DESIGN STUDIO
Inspiring Livable Places

DRAINAGE REPORT

PREPARED FOR THE CITY OF SANDY
SANDY ART STUDIO, SANDY, OREGON | JANUARY 27, 2025
38756 PIONEER BLVD. SANDY, OR 97005

PROJECT ENGINEER: SARAH JONES, PE

DAVID EVANS AND ASSOCIATES INC.

CONTENTS

APPENDICES

TABLES AND FIGURES

1 INTRODUCTION AND PURPOSE

The purpose of this report is to provide documentation for the stormwater management associated with the development of the Sandy Art Studio project. The project consists of a 2355 square foot building adjacent to the Mt. Hood Highway in Sandy Oregon. DEA has evaluated the existing conditions and proposed stormwater management facilities, including detention and water quality design.

The calculations and stormwater management methods contained in this report have been based on the 2020 City of Portland Stormwater Water Management Manual (SWMM), as per the City of Sandy code.

2 PROJECT LOCATION AND DESCRIPTION

The project site is located at 38756 Pioneer Blvd, Sandy, OR 97005. The map and tax lot is 24E13CA04600 and is zoned as Commercial Building District (C1-CBD). The size of the lot is approximately 0.17 acres. The area of redevelopment consists of an existing building, parking lot, concrete sidewalks, a concrete staircase, and vegetated areas containing mostly grass and two trees. The existing site slopes south from Mt Hood Hwy to the existing asphalt parking area. The runoff is captured in the parking area via catch basins and is discharged into the public stormwater system.

The project includes the construction of a new building and patio area. The existing staircase, sidewalks and trees are to be protected in place.

3 PRE-DEVELOPED CONDITIONS

The analysis of the pre-developed site conditions assumes a fully undeveloped site with natural groundcover and surface grades. The Natural Resources Conservation Service (NRCS) Web Soil Survey data was used to determine the hydrologic soil groups covering the project site, and assumptions were made for the pre-developed groundcovers based on natural land surrounding the site. The NRCS Soil Survey documentation is provided in Appendix 2.

The soil on site is composed of:

- 15B – Cazadero silty clay loam

The pre-developed groundcover assumed is grassland with 50 to 75% ground cover in fair hydrologic condition.

The Santa Barbara Urban Hydrograph was used with HydroCAD software to calculate the peak storm runoff from the site for pre-developed site conditions for the 2, 5, 10 and 25-year, 24-hour rain event defined in the SWMM. The rainfall depths used for the 2, 5, 10 and 25-year rain events are 3.5, 4.5, 4.8 and 5.5 inches respectively. The curve number (CN) used for the site's soil is 73 for HSG C, Woods.

The time of concentration (tc) from the most remote point of the site in pre-developed conditions was estimated to be less than 10 minutes, and a minimum time of concentration of 10 minutes was used per the SWMM.

Exhibit BM-01 in Appendix 1 displays the pre-developed area conditions for the post-developed site that were used to calculate the peak runoff for each 24-hour storm report. The results are listed in Table 3-1 below, and hydrographs of the results are included in Appendix 3.

Table 3-1 Peak Basin Runoff Results for Pre-developed Conditions

Storm Event (Year)	Area (sf)	CN	Tc (min)	Rainfall Depth (in)	Peak Runoff (cfs)
2	3,470	73	10	3.5	0.02
5	3,470	73	10	4.5	0.03
10	3,470	73	10	4.8	0.04
25	3,470	73	10	5.5	0.05

4 ANALYSIS OF PROPOSED PROJECT

4.1 POST-DEVELOPED DRAINAGE ANALYSIS

The proposed drainage water quality analysis is based on the City of Portlands SWMM and the City of Sandy standards which requires facilities to meet both the following pollution and flow control requirements:

1) Achieve 70% TSS removal from the runoff resulting from 90% of the average annual rainfall.
2) For discharge to storm-only systems that drain to large water bodies including the Willamette, Columbia Slough and Columbia River when there is a system need, limit the post-development peak runoff rates to pre-development rates for the 2-, 5-, 10- and 25-year events.

The project proposes an open, vegetated stormwater planter to capture and treat runoff from the site via storm drains and overland flow. The planter will be lined with an impermeable geotextile fabric, so no infiltration occurs. The stormwater treated will then outlet into a lined R-Tank Stormwater Storage System that detains the runoff and discharges at or below pre-development rates into the public stormwater sewer system.

Exhibit BM-02 in **Appendix 1** displays the post-developed basin areas used to calculate the peak run off for a 2, 5, 10 and 25-year storm. Results for the peak stormwater facility runoffs are listed in Tables 4-1 and 4-2 below, and hydrographs of the results are included in **Appendix 3.**

- Pollution Reduction rainfall depth in 24 hours:
    - Water Quality (WQ): 1.6 inches
- Rainfall depths in 24 hours:
    - 2-year, 3.5”
    - 5-year, 4.5”
    - 10-year, 4.8”
    - 25-year, 5.5”
- Hydrologic Soil Group is C taken from the NRCS Soil Survey
- The runoff curve number (CN) value for post-developed impervious surface is 98.
- The runoff curve number (CN) value for post-developed grassy surfacing is 79.
- A time of concentration (Tc) of 5 minutes for post-developed conditions.

Table 4-1 Peak Stormwater Facility Runoff Results for Post-developed

Storm Event (Year)	Area (sf)	Weighted CN	Tc (min)	Rainfall Depth (in)	Detaining Stormwater Facility	Peak Runoff (cfs)
2	3,470	93	5	3.5	SF-A	0.02
5	3,470	93	5	4.5	SF-A	0.03
10	3,470	93	5	4.8	SF-A	0.03
25	3,470	93	5	5.5	SF-A	0.04

Table 4-2 Peak Stormwater Facility Runoff Results Comparison

Storm Event (Year)	Pre-Developed Peak Runoff (cfs)	Post-Developed Peak Runoff (cfs)	Net Runoff (cfs)
2	0.02	0.02	0.00
5	0.03	0.03	0.00
10	0.04	0.03	-0.01
25	0.05	0.04	-0.01

5 CONCLUSION

The proposed development will meet all stormwater treatment requirements based on the City of Sandy Stormwater Standards and the City of Portland's Stormwater Management Manual by using one water quality facility and one detention facility. Flow control will be sufficient to maintain peak flow rates at or below their pre-development levels for 2, 5, 10, 25-year, 24-hour storms.

6 REFERENCES

Stormwater Management Manual, City of Portland, dated 2020.

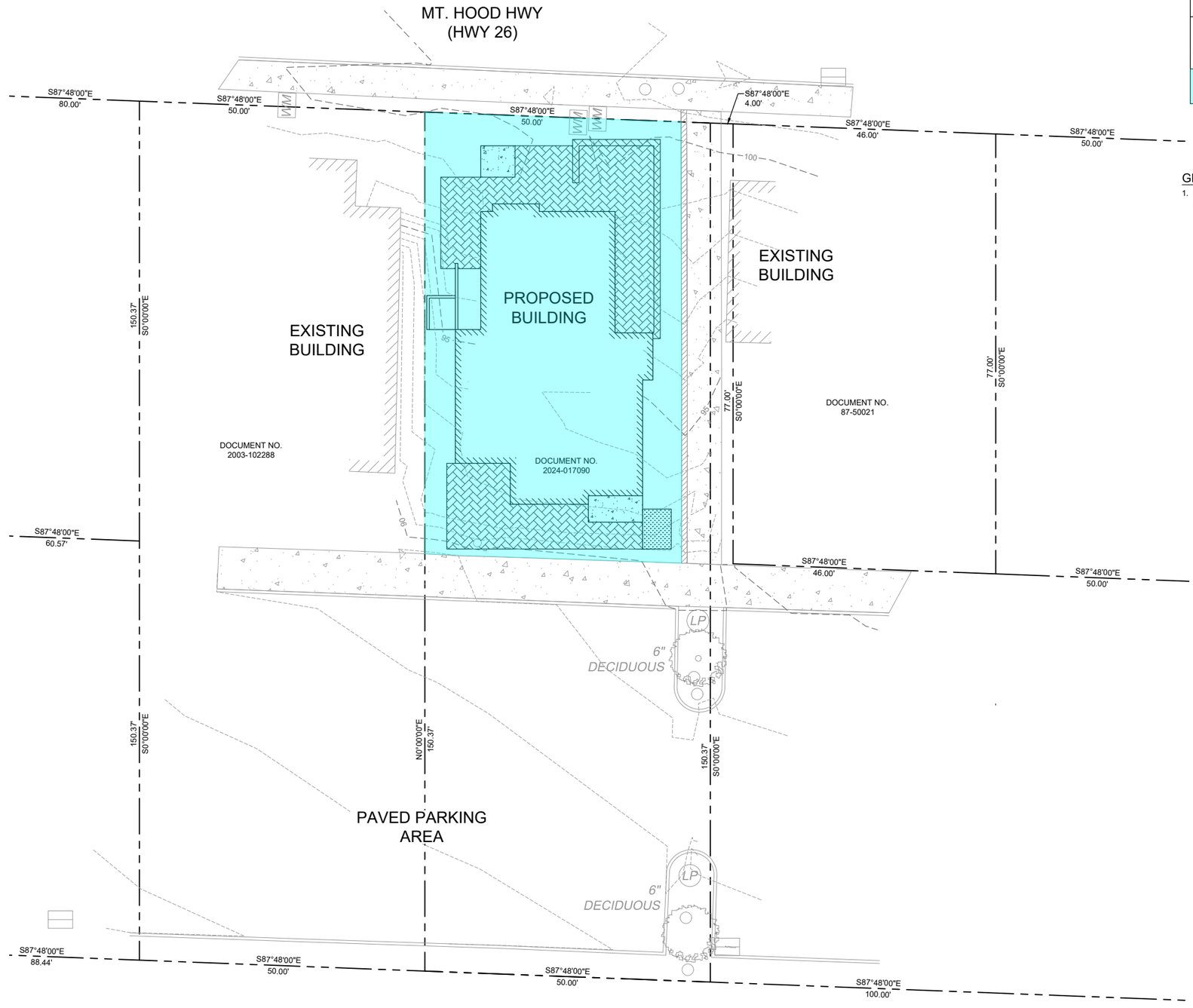
Natural Resources Conservation Service (NRCS) Soil Survey, accessed online on January 08, 2024.

APPENDICES

SANDY ART STUDIO

APPENDIX 1. EXISTING CONDITIONS AND PROPOSED DRAINAGE BASIN MAPS

- BM-01 – Pre-Developed Stormwater Basin Map
- BM-02 – Post-Developed Stormwater Basin Map



PRE-DEVELOPED AREAS				
BASIN COLOR	AREA (SF)	CN	PRE-DEVELOPED DESCRIPTION	RECEIVING STORMWATER FACILITY ID
	3,470	73	WOODS, FAIR, HSG C	SF-A

GENERAL NOTES

1. BASIN AREA SHOWN INCLUDES AREAS WITHIN THE PROJECT DISTURBANCE LIMITS FROM WHICH SURFACE RUNOFF WILL BE CAPTURED AND TREATED PRIOR TO BEING DISCHARGED INTO THE PUBLIC STORM SYSTEM

N

SCALE
20 0 10 20 40
(FEET)
1 INCH = 20 FT.

DAVID EVANS AND ASSOCIATES INC.
2100 S River Pkwy,
Portland OR, 97201
Phone: 503.223.6663

PROJECT
SANDY ART STUDIO

CLIENT
SAJ ARCHITECTURE LLC

SHEET TITLE
PRE-DEVELOPED STORMWATER MAP

SANDY OR

NO.	REVIEWED BY: --- DATE	REVISION	DATE: --- BY	CK

EXHIBIT

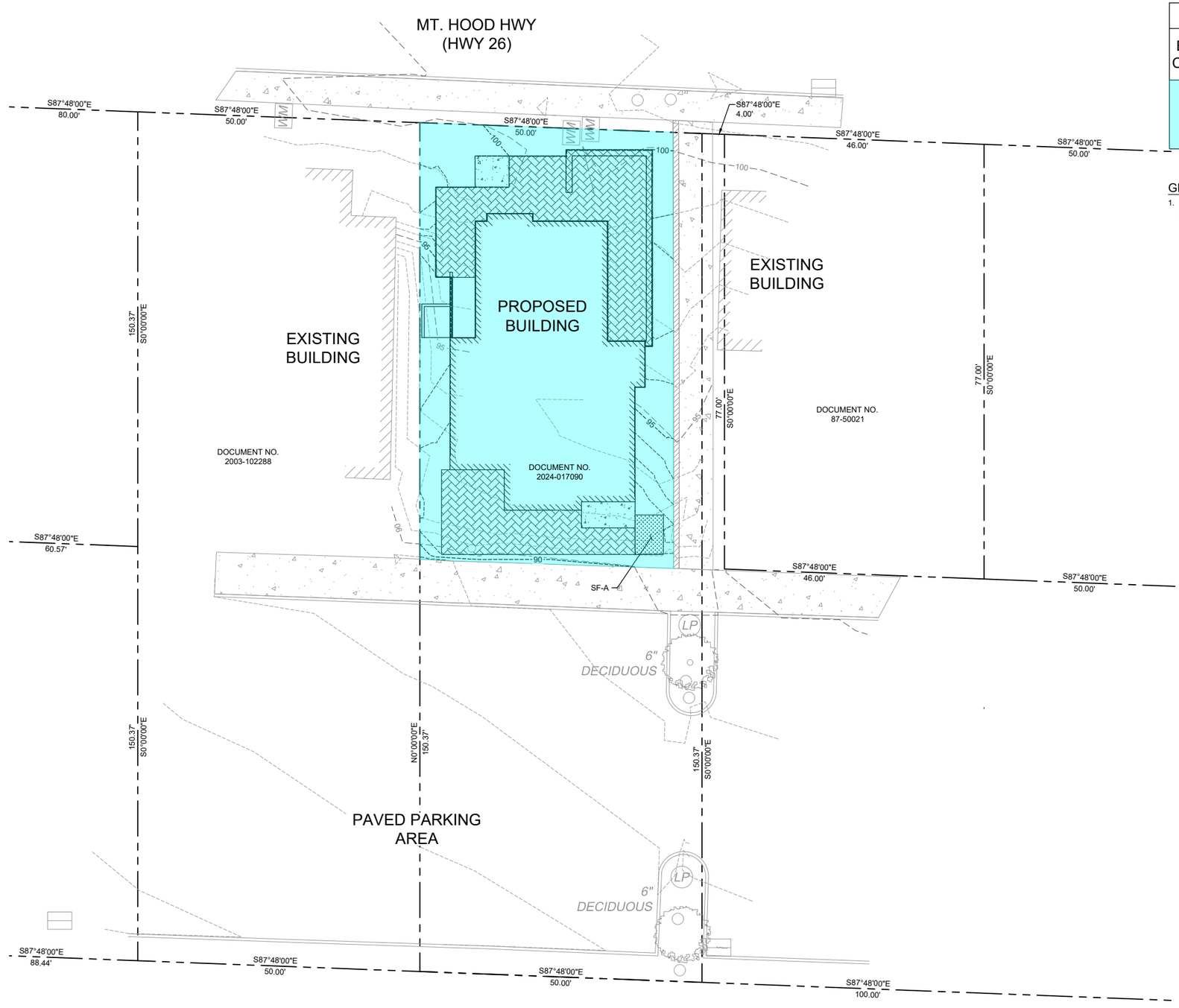
CHECKED BY: SRJ
DESIGNED BY: ERTH
DRAWN BY: ERTH

FIRST SUBMITTAL DATE: 01/27/25

PROJECT NO.
SAJA00000001

SHEET NO.
BM-01

Plot Date: 1/30/2025 5:59 PM
Save Date: 1/30/2025 5:59 PM
By: Eric Thomas
By: ERTH
File: \\deainc.com\files\PROJECTS\SAJA\00000011600\INFO\06?0\Reports-\Stormwater\05 Exhibits\Storm_Exhibit.dwg



POST-DEVELOPED AREAS				
BASIN COLOR	AREA (SF)	CN	POST-DEVELOPED DESCRIPTION	RECEIVING STORMWATER FACILITY ID
	2,518	98	ROOF, HSG C	SF-A
	952	79	50-75% GRASS, HSG C	

GENERAL NOTES

1. BASIN AREA SHOWN INCLUDES AREAS WITHIN THE PROJECT DISTURBANCE LIMITS FROM WHICH SURFACE RUNOFF WILL BE CAPTURED AND TREATED PRIOR TO BEING DISCHARGED INTO THE PUBLIC STORM SYSTEM

N

SCALE
20 0 10 20 40
(FEET)
1 INCH = 20 FT.

