STORM WATER REPORT

for
DOLLAR GENERAL
CHERRY ROAD NW
CITY OF MASSILLON, STARK COUNTY, OHIO

February 31, 2019
REVISED June 21, 2019

Prepared By:
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Green, Ohio 44685
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Birmingham, AL 35243

TABLE OF CONTENTS

APPENDICES

I. PURPOSE:

This report is to document that the Dollar General store in Massillon, Ohio was designed to comply with the standard accepted practices of the City. This report will discuss the drainage and hydrology within the proposed development area. Specifically, it will address the drainage concept, routing, and water quality treatment.

II. SITE DESCRIPTION:

2.1 Site Location / Land Use

The project site is located at the northeast corner of the intersection of S.R.21 and Cherry Rd. NW in Massillon, Ohio. The site is currently undeveloped and is a grassy vacate lot; however, records indicate that the site was occupied by the Horace Mann School building at one time. The proposed development consists of a Dollar General retail store and the total area expected to be disturbed during this project is roughly 1.5± acres.

2.2 Curve Numbers / Impervious Area

PRE-CONSTRUCTION

TYPE OF LAND USE	DRAINAGE AREA (ac.)	Curve Number
Roadway / Paved Parking / Roofs	0.19	98
Grass (>75% cover, good) HSG D	1.38	80
TOTAL DRAINAGE AREA	1.57	
WEIGHTED RUNOFF COEFFICIENT	82	

POST CONSTRUCTION

TYPE OF LAND USE	DRAINAGE AREA (ac.)	Curve Number
Roadway / Paved Parking / Roofs	0.76	98
Grass (>75% cover, good) HSG D	0.81	80
TOTAL DRAINAGE AREA	1.57	
WEIGHTED RUNOFF COEFFICIENT	89	

	IMPERVIOUS AREA	
Pre-Construction	0.19	
Post-Construction	0.79	
Percent Increase	316%	

2.3 Soils Information

A soil report was generated with the USGS Web Soil Survey. The proposed location consists Ua, Udorthents. The hydrologic soils group is type D.

III. HISTORIC DRAINAGE:

3.1 Existing Conditions Analysis

Most of the runoff from the site ends up in a catch basin in Cherry Rd. NW which is approximately 300' west from the intersection of 1st St. NW. The remaining northwest portion of the site drains to a ditch along S.R.21.

IV. DEVELOPED DRAINAGE:

4.1 Developed Conditions

The proposed site will direct all onsite runoff to the existing catch basin in Cherry Rd. NW. The runoff will be detained as required by City code using two detention basins at are interconnected by a 12" storm sewer. The 12" storm sewer allows the volume of both basins to be utilized by equalizing the runoff between them. The detention calculations used a CN of 98 for the entire site, instead of just the actual impervious area. Ultimately, the limiting feature of the detention basin is the 6" diameter outlet pipe. Due to the small size of the site, a Tc of 10 minutes was used for both pre & post calculations.

Storm Event	**Pre-Developed Q (cfs) to Cherry Rd catch basin**	**Post-Developed Q (cfs) to Cherry Rd catch basin & det. basin elev.**	**Pre-Developed Q (cfs) to S.R. 21 ditch**	**Post-Developed Q (cfs) to S.R. 21 dich**
1 yr	1.08	0.83 @ 931.36	0.53	0
2 yr	1.55	0.86 @ 931.50	0.75	0
5 yr	2.31	0.90 @ 931.70	1.10	0
10 yr	3.00	0.93 @ 931.86	1.42	0
25 yr	4.06	0.97 @ 932.08	1.90	0
50 yr	5.00	1.00 @ 932.26	2.33	0
100 yr	6.04	1.04 @ 932.45	2.81	0

V. STORM WATER POLLUTION PREVENTION PLAN:

5.1 Construction

A Storm Water Pollution Prevention Plan (SWP3) has been developed in accordance with applicable Township, County and OEPA requirements. The SWP3 is included with the construction plans and is intended to limit erosion and control sediment deposits during the construction process. This will be accomplished, at a minimum, using construction entrances, inlet protection, silt fence, and temporary seeding/mulching as appropriate during construction.

5.2 Post-construction

Post construction water quality treatment consists of routing the runoff from the developed area into a detention basin. Runoff from the parking lot is pretreated using sumped catch basins or routing through

vegetated areas prior to reaching the detention basin outlet structure. The low flow orifice is protected from clogging by filtering runoff through a gravel trench.

VI. REFERENCES

1. Rainwater and Land Development Manual, ODNR Division of Soil and Water Resources, Third Edition 2006

Appendix A

GRAPHIC SCALE
20 10 0 20
SCALE IN FEET

PRE-DEVELOPED S.R. 21 DITCH
D.A.=0.49
SOIL TYPE 'D'
CN=80 (0.41 AC.)
CN=98 (0.08 AC.)

PRE-DEVELOPED TO CATCH BASIN IN CHERRY RD.
D.A.=1.08
SOIL TYPE 'D'
CN=80 (0.97 AC.)
CN=98 (0.11 AC.)

STATE ROUTE 21

WARWICK AVENUE NW
(50' Wide R/W)

1ST STREET NW
(50' Wide R/W)

CHERRY ROAD NW
(Variable Width R/W)

PROPOSED BOUNDARY

BOUNDARY LINE PER EXCEPTION AND BOUNDARY EVIDENCE

INSTR: 20080130004194
PPN: 06-05651 & 06-17015
ANDREW M. OSER
1.56 ACRES

06-05651
06-17015

N68°57'33"E 178.50'
N26°23'06"E 33.87'
N26°23'06"E 140.44'
PROPOSED N21°48'16"E 30.23'
PROPOSED N17°42'37"E 27.00'
PROPOSED N10°58'46"E 107.63'
N11°58'35"E 124.50'
PROPOSED N40°01'21"W 71.70'
N43°07'49"W 75.82'
S75°37'13"W 55.27'
N20°58'53"W 11.00'
S68°57'25"W 100.00'
S68°57'25"W 157.00'
S21°02'35"E 143.00'

4' Chainlink Right-of-Way Fence
2in" Iron Pipe
1" Iron Pin
3/4" Iron Pipe
3/4" Bent Iron Pipe
Hinton6270 Capped Iron Pin
"Stop Here On Red" Sign
Stop Sign
Water Valve
Gas Valve
Hydrant
Brick
Shed
Garage
House
2-Story Wood Framed House
Concrete
~Grass~
~Asphalt~
~Gravel~
SIDEWALK CONDITION UNKNOWN (COVERED BY DIRT/GRASS)
SIDEWALK BROKEN

San MH
RIM=934.60
24" METAL (N)=923.75
6" VCP (E)=924.60
24" METAL (S)=923.70
8" VCP (W)=924.70

San MH
RIM=932.95
12" VCP (E)=926.95 (DEBRIS)

"C-L"CB
GRATE=931.76
6" VCP (N)=928.89
10" CMP (S)=928.42

"C-L"CB
RIM=931.46
10" CMP (N)=927.91
10" CMP (SW)=927.78

San MH
RIM=933.36
24" METAL (E)=923.16
24" METAL (S)=923.11
12" VCP (W)=924.81

San MH
RIM=933.50
24" METAL (N)=923.50
8" VCP (E)=924.60
24" VCP (W)=923.30

2521B4-4 #OE
2521B4-85 #OE
2521-B4 #OE
6EC25032 #
253429 #

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DOLLAR GENERAL

DOLLAR GENERAL
STORE NUMBER #08358
CHERRY RD. NW
CITY OF MASSILLON, OHIO

REVISIONS
No. Date Desc.

DRAFT FOR PERMITTING PURPOSES ONLY
NOT RELEASED FOR CONSTRUCTION

Designed	HFT
Drawn	HFT
Reviewed	JCJ
Scale	AS SHOWN
Project No.	1800612
Date	XX/XX/XX
CAD File:	PD180061201

Title
PRE-DEV
DRAINAGE MAP

Sheet No.
PD-01
No. 1 of 2

2/26/2019, nthOMAS, G:_JOBS\18\06\1800612\DWG\PD\180061201.DWG,PRE-

Xref (s): - XC180061201 - BD180061201 - XT180061201

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POST-DEVELOPED TO CATCH BASIN IN CHERRY RD.
D.A.=1.57
SOIL TYPE 'D'
CN=98 (1.57 AC.)
THE ENTIRE DRAINAGE AREA WAS CONSIDERED IMPERVIOUS FOR DETENTION CALCULATIONS. ACTUAL IMPERVIOUS AREA IS 0.76± AC

GRAPHIC SCALE
20 10 0 20
SCALE IN FEET

STATE ROUTE 21

WARWICK AVENUE NW
(50' Wide R/W)

1ST STREET NW
(50' Wide R/W)

CHERRY ROAD NW
(Variable Width R/W)

PROPOSED DOLLAR GENERAL STORE
141' X 77' 10,640 GFA
34 TOTAL SPACES PROVIDED
2 HANDICAP SPACES
FINISH FLOOR: 935.25

CB#1 D.A.=0.17 AC.

CB#2 D.A.=0.15 AC.

INSTR: 20080130004194
PPN: 06-05651 & 06-17015
ANDREW M. OSER
1.56 ACRES

06-05651

06-17015

PROPOSED BOUNDARY

BOUNDARY LINE PER EXCEPTION AND BOUNDARY EVIDENCE

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S68°57'25"W 100.00'

S21°02'35"E 158.00'

N21°02'35"W 143.00'

N26°23'06"E 33.87'

N26°23'06"E 140.44'

PROPOSED N21°48'16"E 30.23'

PROPOSED N17°42'37"E 27.00'

PROPOSED N10°58'46"E 107.63'

N11°58'35"E 124.50'

PROPOSED N40°01'21"W 71.70'

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S75°37'13"W 56.27'

N20°58'53"W 11.00'

2in" Iron Pipe

1" Iron Pin

3/4" Iron Pipe

3/4" Bent Iron Pipe

Hinton6270 Capped Iron Pin

4' Chainlink Right-of-Way Fence

"Stop Here On Red" Sign

Stop Sign

Water Valve

Gas Valve

Hydrant

Brick

SIDEWALK CONDITION UNKNOWN (COVERED BY DIRT/GRASS)

SIDEWALK BROKEN

~Grass~

~Asphalt~

~Gravel~

~Concrete~

Shed

Garage

House

2-Story Wood Framed House

San MH
RIM=934.60
24" METAL (N)=923.75
6" VCP (E)=924.60
24" METAL (S)=923.70
8" VCP (W)=924.70

2521B4-4 #OE

2521B4-85 #OE

253497 #

6EC25632 #

"C-L"CB
GRATE=931.76
6" VCP (N)=928.89
10" CMP (S)=928.42

San MH
RIM=932.95
12" VCP (E)=926.95 (DEBRIS)

"C-L"CB
RIM=931.46
10" CMP (N)=927.91
10" CMP (SW)=927.78

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Designed	HFT
Drawn	HFT
Reviewed	JCJ
Scale	AS SHOWN
Project No.	1800612
Date	XX/XX/XX
CAD File:	PD180061201

Title
POST-DEV DRAINAGE MAP

Sheet No.
PD-02
No. 2 of 2

Xref (s): ; XC180061201 ; BD180061201 ; XY180061201

2/26/2019, HTHOMAS, G:\JOBS\18\06\1800612\DWG\PD180061201.DWG,POST.

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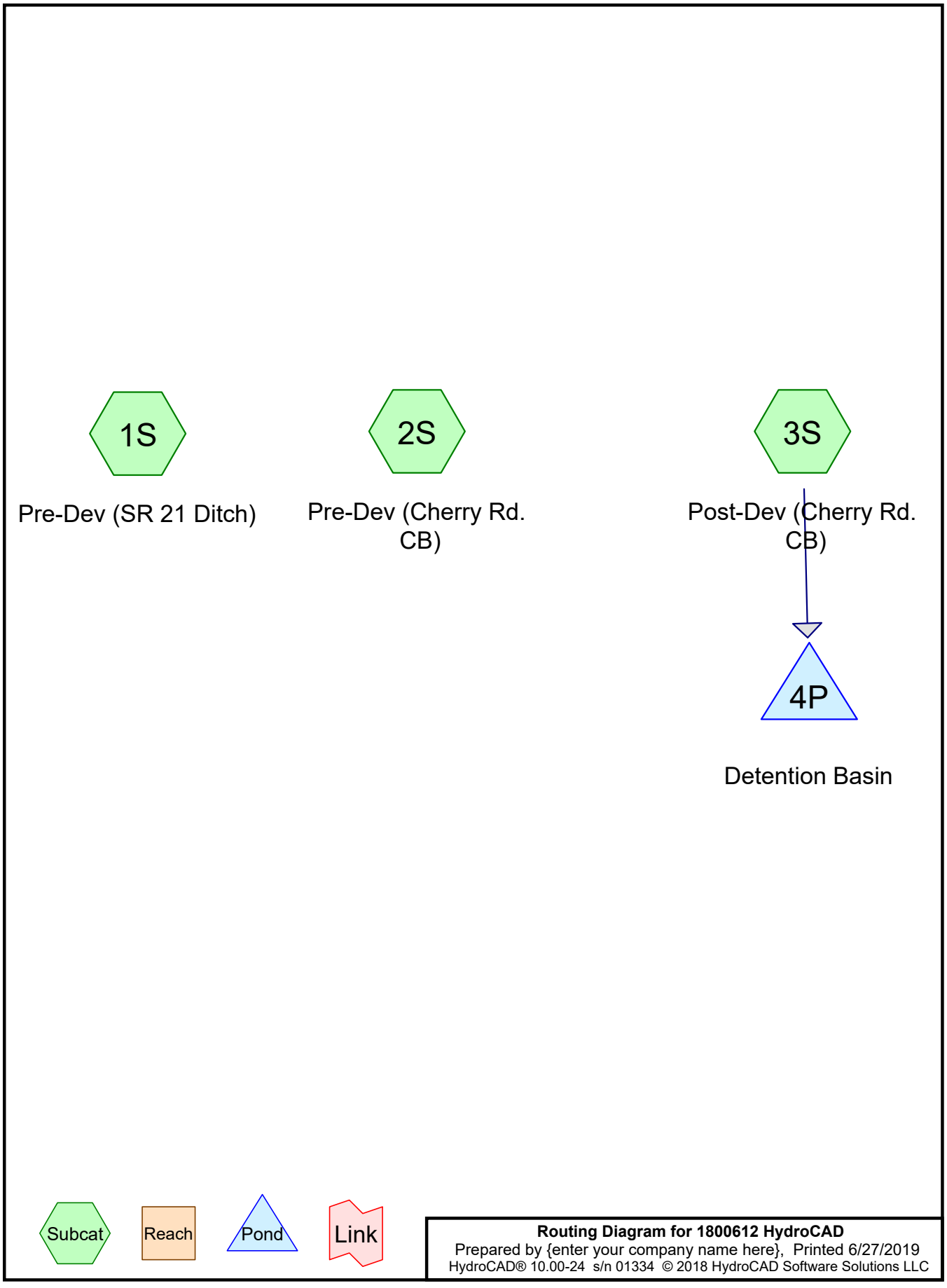
Appendix B



Routing Diagram for 1800612 HydroCAD
Prepared by {enter your company name here}, Printed 6/27/2019
HydroCAD® 10.00-24 s/n 01334 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

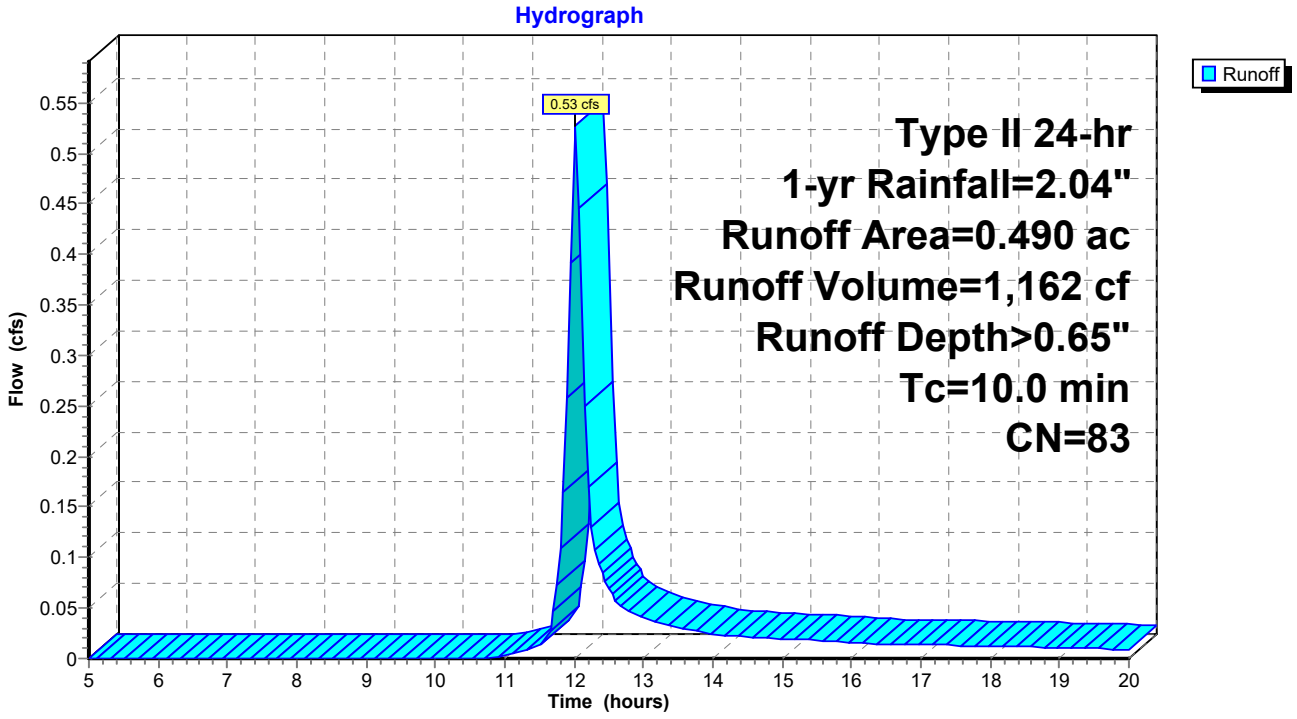
Runoff = 0.53 cfs @ 12.02 hrs, Volume= 1,162 cf, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.04"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

