Preliminary Stormwater Management Plan

prepared for

Blackwell Road
Blue Parkway & Blackwell Road
Lee's Summit, MO 64081

August 6, 2021
Revised: September 7, 2021

prepared by

SCHLAGEL
ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS

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Lenexa, Kansas
(913) 492-5158

Schlagel & Associates Project 20-205

for

Griffin Riley Property Group
21 SE 29th Terrace
Lee's Summit, Missouri 64082

Executive Summary

August 6, 2021

Gene Williams, P.E.
220 SE Green Street
Lee's Summit, MO 64063

RE: Blackwell Road
Blue Parkway & Blackwell Road
Lee's Summit, MO 64081

Dear Gene Williams,

We are submitting the enclosed preliminary stormwater management study in support of the preliminary development plan for Blackwell Road. This report has been prepared to address permitting requirements and provides preliminary design calculations for the required storm water detention and BMP facilities. We have modeled the existing site conditions as they existed at the time this report was prepared.

The proposed site is a 62.40-acre mixed use parcel located in Lee's Summit, MO at the intersection of Blue Parkway and Blackwell Road. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. One Extended Dry Detention Basin (EDDB) and three Extended Wet Detention Basins (EWDB) have been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

Sincerely,

Schlagel & Associates, P.A.

Nick Augustine

Nick Augustine, E.I.T.
Design Engineer

09.06.2021

Mark Breuer, P.E.
Project Engineer

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1.0 GENERAL INFORMATION

Griffin Riley Property Group is proposing to develop the 62.40 acres of land located in Section 11, Township 47 North, Range 31 West, Jackson County, Missouri. The property is located at the intersection of Blue Parkway and Blackwell Road. The proposed development consists of single-family lots, townhomes, apartments, and commercial use along with associated infrastructure.

1.1 OBJECTIVE

The intent of this report is to provide information pertaining to the existing and proposed watersheds, identifying and addressing any downstream drainage issues, determine and address any detention requirements, provide 40-hour extended detention of runoff from the local 90% mean annual event, and address permitting requirements. This study provides the preliminary design calculations for the development of the facility and associated infrastructure. Detailed designs will be required and provided with permit documents.

1.2 METHODOLOGY

The following were utilized in the assessment, preparation and analysis of watersheds in this design concept plan: *Section 5600, 2011, Storm Drainage Systems & Facilities* of the Standard Specifications & Design Criteria of the Kansas City Metropolitan Chapter of the American Public Works Association; *City of Lee's Summit, Missouri Design Criteria (2011 Revision), Storm Drainage Systems & Facilities,* prepared by the City of Lee's Summit, Missouri, Public Works Department.

Watersheds for the site were defined according to soil cover and type, tributary area, and runoff times of concentration. Soil cover was determined from inspection of the site and aerial photography. A soil survey for the project area was obtained from the United States Department of Agriculture, Natural Resources Conservation Service (NRCS), website and was utilized in determining soil type. The entire NRCS Soil Resource

Report can be found in Appendix B. Watershed size was determined from both aerial topography and topographical survey, and by the proposed grading plan.

Times of concentration were compiled according to *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)* methodology for sheet flow, shallow concentrated flow, and channel flow. For this report, sheet flow travel lengths were modeled at a total distance of 100'. Travel times for channel flows were determined using the length and velocity of the open channel. *HydroCAD-10* was utilized to model the runoff. All storm events were modeled using *SCS 24-hour Type II* distributions and were modeled for 2-Year, 10-Year, and 100-Year storm events.

* * * * *

2.0 EXISTING CONDITIONS ANALYSIS

The site lies within the East Fork Little Blue River Watershed. The existing site contains 4 watersheds which have release points located in the southwest, northwest, northern boundary, and eastern boundary of the site. Offsite stormwater comes into the site from south and drains to the release point located along the eastern boundary.

2.1 TRIBUTARY AREAS

The existing drainage tributary map is provided in Appendix A, Figure A.1. The site release points have been identified as Release Point 1(RP-1), Release Point 2 (RP-2), Release Point 3 (RP-3), and Release Point 4 (RP-4). The area has been delineated according to the existing topography and an annotation callout of EX DA-1, EX DA-2, EX DA-3, EX DA-4, and EX OFF DA-4, on Figure A.2, have been provided for the watersheds that drain to the release points RP-1 – RP-4 respectively.

2.2 CURVE NUMBER AND TIME OF CONCENTRATION

The existing curve numbers and time of concentrations for each area have been established based on the procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)*. Existing curve numbers were based upon aerial photography, site inspection, and the soil types present on site.

The NRCS Soil Resource Report indicated that a Hydrologic Soil Group (HSG) of C and D were present on site. A current aerial photograph can be found in Appendix A; it depicts the existing cover conditions. Table 2-1 found in section 2.3 Existing Flow Rates summarizes the curve numbers for each of the watershed areas.

Cover types for existing conditions were considered to be “pasture/grassland” in fair condition for the on-site area, and “Woods/grass combo” in fair condition for the off-site area. Procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds* recommends utilizing curve numbers 79 and 84 for HSG C and D for pasture/grassland, and 76 and 82 for the Woods/Grass combination.

Time of concentration flow paths were based upon sheet flow and shallow concentrated flow for the existing conditions. Sheet flow lengths were limited to where a grade break occurred. Flow was then considered shallow concentrated flow until a channel was visible either from the USGS topographic map or the aerial photograph, and then from that point was considered channel flow determined by the length of the channel and the velocity of flow.

2.3 EXISTING FLOW RATES

Existing flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Offsite runoff is included in the calculations for Table 2-1 below for existing site conditions. Appropriate runoff coefficient curve numbers were based upon aerial photography, site inspection, and the soil types present on site. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B.

Table 2-1 - Existing Flow Rates

Drainage Sub-Basin	Area (Acres)	CN	Storm Event	Runoff (CFS)
EX DA-1	9.52	79	2-YR	14.34
			10-YR	28.81
			100-YR	48.20
EX DA-2	4.28	80	2-YR	7.26
			10-YR	14.09
			100-YR	23.62
EX DA-3	29.35	80	2-YR	36.97
			10-YR	72.33
			100-YR	121.81
EX DA-4	19.25	82	2-YR	31.44
			10-YR	64.09
			100-YR	110.52
EX OFF DA-4	4.58	92	2-YR	11.43
			10-YR	18.56
			100-YR	27.98

2.4 DOWNSTREAM DRAINAGE ISSUES

The existing downstream drainage system has been reviewed with this development plan. FEMA flood maps have been checked and currently no immediate downstream issues appear to be present. A FEMA FIRMette is included in Appendix A. The project lies outside of the identified FEMA floodplain per map numbers 29095C0437G, 29095C0439G, 29095C0441G, and 29095C0445G.

2.5 AGENCY REVIEW

Permitting requirements of the following agencies were reviewed as part of the existing conditions analysis.

2.5.1 Corps of Engineers Review

The National Wetlands Inventory (NWI) map was reviewed for the site and there are no identified wetlands located within the project site. The NWI map can be found in Appendix A. We do not anticipate any Corps of Engineers requirements associated with this project at this time.

2.5.2 FEMA Requirements

No FEMA identified floodplain is located on the proposed property per Flood Insurance Rate Map Panel Nos. 29095C0437G, 29095C0439G, 29095C0441G, and 29095C0445G. There is currently no work proposed in the regulated floodplain. Please see the attached FEMA FIRMette in Appendix A.

2.5.3 Missouri Department of Natural Resources

All land disturbance activities will be permitted in accordance with the City of Lee's Summit, MO specifications as well as the Missouri Department of Water Pollution Control general permit under the National Pollution Discharge Elimination System (NPDES) and an authorized Notice of Intent (NOI) application form. The disturbance of the site is greater than one acre; therefore, NPDES and NOI applications are required with the future permitting of the site in compliance with local, state and federal guidelines.

* * * * *

3.0 PROPOSED CONDITIONS ANALYSIS

With the proposed development, the site watershed will be divided into four sub-basins for analysis. These sub-basins correspond to: Release Points 1-4. Stormwater runoff will be conveyed through the site via open sheet flow, shallow concentrated flow, one extended dry detention basin, and 3 extended wet detention basins. All detention facilities have been designed to detain the 2-Year, 10- Year, and 100-Year storm events.

All components of the overland and enclosed storm sewer systems will meet or exceed the specifications provided in *Section 5600 – Storm Drainage Systems & Facilities* of the *Standard Specifications and Design Criteria* compiled by the Kansas City Metropolitan Chapter of the American Public Works Association.

3.1 TRIBUTARY AREAS

RP-1 will be divided into two sub-catchments, Onsite 1 and Onsite 2. Onsite 1 will bypass the proposed extended dry detention basin, while Onsite 2 will be collected by the extended dry detention basin and then released to two existing 24” pipes located under Blue Parkway. RP-2 sub-catchment existing flows are proposed to be routed to the detention facility located in the northeast corner of the site. RP-3 will also be divided into two sub-catchments, Onsite 4 and Onsite 5. Onsite 4 will be collected by a proposed extended wet detention basin. It will then be routed downstream to a second proposed extended wet detention basin that will collect Onsite 5 and then be released via storm sewer to an existing area inlet located directly north of our proposed site. Final design of this basin will be designed to ensure the downstream storm sewer system does not exceed the 100-year storm event. RP-4 sub-catchment, Onsite 6, will be collected by an extended wet detention basin. The proposed extended wet detention basin will also collect the off-site area, EX OFF, from the south. Stormwater runoff will be released into the existing swale and continue to flow to the northeast.

3.2 CURVE NUMBER AND TIME OF CONCENTRATION

Curve numbers for the proposed development were developed in a similar manner as the existing conditions. Hydrologic Soil Group (HSG) of D was utilized for post-development conditions. Cover types for the proposed conditions were considered to be 1/8 acre lots, Single Family lots, and urban commercial in good condition.

Time of concentration was established in a similar manner as the existing conditions. Shallow concentrated flow lengths were shortened and considered paved. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B. Appendix A, Figure A.2 depicts the proposed drainage conditions.

3.3 PROPOSED FLOW RATES

Proposed flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Detailed calculations can be found in the HydroCAD Model Output Report in Appendix B.

Table 3-1 – HydroCAD Runoff Conditions

Drainage Sub-Basin	Drainage Area (Acres)	Storm Event	Peak Discharge (CFS)
OnSite 1	0.54	2-YR	2.43
		10-YR	3.79
		100-YR	5.58
OnSite 2	4.97	2-YR	22.39
		10-YR	34.88
		100-YR	51.36
OnSite 3	10.76	2-YR	44.14
		10-YR	71.05
		100-YR	106.44
OnSite 4	25.50	2-YR	88.82
		10-YR	143.48
		100-YR	215.38
OnSite 5	20.47	2-YR	83.49
		10-YR	130.29
		100-YR	192.01
EX OFF	4.58	2-YR	11.43
		10-YR	18.56
		100-YR	27.98

3.4 DETENTION ANALYSIS

The runoff hydrographs utilized to determine the peak flow volumes for each tributary area were determined using *TR-55* methodology and *HydroCAD-10*. For the 2-Year, 10-

Year, and 100-Year storm events, the complete hydrograph routing and model output can be found in the HydroCAD Model Output Report in Appendix B.

The site will need to provide detention that meets the requirement under the Comprehensive Control release rates under Section 5608.4C1a and 5608.4C1b of the APWA. This entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events, as well as providing 40-Hour extended detention of runoff from the local 90% mean annual event. The post-development peak discharge rates from the site shall not exceed the following:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

For Release Points 1, 3, and 4, HydroCAD output represents the design release rate. For Release Point 2, we are proposed to route all existing flows to the proposed detention facility located in the northeast corner of the site.

Table 3-1 – HydroCAD Runoff Conditions are shown in Table 3-3.B - Required & Proposed Runoff Comparison. The proposed post-development design release rates are shown next to the allowable release rates for comparison.

Table 3-2.B – Allowable Release Rate Calculations

	Allowable Release Rate (CFS) Calculations				
Release Point	Area (Acres)	Storm Event	Allowable On-Site Release Rate (CFS) (A)	Allowable Off-Site Release Rate (CFS) (B)	Allowable Release Rate (CFS) (A+B)
RP-1	5.51	2-YR	2.76	0.00	2.76
		10-YR	11.02	0.00	11.02
		100-YR	16.53	0.00	16.53
RP-3	36.31	2-YR	18.16	0.00	18.16
		10-YR	72.62	0.00	72.62
		100-YR	108.93	0.00	108.93
RP-4	20.47	2-YR	10.24	11.43	21.67
		10-YR	40.94	18.56	59.50
		100-YR	61.41	27.98	89.39

Table 3-3.B - Required & Proposed Runoff Comparison

Site Release Information (cubic feet per second) (w/ EDDB)				
Area	Drainage Area	Storm Event	Allowable Release Rate (CFS)	Design Release Rate (CFS)
RP-1	5.51	2-YR	2.76	2.67
		10-YR	11.02	4.05
		100-YR	16.53	15.22
RP-3	36.31	2-YR	18.16	13.80
		10-YR	72.62	35.30
		100-YR	108.93	87.30
RP-4	20.47	2-YR	21.67	4.69
		10-YR	59.50	10.37
		100-YR	89.39	12.89

Please note: Site release rates are not a direct addition of sub-basin runoff due to differences in the time peak as well as storage effects within the basins.

Proposed stormwater drainage structures will be located throughout the site to capture and convey proposed stormwater runoff to both dry detention basins. The Water Quality volume for all proposed basins will be released over 40 hours. Water quality outlet structures have been provided for each basin and have been designed to meet the allowable release rates provided in Table 3-2 for the 2, 10, and 100 year storm events. The water quality storm event will be controlled by a 15” riser pipe with 1” diameter orifices evenly spaced across the pipe for the extended dry detention basin, and V-notch weirs will be utilized for all proposed extended wet detention basins.

Emergency spillways will be provided for each basin per Section 5600 of the Design and Construction Manual. Each emergency spillway will be set 0.5 feet above the 100-year water surface elevation and designed to carry the 100-year storm event assuming a 100% clogged condition. An additional 1 foot of freeboard will be provided from the

water surface elevation in the spillway and the top of dam. Final emergency spillway details will be provided with the Final Stormwater Management Report and construction documents.

Additionally, erosion control procedures will be designed and implemented at the outlets to reduce impact on the site downstream.

* * * * *

4.0 SUMMARY AND RECOMMENDATIONS

The proposed drainage site is a 62.40-acre mixed use parcel of land located in Lee's Summit, MO at the intersection of Blue Parkway and Blackwell Road. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. One extended dry detention basin and three extended wet detention basins have been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

* * * *

APPENDIX A

-Existing Site Aerial Photograph

-Existing Drainage Map

-Proposed Drainage Map

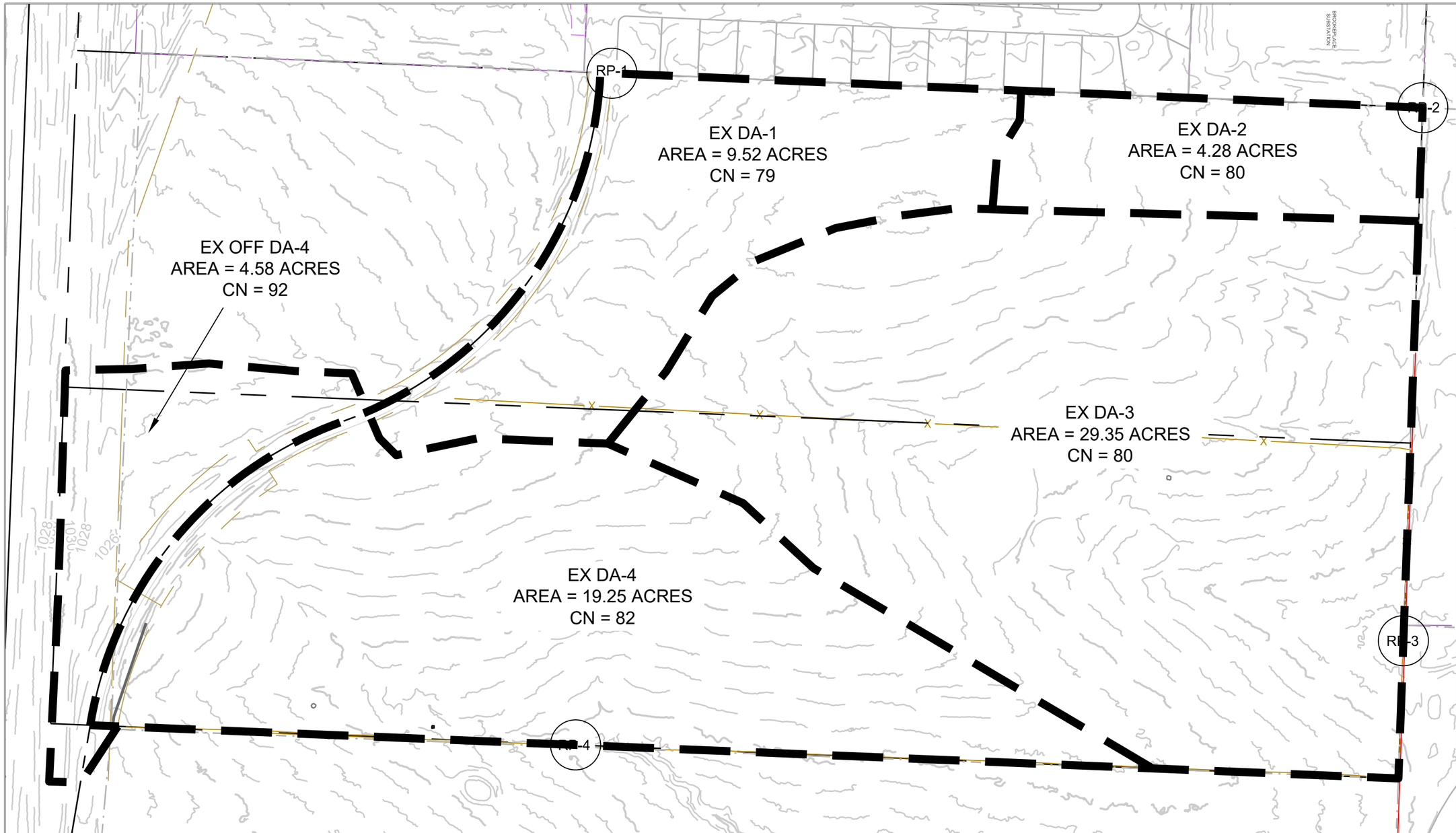
-EDDB Water Quality Design

-EWDB Water Quality Design

-FEMA FIRMette

-National Wetlands Inventory


Google Earth
Imagery date: 2/21/20–newer
300 m
Camera: 3,003 m 38°54'21"N 94°18'38"W 302 m



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BLACKWELL ROAD HYDRO MAPS

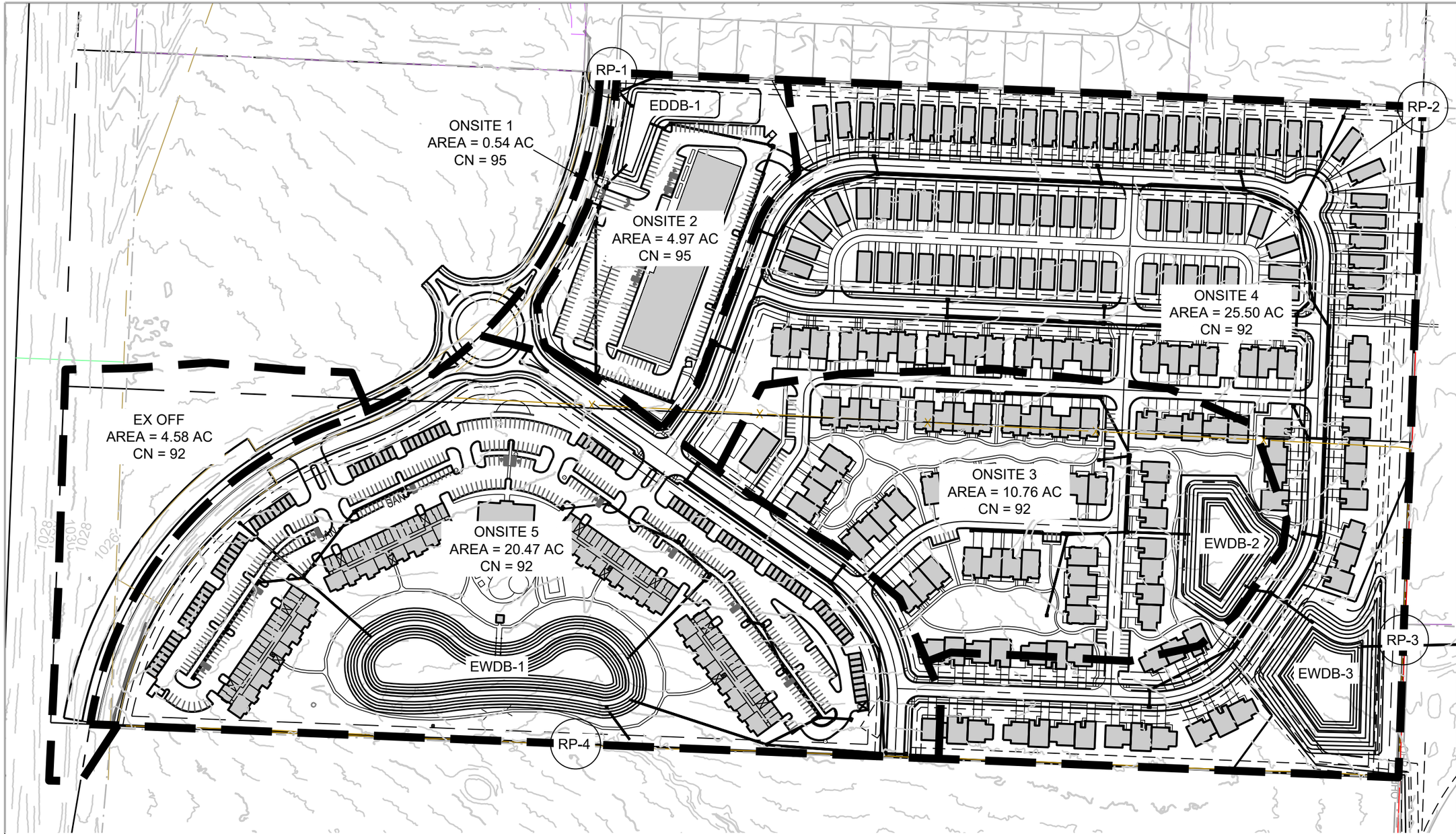
BLUE PARKWAY & BLACKWELL ROAD LEE'S SUMMIT, MISSOURI

DRAWN BY:	DATE PREPARED:	PROJ. NUMBER:
NCA	08/06/2021	20-205

EXISTING DRAINAGE MAP

SHEET A.1

I:\PROJECTS\2020\20-205\3.0 Design\4.0 Civil\2.0 Hydro\Preliminary\HydroMaps\20-205-HYDRO-EX.dwg, 9/3/2021 1:21:51 PM



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0 200' 400'

SCALE: 1" = 200'

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BLACKWELL ROAD
HYDRO MAPS

BLUE PARKWAY & BLACKWELL ROAD LEE'S
SUMMIT, MISSOURI

DRAWN BY:	DATE PREPARED:	PROJ. NUMBER:
NCA	08/06/2021	20-205

PROPOSED
DRAINAGE MAP

SHEET
A.2

Water Quality Volume Calculation - EDDB#1

WQV = P * Weighted RV

WQV - Water Quality Volume (watershed-inches)
P - Rainfall Event (1.37 inches in Kansas City)
RV - Volumetric Runoff Coefficient

RV = 0.05 + 0.009(I)

I - Percent Site Imperviousness (%)

I. Determine Weighted RV & Weighted Rational C Coefficient

Cover Type	% Impervious	Area (Ac.)	Total Impervious Area (Ac.)	Rational Runoff Coefficient	RV	C * Area	RV * Area
Commercial	85	4.97	4.22	0.81	0.82	4.03	4.05
Total	**85**	**4.97**	**4.22**			**4.03**	**4.05**

Rv = Sum(Rv*A)/Total Area = 4.051 / 4.97 = 0.815

C = Sum(C*A)/Total Area = 4.026 / 4.97 = 0.810

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.815 = **1.117 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 4.97 acres
WQV = 1.117 in

WQV = (4.97 * 1.116)/12 = **0.46 ac-ft** 20143.79 c.f.

IV. Peak rate of runoff for WQv

Q = K*C*i*A
K = 1 for WQv
C = 0.3 + 0.6 I
I = Percent impervious
i = Rainfall Intensity from Table 9 in BMP manual

C = 0.3+0.6*I = 0.81
K = 1.00
i = 1.90
Q (cfs) = **7.65**

Design Procedure Form: Extended Dry Detention Basin (EDDB)
Main Worksheet

Designer:	NCA
Checked by:	MAB
Company:	SCHLAGEL & ASSOCIATES, P.A.
Date:	8/2/2021
Project:	20-205
Location:	

EDDB#1

I. Basin Water Quality Storage Volume:

Step 1) Tributary Area to EDDB, A_T (ac.)	A_T (ac.) =	4.97
Step 2) Calculate WQv using method in Section 6.1	WQv (ac-ft) =	0.46
Step 3) Add 20 percent to account for silt and sand sediment deposition in the basin	V_{design} (ac-ft) =	0.55

IIa. Water Quality Outlet Type

Step 1) Set Water Quality Outlet Type — Outlet Type = 1.00

Type 1 = Single Orifice
Type 2 = Perforated riser or plate
Type 3 = v-notch weir

Step 2) Proceed to step 2b, 2c, or 2d based on water quality outlet type

IIb. Water Quality Outlet, Single Orifice

Step 1) Depth of water quality volume at outlet, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	3.70
Step 2) Average head of Water Quality volume over invert of orifice, H_{WQ} (ft) $H_{WQ} = 0.5 * Z_{WQ}$	H_{WQ} (ft.) =	1.85
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) $Q_{WQ} = (WQv * 43{,}560)/(40 * 3600)$	Q_{WQ} (cfs) =	0.17
Step 4) Set value of orifice discharge coefficient, C_O $C_O = 0.66$ when thickness of riser/weir plate is = or < orifice diameter $C_O = 0.80$ when thickness of riser/weir plate is > orifice diameter	C_O =	0.66
Step 5) Water quality outlet orifice diameter (4.0-in, min.), D_O (in) $D_O = 12 * 2 * (Q_{WQ}/C_O * \pi * (2 * g * H)^{0.5}))^{0.5}$	D_O (in) =	2.07

Step 6) To size outlet orifice for EDDB with an irregular stage-volume relationship, use Single Outlet Worksheet

IIc. Water Quality Outlet, Perforated Riser

Step 1) Depth at outlet above lowest perforation, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	5.00
Step 2) Recommended maximum outlet area per row, A_O (in^2) $A_O = (WQv)/(0.013 * Z_{WQ}^2 + 0.22 * Z_{WQ} - 0.10)$	A_O (in^2) =	0.35
Step 3) Circular perforation diameter per row assuming a single column, D_1 (in)	D_1 (in) =	0.67
Step 4) Number of Columns, n_c	n_c =	1.00
Step 5) Design circular perforation diameter (should be between 1 and 2 inches), D_{perf} (in)	D_{perf} (in) =	1.00
Step 6) Horizontal perforation column spacing when $n_c > 1$, center to center, S_c If D_{perf} >/= 1.0 in, S_c =4	S_c (in)=	4.00
Step 7) Number of rows (4" vertical spacing between perforations, center to center), n_r	n_r =	16.00

IIb. Water Quality Outlet, V-notch Weir

Step 1) Depth of water quality volume above permanent pool, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	2.50
Step 2) Average head of Water Quality volume over invert of V-notch, H_{WQ} (ft) $H_{WQ} = 0.5 * Z_{WQ}$	H_{WQ} (ft.) =	1.25
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) $Q_{WQ} = (WQv * 43{,}560)/(40 * 3600)$	Q_{WQ} (cfs) =	0.17
Step 4) V-notch weir coefficient, C_V	C_V =	2.50
Step 5) V-notch weir angle, θ (deg) $\theta = 2 * \arctan(Q_{WQ} / C_V * H_{WQ}^{5/2})$ V-notch angle should be at least 20 degeres. Set to 20 degrees if calculated angle is smaller.	θ (deg) =	20.00 Use 20
Step 6) Top width of V-notch weir $W_V = 2 * Z_{WQ} * TAN(\theta/2)$	W_V (ft.) =	0.88

Step 7) To calculate v-notch angle for EDDB with and irregular stage-volume relationship, use the V-notch Weir Worksheet

Extended Wet Detention Basin - EWDB#2

Project: 20-096 CANYON CREEK FOREST
8/2/2021 7:30

Water Quality Volume Calculation

WQV = P * Weighted RV

WQV - Water Quality Volume (watershed-inches)
P - Rainfall Event (1.37 inches in Kansas City)
RV - Volumetric Runoff Coefficient

RV = 0.05 + 0.009(I)

I - Percent Site Imperviousness (%)

I. Determine Weighted RV & Weighted Rational C Coefficient

Cover Type	% Impervious	Area (Ac.)	Total Impervious Area (Ac.)	Rational Runoff Coefficient	RV	C * Area	RV * Area
Commercial	85	20.47	17.40	0.81	0.815	16.5807	16.68305
			0.00		0.05	0	0
Total		**20.47**	**17.40**			**16.581**	**16.68305**

Rv = Sum(Rv*A)/Total Area = 16.68 / 20.47 = 0.815

C = Sum(C*A)/Total Area = 16.58 / 20.47 = 0.810

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.815 = **1.117 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 20.47 acres
WQV = 1.117 in

WQV = (20.47 * 1.116)/12 = **1.90 ac-ft**

Extended Wet Detention Basin - EWDB#2

Design Worksheet

CANYON CREEK FOREST
PRELIMINARY STORMWATER MANAGEMENT PLAN
8/2/2021

I. Basin Water Quality Volume			
Tributary Area to EWDB, A_T	A_T =	20.47	acres
Water Qualtity Volume, WQ_V - See Attached Calculations	WQ_V =	1.905	ac-ft
IIa. Permanent Pool Volume - Method 1			
Average 14 Day Wet Season Rainfal, R_{14}	R_{14} =	2.2	in
Rational Runoff Coefficient, C	C =	0.810	
Permanent Pool Volume by Method 1, V_{P1} $V_{P1} = (C*A_T*R_{14})/12$	V_{P1} =	3.040	ac-ft
IIb. Permanent Pool Volume - Method 2			
Ratio of Basin Volume to Runoff Volume, $V_{B/R}$ (From Figure 12; $V_{B/R}$ should be >= 4.0)	$V_{B/R}$ =	4	
Mean Storm Depth, Sd	Sd =	0.6	in
Impervious Tributary Area, Ai	Ai =	17.40	acres
Permanent Pool Volume by Method 2, V_{P2} $V_{P2} = (V_{B/R}*Sd*Ai)/12$	V_{P2} =	3.480	ac-ft
IIc. Permanent Pool Design Volume			
Design Permanent Pool Volume, V_P (Larger of V_{P1} and V_{P2} plus 20%)	V_P =	4.176	ac-ft
Average Permanent Pool Depth, Z_P	Z_P =	6	ft
Permanent Pool Surface Area, A_P	A_P =	0.696	ac
IIId. Water Quality Outlet - V-Notch Weir			
Depth of Water Quality Volume Above Permanent Pool, Z_{WQ}	Z_{WQ} =	1.25	ft
Average Head of Water Quality Pool Volume Over Invert of V-Notch, H_{WQ} $H_{WQ} = 0.50 * Z_{WQ}$	H_{WQ} =	0.6	ft
Average Water Quality Pool Outflow Rate, Q_{WQ} $Q_{WQ} = (WQ_V * 43560)/(40*3600)$	Q_{WQ} =	0.58	cfs
V-Notch Weir Coefficient, Cv	Cv	2.62	
V-Notch Weir Angle $\Theta = 2*(180/\Pi)*\arctan(Q_{WQ}/(Cv*H_{QW}\text{^}5/2))$ - Not < 20 degrees	Θ =	1.2	deg
V-Notch Weir Top Width, WV $Wv = 2*Z_{WQ}*\tan(\Theta/2)$	Wv =	0.03	ft

Extended Wet Detention Basin - EWDB#2

Project: 20-096 CANYON CREEK FOREST
8/2/2021 7:30

Water Quality Volume Calculation

WQV = P * Weighted RV

WQV - Water Quality Volume (watershed-inches)
P - Rainfall Event (1.37 inches in Kansas City)
RV - Volumetric Runoff Coefficient

RV = 0.05 + 0.009(I)

I - Percent Site Imperviousness (%)

I. Determine Weighted RV & Weighted Rational C Coefficient

Cover Type	% Impervious	Area (Ac.)	Total Impervious Area (Ac.)	Rational Runoff Coefficient	RV	C * Area	RV * Area
Townhomes	65	10.76	6.99	0.66	0.635	7.1016	6.8326
			0.00		0.05	0	0
Total		**10.76**	**6.99**			**7.102**	**6.8326**

Rv = Sum(Rv*A)/Total Area = 6.83 / 10.76 = 0.635

C = Sum(C*A)/Total Area = 7.1 / 10.76 = 0.660

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.635 = **0.870 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 10.76 acres
WQV = 0.870 in

WQV = (10.76 * 0.869)/12 = **0.78 ac-ft**

Extended Wet Detention Basin - EWDB#2

Design Worksheet

CANYON CREEK FOREST
PRELIMINARY STORMWATER MANAGEMENT PLAN
8/2/2021

I. Basin Water Quality Volume			
Tributary Area to EWDB, A_T	A_T =	10.76	acres
Water Qualtity Volume, WQ_V - See Attached Calculations	WQ_V =	0.780	ac-ft
IIa. Permanent Pool Volume - Method 1			
Average 14 Day Wet Season Rainfal, R_{14}	R_{14} =	2.2	in
Rational Runoff Coefficient, C	C =	0.660	
Permanent Pool Volume by Method 1, V_{P1}	V_{P1} =	1.302	ac-ft
$V_{P1} = (C*A_T*R_{14})/12$			
IIb. Permanent Pool Volume - Method 2			
Ratio of Basin Volume to Runoff Volume, $V_{B/R}$	$V_{B/R}$ =	4	
(From Figure 12; $V_{B/R}$ should be >= 4.0)			
Mean Storm Depth, Sd	Sd =	0.6	in
Impervious Tributary Area, Ai	Ai =	6.99	acres
Permanent Pool Volume by Method 2, V_{P2}	V_{P2} =	1.399	ac-ft
$V_{P2} = (V_{B/R}*Sd*Ai)/12$			
IIc. Permanent Pool Design Volume			
Design Permanent Pool Volume, V_P	V_P =	1.679	ac-ft
(Larger of V_{P1} and V_{P2} plus 20%)			
Average Permanent Pool Depth, Z_P	Z_P =	6	ft
Permanent Pool Surface Area, A_P	A_P =	0.280	ac
IIId. Water Quality Outlet - V-Notch Weir			
Depth of Water Quality Volume Above Permanent Pool, Z_{WQ}	Z_{WQ} =	1.5	ft
Average Head of Water Quality Pool Volume Over Invert of V-Notch, H_{WQ}	H_{WQ} =	0.8	ft
$H_{WQ} = 0.50 * Z_{WQ}$			
Average Water Quality Pool Outflow Rate, Q_{WQ}	Q_{WQ} =	0.24	cfs
$Q_{WQ} = (WQ_V * 43560)/(40*3600)$			
V-Notch Weir Coefficient, Cv	Cv	2.62	
V-Notch Weir Angle			
$\Theta = 2*(180/\Pi)*\arctan(Q_{WQ}/(Cv*H_{QW}\text{^}5/2))$ - Not < 20 degrees	Θ =	0.4	deg
V-Notch Weir Top Width, WV	Wv =	0.01	ft
$Wv = 2*Z_{WQ}*\tan(\Theta/2)$			

Extended Wet Detention Basin - EWDB#3

Project: 20-205 Blackwell Road
8/2/2021 7:30

Water Quality Volume Calculation

WQV = P * Weighted RV

WQV - Water Quality Volume (watershed-inches)
P - Rainfall Event (1.37 inches in Kansas City)
RV - Volumetric Runoff Coefficient

RV = 0.05 + 0.009(I)

I - Percent Site Imperviousness (%)

I. Determine Weighted RV & Weighted Rational C Coefficient

Cover Type	% Impervious	Area (Ac.)	Total Impervious Area (Ac.)	Rational Runoff Coefficient	RV	C * Area	RV * Area
Single-Family Lots	53	10.89	5.77	0.66	0.527	7.1874	5.73903
Townhomes	65	12.48	8.11	0.66	0.635	8.2368	7.9248
			0.00		0.05	0	0
Total		**23.37**	**13.88**			**15.424**	**13.66383**

Rv = Sum(Rv*A)/Total Area = 13.66 / 23.37 = 0.585

C = Sum(C*A)/Total Area = 15.42 / 23.37 = 0.660

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.58467: **0.801 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 23.37 acres
WQV = 0.801 in

WQV = (23.37 * 0.801)/12 = **1.56 ac-ft**

Extended Wet Detention Basin - EWDB#2

Design Worksheet

CANYON CREEK FOREST
PRELIMINARY STORMWATER MANAGEMENT PLAN
8/2/2021

I. Basin Water Quality Volume			
Tributary Area to EWDB, A_T	A_T =	23.37	acres
Water Qualtity Volume, WQ_V - See Attached Calculations	WQ_V =	1.560	ac-ft
IIa. Permanent Pool Volume - Method 1			
Average 14 Day Wet Season Rainfal, R_{14}	R_{14} =	2.2	in
Rational Runoff Coefficient, C	C =	0.660	
Permanent Pool Volume by Method 1, V_{P1}	V_{P1} =	2.828	ac-ft
$V_{P1} = (C*A_T*R_{14})/12$			
IIb. Permanent Pool Volume - Method 2			
Ratio of Basin Volume to Runoff Volume, $V_{B/R}$	$V_{B/R}$ =	4	
(From Figure 12; $V_{B/R}$ should be >= 4.0)			
Mean Storm Depth, Sd	Sd =	0.6	in
Impervious Tributary Area, Ai	Ai =	13.88	acres
Permanent Pool Volume by Method 2, V_{P2}	V_{P2} =	2.777	ac-ft
$V_{P2} = (V_{B/R}*Sd*Ai)/12$			
IIc. Permanent Pool Design Volume			
Design Permanent Pool Volume, V_P	V_P =	3.393	ac-ft
(Larger of V_{P1} and V_{P2} plus 20%)			
Average Permanent Pool Depth, Z_P	Z_P =	6	ft
Permanent Pool Surface Area, A_P	A_P =	0.566	ac
IIId. Water Quality Outlet - V-Notch Weir			
Depth of Water Quality Volume Above Permanent Pool, Z_{WQ}	Z_{WQ} =	2.0	ft
Average Head of Water Quality Pool Volume Over Invert of V-Notch, H_{WQ}	H_{WQ} =	1.0	ft
$H_{WQ} = 0.50 * Z_{WQ}$			
Average Water Quality Pool Outflow Rate, Q_{WQ}	Q_{WQ} =	0.47	cfs
$Q_{WQ} = (WQ_V * 43560)/(40*3600)$			
V-Notch Weir Coefficient, Cv	Cv	2.62	
V-Notch Weir Angle			
$\Theta = 2*(180/\Pi)*\arctan(Q_{WQ}/(Cv*H_{QW}\text{^}5/2))$ - Not < 20 degrees	Θ =	0.4	deg
V-Notch Weir Top Width, WV	Wv =	0.01	ft
$Wv = 2*Z_{WQ}*\tan(\Theta/2)$			

Elevation (ft)	Area (ft^2)	Area (AC)	Δ Volume (ft^3)	Total Volume (ft^3)	Total Volume (ac-ft)
976	11,401	0.262	0	0	0.000
978	14,461	0.332	25,799	25,799	0.592
980	17,901	0.411	32,298	58,097	1.334
982	22,615	0.519	40,420	98,517	2.262
0	0	-	-	-	-
0	0	-	-	-	-
0	0	-	-	-	-
0	0	-	-	-	-

Sediment Basin Design Data Summary - Required on all Sediment Basin Plan Sheets

Permanent Pool

Basin Volume - EWDB

Project #: Canyon Creek Forest 20-096
Time: 8/2/2021 7:30
Work By: RPM

Volume computed using Conic Method For Reservoir Volumes

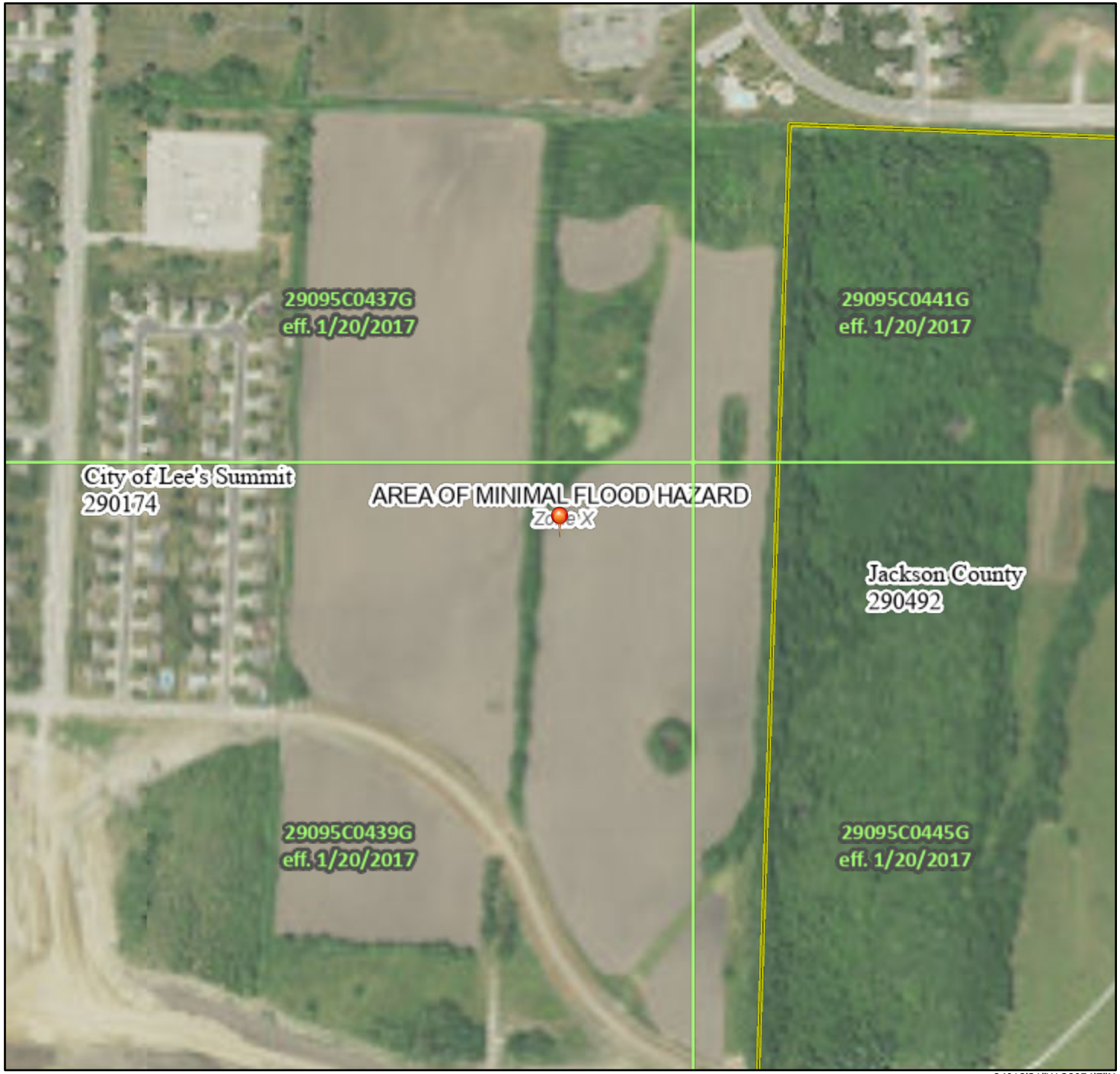
Volume = (1/3) * (EL2-EL1)*(Area1 + Area2 + $(Area1*Area2)^{0.5}$)

Elevation (ft)	Area (ft^2)	Area (AC)	Δ Volume (ft^3)	Total Volume (ft^3)	Total Volume (ac-ft)
968	986.50	0.023	0	0	0.000
970	1964.65	0.045	2895	2895	0.066
972	3258.81	0.075	5169	8064	0.185
974	4868.96	0.112	8073	16137	0.370
975	5792.60	0.133	5324	21461	0.493
976	10290.87	0.236	7934	29395	0.675
0	0.00	-	-	-	-

