AAI afghan associates, inc.
ENGINEERING

32nd Avenue Mixed Use

PRELIMINARY STORMWATER REPORT & CALCULATIONS

9391 SE 32nd Ave,
Milwaukie, Oregon 97222

January 13, 2020
PROJECT NUMBER: A20011.10

AAI Engineering
John Megrditchian
4875 S.W. Griffith Drive
Suite 300
Beaverton, Oregon
PH 503.620.3030
FX 503.620.5539
EMAIL: johnm@aaieng.com

32nd Avenue Mixed Use

Table of Contents

I. Project Summary 1
II. Stormwater Design 1
III. Conveyance Calculations 2
IV. Operations and Maintenance 2
V. Engineering Conclusion 2

Appendices

Appendix A
Existing Conditions

Appendix B
Site Plan

Appendix C
Storm Plan and Details

Appendix D
Stormwater Calculation

Appendix E
Geotechnical Report

Appendix F
Operations and Maintenance Form

32nd Avenue Mixed Use

I. Project Summary

This preliminary report has been prepared to outline the existing and proposed on-site stormwater conditions for the 32nd Avenue Mixed Use project. The final report will be based off field observation, existing survey, geotechnical report, and will include completed appendices. The current preliminary report demonstrates feasibility for a stormwater system at a worst case scenario.

The project is located in the city of Milwaukie at the corner of SE Olsen St. and SE 32nd Ave. The existing site consists of a grocery store and asphalt parking which is mostly impervious. The site slightly slopes to the west. No stormwater facilities currently exist on site.

See Appendix A – Existing Conditions

The proposed improvements consist of a multistory mixed used building. The project proposes 8,452 sf (0.19 acres) of building and bike parking area (impervious) and 2,348 sf (0.05 acres) will be landscape or lawn pervious.

See Appendix B – Site Plan and Appendix C – Storm Plan and Details.

All proposed runoff from new impervious and existing impervious will be collect and detained onsite. No adjacent properties are anticipated to be captured by the proposed facilities.

II. Stormwater Design

The stormwater design for the 32nd Avenue Mixed project consists roof drains, conveyance piping, and detention piping. Since none of the onsite impervious area is pollution generating no water quality treatment is required.

A Geotech report has not been completed but will be in the coming weeks. Until completion of the Geotechnical report, the project has been designed for the worst-case scenario assuming no infiltration is available. The detention system is sized to detain the run off from the 2, 5, 10, and 25 yr storm events of the post developed site to predeveloped (Lewis and Clark era) conditions. The flow control will be accomplished with the use of a flow control tee with no orifice smaller than 1 inch in diameter.

See Appendix D – Stormwater Calculations for additional information on the proposed stormwater system sizing and See Appendix E – Geotechnical Report for additional information on the onsite soil properties.

III. Conveyance Calculations

See Appendix D – Stormwater Calculations for conveyance calculations.

IV. Operations and Maintenance

See Appendix F – Operations and Maintenance Form for O&M requirements.

V. Engineering Conclusion

Based on the requirements of the Stormwater Design Standard of Milwaukie Public Works standards and the City of Portland 2016 Stormwater Management Manual, the proposed site facilities will be adequately designed to manage the proposed development conditions and should be approved as designed.

Appendix A

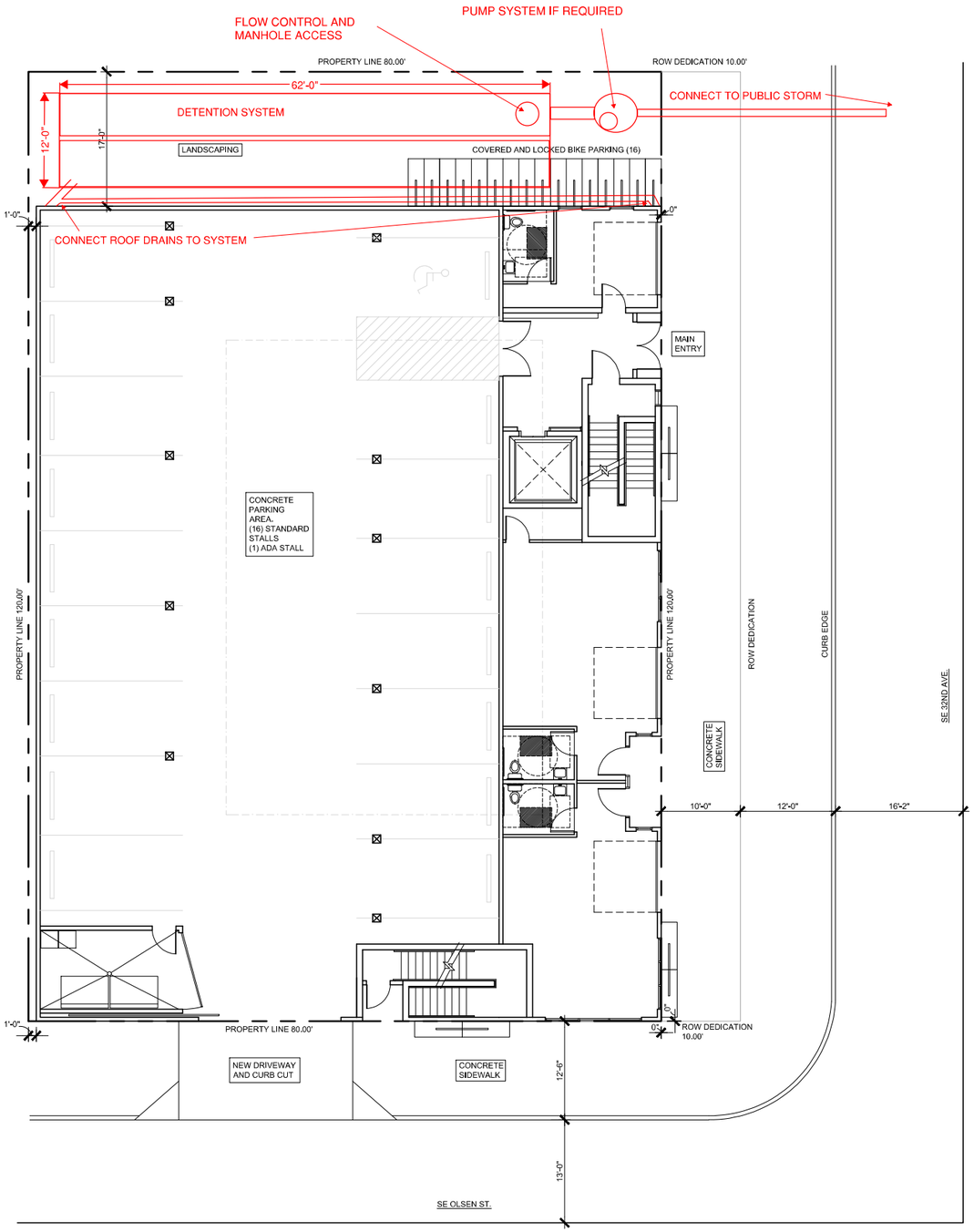
Existing Conditions - To be provided in future submittals

Appendix B

Site Plan - To be provided in future submittals

Appendix C

Preliminary Storm Plan



TRUE NORTH

1 / SD1.1 SITE PLAN

SCALE: 1/8" = 1'-0"

PROPERTY INFORMATION

ADDRESS: 9391 SE 32ND AVE. MILWAUKIE, OR 97222

PROJECT: RETAIL AND PARKING ON FIRST FLOOR, WITH 28 APARTMENT UNITS 800 SF OR LESS ABOVE.

LEGAL DESCRIPTION

LEGAL DESCRIPTIONS: ARDENWALD, BLOCK 5, LOT 21 AND 22

TAX LOT ID: 11E25BD07700

PARCEL NUMBER: 00008547

ZONING CODE INFORMATION

BASE ZONE: NMU (NEIGHBORHOOD MIXED USE)

SITE AREA: 0.24 ACRES (10,800 SF)

PROPOSED SITE INFORMATION:

BUILDING FOOTPRINT: 9,775 SF (90%)

EXTERIOR CONCRETE PAVING: 60 SF (0.5%)

MINIMUM FAR ALLOWED: 0.5:1

BUILDING HEIGHT:

MAXIMUM ALLOWABLE HEIGHT (TABLE 19.303.3):	45'-0"
ACTUAL HEIGHT: (VARIANCE REQUESTED)	51'-1"

MAX SETBACKS ALLOWED:

MAXIMUM STREET SETBACK: 10'-0"

AUTOMOBILE PARKING REQUIREMENTS (TABLE 19.605.1):

PROVIDED STANDARD PARKING SPACES: 17
(QUANTITY MODIFICATION REQUESTED)

BICYCLE PARKING REQUIREMENTS (TABLE 266-6):

BIKE PARKING MIN. OF 22 REQUIRED, 22 TO BE PROVIDED.

STANDARD BIKE PARKING (MIN OF 1 SPACE REQUIRED).

ENCLOSED BIKE PARKING (1 PER UNIT, 50% MINIMUM OF REQUIRED)

SEE SECTION: 19.609.2

FLOOR AND BUILDING COVERAGE AREA:

FIRST FLOOR COVERED PARKING AREA/RETAIL:	8,137 SF
SECOND FLOOR BUILDING AREA:	8,137 SF
THIRD FLOOR BUILDING AREA:	8,137 SF
FOURTH FLOOR PENTHOUSE BUILDING AREA:	8,137 SF
TOTAL AREA (INCLUDING COVERED PARKING):	32,548 SF

SITE PLAN GENERAL NOTES

EXISTING INFORMATION IS BASED ON DRAWINGS PROVIDED BY AKS.

DIMENSIONS ARE TO FACE OF CURB, FACE OF BUILDING, PROPERTY LINE, OR CENTER OF PAINT STRIPING UNLESS NOTED OTHERWISE.

