



# Final Stormwater Management Plan

prepared for

## Cornerstone at Bailey Farms, 1<sup>st</sup> Plat

1300 SE Ranson Road  
Lee's Summit, MO 64081

November 5, 2021  
April 18, 2022  
May 18, 2022

prepared by

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for

**Clayton Properties Group Inc.,  
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Lee's Summit, Missouri**



5/18/2022

## Executive Summary

May 18, 2022

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

**RE: Manor at Bailey Farms, 1<sup>st</sup> Plat  
1300 SE Ranson Road  
Lee's Summit, MO 64081**

Dear Gene Williams,

We are submitting the enclosed final stormwater management study in support of the final development plan for the Manor at Bailey Farms 1<sup>st</sup> Plat. This report has been prepared to address permitting requirements and provides final 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 88.70 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 the City of Lee's Summit, Missouri requirements.

This project includes requesting 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 888.64 acres of land located in Section 16, Township 47 North, Range 31 West, Jackson County, Missouri. This analysis includes the 0.75 ac. Bailey Farms, Homestead located in the northeast corner of the site. 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 final design calculations for the development of the facility and associated infrastructure. Detailed designs are 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 feet. 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 at the southwest corner of the site.

Offsite stormwater comes into the site from the east and drains to the same release point previously mentioned. See Existing Offsite #1 on Sheet A.1 – Existing Drainage Map included in Appendix A.

### 2.1 TRIBUTARY AREAS

The existing drainage tributary areas are shown in Appendix A, Sheet A.1. The site release points have been identified as:

Release Point 1 (RP-1) - The full site release point.

Release Point 2 (RP-2) – The location where Bailey Farms site releases directly to the drainage channel that parallels the southern property line. Includes Exist. On-Site #2 area

Release Point 3 (RP-3) – The point at the southwest corner of the site. Includes Exist. On-Site #3

Release Point 4 (RP-4) – The centrally located point where the majority of the site drains too. Includes Exist. On-Site #1 and Exist. Off-Site #1 (Area east of Ranson Road) drainage areas.

The tributary areas are delineated according to the existing topography.

### 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.

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

Following TR-55 through HydroCAD the existing flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Offsite runoff is included in the calculations for Table 2-1 below. Appropriate runoff coefficient curve numbers were based upon aerial photography, site inspection, and the soil types present on site. See NRCS Soils Report included in Appendix B. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B. Note these flow rates are for informational purposes and not used in the final analysis as the site will be designed to meet the Comprehensive Control rates as defined in APWA 5600.

**Table 2-1 Existing Flow Rates**

Drainage Sub-Basin	Area, ac.	CN	Storm Event	Runoff, cfs
Existing On-Site #1	64.82	77	2-YR	56.78
			10-YR	118.07
			100-YR	206.11
Existing On-Site #2	6.42	76	2-YR	10.50
			10-YR	21.81
			100-YR	38.02
Existing On-Site #3	17.54	77	2-YR	18.79
			10-YR	38.90
			100-YR	67.74
Existing Off-Site #1	18.43	77	2-YR	31.32
			10-YR	63.84
			100-YR	110.11

Referring to Sheet A.1 – Existing Drainage Map.

RP-1 - Represents the total outfall for the site which is located in the southwest corner of the site.

RP-2 - Represents the release point for the run-off for Exist. On-Site #2 which is located in the southeast corner of the site. This area discharges into the existing drainage channel that parallels the southern property line.

RP-3 - Represents the run-off for Exist. On-Site #3 which is the point of convergence for this area just before exiting the site in the southwest corner.

RP-4 - Represents the point of convergence between the main tributary running north/south along the west property line and the minor tributary running east/west in the middle of the site. It includes the Off-Site #1.

## **2.4 DOWNSTREAM DRAINAGE ISSUES**

The existing downstream drainage system has been reviewed with the preliminary 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.

### **2.4.1 Agency Review**

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

### **2.4.2 Corps of Engineers Review**

The Approved jurisdictional determination map is included in Appendix A. The assessment indicates there are two wetlands and two intermittent streams on the site. Grading activities will be restricted in these areas.

### **2.4.3 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 FIRMap in Appendix A, Figure A.4.

### **2.4.4 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 are similar to the existing condition sub-basins. And are broken down accordingly, refer to Sheet A.3 – Proposed Drainage Map included in Appendix A:

On-site #1 – Which is the northern portion of the site draining to EDDB-1 which will be constructed with Cornerstone at Bailey Farms, 1<sup>st</sup> Plat.

On-site #2 – Which is the southern portion of the site draining to EDDB-2 which will be constructed with Manor at Bailey Farms, 1<sup>st</sup> Plat.

On-site #3 – The southeastern portion of the site that discharges to the drainage channel that flows parallel with our southern property line.

On-site #4 – Which is the central portion of the site. It includes the drainage channel located within a stream buffer. This will be direct release, no detention for this drainage area. Off-site #1 drains through On-Site #4.

The proposed detention basins will both be dry and used for water quality compliance. Both proposed dry detention basins have been sized to detain the 2, 10, and 100-year storm events for on-site drainage. Discharge rates are based on Comprehensive Control per APWA 5608.4.C.1.a.

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 and through a portion of the centrally located drainage channel. The proposed buffer zones will meet the requirements provided in APWA Section 5600. Drainage areas have been delineated to determine the required width of the stream buffer zones.

### **3.1 STREAM BUFFERS**

Referring to Sheet A.4 – Stream Buffer Map there will be two stream buffers on the site.

Drainage Area 1 - 125.2 ac. to Point 1 will require a 60' stream buffer. This buffer will extend from Bailey Farms northwest property line to Point 1.

Sub-Drainage Area 1 – 37.8 ac. to Point 3 will not require a stream buffer. The drainage that is carried from the east side of Ranson Road will be transported through a storm pipe system and discharged at approximately Point 3.

Sub-Drainage Area 2 – 55.1 ac. to Point 1 includes Sub-Drainage Area 1. This will require a 60' stream buffer from Point 3 to Point 1.

Drainage Area 2 – 199.3 ac. to Point 2 includes all of Drainage Area 1 and the sub-drainage area of 55.1 ac. This will require a 100' buffer which will extend from Point 1 to Point 2.

The buffer widths stated above are to be on each side of the channel measured from the ordinary high-water mark or surveyed top of bank.

### **3.2 TRIBUTARY AREAS**

As stated previously the developed site will be divided into four sub-basins. Please refer to Sheet A.3 – Proposed Drainage Map included in Appendix A.

### **3.3 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 all post-development conditions. Cover types for the proposed conditions were considered to be 1/8 acre lots, 1/4 acre lots, 1/2 acre lots, open space, and urban commercial (used for the amenity site) all in good condition.

Time of concentration was established in a similar manner as the existing conditions. Shallow concentrated flow lengths were shortened. Most of the shallow concentrated flow is now along paved drainage ways. Detailed calculations with composite curve

numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B.



### 3.4 DEVELOPED RELEASE RATES

Developed release rates will follow the Comprehensive Control per APWA 5608.4.C.1.a for the 2-Year, 10-Year, and 100-Year design storms.

- 50% (2 yr) storm peak rate less than or equal to 0.5 cfs per site acre
- 10% (10 yr) storm peak rate less than or equal to 2.0 cfs per site acre
- 1% (100 yr) storm peak rate less than or equal to 3.0 cfs per site acre

The offsite release rates for Off-Site #1 will be calculated using HydroCAD and added to the site developed release rates under Comprehensive Control.

**Table 3-1 Allowable Release Rate Calculations**

Allowable Release Rate 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)
Total Site RP-1 See Note 1	88.64	2-YR	44.35	30.84	<b>75.19</b>
		10-YR	177.4	62.92	<b>240.32</b>
		100-YR	266.1	108.57	<b>374.67</b>
South Bypass RP-2 See Note 2	2.38	2-YR	8.14	0	<b>8.14</b>
		10-YR	11.39	0	<b>11.39</b>
		100-YR	20.48	0	<b>20.48</b>
Manor RP-3 EDDB-2 (5P-HydroCAD)	29.34	2-YR	14.67	0	<b>14.67</b>
		10-YR	58.68	0	<b>58.68</b>
		100-YR	88.02	0	<b>88.02</b>
Cornerstone and Retreat RP-4 EDDB-1 (4P in HydroCAD)	31.71	2-YR	15.86	0	<b>15.86</b>
		10-YR	63.42	0	<b>63.42</b>
		100-YR	95.13	0	<b>95.13</b>

- Note 1. Release rate for the offsite area of 18.43 ac. is generated from HydroCAD. See HydroCAD output included with this study. (5S OFF-SITE #1 in HydroCAD).
- Note 2. Release rate based on the existing drainage area of 6.42 ac. using the rational method ( $Q=kCiA$ ). Calculations are in Section 3.4. Note that in the evaluation of the total run-off from the site this drainage area was evaluated under the comprehensive control rates.

### 3.5 DETENTION AND WATER QUALITY 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.

Detention will be provided in two locations:

EDDB 1 – Will provide detention for the northern drainage areas and will be constructed with Cornerstone at Bailey Farms, 1<sup>st</sup> Plat.

EDDB 2 – Will provide detention for the southern drainage areas and will be constructed with Manor at Bailey Farms, 1<sup>st</sup> Plat.

Both detention basins will be sized to comply with the Comprehensive Control Rates from the total development of the Bailey Farms subdivision.

#### 3.5.1 EDDB-1 for Cornerstone at Bailey Farms, 1<sup>st</sup> Plat

This is the analysis of the detention and water quality to be constructed with Cornerstone at Bailey Farms, 1<sup>st</sup> Plat.

Referring to Sheet A.3 – Proposed Drainage Map, the proposed drainage area to this detention basin is 31.71 acres. Using HydroCAD, the design storms for the 2, 10 and 100 year storms are routed through the basin to reduce the peak storm rates to meet the comprehensive control requirements. The control structure will be a combination of culverts, weirs associated with a storm inlet and an orifice whose primary function is to

control the water quality event. A perforated standpipe will be utilized to help keep the orifice plate from clogging. See the attached Plan Sheet 34 – Detention Basin Details for details on the control structure.

The stage-storage and discharge rates are shown in the table below. Additional information can be found in the HydroCAD output located in Appendix B

**Table 3-2 Detention Basin Stage-Storage-Discharge Rate Table**

		Surface Area, sf	Incremental Storage, cf	Cummulative Storage, cf	Discharge Rate, cfs
Orifice FL	994.16	0	0	0	0.00
FL at Riser	995.67	0	0	0	0.00
	996.00	700	115	115	0.10
	997.00	7,200	3,950	4,065	0.37
	998.00	12,000	9,600	13,665	0.42
	999.00	17,900	14,950	28,615	0.48
	1000.00	27,000	22,450	51,065	0.53
	1001.00	36,000	31,500	82,565	0.60
	1002.00	40,000	38,000	120,565	7.62
	1003.00	44,800	42,400	162,965	13.20
	1004.00	48,700	46,750	209,715	17.34
	1005.00	53,000	50,850	260,565	75.51
	1006.00	57,000	55,000	315,565	79.13
	1007.00	61,000	59,000	374,565	82.00

Storm water run-off is delivered to the detention via a storm sewer pipe system and overland flow. Below is the inflow-outflow summary table with water surface elevations for each of the design storms.

**Table 3-3 Detention Basin Inflow/Outflow Summary**

Release Point	Area (Acres)	Storm Event	Inflow to Basin, cfs	Discharge Rate from Basin, cfs	Water Surface Elevation
Cornerstone RP-4 EDDB-1 (4P In HydroCAD)	31.71	2-YR	107.19	13.32	1003.03
		10-YR	173.27	60.26	1004.79
		100-YR	260.19	81.35	1006.64
		WQV	29.17	0.54	1000.17

Water Quality

~~Refer to the MARC-BMP Manual worksheets for extended dry detention basins included in Appendix C for design of the water quality outlet orifice. Per the Worksheet, the water quality outlet calculates to require a 3.53" orifice. This design will use a 2.90" orifice resulting in a maximum discharge rate of 0.54 cfs. Meeting the MARC-BMP requirement shown in the worksheet included in Appendix A.~~

### 3.5.2 Eddb-2 for Manor at Bailey Farms, 1<sup>st</sup> Plat

**This analysis of the Eddb 1 is provided for informational purposes. Refer to the stormwater report specific to Eddb 1 “Manor at Bailey Farms, 1<sup>st</sup> Plat” for the final analysis.**

~~This is the analysis of the detention and water quality to be constructed with Manor at Bailey Farms, 1<sup>st</sup> Plat.~~

~~Referring to Sheet A.3 Proposed Drainage Map, the proposed drainage area to this detention basin is 29.69 acres. Using HydroCAD, the design storms for the 2, 10 and 100 year storms are routed through the basin to reduce the peak storm rates to meet the comprehensive control requirements. The control structure will be a combination of culverts, weirs associated with a storm inlet and an orifice whose primary function is to control the water quality event. A perforated standpipe will be utilized to help keep the orifice from clogging. See the attached Plan Sheet 34 Detention Basin Design for details on the control structure.~~

~~The stage storage and discharge rates are shown in the table below. Additional information can be found in the HydroCAD output located in Appendix B.~~

***Table 3-4 Detention Basin Stage-Storage-Discharge Rate Table***

		Surface Area, sf	Incremental Storage, cf	Cummulative Storage, cf	Discharge Rate, cfs
Orifice FL	986.62	0	0	0	0.00
FL at Riser	988.16	0	0	0	0.00
	989.00	800	336	336	0.24
	990.00	4,200	2,500	2,836	0.30
	991.00	10,400	7,300	10,136	0.34
	992.00	21,600	16,000	26,136	0.38
	993.00	37,600	29,600	55,736	0.41
	994.00	41,700	39,650	95,386	5.75
	995.00	46,000	43,850	139,236	11.63
	996.00	49,700	47,850	187,086	53.08

	997.00	53,200	51,450	238,536	73.80
	998.00	56,900	55,050	293,586	77.49
	999.00	60,400	58,650	352,236	82.00

~~Storm water run-off is delivered to the detention via a storm sewer pipe system and overland flow. Below is the inflow-outflow summary table with water surface elevations for each of the design storms.~~

**Table 3-5 Detention Basin Inflow/Outflow Summary**

Release Point	Area (Acres)	Storm Event	Inflow to Basin, cfs	Discharge Rate from Basin, cfs	Water Surface Elevation
Manor RP-3 EDDB2 (5P In HydroCAD)	29.34	2-YR	86.05	9.97	994.63
		10-YR	148.68	58.14	996.06
		100-YR	232.03	76.98	997.86
		WQV	17.13	0.38	992.24

### Water Quality

~~Refer to the MARC BMP Manual worksheets for extended dry detention basins included in Appendix C for design of the water quality outlet orifice. Per the Worksheet, the water quality outlet calculates to require a 3.22" orifice. This design will require a 2.50" orifice resulting in a maximum discharge rate of 0.54 cfs. Meeting the MARC BMP requirement shown in the worksheet included in Appendix A.~~

### 3.6 DRAINAGE AREA FOR ON-SITE #3 AT RELEASE POINT #2

On-site #3 will be released un-detained into the existing drainage channel to the south. Referring to Sheet A1 – Existing Drainage Map and Sheet A2 – Developed Drainage Area the pre-developed drainage area is 6.42 acres. The developed drainage area will reduce this to 2.38 acres. Table 3.6 shows the comprehensive rates compared to the discharge rates from HydroCAD. It can be seen that the 2 year rates have not been reduced to meet the comprehensive requirements.

**Table 3-6 Comprehensive Rates v. Developed Discharge Rates**

	Area, ac.	2-yr, cfs	10-yr, cfs	100-yr, cfs
Pre-Developed, Comprehensive	6.42	3.21	12.84	19.26
Developed, HydroCAD	2.38	7.15	12.33	19.23
Difference		-3.94	0.51	0.03

Using the rational-method to analyze this drainage area shows a significant reduction in stormwater run-off. See Table 3.8 below. This is expected as there is more than a 60% reduction in the drainage area. Also, note that the developed drainage area will be only the homes themselves. The streets will all be captured by a storm sewer system and conveyed to the EDDB-2 at the southwest corner of the site.

**Table 3-7 Pre-Developed and Developed Discharge Rates**

Pre-Developed Run-Off Calculations				
	Tc, min.	Storm Event	Rainfall Intensity, in/hr	Q, cfs
Tc, min.	16.7	2-yr	3.52	8.14
C-factor <sup>1</sup>	0.36	10-yr	4.93	11.39
Drainage Area, ac.	6.42	100-yr	7.09	20.48
<sup>1</sup> Equivalent c-factor based on a CN = 76 from TR-55 and Soil Survey				
Developed Run-Off Calculations				
	Tc, min.	Storm Event	Rainfall Intensity, in/hr	Q, cfs
Tc, min.	12.7	2-yr	4.01	4.87
C-factor	0.51	10-yr	5.56	6.75
Drainage Area, ac.	2.38	100-yr	7.88	11.96



### 3.7 TOTAL SITE DISCHARGE

To meet Comprehensive Control rates as stated in APWA 5600 the two detention basins have been designed to enable the entire site to meet these rates. Referring to Sheet A.3 – Proposed Drainage there are two drainage areas that will be un-detained - On-Site #3 and On-Site #4. Detention has been designed to adequately control and reduce the total run-off from the site to the Comprehensive Control rates.

The Off-Site #1 drainage area collects at a point on the east side of Ranson Road where a culvert conveys the run-off to the Bailey Farms site, through On-Site #4.

**Table 3-8 Required & Proposed Runoff Comparison**

Release Point	Area (Acres)	Storm Event	Allowable Release Rate, cfs	Proposed Release Rate, cfs
Total Site RP-1	88.64	2-YR	75.19	75.14
		10-YR	240.32	214.00
		100-YR	374.67	369.46
South Bypass RP-2	2.38	2-YR	8.14	7.15
		10-YR	11.39	12.33
		100-YR	20.48	19.23
Manor RP-3 EDDB-2 (5P- HydroCAD)	29.34	2-YR	14.67	9.97
		10-YR	58.68	58.14
		100-YR	88.02	76.98
Cornerstone and Retreat RP-4 EDDB-1 (4P in HydroCAD)	31.71	2-YR	15.86	13.32
		10-YR	63.42	60.26
		100-YR	95.13	81.35

It can be seen in Table 3.9 that the developed site has been designed to reduce the additional run-off peak flow rates to the Comprehensive Control Rates:

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 #2 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 #4 free releases from the site at RP-3. RP-2, RP-3, and RP-4 all converge to RP-1 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 with an orifice located in the 4'x5' storm structures. Perforated riser pipe will be utilized to help reduce the clogging at the orifices.

Emergency spillways haven been 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 and full basin. An additional 1 foot of freeboard will be provided from the water surface elevation in the spillway to the top of dam. Using HydroCAD, all primary discharge devices have been removed to simulate the clogged situation. The water surface elevation was set at the flowline of the emergency spillway to simulate that the basin is completely full prior to the storm event. Table 3-9 below summarizes the analysis. HydroCAD output is included in Appendix B. Also, refer to the included Sheet 34 – Detention Basin Design of the Manor at Bailey Farms, 1<sup>st</sup> Plat for detailed calculations.

**Table 3-9 Emergency Spillway Analysis**

	Storm Event	Inflow to Basin, cfs	Emergency Spillway Elevation	Emergency Spillway Length, ft	Clogged Surface Elevation
Manor	100-YR	232.03	998.36	160.0	998.92
Cornerstone	100-YR	260.19	1007.14	216.0	1007.64

Release Point 2 (RP-2) does not meet the allowable release rate required by the comprehensive control requirements for the 2-year storm event. This area has been reduced from 6.42 acres to 2.38 acres and consists of houses and their backyards only. Given this reduction in drainage area and the entire site is collectively meeting comprehensive control requirements, we will be requesting a waiver for this peripheral drainage area to avoid adding additional detention facilities.

\* \* \* \* \*

## 4.0 SUMMARY AND RECOMMENDATIONS

The proposed drainage site is an 88.70-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.

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**

Sheet A.1 – Existing Conditions Aerial Map

Sheet A.2 - Existing Drainage Map

Sheet A.3 - Proposed Drainage Map

Sheet A.4 – Stream Corridor Map

EDDB Water Quality Design

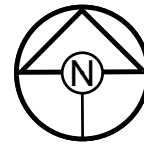
Figure A.4 - FEMA FIRMette

Figure A.5 Approved Jurisdictional Determination Map



Bailey Farms,  
Homestead

Bailey Farms



SCALE: 1" = 250'

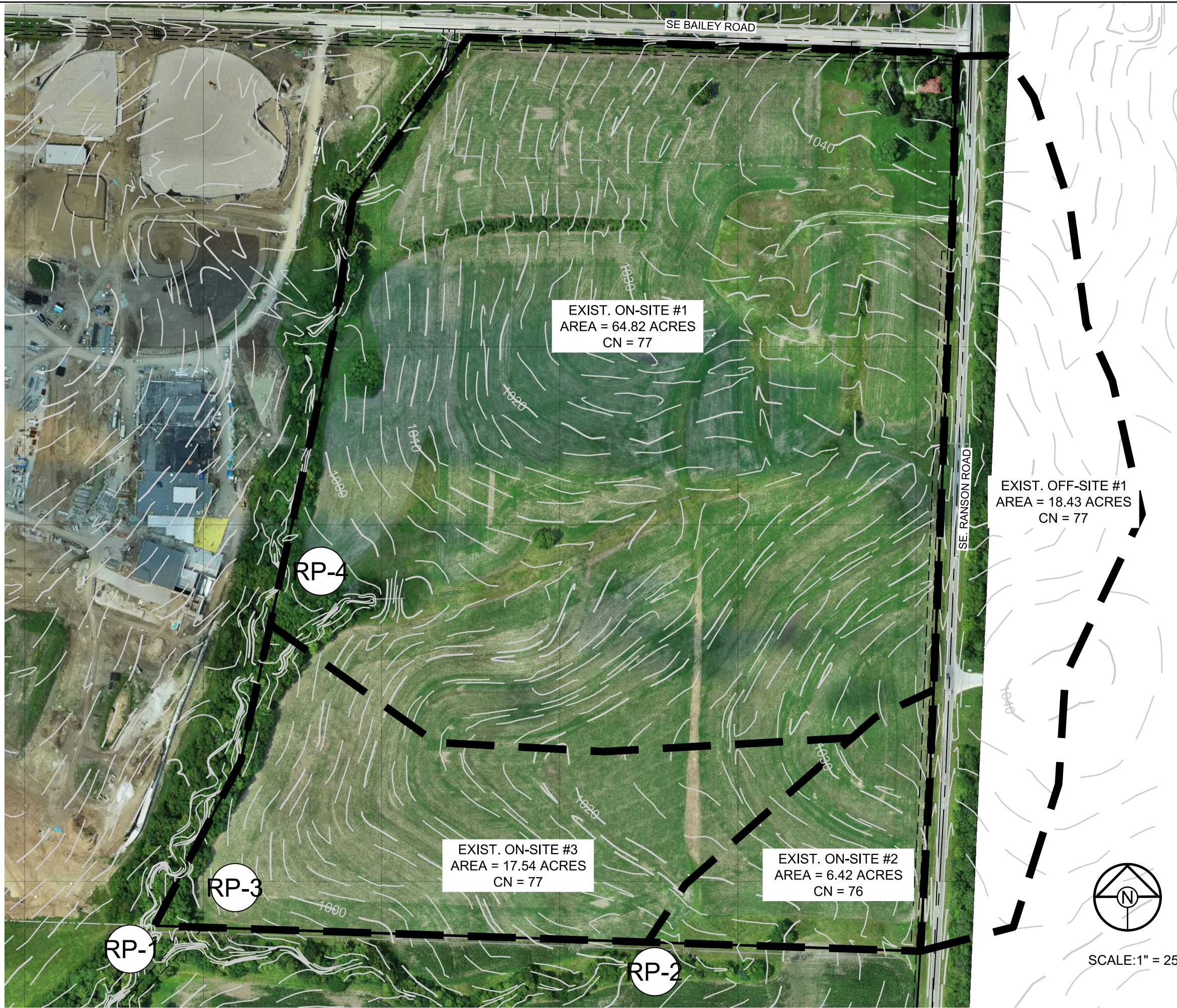
BAILEY FARMS  
HYDRO MAPS

1300 SE RANSON ROAD LEE'S SUMMIT, MISSOURI

**SCHLAGEL**  
 ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS  
 14920 West 107th Street Lenexa, Kansas 66215  
 (913) 492-5158 Fax: (913) 492-8400  
 WWW.SCHLAGELASSOCIATES.COM  
 Missouri State Certificates of Authority  
 #E2002003800-F #LAC2001005237 #LS2002008859-F

DRAWN BY:	JLL	EXISTING CONDITIONS AERIAL MAP
DATE PREPARED:	4/18/2022	
PROJ. NUMBER:	21-130	
SHEET		<b>A.1</b>

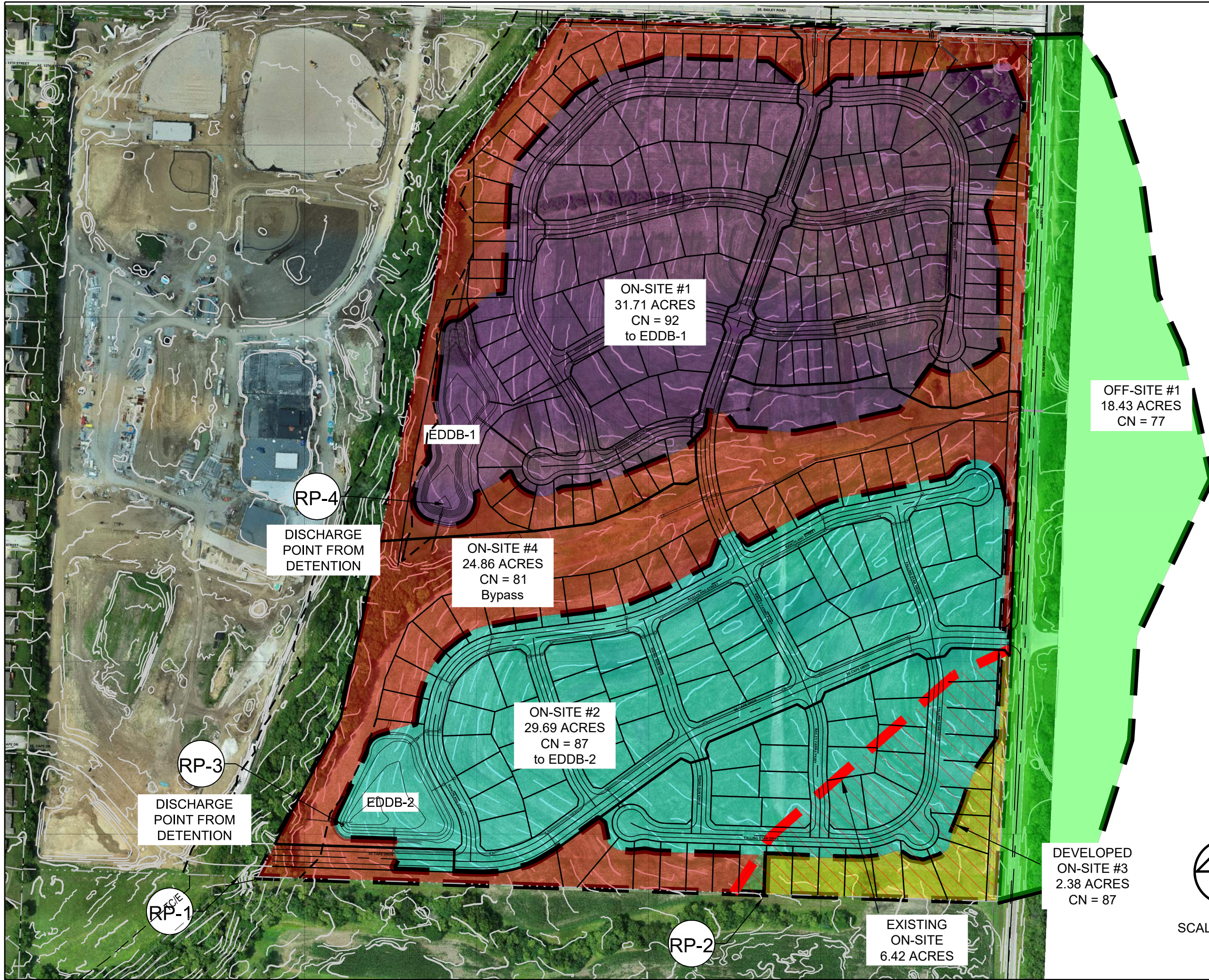
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DRAWN BY:	JLL
DATE PREPARED:	4/18/2022
PROJ. NUMBER:	21-130

EXISTING DRAINAGE MAP

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ON-SITE #1  
31.71 ACRES  
CN = 92  
to EDDB-1

EDDB-1

OFF-SITE #1  
18.43 ACRES  
CN = 77

RP-4

DISCHARGE  
POINT FROM  
DETENTION

ON-SITE #4  
24.86 ACRES  
CN = 81  
Bypass

ON-SITE #2  
29.69 ACRES  
CN = 87  
to EDDB-2

EDDB-2

RP-3

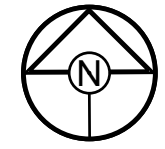
DISCHARGE  
POINT FROM  
DETENTION

RP-1

RP-2

EXISTING  
ON-SITE  
6.42 ACRES

DEVELOPED  
ON-SITE #3  
2.38 ACRES  
CN = 87



SCALE: 1" = 250'

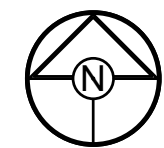
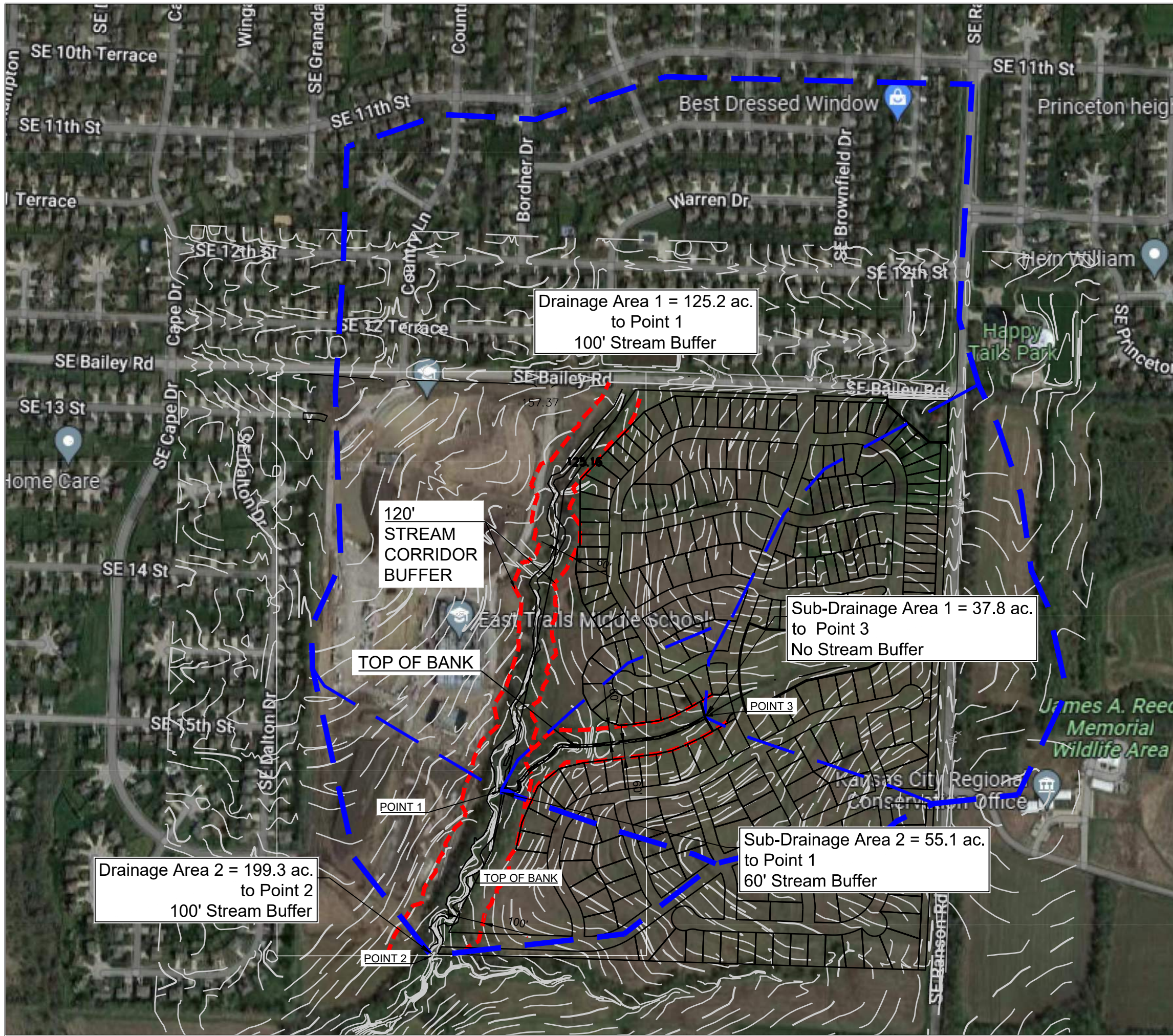
DRAWN BY:	JLL
DATE PREPARED:	4/18/2022
PROJ. NUMBER:	21-130

PROPOSED  
DRAINAGE MAP

SHEET  
**A.3**



I:\PROJECTS\2021\21-130\3.0 Design\4.0 Hydro\21-130-STREAM CORRIDOR.dwg, 4/18/2022 1:47:22 PM, 1:1



SCALE: 1" = 400'

**SCHLAGEL**  
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 WWW.SCHLAGELASSOCIATES.COM

**BAILEY FARMS  
 HYDRO MAPS**

1300 SE RANSON ROAD LEE'S SUMMIT, MISSOURI

DRAWN BY:	JLL
DATE PREPARED:	4/18/2022
PROJ. NUMBER:	21-130

**STREAM  
 CORRIDOR MAP**

SHEET  
**A.4**

## Extended Dry Detention Basin 1

(EDDB-1 To be reviewed during construction of Cornerstone at Bailey Farms, 1st Plat)

### Water Quality Volume Calculation

$$WQV = P * \text{Weighted RV}$$

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	11.14	7.24	0.66	0.64	7.35	7.07
1/4 Acre Lots	38	19.33	7.35	0.66	0.39	12.76	7.58
Commercial/Clubhouse Area	85	1.24	1.05	0.81	0.82	1.00	1.01
<b>Total</b>		<b>31.71</b>	<b>15.64</b>			<b>21.11</b>	<b>15.66</b>

$$Rv = \text{Sum}(Rv * A) / \text{Total Area} = 15.66 / 31.71 = 0.494$$

$$C = \text{Sum}(C * A) / \text{Total Area} = 21.11 / 31.71 = 0.666$$

#### II. Determine Water Quality Volume

$$WQV = P * Rv = 1.37 * 0.4939 = \mathbf{0.677 \text{ in}}$$

#### III. Determine Total Water Quality Volume

Total Watershed Area (AT) = 31.71 acres

WQV = 0.677 in

$$WQV = (31.71 * 0.676) / 12 = \mathbf{1.79 \text{ ac-ft}}$$

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

**Designer:**                     N. AUGUSTINE                      
**Checked by:**                     J. LONG                      
**Company:**                     Schlagel                      
**Date:**                     4/18/2022                      
**Project:**                     21-136                      
**Location:**                     Lee's Summit                    

**EDDB -1**  
 (To be reviewed with construction of  
 Cornerstone at Bailey Farms, 1st Plat)

**I. Basin Water Quality Storage Volume:**

Step 1) Tributary Area to EDDB,  $A_T$  (ac.)  $A_T$  (ac.) =           31.71            
 Step 2) Calculate WQv using method in Section 6.1 WQv (ac-ft) =           1.79            
 Step 3) Add 20 percent to account for silt and sand sediment deposition in the basin  $V_{design}$  (ac-ft) =           2.15          

**Ila. 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

**Ilb. Water Quality Outlet, Single Orifice**

Step 1) Depth of water quality volume at outlet,  $Z_{WQ}$  (ft.)  $Z_{WQ}$  (ft.) =           4.50            
 Step 2) Average head of Water Quality volume over invert of orifice,  $H_{WQ}$  (ft.)  $H_{WQ}$  (ft.) =           2.25            
            $H_{WQ} = 0.5 * Z_{WQ}$   
 Step 3) Average water quality outflow rate,  $Q_{WQ}$  (cfs)  $Q_{WQ}$  (cfs) =           0.54            
            $Q_{WQ} = (WQv * 43,560)/(40 * 3600)$   
 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)  $D_o$  (in) =           3.53           calculated  
            $D_o = 12 * 2 * (Q_{WQ}/C_o * \pi * (2 * g * H)^{0.5})^{0.5}$  2.9 used  
 Step 6) To size outlet orifice for EDDB with an irregular stage-volume relationship, use Single Outlet Worksheet

**Ilc. Water Quality Outlet, Perforated Riser**

Step 1) Depth at outlet above lowest perforation,  $Z_{WQ}$  (ft.)  $Z_{WQ}$  (ft.) =           4.50            
 Step 2) Recommended maximum outlet area per row,  $A_o$  (in<sup>2</sup>)  $A_o$  (in<sup>2</sup>) =           1.55            
            $A_o = (WQv)/(0.013 * Z_{WQ}^2 + 0.22 * Z_{WQ} - 0.10)$  10.99  
 Step 3) Circular perforation diameter per row assuming a single column,  $D_1$  (in)  $D_1$  (in) =           1.41

Step 4) Number of Columns, $n_c$	$n_c =$	<u>20.00</u>
Step 5) Design circular perforation diameter (should be between 1 and 2 inches), $D_{\text{perf}}$ (in)	$D_{\text{perf}}$ (in) =	<u>1.00</u>
Step 6) Horizontal perforation column spacing when $n_c > 1$ , center to center, $S_c$ If $D_{\text{perf}} \geq 1.0$ in, $S_c = 4$	$S_c$ (in) =	<u>4.00</u>
Step 7) Number of rows (4" vertical spacing between perforations, center to center), $n_r$	$n_r =$	<u>13</u>

### IIb. Water Quality Outlet, V-notch Weir

Step 1) Depth of water quality volume at outlet, $Z_{WQ}$ (ft.)	$Z_{WQ}$ (ft.) =	<u>4.50</u>
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.) =	<u>2.25</u>
Step 3) Average water quality outflow rate, $Q_{WQ}$ (cfs) $Q_{WQ} = (WQV * 43,560) / (40 * 3600)$	$Q_{WQ}$ (cfs) =	<u>0.54</u>
Step 4) V-notch weir coefficient, $C_v$	$C_v =$	<u>2.69</u>
Step 5) V-notch weir angle, $\theta$ (deg) $\theta = 2 * (180/\pi) * \arctan(Q_{WQ} / C_v * H_{WQ}^{5/2})$ V-notch angle should be at least 20 degrees. Set to 20 degrees if calculated angle is smaller.	$\theta$ (deg) =	<u>20.0</u>
Step 6) Top width of V-notch weir $W_v = 2 * Z_{WQ} * \text{TAN}(\theta/2)$	$W_v =$	<u>1.59</u>

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

(EDDB-1 To be reviewed during construction of Manor at Bailey Farms, 1st Plat)

### Water Quality Volume Calculation

$$WQV = P * \text{Weighted RV}$$

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	29.69	11.28	0.66	0.39	19.60	11.64
<b>Total</b>		<b>29.69</b>	<b>11.28</b>			<b>19.60</b>	<b>11.64</b>

$$Rv = \text{Sum}(Rv * A) / \text{Total Area} = 11.63 / 29.69 = 0.392$$

$$C = \text{Sum}(C * A) / \text{Total Area} = 19.59 / 29.69 = 0.660$$

#### II. Determine Water Quality Volume

$$WQV = P * Rv = 1.37 * 0.392 = 0.537 \text{ in}$$

#### III. Determine Total Water Quality Volume

$$\text{Total Watershed Area (AT)} = 29.69 \text{ acres}$$

$$WQV = 0.537 \text{ in}$$

$$WQV = (29.69 * 0.537) / 12 = 1.33 \text{ ac-ft}$$

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

**Designer:**                     N. AUGUSTINE                      
**Checked by:**                     J. LONG                      
**Company:**                     Schlagel                      
**Date:**                     4/18/2022                      
**Project:**                     21-130                      
**Location:**                     Lee's Summit                    

**EDDB -2**  
 (To be reviewed with construction of  
 Manor at Bailey Farms, 1st Plat)

**I. Basin Water Quality Storage Volume:**

Step 1) Tributary Area to EDDB,  $A_T$  (ac.)  $A_T$  (ac.) =           29.69            
 Step 2) Calculate WQv using method in Section 6.1 WQv (ac-ft) =           1.33            
 Step 3) Add 20 percent to account for silt and sand sediment deposition in the basin  $V_{design}$  (ac-ft) =           1.59          

**Ia. Water** 13.88  
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.) =           3.62            
 Step 2) Average head of Water Quality volume over invert of orifice,  $H_{WQ}$  (ft.)  $H_{WQ}$  (ft.) =           1.81            
            $H_{WQ} = 0.5 * Z_{WQ}$   
 Step 3) Average water quality outflow rate,  $Q_{WQ}$  (cfs)  $Q_{WQ}$  (cfs) =           0.40            
            $Q_{WQ} = (WQv * 43,560)/(40 * 3600)$   
 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)  $D_O$  (in) =           3.22           Calculated  
            $D_O = 12 * 2 * ((Q_{WQ}/C_O * \pi * (2 * g * H)^{0.5}))^{0.5}$  2.5 Used  
 Step 6) To size outlet orifice for EDDB with an irregular stage-volume relationship, use Single Outlet Worksheet

**Iic. Water Quality Outlet, Perforated Riser**

Step 1) Depth at outlet above lowest perforation,  $Z_{WQ}$  (ft.)  $Z_{WQ}$  (ft.) =           5.64            
 Step 2) Recommended maximum outlet area per row,  $A_O$  (in<sup>2</sup>)  $A_O$  (in<sup>2</sup>) =           0.85            
            $A_O = (WQv)/(0.013 * Z_{WQ}^2 + 0.22 * Z_{WQ} - 0.10)$   
 Step 3) Circular perforation diameter per row assuming a single column,  $D_1$  (in)  $D_1$  (in) =           1.04            
 Step 4) Number of Columns,  $n_c$   $n_c$  =           1.00

Step 5) Design circular perforation diameter (should be between 1 and 2 inches),  $D_{\text{perf}}$  (in)  $D_{\text{perf}}$  (in) = 2.00

Step 6) Horizontal perforation column spacing when  $n_c > 1$ , center to center,  $S_c$   $S_c$  (in) = 4.00  
 If  $D_{\text{perf}} \geq 1.0$  in,  $S_c = 4$

Step 7) Number of rows (4" vertical spacing between perforations, center to center),  $n_r$   $n_r$  = 17

**IIb. Water Quality Outlet, V-notch Weir**

Step 1) Depth of water quality volume at outlet,  $Z_{\text{WQ}}$  (ft.)  $Z_{\text{WQ}}$  (ft.) = 5.64

Step 2) Average head of Water Quality volume over invert of V-notch,  $H_{\text{WQ}}$  (ft)  $H_{\text{WQ}}$  (ft.) = 2.82  
 $H_{\text{WQ}} = 0.5 * Z_{\text{WQ}}$

Step 3) Average water quality outflow rate,  $Q_{\text{WQ}}$  (cfs)  $Q_{\text{WQ}}$  (cfs) = 0.40  
 $Q_{\text{WQ}} = (\text{WQV} * 43,560) / (40 * 3600)$

Step 4) V-notch weir coefficient,  $C_v$   $C_v$  = 2.69

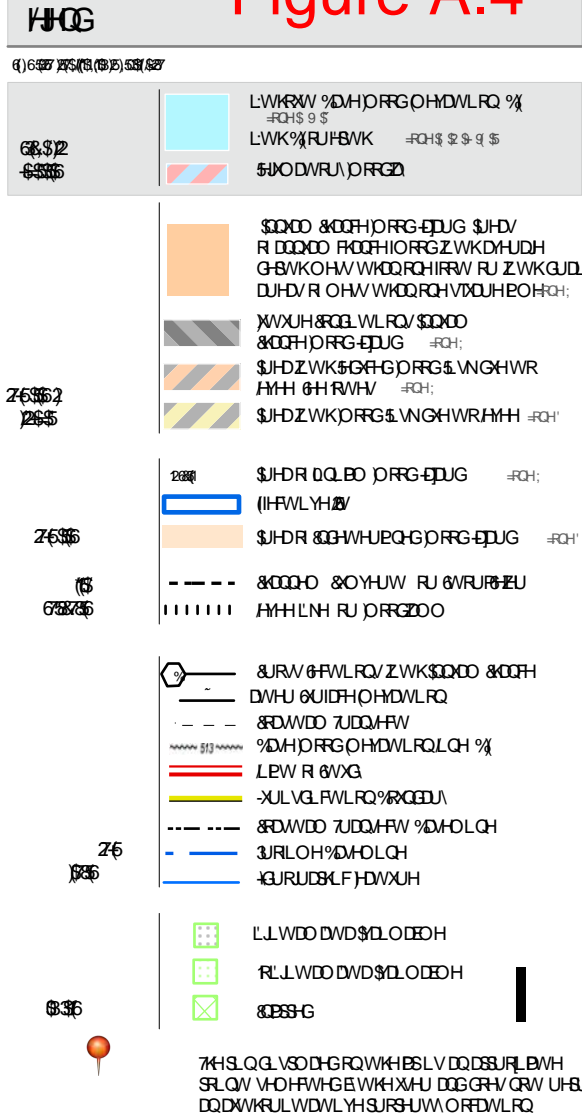
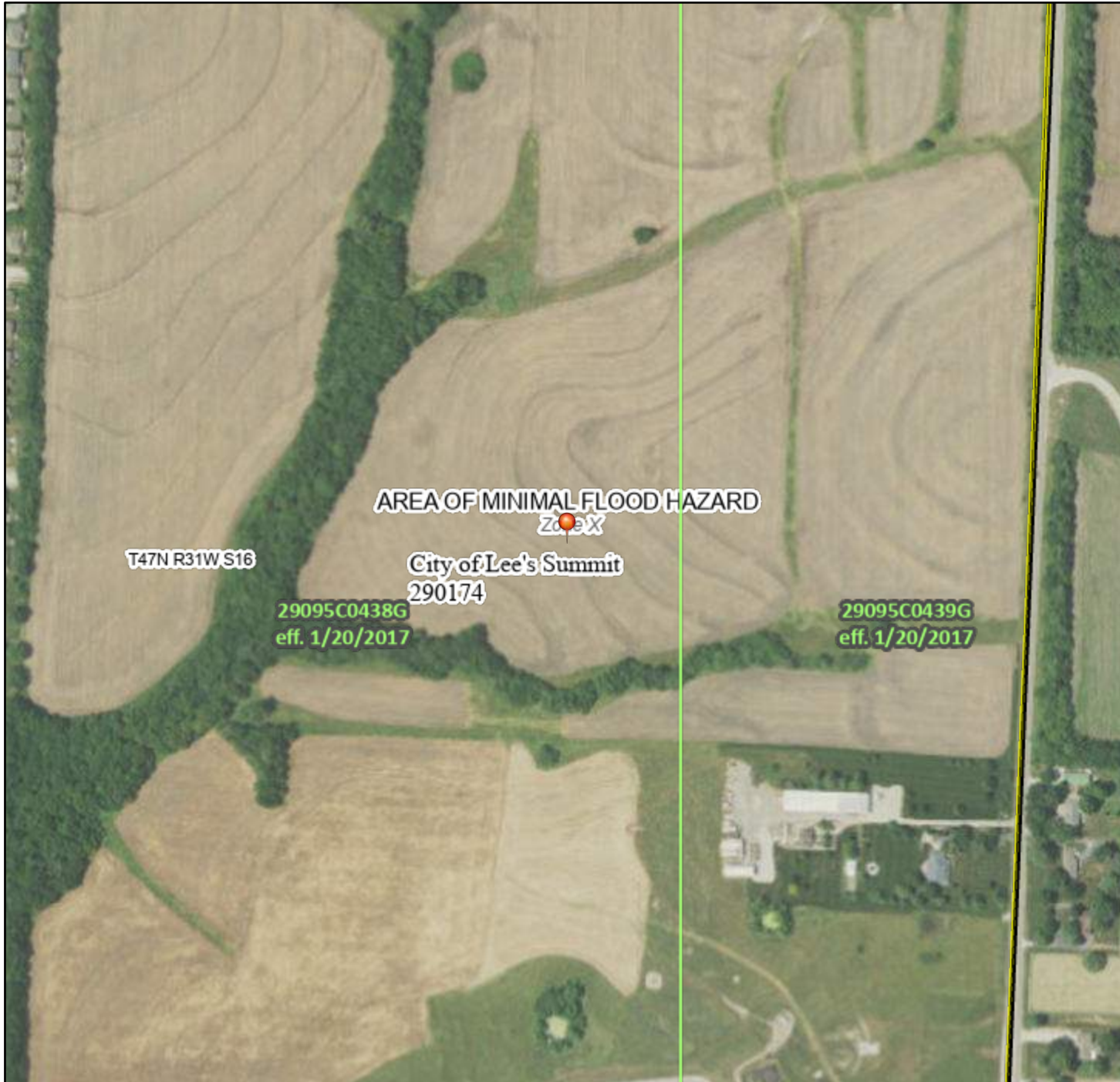
Step 5) V-notch weir angle,  $\theta$  (deg)  $\theta$  (deg) = 20.0  
 $\theta = 2 * \arctan(Q_{\text{WQ}} / C_v * H_{\text{WQ}}^{5/2})$   
 V-notch angle should be at least 20 degrees. Set to 20 degrees if calculated angle is smaller.

Step 6) Top width of V-notch weir  $W_v$  = 1.99  
 $W_v = 2 * Z_{\text{WQ}} * \text{TAN}(\theta/2)$

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



74LVESFBDLHV.ZWKJ.VW.DQDQJG/IRU.WKH.XHR  
G.L.WDQD.IORRGS/LI.LW.LVQRV.YRLGDV.GH.VULF.G&DORZ  
74HEDFBSVKRQFBDLHV.ZWKJ.VV.DVHES  
DFXUR.WDQDQJG/

74IORRGGQJGLQRUBMLRQ.LV.GULYHG.GLUHFWO.IURFVH  
DVKRLWDLVH.YH.ZEVHUYL.FH.SURL.GHG.74LVES  
ZV.HSRUVHGRQ DV.3 DQDGRVQRV  
UHOHFW.FROQH.RU.DQDQJG.VX.HIX.QV.VR.WKLV.GDVH.DQD  
WLF.74H.YDQGH.HFV.LYH.LQRUBMLRQ.B.FROQRU  
E.FFRVXUVH.G.GE.QZGDVDRYHU.WLF

74LVESLBDLHV.YRLGLI.WKHQRURU.RUHR.WKHIROORZQJES  
HOFQWVGRQRV.DSSDU.EDHESLBUH.IORRGRQDDEHV  
OHFQD.VDQDEU.BSFUHDVLRQ.DVH.FRQ.WL.GQV.LLHV  
)\$DQD.QEHU.DQD)SHIFVLYHG.DVH.DS.LBH/IRU  
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NWK-2020-828  
Approved Jurisdictional Determination

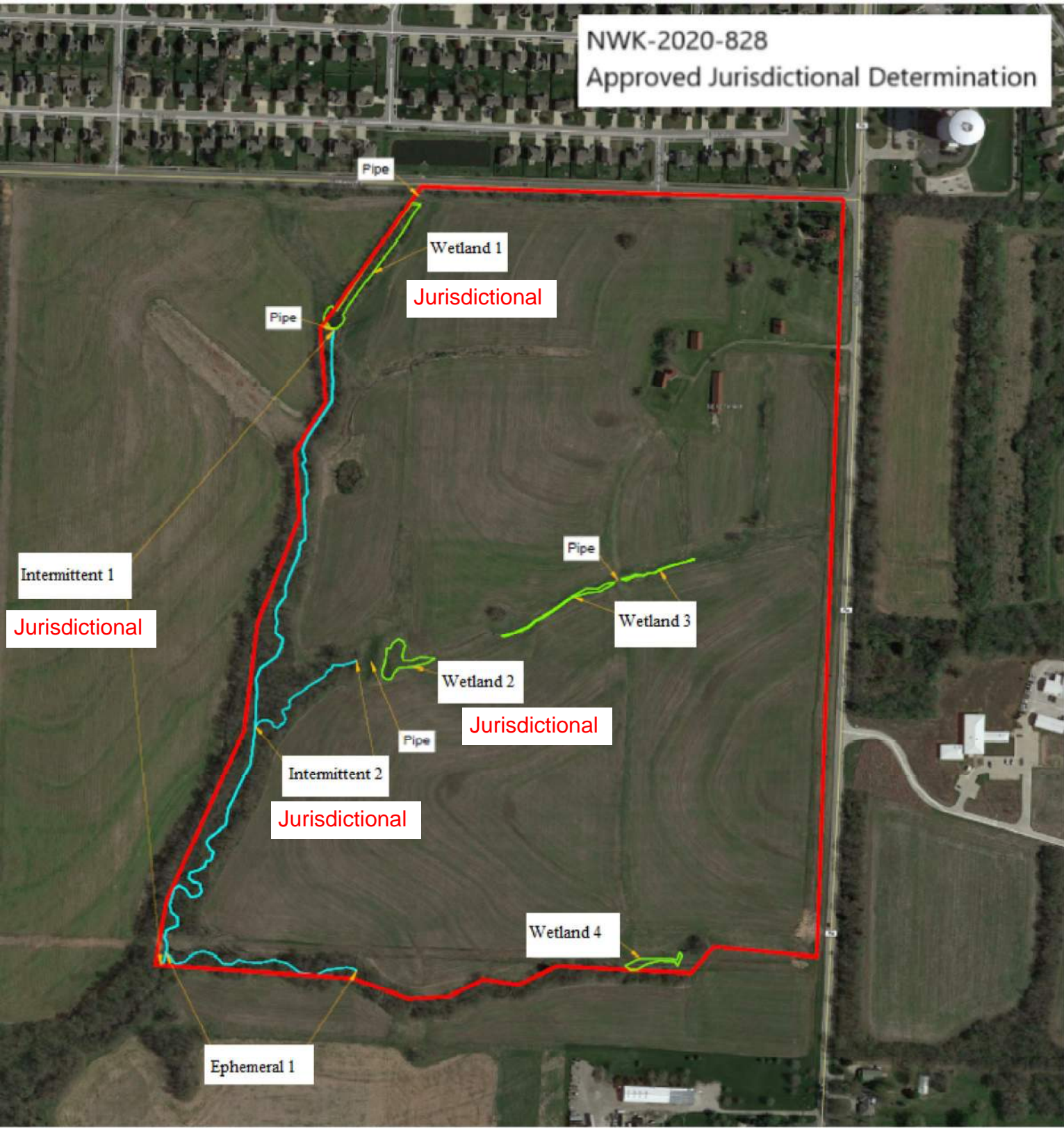
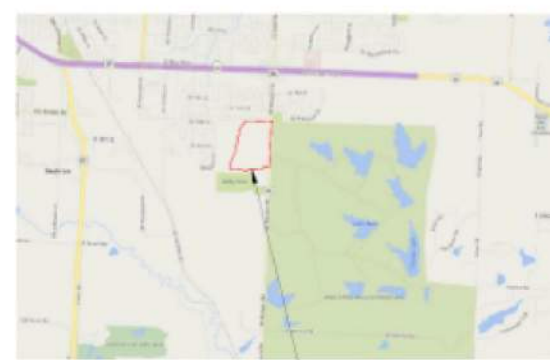


Figure A.5



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

GRAPHIC SCALE  
1" = 400'  
1 Mile = 1600'

**From:** John Kahl <[jk@terratechnologies.com](mailto:jk@terratechnologies.com)>

**Sent:** Wednesday, March 10, 2021 10:33 AM

**To:** Dan Foster <[df@schlagelassociates.com](mailto:df@schlagelassociates.com)>; Tiffany Ford <[Tiffany@summithomeskc.com](mailto:Tiffany@summithomeskc.com)>

**Cc:** David Rinne <[dr@schlagelassociates.com](mailto:dr@schlagelassociates.com)>; Brad Kempf <[Bradley@summithomeskc.com](mailto:Bradley@summithomeskc.com)>; Travis Ruf <[Travis@summithomeskc.com](mailto:Travis@summithomeskc.com)>

**Subject:** RE: [External] 19-227 RE: Bailey Farms ACAD base file

The DWG file has been received and I have confirmed that the proposed layout will avoid all jurisdictional waters under the Clean Water Act, making 404 Permitting unnecessary under current rules.

For reference and for your records, I have attached a copy of our **Jurisdictional Assessment autoCAD file that shows the identified waters in true State Plane coordinates. Only intermittent #1 & #2 and Wetland #1 & #2 are jurisdictional. All other waters identified on the site were deemed to be non-jurisdictional by the USACE.**

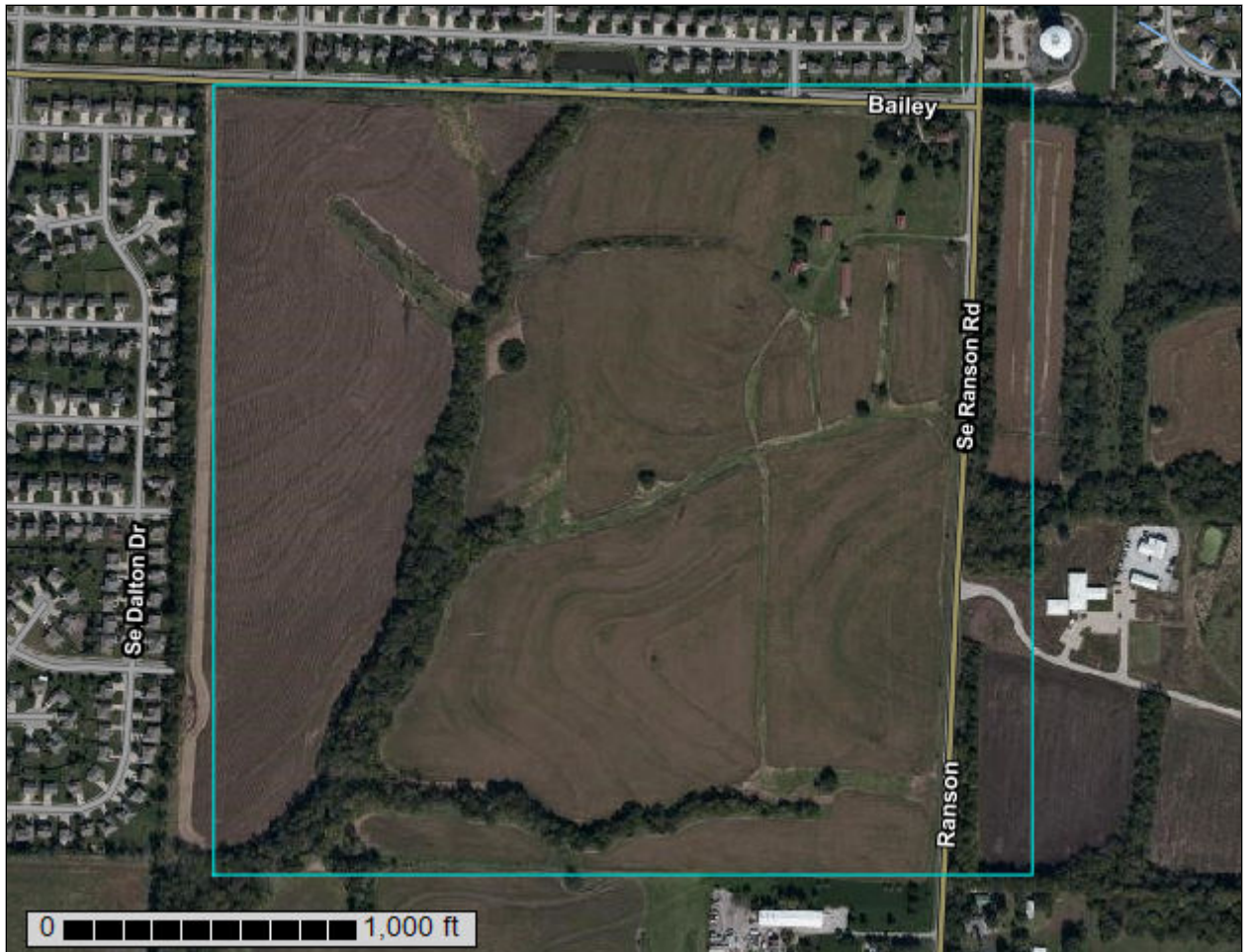
John M. Kahl, P.E.  
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**Appendix B**  
**NRCS Soil Resource Report**  
**HydroCAD Model Output Reports**  
**Existing Conditions**  
**Developed Conditions**  
**Clogged Conditions**

# Custom Soil Resource Report for Jackson County, Missouri



# Preface

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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](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

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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



## Custom Soil Resource Report

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

## Custom Soil Resource Report

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

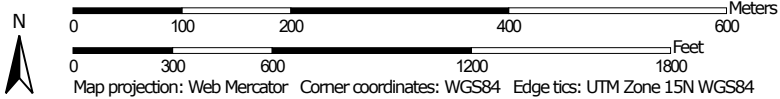
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The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce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



### 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%
<b>Totals for Area of Interest</b>		<b>173.0</b>	<b>100.0%</b>

## 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

## Custom Soil Resource Report

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

## Custom Soil Resource Report

### **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

## Custom Soil Resource Report

### 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

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## 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.

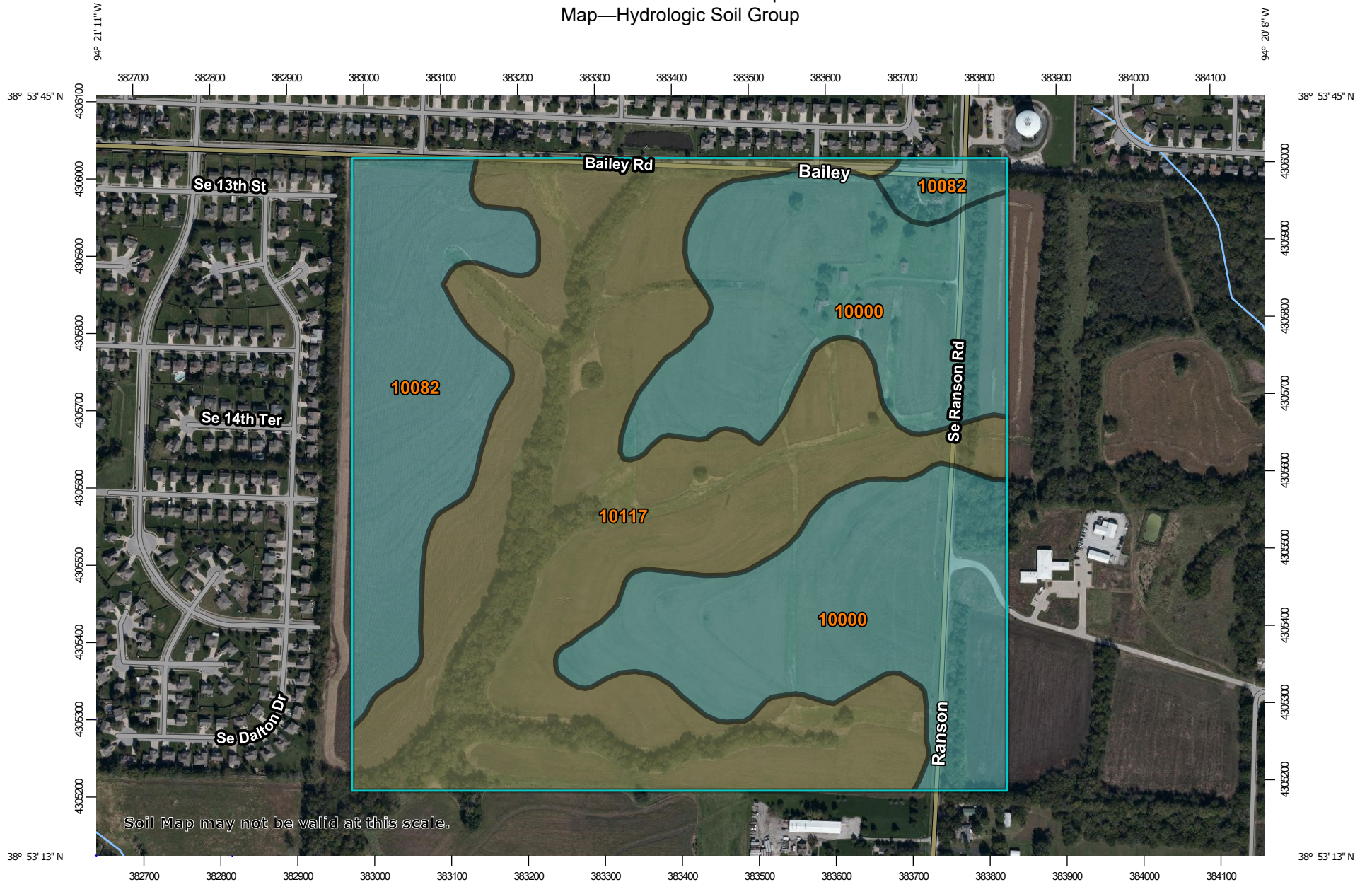
## Custom Soil Resource Report

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.