National Flood Hazard Layer FIRMette

FEMA

94°19'8"W 38°54'35"N



94°18'31"W 38°54'7"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

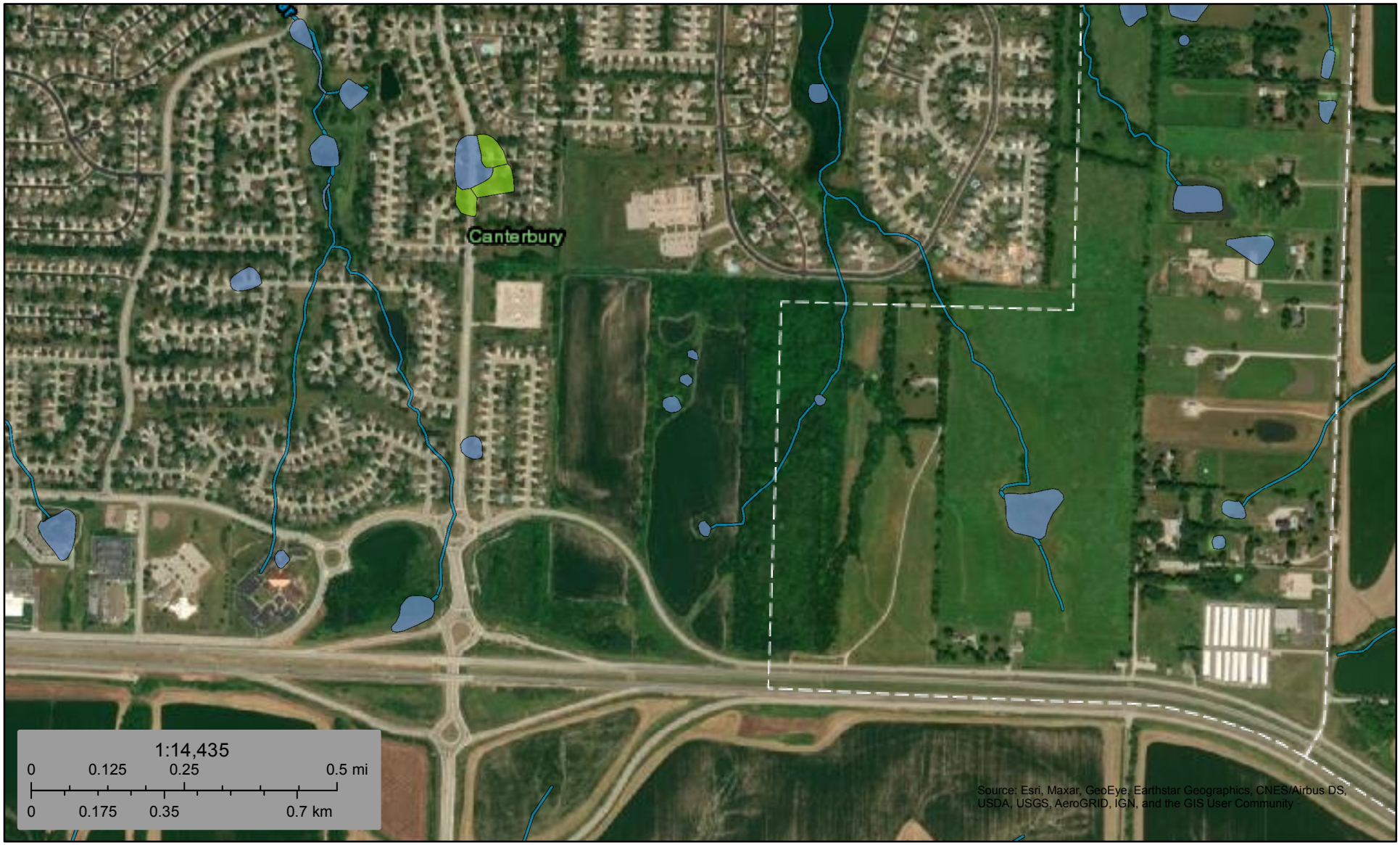
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/30/2021 at 10:56 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetland Inventory Map



July 30, 2021

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

APPENDIX B

-NRCS Soil Resource Report

-HydroCAD Model Output Report

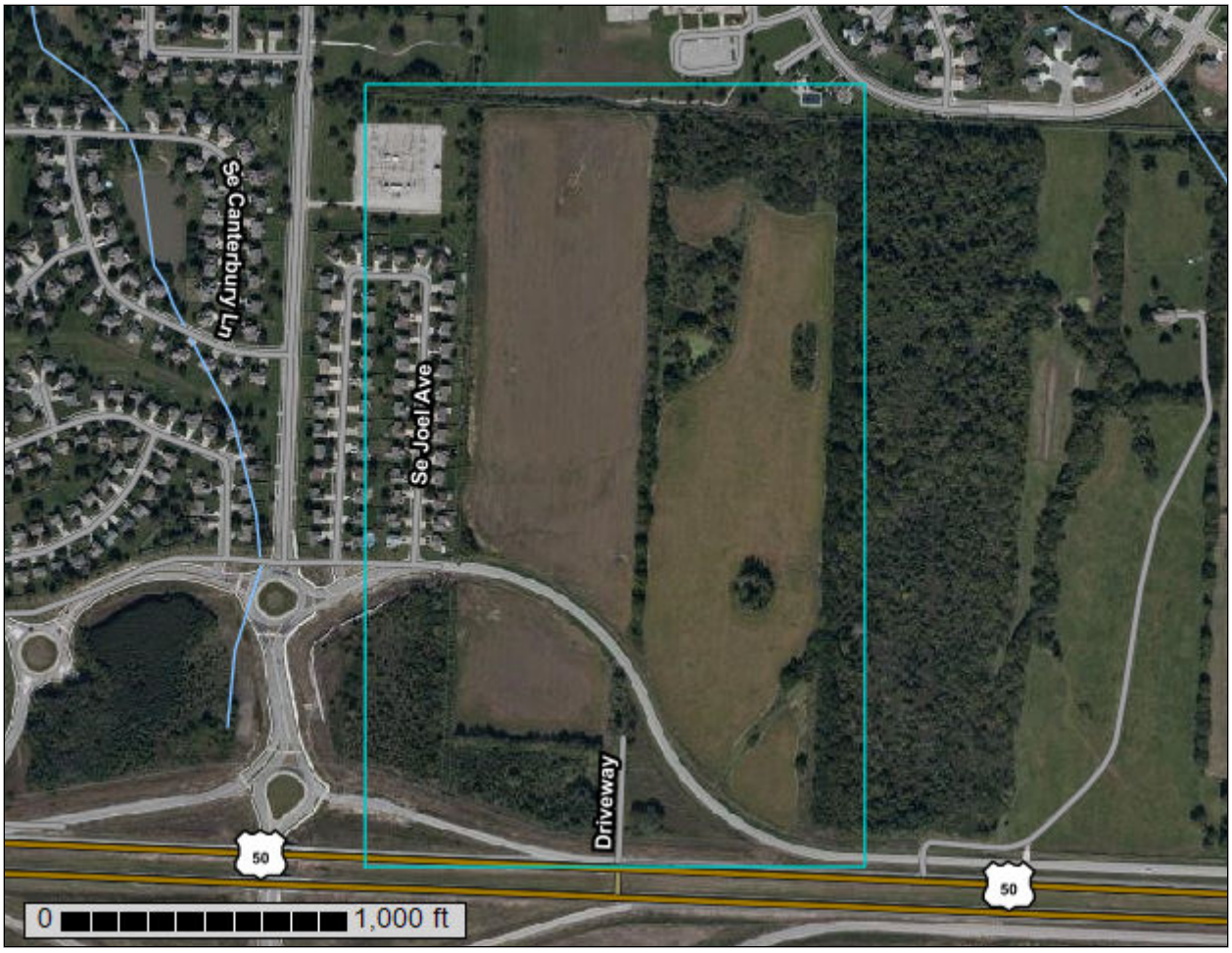
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jackson County, Missouri



July 26, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,870 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 22, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 6, 2019—Nov 16, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10000	Arisburg silt loam, 1 to 5 percent slopes	50.5	46.1%
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	9.1	8.3%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	27.1	24.8%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	5.9	5.4%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	5.8	5.3%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	9.2	8.4%
10183	Udarents-Urban land-Polo complex, 5 to 9 percent slopes	1.9	1.8%
Totals for Area of Interest		**109.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the

scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jackson County, Missouri

10000—Arisburg silt loam, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2w22b
Elevation: 610 to 1,130 feet
Mean annual precipitation: 39 to 43 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Arisburg and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arisburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 13 inches: silt loam
Bt - 13 to 19 inches: silty clay loam
Btg - 19 to 56 inches: silty clay loam
BCg - 56 to 79 inches: silty clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R107BY007MO - Loess Upland Prairie Amorpha canescens/ Andropogon gerardii-Zizia aurea Leadplant/Big Bluestem-Golden Zizia
Hydric soil rating: No

Minor Components

Greenton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Sharpsburg

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Haig

Percent of map unit: 3 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R109XY001MO - Claypan Summit Prairie
Hydric soil rating: Yes

10082—Arisburg-Urban land complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2w7ld
Elevation: 750 to 1,130 feet
Mean annual precipitation: 39 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Arisburg and similar soils: 61 percent
Urban land: 30 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arisburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 13 inches: silt loam
Bt - 13 to 19 inches: silty clay loam
Btg - 19 to 56 inches: silty clay loam
BCg - 56 to 79 inches: silty clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R107BY007MO - Loess Upland Prairie Amorpha canescens/ Andropogon gerardii-Zizia aurea Leadplant/Big Bluestem-Golden Zizia
Hydric soil rating: No

Description of Urban Land

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Sampsel

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Concave
Ecological site: R109XY010MO - Interbedded Sedimentary Upland Savanna
Hydric soil rating: Yes

Greenton

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Sharpsburg

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

10117—Sampsel silty clay loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2qkzz
Elevation: 600 to 900 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Sampsel and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex, concave
Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R109XY010MO - Interbedded Sedimentary Upland Savanna
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

10128—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2ql09
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 60 percent
Urban land: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

A - 0 to 17 inches: silt loam
Bt - 17 to 55 inches: silty clay loam
C - 55 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: R109XY002MO - Loess Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

10180—Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1n85h
Elevation: 600 to 900 feet
Mean annual precipitation: 33 to 43 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Udarents and similar soils: 41 percent
Urban land: 39 percent
Sampsel and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udarents

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill

Typical profile

C1 - 0 to 5 inches: silt loam
C2 - 5 to 80 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R107BY002MO - Deep Loess Upland Prairie Amorpha canescens/Schizachyrium scoparium-Sporobolus heterolepis Leadplant/Little Bluestem-Prairie Dropseed
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex

Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: R109XY010MO - Interbedded Sedimentary Upland Savanna
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

10181—Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 1n85g
Elevation: 600 to 900 feet
Mean annual precipitation: 33 to 43 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Udarents and similar soils: 41 percent
Urban land: 39 percent
Sampsel and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udarents

Setting

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Mine spoil or earthy fill

Typical profile

C1 - 0 to 5 inches: silt loam
C2 - 5 to 80 inches: silty clay loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R107BY002MO - Deep Loess Upland Prairie Amorpha canescens/Schizachyrium scoparium-Sporobolus heterolepis Leadplant/Little Bluestem-Prairie Dropseed
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R109XY010MO - Interbedded Sedimentary Upland Savanna
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

10183—Udarents-Urban land-Polo complex, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 1n85d
Elevation: 600 to 1,000 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Udarents and similar soils: 41 percent
Urban land: 39 percent
Polo and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udarents

Setting

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill

Typical profile

C1 - 0 to 5 inches: silt loam
C2 - 5 to 80 inches: silty clay loam

Properties and qualities

Slope: 5 to 9 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R107BY002MO - Deep Loess Upland Prairie Amorpha canescens/Schizachyrium scoparium-Sporobolus heterolepis Leadplant/Little Bluestem-Prairie Dropseed
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Polo

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave, convex
Parent material: Loess over residuum

Typical profile

A - 0 to 12 inches: silt loam
BA - 12 to 29 inches: silty clay loam
Bt1 - 29 to 35 inches: silty clay loam
2Bt2 - 35 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R107BY007MO - Loess Upland Prairie Amorpha canescens/ Andropogon gerardii-Zizia aurea Leadplant/Big Bluestem-Golden Zizia
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Map Scale: 1:4,870 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 22, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 6, 2019—Nov 16, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10000	Arisburg silt loam, 1 to 5 percent slopes	C	50.5	46.1%
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	C	9.1	8.3%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	C/D	27.1	24.8%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	D	5.9	5.4%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	C	5.8	5.3%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	C	9.2	8.4%
10183	Udarents-Urban land-Polo complex, 5 to 9 percent slopes	C	1.9	1.8%
Totals for Area of Interest			**109.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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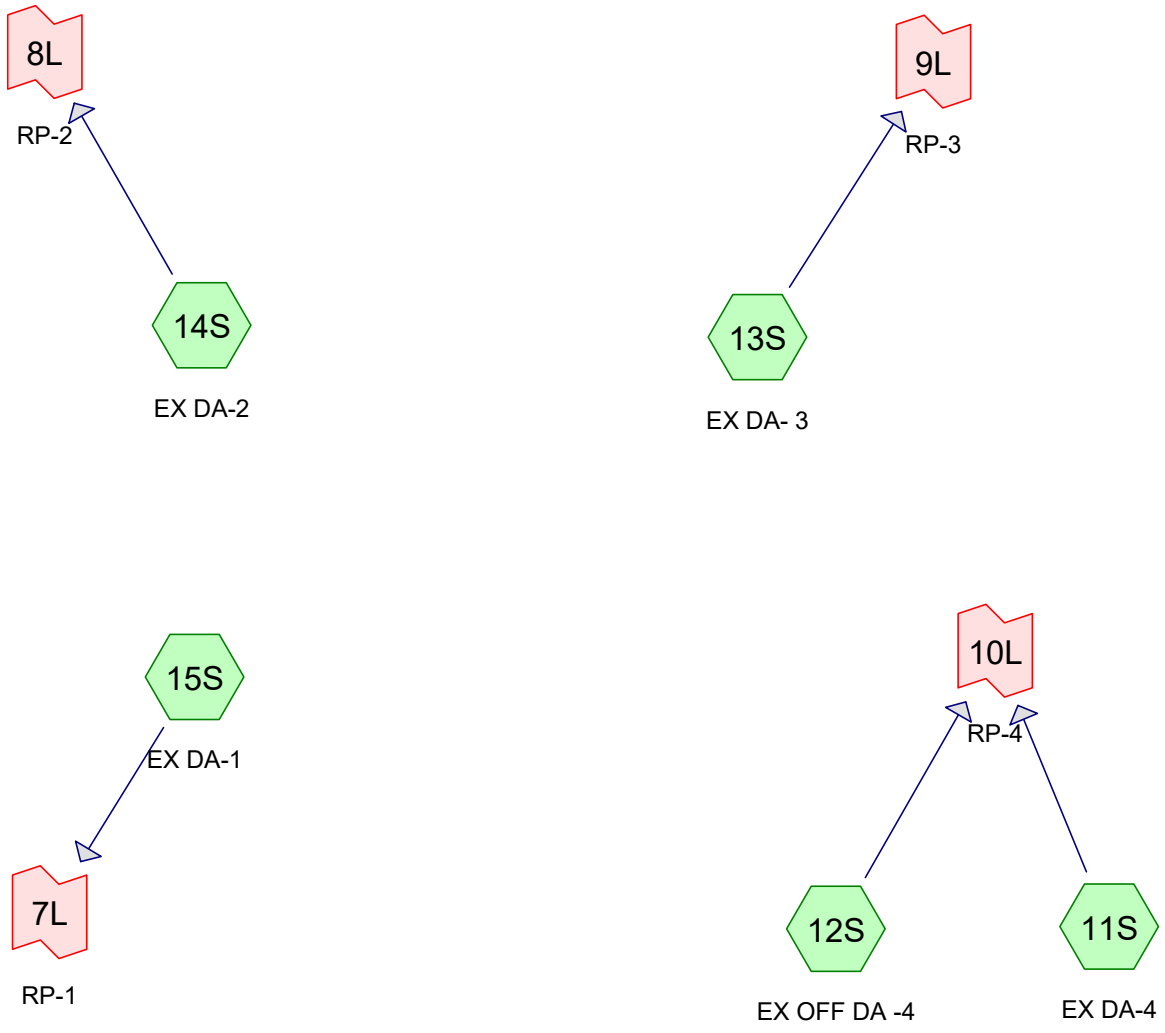
United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Existing Conditions



Subcat Reach Pond Link

Routing Diagram for 20-205-HYDRO-EX
Prepared by {enter your company name here}, Printed 7/30/2021

Summary for Subcatchment 11S: EX DA-4

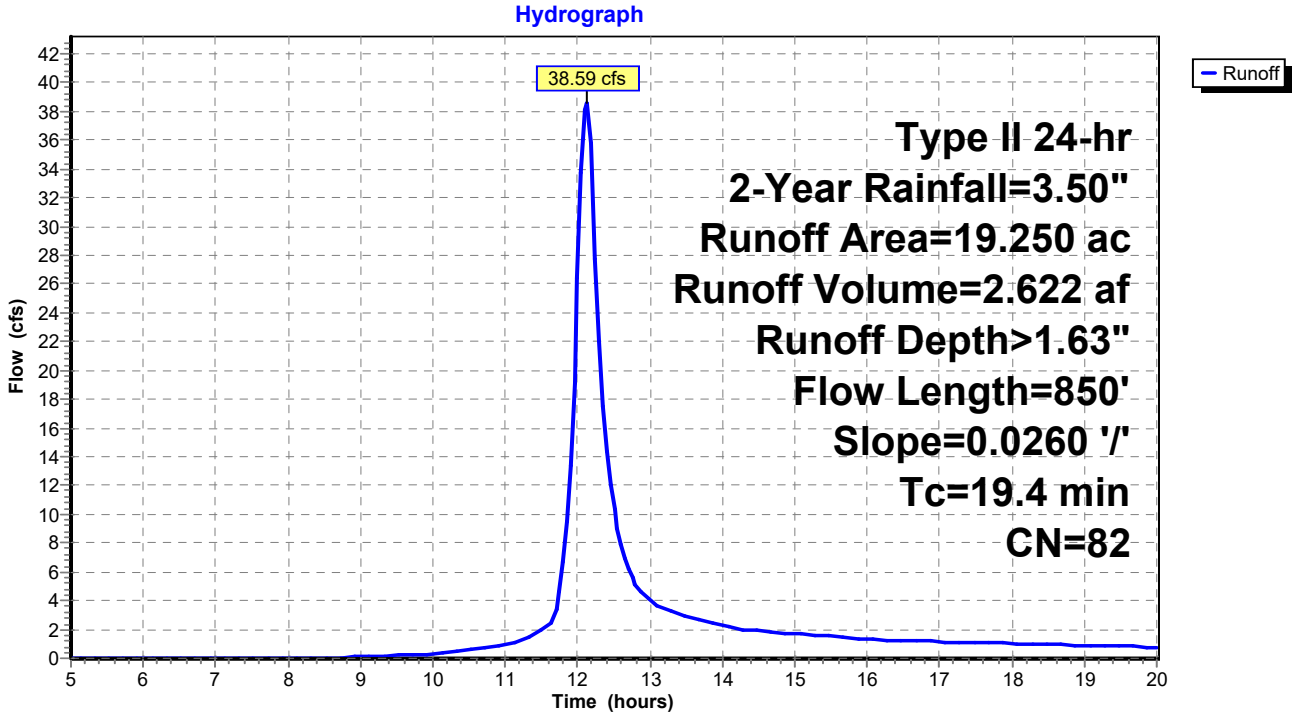
Runoff = 38.59 cfs @ 12.12 hrs, Volume= 2.622 af, Depth> 1.63"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
8.950	79	Pasture/grassland/range, Fair, HSG C
10.300	84	Pasture/grassland/range, Fair, HSG D
19.250	82	Weighted Average
19.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
11.1	750	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.4	850	Total			

Subcatchment 11S: EX DA-4



Summary for Subcatchment 12S: EX OFF DA -4

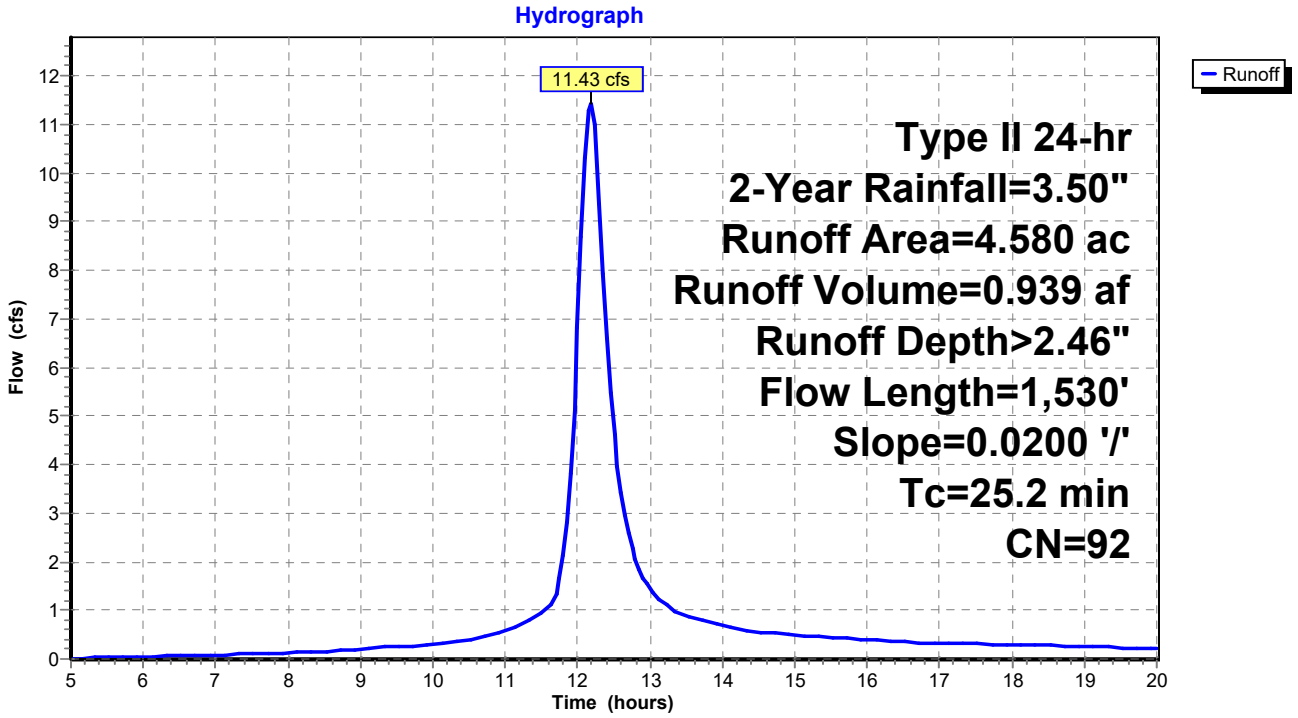
Runoff = 11.43 cfs @ 12.18 hrs, Volume= 0.939 af, Depth> 2.46"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
4.580	92	Paved roads w/open ditches, 50% imp, HSG C
2.290		50.00% Pervious Area
2.290		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
24.1	1,430	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.2	1,530	Total			

Subcatchment 12S: EX OFF DA -4



Summary for Subcatchment 13S: EX DA- 3

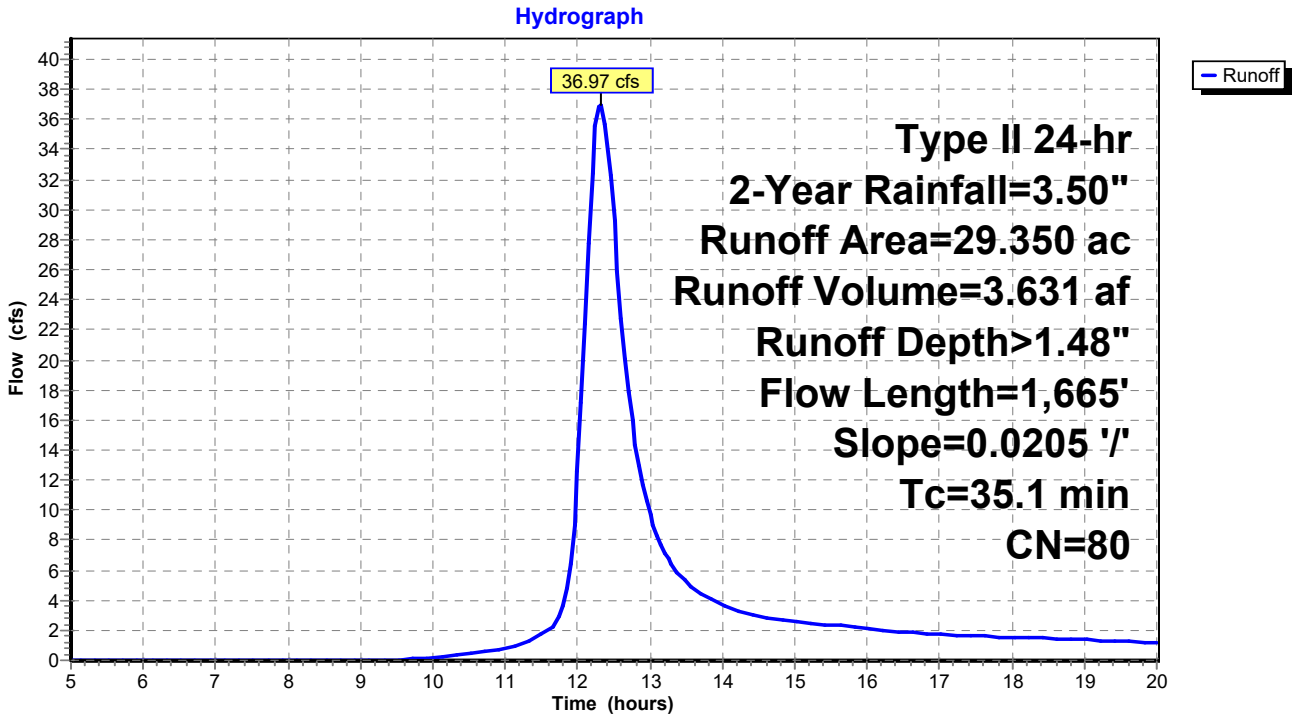
Runoff = 36.97 cfs @ 12.31 hrs, Volume= 3.631 af, Depth> 1.48"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
2.920	76	Woods/grass comb., Fair, HSG C
14.020	79	Pasture/grassland/range, Fair, HSG C
7.890	82	Woods/grass comb., Fair, HSG D
4.520	84	Pasture/grassland/range, Fair, HSG D
29.350	80	Weighted Average
29.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0205	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
26.0	1,565	0.0205	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
35.1	1,665	Total			

Subcatchment 13S: EX DA- 3



Summary for Subcatchment 14S: EX DA-2

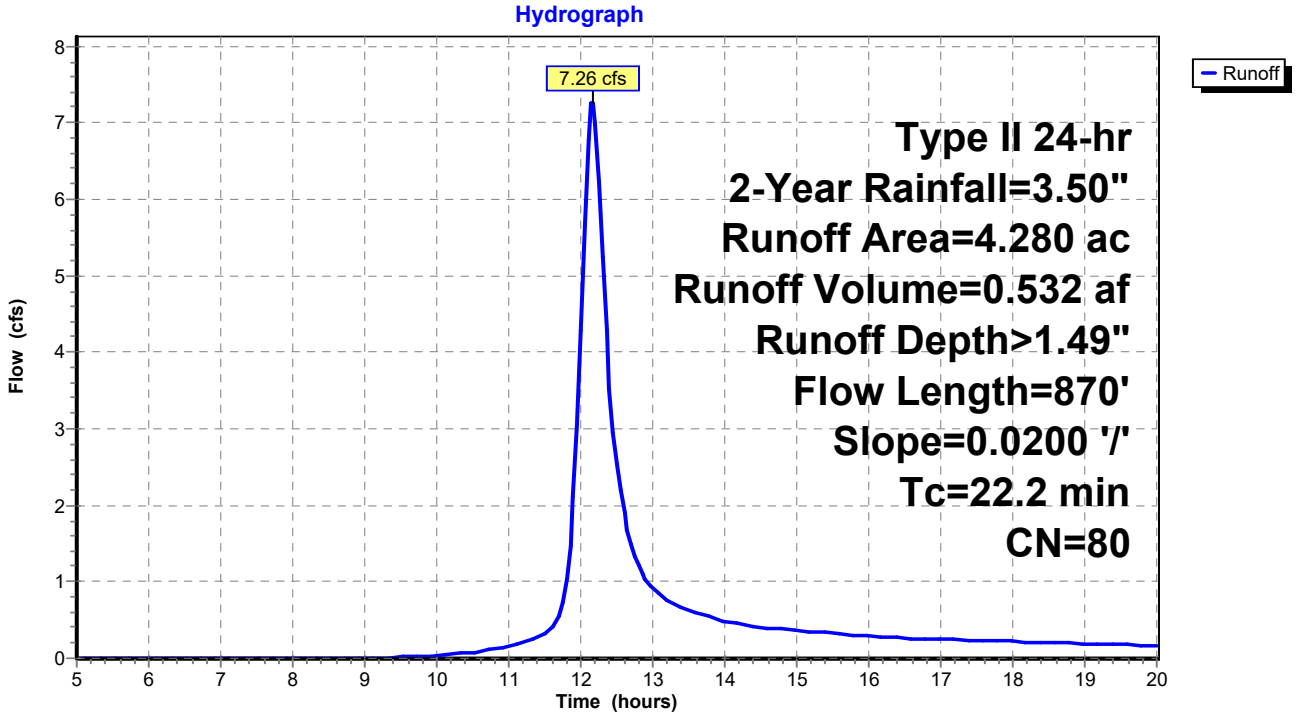
Runoff = 7.26 cfs @ 12.16 hrs, Volume= 0.532 af, Depth> 1.49"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
3.220	79	Pasture/grassland/range, Fair, HSG C
1.060	84	Pasture/grassland/range, Fair, HSG D
4.280	80	Weighted Average
4.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0200	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
13.0	770	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.2	870	Total			

Subcatchment 14S: EX DA-2



Summary for Subcatchment 15S: EX DA-1

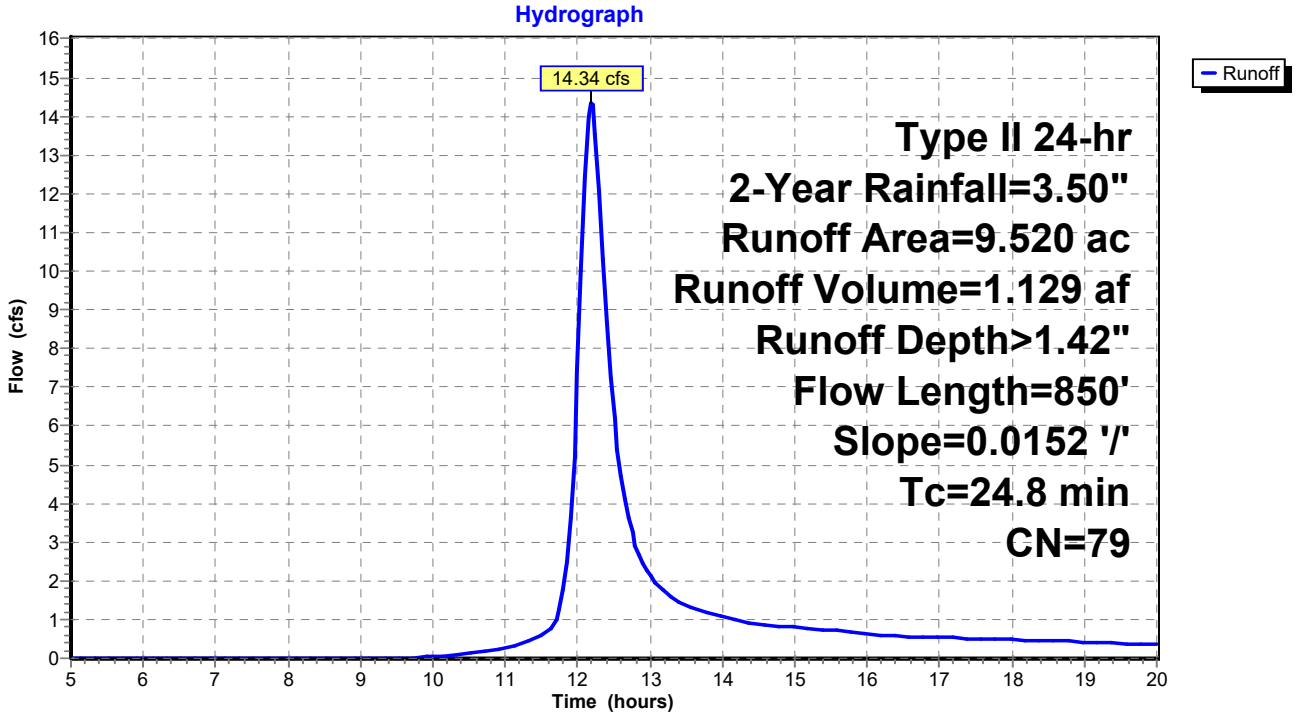
Runoff = 14.34 cfs @ 12.19 hrs, Volume= 1.129 af, Depth> 1.42"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
0.590	76	Woods/grass comb., Fair, HSG C
8.930	79	Pasture/grassland/range, Fair, HSG C
9.520	79	Weighted Average
9.520		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.0152	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
14.5	750	0.0152	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.8	850	Total			

Subcatchment 15S: EX DA-1

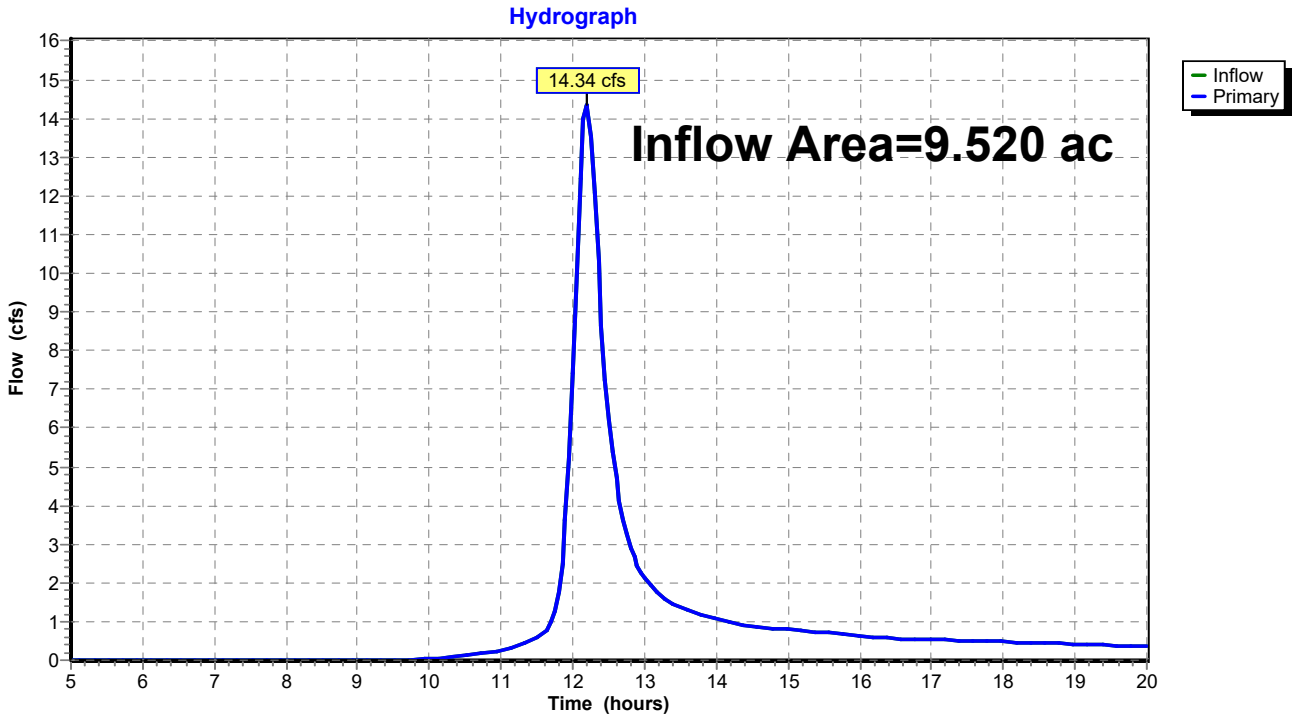


Summary for Link 7L: RP-1

Inflow Area = 9.520 ac, 0.00% Impervious, Inflow Depth > 1.42" for 2-Year event
Inflow = 14.34 cfs @ 12.19 hrs, Volume= 1.129 af
Primary = 14.34 cfs @ 12.19 hrs, Volume= 1.129 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: RP-1

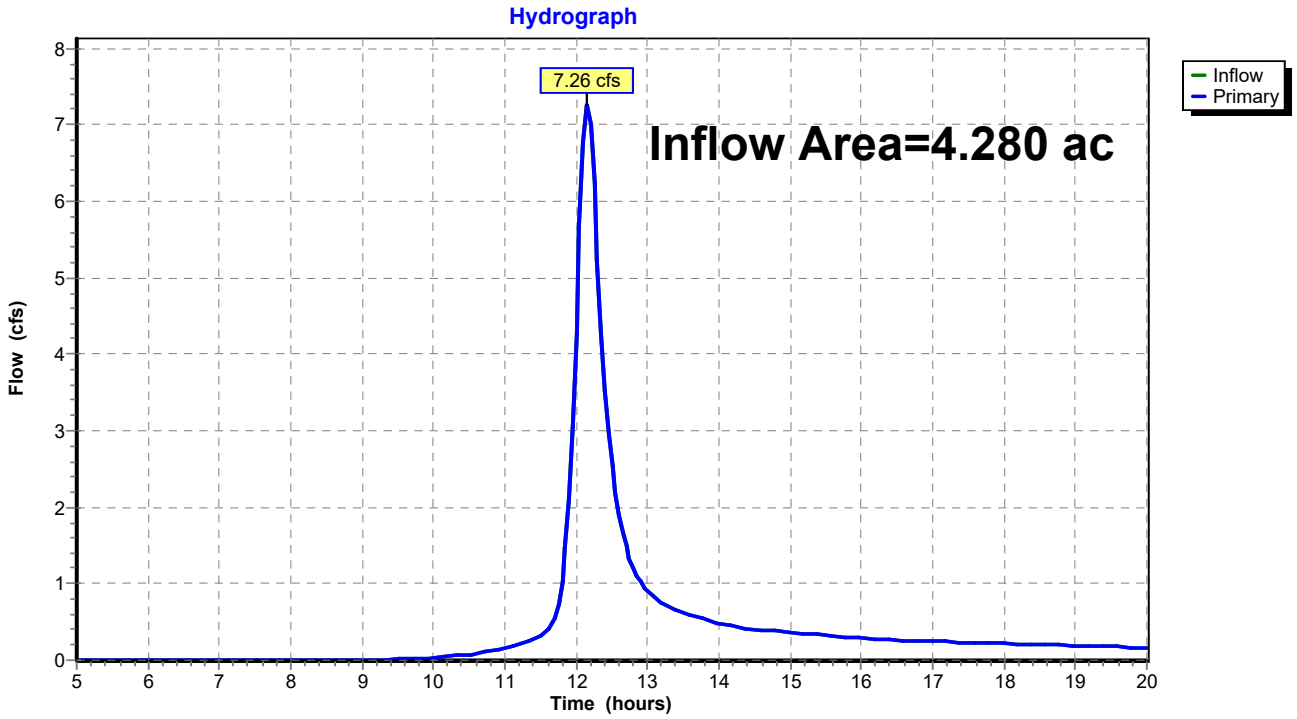


Summary for Link 8L: RP-2

Inflow Area = 4.280 ac, 0.00% Impervious, Inflow Depth > 1.49" for 2-Year event
Inflow = 7.26 cfs @ 12.16 hrs, Volume= 0.532 af
Primary = 7.26 cfs @ 12.16 hrs, Volume= 0.532 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 8L: RP-2

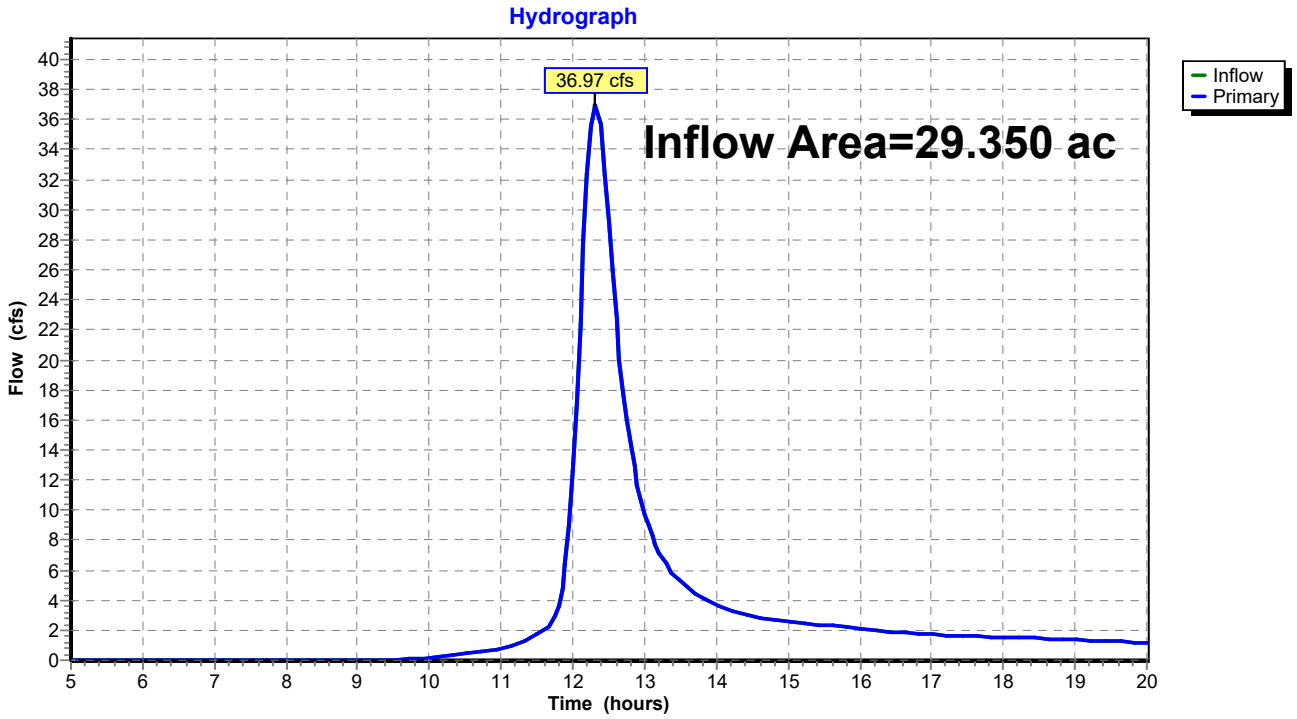


Summary for Link 9L: RP-3

Inflow Area = 29.350 ac, 0.00% Impervious, Inflow Depth > 1.48" for 2-Year event
Inflow = 36.97 cfs @ 12.31 hrs, Volume= 3.631 af
Primary = 36.97 cfs @ 12.31 hrs, Volume= 3.631 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 9L: RP-3

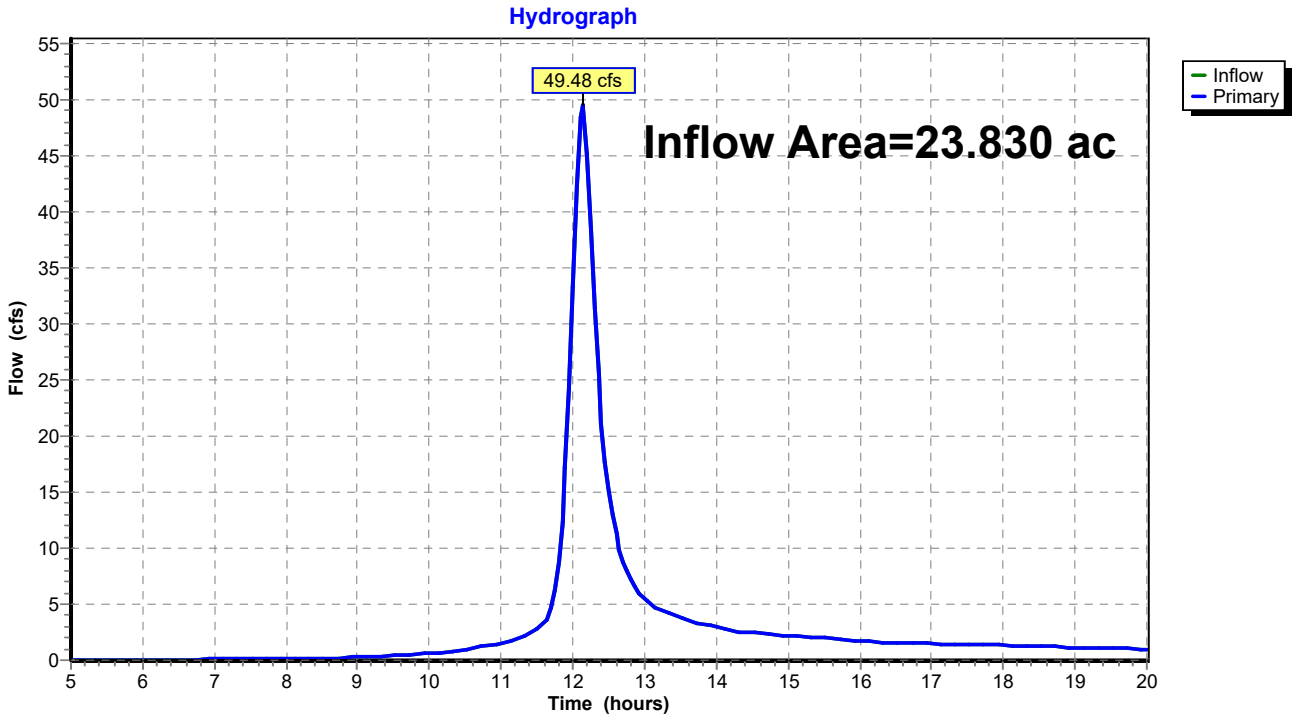


Summary for Link 10L: RP-4

Inflow Area = 23.830 ac, 9.61% Impervious, Inflow Depth > 1.79" for 2-Year event
Inflow = 49.48 cfs @ 12.13 hrs, Volume= 3.560 af
Primary = 49.48 cfs @ 12.13 hrs, Volume= 3.560 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 10L: RP-4



