Stantec

Stantec Planning and Landscape Architecture, P.C.
226 Causeway Street 6th Floor, Boston MA 02114-2155

August 15, 2018

File: 210810271

Reference: Puddingstone at Chestnut Hill

Attention: Alison C. Steinfeld, Planning Director

Department of Planning and Community Development

333 Washington Street

Brookline, MA 02445

CC: Adam Kran, EPG

Chestnut Hill Realty

Dear Ms. Alison Steinfeld,

The purpose of this letter is to address comments received at our meeting with Thomas Brady of the Town of Brookline's Conservation Commission and the Town's peer review consultant, Adam Kran, regarding the proposed Puddingstone at Chestnut Hill project located on Gerry Road.

Mr. Brady was concerned with the change in stormwater volume to the wetland located within the Hoar Sanctuary and to the drainage system in Independence Drive that would result from the project. Per discussion, contributing areas to each design point have been revised to reduce the change in stormwater volume to each design point.

A summary of the design changes is as follows:

Area Drain 4A-2 and a portion of the roof of the Sherman building have been rerouted to subsurface recharge system D-2B and subsurface detention system D-2C prior to discharging to the Independence Drive closed drainage system. These areas were previously routed to subsurface detention system D-1C which ultimately discharges to the wetland within the Hoar Sanctuary.

By rerouting these two areas, the stormwater volume increase to the wetland (DP-1) was significantly reduced. A summary of the discharge volumes and their percent decrease from the original design has been included as part of this submission.

Supplemental and revised documents and plans will be submitted with this letter to the peer review consultant that will address these comments, as noted above.

If there are any questions regarding the provided responses or site plans, please contact me by any means listed below.

Regards,

Frank Holmes

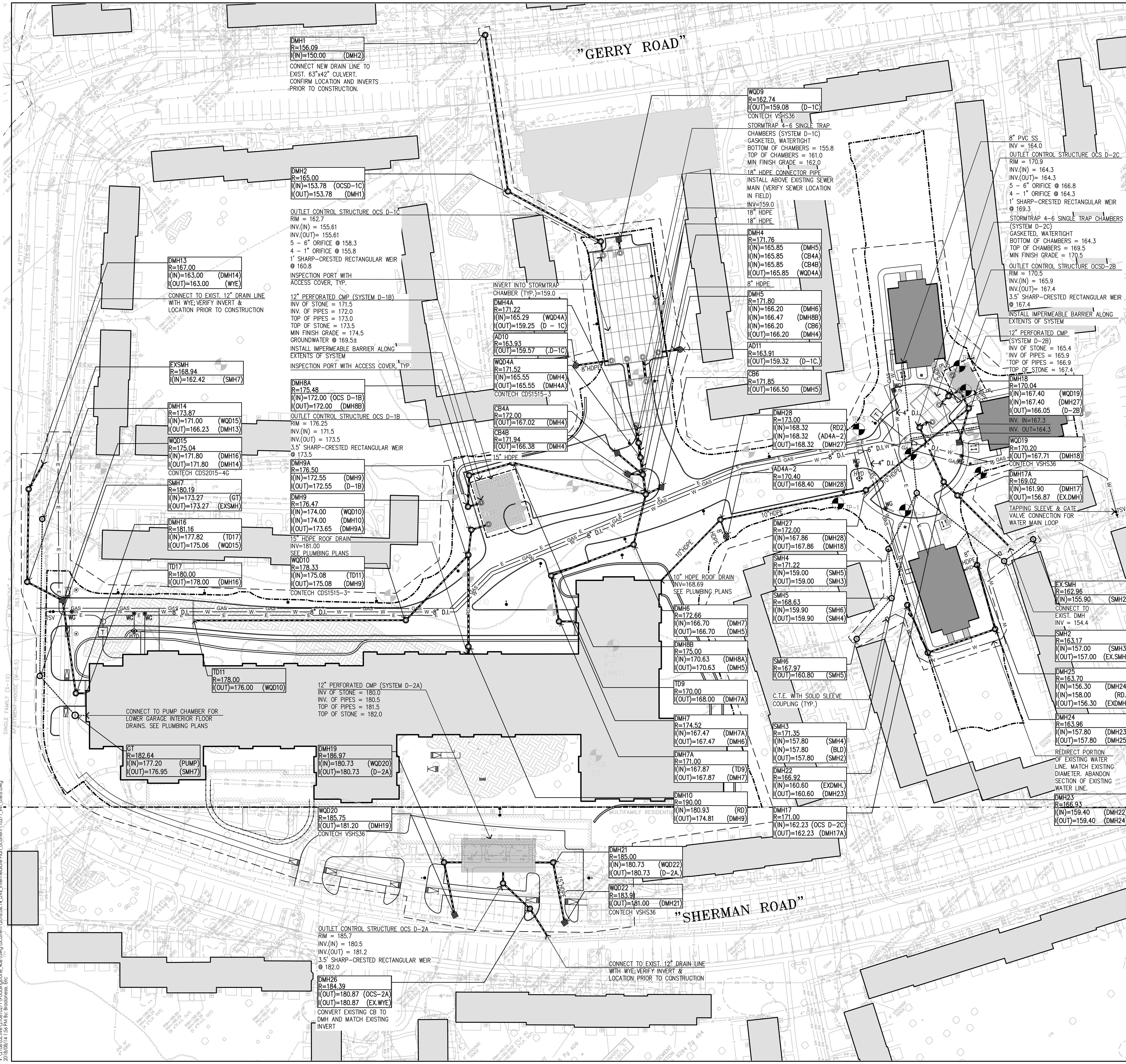
Frank Holmes, PE
Principal
Phone: (617) 654-6059
Frank.holmes@stantec.com

Attachments:
1. Sheet L-0700 "Utility Plan"
2. Discharge Volume Summary
3. Revised Peak Runoff Rate Summary
4. Revised Proposed HydroCAD Analyais
5. Revised Proposed Watershed Plan
6. Revised Standard 3 Calculations
7. Revised TSS Removal Calculations
8. Revised Pipe Calculations
9. Hydraflow Express Extension Hydraulic Analyses (Tailwater Analysis)

PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENTS #1

Sheet L-0700 “Utility Plan”



LEGEND

PROPERTY LINE		WG	WATER GATE
TOWN LINE		HYD	HYDRANT
SEWER LINE		T	TRANSFORMER
DRAIN LINE		DI	DUCTILE IRON
W	WATER LINE	RD	ROOF DRAIN
	REDUCER	TSV	TAPPING SLEEVE AND VALVE
	COUPLING		ELECTRIC MANHOLE
GAS	GAS LINE		
E	UNDERGROUND ELECTRIC		
RD	ROOF DRAIN LINE		
	CATCH BASIN		
	AREA DRAIN		
	DRAIN MANHOLE		
	SEWER MANHOLE		

UTILITY NOTES

1. EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM A SURVEY PREPARED BY REED LAND SURVEYING OF LAKEVILLE, MASSACHUSETTS; DATED JUNE 8, 2008.
2. PRIOR TO THE START OF ANY EXCAVATION FOR THE PROJECT, BOTH ON AND OFF THE SITE, THE CONTRACTOR SHALL NOTIFY DIGSAFE AND BE PROVIDED WITH A DIGSAFE NUMBER INDICATING THAT ALL EXISTING UTILITIES HAVE BEEN LOCATED AND MARKED.
3. CONTRACTOR TO ADJUST UTILITY ELEMENT MEANT TO BE FLUSH WITH GRADE (CLEAN-OUTS, UTILITY MANHOLES, CATCH BASINS, INLETS, ETC.) THAT IS AFFECTED BY SITE WORK OR GRADE CHANGES, WHETHER SPECIFICALLY NOTED ON PLANS OR NOT.
4. ALL WORK TO BE DONE WITHIN PUBLIC RIGHT-OF-WAYS SHALL CONFORM TO THE REQUIREMENTS AND SPECIFICATIONS OF THE TOWN OF BROOKLINE.
5. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES.
6. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
7. THE CONTRACTOR SHALL ALTER THE MASONRY OF THE TOP SECTION OF ALL EXISTING DRAINAGE STRUCTURES AS NECESSARY FOR CHANGES IN GRADE, AND RESET ALL WATER AND DRAINAGE FRAMES, GRATES, AND BOXES TO THE PROPOSED FINISH SURFACE GRADE.
8. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF ALL GAS, ELECTRIC, TELEPHONE, AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES.
9. CONTRACTOR SHALL MAINTAIN, OR ADJUST TO NEW FINISH GRADE, AS NECESSARY ALL UTILITY AND SITE STRUCTURES SUCH AS: LIGHT POLES, SIGN POLES, MANHOLES, CATCH BASINS, HAND HOLES, WATER AND GAS GATES, HYDRANTS, ETC., FROM MAINTAINED UTILITY AND SITE SYSTEMS, UNLESS OTHERWISE NOTED OR DIRECTED BY OWNER'S REPRESENTATIVE.
10. ALL SEWER PIPES SHALL BE PVC PER ASTM D3034, SDR-35 AND ASTM D1784 WITH RUBBER GASKET JOINTS.
11. SITE LIGHTING IS SHOWN ON THIS PLAN FOR COORDINATION PURPOSES ONLY. REFER TO ELECTRICAL PLANS FOR EXACT TYPE AND LOCATION.
12. REFER TO ELECTRICAL PLANS FOR SECTIONS AND DETAILS OF THE UTILITY DUCT BANK.
13. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION, AT THE CONTRACTOR'S EXPENSE.
14. REFER TO ARCHITECTURAL PLANS FOR PROPOSED LOCATION OF UTILITY SERVICE STUBS AT BUILDING.
15. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS, TELEPHONE, ELECTRICAL.) FINAL DESIGN AND LOCATIONS AT THE BUILDING WILL BE PROVIDED BY THE ARCHITECT. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF THE UTILITY CONNECTIONS WITH THE RESPECTIVE COMPANIES PRIOR TO ANY UTILITY CONSTRUCTION.
16. ALL CEMENT LINED DUCTILE IRON JOINTS AT FITTINGS (CLASS 52), VALVES, AND HYDRANT LATERALS SHALL BE MECHANICAL JOINT WITH NEOPRENE GASKETS. JOINTS AT OTHER LOCATIONS SHALL BE PUSH-ON TYPE WITH NEOPRENE OR SYNTHETIC RUBBER GASKETS. ALL WATER GATES SHALL OPEN AS PER CITY REQUIREMENTS. ALL WATER LINES SHALL HAVE A MINIMUM OF 5 FEET OF GROUND COVER AND A MINIMUM SEPARATION OF 10 FEET FROM THE SEWER SYSTEM IN A SEPARATE TRENCH. AT WATER AND SEWER CROSSINGS, THE WATER LINE SHALL BE ENCASED IN SIX INCHES OF CONCRETE FOR A DISTANCE OF 10 FEET ON EITHER SIDE OF THE CROSSING. ONE FULL LENGTH OF WATER PIPE SHALL BE LOCATED SO BOTH JOINTS WILL BE AS FAR FROM THE SEWER AS POSSIBLE, AND THE SEWER MATERIALS SHALL BE WATER WORKS GRADE 150 PSI PRESSURE RATED PIPE MEETING LATEST AWWA STANDARDS AND SHALL BE PRESSURE TESTED TO ENSURE WATER TIGHTNESS.
17. ALL NEW WATER MAINS SHALL BE PRESSURE TESTED AND DISINFECTED IN ACCORDANCE WITH AWWA STANDARDS.
18. PROTECT AND MAINTAIN EXISTING ON-SITE DRAINAGE STRUCTURES AND PIPES UNLESS OTHERWISE NOTED.
19. ALL PROPOSED DRAIN LINES SHALL BE 12" HDPE UNLESS OTHERWISE NOTED.
20. UPON INSTALLATION OF SUBSURFACE DETENTION FACILITIES (STORMTRAP), WATERTIGHT TESTING OF EACH SYSTEM SHALL CONSIST OF PUMPING CHAMBERS DRY AND MONITORING FOR TWENTY-FOUR HOURS TO ENSURE THAT NO GROUNDWATER WILL HAVE ENTERED THE SYSTEMS.

Stantec

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Consultants

COMPREHENSIVE PERMIT APPLICATION			08.20.18
Issued	By	Appd.	MM.DD.YY

File Name: 10271_INT_utility.dwg				
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

Permit-Seal

Client/Project

PUDDINGSTONE AT CHESTNUT HILL

Brookline, MA

Title

UTILITY PLAN

Project No. 210810271

Scale As Noted

Drawing No.

L-0700

ORIGINAL SHEET - ARCH D

PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #2

Discharge Volume Summary

Stantec

Discharge Volume Summary

Project:	Puddingstone at Chestnut Hill	Author:	Eric Bradanese, PE
	Brookline, MA	Checked:	Frank Holmes, PE
Summary:	Discharge Volume	Date:	August 13, 2018

Discharge Volume Summary

	Design Storms															
	2-Year (3.20")				10-Year (4.60")				25-Year (5.50")				100-Year (6.70")			
Design Points	Ex. Volume (af)	Pr. Volume (af)	Vol. Diff. +/- (af)	% Closer to Ex. Volume(1)	Ex. Volume (af)	Pr. Volume (af)	Vol. Diff. +/- (af)	% Closer to Ex. Volume(1)	Ex. Volume (af)	Pr. Volume (af)	Vol. Diff. +/- (af)	% Closer to Ex. Volume(1)	Ex. Volume (af)	Pr. Volume (af)	Vol. Diff. +/- (af)	% Closer to Ex. Volume(1)
DP-1	0.318	0.311	-0.007	86%	0.563	0.632	+0.069	59%	0.729	0.847	+0.118	52%	0.957	1.140	+0.183	48%
DP-2	0.429	0.422	-0.007	91%	0.739	0.683	-0.056	66%	0.947	0.855	-0.092	60%	1.231	1.086	-0.145	54%

(1) Compared to discharge volumes from the Stormwater Report dated July 5, 2018.

PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #3

Revised Peak Runoff Rate Summary

Stantec

Peak Runoff Rate Summary

Project:	Puddingstone at Chestnut Hill	Author:	Eric Bradanese, PE
	Brookline, MA	Checked:	Frank Holmes, PE
Summary:	Peak Runoff Rate	Date:	August 13, 2018

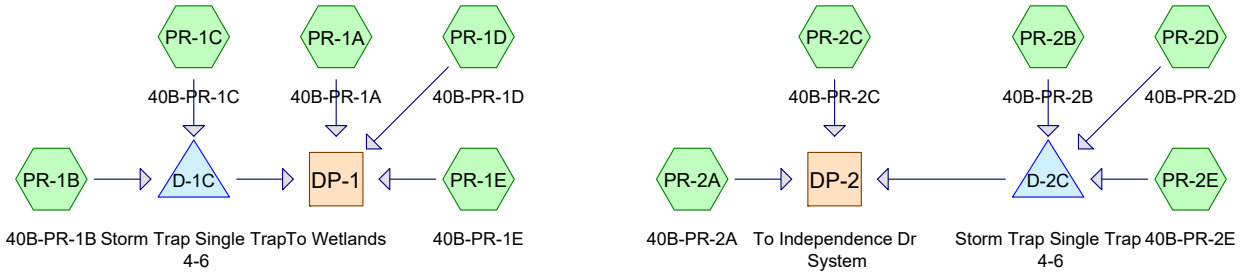
Peak Runoff Rate Summary (Revised 08/13/18)

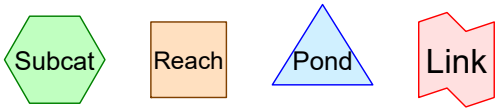
	Design Storms							
	2-Year (3.20”		10-Year (4.60”)		25-Year (5.50”)		100-Year (6.70”)	
Design Points	Ex. Rate (cfs)	Pr. Rate (cfs)	Ex. Rate (cfs)	Pr. Rate (cfs)	Ex. Rate (cfs)	Pr. Rate (cfs)	Ex. Rate (cfs)	Pr. Rate (cfs)
DP-1	4.45	1.70	7.91	3.36	10.20	5.66	13.28	8.58
DP-2	6.03	5.69	10.33	8.95	13.15	11.01	16.92	13.71

PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #4

Revised Proposed HydroCAD Analysis





Routing Diagram for Puddingstone Proposed Hydrologic Analysis_INT_REV2

Prepared by Stantec Consulting Ltd., Printed 8/15/2018

HydroCAD® 10.00-20 s/n 02809 © 2017 HydroCAD Software Solutions LLC

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	2.272	0.000	2.272	>75% Grass cover, Good	PR-1A, PR-1B, PR-1D, PR-1E, PR-2A, PR-2B, PR-2C, PR-2E
0.000	0.000	0.000	0.000	3.039	3.039	Impervious	PR-1A, PR-1B, PR-1C, PR-2A, PR-2B, PR-2C, PR-2D, PR-2E
0.000	0.000	0.000	0.000	0.203	0.203	Roof	PR-2B, PR-2C
0.000	**0.000**	**0.000**	**2.272**	**3.242**	**5.514**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: 40B-PR-1A Runoff Area=25,311 sf 27.26% Impervious Runoff Depth>1.76"
Tc=6.0 min CN=85 Runoff=1.20 cfs 0.085 af

Subcatchment PR-1B: 40B-PR-1B Runoff Area=52,416 sf 68.33% Impervious Runoff Depth>2.35"
Tc=6.0 min CN=92 Runoff=3.24 cfs 0.235 af

Subcatchment PR-1C: 40B-PR-1C Runoff Area=46,421 sf 100.00% Impervious Runoff Depth>2.97"
Tc=6.0 min CN=98 Runoff=3.31 cfs 0.263 af

Subcatchment PR-1D: 40B-PR-1D Runoff Area=1,848 sf 0.00% Impervious Runoff Depth>1.40"
Tc=6.0 min CN=80 Runoff=0.07 cfs 0.005 af

Subcatchment PR-1E: 40B-PR-1E Runoff Area=8,324 sf 0.00% Impervious Runoff Depth>1.40"
Tc=6.0 min CN=80 Runoff=0.31 cfs 0.022 af

Subcatchment PR-2A: 40B-PR-2A Runoff Area=54,932 sf 39.39% Impervious Runoff Depth>1.91"
Tc=6.0 min CN=87 Runoff=2.83 cfs 0.201 af

Subcatchment PR-2B: 40B-PR-2B Runoff Area=22,078 sf 82.43% Impervious Runoff Depth>2.64"
Tc=6.0 min CN=95 Runoff=1.49 cfs 0.112 af

Subcatchment PR-2C: 40B-PR-2C Runoff Area=11,737 sf 34.36% Impervious Runoff Depth>1.83"
Tc=6.0 min CN=86 Runoff=0.58 cfs 0.041 af

Subcatchment PR-2D: 40B-PR-2D Runoff Area=8,000 sf 100.00% Impervious Runoff Depth>2.97"
Tc=6.0 min CN=98 Runoff=0.57 cfs 0.045 af

Subcatchment PR-2E: 40B-PR-2E Runoff Area=9,102 sf 2.19% Impervious Runoff Depth>1.40"
Tc=6.0 min CN=80 Runoff=0.34 cfs 0.024 af

Reach DP-1: To Wetlands Inflow=1.70 cfs 0.311 af
Outflow=1.70 cfs 0.311 af

Reach DP-2: To Independence Dr System Inflow=5.69 cfs 0.422 af
Outflow=5.69 cfs 0.422 af

Pond D-1C: Storm Trap Single Trap 4-6 Peak Elev=158.37' Storage=15,066 cf Inflow=6.55 cfs 0.499 af
Outflow=0.25 cfs 0.199 af

Pond D-2C: Storm Trap Single Trap 4-6 Peak Elev=167.25' Storage=1,482 cf Inflow=2.40 cfs 0.181 af
Outflow=2.31 cfs 0.180 af

Total Runoff Area = 5.514 ac Runoff Volume = 1.035 af Average Runoff Depth = 2.25"
41.21% Pervious = 2.272 ac 58.79% Impervious = 3.242 ac

Summary for Subcatchment PR-1A: 40B-PR-1A

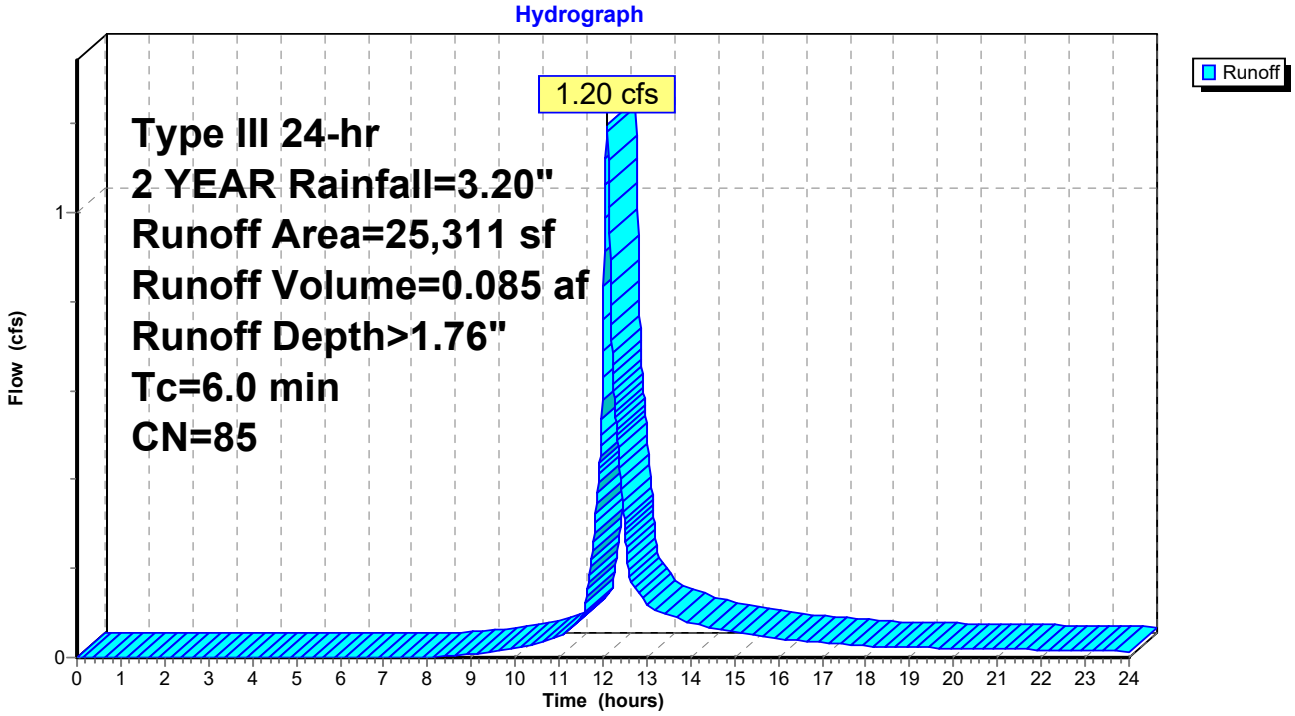
Runoff = 1.20 cfs @ 12.09 hrs, Volume= 0.085 af, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	6,900	98	Impervious
	18,411	80	>75% Grass cover, Good, HSG D
	25,311	85	Weighted Average
	18,411		72.74% Pervious Area
	6,900		27.26% Impervious Area

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

Subcatchment PR-1A: 40B-PR-1A



Summary for Subcatchment PR-1B: 40B-PR-1B

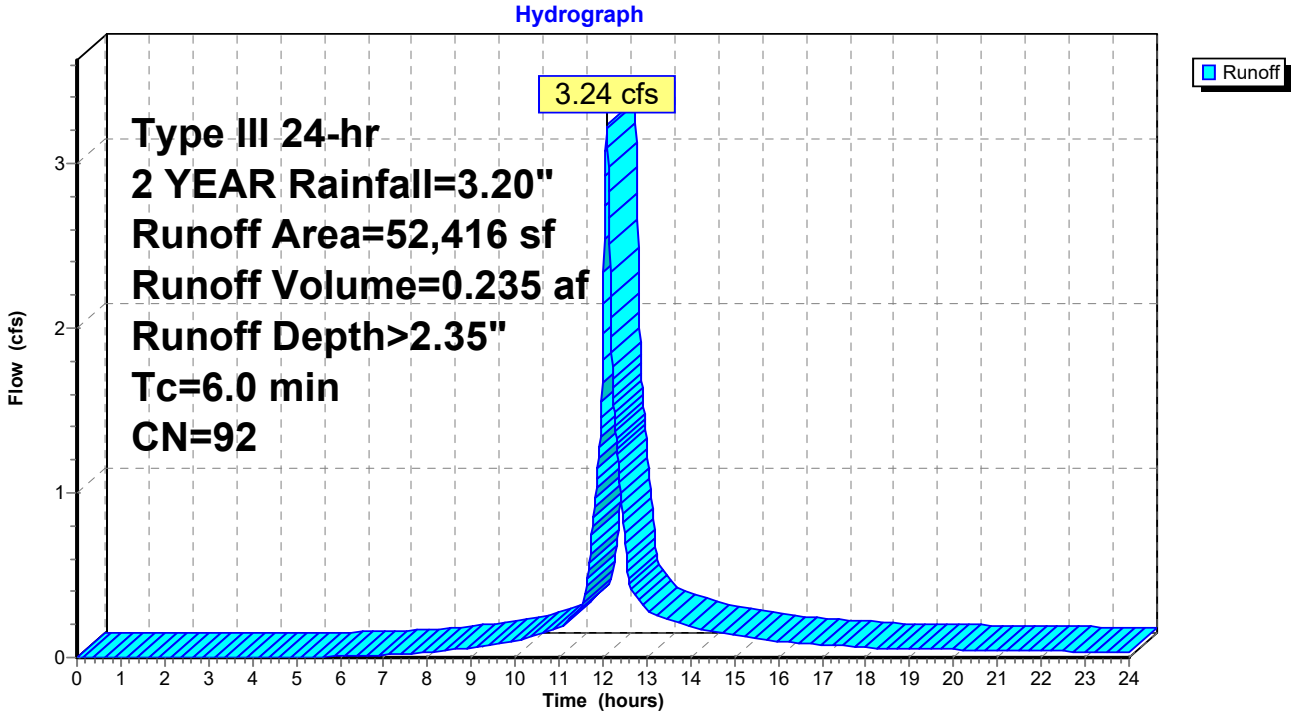
Runoff = 3.24 cfs @ 12.09 hrs, Volume= 0.235 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	35,817	98	Impervious
	16,599	80	>75% Grass cover, Good, HSG D
	52,416	92	Weighted Average
	16,599		31.67% Pervious Area
	35,817		68.33% Impervious Area

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

Subcatchment PR-1B: 40B-PR-1B



Summary for Subcatchment PR-1C: 40B-PR-1C

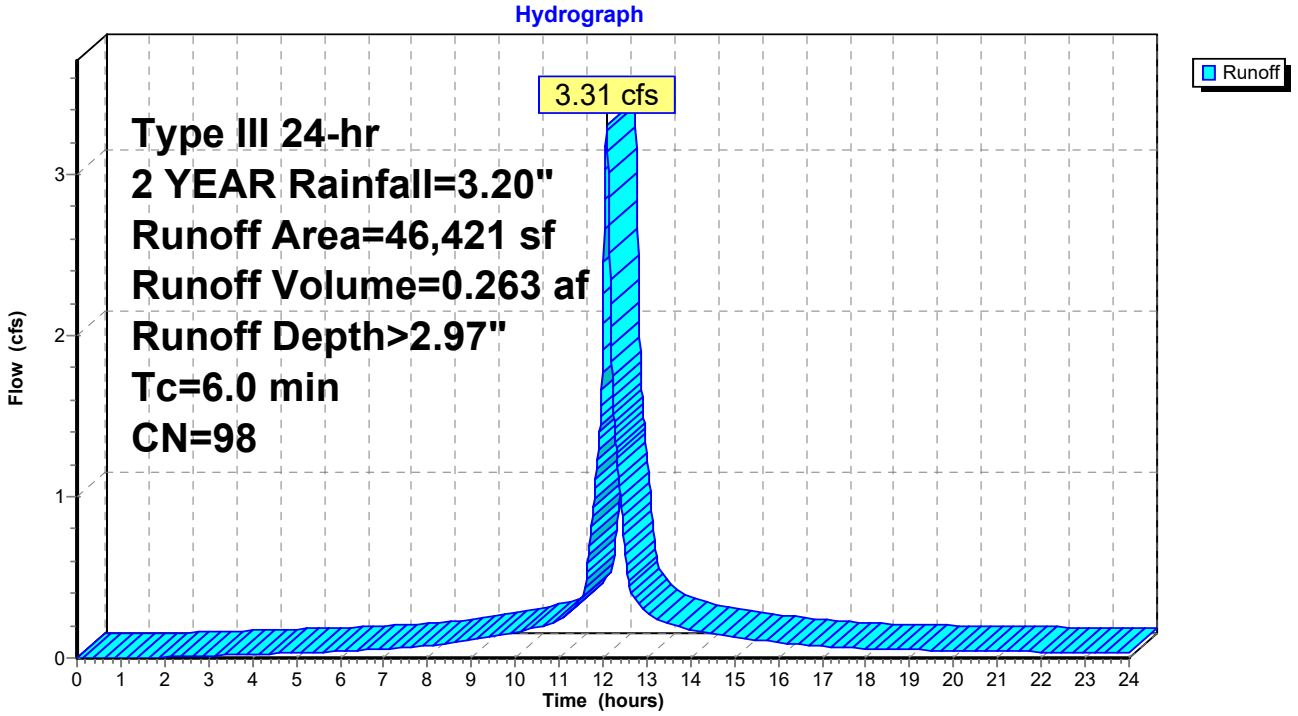
Runoff = 3.31 cfs @ 12.08 hrs, Volume= 0.263 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	46,421	98	Impervious
	46,421		100.00% Impervious Area

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

Subcatchment PR-1C: 40B-PR-1C



Summary for Subcatchment PR-1D: 40B-PR-1D

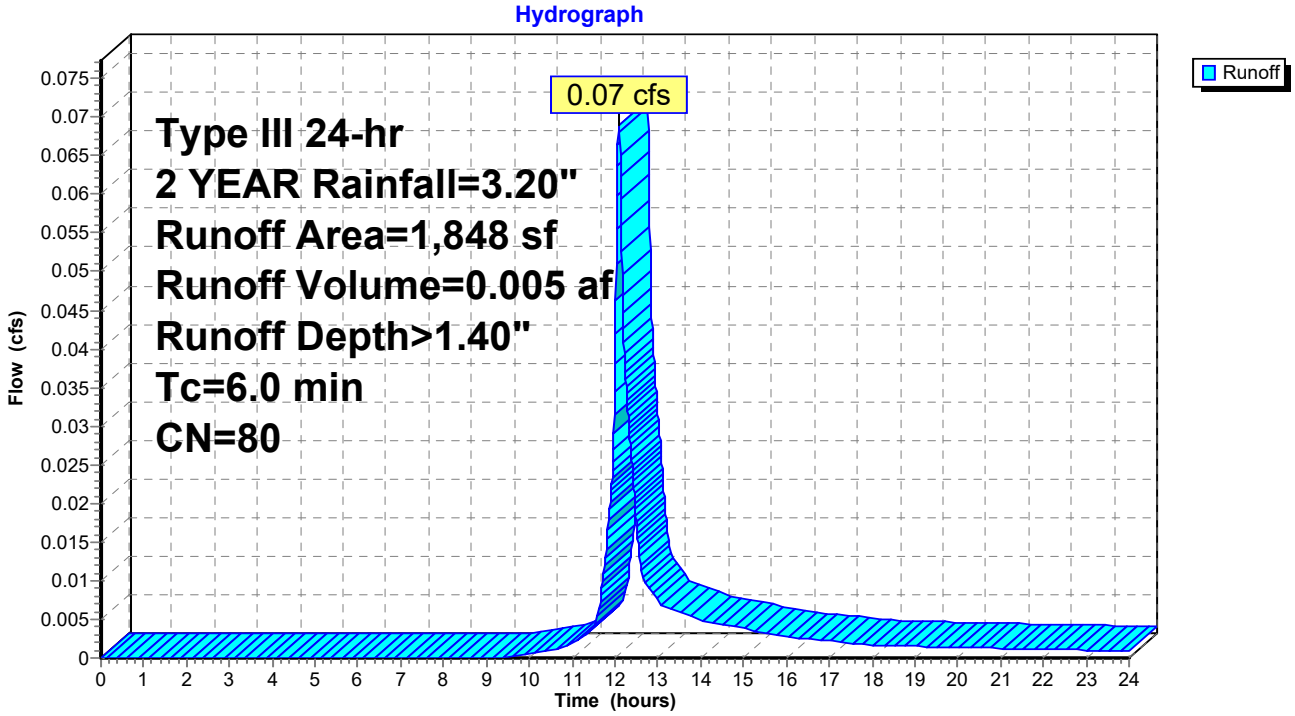
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 0.005 af, Depth> 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

Area (sf)	CN	Description
1,848	80	>75% Grass cover, Good, HSG D
1,848		100.00% Pervious Area

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

Subcatchment PR-1D: 40B-PR-1D



Summary for Subcatchment PR-1E: 40B-PR-1E

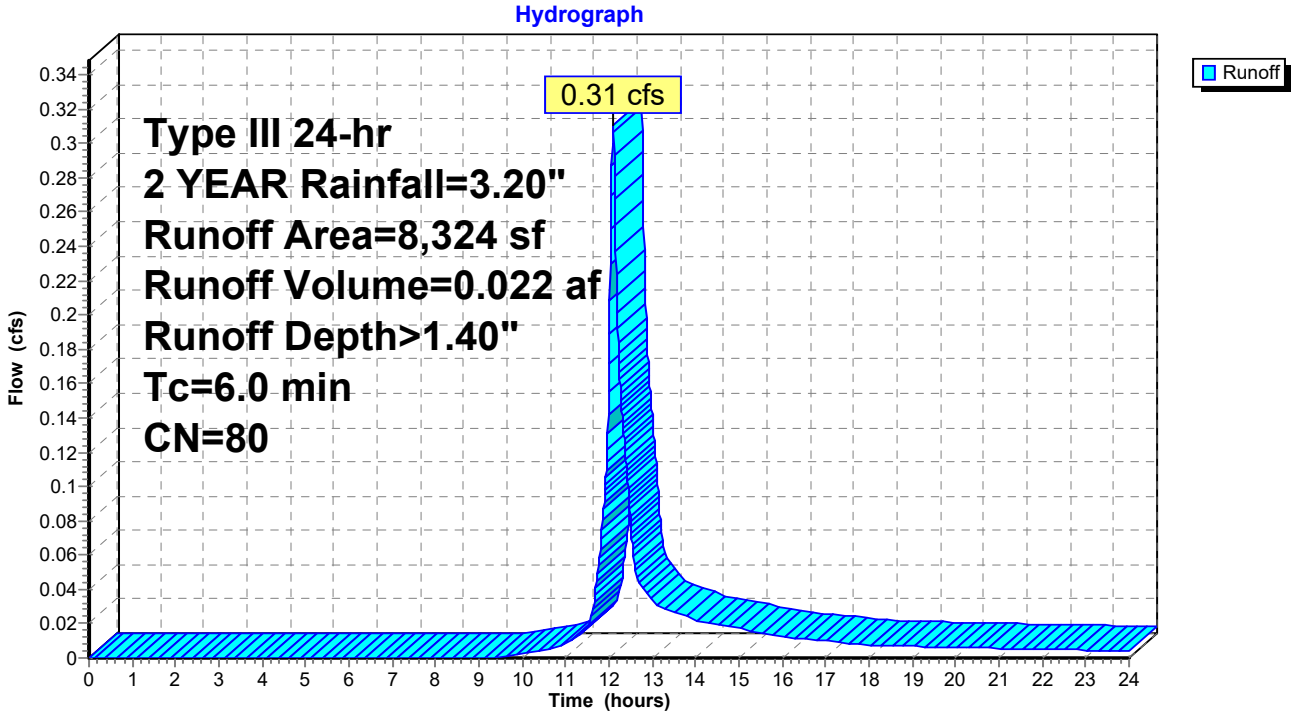
Runoff = 0.31 cfs @ 12.09 hrs, Volume= 0.022 af, Depth> 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