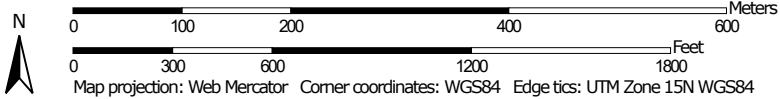
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report  
Map—Hydrologic Soil Group




Soil Map may not be valid at this scale.

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



### 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%
<b>Totals for Area of Interest</b>			<b>173.0</b>	<b>100.0%</b>

**Rating Options—Hydrologic Soil Group**

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

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## Custom Soil Resource Report

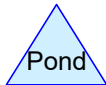
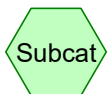
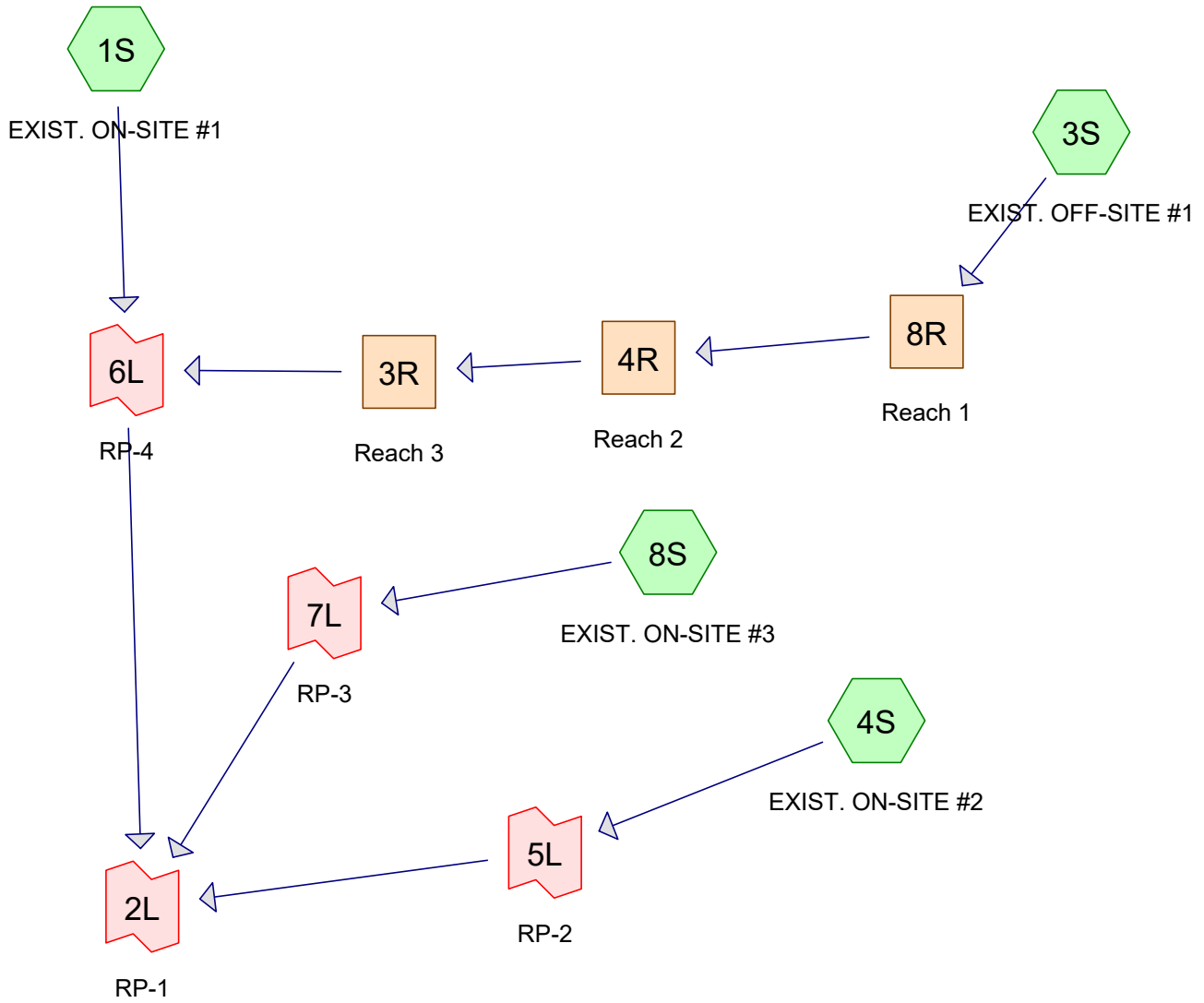
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# HydroCAD - Pre-Developed



**Routing Diagram for 21-130-HYDRO-EX**  
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**21-130-HYDRO-EX**

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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
48.870	74	Pasture/grassland/range, Good, HSG C (1S, 4S, 8S)
39.910	80	Pasture/grassland/range, Good, HSG D (1S, 4S, 8S)
15.640	76	Woods/grass comb., Fair, HSG C (3S)
2.790	82	Woods/grass comb., Fair, HSG D (3S)

## 21-130-HYDRO-EX

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Type II 24-hr 2-Year Rainfall=3.50"

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Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1S: EXIST. ON-SITE #1** Runoff Area=64.820 ac 0.00% Impervious Runoff Depth=1.43"  
Flow Length=3,450' Tc=47.2 min CN=77 **Runoff=56.78 cfs** 7.727 af

**Subcatchment3S: EXIST. OFF-SITE #1** Runoff Area=18.430 ac 0.00% Impervious Runoff Depth=1.43"  
Flow Length=1,147' Slope=0.0210 '/' Tc=17.1 min CN=77 **Runoff=31.32 cfs** 2.197 af

**Subcatchment4S: EXIST. ON-SITE #2** Runoff Area=6.420 ac 0.00% Impervious Runoff Depth=1.37"  
Flow Length=1,020' Slope=0.0300 '/' Tc=16.7 min CN=76 **Runoff=10.50 cfs** 0.730 af

**Subcatchment8S: EXIST. ON-SITE #3** Runoff Area=17.540 ac 0.00% Impervious Runoff Depth=1.43"  
Flow Length=1,930' Tc=35.6 min CN=77 **Runoff=18.79 cfs** 2.091 af

**Reach 3R: Reach 3** Avg. Flow Depth=0.92' Max Vel=3.48 fps Inflow=27.94 cfs 2.197 af  
n=0.030 L=1,041.0' S=0.0088 '/' Capacity=2,150.14 cfs Outflow=25.62 cfs 2.197 af

**Reach 4R: Reach 2** Avg. Flow Depth=0.66' Max Vel=3.55 fps Inflow=30.23 cfs 2.197 af  
n=0.030 L=853.0' S=0.0225 '/' Capacity=1,999.47 cfs Outflow=27.94 cfs 2.197 af

**Reach 8R: Reach 1** Avg. Flow Depth=0.27' Max Vel=5.05 fps Inflow=31.32 cfs 2.197 af  
n=0.012 L=875.0' S=0.0147 '/' Capacity=1,475.63 cfs Outflow=30.23 cfs 2.197 af

**Link 2L: RP-1** Inflow=101.93 cfs 12.745 af  
Primary=101.93 cfs 12.745 af

**Link 5L: RP-2** Inflow=10.50 cfs 0.730 af  
Primary=10.50 cfs 0.730 af

**Link 6L: RP-4** Inflow=82.34 cfs 9.924 af  
Primary=82.34 cfs 9.924 af

**Link 7L: RP-3** Inflow=18.79 cfs 2.091 af  
Primary=18.79 cfs 2.091 af

**21-130-HYDRO-EX**

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

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

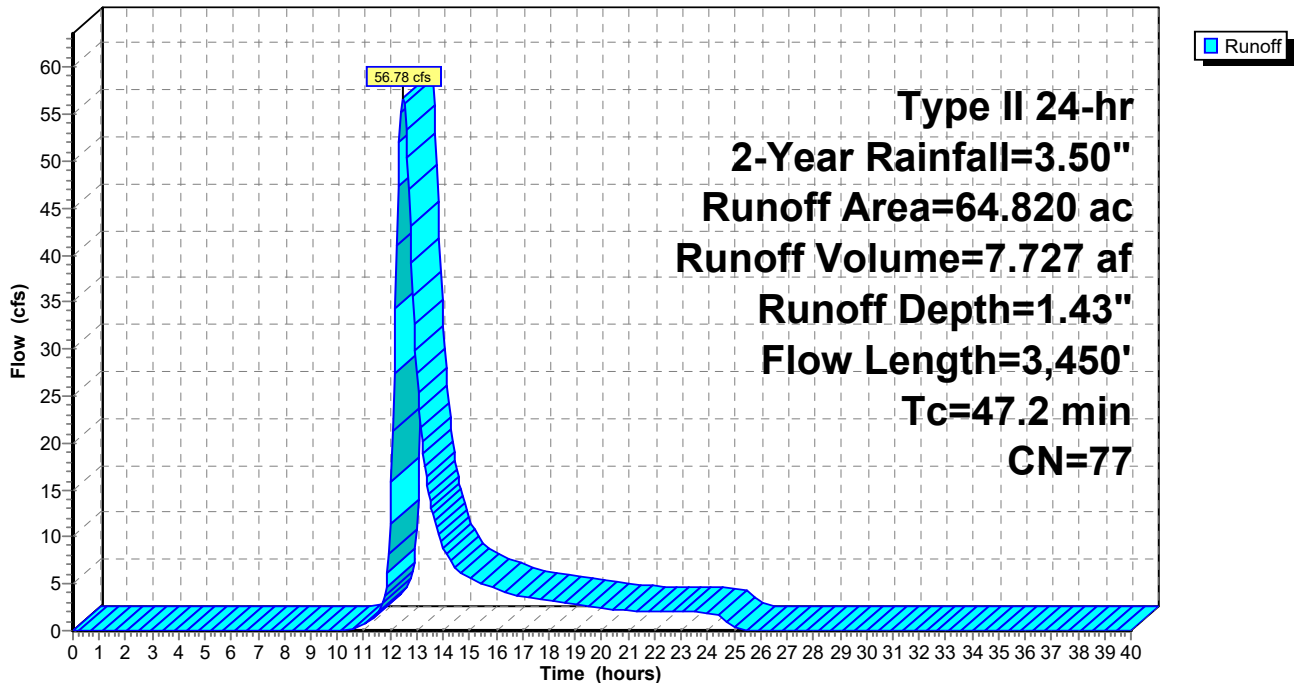
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.50"

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		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
24.7	2,132	0.0255	1.44		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
14.1	1,218	0.0092	1.44		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
47.2	3,450	Total			

**Subcatchment 1S: EXIST. ON-SITE #1**

Hydrograph





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

Runoff = 31.32 cfs @ 12.10 hrs, Volume= 2.197 af, Depth= 1.43"

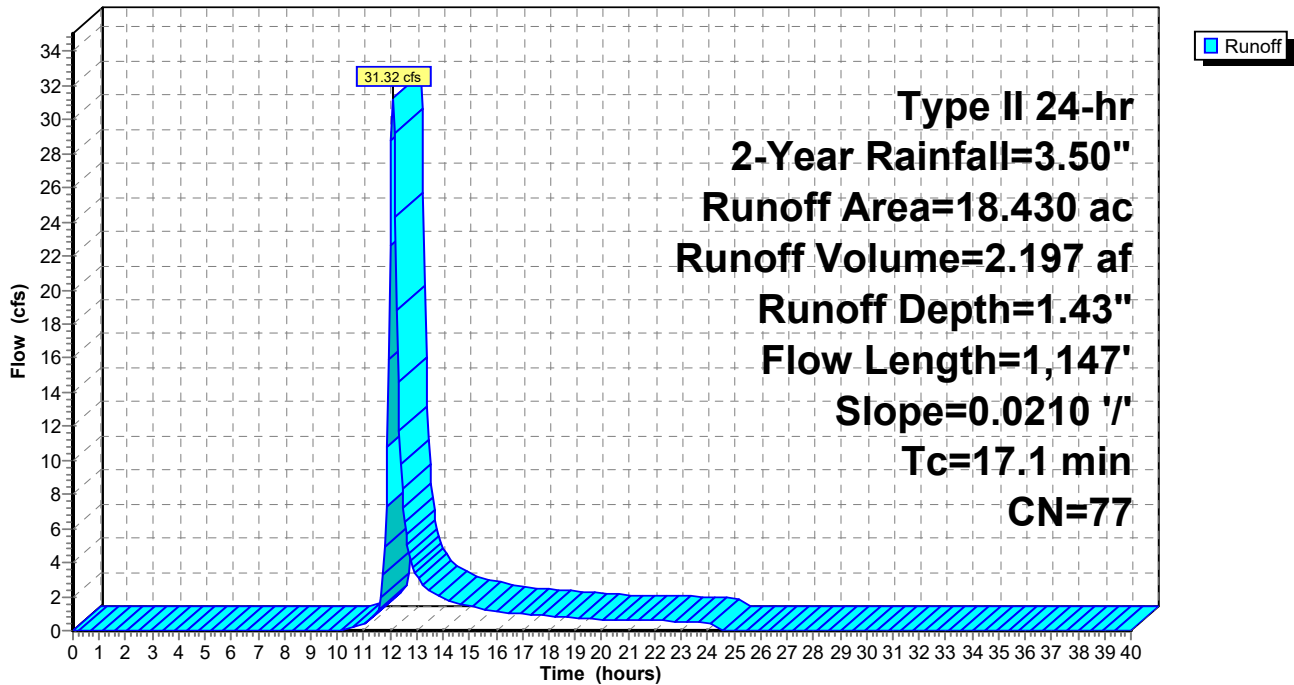
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

**Subcatchment 3S: EXIST. OFF-SITE #1**

Hydrograph



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

Runoff = 10.50 cfs @ 12.10 hrs, Volume= 0.730 af, Depth= 1.37"

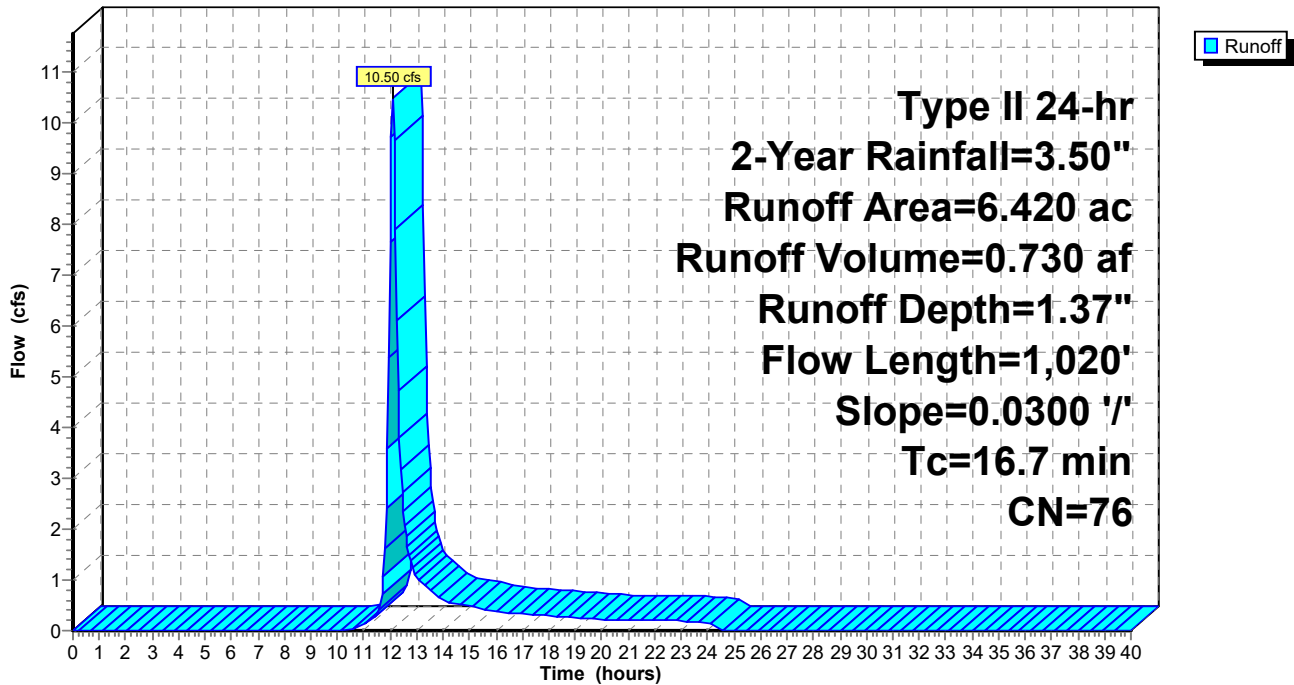
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.50"

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
6.6	80	0.0300	0.20		Sheet Flow, Grass: Short n= 0.150 P2= 3.60"
10.1	940	0.0300	1.56		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
16.7	1,020	Total			

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

Hydrograph



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Type II 24-hr 2-Year Rainfall=3.50"

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## 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"

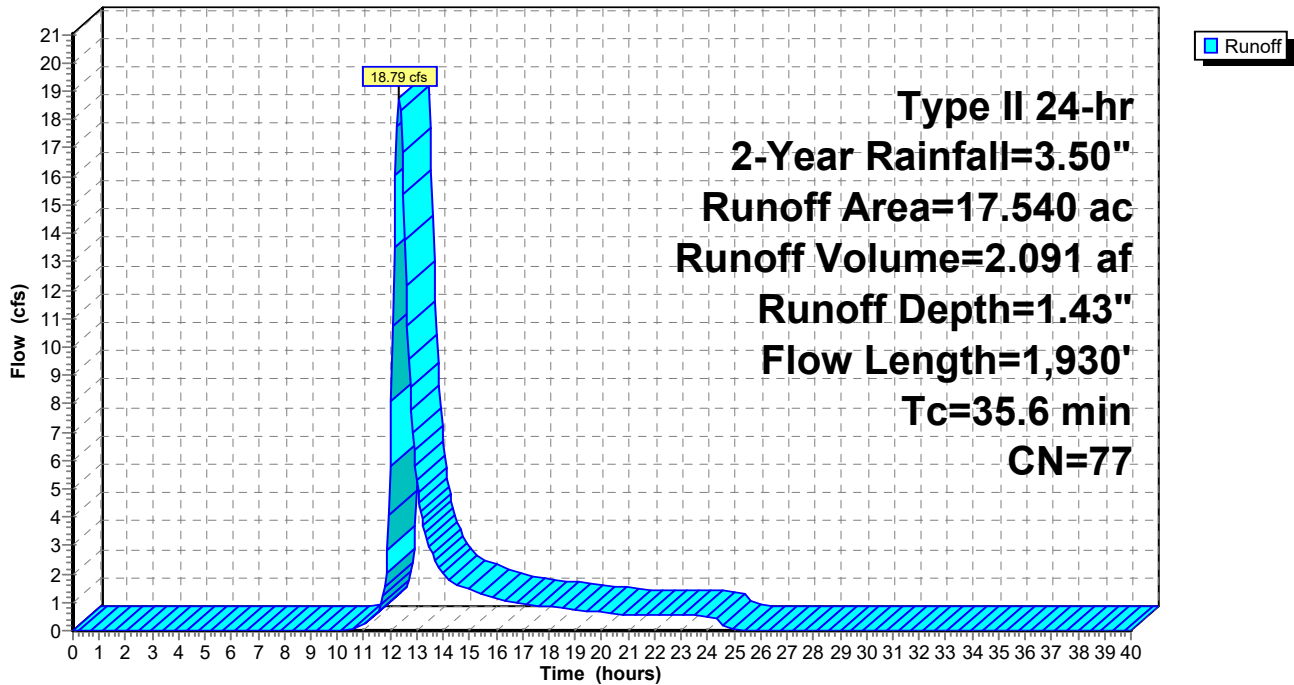
Area (ac)	CN	Description
9.830	74	Pasture/grassland/range, Good, HSG C
7.710	80	Pasture/grassland/range, Good, HSG D
17.540	77	Weighted Average
17.540		100.00% Pervious Area

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

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

Hydrograph



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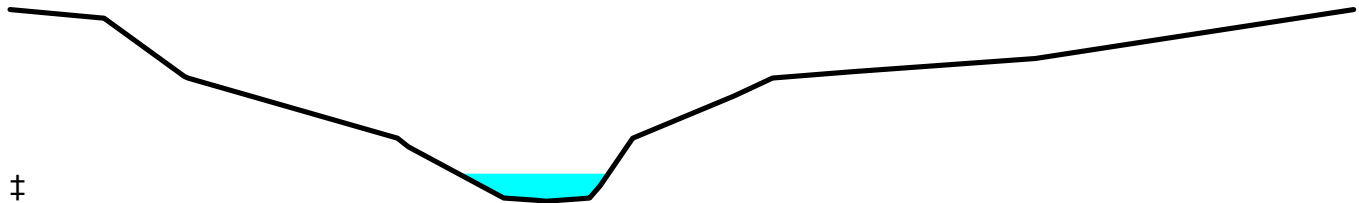
## Summary for Reach 3R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 27.94 cfs @ 12.30 hrs, Volume= 2.197 af  
Outflow = 25.62 cfs @ 12.45 hrs, Volume= 2.197 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= 3.48 fps, Min. Travel Time= 5.0 min  
Avg. Velocity = 0.89 fps, Avg. Travel Time= 19.5 min

Peak Storage= 7,741 cf @ 12.37 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

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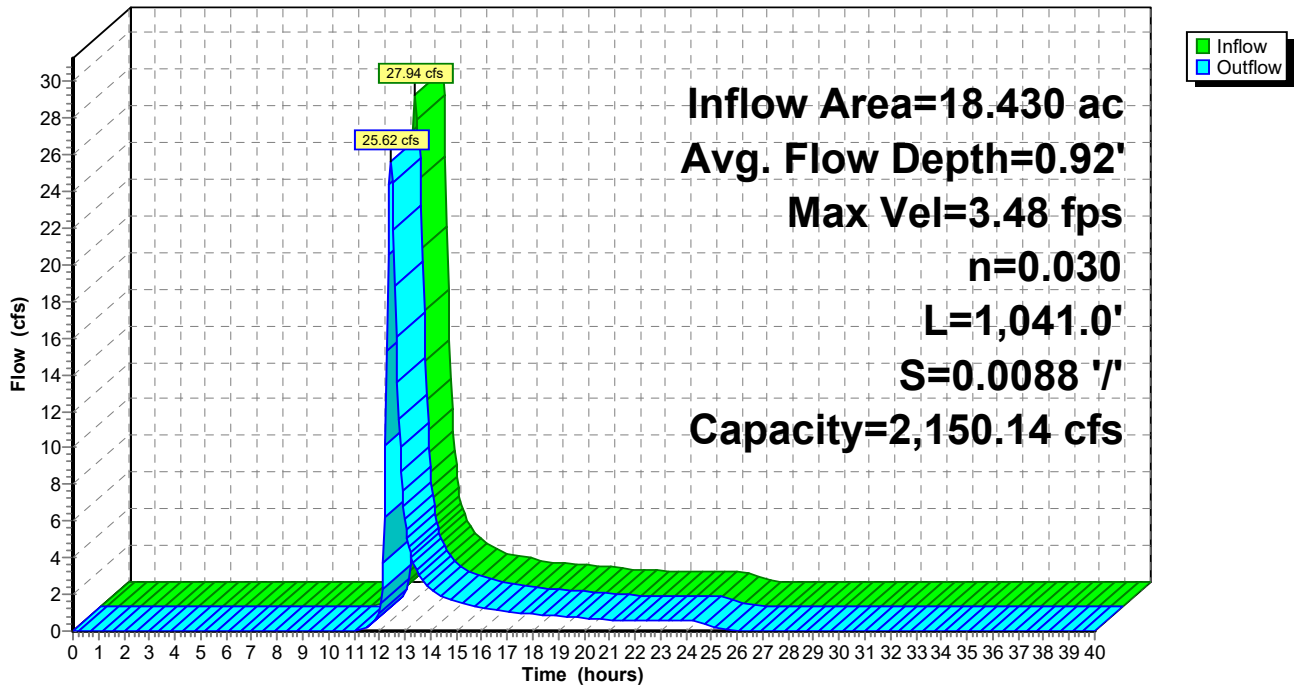
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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**

Hydrograph



**21-130-HYDRO-EX**

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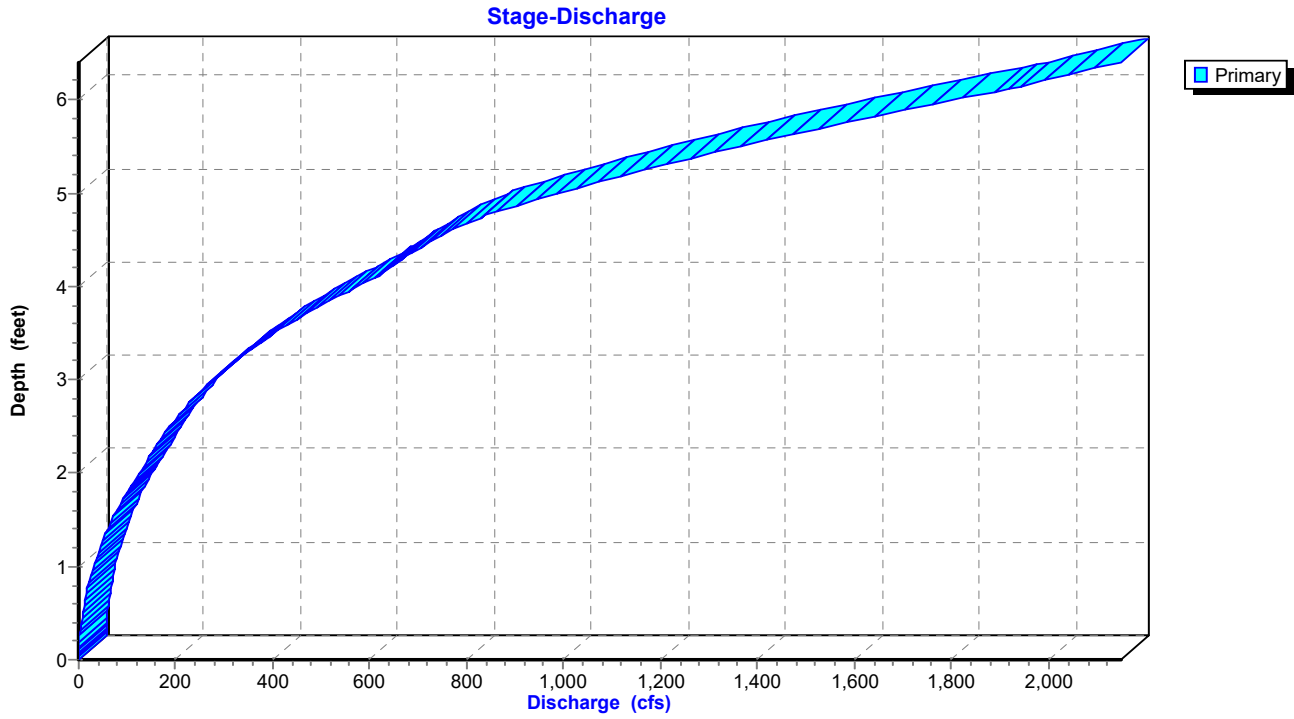
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**Reach 3R: Reach 3**



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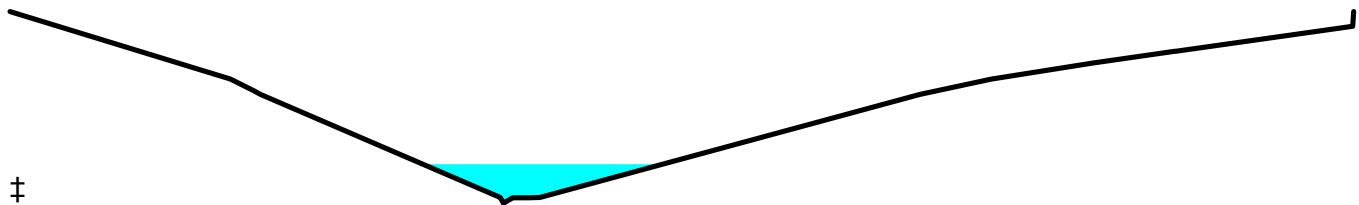
## Summary for Reach 4R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 30.23 cfs @ 12.18 hrs, Volume= 2.197 af  
Outflow = 27.94 cfs @ 12.30 hrs, Volume= 2.197 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= 6,789 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

**21-130-HYDRO-EX**

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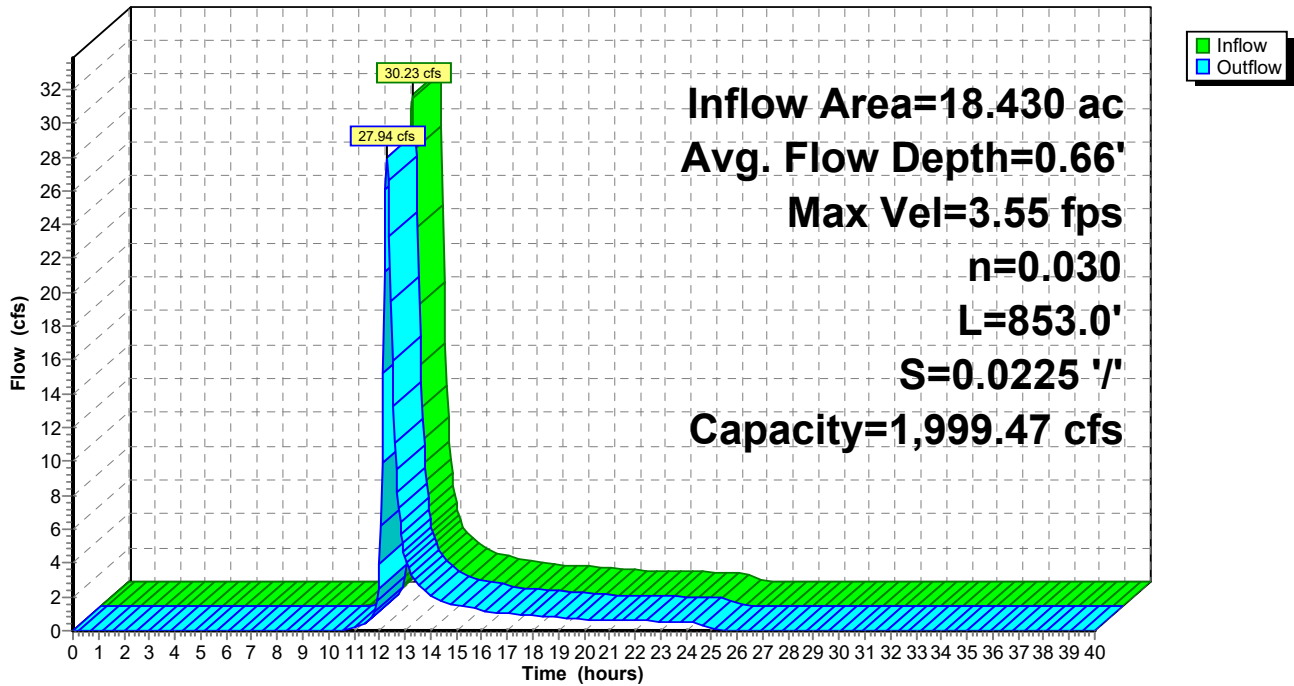
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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**

Hydrograph





**21-130-HYDRO-EX**

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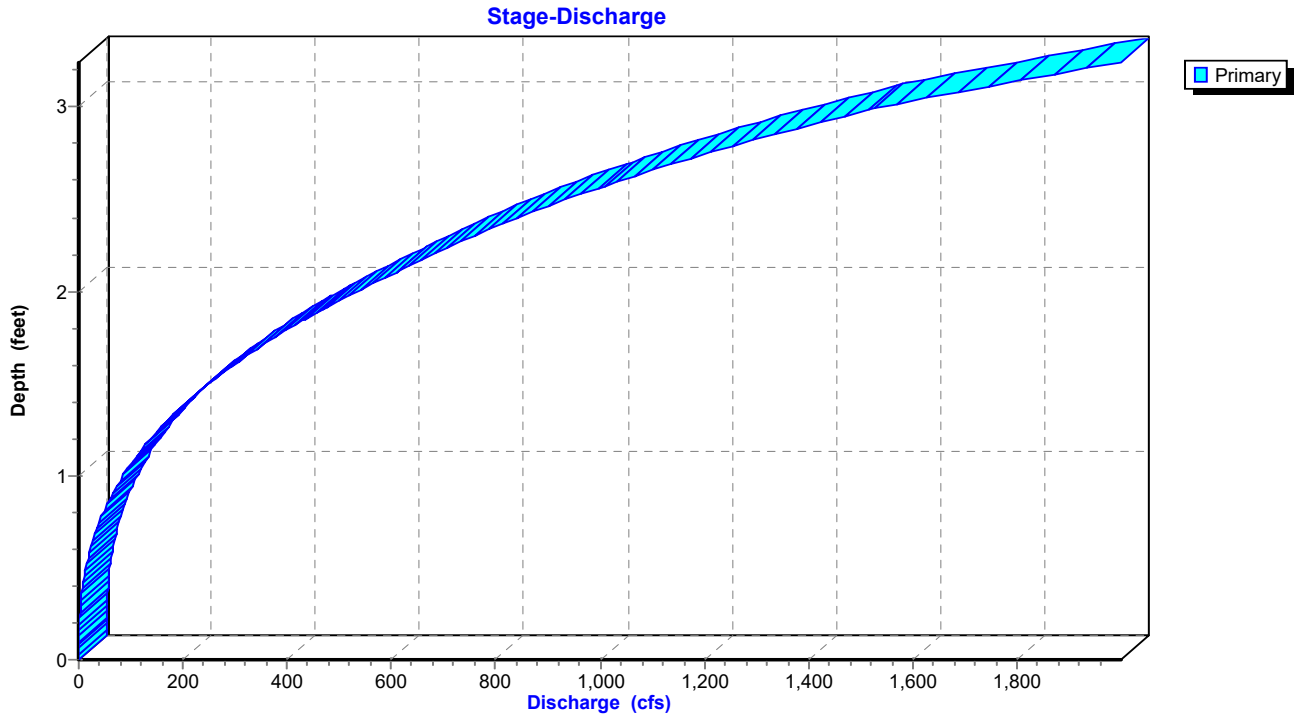
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Type II 24-hr 2-Year Rainfall=3.50"

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**Reach 4R: Reach 2**



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## Summary for Reach 8R: Reach 1

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 31.32 cfs @ 12.10 hrs, Volume= 2.197 af  
Outflow = 30.23 cfs @ 12.18 hrs, Volume= 2.197 af, Atten= 3%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Max. Velocity= 5.05 fps, Min. Travel Time= 2.9 min  
Avg. Velocity = 1.38 fps, Avg. Travel Time= 10.6 min

Peak Storage= 5,243 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

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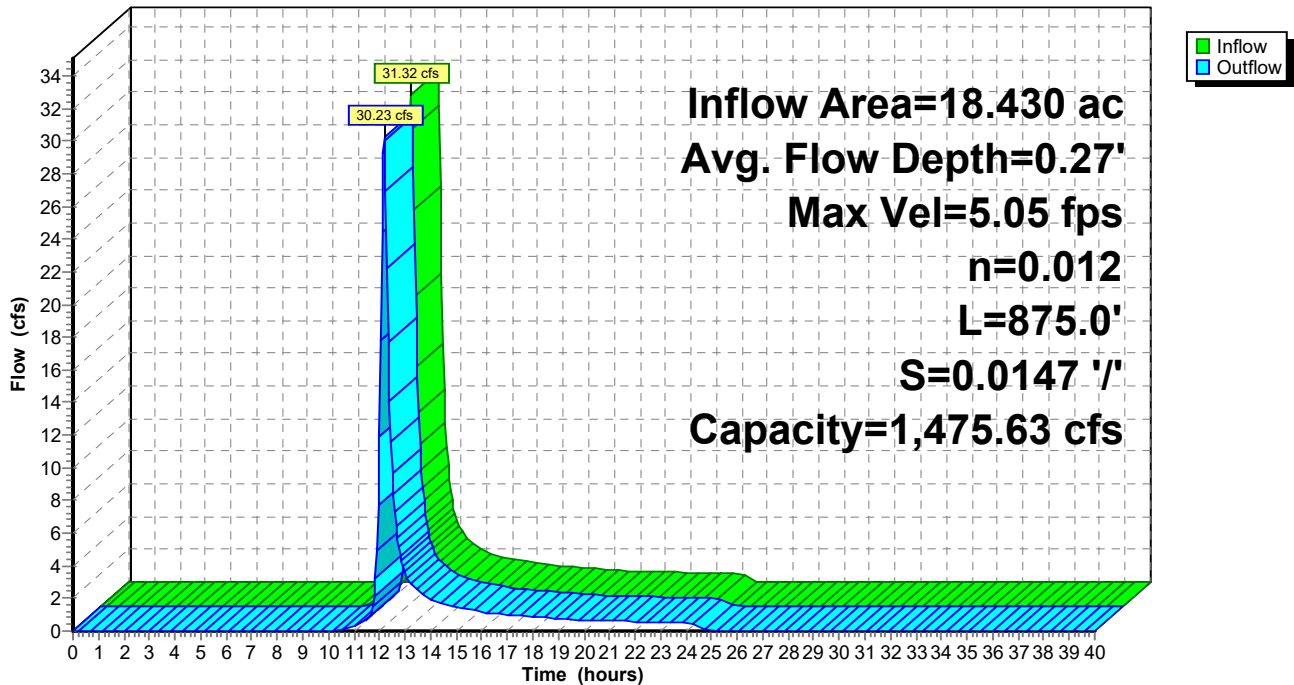
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.01	0.0	1.6	7	0.00
0.05	0.2	12.5	205	0.25
0.08	0.8	23.9	682	1.19
0.23	4.7	29.3	4,152	21.15
0.26	5.6	30.4	4,934	27.55
0.45	11.9	35.1	10,372	86.23
0.84	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**

Hydrograph



**21-130-HYDRO-EX**

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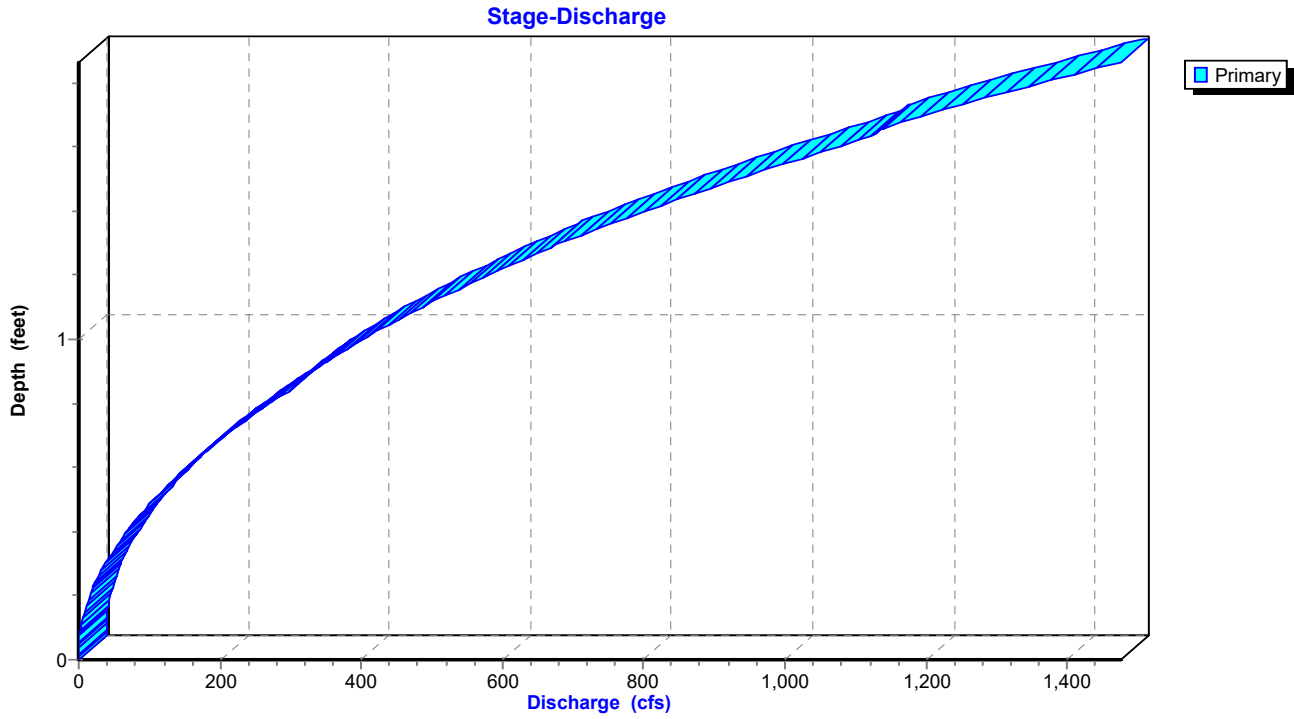
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**Reach 8R: Reach 1**



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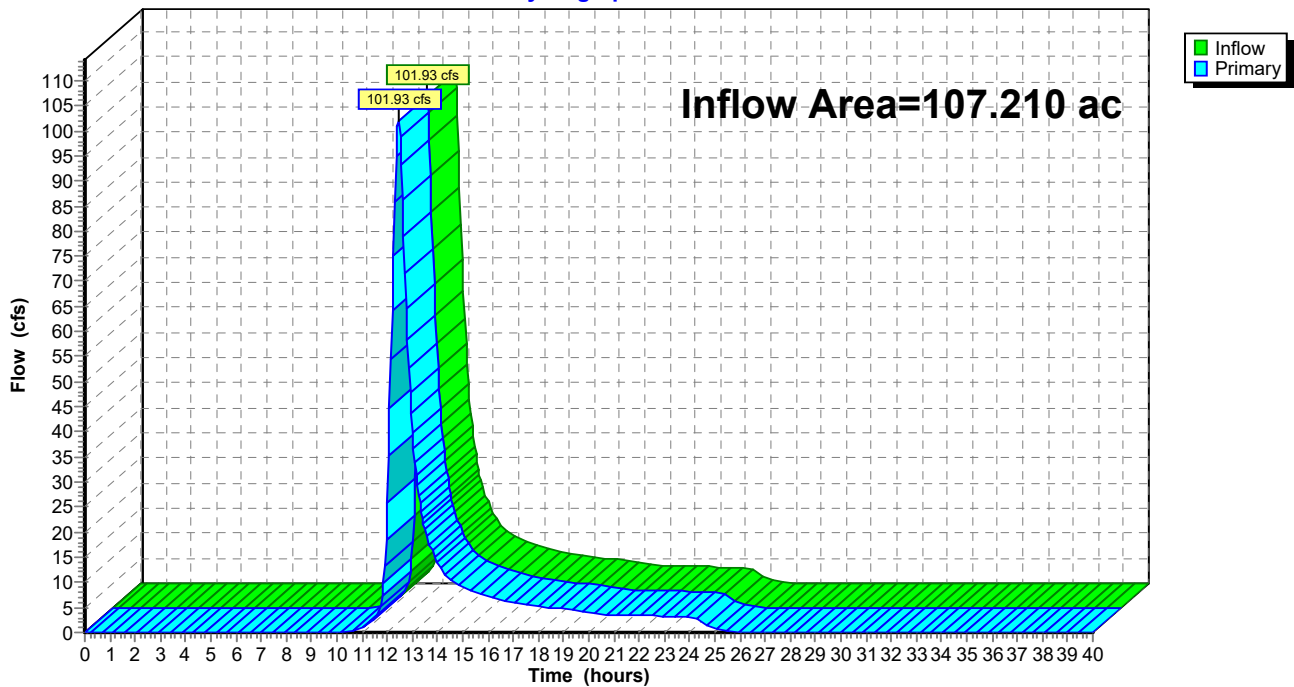
**Summary for Link 2L: RP-1**

Inflow Area = 107.210 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 101.93 cfs @ 12.44 hrs, Volume= 12.745 af  
Primary = 101.93 cfs @ 12.44 hrs, Volume= 12.745 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**

Hydrograph



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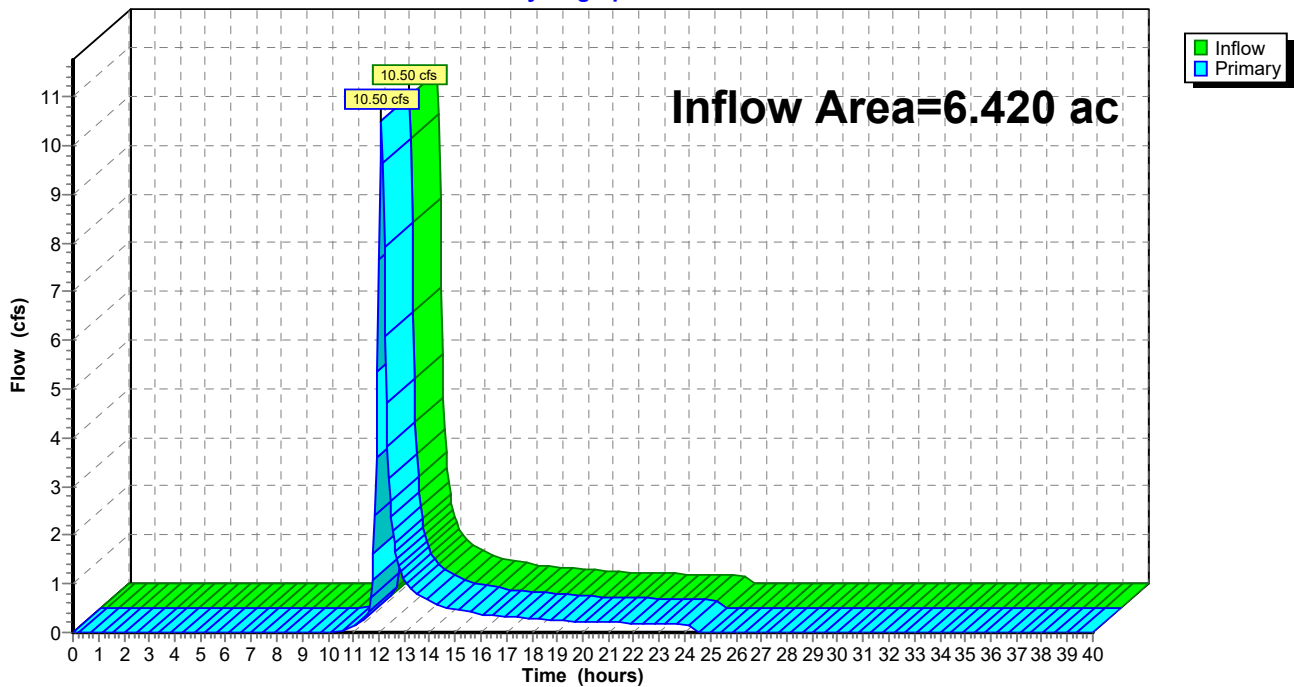
**Summary for Link 5L: RP-2**

Inflow Area = 6.420 ac, 0.00% Impervious, Inflow Depth = 1.37" for 2-Year event  
Inflow = 10.50 cfs @ 12.10 hrs, Volume= 0.730 af  
Primary = 10.50 cfs @ 12.10 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**

Hydrograph



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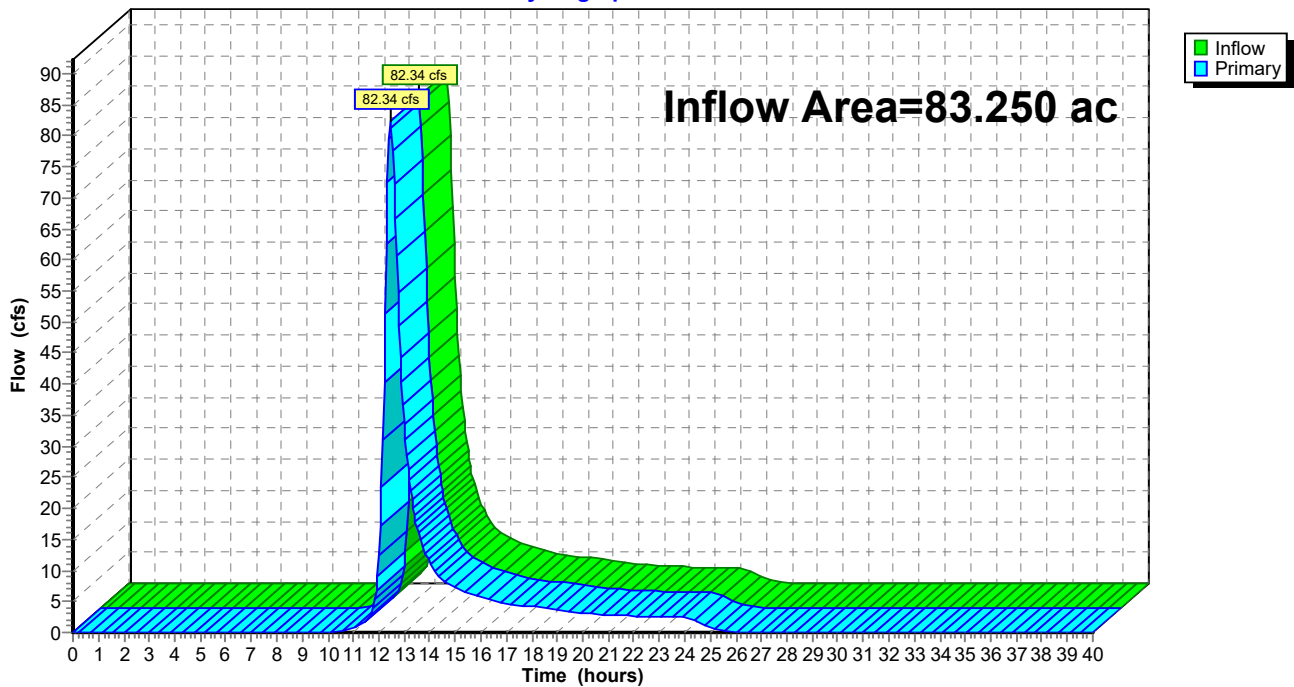
**Summary for Link 6L: RP-4**

Inflow Area = 83.250 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 82.34 cfs @ 12.46 hrs, Volume= 9.924 af  
Primary = 82.34 cfs @ 12.46 hrs, Volume= 9.924 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**

Hydrograph



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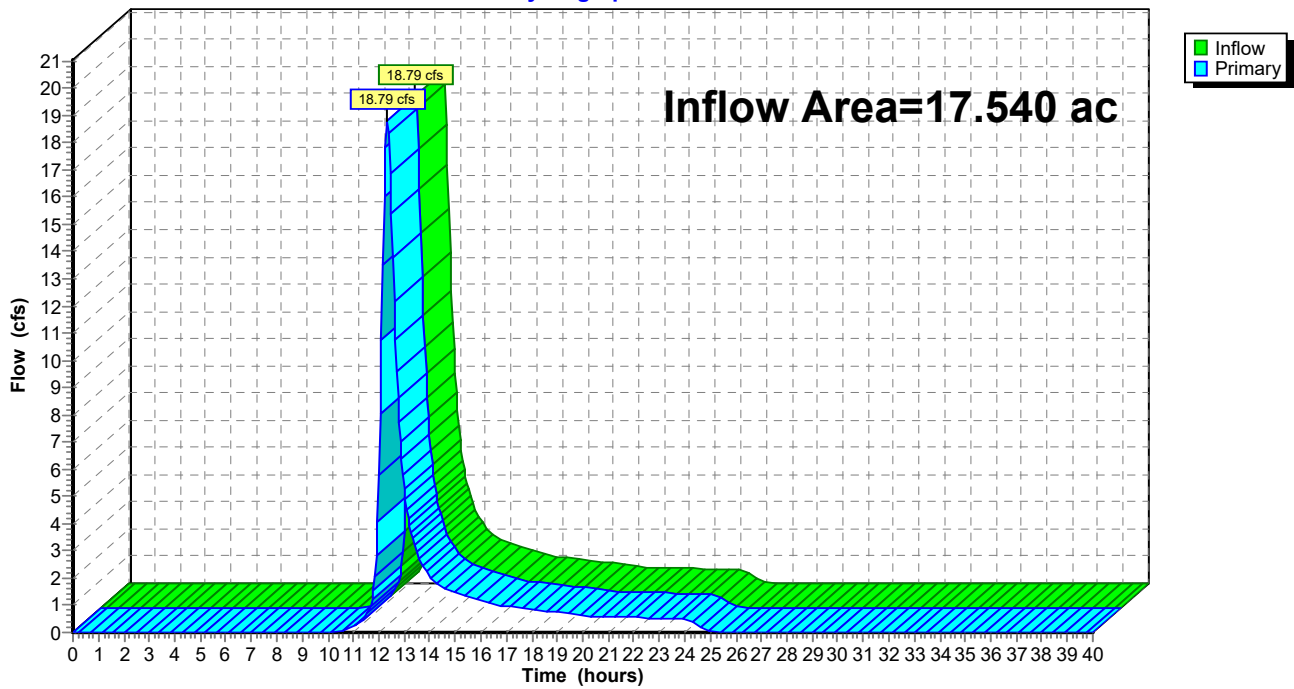
**Summary for Link 7L: RP-3**

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**

Hydrograph





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Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1S: EXIST. ON-SITE #1** Runoff Area=64.820 ac 0.00% Impervious Runoff Depth=2.88"  
Flow Length=3,450' Tc=47.2 min CN=77 **Runoff=118.07 cfs** 15.535 af

**Subcatchment3S: EXIST. OFF-SITE #1** Runoff Area=18.430 ac 0.00% Impervious Runoff Depth=2.88"  
Flow Length=1,147' Slope=0.0210 '/' Tc=17.1 min CN=77 **Runoff=68.84 cfs** 4.417 af

**Subcatchment4S: EXIST. ON-SITE #2** Runoff Area=6.420 ac 0.00% Impervious Runoff Depth=2.78"  
Flow Length=1,020' Slope=0.0300 '/' Tc=16.7 min CN=76 **Runoff=21.81 cfs** 1.490 af

**Subcatchment8S: EXIST. ON-SITE #3** Runoff Area=17.540 ac 0.00% Impervious Runoff Depth=2.88"  
Flow Length=1,930' Tc=35.6 min CN=77 **Runoff=38.90 cfs** 4.204 af

**Reach 3R: Reach 3** Avg. Flow Depth=1.35' Max Vel=4.36 fps Inflow=58.82 cfs 4.417 af  
n=0.030 L=1,041.0' S=0.0088 '/' Capacity=2,150.14 cfs Outflow=55.15 cfs 4.417 af

**Reach 4R: Reach 2** Avg. Flow Depth=0.87' Max Vel=4.28 fps Inflow=61.90 cfs 4.417 af  
n=0.030 L=853.0' S=0.0225 '/' Capacity=1,999.47 cfs Outflow=58.82 cfs 4.417 af

**Reach 8R: Reach 1** Avg. Flow Depth=0.38' Max Vel=6.50 fps Inflow=63.84 cfs 4.417 af  
n=0.012 L=875.0' S=0.0147 '/' Capacity=1,475.63 cfs Outflow=61.90 cfs 4.417 af

**Link 2L: RP-1** Inflow=213.45 cfs 25.645 af  
Primary=213.45 cfs 25.645 af

**Link 5L: RP-2** Inflow=21.81 cfs 1.490 af  
Primary=21.81 cfs 1.490 af

**Link 6L: RP-4** Inflow=170.41 cfs 19.951 af  
Primary=170.41 cfs 19.951 af

**Link 7L: RP-3** Inflow=38.90 cfs 4.204 af  
Primary=38.90 cfs 4.204 af

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

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

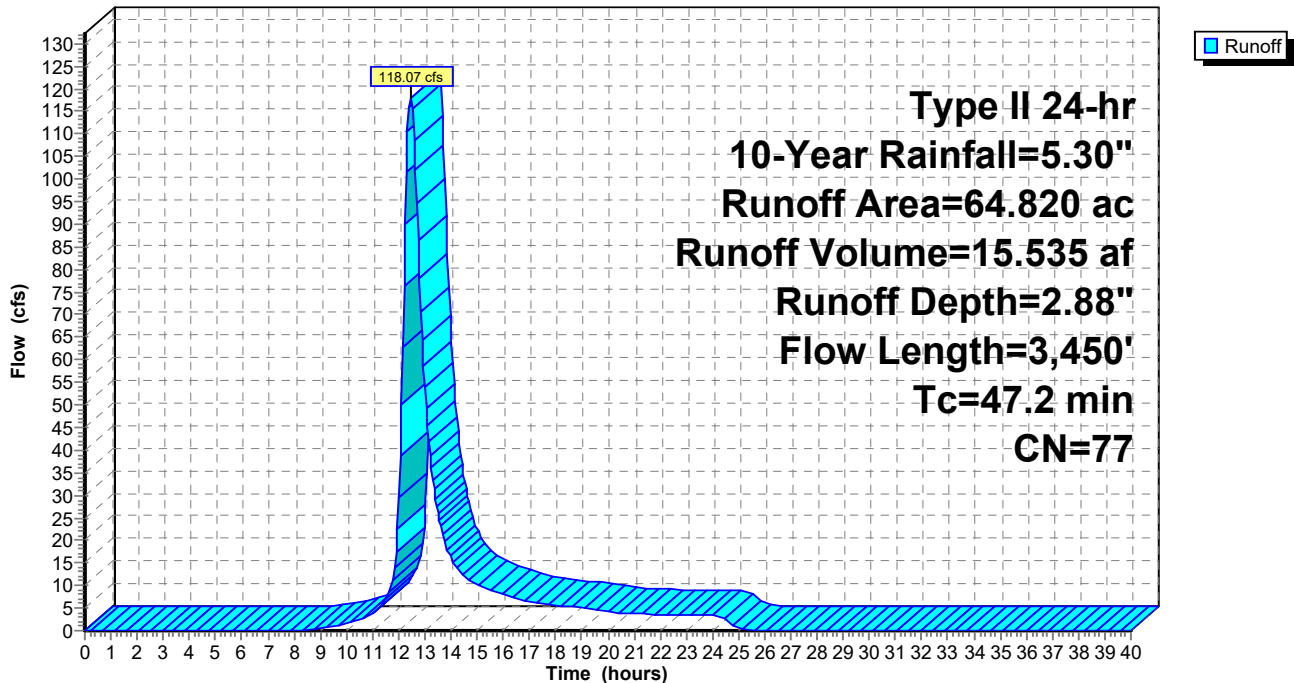
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=5.30"

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		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
24.7	2,132	0.0255	1.44		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
14.1	1,218	0.0092	1.44		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
47.2	3,450	Total			

**Subcatchment 1S: EXIST. ON-SITE #1**

Hydrograph



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

Runoff = 63.84 cfs @ 12.10 hrs, Volume= 4.417 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"

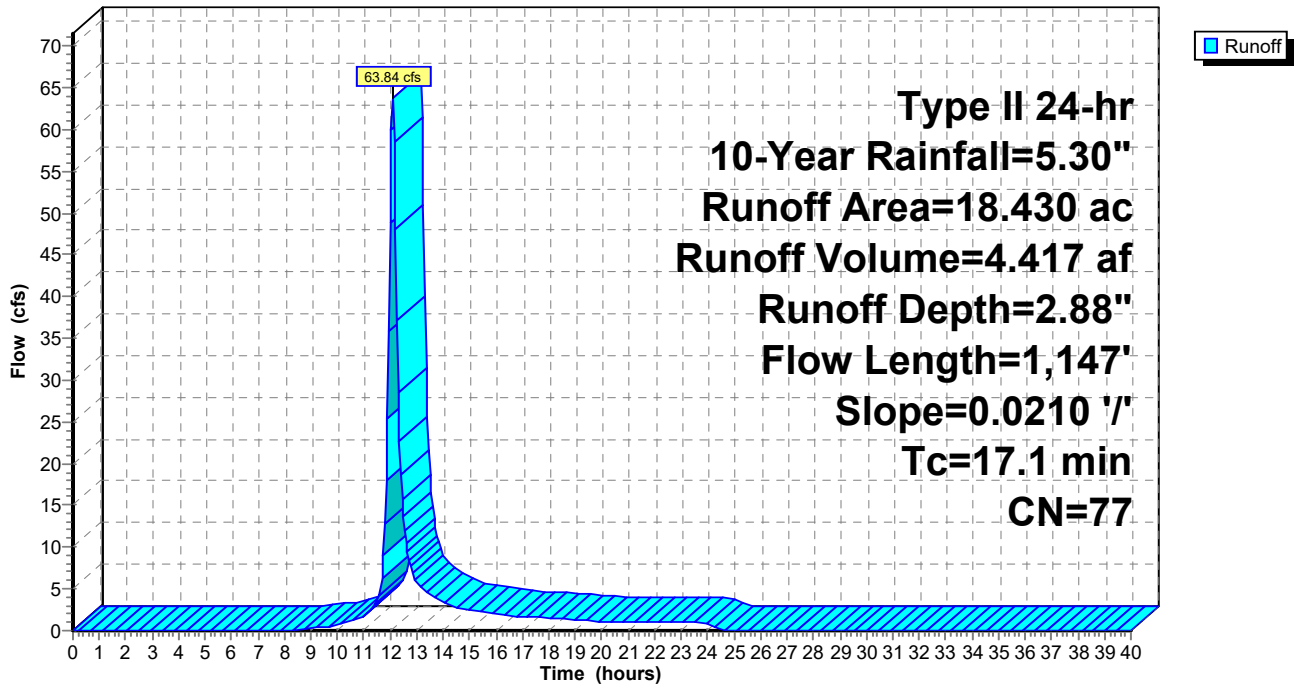
Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

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

Hydrograph



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

Runoff = 21.81 cfs @ 12.09 hrs, Volume= 1.490 af, Depth= 2.78"

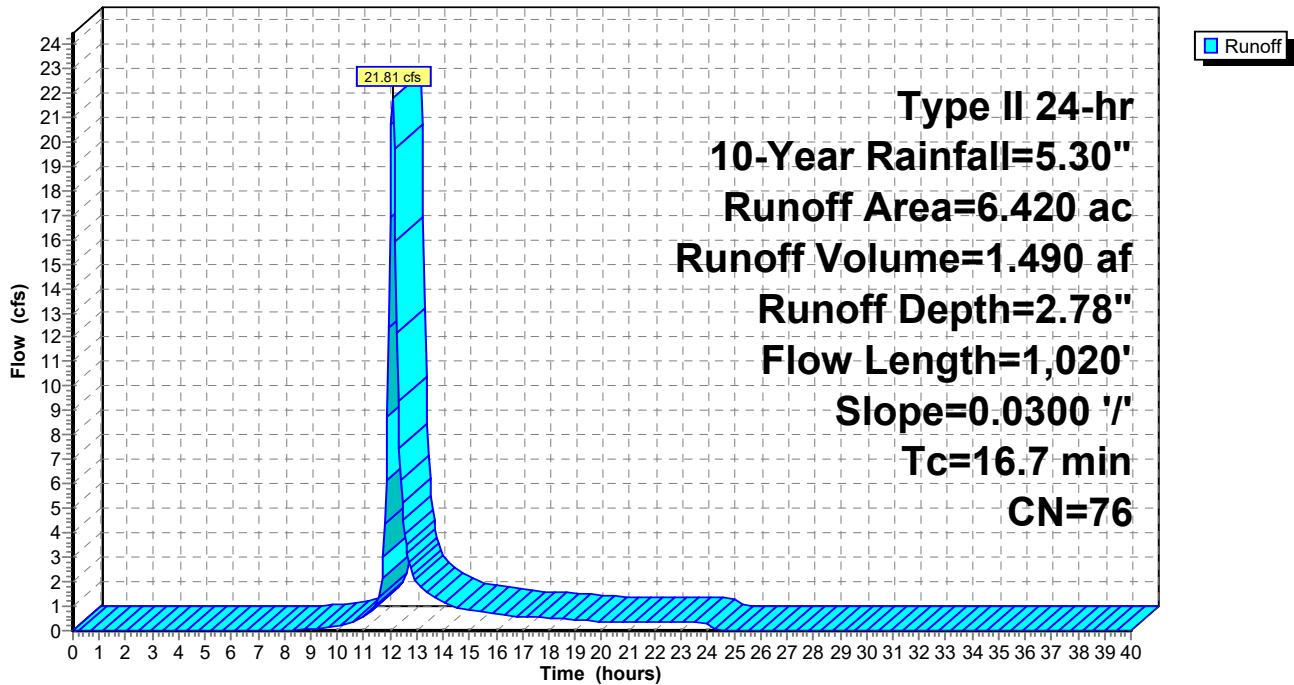
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=5.30"