WHERE ACCESS TO OR WITHIN A STRUCTURE OR AN AREA IS RESTRICTED BECAUSE OF SECURED OPENINGS OR WHERE IMMEDIATE ACCESS IS NECCESARY FOR LIFE-SAVING OR FIRE FIGHTING PURPOSES A "KNOXBOX" KEY BOX SHALL BE INSTALLED IN AN APPROVED LOCATION.

SITE PLAN LEGEND

PROPERTY LINE

B A M A
Architecture and Design
7350 SE Milwaukie Ave.
Portland, Oregon 97202
Ph: 503.253.4283

REGISTERED ARCHITECT · STATE OF OREGON ·
MILDRED WHITE
PORTLAND, OREGON
EXPIRES 12/31/2019

32ND AVE MIXED USE

9391 SE 32ND AVE,
MILWAUKIE, OR 97222

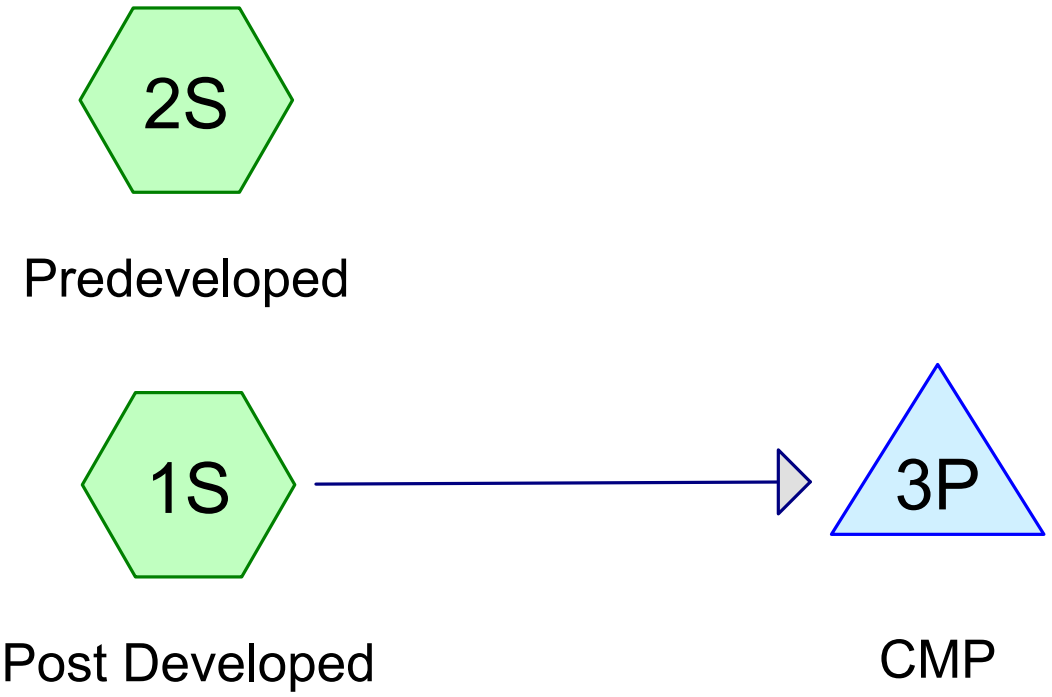
Proj # 201931

BUILDING PERMIT:

SHEET NO.
SD1.1
SITE PLAN

Appendix D

Stormwater Calculation



Subcat Reach Pond Link

Routing Diagram for 32nd Mixed Use
Prepared by {enter your company name here}, Printed 1/13/2020

Project Notes

Rainfall events imported from "A18203.HydroCad.hcp"
Rainfall events imported from "A18205.hcp"

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.187	98	(1S)
0.031	98	Water Surface, HSG A (1S)
0.218	60	Woods/grass comb., Fair, HSG B (2S)
0.436	**79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.031	HSG A	1S
0.218	HSG B	2S
0.000	HSG C	
0.000	HSG D	
0.187	Other	1S
0.436		**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	0.000	0.000	0.187	0.187		1S
0.031	0.000	0.000	0.000	0.000	0.031	Water Surface	1S
0.000	0.218	0.000	0.000	0.000	0.218	Woods/grass comb., Fair	2S
0.031	**0.218**	**0.000**	**0.000**	**0.187**	**0.436**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Post Developed Runoff Area=9,497 sf 100.00% Impervious Runoff Depth>1.80"
Tc=0.0 min AMC Adjusted CN=99 Runoff=0.13 cfs 0.033 af

Subcatchment2S: Predeveloped Runoff Area=9,497 sf 0.00% Impervious Runoff Depth>0.60"
Tc=0.0 min AMC Adjusted CN=78 Runoff=0.03 cfs 0.011 af

Pond 3P: CMP Peak Elev=1.55' Storage=0.007 af Inflow=0.13 cfs 0.033 af
Outflow=0.03 cfs 0.033 af

Total Runoff Area = 0.436 ac Runoff Volume = 0.044 af Average Runoff Depth = 1.20"
50.00% Pervious = 0.218 ac 50.00% Impervious = 0.218 ac

Summary for Subcatchment 1S: Post Developed

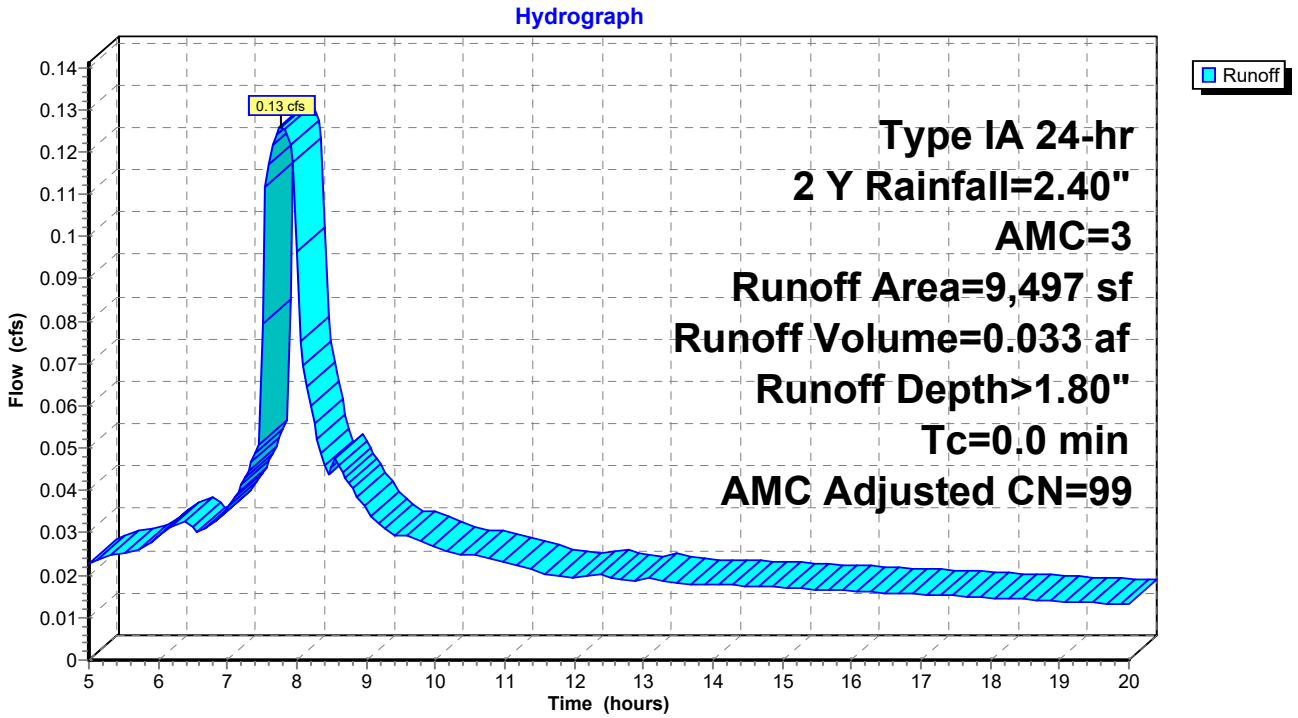
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.13 cfs @ 7.78 hrs, Volume= 0.033 af, Depth> 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2 Y Rainfall=2.40", AMC=3

	Area (sf)	CN	Adj	Description
*	8,137	98		
	1,360	98		Water Surface, HSG A
	9,497	98	99	Weighted Average, AMC Adjusted
	9,497			100.00% Impervious Area

