Preliminary Stormwater Management Plan

prepared for

Bailey Farms
1300 SE Ranson Road
Lee's Summit, MO 64081

March 5, 2021
Revised: April 16, 2021
Revised: May 11, 2021

prepared by

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Schlagel & Associates Project 19-227

for

Summit Homes
120 SE 30th Street
Lee's Summit, Missouri

5/11/2021

Executive Summary

March 5, 2021

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

RE: Bailey Farms
1300 SE Ranson 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 Bailey Farms. 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 an 88.80 acre single-family proposed parcel located in Lee's Summit, MO at the intersection of SE Bailey Road and SE Ranson 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. Two Extended Dry Detention Basins (EDDB) 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.

The project includes a request for modification to the stream setback to allow transition grading. There is sufficient space to allow for the existing stream to flow naturally. Any proposed construction activities with this development will not disrupt the natural movement of this stream. This project is also requested a waiver for a small area located in the southeast corner of the site to allow free-release off-site without additional detention facilities to be implemented.

Sincerely,

Schlagel & Associates, P.A.

Nick Augustine, E.I.T.
Design Engineer

Jim Long, P.E.
Project Engineer

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1.0 GENERAL INFORMATION

Summit Homes is proposing to develop the 89.60 acres of land located in Section 16, Township 47 North, Range 31 West, Jackson County, Missouri. The property is located at the intersection of SE Bailey Road and SE Ranson Road. The proposed development consists of single-family lots 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 Big Creek Watershed. The existing site contains one watershed which has a release point located on the southwest portion of the site.
Offsite stormwater comes into the site from the east and drains to the same release point previously mentioned.

2.1 TRIBUTARY AREAS

The existing drainage tributary 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 Exist. On-Site #1, Exist. On-Site #2, Exist. On-Site #3, and Exist. Off-Site #1, on Figure A.2, has been provided for the watershed that drains to the release point, RP-1.

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 good 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 74 and 80 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 and Table 2-2 below for Ex. Drainage Area A, Ex. DA-A. 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)
Exist. On-Site #1	64.82	77	2-YR	56.78
			10-YR	118.07
			100-YR	206.11
Exist. On-Site #2	6.42	76	2-YR	11.69
			10-YR	24.16
			100-YR	41.99
Exist. On-Site #3	17.54	77	2-YR	18.79
			10-YR	38.90
			100-YR	67.74
Exist. Off-Site #1	18.50	77	2-YR	31.44
			10-YR	64.09
			100-YR	110.52

Table 2-2 below reflects the total existing runoff for the sites stormwater at the release point identified in Figure A.2 found in Appendix A. RP-1 represents the total outfall for the site located in the southwest corner. RP-2 represents the release point located in the southeast corner of the site. RP-3 represents the run-off for Exist. On-site #3 that is the point of convergence just before exiting the site in the southwest corner. RP-4 represents the point of convergence between the main tributary running north/south and the minor tributary running east/west.

Table 2-2 - Existing Runoff Evaluation

Drainage Sub-Basin Release Points	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
RP - 1	101.52	212.26	369.53
RP - 2	11.69	24.16	41.99
RP - 3	18.79	38.90	67.74
RP - 4	82.44	170.61	294.90

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 number 29095C0438G.

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

A preliminary jurisdictional determination prepared by Terra Technologies has identified existing wetlands onsite. A preliminary assessment figure has been provided in Appendix A.

2.5.2 FEMA Requirements

No FEMA identified floodplain is located on the proposed property per Flood Insurance Rate Map Panel No. 29095C0430G. There is currently no work proposed in the regulated floodplain. Please see the attached FEMA FIRMette in Appendix A, Figure A.4.

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: Onsite #1, On-site #2, On-site #3, and On-site #4. On-site #1 and On-site #2 area stormwater runoff will be conveyed through the site via open sheet flow, shallow concentrated flow to the proposed Extended Dry Detention Basins. Both proposed dry detention basins have been sized to detain the 2, 10, and 100-year storm events for on-site drainage.

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.

A stream buffer protection zone will be located on the west side of the property. The proposed buffer zone will meet the requirements provided in APWA Section 5600. Drainage areas have been pulled to determine the required width of the stream buffer zone. Point 1 is located where the major tributary along the west property line meets with the minor tributary coming from the east side of the property. The drainage area to Point 1 is 158 acres, which requires a 60’ offset. Point 2 is located in the southwest corner where the major tributary running in the north/south direction exits the site. The total drainage area to Point 2 is 206 acres, which requires a 100’ offset. Both stream buffer offsets provided are measured from the ordinary high-water mark, or surveyed top of bank. An exhibit has been provided in Appendix A.

3.1 TRIBUTARY AREAS

The post-development site will be divided into four sub-catchments, On-Site #1, On-site #2, and On-site #3, and On-Site #4. On-site #1 and On-site #3 will collect into two proposed dry detention basins. On-site #3 and #4 will bypass to release point #1. These tributary areas and their release point can be located in Appendix A.

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, 1/4 acre lots, ½ acre lots, open space, 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)
On-Site #1	38.54	2-YR	118.86
		10-YR	199.77
		100-YR	306.72
On-Site #2	32.44	2-YR	94.02
		10-YR	162.45
		100-YR	253.52
On-Site #3	2.00	2-YR	7.04
		10-YR	11.36
		100-YR	17.05
On-Site #4	3.60	2-YR	7.81
		10-YR	15.04
		100-YR	25.06
On-Site #5	13.02	2-YR	28.24
		10-YR	54.39
		100-YR	90.64
Off-Site #1	18.50	2-YR	30.96
		10-YR	63.16
		100-YR	108.98

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, since there is no detention proposed and given that the drainage area has been decreased from 6.42 acres to 2.00 acres, the Rational Method was used to calculate the allowable and design release rates.

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	89.60	2-YR	44.80	31.44	76.24
		10-YR	179.20	64.09	243.29
		100-YR	268.80	110.52	379.32
RP-2	2.00	2-YR	3.21	0.00	3.21
		10-YR	12.84	0.00	7.50
		100-YR	19.26	0.00	19.26
RP-3	32.44	2-YR	16.22	0.00	16.22
		10-YR	64.88	0.00	64.88
		100-YR	97.32	0.00	97.32
RP-4	42.14	2-YR	21.07	0.00	21.07
		10-YR	84.28	0.00	84.88
		100-YR	126.42	0.00	126.42

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	89.60	2-YR	76.24	49.32
		10-YR	243.29	91.60
		100-YR	379.32	174.39
RP-2	Prop. = 2.00 Exist. = 6.42	2-YR	3.21	5.52
		10-YR	12.84	7.50
		100-YR	19.26	13.15
RP-3	32.44	2-YR	16.22	6.29
		10-YR	64.88	33.28
		100-YR	97.32	40.81
RP-4	42.14	2-YR	21.07	9.62
		10-YR	84.28	19.62
		100-YR	126.42	70.92

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.

Stormwater runoff for On-Site #1 is mitigated and detained by Extended Dry Detention Basin 1 located on the west side of the property and discharges to RP-4. Stormwater runoff for On-Site #3 is mitigated and detained by Extended Dry Detention Basin 2 located in the southwest corner of the site and discharges to RP-3. Stormwater run-off from On-Site #2 free releases from the site at RP-3. RP-2, RP-3, and RP-4 all converge to RP-4 located in the southwest corner of the site.

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 both 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 10” and 12” diameter orifice plate for Basin 1 and Basin 2 respectively.

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.

Release Point 2 (RP-2) does not meet the allowable release rate required by the comprehensive control requirements for the 2-year storm event. Given that this is a small drainage area and the entire site is collectively meeting comprehensive control requirements, we are asking for a waiver for this peripheral drainage area to avoid adding any additional detention facilities.

* * * * *

4.0 SUMMARY AND RECOMMENDATIONS

The proposed drainage site is an 89.60 acre single-family parcel of land located in Lee's Summit, MO at the intersection of SE Bailey Road and SE Ranson 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. Two extended dry 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.

The project includes a request for modification to the stream setback to allow transition grading. There is sufficient space to allow for the existing stream to flow naturally. Any proposed construction activities with this development will not disrupt the natural movement of this stream. This project is also requested a waiver for a small area located in the southeast corner of the site to allow free-release off-site without additional detention facilities to be implemented.

* * * *

APPENDIX A

-Existing Site Aerial Photograph

-Existing Drainage Map

-Proposed Drainage Map

-EDDB Water Quality Design

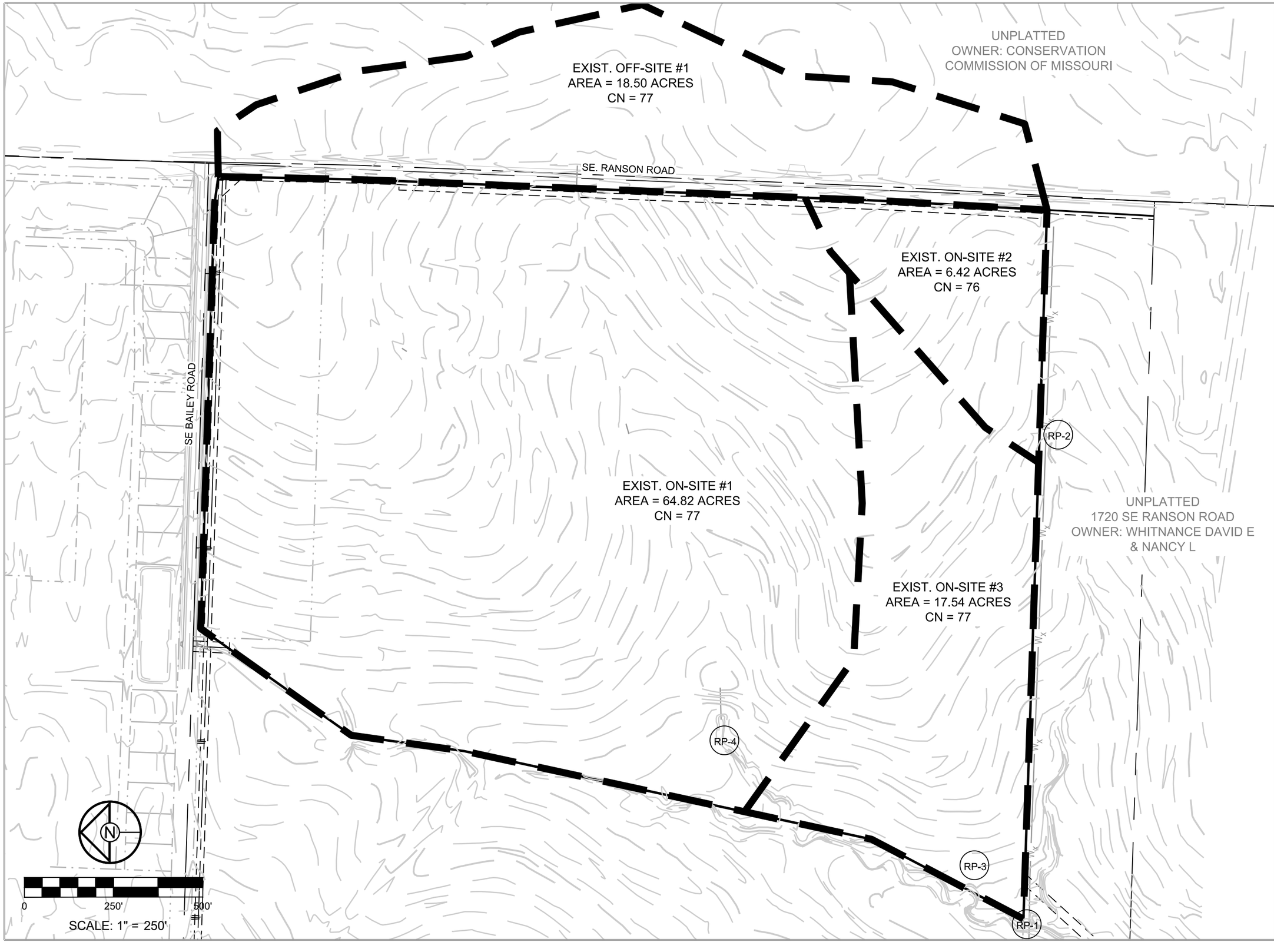
-Stream Corridor Exhibit

-FEMA FIRMette

-Terra Technologies Preliminary Assessment

-National Wetlands Inventory

100% Camera: 1,739 m 38°53'17"N 94°20'25"W 327 m



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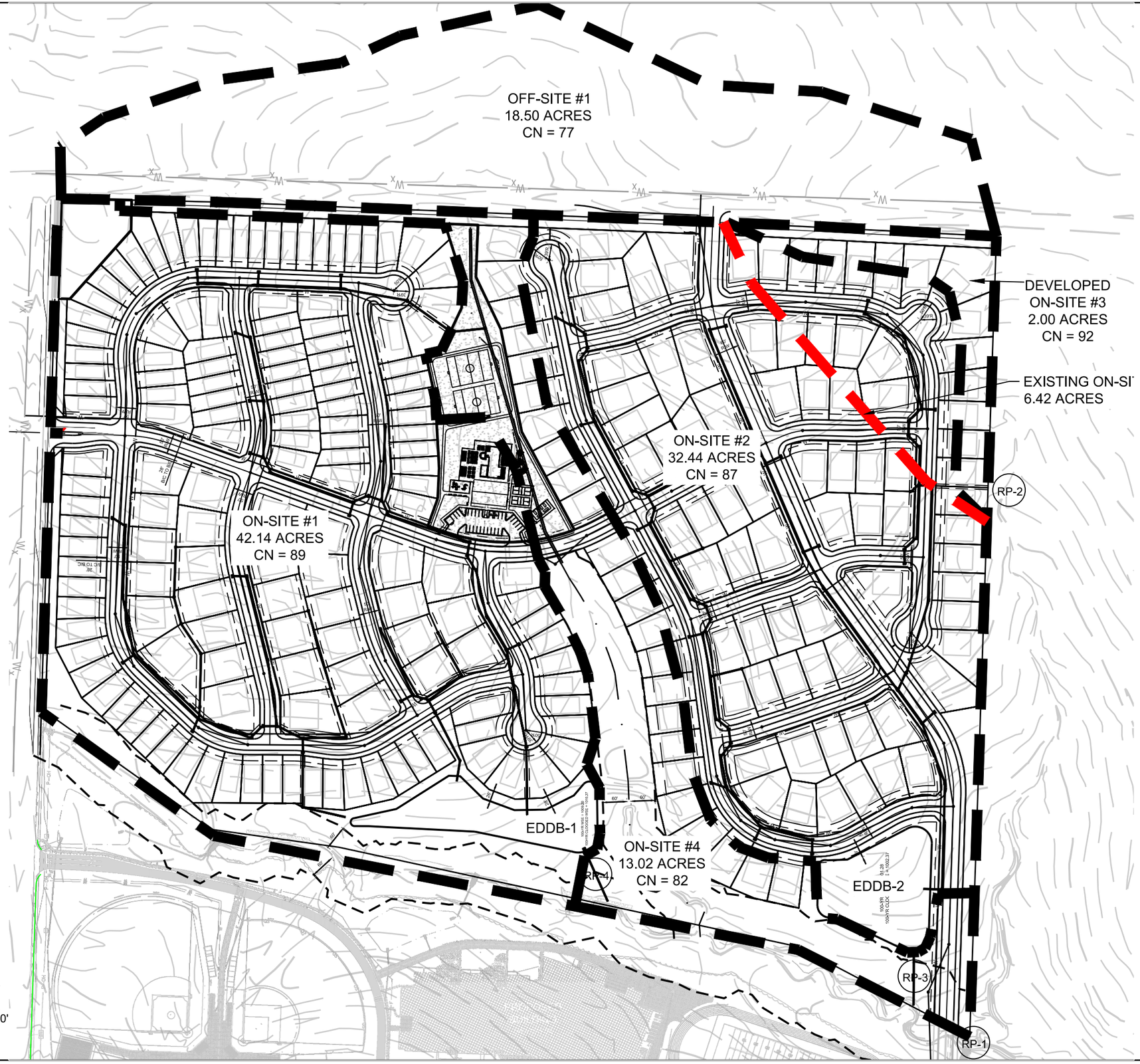
BAILEY FARMS
HYDRO MAPS

1300 SE RANSON ROAD LEE'S SUMMIT, MISSOURI

DRAWN BY:	DATE PREPARED:	PROJ. NUMBER:
NCA	02/25/2021	19-227

EXISTING
DRAINAGE MAP

SHEET
A.1



N

0 250' 500'

SCALE: 1" = 250'

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BAILEY FARMS
HYDRO MAPS

1300 SE RANSON ROAD LEE'S SUMMIT, MISSOURI

DRAWN BY:	DATE PREPARED:	PROJ. NUMBER:
NCA	02/25/2021	19-227

PROPOSED
DRAINAGE MAP

SHEET
A.2

Extended Dry Detention Basin 1

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
1/8 ACRE LOTS	65	13.88	9.02	0.66	0.64	9.16	8.81
1/4 ACRE LOTS	38	27.00	10.26	0.66	0.39	17.82	10.58
1/2 ACRE LOTS	25	0.58	0.15	0.51	0.28	0.30	0.16
URBAN COMMERCIAL	85	1.41	1.20	0.81	0.82	1.14	1.15
Total		**42.87**	**20.63**			**28.42**	**20.71**

Rv = Sum(Rv*A)/Total Area = 20.7 / 42.87 = 0.483

C = Sum(C*A)/Total Area = 28.41 / 42.87 = 0.663

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.4830 **0.662 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 42.87 acres
WQV = 0.662 in

WQV = (42.87 * 0.661)/12 = **2.36 ac-ft**

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

Designer:	N. AUGUSTINE
Checked b	J. LONG
Company:	Schlagel
Date:	4/15/2021
Project:	19-227
Location:	Lee's Summit

EDD -1

I. Basin Water Quality Storage Volume:

Step 1) Tributary Area to EDDB, A_T (ac.)	A_T (ac.) =	42.87
Step 2) Calculate WQv using method in Section 6.1	WQv (ac-ft) =	2.36
Step 3) Add 20 percent to account for silt and sand sediment deposition in the basin	V_{design} (ac-ft) =	2.84

IIa. Water Quality Outlet Type

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.) =	1.00
Step 2) Average head of Water Quality volume over invert of orifice, H_{WQ} (ft) $H_{WQ} = 0.5 * Z_{WQ}$	H_{WQ} (ft.) =	0.50
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) $Q_{WQ} = (WQv * 43{,}560)/(40 * 3600)$	Q_{WQ} (cfs) =	0.72
Step 4) Set value of orifice discharge coefficient, C_O	C_O =	0.66
$C_O = 0.66$ when thickness of riser/weir plate is = or < orifice diameter $C_O = 0.80$ when thickness of riser/weir plate is > orifice diameter		
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) =	6

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.) =	7.75
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) =	0.99
Step 3) Circular perforation diameter per row assuming a single column, D_1 (in)	D_1 (in) =	1.12

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) =	2.00
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 =	23

IIb. Water Quality Outlet, V-notch Weir

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 V-notch, 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) =	0.72
Step 4) V-notch weir coefficient, C_V	C_V =	2.69
Step 5) V-notch weir angle, θ (deg) $\theta = 2 * (180/\pi) * \arctan(Q_{WQ} / C_V * H_{WQ}^{5/2}))$ V-notch angle should be at least 20 degeres. Set to 20 degrees if calculated angle is smaller.	θ (deg) =	20.0
Step 6) Top width of V-notch weir $W_V = 2 * Z_{WQ} * TAN(\theta/2)$	W_V =	1.30

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

III. Flood Control

Refer to APWA Specifications Section 5608

Extended Dry Detention Basin 2

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
1/4 ACRE LOTS	38	32.44	12.33	0.66	0.39	21.41	12.72
Total		**32.44**	**12.33**			**21.41**	**12.72**

Rv = Sum(Rv*A)/Total Area = 12.71 / 32.44 = 0.392

C = Sum(C*A)/Total Area = 21.41 / 32.44 = 0.660

II. Determine Water Quality Volume

WQV = P * Rv = 1.37 * 0.392 = **0.537 in**

III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 32.44 acres
WQV = 0.537 in

WQV = (32.44 * 0.537)/12 = **1.45 ac-ft**

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

Designer:	N. AUGUSTINE
Checked b	J. LONG
Company:	Schlagel
Date:	4/15/2021
Project:	19-227
Location:	Lee's Summit

EDD -2

I. Basin Water Quality Storage Volume:

Step 1) Tributary Area to EDDB, A_T (ac.)	A_T (ac.) =	32.44
Step 2) Calculate WQv using method in Section 6.1	WQv (ac-ft) =	1.45
Step 3) Add 20 percent to account for silt and sand sediment deposition in the basin	V_{design} (ac-ft) =	1.74

13.88
IIa. Water 27

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.) =	2.00
Step 2) Average head of Water Quality volume over invert of orifice, H_{WQ} (ft) $H_{WQ} = 0.5 * Z_{WQ}$	H_{WQ} (ft.) =	1.00
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) $Q_{WQ} = (WQv * 43{,}560)/(40 * 3600)$	Q_{WQ} (cfs) =	0.44
Step 4) Set value of orifice discharge coefficient, C_O	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) =	4

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.) =	6.40
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) =	0.79
Step 3) Circular perforation diameter per row assuming a single column, D_1 (in)	D_1 (in) =	1.00

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) =	2.00
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 =	19

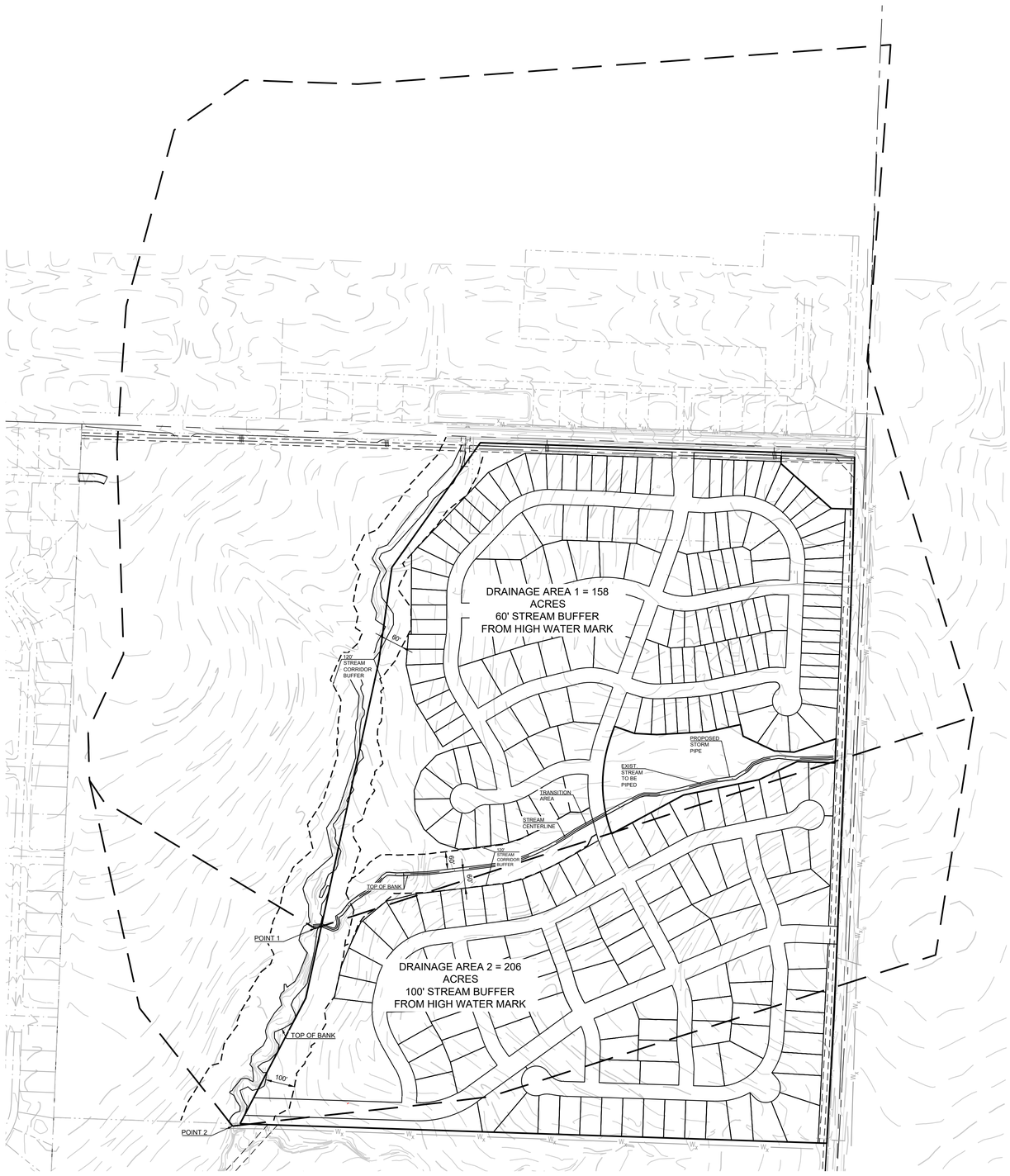
IIb. Water Quality Outlet, V-notch Weir

Step 1) Depth of water quality volume at outlet, Z_{WQ} (ft.)	Z_{WQ} (ft.) =	0.90
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.) =	0.45
Step 3) Average water quality outflow rate, Q_{WQ} (cfs) Q_{WQ} = (WQv * 43,560)/(40 * 3600)	Q_{WQ} (cfs) =	0.44
Step 4) V-notch weir coefficient, C_V	C_V =	2.69
Step 5) V-notch weir angle, θ (deg) θ = 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) =	100.5
Step 6) Top width of V-notch weir W_V = 2 * Z_{WQ} * TAN(θ/2)	W_V =	2.16

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

III. Flood Control

Refer to APWA Specifications Section 5608



0 200' 400'

SCALE: 1" = 200'

SCHLAGEL

ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS
14920 W. 107th Street • Lenexa, Kansas 66215
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Missouri State Certificates of Authority
#E2000003800-F #LA2001005237 #LS2002008859-F

PREPARED BY:

SCHLAGEL & ASSOCIATES, P.A.

BAILEY FARMS
STREAM CORRIDOR EXHIBIT
1300 SE RANSON ROAD LEE'S SUMMIT, MISSOURI

REVISION DATE	DESCRIPTION
1 #####	#####
2 #####	#####
3 #####	#####
4 #####	#####
5 #####	#####
6 #####	#####
7 #####	#####
8 #####	#####
9 #####	#####

DRAWN BY: NCA
CHECKED BY: JLL
DATE PREPARED: 04/16/2021
PROJ. NUMBER: 19-227

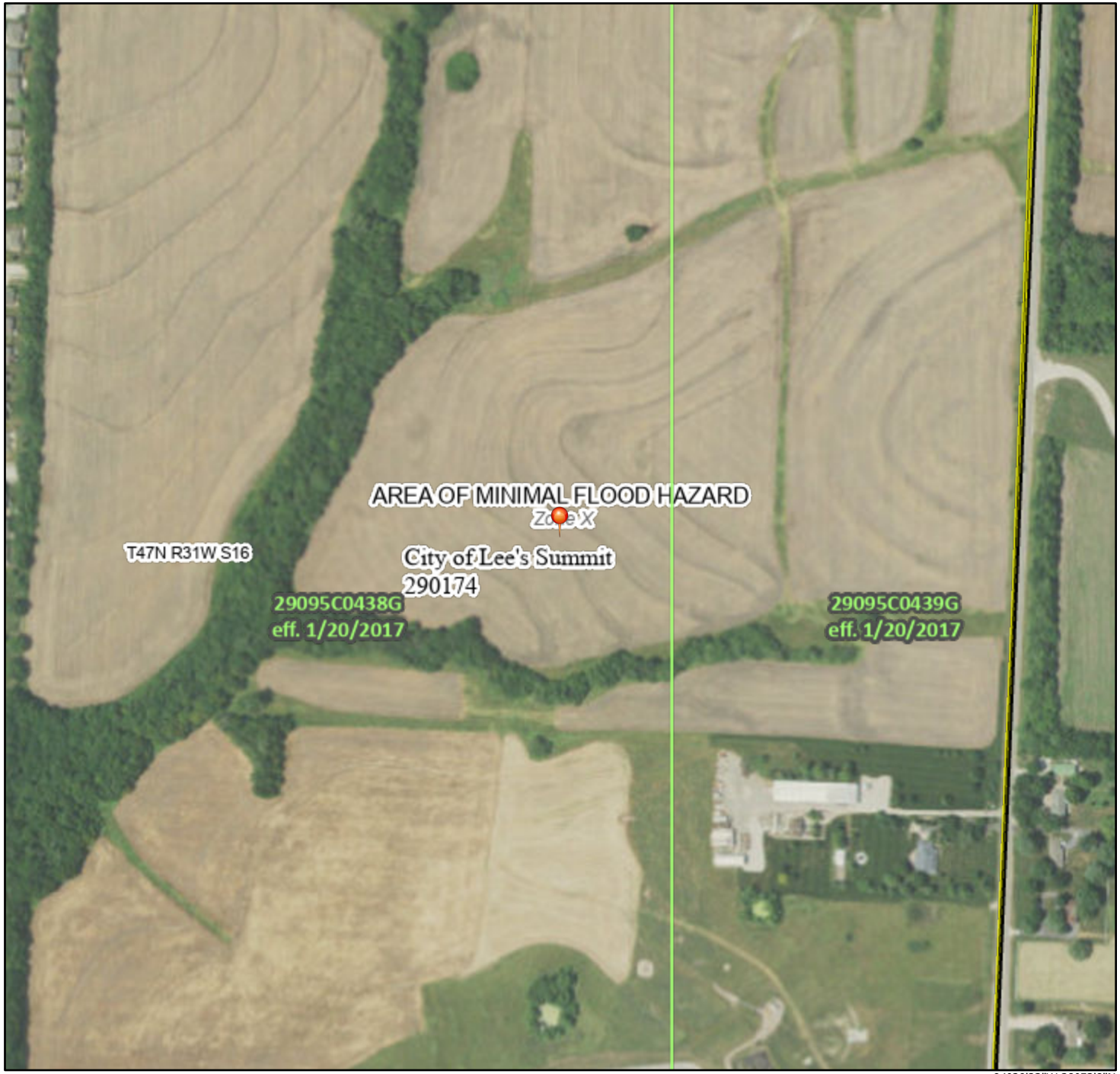
STREAM CORRIDOR EXHIBIT

SHEET 1

National Flood Hazard Layer FIRMette

FEMA

94°21'W 38°53'36"N



94°20'23"W 38°53'8"N

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

1:6,000

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 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 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 2/19/2021 at 12:00 PM 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.

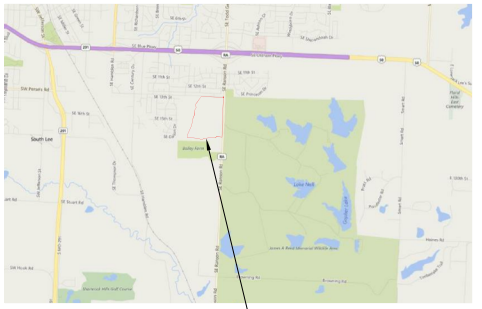
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory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

PRELIMINARY ASSESSMENT

Wetland 1: 0.33 acre, Lat. 38.89427, Long. -94.34575
Wetland 2: 0.16 acre, Lat. 38.89115, Long. -94.34532
Wetland 3: 0.06 acre, Lat. 38.89182, Long. -94.34293
Wetland 4: 0.06 acre, Lat. 38.88862, Long. -94.34256
TOTAL WETLAND AREA: 0.61 Acres

Intermittent 1: 2,349 LF X 7 FT, Lat. 38.89261, Long. -94.34621
TOTAL INTERMITTENT LENGTH: 2,349 LF

Ephemeral 1: 445 LF X 4 FT, Lat. 38.89072, Long. -94.34647
Ephemeral 2: 657 LF X 3 FT, Lat. 38.88862, Long. -94.34672
TOTAL EPHEMERAL LENGTH: 1,102 LF



Site Location
T47N-R31W-S16
Lee's Summit, Jackson County, Missouri
95.92 Acres
Lat. 38.89207
Long. -94.34343

GRAPHIC SCALE
150 0 75 150 300 600
(IN FEET)
1 inch = 150 ft.

Terra Technologies
6240 W. 135th St., Ste. 100
Overland Park, Kansas 66223
Tel 913.385.9560 Fax 913.385.5295

FIGURE

SHEET TITLE: PRELIMINARY ASSESSMENT
PROJECT: BAILEY FARM PARCEL
CLIENT: CLAYTON PROPERTIES GROUP, INC. DBA SUMMIT HOMES

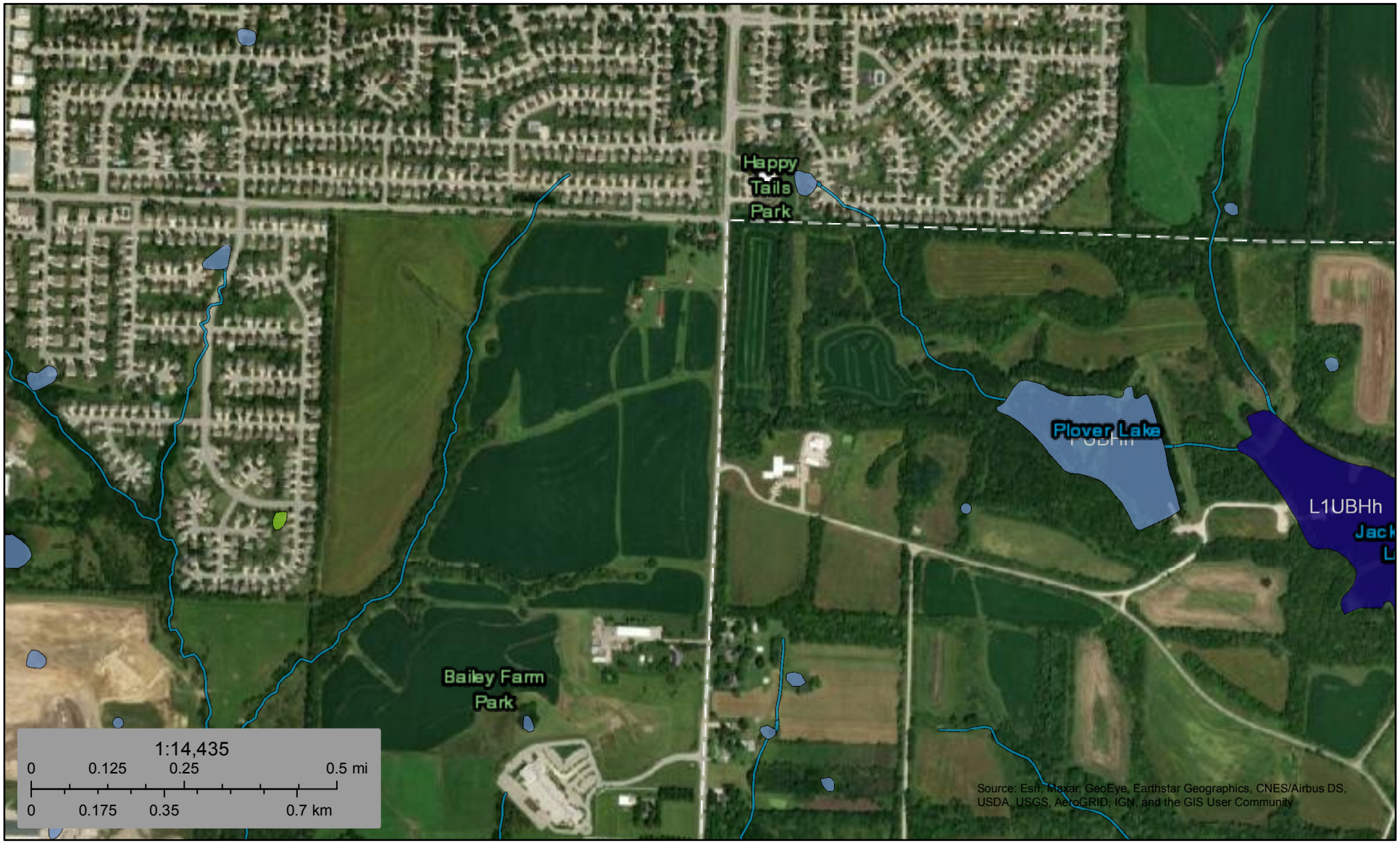
REVISIONS	
DATE	DESCRIPTION

DATE 12/18/2019
CHECKED BY JMK DRAWN BY SNS
SHEET NO. PA
JOB NO. XXX

U.S. Fish and Wildlife Service

National Wetlands Inventory

Bailey Farms



February 25, 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

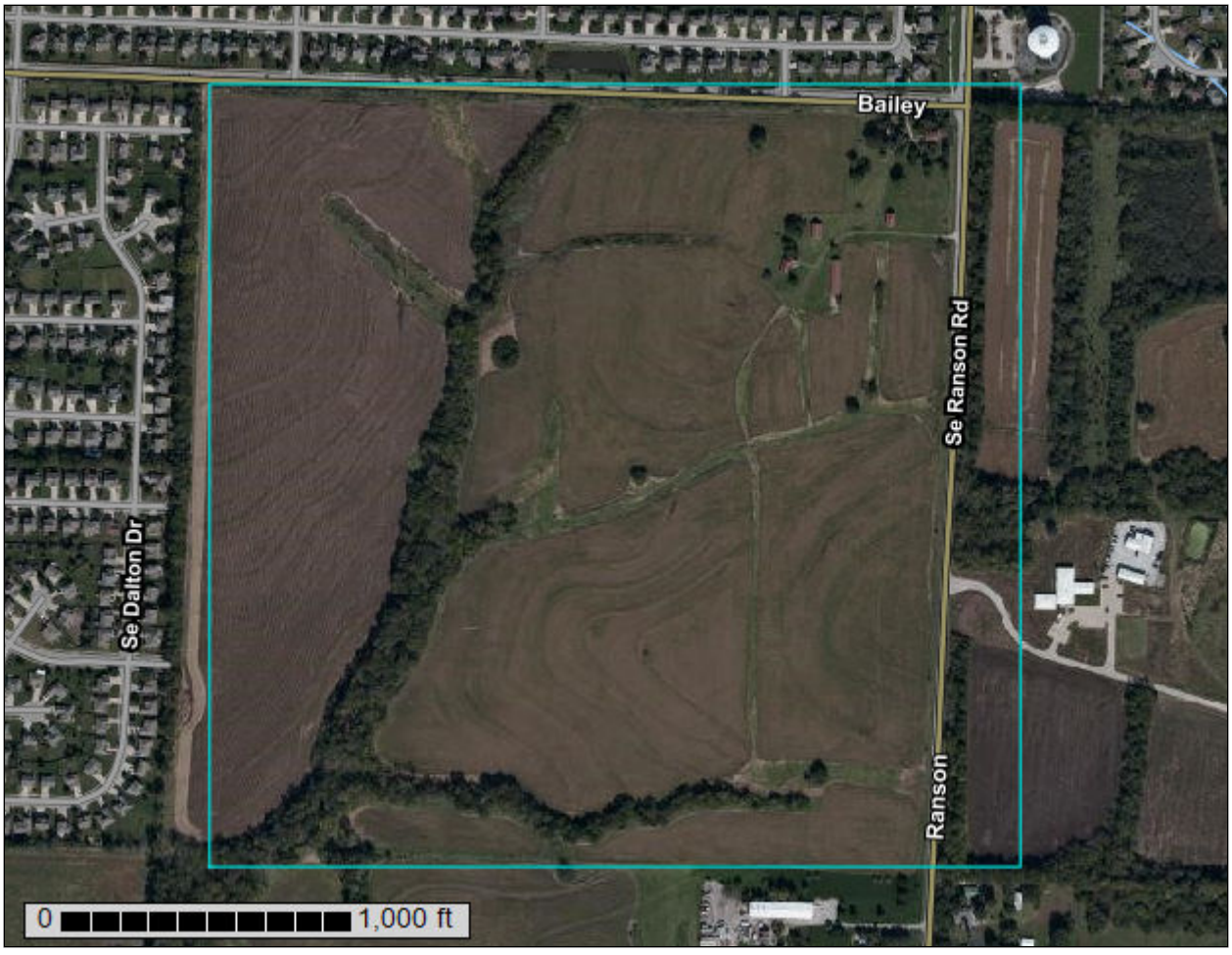
United States Department of Agriculture

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



February 10, 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: 1:6,940 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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	62.9	36.4%
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	28.0	16.2%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	82.1	47.5%
Totals for Area of Interest		**173.0**	**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

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: 1:6,940 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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	62.9	36.4%
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	C	28.0	16.2%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	C/D	82.1	47.5%
Totals for Area of Interest			**173.0**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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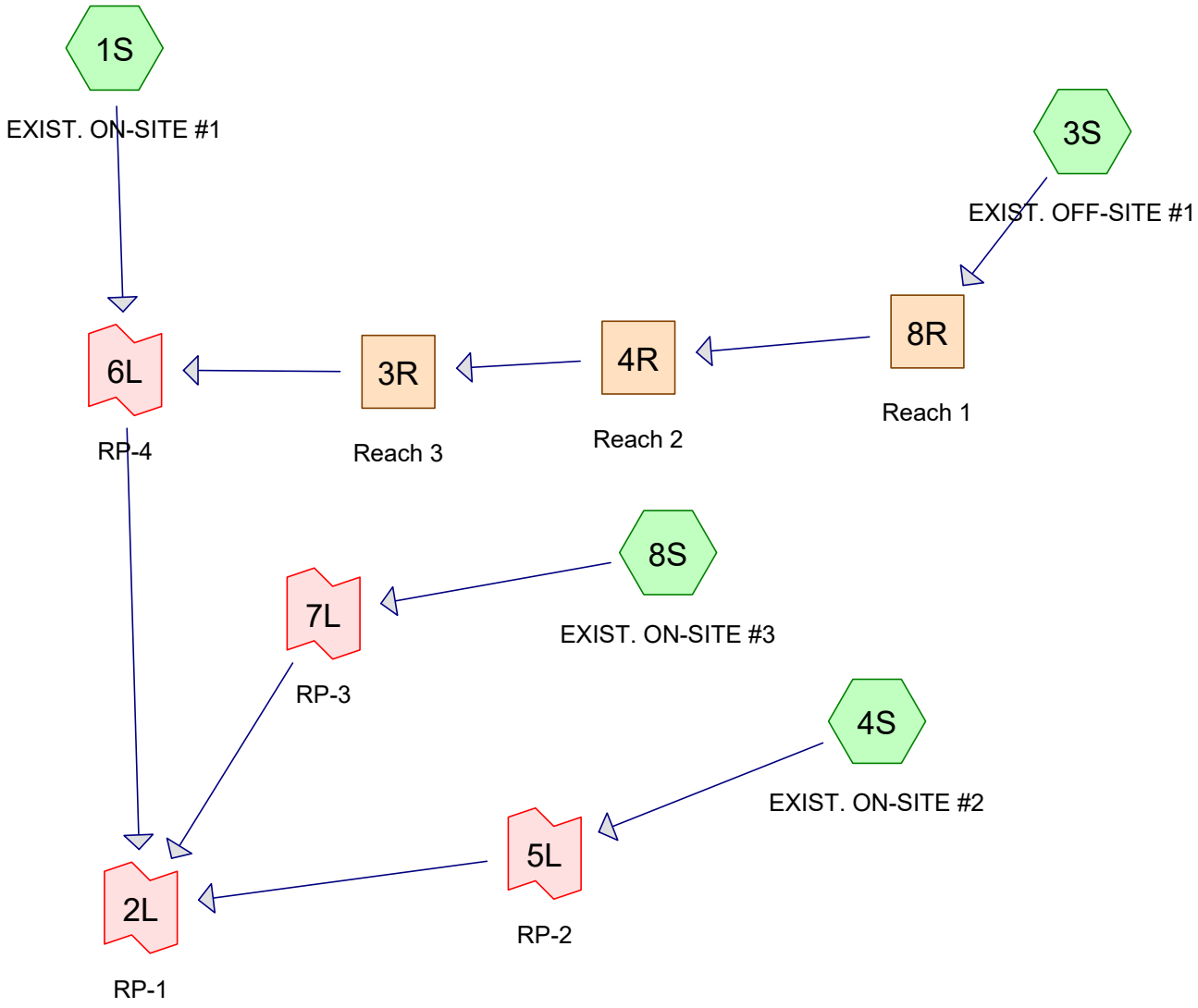


Subcat Reach Pond Link

Routing Diagram for 19-227-HYDRO-EX

Prepared by {enter your company name here}, Printed 4/15/2021

Summary for Subcatchment 1S: EXIST. ON-SITE #1

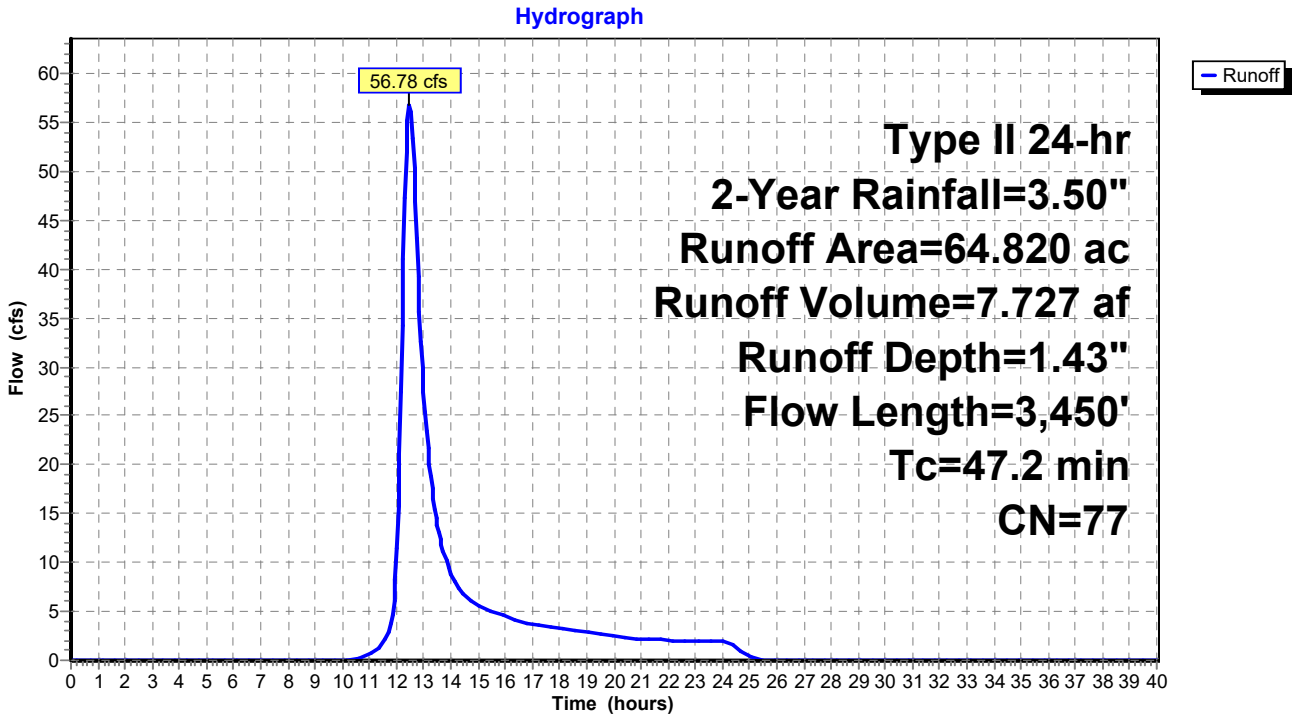
Runoff = 56.78 cfs @ 12.48 hrs, Volume= 7.727 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
34.840	74	Pasture/grassland/range, Good, HSG C
29.980	80	Pasture/grassland/range, Good, HSG D
64.820	77	Weighted Average
64.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
24.7	2,132	0.0255	1.44		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
14.1	1,218	0.0092	1.44		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
47.2	3,450	Total			

Subcatchment 1S: EXIST. ON-SITE #1



Summary for Subcatchment 3S: EXIST. OFF-SITE #1

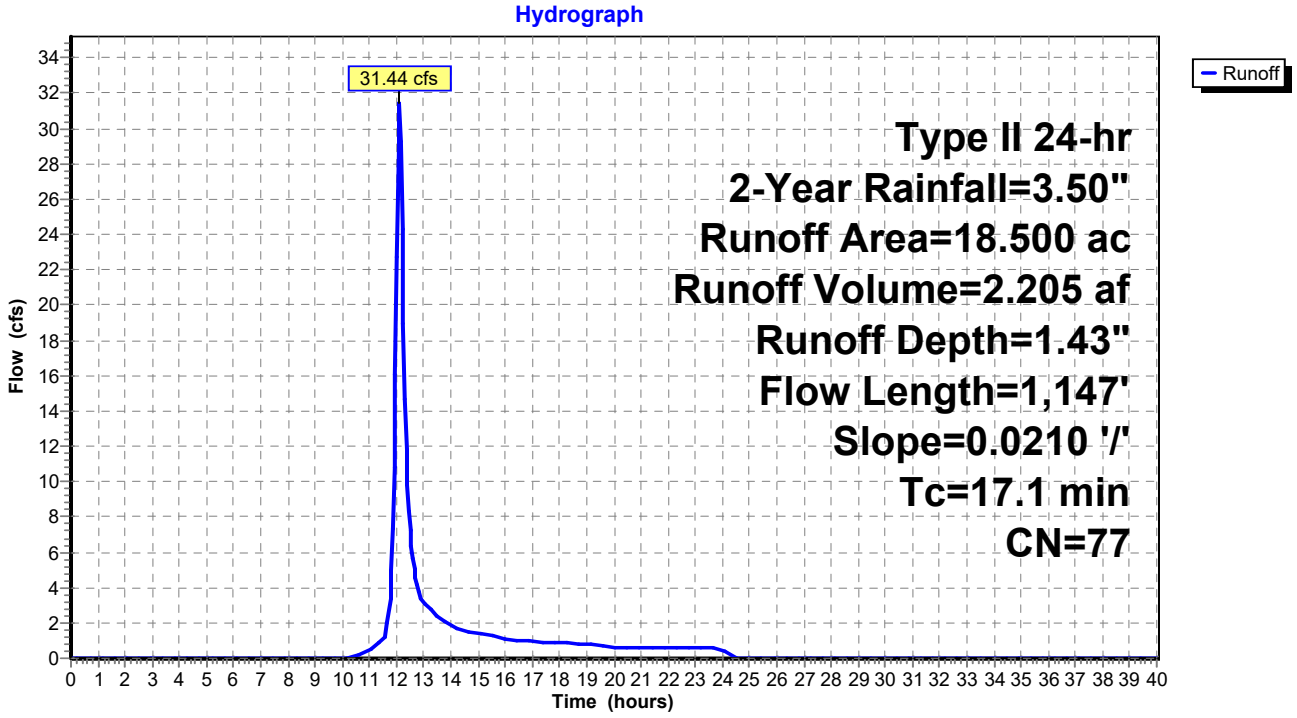
Runoff = 31.44 cfs @ 12.10 hrs, Volume= 2.205 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.860	82	Woods/grass comb., Fair, HSG D
18.500	77	Weighted Average
18.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0210	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
8.0	1,047	0.0210	2.17		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
17.1	1,147	Total			

Subcatchment 3S: EXIST. OFF-SITE #1



Summary for Subcatchment 4S: EXIST. ON-SITE #2

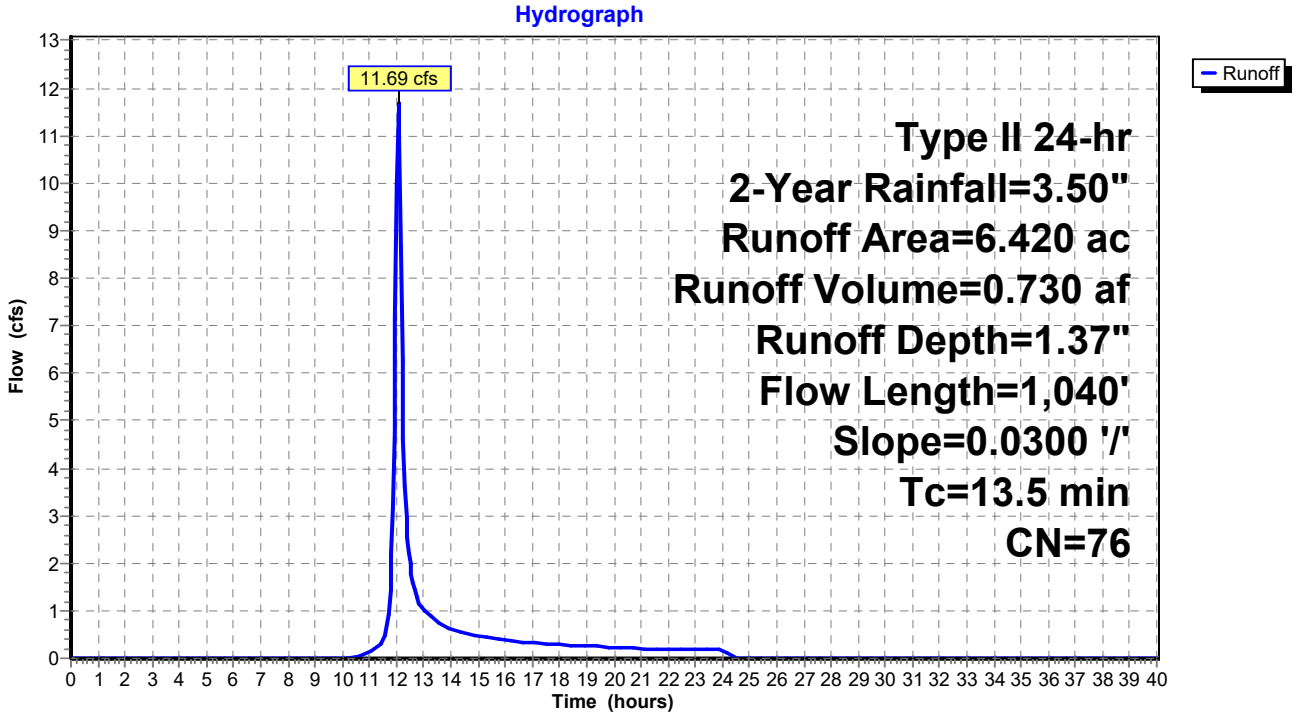
Runoff = 11.69 cfs @ 12.06 hrs, Volume= 0.730 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
4.200	74	Pasture/grassland/range, Good, HSG C
2.220	80	Pasture/grassland/range, Good, HSG D
6.420	76	Weighted Average
6.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0300	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	940	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.5	1,040	Total			

Subcatchment 4S: EXIST. ON-SITE #2



Summary for Subcatchment 8S: EXIST. ON-SITE #3

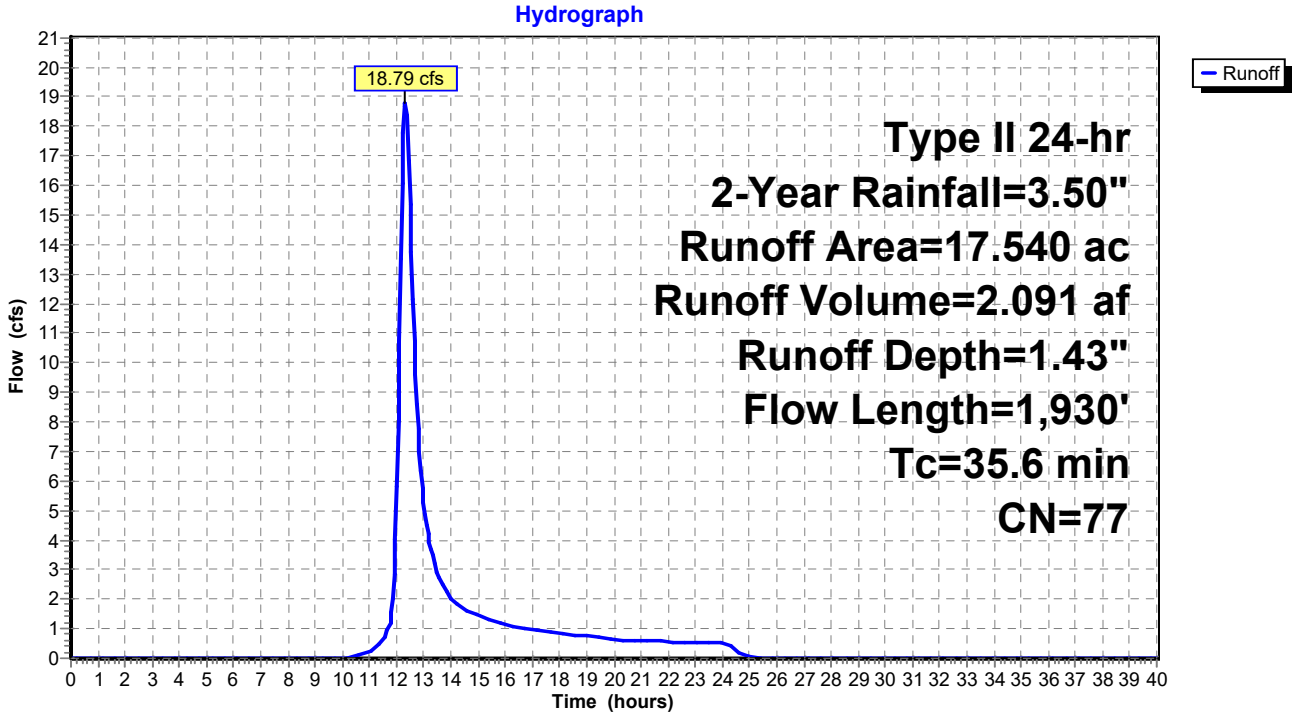
Runoff = 18.79 cfs @ 12.32 hrs, Volume= 2.091 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
9.830	74	Pasture/grassland/range, Good, HSG C
7.710	80	Pasture/grassland/range, Good, HSG D
17.540	77	Weighted Average
17.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0265	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
27.3	1,830	0.0255	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
35.6	1,930	Total			

Subcatchment 8S: EXIST. ON-SITE #3



Summary for Reach 3R: Reach 3

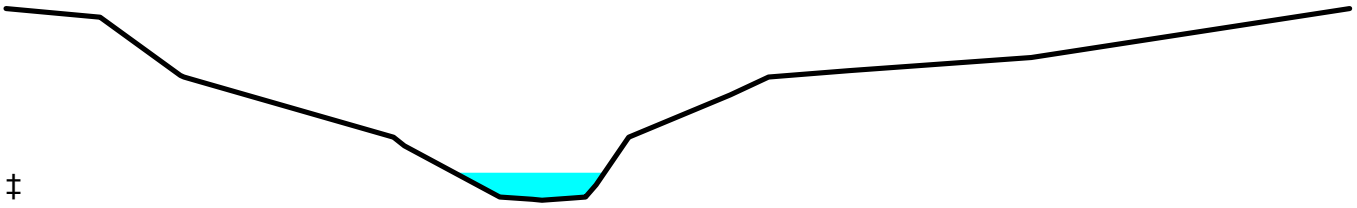
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.37' @ 12.40 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 28.05 cfs @ 12.30 hrs, Volume= 2.205 af
Outflow = 25.72 cfs @ 12.45 hrs, Volume= 2.205 af, Atten= 8%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.49 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 19.5 min

Peak Storage= 7,763 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 6.40' Flow Area= 252.4 sf, Capacity= 2,150.14 cfs

Custom cross-section, Length= 1,041.0' Slope= 0.0088 '/' (110 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 989.92', Outlet Invert= 980.77'