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
6.6	80	0.0300	0.20		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
10.1	940	0.0300	1.56		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
16.7	1,020	Total			

**Subcatchment 4S: EXIST. ON-SITE #2**

Hydrograph



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

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

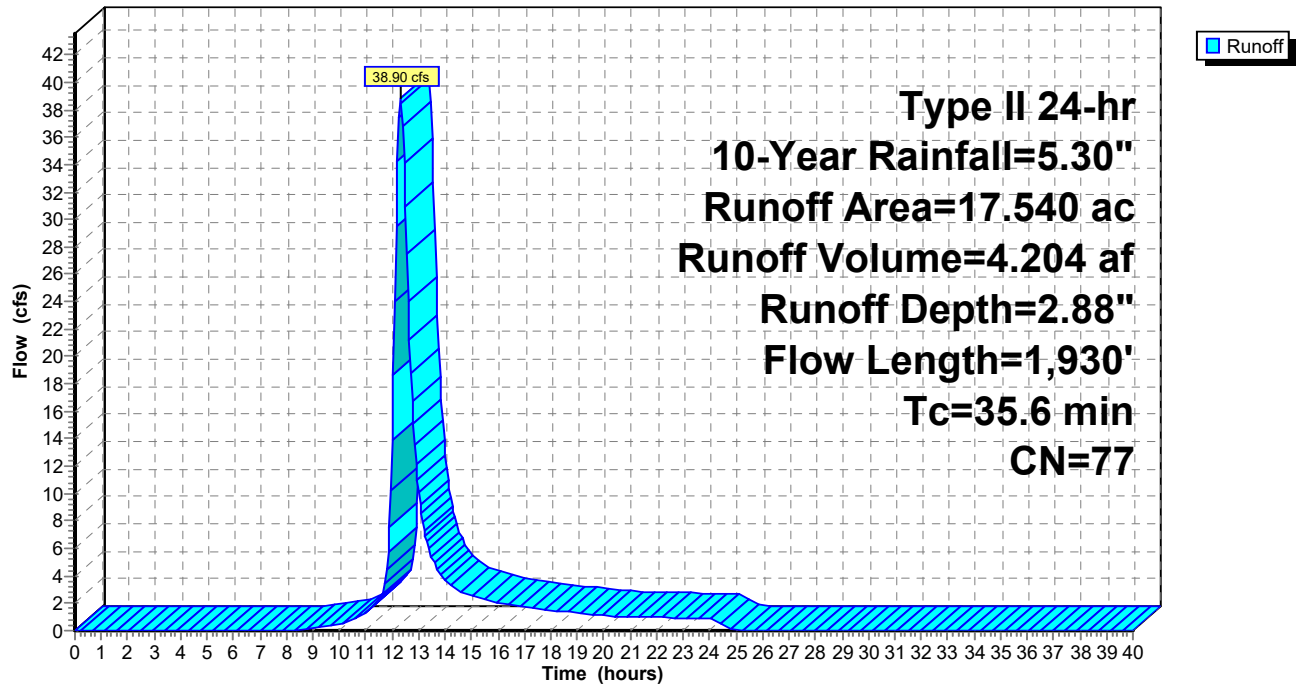
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=5.30"

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		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
27.3	1,830	0.0255	1.12		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
35.6	1,930	Total			

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

Hydrograph



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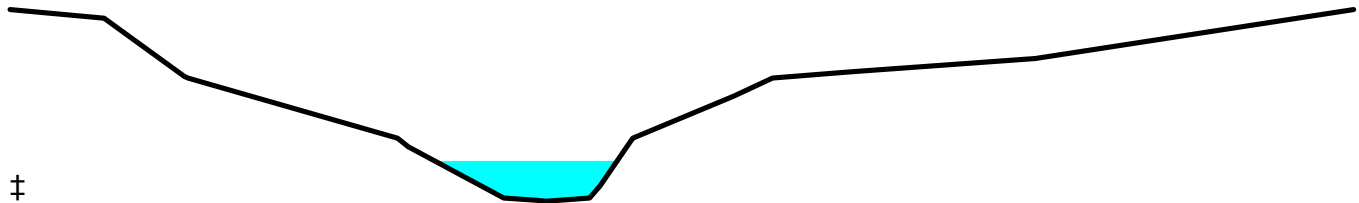
## Summary for Reach 3R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 58.82 cfs @ 12.26 hrs, Volume= 4.417 af  
Outflow = 55.15 cfs @ 12.37 hrs, Volume= 4.417 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= 13,333 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

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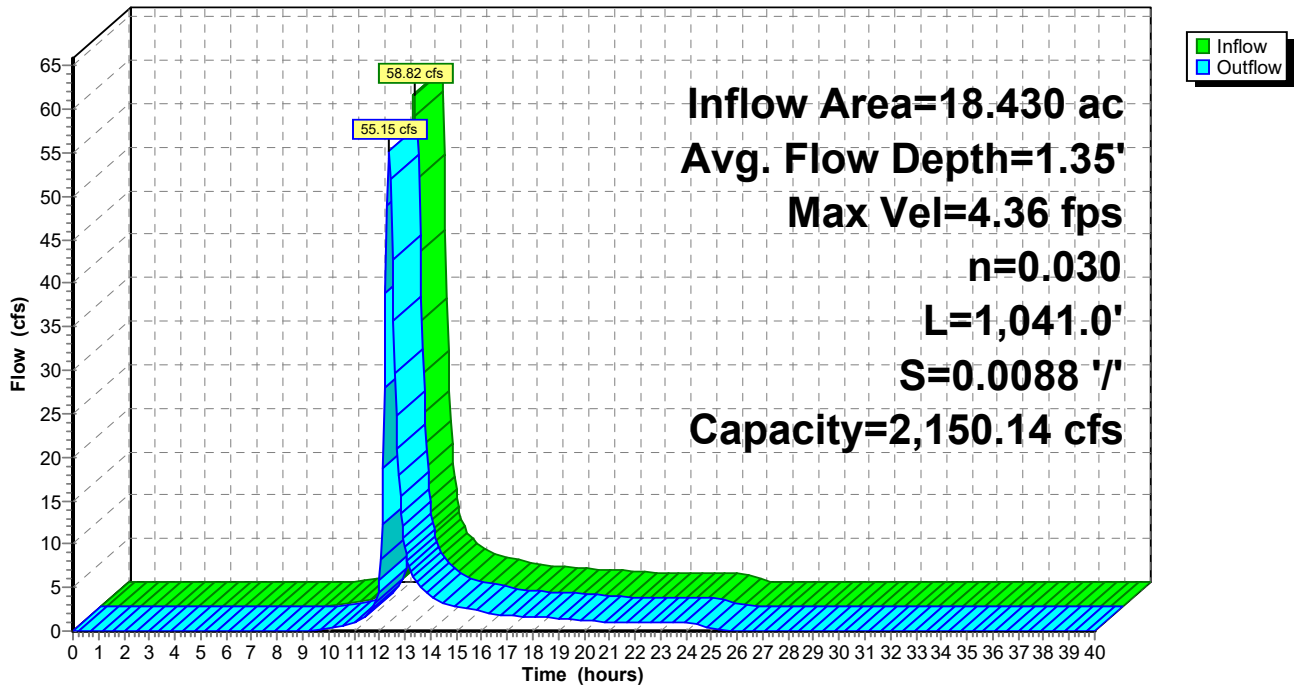
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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**

**Hydrograph**



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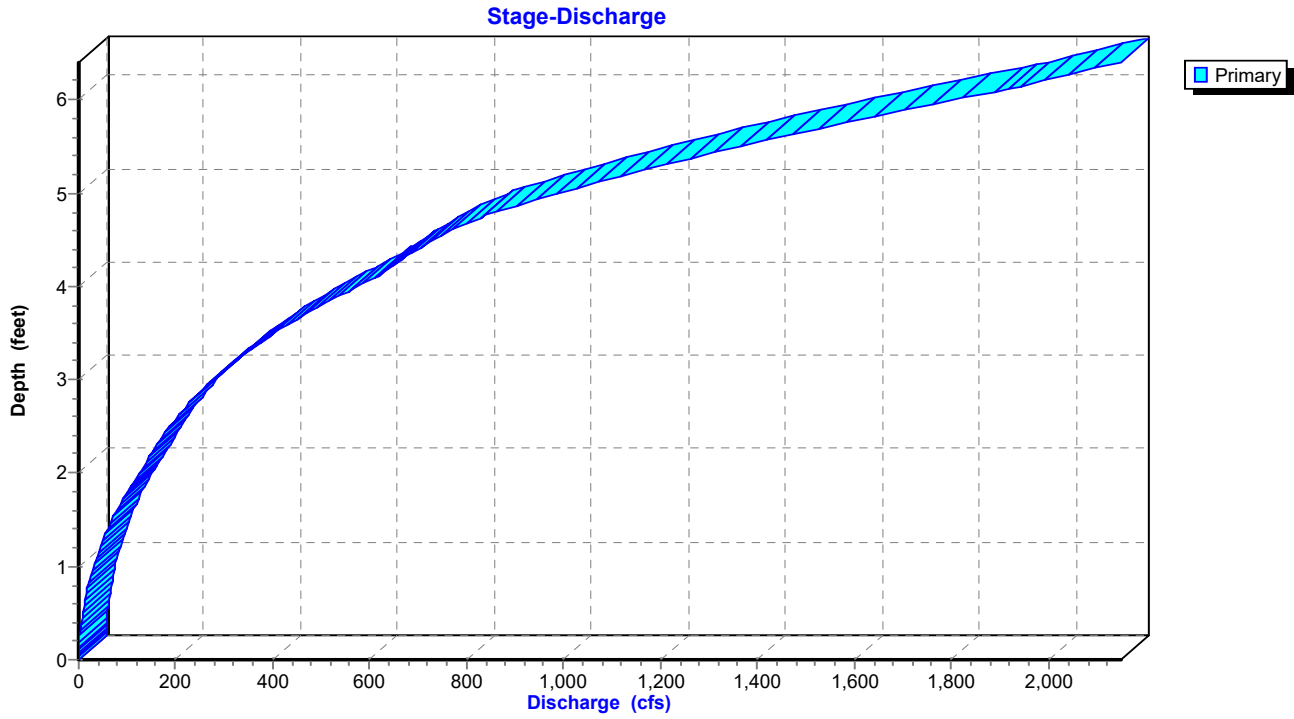
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**Reach 3R: Reach 3**





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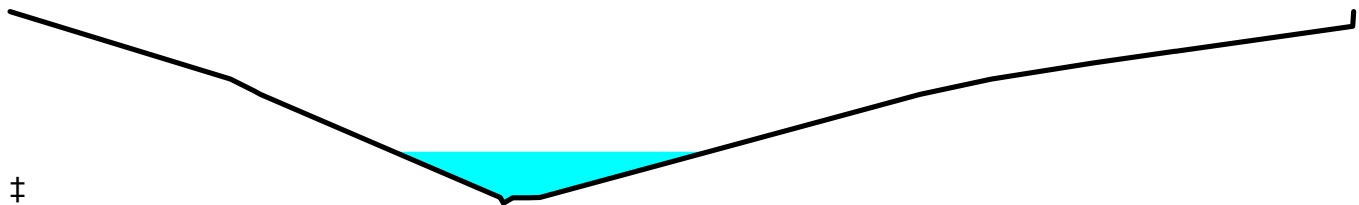
## Summary for Reach 4R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 61.90 cfs @ 12.16 hrs, Volume= 4.417 af  
Outflow = 58.82 cfs @ 12.26 hrs, Volume= 4.417 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= 11,793 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

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Type II 24-hr 10-Year Rainfall=5.30"

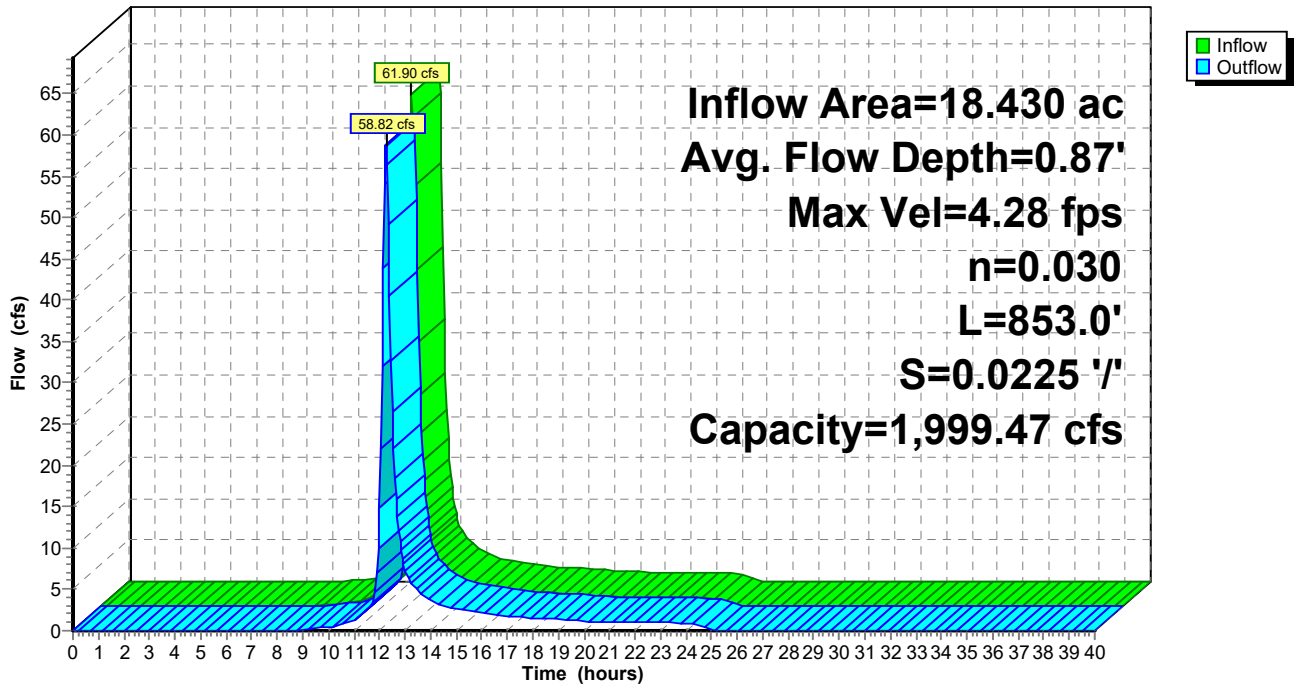
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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**

Hydrograph



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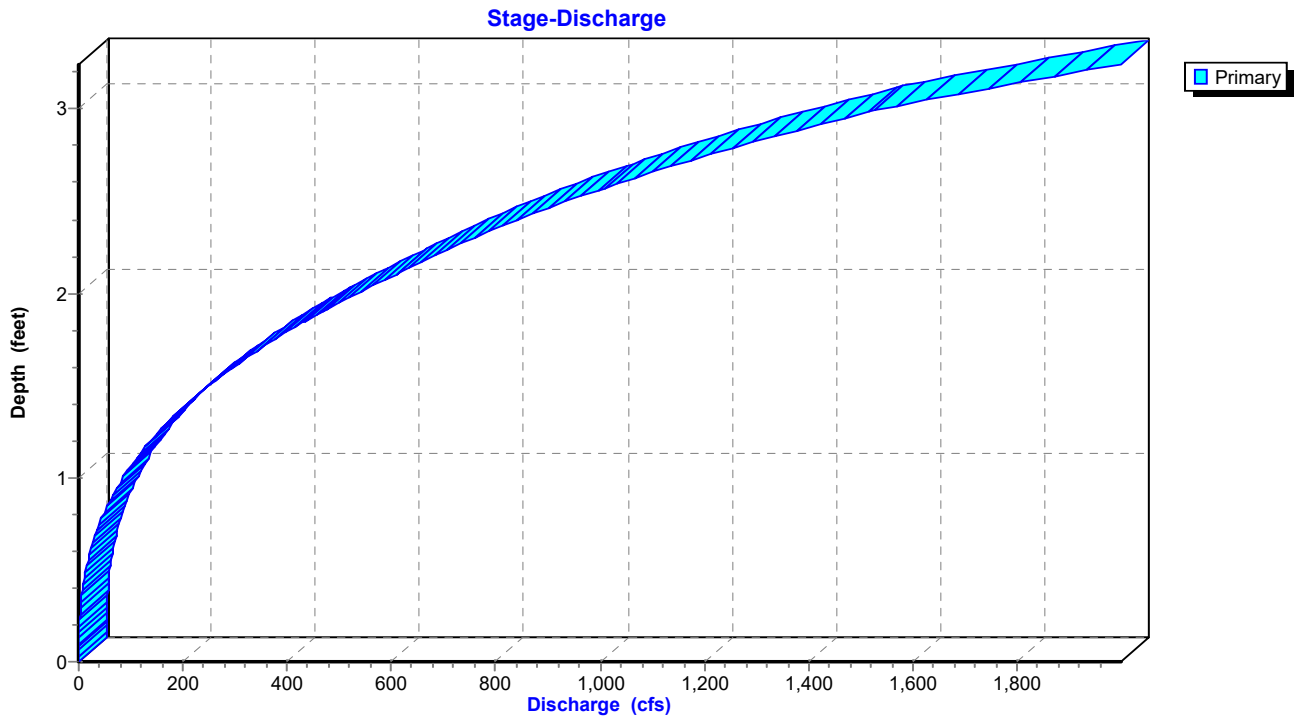
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**Reach 4R: Reach 2**



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## Summary for Reach 8R: Reach 1

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 63.84 cfs @ 12.10 hrs, Volume= 4.417 af  
Outflow = 61.90 cfs @ 12.16 hrs, Volume= 4.417 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= 6.50 fps, Min. Travel Time= 2.2 min  
Avg. Velocity = 1.61 fps, Avg. Travel Time= 9.1 min

Peak Storage= 8,403 cf @ 12.12 hrs  
Average Depth at Peak Storage= 0.38'  
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

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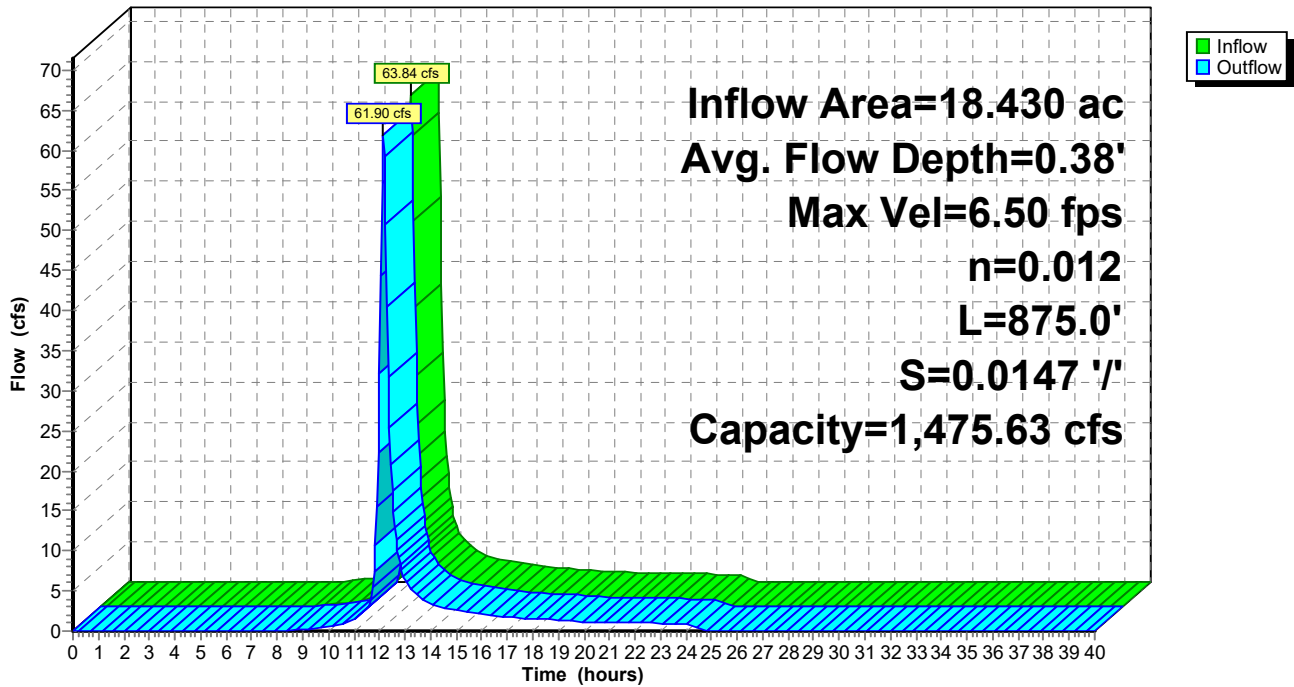
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.01	0.0	1.6	7	0.00
0.05	0.2	12.5	205	0.25
0.08	0.8	23.9	682	1.19
0.23	4.7	29.3	4,152	21.15
0.26	5.6	30.4	4,934	27.55
0.45	11.9	35.1	10,372	86.23
0.84	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**

Hydrograph



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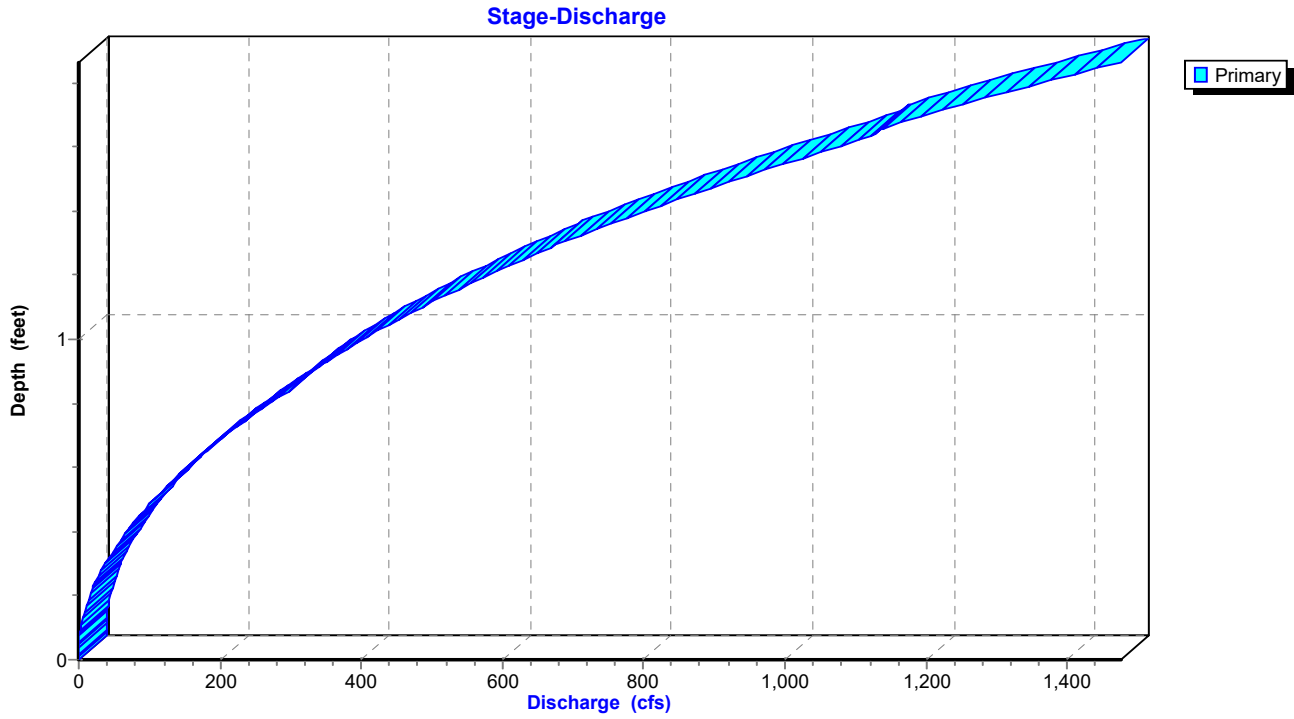
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**Reach 8R: Reach 1**



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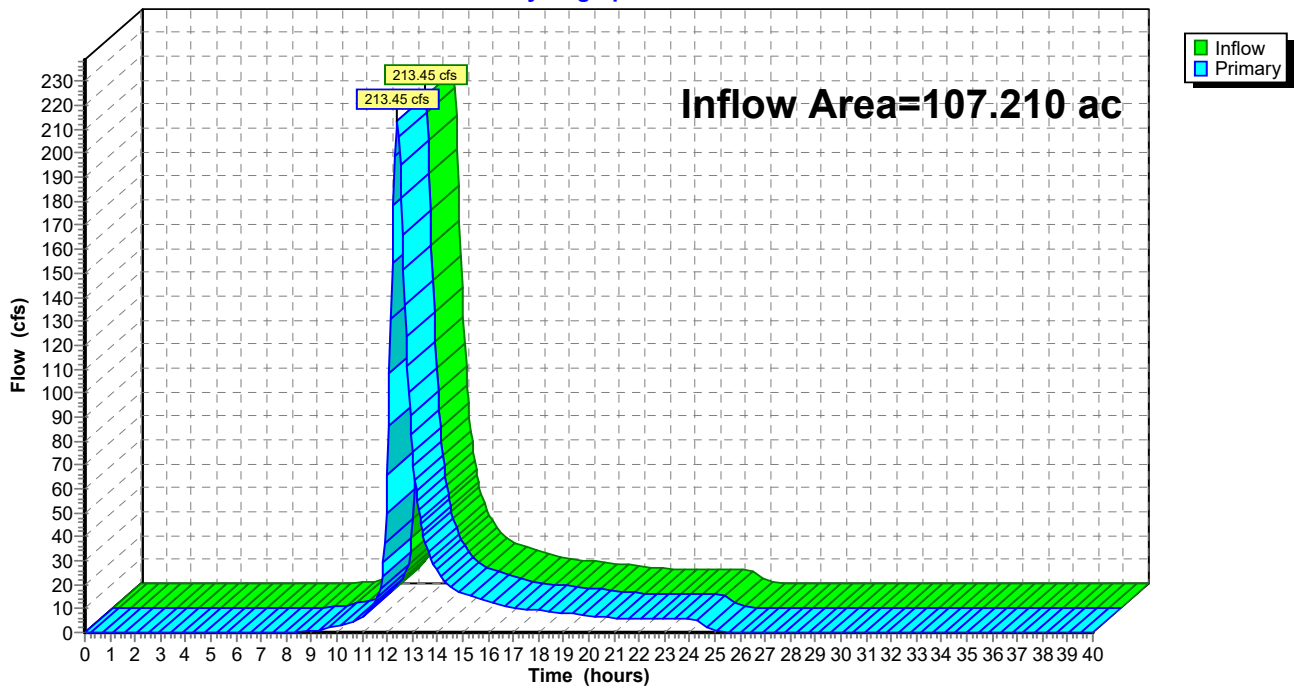
## Summary for Link 2L: RP-1

Inflow Area = 107.210 ac, 0.00% Impervious, Inflow Depth = 2.87" for 10-Year event  
Inflow = 213.45 cfs @ 12.39 hrs, Volume= 25.645 af  
Primary = 213.45 cfs @ 12.39 hrs, Volume= 25.645 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

Hydrograph



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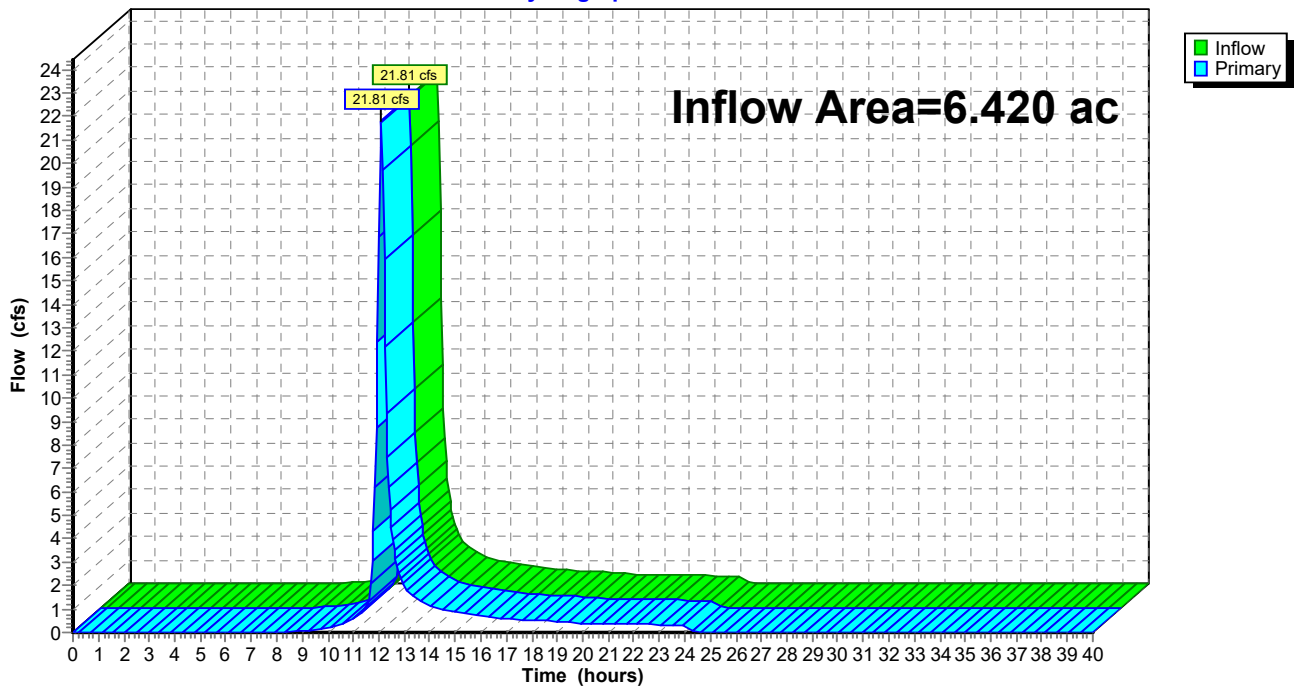
## Summary for Link 5L: RP-2

Inflow Area = 6.420 ac, 0.00% Impervious, Inflow Depth = 2.78" for 10-Year event  
Inflow = 21.81 cfs @ 12.09 hrs, Volume= 1.490 af  
Primary = 21.81 cfs @ 12.09 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

Hydrograph





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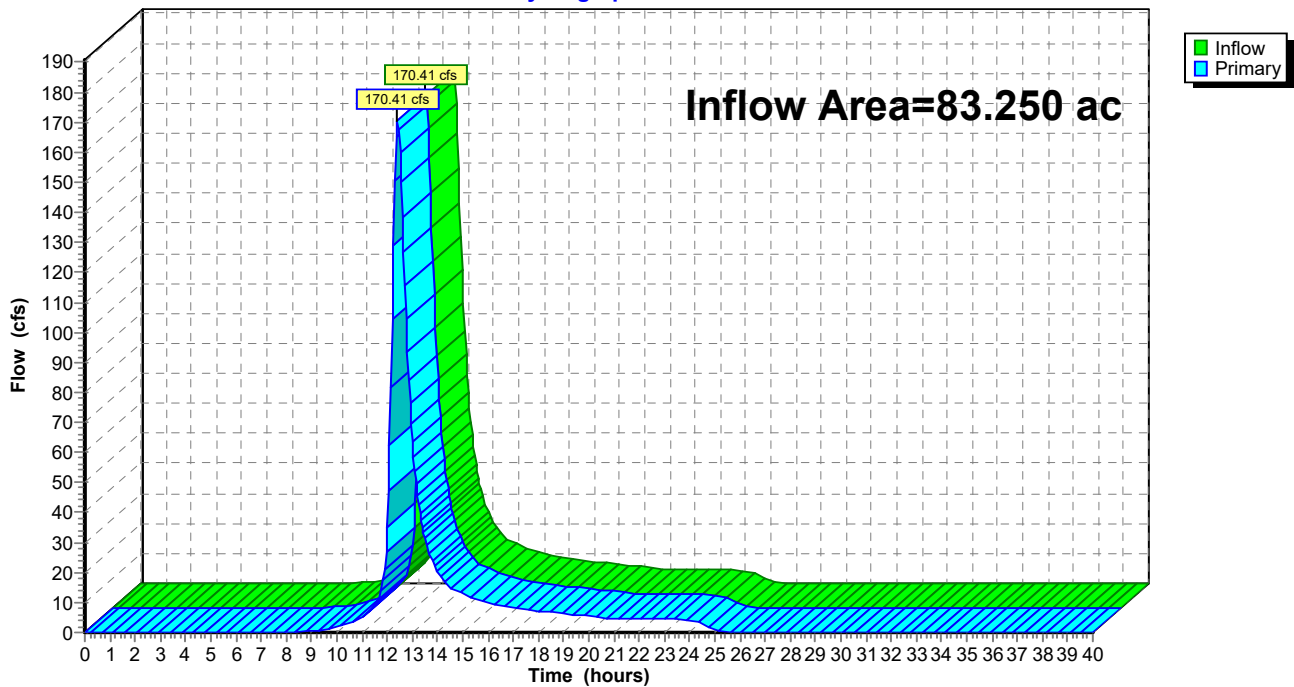
**Summary for Link 6L: RP-4**

Inflow Area = 83.250 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 170.41 cfs @ 12.41 hrs, Volume= 19.951 af  
Primary = 170.41 cfs @ 12.41 hrs, Volume= 19.951 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**

Hydrograph



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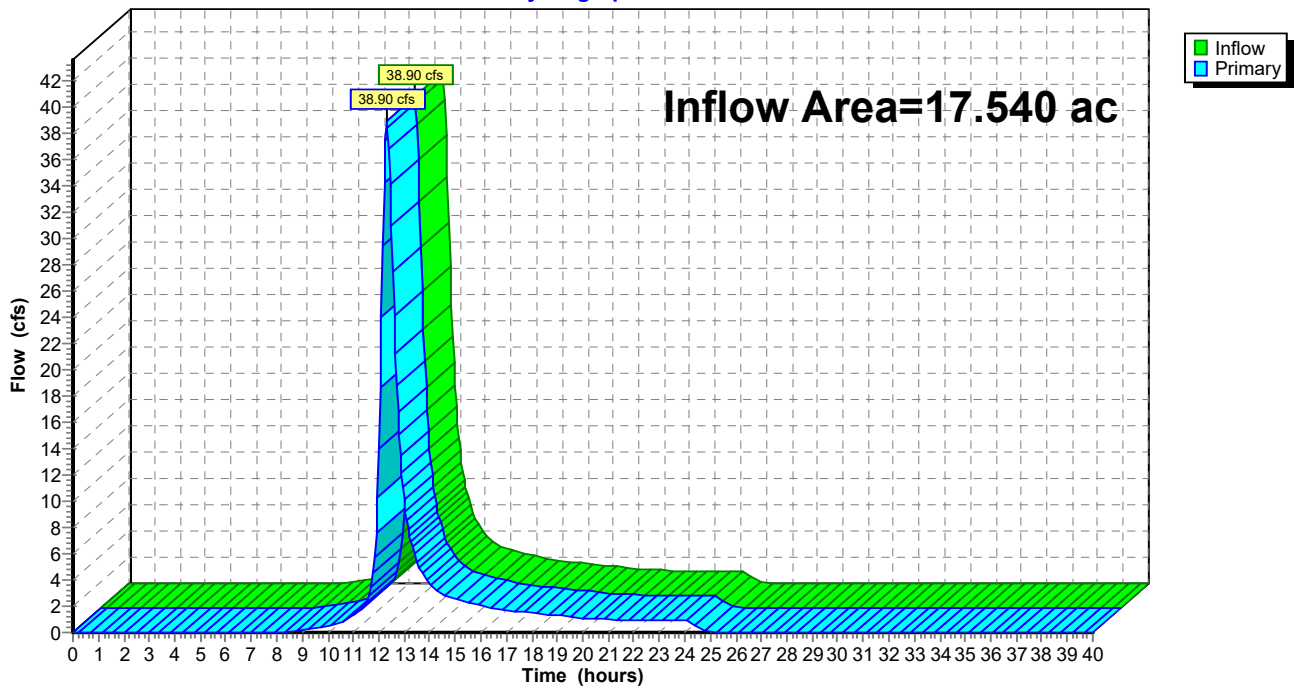
## Summary for Link 7L: RP-3

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

Hydrograph



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Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1S: EXIST. ON-SITE #1** Runoff Area=64.820 ac 0.00% Impervious Runoff Depth=5.00"  
Flow Length=3,450' Tc=47.2 min CN=77 **Runoff=206.11 cfs** 27.008 af

**Subcatchment3S: EXIST. OFF-SITE #1** Runoff Area=18.430 ac 0.00% Impervious Runoff Depth=5.00"  
Flow Length=1,147' Slope=0.0210 '/' Tc=17.1 min CN=77 **Runoff=110.11 cfs** 7.679 af

**Subcatchment4S: EXIST. ON-SITE #2** Runoff Area=6.420 ac 0.00% Impervious Runoff Depth=4.89"  
Flow Length=1,020' Slope=0.0300 '/' Tc=16.7 min CN=76 **Runoff=38.02 cfs** 2.614 af

**Subcatchment8S: EXIST. ON-SITE #3** Runoff Area=17.540 ac 0.00% Impervious Runoff Depth=5.00"  
Flow Length=1,930' Tc=35.6 min CN=77 **Runoff=67.74 cfs** 7.308 af

**Reach 3R: Reach 3** Avg. Flow Depth=1.80' Max Vel=5.10 fps Inflow=103.03 cfs 7.679 af  
n=0.030 L=1,041.0' S=0.0088 '/' Capacity=2,150.14 cfs Outflow=98.34 cfs 7.679 af

**Reach 4R: Reach 2** Avg. Flow Depth=1.08' Max Vel=4.91 fps Inflow=106.97 cfs 7.679 af  
n=0.030 L=853.0' S=0.0225 '/' Capacity=1,999.47 cfs Outflow=103.03 cfs 7.679 af

**Reach 8R: Reach 1** Avg. Flow Depth=0.50' Max Vel=7.87 fps Inflow=110.11 cfs 7.679 af  
n=0.012 L=875.0' S=0.0147 '/' Capacity=1,475.63 cfs Outflow=106.97 cfs 7.679 af

**Link 2L: RP-1** Inflow=372.07 cfs 44.609 af  
Primary=372.07 cfs 44.609 af

**Link 5L: RP-2** Inflow=38.02 cfs 2.614 af  
Primary=38.02 cfs 2.614 af

**Link 6L: RP-4** Inflow=294.00 cfs 34.687 af  
Primary=294.00 cfs 34.687 af

**Link 7L: RP-3** Inflow=67.74 cfs 7.308 af  
Primary=67.74 cfs 7.308 af

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

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

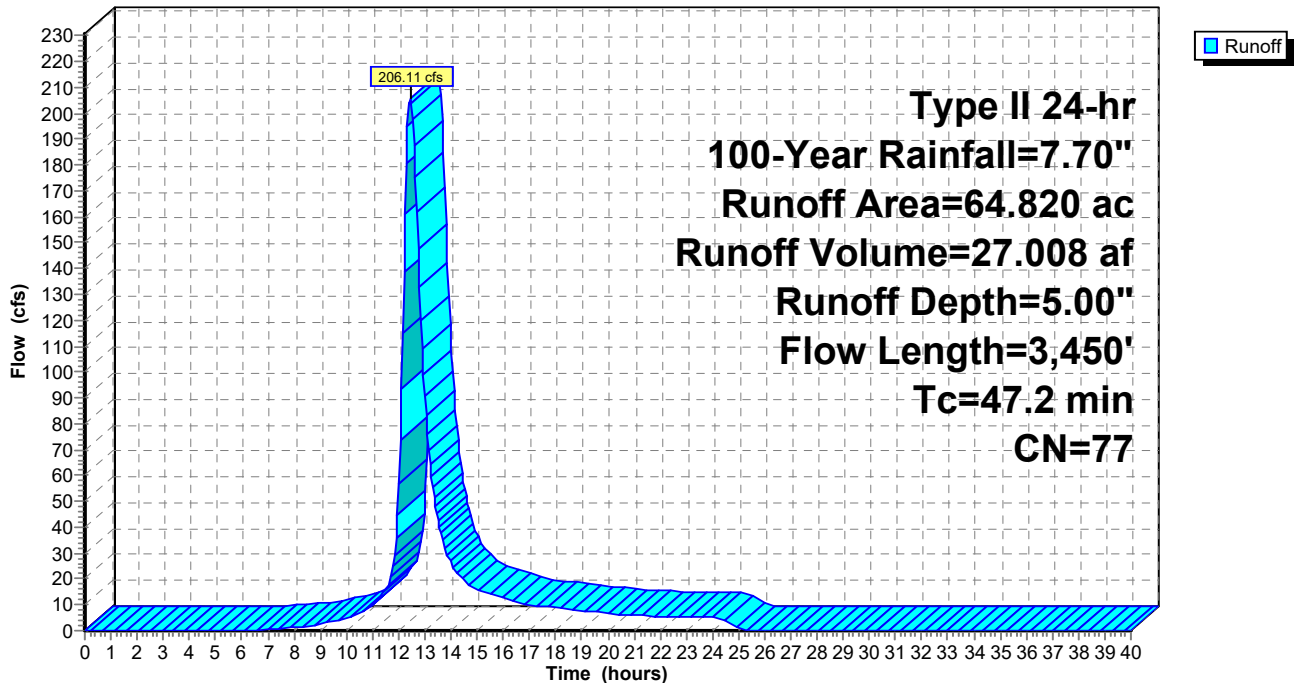
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 100-Year Rainfall=7.70"

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		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
24.7	2,132	0.0255	1.44		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
14.1	1,218	0.0092	1.44		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
47.2	3,450	Total			

**Subcatchment 1S: EXIST. ON-SITE #1**

Hydrograph



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

Runoff = 110.11 cfs @ 12.09 hrs, Volume= 7.679 af, Depth= 5.00"

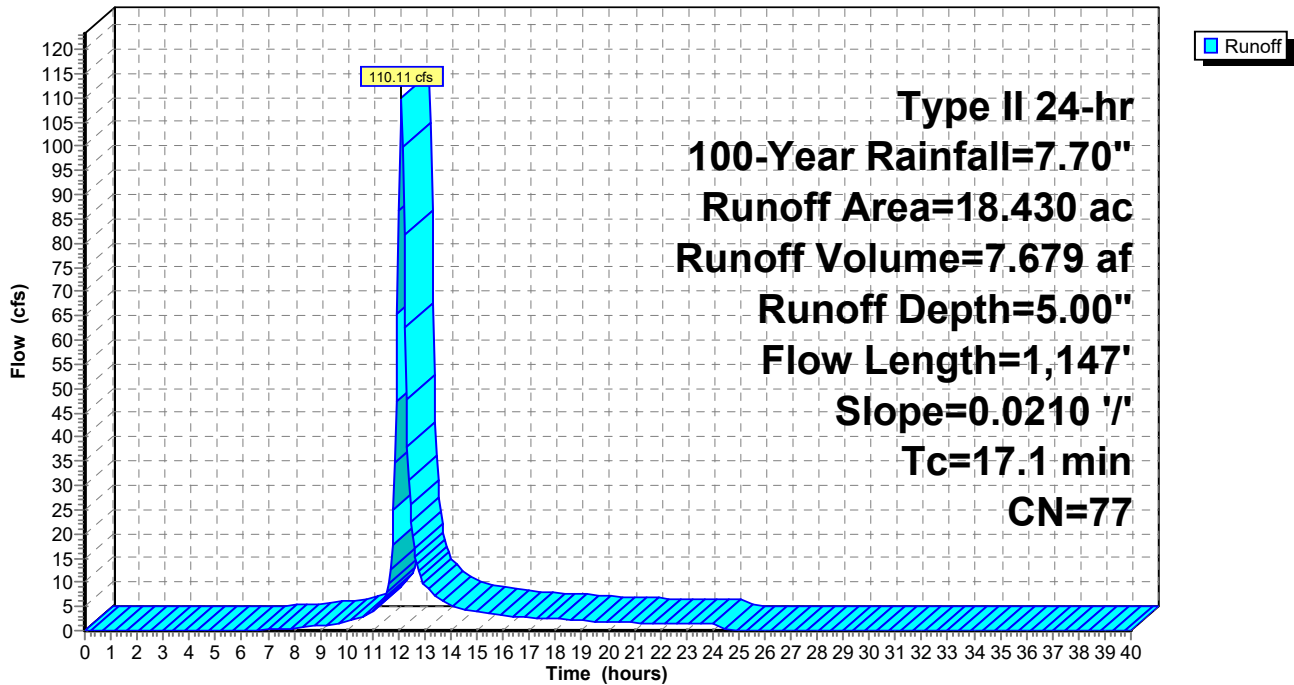
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

**Subcatchment 3S: EXIST. OFF-SITE #1**

Hydrograph



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

Runoff = 38.02 cfs @ 12.09 hrs, Volume= 2.614 af, Depth= 4.89"

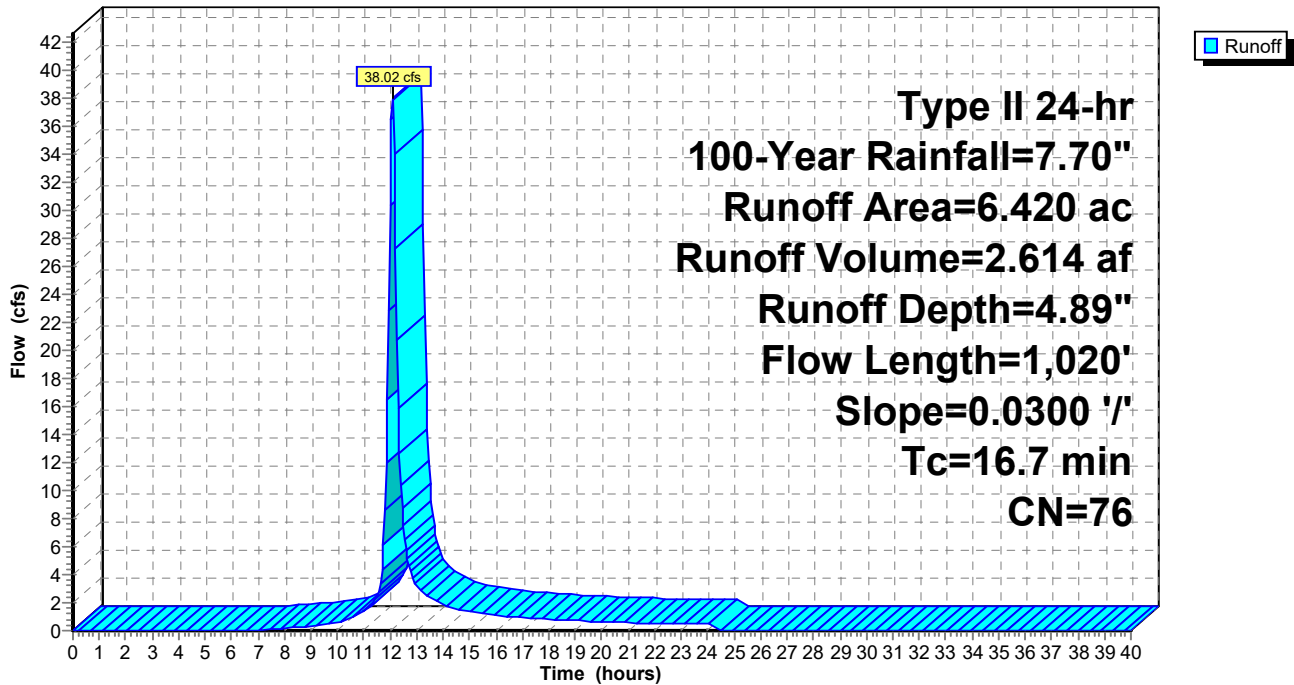
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.70"

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
6.6	80	0.0300	0.20		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
10.1	940	0.0300	1.56		<b>Shallow Concentrated Flow,</b> Cultivated Straight Rows Kv= 9.0 fps
16.7	1,020	Total			

**Subcatchment 4S: EXIST. ON-SITE #2**

Hydrograph



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

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

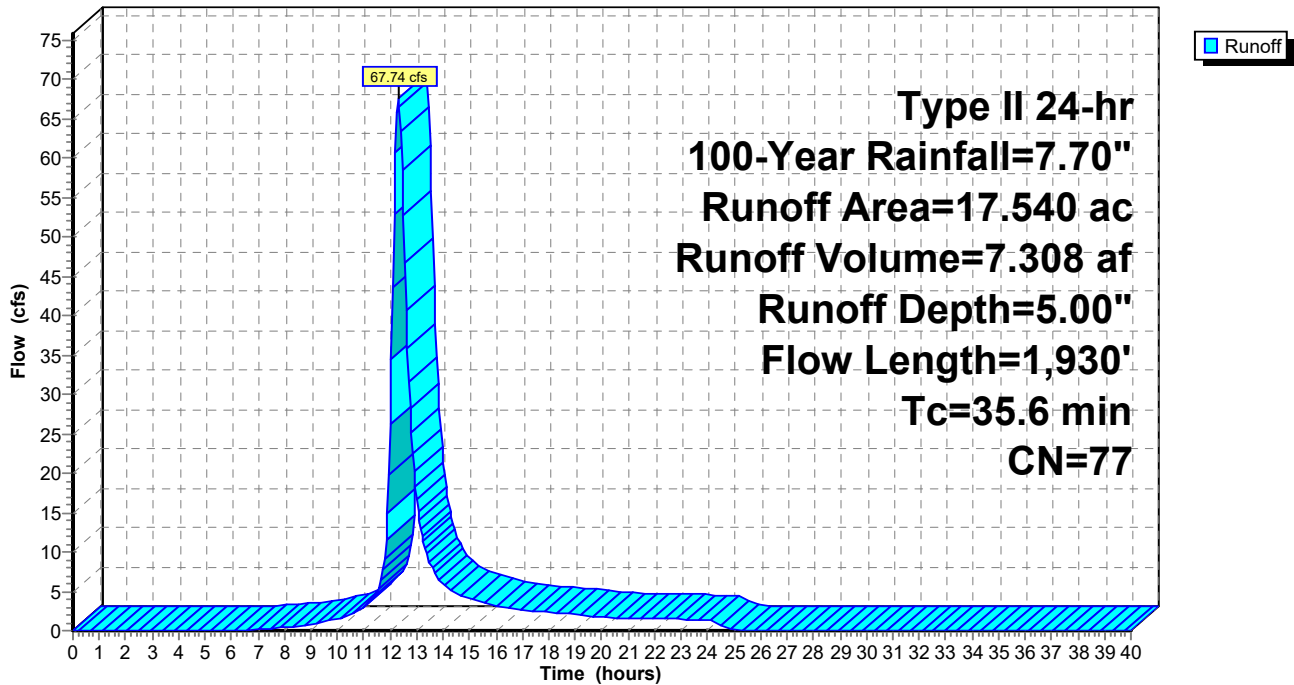
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.70"

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		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
27.3	1,830	0.0255	1.12		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
35.6	1,930	Total			

**Subcatchment 8S: EXIST. ON-SITE #3**

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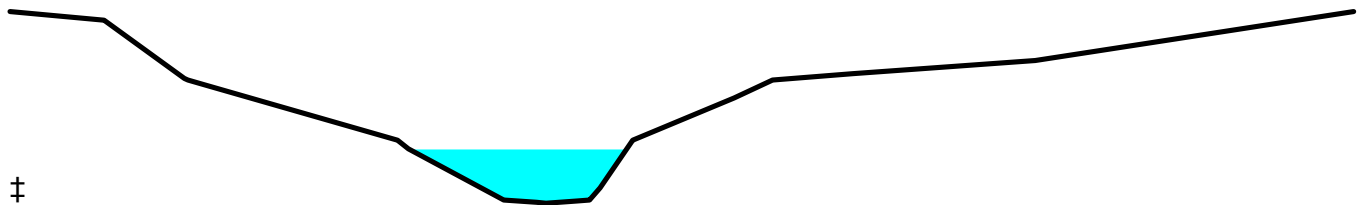
## Summary for Reach 3R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 103.03 cfs @ 12.23 hrs, Volume= 7.679 af  
Outflow = 98.34 cfs @ 12.33 hrs, Volume= 7.679 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= 14.2 min

Peak Storage= 20,194 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



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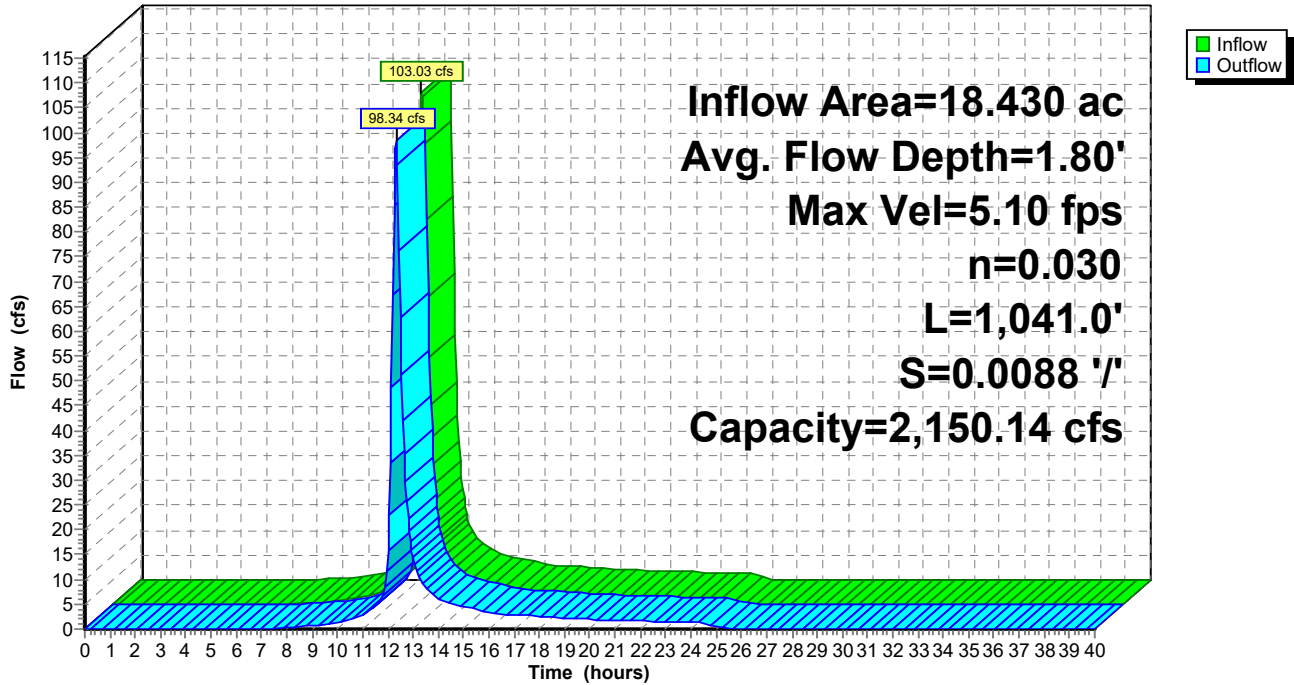
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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**

Hydrograph



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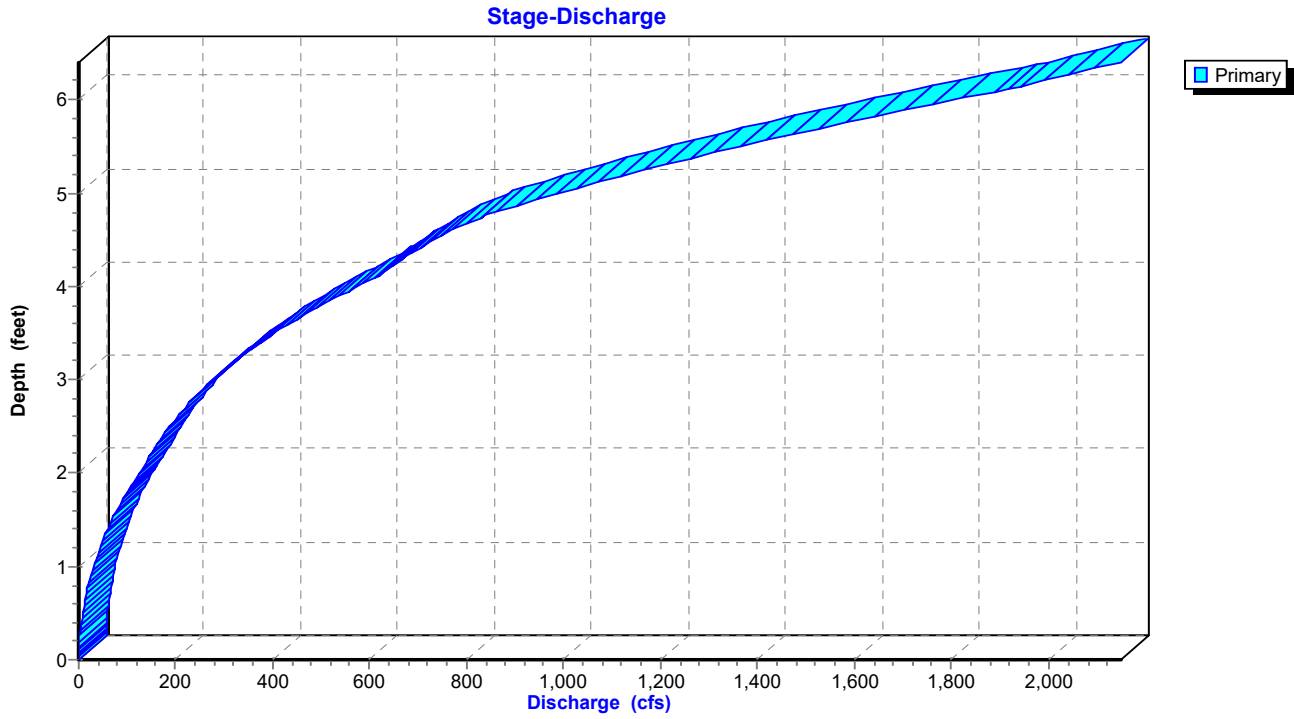
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**Reach 3R: Reach 3**



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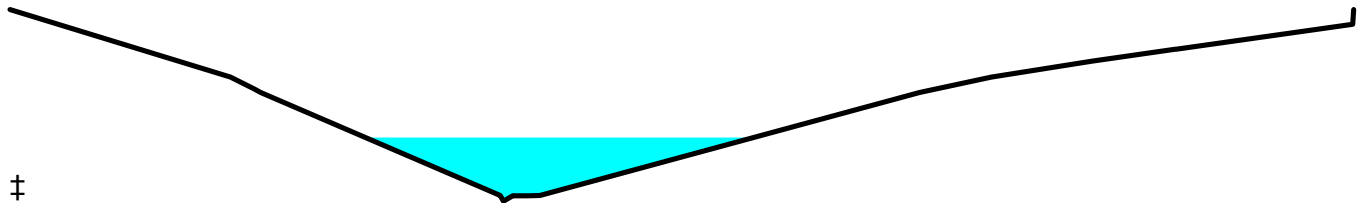
## Summary for Reach 4R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 106.97 cfs @ 12.15 hrs, Volume= 7.679 af  
Outflow = 103.03 cfs @ 12.23 hrs, Volume= 7.679 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= 4.91 fps, Min. Travel Time= 2.9 min  
Avg. Velocity = 1.62 fps, Avg. Travel Time= 8.8 min

Peak Storage= 17,892 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

**21-130-HYDRO-EX**

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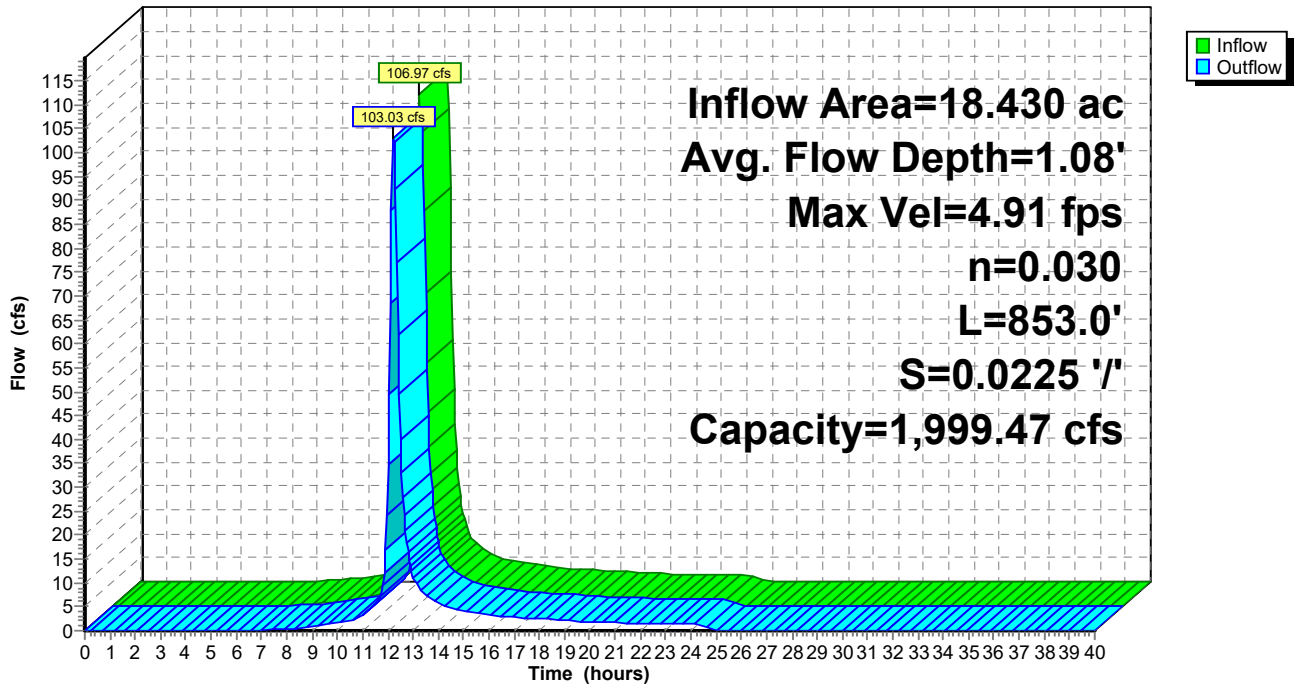
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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**

**Hydrograph**



**21-130-HYDRO-EX**

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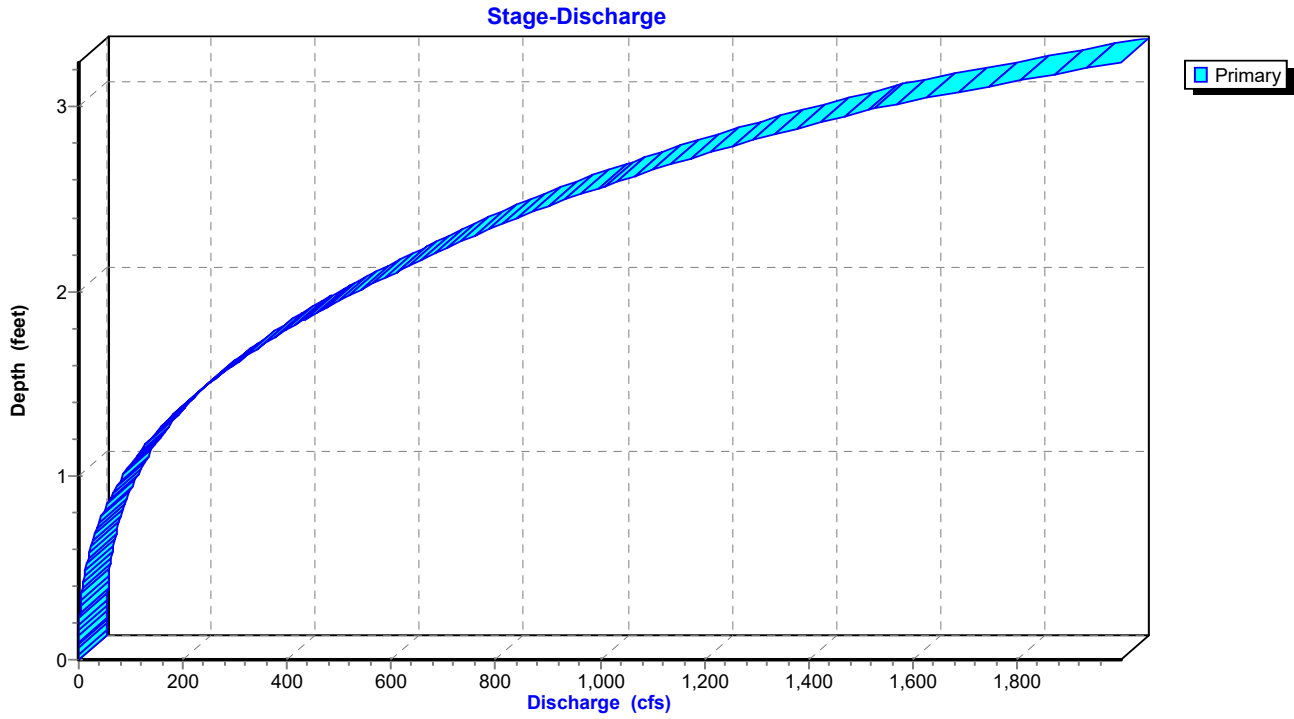
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**Reach 4R: Reach 2**