Area (sf)	CN	Description
8,324	80	>75% Grass cover, Good, HSG D
8,324		100.00% Pervious Area

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

Subcatchment PR-1E: 40B-PR-1E



Summary for Subcatchment PR-2A: 40B-PR-2A

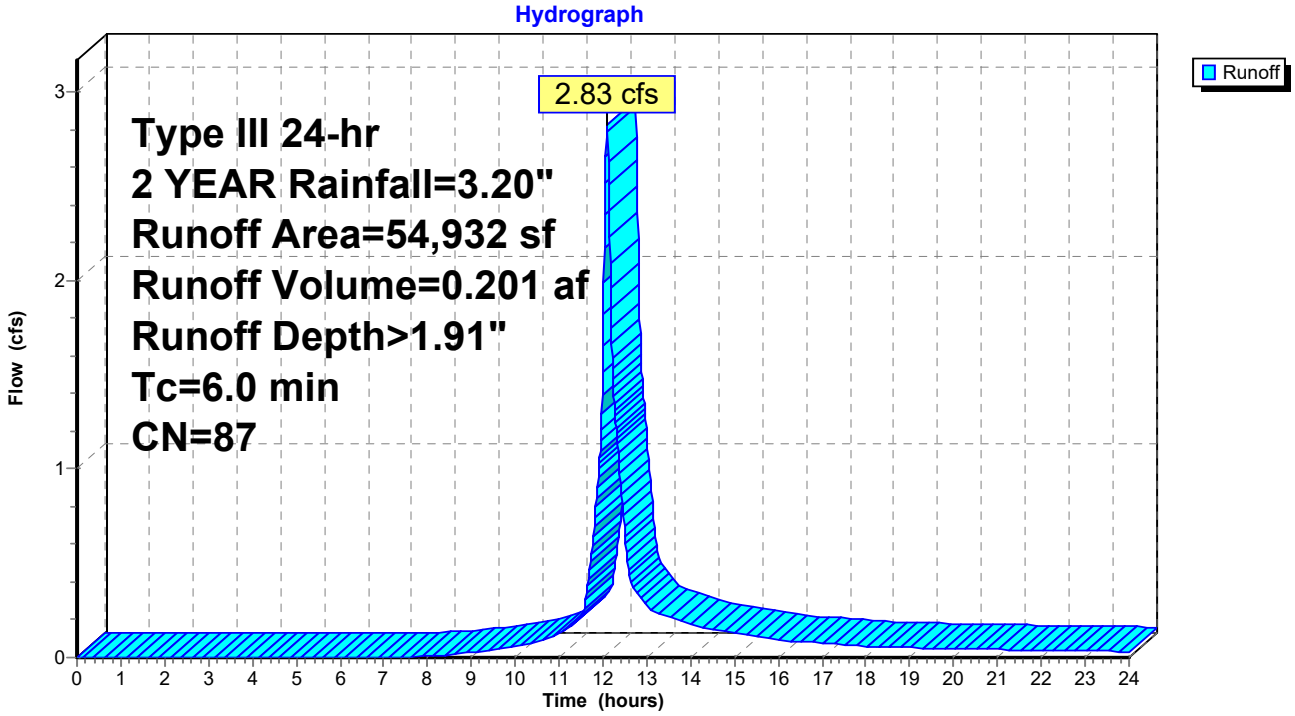
Runoff = 2.83 cfs @ 12.09 hrs, Volume= 0.201 af, Depth> 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	21,637	98	Impervious
	33,295	80	>75% Grass cover, Good, HSG D
	54,932	87	Weighted Average
	33,295		60.61% Pervious Area
	21,637		39.39% Impervious Area

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

Subcatchment PR-2A: 40B-PR-2A



Summary for Subcatchment PR-2B: 40B-PR-2B

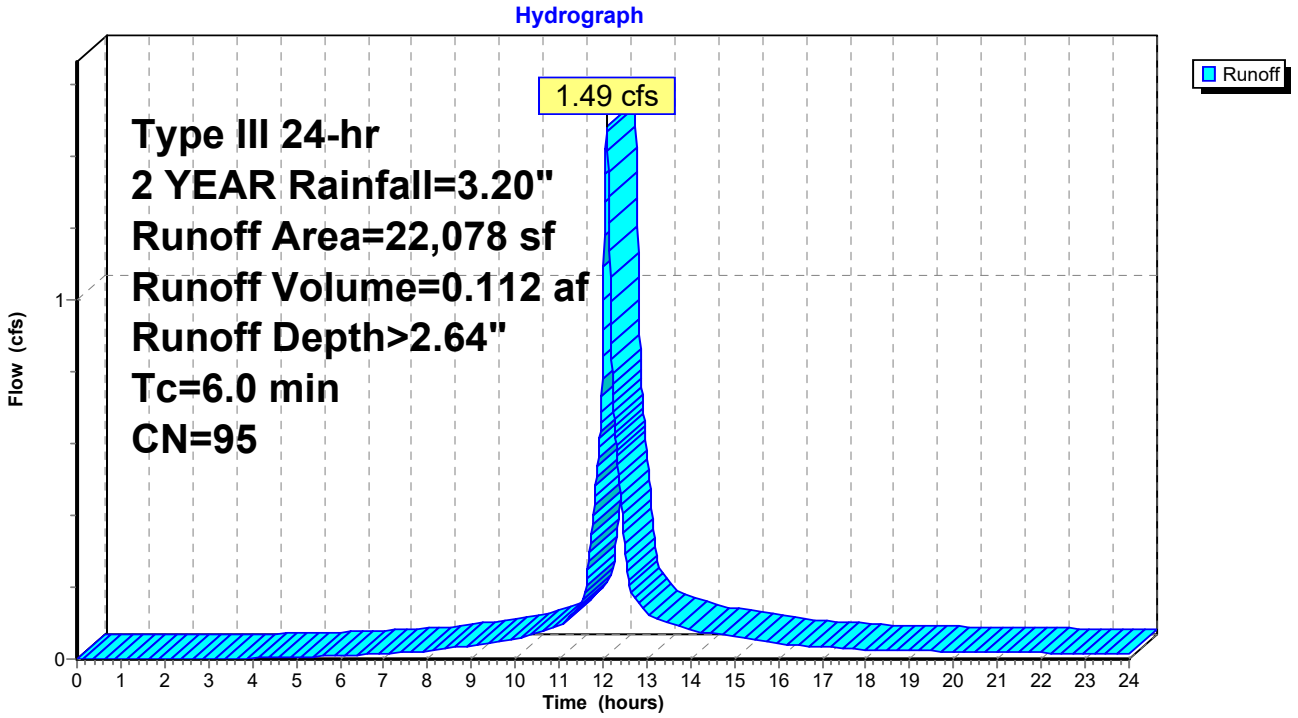
Runoff = 1.49 cfs @ 12.08 hrs, Volume= 0.112 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	12,305	98	Impervious
	3,879	80	>75% Grass cover, Good, HSG D
*	5,894	98	Roof
	22,078	95	Weighted Average
	3,879		17.57% Pervious Area
	18,199		82.43% Impervious Area

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

Subcatchment PR-2B: 40B-PR-2B



Summary for Subcatchment PR-2C: 40B-PR-2C

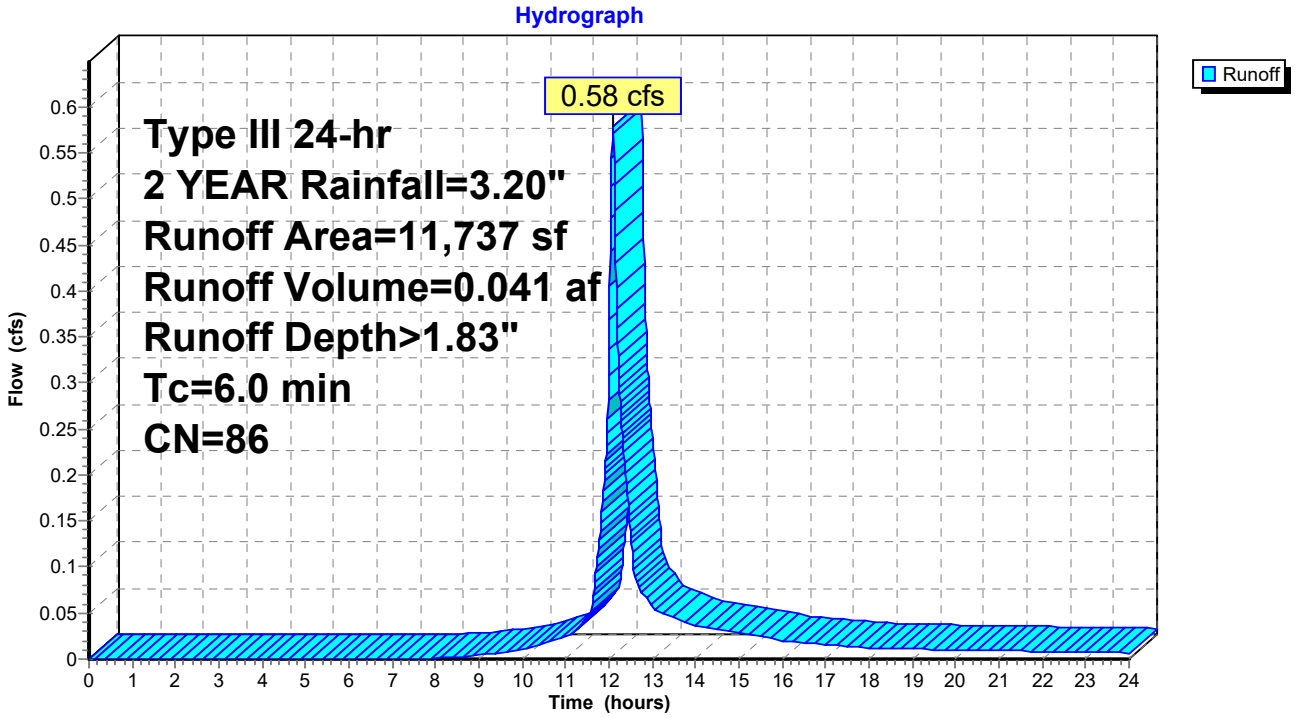
Runoff = 0.58 cfs @ 12.09 hrs, Volume= 0.041 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
	7,704	80	>75% Grass cover, Good, HSG D
*	1,086	98	Impervious
*	2,947	98	Roof
	11,737	86	Weighted Average
	7,704		65.64% Pervious Area
	4,033		34.36% Impervious Area

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

Subcatchment PR-2C: 40B-PR-2C



Summary for Subcatchment PR-2D: 40B-PR-2D

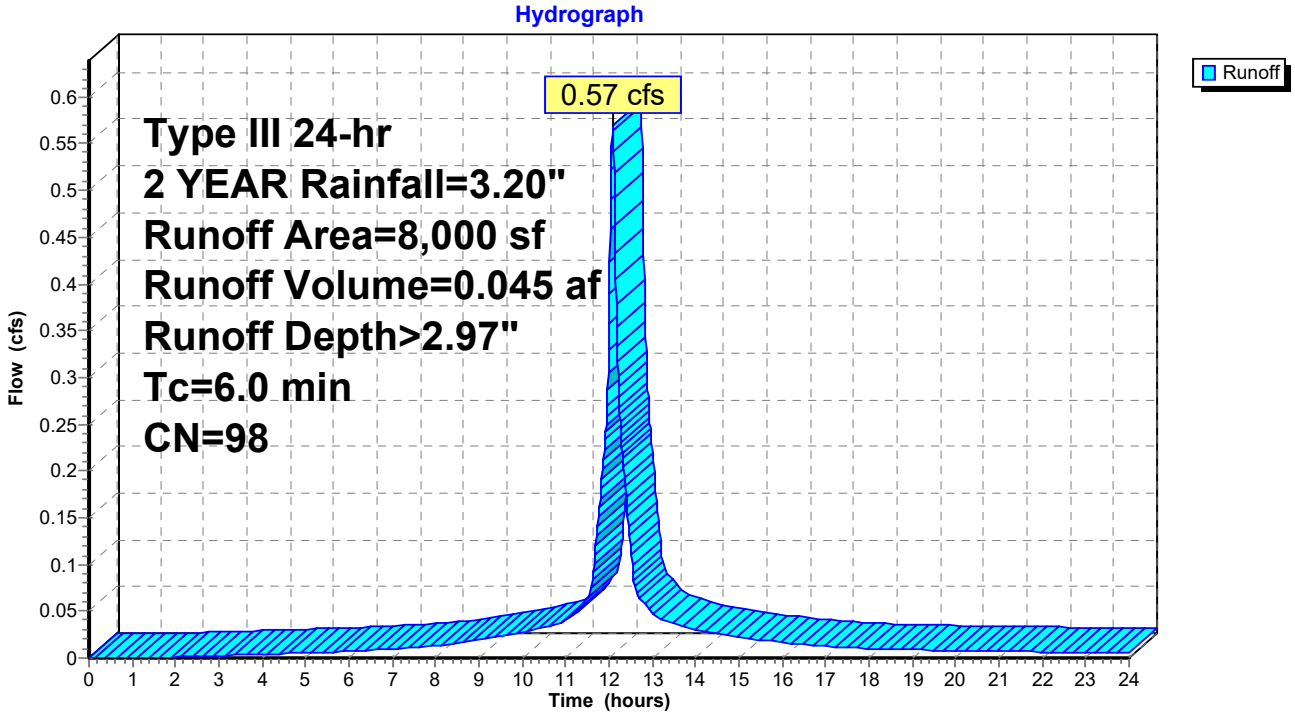
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.045 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	8,000	98	Impervious
	8,000		100.00% Impervious Area

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

Subcatchment PR-2D: 40B-PR-2D



Summary for Subcatchment PR-2E: 40B-PR-2E

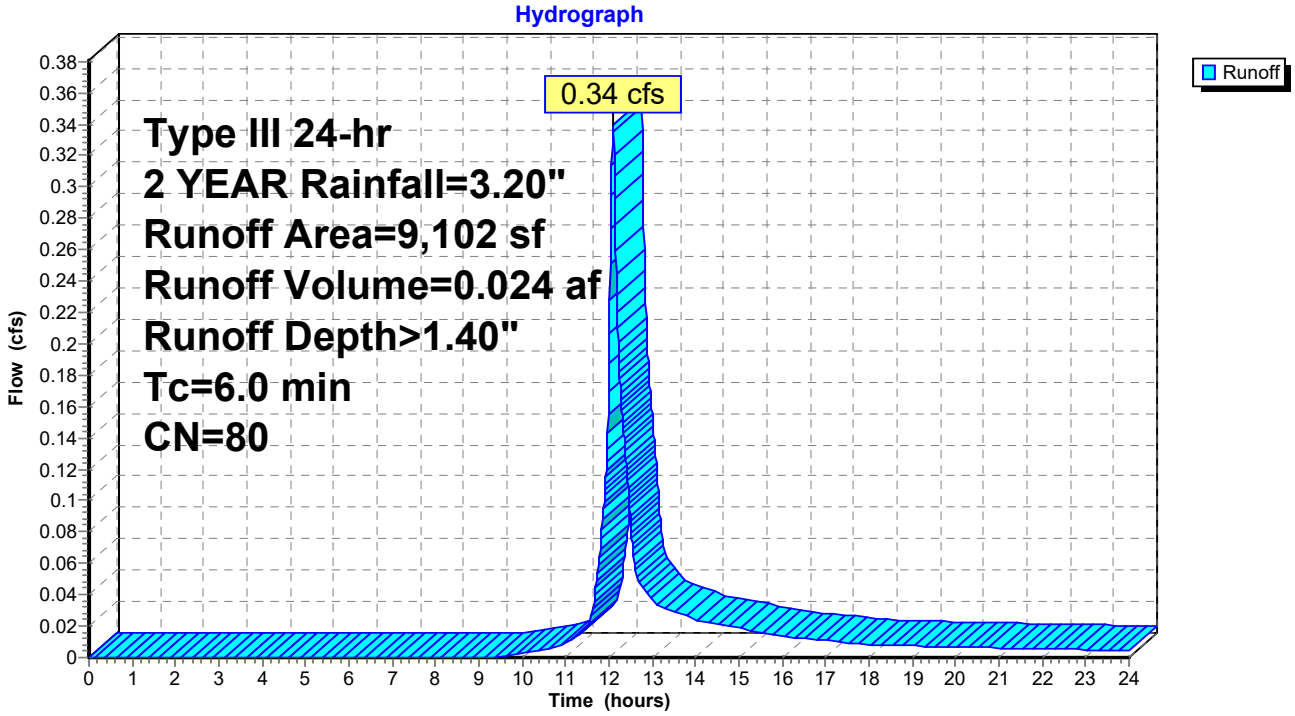
Runoff = 0.34 cfs @ 12.09 hrs, Volume= 0.024 af, Depth> 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YEAR Rainfall=3.20"

	Area (sf)	CN	Description
*	199	98	Impervious
	8,903	80	>75% Grass cover, Good, HSG D
	9,102	80	Weighted Average
	8,903		97.81% Pervious Area
	199		2.19% Impervious Area

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

Subcatchment PR-2E: 40B-PR-2E

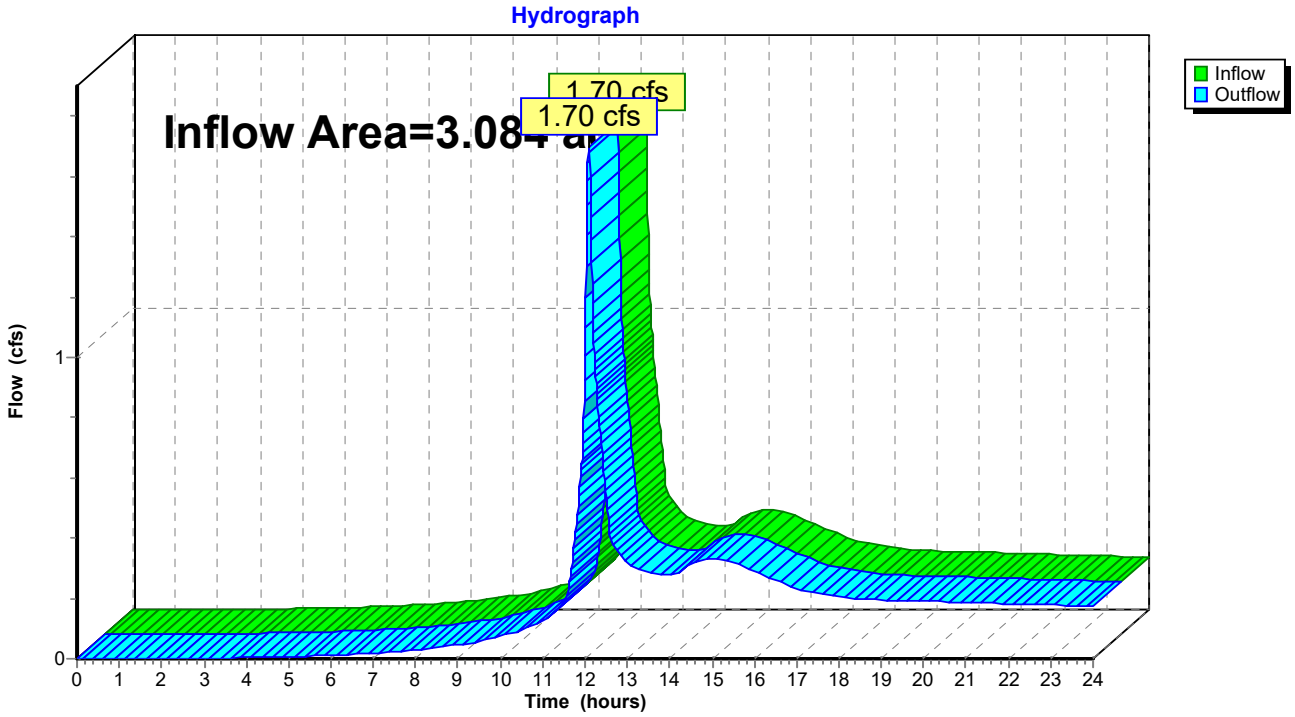


Summary for Reach DP-1: To Wetlands

Inflow Area = 3.084 ac, 66.36% Impervious, Inflow Depth > 1.21" for 2 YEAR event
Inflow = 1.70 cfs @ 12.09 hrs, Volume= 0.311 af
Outflow = 1.70 cfs @ 12.09 hrs, Volume= 0.311 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-1: To Wetlands

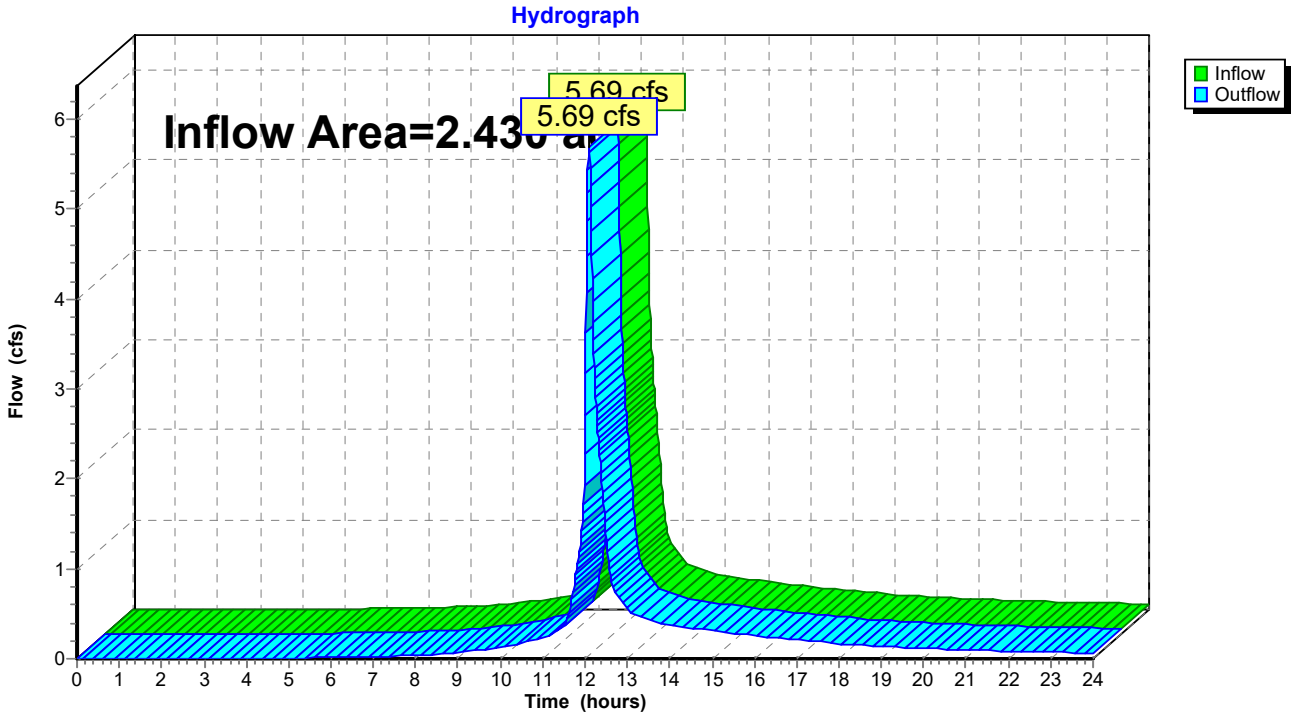


Summary for Reach DP-2: To Independence Dr System

Inflow Area = 2.430 ac, 49.19% Impervious, Inflow Depth > 2.09" for 2 YEAR event
Inflow = 5.69 cfs @ 12.09 hrs, Volume= 0.422 af
Outflow = 5.69 cfs @ 12.09 hrs, Volume= 0.422 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-2: To Independence Dr System



Summary for Pond D-1C: Storm Trap Single Trap 4-6

Inflow Area = 2.269 ac, 83.21% Impervious, Inflow Depth > 2.64" for 2 YEAR event
Inflow = 6.55 cfs @ 12.08 hrs, Volume= 0.499 af
Outflow = 0.25 cfs @ 15.22 hrs, Volume= 0.199 af, Atten= 96%, Lag= 188.4 min
Primary = 0.25 cfs @ 15.22 hrs, Volume= 0.199 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 158.37' @ 15.22 hrs Surf.Area= 6,836 sf Storage= 15,066 cf

Plug-Flow detention time= 372.8 min calculated for 0.198 af (40% of inflow)
Center-of-Mass det. time= 236.1 min (1,011.4 - 775.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.80'	0 cf	**48.27'W x 141.63'L x 5.17'H Field A** 35,321 cf Overall - 35,321 cf Embedded = 0 cf x 0.0% Voids
#2A	155.80'	26,355 cf	**StormTrap ST1 SingleTrap 4-6** x 70 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 7 Rows of 10 Chambers 48.27' x 140.63' Core + 0.00' x 0.50' Border = 48.27' x 141.63' System
		26,355 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.30'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	160.80'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	155.80'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.25 cfs @ 15.22 hrs HW=158.37' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.08 cfs @ 0.92 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.17 cfs @ 7.66 fps)

Pond D-1C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

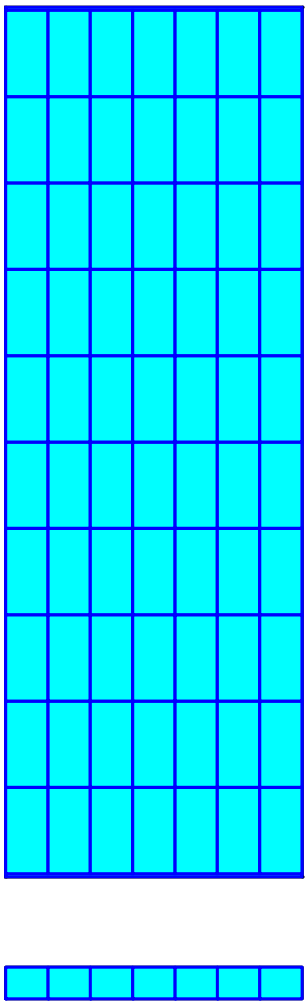
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

10 Chambers/Row x 14.06' Long = 140.63' Row Length +6.0" Border x 2 = 141.63' Base Length
7 Rows x 82.8" Wide = 48.27' Base Width
62.0" Chamber Height = 5.17' Field Height

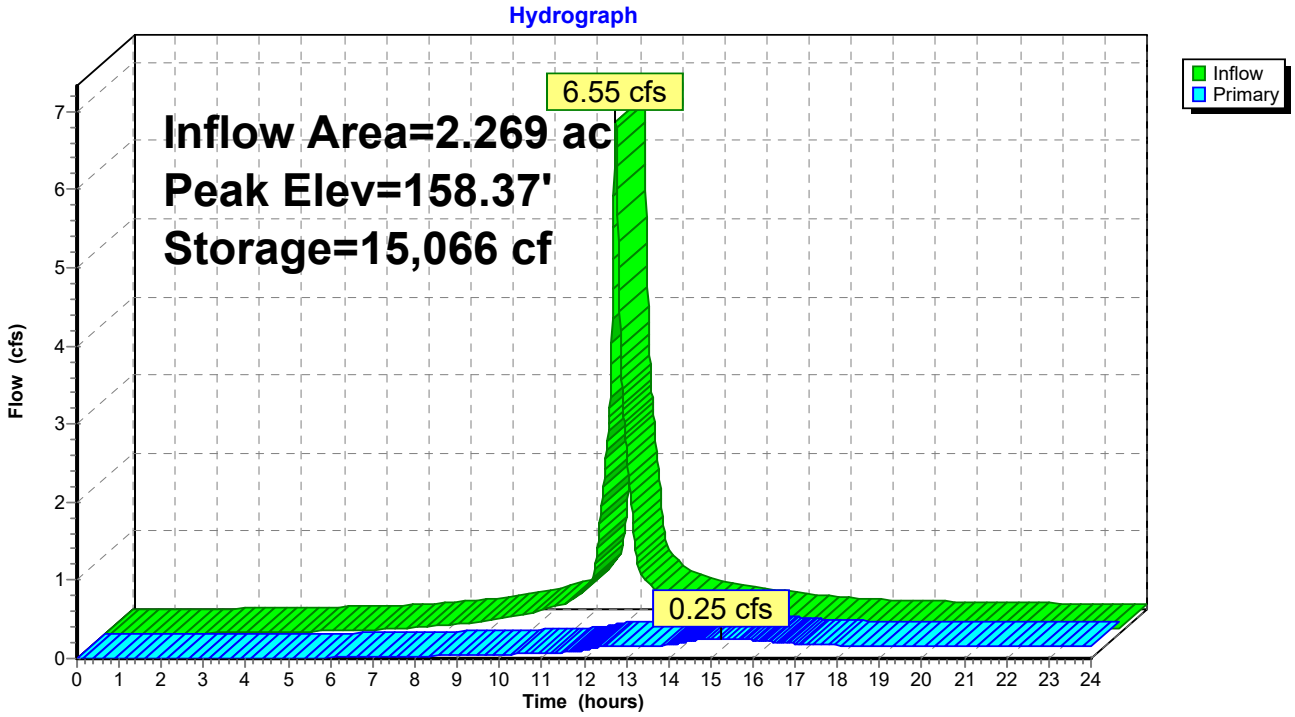
70 Chambers x 376.5 cf = 26,355.1 cf Chamber Storage
70 Chambers x 501.0 cf + 249.4 cf Border = 35,321.2 cf Displacement

Chamber Storage = 26,355.1 cf = 0.605 af
Overall Storage Efficiency = 74.6%
Overall System Size = 141.63' x 48.27' x 5.17'

70 Chambers (plus border)
1,308.2 cy Field



Pond D-1C: Storm Trap Single Trap 4-6



Summary for Pond D-2C: Storm Trap Single Trap 4-6

Inflow Area = 0.899 ac, 67.38% Impervious, Inflow Depth > 2.42" for 2 YEAR event
Inflow = 2.40 cfs @ 12.09 hrs, Volume= 0.181 af
Outflow = 2.31 cfs @ 12.11 hrs, Volume= 0.180 af, Atten= 4%, Lag= 1.3 min
Primary = 2.31 cfs @ 12.11 hrs, Volume= 0.180 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 167.25' @ 12.11 hrs Surf.Area= 603 sf Storage= 1,482 cf

Plug-Flow detention time= 62.8 min calculated for 0.180 af (99% of inflow)
Center-of-Mass det. time= 58.6 min (841.1 - 782.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.30'	0 cf	**20.69'W x 29.13'L x 5.17'H Field A** 3,113 cf Overall - 3,113 cf Embedded = 0 cf x 0.0% Voids
#2A	164.30'	2,259 cf	**StormTrap ST1 SingleTrap 4-6** x 6 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 3 Rows of 2 Chambers 20.69' x 28.13' Core + 0.00' x 0.50' Border = 20.69' x 29.13' System
		2,259 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	166.80'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	169.30'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	164.30'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=2.31 cfs @ 12.11 hrs HW=167.25' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 2.13 cfs @ 2.29 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.18 cfs @ 8.21 fps)

Pond D-2C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

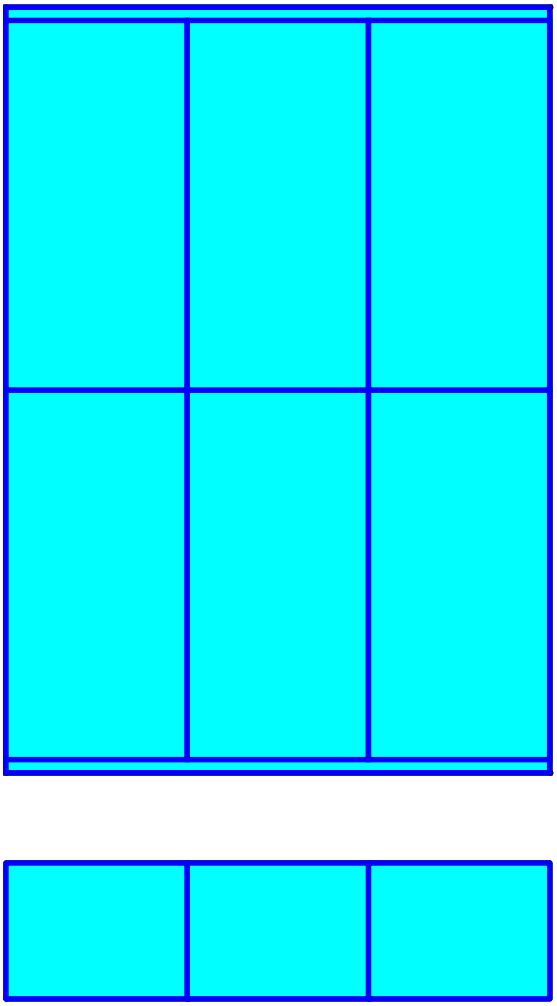
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

2 Chambers/Row x 14.06' Long = 28.13' Row Length +6.0" Border x 2 = 29.13' Base Length
3 Rows x 82.8" Wide = 20.69' Base Width
62.0" Chamber Height = 5.17' Field Height