Summary for Subcatchment 11S: EX DA-4

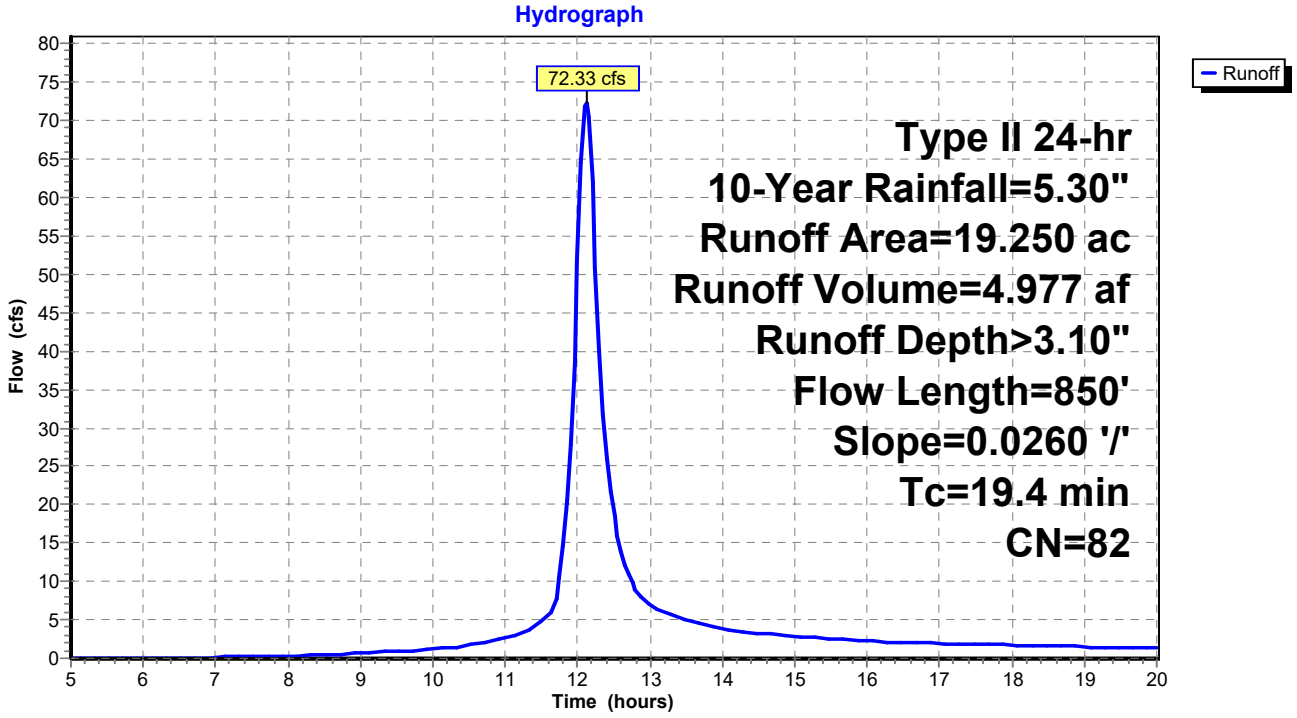
Runoff = 72.33 cfs @ 12.12 hrs, Volume= 4.977 af, Depth> 3.10"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
8.950	79	Pasture/grassland/range, Fair, HSG C
10.300	84	Pasture/grassland/range, Fair, HSG D
19.250	82	Weighted Average
19.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
11.1	750	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.4	850	Total			

Subcatchment 11S: EX DA-4



Summary for Subcatchment 12S: EX OFF DA -4

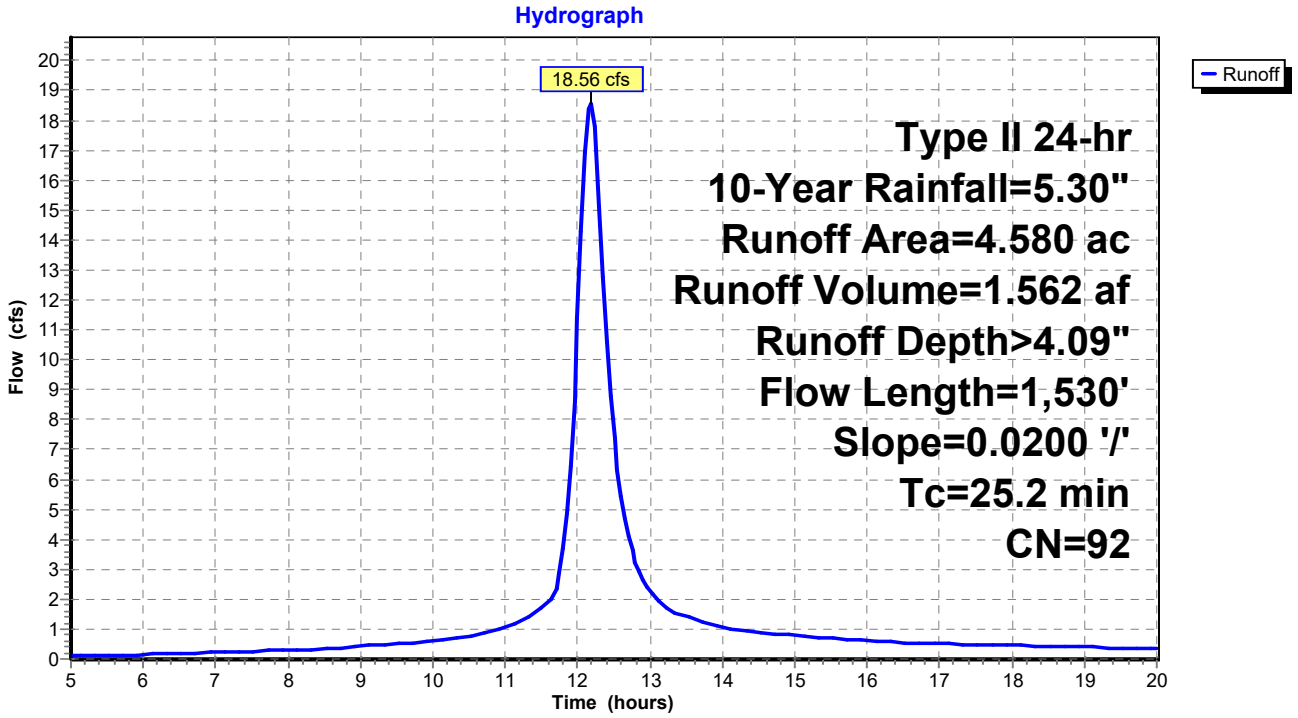
Runoff = 18.56 cfs @ 12.18 hrs, Volume= 1.562 af, Depth> 4.09"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
4.580	92	Paved roads w/open ditches, 50% imp, HSG C
2.290		50.00% Pervious Area
2.290		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
24.1	1,430	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.2	1,530	Total			

Subcatchment 12S: EX OFF DA -4



Summary for Subcatchment 13S: EX DA- 3

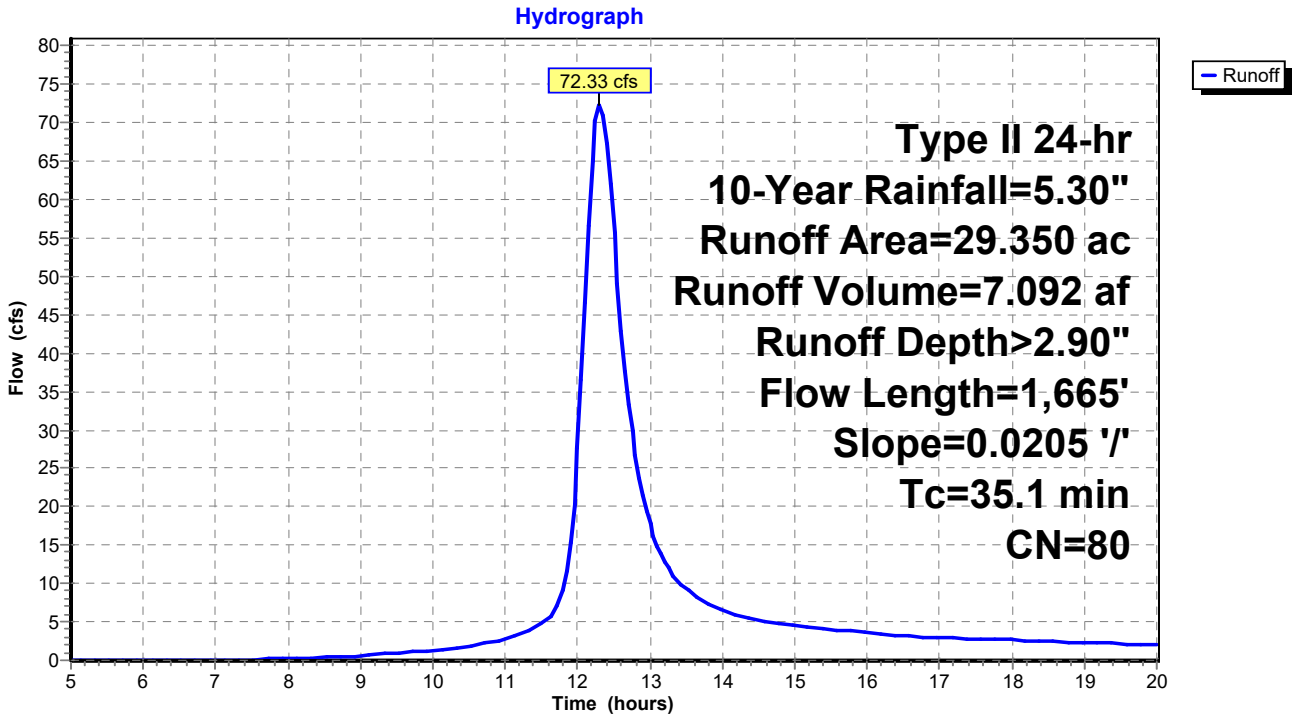
Runoff = 72.33 cfs @ 12.31 hrs, Volume= 7.092 af, Depth> 2.90"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
2.920	76	Woods/grass comb., Fair, HSG C
14.020	79	Pasture/grassland/range, Fair, HSG C
7.890	82	Woods/grass comb., Fair, HSG D
4.520	84	Pasture/grassland/range, Fair, HSG D
29.350	80	Weighted Average
29.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0205	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
26.0	1,565	0.0205	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
35.1	1,665	Total			

Subcatchment 13S: EX DA- 3



Summary for Subcatchment 14S: EX DA-2

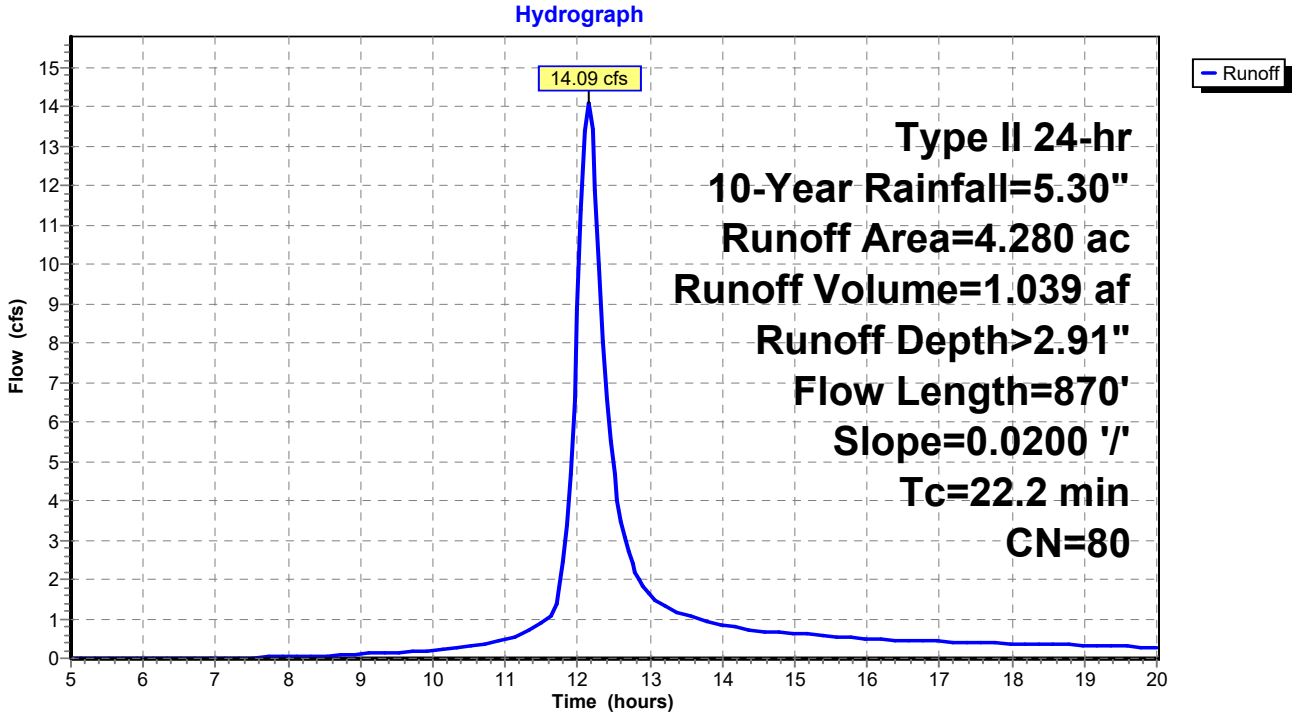
Runoff = 14.09 cfs @ 12.15 hrs, Volume= 1.039 af, Depth> 2.91"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
3.220	79	Pasture/grassland/range, Fair, HSG C
1.060	84	Pasture/grassland/range, Fair, HSG D
4.280	80	Weighted Average
4.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0200	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
13.0	770	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.2	870	Total			

Subcatchment 14S: EX DA-2



Summary for Subcatchment 15S: EX DA-1

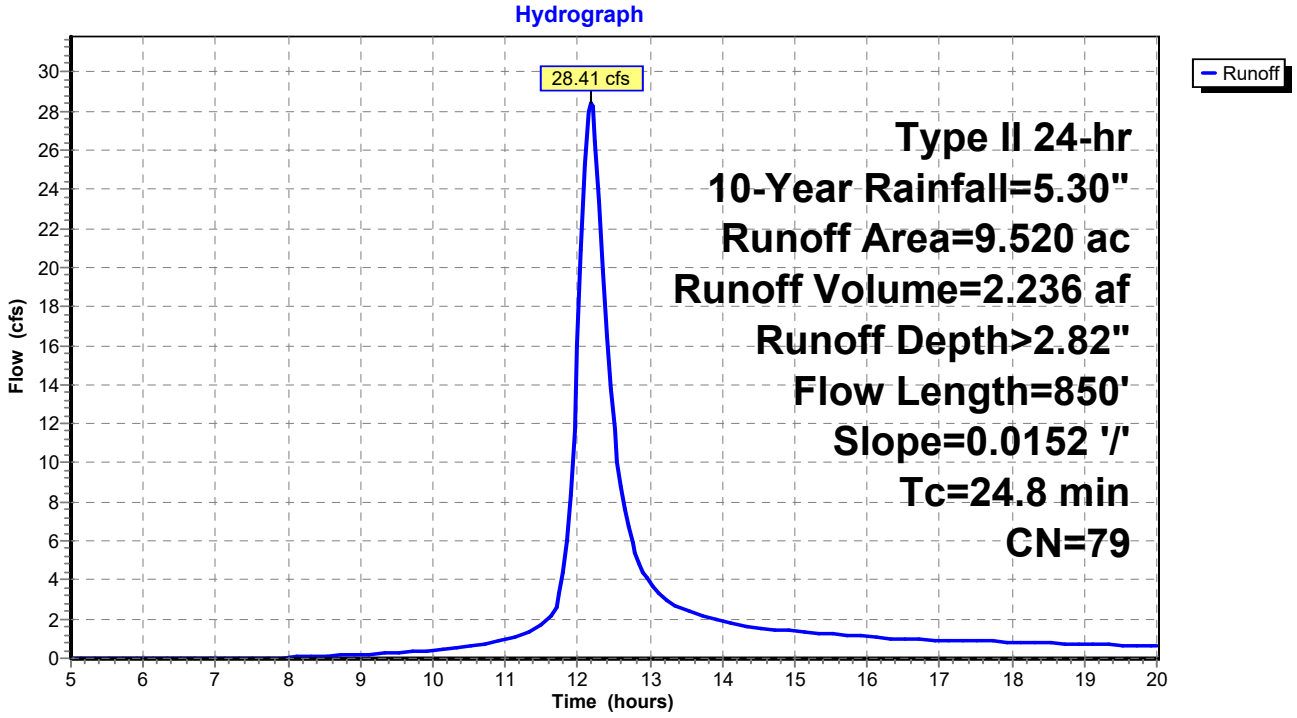
Runoff = 28.41 cfs @ 12.18 hrs, Volume= 2.236 af, Depth> 2.82"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
0.590	76	Woods/grass comb., Fair, HSG C
8.930	79	Pasture/grassland/range, Fair, HSG C
9.520	79	Weighted Average
9.520		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.0152	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
14.5	750	0.0152	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.8	850	Total			

Subcatchment 15S: EX DA-1

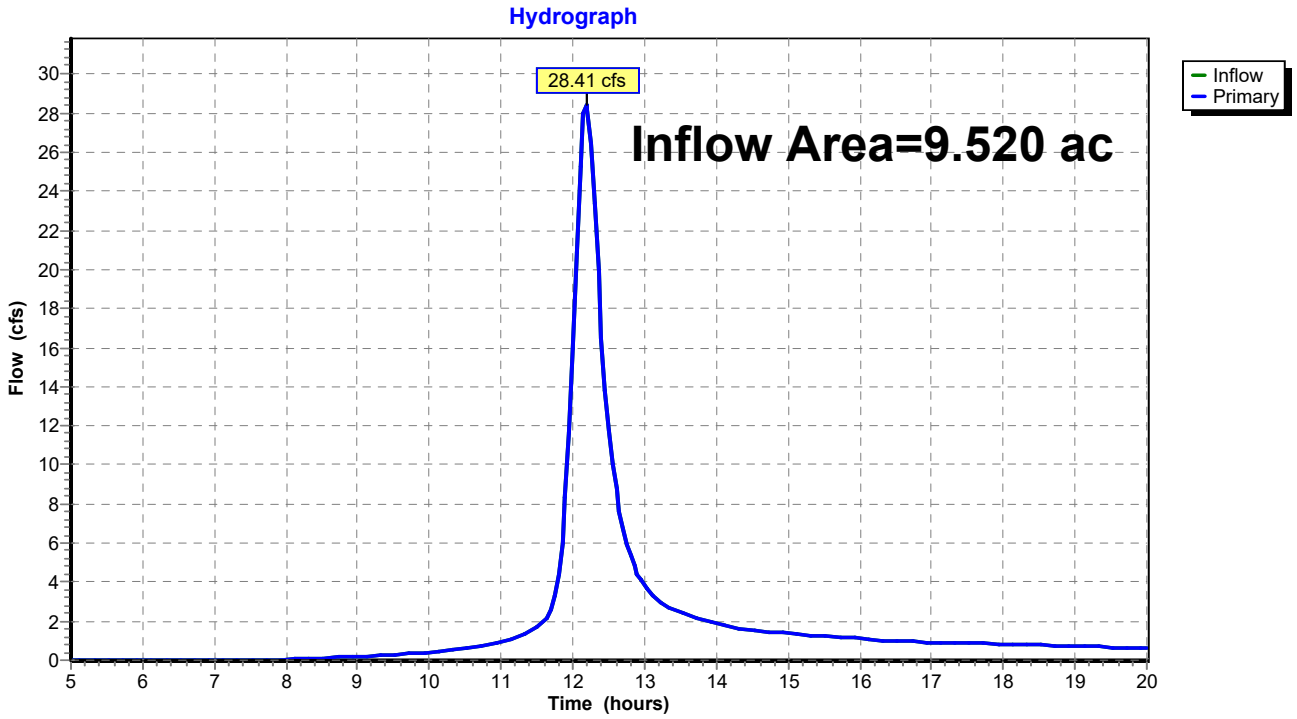


Summary for Link 7L: RP-1

Inflow Area = 9.520 ac, 0.00% Impervious, Inflow Depth > 2.82" for 10-Year event
Inflow = 28.41 cfs @ 12.18 hrs, Volume= 2.236 af
Primary = 28.41 cfs @ 12.18 hrs, Volume= 2.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: RP-1

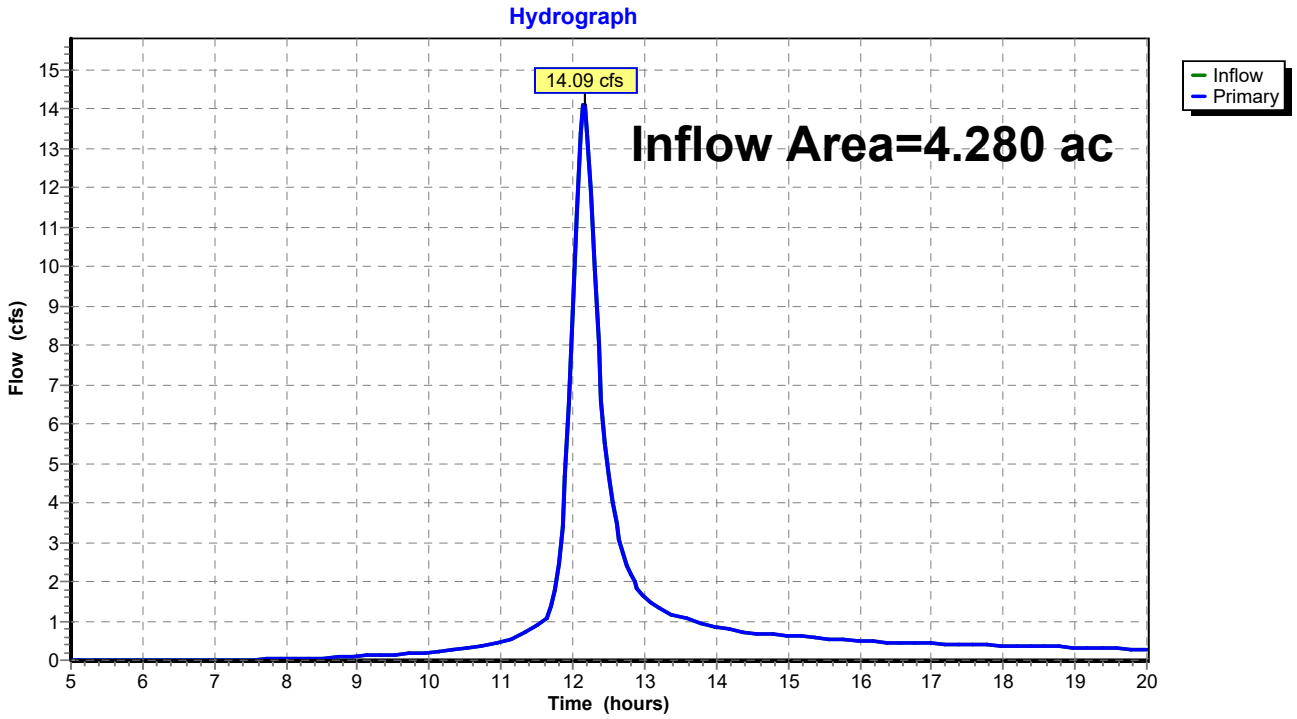


Summary for Link 8L: RP-2

Inflow Area = 4.280 ac, 0.00% Impervious, Inflow Depth > 2.91" for 10-Year event
Inflow = 14.09 cfs @ 12.15 hrs, Volume= 1.039 af
Primary = 14.09 cfs @ 12.15 hrs, Volume= 1.039 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 8L: RP-2

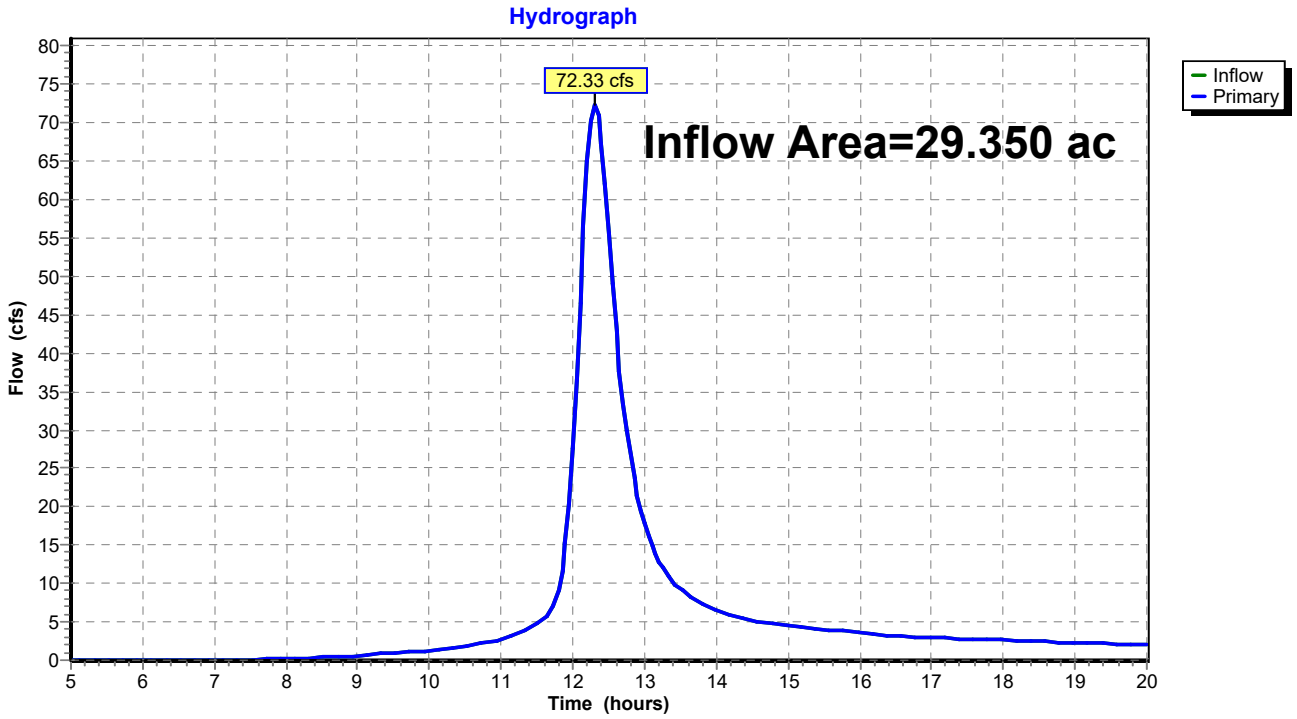


Summary for Link 9L: RP-3

Inflow Area = 29.350 ac, 0.00% Impervious, Inflow Depth > 2.90" for 10-Year event
Inflow = 72.33 cfs @ 12.31 hrs, Volume= 7.092 af
Primary = 72.33 cfs @ 12.31 hrs, Volume= 7.092 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 9L: RP-3

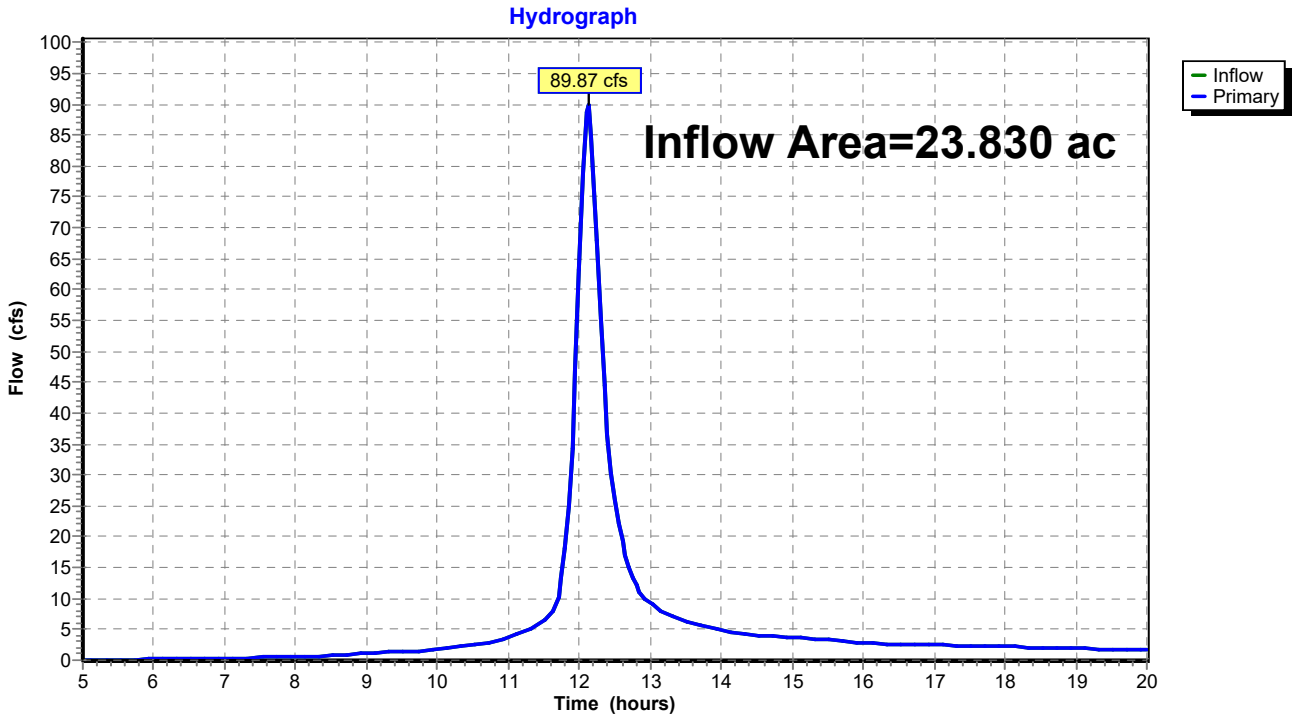


Summary for Link 10L: RP-4

Inflow Area = 23.830 ac, 9.61% Impervious, Inflow Depth > 3.29" for 10-Year event
Inflow = 89.87 cfs @ 12.13 hrs, Volume= 6.539 af
Primary = 89.87 cfs @ 12.13 hrs, Volume= 6.539 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 10L: RP-4



Summary for Subcatchment 11S: EX DA-4

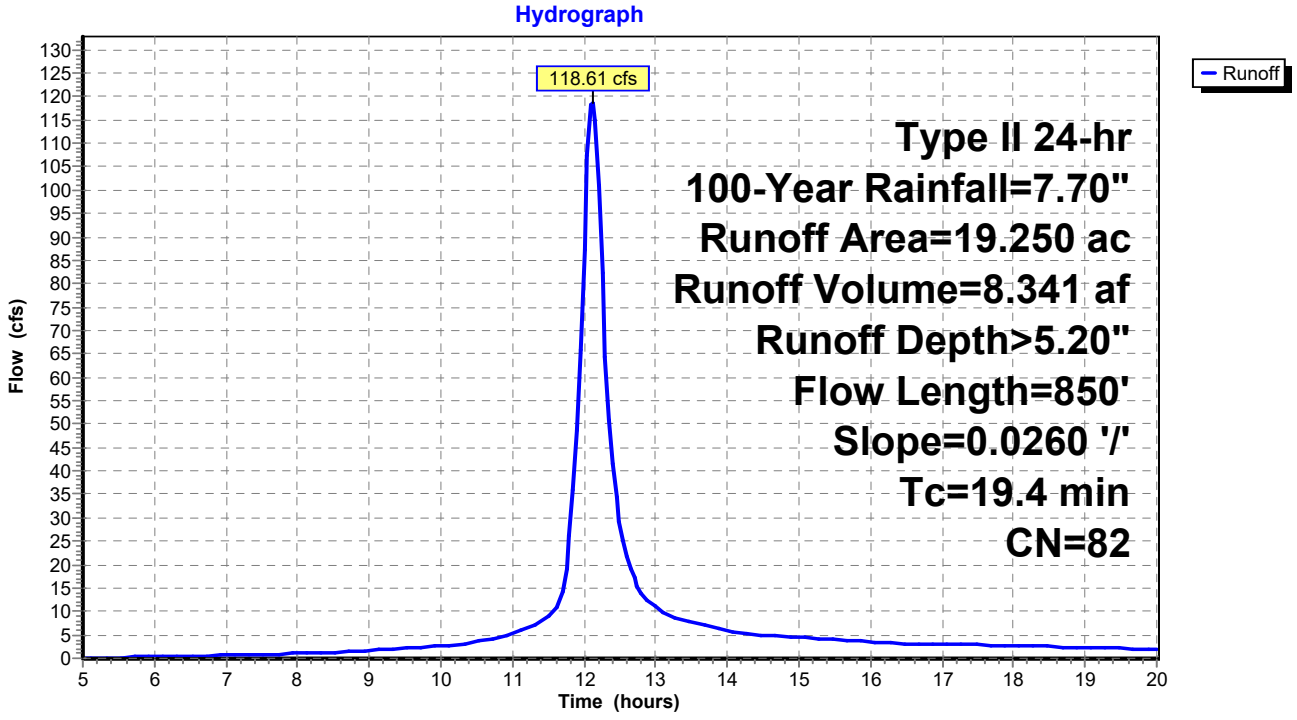
Runoff = 118.61 cfs @ 12.11 hrs, Volume= 8.341 af, Depth> 5.20"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
8.950	79	Pasture/grassland/range, Fair, HSG C
10.300	84	Pasture/grassland/range, Fair, HSG D
19.250	82	Weighted Average
19.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
11.1	750	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.4	850	Total			

Subcatchment 11S: EX DA-4



Summary for Subcatchment 12S: EX OFF DA -4

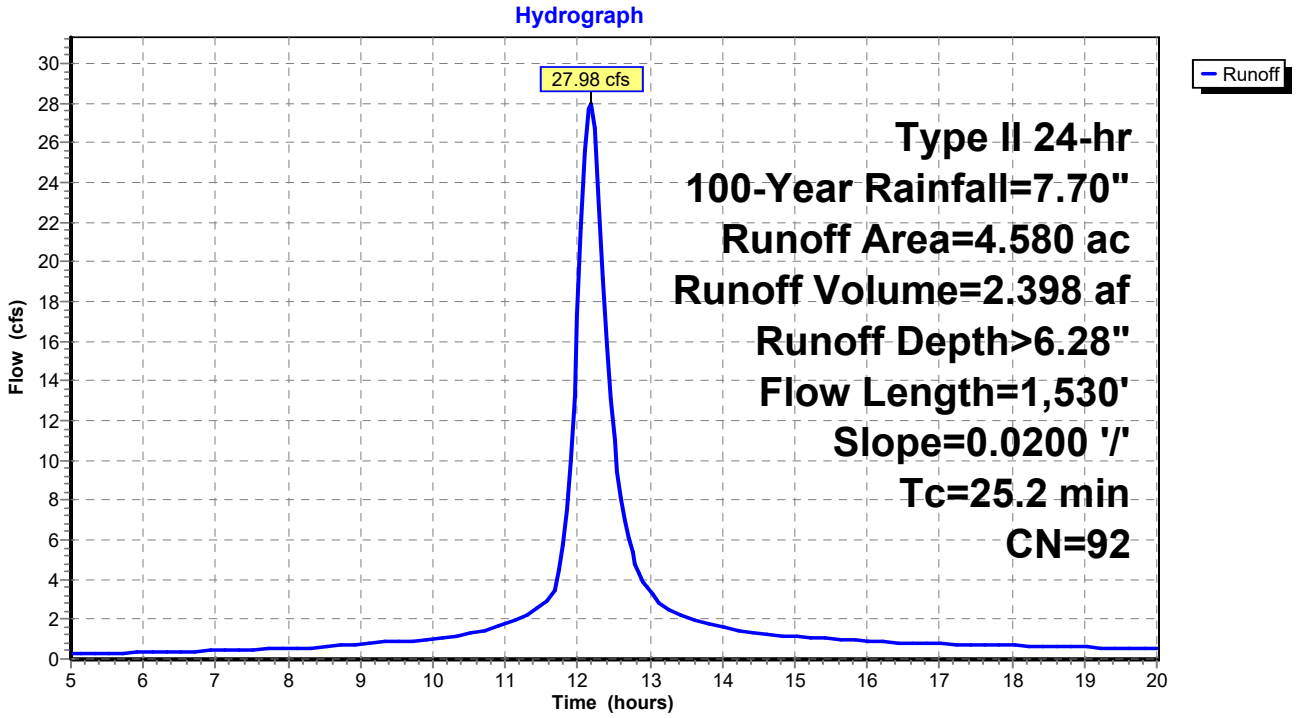
Runoff = 27.98 cfs @ 12.17 hrs, Volume= 2.398 af, Depth> 6.28"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
4.580	92	Paved roads w/open ditches, 50% imp, HSG C
2.290		50.00% Pervious Area
2.290		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
24.1	1,430	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.2	1,530	Total			

Subcatchment 12S: EX OFF DA -4



Summary for Subcatchment 13S: EX DA- 3

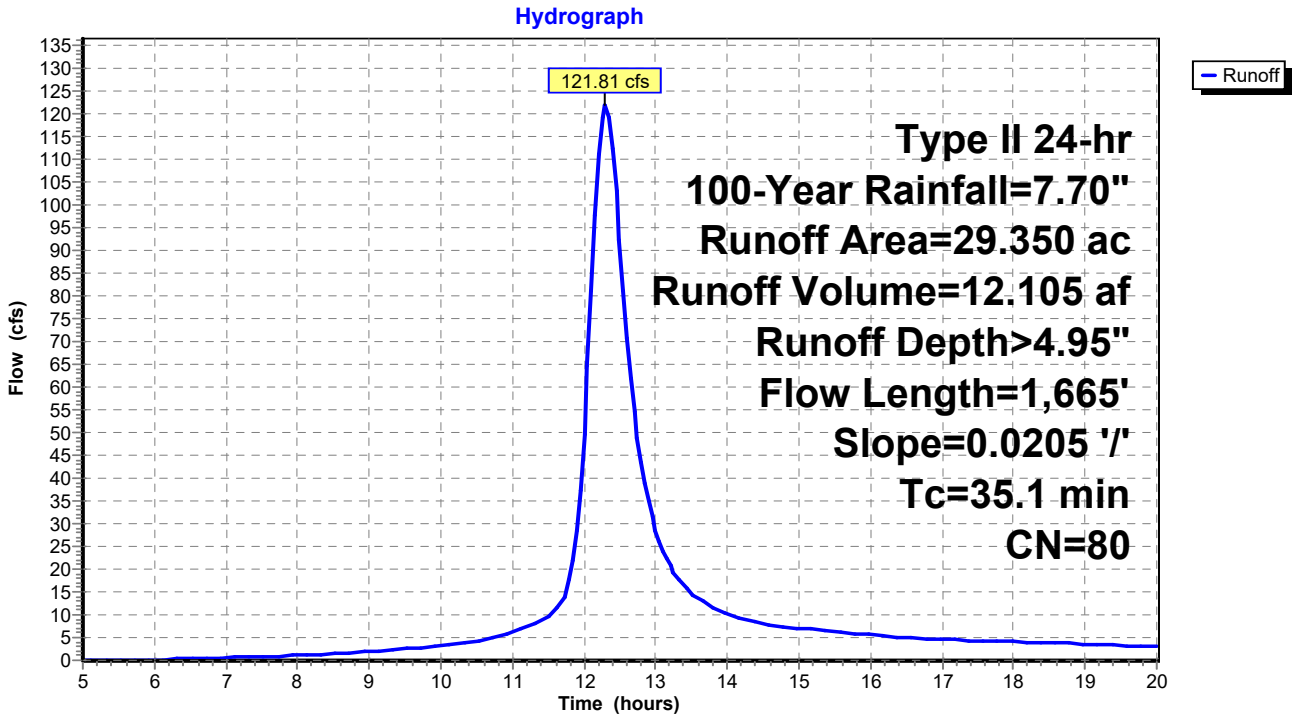
Runoff = 121.81 cfs @ 12.30 hrs, Volume= 12.105 af, Depth> 4.95"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
2.920	76	Woods/grass comb., Fair, HSG C
14.020	79	Pasture/grassland/range, Fair, HSG C
7.890	82	Woods/grass comb., Fair, HSG D
4.520	84	Pasture/grassland/range, Fair, HSG D
29.350	80	Weighted Average
29.350		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0205	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
26.0	1,565	0.0205	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
35.1	1,665	Total			

Subcatchment 13S: EX DA- 3



Summary for Subcatchment 14S: EX DA-2

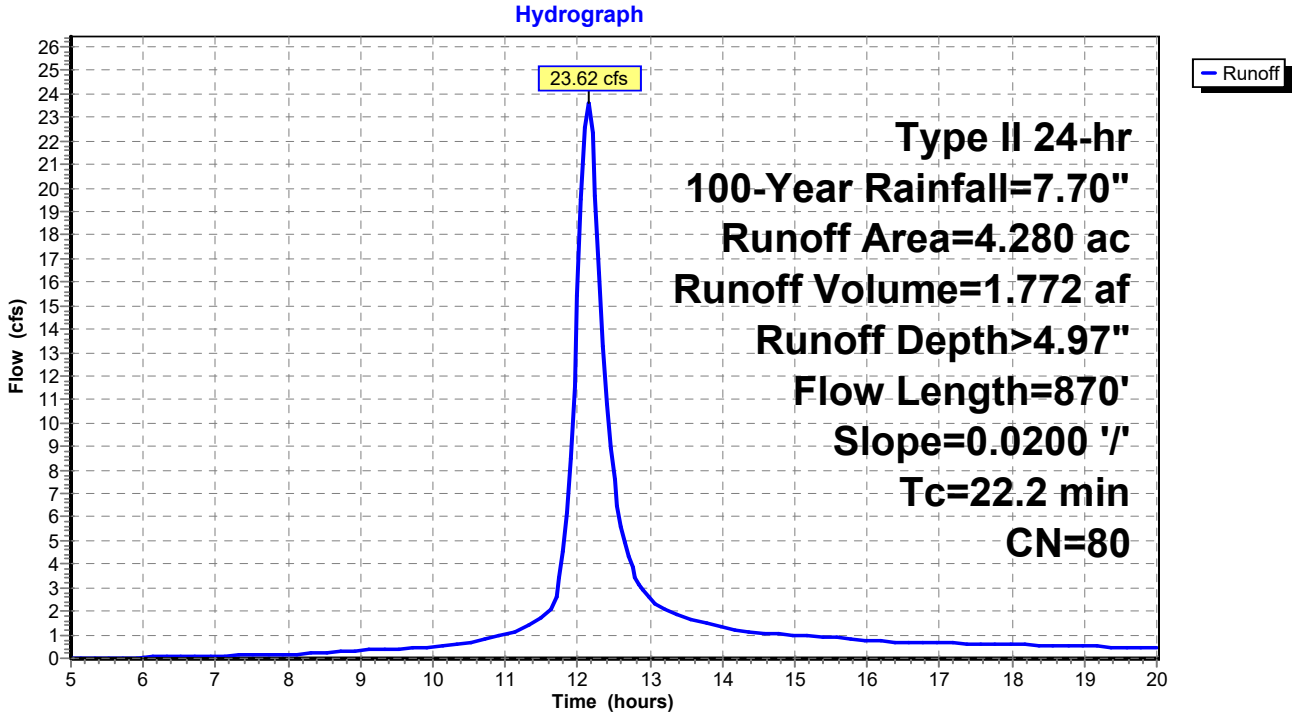
Runoff = 23.62 cfs @ 12.15 hrs, Volume= 1.772 af, Depth> 4.97"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
3.220	79	Pasture/grassland/range, Fair, HSG C
1.060	84	Pasture/grassland/range, Fair, HSG D
4.280	80	Weighted Average
4.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0200	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
13.0	770	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
22.2	870	Total			

Subcatchment 14S: EX DA-2



Summary for Subcatchment 15S: EX DA-1

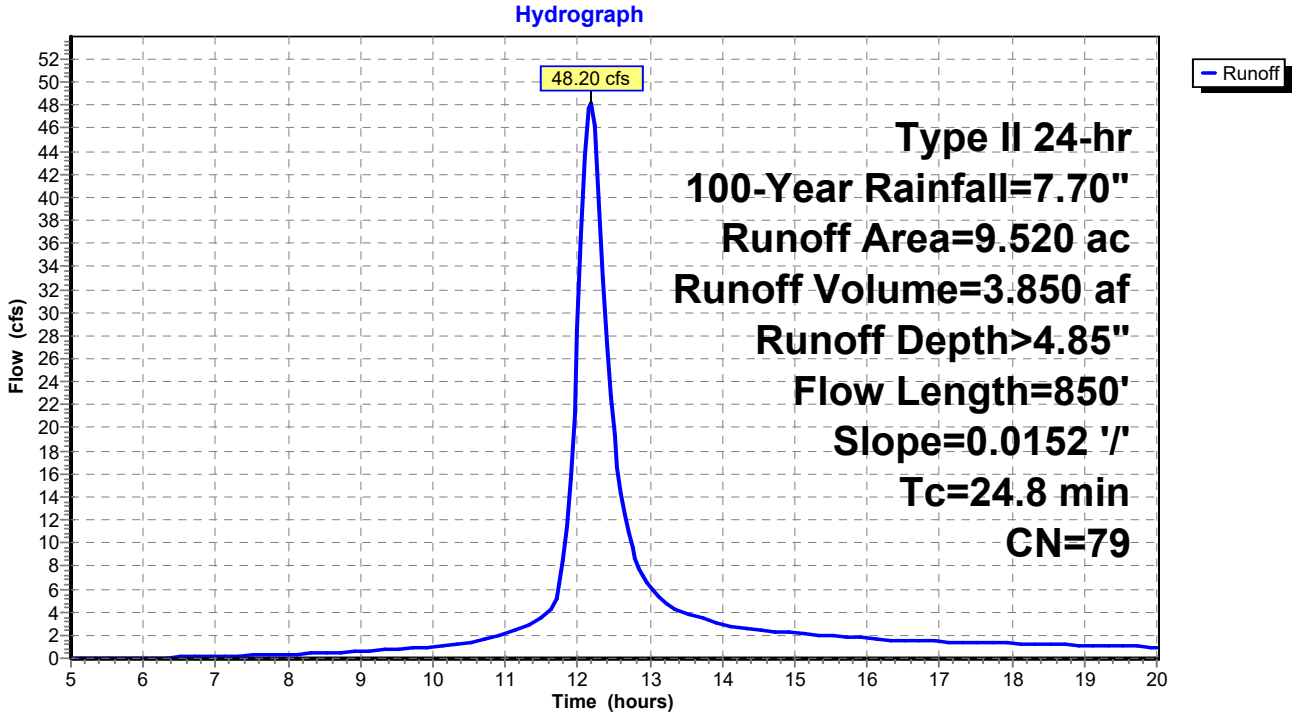
Runoff = 48.20 cfs @ 12.18 hrs, Volume= 3.850 af, Depth> 4.85"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
0.590	76	Woods/grass comb., Fair, HSG C
8.930	79	Pasture/grassland/range, Fair, HSG C
9.520	79	Weighted Average
9.520		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	100	0.0152	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
14.5	750	0.0152	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.8	850	Total			