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**Summary for Reach 8R: Reach 1**

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 110.11 cfs @ 12.09 hrs, Volume= 7.679 af  
Outflow = 106.97 cfs @ 12.15 hrs, Volume= 7.679 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= 7.87 fps, Min. Travel Time= 1.9 min  
Avg. Velocity = 1.86 fps, Avg. Travel Time= 7.8 min

Peak Storage= 12,079 cf @ 12.11 hrs  
Average Depth at Peak Storage= 0.50'  
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

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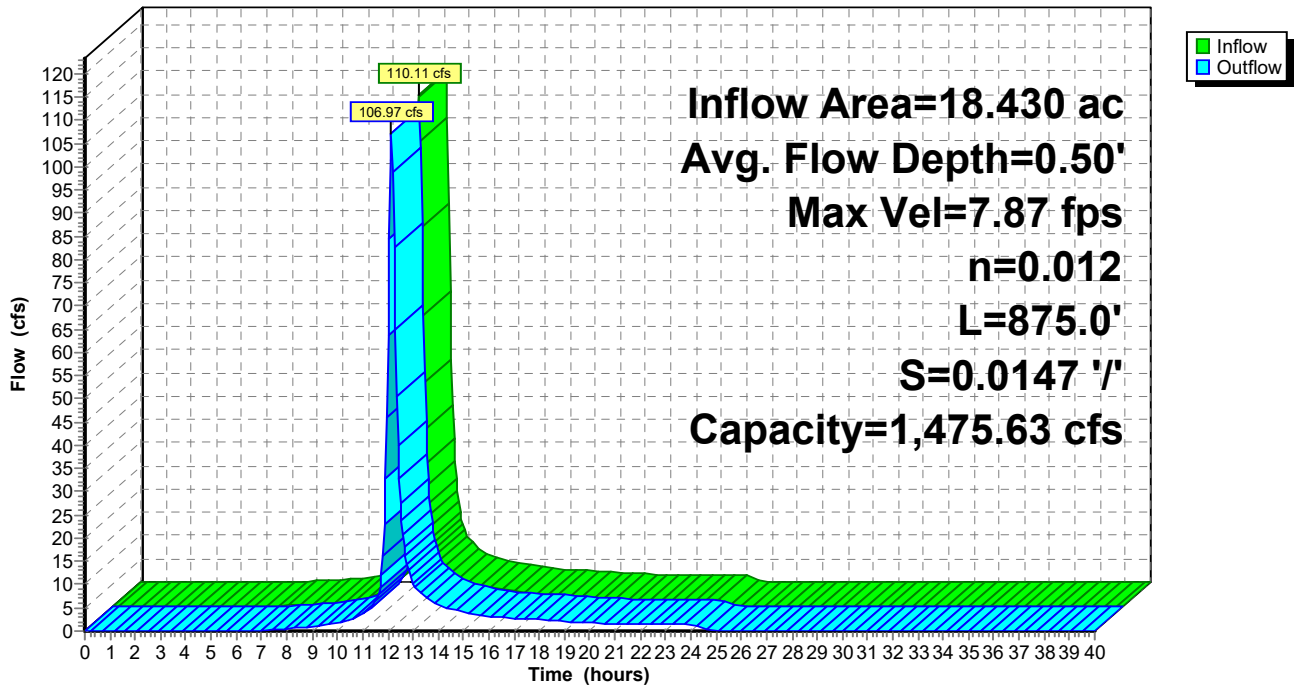
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.01	0.0	1.6	7	0.00
0.05	0.2	12.5	205	0.25
0.08	0.8	23.9	682	1.19
0.23	4.7	29.3	4,152	21.15
0.26	5.6	30.4	4,934	27.55
0.45	11.9	35.1	10,372	86.23
0.84	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**

Hydrograph



**21-130-HYDRO-EX**

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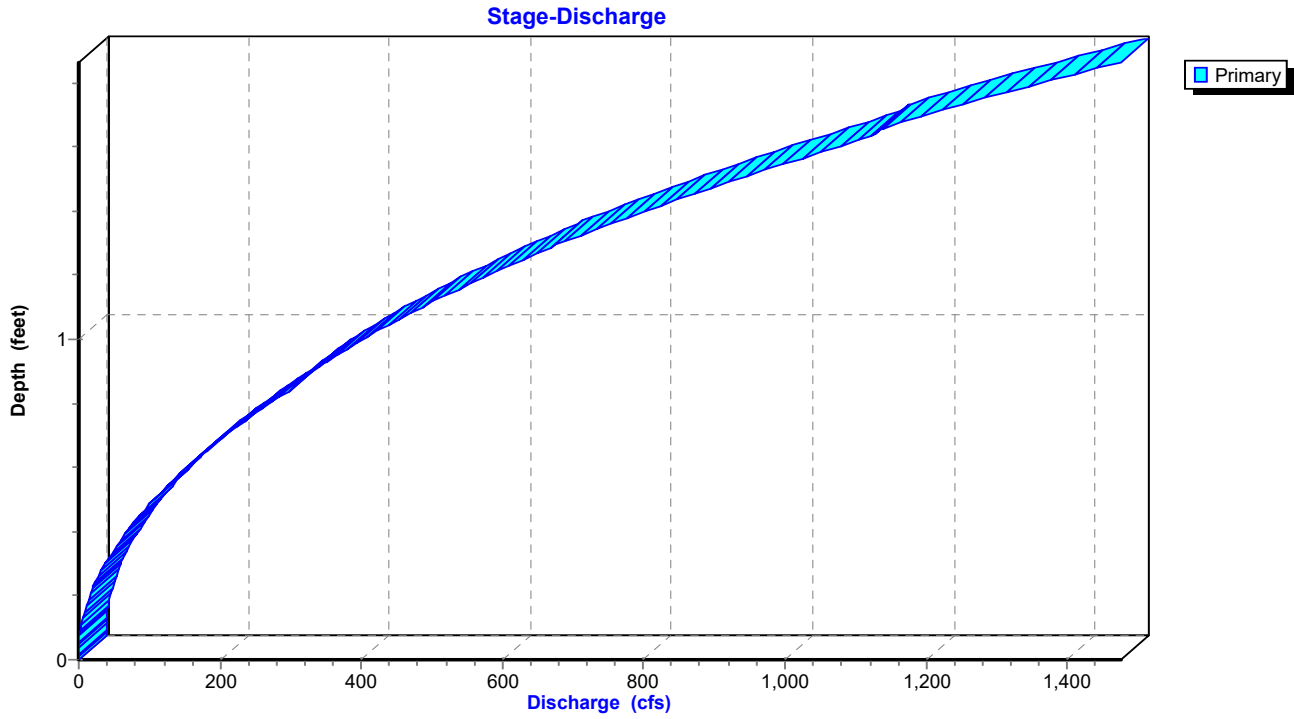
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**Reach 8R: Reach 1**





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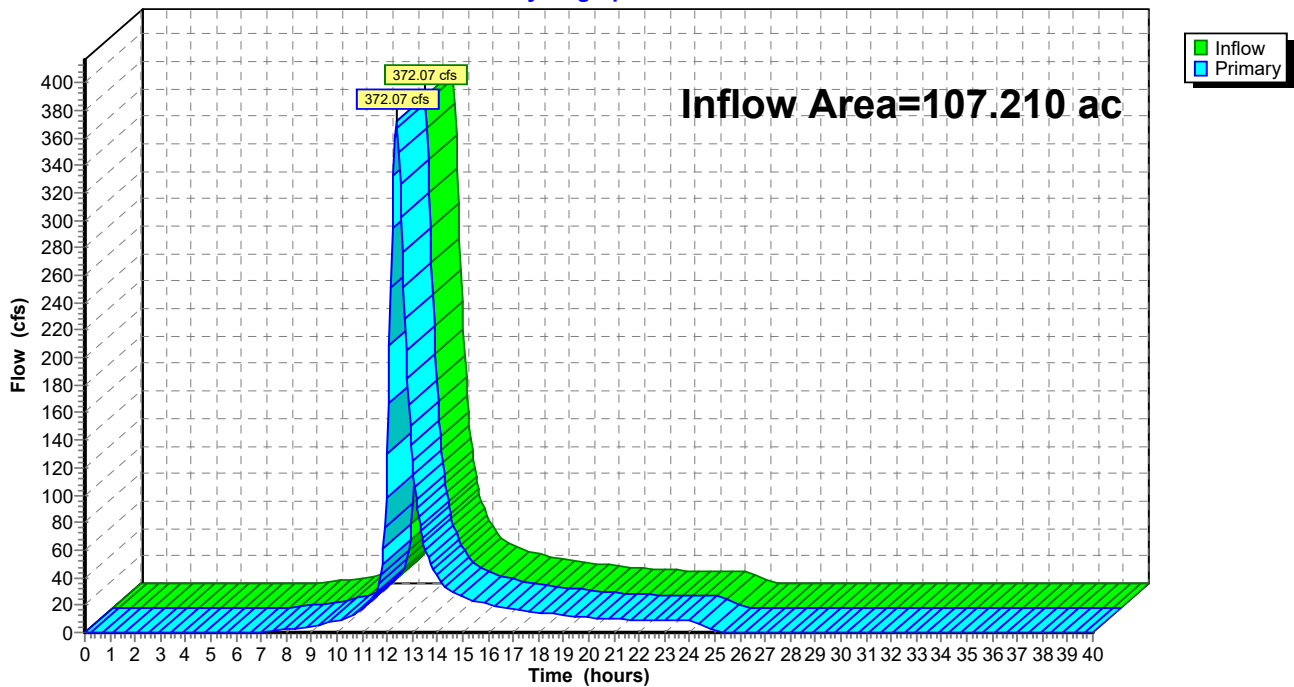
## Summary for Link 2L: RP-1

Inflow Area = 107.210 ac, 0.00% Impervious, Inflow Depth = 4.99" for 100-Year event  
Inflow = 372.07 cfs @ 12.36 hrs, Volume= 44.609 af  
Primary = 372.07 cfs @ 12.36 hrs, Volume= 44.609 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

Hydrograph



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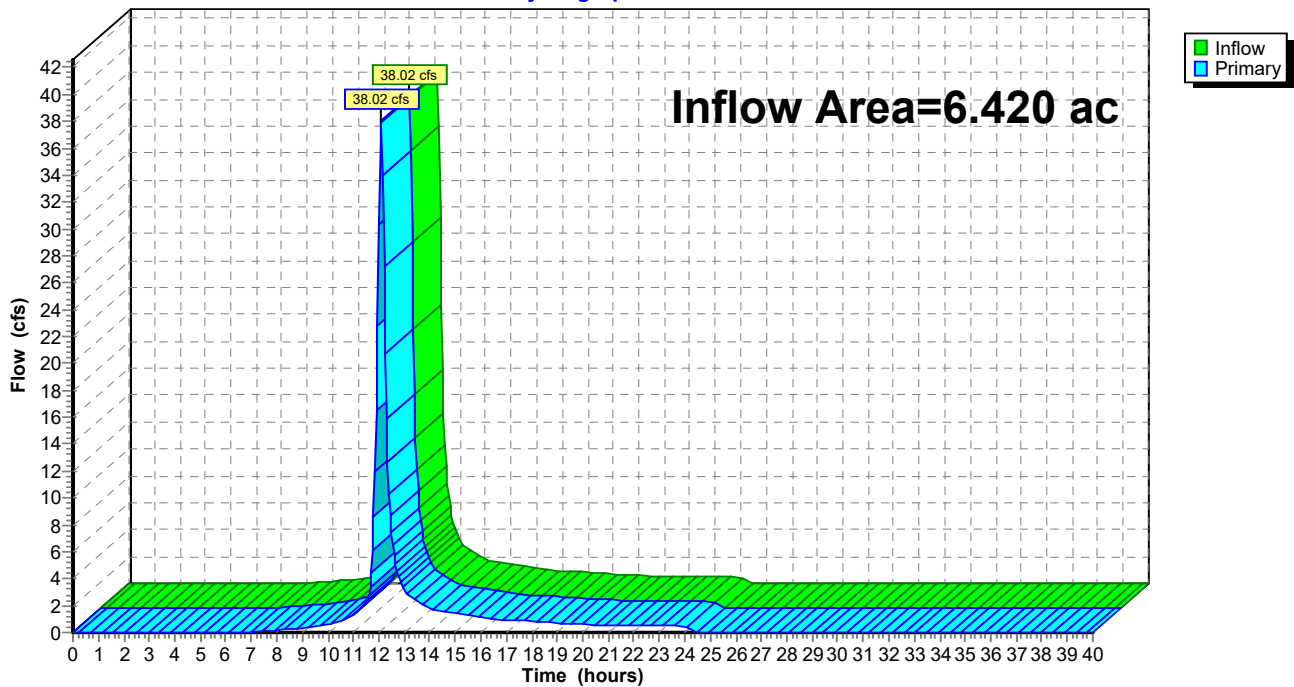
**Summary for Link 5L: RP-2**

Inflow Area = 6.420 ac, 0.00% Impervious, Inflow Depth = 4.89" for 100-Year event  
Inflow = 38.02 cfs @ 12.09 hrs, Volume= 2.614 af  
Primary = 38.02 cfs @ 12.09 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**

Hydrograph



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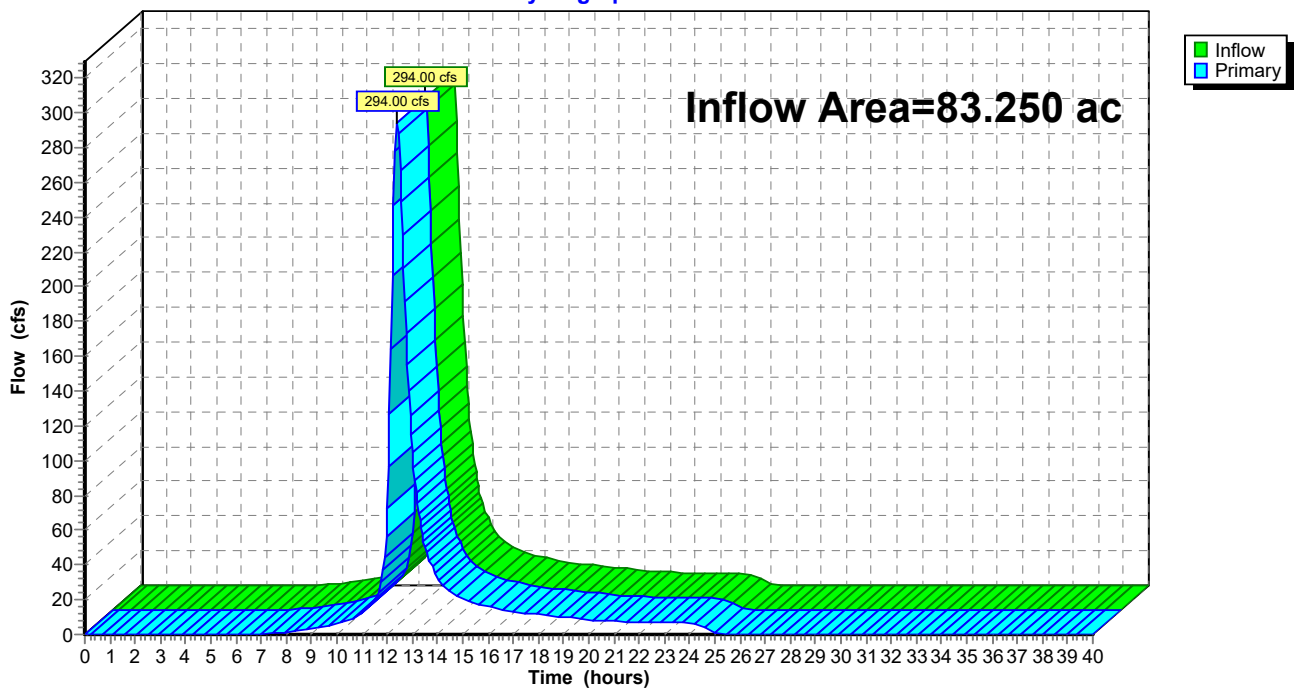
## Summary for Link 6L: RP-4

Inflow Area = 83.250 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 294.00 cfs @ 12.38 hrs, Volume= 34.687 af  
Primary = 294.00 cfs @ 12.38 hrs, Volume= 34.687 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

Hydrograph



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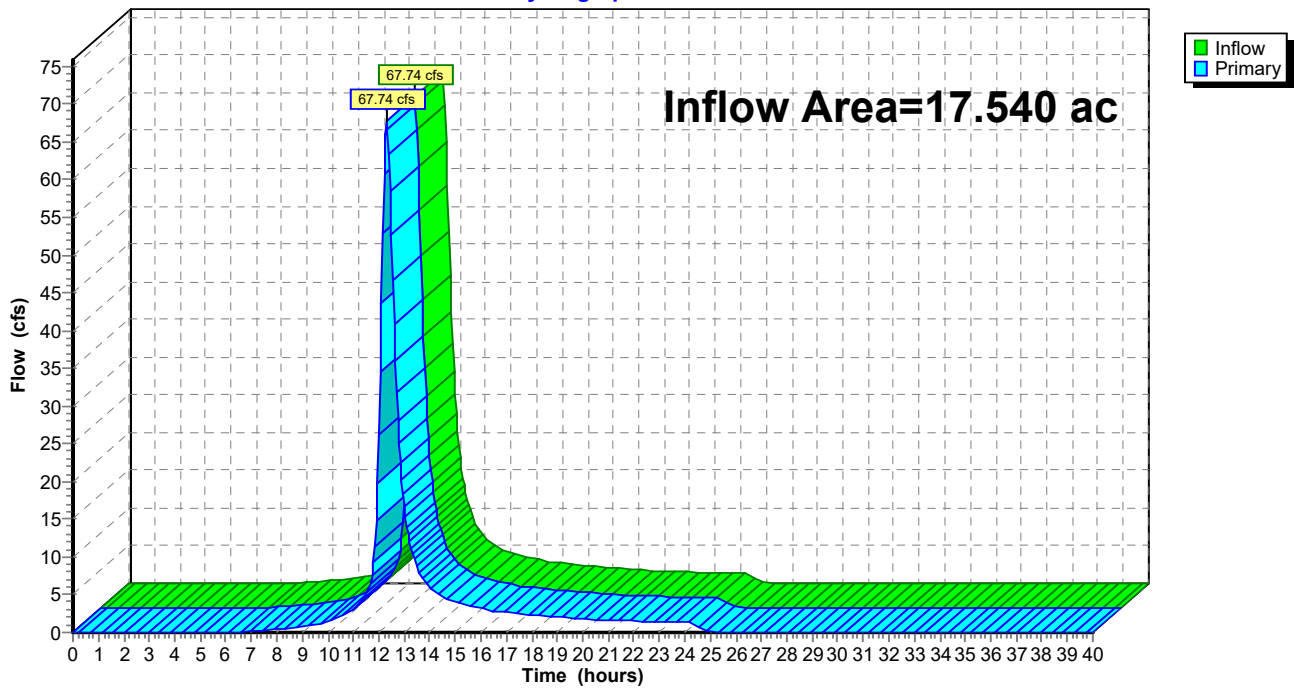
## Summary for Link 7L: RP-3

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

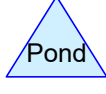
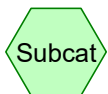
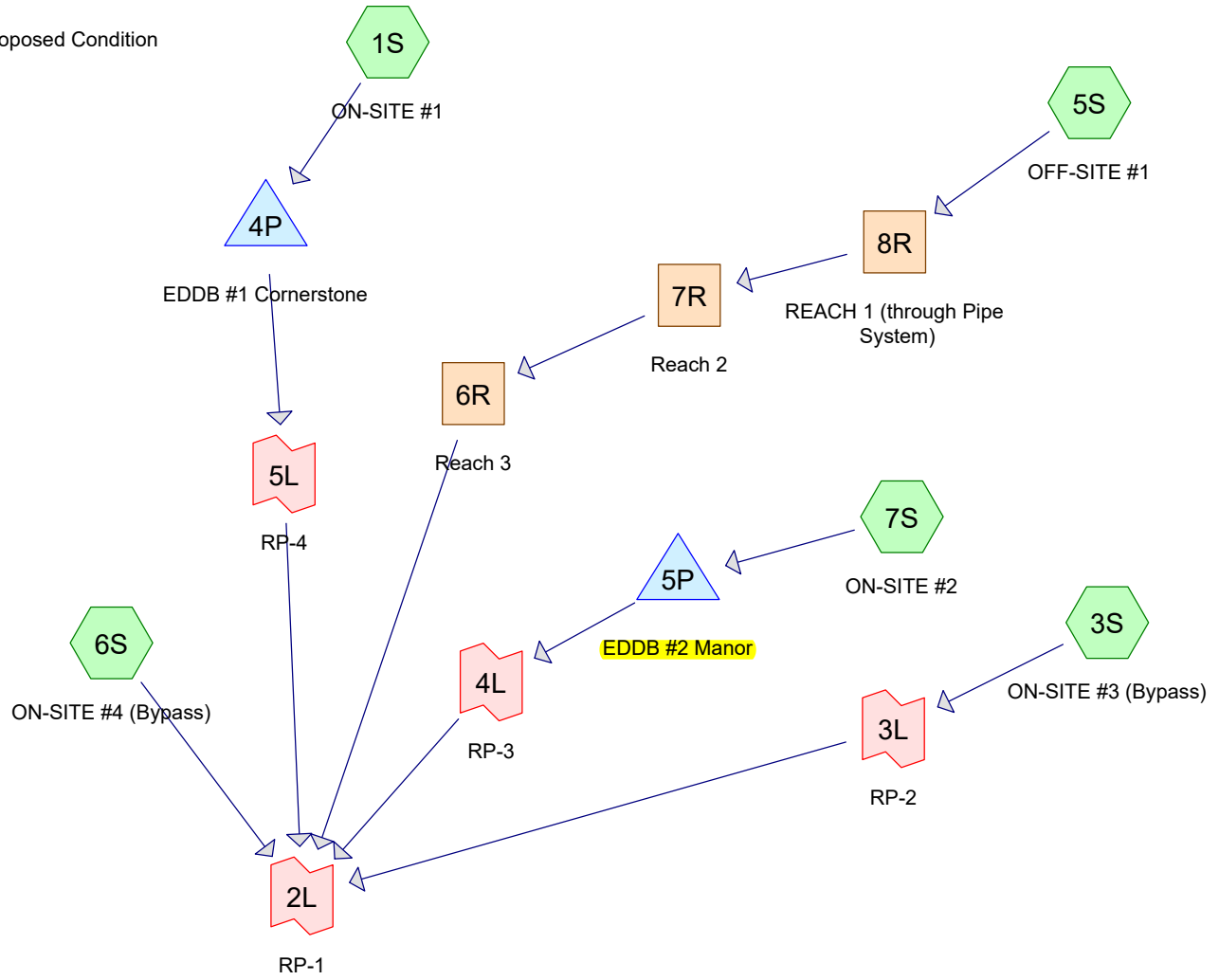
Hydrograph





# HydroCAD - Developed

Proposed Condition



**Routing Diagram for 21-130-HYDRO-PRO orifice plate option**  
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**21-130-HYDRO-PRO orifice plate option**

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Page 2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
32.070	87	1/4 acre lots, 38% imp, HSG D (3S, 7S)
11.140	92	1/8 acre lots, 65% imp, HSG D (1S)
22.730	80	>75% Grass cover, Good, HSG D (6S)
19.330	92	Duplex/Townhomes (1S)
3.190	95	Urban commercial, 85% imp, HSG D (1S, 6S)
15.640	76	Woods/grass comb., Fair, HSG C (5S)
2.790	82	Woods/grass comb., Fair, HSG D (5S)

## 21-130-HYDRO-PRO orifice plate option

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1S: ON-SITE #1** Runoff Area=31.710 ac 26.16% Impervious Runoff Depth=2.64"  
Flow Length=1,186' Slope=0.0250 '/' Tc=14.0 min CN=92 Runoff=107.19 cfs 6.968 af

**Subcatchment3S: ON-SITE #3 (Bypass)** Runoff Area=2.380 ac 38.00% Impervious Runoff Depth=2.18"  
Flow Length=1,110' Tc=12.7 min CN=87 Runoff=7.15 cfs 0.433 af

**Subcatchment5S: OFF-SITE #1** Runoff Area=18.430 ac 0.00% Impervious Runoff Depth=1.43"  
Flow Length=1,247' Tc=17.6 min CN=77 Runoff=30.84 cfs 2.197 af

**Subcatchment6S: ON-SITE #4 (Bypass)** Runoff Area=24.680 ac 6.72% Impervious Runoff Depth=1.71"  
Flow Length=1,186' Slope=0.0250 '/' Tc=15.5 min CN=81 Runoff=53.19 cfs 3.514 af

**Subcatchment7S: ON-SITE #2** Runoff Area=29.690 ac 38.00% Impervious Runoff Depth=2.18"  
Flow Length=1,769' Slope=0.0250 '/' Tc=13.8 min CN=87 Runoff=86.05 cfs 5.400 af

**Reach 6R: Reach 3** Avg. Flow Depth=0.91' Max Vel=3.48 fps Inflow=27.77 cfs 2.197 af  
n=0.030 L=1,041.0' S=0.0088 '/' Capacity=2,150.14 cfs Outflow=25.59 cfs 2.197 af

**Reach 7R: Reach 2** Avg. Flow Depth=0.66' Max Vel=3.55 fps Inflow=29.97 cfs 2.197 af  
n=0.030 L=853.0' S=0.0225 '/' Capacity=1,999.47 cfs Outflow=27.77 cfs 2.197 af

**Reach 8R: REACH 1 (through Pipe** Avg. Flow Depth=1.19' Max Vel=11.56 fps Inflow=30.84 cfs 2.197 af  
36.0" Round Pipe n=0.012 L=1,067.0' S=0.0159 '/' Capacity=91.10 cfs Outflow=29.97 cfs 2.197 af

**Pond 4P: EDDB #1 Cornerstone** Peak Elev=1,003.03' Storage=164,409 cf Inflow=107.19 cfs 6.968 af  
Outflow=13.32 cfs 6.025 af

**Pond 5P: EDDB #2 Manor** Peak Elev=994.63' Storage=122,558 cf Inflow=86.05 cfs 5.400 af  
Outflow=9.97 cfs 4.497 af

**Link 2L: RP-1** Inflow=75.14 cfs 16.666 af  
Primary=75.14 cfs 16.666 af

**Link 3L: RP-2** Inflow=7.15 cfs 0.433 af  
Primary=7.15 cfs 0.433 af

**Link 4L: RP-3** Inflow=9.97 cfs 4.497 af  
Primary=9.97 cfs 4.497 af

**Link 5L: RP-4** Inflow=13.32 cfs 6.025 af  
Primary=13.32 cfs 6.025 af



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

Runoff = 107.19 cfs @ 12.05 hrs, Volume= 6.968 af, Depth= 2.64"

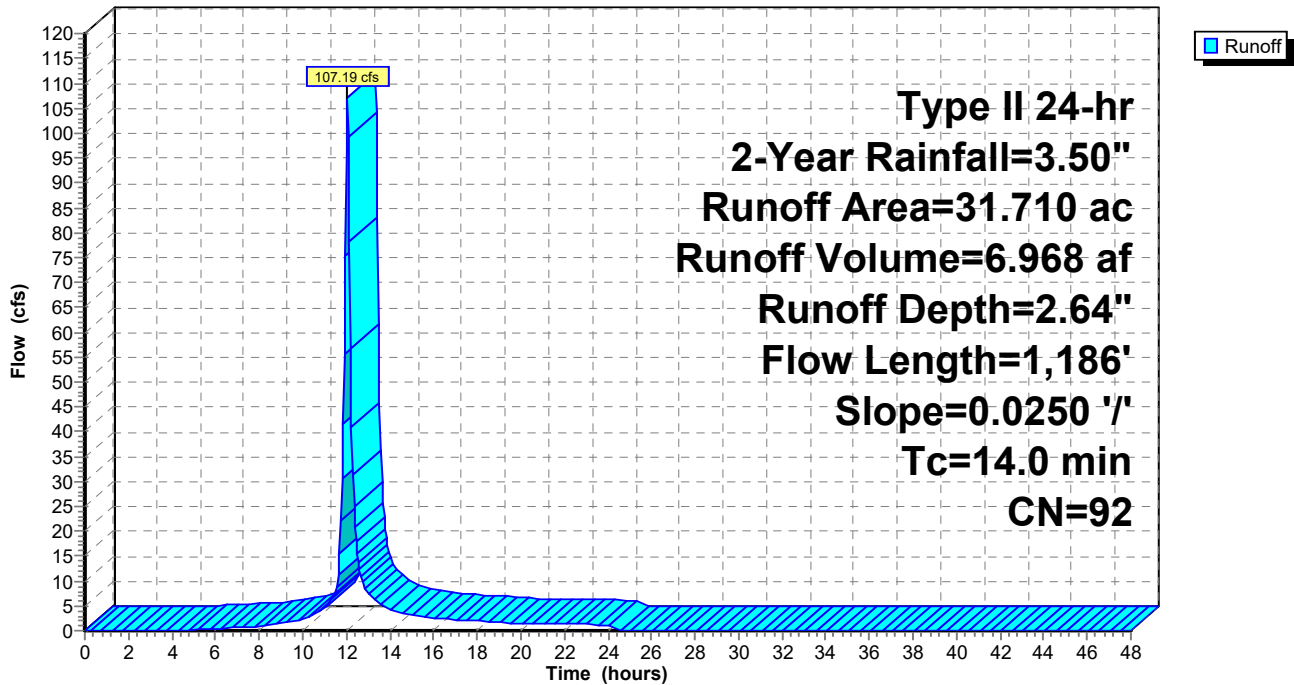
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
* 19.330	92	Duplex/Townhomes
11.140	92	1/8 acre lots, 65% imp, HSG D
1.240	95	Urban commercial, 85% imp, HSG D
31.710	92	Weighted Average
23.415		73.84% Pervious Area
8.295		26.16% Impervious Area

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

## Subcatchment 1S: ON-SITE #1

Hydrograph



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## Summary for Subcatchment 3S: ON-SITE #3 (Bypass)

Runoff = 7.15 cfs @ 12.04 hrs, Volume= 0.433 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"

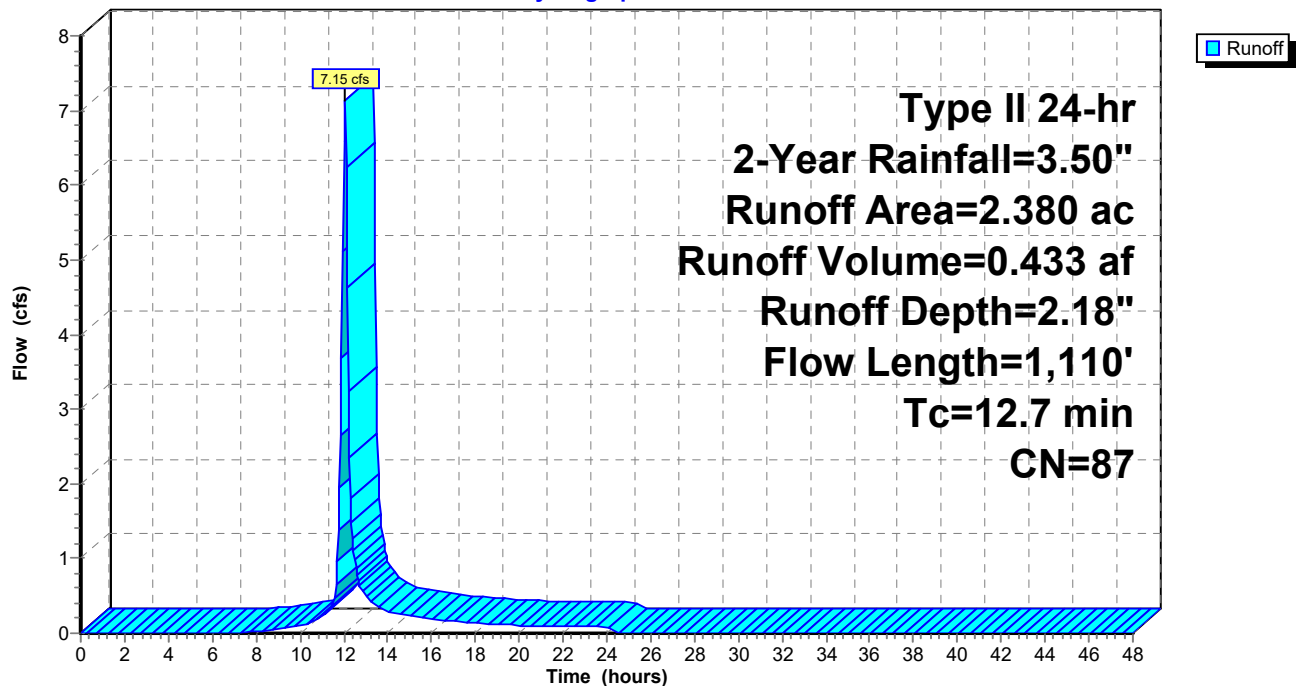
Area (ac)	CN	Description
2.380	87	1/4 acre lots, 38% imp, HSG D
1.476		62.00% Pervious Area
0.904		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		Sheet Flow, 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 (Bypass)

Hydrograph



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## Summary for Subcatchment 5S: OFF-SITE #1

Runoff = 30.84 cfs @ 12.11 hrs, Volume= 2.197 af, Depth= 1.43"

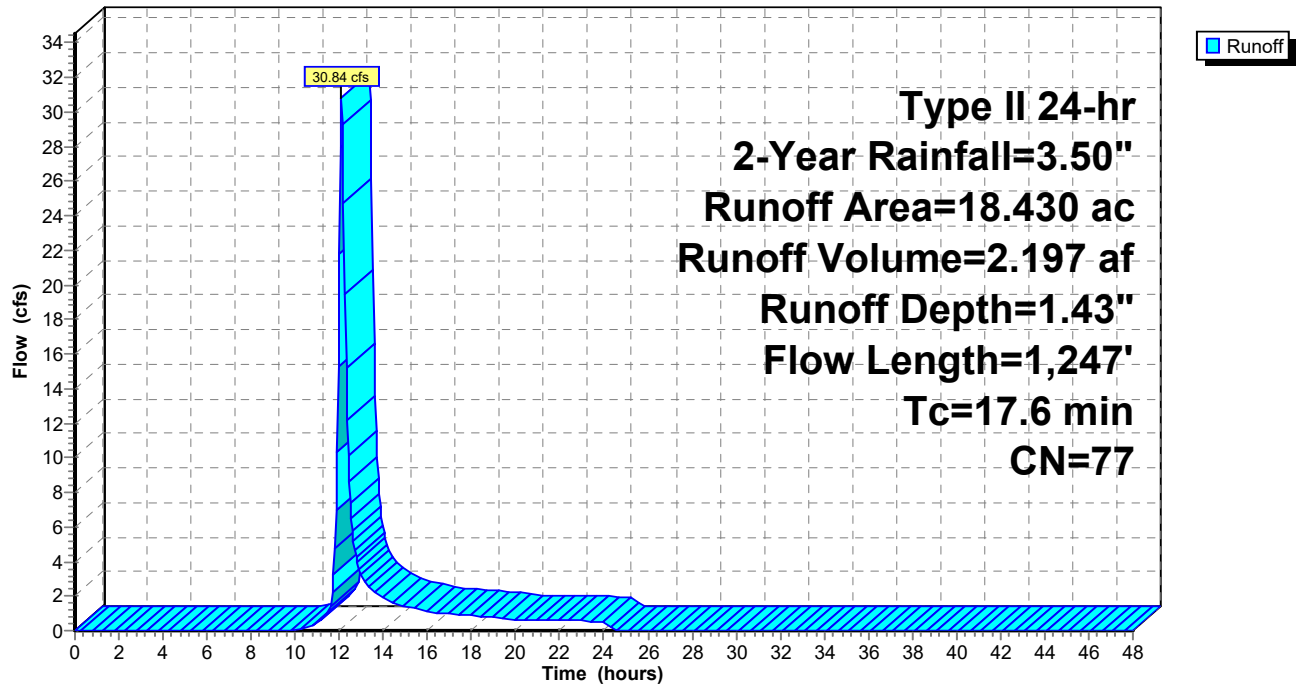
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

## Subcatchment 5S: OFF-SITE #1

Hydrograph



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**Summary for Subcatchment 6S: ON-SITE #4 (Bypass)**

Runoff = 53.19 cfs @ 12.08 hrs, Volume= 3.514 af, Depth= 1.71"

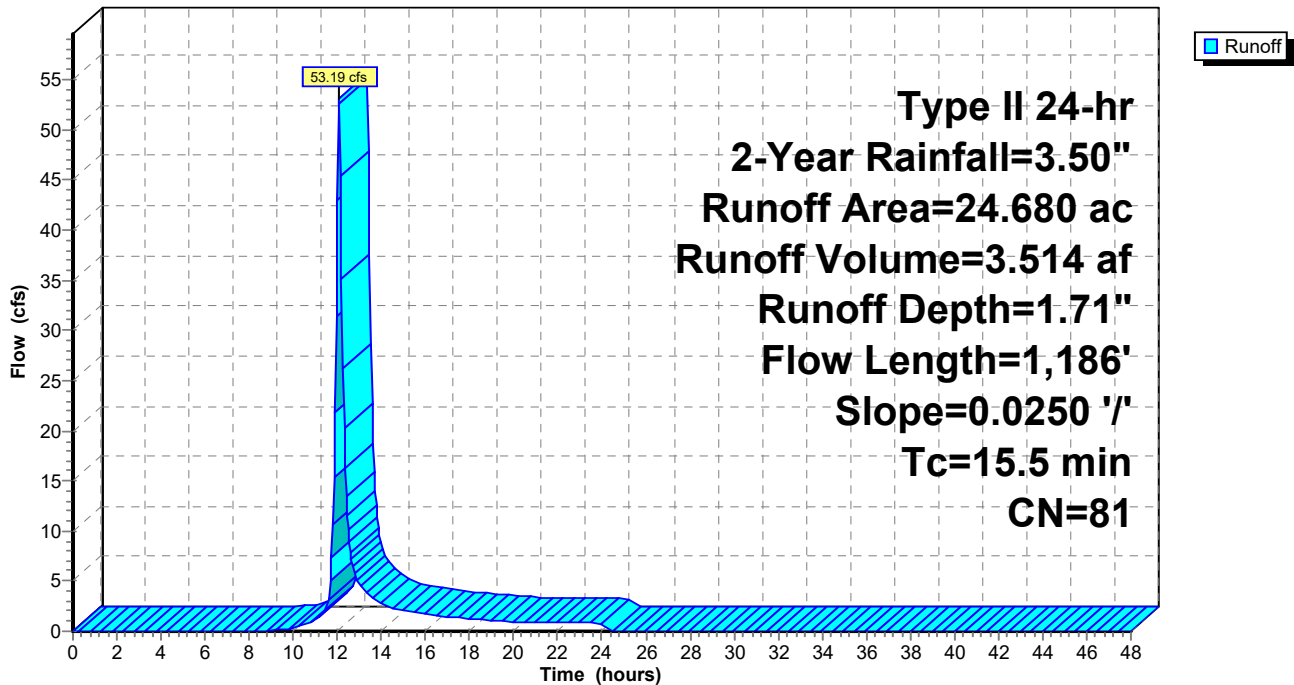
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.50"

Area (ac)	CN	Description
22.730	80	>75% Grass cover, Good, HSG D
1.950	95	Urban commercial, 85% imp, HSG D
24.680	81	Weighted Average
23.023		93.28% Pervious Area
1.657		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
7.1	1,086	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.5	1,186	Total			

**Subcatchment 6S: ON-SITE #4 (Bypass)**

Hydrograph



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## Summary for Subcatchment 7S: ON-SITE #2

Runoff = 86.05 cfs @ 12.06 hrs, Volume= 5.400 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"

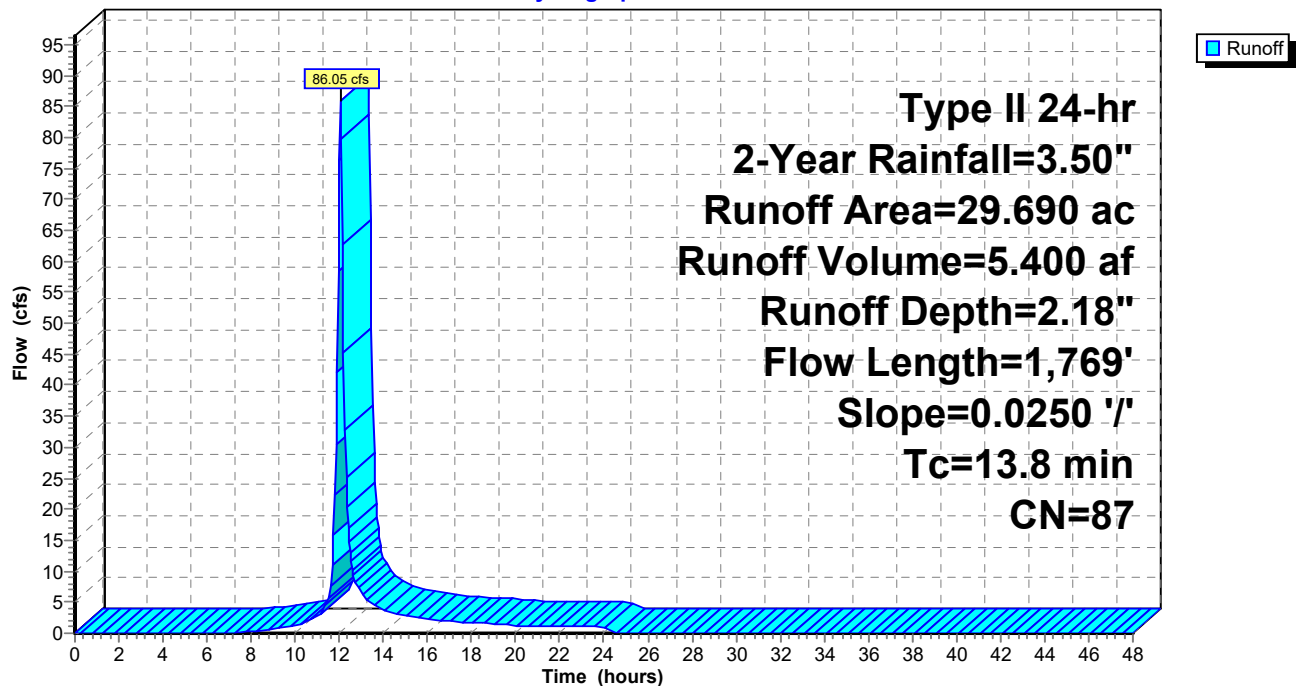
Area (ac)	CN	Description
29.690	87	1/4 acre lots, 38% imp, HSG D
18.408		62.00% Pervious Area
11.282		38.00% Impervious Area

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

## Subcatchment 7S: ON-SITE #2

Hydrograph



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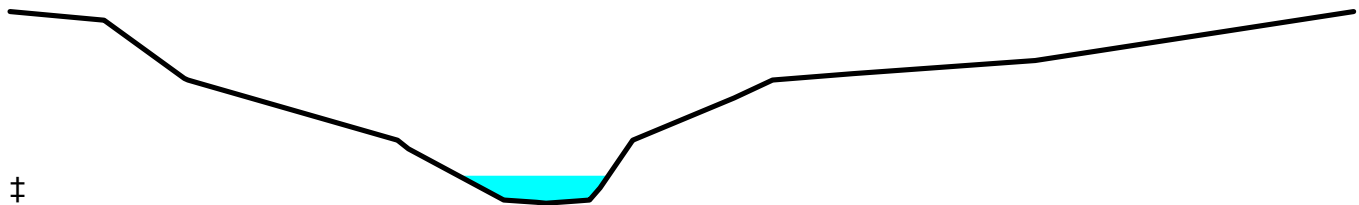
## Summary for Reach 6R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 27.77 cfs @ 12.27 hrs, Volume= 2.197 af  
Outflow = 25.59 cfs @ 12.42 hrs, Volume= 2.197 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= 19.4 min

Peak Storage= 7,714 cf @ 12.33 hrs  
Average Depth at Peak Storage= 0.91'  
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

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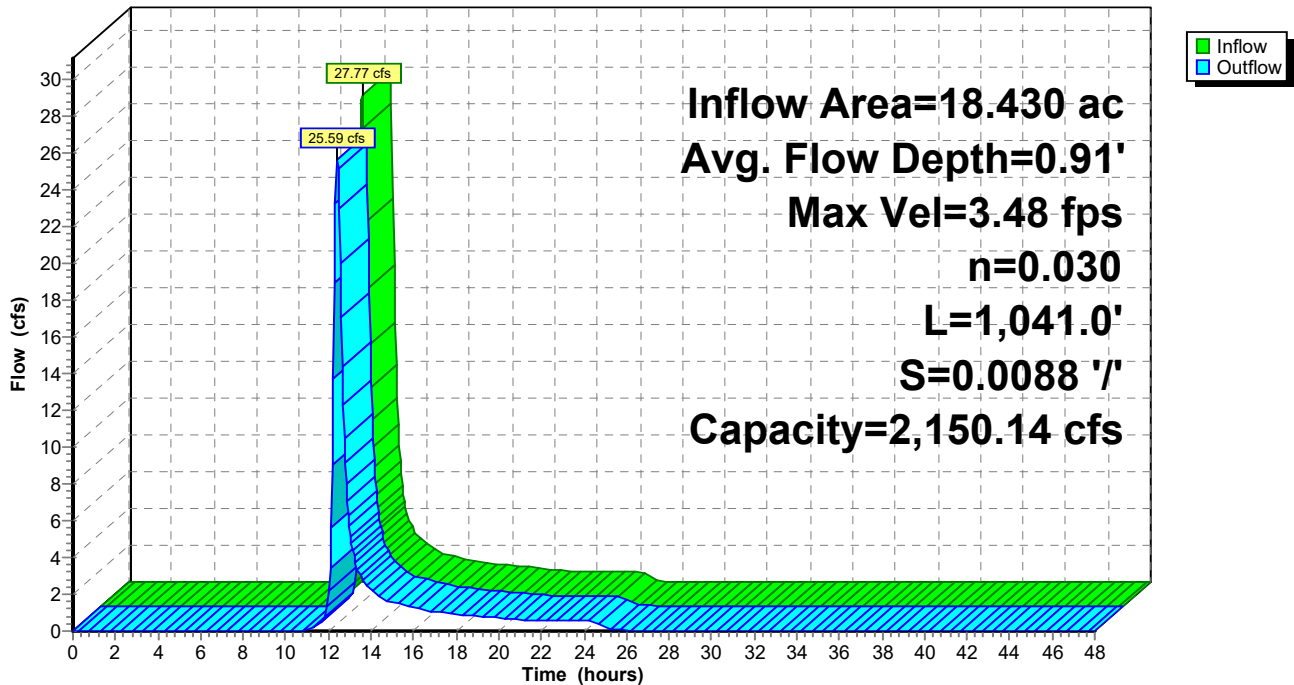
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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

### Hydrograph



**21-130-HYDRO-PRO orifice plate option**

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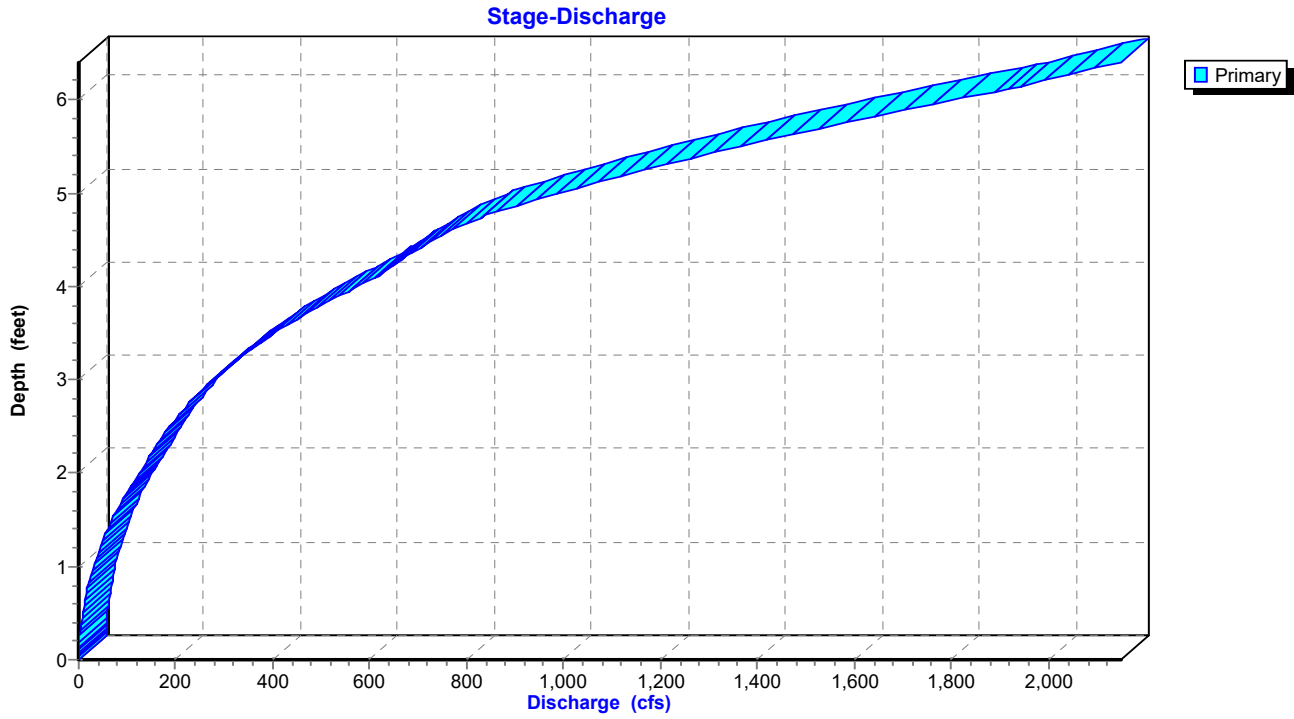
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**Reach 6R: Reach 3**





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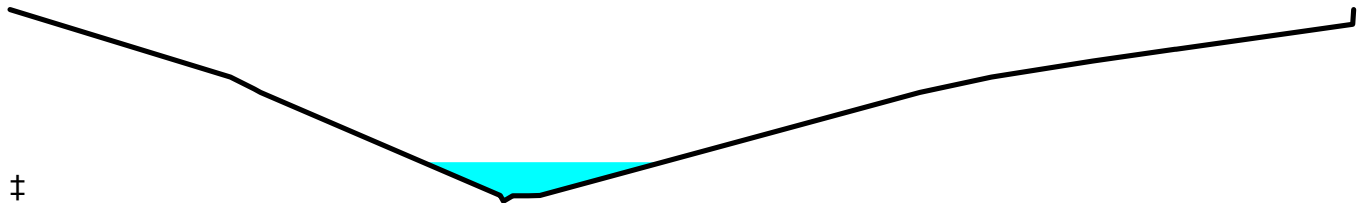
## Summary for Reach 7R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 29.97 cfs @ 12.15 hrs, Volume= 2.197 af  
Outflow = 27.77 cfs @ 12.27 hrs, Volume= 2.197 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= 6,767 cf @ 12.21 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

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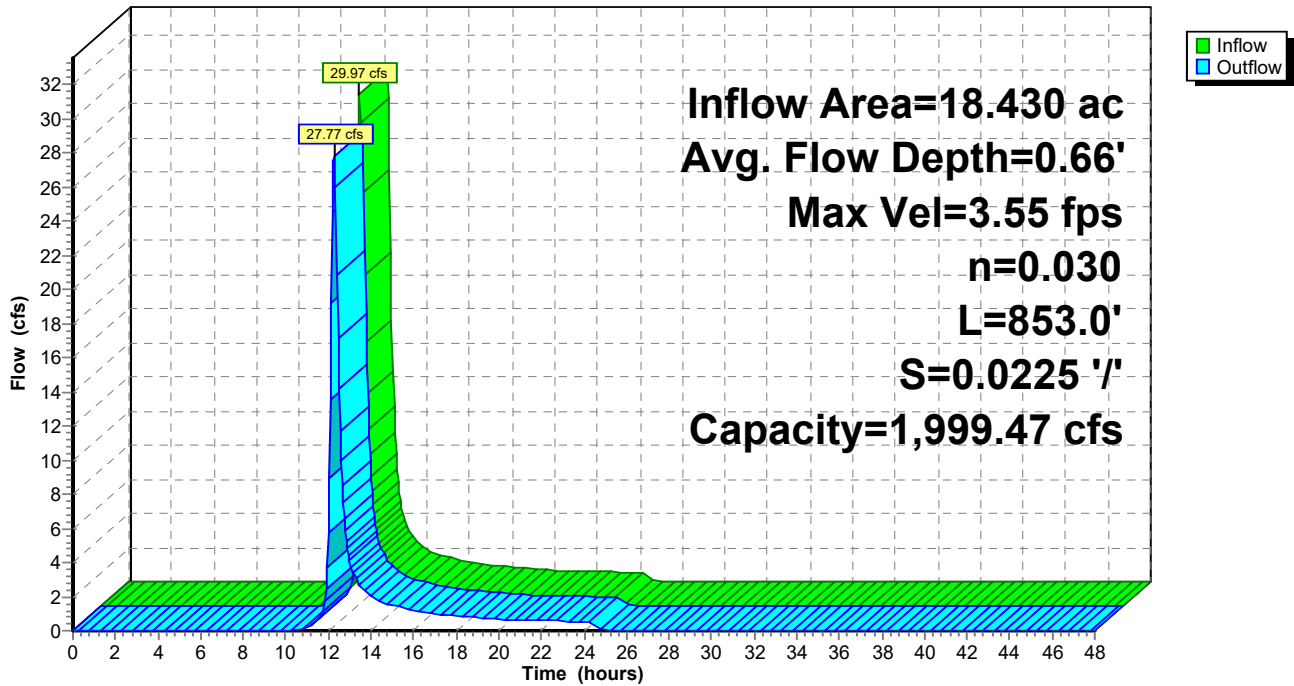
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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

### Hydrograph



**21-130-HYDRO-PRO orifice plate option**

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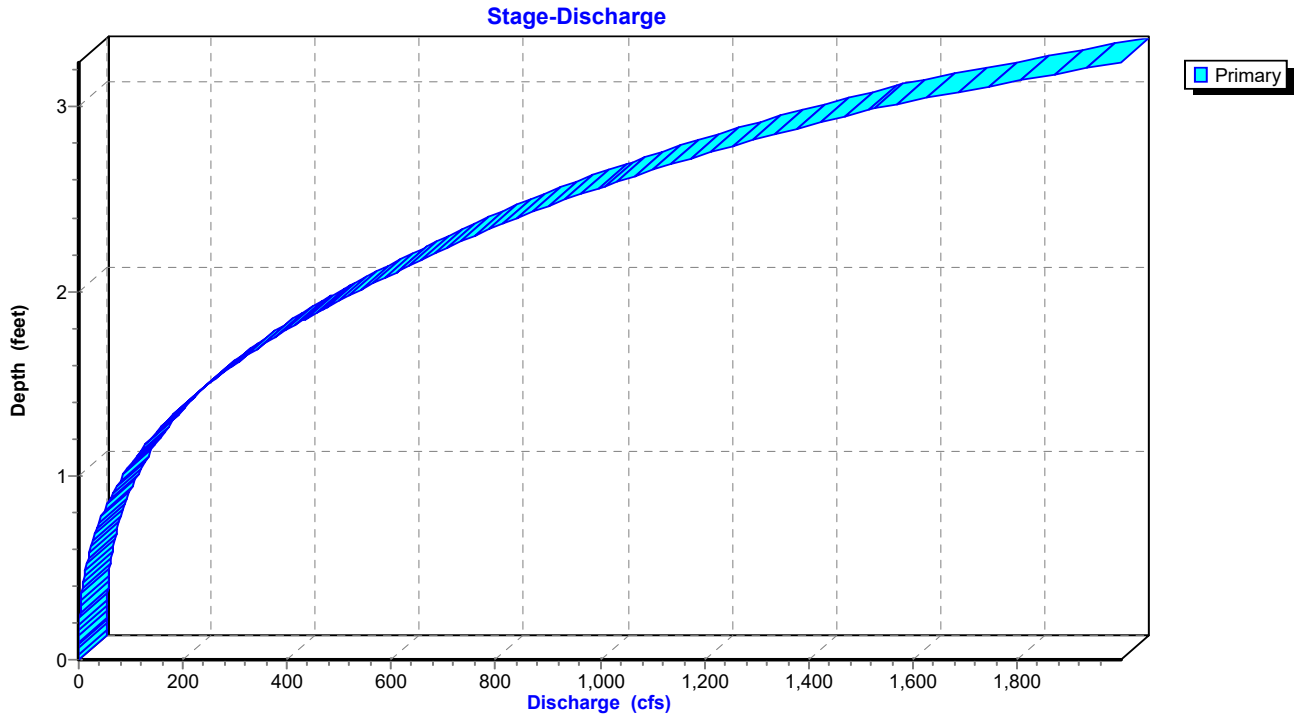
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**Reach 7R: Reach 2**



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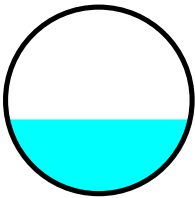
## Summary for Reach 8R: REACH 1 (through Pipe System)

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 1.43" for 2-Year event  
Inflow = 30.84 cfs @ 12.11 hrs, Volume= 2.197 af  
Outflow = 29.97 cfs @ 12.15 hrs, Volume= 2.197 af, Atten= 3%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 11.56 fps, Min. Travel Time= 1.5 min  
Avg. Velocity = 4.01 fps, Avg. Travel Time= 4.4 min

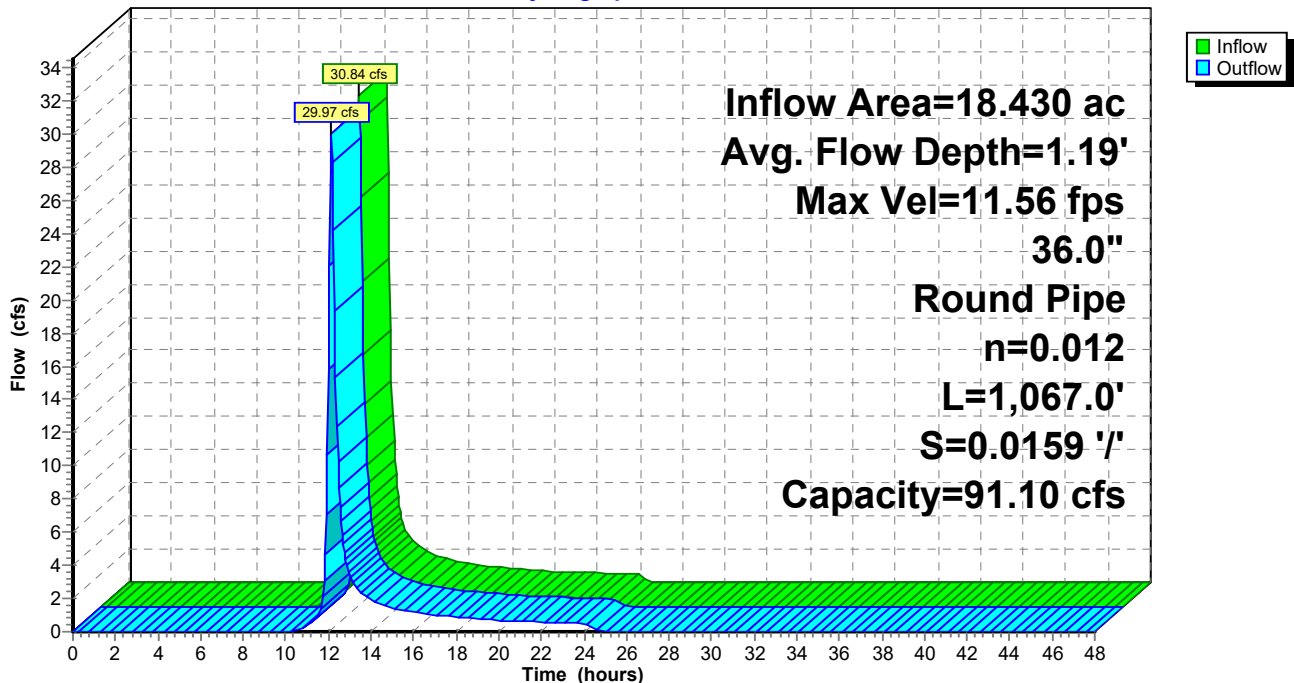
Peak Storage= 2,798 cf @ 12.13 hrs  
Average Depth at Peak Storage= 1.19'  
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 91.10 cfs

36.0" Round Pipe  
n= 0.012 Concrete pipe, finished  
Length= 1,067.0' Slope= 0.0159 '/'  
Inlet Invert= 1,021.96', Outlet Invert= 1,005.00'



## Reach 8R: REACH 1 (through Pipe System)

Hydrograph



**21-130-HYDRO-PRO orifice plate option**

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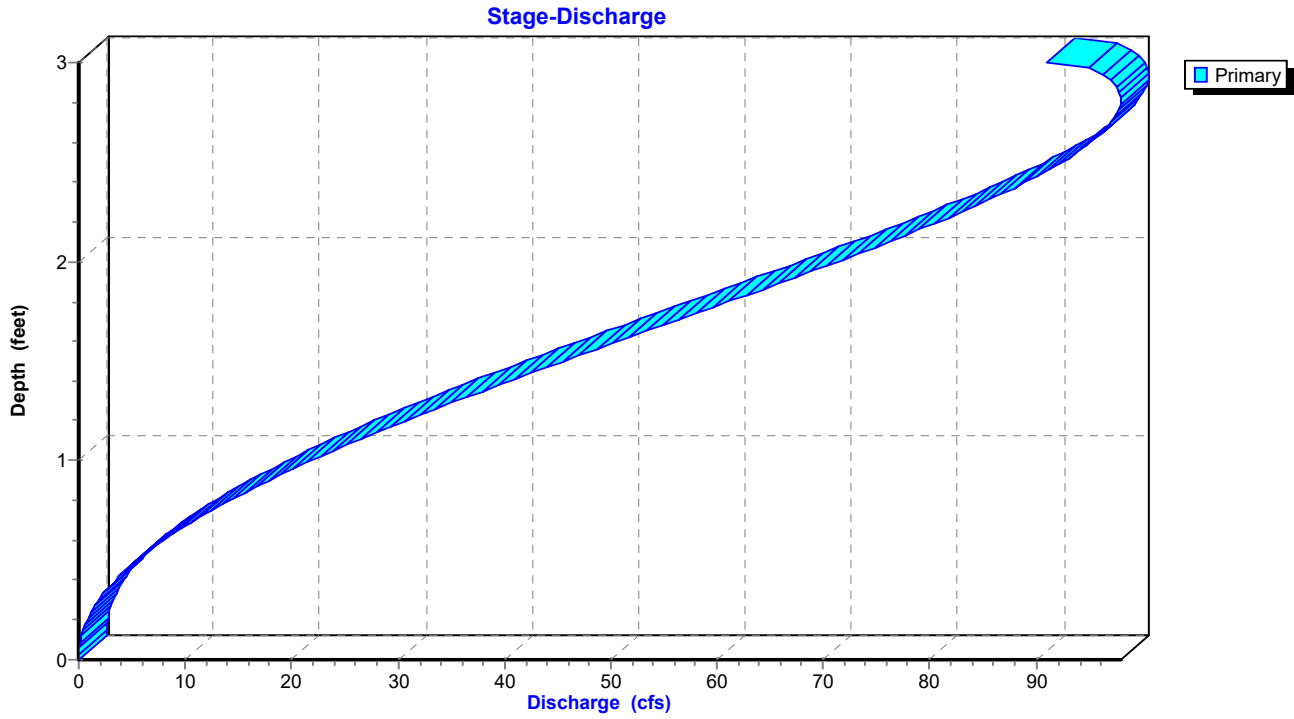
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**Reach 8R: REACH 1 (through Pipe System)**