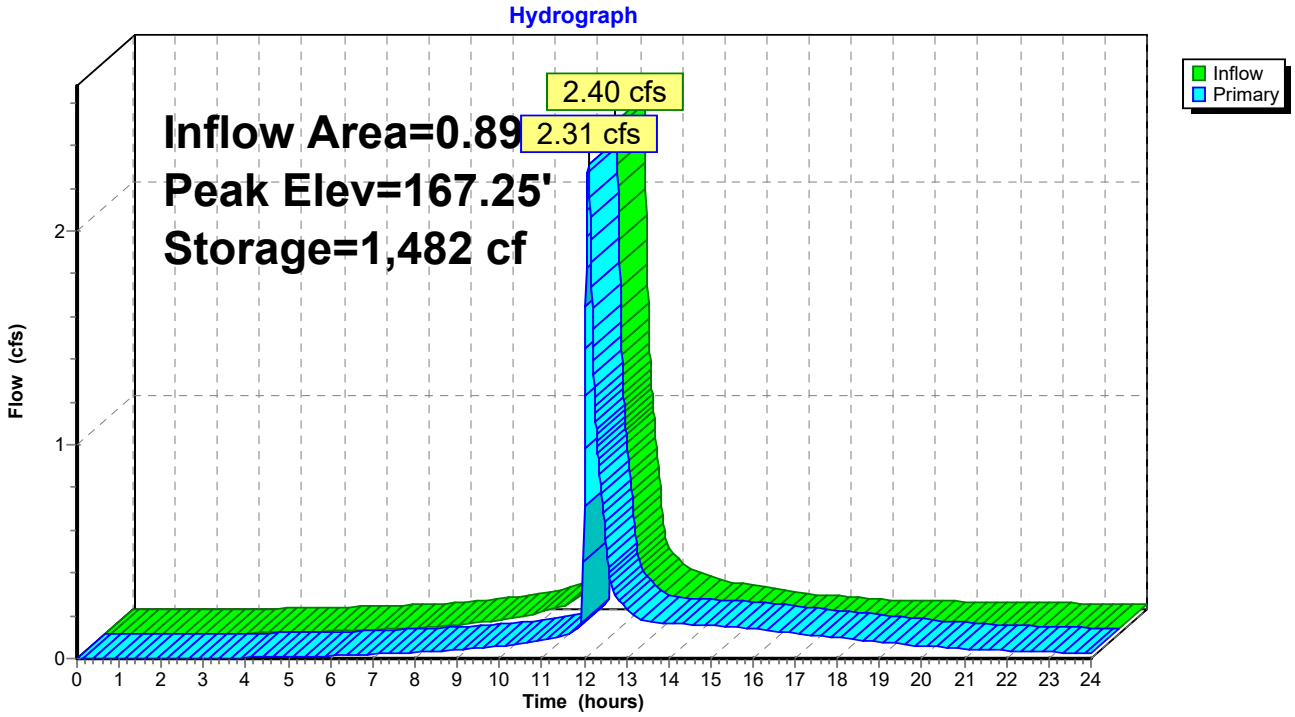
6 Chambers x 376.5 cf = 2,259.0 cf Chamber Storage
6 Chambers x 501.0 cf + 106.9 cf Border = 3,113.0 cf Displacement

Chamber Storage = 2,259.0 cf = 0.052 af
Overall Storage Efficiency = 72.6%
Overall System Size = 29.13' x 20.69' x 5.17'

6 Chambers (plus border)
115.3 cy Field



Pond D-2C: Storm Trap Single Trap 4-6



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: 40B-PR-1A Runoff Area=25,311 sf 27.26% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=85 Runoff=2.03 cfs 0.145 af

Subcatchment PR-1B: 40B-PR-1B Runoff Area=52,416 sf 68.33% Impervious Runoff Depth>3.70"
Tc=6.0 min CN=92 Runoff=4.98 cfs 0.371 af

Subcatchment PR-1C: 40B-PR-1C Runoff Area=46,421 sf 100.00% Impervious Runoff Depth>4.36"
Tc=6.0 min CN=98 Runoff=4.79 cfs 0.387 af

Subcatchment PR-1D: 40B-PR-1D Runoff Area=1,848 sf 0.00% Impervious Runoff Depth>2.54"
Tc=6.0 min CN=80 Runoff=0.13 cfs 0.009 af

Subcatchment PR-1E: 40B-PR-1E Runoff Area=8,324 sf 0.00% Impervious Runoff Depth>2.54"
Tc=6.0 min CN=80 Runoff=0.57 cfs 0.041 af

Subcatchment PR-2A: 40B-PR-2A Runoff Area=54,932 sf 39.39% Impervious Runoff Depth>3.19"
Tc=6.0 min CN=87 Runoff=4.65 cfs 0.335 af

Subcatchment PR-2B: 40B-PR-2B Runoff Area=22,078 sf 82.43% Impervious Runoff Depth>4.02"
Tc=6.0 min CN=95 Runoff=2.21 cfs 0.170 af

Subcatchment PR-2C: 40B-PR-2C Runoff Area=11,737 sf 34.36% Impervious Runoff Depth>3.09"
Tc=6.0 min CN=86 Runoff=0.97 cfs 0.069 af

Subcatchment PR-2D: 40B-PR-2D Runoff Area=8,000 sf 100.00% Impervious Runoff Depth>4.36"
Tc=6.0 min CN=98 Runoff=0.83 cfs 0.067 af

Subcatchment PR-2E: 40B-PR-2E Runoff Area=9,102 sf 2.19% Impervious Runoff Depth>2.54"
Tc=6.0 min CN=80 Runoff=0.62 cfs 0.044 af

Reach DP-1: To Wetlands Inflow=3.36 cfs 0.632 af
Outflow=3.36 cfs 0.632 af

Reach DP-2: To Independence Dr System Inflow=8.95 cfs 0.683 af
Outflow=8.95 cfs 0.683 af

Pond D-1C: Storm Trap Single Trap 4-6 Peak Elev=158.79' Storage=17,501 cf Inflow=9.77 cfs 0.758 af
Outflow=2.49 cfs 0.437 af

Pond D-2C: Storm Trap Single Trap 4-6 Peak Elev=167.52' Storage=1,616 cf Inflow=3.66 cfs 0.281 af
Outflow=3.42 cfs 0.278 af

Total Runoff Area = 5.514 ac Runoff Volume = 1.638 af Average Runoff Depth = 3.56"
41.21% Pervious = 2.272 ac 58.79% Impervious = 3.242 ac

Summary for Subcatchment PR-1A: 40B-PR-1A

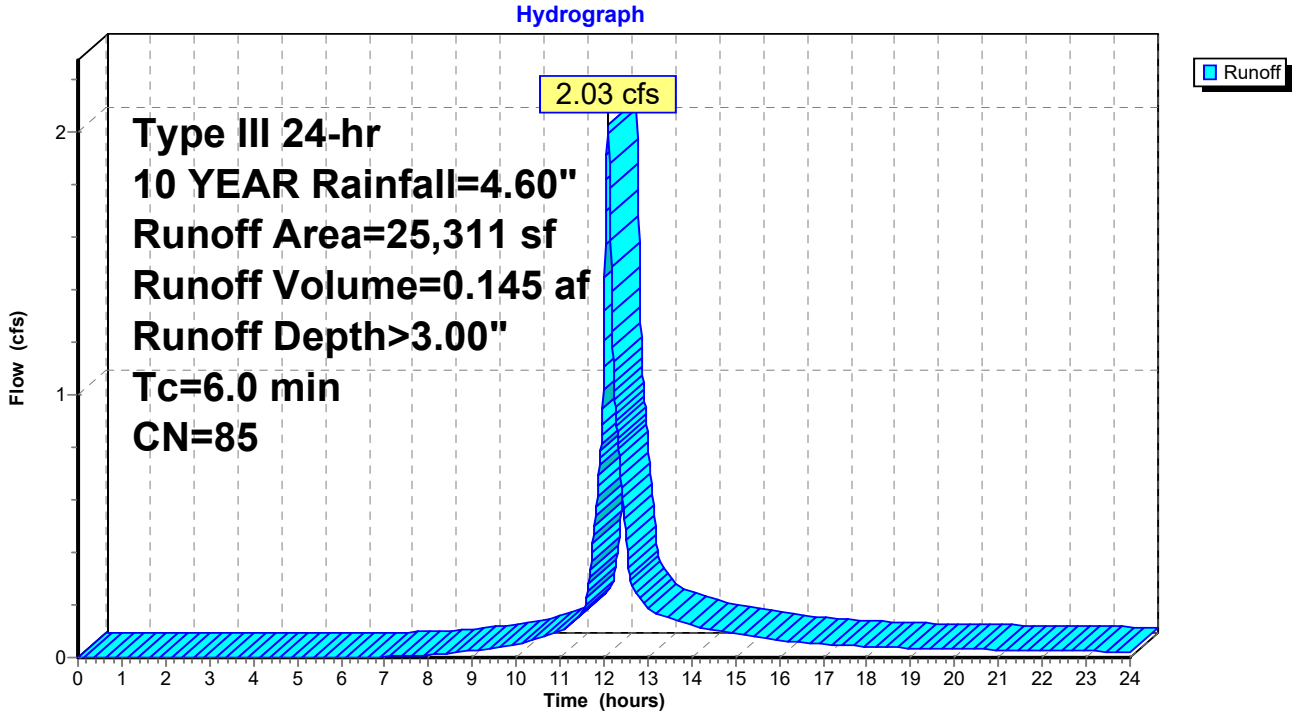
Runoff = 2.03 cfs @ 12.09 hrs, Volume= 0.145 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	6,900	98	Impervious
	18,411	80	>75% Grass cover, Good, HSG D
	25,311	85	Weighted Average
	18,411		72.74% Pervious Area
	6,900		27.26% Impervious Area

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

Subcatchment PR-1A: 40B-PR-1A



Summary for Subcatchment PR-1B: 40B-PR-1B

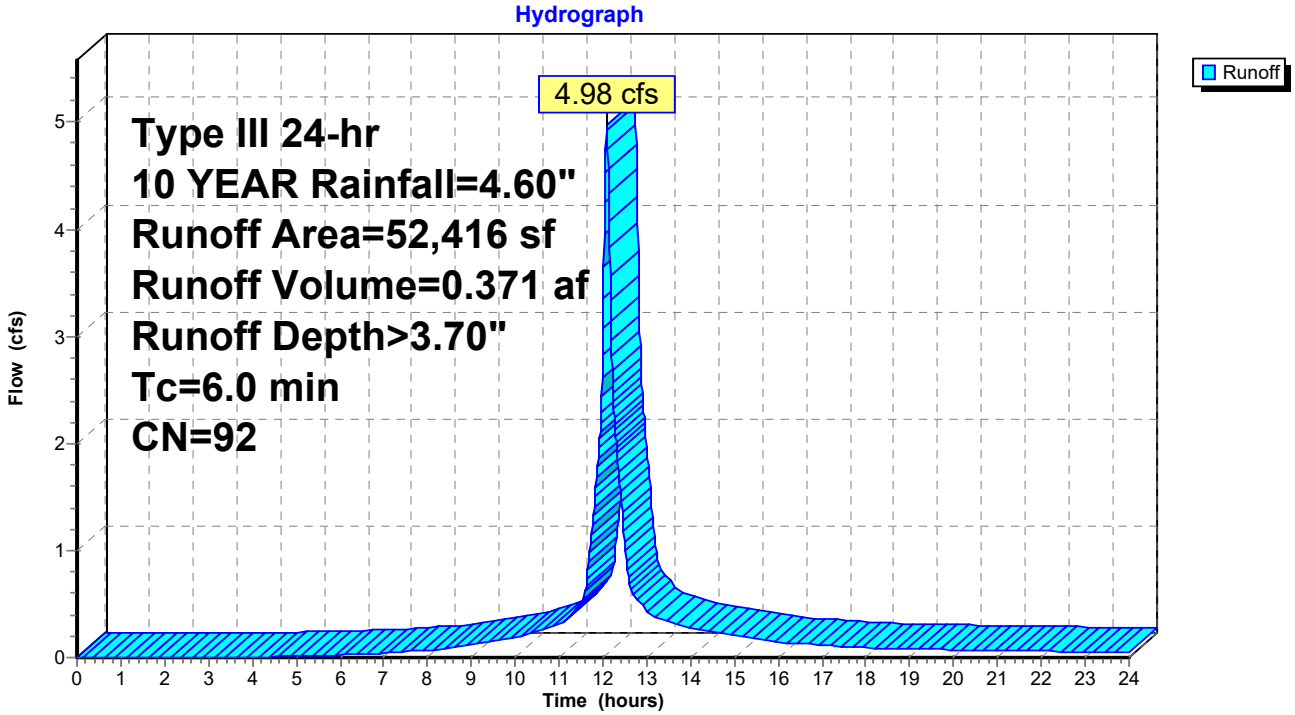
Runoff = 4.98 cfs @ 12.08 hrs, Volume= 0.371 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	35,817	98	Impervious
	16,599	80	>75% Grass cover, Good, HSG D
	52,416	92	Weighted Average
	16,599		31.67% Pervious Area
	35,817		68.33% Impervious Area

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

Subcatchment PR-1B: 40B-PR-1B



Summary for Subcatchment PR-1C: 40B-PR-1C

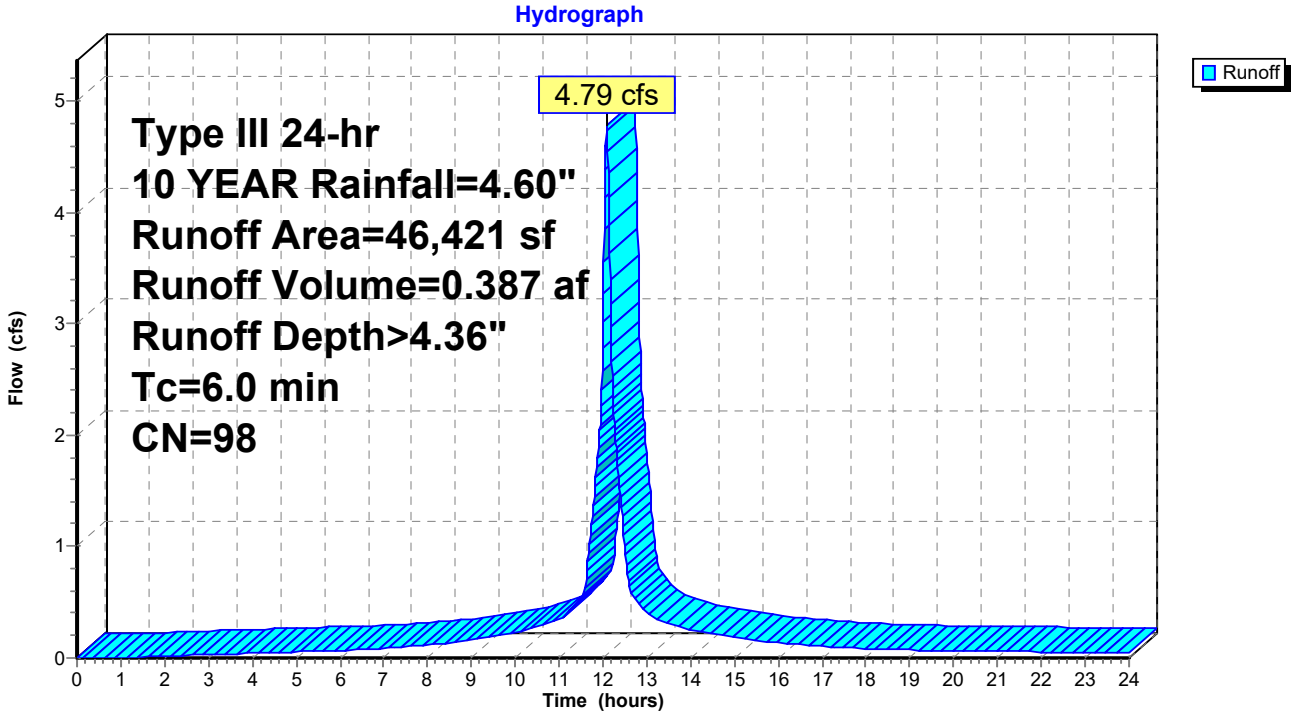
Runoff = 4.79 cfs @ 12.08 hrs, Volume= 0.387 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	46,421	98	Impervious
	46,421		100.00% Impervious Area

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

Subcatchment PR-1C: 40B-PR-1C



Summary for Subcatchment PR-1D: 40B-PR-1D

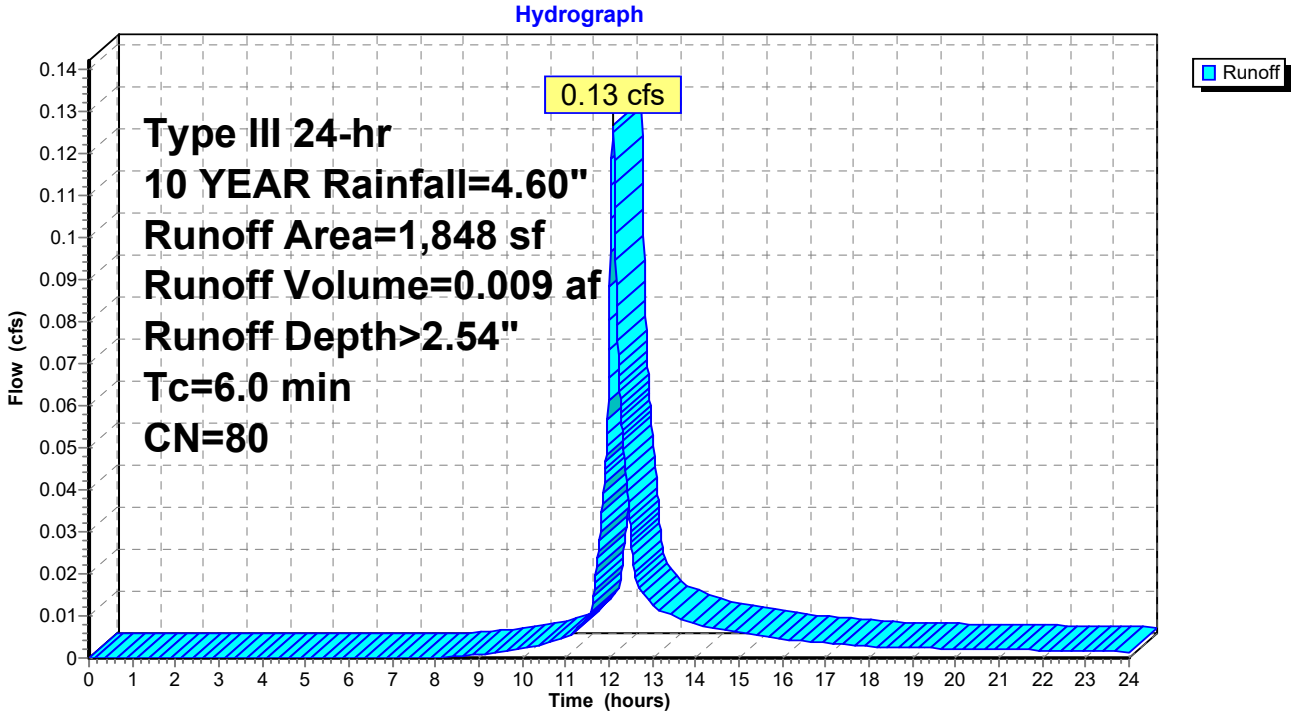
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 0.009 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

Area (sf)	CN	Description
1,848	80	>75% Grass cover, Good, HSG D
1,848		100.00% Pervious Area

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

Subcatchment PR-1D: 40B-PR-1D



Summary for Subcatchment PR-1E: 40B-PR-1E

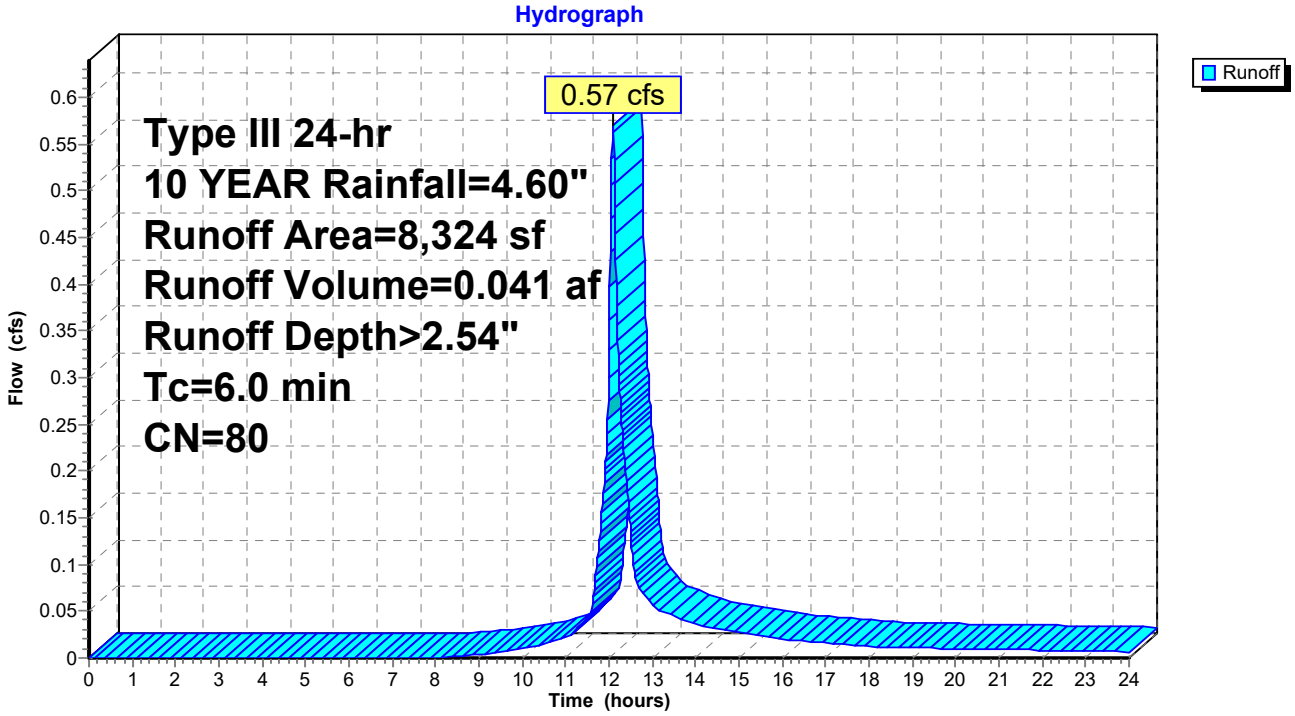
Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.041 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

Area (sf)	CN	Description
8,324	80	>75% Grass cover, Good, HSG D
8,324		100.00% Pervious Area

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

Subcatchment PR-1E: 40B-PR-1E



Summary for Subcatchment PR-2A: 40B-PR-2A

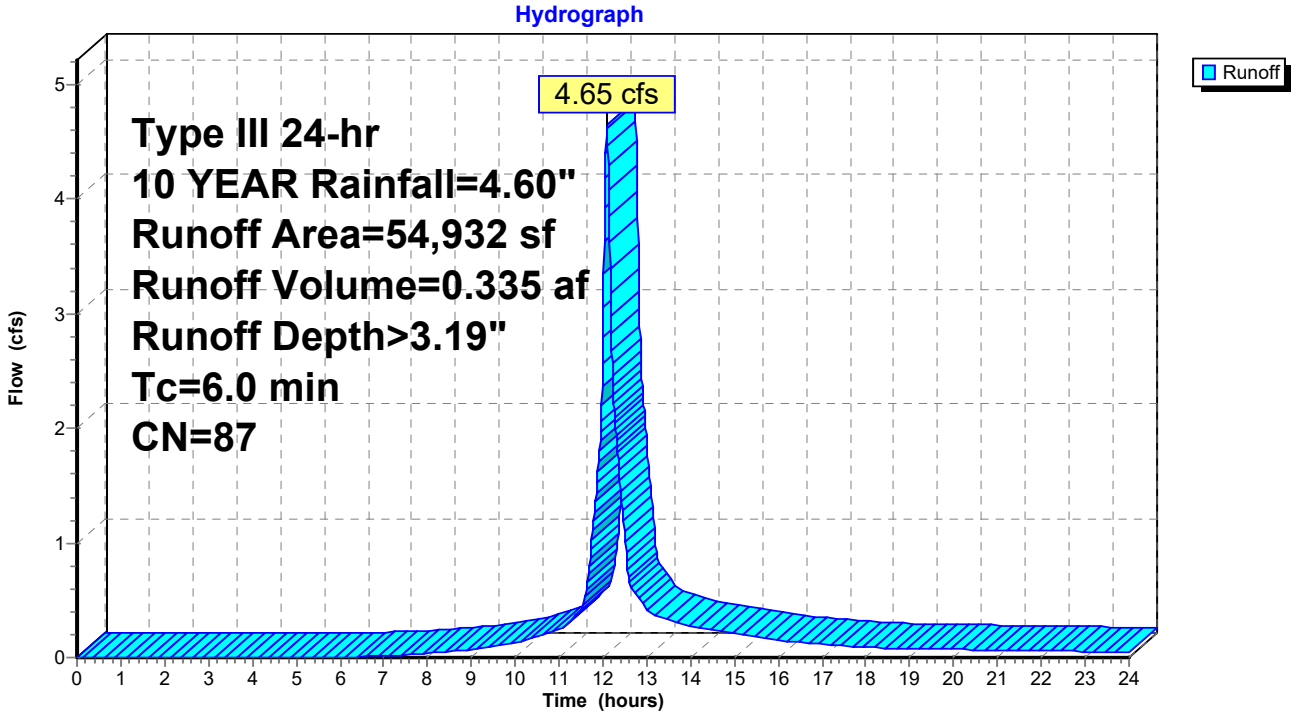
Runoff = 4.65 cfs @ 12.09 hrs, Volume= 0.335 af, Depth> 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	21,637	98	Impervious
	33,295	80	>75% Grass cover, Good, HSG D
	54,932	87	Weighted Average
	33,295		60.61% Pervious Area
	21,637		39.39% Impervious Area

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

Subcatchment PR-2A: 40B-PR-2A



Summary for Subcatchment PR-2B: 40B-PR-2B

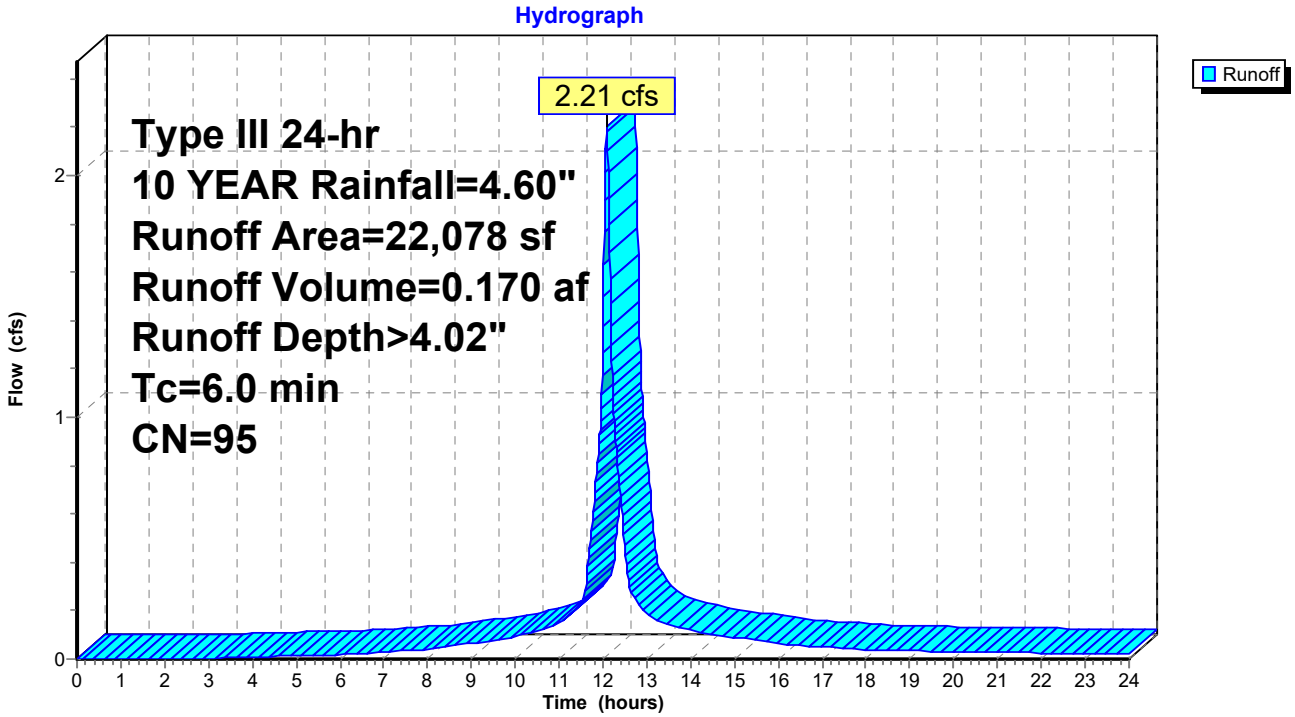
Runoff = 2.21 cfs @ 12.08 hrs, Volume= 0.170 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	12,305	98	Impervious
	3,879	80	>75% Grass cover, Good, HSG D
*	5,894	98	Roof
	22,078	95	Weighted Average
	3,879		17.57% Pervious Area
	18,199		82.43% Impervious Area

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

Subcatchment PR-2B: 40B-PR-2B



Summary for Subcatchment PR-2C: 40B-PR-2C

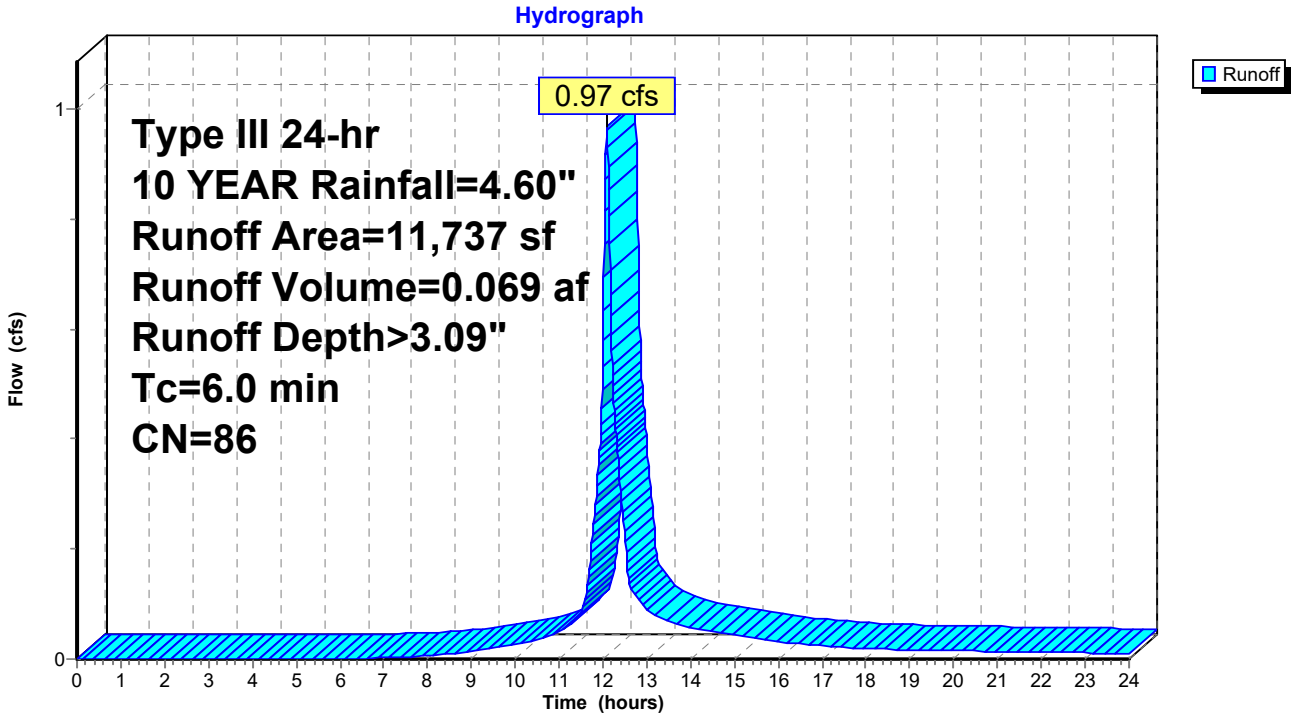
Runoff = 0.97 cfs @ 12.09 hrs, Volume= 0.069 af, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
	7,704	80	>75% Grass cover, Good, HSG D
*	1,086	98	Impervious
*	2,947	98	Roof
	11,737	86	Weighted Average
	7,704		65.64% Pervious Area
	4,033		34.36% Impervious Area

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

Subcatchment PR-2C: 40B-PR-2C



Summary for Subcatchment PR-2D: 40B-PR-2D

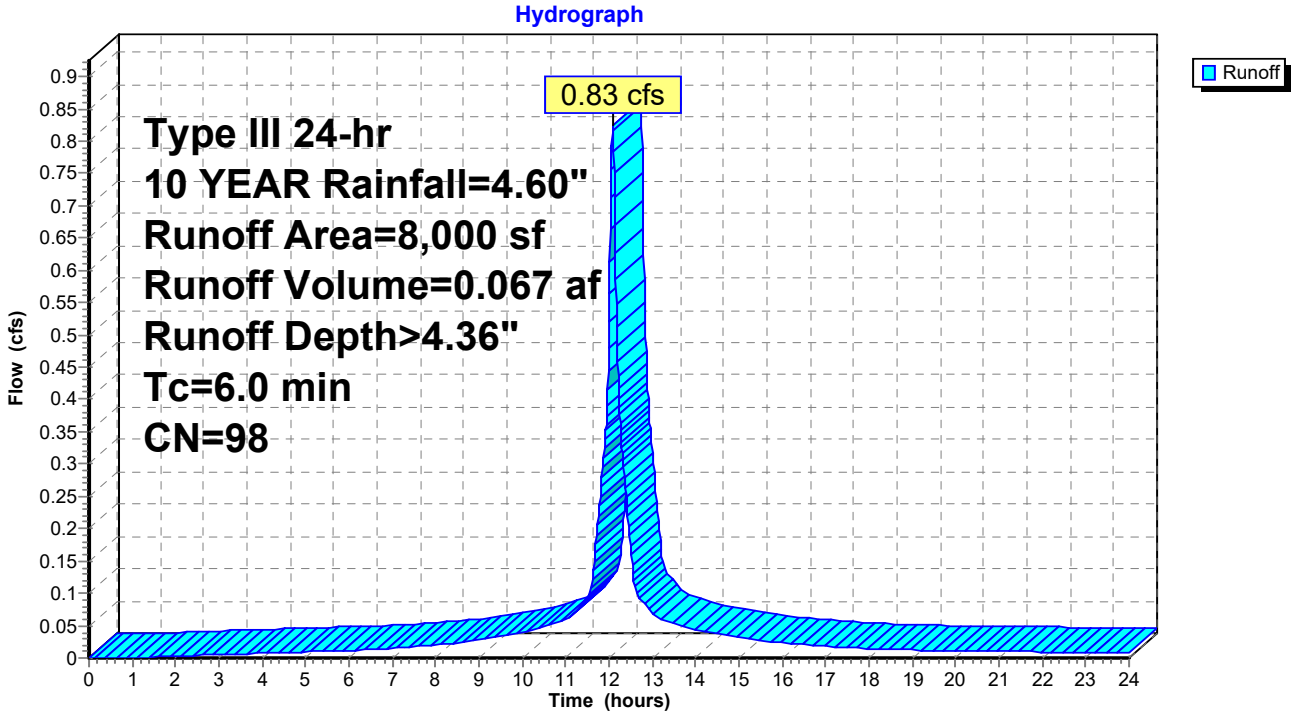
Runoff = 0.83 cfs @ 12.08 hrs, Volume= 0.067 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	8,000	98	Impervious
	8,000		100.00% Impervious Area