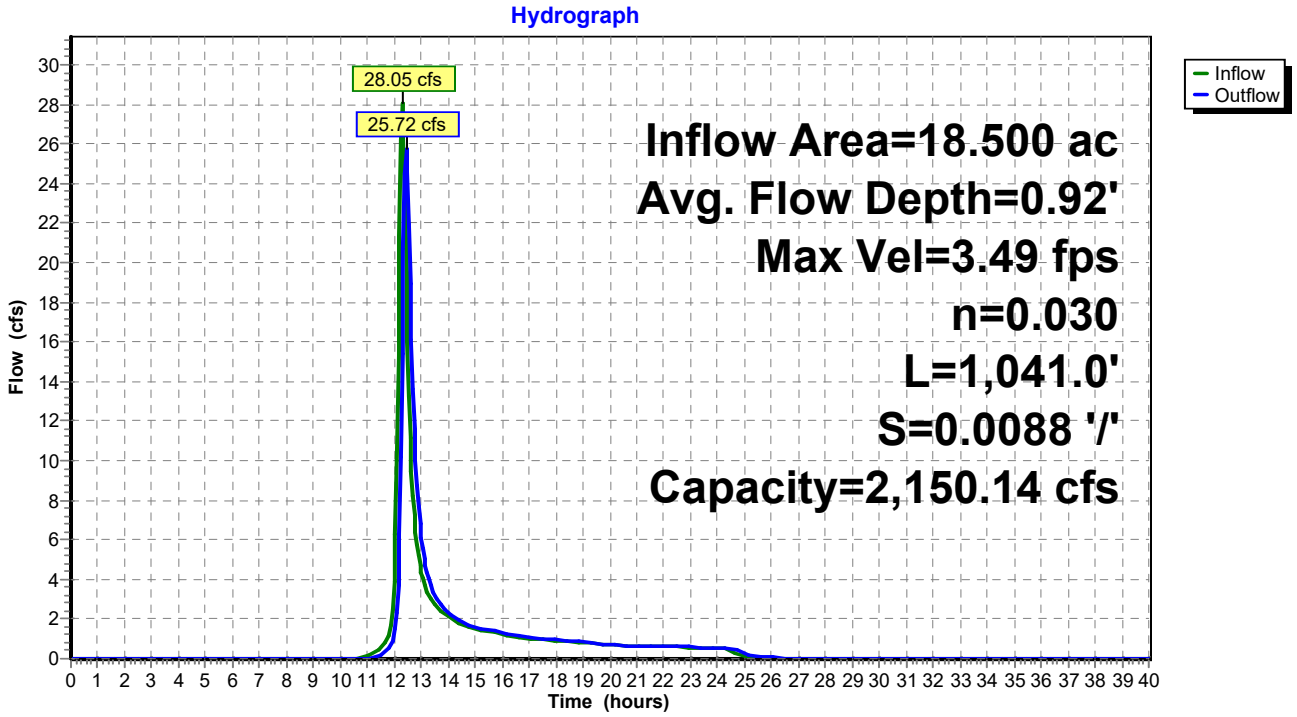


‡

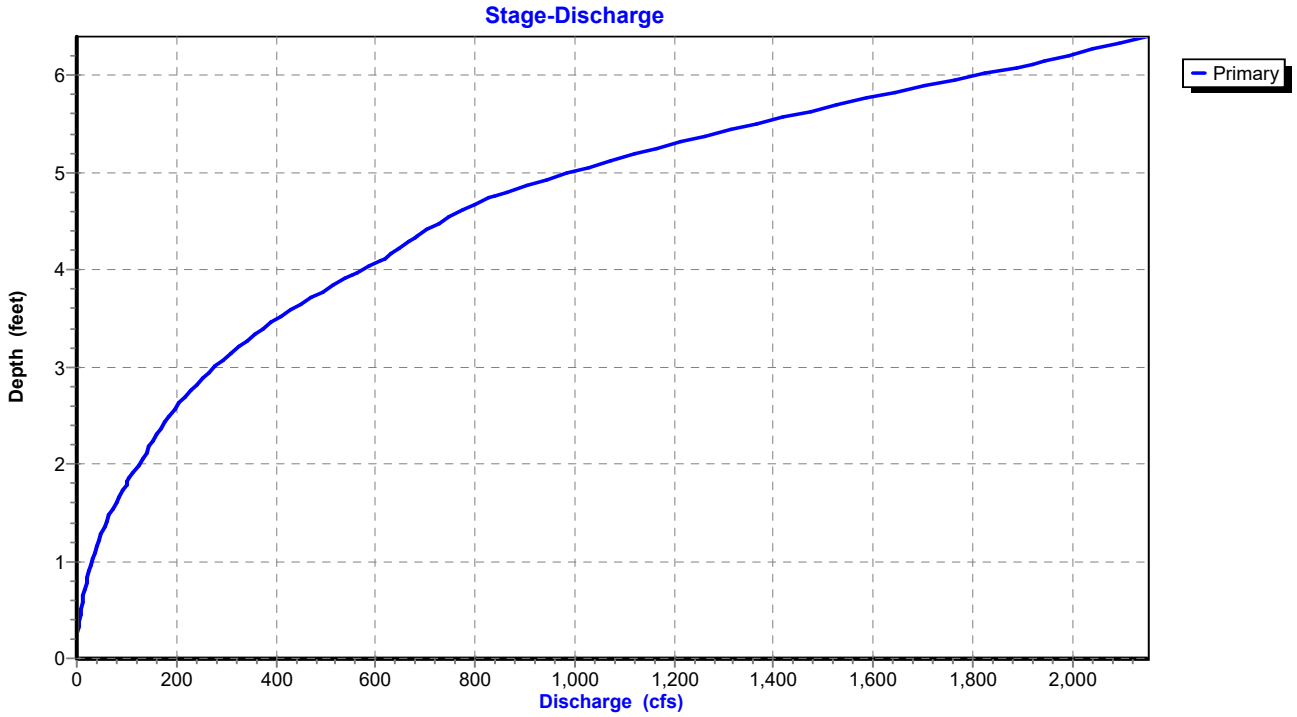
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	996.29	0.00
7.00	996.00	0.29
12.99	994.06	2.23
13.24	994.00	2.29
14.48	993.84	2.45
28.84	992.00	4.29
29.66	991.71	4.58
36.75	990.00	6.29
39.18	989.92	6.37
39.90	989.89	6.40
42.20	989.97	6.32
43.14	990.00	6.29
43.91	990.40	5.89
46.34	992.00	4.29
53.90	993.41	2.88
56.74	994.00	2.29
62.76	994.22	2.07
76.31	994.65	1.64
100.00	996.29	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
3.52	62.5	37.1	65,011	410.25
3.95	79.1	42.6	82,369	555.08
4.11	85.9	44.7	89,447	617.31
4.17	88.6	46.6	92,223	631.78
4.33	96.2	51.5	100,189	678.51
4.76	121.1	66.4	126,018	838.92
6.11	225.0	90.3	234,197	1,919.54
6.40	252.4	101.5	262,697	2,150.14

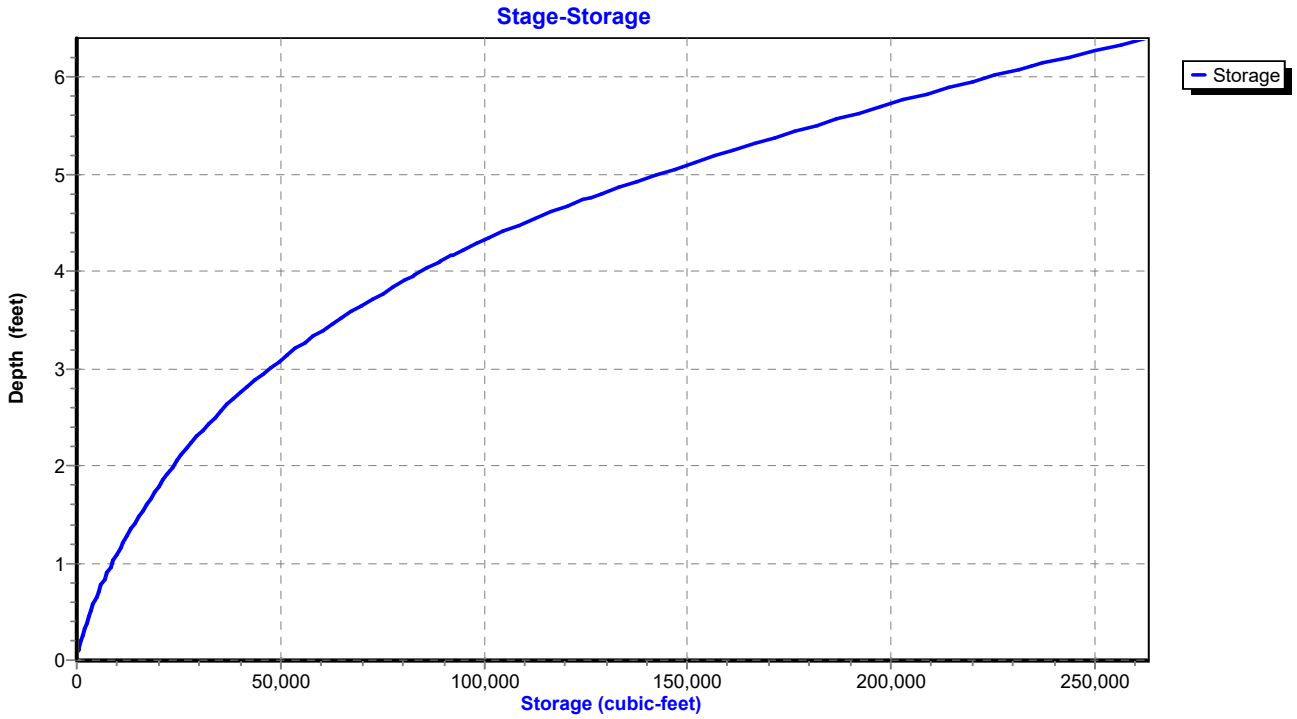
Reach 3R: Reach 3



Reach 3R: Reach 3



Reach 3R: Reach 3



Summary for Reach 4R: Reach 2

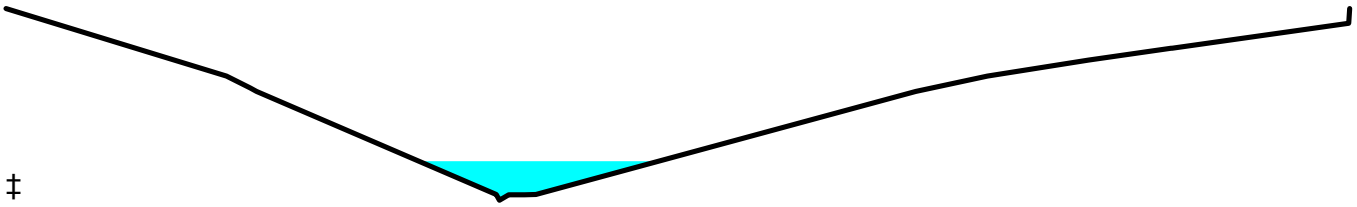
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.43' @ 12.30 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 30.34 cfs @ 12.18 hrs, Volume= 2.205 af
Outflow = 28.05 cfs @ 12.30 hrs, Volume= 2.205 af, Atten= 8%, Lag= 7.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 11.2 min

Peak Storage= 6,808 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 3.24' Flow Area= 204.3 sf, Capacity= 1,999.47 cfs

Custom cross-section, Length= 853.0' Slope= 0.0225 '/' (106 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 1,009.12', Outlet Invert= 989.90'

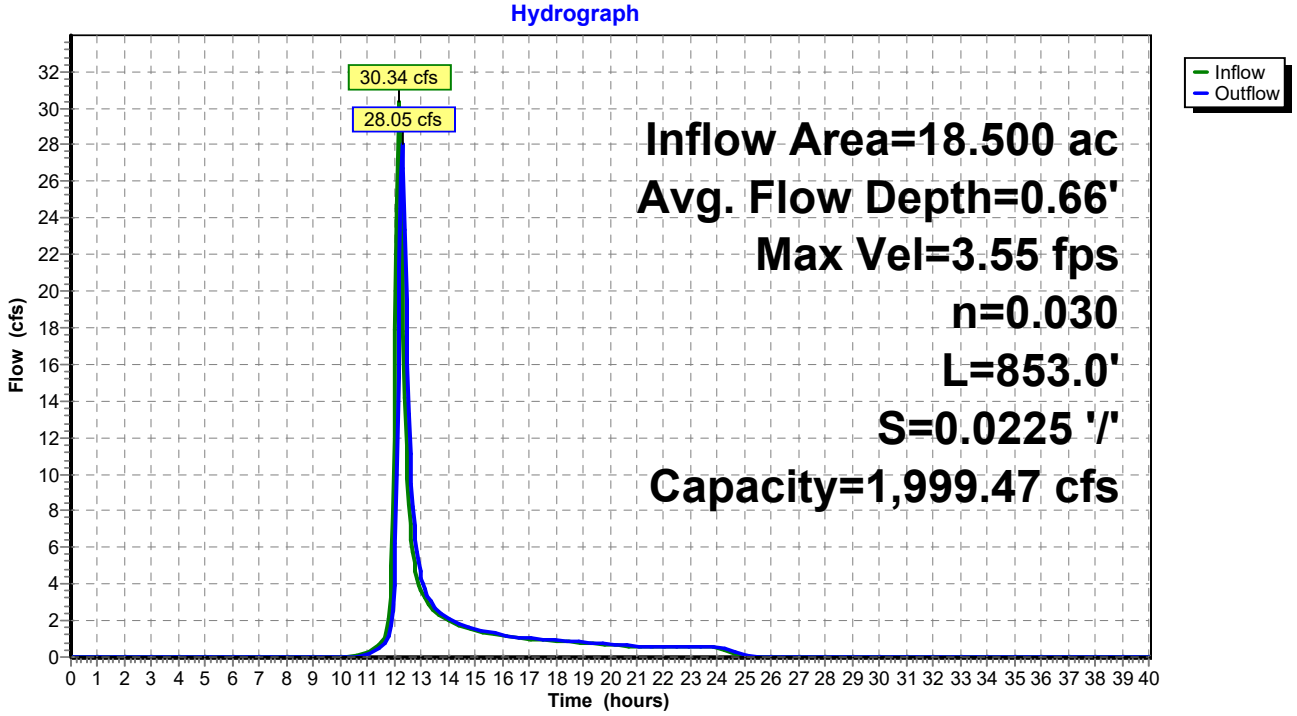


‡

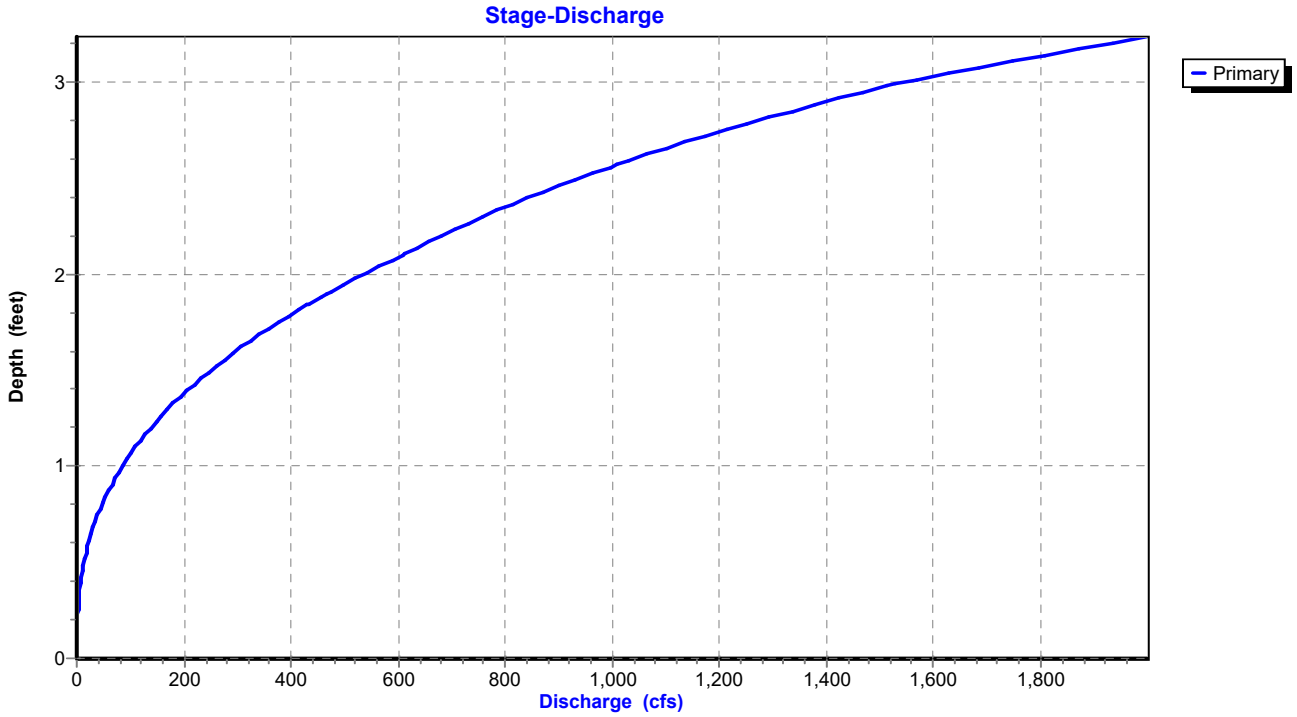
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,009.14	0.00
22.15	1,008.00	1.14
24.54	1,007.80	1.34
25.18	1,007.74	1.40
49.26	1,006.00	3.14
49.59	1,005.90	3.24
50.51	1,005.99	3.15
52.13	1,005.99	3.15
53.24	1,006.00	3.14
91.41	1,007.74	1.40
98.60	1,008.00	1.14
108.78	1,008.27	0.87
117.07	1,008.47	0.67
117.16	1,008.47	0.67
134.91	1,008.89	0.25
135.00	1,009.14	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	818.03
2.57	122.0	104.3	104,091	1,007.45
2.99	171.2	130.2	146,042	1,527.76
3.24	204.3	135.4	174,303	1,999.47

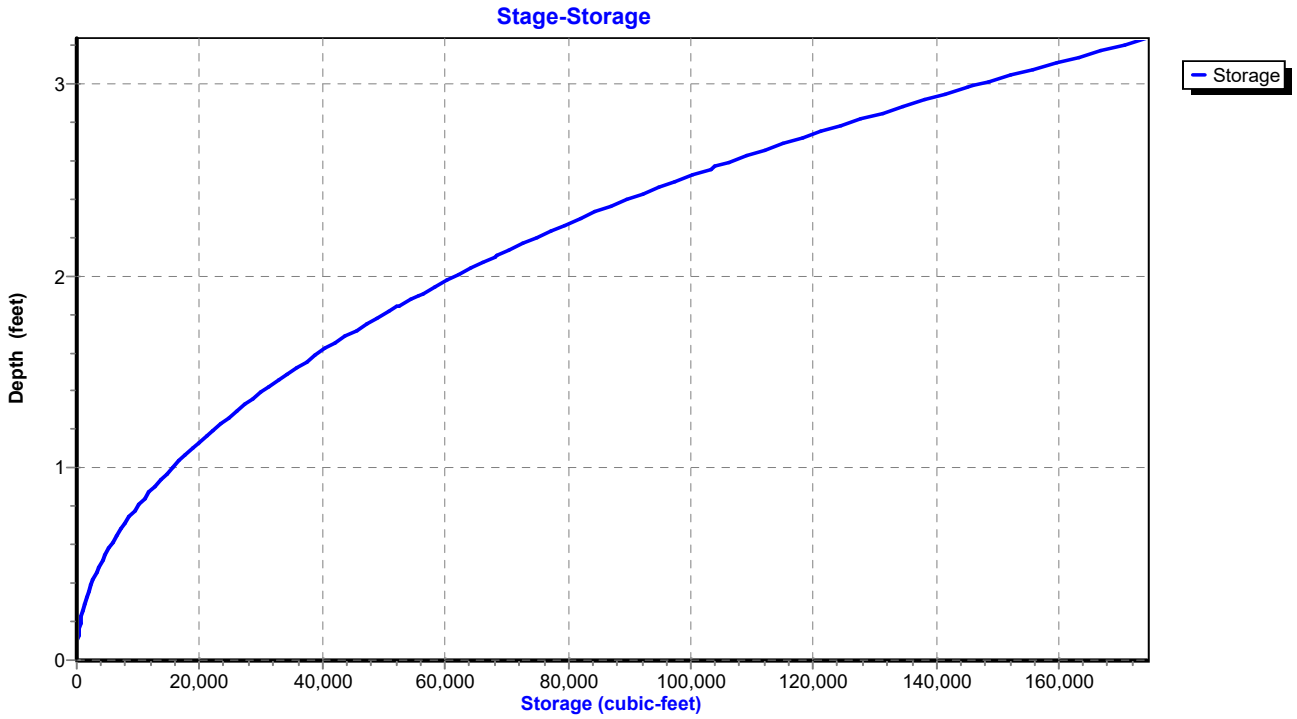
Reach 4R: Reach 2



Reach 4R: Reach 2



Reach 4R: Reach 2



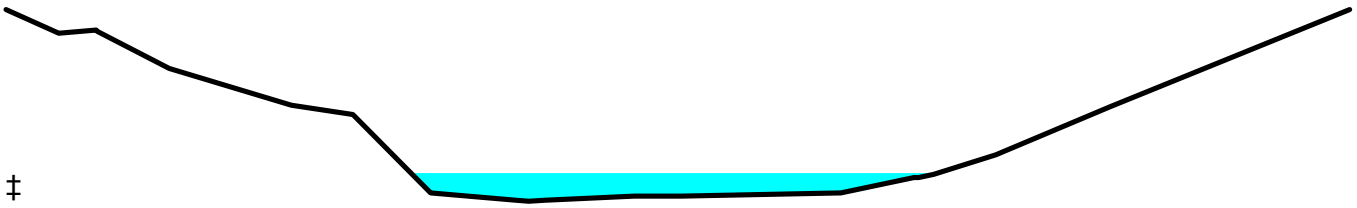
Summary for Reach 8R: Reach 1

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 31.44 cfs @ 12.10 hrs, Volume= 2.205 af
Outflow = 30.34 cfs @ 12.18 hrs, Volume= 2.205 af, Atten= 4%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.06 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 10.6 min

Peak Storage= 5,256 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.86' Flow Area= 89.8 sf, Capacity= 1,475.63 cfs

Custom cross-section, Length= 875.0' Slope= 0.0147 '/' (108 Elevation Intervals)
Constant n= 0.012 Concrete pipe, finished
Inlet Invert= 1,021.96', Outlet Invert= 1,009.12'

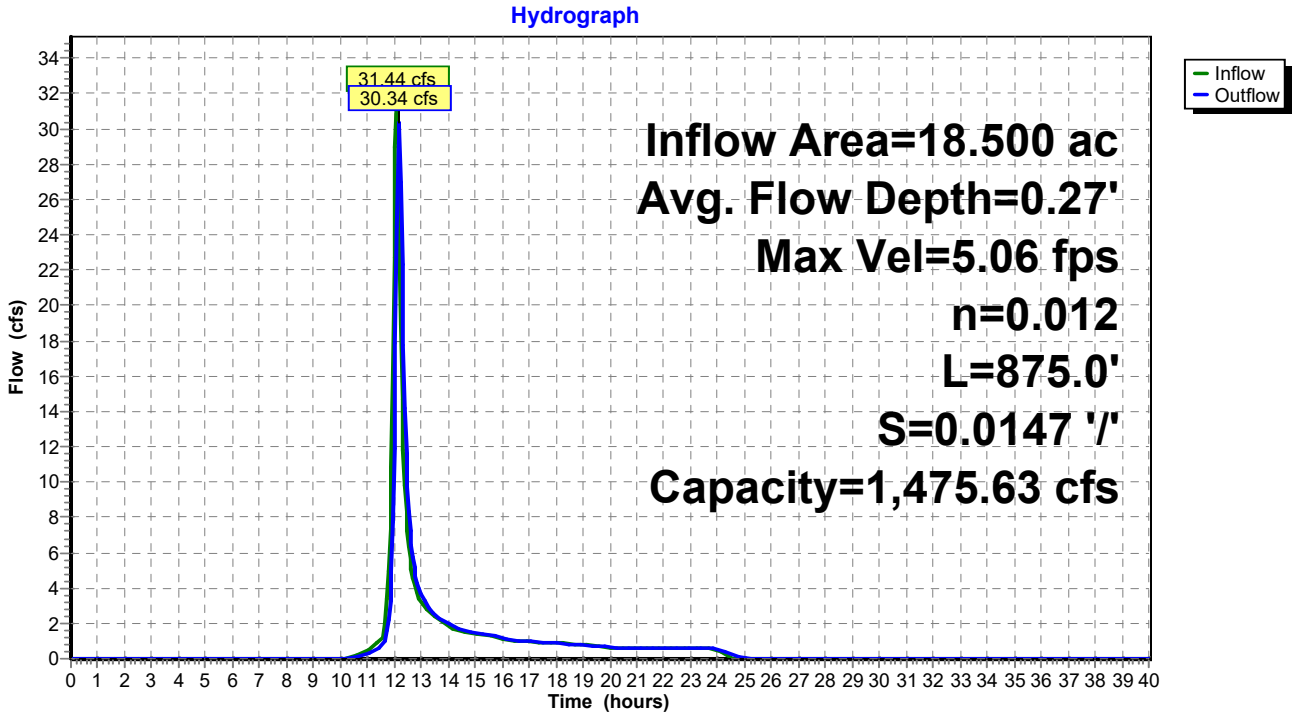


‡

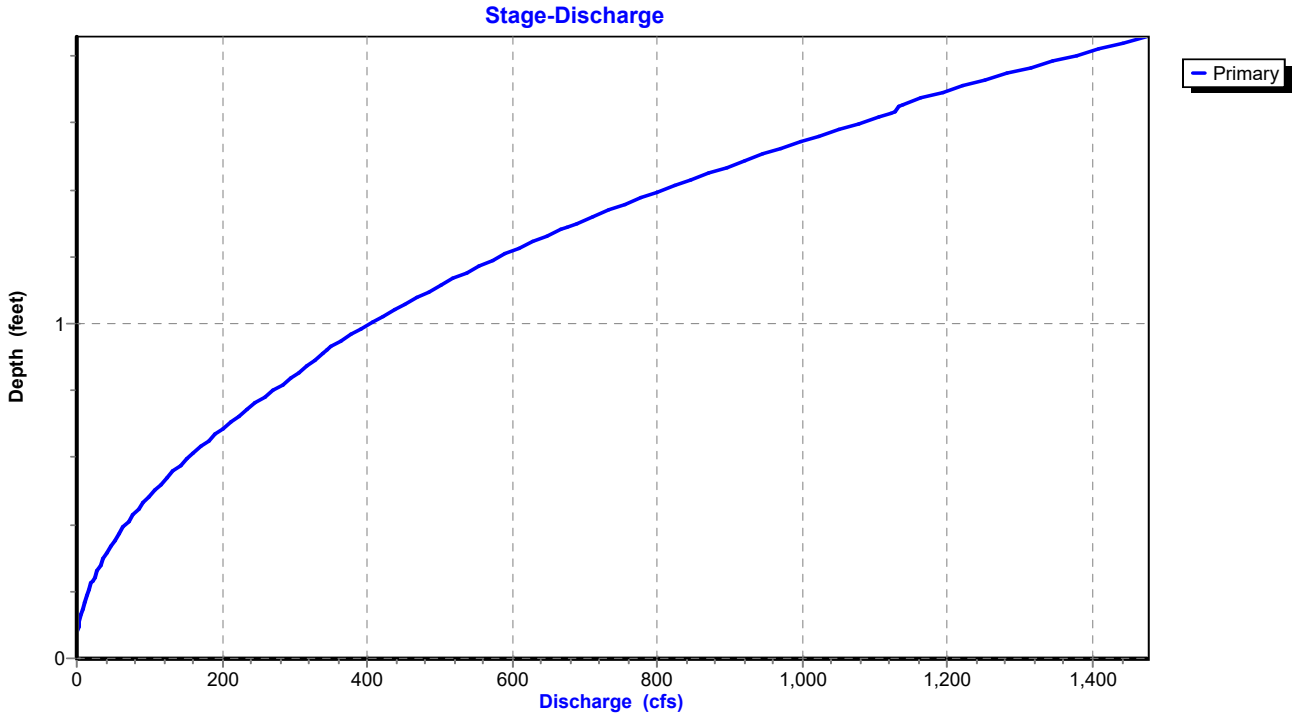
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
6.08	1,023.78	0.00
9.16	1,023.55	0.23
11.33	1,023.58	0.20
11.39	1,023.57	0.21
15.58	1,023.21	0.57
22.68	1,022.85	0.93
26.25	1,022.76	1.02
30.78	1,022.00	1.78
35.77	1,021.93	1.85
36.49	1,021.92	1.86
37.38	1,021.93	1.85
42.61	1,021.97	1.81
45.38	1,021.97	1.81
54.65	1,022.00	1.78
58.89	1,022.15	1.63
59.16	1,022.15	1.63
60.04	1,022.18	1.60
63.66	1,022.37	1.41
70.33	1,022.84	0.94
84.24	1,023.78	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.01	0.0	1.6	7	0.00
0.05	0.2	12.5	205	0.25
0.08	0.8	23.9	682	1.19
0.23	4.7	29.3	4,152	21.15
0.26	5.6	30.4	4,934	27.55
0.45	11.9	35.1	10,372	86.23
0.84	27.1	43.0	23,687	297.75
0.92	30.7	47.3	26,843	344.59
0.93	31.2	47.9	27,258	350.85
1.29	50.6	60.3	44,272	674.94
1.63	72.6	69.4	63,526	1,122.85
1.65	74.0	71.6	64,757	1,134.97
1.66	74.7	72.7	65,388	1,145.01
1.86	89.8	78.3	78,572	1,475.63

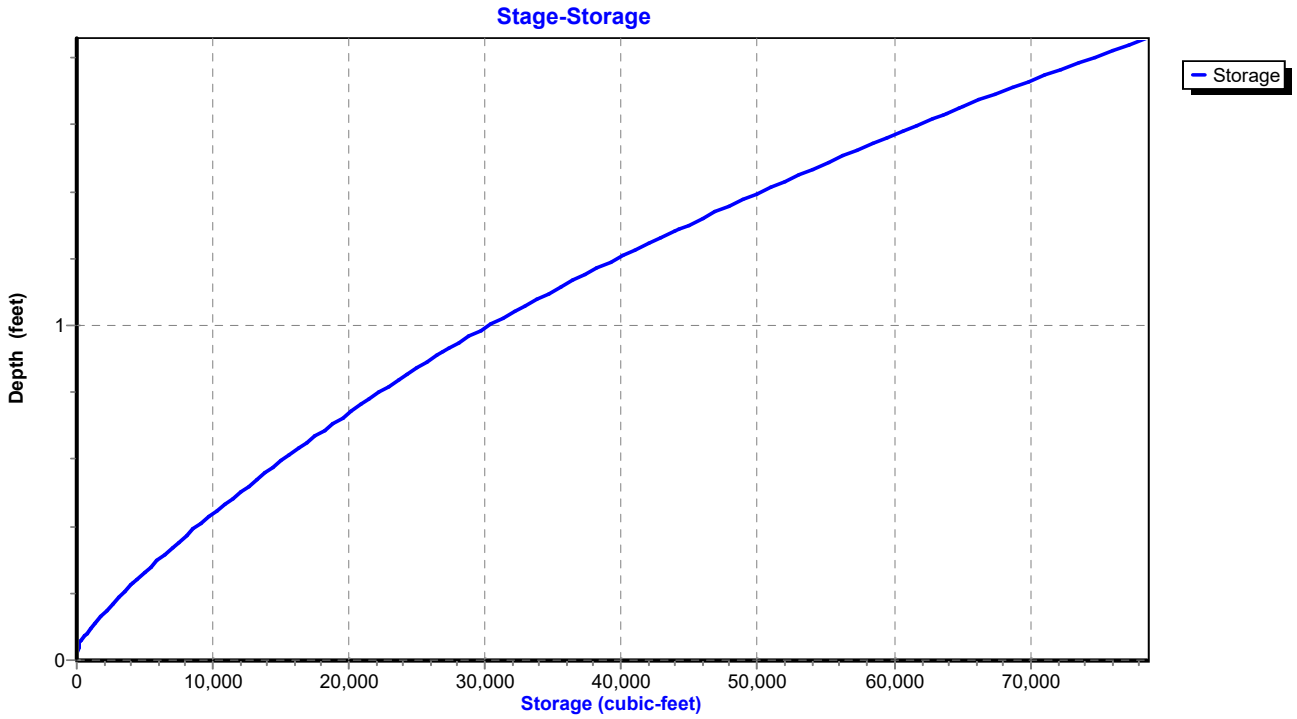
Reach 8R: Reach 1



Reach 8R: Reach 1



Reach 8R: Reach 1

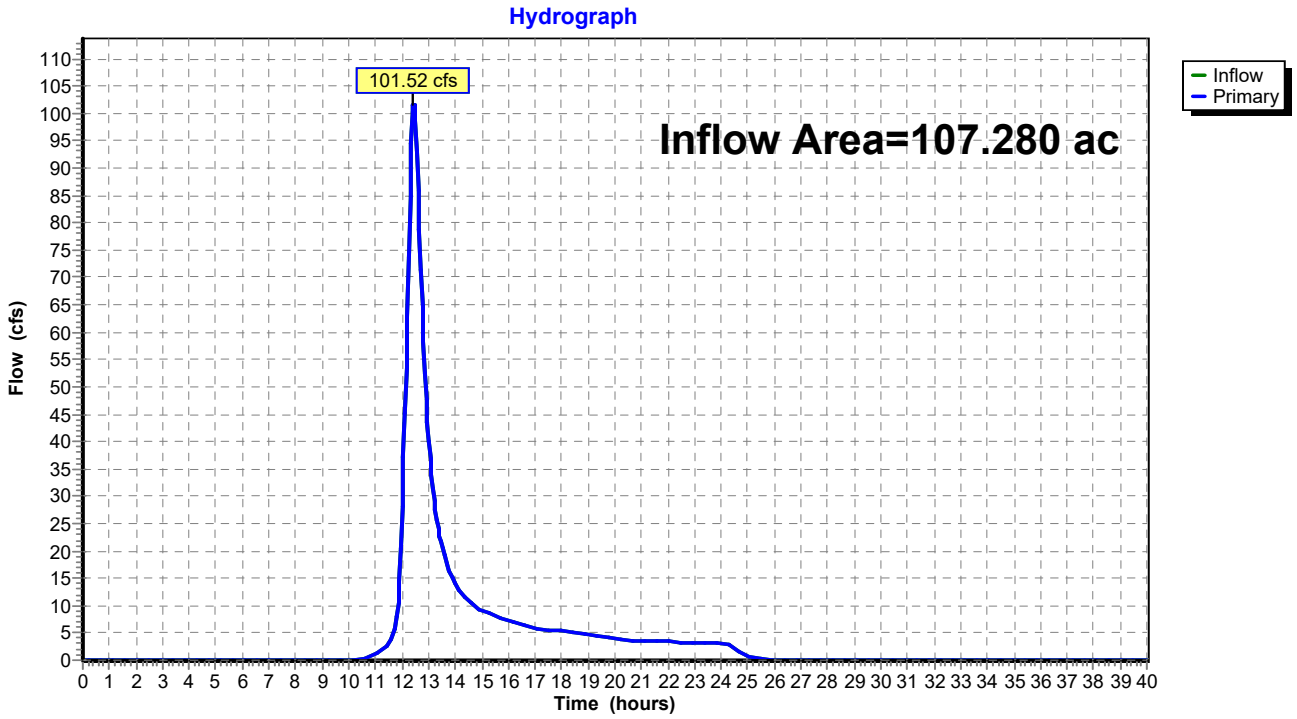


Summary for Link 2L: RP-1

Inflow Area = 107.280 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 101.52 cfs @ 12.44 hrs, Volume= 12.754 af
Primary = 101.52 cfs @ 12.44 hrs, Volume= 12.754 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: RP-1

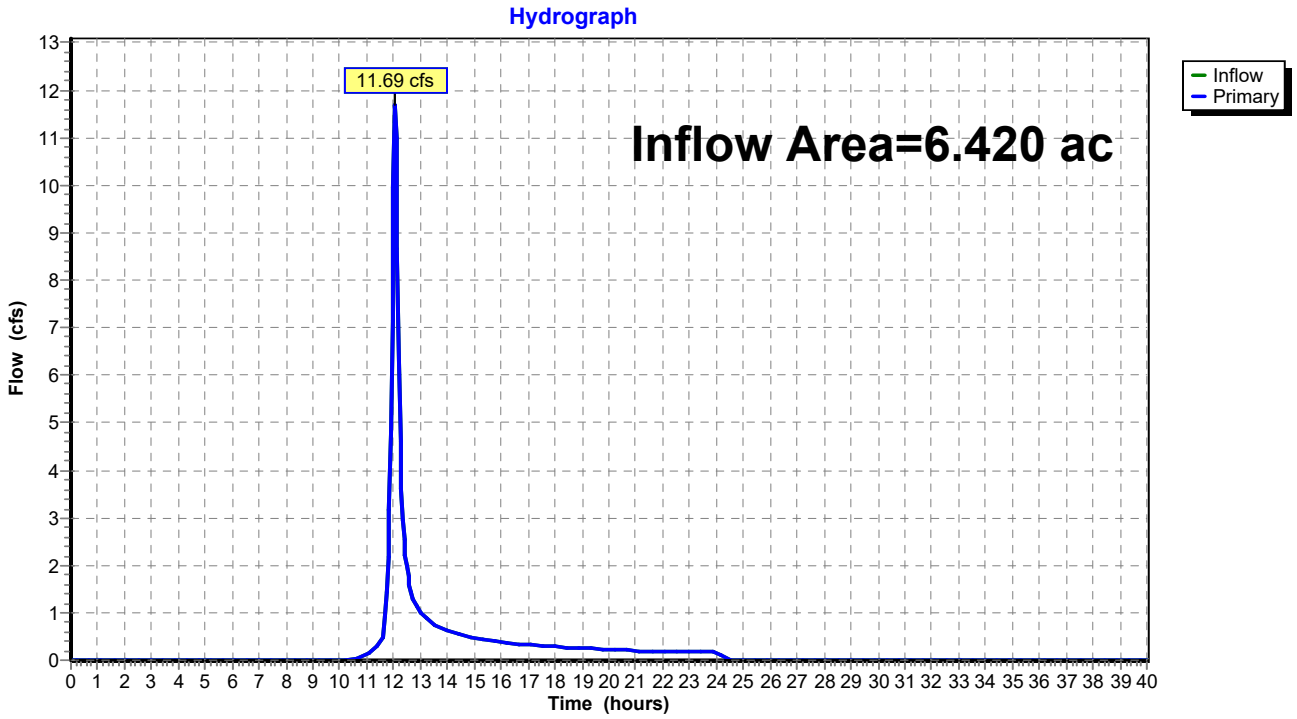


Summary for Link 5L: RP-2

Inflow Area = 6.420 ac, 0.00% Impervious, Inflow Depth = 1.37" for 2-Year event
Inflow = 11.69 cfs @ 12.06 hrs, Volume= 0.730 af
Primary = 11.69 cfs @ 12.06 hrs, Volume= 0.730 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: RP-2

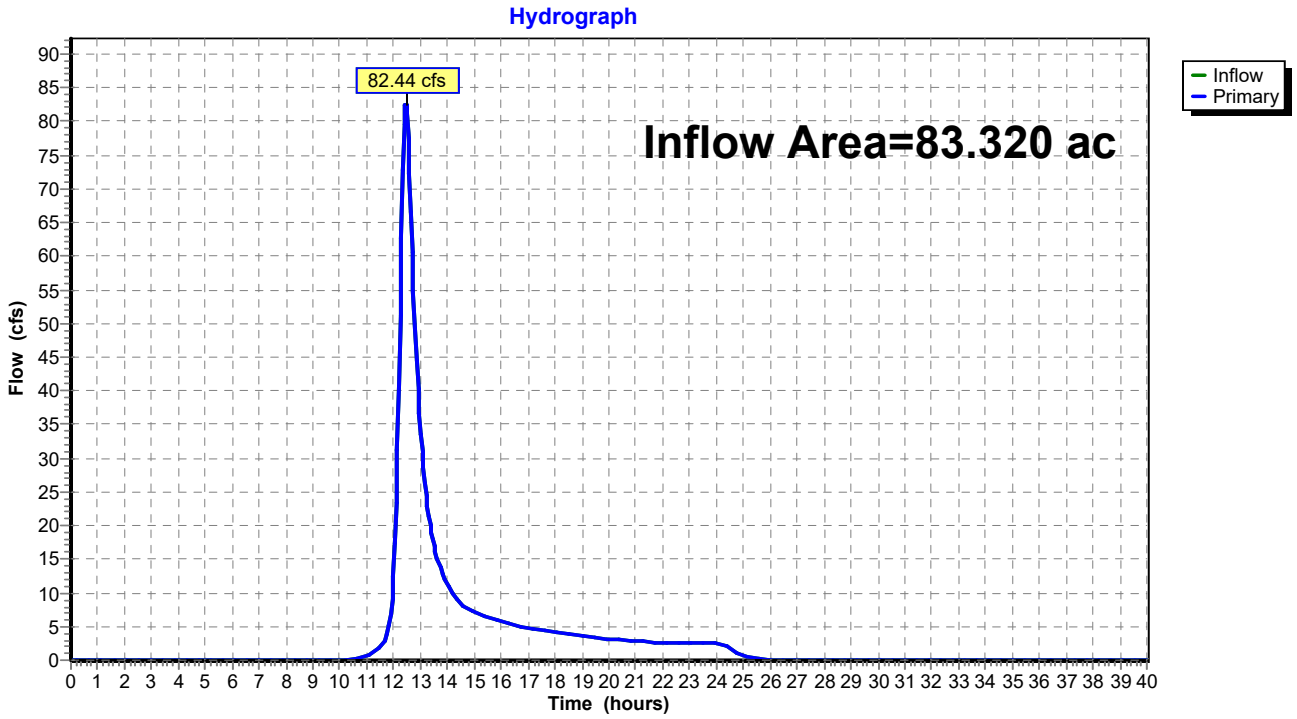


Summary for Link 6L: RP-4

Inflow Area = 83.320 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 82.44 cfs @ 12.46 hrs, Volume= 9.932 af
Primary = 82.44 cfs @ 12.46 hrs, Volume= 9.932 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: RP-4

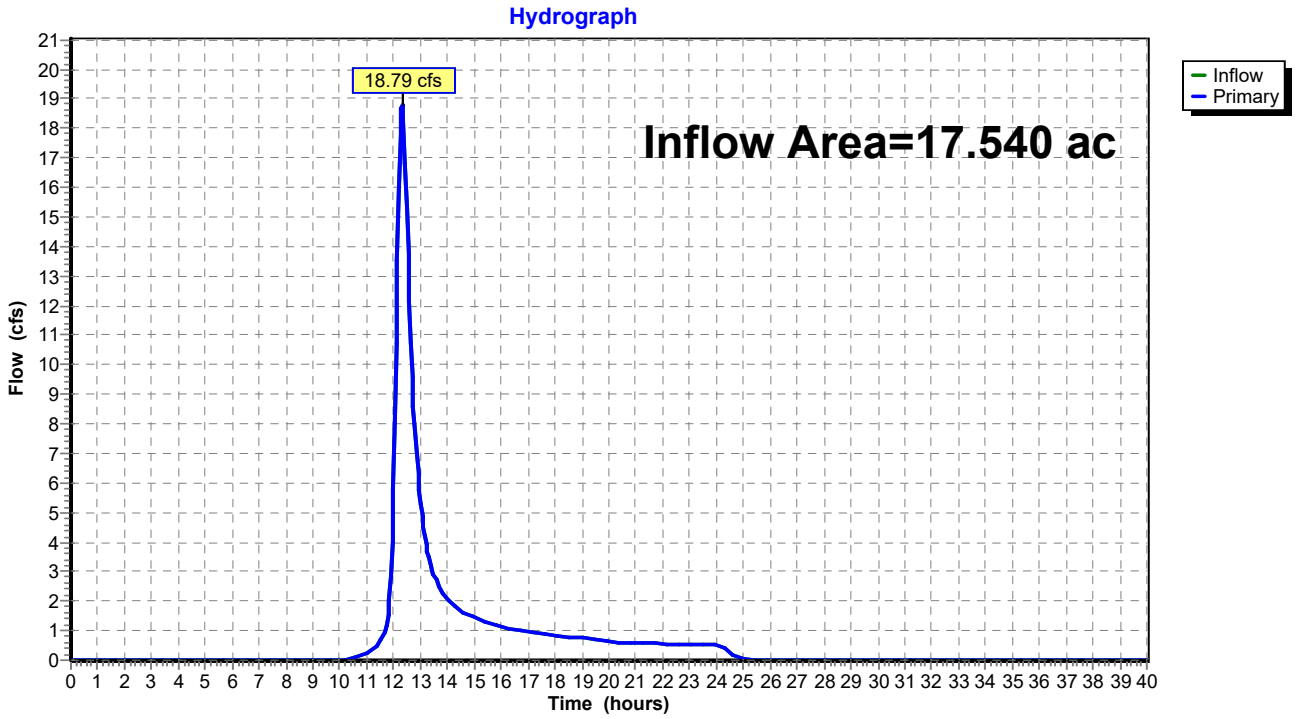


Summary for Link 7L: RP-3

Inflow Area = 17.540 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 18.79 cfs @ 12.32 hrs, Volume= 2.091 af
Primary = 18.79 cfs @ 12.32 hrs, Volume= 2.091 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 7L: RP-3



Summary for Subcatchment 1S: EXIST. ON-SITE #1

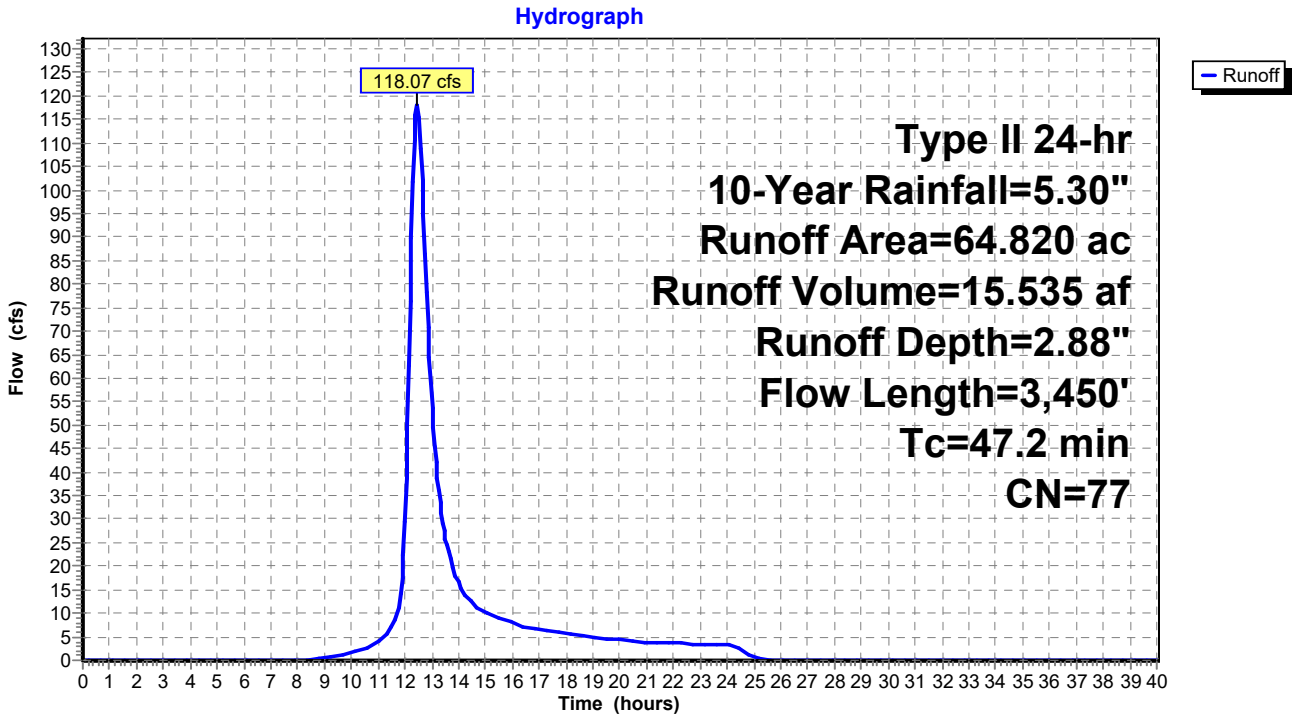
Runoff = 118.07 cfs @ 12.46 hrs, Volume= 15.535 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
34.840	74	Pasture/grassland/range, Good, HSG C
29.980	80	Pasture/grassland/range, Good, HSG D
64.820	77	Weighted Average
64.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
24.7	2,132	0.0255	1.44		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
14.1	1,218	0.0092	1.44		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
47.2	3,450	Total			

Subcatchment 1S: EXIST. ON-SITE #1



Summary for Subcatchment 3S: EXIST. OFF-SITE #1

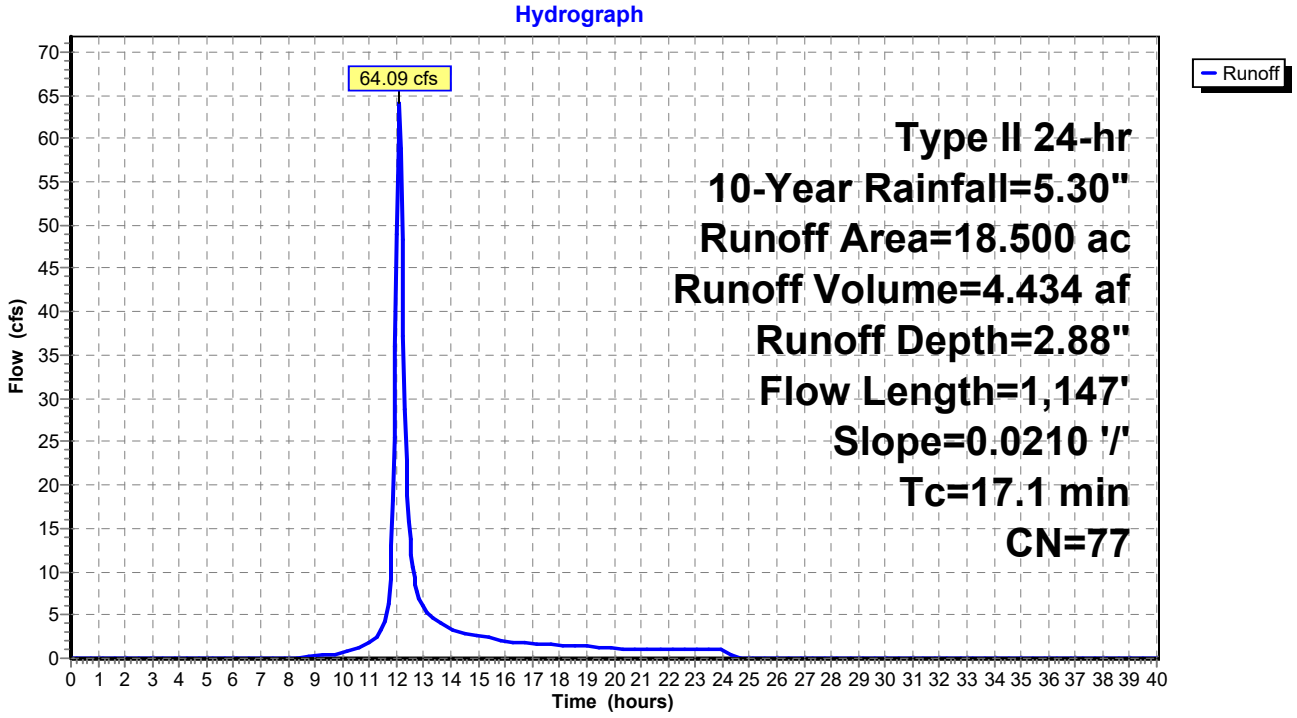
Runoff = 64.09 cfs @ 12.10 hrs, Volume= 4.434 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.860	82	Woods/grass comb., Fair, HSG D
18.500	77	Weighted Average
18.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0210	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
8.0	1,047	0.0210	2.17		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
17.1	1,147	Total			

Subcatchment 3S: EXIST. OFF-SITE #1



Summary for Subcatchment 4S: EXIST. ON-SITE #2

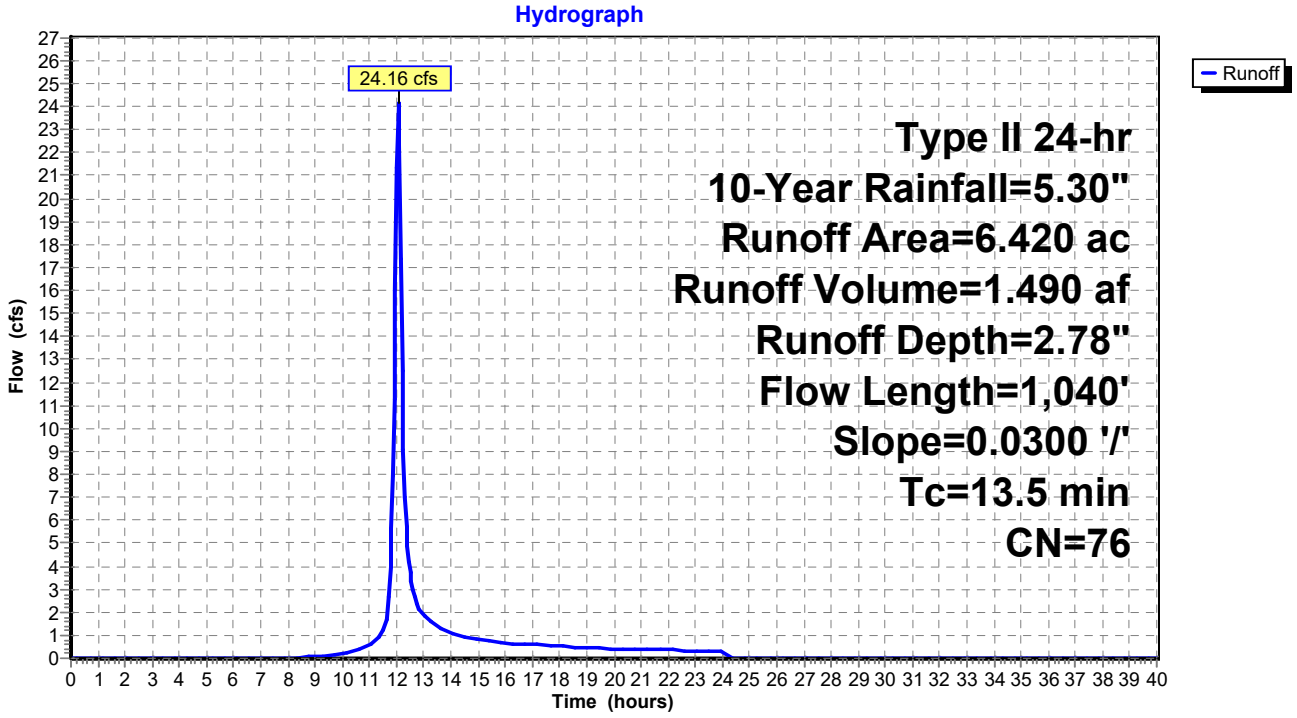
Runoff = 24.16 cfs @ 12.06 hrs, Volume= 1.490 af, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
4.200	74	Pasture/grassland/range, Good, HSG C
2.220	80	Pasture/grassland/range, Good, HSG D
6.420	76	Weighted Average
6.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0300	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	940	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.5	1,040	Total			

Subcatchment 4S: EXIST. ON-SITE #2



Summary for Subcatchment 8S: EXIST. ON-SITE #3

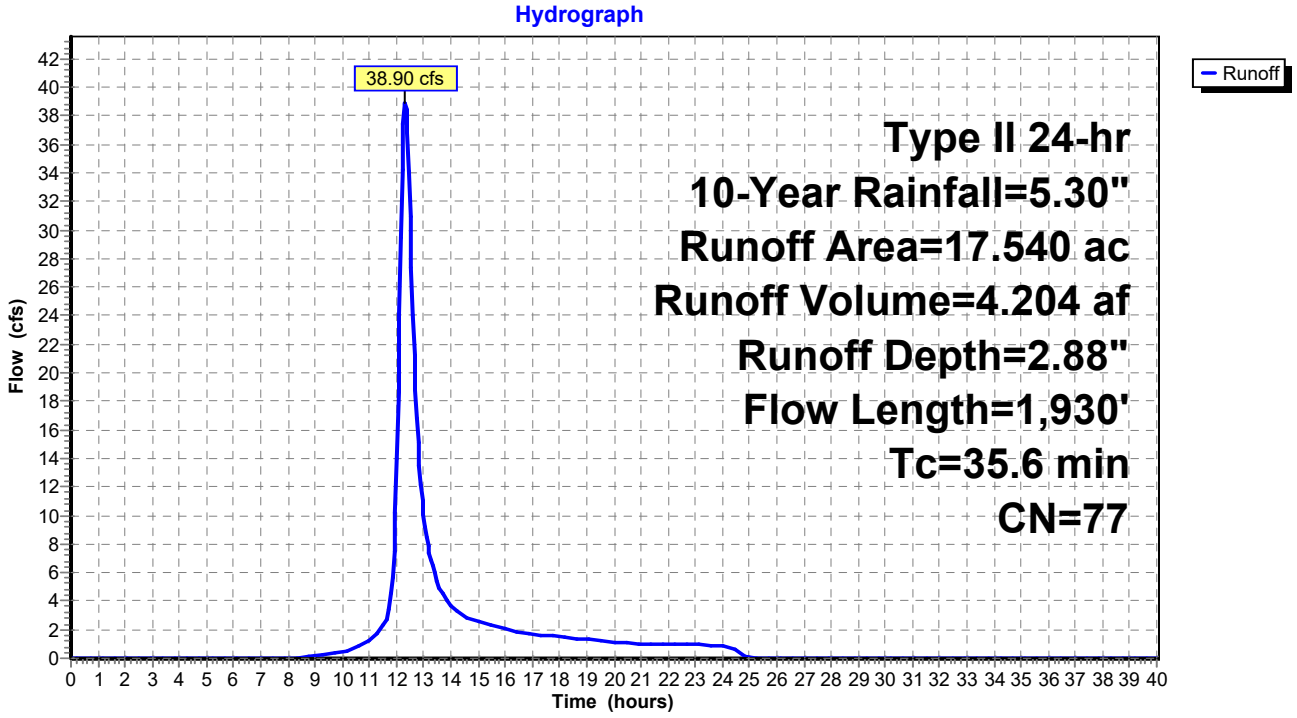
Runoff = 38.90 cfs @ 12.31 hrs, Volume= 4.204 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
9.830	74	Pasture/grassland/range, Good, HSG C
7.710	80	Pasture/grassland/range, Good, HSG D
17.540	77	Weighted Average
17.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0265	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
27.3	1,830	0.0255	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
35.6	1,930	Total			

Subcatchment 8S: EXIST. ON-SITE #3



Summary for Reach 3R: Reach 3

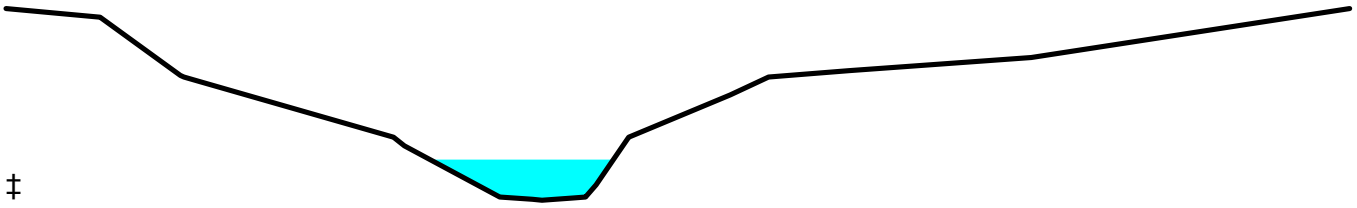
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.60' @ 12.35 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 59.05 cfs @ 12.26 hrs, Volume= 4.434 af
Outflow = 55.38 cfs @ 12.37 hrs, Volume= 4.434 af, Atten= 6%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.36 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 16.4 min

Peak Storage= 13,371 cf @ 12.31 hrs
Average Depth at Peak Storage= 1.35'
Bank-Full Depth= 6.40' Flow Area= 252.4 sf, Capacity= 2,150.14 cfs

Custom cross-section, Length= 1,041.0' Slope= 0.0088 '/' (110 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 989.92', Outlet Invert= 980.77'