Subcatchment 15S: EX DA-1

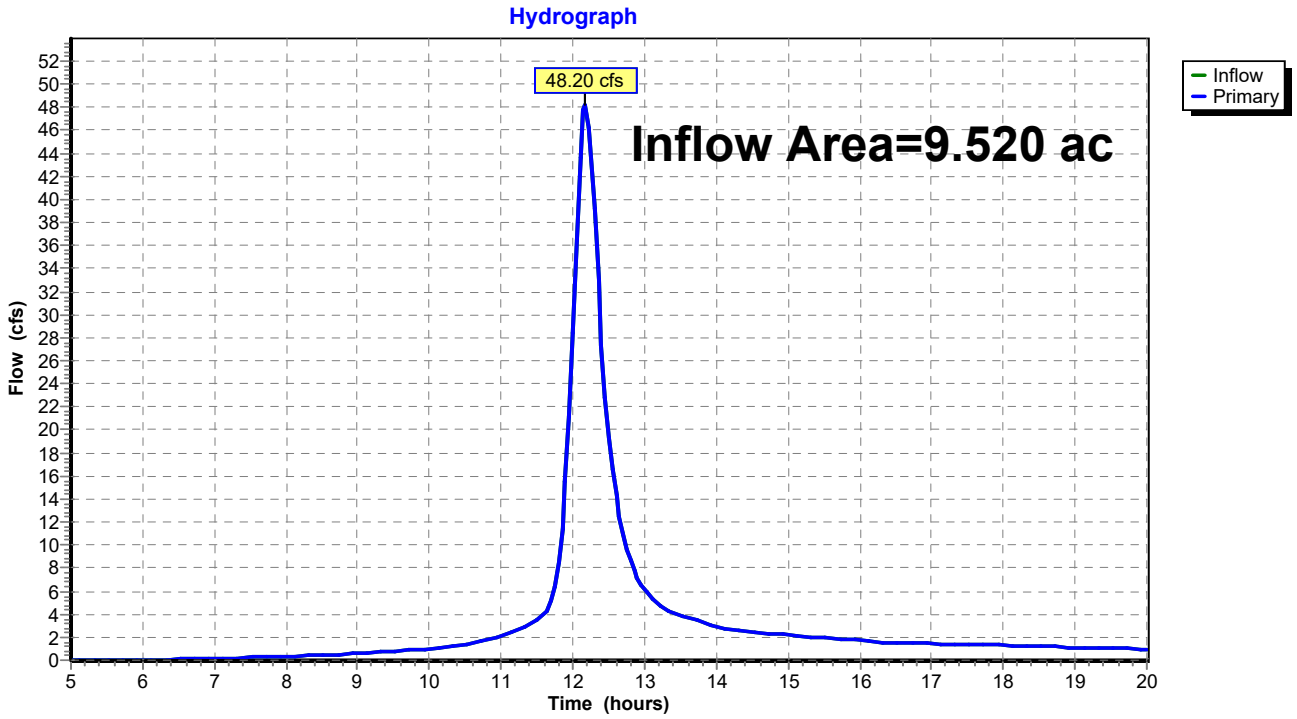


Summary for Link 7L: RP-1

Inflow Area = 9.520 ac, 0.00% Impervious, Inflow Depth > 4.85" for 100-Year event
Inflow = 48.20 cfs @ 12.18 hrs, Volume= 3.850 af
Primary = 48.20 cfs @ 12.18 hrs, Volume= 3.850 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: RP-1

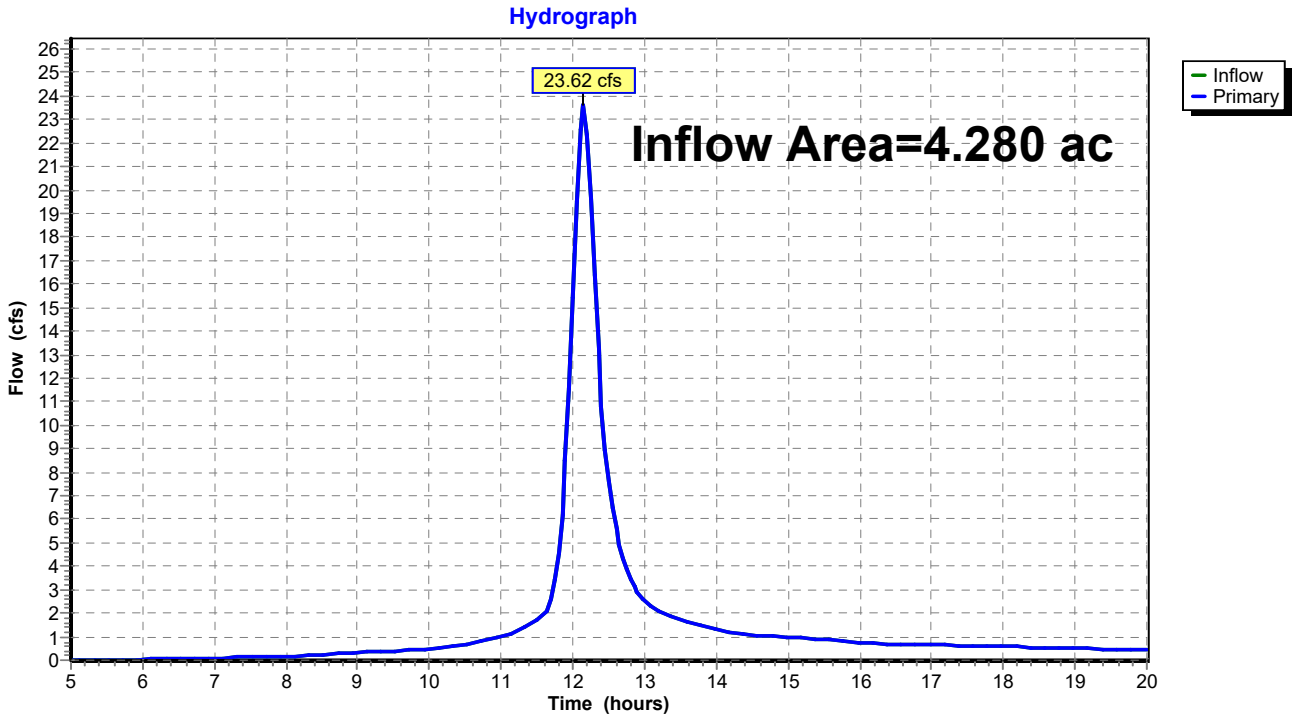


Summary for Link 8L: RP-2

Inflow Area = 4.280 ac, 0.00% Impervious, Inflow Depth > 4.97" for 100-Year event
Inflow = 23.62 cfs @ 12.15 hrs, Volume= 1.772 af
Primary = 23.62 cfs @ 12.15 hrs, Volume= 1.772 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 8L: RP-2

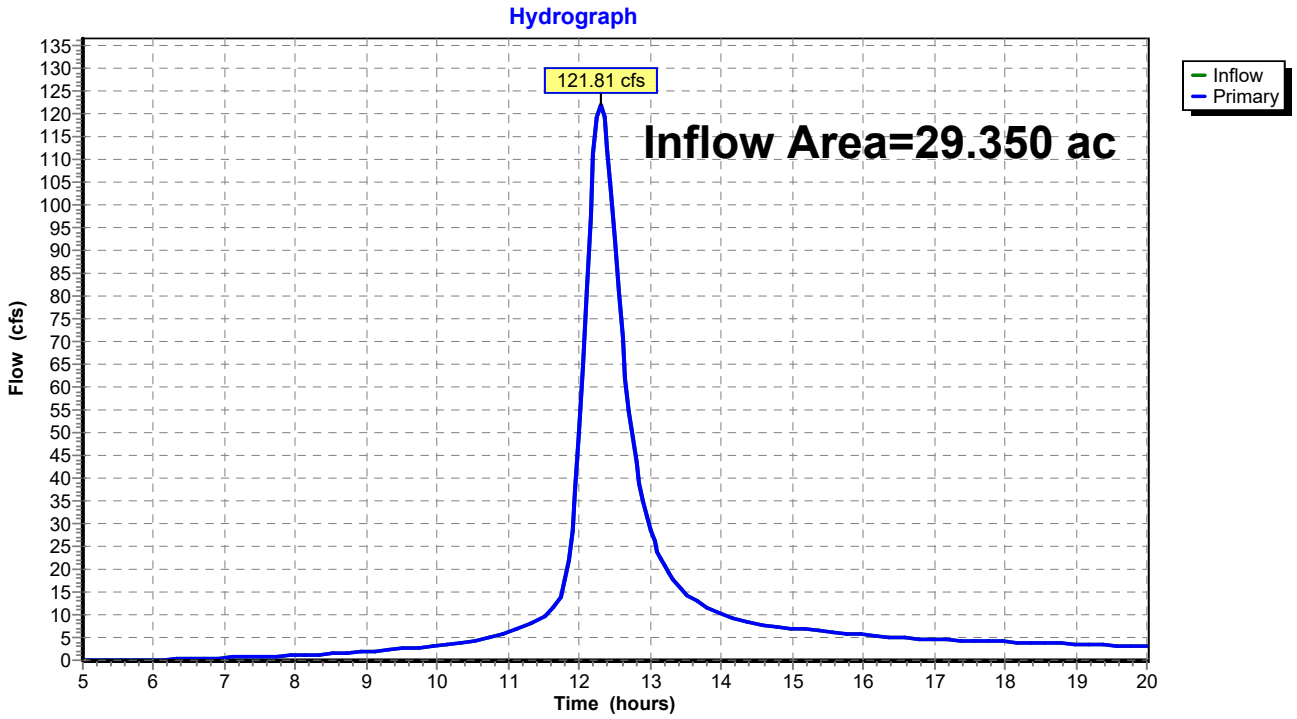


Summary for Link 9L: RP-3

Inflow Area = 29.350 ac, 0.00% Impervious, Inflow Depth > 4.95" for 100-Year event
Inflow = 121.81 cfs @ 12.30 hrs, Volume= 12.105 af
Primary = 121.81 cfs @ 12.30 hrs, Volume= 12.105 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 9L: RP-3

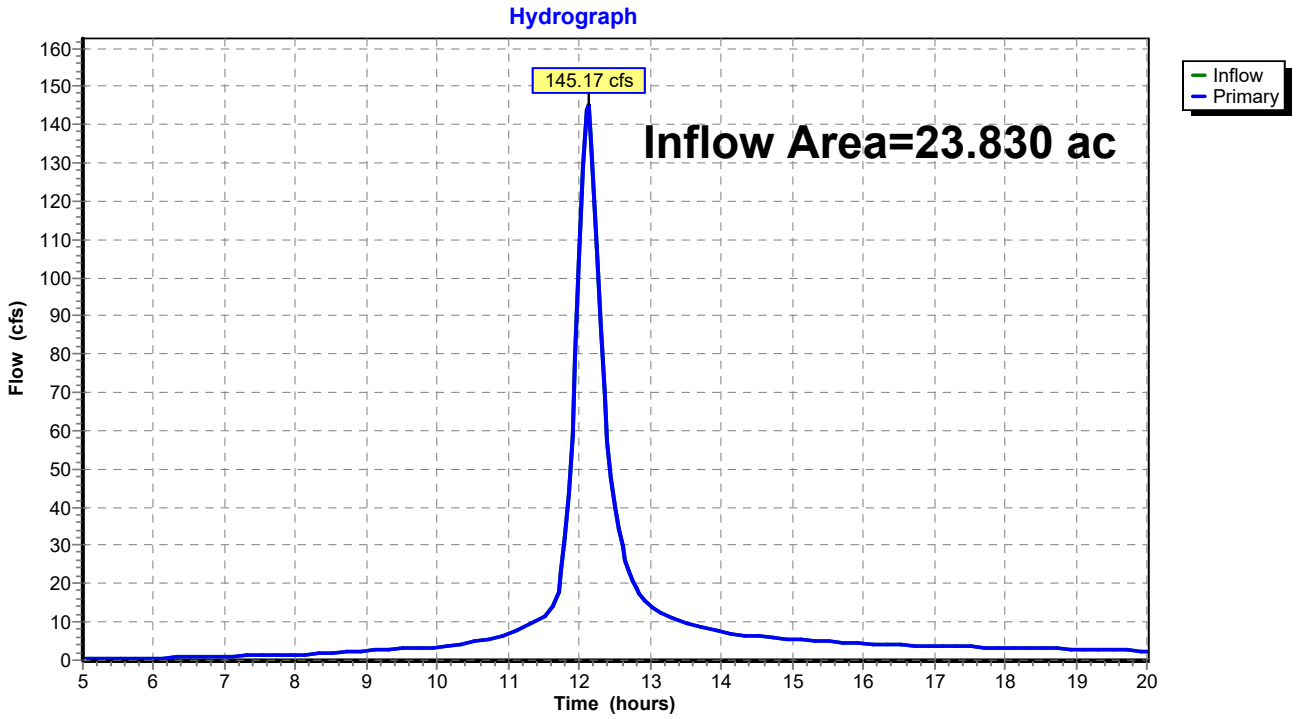


Summary for Link 10L: RP-4

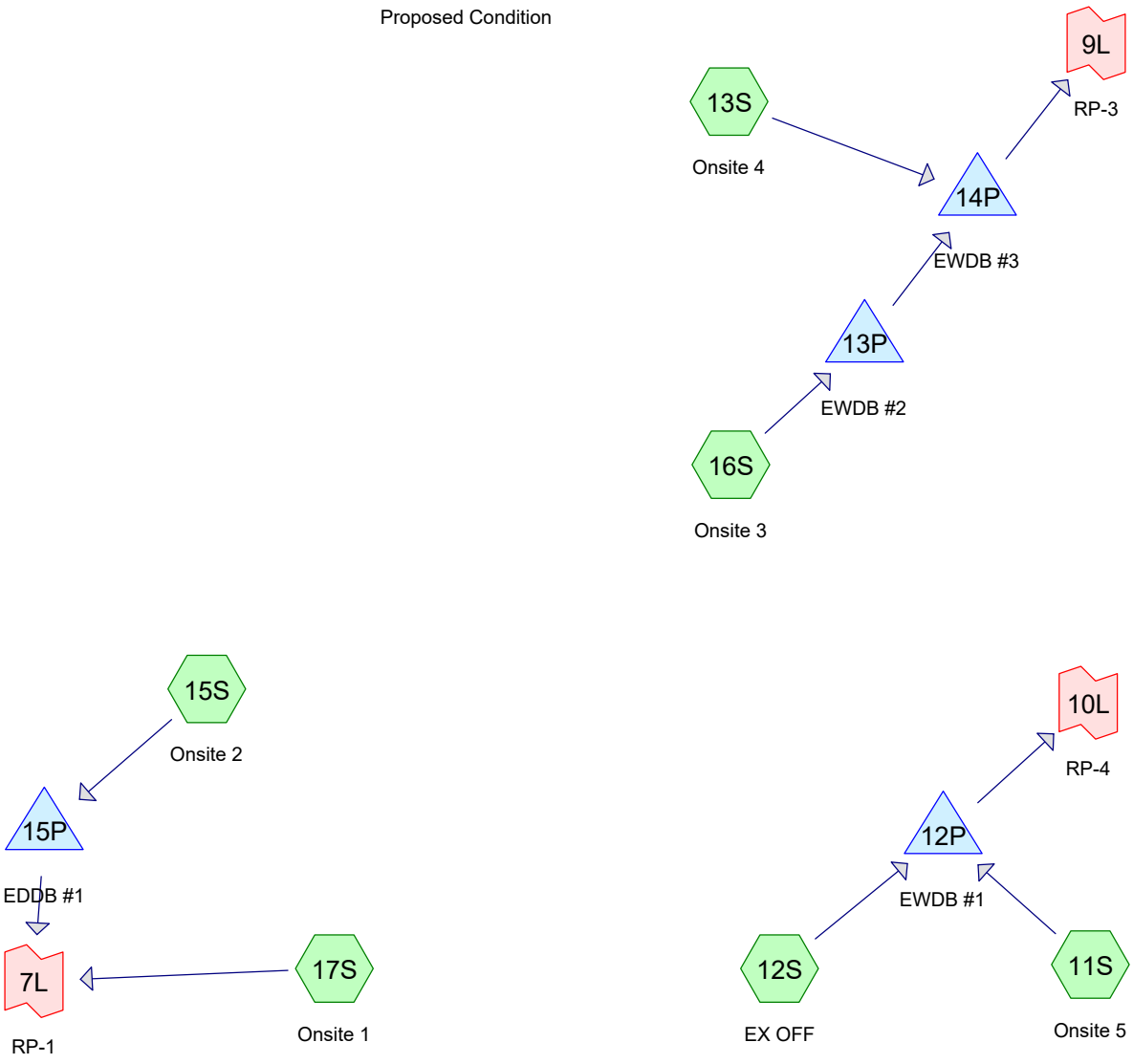
Inflow Area = 23.830 ac, 9.61% Impervious, Inflow Depth > 5.41" for 100-Year event
Inflow = 145.17 cfs @ 12.12 hrs, Volume= 10.739 af
Primary = 145.17 cfs @ 12.12 hrs, Volume= 10.739 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 10L: RP-4



Proposed Condition



Routing Diagram for 20-205-HYDRO-PRO
Prepared by {enter your company name here}, Printed 9/3/2021

Summary for Subcatchment 11S: Onsite 5

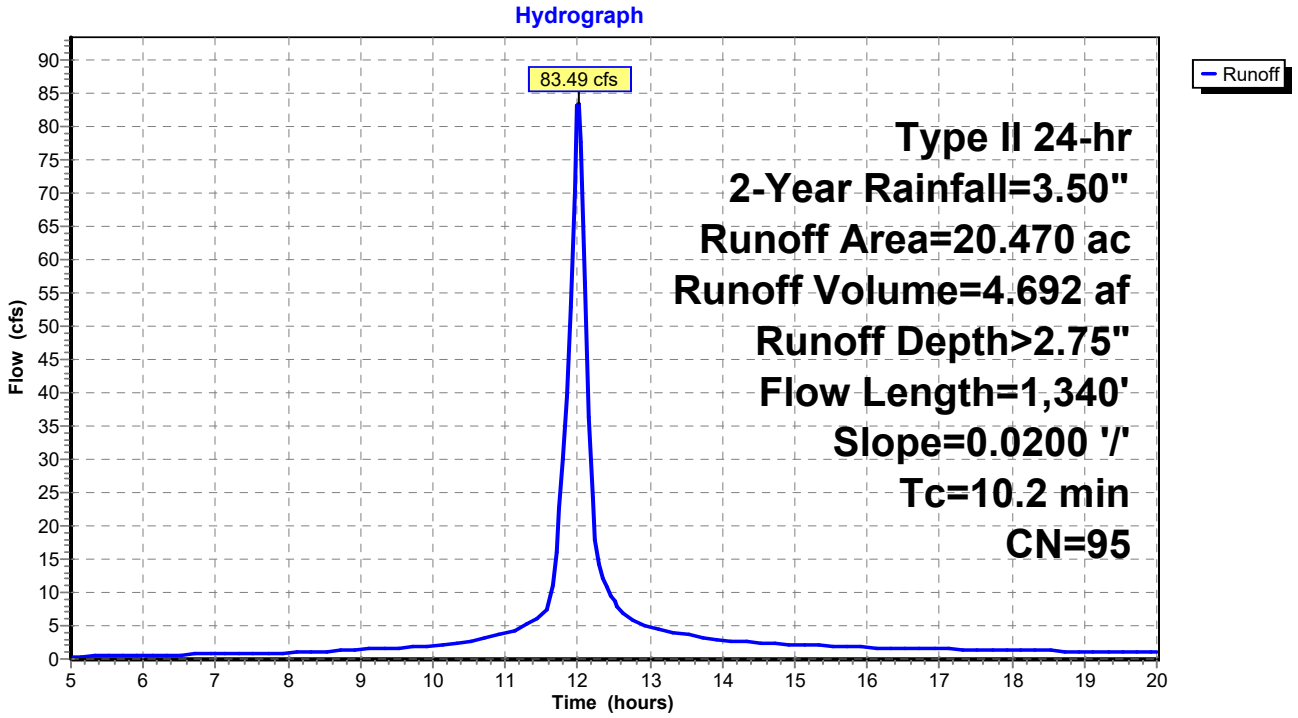
Runoff = 83.49 cfs @ 12.01 hrs, Volume= 4.692 af, Depth> 2.75"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
20.470	95	Urban commercial, 85% imp, HSG D
3.070		15.00% Pervious Area
17.399		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
9.1	1,240	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.2	1,340	Total			

Subcatchment 11S: Onsite 5



Summary for Subcatchment 12S: EX OFF

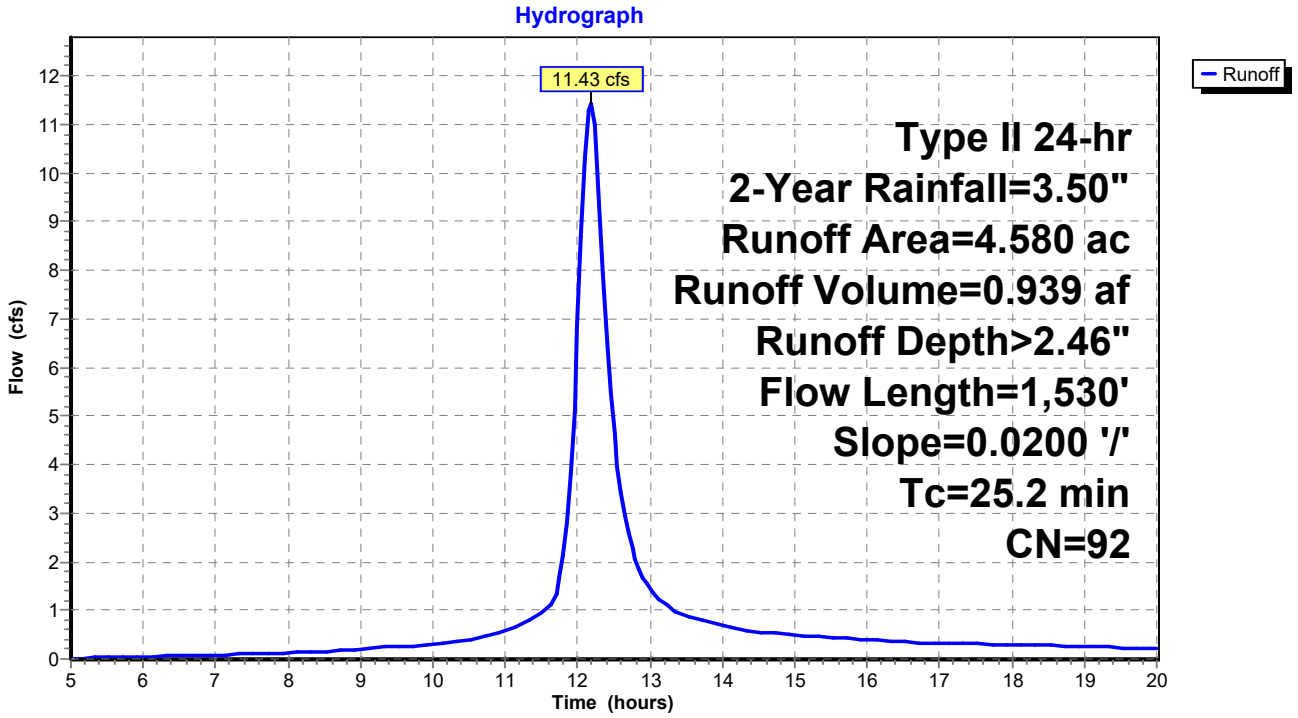
Runoff = 11.43 cfs @ 12.18 hrs, Volume= 0.939 af, Depth> 2.46"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
4.580	92	Paved roads w/open ditches, 50% imp, HSG C
2.290		50.00% Pervious Area
2.290		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
24.1	1,430	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.2	1,530	Total			

Subcatchment 12S: EX OFF



Summary for Subcatchment 13S: Onsite 4

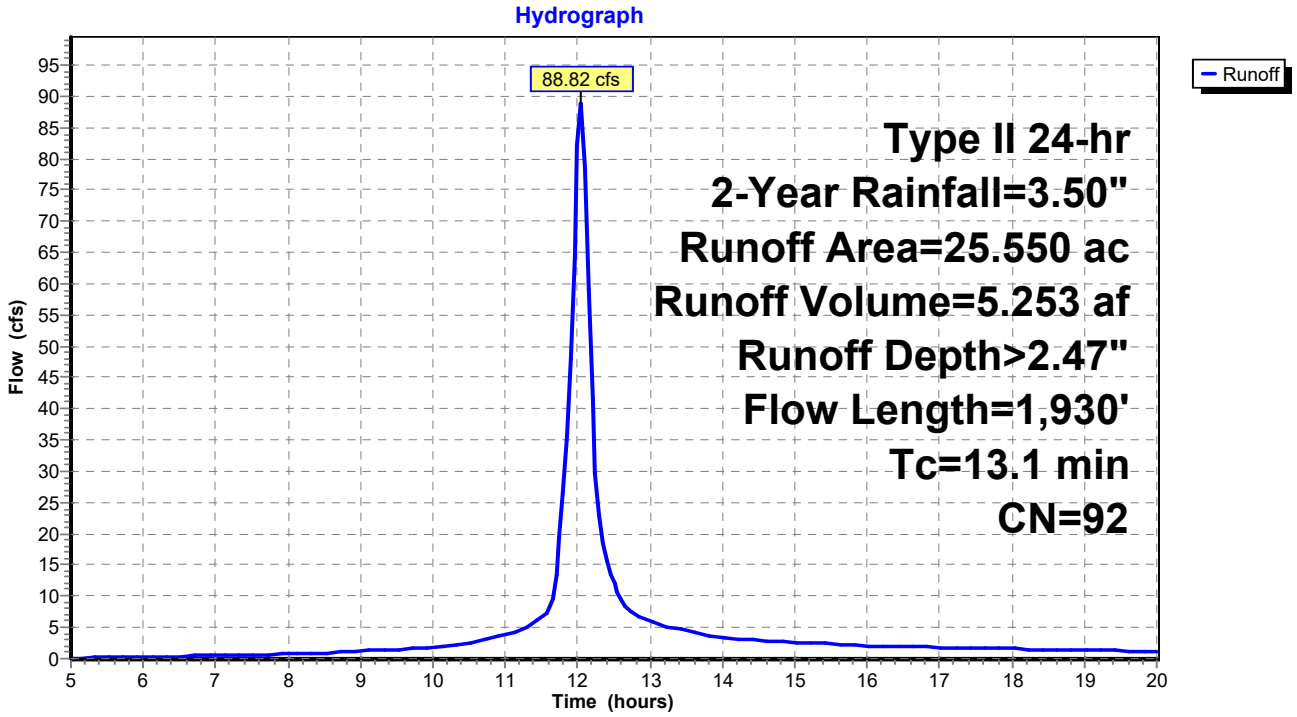
Runoff = 88.82 cfs @ 12.04 hrs, Volume= 5.253 af, Depth> 2.47"

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-Year Rainfall=3.50"

	Area (ac)	CN	Description
*	13.070	92	SINGLE FAMILY LOTS
	12.480	92	1/8 acre lots, 65% imp, HSG D
	25.550	92	Weighted Average
	17.438		68.25% Pervious Area
	8.112		31.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0205	1.47		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
12.0	1,830	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.1	1,930	Total			

Subcatchment 13S: Onsite 4



Summary for Subcatchment 15S: Onsite 2

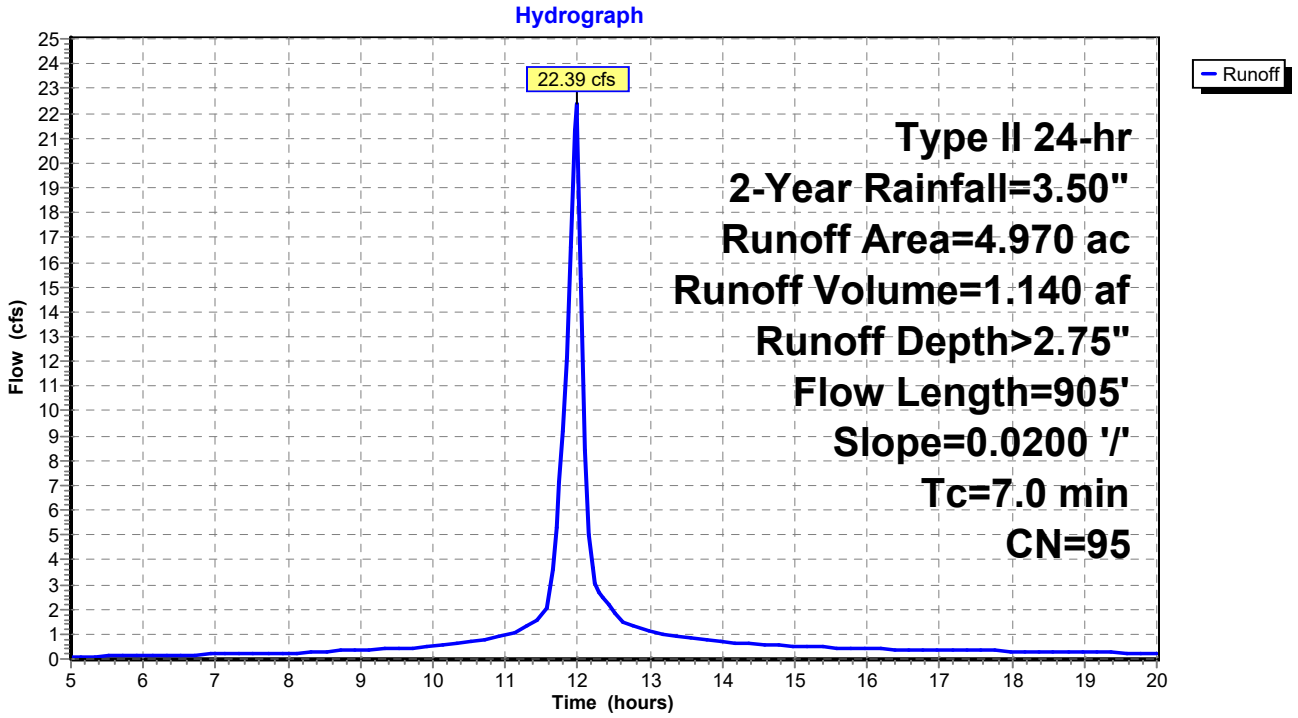
Runoff = 22.39 cfs @ 11.98 hrs, Volume= 1.140 af, Depth> 2.75"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
4.970	95	Urban commercial, 85% imp, HSG D
0.746		15.00% Pervious Area
4.224		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
5.9	805	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	905	Total			

Subcatchment 15S: Onsite 2



Summary for Subcatchment 16S: Onsite 3

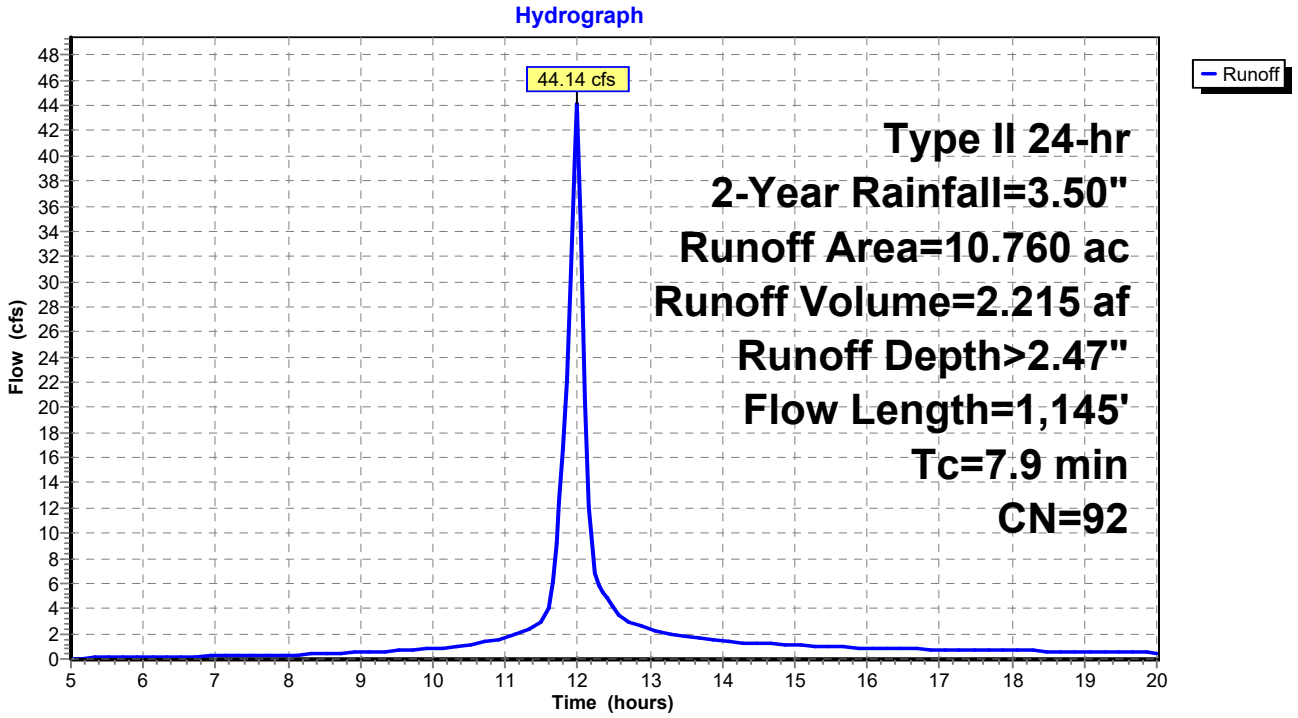
Runoff = 44.14 cfs @ 11.99 hrs, Volume= 2.215 af, Depth> 2.47"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
10.760	92	1/8 acre lots, 65% imp, HSG D
3.766		35.00% Pervious Area
6.994		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
6.8	1,045	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.9	1,145	Total			

Subcatchment 16S: Onsite 3



Summary for Subcatchment 17S: Onsite 1

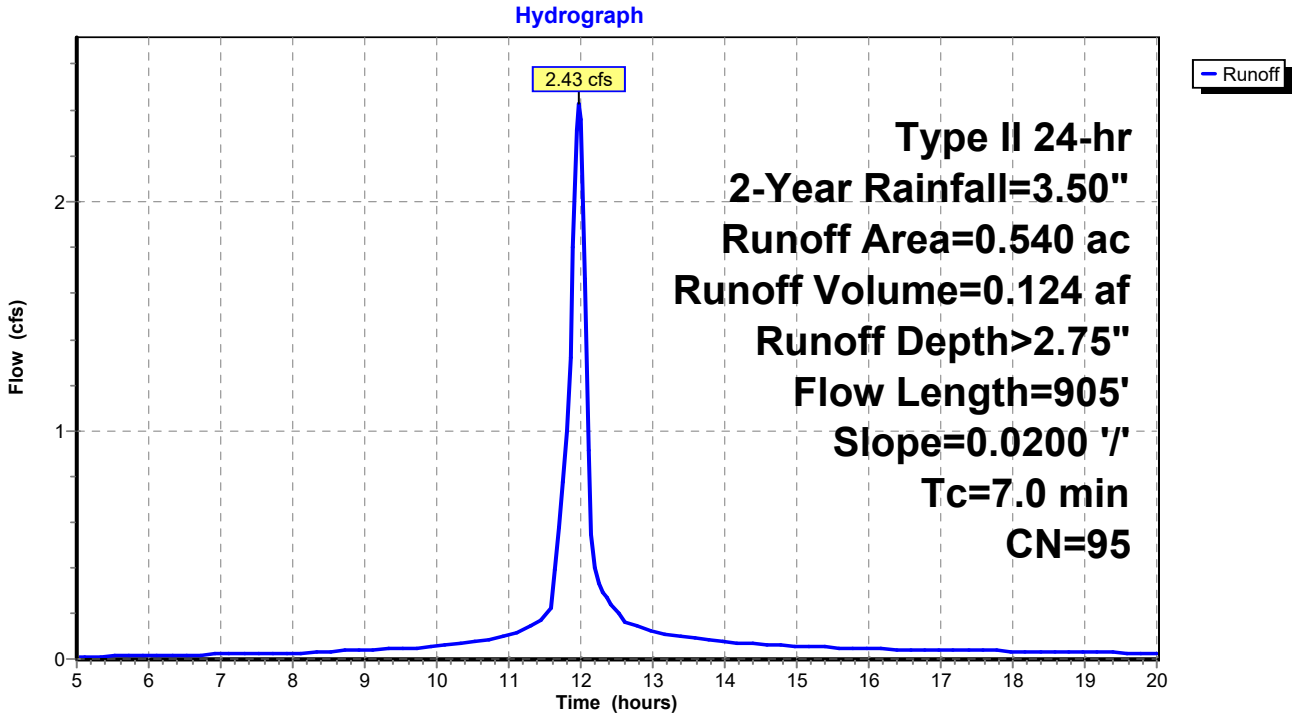
Runoff = 2.43 cfs @ 11.98 hrs, Volume= 0.124 af, Depth> 2.75"

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-Year Rainfall=3.50"

Area (ac)	CN	Description
0.540	95	Urban commercial, 85% imp, HSG D
0.081		15.00% Pervious Area
0.459		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
5.9	805	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	905	Total			

Subcatchment 17S: Onsite 1



Summary for Pond 12P: EWDB #1

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.050 ac, 78.60% Impervious, Inflow Depth > 2.70" for 2-Year event
Inflow = 90.76 cfs @ 12.02 hrs, Volume= 5.631 af
Outflow = 4.69 cfs @ 13.43 hrs, Volume= 2.516 af, Atten= 95%, Lag= 84.7 min
Primary = 4.69 cfs @ 13.43 hrs, Volume= 2.516 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 996.50' @ 13.43 hrs Surf.Area= 73,897 sf Storage= 172,388 cf

Plug-Flow detention time= 277.3 min calculated for 2.507 af (45% of inflow)
Center-of-Mass det. time= 187.5 min (939.8 - 752.3)

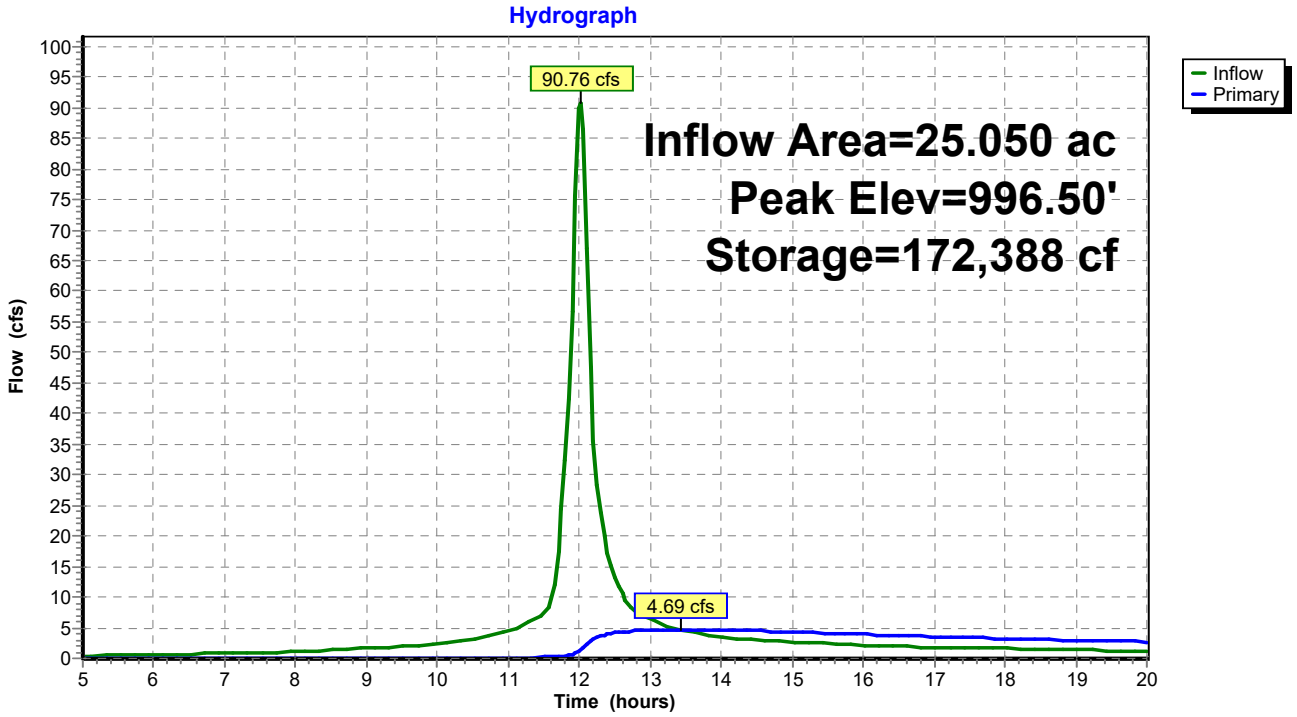
Volume	Invert	Avail.Storage	Storage Description
#1	994.00'	640,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
994.00	64,027	0	0
996.00	71,876	135,903	135,903
998.00	79,952	151,828	287,731
1,000.00	88,254	168,206	455,937
1,002.00	96,782	185,036	640,973

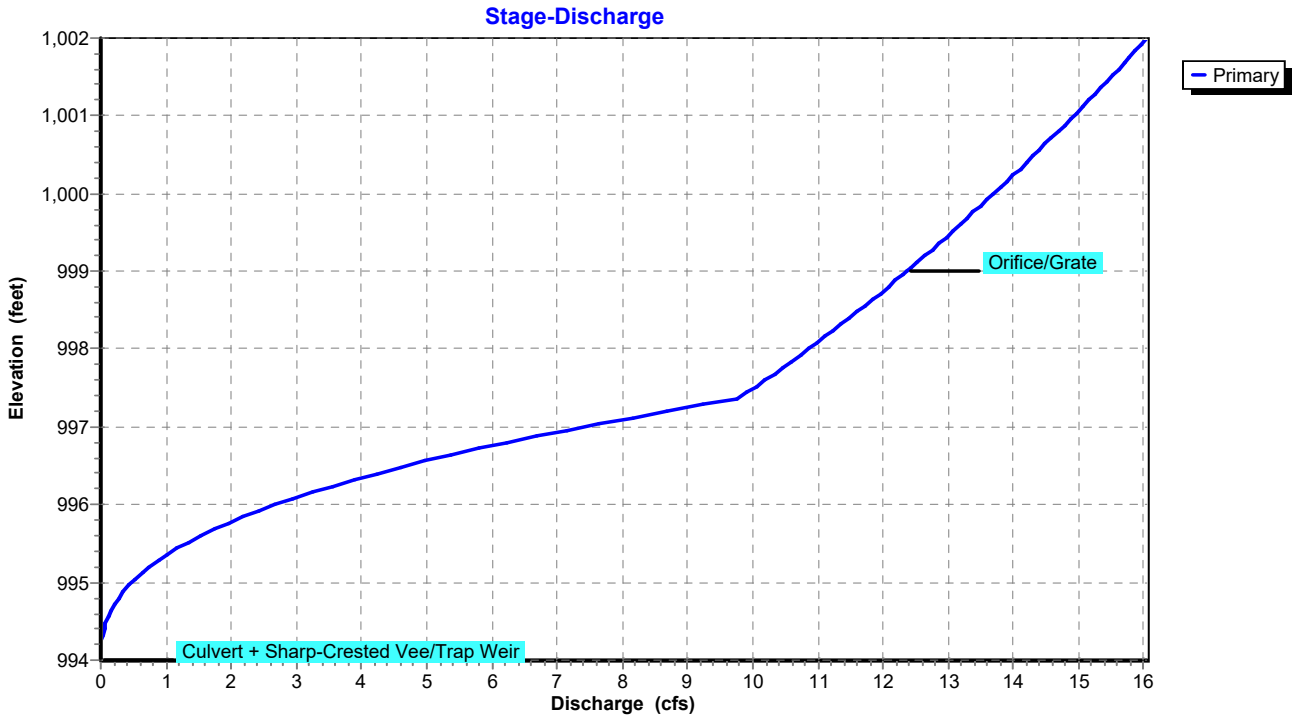
Device	Routing	Invert	Outlet Devices
#1	Primary	994.00'	**15.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 994.00' / 993.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	994.00'	**20.0 deg x 5.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	999.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.69 cfs @ 13.43 hrs HW=996.50' (Free Discharge)
└**1=Culvert** (Passes 4.69 cfs of 8.09 cfs potential flow)
  ├**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 4.69 cfs @ 4.25 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

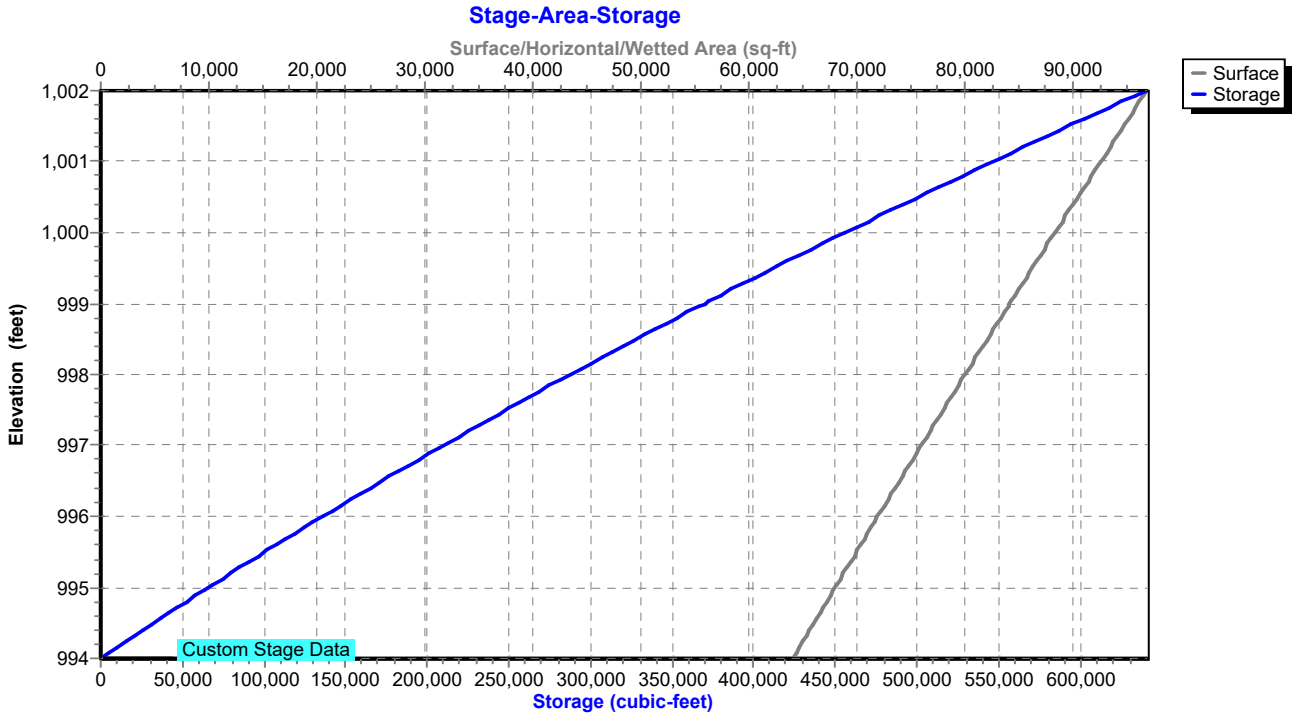
Pond 12P: EWDB #1



Pond 12P: EWDB #1



Pond 12P: EWDB #1



Summary for Pond 13P: EWDB #2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 10.760 ac, 65.00% Impervious, Inflow Depth > 2.47" for 2-Year event
Inflow = 44.14 cfs @ 11.99 hrs, Volume= 2.215 af
Outflow = 4.26 cfs @ 12.47 hrs, Volume= 1.504 af, Atten= 90%, Lag= 29.0 min
Primary = 4.26 cfs @ 12.47 hrs, Volume= 1.504 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 994.41' @ 12.47 hrs Surf.Area= 27,548 sf Storage= 58,821 cf

