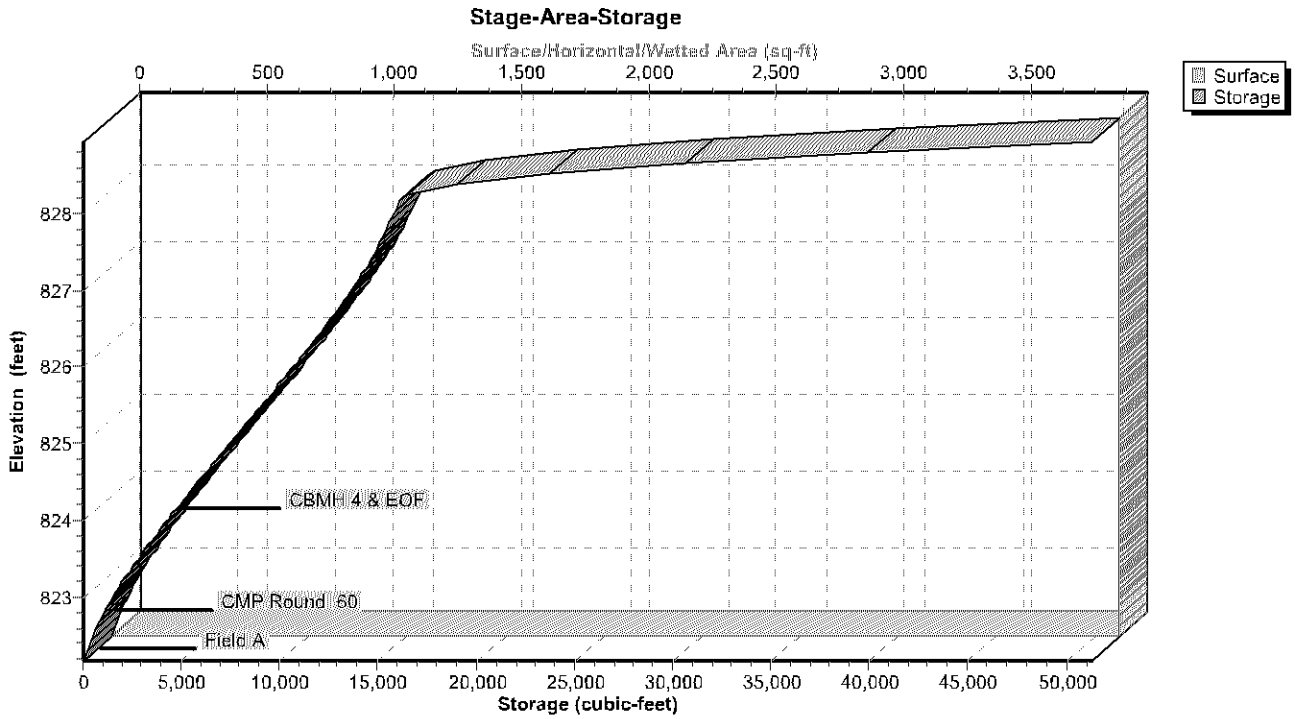




Pond 1P: Underground Storage & Infiltration System



Pond 1P: Underground Storage & Infiltration System



Stage-Area-Storage for Pond 1P: Underground Storage & Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
822.17	**3,959**	0
822.27	3,959	158
822.37	3,959	317
822.47	3,959	475
822.57	3,959	633
822.67	3,959	792
822.77	3,959	981
822.87	3,959	1,195
822.97	3,959	1,424
823.07	3,959	1,666
823.17	3,959	1,918
823.27	3,959	2,178
823.37	3,959	2,447
823.47	3,959	2,722
823.57	3,959	3,003
823.67	3,959	3,290
823.77	3,959	3,581
823.87	3,959	3,877
823.97	3,959	4,177
824.07	3,959	4,481
824.17	3,959	4,789
824.27	3,959	5,100
824.37	3,959	5,414
824.47	3,959	5,729
824.57	3,959	6,047
824.67	3,959	6,366
824.77	3,959	6,686
824.87	3,959	7,008
824.97	3,959	7,330
825.07	3,959	7,653
825.17	3,959	7,976
825.27	3,959	8,299
825.37	3,959	8,622
825.47	3,959	8,945
825.57	3,959	9,266
825.67	3,959	9,587
825.77	3,959	9,906
825.87	3,959	10,223
825.97	3,959	10,539
826.07	3,959	10,852
826.17	3,959	11,163
826.27	3,959	11,471
826.37	3,959	11,776
826.47	3,959	12,077
826.57	3,959	12,375
826.67	3,959	12,667
826.77	3,959	12,955
826.87	3,959	13,238
826.97	3,959	13,514
827.07	3,959	13,784
827.17	3,959	14,046
827.27	3,959	14,299
827.37	3,959	14,542
827.47	3,959	14,773
827.57	3,959	14,988
827.67	3,959	15,178
827.77	3,959	15,343
827.87	3,959	15,517
827.97	3,959	15,701
828.07	3,959	15,895
828.17	3,959	16,098
828.27	3,959	16,748
828.37	3,959	18,596
828.47	3,959	21,643
828.57	3,959	25,889
828.67	3,959	31,333
828.77	3,959	37,977
828.87	3,959	45,819
828.97	3,959	**54,860**

TABLE OF CONTENTS