Subcatchment 1S: Post Developed



Summary for Subcatchment 2S: Predeveloped

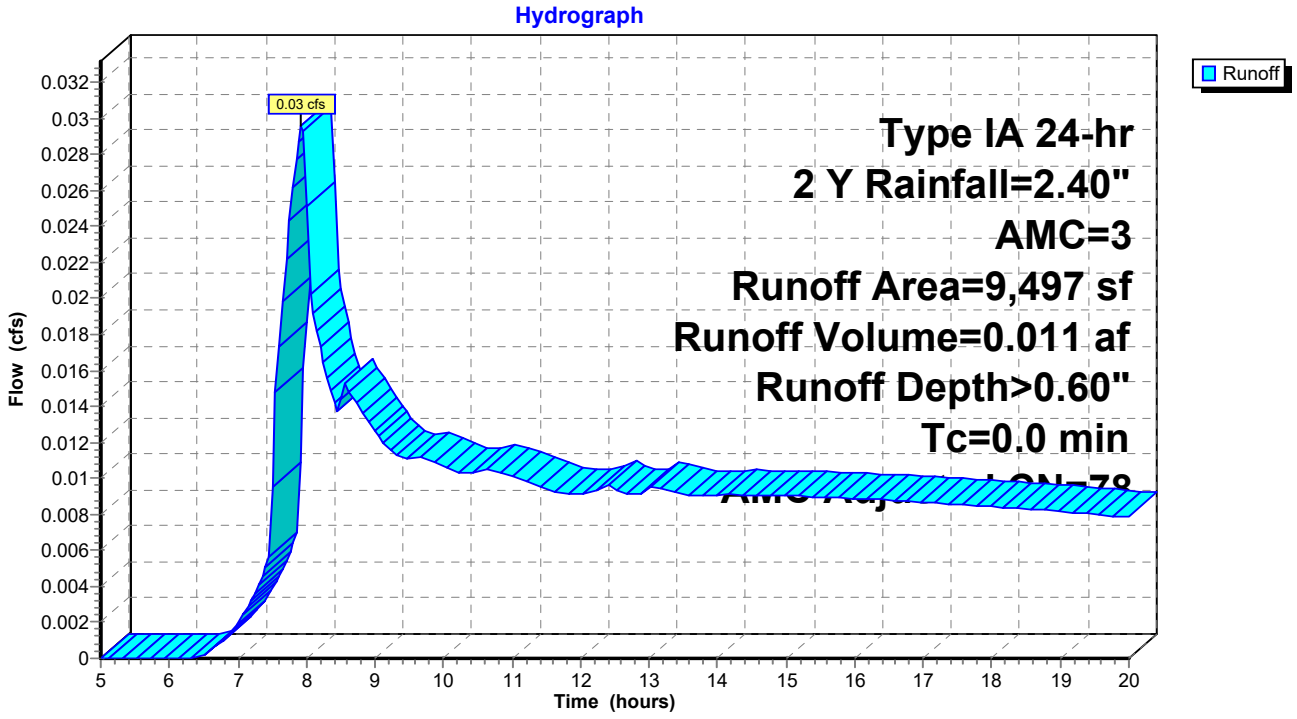
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.03 cfs @ 7.93 hrs, Volume= 0.011 af, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2 Y Rainfall=2.40", AMC=3

	Area (sf)	CN	Adj	Description
*	9,497	60		Woods/grass comb., Fair, HSG B
	9,497	60	78	Weighted Average, AMC Adjusted
	9,497			100.00% Pervious Area

Subcatchment 2S: Predeveloped



Summary for Pond 3P: CMP

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.218 ac,100.00% Impervious, Inflow Depth > 1.80" for 2 Y event
Inflow = 0.13 cfs @ 7.78 hrs, Volume= 0.033 af
Outflow = 0.03 cfs @ 9.15 hrs, Volume= 0.033 af, Atten= 74%, Lag= 82.3 min
Primary = 0.03 cfs @ 9.15 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.55' @ 9.15 hrs Surf.Area= 0.017 ac Storage= 0.007 af

Plug-Flow detention time= 90.5 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 90.0 min (732.4 - 642.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.000 af	**12.00'W x 62.00'L x 5.00'H Field A** 0.085 af Overall - 0.035 af Embedded = 0.051 af x 0.0% Voids
#2A	0.50'	0.035 af	**CMP Round 48** x 6 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 6 Chambers in 2 Rows
		0.035 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**1.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	2.78'	**0.7" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.03 cfs @ 9.15 hrs HW=1.55' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.03 cfs @ 6.00 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: CMP - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

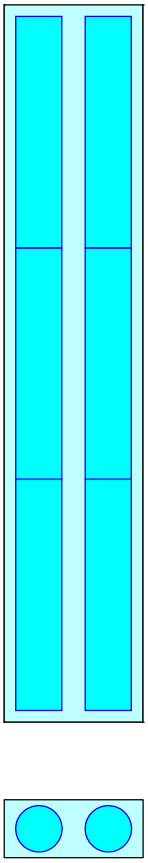
3 Chambers/Row x 20.00' Long = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length
2 Rows x 48.0" Wide + 24.0" Spacing x 1 + 12.0" Side Stone x 2 = 12.00' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

6 Chambers x 251.3 cf = 1,508.0 cf Chamber Storage

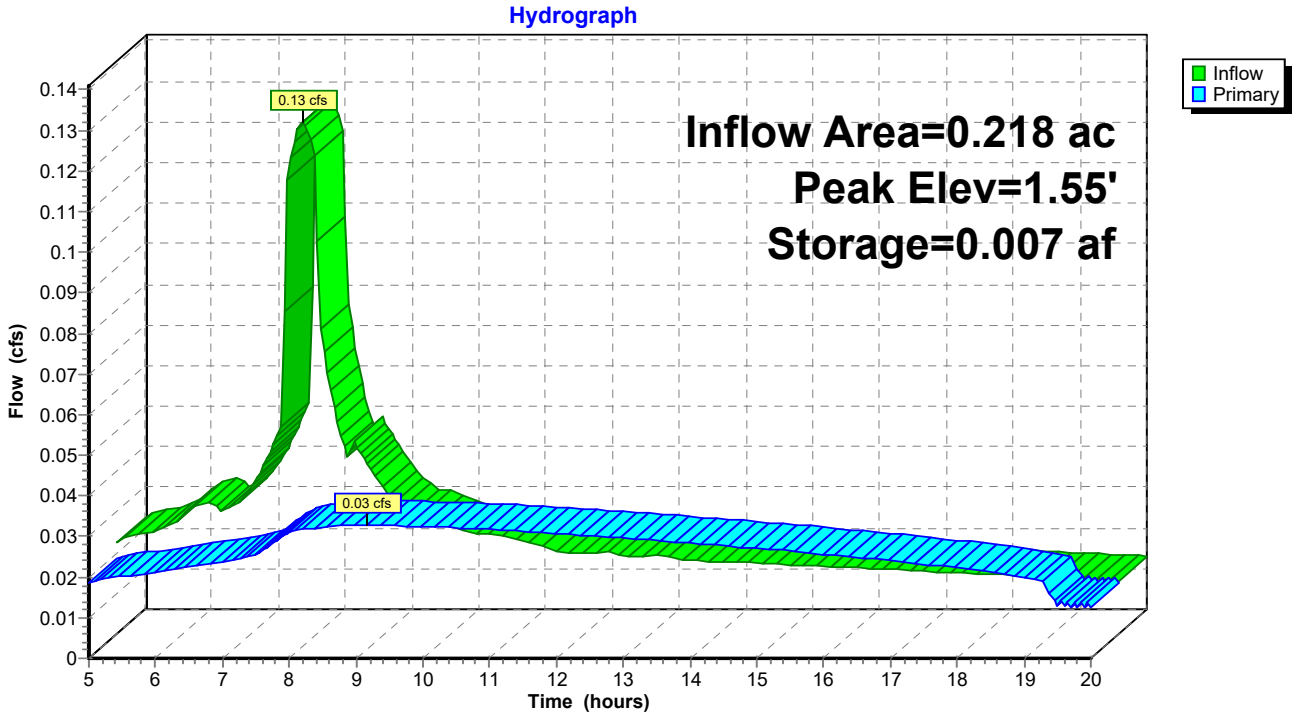
3,720.0 cf Field - 1,508.0 cf Chambers = 2,212.0 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 1,508.0 cf = 0.035 af
Overall Storage Efficiency = 40.5%
Overall System Size = 62.00' x 12.00' x 5.00'

6 Chambers
137.8 cy Field
81.9 cy Stone



Pond 3P: CMP


Hydrograph
Inflow
Primary
Inflow Area=0.218 ac
Peak Elev=1.55'
Storage=0.007 af
0.13 cfs
0.03 cfs
Flow (cfs)
Time (hours)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Post Developed Runoff Area=9,497 sf 100.00% Impervious Runoff Depth>2.18"
Tc=0.0 min AMC Adjusted CN=99 Runoff=0.15 cfs 0.040 af

Subcatchment2S: Predeveloped Runoff Area=9,497 sf 0.00% Impervious Runoff Depth>0.89"
Tc=0.0 min AMC Adjusted CN=78 Runoff=0.05 cfs 0.016 af

Pond 3P: CMP Peak Elev=1.84' Storage=0.010 af Inflow=0.15 cfs 0.040 af
Outflow=0.04 cfs 0.038 af

Total Runoff Area = 0.436 ac Runoff Volume = 0.056 af Average Runoff Depth = 1.53"
50.00% Pervious = 0.218 ac 50.00% Impervious = 0.218 ac

Summary for Subcatchment 1S: Post Developed

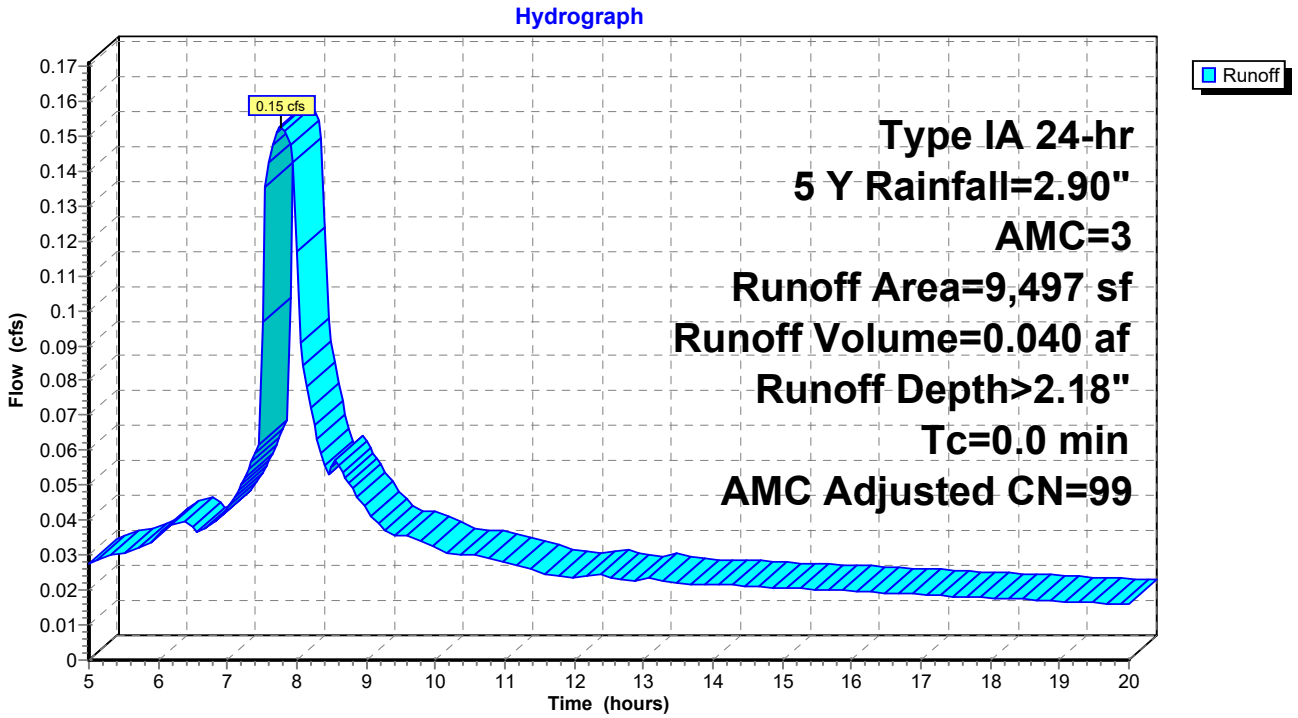
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.15 cfs @ 7.78 hrs, Volume= 0.040 af, Depth> 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5 Y Rainfall=2.90", AMC=3