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

Subcatchment PR-2D: 40B-PR-2D



Summary for Subcatchment PR-2E: 40B-PR-2E

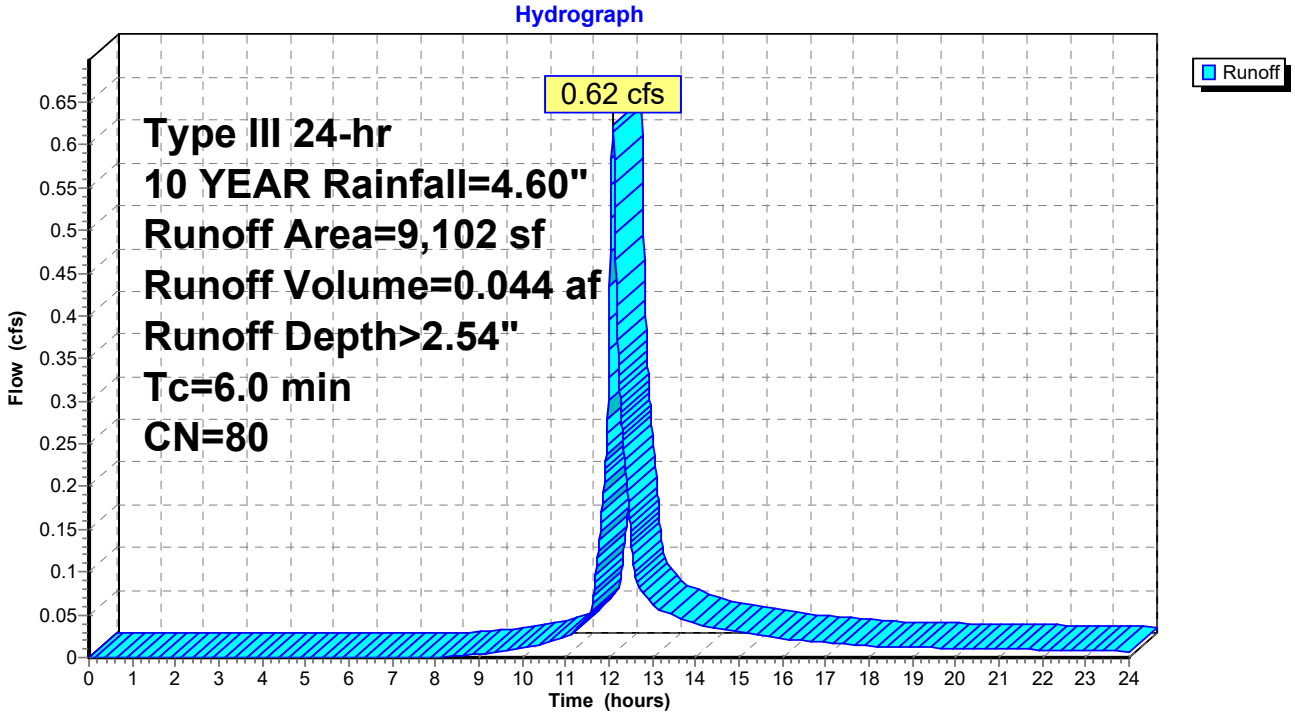
Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.044 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YEAR Rainfall=4.60"

	Area (sf)	CN	Description
*	199	98	Impervious
	8,903	80	>75% Grass cover, Good, HSG D
	9,102	80	Weighted Average
	8,903		97.81% Pervious Area
	199		2.19% Impervious Area

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

Subcatchment PR-2E: 40B-PR-2E

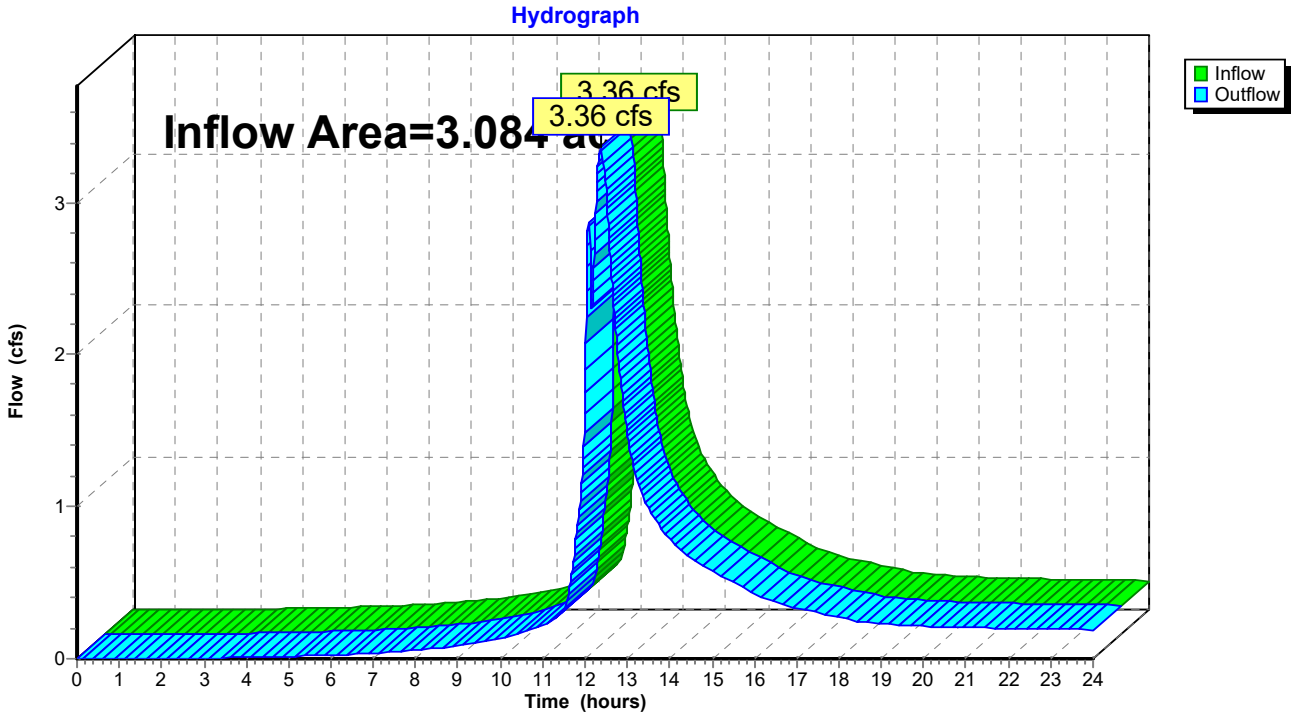


Summary for Reach DP-1: To Wetlands

Inflow Area = 3.084 ac, 66.36% Impervious, Inflow Depth > 2.46" for 10 YEAR event
Inflow = 3.36 cfs @ 12.37 hrs, Volume= 0.632 af
Outflow = 3.36 cfs @ 12.37 hrs, Volume= 0.632 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-1: To Wetlands

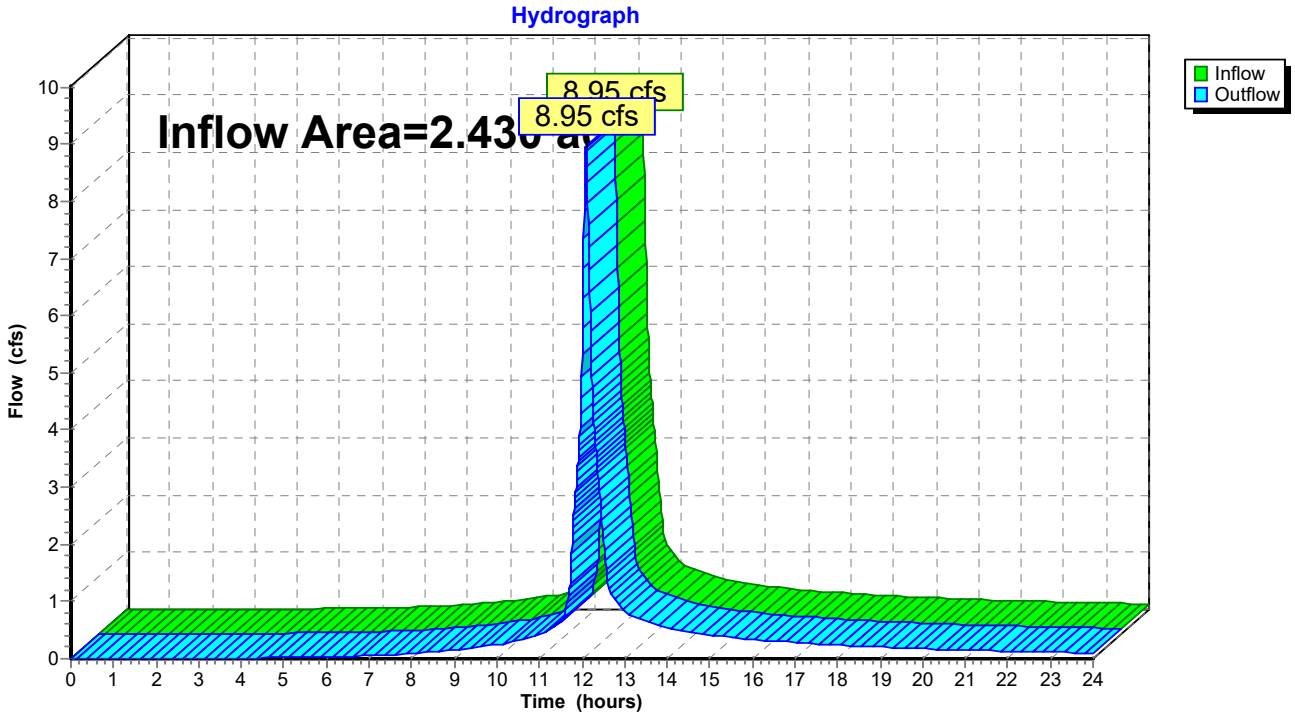


Summary for Reach DP-2: To Independence Dr System

Inflow Area = 2.430 ac, 49.19% Impervious, Inflow Depth > 3.37" for 10 YEAR event
Inflow = 8.95 cfs @ 12.09 hrs, Volume= 0.683 af
Outflow = 8.95 cfs @ 12.09 hrs, Volume= 0.683 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-2: To Independence Dr System



Summary for Pond D-1C: Storm Trap Single Trap 4-6

Inflow Area = 2.269 ac, 83.21% Impervious, Inflow Depth > 4.01" for 10 YEAR event
Inflow = 9.77 cfs @ 12.08 hrs, Volume= 0.758 af
Outflow = 2.49 cfs @ 12.45 hrs, Volume= 0.437 af, Atten= 75%, Lag= 22.0 min
Primary = 2.49 cfs @ 12.45 hrs, Volume= 0.437 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 158.79' @ 12.45 hrs Surf.Area= 6,836 sf Storage= 17,501 cf

Plug-Flow detention time= 236.9 min calculated for 0.437 af (58% of inflow)
Center-of-Mass det. time= 127.5 min (894.0 - 766.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.80'	0 cf	**48.27'W x 141.63'L x 5.17'H Field A** 35,321 cf Overall - 35,321 cf Embedded = 0 cf x 0.0% Voids
#2A	155.80'	26,355 cf	**StormTrap ST1 SingleTrap 4-6** x 70 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 7 Rows of 10 Chambers 48.27' x 140.63' Core + 0.00' x 0.50' Border = 48.27' x 141.63' System
		26,355 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.30'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	160.80'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	155.80'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=2.50 cfs @ 12.45 hrs HW=158.79' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 2.32 cfs @ 2.38 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.18 cfs @ 8.27 fps)

Pond D-1C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

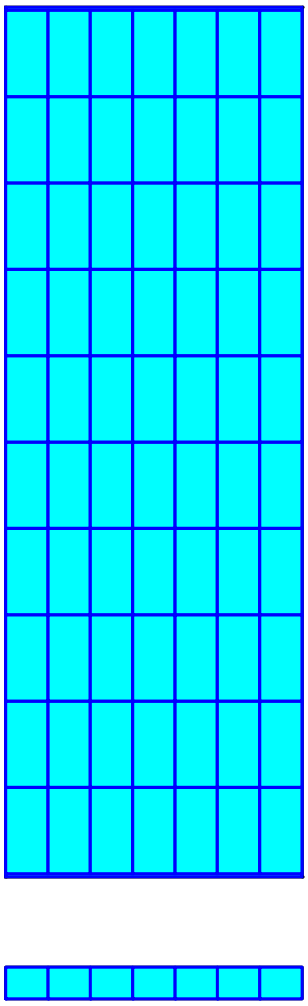
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

10 Chambers/Row x 14.06' Long = 140.63' Row Length +6.0" Border x 2 = 141.63' Base Length
7 Rows x 82.8" Wide = 48.27' Base Width
62.0" Chamber Height = 5.17' Field Height

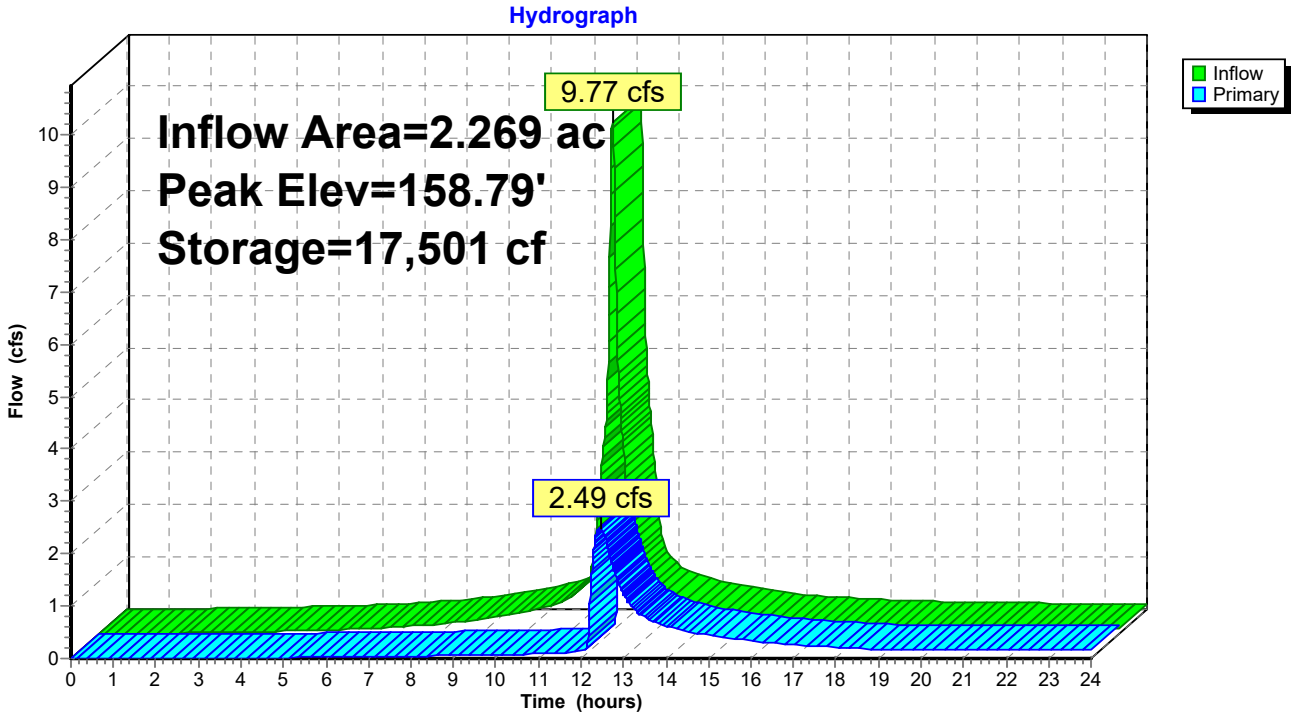
70 Chambers x 376.5 cf = 26,355.1 cf Chamber Storage
70 Chambers x 501.0 cf + 249.4 cf Border = 35,321.2 cf Displacement

Chamber Storage = 26,355.1 cf = 0.605 af
Overall Storage Efficiency = 74.6%
Overall System Size = 141.63' x 48.27' x 5.17'

70 Chambers (plus border)
1,308.2 cy Field



Pond D-1C: Storm Trap Single Trap 4-6



Summary for Pond D-2C: Storm Trap Single Trap 4-6

Inflow Area = 0.899 ac, 67.38% Impervious, Inflow Depth > 3.75" for 10 YEAR event
Inflow = 3.66 cfs @ 12.08 hrs, Volume= 0.281 af
Outflow = 3.42 cfs @ 12.11 hrs, Volume= 0.278 af, Atten= 6%, Lag= 1.8 min
Primary = 3.42 cfs @ 12.11 hrs, Volume= 0.278 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 167.52' @ 12.11 hrs Surf.Area= 603 sf Storage= 1,616 cf

Plug-Flow detention time= 55.2 min calculated for 0.278 af (99% of inflow)
Center-of-Mass det. time= 49.7 min (823.3 - 773.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.30'	0 cf	**20.69'W x 29.13'L x 5.17'H Field A** 3,113 cf Overall - 3,113 cf Embedded = 0 cf x 0.0% Voids
#2A	164.30'	2,259 cf	**StormTrap ST1 SingleTrap 4-6** x 6 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 3 Rows of 2 Chambers 20.69' x 28.13' Core + 0.00' x 0.50' Border = 20.69' x 29.13' System
		2,259 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	166.80'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	169.30'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	164.30'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=3.42 cfs @ 12.11 hrs HW=167.52' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 3.23 cfs @ 3.29 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.58 fps)

Pond D-2C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

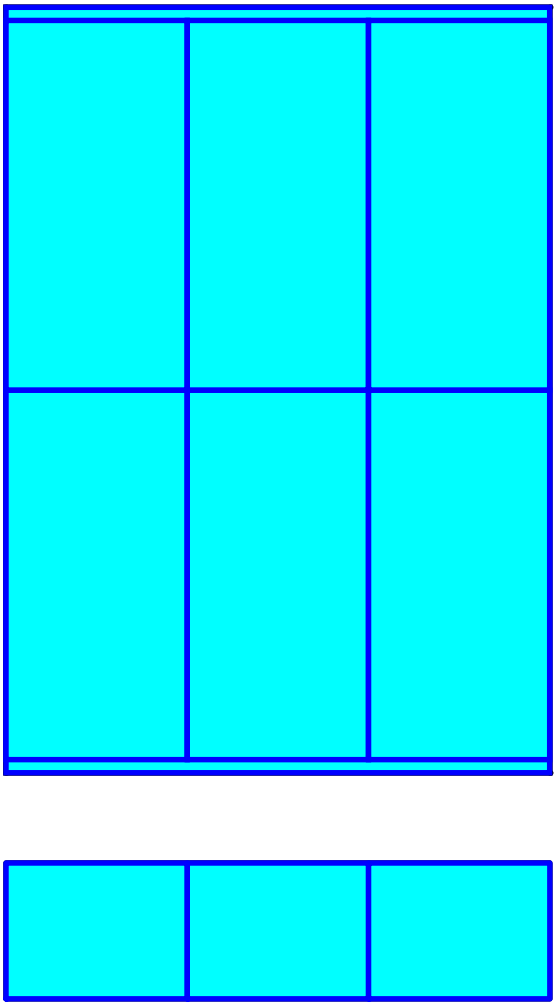
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

2 Chambers/Row x 14.06' Long = 28.13' Row Length +6.0" Border x 2 = 29.13' Base Length
3 Rows x 82.8" Wide = 20.69' Base Width
62.0" Chamber Height = 5.17' Field Height

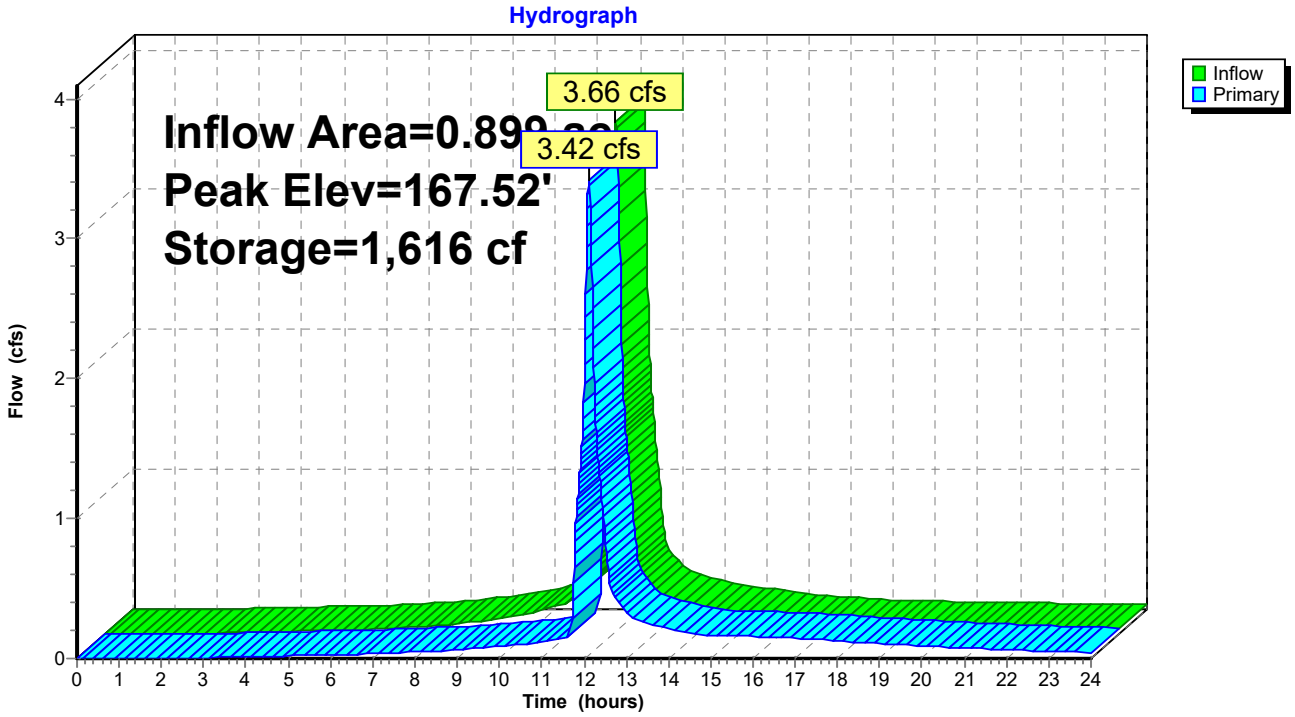
6 Chambers x 376.5 cf = 2,259.0 cf Chamber Storage
6 Chambers x 501.0 cf + 106.9 cf Border = 3,113.0 cf Displacement

Chamber Storage = 2,259.0 cf = 0.052 af
Overall Storage Efficiency = 72.6%
Overall System Size = 29.13' x 20.69' x 5.17'

6 Chambers (plus border)
115.3 cy Field



Pond D-2C: Storm Trap Single Trap 4-6



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: 40B-PR-1A Runoff Area=25,311 sf 27.26% Impervious Runoff Depth>3.83"
Tc=6.0 min CN=85 Runoff=2.57 cfs 0.185 af

Subcatchment PR-1B: 40B-PR-1B Runoff Area=52,416 sf 68.33% Impervious Runoff Depth>4.57"
Tc=6.0 min CN=92 Runoff=6.09 cfs 0.459 af

Subcatchment PR-1C: 40B-PR-1C Runoff Area=46,421 sf 100.00% Impervious Runoff Depth>5.26"
Tc=6.0 min CN=98 Runoff=5.74 cfs 0.467 af

Subcatchment PR-1D: 40B-PR-1D Runoff Area=1,848 sf 0.00% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=80 Runoff=0.17 cfs 0.012 af

Subcatchment PR-1E: 40B-PR-1E Runoff Area=8,324 sf 0.00% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=80 Runoff=0.75 cfs 0.053 af

Subcatchment PR-2A: 40B-PR-2A Runoff Area=54,932 sf 39.39% Impervious Runoff Depth>4.04"
Tc=6.0 min CN=87 Runoff=5.83 cfs 0.424 af

Subcatchment PR-2B: 40B-PR-2B Runoff Area=22,078 sf 82.43% Impervious Runoff Depth>4.91"
Tc=6.0 min CN=95 Runoff=2.67 cfs 0.207 af

Subcatchment PR-2C: 40B-PR-2C Runoff Area=11,737 sf 34.36% Impervious Runoff Depth>3.93"
Tc=6.0 min CN=86 Runoff=1.22 cfs 0.088 af

Subcatchment PR-2D: 40B-PR-2D Runoff Area=8,000 sf 100.00% Impervious Runoff Depth>5.26"
Tc=6.0 min CN=98 Runoff=0.99 cfs 0.080 af

Subcatchment PR-2E: 40B-PR-2E Runoff Area=9,102 sf 2.19% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=80 Runoff=0.82 cfs 0.058 af

Reach DP-1: To Wetlands Inflow=5.66 cfs 0.847 af
Outflow=5.66 cfs 0.847 af

Reach DP-2: To Independence Dr System Inflow=11.01 cfs 0.855 af
Outflow=11.01 cfs 0.855 af

Pond D-1C: Storm Trap Single Trap 4-6 Peak Elev=159.16' Storage=19,654 cf Inflow=11.83 cfs 0.926 af
Outflow=3.87 cfs 0.596 af

Pond D-2C: Storm Trap Single Trap 4-6 Peak Elev=167.74' Storage=1,725 cf Inflow=4.47 cfs 0.346 af
Outflow=4.11 cfs 0.342 af

Total Runoff Area = 5.514 ac Runoff Volume = 2.034 af Average Runoff Depth = 4.43"
41.21% Pervious = 2.272 ac 58.79% Impervious = 3.242 ac

Summary for Subcatchment PR-1A: 40B-PR-1A

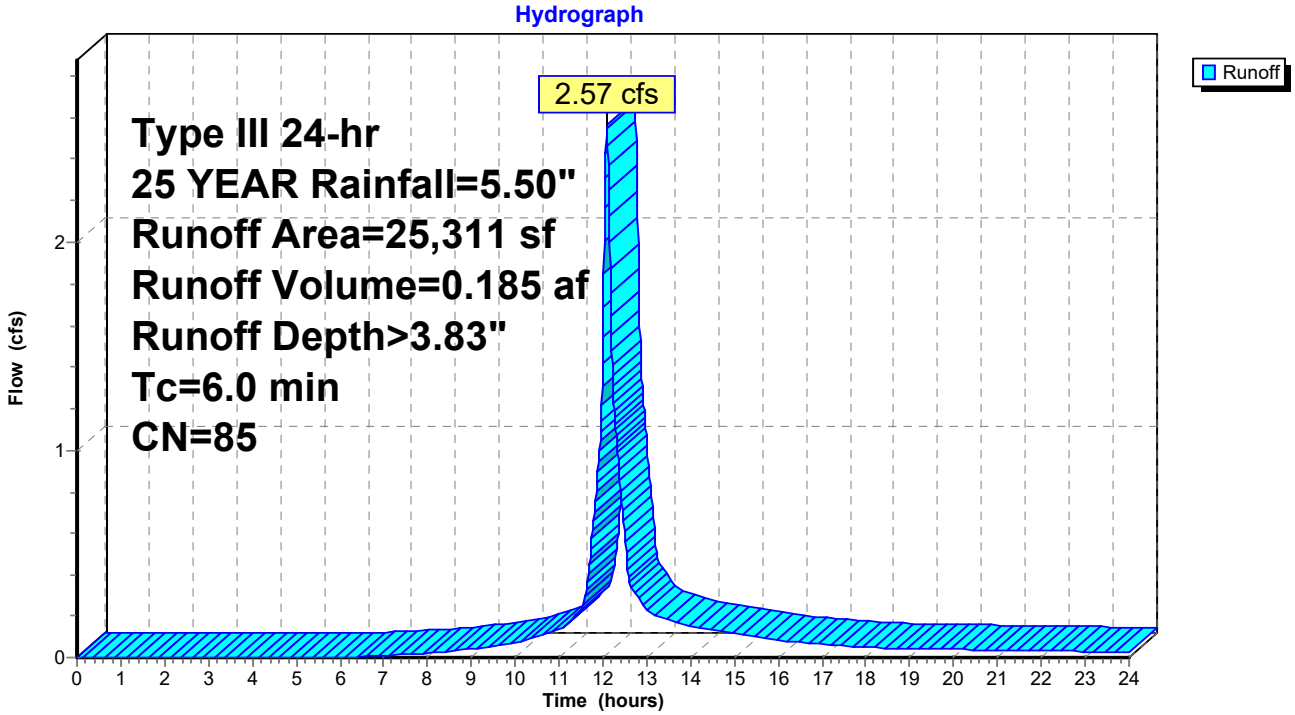
Runoff = 2.57 cfs @ 12.09 hrs, Volume= 0.185 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	6,900	98	Impervious
	18,411	80	>75% Grass cover, Good, HSG D
	25,311	85	Weighted Average
	18,411		72.74% Pervious Area
	6,900		27.26% Impervious Area

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

Subcatchment PR-1A: 40B-PR-1A



Summary for Subcatchment PR-1B: 40B-PR-1B

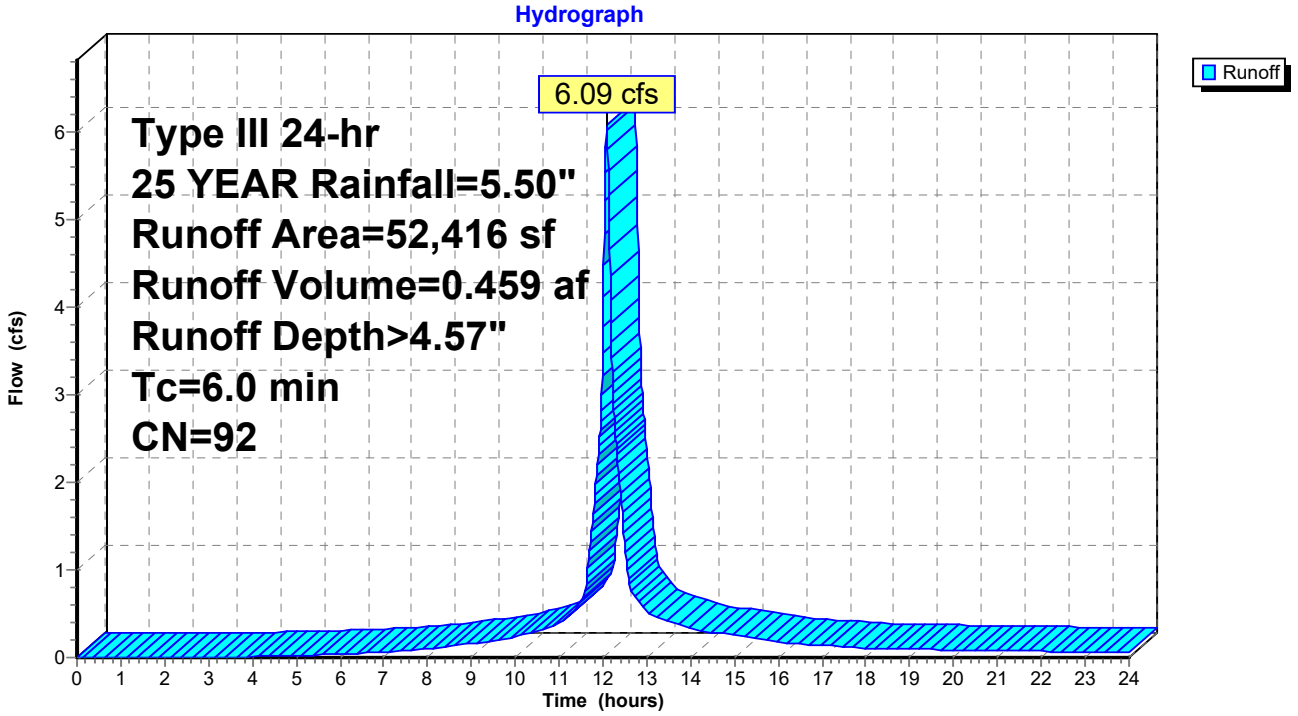
Runoff = 6.09 cfs @ 12.08 hrs, Volume= 0.459 af, Depth> 4.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	35,817	98	Impervious
	16,599	80	>75% Grass cover, Good, HSG D
	52,416	92	Weighted Average
	16,599		31.67% Pervious Area
	35,817		68.33% Impervious Area