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### Summary for Pond 4P: Eddb #1 Cornerstone

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth = 2.64" for 2-Year event  
 Inflow = 107.19 cfs @ 12.05 hrs, Volume= 6.968 af  
 Outflow = 13.32 cfs @ 12.57 hrs, Volume= 6.025 af, Atten= 88%, Lag= 30.8 min  
 Primary = 13.32 cfs @ 12.57 hrs, Volume= 6.025 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,003.03' @ 12.57 hrs Surf.Area= 44,926 sf Storage= 164,409 cf

Plug-Flow detention time= 398.2 min calculated for 6.025 af (86% of inflow)  
 Center-of-Mass det. time= 334.8 min ( 1,133.6 - 798.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	995.67'	374,566 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.67	0	0	0
996.00	700	116	116
997.00	7,200	3,950	4,066
998.00	12,000	9,600	13,666
999.00	17,900	14,950	28,616
1,000.00	27,000	22,450	51,066
1,001.00	36,000	31,500	82,566
1,002.00	40,000	38,000	120,566
1,003.00	44,800	42,400	162,966
1,004.00	48,700	46,750	209,716
1,005.00	53,000	50,850	260,566
1,006.00	57,000	55,000	315,566
1,007.00	61,000	59,000	374,566

Device	Routing	Invert	Outlet Devices
#1	Primary	993.54'	<b>30.0" Round 30" Culvert</b> L= 87.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.54' / 993.11' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	994.16'	<b>2.9" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	994.36'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 994.36' / 994.16' S= 0.0100 '/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#4	Device 3	995.67'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 9 rows with 4.0" cc spacing C= 0.600
#5	Device 1	1,001.05'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	1,004.00'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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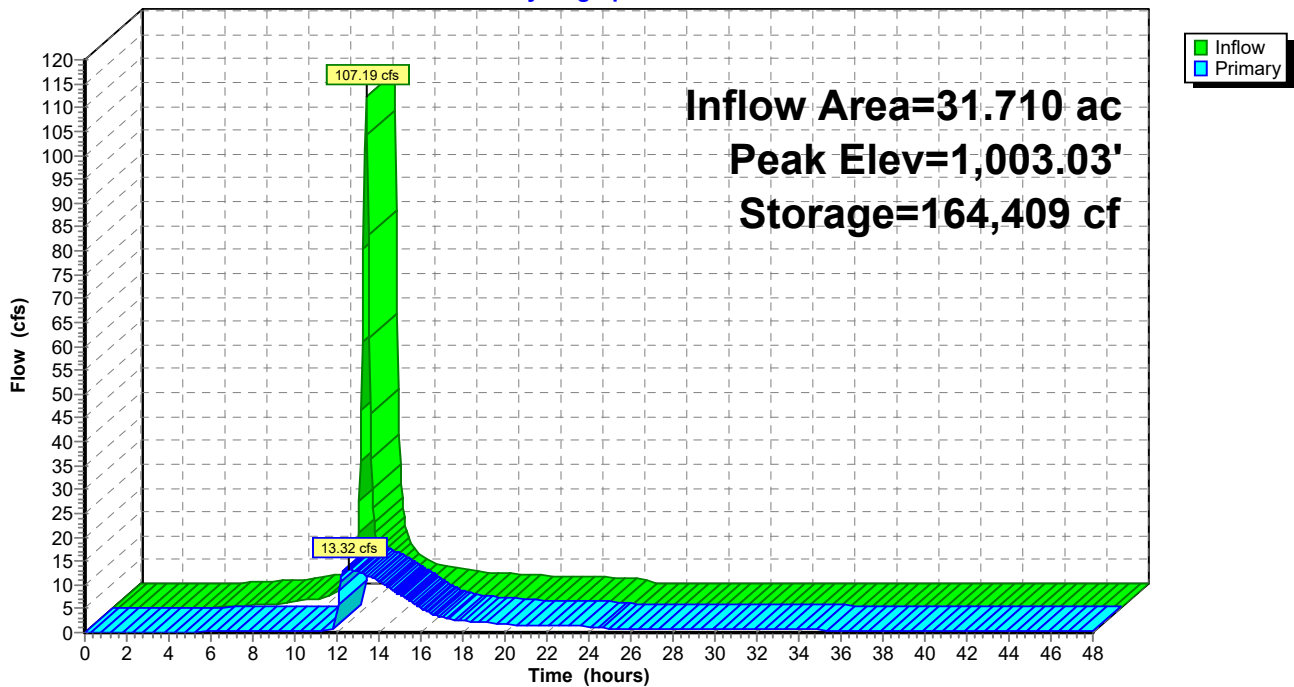
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**Primary OutFlow Max=13.31 cfs @ 12.57 hrs HW=1,003.03' (Free Discharge)**

- 1=30" Culvert (Passes 13.31 cfs of 67.85 cfs potential flow)
- 2=WQ Orifice (Orifice Controls 0.65 cfs @ 14.24 fps)
- 3=8" PVC Pipe (Passes 0.65 cfs of 5.51 cfs potential flow)
- 4=Riser Pipe (Passes 0.65 cfs of 4.61 cfs potential flow)
- 5=Opening in Box (Orifice Controls 12.66 cfs @ 6.33 fps)
- 6=Open Top of Box ( Controls 0.00 cfs)

## Pond 4P: EDDB #1 Cornerstone

Hydrograph



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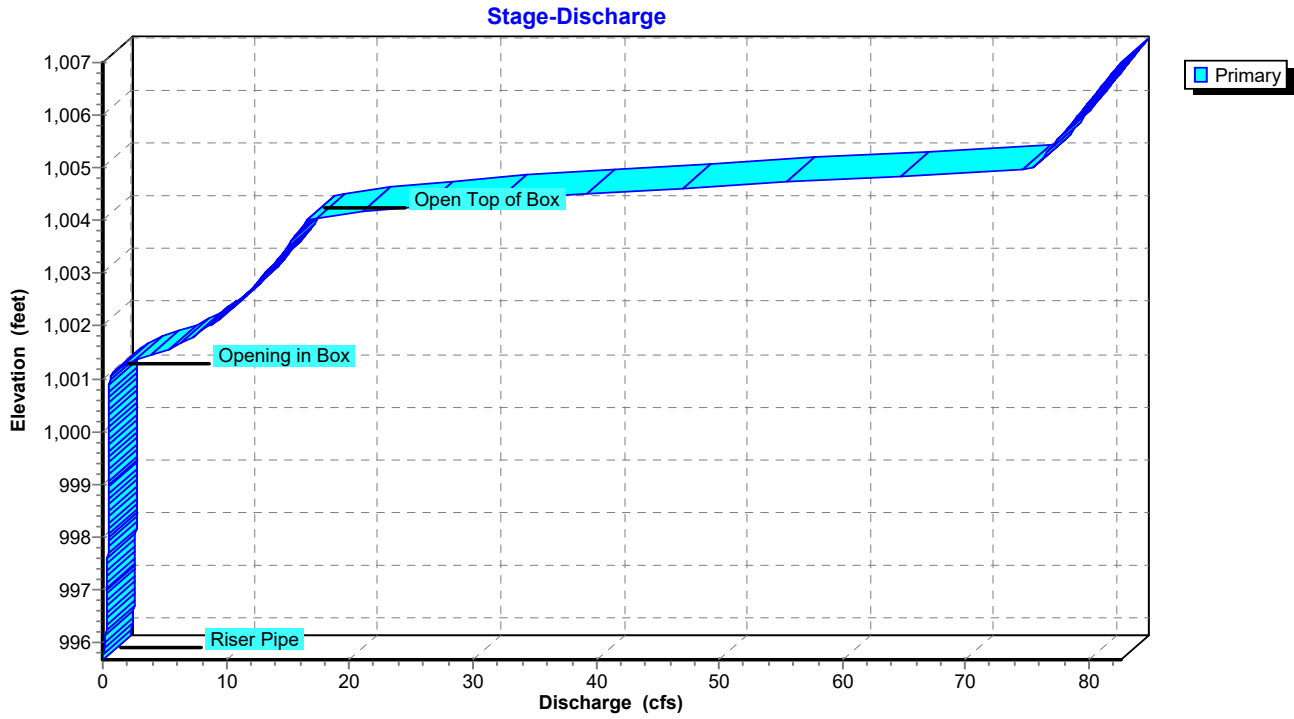
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## Pond 4P: Eddb #1 Cornerstone





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### Summary for Pond 5P: Eddb #2 Manor

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth = 2.18" for 2-Year event  
Inflow = 86.05 cfs @ 12.06 hrs, Volume= 5.400 af  
Outflow = 9.97 cfs @ 12.62 hrs, Volume= 4.497 af, Atten= 88%, Lag= 33.7 min  
Primary = 9.97 cfs @ 12.62 hrs, Volume= 4.497 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Peak Elev= 994.63' @ 12.62 hrs Surf.Area= 44,414 sf Storage= 122,558 cf

Plug-Flow detention time= 407.5 min calculated for 4.492 af (83% of inflow)  
Center-of-Mass det. time= 335.4 min ( 1,154.7 - 819.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	988.16'	352,236 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
988.16	0	0	0
989.00	800	336	336
990.00	4,200	2,500	2,836
991.00	10,400	7,300	10,136
992.00	21,600	16,000	26,136
993.00	37,600	29,600	55,736
994.00	41,700	39,650	95,386
995.00	46,000	43,850	139,236
996.00	49,700	47,850	187,086
997.00	53,200	51,450	238,536
998.00	56,900	55,050	293,586
999.00	60,400	58,650	352,236

Device	Routing	Invert	Outlet Devices
#1	Primary	986.00'	<b>30.0" Round 30" Culvert</b> L= 77.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.00' / 985.62' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	986.62'	<b>2.5" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	986.86'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.86' / 986.62' S= 0.0120 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#4	Device 3	988.16'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 8 rows with 4.0" cc spacing C= 0.600
#5	Device 1	993.40'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	995.25'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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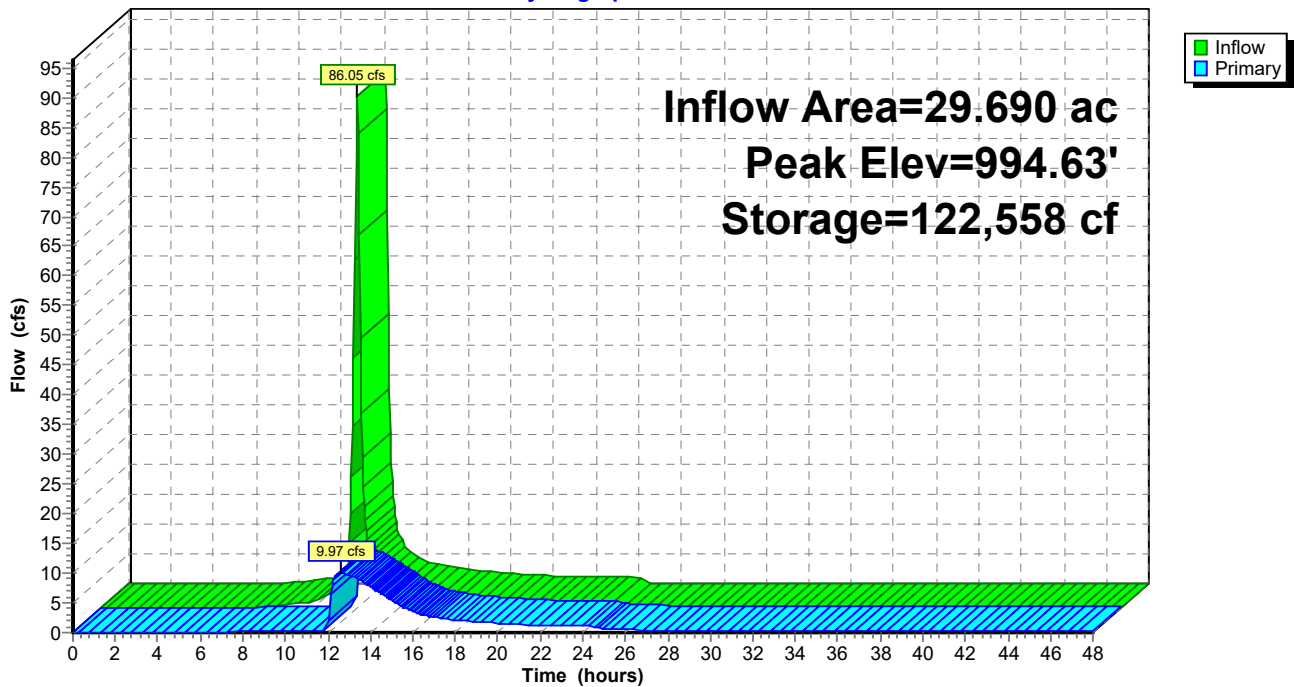
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**Primary OutFlow Max=9.97 cfs @ 12.62 hrs HW=994.63' (Free Discharge)**

- 1=30" Culvert (Passes 9.97 cfs of 64.21 cfs potential flow)
- 2=WQ Orifice (Orifice Controls 0.46 cfs @ 13.54 fps)
- 3=8" PVC Pipe (Passes 0.46 cfs of 4.58 cfs potential flow)
- 4=Riser Pipe (Passes 0.46 cfs of 3.85 cfs potential flow)
- 5=Opening in Box (Orifice Controls 9.51 cfs @ 4.75 fps)
- 6=Open Top of Box ( Controls 0.00 cfs)

## Pond 5P: EDDB #2 Manor

Hydrograph



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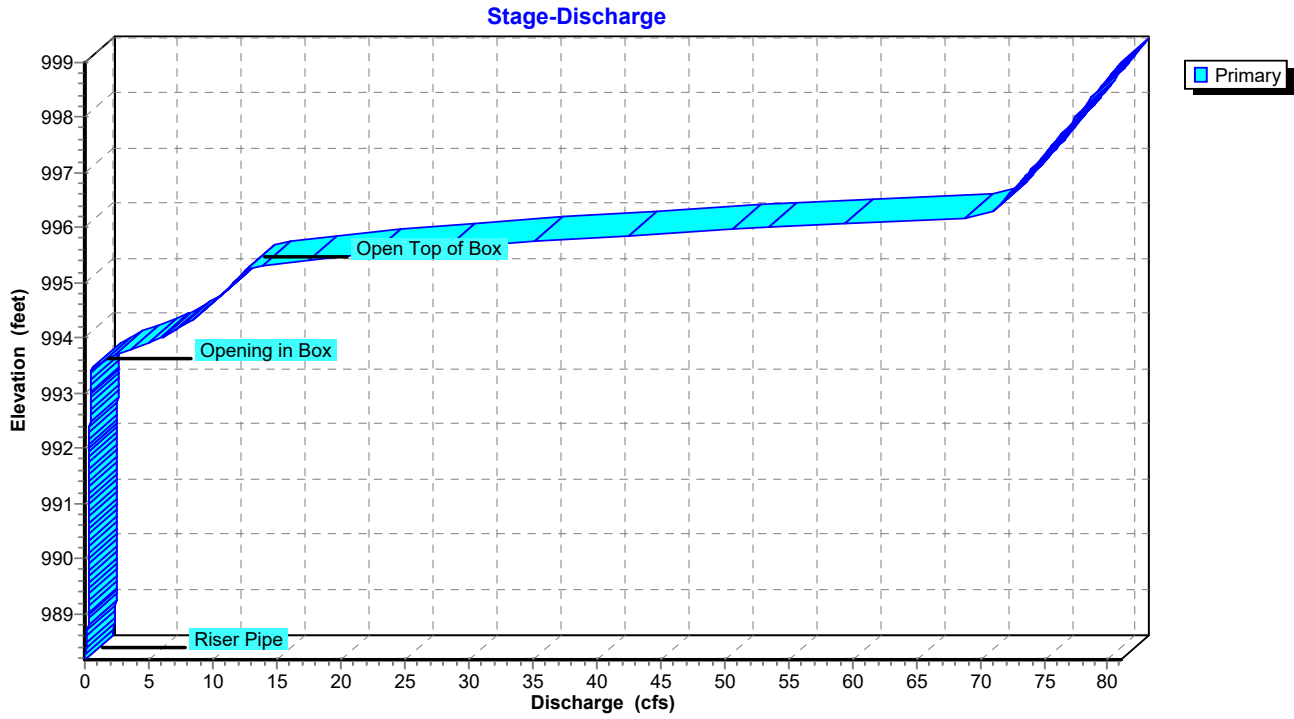
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## Pond 5P: EDDB #2 Manor



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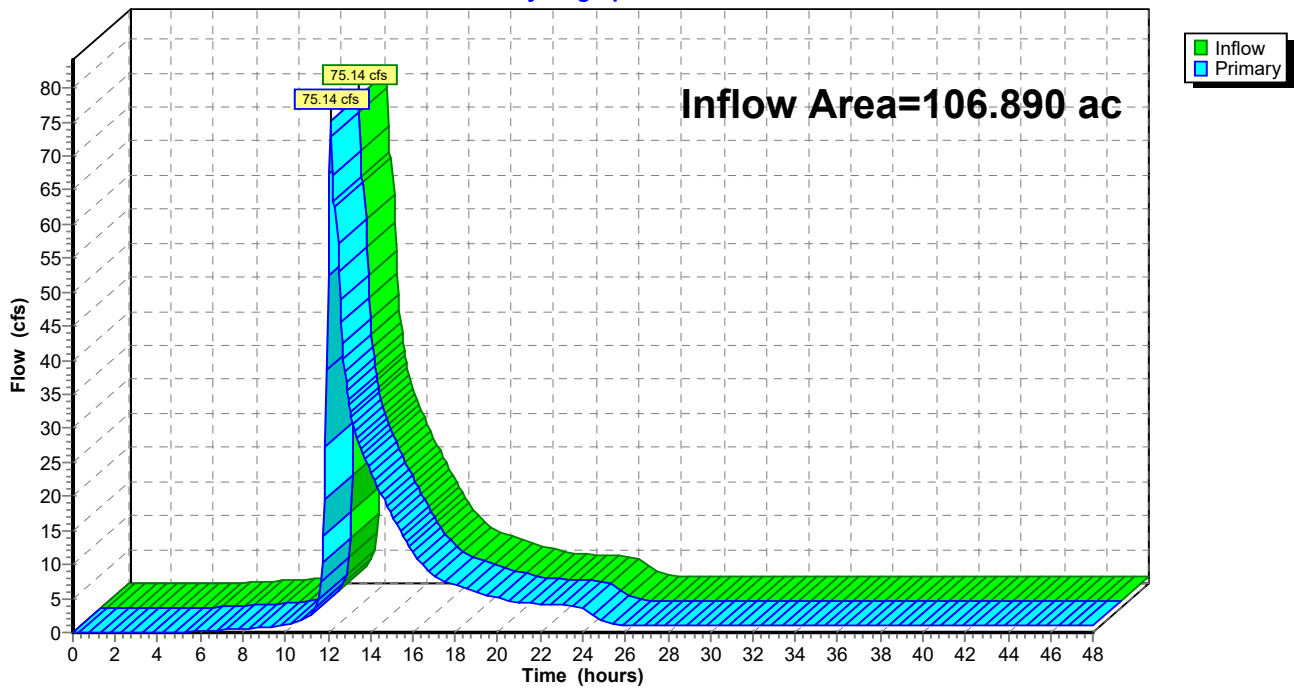
## Summary for Link 2L: RP-1

Inflow Area = 106.890 ac, 20.71% Impervious, Inflow Depth > 1.87" for 2-Year event  
Inflow = 75.14 cfs @ 12.12 hrs, Volume= 16.666 af  
Primary = 75.14 cfs @ 12.12 hrs, Volume= 16.666 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

Hydrograph



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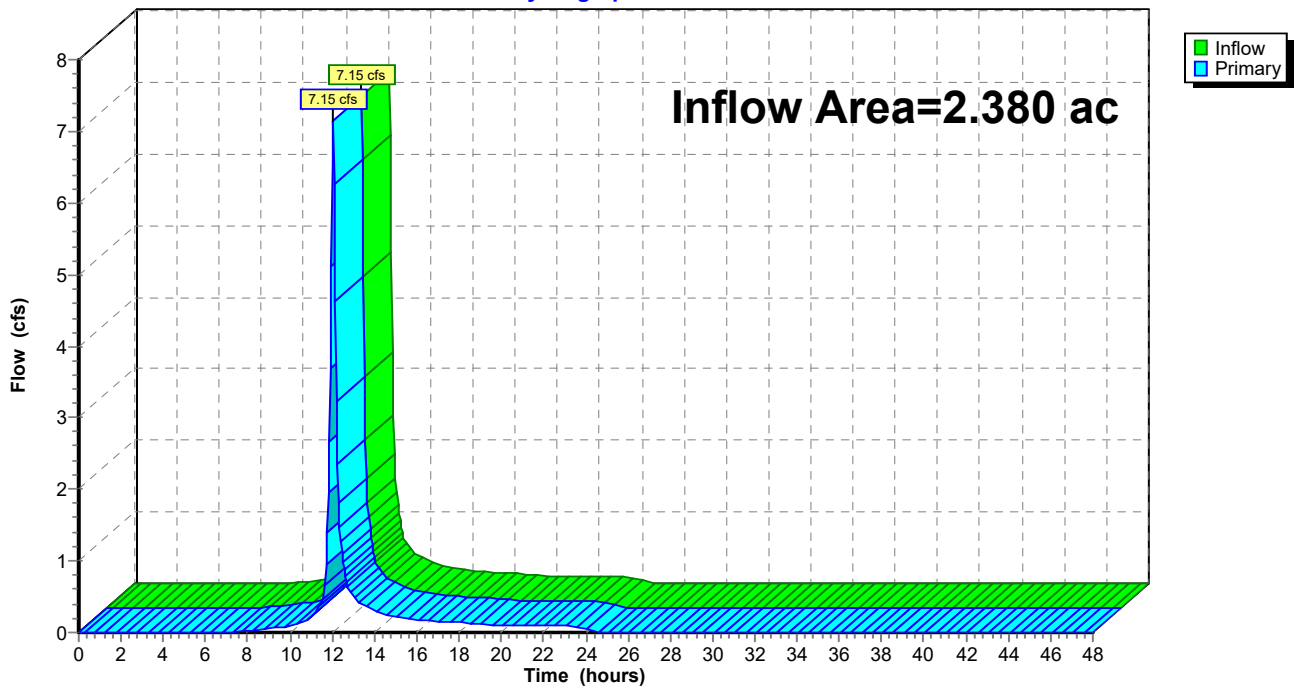
## Summary for Link 3L: RP-2

Inflow Area = 2.380 ac, 38.00% Impervious, Inflow Depth = 2.18" for 2-Year event  
Inflow = 7.15 cfs @ 12.04 hrs, Volume= 0.433 af  
Primary = 7.15 cfs @ 12.04 hrs, Volume= 0.433 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

Hydrograph



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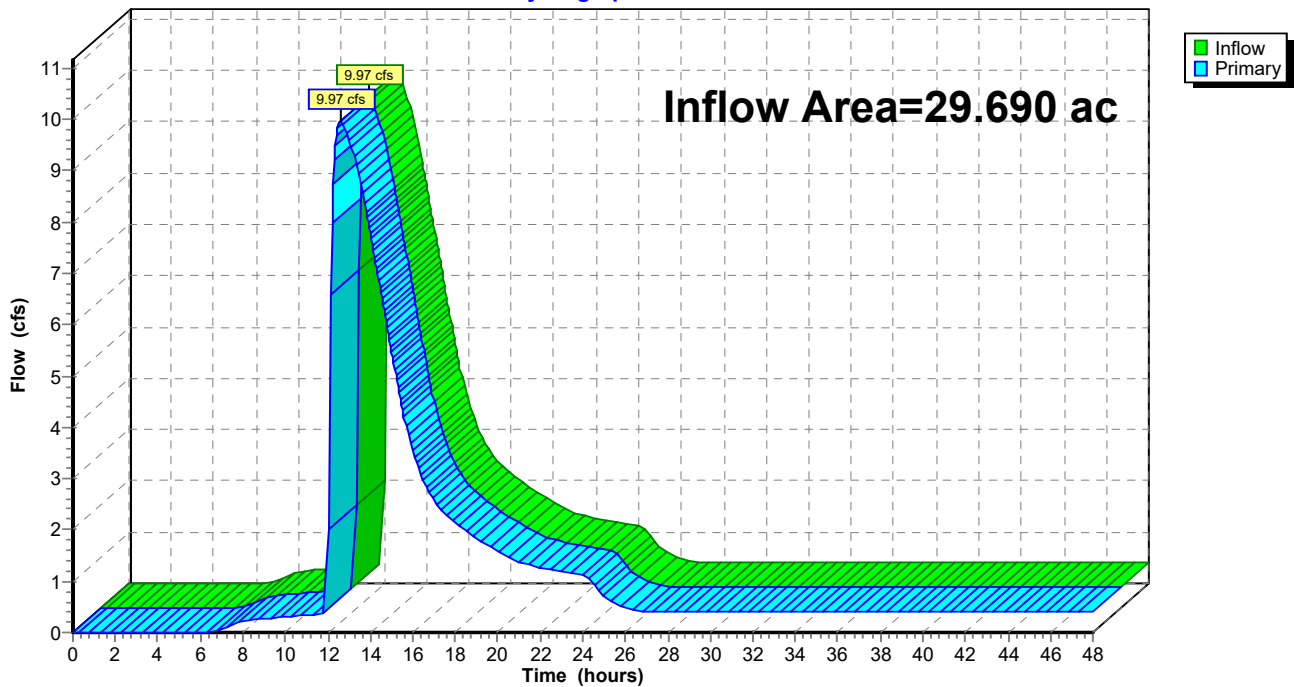
## Summary for Link 4L: RP-3

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth > 1.82" for 2-Year event  
Inflow = 9.97 cfs @ 12.62 hrs, Volume= 4.497 af  
Primary = 9.97 cfs @ 12.62 hrs, Volume= 4.497 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

Hydrograph



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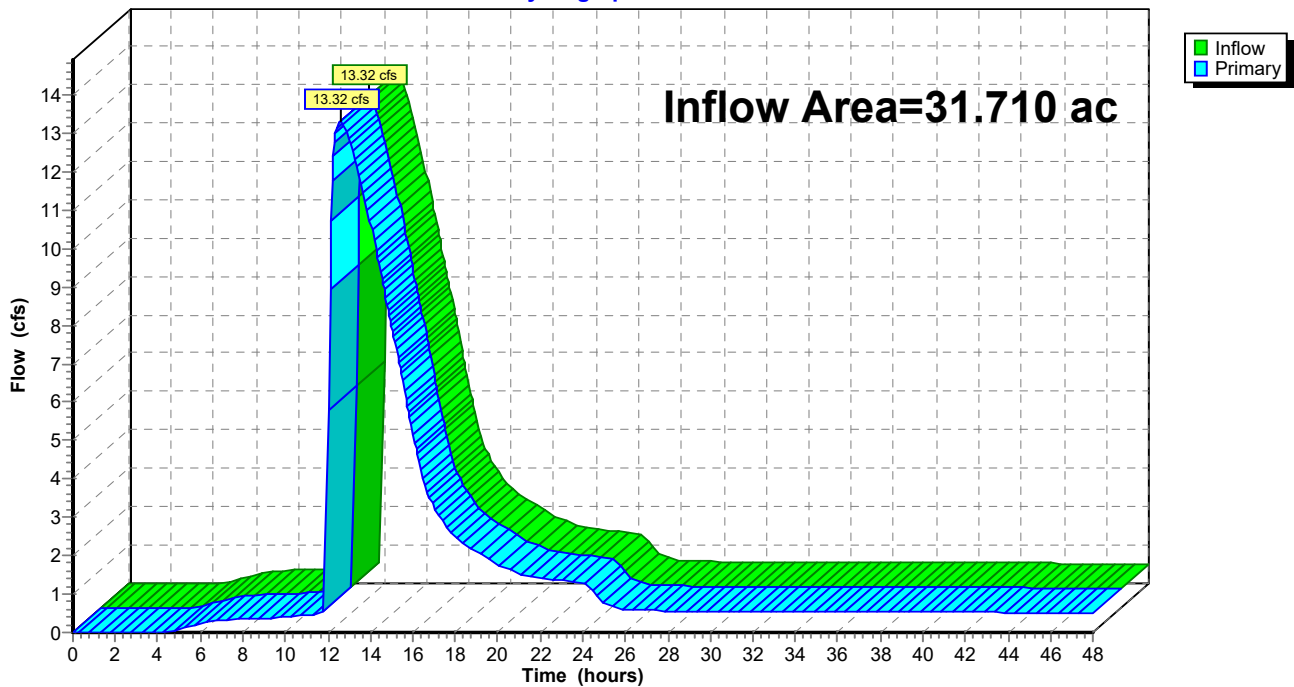
## Summary for Link 5L: RP-4

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth > 2.28" for 2-Year event  
Inflow = 13.32 cfs @ 12.57 hrs, Volume= 6.025 af  
Primary = 13.32 cfs @ 12.57 hrs, Volume= 6.025 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

Hydrograph



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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1S: ON-SITE #1** Runoff Area=31.710 ac 26.16% Impervious Runoff Depth=4.38"  
Flow Length=1,186' Slope=0.0250 '/' Tc=14.0 min CN=92 Runoff=173.27 cfs 11.581 af

**Subcatchment3S: ON-SITE #3 (Bypass)** Runoff Area=2.380 ac 38.00% Impervious Runoff Depth=3.85"  
Flow Length=1,110' Tc=12.7 min CN=87 Runoff=12.33 cfs 0.764 af

**Subcatchment5S: OFF-SITE #1** Runoff Area=18.430 ac 0.00% Impervious Runoff Depth=2.88"  
Flow Length=1,247' Tc=17.6 min CN=77 Runoff=62.92 cfs 4.417 af

**Subcatchment6S: ON-SITE #4 (Bypass)** Runoff Area=24.680 ac 6.72% Impervious Runoff Depth=3.25"  
Flow Length=1,186' Slope=0.0250 '/' Tc=15.5 min CN=81 Runoff=100.98 cfs 6.688 af

**Subcatchment7S: ON-SITE #2** Runoff Area=29.690 ac 38.00% Impervious Runoff Depth=3.85"  
Flow Length=1,769' Slope=0.0250 '/' Tc=13.8 min CN=87 Runoff=148.68 cfs 9.527 af

**Reach 6R: Reach 3** Avg. Flow Depth=1.35' Max Vel=4.35 fps Inflow=58.33 cfs 4.417 af  
n=0.030 L=1,041.0' S=0.0088 '/' Capacity=2,150.14 cfs Outflow=54.88 cfs 4.417 af

**Reach 7R: Reach 2** Avg. Flow Depth=0.87' Max Vel=4.26 fps Inflow=61.28 cfs 4.417 af  
n=0.030 L=853.0' S=0.0225 '/' Capacity=1,999.47 cfs Outflow=58.33 cfs 4.417 af

**Reach 8R: REACH 1 (through Pipe** Avg. Flow Depth=1.82' Max Vel=13.85 fps Inflow=62.92 cfs 4.417 af  
36.0" Round Pipe n=0.012 L=1,067.0' S=0.0159 '/' Capacity=91.10 cfs Outflow=61.28 cfs 4.417 af

**Pond 4P: EDDB #1 Cornerstone** Peak Elev=1,004.79' Storage=249,634 cf Inflow=173.27 cfs 11.581 af  
Outflow=60.26 cfs 10.616 af

**Pond 5P: EDDB #2 Manor** Peak Elev=996.06' Storage=189,935 cf Inflow=148.68 cfs 9.527 af  
Outflow=58.14 cfs 8.604 af

**Link 2L: RP-1** Inflow=214.00 cfs 31.088 af  
Primary=214.00 cfs 31.088 af

**Link 3L: RP-2** Inflow=12.33 cfs 0.764 af  
Primary=12.33 cfs 0.764 af

**Link 4L: RP-3** Inflow=58.14 cfs 8.604 af  
Primary=58.14 cfs 8.604 af

**Link 5L: RP-4** Inflow=60.26 cfs 10.616 af  
Primary=60.26 cfs 10.616 af



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

Runoff = 173.27 cfs @ 12.05 hrs, Volume= 11.581 af, Depth= 4.38"

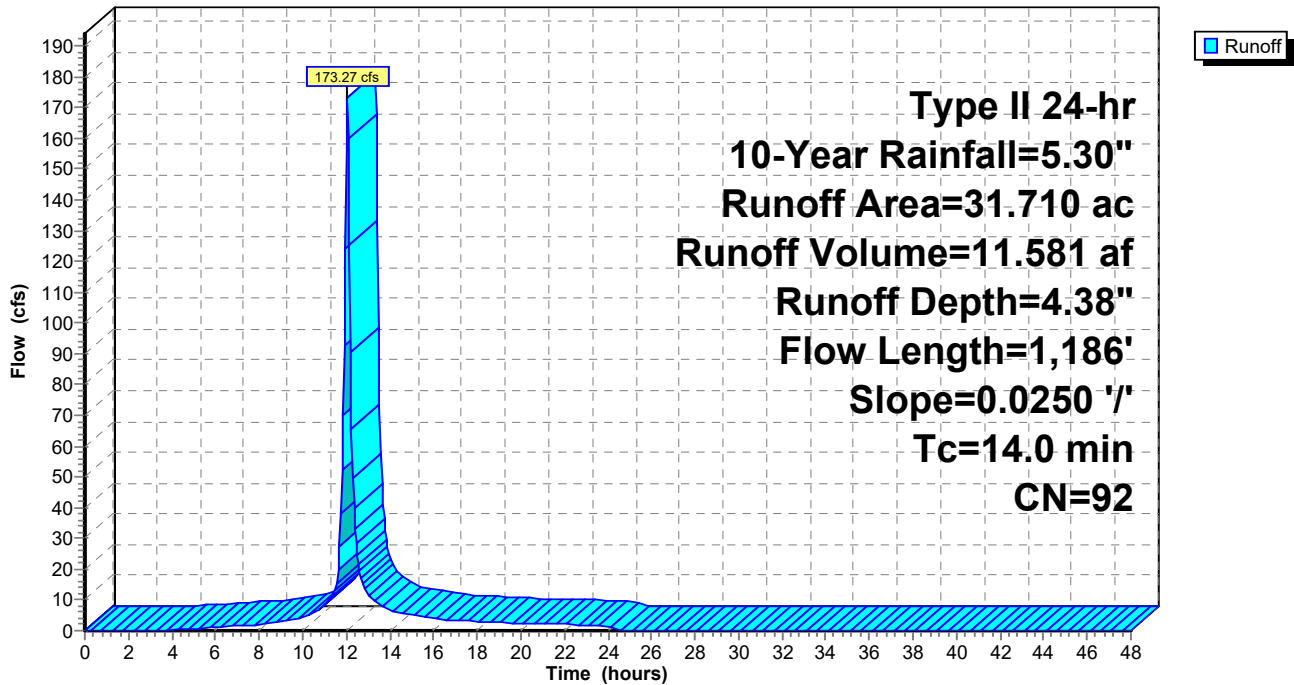
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
* 19.330	92	Duplex/Townhomes
11.140	92	1/8 acre lots, 65% imp, HSG D
1.240	95	Urban commercial, 85% imp, HSG D
31.710	92	Weighted Average
23.415		73.84% Pervious Area
8.295		26.16% Impervious Area

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

## Subcatchment 1S: ON-SITE #1

Hydrograph



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## Summary for Subcatchment 3S: ON-SITE #3 (Bypass)

Runoff = 12.33 cfs @ 12.04 hrs, Volume= 0.764 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"

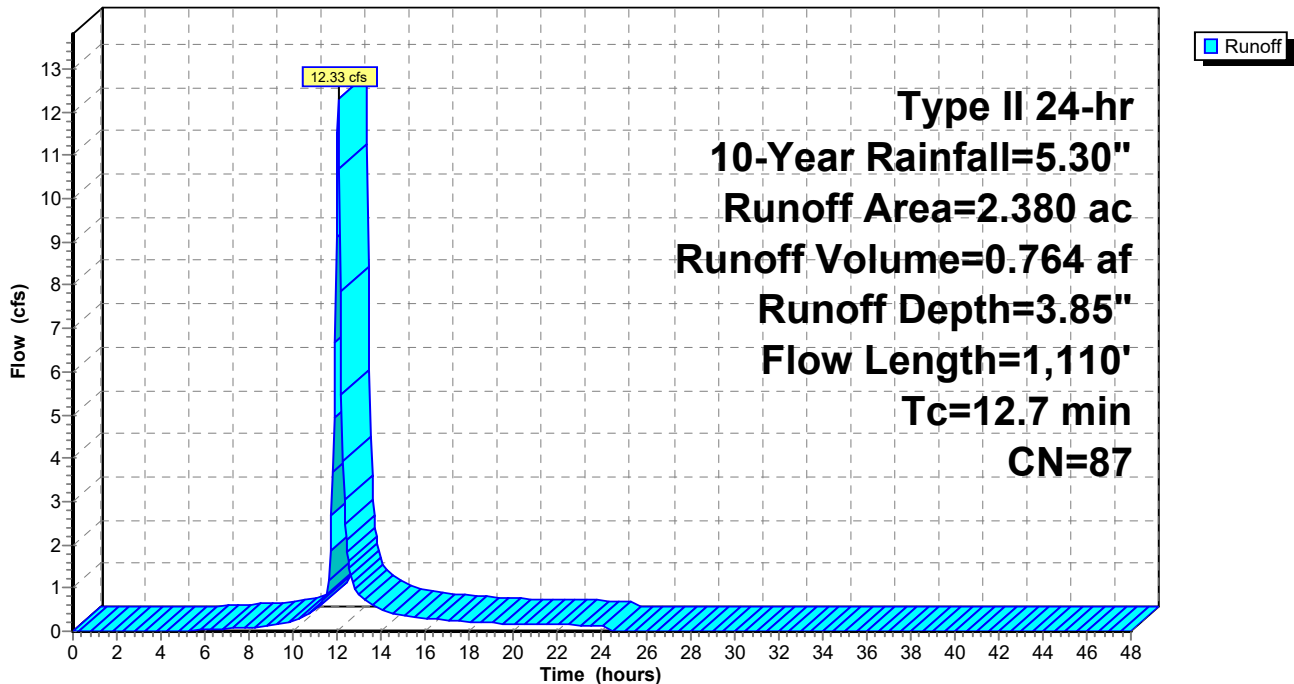
Area (ac)	CN	Description
2.380	87	1/4 acre lots, 38% imp, HSG D
1.476		62.00% Pervious Area
0.904		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		Sheet Flow, 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 (Bypass)

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## Summary for Subcatchment 5S: OFF-SITE #1

Runoff = 62.92 cfs @ 12.10 hrs, Volume= 4.417 af, Depth= 2.88"

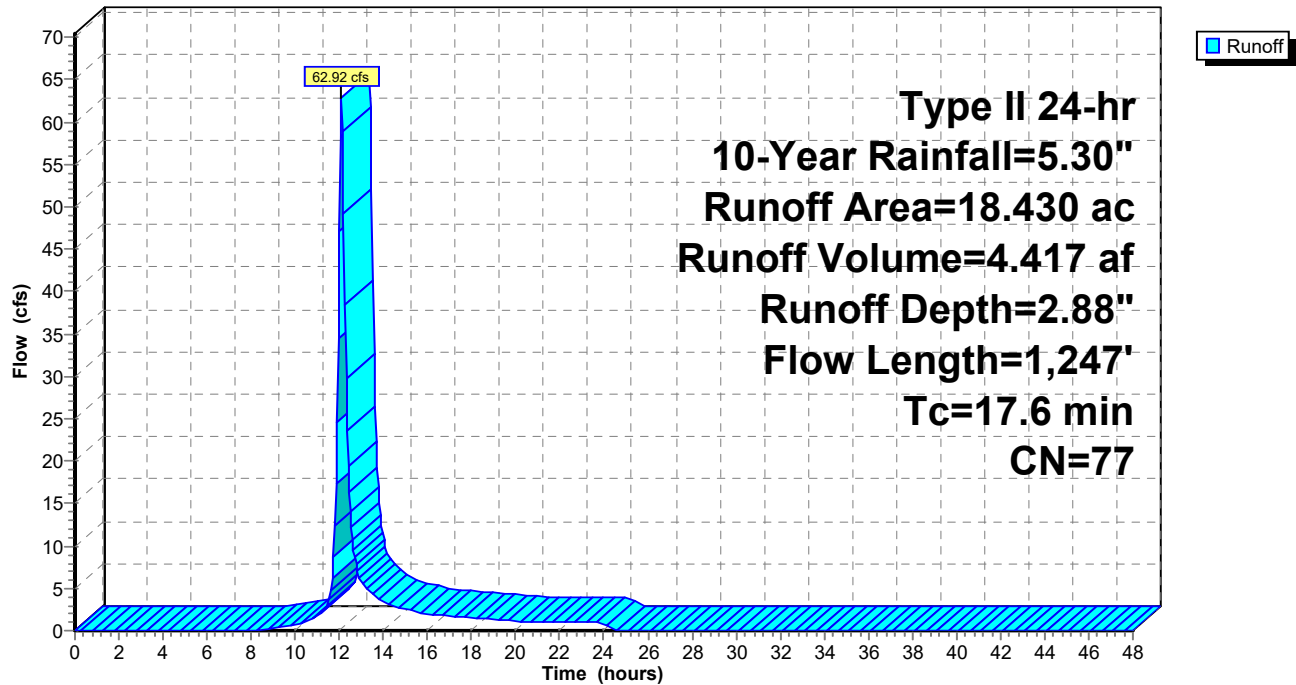
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

## Subcatchment 5S: OFF-SITE #1

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### Summary for Subcatchment 6S: ON-SITE #4 (Bypass)

Runoff = 100.98 cfs @ 12.07 hrs, Volume= 6.688 af, Depth= 3.25"

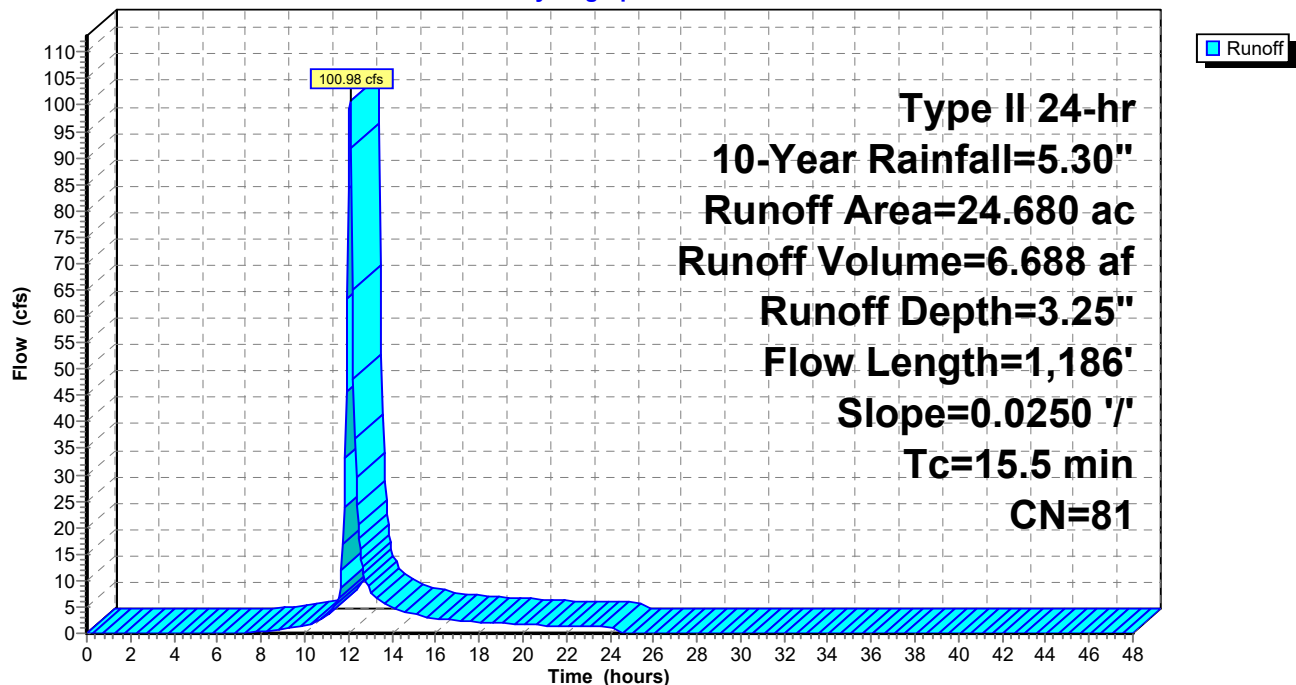
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-Year Rainfall=5.30"

Area (ac)	CN	Description
22.730	80	>75% Grass cover, Good, HSG D
1.950	95	Urban commercial, 85% imp, HSG D
24.680	81	Weighted Average
23.023		93.28% Pervious Area
1.657		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
7.1	1,086	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.5	1,186	Total			

### Subcatchment 6S: ON-SITE #4 (Bypass)

Hydrograph



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## Summary for Subcatchment 7S: ON-SITE #2

Runoff = 148.68 cfs @ 12.05 hrs, Volume= 9.527 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"

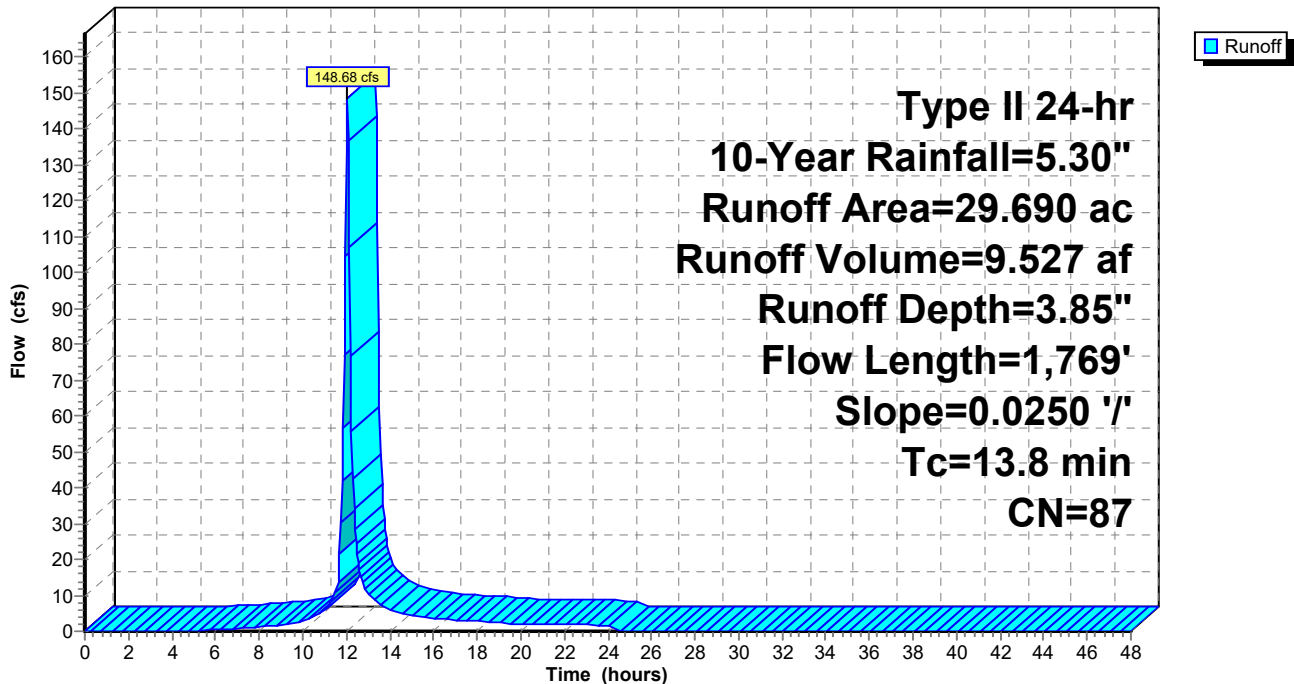
Area (ac)	CN	Description
29.690	87	1/4 acre lots, 38% imp, HSG D
18.408		62.00% Pervious Area
11.282		38.00% Impervious Area

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

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## Summary for Reach 6R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 58.33 cfs @ 12.24 hrs, Volume= 4.417 af  
Outflow = 54.88 cfs @ 12.36 hrs, Volume= 4.417 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 = 1.06 fps, Avg. Travel Time= 16.3 min

Peak Storage= 13,270 cf @ 12.29 hrs

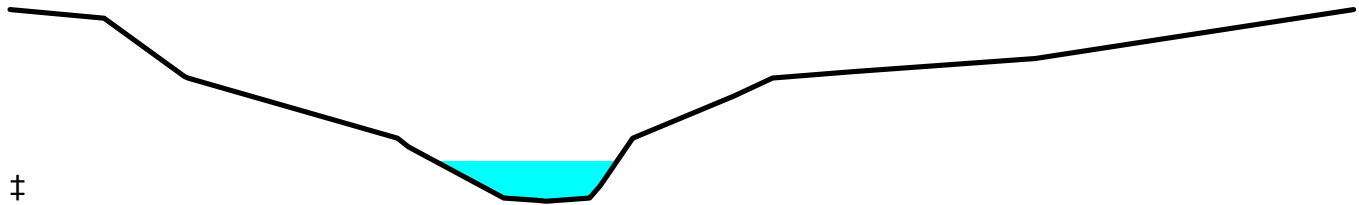
Average Depth at Peak Storage= 1.35'

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

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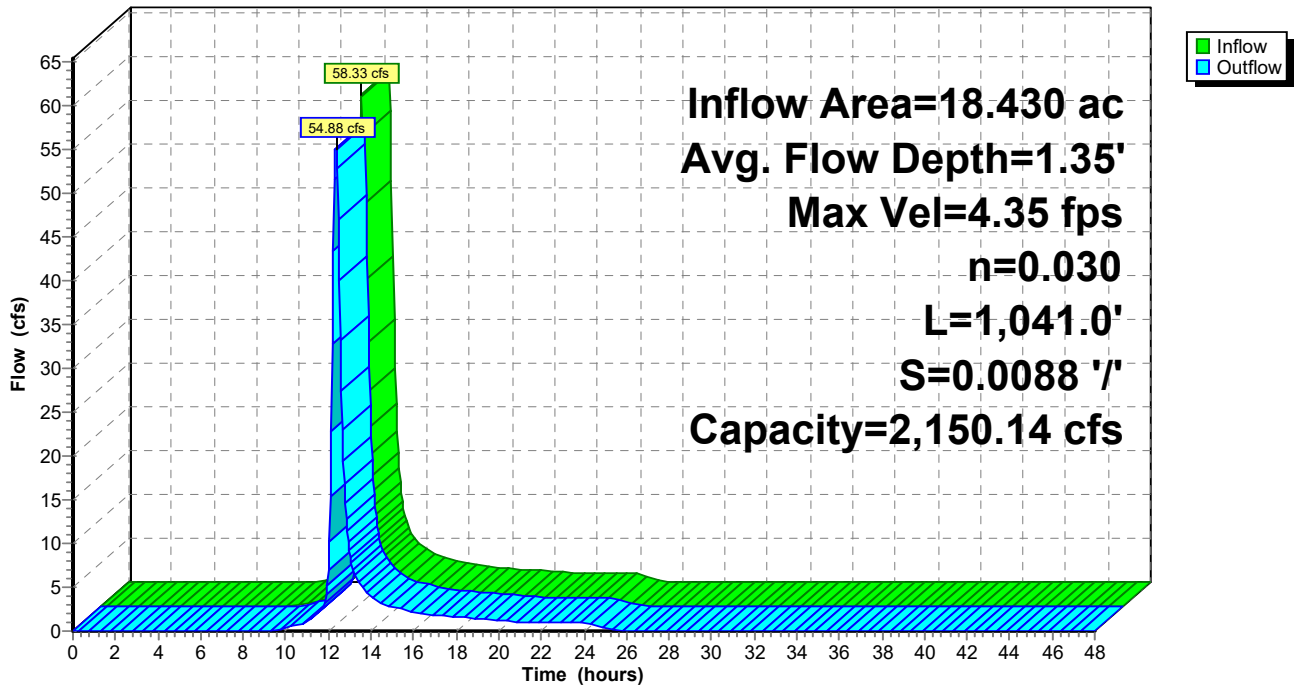
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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

### Hydrograph



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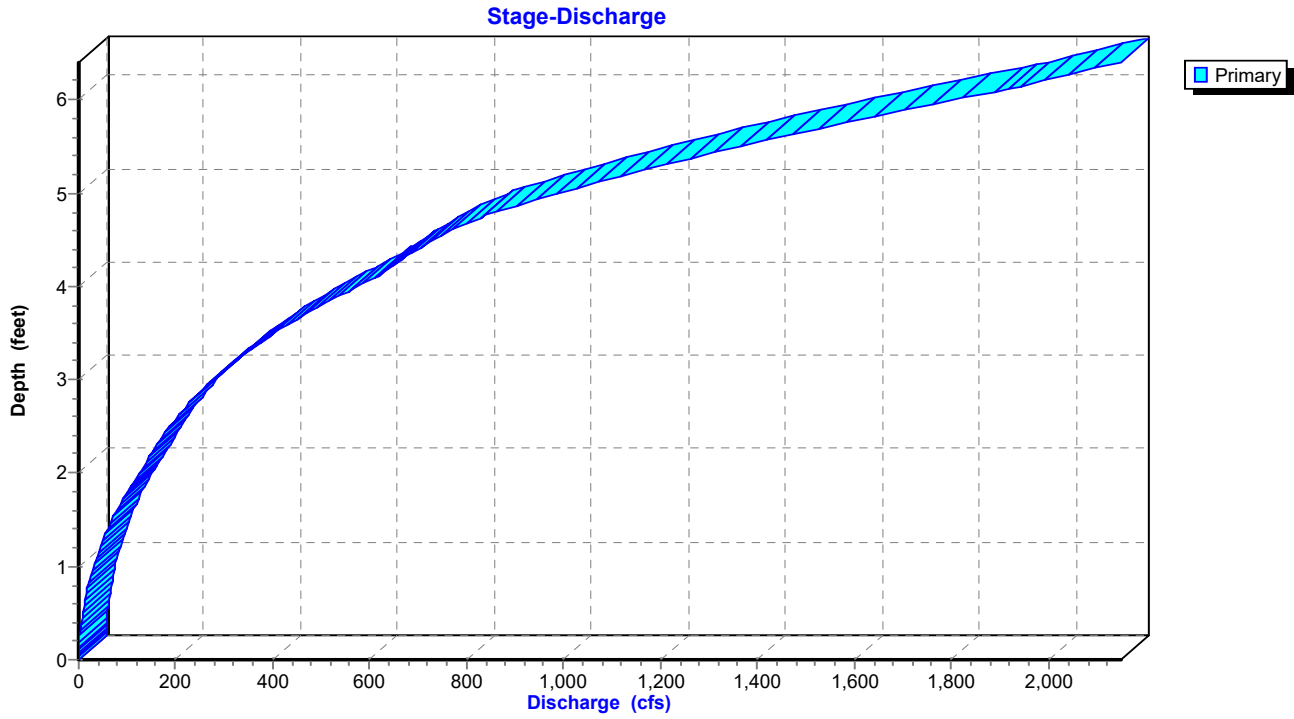
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**Reach 6R: Reach 3**





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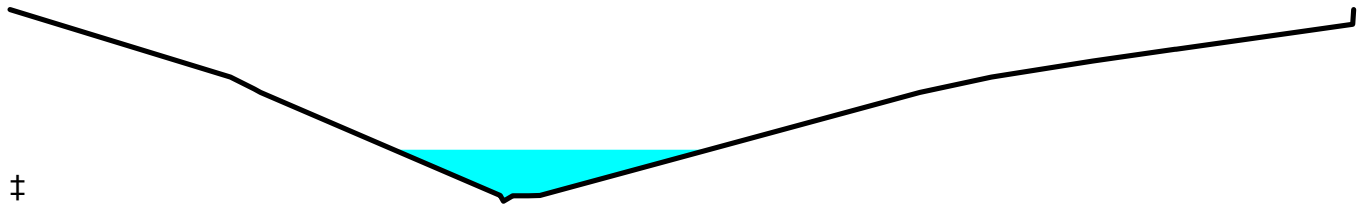
## Summary for Reach 7R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 61.28 cfs @ 12.14 hrs, Volume= 4.417 af  
Outflow = 58.33 cfs @ 12.24 hrs, Volume= 4.417 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 = 1.48 fps, Avg. Travel Time= 9.6 min

Peak Storage= 11,715 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'



z

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

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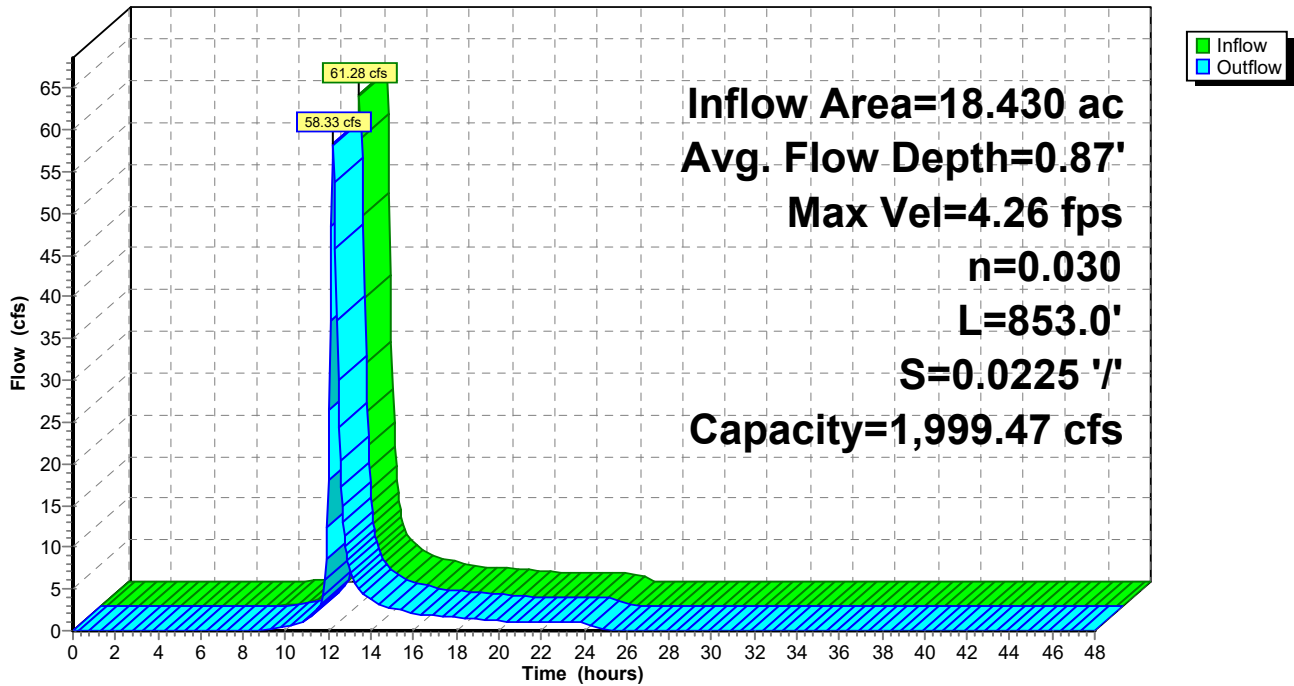
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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

### Hydrograph



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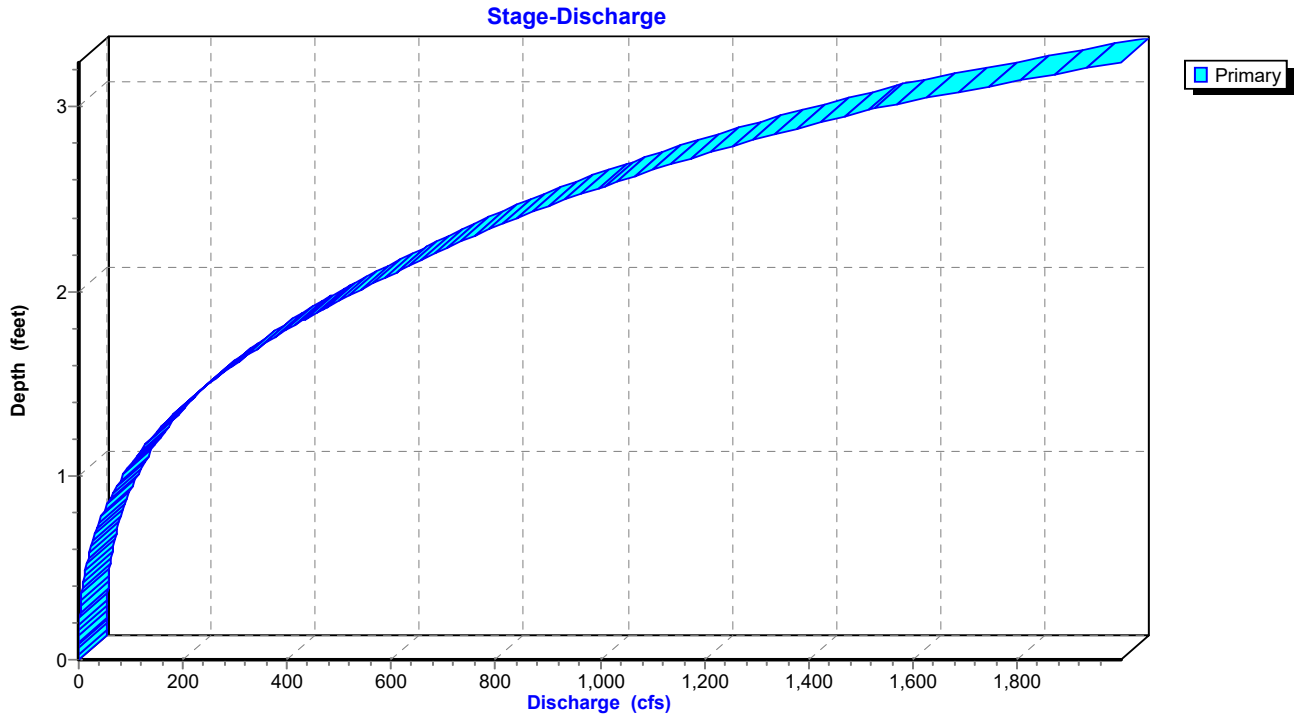
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## Reach 7R: Reach 2



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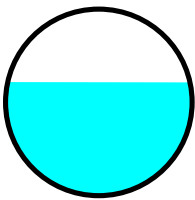
## Summary for Reach 8R: REACH 1 (through Pipe System)

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 2.88" for 10-Year event  
Inflow = 62.92 cfs @ 12.10 hrs, Volume= 4.417 af  
Outflow = 61.28 cfs @ 12.14 hrs, Volume= 4.417 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= 13.85 fps, Min. Travel Time= 1.3 min  
Avg. Velocity = 4.64 fps, Avg. Travel Time= 3.8 min