DAVID EVANS AND ASSOCIATES INC.
2100 S River Pkwy,
Portland OR, 97201
Phone: 503.223.6663

PROJECT
SANDY ART STUDIO

CLIENT
SAJ ARCHITECTURE LLC

SHEET TITLE
POST-DEVELOPED STORMWATER MAP

OR
SANDY

DATE: ---- BY: CK

NO.	DATE	REVISION
1	REVIEWED BY: ---	

EXHIBIT

CHECKED BY: SRJ
DESIGNED BY: ERTH
DRAWN BY: ERTH

FIRST SUBMITTAL DATE: 01/27/25

PROJECT NO.
SAJA00000001

SHEET NO.
BM-02

Plot Date: 1/30/2025 5:59 PM
Save Date: 1/30/2025 5:59 PM
By: Eric Thomas
By: Erth
File: \\deainc.com\files\PROJECTS\SAJA\00000011600\INFO\06?0\Reports-\Stormwater\05 Exhibits\Storm_Exhibit.dwg

APPENDIX 2. NATURAL RESOURCES CONSERVATION SERVICE (NRCS) SOIL SURVEY

- Soil Map and Description
- Hydrologic Soil Group

Clackamas County Area, Oregon

15B—Cazadero silty clay loam, 0 to 7 percent slopes

Map Unit Setting

National map unit symbol: 223c
Elevation: 300 to 900 feet
Mean annual precipitation: 48 to 85 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Cazadero and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cazadero

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old mixed alluvium

Typical profile

H1 - 0 to 21 inches: silty clay loam
H2 - 21 to 75 inches: clay

Properties and qualities

Slope: 0 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F003XC003OR - Glaciated Middle Cascades Mesic Udic Forest Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)

Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Minor Components

Borges

Percent of map unit: 2 percent
Landform: Hillslopes, depressions on terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 21, Aug 30, 2024

APPENDIX 3. STORMWATER HYDROGRAPHS

- Water Quality-Calculation Results
- Flow Control & Detention-Calculation Results

Environmental Services
working for clean rivers

PHONE: 503-823-7740
FAX: 503-823-6995

1120 SW 5th Ave, Suite 613, Portland, OR 97204
More Contact Info

Stormwater Presumptive Approach Calculator

Project Details

View Details

Project Name
Sandy Art Studio

Permit No

Catchment Details

View Details

Catchment ID
3388

Name
Rain Garden

Impervious Area
2518 sq ft

Hierarchy Level
2C

Hierarchy Description
Base requirement for all other discharge points

Facility Details

Category

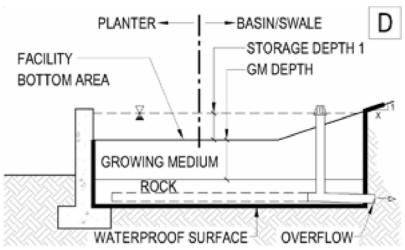
Planter (Flat)

Location

Parcel

Configuration

D: Lined Facility with RS and Ud



ABOVE GRADE STORAGE DATA

Bottom Area

35

sq ft

Bottom Width

5.00

ft

Overflow Height

18.0

in

Total Depth of Blended Soil plus Rock

16

in

Surface Storage Capacity at Overflow

52.50

cf

Design Infiltration Rate to Soil Underlying the Facility

0.000

cfs

Design Infiltration Rate for Blended Soil

0.005

cfs

BELOW GRADE STORAGE DATA

Use Standard Rock Values

Rock Area

5.25

sq ft

Rock Width

3.00

ft

Rock Storage Depth

10.0

in

Rock Porosity

0.3

Underdrain Height

4

in

Catchment is too small for flow control

☐

Orifice (Y/N)?

Yes

Orifice Diameter

⅜

in

Save Catchment and Facility | Check Results | Cancel

RESULTS

Pollution Reduction

Pass

Overflow Volume
0.00 cf

Surface Capacity Used
64.51 %

Flow Control Results

Fail

	STORMWATER FACILITY OUTFLOW (CFS)		PRE-DEVELOPMENT RUNOFF (CFS)
2 year	0.0265	≤	0.0033
5 year	0.0391	≤	0.0073
10 year	0.0472	≤	0.0120

	Overflow		Underdrain Outflow		Infiltration	
	Peak Rate (cfs)	Total Volume (cu ft)	Peak Rate (cfs)	Total Volume (cu ft)	Peak Rate (cfs)	Total Volume (cu ft)
PR	0	0	0.005	232.4	0	0
2-Year	0.022	50.5	0.005	339.7	0	0
5-Year	0.034	114	0.005	378	0	0
10-Year	0.042	188.8	0.005	405.8	0	0

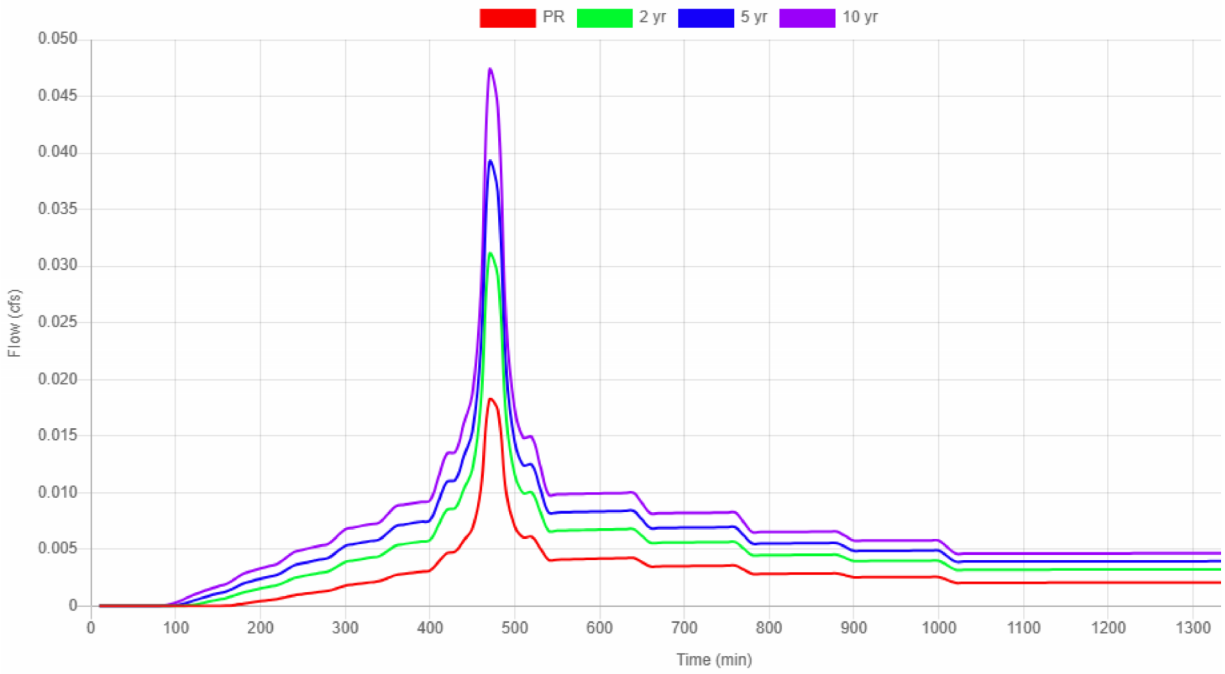
FACILITY FACTS

Total Facility Area (excluding freeboard)
35.00 sf

Sizing Ratio (Total Facility Area / Catchment Area)
1.39 %

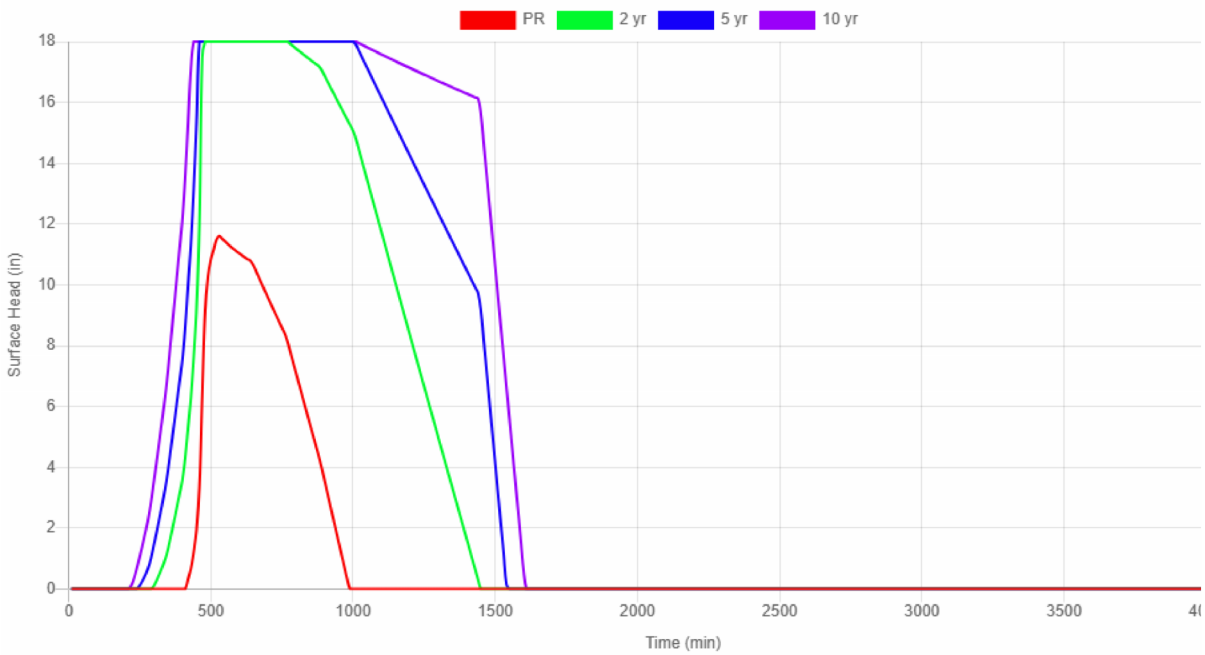
OUTPUT HYDROGRAPHS

Post-Development Runoff

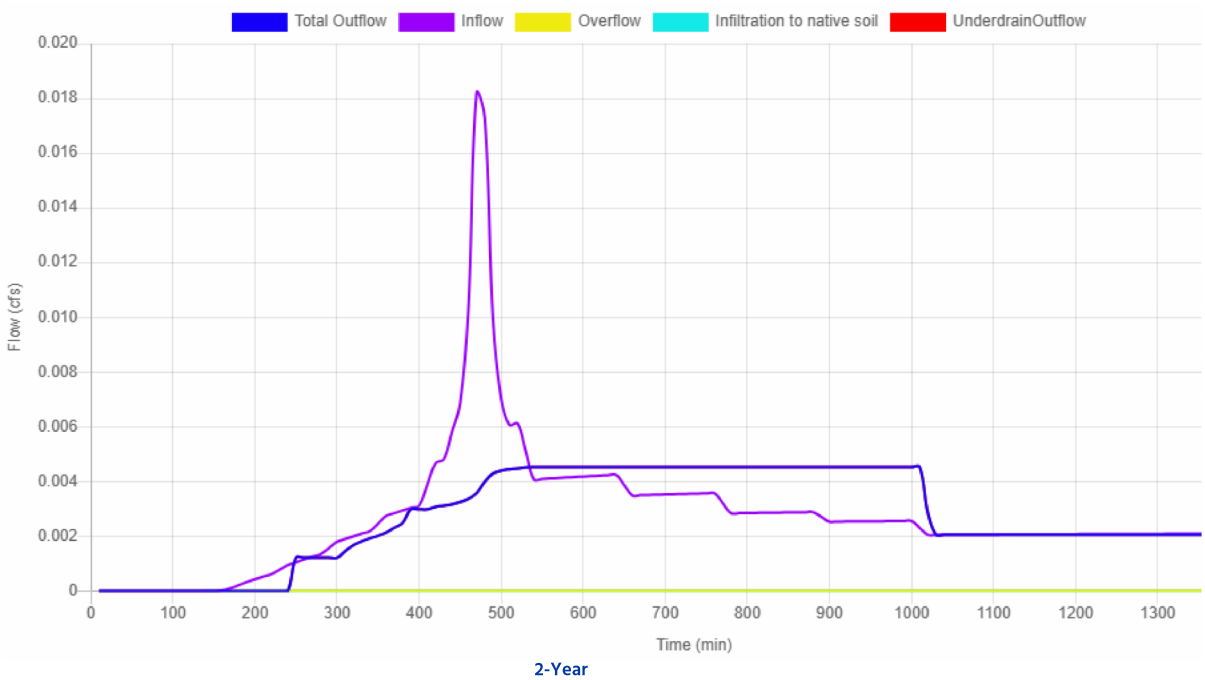


	Pre-Development Rate and Volume		Post-Development Rate and Volume	
	Peak Rate (cfs)	**Total Volume (cu ft)**	**Peak Rate (cfs)**	**Total Volume (cu ft)**
PR	0.0008	34.8	0.0182	233.9
2-Year	0.0033	107.9	0.031	391.7
5-Year	0.0073	167.1	0.0391	493.5
10-Year	0.012	233.5	0.0472	596.1

