Holistic Hydrologic and Hydraulic Evaluation for Forbush Mill Road Culverts

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Section 1
Introduction

Tighe & Bond prepared a hydrologic and hydraulic analysis of four Forbush Mill Road culverts. The culverts are located over the Still River between Main Street (Route 117) and Forbush Fields. The primary reasons for performing the hydrologic and hydraulic analysis were to:

- Evaluate the hydraulics of the existing culverts.
- Develop a proposed scenario with all crossings passing the 10-year frequency storm event with freeboard (Alternative 1).
- Develop a proposed scenario with all crossings meeting the stream crossing standards (Alternative 2).
- Develop a proposed scenario with Crossing 2 passing climate change scenarios in 2100 and meeting the stream crossing standards, while existing conditions at Crossings 1, 3, and 4 remain in place (Alternative 3, the proposed design for the FEMA Hazard Mitigation Grant).

The existing Forbush Mill Road culvert crossings are numbered 1 through 4 from east (upstream) to west (downstream). At Crossings 1 and 2, a 9.9-foot wide box culvert can pass the 10-year frequency storm event with freeboard. At Crossings 3 and 4, a 14-foot span bridge can pass the 10-year frequency storm event with freeboard. At all culvert crossing locations, a 14-foot span bridge opening completely meets stream crossing standards. A 16-foot span bridge opening at Crossing 2 would pass the present 100-year frequency storm event and a 50-year storm event in 2100.

Attachment A contains figures depicting an aerial overview of the Forbush Mill Road Culverts (Figure 1), a topographic map of the drainage-area (Figure 2), the geometry used to define the cross-sections in the HEC-RAS model (Figure 3), and inundation mapping for Alternative 3 (Figure 4). Attachment B contains the HydroCAD model output. Attachment C contains the HEC-RAS model output for the existing and proposed alterative conditions. Attachment D contains Opinions of Probable Construction Costs for proposed alternatives.

Section 2
Project Site Description

2.1 Existing Structures

Forbush Mill Road crosses the Still River at four locations, numbered 1 through 4 from east (upstream) to west (downstream). The location of each structure is shown on Figure 1 in Attachment A. Culverts at the four locations are undersized and do not meet the Massachusetts River and Stream Crossing Standards (MARSCS), which suggest an open width of 1.2 times the stream bankfull width.

The four existing culverts crossing under Forbush Mill Road can be described as follows:

- The existing culvert at Crossing 1 consists of two corrugated metal pipes, both 30-inch diameter, and a stone masonry headwall. Streamflow from the Still River is conveyed through the pipes and into a small impoundment, which appears to be storage for a dry hydrant, then continues west.
- The existing culvert at Crossing 2 consists of two corrugated HDPE pipes with precast concrete headwalls, 36-inch and 24-inch diameter. The existing crossing was installed several years ago as part of a temporary culvert replacement. The 36-inch diameter pipe conveys streamflow from the Still River, while the 24-inch diameter pipe is intended to be a stream bypass during the permanent replacement of the culvert. The temporary culvert is undersized for streamflow and has become undermined at the downstream end due to the temporary nature of their construction.
- The existing culvert at Crossing 3 consists of three PVC pipes, two 18-inch diameter and one 6-inch diameter. One of the 18-inch diameter pipes appears to have been sliplined with HDPE pipe. Streamflow from the Still River is conveyed through the pipes and continues west.
- The existing culvert at Crossing 4 consists of one cast iron pipe, sized 36” diameter, retrofitted with an HDPE apron at the upstream invert. Streamflow from the Still River is conveyed through the pipe and continues west.

2.1.1 Waterway at Crossing Locations

The Still River is a tributary of the Nashua River, with a bankfull width of 11.0 feet. Stream flow is generally from east to west along Forbush Mill Road. The brook is generally bending upstream and downstream of the crossings. Upstream (east) of the Forbush Mill Road crossings is a culvert crossing through Main Street (Route 117). Downstream (west) of the Forbush Mill Road crossings are two additional crossings through Sand Road and Lower Bolton Road (Route 110). These culvert crossings also constrain the Still River channel upstream and downstream of the Forbush Mill Road crossings.

2.1.2 Highway Conveyed

Forbush Mill Road is not part of the National Highway System. Rather, it is a locally owned and operated roadway serving a residential area in town. The most recent available Annual Average Daily Traffic (AADT), provided by MassDOT, indicates an AADT of 584 vehicles

per day, with no information regarding truck percentages. MassDOT classifies Forbush Mill Road as a Rural Minor Collector and notes its speed limit as 30 MPH.

2.1.3 Adjacent Land Uses

The areas adjacent to Forbush Mill Road primarily comprise forested and grassland areas as shown on the MassGIS Land Use (2016) and MassGIS 2019 Ortho-imagery.

2.1.4 Special Site Considerations

The four Forbush Mill Road culverts are located in a Zone X 0.2-percent annual chance flood zone (i.e., the 500-year frequency storm event flood zone) Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA) as shown on Flood Insurance Rate Map (FIRM) 25027C0459E. The Flood Insurance Study (FIS) for Worcester County Massachusetts (effective July 16, 2014) notes that flooding for this reach is controlled by the Nashua River and that hydraulic modeling for this reach of the Still River is not available. As a result, available model data is not available from FEMA to develop the hydrologic or hydraulic models.

2.1.5 Bankfull Width

The bankfull width was determined using field measurements and regression estimates. Wetland flags were placed at the bank lines and field measurements were taken in April 2022. Four bankfull width measurements, ranging from 8.0 feet to 14.5 feet, were taken 138 feet, 218 feet, 282 feet, and over 300 feet upstream of Crossing 2. The average field measured bank widths were estimated to be approximately 11 feet. The bankfull width was also estimated using Bend & Waite 2013[1] regression approach available in the USGS Streamstats program. The regression estimate for bankfull width was 14-feet, and the 90-percent prediction interval limits were estimated to be from 10-feet to 20-feet. Based on the methods used, a bankfull width of 11-feet was considered reasonable.

[1] Bent, G.C., and Waite, A.M., 2013, Equations for estimating bankfull channel geometry and discharge for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2013-5115, 62 p.

Section 3
Data Collection

The data collected for the hydraulic analysis are listed in Table 3-1.

TABLE 3-1
Data Sources

Item	Source/Reference
FEMA Effective Base Flood Elevations, Flows, and Profile for the Still River	Not available for the Still River
FEMA Flood Insurance Rate Map (FIRM)	Flood Insurance Rate Map (FIRM) Map Number 25027C0459E effective July 16, 2014, prepared by FEMA, available online at: https://msc.fema.gov/portal/home
USGS Streamstats Program (v. 4.8.1)	https://streamstats.usgs.gov/ss/
Hydrologic soil type	Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO), available online at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.
Elevation terrain	The Commonwealth of Massachusetts, Executive Office of Technology Services and Security, Bureau of Geographic Information (MassGIS) 2010-2011 LiDAR Dataset, available online at: https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html
Design storm rainfall data	National Oceanic and Atmospheric Administrations (NOAA) Atlas 14 Volume 10, available online at: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html
Massachusetts Land Cover/Land Use (2016)	MassGIS, Land Cover/Land Use (2016) Dataset, available online at: https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html
Survey & Bathymetric Survey: Existing Conditions Survey – Forbush Mill Road Bolton, Massachusetts	Prepared by WSP Inc., dated April 12, 2022

Section 4
Engineering Methods

4.1 Hydrologic Analysis

The hydrologic data for the hydrologic and hydraulic analysis was developed using the HydroCAD (v. 10.00-20) stormwater modeling program which is based on the United States Department of Agriculture's Technical Release 20 program (TR-20). The model was developed using information from USGS and GIS mapping, soil characteristics, watershed characteristics, and ground-cover/land-use types within the watershed. The 24-hour precipitation events used in this study were estimated for this location based on the National Oceanic and Atmospheric Administrations (NOAA) Atlas 14 Volume 10 data, which is considered the most up to date for the region. A range of storm return events were assessed. Tighe & Bond developed 24-hour synthetic storms using the NOAA Atlas 14 intensity duration frequency (IDF) for each storm event. Table 4-1 provides the precipitation amounts used for the various storms analyzed.

TABLE 4-1
24-hr Precipitation Values from the National Oceanic and Atmospheric Administration NOAA Atlas 14

Annual Exceedance Probability (AEP)	Precipitation Values from NOAA Atlas 14 (inches)
50% (2-year)	3.25
10% (10-year)	4.98
4% (25-year)	6.05
2% (50-year)	6.85
1% (100-year)	7.71
0.2% (500-year)	10.30

To encompass the anticipated 75-year service life of the proposed alternatives, we modeled climate change scenarios that incorporate increases in precipitation using the Climate Science Special Report (CSSR) Fourth National Climate Assessment[2]. We evaluated climate change scenarios in 2070 for the 10-, 25-, 50-year frequency storm events. Table 4-2 provides the precipitation amounts used for the various storms analyzed.

[2] USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 470 pp. Available at http://science2017.globalchange.gov/chapter/7/.

TABLE 4-2
24-hr Precipitation Values from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 and the CSSR Fourth National Climate Assessment

Storm Event	Precipitation Values from NOAA Atlas 14 and CSSR Fourth National Climate Assessment (inches)
2100 Climate Change 10-year	5.88
2100 Climate Change 25-year	7.14
2100 Climate Change 50-year	8.42

The time of concentration was determined using the Velocity Method outlined in the USDA NRCS Part 630 Hydrology National Engineering Handbook Chapter 15, which is a function of the surface type, flow path length, and slope of the land surface. This was applied to the sub-basins in the watershed upstream of Still River Road (State Route 110) that ranged in size from 36 acres to 307 acres.

Given the configuration of the drainage area, the watershed was divided into five sub-basins in the analysis to improve the modeling of potential inflows to the Forbush Mill Road Culverts (see Attachment A Figure 2). The sub-basins were delineated based on topography within the watershed as well as the location of roadway crossings. A summary of the hydrologic information for the HydroCAD model input values is presented in Table 4-3.

TABLE 4-3
Sub-basin Characteristics Used in Model

Sub-Basin ID	Downstream Design Point	Drainage Area (acres)	Curve Number	Time of Concentration (hours)
1	Main Street (Route 117) Culvert	201	76	215.7
2	Forbush Mill Road Crossing 2	307	68	190.9
3	Forbush Mill Road Crossing 4	272	52	195.8
4	Sand Road Crossing	36	45	52.2
5	Lower Bolton Road (Route 110) Crossing	99	44	118.9

The Still River watershed along Forbush Mill Road consists of mostly forested land (54%), forested wetlands (9%), and very low density residential (14%) with other smaller contributing land uses including cultivated land and pasture. The topography within the watershed contains mostly mild to moderate hillslopes.

Approximately 26% of the soils within the watershed have a hydrologic soil group rating of A and approximately 19% of the soils within the watershed have a hydrologic soil group rating of B, which have moderate to high infiltration rates. Of the remaining soils within

the watershed, approximately 33% have a hydrologic soil group rating of C and 21% have a hydrologic soil group rating of D, which have low infiltration rates.

Peak flows for present day storms were also calculated through regression analysis using the Zarriello 2017[3] approach available in the USGS Streamstats program[4]. These flow estimates were used as a basis for comparison with the computed design storm flow rates.

Table 4-4 and Figure 4-1 show the peak flow results from the HydroCAD model as well as the regression analysis predicted peak flows and prediction intervals. In general, the original peak flows estimated using HydroCAD are within the range predicted by the regression analysis.

[3] Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p.

[4] U.S. Geological Survey, 2016, The StreamStats program, online at http://streamstats.usgs.gov, accessed August 21, 2018.

TABLE 4-4
Design Storm Peak Flow Rates from HydroCAD Hydrologic Model under Existing Conditions

Crossing	Annual Exceedance Probability (AEP)	HydroCAD Flow Rate (cfs*)	Regression Analysis Prediction Interval Lower† (cfs*)	Regression Analysis Prediction† (cfs*)	Regression Analysis Prediction Interval Upper† (cfs*)
Main Street (Route 117) Culvert	50% (2-year)	39.1	10.4	21.0	10.4
	10% (10-year)	83.6	23.1	47.0	23.1
	10-year in 2100	109.6	-	-	-
	4% (25-year)	113.4	31.0	65.0	31.0
	25-year in 2100	145.5	-	-	-
	2% (50-year)	136.1	36.7	80.0	36.7
	50-year in 2100	183.2	-	-	-
	1% (100-year)	160.2	42.8	97.0	42.8
	0.2% (500-year)	230.0	57.8	141.0	57.8
Forbush Mill Road Crossing 1	02-Year	76.8	21.0	42.0	21.0
	10-Year	183.7	46.0	94.0	46.0
	10-year in 2100	248.5	-	-	-
	25-Year	258.3	61.0	129.0	61.0
	25-year in 2100	145.5	-	-	-
	50-Year	316.2	72.0	158.0	72.0
	50-year in 2100	183.2	-	-	-
	100-Year	378.2	84.0	189.0	84.0
	500-Year	559.1	112.0	274.0	112.0
Forbush Mill Road Crossing 2	02-Year	76.8	21.0	42.0	21.0
	10-Year	184.0	46.0	94.0	46.0
	10-year in 2100	248.5	-	-	-
	25-Year	261.8	61.0	129.0	61.0
	25-year in 2100	340.1	-	-	-
	50-Year	318.4	72.0	158.0	72.0
	50-year in 2100	436.9	-	-	-
	100-Year	379.3	84.0	189.0	84.0
	500-Year	559.3	112.0	274.0	112.0
Forbush Mill Road Crossing 3	02-Year	80.7	29.0	58.0	29.0
	10-Year	211.5	63.0	129.0	63.0
	10-year in 2100	296.5	-	-	-
	25-Year	309.8	83.0	176.0	83.0
	25-year in 2100	421.9	-	-	-
	50-Year	389.1	98.0	215.0	98.0
	50-year in 2100	558.1	-	-	-
	100-Year	475.8	114.0	257.0	114.0
	500-Year	737.2	152.0	370.0	152.0

Crossing	Annual Exceedance Probability (AEP)	HydroCAD Flow Rate (cfs*)	Regression Analysis Prediction Interval Lower† (cfs*)	Regression Analysis Prediction† (cfs*)	Regression Analysis Prediction Interval Upper† (cfs*)
Forbush Mill Road Crossing 4	02-Year	80.7	29.0	58.0	29.0
	10-Year	211.5	63.0	129.0	63.0
	10-year in 2100	296.5	-	-	-
	25-Year	309.8	83.0	176.0	83.0
	25-year in 2100	421.9	-	-	-
	50-Year	389.1	98.0	215.0	98.0
	50-year in 2100	558.1	-	-	-
	100-Year	475.8	114.0	257.0	114.0
	500-Year	737.5	152.0	370.0	152.0
Sand Road Crossing	02-Year	80.8	31.0	60.0	31.0
	10-Year	213.7	66.0	134.0	66.0
	10-year in 2100	299.9	-	-	-
	25-Year	314.2	87.0	183.0	87.0
	25-year in 2100	427.2	-	-	-
	50-Year	394.0	102.0	224.0	102.0
	50-year in 2100	564.9	-	-	-
	100-Year	482.0	118.0	267.0	118.0
	500-Year	747.5	158.0	385.0	158.0
Lower Bolton Road (Route 110) Crossing	02-Year	81.9	33.0	66.0	33.0
	10-Year	227.3	71.0	146.0	71.0
	10-year in 2100	315.0	-	-	-
	25-Year	324.4	94.0	198.0	94.0
	25-year in 2100	451.3	-	-	-
	50-Year	409.0	111.0	243.0	111.0
	50-year in 2100	597.1	-	-	-
	100-Year	511.6	128.0	290.0	128.0
	500-Year	794.1	171.0	417.0	171.0

* cfs = cubic feet per second

† Regression analysis completed using "Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156" (Zarriello 2017)

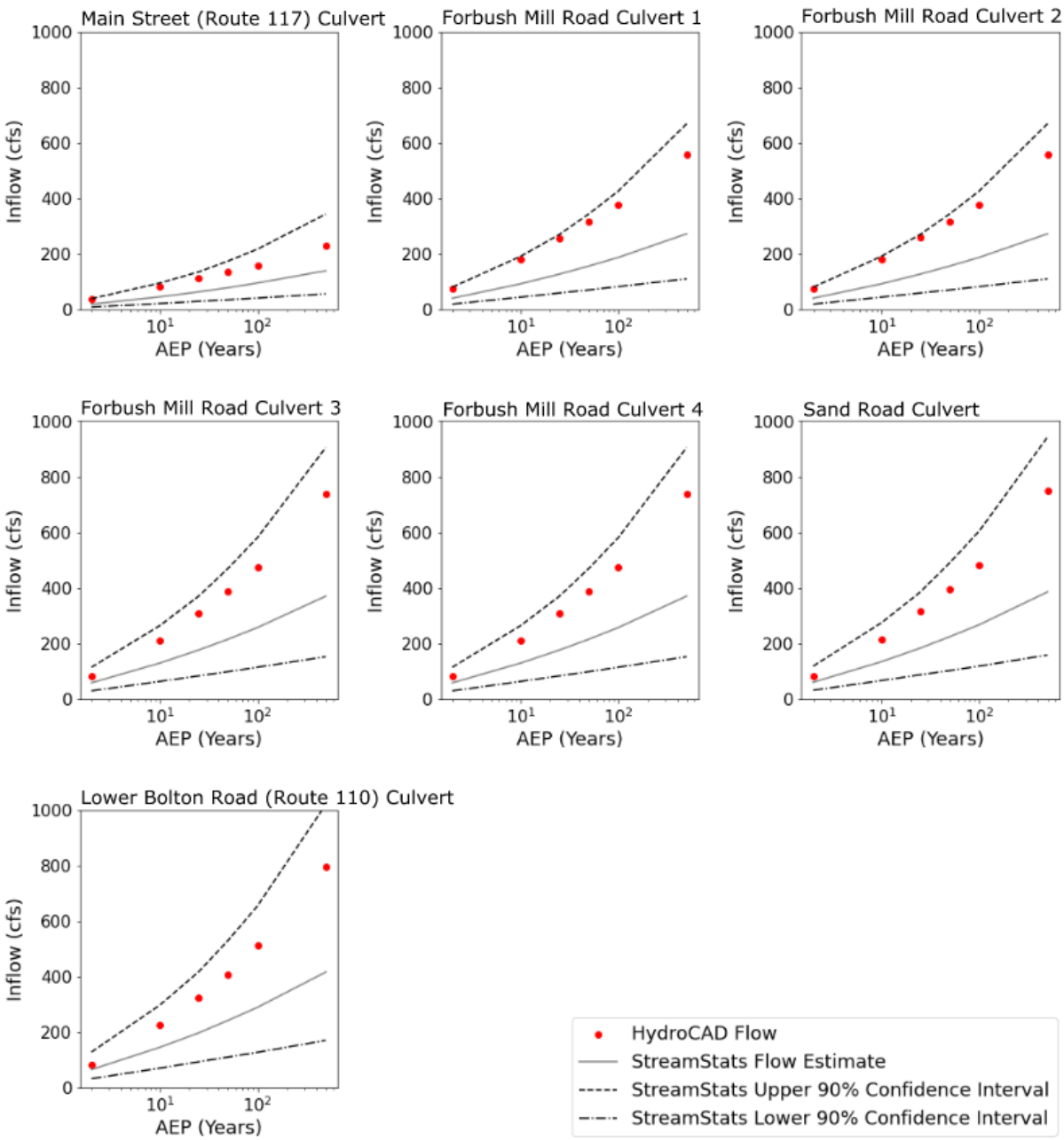

FIGURE 4-1
Present Day Flow rate predictions along the Still River under existing conditions using regression equations and HydroCAD

4.2 Hydraulic Analysis

4.2.1 Alternatives Evaluated

Three alternative scenarios were evaluated to replace the existing culverts at Crossings 1, 2, 3, and 4 on Forbush Mill Road. The alternatives were developed based on hydraulic requirements and stream crossing standards. The three alternative scenarios are:

1. Proposed Alternative 1 – Replace existing culverts at Crossings 1 & 2 with 9.9-foot wide Box Culverts and existing culverts at Crossings 3 & 4 with 14-foot span bridges to pass 10-year frequency storm event with freeboard
2. Proposed Alternative 2 – Replace all existing culverts with 14-foot span bridges to meet stream crossing standards
3. Proposed Alternative 3 – Replace the existing culvert at Crossing 2 with a 16-foot span bridge to pass the 50-year storm in 2100 without overtopping Forbush Mill Road and meet stream crossing standards

Proposed Alternatives 1 and 2 provide a holistic analysis of upgrading all existing culverts along Forbush Mill Road. Due to the temporary nature of the existing culvert at Crossing 2, the Town intends to replace this culvert prior to making improvements at Crossings 1, 3, or 4. As such, Proposed Alternative 3 provides an analysis of how upgrading Crossing 2 will affect the Forbush Mill Road without altering any other crossings.

4.2.2 Design Hydraulic Analysis

A hydraulic analysis of Still River was developed using HEC-RAS (v. 5.0.7), a hydraulic modeling program available from the U.S. Army Corps of Engineers. A steady state model was developed for the Still River from approximately 350 feet upstream of Crossing 1 to approximately 500 feet downstream of Lower Bolton Road (Route 110). The geometry of each culvert crossing was included in the HEC-RAS model.

To create the model, Tighe & Bond first created a Triangular Irregular Network (TIN) elevation surface using the April 2022 survey performed by WSP USA Inc. and MassGIS LiDAR topographic data for overbank areas beyond the extent of the surveyed cross sections. A geometric representation of the channel, banks, and cross-sections was created using the GeoHEC-RAS tool to extract cross sections from the TIN. The hydraulic model of the Still River was modeled using 76 cross sections. The channel Manning's roughness coefficient (Manning's n) was estimated to be 0.032 based on the survey and orthographic imagery. The overbank area Manning's n varied from 0.011 (bare land) to 0.15 (forested wetland). The overbank Manning's n were estimated using MassGIS Land Use and Land Cover data.

Model geometry scenarios were developed for:

1. Existing Conditions
2. Proposed Conditions Meeting Hydraulic Requirements (Proposed Alternative 1)
3. Proposed Conditions Meeting 1.2 x Bankfull Width (Proposed Alternative 2)
4. Proposed Conditions for a 16-foot span Bridge at Crossing 2 (Proposed Alternative 3)

Normal depth upstream and downstream boundary conditions were used for the hydraulic model.

Following the development of the geometric parameterization of the cross-sections along the Still River, flows from the HydroCAD model were assigned by cross-section for both existing and proposed conditions. Water surface elevations and channel velocities were evaluated for the 2-, 10-, 25-, 50-, 100-, and 500-year frequency storm events.

MassDOT classifies Forbush Mill Road as a Rural Minor Collector. The LRFD Bridge Manual recommends 10% AEP hydraulic design storm. Freeboard is defined as the distance from the peak water surface elevation upstream of a culvert to the top of the culvert opening (referred to as the low chord, or the culvert crown), which was evaluated across the range of storms.

Peak flows evaluated in the hydrologic analysis were subsequently used as input to the HEC-RAS model to evaluate hydraulics at the Forbush Mill Road crossings for existing and proposed alternative conditions. Tables 4-4 through 4-13 show results of the hydraulic analysis, and Attachment C provides HEC-RAS model output for the existing and proposed conditions.

TABLE 4-5
HEC-RAS Results for Existing Conditions and Alternative 3† at Crossing 1 (culvert crown at 332.0)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	334.3	-2.3	1.1	7.8	8.8
10-Year	335.1	-3.1	0.2	9.2	9.2
10-Year 2100	335.2	-3.2	0.1	9.8	9.3
25-Year	335.2	-3.2	0.1	9.3	9.6
25-Year 2100	335.2	-3.2	0.1	8.1	8.1
50-Year	335.2	-3.2	0.1	8.6	8.6
50-Year 2100	335.2	-3.2	0.1	6.5	6.5
100-Year	335.2	-3.2	0.1	7.4	7.4
500-Year	335.6	-3.6	-0.2	4.4	4.4

* AEP = annual exceedance probability, ft/s = feet per second
† The existing culvert remains in place in Alternative 3

TABLE 4-6
HEC-RAS Results for Alternative 1 at Crossing 1 (replace the existing culvert with a 9.9-foot wide box) (culvert crown at 333.6)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	331.3	2.3	4.0	3.7	3.7
10-Year	332.7	0.9	2.6	6.0	6.2
10-Year 2100	333.3	0.3	2.0	7.5	9.3
25-Year	333.4	0.2	1.9	7.6	9.4
25-Year 2100	334.4	-0.8	1.0	8.6	10.3
50-Year	334.0	-0.4	1.3	8.2	10.1
50-Year 2100	334.7	-1.1	0.7	9.4	10.7
100-Year	334.9	-1.3	0.4	9.4	10.7
500-Year	336.3	-2.7	-0.9	6.0	6.0

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-7
HEC-RAS Results for Alternative 2 at Crossing 1 (replace the existing culvert with a 14-foot span bridge) (low chord at 333.6)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	331.2	2.4	4.1	2.6	2.6
10-Year	332.3	1.3	3.1	4.3	4.2
10-Year 2100	332.3	1.3	3.0	5.8	5.9
25-Year	332.4	1.2	2.9	5.9	6.0
25-Year 2100	333.0	0.6	2.3	6.7	6.9
50-Year	332.9	0.8	2.5	6.5	6.6
50-Year 2100	334.0	-0.4	1.3	7.8	7.8
100-Year	333.3	0.3	2.0	7.0	7.2
500-Year	334.5	-0.8	0.9	7.3	7.3

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-8
HEC-RAS Results for Existing Conditions at Crossing 2 (culvert crown at 308.2)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	310.1	-1.9	-0.1	8.1	11.9
10-Year	310.7	-2.4	-0.7	9.0	12.5
10-Year 2100	310.9	-2.7	-0.9	8.2	12.8
25-Year	311.0	-2.7	-0.9	8.3	12.9
25-Year 2100	311.2	-2.9	-1.1	8.6	13.0
50-Year	311.0	-2.8	-1.0	9.8	9.8
50-Year 2100	311.3	-3.1	-1.3	8.9	13.2
100-Year	311.2	-2.9	-1.2	9.6	9.6
500-Year	311.5	-3.3	-1.5	9.4	9.4

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-9
HEC-RAS Results for Alternative 1 at Crossing 2 (replace the existing culvert with a 9.9-foot wide) (culvert crown at 309.5)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	307.2	2.3	2.8	6.3	8.8
10-Year	308.9	0.6	1.1	8.4	11.5
10-Year 2100	309.7	-0.2	0.3	9.2	12.5
25-Year	309.8	-0.2	0.3	9.3	12.6
25-Year 2100	310.4	-0.9	-0.4	9.7	13.0
50-Year	310.3	-0.8	-0.3	9.6	12.9
50-Year 2100	310.7	-1.2	-0.7	10.0	13.3
100-Year	310.5	-1.0	-0.5	9.9	13.2
500-Year	311.0	-1.5	-1.0	10.3	13.6

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-10
HEC-RAS Results for Alternative 2 at Crossing 2 (replace the existing culvert with a 14-foot span bridge) (bridge low chord at 308.5)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	307.2	1.3	2.8	8.1	5.6
10-Year	308.1	0.4	1.9	10.7	7.5
10-Year 2100	308.4	0.1	1.6	11.7	8.3
25-Year	308.5	0.0	1.5	11.9	8.4
25-Year 2100	309.5	-1.0	0.5	12.8	9.2
50-Year	309.3	-0.8	0.7	12.6	9.0
50-Year 2100	310.2	-1.7	-0.2	13.3	9.6
100-Year	309.6	-1.1	0.4	13.0	9.4
500-Year	310.5	-2.0	-0.5	10.6	10.6

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-11
HEC-RAS Results for Alternative 3 at Crossing 2 (replace the existing culvert with a 16-foot span bridge) (bridge low chord at 308.5) (PROPOOSED DESIGN FOR FEMA HAZARD MITIGATION GRANT APPLICATION)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	307.2	1.3	2.8	5.4	7.7
10-Year	308.1	0.4	1.9	7.2	10.3
10-Year 2100	308.4	0.1	1.6	7.9	11.4
25-Year	308.5	0.0	1.5	8.0	11.5
25-Year 2100	308.8	-0.3	1.2	8.8	12.4
50-Year	308.7	-0.2	1.3	8.6	12.2
50-Year 2100	309.6	-1.1	0.4	9.4	13.2
100-Year	309.3	-0.8	0.7	9.1	12.8
500-Year	310.2	-1.7	-0.2	10.2	10.2

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-12
HEC-RAS Results for Existing Conditions at Crossing 3 (culvert crown at 289.3)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	292.4	-3.1	0.7	10.0	10.0
10-Year	292.8	-3.5	0.2	10.8	10.8
10-Year 2100	293.0	-3.7	0.1	10.3	10.3
25-Year	293.0	-3.7	0.0	10.2	10.2
25-Year 2100	293.2	-3.9	-0.1	9.4	9.4
50-Year	293.2	-3.9	-0.1	9.7	9.7
50-Year 2100	293.4	-4.1	-0.4	8.0	8.0
100-Year	293.3	-4.0	-0.2	9.2	9.2
500-Year	293.7	-4.4	-0.6	4.3	4.3

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-13
HEC-RAS Results for Alternatives 1 & 2 at Crossing 3 (replace the existing culvert with a 14-foot span bridge†) (bridge low chord at 291.7)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	288.8	2.9	4.2	4.5	4.0
10-Year	290.6	1.1	2.5	6.5	6.1
10-Year 2100	291.4	0.3	1.6	7.9	7.3
25-Year	291.6	0.1	1.5	8.1	7.6
25-Year 2100	292.3	-0.6	0.7	7.6	7.3
50-Year	292.1	-0.4	1.0	8.3	7.8
50-Year 2100	292.9	-1.2	0.2	5.9	5.9
100-Year	292.5	-0.8	0.5	6.8	6.8
500-Year	293.5	-1.8	-0.4	2.7	2.7

* AEP = annual exceedance probability, ft/s = feet per second
† A 14-foot wide opening is required hydraulically and meets requirements of MARSCS

TABLE 4-14
HEC-RAS Results for Alternative 3 at Crossing 3 (replace the existing culvert at Crossing 2 with a 16-foot span bridge and leave the existing culvert at Crossing 3 in place) (culvert crown at 289.3)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	292.4	-0.7	0.7	10.0	10.0
10-Year	292.8	-1.1	0.3	10.6	10.6
10-Year 2100	292.9	-1.2	0.2	10.5	10.5
25-Year	292.9	-1.2	0.1	10.5	10.5
25-Year 2100	293.1	-1.4	0.0	10.0	10.0
50-Year	293.1	-1.4	0.0	10.2	10.2
50-Year 2100	293.3	-1.6	-0.2	9.4	9.4
100-Year	293.1	-1.4	-0.1	9.8	9.8
500-Year	293.4	-1.7	-0.4	8.0	8.0

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-15
HEC-RAS Results for Existing Conditions at Crossing 4 (culvert crown at 284.6)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	286.1	-1.5	-0.1	7.8	9.1
10-Year	286.5	-1.8	-0.5	8.6	9.6
10-Year 2100	286.6	-2.0	-0.6	8.8	9.7
25-Year	286.6	-2.0	-0.7	8.9	9.8
25-Year 2100	286.7	-2.1	-0.8	8.9	9.0
50-Year	286.7	-2.1	-0.8	9.0	9.3
50-Year 2100	286.9	-2.3	-1.0	6.2	6.2
100-Year	286.8	-2.2	-0.9	8.2	8.2
500-Year	287.0	-2.4	-1.1	7.3	7.3

* AEP = annual exceedance probability, ft/s = feet per second

TABLE 4-16
HEC-RAS Results for Alternatives 1 & 2 at Crossing 4 (replace the existing culvert with a 14-foot span bridge) (low chord at 285.6)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	282.8	2.8	3.1	4.0	3.6
10-Year	284.6	1.0	1.4	7.2	6.5
10-Year 2100	284.7	0.9	1.2	8.8	7.7
25-Year	284.9	0.8	1.1	8.9	7.9
25-Year 2100	286.1	-0.5	-0.2	7.3	6.9
50-Year	285.7	-0.1	0.2	9.6	8.8
50-Year 2100	286.6	-1.0	-0.7	4.8	4.8
100-Year	286.3	-0.7	-0.4	6.1	6.1
500-Year	286.6	-1.0	-0.7	6.7	6.7

* AEP = annual exceedance probability, ft/s = feet per second
† A 14-foot span bridge is required hydraulically and meets requirements of MARSCS

TABLE 4-17
HEC-RAS Results for Alternative 3 at Crossing 4 (replace the existing culvert at Crossing 2 with a 16-foot span bridge and leave the existing culvert at Crossing 4 in place) (culvert crown at 284.6)

AEP*	Peak Water Surface Elevation Upstream of Crossing (NAVD88*)	Freeboard (feet)	Distance to Top of Road (feet)	Average Velocity Upstream Inside Structure (ft/s*)	Average Velocity Downstream Inside Structure (ft/s*)
02-Year	286.1	-0.5	-0.1	7.8	9.1
10-Year	286.4	-0.8	-0.5	8.5	9.6
10-Year 2100	286.6	-1.0	-0.7	8.8	9.8
25-Year	286.6	-1.0	-0.7	8.9	9.8
25-Year 2100	286.8	-1.2	-0.9	9.0	9.1
50-Year	286.7	-1.1	-0.8	8.9	9.2
50-Year 2100	286.9	-1.3	-1.0	6.3	6.3
100-Year	286.8	-1.2	-0.9	8.1	8.1
500-Year	287.1	-1.5	-1.1	7.4	7.4

* AEP = annual exceedance probability, ft/s = feet per second

Detailed survey would be required at Crossing 1, Crossing 3, and Crossing 4 if the Town decided to replace the culverts. The hydraulic modeling would need to be updated based on survey data which is more detailed than information available from LiDAR.

4.3 Alternatives Evaluation

4.3.1 Hydraulic Summary

The MassDOT Municipal Bridge Project MGL Chapter 85 Section 34 Review Process Design Requirements and Submittal for New Bridge and Full Bridge Replacement Projects indicates that bridge replacements for a rural local road are required to pass the 10% AEP storm event below the bridge low chord and optimally, should be configured to pass the 10% AEP storm event with freeboard.

- Alternative 1 meets MassDOT hydraulic requirements by passing the 10% AEP storm event with 0.6 to 1.1 feet of freeboard (compared to the culvert crown or low chord), and has the ability to pass the 100-year frequency storm event without overtopping at Crossings 1 and 3, but would overtop at Crossings 2 and 4.
- Alternative 2 meets MassDOT hydraulic requirements by passing the 10% AEP storm event with 0.4 to 1.3 feet of freeboard (compared to the low chord), and has the ability to pass the 100-year frequency storm event without overtopping at all locations but Crossing 4.
- Alternative 3 meets MassDOT hydraulic requirements at Crossing 2 by passing the 10% AEP storm event with 0.4 feet of freeboard (compared to the low chord), and has the ability to pass the 100-year frequency storm event and 50-year storm event in 2100 without overtopping Forbush Mill Road.

The three alternatives offer substantial improvements compared to existing conditions and are suitable from a hydraulic perspective. For Alternative 3, the hydraulic capacity of the existing culverts at Crossings 1, 3, and 4 is not negatively affected by proposed improvements at Crossing 2. Alternative 3 is the proposed design for the FEMA Hazard Mitigation Grant Application.

4.3.2 Stream-Crossing Standards

The 10-year frequency storm event is the required design storm and can be passed with freeboard for all proposed 9.9-foot, 14-foot, and 16-foot wide opening alternatives. Alternative 1 meets the stream crossing standards with the exception of the bankfull width requirement and can pass the 25-year storm event without overtopping the road. Alternative 2 meets the stream crossing standards in full and can pass the 100-year frequency storm event without overtopping the road. Alternative 3 meets the stream crossing standards in full and can pass the 100-year frequency storm event without overtopping the road at Crossing 2; however, existing conditions at Crossings 1, 3, and 4 that do not pass stream crossing standards remain in place. A summary of these alternatives is provided in Table 4-18.

TABLE 4-18
Summary of Alternative Conditions

Model Scenario	Crossing	Bankfull Width Factor*†	Openness Ratio‡	Largest Annual AEP Storm Passing Without Overtopping Roadway
Existing Conditions	Crossing 1	0.45	0.24	100-year
	Crossing 2	0.27	0.18	< 2-year
	Crossing 3	0.32	0.10	25-year
	Crossing 4	0.27	0.18	< 2-year
Alternative 1 - *Meeting stream crossing standards other than width*	Crossing 1	0.90	>0.82 (meeting stream crossing standards)	100-year
	Crossing 2	0.90		25-year
	Crossing 3	1.3		100-year
	Crossing 4	1.3		50-year
Alternative 2 - *Completely meeting stream crossing standards*	Crossing 1	1.3	>0.82 (meeting stream crossing standards)	500-year
	Crossing 2	1.3		100-year
	Crossing 3	1.3		100-year
	Crossing 4	1.3		50-year
Alternative 3 – *Completely meeting stream crossing standards at Crossing 2*	Crossing 1	0.45	0.24	100-year
	Crossing 2	1.5	>0.82 (meeting stream crossing standards)	100-year
	Crossing 3	0.32	0.10	25-year
	Crossing 4	0.27	0.18	< 2-year

* The bankfull width was estimated to be 11 feet.
† The stream crossing standards suggest a bankfull width factor of 1.2 or larger.
‡ The stream crossing standards suggest an openness ratio of 0.82 or higher.

A 9.9-foot wide box culvert will meet the Stream-Crossing standards with the exception of bankfull width, and a 14-foot or 16-foot span bridge will completely meet stream crossing standards. For replacement projects, stream simulation approaches typically result in greater hydraulic capacity for passing flood flows than the existing bridge or culvert. This is true in this case, as the existing culverts are 3 feet in diameter or smaller and the proposed structures are at least 9.9 feet wide. All alternatives span the streambed and banks with sufficient headroom to provide dry passage for wildlife at Crossing 2, and Alternatives 1 and 2 provide sufficient headroom for all crossings.

Section 5
Opinion of Probable Construction Cost

Tighe & Bond developed planning level Opinions of Probable Construction Cost (OPCC) for Alternatives 1, 2 and 3 at Crossing 2.

Costs for site preparation, erosion controls, water controls, borrow materials, excavation, culvert or bridge structures, and restoration were included. In addition, Tighe & Bond estimated additional costs for material and bidding escalation contingency, construction phase services, additional permitting, and additional engineering for each alternative. A summary of total construction costs, including the additional costs and a 30% contingency, is shown on Table 5-1. A more detailed breakdown of expected pay items and contingencies is included as Attachment D.

TABLE 5-1
Opinion of Probable Construction Cost for Crossing 2

Alternative	Total Cost*
Precast Concrete Box Culvert – 9.9 foot span	$940,000
Precast Concrete Rigid Frame – 14 foot span	$1,270,000
Precast Concrete Rigid Frame – 16 foot span	$1,300,000

*Rounded to the nearest $10,000

Based on the OPCC for Crossing 2, a 14-foot span bridge or 16-foot span bridge would be more expensive than a 9.9-foot wide box culvert. Additional permitting requirements for a 9.9-foot wide box culvert, which include a Project Notification form, are expected to cost less than additional engineering requirements for constructing a 14-foot span bridge of 16-foot span bridge, which include MassDOT Chapter 85 submittals for municipal bridge projects. Though total costs for a 14-foot span and 16-foot span bridge are relatively comparable, the additional materials required to construct a 16-foot span bridge cause this alternative to be more expensive than a 14-foot span bridge. As such, Alternative 1 is expected to be less expensive than Alternatives 2 and 3 based on cost savings for materials, permitting, and engineering.

Section 6
Conclusions

Tighe & Bond evaluated three alternative scenarios to replace the existing culverts along Forbush Mill Road:

- Alternative 1**:** a proposed scenario with all crossings passing the 10-year frequency storm event with freeboard (two 9.9 foot wide box culverts and two 14-foot span bridges)
- Alternative 2: a proposed scenario with all crossings meeting the stream crossing standards and passing the 10-year frequency storm event with freeboard (four 14-foot span bridges)
- Alternative 3: a proposed scenario where Crossing 2 passes the 100-year storm and 50-year storm in 2100 with freeboard and meets stream crossing standards, while existing conditions at Crossings 1, 3, and 4 remain in place (one 16-foot span bridge at Crossing 2). This is the proposed design for the FEMA Hazard Mitigation Grant Application.

Alternatives 1 and 2 are anticipated to provide adequate hydraulic capacity for the hydraulic design storm (10-year frequency storm event), but only Alternative 2 will completely meet the stream crossing standards. At Crossing 2, Alternative 3 provides hydraulic capacity for the 25-year storm, is expected to prevent overtopping of Forbush Mill Road during a 50-year storm in 2100, and meets the stream crossing standards; however, Crossings 1, 3, and 4 conditions would remain the same.

The design of each alternative will need to consider construction and permitting requirements and restrictions pertinent to the selected alternative. Potential environmental impacts, hydraulic impacts, and potential for wildlife stream crossing should be considered. For example, construction of a 9.9-foot wide culvert would require additional permitting since stream crossing standards are not met completely, while construction of a 14-foot or 16-foot span bridge would require additional engineering related to MassDOT Chapter 85 requirements.

Based on the OPCC in Section 5, additional engineering and material cost for a 14-foot span of 16-foot span bridge is likely more expensive than additional permitting for a 9.9-foot wide culvert.

ATTACHMENT A
Figures

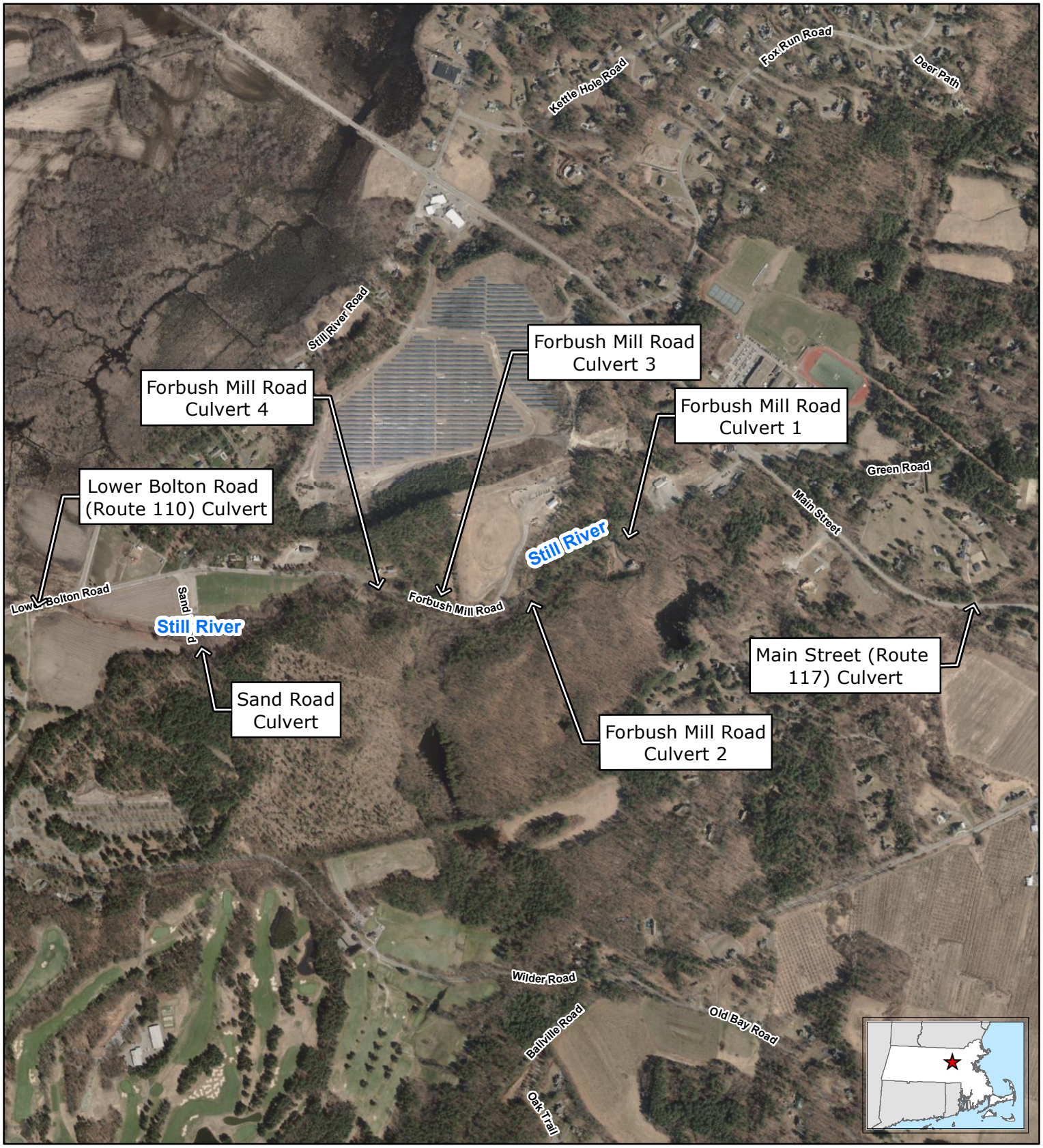

FIGURE 1
SITE AERIAL OVERVIEW

Forbush Mill Road Holistic
Hydrologic and Hydraulic Analysis
Bolton, Massachusetts

July 2022

Tighe&Bond

Based on MassGIS Color Orthophotography (2013)

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Feet

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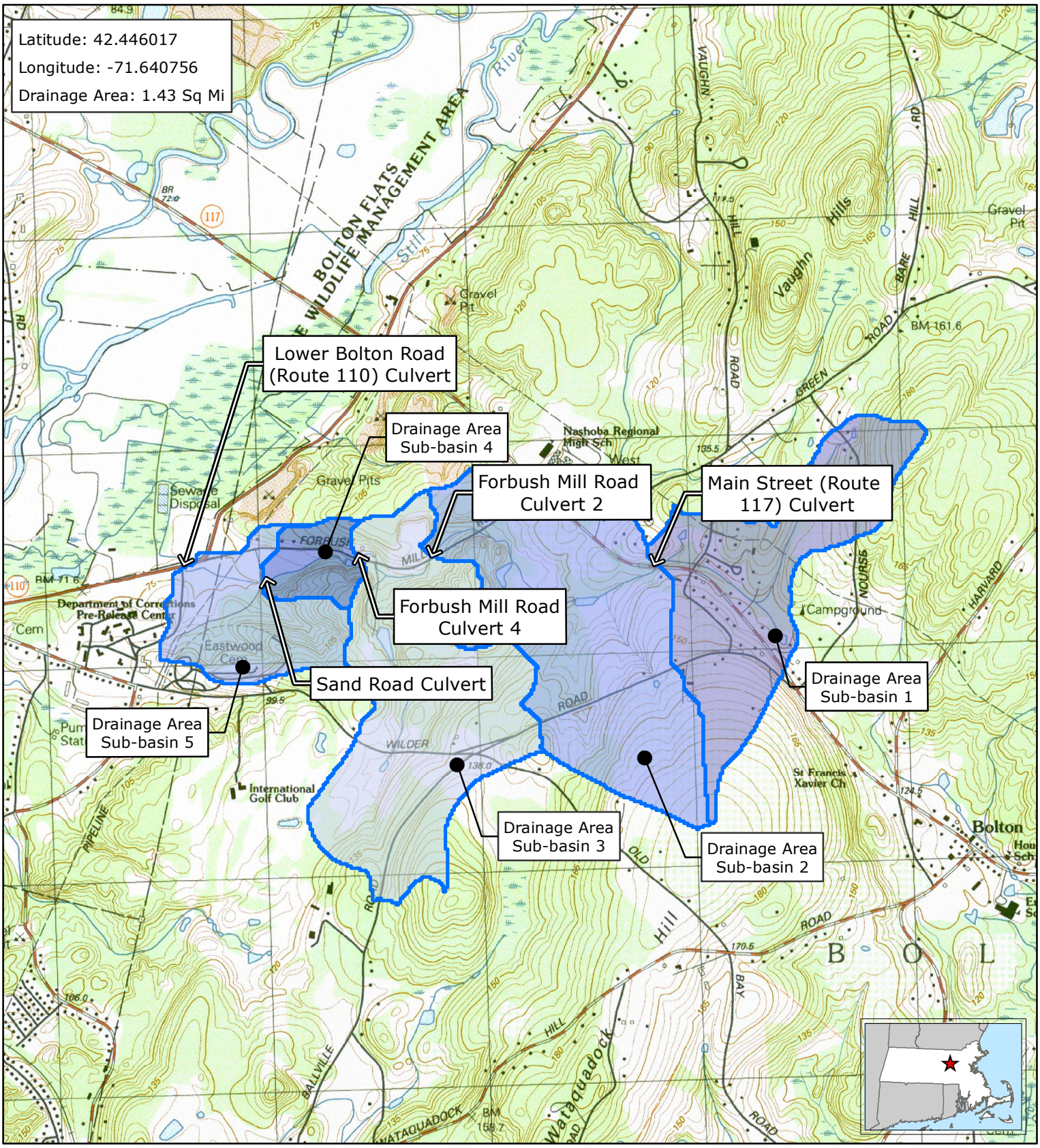
Q-0019



Legend

Drainage Area

1:24,000

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Feet

N

Tighe&Bond

Based on USGS Topographic Map for Boston South, MA Revised 1987. Blue Hills, MA Revised 1985.

FIGURE 2
DRAINAGE AREA MAP

Forbush Mill Road Holistic Hydrologic and Hydraulic Analysis
Bolton, Massachusetts

July 2022

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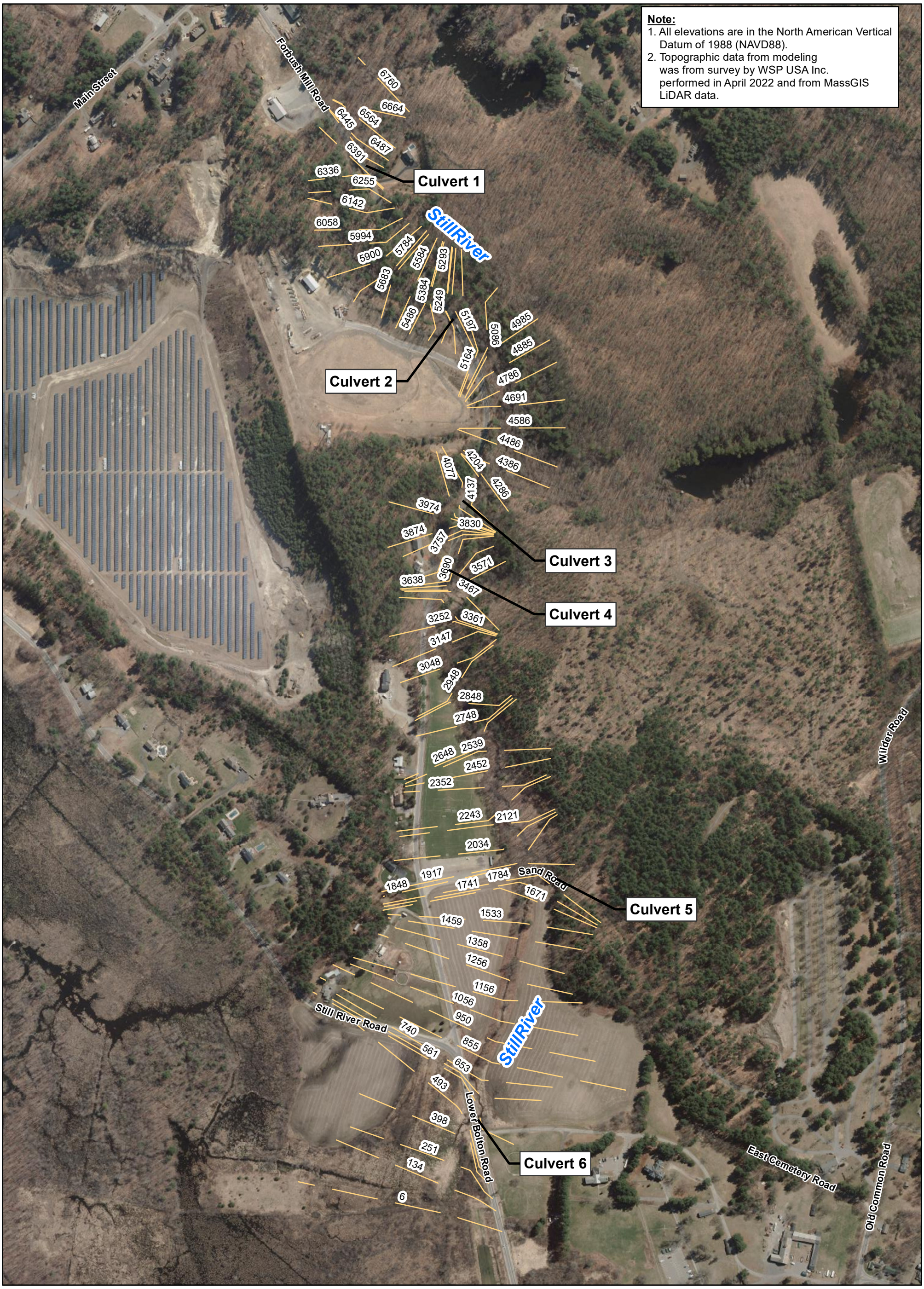

FIGURE 3
HYDRAULIC MODEL GEOMETRY

Forbush Mill Road Holistic
Hydrologic and Hydraulic Analysis
Bolton, Massachusetts

July 2022

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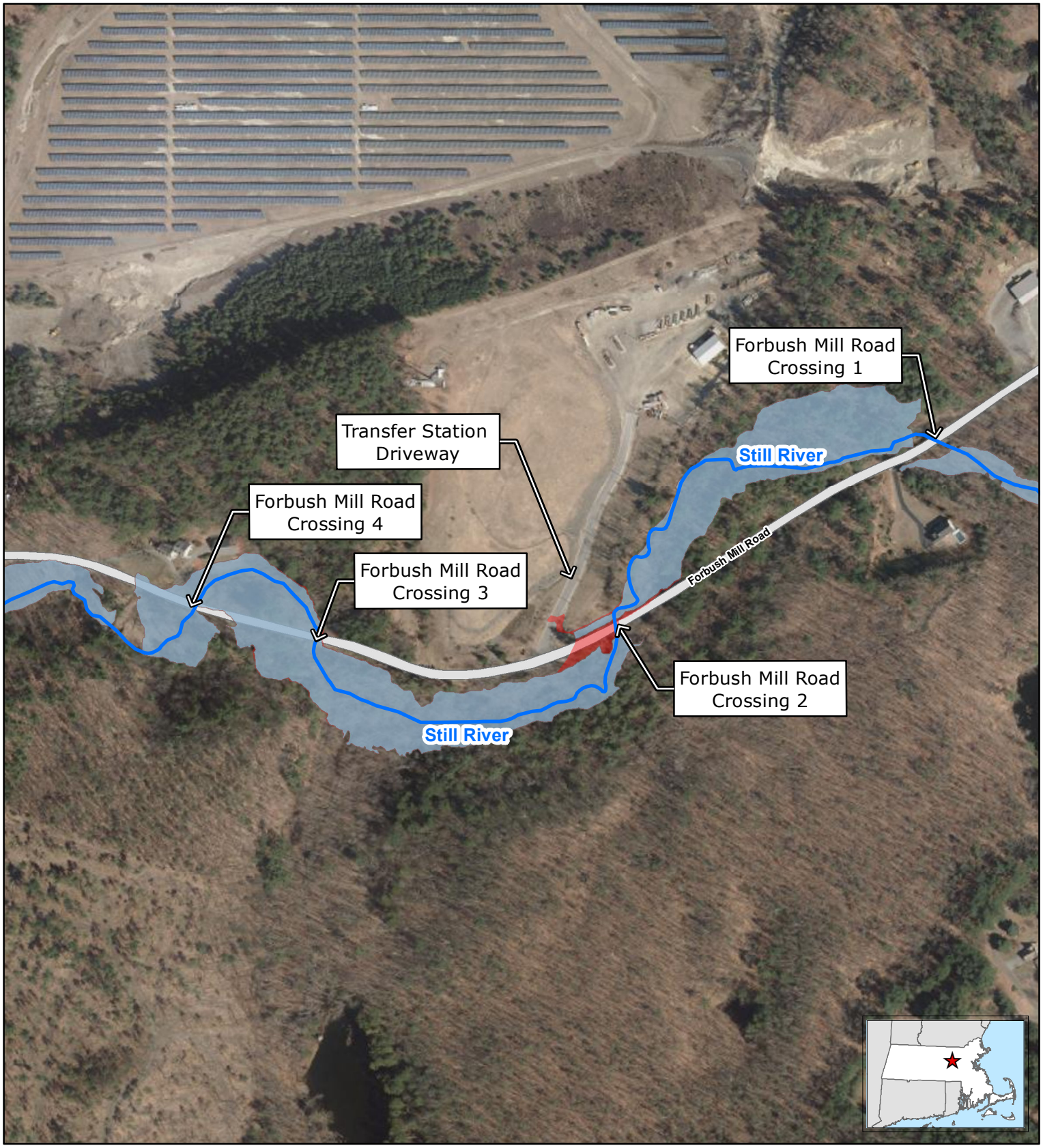

Legend

- Stream Centerline
- Conceptual Proposed 100-Year Flood Extents from Still River
- Existing 100-Year Flood Extents from Still River
- Forbush Mill Road

Tighe&Bond

Based on MassGIS Color Orthophotography (2013)

1:4,000

0 200 400

Feet

N

FIGURE 4
CONCEPTUAL 100-YEAR FLOODPLAIN

Forbush Mill Road Holistic
Hydrologic and Hydraulic Analysis
Bolton, Massachusetts

November 2022

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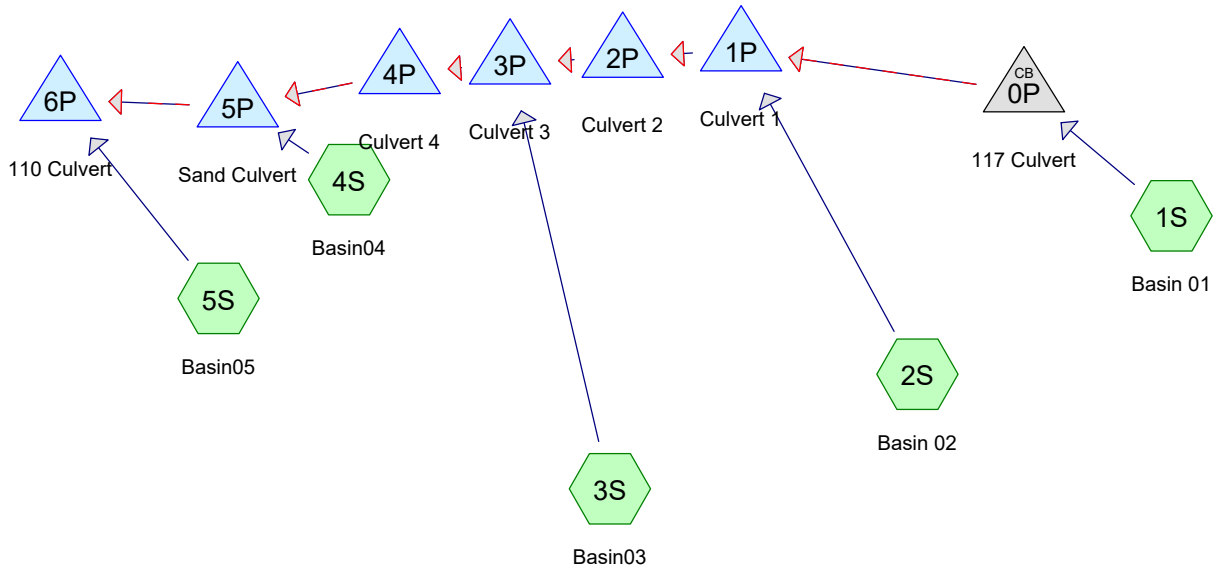
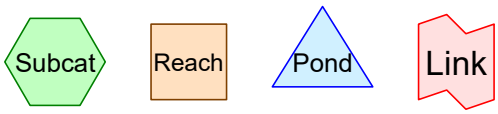
B-5108

Tighe&Bond

ATTACHMENT B
HydroCAD Report





Routing Diagram for forbush_existing
Prepared by Tighe & Bond, Printed 7/8/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

Summary for Pond 0P: 117 Culvert

Inflow Area =	201.341 ac,	0.00% Impervious,	Inflow Depth >	2.51"	for 10-yr event
Inflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af	
Outflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.48 cfs @	14.86 hrs,	Volume=	0.086 af	
Secondary =	83.14 cfs @	14.86 hrs,	Volume=	42.085 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 425.63' @ 14.86 hrs
Flood Elev= 424.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	425.40'	**48.0" Round 48" RCP Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 425.40' / 414.80' S= 0.1631 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Secondary	424.85'	**Route 117, C= 3.27** Offset (feet) 0.00 2.48 2.49 2.50 2.57 5.48 5.79 6.17 8.46 9.09 9.85 11.45 12.38 13.54 14.43 15.68 17.23 17.41 18.98 20.40 20.92 22.28 23.38 24.61 25.58 26.36 28.29 28.87 29.34 31.98 32.17 32.33 33.79 35.31 35.47 35.67 38.29 38.77 39.36 41.28 42.07 43.04 44.26 45.37 46.73 47.24 48.66 50.23 50.42 51.96 53.21 54.11 55.26 56.19 57.80 58.56 59.18 61.48 61.86 62.16 65.02 65.14 65.16 65.17 68.13 68.45 68.86 71.11 71.75 72.55 74.09 75.05 76.24 77.07 78.35 79.92 80.06 81.65 83.04 83.61 84.94 86.02 87.30 88.24 89.01 90.99 91.54 91.99 94.67 94.84 94.97 96.24 97.96 98.14 98.36 100.94 101.44 102.05 103.92 104.73 105.74 106.91 108.03 109.43 109.89 111.33 112.87 113.11 114.63 115.86 116.80 117.77 117.93 118.99 120.11 121.21 122.39 123.27 124.49 125.80 126.44 127.77 129.20 129.61 131.06 132.61 132.78 134.34 135.95 136.01 137.62 139.11 139.42 140.90 142.28 142.82 144.18 145.45 146.23 147.47 148.62 149.63 150.75 151.79 153.03 154.03 154.96 156.44 157.31 158.12 159.84 160.59 161.29 163.25 163.88 164.46 166.65 167.16 167.63 170.06 170.44 170.80 173.46 173.72 173.97 176.87 177.00 177.13 180.27 180.29 180.30 180.74 183.47 183.57 183.67 186.64 186.85 187.08 189.81 190.13 190.48 192.98 193.42 193.89 196.14 196.70 197.29 199.31 199.98 200.70 202.48 203.26 204.10 205.65 206.54 207.51 208.82 209.83 210.91 211.99 213.11 214.31 215.15 216.39 217.72 218.32 219.67 221.12 221.49 222.95 224.53 224.66 226.24 227.83 227.93 229.52 231.00 231.34 232.80 234.16 234.74 236.08 237.33 238.15 239.36 240.50 241.55 242.65 243.67 244.95 245.93 246.84 248.36 249.21 250.00 251.76 252.49 253.17 255.17 255.78 256.34 258.57 259.06 259.51 261.98 262.34 262.68 265.38 265.62 265.85 268.79 268.90 269.01 272.09 272.18 275.35 275.47 275.59 278.52 278.75 279.00 281.69 282.03 282.40 284.86 285.31 285.81 288.02 288.60 289.21 291.19 291.88 292.62 294.36 295.16 296.02 297.53 298.44 299.42 300.70 301.73 302.83 303.87 305.01 306.23 307.03 308.29 309.64 310.20 311.57 313.04

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499.38 500.80 501.98 503.64 504.26 504.57 505.50 507.16
507.72 508.82 509.76 511.17 512.35 514.01 514.63 514.94
515.88 517.53 518.09 519.19 520.13 521.54 522.72 524.38
525.00 525.31 526.25 527.91 528.46 529.57 530.50 531.92
533.09 534.75 535.37 535.69 536.62 538.28 538.83 539.94
540.87 542.29 543.47 545.12 545.75 546.06 546.99 547.15
548.56 549.34 551.00 551.71 553.02 553.44 554.28 555.88
556.69 558.32 559.19 560.37 560.76 561.52 563.20 564.05
565.64 566.67 567.73 568.08 568.76 570.52 571.41 572.96
574.15 575.09 575.40 576.00 577.84 578.77 580.28 581.63
582.45 582.72 583.24 585.16 586.13 587.59 589.11 589.81
590.03 590.48

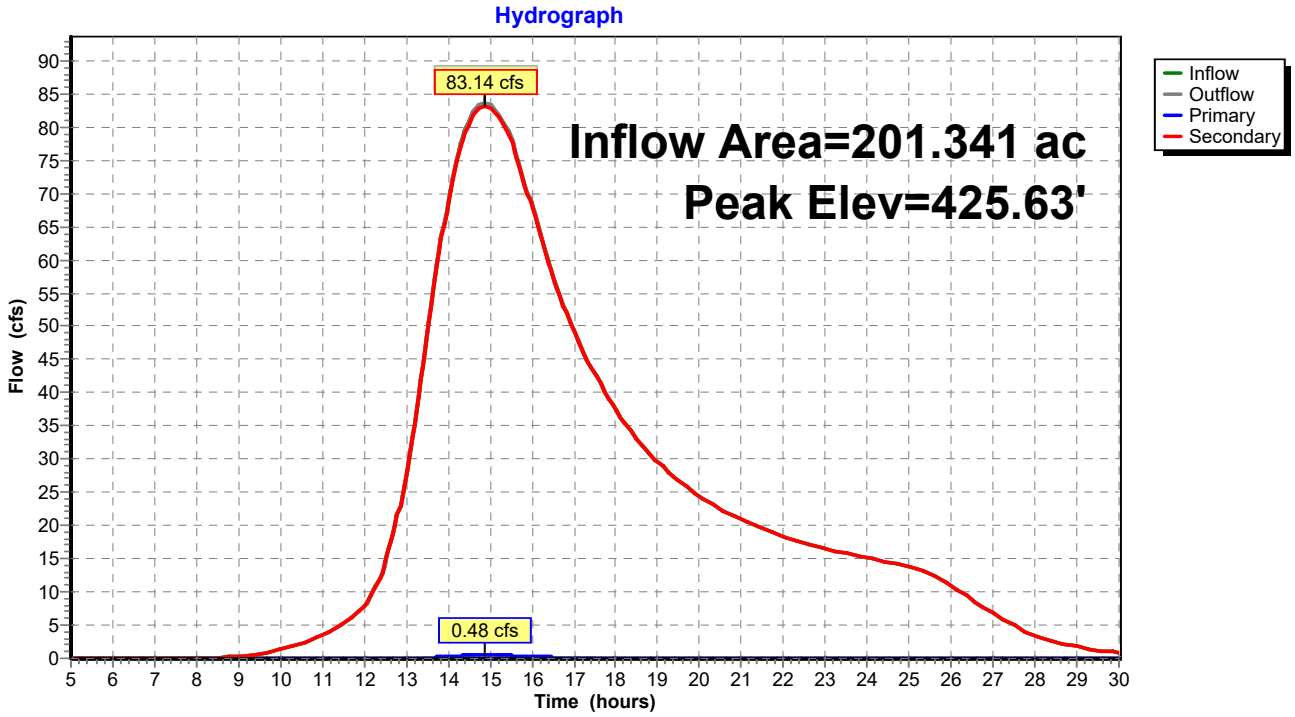
Height (feet) 11.60 11.60 11.60 11.60 11.59 11.51 11.50 11.49
11.45 11.44 11.43 11.39 11.38 11.35 11.33 11.30 11.26 11.26
11.22 11.18 11.17 11.13 11.11 11.09 11.07 11.06 11.03 11.02
11.01 10.96 10.95 10.95 10.90 10.85 10.85 10.84 10.75 10.74
10.73 10.69 10.67 10.64 10.63 10.60 10.55 10.55 10.50 10.45
10.45 10.41 10.36 10.35 10.31 10.28 10.23 10.21 10.20 10.13
10.12 10.11 10.06 10.05 10.05 10.05 9.97 9.96 9.95 9.88 9.87
9.85 9.83 9.81 9.78 9.77 9.74 9.69 9.69 9.64 9.57 9.58 9.52
9.49 9.46 9.43 9.42 9.36 9.36 9.35 9.28 9.28 9.28 9.24 9.19
9.18 9.18 9.10 9.09 9.07 9.01 8.98 8.95 8.91 8.88 8.84 8.84
8.80 8.76 8.75 8.71 8.68 8.69 8.67 8.66 8.62 8.59 8.55 8.50
8.49 8.44 8.41 8.39 8.35 8.31 8.29 8.26 8.22 8.21 8.18 8.14
8.14 8.11 8.05 8.05 8.00 7.95 7.94 7.89 7.87 7.87 7.85 7.84
7.82 7.81 7.79 7.73 7.70 7.65 7.58 7.53 7.49 7.44 7.41 7.37
7.30 7.27 7.25 7.19 7.17 7.17 7.10 7.09 7.07 6.98 6.97 6.96
6.86 6.85 6.84 6.70 6.70 6.70 6.69 6.60 6.59 6.59 6.59 6.58
6.58 6.55 6.55 6.54 6.45 6.44 6.42 6.31 6.29 6.27 6.19 6.17
6.16 6.09 6.09 6.07 6.00 5.98 5.94 5.90 5.86 5.84 5.80 5.78

5.74	5.71	5.68	5.62	5.60	5.54	5.50	5.49	5.45	5.41	5.42	5.37
5.31	5.30	5.25	5.21	5.21	5.18	5.16	5.18	5.17	5.12	5.15	5.10
5.07	5.02	4.98	4.96	4.88	4.86	4.84	4.78	4.76	4.74	4.70	4.68
4.67	4.64	4.62	4.61	4.58	4.57	4.56	4.51	4.50	4.48	4.39	4.38
4.37	4.27	4.27	4.26	4.20	4.19	4.15	4.15	4.15	4.06	4.05	4.04
3.94	3.93	3.91	3.84	3.82	3.80	3.73	3.71	3.69	3.63	3.60	3.57
3.52	3.48	3.46	3.39	3.36	3.36	3.32	3.32	3.29	3.29	3.27	3.19
3.17	3.10	3.08	3.02	3.01	2.98	2.97	2.94	2.88	2.89	2.84	2.79
2.78	2.73	2.70	2.71	2.68	2.64	2.64	2.60	2.54	2.53	2.48	2.45
2.42	2.39	2.37	2.34	2.33	2.32	2.28	2.27	2.25	2.20	2.18	2.16
2.07	2.05	2.04	1.94	1.93	1.92	1.85	1.84	1.83	1.77	1.77	1.76
1.69	1.69	1.69	1.64	1.63	1.63	1.63	1.58	1.57	1.57	1.48	1.47
1.46	1.37	1.36	1.34	1.31	1.29	1.28	1.23	1.22	1.21	1.16	1.14
1.13	1.08	1.06	1.04	1.02	1.01	1.00	1.02	1.01	1.01	1.00	0.97
0.93	0.90	0.82	0.73	0.71	0.71	0.70	0.60	0.57	0.54	0.49	0.47
0.46	0.39	0.38	0.31	0.29	0.27	0.22	0.21	0.19	0.15	0.14	0.14
0.12	0.10	0.05	0.04	0.01	0.00	0.00	0.01	0.03	0.04	0.06	0.13
0.14	0.14	0.23	0.23	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26
0.23	0.23	0.23	0.19	0.19	0.19	0.21	0.21	0.24	0.28	0.32	0.36
0.28	0.32	0.35	0.36	0.39	0.44	0.48	0.53	0.64	0.71	0.82	0.92
0.93	1.03	1.13	1.16	1.27	1.35	1.38	1.46	1.57	1.64	1.74	1.83
1.94	2.02	2.03	2.07	2.14	2.19	2.23	2.29	2.31	2.32	2.41	2.54
2.56	2.60	2.65	2.69	2.72	2.87	2.90	2.92	3.01	3.07	3.12	3.26
3.24	3.45	3.49	3.74	3.78	3.79	3.89	3.98	4.06	4.16	4.14	4.29
4.37	4.54	4.59	4.62	4.67	4.73	4.76	4.78	4.69	4.75	4.87	5.13
5.20	5.24	5.38	5.59	5.65	5.77	5.89	6.05	6.13	6.38	6.44	6.46
6.56	6.56	6.63	6.72	6.79	6.95	7.04	7.08	7.15	7.21	7.34	7.52
7.72	7.88	7.93	8.03	8.23	8.41	8.63	8.74	8.88	8.93	9.01	9.21
9.31	9.48	9.62	9.72	9.75	9.82	10.02	10.12	10.29	10.46	10.55	
10.59	10.65	10.88	11.00	11.18	11.40	11.49	11.52	11.60			

Primary OutFlow Max=0.46 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**1=48" RCP Culvert** (Inlet Controls 0.46 cfs @ 1.62 fps)

Secondary OutFlow Max=82.70 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**2=Route 117** (Weir Controls 82.70 cfs @ 2.33 fps)

Pond 0P: 117 Culvert



Hydrograph for Pond 0P: 117 Culvert

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	424.85	0.00	0.00	0.00
5.50	0.00	424.85	0.00	0.00	0.00
6.00	0.00	424.85	0.00	0.00	0.00
6.50	0.00	424.85	0.00	0.00	0.00
7.00	0.00	424.85	0.00	0.00	0.00
7.50	0.00	424.85	0.00	0.00	0.00
8.00	0.02	424.85	0.02	0.00	0.02
8.50	0.10	424.86	0.10	0.00	0.10
9.00	0.30	424.89	0.30	0.00	0.30
9.50	0.68	424.95	0.68	0.00	0.68
10.00	1.31	424.99	1.31	0.00	1.31
10.50	2.22	425.02	2.22	0.00	2.22
11.00	3.48	425.07	3.48	0.00	3.48
11.50	5.20	425.10	5.20	0.00	5.20
12.00	7.77	425.14	7.77	0.00	7.77
12.50	14.40	425.22	14.40	0.00	14.40
13.00	27.87	425.33	27.87	0.00	27.87
13.50	48.49	425.46	48.49	0.06	48.44
14.00	69.02	425.56	69.02	0.25	68.77
14.50	**81.14**	**425.62**	**81.14**	**0.44**	**80.69**
15.00	**83.38**	**425.63**	**83.38**	**0.48**	**82.91**
15.50	78.23	425.60	78.23	0.40	77.83
16.00	68.10	425.56	68.10	0.24	67.86
16.50	57.62	425.51	57.62	0.13	57.49
17.00	49.39	425.46	49.39	0.06	49.32
17.50	42.79	425.43	42.79	0.01	42.78
18.00	37.42	425.40	37.42	0.00	37.42
18.50	33.09	425.37	33.09	0.00	33.09
19.00	29.58	425.35	29.58	0.00	29.58
19.50	26.71	425.33	26.71	0.00	26.71
20.00	24.37	425.31	24.37	0.00	24.37
20.50	22.46	425.29	22.46	0.00	22.46
21.00	20.85	425.28	20.85	0.00	20.85
21.50	19.51	425.27	19.51	0.00	19.51
22.00	18.36	425.26	18.36	0.00	18.36
22.50	17.39	425.25	17.39	0.00	17.39
23.00	16.53	425.24	16.53	0.00	16.53
23.50	15.76	425.23	15.76	0.00	15.76
24.00	15.05	425.23	15.05	0.00	15.05
24.50	14.45	425.22	14.45	0.00	14.45
25.00	13.73	425.22	13.73	0.00	13.73
25.50	12.64	425.21	12.64	0.00	12.64
26.00	10.94	425.19	10.94	0.00	10.94
26.50	8.86	425.16	8.86	0.00	8.86
27.00	6.76	425.13	6.76	0.00	6.76
27.50	4.91	425.10	4.91	0.00	4.91
28.00	3.45	425.07	3.45	0.00	3.45
28.50	2.44	425.03	2.44	0.00	2.44
29.00	1.73	425.00	1.73	0.00	1.73
29.50	1.23	424.98	1.23	0.00	1.23
30.00	0.87	424.97	0.87	0.00	0.87

Summary for Pond 1P: Culvert 1

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Outflow = 183.67 cfs @ 14.70 hrs, Volume= 89.851 af, Atten= 0%, Lag= 1.9 min
Primary = 96.36 cfs @ 14.70 hrs, Volume= 72.896 af
Secondary = 87.31 cfs @ 14.70 hrs, Volume= 16.956 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 336.03' @ 14.70 hrs Surf.Area= 0.000 ac Storage= 0.316 af
Flood Elev= 334.80' Surf.Area= 0.000 ac Storage= 0.098 af

Plug-Flow detention time= 0.8 min calculated for 89.851 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (1,055.4 - 1,054.6)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	3.406 af	**Custom Stage Data** Listed below

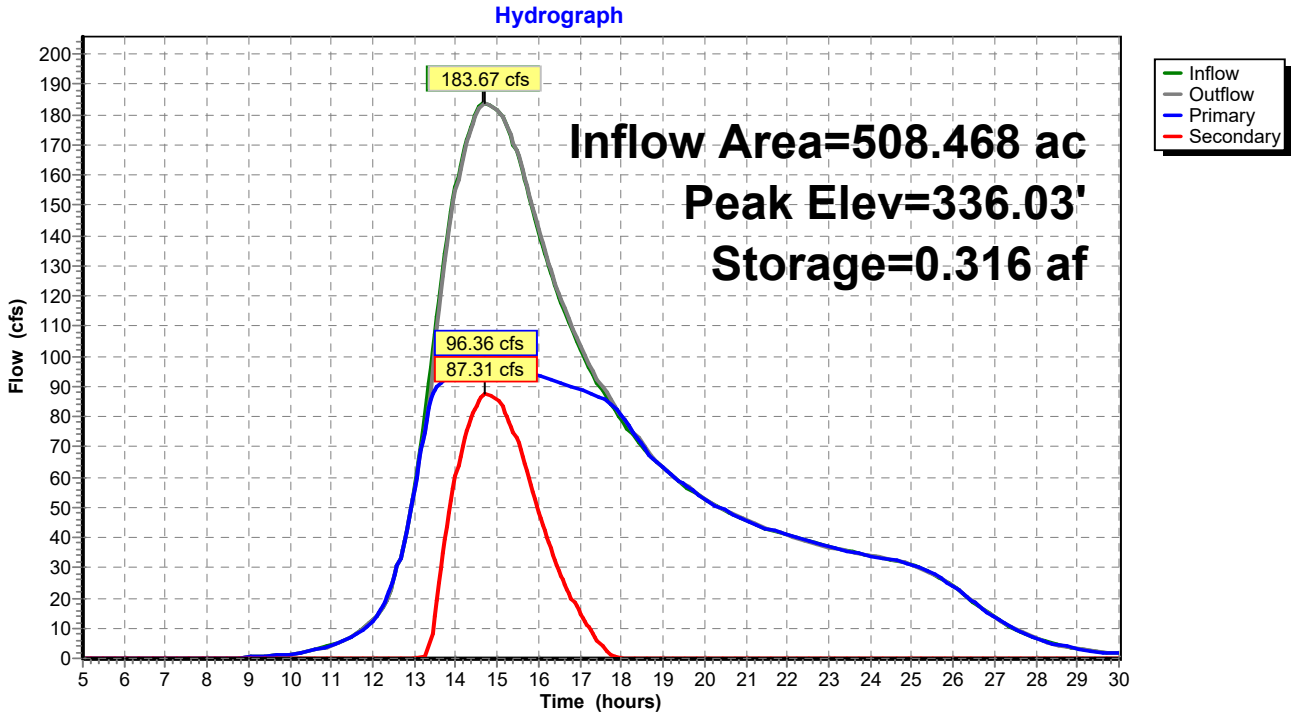
Elevation (feet)	Cum.Store (acre-feet)
329.70	0.000
333.00	0.003
334.00	0.024
335.00	0.116
336.00	0.309
337.00	0.575
338.00	0.886
339.00	1.252
340.00	1.773
341.00	2.503
342.00	3.406

Device	Routing	Invert	Outlet Devices
#1	Secondary	334.80'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.00 80.00 Height (feet) 2.00 0.00 2.00
#2	Primary	329.72'	**30.0" Round Culvert #1 - Left Barrel** L= 40.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.72' / 329.29' S= 0.0106 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#3	Primary	329.86'	**30.0" Round Culvert #1 - Right Barrel** L= 40.4' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.86' / 329.12' S= 0.0183 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf

Primary OutFlow Max=96.37 cfs @ 14.70 hrs HW=336.03' (Free Discharge)
└─**2=Culvert #1 - Left Barrel** (Barrel Controls 47.67 cfs @ 9.71 fps)
└─**3=Culvert #1 - Right Barrel** (Barrel Controls 48.70 cfs @ 9.92 fps)

Secondary OutFlow Max=87.11 cfs @ 14.70 hrs HW=336.03' (Free Discharge)
└─**1=Forbush Mill Road** (Weir Controls 87.11 cfs @ 1.45 fps)

Pond 1P: Culvert 1



Hydrograph for Pond 1P: Culvert 1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	329.70	0.00	0.00	0.00
5.50	0.00	0.000	329.70	0.00	0.00	0.00
6.00	0.00	0.000	329.70	0.00	0.00	0.00
6.50	0.00	0.000	329.70	0.00	0.00	0.00
7.00	0.00	0.000	329.70	0.00	0.00	0.00
7.50	0.00	0.000	329.72	0.00	0.00	0.00
8.00	0.02	0.000	329.77	0.02	0.02	0.00
8.50	0.10	0.000	329.87	0.10	0.10	0.00
9.00	0.30	0.000	329.96	0.30	0.30	0.00
9.50	0.69	0.000	330.06	0.68	0.68	0.00
10.00	1.35	0.000	330.16	1.35	1.35	0.00
10.50	2.47	0.001	330.30	2.46	2.46	0.00
11.00	4.29	0.001	330.46	4.29	4.29	0.00
11.50	7.27	0.001	330.67	7.26	7.26	0.00
12.00	12.35	0.001	330.96	12.34	12.34	0.00
12.50	25.57	0.002	331.56	25.55	25.55	0.00
13.00	57.29	0.005	333.10	56.25	56.25	0.00
13.50	107.32	0.190	335.38	102.70	88.91	13.79
14.00	155.84	0.281	335.86	154.57	94.45	60.12
14.50	**180.37**	**0.311**	**336.01**	**179.92**	**96.15**	**83.77**
15.00	**181.34**	**0.313**	**336.02**	**181.56**	**96.24**	**85.31**
15.50	165.73	0.295	335.93	166.34	95.26	71.08
16.00	141.03	0.264	335.77	141.80	93.42	48.38
16.50	119.55	0.230	335.59	120.48	91.36	29.11
17.00	102.86	0.193	335.40	103.80	89.08	14.72
17.50	89.37	0.148	335.17	90.68	86.23	4.45
18.00	78.61	0.088	334.70	80.15	80.15	0.00
18.50	69.95	0.030	334.06	71.15	71.15	0.00
19.00	62.95	0.015	333.56	63.14	63.14	0.00
19.50	57.27	0.008	333.23	57.51	57.51	0.00
20.00	52.67	0.003	332.76	52.88	52.88	0.00
20.50	48.88	0.003	332.55	49.01	49.01	0.00
21.00	45.70	0.002	332.40	45.78	45.78	0.00
21.50	43.02	0.002	332.28	43.08	43.08	0.00
22.00	40.68	0.002	332.18	40.73	40.73	0.00
22.50	38.63	0.002	332.10	38.66	38.66	0.00
23.00	36.85	0.002	332.03	36.87	36.87	0.00
23.50	35.33	0.002	331.96	35.35	35.35	0.00
24.00	33.96	0.002	331.91	33.97	33.97	0.00
24.50	32.67	0.002	331.85	32.68	32.68	0.00
25.00	30.95	0.002	331.78	30.96	30.96	0.00
25.50	28.06	0.002	331.67	28.07	28.07	0.00
26.00	23.68	0.002	331.48	23.69	23.69	0.00
26.50	18.55	0.001	331.26	18.56	18.56	0.00
27.00	13.65	0.001	331.03	13.65	13.65	0.00
27.50	9.58	0.001	330.81	9.59	9.59	0.00
28.00	6.58	0.001	330.63	6.59	6.59	0.00
28.50	4.58	0.001	330.48	4.58	4.58	0.00
29.00	3.18	0.001	330.37	3.19	3.19	0.00
29.50	2.21	0.001	330.27	2.21	2.21	0.00
30.00	1.53	0.000	330.19	1.53	1.53	0.00