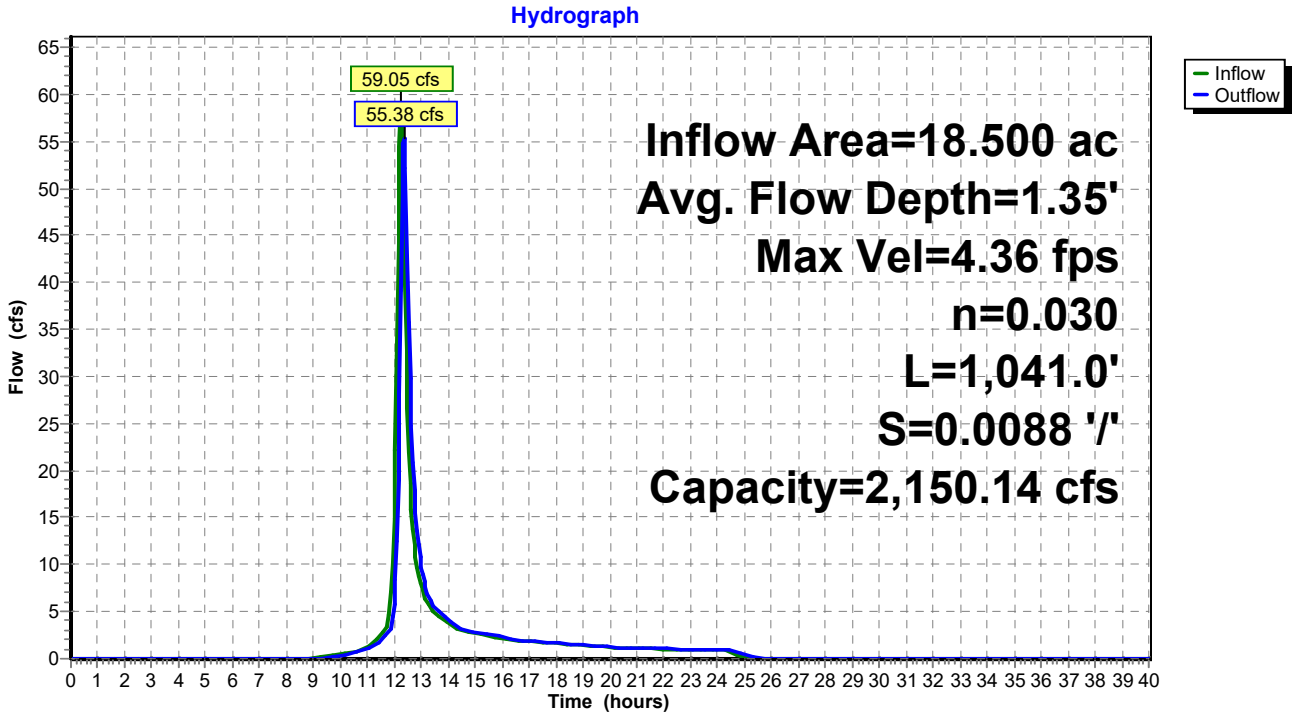


‡

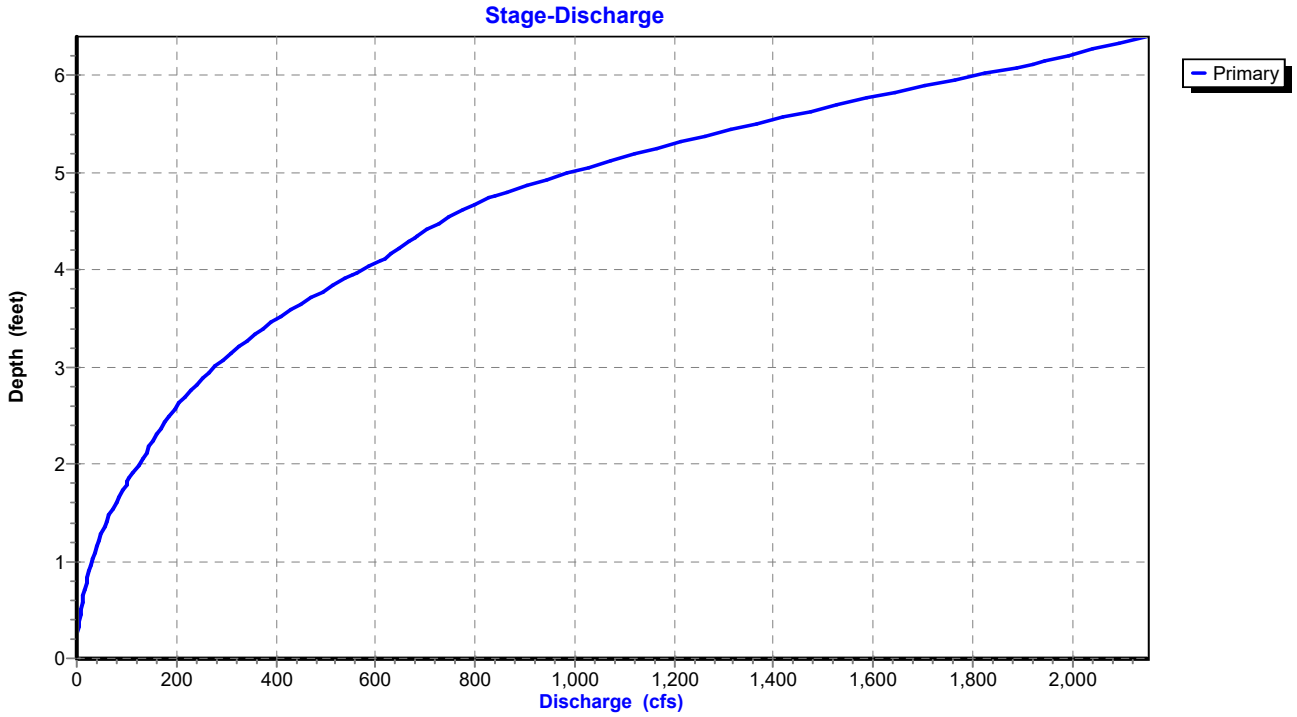
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	996.29	0.00
7.00	996.00	0.29
12.99	994.06	2.23
13.24	994.00	2.29
14.48	993.84	2.45
28.84	992.00	4.29
29.66	991.71	4.58
36.75	990.00	6.29
39.18	989.92	6.37
39.90	989.89	6.40
42.20	989.97	6.32
43.14	990.00	6.29
43.91	990.40	5.89
46.34	992.00	4.29
53.90	993.41	2.88
56.74	994.00	2.29
62.76	994.22	2.07
76.31	994.65	1.64
100.00	996.29	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
3.52	62.5	37.1	65,011	410.25
3.95	79.1	42.6	82,369	555.08
4.11	85.9	44.7	89,447	617.31
4.17	88.6	46.6	92,223	631.78
4.33	96.2	51.5	100,189	678.51
4.76	121.1	66.4	126,018	838.92
6.11	225.0	90.3	234,197	1,919.54
6.40	252.4	101.5	262,697	2,150.14

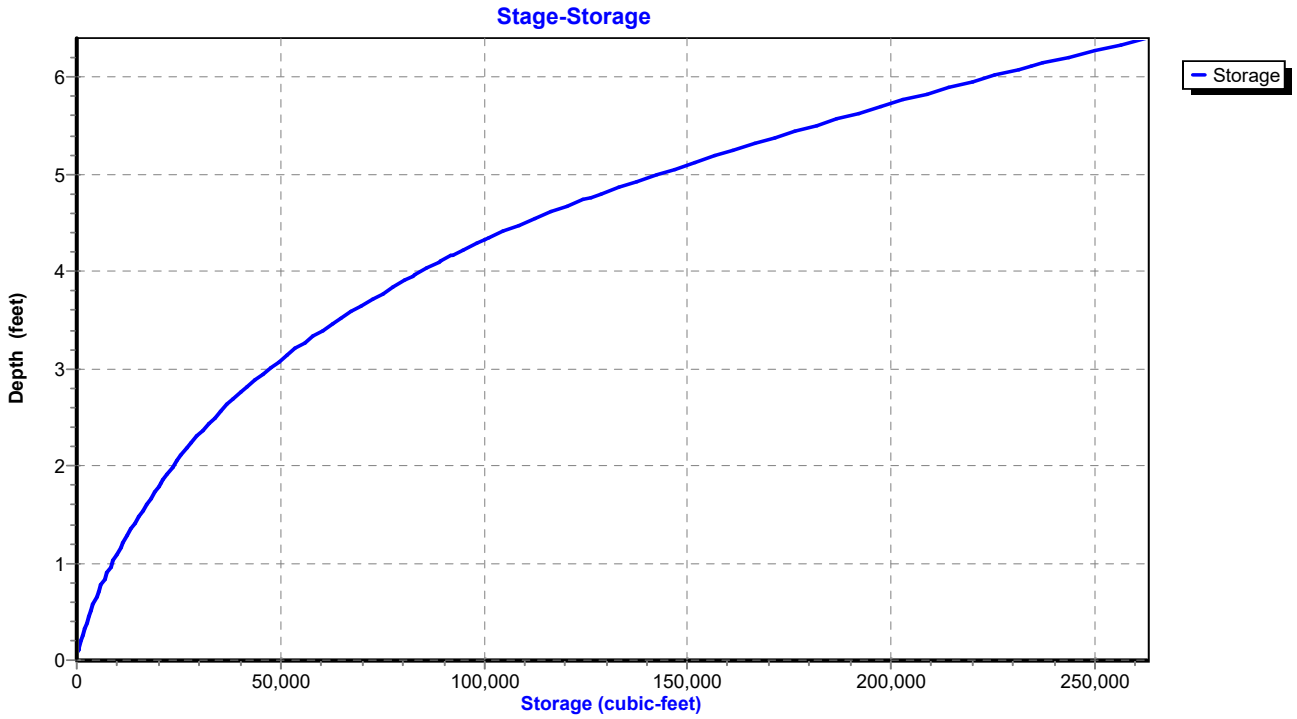
Reach 3R: Reach 3



Reach 3R: Reach 3



Reach 3R: Reach 3



Summary for Reach 4R: Reach 2

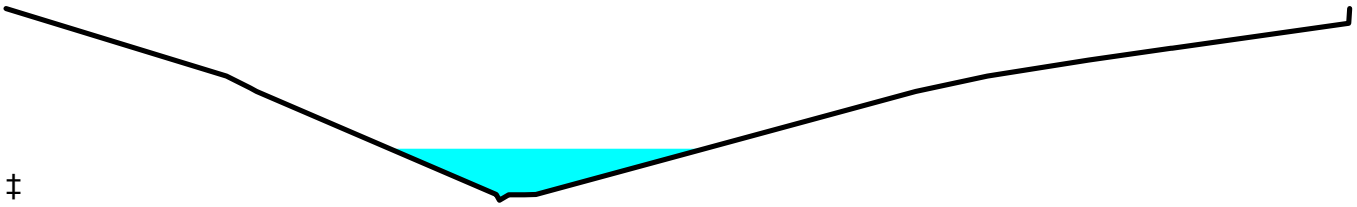
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.53' @ 12.25 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 62.13 cfs @ 12.16 hrs, Volume= 4.434 af
Outflow = 59.05 cfs @ 12.26 hrs, Volume= 4.434 af, Atten= 5%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.28 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 9.8 min

Peak Storage= 11,827 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 3.24' Flow Area= 204.3 sf, Capacity= 1,999.47 cfs

Custom cross-section, Length= 853.0' Slope= 0.0225 '/' (106 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 1,009.12', Outlet Invert= 989.90'

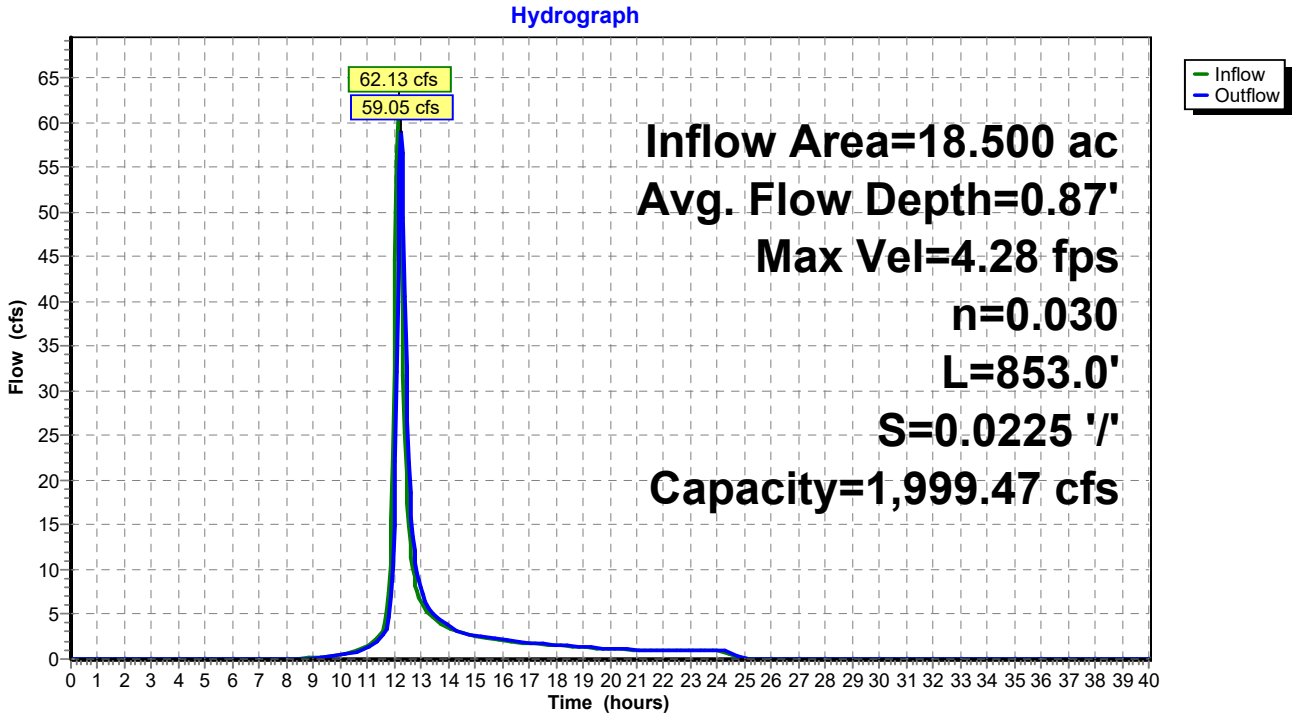


‡

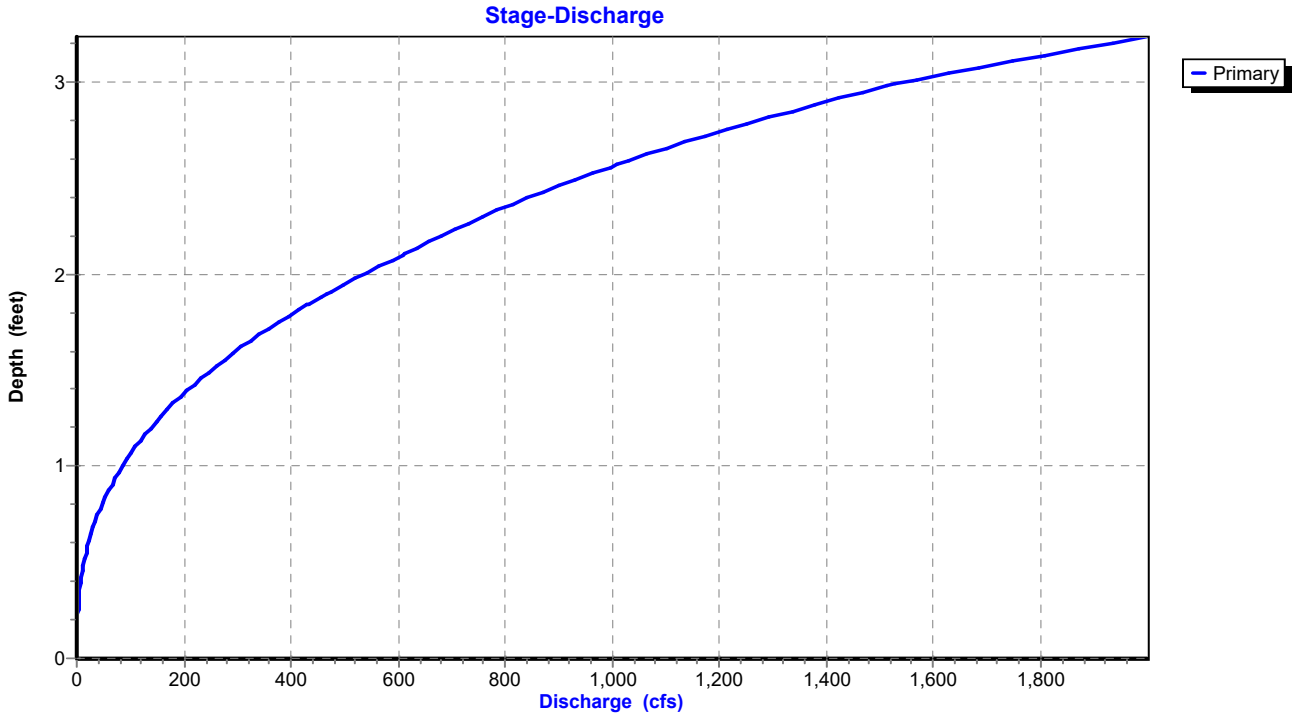
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,009.14	0.00
22.15	1,008.00	1.14
24.54	1,007.80	1.34
25.18	1,007.74	1.40
49.26	1,006.00	3.14
49.59	1,005.90	3.24
50.51	1,005.99	3.15
52.13	1,005.99	3.15
53.24	1,006.00	3.14
91.41	1,007.74	1.40
98.60	1,008.00	1.14
108.78	1,008.27	0.87
117.07	1,008.47	0.67
117.16	1,008.47	0.67
134.91	1,008.89	0.25
135.00	1,009.14	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	818.03
2.57	122.0	104.3	104,091	1,007.45
2.99	171.2	130.2	146,042	1,527.76
3.24	204.3	135.4	174,303	1,999.47

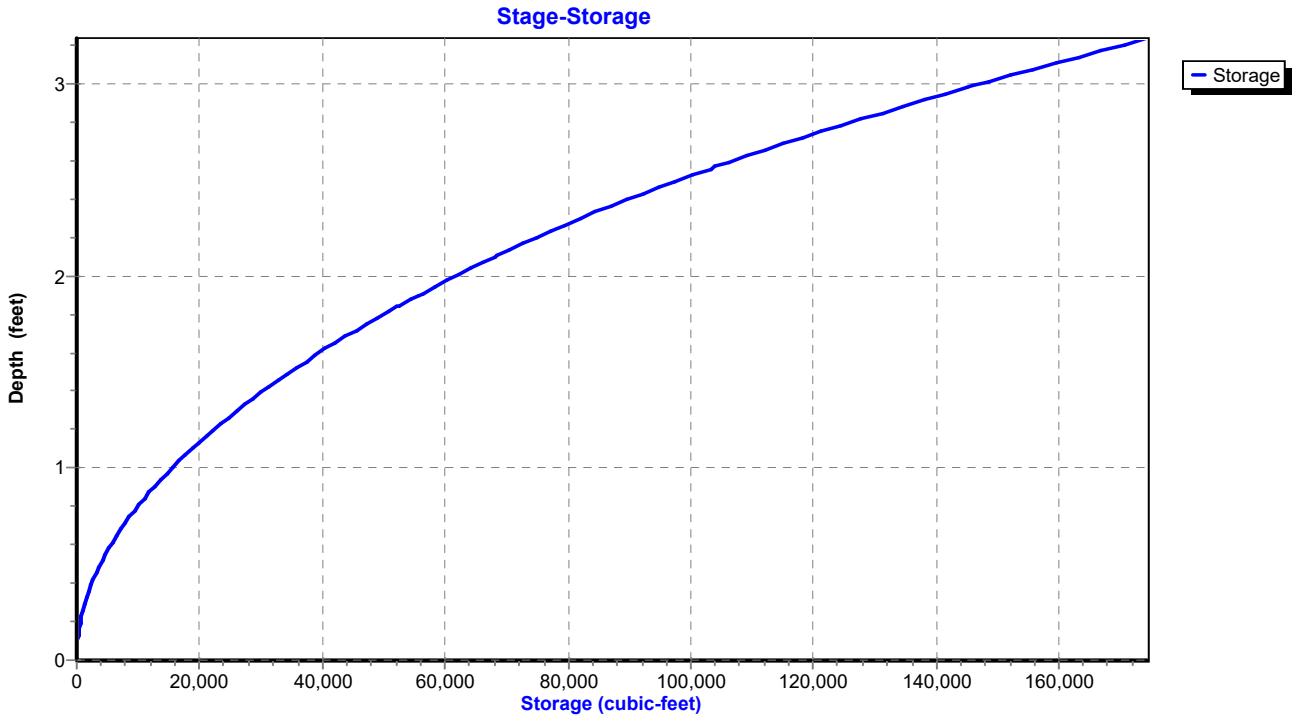
Reach 4R: Reach 2



Reach 4R: Reach 2



Reach 4R: Reach 2



Summary for Reach 8R: Reach 1

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 64.09 cfs @ 12.10 hrs, Volume= 4.434 af
Outflow = 62.13 cfs @ 12.16 hrs, Volume= 4.434 af, Atten= 3%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.51 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 9.1 min

Peak Storage= 8,425 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.86' Flow Area= 89.8 sf, Capacity= 1,475.63 cfs

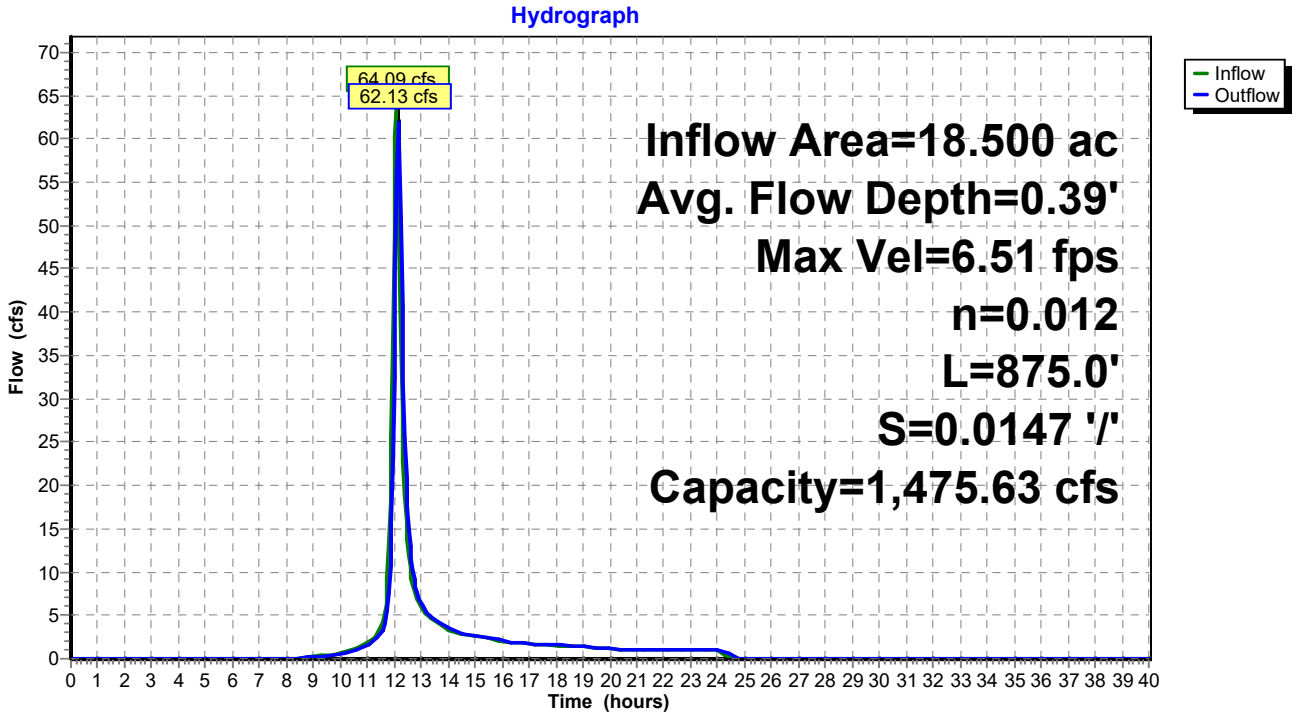
Custom cross-section, Length= 875.0' Slope= 0.0147 '/' (108 Elevation Intervals)
Constant n= 0.012 Concrete pipe, finished
Inlet Invert= 1,021.96', Outlet Invert= 1,009.12'

‡

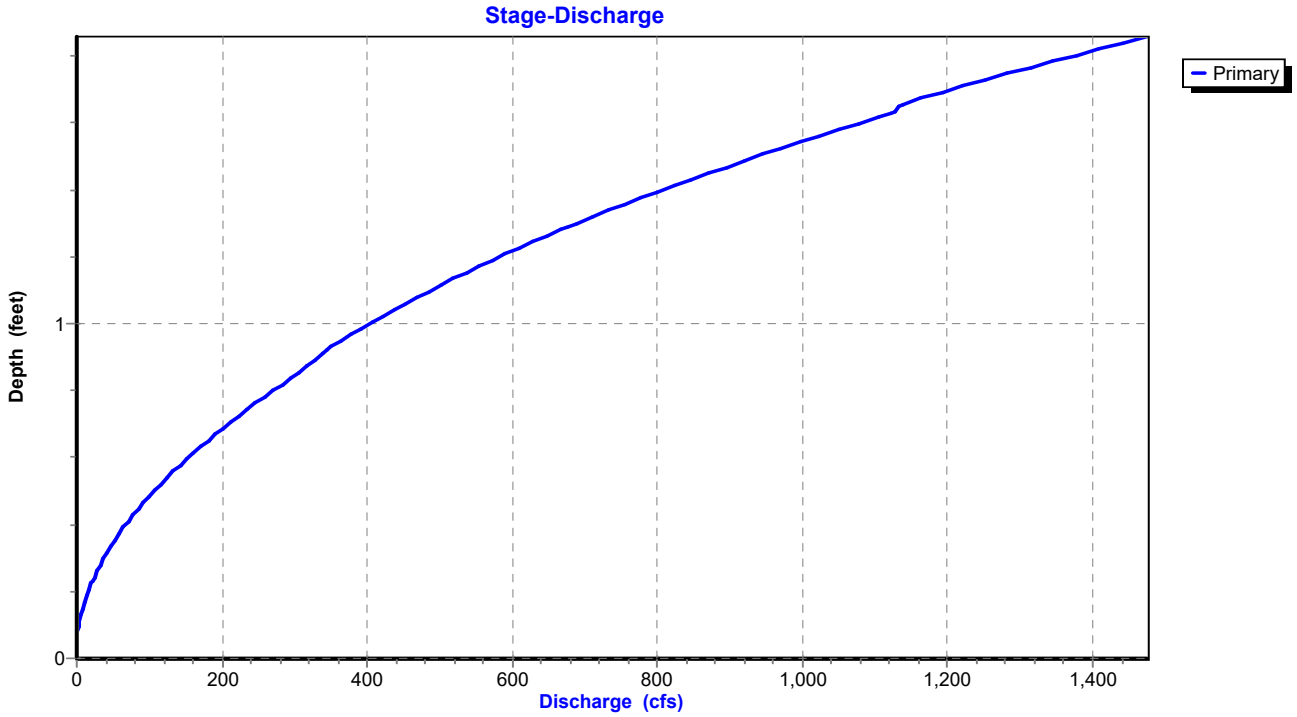
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
6.08	1,023.78	0.00
9.16	1,023.55	0.23
11.33	1,023.58	0.20
11.39	1,023.57	0.21
15.58	1,023.21	0.57
22.68	1,022.85	0.93
26.25	1,022.76	1.02
30.78	1,022.00	1.78
35.77	1,021.93	1.85
36.49	1,021.92	1.86
37.38	1,021.93	1.85
42.61	1,021.97	1.81
45.38	1,021.97	1.81
54.65	1,022.00	1.78
58.89	1,022.15	1.63
59.16	1,022.15	1.63
60.04	1,022.18	1.60
63.66	1,022.37	1.41
70.33	1,022.84	0.94
84.24	1,023.78	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.01	0.0	1.6	7	0.00
0.05	0.2	12.5	205	0.25
0.08	0.8	23.9	682	1.19
0.23	4.7	29.3	4,152	21.15
0.26	5.6	30.4	4,934	27.55
0.45	11.9	35.1	10,372	86.23
0.84	27.1	43.0	23,687	297.75
0.92	30.7	47.3	26,843	344.59
0.93	31.2	47.9	27,258	350.85
1.29	50.6	60.3	44,272	674.94
1.63	72.6	69.4	63,526	1,122.85
1.65	74.0	71.6	64,757	1,134.97
1.66	74.7	72.7	65,388	1,145.01
1.86	89.8	78.3	78,572	1,475.63

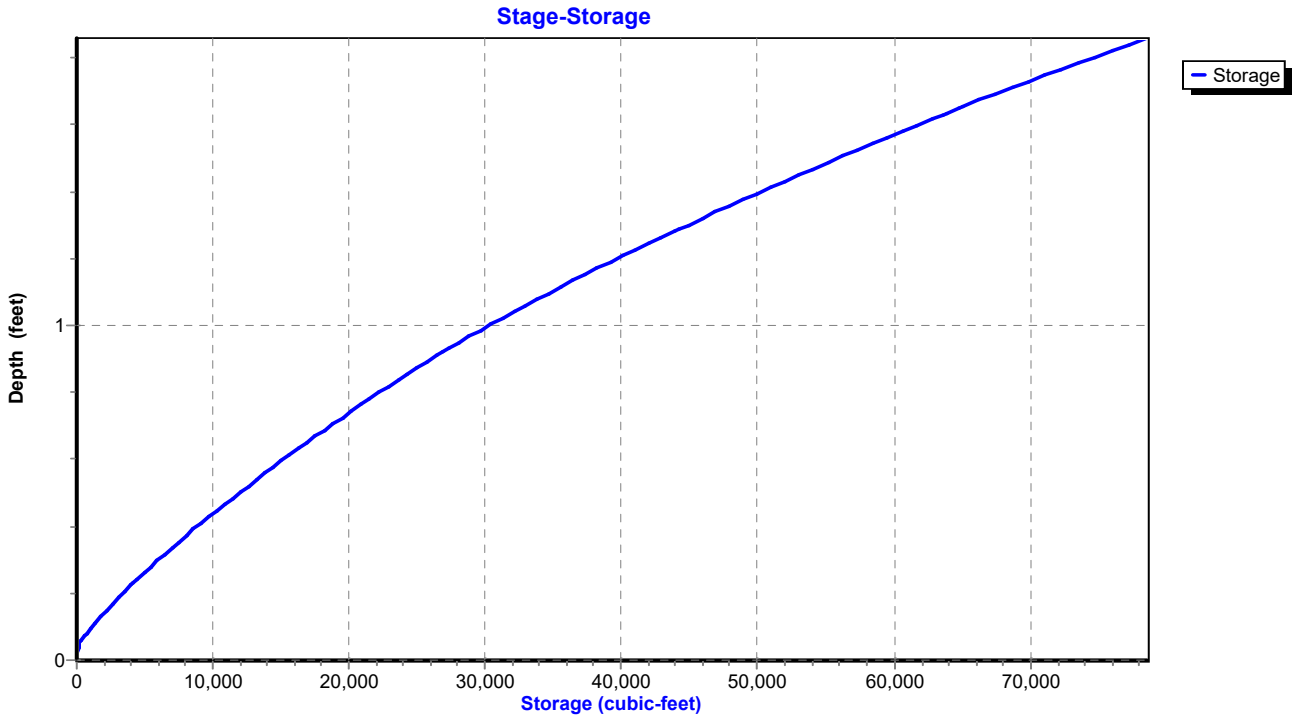
Reach 8R: Reach 1



Reach 8R: Reach 1



Reach 8R: Reach 1

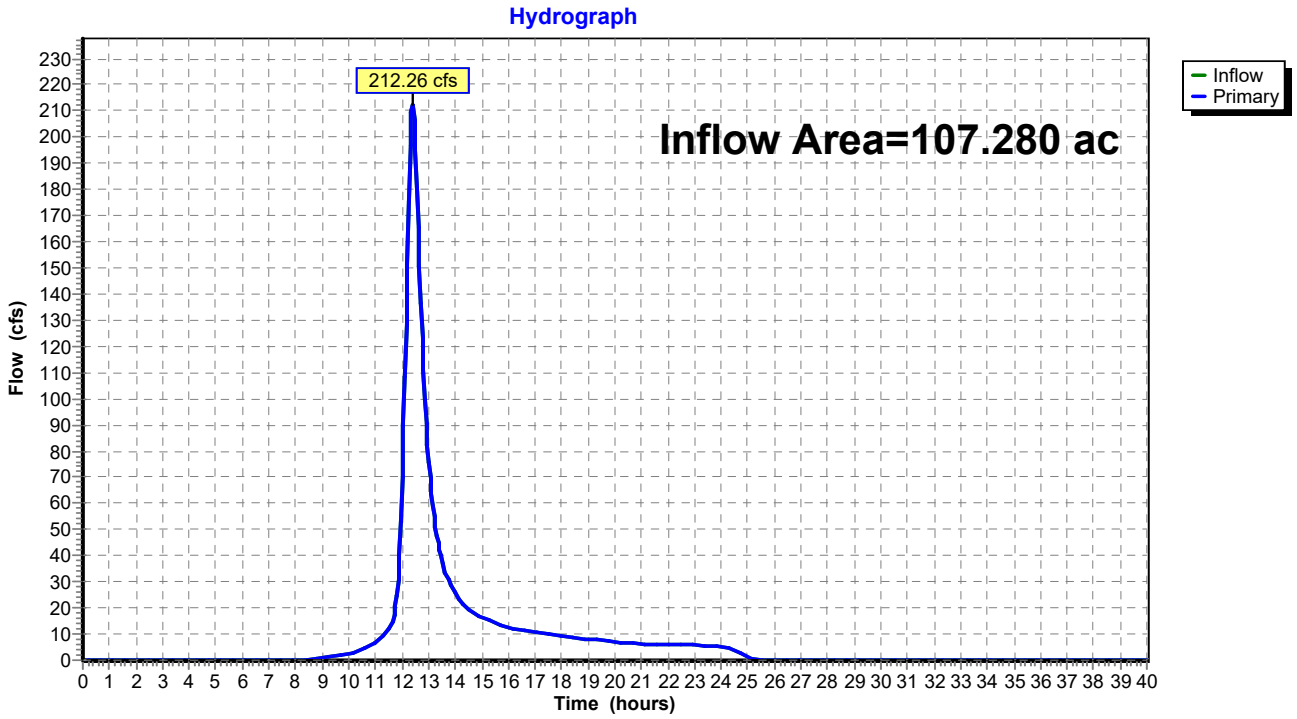


Summary for Link 2L: RP-1

Inflow Area = 107.280 ac, 0.00% Impervious, Inflow Depth = 2.87" for 10-Year event
Inflow = 212.26 cfs @ 12.39 hrs, Volume= 25.662 af
Primary = 212.26 cfs @ 12.39 hrs, Volume= 25.662 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: RP-1

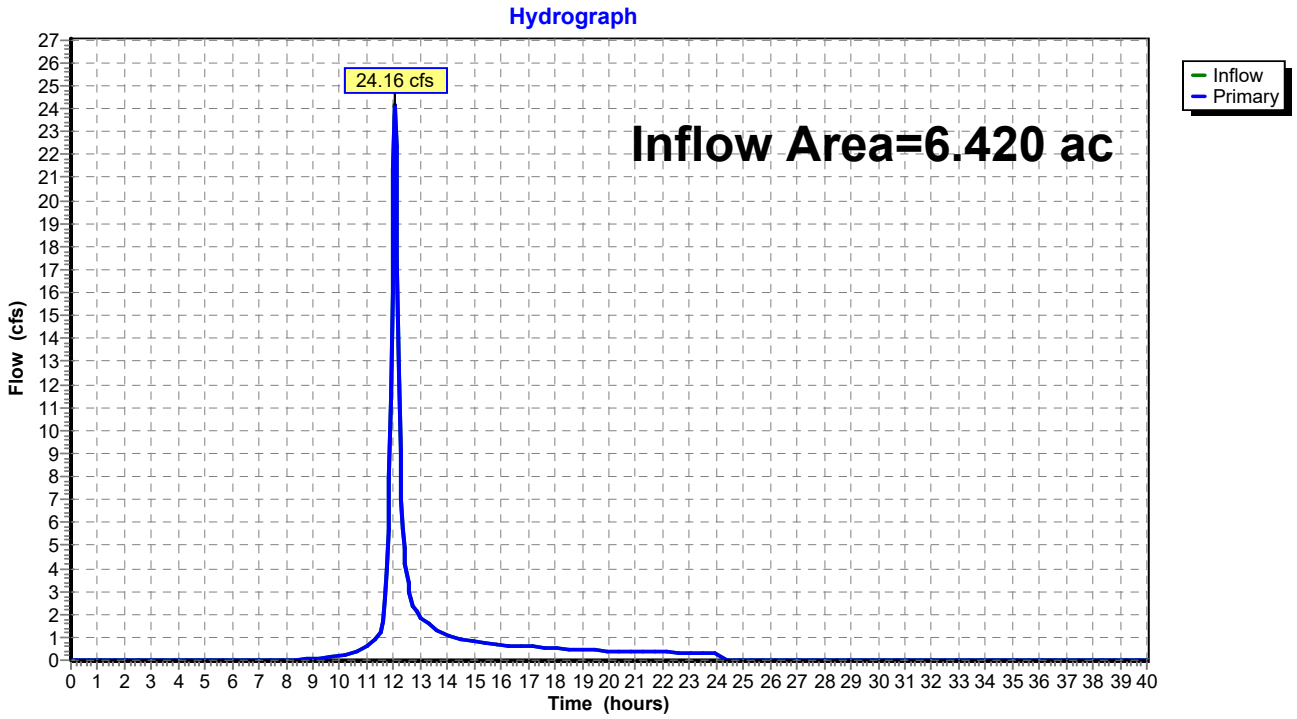


Summary for Link 5L: RP-2

Inflow Area = 6.420 ac, 0.00% Impervious, Inflow Depth = 2.78" for 10-Year event
Inflow = 24.16 cfs @ 12.06 hrs, Volume= 1.490 af
Primary = 24.16 cfs @ 12.06 hrs, Volume= 1.490 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: RP-2

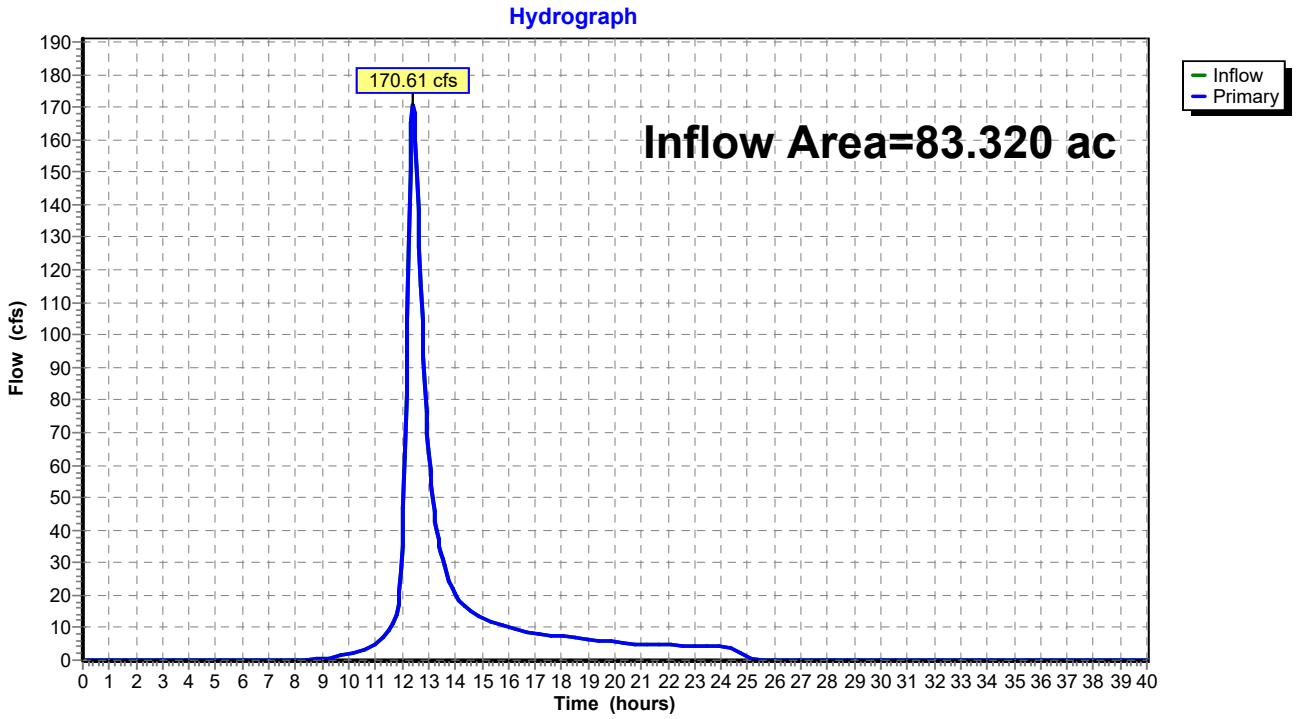


Summary for Link 6L: RP-4

Inflow Area = 83.320 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 170.61 cfs @ 12.41 hrs, Volume= 19.968 af
Primary = 170.61 cfs @ 12.41 hrs, Volume= 19.968 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: RP-4

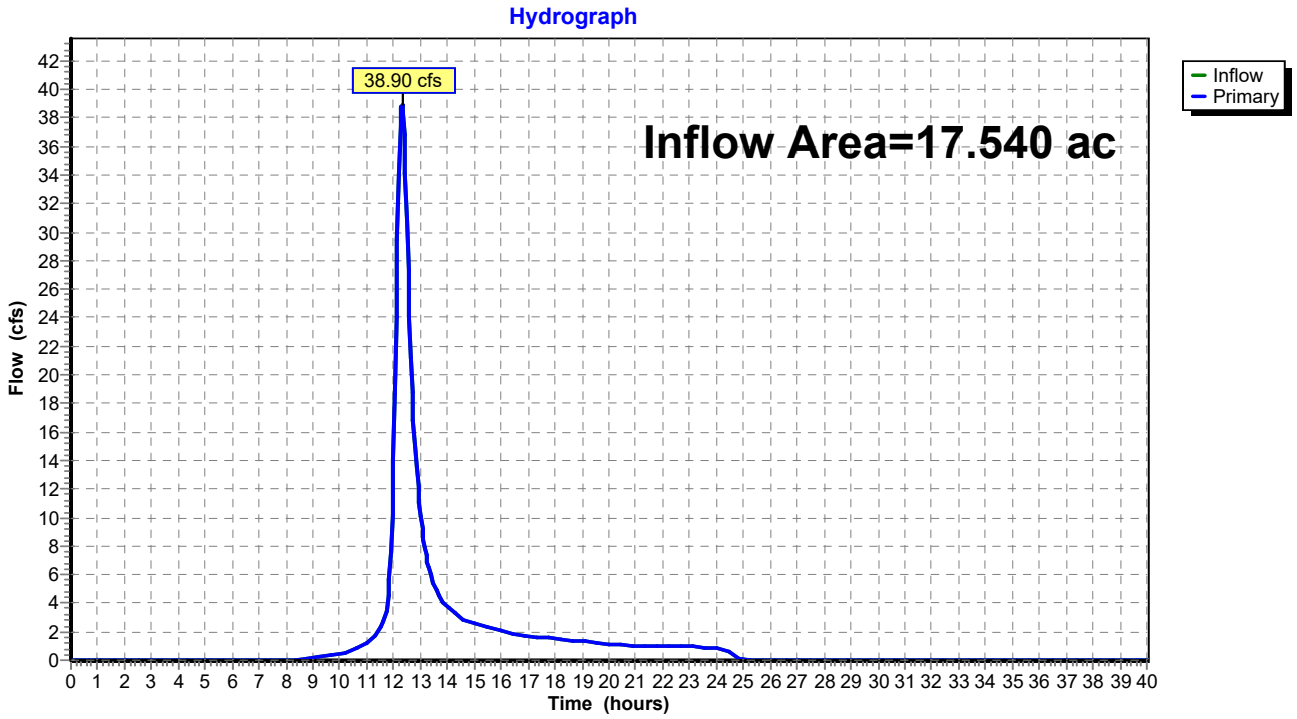


Summary for Link 7L: RP-3

Inflow Area = 17.540 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 38.90 cfs @ 12.31 hrs, Volume= 4.204 af
Primary = 38.90 cfs @ 12.31 hrs, Volume= 4.204 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 7L: RP-3



Summary for Subcatchment 1S: EXIST. ON-SITE #1

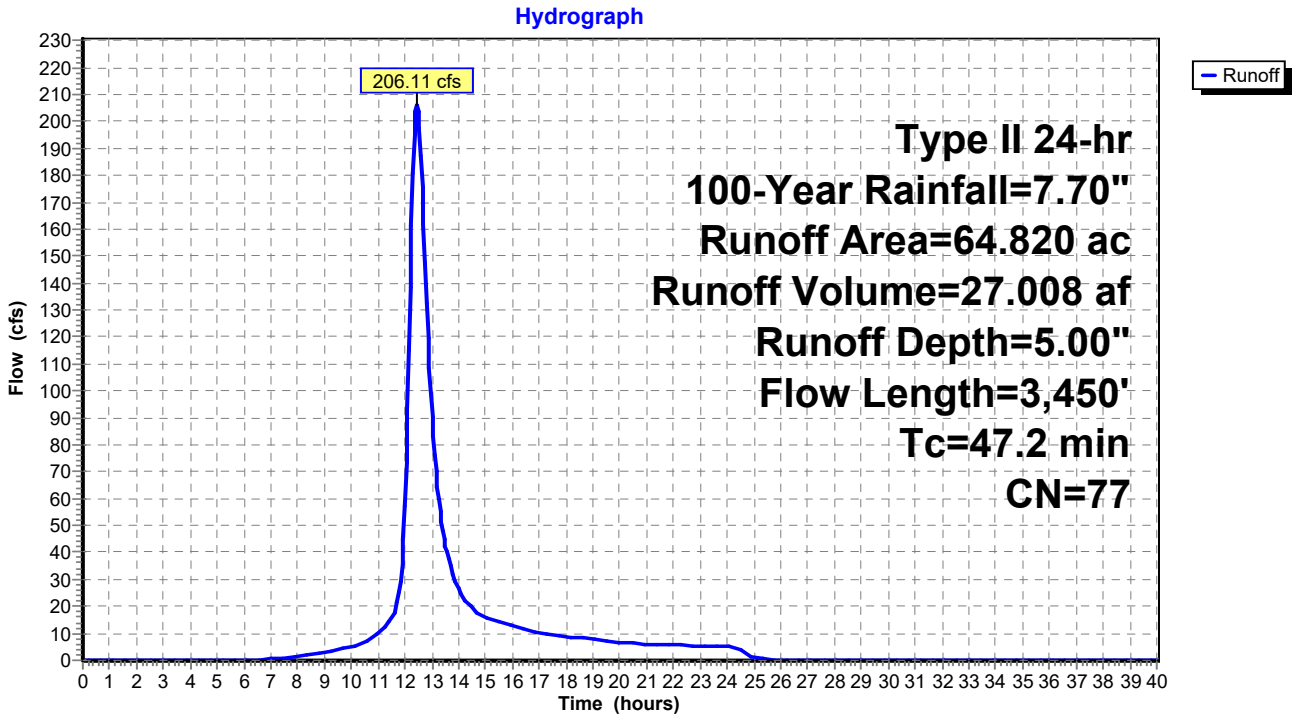
Runoff = 206.11 cfs @ 12.45 hrs, Volume= 27.008 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
34.840	74	Pasture/grassland/range, Good, HSG C
29.980	80	Pasture/grassland/range, Good, HSG D
64.820	77	Weighted Average
64.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
24.7	2,132	0.0255	1.44		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
14.1	1,218	0.0092	1.44		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
47.2	3,450	Total			

Subcatchment 1S: EXIST. ON-SITE #1



Summary for Subcatchment 3S: EXIST. OFF-SITE #1

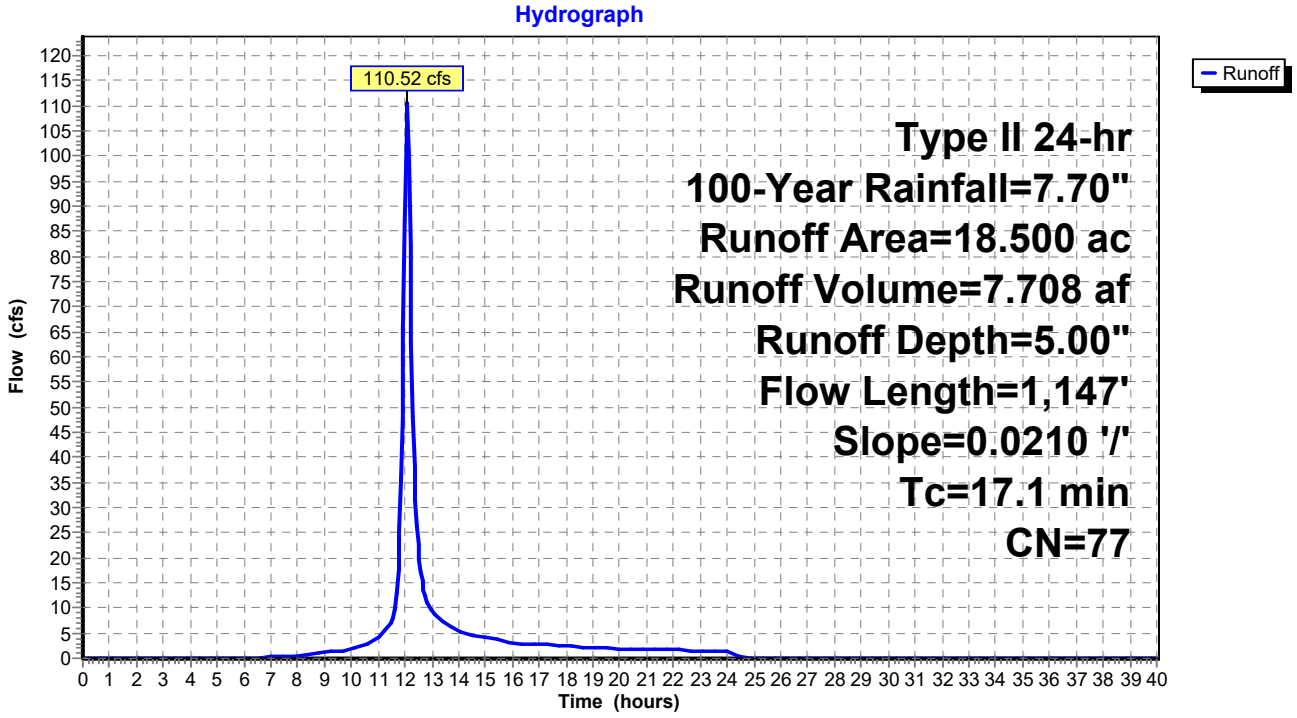
Runoff = 110.52 cfs @ 12.09 hrs, Volume= 7.708 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.860	82	Woods/grass comb., Fair, HSG D
18.500	77	Weighted Average
18.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0210	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
8.0	1,047	0.0210	2.17		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
17.1	1,147	Total			

Subcatchment 3S: EXIST. OFF-SITE #1



Summary for Subcatchment 4S: EXIST. ON-SITE #2

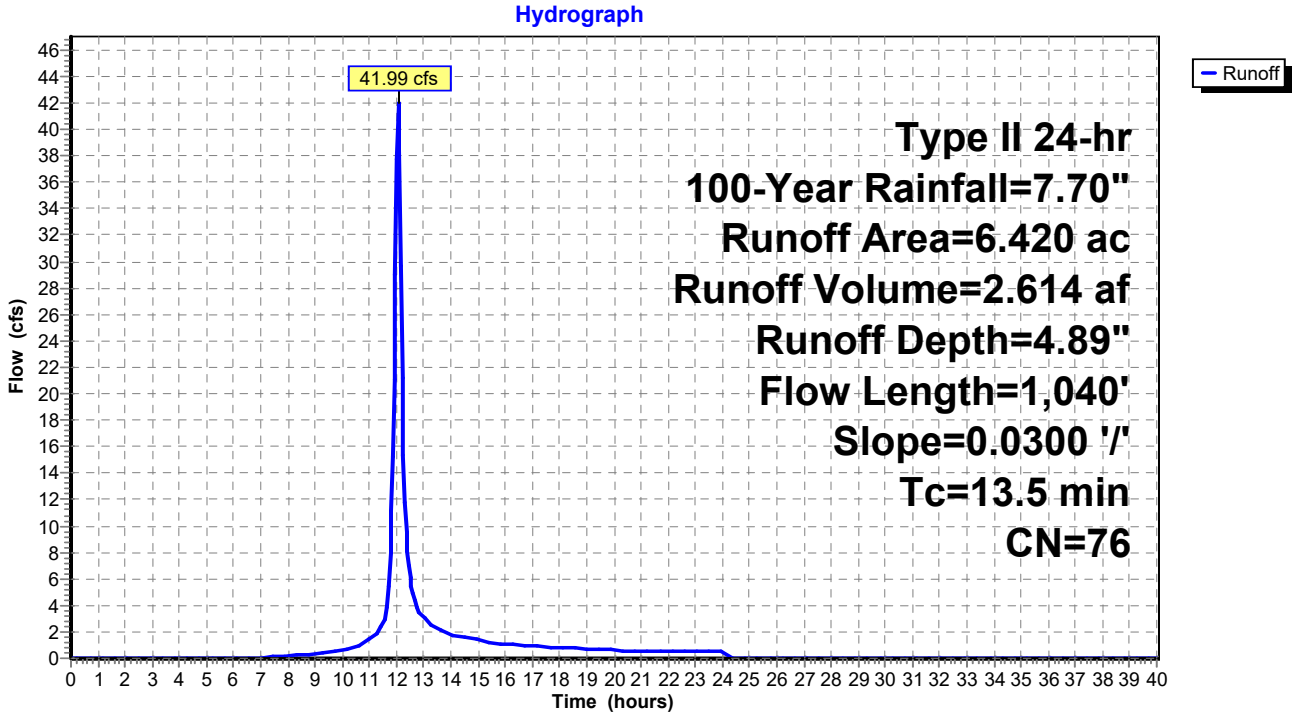
Runoff = 41.99 cfs @ 12.05 hrs, Volume= 2.614 af, Depth= 4.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
4.200	74	Pasture/grassland/range, Good, HSG C
2.220	80	Pasture/grassland/range, Good, HSG D
6.420	76	Weighted Average
6.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0300	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	940	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.5	1,040	Total			

Subcatchment 4S: EXIST. ON-SITE #2



Summary for Subcatchment 8S: EXIST. ON-SITE #3

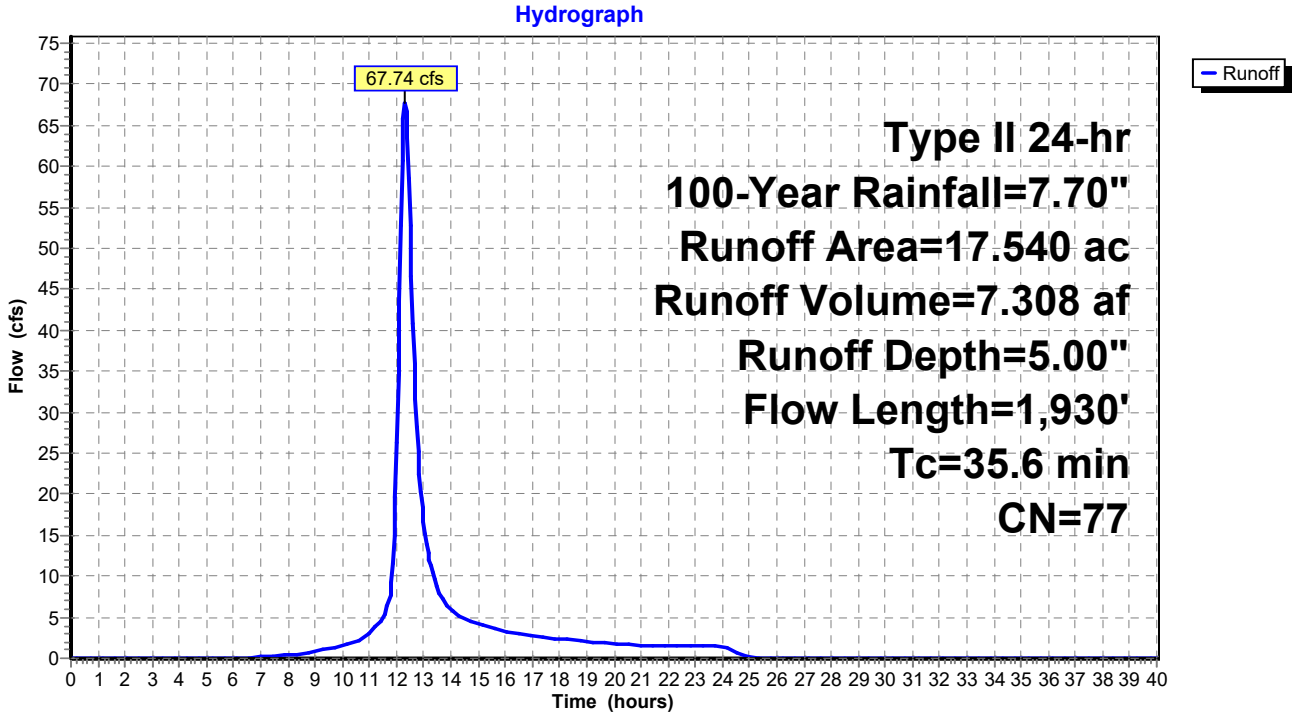
Runoff = 67.74 cfs @ 12.31 hrs, Volume= 7.308 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
9.830	74	Pasture/grassland/range, Good, HSG C
7.710	80	Pasture/grassland/range, Good, HSG D
17.540	77	Weighted Average
17.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0265	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
27.3	1,830	0.0255	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
35.6	1,930	Total			

Subcatchment 8S: EXIST. ON-SITE #3



Summary for Reach 3R: Reach 3

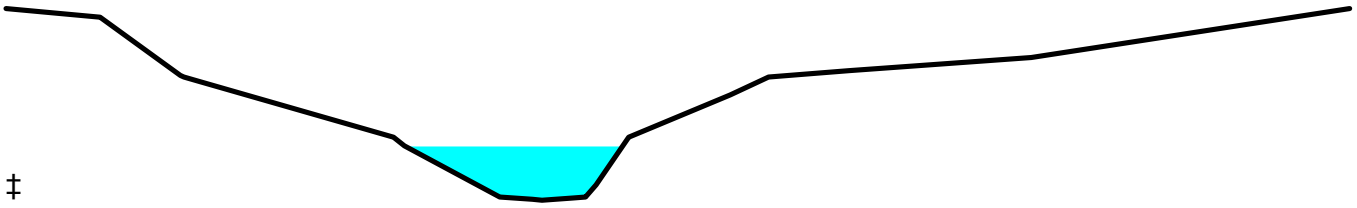
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.84' @ 12.30 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 103.42 cfs @ 12.23 hrs, Volume= 7.708 af
Outflow = 98.72 cfs @ 12.33 hrs, Volume= 7.708 af, Atten= 5%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.10 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 14.1 min

Peak Storage= 20,252 cf @ 12.27 hrs
Average Depth at Peak Storage= 1.80'
Bank-Full Depth= 6.40' Flow Area= 252.4 sf, Capacity= 2,150.14 cfs

Custom cross-section, Length= 1,041.0' Slope= 0.0088 '/' (110 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 989.92', Outlet Invert= 980.77'