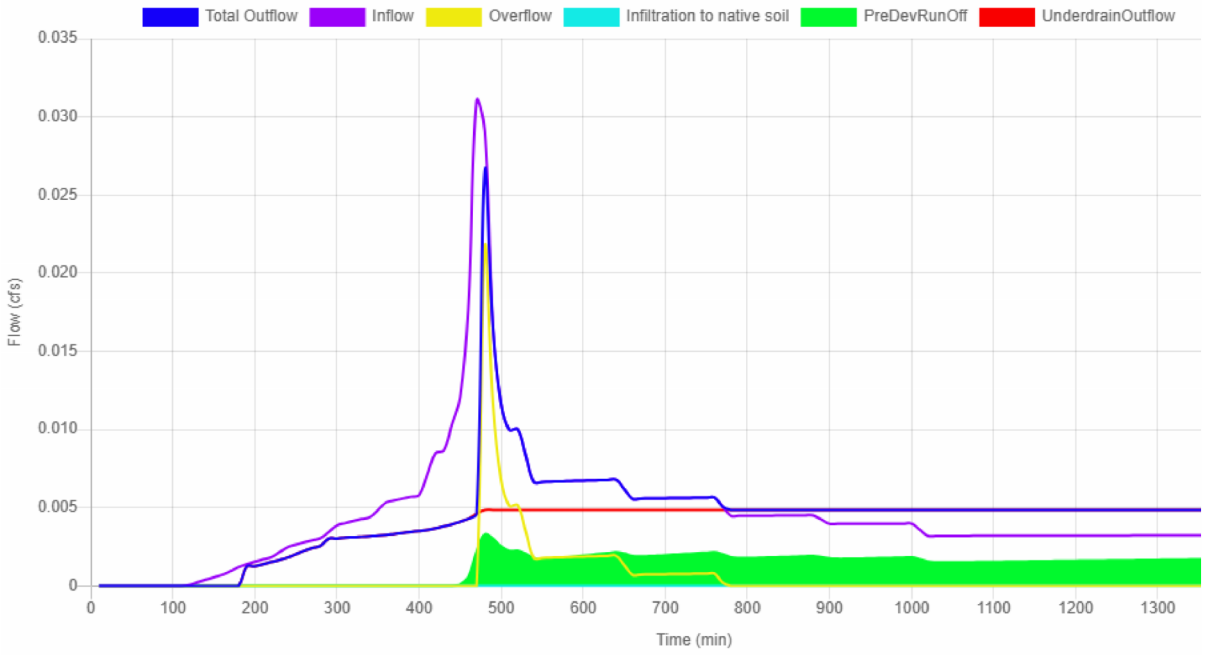
Surface Head



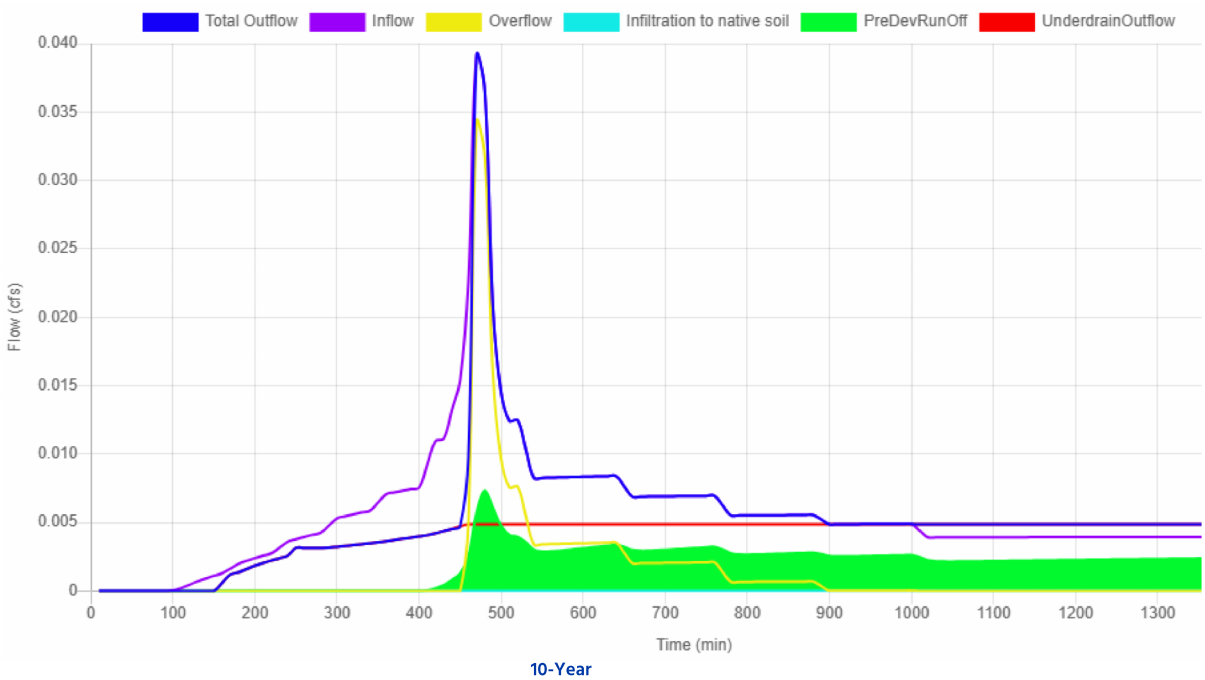
Water Quality


Total Outflow
Inflow
Overflow
Infiltration to native soil
UnderdrainOutflow
Flow (cfs)
Time (min)

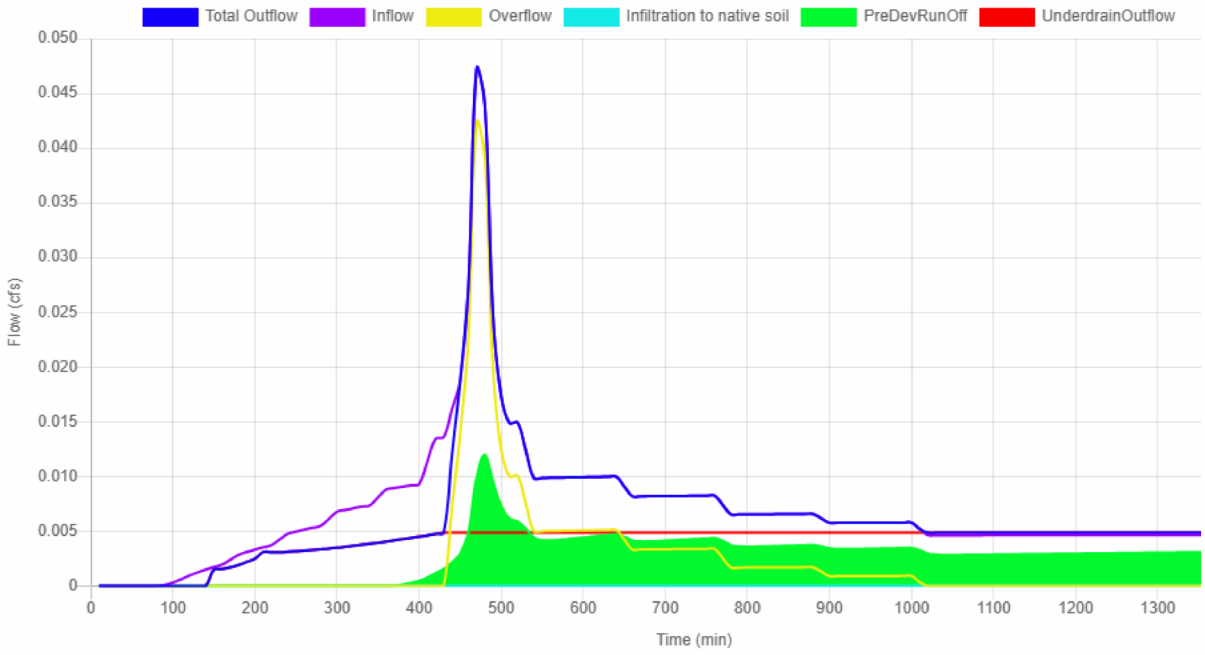
2-Year


Total Outflow
Inflow
Overflow
Infiltration to native soil
PreDevRunOff
UnderdrainOutflow
Flow (cfs)
Time (min)

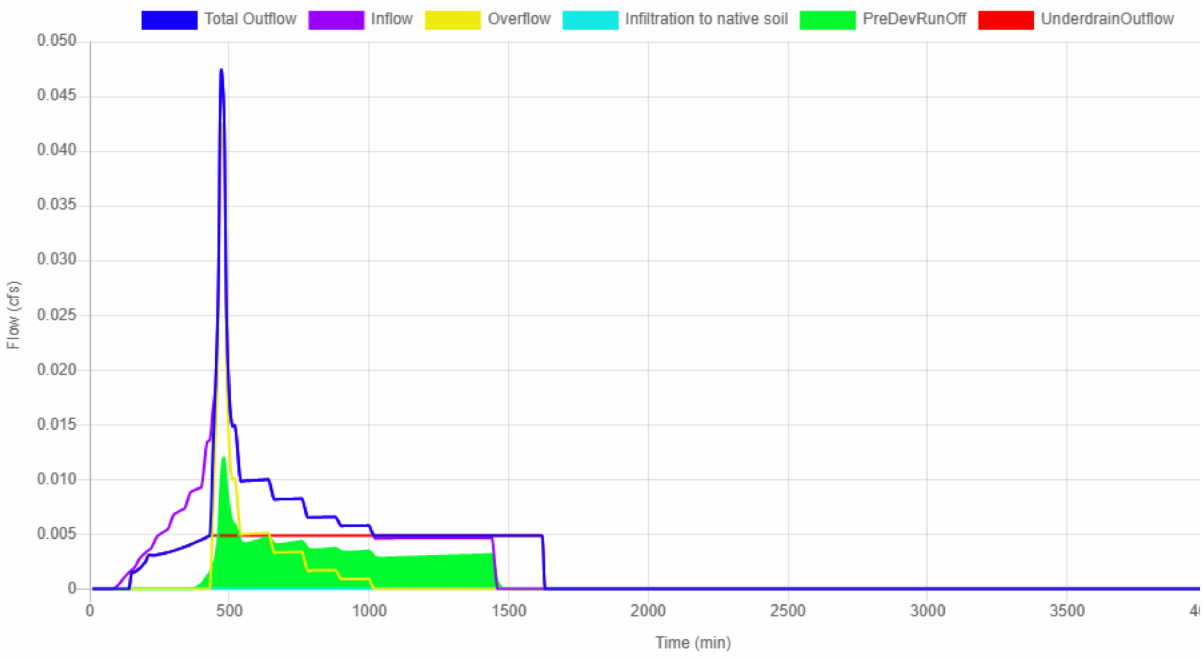
5-Year



10-Year



10-Year



Save Catchment and Facility | Cancel

↑ Scroll to Top

City of Portland

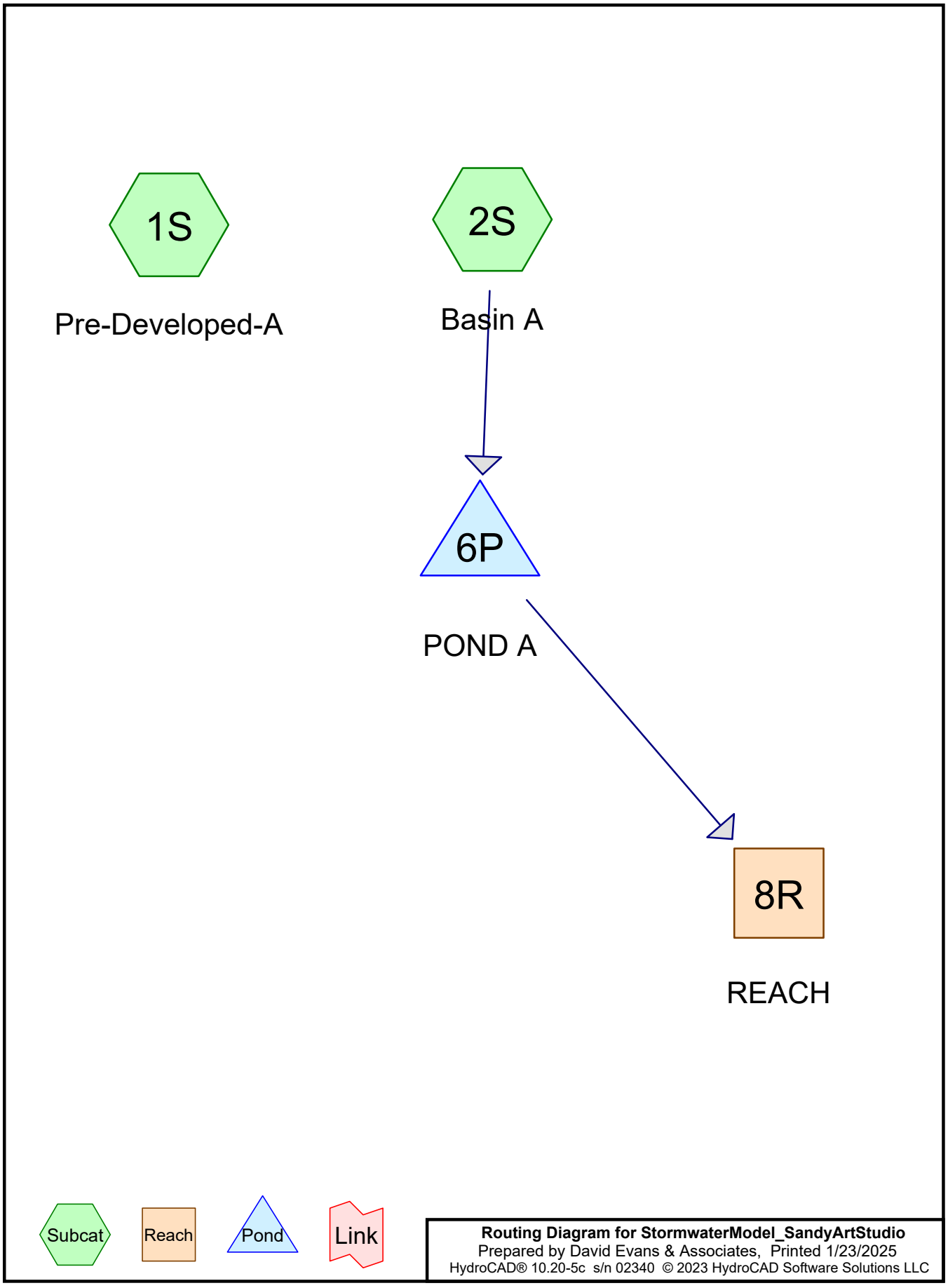
Community
Business
Visitors
Government
Investor Information

Site Menu

Environmental Services Home
What We Do
Customer Services
Programs
Library

Access

Subscribe
Website Feedback
View Text-Only
Request ADA Accommodation
Captioning / Transcription Policy



Routing Diagram for StormwaterModel_SandyArtStudio
Prepared by David Evans & Associates, Printed 1/23/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 YR	Type IA 24-hr		Default	24.00	1	3.50	2
2	5 YR	Type IA 24-hr		Default	24.00	1	4.50	2
3	10 YR	Type IA 24-hr		Default	24.00	1	4.80	2
4	25 YR	Type IA 24-hr		Default	24.00	1	5.50	2
5	WQ	Type IA 24-hr		Default	24.00	1	1.61	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.022	79	50-75% Grass cover, Fair, HSG C (2S)
0.058	98	Paved parking, HSG A (2S)
0.080	73	Woods, Fair, HSG C (1S)
0.159	**83**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.058	HSG A	2S
0.000	HSG B	
0.102	HSG C	1S, 2S
0.000	HSG D	
0.000	Other	
0.159		**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	0.000	0.022	0.000	0.000	0.022	50-75% Grass cover, Fair	2S
0.058	0.000	0.000	0.000	0.000	0.058	Paved parking	2S
0.000	0.000	0.080	0.000	0.000	0.080	Woods, Fair	1S
0.058	**0.000**	**0.102**	**0.000**	**0.000**	**0.159**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	8R	100.00	99.90	1.0	0.1000	0.010	0.0	10.0	0.0	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Developed-A Runoff Area=3,470 sf 0.00% Impervious Runoff Depth>0.97"
Tc=10.0 min CN=73/0 Runoff=0.02 cfs 0.006 af

Subcatchment2S: Basin A Runoff Area=3,470 sf 72.56% Impervious Runoff Depth>2.26"
Tc=5.0 min CN=79/98 Runoff=0.05 cfs 0.015 af

Reach 8R: REACH Avg. Flow Depth=0.03' Max Vel=3.51 fps Inflow=0.02 cfs 0.015 af
10.0" Round Pipe n=0.010 L=1.0' S=0.1000 '/' Capacity=9.01 cfs Outflow=0.02 cfs 0.015 af

Pond 6P: POND A Peak Elev=101.16' Storage=105 cf Inflow=0.05 cfs 0.015 af
Outflow=0.02 cfs 0.015 af

Total Runoff Area = 0.159 ac Runoff Volume = 0.021 af Average Runoff Depth = 1.62"
63.72% Pervious = 0.102 ac 36.28% Impervious = 0.058 ac

Summary for Subcatchment 1S: Pre-Developed-A

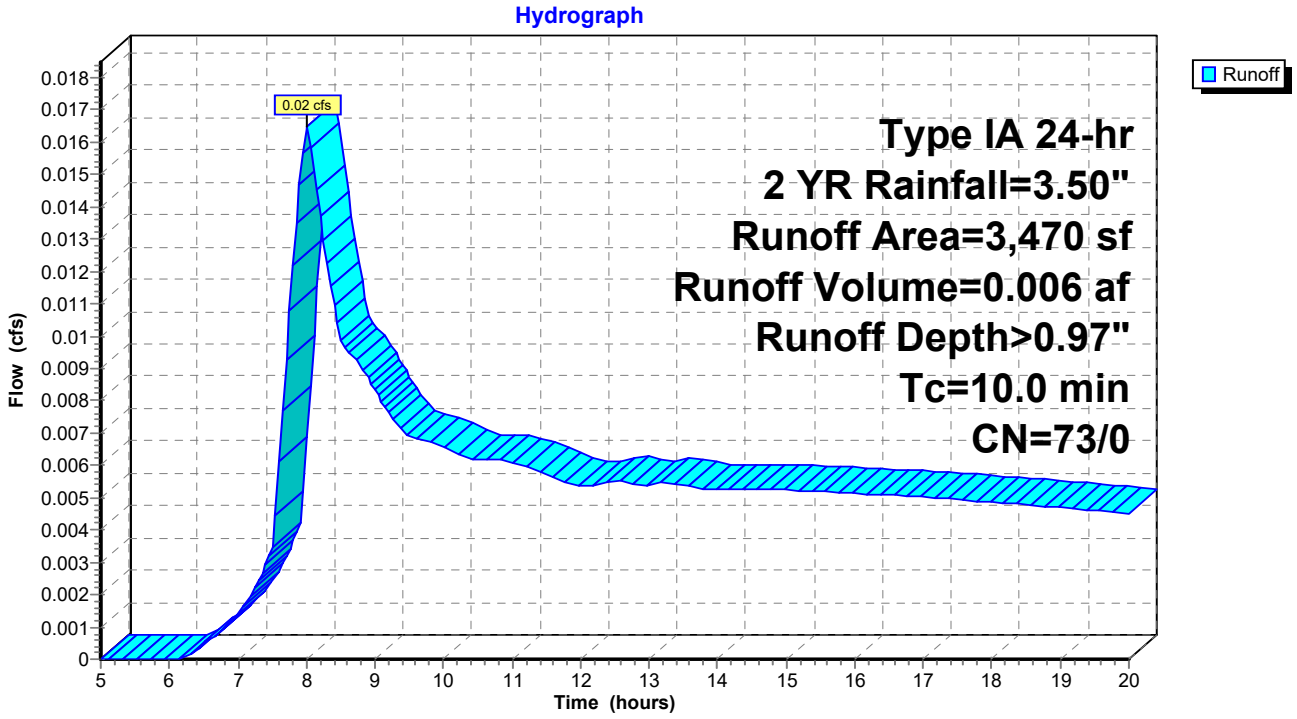
Runoff = 0.02 cfs @ 8.02 hrs, Volume= 0.006 af, Depth> 0.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2 YR Rainfall=3.50"