Plug-Flow detention time= 203.2 min calculated for 1.499 af (68% of inflow)
Center-of-Mass det. time= 136.9 min (895.2 - 758.3)

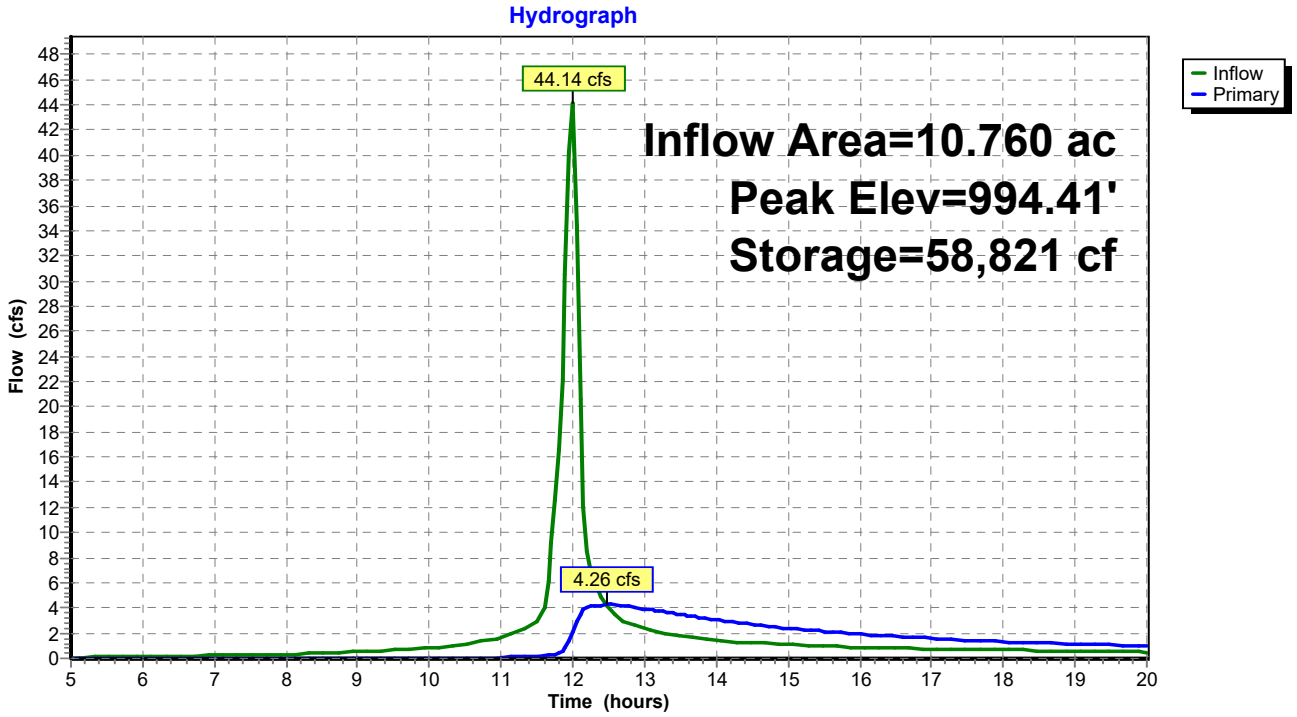
Volume	Invert	Avail.Storage	Storage Description
#1	992.00'	175,799 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.00	21,391	0	0
994.00	26,438	47,829	47,829
996.00	31,892	58,330	106,159
998.00	37,748	69,640	175,799

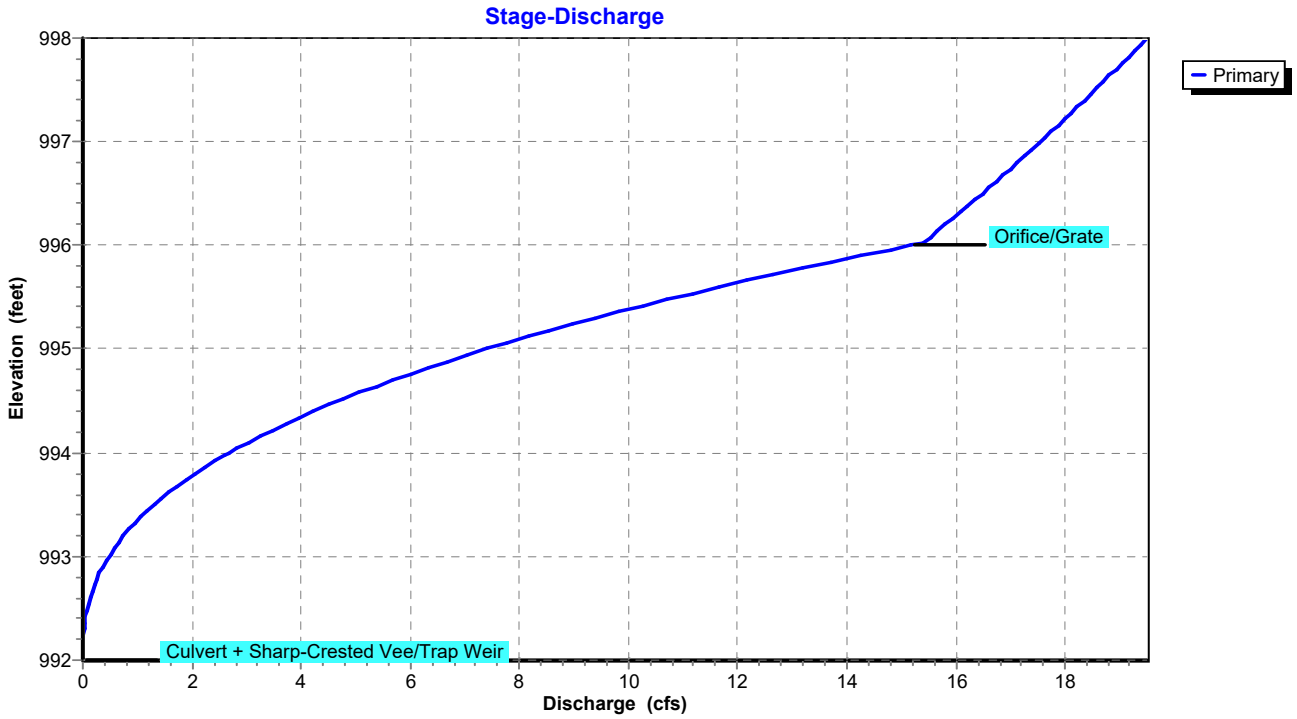
Device	Routing	Invert	Outlet Devices
#1	Primary	992.00'	**18.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 992.00' / 991.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Device 1	992.00'	**20.0 deg x 4.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	996.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.26 cfs @ 12.47 hrs HW=994.41' (Free Discharge)
└**1=Culvert** (Passes 4.26 cfs of 10.95 cfs potential flow)
  ├**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 4.26 cfs @ 4.17 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

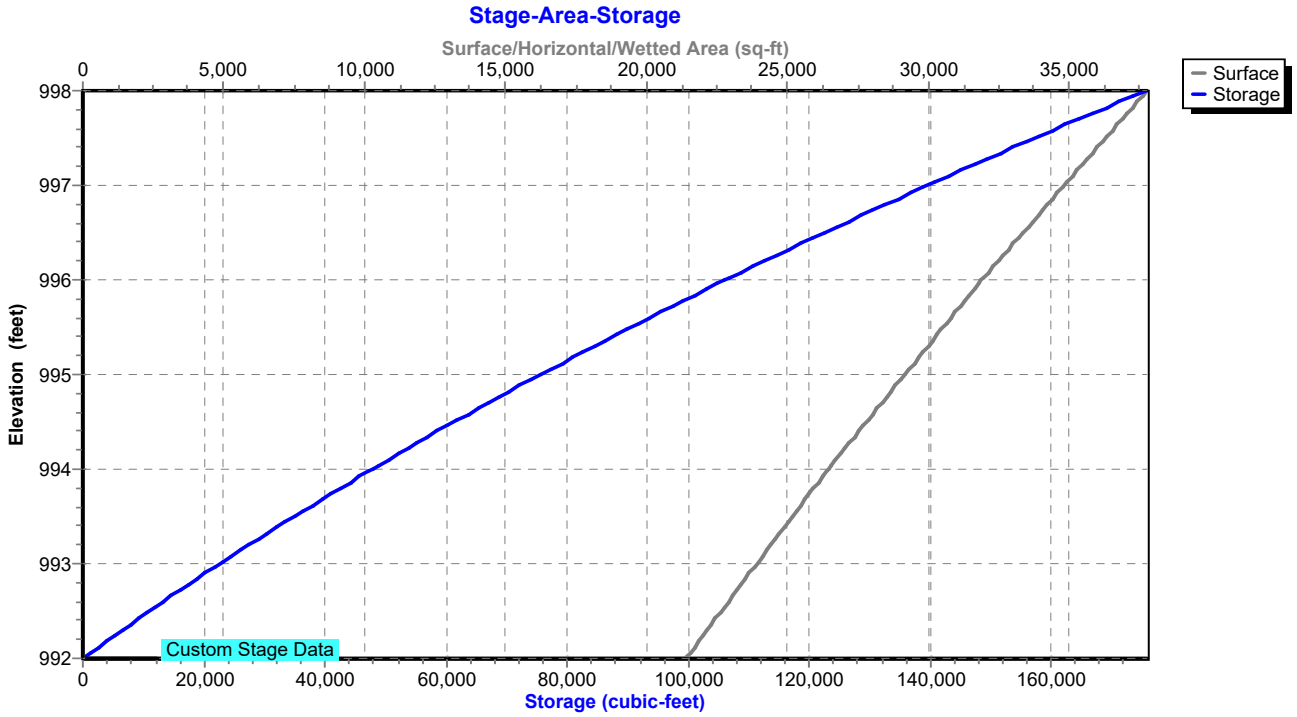
Pond 13P: EWDB #2



Pond 13P: EWDB #2



Pond 13P: EWDB #2



Summary for Pond 14P: EWDB #3

[82] Warning: Early inflow requires earlier time span

Inflow Area = 36.310 ac, 41.60% Impervious, Inflow Depth > 2.23" for 2-Year event
Inflow = 91.67 cfs @ 12.05 hrs, Volume= 6.757 af
Outflow = 13.80 cfs @ 12.60 hrs, Volume= 5.024 af, Atten= 85%, Lag= 33.1 min
Primary = 13.80 cfs @ 12.60 hrs, Volume= 5.024 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 987.85' @ 12.60 hrs Surf.Area= 43,319 sf Storage= 142,053 cf

Plug-Flow detention time= 179.0 min calculated for 5.007 af (74% of inflow)
Center-of-Mass det. time= 109.2 min (901.2 - 791.9)

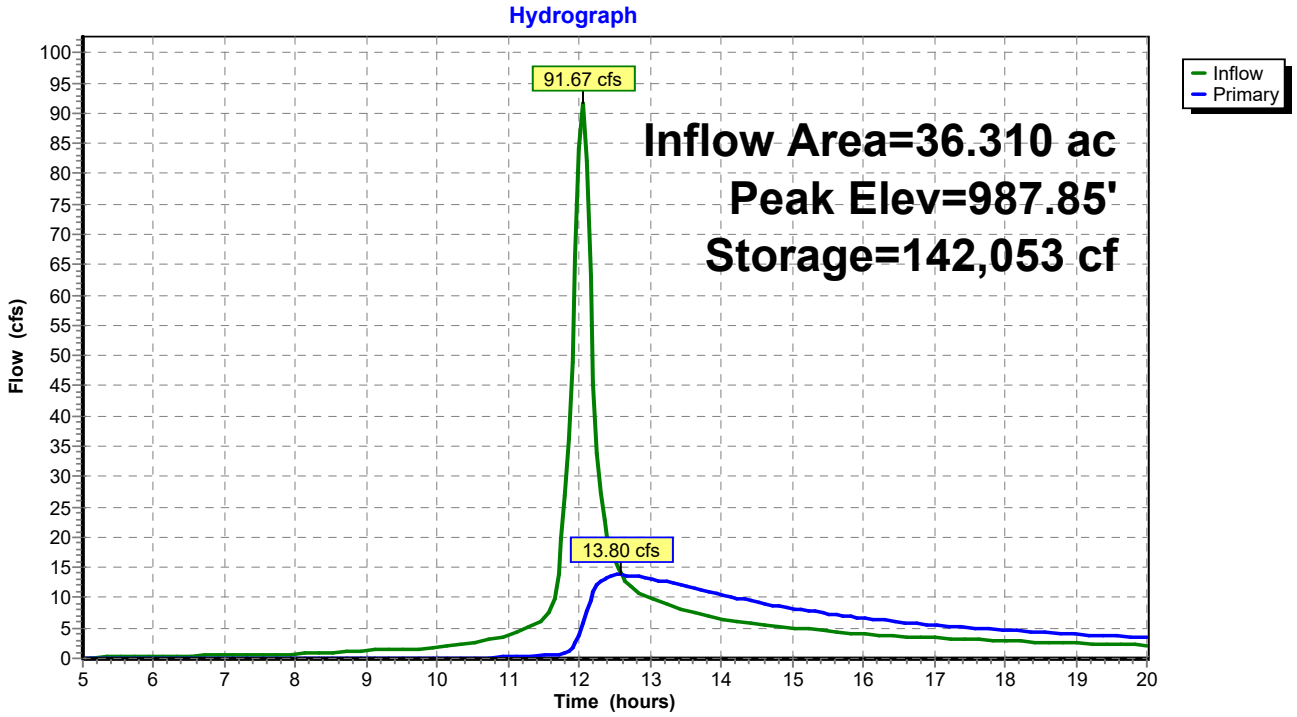
Volume	Invert	Avail.Storage	Storage Description
#1	984.00'	355,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
984.00	30,844	0	0
986.00	36,957	67,801	67,801
988.00	43,835	80,792	148,593
990.00	51,620	95,455	244,048
992.00	59,957	111,577	355,625

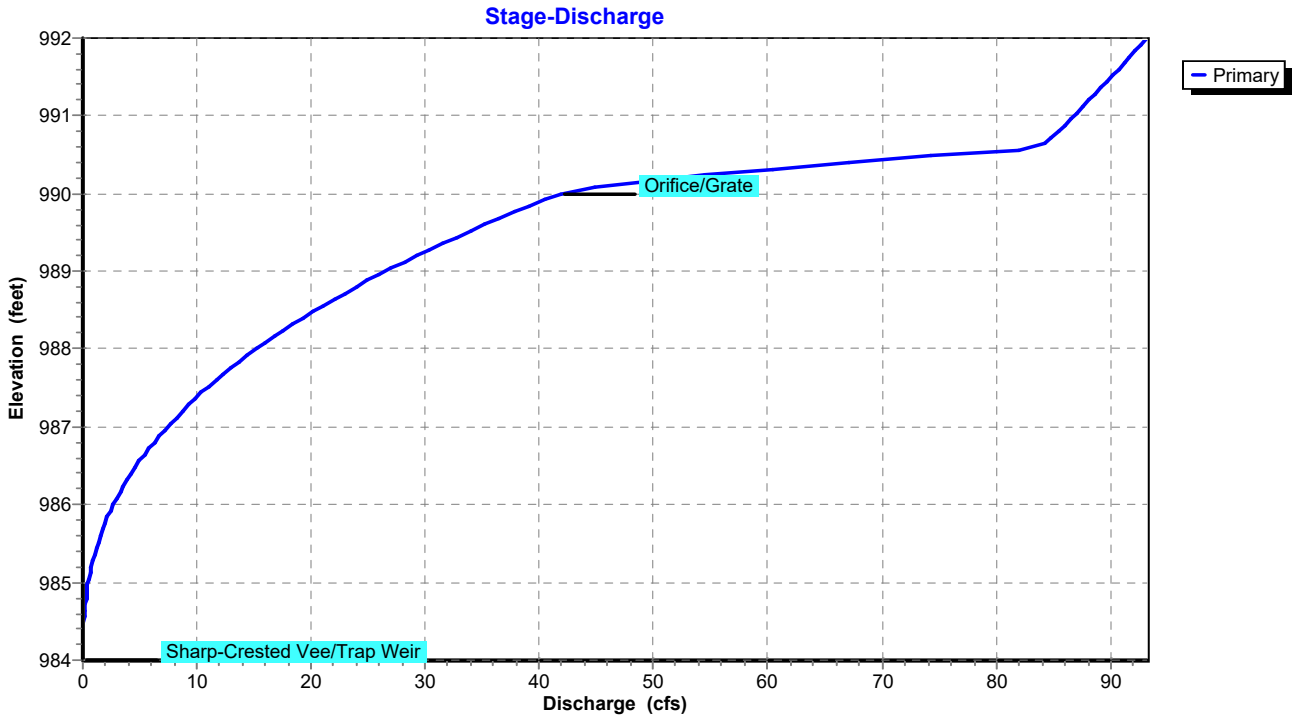
Device	Routing	Invert	Outlet Devices
#1	Primary	983.00'	**36.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.00' / 982.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Device 1	984.00'	**20.0 deg x 6.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	990.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=13.79 cfs @ 12.60 hrs HW=987.85' (Free Discharge)
└─**1=Culvert** (Passes 13.79 cfs of 62.29 cfs potential flow)
  ├─**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 13.79 cfs @ 5.28 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

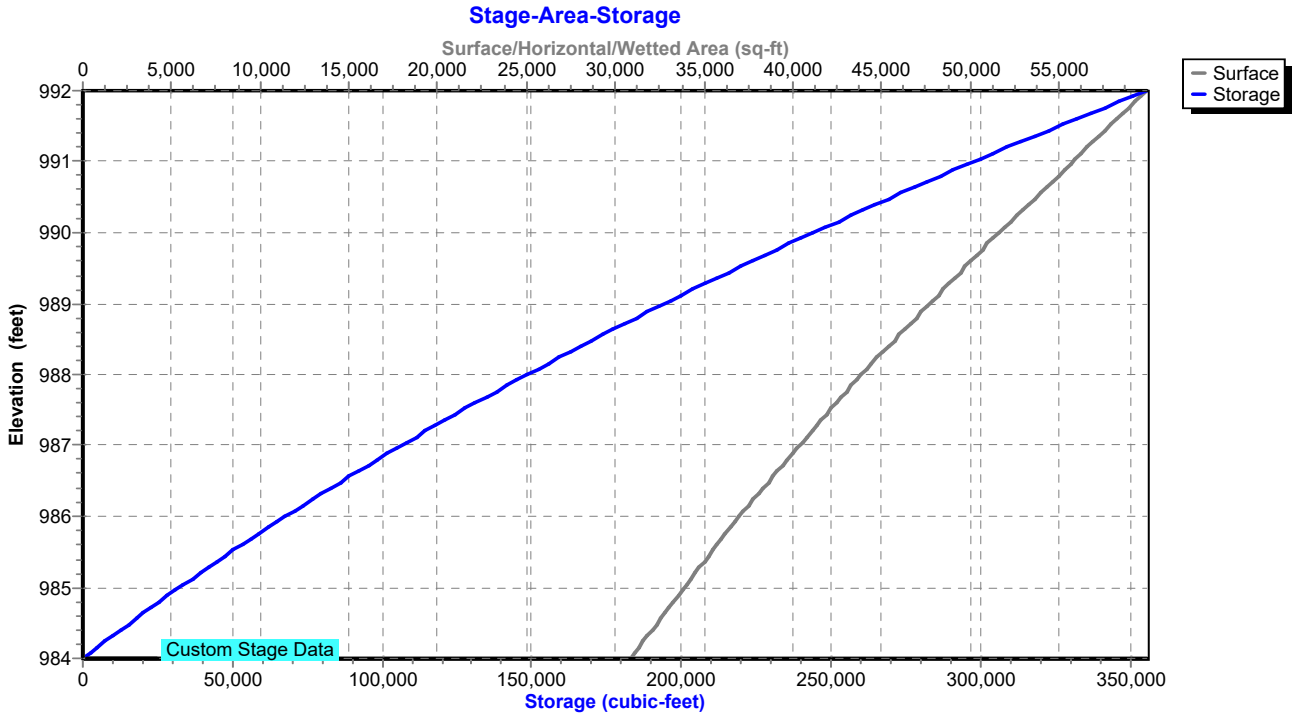
Pond 14P: EWDB #3



Pond 14P: EWDB #3



Pond 14P: EWDB #3



Summary for Pond 15P: EDDB #1

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #4 is below defined storage
[92] Warning: Device #6 is above defined storage

Inflow Area = 4.970 ac, 85.00% Impervious, Inflow Depth > 2.75" for 2-Year event
Inflow = 22.39 cfs @ 11.98 hrs, Volume= 1.140 af
Outflow = 4.75 cfs @ 12.17 hrs, Volume= 0.643 af, Atten= 79%, Lag= 11.4 min
Primary = 4.75 cfs @ 12.17 hrs, Volume= 0.643 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,007.87' @ 12.17 hrs Surf.Area= 14,115 sf Storage= 26,583 cf

Plug-Flow detention time= 138.2 min calculated for 0.642 af (56% of inflow)
Center-of-Mass det. time= 60.9 min (806.8 - 745.9)

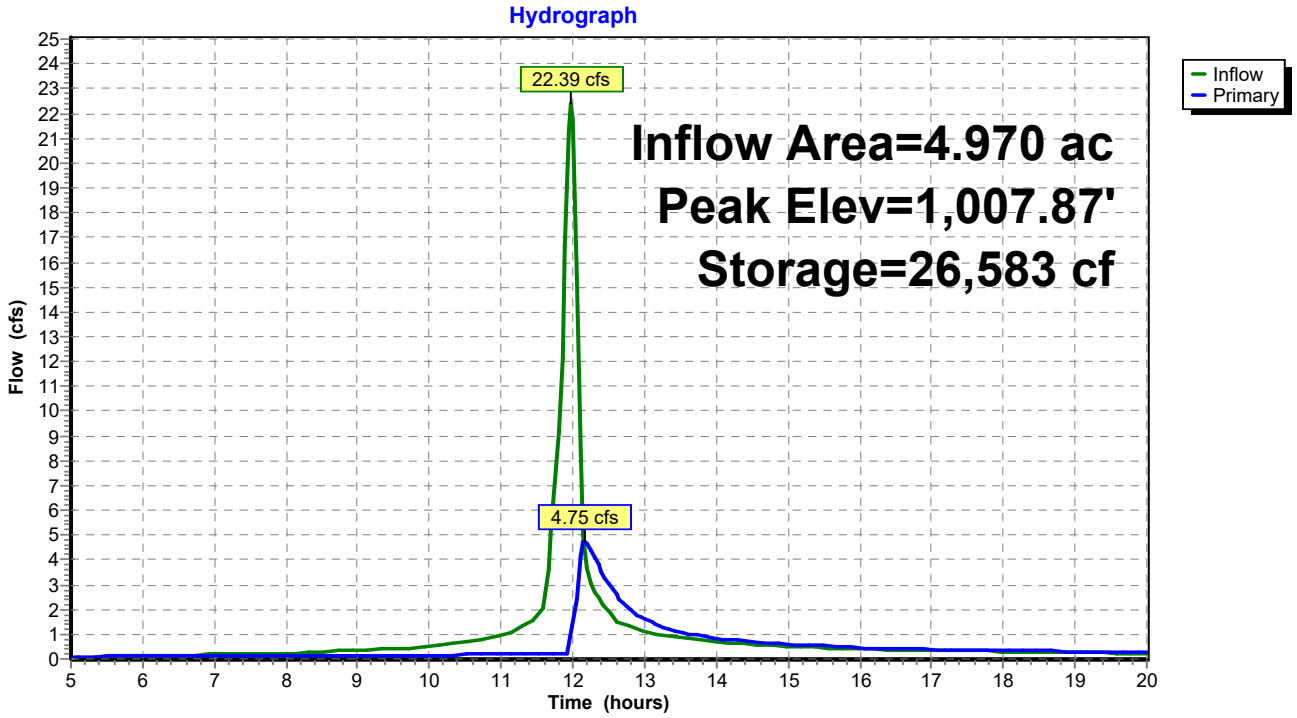
Volume	Invert	Avail.Storage	Storage Description
#1	1,004.00'	68,100 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,004.00	50	0	0
1,006.00	6,872	6,922	6,922
1,008.00	14,603	21,475	28,397
1,010.00	25,100	39,703	68,100

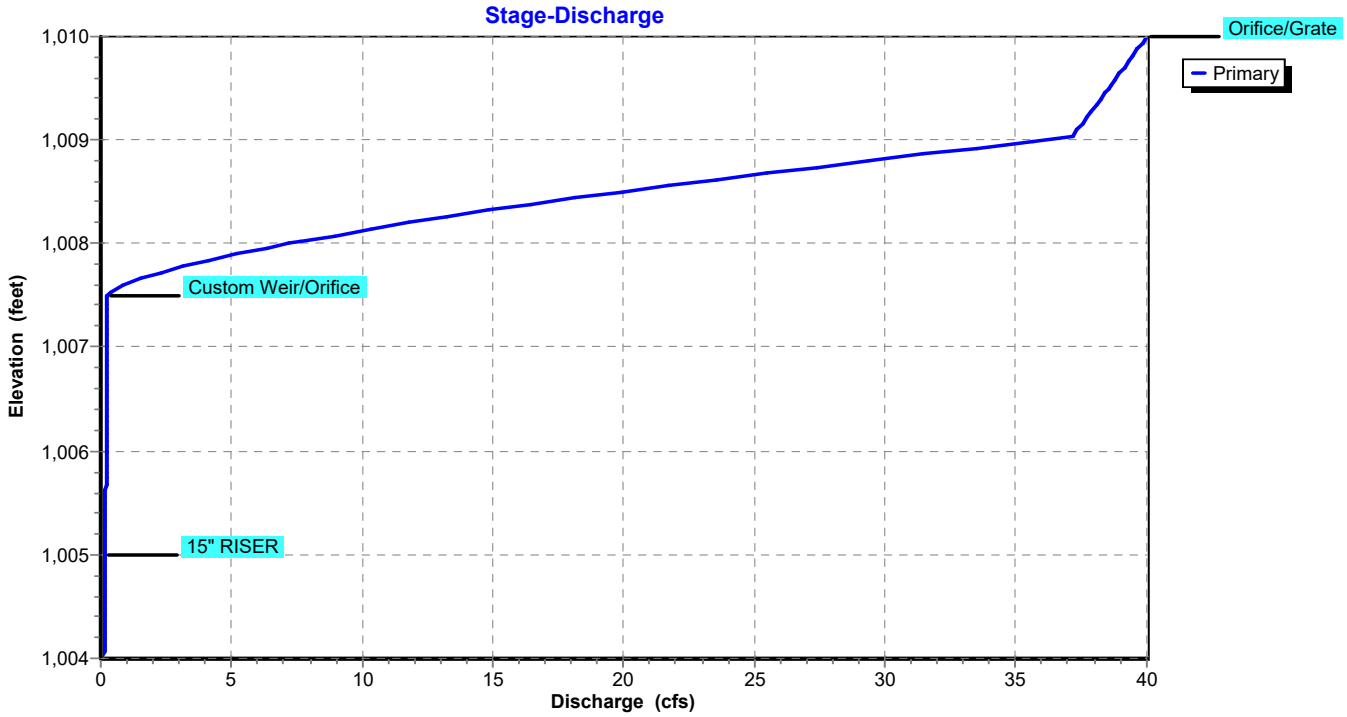
Device	Routing	Invert	Outlet Devices
#1	Primary	1,002.00'	**24.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,002.00' / 1,001.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	1,002.25'	**2.0" Vert. 2.0" ORIFICE** C= 0.600
#3	Device 1	1,007.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Elev. (feet) 1,007.50 1,009.50 Width (feet) 6.00 6.00
#4	Device 2	1,002.50'	**6.0" Round 6" PVC** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,002.50' / 1,002.25' S= 0.0083 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#5	Device 2	1,005.00'	**1.0" Vert. 15" RISER X 7.00 columns** X 9 rows with 4.0" cc spacing C= 0.600
#6	Device 1	1,010.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.67 cfs @ 12.17 hrs HW=1,007.87' (Free Discharge)
└**1=Culvert** (Passes 4.67 cfs of 33.38 cfs potential flow)
  └**2=2.0" ORIFICE** (Orifice Controls 0.25 cfs @ 11.33 fps)
    └**4=6" PVC** (Passes < 2.09 cfs potential flow)
    └**5=15" RISER** (Passes < 1.91 cfs potential flow)
  └**3=Custom Weir/Orifice** (Weir Controls 4.42 cfs @ 1.99 fps)
  └**6=Orifice/Grate** (Controls 0.00 cfs)

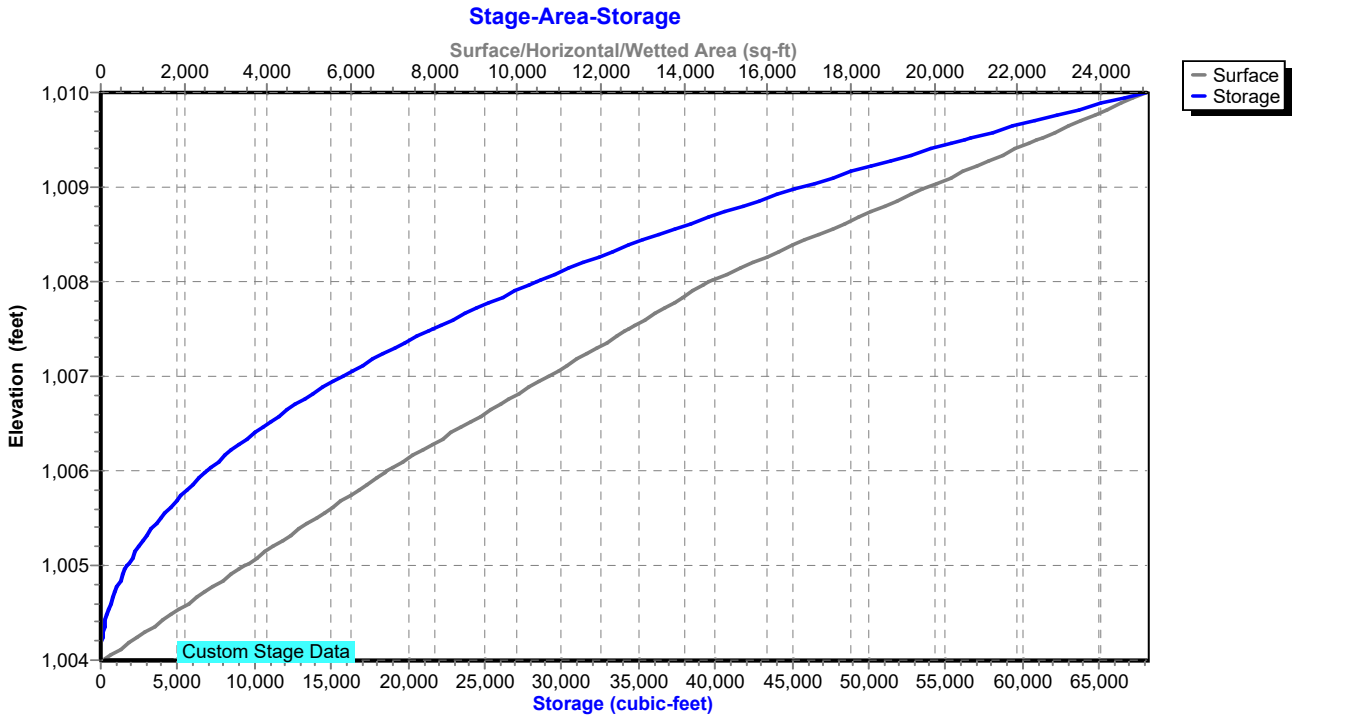
Pond 15P: EDDB #1



Pond 15P: EDDB #1



Pond 15P: EDDB #1

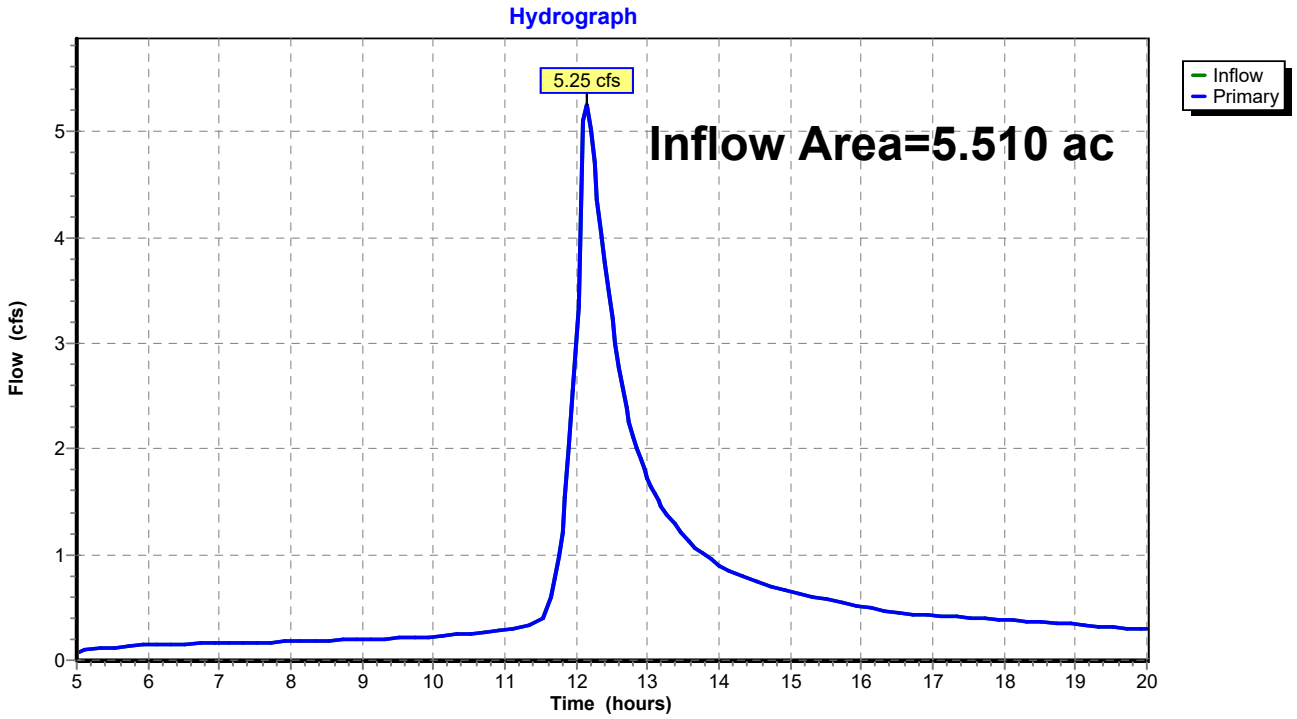


Summary for Link 7L: RP-1

Inflow Area = 5.510 ac, 85.00% Impervious, Inflow Depth > 1.67" for 2-Year event
Inflow = 5.25 cfs @ 12.14 hrs, Volume= 0.766 af
Primary = 5.25 cfs @ 12.14 hrs, Volume= 0.766 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: RP-1

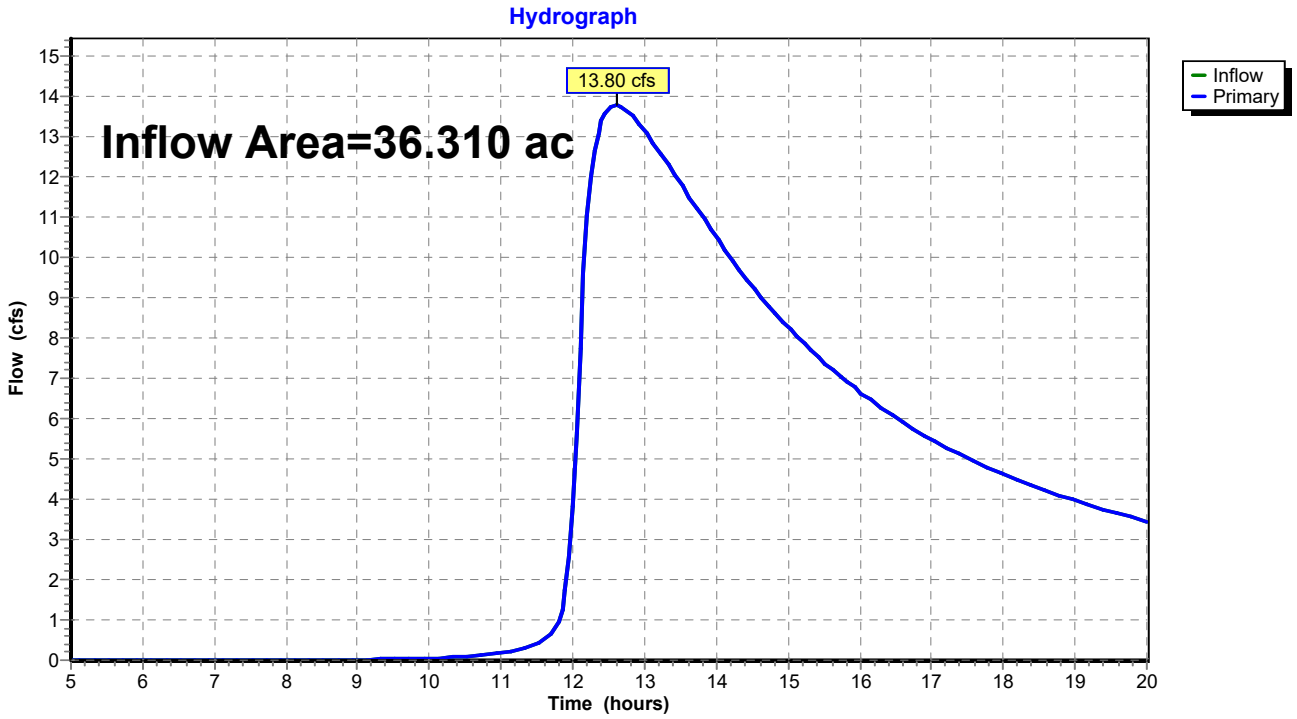


Summary for Link 9L: RP-3

Inflow Area = 36.310 ac, 41.60% Impervious, Inflow Depth > 1.66" for 2-Year event
Inflow = 13.80 cfs @ 12.60 hrs, Volume= 5.024 af
Primary = 13.80 cfs @ 12.60 hrs, Volume= 5.024 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 9L: RP-3

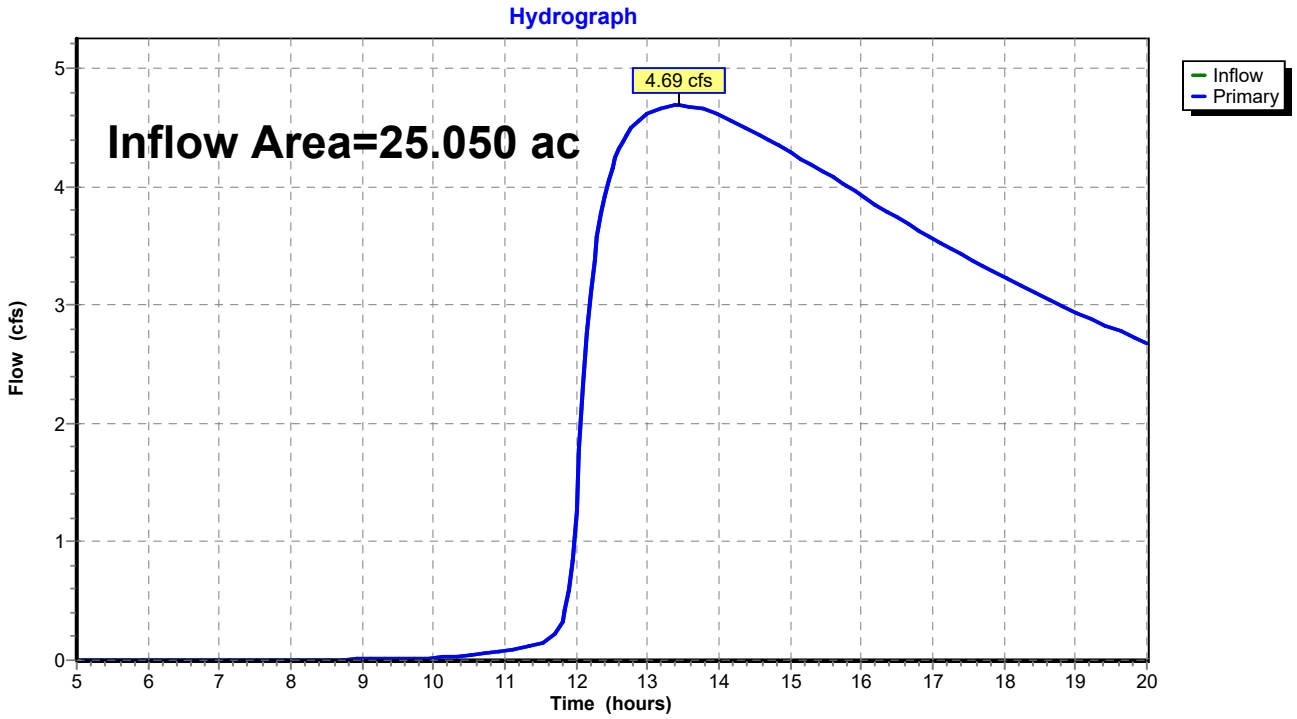


Summary for Link 10L: RP-4

Inflow Area = 25.050 ac, 78.60% Impervious, Inflow Depth > 1.21" for 2-Year event
Inflow = 4.69 cfs @ 13.43 hrs, Volume= 2.516 af
Primary = 4.69 cfs @ 13.43 hrs, Volume= 2.516 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 10L: RP-4



Summary for Subcatchment 11S: Onsite 5

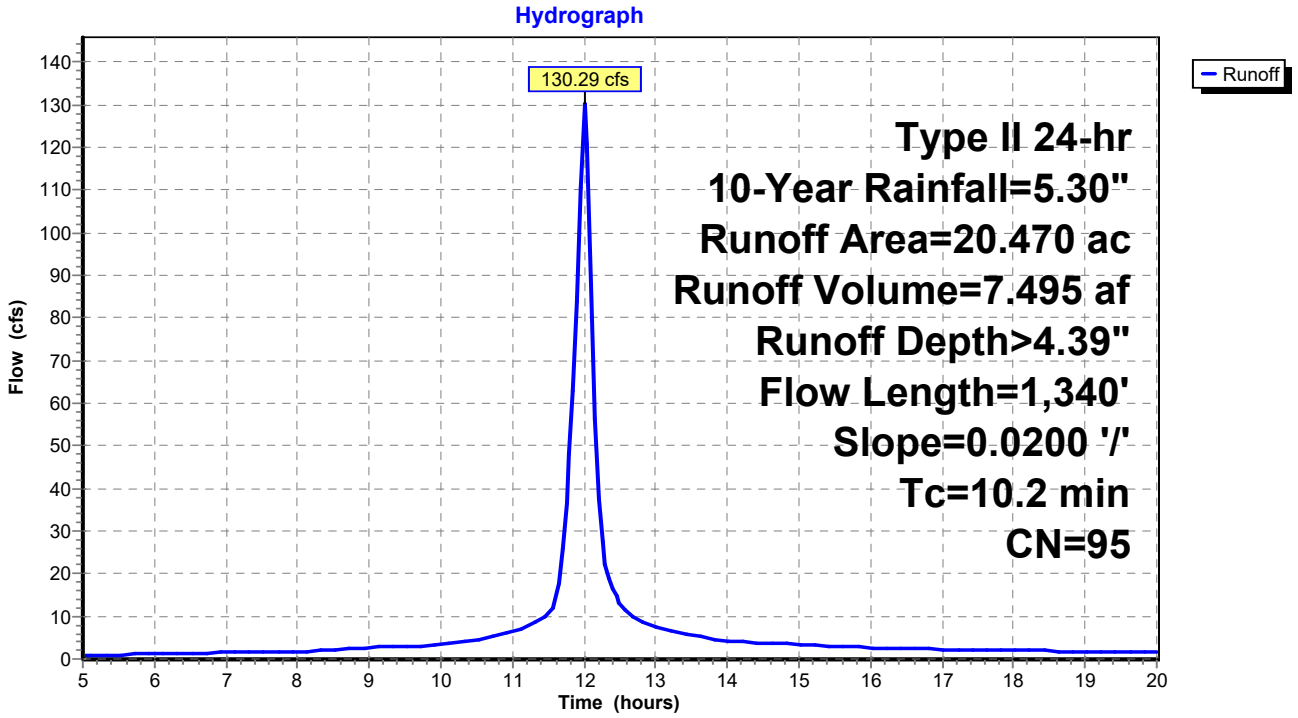
Runoff = 130.29 cfs @ 12.01 hrs, Volume= 7.495 af, Depth> 4.39"

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 10-Year Rainfall=5.30"

Area (ac)	CN	Description
20.470	95	Urban commercial, 85% imp, HSG D
3.070		15.00% Pervious Area
17.399		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
9.1	1,240	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.2	1,340	Total			