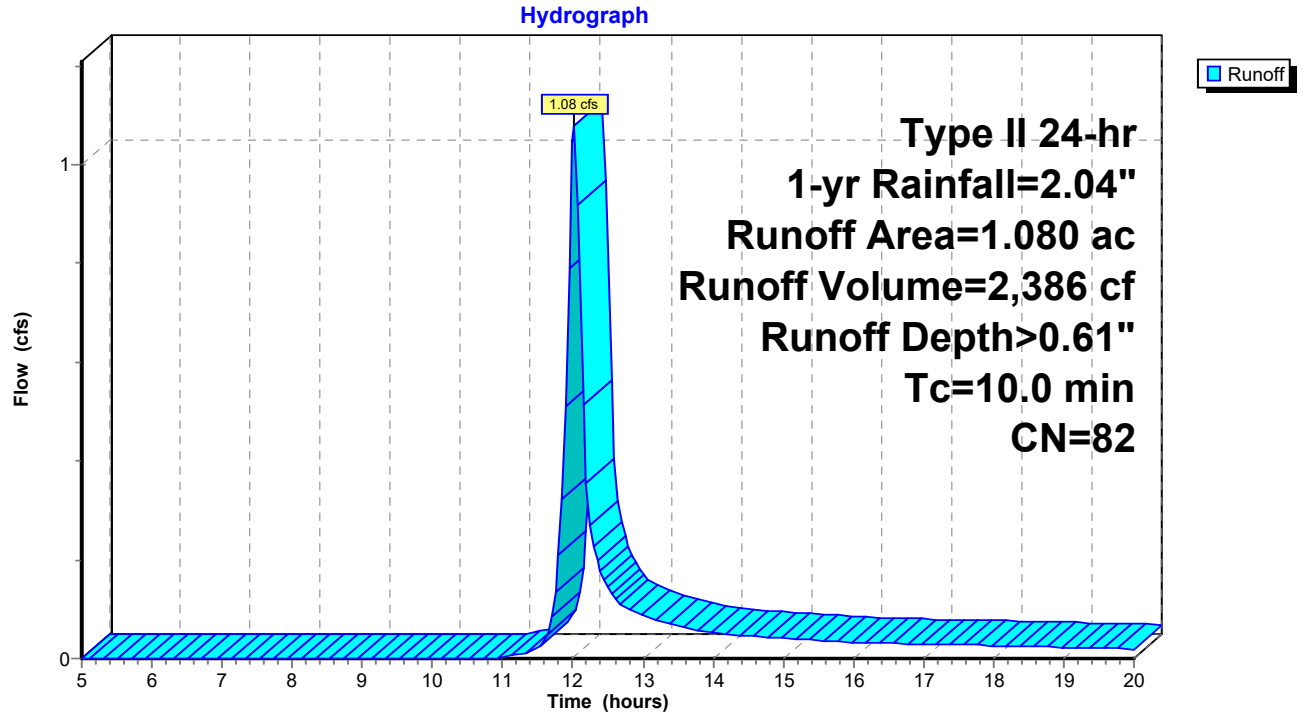
Runoff = 1.08 cfs @ 12.02 hrs, Volume= 2,386 cf, Depth> 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.04"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

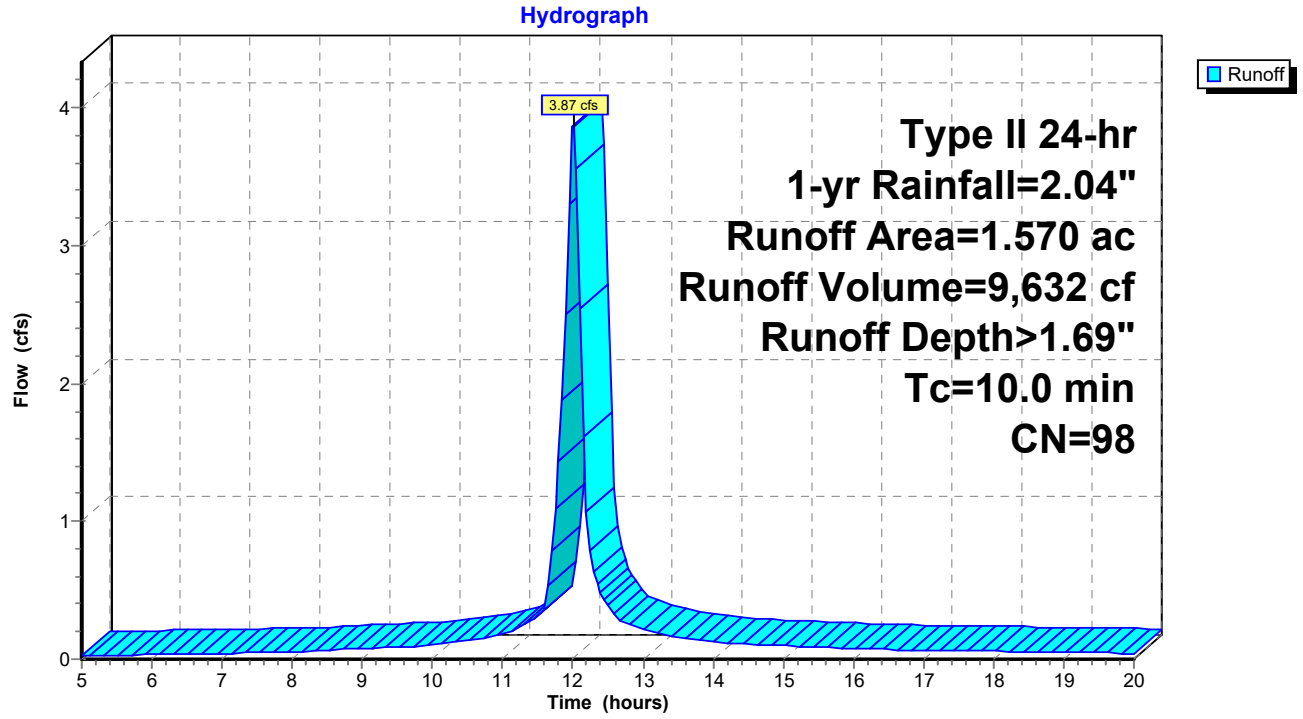
Runoff = 3.87 cfs @ 12.01 hrs, Volume= 9,632 cf, Depth> 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.04"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 1.69" for 1-yr event
Inflow = 3.87 cfs @ 12.01 hrs, Volume= 9,632 cf
Outflow = 0.83 cfs @ 12.25 hrs, Volume= 9,348 cf, Atten= 79%, Lag= 14.5 min
Primary = 0.83 cfs @ 12.25 hrs, Volume= 9,348 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 931.36' @ 12.25 hrs Surf.Area= 5,993 sf Storage= 6,592 cf (3,943 cf above start)

Plug-Flow detention time= 176.5 min calculated for 6,675 cf (69% of inflow)
Center-of-Mass det. time= 54.4 min (795.7 - 741.3)

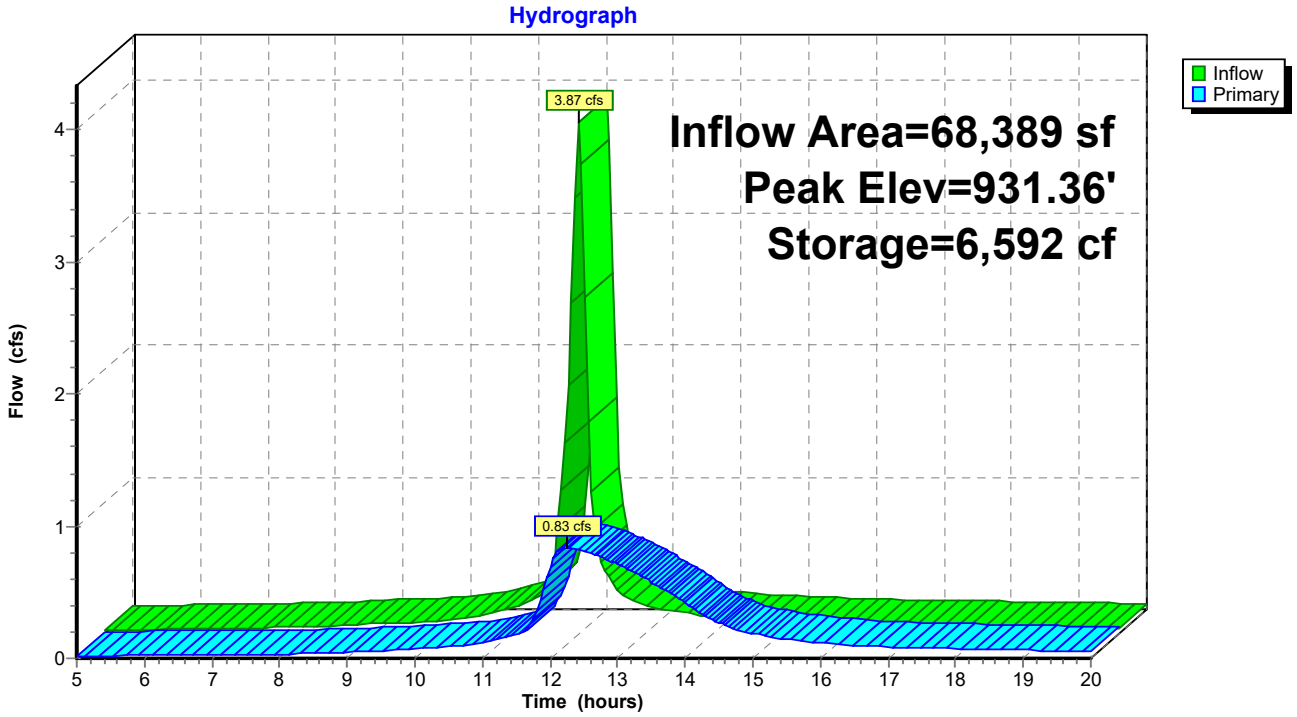
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.83 cfs @ 12.25 hrs HW=931.36' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.83 cfs @ 4.23 fps)
  ├**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 0.81 cfs potential flow)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Detention Basin



Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

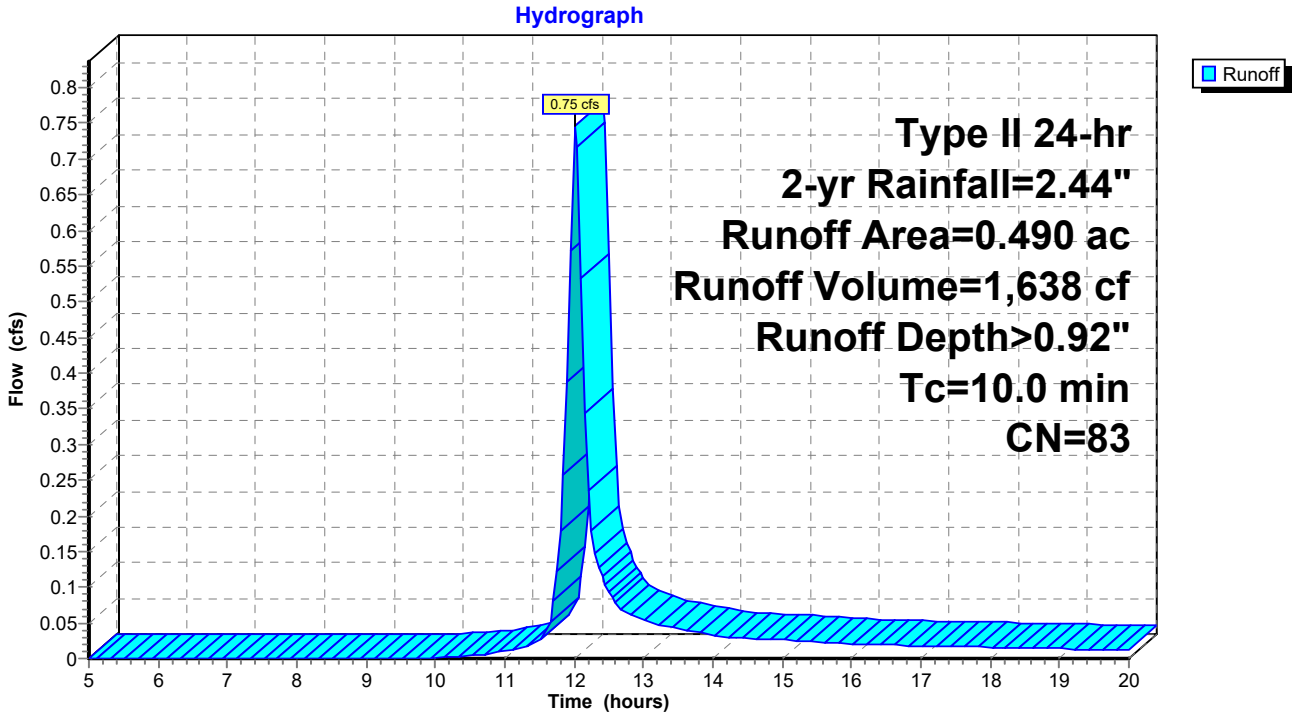
Runoff = 0.75 cfs @ 12.02 hrs, Volume= 1,638 cf, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.44"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

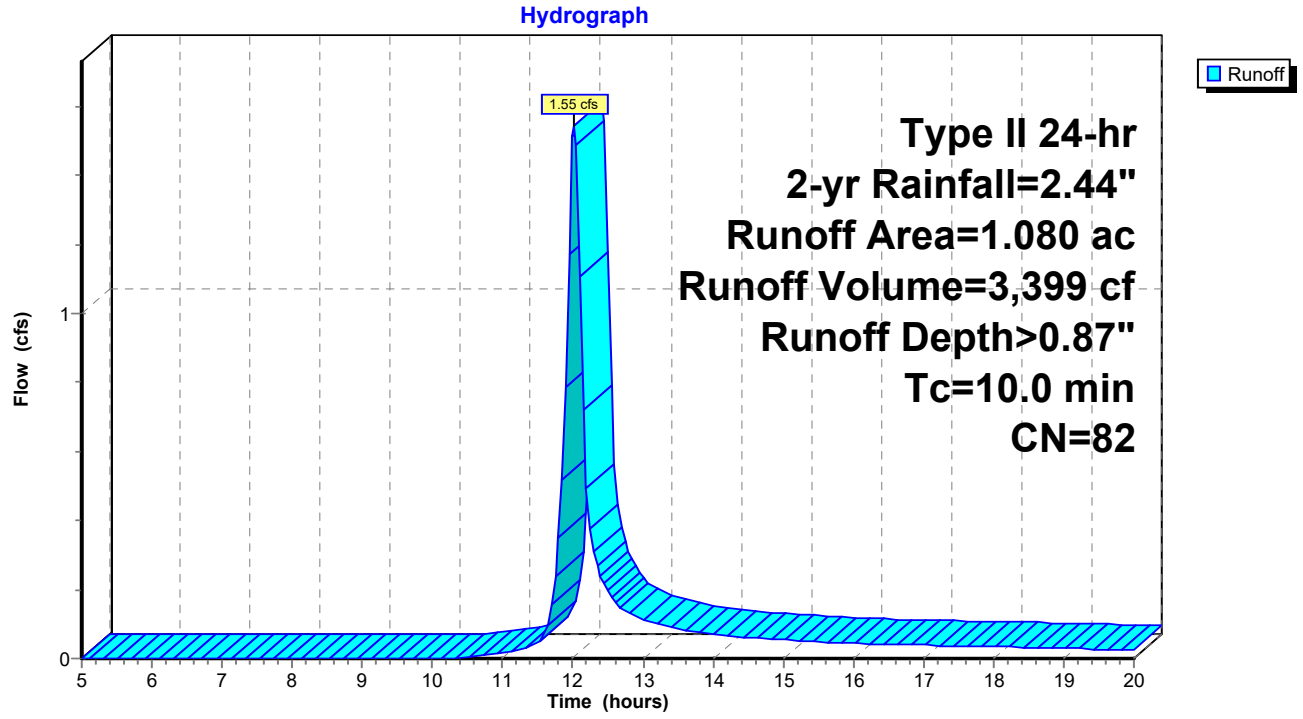
Runoff = 1.55 cfs @ 12.02 hrs, Volume= 3,399 cf, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.44"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