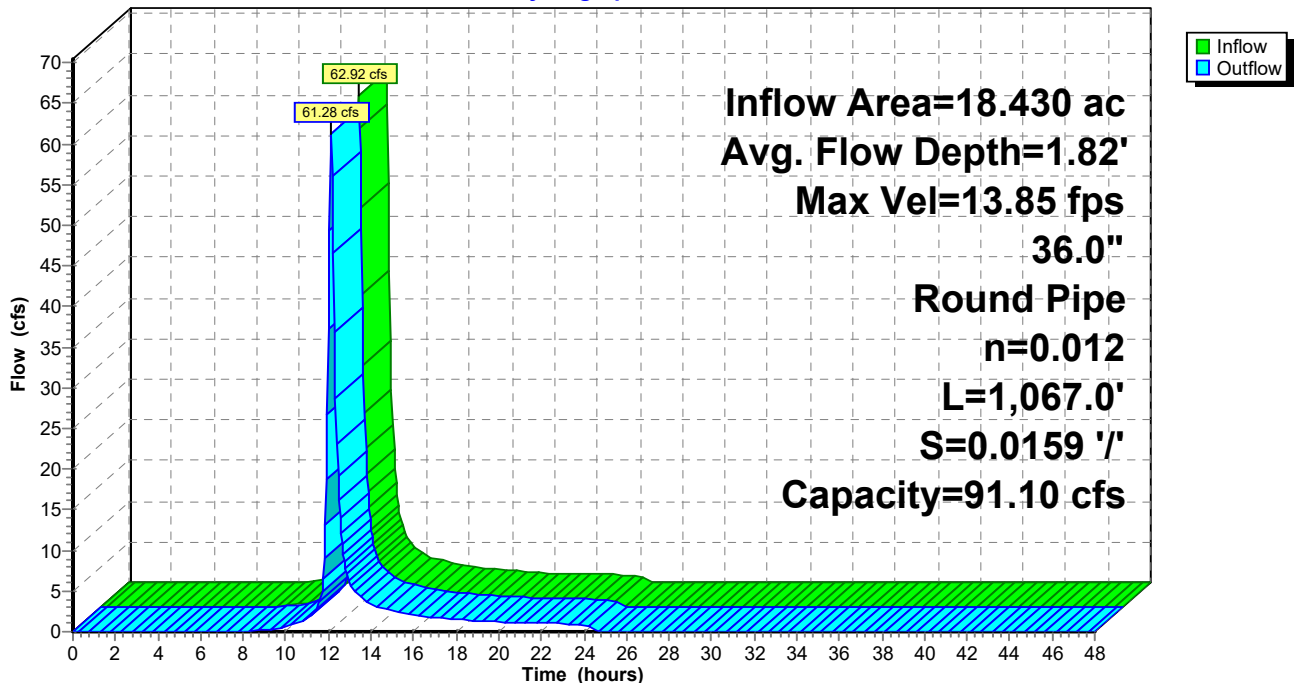
Peak Storage= 4,795 cf @ 12.12 hrs  
Average Depth at Peak Storage= 1.82'  
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 91.10 cfs

36.0" Round Pipe  
n= 0.012 Concrete pipe, finished  
Length= 1,067.0' Slope= 0.0159 '/'  
Inlet Invert= 1,021.96', Outlet Invert= 1,005.00'



## Reach 8R: REACH 1 (through Pipe System)

Hydrograph



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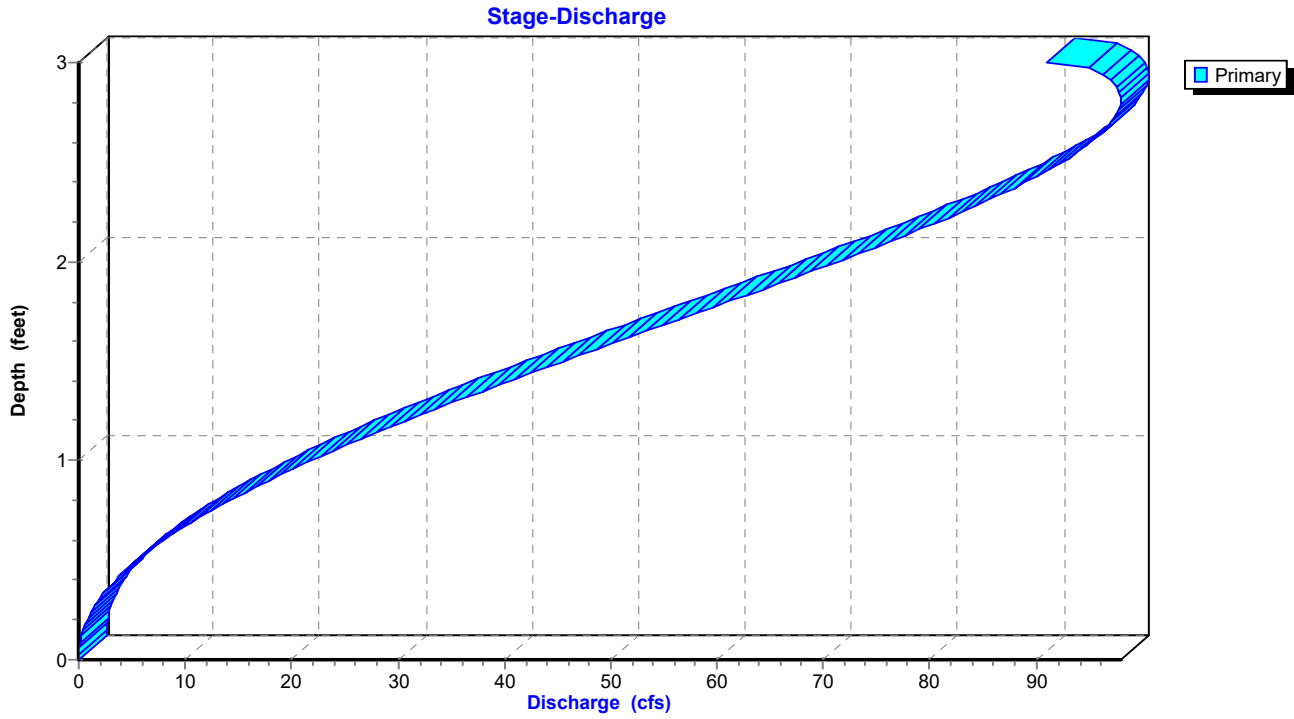
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## Reach 8R: REACH 1 (through Pipe System)



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### Summary for Pond 4P: Eddb #1 Cornerstone

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth = 4.38" for 10-Year event  
 Inflow = 173.27 cfs @ 12.05 hrs, Volume= 11.581 af  
 Outflow = 60.26 cfs @ 12.27 hrs, Volume= 10.616 af, Atten= 65%, Lag= 13.1 min  
 Primary = 60.26 cfs @ 12.27 hrs, Volume= 10.616 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,004.79' @ 12.27 hrs Surf.Area= 52,106 sf Storage= 249,634 cf

Plug-Flow detention time= 282.2 min calculated for 10.616 af (92% of inflow)  
 Center-of-Mass det. time= 237.4 min ( 1,022.3 - 784.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	995.67'	374,566 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.67	0	0	0
996.00	700	116	116
997.00	7,200	3,950	4,066
998.00	12,000	9,600	13,666
999.00	17,900	14,950	28,616
1,000.00	27,000	22,450	51,066
1,001.00	36,000	31,500	82,566
1,002.00	40,000	38,000	120,566
1,003.00	44,800	42,400	162,966
1,004.00	48,700	46,750	209,716
1,005.00	53,000	50,850	260,566
1,006.00	57,000	55,000	315,566
1,007.00	61,000	59,000	374,566

Device	Routing	Invert	Outlet Devices
#1	Primary	993.54'	<b>30.0" Round 30" Culvert</b> L= 87.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.54' / 993.11' S= 0.0049 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	994.16'	<b>2.9" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	994.36'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 994.36' / 994.16' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#4	Device 3	995.67'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 9 rows with 4.0" cc spacing C= 0.600
#5	Device 1	1,001.05'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	1,004.00'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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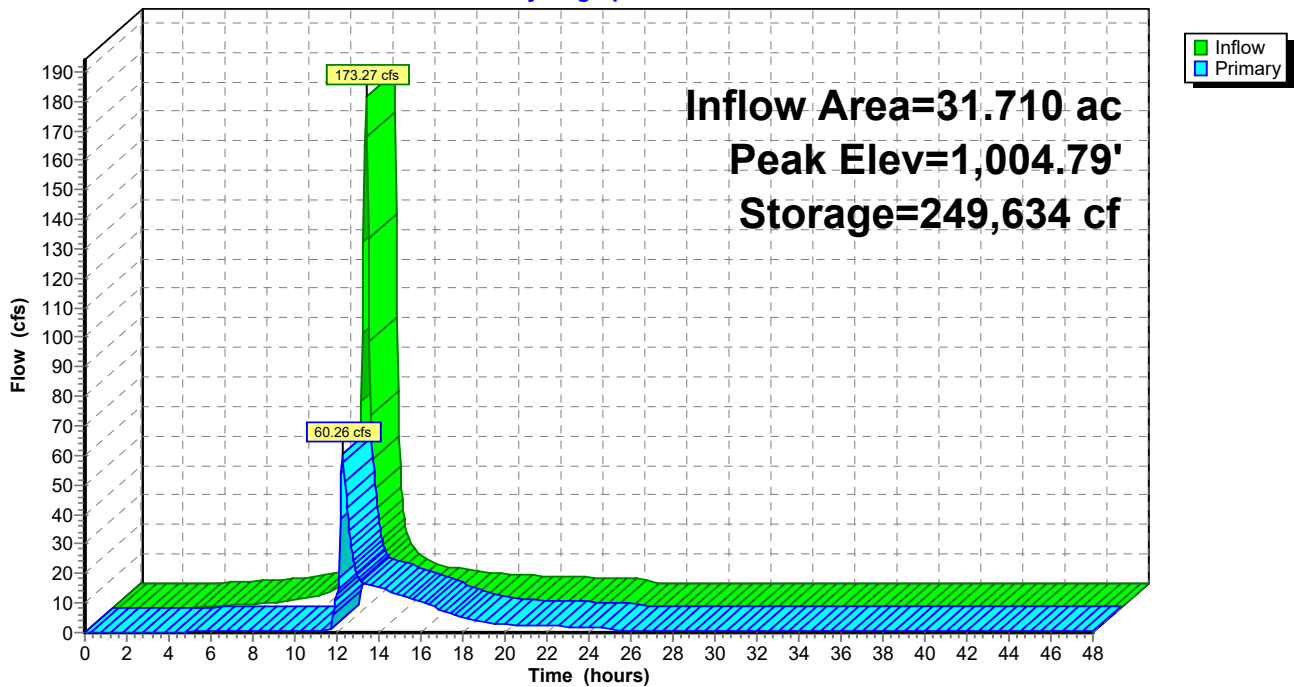
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**Primary OutFlow** Max=59.41 cfs @ 12.27 hrs HW=1,004.78' (Free Discharge)

- 1=30" Culvert (Passes 59.41 cfs of 74.71 cfs potential flow)
- 2=WQ Orifice (Orifice Controls 0.72 cfs @ 15.60 fps)
- 3=8" PVC Pipe (Passes 0.72 cfs of 6.07 cfs potential flow)
- 4=Riser Pipe (Passes 0.72 cfs of 5.25 cfs potential flow)
- 5=Opening in Box (Orifice Controls 17.97 cfs @ 8.98 fps)
- 6=Open Top of Box (Weir Controls 40.73 cfs @ 2.89 fps)

## Pond 4P: EDDB #1 Cornerstone

Hydrograph



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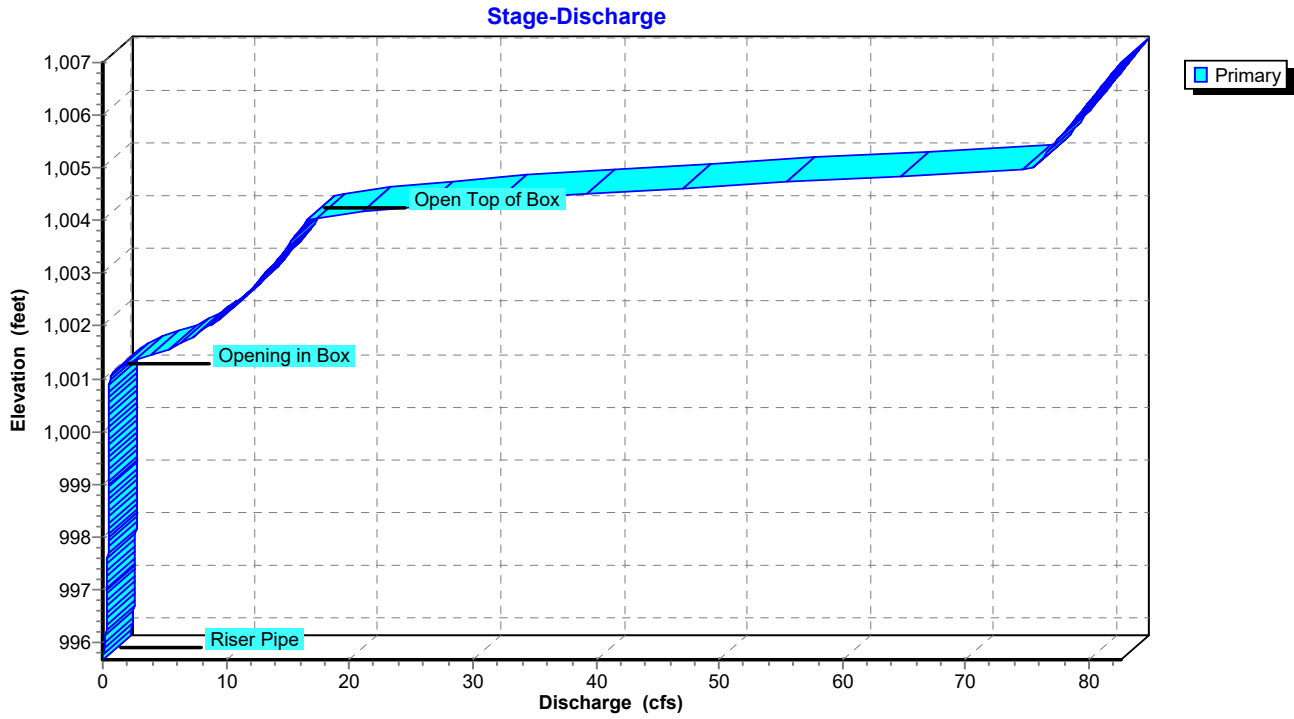
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## Pond 4P: Eddb #1 Cornerstone





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### Summary for Pond 5P: Eddb #2 Manor

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth = 3.85" for 10-Year event  
 Inflow = 148.68 cfs @ 12.05 hrs, Volume= 9.527 af  
 Outflow = 58.14 cfs @ 12.25 hrs, Volume= 8.604 af, Atten= 61%, Lag= 12.0 min  
 Primary = 58.14 cfs @ 12.25 hrs, Volume= 8.604 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 996.06' @ 12.25 hrs Surf.Area= 49,900 sf Storage= 189,935 cf

Plug-Flow detention time= 261.1 min calculated for 8.595 af (90% of inflow)  
 Center-of-Mass det. time= 212.7 min ( 1,015.9 - 803.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	988.16'	352,236 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
988.16	0	0	0
989.00	800	336	336
990.00	4,200	2,500	2,836
991.00	10,400	7,300	10,136
992.00	21,600	16,000	26,136
993.00	37,600	29,600	55,736
994.00	41,700	39,650	95,386
995.00	46,000	43,850	139,236
996.00	49,700	47,850	187,086
997.00	53,200	51,450	238,536
998.00	56,900	55,050	293,586
999.00	60,400	58,650	352,236

Device	Routing	Invert	Outlet Devices
#1	Primary	986.00'	<b>30.0" Round 30" Culvert</b> L= 77.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.00' / 985.62' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	986.62'	<b>2.5" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	986.86'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.86' / 986.62' S= 0.0120 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#4	Device 3	988.16'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 8 rows with 4.0" cc spacing C= 0.600
#5	Device 1	993.40'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	995.25'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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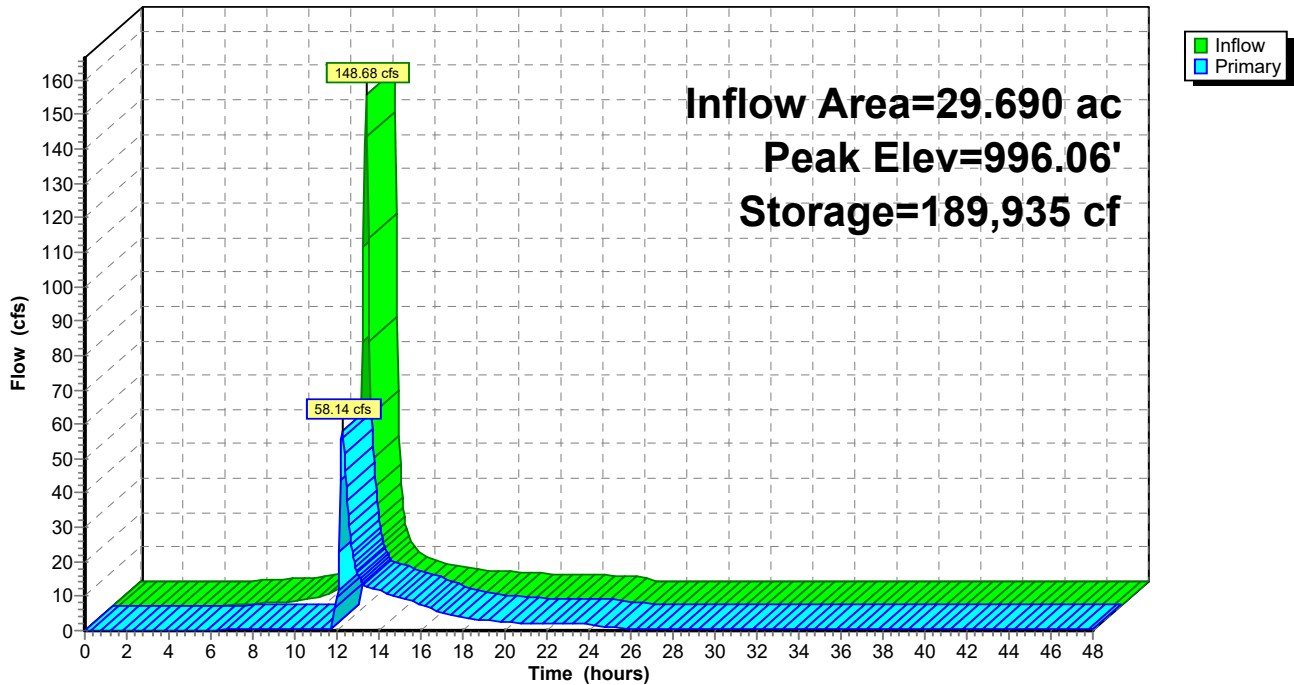
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**Primary OutFlow** Max=58.03 cfs @ 12.25 hrs HW=996.06' (Free Discharge)

- 1=30" Culvert (Passes 58.03 cfs of 70.14 cfs potential flow)
- 2=WQ Orifice (Orifice Controls 0.50 cfs @ 14.71 fps)
- 3=8" PVC Pipe (Passes 0.50 cfs of 5.00 cfs potential flow)
- 4=Riser Pipe (Passes 0.50 cfs of 4.34 cfs potential flow)
- 5=Opening in Box (Orifice Controls 14.93 cfs @ 7.47 fps)
- 6=Open Top of Box (Weir Controls 42.60 cfs @ 2.94 fps)

## Pond 5P: EDDB #2 Manor

Hydrograph



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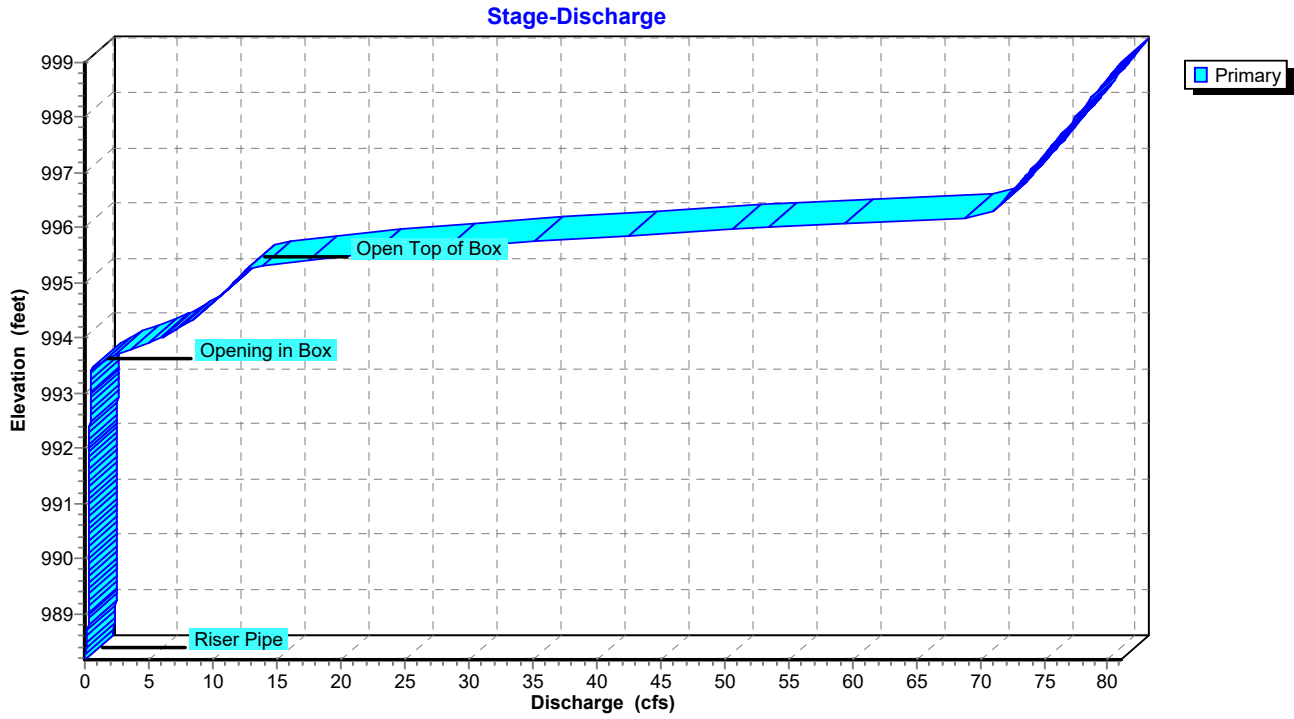
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## Pond 5P: EDDB #2 Manor



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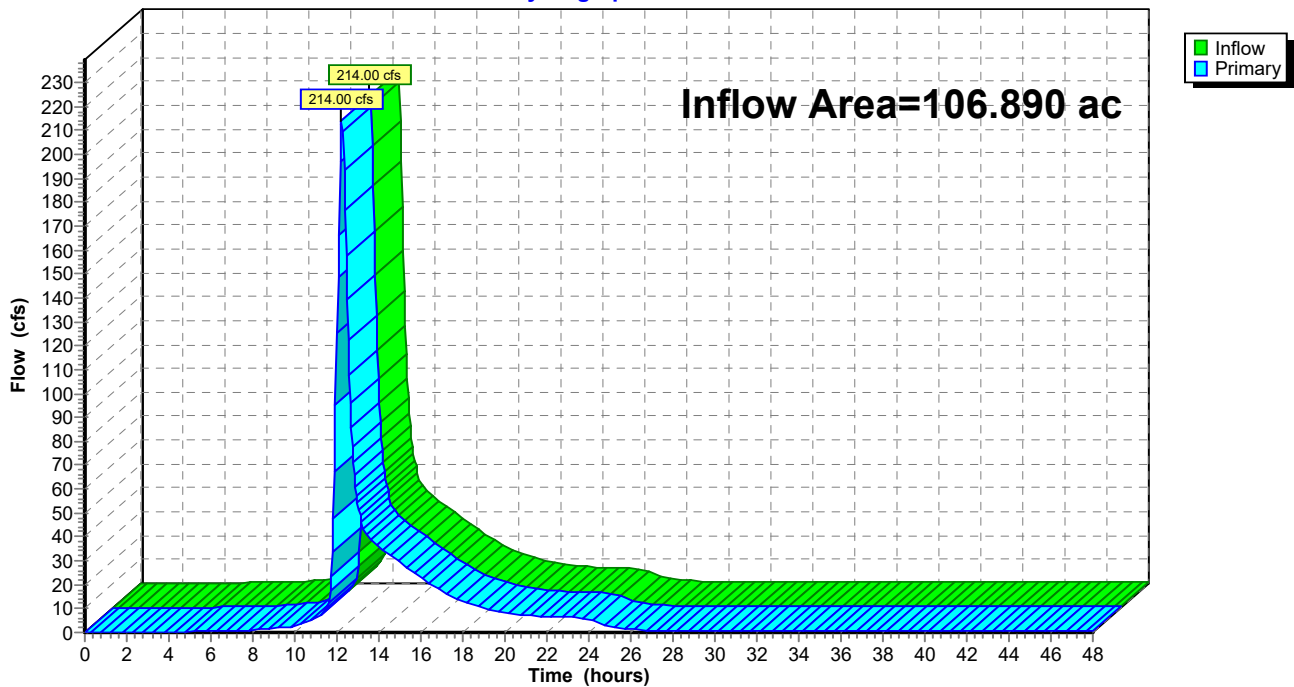
## Summary for Link 2L: RP-1

Inflow Area = 106.890 ac, 20.71% Impervious, Inflow Depth > 3.49" for 10-Year event  
Inflow = 214.00 cfs @ 12.23 hrs, Volume= 31.088 af  
Primary = 214.00 cfs @ 12.23 hrs, Volume= 31.088 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

Hydrograph



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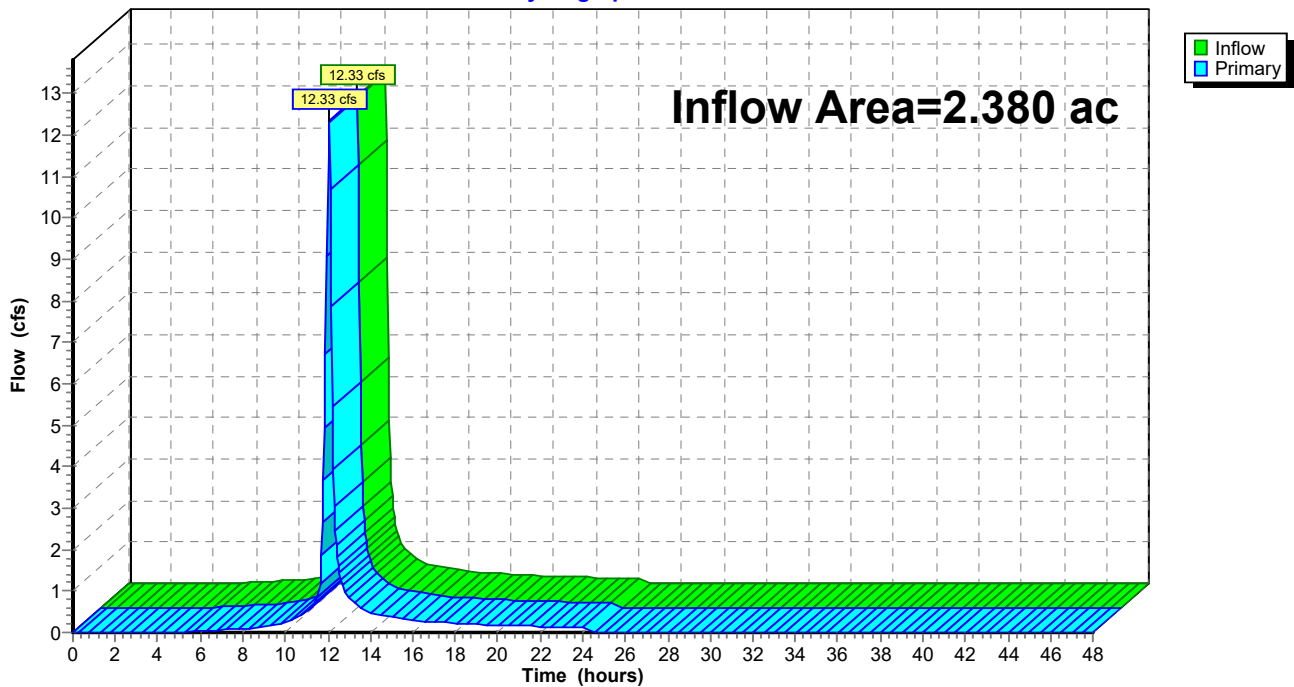
## Summary for Link 3L: RP-2

Inflow Area = 2.380 ac, 38.00% Impervious, Inflow Depth = 3.85" for 10-Year event  
Inflow = 12.33 cfs @ 12.04 hrs, Volume= 0.764 af  
Primary = 12.33 cfs @ 12.04 hrs, Volume= 0.764 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

Hydrograph



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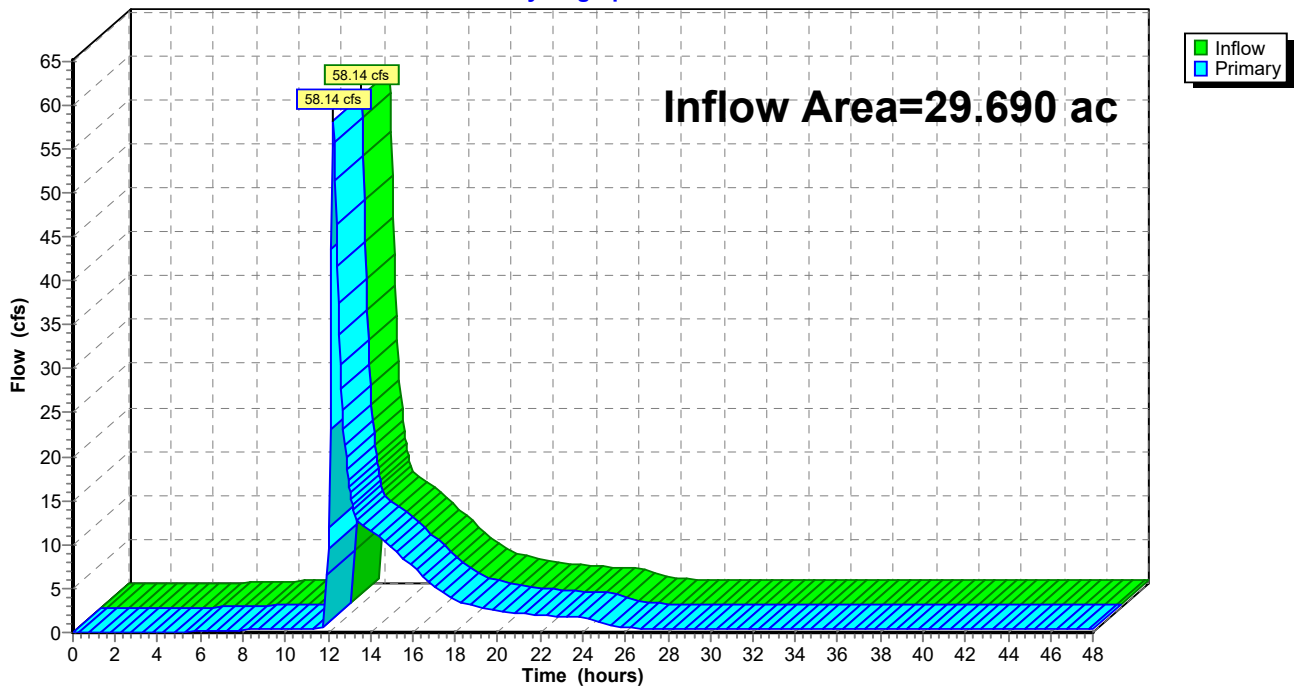
## Summary for Link 4L: RP-3

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth > 3.48" for 10-Year event  
Inflow = 58.14 cfs @ 12.25 hrs, Volume= 8.604 af  
Primary = 58.14 cfs @ 12.25 hrs, Volume= 8.604 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

Hydrograph



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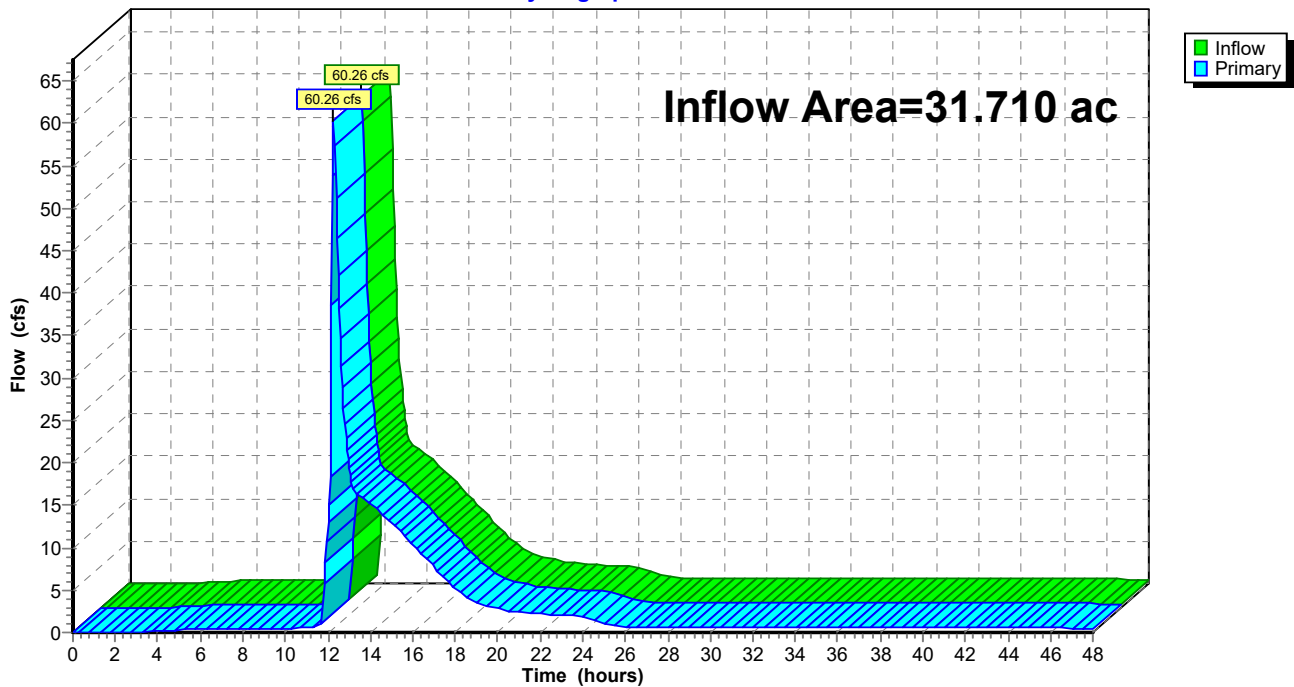
## Summary for Link 5L: RP-4

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth > 4.02" for 10-Year event  
Inflow = 60.26 cfs @ 12.27 hrs, Volume= 10.616 af  
Primary = 60.26 cfs @ 12.27 hrs, Volume= 10.616 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

Hydrograph



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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1S: ON-SITE #1** Runoff Area=31.710 ac 26.16% Impervious Runoff Depth=6.75"  
Flow Length=1,186' Slope=0.0250 '/' Tc=14.0 min CN=92 Runoff=260.19 cfs 17.828 af

**Subcatchment3S: ON-SITE #3 (Bypass)** Runoff Area=2.380 ac 38.00% Impervious Runoff Depth=6.16"  
Flow Length=1,110' Tc=12.7 min CN=87 Runoff=19.23 cfs 1.221 af

**Subcatchment5S: OFF-SITE #1** Runoff Area=18.430 ac 0.00% Impervious Runoff Depth=5.00"  
Flow Length=1,247' Tc=17.6 min CN=77 Runoff=108.57 cfs 7.679 af

**Subcatchment6S: ON-SITE #4 (Bypass)** Runoff Area=24.680 ac 6.72% Impervious Runoff Depth=5.46"  
Flow Length=1,186' Slope=0.0250 '/' Tc=15.5 min CN=81 Runoff=166.84 cfs 11.229 af

**Subcatchment7S: ON-SITE #2** Runoff Area=29.690 ac 38.00% Impervious Runoff Depth=6.16"  
Flow Length=1,769' Slope=0.0250 '/' Tc=13.8 min CN=87 Runoff=232.03 cfs 15.236 af

**Reach 6R: Reach 3** Avg. Flow Depth=1.72' Max Vel=4.99 fps Inflow=91.47 cfs 7.679 af  
n=0.030 L=1,041.0' S=0.0088 '/' Capacity=2,150.14 cfs Outflow=90.50 cfs 7.679 af

**Reach 7R: Reach 2** Avg. Flow Depth=1.03' Max Vel=4.78 fps Inflow=92.93 cfs 7.679 af  
n=0.030 L=853.0' S=0.0225 '/' Capacity=1,999.47 cfs Outflow=91.47 cfs 7.679 af

**Reach 8R: REACH 1 (through Pipe 36.0" Round Pipe** Avg. Flow Depth=3.00' Max Vel=14.68 fps Inflow=108.57 cfs 7.679 af  
n=0.012 L=1,067.0' S=0.0159 '/' Capacity=91.10 cfs Outflow=92.93 cfs 7.679 af

**Pond 4P: EDDB #1 Cornerstone** Peak Elev=1,006.64' Storage=352,702 cf Inflow=260.19 cfs 17.828 af  
Outflow=81.35 cfs 16.846 af

**Pond 5P: EDDB #2 Manor** Peak Elev=997.86' Storage=285,540 cf Inflow=232.03 cfs 15.236 af  
Outflow=76.98 cfs 14.297 af

**Link 2L: RP-1** Inflow=369.46 cfs 51.273 af  
Primary=369.46 cfs 51.273 af

**Link 3L: RP-2** Inflow=19.23 cfs 1.221 af  
Primary=19.23 cfs 1.221 af

**Link 4L: RP-3** Inflow=76.98 cfs 14.297 af  
Primary=76.98 cfs 14.297 af

**Link 5L: RP-4** Inflow=81.35 cfs 16.846 af  
Primary=81.35 cfs 16.846 af



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

Runoff = 260.19 cfs @ 12.05 hrs, Volume= 17.828 af, Depth= 6.75"

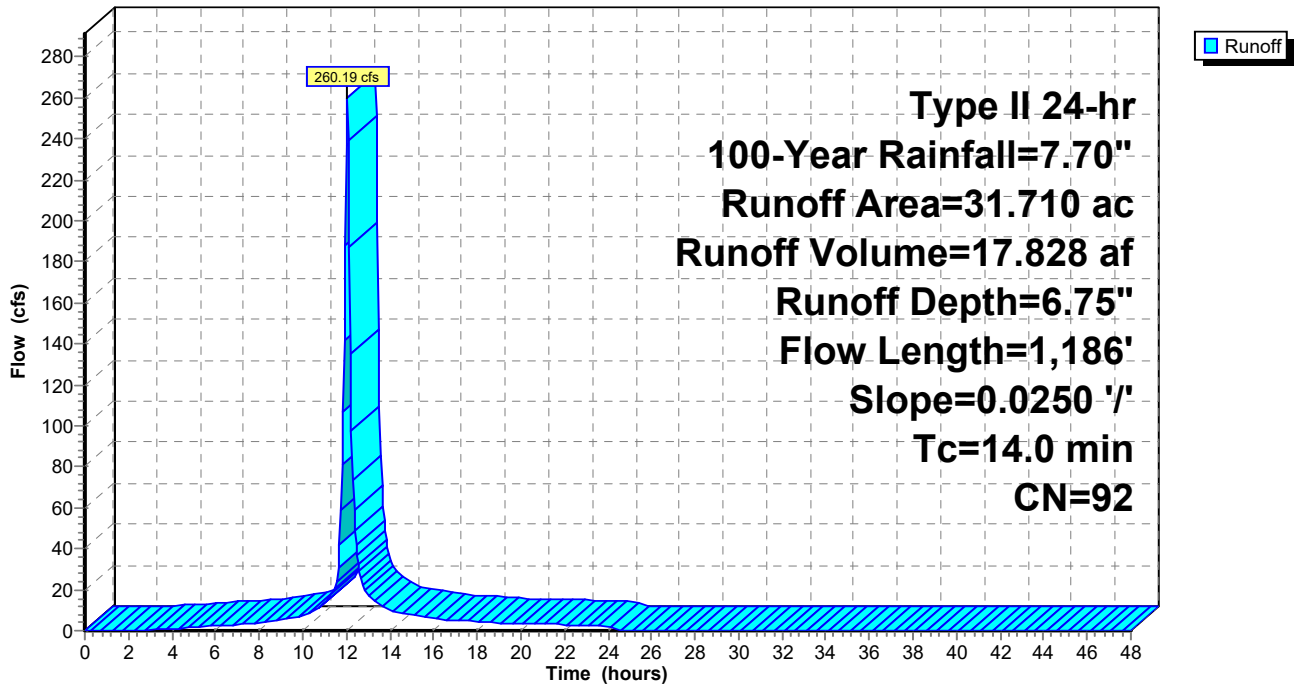
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
* 19.330	92	Duplex/Townhomes
11.140	92	1/8 acre lots, 65% imp, HSG D
1.240	95	Urban commercial, 85% imp, HSG D
31.710	92	Weighted Average
23.415		73.84% Pervious Area
8.295		26.16% Impervious Area

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

## Subcatchment 1S: ON-SITE #1

Hydrograph



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**Summary for Subcatchment 3S: ON-SITE #3 (Bypass)**

Runoff = 19.23 cfs @ 12.04 hrs, Volume= 1.221 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"

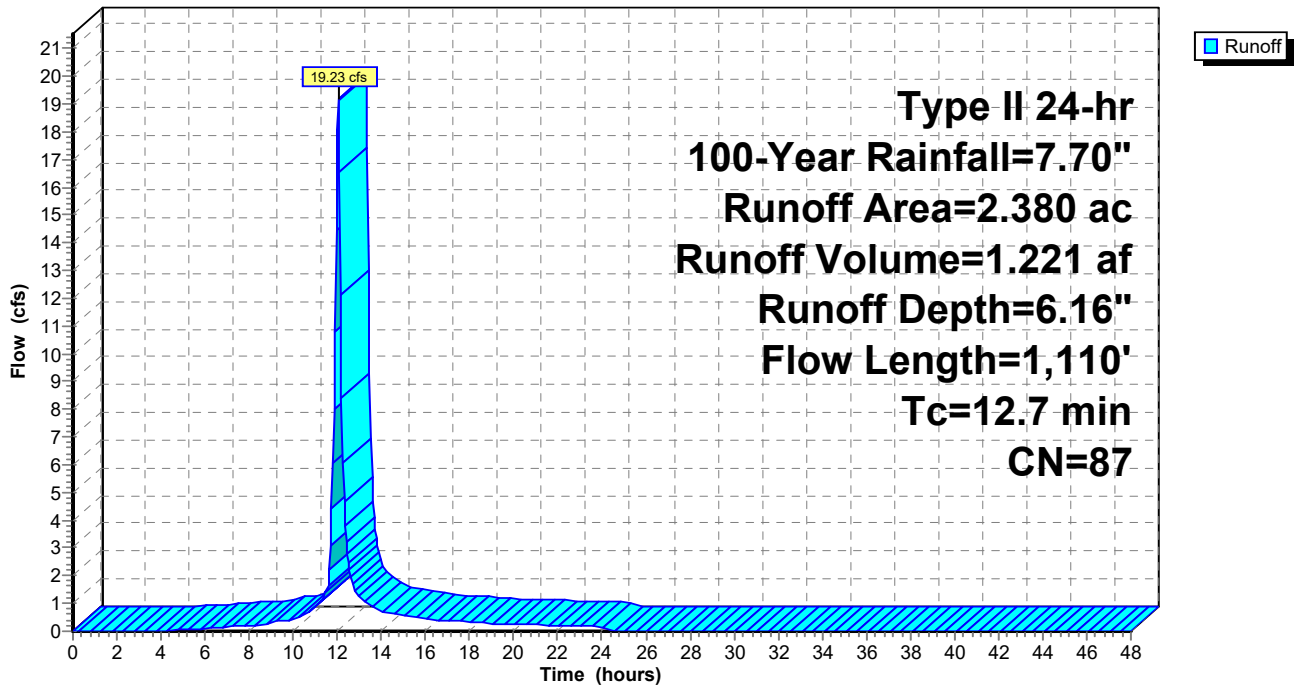
Area (ac)	CN	Description
2.380	87	1/4 acre lots, 38% imp, HSG D
1.476		62.00% Pervious Area
0.904		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		Sheet Flow, 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 (Bypass)**

Hydrograph



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**Summary for Subcatchment 5S: OFF-SITE #1**

Runoff = 108.57 cfs @ 12.10 hrs, Volume= 7.679 af, Depth= 5.00"

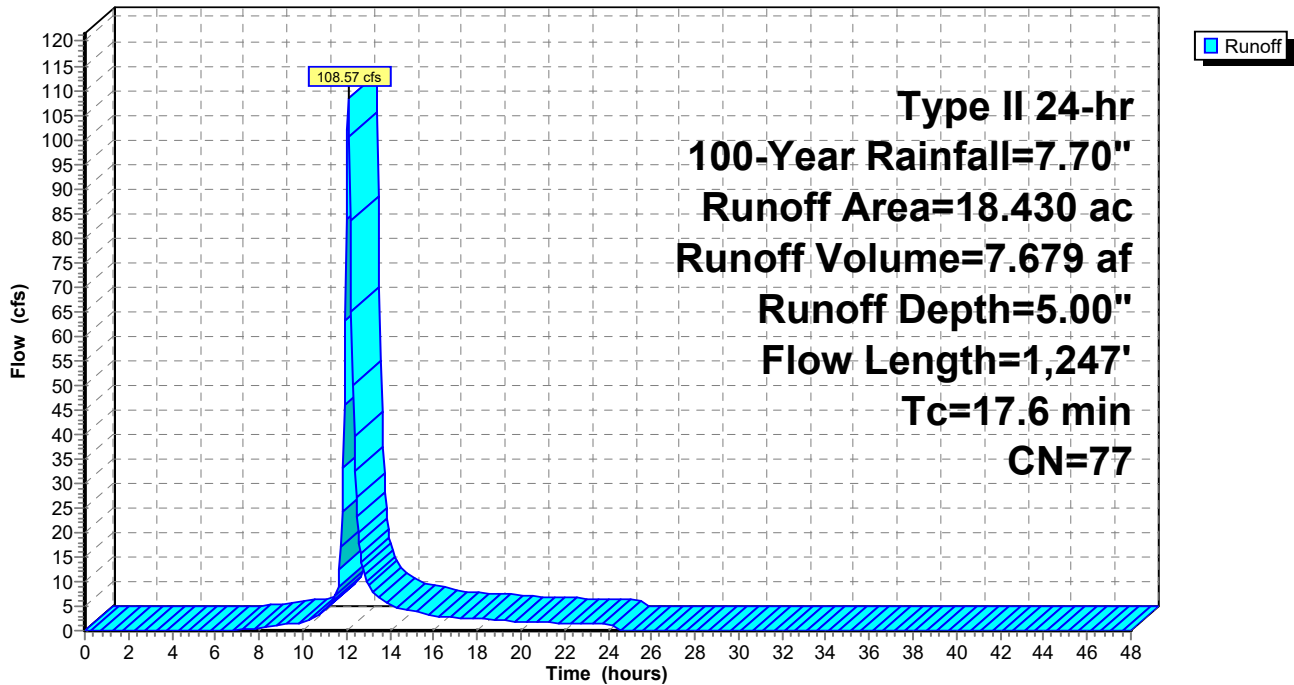
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

**Subcatchment 5S: OFF-SITE #1**

Hydrograph



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### Summary for Subcatchment 6S: ON-SITE #4 (Bypass)

Runoff = 166.84 cfs @ 12.07 hrs, Volume= 11.229 af, Depth= 5.46"

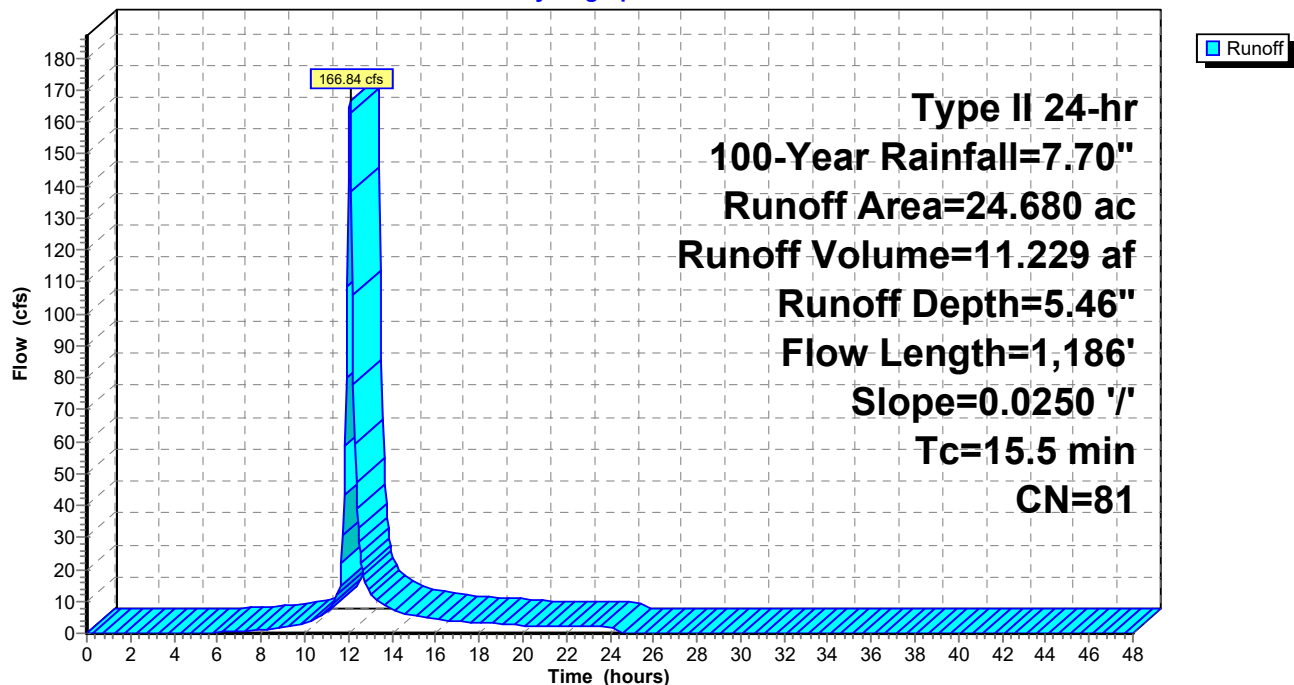
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=7.70"

Area (ac)	CN	Description
22.730	80	>75% Grass cover, Good, HSG D
1.950	95	Urban commercial, 85% imp, HSG D
24.680	81	Weighted Average
23.023		93.28% Pervious Area
1.657		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
7.1	1,086	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.5	1,186	Total			

### Subcatchment 6S: ON-SITE #4 (Bypass)

Hydrograph



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## Summary for Subcatchment 7S: ON-SITE #2

Runoff = 232.03 cfs @ 12.05 hrs, Volume= 15.236 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"

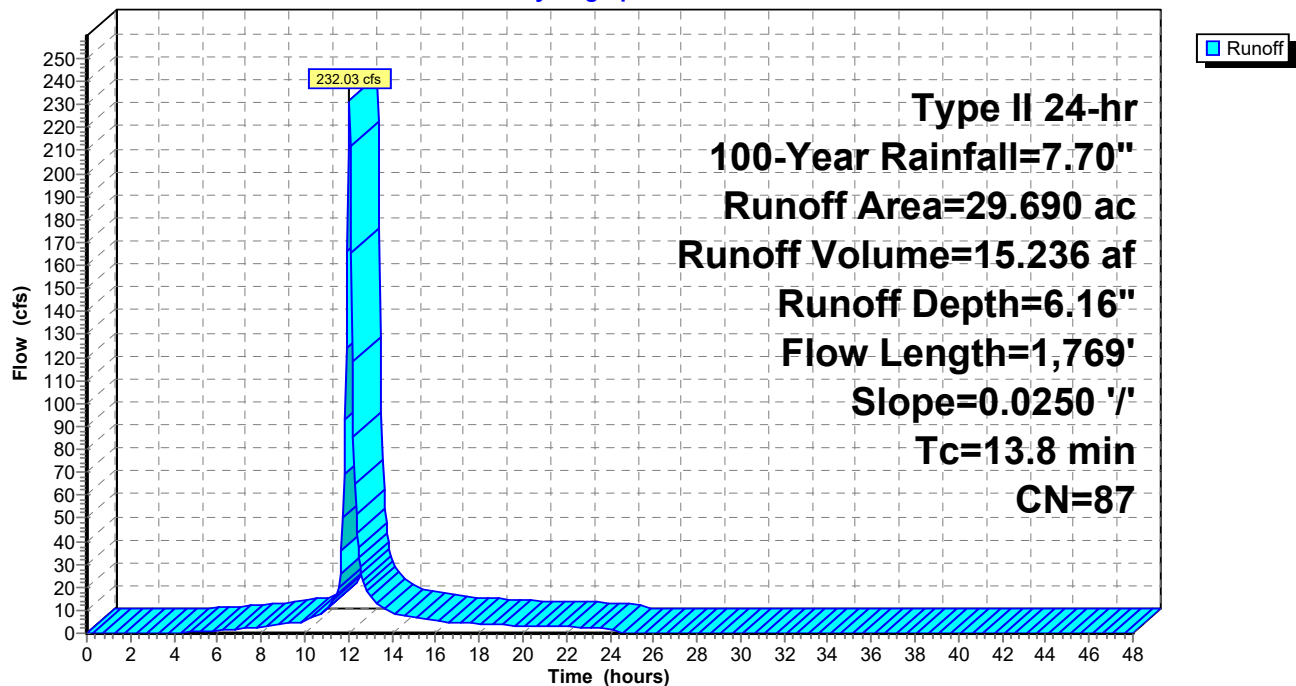
Area (ac)	CN	Description
29.690	87	1/4 acre lots, 38% imp, HSG D
18.408		62.00% Pervious Area
11.282		38.00% Impervious Area

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

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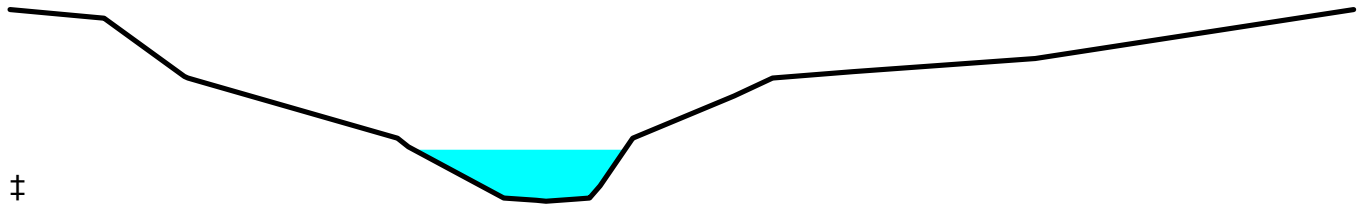
## Summary for Reach 6R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 91.47 cfs @ 12.30 hrs, Volume= 7.679 af  
Outflow = 90.50 cfs @ 12.36 hrs, Volume= 7.679 af, Atten= 1%, Lag= 3.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 4.99 fps, Min. Travel Time= 3.5 min  
Avg. Velocity = 1.24 fps, Avg. Travel Time= 14.0 min

Peak Storage= 18,925 cf @ 12.30 hrs  
Average Depth at Peak Storage= 1.72'  
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

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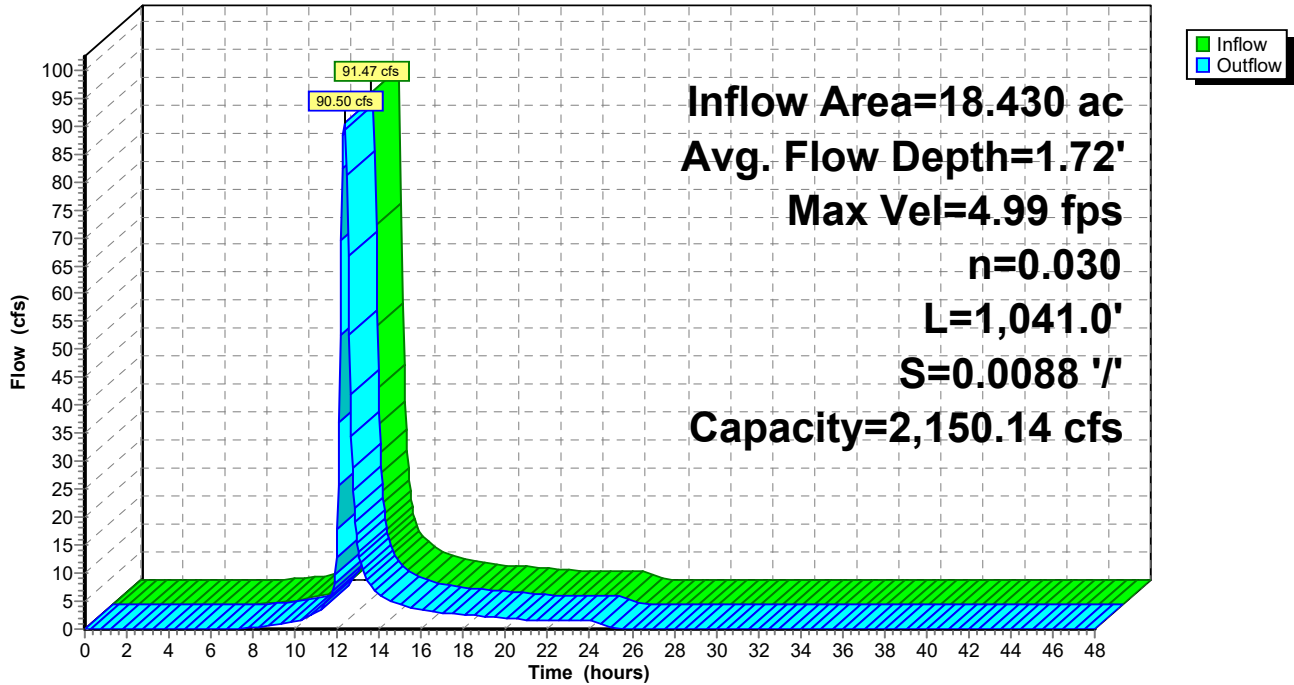
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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

Hydrograph



**21-130-HYDRO-PRO orifice plate option**

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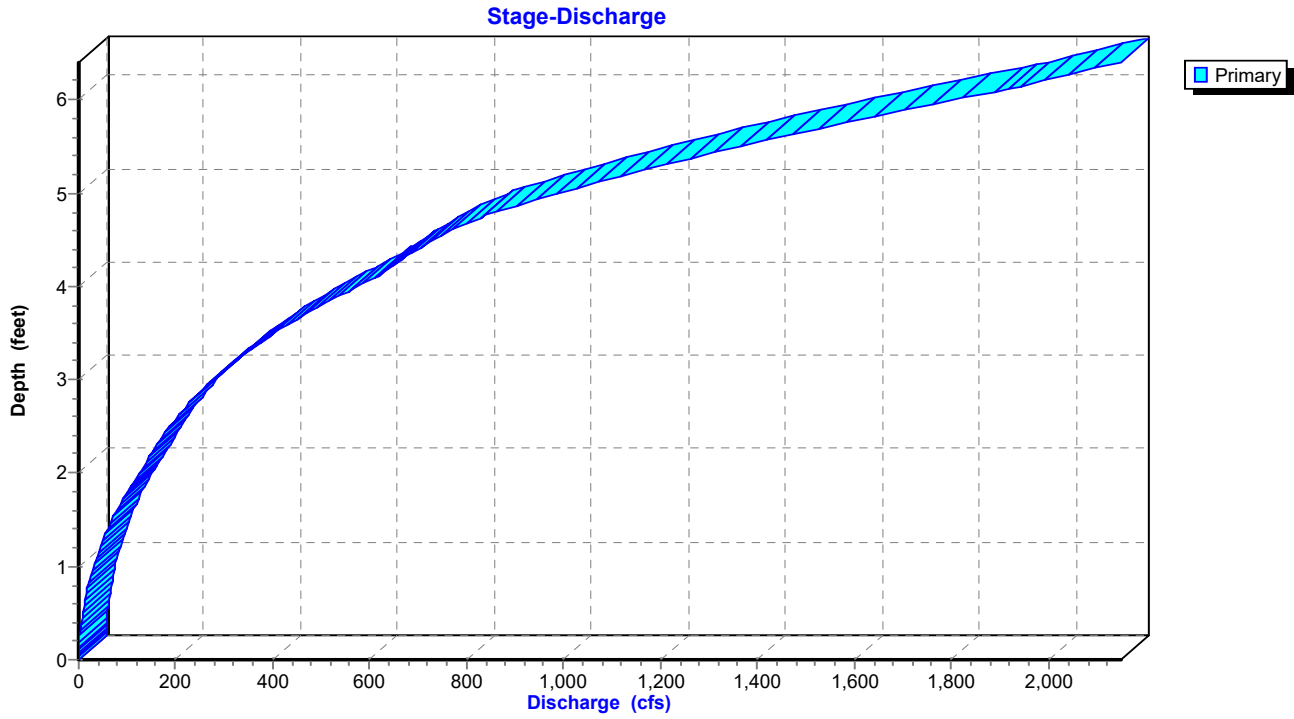
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**Reach 6R: Reach 3**





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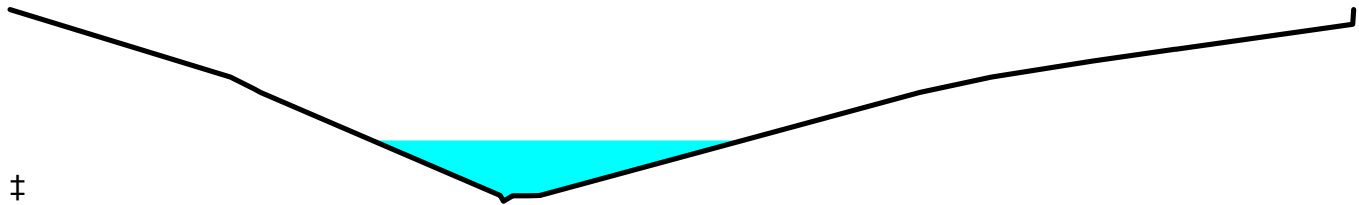
## Summary for Reach 7R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 92.93 cfs @ 12.11 hrs, Volume= 7.679 af  
Outflow = 91.47 cfs @ 12.30 hrs, Volume= 7.679 af, Atten= 2%, Lag= 11.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 4.78 fps, Min. Travel Time= 3.0 min  
Avg. Velocity = 1.66 fps, Avg. Travel Time= 8.6 min

Peak Storage= 16,345 cf @ 12.25 hrs  
Average Depth at Peak Storage= 1.03'  
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

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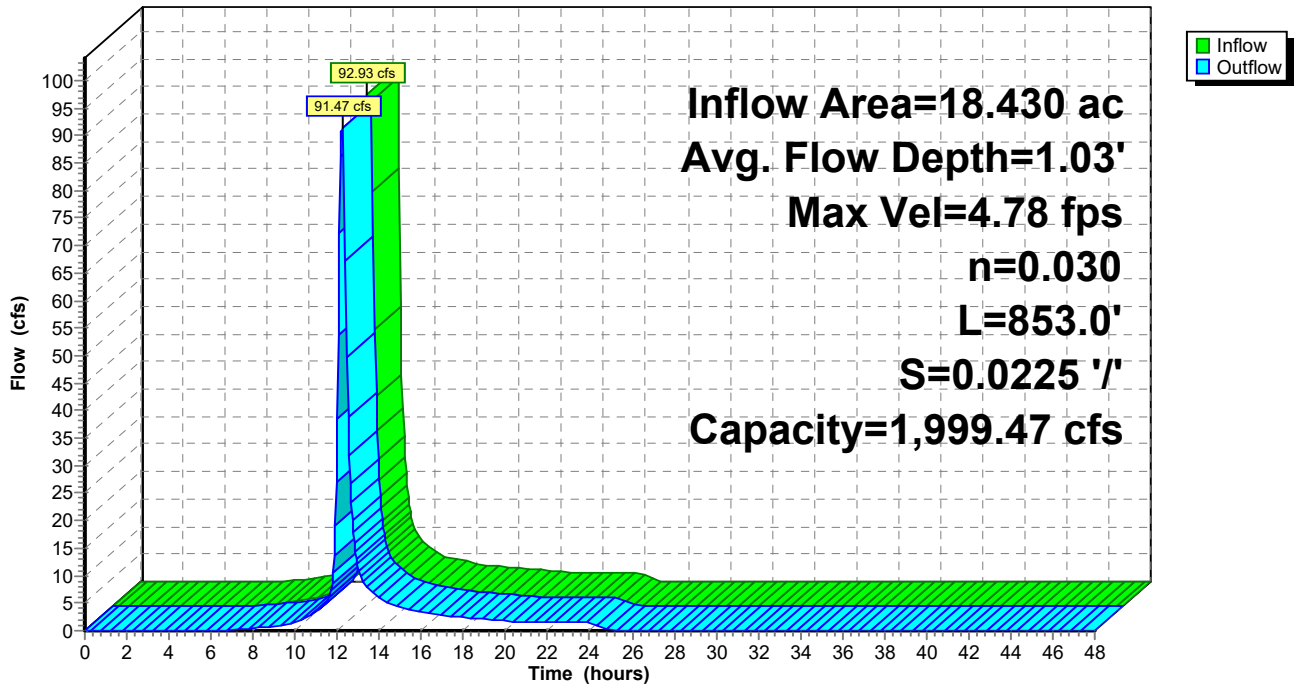
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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