	Area (sf)	CN	Adj	Description
*	8,137	98		
	1,360	98		Water Surface, HSG A
	9,497	98	99	Weighted Average, AMC Adjusted
	9,497			100.00% Impervious Area

Subcatchment 1S: Post Developed



Summary for Subcatchment 2S: Predeveloped

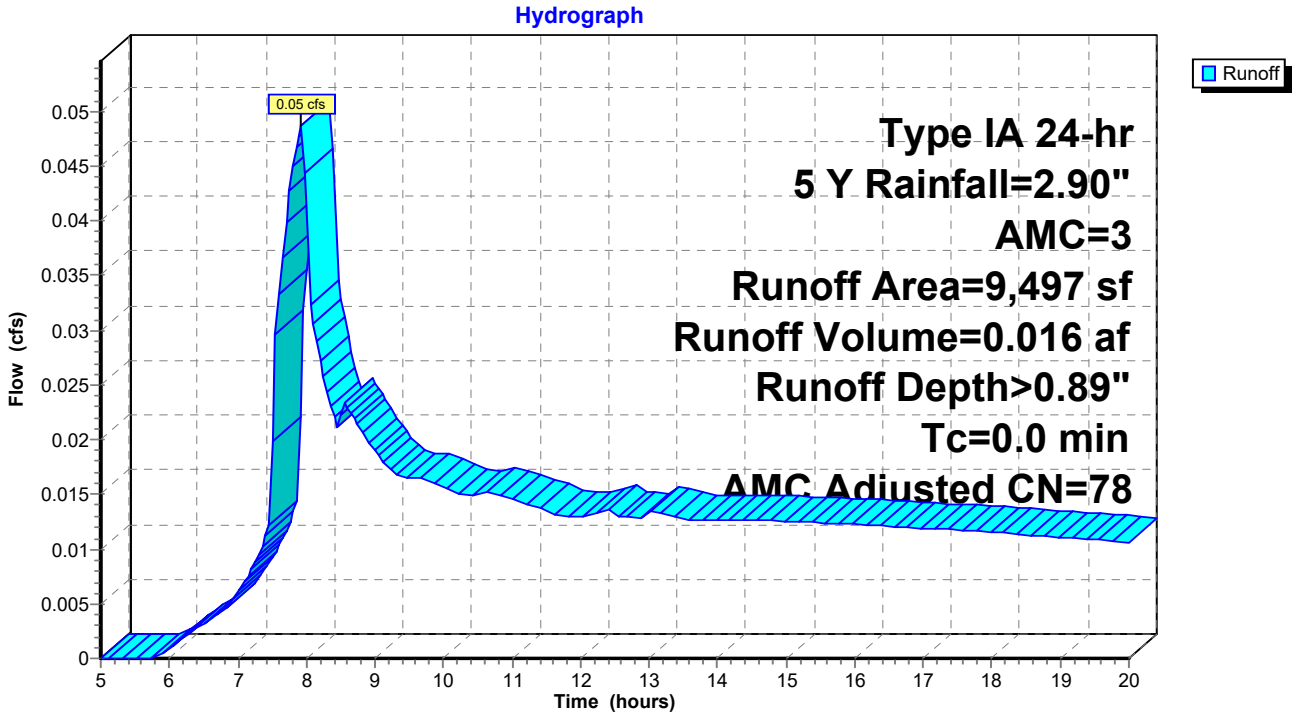
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.05 cfs @ 7.93 hrs, Volume= 0.016 af, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 5 Y Rainfall=2.90", AMC=3

	Area (sf)	CN	Adj	Description
*	9,497	60		Woods/grass comb., Fair, HSG B
	9,497	60	78	Weighted Average, AMC Adjusted
	9,497			100.00% Pervious Area

Subcatchment 2S: Predeveloped



Summary for Pond 3P: CMP

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.218 ac,100.00% Impervious, Inflow Depth > 2.18" for 5 Y event
Inflow = 0.15 cfs @ 7.78 hrs, Volume= 0.040 af
Outflow = 0.04 cfs @ 9.41 hrs, Volume= 0.038 af, Atten= 77%, Lag= 98.0 min
Primary = 0.04 cfs @ 9.41 hrs, Volume= 0.038 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.84' @ 9.41 hrs Surf.Area= 0.017 ac Storage= 0.010 af

Plug-Flow detention time= 137.0 min calculated for 0.038 af (95% of inflow)
Center-of-Mass det. time= 110.0 min (752.0 - 642.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.000 af	**12.00'W x 62.00'L x 5.00'H Field A** 0.085 af Overall - 0.035 af Embedded = 0.051 af x 0.0% Voids
#2A	0.50'	0.035 af	**CMP Round 48** x 6 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 6 Chambers in 2 Rows
		0.035 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**1.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	2.78'	**0.7" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 9.41 hrs HW=1.84' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 6.52 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: CMP - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

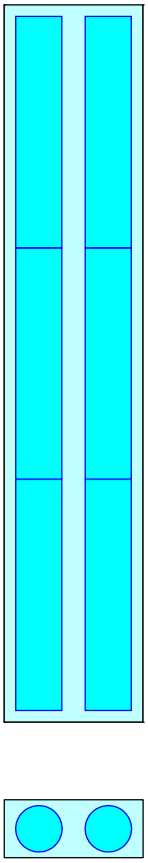
3 Chambers/Row x 20.00' Long = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length
2 Rows x 48.0" Wide + 24.0" Spacing x 1 + 12.0" Side Stone x 2 = 12.00' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

6 Chambers x 251.3 cf = 1,508.0 cf Chamber Storage

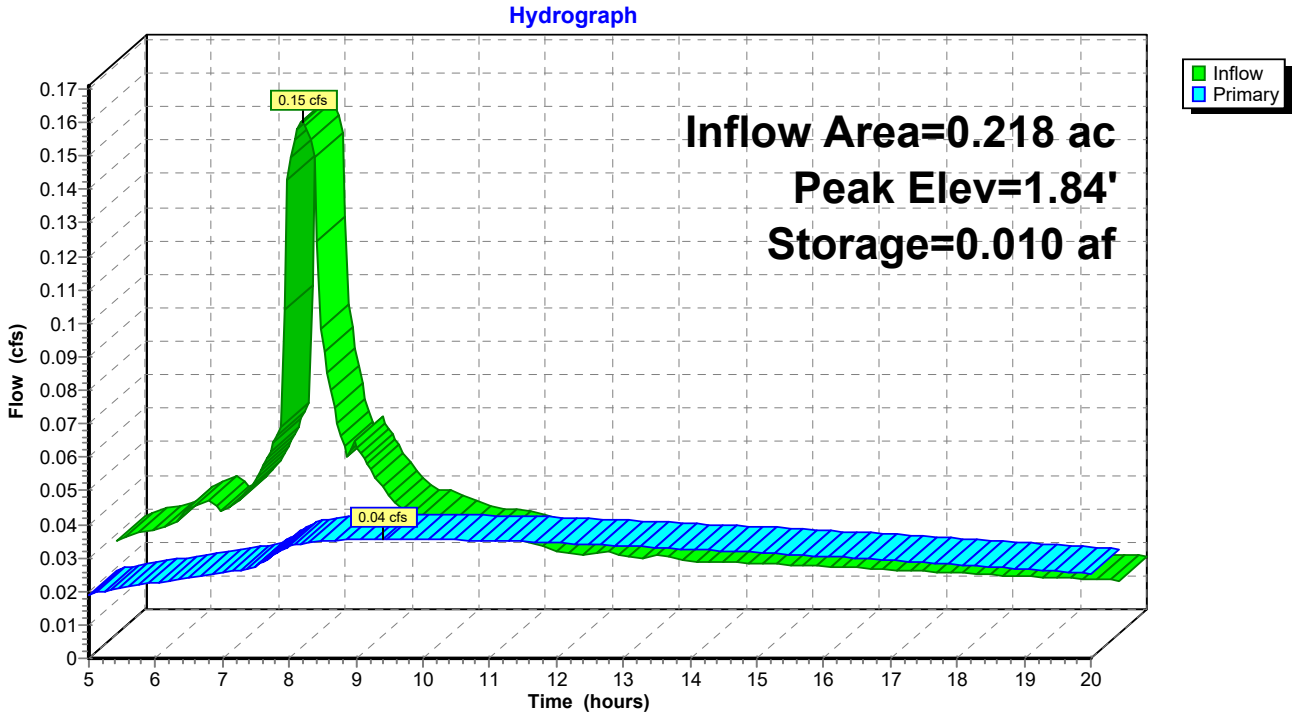
3,720.0 cf Field - 1,508.0 cf Chambers = 2,212.0 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 1,508.0 cf = 0.035 af
Overall Storage Efficiency = 40.5%
Overall System Size = 62.00' x 12.00' x 5.00'