Summary for Pond 2P: Culvert 2

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.67 cfs @ 14.70 hrs, Volume= 89.851 af
Outflow = 183.70 cfs @ 14.71 hrs, Volume= 89.851 af, Atten= 0%, Lag= 0.4 min
Primary = 61.16 cfs @ 14.71 hrs, Volume= 58.085 af
Secondary = 122.54 cfs @ 14.71 hrs, Volume= 31.766 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 309.47' @ 14.71 hrs Surf.Area= 0.000 ac Storage= 0.313 af
Flood Elev= 308.70' Surf.Area= 0.000 ac Storage= 0.158 af

Plug-Flow detention time= 1.6 min calculated for 89.851 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (1,057.0 - 1,055.4)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	0.445 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
306.00	0.000
307.00	0.013
308.00	0.066
309.00	0.198
310.00	0.445

Device	Routing	Invert	Outlet Devices
#1	Primary	305.35'	**36.0" Round 36" Culvert** L= 40.0' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.35' / 304.10' S= 0.0313 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 7.07 sf
#2	Primary	307.03'	**24.0" Round 24" Culvert** L= 58.9' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 307.03' / 306.80' S= 0.0039 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 3.14 sf
#3	Secondary	308.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 1.57 2.55 3.95 6.16 6.33 6.43 6.88 8.70 10.30 11.08 12.32 13.46 14.18 15.84 17.32 17.77 18.05 18.22 18.48 20.60 21.93 22.98 24.64 25.35 25.80 27.73 27.79 29.68 30.11 30.80 32.49 33.56 34.87 36.95 37.25 37.43 38.25 39.63 41.31 42.00 43.11 44.38 45.18 46.76 48.72 49.06 49.14 49.26 51.52 52.94 53.90 55.42 56.27 56.81 58.65 59.18 60.69 61.03 61.58 63.41 64.56 65.79 67.73 68.17 68.44 69.65 70.54 72.32 72.92 73.89 75.30 76.19 77.68 80.04 80.06 80.07 80.11 82.44 83.94 84.82 86.20 87.19 87.82 89.57 90.58 91.70 91.95 92.36 94.33 95.57 96.71 98.51 99.09 99.37 99.45 100.73 101.49 103.20 103.90 105.16 106.31 106.96 108.73 109.23 110.72 111.14 111.89 113.55 114.47 115.96 117.73 118.23 118.37 118.62 120.78 121.98 123.19 125.35 125.60 125.74 126.23 128.01 129.50 130.42 132.08 132.83 133.25 134.73 135.24 137.01 137.65 138.81 140.07 140.77 142.48 143.23 144.52 144.89

145.54	147.30	148.28	149.71	151.74	152.03	152.12	152.27
154.53	155.79	156.94	159.00	159.35	159.55	160.24	161.76
163.30	164.17	165.73	166.58	167.06	168.74	168.99	170.82
171.41	172.46	173.82	174.57	176.23	177.24	178.33	178.64
179.19	181.05	182.09	183.46	185.74	185.84	185.87	185.92
188.28	189.60	190.69	192.65	193.10	193.35	193.84	194.06
195.69	196.80	198.37	198.73	200.20	201.04	203.39	203.60
203.71	204.14	206.39	207.00	208.06	209.06	210.40	211.73
212.73	213.79	214.40	216.65	217.08	217.19	217.40	219.75
220.59	222.06	222.42	223.99	225.09	226.73	227.39	227.77
229.16	230.44	230.79	231.40	233.11	234.19	235.79	236.07
237.59	238.46	240.73	240.99	241.13	241.66	243.80	244.38
245.40	246.48	247.78	249.15	250.07	251.18	251.82	254.17
254.49	254.58	254.73	254.80	256.30	257.73	257.89	258.09
260.70	261.19	261.80	263.67	264.49	265.51	266.64	267.79
269.22	269.61	271.09	272.58	272.94	274.39	275.55	276.65
277.69	278.52	280.36	280.99	281.49	284.08	284.29	284.46
286.00	287.43	287.59	287.79	290.40	290.89	291.50	293.37
294.19	295.21	296.34	297.49	298.93	299.31	300.79	301.12
302.18	302.97	304.17	304.88	307.50	307.55	307.58	307.68
310.28	310.93	312.03	312.98	314.32	315.68	316.56	317.70
318.38	321.05	321.08	321.08	321.09	323.78	324.47	325.62
326.48	327.85	329.18	330.16	331.23	331.88	334.41	334.58
334.62	334.69	337.28	338.00	339.22	339.98	341.38	342.68
343.75	344.77	345.38	347.78	348.08	348.15	348.28	350.78
351.53	352.81	353.23					

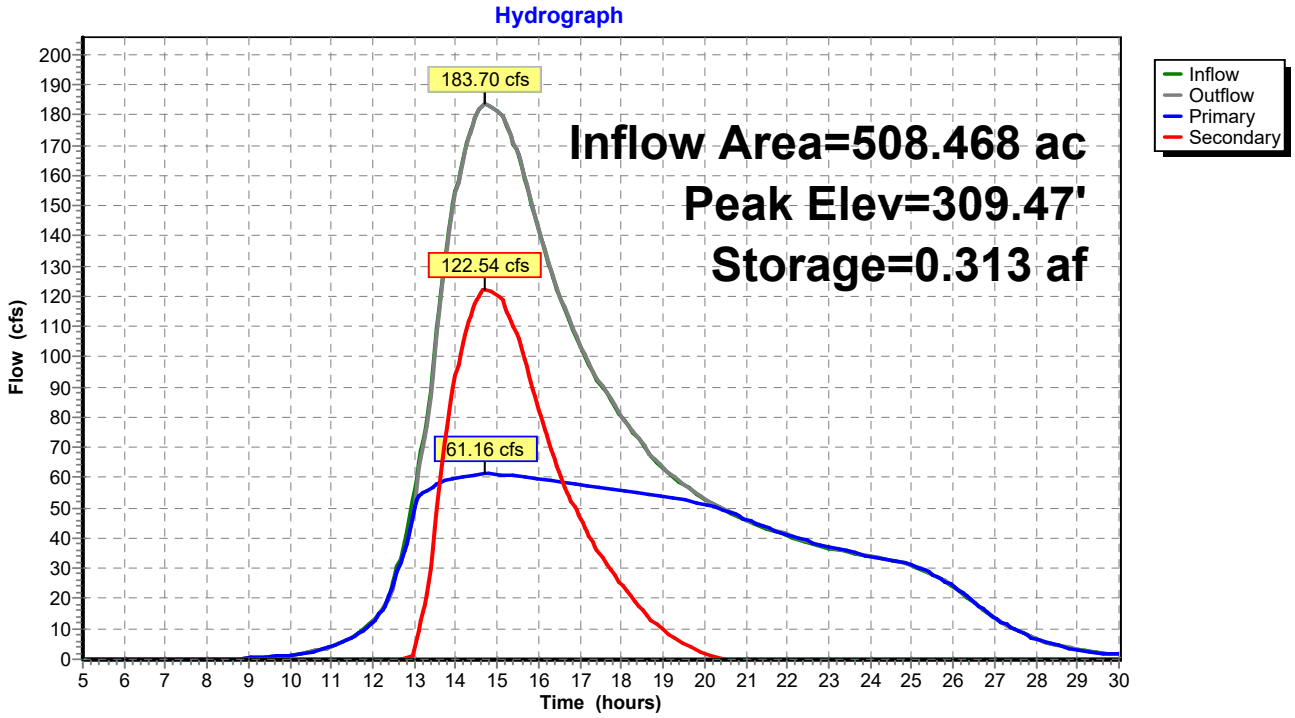
Height (feet)	3.08	2.98	2.95	2.91	2.91	2.91	2.91	2.92	2.94	2.94	
2.93	2.91	2.87	2.86	2.82	2.79	2.78	2.77	2.77	2.76	2.71	2.68
2.65	2.62	2.60	2.60	2.55	2.58	2.55	2.54	2.54	2.49	2.48	2.44
2.41	2.40	2.40	2.39	2.34	2.35	2.34	2.33	2.29	2.29	2.24	2.21
2.20	2.20	2.20	2.14	2.11	2.08	2.06	2.03	2.02	1.99	1.99	1.97
1.96	1.97	1.98	1.98	1.97	1.95	1.94	1.93	1.90	1.83	1.81	1.79
1.78	1.74	1.74	1.71	1.68	1.68	1.68	1.68	1.62	1.60	1.58	1.56
1.54	1.53	1.51	1.50	1.49	1.49	1.49	1.45	1.45	1.42	1.43	1.42
1.41	1.41	1.39	1.32	1.31	1.29	1.28	1.24	1.23	1.18	1.21	1.19
1.18	1.18	1.15	1.12	1.09	1.07	1.06	1.05	1.05	1.01	1.00	0.98
0.98	0.98	0.98	0.98	0.97	0.97	0.96	1.00	1.00	1.01	1.01	1.00
1.01	1.00	0.99	0.96	0.96	0.93	0.94	0.92	0.91	0.90	0.87	0.87
0.84	0.84	0.83	0.83	0.83	0.81	0.80	0.78	0.76	0.75	0.75	0.74
0.68	0.67	0.64	0.62	0.60	0.59	0.58	0.55	0.55	0.56	0.56	0.55
0.55	0.53	0.53	0.52	0.52	0.52	0.49	0.48	0.48	0.47	0.47	0.47
0.47	0.44	0.44	0.43	0.44	0.44	0.44	0.44	0.44	0.41	0.41	0.40
0.40	0.39	0.39	0.36	0.36	0.36	0.36	0.35	0.35	0.34	0.38	0.37
0.44	0.40	0.44	0.46	0.47	0.47	0.47	0.47	0.44	0.42	0.38	0.37
0.32	0.30	0.27	0.25	0.27	0.27	0.31	0.30	0.31	0.49	0.50	0.60
0.61	0.70	0.69	0.61	0.60	0.60	0.56	0.45	0.40	0.37	0.38	0.33
0.22	0.35	0.29	0.25	0.40	0.41	0.41	0.41	0.42	0.53	0.62	0.63
0.64	0.79	0.81	0.79	0.87	0.84	0.81	0.81	0.77	0.79	0.70	0.73
0.73	0.74	0.74	0.79	0.74	0.78	0.81	0.79	0.81	0.81	0.92	0.92
0.92	0.99	1.03	1.04	1.06	1.09	1.13	1.18	1.21	1.29	1.31	1.21
1.23	1.11	1.00	0.88	0.85	0.73	0.68	0.56	0.50	0.29	0.29	0.29
0.28	0.14	0.12	0.09	0.11	0.07	0.08	0.09	0.10	0.10	0.14	0.14

0.14	0.14	0.16	0.16	0.15	0.15	0.14	0.13	0.11	0.11	0.10	0.07
0.07	0.06	0.06	0.01	0.00	0.05	0.05	0.12	0.36	0.62	0.81	0.98
1.66	1.75	1.77	1.80	2.50	2.72	3.08	3.08				

Primary OutFlow Max=61.16 cfs @ 14.71 hrs HW=309.47' (Free Discharge)
└─**1=36" Culvert** (Inlet Controls 48.58 cfs @ 6.87 fps)
└─**2=24" Culvert** (Barrel Controls 12.59 cfs @ 4.18 fps)

Secondary OutFlow Max=122.48 cfs @ 14.71 hrs HW=309.47' (Free Discharge)
└─**3=Forbush Mill Road** (Weir Controls 122.48 cfs @ 2.08 fps)

Pond 2P: Culvert 2



Hydrograph for Pond 2P: Culvert 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	306.00	0.00	0.00	0.00
5.50	0.00	0.000	306.00	0.00	0.00	0.00
6.00	0.00	0.000	306.00	0.00	0.00	0.00
6.50	0.00	0.000	306.00	0.00	0.00	0.00
7.00	0.00	0.000	306.00	0.00	0.00	0.00
7.50	0.00	0.000	306.00	0.00	0.00	0.00
8.00	0.02	0.000	306.00	0.02	0.02	0.00
8.50	0.10	0.000	306.00	0.10	0.10	0.00
9.00	0.30	0.000	306.01	0.29	0.29	0.00
9.50	0.68	0.000	306.01	0.68	0.68	0.00
10.00	1.35	0.000	306.02	1.35	1.35	0.00
10.50	2.46	0.001	306.04	2.46	2.46	0.00
11.00	4.29	0.002	306.17	4.22	4.22	0.00
11.50	7.26	0.006	306.43	7.17	7.17	0.00
12.00	12.34	0.010	306.80	12.19	12.19	0.00
12.50	25.55	0.039	307.49	24.31	24.31	0.00
13.00	56.25	0.173	308.81	50.97	50.33	0.64
13.50	102.70	0.254	309.23	100.89	57.56	43.33
14.00	154.57	0.295	309.39	153.94	60.13	93.82
14.50	**179.92**	**0.311**	**309.46**	**179.76**	**61.03**	**118.73**
15.00	**181.56**	**0.312**	**309.46**	**181.64**	**61.10**	**120.55**
15.50	166.34	0.303	309.43	166.64	60.59	106.05
16.00	141.80	0.287	309.36	142.16	59.66	82.50
16.50	120.48	0.272	309.30	120.80	58.69	62.11
17.00	103.80	0.257	309.24	104.13	57.77	46.35
17.50	90.68	0.244	309.19	90.98	56.88	34.10
18.00	80.15	0.230	309.13	80.45	55.97	24.48
18.50	71.15	0.215	309.07	71.49	54.96	16.53
19.00	63.14	0.198	309.00	63.52	53.75	9.77
19.50	57.51	0.189	308.93	57.71	52.53	5.18
20.00	52.88	0.179	308.85	52.92	51.17	1.75
20.50	49.01	0.165	308.75	49.36	49.26	0.10
21.00	45.78	0.143	308.58	46.22	46.22	0.00
21.50	43.08	0.124	308.44	43.46	43.46	0.00
22.00	40.73	0.107	308.31	41.13	41.13	0.00
22.50	38.66	0.091	308.19	38.98	38.98	0.00
23.00	36.87	0.079	308.10	37.12	37.12	0.00
23.50	35.35	0.069	308.02	35.56	35.56	0.00
24.00	33.97	0.063	307.95	34.04	34.04	0.00
24.50	32.68	0.060	307.89	32.76	32.76	0.00
25.00	30.96	0.056	307.81	31.08	31.08	0.00
25.50	28.07	0.049	307.68	28.29	28.29	0.00
26.00	23.69	0.038	307.47	23.99	23.99	0.00
26.50	18.56	0.024	307.21	18.92	18.92	0.00
27.00	13.65	0.012	306.90	13.73	13.73	0.00
27.50	9.59	0.008	306.62	9.67	9.67	0.00
28.00	6.59	0.005	306.39	6.66	6.66	0.00
28.50	4.58	0.003	306.21	4.63	4.63	0.00
29.00	3.19	0.001	306.06	3.23	3.23	0.00
29.50	2.21	0.001	306.04	2.22	2.22	0.00
30.00	1.53	0.000	306.03	1.53	1.53	0.00

Summary for Pond 3P: Culvert 3

Inflow Area = 780.951 ac, 0.00% Impervious, Inflow Depth > 1.66" for 10-yr event
Inflow = 211.59 cfs @ 14.83 hrs, Volume= 107.848 af
Outflow = 211.59 cfs @ 14.84 hrs, Volume= 107.770 af, Atten= 0%, Lag= 0.3 min
Primary = 28.45 cfs @ 14.84 hrs, Volume= 32.699 af
Secondary = 183.14 cfs @ 14.84 hrs, Volume= 75.071 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 291.06' @ 14.84 hrs Surf.Area= 0.000 ac Storage= 0.365 af
Flood Elev= 289.70' Surf.Area= 0.000 ac Storage= 0.225 af

Plug-Flow detention time= 2.8 min calculated for 107.770 af (100% of inflow)
Center-of-Mass det. time= 2.3 min (1,071.0 - 1,068.7)

Volume	Invert	Avail.Storage	Storage Description
#1	287.50'	0.461 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
287.50	0.000
292.00	0.461

Device	Routing	Invert	Outlet Devices
#1	Primary	288.07'	**18.0" Round 18" Culvert - Left Barrel** L= 36.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.81' / 288.07' S= -0.0072 '/' Cc= 0.900 n= 0.009, Flow Area= 1.77 sf
#2	Primary	288.19'	**6.0" Round 6" Culvert - Center Barrel** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 288.19' / 287.37' S= 0.0221 '/' Cc= 0.900 n= 0.009, Flow Area= 0.20 sf
#3	Primary	287.53'	**18.0" Round 18" Culvert - Right Barrel** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.53' / 287.38' S= 0.0040 '/' Cc= 0.900 n= 0.009, Flow Area= 1.77 sf
#4	Secondary	289.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.52 1.01 2.44 3.03 4.98 5.54 7.28 8.05 8.29 9.30 10.29 11.61 12.42 12.44 13.86 14.32 15.29 17.56 18.86 19.90 20.58 21.56 21.84 22.70 23.09 24.57 24.87 26.53 26.85 28.19 29.36 30.61 31.87 32.43 32.98 33.85 34.37 35.28 35.99 36.48 36.88 37.42 38.13 38.85 39.56 40.28 41.45 43.11 43.26 44.40 44.77 45.66 46.70 47.42 48.09 48.40 49.74 51.40 52.41 53.18 53.84 55.27 56.70 58.19 60.98 61.95 62.41 63.82 63.84 64.67 65.26 65.72 65.98 66.33 67.41 67.98 68.83 68.96 69.64 71.69 74.10 75.26 77.40 78.25 79.51 79.59 80.97 81.68 82.40 83.83 84.38 85.25 86.68 88.82 89.54 90.25 91.20 92.39 92.85 93.82 94.66 95.25 96.17 96.68 98.10 99.49 99.80 101.15 102.07 102.80 103.33 104.58 104.94 106.12 106.67 107.78 108.10 110.24 111.09 112.75 114.61 115.22 115.86 115.95 117.73 119.38 119.62 120.88 121.04 121.66 122.13 123.38 124.36

125.50	128.09	128.80	129.33	130.23	132.37	134.31	135.78
135.96	137.17	139.68	140.22	140.94	141.65	142.36	142.60
143.79	146.07	147.20	147.57	148.08	148.46	150.22	150.89
151.65	152.55	153.07	154.20	154.50	155.21	156.35	156.64
157.52	158.07	158.78	159.50	161.64	162.35	162.49	163.78
164.76	166.01	166.64	167.47	168.56	173.94	174.40	175.89
176.89	177.22	177.73	178.05	179.07	180.23	182.15	182.57
183.91	184.39	186.06	187.29	188.31	188.56	189.26	190.37
191.06	194.61	195.22	196.89	198.46	199.39	199.61	200.22
201.29	201.89	203.56	204.74	205.22	205.77	207.72	210.65
210.90	211.93	211.99	213.98	214.39	217.72	218.55	219.11
220.01	222.68	223.55	224.02	225.27	225.36	226.89	227.32
228.55	229.37	231.43	231.88	234.71	236.05	236.05	236.88
237.72	238.26	238.72	240.06	240.67	241.40	242.68	243.55
243.75	244.38	245.22	246.75	249.42	251.05	251.88	251.96
252.71	253.43	255.21	256.11	257.10	258.55	259.38	261.05
262.71	262.79	263.55	265.21	265.31	266.04	268.54	269.22
270.21	271.88	273.49	273.64	274.55	275.21	278.54	278.83
280.71	281.04	281.73	282.48	284.18	285.21	286.04	287.71
288.19	288.54	290.21	292.00	292.71	293.03	294.05	294.37
295.21	296.04	296.36	297.71	298.49	300.03	300.40	301.25
301.83	302.55	303.12	305.43	305.77	306.55	306.85	307.92
308.32	309.00	309.29	311.61	311.86	312.78	313.92	314.69
315.40	317.78	319.32	320.70	321.63	322.96	323.18	324.72
325.11	325.49	326.19	327.03	328.33	328.58	330.12	330.48
331.66	332.43	333.21	333.71	334.67	335.52	337.40	338.00
339.08	341.23	342.88	344.45	344.78	345.61	346.32	346.60
347.86	349.41	350.77	351.72	351.97	352.49	353.04	354.12
354.31	355.58	356.35	357.12	359.29	359.49	360.21	361.39
363.16	364.06	364.77	367.01	368.69	371.78	372.00	373.46
374.09	374.86	375.60	376.41	376.68	379.07	379.49	380.26
380.98	381.18	381.81	382.58	385.66	387.42	388.50	388.75
391.06	392.13	393.38	394.86	395.69	398.01	398.78	400.30
400.34	401.86	403.07	404.18	405.69	406.76	407.83	408.91
409.58	410.35	411.28	411.89	413.43	414.02	414.45	414.98
416.43	417.29	417.50	418.83	419.61			

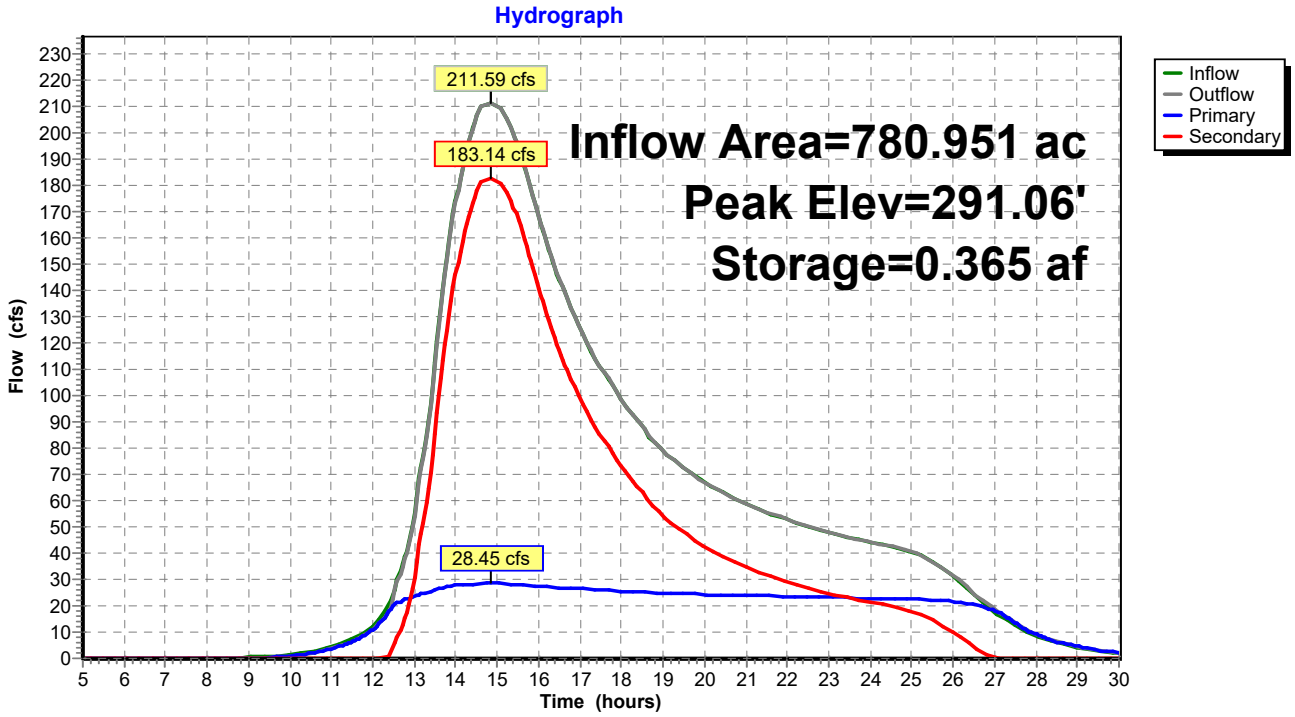
Height (feet)	17.94	17.81	17.58	16.87	16.57	15.64	15.38	14.53			
14.16	14.03	13.54	13.05	12.43	12.02	12.02	11.28	11.05	10.54		
9.38	8.73	8.22	7.90	7.45	7.33	6.92	6.75	6.06	5.93	5.18	5.04
4.42	3.91	3.38	2.83	2.63	2.42	2.14	1.99	1.71	1.50	1.37	1.29
1.21	1.14	1.06	1.00	0.96	0.93	0.83	0.81	0.73	0.71	0.64	0.57
0.51	0.47	0.44	0.35	0.23	0.15	0.10	0.07	0.05	0.05	0.11	0.24
0.27	0.27	0.31	0.30	0.33	0.33	0.35	0.34	0.35	0.35	0.36	0.36
0.37	0.37	0.29	0.18	0.12	0.03	0.01	0.01	0.00	0.08	0.13	0.20
0.32	0.38	0.45	0.59	0.84	0.94	1.02	1.14	1.27	1.33	1.44	1.55
1.62	1.75	1.80	1.96	2.10	2.14	2.29	2.36	2.40	2.42	2.45	2.47
2.51	2.51	2.53	2.52	2.55	2.57	2.60	2.60	2.61	2.61	2.62	2.62
2.54	2.52	2.45	2.45	2.41	2.40	2.33	2.28	2.20	2.04	2.00	1.98
1.93	1.87	1.85	1.82	1.81	1.79	1.79	1.78	1.78	1.77	1.77	1.78
1.78	1.75	1.72	1.70	1.69	1.67	1.60	1.58	1.53	1.48	1.44	1.37
1.36	1.31	1.25	1.22	1.16	1.13	1.08	1.04	0.98	0.98	0.97	0.97
0.99	1.04	1.06	1.10	1.14	1.40	1.41	1.46	1.48	1.50	1.51	1.53

1.57	1.63	1.71	1.72	1.78	1.79	1.85	1.89	1.93	1.93	1.96	1.99
2.02	2.15	2.16	2.20	2.22	2.22	2.23	2.23	2.25	2.25	2.27	2.30
2.32	2.33	2.40	2.44	2.45	2.45	2.46	2.46	2.47	2.51	2.53	2.53
2.55	2.58	2.58	2.59	2.59	2.60	2.59	2.60	2.60	2.61	2.61	2.60
2.60	2.63	2.64	2.66	2.69	2.72	2.73	2.79	2.81	2.85	2.88	2.89
2.90	2.90	2.92	2.94	3.00	3.06	3.08	3.09	3.10	3.13	3.17	3.20
3.24	3.28	3.31	3.36	3.40	3.41	3.42	3.46	3.47	3.48	3.54	3.55
3.58	3.62	3.68	3.68	3.72	3.74	3.82	3.82	3.86	3.86	3.88	3.89
3.94	3.96	3.99	4.03	4.05	4.05	4.09	4.12	4.12	4.13	4.13	4.14
4.14	4.16	4.16	4.18	4.18	4.21	4.21	4.23	4.23	4.25	4.25	4.28
4.29	4.29	4.30	4.30	4.31	4.31	4.32	4.32	4.31	4.31	4.29	4.29
4.28	4.28	4.30	4.33	4.36	4.41	4.41	4.51	4.56	4.59	4.68	4.80
5.04	5.08	5.40	5.47	5.68	5.81	5.93	6.02	6.17	6.31	6.60	6.70
6.86	7.20	7.48	7.73	7.79	7.92	8.05	8.09	8.30	8.52	8.70	8.82
8.86	8.91	8.98	9.09	9.12	9.25	9.34	9.41	9.64	9.67	9.74	9.88
10.08	10.20	10.28	10.57	10.80	11.24	11.28	11.49	11.59	11.70		
11.82	11.94	11.99	12.37	12.43	12.56	12.67	12.71	12.80	12.93		
13.41	13.69	13.85	13.88	14.22	14.36	14.53	14.74	14.85	15.18		
15.28	15.50	15.50	15.72	15.88	16.04	16.21	16.31	16.40	16.50		
16.58	16.66	16.78	16.85	17.08	17.16	17.23	17.30	17.52	17.64		
17.68	17.86	17.94									

Primary OutFlow Max=28.45 cfs @ 14.84 hrs HW=291.06' (Free Discharge)
- **1=18" Culvert - Left Barrel** (Inlet Controls 12.74 cfs @ 7.21 fps)
- **2=6" Culvert - Center Barrel** (Inlet Controls 1.53 cfs @ 7.79 fps)
- **3=18" Culvert - Right Barrel** (Inlet Controls 14.19 cfs @ 8.03 fps)

Secondary OutFlow Max=181.78 cfs @ 14.84 hrs HW=291.06' (Free Discharge)
- **4=Forbush Mill Road** (Weir Controls 181.78 cfs @ 3.06 fps)

Pond 3P: Culvert 3



Hydrograph for Pond 3P: Culvert 3

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	287.50	0.00	0.00	0.00
5.50	0.00	0.000	287.50	0.00	0.00	0.00
6.00	0.00	0.000	287.50	0.00	0.00	0.00
6.50	0.00	0.000	287.50	0.00	0.00	0.00
7.00	0.00	0.000	287.50	0.00	0.00	0.00
7.50	0.00	0.000	287.50	0.00	0.00	0.00
8.00	0.02	0.000	287.50	0.00	0.00	0.00
8.50	0.10	0.002	287.52	0.00	0.00	0.00
9.00	0.29	0.009	287.59	0.05	0.05	0.00
9.50	0.68	0.024	287.74	0.21	0.21	0.00
10.00	1.35	0.047	287.95	0.75	0.75	0.00
10.50	2.46	0.073	288.21	1.84	1.84	0.00
11.00	4.22	0.095	288.43	3.68	3.68	0.00
11.50	7.17	0.121	288.68	6.46	6.46	0.00
12.00	12.19	0.158	289.05	10.93	10.93	0.00
12.50	25.14	0.248	289.92	22.87	20.05	2.82
13.00	55.34	0.286	290.29	54.31	23.66	30.65
13.50	112.69	0.323	290.66	111.57	26.05	85.52
14.00	174.26	0.352	290.93	173.84	27.72	146.12
14.50	**206.04**	**0.363**	**291.04**	**205.90**	**28.34**	**177.56**
15.00	**210.47**	**0.364**	**291.06**	**210.51**	**28.43**	**182.08**
15.50	195.03	0.359	291.01	195.22	28.13	167.09
16.00	168.14	0.350	290.91	168.44	27.60	140.84
16.50	144.40	0.339	290.81	144.62	27.00	117.62
17.00	125.70	0.331	290.73	125.87	26.52	99.35
17.50	110.73	0.323	290.65	110.92	26.03	84.88
18.00	98.65	0.316	290.59	98.79	25.62	73.18
18.50	88.38	0.311	290.53	88.50	25.27	63.23
19.00	79.27	0.305	290.47	79.39	24.88	54.51
19.50	72.49	0.300	290.43	72.59	24.57	48.02
20.00	66.88	0.296	290.39	66.97	24.32	42.65
20.50	62.62	0.293	290.36	62.69	24.12	38.56
21.00	58.87	0.290	290.33	58.93	23.95	34.98
21.50	55.59	0.288	290.31	55.66	23.76	31.90
22.00	52.79	0.285	290.28	52.85	23.55	29.30
22.50	50.21	0.282	290.26	50.27	23.35	26.92
23.00	47.95	0.280	290.24	48.00	23.18	24.82
23.50	46.03	0.278	290.22	46.07	23.03	23.04
24.00	44.21	0.277	290.20	44.25	22.89	21.35
24.50	42.64	0.275	290.19	42.68	22.78	19.91
25.00	40.51	0.273	290.17	40.57	22.62	17.95
25.50	36.82	0.270	290.13	36.93	22.34	14.59
26.00	31.11	0.262	290.05	31.36	21.53	9.83
26.50	24.41	0.251	289.95	24.68	20.37	4.31
27.00	17.69	0.229	289.73	18.35	18.10	0.25
27.50	12.39	0.183	289.28	13.61	13.61	0.00
28.00	8.51	0.144	288.90	9.24	9.24	0.00
28.50	5.90	0.120	288.67	6.38	6.38	0.00
29.00	4.10	0.103	288.51	4.44	4.44	0.00
29.50	2.81	0.089	288.37	3.11	3.11	0.00
30.00	1.93	0.078	288.26	2.20	2.20	0.00

Summary for Pond 4P: Culvert 4

Inflow Area = 780.951 ac, 0.00% Impervious, Inflow Depth > 1.66" for 10-yr event
Inflow = 211.59 cfs @ 14.84 hrs, Volume= 107.770 af
Outflow = 212.49 cfs @ 14.85 hrs, Volume= 107.555 af, Atten= 0%, Lag= 0.6 min
Primary = 46.84 cfs @ 14.85 hrs, Volume= 52.345 af
Secondary = 165.65 cfs @ 14.85 hrs, Volume= 55.210 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 286.23' @ 14.85 hrs Surf.Area= 0.000 ac Storage= 1.076 af
Flood Elev= 285.22' Surf.Area= 0.000 ac Storage= 0.889 af

Plug-Flow detention time= 8.8 min calculated for 107.555 af (100% of inflow)
Center-of-Mass det. time= 7.4 min (1,078.4 - 1,071.0)

Volume	Invert	Avail.Storage	Storage Description
#1	281.50'	1.076 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
281.50	0.000
286.00	1.076

Device	Routing	Invert	Outlet Devices
#1	Primary	281.69'	**36.0" Round 36" PVC-lined DI Culvert** L= 39.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 281.50' / 281.69' S= -0.0048 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 7.07 sf
#2	Secondary	285.22'	**Forbrush Mill Road, C= 3.27** Offset (feet) 0.00 0.10 0.33 0.48 1.07 3.19 3.71 4.55 5.91 7.08 8.63 9.00 10.46 11.35 13.44 13.83 14.07 15.04 16.78 17.20 17.89 19.50 20.58 22.22 22.34 23.95 24.94 26.79 27.33 27.66 29.02 30.37 30.70 31.23 33.09 34.07 35.68 35.81 37.45 38.53 40.13 40.82 41.25 43.00 43.97 44.20 44.58 46.68 47.57 49.03 49.40 50.95 52.12 53.47 54.32 54.84 56.98 57.56 57.69 57.92 60.27 61.07 62.37 62.99 64.44 65.71 66.82 67.82 68.43 70.96 71.15 71.19 71.26 73.86 74.57 75.71 76.58 77.94 79.30 80.16 81.31 82.02 84.61 84.69 84.74 84.94 87.45 88.06 89.06 90.17 91.44 92.89 93.50 94.81 95.61 97.95 98.18 98.33 98.92 101.05 101.56 102.40 103.76 104.93 106.48 106.85 108.31 109.20 111.30 111.68 111.92 112.90 114.64 115.06 115.74 117.35 118.43 120.07 120.19 121.80 122.79 124.64 125.18 125.51 126.88 128.23 128.55 129.09 130.94 131.93 133.53 133.66 135.30 136.38 137.98 138.68 139.10 140.85 141.82 142.05 142.43 144.53 145.42 146.88 147.25 147.74 148.83 149.86 151.97 152.29 152.45 152.91 155.03 155.75 157.21 157.62 159.22 160.21 162.46 162.68 162.79 163.11 165.38 166.15 167.71 167.96 169.61 170.55 172.95 173.07 173.13 173.31 175.72 176.54 178.20 178.31 180.00 180.89 183.44 183.47 183.48 183.51 186.06 186.93 188.65 188.69 190.39 191.24 193.71 193.82 193.86 193.93 196.41 197.32 198.99 199.18

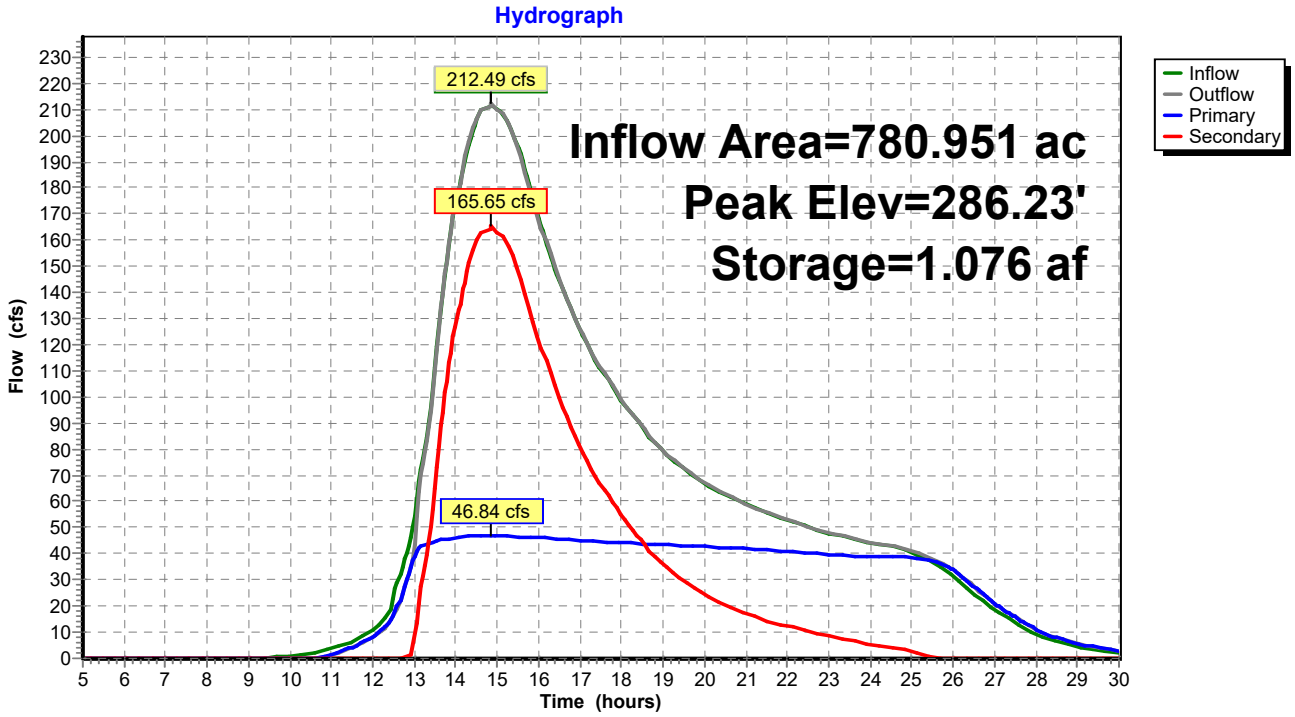
200.79	201.58	203.91	204.16	204.25	204.42	206.75	207.71
209.34	209.67	211.18	211.92	214.11	214.51	214.64	214.91
217.09	218.11	219.68	220.16	221.57	222.27	224.31	224.85
225.03	225.41	227.44	228.50	230.02	230.65	231.96	232.61
234.51	235.19	235.43	235.90	237.78	238.89	240.37	241.14
242.35	242.95	244.71	245.54	245.82	246.39	248.12	249.28
250.71	251.63	252.75	253.29	254.91	255.88	256.21	256.88
258.47	258.61	260.03	260.80	261.57	263.12	264.67	265.44
266.21	267.76	269.31	270.08	270.85	272.40	273.95	274.72
275.48	277.04	278.59	279.36	280.12	281.67	283.23	283.99
284.76	286.31	287.87	288.63	289.40	290.95	292.50	293.27
294.04	295.59	297.14	297.91	298.68	300.23	301.78	302.55
303.32	304.84	304.95	305.63	307.37	308.04	309.23	310.45
311.14	312.86	313.62					

Height (feet)	3.15	3.15	3.15	3.14	3.11	3.00	2.98	2.95	2.89	2.83	
2.80	2.80	2.77	2.76	2.77	2.77	2.77	2.76	2.72	2.71	2.70	2.58
2.57	2.50	2.52	2.46	2.43	2.41	2.39	2.39	2.37	2.36	2.36	2.35
2.34	2.32	2.25	2.25	2.18	2.14	2.09	2.06	2.07	2.03	2.02	2.01
2.01	2.00	1.98	1.96	1.96	1.94	1.92	1.91	1.90	1.90	1.88	1.87
1.87	1.86	1.83	1.81	1.78	1.78	1.75	1.72	1.70	1.68	1.66	1.61
1.60	1.60	1.60	1.54	1.52	1.50	1.46	1.43	1.38	1.38	1.35	1.34
1.31	1.31	1.31	1.31	1.27	1.26	1.25	1.24	1.23	1.22	1.23	1.22
1.22	1.25	1.25	1.25	1.25	1.23	1.23	1.22	1.19	1.17	1.14	1.15
1.13	1.13	1.14	1.13	1.13	1.13	1.11	1.11	1.10	1.06	1.05	1.02
1.05	1.02	1.01	1.01	1.01	1.00	1.00	1.00	0.99	0.97	0.96	0.94
0.93	0.91	0.91	0.90	0.94	0.93	0.93	0.96	0.97	0.97	0.96	0.95
0.94	0.94	0.92	0.92	0.92	0.91	0.94	0.93	0.93	0.94	0.94	0.94
0.95	0.94	0.95	0.94	0.96	0.96	0.96	0.96	0.93	0.94	0.93	0.92
0.91	0.90	0.87	0.87	0.87	0.86	0.81	0.80	0.78	0.77	0.75	0.75
0.76	0.76	0.76	0.76	0.73	0.73	0.70	0.71	0.68	0.68	0.67	0.67
0.67	0.67	0.67	0.64	0.59	0.61	0.57	0.53	0.55	0.55	0.55	0.56
0.58	0.59	0.57	0.59	0.58	0.56	0.60	0.60	0.60	0.60	0.54	0.55
0.54	0.58	0.58	0.60	0.63	0.63	0.63	0.63	0.59	0.59	0.55	0.60
0.58	0.58	0.58	0.58	0.57	0.56	0.53	0.50	0.46	0.47	0.44	0.43
0.44	0.44	0.44	0.44	0.44	0.44	0.42	0.42	0.41	0.39	0.36	0.34
0.34	0.32	0.29	0.28	0.25	0.24	0.22	0.18	0.14	0.12	0.11	0.08
0.05	0.04	0.03	0.03	0.02	0.01	0.00	0.00	0.01	0.01	0.02	0.13
0.28	0.33	0.28	0.30	0.48	0.58	0.61	0.74	0.82	0.90	0.90	0.99
0.97	0.97	0.98	1.03	1.05	1.08	1.09	1.19	1.19	1.30	1.75	1.91
2.23	2.55	2.71	3.11	3.15							

Primary OutFlow Max=46.84 cfs @ 14.85 hrs HW=286.23' (Free Discharge)
└─**1=36" PVC-lined DI Culvert** (Inlet Controls 46.84 cfs @ 6.63 fps)

Secondary OutFlow Max=165.25 cfs @ 14.85 hrs HW=286.23' (Free Discharge)
└─**2=Forbrush Mill Road** (Weir Controls 165.25 cfs @ 2.38 fps)

Pond 4P: Culvert 4



Hydrograph for Pond 4P: Culvert 4

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	281.50	0.00	0.00	0.00
5.50	0.00	0.000	281.50	0.00	0.00	0.00
6.00	0.00	0.000	281.50	0.00	0.00	0.00
6.50	0.00	0.000	281.50	0.00	0.00	0.00
7.00	0.00	0.000	281.50	0.00	0.00	0.00
7.50	0.00	0.000	281.50	0.00	0.00	0.00
8.00	0.00	0.000	281.50	0.00	0.00	0.00
8.50	0.00	0.000	281.50	0.00	0.00	0.00
9.00	0.05	0.001	281.50	0.00	0.00	0.00
9.50	0.21	0.005	281.52	0.00	0.00	0.00
10.00	0.75	0.023	281.60	0.00	0.00	0.00
10.50	1.84	0.073	281.81	0.09	0.09	0.00
11.00	3.68	0.161	282.18	1.39	1.39	0.00
11.50	6.46	0.255	282.57	4.14	4.14	0.00
12.00	10.93	0.360	283.01	8.13	8.13	0.00
12.50	22.87	0.519	283.67	15.99	15.99	0.00
13.00	54.31	0.945	285.45	43.89	38.91	4.98
13.50	111.57	**1.063**	285.95	109.65	44.62	65.04
14.00	173.84	**1.076**	286.14	172.94	46.14	126.80
14.50	**205.90**	1.076	**286.21**	**205.00**	**46.71**	**158.28**
15.00	**210.51**	1.076	**286.22**	**209.61**	**46.79**	**162.82**
15.50	195.22	1.076	286.19	194.32	46.54	147.78
16.00	168.44	1.076	286.13	167.54	46.03	121.50
16.50	144.62	1.076	286.06	143.71	45.51	98.20
17.00	125.87	1.076	286.00	124.97	45.06	79.91
17.50	110.92	1.065	285.95	111.21	44.67	66.55
18.00	98.79	1.053	285.91	99.03	44.28	54.75
18.50	88.50	1.042	285.86	88.76	43.89	44.87
19.00	79.39	1.031	285.81	79.67	43.49	36.18
19.50	72.59	1.020	285.77	72.81	43.12	29.69
20.00	66.97	1.010	285.72	67.21	42.76	24.46
20.50	62.69	1.001	285.69	62.88	42.42	20.46
21.00	58.93	0.992	285.65	59.13	41.85	17.28
21.50	55.66	0.985	285.62	55.86	41.33	14.52
22.00	52.85	0.977	285.59	53.03	40.74	12.29
22.50	50.27	0.970	285.56	50.44	40.19	10.24
23.00	48.00	0.963	285.53	48.18	39.71	8.47
23.50	46.07	0.956	285.50	46.23	39.29	6.94
24.00	44.25	0.948	285.47	44.45	38.98	5.47
24.50	42.68	0.940	285.43	42.89	38.78	4.11
25.00	40.57	0.929	285.38	40.96	38.43	2.53
25.50	36.93	0.904	285.28	37.84	37.50	0.35
26.00	31.36	0.830	284.97	33.91	33.91	0.00
26.50	24.68	0.716	284.50	27.48	27.48	0.00
27.00	18.35	0.608	284.04	21.05	21.05	0.00
27.50	13.61	0.515	283.65	15.79	15.79	0.00
28.00	9.24	0.426	283.28	11.19	11.19	0.00
28.50	6.38	0.354	282.98	7.89	7.89	0.00
29.00	4.44	0.298	282.75	5.66	5.66	0.00
29.50	3.11	0.253	282.56	4.09	4.09	0.00
30.00	2.20	0.217	282.41	2.95	2.95	0.00

Summary for Pond 5P: Sand Culvert

Inflow Area = 816.682 ac, 0.00% Impervious, Inflow Depth > 1.60" for 10-yr event
Inflow = 214.10 cfs @ 14.85 hrs, Volume= 108.852 af
Outflow = 217.34 cfs @ 14.80 hrs, Volume= 108.757 af, Atten= 0%, Lag= 0.0 min
Primary = 177.72 cfs @ 14.80 hrs, Volume= 94.533 af
Secondary = 39.61 cfs @ 14.80 hrs, Volume= 14.224 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.67' @ 14.80 hrs Surf.Area= 0.000 ac Storage= 0.637 af
Flood Elev= 245.59' Surf.Area= 0.000 ac Storage= 0.461 af

Plug-Flow detention time= 4.6 min calculated for 108.540 af (100% of inflow)
Center-of-Mass det. time= 4.1 min (1,082.1 - 1,078.0)

Volume	Invert	Avail.Storage	Storage Description
#1	241.90'	0.637 af	**Custom Stage Data** Listed below

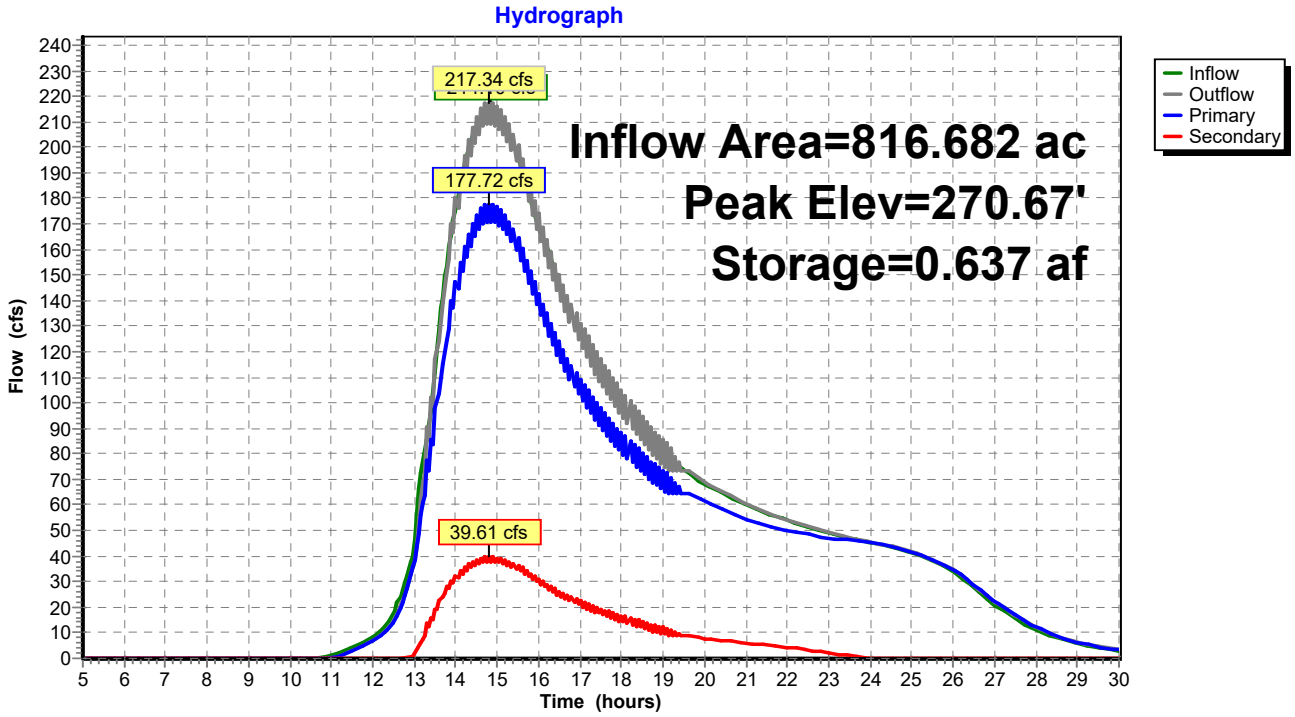
Elevation (feet)	Cum.Store (acre-feet)
241.90	0.000
247.00	0.637

Device	Routing	Invert	Outlet Devices
#1	Primary	241.90'	**36.0" Round 36" Concrete Culvert** L= 30.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.90' / 241.70' S= 0.0067 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Secondary	245.59'	**Sand Road, C= 3.27** Offset (feet) 0.00 0.42 1.87 3.41 3.66 5.17 6.41 7.31 8.47 9.41 10.97 11.76 12.41 14.63 15.06 15.41 18.29 18.36 18.41 18.92 Height (feet) 0.17 0.11 0.11 0.05 0.06 0.00 0.00 0.02 0.02 0.05 0.07 0.09 0.10 0.13 0.14 0.14 0.17 0.17 0.17 0.17

Primary OutFlow Max=177.70 cfs @ 14.80 hrs HW=270.66' (Free Discharge)
└─**1=36" Concrete Culvert** (Inlet Controls 177.70 cfs @ 25.14 fps)

Secondary OutFlow Max=39.61 cfs @ 14.80 hrs HW=270.66' (Free Discharge)
└─**2=Sand Road** (Weir Controls 39.61 cfs @ 21.41 fps)

Pond 5P: Sand Culvert



Hydrograph for Pond 5P: Sand Culvert

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	241.90	0.00	0.00	0.00
5.50	0.00	0.000	241.90	0.00	0.00	0.00
6.00	0.00	0.000	241.90	0.00	0.00	0.00
6.50	0.00	0.000	241.90	0.00	0.00	0.00
7.00	0.00	0.000	241.90	0.00	0.00	0.00
7.50	0.00	0.000	241.90	0.00	0.00	0.00
8.00	0.00	0.000	241.90	0.00	0.00	0.00
8.50	0.00	0.000	241.90	0.00	0.00	0.00
9.00	0.00	0.000	241.90	0.00	0.00	0.00
9.50	0.00	0.000	241.90	0.00	0.00	0.00
10.00	0.00	0.000	241.90	0.00	0.00	0.00
10.50	0.09	0.001	241.90	0.01	0.01	0.00
11.00	1.39	0.022	242.07	0.23	0.23	0.00
11.50	4.14	0.084	242.57	2.66	2.66	0.00
12.00	8.13	0.141	243.03	6.77	6.77	0.00
12.50	17.14	0.216	243.63	14.26	14.26	0.00
13.00	46.61	**0.406**	245.15	38.73	38.73	0.00
13.50	112.01	**0.637**	251.65	117.11	97.77	19.34
14.00	174.92	0.637	262.25	180.01	147.76	32.25
14.50	**206.73**	0.637	**269.32**	**211.83**	**173.29**	**38.53**
15.00	**211.18**	0.637	**270.40**	**216.27**	**176.86**	**39.40**
15.50	195.77	0.637	266.75	200.86	164.48	36.38
16.00	168.89	0.637	261.04	173.98	142.94	31.05
16.50	145.00	0.637	256.64	150.09	123.86	26.23
17.00	126.19	0.637	253.65	131.29	108.94	22.35
17.50	112.39	0.637	251.70	117.48	98.06	19.42
18.00	100.16	0.637	250.16	105.25	88.51	16.75
18.50	89.85	0.637	249.00	94.94	80.54	14.40
19.00	80.72	0.637	248.08	85.81	73.60	12.22
19.50	73.83	0.637	247.04	74.08	64.91	9.16
20.00	68.21	0.598	246.69	69.23	61.36	7.87
20.50	63.85	0.567	246.44	64.41	57.61	6.80
21.00	60.08	0.545	246.27	60.57	54.64	5.93
21.50	56.78	0.527	246.12	57.13	52.04	5.09
22.00	53.93	0.513	246.01	54.25	49.91	4.35
22.50	51.32	0.498	245.89	51.68	48.43	3.25
23.00	49.05	0.485	245.78	49.37	47.23	2.15
23.50	47.08	0.473	245.69	47.35	46.22	1.12
24.00	45.29	0.463	245.61	45.52	45.32	0.20
24.50	43.55	0.450	245.51	43.97	43.97	0.00
25.00	41.16	0.430	245.34	41.70	41.70	0.00
25.50	37.89	0.405	245.14	38.62	38.62	0.00
26.00	33.93	0.376	244.91	34.84	34.84	0.00
26.50	27.48	0.330	244.54	28.70	28.70	0.00
27.00	21.05	0.281	244.15	22.24	22.24	0.00
27.50	15.79	0.237	243.80	16.77	16.77	0.00
28.00	11.19	0.196	243.47	12.14	12.14	0.00
28.50	7.89	0.162	243.19	8.64	8.64	0.00
29.00	5.66	0.135	242.98	6.24	6.24	0.00
29.50	4.09	0.113	242.80	4.57	4.57	0.00
30.00	2.95	0.095	242.66	3.36	3.36	0.00

Summary for Pond 6P: 110 Culvert

Inflow Area = 915.598 ac, 0.00% Impervious, Inflow Depth > 1.47" for 10-yr event
Inflow = 221.88 cfs @ 14.80 hrs, Volume= 111.980 af
Outflow = 216.29 cfs @ 15.02 hrs, Volume= 111.530 af, Atten= 3%, Lag= 13.4 min
Primary = 216.29 cfs @ 15.02 hrs, Volume= 111.530 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 237.34' @ 15.02 hrs Surf.Area= 0.000 ac Storage= 4.722 af
Flood Elev= 238.05' Surf.Area= 0.000 ac Storage= 5.491 af

Plug-Flow detention time= 21.1 min calculated for 111.530 af (100% of inflow)
Center-of-Mass det. time= 18.4 min (1,101.6 - 1,083.1)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	5.491 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
233.00	0.000
238.05	5.491

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**120.0" W x 48.0" H Box 10' Wide Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 233.00' / 233.00' S= 0.0000 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf
#2	Secondary	238.05'	**Route 110, C= 3.27** Offset (feet) 0.00 0.77 3.09 3.35 3.53 4.31 6.28 6.71 7.38 9.04 10.07 11.67 11.80 13.43 14.55 15.96 16.78 17.31 19.74 20.07 20.14 20.25 22.82 23.50 24.54 25.58 26.85 28.34 28.83 30.21 31.09 33.12 33.57 33.85 35.16 36.61 36.92 37.41 39.36 40.28 41.70 42.12 43.64 44.88 45.99 46.99 47.64 50.28 50.35 50.39 50.59 53.15 53.71 54.57 55.91 57.06 58.66 58.86 60.42 61.42 63.15 63.78 64.18 66.01 66.93 67.13 67.44 69.69 70.49 71.74 72.45 73.85 75.20 76.03 77.20 77.96 80.32 80.56 80.72 81.44 83.47 83.92 84.61 86.23 87.27 88.90 88.99 90.63 91.74 93.19 93.99 94.50 96.87 97.26 97.34 97.48 100.02 100.70 101.77 102.77 104.06 105.53 106.06 107.41 108.29 110.35 110.77 111.04 112.29 113.80 114.13 114.64 116.56 117.48 118.93 119.31 120.84 122.07 123.22 124.20 124.83 127.51 127.55 127.58 127.72 130.34 130.91 131.80 133.10 134.27 135.85 136.09 137.63 138.61 140.38 140.98 141.37 143.14 144.13 144.34 144.67 146.88 147.70 148.96 149.64 151.05 152.40 153.25 154.41 155.15 157.54 157.77 157.91 158.57 160.67 161.12 161.83 163.42 164.48 166.12 166.18 167.84 168.94 170.41 171.19 171.69 174.00 174.45 174.55 174.70 177.21 177.91 178.99 179.96 181.26 182.72 183.28 184.62 185.48 187.57 187.98 188.23 189.42 190.99 191.33 191.87 193.75 194.69 196.16 196.51 198.05 199.26 200.45 201.40 202.02

204.74	204.76	204.78	204.85	207.53	208.12	209.03	210.29
211.47	213.05	213.32	214.83	215.80	217.61	218.19	218.56
220.27	221.32	221.54	221.90	224.07	224.90	226.19	226.83
228.26	229.59	230.48	231.61	232.34	234.77	234.97	235.10
235.70	237.86	238.33	239.06	240.62	241.68	243.35	243.37
245.04	246.13	247.64	248.40	248.89	251.13	251.64	251.76
251.93	254.40	255.11	256.22	257.16	258.47	259.91	260.51
261.83	262.67	264.80	265.18	265.43	266.55	268.18	268.54
269.09	270.94	271.90	273.38	273.70	275.25	276.45	277.67
278.61	279.21	281.96	281.97	281.98	284.72	285.32	286.25
287.48	288.68	290.24	290.54	292.04	293.00	294.83	295.39
295.75	297.40	298.51	298.75	299.12	301.27	302.11	303.41
304.02	305.46	306.78	307.70	308.82	309.54	312.00	312.18
312.29	312.83	315.05	315.53	316.29	317.81	318.89	320.56
320.58	322.25	323.32	324.87	325.60	326.08	328.26	328.83
328.96	329.16	331.59	332.32	333.45	334.35	335.67	337.11
337.74	339.03	339.86	342.03	342.39	342.62	343.68	345.38
345.74	346.32	348.13	349.10	350.61	350.89	352.46	353.65
354.90	355.81	356.40	359.11	359.16	359.17	359.19	361.92
362.53	363.48	364.67	365.88	367.43	367.77	369.24	370.19
372.06	372.60	372.94	374.53	375.70	375.96	376.35	378.46
379.31	380.64	381.21	382.67	383.97	384.93	386.03	386.73
389.22	389.38	389.49	389.96	392.24	392.74	393.51	395.00
396.10	397.76	397.80	399.45	400.51	402.09	402.81	403.27
405.39	406.03	406.17	406.38	408.78	409.52	410.67	411.54
412.88	414.30	414.96	416.24	417.05	419.25	419.59	419.81
420.81	422.57	422.95	423.54	425.32	426.31	427.83	428.08
429.66	430.84						

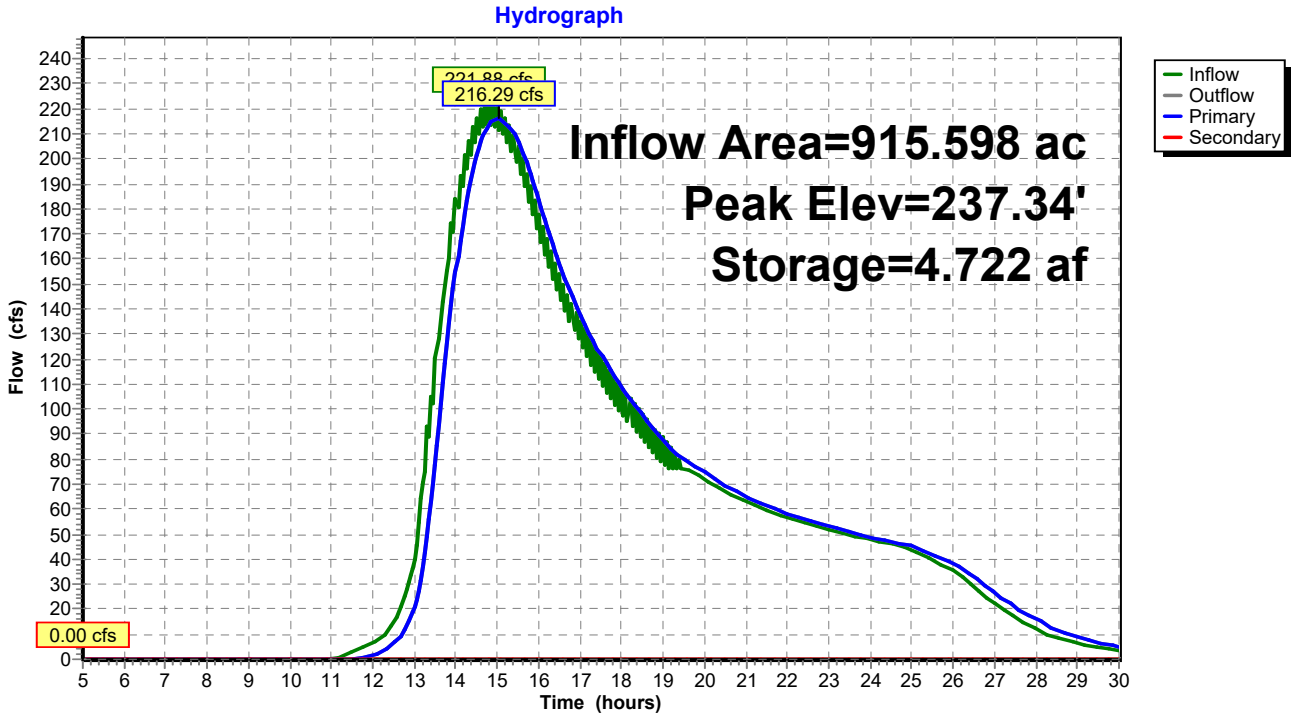
Height (feet)	0.77	0.76	0.75	0.75	0.75	0.74	0.72	0.71	0.71	0.69
0.69	0.70	0.69	0.70	0.70	0.71	0.71	0.71	0.70	0.69	0.69	0.69
0.67	0.67	0.68	0.65	0.66	0.63	0.66	0.64	0.63	0.61	0.60	0.60
0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.59	0.57	0.55	0.56	0.55
0.55	0.53	0.53	0.53	0.53	0.48	0.48	0.48	0.49	0.50	0.51	0.51
0.51	0.50	0.50	0.49	0.49	0.47	0.46	0.46	0.46	0.46	0.45	0.46
0.47	0.48	0.48	0.51	0.52	0.52	0.55	0.55	0.55	0.57	0.62	0.64
0.65	0.69	0.70	0.69	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.64
0.64	0.64	0.65	0.65	0.66	0.69	0.70	0.72	0.68	0.69	0.68	0.73
0.72	0.72	0.70	0.68	0.67	0.66	0.58	0.56	0.51	0.50	0.46	0.46
0.46	0.46	0.46	0.44	0.44	0.44	0.44	0.44	0.42	0.40	0.37	0.35
0.33	0.32	0.31	0.32	0.30	0.30	0.30	0.28	0.27	0.27	0.27	0.25
0.25	0.25	0.24	0.25	0.25	0.28	0.28	0.28	0.30	0.30	0.30	0.29
0.26	0.25	0.24	0.24	0.22	0.21	0.21	0.20	0.17	0.09	0.07	0.06
0.01	0.00	0.00	0.00	0.01	0.02	0.09	0.06	0.15	0.20	0.18	0.22
0.23	0.27	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.24	0.24	0.23
0.22	0.22	0.22	0.21	0.22	0.25	0.25	0.25	0.25	0.30	0.31	0.31
0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.28
0.28	0.28	0.28	0.27	0.29	0.27	0.27	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.26	0.26	0.27	0.27	0.29	0.33	0.31	0.35	0.35	0.34
0.34	0.34	0.33	0.33	0.33	0.33	0.31	0.31	0.32	0.30	0.31	0.30
0.32	0.31	0.32	0.29	0.29	0.29	0.29	0.28	0.27	0.28	0.28	0.28
0.27	0.27	0.27	0.26	0.25	0.24	0.24	0.20	0.20	0.20	0.21	0.22
0.24	0.27	0.30	0.30	0.32	0.32	0.32	0.37	0.37	0.37	0.38	0.38

0.38	0.38	0.31	0.32	0.34	0.34	0.36	0.40	0.40	0.43	0.42	0.36
0.36	0.36	0.35	0.32	0.31	0.31	0.31	0.31	0.30	0.31	0.31	0.31
0.33	0.34	0.34	0.37	0.38	0.38	0.38	0.40	0.40	0.40	0.41	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40
0.40	0.38	0.39	0.38	0.39	0.40	0.41	0.41	0.44	0.44	0.44	0.44
0.46	0.46	0.46	0.45	0.45	0.46	0.45	0.46	0.48	0.49	0.50	0.50
0.51	0.52	0.52	0.52	0.52	0.51	0.52	0.53	0.53	0.55	0.56	0.58
0.57	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.61
0.62	0.62	0.63	0.63	0.63	0.67	0.68	0.68	0.68	0.69	0.69	0.68
0.65	0.64	0.65	0.66	0.66	0.67	0.67	0.68	0.68	0.68	0.69	0.69
0.70	0.74	0.76	0.76	0.77	0.77	0.77					

Primary OutFlow Max=216.27 cfs @ 15.02 hrs HW=237.34' (Free Discharge)
└─**1=10' Wide Box Culvert** (Barrel Controls 216.27 cfs @ 6.64 fps)

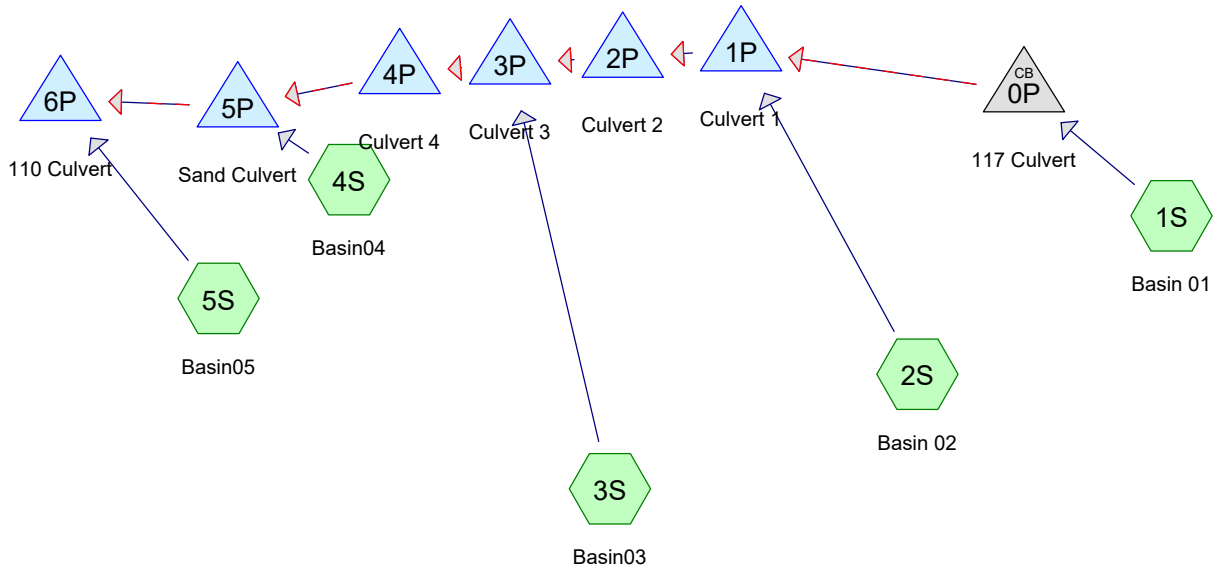
Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=233.00' (Free Discharge)
└─**2=Route 110** (Controls 0.00 cfs)

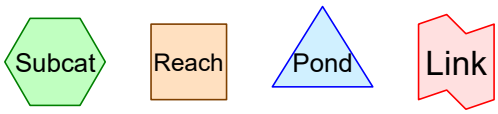
Pond 6P: 110 Culvert



Hydrograph for Pond 6P: 110 Culvert

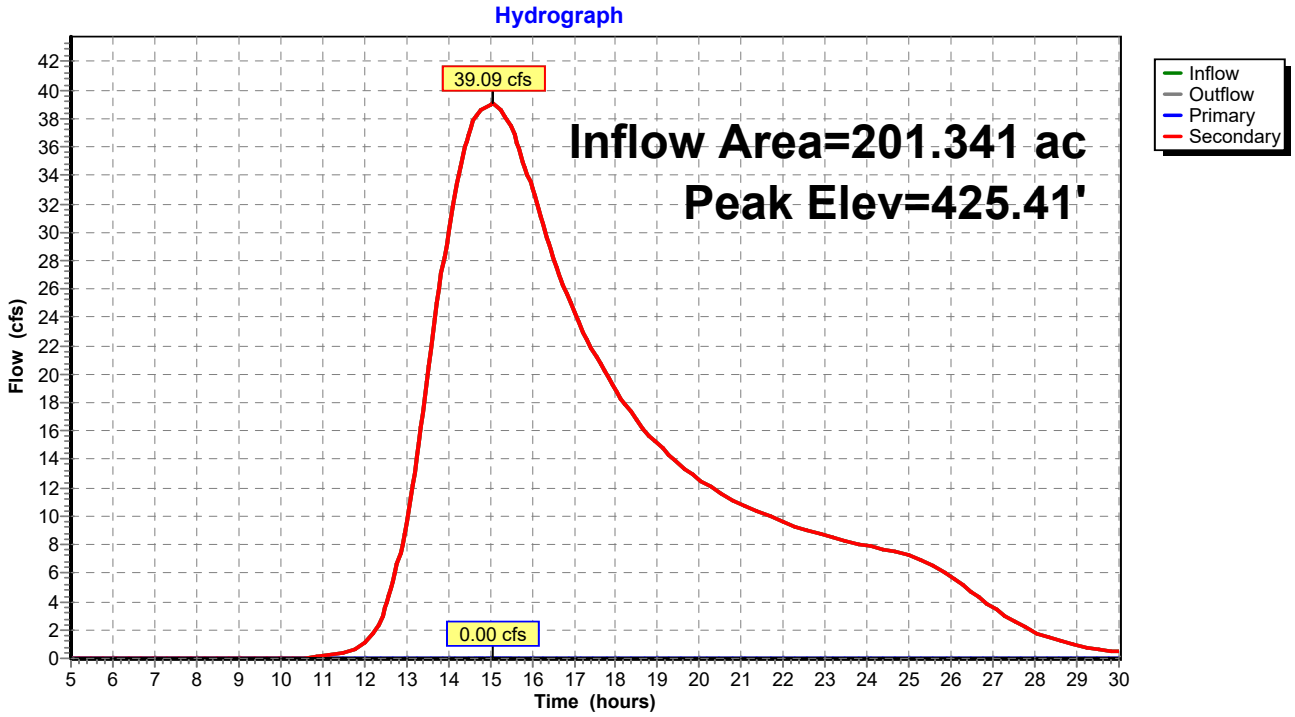
Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	233.00	0.00	0.00	**0.00**
5.50	0.00	0.000	233.00	0.00	0.00	0.00
6.00	0.00	0.000	233.00	0.00	0.00	0.00
6.50	0.00	0.000	233.00	0.00	0.00	0.00
7.00	0.00	0.000	233.00	0.00	0.00	0.00
7.50	0.00	0.000	233.00	0.00	0.00	0.00
8.00	0.00	0.000	233.00	0.00	0.00	0.00
8.50	0.00	0.000	233.00	0.00	0.00	0.00
9.00	0.00	0.000	233.00	0.00	0.00	0.00
9.50	0.00	0.000	233.00	0.00	0.00	0.00
10.00	0.00	0.000	233.00	0.00	0.00	0.00
10.50	0.01	0.000	233.00	0.00	0.00	0.00
11.00	0.23	0.003	233.00	0.01	0.01	0.00
11.50	2.66	0.051	233.05	0.09	0.09	0.00
12.00	6.77	0.220	233.20	1.35	1.35	0.00
12.50	14.43	0.495	233.46	5.91	5.91	0.00
13.00	40.04	1.064	233.98	21.23	21.23	0.00
13.50	120.27	2.419	235.23	77.62	77.62	0.00
14.00	184.39	3.795	236.49	155.02	155.02	0.00
14.50	**216.46**	4.513	237.15	201.94	201.94	0.00
15.00	**220.73**	**4.721**	**237.34**	**216.28**	**216.28**	0.00
15.50	205.06	4.591	237.22	207.21	207.21	0.00
16.00	177.93	4.235	236.90	183.28	183.28	0.00
16.50	153.80	3.850	236.54	158.46	158.46	0.00
17.00	134.78	3.517	236.23	137.98	137.98	0.00
17.50	120.80	3.242	235.98	121.80	121.80	0.00
18.00	108.42	3.008	235.77	108.57	108.57	0.00
18.50	97.98	2.805	235.58	97.51	97.51	0.00
19.00	88.73	2.617	235.41	87.62	87.62	0.00
19.50	76.90	2.465	235.27	79.87	79.87	0.00
20.00	71.96	2.360	235.17	74.69	74.69	0.00
20.50	67.06	2.252	235.07	69.45	69.45	0.00
21.00	63.15	2.162	234.99	65.20	65.20	0.00
21.50	59.65	2.082	234.91	61.46	61.46	0.00
22.00	56.71	2.012	234.85	58.27	58.27	0.00
22.50	54.08	1.950	234.79	55.52	55.52	0.00
23.00	51.73	1.894	234.74	53.03	53.03	0.00
23.50	49.65	1.843	234.69	50.81	50.81	0.00
24.00	47.78	1.797	234.65	48.84	48.84	0.00
24.50	46.16	1.757	234.62	47.15	47.15	0.00
25.00	43.60	1.707	234.57	45.07	45.07	0.00
25.50	39.93	1.633	234.50	42.04	42.04	0.00
26.00	35.59	1.537	234.41	38.22	38.22	0.00
26.50	29.10	1.401	234.29	33.00	33.00	0.00
27.00	22.45	1.228	234.13	26.76	26.76	0.00
27.50	16.88	1.053	233.97	20.90	20.90	0.00
28.00	12.20	0.893	233.82	15.95	15.95	0.00
28.50	8.67	0.747	233.69	11.89	11.89	0.00
29.00	6.25	0.627	233.58	8.85	8.85	0.00
29.50	4.58	0.531	233.49	6.66	6.66	0.00
30.00	3.36	0.453	233.42	5.05	5.05	0.00



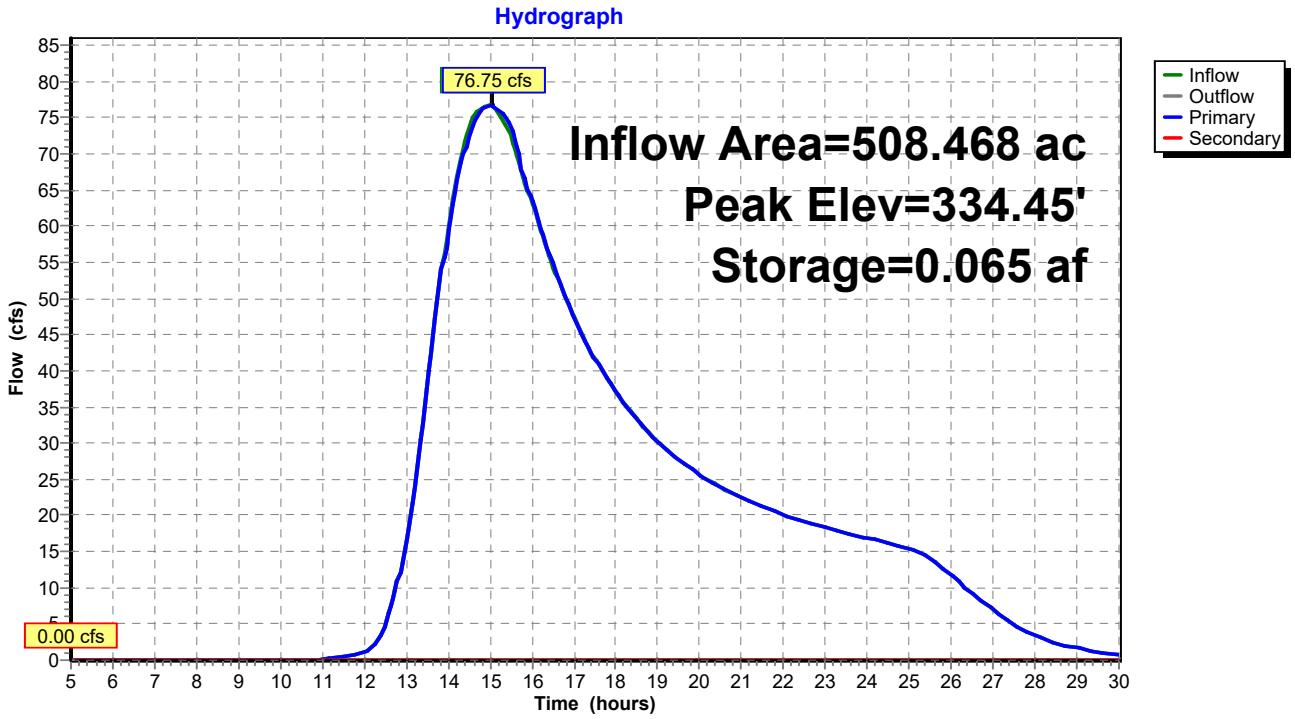


Routing Diagram for forbush_existing
Prepared by Tighe & Bond, Printed 11/29/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