### Hydrograph



# 21-130-HYDRO-PRO orifice plate option

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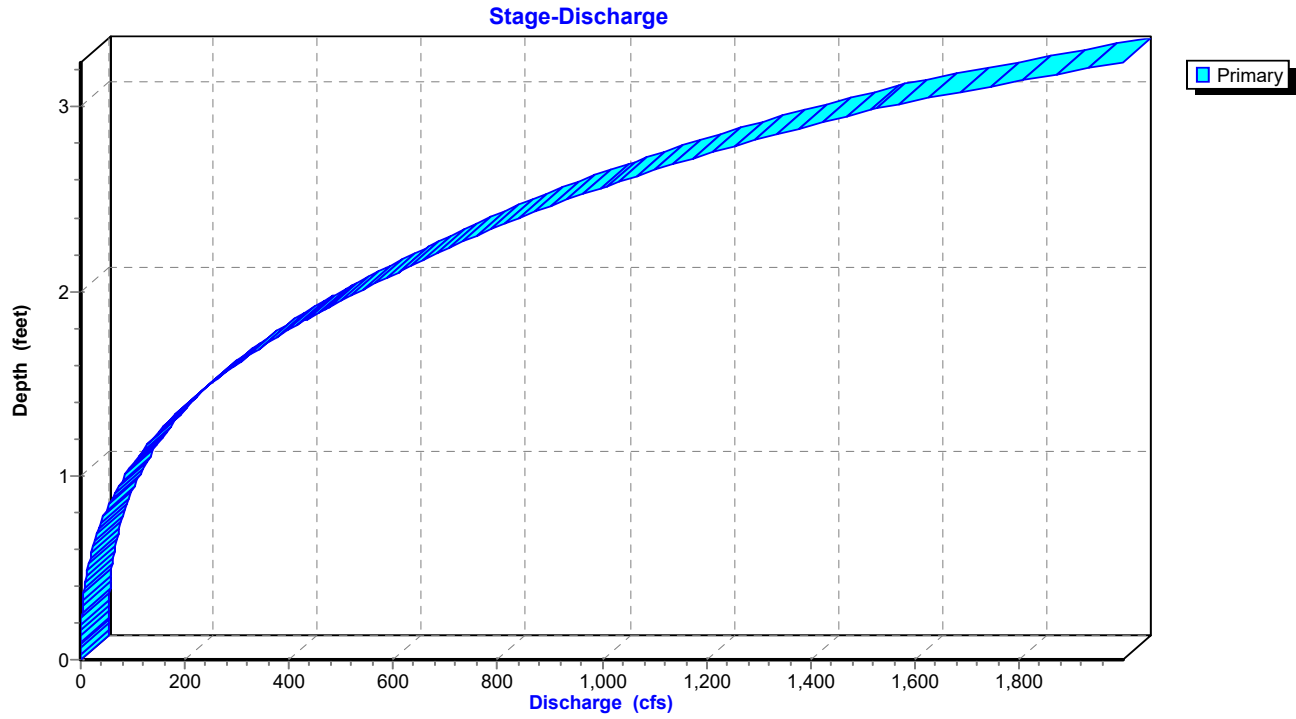
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## Reach 7R: Reach 2



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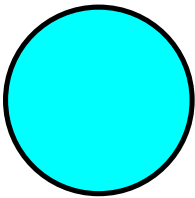
## Summary for Reach 8R: REACH 1 (through Pipe System)

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 5.00" for 100-Year event  
Inflow = 108.57 cfs @ 12.10 hrs, Volume= 7.679 af  
Outflow = 92.93 cfs @ 12.11 hrs, Volume= 7.679 af, Atten= 14%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 14.68 fps, Min. Travel Time= 1.2 min  
Avg. Velocity = 5.23 fps, Avg. Travel Time= 3.4 min

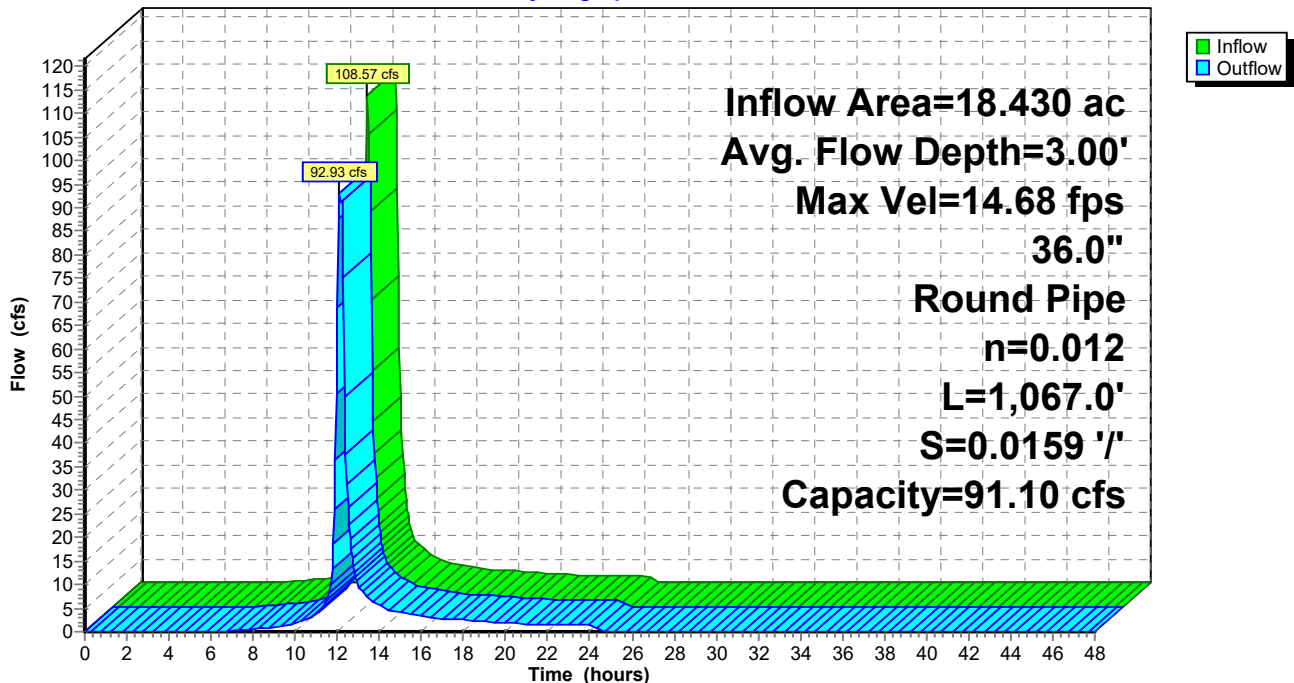
Peak Storage= 7,542 cf @ 12.10 hrs  
Average Depth at Peak Storage= 3.00'  
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 91.10 cfs

36.0" Round Pipe  
n= 0.012 Concrete pipe, finished  
Length= 1,067.0' Slope= 0.0159 '/'  
Inlet Invert= 1,021.96', Outlet Invert= 1,005.00'



## Reach 8R: REACH 1 (through Pipe System)

Hydrograph



**21-130-HYDRO-PRO orifice plate option**

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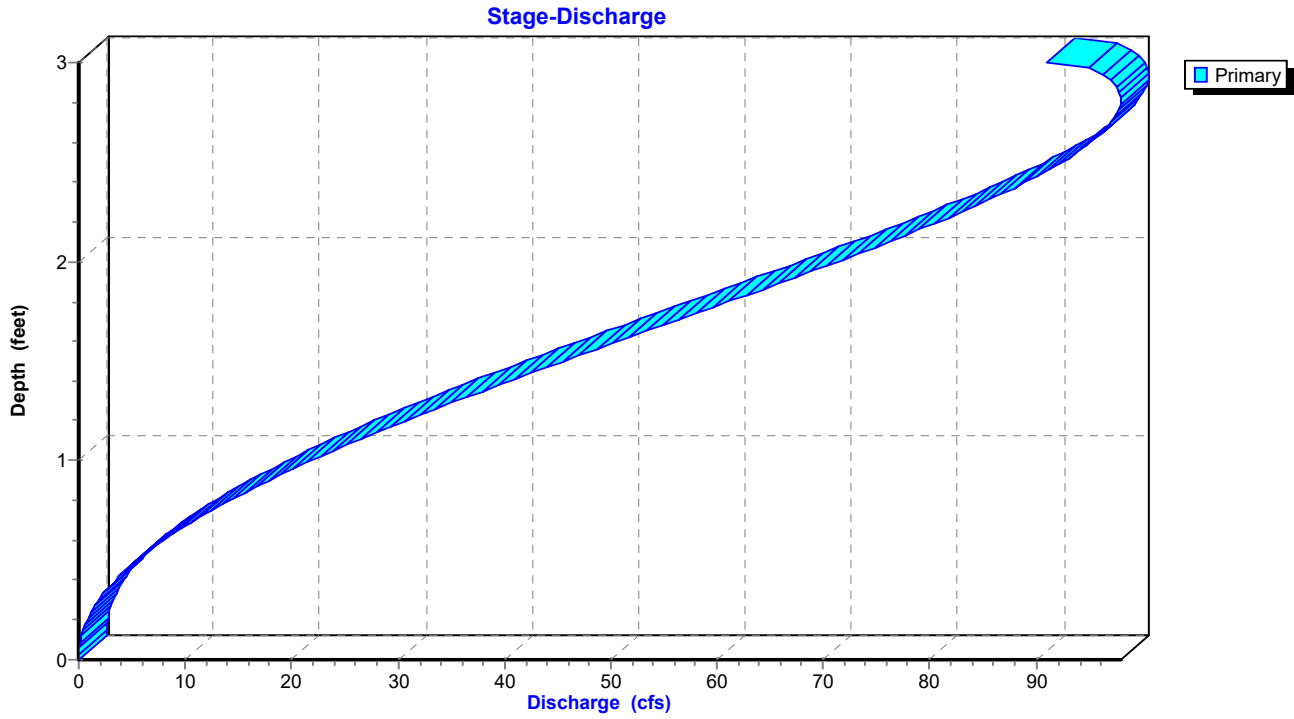
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**Reach 8R: REACH 1 (through Pipe System)**



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### Summary for Pond 4P: Eddb #1 Cornerstone

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth = 6.75" for 100-Year event  
Inflow = 260.19 cfs @ 12.05 hrs, Volume= 17.828 af  
Outflow = 81.35 cfs @ 12.29 hrs, Volume= 16.846 af, Atten= 69%, Lag= 14.1 min  
Primary = 81.35 cfs @ 12.29 hrs, Volume= 16.846 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Peak Elev= 1,006.64' @ 12.29 hrs Surf.Area= 59,549 sf Storage= 352,702 cf

Plug-Flow detention time= 212.5 min calculated for 16.846 af (94% of inflow)  
Center-of-Mass det. time= 180.3 min ( 954.2 - 773.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	995.67'	374,566 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.67	0	0	0
996.00	700	116	116
997.00	7,200	3,950	4,066
998.00	12,000	9,600	13,666
999.00	17,900	14,950	28,616
1,000.00	27,000	22,450	51,066
1,001.00	36,000	31,500	82,566
1,002.00	40,000	38,000	120,566
1,003.00	44,800	42,400	162,966
1,004.00	48,700	46,750	209,716
1,005.00	53,000	50,850	260,566
1,006.00	57,000	55,000	315,566
1,007.00	61,000	59,000	374,566

Device	Routing	Invert	Outlet Devices
#1	Primary	993.54'	<b>30.0" Round 30" Culvert</b> L= 87.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.54' / 993.11' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	994.16'	<b>2.9" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	994.36'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 994.36' / 994.16' S= 0.0100 '/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#4	Device 3	995.67'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 9 rows with 4.0" cc spacing C= 0.600
#5	Device 1	1,001.05'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	1,004.00'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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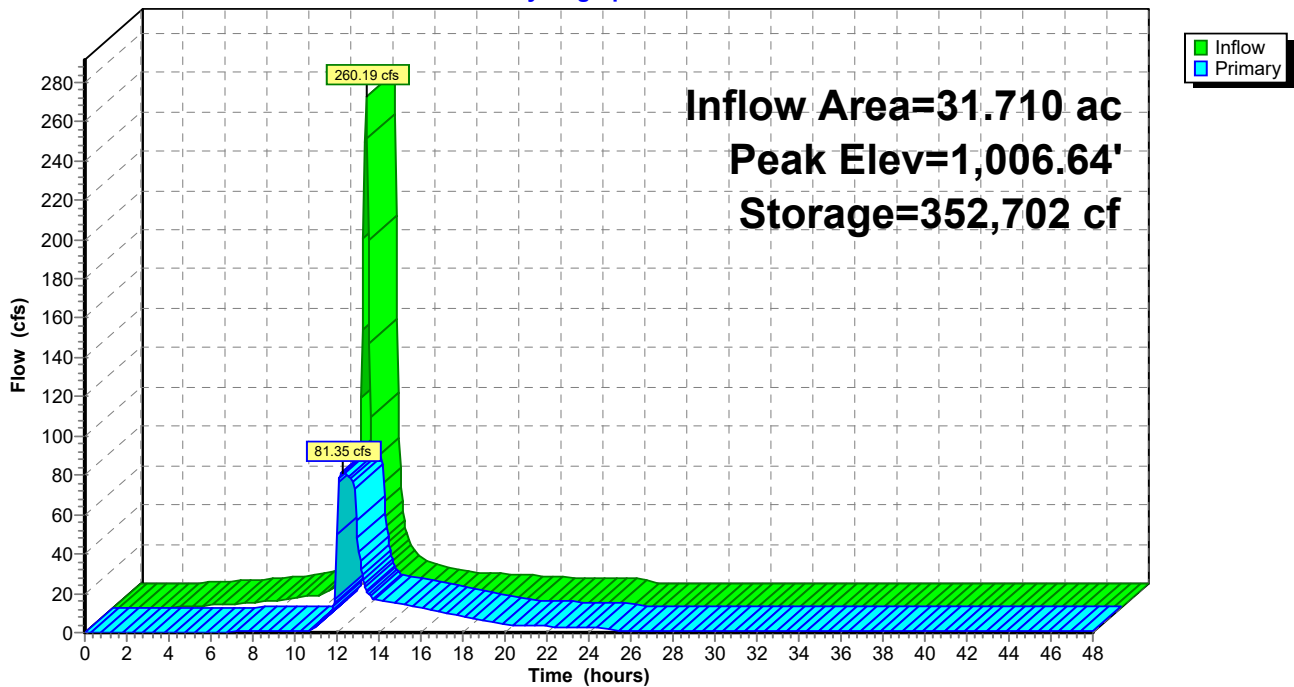
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**Primary OutFlow** Max=81.33 cfs @ 12.29 hrs HW=1,006.63' (Free Discharge)

- 1=30" Culvert (Inlet Controls 81.33 cfs @ 16.57 fps)
- 2=WQ Orifice (Passes < 0.78 cfs potential flow)
- 3=8" PVC Pipe (Passes < 6.61 cfs potential flow)
- 4=Riser Pipe (Passes < 5.85 cfs potential flow)
- 5=Opening in Box (Passes < 22.23 cfs potential flow)
- 6=Open Top of Box (Passes < 156.21 cfs potential flow)

## Pond 4P: EDDB #1 Cornerstone

Hydrograph



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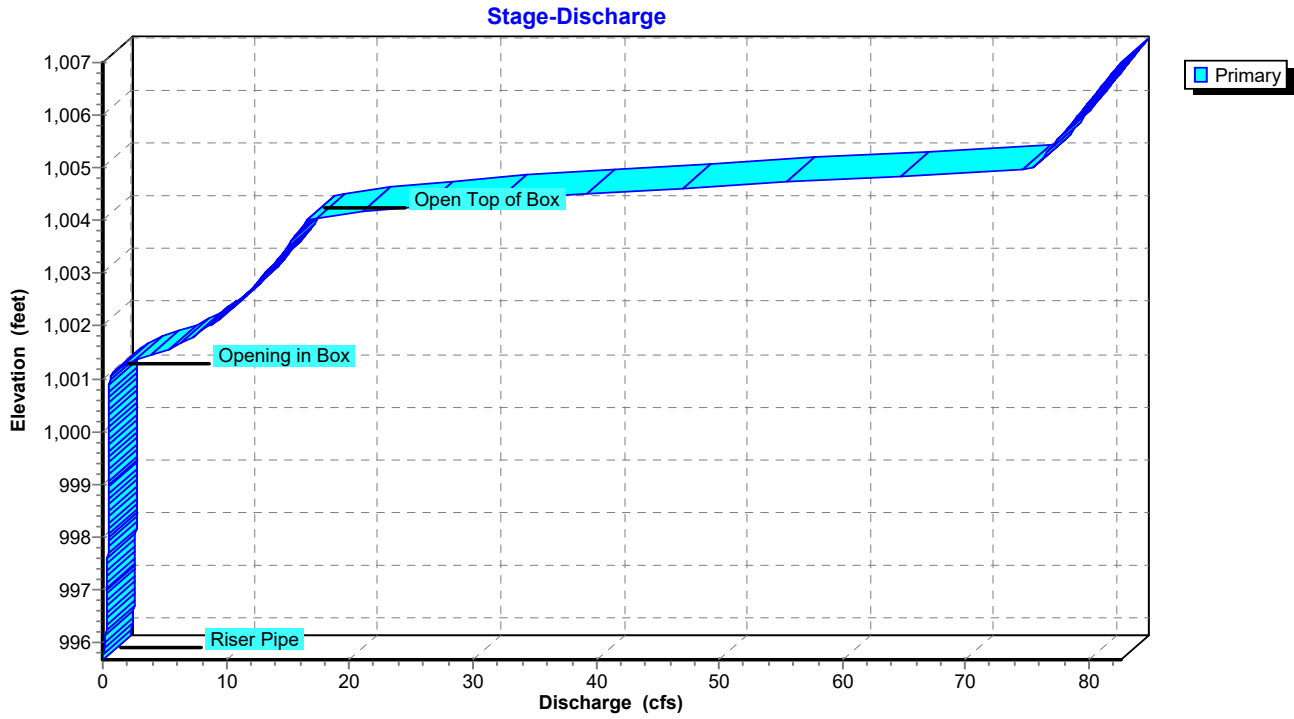
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## Pond 4P: Eddb #1 Cornerstone





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### Summary for Pond 5P: Eddb #2 Manor

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth = 6.16" for 100-Year event  
 Inflow = 232.03 cfs @ 12.05 hrs, Volume= 15.236 af  
 Outflow = 76.98 cfs @ 12.27 hrs, Volume= 14.297 af, Atten= 67%, Lag= 13.3 min  
 Primary = 76.98 cfs @ 12.27 hrs, Volume= 14.297 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 997.86' @ 12.27 hrs Surf.Area= 56,374 sf Storage= 285,540 cf

Plug-Flow detention time= 188.5 min calculated for 14.283 af (94% of inflow)  
 Center-of-Mass det. time= 155.1 min ( 945.3 - 790.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	988.16'	352,236 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
988.16	0	0	0
989.00	800	336	336
990.00	4,200	2,500	2,836
991.00	10,400	7,300	10,136
992.00	21,600	16,000	26,136
993.00	37,600	29,600	55,736
994.00	41,700	39,650	95,386
995.00	46,000	43,850	139,236
996.00	49,700	47,850	187,086
997.00	53,200	51,450	238,536
998.00	56,900	55,050	293,586
999.00	60,400	58,650	352,236

Device	Routing	Invert	Outlet Devices
#1	Primary	986.00'	<b>30.0" Round 30" Culvert</b> L= 77.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.00' / 985.62' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	986.62'	<b>2.5" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	986.86'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.86' / 986.62' S= 0.0120 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#4	Device 3	988.16'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 8 rows with 4.0" cc spacing C= 0.600
#5	Device 1	993.40'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	995.25'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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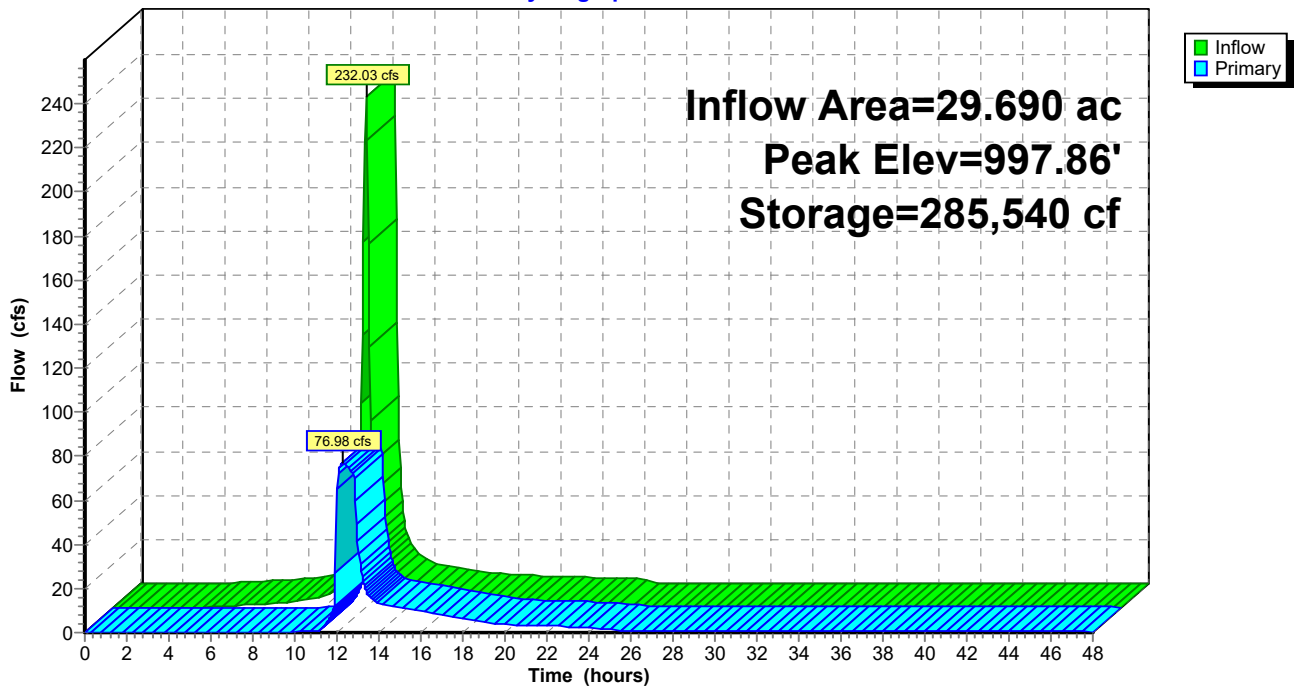
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**Primary OutFlow Max=76.94 cfs @ 12.27 hrs HW=997.85' (Free Discharge)**

- 1=30" Culvert (Inlet Controls 76.94 cfs @ 15.67 fps)
- 2=WQ Orifice (Passes < 0.55 cfs potential flow)
- 3=8" PVC Pipe (Passes < 5.49 cfs potential flow)
- 4=Riser Pipe (Passes < 4.89 cfs potential flow)
- 5=Opening in Box (Passes < 19.73 cfs potential flow)
- 6=Open Top of Box (Passes < 155.20 cfs potential flow)

## Pond 5P: EDDB #2 Manor

Hydrograph



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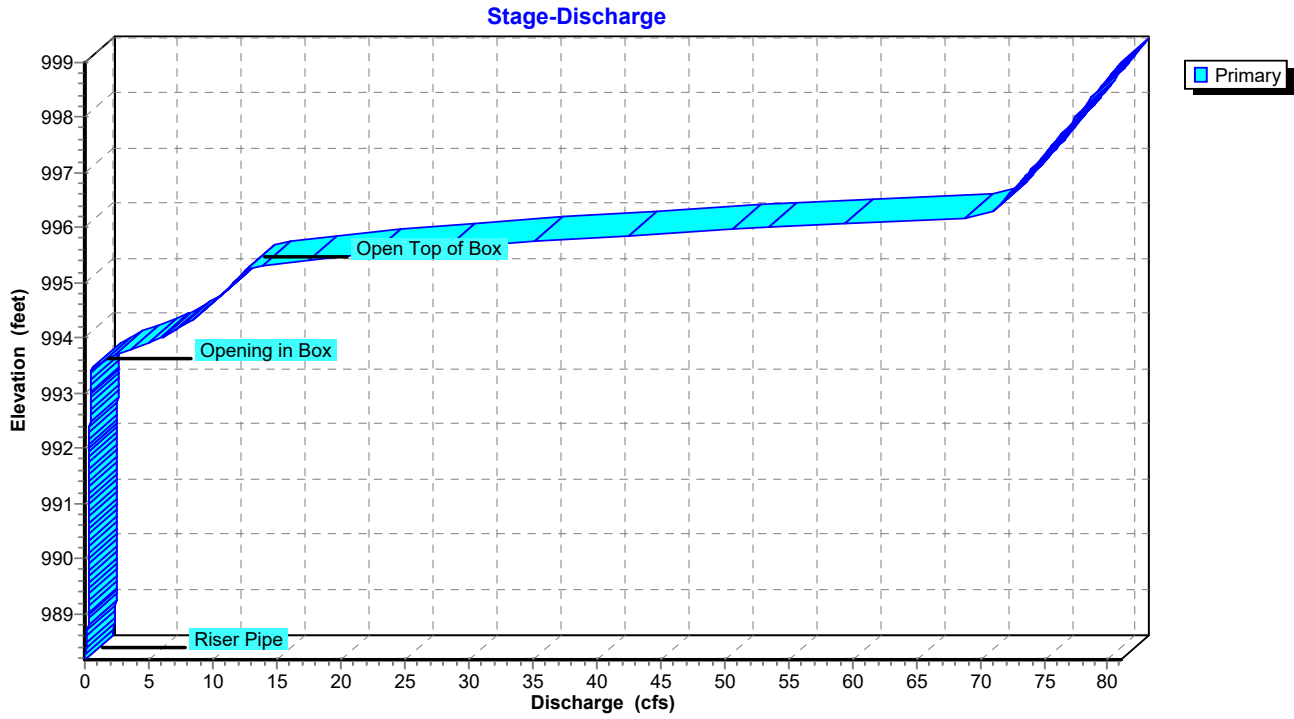
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## Pond 5P: EDDB #2 Manor



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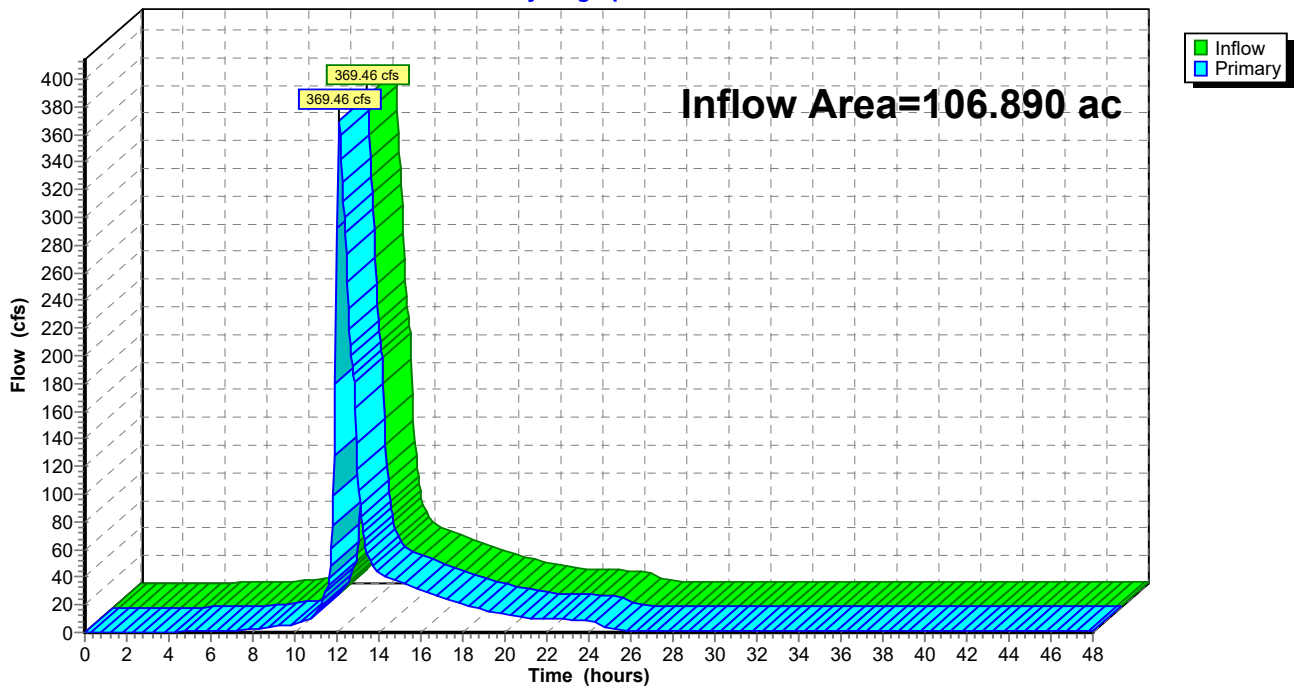
## Summary for Link 2L: RP-1

Inflow Area = 106.890 ac, 20.71% Impervious, Inflow Depth > 5.76" for 100-Year event  
Inflow = 369.46 cfs @ 12.10 hrs, Volume= 51.273 af  
Primary = 369.46 cfs @ 12.10 hrs, Volume= 51.273 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

Hydrograph



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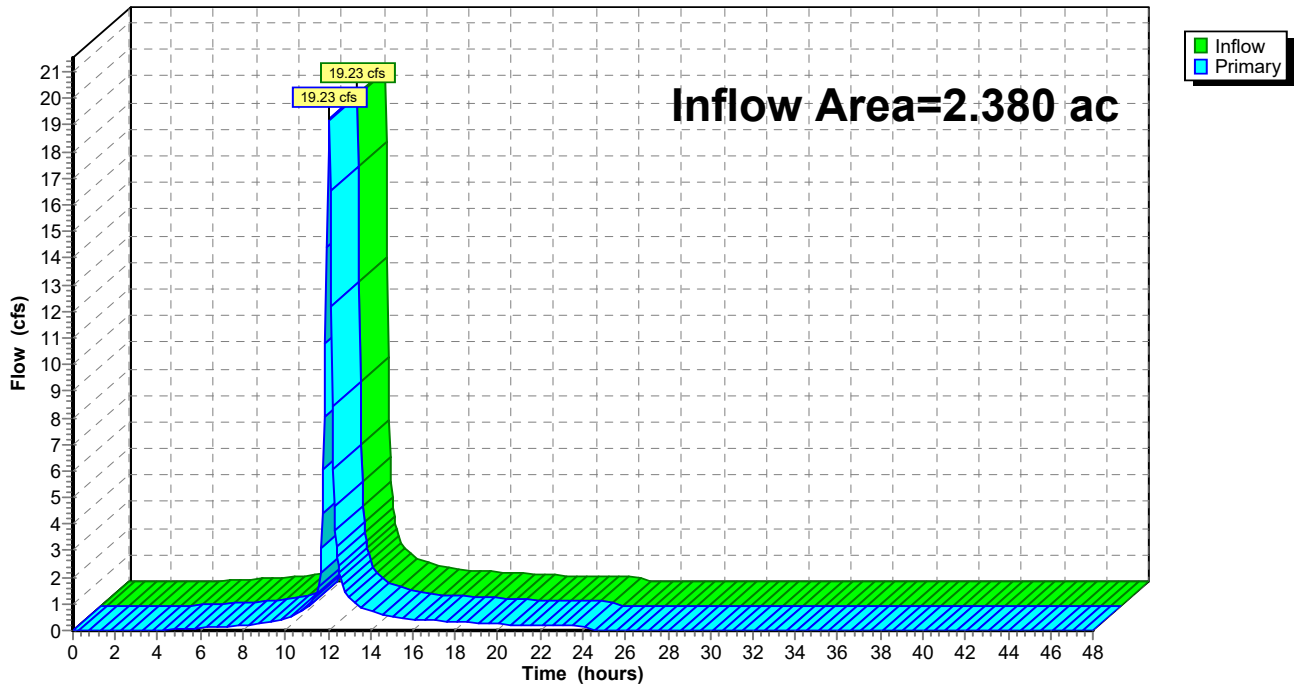
## Summary for Link 3L: RP-2

Inflow Area = 2.380 ac, 38.00% Impervious, Inflow Depth = 6.16" for 100-Year event  
Inflow = 19.23 cfs @ 12.04 hrs, Volume= 1.221 af  
Primary = 19.23 cfs @ 12.04 hrs, Volume= 1.221 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

Hydrograph



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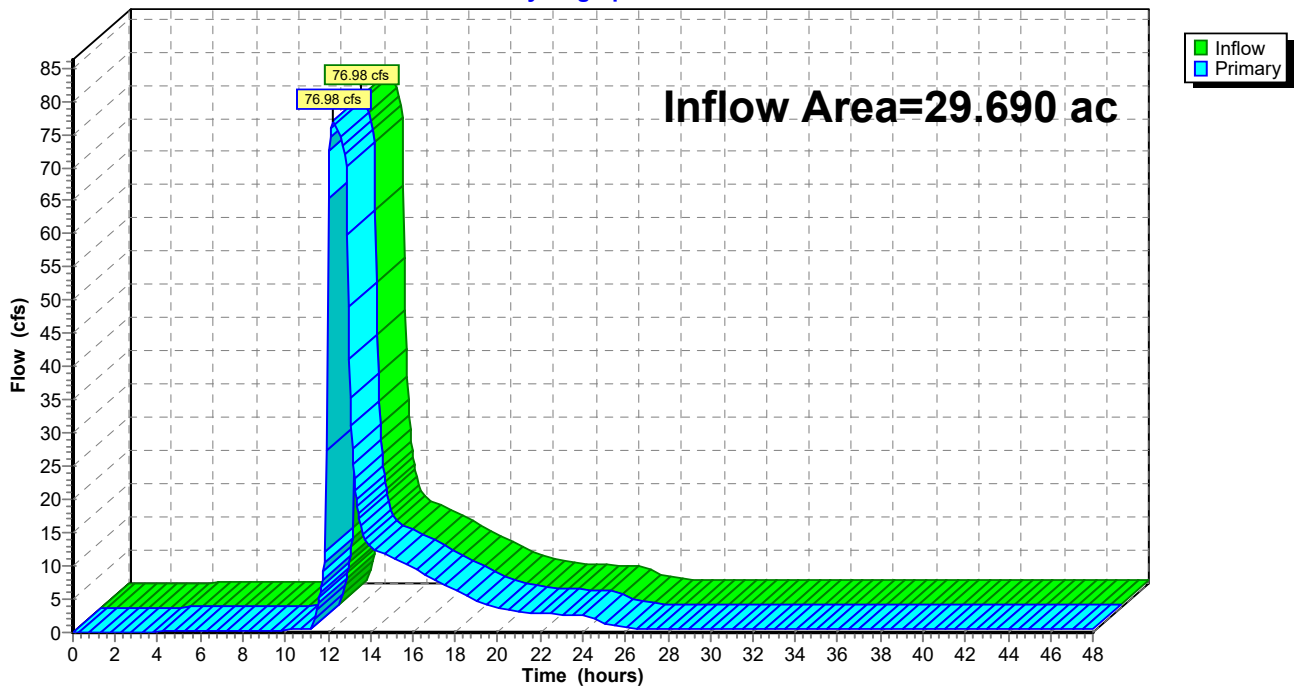
## Summary for Link 4L: RP-3

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth > 5.78" for 100-Year event  
Inflow = 76.98 cfs @ 12.27 hrs, Volume= 14.297 af  
Primary = 76.98 cfs @ 12.27 hrs, Volume= 14.297 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

Hydrograph



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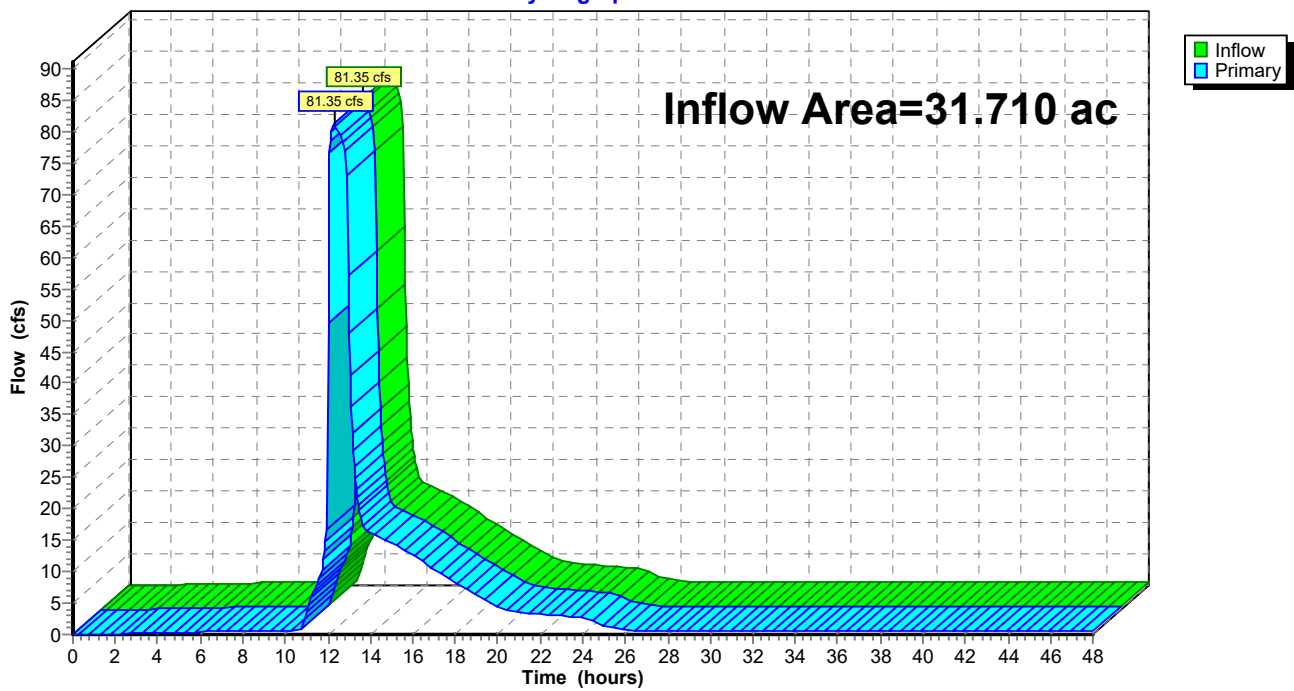
## Summary for Link 5L: RP-4

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth > 6.37" for 100-Year event  
Inflow = 81.35 cfs @ 12.29 hrs, Volume= 16.846 af  
Primary = 81.35 cfs @ 12.29 hrs, Volume= 16.846 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

Hydrograph



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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment1S: ON-SITE #1</b>	Runoff Area=31.710 ac 26.16% Impervious	Runoff Depth=0.69"
	Flow Length=1,186' Slope=0.0250 '/'	Tc=14.0 min CN=92 Runoff=29.17 cfs 1.830 af
<b>Subcatchment3S: ON-SITE #3 (Bypass)</b>	Runoff Area=2.380 ac 38.00% Impervious	Runoff Depth=0.45"
	Flow Length=1,110' Tc=12.7 min CN=87	Runoff=1.43 cfs 0.089 af
<b>Subcatchment5S: OFF-SITE #1</b>	Runoff Area=18.430 ac 0.00% Impervious	Runoff Depth=0.16"
	Flow Length=1,247' Tc=17.6 min CN=77	Runoff=2.03 cfs 0.244 af
<b>Subcatchment6S: ON-SITE #4 (Bypass)</b>	Runoff Area=24.680 ac 6.72% Impervious	Runoff Depth=0.25"
	Flow Length=1,186' Slope=0.0250 '/'	Tc=15.5 min CN=81 Runoff=6.28 cfs 0.514 af
<b>Subcatchment7S: ON-SITE #2</b>	Runoff Area=29.690 ac 38.00% Impervious	Runoff Depth=0.45"
	Flow Length=1,769' Slope=0.0250 '/'	Tc=13.8 min CN=87 Runoff=17.13 cfs 1.107 af
<b>Reach 6R: Reach 3</b>	Avg. Flow Depth=0.20' Max Vel=1.21 fps	Inflow=1.47 cfs 0.244 af
	n=0.030 L=1,041.0' S=0.0088 '/'	Capacity=2,150.14 cfs Outflow=1.10 cfs 0.244 af
<b>Reach 7R: Reach 2</b>	Avg. Flow Depth=0.23' Max Vel=1.65 fps	Inflow=1.90 cfs 0.244 af
	n=0.030 L=853.0' S=0.0225 '/'	Capacity=1,999.47 cfs Outflow=1.47 cfs 0.244 af
<b>Reach 8R: REACH 1 (through Pipe</b>	Avg. Flow Depth=0.30' Max Vel=5.18 fps	Inflow=2.03 cfs 0.244 af
	36.0" Round Pipe n=0.012 L=1,067.0' S=0.0159 '/'	Capacity=91.10 cfs Outflow=1.90 cfs 0.244 af
<b>Pond 4P: EDDB #1 Cornerstone</b>	Peak Elev=1,000.17' Storage=55,660 cf	Inflow=29.17 cfs 1.830 af
		Outflow=0.54 cfs 1.544 af
<b>Pond 5P: EDDB #2 Manor</b>	Peak Elev=992.24' Storage=31,748 cf	Inflow=17.13 cfs 1.107 af
		Outflow=0.39 cfs 1.083 af
<b>Link 2L: RP-1</b>		Inflow=8.39 cfs 3.473 af
		Primary=8.39 cfs 3.473 af
<b>Link 3L: RP-2</b>		Inflow=1.43 cfs 0.089 af
		Primary=1.43 cfs 0.089 af
<b>Link 4L: RP-3</b>		Inflow=0.39 cfs 1.083 af
		Primary=0.39 cfs 1.083 af
<b>Link 5L: RP-4</b>		Inflow=0.54 cfs 1.544 af
		Primary=0.54 cfs 1.544 af



**21-130-HYDRO-PRO orifice plate option**

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Type II 24-hr WQV Rainfall=1.37"

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**Summary for Subcatchment 1S: ON-SITE #1**

Runoff = 29.17 cfs @ 12.06 hrs, Volume= 1.830 af, Depth= 0.69"

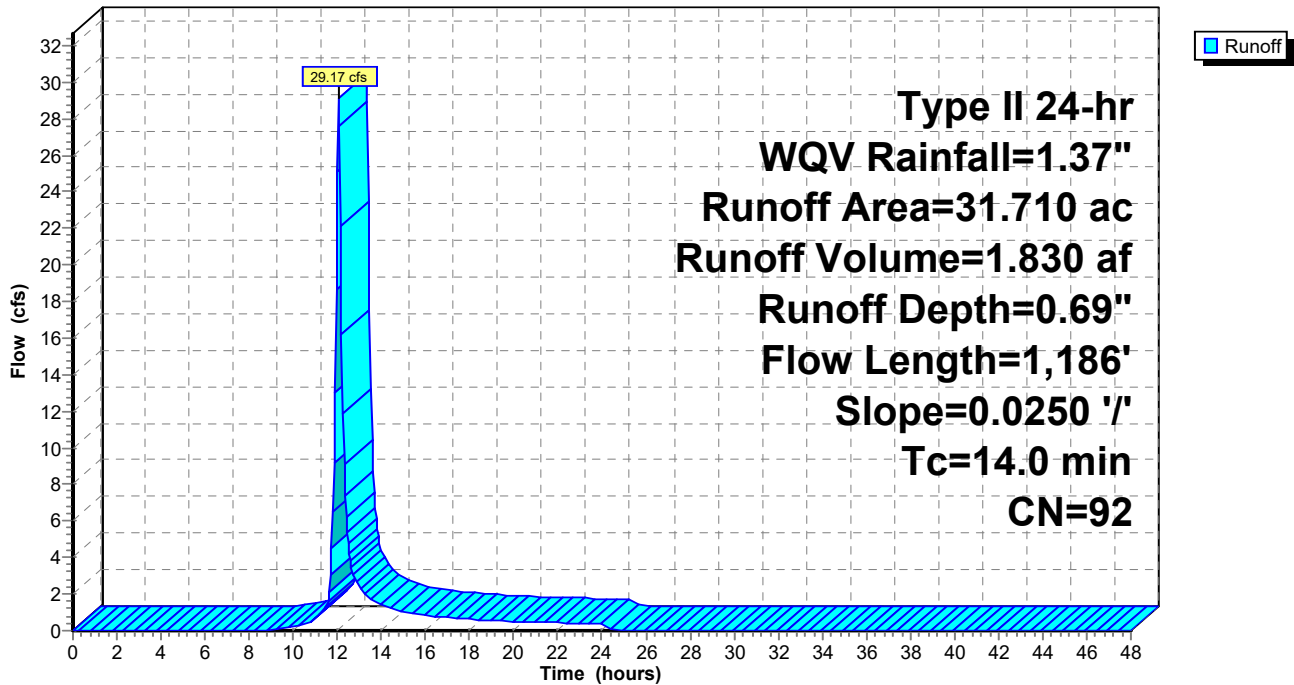
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr WQV Rainfall=1.37"

Area (ac)	CN	Description
* 19.330	92	Duplex/Townhomes
11.140	92	1/8 acre lots, 65% imp, HSG D
1.240	95	Urban commercial, 85% imp, HSG D
31.710	92	Weighted Average
23.415		73.84% Pervious Area
8.295		26.16% Impervious Area

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

**Subcatchment 1S: ON-SITE #1**

Hydrograph



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**Summary for Subcatchment 3S: ON-SITE #3 (Bypass)**

Runoff = 1.43 cfs @ 12.06 hrs, Volume= 0.089 af, Depth= 0.45"

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 WQV Rainfall=1.37"

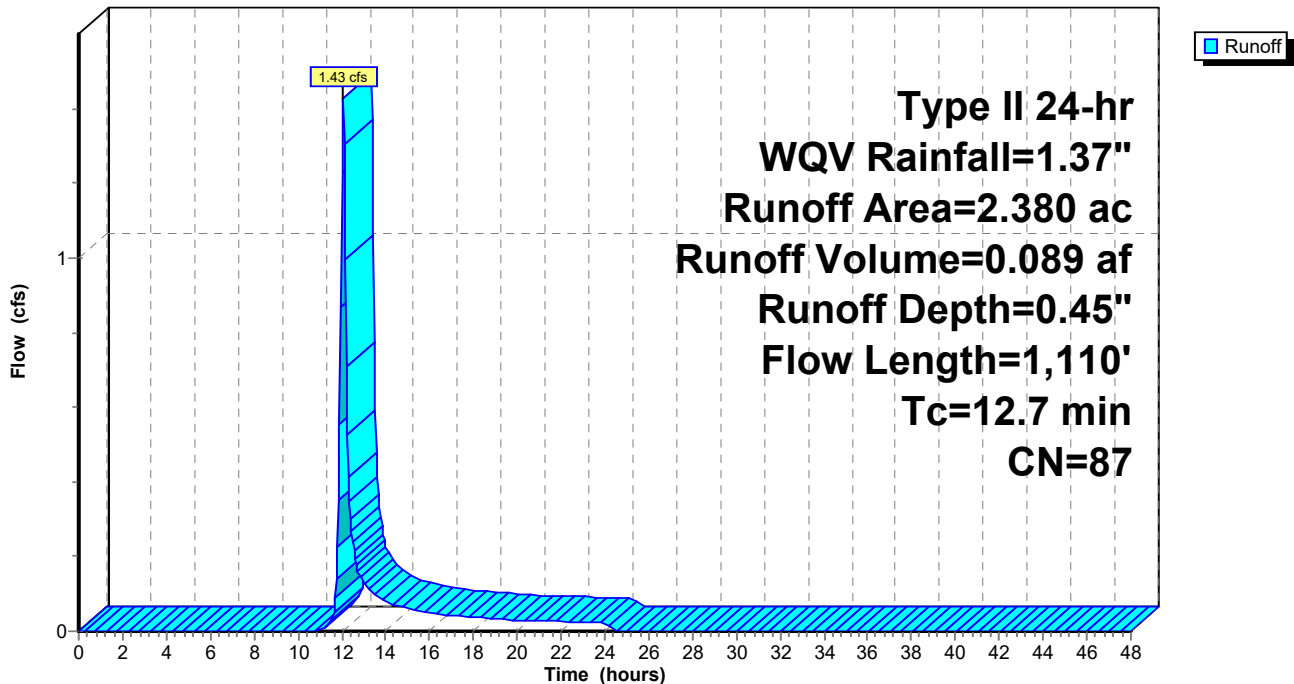
Area (ac)	CN	Description
2.380	87	1/4 acre lots, 38% imp, HSG D
1.476		62.00% Pervious Area
0.904		38.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0250	0.17		Sheet Flow, 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 (Bypass)**

Hydrograph



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## Summary for Subcatchment 5S: OFF-SITE #1

Runoff = 2.03 cfs @ 12.16 hrs, Volume= 0.244 af, Depth= 0.16"

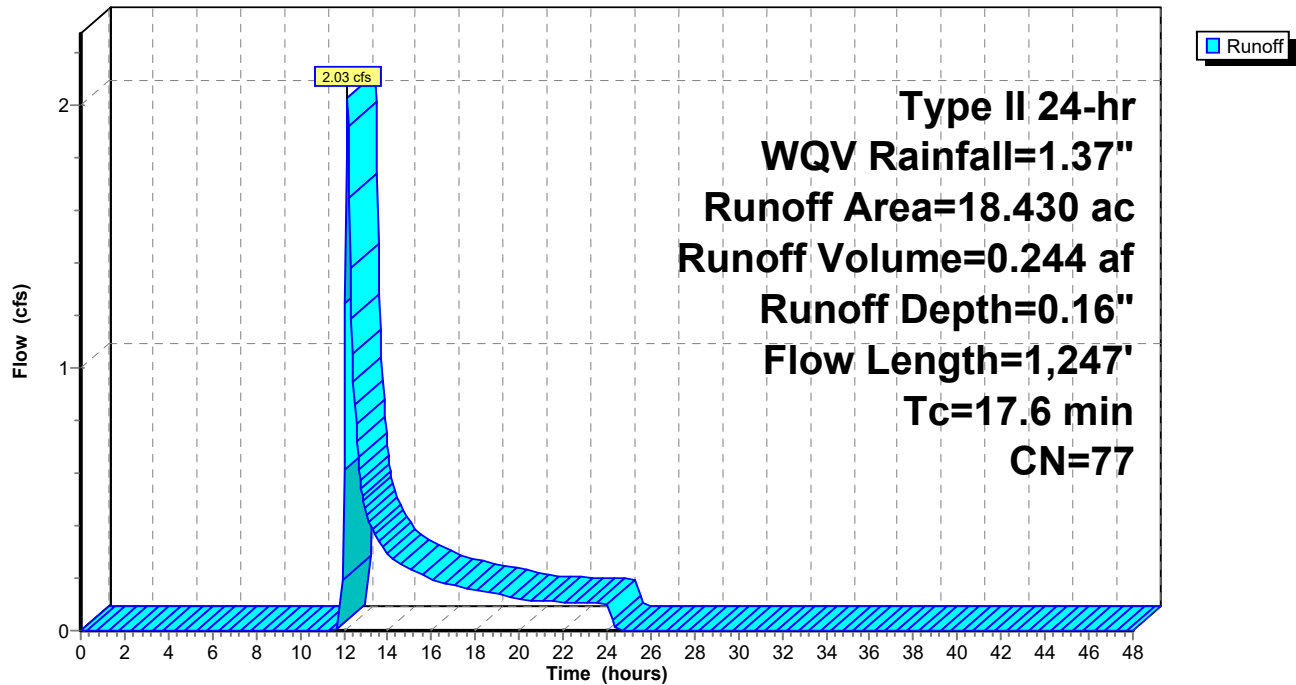
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr WQV Rainfall=1.37"

Area (ac)	CN	Description
15.640	76	Woods/grass comb., Fair, HSG C
2.790	82	Woods/grass comb., Fair, HSG D
18.430	77	Weighted Average
18.430		100.00% Pervious Area

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

## Subcatchment 5S: OFF-SITE #1

Hydrograph



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## Summary for Subcatchment 6S: ON-SITE #4 (Bypass)

Runoff = 6.28 cfs @ 12.11 hrs, Volume= 0.514 af, Depth= 0.25"

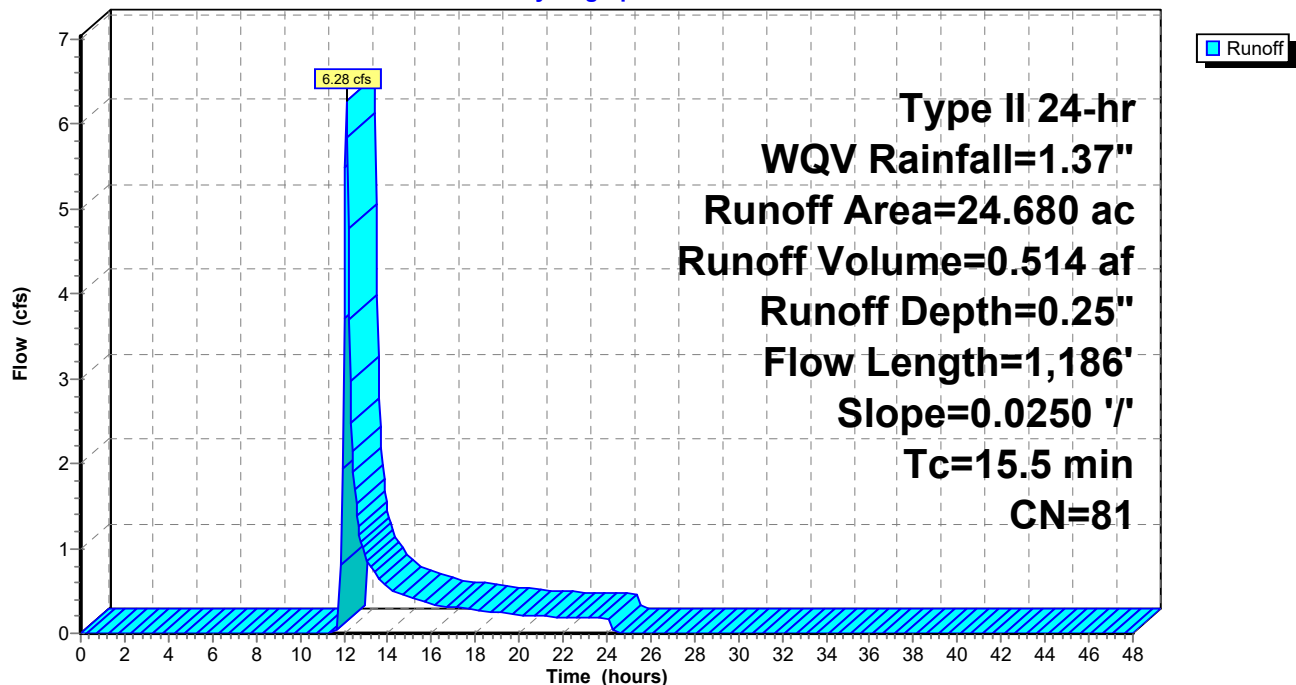
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type II 24-hr WQV Rainfall=1.37"

Area (ac)	CN	Description
22.730	80	>75% Grass cover, Good, HSG D
1.950	95	Urban commercial, 85% imp, HSG D
24.680	81	Weighted Average
23.023		93.28% Pervious Area
1.657		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0250	0.20		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.60"
7.1	1,086	0.0250	2.55		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.5	1,186	Total			

## Subcatchment 6S: ON-SITE #4 (Bypass)

Hydrograph



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## Summary for Subcatchment 7S: ON-SITE #2

Runoff = 17.13 cfs @ 12.07 hrs, Volume= 1.107 af, Depth= 0.45"

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 WQV Rainfall=1.37"

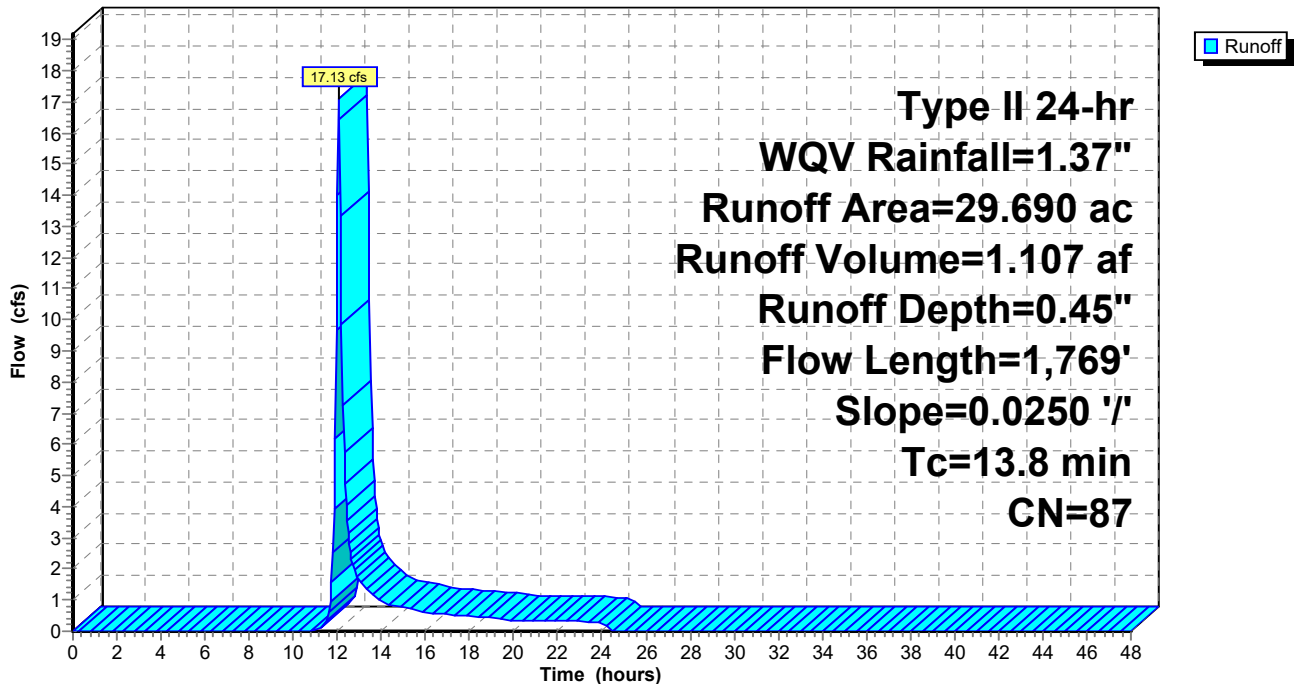
Area (ac)	CN	Description
29.690	87	1/4 acre lots, 38% imp, HSG D
18.408		62.00% Pervious Area
11.282		38.00% Impervious Area

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

Hydrograph



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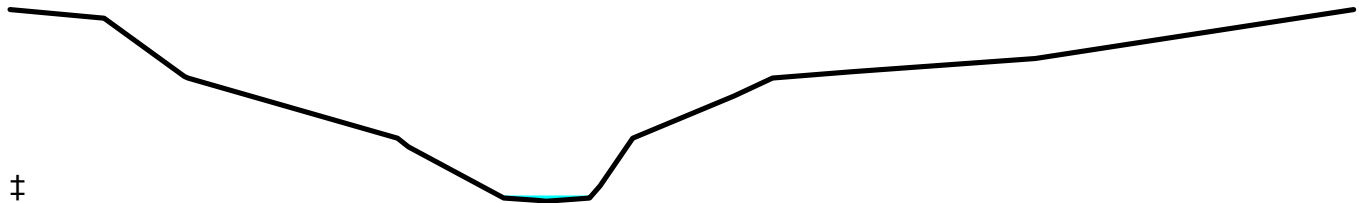
### Summary for Reach 6R: Reach 3

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 0.16" for WQV event  
Inflow = 1.47 cfs @ 12.53 hrs, Volume= 0.244 af  
Outflow = 1.10 cfs @ 12.99 hrs, Volume= 0.244 af, Atten= 25%, Lag= 27.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.21 fps, Min. Travel Time= 14.4 min  
Avg. Velocity = 0.53 fps, Avg. Travel Time= 32.8 min

Peak Storage= 950 cf @ 12.75 hrs  
Average Depth at Peak Storage= 0.20'  
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

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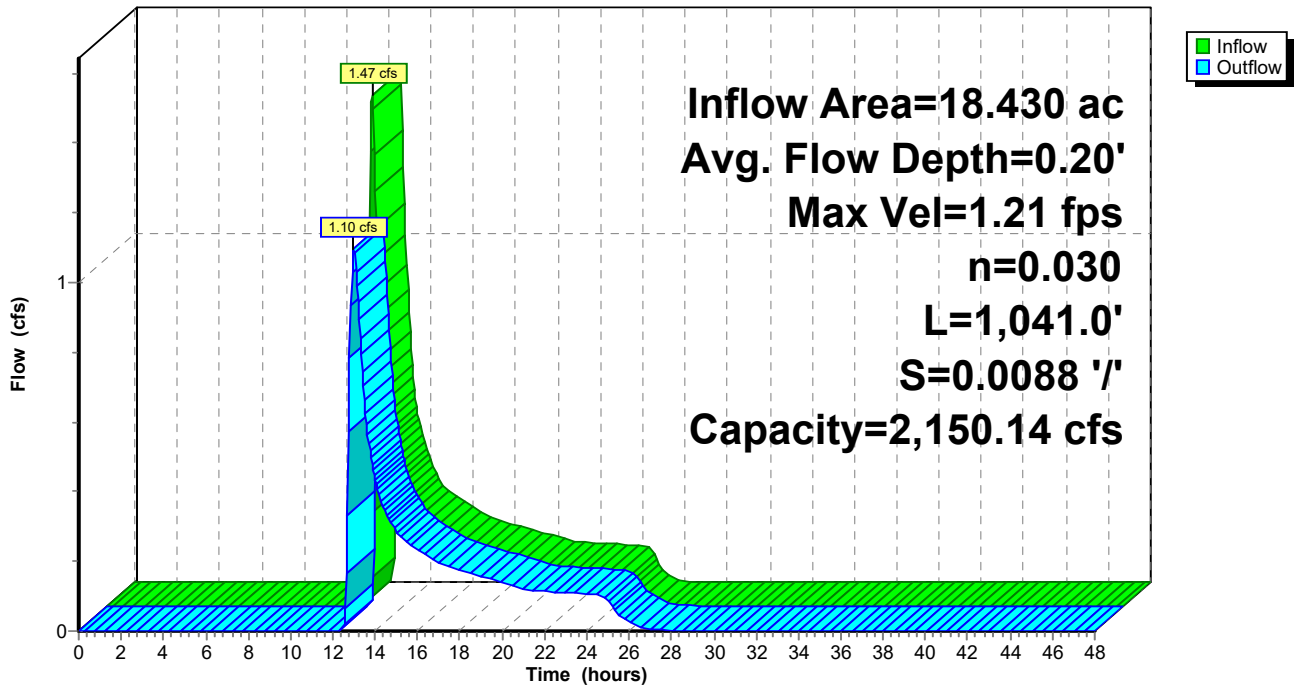
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.03	0.0	1.6	25	0.01
0.08	0.2	4.5	184	0.09
0.11	0.3	6.4	355	0.22
0.51	3.4	9.0	3,521	8.20
1.82	19.8	16.9	20,607	102.00
2.11	24.7	18.3	25,700	139.72
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