Area (sf)	CN	Description
3,470	73	Woods, Fair, HSG C
3,470	73	100.00% Pervious Area

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

Subcatchment 1S: Pre-Developed-A



Summary for Subcatchment 2S: Basin A

[49] Hint: Tc<2dt may require smaller dt

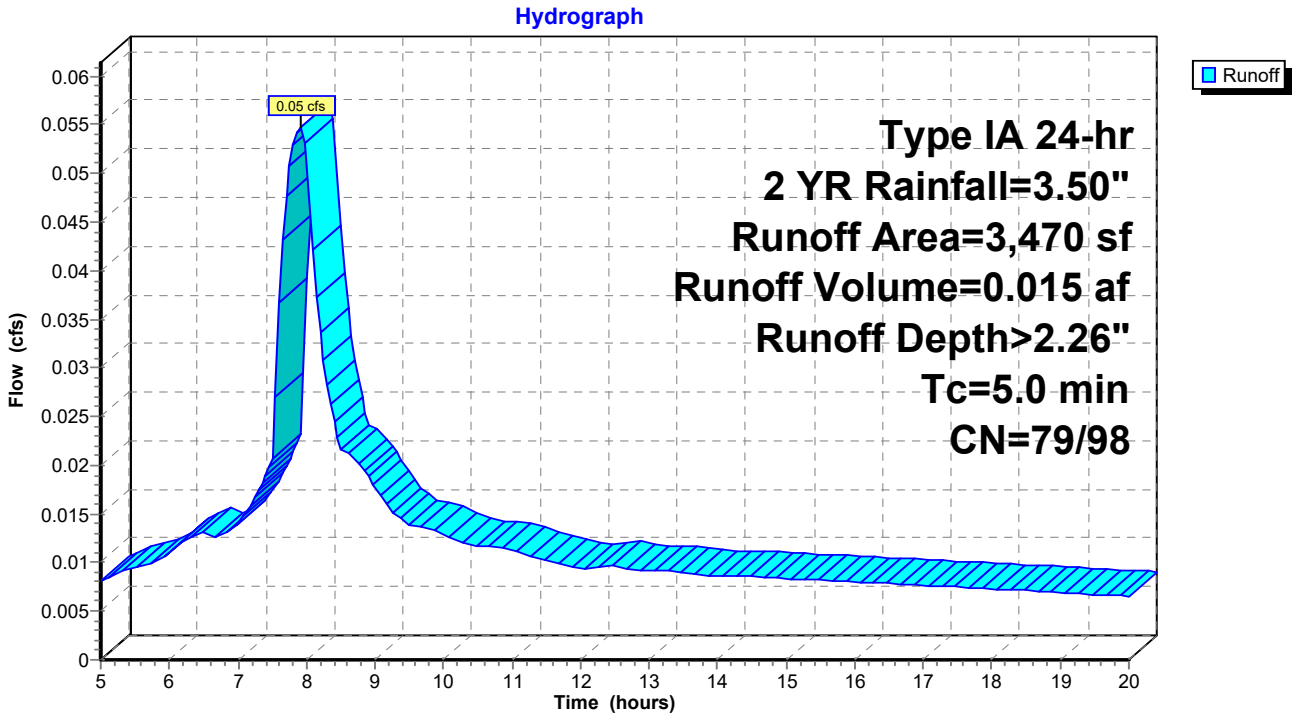
Runoff = 0.05 cfs @ 7.91 hrs, Volume= 0.015 af, Depth> 2.26"
Routed to Pond 6P : POND A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2 YR Rainfall=3.50"

Area (sf)	CN	Description
2,518	98	Paved parking, HSG A
952	79	50-75% Grass cover, Fair, HSG C
3,470	93	Weighted Average
952	79	27.44% Pervious Area
2,518	98	72.56% Impervious Area

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

Subcatchment 2S: Basin A



Summary for Reach 8R: REACH

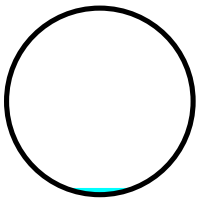
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=127)
[79] Warning: Submerged Pond 6P Primary device # 1 by 0.03'

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 2.23" for 2 YR event
Inflow = 0.02 cfs @ 8.46 hrs, Volume= 0.015 af
Outflow = 0.02 cfs @ 8.45 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

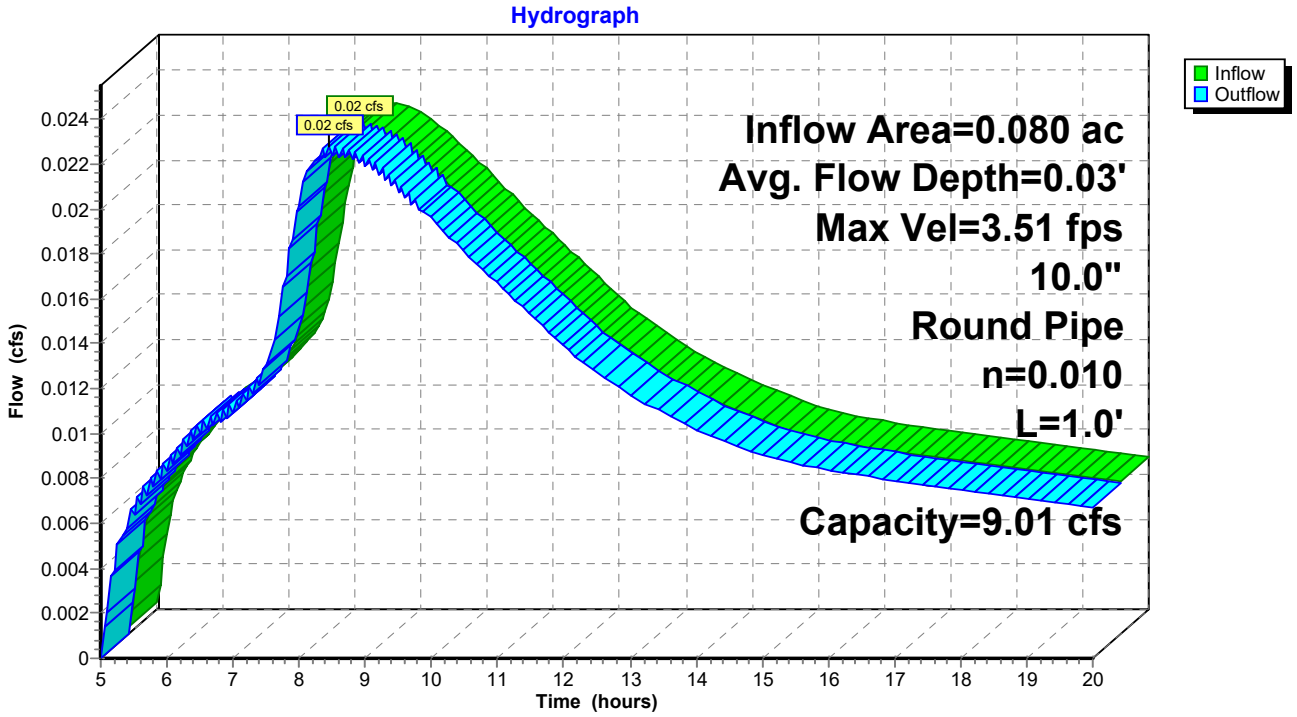
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.51 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.85 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 8.45 hrs
Average Depth at Peak Storage= 0.03' , Surface Width= 0.31'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 9.01 cfs

10.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 1.0' Slope= 0.1000 '/'
Inlet Invert= 100.00', Outlet Invert= 99.90'



Reach 8R: REACH



Summary for Pond 6P: POND A

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 2.26" for 2 YR event
Inflow = 0.05 cfs @ 7.91 hrs, Volume= 0.015 af
Outflow = 0.02 cfs @ 8.46 hrs, Volume= 0.015 af, Atten= 59%, Lag= 33.0 min
Primary = 0.02 cfs @ 8.46 hrs, Volume= 0.015 af
Routed to Reach 8R : REACH

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 101.16' @ 8.46 hrs Surf.Area= 166 sf Storage= 105 cf

Plug-Flow detention time= 47.3 min calculated for 0.015 af (98% of inflow)
Center-of-Mass det. time= 38.6 min (698.2 - 659.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	147 cf	**6.62'W x 25.11'L x 2.69'H Field A** 448 cf Overall - 80 cf Embedded = 368 cf x 40.0% Voids
#2A	100.25'	76 cf	**Ferguson R-Tank HD 1** x 18 Inside #1 Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf 18 Chambers in 2 Rows
		223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**0.9" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	102.20'	**0.9" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.02 cfs @ 8.46 hrs HW=101.16' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.02 cfs @ 5.11 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 6P: POND A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 1 (Ferguson R-Tank HD)
Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf
Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf

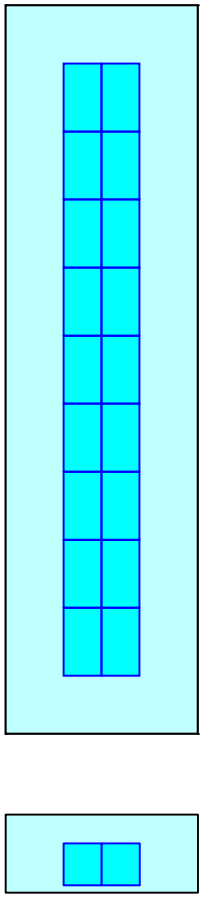
9 Chambers/Row x 2.35' Long = 21.11' Row Length +24.0" End Stone x 2 = 25.11' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
3.0" Stone Base + 17.3" Chamber Height + 12.0" Stone Cover = 2.69' Field Height

18 Chambers x 4.2 cf = 76.0 cf Chamber Storage
18 Chambers x 4.4 cf = 80.0 cf Displacement

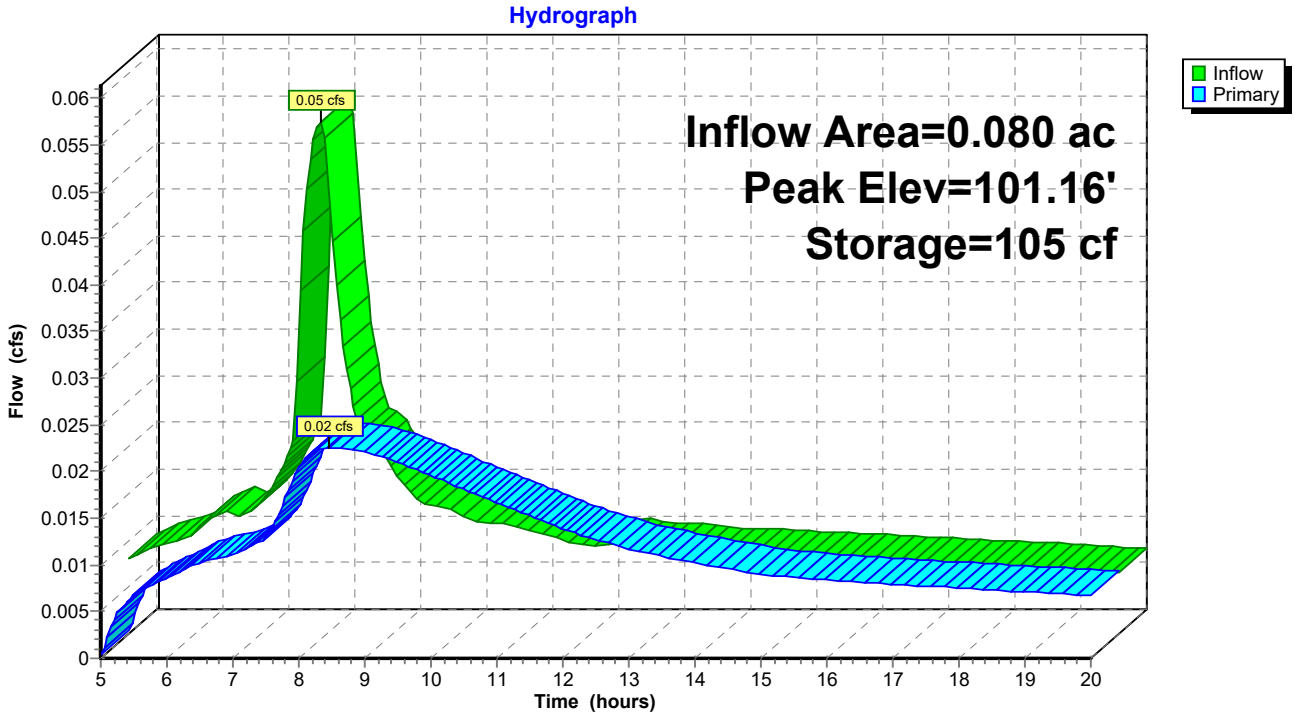
448.1 cf Field - 80.0 cf Chambers = 368.1 cf Stone x 40.0% Voids = 147.2 cf Stone Storage

Chamber Storage + Stone Storage = 223.2 cf = 0.005 af
Overall Storage Efficiency = 49.8%
Overall System Size = 25.11' x 6.62' x 2.69'

18 Chambers
16.6 cy Field
13.6 cy Stone



Pond 6P: POND A



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Developed-A Runoff Area=3,470 sf 0.00% Impervious Runoff Depth>1.59"
Tc=10.0 min CN=73/0 Runoff=0.03 cfs 0.011 af

Subcatchment2S: Basin A Runoff Area=3,470 sf 72.56% Impervious Runoff Depth>3.01"
Tc=5.0 min CN=79/98 Runoff=0.07 cfs 0.020 af

Reach 8R: REACH Avg. Flow Depth=0.03' Max Vel=3.72 fps Inflow=0.03 cfs 0.020 af
10.0" Round Pipe n=0.010 L=1.0' S=0.1000 '/' Capacity=9.01 cfs Outflow=0.03 cfs 0.020 af

Pond 6P: POND A Peak Elev=101.73' Storage=159 cf Inflow=0.07 cfs 0.020 af
Outflow=0.03 cfs 0.020 af

Total Runoff Area = 0.159 ac Runoff Volume = 0.031 af Average Runoff Depth = 2.30"
63.72% Pervious = 0.102 ac 36.28% Impervious = 0.058 ac