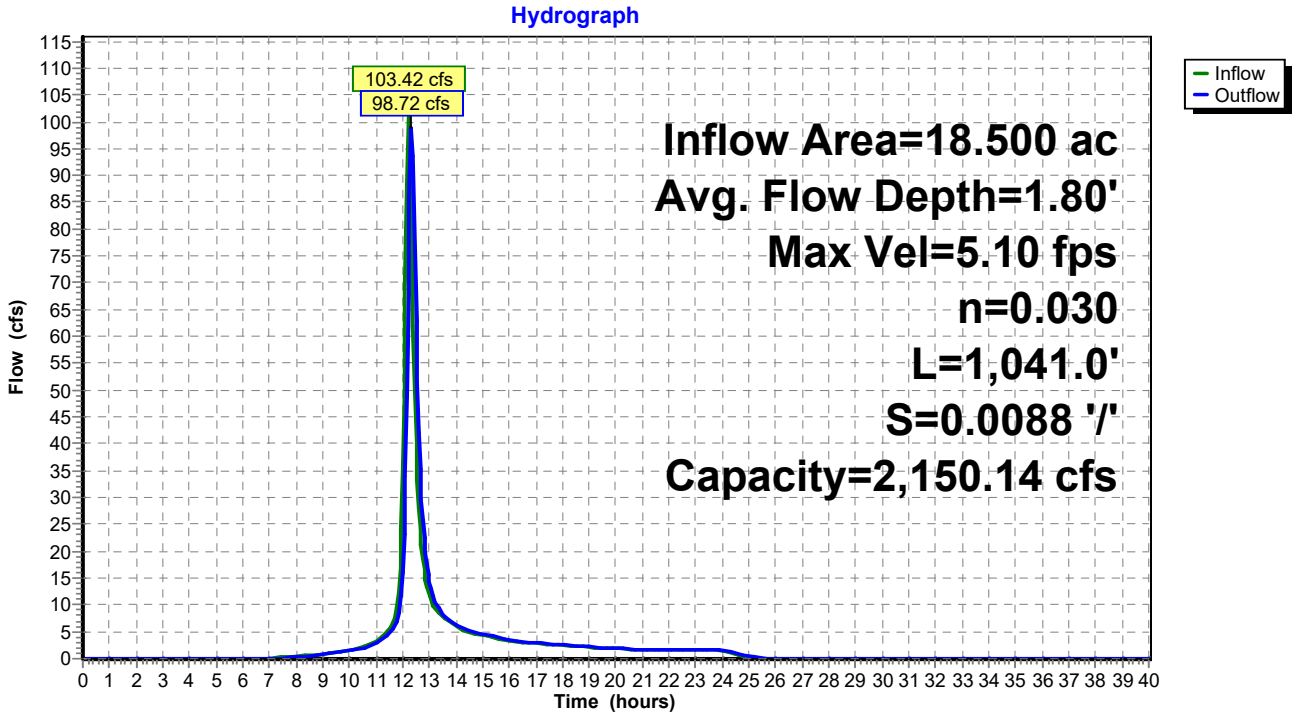


‡

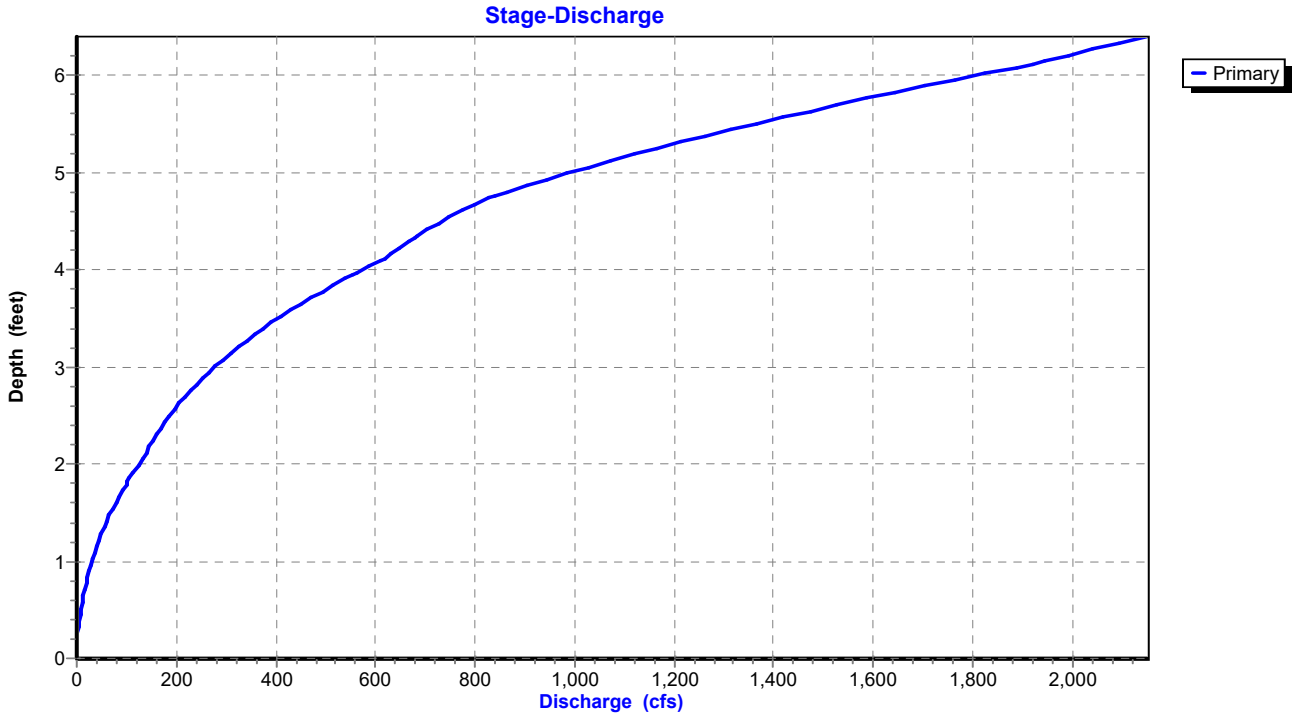
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	996.29	0.00
7.00	996.00	0.29
12.99	994.06	2.23
13.24	994.00	2.29
14.48	993.84	2.45
28.84	992.00	4.29
29.66	991.71	4.58
36.75	990.00	6.29
39.18	989.92	6.37
39.90	989.89	6.40
42.20	989.97	6.32
43.14	990.00	6.29
43.91	990.40	5.89
46.34	992.00	4.29
53.90	993.41	2.88
56.74	994.00	2.29
62.76	994.22	2.07
76.31	994.65	1.64
100.00	996.29	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
3.52	62.5	37.1	65,011	410.25
3.95	79.1	42.6	82,369	555.08
4.11	85.9	44.7	89,447	617.31
4.17	88.6	46.6	92,223	631.78
4.33	96.2	51.5	100,189	678.51
4.76	121.1	66.4	126,018	838.92
6.11	225.0	90.3	234,197	1,919.54
6.40	252.4	101.5	262,697	2,150.14

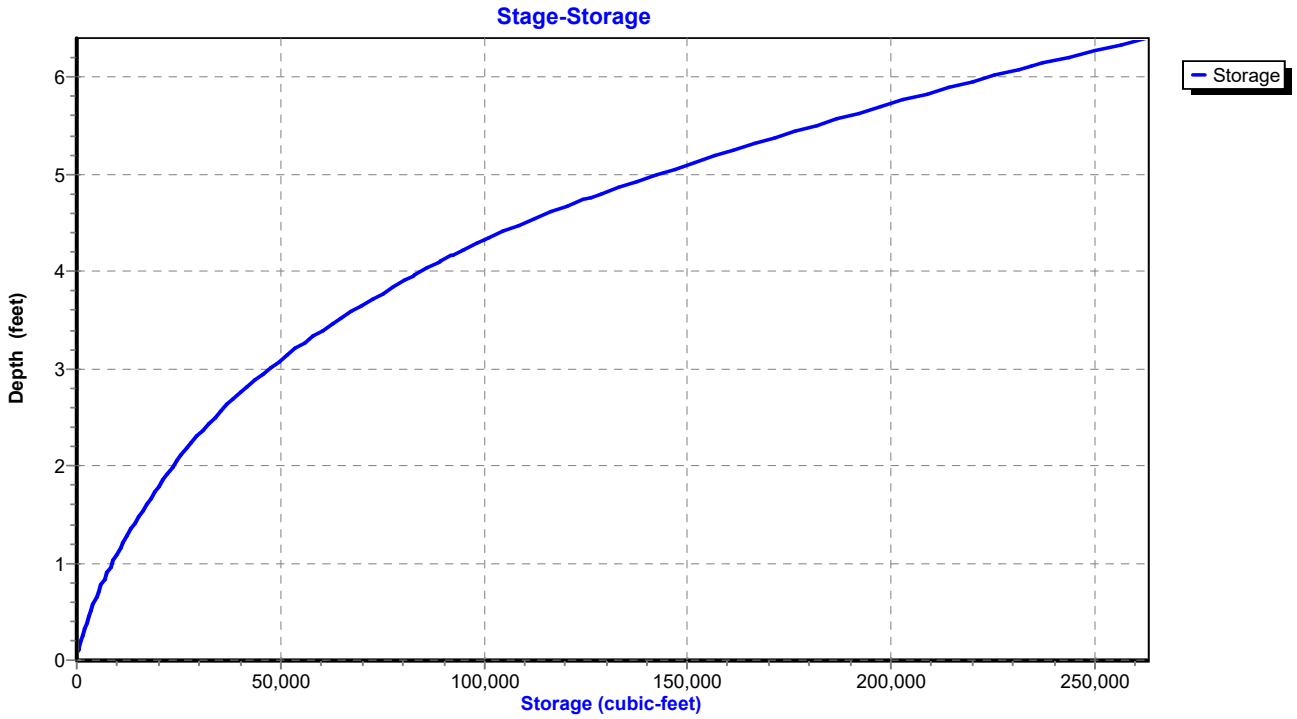
Reach 3R: Reach 3



Reach 3R: Reach 3



Reach 3R: Reach 3



Summary for Reach 4R: Reach 2

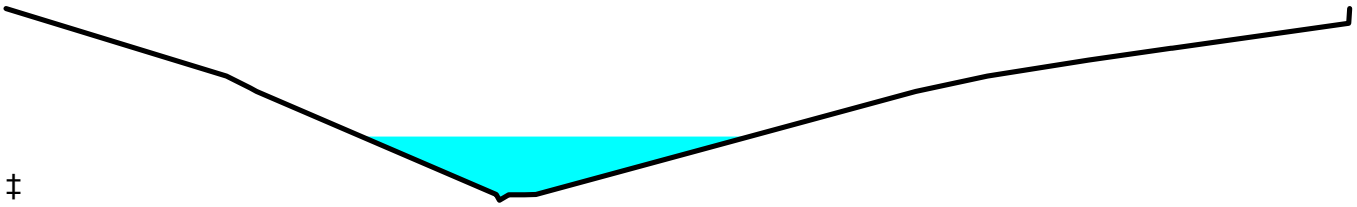
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.62' @ 12.25 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 107.38 cfs @ 12.15 hrs, Volume= 7.708 af
Outflow = 103.42 cfs @ 12.23 hrs, Volume= 7.708 af, Atten= 4%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.92 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 8.8 min

Peak Storage= 17,944 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.08'
Bank-Full Depth= 3.24' Flow Area= 204.3 sf, Capacity= 1,999.47 cfs

Custom cross-section, Length= 853.0' Slope= 0.0225 '/' (106 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 1,009.12', Outlet Invert= 989.90'

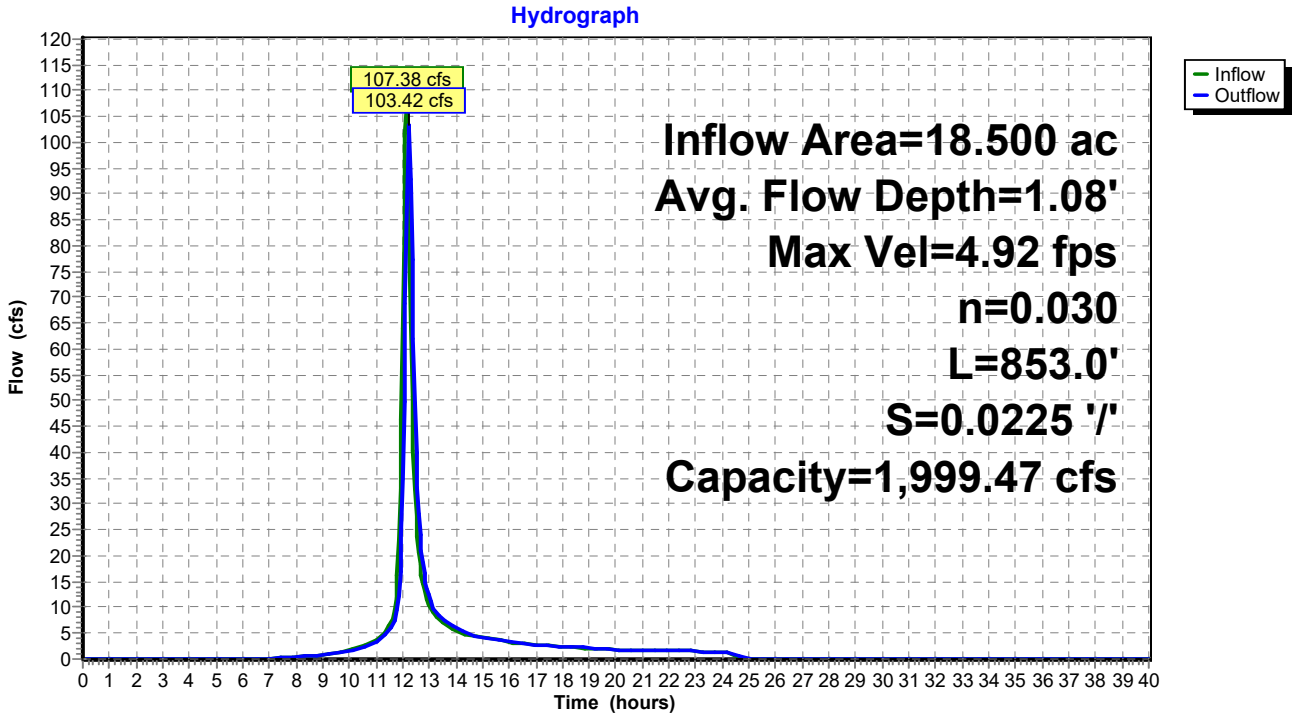


‡

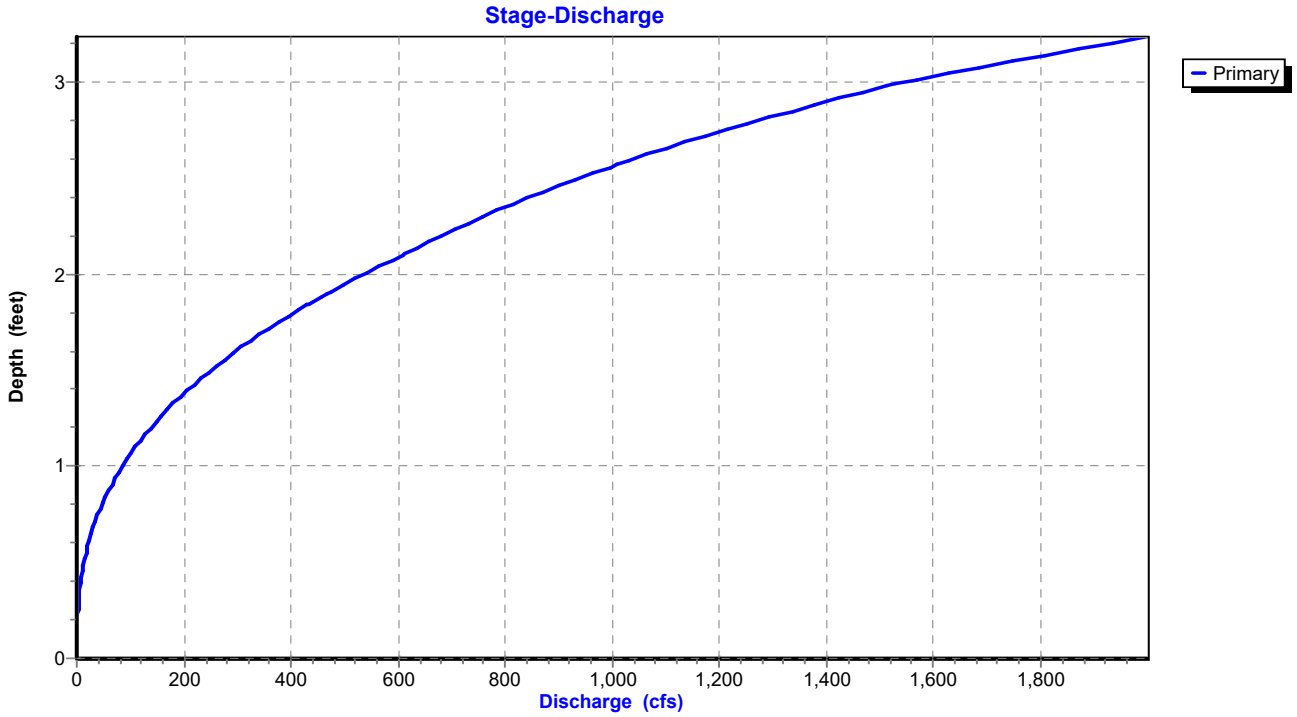
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,009.14	0.00
22.15	1,008.00	1.14
24.54	1,007.80	1.34
25.18	1,007.74	1.40
49.26	1,006.00	3.14
49.59	1,005.90	3.24
50.51	1,005.99	3.15
52.13	1,005.99	3.15
53.24	1,006.00	3.14
91.41	1,007.74	1.40
98.60	1,008.00	1.14
108.78	1,008.27	0.87
117.07	1,008.47	0.67
117.16	1,008.47	0.67
134.91	1,008.89	0.25
135.00	1,009.14	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	818.03
2.57	122.0	104.3	104,091	1,007.45
2.99	171.2	130.2	146,042	1,527.76
3.24	204.3	135.4	174,303	1,999.47

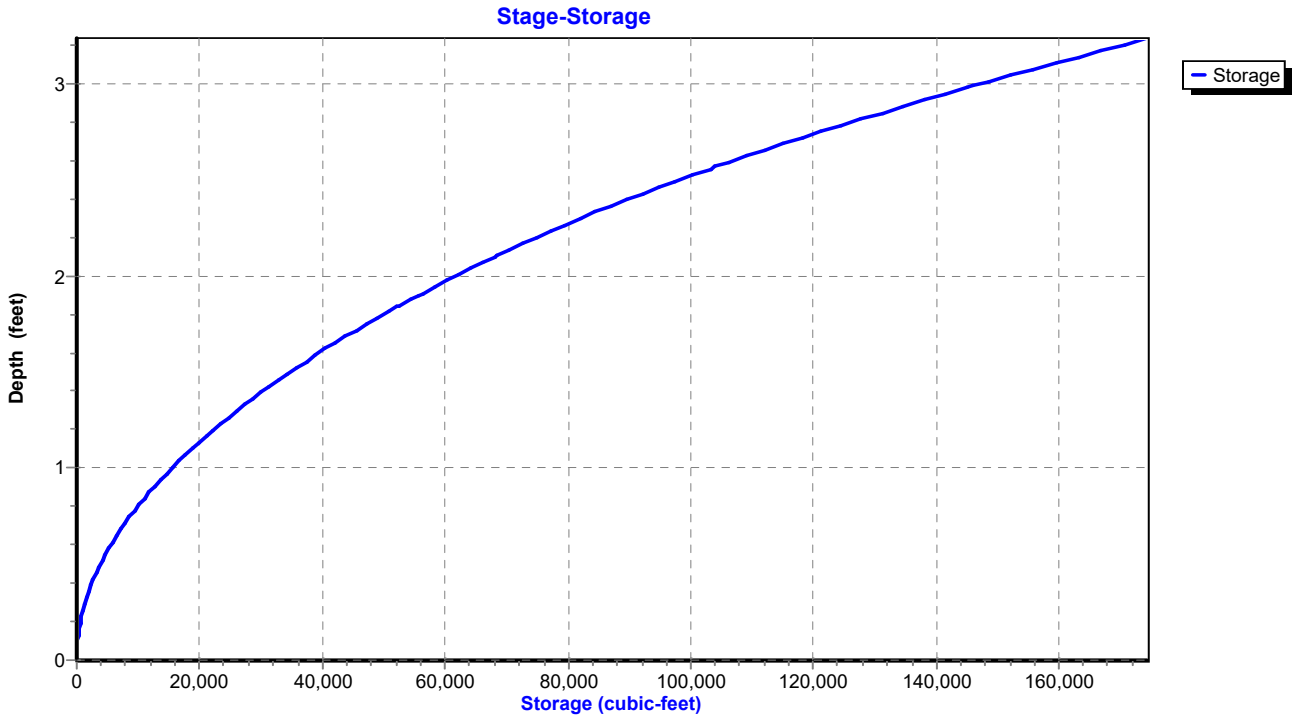
Reach 4R: Reach 2



Reach 4R: Reach 2



Reach 4R: Reach 2



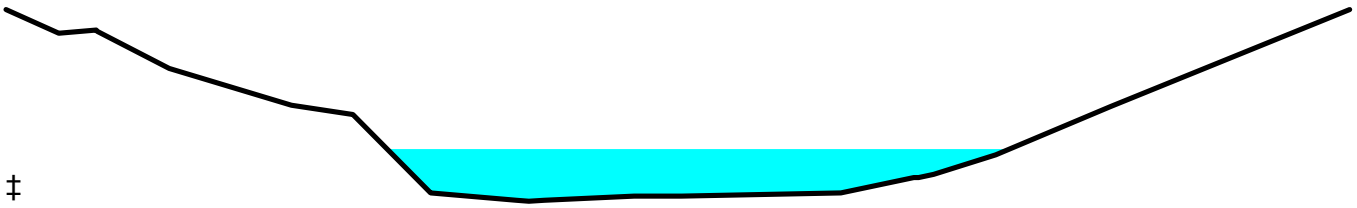
Summary for Reach 8R: Reach 1

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 110.52 cfs @ 12.09 hrs, Volume= 7.708 af
Outflow = 107.38 cfs @ 12.15 hrs, Volume= 7.708 af, Atten= 3%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.88 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.86 fps, Avg. Travel Time= 7.8 min

Peak Storage= 12,109 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.86' Flow Area= 89.8 sf, Capacity= 1,475.63 cfs

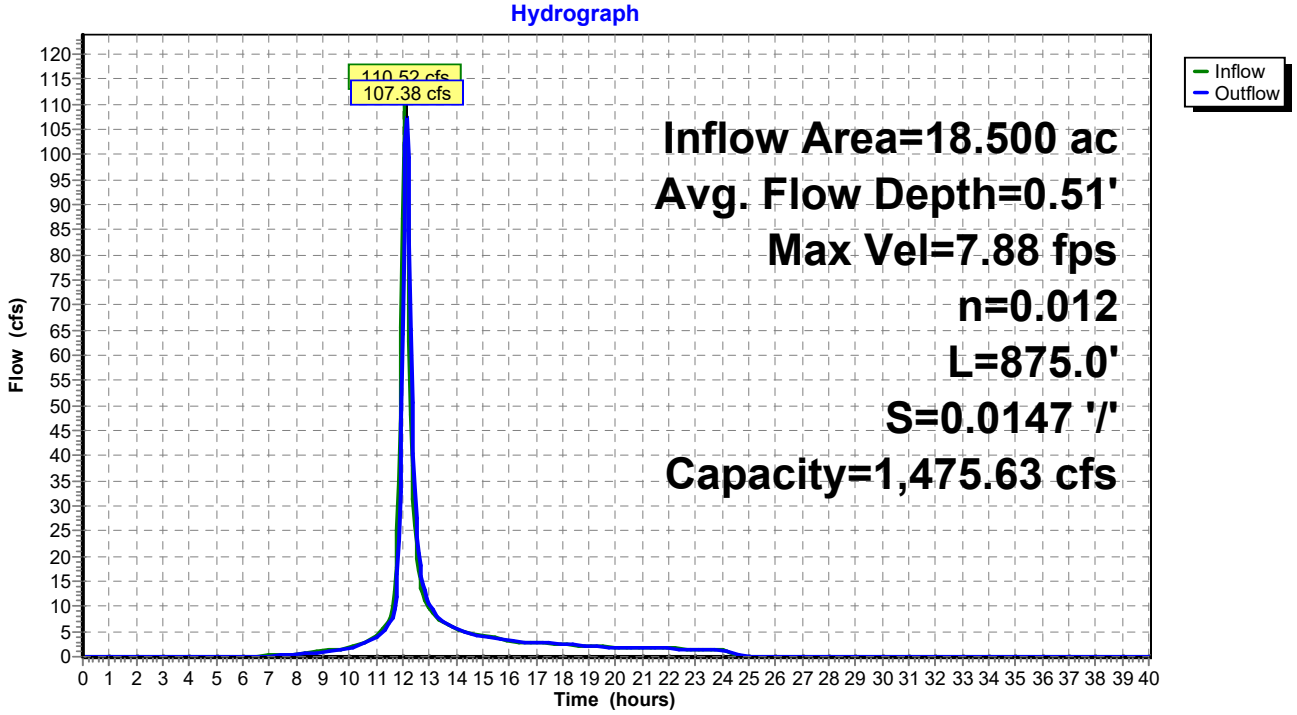
Custom cross-section, Length= 875.0' Slope= 0.0147 '/' (108 Elevation Intervals)
Constant n= 0.012 Concrete pipe, finished
Inlet Invert= 1,021.96', Outlet Invert= 1,009.12'



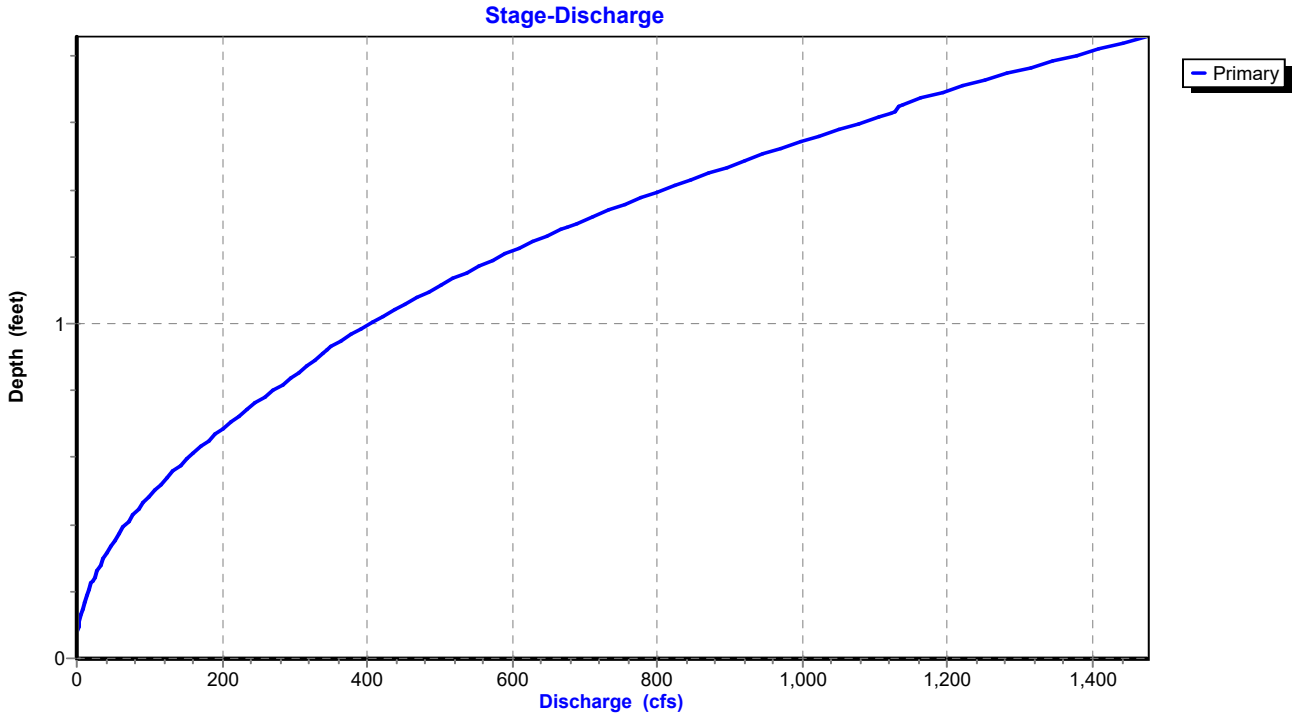
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
6.08	1,023.78	0.00
9.16	1,023.55	0.23
11.33	1,023.58	0.20
11.39	1,023.57	0.21
15.58	1,023.21	0.57
22.68	1,022.85	0.93
26.25	1,022.76	1.02
30.78	1,022.00	1.78
35.77	1,021.93	1.85
36.49	1,021.92	1.86
37.38	1,021.93	1.85
42.61	1,021.97	1.81
45.38	1,021.97	1.81
54.65	1,022.00	1.78
58.89	1,022.15	1.63
59.16	1,022.15	1.63
60.04	1,022.18	1.60
63.66	1,022.37	1.41
70.33	1,022.84	0.94
84.24	1,023.78	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.01	0.0	1.6	7	0.00
0.05	0.2	12.5	205	0.25
0.08	0.8	23.9	682	1.19
0.23	4.7	29.3	4,152	21.15
0.26	5.6	30.4	4,934	27.55
0.45	11.9	35.1	10,372	86.23
0.84	27.1	43.0	23,687	297.75
0.92	30.7	47.3	26,843	344.59
0.93	31.2	47.9	27,258	350.85
1.29	50.6	60.3	44,272	674.94
1.63	72.6	69.4	63,526	1,122.85
1.65	74.0	71.6	64,757	1,134.97
1.66	74.7	72.7	65,388	1,145.01
1.86	89.8	78.3	78,572	1,475.63

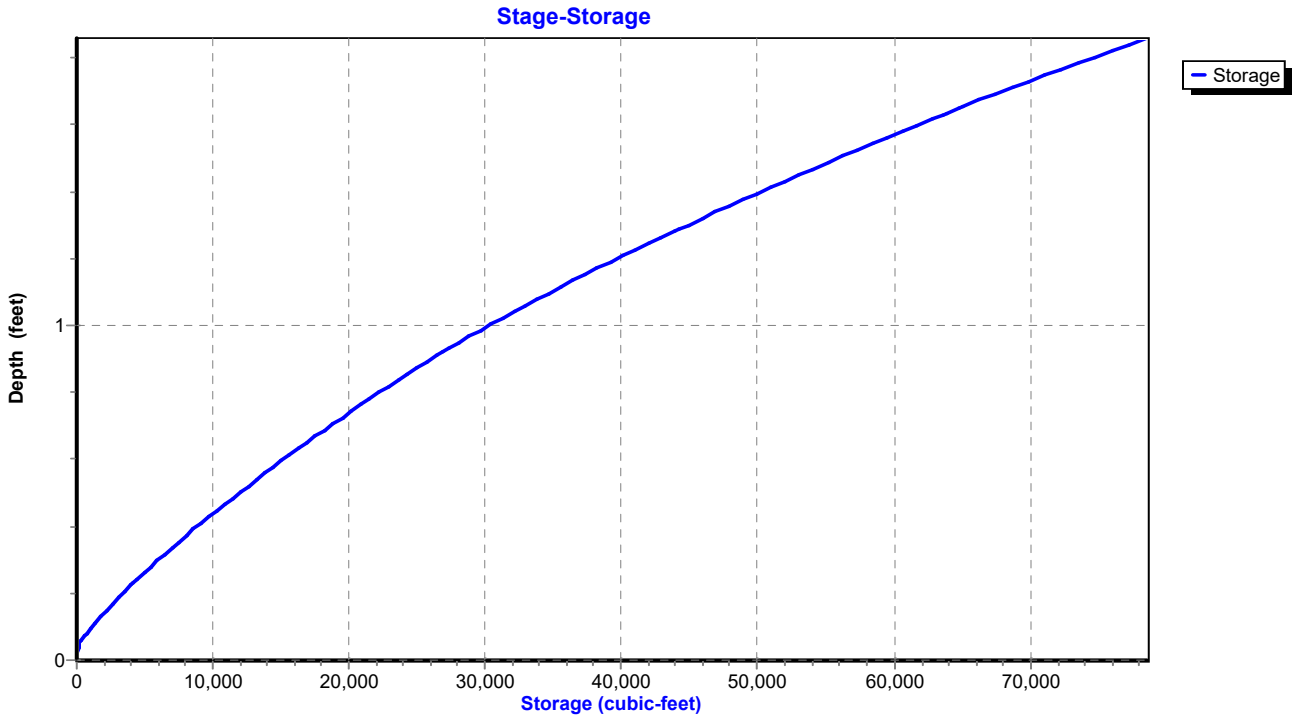
Reach 8R: Reach 1



Reach 8R: Reach 1



Reach 8R: Reach 1

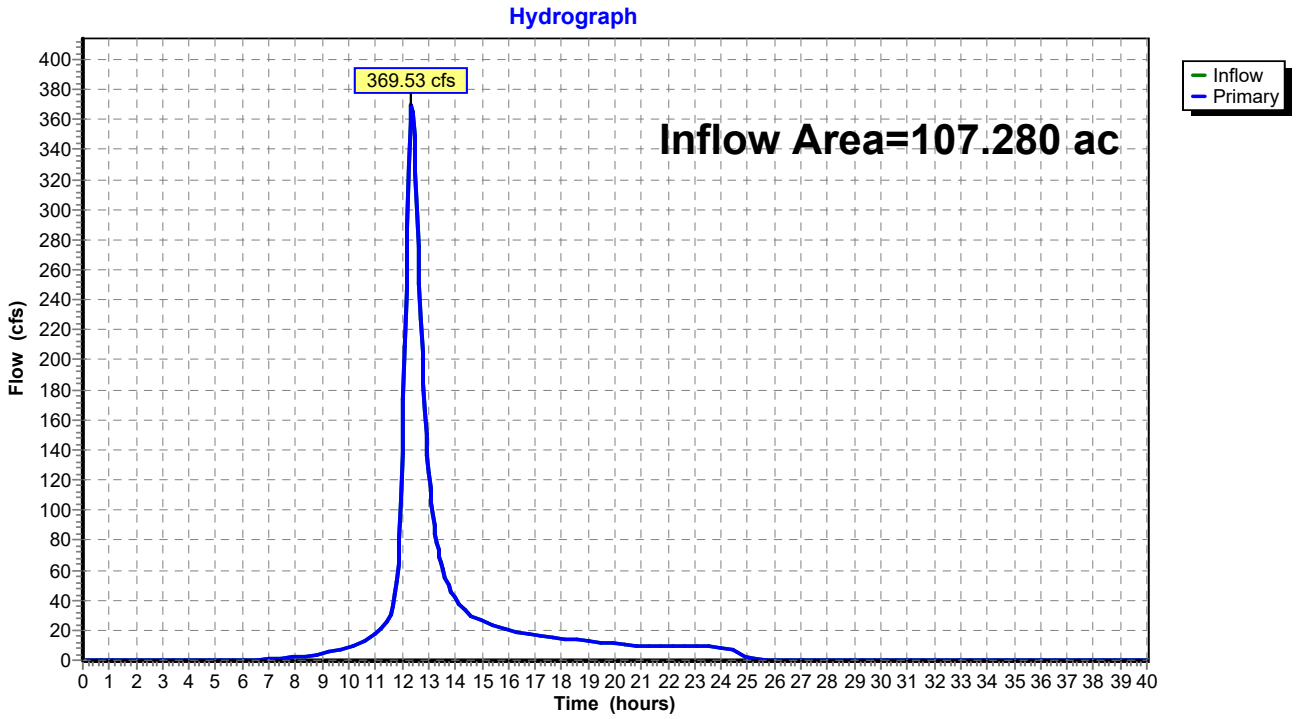


Summary for Link 2L: RP-1

Inflow Area = 107.280 ac, 0.00% Impervious, Inflow Depth = 4.99" for 100-Year event
Inflow = 369.53 cfs @ 12.36 hrs, Volume= 44.638 af
Primary = 369.53 cfs @ 12.36 hrs, Volume= 44.638 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: RP-1

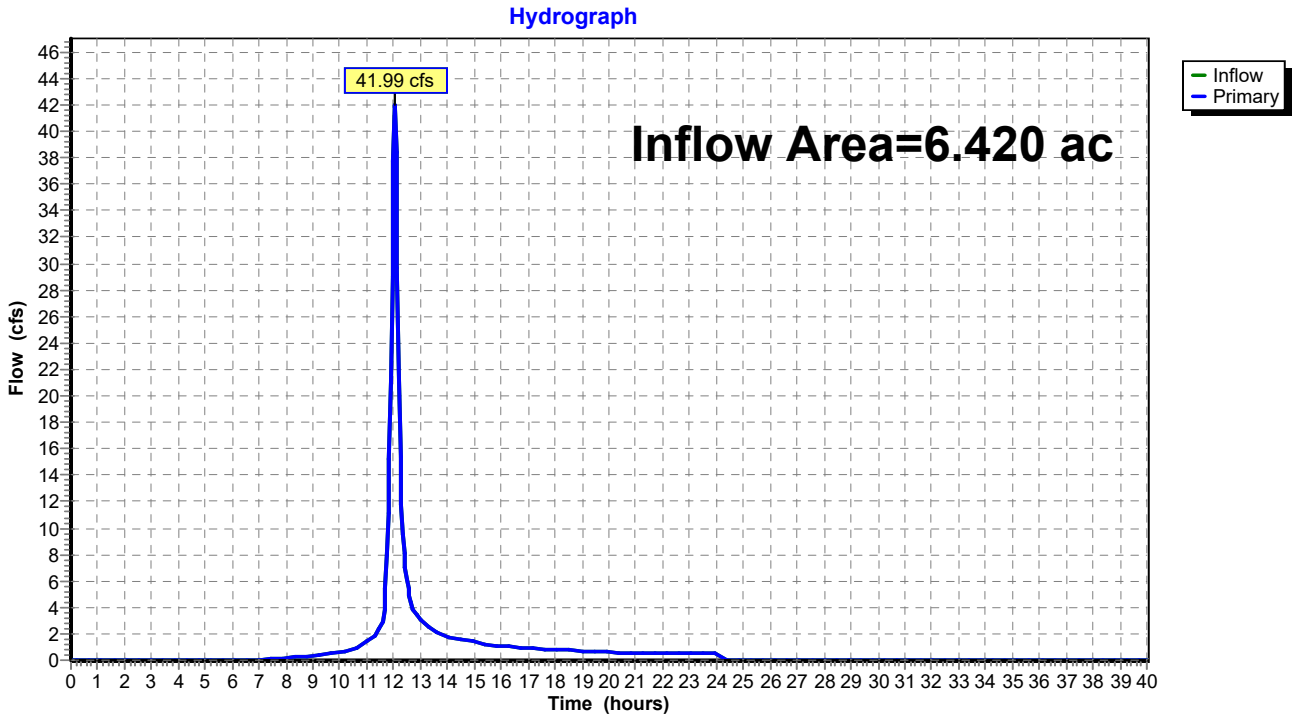


Summary for Link 5L: RP-2

Inflow Area = 6.420 ac, 0.00% Impervious, Inflow Depth = 4.89" for 100-Year event
Inflow = 41.99 cfs @ 12.05 hrs, Volume= 2.614 af
Primary = 41.99 cfs @ 12.05 hrs, Volume= 2.614 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: RP-2

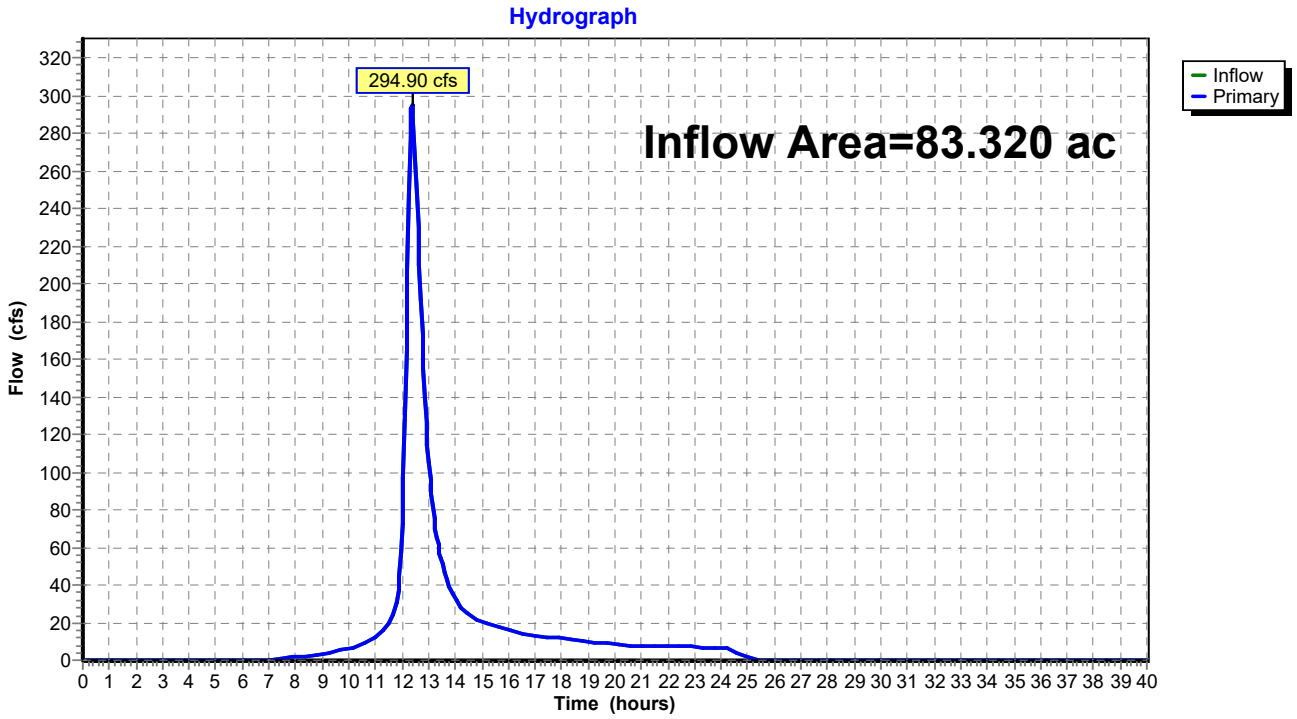


Summary for Link 6L: RP-4

Inflow Area = 83.320 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 294.90 cfs @ 12.37 hrs, Volume= 34.716 af
Primary = 294.90 cfs @ 12.37 hrs, Volume= 34.716 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: RP-4

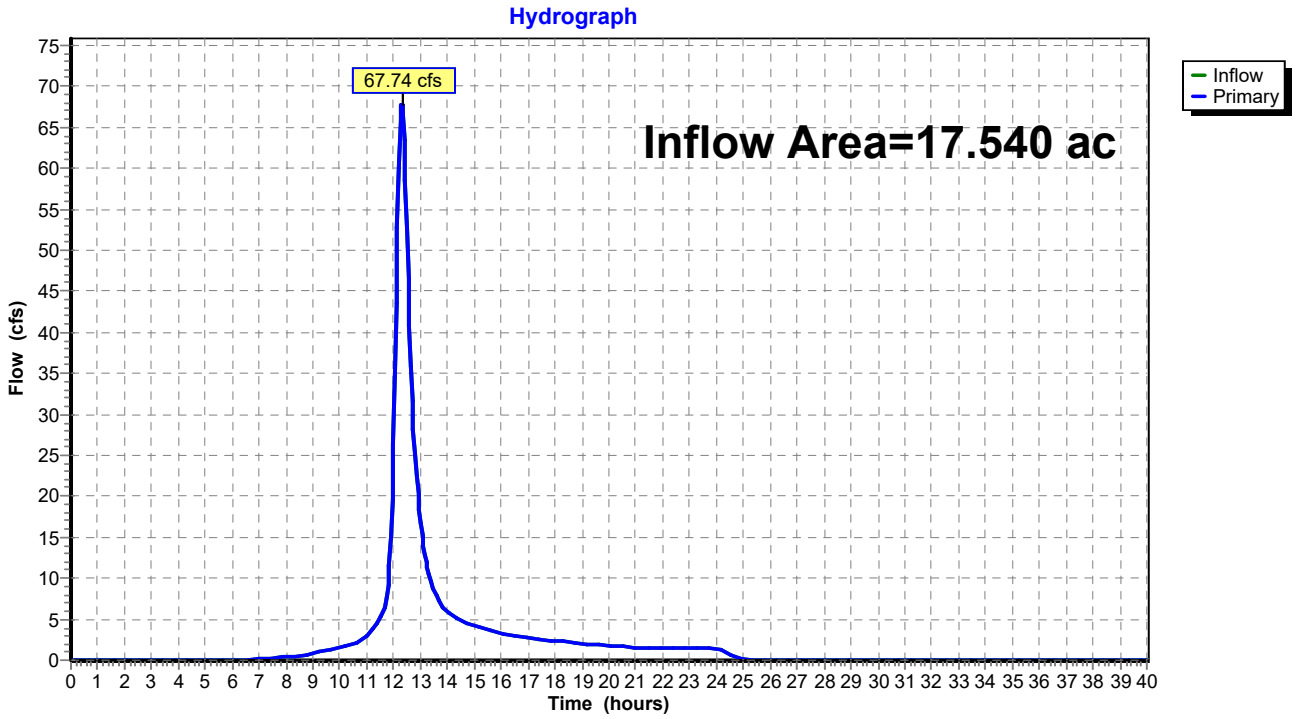


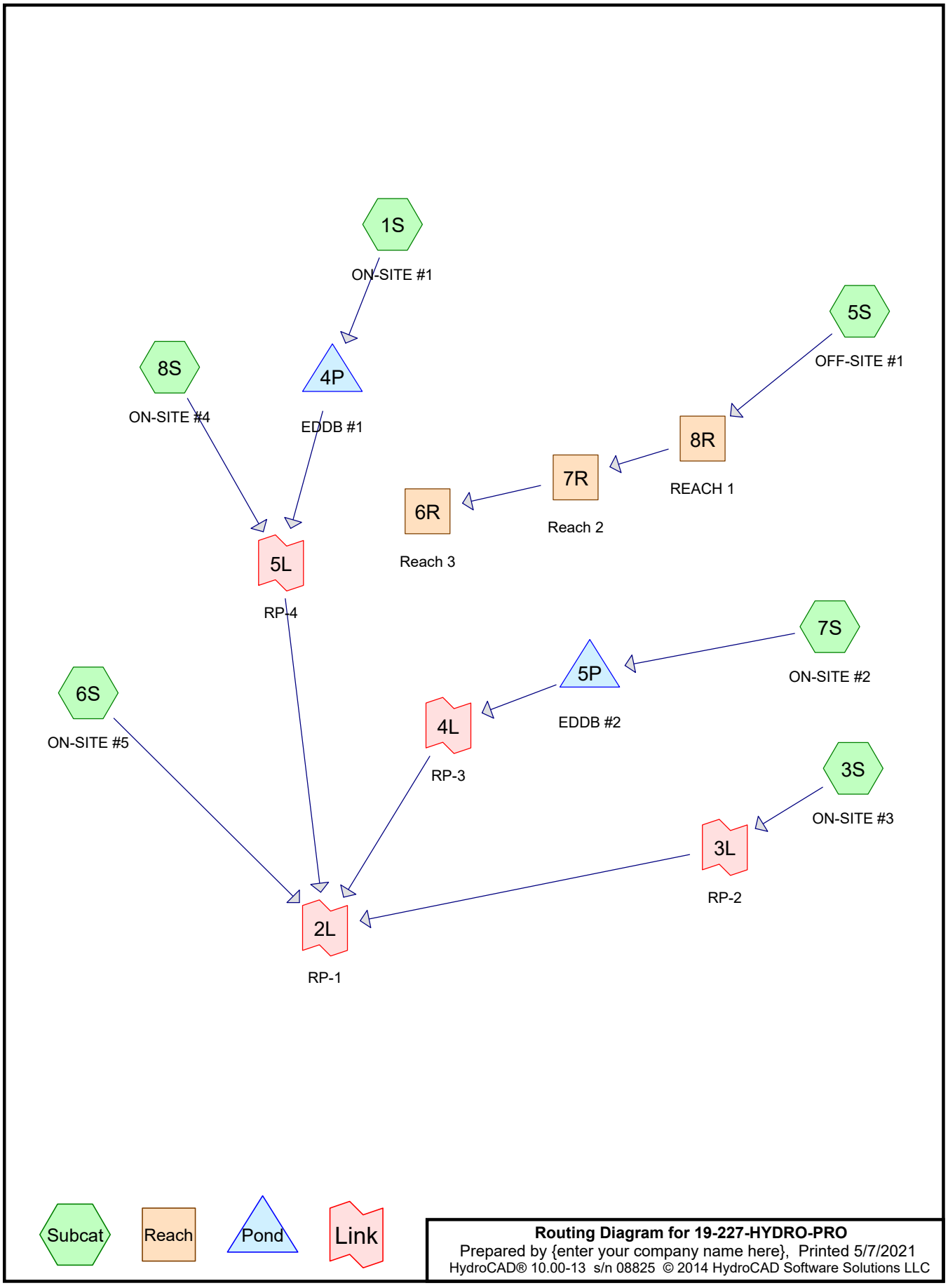
Summary for Link 7L: RP-3

Inflow Area = 17.540 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 67.74 cfs @ 12.31 hrs, Volume= 7.308 af
Primary = 67.74 cfs @ 12.31 hrs, Volume= 7.308 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 7L: RP-3





Routing Diagram for 19-227-HYDRO-PRO
Prepared by {enter your company name here}, Printed 5/7/2021

Summary for Subcatchment 1S: ON-SITE #1

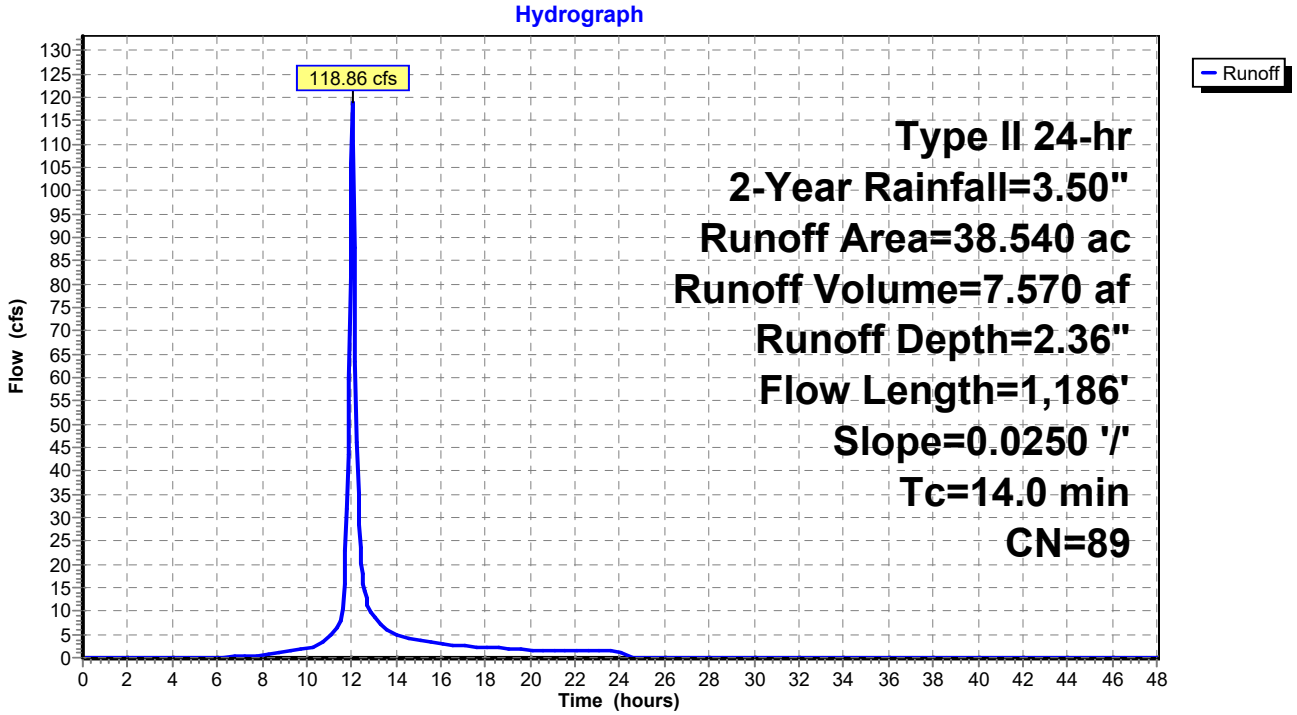
Runoff = 118.86 cfs @ 12.06 hrs, Volume= 7.570 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
13.930	92	1/8 acre lots, 65% imp, HSG D
0.580	85	1/2 acre lots, 25% imp, HSG D
22.620	87	1/4 acre lots, 38% imp, HSG D
1.410	95	Urban commercial, 85% imp, HSG D
38.540	89	Weighted Average
19.546		50.72% Pervious Area
18.994		49.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 1S: ON-SITE #1



Summary for Subcatchment 3S: ON-SITE #3

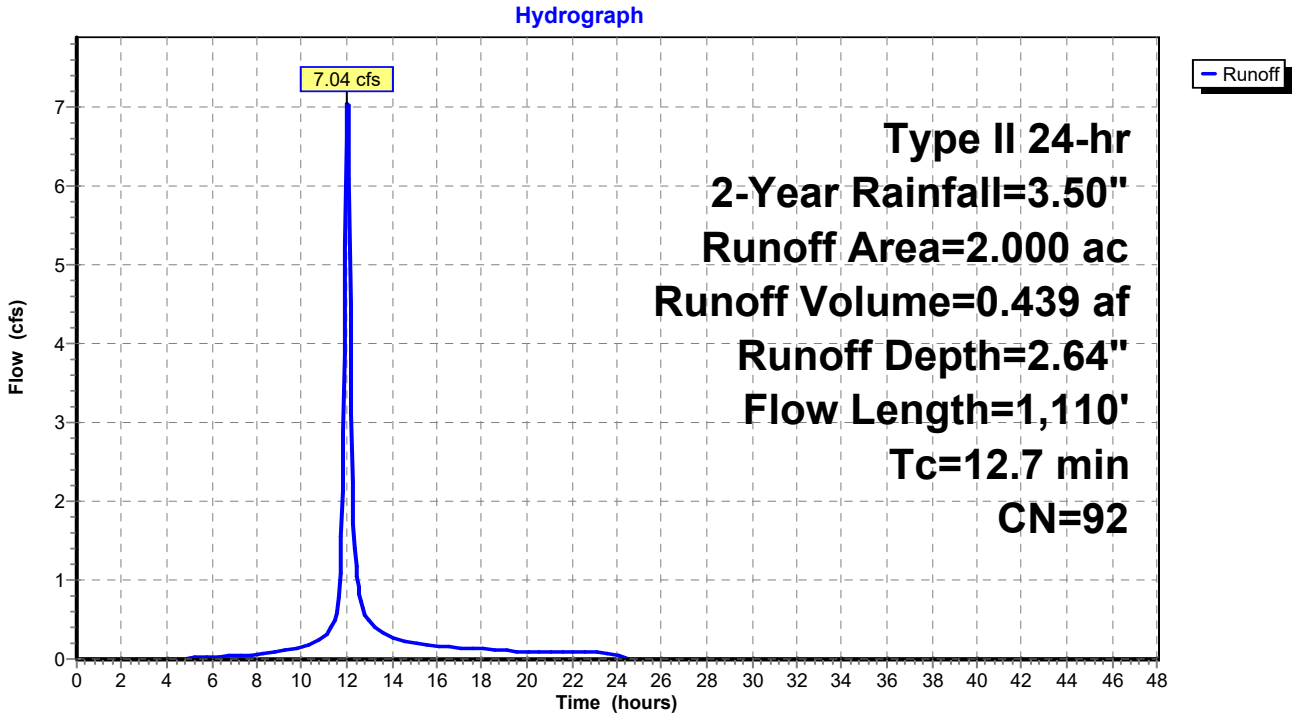
Runoff = 7.04 cfs @ 12.04 hrs, Volume= 0.439 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
2.000	92	1/8 acre lots, 65% imp, HSG D
0.700		35.00% Pervious Area
1.300		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
7.8	1,060	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.7	1,110	Total			

Subcatchment 3S: ON-SITE #3



Summary for Subcatchment 5S: OFF-SITE #1

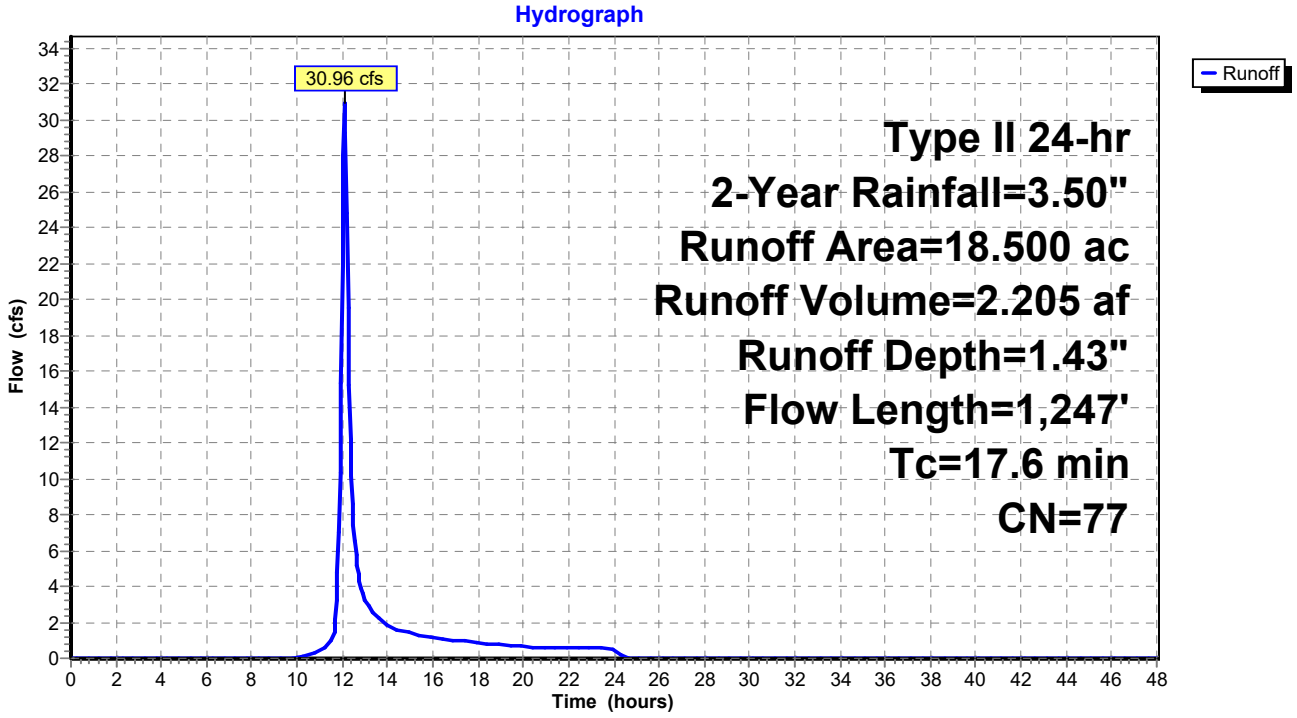
Runoff = 30.96 cfs @ 12.11 hrs, Volume= 2.205 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.860	82	Woods/grass comb., Fair, HSG D
18.500	77	Weighted Average
18.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
9.2	1,147	0.0192	2.08		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
17.6	1,247	Total			

Subcatchment 5S: OFF-SITE #1



Summary for Subcatchment 6S: ON-SITE #5

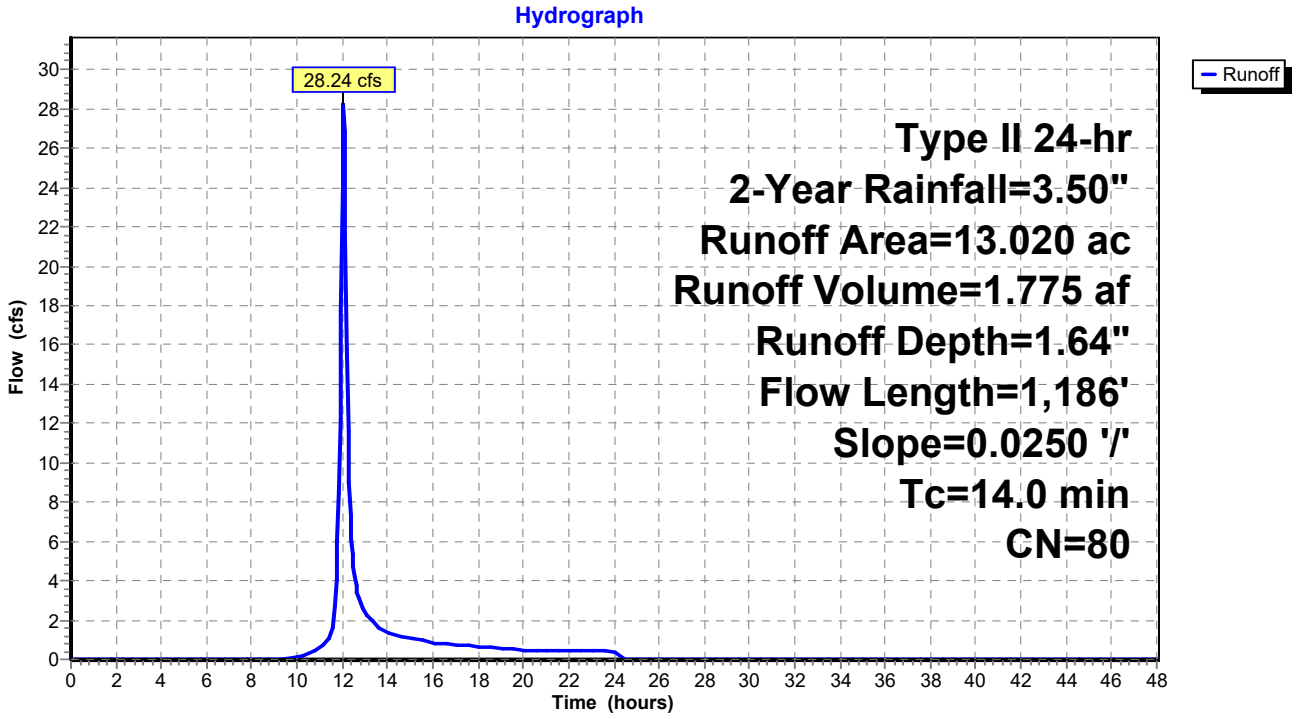
Runoff = 28.24 cfs @ 12.06 hrs, Volume= 1.775 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
13.020	80	>75% Grass cover, Good, HSG D
13.020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 6S: ON-SITE #5