Subcatchment 11S: Onsite 5



Summary for Subcatchment 12S: EX OFF

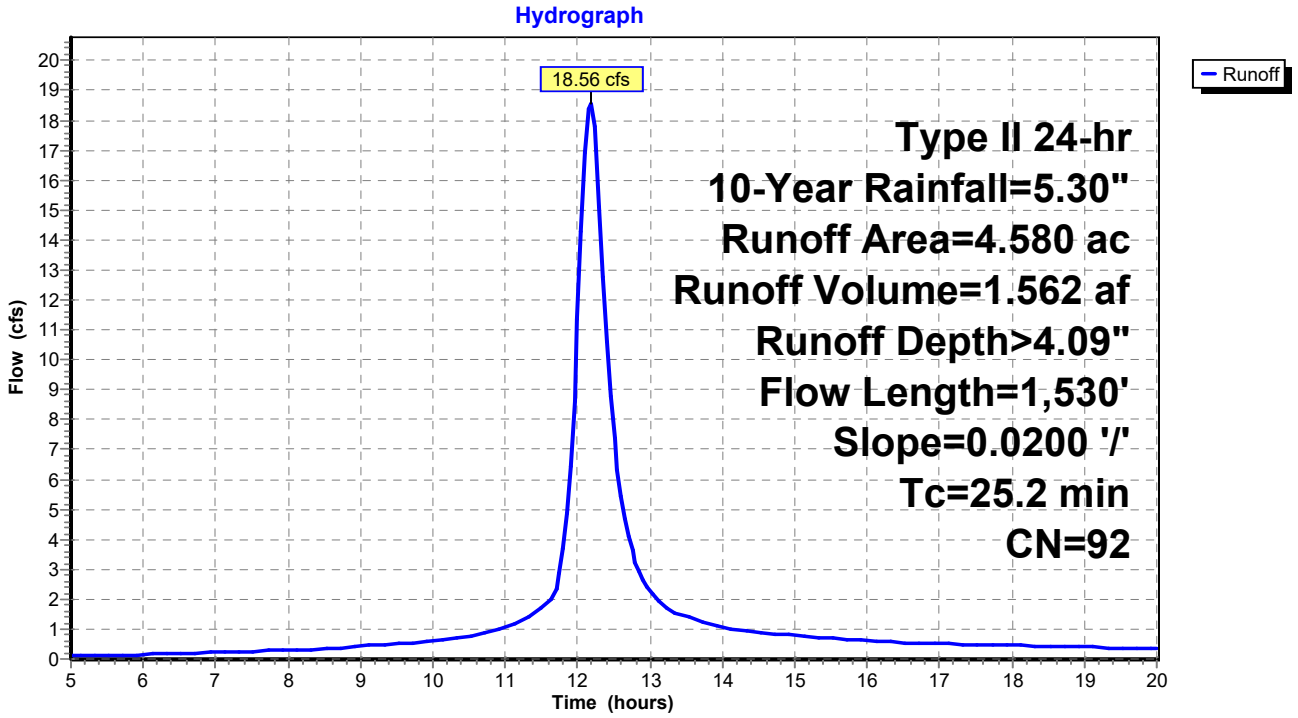
Runoff = 18.56 cfs @ 12.18 hrs, Volume= 1.562 af, Depth> 4.09"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
4.580	92	Paved roads w/open ditches, 50% imp, HSG C
2.290		50.00% Pervious Area
2.290		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
24.1	1,430	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.2	1,530	Total			

Subcatchment 12S: EX OFF



Summary for Subcatchment 13S: Onsite 4

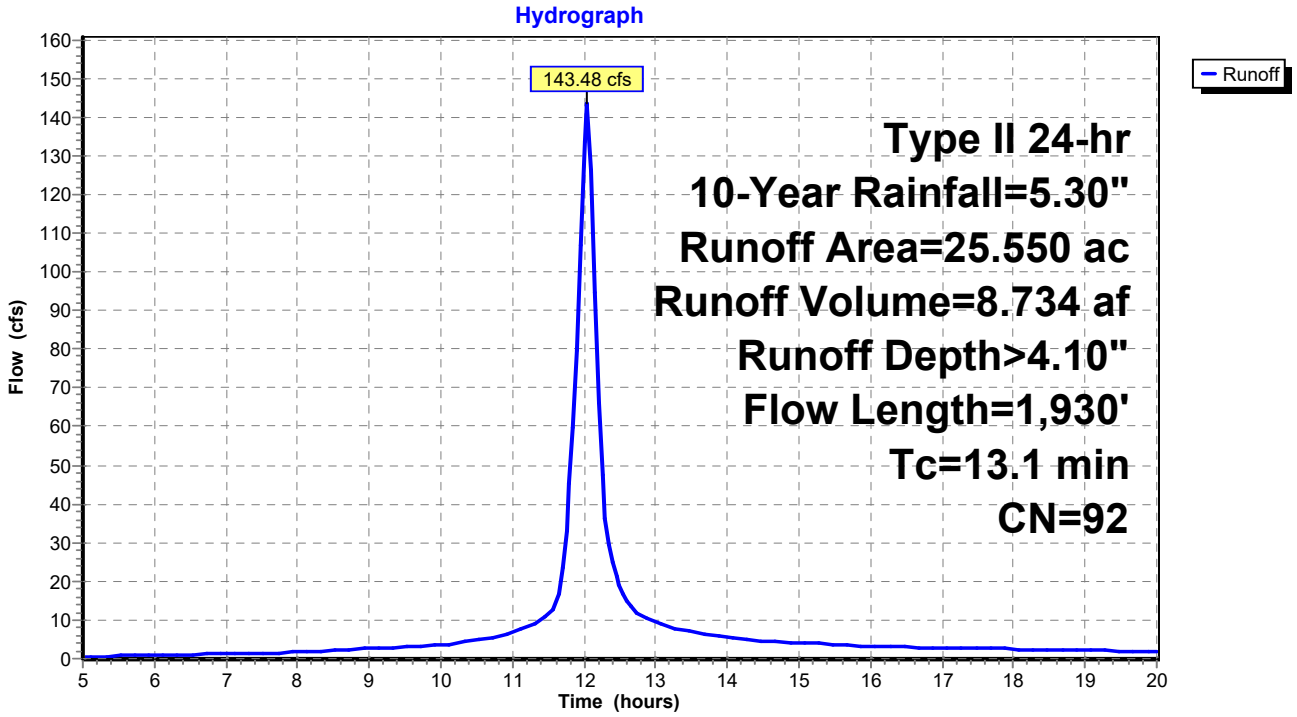
Runoff = 143.48 cfs @ 12.04 hrs, Volume= 8.734 af, Depth> 4.10"

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-Year Rainfall=5.30"

	Area (ac)	CN	Description
*	13.070	92	SINGLE FAMILY LOTS
	12.480	92	1/8 acre lots, 65% imp, HSG D
	25.550	92	Weighted Average
	17.438		68.25% Pervious Area
	8.112		31.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0205	1.47		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
12.0	1,830	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.1	1,930	Total			

Subcatchment 13S: Onsite 4



Summary for Subcatchment 15S: Onsite 2

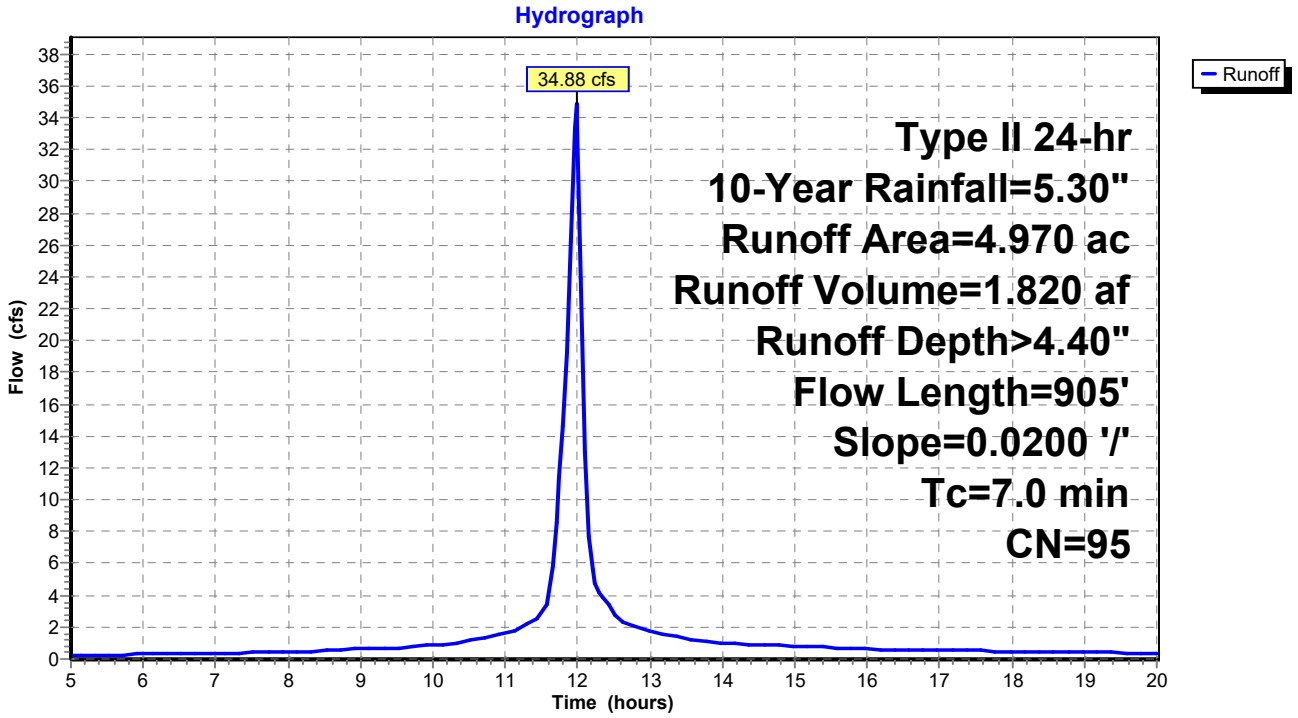
Runoff = 34.88 cfs @ 11.98 hrs, Volume= 1.820 af, Depth> 4.40"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
4.970	95	Urban commercial, 85% imp, HSG D
0.746		15.00% Pervious Area
4.224		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
5.9	805	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	905	Total			

Subcatchment 15S: Onsite 2



Summary for Subcatchment 16S: Onsite 3

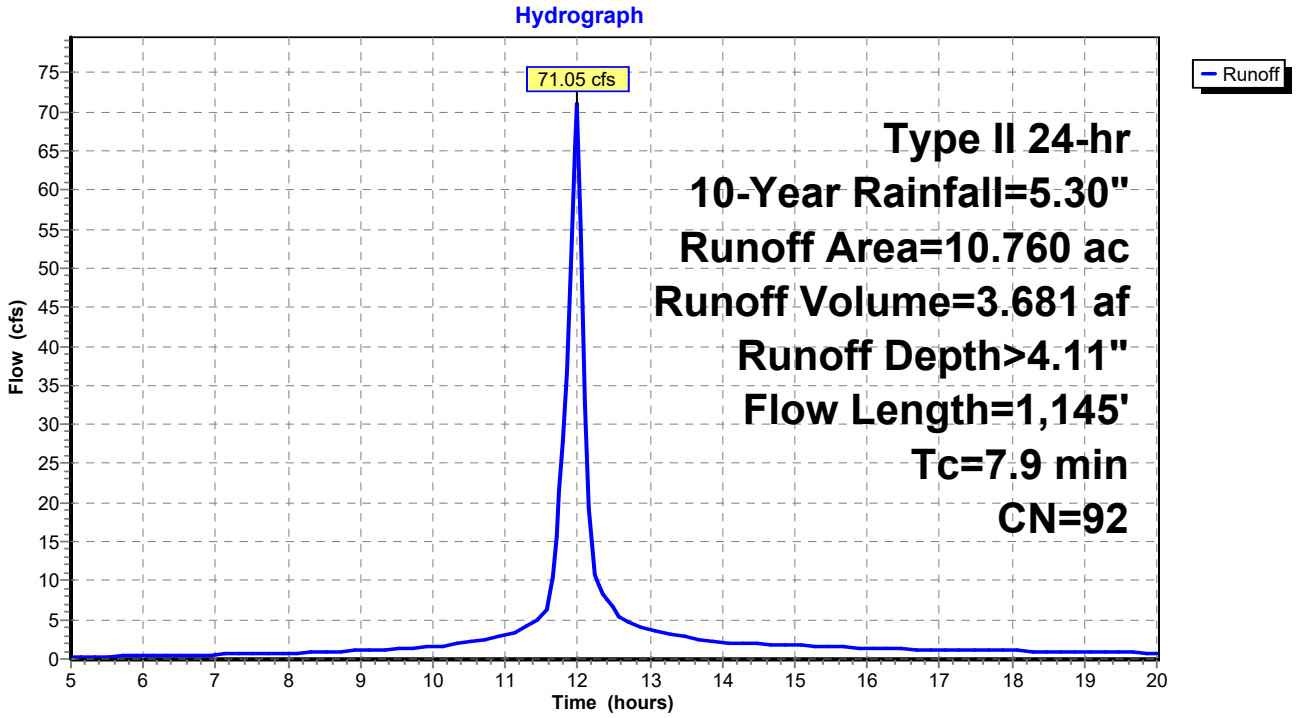
Runoff = 71.05 cfs @ 11.99 hrs, Volume= 3.681 af, Depth> 4.11"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
10.760	92	1/8 acre lots, 65% imp, HSG D
3.766		35.00% Pervious Area
6.994		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
6.8	1,045	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.9	1,145	Total			

Subcatchment 16S: Onsite 3



Summary for Subcatchment 17S: Onsite 1

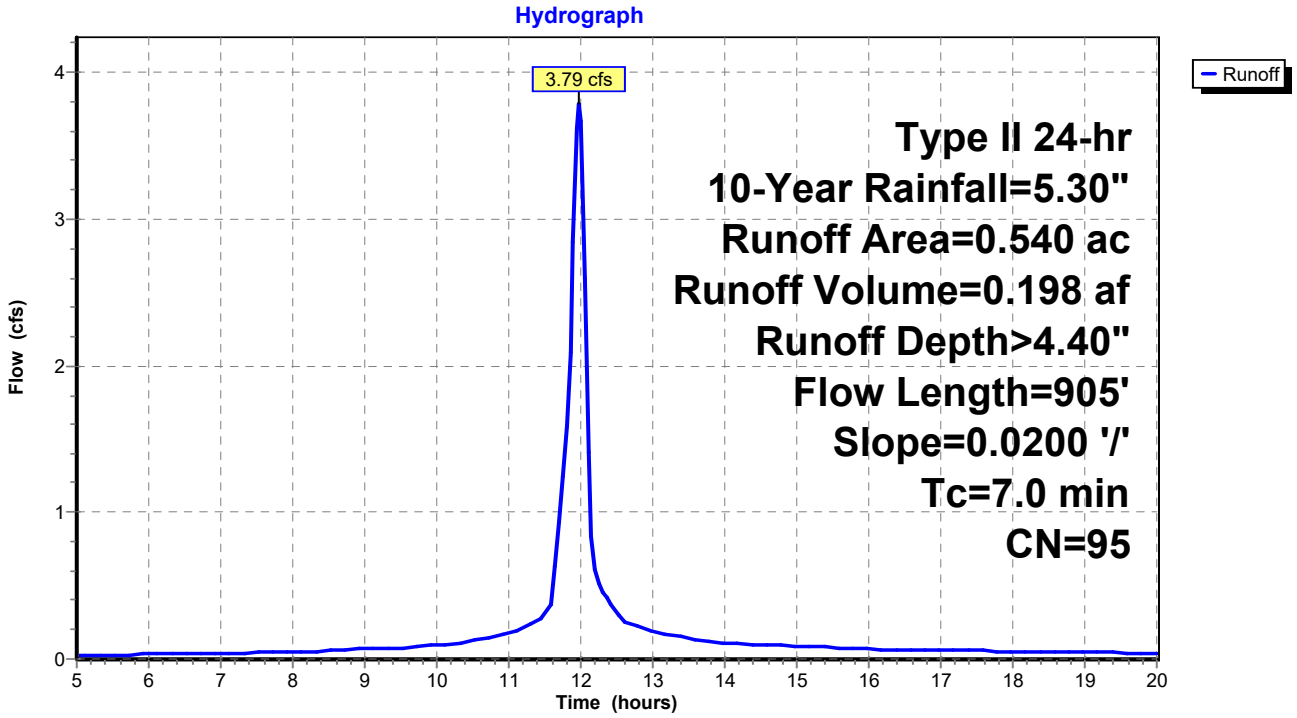
Runoff = 3.79 cfs @ 11.98 hrs, Volume= 0.198 af, Depth> 4.40"

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-Year Rainfall=5.30"

Area (ac)	CN	Description
0.540	95	Urban commercial, 85% imp, HSG D
0.081		15.00% Pervious Area
0.459		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
5.9	805	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	905	Total			

Subcatchment 17S: Onsite 1



Summary for Pond 12P: EWDB #1

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.050 ac, 78.60% Impervious, Inflow Depth > 4.34" for 10-Year event
Inflow = 142.32 cfs @ 12.01 hrs, Volume= 9.057 af
Outflow = 10.37 cfs @ 12.93 hrs, Volume= 5.228 af, Atten= 93%, Lag= 55.0 min
Primary = 10.37 cfs @ 12.93 hrs, Volume= 5.228 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 997.71' @ 12.93 hrs Surf.Area= 78,771 sf Storage= 264,517 cf

Plug-Flow detention time= 253.3 min calculated for 5.226 af (58% of inflow)
Center-of-Mass det. time= 175.7 min (920.6 - 744.9)

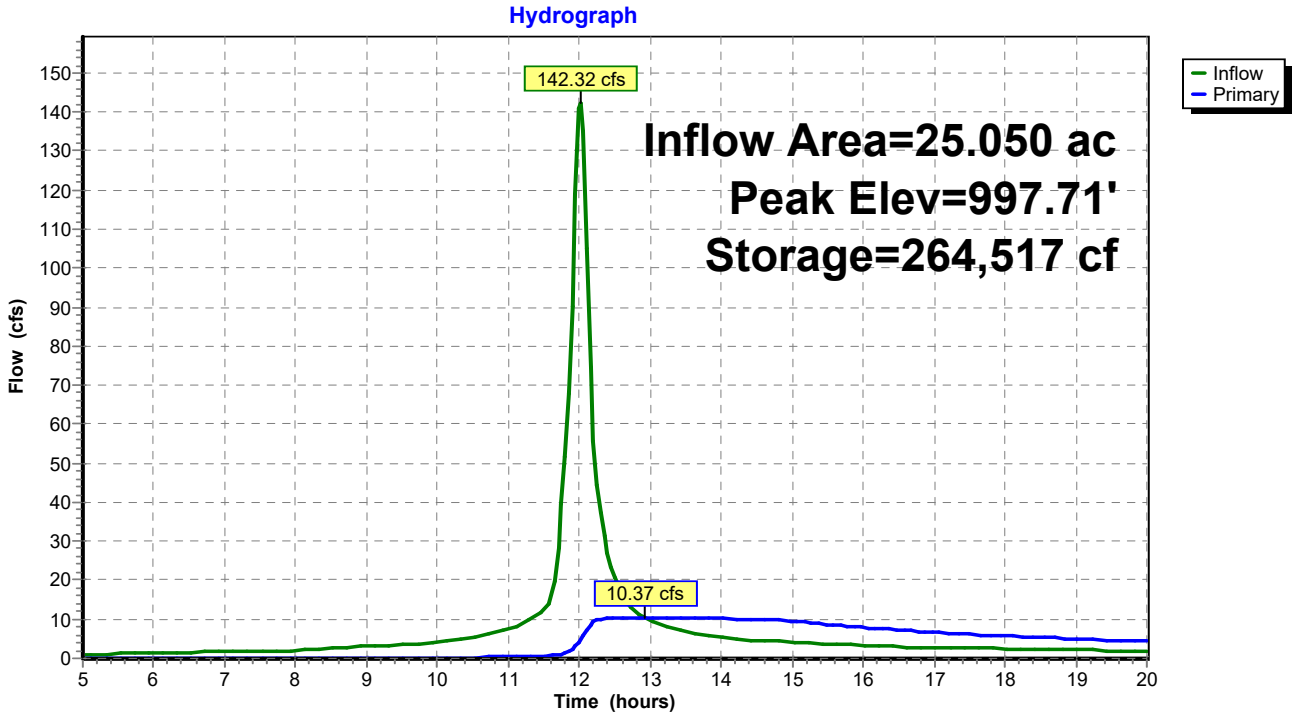
Volume	Invert	Avail.Storage	Storage Description
#1	994.00'	640,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
994.00	64,027	0	0
996.00	71,876	135,903	135,903
998.00	79,952	151,828	287,731
1,000.00	88,254	168,206	455,937
1,002.00	96,782	185,036	640,973

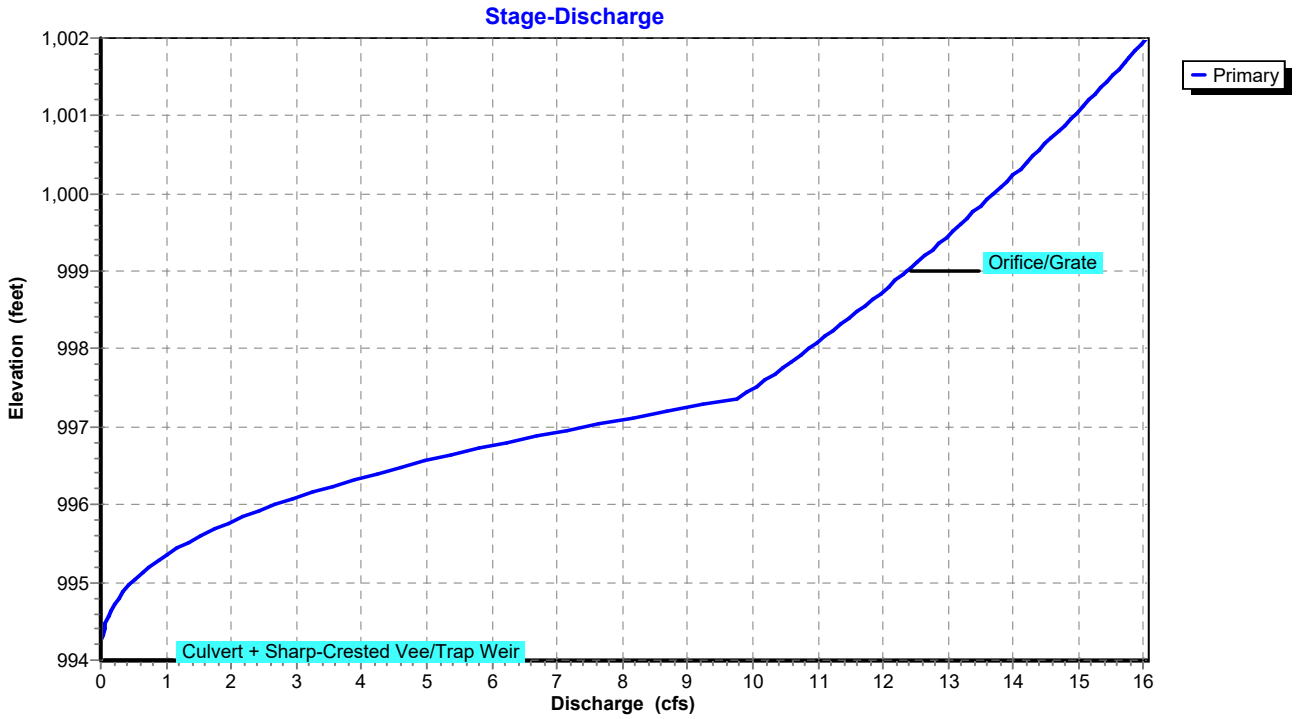
Device	Routing	Invert	Outlet Devices
#1	Primary	994.00'	**15.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 994.00' / 993.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	994.00'	**20.0 deg x 5.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	999.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=10.37 cfs @ 12.93 hrs HW=997.71' (Free Discharge)
└**1=Culvert** (Inlet Controls 10.37 cfs @ 8.45 fps)
  ├**2=Sharp-Crested Vee/Trap Weir** (Passes 10.37 cfs of 12.55 cfs potential flow)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

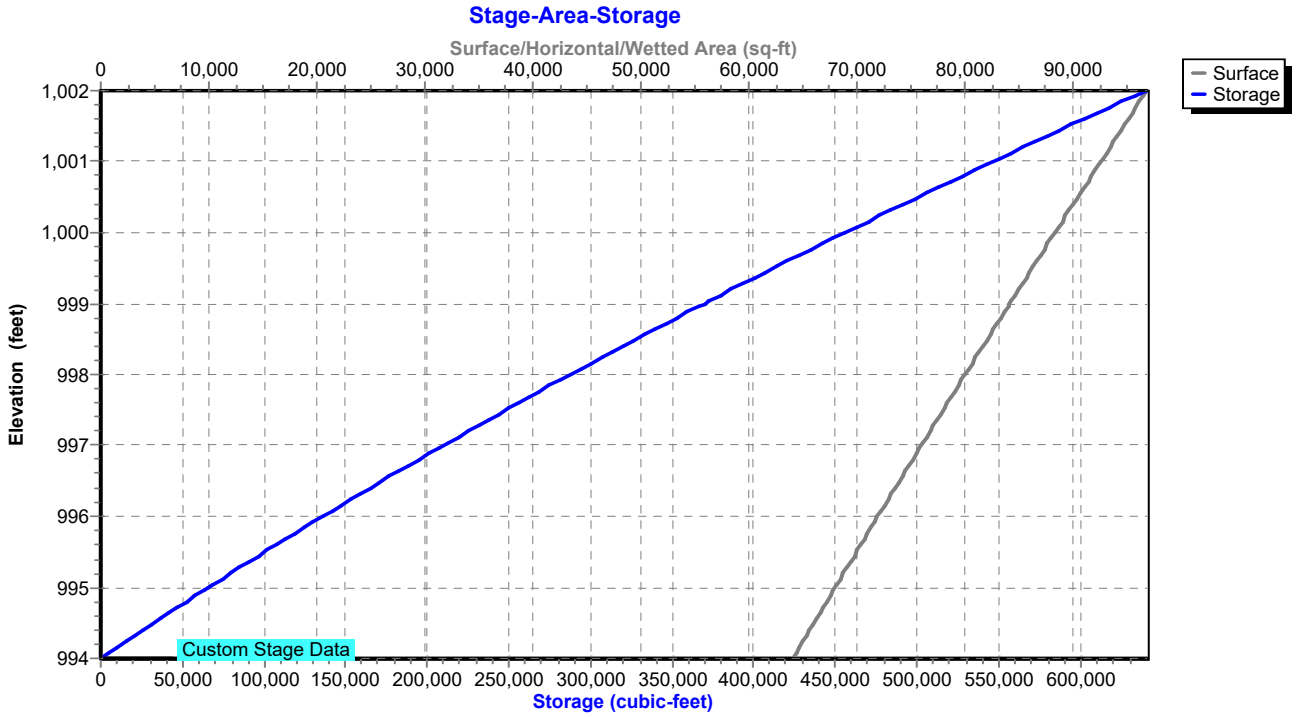
Pond 12P: EWDB #1



Pond 12P: EWDB #1



Pond 12P: EWDB #1



Summary for Pond 13P: EWDB #2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 10.760 ac, 65.00% Impervious, Inflow Depth > 4.11" for 10-Year event
Inflow = 71.05 cfs @ 11.99 hrs, Volume= 3.681 af
Outflow = 11.33 cfs @ 12.25 hrs, Volume= 2.859 af, Atten= 84%, Lag= 15.5 min
Primary = 11.33 cfs @ 12.25 hrs, Volume= 2.859 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 995.56' @ 12.25 hrs Surf.Area= 30,688 sf Storage= 92,348 cf

Plug-Flow detention time= 174.0 min calculated for 2.859 af (78% of inflow)
Center-of-Mass det. time= 116.6 min (864.9 - 748.3)

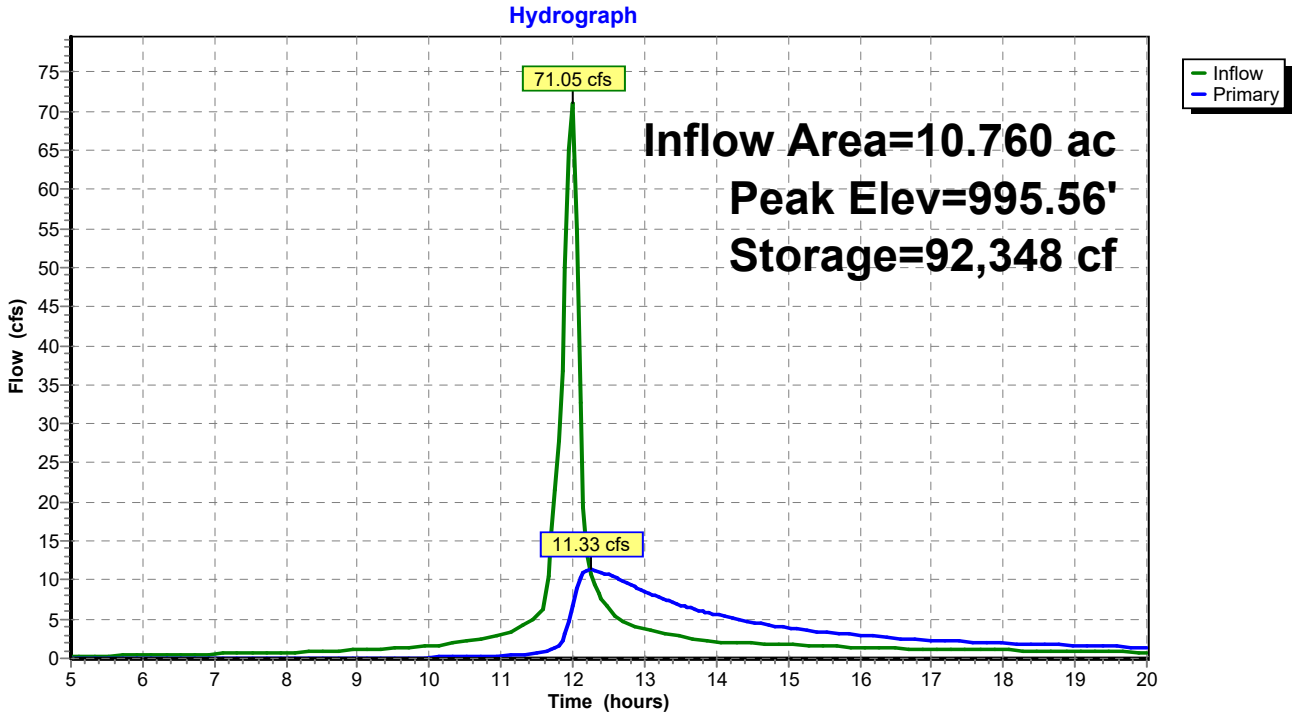
Volume	Invert	Avail.Storage	Storage Description
#1	992.00'	175,799 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.00	21,391	0	0
994.00	26,438	47,829	47,829
996.00	31,892	58,330	106,159
998.00	37,748	69,640	175,799

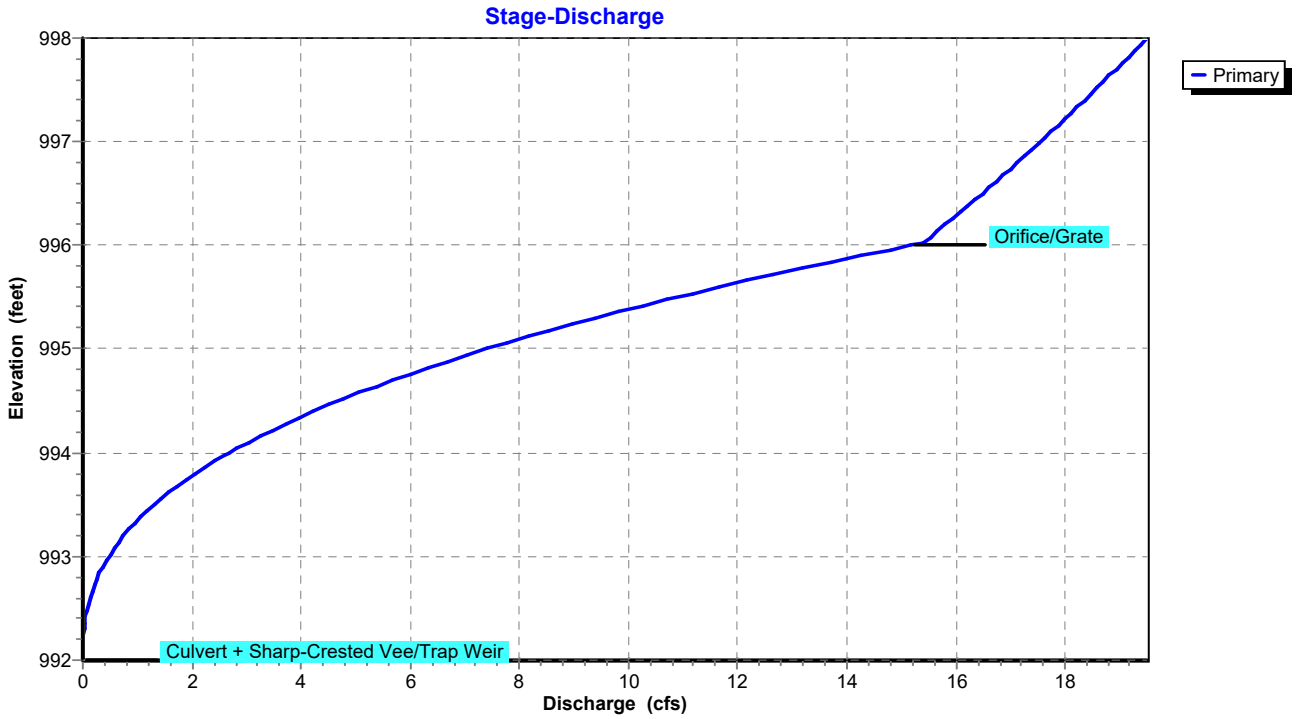
Device	Routing	Invert	Outlet Devices
#1	Primary	992.00'	**18.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 992.00' / 991.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Device 1	992.00'	**20.0 deg x 4.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	996.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=11.33 cfs @ 12.25 hrs HW=995.56' (Free Discharge)
└**1=Culvert** (Passes 11.33 cfs of 14.26 cfs potential flow)
  ├**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 11.33 cfs @ 5.07 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

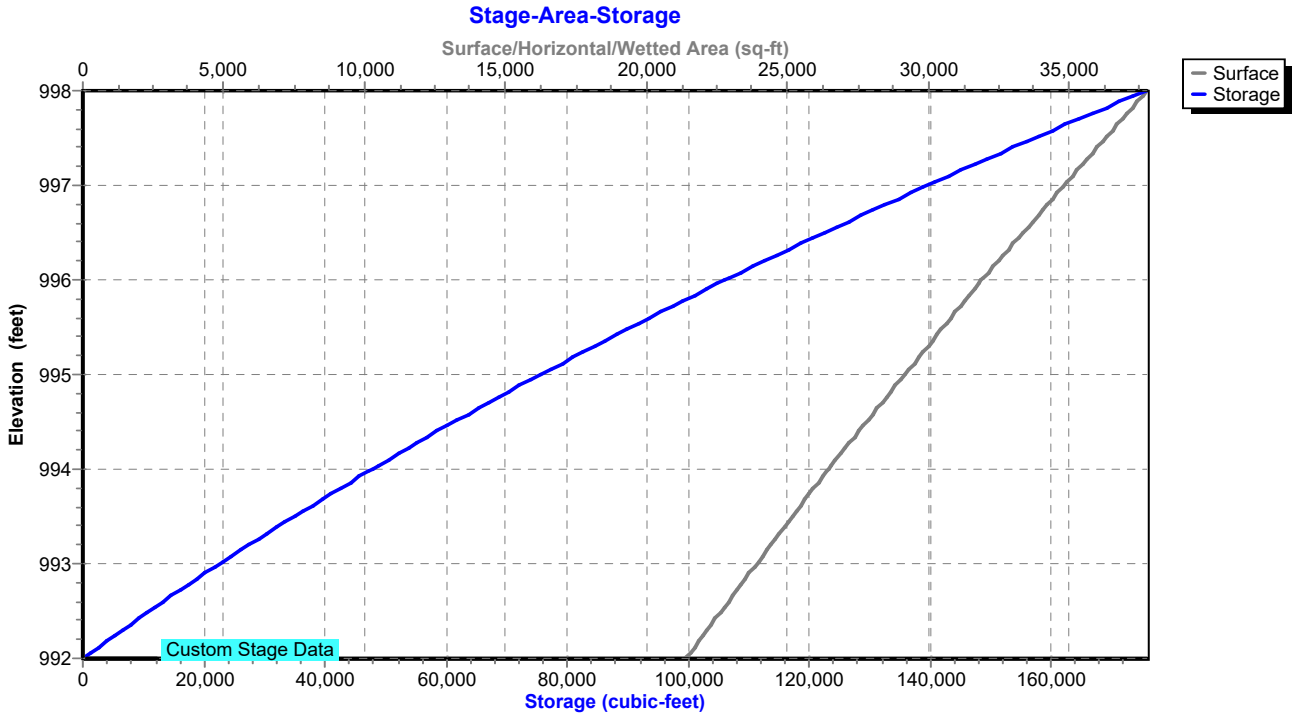
Pond 13P: EWDB #2



Pond 13P: EWDB #2



Pond 13P: EWDB #2



Summary for Pond 14P: EWDB #3

[82] Warning: Early inflow requires earlier time span

Inflow Area = 36.310 ac, 41.60% Impervious, Inflow Depth > 3.83" for 10-Year event
Inflow = 152.18 cfs @ 12.05 hrs, Volume= 11.593 af
Outflow = 35.30 cfs @ 12.41 hrs, Volume= 9.576 af, Atten= 77%, Lag= 21.8 min
Primary = 35.30 cfs @ 12.41 hrs, Volume= 9.576 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 989.61' @ 12.41 hrs Surf.Area= 50,089 sf Storage= 224,042 cf

Plug-Flow detention time= 144.2 min calculated for 9.543 af (82% of inflow)
Center-of-Mass det. time= 91.8 min (871.8 - 780.1)

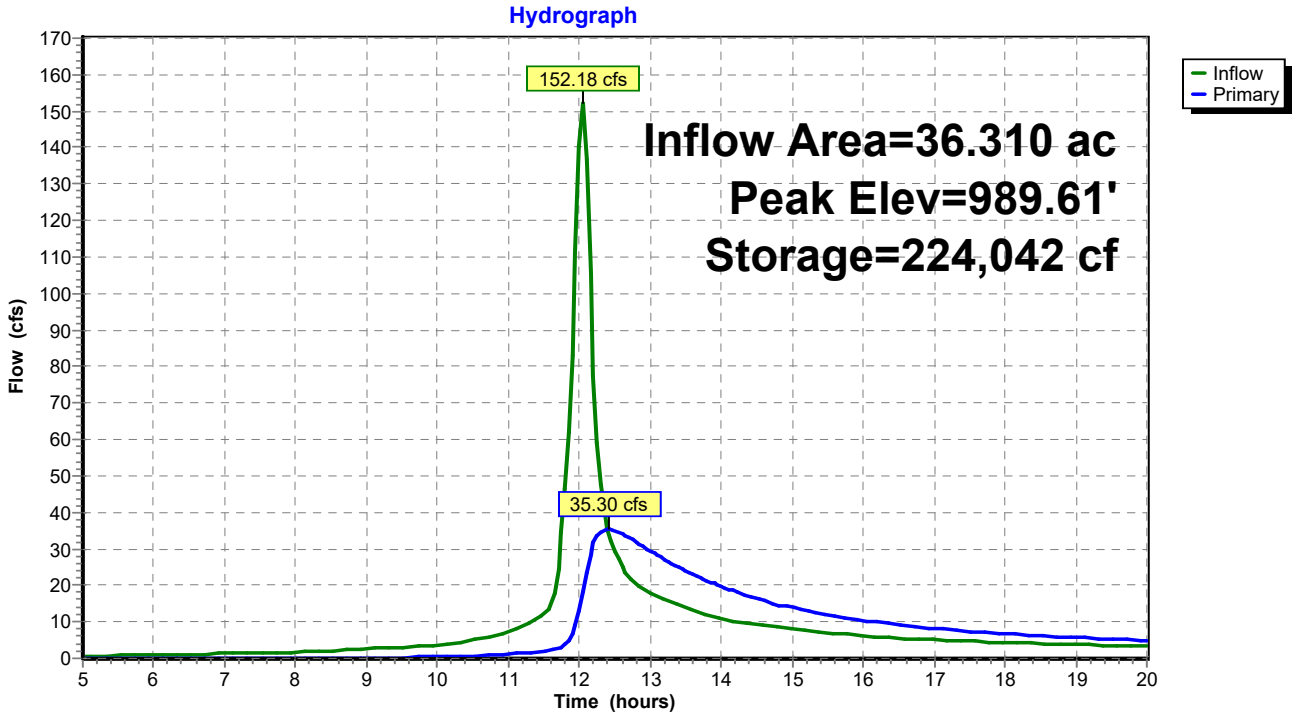
Volume	Invert	Avail.Storage	Storage Description
#1	984.00'	355,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
984.00	30,844	0	0
986.00	36,957	67,801	67,801
988.00	43,835	80,792	148,593
990.00	51,620	95,455	244,048
992.00	59,957	111,577	355,625

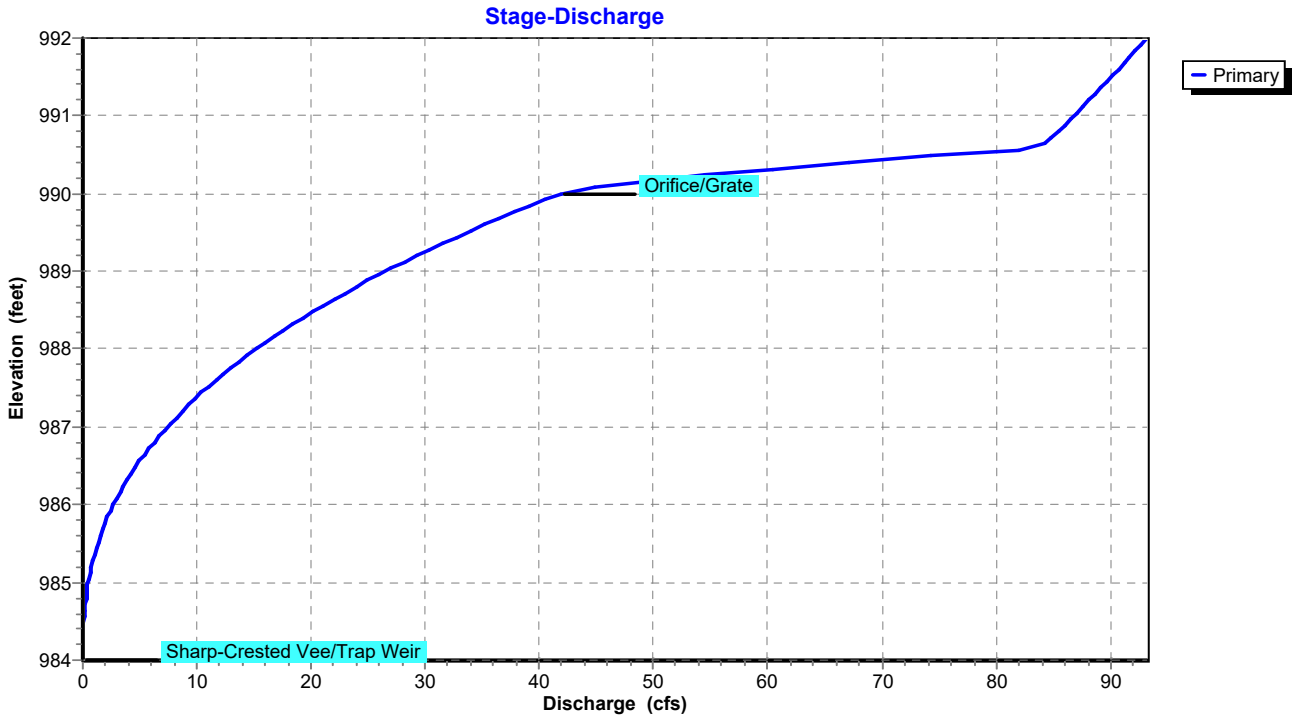
Device	Routing	Invert	Outlet Devices
#1	Primary	983.00'	**36.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.00' / 982.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Device 1	984.00'	**20.0 deg x 6.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	990.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=35.29 cfs @ 12.41 hrs HW=989.61' (Free Discharge)
└**1=Culvert** (Passes 35.29 cfs of 76.90 cfs potential flow)
  ├**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 35.29 cfs @ 6.37 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

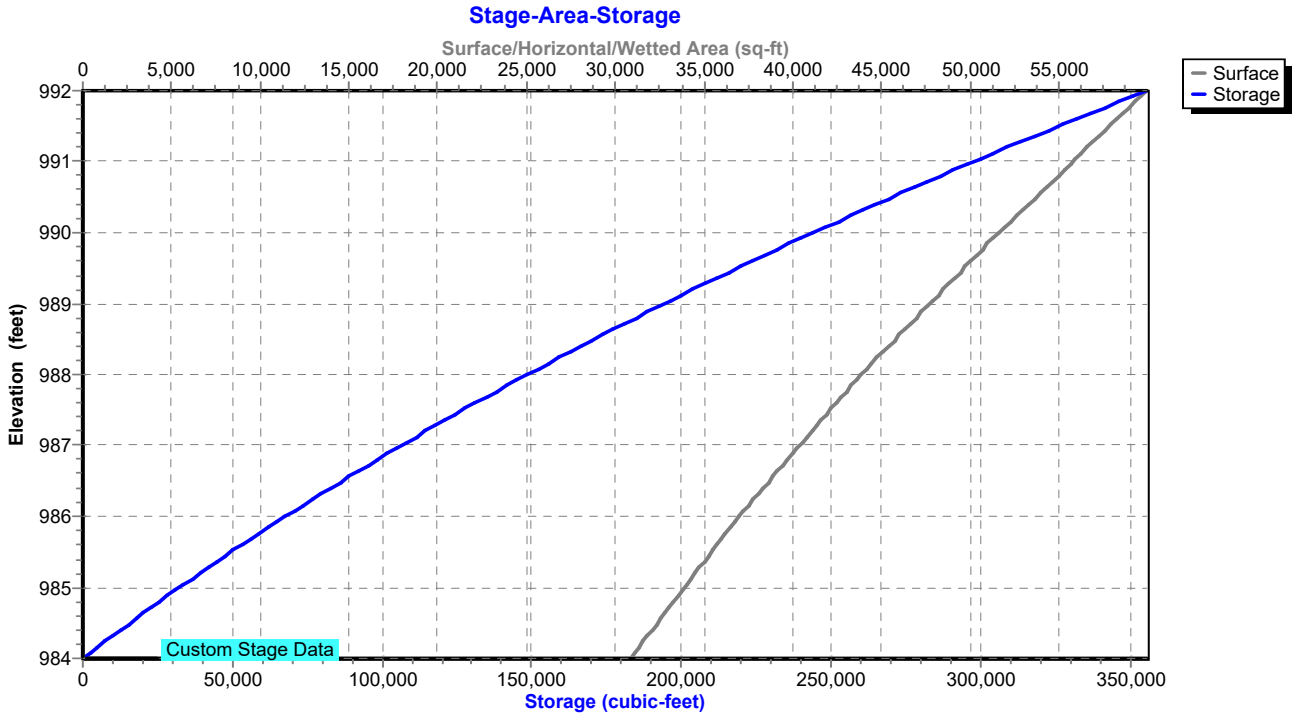
Pond 14P: EWDB #3



Pond 14P: EWDB #3



Pond 14P: EWDB #3



Summary for Pond 15P: EDDB #1

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #4 is below defined storage
[92] Warning: Device #6 is above defined storage