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

Subcatchment PR-1B: 40B-PR-1B



Summary for Subcatchment PR-1C: 40B-PR-1C

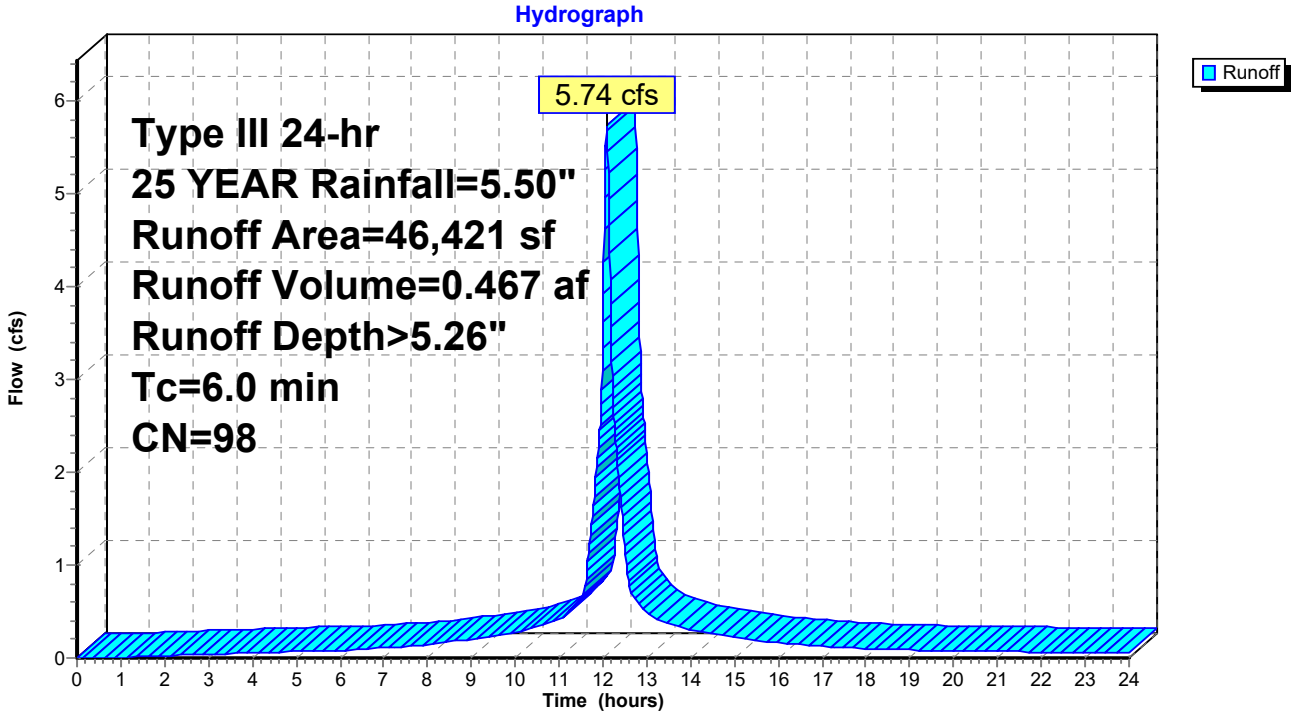
Runoff = 5.74 cfs @ 12.08 hrs, Volume= 0.467 af, Depth> 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	46,421	98	Impervious
	46,421		100.00% Impervious Area

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

Subcatchment PR-1C: 40B-PR-1C



Summary for Subcatchment PR-1D: 40B-PR-1D

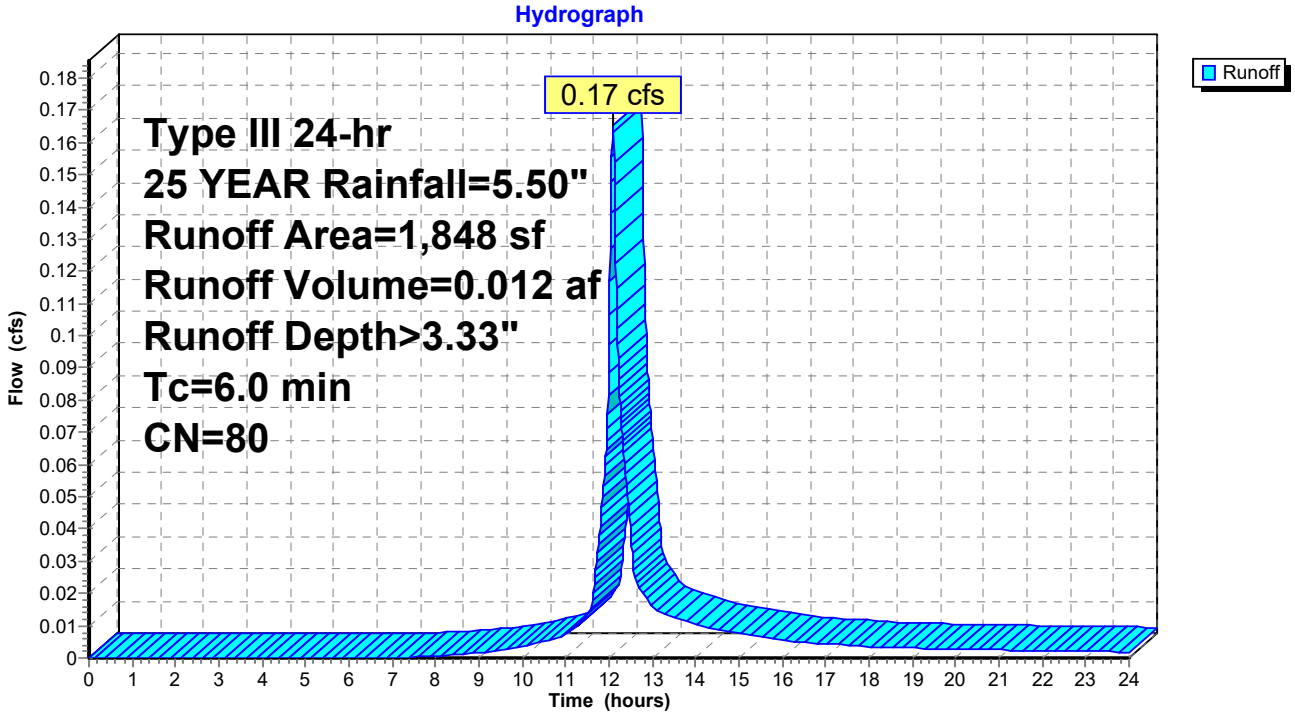
Runoff = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

Area (sf)	CN	Description
1,848	80	>75% Grass cover, Good, HSG D
1,848		100.00% Pervious Area

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

Subcatchment PR-1D: 40B-PR-1D



Summary for Subcatchment PR-1E: 40B-PR-1E

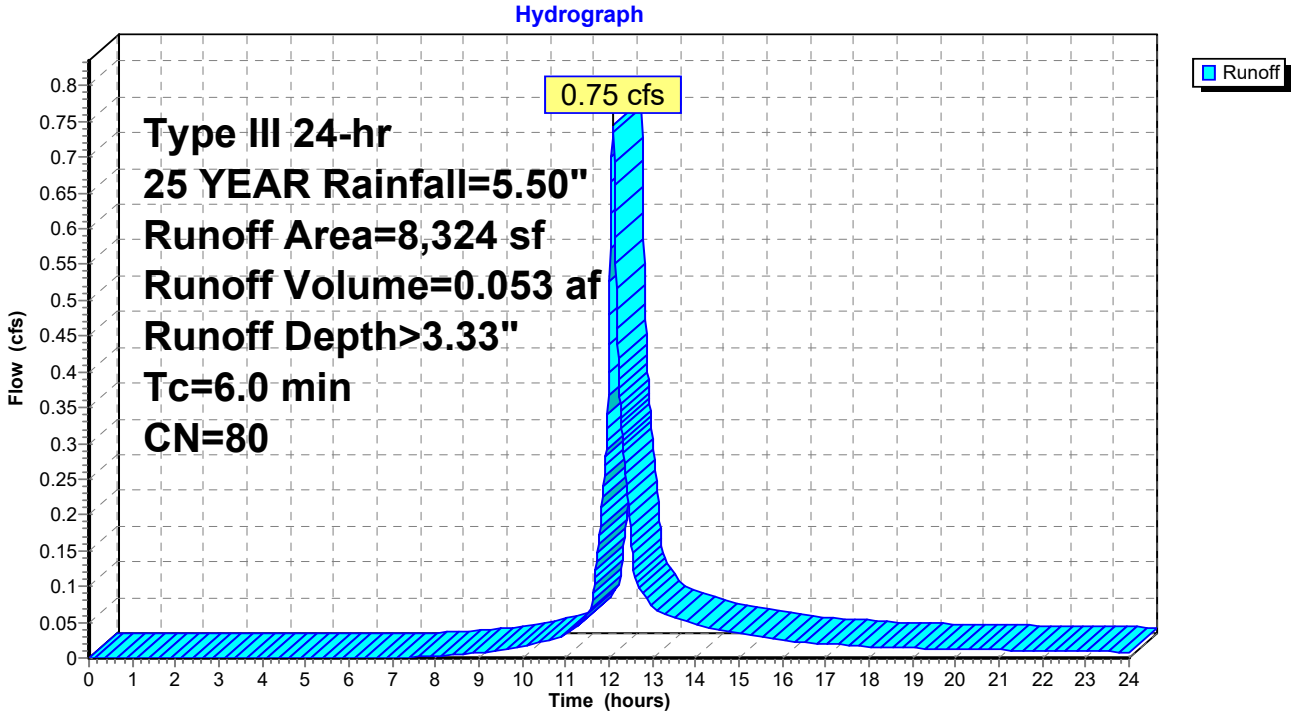
Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.053 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

Area (sf)	CN	Description
8,324	80	>75% Grass cover, Good, HSG D
8,324		100.00% Pervious Area

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

Subcatchment PR-1E: 40B-PR-1E



Summary for Subcatchment PR-2A: 40B-PR-2A

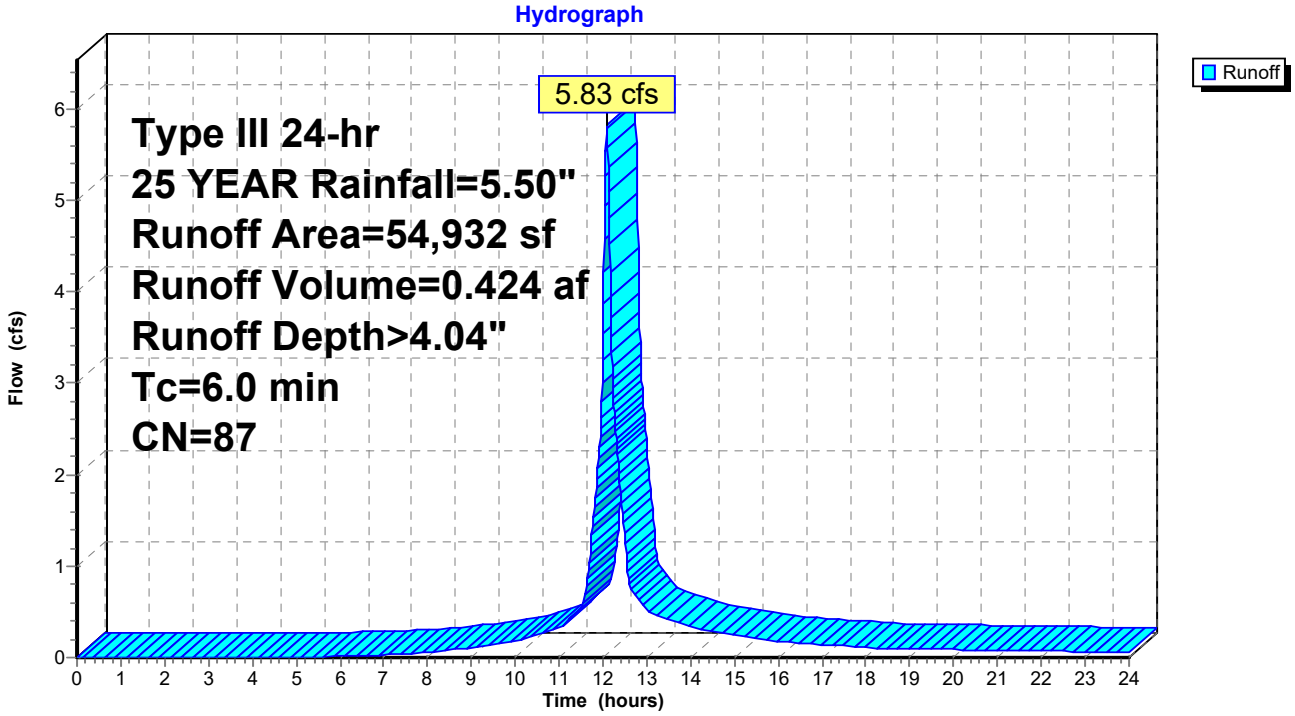
Runoff = 5.83 cfs @ 12.09 hrs, Volume= 0.424 af, Depth> 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	21,637	98	Impervious
	33,295	80	>75% Grass cover, Good, HSG D
	54,932	87	Weighted Average
	33,295		60.61% Pervious Area
	21,637		39.39% Impervious Area

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

Subcatchment PR-2A: 40B-PR-2A



Summary for Subcatchment PR-2B: 40B-PR-2B

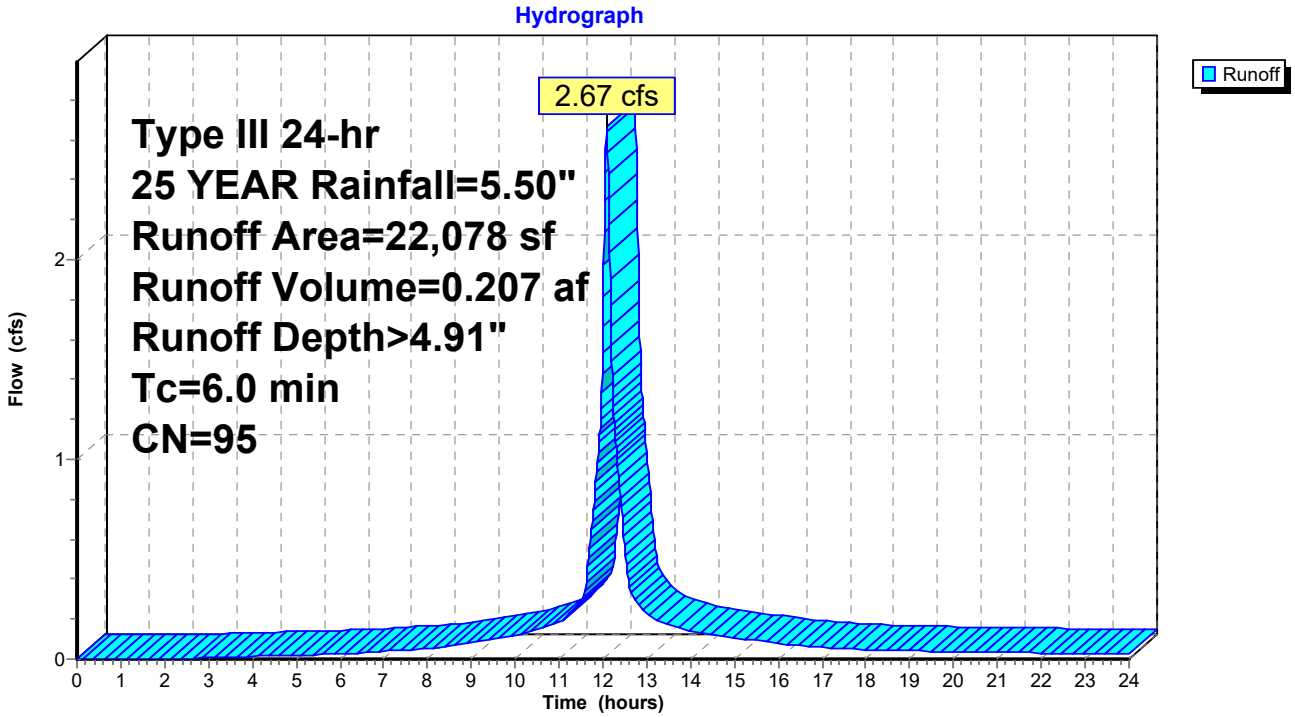
Runoff = 2.67 cfs @ 12.08 hrs, Volume= 0.207 af, Depth> 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	12,305	98	Impervious
	3,879	80	>75% Grass cover, Good, HSG D
*	5,894	98	Roof
	22,078	95	Weighted Average
	3,879		17.57% Pervious Area
	18,199		82.43% Impervious Area

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

Subcatchment PR-2B: 40B-PR-2B



Summary for Subcatchment PR-2C: 40B-PR-2C

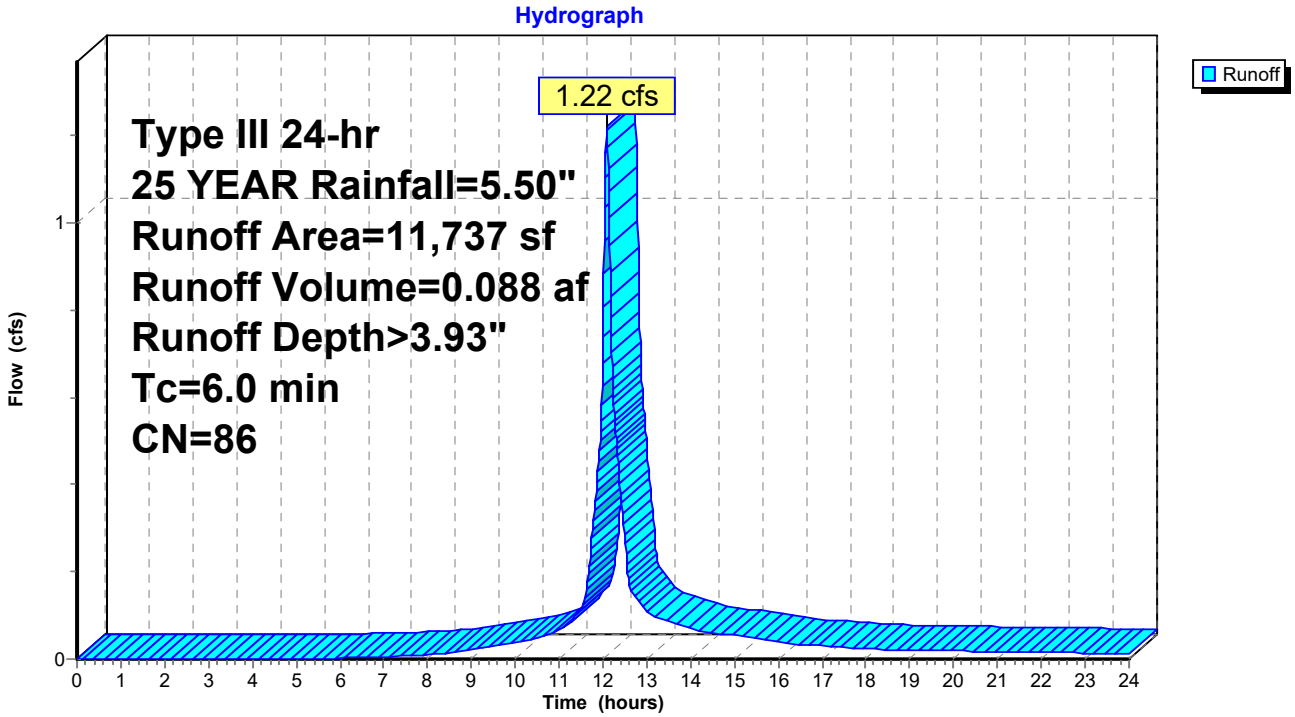
Runoff = 1.22 cfs @ 12.09 hrs, Volume= 0.088 af, Depth> 3.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
	7,704	80	>75% Grass cover, Good, HSG D
*	1,086	98	Impervious
*	2,947	98	Roof
	11,737	86	Weighted Average
	7,704		65.64% Pervious Area
	4,033		34.36% Impervious Area

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

Subcatchment PR-2C: 40B-PR-2C



Summary for Subcatchment PR-2D: 40B-PR-2D

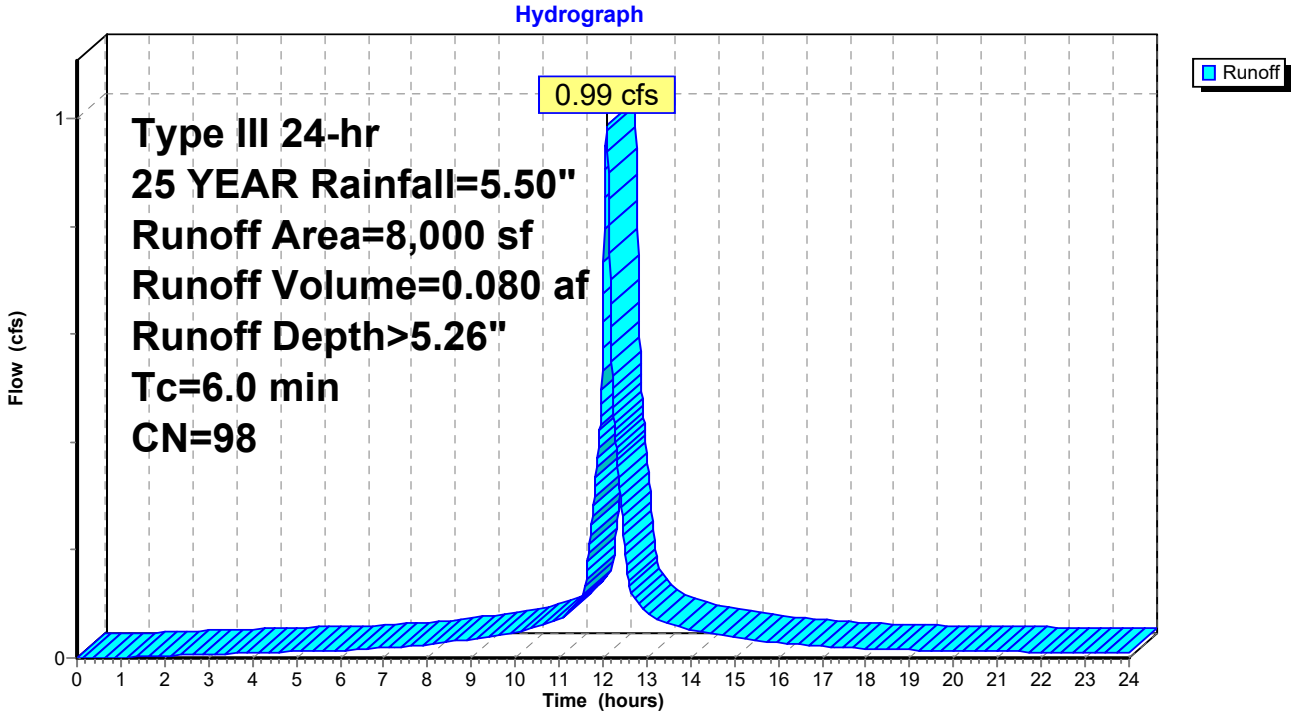
Runoff = 0.99 cfs @ 12.08 hrs, Volume= 0.080 af, Depth> 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	8,000	98	Impervious
	8,000		100.00% Impervious Area

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

Subcatchment PR-2D: 40B-PR-2D



Summary for Subcatchment PR-2E: 40B-PR-2E

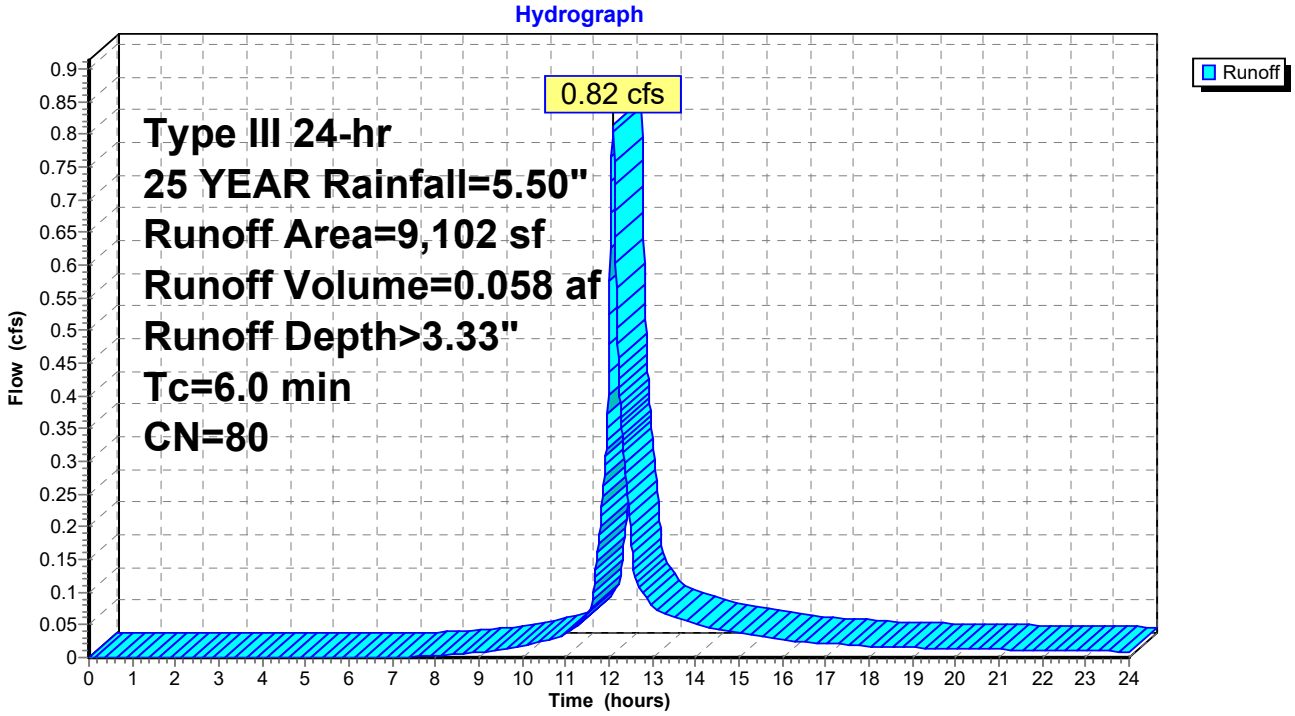
Runoff = 0.82 cfs @ 12.09 hrs, Volume= 0.058 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YEAR Rainfall=5.50"

	Area (sf)	CN	Description
*	199	98	Impervious
	8,903	80	>75% Grass cover, Good, HSG D
	9,102	80	Weighted Average
	8,903		97.81% Pervious Area
	199		2.19% Impervious Area

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

Subcatchment PR-2E: 40B-PR-2E

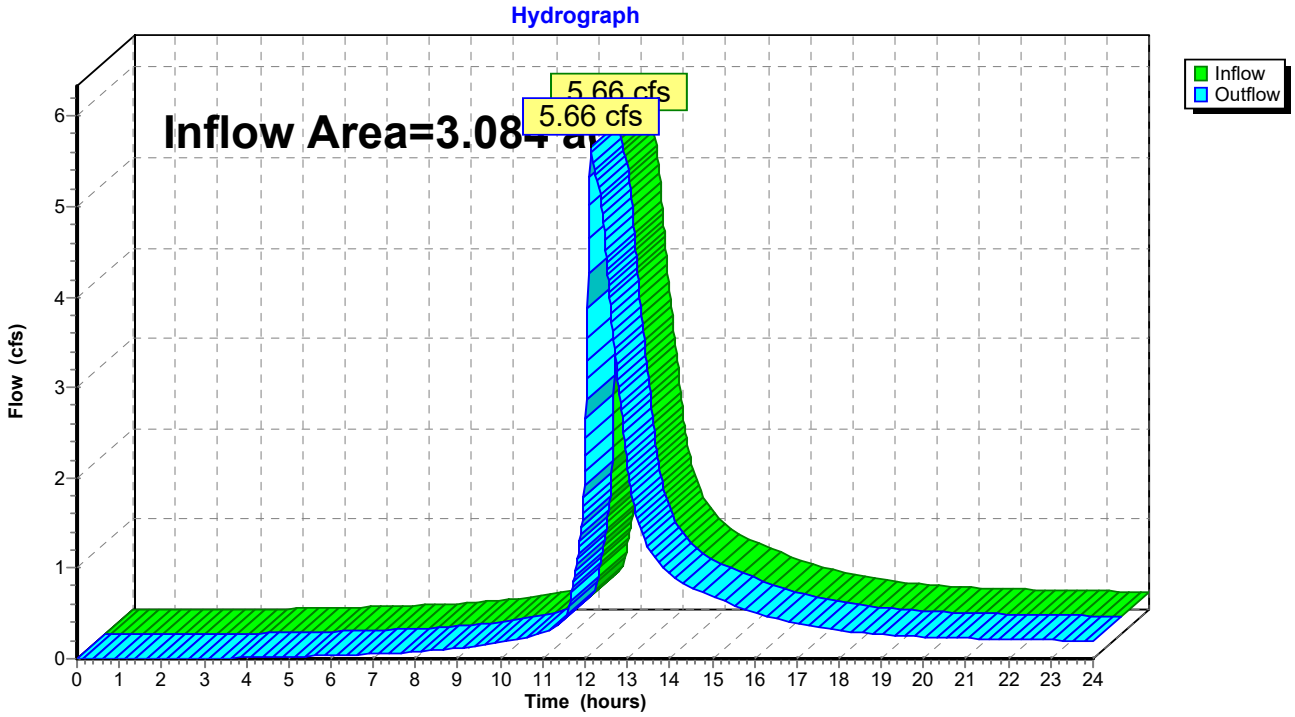


Summary for Reach DP-1: To Wetlands

Inflow Area = 3.084 ac, 66.36% Impervious, Inflow Depth > 3.29" for 25 YEAR event
Inflow = 5.66 cfs @ 12.14 hrs, Volume= 0.847 af
Outflow = 5.66 cfs @ 12.14 hrs, Volume= 0.847 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-1: To Wetlands

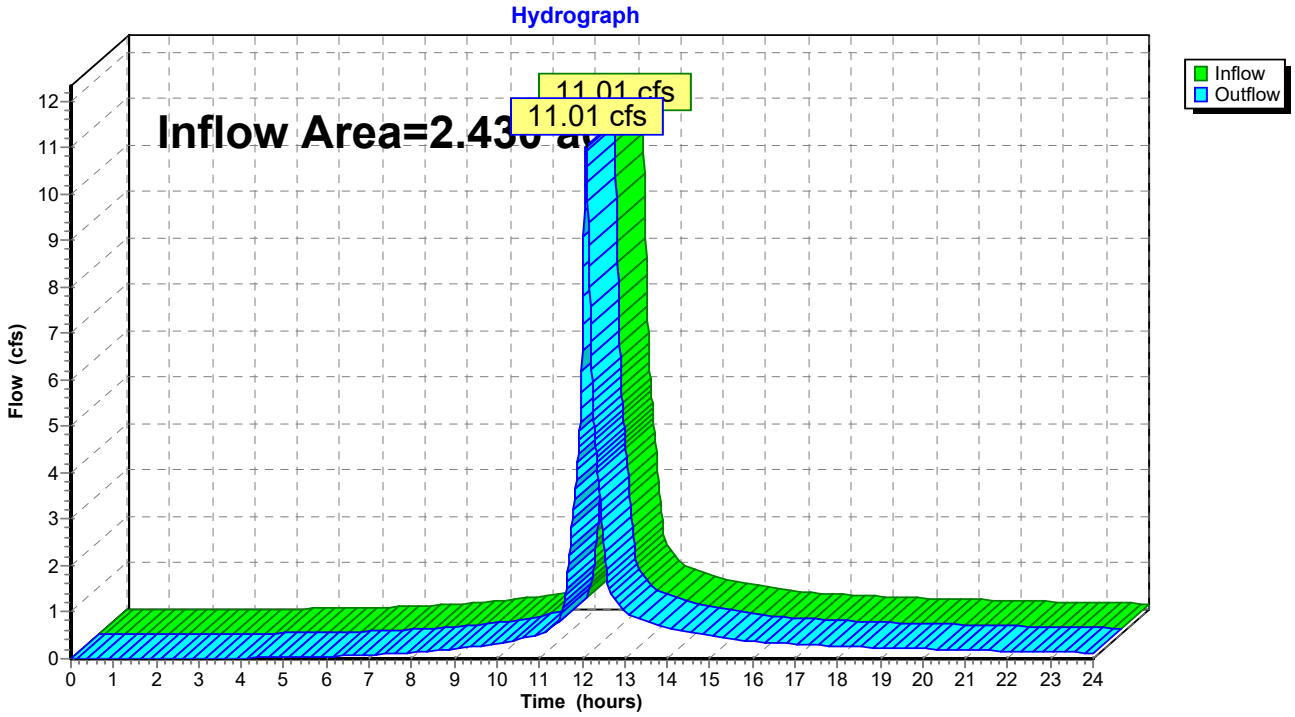


Summary for Reach DP-2: To Independence Dr System

Inflow Area = 2.430 ac, 49.19% Impervious, Inflow Depth > 4.22" for 25 YEAR event
Inflow = 11.01 cfs @ 12.09 hrs, Volume= 0.855 af
Outflow = 11.01 cfs @ 12.09 hrs, Volume= 0.855 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-2: To Independence Dr System



Summary for Pond D-1C: Storm Trap Single Trap 4-6

Inflow Area = 2.269 ac, 83.21% Impervious, Inflow Depth > 4.90" for 25 YEAR event
Inflow = 11.83 cfs @ 12.08 hrs, Volume= 0.926 af
Outflow = 3.87 cfs @ 12.37 hrs, Volume= 0.596 af, Atten= 67%, Lag= 17.2 min
Primary = 3.87 cfs @ 12.37 hrs, Volume= 0.596 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 159.16' @ 12.37 hrs Surf.Area= 6,836 sf Storage= 19,654 cf

Plug-Flow detention time= 203.7 min calculated for 0.596 af (64% of inflow)
Center-of-Mass det. time= 102.6 min (865.0 - 762.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.80'	0 cf	**48.27'W x 141.63'L x 5.17'H Field A** 35,321 cf Overall - 35,321 cf Embedded = 0 cf x 0.0% Voids
#2A	155.80'	26,355 cf	**StormTrap ST1 SingleTrap 4-6** x 70 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 7 Rows of 10 Chambers 48.27' x 140.63' Core + 0.00' x 0.50' Border = 48.27' x 141.63' System
		26,355 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.30'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	160.80'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	155.80'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=3.87 cfs @ 12.37 hrs HW=159.16' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 3.68 cfs @ 3.75 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.77 fps)

Pond D-1C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

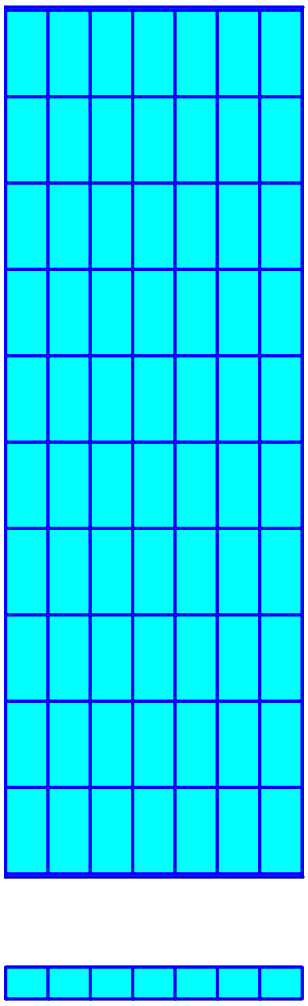
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

10 Chambers/Row x 14.06' Long = 140.63' Row Length +6.0" Border x 2 = 141.63' Base Length
7 Rows x 82.8" Wide = 48.27' Base Width
62.0" Chamber Height = 5.17' Field Height