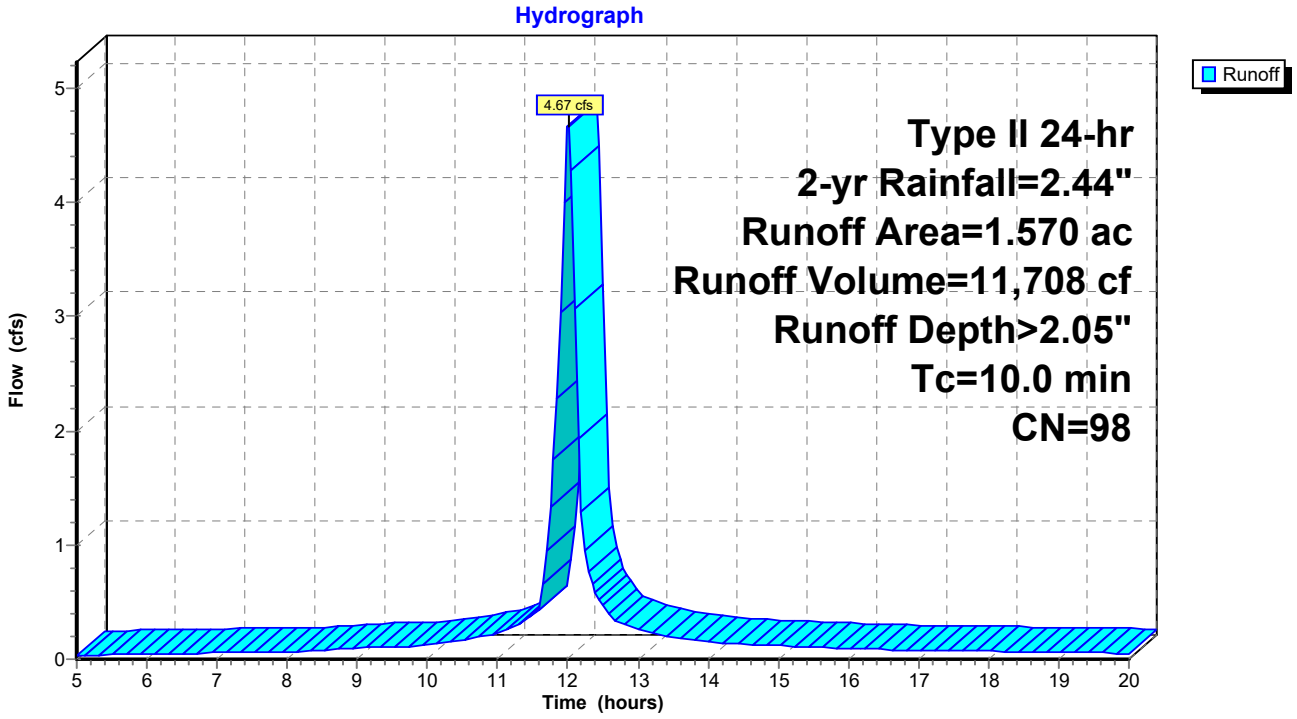
Runoff = 4.67 cfs @ 12.01 hrs, Volume= 11,708 cf, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.44"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 2.05" for 2-yr event
Inflow = 4.67 cfs @ 12.01 hrs, Volume= 11,708 cf
Outflow = 0.86 cfs @ 12.27 hrs, Volume= 11,383 cf, Atten= 82%, Lag= 16.1 min
Primary = 0.86 cfs @ 12.27 hrs, Volume= 11,383 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 931.50' @ 12.27 hrs Surf.Area= 6,747 sf Storage= 7,525 cf (4,876 cf above start)

Plug-Flow detention time= 170.4 min calculated for 8,702 cf (74% of inflow)
Center-of-Mass det. time= 59.1 min (798.1 - 739.0)

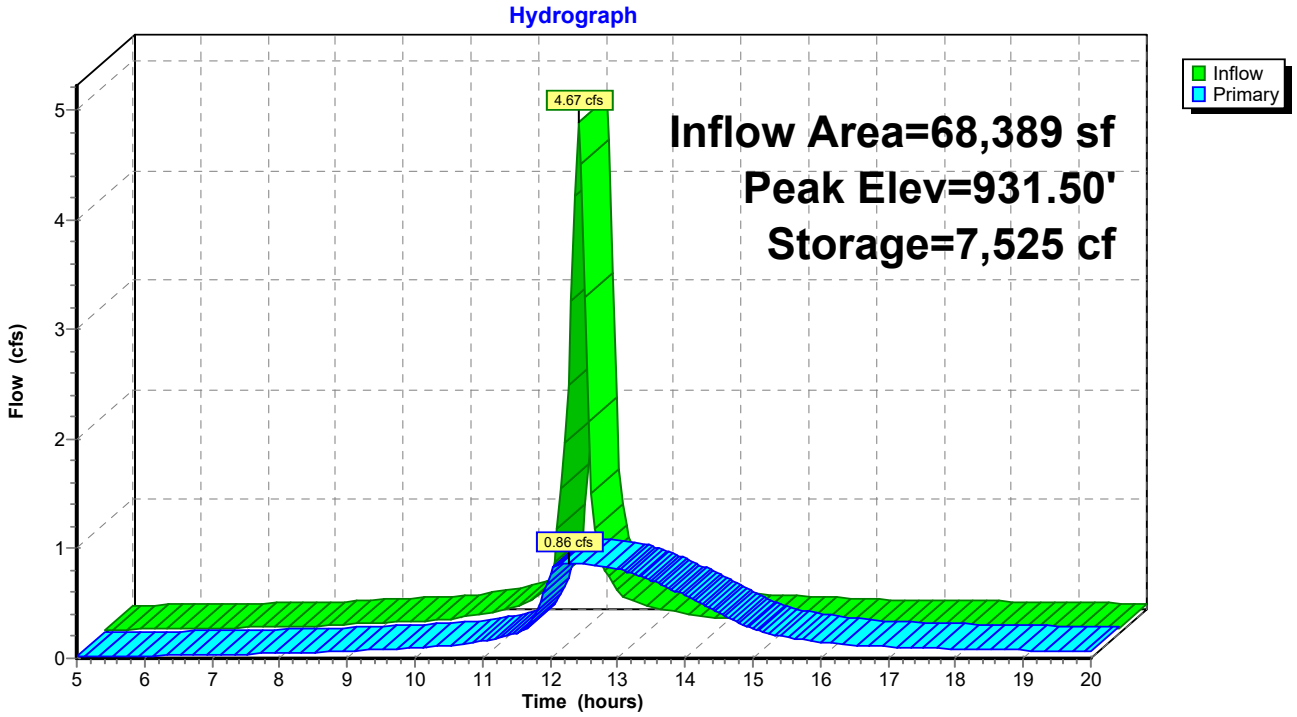
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.86 cfs @ 12.27 hrs HW=931.50' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.86 cfs @ 4.39 fps)
  ├**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 0.89 cfs potential flow)
  └**4=Sharp-Crested Rectangular Weir** (Passes < 0.62 cfs potential flow)

Pond 4P: Detention Basin



Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

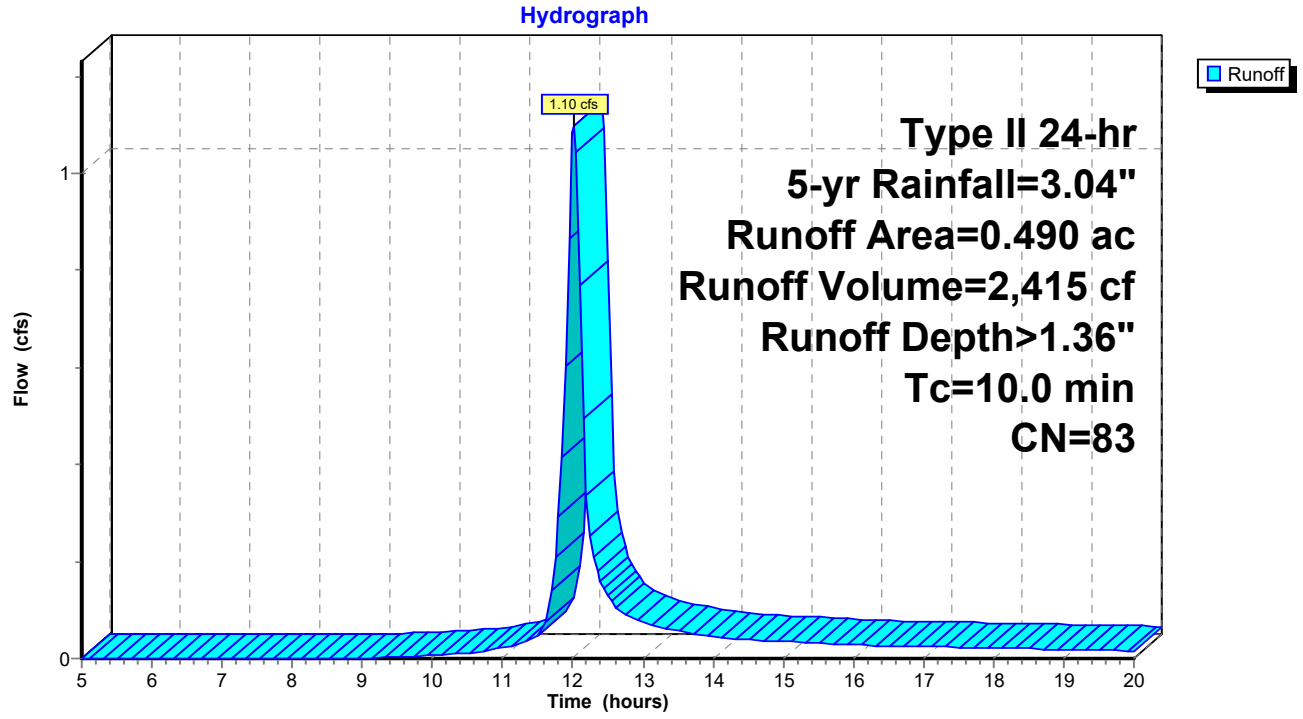
Runoff = 1.10 cfs @ 12.02 hrs, Volume= 2,415 cf, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.04"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

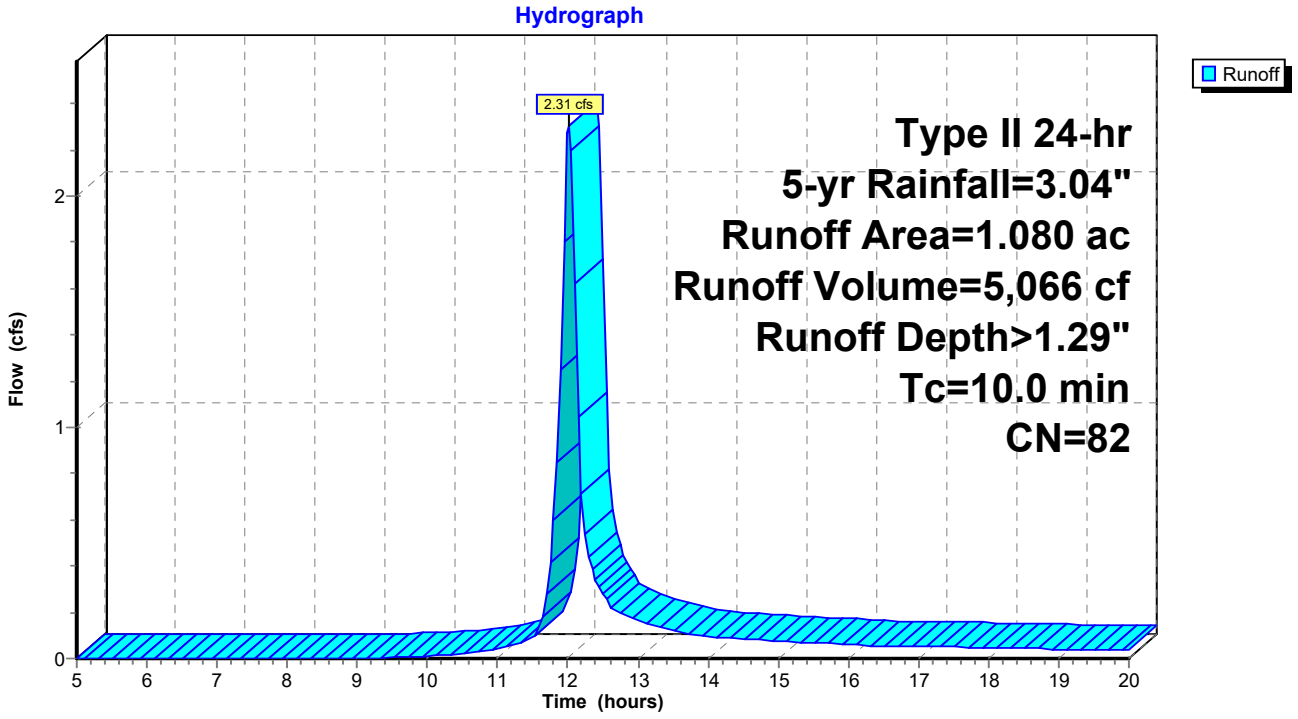
Runoff = 2.31 cfs @ 12.02 hrs, Volume= 5,066 cf, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.04"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

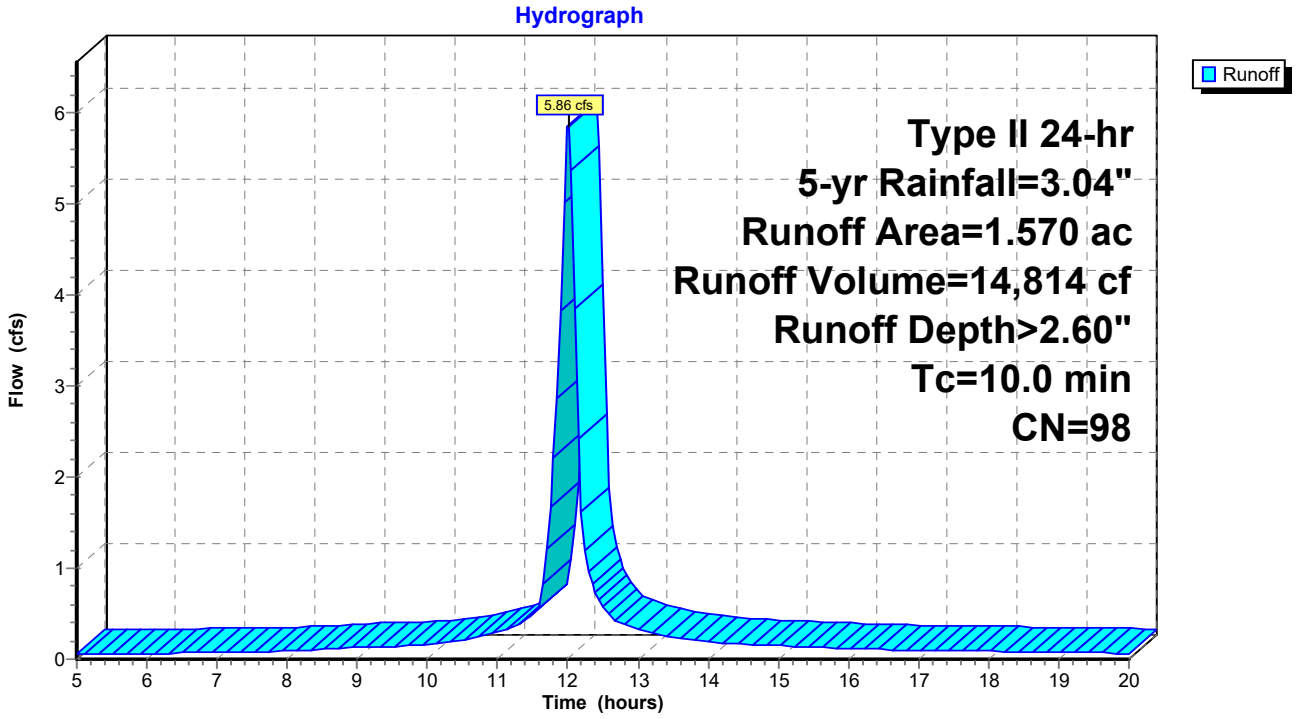
Runoff = 5.86 cfs @ 12.01 hrs, Volume= 14,814 cf, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.04"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 2.60" for 5-yr event
Inflow = 5.86 cfs @ 12.01 hrs, Volume= 14,814 cf
Outflow = 0.90 cfs @ 12.32 hrs, Volume= 14,430 cf, Atten= 85%, Lag= 18.9 min
Primary = 0.90 cfs @ 12.32 hrs, Volume= 14,430 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 931.70' @ 12.32 hrs Surf.Area= 7,774 sf Storage= 8,976 cf (6,327 cf above start)