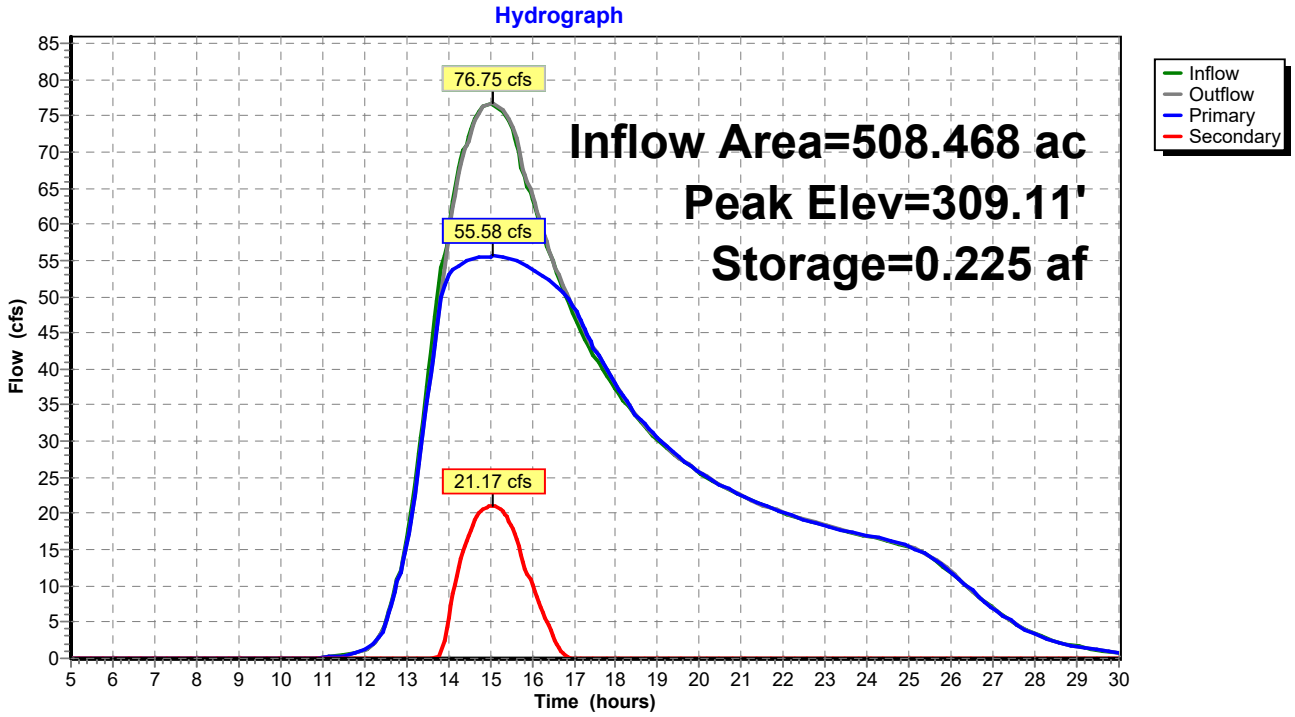
Pond 0P: 117 Culvert



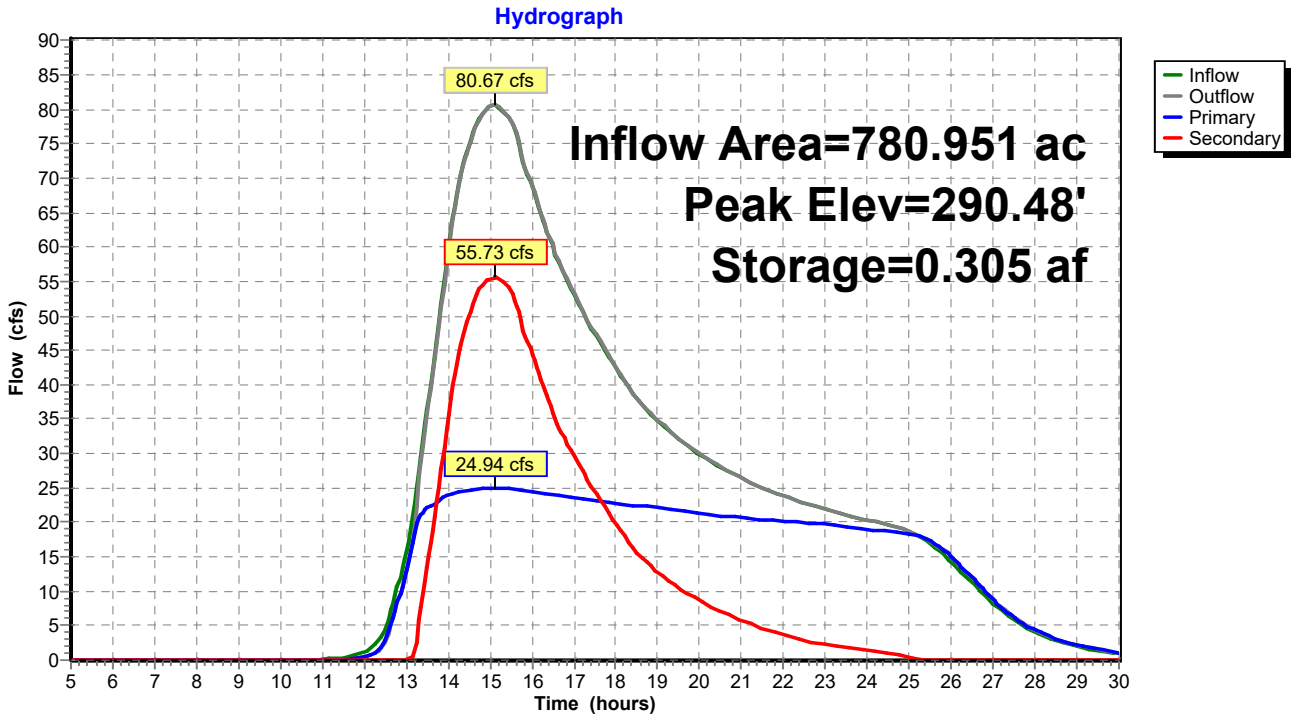
Pond 1P: Culvert 1



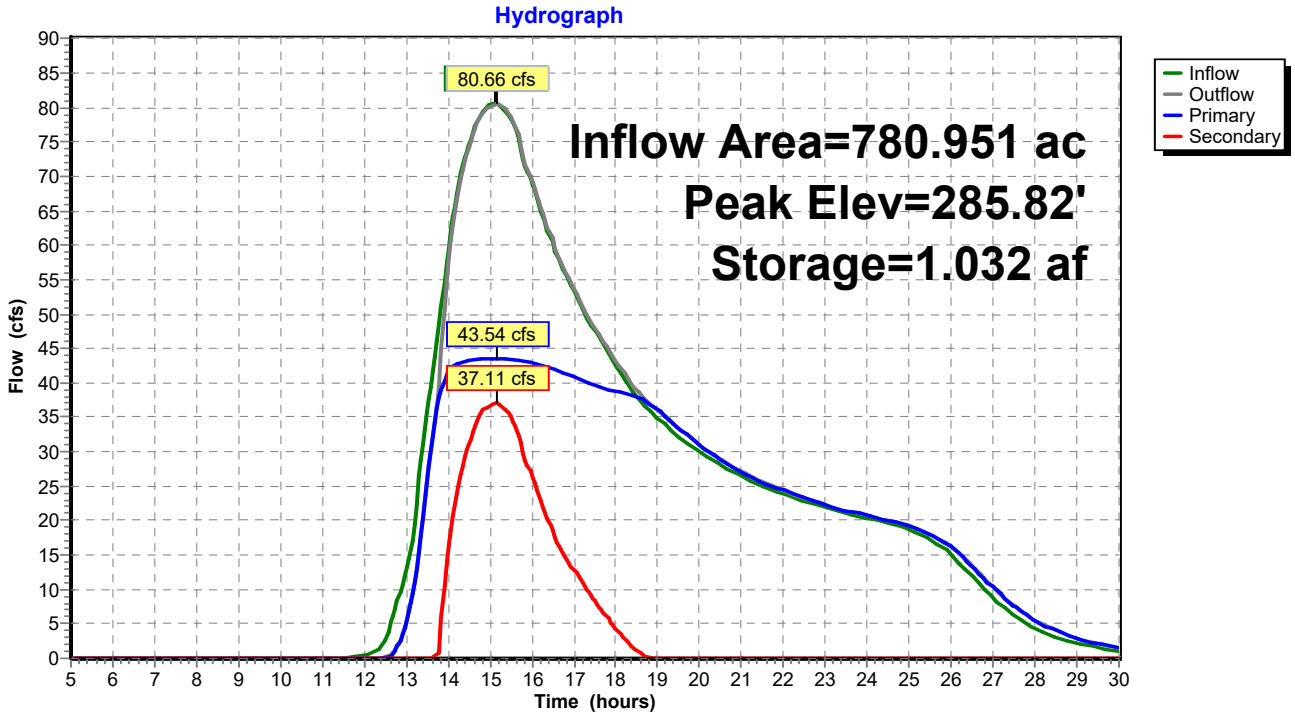
Pond 2P: Culvert 2



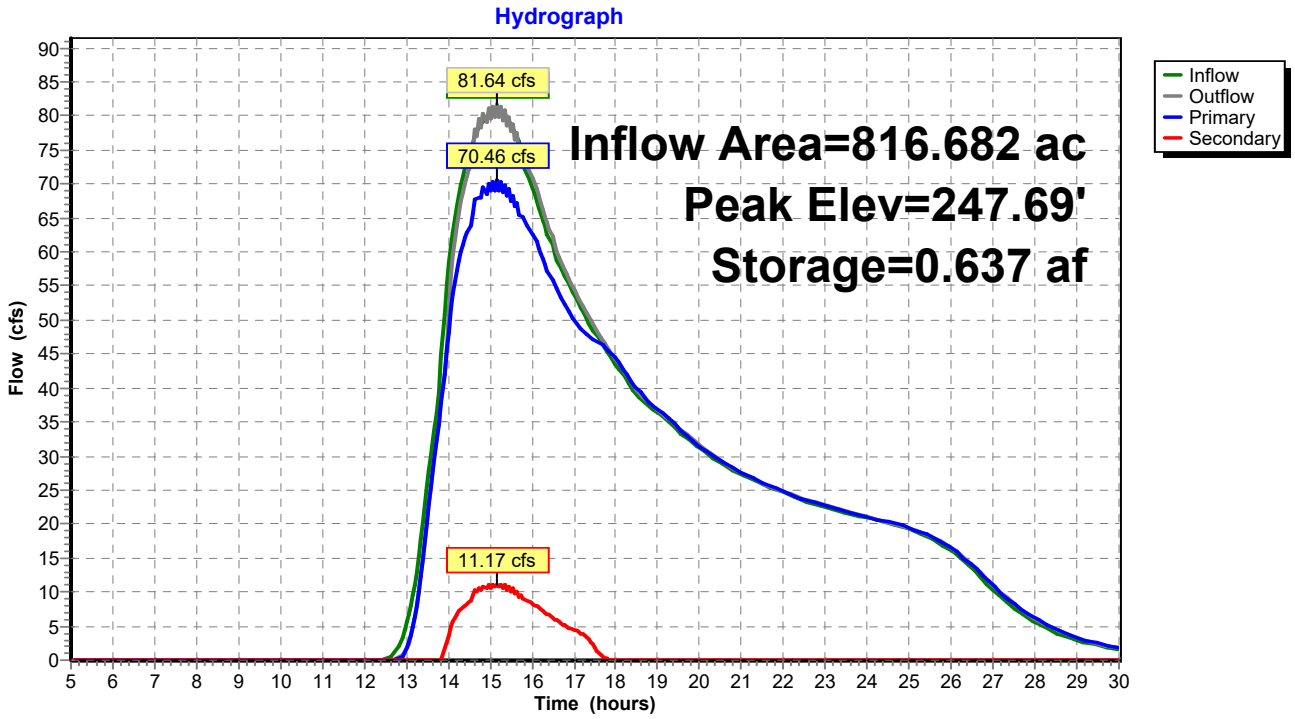
Pond 3P: Culvert 3



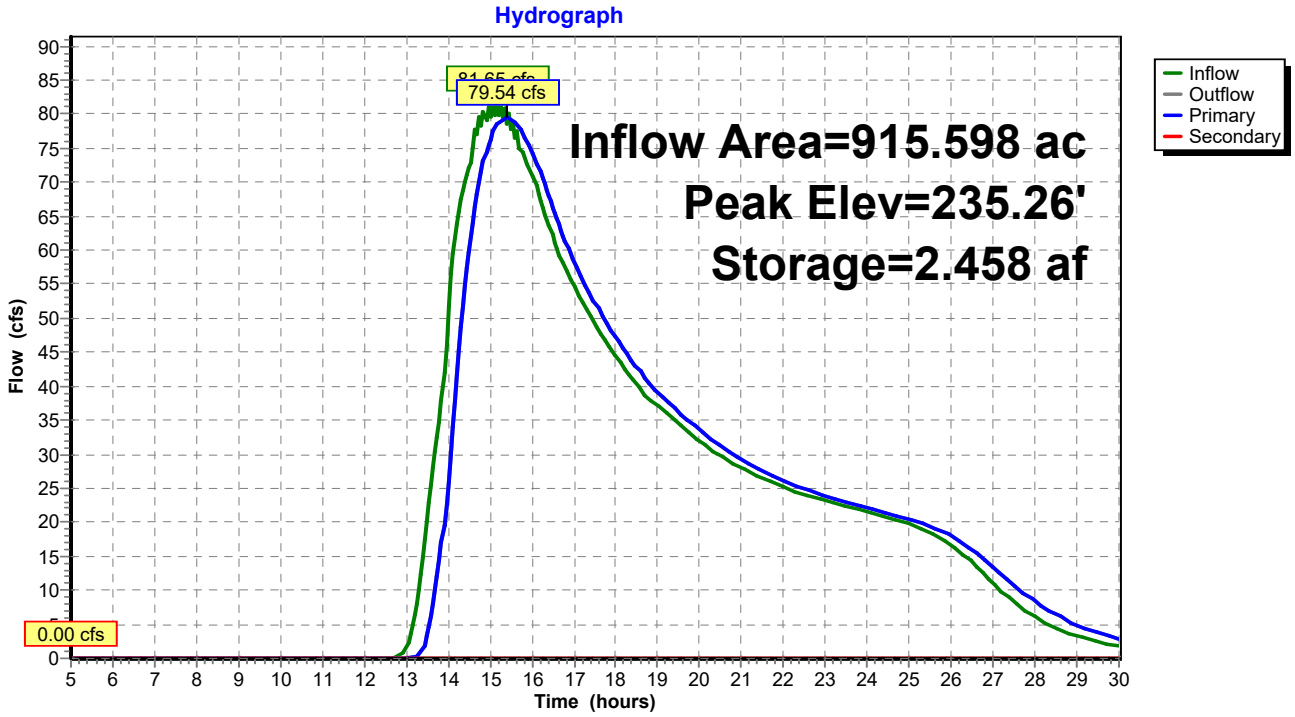
Pond 4P: Culvert 4



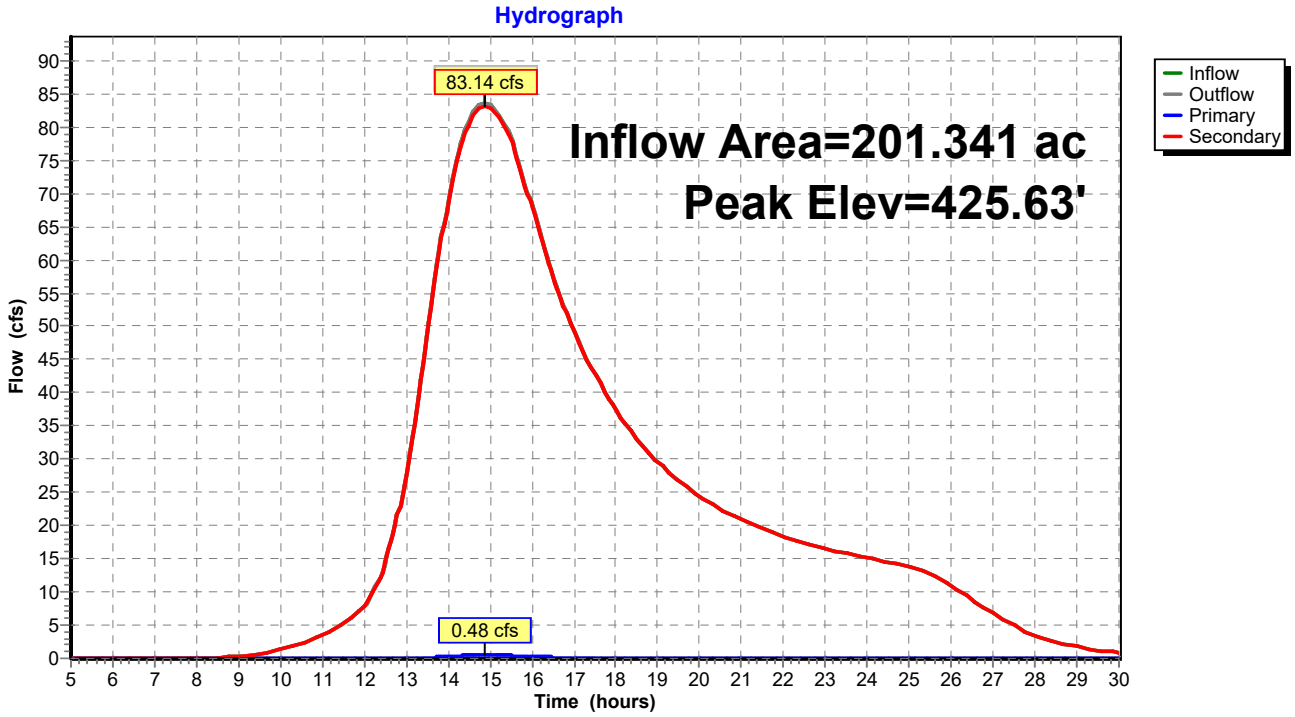
Pond 5P: Sand Culvert



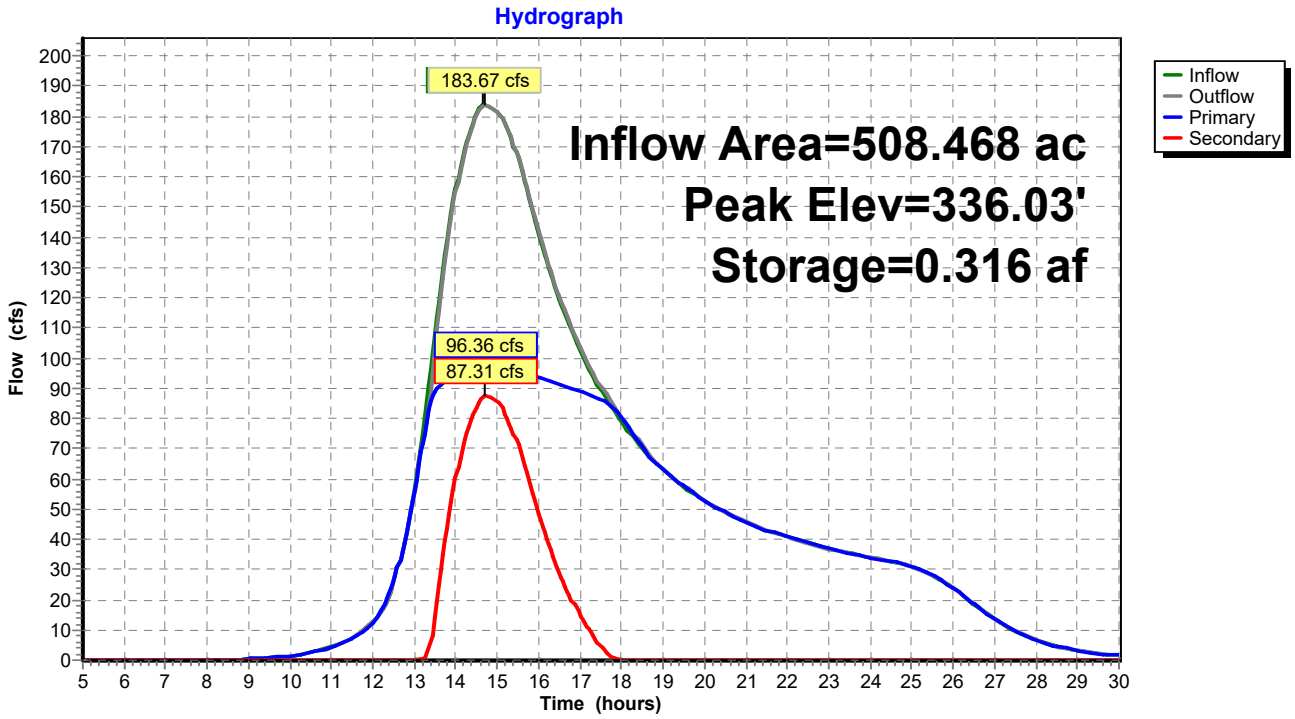
Pond 6P: 110 Culvert



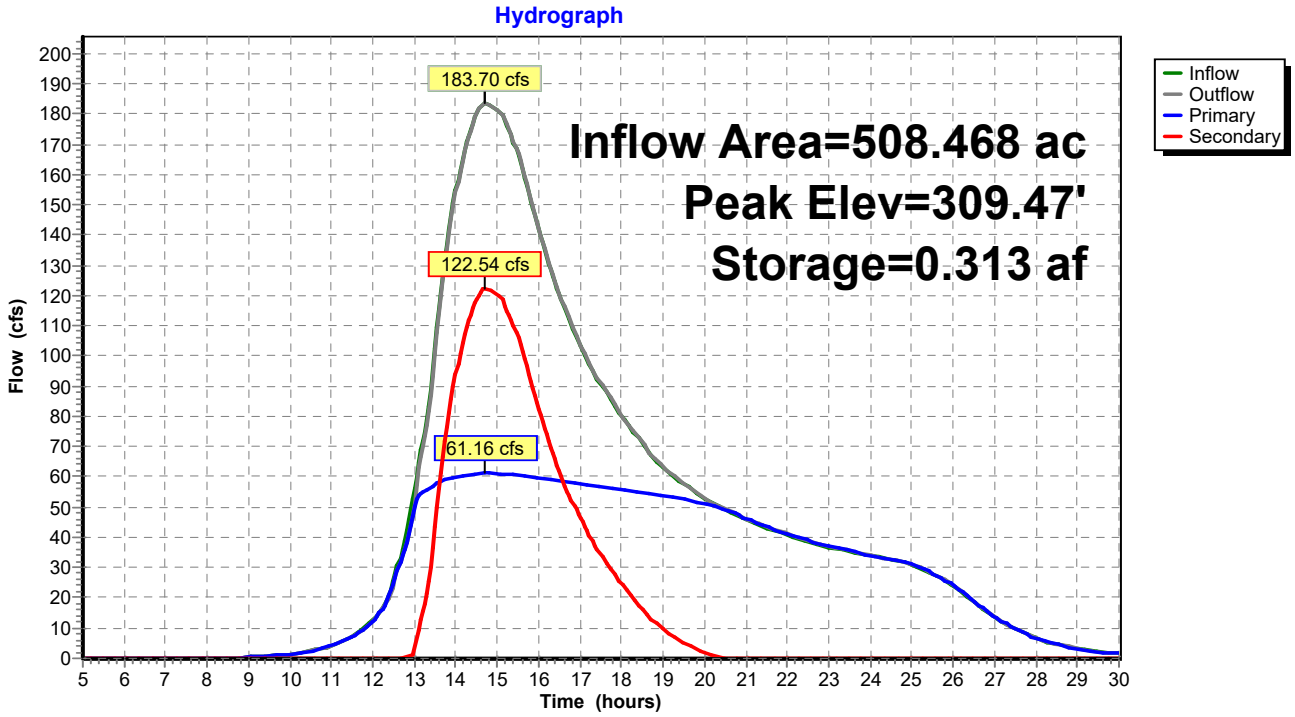
Pond 0P: 117 Culvert



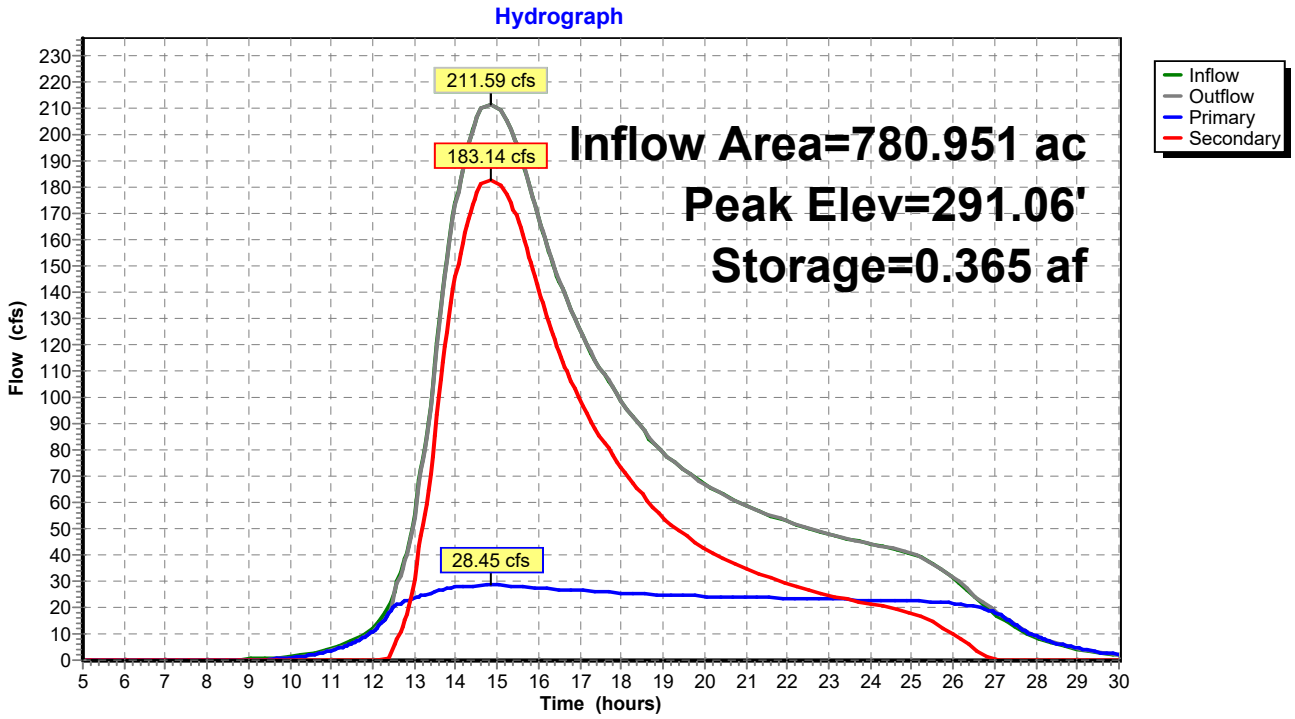
Pond 1P: Culvert 1



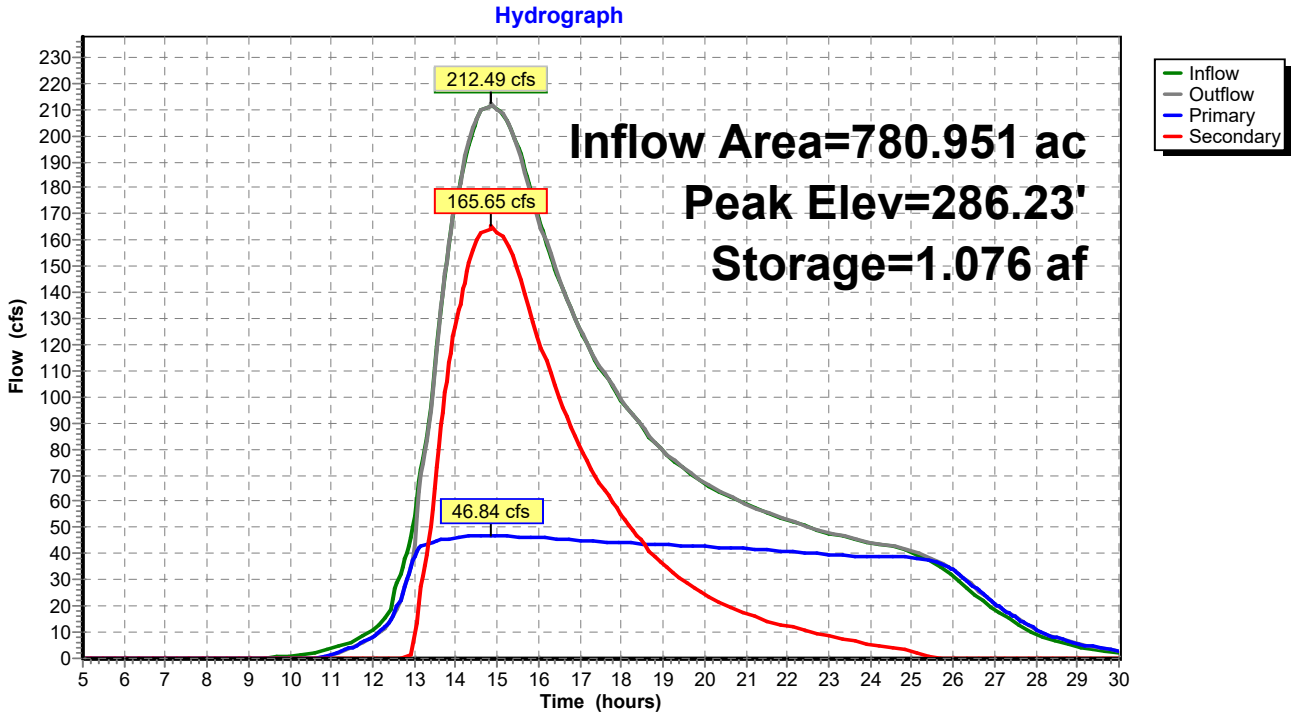
Pond 2P: Culvert 2



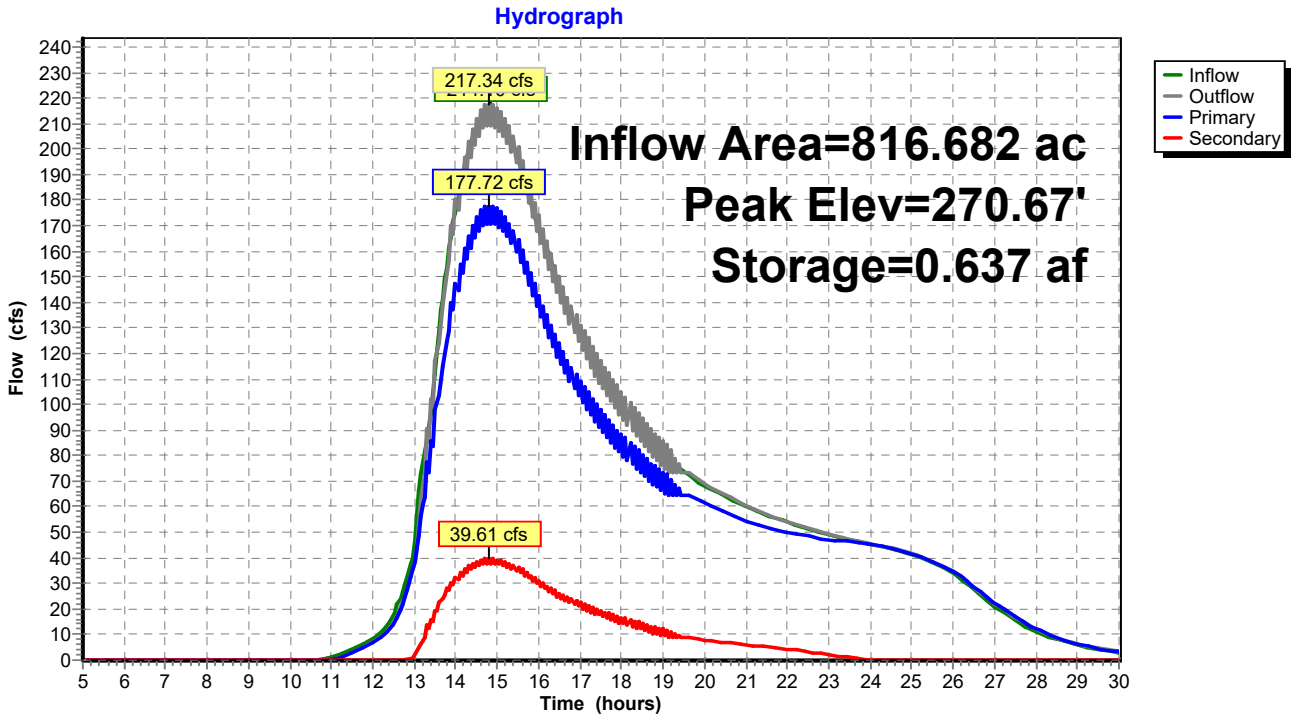
Pond 3P: Culvert 3



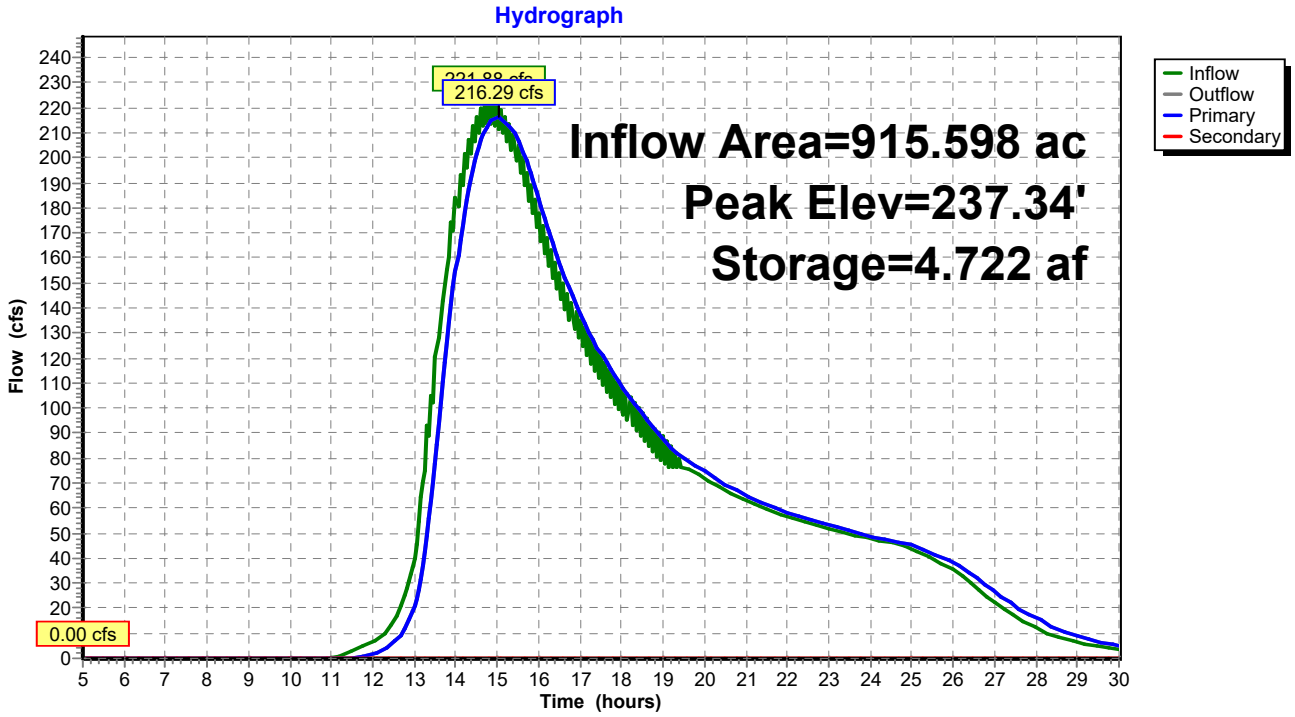
Pond 4P: Culvert 4



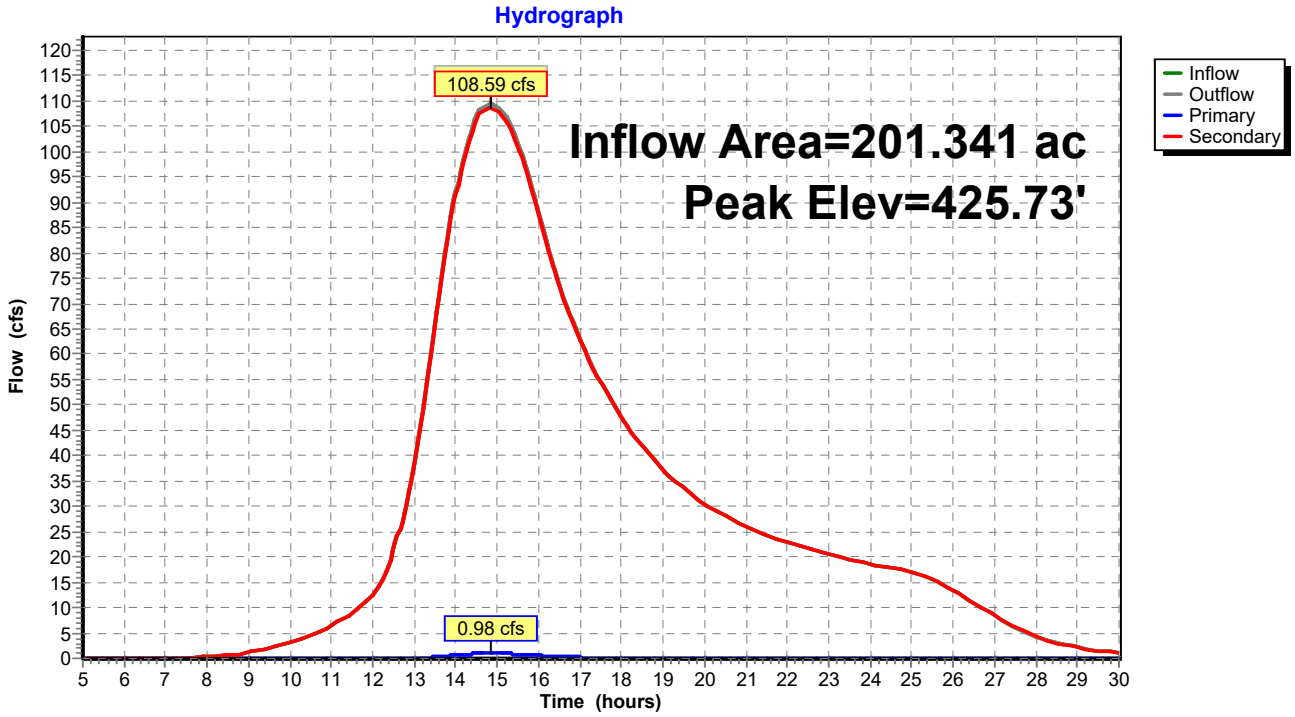
Pond 5P: Sand Culvert



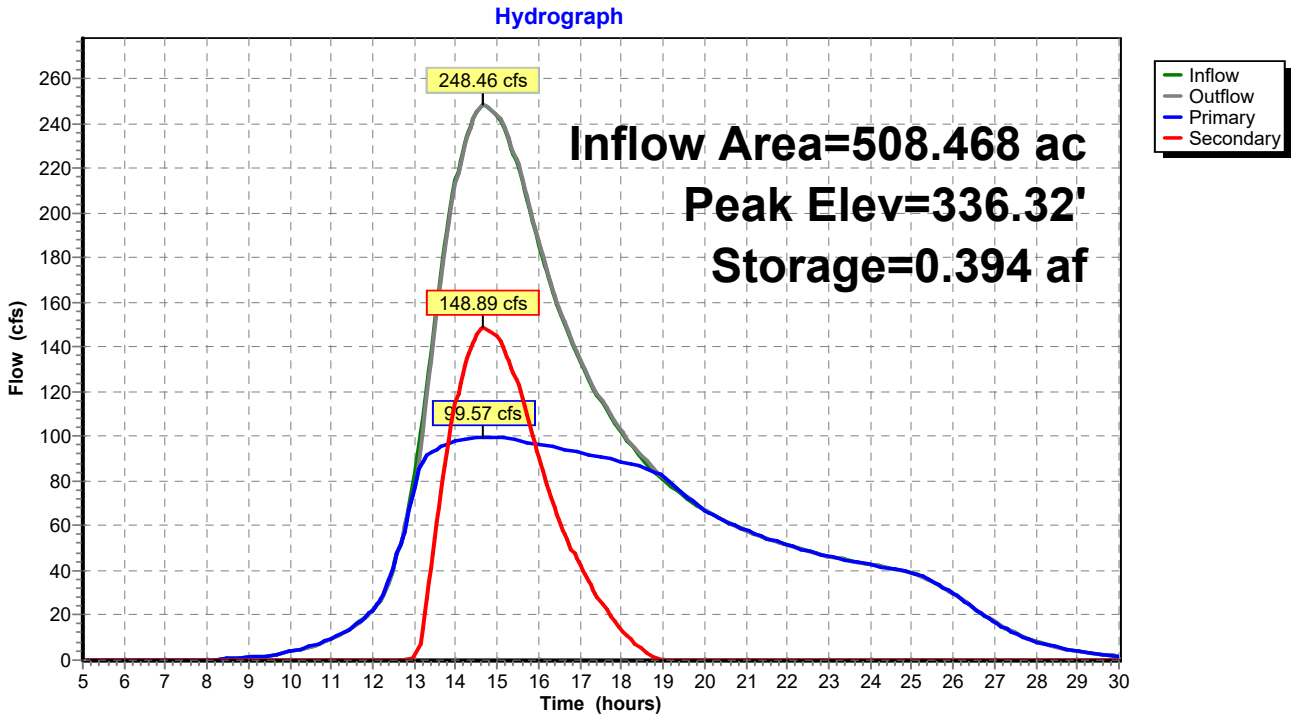
Pond 6P: 110 Culvert



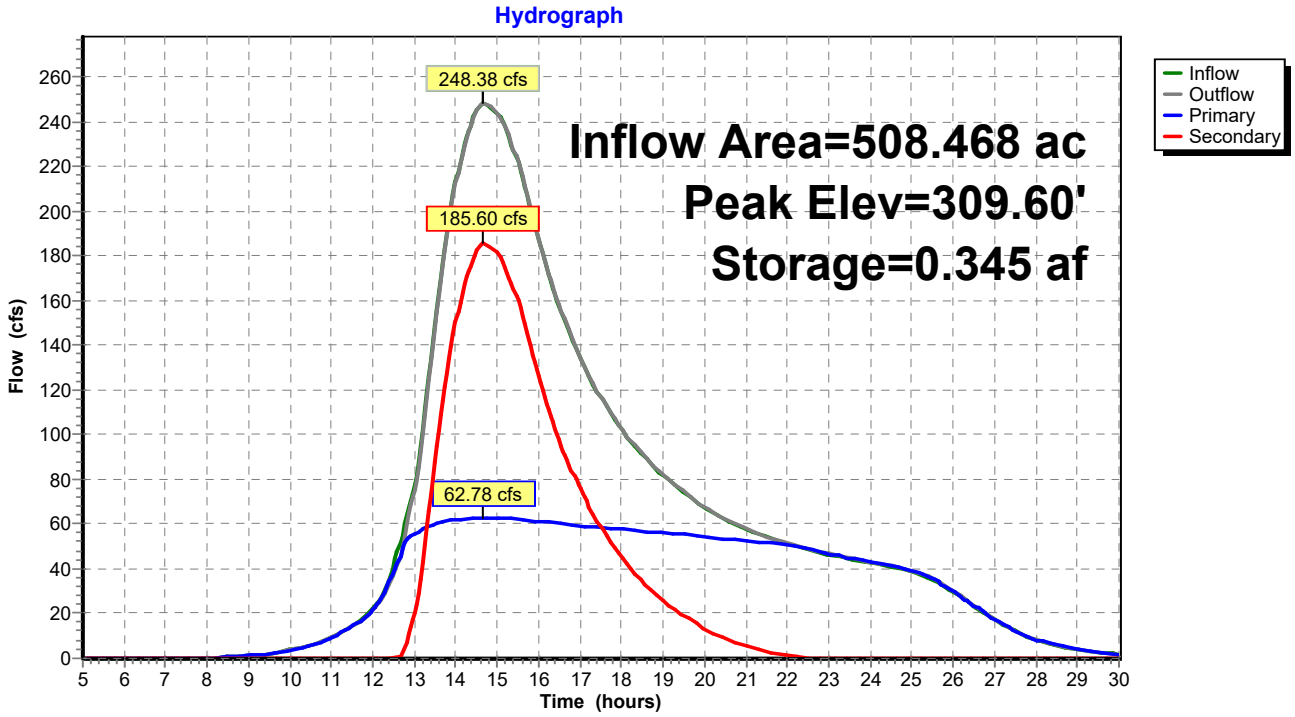
Pond 0P: 117 Culvert



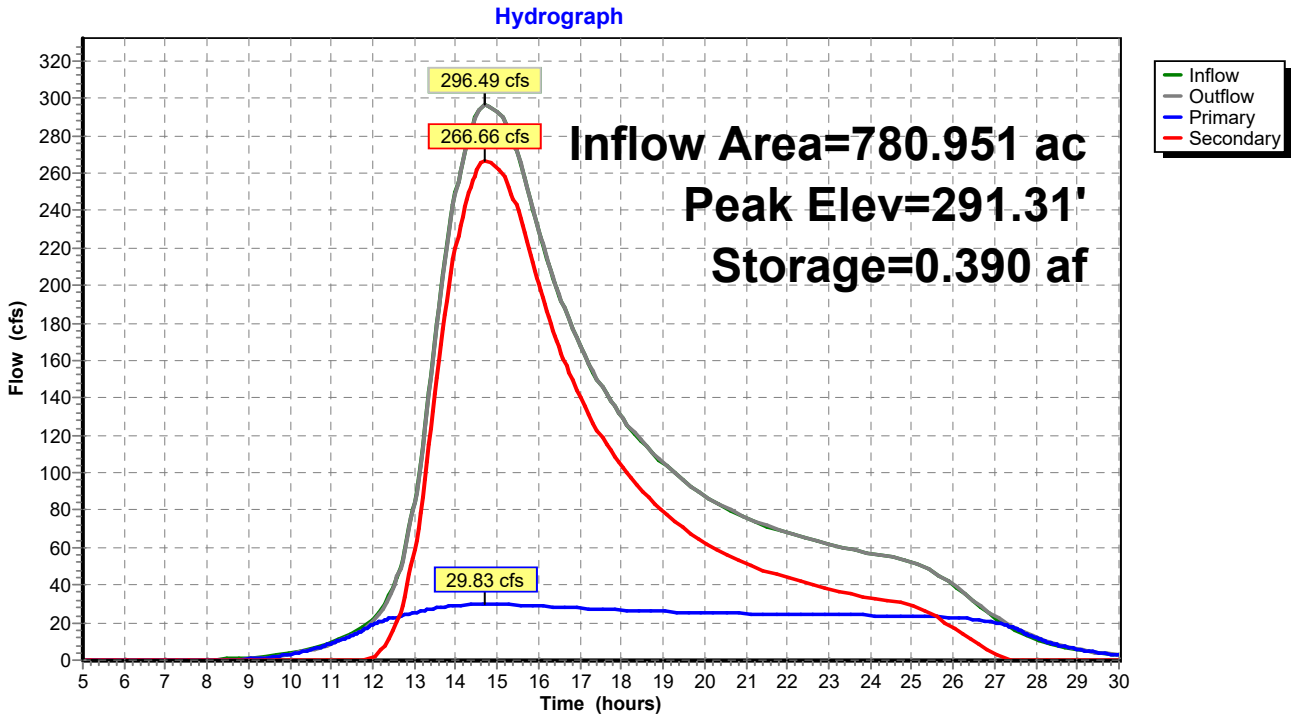
Pond 1P: Culvert 1



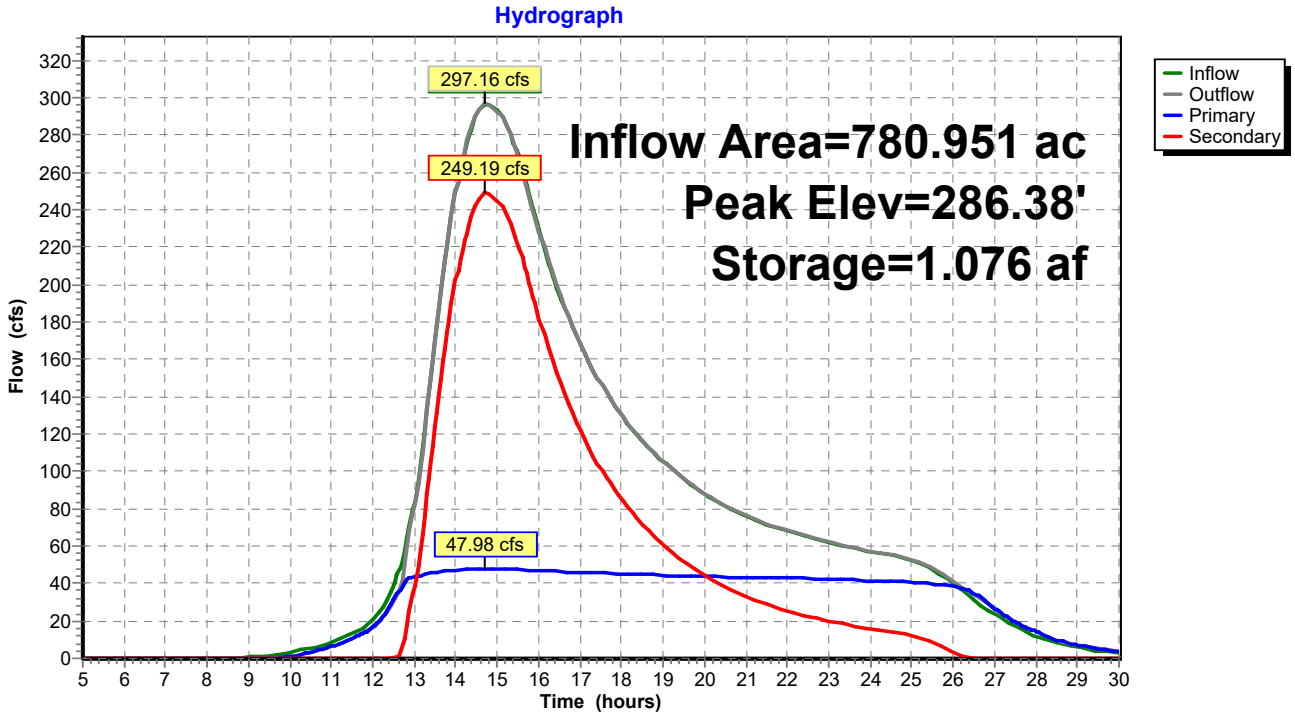
Pond 2P: Culvert 2



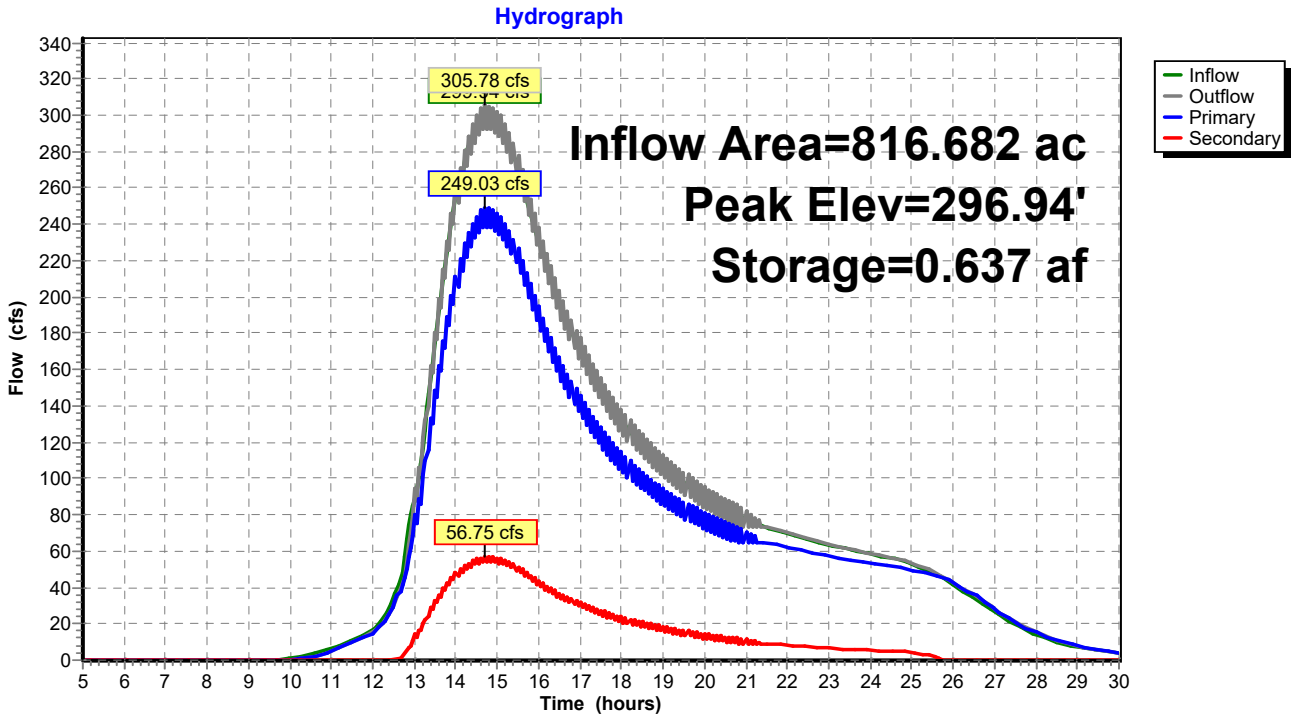
Pond 3P: Culvert 3



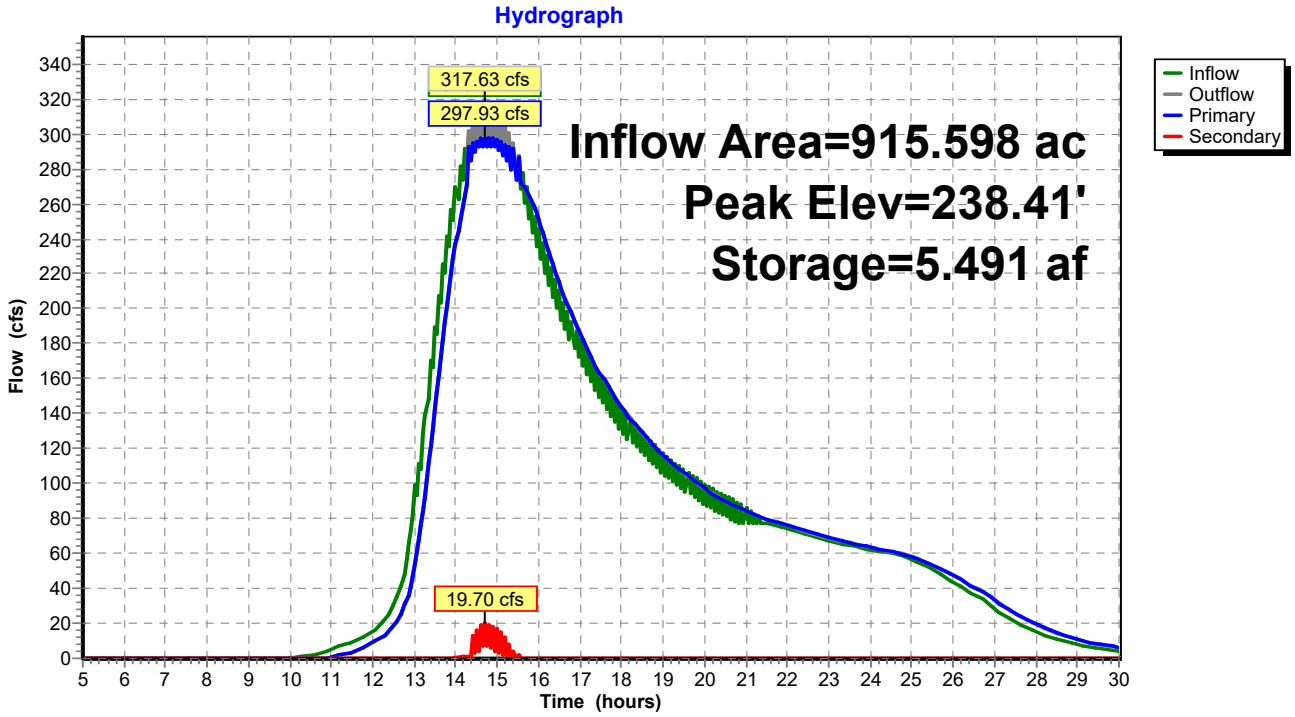
Pond 4P: Culvert 4



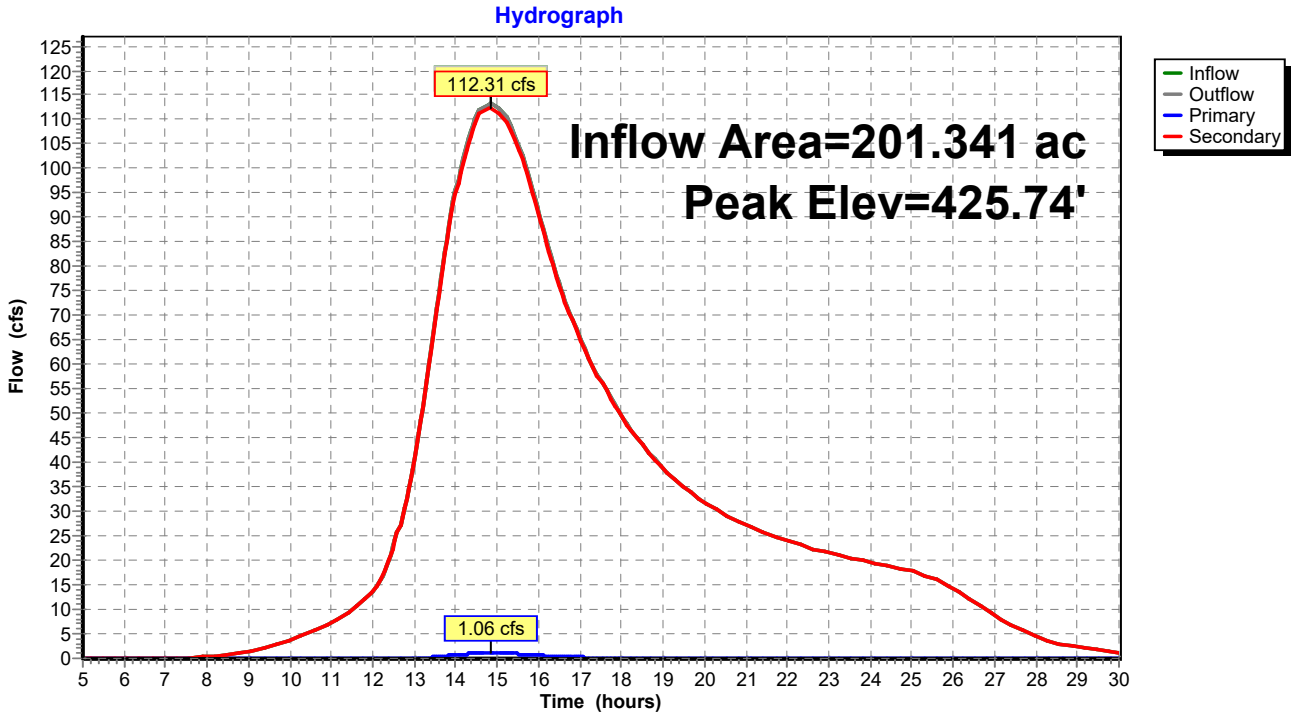
Pond 5P: Sand Culvert



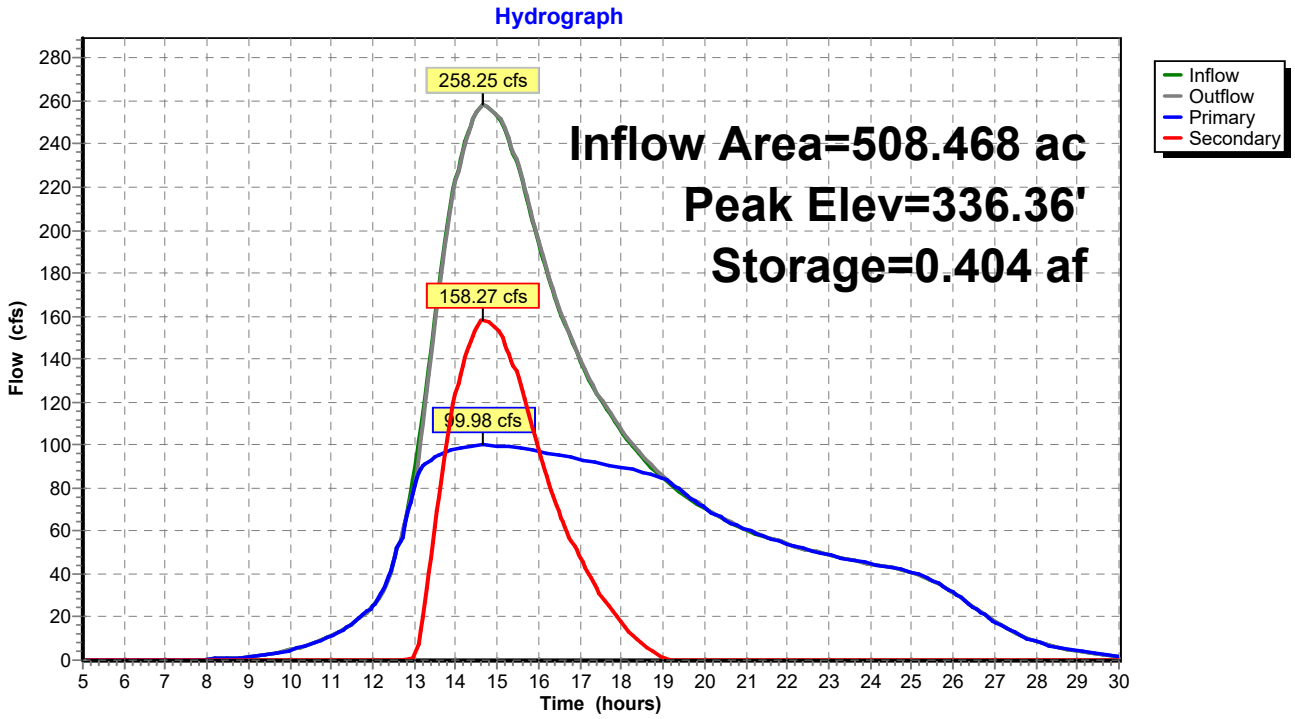
Pond 6P: 110 Culvert



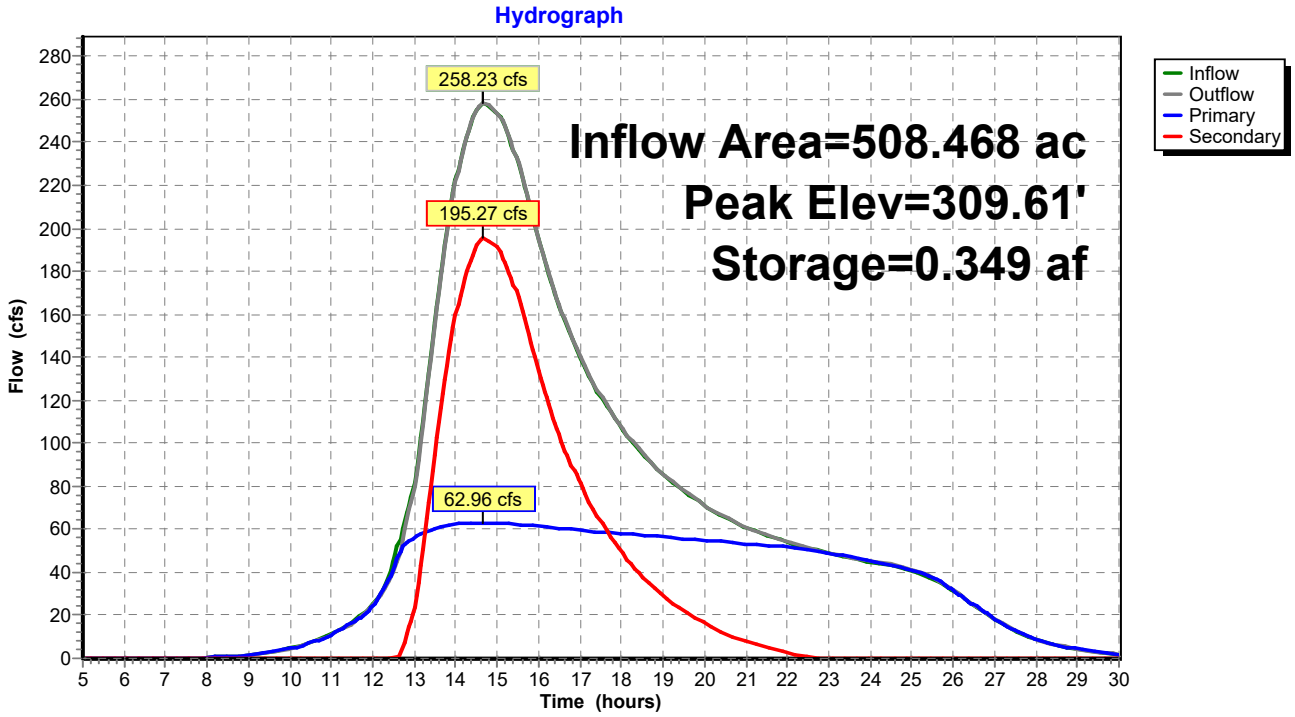
Pond 0P: 117 Culvert



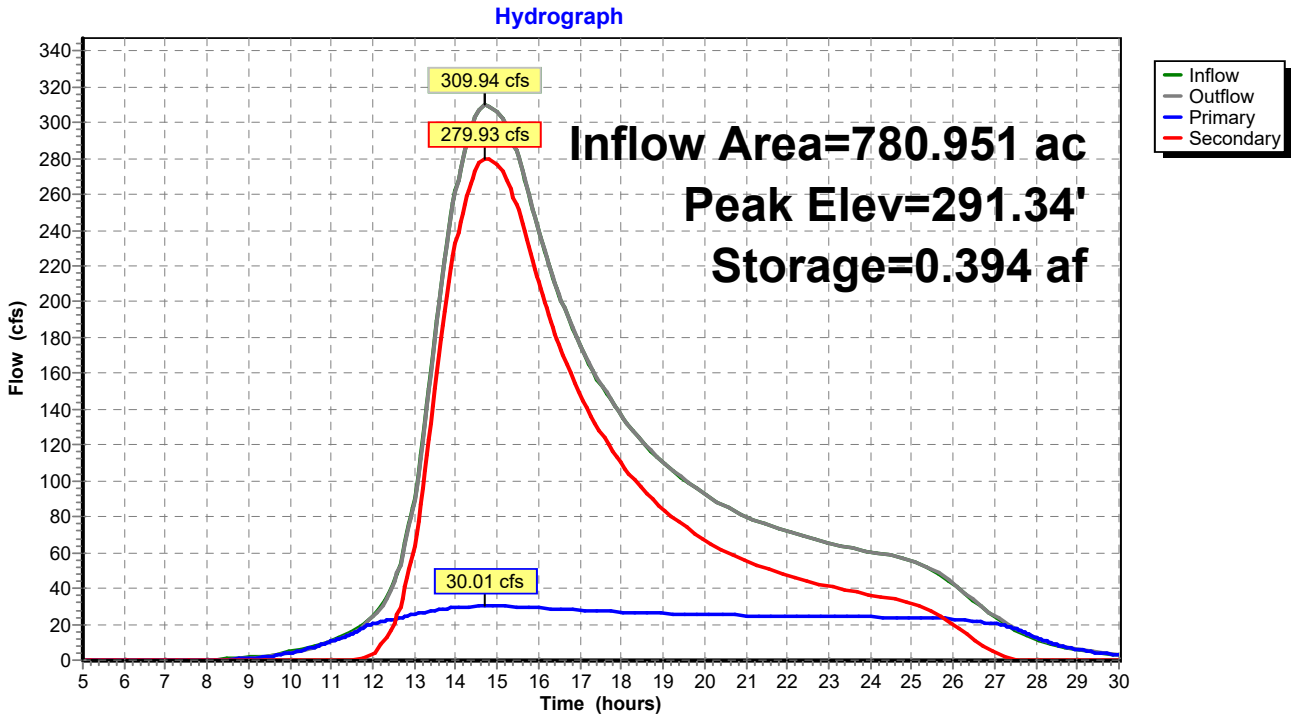
Pond 1P: Culvert 1



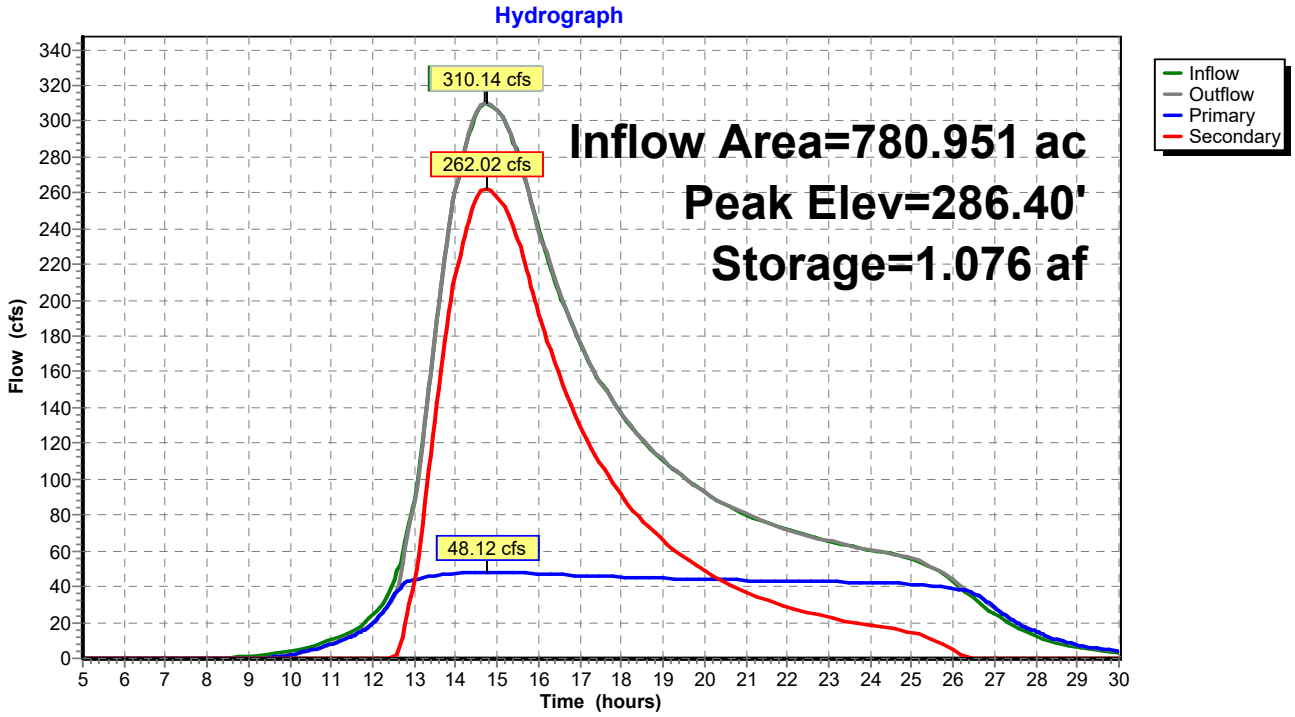
Pond 2P: Culvert 2



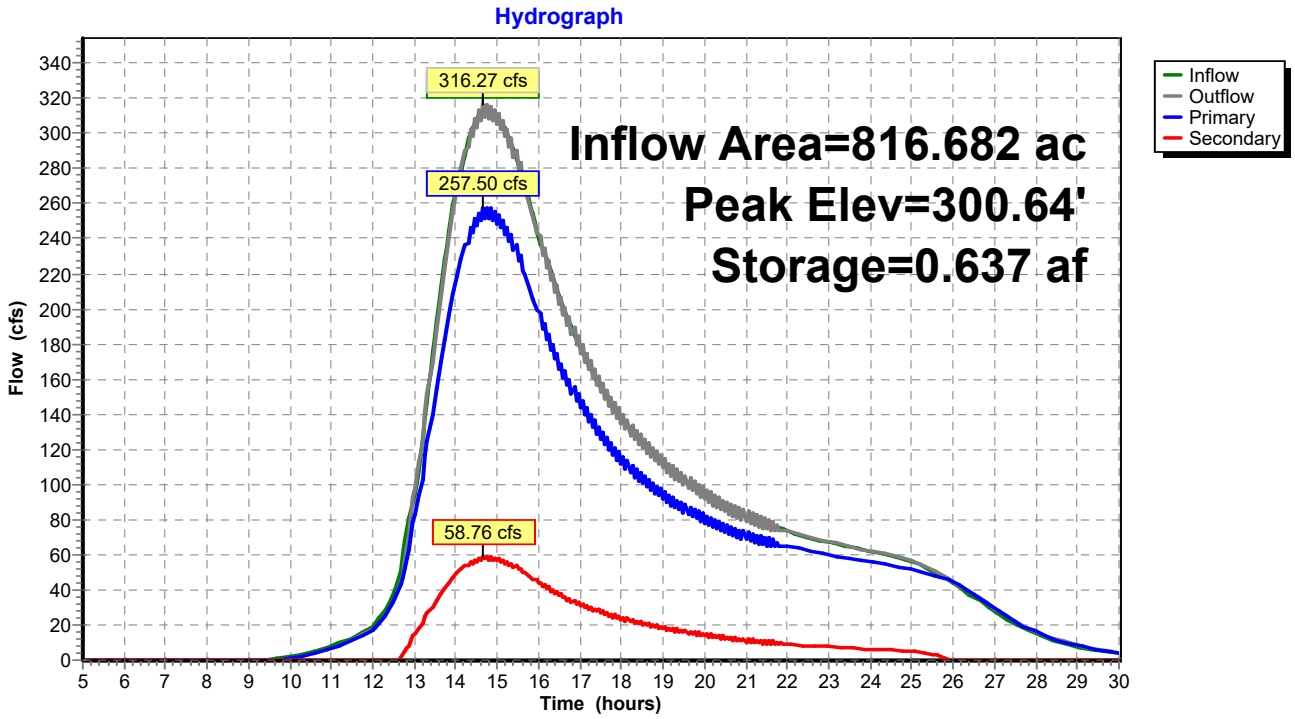
Pond 3P: Culvert 3



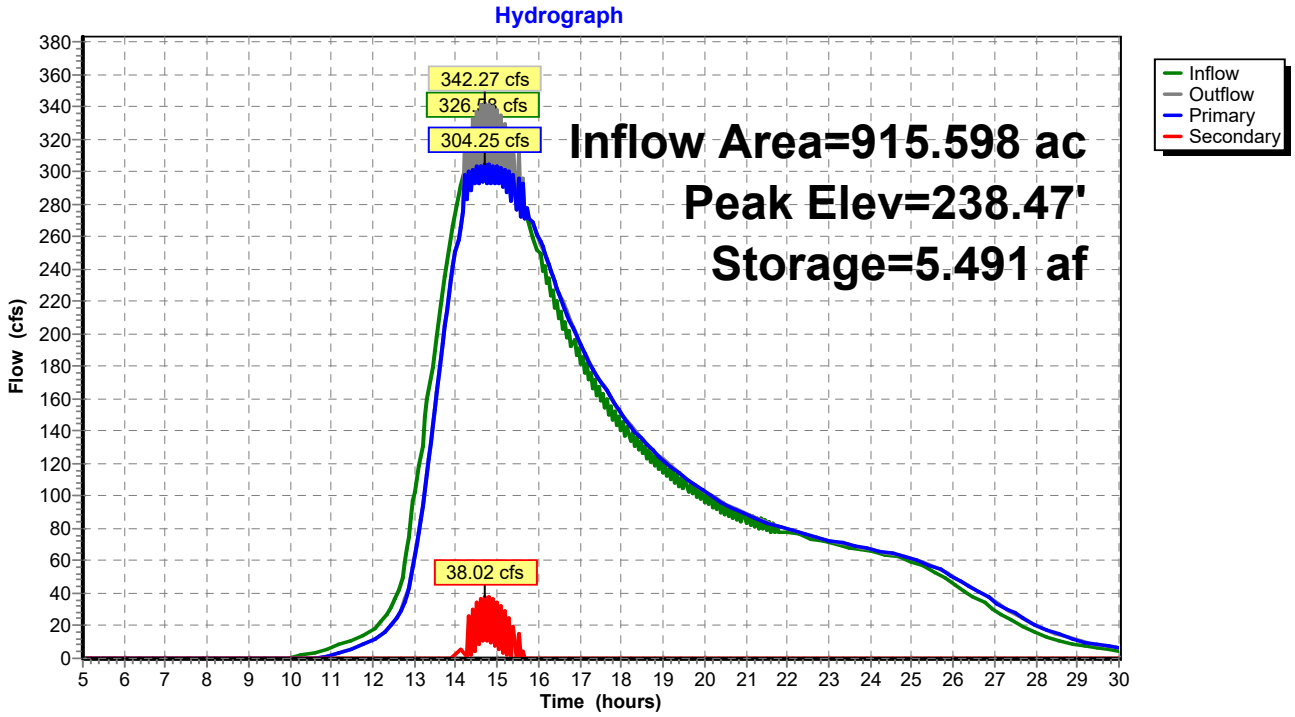
Pond 4P: Culvert 4



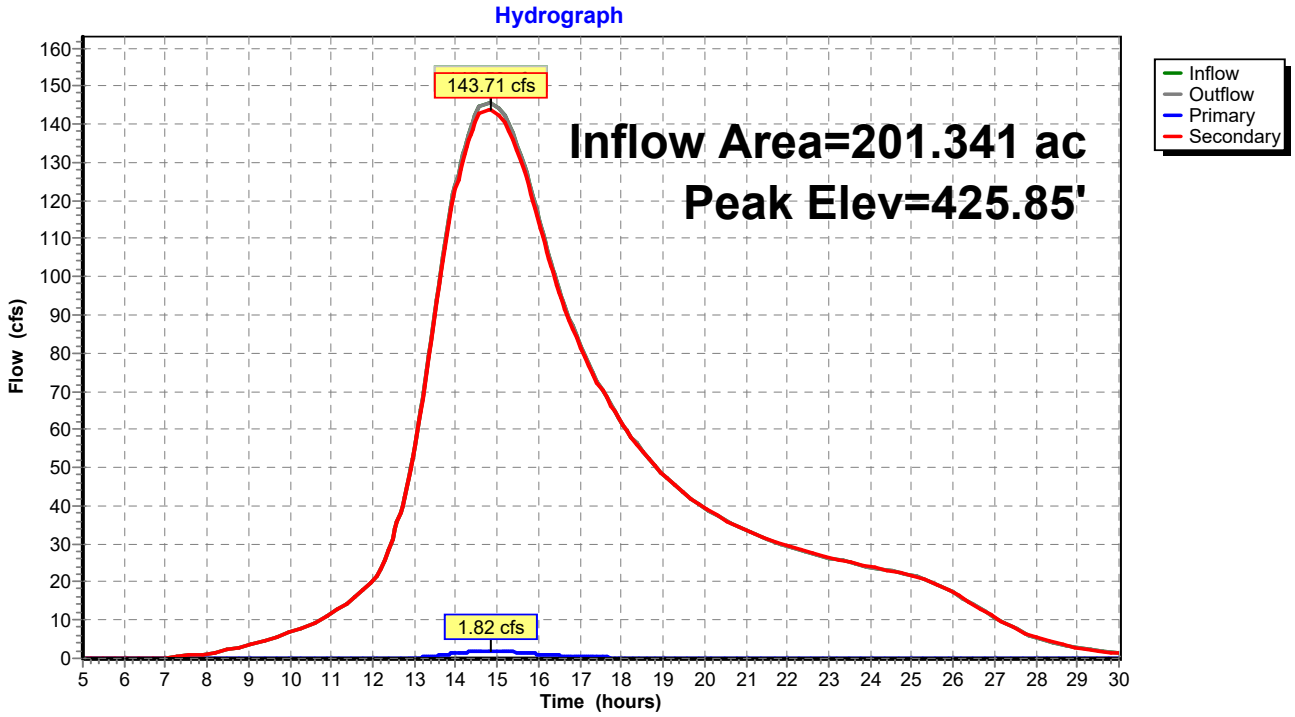
Pond 5P: Sand Culvert



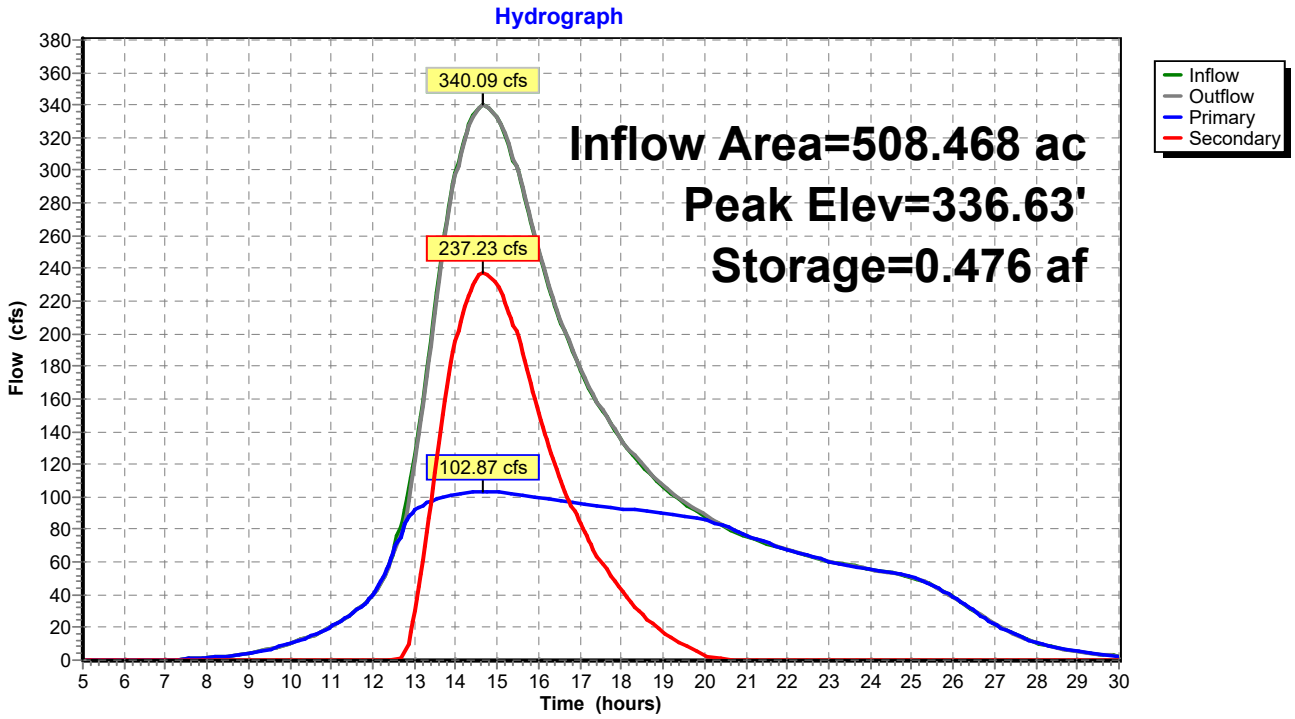
Pond 6P: 110 Culvert



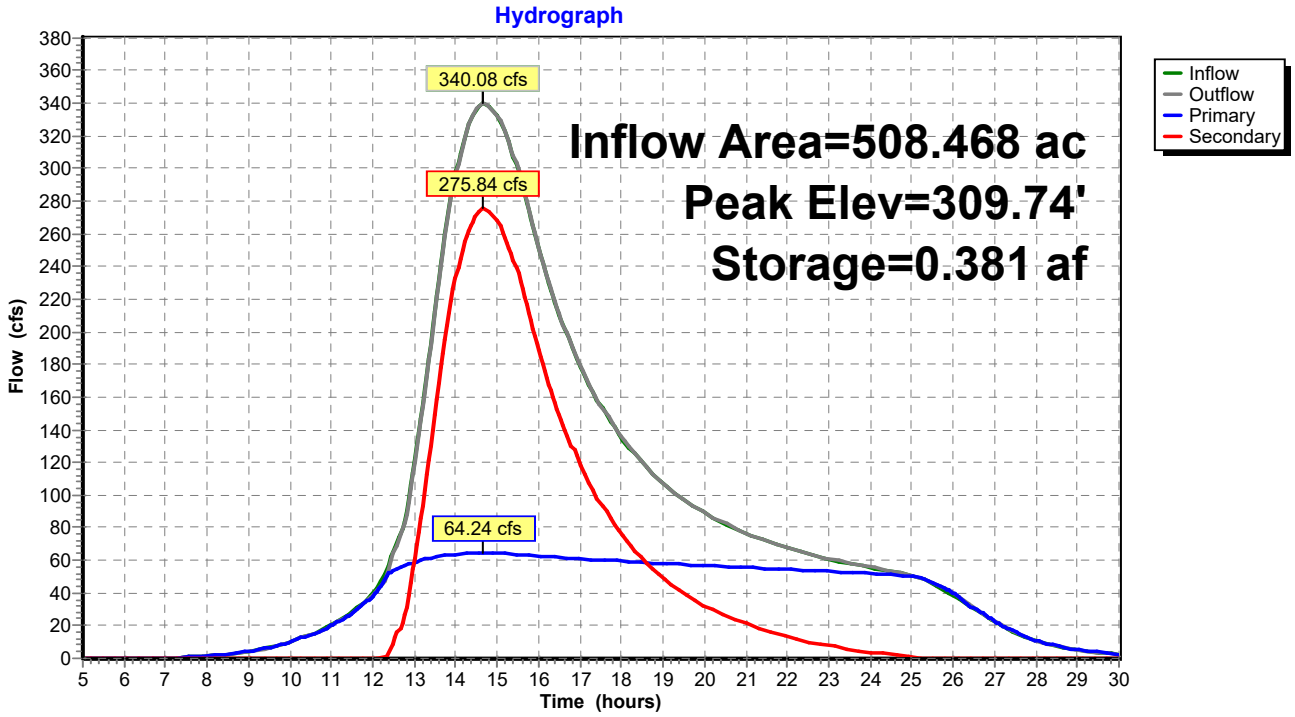
Pond 0P: 117 Culvert



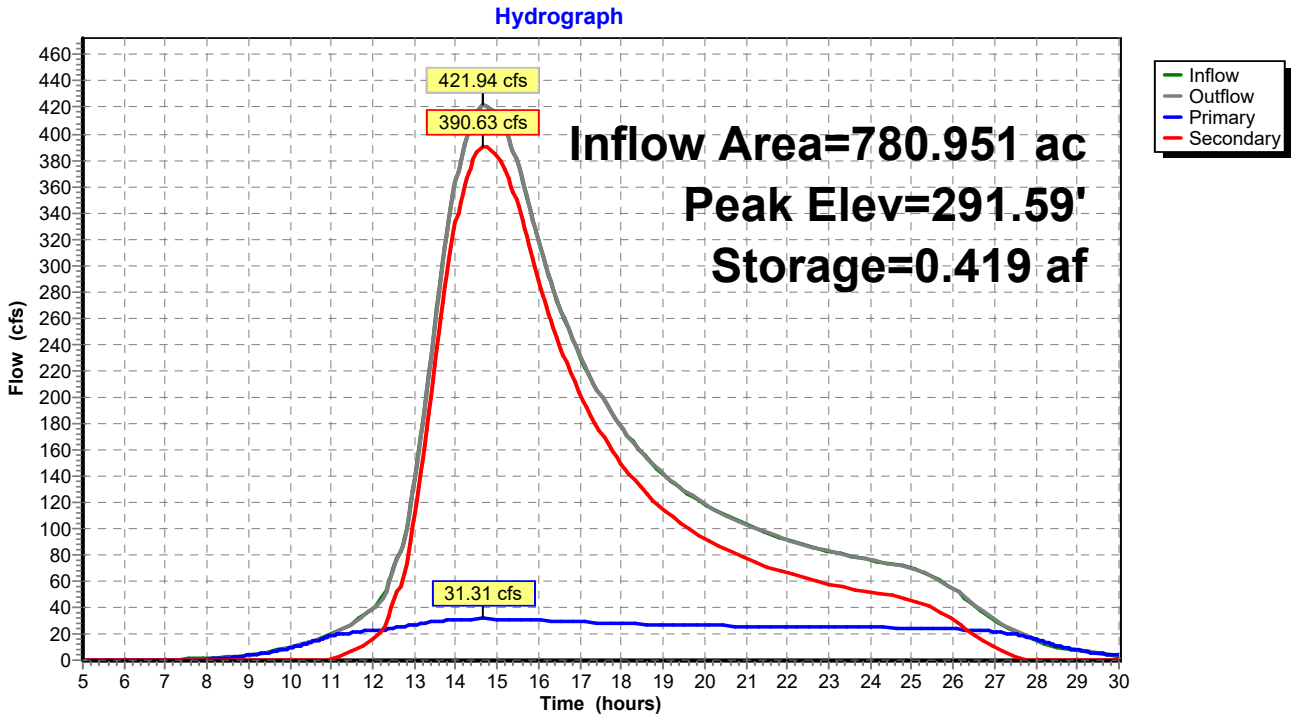
Pond 1P: Culvert 1



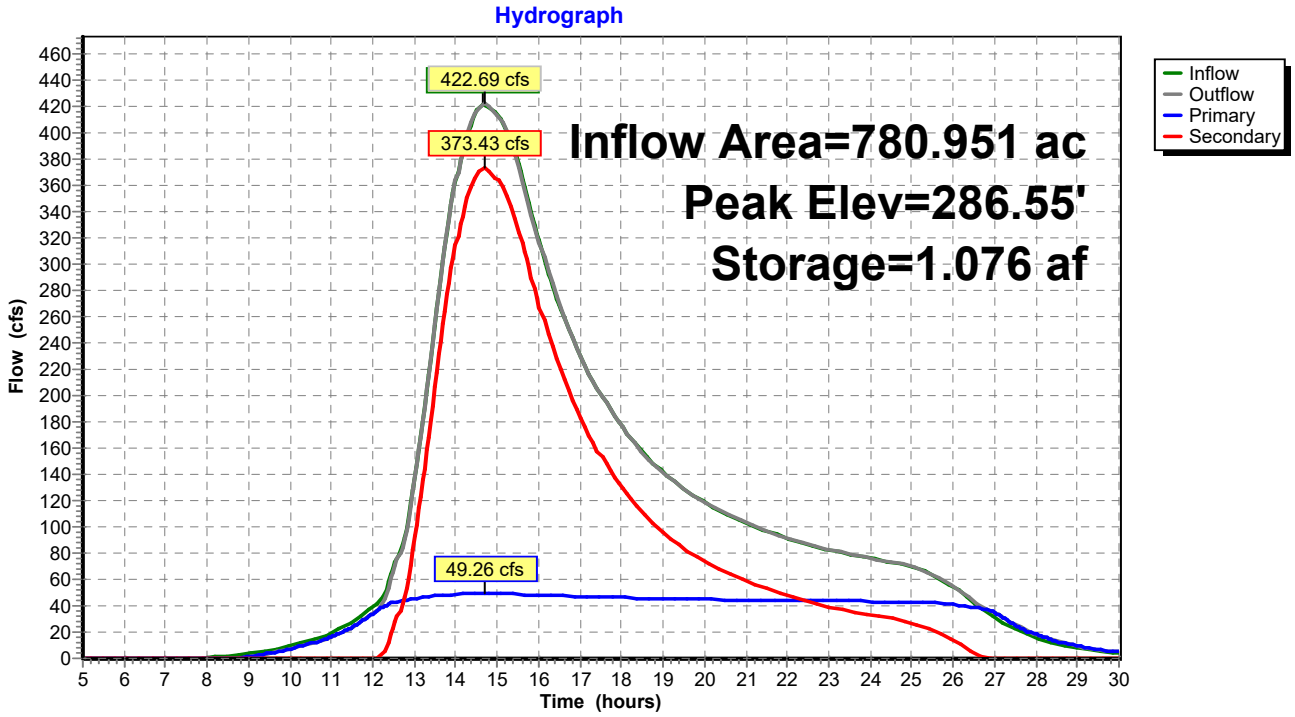
Pond 2P: Culvert 2



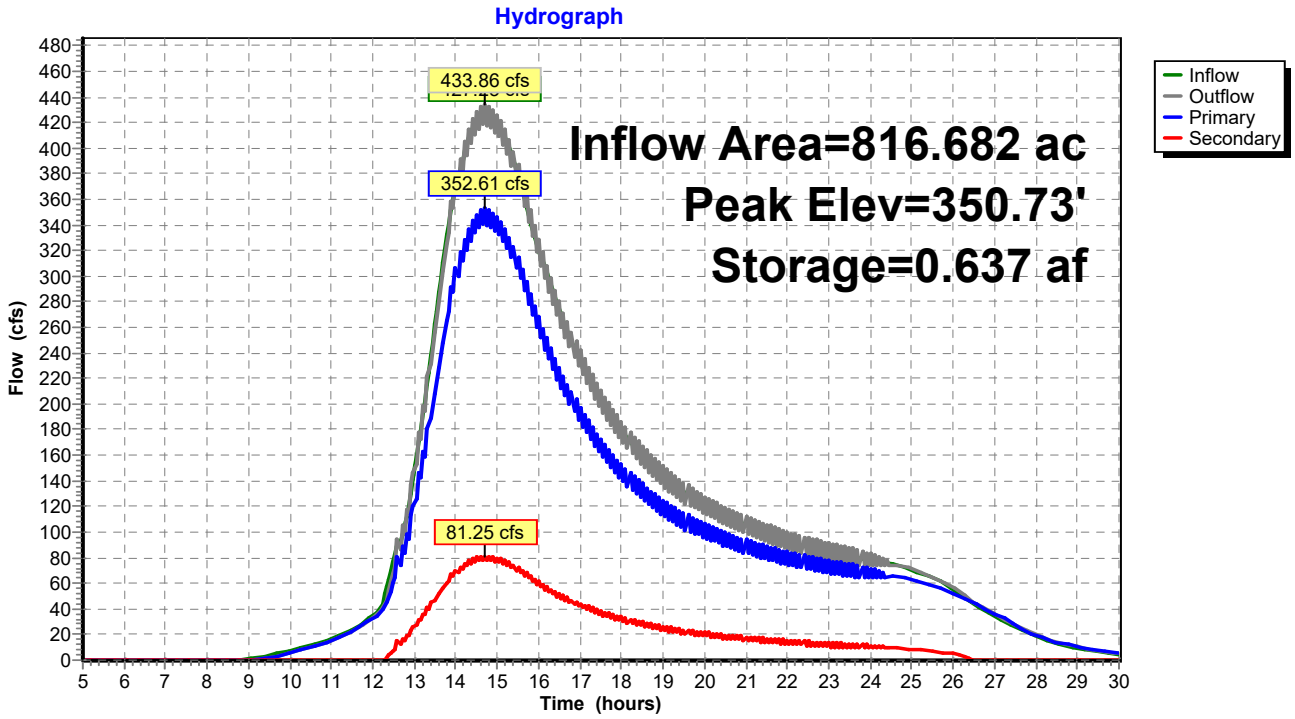
Pond 3P: Culvert 3



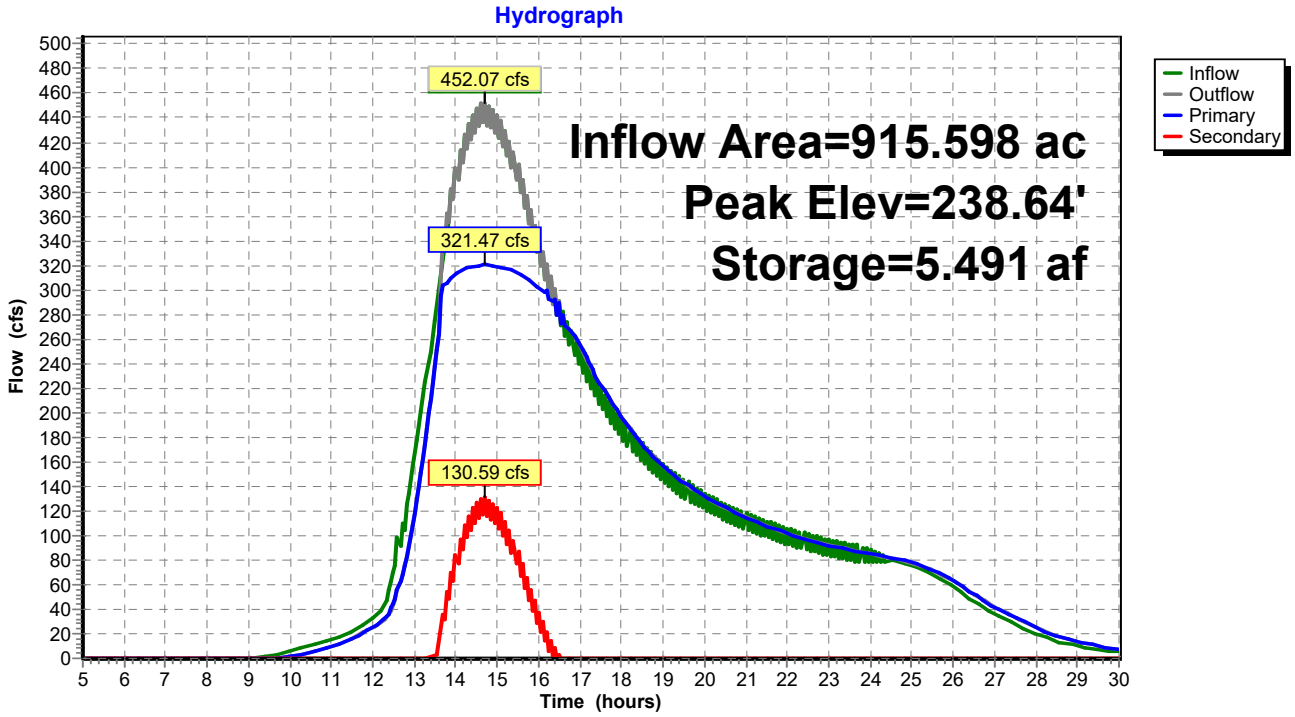