Summary for Subcatchment 1S: Pre-Developed-A

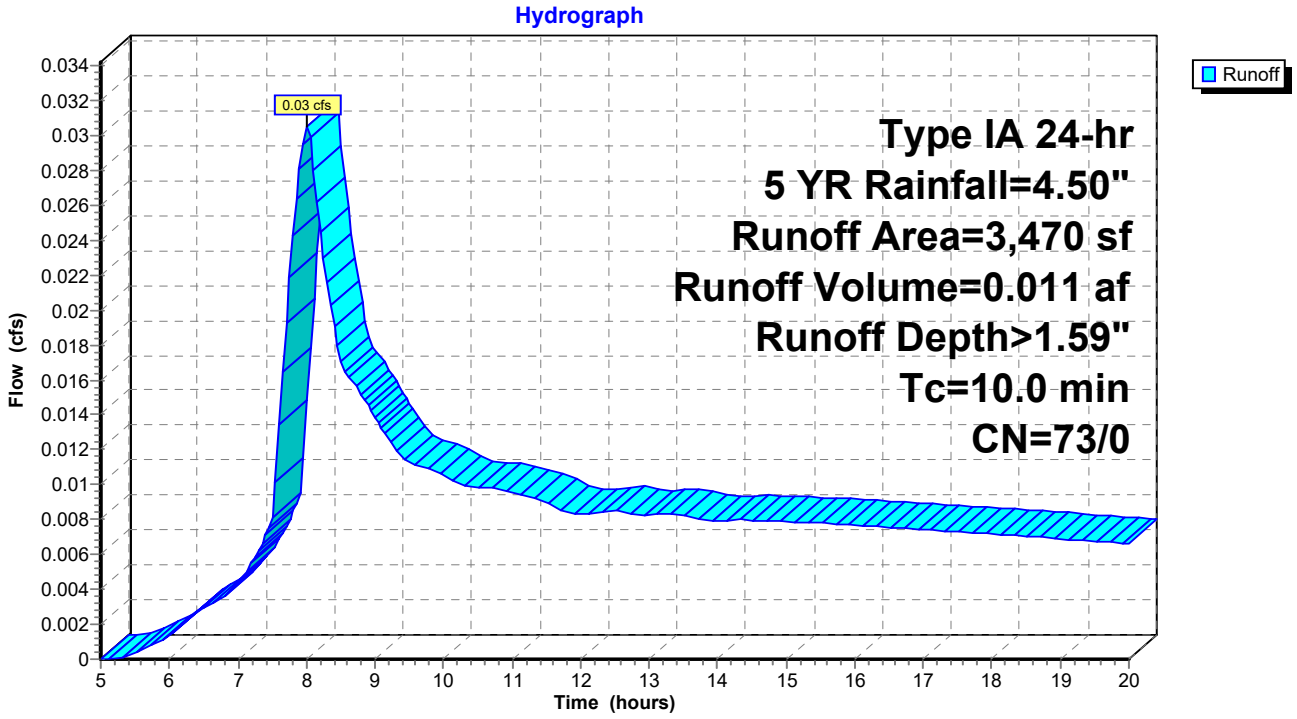
Runoff = 0.03 cfs @ 8.01 hrs, Volume= 0.011 af, Depth> 1.59"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5 YR Rainfall=4.50"

Area (sf)	CN	Description
3,470	73	Woods, Fair, HSG C
3,470	73	100.00% Pervious Area

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

Subcatchment 1S: Pre-Developed-A



Summary for Subcatchment 2S: Basin A

[49] Hint: Tc<2dt may require smaller dt

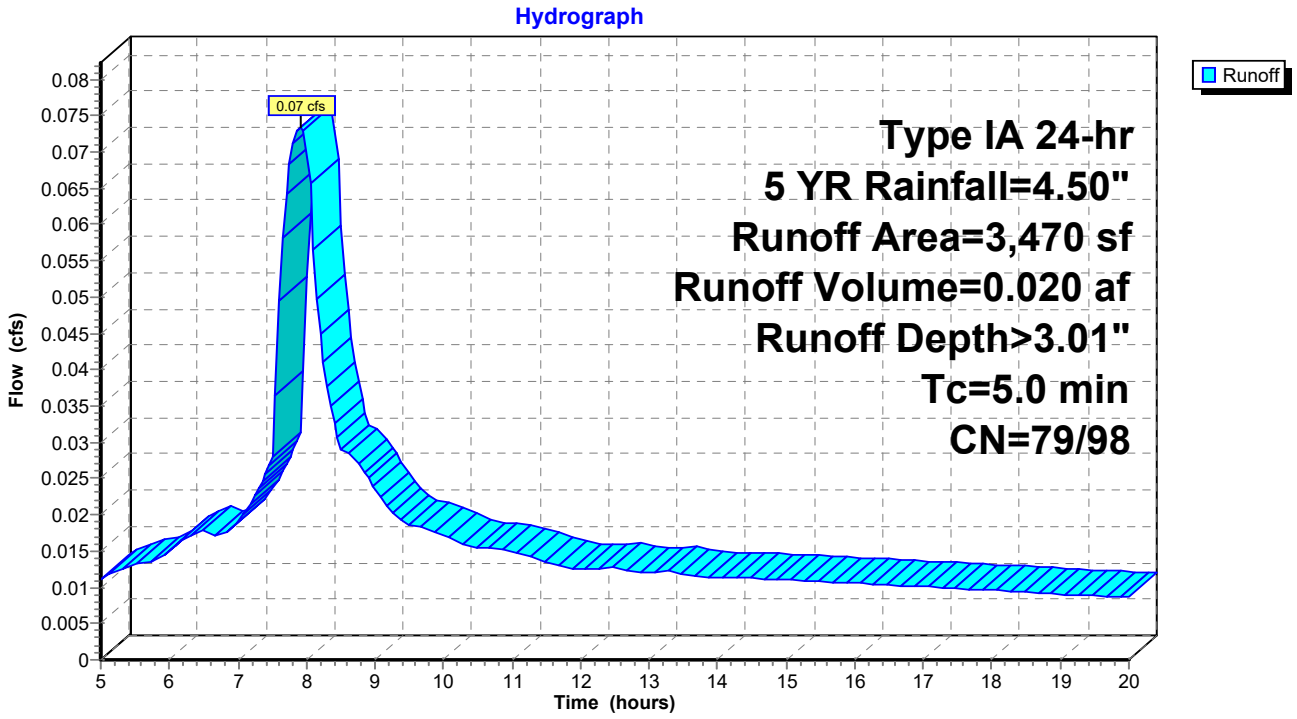
Runoff = 0.07 cfs @ 7.91 hrs, Volume= 0.020 af, Depth> 3.01"
Routed to Pond 6P : POND A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5 YR Rainfall=4.50"

Area (sf)	CN	Description
2,518	98	Paved parking, HSG A
952	79	50-75% Grass cover, Fair, HSG C
3,470	93	Weighted Average
952	79	27.44% Pervious Area
2,518	98	72.56% Impervious Area

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

Subcatchment 2S: Basin A



Summary for Reach 8R: REACH

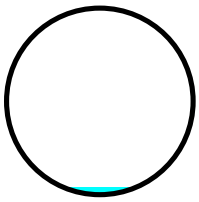
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=139)
[79] Warning: Submerged Pond 6P Primary device # 1 by 0.03'

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 2.96" for 5 YR event
Inflow = 0.03 cfs @ 8.72 hrs, Volume= 0.020 af
Outflow = 0.03 cfs @ 8.75 hrs, Volume= 0.020 af, Atten= 0%, Lag= 1.9 min

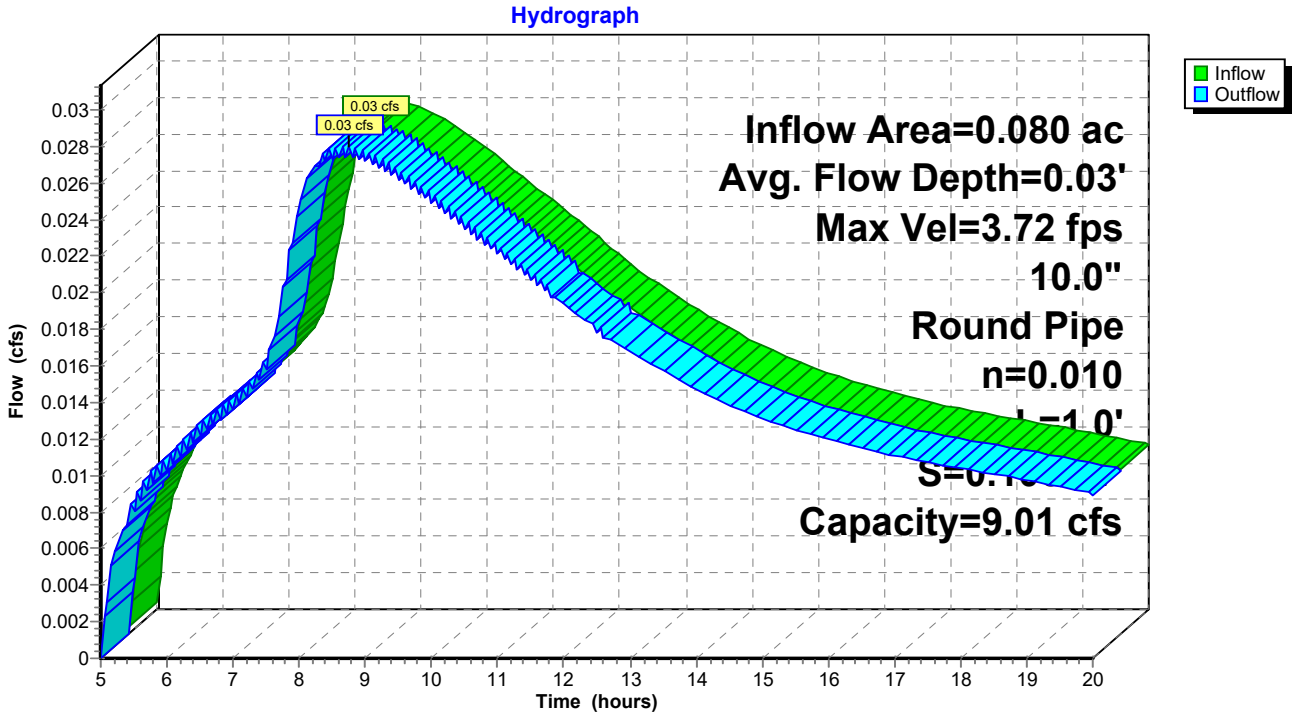
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.72 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.10 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 8.75 hrs
Average Depth at Peak Storage= 0.03' , Surface Width= 0.33'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 9.01 cfs

10.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 1.0' Slope= 0.1000 '/'
Inlet Invert= 100.00', Outlet Invert= 99.90'



Reach 8R: REACH



Summary for Pond 6P: POND A

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 3.01" for 5 YR event
Inflow = 0.07 cfs @ 7.91 hrs, Volume= 0.020 af
Outflow = 0.03 cfs @ 8.72 hrs, Volume= 0.020 af, Atten= 62%, Lag= 48.4 min
Primary = 0.03 cfs @ 8.72 hrs, Volume= 0.020 af
Routed to Reach 8R : REACH

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 101.73' @ 8.72 hrs Surf.Area= 166 sf Storage= 159 cf

Plug-Flow detention time= 62.1 min calculated for 0.020 af (98% of inflow)
Center-of-Mass det. time= 51.9 min (708.9 - 656.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	147 cf	**6.62'W x 25.11'L x 2.69'H Field A** 448 cf Overall - 80 cf Embedded = 368 cf x 40.0% Voids
#2A	100.25'	76 cf	**Ferguson R-Tank HD 1** x 18 Inside #1 Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf 18 Chambers in 2 Rows
		223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices		
#1	Primary	100.00'	**0.9" Vert. Orifice/Grate**	C= 0.600	Limited to weir flow at low heads
#2	Primary	102.20'	**0.9" Vert. Orifice/Grate**	C= 0.600	Limited to weir flow at low heads

Primary OutFlow Max=0.03 cfs @ 8.72 hrs HW=101.73' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.03 cfs @ 6.27 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 6P: POND A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 1 (Ferguson R-Tank HD)
Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf
Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf

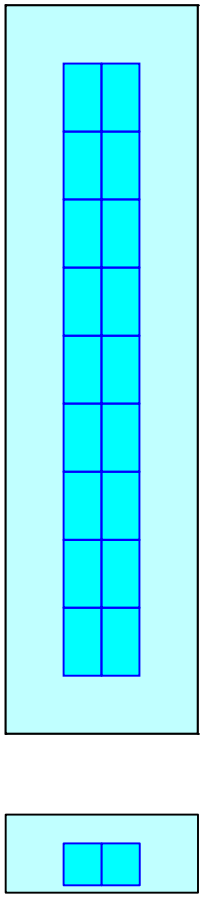
9 Chambers/Row x 2.35' Long = 21.11' Row Length +24.0" End Stone x 2 = 25.11' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
3.0" Stone Base + 17.3" Chamber Height + 12.0" Stone Cover = 2.69' Field Height

18 Chambers x 4.2 cf = 76.0 cf Chamber Storage
18 Chambers x 4.4 cf = 80.0 cf Displacement

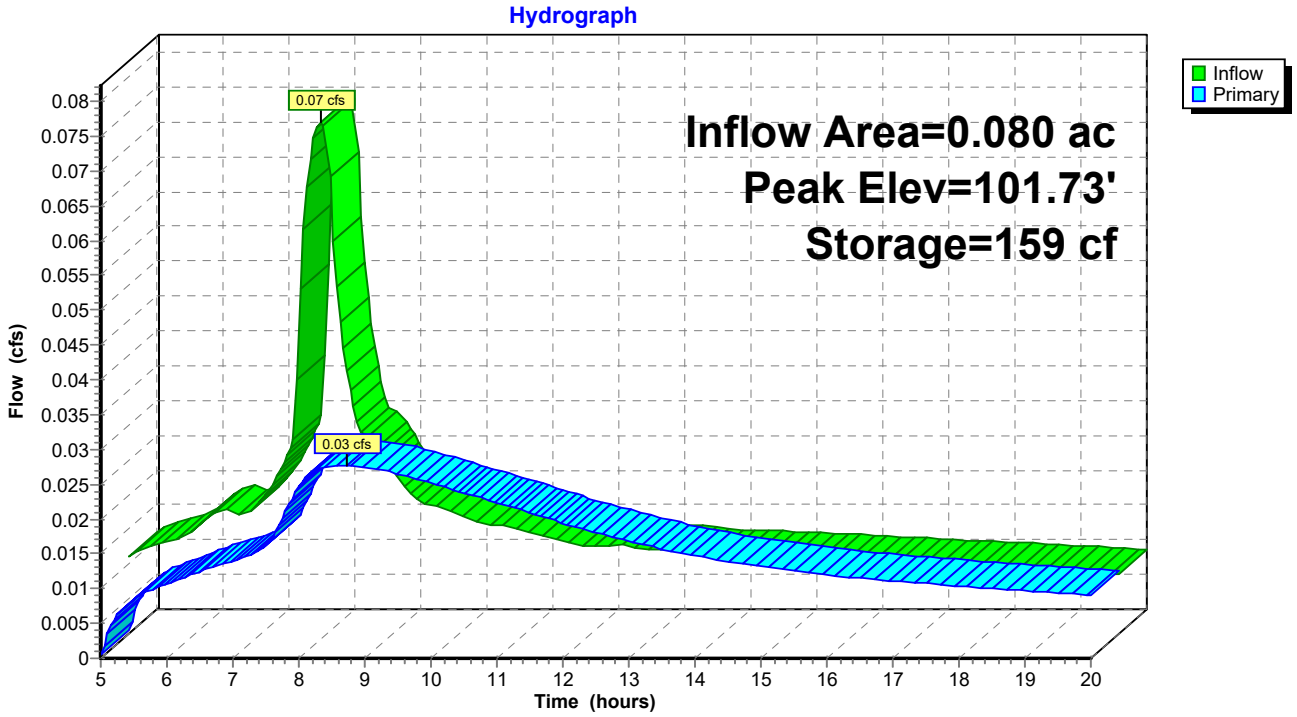
448.1 cf Field - 80.0 cf Chambers = 368.1 cf Stone x 40.0% Voids = 147.2 cf Stone Storage

Chamber Storage + Stone Storage = 223.2 cf = 0.005 af
Overall Storage Efficiency = 49.8%
Overall System Size = 25.11' x 6.62' x 2.69'

18 Chambers
16.6 cy Field
13.6 cy Stone



Pond 6P: POND A



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Developed-A Runoff Area=3,470 sf 0.00% Impervious Runoff Depth>1.79"
Tc=10.0 min CN=73/0 Runoff=0.04 cfs 0.012 af

Subcatchment2S: Basin A Runoff Area=3,470 sf 72.56% Impervious Runoff Depth>3.24"
Tc=5.0 min CN=79/98 Runoff=0.08 cfs 0.022 af