Plug-Flow detention time= 169.0 min calculated for 11,777 cf (80% of inflow)
Center-of-Mass det. time= 67.4 min (804.0 - 736.6)

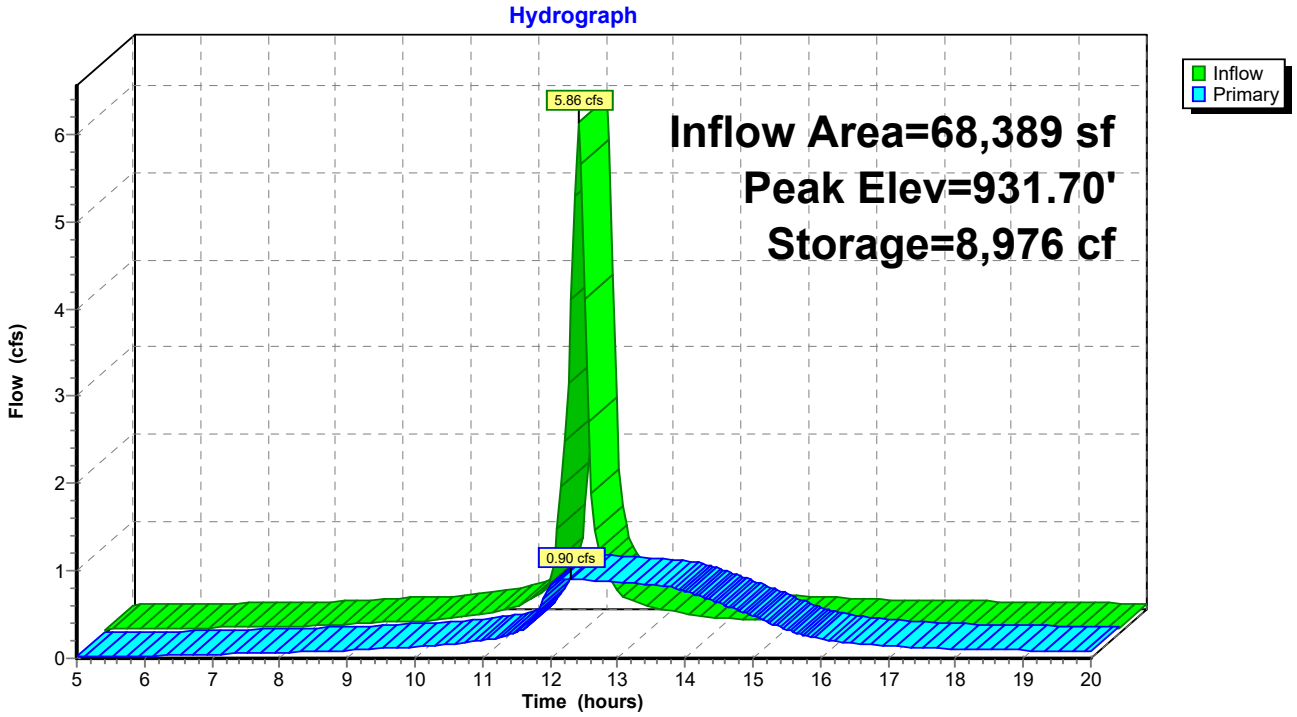
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.90 cfs @ 12.32 hrs HW=931.70' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.90 cfs @ 4.59 fps)
↑**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
3=Orifice/Grate (Passes < 0.98 cfs potential flow)
4=Sharp-Crested Rectangular Weir (Passes < 2.45 cfs potential flow)

Pond 4P: Detention Basin



Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

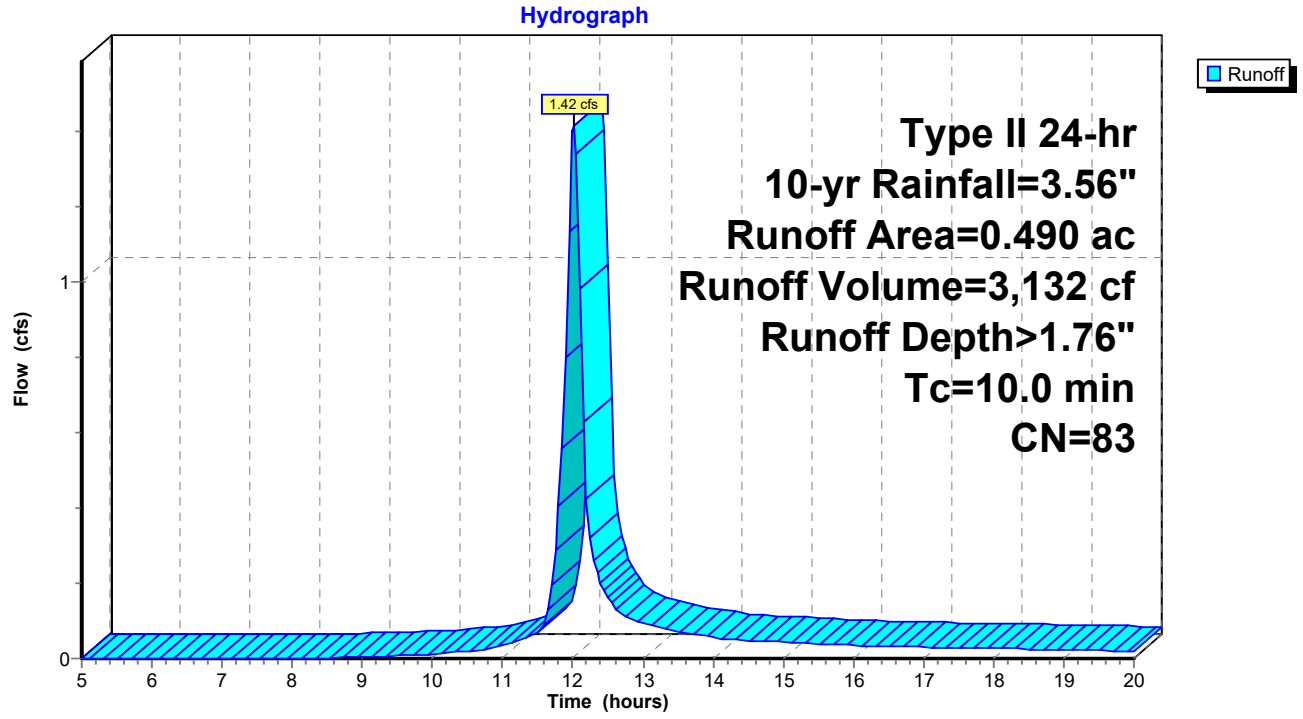
Runoff = 1.42 cfs @ 12.02 hrs, Volume= 3,132 cf, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.56"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

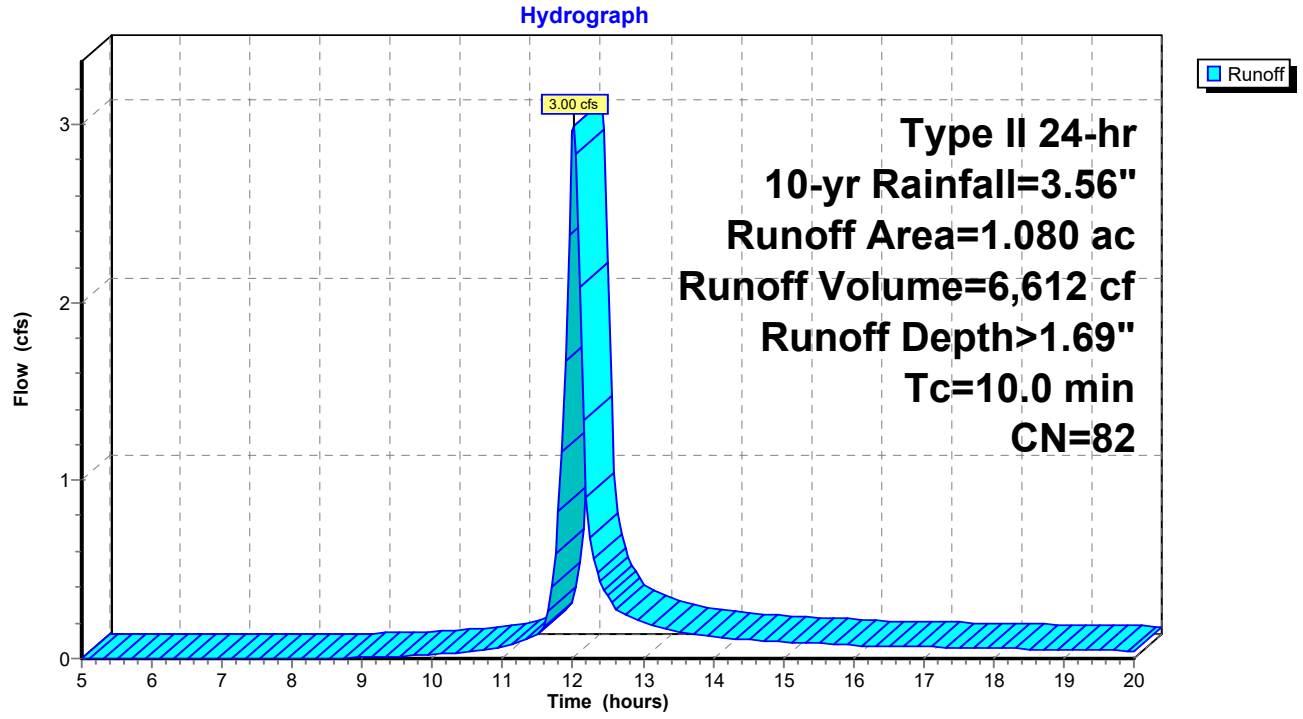
Runoff = 3.00 cfs @ 12.02 hrs, Volume= 6,612 cf, Depth> 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.56"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

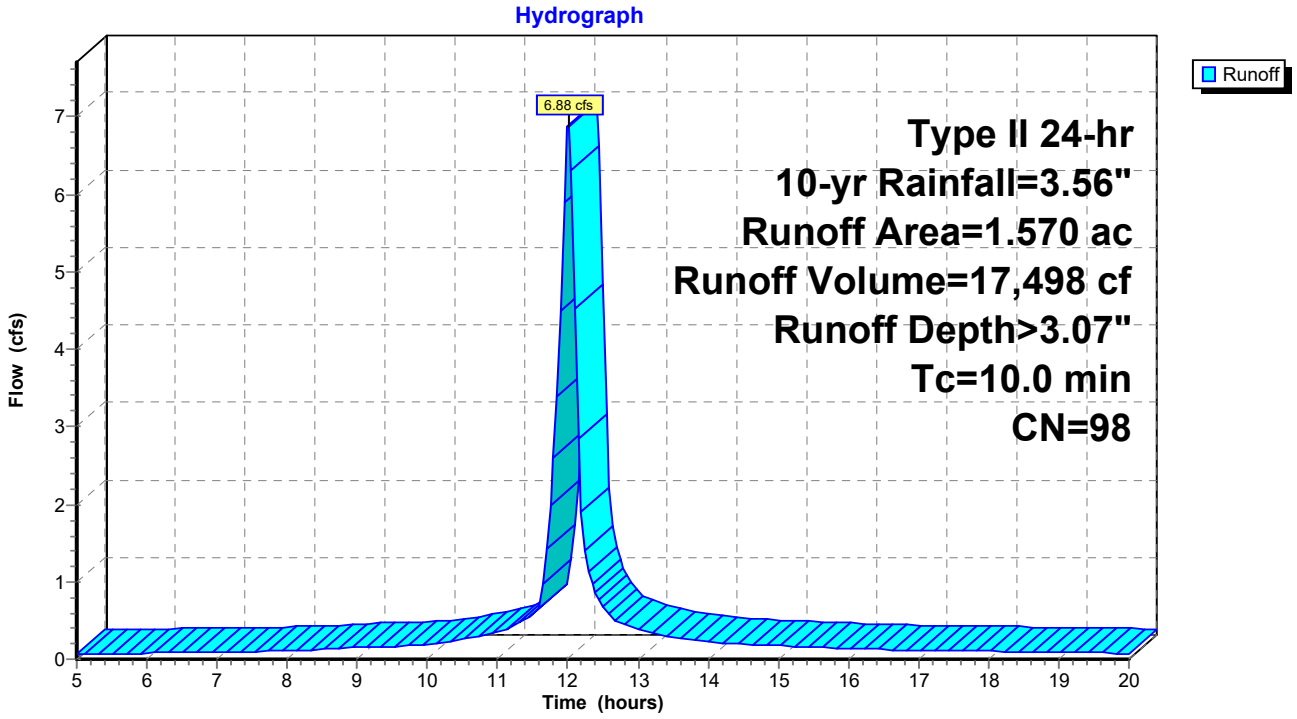
Runoff = 6.88 cfs @ 12.01 hrs, Volume= 17,498 cf, Depth> 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.56"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 3.07" for 10-yr event
Inflow = 6.88 cfs @ 12.01 hrs, Volume= 17,498 cf
Outflow = 0.93 cfs @ 12.37 hrs, Volume= 17,067 cf, Atten= 86%, Lag= 21.6 min
Primary = 0.93 cfs @ 12.37 hrs, Volume= 17,067 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 931.86' @ 12.37 hrs Surf.Area= 8,588 sf Storage= 10,271 cf (7,622 cf above start)

Plug-Flow detention time= 169.5 min calculated for 14,364 cf (82% of inflow)
Center-of-Mass det. time= 75.4 min (810.6 - 735.2)

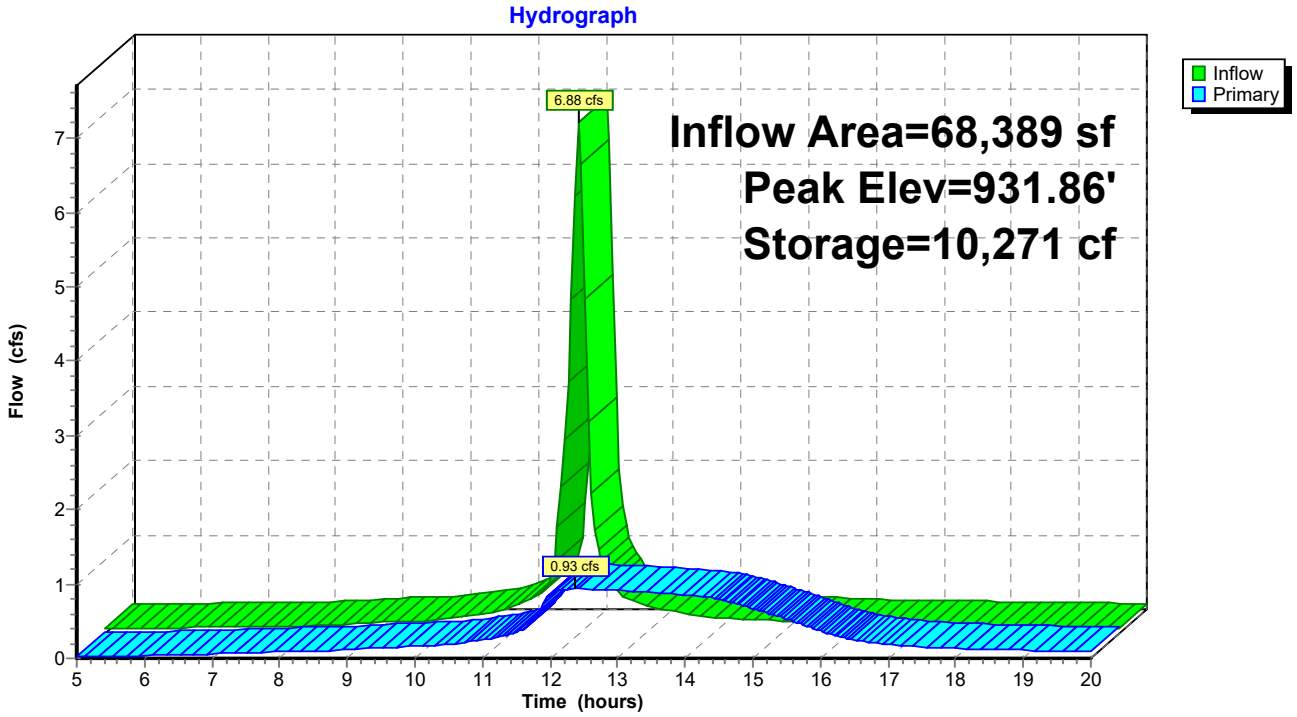
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.93 cfs @ 12.37 hrs HW=931.86' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.93 cfs @ 4.75 fps)
  ├**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 1.05 cfs potential flow)
  └**4=Sharp-Crested Rectangular Weir** (Passes < 4.37 cfs potential flow)