6 Chambers
137.8 cy Field
81.9 cy Stone



Pond 3P: CMP


Hydrograph
Inflow
Primary
Inflow Area=0.218 ac
Peak Elev=1.84'
Storage=0.010 af
0.15 cfs
0.04 cfs
Flow (cfs)
Time (hours)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Post Developed Runoff Area=9,497 sf 100.00% Impervious Runoff Depth>2.56"
Tc=0.0 min AMC Adjusted CN=99 Runoff=0.18 cfs 0.047 af

Subcatchment2S: Predeveloped Runoff Area=9,497 sf 0.00% Impervious Runoff Depth>1.20"
Tc=0.0 min AMC Adjusted CN=78 Runoff=0.07 cfs 0.022 af

Pond 3P: CMP Peak Elev=2.12' Storage=0.013 af Inflow=0.18 cfs 0.047 af
Outflow=0.04 cfs 0.042 af

Total Runoff Area = 0.436 ac Runoff Volume = 0.068 af Average Runoff Depth = 1.88"
50.00% Pervious = 0.218 ac 50.00% Impervious = 0.218 ac

Summary for Subcatchment 1S: Post Developed

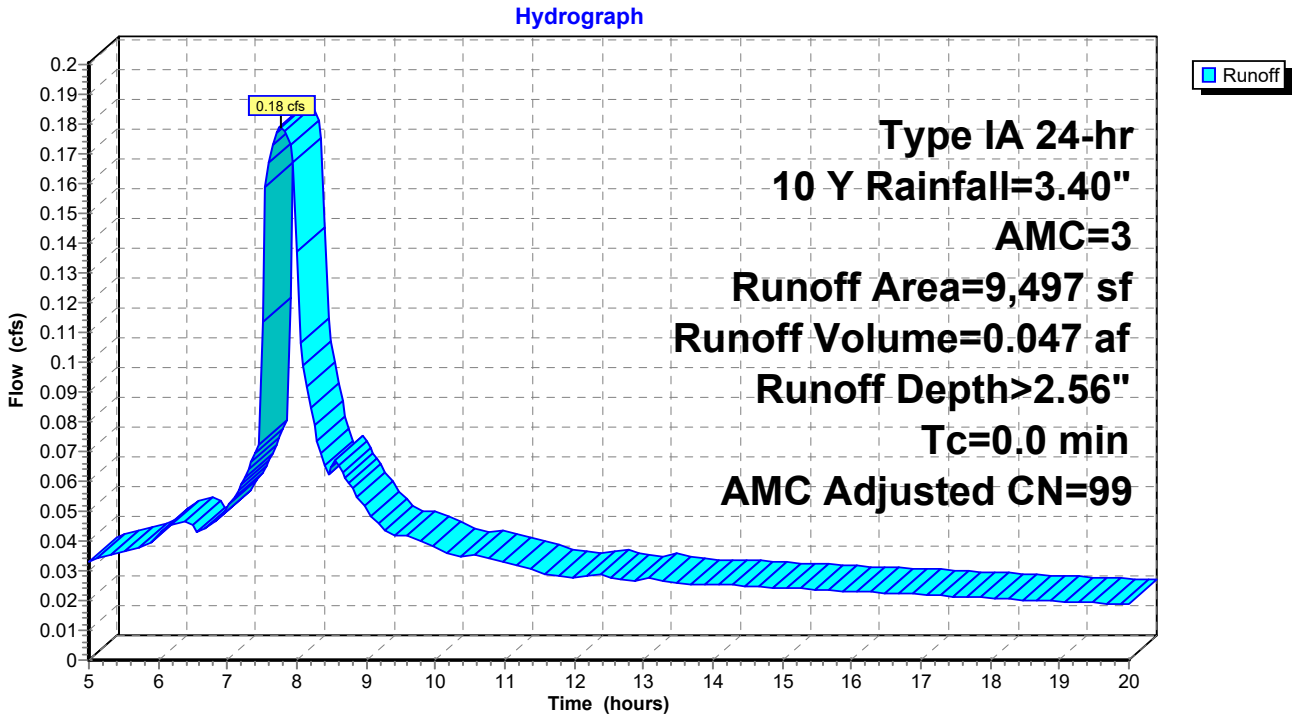
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.18 cfs @ 7.78 hrs, Volume= 0.047 af, Depth> 2.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 Y Rainfall=3.40", AMC=3

	Area (sf)	CN	Adj	Description
*	8,137	98		
	1,360	98		Water Surface, HSG A
	9,497	98	99	Weighted Average, AMC Adjusted
	9,497			100.00% Impervious Area

Subcatchment 1S: Post Developed



Summary for Subcatchment 2S: Predeveloped

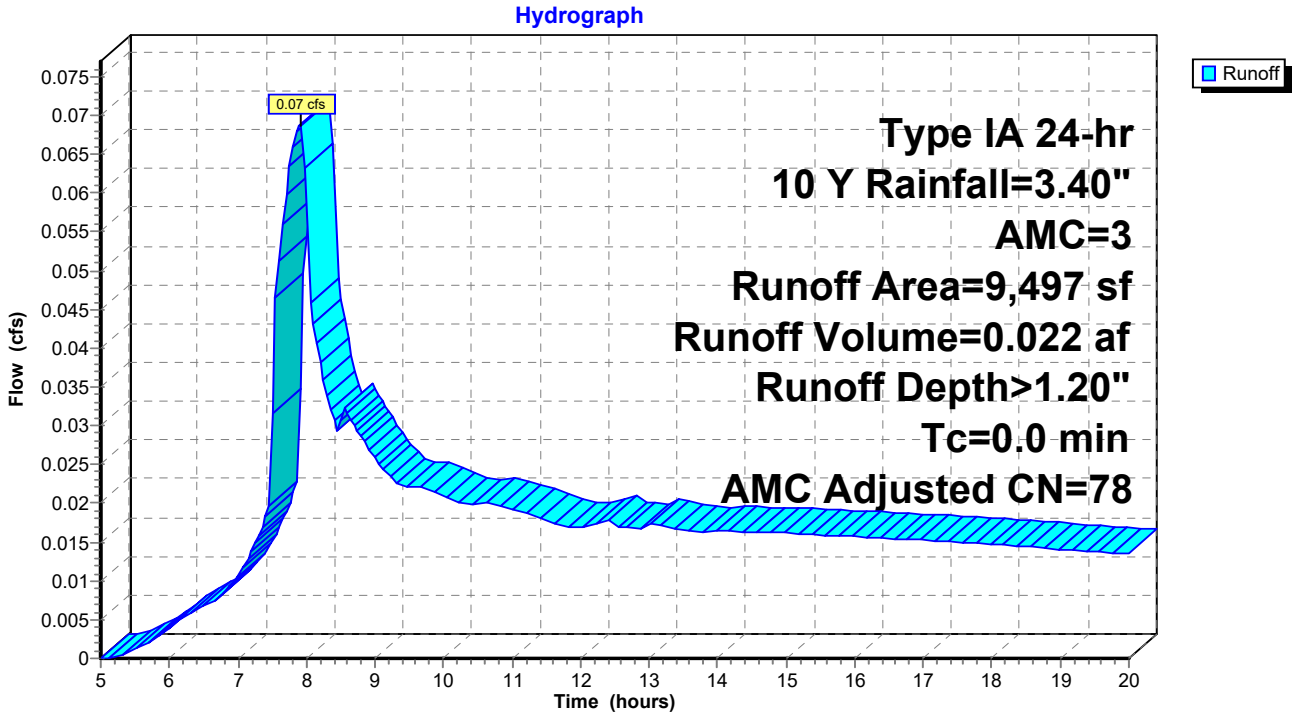
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.07 cfs @ 7.91 hrs, Volume= 0.022 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 Y Rainfall=3.40", AMC=3

	Area (sf)	CN	Adj	Description
*	9,497	60		Woods/grass comb., Fair, HSG B
	9,497	60	78	Weighted Average, AMC Adjusted
	9,497			100.00% Pervious Area

Subcatchment 2S: Predeveloped



Summary for Pond 3P: CMP

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.218 ac,100.00% Impervious, Inflow Depth > 2.56" for 10 Y event
Inflow = 0.18 cfs @ 7.78 hrs, Volume= 0.047 af
Outflow = 0.04 cfs @ 9.96 hrs, Volume= 0.042 af, Atten= 79%, Lag= 131.1 min
Primary = 0.04 cfs @ 9.96 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.12' @ 9.96 hrs Surf.Area= 0.017 ac Storage= 0.013 af

Plug-Flow detention time= 175.7 min calculated for 0.041 af (89% of inflow)
Center-of-Mass det. time= 118.8 min (760.4 - 641.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.000 af	**12.00'W x 62.00'L x 5.00'H Field A** 0.085 af Overall - 0.035 af Embedded = 0.051 af x 0.0% Voids
#2A	0.50'	0.035 af	**CMP Round 48** x 6 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 6 Chambers in 2 Rows
		0.035 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**1.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	2.78'	**0.7" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 9.96 hrs HW=2.12' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.02 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: CMP - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

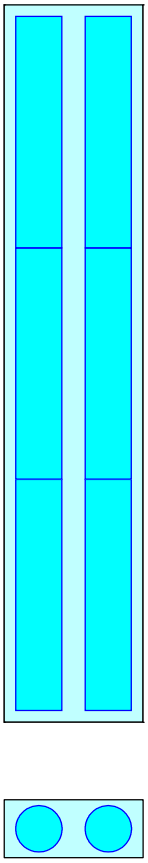
3 Chambers/Row x 20.00' Long = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length
2 Rows x 48.0" Wide + 24.0" Spacing x 1 + 12.0" Side Stone x 2 = 12.00' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