Inflow Area = 4.970 ac, 85.00% Impervious, Inflow Depth > 4.40" for 10-Year event
Inflow = 34.88 cfs @ 11.98 hrs, Volume= 1.820 af
Outflow = 19.40 cfs @ 12.07 hrs, Volume= 1.314 af, Atten= 44%, Lag= 5.7 min
Primary = 19.40 cfs @ 12.07 hrs, Volume= 1.314 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,008.48' @ 12.07 hrs Surf.Area= 17,138 sf Storage= 36,062 cf

Plug-Flow detention time= 112.6 min calculated for 1.310 af (72% of inflow)
Center-of-Mass det. time= 50.0 min (789.0 - 739.0)

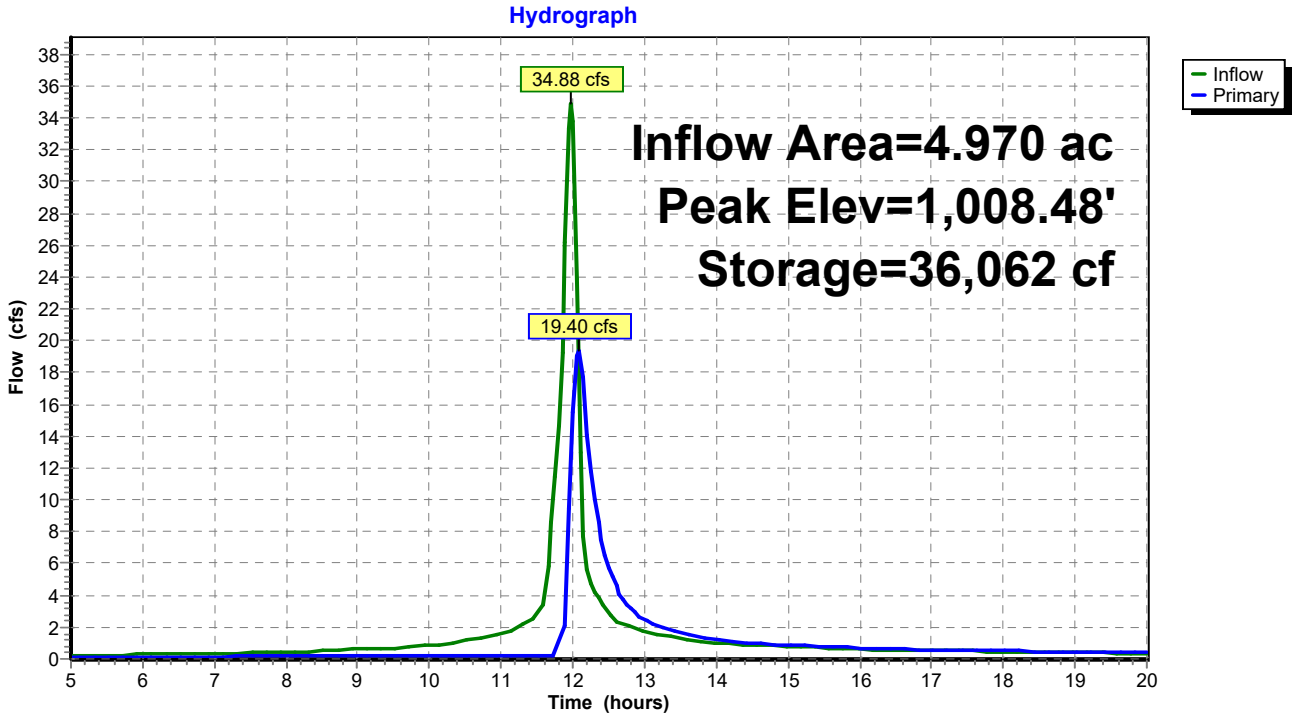
Volume	Invert	Avail.Storage	Storage Description
#1	1,004.00'	68,100 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,004.00	50	0	0
1,006.00	6,872	6,922	6,922
1,008.00	14,603	21,475	28,397
1,010.00	25,100	39,703	68,100

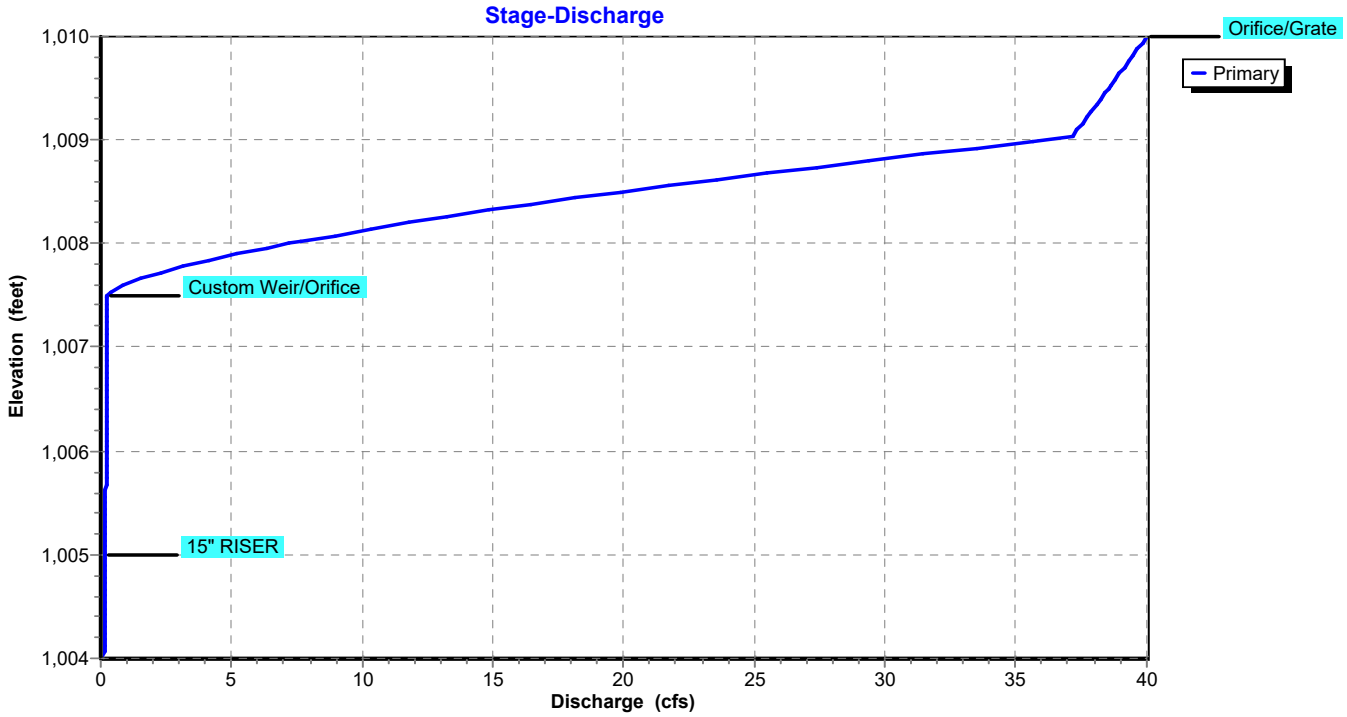
Device	Routing	Invert	Outlet Devices
#1	Primary	1,002.00'	**24.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,002.00' / 1,001.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	1,002.25'	**2.0" Vert. 2.0" ORIFICE** C= 0.600
#3	Device 1	1,007.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Elev. (feet) 1,007.50 1,009.50 Width (feet) 6.00 6.00
#4	Device 2	1,002.50'	**6.0" Round 6" PVC** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,002.50' / 1,002.25' S= 0.0083 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#5	Device 2	1,005.00'	**1.0" Vert. 15" RISER X 7.00 columns** X 9 rows with 4.0" cc spacing C= 0.600
#6	Device 1	1,010.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=18.94 cfs @ 12.07 hrs HW=1,008.47' (Free Discharge)
└**1=Culvert** (Passes 18.94 cfs of 35.37 cfs potential flow)
  └**2=2.0" ORIFICE** (Orifice Controls 0.26 cfs @ 11.92 fps)
    └**4=6" PVC** (Passes < 2.21 cfs potential flow)
    └**5=15" RISER** (Passes < 2.34 cfs potential flow)
  └**3=Custom Weir/Orifice** (Weir Controls 18.68 cfs @ 3.22 fps)
  └**6=Orifice/Grate** (Controls 0.00 cfs)

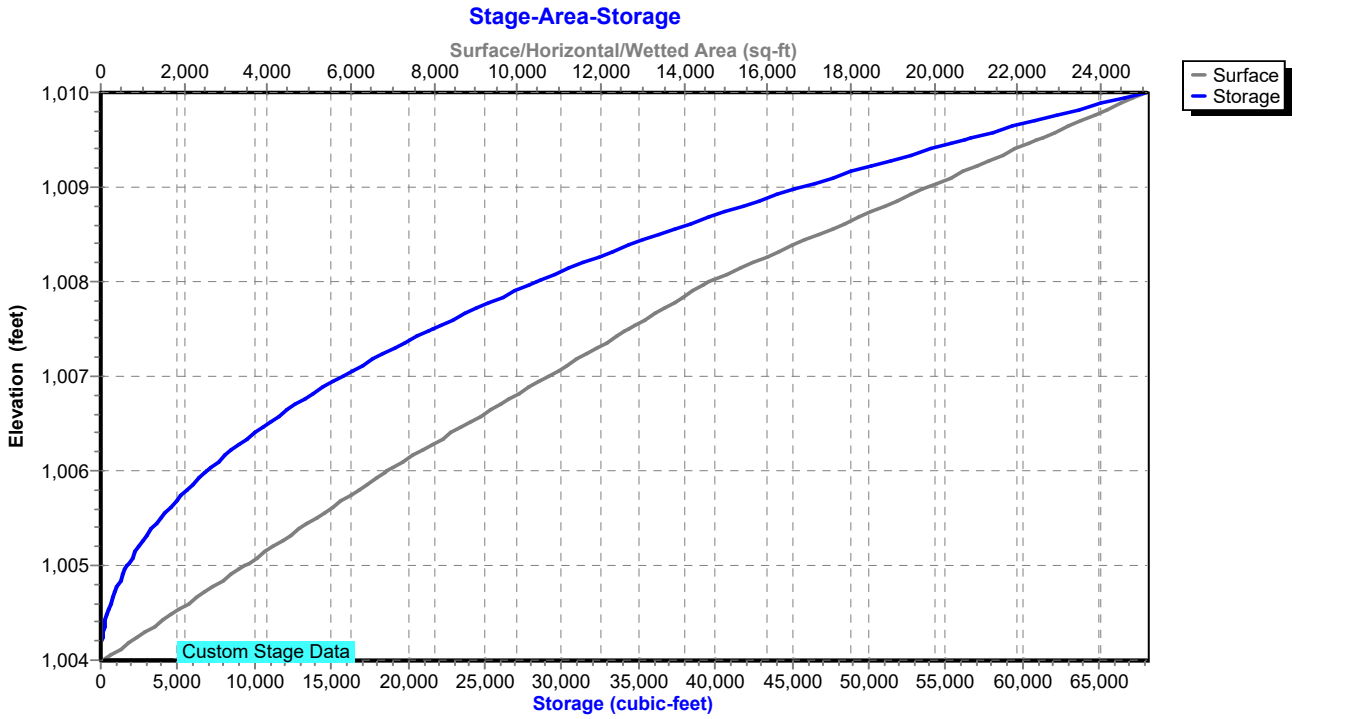
Pond 15P: EDDB #1



Pond 15P: EDDB #1



Pond 15P: EDDB #1

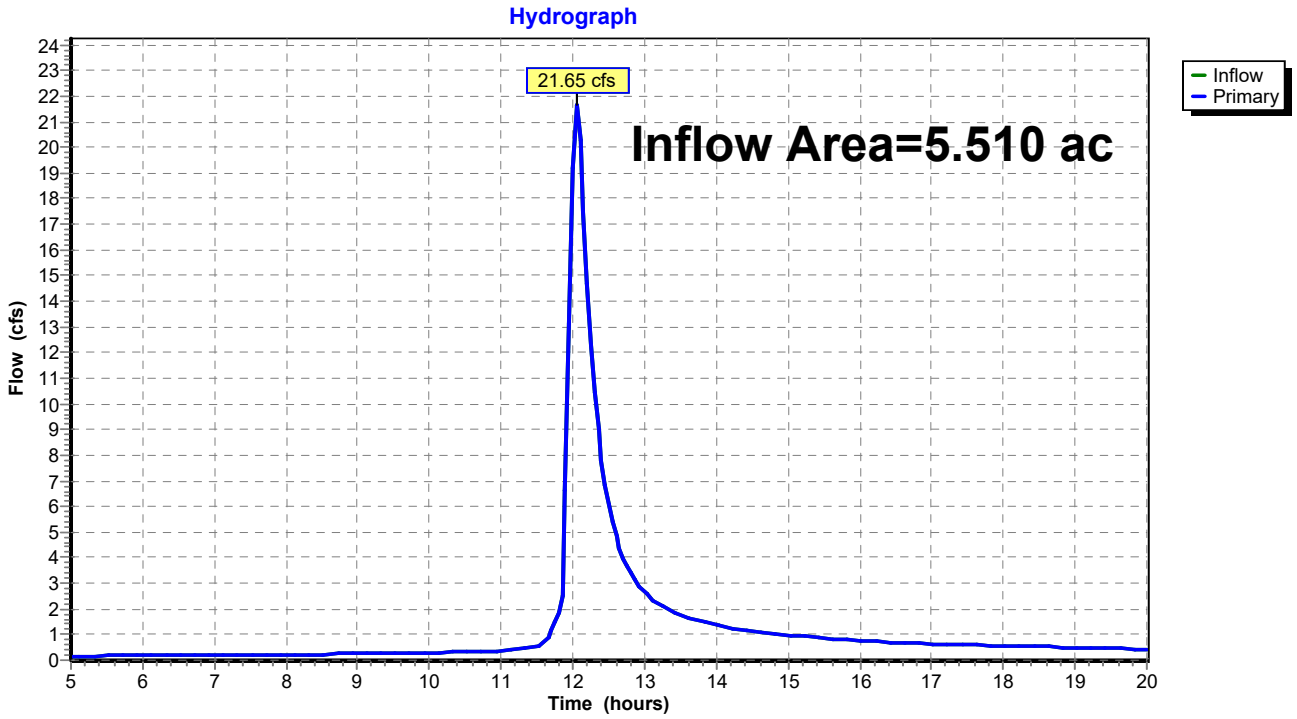


Summary for Link 7L: RP-1

Inflow Area = 5.510 ac, 85.00% Impervious, Inflow Depth > 3.29" for 10-Year event
Inflow = 21.65 cfs @ 12.06 hrs, Volume= 1.512 af
Primary = 21.65 cfs @ 12.06 hrs, Volume= 1.512 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: RP-1

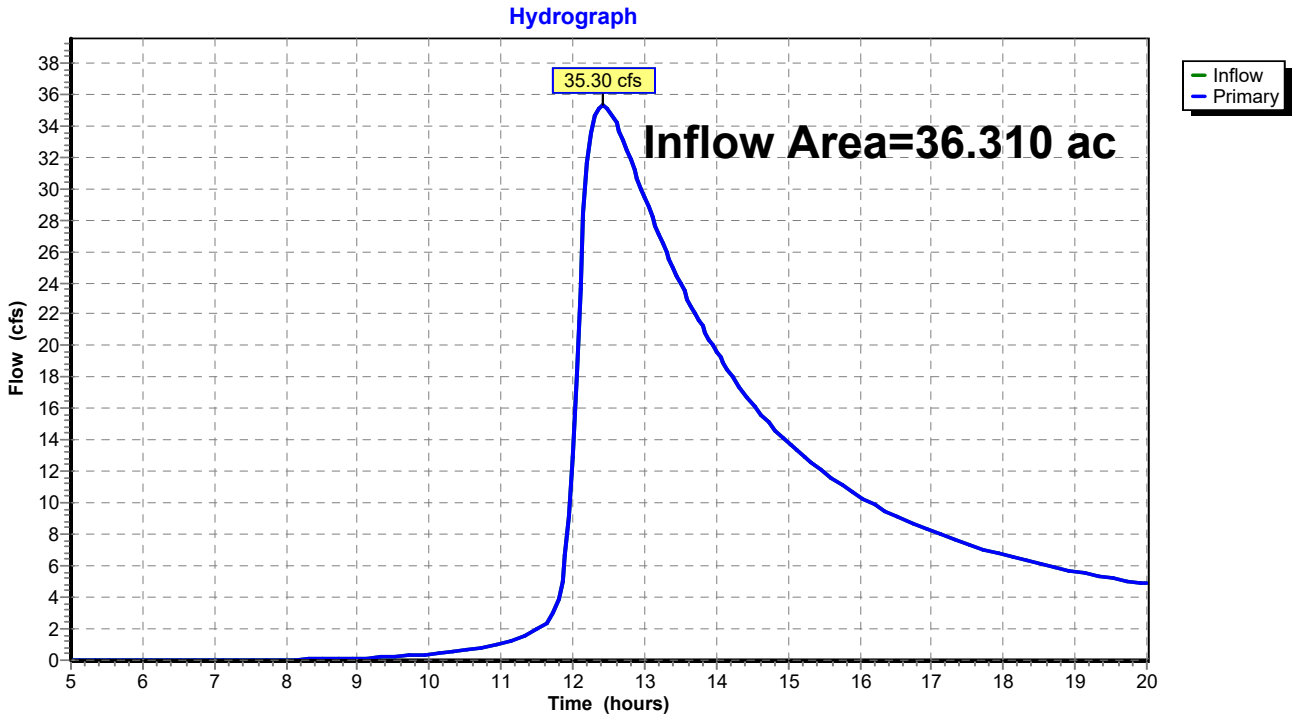


Summary for Link 9L: RP-3

Inflow Area = 36.310 ac, 41.60% Impervious, Inflow Depth > 3.16" for 10-Year event
Inflow = 35.30 cfs @ 12.41 hrs, Volume= 9.576 af
Primary = 35.30 cfs @ 12.41 hrs, Volume= 9.576 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 9L: RP-3

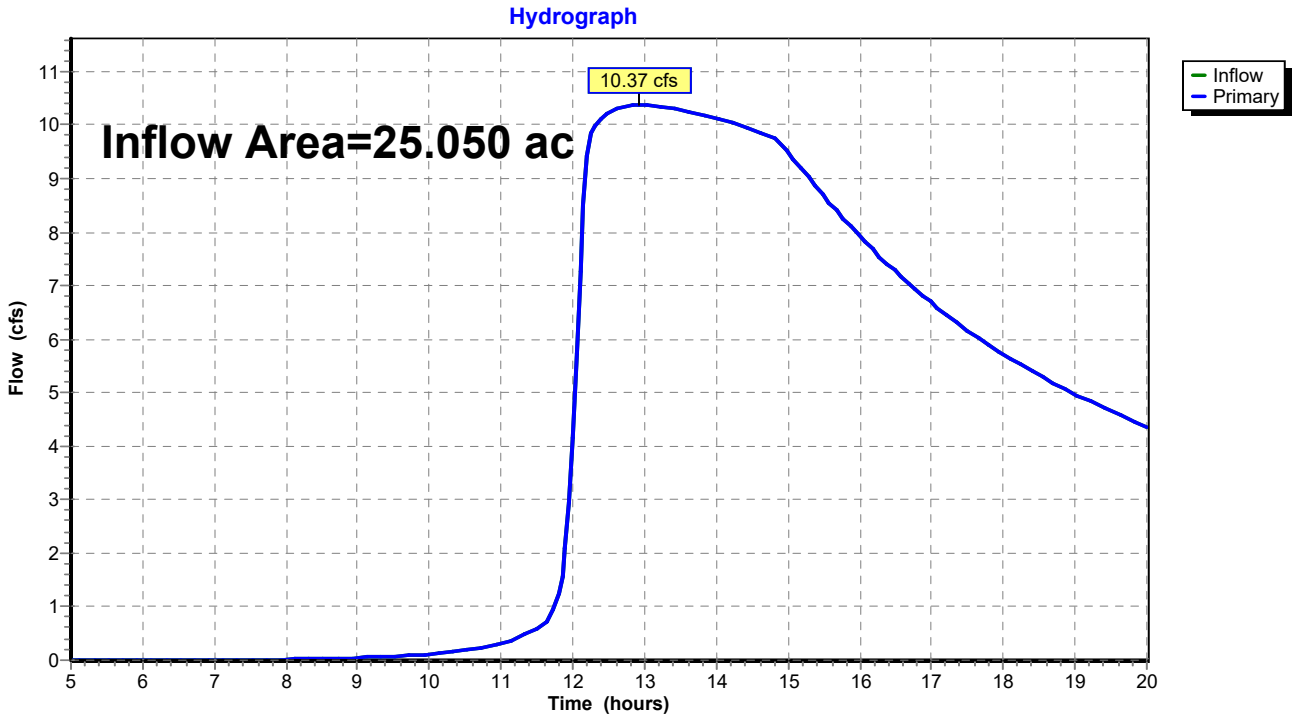


Summary for Link 10L: RP-4

Inflow Area = 25.050 ac, 78.60% Impervious, Inflow Depth > 2.50" for 10-Year event
Inflow = 10.37 cfs @ 12.93 hrs, Volume= 5.228 af
Primary = 10.37 cfs @ 12.93 hrs, Volume= 5.228 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 10L: RP-4



Summary for Subcatchment 11S: Onsite 5

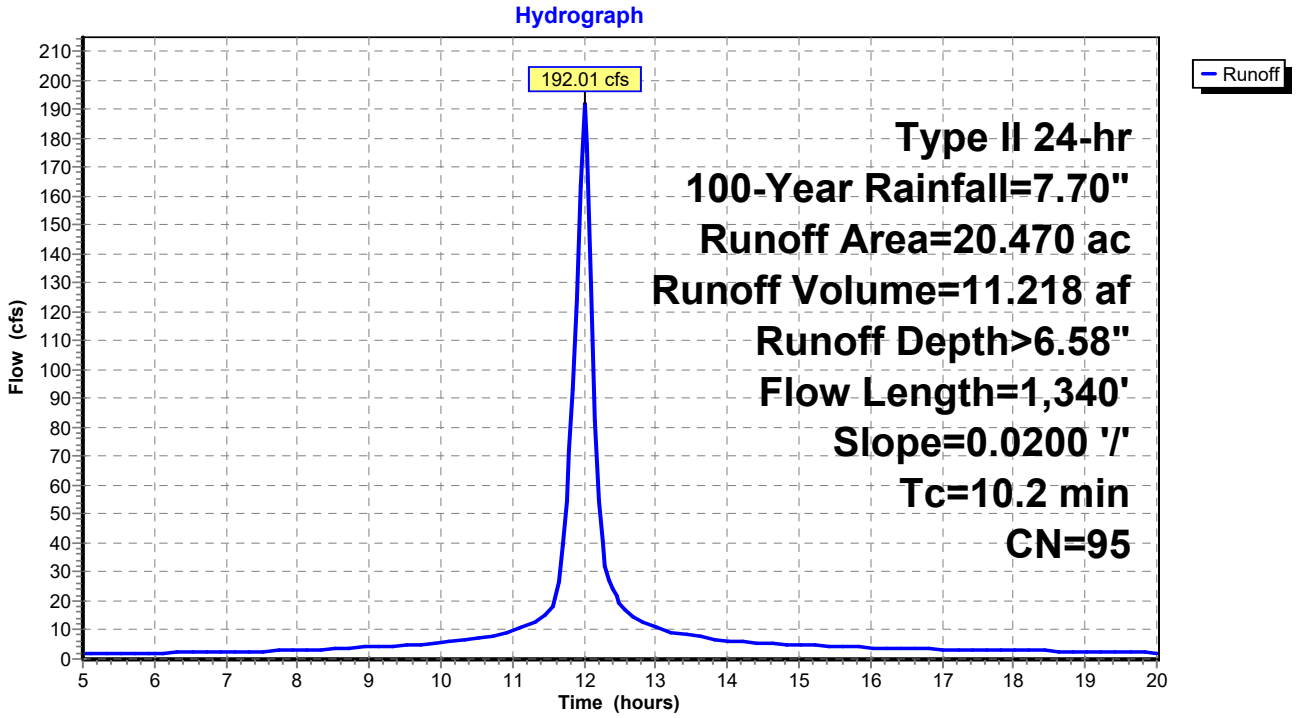
Runoff = 192.01 cfs @ 12.01 hrs, Volume= 11.218 af, Depth> 6.58"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
20.470	95	Urban commercial, 85% imp, HSG D
3.070		15.00% Pervious Area
17.399		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
9.1	1,240	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.2	1,340	Total			

Subcatchment 11S: Onsite 5



Summary for Subcatchment 12S: EX OFF

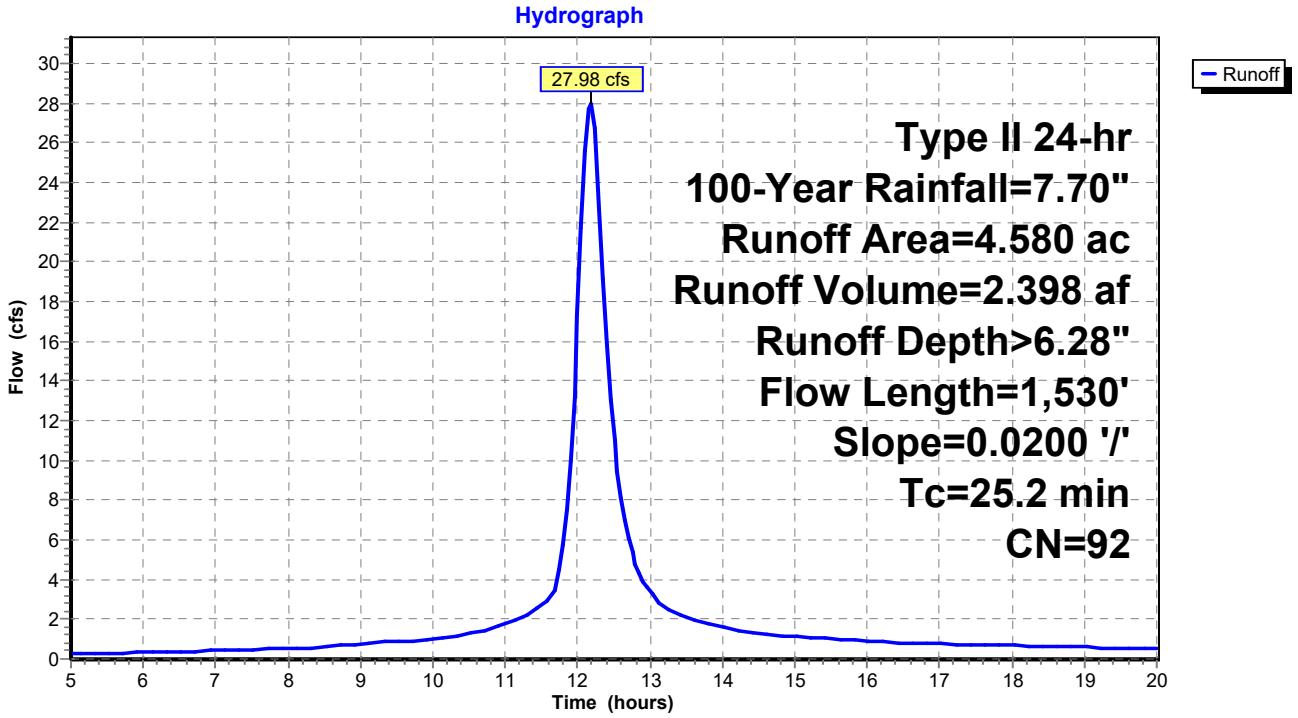
Runoff = 27.98 cfs @ 12.17 hrs, Volume= 2.398 af, Depth> 6.28"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
4.580	92	Paved roads w/open ditches, 50% imp, HSG C
2.290		50.00% Pervious Area
2.290		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
24.1	1,430	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.2	1,530	Total			

Subcatchment 12S: EX OFF



Summary for Subcatchment 13S: Onsite 4

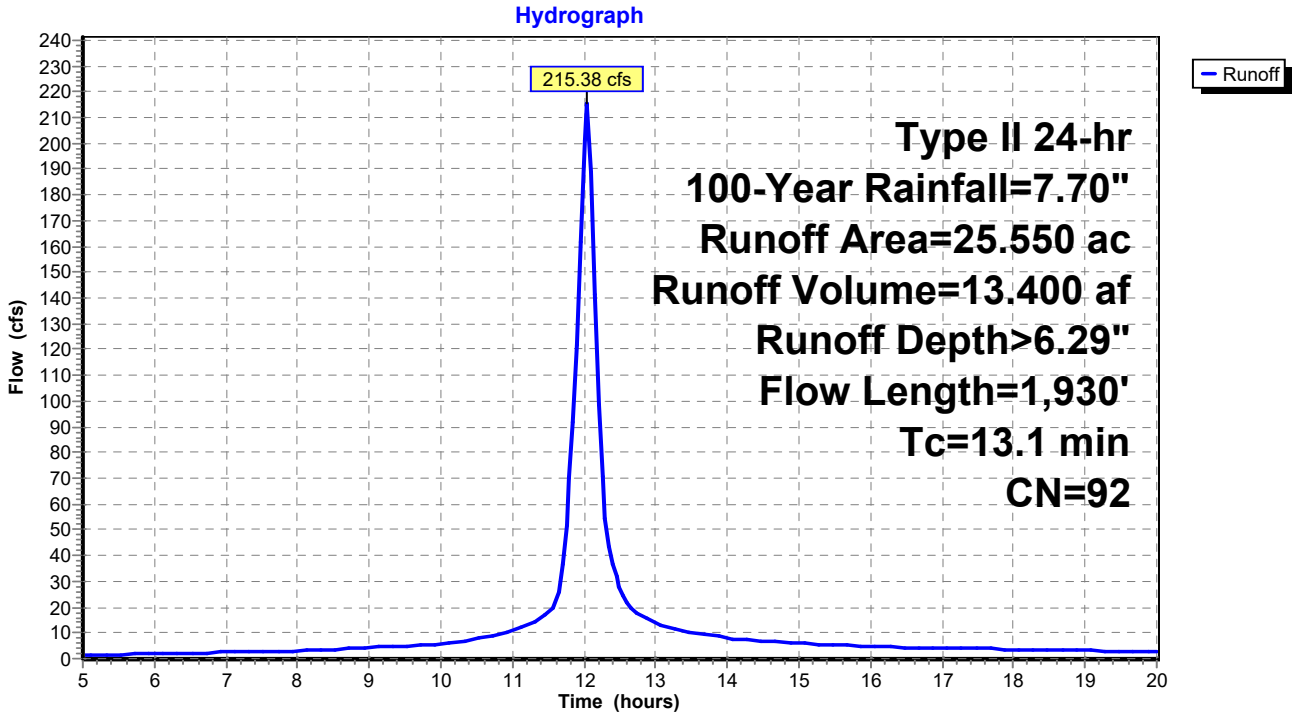
Runoff = 215.38 cfs @ 12.04 hrs, Volume= 13.400 af, Depth> 6.29"

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 100-Year Rainfall=7.70"

	Area (ac)	CN	Description
*	13.070	92	SINGLE FAMILY LOTS
	12.480	92	1/8 acre lots, 65% imp, HSG D
	25.550	92	Weighted Average
	17.438		68.25% Pervious Area
	8.112		31.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0205	1.47		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
12.0	1,830	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.1	1,930	Total			

Subcatchment 13S: Onsite 4



Summary for Subcatchment 15S: Onsite 2

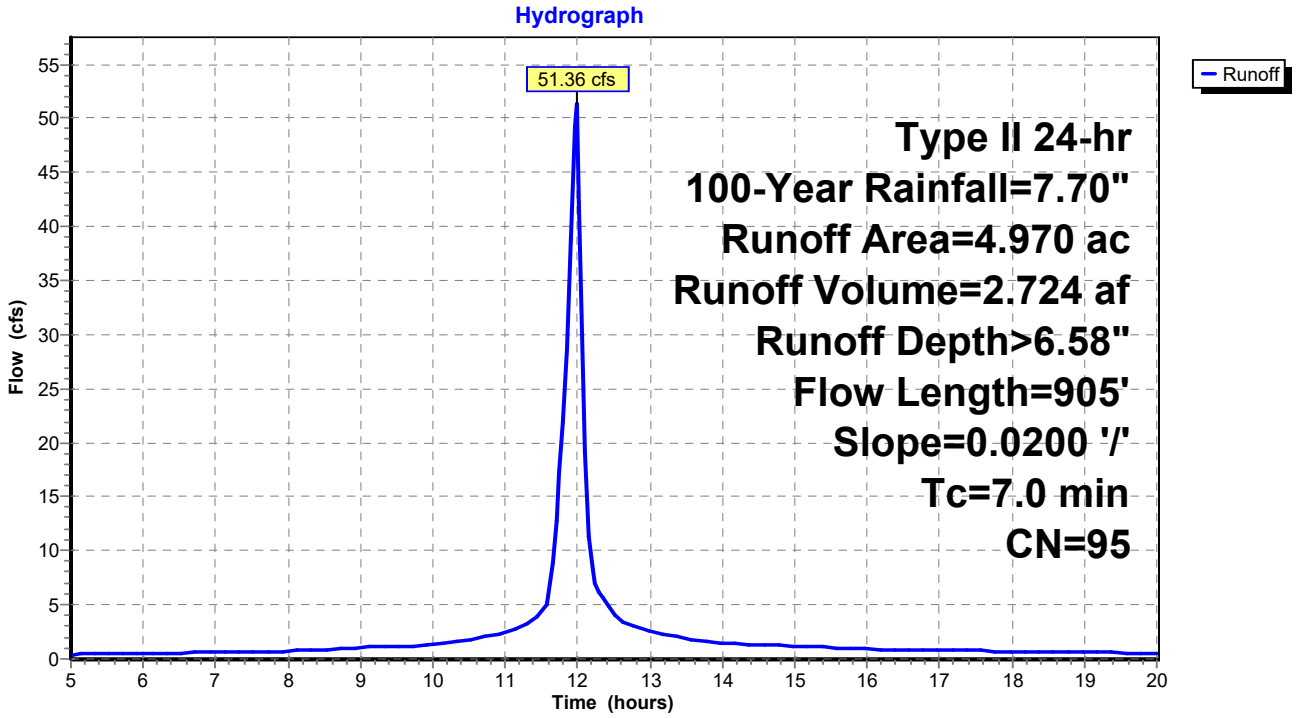
Runoff = 51.36 cfs @ 11.98 hrs, Volume= 2.724 af, Depth> 6.58"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
4.970	95	Urban commercial, 85% imp, HSG D
0.746		15.00% Pervious Area
4.224		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
5.9	805	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	905	Total			

Subcatchment 15S: Onsite 2



Summary for Subcatchment 16S: Onsite 3

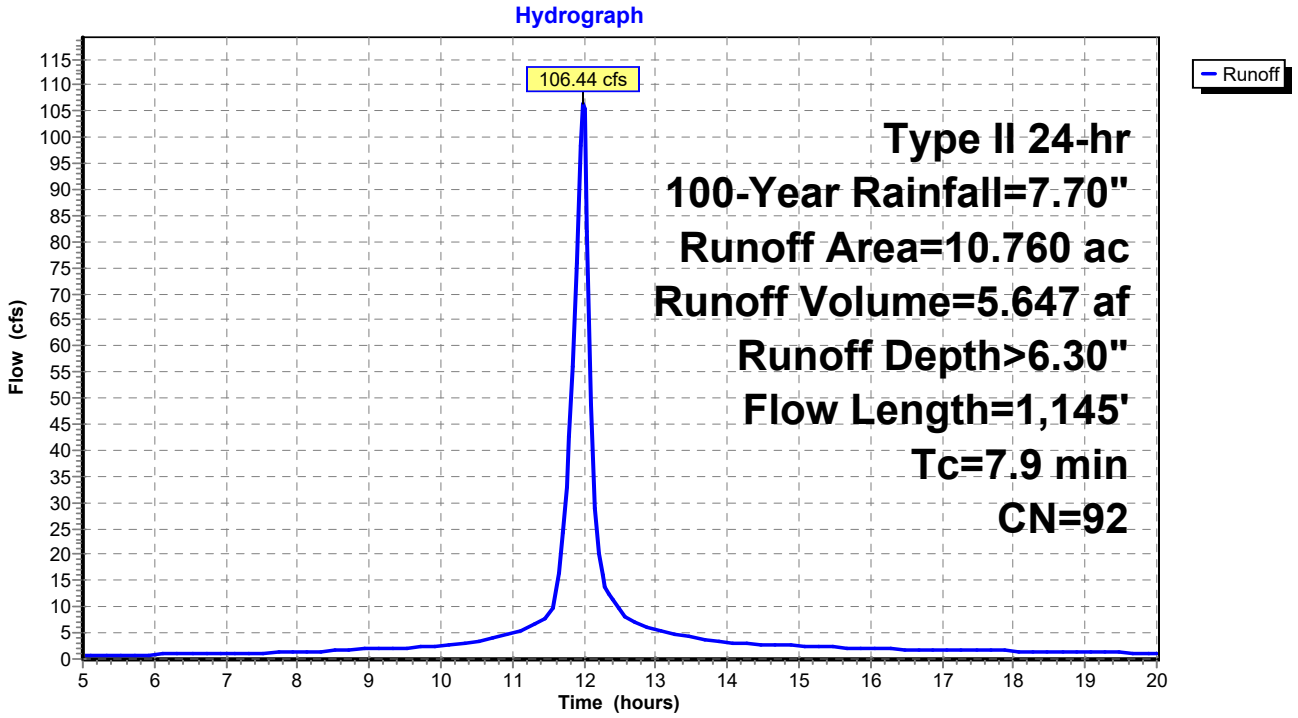
Runoff = 106.44 cfs @ 11.99 hrs, Volume= 5.647 af, Depth> 6.30"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
10.760	92	1/8 acre lots, 65% imp, HSG D
3.766		35.00% Pervious Area
6.994		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
6.8	1,045	0.0250	2.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.9	1,145	Total			

Subcatchment 16S: Onsite 3



Summary for Subcatchment 17S: Onsite 1

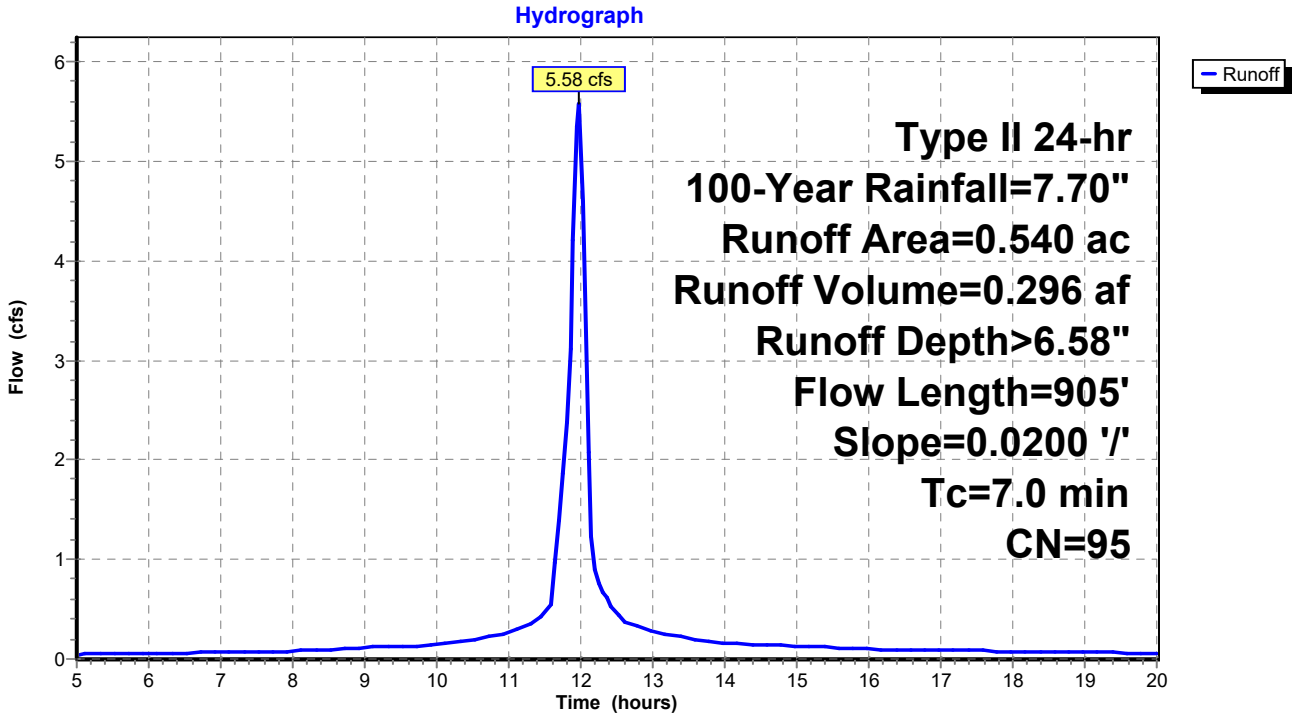
Runoff = 5.58 cfs @ 11.98 hrs, Volume= 0.296 af, Depth> 6.58"

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-Year Rainfall=7.70"

Area (ac)	CN	Description
0.540	95	Urban commercial, 85% imp, HSG D
0.081		15.00% Pervious Area
0.459		85.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	100	0.0200	1.46		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.60"
5.9	805	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	905	Total			

Subcatchment 17S: Onsite 1



Summary for Pond 12P: EWDB #1

[82] Warning: Early inflow requires earlier time span

Inflow Area = 25.050 ac, 78.60% Impervious, Inflow Depth > 6.52" for 100-Year event
Inflow = 210.31 cfs @ 12.01 hrs, Volume= 13.616 af
Outflow = 12.89 cfs @ 13.12 hrs, Volume= 8.084 af, Atten= 94%, Lag= 66.2 min
Primary = 12.89 cfs @ 13.12 hrs, Volume= 8.084 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 999.38' @ 13.12 hrs Surf.Area= 85,694 sf Storage= 402,290 cf

Plug-Flow detention time= 276.6 min calculated for 8.053 af (59% of inflow)
Center-of-Mass det. time= 200.3 min (940.3 - 740.0)

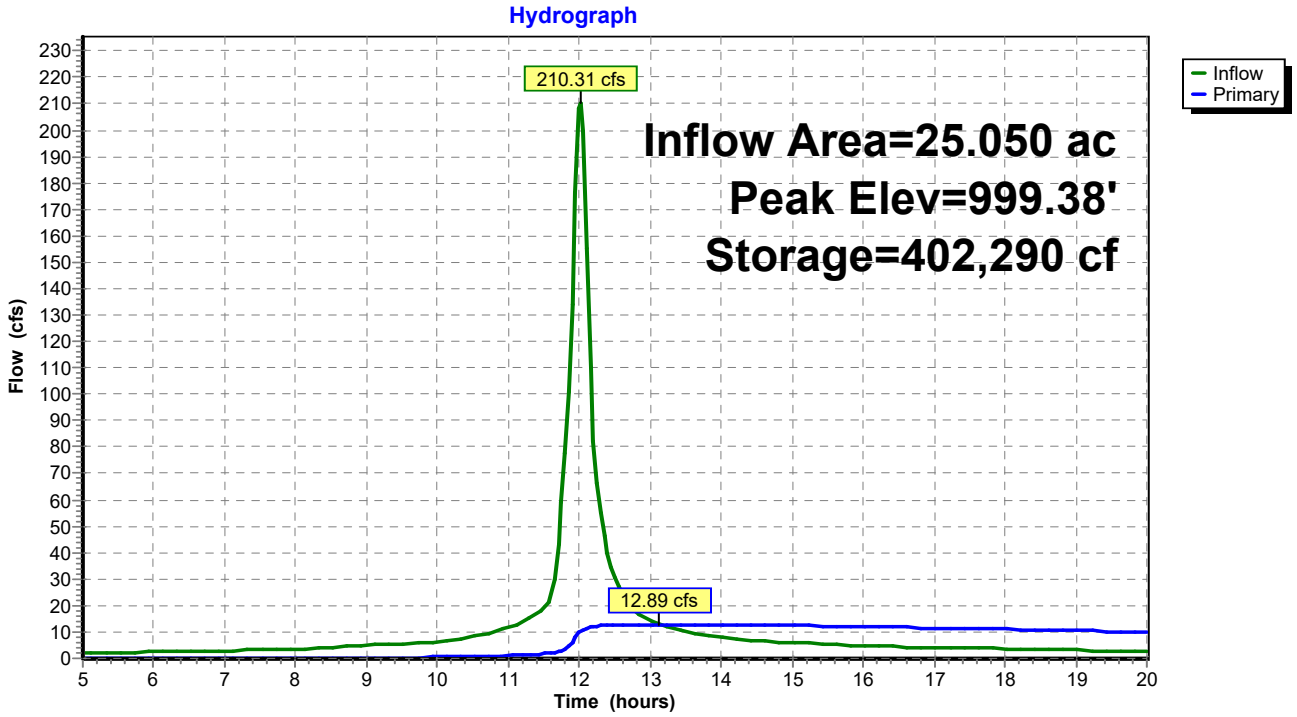
Volume	Invert	Avail.Storage	Storage Description
#1	994.00'	640,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
994.00	64,027	0	0
996.00	71,876	135,903	135,903
998.00	79,952	151,828	287,731
1,000.00	88,254	168,206	455,937
1,002.00	96,782	185,036	640,973