Pond 4P: Detention Basin



Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

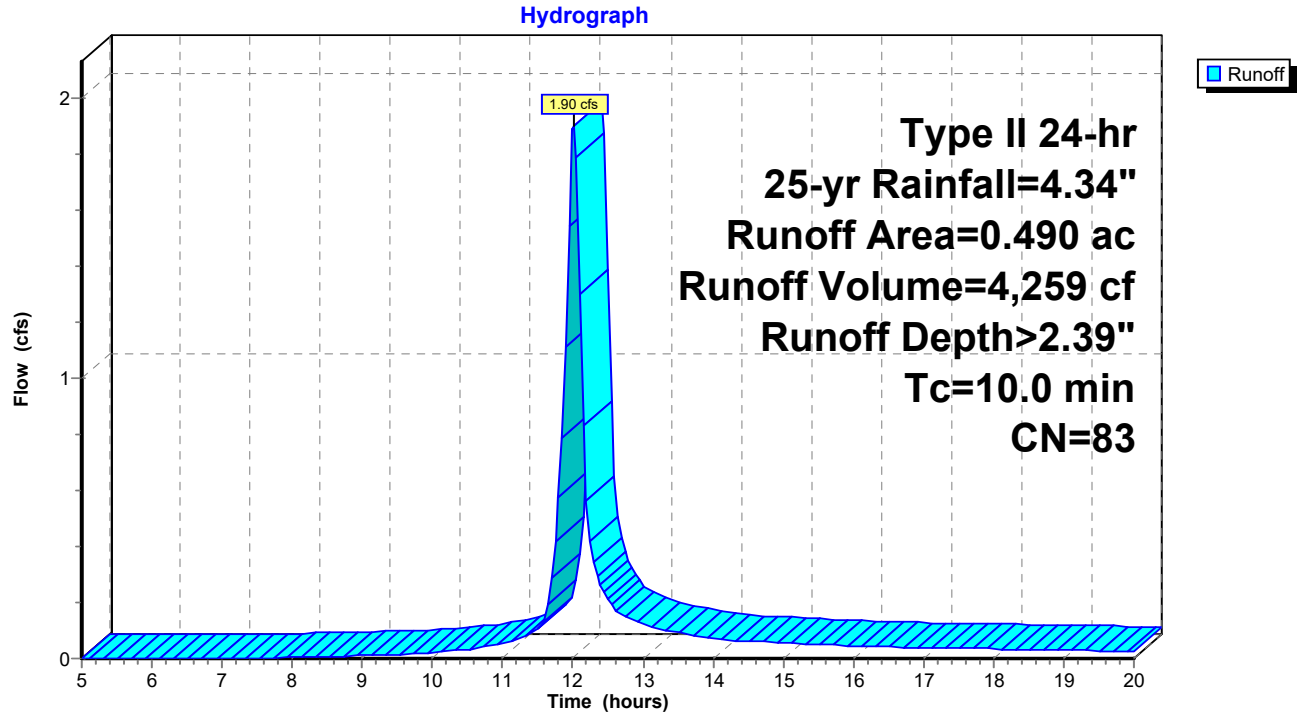
Runoff = 1.90 cfs @ 12.01 hrs, Volume= 4,259 cf, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.34"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

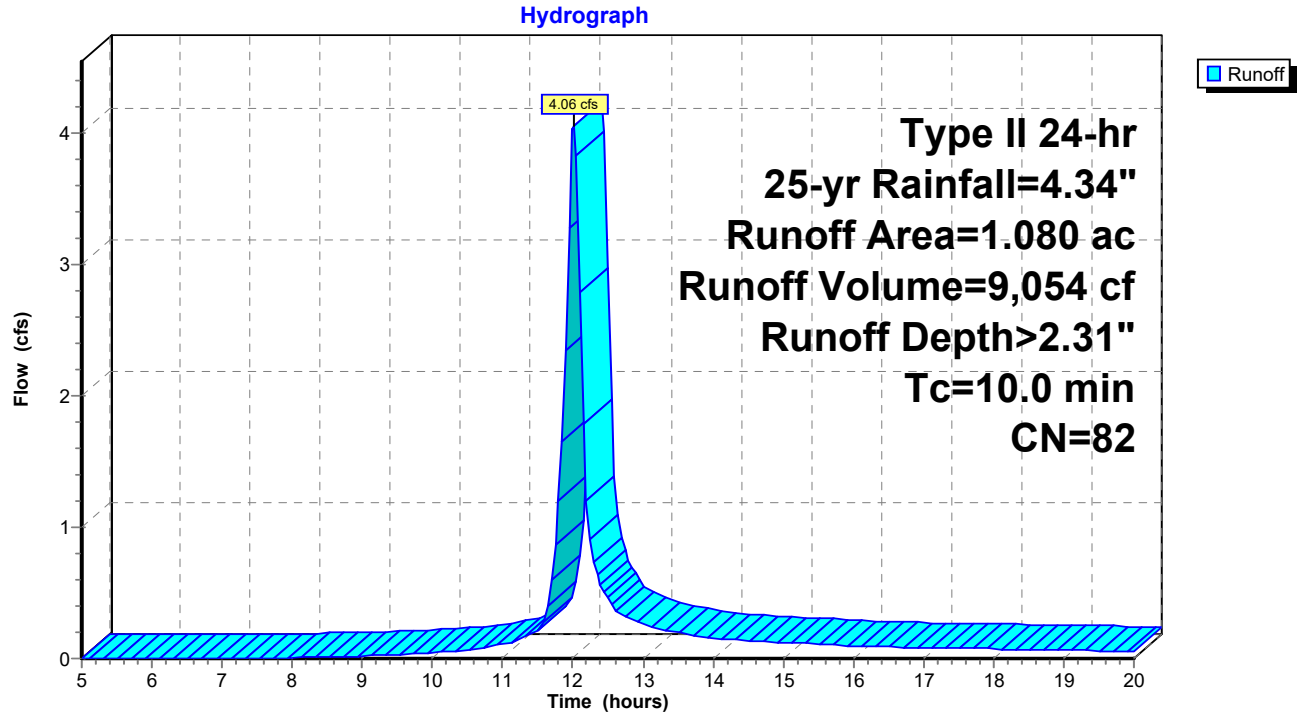
Runoff = 4.06 cfs @ 12.01 hrs, Volume= 9,054 cf, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.34"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

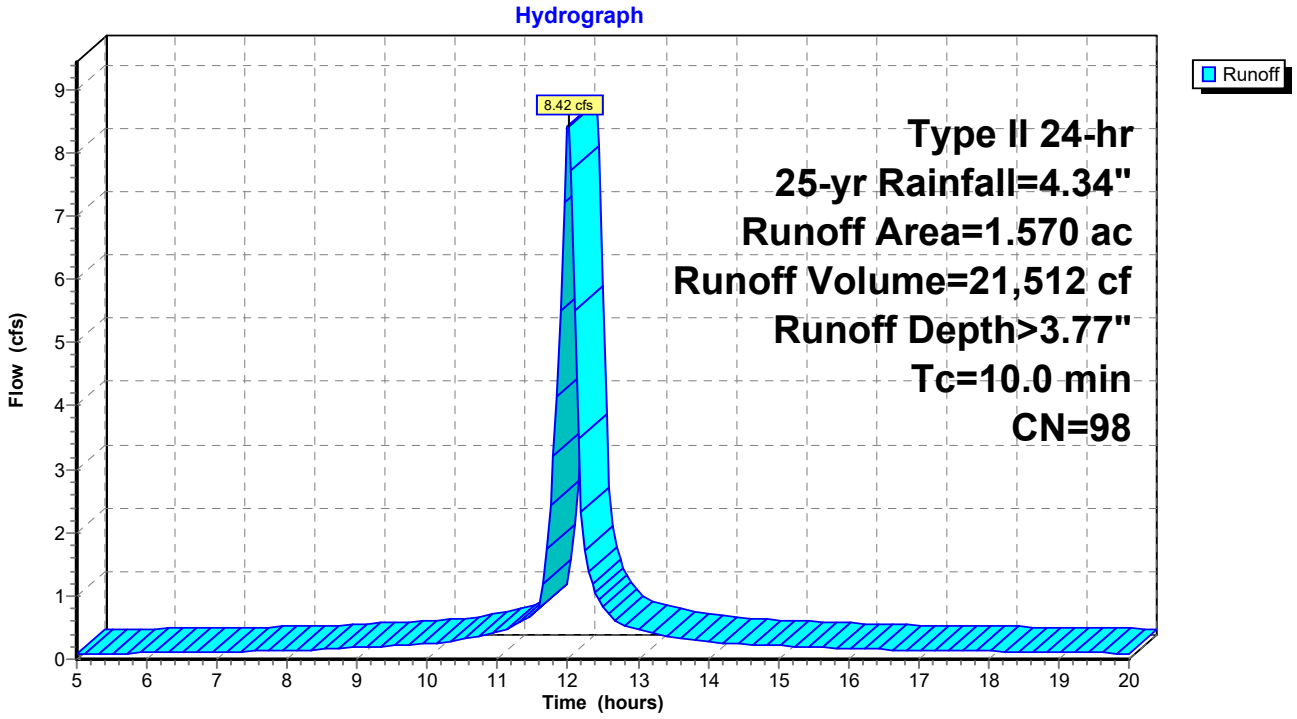
Runoff = 8.42 cfs @ 12.01 hrs, Volume= 21,512 cf, Depth> 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.34"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 3.77" for 25-yr event
Inflow = 8.42 cfs @ 12.01 hrs, Volume= 21,512 cf
Outflow = 0.97 cfs @ 12.43 hrs, Volume= 21,013 cf, Atten= 88%, Lag= 25.5 min
Primary = 0.97 cfs @ 12.43 hrs, Volume= 21,013 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 932.08' @ 12.43 hrs Surf.Area= 9,599 sf Storage= 12,279 cf (9,630 cf above start)

Plug-Flow detention time= 174.5 min calculated for 18,295 cf (85% of inflow)
Center-of-Mass det. time= 88.6 min (822.4 - 733.8)

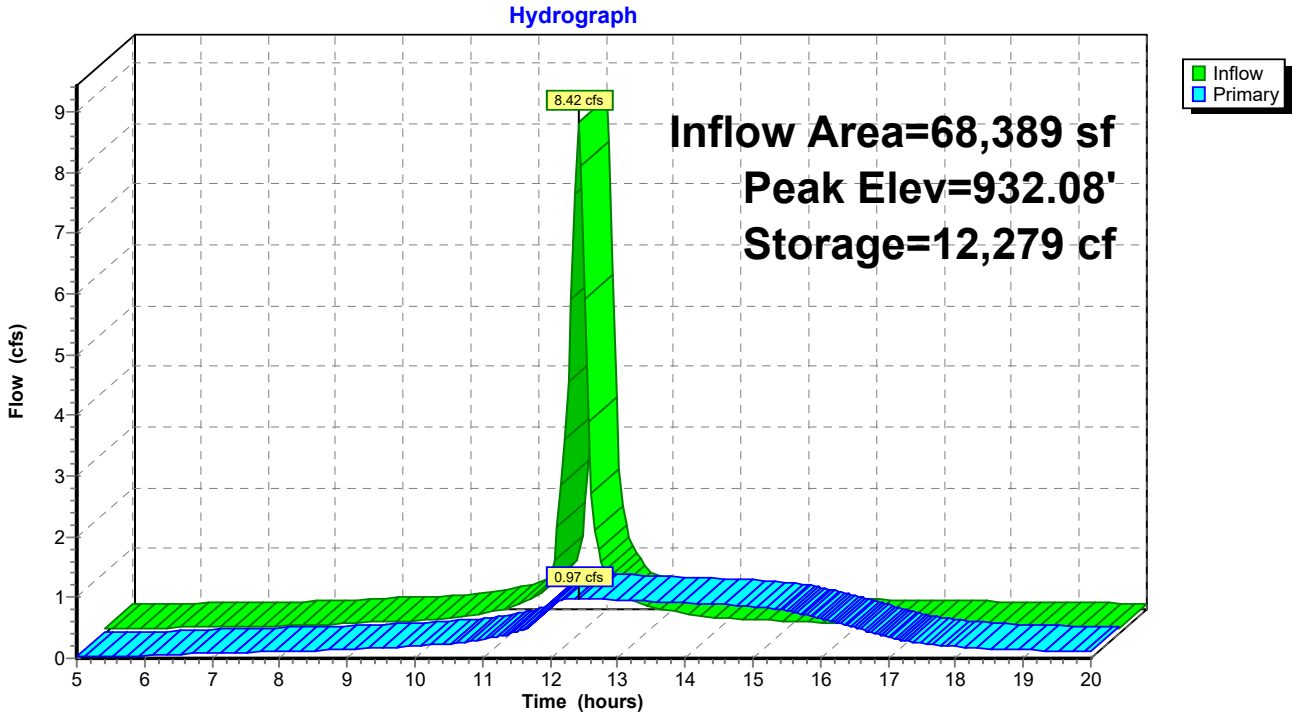
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.97 cfs @ 12.43 hrs HW=932.08' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.97 cfs @ 4.95 fps)
  ├**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 1.14 cfs potential flow)
  └**4=Sharp-Crested Rectangular Weir** (Passes < 7.54 cfs potential flow)

Pond 4P: Detention Basin



Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

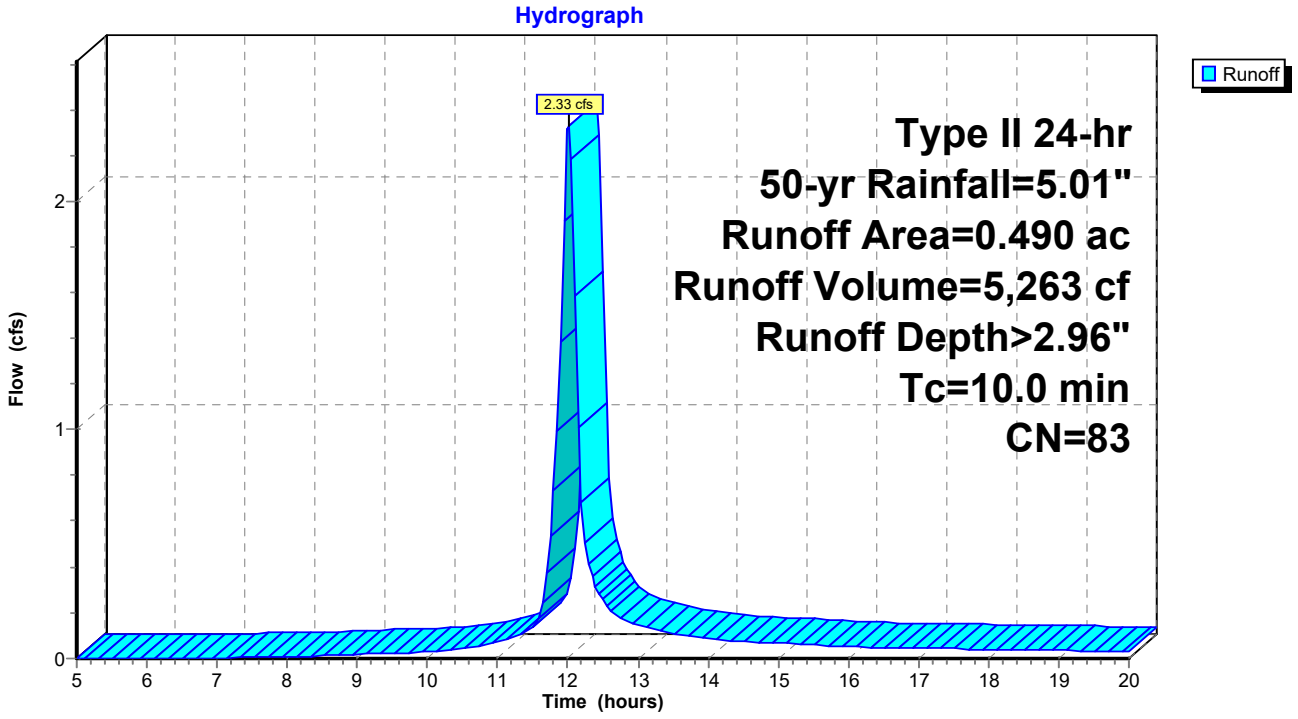
Runoff = 2.33 cfs @ 12.01 hrs, Volume= 5,263 cf, Depth> 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.01"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