6 Chambers x 251.3 cf = 1,508.0 cf Chamber Storage

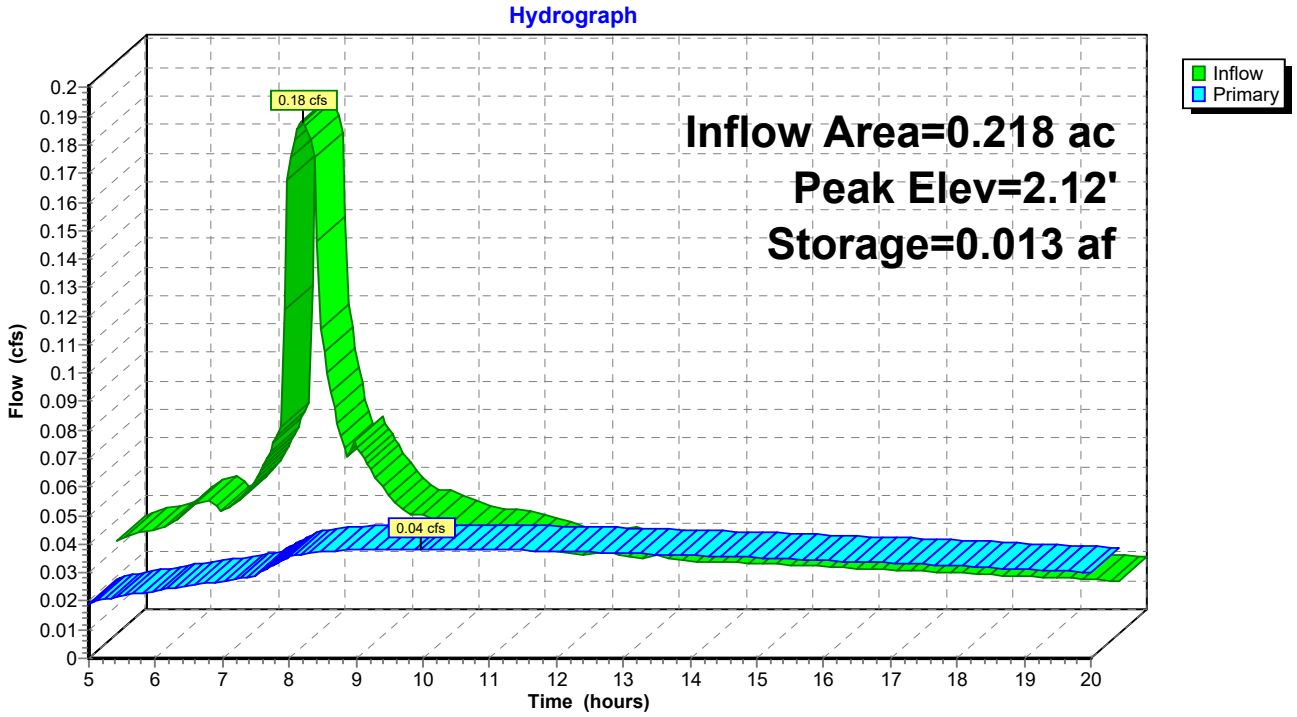
3,720.0 cf Field - 1,508.0 cf Chambers = 2,212.0 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 1,508.0 cf = 0.035 af
Overall Storage Efficiency = 40.5%
Overall System Size = 62.00' x 12.00' x 5.00'

6 Chambers
137.8 cy Field
81.9 cy Stone



Pond 3P: CMP


Hydrograph
Inflow
Primary
0.18 cfs
0.04 cfs
Inflow Area=0.218 ac
Peak Elev=2.12'
Storage=0.013 af
Flow (cfs)
Time (hours)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19
0.2
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Post Developed Runoff Area=9,497 sf 100.00% Impervious Runoff Depth>2.95"
Tc=0.0 min AMC Adjusted CN=99 Runoff=0.21 cfs 0.054 af

Subcatchment2S: Predeveloped Runoff Area=9,497 sf 0.00% Impervious Runoff Depth>1.54"
Tc=0.0 min AMC Adjusted CN=78 Runoff=0.09 cfs 0.028 af

Pond 3P: CMP Peak Elev=2.42' Storage=0.016 af Inflow=0.21 cfs 0.054 af
Outflow=0.04 cfs 0.045 af

Total Runoff Area = 0.436 ac Runoff Volume = 0.082 af Average Runoff Depth = 2.24"
50.00% Pervious = 0.218 ac 50.00% Impervious = 0.218 ac

Summary for Subcatchment 1S: Post Developed

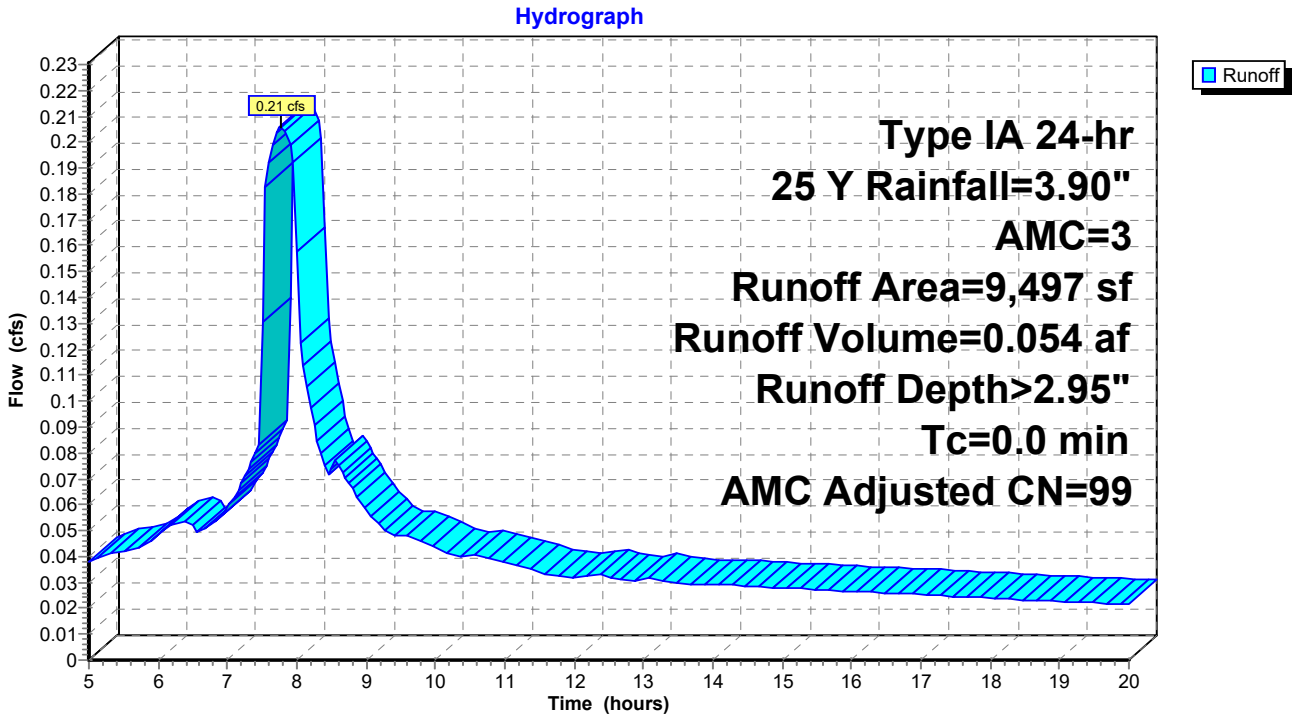
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.21 cfs @ 7.78 hrs, Volume= 0.054 af, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 Y Rainfall=3.90", AMC=3

	Area (sf)	CN	Adj	Description
*	8,137	98		
	1,360	98		Water Surface, HSG A
	9,497	98	99	Weighted Average, AMC Adjusted
	9,497			100.00% Impervious Area

Subcatchment 1S: Post Developed



Summary for Subcatchment 2S: Predeveloped

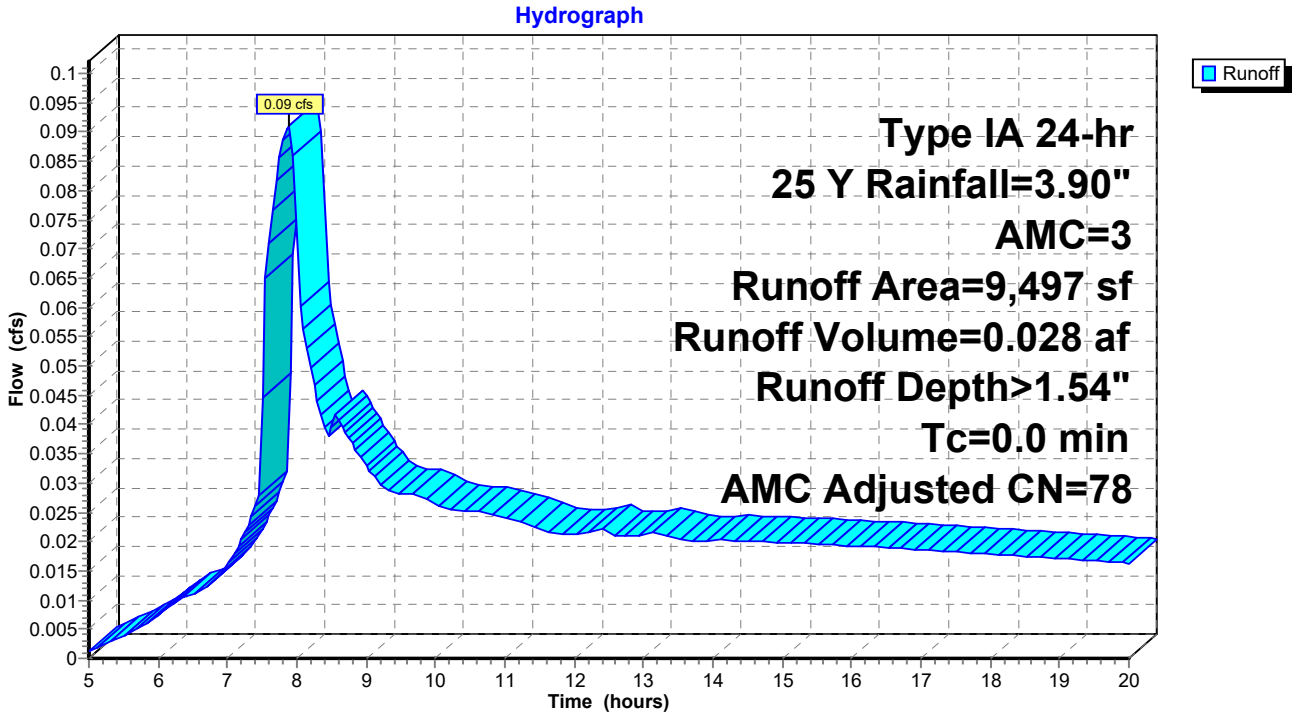
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.09 cfs @ 7.90 hrs, Volume= 0.028 af, Depth> 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 Y Rainfall=3.90", AMC=3