Pond 4P: Culvert 4



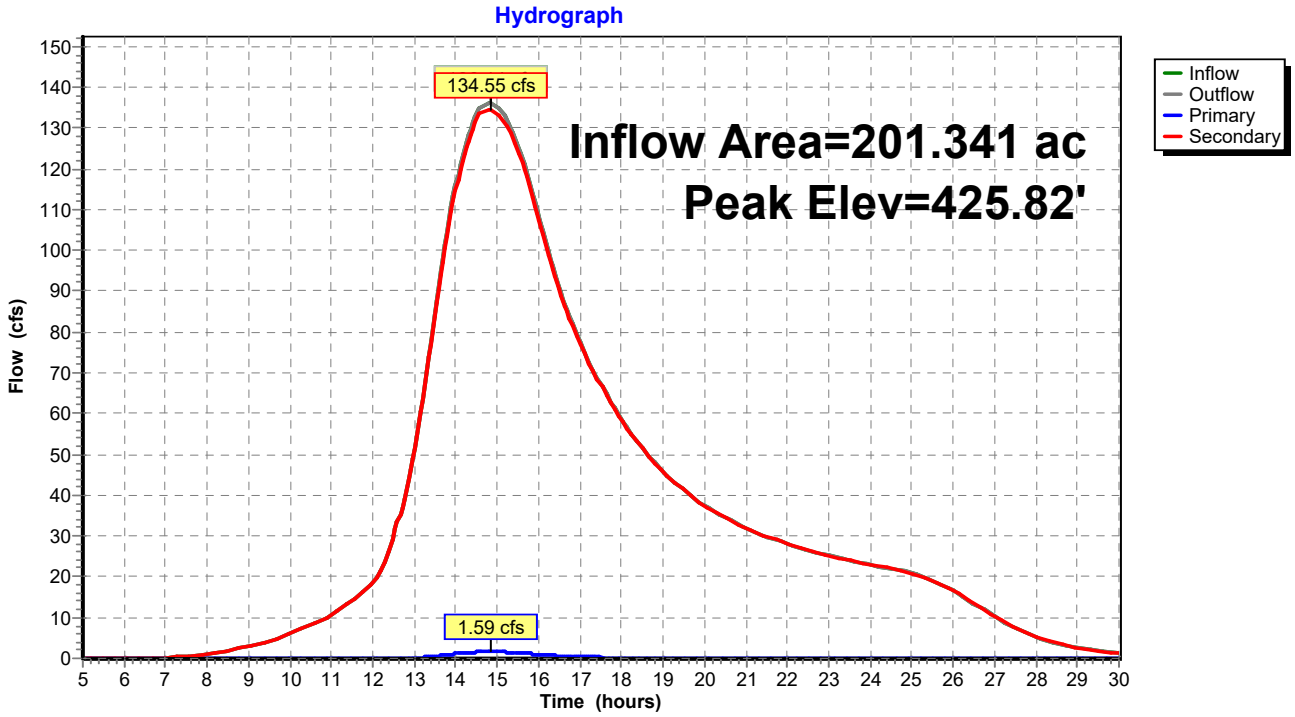
Pond 5P: Sand Culvert



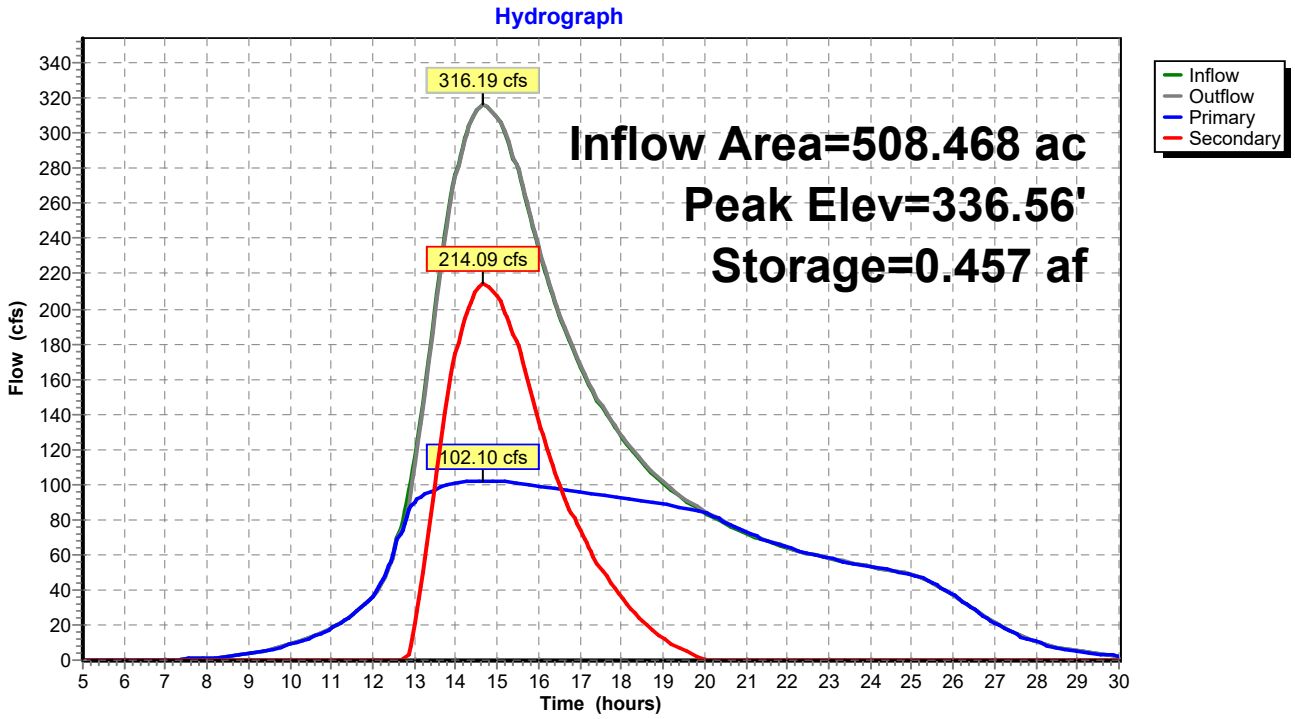
Pond 6P: 110 Culvert



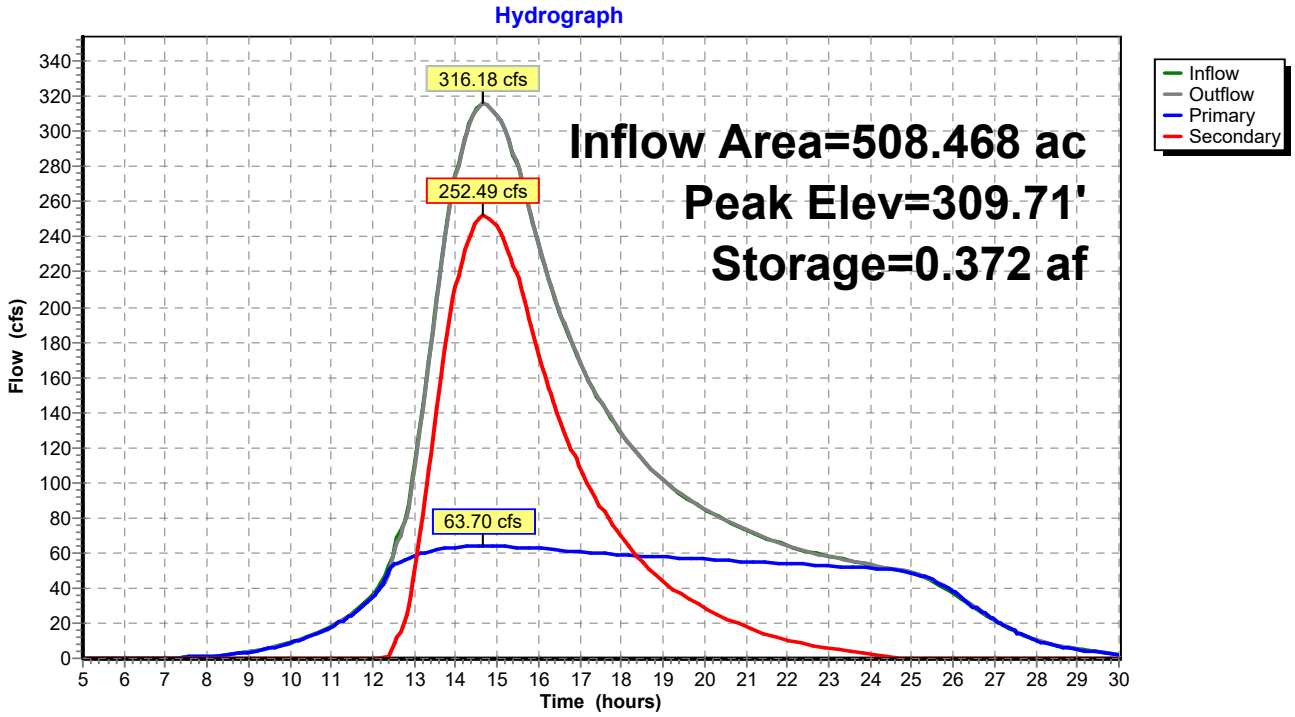
Pond 0P: 117 Culvert



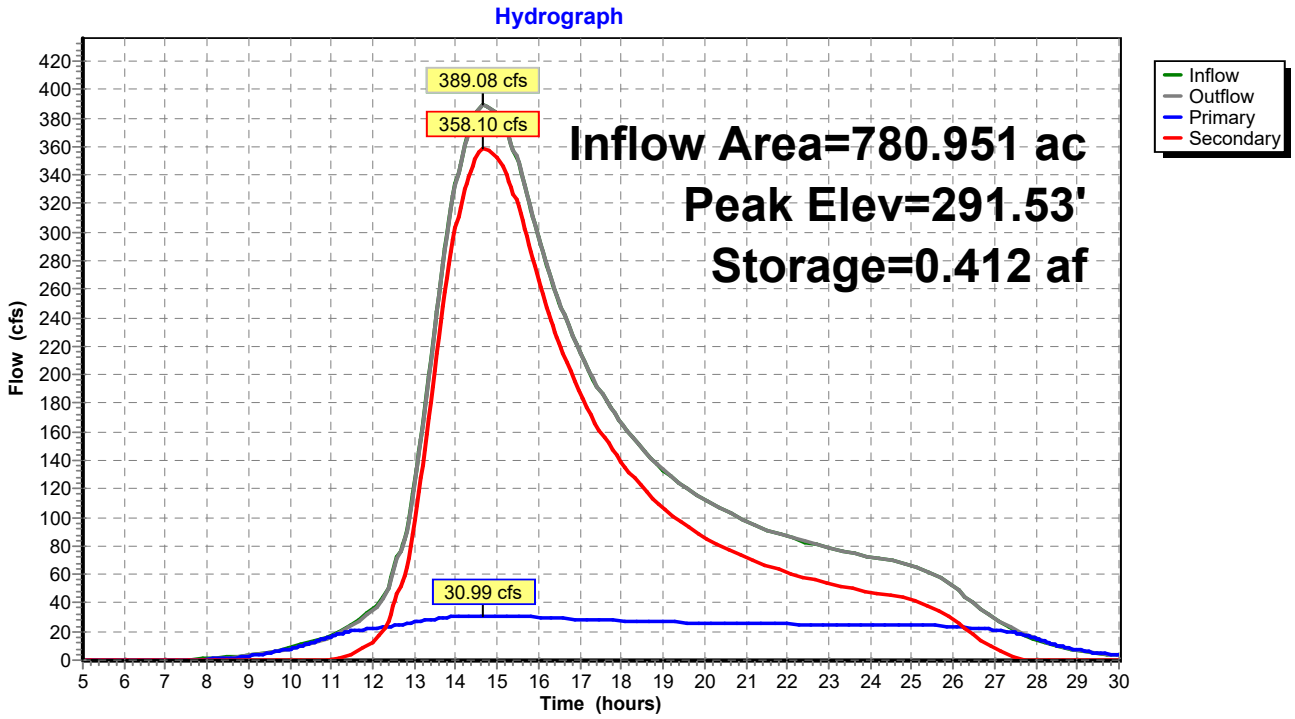
Pond 1P: Culvert 1



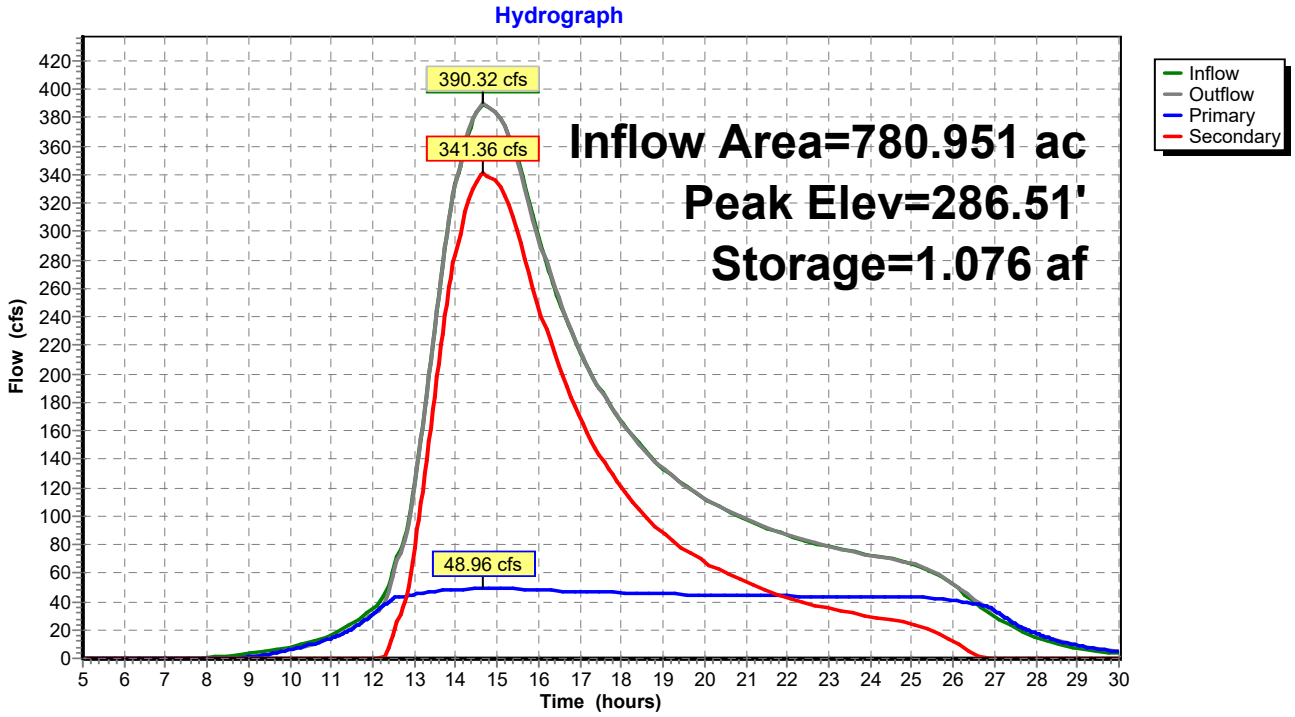
Pond 2P: Culvert 2



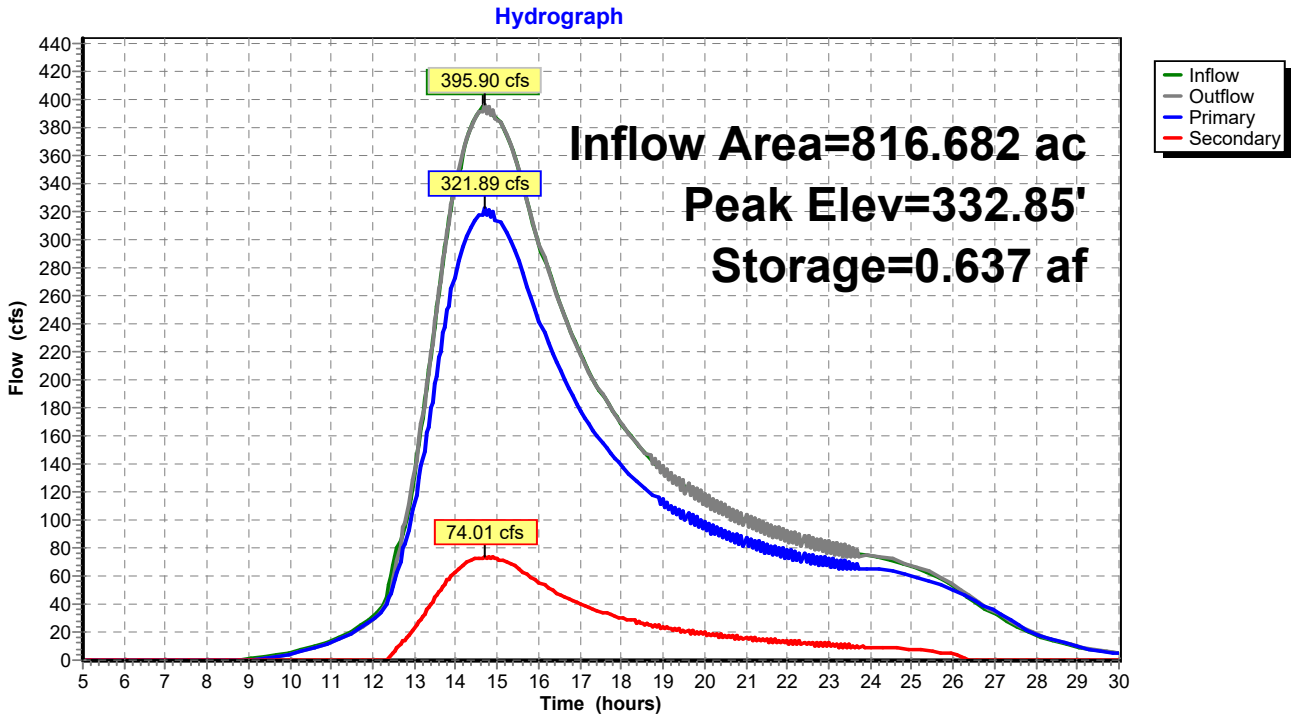
Pond 3P: Culvert 3



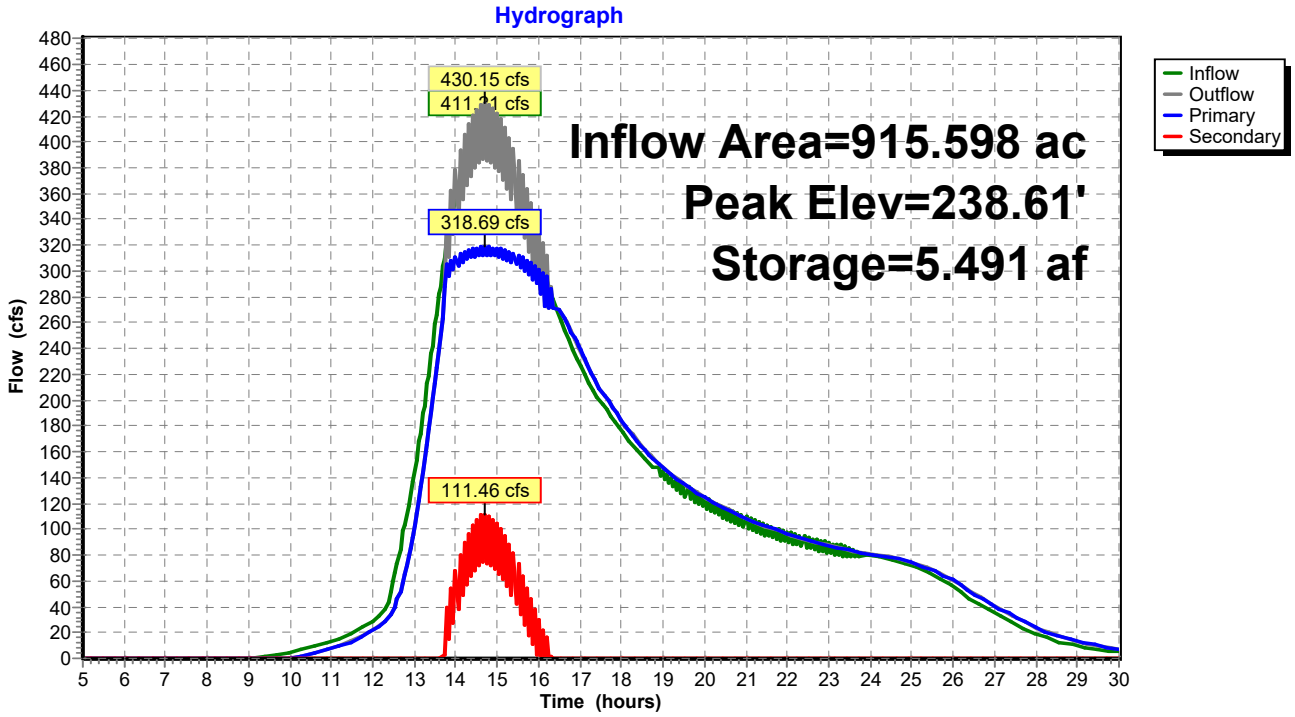
Pond 4P: Culvert 4



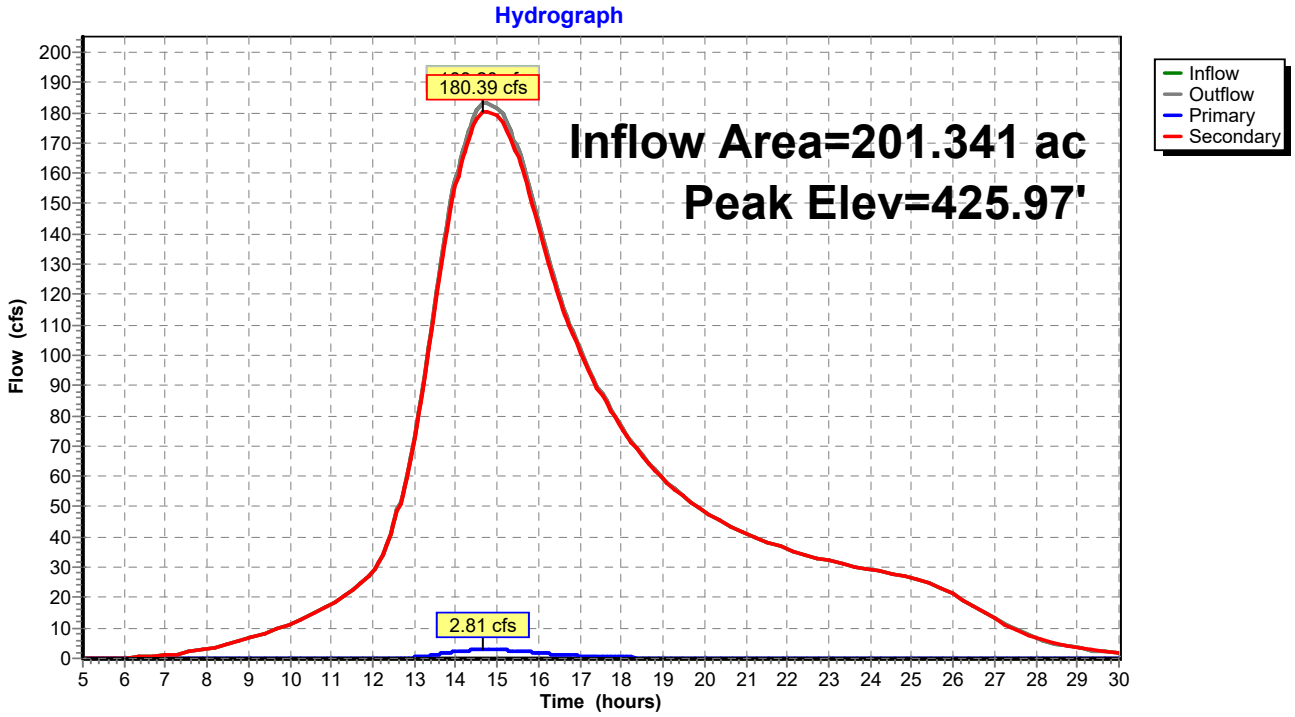
Pond 5P: Sand Culvert



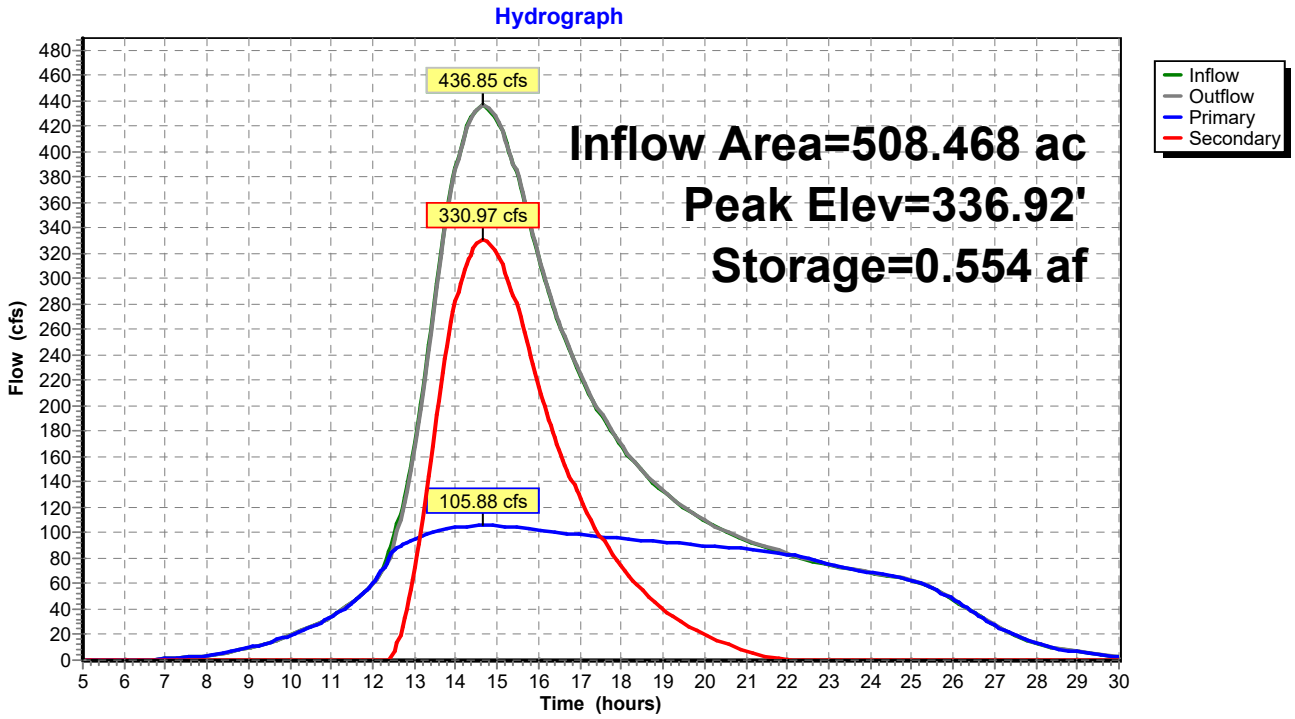
Pond 6P: 110 Culvert



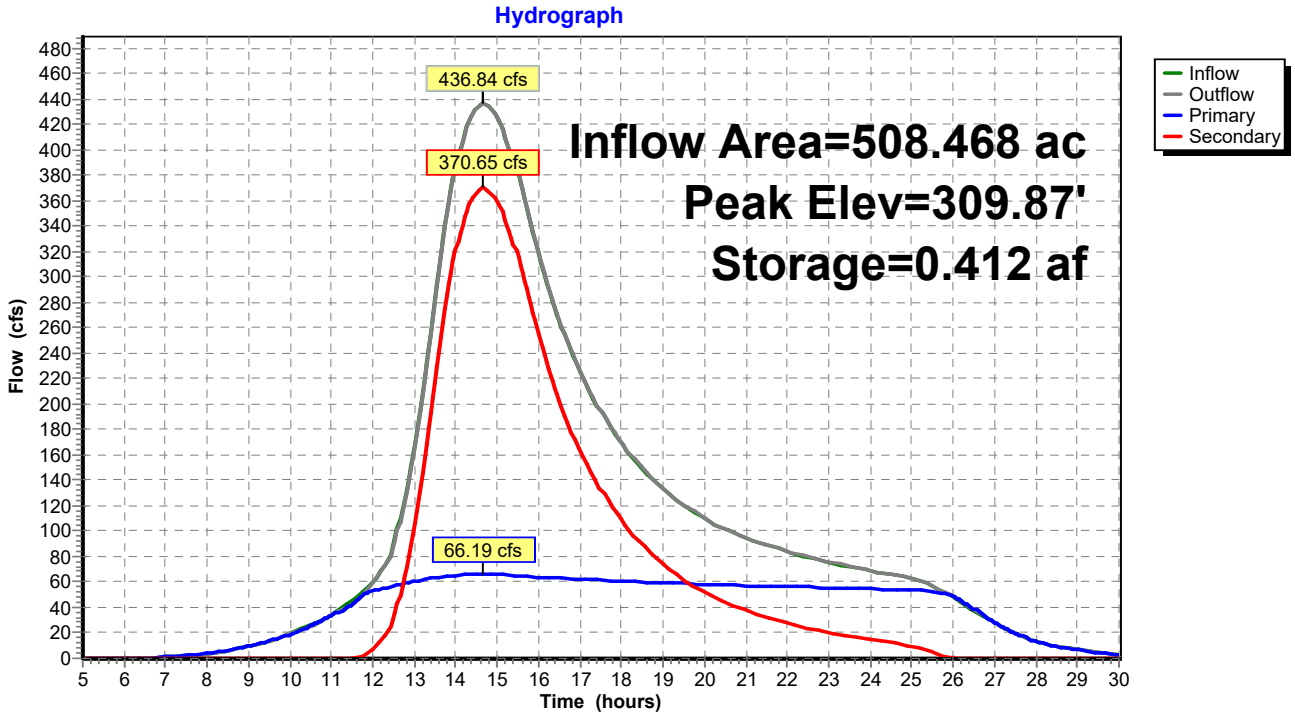
Pond 0P: 117 Culvert



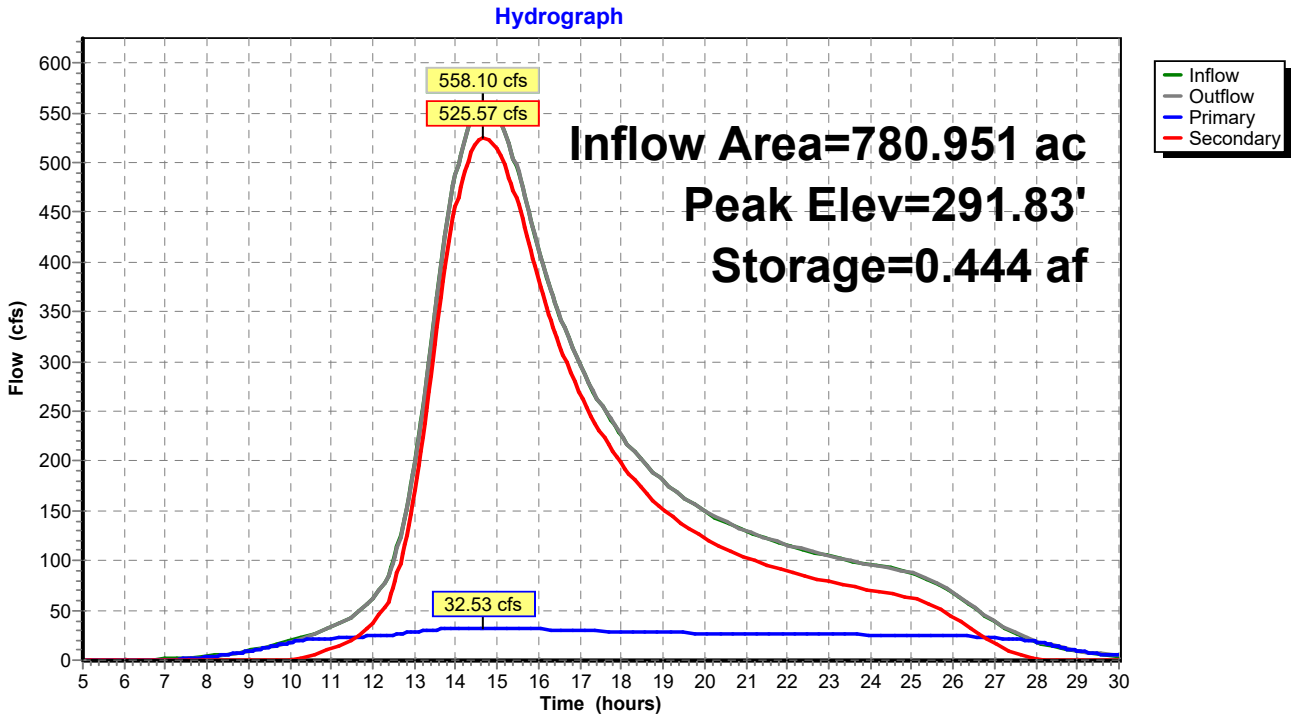
Pond 1P: Culvert 1



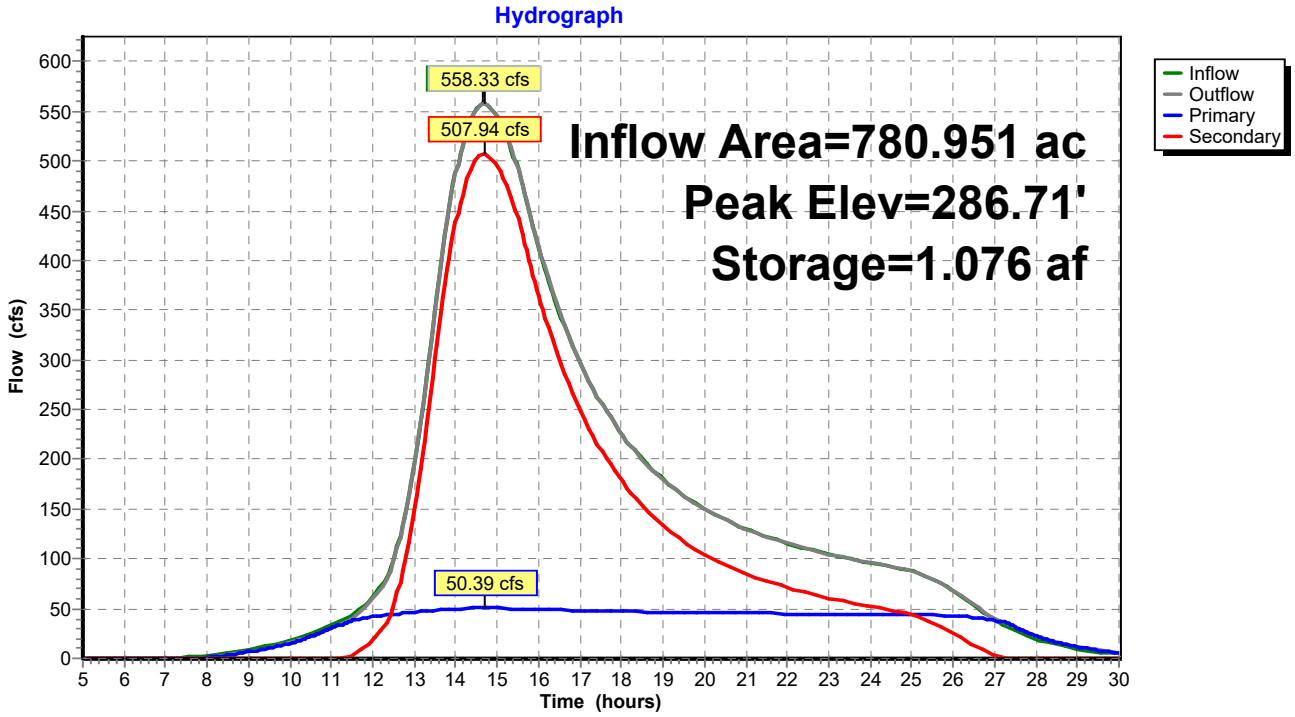
Pond 2P: Culvert 2



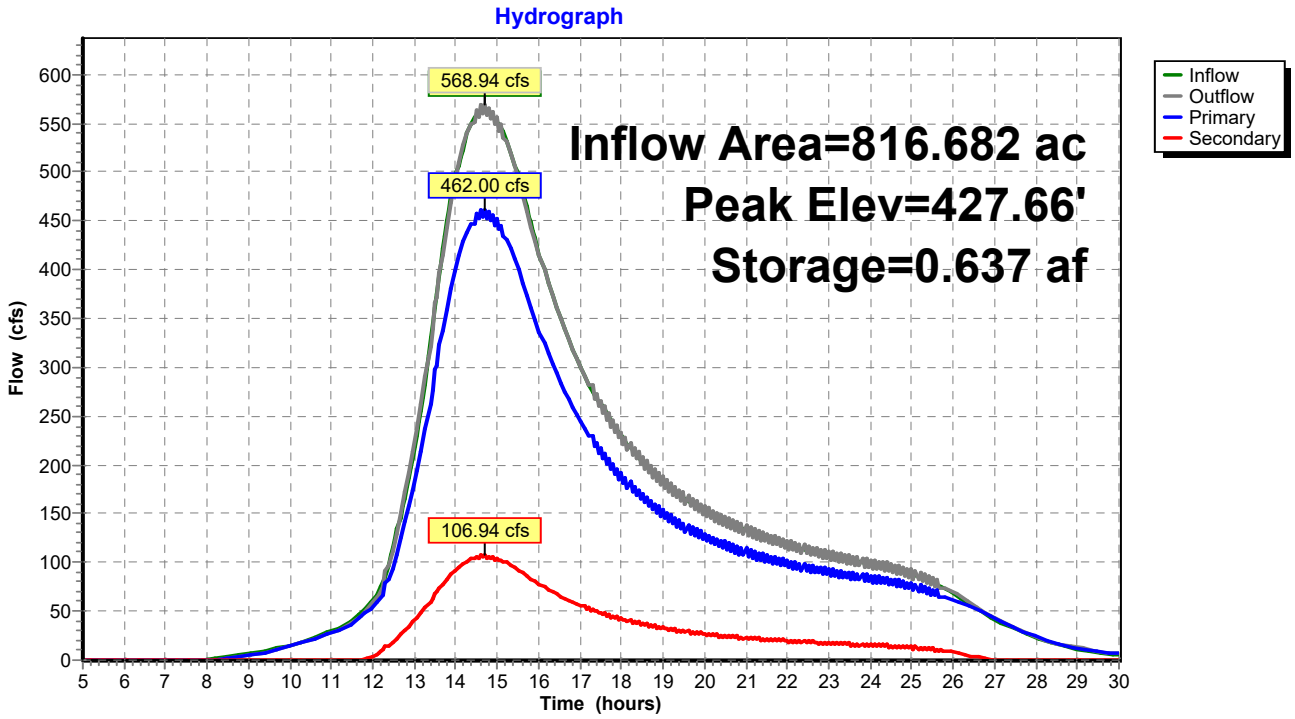
Pond 3P: Culvert 3



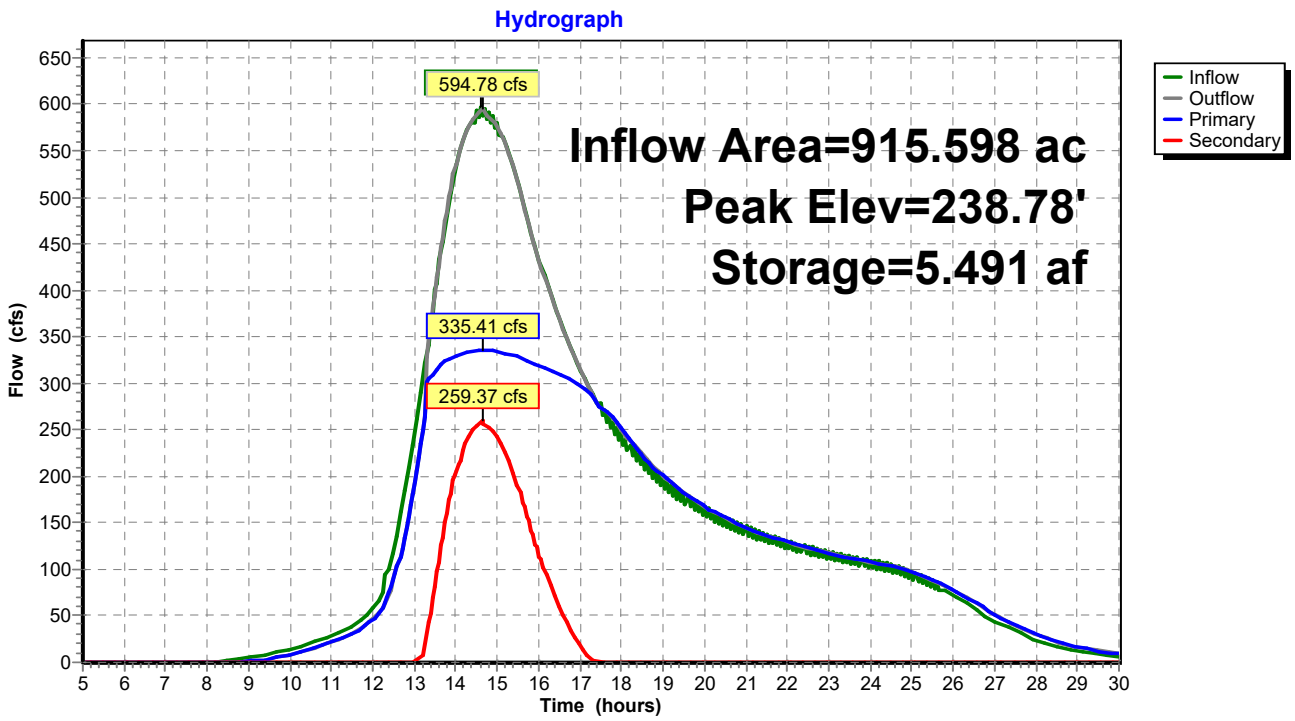
Pond 4P: Culvert 4



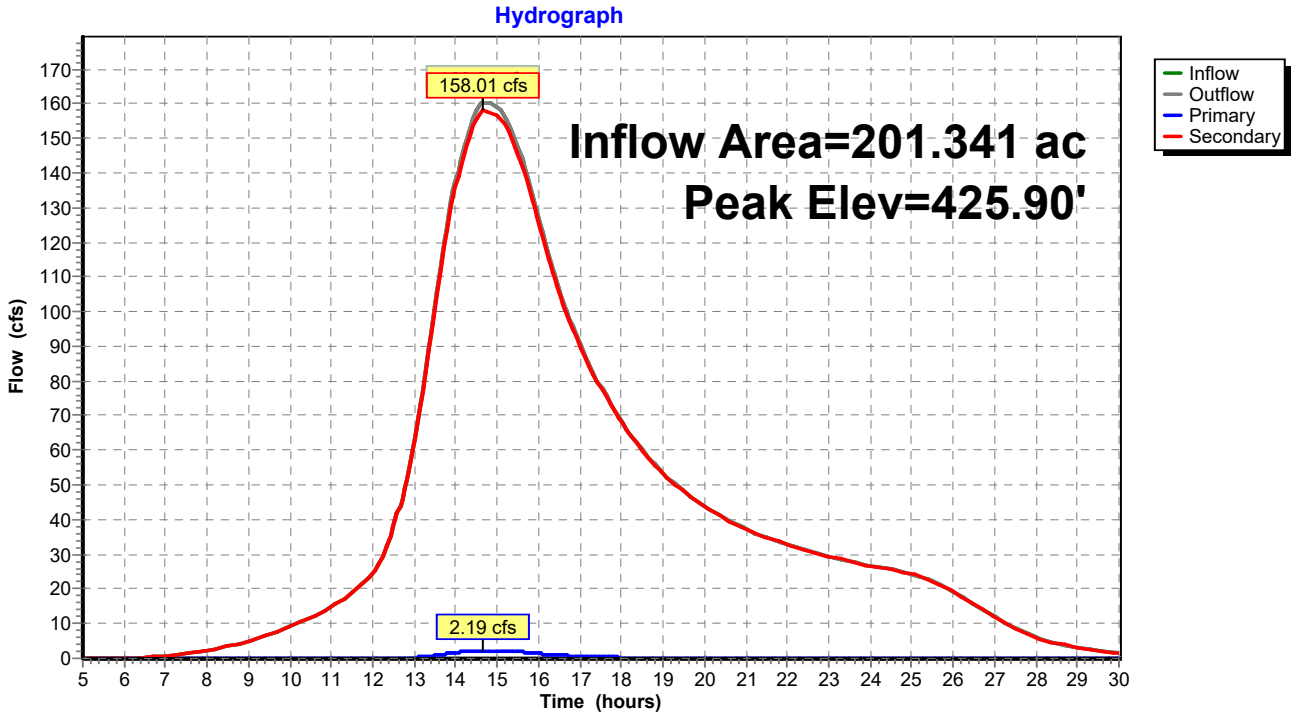
Pond 5P: Sand Culvert



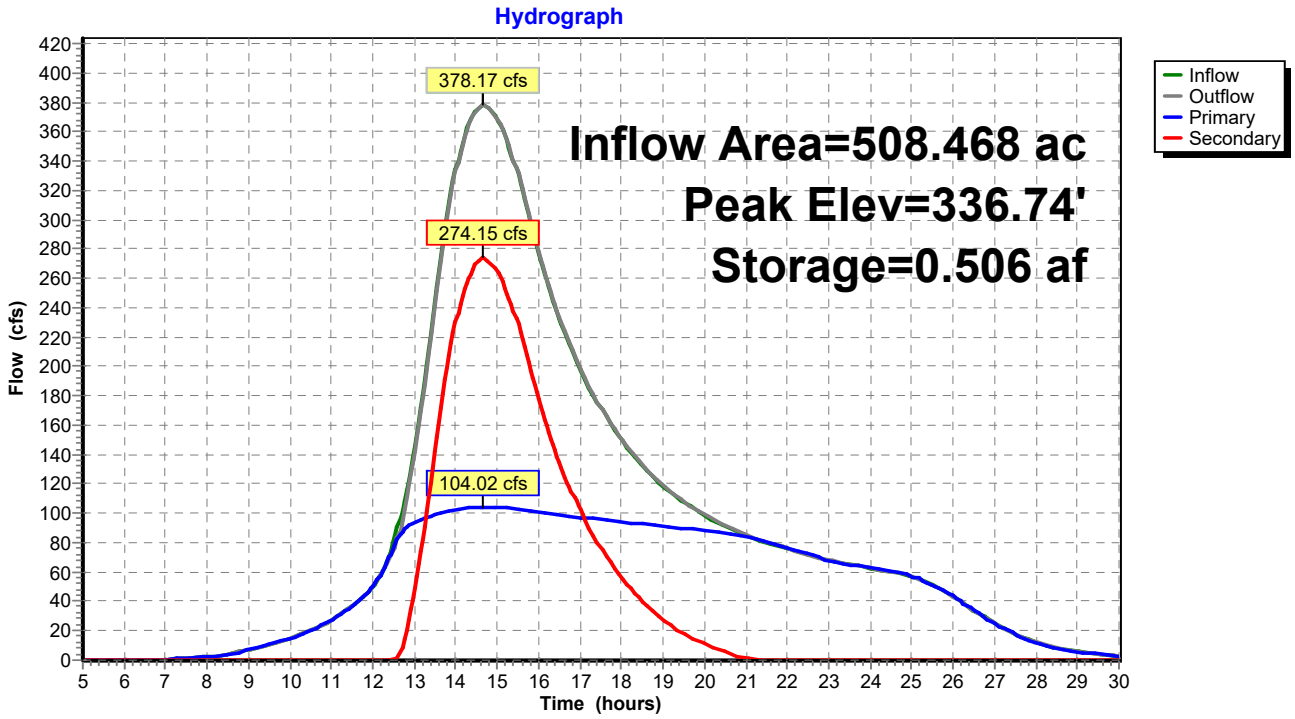
Pond 6P: 110 Culvert



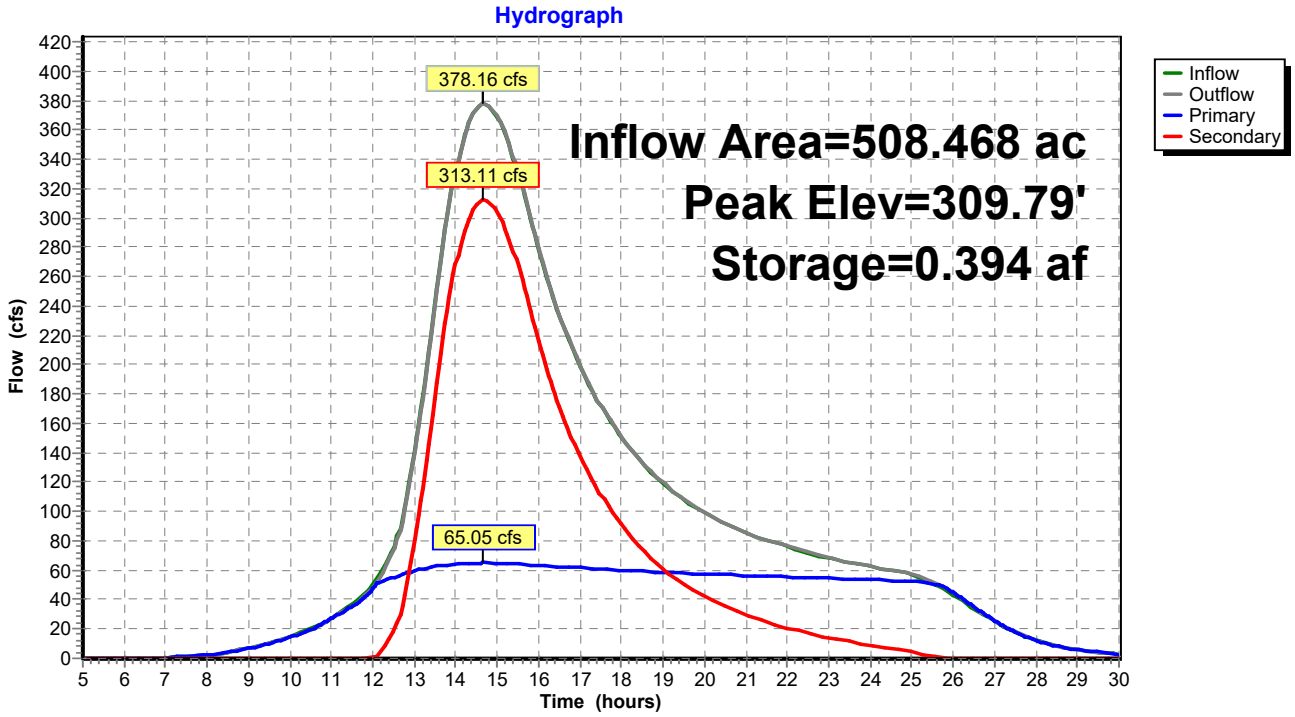
Pond 0P: 117 Culvert



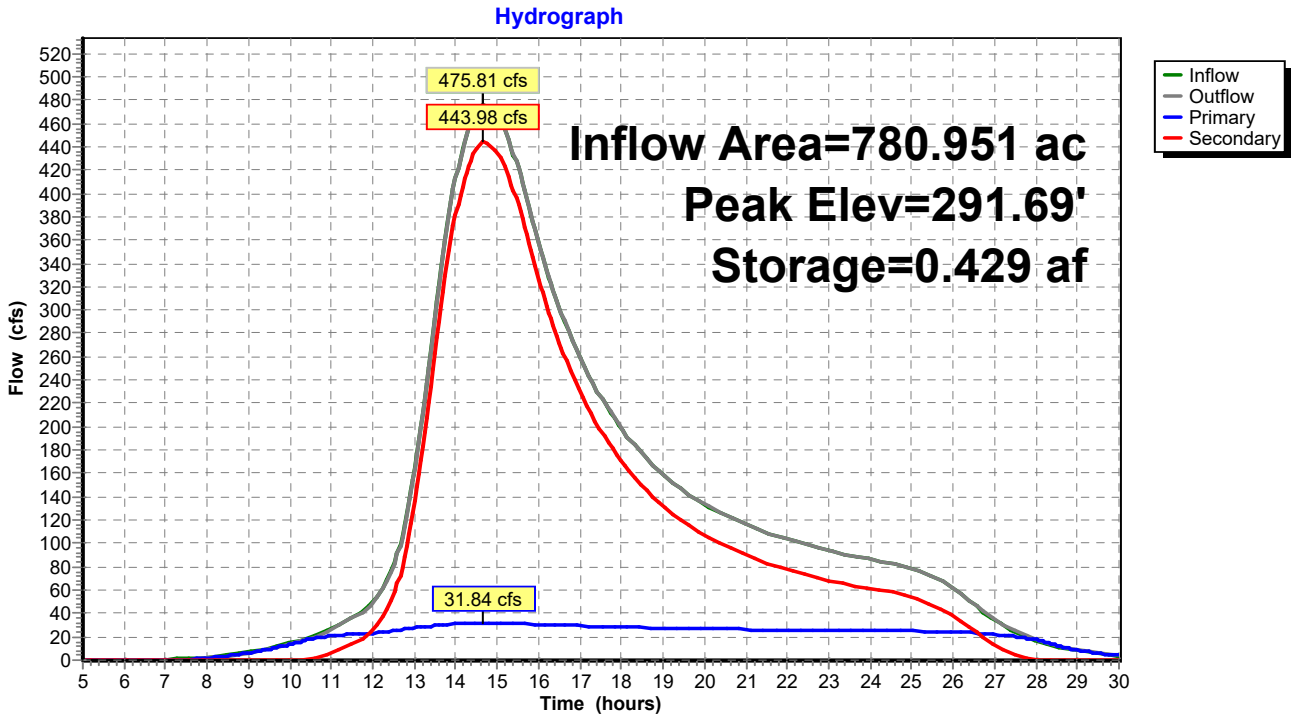
Pond 1P: Culvert 1



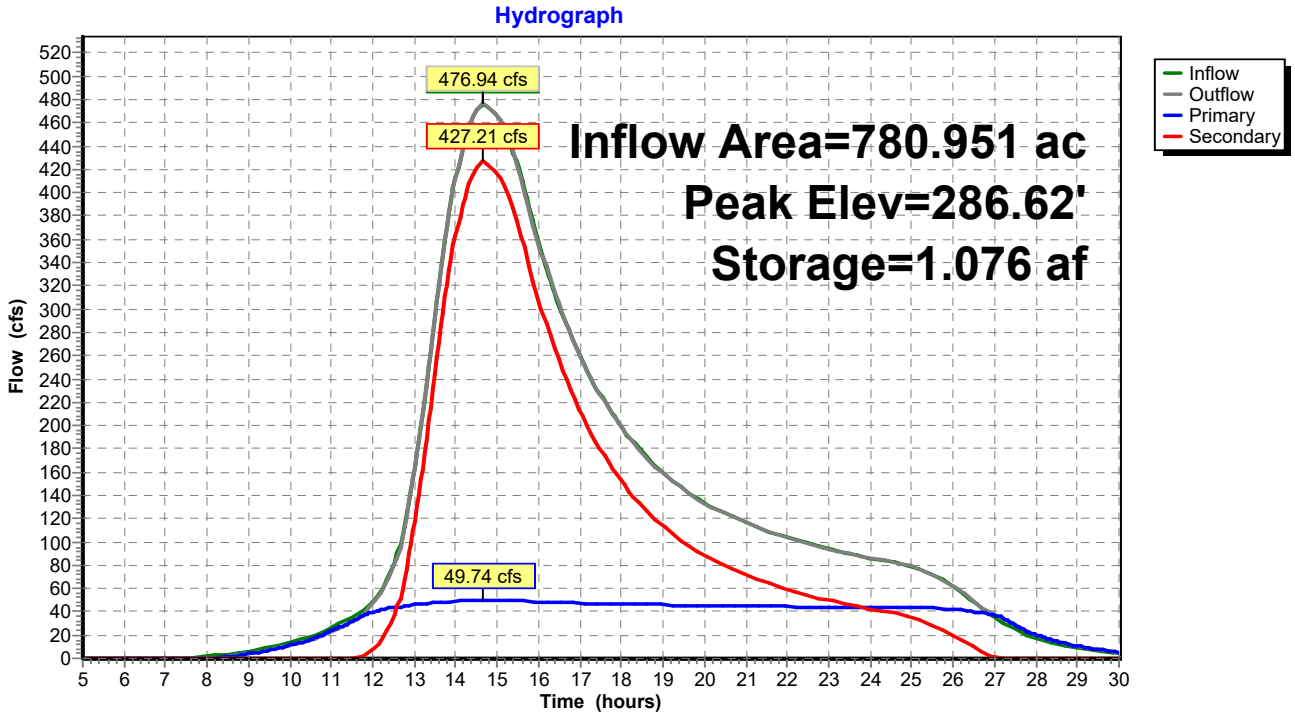
Pond 2P: Culvert 2



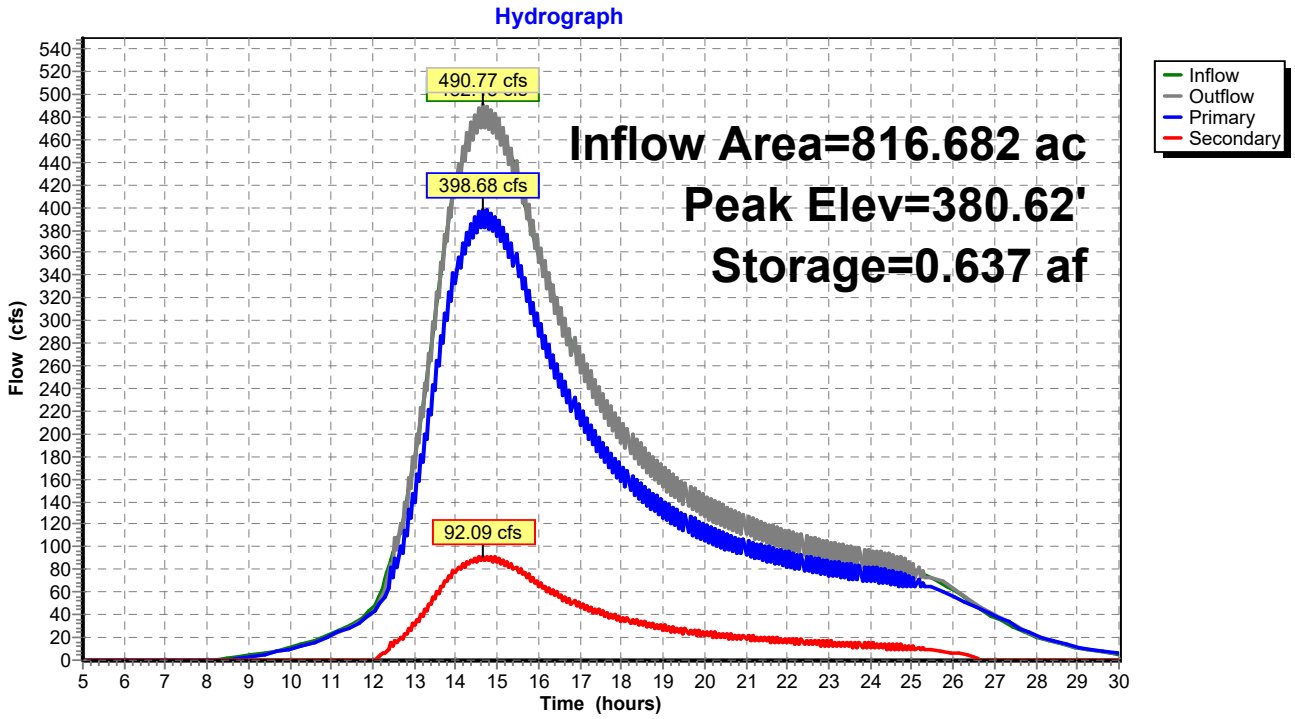
Pond 3P: Culvert 3



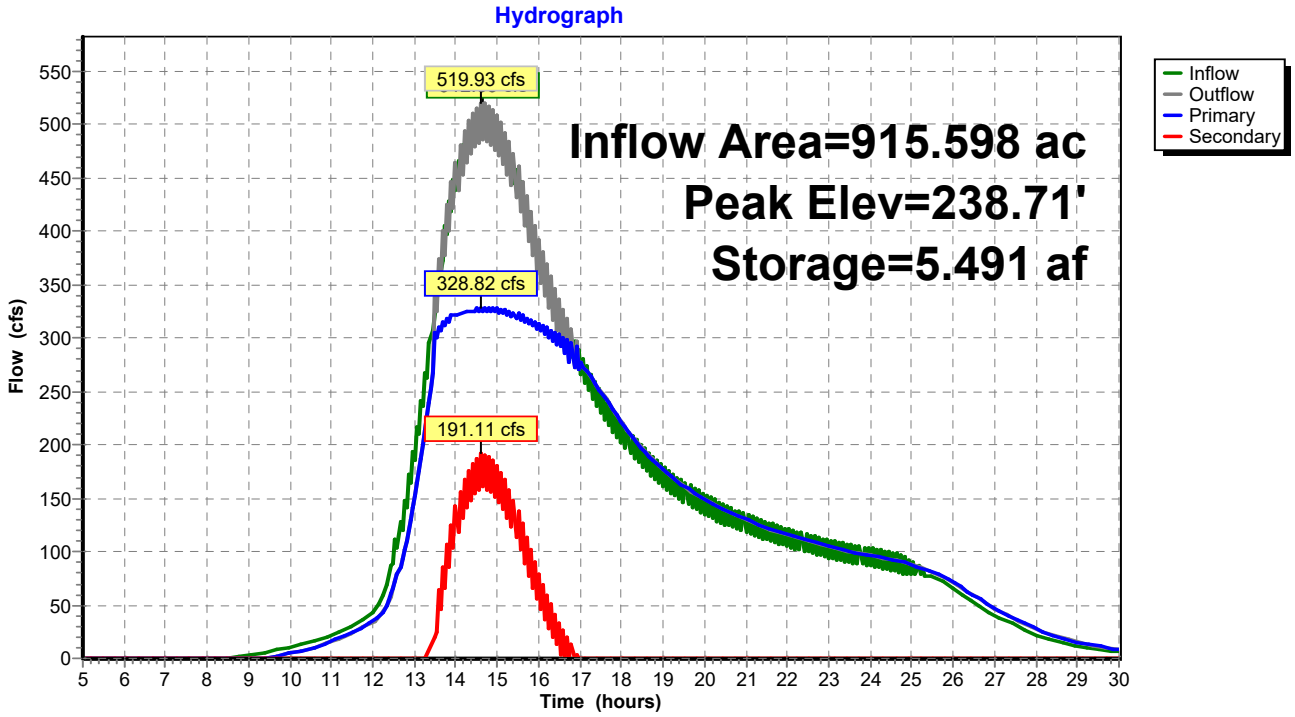
Pond 4P: Culvert 4



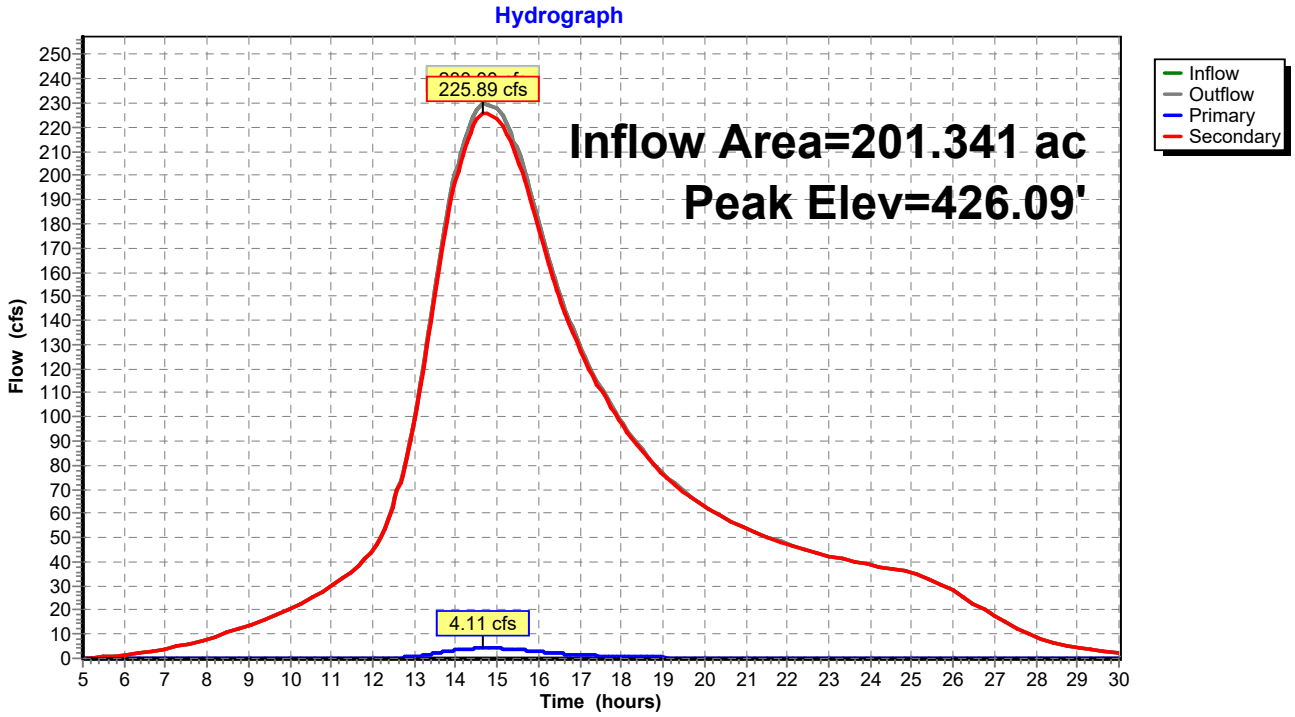
Pond 5P: Sand Culvert



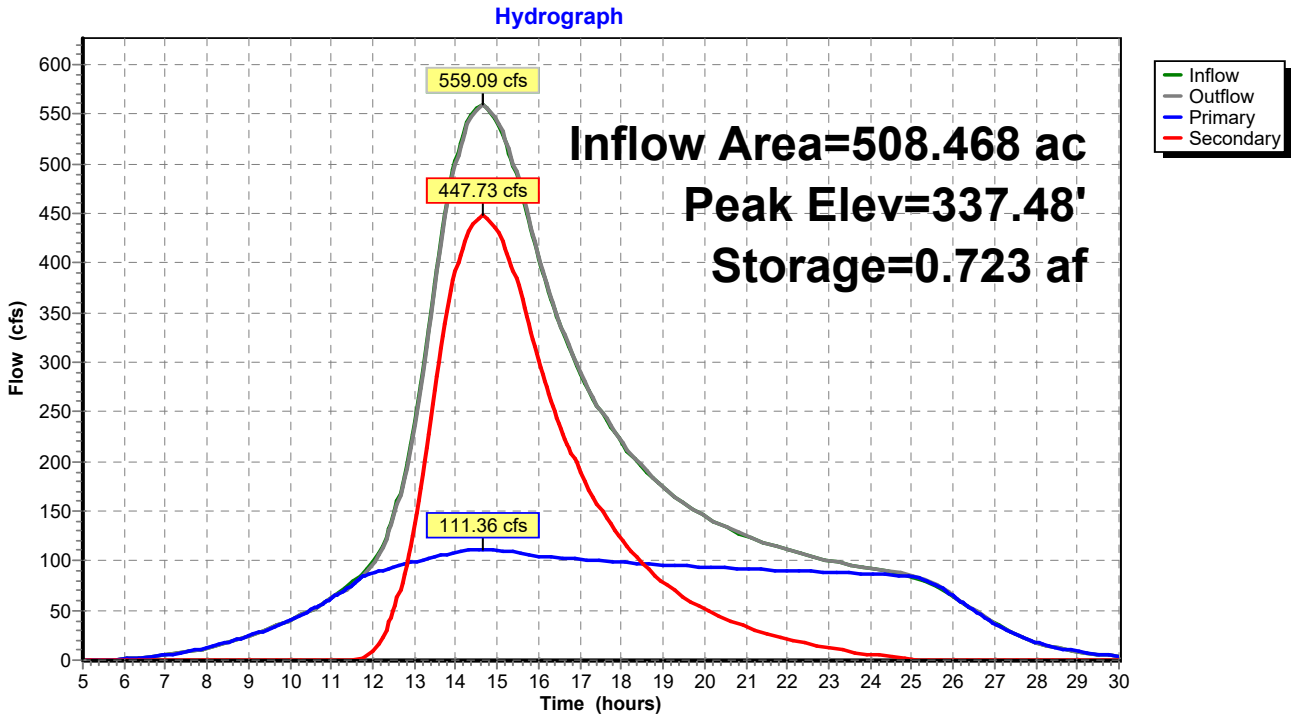
Pond 6P: 110 Culvert



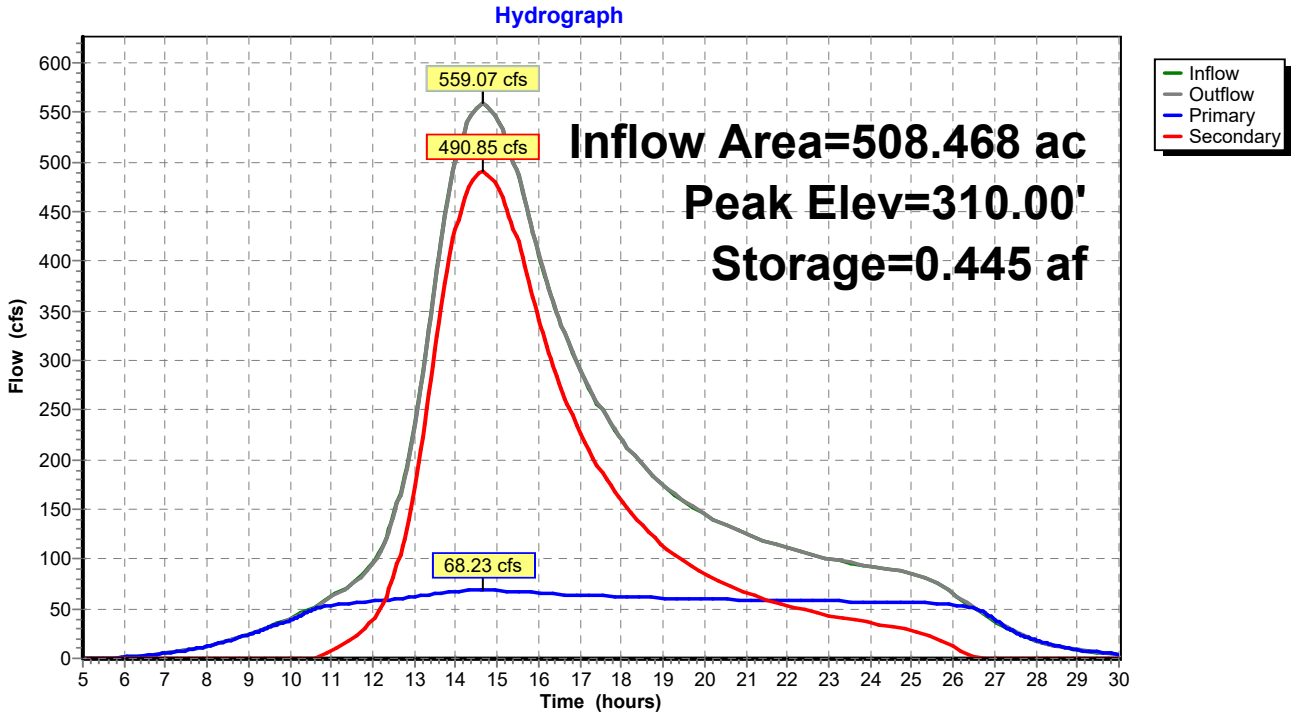
Pond 0P: 117 Culvert



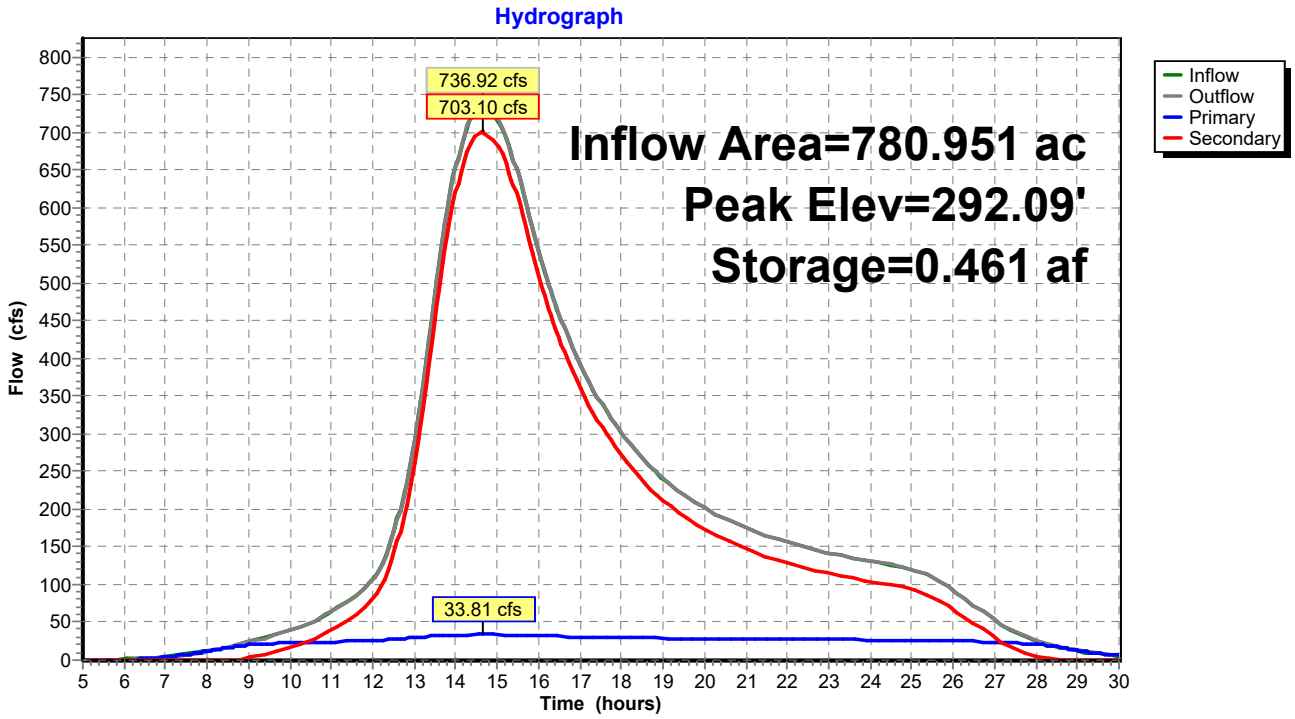
Pond 1P: Culvert 1



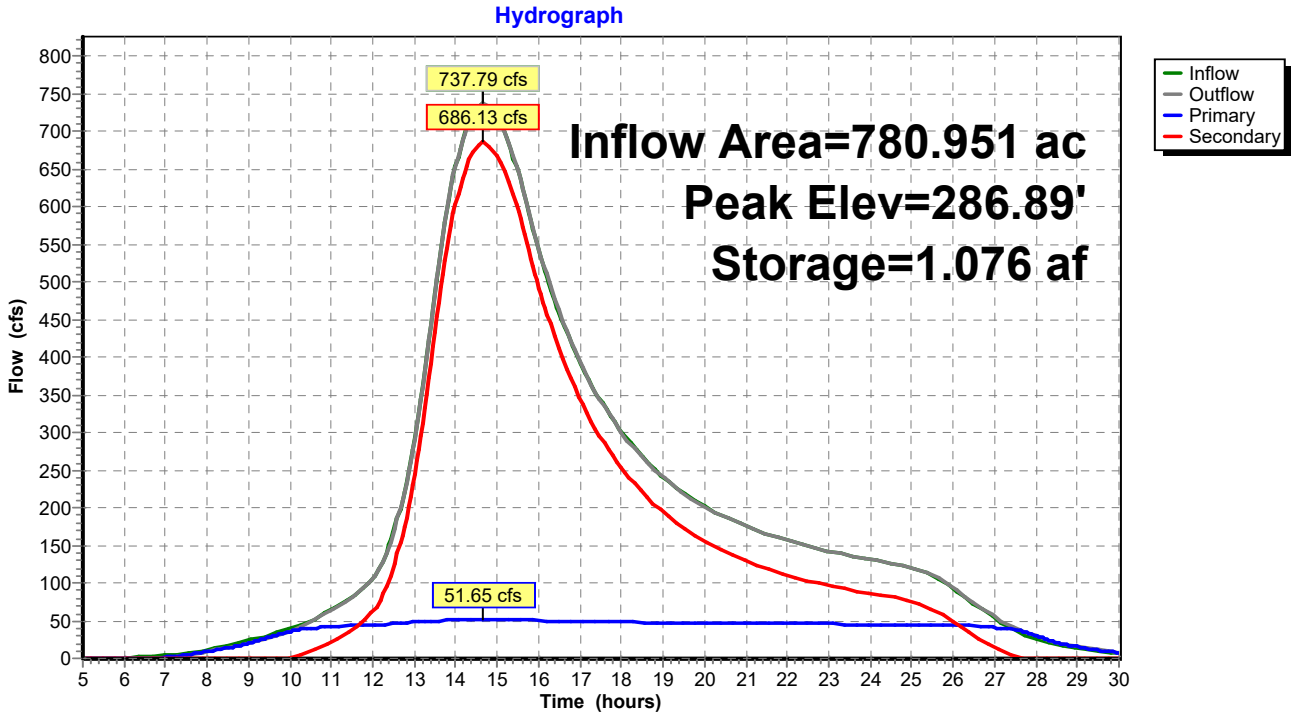
Pond 2P: Culvert 2



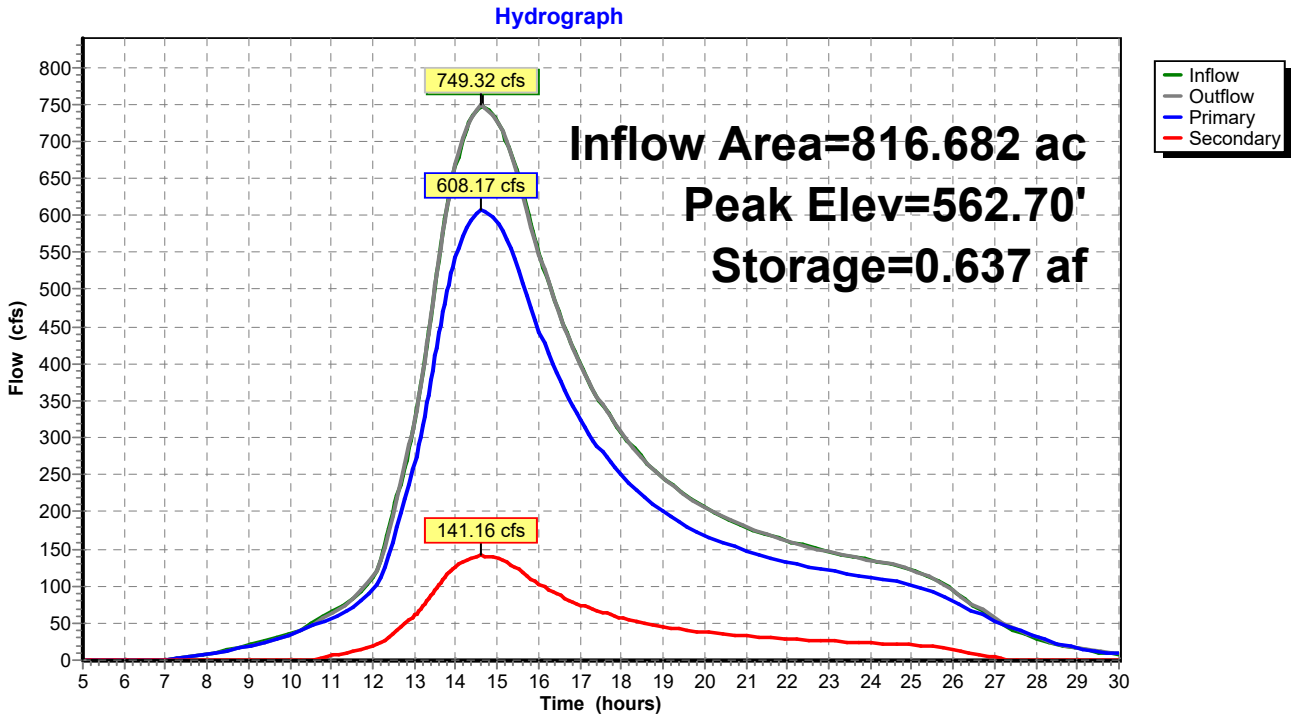
Pond 3P: Culvert 3



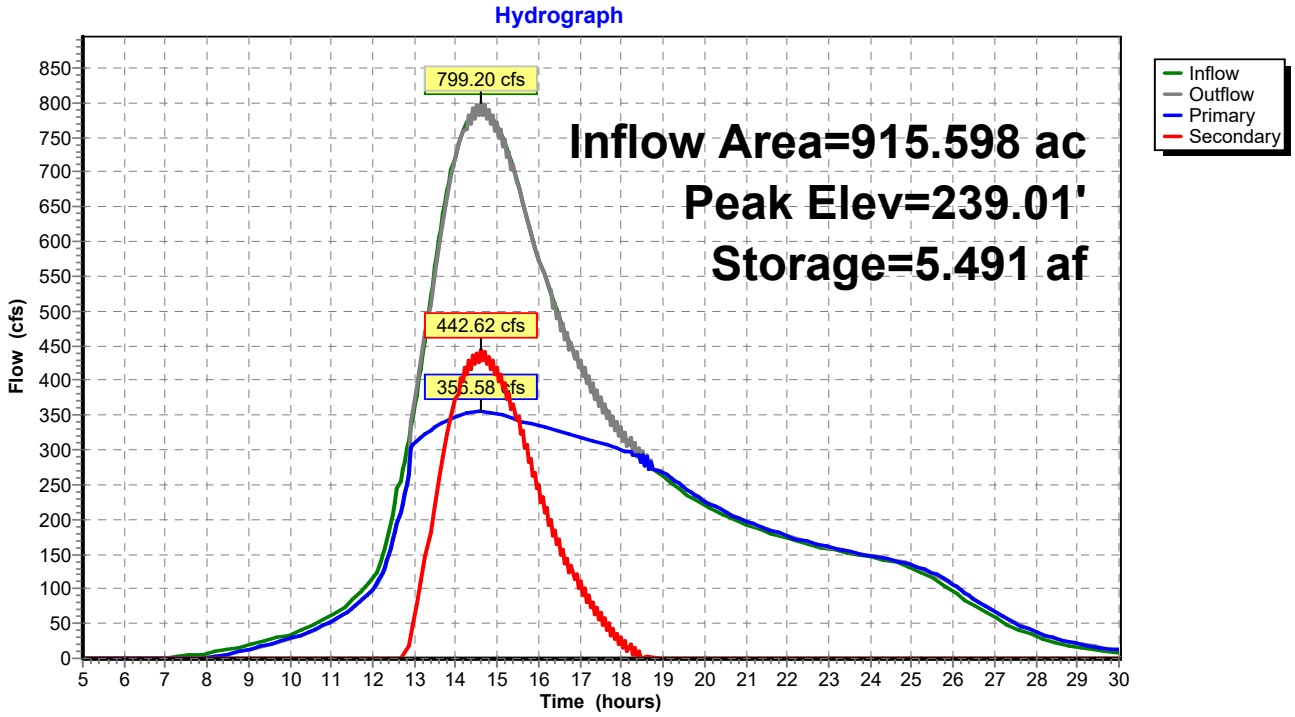
Pond 4P: Culvert 4

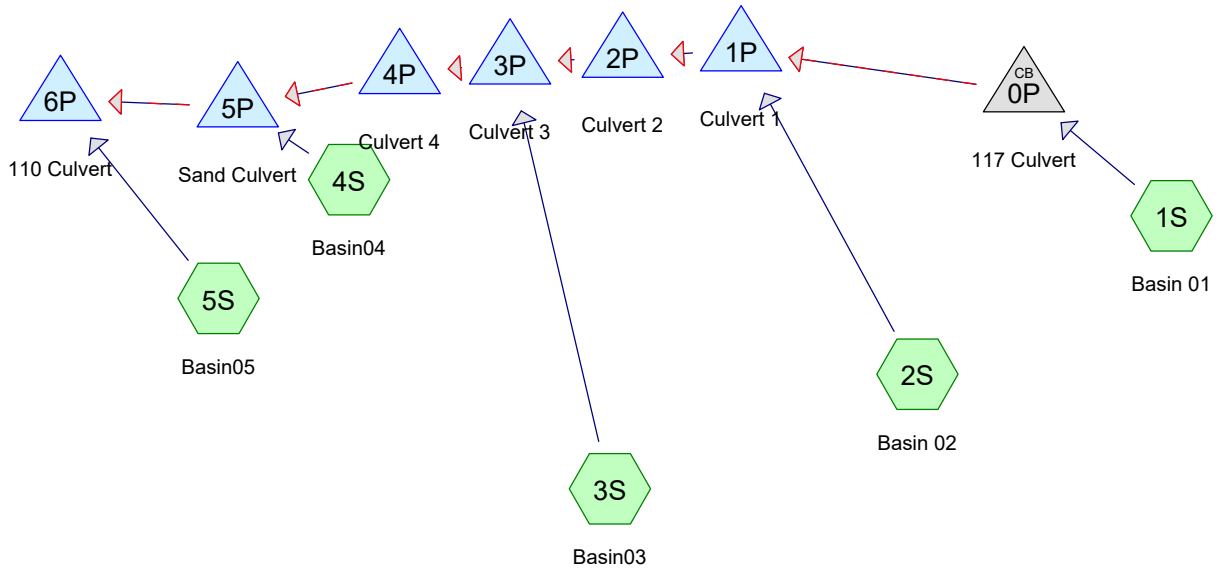


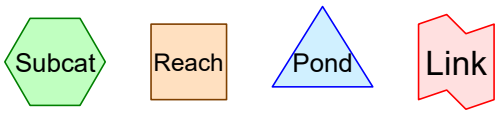
Pond 5P: Sand Culvert



Pond 6P: 110 Culvert







Routing Diagram for forbush_prop_alt1_hydraulic
Prepared by Tighe & Bond, Printed 7/8/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