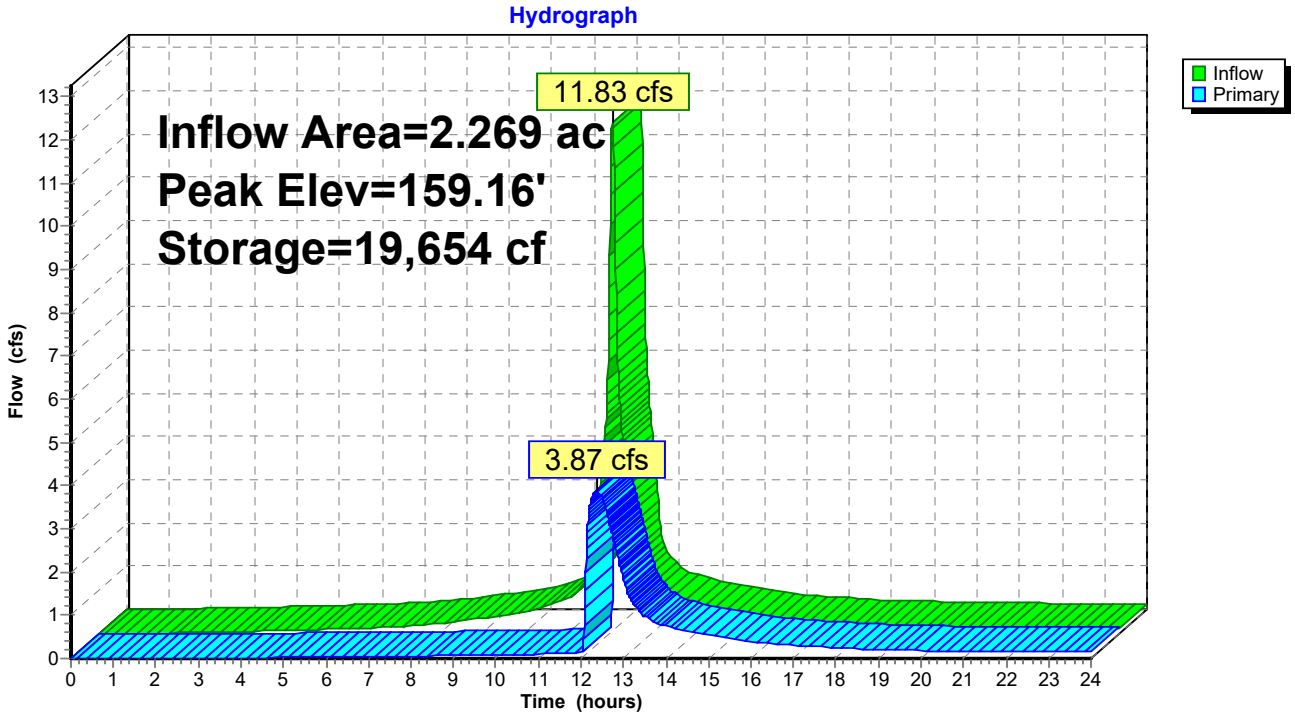
70 Chambers x 376.5 cf = 26,355.1 cf Chamber Storage
70 Chambers x 501.0 cf + 249.4 cf Border = 35,321.2 cf Displacement

Chamber Storage = 26,355.1 cf = 0.605 af
Overall Storage Efficiency = 74.6%
Overall System Size = 141.63' x 48.27' x 5.17'

70 Chambers (plus border)
1,308.2 cy Field



Pond D-1C: Storm Trap Single Trap 4-6



Summary for Pond D-2C: Storm Trap Single Trap 4-6

Inflow Area = 0.899 ac, 67.38% Impervious, Inflow Depth > 4.61" for 25 YEAR event
Inflow = 4.47 cfs @ 12.08 hrs, Volume= 0.346 af
Outflow = 4.11 cfs @ 12.12 hrs, Volume= 0.342 af, Atten= 8%, Lag= 2.1 min
Primary = 4.11 cfs @ 12.12 hrs, Volume= 0.342 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 167.74' @ 12.12 hrs Surf.Area= 603 sf Storage= 1,725 cf

Plug-Flow detention time= 51.7 min calculated for 0.342 af (99% of inflow)
Center-of-Mass det. time= 44.9 min (814.3 - 769.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.30'	0 cf	**20.69'W x 29.13'L x 5.17'H Field A** 3,113 cf Overall - 3,113 cf Embedded = 0 cf x 0.0% Voids
#2A	164.30'	2,259 cf	**StormTrap ST1 SingleTrap 4-6** x 6 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 3 Rows of 2 Chambers 20.69' x 28.13' Core + 0.00' x 0.50' Border = 20.69' x 29.13' System
		2,259 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	166.80'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	169.30'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	164.30'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=4.11 cfs @ 12.12 hrs HW=167.74' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 3.91 cfs @ 3.99 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.87 fps)

Pond D-2C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

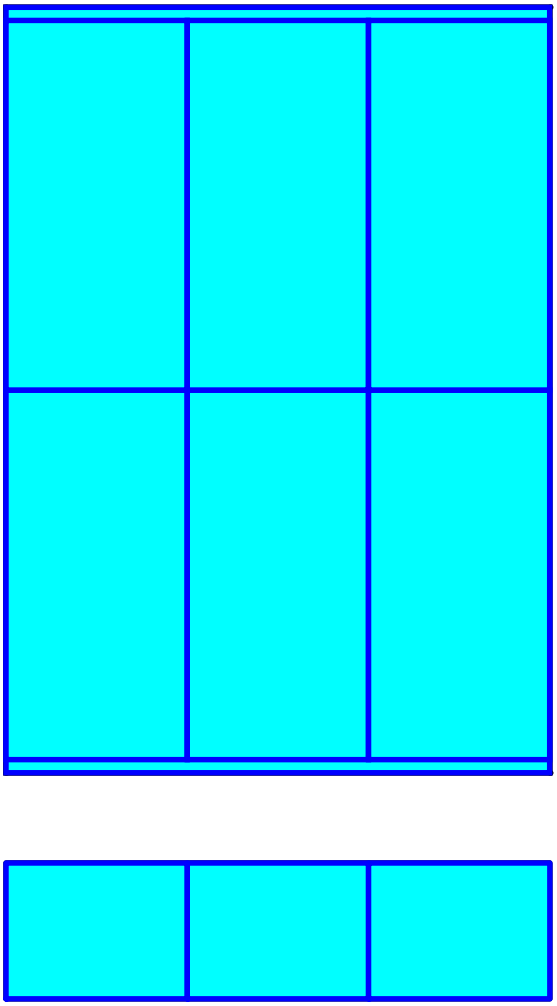
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

2 Chambers/Row x 14.06' Long = 28.13' Row Length +6.0" Border x 2 = 29.13' Base Length
3 Rows x 82.8" Wide = 20.69' Base Width
62.0" Chamber Height = 5.17' Field Height

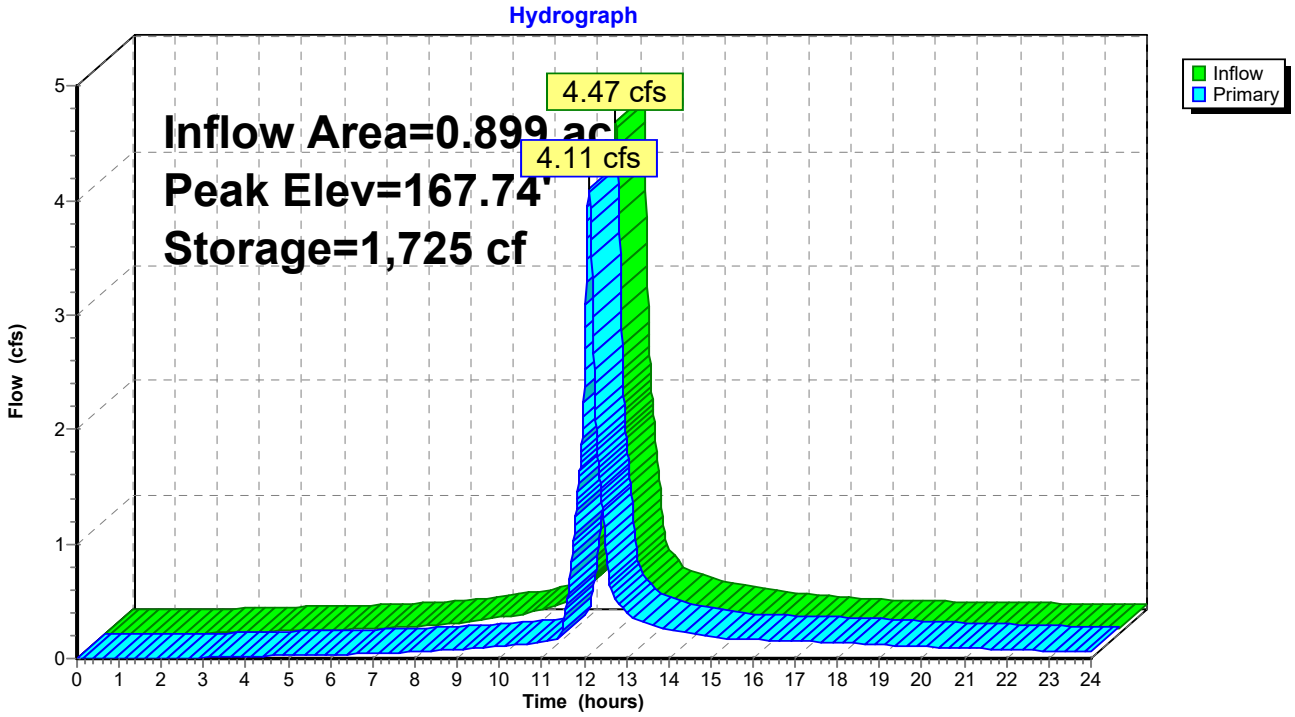
6 Chambers x 376.5 cf = 2,259.0 cf Chamber Storage
6 Chambers x 501.0 cf + 106.9 cf Border = 3,113.0 cf Displacement

Chamber Storage = 2,259.0 cf = 0.052 af
Overall Storage Efficiency = 72.6%
Overall System Size = 29.13' x 20.69' x 5.17'

6 Chambers (plus border)
115.3 cy Field



Pond D-2C: Storm Trap Single Trap 4-6



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: 40B-PR-1A Runoff Area=25,311 sf 27.26% Impervious Runoff Depth>4.96"
Tc=6.0 min CN=85 Runoff=3.30 cfs 0.240 af

Subcatchment PR-1B: 40B-PR-1B Runoff Area=52,416 sf 68.33% Impervious Runoff Depth>5.75"
Tc=6.0 min CN=92 Runoff=7.56 cfs 0.577 af

Subcatchment PR-1C: 40B-PR-1C Runoff Area=46,421 sf 100.00% Impervious Runoff Depth>6.46"
Tc=6.0 min CN=98 Runoff=7.00 cfs 0.573 af

Subcatchment PR-1D: 40B-PR-1D Runoff Area=1,848 sf 0.00% Impervious Runoff Depth>4.41"
Tc=6.0 min CN=80 Runoff=0.22 cfs 0.016 af

Subcatchment PR-1E: 40B-PR-1E Runoff Area=8,324 sf 0.00% Impervious Runoff Depth>4.41"
Tc=6.0 min CN=80 Runoff=0.98 cfs 0.070 af

Subcatchment PR-2A: 40B-PR-2A Runoff Area=54,932 sf 39.39% Impervious Runoff Depth>5.18"
Tc=6.0 min CN=87 Runoff=7.40 cfs 0.545 af

Subcatchment PR-2B: 40B-PR-2B Runoff Area=22,078 sf 82.43% Impervious Runoff Depth>6.10"
Tc=6.0 min CN=95 Runoff=3.28 cfs 0.258 af

Subcatchment PR-2C: 40B-PR-2C Runoff Area=11,737 sf 34.36% Impervious Runoff Depth>5.07"
Tc=6.0 min CN=86 Runoff=1.56 cfs 0.114 af

Subcatchment PR-2D: 40B-PR-2D Runoff Area=8,000 sf 100.00% Impervious Runoff Depth>6.46"
Tc=6.0 min CN=98 Runoff=1.21 cfs 0.099 af

Subcatchment PR-2E: 40B-PR-2E Runoff Area=9,102 sf 2.19% Impervious Runoff Depth>4.41"
Tc=6.0 min CN=80 Runoff=1.07 cfs 0.077 af

Reach DP-1: To Wetlands Inflow=8.58 cfs 1.140 af
Outflow=8.58 cfs 1.140 af

Reach DP-2: To Independence Dr System Inflow=13.71 cfs 1.086 af
Outflow=13.71 cfs 1.086 af

Pond D-1C: Storm Trap Single Trap 4-6 Peak Elev=159.72' Storage=22,982 cf Inflow=14.56 cfs 1.150 af
Outflow=5.33 cfs 0.814 af

Pond D-2C: Storm Trap Single Trap 4-6 Peak Elev=168.08' Storage=1,895 cf Inflow=5.56 cfs 0.433 af
Outflow=4.99 cfs 0.428 af

Total Runoff Area = 5.514 ac Runoff Volume = 2.569 af Average Runoff Depth = 5.59"
41.21% Pervious = 2.272 ac 58.79% Impervious = 3.242 ac

Summary for Subcatchment PR-1A: 40B-PR-1A

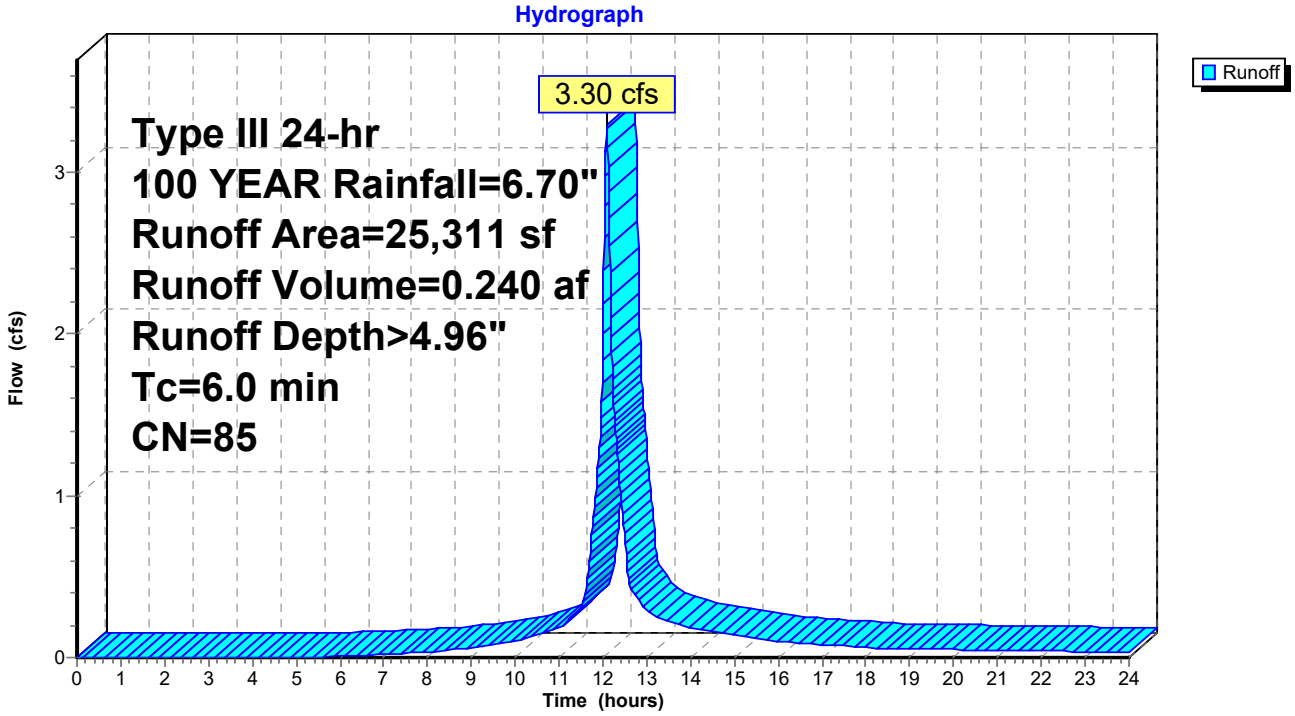
Runoff = 3.30 cfs @ 12.09 hrs, Volume= 0.240 af, Depth> 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	6,900	98	Impervious
	18,411	80	>75% Grass cover, Good, HSG D
	25,311	85	Weighted Average
	18,411		72.74% Pervious Area
	6,900		27.26% Impervious Area

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

Subcatchment PR-1A: 40B-PR-1A



Summary for Subcatchment PR-1B: 40B-PR-1B

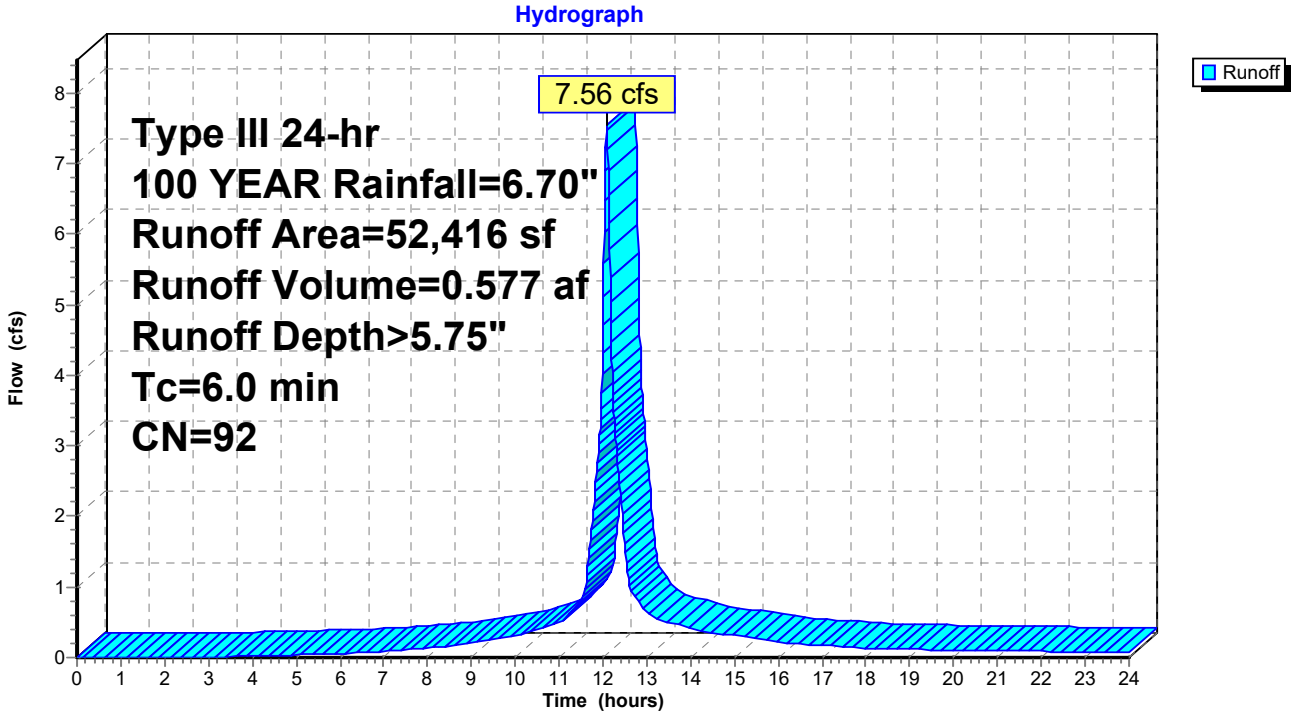
Runoff = 7.56 cfs @ 12.08 hrs, Volume= 0.577 af, Depth> 5.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	35,817	98	Impervious
	16,599	80	>75% Grass cover, Good, HSG D
	52,416	92	Weighted Average
	16,599		31.67% Pervious Area
	35,817		68.33% Impervious Area

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

Subcatchment PR-1B: 40B-PR-1B



Summary for Subcatchment PR-1C: 40B-PR-1C

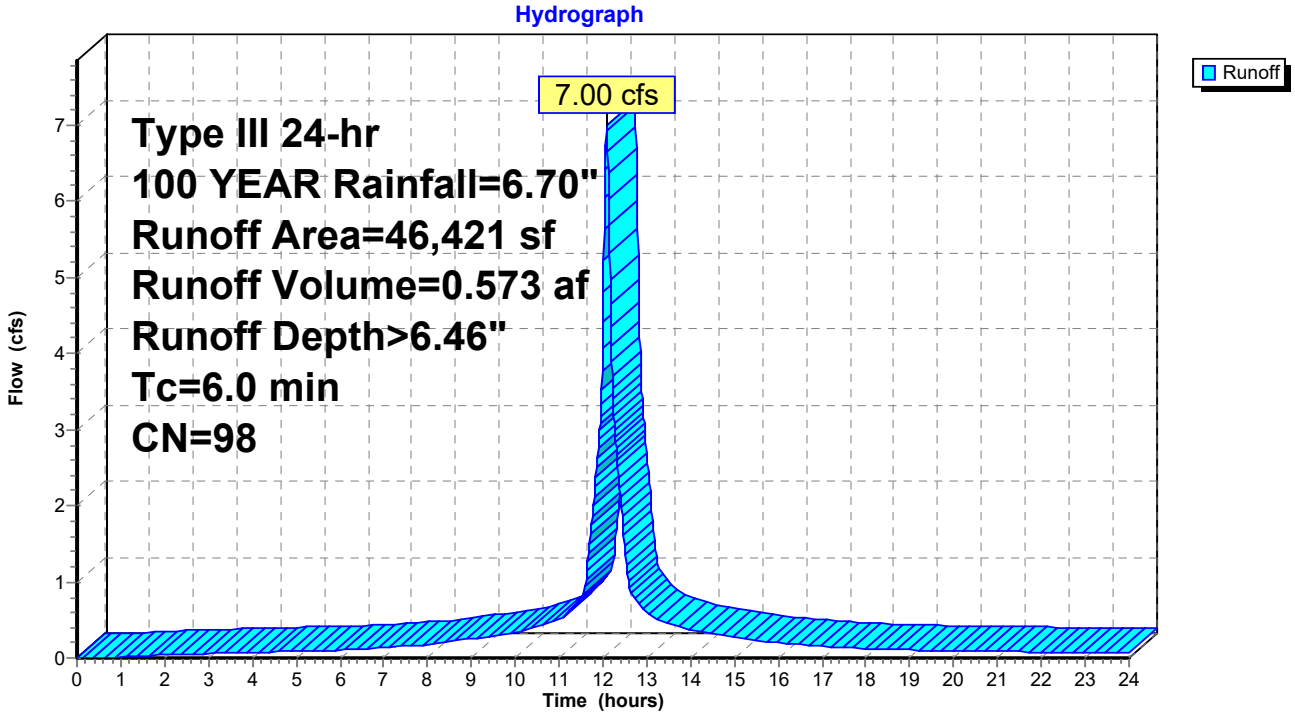
Runoff = 7.00 cfs @ 12.08 hrs, Volume= 0.573 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	46,421	98	Impervious
	46,421		100.00% Impervious Area

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

Subcatchment PR-1C: 40B-PR-1C



Summary for Subcatchment PR-1D: 40B-PR-1D

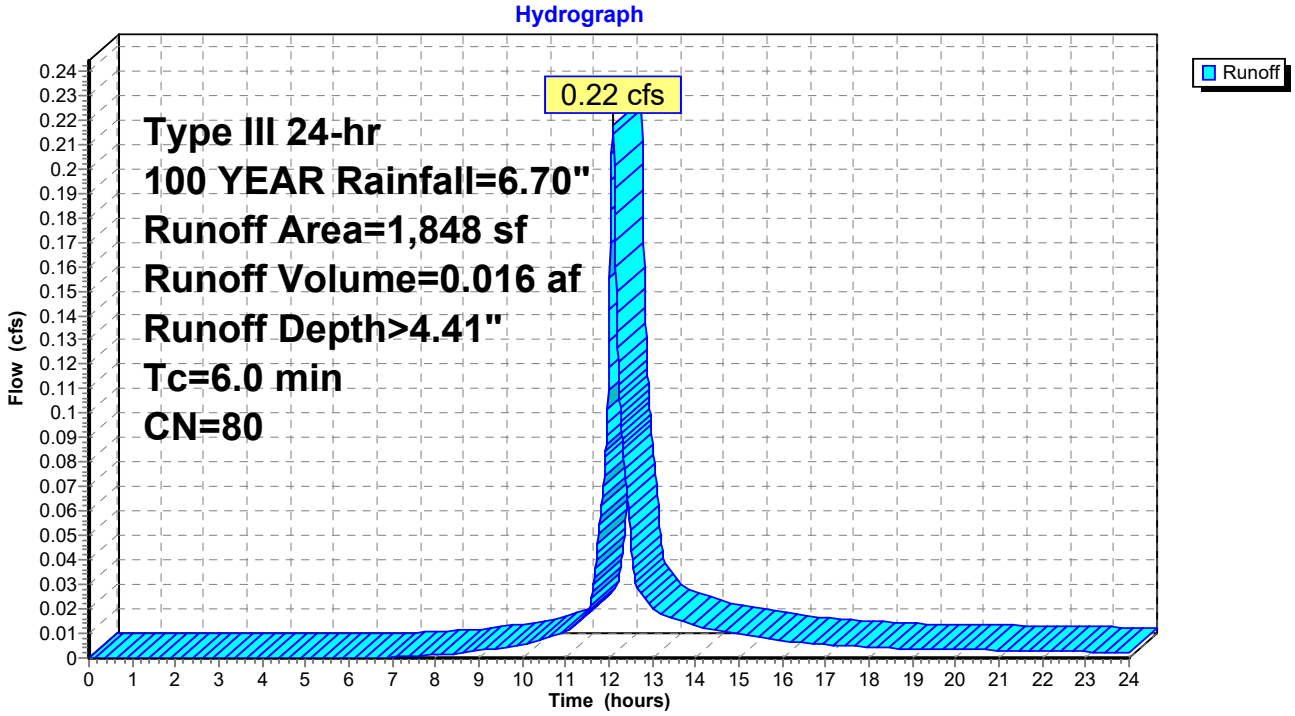
Runoff = 0.22 cfs @ 12.09 hrs, Volume= 0.016 af, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

Area (sf)	CN	Description
1,848	80	>75% Grass cover, Good, HSG D
1,848		100.00% Pervious Area

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

Subcatchment PR-1D: 40B-PR-1D



Summary for Subcatchment PR-1E: 40B-PR-1E

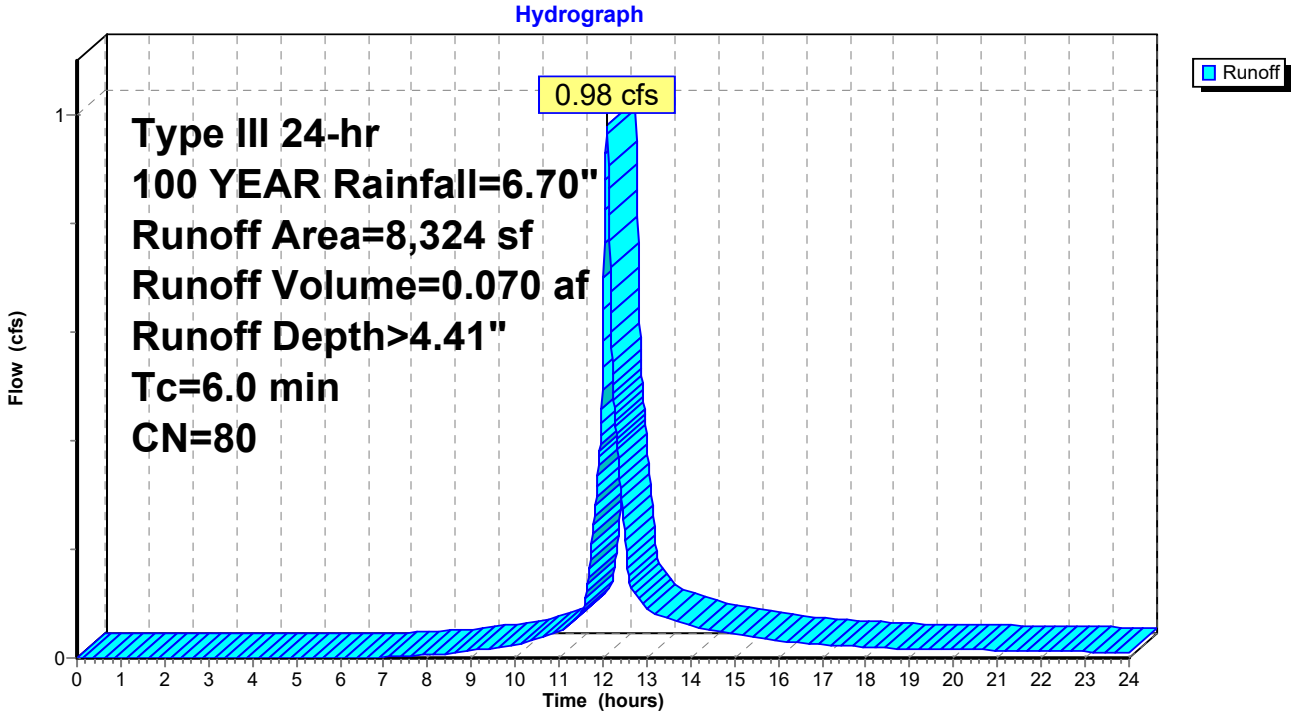
Runoff = 0.98 cfs @ 12.09 hrs, Volume= 0.070 af, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

Area (sf)	CN	Description
8,324	80	>75% Grass cover, Good, HSG D
8,324		100.00% Pervious Area

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

Subcatchment PR-1E: 40B-PR-1E



Summary for Subcatchment PR-2A: 40B-PR-2A

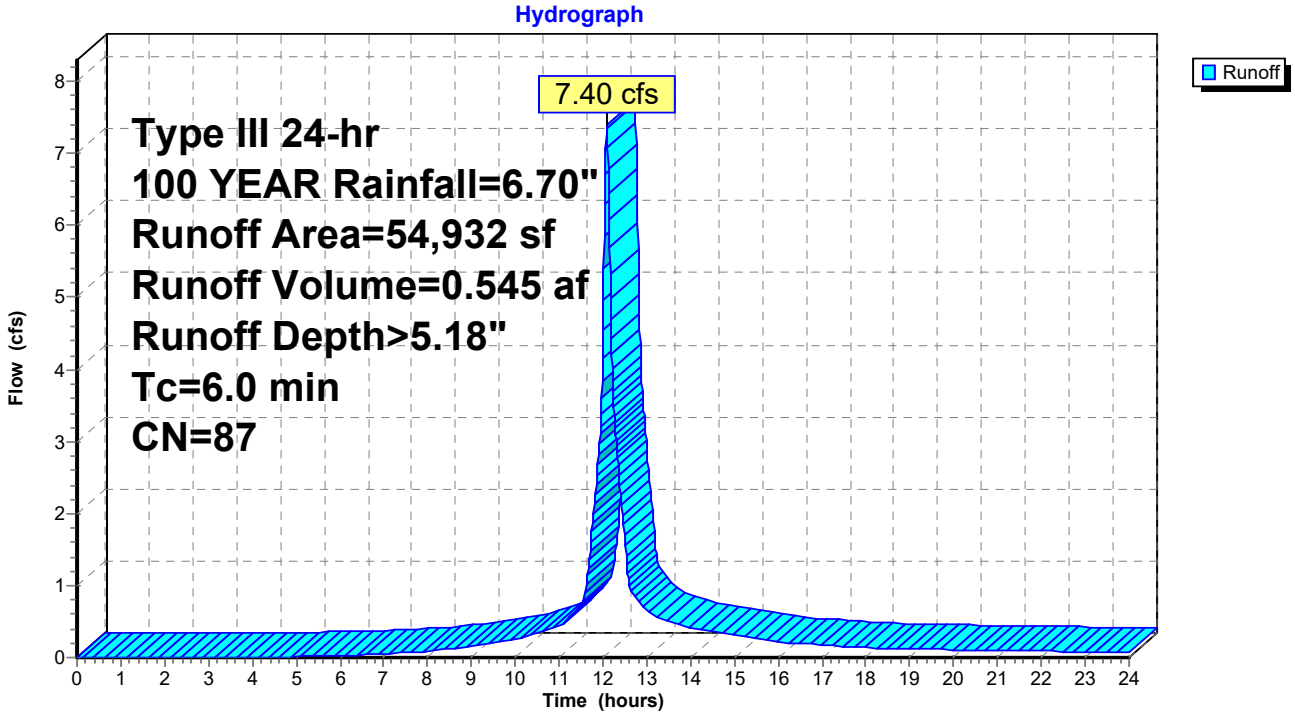
Runoff = 7.40 cfs @ 12.09 hrs, Volume= 0.545 af, Depth> 5.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	21,637	98	Impervious
	33,295	80	>75% Grass cover, Good, HSG D
	54,932	87	Weighted Average
	33,295		60.61% Pervious Area
	21,637		39.39% Impervious Area