	Area (sf)	CN	Adj	Description
*	9,497	60		Woods/grass comb., Fair, HSG B
	9,497	60	78	Weighted Average, AMC Adjusted
	9,497			100.00% Pervious Area

Subcatchment 2S: Predeveloped



Summary for Pond 3P: CMP

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.218 ac,100.00% Impervious, Inflow Depth > 2.95" for 25 Y event
Inflow = 0.21 cfs @ 7.78 hrs, Volume= 0.054 af
Outflow = 0.04 cfs @ 10.27 hrs, Volume= 0.045 af, Atten= 80%, Lag= 149.4 min
Primary = 0.04 cfs @ 10.27 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.42' @ 10.27 hrs Surf.Area= 0.017 ac Storage= 0.016 af

Plug-Flow detention time= 206.4 min calculated for 0.045 af (84% of inflow)
Center-of-Mass det. time= 124.7 min (766.1 - 641.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.000 af	**12.00'W x 62.00'L x 5.00'H Field A** 0.085 af Overall - 0.035 af Embedded = 0.051 af x 0.0% Voids
#2A	0.50'	0.035 af	**CMP Round 48** x 6 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 6 Chambers in 2 Rows
		0.035 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**1.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	2.78'	**0.7" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 10.27 hrs HW=2.42' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.49 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: CMP - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

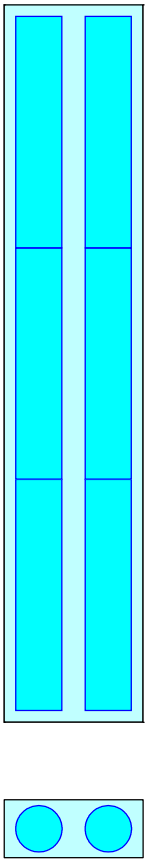
3 Chambers/Row x 20.00' Long = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length
2 Rows x 48.0" Wide + 24.0" Spacing x 1 + 12.0" Side Stone x 2 = 12.00' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

6 Chambers x 251.3 cf = 1,508.0 cf Chamber Storage

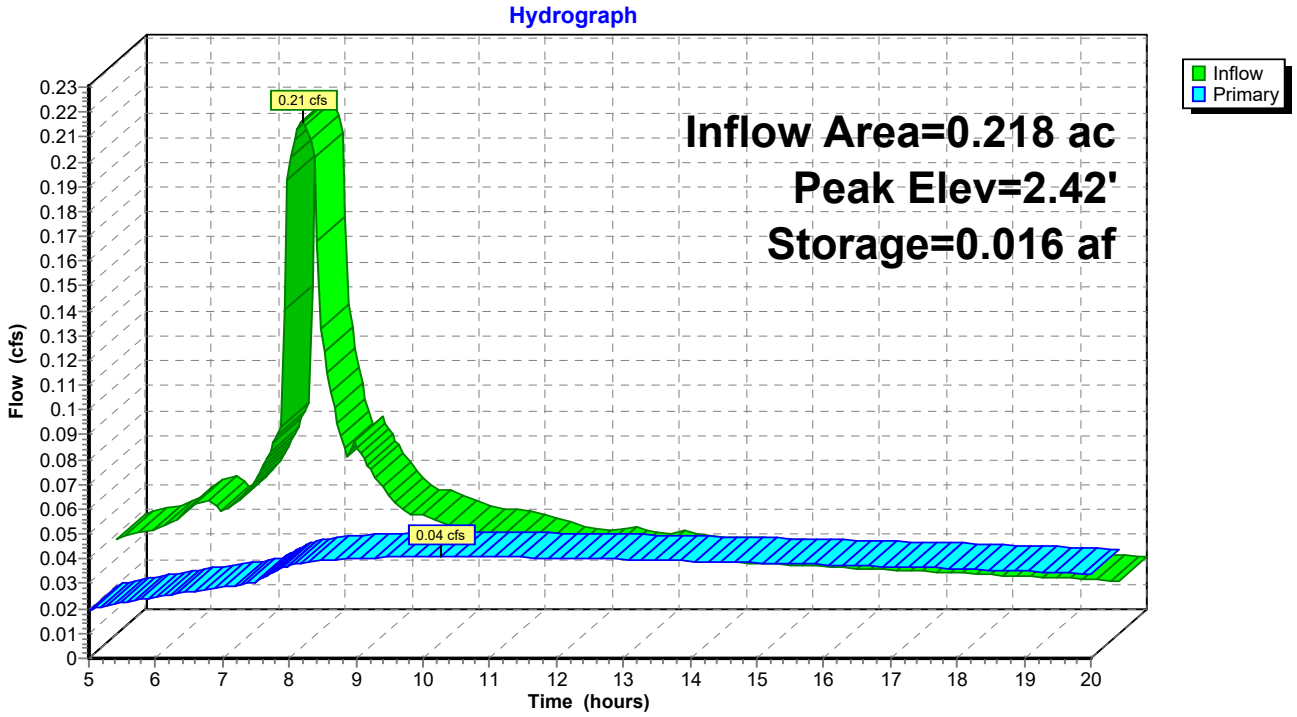
3,720.0 cf Field - 1,508.0 cf Chambers = 2,212.0 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 1,508.0 cf = 0.035 af
Overall Storage Efficiency = 40.5%
Overall System Size = 62.00' x 12.00' x 5.00'

6 Chambers
137.8 cy Field
81.9 cy Stone



Pond 3P: CMP


Hydrograph
Inflow
Primary
Inflow Area=0.218 ac
Peak Elev=2.42'
Storage=0.016 af
0.21 cfs
0.04 cfs
Flow (cfs)
Time (hours)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19
0.2
0.21
0.22
0.23
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Post Developed Runoff Area=9,497 sf 100.00% Impervious Runoff Depth>3.33"
Tc=0.0 min AMC Adjusted CN=99 Runoff=0.23 cfs 0.060 af

Subcatchment2S: Predeveloped Runoff Area=9,497 sf 0.00% Impervious Runoff Depth>1.90"
Tc=0.0 min AMC Adjusted CN=78 Runoff=0.11 cfs 0.034 af

Pond 3P: CMP Peak Elev=2.73' Storage=0.020 af Inflow=0.23 cfs 0.060 af
Outflow=0.04 cfs 0.048 af

Total Runoff Area = 0.436 ac Runoff Volume = 0.095 af Average Runoff Depth = 2.61"
50.00% Pervious = 0.218 ac 50.00% Impervious = 0.218 ac

Summary for Subcatchment 1S: Post Developed

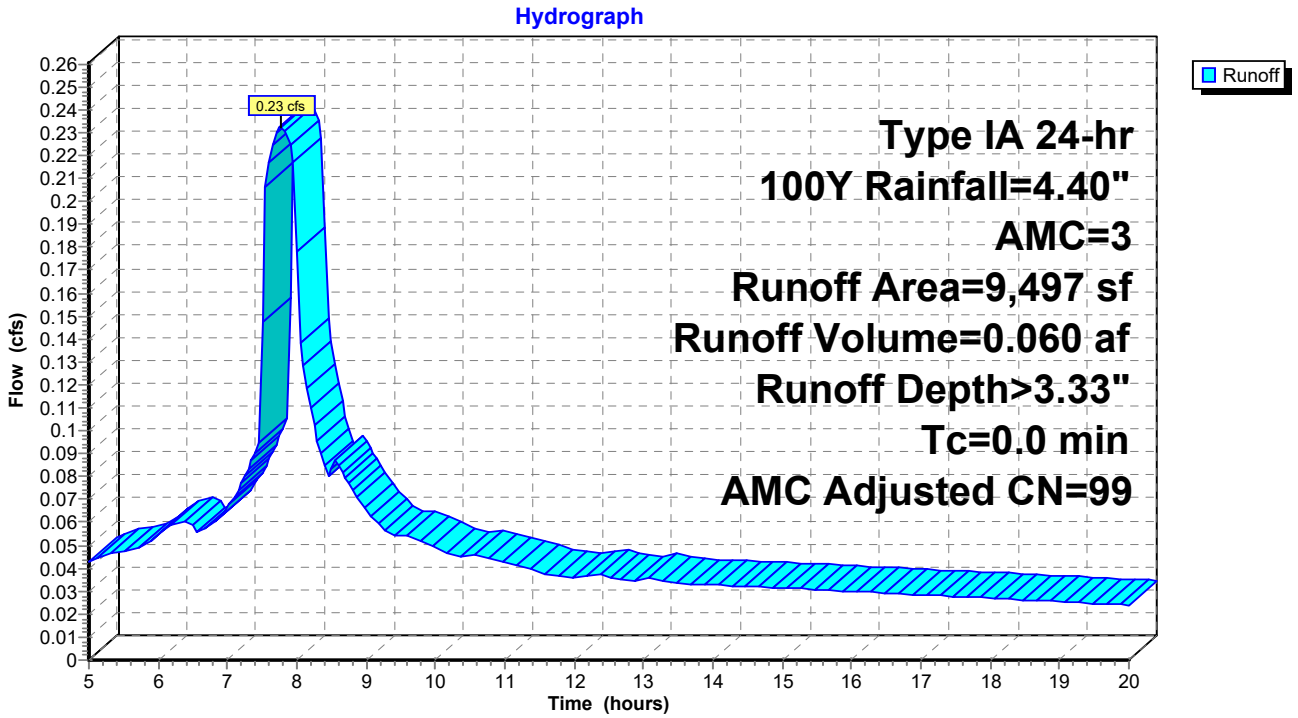
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.23 cfs @ 7.78 hrs, Volume= 0.060 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100Y Rainfall=4.40", AMC=3