Summary for Subcatchment 7S: ON-SITE #2

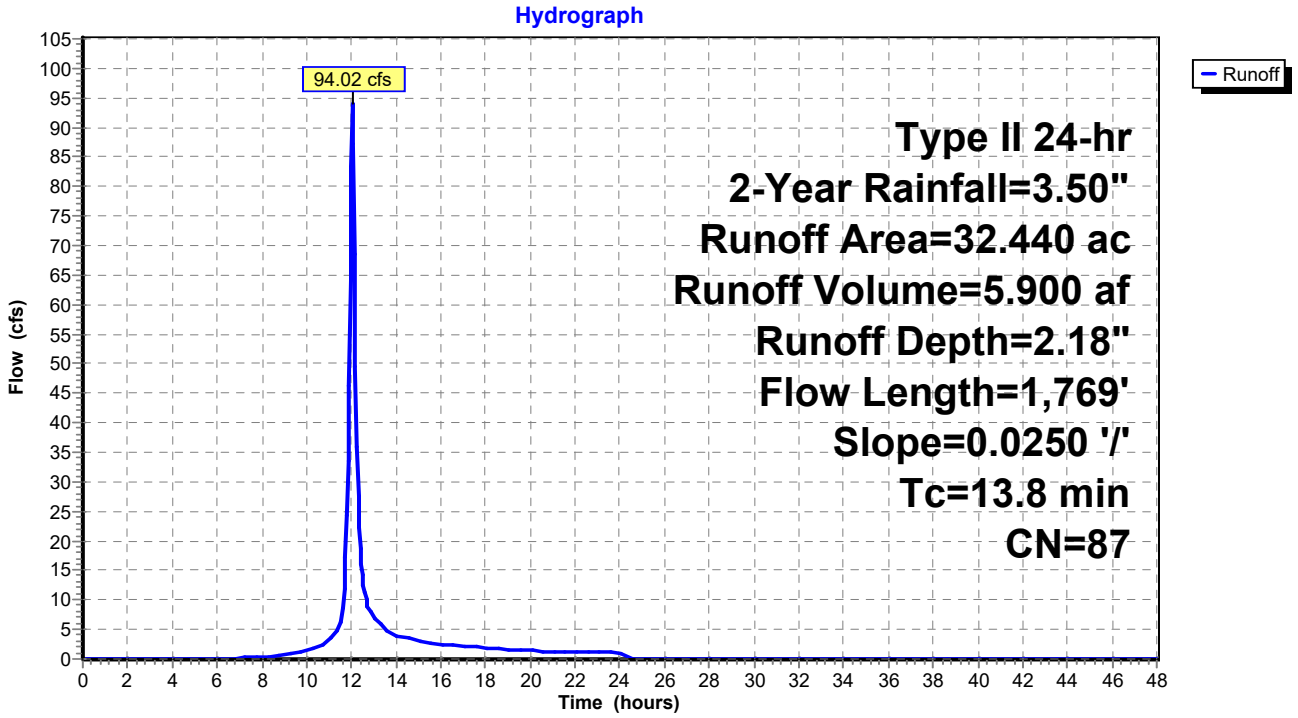
Runoff = 94.02 cfs @ 12.06 hrs, Volume= 5.900 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
32.440	87	1/4 acre lots, 38% imp, HSG D
20.113		62.00% Pervious Area
12.327		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
8.9	1,719	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
13.8	1,769	Total			

Subcatchment 7S: ON-SITE #2



Summary for Subcatchment 8S: ON-SITE #4

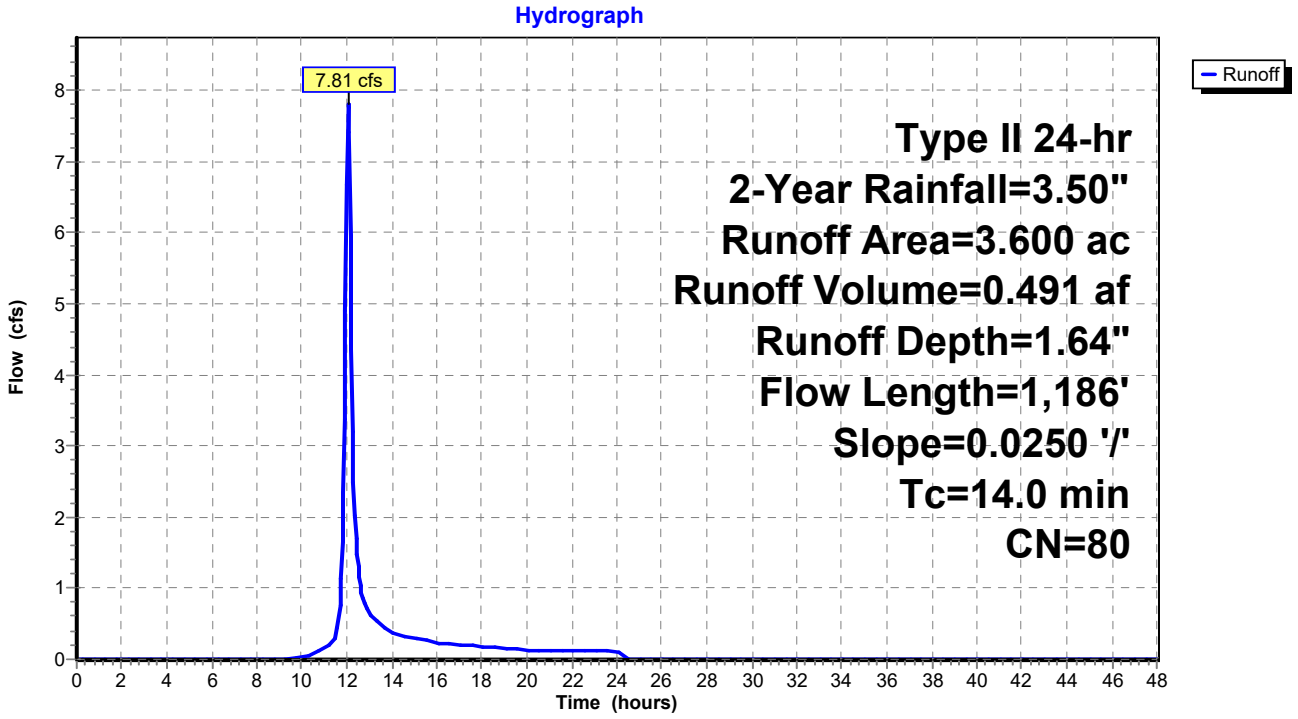
Runoff = 7.81 cfs @ 12.06 hrs, Volume= 0.491 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
3.600	80	>75% Grass cover, Good, HSG D
3.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 8S: ON-SITE #4



Summary for Reach 6R: Reach 3

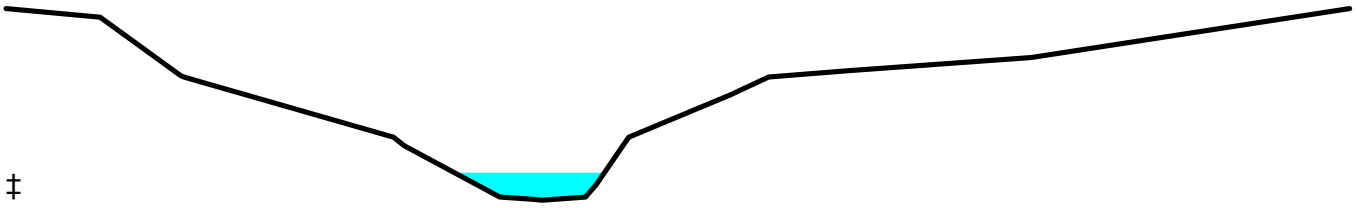
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.37' @ 12.40 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 27.97 cfs @ 12.27 hrs, Volume= 2.205 af
Outflow = 25.75 cfs @ 12.41 hrs, Volume= 2.205 af, Atten= 8%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.48 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 19.3 min

Peak Storage= 7,747 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 6.40' Flow Area= 252.4 sf, Capacity= 2,150.14 cfs

Custom cross-section, Length= 1,041.0' Slope= 0.0088 '/' (110 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 989.92', Outlet Invert= 980.77'

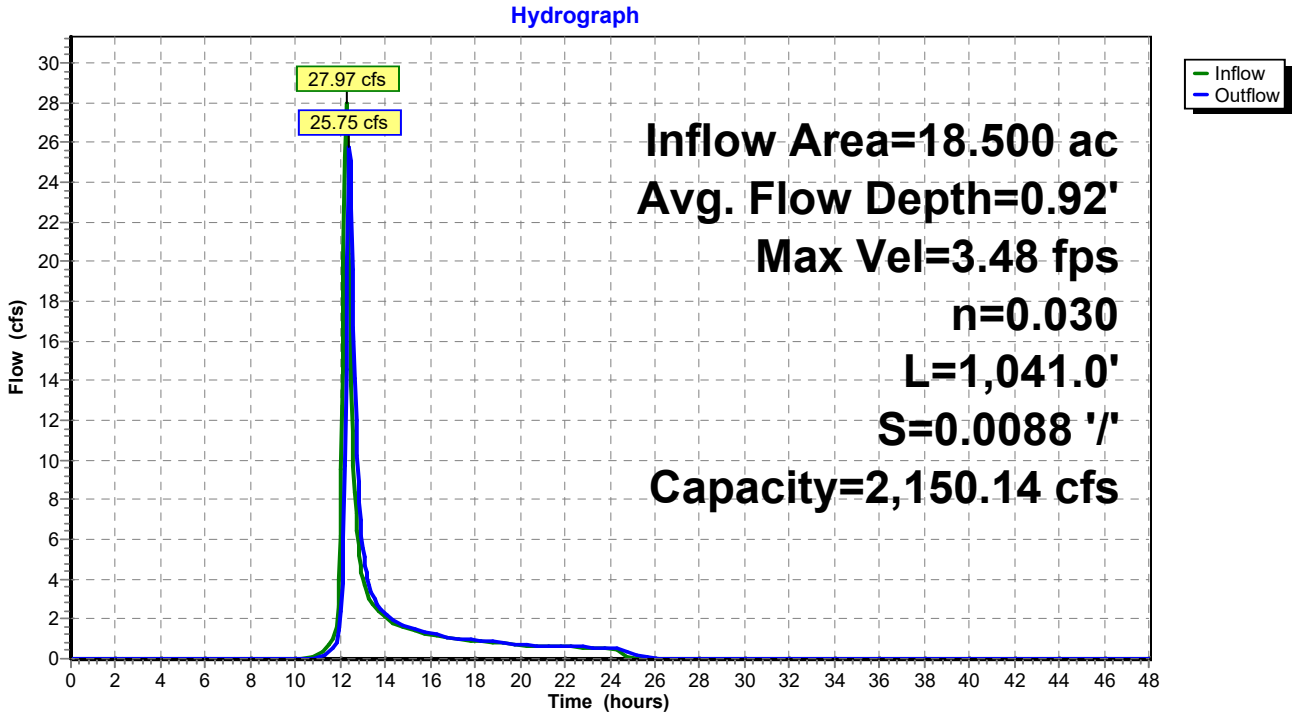


‡

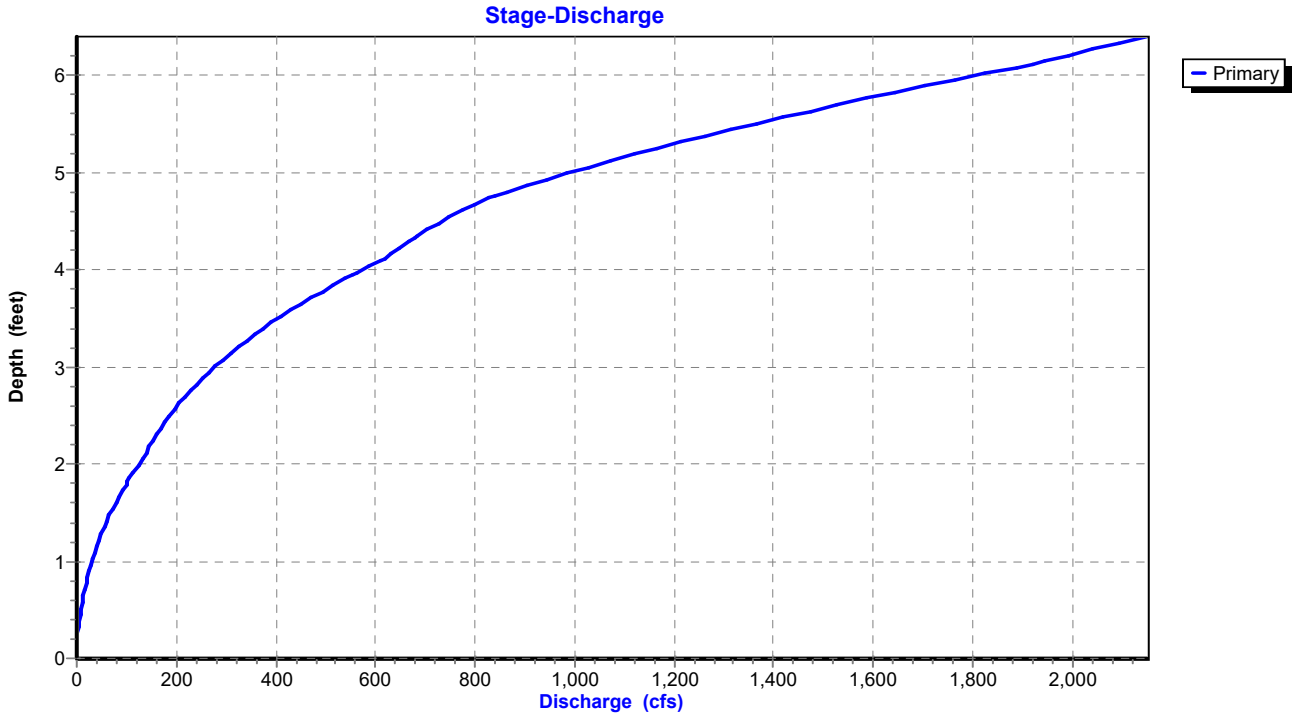
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	996.29	0.00
7.00	996.00	0.29
12.99	994.06	2.23
13.24	994.00	2.29
14.48	993.84	2.45
28.84	992.00	4.29
29.66	991.71	4.58
36.75	990.00	6.29
39.18	989.92	6.37
39.90	989.89	6.40
42.20	989.97	6.32
43.14	990.00	6.29
43.91	990.40	5.89
46.34	992.00	4.29
53.90	993.41	2.88
56.74	994.00	2.29
62.76	994.22	2.07
76.31	994.65	1.64
100.00	996.29	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
3.52	62.5	37.1	65,011	410.25
3.95	79.1	42.6	82,369	555.08
4.11	85.9	44.7	89,447	617.31
4.17	88.6	46.6	92,223	631.78
4.33	96.2	51.5	100,189	678.51
4.76	121.1	66.4	126,018	838.92
6.11	225.0	90.3	234,197	1,919.54
6.40	252.4	101.5	262,697	2,150.14

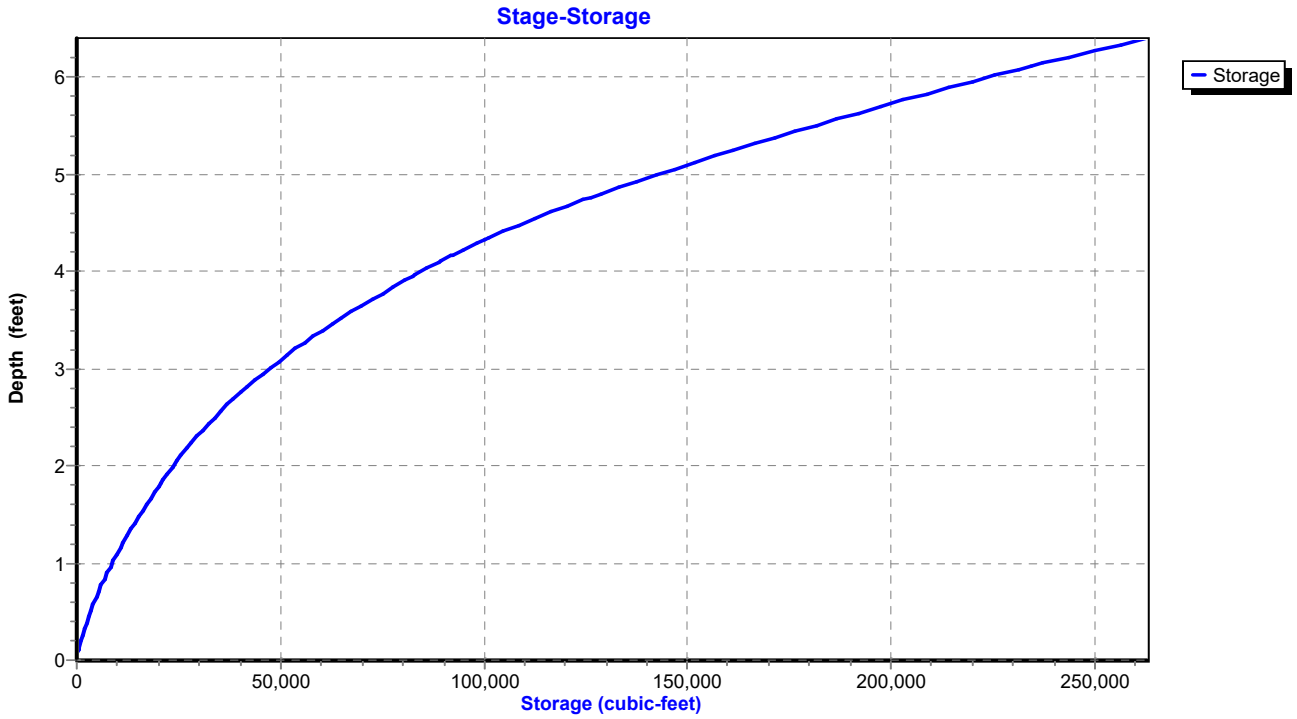
Reach 6R: Reach 3



Reach 6R: Reach 3



Reach 6R: Reach 3



Summary for Reach 7R: Reach 2

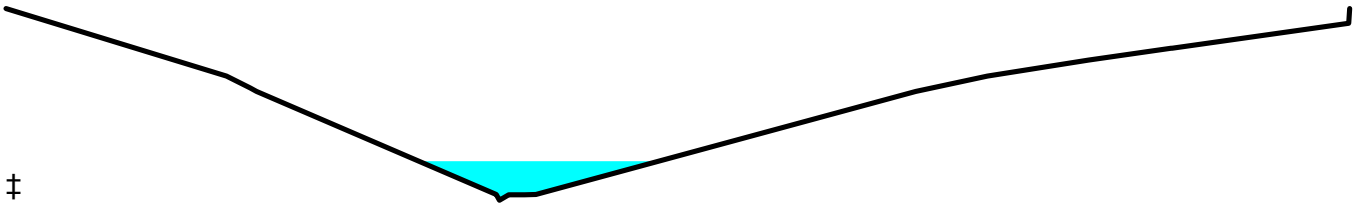
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.20' @ 25.10 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 30.16 cfs @ 12.15 hrs, Volume= 2.205 af
Outflow = 27.97 cfs @ 12.27 hrs, Volume= 2.205 af, Atten= 7%, Lag= 7.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 10.9 min

Peak Storage= 6,799 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 3.24' Flow Area= 204.3 sf, Capacity= 1,999.47 cfs

Custom cross-section, Length= 853.0' Slope= 0.0225 '/' (106 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 1,009.12', Outlet Invert= 989.90'

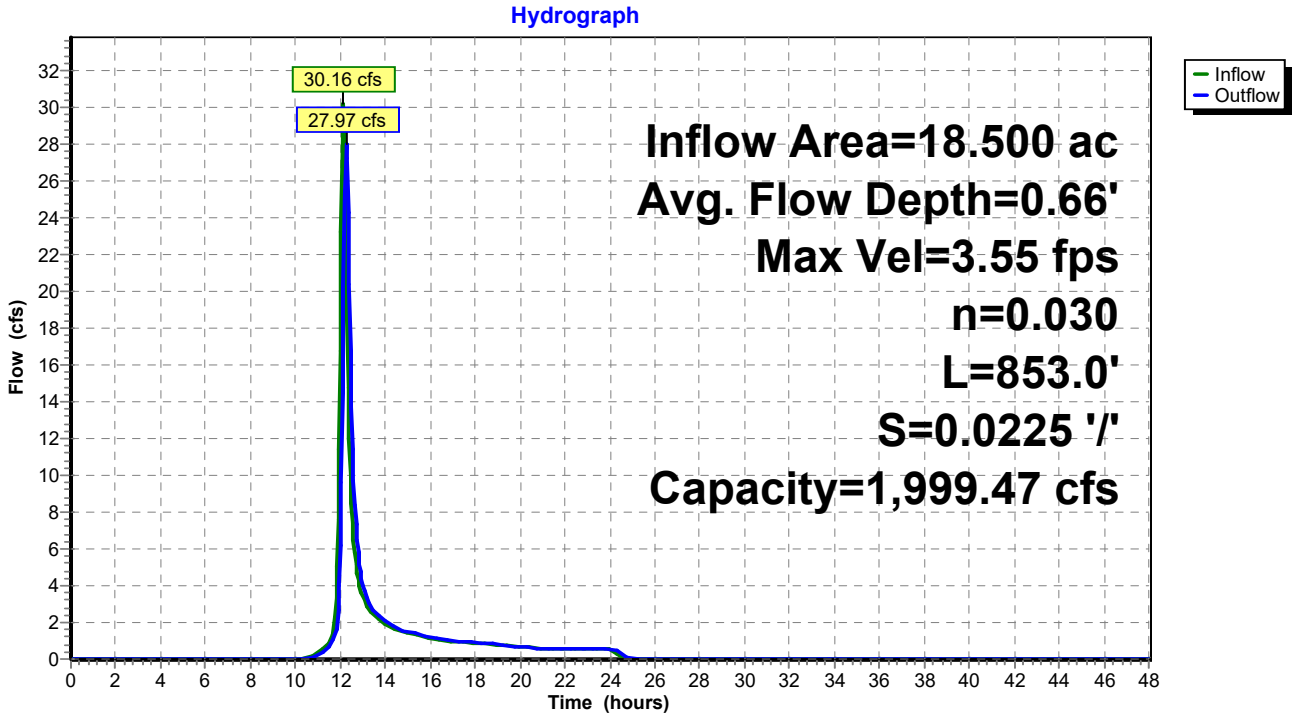


‡

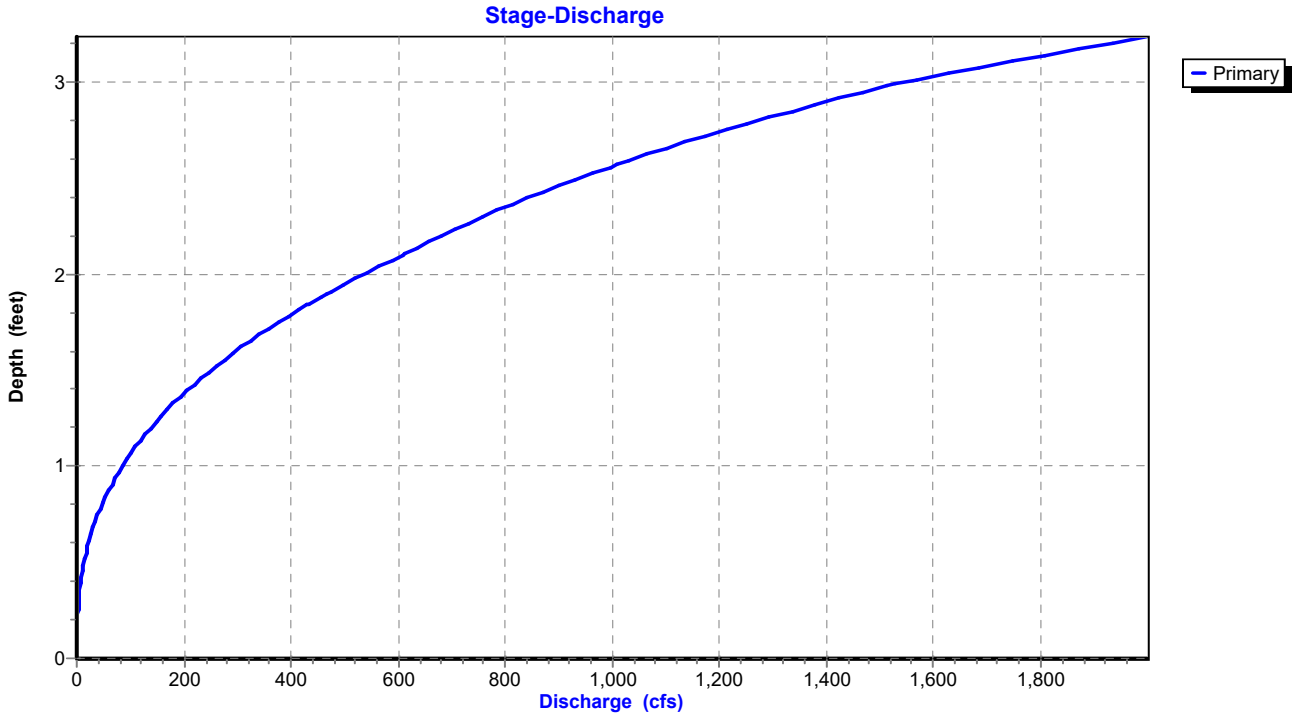
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,009.14	0.00
22.15	1,008.00	1.14
24.54	1,007.80	1.34
25.18	1,007.74	1.40
49.26	1,006.00	3.14
49.59	1,005.90	3.24
50.51	1,005.99	3.15
52.13	1,005.99	3.15
53.24	1,006.00	3.14
91.41	1,007.74	1.40
98.60	1,008.00	1.14
108.78	1,008.27	0.87
117.07	1,008.47	0.67
117.16	1,008.47	0.67
134.91	1,008.89	0.25
135.00	1,009.14	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	818.03
2.57	122.0	104.3	104,091	1,007.45
2.99	171.2	130.2	146,042	1,527.76
3.24	204.3	135.4	174,303	1,999.47

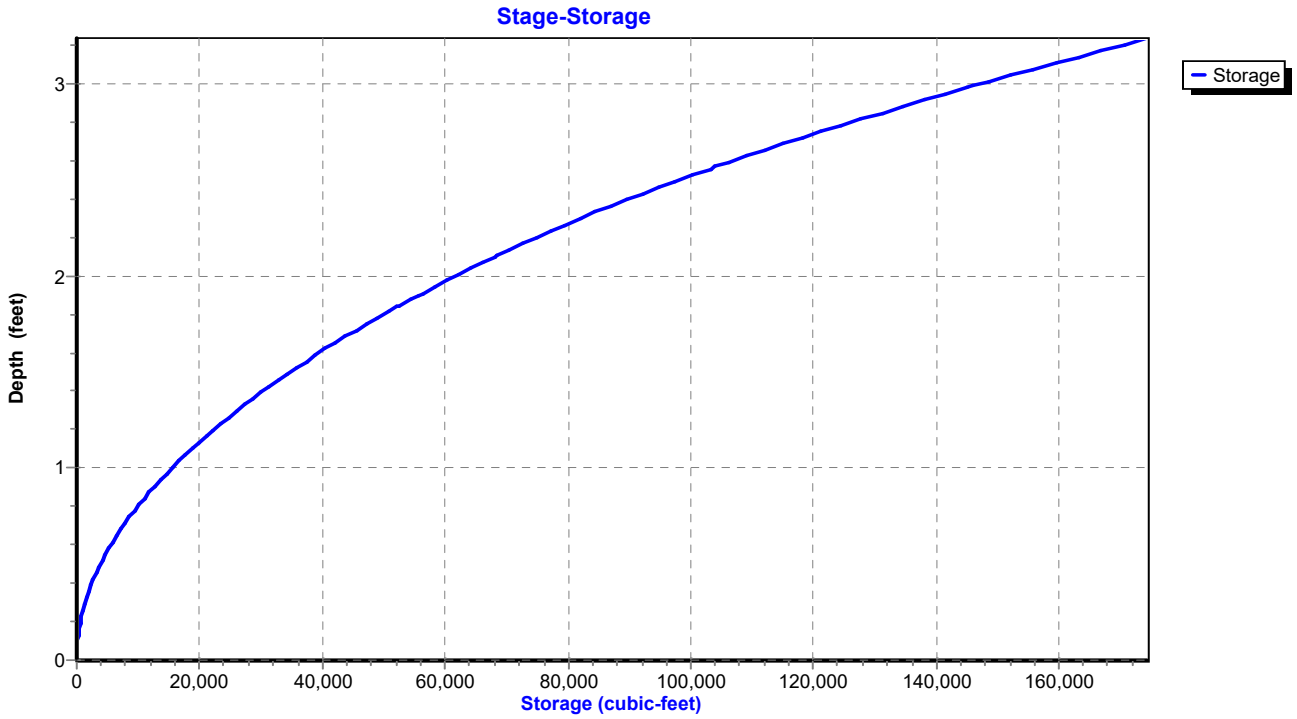
Reach 7R: Reach 2



Reach 7R: Reach 2



Reach 7R: Reach 2



Summary for Reach 8R: REACH 1

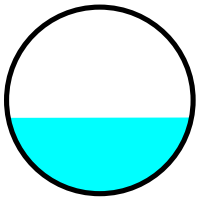
[52] Hint: Inlet/Outlet conditions not evaluated

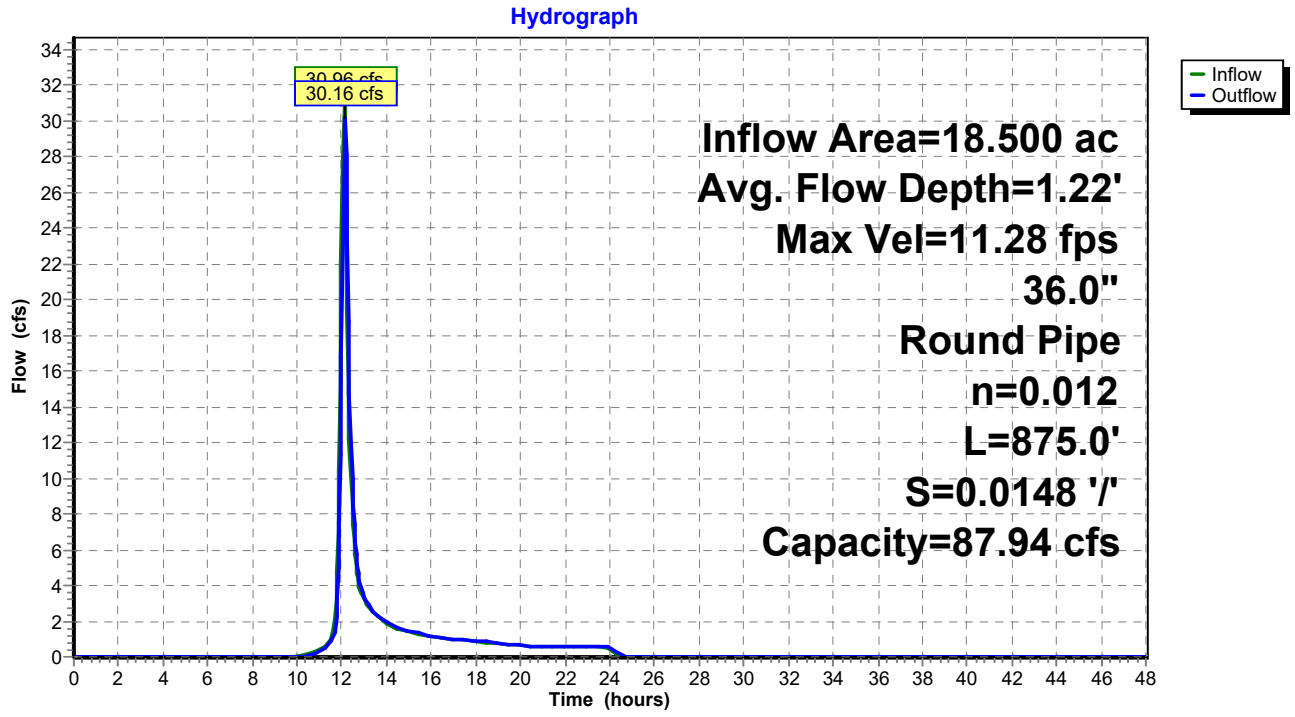
Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 30.96 cfs @ 12.11 hrs, Volume= 2.205 af
Outflow = 30.16 cfs @ 12.15 hrs, Volume= 2.205 af, Atten= 3%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.28 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 3.96 fps, Avg. Travel Time= 3.7 min

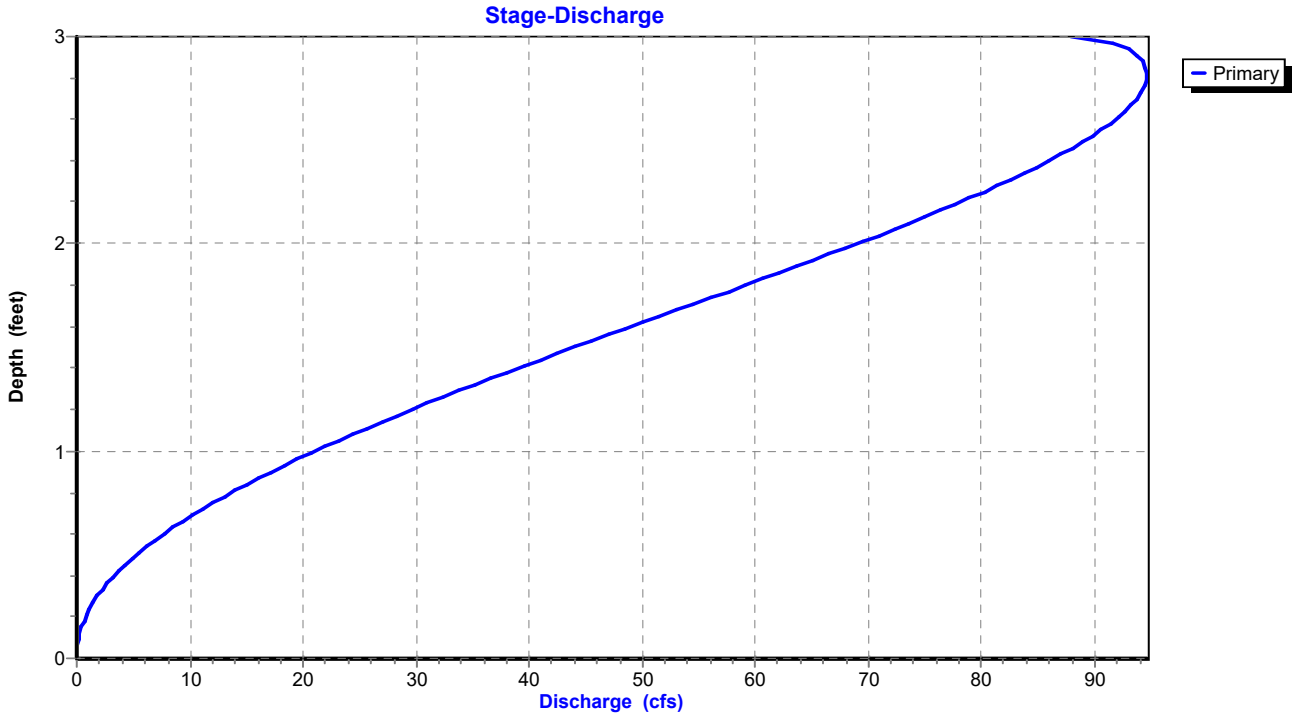
Peak Storage= 2,371 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.22'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 87.94 cfs

36.0" Round Pipe
n= 0.012 Concrete pipe, finished
Length= 875.0' Slope= 0.0148 '/'
Inlet Invert= 1,021.96', Outlet Invert= 1,009.00'

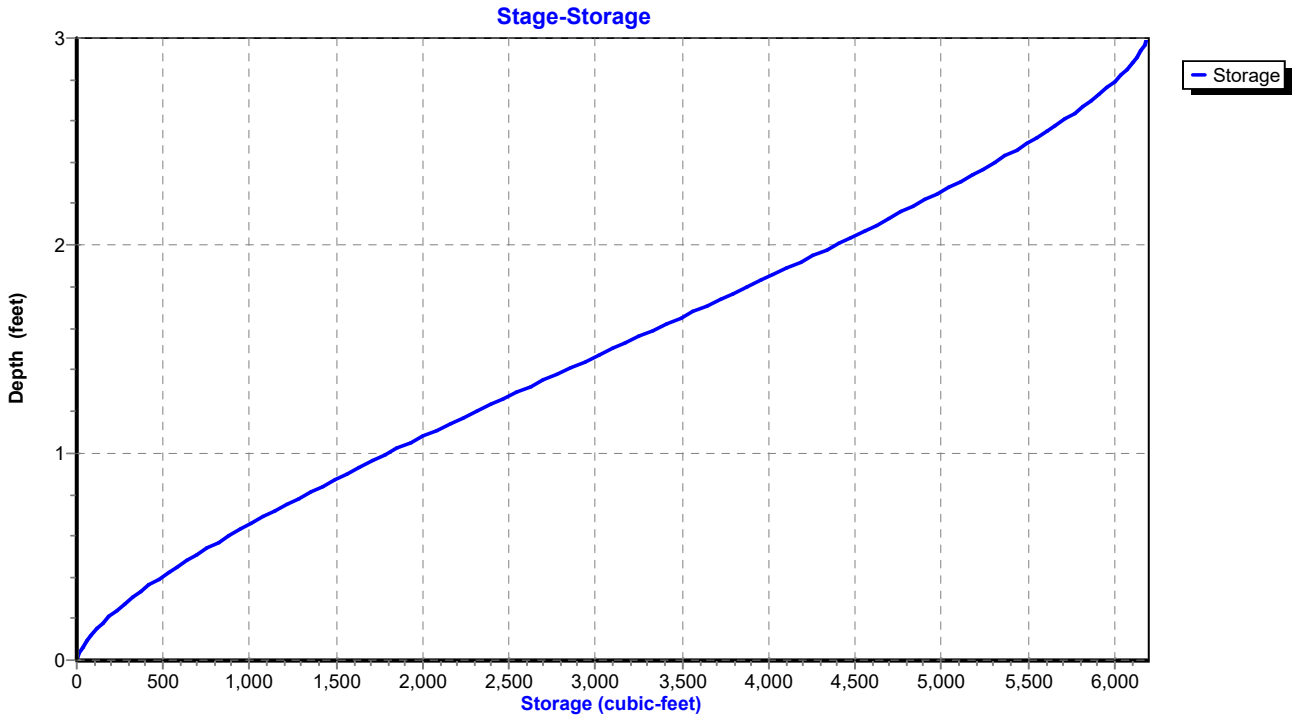




Reach 8R: REACH 1



Reach 8R: REACH 1



Summary for Pond 4P: EDDB #1

Inflow Area = 38.540 ac, 49.28% Impervious, Inflow Depth = 2.36" for 2-Year event
Inflow = 118.86 cfs @ 12.06 hrs, Volume= 7.570 af
Outflow = 4.40 cfs @ 14.37 hrs, Volume= 6.305 af, Atten= 96%, Lag= 138.9 min
Primary = 4.40 cfs @ 14.37 hrs, Volume= 6.305 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 1,001.23' @ 14.37 hrs Surf.Area= 27,081 sf Storage= 217,160 cf

Plug-Flow detention time= 687.9 min calculated for 6.298 af (83% of inflow)
Center-of-Mass det. time= 616.0 min (1,427.9 - 811.9)

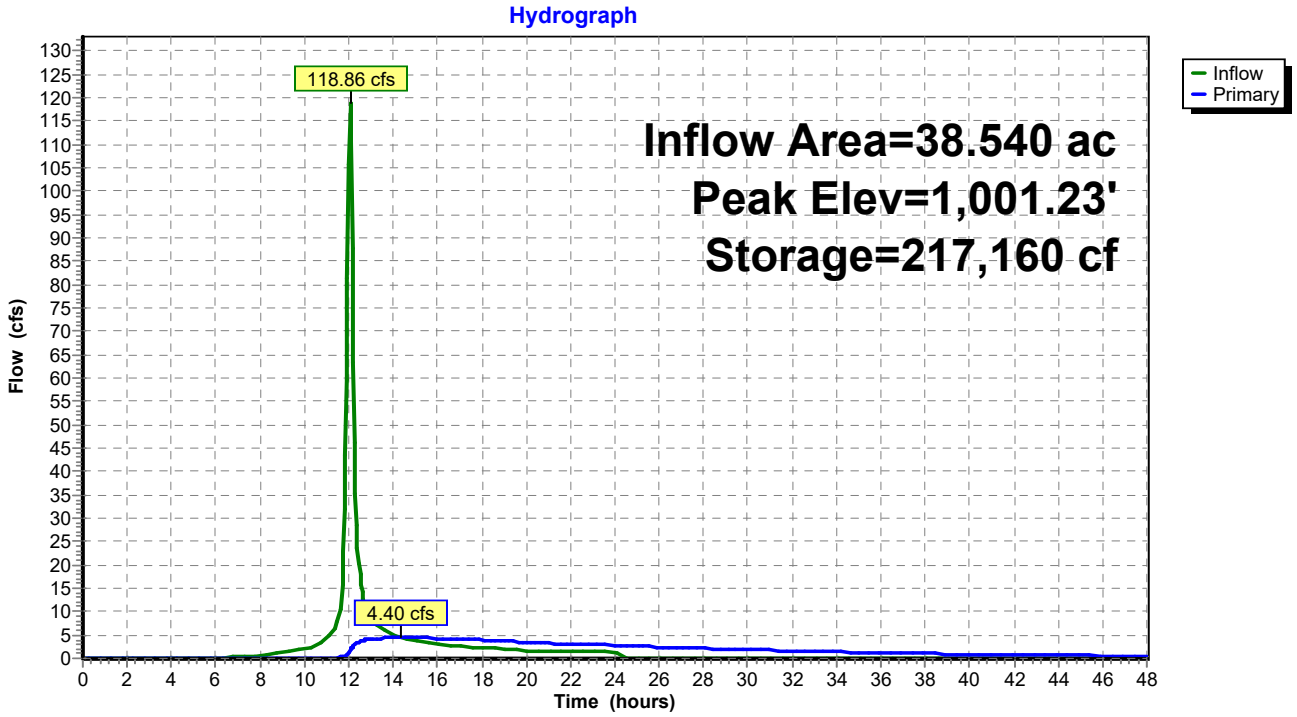
Volume	Invert	Avail.Storage	Storage Description
#1	998.00'	575,807 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
998.00	163,763	0	0
1,000.00	22,818	186,581	186,581
1,002.00	29,774	52,592	239,173
1,004.00	37,349	67,123	306,296
1,006.00	41,841	79,190	385,486
1,008.00	46,596	88,437	473,923
1,010.00	55,288	101,884	575,807

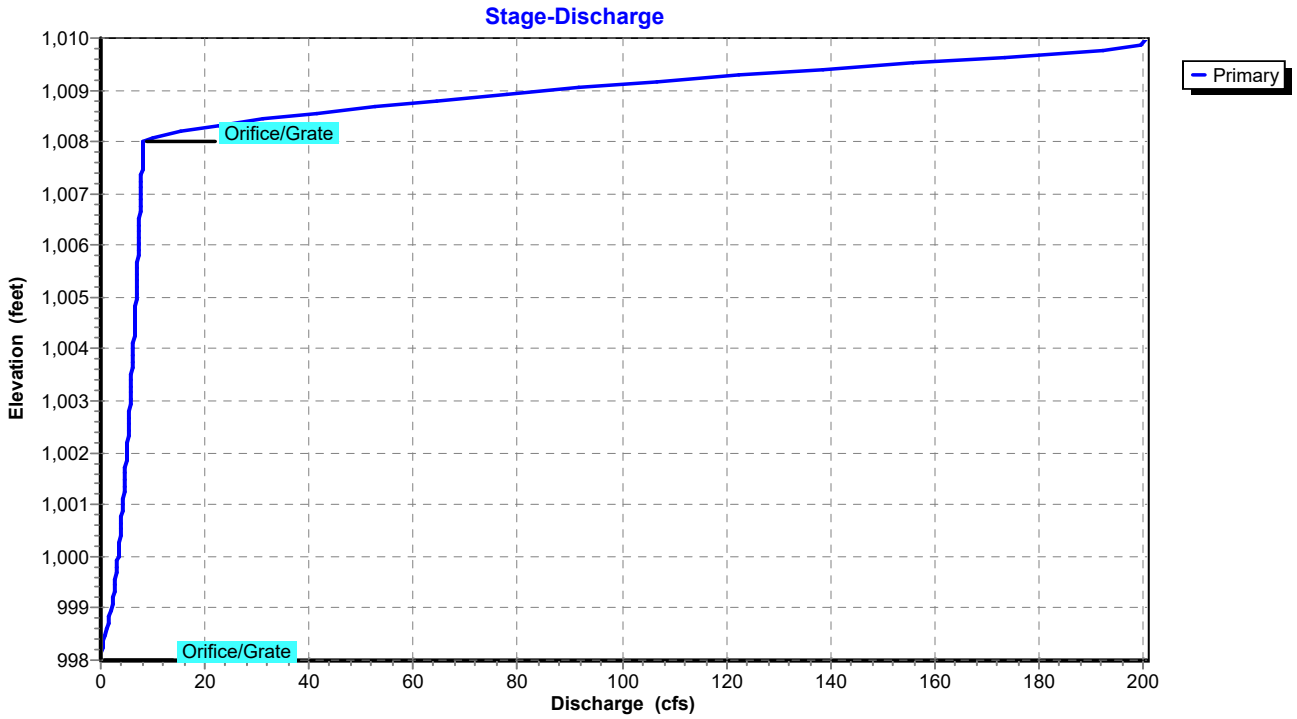
Device	Routing	Invert	Outlet Devices
#1	Primary	997.00'	**48.0" Round Culvert** L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 997.00' / 996.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Device 1	998.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,008.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.40 cfs @ 14.37 hrs HW=1,001.23' (Free Discharge)
└**1=Culvert** (Passes 4.40 cfs of 90.27 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 4.40 cfs @ 8.07 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

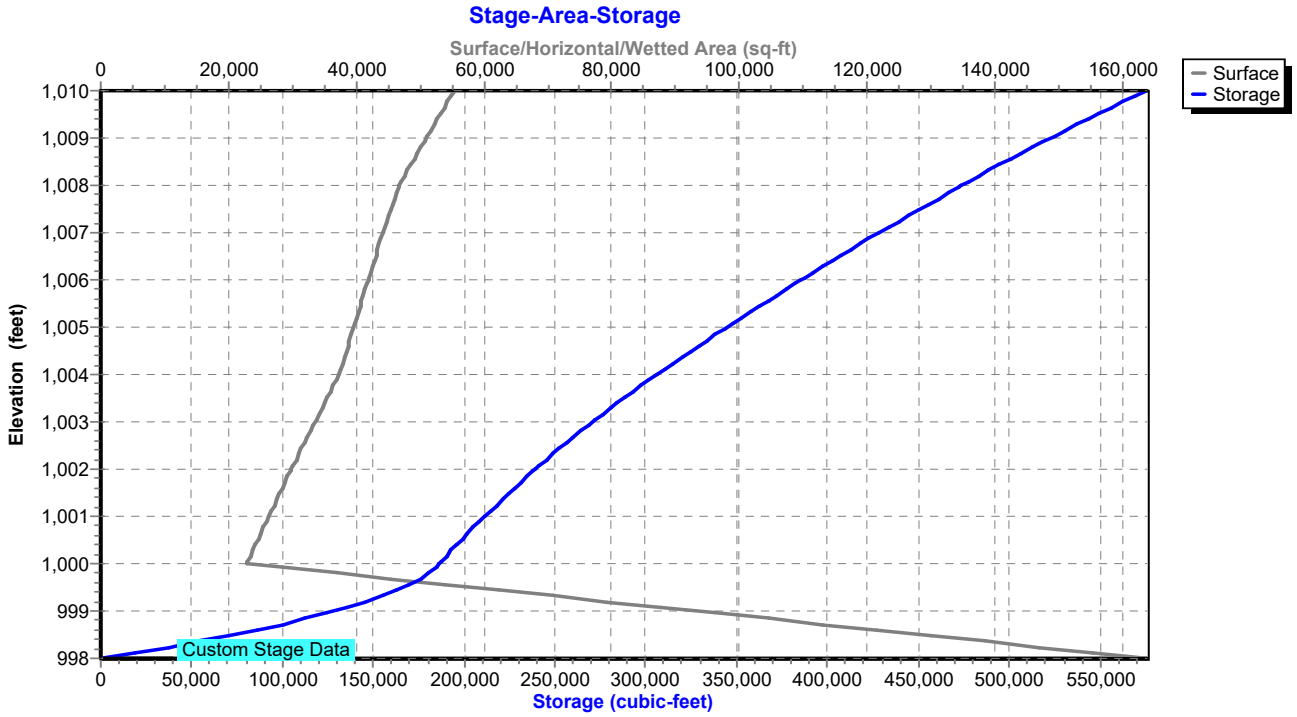
Pond 4P: EDDB #1



Pond 4P: EDDB #1



Pond 4P: EDDB #1



Summary for Pond 5P: EDDB #2

Inflow Area = 32.440 ac, 38.00% Impervious, Inflow Depth = 2.18" for 2-Year event
Inflow = 94.02 cfs @ 12.06 hrs, Volume= 5.900 af
Outflow = 6.29 cfs @ 13.15 hrs, Volume= 5.810 af, Atten= 93%, Lag= 65.9 min
Primary = 6.29 cfs @ 13.15 hrs, Volume= 5.810 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 997.26' @ 13.15 hrs Surf.Area= 48,213 sf Storage= 143,158 cf

Plug-Flow detention time= 320.8 min calculated for 5.804 af (98% of inflow)
Center-of-Mass det. time= 312.7 min (1,132.0 - 819.3)

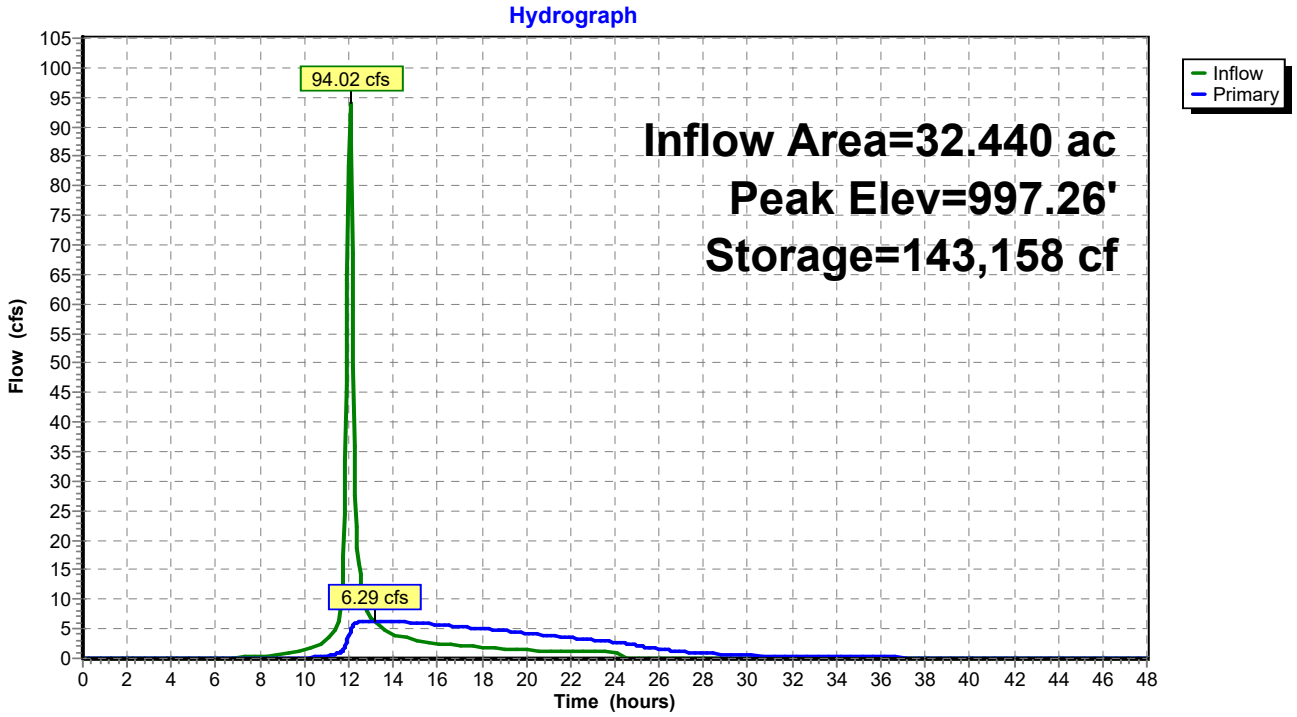
Volume	Invert	Avail.Storage	Storage Description
#1	994.00'	403,026 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
994.00	39,623	0	0
996.00	44,795	84,418	84,418
998.00	50,207	95,002	179,420
1,000.00	55,845	106,052	285,472
1,002.00	61,709	117,554	403,026

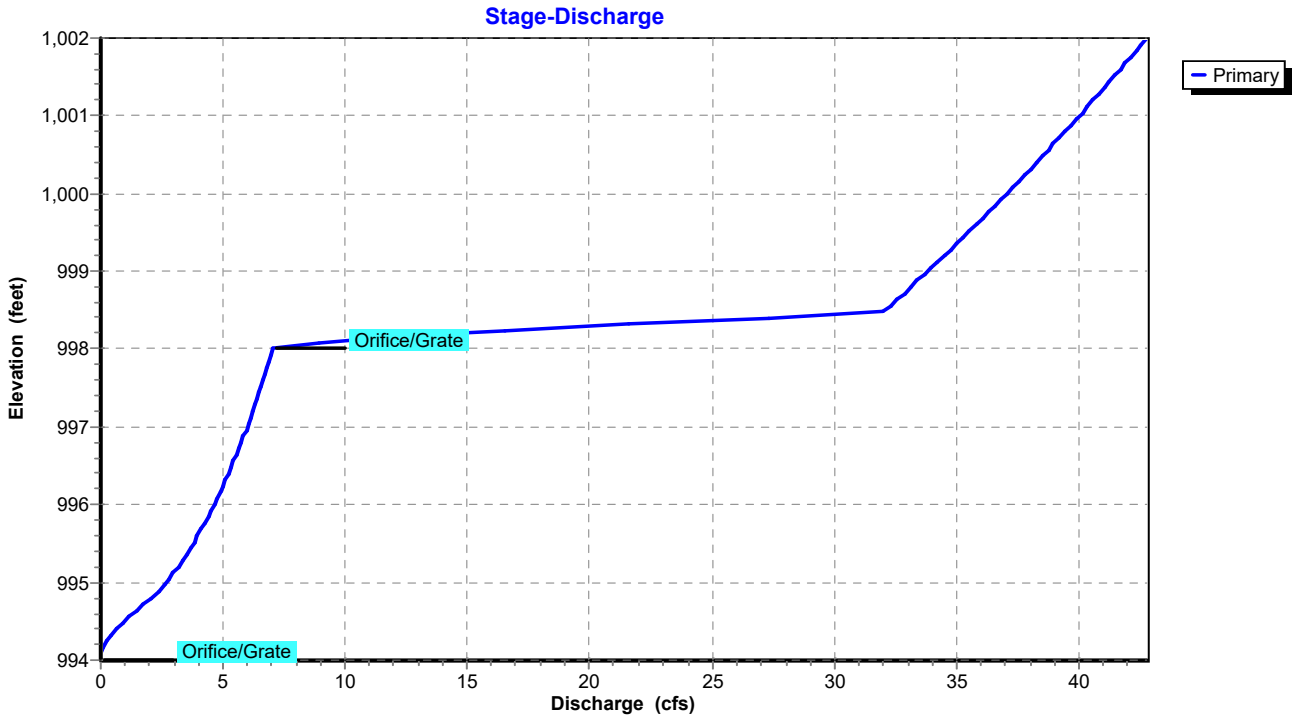
Device	Routing	Invert	Outlet Devices
#1	Primary	993.00'	**24.0" Round Culvert** L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.00' / 992.50' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	994.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	998.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.29 cfs @ 13.15 hrs HW=997.26' (Free Discharge)
└**1=Culvert** (Passes 6.29 cfs of 27.32 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 6.29 cfs @ 8.00 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

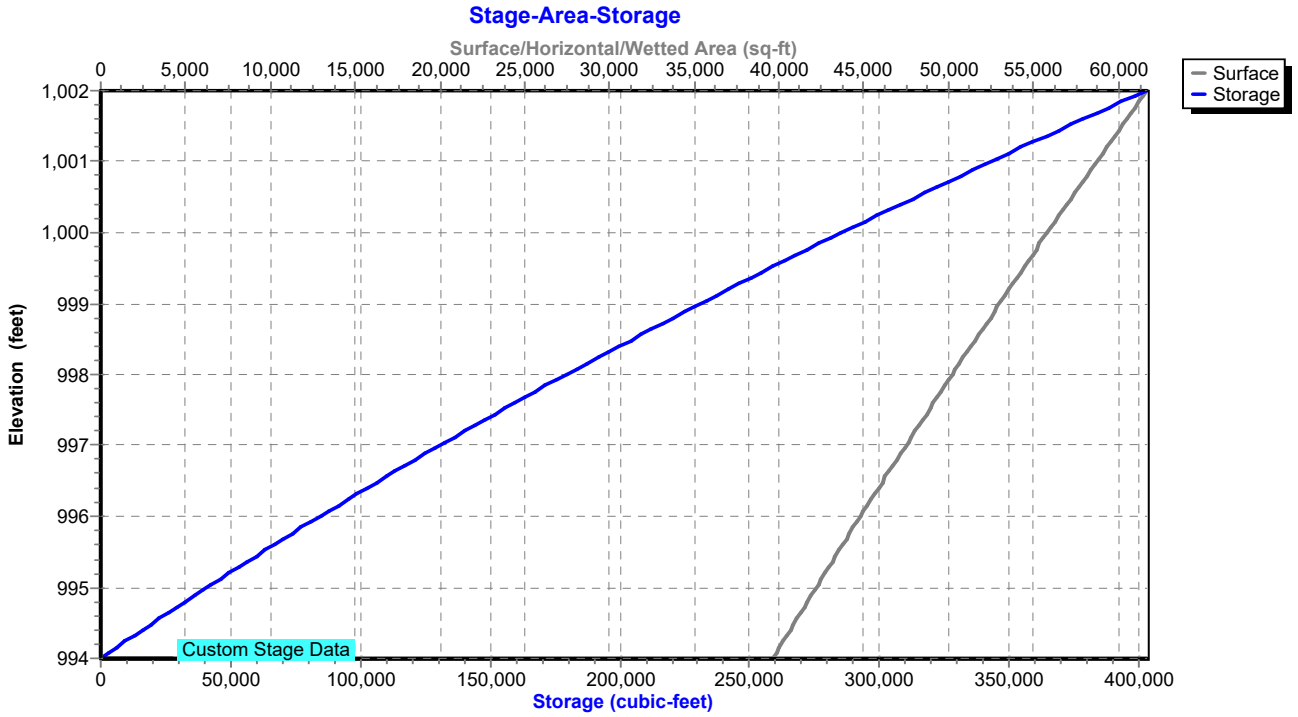
Pond 5P: EDDB #2



Pond 5P: EDDB #2



Pond 5P: EDDB #2

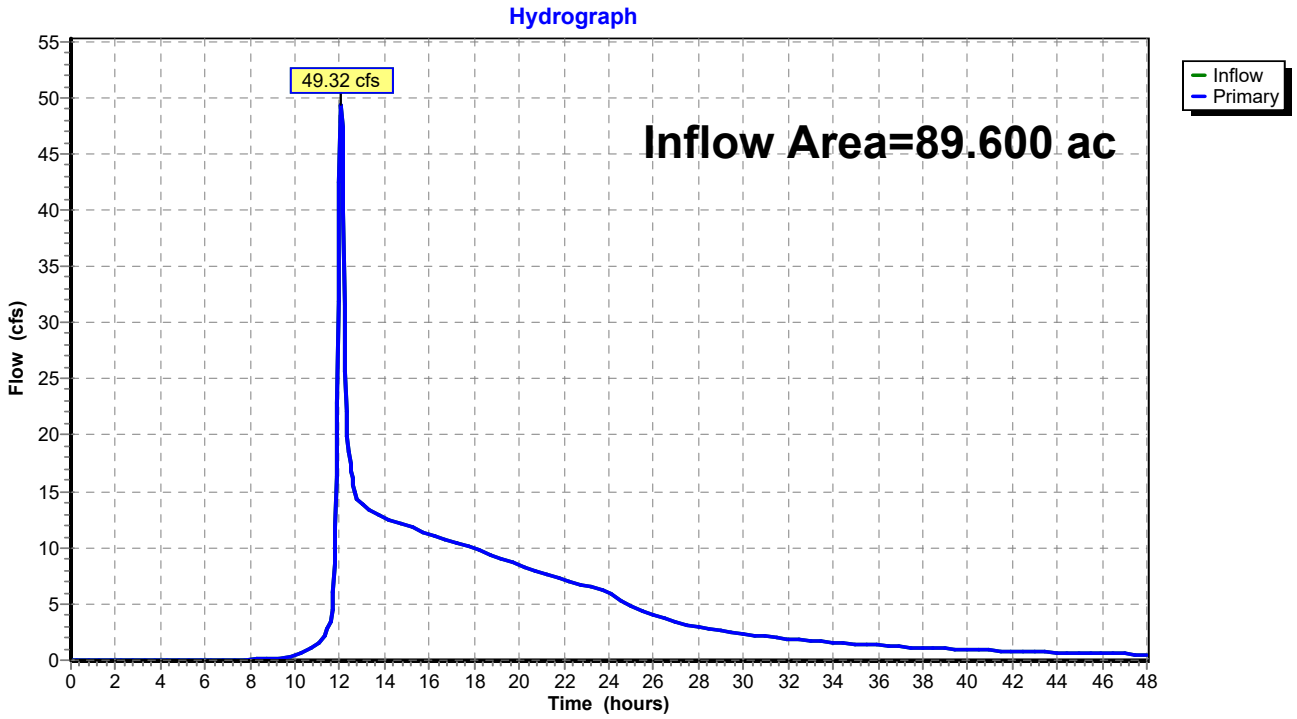


Summary for Link 2L: RP-1

Inflow Area = 89.600 ac, 36.41% Impervious, Inflow Depth > 1.98" for 2-Year event
Inflow = 49.32 cfs @ 12.06 hrs, Volume= 14.820 af
Primary = 49.32 cfs @ 12.06 hrs, Volume= 14.820 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2L: RP-1