Reach 8R: REACH Avg. Flow Depth=0.03' Max Vel=3.81 fps Inflow=0.03 cfs 0.021 af
10.0" Round Pipe n=0.010 L=1.0' S=0.1000 '/' Capacity=9.01 cfs Outflow=0.03 cfs 0.021 af

Pond 6P: POND A Peak Elev=101.98' Storage=176 cf Inflow=0.08 cfs 0.022 af
Outflow=0.03 cfs 0.021 af

Total Runoff Area = 0.159 ac Runoff Volume = 0.033 af Average Runoff Depth = 2.52"
63.72% Pervious = 0.102 ac 36.28% Impervious = 0.058 ac

Summary for Subcatchment 1S: Pre-Developed-A

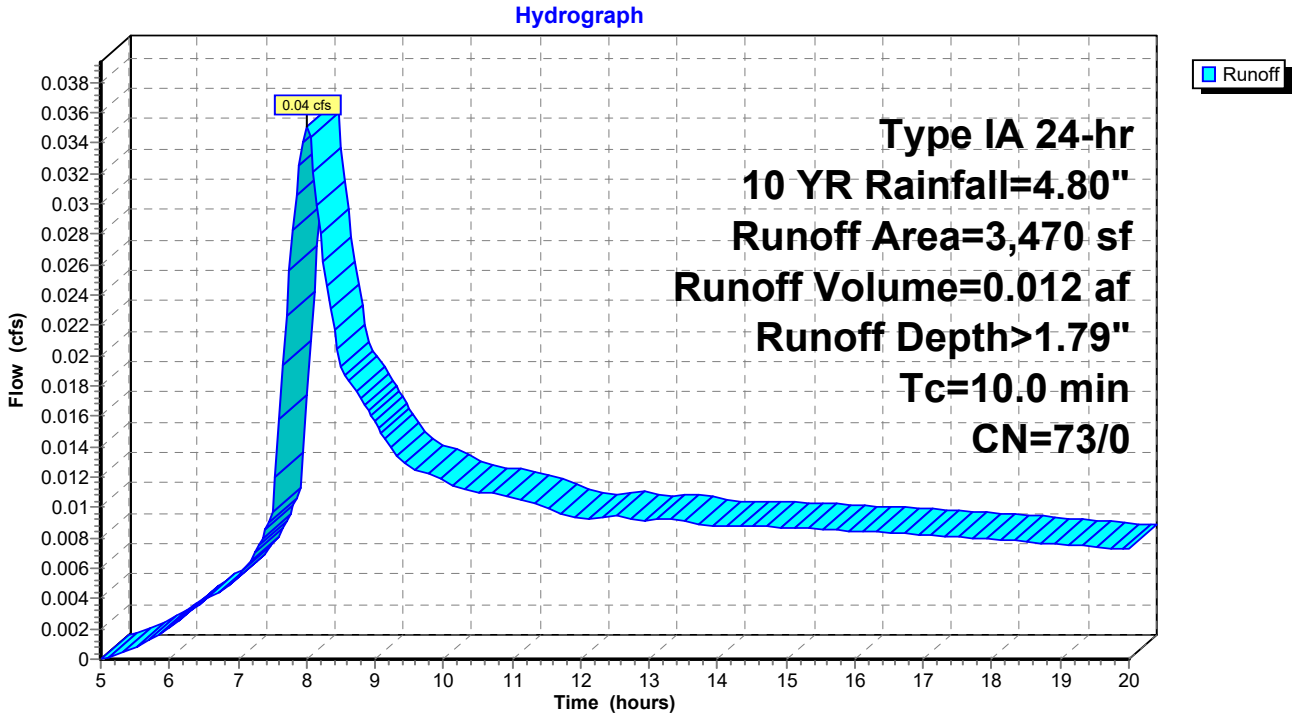
Runoff = 0.04 cfs @ 8.00 hrs, Volume= 0.012 af, Depth> 1.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 YR Rainfall=4.80"

Area (sf)	CN	Description
3,470	73	Woods, Fair, HSG C
3,470	73	100.00% Pervious Area

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

Subcatchment 1S: Pre-Developed-A



Summary for Subcatchment 2S: Basin A

[49] Hint: Tc<2dt may require smaller dt

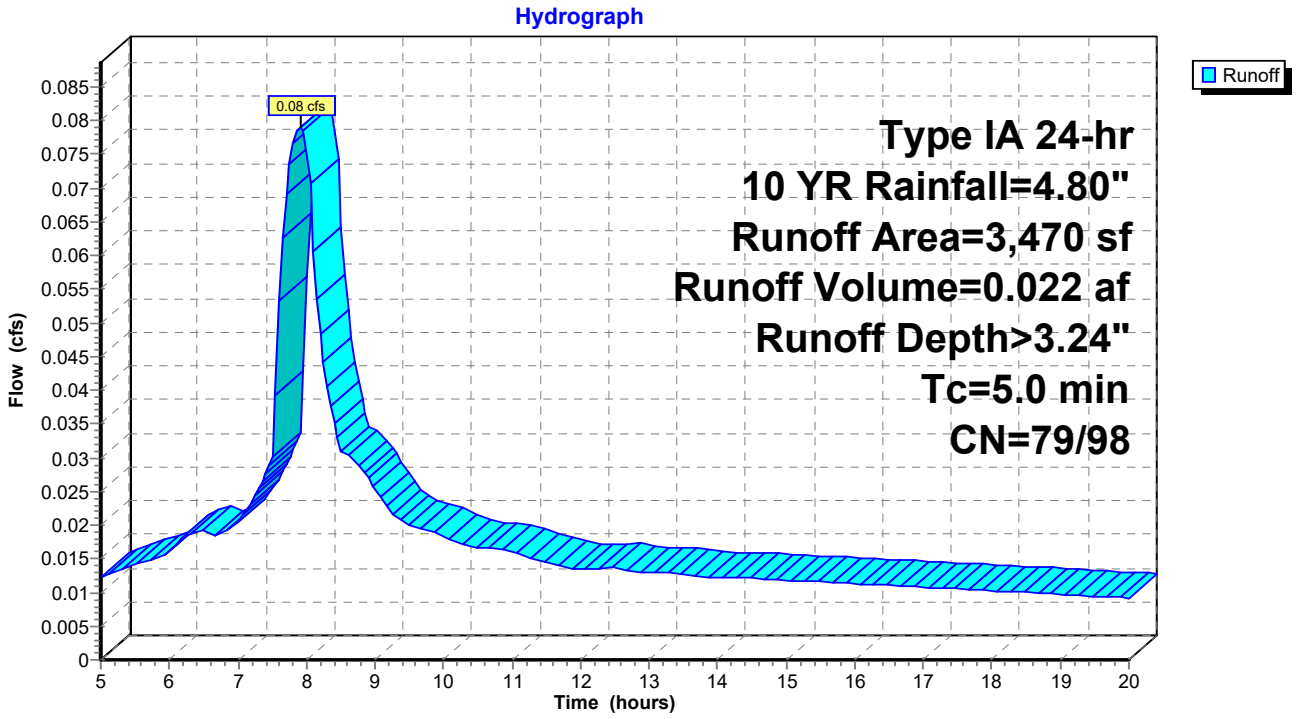
Runoff = 0.08 cfs @ 7.91 hrs, Volume= 0.022 af, Depth> 3.24"
Routed to Pond 6P : POND A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 YR Rainfall=4.80"

Area (sf)	CN	Description
2,518	98	Paved parking, HSG A
952	79	50-75% Grass cover, Fair, HSG C
3,470	93	Weighted Average
952	79	27.44% Pervious Area
2,518	98	72.56% Impervious Area

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

Subcatchment 2S: Basin A



Summary for Reach 8R: REACH

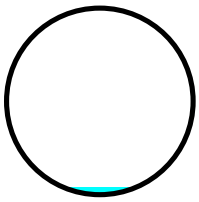
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=138)
[79] Warning: Submerged Pond 6P Primary device # 1 by 0.03'

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 3.18" for 10 YR event
Inflow = 0.03 cfs @ 8.73 hrs, Volume= 0.021 af
Outflow = 0.03 cfs @ 8.75 hrs, Volume= 0.021 af, Atten= 0%, Lag= 1.3 min

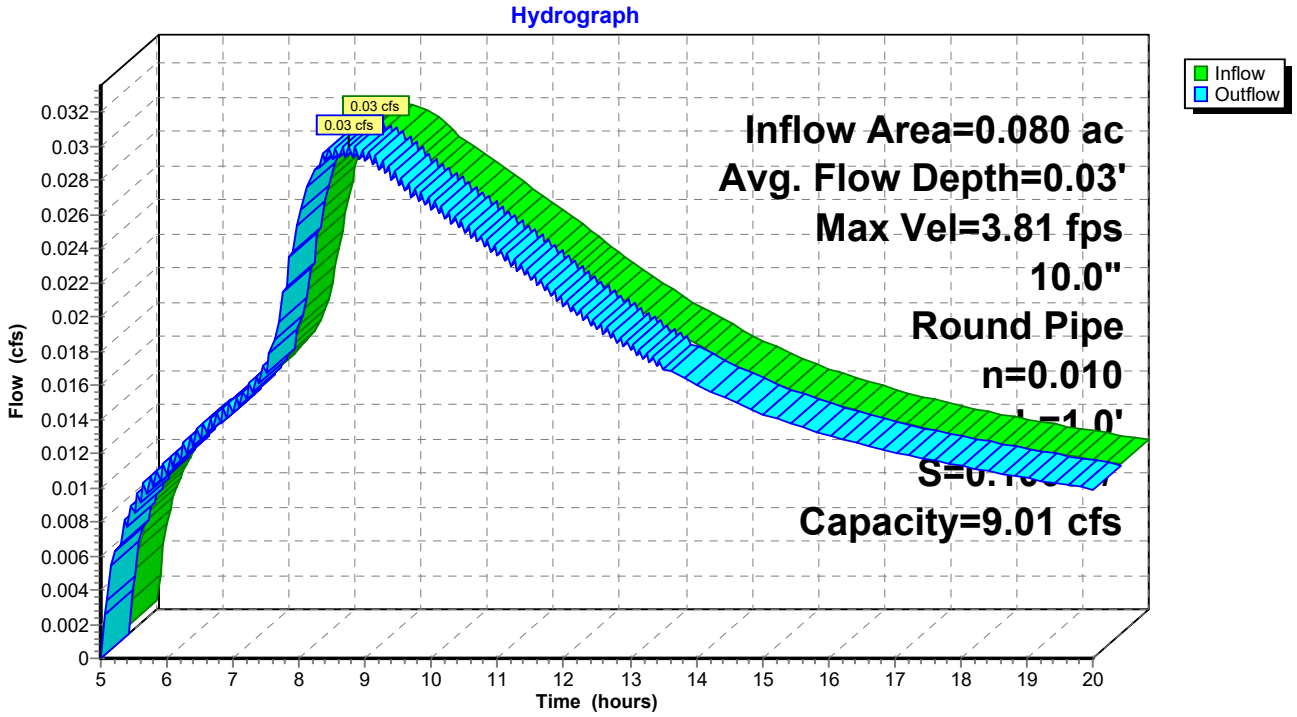
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.81 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.17 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 8.75 hrs
Average Depth at Peak Storage= 0.03' , Surface Width= 0.33'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 9.01 cfs

10.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 1.0' Slope= 0.1000 '/'
Inlet Invert= 100.00', Outlet Invert= 99.90'



Reach 8R: REACH



Summary for Pond 6P: POND A

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 3.24" for 10 YR event
Inflow = 0.08 cfs @ 7.91 hrs, Volume= 0.022 af
Outflow = 0.03 cfs @ 8.73 hrs, Volume= 0.021 af, Atten= 63%, Lag= 49.0 min
Primary = 0.03 cfs @ 8.73 hrs, Volume= 0.021 af
Routed to Reach 8R : REACH

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 101.98' @ 8.73 hrs Surf.Area= 166 sf Storage= 176 cf

Plug-Flow detention time= 66.1 min calculated for 0.021 af (98% of inflow)
Center-of-Mass det. time= 55.1 min (711.5 - 656.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	147 cf	**6.62'W x 25.11'L x 2.69'H Field A** 448 cf Overall - 80 cf Embedded = 368 cf x 40.0% Voids
#2A	100.25'	76 cf	**Ferguson R-Tank HD 1** x 18 Inside #1 Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf 18 Chambers in 2 Rows
		223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**0.9" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	102.20'	**0.9" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.03 cfs @ 8.73 hrs HW=101.98' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.03 cfs @ 6.72 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 6P: POND A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 1 (Ferguson R-Tank HD)
Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf
Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf

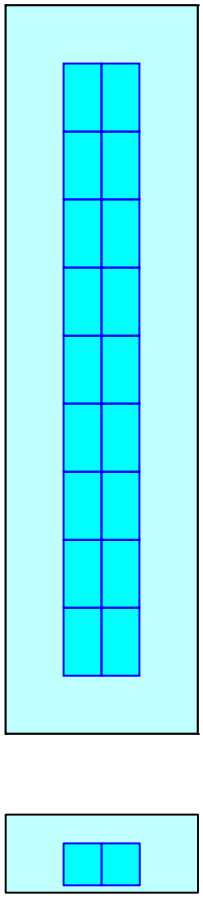
9 Chambers/Row x 2.35' Long = 21.11' Row Length +24.0" End Stone x 2 = 25.11' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
3.0" Stone Base + 17.3" Chamber Height + 12.0" Stone Cover = 2.69' Field Height

18 Chambers x 4.2 cf = 76.0 cf Chamber Storage
18 Chambers x 4.4 cf = 80.0 cf Displacement

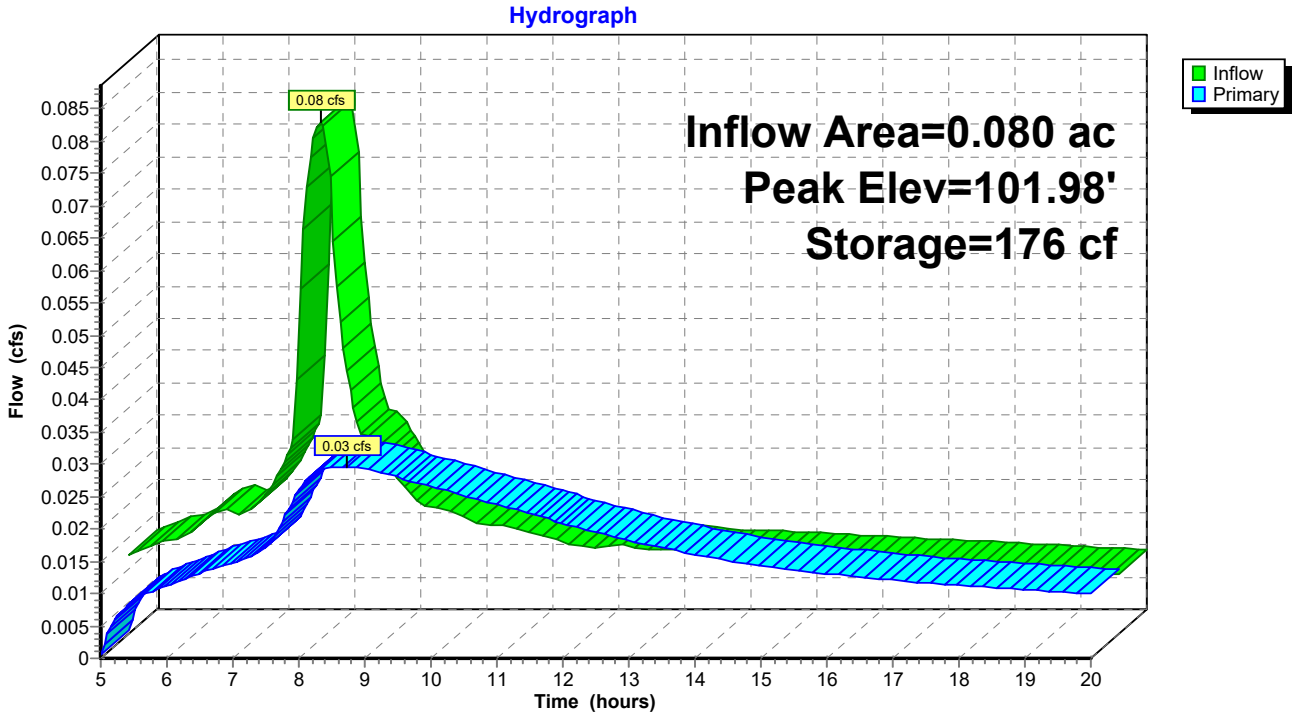
448.1 cf Field - 80.0 cf Chambers = 368.1 cf Stone x 40.0% Voids = 147.2 cf Stone Storage