Summary for Pond 0P: 117 Culvert

[58] Hint: Peaked 0.78' above defined flood level

Inflow Area =	201.341 ac,	0.00% Impervious,	Inflow Depth >	2.51"	for 10-yr event
Inflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af	
Outflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.48 cfs @	14.86 hrs,	Volume=	0.086 af	
Secondary =	83.14 cfs @	14.86 hrs,	Volume=	42.085 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 425.63' @ 14.86 hrs
Flood Elev= 424.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	425.40'	**48.0" Round 48" RCP Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 425.40' / 414.80' S= 0.1631 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Secondary	424.85'	**Route 117, C= 3.27** Offset (feet) 0.00 2.48 2.49 2.50 2.57 5.48 5.79 6.17 8.46 9.09 9.85 11.45 12.38 13.54 14.43 15.68 17.23 17.41 18.98 20.40 20.92 22.28 23.38 24.61 25.58 26.36 28.29 28.87 29.34 31.98 32.17 32.33 33.79 35.31 35.47 35.67 38.29 38.77 39.36 41.28 42.07 43.04 44.26 45.37 46.73 47.24 48.66 50.23 50.42 51.96 53.21 54.11 55.26 56.19 57.80 58.56 59.18 61.48 61.86 62.16 65.02 65.14 65.16 65.17 68.13 68.45 68.86 71.11 71.75 72.55 74.09 75.05 76.24 77.07 78.35 79.92 80.06 81.65 83.04 83.61 84.94 86.02 87.30 88.24 89.01 90.99 91.54 91.99 94.67 94.84 94.97 96.24 97.96 98.14 98.36 100.94 101.44 102.05 103.92 104.73 105.74 106.91 108.03 109.43 109.89 111.33 112.87 113.11 114.63 115.86 116.80 117.77 117.93 118.99 120.11 121.21 122.39 123.27 124.49 125.80 126.44 127.77 129.20 129.61 131.06 132.61 132.78 134.34 135.95 136.01 137.62 139.11 139.42 140.90 142.28 142.82 144.18 145.45 146.23 147.47 148.62 149.63 150.75 151.79 153.03 154.03 154.96 156.44 157.31 158.12 159.84 160.59 161.29 163.25 163.88 164.46 166.65 167.16 167.63 170.06 170.44 170.80 173.46 173.72 173.97 176.87 177.00 177.13 180.27 180.29 180.30 180.74 183.47 183.57 183.67 186.64 186.85 187.08 189.81 190.13 190.48 192.98 193.42 193.89 196.14 196.70 197.29 199.31 199.98 200.70 202.48 203.26 204.10 205.65 206.54 207.51 208.82 209.83 210.91 211.99 213.11 214.31 215.15 216.39 217.72 218.32 219.67 221.12 221.49 222.95 224.53 224.66 226.24 227.83 227.93 229.52 231.00 231.34 232.80 234.16 234.74 236.08 237.33 238.15 239.36 240.50 241.55 242.65 243.67 244.95 245.93 246.84 248.36 249.21 250.00 251.76 252.49 253.17 255.17 255.78 256.34 258.57 259.06 259.51 261.98 262.34 262.68 265.38 265.62 265.85 268.79 268.90 269.01 272.09 272.18 275.35 275.47 275.59 278.52 278.75 279.00 281.69 282.03 282.40 284.86 285.31 285.81 288.02 288.60 289.21 291.19 291.88 292.62 294.36 295.16

296.02 297.53 298.44 299.42 300.70 301.73 302.83 303.87
305.01 306.23 307.03 308.29 309.64 310.20 311.57 313.04
313.37 314.85 316.45 316.54 318.14 319.71 319.85 321.42
322.88 323.26 324.70 326.04 326.66 327.98 329.21 330.06
331.26 332.38 333.47 334.55 335.55 336.87 337.83 338.72
340.28 341.11 341.89 343.68 344.39 345.05 347.09 347.67
348.22 350.49 350.96 351.39 353.90 354.24 354.56 357.30
357.52 357.73 360.70 360.80 360.89 363.45 364.06 364.09
364.11 367.23 367.37 367.51 370.40 370.65 370.92 373.57
373.93 374.32 376.74 377.21 377.73 379.90 380.50 381.13
383.07 383.78 384.54 386.24 387.06 387.94 389.41 390.34
391.34 392.58 393.41 393.66 394.35 395.45 396.73 397.52
399.11 400.94 401.39 401.49 401.66 403.87 405.25 406.25
407.87 408.64 409.11 411.02 411.14 412.97 413.40 414.09
415.78 416.83 418.16 420.30 420.54 420.70 421.35 422.93
424.56 425.31 426.51 427.69 428.42 429.34 430.41 431.13
431.77 433.89 434.41 434.88 437.38 437.70 437.99 440.86
440.99 441.10 443.02 444.20 444.27 444.35 447.31 447.56
447.83 450.42 450.84 451.32 453.53 454.13 454.80 456.63
457.41 458.28 459.74 460.70 461.77 462.85 463.98 465.25
465.96 467.27 468.74 469.07 470.55 472.17 472.22 473.84
475.28 475.71 477.12 478.39 479.19 480.41 481.50 482.68
483.70 484.60 486.16 486.98 487.17 488.08 489.01 490.43
491.60 493.26 493.89 494.20 495.13 496.79 497.34 498.45
499.38 500.80 501.98 503.64 504.26 504.57 505.50 507.16
507.72 508.82 509.76 511.17 512.35 514.01 514.63 514.94
515.88 517.53 518.09 519.19 520.13 521.54 522.72 524.38
525.00 525.31 526.25 527.91 528.46 529.57 530.50 531.92
533.09 534.75 535.37 535.69 536.62 538.28 538.83 539.94
540.87 542.29 543.47 545.12 545.75 546.06 546.99 547.15
548.56 549.34 551.00 551.71 553.02 553.44 554.28 555.88
556.69 558.32 559.19 560.37 560.76 561.52 563.20 564.05
565.64 566.67 567.73 568.08 568.76 570.52 571.41 572.96
574.15 575.09 575.40 576.00 577.84 578.77 580.28 581.63
582.45 582.72 583.24 585.16 586.13 587.59 589.11 589.81
590.03 590.48

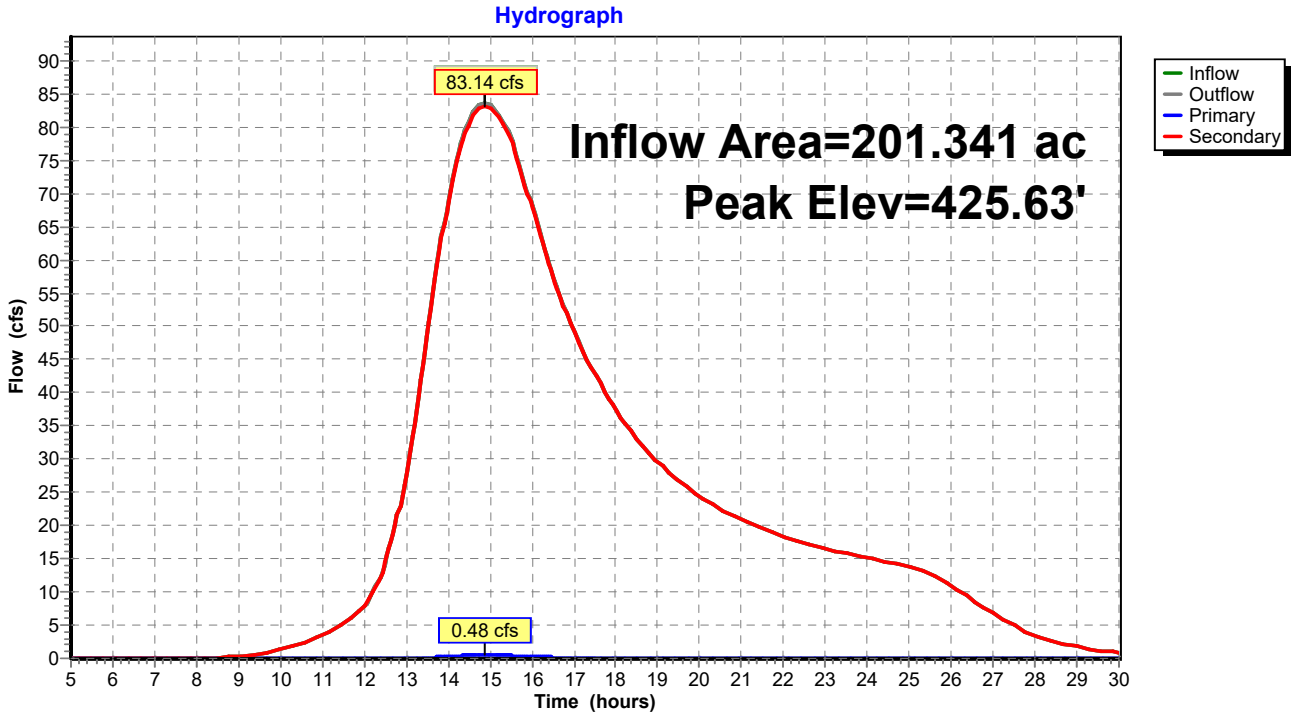
Height (feet) 11.60 11.60 11.60 11.60 11.59 11.51 11.50 11.49
11.45 11.44 11.43 11.39 11.38 11.35 11.33 11.30 11.26 11.26
11.22 11.18 11.17 11.13 11.11 11.09 11.07 11.06 11.03 11.02
11.01 10.96 10.95 10.95 10.90 10.85 10.85 10.84 10.75 10.74
10.73 10.69 10.67 10.64 10.63 10.60 10.55 10.55 10.50 10.45
10.45 10.41 10.36 10.35 10.31 10.28 10.23 10.21 10.20 10.13
10.12 10.11 10.06 10.05 10.05 10.05 9.97 9.96 9.95 9.88 9.87
9.85 9.83 9.81 9.78 9.77 9.74 9.69 9.69 9.64 9.57 9.58 9.52
9.49 9.46 9.43 9.42 9.36 9.36 9.35 9.28 9.28 9.28 9.24 9.19
9.18 9.18 9.10 9.09 9.07 9.01 8.98 8.95 8.91 8.88 8.84 8.84
8.80 8.76 8.75 8.71 8.68 8.69 8.67 8.66 8.62 8.59 8.55 8.50
8.49 8.44 8.41 8.39 8.35 8.31 8.29 8.26 8.22 8.21 8.18 8.14
8.14 8.11 8.05 8.05 8.00 7.95 7.94 7.89 7.87 7.87 7.85 7.84
7.82 7.81 7.79 7.73 7.70 7.65 7.58 7.53 7.49 7.44 7.41 7.37
7.30 7.27 7.25 7.19 7.17 7.17 7.10 7.09 7.07 6.98 6.97 6.96
6.86 6.85 6.84 6.70 6.70 6.70 6.69 6.60 6.59 6.59 6.59 6.58

6.58	6.55	6.55	6.54	6.45	6.44	6.42	6.31	6.29	6.27	6.19	6.17
6.16	6.09	6.09	6.07	6.00	5.98	5.94	5.90	5.86	5.84	5.80	5.78
5.74	5.71	5.68	5.62	5.60	5.54	5.50	5.49	5.45	5.41	5.42	5.37
5.31	5.30	5.25	5.21	5.21	5.18	5.16	5.18	5.17	5.12	5.15	5.10
5.07	5.02	4.98	4.96	4.88	4.86	4.84	4.78	4.76	4.74	4.70	4.68
4.67	4.64	4.62	4.61	4.58	4.57	4.56	4.51	4.50	4.48	4.39	4.38
4.37	4.27	4.27	4.26	4.20	4.19	4.15	4.15	4.15	4.06	4.05	4.04
3.94	3.93	3.91	3.84	3.82	3.80	3.73	3.71	3.69	3.63	3.60	3.57
3.52	3.48	3.46	3.39	3.36	3.36	3.32	3.32	3.29	3.29	3.27	3.19
3.17	3.10	3.08	3.02	3.01	2.98	2.97	2.94	2.88	2.89	2.84	2.79
2.78	2.73	2.70	2.71	2.68	2.64	2.64	2.60	2.54	2.53	2.48	2.45
2.42	2.39	2.37	2.34	2.33	2.32	2.28	2.27	2.25	2.20	2.18	2.16
2.07	2.05	2.04	1.94	1.93	1.92	1.85	1.84	1.83	1.77	1.77	1.76
1.69	1.69	1.69	1.64	1.63	1.63	1.63	1.58	1.57	1.57	1.48	1.47
1.46	1.37	1.36	1.34	1.31	1.29	1.28	1.23	1.22	1.21	1.16	1.14
1.13	1.08	1.06	1.04	1.02	1.01	1.00	1.02	1.01	1.01	1.00	0.97
0.93	0.90	0.82	0.73	0.71	0.71	0.70	0.60	0.57	0.54	0.49	0.47
0.46	0.39	0.38	0.31	0.29	0.27	0.22	0.21	0.19	0.15	0.14	0.14
0.12	0.10	0.05	0.04	0.01	0.00	0.00	0.01	0.03	0.04	0.06	0.13
0.14	0.14	0.23	0.23	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26
0.23	0.23	0.23	0.19	0.19	0.19	0.21	0.21	0.24	0.28	0.32	0.36
0.28	0.32	0.35	0.36	0.39	0.44	0.48	0.53	0.64	0.71	0.82	0.92
0.93	1.03	1.13	1.16	1.27	1.35	1.38	1.46	1.57	1.64	1.74	1.83
1.94	2.02	2.03	2.07	2.14	2.19	2.23	2.29	2.31	2.32	2.41	2.54
2.56	2.60	2.65	2.69	2.72	2.87	2.90	2.92	3.01	3.07	3.12	3.26
3.24	3.45	3.49	3.74	3.78	3.79	3.89	3.98	4.06	4.16	4.14	4.29
4.37	4.54	4.59	4.62	4.67	4.73	4.76	4.78	4.69	4.75	4.87	5.13
5.20	5.24	5.38	5.59	5.65	5.77	5.89	6.05	6.13	6.38	6.44	6.46
6.56	6.56	6.63	6.72	6.79	6.95	7.04	7.08	7.15	7.21	7.34	7.52
7.72	7.88	7.93	8.03	8.23	8.41	8.63	8.74	8.88	8.93	9.01	9.21
9.31	9.48	9.62	9.72	9.75	9.82	10.02	10.12	10.29	10.46	10.55	
10.59	10.65	10.88	11.00	11.18	11.40	11.49	11.52	11.60			

Primary OutFlow Max=0.46 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**1=48" RCP Culvert** (Inlet Controls 0.46 cfs @ 1.62 fps)

Secondary OutFlow Max=82.70 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**2=Route 117** (Weir Controls 82.70 cfs @ 2.33 fps)

Pond 0P: 117 Culvert



Hydrograph for Pond 0P: 117 Culvert

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	424.85	0.00	0.00	0.00
5.50	0.00	424.85	0.00	0.00	0.00
6.00	0.00	424.85	0.00	0.00	0.00
6.50	0.00	424.85	0.00	0.00	0.00
7.00	0.00	424.85	0.00	0.00	0.00
7.50	0.00	424.85	0.00	0.00	0.00
8.00	0.02	424.85	0.02	0.00	0.02
8.50	0.10	424.86	0.10	0.00	0.10
9.00	0.30	424.89	0.30	0.00	0.30
9.50	0.68	424.95	0.68	0.00	0.68
10.00	1.31	424.99	1.31	0.00	1.31
10.50	2.22	425.02	2.22	0.00	2.22
11.00	3.48	425.07	3.48	0.00	3.48
11.50	5.20	425.10	5.20	0.00	5.20
12.00	7.77	425.14	7.77	0.00	7.77
12.50	14.40	425.22	14.40	0.00	14.40
13.00	27.87	425.33	27.87	0.00	27.87
13.50	48.49	425.46	48.49	0.06	48.44
14.00	69.02	425.56	69.02	0.25	68.77
14.50	**81.14**	**425.62**	**81.14**	**0.44**	**80.69**
15.00	**83.38**	**425.63**	**83.38**	**0.48**	**82.91**
15.50	78.23	425.60	78.23	0.40	77.83
16.00	68.10	425.56	68.10	0.24	67.86
16.50	57.62	425.51	57.62	0.13	57.49
17.00	49.39	425.46	49.39	0.06	49.32
17.50	42.79	425.43	42.79	0.01	42.78
18.00	37.42	425.40	37.42	0.00	37.42
18.50	33.09	425.37	33.09	0.00	33.09
19.00	29.58	425.35	29.58	0.00	29.58
19.50	26.71	425.33	26.71	0.00	26.71
20.00	24.37	425.31	24.37	0.00	24.37
20.50	22.46	425.29	22.46	0.00	22.46
21.00	20.85	425.28	20.85	0.00	20.85
21.50	19.51	425.27	19.51	0.00	19.51
22.00	18.36	425.26	18.36	0.00	18.36
22.50	17.39	425.25	17.39	0.00	17.39
23.00	16.53	425.24	16.53	0.00	16.53
23.50	15.76	425.23	15.76	0.00	15.76
24.00	15.05	425.23	15.05	0.00	15.05
24.50	14.45	425.22	14.45	0.00	14.45
25.00	13.73	425.22	13.73	0.00	13.73
25.50	12.64	425.21	12.64	0.00	12.64
26.00	10.94	425.19	10.94	0.00	10.94
26.50	8.86	425.16	8.86	0.00	8.86
27.00	6.76	425.13	6.76	0.00	6.76
27.50	4.91	425.10	4.91	0.00	4.91
28.00	3.45	425.07	3.45	0.00	3.45
28.50	2.44	425.03	2.44	0.00	2.44
29.00	1.73	425.00	1.73	0.00	1.73
29.50	1.23	424.98	1.23	0.00	1.23
30.00	0.87	424.97	0.87	0.00	0.87

Summary for Pond 1P: Culvert 1

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Outflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af, Atten= 0%, Lag= 0.2 min
Primary = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 333.08' @ 14.67 hrs Surf.Area= 0.000 ac Storage= 0.005 af
Flood Elev= 334.80' Surf.Area= 0.000 ac Storage= 0.098 af

Plug-Flow detention time= 0.0 min calculated for 89.852 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (1,054.6 - 1,054.6)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	3.406 af	**Custom Stage Data** Listed below

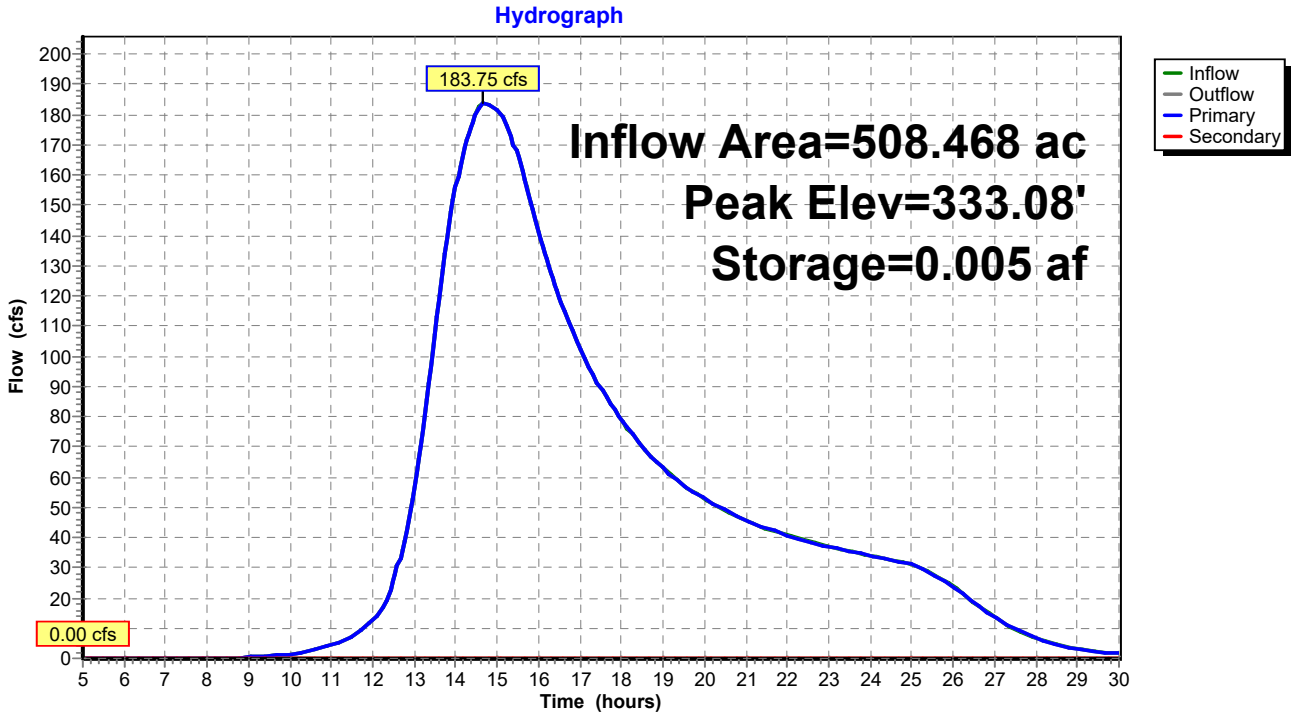
Elevation (feet)	Cum.Store (acre-feet)
329.70	0.000
333.00	0.003
334.00	0.024
335.00	0.116
336.00	0.309
337.00	0.575
338.00	0.886
339.00	1.252
340.00	1.773
341.00	2.503
342.00	3.406

Device	Routing	Invert	Outlet Devices
#1	Secondary	334.80'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.00 80.00 Height (feet) 2.00 0.00 2.00
#2	Primary	329.10'	**118.8" W x 48.0" H Box Prop 9.9ft Box Culvert** L= 40.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.10' / 329.00' S= 0.0025 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 39.60 sf

Primary OutFlow Max=183.64 cfs @ 14.67 hrs HW=333.08' (Free Discharge)
└─**2=Prop 9.9ft Box Culvert** (Barrel Controls 183.64 cfs @ 6.22 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=329.70' (Free Discharge)
└─**1=Forbush Mill Road** (Controls 0.00 cfs)

Pond 1P: Culvert 1



Hydrograph for Pond 1P: Culvert 1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	329.70	0.00	0.00	**0.00**
5.50	0.00	0.000	329.70	0.00	0.00	0.00
6.00	0.00	0.000	329.70	0.00	0.00	0.00
6.50	0.00	0.000	329.70	0.00	0.00	0.00
7.00	0.00	0.000	329.70	0.00	0.00	0.00
7.50	0.00	0.000	329.70	0.00	0.00	0.00
8.00	0.02	0.000	329.70	0.02	0.02	0.00
8.50	0.10	0.000	329.70	0.10	0.10	0.00
9.00	0.30	0.000	329.70	0.30	0.30	0.00
9.50	0.69	0.000	329.71	0.69	0.69	0.00
10.00	1.35	0.000	329.71	1.35	1.35	0.00
10.50	2.47	0.000	329.72	2.47	2.47	0.00
11.00	4.29	0.000	329.74	4.29	4.29	0.00
11.50	7.27	0.000	329.77	7.27	7.27	0.00
12.00	12.35	0.000	329.82	12.35	12.35	0.00
12.50	25.57	0.000	330.23	25.56	25.56	0.00
13.00	57.29	0.001	330.97	57.28	57.28	0.00
13.50	107.32	0.002	331.90	107.30	107.30	0.00
14.00	155.84	0.003	332.67	155.83	155.83	0.00
14.50	**180.37**	**0.004**	**333.03**	**180.30**	**180.30**	0.00
15.00	**181.34**	**0.004**	**333.05**	**181.40**	**181.40**	0.00
15.50	165.73	0.003	332.82	165.68	165.68	0.00
16.00	141.03	0.002	332.45	140.99	140.99	0.00
16.50	119.55	0.002	332.11	119.51	119.51	0.00
17.00	102.86	0.002	331.83	102.83	102.83	0.00
17.50	89.37	0.002	331.59	89.34	89.34	0.00
18.00	78.61	0.002	331.39	78.58	78.58	0.00
18.50	69.95	0.001	331.23	69.93	69.93	0.00
19.00	62.95	0.001	331.09	62.93	62.93	0.00
19.50	57.27	0.001	330.97	57.25	57.25	0.00
20.00	52.67	0.001	330.88	52.66	52.66	0.00
20.50	48.88	0.001	330.79	48.87	48.87	0.00
21.00	45.70	0.001	330.72	45.69	45.69	0.00
21.50	43.02	0.001	330.66	43.01	43.01	0.00
22.00	40.68	0.001	330.61	40.68	40.68	0.00
22.50	38.63	0.001	330.56	38.63	38.63	0.00
23.00	36.85	0.001	330.52	36.85	36.85	0.00
23.50	35.33	0.001	330.48	35.33	35.33	0.00
24.00	33.96	0.001	330.45	33.95	33.95	0.00
24.50	32.67	0.001	330.41	32.67	32.67	0.00
25.00	30.95	0.001	330.37	30.95	30.95	0.00
25.50	28.06	0.001	330.30	28.07	28.07	0.00
26.00	23.68	0.000	330.18	23.68	23.68	0.00
26.50	18.55	0.000	330.03	18.56	18.56	0.00
27.00	13.65	0.000	329.87	13.65	13.65	0.00
27.50	9.58	0.000	329.80	9.58	9.58	0.00
28.00	6.58	0.000	329.77	6.58	6.58	0.00
28.50	4.58	0.000	329.75	4.58	4.58	0.00
29.00	3.18	0.000	329.73	3.18	3.18	0.00
29.50	2.21	0.000	329.72	2.21	2.21	0.00
30.00	1.53	0.000	329.72	1.53	1.53	0.00

Summary for Pond 2P: Culvert 2

[58] Hint: Peaked 0.14' above defined flood level

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Outflow = 183.69 cfs @ 14.70 hrs, Volume= 89.852 af, Atten= 0%, Lag= 1.7 min
Primary = 182.50 cfs @ 14.70 hrs, Volume= 89.801 af
Secondary = 1.19 cfs @ 14.70 hrs, Volume= 0.050 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 308.84' @ 14.70 hrs Surf.Area= 0.000 ac Storage= 0.176 af
Flood Elev= 308.70' Surf.Area= 0.000 ac Storage= 0.158 af

Plug-Flow detention time= 0.4 min calculated for 89.672 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (1,055.0 - 1,054.6)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	1.350 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
306.00	0.000
307.00	0.013
308.00	0.066
309.00	0.198
310.00	0.445
311.00	0.844
312.00	1.350

Device	Routing	Invert	Outlet Devices
#1	Primary	305.35'	**118.8" W x 48.0" H Box Prop 9.9ft Box Culvert** L= 40.0' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.35' / 304.10' S= 0.0313 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 39.60 sf
#2	Secondary	308.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 1.57 2.55 3.95 6.16 6.33 6.43 6.88 8.70 10.30 11.08 12.32 13.46 14.18 15.84 17.32 17.77 18.05 18.22 18.48 20.60 21.93 22.98 24.64 25.35 25.80 27.73 27.79 29.68 30.11 30.80 32.49 33.56 34.87 36.95 37.25 37.43 38.25 39.63 41.31 42.00 43.11 44.38 45.18 46.76 48.72 49.06 49.14 49.26 51.52 52.94 53.90 55.42 56.27 56.81 58.65 59.18 60.69 61.03 61.58 63.41 64.56 65.79 67.73 68.17 68.44 69.65 70.54 72.32 72.92 73.89 75.30 76.19 77.68 80.04 80.06 80.07 80.11 82.44 83.94 84.82 86.20 87.19 87.82 89.57 90.58 91.70 91.95 92.36 94.33 95.57 96.71 98.51 99.09 99.37 99.45 100.73 101.49 103.20 103.90 105.16 106.31 106.96 108.73 109.23 110.72 111.14 111.89 113.55 114.47 115.96 117.73 118.23 118.37 118.62 120.78 121.98 123.19 125.35 125.60 125.74 126.23 128.01 129.50 130.42 132.08 132.83 133.25 134.73 135.24 137.01 137.65 138.81 140.07 140.77 142.48 143.23 144.52 144.89

145.54	147.30	148.28	149.71	151.74	152.03	152.12	152.27
154.53	155.79	156.94	159.00	159.35	159.55	160.24	161.76
163.30	164.17	165.73	166.58	167.06	168.74	168.99	170.82
171.41	172.46	173.82	174.57	176.23	177.24	178.33	178.64
179.19	181.05	182.09	183.46	185.74	185.84	185.87	185.92
188.28	189.60	190.69	192.65	193.10	193.35	193.84	194.06
195.69	196.80	198.37	198.73	200.20	201.04	203.39	203.60
203.71	204.14	206.39	207.00	208.06	209.06	210.40	211.73
212.73	213.79	214.40	216.65	217.08	217.19	217.40	219.75
220.59	222.06	222.42	223.99	225.09	226.73	227.39	227.77
229.16	230.44	230.79	231.40	233.11	234.19	235.79	236.07
237.59	238.46	240.73	240.99	241.13	241.66	243.80	244.38
245.40	246.48	247.78	249.15	250.07	251.18	251.82	254.17
254.49	254.58	254.73	254.80	256.30	257.73	257.89	258.09
260.70	261.19	261.80	263.67	264.49	265.51	266.64	267.79
269.22	269.61	271.09	272.58	272.94	274.39	275.55	276.65
277.69	278.52	280.36	280.99	281.49	284.08	284.29	284.46
286.00	287.43	287.59	287.79	290.40	290.89	291.50	293.37
294.19	295.21	296.34	297.49	298.93	299.31	300.79	301.12
302.18	302.97	304.17	304.88	307.50	307.55	307.58	307.68
310.28	310.93	312.03	312.98	314.32	315.68	316.56	317.70
318.38	321.05	321.08	321.08	321.09	323.78	324.47	325.62
326.48	327.85	329.18	330.16	331.23	331.88	334.41	334.58
334.62	334.69	337.28	338.00	339.22	339.98	341.38	342.68
343.75	344.77	345.38	347.78	348.08	348.15	348.28	350.78
351.53	352.81	353.23					

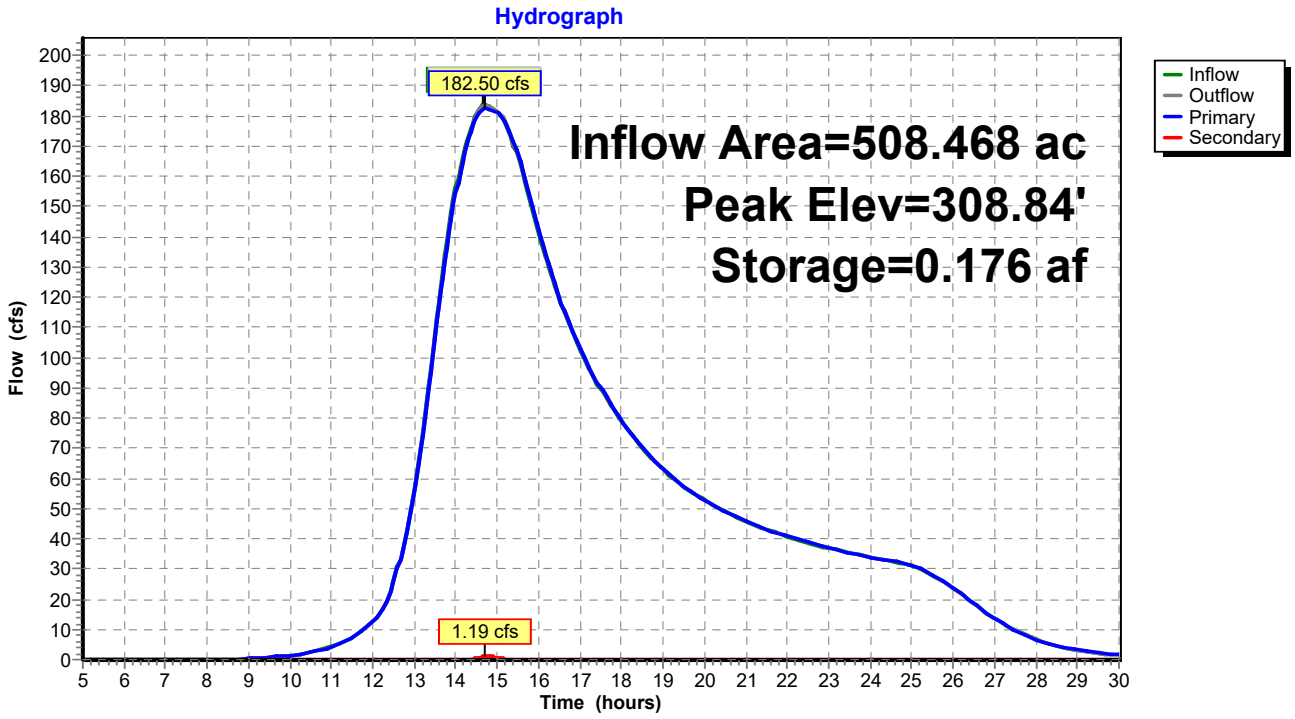
Height (feet)	3.08	2.98	2.95	2.91	2.91	2.91	2.91	2.92	2.94	2.94		
2.93	2.91	2.87	2.86	2.82	2.79	2.78	2.77	2.77	2.76	2.71	2.68	
2.65	2.62	2.60	2.60	2.55	2.58	2.55	2.54	2.54	2.49	2.48	2.44	
2.41	2.40	2.40	2.39	2.34	2.35	2.34	2.33	2.29	2.29	2.24	2.21	
2.20	2.20	2.20	2.14	2.11	2.08	2.06	2.03	2.02	1.99	1.99	1.97	
1.96	1.97	1.98	1.98	1.97	1.95	1.94	1.93	1.90	1.83	1.81	1.79	
1.78	1.74	1.74	1.71	1.68	1.68	1.68	1.68	1.62	1.60	1.58	1.56	
1.54	1.53	1.51	1.50	1.49	1.49	1.49	1.45	1.45	1.42	1.43	1.42	
1.41	1.41	1.39	1.32	1.31	1.29	1.28	1.24	1.23	1.18	1.21	1.19	
1.18	1.18	1.15	1.12	1.09	1.07	1.06	1.05	1.05	1.01	1.00	0.98	
0.98	0.98	0.98	0.98	0.97	0.97	0.96	1.00	1.00	1.01	1.01	1.00	
1.01	1.00	0.99	0.96	0.96	0.93	0.94	0.92	0.91	0.90	0.87	0.87	
0.84	0.84	0.83	0.83	0.83	0.81	0.80	0.78	0.76	0.75	0.75	0.74	
0.68	0.67	0.64	0.62	0.60	0.59	0.58	0.55	0.55	0.56	0.56	0.55	
0.55	0.53	0.53	0.52	0.52	0.52	0.49	0.48	0.48	0.47	0.47	0.47	
0.47	0.44	0.44	0.43	0.44	0.44	0.44	0.44	0.44	0.41	0.41	0.40	
0.40	0.39	0.39	0.36	0.36	0.36	0.36	0.35	0.35	0.34	0.38	0.37	
0.44	0.40	0.44	0.46	0.47	0.47	0.47	0.47	0.44	0.42	0.38	0.37	
0.32	0.30	0.27	0.25	0.27	0.27	0.31	0.30	0.31	0.49	0.50	0.60	
0.61	0.70	0.69	0.61	0.60	0.60	0.56	0.45	0.40	0.37	0.38	0.33	
0.22	0.35	0.29	0.25	0.40	0.41	0.41	0.41	0.42	0.53	0.62	0.63	
0.64	0.79	0.81	0.79	0.87	0.84	0.81	0.81	0.77	0.79	0.70	0.73	
0.73	0.74	0.74	0.79	0.74	0.78	0.81	0.79	0.81	0.81	0.92	0.92	
0.92	0.99	1.03	1.04	1.06	1.09	1.13	1.18	1.21	1.29	1.31	1.21	
1.23	1.11	1.00	0.88	0.85	0.73	0.68	0.56	0.50	0.29	0.29	0.29	
0.28	0.14	0.12	0.09	0.11	0.07	0.08	0.09	0.10	0.10	0.14	0.14	

0.14	0.14	0.16	0.16	0.15	0.15	0.14	0.13	0.11	0.11	0.10	0.07
0.07	0.06	0.06	0.01	0.00	0.05	0.05	0.12	0.36	0.62	0.81	0.98
1.66	1.75	1.77	1.80	2.50	2.72	3.08	3.08				

Primary OutFlow Max=182.49 cfs @ 14.70 hrs HW=308.84' (Free Discharge)
└─**1=Prop 9.9ft Box Culvert** (Inlet Controls 182.49 cfs @ 5.29 fps)

Secondary OutFlow Max=1.05 cfs @ 14.70 hrs HW=308.84' (Free Discharge)
└─**2=Forbush Mill Road** (Weir Controls 1.05 cfs @ 0.68 fps)

Pond 2P: Culvert 2



Hydrograph for Pond 2P: Culvert 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	306.00	0.00	0.00	0.00
5.50	0.00	0.000	306.00	0.00	0.00	0.00
6.00	0.00	0.000	306.00	0.00	0.00	0.00
6.50	0.00	0.000	306.00	0.00	0.00	0.00
7.00	0.00	0.000	306.00	0.00	0.00	0.00
7.50	0.00	0.000	306.00	0.00	0.00	0.00
8.00	0.02	0.000	306.00	0.02	0.02	0.00
8.50	0.10	0.000	306.00	0.10	0.10	0.00
9.00	0.30	0.000	306.00	0.30	0.30	0.00
9.50	0.69	0.000	306.00	0.69	0.69	0.00
10.00	1.35	0.000	306.00	1.35	1.35	0.00
10.50	2.47	0.000	306.01	2.47	2.47	0.00
11.00	4.29	0.000	306.02	4.29	4.29	0.00
11.50	7.27	0.000	306.03	7.26	7.26	0.00
12.00	12.35	0.001	306.04	12.34	12.34	0.00
12.50	25.56	0.004	306.29	25.39	25.39	0.00
13.00	57.28	0.012	306.95	56.99	56.99	0.00
13.50	107.30	0.054	307.78	106.21	106.21	0.00
14.00	155.83	0.127	308.46	154.10	154.10	0.00
14.50	**180.30**	**0.171**	**308.80**	**179.80**	**179.34**	**0.46**
15.00	**181.40**	**0.174**	**308.82**	**181.61**	**180.94**	**0.66**
15.50	165.68	0.149	308.63	166.62	166.62	0.00
16.00	140.99	0.106	308.30	142.06	142.06	0.00
16.50	119.51	0.065	307.99	120.28	120.28	0.00
17.00	102.83	0.052	307.73	103.16	103.16	0.00
17.50	89.34	0.041	307.52	89.63	89.63	0.00
18.00	78.58	0.031	307.34	78.82	78.82	0.00
18.50	69.93	0.023	307.19	70.13	70.13	0.00
19.00	62.93	0.017	307.07	63.10	63.10	0.00
19.50	57.25	0.012	306.96	57.32	57.32	0.00
20.00	52.66	0.011	306.87	52.70	52.70	0.00
20.50	48.87	0.010	306.80	48.91	48.91	0.00
21.00	45.69	0.010	306.74	45.72	45.72	0.00
21.50	43.01	0.009	306.68	43.04	43.04	0.00
22.00	40.68	0.008	306.63	40.70	40.70	0.00
22.50	38.63	0.008	306.59	38.65	38.65	0.00
23.00	36.85	0.007	306.55	36.87	36.87	0.00
23.50	35.33	0.007	306.52	35.34	35.34	0.00
24.00	33.95	0.006	306.49	33.97	33.97	0.00
24.50	32.67	0.006	306.46	32.68	32.68	0.00
25.00	30.95	0.005	306.42	30.97	30.97	0.00
25.50	28.07	0.005	306.35	28.10	28.10	0.00
26.00	23.68	0.003	306.24	23.72	23.72	0.00
26.50	18.56	0.001	306.11	18.60	18.60	0.00
27.00	13.65	0.001	306.05	13.66	13.66	0.00
27.50	9.58	0.000	306.03	9.59	9.59	0.00
28.00	6.58	0.000	306.02	6.59	6.59	0.00
28.50	4.58	0.000	306.02	4.58	4.58	0.00
29.00	3.18	0.000	306.01	3.19	3.19	0.00
29.50	2.21	0.000	306.01	2.21	2.21	0.00
30.00	1.53	0.000	306.01	1.53	1.53	0.00

Summary for Pond 3P: Culvert 3

[58] Hint: Peaked 0.65' above defined flood level

Inflow Area = 780.951 ac, 0.00% Impervious, Inflow Depth > 1.66" for 10-yr event
Inflow = 211.58 cfs @ 14.83 hrs, Volume= 107.848 af
Outflow = 211.57 cfs @ 14.84 hrs, Volume= 107.838 af, Atten= 0%, Lag= 0.2 min
Primary = 174.15 cfs @ 14.84 hrs, Volume= 102.260 af
Secondary = 37.43 cfs @ 14.84 hrs, Volume= 5.579 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 290.35' @ 14.84 hrs Surf.Area= 0.000 ac Storage= 0.292 af
Flood Elev= 289.70' Surf.Area= 0.000 ac Storage= 0.225 af

Plug-Flow detention time= 1.4 min calculated for 107.838 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (1,068.4 - 1,067.0)

Volume	Invert	Avail.Storage	Storage Description
#1	287.50'	0.461 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
287.50	0.000
292.00	0.461

Device	Routing	Invert	Outlet Devices
#1	Primary	287.50'	**168.0" W x 48.0" H Box Prop 14ft Box Culvert** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.50' / 287.40' S= 0.0027 '/' Cc= 0.900 n= 0.009, Flow Area= 56.00 sf
#2	Secondary	289.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.52 1.01 2.44 3.03 4.98 5.54 7.28 8.05 8.29 9.30 10.29 11.61 12.42 12.44 13.86 14.32 15.29 17.56 18.86 19.90 20.58 21.56 21.84 22.70 23.09 24.57 24.87 26.53 26.85 28.19 29.36 30.61 31.87 32.43 32.98 33.85 34.37 35.28 35.99 36.48 36.88 37.42 38.13 38.85 39.56 40.28 41.45 43.11 43.26 44.40 44.77 45.66 46.70 47.42 48.09 48.40 49.74 51.40 52.41 53.18 53.84 55.27 56.70 58.19 60.98 61.95 62.41 63.82 63.84 64.67 65.26 65.72 65.98 66.33 67.41 67.98 68.83 68.96 69.64 71.69 74.10 75.26 77.40 78.25 79.51 79.59 80.97 81.68 82.40 83.83 84.38 85.25 86.68 88.82 89.54 90.25 91.20 92.39 92.85 93.82 94.66 95.25 96.17 96.68 98.10 99.49 99.80 101.15 102.07 102.80 103.33 104.58 104.94 106.12 106.67 107.78 108.10 110.24 111.09 112.75 114.61 115.22 115.86 115.95 117.73 119.38 119.62 120.88 121.04 121.66 122.13 123.38 124.36 125.50 128.09 128.80 129.33 130.23 132.37 134.31 135.78 135.96 137.17 139.68 140.22 140.94 141.65 142.36 142.60 143.79 146.07 147.20 147.57 148.08 148.46 150.22 150.89 151.65 152.55 153.07 154.20 154.50 155.21 156.35 156.64 157.52 158.07 158.78 159.50 161.64 162.35 162.49 163.78 164.76 166.01 166.64 167.47 168.56 173.94 174.40 175.89

176.89 177.22 177.73 178.05 179.07 180.23 182.15 182.57
183.91 184.39 186.06 187.29 188.31 188.56 189.26 190.37
191.06 194.61 195.22 196.89 198.46 199.39 199.61 200.22
201.29 201.89 203.56 204.74 205.22 205.77 207.72 210.65
210.90 211.93 211.99 213.98 214.39 217.72 218.55 219.11
220.01 222.68 223.55 224.02 225.27 225.36 226.89 227.32
228.55 229.37 231.43 231.88 234.71 236.05 236.05 236.88
237.72 238.26 238.72 240.06 240.67 241.40 242.68 243.55
243.75 244.38 245.22 246.75 249.42 251.05 251.88 251.96
252.71 253.43 255.21 256.11 257.10 258.55 259.38 261.05
262.71 262.79 263.55 265.21 265.31 266.04 268.54 269.22
270.21 271.88 273.49 273.64 274.55 275.21 278.54 278.83
280.71 281.04 281.73 282.48 284.18 285.21 286.04 287.71
288.19 288.54 290.21 292.00 292.71 293.03 294.05 294.37
295.21 296.04 296.36 297.71 298.49 300.03 300.40 301.25
301.83 302.55 303.12 305.43 305.77 306.55 306.85 307.92
308.32 309.00 309.29 311.61 311.86 312.78 313.92 314.69
315.40 317.78 319.32 320.70 321.63 322.96 323.18 324.72
325.11 325.49 326.19 327.03 328.33 328.58 330.12 330.48
331.66 332.43 333.21 333.71 334.67 335.52 337.40 338.00
339.08 341.23 342.88 344.45 344.78 345.61 346.32 346.60
347.86 349.41 350.77 351.72 351.97 352.49 353.04 354.12
354.31 355.58 356.35 357.12 359.29 359.49 360.21 361.39
363.16 364.06 364.77 367.01 368.69 371.78 372.00 373.46
374.09 374.86 375.60 376.41 376.68 379.07 379.49 380.26
380.98 381.18 381.81 382.58 385.66 387.42 388.50 388.75
391.06 392.13 393.38 394.86 395.69 398.01 398.78 400.30
400.34 401.86 403.07 404.18 405.69 406.76 407.83 408.91
409.58 410.35 411.28 411.89 413.43 414.02 414.45 414.98
416.43 417.29 417.50 418.83 419.61

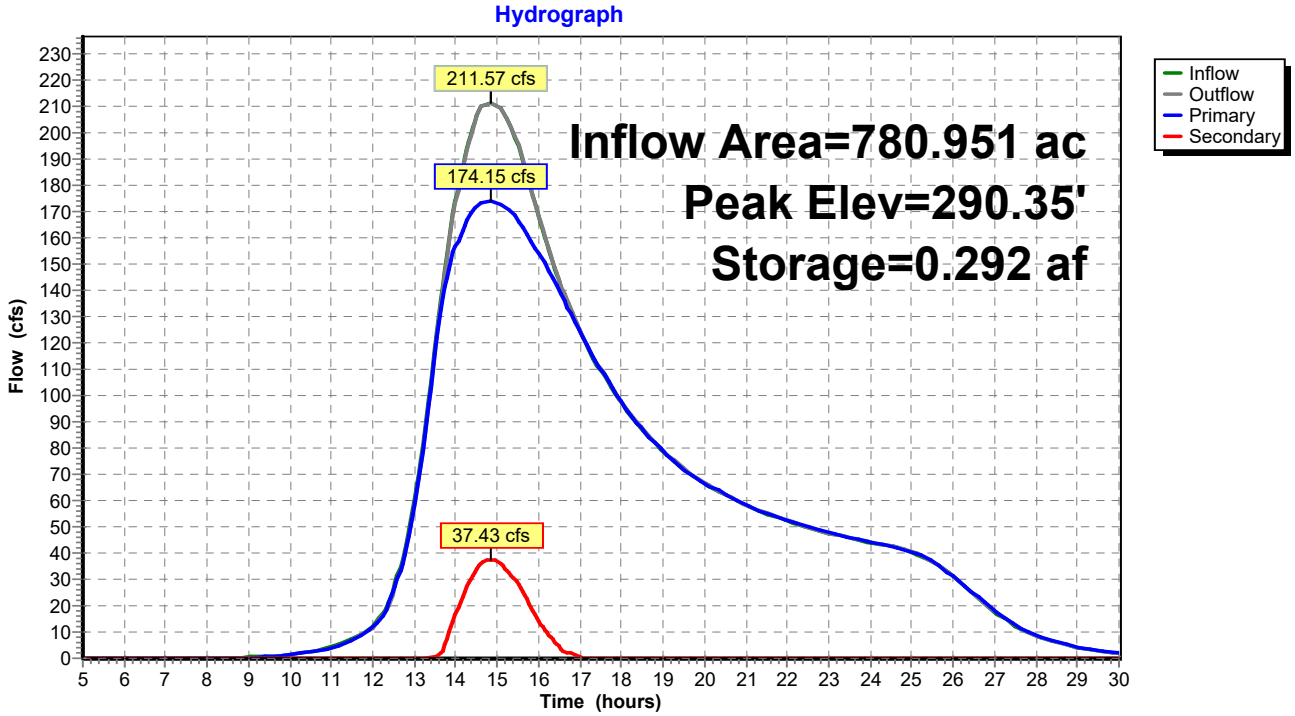
Height (feet) 17.94 17.81 17.58 16.87 16.57 15.64 15.38 14.53
14.16 14.03 13.54 13.05 12.43 12.02 12.02 11.28 11.05 10.54
9.38 8.73 8.22 7.90 7.45 7.33 6.92 6.75 6.06 5.93 5.18 5.04
4.42 3.91 3.38 2.83 2.63 2.42 2.14 1.99 1.71 1.50 1.37 1.29
1.21 1.14 1.06 1.00 0.96 0.93 0.83 0.81 0.73 0.71 0.64 0.57
0.51 0.47 0.44 0.35 0.23 0.15 0.10 0.07 0.05 0.05 0.11 0.24
0.27 0.27 0.31 0.30 0.33 0.33 0.35 0.34 0.35 0.35 0.36 0.36
0.37 0.37 0.29 0.18 0.12 0.03 0.01 0.01 0.00 0.08 0.13 0.20
0.32 0.38 0.45 0.59 0.84 0.94 1.02 1.14 1.27 1.33 1.44 1.55
1.62 1.75 1.80 1.96 2.10 2.14 2.29 2.36 2.40 2.42 2.45 2.47
2.51 2.51 2.53 2.52 2.55 2.57 2.60 2.60 2.61 2.61 2.62 2.62
2.54 2.52 2.45 2.45 2.41 2.40 2.33 2.28 2.20 2.04 2.00 1.98
1.93 1.87 1.85 1.82 1.81 1.79 1.79 1.78 1.78 1.77 1.77 1.78
1.78 1.75 1.72 1.70 1.69 1.67 1.60 1.58 1.53 1.48 1.44 1.37
1.36 1.31 1.25 1.22 1.16 1.13 1.08 1.04 0.98 0.98 0.97 0.97
0.99 1.04 1.06 1.10 1.14 1.40 1.41 1.46 1.48 1.50 1.51 1.53
1.57 1.63 1.71 1.72 1.78 1.79 1.85 1.89 1.93 1.93 1.96 1.99
2.02 2.15 2.16 2.20 2.22 2.22 2.23 2.23 2.25 2.25 2.27 2.30
2.32 2.33 2.40 2.44 2.45 2.45 2.46 2.46 2.47 2.51 2.53 2.53
2.55 2.58 2.58 2.59 2.59 2.60 2.59 2.60 2.60 2.61 2.61 2.60
2.60 2.63 2.64 2.66 2.69 2.72 2.73 2.79 2.81 2.85 2.88 2.89
2.90 2.90 2.92 2.94 3.00 3.06 3.08 3.09 3.10 3.13 3.17 3.20

3.24	3.28	3.31	3.36	3.40	3.41	3.42	3.46	3.47	3.48	3.54	3.55
3.58	3.62	3.68	3.68	3.72	3.74	3.82	3.82	3.86	3.86	3.88	3.89
3.94	3.96	3.99	4.03	4.05	4.05	4.09	4.12	4.12	4.13	4.13	4.14
4.14	4.16	4.16	4.18	4.18	4.21	4.21	4.23	4.23	4.25	4.25	4.28
4.29	4.29	4.30	4.30	4.31	4.31	4.32	4.32	4.31	4.31	4.29	4.29
4.28	4.28	4.30	4.33	4.36	4.41	4.41	4.51	4.56	4.59	4.68	4.80
5.04	5.08	5.40	5.47	5.68	5.81	5.93	6.02	6.17	6.31	6.60	6.70
6.86	7.20	7.48	7.73	7.79	7.92	8.05	8.09	8.30	8.52	8.70	8.82
8.86	8.91	8.98	9.09	9.12	9.25	9.34	9.41	9.64	9.67	9.74	9.88
10.08	10.20	10.28	10.57	10.80	11.24	11.28	11.49	11.59	11.70		
11.82	11.94	11.99	12.37	12.43	12.56	12.67	12.71	12.80	12.93		
13.41	13.69	13.85	13.88	14.22	14.36	14.53	14.74	14.85	15.18		
15.28	15.50	15.50	15.72	15.88	16.04	16.21	16.31	16.40	16.50		
16.58	16.66	16.78	16.85	17.08	17.16	17.23	17.30	17.52	17.64		
17.68	17.86	17.94									

Primary OutFlow Max=174.10 cfs @ 14.84 hrs HW=290.35' (Free Discharge)
└─**1=Prop 14ft Box Culvert** (Barrel Controls 174.10 cfs @ 5.82 fps)

Secondary OutFlow Max=36.92 cfs @ 14.84 hrs HW=290.35' (Free Discharge)
└─**2=Forbush Mill Road** (Weir Controls 36.92 cfs @ 2.04 fps)

Pond 3P: Culvert 3



Hydrograph for Pond 3P: Culvert 3

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	287.50	0.00	0.00	0.00
5.50	0.00	0.000	287.50	0.00	0.00	0.00
6.00	0.00	0.000	287.50	0.00	0.00	0.00
6.50	0.00	0.000	287.50	0.00	0.00	0.00
7.00	0.00	0.000	287.50	0.00	0.00	0.00
7.50	0.00	0.000	287.50	0.00	0.00	0.00
8.00	0.02	0.000	287.50	0.02	0.02	0.00
8.50	0.10	0.000	287.50	0.08	0.08	0.00
9.00	0.30	0.001	287.51	0.26	0.26	0.00
9.50	0.69	0.003	287.53	0.63	0.63	0.00
10.00	1.35	0.006	287.56	1.25	1.25	0.00
10.50	2.47	0.012	287.61	2.30	2.30	0.00
11.00	4.29	0.020	287.70	4.03	4.03	0.00
11.50	7.26	0.030	287.79	7.00	7.00	0.00
12.00	12.34	0.044	287.93	11.91	11.91	0.00
12.50	26.22	0.075	288.23	25.10	25.10	0.00
13.00	61.36	0.138	288.85	59.43	59.43	0.00
13.50	118.01	0.220	289.65	115.93	115.93	0.00
14.00	174.42	0.272	290.15	173.86	157.10	16.76
14.50	**206.07**	**0.289**	**290.33**	**205.90**	**171.92**	**33.98**
15.00	**210.44**	**0.291**	**290.35**	**210.48**	**173.72**	**36.76**
15.50	195.01	0.284	290.27	195.32	167.09	28.23
16.00	168.04	0.269	290.13	168.37	154.54	13.83
16.50	143.88	0.251	289.95	144.34	139.89	4.45
17.00	124.73	0.232	289.76	125.18	124.56	0.62
17.50	109.38	0.212	289.57	109.82	109.82	0.00
18.00	97.03	0.195	289.41	97.40	97.40	0.00
18.50	87.02	0.181	289.27	87.34	87.34	0.00
19.00	78.85	0.169	289.15	79.12	79.12	0.00
19.50	72.11	0.159	289.05	72.32	72.32	0.00
20.00	66.66	0.150	288.97	66.84	66.84	0.00
20.50	62.16	0.143	288.90	62.33	62.33	0.00
21.00	58.37	0.137	288.83	58.51	58.51	0.00
21.50	55.17	0.131	288.78	55.29	55.29	0.00
22.00	52.36	0.127	288.74	52.47	52.47	0.00
22.50	49.87	0.122	288.69	49.98	49.98	0.00
23.00	47.69	0.118	288.66	47.78	47.78	0.00
23.50	45.82	0.115	288.62	45.89	45.89	0.00
24.00	44.14	0.112	288.59	44.21	44.21	0.00
24.50	42.57	0.109	288.57	42.64	42.64	0.00
25.00	40.39	0.105	288.53	40.51	40.51	0.00
25.50	36.63	0.099	288.46	36.86	36.86	0.00
26.00	30.84	0.087	288.35	31.15	31.15	0.00
26.50	24.10	0.073	288.22	24.45	24.45	0.00
27.00	17.62	0.059	288.08	17.98	17.98	0.00
27.50	12.31	0.046	287.94	12.59	12.59	0.00
28.00	8.44	0.035	287.84	8.68	8.68	0.00
28.50	5.85	0.027	287.76	6.01	6.01	0.00
29.00	4.06	0.021	287.70	4.17	4.17	0.00
29.50	2.80	0.015	287.65	2.94	2.94	0.00
30.00	1.93	0.010	287.60	2.02	2.02	0.00

Summary for Pond 4P: Culvert 4

[93] Warning: Storage range exceeded by 0.25'
[58] Hint: Peaked 1.03' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	780.951 ac,	0.00% Impervious,	Inflow Depth >	1.66"	for	10-yr event
Inflow =	211.57 cfs @	14.84 hrs,	Volume=	107.838 af		
Outflow =	212.53 cfs @	14.85 hrs,	Volume=	107.756 af,	Atten= 0%,	Lag= 0.8 min
Primary =	37.17 cfs @	14.85 hrs,	Volume=	44.915 af		
Secondary =	175.35 cfs @	14.85 hrs,	Volume=	62.840 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 286.25' @ 14.85 hrs Surf.Area= 0.000 ac Storage= 1.076 af
Flood Elev= 285.22' Surf.Area= 0.000 ac Storage= 0.889 af

Plug-Flow detention time= 8.4 min calculated for 107.541 af (100% of inflow)
Center-of-Mass det. time= 7.9 min (1,076.3 - 1,068.4)

Volume	Invert	Avail.Storage	Storage Description
#1	281.50'	1.076 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
281.50	0.000
286.00	1.076

Device	Routing	Invert	Outlet Devices
#1	Primary	281.69'	**168.0" W x 4.0" H Box Prop 14ft Box Culvert** L= 39.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 281.50' / 281.69' S= -0.0048 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 4.67 sf
#2	Secondary	285.22'	**Forbrush Mill Road, C= 3.27** Offset (feet) 0.00 0.10 0.33 0.48 1.07 3.19 3.71 4.55 5.91 7.08 8.63 9.00 10.46 11.35 13.44 13.83 14.07 15.04 16.78 17.20 17.89 19.50 20.58 22.22 22.34 23.95 24.94 26.79 27.33 27.66 29.02 30.37 30.70 31.23 33.09 34.07 35.68 35.81 37.45 38.53 40.13 40.82 41.25 43.00 43.97 44.20 44.58 46.68 47.57 49.03 49.40 50.95 52.12 53.47 54.32 54.84 56.98 57.56 57.69 57.92 60.27 61.07 62.37 62.99 64.44 65.71 66.82 67.82 68.43 70.96 71.15 71.19 71.26 73.86 74.57 75.71 76.58 77.94 79.30 80.16 81.31 82.02 84.61 84.69 84.74 84.94 87.45 88.06 89.06 90.17 91.44 92.89 93.50 94.81 95.61 97.95 98.18 98.33 98.92 101.05 101.56 102.40 103.76 104.93 106.48 106.85 108.31 109.20 111.30 111.68 111.92 112.90 114.64 115.06 115.74 117.35 118.43 120.07 120.19 121.80 122.79 124.64 125.18 125.51 126.88 128.23 128.55 129.09 130.94 131.93 133.53 133.66 135.30 136.38 137.98 138.68 139.10 140.85 141.82 142.05 142.43 144.53 145.42 146.88 147.25 147.74 148.83 149.86 151.97 152.29 152.45 152.91 155.03 155.75 157.21 157.62 159.22 160.21 162.46 162.68 162.79 163.11 165.38 166.15

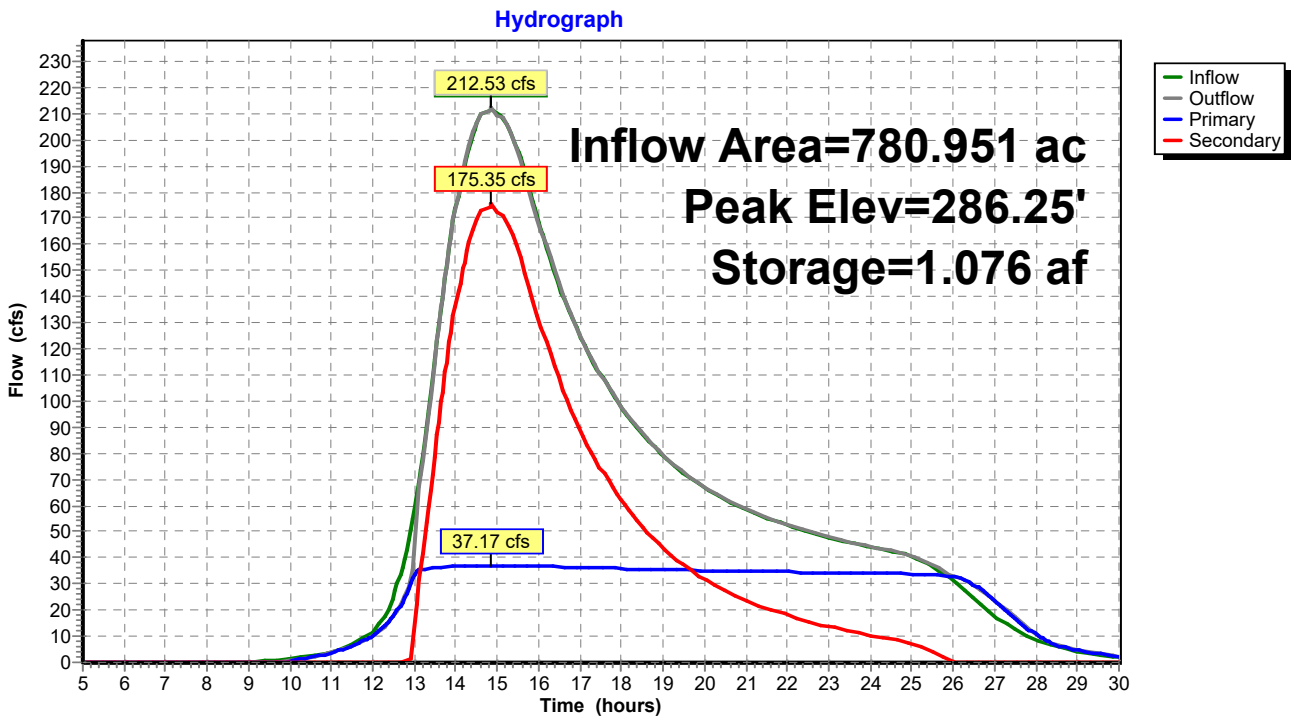
167.71	167.96	169.61	170.55	172.95	173.07	173.13	173.31
175.72	176.54	178.20	178.31	180.00	180.89	183.44	183.47
183.48	183.51	186.06	186.93	188.65	188.69	190.39	191.24
193.71	193.82	193.86	193.93	196.41	197.32	198.99	199.18
200.79	201.58	203.91	204.16	204.25	204.42	206.75	207.71
209.34	209.67	211.18	211.92	214.11	214.51	214.64	214.91
217.09	218.11	219.68	220.16	221.57	222.27	224.31	224.85
225.03	225.41	227.44	228.50	230.02	230.65	231.96	232.61
234.51	235.19	235.43	235.90	237.78	238.89	240.37	241.14
242.35	242.95	244.71	245.54	245.82	246.39	248.12	249.28
250.71	251.63	252.75	253.29	254.91	255.88	256.21	256.88
258.47	258.61	260.03	260.80	261.57	263.12	264.67	265.44
266.21	267.76	269.31	270.08	270.85	272.40	273.95	274.72
275.48	277.04	278.59	279.36	280.12	281.67	283.23	283.99
284.76	286.31	287.87	288.63	289.40	290.95	292.50	293.27
294.04	295.59	297.14	297.91	298.68	300.23	301.78	302.55
303.32	304.84	304.95	305.63	307.37	308.04	309.23	310.45
311.14	312.86	313.62					

Height (feet)	3.15	3.15	3.15	3.14	3.11	3.00	2.98	2.95	2.89	2.83	
2.80	2.80	2.77	2.76	2.77	2.77	2.77	2.76	2.72	2.71	2.70	2.58
2.57	2.50	2.52	2.46	2.43	2.41	2.39	2.39	2.37	2.36	2.36	2.35
2.34	2.32	2.25	2.25	2.18	2.14	2.09	2.06	2.07	2.03	2.02	2.01
2.01	2.00	1.98	1.96	1.96	1.94	1.92	1.91	1.90	1.90	1.88	1.87
1.87	1.86	1.83	1.81	1.78	1.78	1.75	1.72	1.70	1.68	1.66	1.61
1.60	1.60	1.60	1.54	1.52	1.50	1.46	1.43	1.38	1.38	1.35	1.34
1.31	1.31	1.31	1.31	1.27	1.26	1.25	1.24	1.23	1.22	1.23	1.22
1.22	1.25	1.25	1.25	1.25	1.23	1.23	1.22	1.19	1.17	1.14	1.15
1.13	1.13	1.14	1.13	1.13	1.13	1.11	1.11	1.10	1.06	1.05	1.02
1.05	1.02	1.01	1.01	1.01	1.00	1.00	1.00	0.99	0.97	0.96	0.94
0.93	0.91	0.91	0.90	0.94	0.93	0.93	0.96	0.97	0.97	0.96	0.95
0.94	0.94	0.92	0.92	0.92	0.91	0.94	0.93	0.93	0.94	0.94	0.94
0.95	0.94	0.95	0.94	0.96	0.96	0.96	0.96	0.93	0.94	0.93	0.92
0.91	0.90	0.87	0.87	0.87	0.86	0.81	0.80	0.78	0.77	0.75	0.75
0.76	0.76	0.76	0.76	0.73	0.73	0.70	0.71	0.68	0.68	0.67	0.67
0.67	0.67	0.67	0.64	0.59	0.61	0.57	0.53	0.55	0.55	0.55	0.56
0.58	0.59	0.57	0.59	0.58	0.56	0.60	0.60	0.60	0.60	0.54	0.55
0.54	0.58	0.58	0.60	0.63	0.63	0.63	0.63	0.59	0.59	0.55	0.60
0.58	0.58	0.58	0.58	0.57	0.56	0.53	0.50	0.46	0.47	0.44	0.43
0.44	0.44	0.44	0.44	0.44	0.44	0.42	0.42	0.41	0.39	0.36	0.34
0.34	0.32	0.29	0.28	0.25	0.24	0.22	0.18	0.14	0.12	0.11	0.08
0.05	0.04	0.03	0.03	0.02	0.01	0.00	0.00	0.01	0.01	0.02	0.13
0.28	0.33	0.28	0.30	0.48	0.58	0.61	0.74	0.82	0.90	0.90	0.99
0.97	0.97	0.98	1.03	1.05	1.08	1.09	1.19	1.19	1.30	1.75	1.91
2.23	2.55	2.71	3.11	3.15							

Primary OutFlow Max=37.17 cfs @ 14.85 hrs HW=286.25' (Free Discharge)
└─**1=Prop 14ft Box Culvert** (Inlet Controls 37.17 cfs @ 7.97 fps)

Secondary OutFlow Max=175.07 cfs @ 14.85 hrs HW=286.25' (Free Discharge)
└─**2=Forbrush Mill Road** (Weir Controls 175.07 cfs @ 2.40 fps)

Pond 4P: Culvert 4



Hydrograph for Pond 4P: Culvert 4

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	281.50	0.00	0.00	0.00
5.50	0.00	0.000	281.50	0.00	0.00	0.00
6.00	0.00	0.000	281.50	0.00	0.00	0.00
6.50	0.00	0.000	281.50	0.00	0.00	0.00
7.00	0.00	0.000	281.50	0.00	0.00	0.00
7.50	0.00	0.000	281.50	0.00	0.00	0.00
8.00	0.02	0.000	281.50	0.00	0.00	0.00
8.50	0.08	0.002	281.51	0.00	0.00	0.00
9.00	0.26	0.009	281.54	0.00	0.00	0.00
9.50	0.63	0.026	281.61	0.00	0.00	0.00
10.00	1.25	0.060	281.75	0.58	0.58	0.00
10.50	2.30	0.079	281.83	1.91	1.91	0.00
11.00	4.03	0.097	281.90	3.54	3.54	0.00
11.50	7.00	0.121	282.01	6.32	6.32	0.00
12.00	11.91	0.165	282.19	10.15	10.15	0.00
12.50	25.10	0.325	282.86	17.72	17.72	0.00
13.00	59.43	0.949	285.47	39.25	33.71	5.54
13.50	115.93	**1.075**	286.00	114.66	36.09	78.57
14.00	173.86	**1.076**	286.16	172.90	36.81	136.09
14.50	**205.90**	1.076	**286.23**	**204.94**	**37.11**	**167.83**
15.00	**210.48**	1.076	**286.24**	**209.51**	**37.15**	**172.36**
15.50	195.32	1.076	286.21	194.36	37.01	157.35
16.00	168.37	1.076	286.15	167.41	36.75	130.66
16.50	144.34	1.076	286.08	143.38	36.47	106.90
17.00	125.18	1.076	286.03	124.22	36.23	87.99
17.50	109.82	1.072	285.98	110.05	36.02	74.03
18.00	97.40	1.060	285.93	97.66	35.82	61.84
18.50	87.34	1.051	285.89	87.60	35.64	51.96
19.00	79.12	1.041	285.85	79.33	35.46	43.87
19.50	72.32	1.032	285.82	72.57	35.30	37.27
20.00	66.84	1.024	285.78	67.03	35.14	31.90
20.50	62.33	1.016	285.75	62.53	34.99	27.53
21.00	58.51	1.008	285.72	58.68	34.85	23.84
21.50	55.29	1.002	285.69	55.46	34.73	20.74
22.00	52.47	0.994	285.66	52.64	34.59	18.06
22.50	49.98	0.988	285.63	50.14	34.47	15.67
23.00	47.78	0.982	285.61	47.94	34.34	13.60
23.50	45.89	0.976	285.58	46.03	34.23	11.81
24.00	44.21	0.970	285.56	44.33	34.12	10.21
24.50	42.64	0.964	285.53	42.81	34.01	8.80
25.00	40.51	0.956	285.50	40.77	33.85	6.92
25.50	36.86	0.939	285.43	37.43	33.52	3.91
26.00	31.15	0.898	285.26	32.89	32.70	0.19
26.50	24.45	0.750	284.64	29.56	29.56	0.00
27.00	17.98	0.515	283.65	23.76	23.76	0.00
27.50	12.59	0.302	282.76	16.84	16.84	0.00
28.00	8.68	0.174	282.23	10.67	10.67	0.00
28.50	6.01	0.124	282.02	6.60	6.60	0.00
29.00	4.17	0.106	281.94	4.52	4.52	0.00
29.50	2.94	0.093	281.89	3.22	3.22	0.00
30.00	2.02	0.083	281.85	2.23	2.23	0.00

Summary for Pond 5P: Sand Culvert

[93] Warning: Storage range exceeded by 23.96'
[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 25.37' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=59)

Inflow Area =	816.682 ac,	0.00% Impervious,	Inflow Depth >	1.60"	for 10-yr event
Inflow =	214.14 cfs @	14.85 hrs,	Volume=	109.053 af	
Outflow =	218.52 cfs @	14.80 hrs,	Volume=	108.971 af,	Atten= 0%, Lag= 0.0 min
Primary =	178.68 cfs @	14.80 hrs,	Volume=	94.787 af	
Secondary =	39.85 cfs @	14.80 hrs,	Volume=	14.183 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.96' @ 14.80 hrs Surf.Area= 0.000 ac Storage= 0.637 af
Flood Elev= 245.59' Surf.Area= 0.000 ac Storage= 0.461 af

Plug-Flow detention time= 4.7 min calculated for 108.971 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (1,080.1 - 1,075.9)

Volume	Invert	Avail.Storage	Storage Description
#1	241.90'	0.637 af	**Custom Stage Data** Listed below

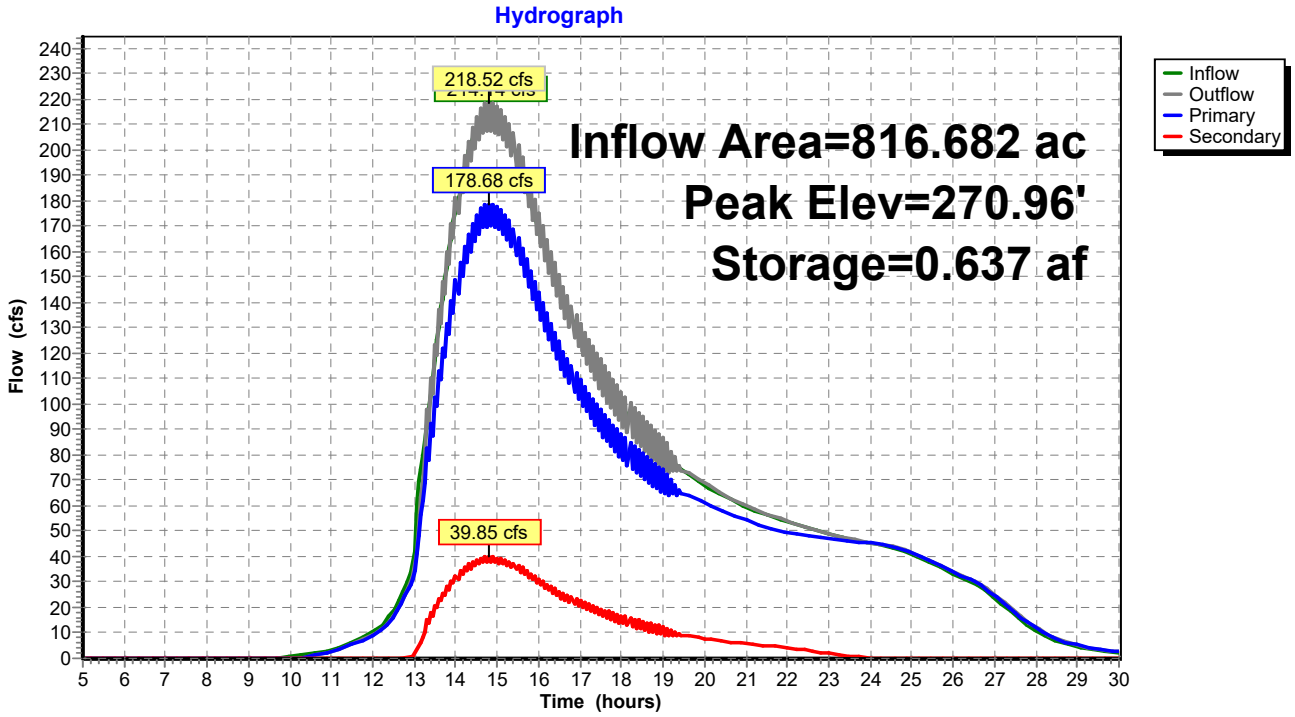
Elevation (feet)	Cum.Store (acre-feet)
241.90	0.000
247.00	0.637

Device	Routing	Invert	Outlet Devices
#1	Primary	241.90'	**36.0" Round 36" Concrete Culvert** L= 30.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.90' / 241.70' S= 0.0067 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Secondary	245.59'	**Sand Road, C= 3.27** Offset (feet) 0.00 0.42 1.87 3.41 3.66 5.17 6.41 7.31 8.47 9.41 10.97 11.76 12.41 14.63 15.06 15.41 18.29 18.36 18.41 18.92 Height (feet) 0.17 0.11 0.11 0.05 0.06 0.00 0.00 0.02 0.02 0.05 0.07 0.09 0.10 0.13 0.14 0.14 0.17 0.17 0.17 0.17

Primary OutFlow Max=178.65 cfs @ 14.80 hrs HW=270.95' (Free Discharge)
└─**1=36" Concrete Culvert** (Inlet Controls 178.65 cfs @ 25.27 fps)