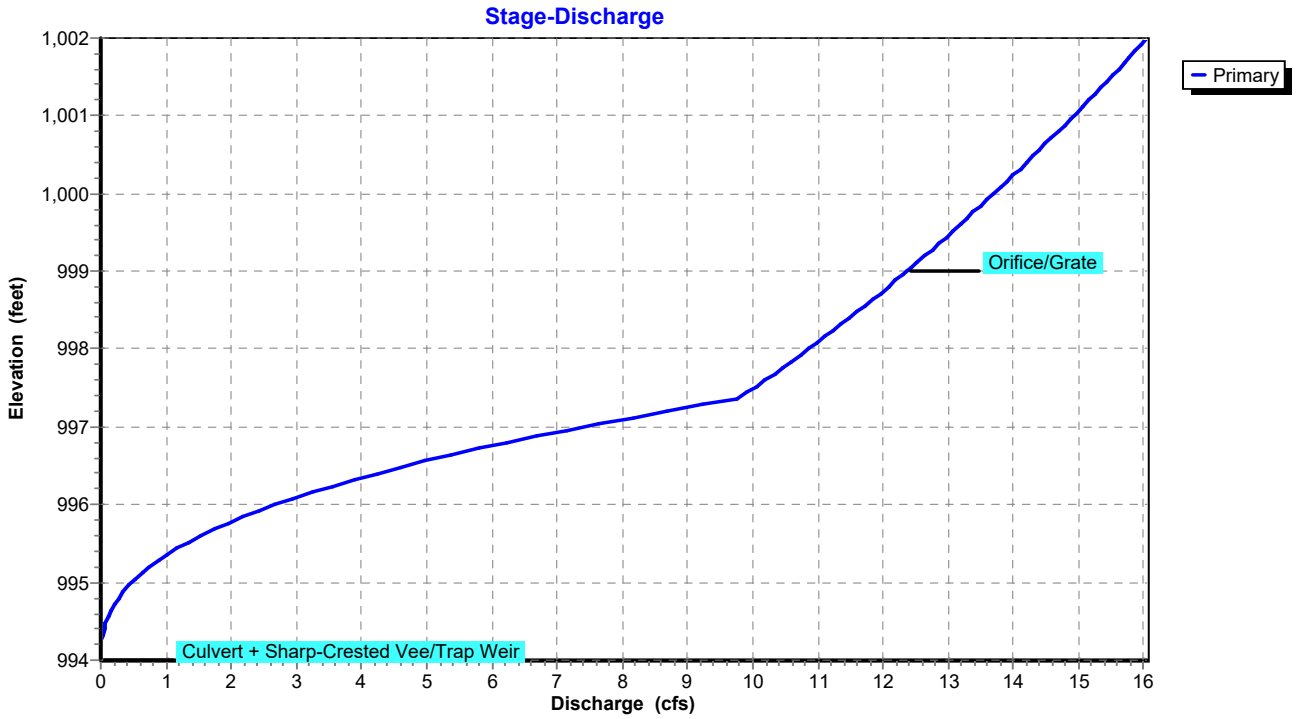
Device	Routing	Invert	Outlet Devices
#1	Primary	994.00'	**15.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 994.00' / 993.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	994.00'	**20.0 deg x 5.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	999.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=12.89 cfs @ 13.12 hrs HW=999.38' (Free Discharge)
└**1=Culvert** (Inlet Controls 12.89 cfs @ 10.50 fps)
  ├**2=Sharp-Crested Vee/Trap Weir** (Passes < 30.44 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 15.50 cfs potential flow)

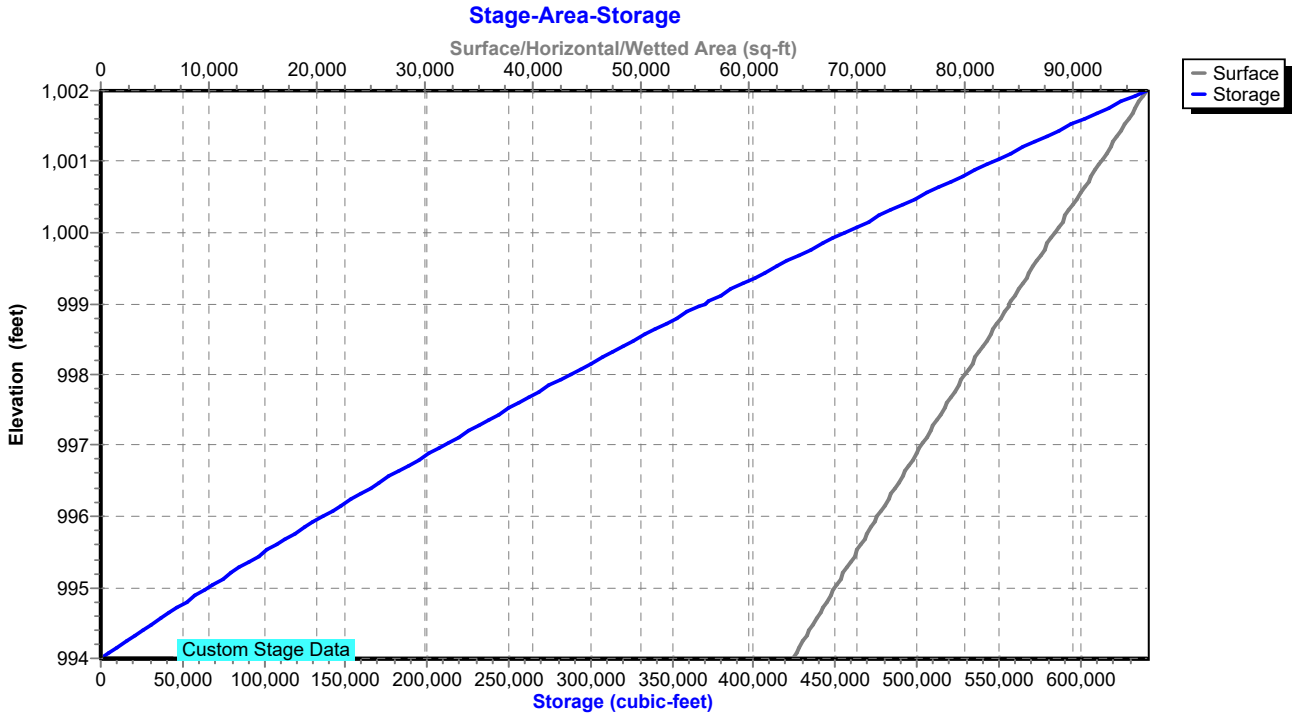
Pond 12P: EWDB #1



Pond 12P: EWDB #1



Pond 12P: EWDB #1



Summary for Pond 13P: EWDB #2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 10.760 ac, 65.00% Impervious, Inflow Depth > 6.30" for 100-Year event
Inflow = 106.44 cfs @ 11.99 hrs, Volume= 5.647 af
Outflow = 17.34 cfs @ 12.24 hrs, Volume= 4.714 af, Atten= 84%, Lag= 15.0 min
Primary = 17.34 cfs @ 12.24 hrs, Volume= 4.714 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 996.90' @ 12.24 hrs Surf.Area= 34,536 sf Storage= 136,148 cf

Plug-Flow detention time= 155.0 min calculated for 4.712 af (83% of inflow)
Center-of-Mass det. time= 106.1 min (847.6 - 741.5)

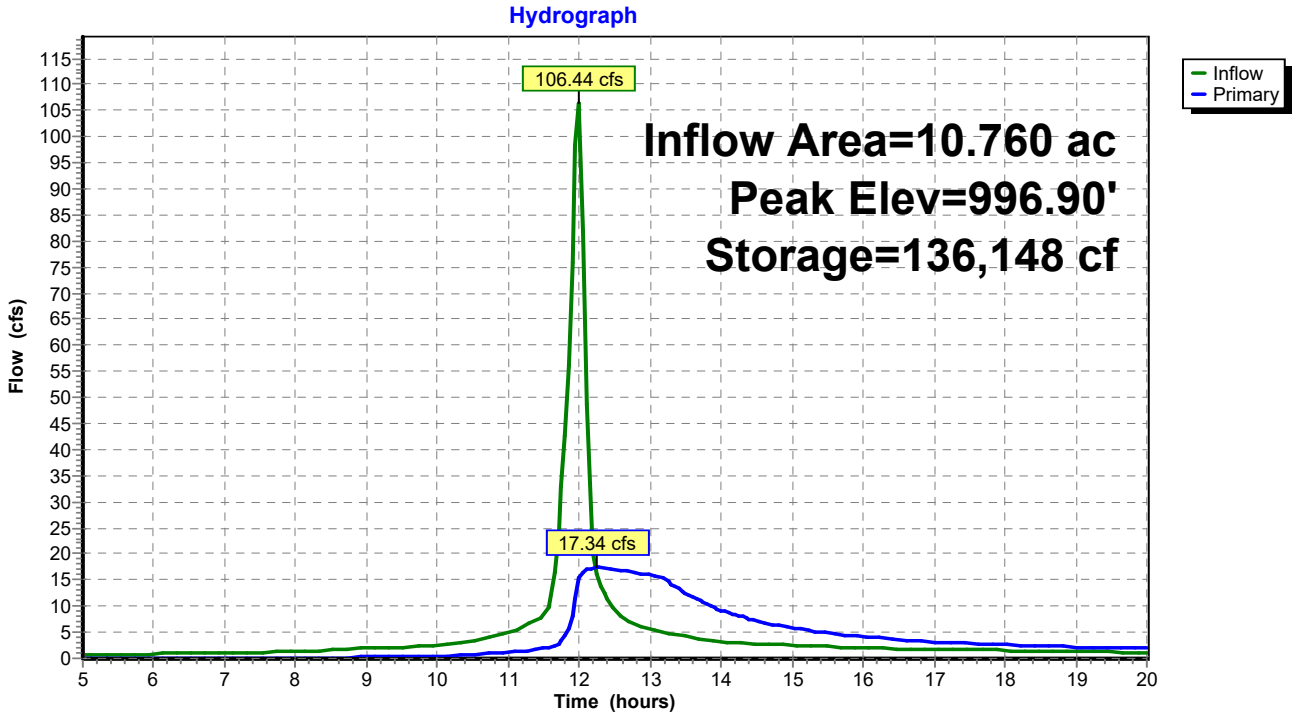
Volume	Invert	Avail.Storage	Storage Description
#1	992.00'	175,799 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
992.00	21,391	0	0
994.00	26,438	47,829	47,829
996.00	31,892	58,330	106,159
998.00	37,748	69,640	175,799

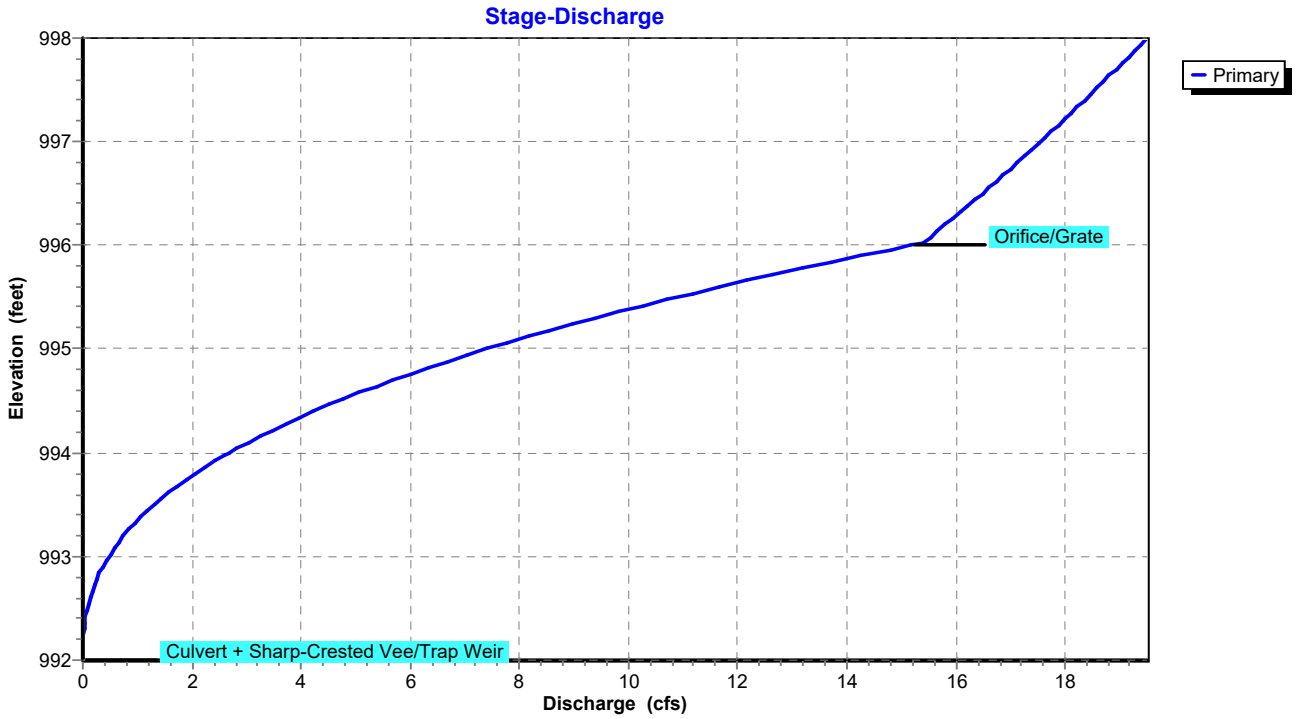
Device	Routing	Invert	Outlet Devices
#1	Primary	992.00'	**18.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 992.00' / 991.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Device 1	992.00'	**20.0 deg x 4.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	996.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=17.34 cfs @ 12.24 hrs HW=996.90' (Free Discharge)
└**1=Culvert** (Inlet Controls 17.34 cfs @ 9.81 fps)
  ├**2=Sharp-Crested Vee/Trap Weir** (Passes < 20.80 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 67.15 cfs potential flow)

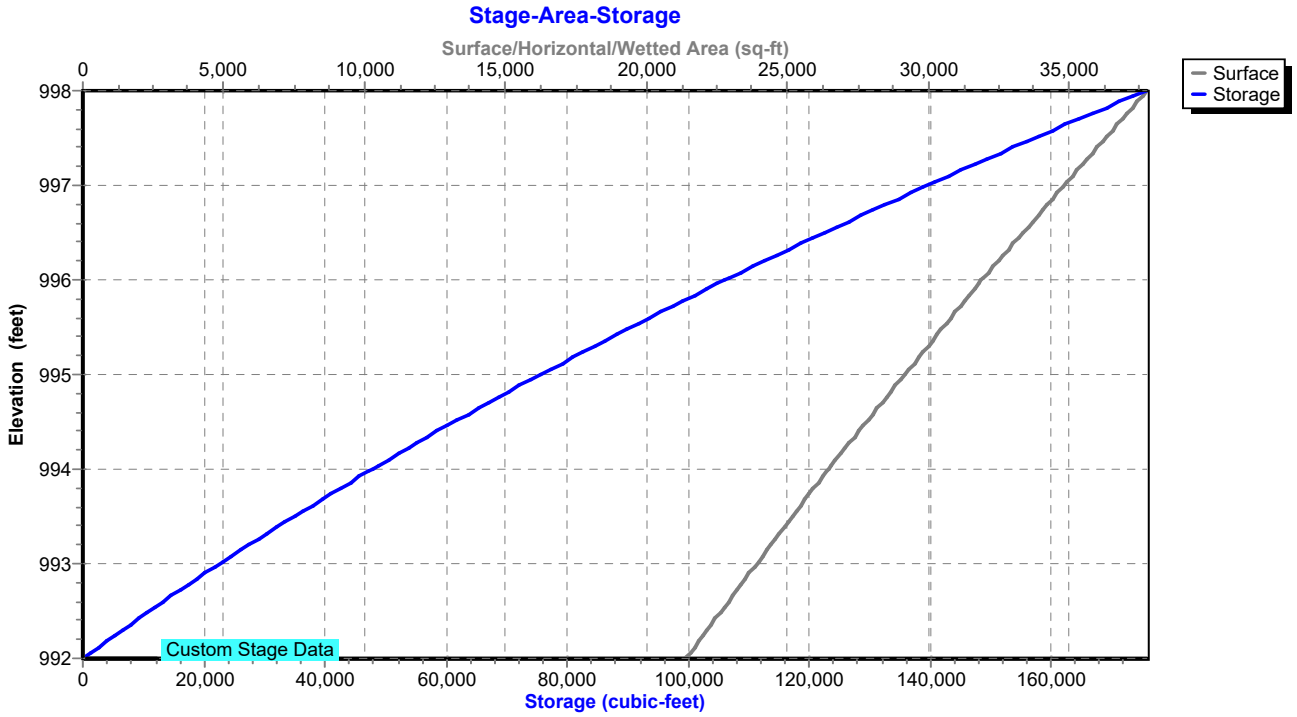
Pond 13P: EWDB #2



Pond 13P: EWDB #2



Pond 13P: EWDB #2



Summary for Pond 14P: EWDB #3

[82] Warning: Early inflow requires earlier time span
[79] Warning: Submerged Pond 13P Primary device # 1 OUTLET by 0.08'

Inflow Area = 36.310 ac, 41.60% Impervious, Inflow Depth > 5.99" for 100-Year event
Inflow = 231.71 cfs @ 12.04 hrs, Volume= 18.113 af
Outflow = 87.30 cfs @ 12.26 hrs, Volume= 15.820 af, Atten= 62%, Lag= 12.9 min
Primary = 87.30 cfs @ 12.26 hrs, Volume= 15.820 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 991.08' @ 12.26 hrs Surf.Area= 56,120 sf Storage= 302,205 cf

Plug-Flow detention time= 116.0 min calculated for 15.764 af (87% of inflow)
Center-of-Mass det. time= 74.9 min (847.0 - 772.0)

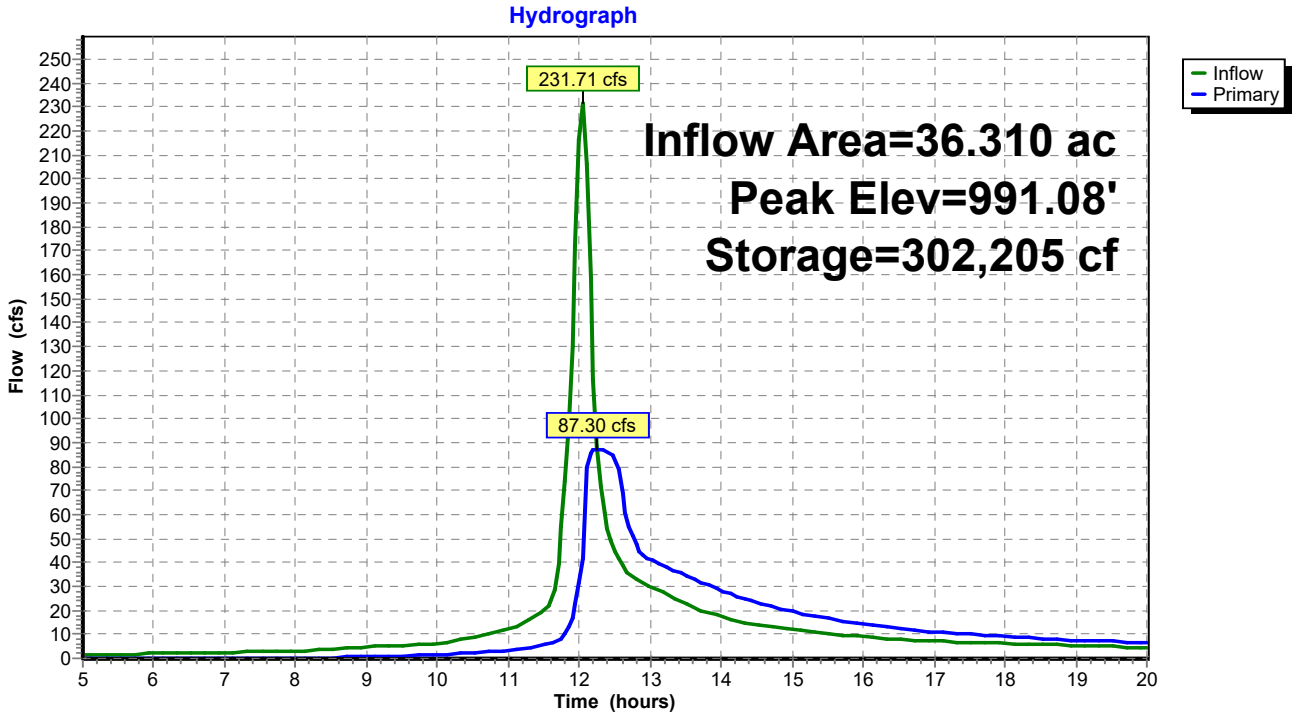
Volume	Invert	Avail.Storage	Storage Description
#1	984.00'	355,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
984.00	30,844	0	0
986.00	36,957	67,801	67,801
988.00	43,835	80,792	148,593
990.00	51,620	95,455	244,048
992.00	59,957	111,577	355,625

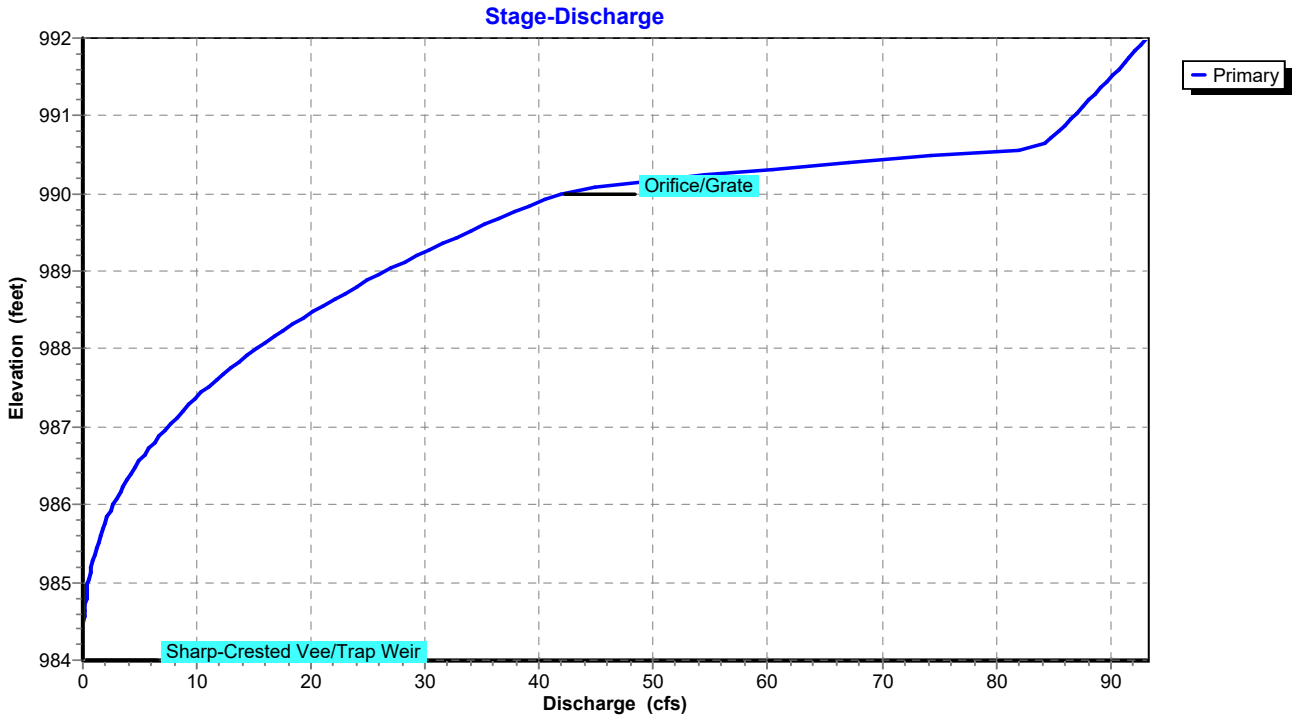
Device	Routing	Invert	Outlet Devices
#1	Primary	983.00'	**36.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.00' / 982.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Device 1	984.00'	**20.0 deg x 6.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.69 (C= 3.36)
#3	Device 1	990.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=87.27 cfs @ 12.26 hrs HW=991.07' (Free Discharge)
↑└**1=Culvert** (Inlet Controls 87.27 cfs @ 12.35 fps)
↑└**2=Sharp-Crested Vee/Trap Weir** (Passes < 54.65 cfs potential flow)
└**3=Orifice/Grate** (Passes < 87.42 cfs potential flow)

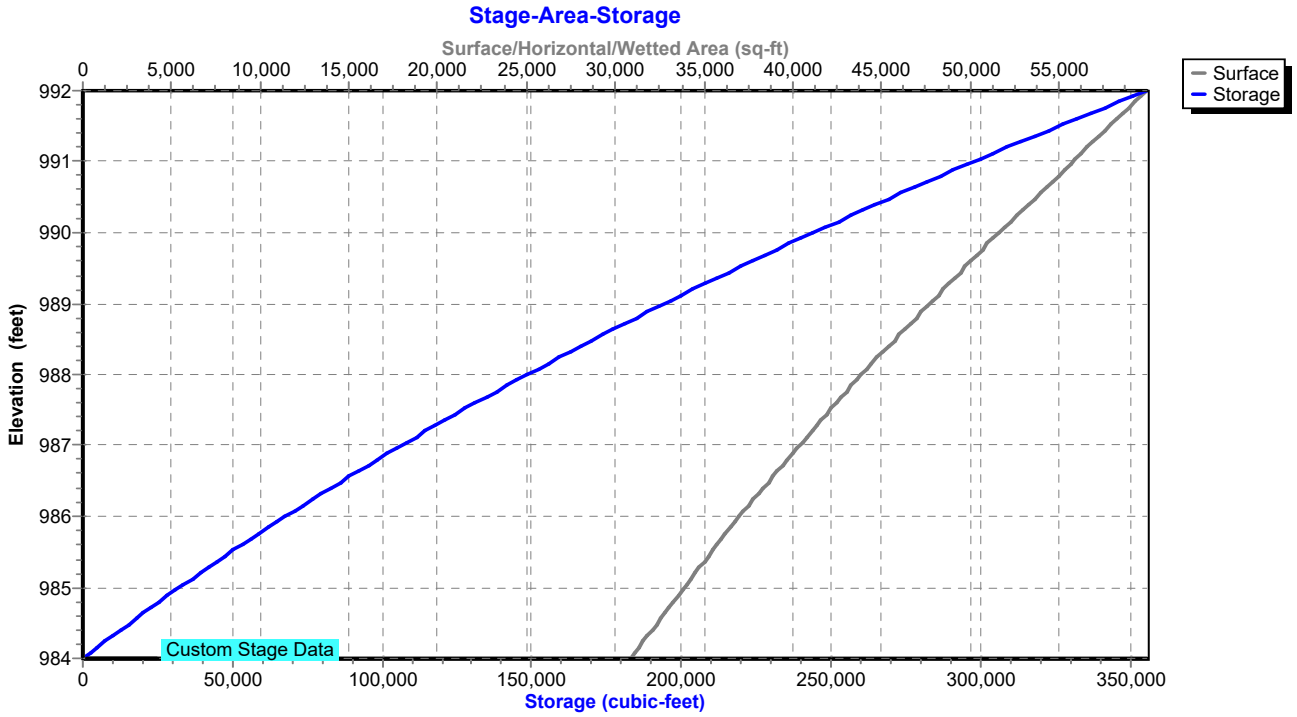
Pond 14P: EWDB #3



Pond 14P: EWDB #3



Pond 14P: EWDB #3



Summary for Pond 15P: EDDB #1

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #4 is below defined storage
[92] Warning: Device #6 is above defined storage

Inflow Area = 4.970 ac, 85.00% Impervious, Inflow Depth > 6.58" for 100-Year event
Inflow = 51.36 cfs @ 11.98 hrs, Volume= 2.724 af
Outflow = 34.77 cfs @ 12.05 hrs, Volume= 2.211 af, Atten= 32%, Lag= 4.6 min
Primary = 34.77 cfs @ 12.05 hrs, Volume= 2.211 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1,008.96' @ 12.05 hrs Surf.Area= 19,616 sf Storage= 44,739 cf

Plug-Flow detention time= 99.1 min calculated for 2.203 af (81% of inflow)
Center-of-Mass det. time= 47.1 min (781.7 - 734.6)

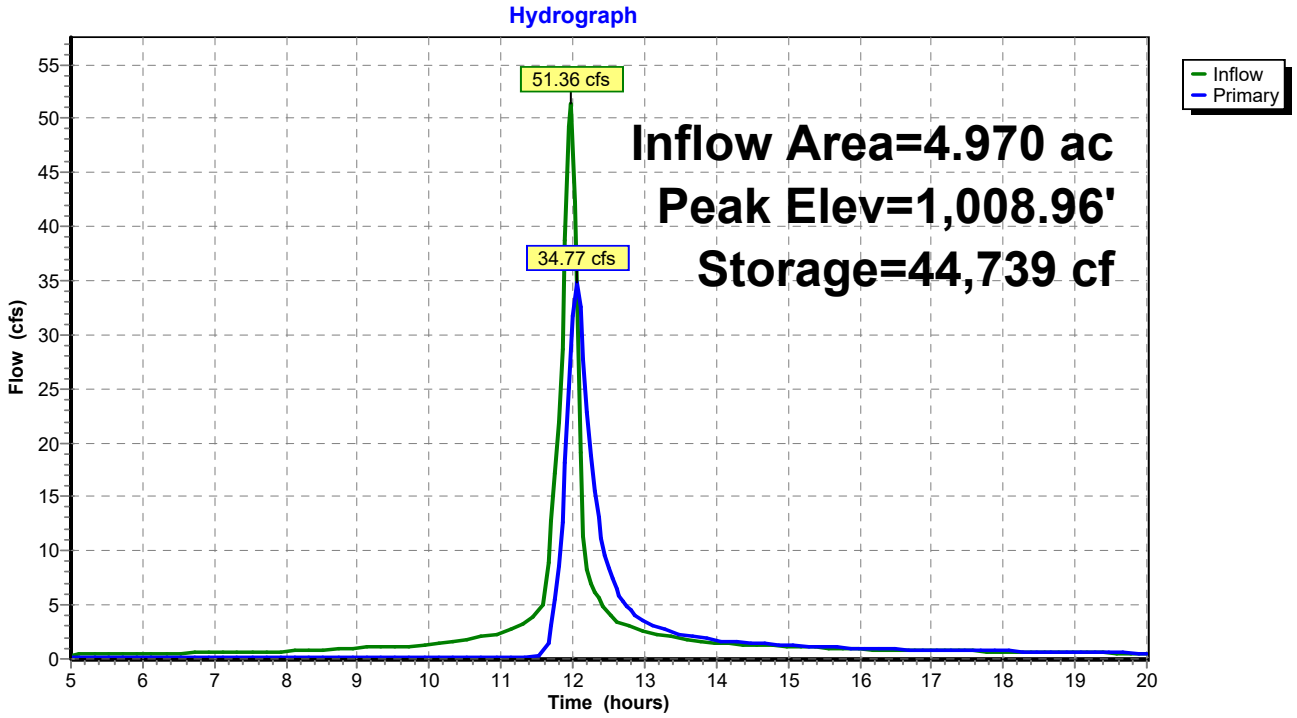
Volume	Invert	Avail.Storage	Storage Description
#1	1,004.00'	68,100 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,004.00	50	0	0
1,006.00	6,872	6,922	6,922
1,008.00	14,603	21,475	28,397
1,010.00	25,100	39,703	68,100

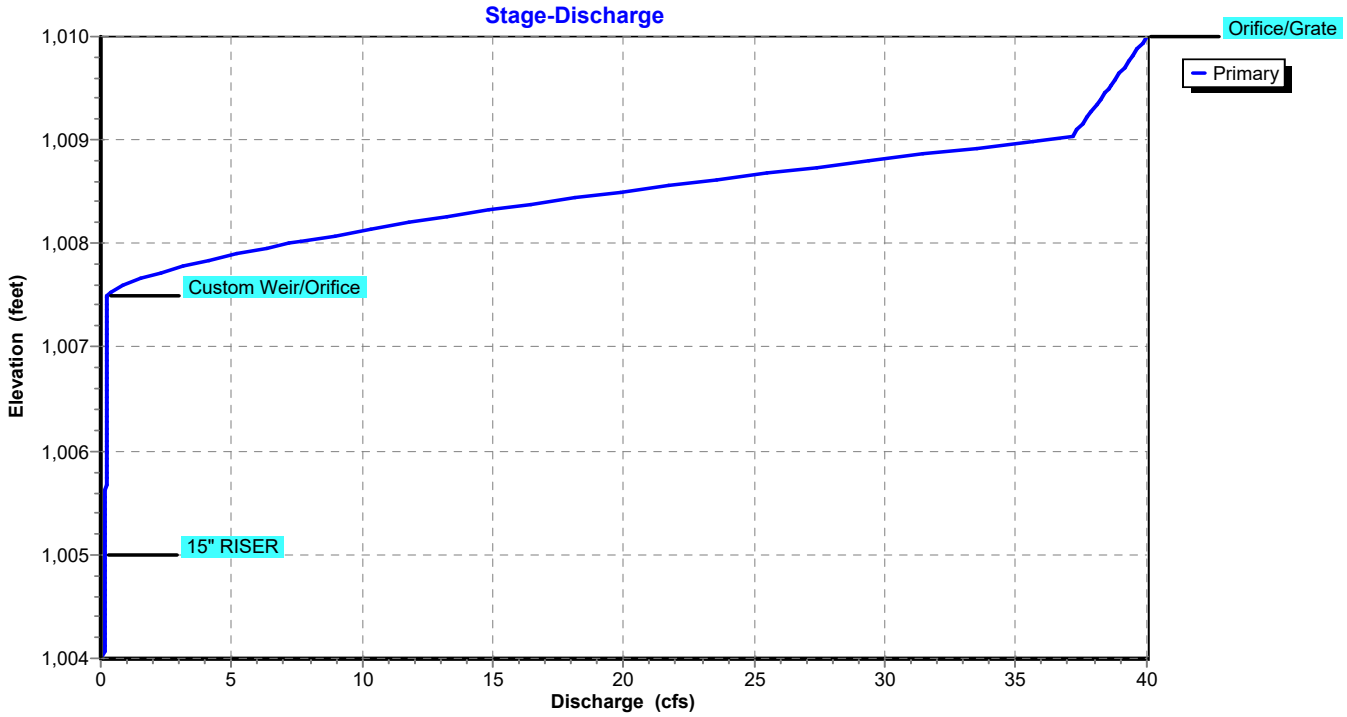
Device	Routing	Invert	Outlet Devices
#1	Primary	1,002.00'	**24.0" Round Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,002.00' / 1,001.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	1,002.25'	**2.0" Vert. 2.0" ORIFICE** C= 0.600
#3	Device 1	1,007.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Elev. (feet) 1,007.50 1,009.50 Width (feet) 6.00 6.00
#4	Device 2	1,002.50'	**6.0" Round 6" PVC** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,002.50' / 1,002.25' S= 0.0083 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#5	Device 2	1,005.00'	**1.0" Vert. 15" RISER X 7.00 columns** X 9 rows with 4.0" cc spacing C= 0.600
#6	Device 1	1,010.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=34.57 cfs @ 12.05 hrs HW=1,008.95' (Free Discharge)
└**1=Culvert** (Passes 34.57 cfs of 36.90 cfs potential flow)
  └**2=2.0" ORIFICE** (Orifice Controls 0.27 cfs @ 12.39 fps)
    └**4=6" PVC** (Passes < 2.30 cfs potential flow)
    └**5=15" RISER** (Passes < 2.62 cfs potential flow)
  └**3=Custom Weir/Orifice** (Weir Controls 34.30 cfs @ 3.94 fps)
  └**6=Orifice/Grate** (Controls 0.00 cfs)

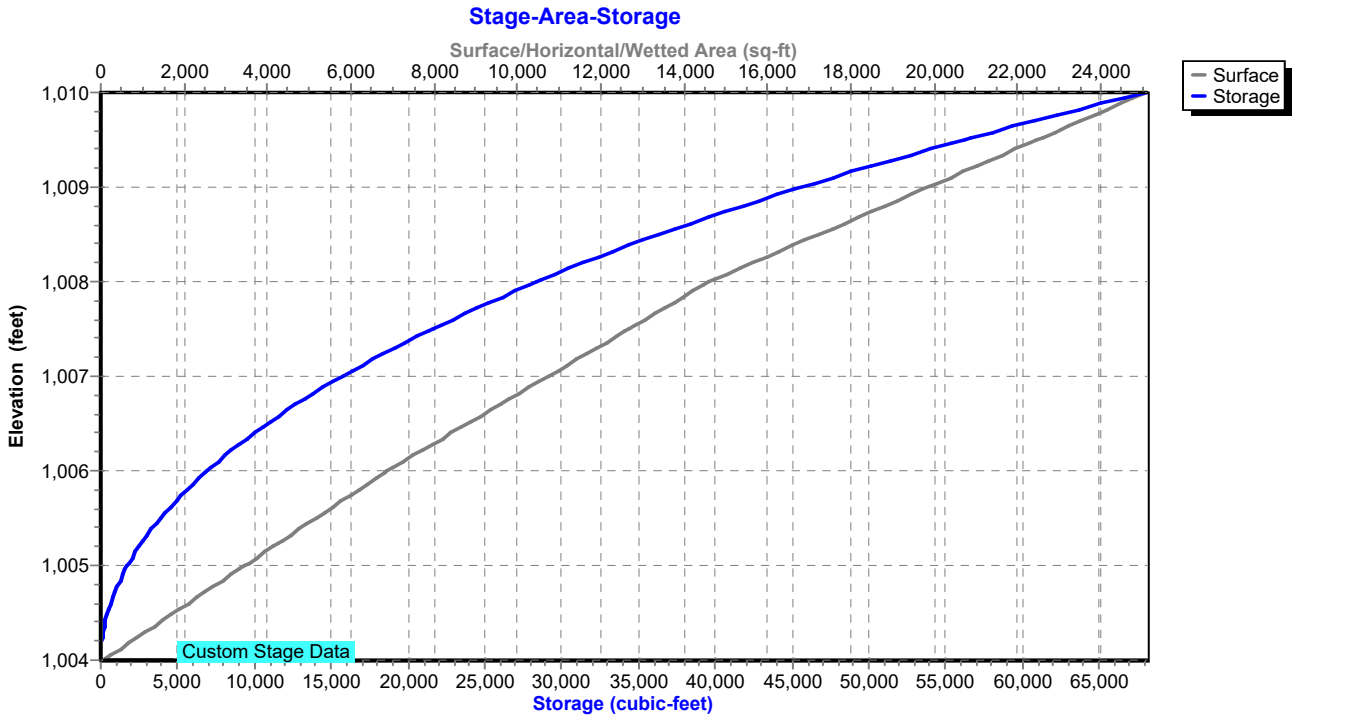
Pond 15P: EDDB #1



Pond 15P: EDDB #1



Pond 15P: EDDB #1

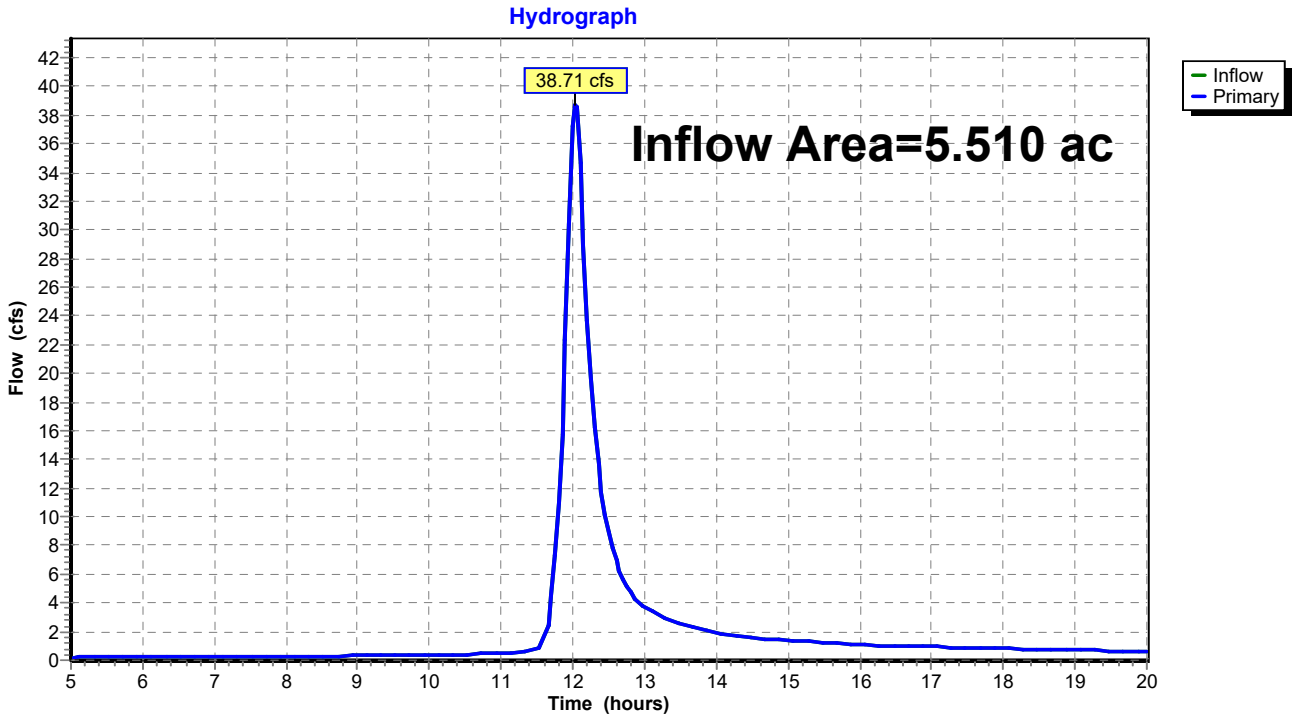


Summary for Link 7L: RP-1

Inflow Area = 5.510 ac, 85.00% Impervious, Inflow Depth > 5.46" for 100-Year event
Inflow = 38.71 cfs @ 12.04 hrs, Volume= 2.507 af
Primary = 38.71 cfs @ 12.04 hrs, Volume= 2.507 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: RP-1

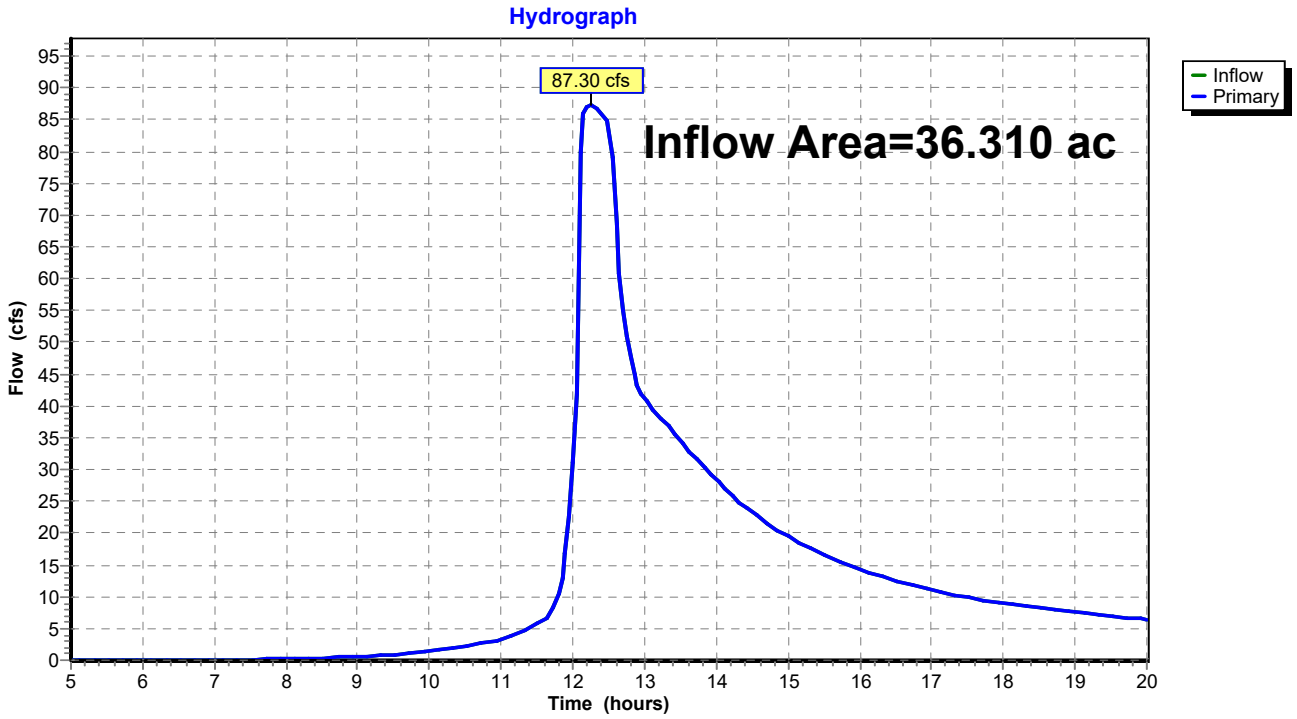


Summary for Link 9L: RP-3

Inflow Area = 36.310 ac, 41.60% Impervious, Inflow Depth > 5.23" for 100-Year event
Inflow = 87.30 cfs @ 12.26 hrs, Volume= 15.820 af
Primary = 87.30 cfs @ 12.26 hrs, Volume= 15.820 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 9L: RP-3



Summary for Link 10L: RP-4

Inflow Area = 25.050 ac, 78.60% Impervious, Inflow Depth > 3.87" for 100-Year event
Inflow = 12.89 cfs @ 13.12 hrs, Volume= 8.084 af
Primary = 12.89 cfs @ 13.12 hrs, Volume= 8.084 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 10L: RP-4