	Area (sf)	CN	Adj	Description
*	8,137	98		
	1,360	98		Water Surface, HSG A
	9,497	98	99	Weighted Average, AMC Adjusted
	9,497			100.00% Impervious Area

Subcatchment 1S: Post Developed



Summary for Subcatchment 2S: Predeveloped

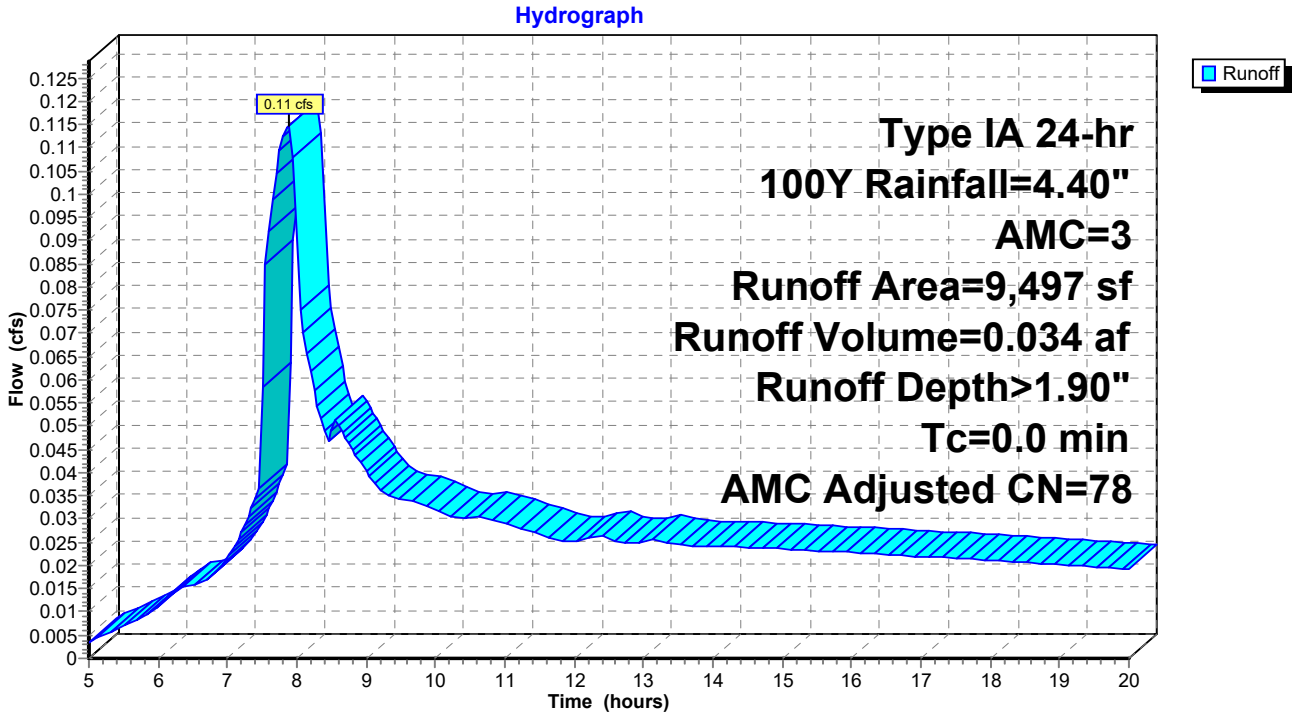
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.11 cfs @ 7.88 hrs, Volume= 0.034 af, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100Y Rainfall=4.40", AMC=3

	Area (sf)	CN	Adj	Description
*	9,497	60		Woods/grass comb., Fair, HSG B
	9,497	60	78	Weighted Average, AMC Adjusted
	9,497			100.00% Pervious Area

Subcatchment 2S: Predeveloped



Summary for Pond 3P: CMP

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.218 ac,100.00% Impervious, Inflow Depth > 3.33" for 100Y event
Inflow = 0.23 cfs @ 7.78 hrs, Volume= 0.060 af
Outflow = 0.04 cfs @ 10.89 hrs, Volume= 0.048 af, Atten= 81%, Lag= 186.8 min
Primary = 0.04 cfs @ 10.89 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.73' @ 10.89 hrs Surf.Area= 0.017 ac Storage= 0.020 af

Plug-Flow detention time= 230.3 min calculated for 0.048 af (79% of inflow)
Center-of-Mass det. time= 129.1 min (770.4 - 641.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.000 af	**12.00'W x 62.00'L x 5.00'H Field A** 0.085 af Overall - 0.035 af Embedded = 0.051 af x 0.0% Voids
#2A	0.50'	0.035 af	**CMP Round 48** x 6 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 6 Chambers in 2 Rows
		0.035 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**1.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	2.78'	**0.7" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 10.89 hrs HW=2.73' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.95 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: CMP - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

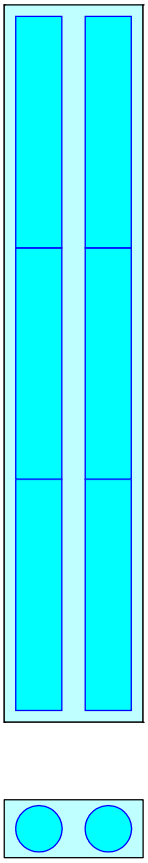
3 Chambers/Row x 20.00' Long = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length
2 Rows x 48.0" Wide + 24.0" Spacing x 1 + 12.0" Side Stone x 2 = 12.00' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

6 Chambers x 251.3 cf = 1,508.0 cf Chamber Storage

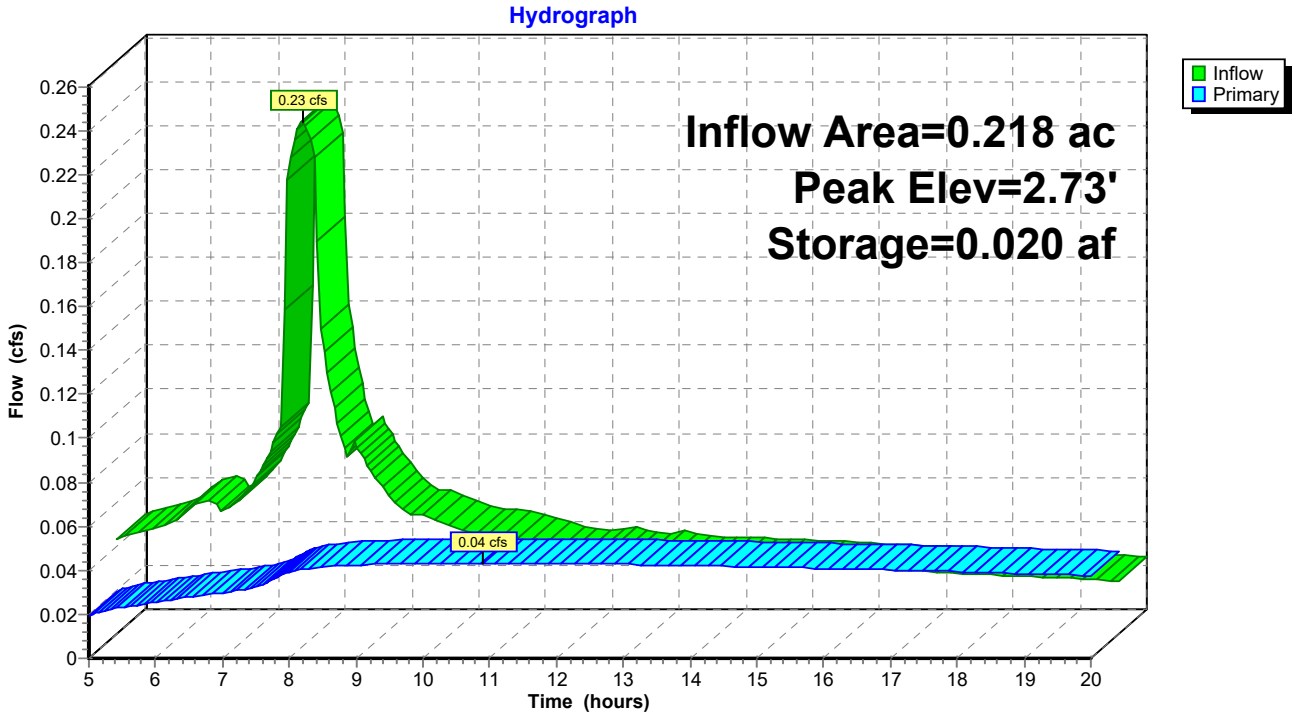
3,720.0 cf Field - 1,508.0 cf Chambers = 2,212.0 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 1,508.0 cf = 0.035 af
Overall Storage Efficiency = 40.5%
Overall System Size = 62.00' x 12.00' x 5.00'

6 Chambers
137.8 cy Field
81.9 cy Stone



Pond 3P: CMP


Hydrograph
Inflow
Primary
Inflow Area=0.218 ac
Peak Elev=2.73'
Storage=0.020 af
0.23 cfs
0.04 cfs
Flow (cfs)
Time (hours)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Appendix E

Geotechnical Report- To be provided in future submittals

Appendix F

Operations and Maintenance Form- To be provided in future submittals