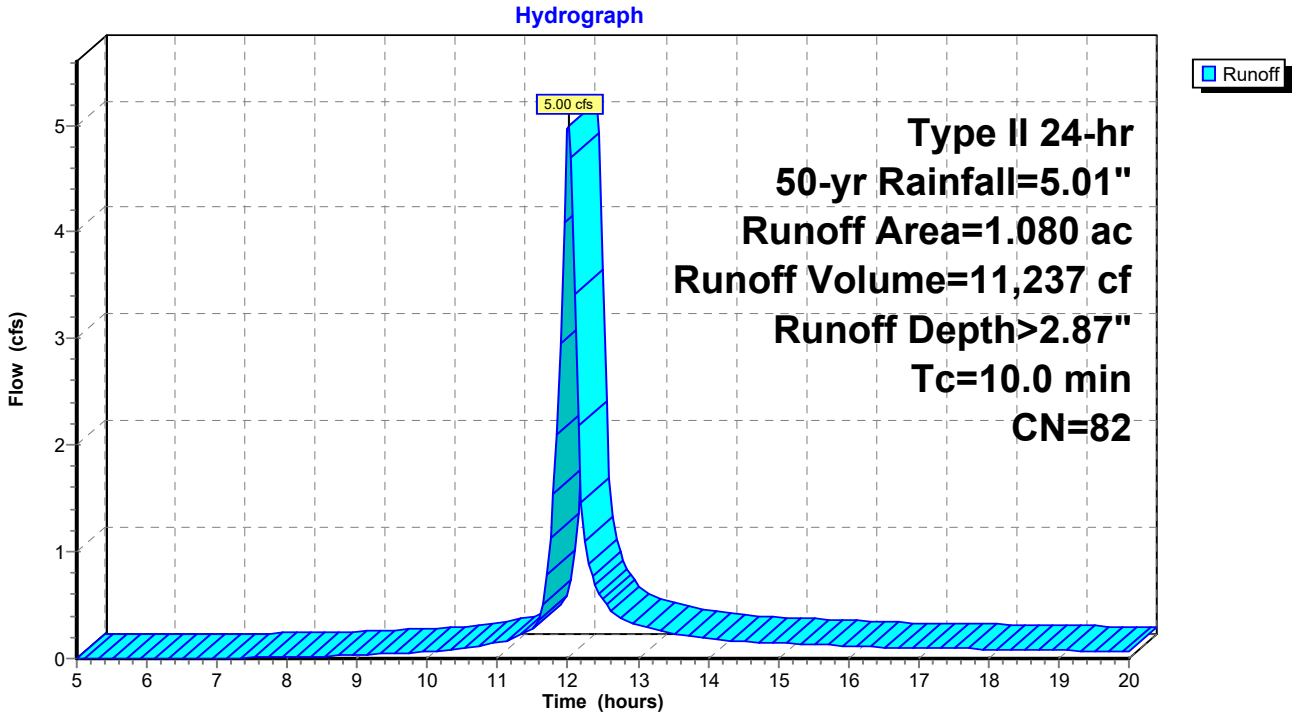
Runoff = 5.00 cfs @ 12.01 hrs, Volume= 11,237 cf, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.01"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

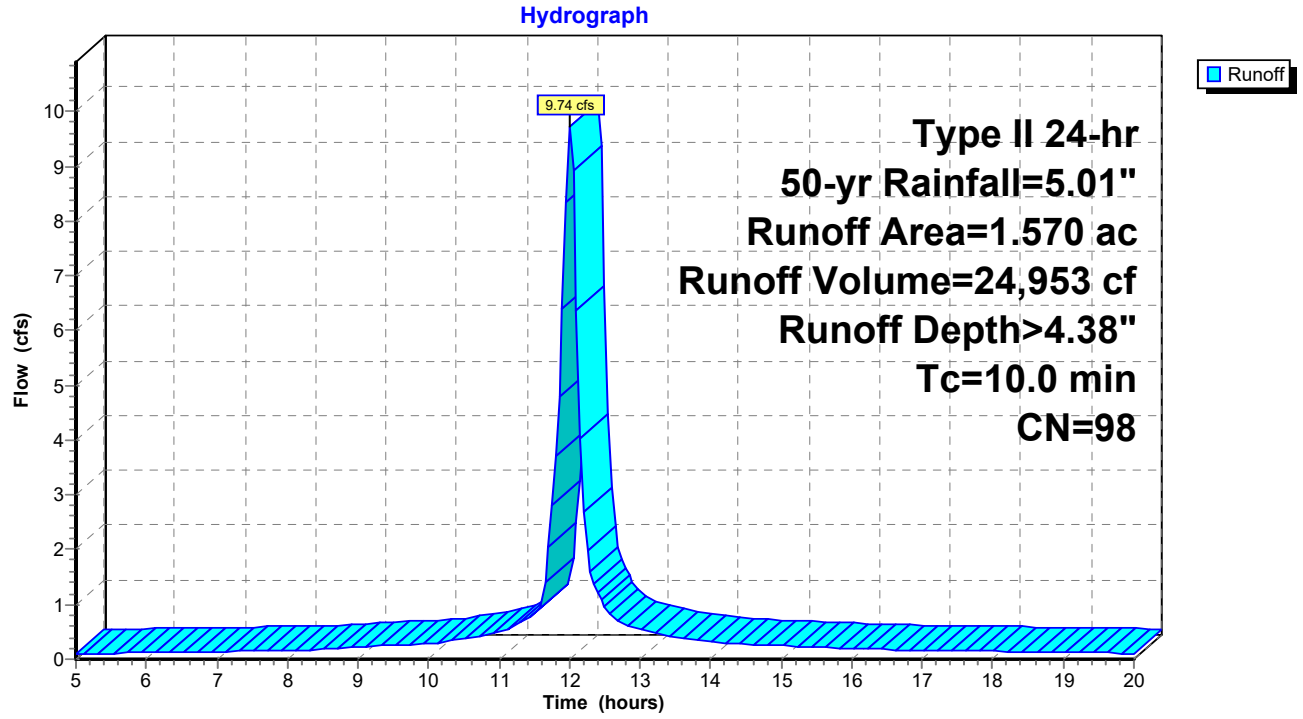
Runoff = 9.74 cfs @ 12.01 hrs, Volume= 24,953 cf, Depth> 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.01"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 4.38" for 50-yr event
Inflow = 9.74 cfs @ 12.01 hrs, Volume= 24,953 cf
Outflow = 1.00 cfs @ 12.48 hrs, Volume= 24,385 cf, Atten= 90%, Lag= 28.7 min
Primary = 1.00 cfs @ 12.48 hrs, Volume= 24,385 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 932.26' @ 12.48 hrs Surf.Area= 10,252 sf Storage= 14,058 cf (11,409 cf above start)

Plug-Flow detention time= 181.3 min calculated for 21,727 cf (87% of inflow)
Center-of-Mass det. time= 100.6 min (833.5 - 732.9)

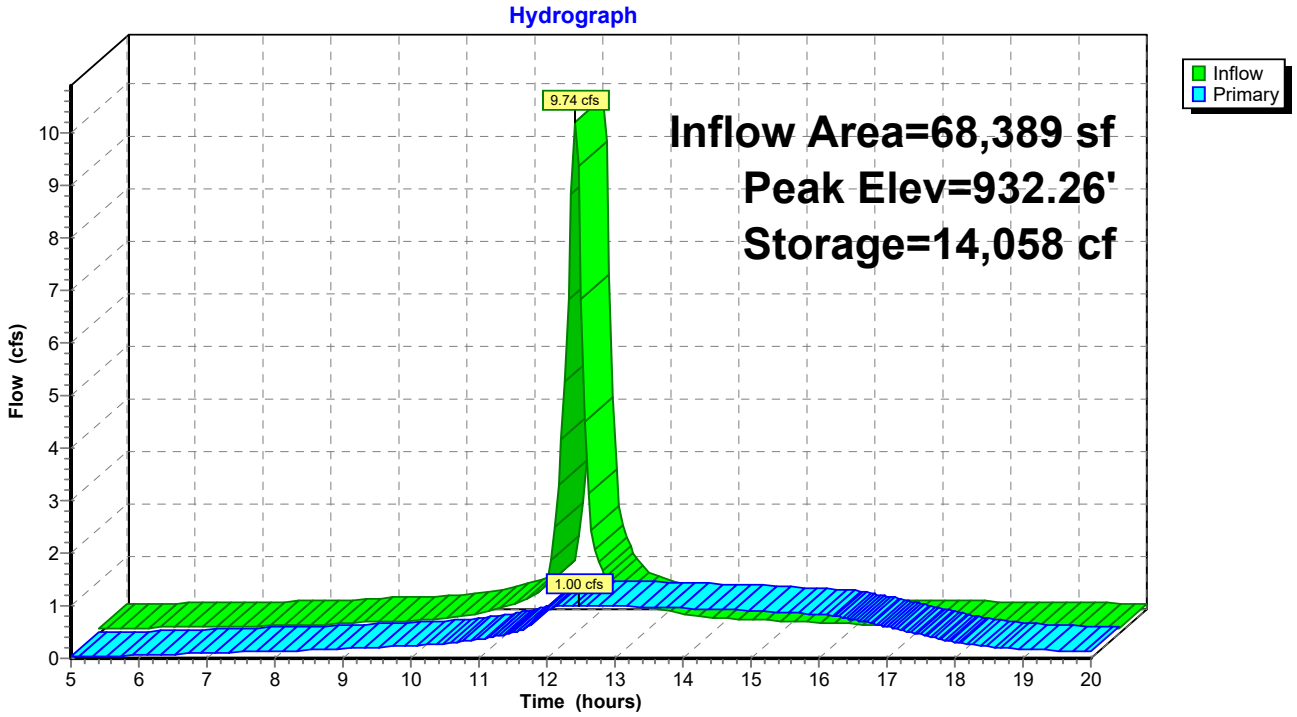
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.00 cfs @ 12.48 hrs HW=932.26' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.00 cfs @ 5.12 fps)
  ├**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 1.21 cfs potential flow)
  └**4=Sharp-Crested Rectangular Weir** (Passes < 10.48 cfs potential flow)

Pond 4P: Detention Basin



Summary for Subcatchment 1S: Pre-Dev (SR 21 Ditch)

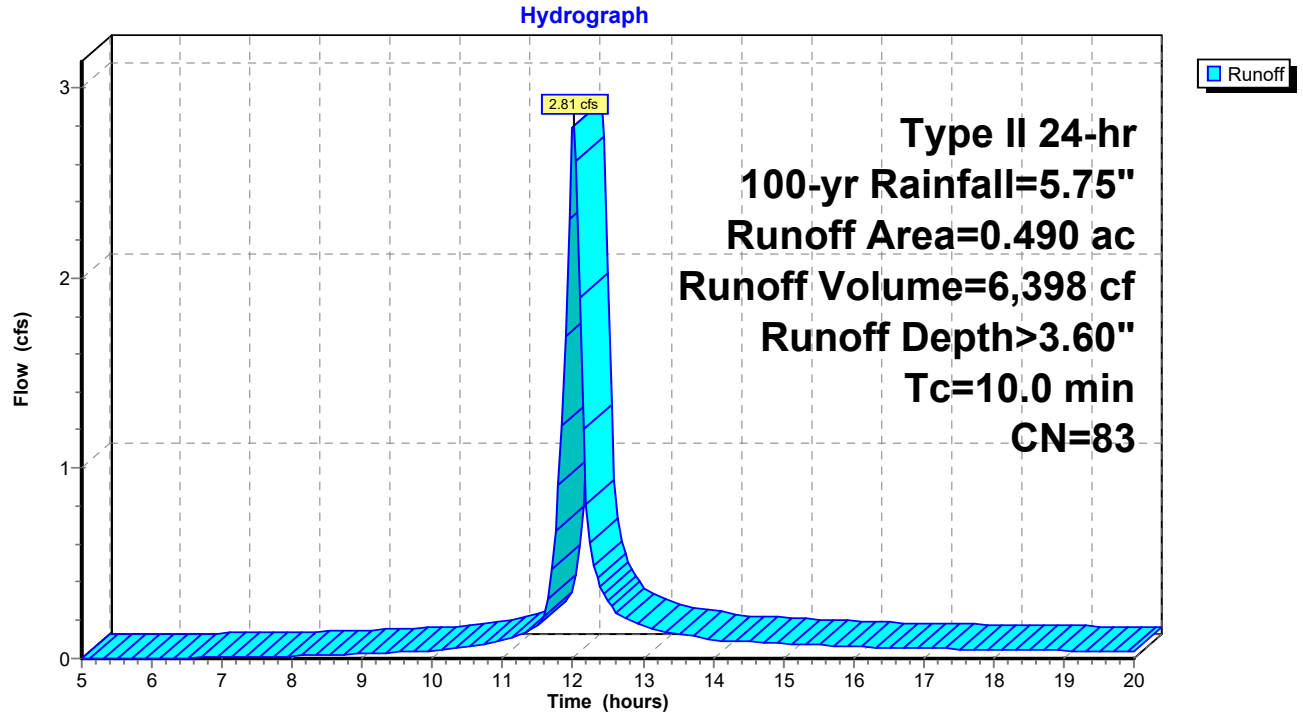
Runoff = 2.81 cfs @ 12.01 hrs, Volume= 6,398 cf, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.75"

	Area (ac)	CN	Description
*	0.410	80	
*	0.080	98	
	0.490	83	Weighted Average
	0.410		83.67% Pervious Area
	0.080		16.33% Impervious Area

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

Subcatchment 1S: Pre-Dev (SR 21 Ditch)



Summary for Subcatchment 2S: Pre-Dev (Cherry Rd. CB)

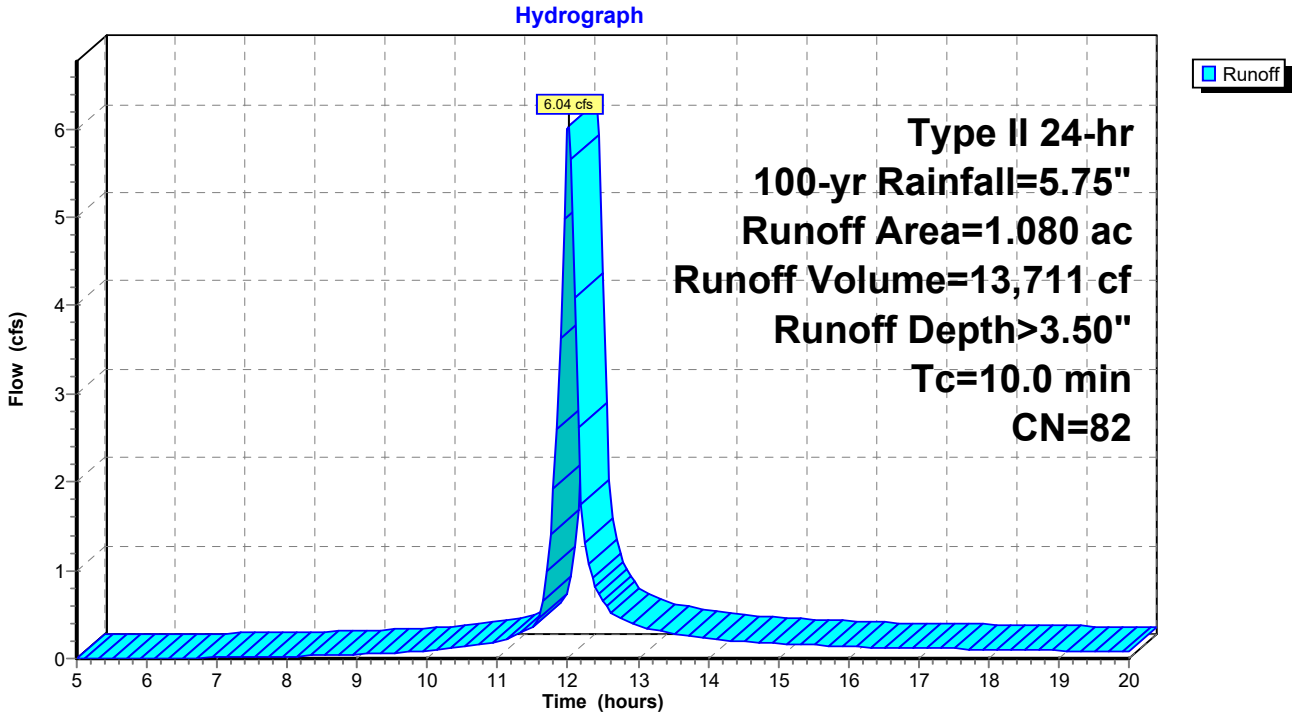
Runoff = 6.04 cfs @ 12.01 hrs, Volume= 13,711 cf, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.75"

	Area (ac)	CN	Description
*	0.970	80	
*	0.110	98	
	1.080	82	Weighted Average
	0.970		89.81% Pervious Area
	0.110		10.19% Impervious Area

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

Subcatchment 2S: Pre-Dev (Cherry Rd. CB)



Summary for Subcatchment 3S: Post-Dev (Cherry Rd. CB)