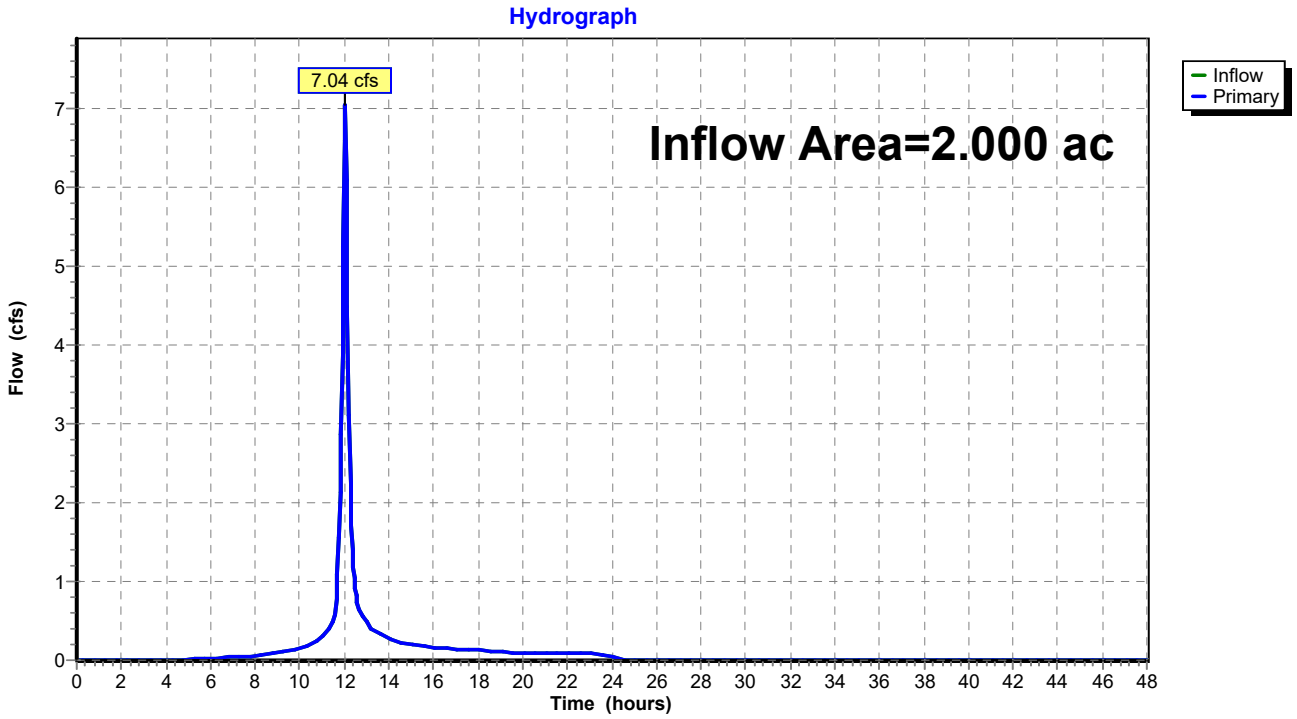


Summary for Link 3L: RP-2

Inflow Area = 2.000 ac, 65.00% Impervious, Inflow Depth = 2.64" for 2-Year event
Inflow = 7.04 cfs @ 12.04 hrs, Volume= 0.439 af
Primary = 7.04 cfs @ 12.04 hrs, Volume= 0.439 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: RP-2

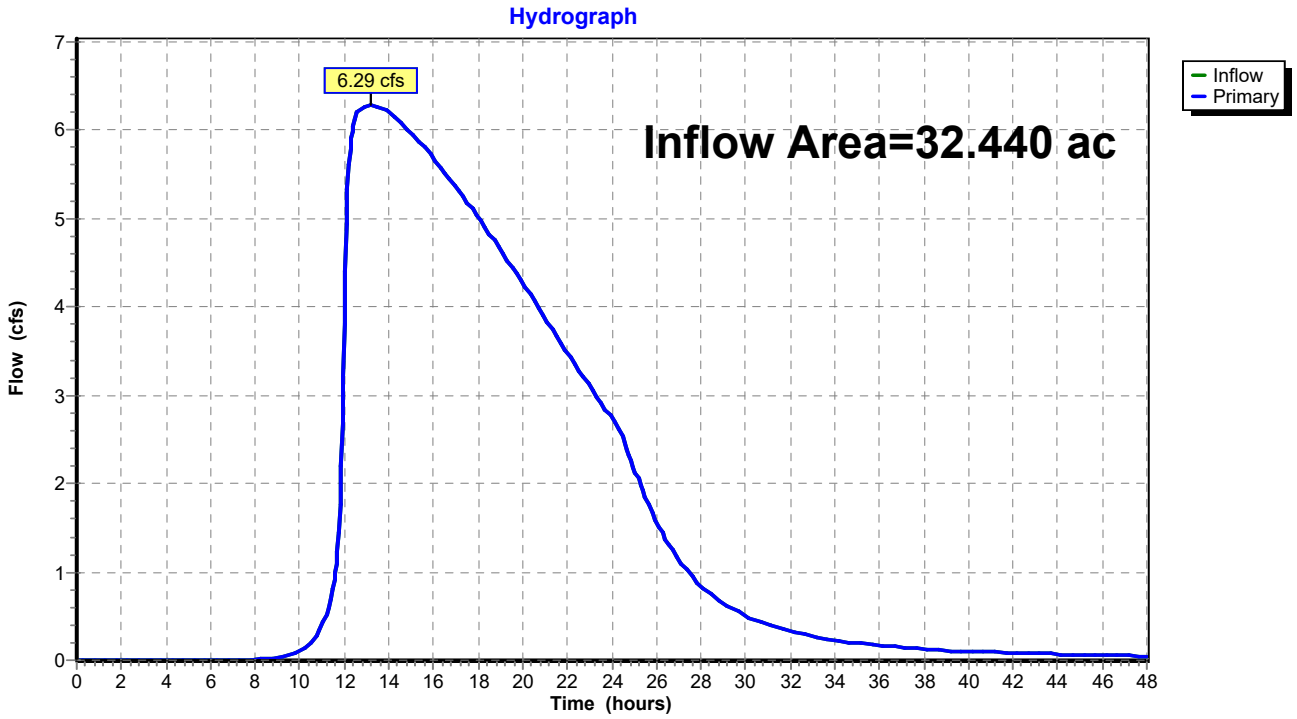


Summary for Link 4L: RP-3

Inflow Area = 32.440 ac, 38.00% Impervious, Inflow Depth > 2.15" for 2-Year event
Inflow = 6.29 cfs @ 13.15 hrs, Volume= 5.810 af
Primary = 6.29 cfs @ 13.15 hrs, Volume= 5.810 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 4L: RP-3

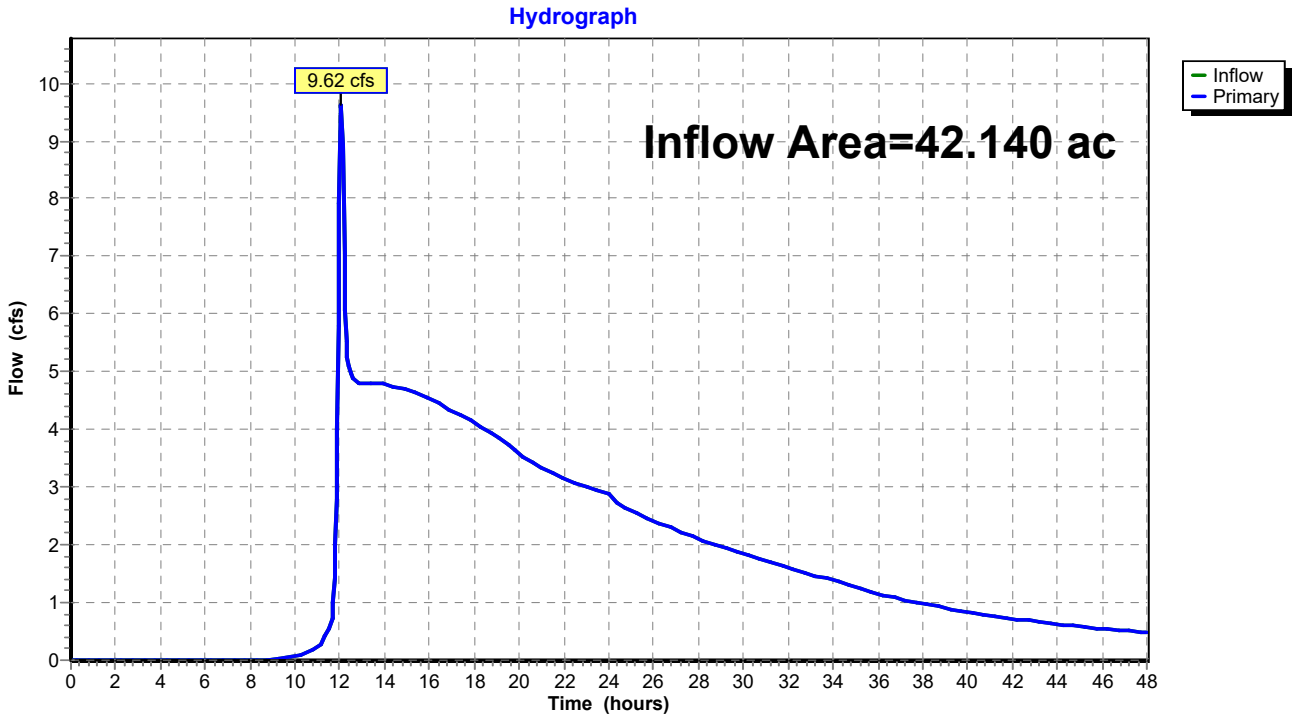


Summary for Link 5L: RP-4

Inflow Area = 42.140 ac, 45.07% Impervious, Inflow Depth > 1.94" for 2-Year event
Inflow = 9.62 cfs @ 12.08 hrs, Volume= 6.795 af
Primary = 9.62 cfs @ 12.08 hrs, Volume= 6.795 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: RP-4



Summary for Subcatchment 1S: ON-SITE #1

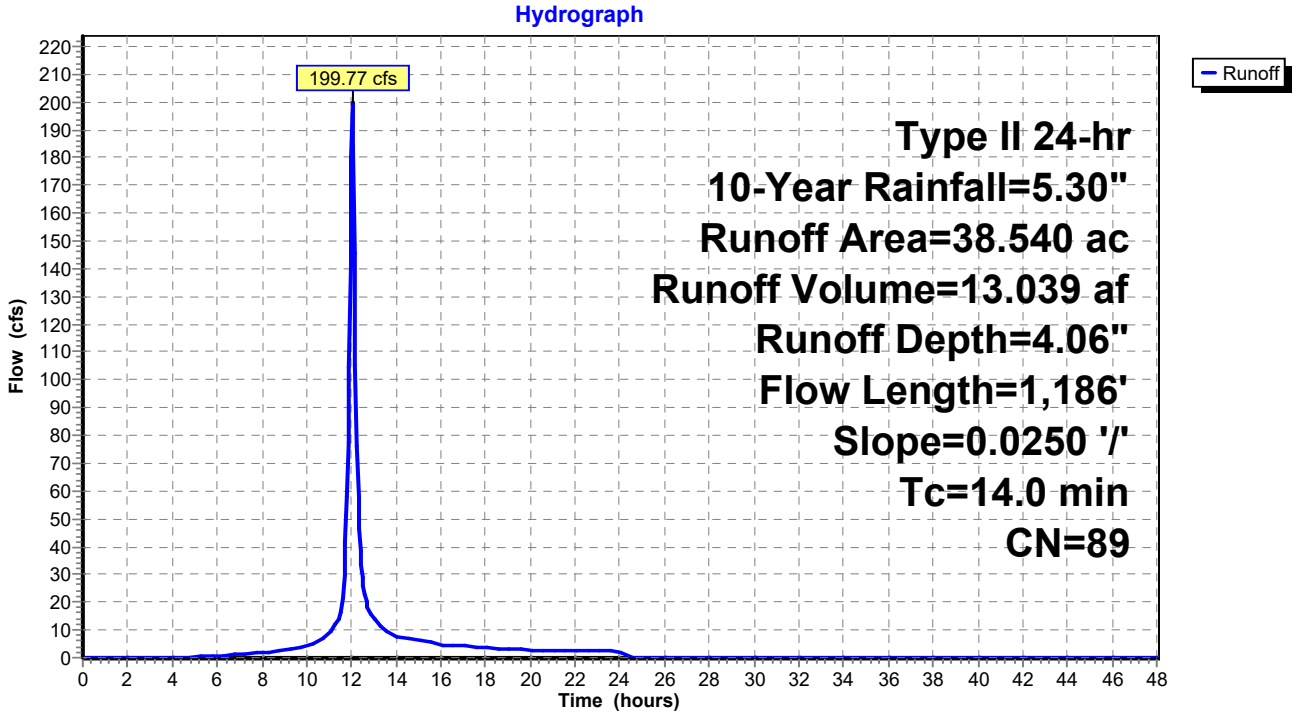
Runoff = 199.77 cfs @ 12.05 hrs, Volume= 13.039 af, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
13.930	92	1/8 acre lots, 65% imp, HSG D
0.580	85	1/2 acre lots, 25% imp, HSG D
22.620	87	1/4 acre lots, 38% imp, HSG D
1.410	95	Urban commercial, 85% imp, HSG D
38.540	89	Weighted Average
19.546		50.72% Pervious Area
18.994		49.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 1S: ON-SITE #1



Summary for Subcatchment 3S: ON-SITE #3

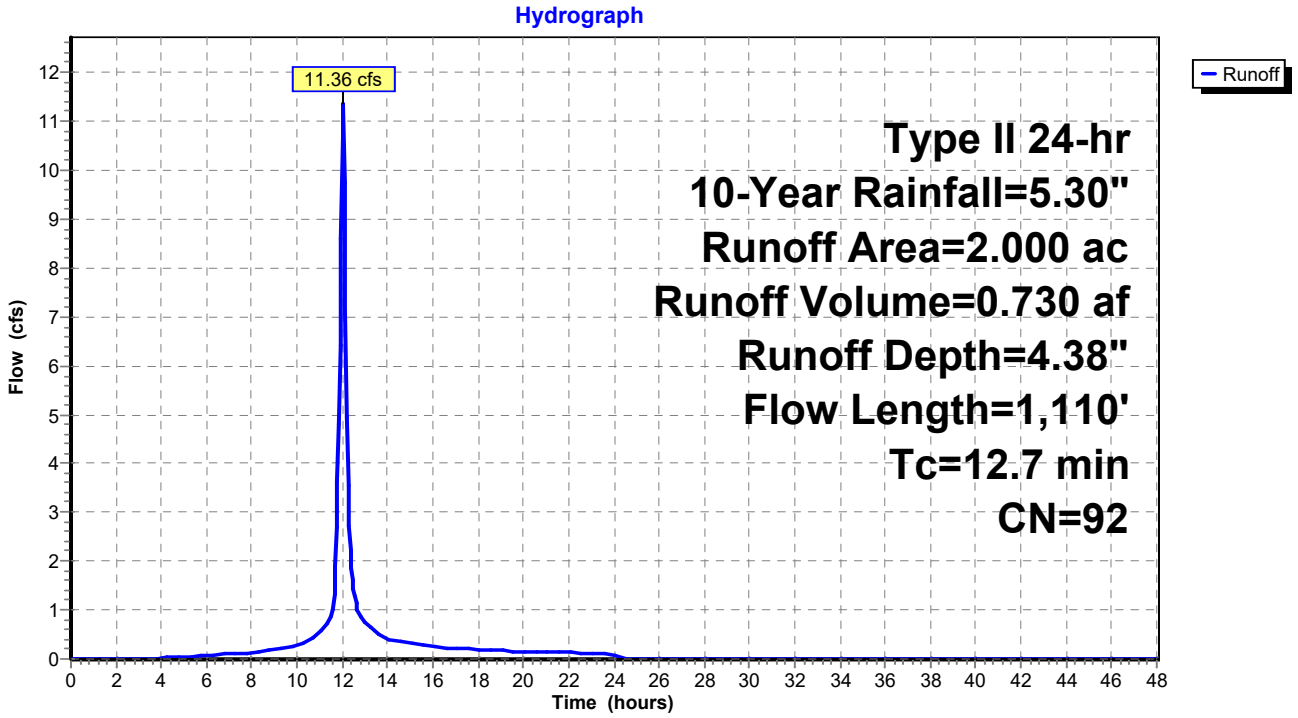
Runoff = 11.36 cfs @ 12.04 hrs, Volume= 0.730 af, Depth= 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
2.000	92	1/8 acre lots, 65% imp, HSG D
0.700		35.00% Pervious Area
1.300		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
7.8	1,060	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.7	1,110	Total			

Subcatchment 3S: ON-SITE #3



Summary for Subcatchment 5S: OFF-SITE #1

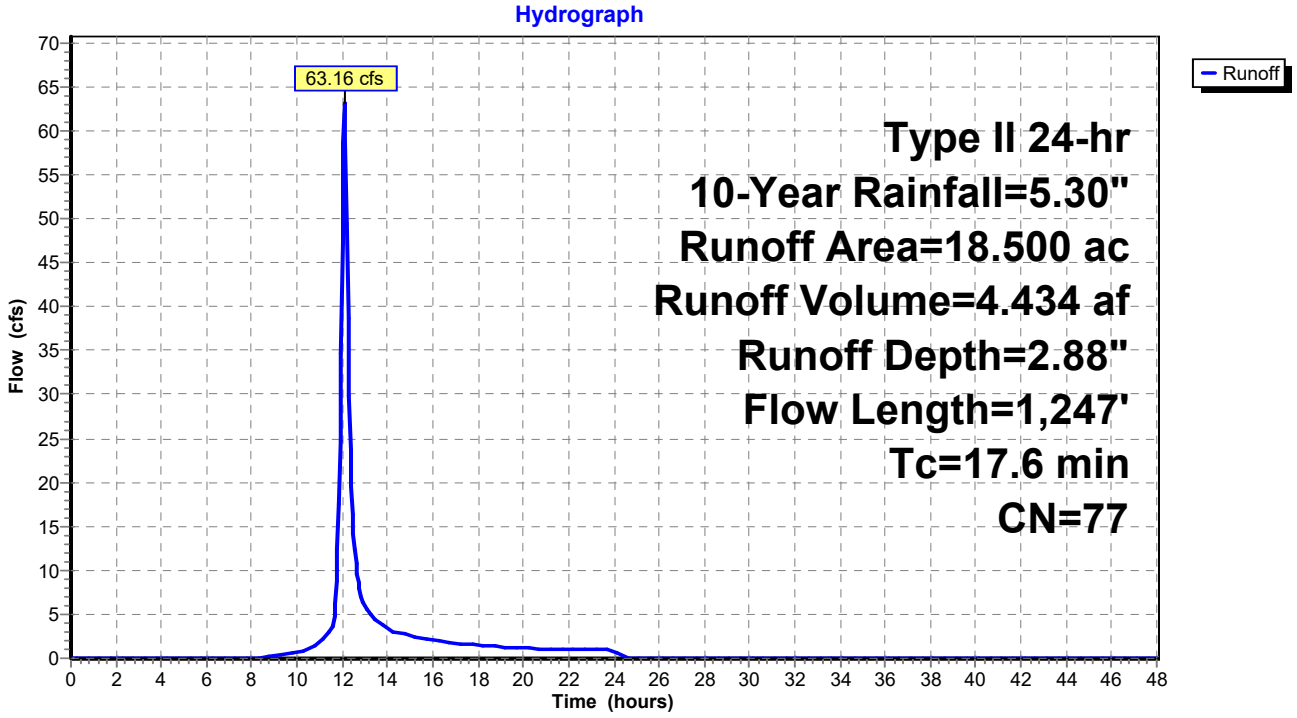
Runoff = 63.16 cfs @ 12.10 hrs, Volume= 4.434 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.860	82	Woods/grass comb., Fair, HSG D
18.500	77	Weighted Average
18.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
9.2	1,147	0.0192	2.08		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
17.6	1,247	Total			

Subcatchment 5S: OFF-SITE #1



Summary for Subcatchment 6S: ON-SITE #5

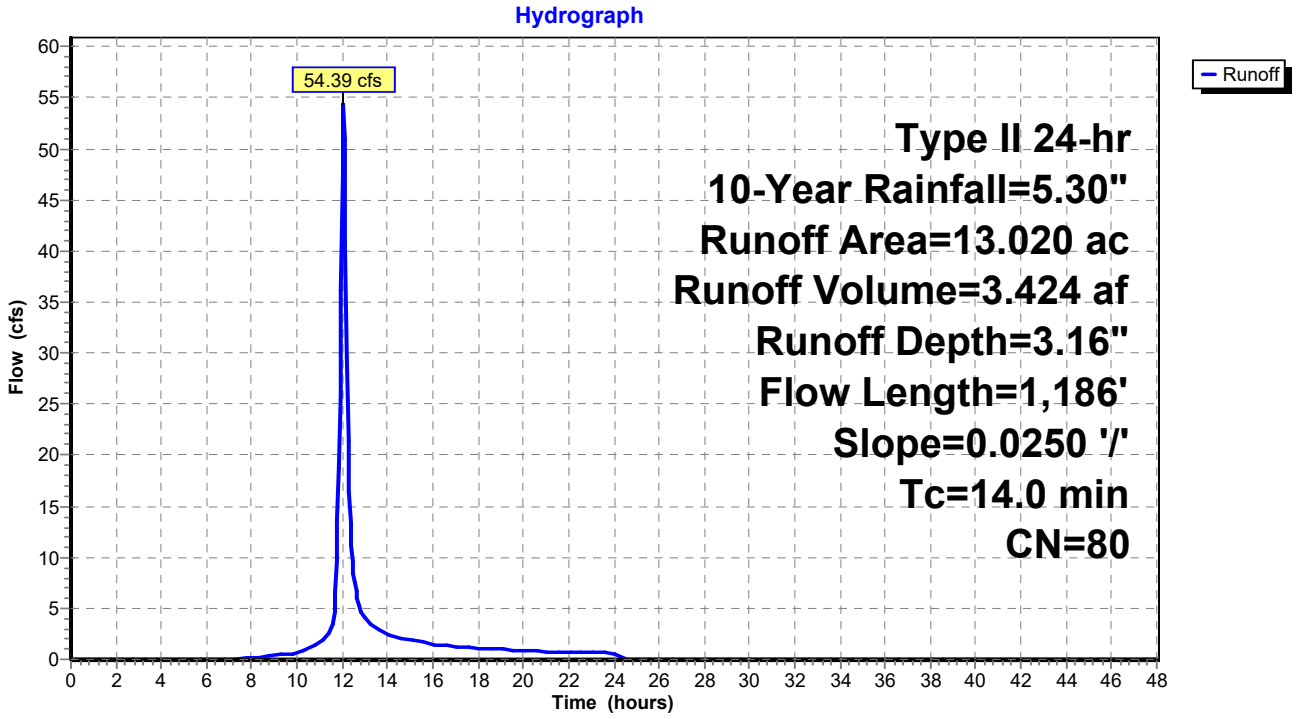
Runoff = 54.39 cfs @ 12.06 hrs, Volume= 3.424 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
13.020	80	>75% Grass cover, Good, HSG D
13.020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 6S: ON-SITE #5



Summary for Subcatchment 7S: ON-SITE #2

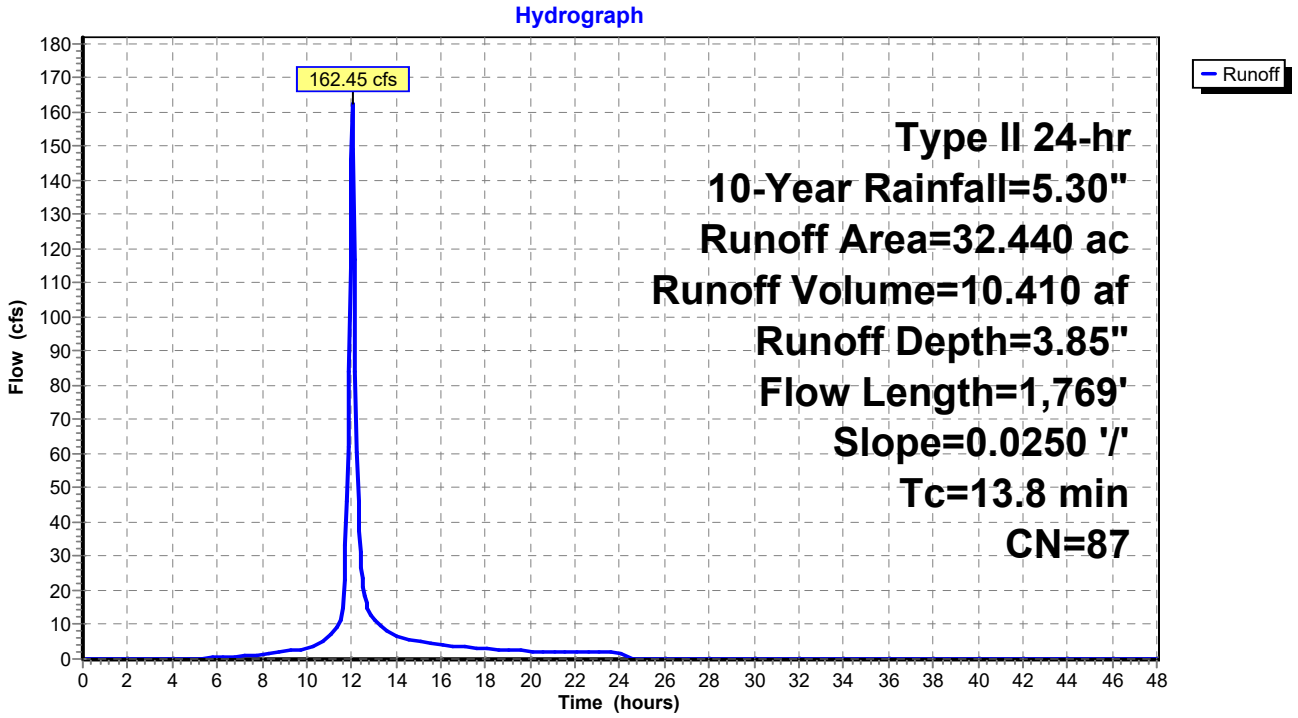
Runoff = 162.45 cfs @ 12.05 hrs, Volume= 10.410 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
32.440	87	1/4 acre lots, 38% imp, HSG D
20.113		62.00% Pervious Area
12.327		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
8.9	1,719	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
13.8	1,769	Total			

Subcatchment 7S: ON-SITE #2



Summary for Subcatchment 8S: ON-SITE #4

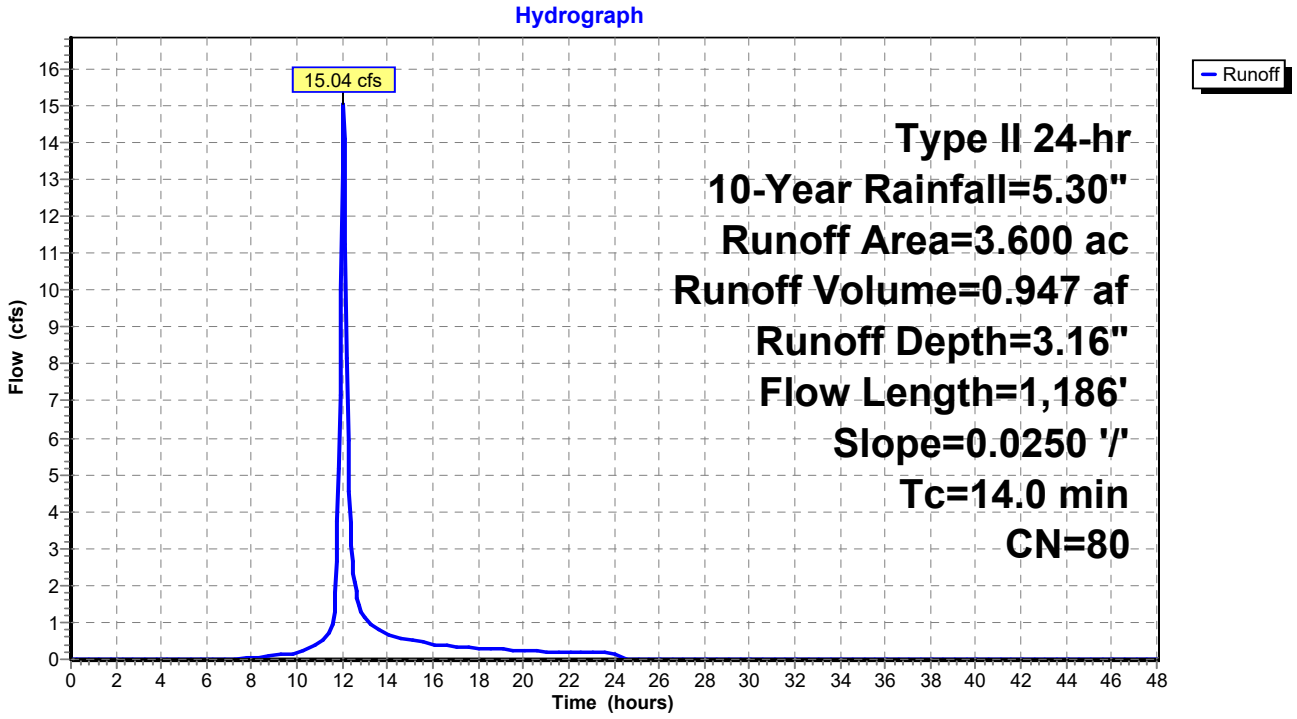
Runoff = 15.04 cfs @ 12.06 hrs, Volume= 0.947 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
3.600	80	>75% Grass cover, Good, HSG D
3.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 8S: ON-SITE #4



Summary for Reach 6R: Reach 3

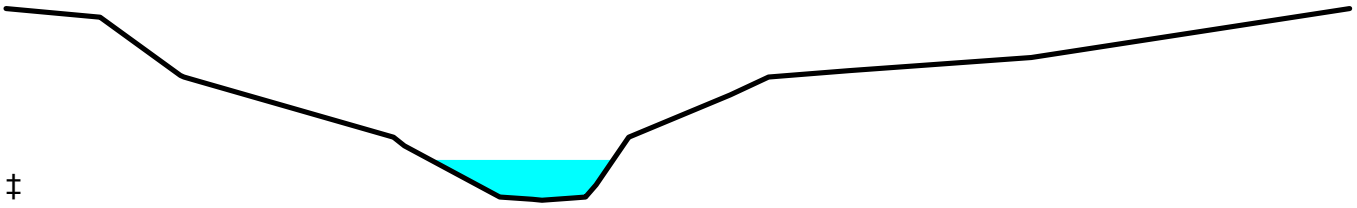
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.59' @ 12.35 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 58.68 cfs @ 12.23 hrs, Volume= 4.434 af
Outflow = 55.22 cfs @ 12.35 hrs, Volume= 4.434 af, Atten= 6%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.35 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 16.3 min

Peak Storage= 13,326 cf @ 12.28 hrs
Average Depth at Peak Storage= 1.35'
Bank-Full Depth= 6.40' Flow Area= 252.4 sf, Capacity= 2,150.14 cfs

Custom cross-section, Length= 1,041.0' Slope= 0.0088 '/' (110 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 989.92', Outlet Invert= 980.77'

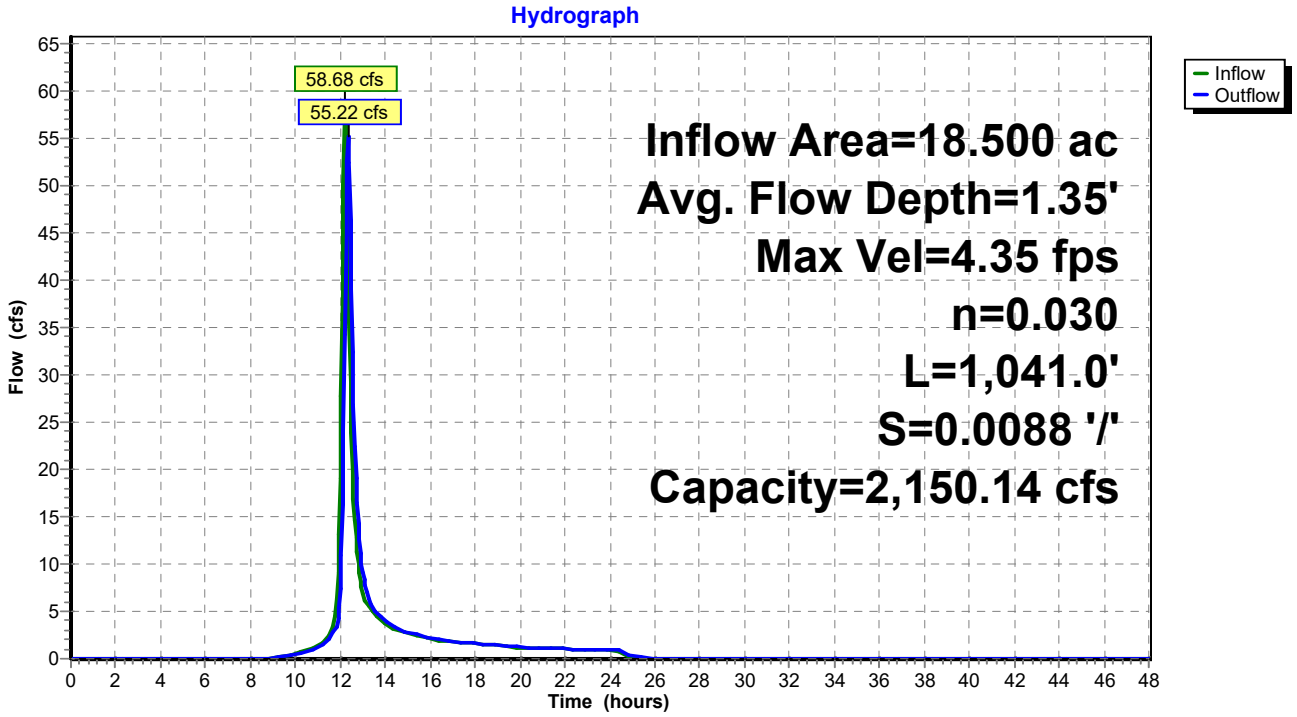


‡

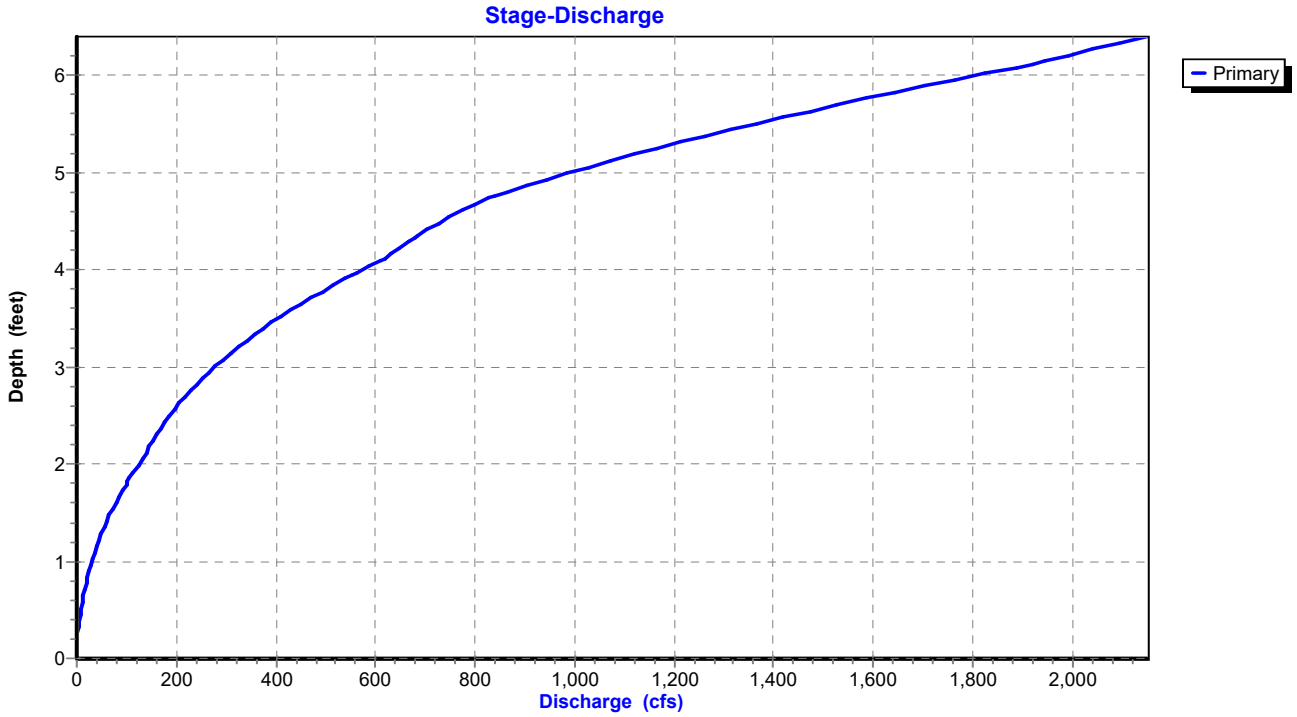
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	996.29	0.00
7.00	996.00	0.29
12.99	994.06	2.23
13.24	994.00	2.29
14.48	993.84	2.45
28.84	992.00	4.29
29.66	991.71	4.58
36.75	990.00	6.29
39.18	989.92	6.37
39.90	989.89	6.40
42.20	989.97	6.32
43.14	990.00	6.29
43.91	990.40	5.89
46.34	992.00	4.29
53.90	993.41	2.88
56.74	994.00	2.29
62.76	994.22	2.07
76.31	994.65	1.64
100.00	996.29	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
3.52	62.5	37.1	65,011	410.25
3.95	79.1	42.6	82,369	555.08
4.11	85.9	44.7	89,447	617.31
4.17	88.6	46.6	92,223	631.78
4.33	96.2	51.5	100,189	678.51
4.76	121.1	66.4	126,018	838.92
6.11	225.0	90.3	234,197	1,919.54
6.40	252.4	101.5	262,697	2,150.14

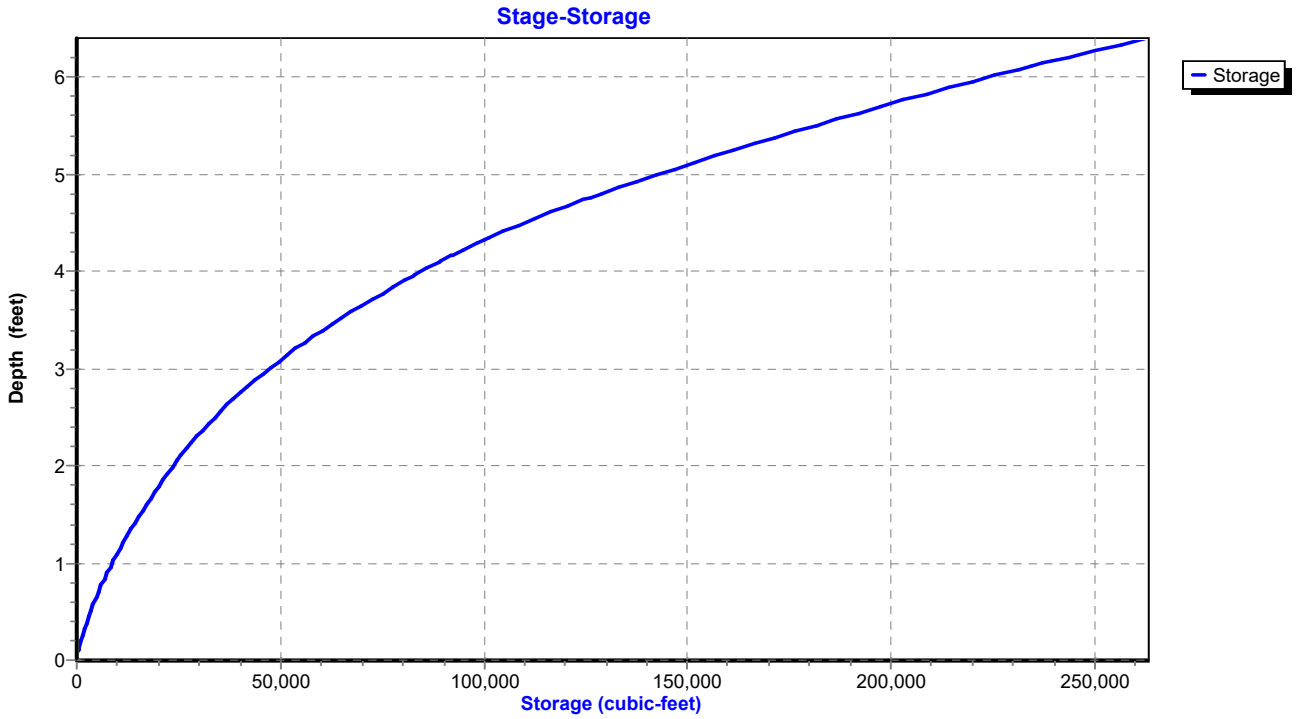
Reach 6R: Reach 3



Reach 6R: Reach 3



Reach 6R: Reach 3



Summary for Reach 7R: Reach 2

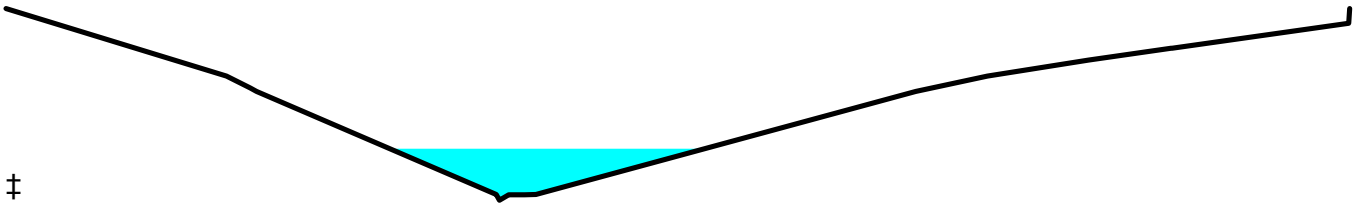
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.20' @ 25.10 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 61.67 cfs @ 12.13 hrs, Volume= 4.434 af
Outflow = 58.68 cfs @ 12.23 hrs, Volume= 4.434 af, Atten= 5%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.26 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 1.49 fps, Avg. Travel Time= 9.6 min

Peak Storage= 11,769 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 3.24' Flow Area= 204.3 sf, Capacity= 1,999.47 cfs

Custom cross-section, Length= 853.0' Slope= 0.0225 '/' (106 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 1,009.12', Outlet Invert= 989.90'

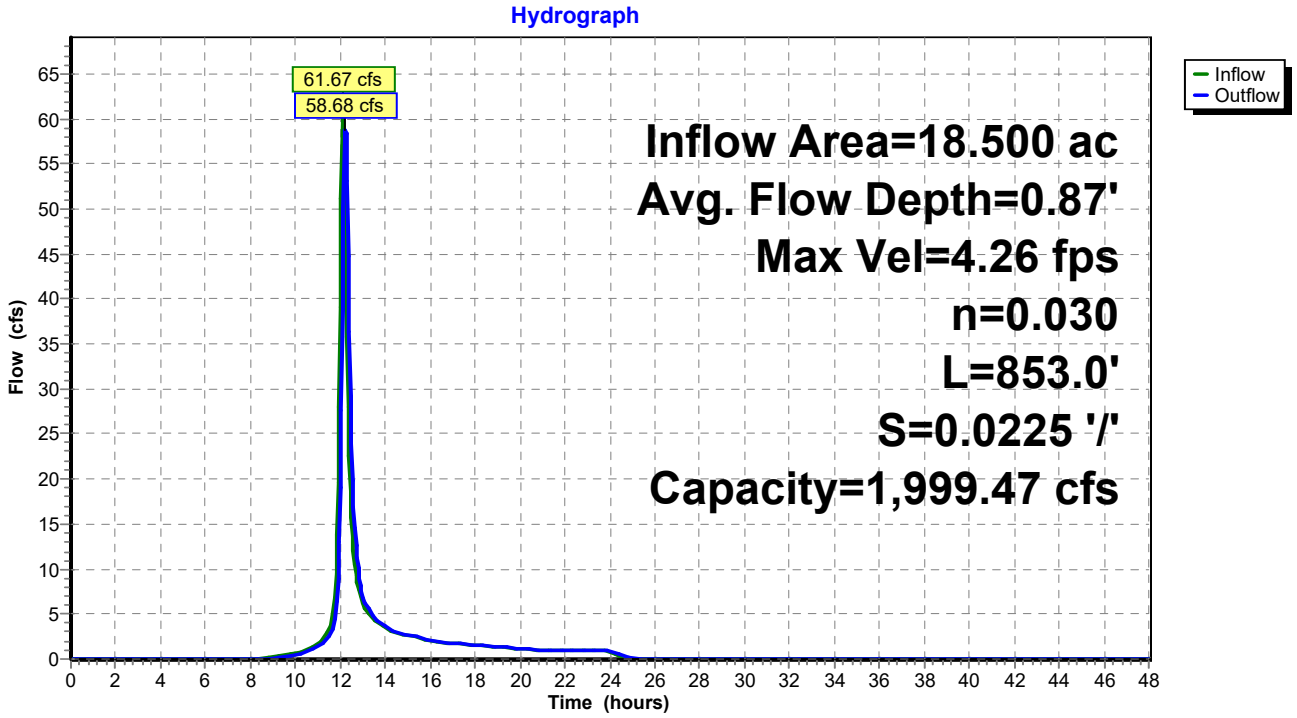


‡

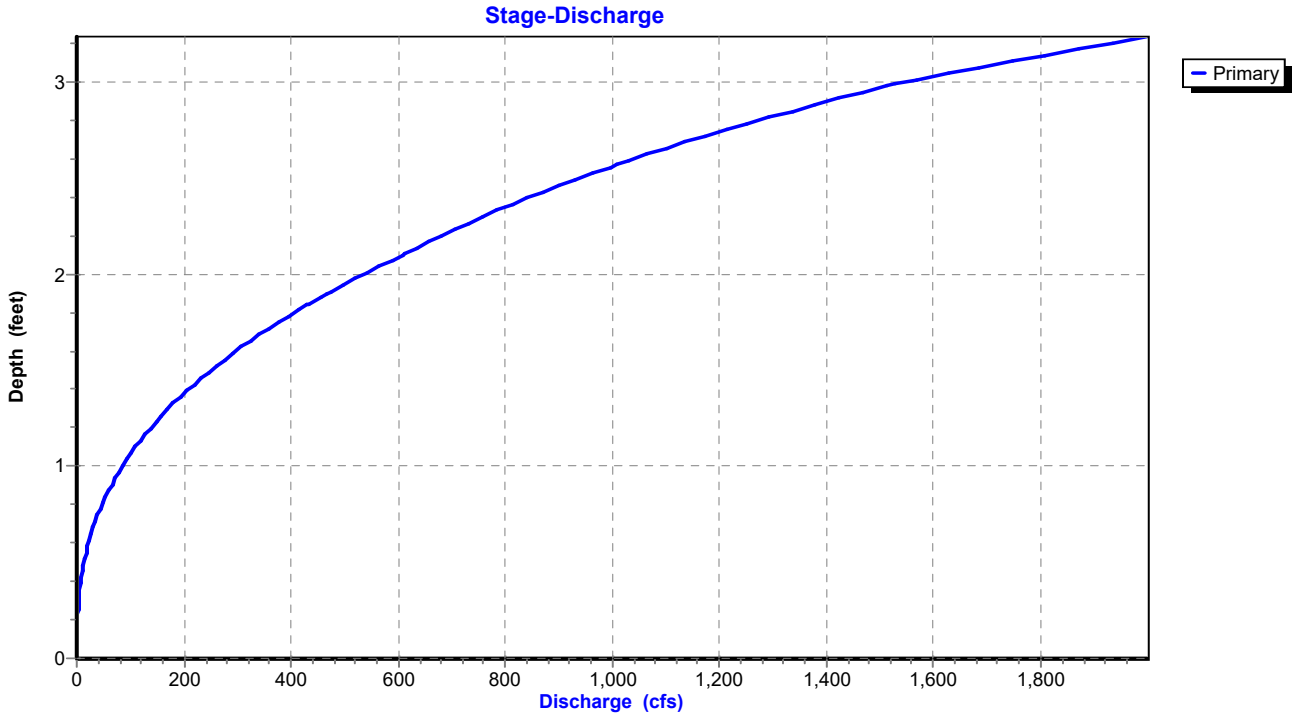
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,009.14	0.00
22.15	1,008.00	1.14
24.54	1,007.80	1.34
25.18	1,007.74	1.40
49.26	1,006.00	3.14
49.59	1,005.90	3.24
50.51	1,005.99	3.15
52.13	1,005.99	3.15
53.24	1,006.00	3.14
91.41	1,007.74	1.40
98.60	1,008.00	1.14
108.78	1,008.27	0.87
117.07	1,008.47	0.67
117.16	1,008.47	0.67
134.91	1,008.89	0.25
135.00	1,009.14	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	818.03
2.57	122.0	104.3	104,091	1,007.45
2.99	171.2	130.2	146,042	1,527.76
3.24	204.3	135.4	174,303	1,999.47

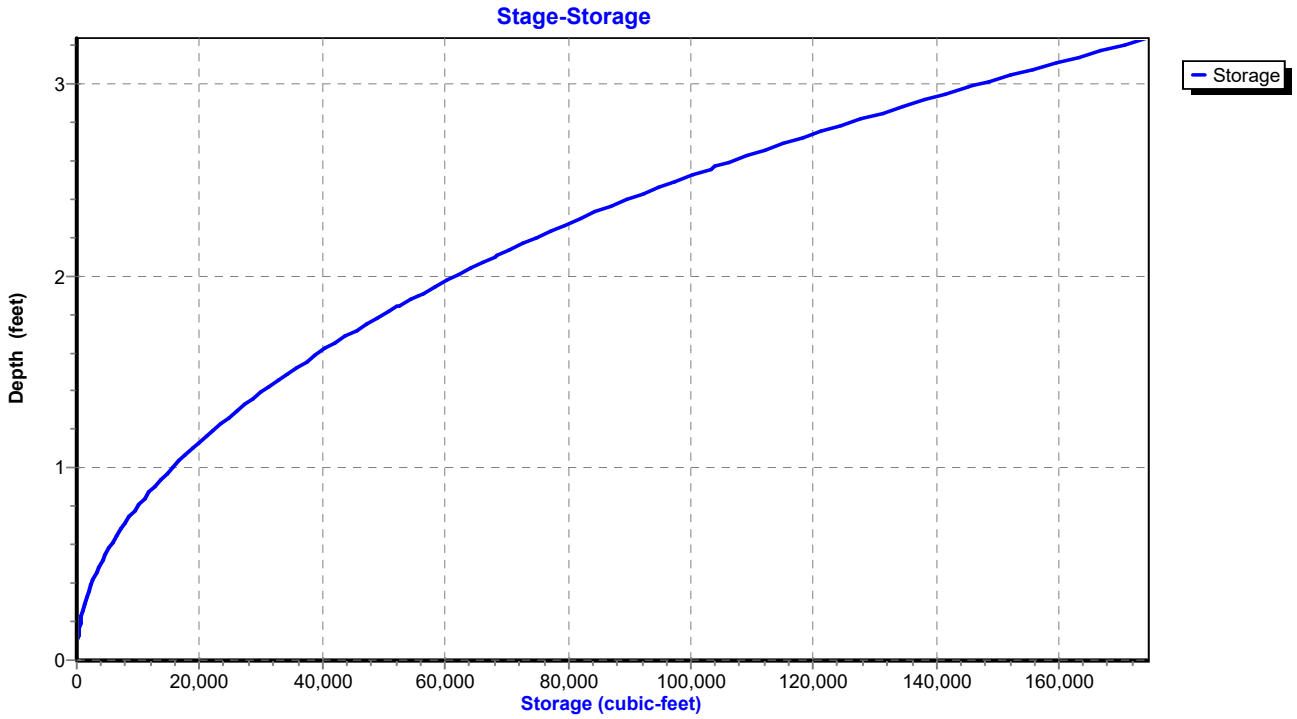
Reach 7R: Reach 2



Reach 7R: Reach 2



Reach 7R: Reach 2



Summary for Reach 8R: REACH 1

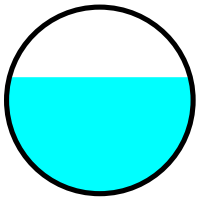
[52] Hint: Inlet/Outlet conditions not evaluated

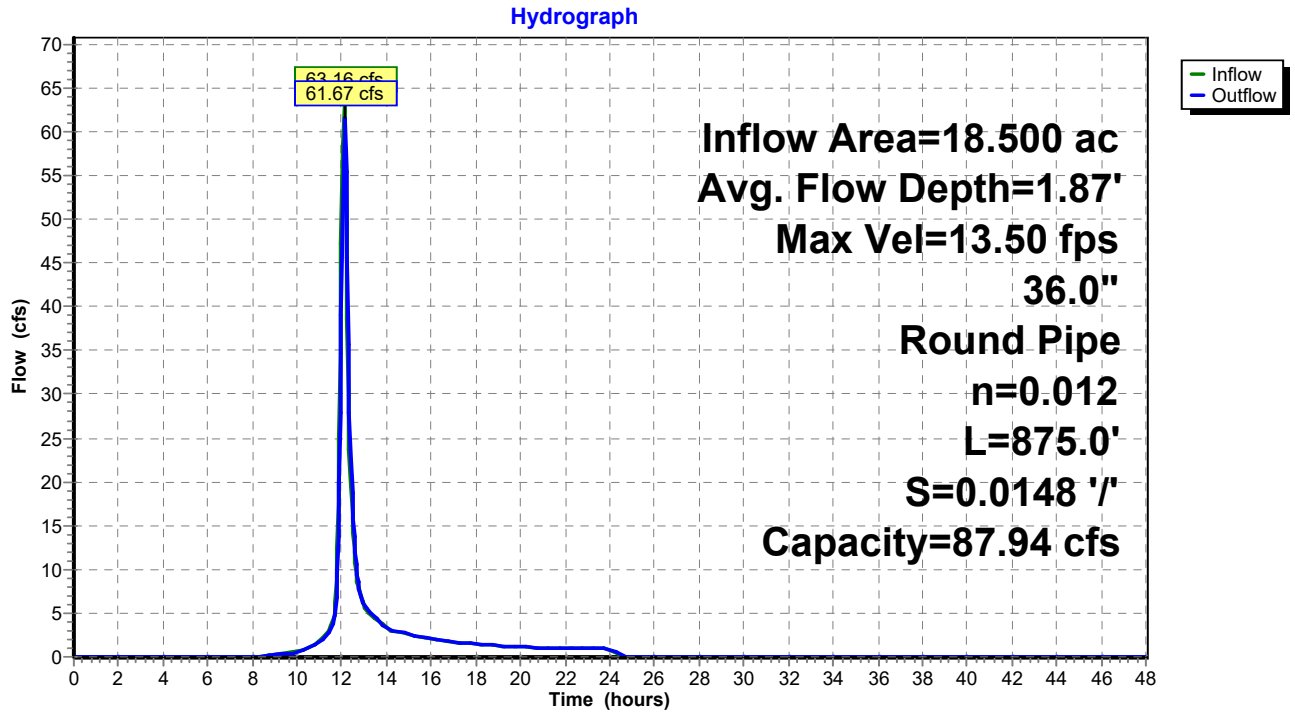
Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event
Inflow = 63.16 cfs @ 12.10 hrs, Volume= 4.434 af
Outflow = 61.67 cfs @ 12.13 hrs, Volume= 4.434 af, Atten= 2%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.50 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 4.58 fps, Avg. Travel Time= 3.2 min

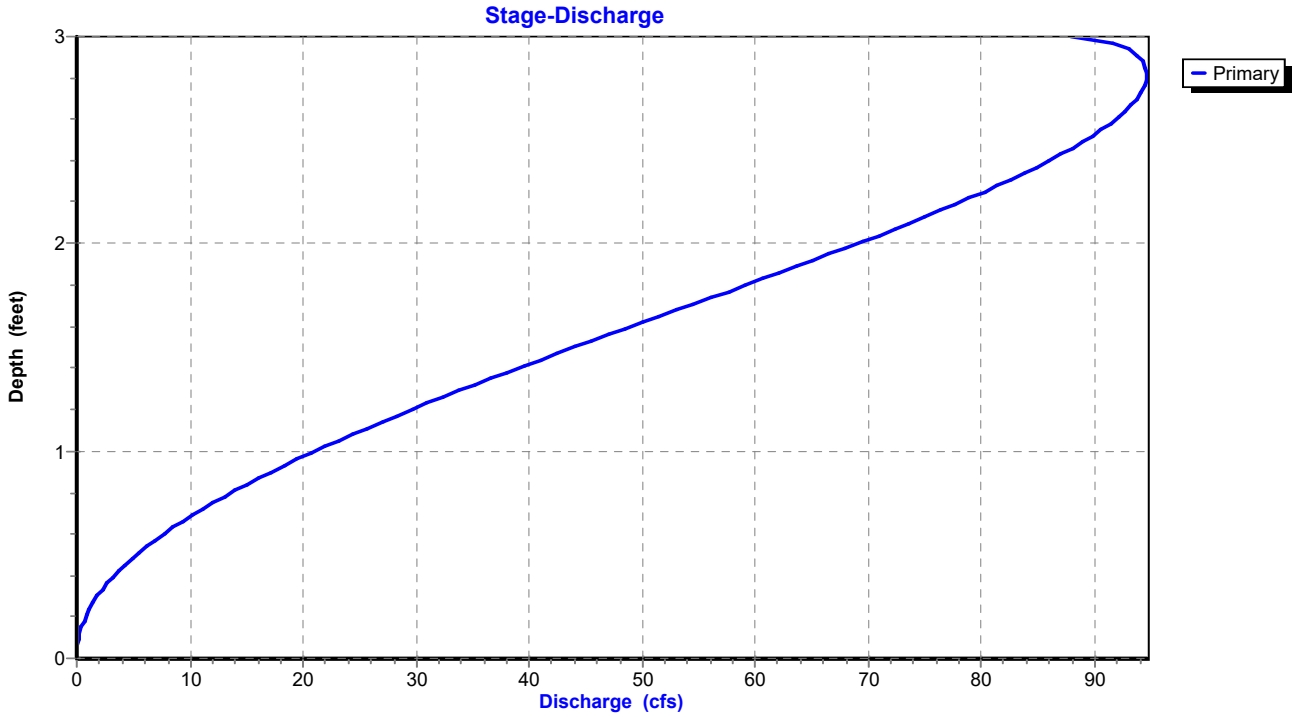
Peak Storage= 4,063 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.87'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 87.94 cfs