Chamber Storage + Stone Storage = 223.2 cf = 0.005 af
Overall Storage Efficiency = 49.8%
Overall System Size = 25.11' x 6.62' x 2.69'

18 Chambers
16.6 cy Field
13.6 cy Stone



Pond 6P: POND A



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Developed-A Runoff Area=3,470 sf 0.00% Impervious Runoff Depth>2.28"
Tc=10.0 min CN=73/0 Runoff=0.05 cfs 0.015 af

Subcatchment2S: Basin A Runoff Area=3,470 sf 72.56% Impervious Runoff Depth>3.77"
Tc=5.0 min CN=79/98 Runoff=0.09 cfs 0.025 af

Reach 8R: REACH Avg. Flow Depth=0.04' Max Vel=4.22 fps Inflow=0.04 cfs 0.024 af
10.0" Round Pipe n=0.010 L=1.0' S=0.1000 '/' Capacity=9.01 cfs Outflow=0.04 cfs 0.024 af

Pond 6P: POND A Peak Elev=102.42' Storage=205 cf Inflow=0.09 cfs 0.025 af
Outflow=0.04 cfs 0.024 af

Total Runoff Area = 0.159 ac Runoff Volume = 0.040 af Average Runoff Depth = 3.02"
63.72% Pervious = 0.102 ac 36.28% Impervious = 0.058 ac

Summary for Subcatchment 1S: Pre-Developed-A

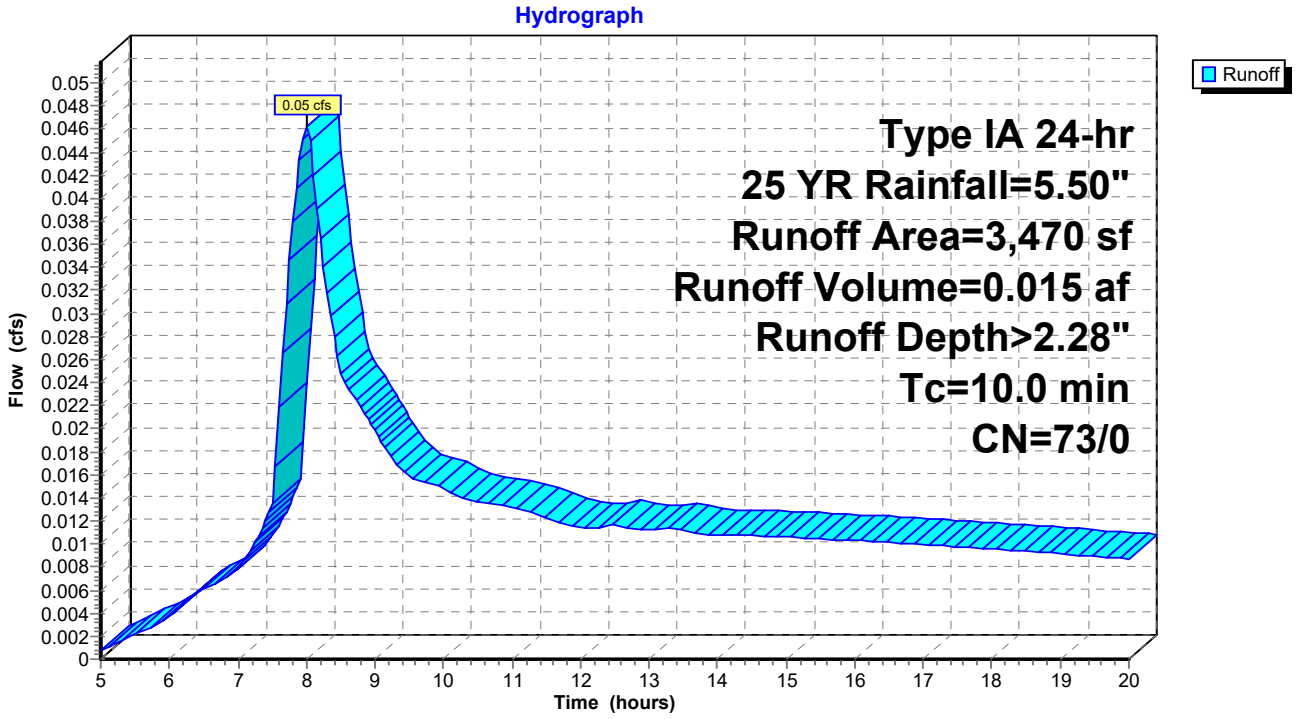
Runoff = 0.05 cfs @ 8.00 hrs, Volume= 0.015 af, Depth> 2.28"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 YR Rainfall=5.50"

Area (sf)	CN	Description
3,470	73	Woods, Fair, HSG C
3,470	73	100.00% Pervious Area

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

Subcatchment 1S: Pre-Developed-A



Summary for Subcatchment 2S: Basin A

[49] Hint: Tc<2dt may require smaller dt

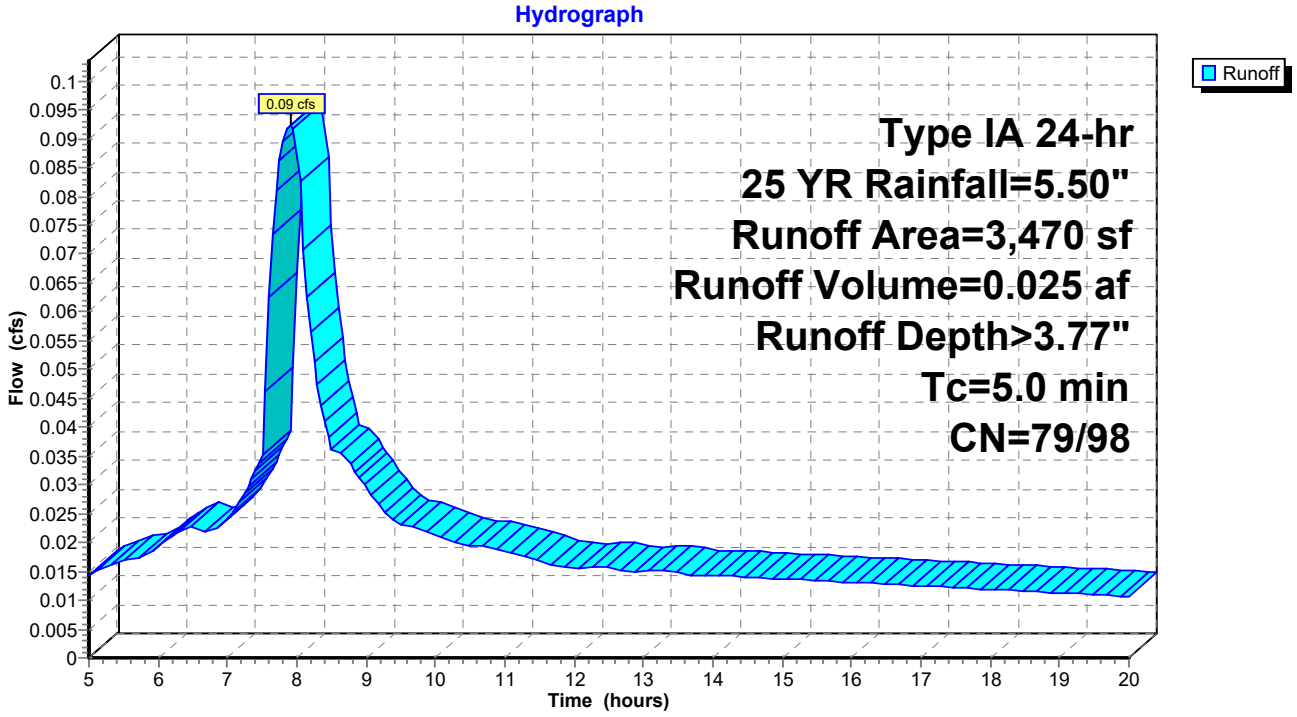
Runoff = 0.09 cfs @ 7.91 hrs, Volume= 0.025 af, Depth> 3.77"
Routed to Pond 6P : POND A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 YR Rainfall=5.50"

Area (sf)	CN	Description
2,518	98	Paved parking, HSG A
952	79	50-75% Grass cover, Fair, HSG C
3,470	93	Weighted Average
952	79	27.44% Pervious Area
2,518	98	72.56% Impervious Area

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

Subcatchment 2S: Basin A



Summary for Reach 8R: REACH

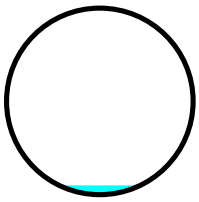
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=130)
[79] Warning: Submerged Pond 6P Primary device # 1 by 0.04'

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 3.69" for 25 YR event
Inflow = 0.04 cfs @ 8.38 hrs, Volume= 0.024 af
Outflow = 0.04 cfs @ 8.35 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

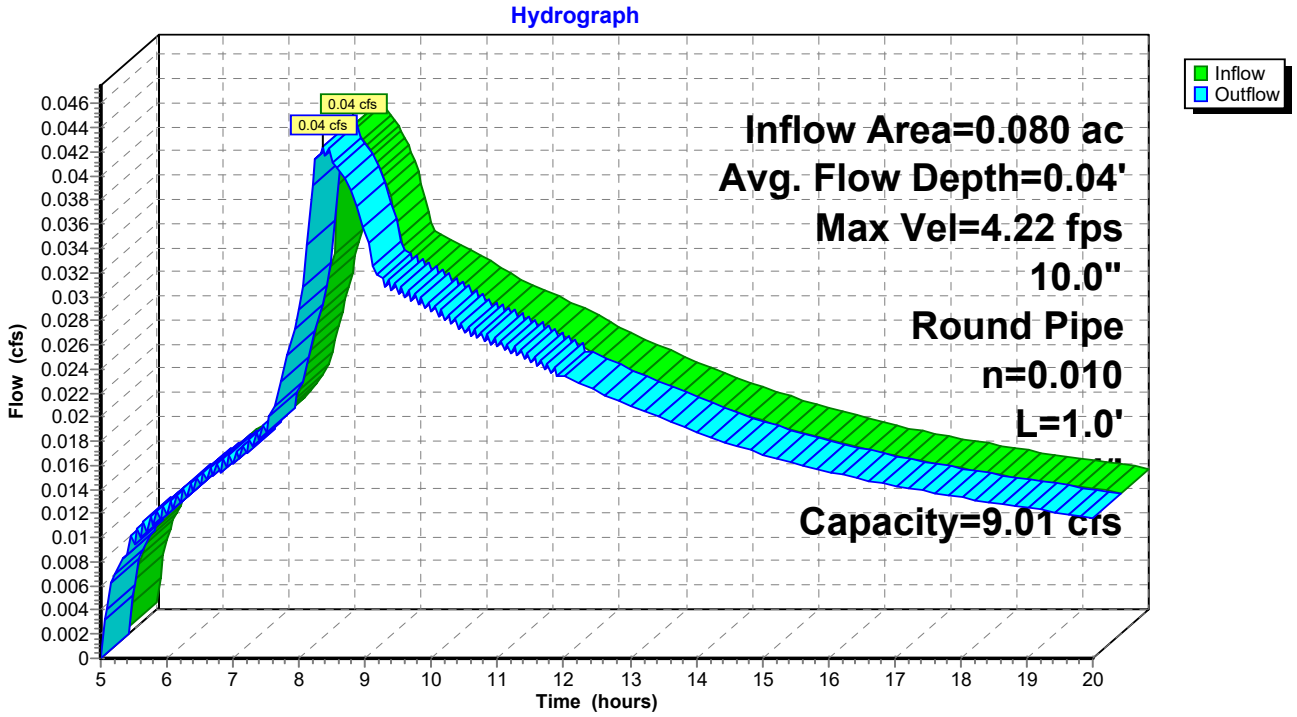
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.22 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 8.35 hrs
Average Depth at Peak Storage= 0.04' , Surface Width= 0.36'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 9.01 cfs

10.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 1.0' Slope= 0.1000 '/'
Inlet Invert= 100.00', Outlet Invert= 99.90'



Reach 8R: REACH



Summary for Pond 6P: POND A

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 3.77" for 25 YR event
Inflow = 0.09 cfs @ 7.91 hrs, Volume= 0.025 af
Outflow = 0.04 cfs @ 8.38 hrs, Volume= 0.024 af, Atten= 54%, Lag= 28.3 min
Primary = 0.04 cfs @ 8.38 hrs, Volume= 0.024 af
Routed to Reach 8R : REACH

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 102.42' @ 8.38 hrs Surf.Area= 166 sf Storage= 205 cf

Plug-Flow detention time= 71.4 min calculated for 0.024 af (97% of inflow)
Center-of-Mass det. time= 57.7 min (712.8 - 655.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	147 cf	**6.62'W x 25.11'L x 2.69'H Field A** 448 cf Overall - 80 cf Embedded = 368 cf x 40.0% Voids
#2A	100.25'	76 cf	**Ferguson R-Tank HD 1** x 18 Inside #1 Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf 18 Chambers in 2 Rows
		223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices		
#1	Primary	100.00'	**0.9" Vert. Orifice/Grate**	C= 0.600	Limited to weir flow at low heads
#2	Primary	102.20'	**0.9" Vert. Orifice/Grate**	C= 0.600	Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 8.38 hrs HW=102.42' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.03 cfs @ 7.44 fps)
2=Orifice/Grate (Orifice Controls 0.01 cfs @ 2.08 fps)

Pond 6P: POND A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 1 (Ferguson R-Tank HD)
Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf
Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf

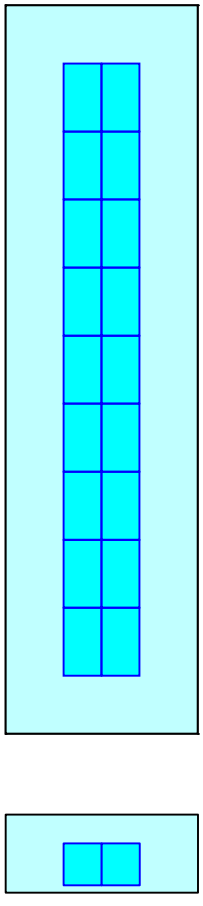
9 Chambers/Row x 2.35' Long = 21.11' Row Length +24.0" End Stone x 2 = 25.11' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
3.0" Stone Base + 17.3" Chamber Height + 12.0" Stone Cover = 2.69' Field Height

18 Chambers x 4.2 cf = 76.0 cf Chamber Storage
18 Chambers x 4.4 cf = 80.0 cf Displacement

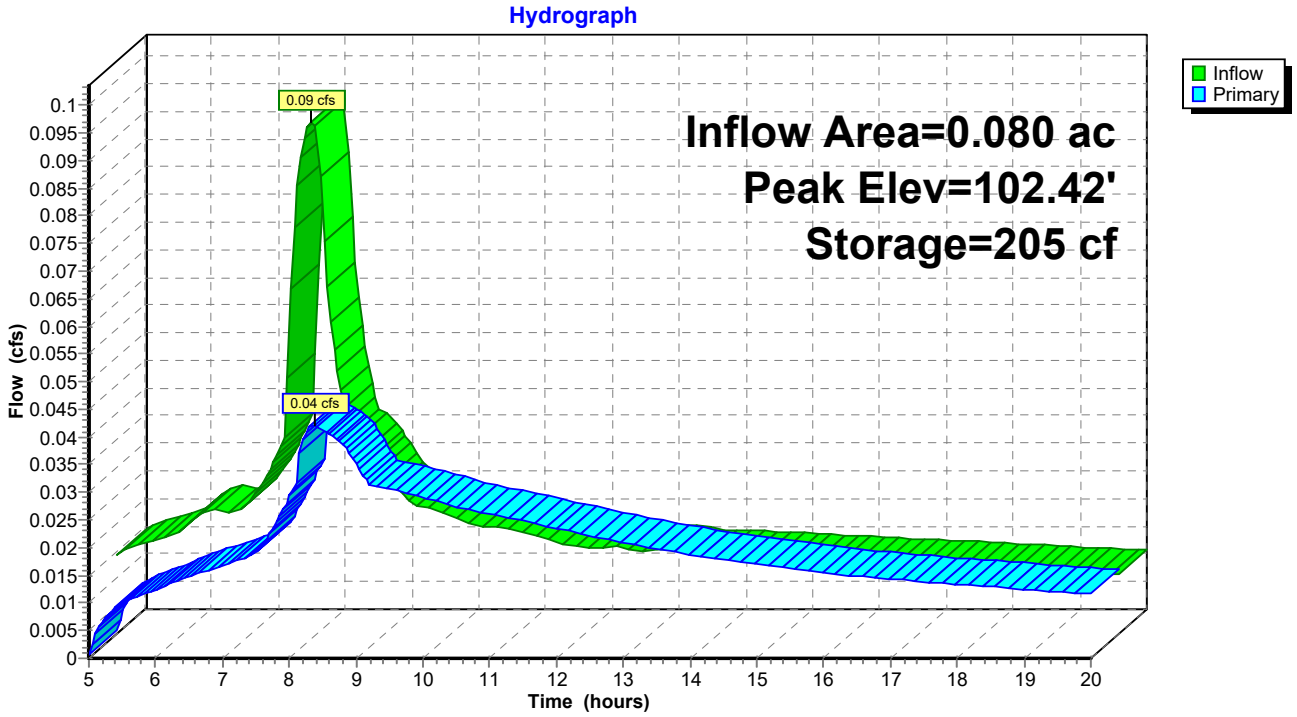
448.1 cf Field - 80.0 cf Chambers = 368.1 cf Stone x 40.0% Voids = 147.2 cf Stone Storage