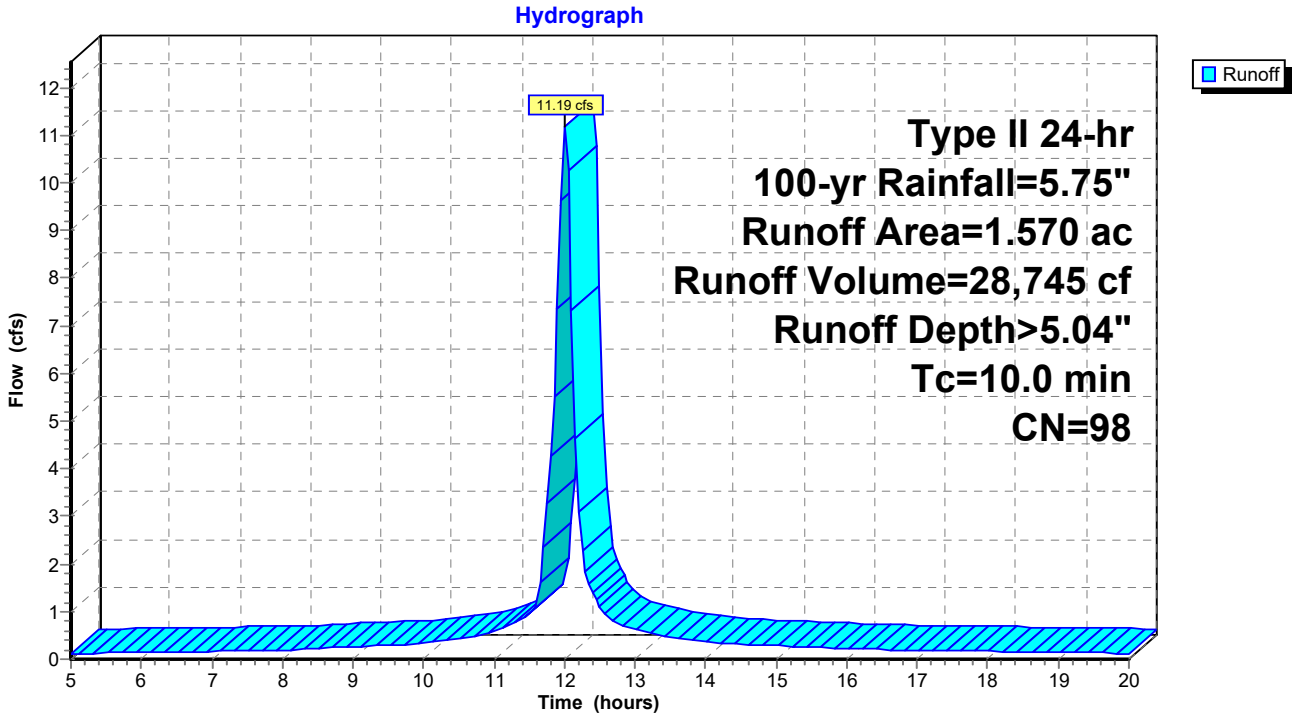
Runoff = 11.19 cfs @ 12.01 hrs, Volume= 28,745 cf, Depth> 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.75"

	Area (ac)	CN	Description
*	1.570	98	
	1.570		100.00% Impervious Area

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

Subcatchment 3S: Post-Dev (Cherry Rd. CB)



Summary for Pond 4P: Detention Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 68,389 sf,100.00% Impervious, Inflow Depth > 5.04" for 100-yr event
Inflow = 11.19 cfs @ 12.01 hrs, Volume= 28,745 cf
Outflow = 1.04 cfs @ 12.54 hrs, Volume= 28,068 cf, Atten= 91%, Lag= 31.8 min
Primary = 1.04 cfs @ 12.54 hrs, Volume= 28,068 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 930.37' Surf.Area= 2,621 sf Storage= 2,649 cf
Peak Elev= 932.45' @ 12.54 hrs Surf.Area= 10,944 sf Storage= 16,073 cf (13,424 cf above start)

Plug-Flow detention time= 189.7 min calculated for 25,408 cf (88% of inflow)
Center-of-Mass det. time= 114.0 min (846.3 - 732.3)

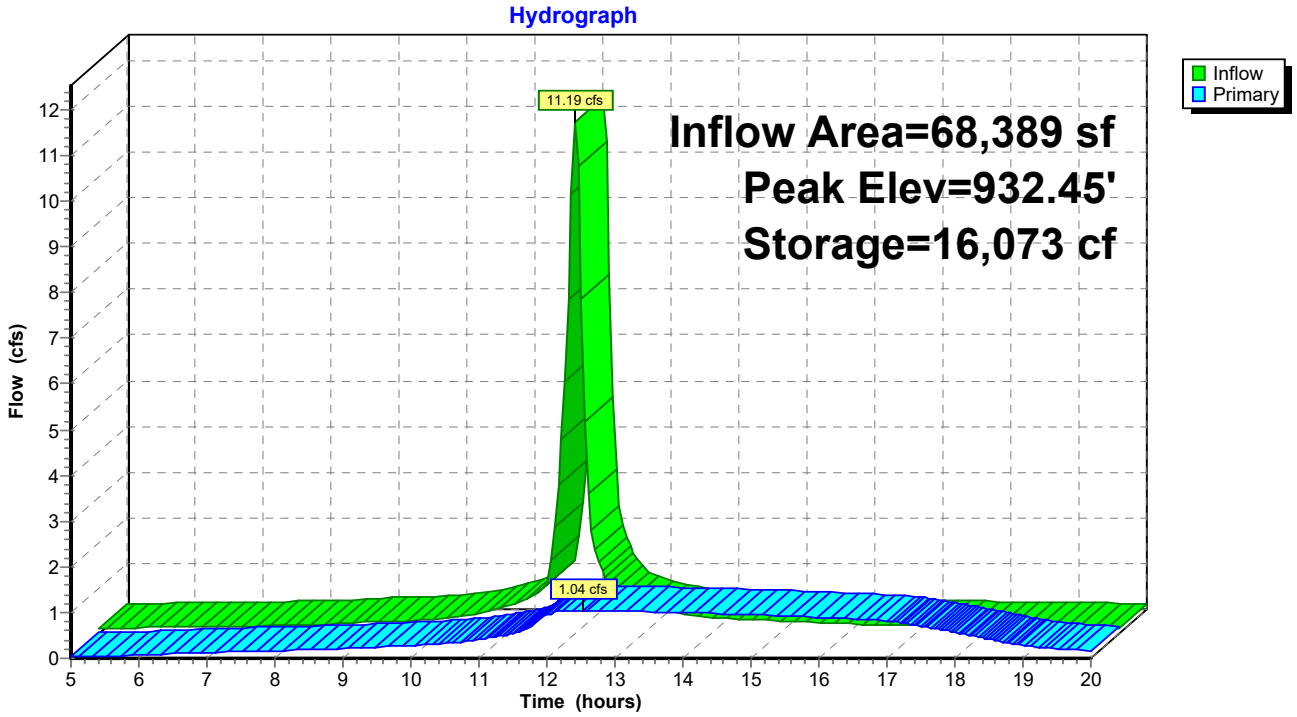
Volume	Invert	Avail.Storage	Storage Description
#1	928.50'	22,653 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.50	588	0	0
929.00	1,125	428	428
930.00	1,713	1,419	1,847
931.00	4,166	2,940	4,787
932.00	9,308	6,737	11,524
933.00	12,950	11,129	22,653

Device	Routing	Invert	Outlet Devices
#1	Primary	929.00'	**6.0" Round Culvert** L= 49.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 929.00' / 928.89' S= 0.0022 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	929.00'	**0.8" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.37'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	931.37'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.04 cfs @ 12.54 hrs HW=932.45' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.04 cfs @ 5.28 fps)
  ├**2=Orifice/Grate** (Passes < 0.03 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 1.28 cfs potential flow)
  └**4=Sharp-Crested Rectangular Weir** (Passes < 13.87 cfs potential flow)

Pond 4P: Detention Basin



Appendix C

NOAA Atlas 14, Volume 2, Version 3
Location name: Massillon, Ohio, USA*
Latitude: 40.8008°, Longitude: -81.5274°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.323** (0.295–0.354)	**0.385** (0.352–0.422)	**0.467** (0.425–0.511)	**0.529** (0.480–0.578)	**0.608** (0.550–0.664)	**0.669** (0.603–0.730)	**0.727** (0.653–0.792)	**0.786** (0.703–0.856)	**0.866** (0.770–0.941)	**0.924** (0.817–1.00)
10-min	**0.501** (0.458–0.550)	**0.602** (0.549–0.658)	**0.726** (0.660–0.794)	**0.817** (0.742–0.893)	**0.930** (0.842–1.02)	**1.01** (0.914–1.11)	**1.09** (0.983–1.19)	**1.17** (1.05–1.28)	**1.27** (1.13–1.38)	**1.35** (1.19–1.46)
15-min	**0.615** (0.561–0.675)	**0.736** (0.671–0.805)	**0.891** (0.811–0.975)	**1.00** (0.912–1.10)	**1.15** (1.04–1.25)	**1.25** (1.13–1.37)	**1.36** (1.22–1.48)	**1.46** (1.31–1.59)	**1.59** (1.41–1.73)	**1.68** (1.49–1.83)
30-min	**0.813** (0.743–0.893)	**0.985** (0.898–1.08)	**1.22** (1.11–1.34)	**1.40** (1.27–1.53)	**1.62** (1.47–1.77)	**1.79** (1.62–1.96)	**1.96** (1.76–2.14)	**2.13** (1.91–2.32)	**2.35** (2.09–2.56)	**2.52** (2.23–2.74)
60-min	**0.993** (0.907–1.09)	**1.21** (1.10–1.32)	**1.53** (1.39–1.68)	**1.78** (1.61–1.94)	**2.10** (1.90–2.30)	**2.36** (2.13–2.58)	**2.62** (2.36–2.86)	**2.89** (2.59–3.15)	**3.25** (2.90–3.54)	**3.54** (3.13–3.85)
2-hr	**1.14** (1.03–1.25)	**1.38** (1.25–1.52)	**1.78** (1.61–1.96)	**2.10** (1.90–2.31)	**2.57** (2.31–2.81)	**2.96** (2.66–3.24)	**3.38** (3.03–3.69)	**3.84** (3.42–4.18)	**4.50** (3.98–4.89)	**5.05** (4.45–5.49)
3-hr	**1.21** (1.10–1.33)	**1.46** (1.33–1.62)	**1.88** (1.70–2.07)	**2.22** (2.01–2.45)	**2.72** (2.45–2.99)	**3.14** (2.81–3.44)	**3.60** (3.21–3.93)	**4.11** (3.64–4.47)	**4.84** (4.26–5.26)	**5.46** (4.77–5.92)
6-hr	**1.46** (1.32–1.63)	**1.76** (1.60–1.96)	**2.24** (2.02–2.49)	**2.64** (2.38–2.93)	**3.24** (2.91–3.59)	**3.75** (3.35–4.14)	**4.31** (3.83–4.74)	**4.94** (4.36–5.42)	**5.86** (5.12–6.40)	**6.64** (5.76–7.25)
12-hr	**1.73** (1.57–1.93)	**2.08** (1.89–2.32)	**2.61** (2.37–2.91)	**3.08** (2.78–3.42)	**3.77** (3.39–4.18)	**4.37** (3.91–4.83)	**5.04** (4.48–5.55)	**5.78** (5.10–6.34)	**6.88** (6.01–7.53)	**7.83** (6.79–8.55)
24-hr	**2.04** (1.87–2.24)	**2.44** (2.23–2.69)	**3.04** (2.78–3.35)	**3.56** (3.25–3.91)	**4.34** (3.93–4.76)	**5.01** (4.51–5.48)	**5.75** (5.13–6.28)	**6.57** (5.80–7.17)	**7.79** (6.78–8.50)	**8.84** (7.59–9.65)
2-day	**2.35** (2.16–2.58)	**2.81** (2.58–3.08)	**3.46** (3.18–3.80)	**4.02** (3.68–4.41)	**4.85** (4.41–5.31)	**5.55** (5.02–6.08)	**6.32** (5.67–6.92)	**7.16** (6.36–7.85)	**8.40** (7.34–9.20)	**9.45** (8.14–10.4)
3-day	**2.51** (2.32–2.74)	**3.00** (2.76–3.27)	**3.67** (3.38–4.01)	**4.25** (3.90–4.63)	**5.08** (4.64–5.54)	**5.78** (5.25–6.30)	**6.54** (5.89–7.12)	**7.36** (6.57–8.02)	**8.57** (7.55–9.35)	**9.61** (8.36–10.5)
4-day	**2.68** (2.48–2.91)	**3.19** (2.95–3.46)	**3.89** (3.59–4.22)	**4.47** (4.11–4.85)	**5.31** (4.86–5.76)	**6.01** (5.48–6.51)	**6.76** (6.12–7.33)	**7.56** (6.79–8.20)	**8.74** (7.77–9.50)	**9.77** (8.58–10.6)
7-day	**3.20** (2.97–3.46)	**3.81** (3.53–4.11)	**4.60** (4.26–4.97)	**5.26** (4.87–5.68)	**6.21** (5.71–6.70)	**6.99** (6.40–7.54)	**7.81** (7.11–8.42)	**8.68** (7.86–9.37)	**9.92** (8.88–10.7)	**10.9** (9.69–11.8)
10-day	**3.69** (3.43–3.96)	**4.37** (4.07–4.70)	**5.23** (4.87–5.62)	**5.93** (5.51–6.36)	**6.90** (6.39–7.40)	**7.68** (7.08–8.24)	**8.49** (7.79–9.11)	**9.32** (8.51–10.0)	**10.5** (9.49–11.3)	**11.4** (10.2–12.3)
20-day	**5.15** (4.83–5.49)	**6.08** (5.71–6.49)	**7.17** (6.72–7.65)	**8.02** (7.51–8.56)	**9.15** (8.54–9.76)	**10.0** (9.33–10.7)	**10.9** (10.1–11.6)	**11.7** (10.9–12.6)	**12.9** (11.8–13.8)	**13.7** (12.6–14.7)
30-day	**6.46** (6.06–6.87)	**7.61** (7.15–8.09)	**8.87** (8.32–9.43)	**9.83** (9.21–10.4)	**11.1** (10.4–11.8)	**12.0** (11.2–12.8)	**13.0** (12.1–13.8)	**13.9** (12.9–14.8)	**15.0** (13.9–16.0)	**15.9** (14.6–17.0)
45-day	**8.26** (7.79–8.75)	**9.69** (9.15–10.3)	**11.1** (10.5–11.8)	**12.2** (11.5–13.0)	**13.6** (12.8–14.4)	**14.6** (13.7–15.5)	**15.6** (14.6–16.5)	**16.5** (15.4–17.5)	**17.7** (16.5–18.8)	**18.5** (17.2–19.7)
60-day	**9.98** (9.45–10.5)	**11.7** (11.1–12.3)	**13.3** (12.6–14.1)	**14.5** (13.8–15.3)	**16.0** (15.2–16.9)	**17.1** (16.2–18.1)	**18.2** (17.1–19.2)	**19.1** (18.0–20.2)	**20.2** (19.0–21.4)	**21.0** (19.7–22.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