36.0" Round Pipe
n= 0.012 Concrete pipe, finished
Length= 875.0' Slope= 0.0148 '/'
Inlet Invert= 1,021.96', Outlet Invert= 1,009.00'

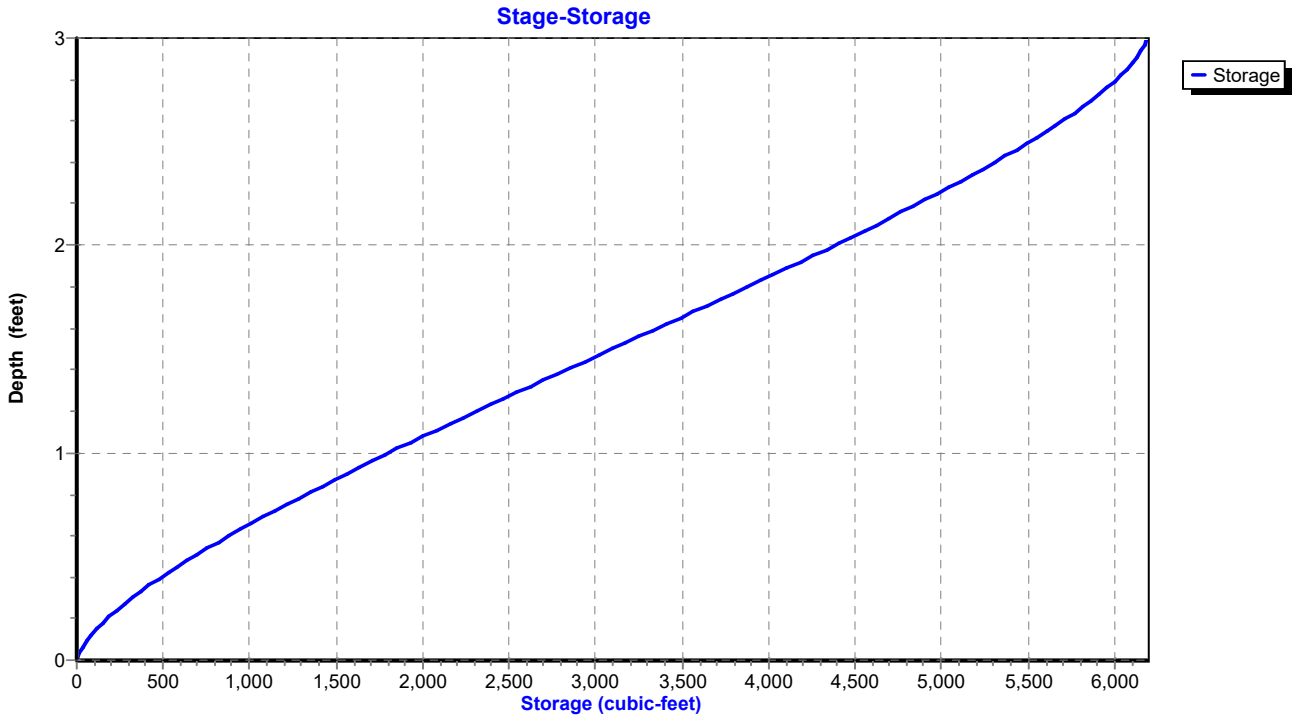




Reach 8R: REACH 1



Reach 8R: REACH 1



Summary for Pond 4P: EDDB #1

Inflow Area = 38.540 ac, 49.28% Impervious, Inflow Depth = 4.06" for 10-Year event
Inflow = 199.77 cfs @ 12.05 hrs, Volume= 13.039 af
Outflow = 7.18 cfs @ 14.28 hrs, Volume= 11.419 af, Atten= 96%, Lag= 133.6 min
Primary = 7.18 cfs @ 14.28 hrs, Volume= 11.419 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 1,005.89' @ 14.28 hrs Surf.Area= 41,588 sf Storage= 380,782 cf

Plug-Flow detention time= 684.6 min calculated for 11.419 af (88% of inflow)
Center-of-Mass det. time= 624.8 min (1,421.4 - 796.6)

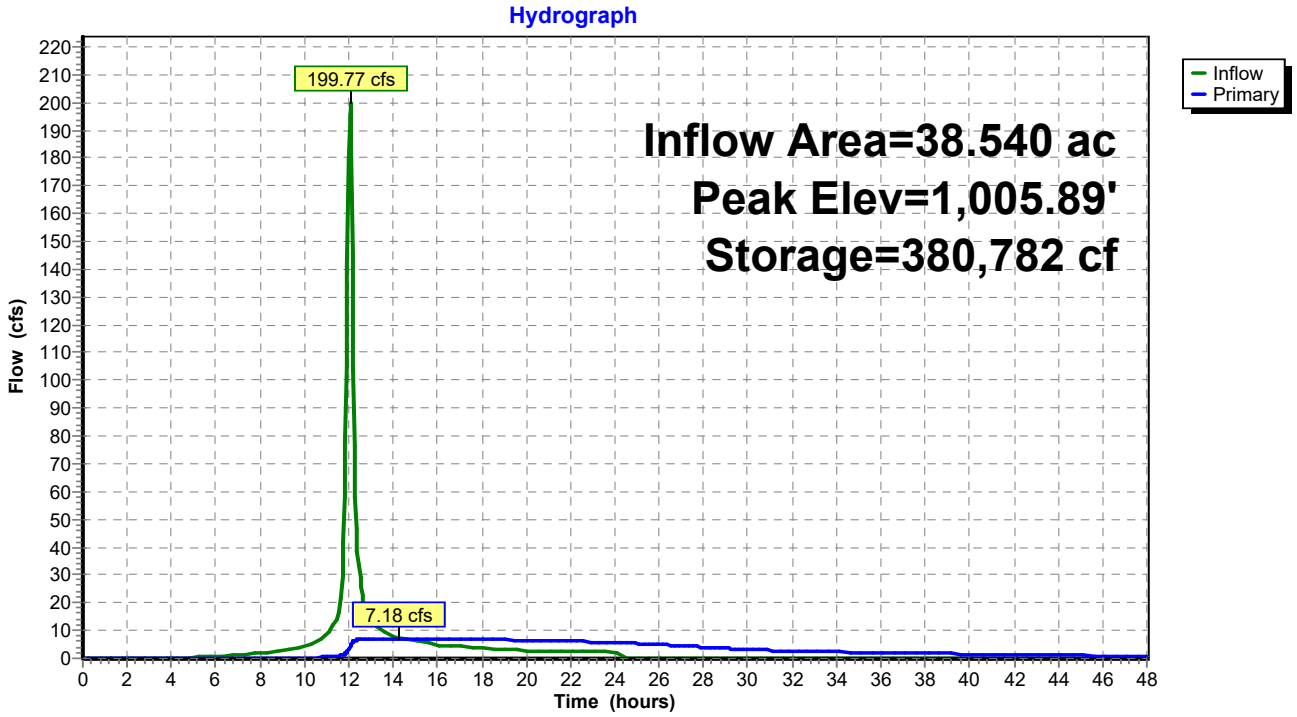
Volume	Invert	Avail.Storage	Storage Description
#1	998.00'	575,807 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
998.00	163,763	0	0
1,000.00	22,818	186,581	186,581
1,002.00	29,774	52,592	239,173
1,004.00	37,349	67,123	306,296
1,006.00	41,841	79,190	385,486
1,008.00	46,596	88,437	473,923
1,010.00	55,288	101,884	575,807

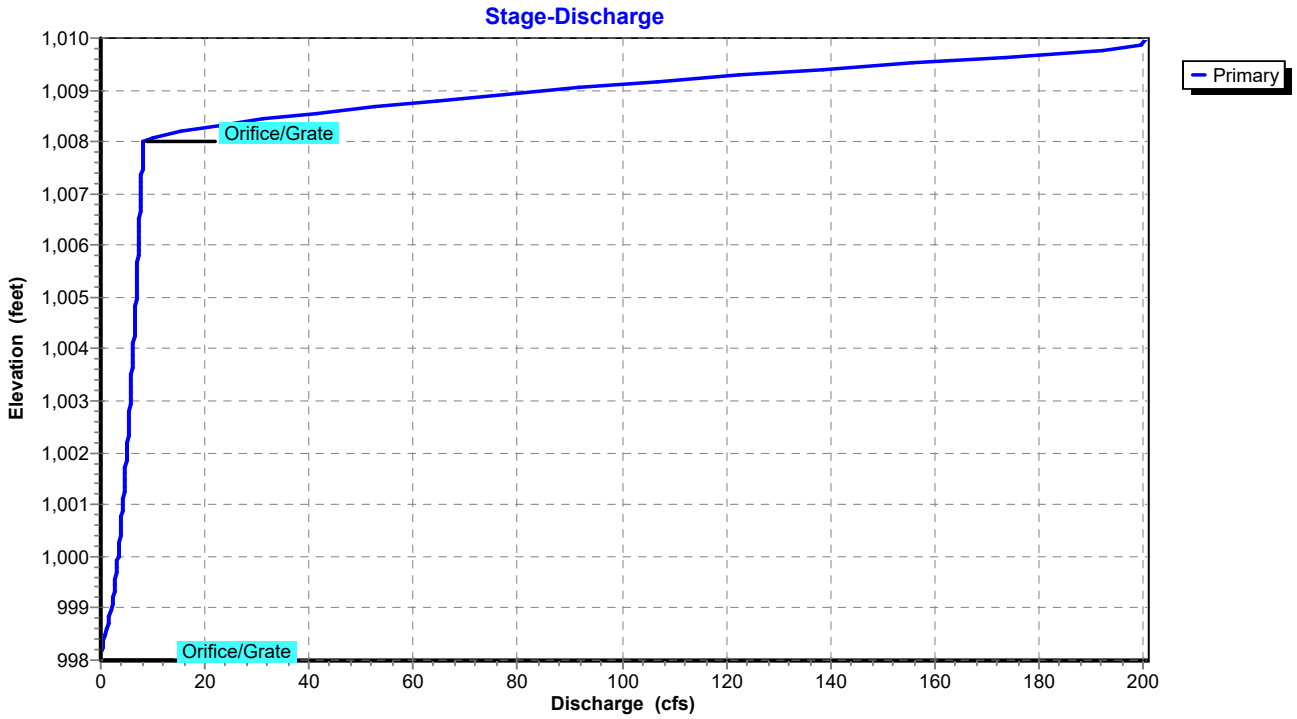
Device	Routing	Invert	Outlet Devices
#1	Primary	997.00'	**48.0" Round Culvert** L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 997.00' / 996.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Device 1	998.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,008.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.18 cfs @ 14.28 hrs HW=1,005.89' (Free Discharge)
└**1=Culvert** (Passes 7.18 cfs of 158.79 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 7.18 cfs @ 13.16 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

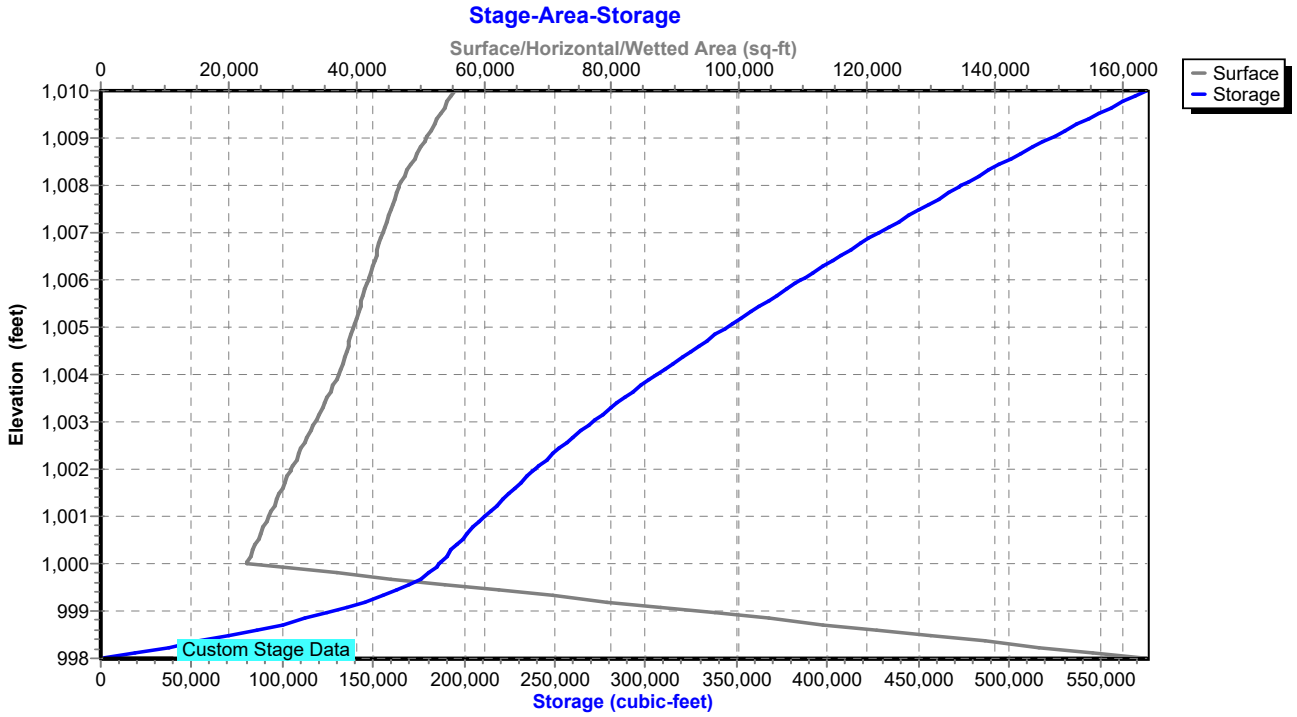
Pond 4P: EDDB #1



Pond 4P: EDDB #1



Pond 4P: EDDB #1



Summary for Pond 5P: EDDB #2

Inflow Area = 32.440 ac, 38.00% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 162.45 cfs @ 12.05 hrs, Volume= 10.410 af
Outflow = 33.28 cfs @ 12.38 hrs, Volume= 10.307 af, Atten= 80%, Lag= 19.8 min
Primary = 33.28 cfs @ 12.38 hrs, Volume= 10.307 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 998.84' @ 12.38 hrs Surf.Area= 52,574 sf Storage= 222,576 cf

Plug-Flow detention time= 284.2 min calculated for 10.307 af (99% of inflow)
Center-of-Mass det. time= 278.1 min (1,081.2 - 803.2)

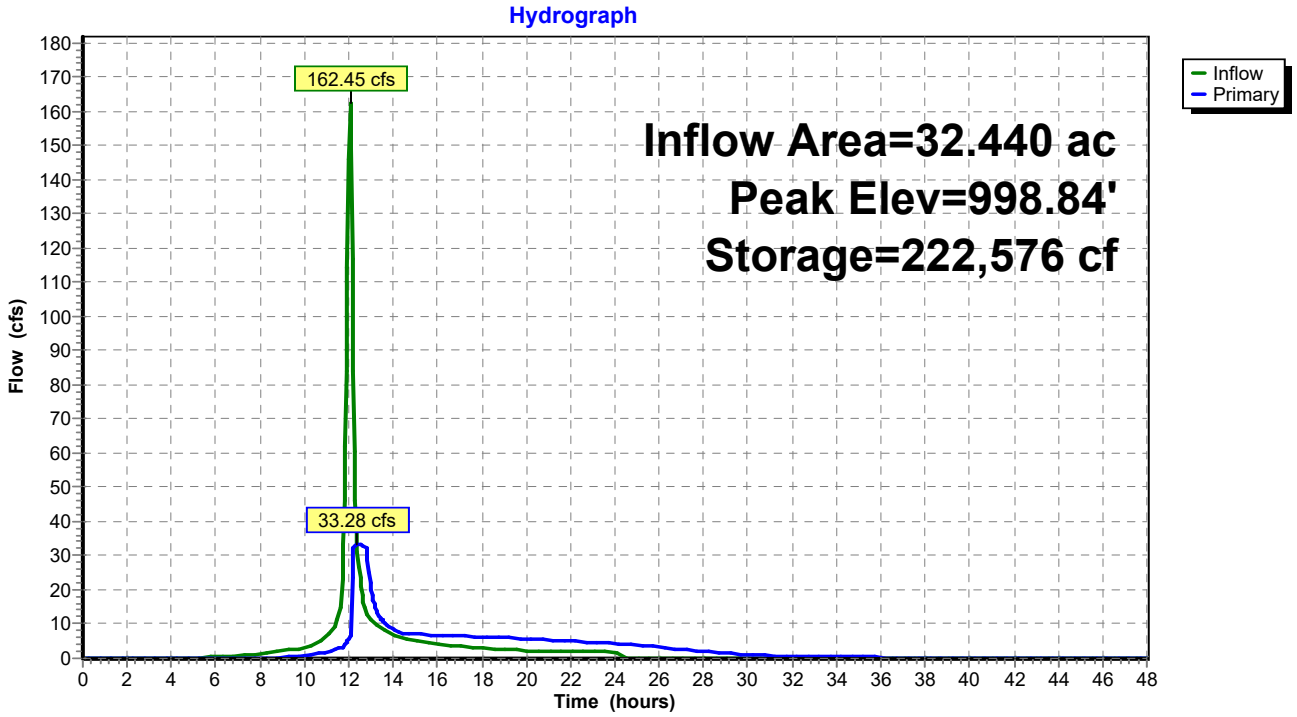
Volume	Invert	Avail.Storage	Storage Description
#1	994.00'	403,026 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
994.00	39,623	0	0
996.00	44,795	84,418	84,418
998.00	50,207	95,002	179,420
1,000.00	55,845	106,052	285,472
1,002.00	61,709	117,554	403,026

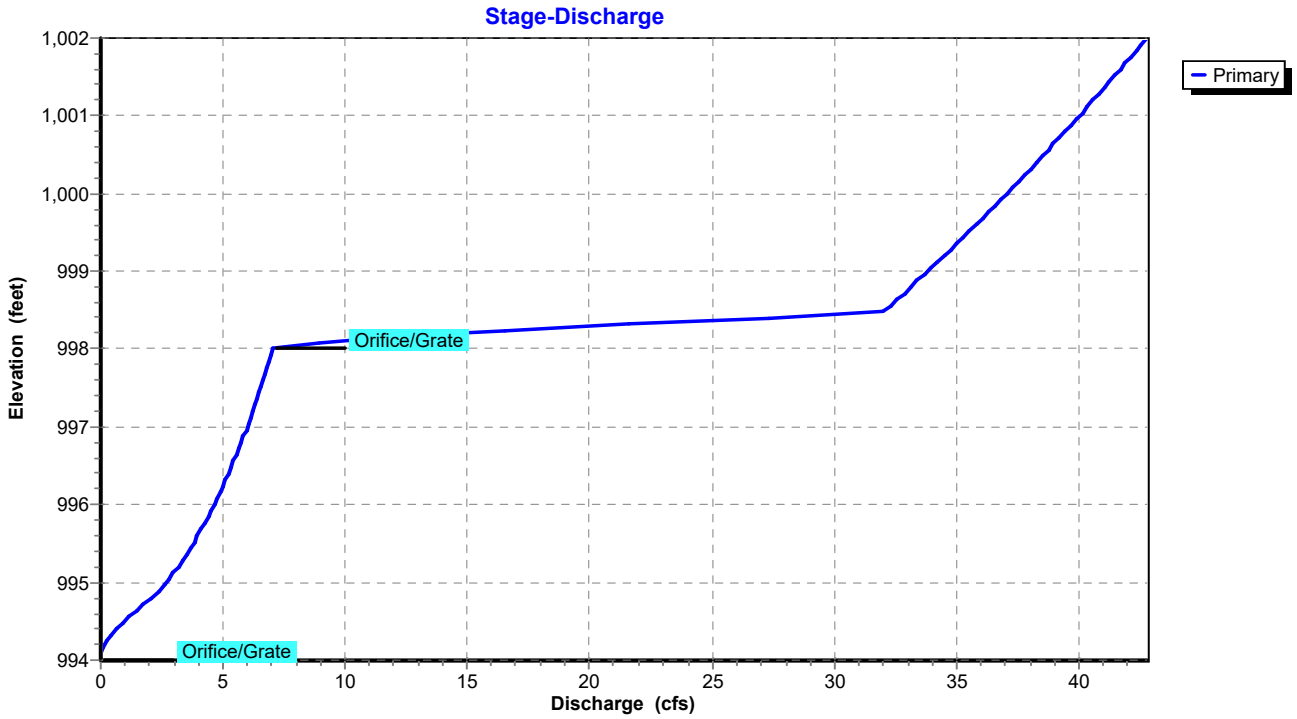
Device	Routing	Invert	Outlet Devices
#1	Primary	993.00'	**24.0" Round Culvert** L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.00' / 992.50' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	994.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	998.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=33.27 cfs @ 12.38 hrs HW=998.84' (Free Discharge)
└**1=Culvert** (Inlet Controls 33.27 cfs @ 10.59 fps)
  ├**2=Orifice/Grate** (Passes < 7.88 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 60.18 cfs potential flow)

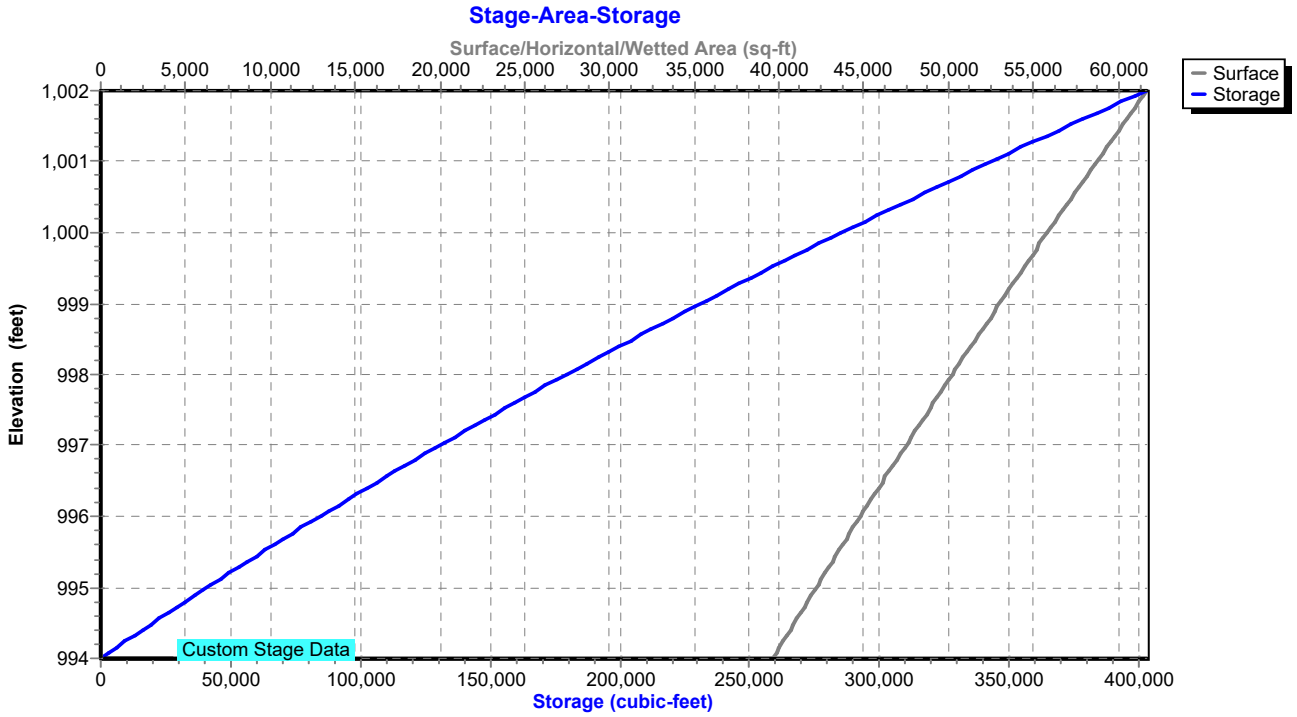
Pond 5P: EDDB #2



Pond 5P: EDDB #2



Pond 5P: EDDB #2

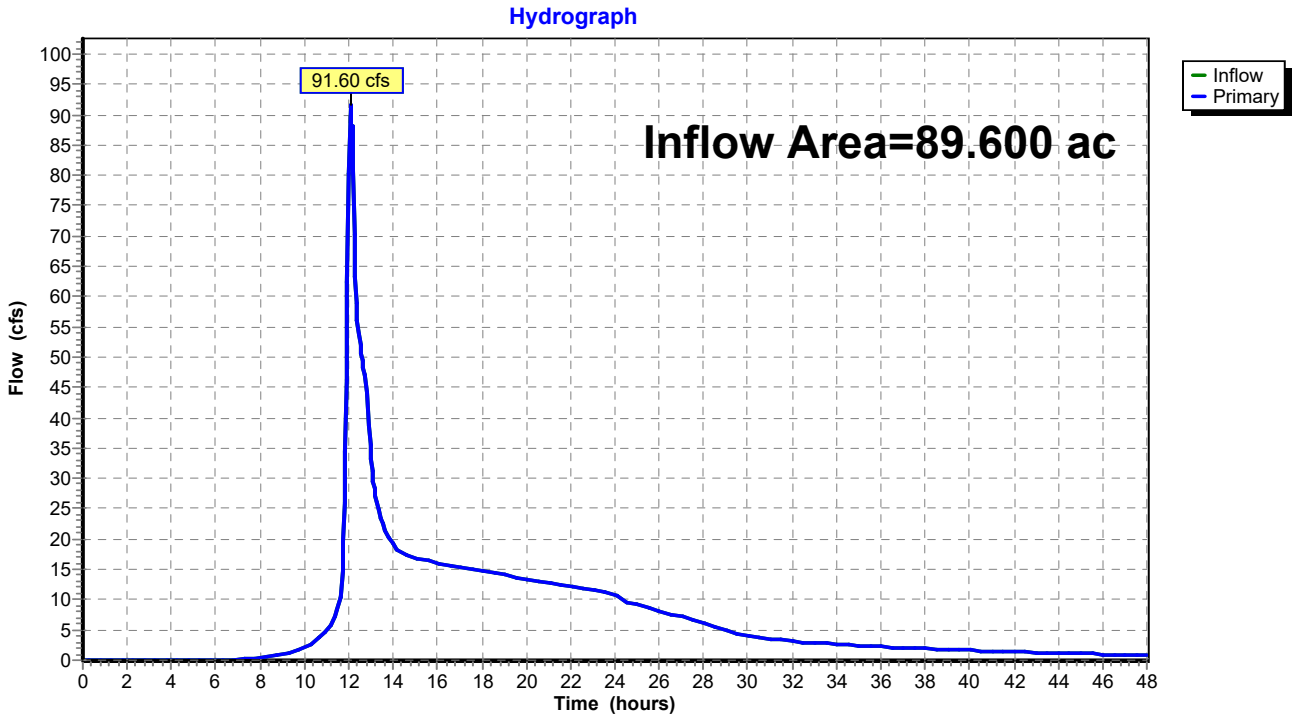


Summary for Link 2L: RP-1

Inflow Area = 89.600 ac, 36.41% Impervious, Inflow Depth > 3.59" for 10-Year event
Inflow = 91.60 cfs @ 12.06 hrs, Volume= 26.828 af
Primary = 91.60 cfs @ 12.06 hrs, Volume= 26.828 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2L: RP-1

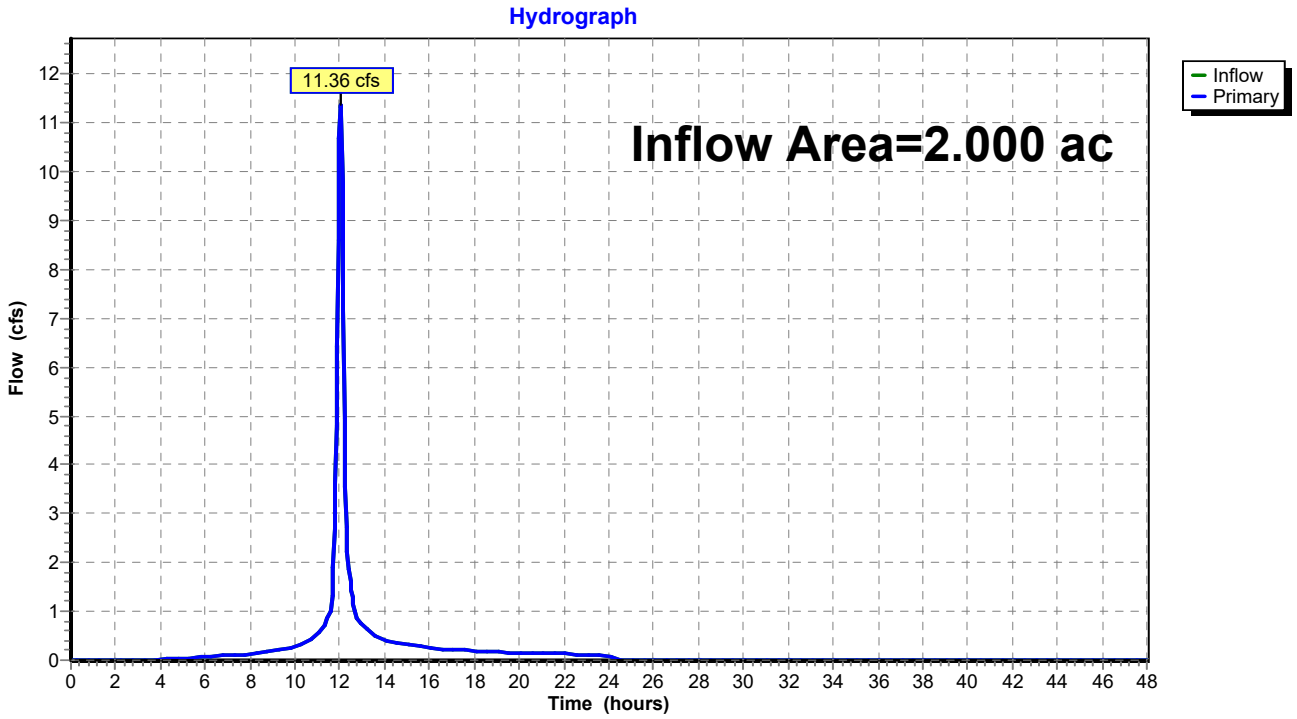


Summary for Link 3L: RP-2

Inflow Area = 2.000 ac, 65.00% Impervious, Inflow Depth = 4.38" for 10-Year event
Inflow = 11.36 cfs @ 12.04 hrs, Volume= 0.730 af
Primary = 11.36 cfs @ 12.04 hrs, Volume= 0.730 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: RP-2

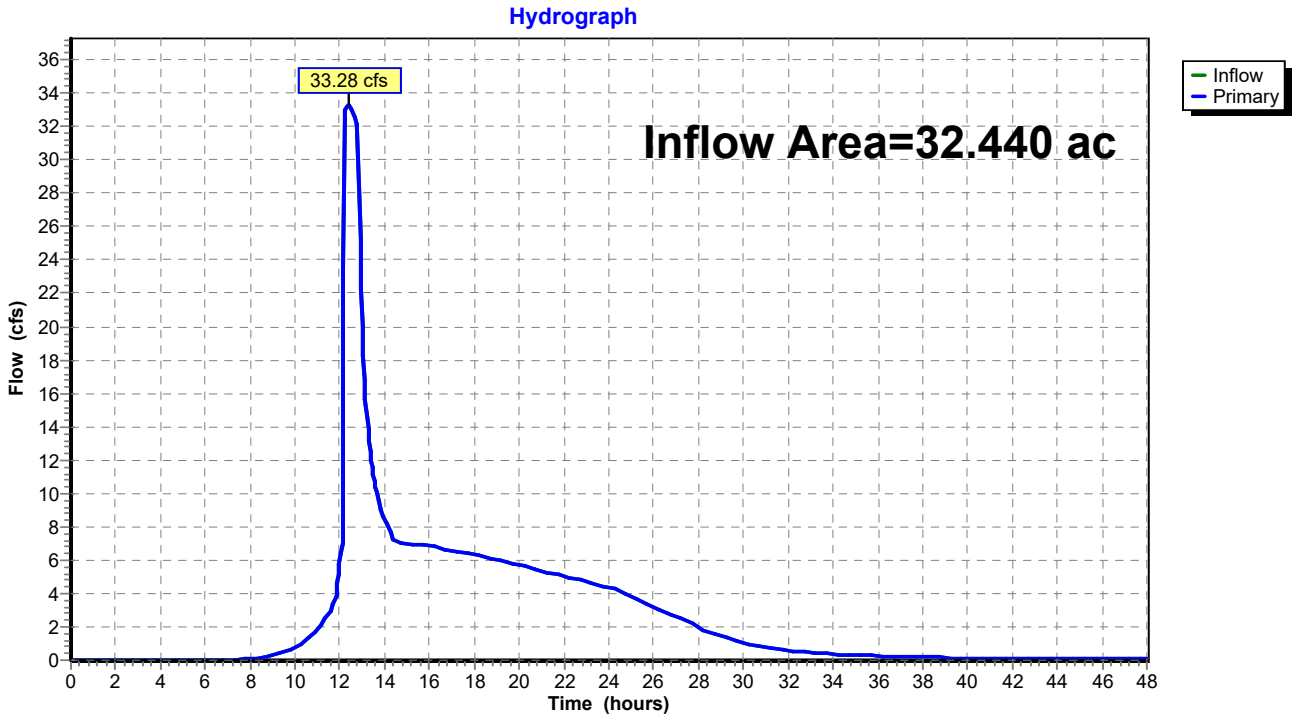


Summary for Link 4L: RP-3

Inflow Area = 32.440 ac, 38.00% Impervious, Inflow Depth > 3.81" for 10-Year event
Inflow = 33.28 cfs @ 12.38 hrs, Volume= 10.307 af
Primary = 33.28 cfs @ 12.38 hrs, Volume= 10.307 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 4L: RP-3

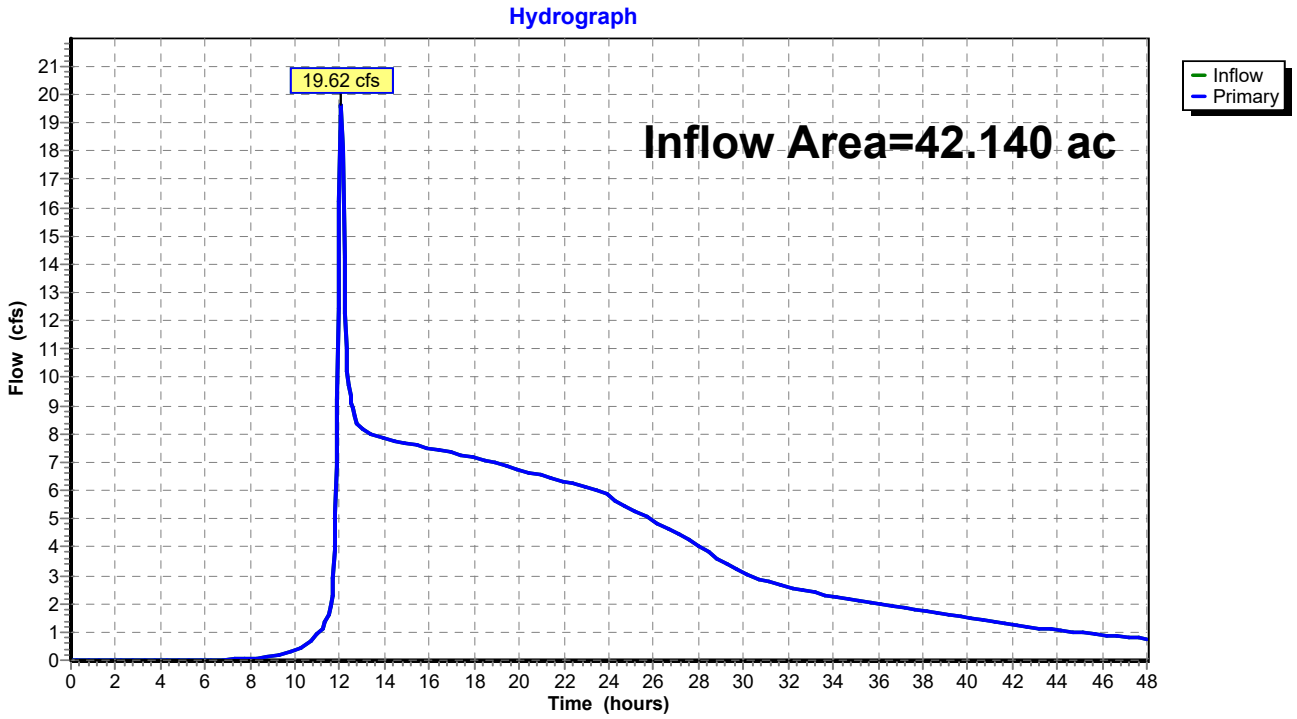


Summary for Link 5L: RP-4

Inflow Area = 42.140 ac, 45.07% Impervious, Inflow Depth > 3.52" for 10-Year event
Inflow = 19.62 cfs @ 12.07 hrs, Volume= 12.366 af
Primary = 19.62 cfs @ 12.07 hrs, Volume= 12.366 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: RP-4



Summary for Subcatchment 1S: ON-SITE #1

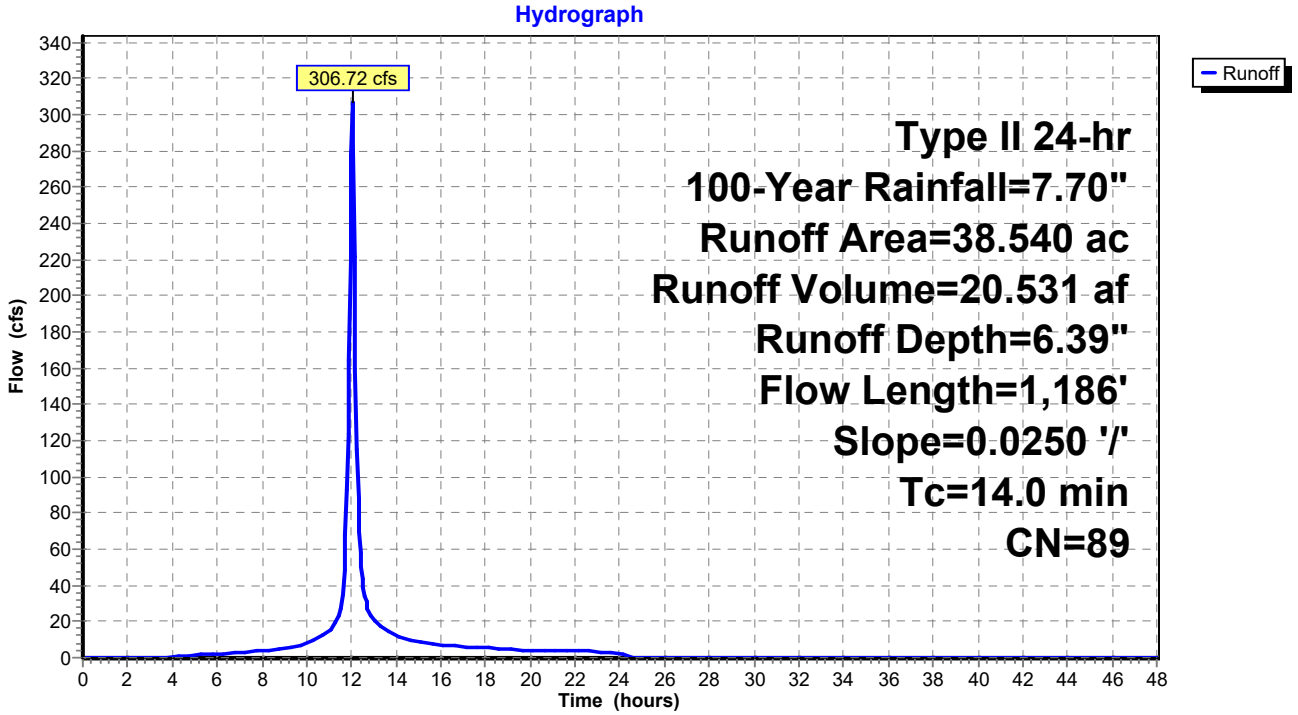
Runoff = 306.72 cfs @ 12.05 hrs, Volume= 20.531 af, Depth= 6.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
13.930	92	1/8 acre lots, 65% imp, HSG D
0.580	85	1/2 acre lots, 25% imp, HSG D
22.620	87	1/4 acre lots, 38% imp, HSG D
1.410	95	Urban commercial, 85% imp, HSG D
38.540	89	Weighted Average
19.546		50.72% Pervious Area
18.994		49.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 1S: ON-SITE #1



Summary for Subcatchment 3S: ON-SITE #3

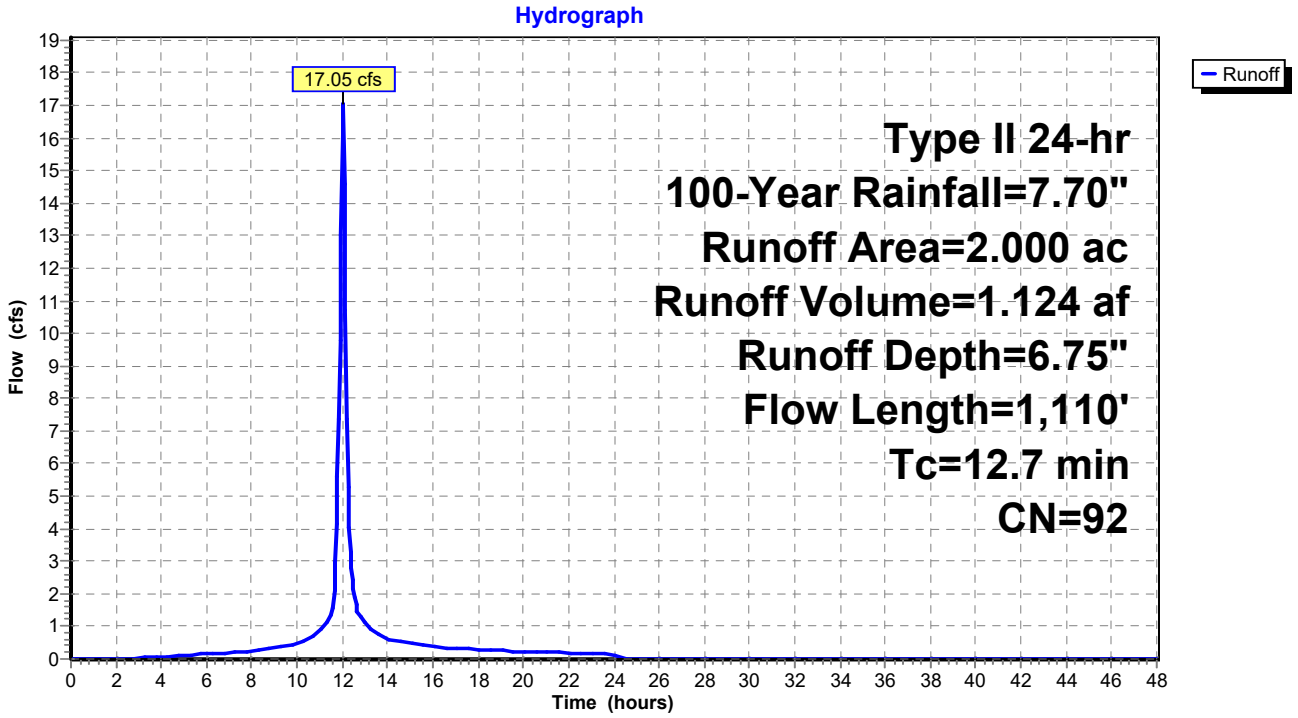
Runoff = 17.05 cfs @ 12.04 hrs, Volume= 1.124 af, Depth= 6.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
2.000	92	1/8 acre lots, 65% imp, HSG D
0.700		35.00% Pervious Area
1.300		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
7.8	1,060	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.7	1,110	Total			

Subcatchment 3S: ON-SITE #3



Summary for Subcatchment 5S: OFF-SITE #1

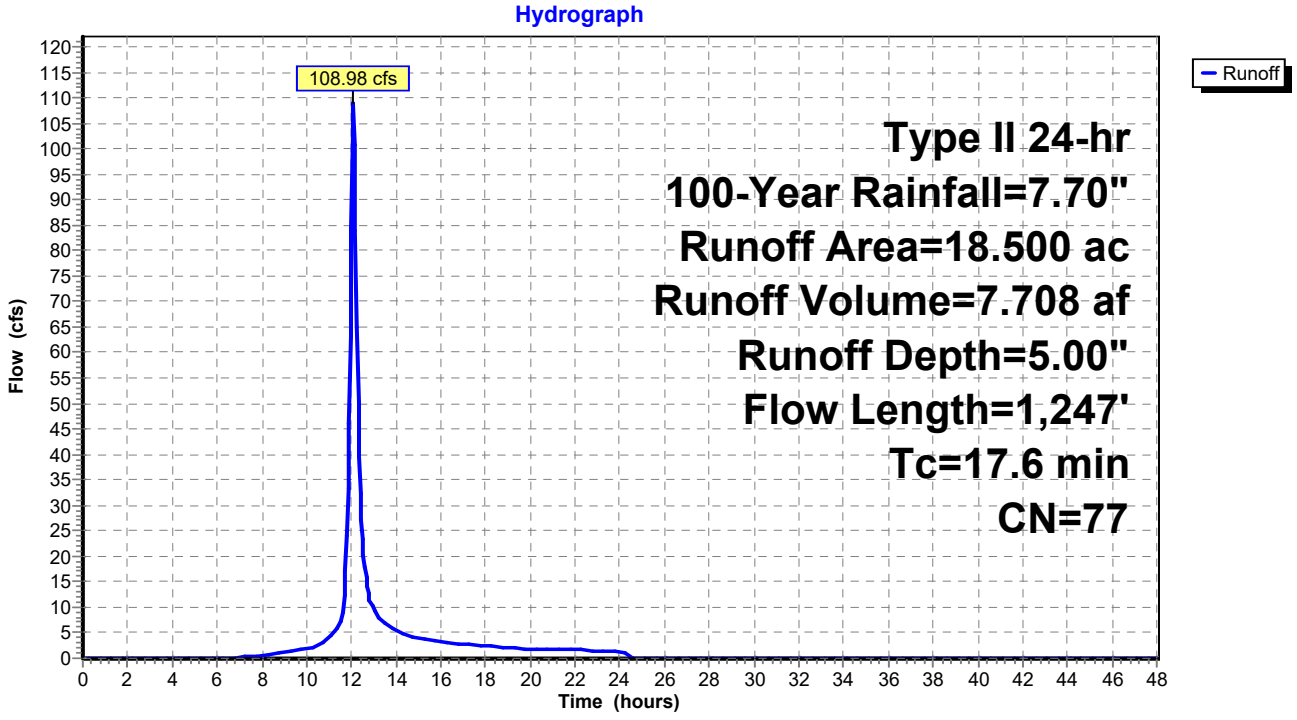
Runoff = 108.98 cfs @ 12.10 hrs, Volume= 7.708 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.860	82	Woods/grass comb., Fair, HSG D
18.500	77	Weighted Average
18.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
9.2	1,147	0.0192	2.08		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
17.6	1,247	Total			

Subcatchment 5S: OFF-SITE #1



Summary for Subcatchment 6S: ON-SITE #5

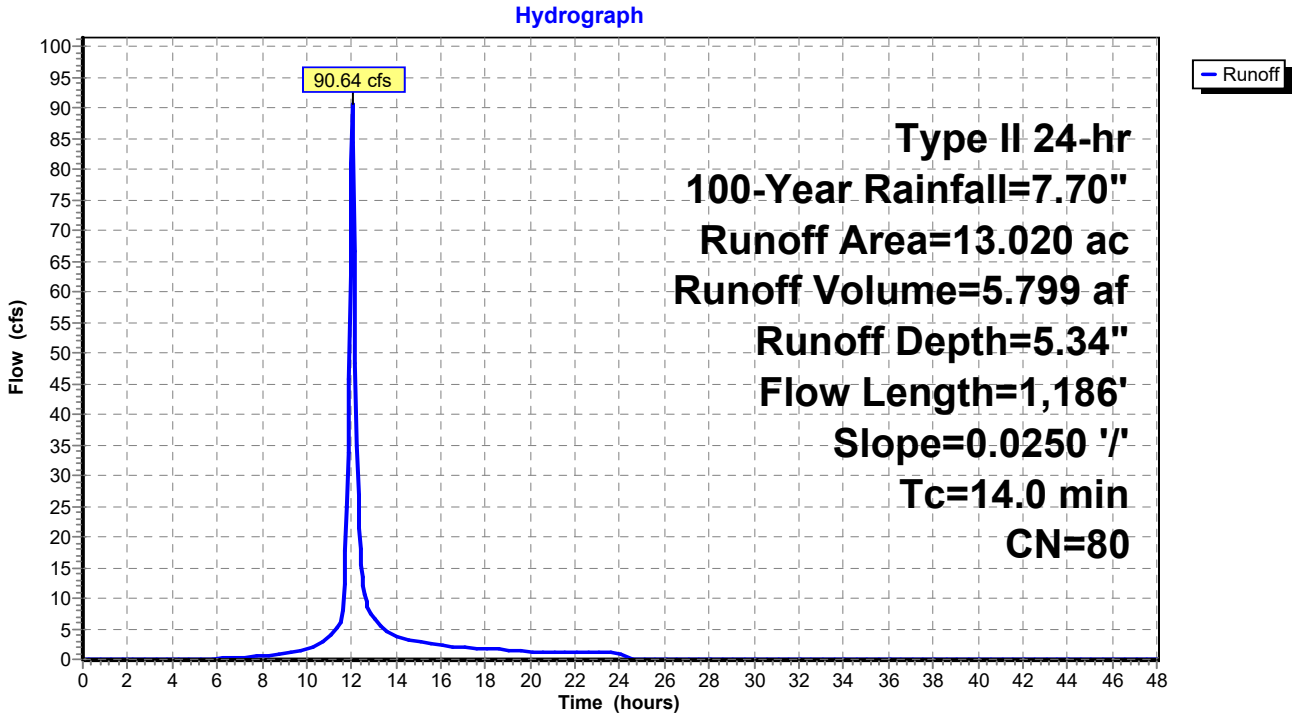
Runoff = 90.64 cfs @ 12.06 hrs, Volume= 5.799 af, Depth= 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
13.020	80	>75% Grass cover, Good, HSG D
13.020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 6S: ON-SITE #5



Summary for Subcatchment 7S: ON-SITE #2

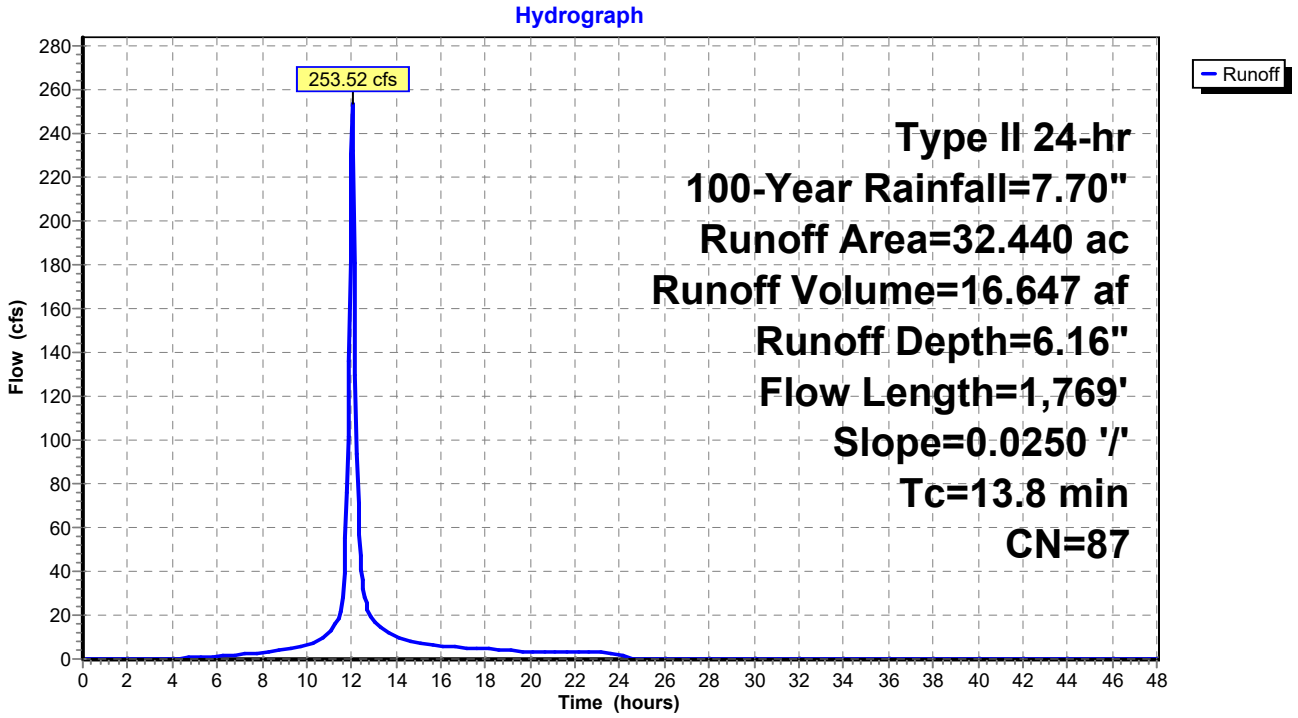
Runoff = 253.52 cfs @ 12.05 hrs, Volume= 16.647 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
32.440	87	1/4 acre lots, 38% imp, HSG D
20.113		62.00% Pervious Area
12.327		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
8.9	1,719	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
13.8	1,769	Total			

Subcatchment 7S: ON-SITE #2



Summary for Subcatchment 8S: ON-SITE #4

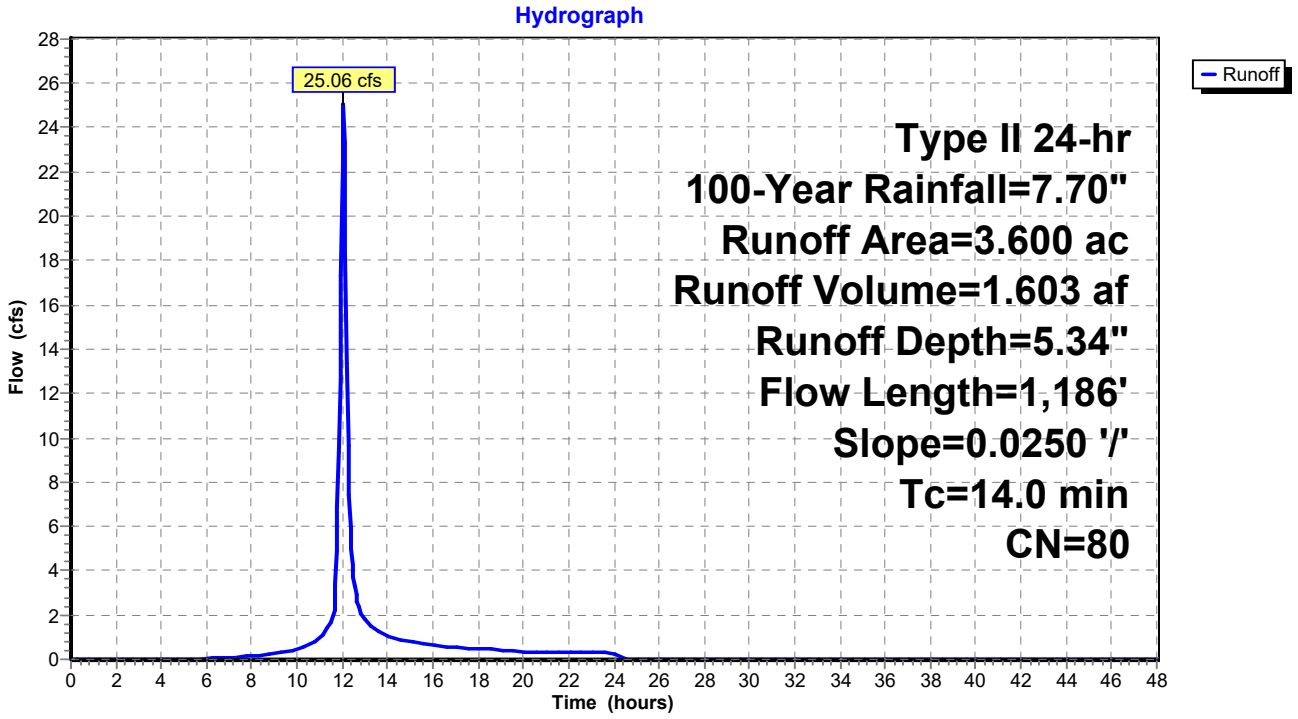
Runoff = 25.06 cfs @ 12.06 hrs, Volume= 1.603 af, Depth= 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
3.600	80	>75% Grass cover, Good, HSG D
3.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.60"
5.6	1,086	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.0	1,186	Total			

Subcatchment 8S: ON-SITE #4



Summary for Reach 6R: Reach 3

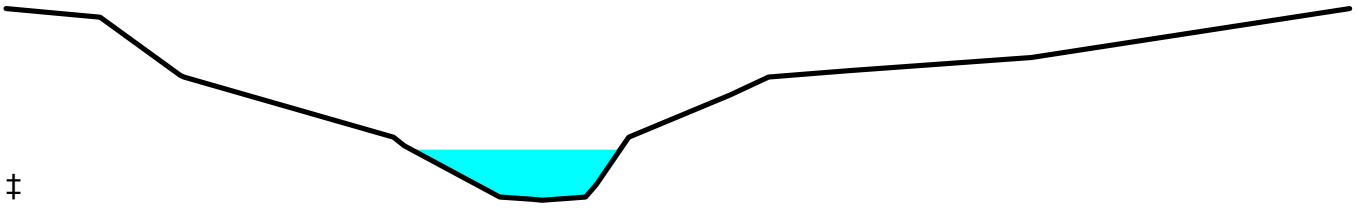
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.82' @ 12.40 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 88.00 cfs @ 12.28 hrs, Volume= 7.708 af
Outflow = 87.73 cfs @ 12.38 hrs, Volume= 7.708 af, Atten= 0%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.94 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 1.24 fps, Avg. Travel Time= 14.0 min

Peak Storage= 18,431 cf @ 12.32 hrs
Average Depth at Peak Storage= 1.69'
Bank-Full Depth= 6.40' Flow Area= 252.4 sf, Capacity= 2,150.14 cfs

Custom cross-section, Length= 1,041.0' Slope= 0.0088 '/' (110 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 989.92', Outlet Invert= 980.77'