### Hydrograph



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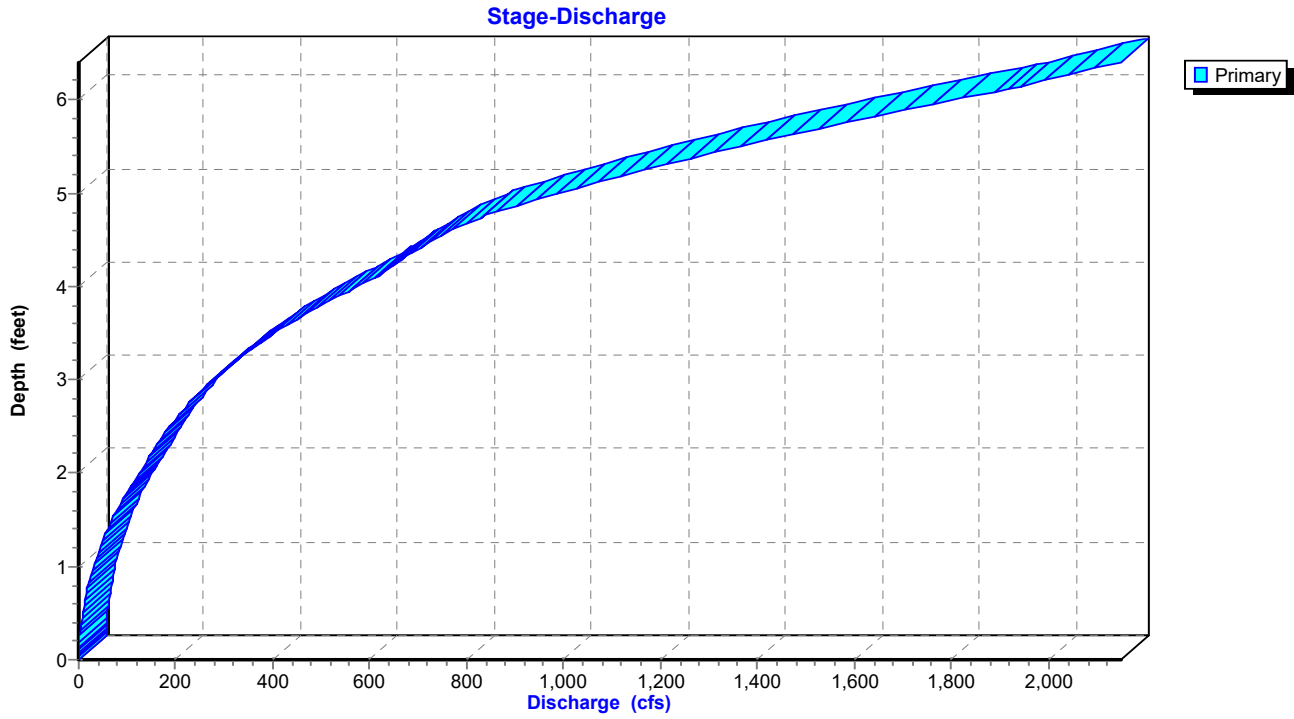
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**Reach 6R: Reach 3**





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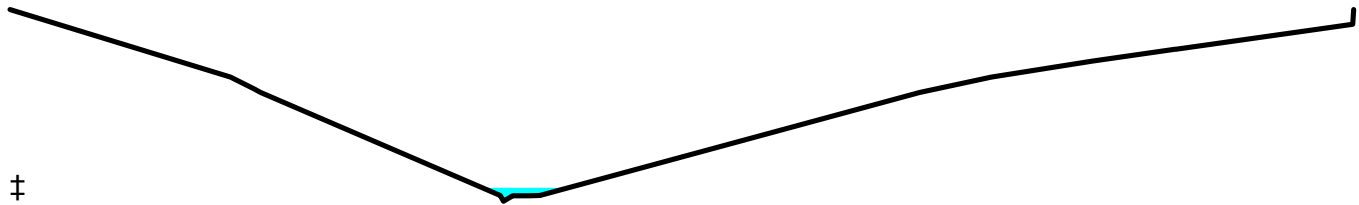
## Summary for Reach 7R: Reach 2

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 0.16" for WQV event  
Inflow = 1.90 cfs @ 12.27 hrs, Volume= 0.244 af  
Outflow = 1.47 cfs @ 12.53 hrs, Volume= 0.244 af, Atten= 23%, Lag= 16.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 1.65 fps, Min. Travel Time= 8.6 min  
Avg. Velocity = 0.84 fps, Avg. Travel Time= 16.9 min

Peak Storage= 764 cf @ 12.39 hrs  
Average Depth at Peak Storage= 0.23'  
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

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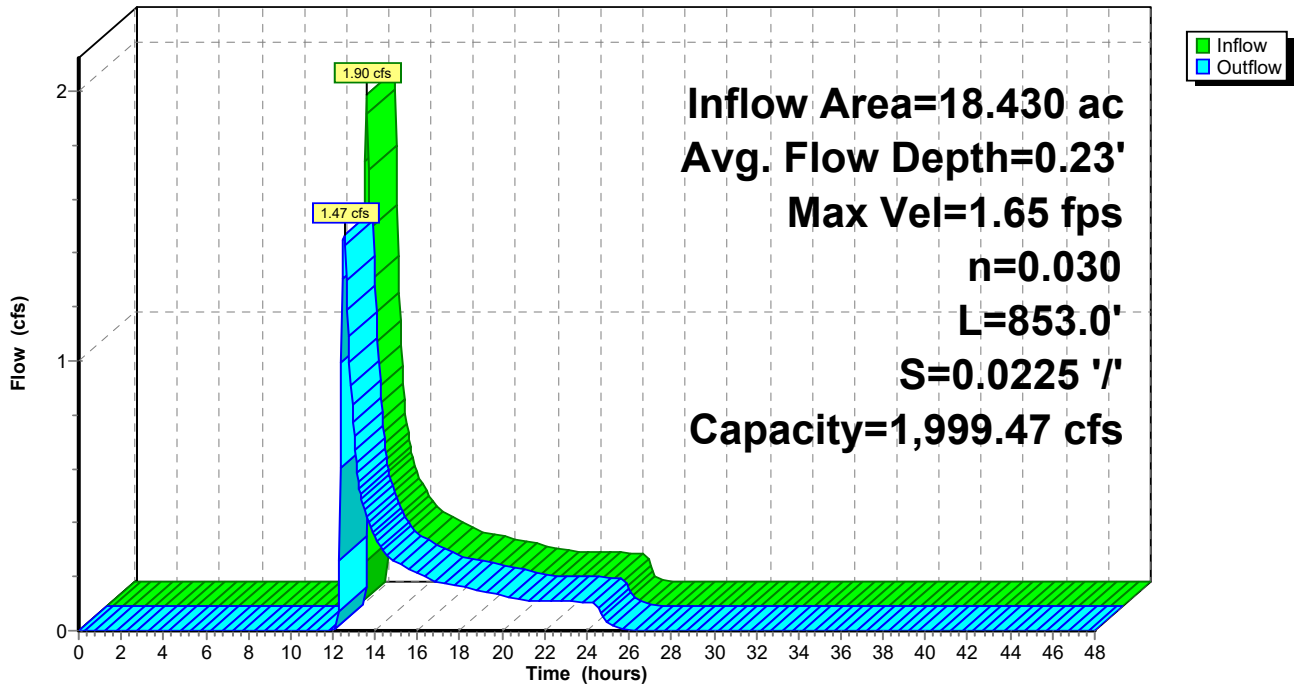
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Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.09	0.1	2.9	47	0.03
0.10	0.1	4.0	77	0.06
1.84	61.2	66.4	52,179	430.84
1.90	65.2	68.7	55,628	468.55
2.10	79.7	76.6	67,995	608.70
2.37	102.4	92.0	87,382	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

### Hydrograph



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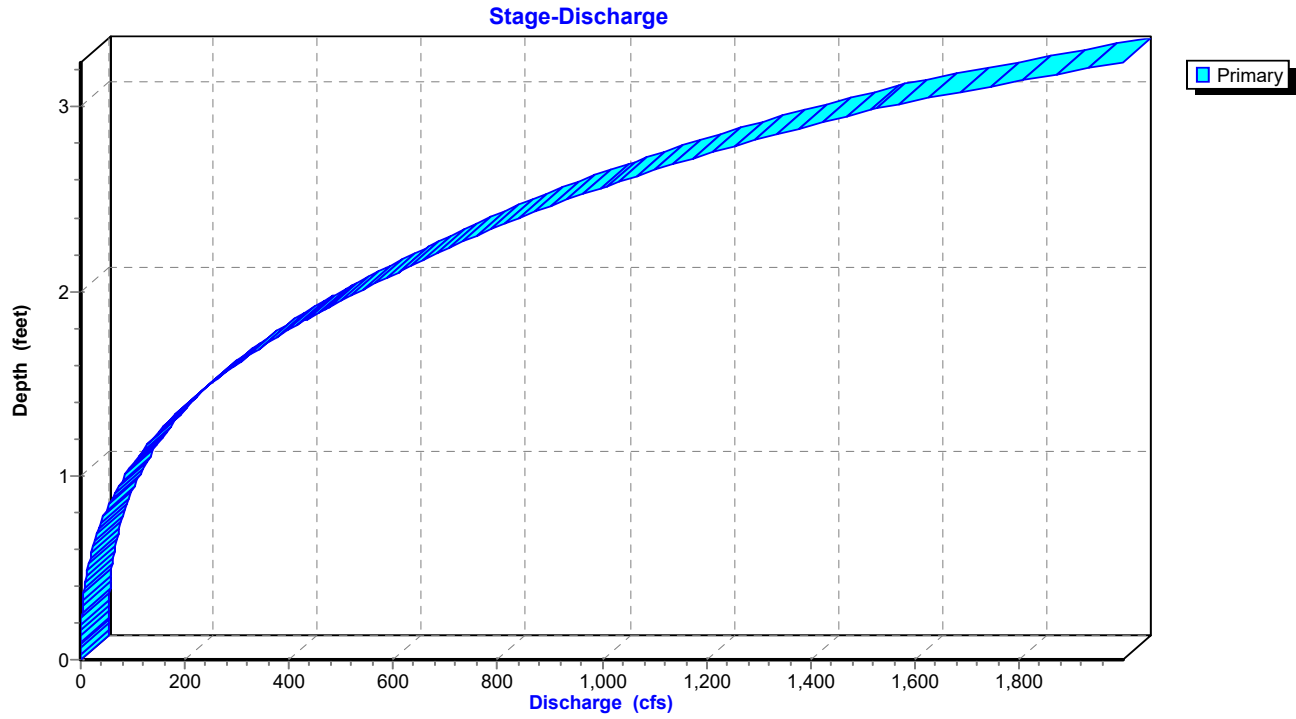
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## Reach 7R: Reach 2



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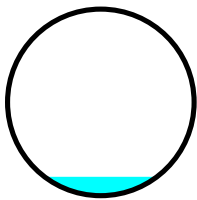
## Summary for Reach 8R: REACH 1 (through Pipe System)

Inflow Area = 18.430 ac, 0.00% Impervious, Inflow Depth = 0.16" for WQV event  
Inflow = 2.03 cfs @ 12.16 hrs, Volume= 0.244 af  
Outflow = 1.90 cfs @ 12.27 hrs, Volume= 0.244 af, Atten= 6%, Lag= 6.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Max. Velocity= 5.18 fps, Min. Travel Time= 3.4 min  
Avg. Velocity = 2.44 fps, Avg. Travel Time= 7.3 min

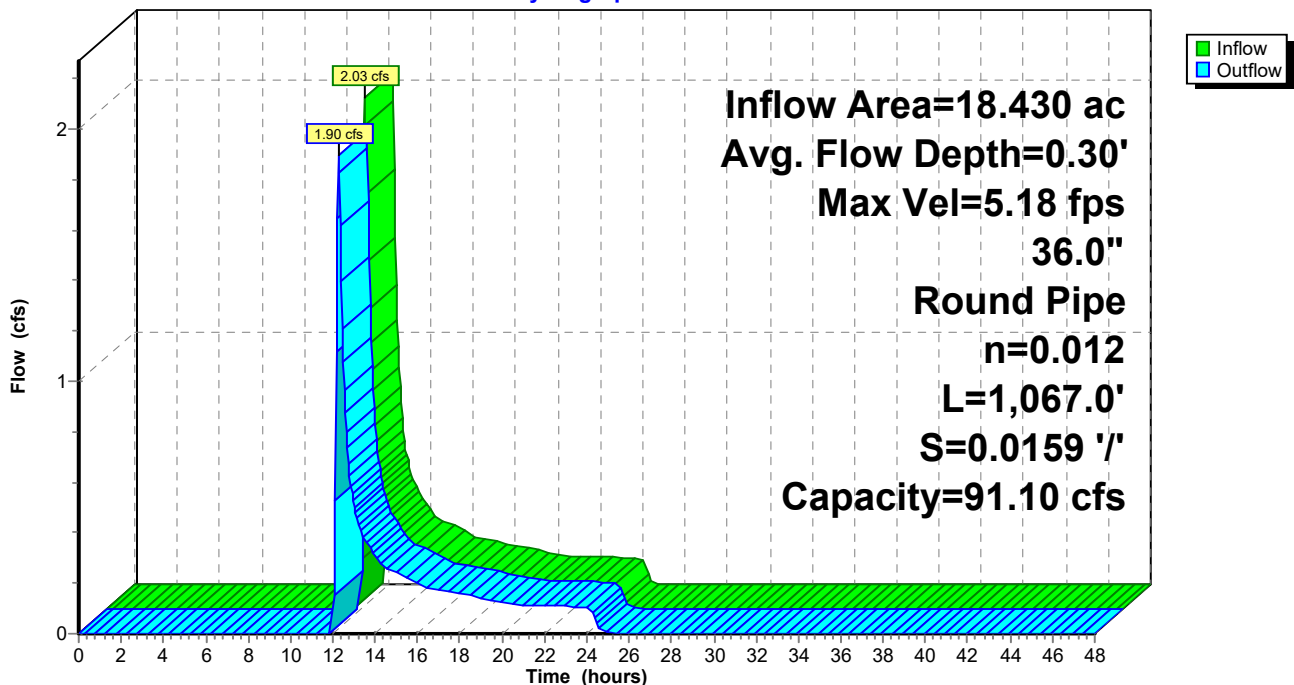
Peak Storage= 394 cf @ 12.21 hrs  
Average Depth at Peak Storage= 0.30'  
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 91.10 cfs

36.0" Round Pipe  
n= 0.012 Concrete pipe, finished  
Length= 1,067.0' Slope= 0.0159 '/'  
Inlet Invert= 1,021.96', Outlet Invert= 1,005.00'



## Reach 8R: REACH 1 (through Pipe System)

Hydrograph



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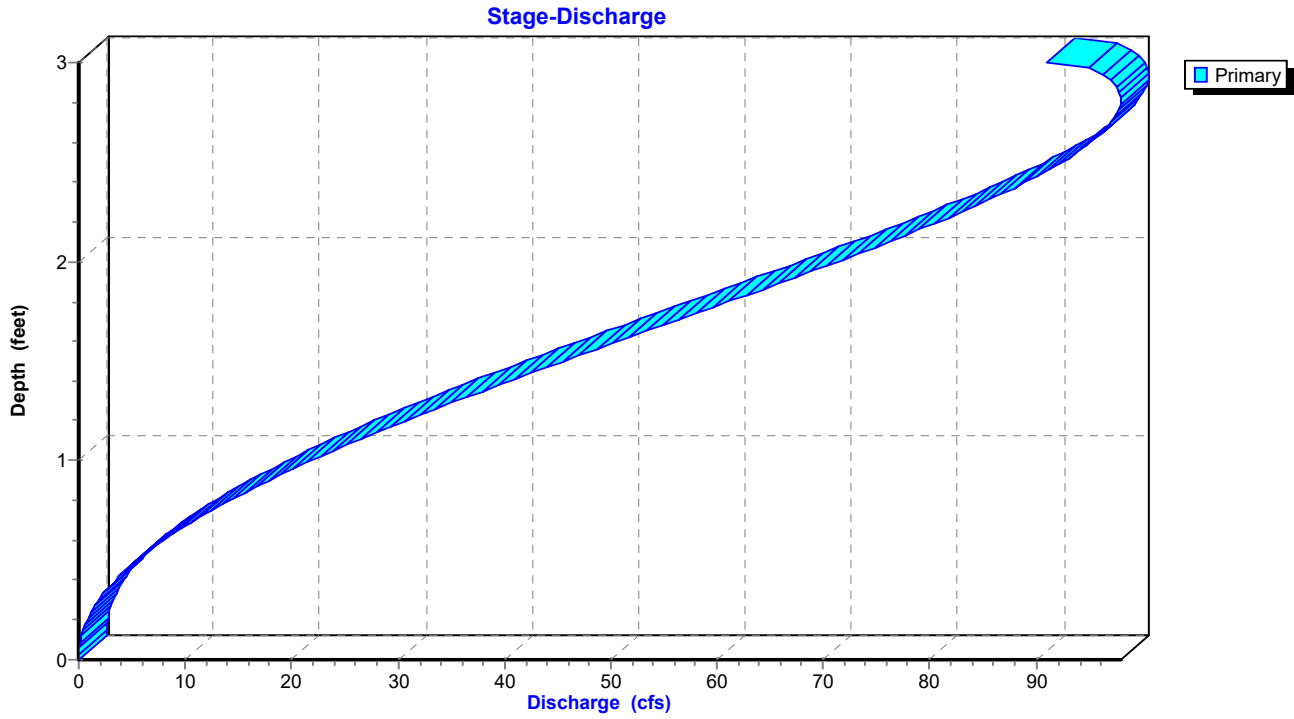
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**Reach 8R: REACH 1 (through Pipe System)**



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### Summary for Pond 4P: Eddb #1 Cornerstone

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth = 0.69" for WQV event  
 Inflow = 29.17 cfs @ 12.06 hrs, Volume= 1.830 af  
 Outflow = 0.54 cfs @ 19.36 hrs, Volume= 1.544 af, Atten= 98%, Lag= 437.9 min  
 Primary = 0.54 cfs @ 19.36 hrs, Volume= 1.544 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,000.17' @ 19.36 hrs Surf.Area= 28,490 sf Storage= 55,660 cf

Plug-Flow detention time= 957.6 min calculated for 1.542 af (84% of inflow)  
 Center-of-Mass det. time= 886.9 min ( 1,723.7 - 836.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	995.67'	374,566 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.67	0	0	0
996.00	700	116	116
997.00	7,200	3,950	4,066
998.00	12,000	9,600	13,666
999.00	17,900	14,950	28,616
1,000.00	27,000	22,450	51,066
1,001.00	36,000	31,500	82,566
1,002.00	40,000	38,000	120,566
1,003.00	44,800	42,400	162,966
1,004.00	48,700	46,750	209,716
1,005.00	53,000	50,850	260,566
1,006.00	57,000	55,000	315,566
1,007.00	61,000	59,000	374,566

Device	Routing	Invert	Outlet Devices
#1	Primary	993.54'	<b>30.0" Round 30" Culvert</b> L= 87.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 993.54' / 993.11' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	994.16'	<b>2.9" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	994.36'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 994.36' / 994.16' S= 0.0100 '/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#4	Device 3	995.67'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 9 rows with 4.0" cc spacing C= 0.600
#5	Device 1	1,001.05'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	1,004.00'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

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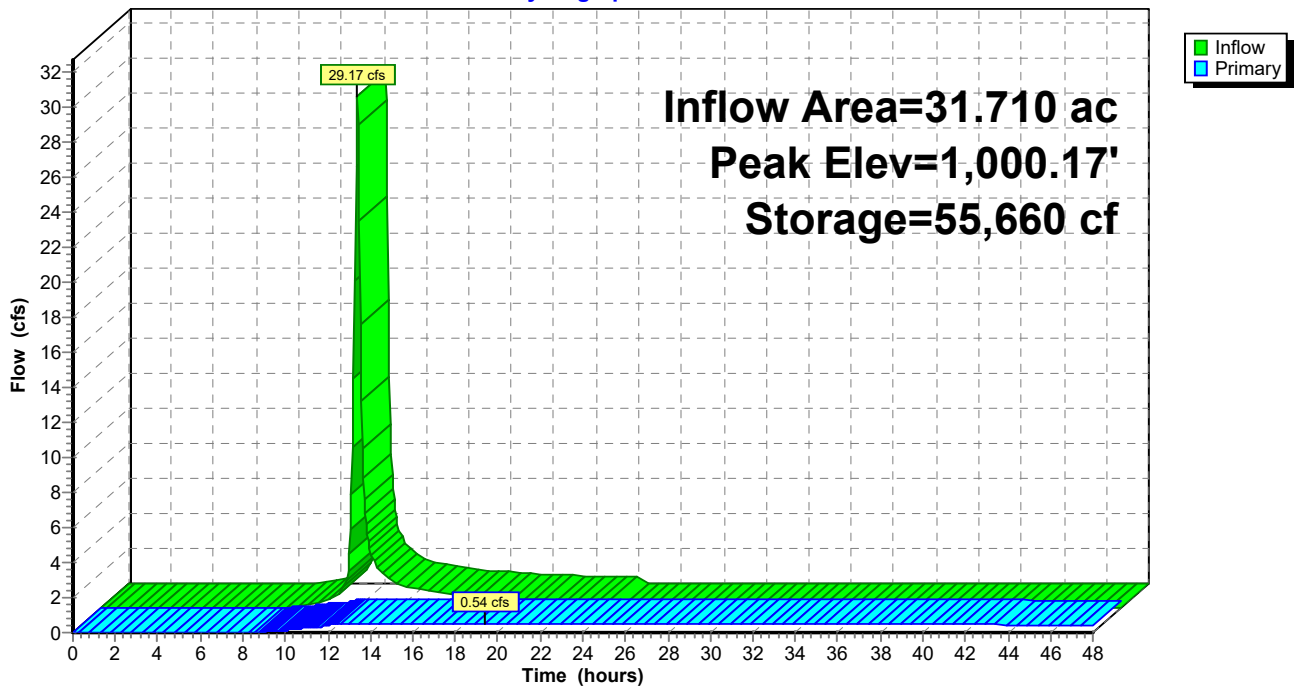
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**Primary OutFlow Max=0.54 cfs @ 19.36 hrs HW=1,000.17' (Free Discharge)**

- 1=30" Culvert (Passes 0.54 cfs of 54.80 cfs potential flow)
- 2=WQ Orifice (Orifice Controls 0.54 cfs @ 11.68 fps)
- 3=8" PVC Pipe (Passes 0.54 cfs of 4.45 cfs potential flow)
- 4=Riser Pipe (Passes 0.54 cfs of 3.31 cfs potential flow)
- 5=Opening in Box ( Controls 0.00 cfs)
- 6=Open Top of Box ( Controls 0.00 cfs)

## Pond 4P: EDDB #1 Cornerstone

Hydrograph



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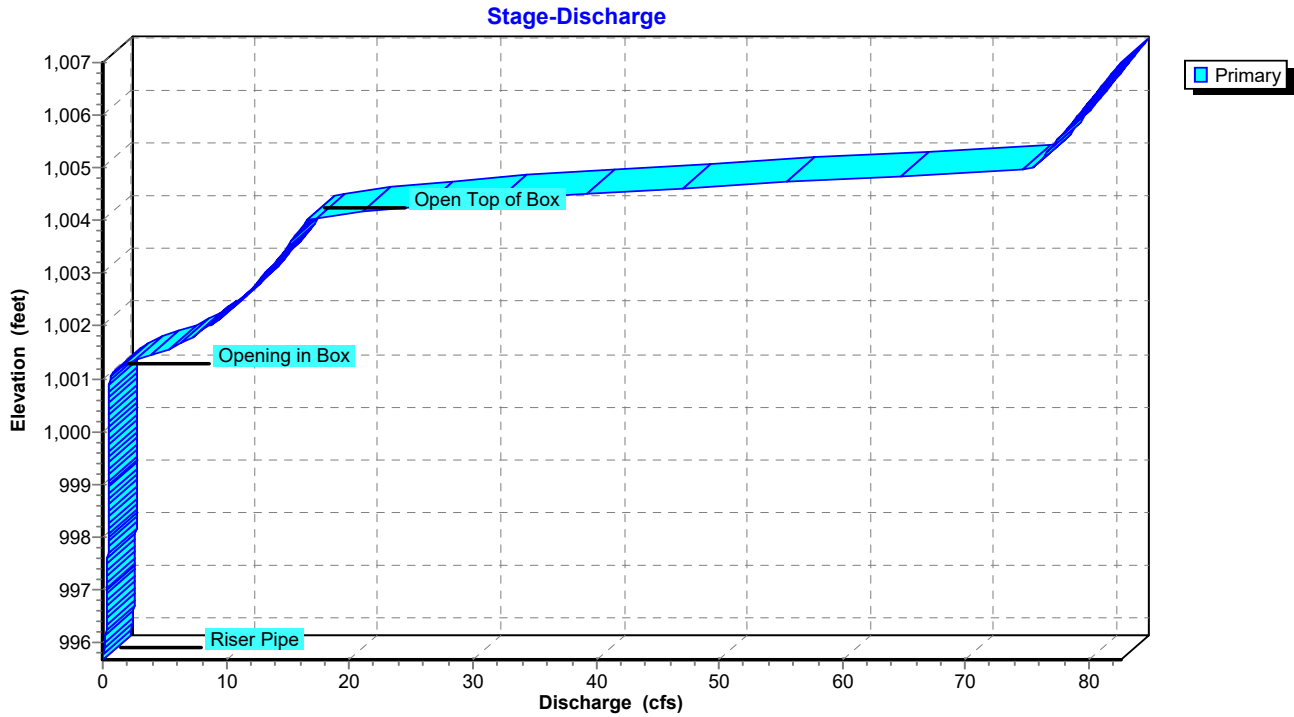
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## Pond 4P: Eddb #1 Cornerstone





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### Summary for Pond 5P: Eddb #2 Manor

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth = 0.45" for WQV event  
 Inflow = 17.13 cfs @ 12.07 hrs, Volume= 1.107 af  
 Outflow = 0.39 cfs @ 19.53 hrs, Volume= 1.083 af, Atten= 98%, Lag= 447.7 min  
 Primary = 0.39 cfs @ 19.53 hrs, Volume= 1.083 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 992.24' @ 19.53 hrs Surf.Area= 25,419 sf Storage= 31,748 cf

Plug-Flow detention time= 890.2 min calculated for 1.083 af (98% of inflow)  
 Center-of-Mass det. time= 878.1 min ( 1,743.6 - 865.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	988.16'	352,236 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
988.16	0	0	0
989.00	800	336	336
990.00	4,200	2,500	2,836
991.00	10,400	7,300	10,136
992.00	21,600	16,000	26,136
993.00	37,600	29,600	55,736
994.00	41,700	39,650	95,386
995.00	46,000	43,850	139,236
996.00	49,700	47,850	187,086
997.00	53,200	51,450	238,536
998.00	56,900	55,050	293,586
999.00	60,400	58,650	352,236

Device	Routing	Invert	Outlet Devices
#1	Primary	986.00'	<b>30.0" Round 30" Culvert</b> L= 77.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.00' / 985.62' S= 0.0049 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	986.62'	<b>2.5" Vert. WQ Orifice</b> C= 0.600
#3	Device 2	986.86'	<b>8.0" Round 8" PVC Pipe</b> L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.86' / 986.62' S= 0.0120 '/ Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#4	Device 3	988.16'	<b>1.0" Vert. Riser Pipe X 8.00 columns</b> X 8 rows with 4.0" cc spacing C= 0.600
#5	Device 1	993.40'	<b>48.0" W x 6.0" H Vert. Opening in Box</b> C= 0.600
#6	Device 1	995.25'	<b>60.0" x 48.0" Horiz. Open Top of Box</b> C= 0.600 Limited to weir flow at low heads

# 21-130-HYDRO-PRO orifice plate option

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Bailey Farms - Developed  
Type II 24-hr WQV Rainfall=1.37"

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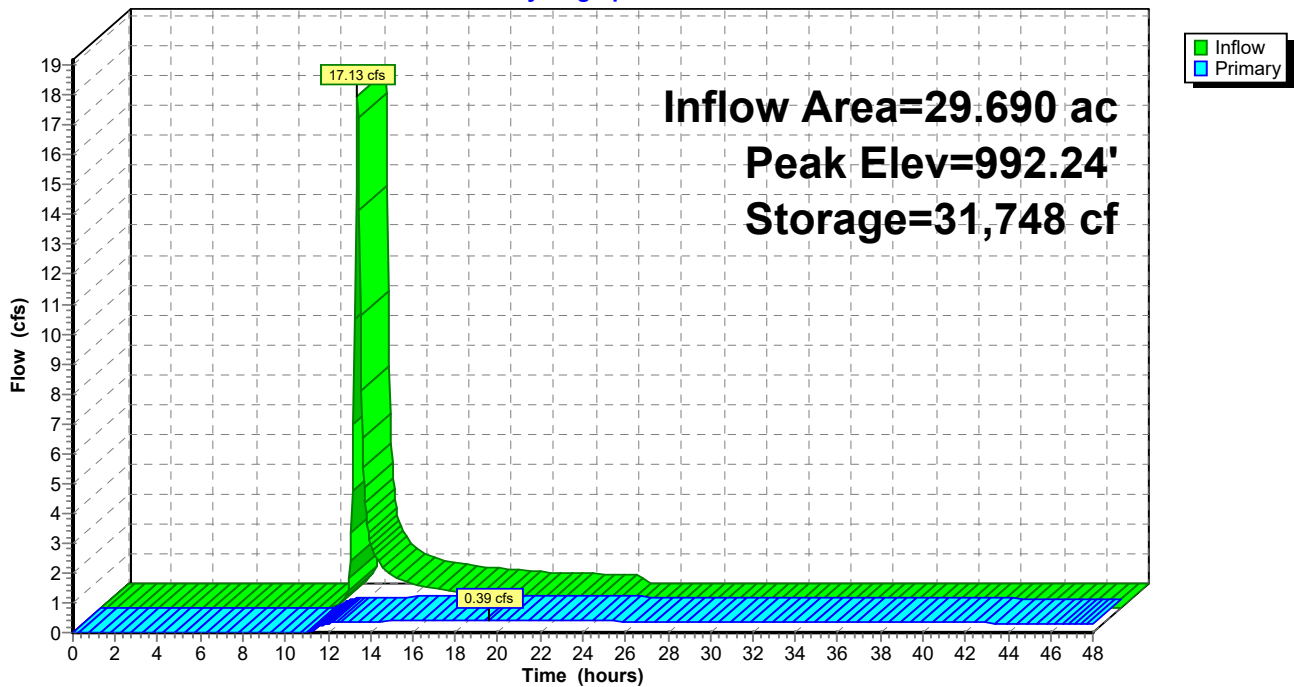
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**Primary OutFlow Max=0.39 cfs @ 19.53 hrs HW=992.24' (Free Discharge)**

- 1=30" Culvert (Passes 0.39 cfs of 52.79 cfs potential flow)
- 2=WQ Orifice (Orifice Controls 0.39 cfs @ 11.31 fps)
- 3=8" PVC Pipe (Passes 0.39 cfs of 3.78 cfs potential flow)
- 4=Riser Pipe (Passes 0.39 cfs of 2.82 cfs potential flow)
- 5=Opening in Box ( Controls 0.00 cfs)
- 6=Open Top of Box ( Controls 0.00 cfs)

## Pond 5P: EDDB #2 Manor

Hydrograph



# 21-130-HYDRO-PRO orifice plate option

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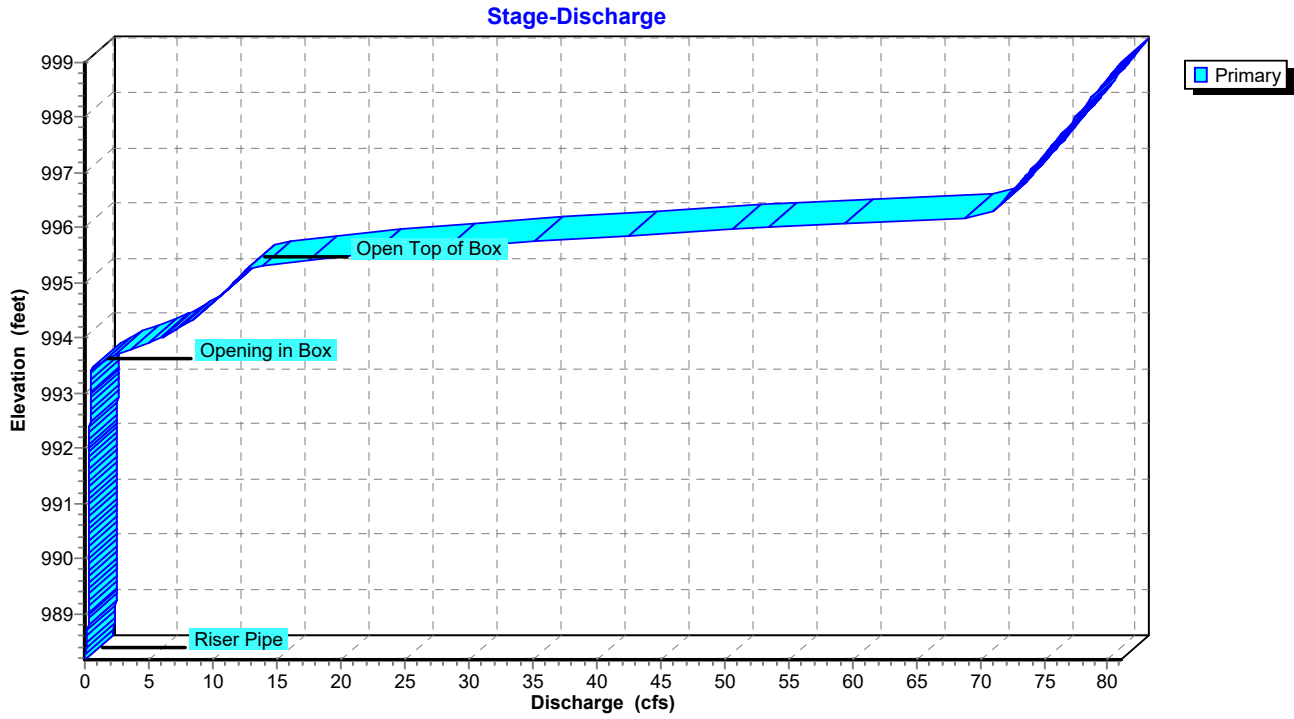
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## Pond 5P: EDDB #2 Manor



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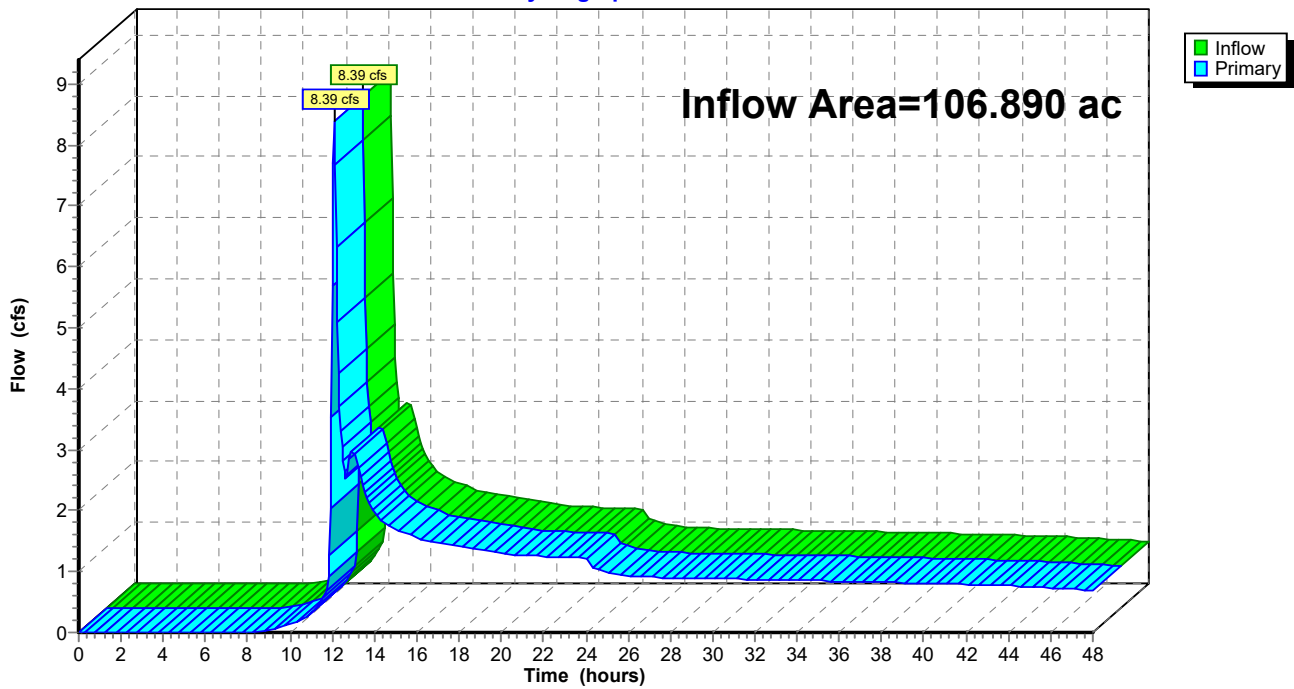
## Summary for Link 2L: RP-1

Inflow Area = 106.890 ac, 20.71% Impervious, Inflow Depth > 0.39" for WQV event  
Inflow = 8.39 cfs @ 12.10 hrs, Volume= 3.473 af  
Primary = 8.39 cfs @ 12.10 hrs, Volume= 3.473 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

Hydrograph



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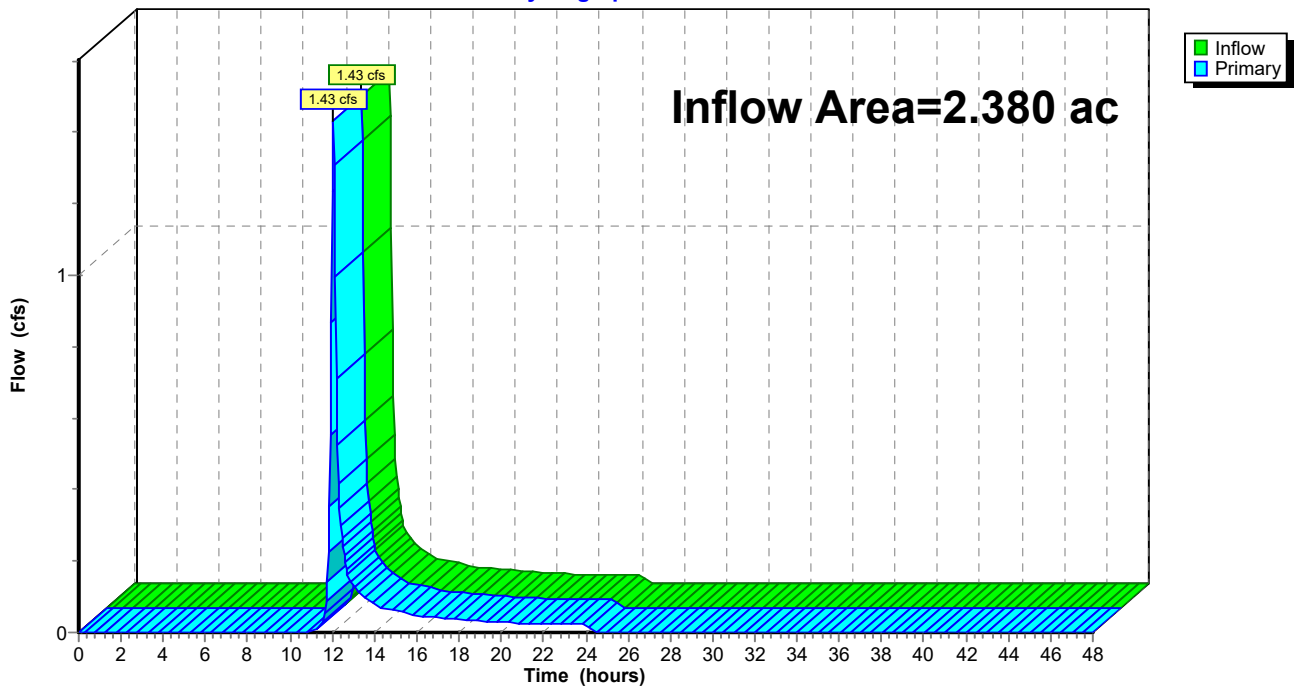
## Summary for Link 3L: RP-2

Inflow Area = 2.380 ac, 38.00% Impervious, Inflow Depth = 0.45" for WQV event  
Inflow = 1.43 cfs @ 12.06 hrs, Volume= 0.089 af  
Primary = 1.43 cfs @ 12.06 hrs, Volume= 0.089 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

Hydrograph



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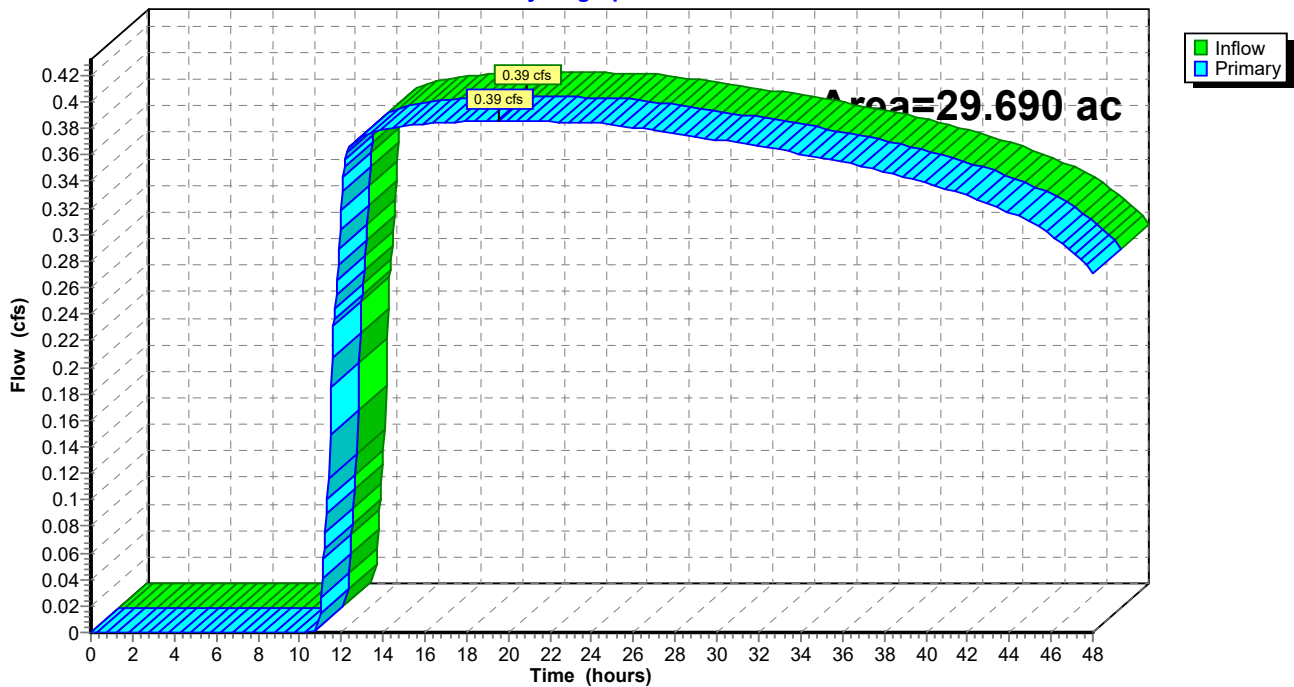
## Summary for Link 4L: RP-3

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth > 0.44" for WQV event  
Inflow = 0.39 cfs @ 19.53 hrs, Volume= 1.083 af  
Primary = 0.39 cfs @ 19.53 hrs, Volume= 1.083 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

Hydrograph



# 21-130-HYDRO-PRO orifice plate option

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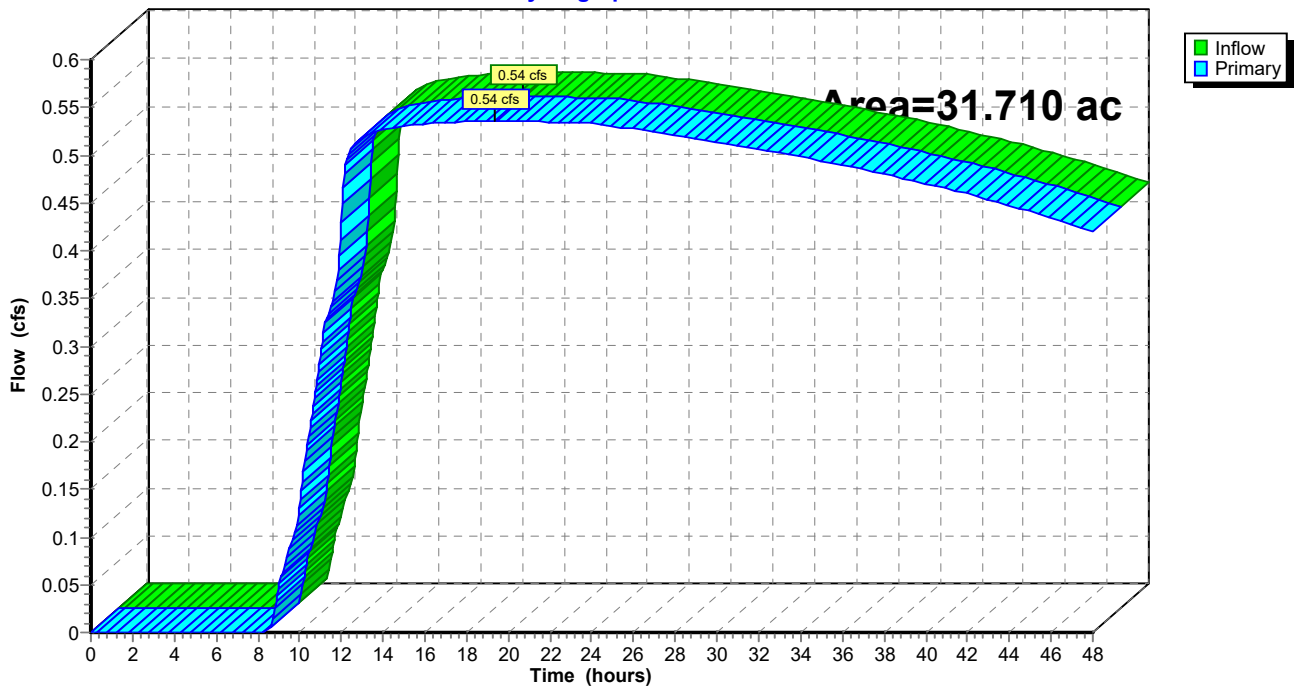
## Summary for Link 5L: RP-4

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth > 0.58" for WQV event  
Inflow = 0.54 cfs @ 19.36 hrs, Volume= 1.544 af  
Primary = 0.54 cfs @ 19.36 hrs, Volume= 1.544 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

Hydrograph

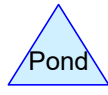
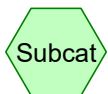
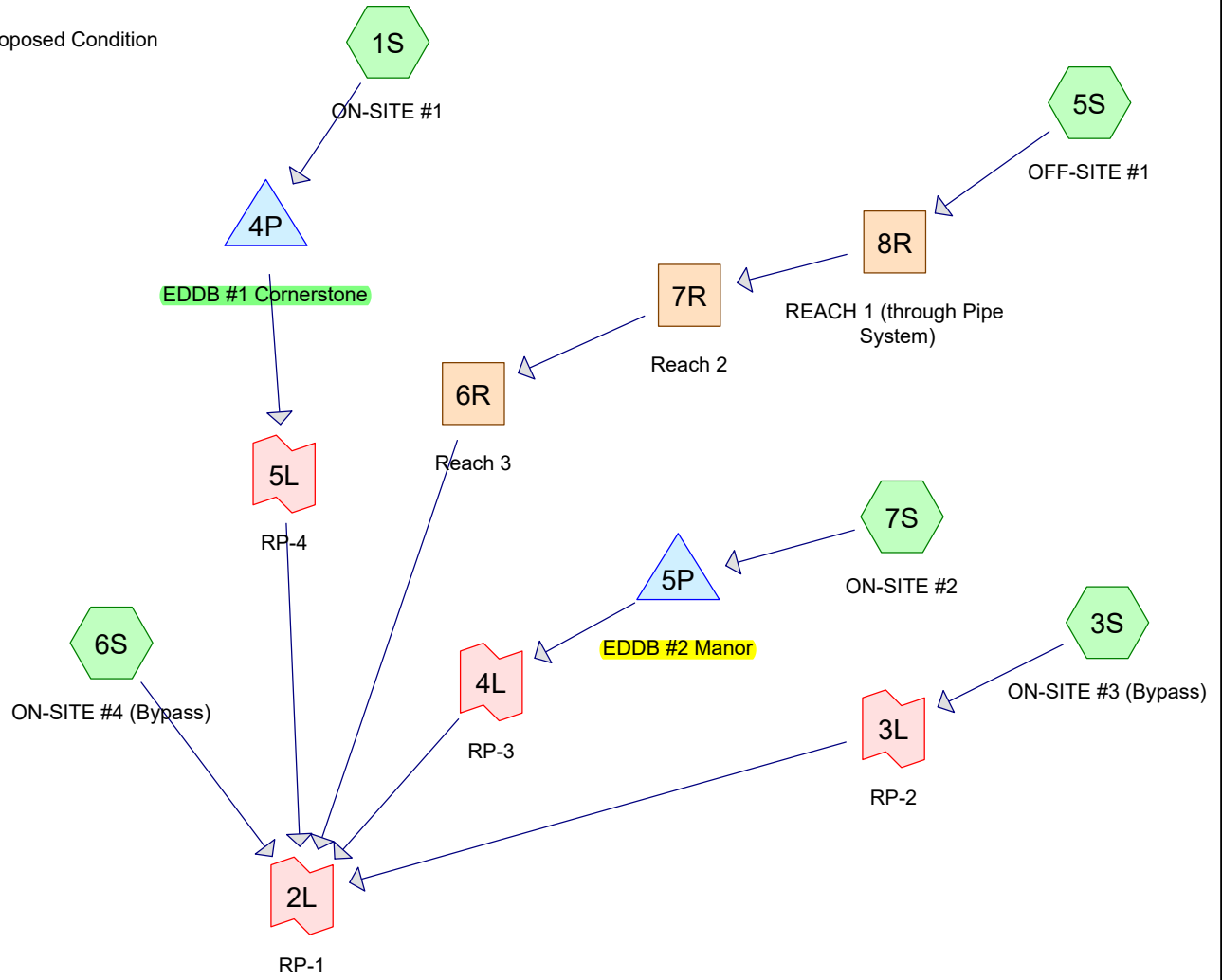


HydroCAD - Clogged Conditions



# HydroCAD - Clogged Conditions

Proposed Condition



Routing Diagram for 21-130-HYDRO-PRO orifice plate option Clogged

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**21-130-HYDRO-PRO orifice plate option Clogged**

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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
32.070	87	1/4 acre lots, 38% imp, HSG D (3S, 7S)
11.140	92	1/8 acre lots, 65% imp, HSG D (1S)
22.730	80	>75% Grass cover, Good, HSG D (6S)
19.330	92	Duplex/Townhomes (1S)
3.190	95	Urban commercial, 85% imp, HSG D (1S, 6S)
15.640	76	Woods/grass comb., Fair, HSG C (5S)
2.790	82	Woods/grass comb., Fair, HSG D (5S)

**21-130-HYDRO-PRO orifice plate option Clogged**

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**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
15.640	HSG C	5S
71.920	HSG D	1S, 3S, 5S, 6S, 7S
19.330	Other	1S

**21-130-HYDRO-PRO orifice plate option Clogged**

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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	32.070	0.000	32.070	1/4 acre lots, 38% imp	3S, 7S
0.000	0.000	0.000	11.140	0.000	11.140	1/8 acre lots, 65% imp	1S
0.000	0.000	0.000	22.730	0.000	22.730	>75% Grass cover, Good	6S
0.000	0.000	0.000	0.000	19.330	19.330	Duplex/Townhomes	1S
0.000	0.000	0.000	3.190	0.000	3.190	Urban commercial, 85% imp	1S, 6S
0.000	0.000	15.640	2.790	0.000	18.430	Woods/grass comb., Fair	5S

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Pond 4P: EDDB #1 Cornerstone** Peak Elev=1,007.64' Storage=414,456 cf Inflow=260.19 cfs 17.828 af  
Outflow=254.01 cfs 17.828 af

**Pond 5P: EDDB #2 Manor** Peak Elev=998.91' Storage=347,072 cf Inflow=232.03 cfs 15.236 af  
Outflow=224.75 cfs 15.236 af

**21-130-HYDRO-PRO orifice plate option Clogged**

Bailey Farms - 100 yr Clogged  
Type II 24-hr 100-Year Rainfall=7.70"

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**Summary for Pond 4P: Eddb #1 Cornerstone**

Inflow Area = 31.710 ac, 26.16% Impervious, Inflow Depth = 6.75" for 100-Year event  
 Inflow = 260.19 cfs @ 12.05 hrs, Volume= 17.828 af  
 Outflow = 254.01 cfs @ 12.08 hrs, Volume= 17.828 af, Atten= 2%, Lag= 1.5 min  
 Primary = 254.01 cfs @ 12.08 hrs, Volume= 17.828 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Starting Elev= 1,007.14' Surf.Area= 61,714 sf Storage= 383,155 cf

Peak Elev= 1,007.64' @ 12.08 hrs Surf.Area= 64,249 sf Storage= 414,456 cf (31,300 cf above start)

Plug-Flow detention time= 239.8 min calculated for 9.032 af (51% of inflow)

Center-of-Mass det. time= 3.8 min ( 777.7 - 773.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	995.67'	482,088 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.67	0	0	0
996.00	700	115	115
997.00	7,200	3,950	4,065
998.00	12,000	9,600	13,665
999.00	17,900	14,950	28,615
1,000.00	27,000	22,450	51,065
1,001.00	36,000	31,500	82,565
1,002.00	40,000	38,000	120,565
1,003.00	44,800	42,400	162,965
1,004.00	48,700	46,750	209,715
1,005.00	53,000	50,850	260,565
1,006.00	57,000	55,000	315,566
1,007.00	61,000	59,000	374,566
1,008.00	66,100	63,550	438,116
1,008.65	69,200	43,972	482,088

Device	Routing	Invert	Outlet Devices
#1	Primary	1,007.14'	<b>Asymmetrical Weir, C= 3.33</b> Offset (feet) 0.00 4.50 220.50 225.00 Height (feet) 1.50 0.00 0.00 1.50

**Primary OutFlow** Max=248.51 cfs @ 12.08 hrs HW=1,007.63' (Free Discharge)

↑1=Asymmetrical Weir (Weir Controls 248.51 cfs @ 2.31 fps)

# 21-130-HYDRO-PRO orifice plate option Clogged

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Bailey Farms - 100 yr Clogged

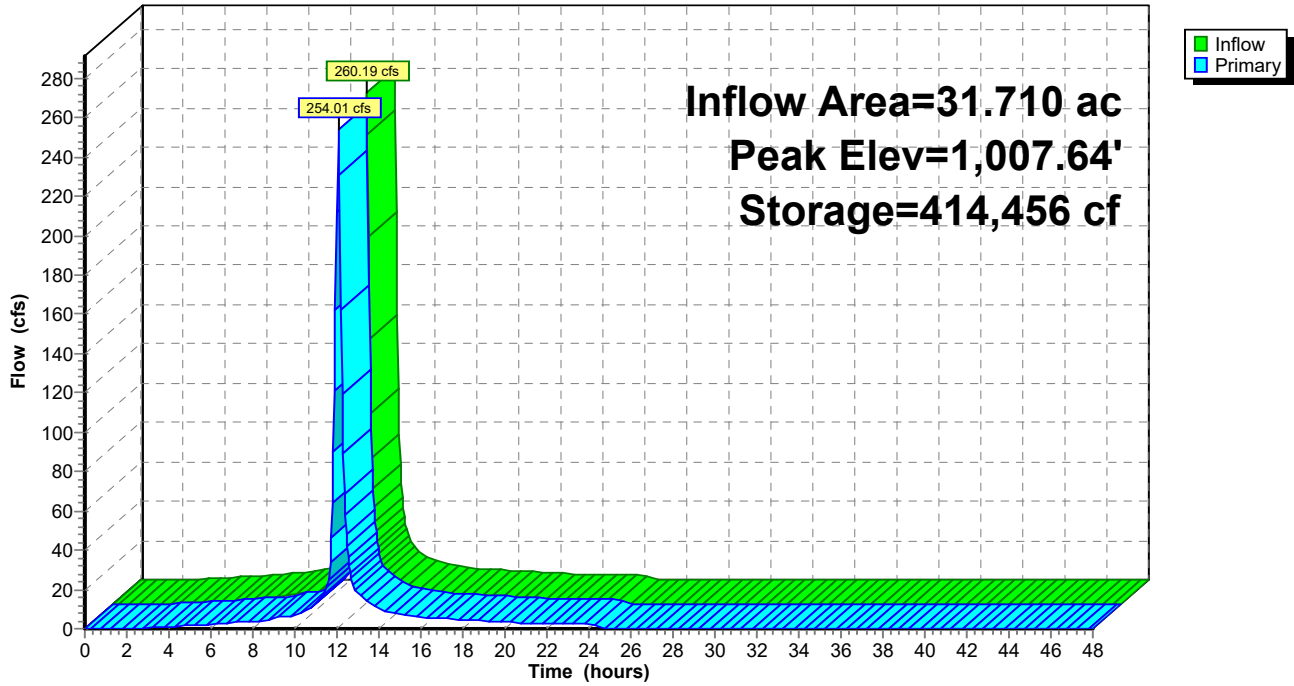
Type II 24-hr 100-Year Rainfall=7.70"

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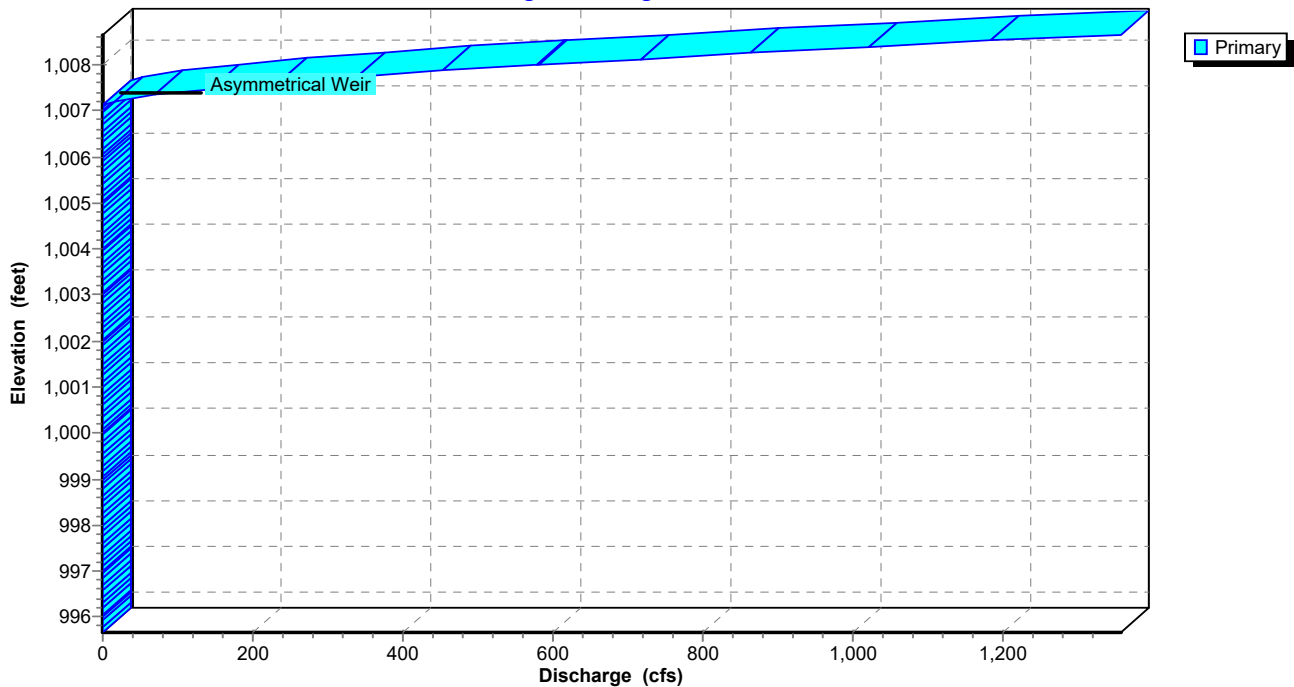
## Pond 4P: Eddb #1 Cornerstone

Hydrograph



## Pond 4P: Eddb #1 Cornerstone

Stage-Discharge



**21-130-HYDRO-PRO orifice plate option Clogged**

Bailey Farms - 100 yr Clogged  
 Type II 24-hr 100-Year Rainfall=7.70"

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**Summary for Pond 5P: Eddb #2 Manor**

Inflow Area = 29.690 ac, 38.00% Impervious, Inflow Depth = 6.16" for 100-Year event  
 Inflow = 232.03 cfs @ 12.05 hrs, Volume= 15.236 af  
 Outflow = 224.75 cfs @ 12.08 hrs, Volume= 15.236 af, Atten= 3%, Lag= 1.7 min  
 Primary = 224.75 cfs @ 12.08 hrs, Volume= 15.236 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Starting Elev= 998.36' Surf.Area= 58,160 sf Storage= 314,297 cf

Peak Elev= 998.91' @ 12.08 hrs Surf.Area= 60,100 sf Storage= 347,072 cf (32,775 cf above start)

Plug-Flow detention time= 222.9 min calculated for 8.020 af (53% of inflow)

Center-of-Mass det. time= 4.4 min ( 794.5 - 790.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	988.16'	352,236 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
988.16	0	0	0
989.00	800	336	336
990.00	4,200	2,500	2,836
991.00	10,400	7,300	10,136
992.00	21,600	16,000	26,136
993.00	37,600	29,600	55,736
994.00	41,700	39,650	95,386
995.00	46,000	43,850	139,236
996.00	49,700	47,850	187,086
997.00	53,200	51,450	238,536
998.00	56,900	55,050	293,586
999.00	60,400	58,650	352,236

Device	Routing	Invert	Outlet Devices
#1	Primary	998.36'	<b>Asymmetrical Weir, C= 3.27</b> Offset (feet) 0.00 4.50 169.50 174.00 Height (feet) 1.50 0.00 0.00 1.50

**Primary OutFlow** Max=220.16 cfs @ 12.08 hrs HW=998.91' (Free Discharge)

↑1=Asymmetrical Weir (Weir Controls 220.16 cfs @ 2.39 fps)



# 21-130-HYDRO-PRO orifice plate option Clogged

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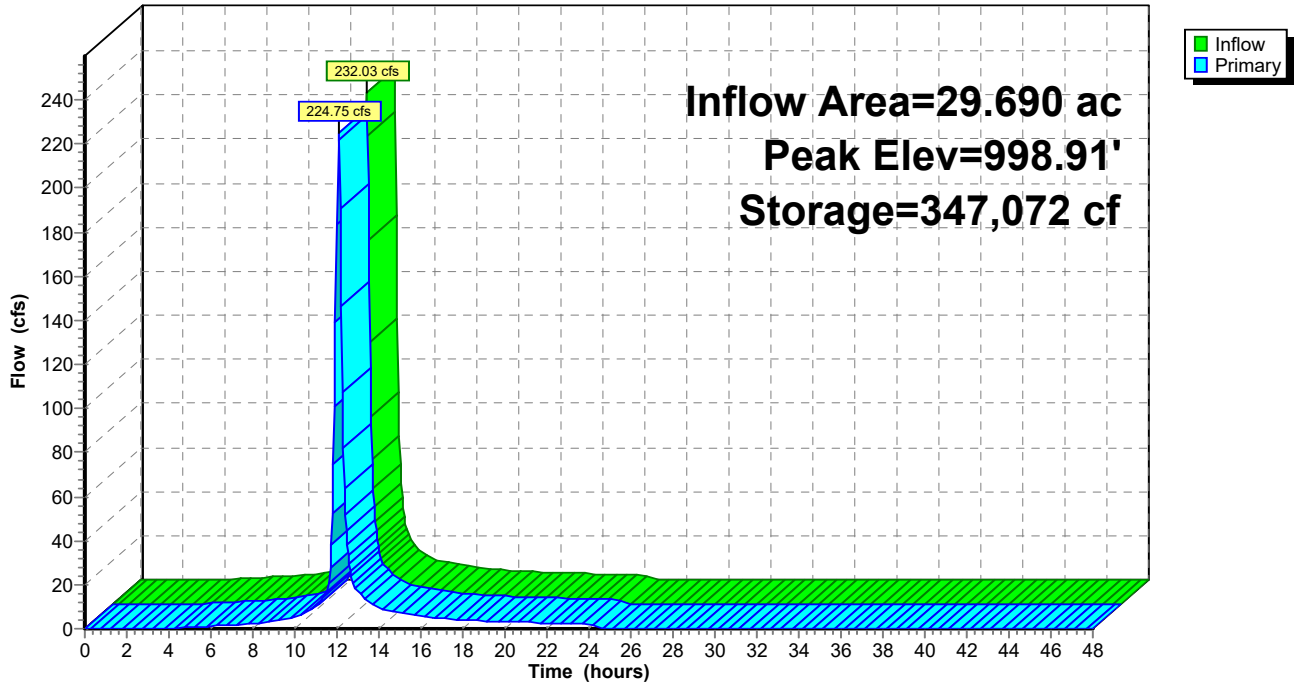
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Type II 24-hr 100-Year Rainfall=7.70"

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## Pond 5P: EDDB #2 Manor

Hydrograph



## Pond 5P: EDDB #2 Manor

Stage-Discharge