Secondary OutFlow Max=39.84 cfs @ 14.80 hrs HW=270.95' (Free Discharge)
└─**2=Sand Road** (Weir Controls 39.84 cfs @ 21.53 fps)

Pond 5P: Sand Culvert



Hydrograph for Pond 5P: Sand Culvert

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	241.90	0.00	0.00	0.00
5.50	0.00	0.000	241.90	0.00	0.00	0.00
6.00	0.00	0.000	241.90	0.00	0.00	0.00
6.50	0.00	0.000	241.90	0.00	0.00	0.00
7.00	0.00	0.000	241.90	0.00	0.00	0.00
7.50	0.00	0.000	241.90	0.00	0.00	0.00
8.00	0.00	0.000	241.90	0.00	0.00	0.00
8.50	0.00	0.000	241.90	0.00	0.00	0.00
9.00	0.00	0.000	241.90	0.00	0.00	0.00
9.50	0.00	0.000	241.90	0.00	0.00	0.00
10.00	0.58	0.004	241.93	0.05	0.05	0.00
10.50	1.91	0.044	242.25	0.82	0.82	0.00
11.00	3.54	0.084	242.57	2.68	2.68	0.00
11.50	6.32	0.123	242.89	5.32	5.32	0.00
12.00	10.15	0.166	243.23	9.05	9.05	0.00
12.50	18.87	0.234	243.77	16.38	16.38	0.00
13.00	41.97	**0.371**	244.87	34.24	34.24	0.00
13.50	117.02	**0.637**	252.50	123.36	102.69	20.68
14.00	174.88	0.637	262.50	181.22	148.73	32.49
14.50	**206.67**	0.637	**269.61**	**213.02**	**174.25**	**38.77**
15.00	**211.08**	0.637	**270.69**	**217.43**	**177.79**	**39.63**
15.50	195.81	0.637	267.05	202.15	165.52	36.63
16.00	168.76	0.637	261.26	175.11	143.83	31.27
16.50	144.66	0.637	256.80	151.00	124.59	26.41
17.00	125.44	0.637	253.72	131.79	109.34	22.45
17.50	111.23	0.637	251.71	117.57	98.13	19.44
18.00	98.79	0.637	250.15	105.13	88.41	16.72
18.50	88.69	0.637	249.01	95.03	80.61	14.42
19.00	80.39	0.637	248.16	86.73	74.29	12.44
19.50	73.59	0.637	247.02	73.81	64.72	9.09
20.00	68.03	0.597	246.68	69.02	61.20	7.82
20.50	63.50	0.565	246.43	64.11	57.37	6.74
21.00	59.63	0.543	246.25	60.12	54.29	5.83
21.50	56.39	0.525	246.10	56.74	51.75	4.99
22.00	53.55	0.511	245.99	53.88	49.63	4.25
22.50	51.02	0.497	245.88	51.38	48.27	3.11
23.00	48.81	0.483	245.77	49.12	47.10	2.02
23.50	46.89	0.472	245.68	47.14	46.12	1.02
24.00	45.17	0.462	245.60	45.40	45.26	0.14
24.50	43.47	0.450	245.50	43.89	43.89	0.00
25.00	40.96	0.429	245.33	41.53	41.53	0.00
25.50	37.48	0.402	245.12	38.26	38.26	0.00
26.00	32.90	0.367	244.84	33.67	33.67	0.00
26.50	29.57	0.342	244.64	30.32	30.32	0.00
27.00	23.76	0.302	244.32	24.92	24.92	0.00
27.50	16.84	0.249	243.89	18.20	18.20	0.00
28.00	10.67	0.194	243.46	11.92	11.92	0.00
28.50	6.60	0.150	243.10	7.52	7.52	0.00
29.00	4.52	0.120	242.86	5.11	5.11	0.00
29.50	3.22	0.100	242.70	3.65	3.65	0.00
30.00	2.23	0.083	242.56	2.61	2.61	0.00

Summary for Pond 6P: 110 Culvert

Inflow Area = 915.598 ac, 0.00% Impervious, Inflow Depth > 1.47" for 10-yr event
Inflow = 223.07 cfs @ 14.80 hrs, Volume= 112.193 af
Outflow = 216.27 cfs @ 15.02 hrs, Volume= 111.784 af, Atten= 3%, Lag= 13.4 min
Primary = 216.27 cfs @ 15.02 hrs, Volume= 111.784 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 237.34' @ 15.02 hrs Surf.Area= 0.000 ac Storage= 4.721 af
Flood Elev= 238.05' Surf.Area= 0.000 ac Storage= 5.491 af

Plug-Flow detention time= 21.2 min calculated for 111.784 af (100% of inflow)
Center-of-Mass det. time= 18.8 min (1,100.0 - 1,081.2)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	5.491 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
233.00	0.000
238.05	5.491

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**120.0" W x 48.0" H Box 10' Wide Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 233.00' / 233.00' S= 0.0000 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf
#2	Secondary	238.05'	**Route 110, C= 3.27** Offset (feet) 0.00 0.77 3.09 3.35 3.53 4.31 6.28 6.71 7.38 9.04 10.07 11.67 11.80 13.43 14.55 15.96 16.78 17.31 19.74 20.07 20.14 20.25 22.82 23.50 24.54 25.58 26.85 28.34 28.83 30.21 31.09 33.12 33.57 33.85 35.16 36.61 36.92 37.41 39.36 40.28 41.70 42.12 43.64 44.88 45.99 46.99 47.64 50.28 50.35 50.39 50.59 53.15 53.71 54.57 55.91 57.06 58.66 58.86 60.42 61.42 63.15 63.78 64.18 66.01 66.93 67.13 67.44 69.69 70.49 71.74 72.45 73.85 75.20 76.03 77.20 77.96 80.32 80.56 80.72 81.44 83.47 83.92 84.61 86.23 87.27 88.90 88.99 90.63 91.74 93.19 93.99 94.50 96.87 97.26 97.34 97.48 100.02 100.70 101.77 102.77 104.06 105.53 106.06 107.41 108.29 110.35 110.77 111.04 112.29 113.80 114.13 114.64 116.56 117.48 118.93 119.31 120.84 122.07 123.22 124.20 124.83 127.51 127.55 127.58 127.72 130.34 130.91 131.80 133.10 134.27 135.85 136.09 137.63 138.61 140.38 140.98 141.37 143.14 144.13 144.34 144.67 146.88 147.70 148.96 149.64 151.05 152.40 153.25 154.41 155.15 157.54 157.77 157.91 158.57 160.67 161.12 161.83 163.42 164.48 166.12 166.18 167.84 168.94 170.41 171.19 171.69 174.00 174.45 174.55 174.70 177.21 177.91 178.99 179.96 181.26 182.72 183.28 184.62 185.48 187.57 187.98 188.23 189.42 190.99 191.33 191.87 193.75 194.69 196.16 196.51 198.05 199.26 200.45 201.40 202.02

204.74	204.76	204.78	204.85	207.53	208.12	209.03	210.29
211.47	213.05	213.32	214.83	215.80	217.61	218.19	218.56
220.27	221.32	221.54	221.90	224.07	224.90	226.19	226.83
228.26	229.59	230.48	231.61	232.34	234.77	234.97	235.10
235.70	237.86	238.33	239.06	240.62	241.68	243.35	243.37
245.04	246.13	247.64	248.40	248.89	251.13	251.64	251.76
251.93	254.40	255.11	256.22	257.16	258.47	259.91	260.51
261.83	262.67	264.80	265.18	265.43	266.55	268.18	268.54
269.09	270.94	271.90	273.38	273.70	275.25	276.45	277.67
278.61	279.21	281.96	281.97	281.98	284.72	285.32	286.25
287.48	288.68	290.24	290.54	292.04	293.00	294.83	295.39
295.75	297.40	298.51	298.75	299.12	301.27	302.11	303.41
304.02	305.46	306.78	307.70	308.82	309.54	312.00	312.18
312.29	312.83	315.05	315.53	316.29	317.81	318.89	320.56
320.58	322.25	323.32	324.87	325.60	326.08	328.26	328.83
328.96	329.16	331.59	332.32	333.45	334.35	335.67	337.11
337.74	339.03	339.86	342.03	342.39	342.62	343.68	345.38
345.74	346.32	348.13	349.10	350.61	350.89	352.46	353.65
354.90	355.81	356.40	359.11	359.16	359.17	359.19	361.92
362.53	363.48	364.67	365.88	367.43	367.77	369.24	370.19
372.06	372.60	372.94	374.53	375.70	375.96	376.35	378.46
379.31	380.64	381.21	382.67	383.97	384.93	386.03	386.73
389.22	389.38	389.49	389.96	392.24	392.74	393.51	395.00
396.10	397.76	397.80	399.45	400.51	402.09	402.81	403.27
405.39	406.03	406.17	406.38	408.78	409.52	410.67	411.54
412.88	414.30	414.96	416.24	417.05	419.25	419.59	419.81
420.81	422.57	422.95	423.54	425.32	426.31	427.83	428.08
429.66	430.84						

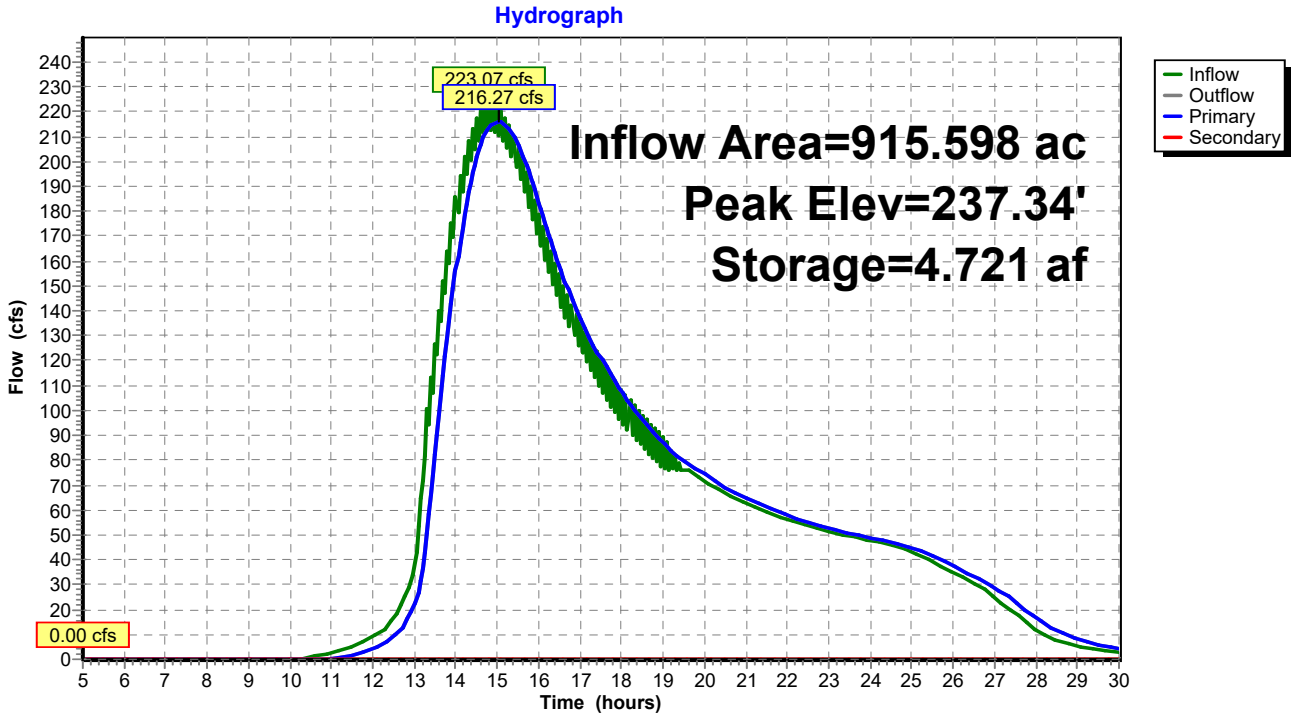
Height (feet)	0.77	0.76	0.75	0.75	0.75	0.74	0.72	0.71	0.71	0.69
0.69	0.70	0.69	0.70	0.70	0.71	0.71	0.71	0.70	0.69	0.69	0.69
0.67	0.67	0.68	0.65	0.66	0.63	0.66	0.64	0.63	0.61	0.60	0.60
0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.59	0.57	0.55	0.56	0.55
0.55	0.53	0.53	0.53	0.53	0.48	0.48	0.48	0.49	0.50	0.51	0.51
0.51	0.50	0.50	0.49	0.49	0.47	0.46	0.46	0.46	0.46	0.45	0.46
0.47	0.48	0.48	0.51	0.52	0.52	0.55	0.55	0.55	0.57	0.62	0.64
0.65	0.69	0.70	0.69	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.64
0.64	0.64	0.65	0.65	0.66	0.69	0.70	0.72	0.68	0.69	0.68	0.73
0.72	0.72	0.70	0.68	0.67	0.66	0.58	0.56	0.51	0.50	0.46	0.46
0.46	0.46	0.46	0.44	0.44	0.44	0.44	0.44	0.42	0.40	0.37	0.35
0.33	0.32	0.31	0.32	0.30	0.30	0.30	0.28	0.27	0.27	0.27	0.25
0.25	0.25	0.24	0.25	0.25	0.28	0.28	0.28	0.30	0.30	0.30	0.29
0.26	0.25	0.24	0.24	0.22	0.21	0.21	0.20	0.17	0.09	0.07	0.06
0.01	0.00	0.00	0.00	0.01	0.02	0.09	0.06	0.15	0.20	0.18	0.22
0.23	0.27	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.24	0.24	0.23
0.22	0.22	0.22	0.21	0.22	0.25	0.25	0.25	0.25	0.30	0.31	0.31
0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.28
0.28	0.28	0.28	0.27	0.29	0.27	0.27	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.26	0.26	0.27	0.27	0.29	0.33	0.31	0.35	0.35	0.34
0.34	0.34	0.33	0.33	0.33	0.33	0.31	0.31	0.32	0.30	0.31	0.30
0.32	0.31	0.32	0.29	0.29	0.29	0.29	0.28	0.27	0.28	0.28	0.28
0.27	0.27	0.27	0.26	0.25	0.24	0.24	0.20	0.20	0.20	0.21	0.22
0.24	0.27	0.30	0.30	0.32	0.32	0.32	0.37	0.37	0.37	0.38	0.38

0.38	0.38	0.31	0.32	0.34	0.34	0.36	0.40	0.40	0.43	0.42	0.36
0.36	0.36	0.35	0.32	0.31	0.31	0.31	0.31	0.30	0.31	0.31	0.31
0.33	0.34	0.34	0.37	0.38	0.38	0.38	0.40	0.40	0.40	0.41	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40
0.40	0.38	0.39	0.38	0.39	0.40	0.41	0.41	0.44	0.44	0.44	0.44
0.46	0.46	0.46	0.45	0.45	0.46	0.45	0.46	0.48	0.49	0.50	0.50
0.51	0.52	0.52	0.52	0.52	0.51	0.52	0.53	0.53	0.55	0.56	0.58
0.57	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.61
0.62	0.62	0.63	0.63	0.63	0.67	0.68	0.68	0.68	0.69	0.69	0.68
0.65	0.64	0.65	0.66	0.66	0.67	0.67	0.68	0.68	0.68	0.69	0.69
0.70	0.74	0.76	0.76	0.77	0.77	0.77					

Primary OutFlow Max=216.24 cfs @ 15.02 hrs HW=237.34' (Free Discharge)
└─**1=10' Wide Box Culvert** (Barrel Controls 216.24 cfs @ 6.64 fps)

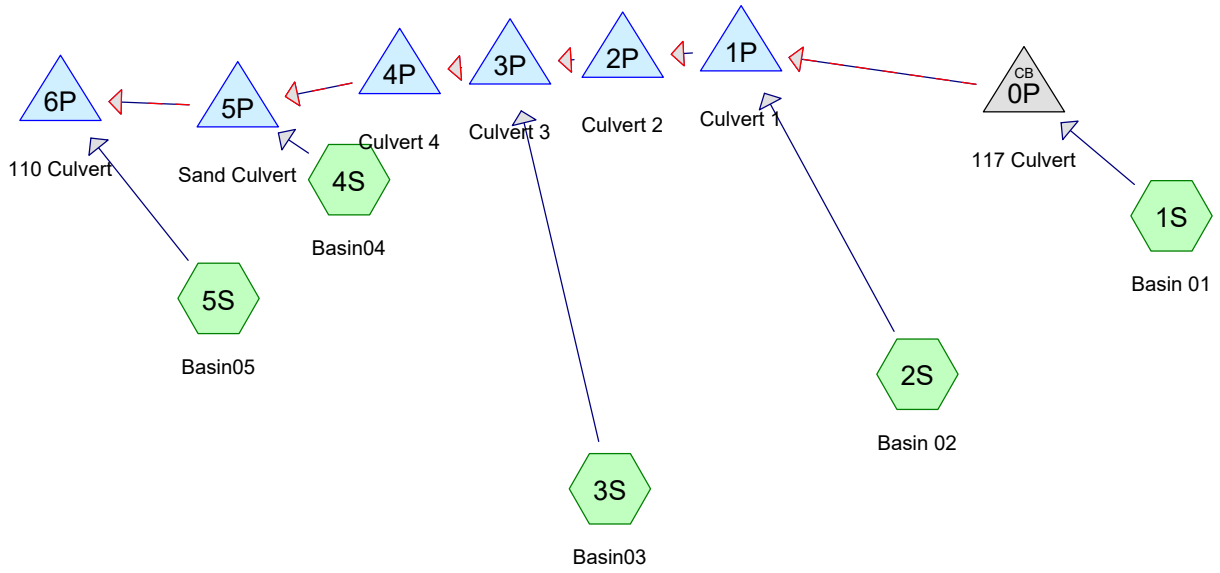
Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=233.00' (Free Discharge)
└─**2=Route 110** (Controls 0.00 cfs)

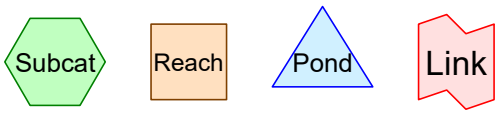
Pond 6P: 110 Culvert



Hydrograph for Pond 6P: 110 Culvert

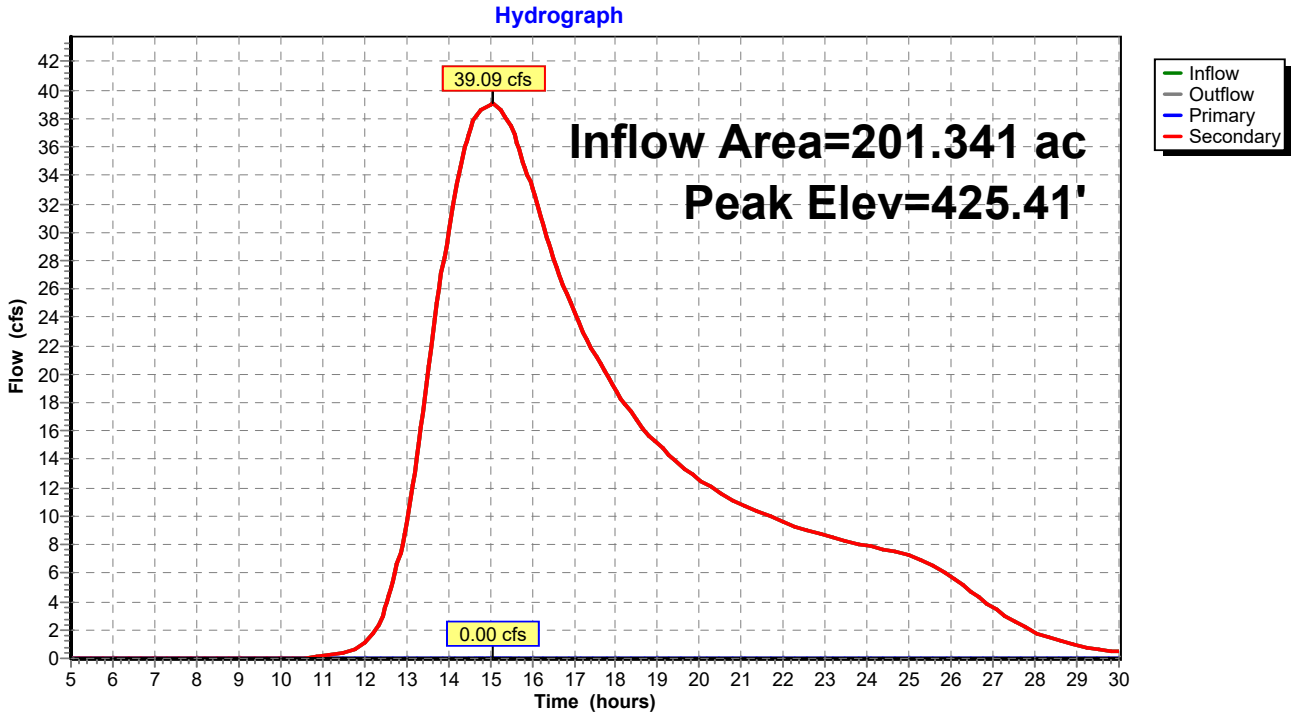
Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	233.00	0.00	0.00	**0.00**
5.50	0.00	0.000	233.00	0.00	0.00	0.00
6.00	0.00	0.000	233.00	0.00	0.00	0.00
6.50	0.00	0.000	233.00	0.00	0.00	0.00
7.00	0.00	0.000	233.00	0.00	0.00	0.00
7.50	0.00	0.000	233.00	0.00	0.00	0.00
8.00	0.00	0.000	233.00	0.00	0.00	0.00
8.50	0.00	0.000	233.00	0.00	0.00	0.00
9.00	0.00	0.000	233.00	0.00	0.00	0.00
9.50	0.00	0.000	233.00	0.00	0.00	0.00
10.00	0.05	0.000	233.00	0.00	0.00	0.00
10.50	0.82	0.012	233.01	0.02	0.02	0.00
11.00	2.68	0.079	233.07	0.20	0.20	0.00
11.50	5.32	0.215	233.20	1.30	1.30	0.00
12.00	9.05	0.403	233.37	4.11	4.11	0.00
12.50	16.55	0.641	233.59	9.19	9.19	0.00
13.00	35.55	1.070	233.98	21.43	21.43	0.00
13.50	126.53	2.509	235.31	82.12	82.12	0.00
14.00	185.60	3.809	236.50	155.90	155.90	0.00
14.50	**217.65**	4.513	237.15	201.89	201.89	0.00
15.00	**221.88**	**4.721**	**237.34**	**216.25**	**216.25**	0.00
15.50	206.36	4.591	237.22	207.27	207.27	0.00
16.00	179.05	4.236	236.90	183.30	183.30	0.00
16.50	154.71	3.849	236.54	158.39	158.39	0.00
17.00	135.29	3.507	236.23	137.38	137.38	0.00
17.50	120.89	3.225	235.97	120.82	120.82	0.00
18.00	108.30	2.985	235.75	107.31	107.31	0.00
18.50	98.07	2.780	235.56	96.19	96.19	0.00
19.00	89.65	2.607	235.40	87.13	87.13	0.00
19.50	76.63	2.460	235.26	79.64	79.64	0.00
20.00	71.75	2.355	235.17	74.45	74.45	0.00
20.50	66.77	2.247	235.07	69.20	69.20	0.00
21.00	62.70	2.153	234.98	64.79	64.79	0.00
21.50	59.26	2.073	234.91	61.05	61.05	0.00
22.00	56.34	2.003	234.84	57.91	57.91	0.00
22.50	53.78	1.943	234.79	55.19	55.19	0.00
23.00	51.47	1.887	234.74	52.75	52.75	0.00
23.50	49.45	1.837	234.69	50.59	50.59	0.00
24.00	47.66	1.793	234.65	48.69	48.69	0.00
24.50	46.08	1.754	234.61	47.06	47.06	0.00
25.00	43.42	1.704	234.57	44.95	44.95	0.00
25.50	39.57	1.627	234.50	41.82	41.82	0.00
26.00	34.42	1.517	234.39	37.42	37.42	0.00
26.50	30.72	1.407	234.29	33.24	33.24	0.00
27.00	25.14	1.284	234.18	28.71	28.71	0.00
27.50	18.31	1.114	234.02	22.87	22.87	0.00
28.00	11.98	0.918	233.84	16.71	16.71	0.00
28.50	7.56	0.735	233.68	11.58	11.58	0.00
29.00	5.12	0.592	233.54	8.03	8.03	0.00
29.50	3.66	0.489	233.45	5.78	5.78	0.00
30.00	2.61	0.412	233.38	4.28	4.28	0.00



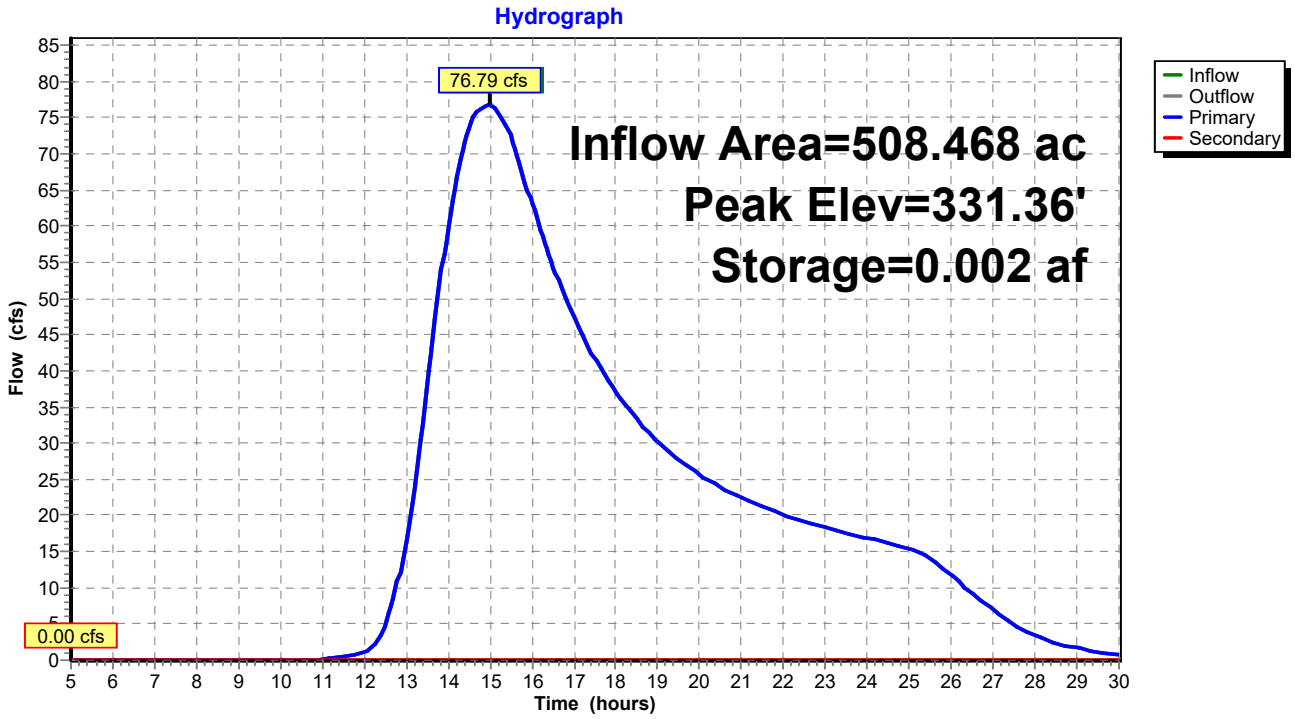


Routing Diagram for forbush_prop_alt1_hydraulic
Prepared by Tighe & Bond, Printed 11/29/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

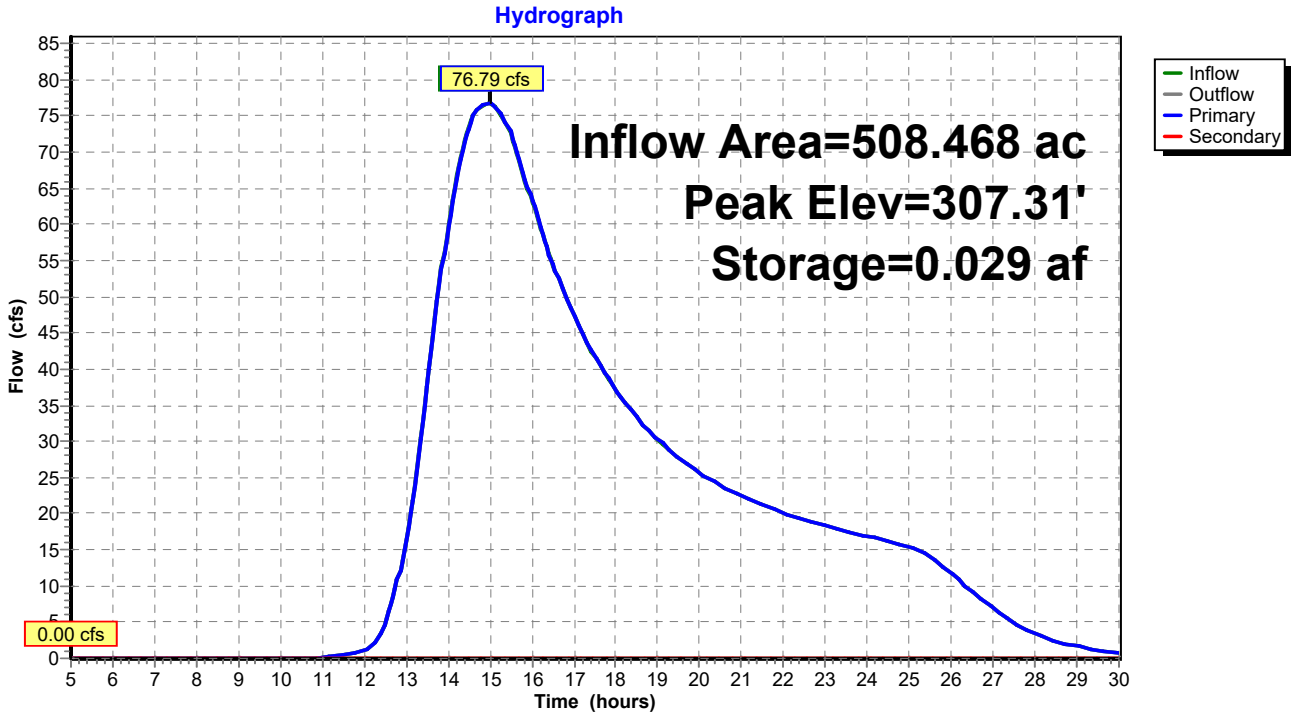
Pond 0P: 117 Culvert



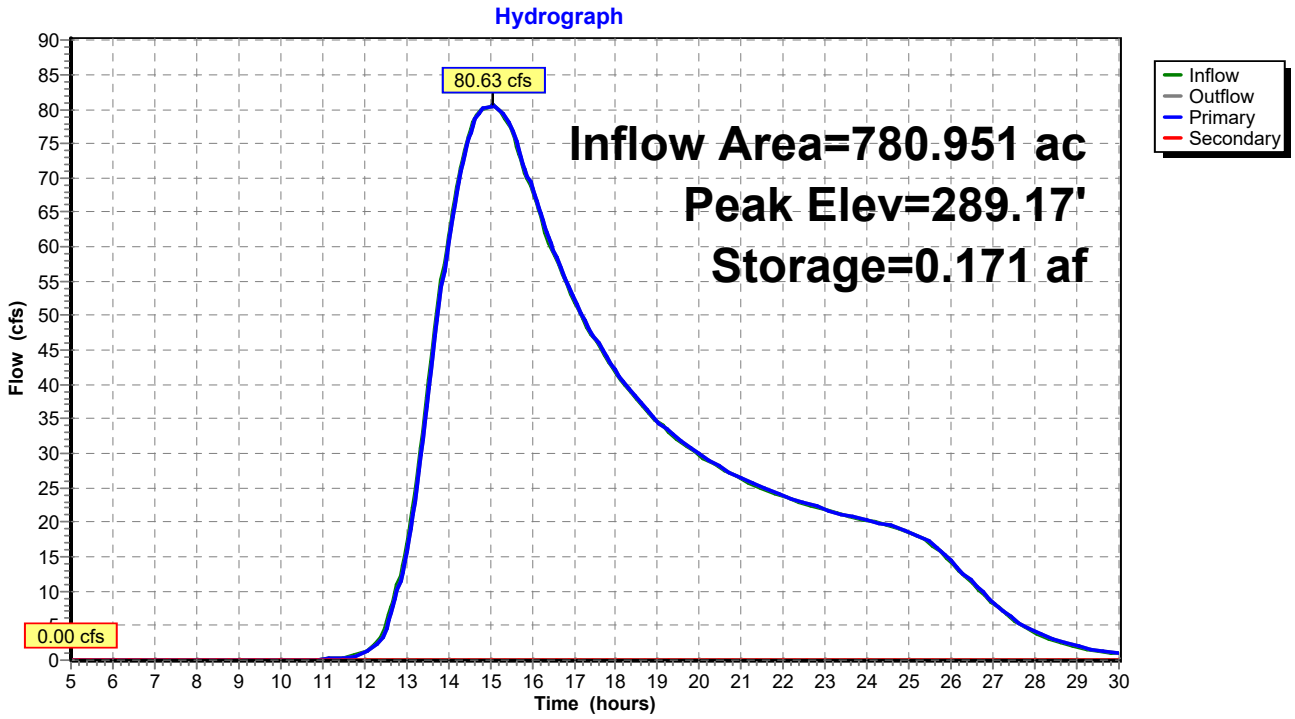
Pond 1P: Culvert 1



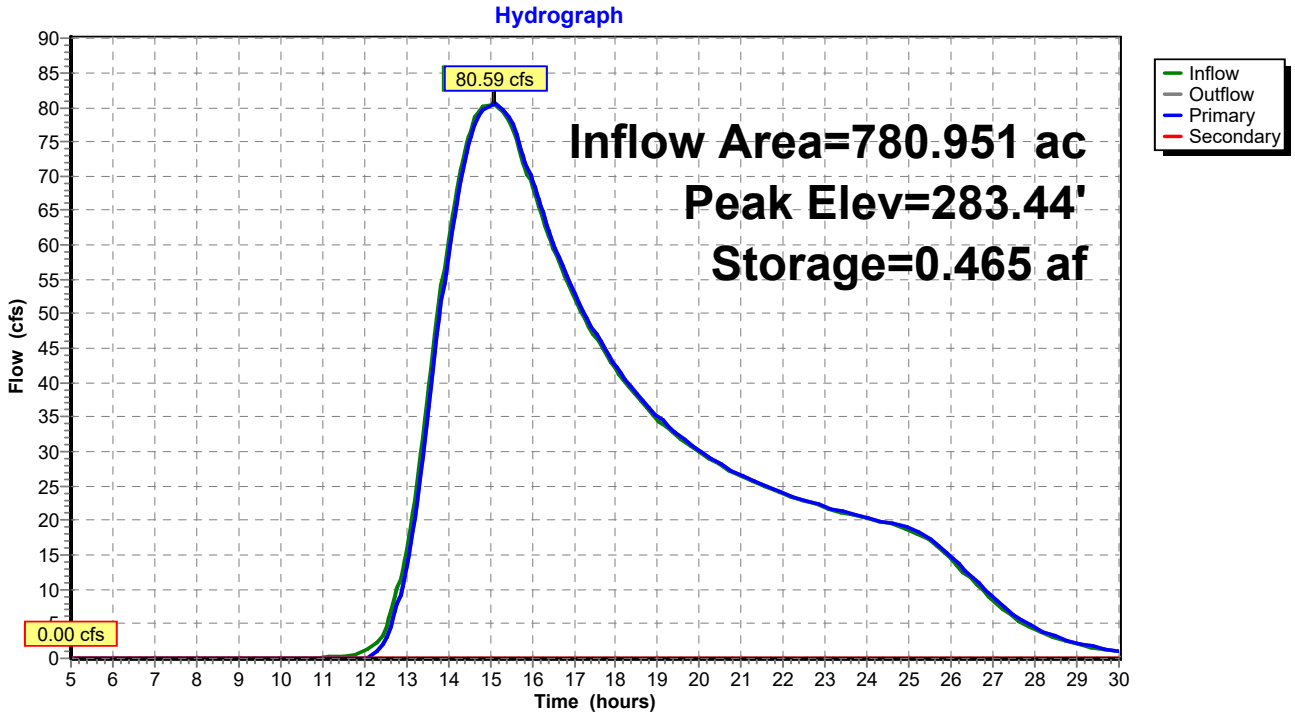
Pond 2P: Culvert 2



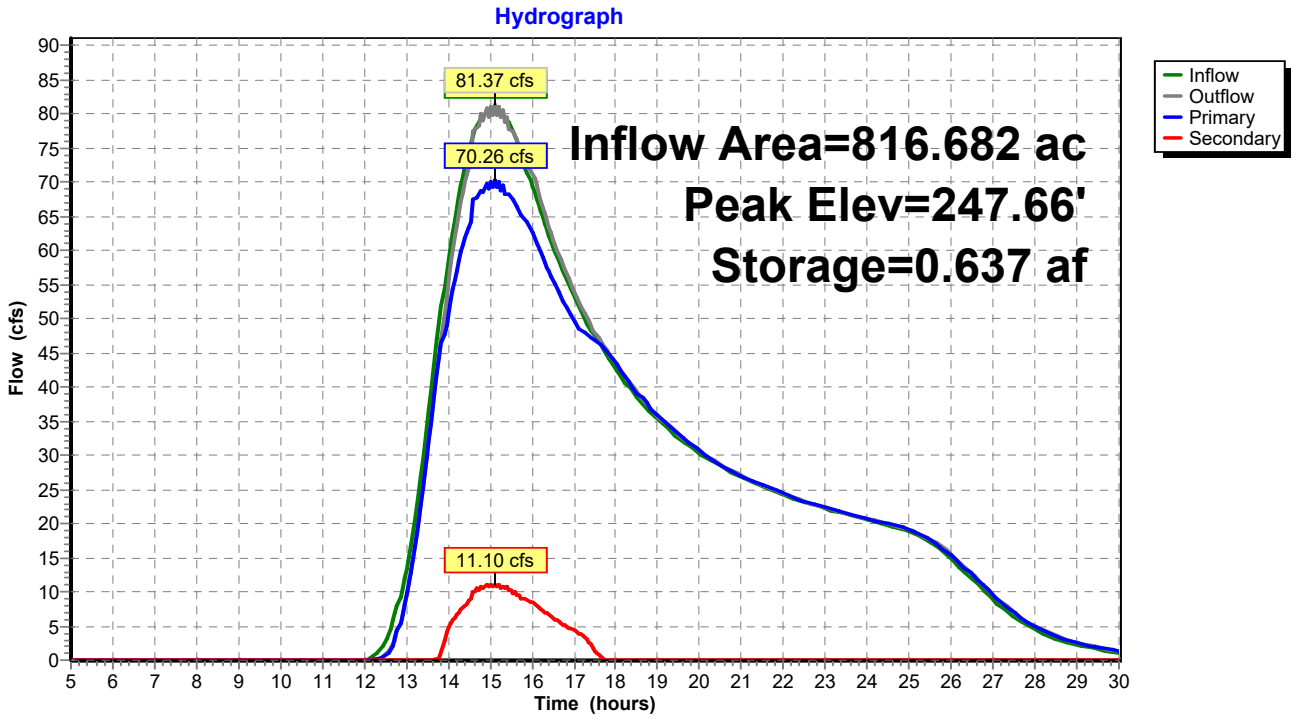
Pond 3P: Culvert 3



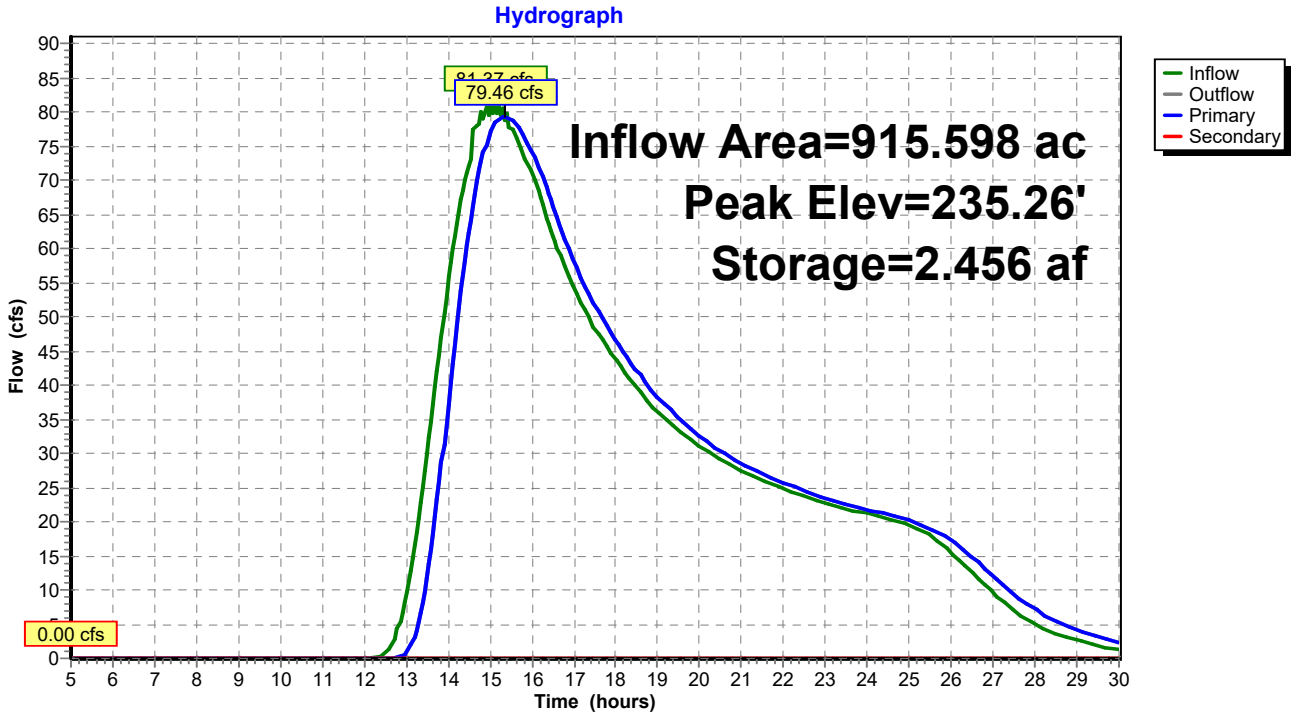
Pond 4P: Culvert 4



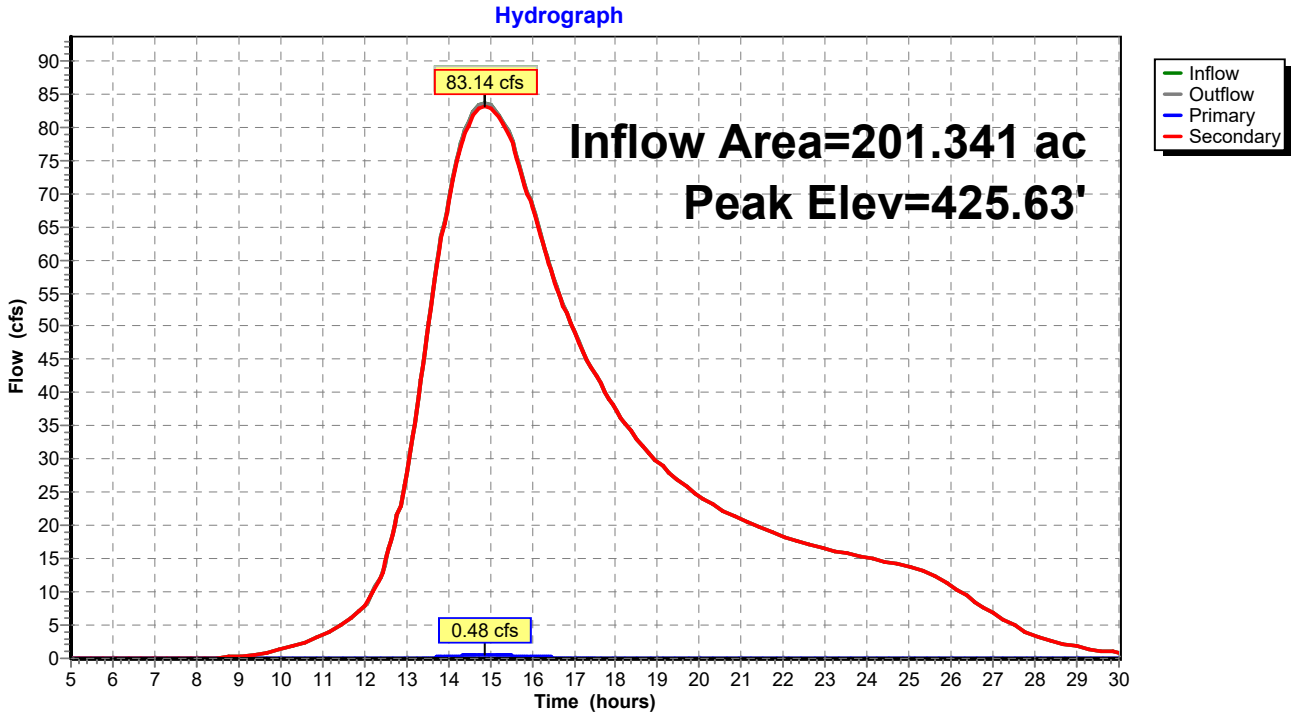
Pond 5P: Sand Culvert



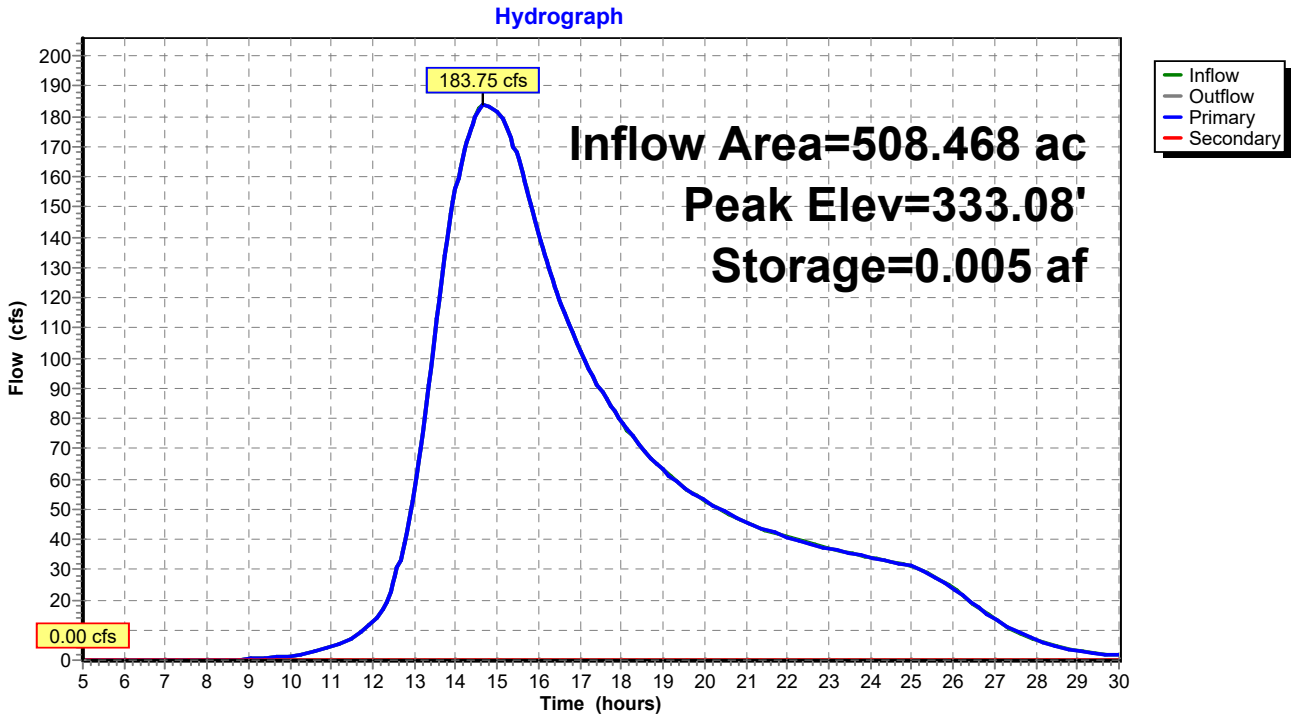
Pond 6P: 110 Culvert



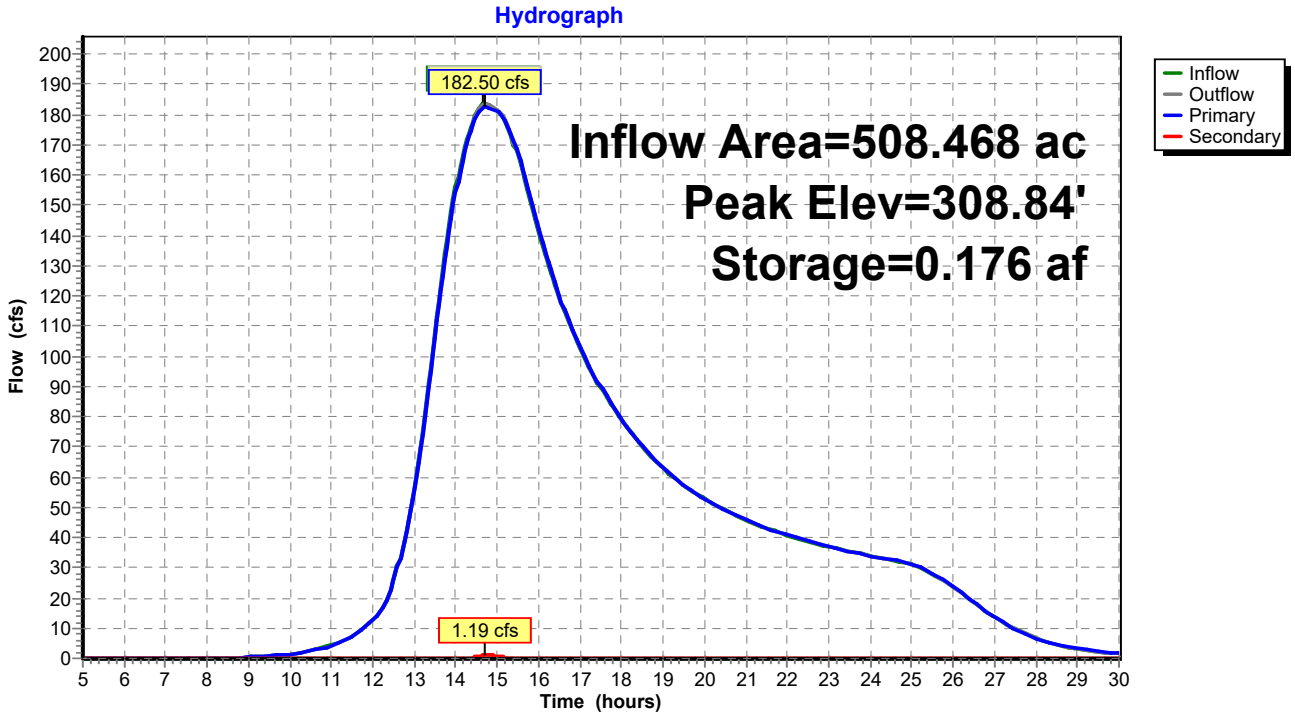
Pond 0P: 117 Culvert



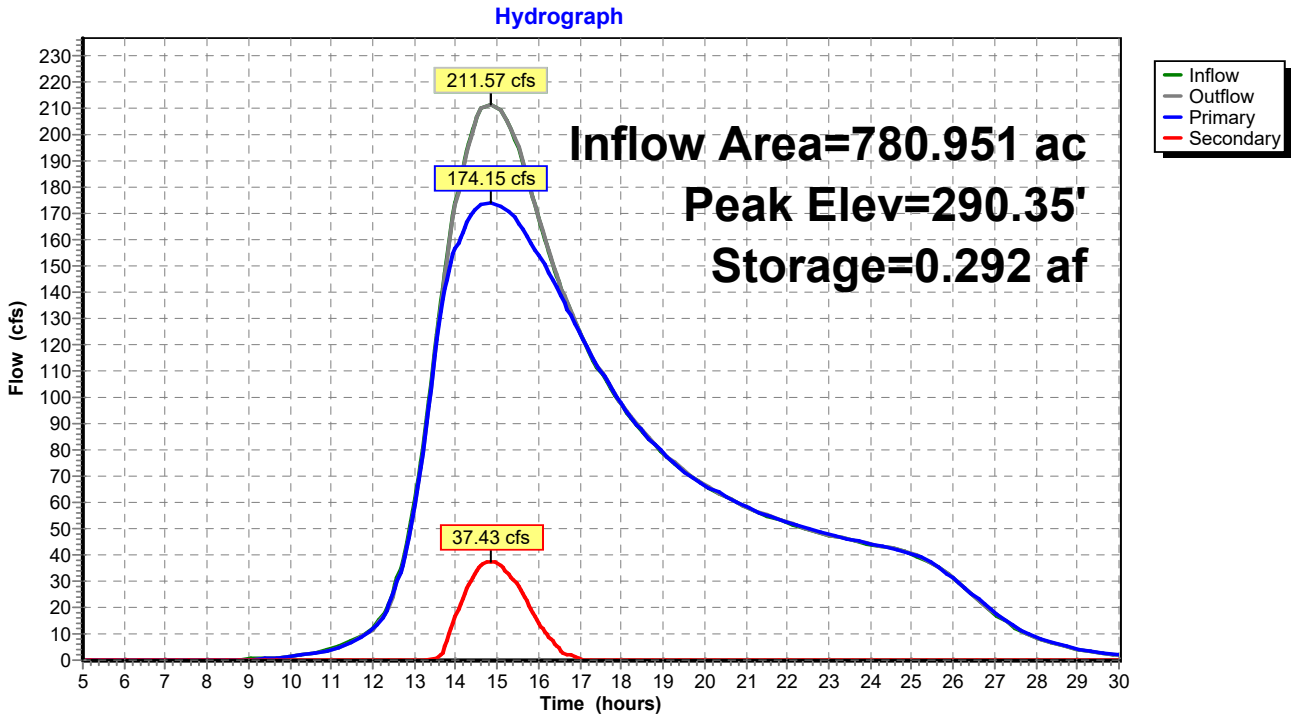
Pond 1P: Culvert 1



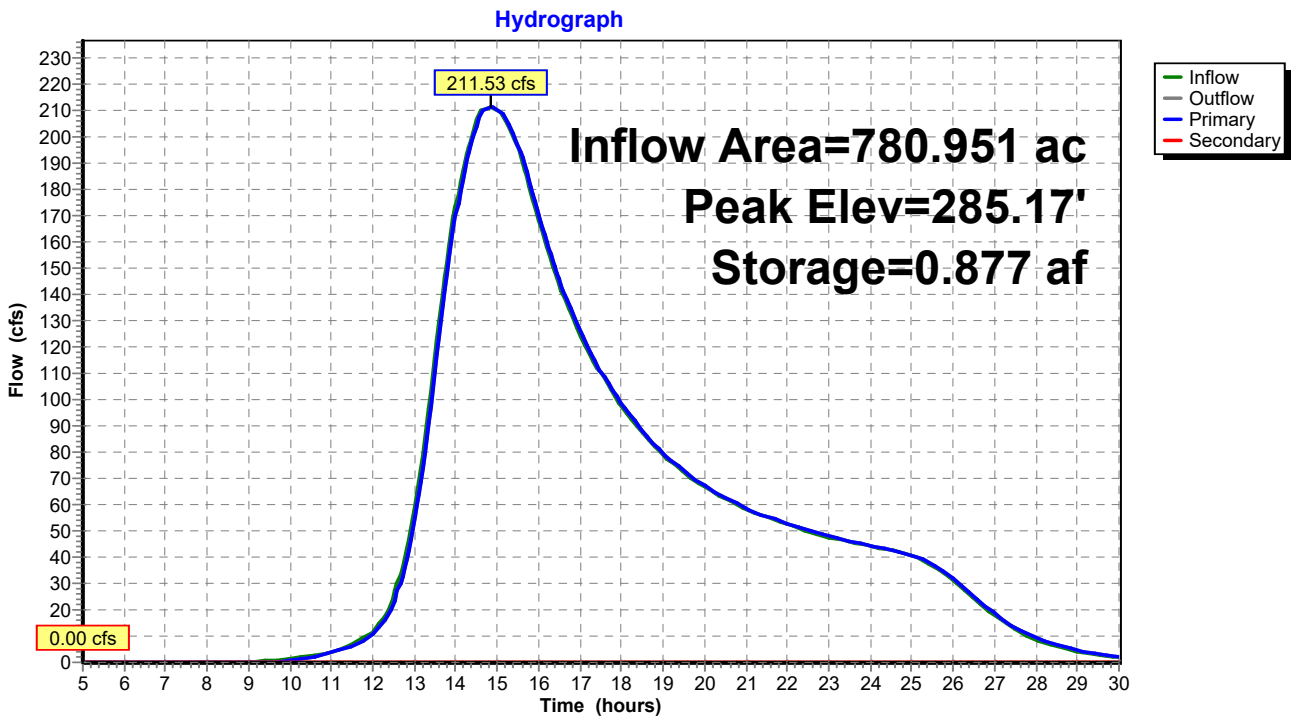
Pond 2P: Culvert 2



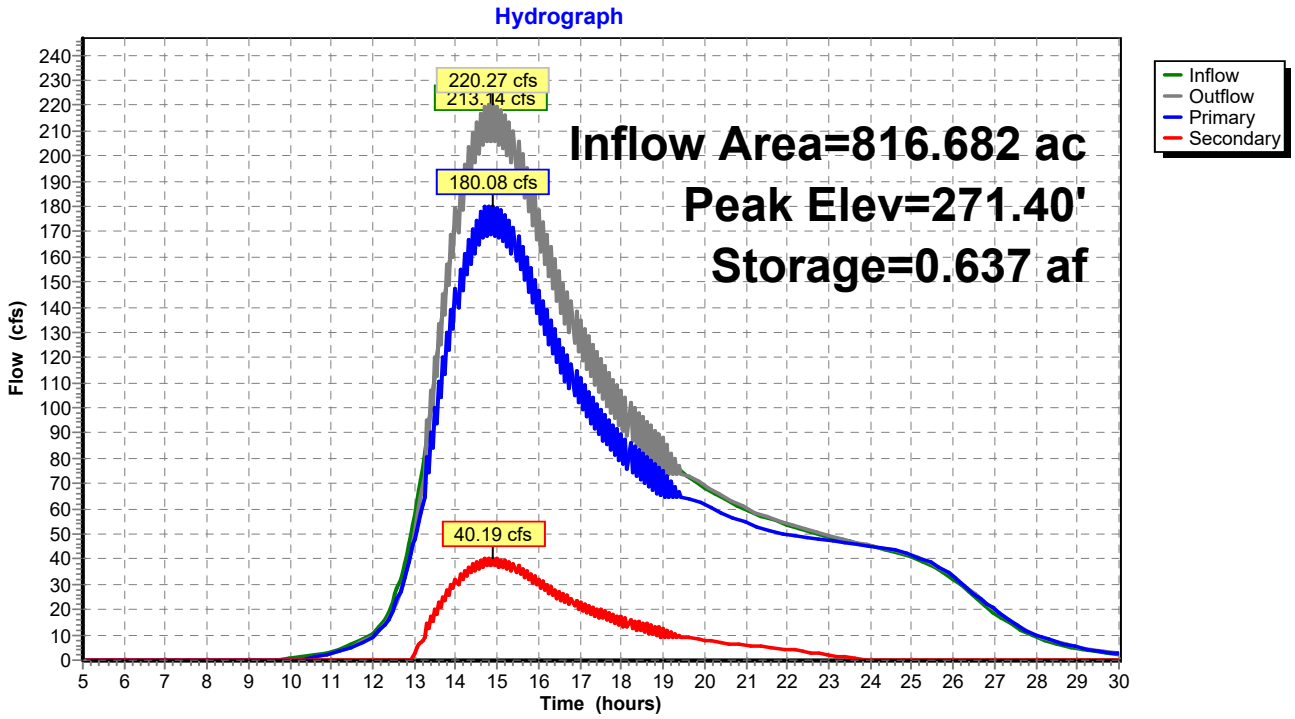
Pond 3P: Culvert 3



Pond 4P: Culvert 4



Pond 5P: Sand Culvert



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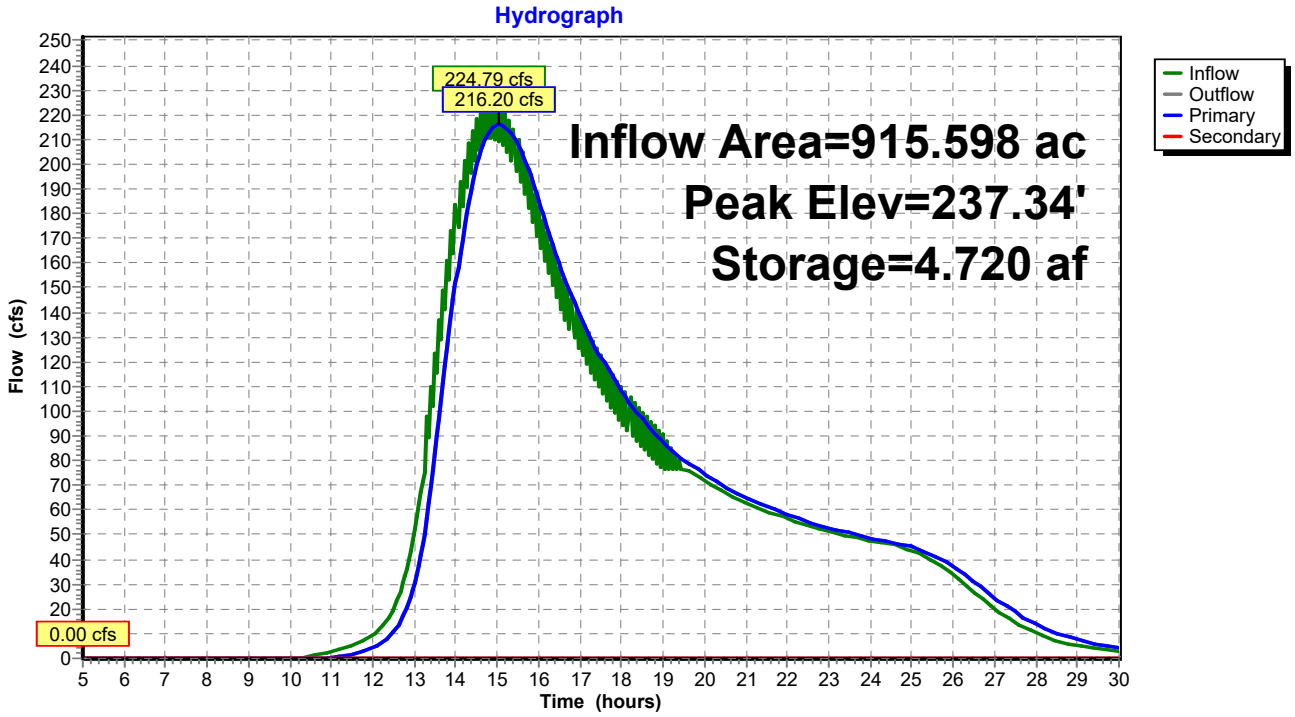
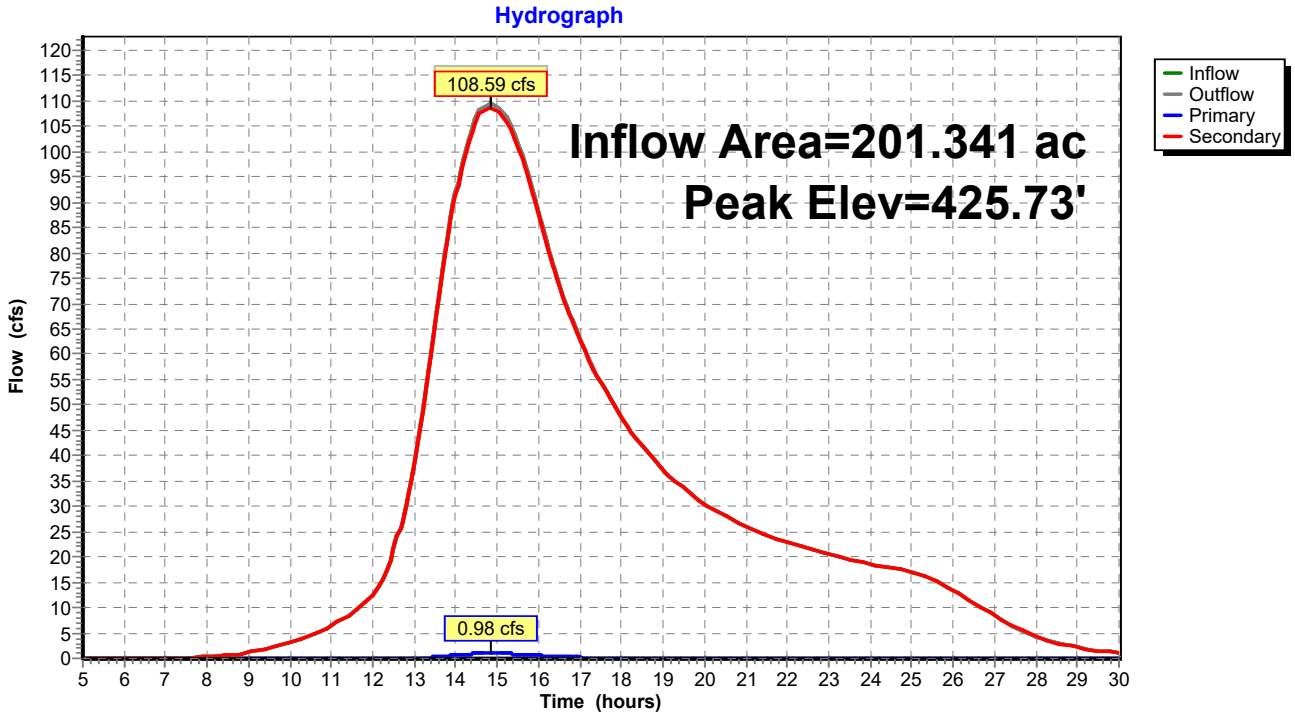
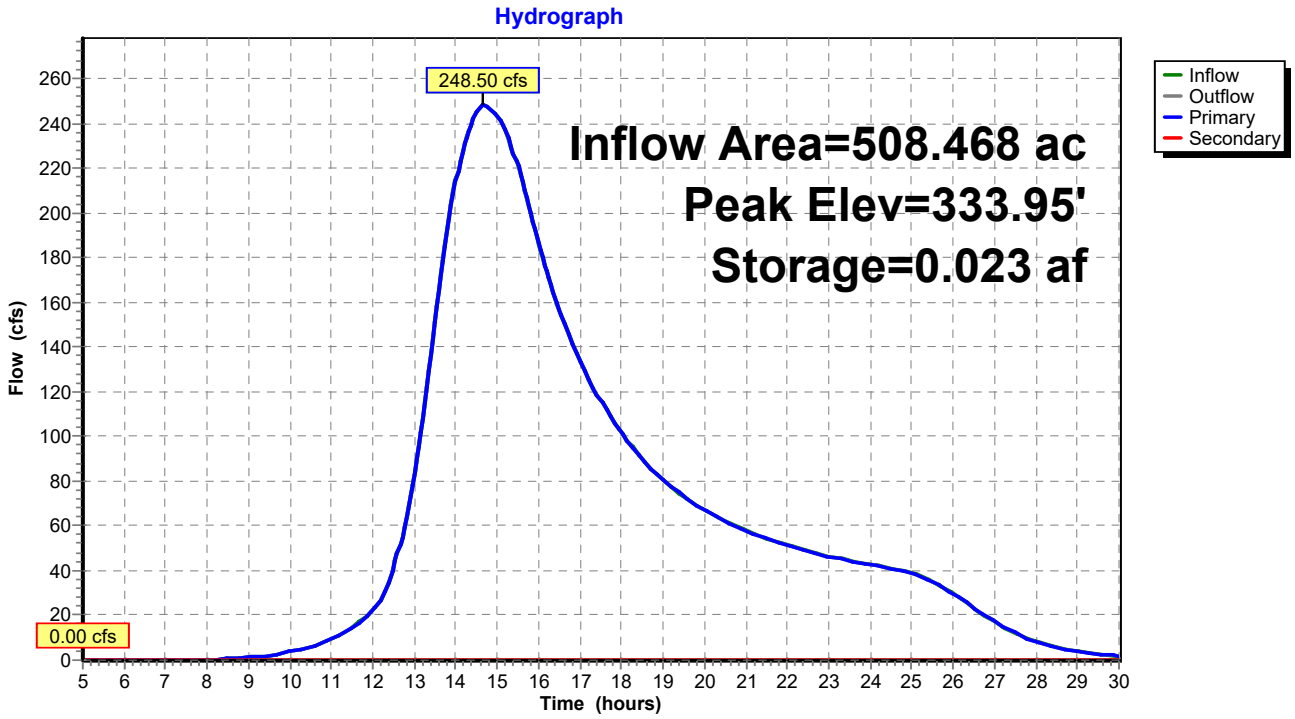