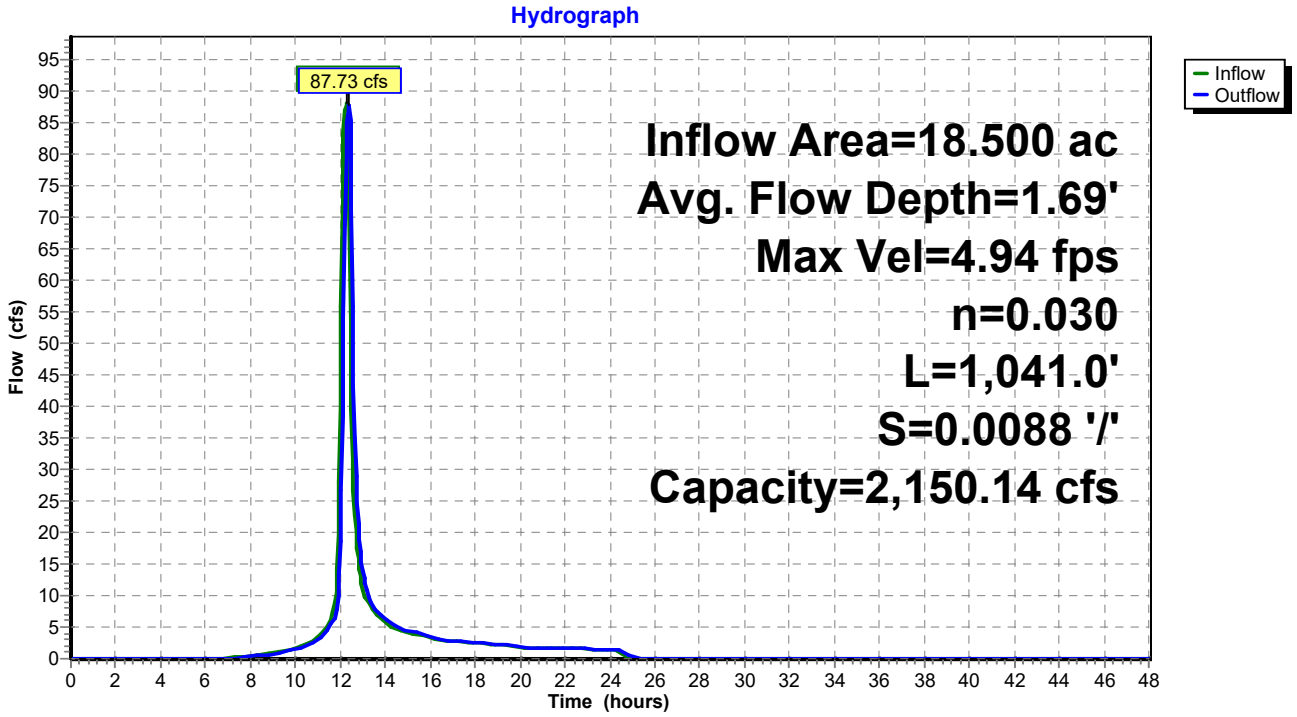


‡

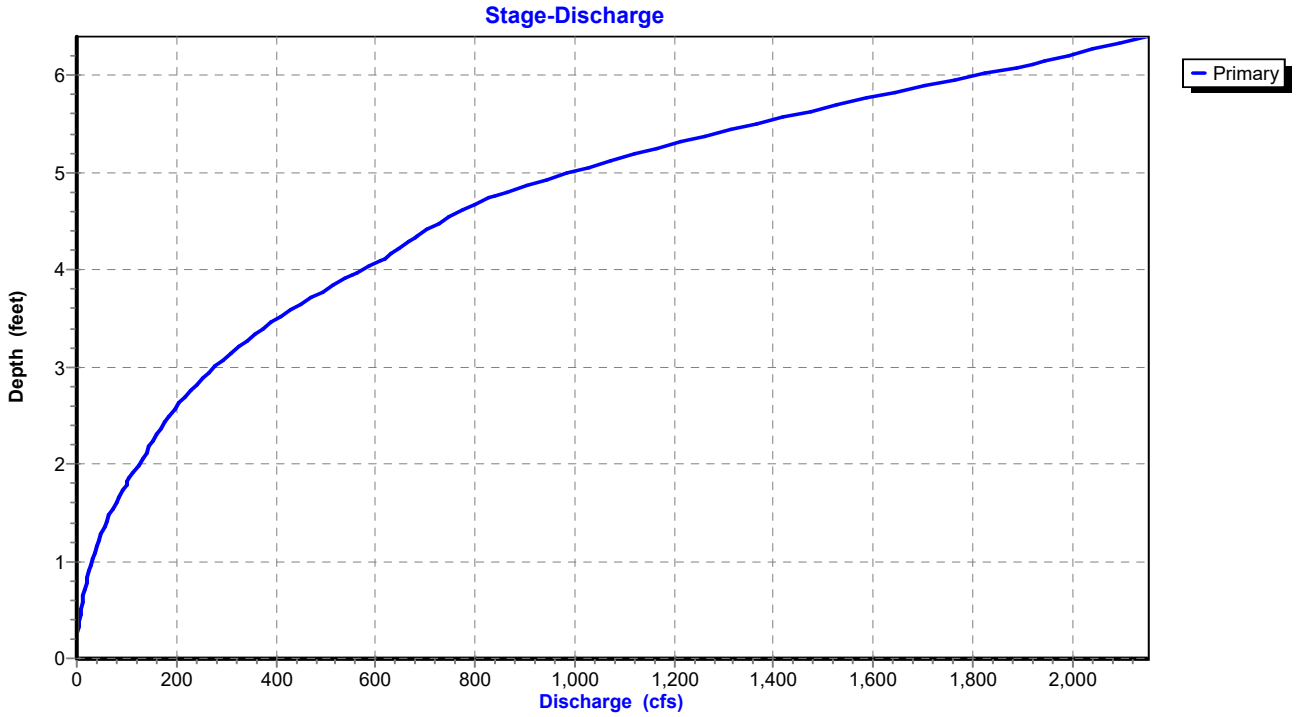
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	996.29	0.00
7.00	996.00	0.29
12.99	994.06	2.23
13.24	994.00	2.29
14.48	993.84	2.45
28.84	992.00	4.29
29.66	991.71	4.58
36.75	990.00	6.29
39.18	989.92	6.37
39.90	989.89	6.40
42.20	989.97	6.32
43.14	990.00	6.29
43.91	990.40	5.89
46.34	992.00	4.29
53.90	993.41	2.88
56.74	994.00	2.29
62.76	994.22	2.07
76.31	994.65	1.64
100.00	996.29	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
3.52	62.5	37.1	65,011	410.25
3.95	79.1	42.6	82,369	555.08
4.11	85.9	44.7	89,447	617.31
4.17	88.6	46.6	92,223	631.78
4.33	96.2	51.5	100,189	678.51
4.76	121.1	66.4	126,018	838.92
6.11	225.0	90.3	234,197	1,919.54
6.40	252.4	101.5	262,697	2,150.14

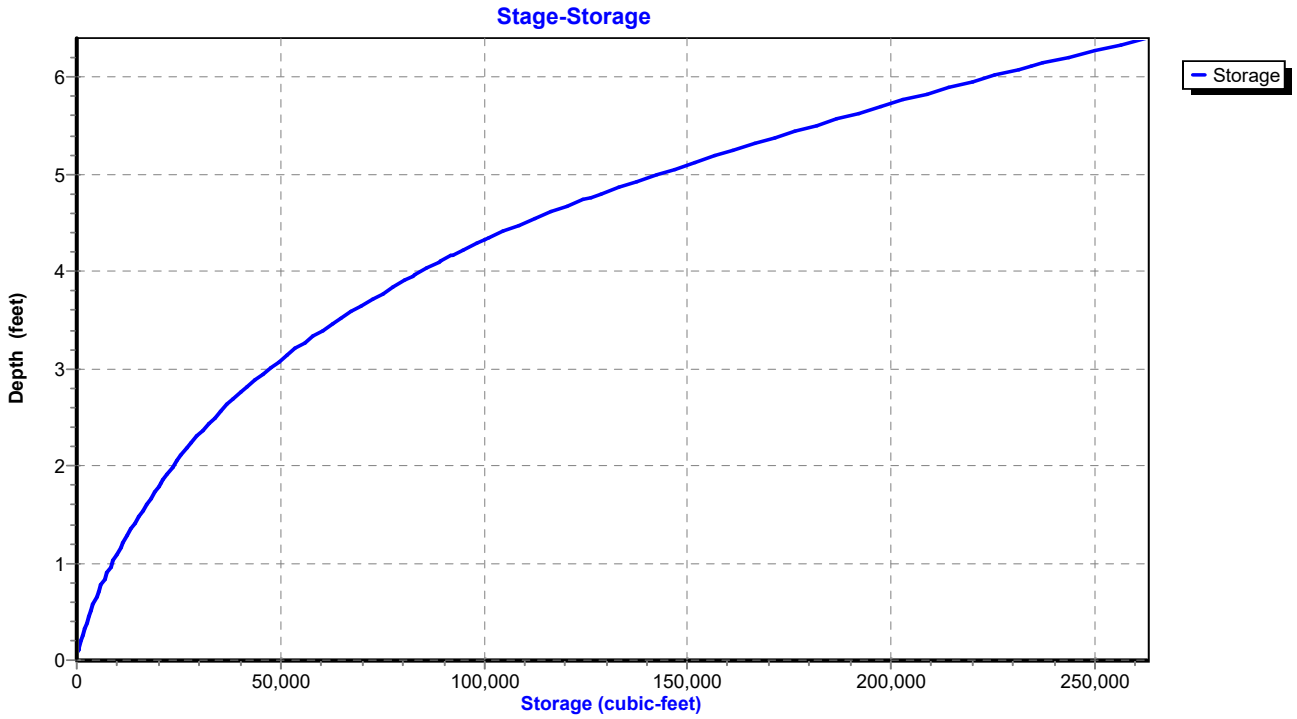
Reach 6R: Reach 3



Reach 6R: Reach 3



Reach 6R: Reach 3



Summary for Reach 7R: Reach 2

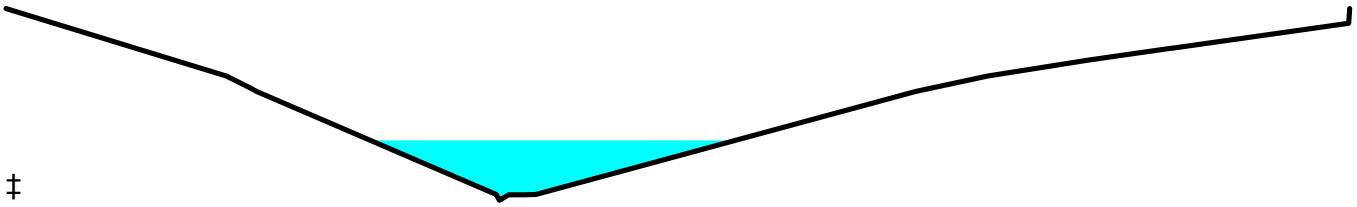
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.21' @ 25.15 hrs

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 87.94 cfs @ 12.10 hrs, Volume= 7.708 af
Outflow = 88.00 cfs @ 12.28 hrs, Volume= 7.708 af, Atten= 0%, Lag= 10.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.73 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 1.66 fps, Avg. Travel Time= 8.5 min

Peak Storage= 15,873 cf @ 12.23 hrs
Average Depth at Peak Storage= 1.01'
Bank-Full Depth= 3.24' Flow Area= 204.3 sf, Capacity= 1,999.47 cfs

Custom cross-section, Length= 853.0' Slope= 0.0225 '/' (106 Elevation Intervals)
Constant n= 0.030 Earth, grassed & winding
Inlet Invert= 1,009.12', Outlet Invert= 989.90'

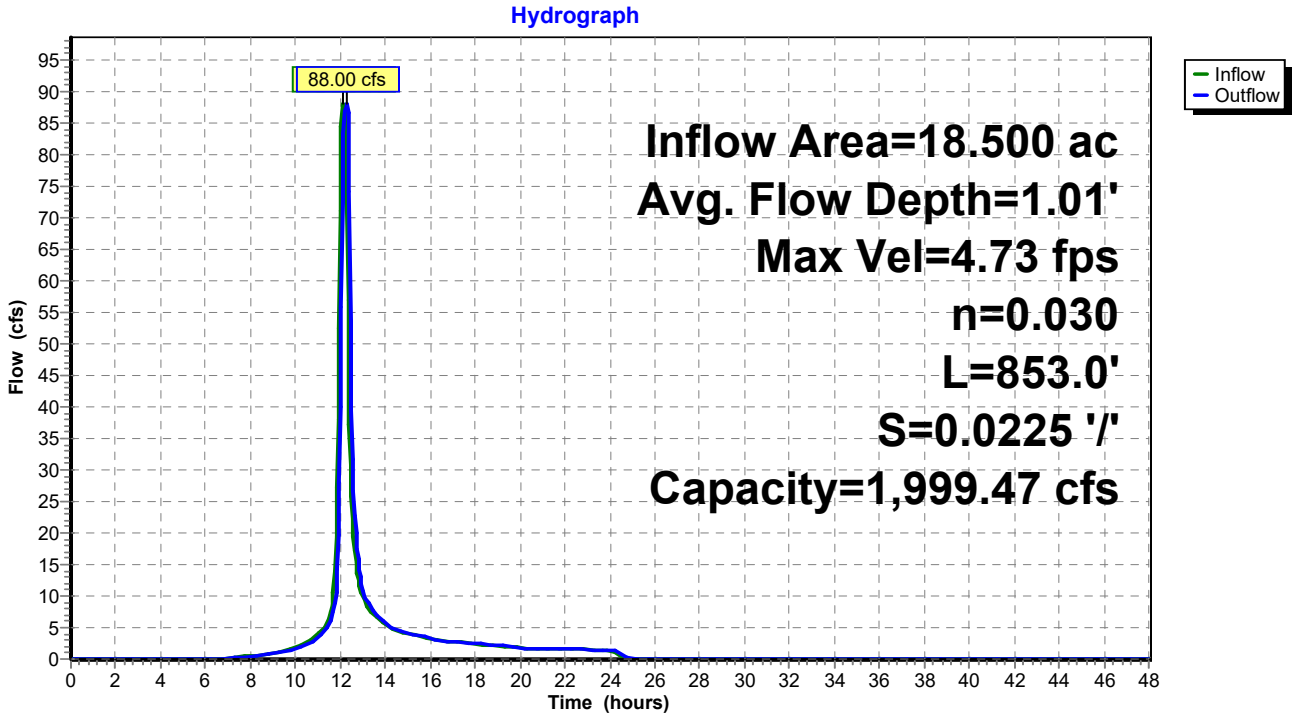


‡

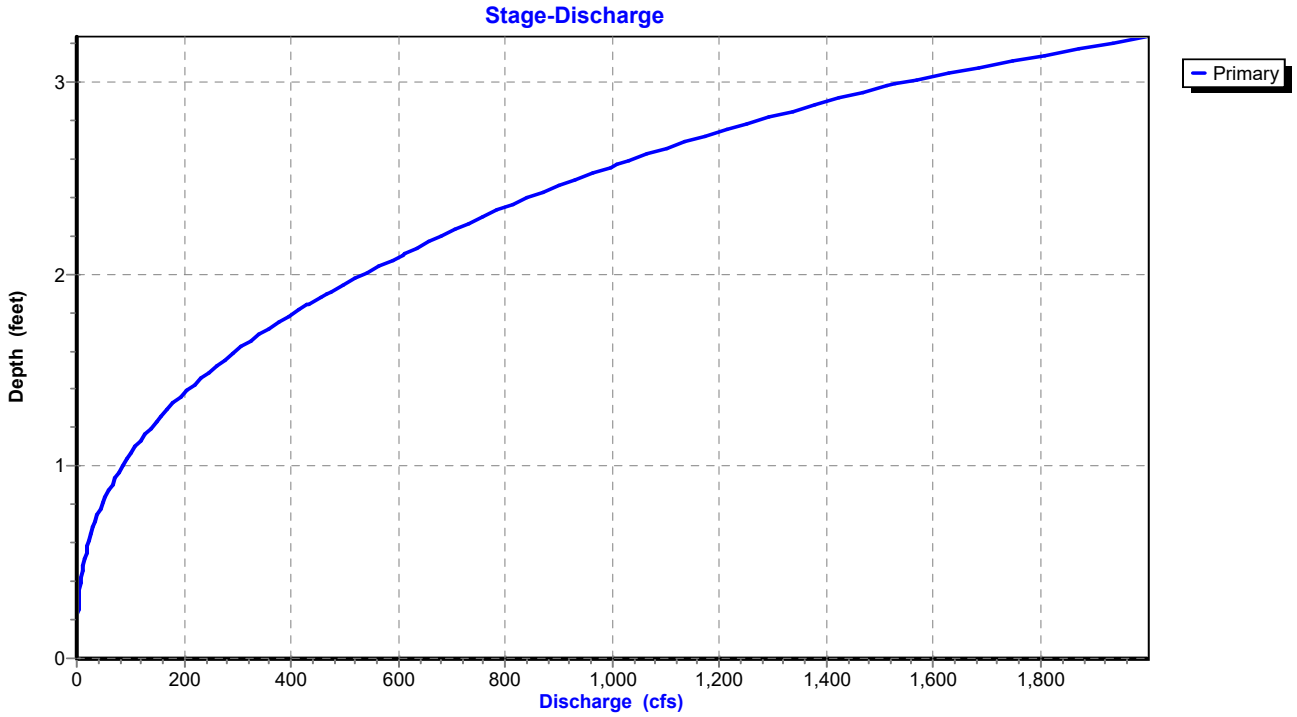
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,009.14	0.00
22.15	1,008.00	1.14
24.54	1,007.80	1.34
25.18	1,007.74	1.40
49.26	1,006.00	3.14
49.59	1,005.90	3.24
50.51	1,005.99	3.15
52.13	1,005.99	3.15
53.24	1,006.00	3.14
91.41	1,007.74	1.40
98.60	1,008.00	1.14
108.78	1,008.27	0.87
117.07	1,008.47	0.67
117.16	1,008.47	0.67
134.91	1,008.89	0.25
135.00	1,009.14	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	818.03
2.57	122.0	104.3	104,091	1,007.45
2.99	171.2	130.2	146,042	1,527.76
3.24	204.3	135.4	174,303	1,999.47

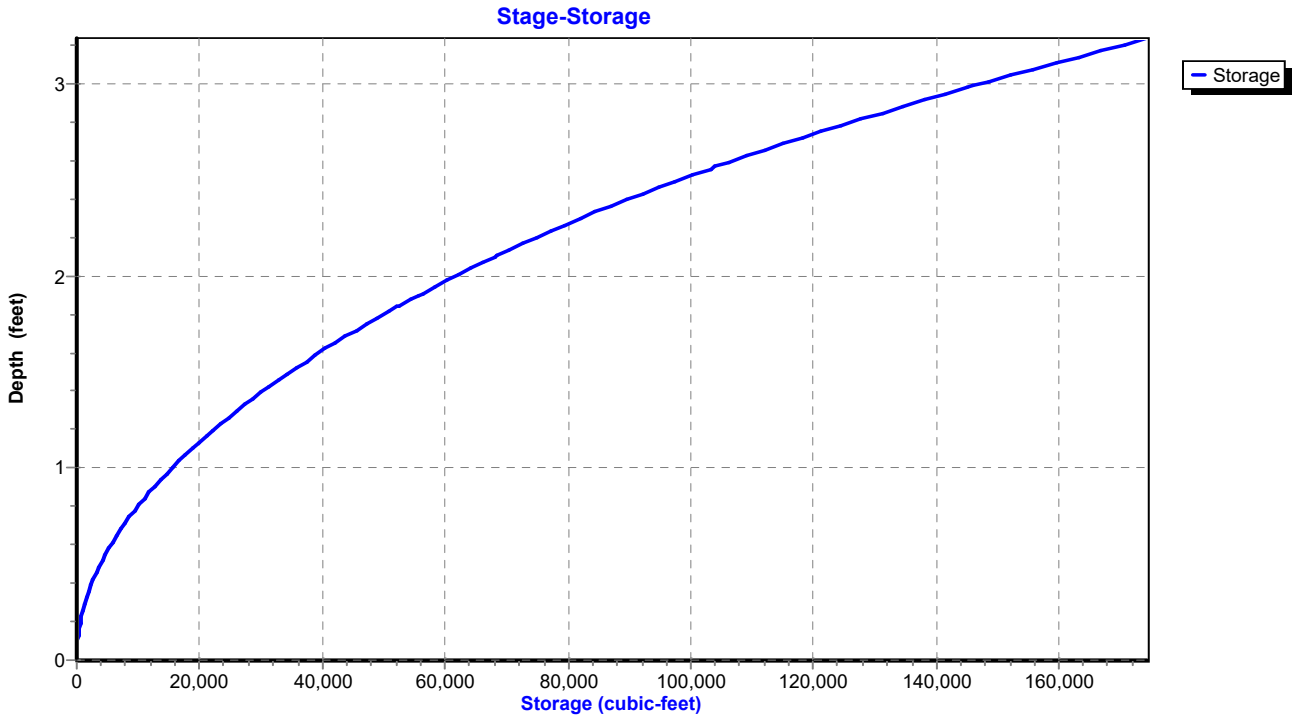
Reach 7R: Reach 2



Reach 7R: Reach 2



Reach 7R: Reach 2



Summary for Reach 8R: REACH 1

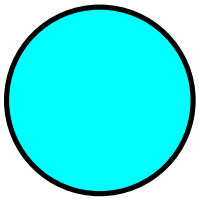
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 124% of Manning's capacity
[76] Warning: Detained 0.183 af (Pond w/culvert advised)

Inflow Area = 18.500 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event
Inflow = 108.98 cfs @ 12.10 hrs, Volume= 7.708 af
Outflow = 87.94 cfs @ 12.10 hrs, Volume= 7.708 af, Atten= 19%, Lag= 0.2 min

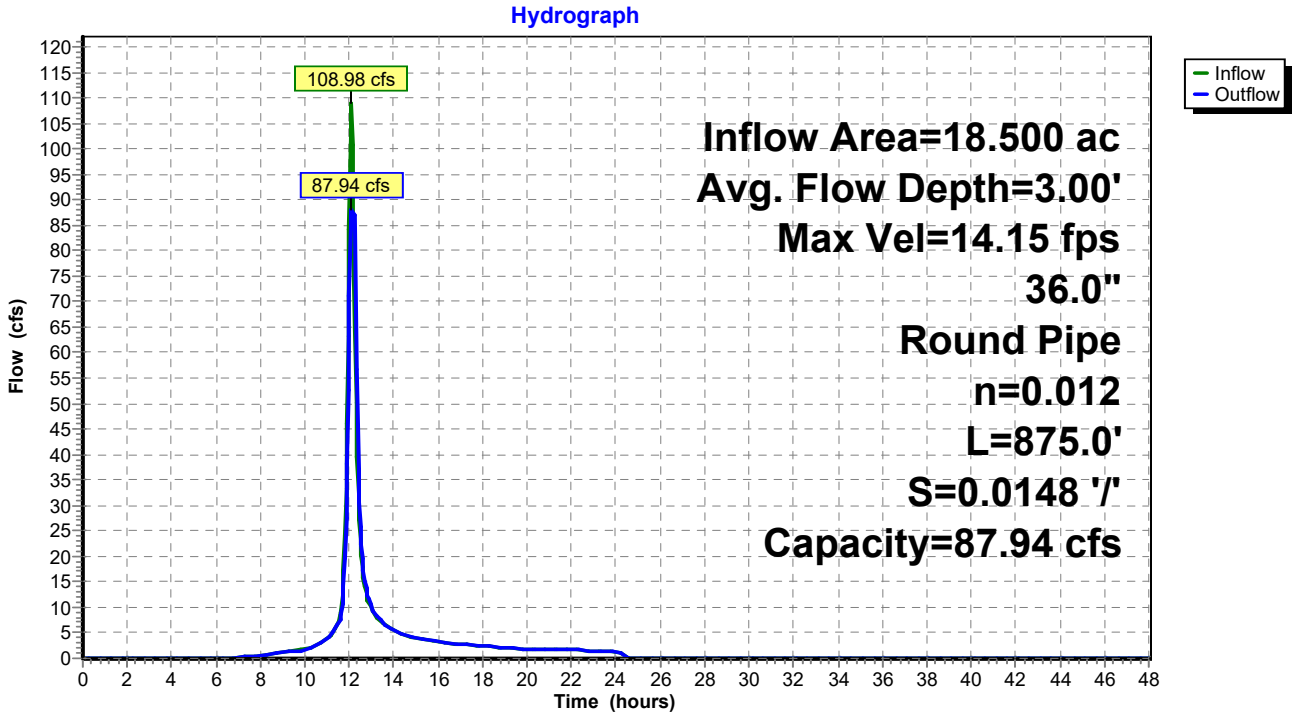
Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.15 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 5.14 fps, Avg. Travel Time= 2.8 min

Peak Storage= 6,185 cf @ 12.05 hrs
Average Depth at Peak Storage= 3.00'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 87.94 cfs

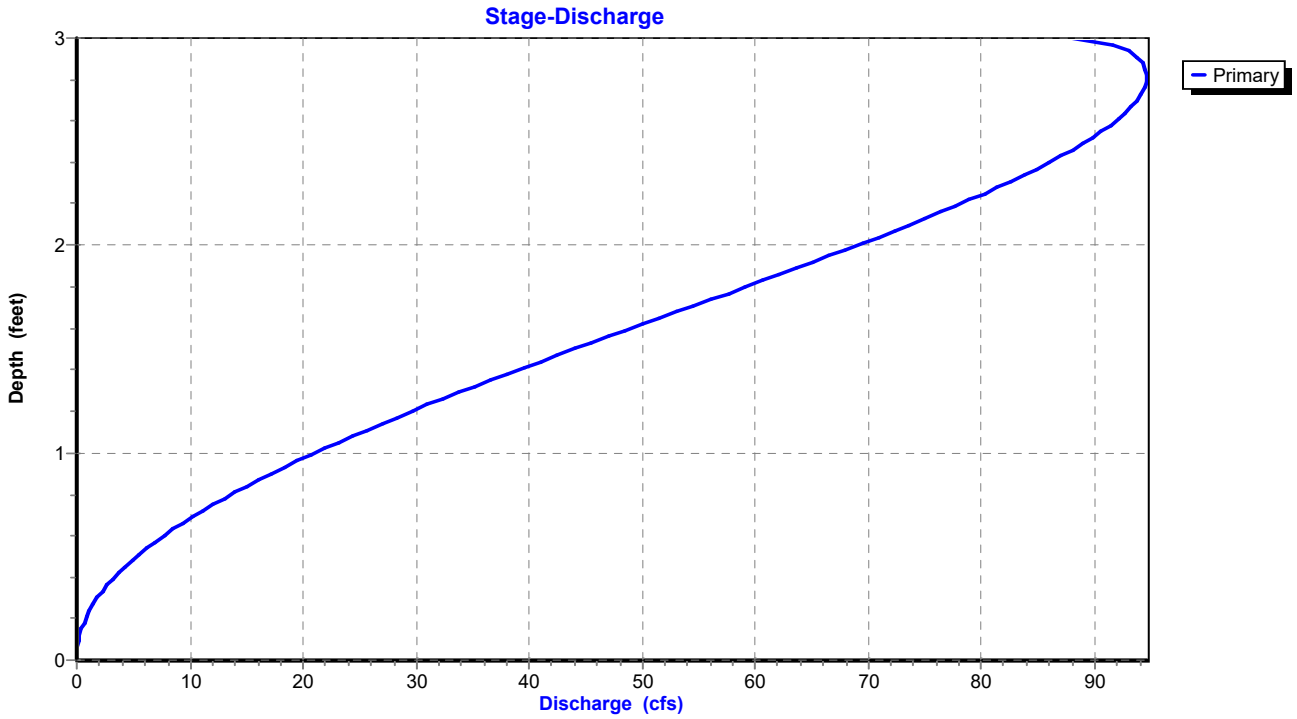
36.0" Round Pipe
n= 0.012 Concrete pipe, finished
Length= 875.0' Slope= 0.0148 '/'
Inlet Invert= 1,021.96', Outlet Invert= 1,009.00'



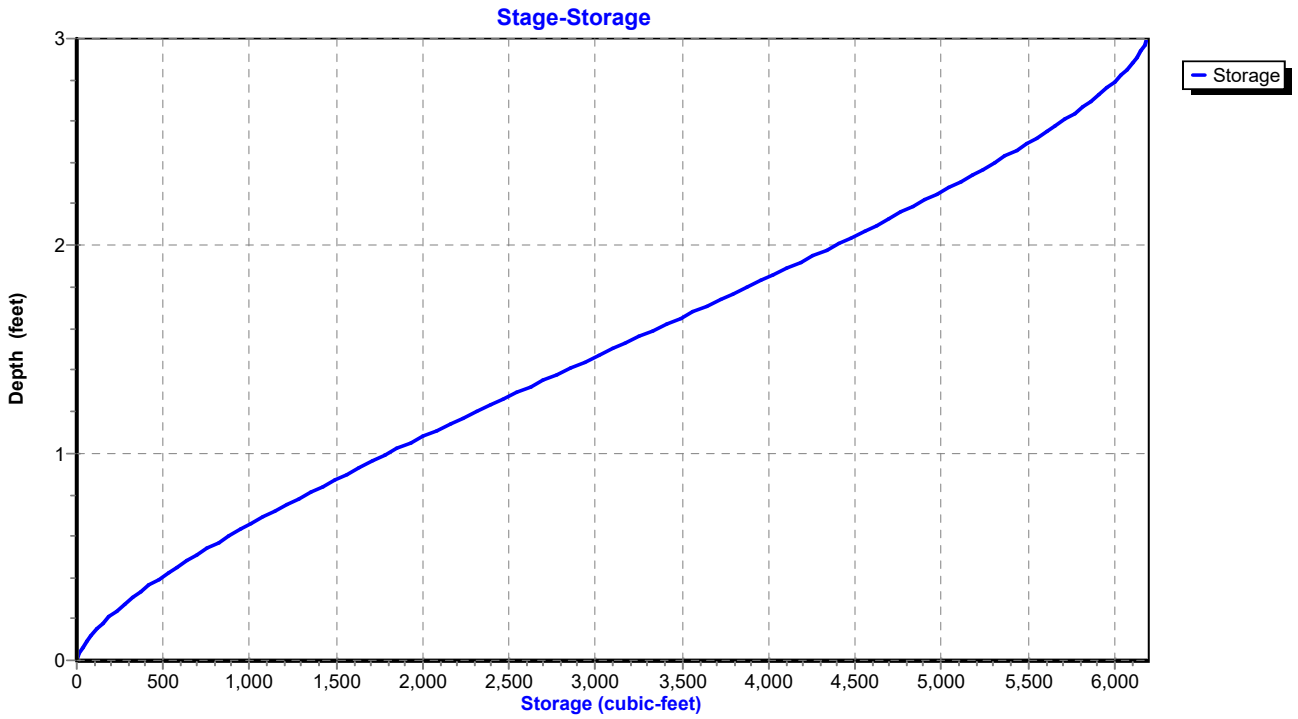
Reach 8R: REACH 1



Reach 8R: REACH 1



Reach 8R: REACH 1



Summary for Pond 4P: EDDB #1

Inflow Area = 38.540 ac, 49.28% Impervious, Inflow Depth = 6.39" for 100-Year event
Inflow = 306.72 cfs @ 12.05 hrs, Volume= 20.531 af
Outflow = 65.42 cfs @ 12.37 hrs, Volume= 18.558 af, Atten= 79%, Lag= 19.3 min
Primary = 65.42 cfs @ 12.37 hrs, Volume= 18.558 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 1,008.81' @ 12.37 hrs Surf.Area= 50,107 sf Storage= 512,985 cf

Plug-Flow detention time= 589.6 min calculated for 18.538 af (90% of inflow)
Center-of-Mass det. time= 541.0 min (1,325.3 - 784.3)

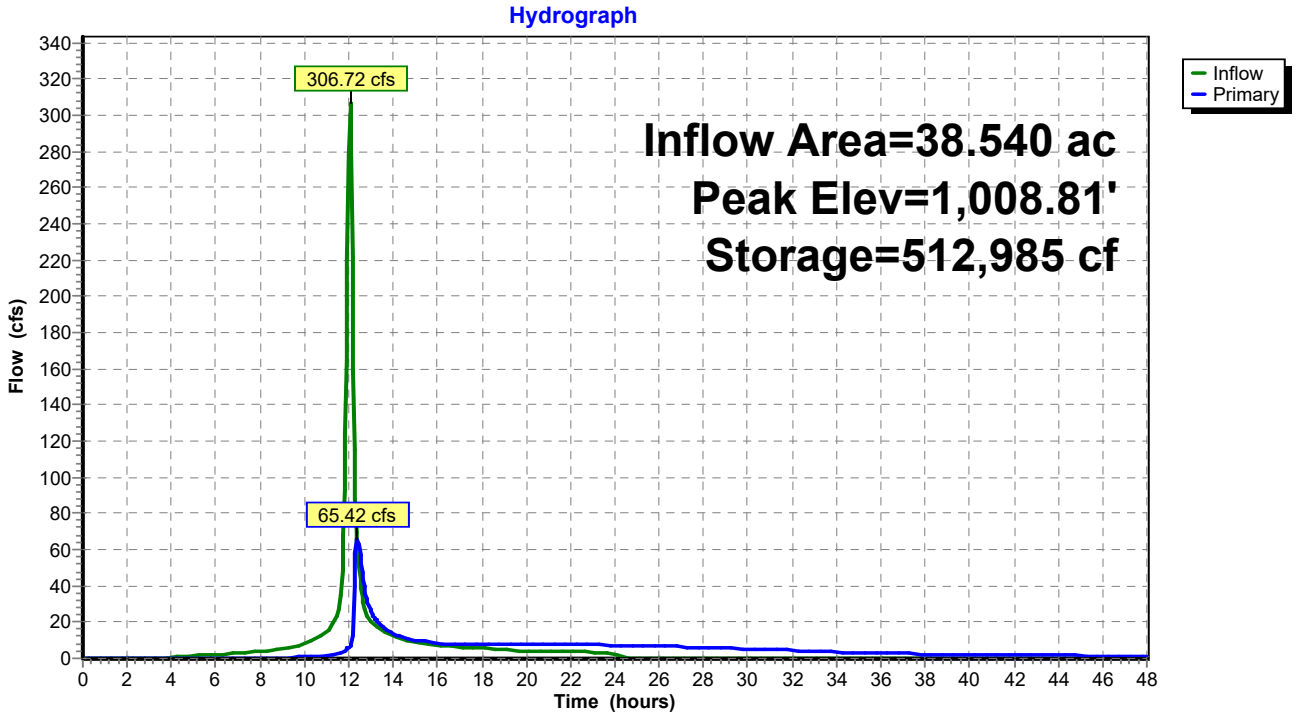
Volume	Invert	Avail.Storage	Storage Description
#1	998.00'	575,807 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
998.00	163,763	0	0
1,000.00	22,818	186,581	186,581
1,002.00	29,774	52,592	239,173
1,004.00	37,349	67,123	306,296
1,006.00	41,841	79,190	385,486
1,008.00	46,596	88,437	473,923
1,010.00	55,288	101,884	575,807

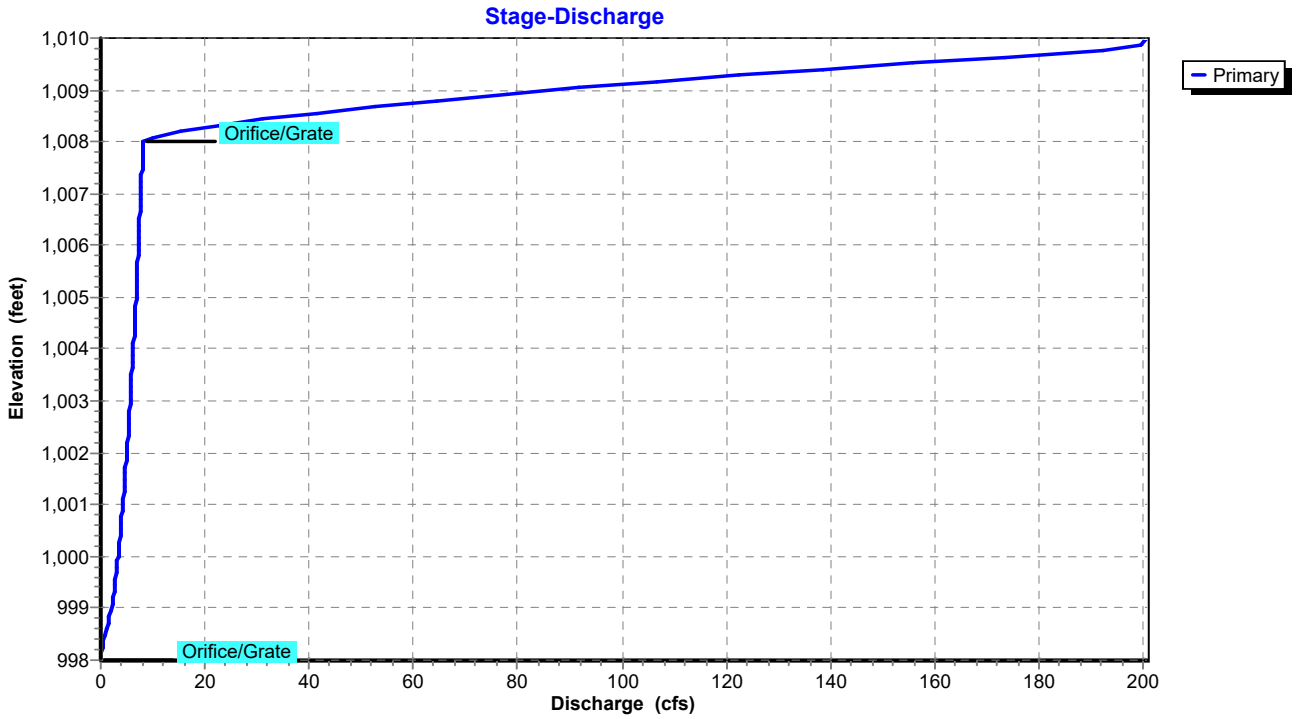
Device	Routing	Invert	Outlet Devices
#1	Primary	997.00'	**48.0" Round Culvert** L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 997.00' / 996.00' S= 0.0500 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Device 1	998.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,008.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=64.60 cfs @ 12.37 hrs HW=1,008.80' (Free Discharge)
└**1=Culvert** (Passes 64.60 cfs of 189.41 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 8.46 cfs @ 15.52 fps)
  └**3=Orifice/Grate** (Weir Controls 56.14 cfs @ 2.92 fps)

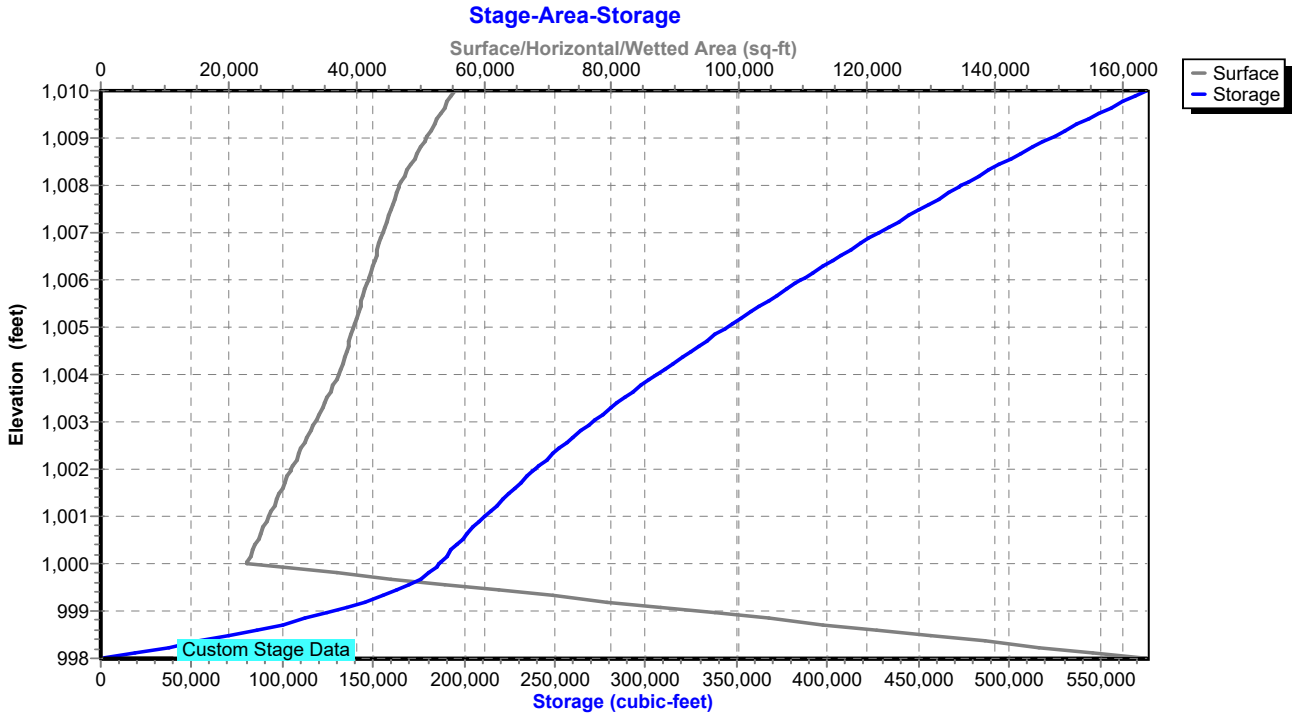
Pond 4P: EDDB #1



Pond 4P: EDDB #1



Pond 4P: EDDB #1



Summary for Pond 5P: EDDB #2

Inflow Area = 32.440 ac, 38.00% Impervious, Inflow Depth = 6.16" for 100-Year event
Inflow = 253.52 cfs @ 12.05 hrs, Volume= 16.647 af
Outflow = 40.81 cfs @ 12.45 hrs, Volume= 16.535 af, Atten= 84%, Lag= 24.1 min
Primary = 40.81 cfs @ 12.45 hrs, Volume= 16.535 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 1,001.28' @ 12.45 hrs Surf.Area= 59,589 sf Storage= 359,172 cf

Plug-Flow detention time= 235.2 min calculated for 16.518 af (99% of inflow)
Center-of-Mass det. time= 232.1 min (1,022.2 - 790.2)

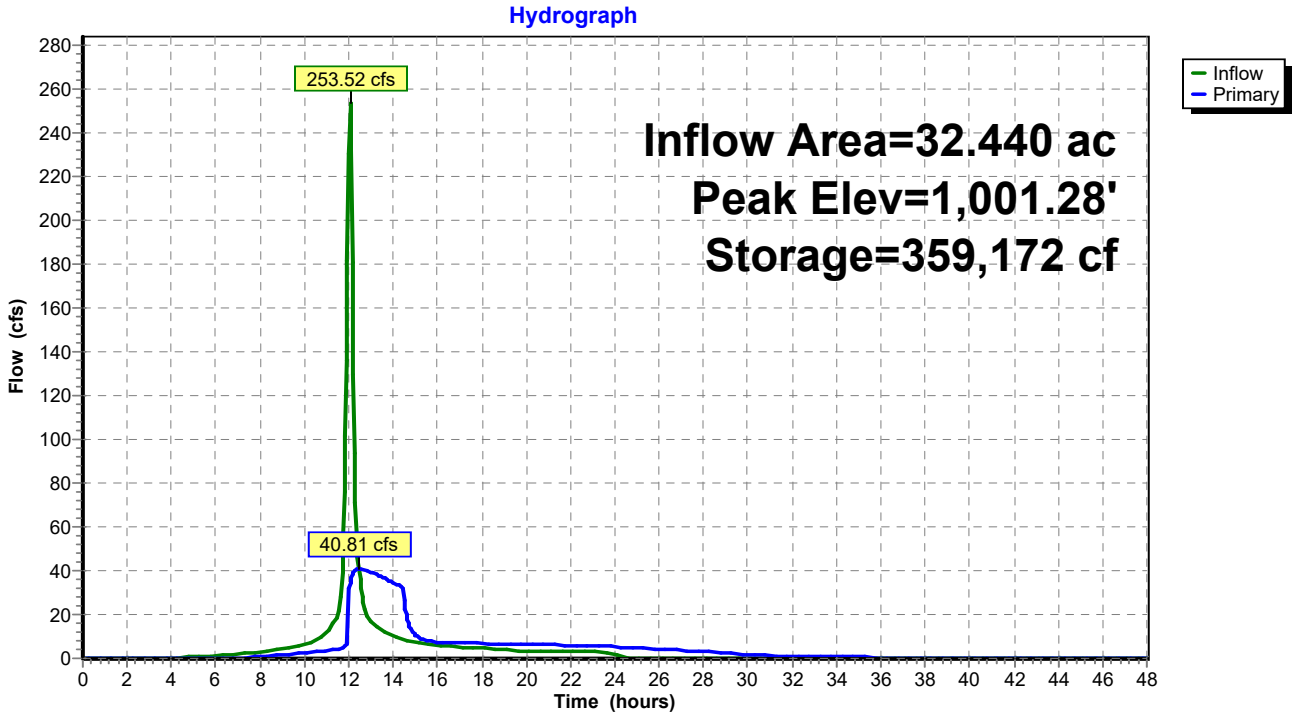
Volume	Invert	Avail.Storage	Storage Description
#1	994.00'	403,026 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
994.00	39,623	0	0
996.00	44,795	84,418	84,418
998.00	50,207	95,002	179,420
1,000.00	55,845	106,052	285,472
1,002.00	61,709	117,554	403,026

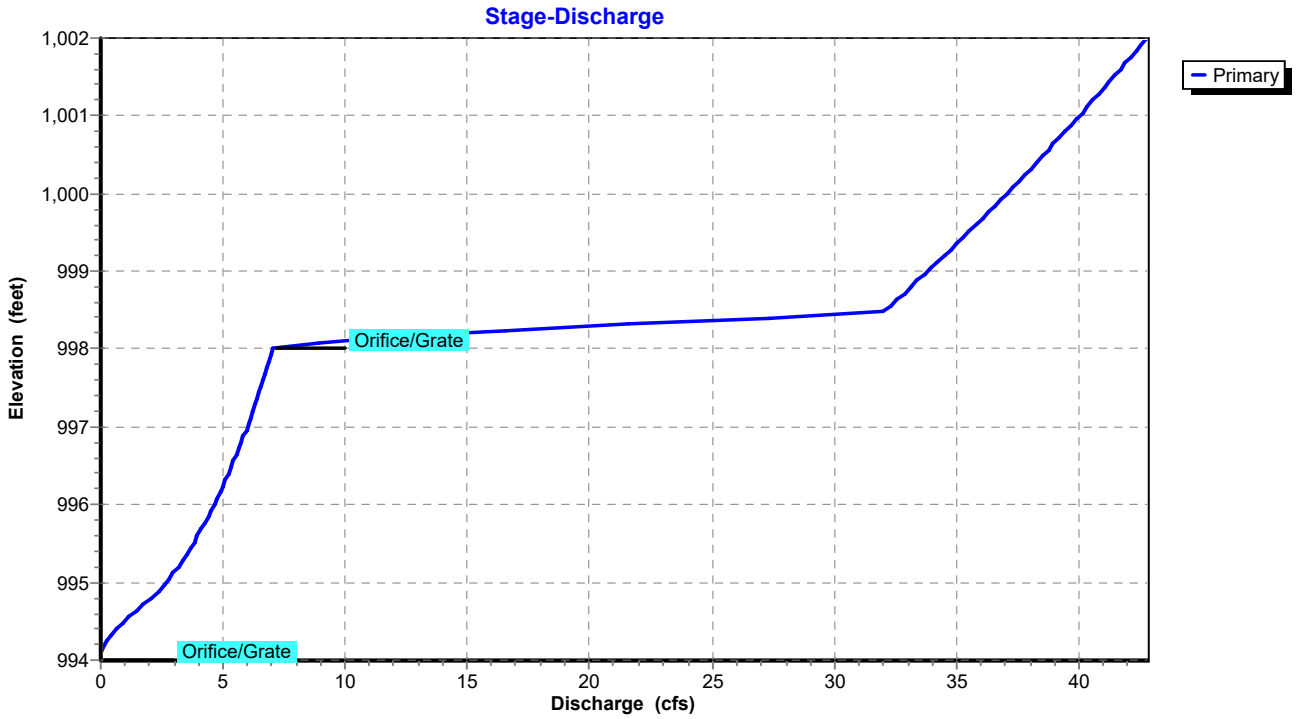
Device	Routing	Invert	Outlet Devices
#1	Primary	993.00'	**24.0" Round Culvert** L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.00' / 992.50' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Device 1	994.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	998.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=40.80 cfs @ 12.45 hrs HW=1,001.28' (Free Discharge)
└**1=Culvert** (Inlet Controls 40.80 cfs @ 12.99 fps)
└**2=Orifice/Grate** (Passes < 9.84 cfs potential flow)
└**3=Orifice/Grate** (Passes < 313.76 cfs potential flow)

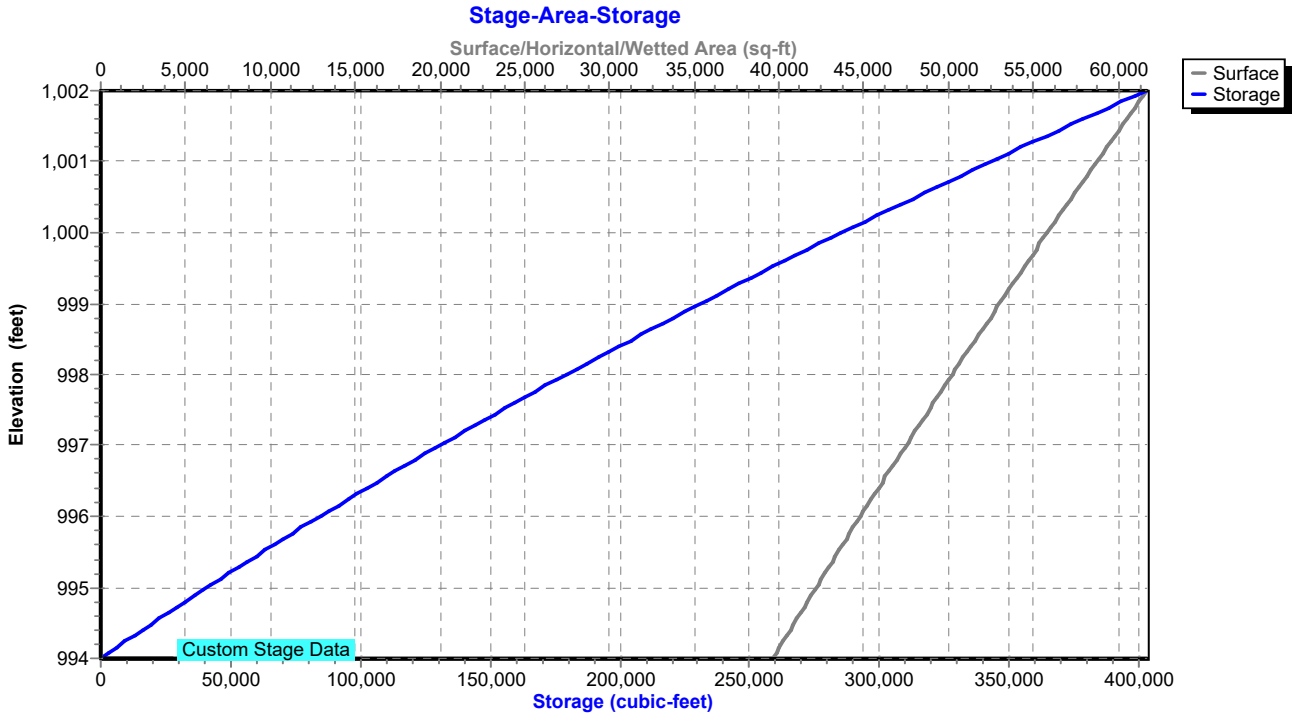
Pond 5P: EDDB #2



Pond 5P: EDDB #2



Pond 5P: EDDB #2

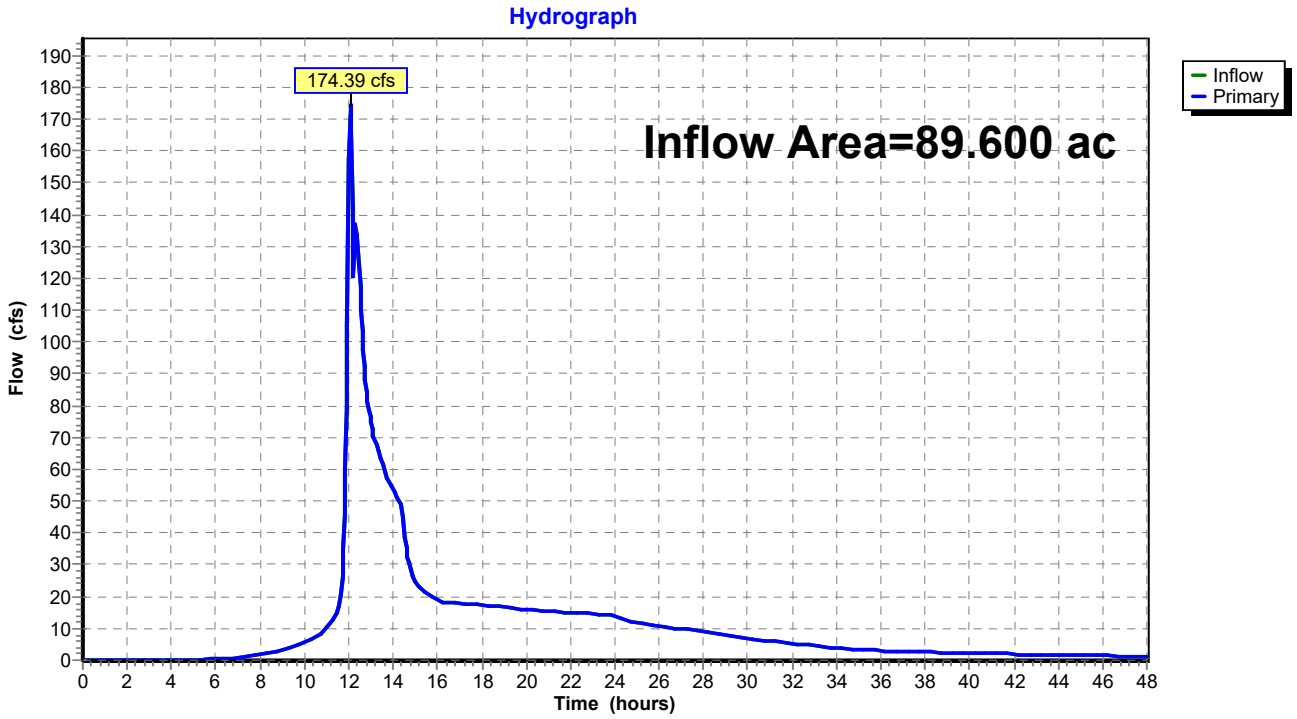


Summary for Link 2L: RP-1

Inflow Area = 89.600 ac, 36.41% Impervious, Inflow Depth > 5.84" for 100-Year event
Inflow = 174.39 cfs @ 12.06 hrs, Volume= 43.619 af
Primary = 174.39 cfs @ 12.06 hrs, Volume= 43.619 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2L: RP-1

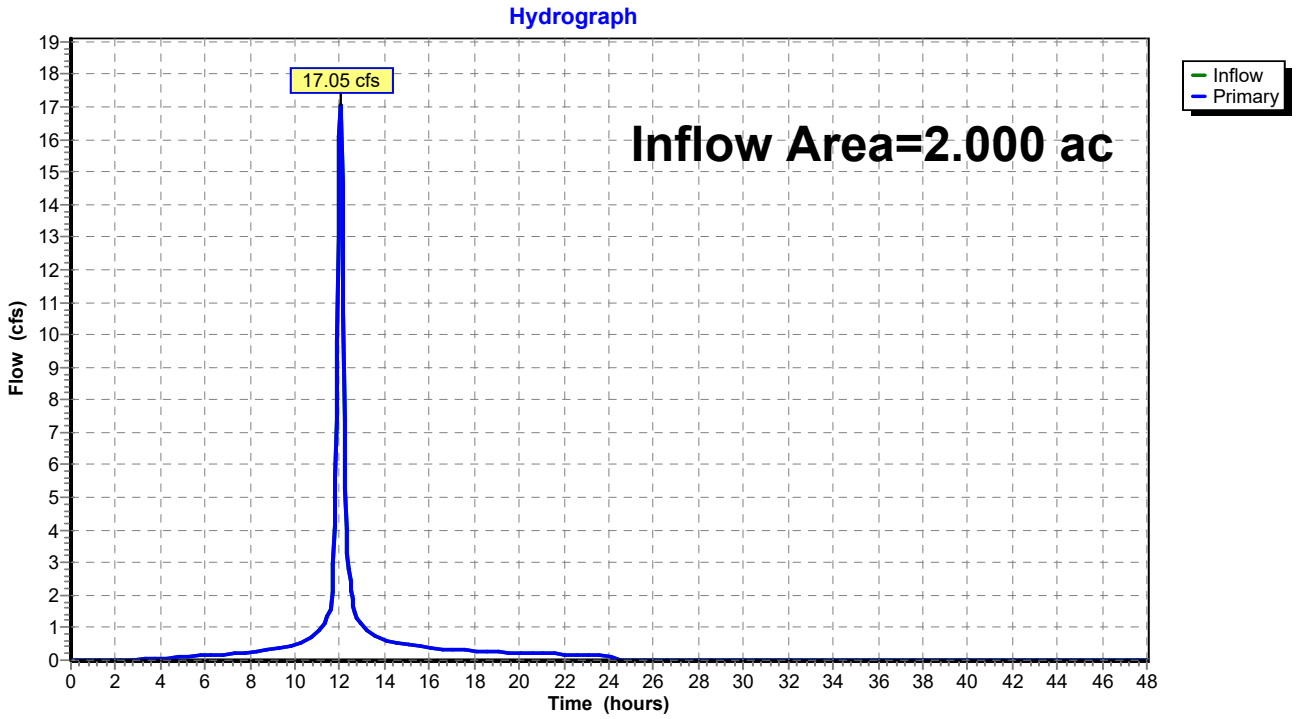


Summary for Link 3L: RP-2

Inflow Area = 2.000 ac, 65.00% Impervious, Inflow Depth = 6.75" for 100-Year event
Inflow = 17.05 cfs @ 12.04 hrs, Volume= 1.124 af
Primary = 17.05 cfs @ 12.04 hrs, Volume= 1.124 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: RP-2

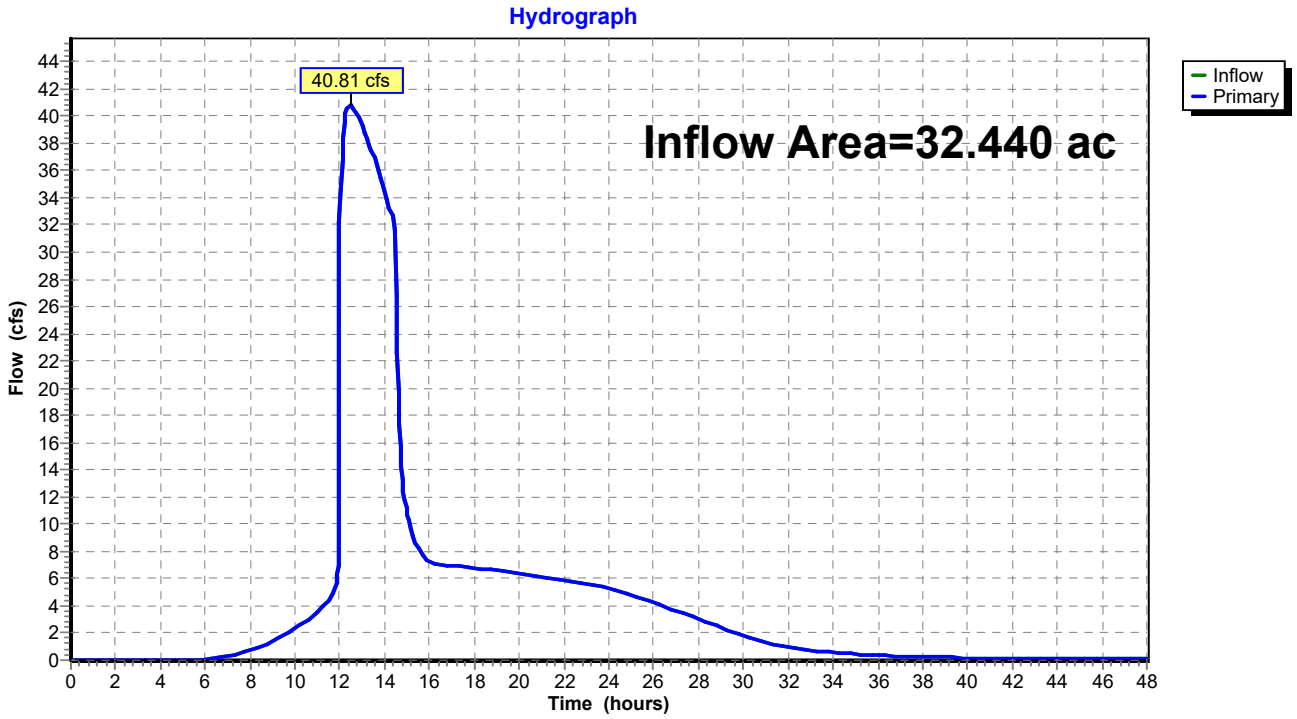


Summary for Link 4L: RP-3

Inflow Area = 32.440 ac, 38.00% Impervious, Inflow Depth > 6.12" for 100-Year event
Inflow = 40.81 cfs @ 12.45 hrs, Volume= 16.535 af
Primary = 40.81 cfs @ 12.45 hrs, Volume= 16.535 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 4L: RP-3



Summary for Link 5L: RP-4

Inflow Area = 42.140 ac, 45.07% Impervious, Inflow Depth > 5.74" for 100-Year event
Inflow = 70.92 cfs @ 12.37 hrs, Volume= 20.161 af
Primary = 70.92 cfs @ 12.37 hrs, Volume= 20.161 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: RP-4