Chamber Storage + Stone Storage = 223.2 cf = 0.005 af
Overall Storage Efficiency = 49.8%
Overall System Size = 25.11' x 6.62' x 2.69'

18 Chambers
16.6 cy Field
13.6 cy Stone



Pond 6P: POND A



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Developed-A Runoff Area=3,470 sf 0.00% Impervious Runoff Depth>0.12"
Tc=10.0 min CN=73/0 Runoff=0.00 cfs 0.001 af

Subcatchment2S: Basin A Runoff Area=3,470 sf 72.56% Impervious Runoff Depth>0.90"
Tc=5.0 min CN=79/98 Runoff=0.02 cfs 0.006 af

Reach 8R: REACH Avg. Flow Depth=0.02' Max Vel=2.92 fps Inflow=0.01 cfs 0.006 af
10.0" Round Pipe n=0.010 L=1.0' S=0.1000 '/' Capacity=9.01 cfs Outflow=0.01 cfs 0.006 af

Pond 6P: POND A Peak Elev=100.36' Storage=27 cf Inflow=0.02 cfs 0.006 af
Outflow=0.01 cfs 0.006 af

Total Runoff Area = 0.159 ac Runoff Volume = 0.007 af Average Runoff Depth = 0.51"
63.72% Pervious = 0.102 ac 36.28% Impervious = 0.058 ac

Summary for Subcatchment 1S: Pre-Developed-A

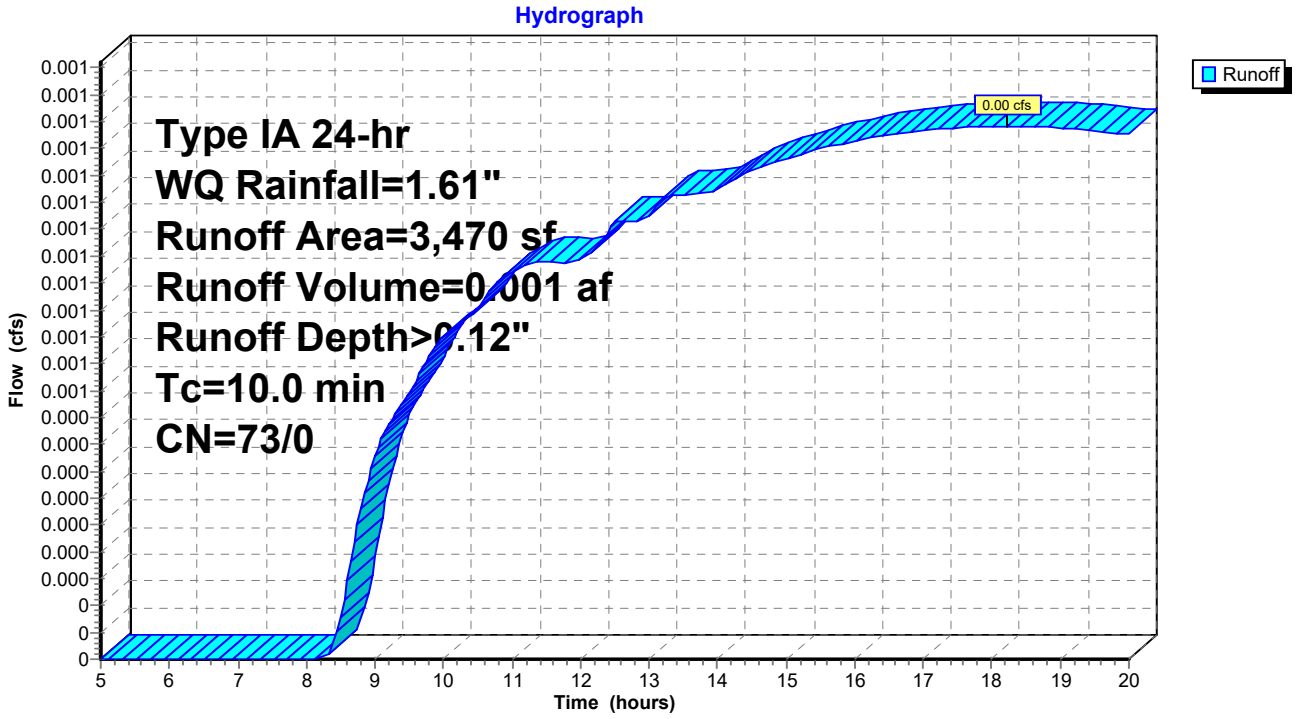
Runoff = 0.00 cfs @ 18.21 hrs, Volume= 0.001 af, Depth> 0.12"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.61"

Area (sf)	CN	Description
3,470	73	Woods, Fair, HSG C
3,470	73	100.00% Pervious Area

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

Subcatchment 1S: Pre-Developed-A



Summary for Subcatchment 2S: Basin A

[49] Hint: Tc<2dt may require smaller dt

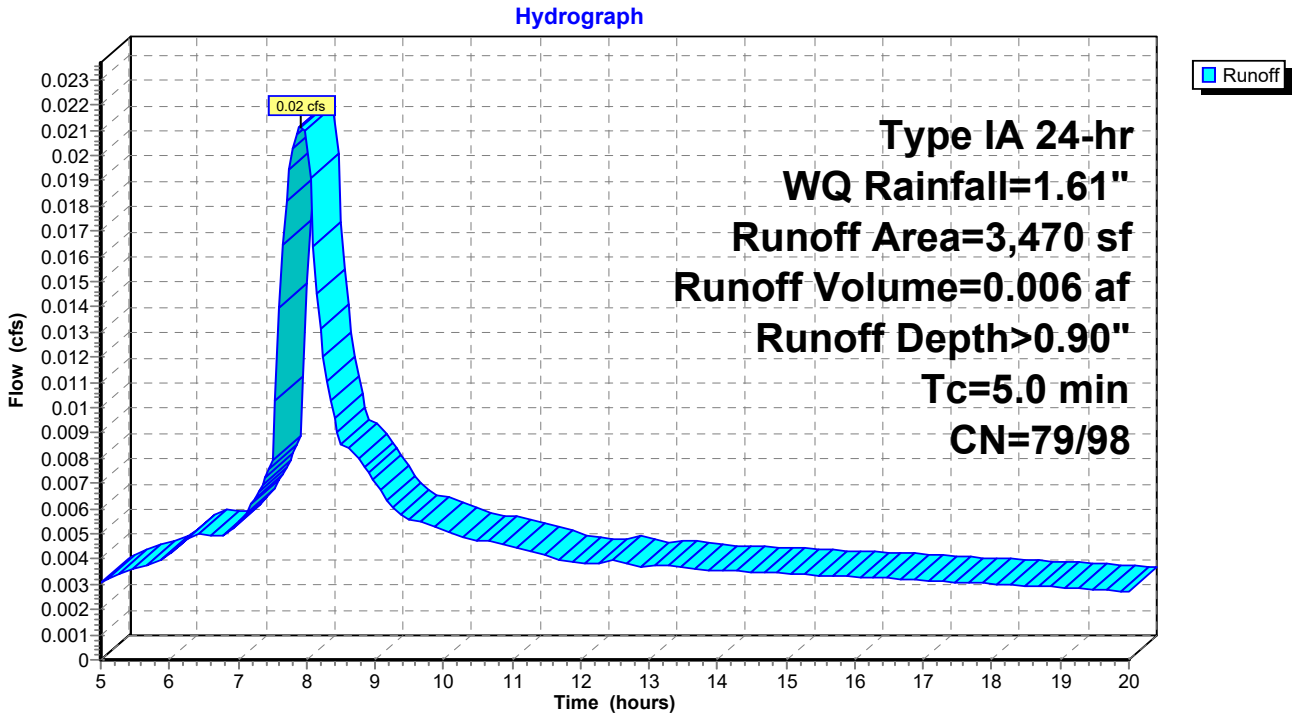
Runoff = 0.02 cfs @ 7.93 hrs, Volume= 0.006 af, Depth> 0.90"
Routed to Pond 6P : POND A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Rainfall=1.61"

Area (sf)	CN	Description
2,518	98	Paved parking, HSG A
952	79	50-75% Grass cover, Fair, HSG C
3,470	93	Weighted Average
952	79	27.44% Pervious Area
2,518	98	72.56% Impervious Area

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

Subcatchment 2S: Basin A



Summary for Reach 8R: REACH

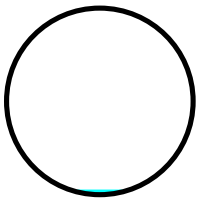
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=24)
[79] Warning: Submerged Pond 6P Primary device # 1 by 0.02'

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 0.89" for WQ event
Inflow = 0.01 cfs @ 8.25 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 8.25 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.1 min

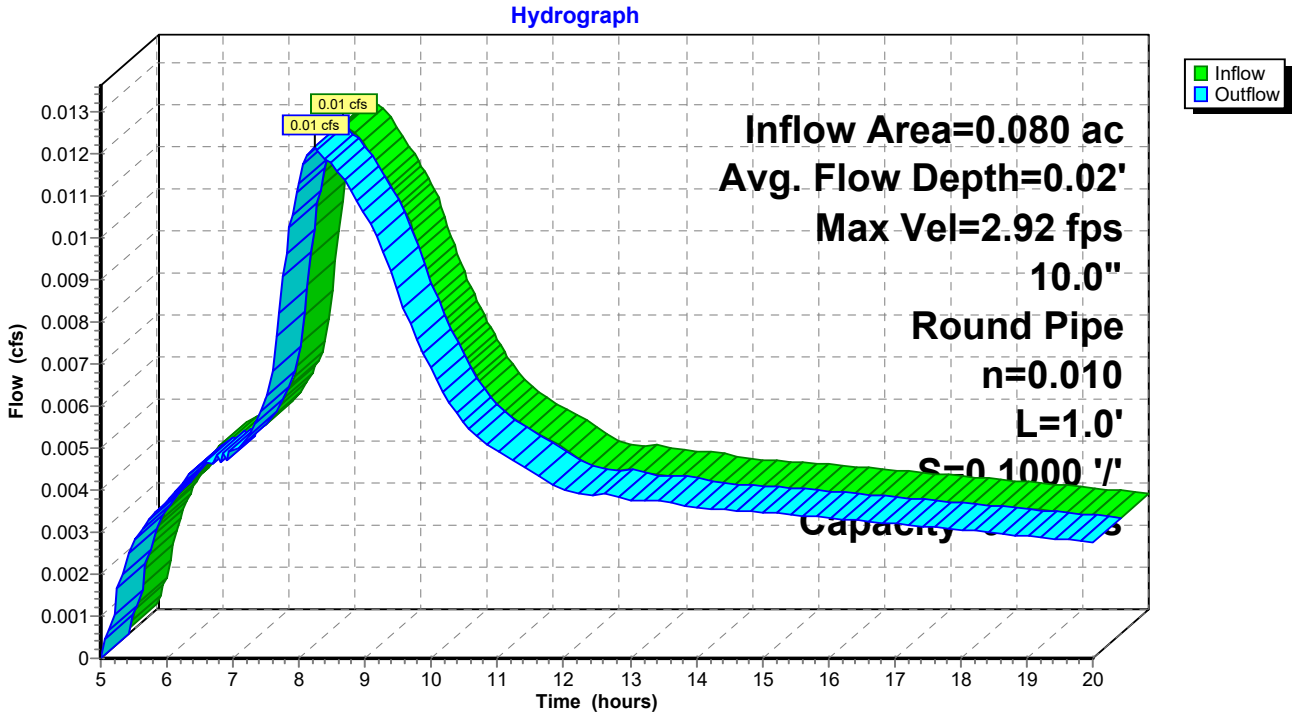
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.92 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.19 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 8.25 hrs
Average Depth at Peak Storage= 0.02' , Surface Width= 0.27'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 9.01 cfs

10.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 1.0' Slope= 0.1000 '/'
Inlet Invert= 100.00', Outlet Invert= 99.90'



Reach 8R: REACH



Summary for Pond 6P: POND A

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.080 ac, 72.56% Impervious, Inflow Depth > 0.90" for WQ event
Inflow = 0.02 cfs @ 7.93 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 8.25 hrs, Volume= 0.006 af, Atten= 43%, Lag= 19.4 min
Primary = 0.01 cfs @ 8.25 hrs, Volume= 0.006 af
Routed to Reach 8R : REACH

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 100.36' @ 8.25 hrs Surf.Area= 166 sf Storage= 27 cf

Plug-Flow detention time= 25.4 min calculated for 0.006 af (98% of inflow)
Center-of-Mass det. time= 17.0 min (683.2 - 666.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	147 cf	**6.62'W x 25.11'L x 2.69'H Field A** 448 cf Overall - 80 cf Embedded = 368 cf x 40.0% Voids
#2A	100.25'	76 cf	**Ferguson R-Tank HD 1** x 18 Inside #1 Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf 18 Chambers in 2 Rows
		223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**0.9" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	102.20'	**0.9" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.01 cfs @ 8.25 hrs HW=100.36' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.01 cfs @ 2.74 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 6P: POND A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank HD 1 (Ferguson R-Tank HD)
Inside= 15.7"W x 17.3"H => 1.80 sf x 2.35'L = 4.2 cf
Outside= 15.7"W x 17.3"H => 1.89 sf x 2.35'L = 4.4 cf

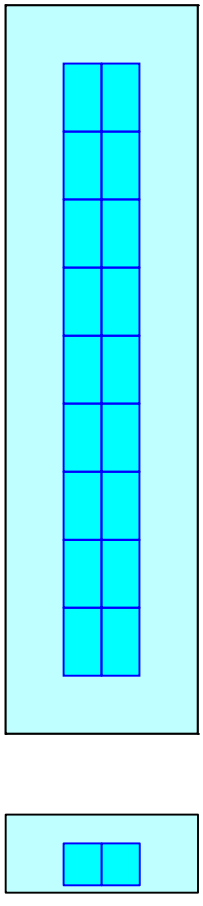
9 Chambers/Row x 2.35' Long = 21.11' Row Length +24.0" End Stone x 2 = 25.11' Base Length
2 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 6.62' Base Width
3.0" Stone Base + 17.3" Chamber Height + 12.0" Stone Cover = 2.69' Field Height

18 Chambers x 4.2 cf = 76.0 cf Chamber Storage
18 Chambers x 4.4 cf = 80.0 cf Displacement

448.1 cf Field - 80.0 cf Chambers = 368.1 cf Stone x 40.0% Voids = 147.2 cf Stone Storage

Chamber Storage + Stone Storage = 223.2 cf = 0.005 af
Overall Storage Efficiency = 49.8%
Overall System Size = 25.11' x 6.62' x 2.69'

18 Chambers
16.6 cy Field
13.6 cy Stone



Pond 6P: POND A