NOAA Atlas 14, Volume 2, Version 3
Location name: Massillon, Ohio, USA*
Latitude: 40.8008°, Longitude: -81.5274°
Elevation: 933.16 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.88** (3.54–4.25)	**4.62** (4.22–5.06)	**5.60** (5.10–6.13)	**6.35** (5.76–6.94)	**7.30** (6.60–7.97)	**8.03** (7.24–8.76)	**8.72** (7.84–9.50)	**9.43** (8.44–10.3)	**10.4** (9.24–11.3)	**11.1** (9.80–12.0)
10-min	**3.01** (2.75–3.30)	**3.61** (3.29–3.95)	**4.36** (3.96–4.76)	**4.90** (4.45–5.36)	**5.58** (5.05–6.10)	**6.08** (5.48–6.64)	**6.56** (5.90–7.15)	**7.04** (6.30–7.67)	**7.63** (6.79–8.30)	**8.07** (7.14–8.77)
15-min	**2.46** (2.24–2.70)	**2.94** (2.68–3.22)	**3.56** (3.24–3.90)	**4.02** (3.65–4.40)	**4.60** (4.16–5.02)	**5.02** (4.52–5.48)	**5.44** (4.88–5.92)	**5.84** (5.22–6.36)	**6.35** (5.65–6.91)	**6.72** (5.95–7.31)
30-min	**1.63** (1.49–1.79)	**1.97** (1.80–2.15)	**2.44** (2.22–2.67)	**2.79** (2.53–3.05)	**3.24** (2.94–3.54)	**3.59** (3.23–3.91)	**3.93** (3.53–4.28)	**4.26** (3.81–4.64)	**4.71** (4.19–5.12)	**5.04** (4.46–5.48)
60-min	**0.993** (0.907–1.09)	**1.21** (1.10–1.32)	**1.53** (1.39–1.68)	**1.78** (1.61–1.94)	**2.10** (1.90–2.30)	**2.36** (2.13–2.58)	**2.62** (2.36–2.86)	**2.89** (2.59–3.15)	**3.25** (2.90–3.54)	**3.54** (3.13–3.85)
2-hr	**0.569** (0.517–0.626)	**0.690** (0.626–0.762)	**0.888** (0.806–0.978)	**1.05** (0.950–1.15)	**1.28** (1.16–1.41)	**1.48** (1.33–1.62)	**1.69** (1.51–1.84)	**1.92** (1.71–2.09)	**2.25** (1.99–2.44)	**2.53** (2.22–2.75)
3-hr	**0.402** (0.365–0.444)	**0.487** (0.442–0.538)	**0.625** (0.566–0.690)	**0.739** (0.668–0.815)	**0.906** (0.815–0.995)	**1.05** (0.937–1.15)	**1.20** (1.07–1.31)	**1.37** (1.21–1.49)	**1.61** (1.42–1.75)	**1.82** (1.59–1.97)
6-hr	**0.244** (0.221–0.272)	**0.294** (0.266–0.328)	**0.374** (0.338–0.416)	**0.441** (0.398–0.489)	**0.541** (0.486–0.599)	**0.627** (0.560–0.691)	**0.720** (0.640–0.792)	**0.825** (0.728–0.905)	**0.978** (0.854–1.07)	**1.11** (0.961–1.21)
12-hr	**0.144** (0.131–0.160)	**0.173** (0.157–0.192)	**0.217** (0.197–0.242)	**0.255** (0.231–0.284)	**0.313** (0.281–0.347)	**0.363** (0.324–0.401)	**0.418** (0.372–0.460)	**0.479** (0.423–0.526)	**0.571** (0.499–0.625)	**0.650** (0.564–0.710)
24-hr	**0.085** (0.078–0.093)	**0.102** (0.093–0.112)	**0.127** (0.116–0.140)	**0.148** (0.135–0.163)	**0.181** (0.164–0.198)	**0.209** (0.188–0.228)	**0.240** (0.214–0.262)	**0.274** (0.242–0.299)	**0.325** (0.283–0.354)	**0.368** (0.316–0.402)
2-day	**0.049** (0.045–0.054)	**0.058** (0.054–0.064)	**0.072** (0.066–0.079)	**0.084** (0.077–0.092)	**0.101** (0.092–0.111)	**0.116** (0.105–0.127)	**0.132** (0.118–0.144)	**0.149** (0.132–0.163)	**0.175** (0.153–0.192)	**0.197** (0.170–0.216)
3-day	**0.035** (0.032–0.038)	**0.042** (0.038–0.045)	**0.051** (0.047–0.056)	**0.059** (0.054–0.064)	**0.071** (0.064–0.077)	**0.080** (0.073–0.087)	**0.091** (0.082–0.099)	**0.102** (0.091–0.111)	**0.119** (0.105–0.130)	**0.133** (0.116–0.146)
4-day	**0.028** (0.026–0.030)	**0.033** (0.031–0.036)	**0.041** (0.037–0.044)	**0.047** (0.043–0.051)	**0.055** (0.051–0.060)	**0.063** (0.057–0.068)	**0.070** (0.064–0.076)	**0.079** (0.071–0.085)	**0.091** (0.081–0.099)	**0.102** (0.089–0.111)
7-day	**0.019** (0.018–0.021)	**0.023** (0.021–0.024)	**0.027** (0.025–0.030)	**0.031** (0.029–0.034)	**0.037** (0.034–0.040)	**0.042** (0.038–0.045)	**0.046** (0.042–0.050)	**0.052** (0.047–0.056)	**0.059** (0.053–0.064)	**0.065** (0.058–0.070)
10-day	**0.015** (0.014–0.017)	**0.018** (0.017–0.020)	**0.022** (0.020–0.023)	**0.025** (0.023–0.027)	**0.029** (0.027–0.031)	**0.032** (0.030–0.034)	**0.035** (0.032–0.038)	**0.039** (0.035–0.042)	**0.044** (0.040–0.047)	**0.047** (0.043–0.051)
20-day	**0.011** (0.010–0.011)	**0.013** (0.012–0.014)	**0.015** (0.014–0.016)	**0.017** (0.016–0.018)	**0.019** (0.018–0.020)	**0.021** (0.019–0.022)	**0.023** (0.021–0.024)	**0.024** (0.023–0.026)	**0.027** (0.025–0.029)	**0.029** (0.026–0.031)
30-day	**0.009** (0.008–0.010)	**0.011** (0.010–0.011)	**0.012** (0.012–0.013)	**0.014** (0.013–0.015)	**0.015** (0.014–0.016)	**0.017** (0.016–0.018)	**0.018** (0.017–0.019)	**0.019** (0.018–0.020)	**0.021** (0.019–0.022)	**0.022** (0.020–0.024)
45-day	**0.008** (0.007–0.008)	**0.009** (0.008–0.010)	**0.010** (0.010–0.011)	**0.011** (0.011–0.012)	**0.013** (0.012–0.013)	**0.014** (0.013–0.014)	**0.014** (0.014–0.015)	**0.015** (0.014–0.016)	**0.016** (0.015–0.017)	**0.017** (0.016–0.018)
60-day	**0.007** (0.007–0.007)	**0.008** (0.008–0.009)	**0.009** (0.009–0.010)	**0.010** (0.010–0.011)	**0.011** (0.011–0.012)	**0.012** (0.011–0.013)	**0.013** (0.012–0.013)	**0.013** (0.012–0.014)	**0.014** (0.013–0.015)	**0.015** (0.014–0.015)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

Appendix D

BL Companies
Architecture
Engineering
Environmental
Land Surveying

An Employee-Owned Company

DOLLAR GENERAL - MASSILLON
WQv Calculation

WQv for redeveloped areas:
Required WQv= 0.9*A * [(Rv*0.2)+(Rv2-Rv1)]/12 * 43,560

where:	WQv=	Water Quality Volume, cf		
	A=	Total site area (acres)	1.57	acres
	Rv1=	volumetric runoff coefficient for existing conditions	0.16	
		Impervious Area Pre (Acres)=	0.19	
	Rv2=	volumetric runoff coefficient for proposed conditions	0.50	
		Impervious Area Post (Acres)=	0.79	

Drainage area=	1.57	ac.
Required WQv=	2,280	cf.
Sediment Storage 20%=	456	cf.

Required Orifice Size:

ED Basin orifice elevation=	929		
WQv elevation=	930.37		(see storage table)
Average Head=	0.685		
Required Average flow over 48 hours=	0.01	cfs	(WQV/172,800sec)
Required orifice area=	0.0033	sf	
Required orifice diameter=	0.8	in	

Note: Cells in yellow are input areas and are site specific.

Stage-Area-Storage for Pond 4P: Detention Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
928.50	588	0	929.02	1,137	451
928.51	599	6	929.03	1,143	462
928.52	609	12	929.04	1,149	474
928.53	620	18	929.05	1,154	485
928.54	631	24	929.06	1,160	497
928.55	642	31	929.07	1,166	508
928.56	652	37	929.08	1,172	520
928.57	663	44	929.09	1,178	532
928.58	674	50	929.10	1,184	544
928.59	685	57	929.11	1,190	556
928.60	695	64	929.12	1,196	567
928.61	706	71	929.13	1,201	579
928.62	717	78	929.14	1,207	592
928.63	728	86	929.15	1,213	604
928.64	738	93	929.16	1,219	616
928.65	749	100	929.17	1,225	628
928.66	760	108	929.18	1,231	640
928.67	771	115	929.19	1,237	653
928.68	781	123	929.20	1,243	665
928.69	792	131	929.21	1,248	677
928.70	803	139	929.22	1,254	690
928.71	814	147	929.23	1,260	703
928.72	824	155	929.24	1,266	715
928.73	835	164	929.25	1,272	728
928.74	846	172	929.26	1,278	741
928.75	857	181	929.27	1,284	753
928.76	867	189	929.28	1,290	766
928.77	878	198	929.29	1,296	779
928.78	889	207	929.30	1,301	792
928.79	899	216	929.31	1,307	805
928.80	910	225	929.32	1,313	818
928.81	921	234	929.33	1,319	832
928.82	932	243	929.34	1,325	845
928.83	942	253	929.35	1,331	858
928.84	953	262	929.36	1,337	871
928.85	964	272	929.37	1,343	885
928.86	975	281	929.38	1,348	898
928.87	985	291	929.39	1,354	912
928.88	996	301	929.40	1,360	925
928.89	1,007	311	929.41	1,366	939
928.90	1,018	321	929.42	1,372	953
928.91	1,028	331	929.43	1,378	966
928.92	1,039	342	929.44	1,384	980
928.93	1,050	352	929.45	1,390	994
928.94	1,061	363	929.46	1,395	1,008
928.95	1,071	373	929.47	1,401	1,022
928.96	1,082	384	929.48	1,407	1,036
928.97	1,093	395	929.49	1,413	1,050
928.98	1,104	406	929.50	1,419	1,064
928.99	1,114	417	929.51	1,425	1,078
929.00	1,125	428	929.52	1,431	1,093
929.01	1,131	440	929.53	1,437	1,107

SEDIMENT STORAGE

Stage-Area-Storage for Pond 4P: Detention Basin (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
929.54	1,443	1,121
929.55	1,448	1,136
929.56	1,454	1,150
929.57	1,460	1,165
929.58	1,466	1,180
929.59	1,472	1,194
929.60	1,478	1,209
929.61	1,484	1,224
929.62	1,490	1,239
929.63	1,495	1,254
929.64	1,501	1,269
929.65	1,507	1,284
929.66	1,513	1,299
929.67	1,519	1,314
929.68	1,525	1,329
929.69	1,531	1,344
929.70	1,537	1,360
929.71	1,542	1,375
929.72	1,548	1,391
929.73	1,554	1,406
929.74	1,560	1,422
929.75	1,566	1,437
929.76	1,572	1,453
929.77	1,578	1,469
929.78	1,584	1,485
929.79	1,590	1,500
929.80	1,595	1,516
929.81	1,601	1,532
929.82	1,607	1,548
929.83	1,613	1,565
929.84	1,619	1,581
929.85	1,625	1,597
929.86	1,631	1,613
929.87	1,637	1,630
929.88	1,642	1,646
929.89	1,648	1,662
929.90	1,654	1,679
929.91	1,660	1,695
929.92	1,666	1,712
929.93	1,672	1,729
929.94	1,678	1,746
929.95	1,684	1,762
929.96	1,689	1,779
929.97	1,695	1,796
929.98	1,701	1,813
929.99	1,707	1,830
930.00	1,713	1,847
930.01	1,738	1,865
930.02	1,762	1,882
930.03	1,787	1,900
930.04	1,811	1,918
930.05	1,836	1,936
930.06	1,860	1,954
930.07	1,885	1,973
930.08	1,909	1,992
930.09	1,934	2,011
930.10	1,958	2,031
930.11	1,983	2,051
930.12	2,007	2,070
930.13	2,032	2,091
930.14	2,056	2,111
930.15	2,081	2,132
930.16	2,105	2,153
930.17	2,130	2,174
930.18	2,155	2,195
930.19	2,179	2,217
930.20	2,204	2,239
930.21	2,228	2,261
930.22	2,253	2,283
930.23	2,277	2,306
930.24	2,302	2,329
930.25	2,326	2,352
930.26	2,351	2,376
930.27	2,375	2,399
930.28	2,400	2,423
930.29	2,424	2,447
930.30	2,449	2,472
930.31	2,473	2,496
930.32	2,498	2,521
930.33	2,522	2,546
930.34	2,547	2,571
930.35	2,572	2,597
930.36	2,596	2,623
930.37	2,621	2,649
930.38	2,645	2,675
930.39	2,670	2,702
930.40	2,694	2,729
930.41	2,719	2,756
930.42	2,743	2,783
930.43	2,768	2,811
930.44	2,792	2,838
930.45	2,817	2,866
930.46	2,841	2,895
930.47	2,866	2,923
930.48	2,890	2,952
930.49	2,915	2,981
930.50	2,940	3,010
930.51	2,964	3,040
930.52	2,989	3,070
930.53	3,013	3,100
930.54	3,038	3,130
930.55	3,062	3,160
930.56	3,087	3,191
930.57	3,111	3,222

WQv ELEVATION

Appendix E

Project #: 1800612

Project Name: Massillon Dollar General

PROPOSED STORM SEWER COMPUTATION SHEET

Calculated by : HFT Date: 2/26/2019 Just Full Capacity .....10 yr. storm

Checked by: JCJ Date:

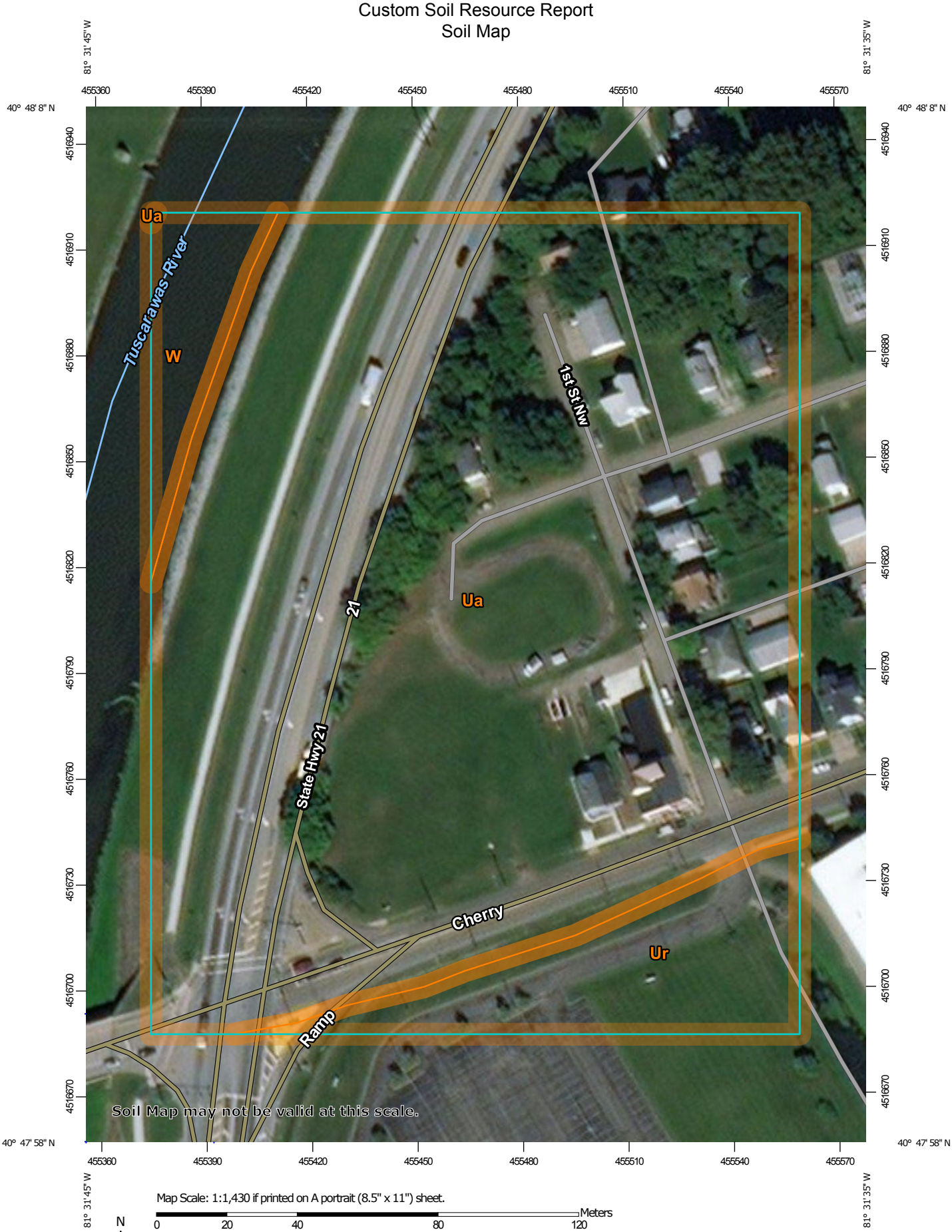
Manning's "n" used for design Q = 0.015

1	2		3	4		5		6	7	8		9	10	11	12	13	14	15	16
MH, CB,	Inlet Station	Outlet Station	Side	Drainage Area in Acres		Time of Concentration		Rainfall in./hr.	"C"	Col. 7 x Col. 4		Discharge 6 x 8	Size of Pipe	Length of Pipe	Slope Pipe	Inlet FL Pipe	Outlet FL Pipe	Vel. Ft/Sec	Cap Q 10
				Delta A	Sum A	Delta A	Sum A	i 10		Delta CA	Sum CA	Q10 (cfs)	Dia"	(ft)	(ft/ft)	Elev.	Elev.	Vm	(cfs)
CB#1	0	119	N/A	0.17	0.17	10.00	10.00	4.90	0.90	0.15	0.15	0.75	12	119	0.0010	930.41	930.29	1.16	0.98
CB#2	119	243	N/A	0.15	0.32	10.00	10.00	4.90	0.90	0.14	0.29	1.41	12	124	0.0010	930.29	930.17	1.22	0.96

NOTE: THE STORM PIPES ARE DESIGNED TO DISTRIBUTE THE FLOW BETWEEN THE TWO DETENTION AREAS AND TO PROVIDE ADDITIONAL STORAGE. THE PIPES WERE NOT DESIGNED IN A CONVENTIOANL MANNER TO THE CONVEY THE 10 YEAR STORM, HOWEVER, THE CAPACITY CALCULATIONS ARE PROVIDED FOR REFERENCE.

Appendix F

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,430 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

Stark County, Ohio

Ua—Udorthents

Map Unit Setting

National map unit symbol: 9nnx
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Ur—Urban land

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.