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

Subcatchment PR-2A: 40B-PR-2A



Summary for Subcatchment PR-2B: 40B-PR-2B

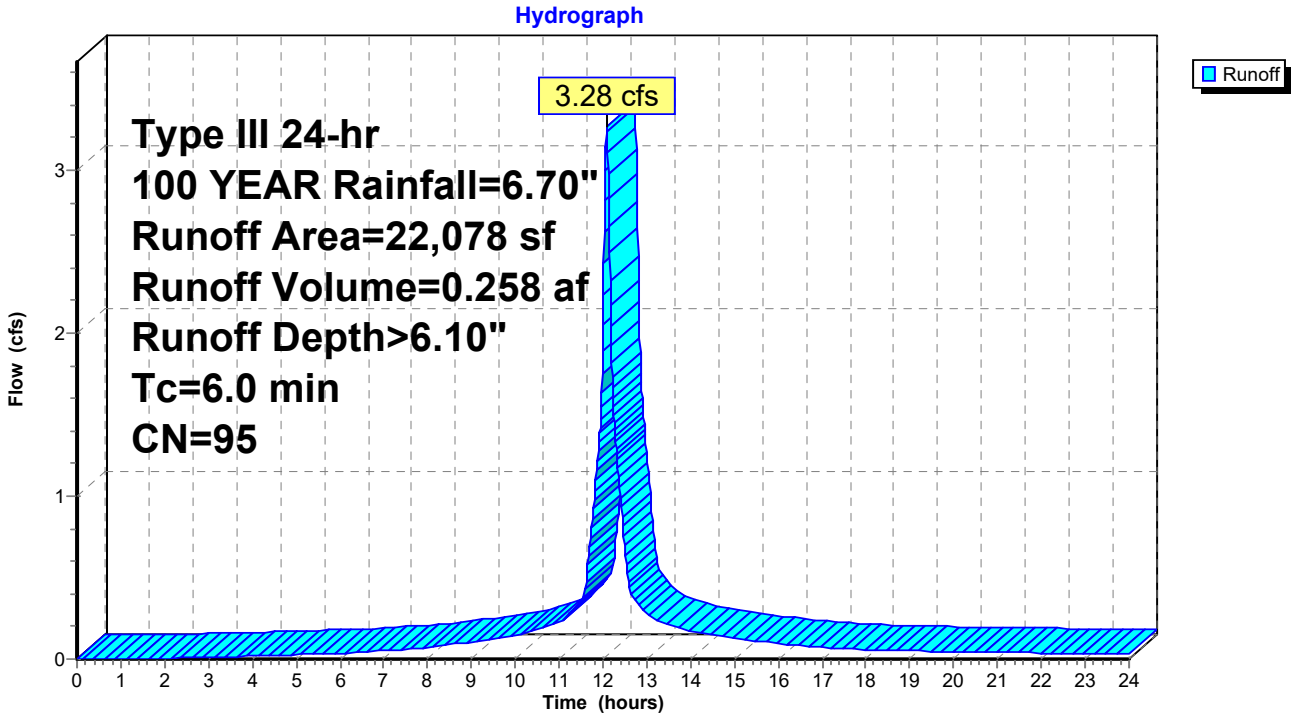
Runoff = 3.28 cfs @ 12.08 hrs, Volume= 0.258 af, Depth> 6.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	12,305	98	Impervious
	3,879	80	>75% Grass cover, Good, HSG D
*	5,894	98	Roof
	22,078	95	Weighted Average
	3,879		17.57% Pervious Area
	18,199		82.43% Impervious Area

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

Subcatchment PR-2B: 40B-PR-2B



Summary for Subcatchment PR-2C: 40B-PR-2C

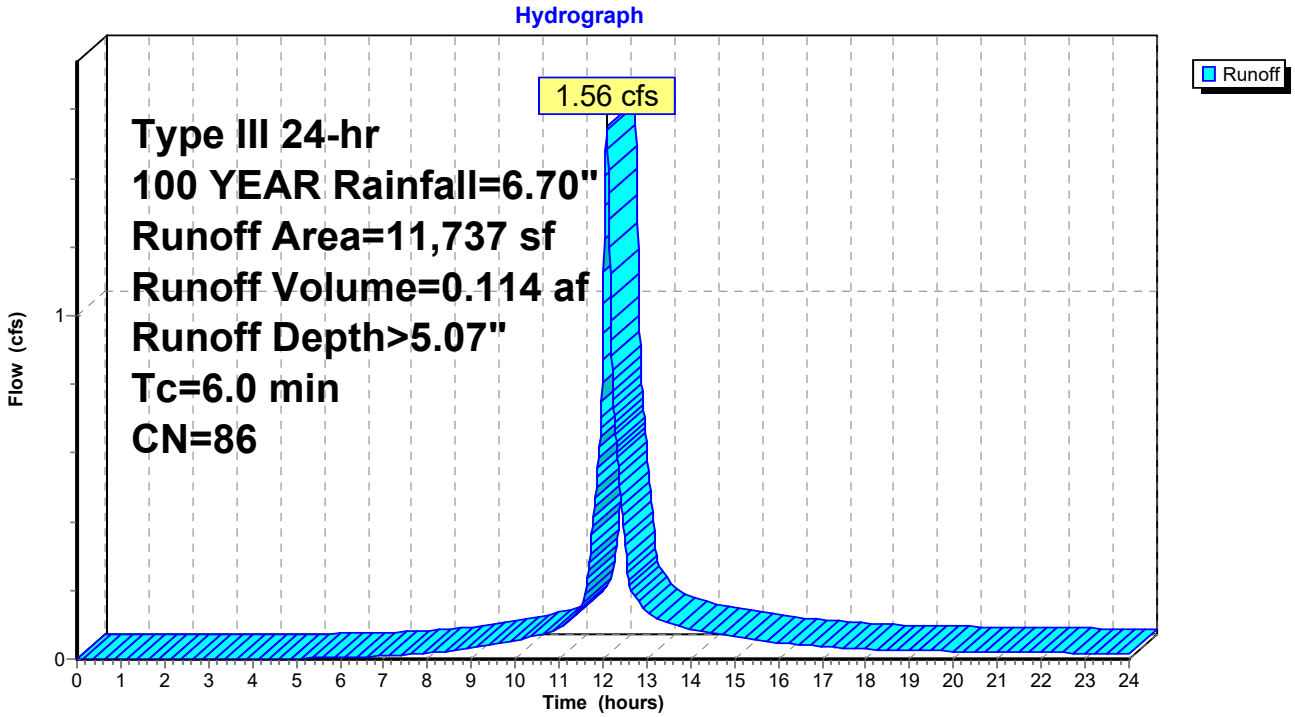
Runoff = 1.56 cfs @ 12.09 hrs, Volume= 0.114 af, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
	7,704	80	>75% Grass cover, Good, HSG D
*	1,086	98	Impervious
*	2,947	98	Roof
	11,737	86	Weighted Average
	7,704		65.64% Pervious Area
	4,033		34.36% Impervious Area

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

Subcatchment PR-2C: 40B-PR-2C



Summary for Subcatchment PR-2D: 40B-PR-2D

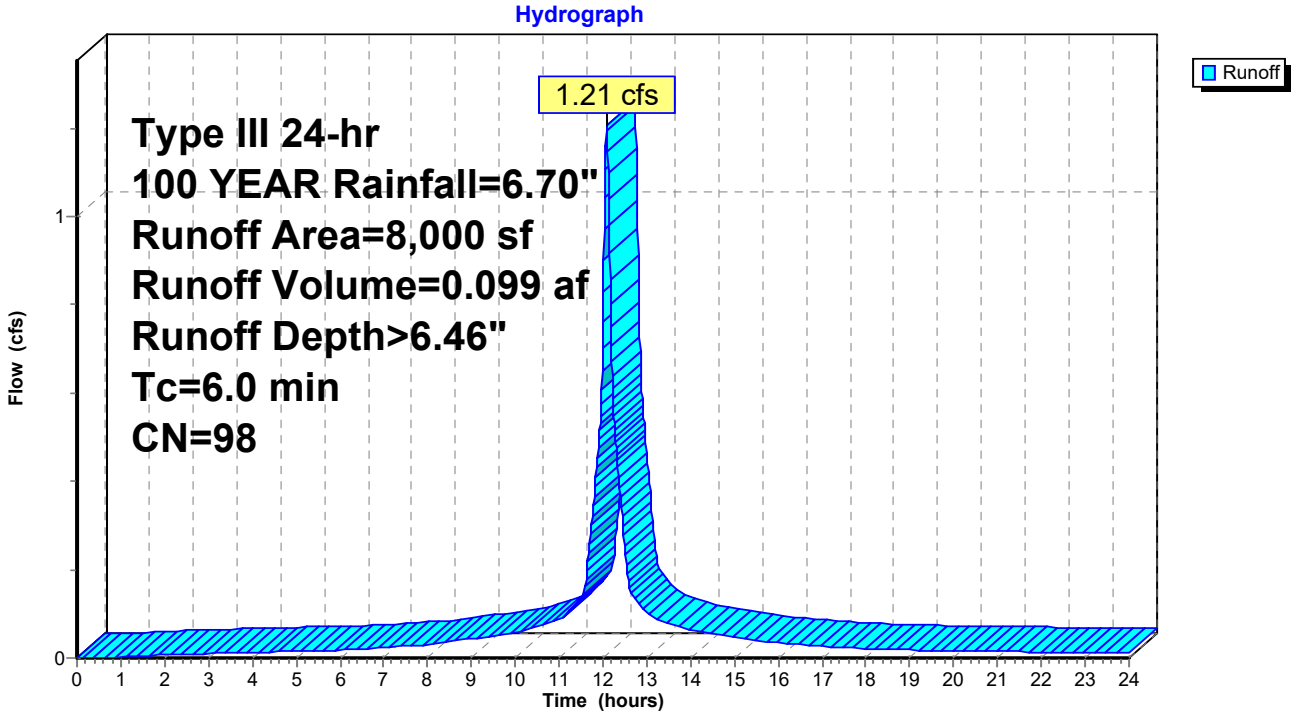
Runoff = 1.21 cfs @ 12.08 hrs, Volume= 0.099 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	8,000	98	Impervious
	8,000		100.00% Impervious Area

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

Subcatchment PR-2D: 40B-PR-2D



Summary for Subcatchment PR-2E: 40B-PR-2E

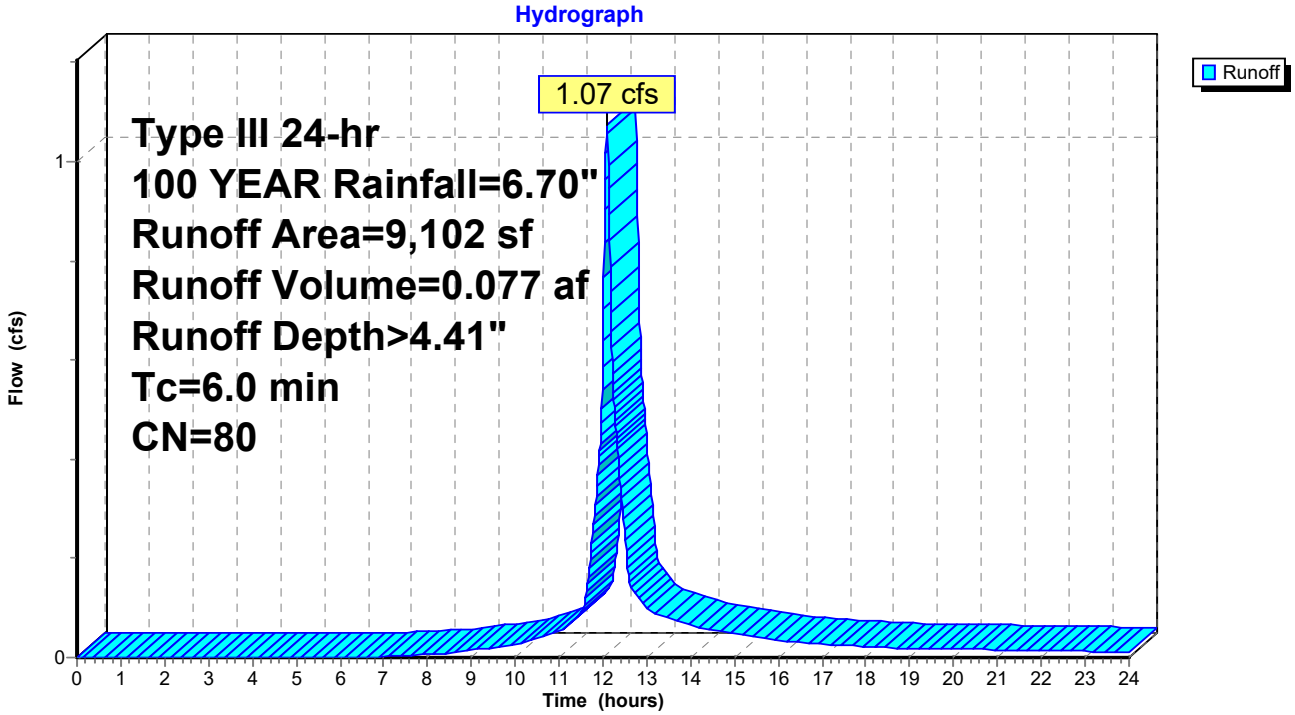
Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.077 af, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YEAR Rainfall=6.70"

	Area (sf)	CN	Description
*	199	98	Impervious
	8,903	80	>75% Grass cover, Good, HSG D
	9,102	80	Weighted Average
	8,903		97.81% Pervious Area
	199		2.19% Impervious Area

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

Subcatchment PR-2E: 40B-PR-2E

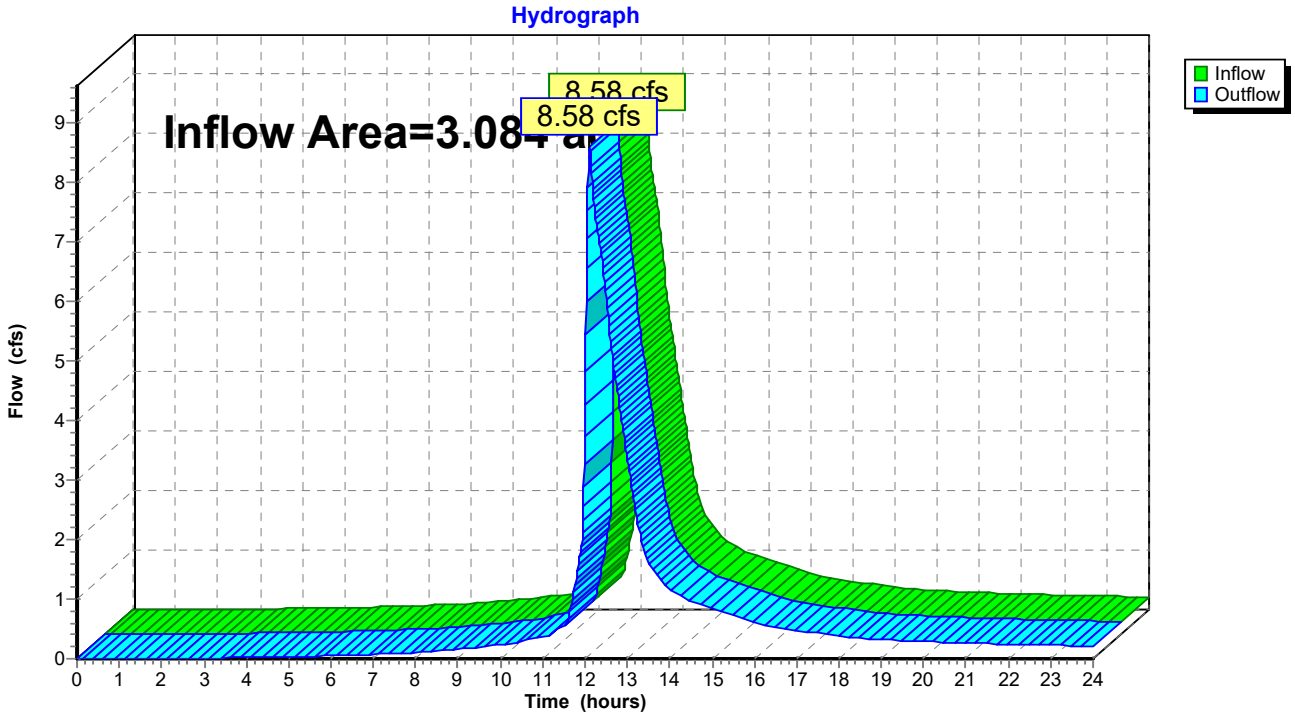


Summary for Reach DP-1: To Wetlands

Inflow Area = 3.084 ac, 66.36% Impervious, Inflow Depth > 4.44" for 100 YEAR event
Inflow = 8.58 cfs @ 12.11 hrs, Volume= 1.140 af
Outflow = 8.58 cfs @ 12.11 hrs, Volume= 1.140 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-1: To Wetlands

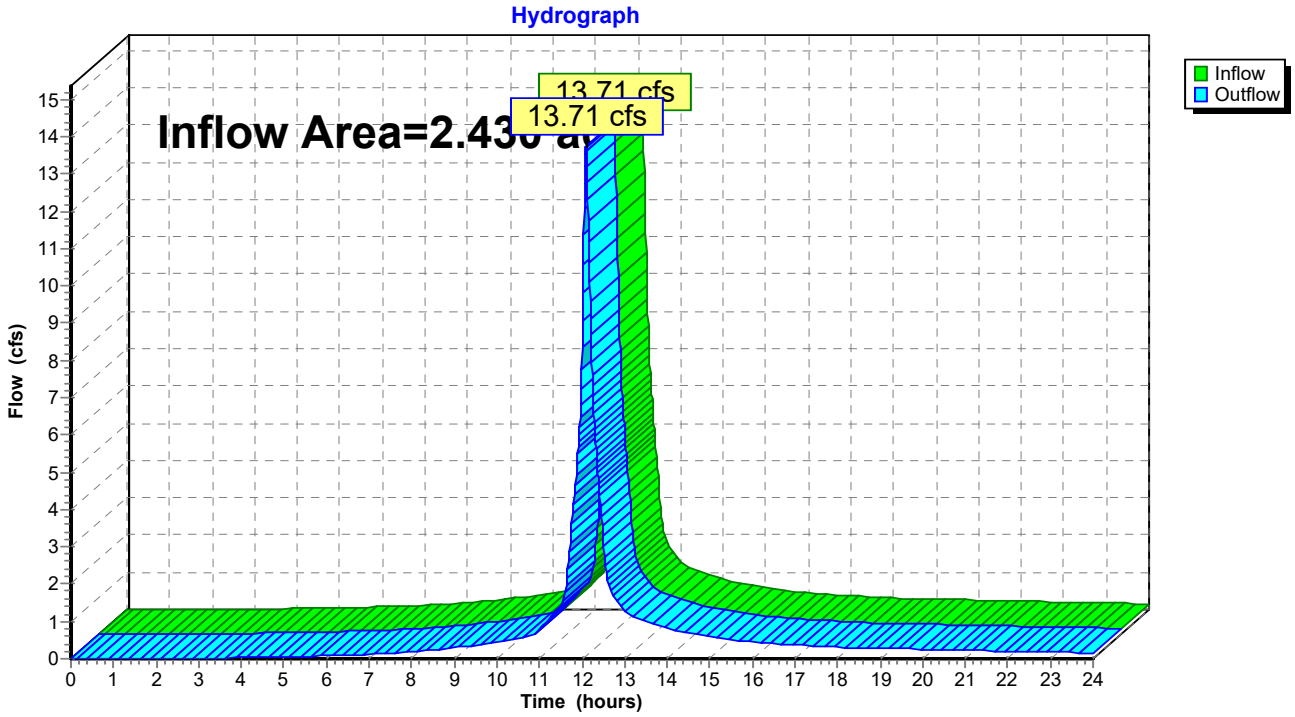


Summary for Reach DP-2: To Independence Dr System

Inflow Area = 2.430 ac, 49.19% Impervious, Inflow Depth > 5.37" for 100 YEAR event
Inflow = 13.71 cfs @ 12.09 hrs, Volume= 1.086 af
Outflow = 13.71 cfs @ 12.09 hrs, Volume= 1.086 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP-2: To Independence Dr System



Summary for Pond D-1C: Storm Trap Single Trap 4-6

Inflow Area = 2.269 ac, 83.21% Impervious, Inflow Depth > 6.08" for 100 YEAR event
Inflow = 14.56 cfs @ 12.08 hrs, Volume= 1.150 af
Outflow = 5.33 cfs @ 12.33 hrs, Volume= 0.814 af, Atten= 63%, Lag= 14.7 min
Primary = 5.33 cfs @ 12.33 hrs, Volume= 0.814 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 159.72' @ 12.33 hrs Surf.Area= 6,836 sf Storage= 22,982 cf

Plug-Flow detention time= 181.2 min calculated for 0.814 af (71% of inflow)
Center-of-Mass det. time= 88.6 min (846.9 - 758.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.80'	0 cf	**48.27'W x 141.63'L x 5.17'H Field A** 35,321 cf Overall - 35,321 cf Embedded = 0 cf x 0.0% Voids
#2A	155.80'	26,355 cf	**StormTrap ST1 SingleTrap 4-6** x 70 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 7 Rows of 10 Chambers 48.27' x 140.63' Core + 0.00' x 0.50' Border = 48.27' x 141.63' System
		26,355 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.30'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	160.80'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	155.80'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=5.33 cfs @ 12.33 hrs HW=159.72' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 5.12 cfs @ 5.22 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.21 cfs @ 9.49 fps)

Pond D-1C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

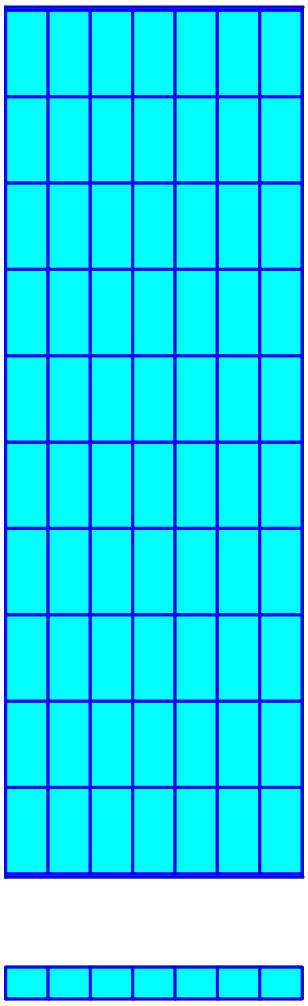
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

10 Chambers/Row x 14.06' Long = 140.63' Row Length +6.0" Border x 2 = 141.63' Base Length
7 Rows x 82.8" Wide = 48.27' Base Width
62.0" Chamber Height = 5.17' Field Height

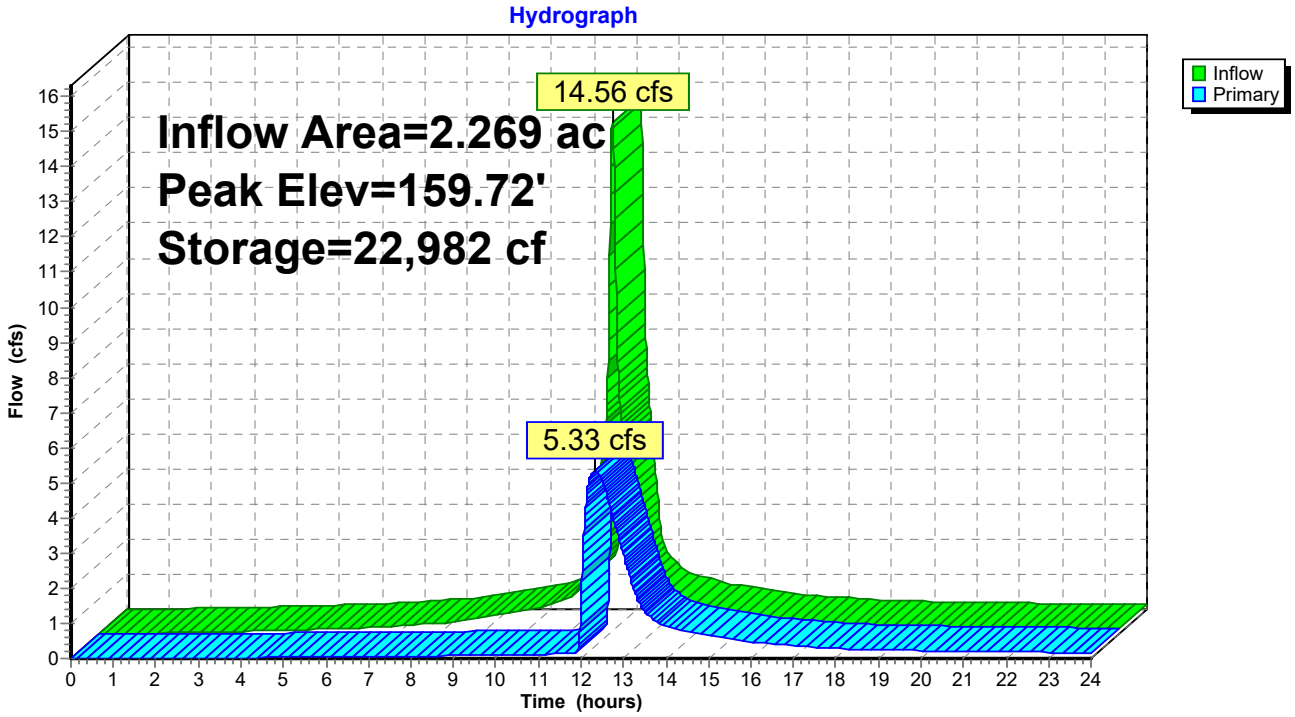
70 Chambers x 376.5 cf = 26,355.1 cf Chamber Storage
70 Chambers x 501.0 cf + 249.4 cf Border = 35,321.2 cf Displacement

Chamber Storage = 26,355.1 cf = 0.605 af
Overall Storage Efficiency = 74.6%
Overall System Size = 141.63' x 48.27' x 5.17'

70 Chambers (plus border)
1,308.2 cy Field



Pond D-1C: Storm Trap Single Trap 4-6



Summary for Pond D-2C: Storm Trap Single Trap 4-6

Inflow Area = 0.899 ac, 67.38% Impervious, Inflow Depth > 5.78" for 100 YEAR event
Inflow = 5.56 cfs @ 12.08 hrs, Volume= 0.433 af
Outflow = 4.99 cfs @ 12.12 hrs, Volume= 0.428 af, Atten= 10%, Lag= 2.3 min
Primary = 4.99 cfs @ 12.12 hrs, Volume= 0.428 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 168.08' @ 12.12 hrs Surf.Area= 603 sf Storage= 1,895 cf

Plug-Flow detention time= 47.8 min calculated for 0.428 af (99% of inflow)
Center-of-Mass det. time= 39.4 min (804.4 - 765.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	164.30'	0 cf	**20.69'W x 29.13'L x 5.17'H Field A** 3,113 cf Overall - 3,113 cf Embedded = 0 cf x 0.0% Voids
#2A	164.30'	2,259 cf	**StormTrap ST1 SingleTrap 4-6** x 6 Inside #1 Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf 3 Rows of 2 Chambers 20.69' x 28.13' Core + 0.00' x 0.50' Border = 20.69' x 29.13' System
		2,259 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	166.80'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#2	Primary	169.30'	**1.0' long Broad-Crested Rectangular Weir** 2 End Contraction(s)
#3	Primary	164.30'	**1.0" Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=4.99 cfs @ 12.12 hrs HW=168.07' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 4.78 cfs @ 4.87 fps)
- **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
- **3=Orifice/Grate** (Orifice Controls 0.20 cfs @ 9.30 fps)

Pond D-2C: Storm Trap Single Trap 4-6 - Chamber Wizard Field A

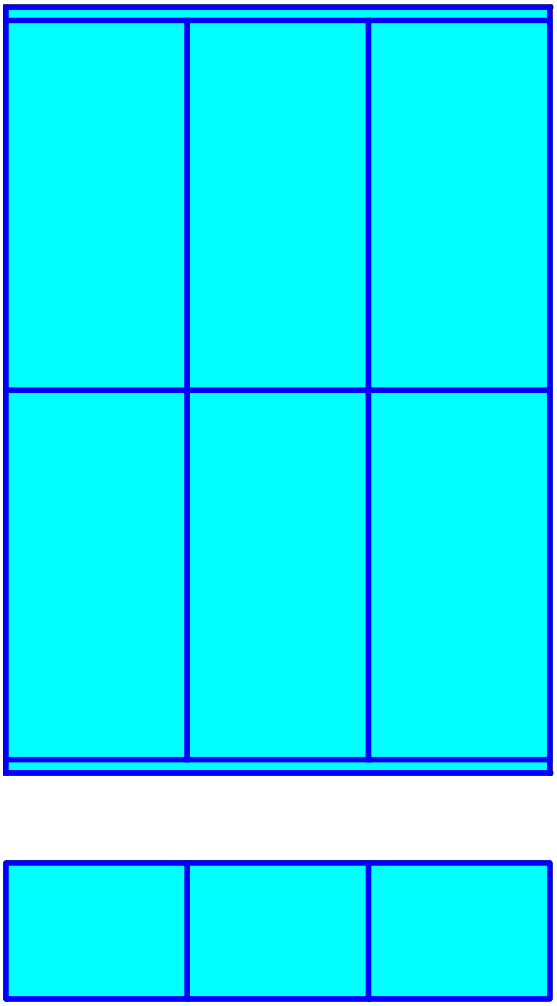
Chamber Model = StormTrap ST1 SingleTrap 4-6 (StormTrap ST1 SingleTrap® Type VI)
Inside= 82.8"W x 54.0"H => 26.77 sf x 14.06'L = 376.5 cf
Outside= 82.8"W x 62.0"H => 35.63 sf x 14.06'L = 501.0 cf

2 Chambers/Row x 14.06' Long = 28.13' Row Length +6.0" Border x 2 = 29.13' Base Length
3 Rows x 82.8" Wide = 20.69' Base Width
62.0" Chamber Height = 5.17' Field Height

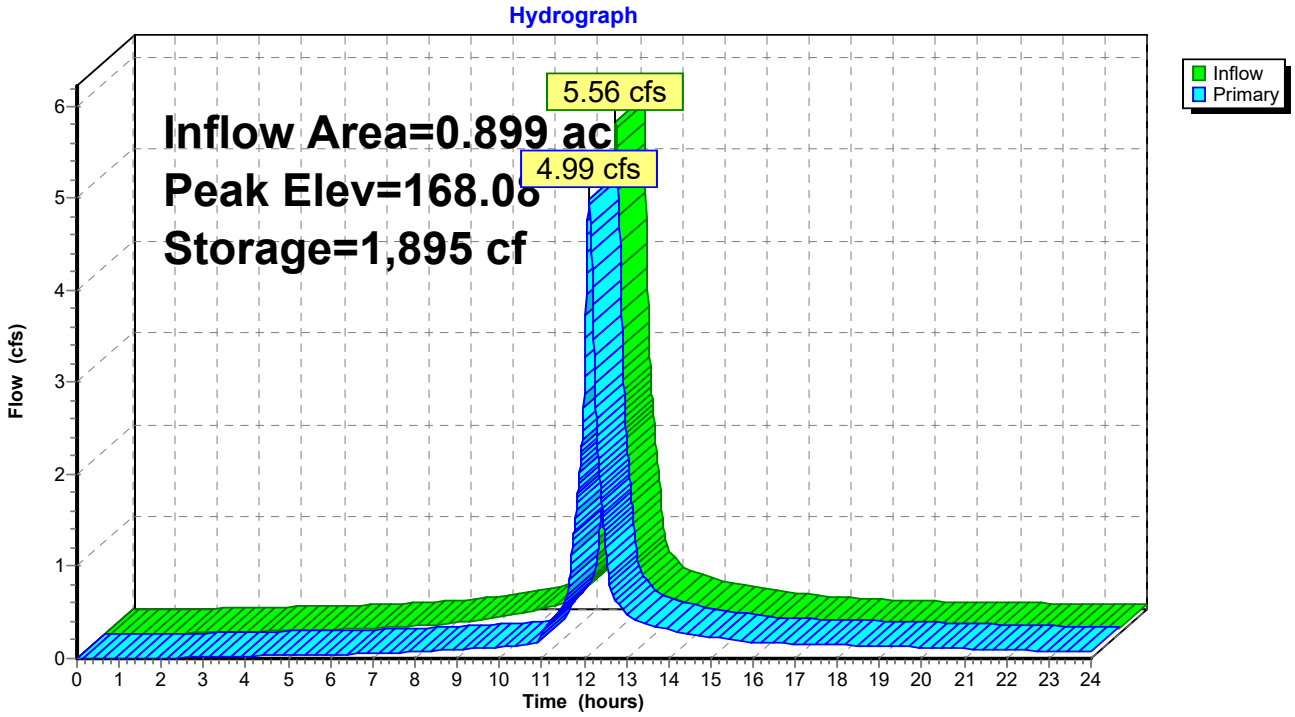
6 Chambers x 376.5 cf = 2,259.0 cf Chamber Storage
6 Chambers x 501.0 cf + 106.9 cf Border = 3,113.0 cf Displacement

Chamber Storage = 2,259.0 cf = 0.052 af
Overall Storage Efficiency = 72.6%
Overall System Size = 29.13' x 20.69' x 5.17'

6 Chambers (plus border)
115.3 cy Field



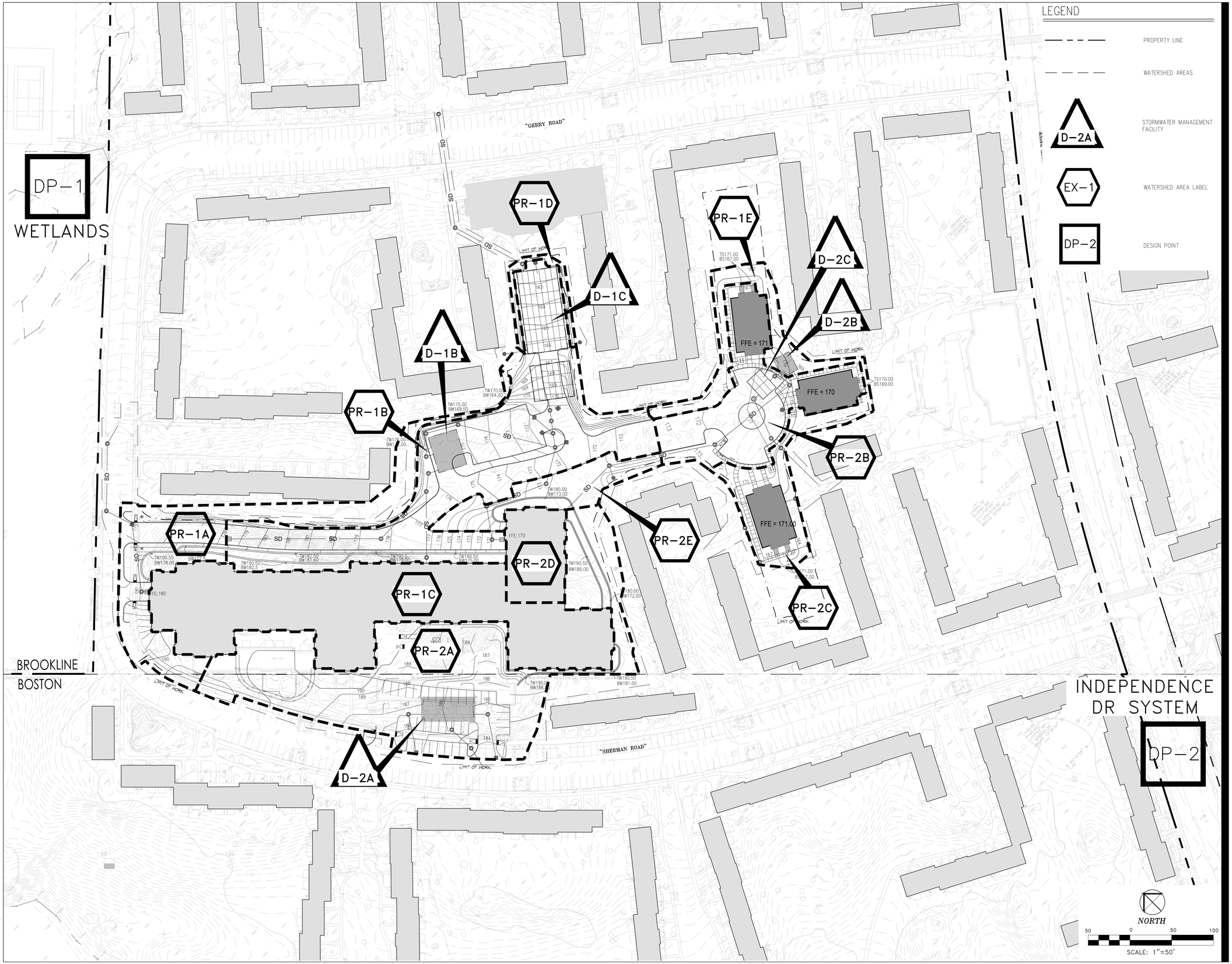
Pond D-2C: Storm Trap Single Trap 4-6



PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #5

Revised Proposed Watershed Plan



LEGEND

— — — —	PROPERTY LINE
— — — —	WATERSHED AREAS
D-2A	STORMWATER MANAGEMENT FACILITY
EX-1	WATERSHED AREA LABEL
DP-2	DESIGN POINT

Stantec

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Permit-Seal

Client/Project

PUDDINGSTONE AT CHESTNUT HILL

Brookline, MA

Title

PROPOSED WATERSHED PLAN

Project No. 210810271

Scale As Noted

Drawing No.