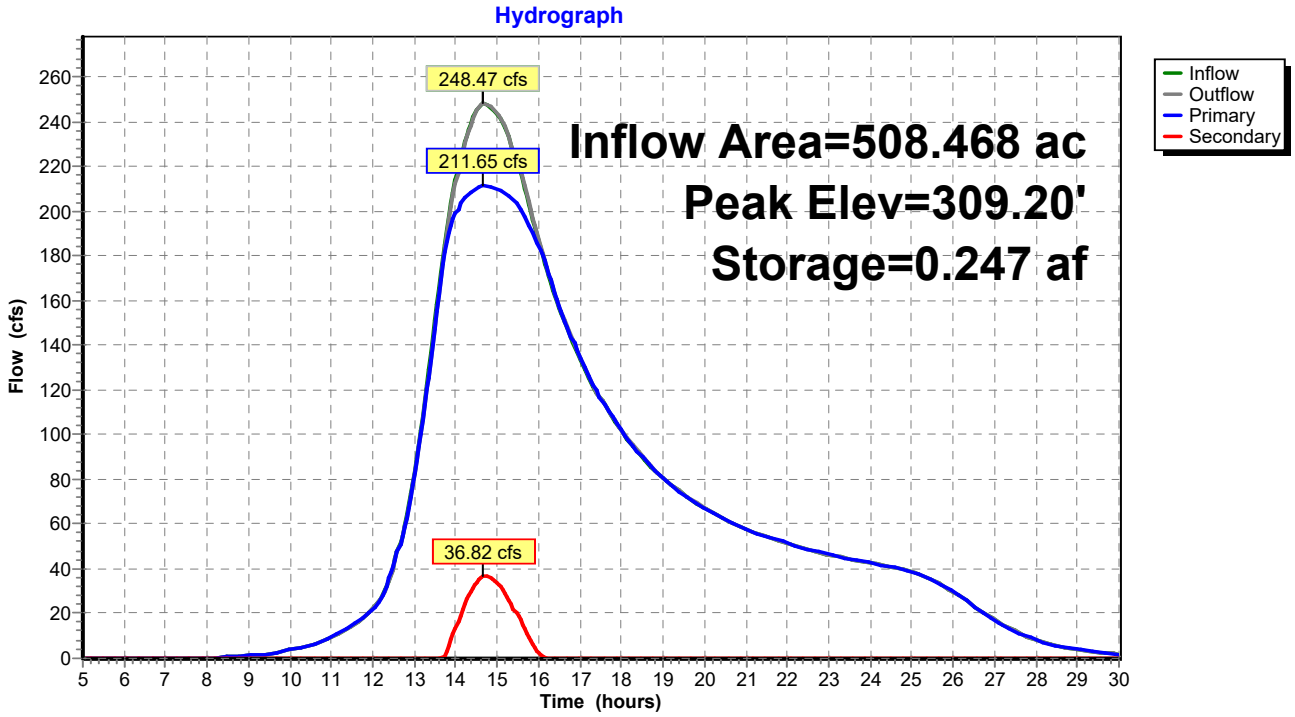
Pond 0P: 117 Culvert



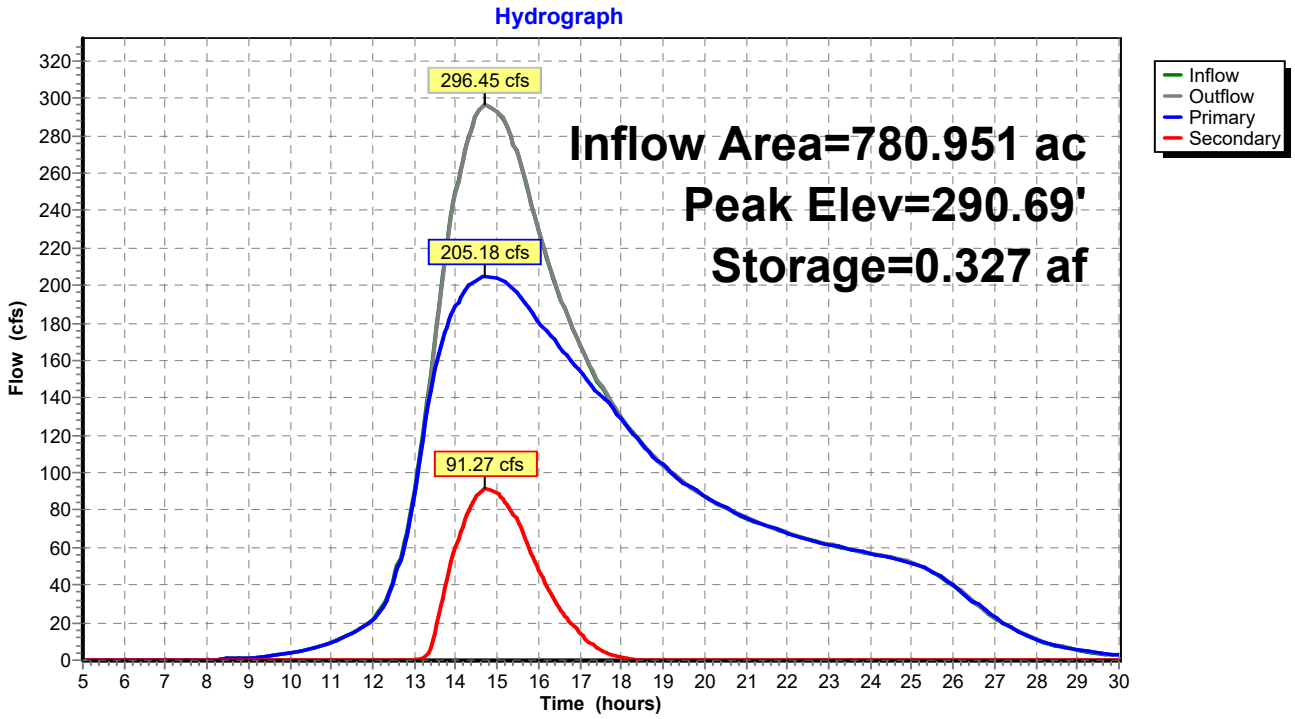
Pond 1P: Culvert 1



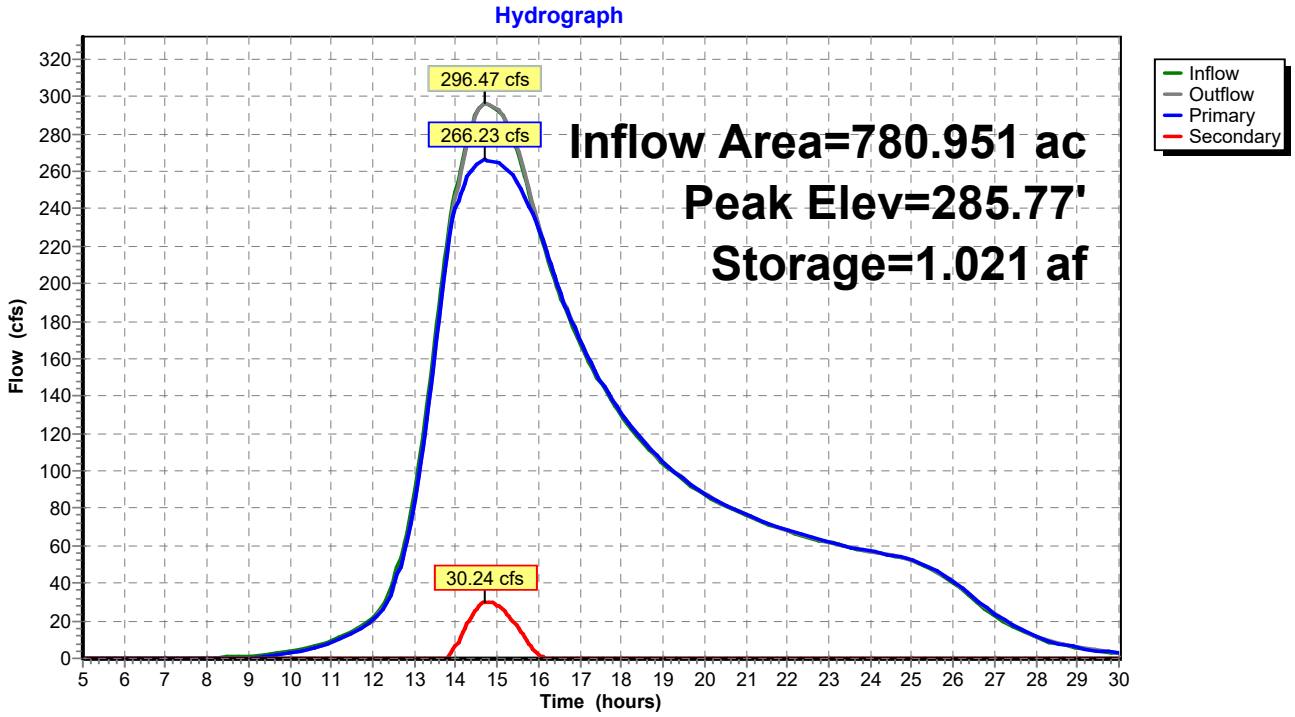
Pond 2P: Culvert 2



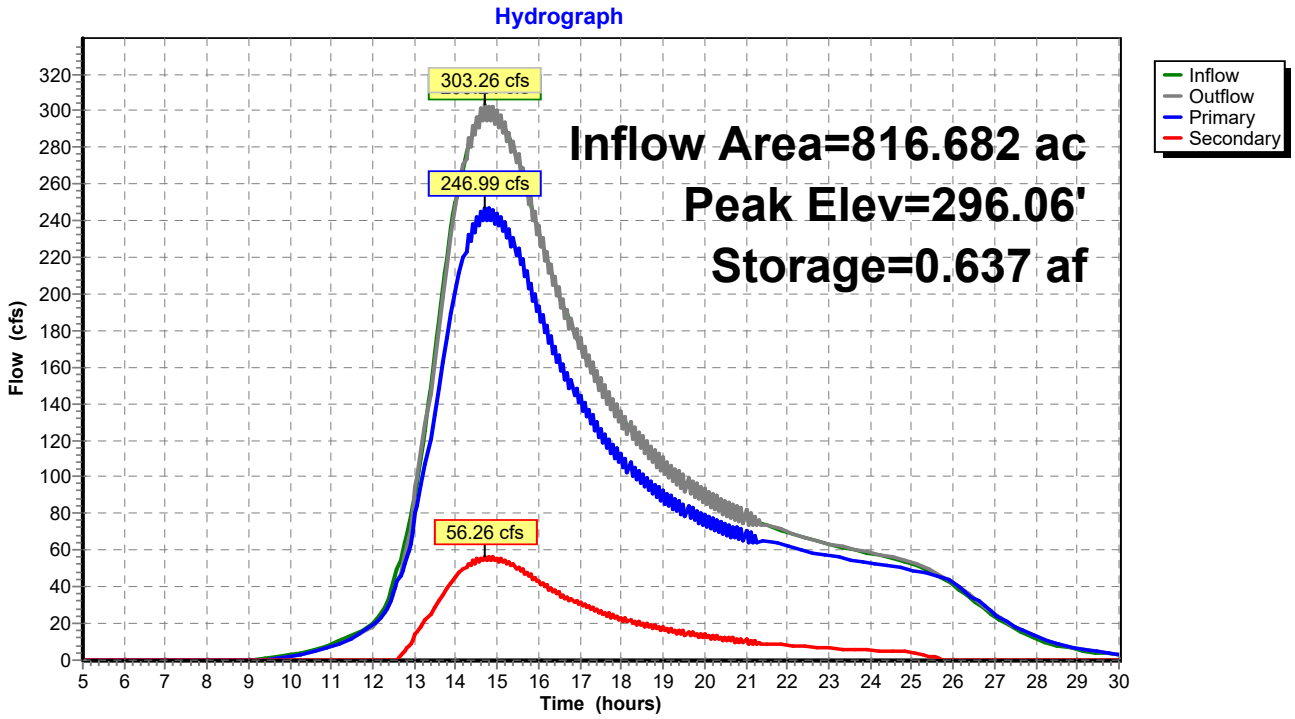
Pond 3P: Culvert 3



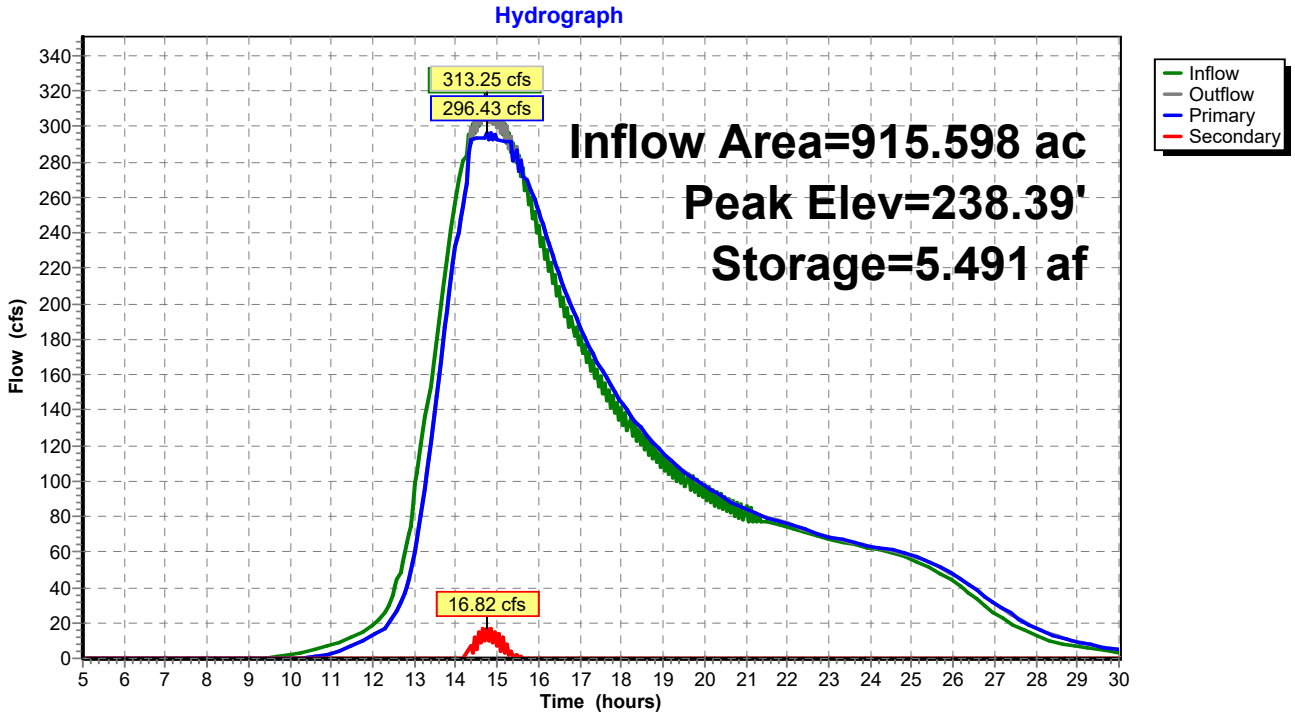
Pond 4P: Culvert 4



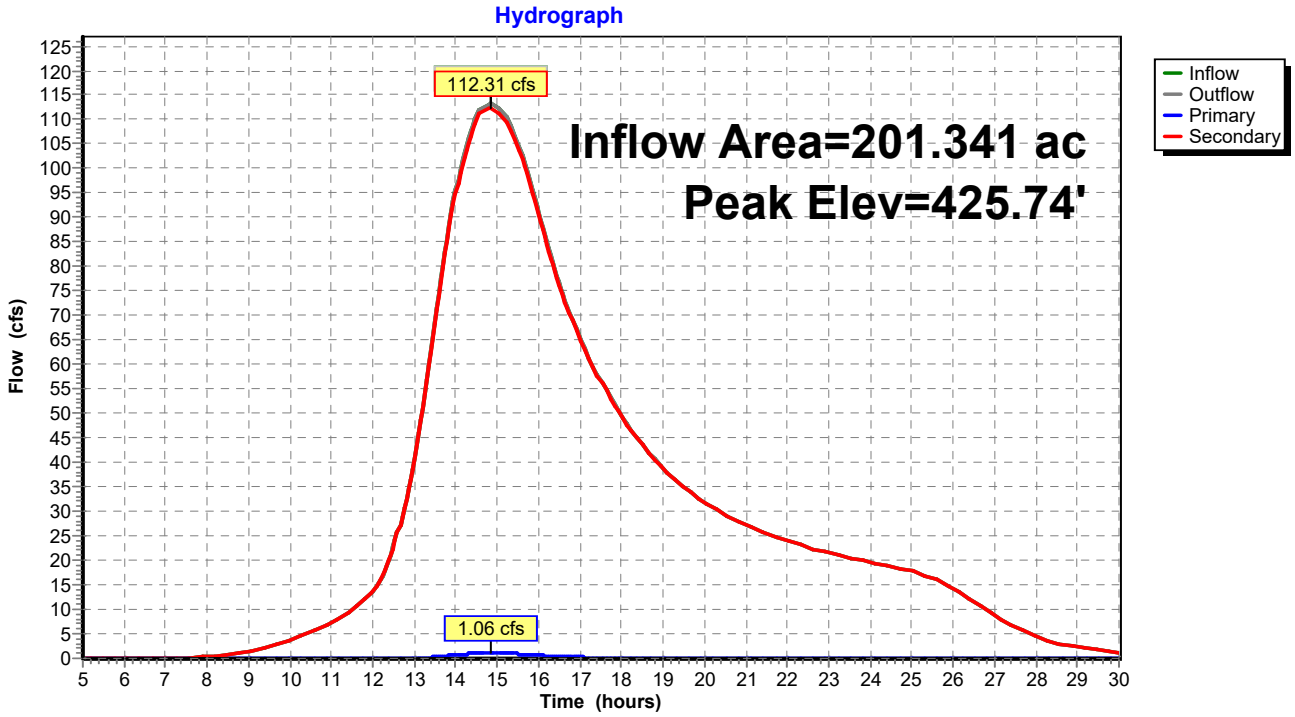
Pond 5P: Sand Culvert



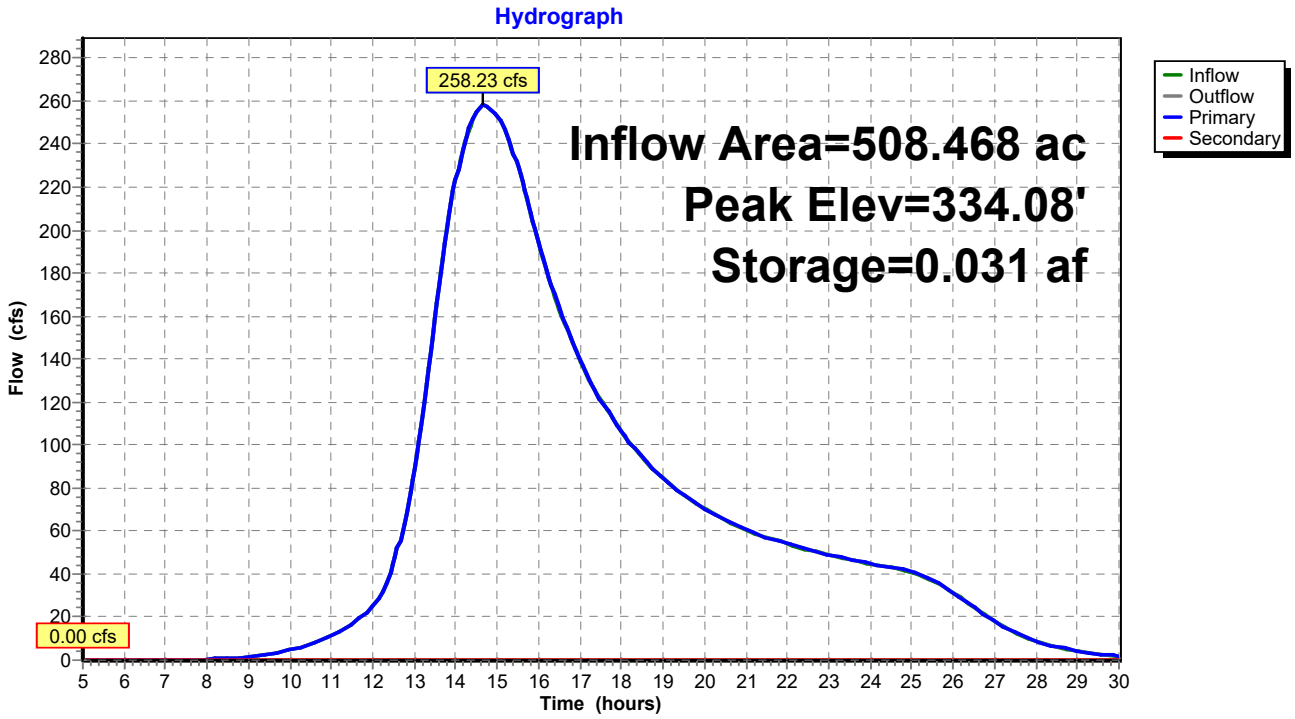
Pond 6P: 110 Culvert



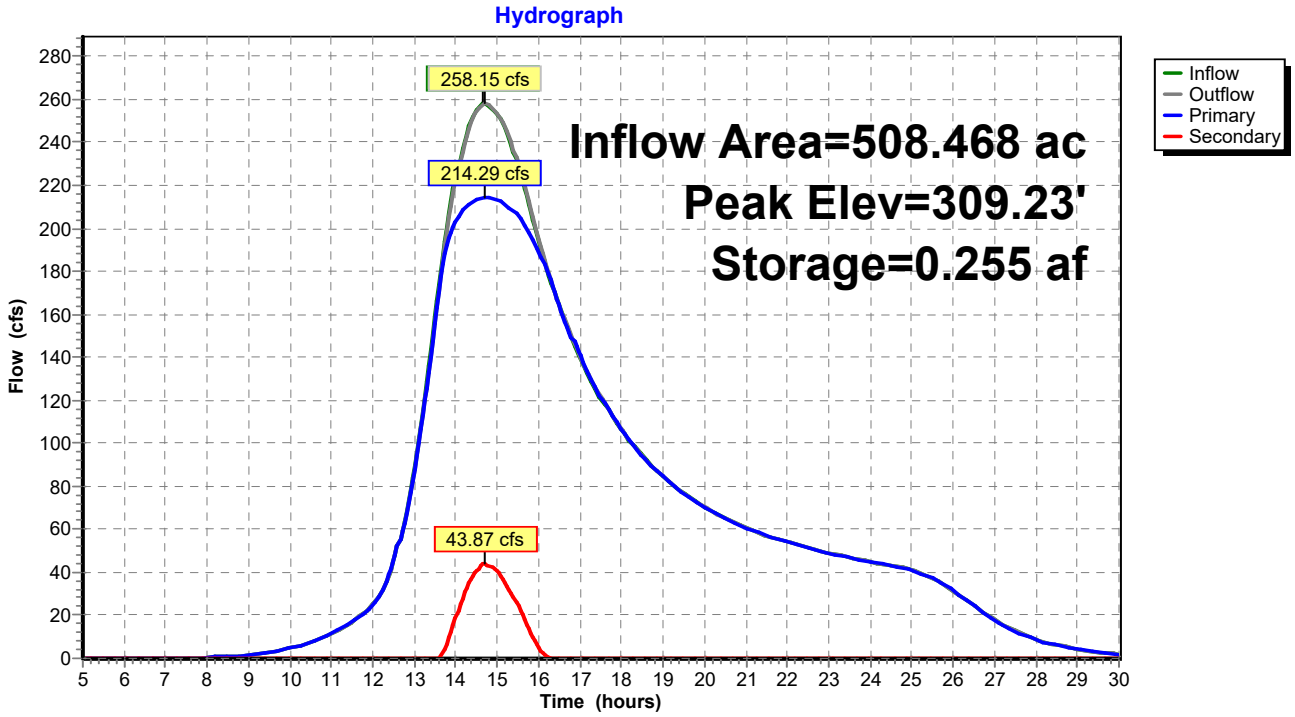
Pond 0P: 117 Culvert



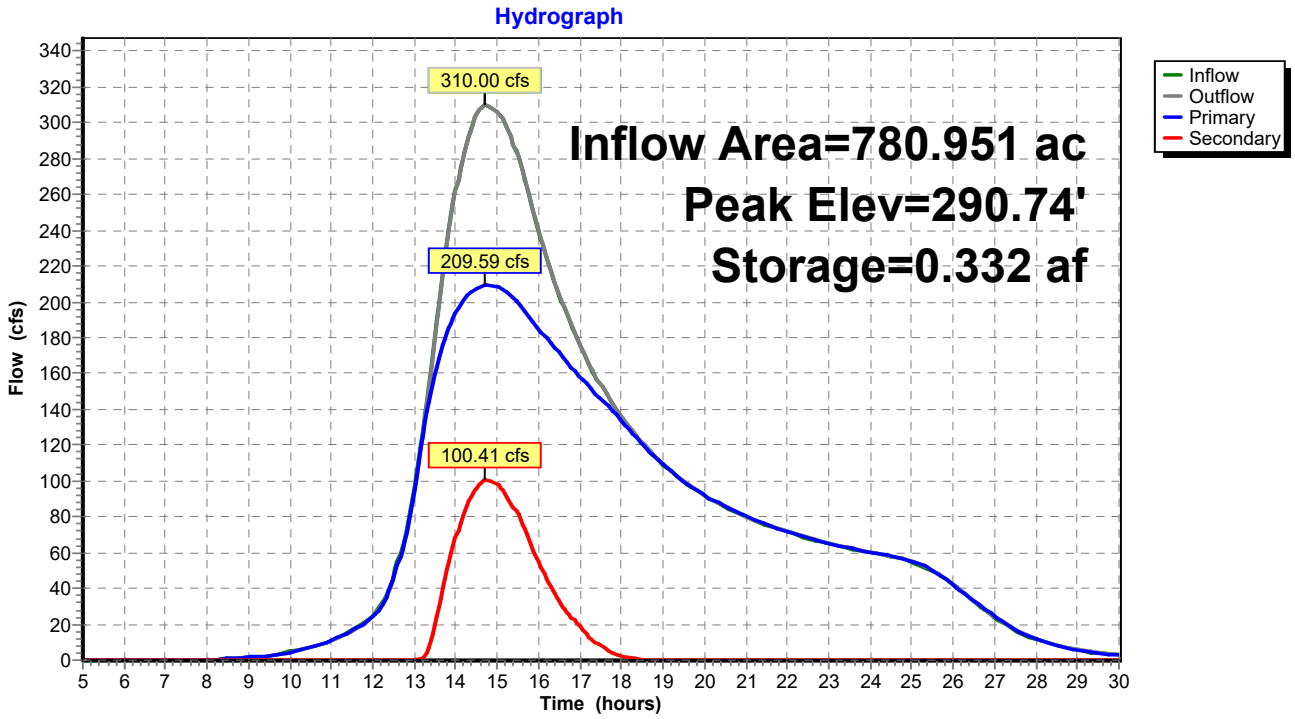
Pond 1P: Culvert 1



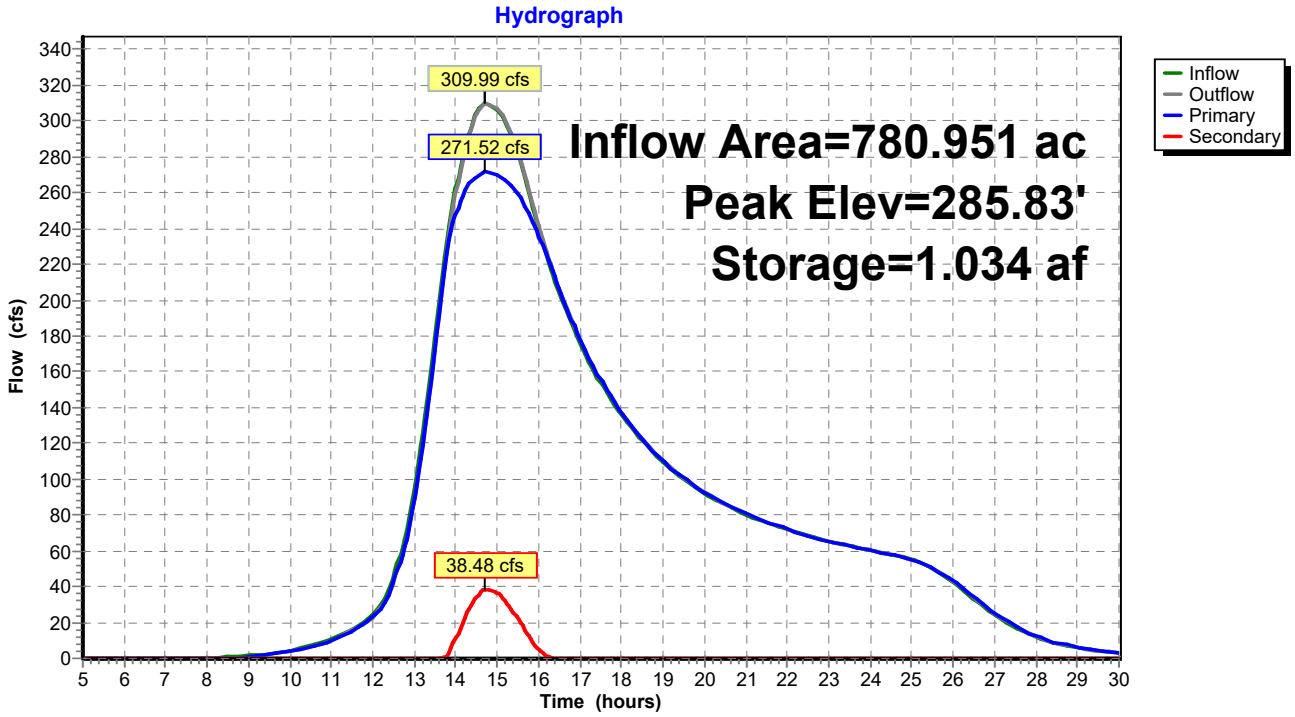
Pond 2P: Culvert 2



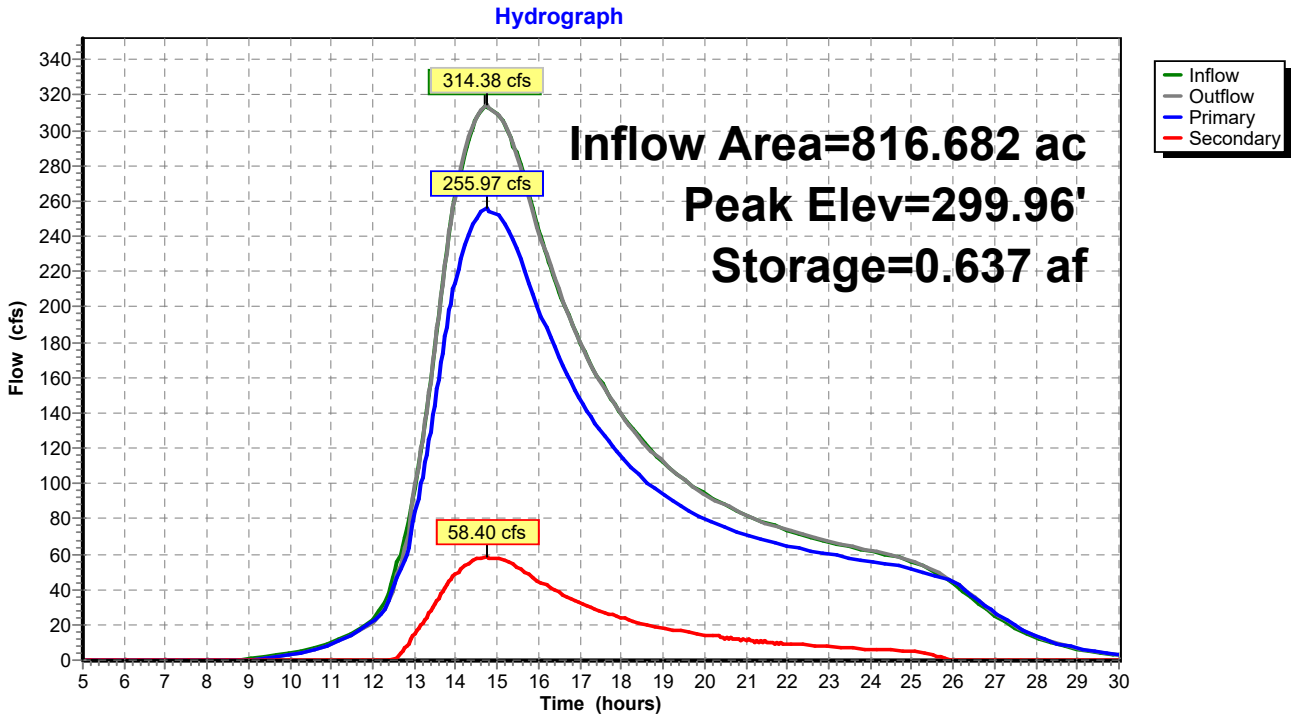
Pond 3P: Culvert 3



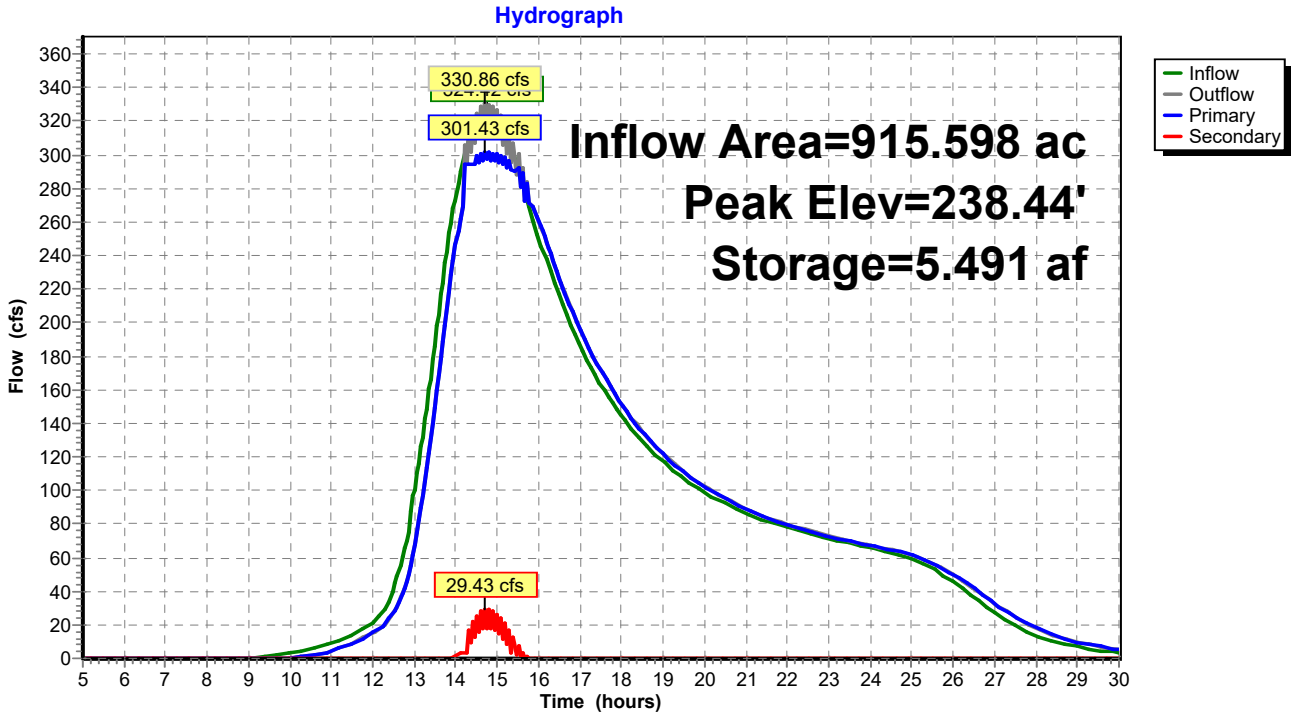
Pond 4P: Culvert 4



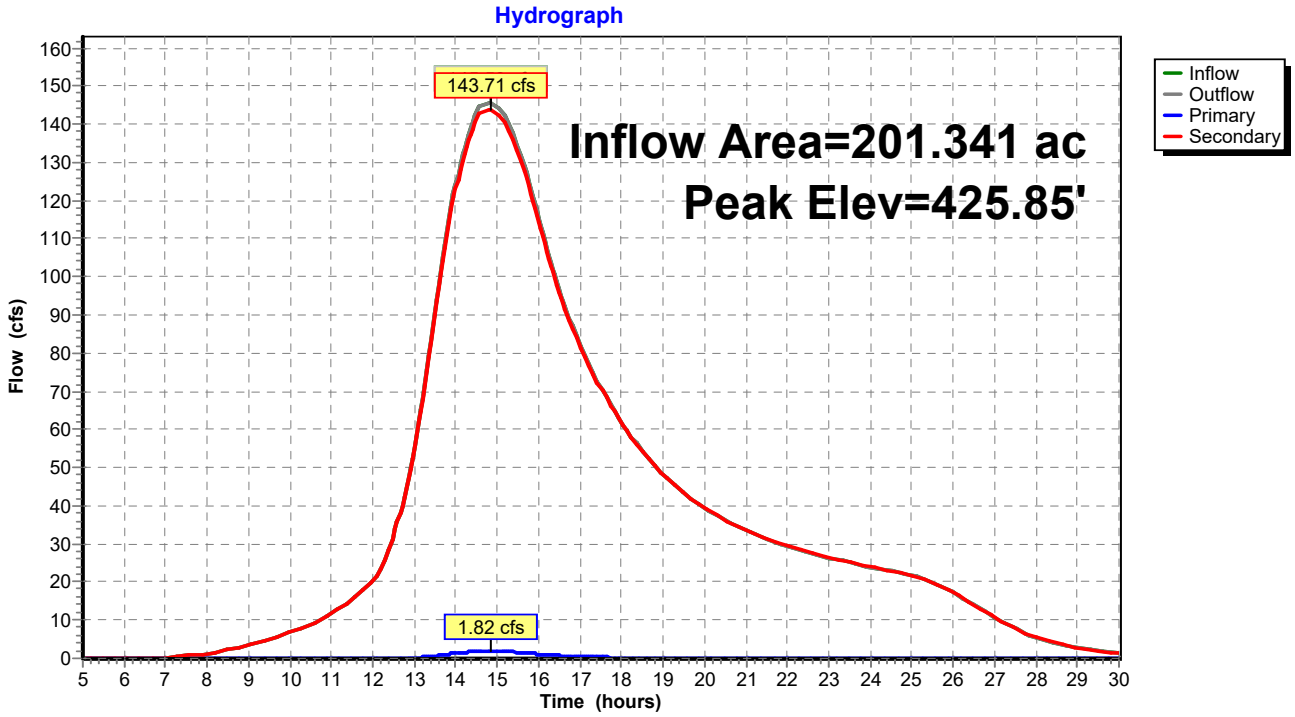
Pond 5P: Sand Culvert



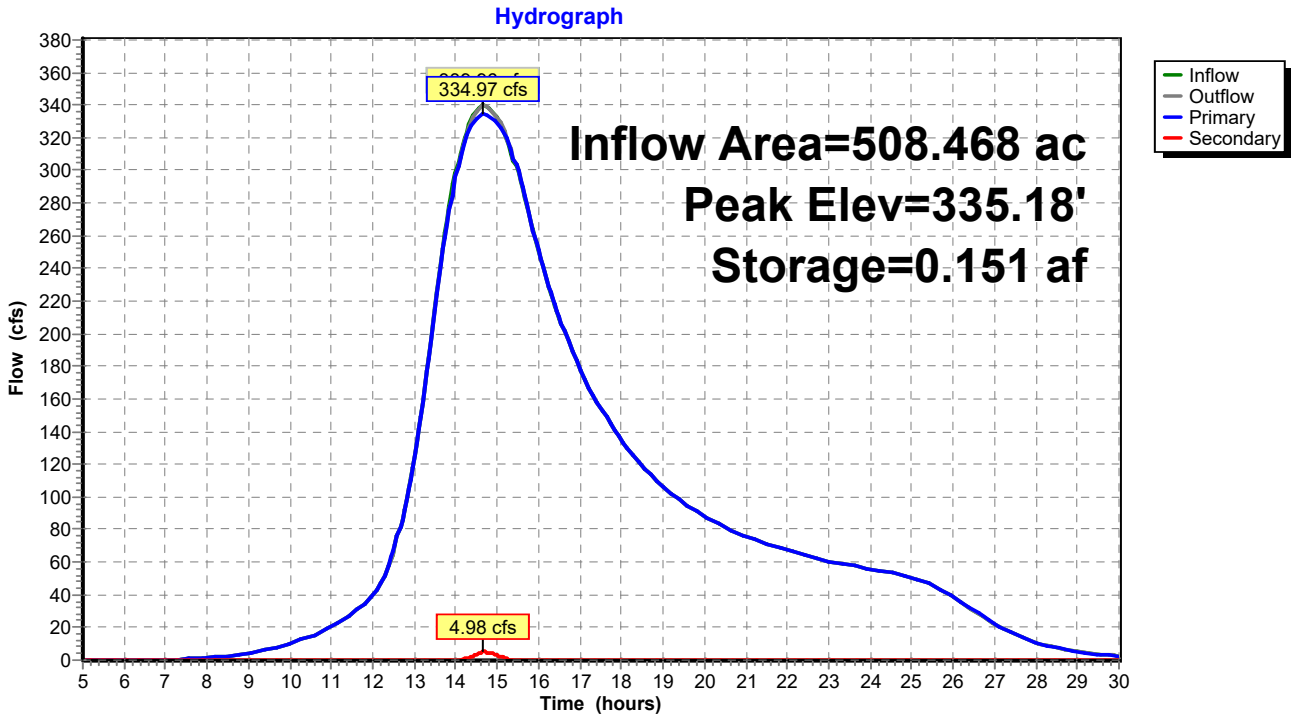
Pond 6P: 110 Culvert



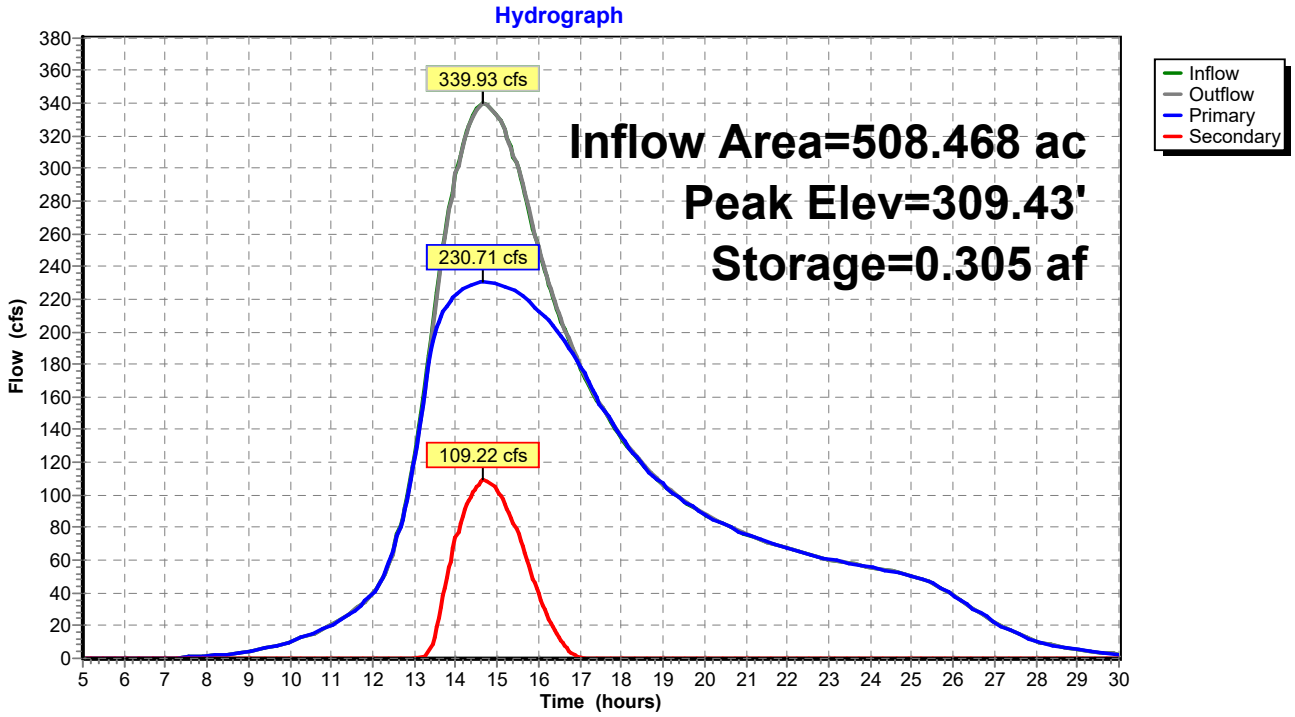
Pond 0P: 117 Culvert



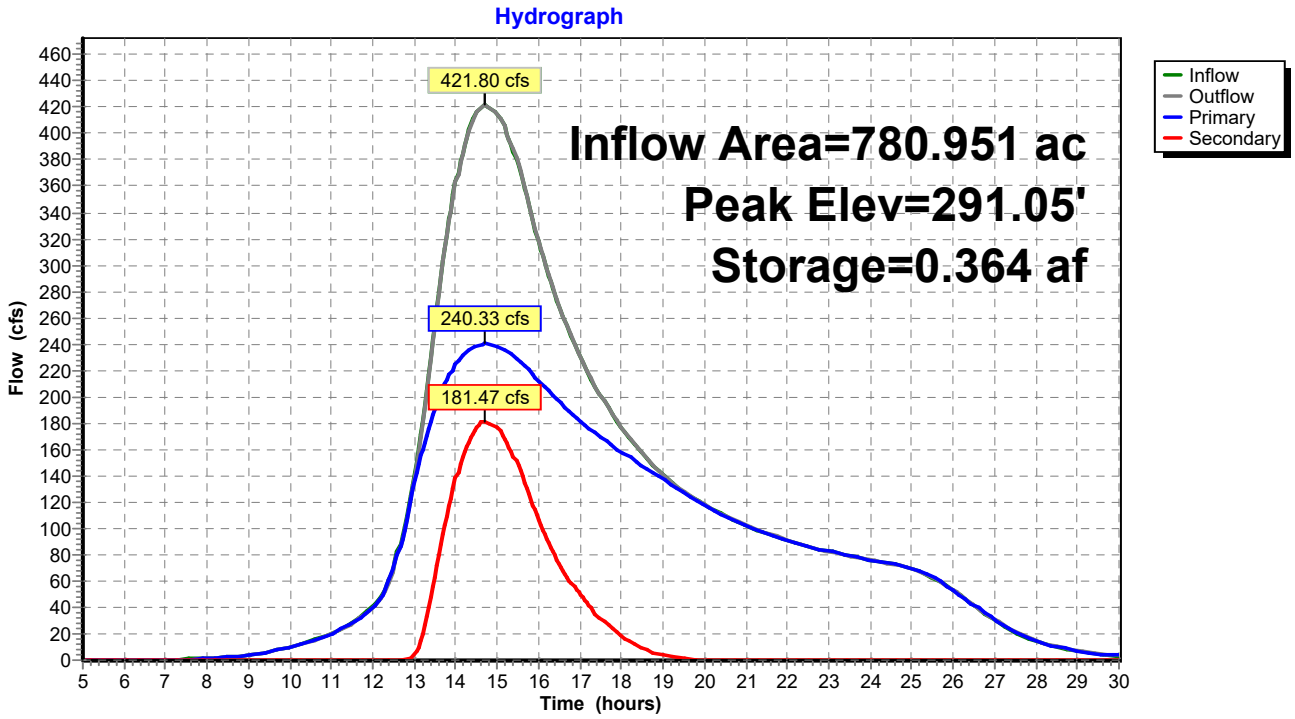
Pond 1P: Culvert 1



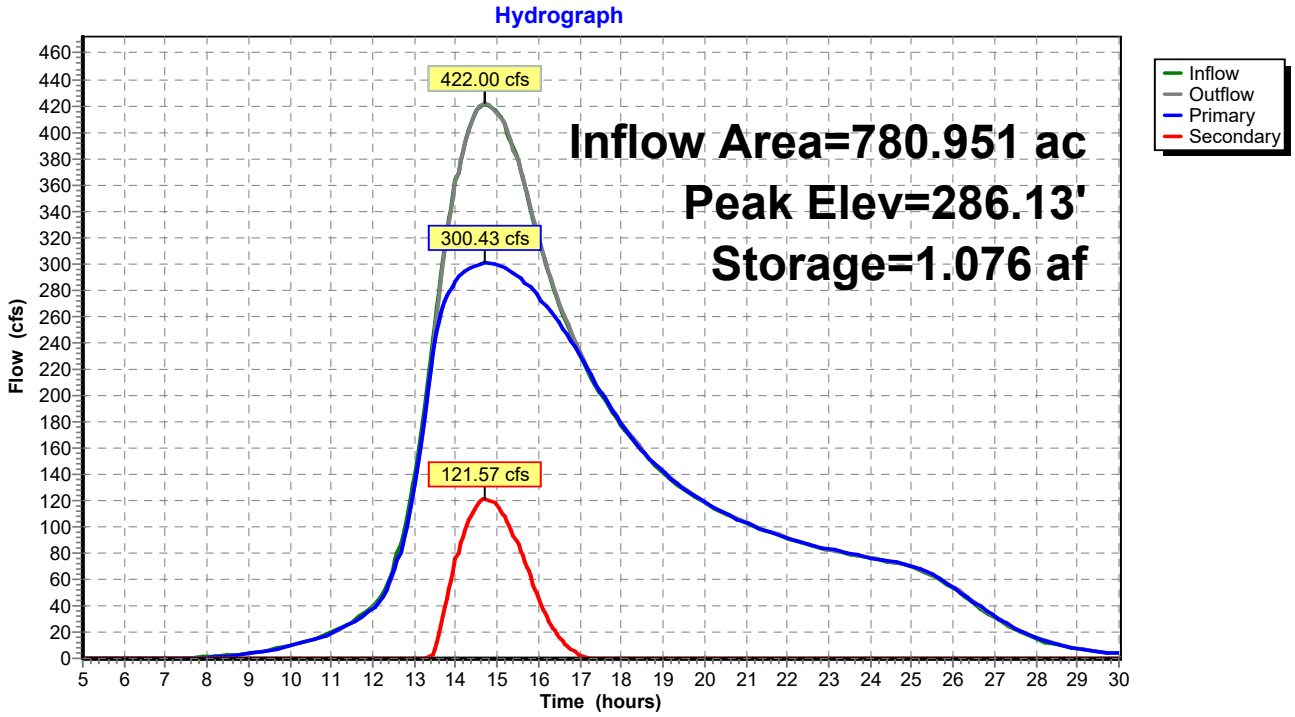
Pond 2P: Culvert 2



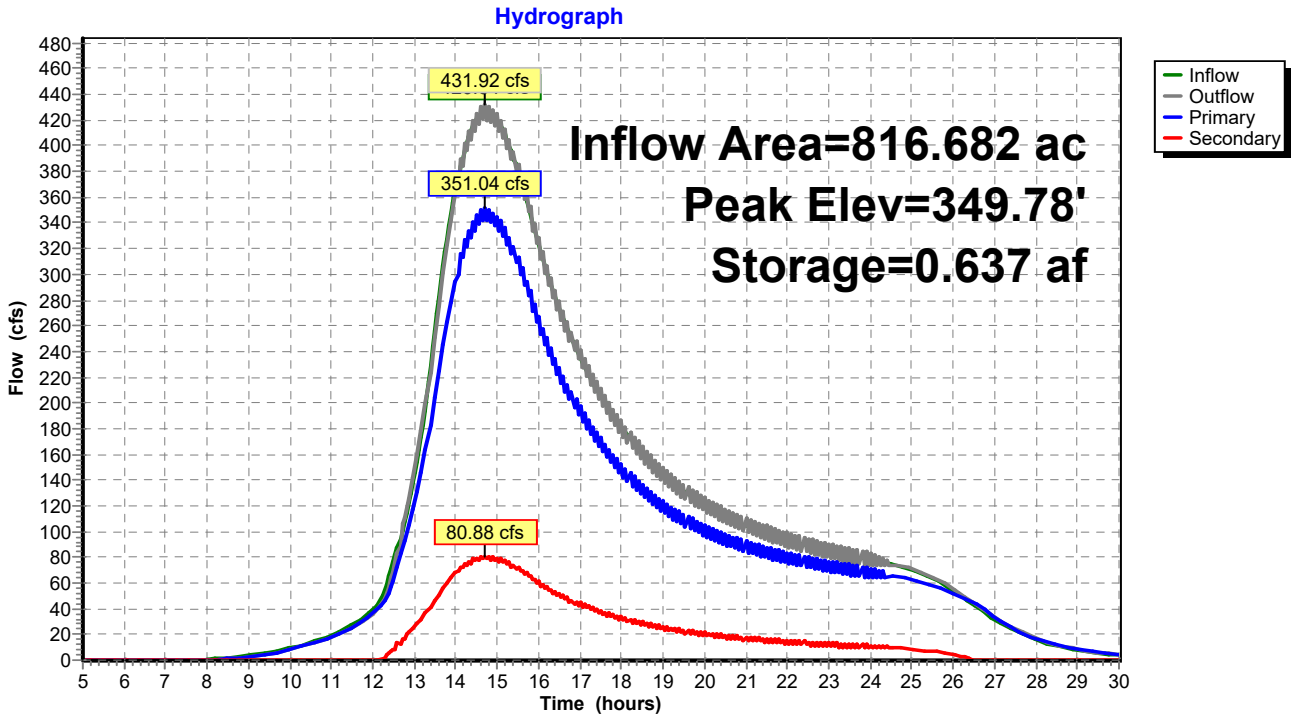
Pond 3P: Culvert 3



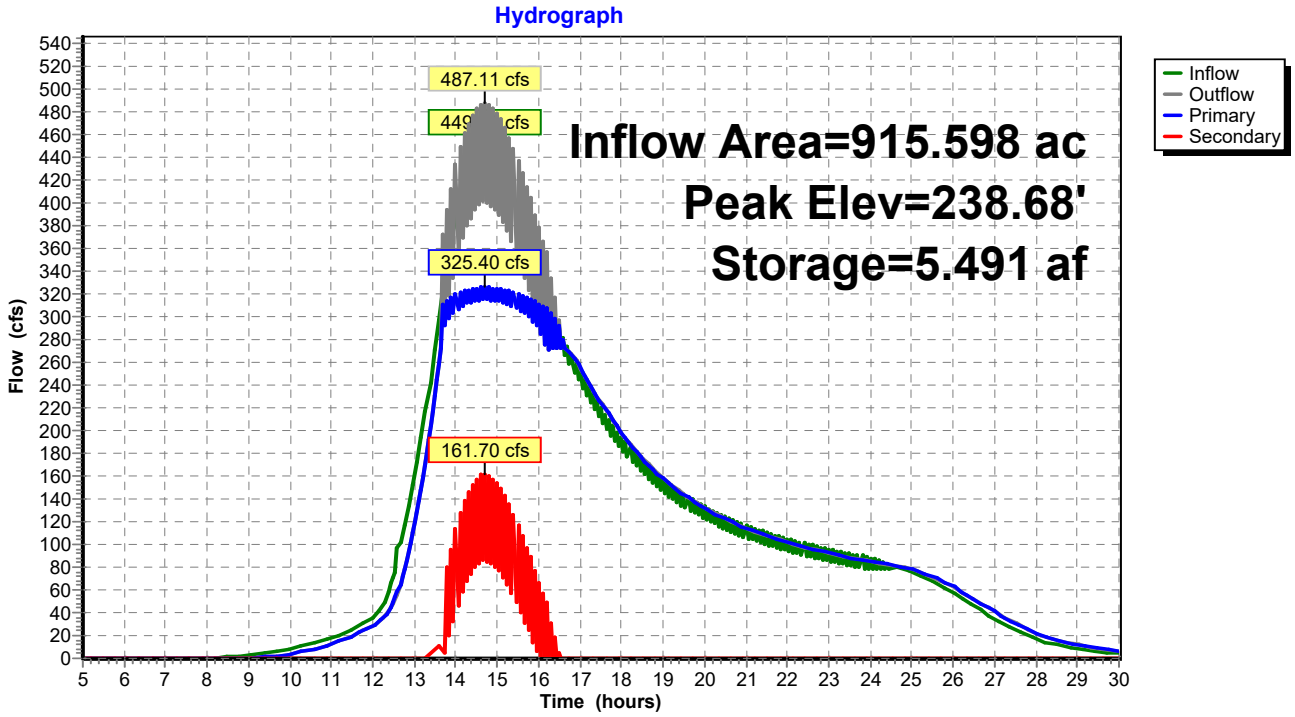
Pond 4P: Culvert 4



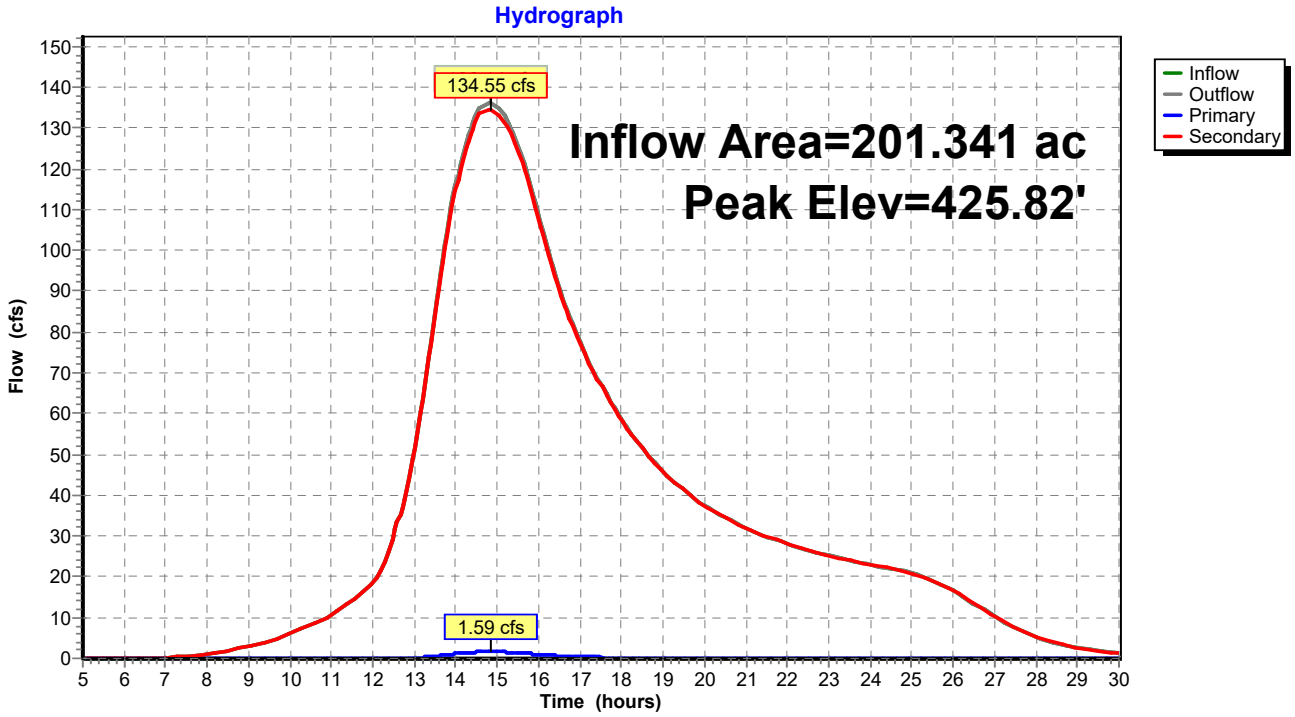
Pond 5P: Sand Culvert



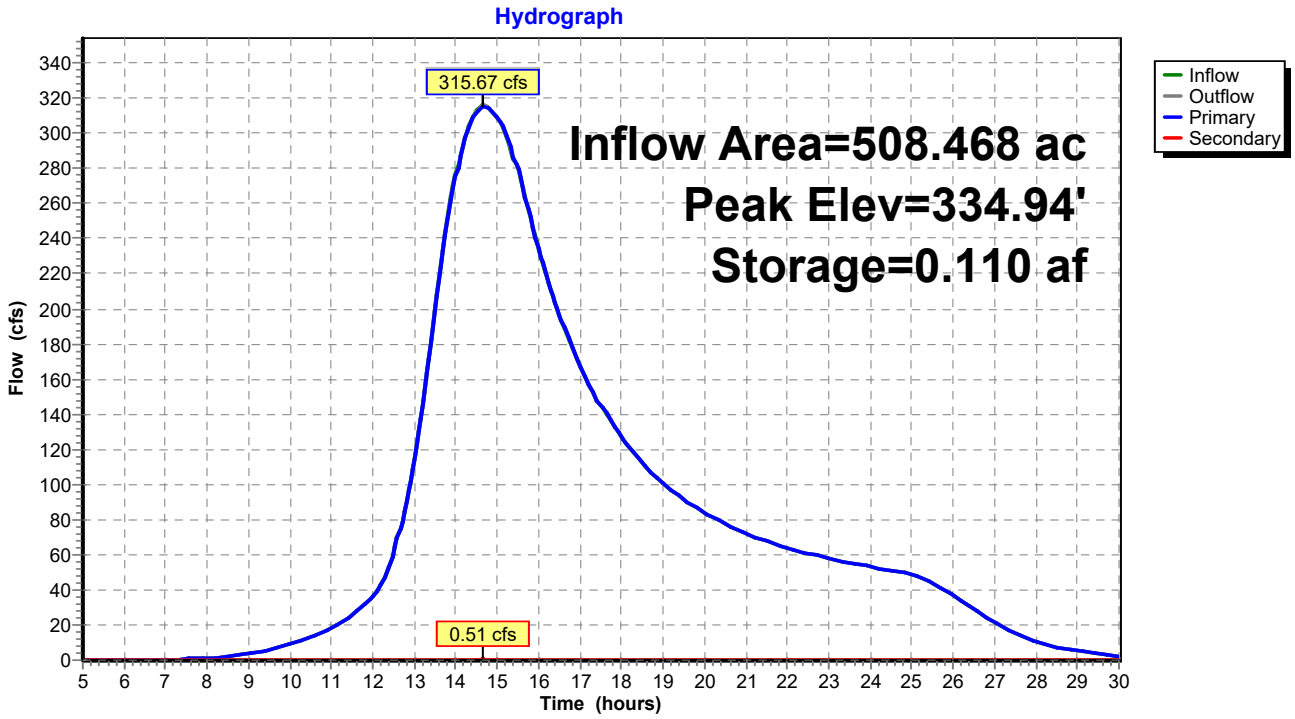
Pond 6P: 110 Culvert



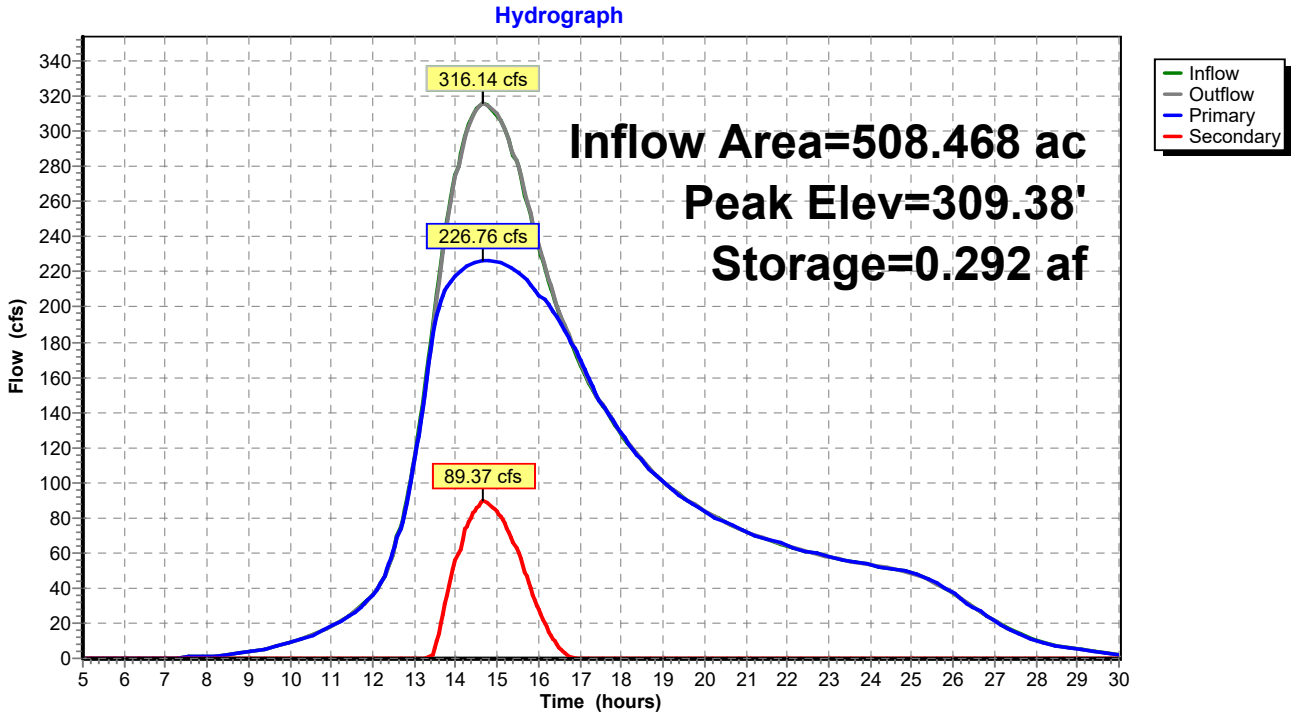
Pond 0P: 117 Culvert



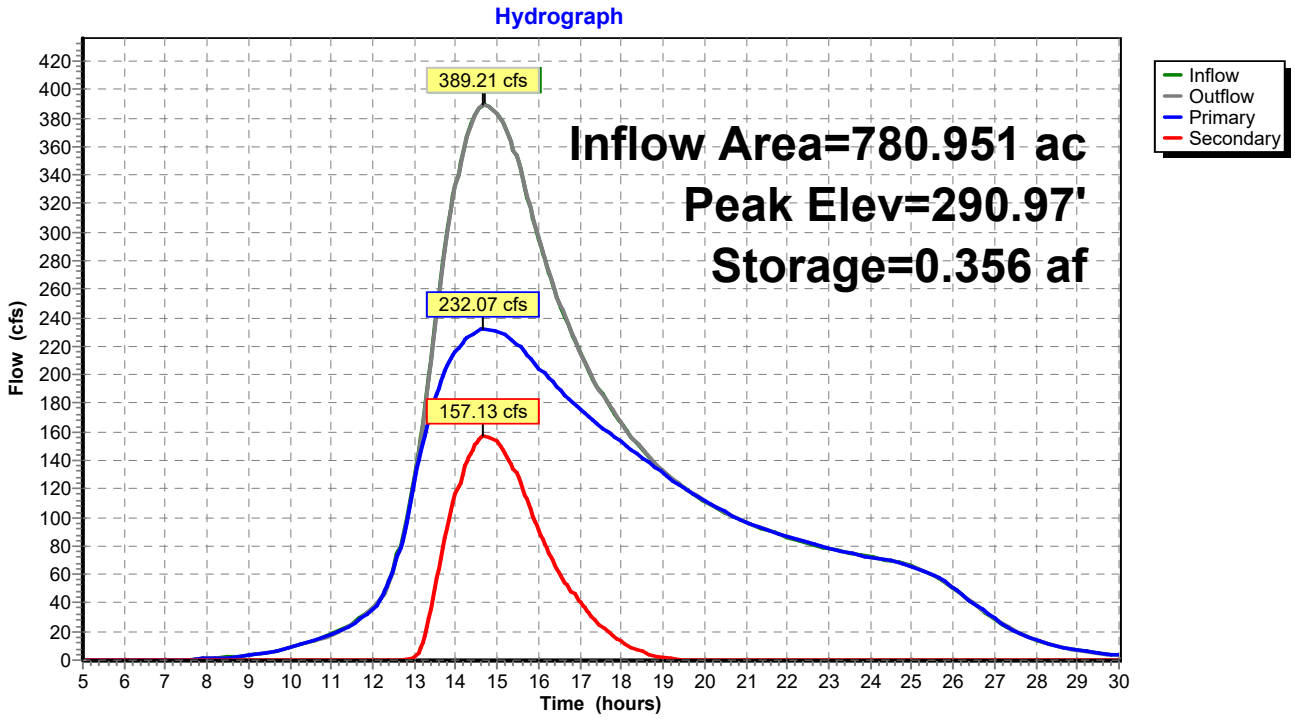
Pond 1P: Culvert 1



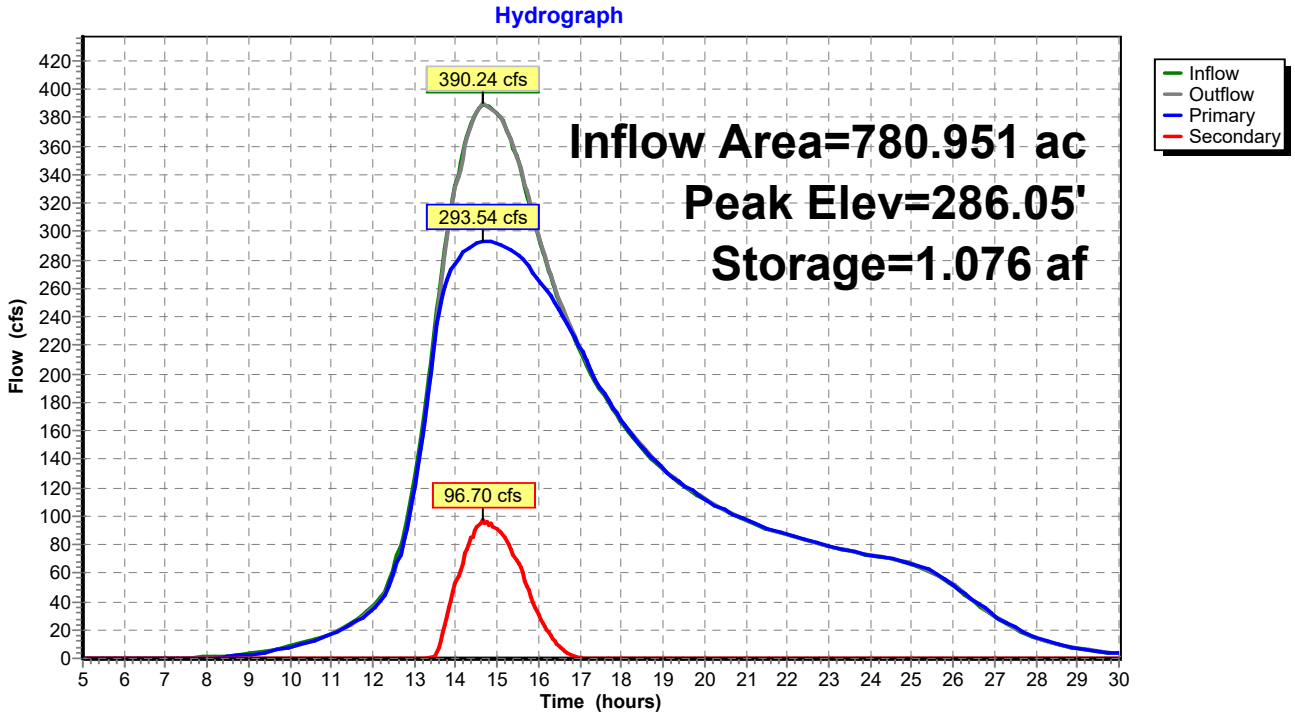
Pond 2P: Culvert 2



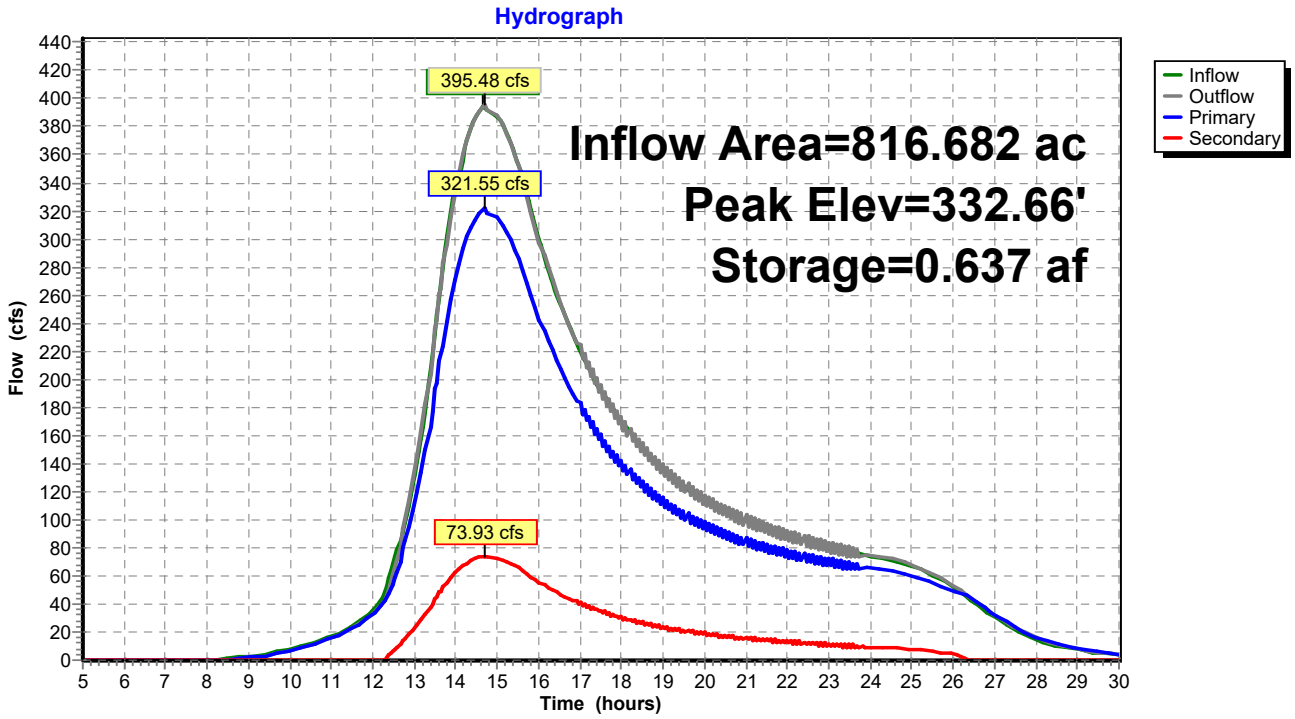
Pond 3P: Culvert 3



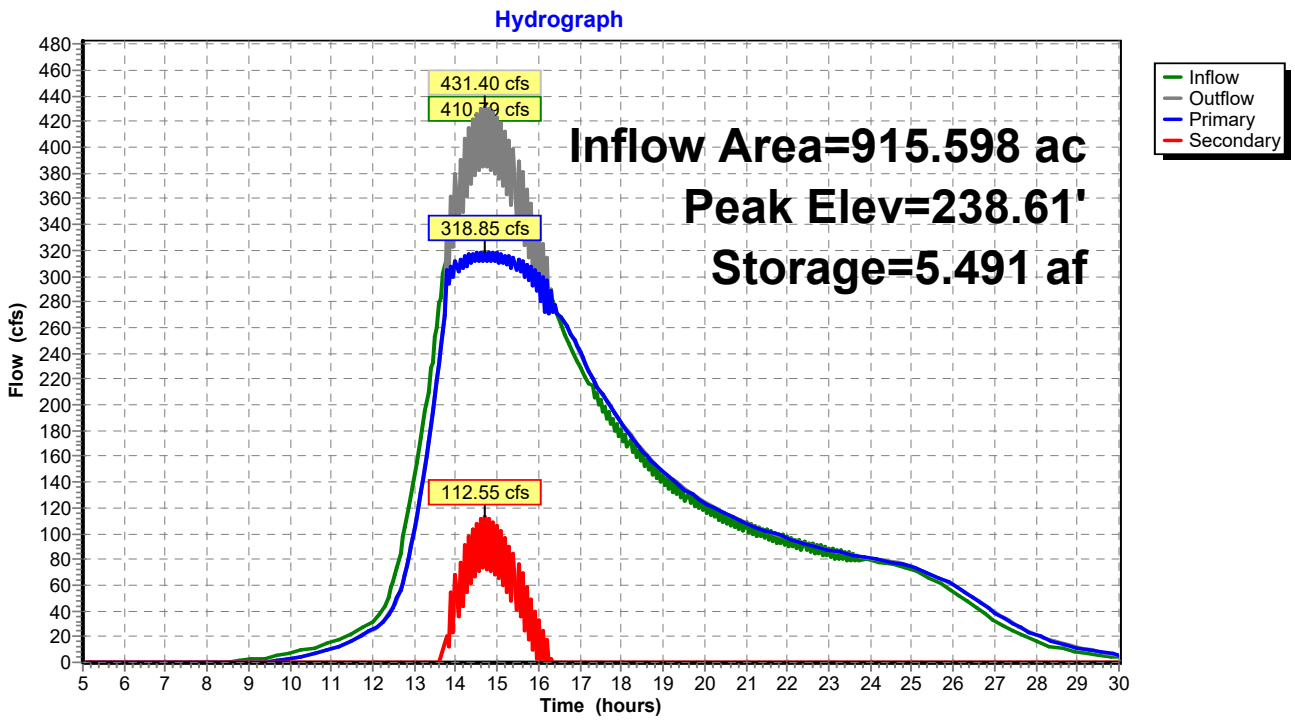
Pond 4P: Culvert 4



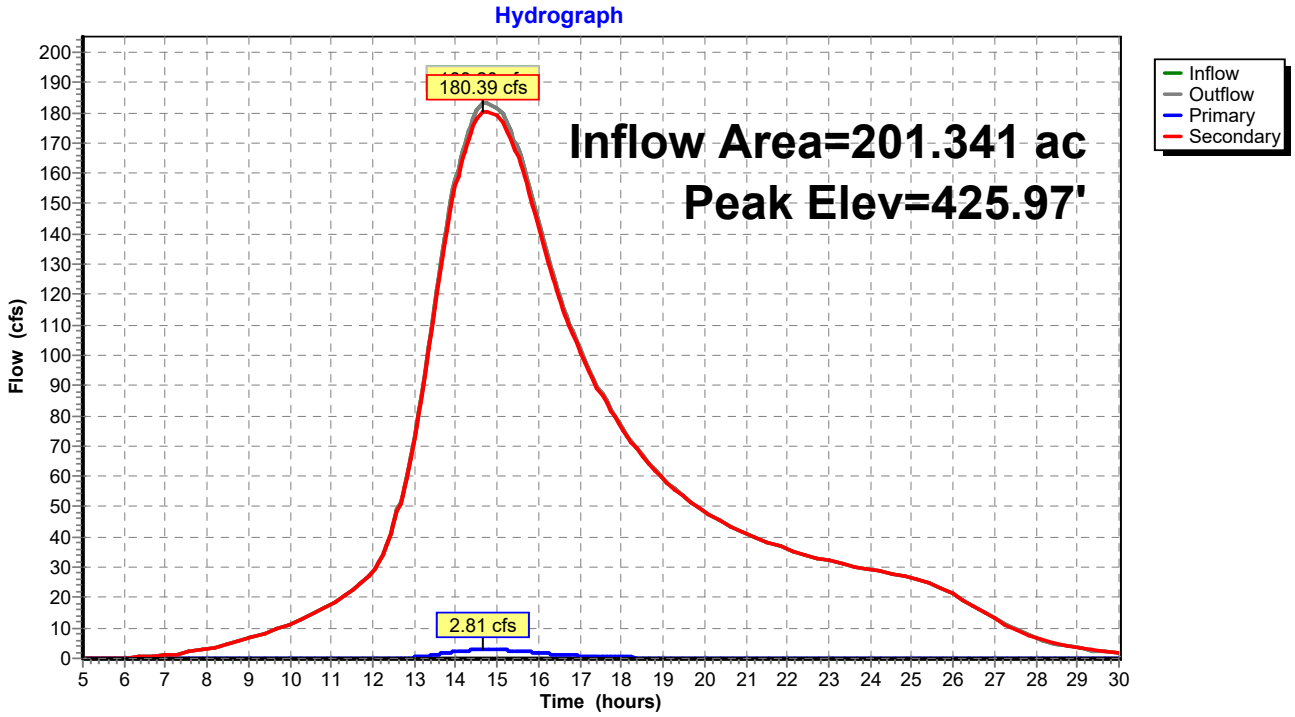
Pond 5P: Sand Culvert



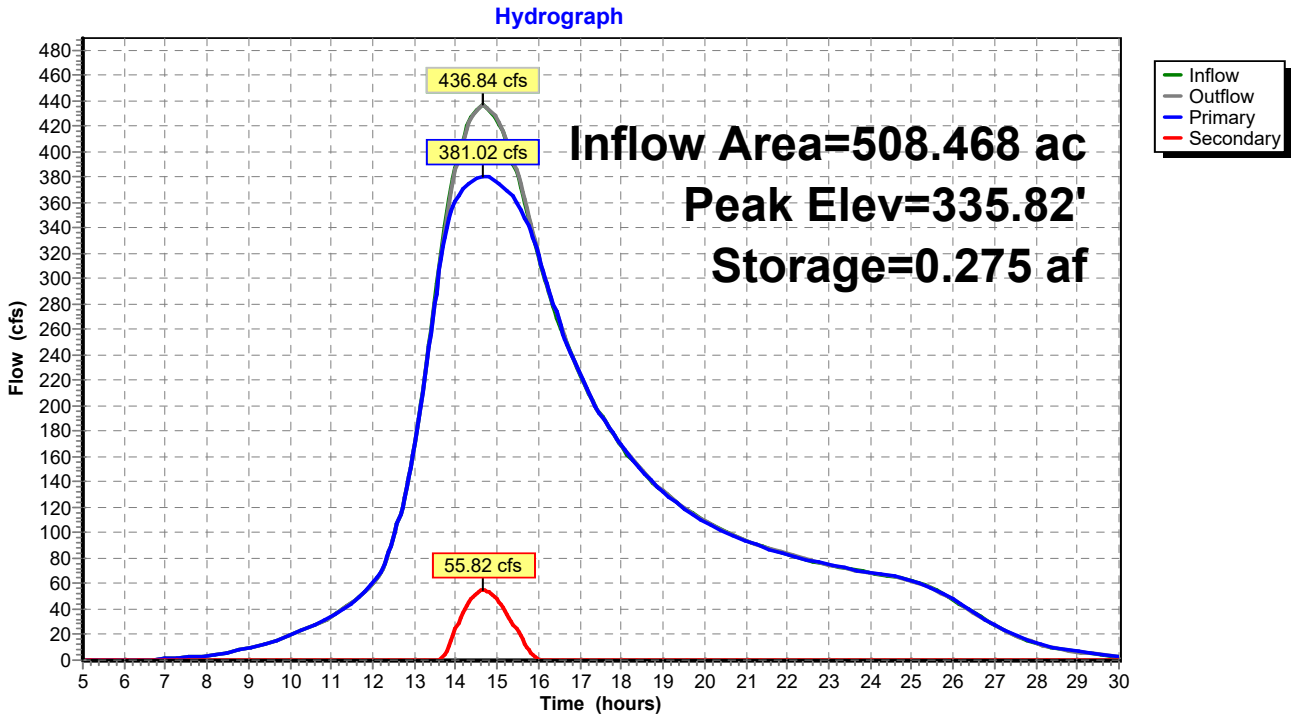
Pond 6P: 110 Culvert



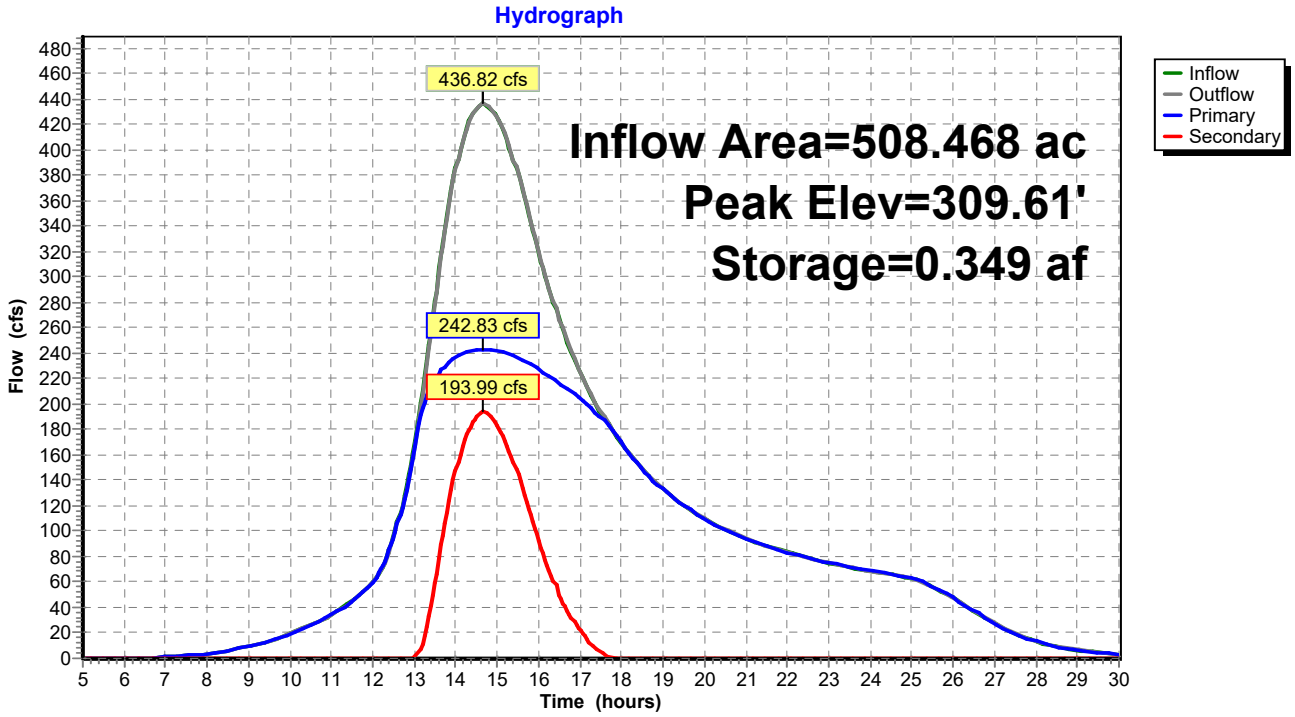
Pond 0P: 117 Culvert



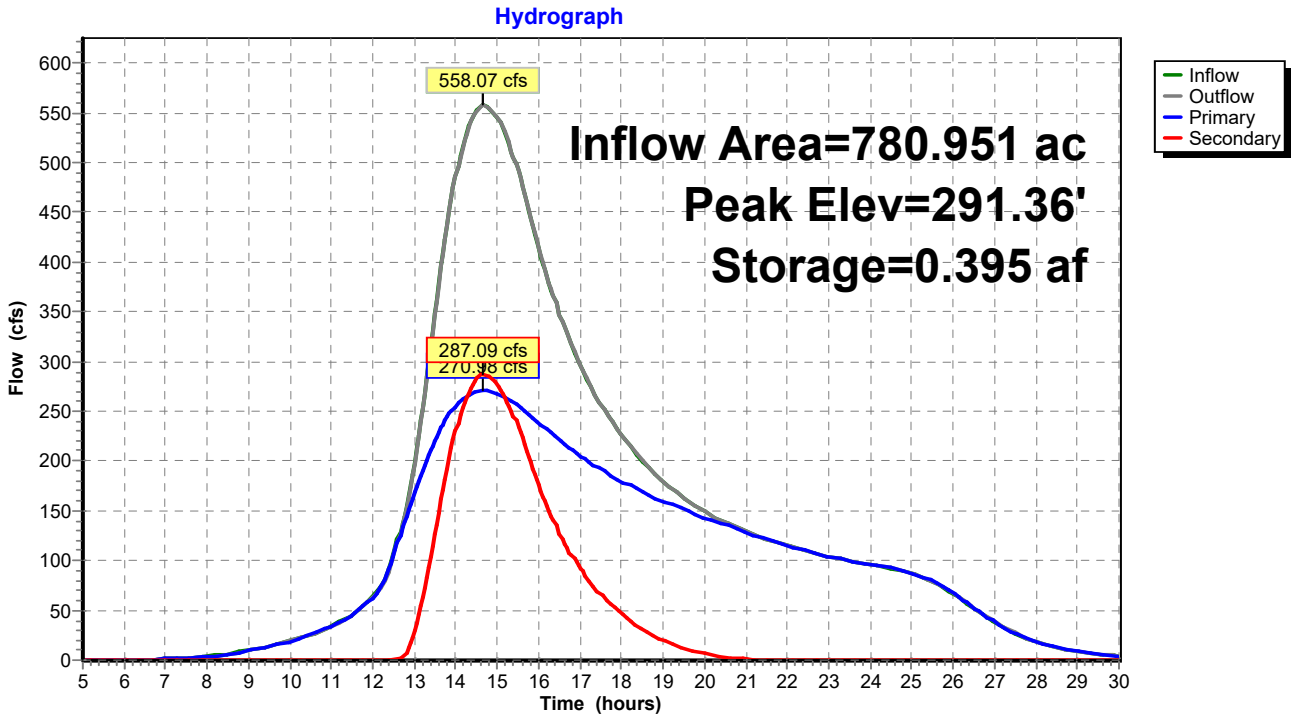
Pond 1P: Culvert 1



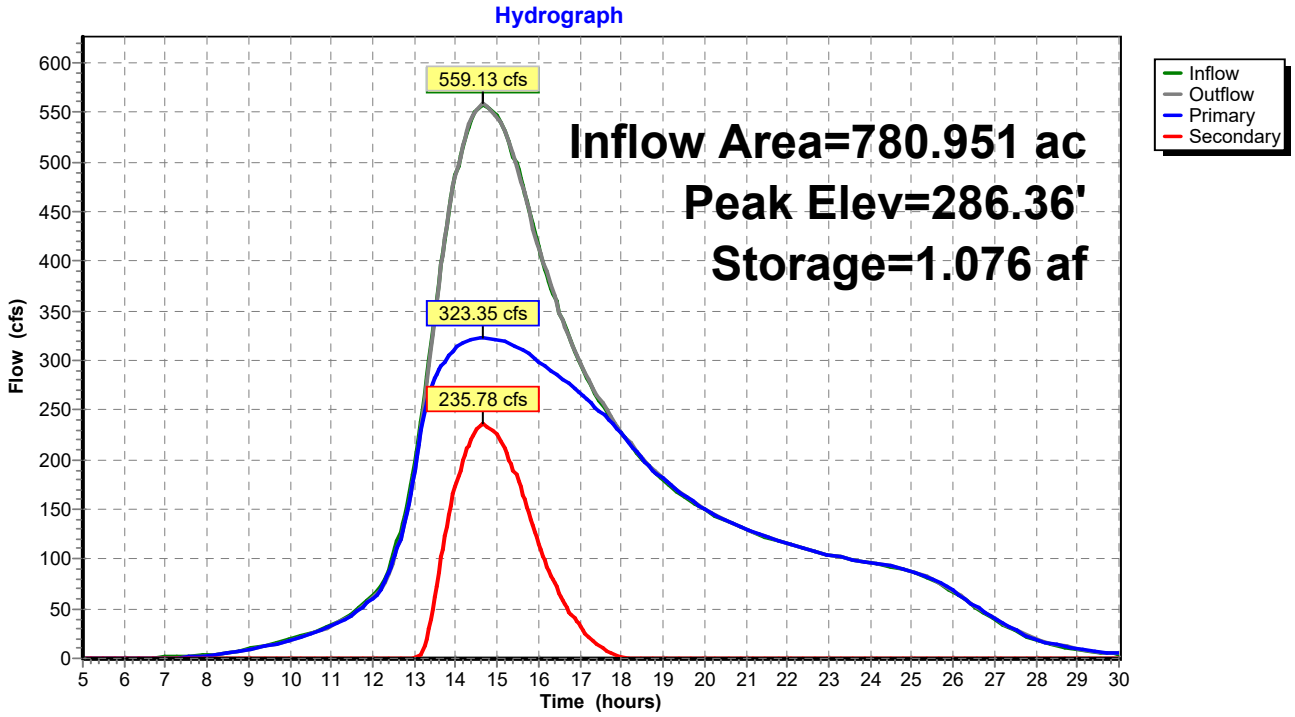
Pond 2P: Culvert 2



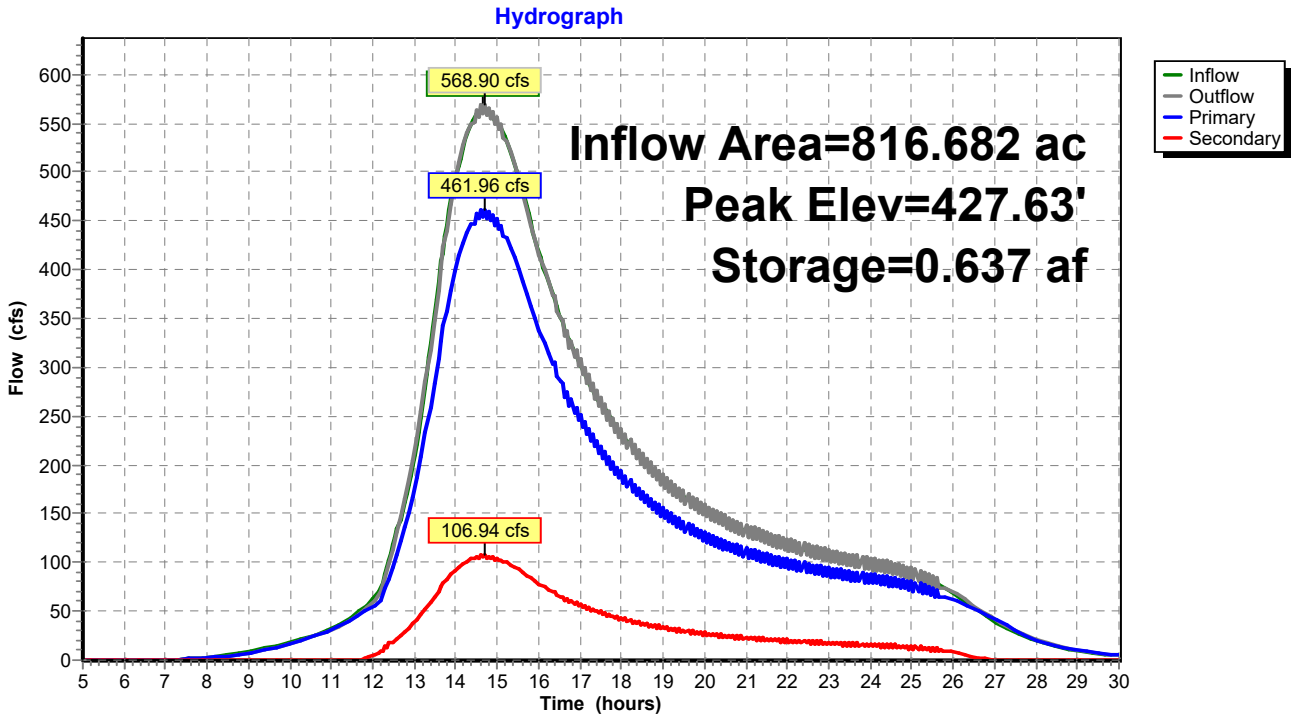
Pond 3P: Culvert 3



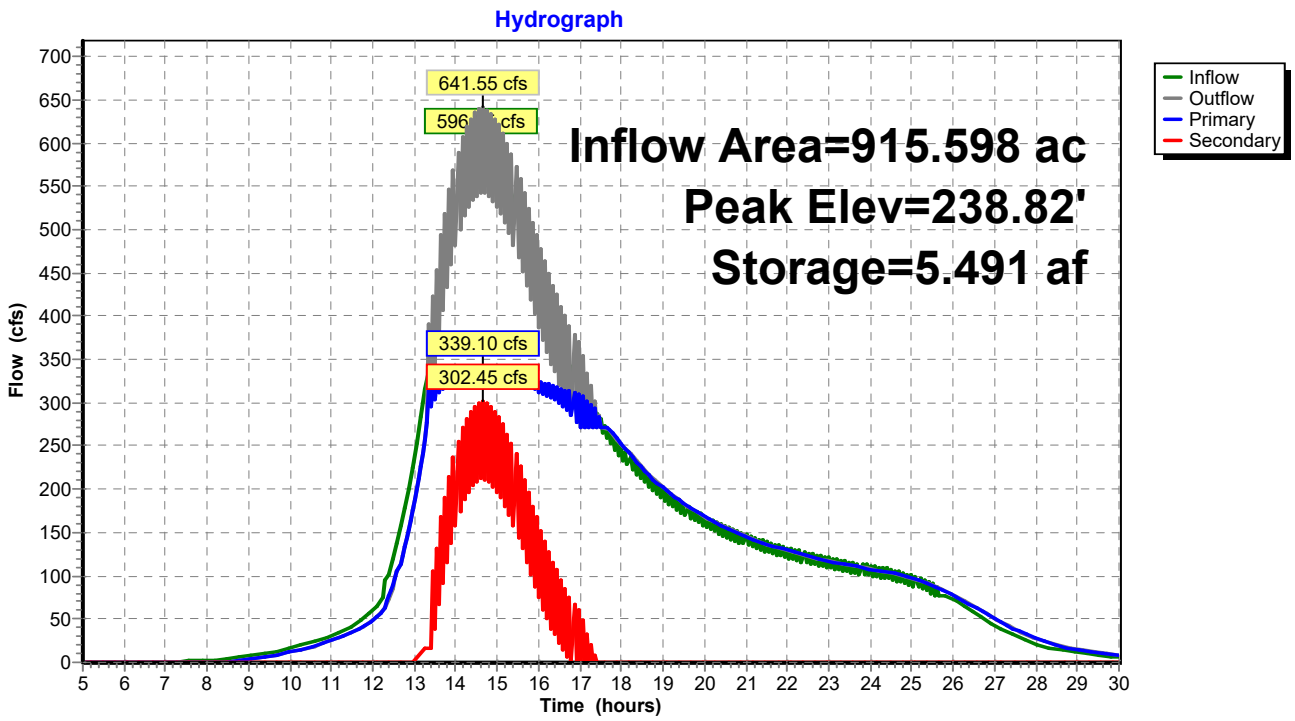
Pond 4P: Culvert 4



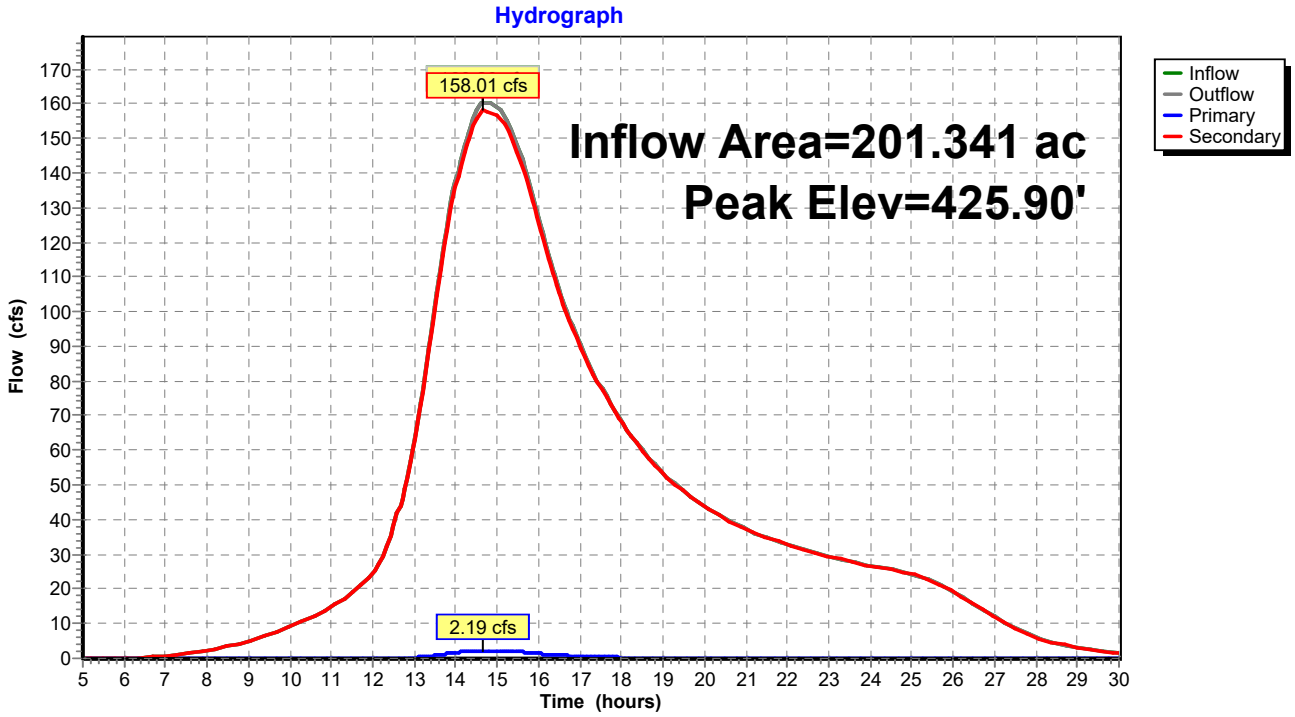
Pond 5P: Sand Culvert



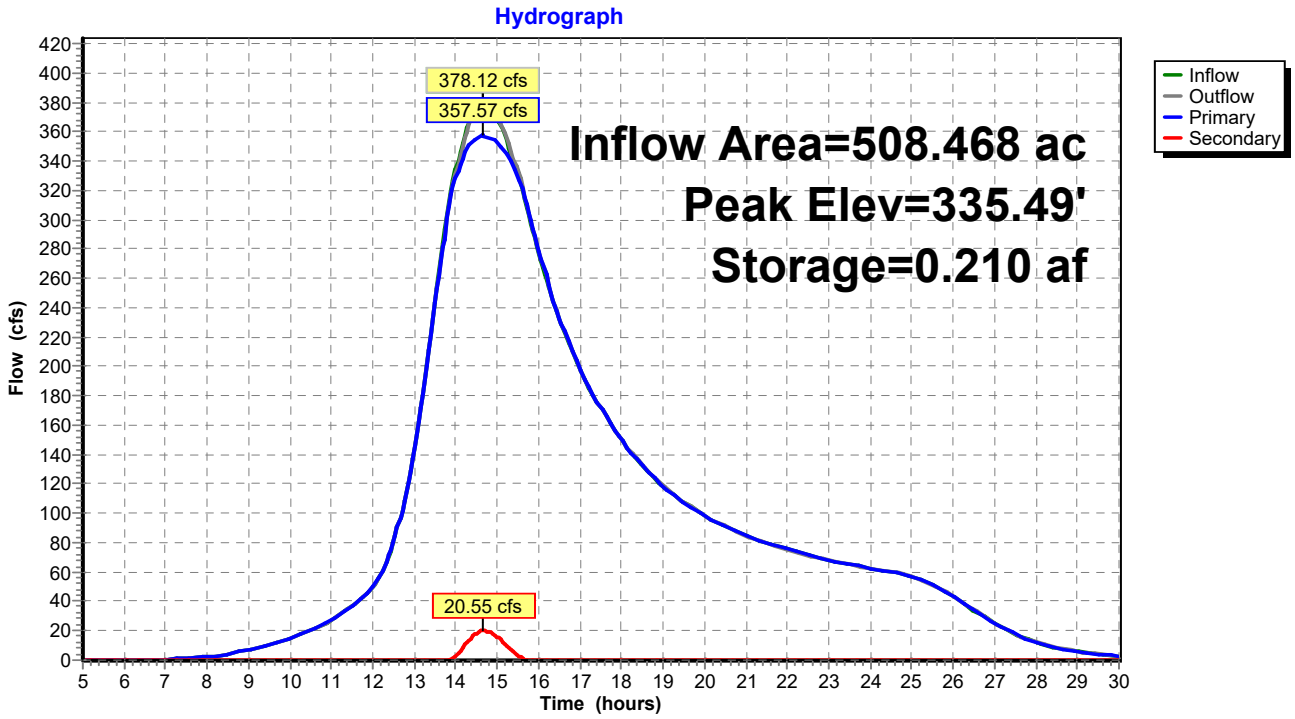
Pond 6P: 110 Culvert



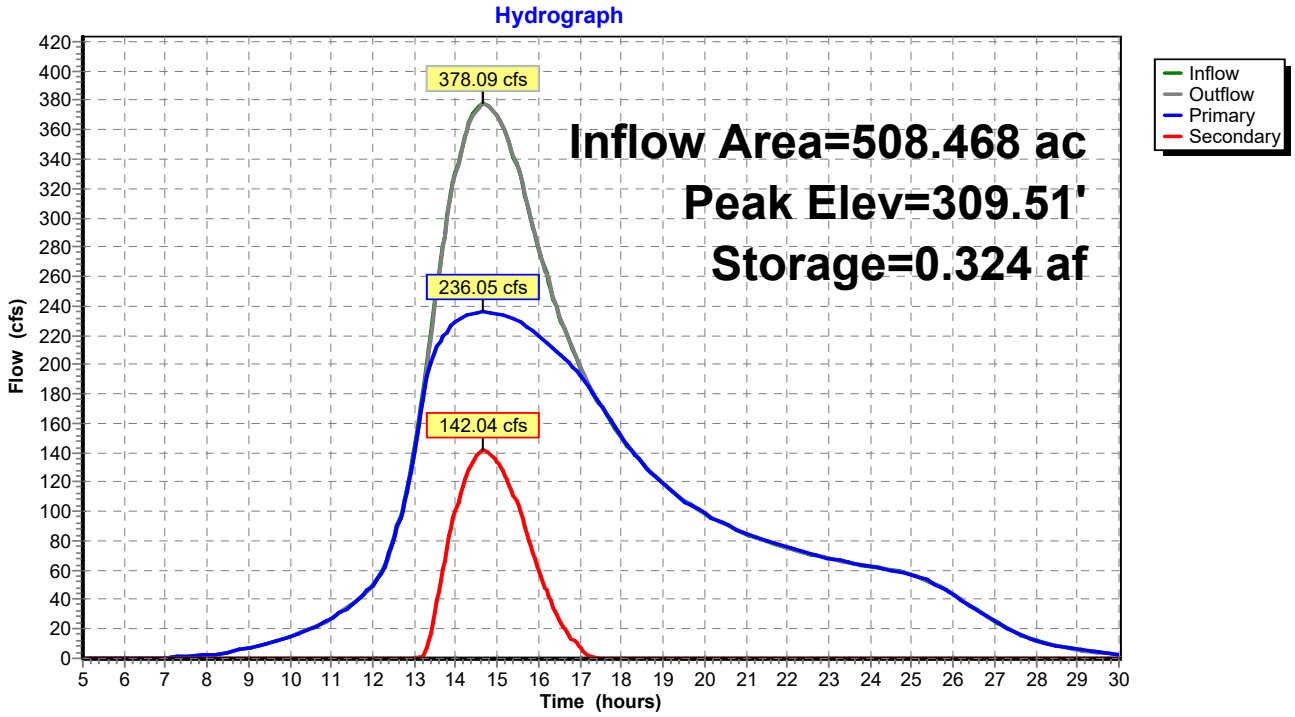
Pond 0P: 117 Culvert



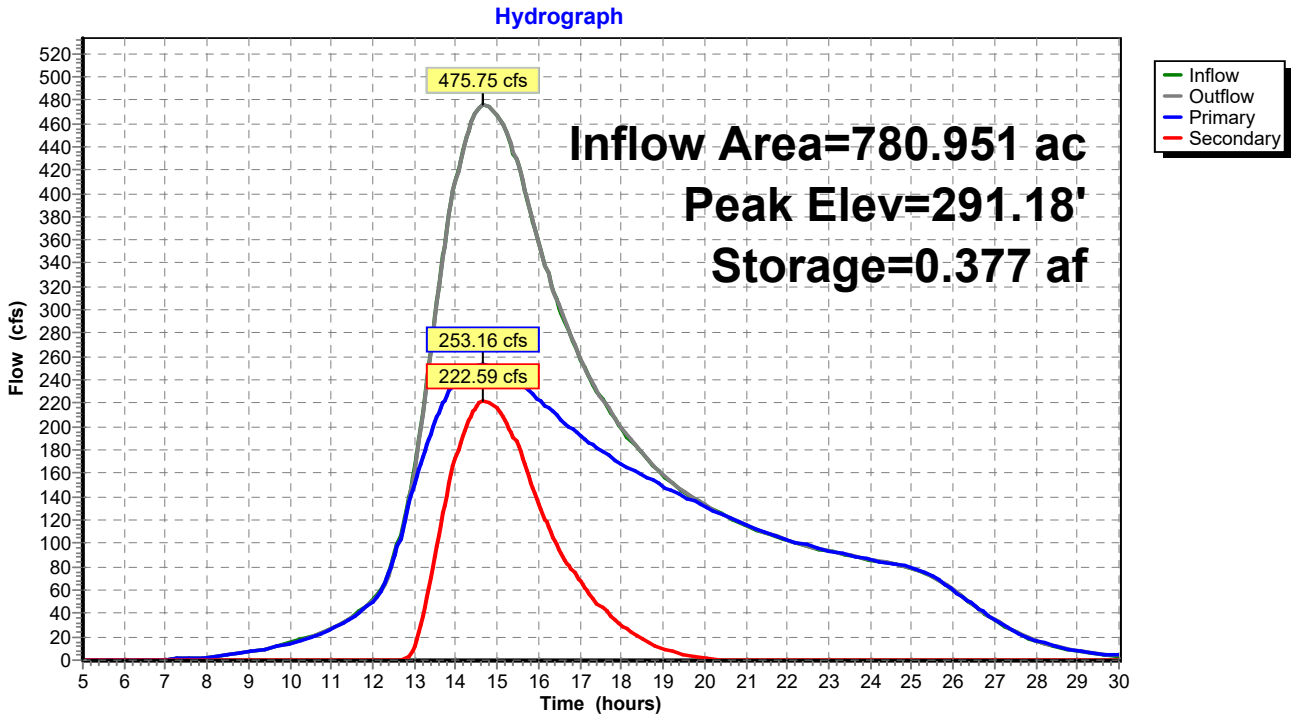
Pond 1P: Culvert 1



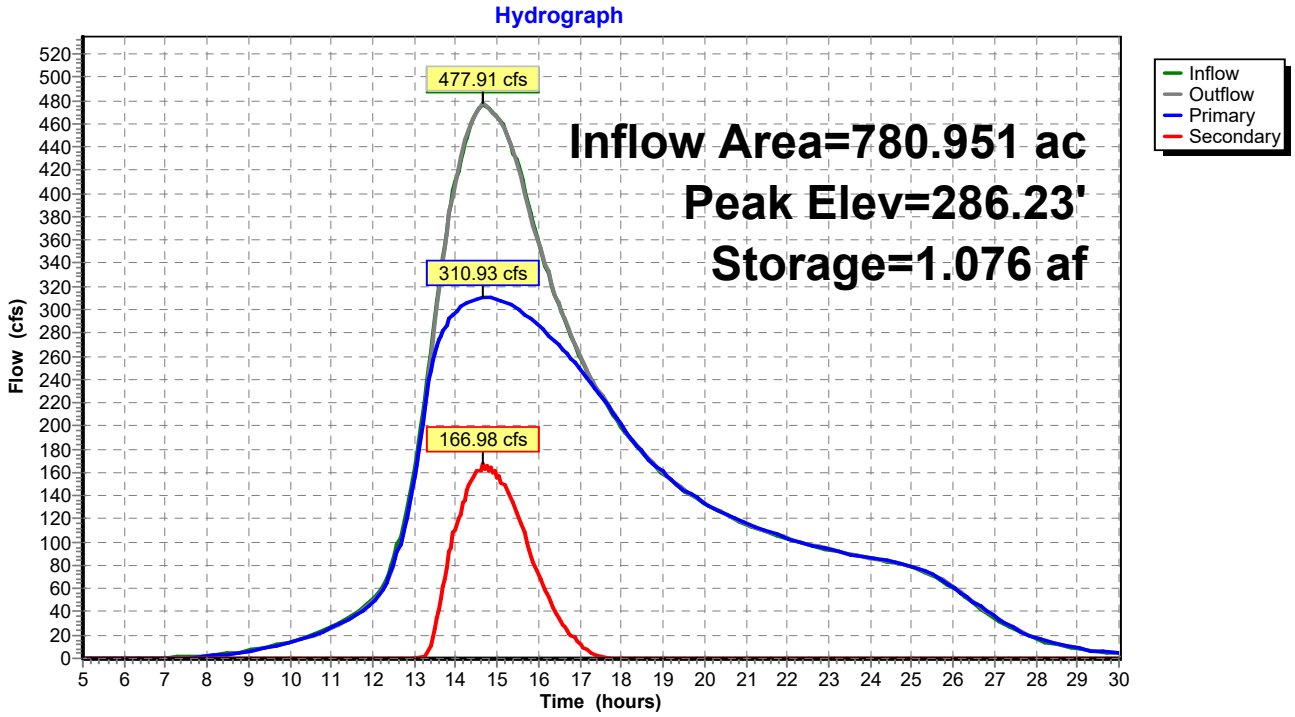
Pond 2P: Culvert 2



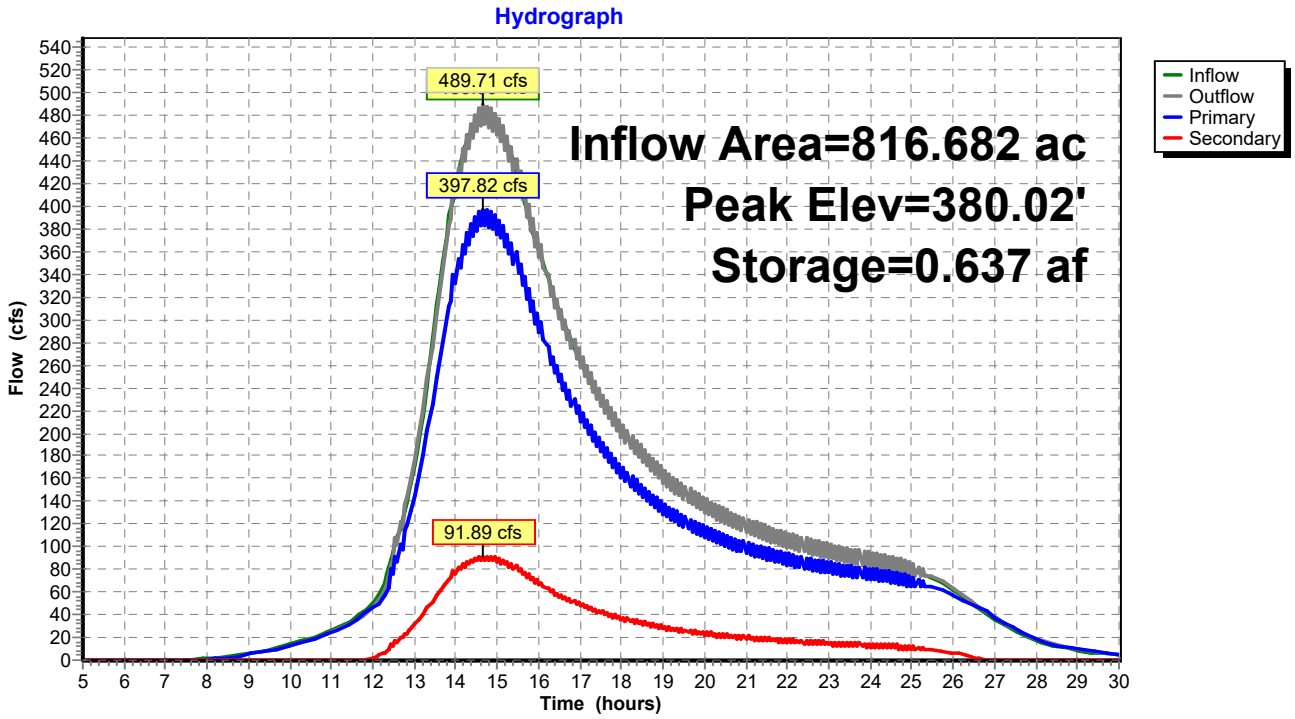
Pond 3P: Culvert 3



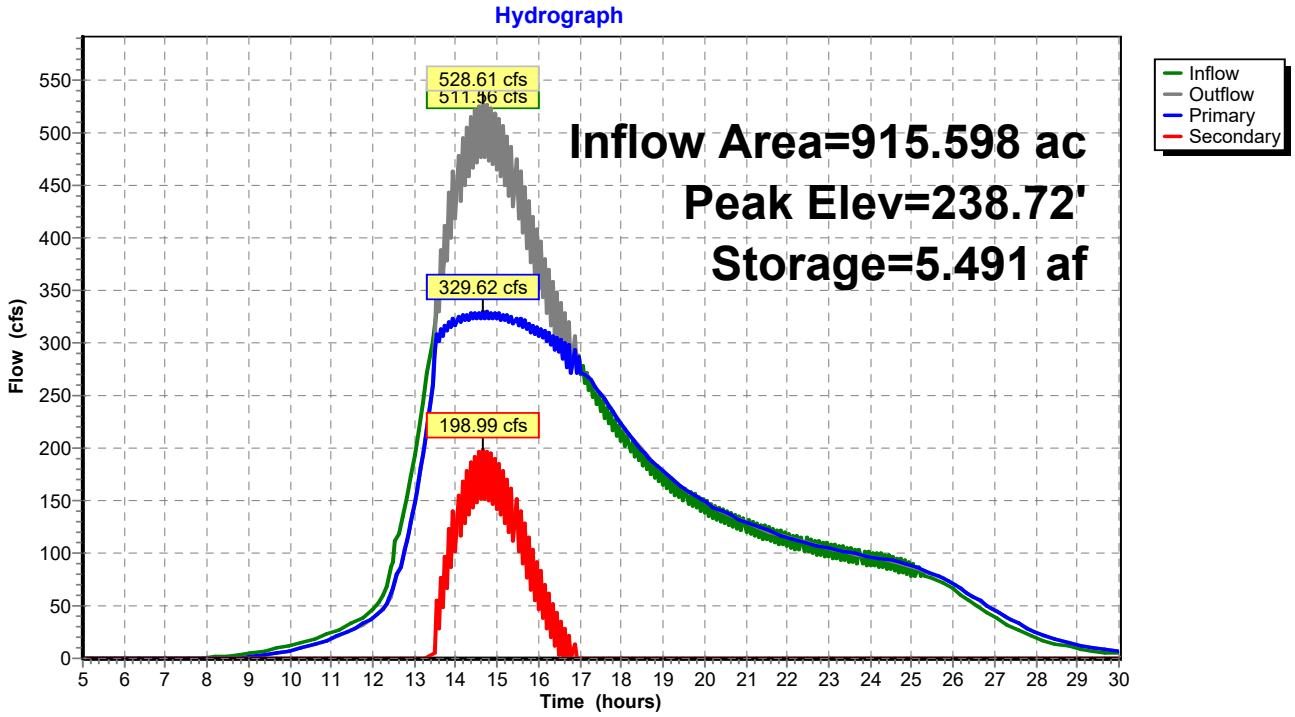
Pond 4P: Culvert 4



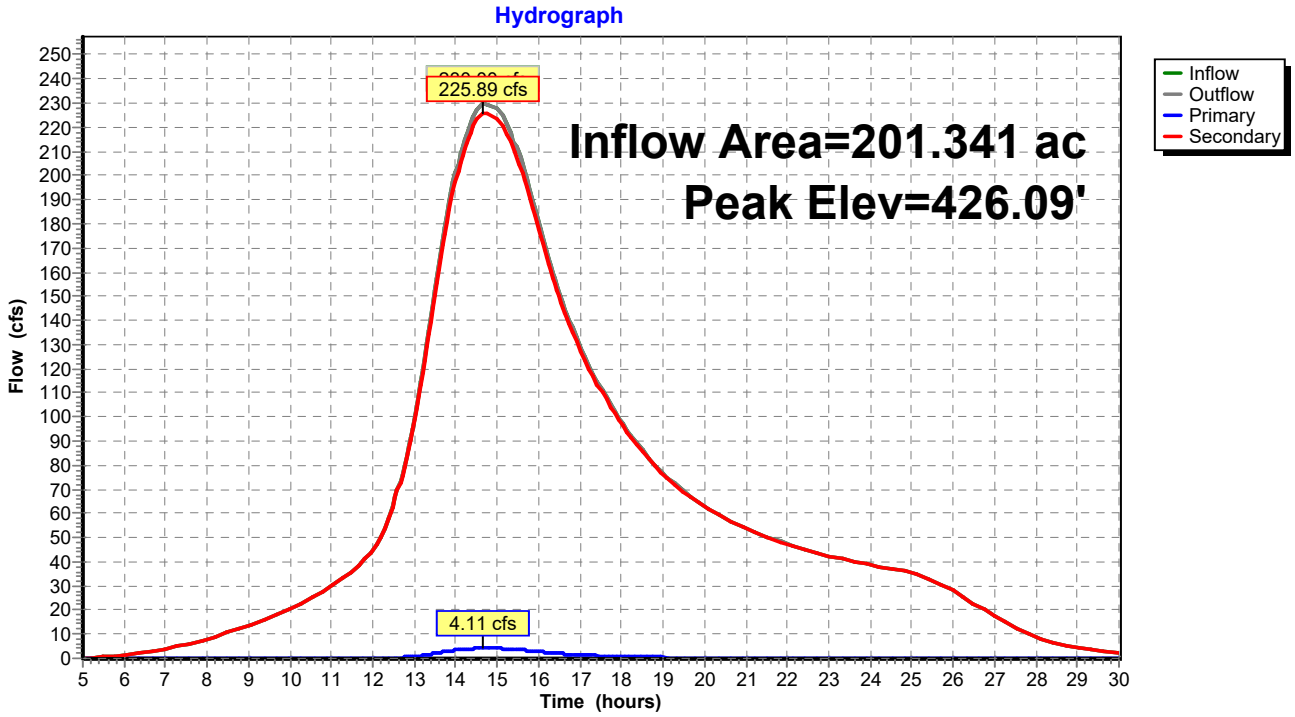
Pond 5P: Sand Culvert



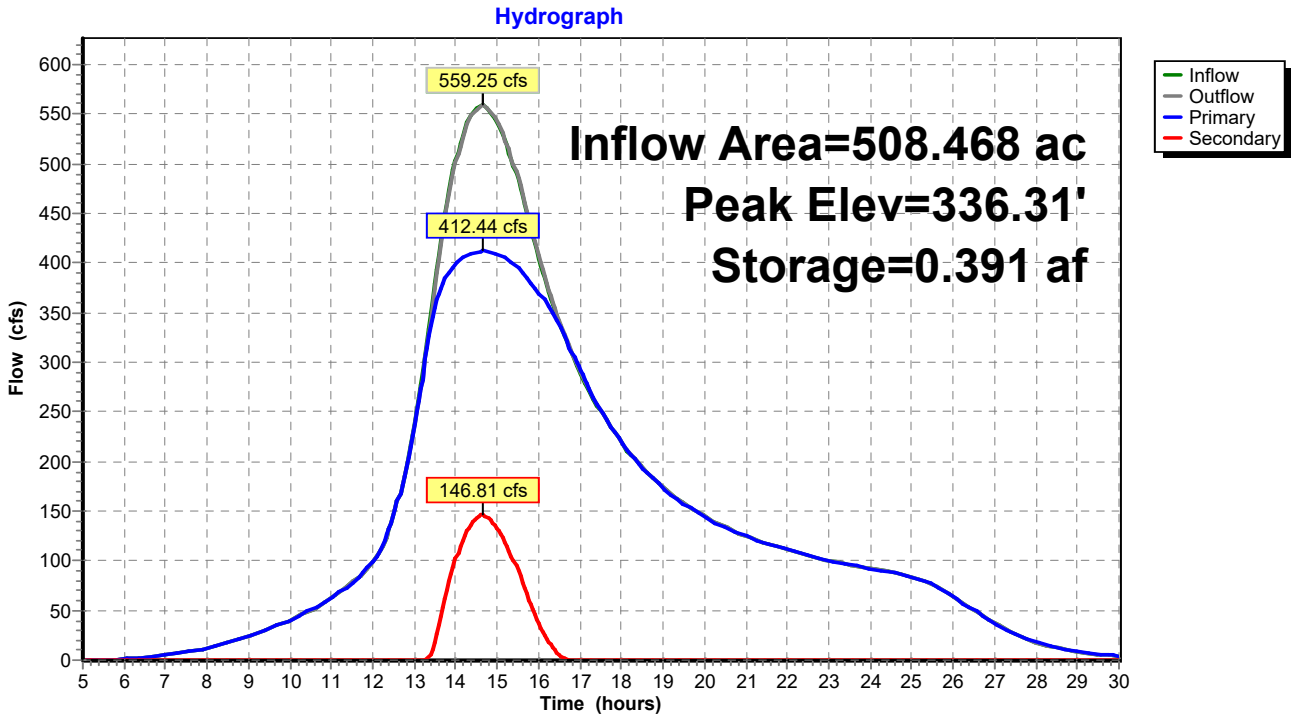
Pond 6P: 110 Culvert



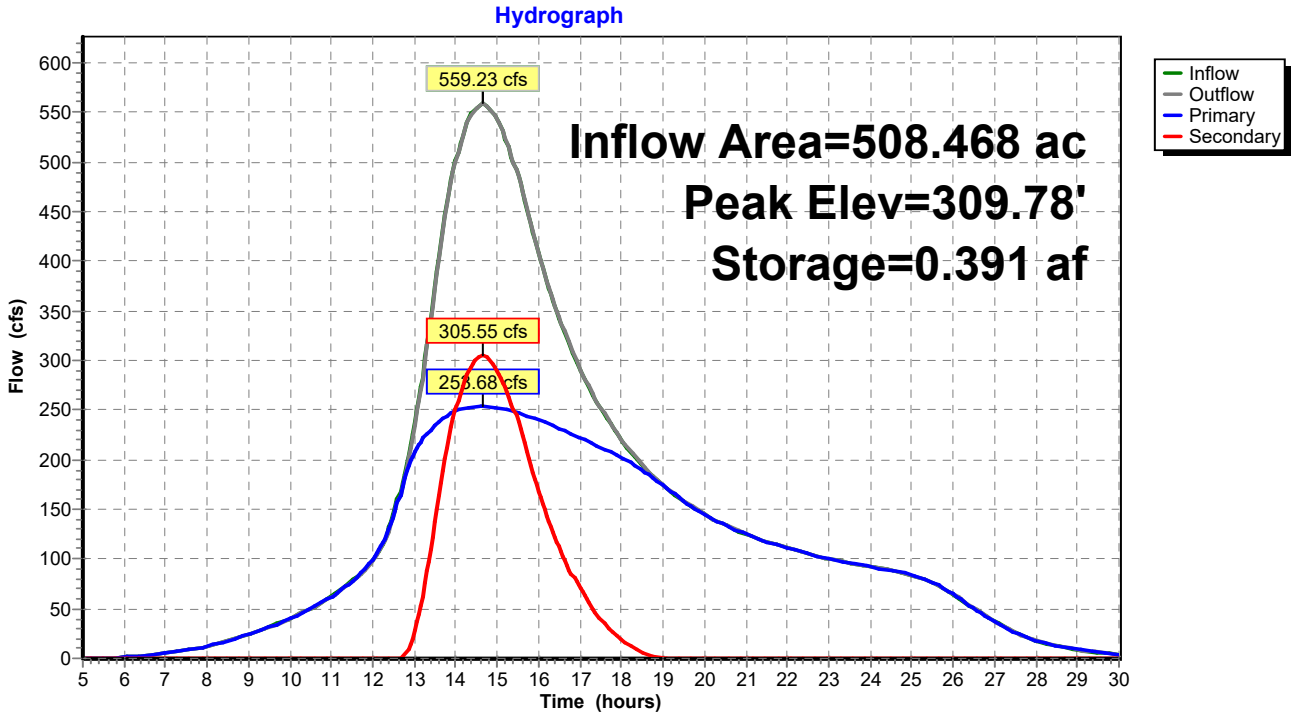
Pond 0P: 117 Culvert



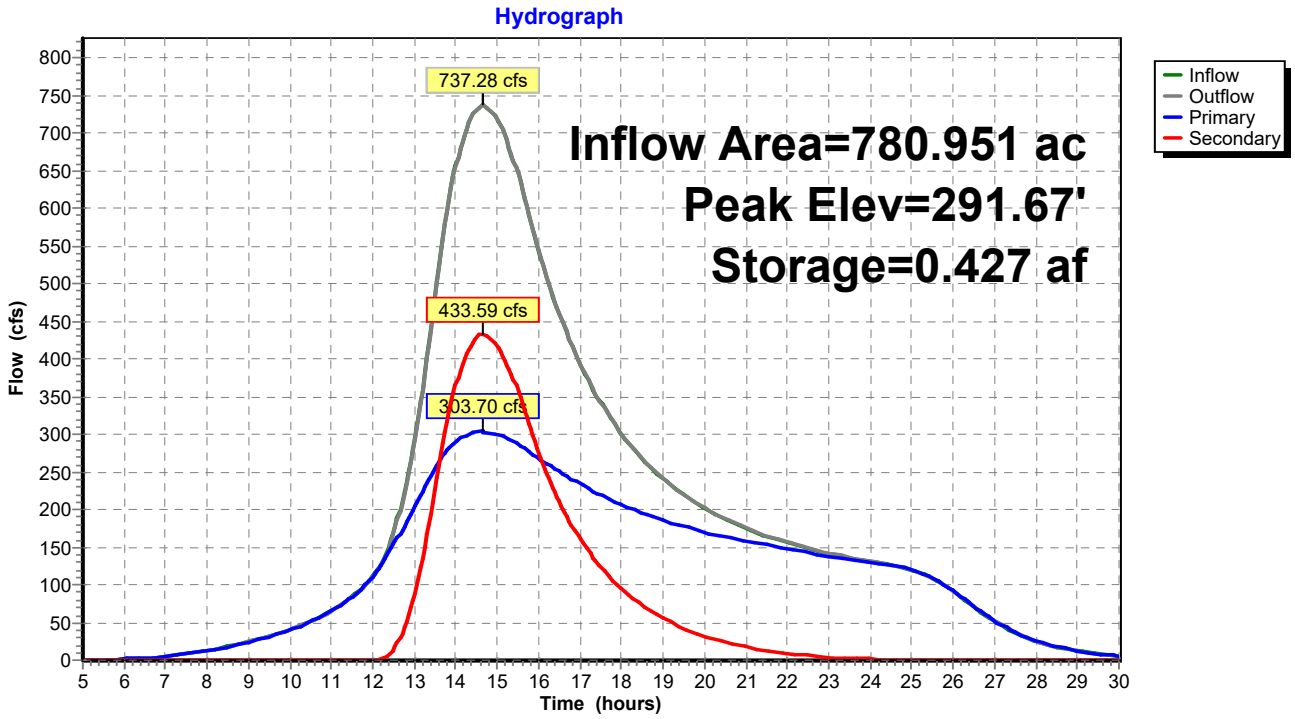
Pond 1P: Culvert 1



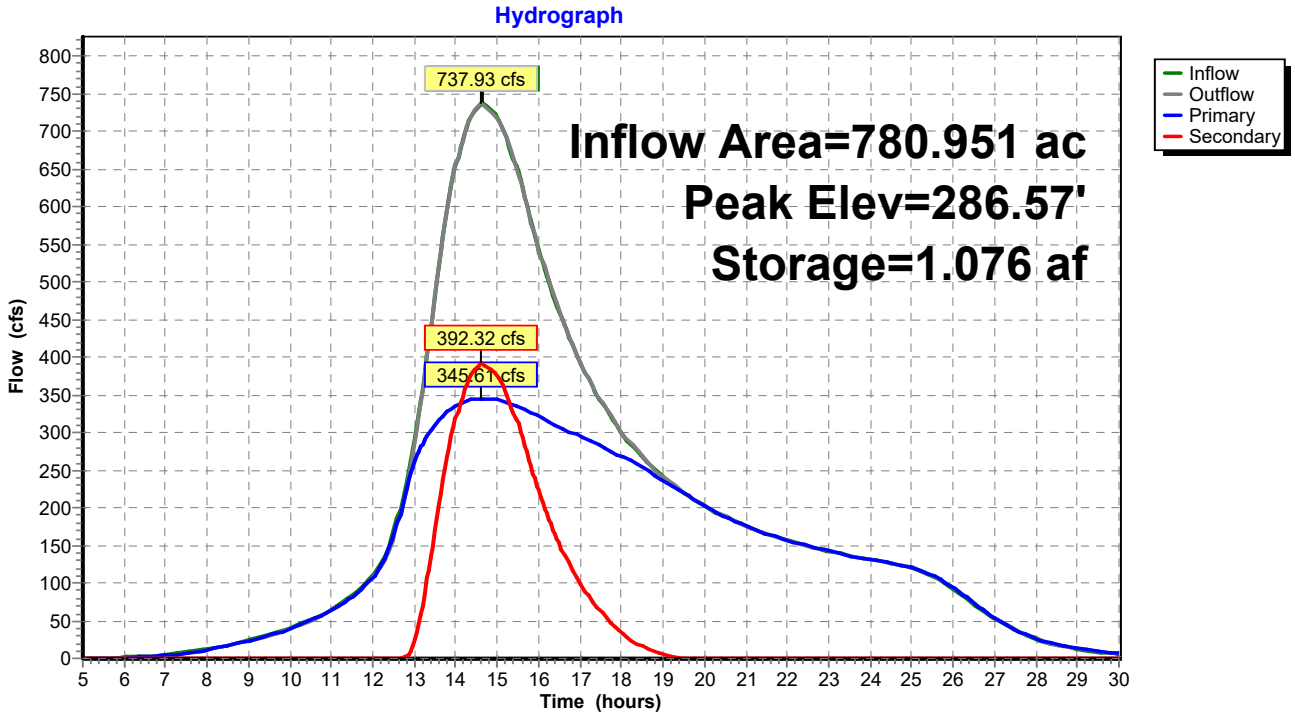
Pond 2P: Culvert 2



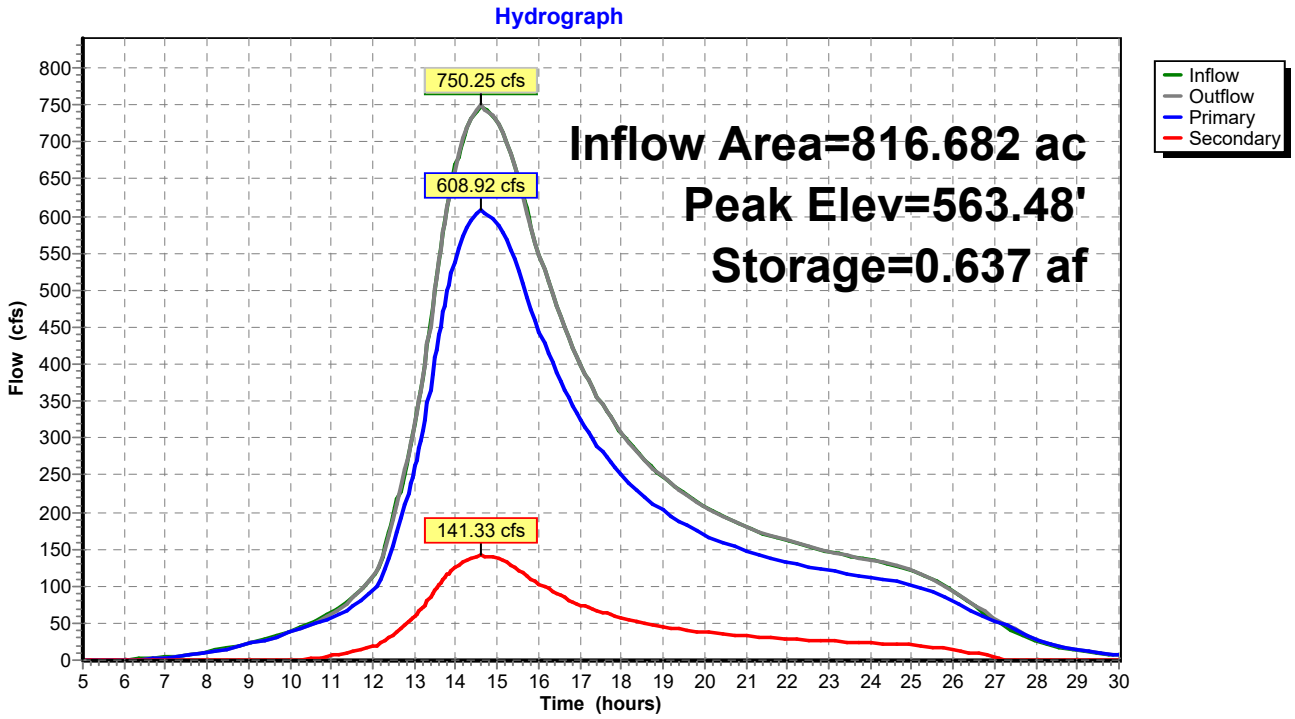
Pond 3P: Culvert 3



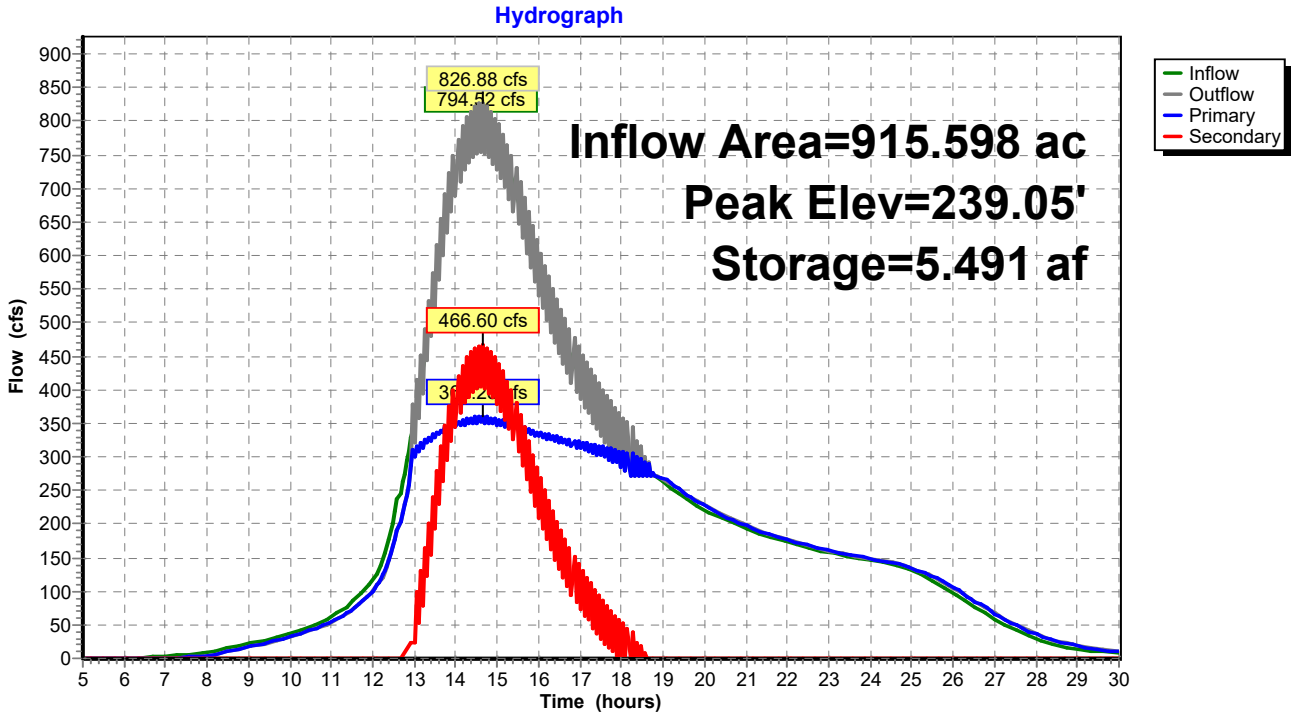
Pond 4P: Culvert 4

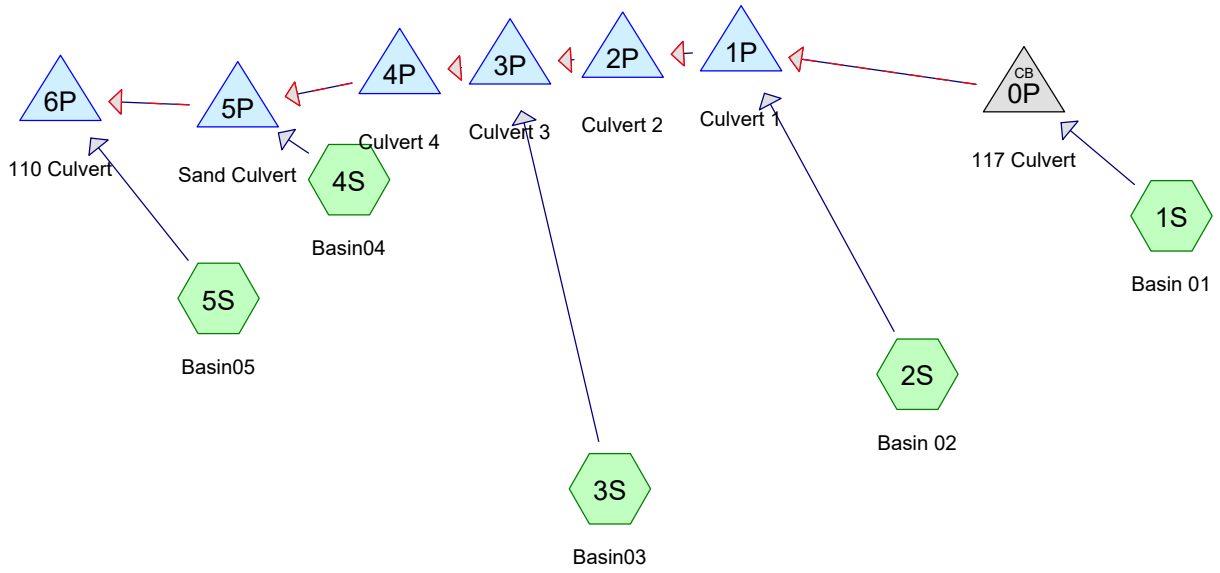


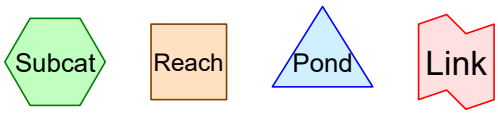
Pond 5P: Sand Culvert



Pond 6P: 110 Culvert







Routing Diagram for forbush_prop_alt2_bankfull
Prepared by Tighe & Bond, Printed 7/8/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

Summary for Pond 0P: 117 Culvert

[58] Hint: Peaked 0.78' above defined flood level

Inflow Area =	201.341 ac,	0.00% Impervious,	Inflow Depth >	2.51"	for 10-yr event
Inflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af	
Outflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.48 cfs @	14.86 hrs,	Volume=	0.086 af	
Secondary =	83.14 cfs @	14.86 hrs,	Volume=	42.085 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 425.63' @ 14.86 hrs
Flood Elev= 424.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	425.40'	**48.0" Round 48" RCP Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 425.40' / 414.80' S= 0.1631 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Secondary	424.85'	**Route 117, C= 3.27** Offset (feet) 0.00 2.48 2.49 2.50 2.57 5.48 5.79 6.17 8.46 9.09 9.85 11.45 12.38 13.54 14.43 15.68 17.23 17.41 18.98 20.40 20.92 22.28 23.38 24.61 25.58 26.36 28.29 28.87 29.34 31.98 32.17 32.33 33.79 35.31 35.47 35.67 38.29 38.77 39.36 41.28 42.07 43.04 44.26 45.37 46.73 47.24 48.66 50.23 50.42 51.96 53.21 54.11 55.26 56.19 57.80 58.56 59.18 61.48 61.86 62.16 65.02 65.14 65.16 65.17 68.13 68.45 68.86 71.11 71.75 72.55 74.09 75.05 76.24 77.07 78.35 79.92 80.06 81.65 83.04 83.61 84.94 86.02 87.30 88.24 89.01 90.99 91.54 91.99 94.67 94.84 94.97 96.24 97.96 98.14 98.36 100.94 101.44 102.05 103.92 104.73 105.74 106.91 108.03 109.43 109.89 111.33 112.87 113.11 114.63 115.86 116.80 117.77 117.93 118.99 120.11 121.21 122.39 123.27 124.49 125.80 126.44 127.77 129.20 129.61 131.06 132.61 132.78 134.34 135.95 136.01 137.62 139.11 139.42 140.90 142.28 142.82 144.18 145.45 146.23 147.47 148.62 149.63 150.75 151.79 153.03 154.03 154.96 156.44 157.31 158.12 159.84 160.59 161.29 163.25 163.88 164.46 166.65 167.16 167.63 170.06 170.44 170.80 173.46 173.72 173.97 176.87 177.00 177.13 180.27 180.29 180.30 180.74 183.47 183.57 183.67 186.64 186.85 187.08 189.81 190.13 190.48 192.98 193.42 193.89 196.14 196.70 197.29 199.31 199.98 200.70 202.48 203.26 204.10 205.65 206.54 207.51 208.82 209.83 210.91 211.99 213.11 214.31 215.15 216.39 217.72 218.32 219.67 221.12 221.49 222.95 224.53 224.66 226.24 227.83 227.93 229.52 231.00 231.34 232.80 234.16 234.74 236.08 237.33 238.15 239.36 240.50 241.55 242.65 243.67 244.95 245.93 246.84 248.36 249.21 250.00 251.76 252.49 253.17 255.17 255.78 256.34 258.57 259.06 259.51 261.98 262.34 262.68 265.38 265.62 265.85 268.79 268.90 269.01 272.09 272.18 275.35 275.47 275.59 278.52 278.75 279.00 281.69 282.03 282.40 284.86 285.31 285.81 288.02 288.60 289.21 291.19 291.88 292.62 294.36 295.16

296.02 297.53 298.44 299.42 300.70 301.73 302.83 303.87
305.01 306.23 307.03 308.29 309.64 310.20 311.57 313.04
313.37 314.85 316.45 316.54 318.14 319.71 319.85 321.42
322.88 323.26 324.70 326.04 326.66 327.98 329.21 330.06
331.26 332.38 333.47 334.55 335.55 336.87 337.83 338.72
340.28 341.11 341.89 343.68 344.39 345.05 347.09 347.67
348.22 350.49 350.96 351.39 353.90 354.24 354.56 357.30
357.52 357.73 360.70 360.80 360.89 363.45 364.06 364.09
364.11 367.23 367.37 367.51 370.40 370.65 370.92 373.57
373.93 374.32 376.74 377.21 377.73 379.90 380.50 381.13
383.07 383.78 384.54 386.24 387.06 387.94 389.41 390.34
391.34 392.58 393.41 393.66 394.35 395.45 396.73 397.52
399.11 400.94 401.39 401.49 401.66 403.87 405.25 406.25
407.87 408.64 409.11 411.02 411.14 412.97 413.40 414.09
415.78 416.83 418.16 420.30 420.54 420.70 421.35 422.93
424.56 425.31 426.51 427.69 428.42 429.34 430.41 431.13
431.77 433.89 434.41 434.88 437.38 437.70 437.99 440.86
440.99 441.10 443.02 444.20 444.27 444.35 447.31 447.56
447.83 450.42 450.84 451.32 453.53 454.13 454.80 456.63
457.41 458.28 459.74 460.70 461.77 462.85 463.98 465.25
465.96 467.27 468.74 469.07 470.55 472.17 472.22 473.84
475.28 475.71 477.12 478.39 479.19 480.41 481.50 482.68
483.70 484.60 486.16 486.98 487.17 488.08 489.01 490.43
491.60 493.26 493.89 494.20 495.13 496.79 497.34 498.45
499.38 500.80 501.98 503.64 504.26 504.57 505.50 507.16
507.72 508.82 509.76 511.17 512.35 514.01 514.63 514.94
515.88 517.53 518.09 519.19 520.13 521.54 522.72 524.38
525.00 525.31 526.25 527.91 528.46 529.57 530.50 531.92
533.09 534.75 535.37 535.69 536.62 538.28 538.83 539.94
540.87 542.29 543.47 545.12 545.75 546.06 546.99 547.15
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582.45 582.72 583.24 585.16 586.13 587.59 589.11 589.81
590.03 590.48

Height (feet) 11.60 11.60 11.60 11.60 11.59 11.51 11.50 11.49
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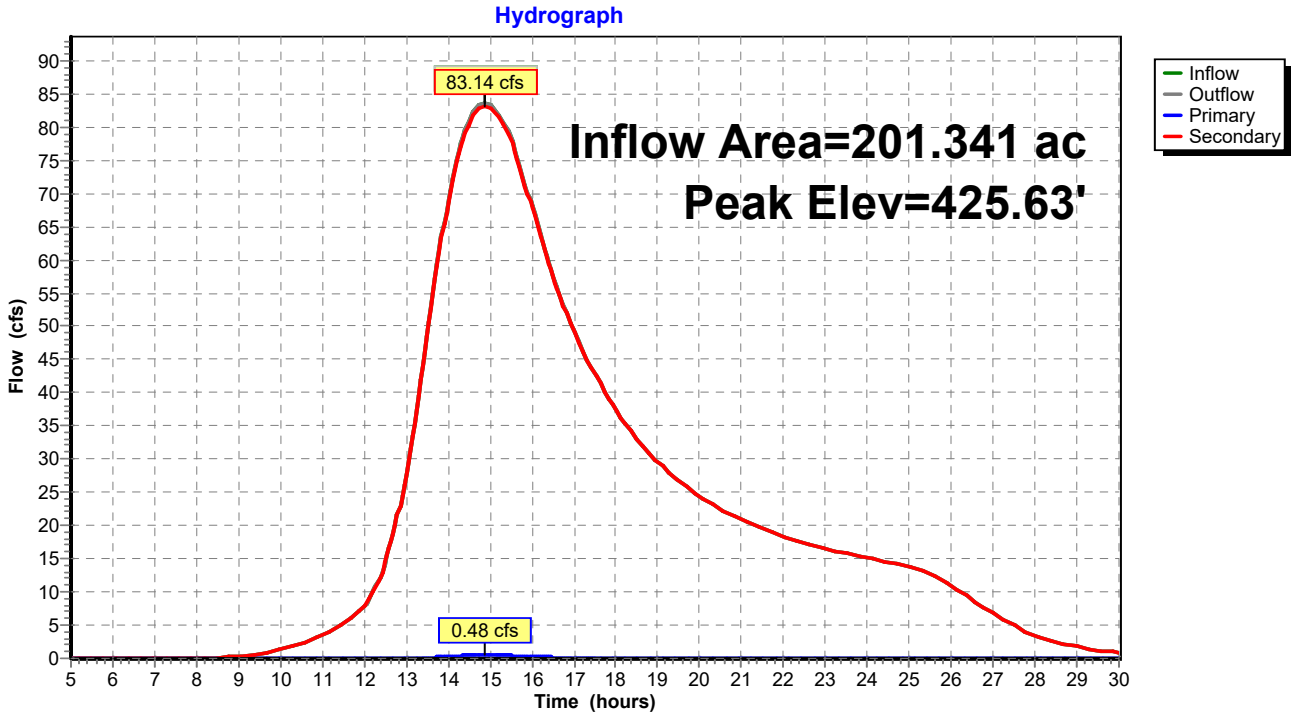
11.22 11.18 11.17 11.13 11.11 11.09 11.07 11.06 11.03 11.02
11.01 10.96 10.95 10.95 10.90 10.85 10.85 10.84 10.75 10.74
10.73 10.69 10.67 10.64 10.63 10.60 10.55 10.55 10.50 10.45
10.45 10.41 10.36 10.35 10.31 10.28 10.23 10.21 10.20 10.13
10.12 10.11 10.06 10.05 10.05 10.05 9.97 9.96 9.95 9.88 9.87
9.85 9.83 9.81 9.78 9.77 9.74 9.69 9.69 9.64 9.57 9.58 9.52
9.49 9.46 9.43 9.42 9.36 9.36 9.35 9.28 9.28 9.28 9.24 9.19
9.18 9.18 9.10 9.09 9.07 9.01 8.98 8.95 8.91 8.88 8.84 8.84
8.80 8.76 8.75 8.71 8.68 8.69 8.67 8.66 8.62 8.59 8.55 8.50
8.49 8.44 8.41 8.39 8.35 8.31 8.29 8.26 8.22 8.21 8.18 8.14
8.14 8.11 8.05 8.05 8.00 7.95 7.94 7.89 7.87 7.87 7.85 7.84
7.82 7.81 7.79 7.73 7.70 7.65 7.58 7.53 7.49 7.44 7.41 7.37
7.30 7.27 7.25 7.19 7.17 7.17 7.10 7.09 7.07 6.98 6.97 6.96
6.86 6.85 6.84 6.70 6.70 6.70 6.69 6.60 6.59 6.59 6.59 6.58

6.58	6.55	6.55	6.54	6.45	6.44	6.42	6.31	6.29	6.27	6.19	6.17
6.16	6.09	6.09	6.07	6.00	5.98	5.94	5.90	5.86	5.84	5.80	5.78
5.74	5.71	5.68	5.62	5.60	5.54	5.50	5.49	5.45	5.41	5.42	5.37
5.31	5.30	5.25	5.21	5.21	5.18	5.16	5.18	5.17	5.12	5.15	5.10
5.07	5.02	4.98	4.96	4.88	4.86	4.84	4.78	4.76	4.74	4.70	4.68
4.67	4.64	4.62	4.61	4.58	4.57	4.56	4.51	4.50	4.48	4.39	4.38
4.37	4.27	4.27	4.26	4.20	4.19	4.15	4.15	4.15	4.06	4.05	4.04
3.94	3.93	3.91	3.84	3.82	3.80	3.73	3.71	3.69	3.63	3.60	3.57
3.52	3.48	3.46	3.39	3.36	3.36	3.32	3.32	3.29	3.29	3.27	3.19
3.17	3.10	3.08	3.02	3.01	2.98	2.97	2.94	2.88	2.89	2.84	2.79
2.78	2.73	2.70	2.71	2.68	2.64	2.64	2.60	2.54	2.53	2.48	2.45
2.42	2.39	2.37	2.34	2.33	2.32	2.28	2.27	2.25	2.20	2.18	2.16
2.07	2.05	2.04	1.94	1.93	1.92	1.85	1.84	1.83	1.77	1.77	1.76
1.69	1.69	1.69	1.64	1.63	1.63	1.63	1.58	1.57	1.57	1.48	1.47
1.46	1.37	1.36	1.34	1.31	1.29	1.28	1.23	1.22	1.21	1.16	1.14
1.13	1.08	1.06	1.04	1.02	1.01	1.00	1.02	1.01	1.01	1.00	0.97
0.93	0.90	0.82	0.73	0.71	0.71	0.70	0.60	0.57	0.54	0.49	0.47
0.46	0.39	0.38	0.31	0.29	0.27	0.22	0.21	0.19	0.15	0.14	0.14
0.12	0.10	0.05	0.04	0.01	0.00	0.00	0.01	0.03	0.04	0.06	0.13
0.14	0.14	0.23	0.23	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26
0.23	0.23	0.23	0.19	0.19	0.19	0.21	0.21	0.24	0.28	0.32	0.36
0.28	0.32	0.35	0.36	0.39	0.44	0.48	0.53	0.64	0.71	0.82	0.92
0.93	1.03	1.13	1.16	1.27	1.35	1.38	1.46	1.57	1.64	1.74	1.83
1.94	2.02	2.03	2.07	2.14	2.19	2.23	2.29	2.31	2.32	2.41	2.54
2.56	2.60	2.65	2.69	2.72	2.87	2.90	2.92	3.01	3.07	3.12	3.26
3.24	3.45	3.49	3.74	3.78	3.79	3.89	3.98	4.06	4.16	4.14	4.29
4.37	4.54	4.59	4.62	4.67	4.73	4.76	4.78	4.69	4.75	4.87	5.13
5.20	5.24	5.38	5.59	5.65	5.77	5.89	6.05	6.13	6.38	6.44	6.46
6.56	6.56	6.63	6.72	6.79	6.95	7.04	7.08	7.15	7.21	7.34	7.52
7.72	7.88	7.93	8.03	8.23	8.41	8.63	8.74	8.88	8.93	9.01	9.21
9.31	9.48	9.62	9.72	9.75	9.82	10.02	10.12	10.29	10.46	10.55	
10.59	10.65	10.88	11.00	11.18	11.40	11.49	11.52	11.60			

Primary OutFlow Max=0.46 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**1=48" RCP Culvert** (Inlet Controls 0.46 cfs @ 1.62 fps)

Secondary OutFlow Max=82.70 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**2=Route 117** (Weir Controls 82.70 cfs @ 2.33 fps)

Pond 0P: 117 Culvert



Hydrograph for Pond 0P: 117 Culvert

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	424.85	0.00	0.00	0.00
5.50	0.00	424.85	0.00	0.00	0.00
6.00	0.00	424.85	0.00	0.00	0.00
6.50	0.00	424.85	0.00	0.00	0.00
7.00	0.00	424.85	0.00	0.00	0.00
7.50	0.00	424.85	0.00	0.00	0.00
8.00	0.02	424.85	0.02	0.00	0.02
8.50	0.10	424.86	0.10	0.00	0.10
9.00	0.30	424.89	0.30	0.00	0.30
9.50	0.68	424.95	0.68	0.00	0.68
10.00	1.31	424.99	1.31	0.00	1.31
10.50	2.22	425.02	2.22	0.00	2.22
11.00	3.48	425.07	3.48	0.00	3.48
11.50	5.20	425.10	5.20	0.00	5.20
12.00	7.77	425.14	7.77	0.00	7.77
12.50	14.40	425.22	14.40	0.00	14.40
13.00	27.87	425.33	27.87	0.00	27.87
13.50	48.49	425.46	48.49	0.06	48.44
14.00	69.02	425.56	69.02	0.25	68.77
14.50	**81.14**	**425.62**	**81.14**	**0.44**	**80.69**
15.00	**83.38**	**425.63**	**83.38**	**0.48**	**82.91**
15.50	78.23	425.60	78.23	0.40	77.83
16.00	68.10	425.56	68.10	0.24	67.86
16.50	57.62	425.51	57.62	0.13	57.49
17.00	49.39	425.46	49.39	0.06	49.32
17.50	42.79	425.43	42.79	0.01	42.78
18.00	37.42	425.40	37.42	0.00	37.42
18.50	33.09	425.37	33.09	0.00	33.09
19.00	29.58	425.35	29.58	0.00	29.58
19.50	26.71	425.33	26.71	0.00	26.71
20.00	24.37	425.31	24.37	0.00	24.37
20.50	22.46	425.29	22.46	0.00	22.46
21.00	20.85	425.28	20.85	0.00	20.85
21.50	19.51	425.27	19.51	0.00	19.51
22.00	18.36	425.26	18.36	0.00	18.36
22.50	17.39	425.25	17.39	0.00	17.39
23.00	16.53	425.24	16.53	0.00	16.53
23.50	15.76	425.23	15.76	0.00	15.76
24.00	15.05	425.23	15.05	0.00	15.05
24.50	14.45	425.22	14.45	0.00	14.45
25.00	13.73	425.22	13.73	0.00	13.73
25.50	12.64	425.21	12.64	0.00	12.64
26.00	10.94	425.19	10.94	0.00	10.94
26.50	8.86	425.16	8.86	0.00	8.86
27.00	6.76	425.13	6.76	0.00	6.76
27.50	4.91	425.10	4.91	0.00	4.91
28.00	3.45	425.07	3.45	0.00	3.45
28.50	2.44	425.03	2.44	0.00	2.44
29.00	1.73	425.00	1.73	0.00	1.73
29.50	1.23	424.98	1.23	0.00	1.23
30.00	0.87	424.97	0.87	0.00	0.87

Summary for Pond 1P: Culvert 1

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Outflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af, Atten= 0%, Lag= 0.0 min