FIGURE 5.0

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PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #6

Revised Standard 3 Calculations

RECHARGE VOLUME CALCULATIONS, PART I

Date: August 13, 2018
Project: Puddingstone at Chestnut Hill
Project No: 210810271
Location: Brookline, MA

Prepared By: EB
Checked By: FH

Recharge Area Design

Objective: Size an infiltration basin that will approximate the annual recharge from the existing conditions

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol.3, Ch.1)

Design Criteria:

The required recharge volume equals a depth of runoff corresponding to the soil type times the impervious areas covering that soil type at the post-development site. A subsurface investigation verified that the soils onsite are classified as HSG "D" soils.

Based on the Site Hydrologic Soil Group:

Hydrologic Soil Group	Soil Texture	Target Depth Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

Recharge Volume Required:

	Impervious Area (sf)	Target Depth (in)	Volume Required (cf)
	141,206	0.10	1,177

	Impervious area routed through stormwater systems:	Capture Area Adjustment	
A	0	0	
B	0	0	
C	0	0	
D	97,089	1.45	
Total	97,089	1,711	(cf)

Recharge Volume Provided:

Subsurface Chambers D-1B

Outlet Elevation =	173.50	Area of system =	1,540 sf			
Bottom Basin Elev =	171.50	Area of system =	1,540 sf	Vol. of Recharge:	1,446 cf	

Subsurface Chambers D-2A

Outlet Elevation =	182.00	Area of system =	1,856 sf			
Bottom Basin Elev =	180.00	Area of system =	1,856 sf	Vol. of Recharge:	1,752 cf	

Subsurface Chambers D-2B

Outlet Elevation =	167.42	Area of system =	504 sf			
Bottom Basin Elev =	165.42	Area of system =	504 sf	Vol. of Recharge:	473 cf	
				Infiltration Basins Total	**3,671 cf** >	1,711 cf

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RECHARGE VOLUME CALCULATIONS, PART II

Date: August 13, 2018
Project: Puddingstone at Chestnut Hill
Project No: 210810271
Location: Brookline, MA
Prepared By: HK
Checked By: EB

Required Drawdown Time

Objective: Size an infiltration basin that will approximate the annual recharge from the existing conditions

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Vol. 3, Ch. 1)

Design Criteria: The required recharge volume equals a depth of runoff corresponding to the soil type times the impervious areas covering that soil type at the post-development site.

Based on the Site Hydrologic Soil Group:

Hydrologic Soil Group	Soil Texture	Target Depth Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

Required Recharge Volume Requried Recharge Volume = Target Depth Factor x Post Development Impervious Area/12

Subsurface Chambers D-1B
Total Impervious Area: 89,138 sf
Total Required Recharge Volume: 743 cf

Subsurface Chambers D-2A
Total Impervious Area: 21,637 sf
Total Required Recharge Volume: 180 cf

Subsurface Chambers D-2B
Total Impervious Area: 30,431 sf
Total Required Recharge Volume: 254 cf

Required Drawdown Time: Maximum of 72 Hours using the following equation:

$$\text{Drawdown Time} = \frac{R_v}{(K x A_{Bot} n)}$$

R_v = Required Recharge Volume
K = the Permeability Rate
A_{Bot} = Bottom area of Infiltration basin
n = porosity of the stone base

Subsurface Chambers D-1B

Outlet Elevation		R_v cf	K in/hr	A_{Bot} sf	n	Drawdown Time Hours
173.50	100%	743	0.09	1,540	0.3	214.38

Subsurface Chambers D-2A

Outlet Elevation		R_v cf	K in/hr	A_{Bot} sf	n	Drawdown Time Hours
182.00	100%	180	0.09	1,856	0.3	43.18

Subsurface Chambers D-2B

Outlet Elevation		R_v cf	K in/hr	A_{Bot} sf	n	Drawdown Time Hours
165.42	100%	254	0.09	504	0.3	223.63

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PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #7

Revised TSS Removal Calculations

TSS Removal Treatment Train Summary

Date: August 13, 2018
Project: Puddingstone at Chestnut Hill
Project No: 210810271
Location: Brookline, MA

Prepared By: EB
Checked By: FH

Objective: Stormwater management systems will be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This will be achieved by the use of following treatment trains.

Treatment Train 1:

Contech WQD 4A

Treatment Train 2:

Contech WQD 9

Treatment Train 3:

Contech WQD 10 → Subsurface Recharge System D-1B

Treatment Train 4:

Contech WQD 15

Treatment Train 5:

Contech WQD 19 & AD4A-2 → Subsurface Recharge System D-2B

Treatment Train 6:

Contech WQD 20 → Subsurface Recharge System D-2A

Treatment Train 7:

Contech WQD 22 → Subsurface Recharge System D-2A

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Boston Massachusetts 02114

TOTAL SUSPENDED SOLIDS (TSS) REMOVAL WORKSHEET

Project	Puddingstone at Chestnut Hill	**Project #**	201810271
Location	Brookline, MA	**Date**	8/13/2018
Calculated By	EB	**Checked By**	FH

Calculations

Treatment Train 5 - WQD 19

Subcatchment Location: **Water Quality Device 19**

A BMP	B TSS Removal Rate	C Starting TSS Load	D Amount Removed (BxC)	E Remaining Load (C-D)	F TSS Removal Rate
Contech VSHS36 Water Quality Inlet 19	**0.912**	**1.00**	**0.91**	**0.09**	**91%**
Subsurface Recharge System D-2B	**0.500**	**0.09**	**0.04**	**0.04**	**96%**

TSS Removal =	**96%**
Contributing Area=	**71%**
Weighted TSS Removal=	**67.9%**

Treatment Train 5 - AD4A-2

Subcatchment Location: **Area Drain 4A-2**

A BMP	B TSS Removal Rate	C Starting TSS Load	D Amount Removed (BxC)	E Remaining Load (C-D)	F TSS Removal Rate
Subsurface Recharge System D-2B	**0.500**	**1.00**	**0.50**	**0.50**	**50%**

TSS Removal =	**50%**
Contributing Area=	**29%**
Weighted TSS Removal=	**14.5%**

Total Treatment Train TSS Removal=	**82.4%**

PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #8

Revised Pipe Calculations

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Boston, MA 02114

Pipe Design Calculations

Project#	210810271	Location	MA
Design Storm (Years)	25	Designed By	EB
Date	3/23/2016	Checked By	FH
Revised	8/10/2018	Checked By	
HDPE Manning's Coeff.	0.012		

LOCATION			DRAINAGE AREA				FLOW TIME (min)			RUNOFF (cfs)		PIPE DATA					FULL FLOW		DESIGN FLOW		
Description	From	To	Area (Ac.)	Runoff Coeff. C	Incr. CA	Sum CA	Overld. Time	Time In Pipe	T_c	Intensity (In/Hr)	Design Flow	Diam (In.)	Drop (Ft.)	Length (Ft.)	Slope (Ft./Ft.)	Manning Coeff.	Capacity (Cfs)	Velocity (Fps)	Depth (Ft.)	Q/Qf	Velocity (Fps.)
Area 01	TD11	WQD10	0.12	0.59	0.07	0.07		0.9	5.0	6.0	0.4	12	0.92	184	0.005	0.012	2.73	3.47	0.29	0.15	2.05
	WQD10	DMH9				0.07		0.2	5.0	6.0	0.4	12	1.09	79	0.014	0.012	4.53	5.77	0.22	0.09	2.83
Area 02	RD1	DMH10	1.07	0.90	0.96	0.96		0.0	5.0	6.0	5.8	15	***0.06***	6	0.010	0.012	7.00	5.70	0.95	0.82	5.65
	DMH10	DMH9						0.0	5.0	6.0	5.8	15	0.80	80	0.010	0.012	7.00	5.70	0.95	0.83	5.65
	DMH9	DMH9A						0.0	5.0	6.0	6.2	12	1.10	22	0.050	0.012	8.63	***10.99***	0.68	0.72	***10.33***
	DMH9A	D-1B						0.0	5.0	6.0	6.2	12	0.52	13	0.040	0.012	7.72	9.83	0.73	0.80	9.63
	D-1B	OCS-D1B						0.0	5.0	6.0	6.2	12	0.52	10	0.052	0.012	8.79	***11.20***	0.67	0.70	***10.52***
	OCS-D1B	DMH8A						0.0	5.0	6.0	6.2	12	1.48	27	0.055	0.012	9.04	***11.50***	0.66	0.68	***10.70***
	DMH8A	DMH8B						0.1	5.0	6.0	6.2	12	1.37	39	0.035	0.012	7.22	9.19	0.78	0.85	9.19
	DMH8B	DMH5						0.2	5.0	6.0	6.2	12	4.17	119	0.035	0.012	7.22	9.19	0.78	0.85	9.19
Area 03	TD9	DMH7A	0.24	0.67	0.17	0.17		0.0	5.0	6.0	1.0	12	***0.13***	13	0.010	0.012	3.86	4.91	0.39	0.26	3.44
	DMH7A	DMH7						0.1	5.0	6.0	1.0	12	0.40	40	0.010	0.012	3.86	4.91	0.39	0.26	3.44
	DMH7	DMH6						0.3	5.0	6.0	1.0	12	0.76	76	0.010	0.012	3.86	4.91	0.39	0.26	3.44
	DMH6	DMH5						0.1	5.0	6.0	1.0	12	0.50	45	0.011	0.012	4.05	5.15	0.38	0.24	3.56
Area 05	CB6	DMH5	0.21	0.90	0.19	0.19		0.0	5.0	6.0	1.1	12	0.30	15	0.020	0.012	5.46	6.95	0.34	0.21	4.52
	DMH5	DMH4						0.0	5.0	6.0	8.3	15	0.34	17	0.020	0.012	9.90	8.06	0.95	0.84	7.98
Area 06	CB4A	DMH4	0.08	0.90	0.07	0.07		0.0	5.0	6.0	0.4	12	1.16	29	0.040	0.012	7.72	9.83	0.15	0.06	3.93
Area 07	CB4B	DMH4	0.16	0.72	0.12	0.12		0.0	5.0	6.0	0.7	12	0.52	13	0.040	0.012	7.72	9.83	0.22	0.09	4.82
	DMH4	WQD4A						0.0	5.0	6.0	9.4	18	0.30	15	0.020	0.012	16.09	9.11	0.89	0.59	8.01
	WQD4A	DMH4A						0.0	5.0	6.0	9.4	18	0.26	13	0.020	0.012	16.09	9.11	0.89	0.59	8.01
	DMH4A	D-1C						0.0	5.0	6.0	9.4	18	0.24	12	0.020	0.012	16.09	9.11	0.89	0.59	8.01
Area 08	AD10	D-1C	0.07	0.35	0.03	0.14		0.1	5.0	6.0	0.8	8	0.56	28	0.020	0.012	1.85	5.30	0.35	0.46	4.35
Area 09	AD11	D-1C	0.10	0.30	0.03	0.03		0.1	5.0	6.0	0.2	8	0.32	16	0.020	0.012	1.85	5.30	0.15	0.10	2.70
Area 10	WQD9	D-1C	0.19	0.90	0.17	0.17		0.0	5.0	6.0	1.0	12	***0.08***	8	0.010	0.012	3.86	4.91	0.40	0.26	3.49
	D-1C	OCS-D1C						0.0	5.0	6.0	4.7	12	***0.18***	9	0.020	0.012	5.46	6.95	0.79	0.86	7.02
	OCS-D1C	DMH2						0.2	5.0	6.0	4.7	12	1.84	92	0.020	0.012	5.46	6.95	0.79	0.86	7.02
	DMH2	DMH1						0.3	5.0	6.0	4.7	12	2.74	137	0.020	0.012	5.46	6.95	0.79	0.86	7.02
Area 11	WQD19	DMH18	0.37	0.76	0.28	0.28		0.1	5.0	6.0	1.7	12	0.31	31	0.010	0.012	3.86	4.91	0.51	0.44	3.98
Area 18	RD2	DMH 28	0.18	0.90	0.17	0.17		0.4	5.0	6.0	1.0	10	0.37	74	0.005	0.012	1.68	3.08	0.50	0.59	2.71
Area 04	AD4A-2	DMH 28	0.23	0.31	0.07	0.07		0.1	5.0	6.0	0.4	8	***0.08***	15	0.005	0.012	0.93	2.65	0.35	0.46	2.20
	DMH28	DMH27						0.8	5.0	6.0	1.4	10	0.46	129	0.004	0.012	1.42	2.61	0.75	1.00	0.86
	DMH27	DMH18						0.7	5.0	6.0	1.4	10	0.46	114	0.004	0.012	1.50	2.75	0.71	0.95	0.91
	DMH18	D-2B						0.0	5.0	6.0	3.1	12	***0.13***	13	0.010	0.012	3.86	4.91	0.74	0.80	4.82
Area 12	RD	D-2B	0.07	0.90	0.06	0.06		0.0	5.0	6.0	0.4	8	0.22	11	0.020	0.012	1.85	5.30	0.22	0.20	3.39
Area 13	RD	D-2B	0.07	0.90	0.06	0.06		0.0	5.0	6.0	0.4	8	0.26	13	0.020	0.012	1.85	5.30	0.22	0.20	3.39
	D-2B	OCS-D2B						0.0	5.0	6.0	3.8	12	***0.08***	8	0.010	0.012	3.86	4.91	0.90	0.99	5.21
	OCS-D2B	D-2C						0.0	5.0	6.0	3.8	12	***0.08***	8	0.010	0.012	3.86	4.91	0.90	0.99	5.21
	D-2C	OCS-D2C						0.0	5.0	6.0	3.8	12	***0.08***	8	0.010	0.012	3.86	4.91	0.90	0.99	5.21
	OCS-D2C	DMH17						0.1	5.0	6.0	3.8	12	2.48	62	0.040	0.012	7.72	9.83	0.55	0.50	8.26
	DMH17	DMH17A						0.0	5.0	6.0	3.8	12	0.34	17	0.020	0.012	5.46	6.95	0.67	0.70	6.53
	DMH17A	EXDMH						0.1	5.0	6.0	3.8	12	2.48	62	0.040	0.012	7.72	9.83	0.55	0.50	8.26
Area 14	TD11	DMH16	0.15	0.53	0.08	0.08		0.0	5.0	6.0	0.5	12	***0.16***	8	0.020	0.012	5.46	6.95	0.20	0.09	3.27
	DMH16	WQD15						0.1	5.0	6.0	0.5	12	3.24	81	0.040	0.012	7.72	9.83	0.17	0.06	4.23
Area 15	WQD15	DMH14	0.42	0.43	0.18	0.26		0.1	5.0	6.0	1.5	12	0.81	35	0.023	0.012	5.85	7.45	0.40	0.26	5.29
	DMH14	DMH13						0.1	5.0	6.0	1.5	12	3.24	81	0.040	0.012	7.72	9.83	0.34	0.20	6.39
	DMH13	WYE						0.1	5.0	6.0	1.5	12	0.50	25	0.020	0.012	5.46	6.95	0.42	0.28	5.00
Area 16	WQD20	DMH19	0.26	0.55	0.14	0.14		0.2	5.0	6.0	0.9	12	0.47	47	0.010	0.012	3.86	4.91	0.36	0.22	3.29
	DMH19	D-2A						0.0	5.0	6.0	0.9	12	0.23	15	0.015	0.012	4.74	6.04	0.32	0.18	3.80
Area 17	WQD22	DMH21	0.44	0.77	0.34	0.48		0.2	5.0	6.0	2.9	15	0.27	53	0.005	0.012	4.95	4.03	0.74	0.58	3.55
	DMH21	D-2A						0.0	5.0	6.0	2.9	12	0.24	16	0.015	0.012	4.73	6.02	0.62	0.61	5.36
	D-2A	OCS-D2A						0.0	5.0	6.0	3.7	12	***0.10***	10	0.010	0.012	3.86	4.91	0.88	0.97	5.16
	OCS-D2A	DMH26						0.1	5.0	6.0	3.7	12	0.33	32	0.010	0.012	3.92	4.99	0.86	0.96	5.19
	DMH26	WYE						0.1	5.0	6.0	3.7	12	0.27	27	0.010	0.012	3.86	4.91	0.88	0.97	5.16

PEER REVIEW RESPONSE
PUDDINGSTONE AT CHESTNUT HILL
BROOKLINE, MASSACHUSETTS

ATTACHMENT #9

Hydraflow Express Extension Hydraulic Analyses (Tailwater Analysis)

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Aug 14 2018

Circular Culvert (DMH18 to D-2B)

Invert Elev Dn (ft)	=	165.92
Pipe Length (ft)	=	13.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	166.05
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Tailwater Elevation from Pipe Calculations 167.40 + 0.90 =168.30

Embankment

Top Elevation (ft)	=	170.04
Top Width (ft)	=	5.00
Crest Width (ft)	=	4.00

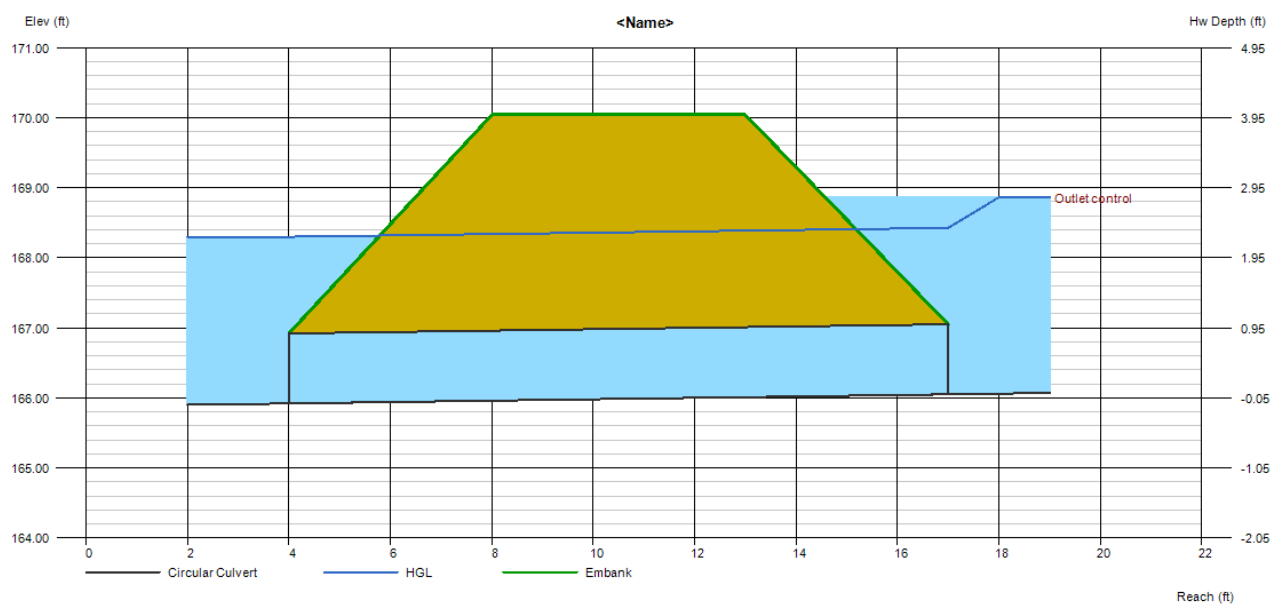
Maximum Headwater Elevation

Calculations

Qmin (cfs)	=	3.80
Qmax (cfs)	=	3.80
Tailwater Elev (ft)	=	168.30

Highlighted

Qtotal (cfs)	=	3.80
Qpipe (cfs)	=	3.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.84
Veloc Up (ft/s)	=	4.84
HGL Dn (ft)	=	168.30
HGL Up (ft)	=	168.43
Hw Elev (ft)	=	168.86
Hw/D (ft)	=	2.81
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Aug 14 2018

Circular Culvert (DMH27 to DMH18)

Invert Elev Dn (ft)	=	167.40
Pipe Length (ft)	=	114.00
Slope (%)	=	0.40
Invert Elev Up (ft)	=	167.86
Rise (in)	=	10.0
Shape	=	Circular
Span (in)	=	10.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

Top Elevation (ft)	=	172.00
Top Width (ft)	=	5.00
Crest Width (ft)	=	4.00

Previous Headwater Elevation used as Tailwater

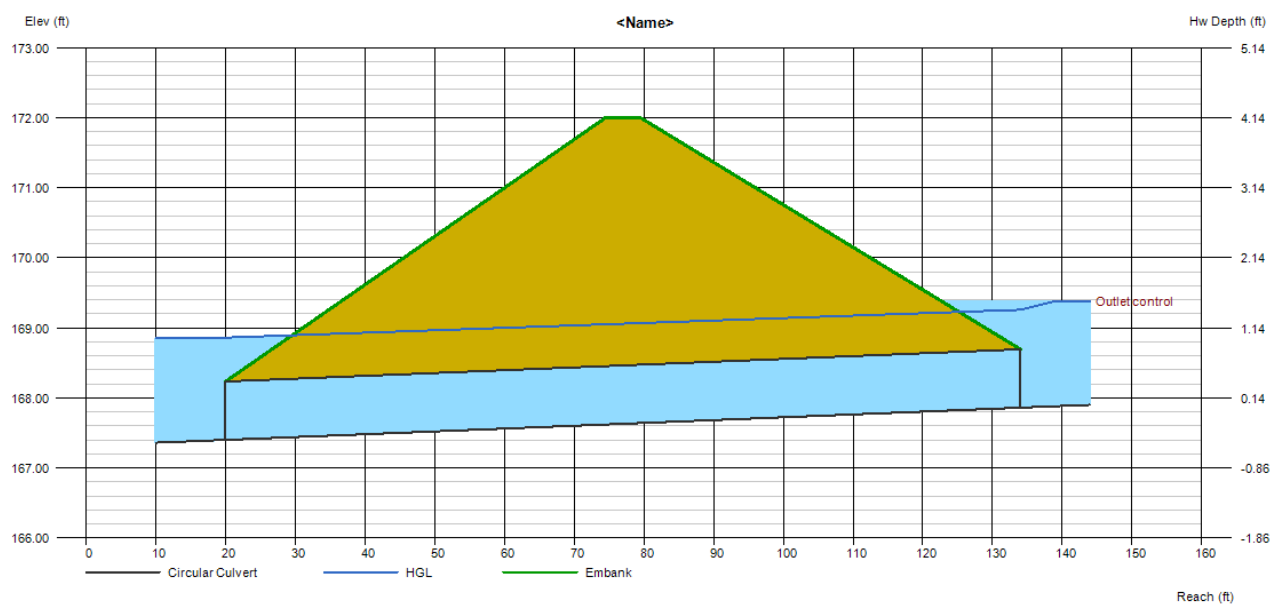
Maximum Headwater Elevation

Calculations

Qmin (cfs)	=	1.40
Qmax (cfs)	=	1.40
Tailwater Elev (ft)	=	168.86

Highlighted

Qtotal (cfs)	=	1.40
Qpipe (cfs)	=	1.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.57
Veloc Up (ft/s)	=	2.57
HGL Dn (ft)	=	168.86
HGL Up (ft)	=	169.26
Hw Elev (ft)	=	169.38
Hw/D (ft)	=	1.82
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Aug 14 2018

Circular Culvert (DMH 28 to DMH 27)

Invert Elev Dn (ft)	=	167.86
Pipe Length (ft)	=	129.00
Slope (%)	=	0.36
Invert Elev Up (ft)	=	168.32
Rise (in)	=	10.0
Shape	=	Circular
Span (in)	=	10.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

Top Elevation (ft)	=	171.22
Top Width (ft)	=	5.00
Crest Width (ft)	=	4.00

Previous Headwater Elevation used as Tailwater

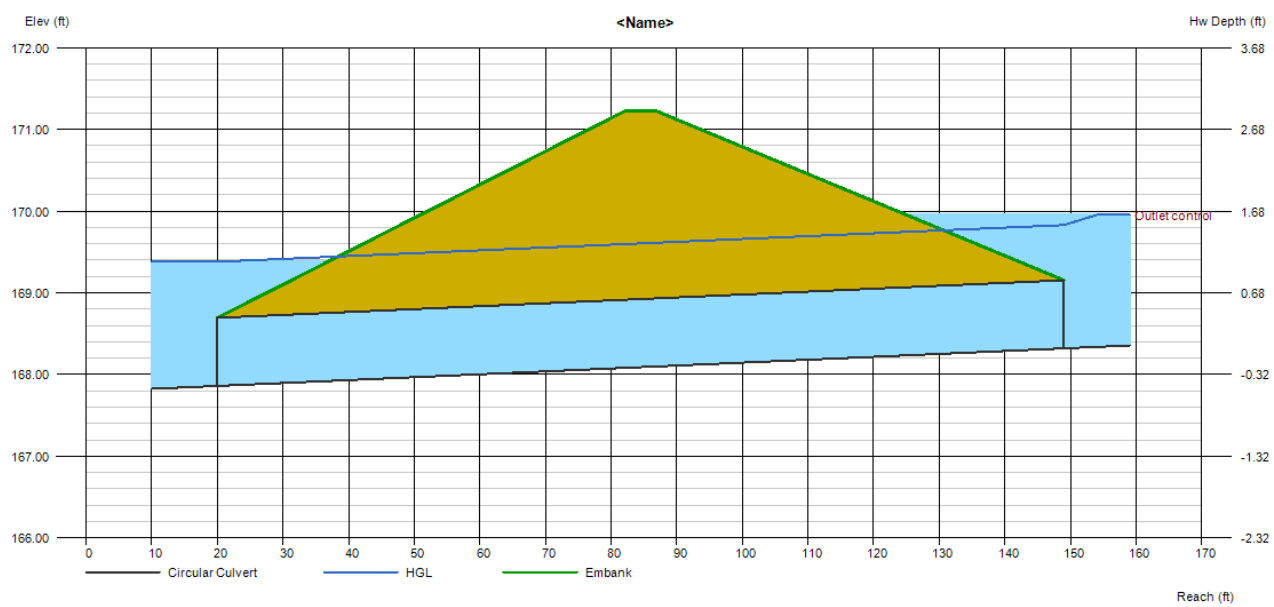
Maximum Headwater Elevation

Calculations

Qmin (cfs)	=	1.40
Qmax (cfs)	=	1.40
Tailwater Elev (ft)	=	169.38

Highlighted

Qtotal (cfs)	=	1.40
Qpipe (cfs)	=	1.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.57
Veloc Up (ft/s)	=	2.57
HGL Dn (ft)	=	169.38
HGL Up (ft)	=	169.83
Hw Elev (ft)	=	169.95
Hw/D (ft)	=	1.96
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Aug 14 2018

Circular Culvert (AD4A-2 to DMH 28)

Invert Elev Dn (ft)	=	168.32
Pipe Length (ft)	=	15.00
Slope (%)	=	0.53
Invert Elev Up (ft)	=	168.40
Rise (in)	=	8.0
Shape	=	Circular
Span (in)	=	8.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

Top Elevation (ft)	=	170.40
Top Width (ft)	=	5.00
Crest Width (ft)	=	4.00

Previous Headwater Elevation used as Tailwater

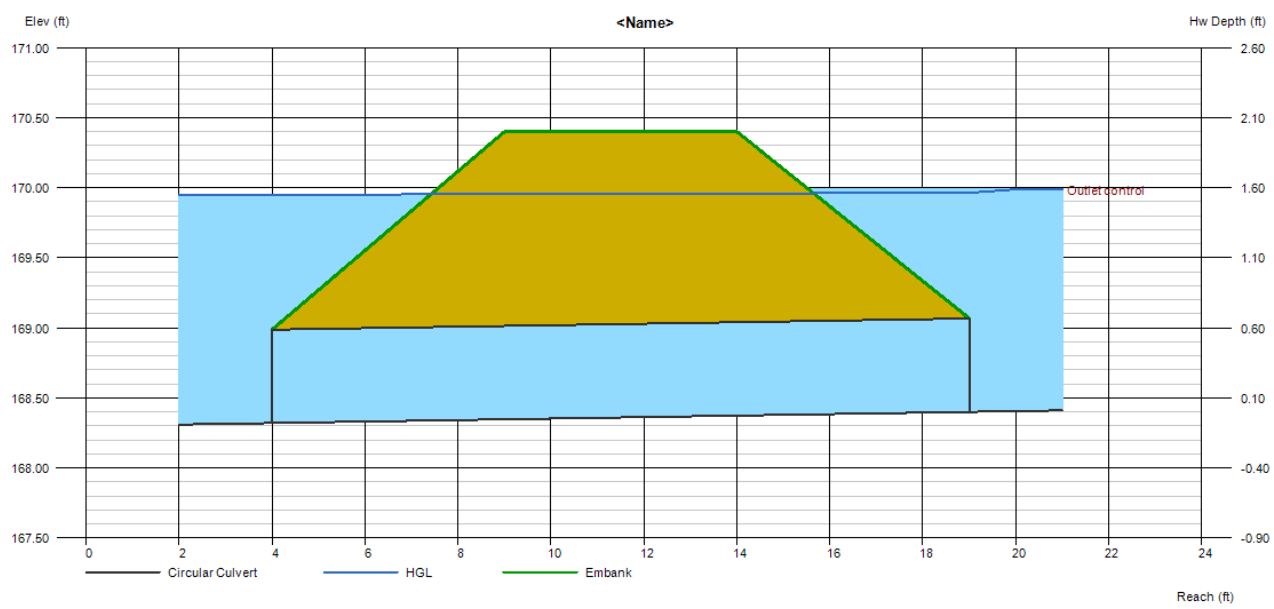
Maximum Headwater Elevation

Calculations

Qmin (cfs)	=	0.40
Qmax (cfs)	=	0.40
Tailwater Elev (ft)	=	169.95

Highlighted

Qtotal (cfs)	=	0.40
Qpipe (cfs)	=	0.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.15
Veloc Up (ft/s)	=	1.15
HGL Dn (ft)	=	169.95
HGL Up (ft)	=	169.96
Hw Elev (ft)	=	169.99
Hw/D (ft)	=	2.38
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Aug 14 2018

Circular Culvert (RD2 to DMH28)

Invert Elev Dn (ft)	=	168.32
Pipe Length (ft)	=	74.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	168.69
Rise (in)	=	10.0
Shape	=	Circular
Span (in)	=	10.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

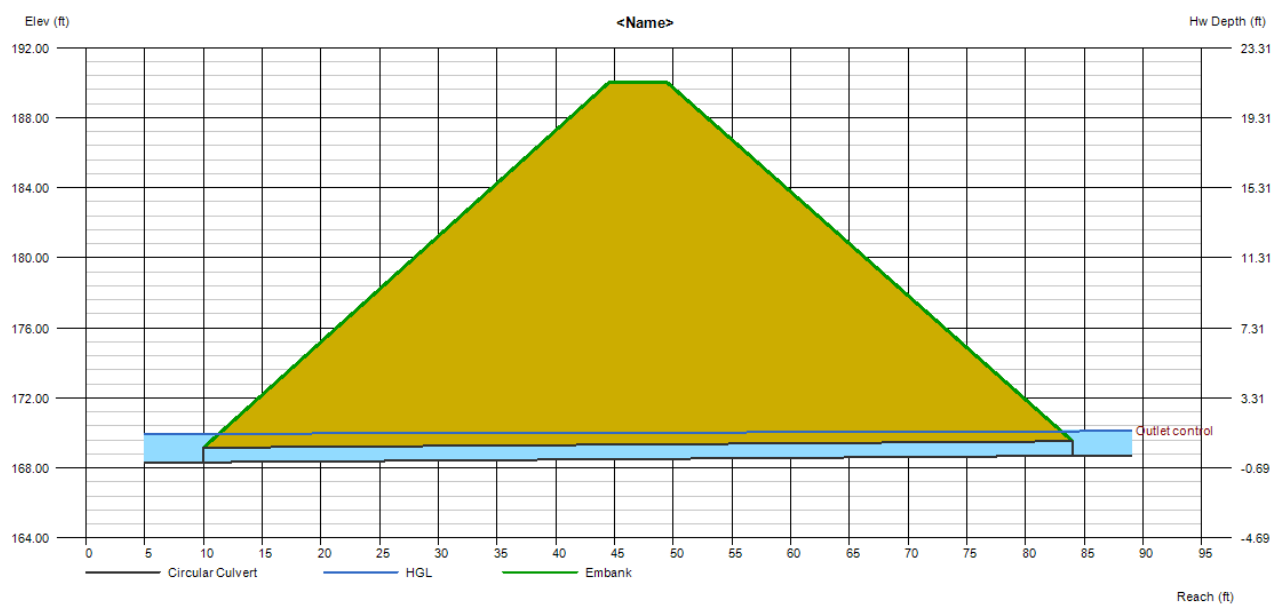
Top Elevation (ft)	=	190.00
Top Width (ft)	=	5.00
Crest Width (ft)	=	4.00

Headwater from DMH28 used as Tailwater

Maximum Headwater Elevation

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	1.00
Tailwater Elev (ft)	=	169.95

Highlighted

Qtotal (cfs)	=	1.00
Qpipe (cfs)	=	1.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.83
Veloc Up (ft/s)	=	1.83
HGL Dn (ft)	=	169.95
HGL Up (ft)	=	170.08
Hw Elev (ft)	=	170.14
Hw/D (ft)	=	1.75
Flow Regime	=	Outlet Control