Primary = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 332.25' @ 14.67 hrs Surf.Area= 0.000 ac Storage= 0.002 af
Flood Elev= 334.80' Surf.Area= 0.000 ac Storage= 0.098 af

Plug-Flow detention time= 0.0 min calculated for 89.672 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (1,054.6 - 1,054.6)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	3.406 af	**Custom Stage Data** Listed below

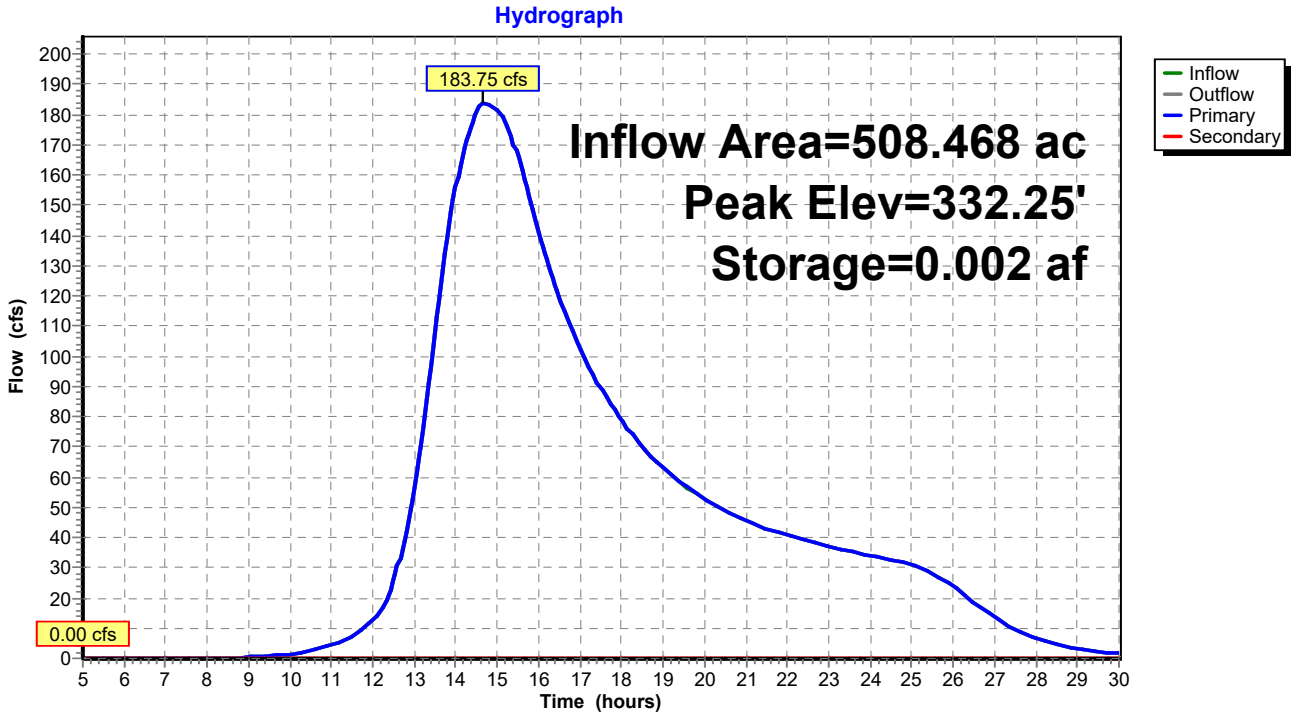
Elevation (feet)	Cum.Store (acre-feet)
329.70	0.000
333.00	0.003
334.00	0.024
335.00	0.116
336.00	0.309
337.00	0.575
338.00	0.886
339.00	1.252
340.00	1.773
341.00	2.503
342.00	3.406

Device	Routing	Invert	Outlet Devices
#1	Secondary	334.80'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.00 80.00 Height (feet) 2.00 0.00 2.00
#2	Primary	329.10'	**168.0" W x 48.0" H Box Prop 14ft Box Culvert** L= 40.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.10' / 329.00' S= 0.0025 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 56.00 sf

Primary OutFlow Max=183.64 cfs @ 14.67 hrs HW=332.25' (Free Discharge)
└─**2=Prop 14ft Box Culvert** (Barrel Controls 183.64 cfs @ 5.56 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=329.70' (Free Discharge)
└─**1=Forbush Mill Road** (Controls 0.00 cfs)

Pond 1P: Culvert 1



Hydrograph for Pond 1P: Culvert 1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	329.70	0.00	0.00	**0.00**
5.50	0.00	0.000	329.70	0.00	0.00	0.00
6.00	0.00	0.000	329.70	0.00	0.00	0.00
6.50	0.00	0.000	329.70	0.00	0.00	0.00
7.00	0.00	0.000	329.70	0.00	0.00	0.00
7.50	0.00	0.000	329.70	0.00	0.00	0.00
8.00	0.02	0.000	329.70	0.02	0.02	0.00
8.50	0.10	0.000	329.70	0.10	0.10	0.00
9.00	0.30	0.000	329.70	0.30	0.30	0.00
9.50	0.69	0.000	329.70	0.69	0.69	0.00
10.00	1.35	0.000	329.71	1.35	1.35	0.00
10.50	2.47	0.000	329.72	2.47	2.47	0.00
11.00	4.29	0.000	329.73	4.29	4.29	0.00
11.50	7.27	0.000	329.75	7.27	7.27	0.00
12.00	12.35	0.000	329.79	12.35	12.35	0.00
12.50	25.57	0.000	330.00	25.56	25.56	0.00
13.00	57.29	0.001	330.59	57.28	57.28	0.00
13.50	107.32	0.001	331.32	107.30	107.30	0.00
14.00	155.84	0.002	331.93	155.83	155.83	0.00
14.50	**180.37**	**0.002**	**332.21**	**180.37**	**180.37**	0.00
15.00	**181.34**	**0.002**	**332.22**	**181.34**	**181.34**	0.00
15.50	165.73	0.002	332.04	165.73	165.73	0.00
16.00	141.03	0.002	331.75	141.04	141.04	0.00
16.50	119.55	0.002	331.48	119.55	119.55	0.00
17.00	102.86	0.001	331.26	102.86	102.86	0.00
17.50	89.37	0.001	331.08	89.38	89.38	0.00
18.00	78.61	0.001	330.92	78.61	78.61	0.00
18.50	69.95	0.001	330.79	69.96	69.96	0.00
19.00	62.95	0.001	330.68	62.95	62.95	0.00
19.50	57.27	0.001	330.59	57.27	57.27	0.00
20.00	52.67	0.001	330.52	52.67	52.67	0.00
20.50	48.88	0.001	330.45	48.88	48.88	0.00
21.00	45.70	0.001	330.40	45.70	45.70	0.00
21.50	43.02	0.001	330.35	43.02	43.02	0.00
22.00	40.68	0.001	330.31	40.68	40.68	0.00
22.50	38.63	0.001	330.27	38.63	38.63	0.00
23.00	36.85	0.000	330.23	36.85	36.85	0.00
23.50	35.33	0.000	330.20	35.33	35.33	0.00
24.00	33.96	0.000	330.18	33.96	33.96	0.00
24.50	32.67	0.000	330.15	32.67	32.67	0.00
25.00	30.95	0.000	330.12	30.95	30.95	0.00
25.50	28.06	0.000	330.06	28.07	28.07	0.00
26.00	23.68	0.000	329.96	23.68	23.68	0.00
26.50	18.55	0.000	329.85	18.56	18.56	0.00
27.00	13.65	0.000	329.80	13.65	13.65	0.00
27.50	9.58	0.000	329.77	9.58	9.58	0.00
28.00	6.58	0.000	329.75	6.59	6.59	0.00
28.50	4.58	0.000	329.73	4.58	4.58	0.00
29.00	3.18	0.000	329.72	3.19	3.19	0.00
29.50	2.21	0.000	329.72	2.21	2.21	0.00
30.00	1.53	0.000	329.71	1.53	1.53	0.00

Summary for Pond 2P: Culvert 2

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Outflow = 183.67 cfs @ 14.70 hrs, Volume= 89.852 af, Atten= 0%, Lag= 1.8 min
Primary = 183.67 cfs @ 14.70 hrs, Volume= 89.852 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 308.13' @ 14.70 hrs Surf.Area= 0.000 ac Storage= 0.083 af
Flood Elev= 308.70' Surf.Area= 0.000 ac Storage= 0.158 af

Plug-Flow detention time= 0.2 min calculated for 89.672 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (1,054.8 - 1,054.6)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	1.350 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
306.00	0.000
307.00	0.013
308.00	0.066
309.00	0.198
310.00	0.445
311.00	0.844
312.00	1.350

Device	Routing	Invert	Outlet Devices
#1	Primary	305.35'	**168.0" W x 48.0" H Box Prop 14ft Box Culvert** L= 40.0' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 305.35' / 304.10' S= 0.0313 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 56.00 sf
#2	Secondary	308.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 1.57 2.55 3.95 6.16 6.33 6.43 6.88 8.70 10.30 11.08 12.32 13.46 14.18 15.84 17.32 17.77 18.05 18.22 18.48 20.60 21.93 22.98 24.64 25.35 25.80 27.73 27.79 29.68 30.11 30.80 32.49 33.56 34.87 36.95 37.25 37.43 38.25 39.63 41.31 42.00 43.11 44.38 45.18 46.76 48.72 49.06 49.14 49.26 51.52 52.94 53.90 55.42 56.27 56.81 58.65 59.18 60.69 61.03 61.58 63.41 64.56 65.79 67.73 68.17 68.44 69.65 70.54 72.32 72.92 73.89 75.30 76.19 77.68 80.04 80.06 80.07 80.11 82.44 83.94 84.82 86.20 87.19 87.82 89.57 90.58 91.70 91.95 92.36 94.33 95.57 96.71 98.51 99.09 99.37 99.45 100.73 101.49 103.20 103.90 105.16 106.31 106.96 108.73 109.23 110.72 111.14 111.89 113.55 114.47 115.96 117.73 118.23 118.37 118.62 120.78 121.98 123.19 125.35 125.60 125.74 126.23 128.01 129.50 130.42 132.08 132.83 133.25 134.73 135.24 137.01 137.65 138.81 140.07 140.77 142.48 143.23 144.52 144.89 145.54 147.30 148.28 149.71 151.74 152.03 152.12 152.27 154.53 155.79 156.94 159.00 159.35 159.55 160.24 161.76

163.30	164.17	165.73	166.58	167.06	168.74	168.99	170.82
171.41	172.46	173.82	174.57	176.23	177.24	178.33	178.64
179.19	181.05	182.09	183.46	185.74	185.84	185.87	185.92
188.28	189.60	190.69	192.65	193.10	193.35	193.84	194.06
195.69	196.80	198.37	198.73	200.20	201.04	203.39	203.60
203.71	204.14	206.39	207.00	208.06	209.06	210.40	211.73
212.73	213.79	214.40	216.65	217.08	217.19	217.40	219.75
220.59	222.06	222.42	223.99	225.09	226.73	227.39	227.77
229.16	230.44	230.79	231.40	233.11	234.19	235.79	236.07
237.59	238.46	240.73	240.99	241.13	241.66	243.80	244.38
245.40	246.48	247.78	249.15	250.07	251.18	251.82	254.17
254.49	254.58	254.73	254.80	256.30	257.73	257.89	258.09
260.70	261.19	261.80	263.67	264.49	265.51	266.64	267.79
269.22	269.61	271.09	272.58	272.94	274.39	275.55	276.65
277.69	278.52	280.36	280.99	281.49	284.08	284.29	284.46
286.00	287.43	287.59	287.79	290.40	290.89	291.50	293.37
294.19	295.21	296.34	297.49	298.93	299.31	300.79	301.12
302.18	302.97	304.17	304.88	307.50	307.55	307.58	307.68
310.28	310.93	312.03	312.98	314.32	315.68	316.56	317.70
318.38	321.05	321.08	321.08	321.09	323.78	324.47	325.62
326.48	327.85	329.18	330.16	331.23	331.88	334.41	334.58
334.62	334.69	337.28	338.00	339.22	339.98	341.38	342.68
343.75	344.77	345.38	347.78	348.08	348.15	348.28	350.78
351.53	352.81	353.23					

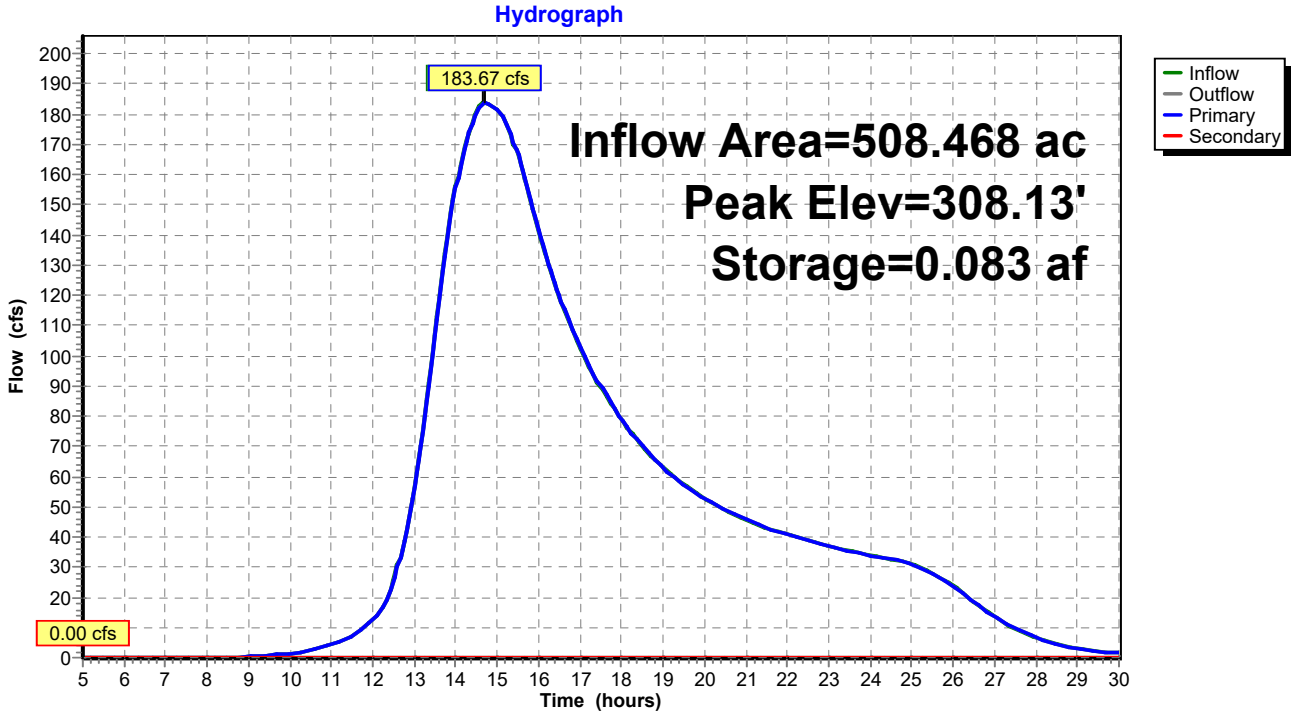
Height (feet)	3.08	2.98	2.95	2.91	2.91	2.91	2.91	2.92	2.94	2.94	
2.93	2.91	2.87	2.86	2.82	2.79	2.78	2.77	2.77	2.76	2.71	2.68
2.65	2.62	2.60	2.60	2.55	2.58	2.55	2.54	2.54	2.49	2.48	2.44
2.41	2.40	2.40	2.39	2.34	2.35	2.34	2.33	2.29	2.29	2.24	2.21
2.20	2.20	2.20	2.14	2.11	2.08	2.06	2.03	2.02	1.99	1.99	1.97
1.96	1.97	1.98	1.98	1.97	1.95	1.94	1.93	1.90	1.83	1.81	1.79
1.78	1.74	1.74	1.71	1.68	1.68	1.68	1.68	1.62	1.60	1.58	1.56
1.54	1.53	1.51	1.50	1.49	1.49	1.49	1.45	1.45	1.42	1.43	1.42
1.41	1.41	1.39	1.32	1.31	1.29	1.28	1.24	1.23	1.18	1.21	1.19
1.18	1.18	1.15	1.12	1.09	1.07	1.06	1.05	1.05	1.01	1.00	0.98
0.98	0.98	0.98	0.98	0.97	0.97	0.96	1.00	1.00	1.01	1.01	1.00
1.01	1.00	0.99	0.96	0.96	0.93	0.94	0.92	0.91	0.90	0.87	0.87
0.84	0.84	0.83	0.83	0.83	0.81	0.80	0.78	0.76	0.75	0.75	0.74
0.68	0.67	0.64	0.62	0.60	0.59	0.58	0.55	0.55	0.56	0.56	0.55
0.55	0.53	0.53	0.52	0.52	0.52	0.49	0.48	0.48	0.47	0.47	0.47
0.47	0.44	0.44	0.43	0.44	0.44	0.44	0.44	0.44	0.41	0.41	0.40
0.40	0.39	0.39	0.36	0.36	0.36	0.36	0.35	0.35	0.34	0.38	0.37
0.44	0.40	0.44	0.46	0.47	0.47	0.47	0.47	0.44	0.42	0.38	0.37
0.32	0.30	0.27	0.25	0.27	0.27	0.31	0.30	0.31	0.49	0.50	0.60
0.61	0.70	0.69	0.61	0.60	0.60	0.56	0.45	0.40	0.37	0.38	0.33
0.22	0.35	0.29	0.25	0.40	0.41	0.41	0.41	0.42	0.53	0.62	0.63
0.64	0.79	0.81	0.79	0.87	0.84	0.81	0.81	0.77	0.79	0.70	0.73
0.73	0.74	0.74	0.79	0.74	0.78	0.81	0.79	0.81	0.81	0.92	0.92
0.92	0.99	1.03	1.04	1.06	1.09	1.13	1.18	1.21	1.29	1.31	1.21
1.23	1.11	1.00	0.88	0.85	0.73	0.68	0.56	0.50	0.29	0.29	0.29
0.28	0.14	0.12	0.09	0.11	0.07	0.08	0.09	0.10	0.10	0.14	0.14
0.14	0.14	0.16	0.16	0.15	0.15	0.14	0.13	0.11	0.11	0.10	0.07
0.07	0.06	0.06	0.01	0.00	0.05	0.05	0.12	0.36	0.62	0.81	0.98

1.66 1.75 1.77 1.80 2.50 2.72 3.08 3.08

Primary OutFlow Max=183.66 cfs @ 14.70 hrs HW=308.13' (Free Discharge)
└─**1=Prop 14ft Box Culvert** (Inlet Controls 183.66 cfs @ 4.72 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=306.00' (Free Discharge)
└─**2=Forbush Mill Road** (Controls 0.00 cfs)

Pond 2P: Culvert 2



Hydrograph for Pond 2P: Culvert 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	306.00	0.00	0.00	**0.00**
5.50	0.00	0.000	306.00	0.00	0.00	0.00
6.00	0.00	0.000	306.00	0.00	0.00	0.00
6.50	0.00	0.000	306.00	0.00	0.00	0.00
7.00	0.00	0.000	306.00	0.00	0.00	0.00
7.50	0.00	0.000	306.00	0.00	0.00	0.00
8.00	0.02	0.000	306.00	0.02	0.02	0.00
8.50	0.10	0.000	306.00	0.10	0.10	0.00
9.00	0.30	0.000	306.00	0.30	0.30	0.00
9.50	0.69	0.000	306.00	0.69	0.69	0.00
10.00	1.35	0.000	306.00	1.35	1.35	0.00
10.50	2.47	0.000	306.01	2.47	2.47	0.00
11.00	4.29	0.000	306.01	4.29	4.29	0.00
11.50	7.27	0.000	306.02	7.27	7.27	0.00
12.00	12.35	0.000	306.03	12.34	12.34	0.00
12.50	25.56	0.001	306.09	25.37	25.37	0.00
13.00	57.28	0.008	306.62	57.05	57.05	0.00
13.50	107.30	0.028	307.28	106.47	106.47	0.00
14.00	155.83	0.057	307.83	155.28	155.28	0.00
14.50	**180.37**	**0.078**	**308.09**	**179.95**	**179.95**	0.00
15.00	**181.34**	**0.080**	**308.11**	**181.55**	**181.55**	0.00
15.50	165.73	0.063	307.95	166.10	166.10	0.00
16.00	141.04	0.049	307.68	141.36	141.36	0.00
16.50	119.55	0.036	307.44	119.85	119.85	0.00
17.00	102.86	0.026	307.24	103.10	103.10	0.00
17.50	89.38	0.017	307.07	89.58	89.58	0.00
18.00	78.61	0.012	306.93	78.61	78.61	0.00
18.50	69.96	0.011	306.81	69.98	69.98	0.00
19.00	62.95	0.009	306.71	62.98	62.98	0.00
19.50	57.27	0.008	306.63	57.30	57.30	0.00
20.00	52.67	0.007	306.56	52.69	52.69	0.00
20.50	48.88	0.006	306.50	48.90	48.90	0.00
21.00	45.70	0.006	306.45	45.71	45.71	0.00
21.50	43.02	0.005	306.41	43.03	43.03	0.00
22.00	40.68	0.005	306.37	40.70	40.70	0.00
22.50	38.63	0.004	306.33	38.64	38.64	0.00
23.00	36.85	0.004	306.30	36.86	36.86	0.00
23.50	35.33	0.004	306.28	35.34	35.34	0.00
24.00	33.96	0.003	306.25	33.96	33.96	0.00
24.50	32.67	0.003	306.23	32.68	32.68	0.00
25.00	30.95	0.003	306.20	30.96	30.96	0.00
25.50	28.07	0.002	306.14	28.09	28.09	0.00
26.00	23.68	0.001	306.06	23.71	23.71	0.00
26.50	18.56	0.001	306.05	18.58	18.58	0.00
27.00	13.65	0.000	306.03	13.66	13.66	0.00
27.50	9.58	0.000	306.02	9.59	9.59	0.00
28.00	6.59	0.000	306.02	6.59	6.59	0.00
28.50	4.58	0.000	306.01	4.58	4.58	0.00
29.00	3.19	0.000	306.01	3.19	3.19	0.00
29.50	2.21	0.000	306.01	2.21	2.21	0.00
30.00	1.53	0.000	306.00	1.53	1.53	0.00

Summary for Pond 3P: Culvert 3

[58] Hint: Peaked 0.65' above defined flood level

Inflow Area = 780.951 ac, 0.00% Impervious, Inflow Depth > 1.66" for 10-yr event
Inflow = 211.57 cfs @ 14.83 hrs, Volume= 107.848 af
Outflow = 211.57 cfs @ 14.83 hrs, Volume= 107.838 af, Atten= 0%, Lag= 0.3 min
Primary = 174.14 cfs @ 14.83 hrs, Volume= 102.261 af
Secondary = 37.42 cfs @ 14.83 hrs, Volume= 5.577 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 290.35' @ 14.83 hrs Surf.Area= 0.000 ac Storage= 0.292 af
Flood Elev= 289.70' Surf.Area= 0.000 ac Storage= 0.225 af

Plug-Flow detention time= 1.4 min calculated for 107.838 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (1,068.2 - 1,066.8)

Volume	Invert	Avail.Storage	Storage Description
#1	287.50'	0.461 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
287.50	0.000
292.00	0.461

Device	Routing	Invert	Outlet Devices
#1	Primary	287.50'	**168.0" W x 48.0" H Box Prop 14ft Box Culvert** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.50' / 287.40' S= 0.0027 '/' Cc= 0.900 n= 0.009, Flow Area= 56.00 sf
#2	Secondary	289.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.52 1.01 2.44 3.03 4.98 5.54 7.28 8.05 8.29 9.30 10.29 11.61 12.42 12.44 13.86 14.32 15.29 17.56 18.86 19.90 20.58 21.56 21.84 22.70 23.09 24.57 24.87 26.53 26.85 28.19 29.36 30.61 31.87 32.43 32.98 33.85 34.37 35.28 35.99 36.48 36.88 37.42 38.13 38.85 39.56 40.28 41.45 43.11 43.26 44.40 44.77 45.66 46.70 47.42 48.09 48.40 49.74 51.40 52.41 53.18 53.84 55.27 56.70 58.19 60.98 61.95 62.41 63.82 63.84 64.67 65.26 65.72 65.98 66.33 67.41 67.98 68.83 68.96 69.64 71.69 74.10 75.26 77.40 78.25 79.51 79.59 80.97 81.68 82.40 83.83 84.38 85.25 86.68 88.82 89.54 90.25 91.20 92.39 92.85 93.82 94.66 95.25 96.17 96.68 98.10 99.49 99.80 101.15 102.07 102.80 103.33 104.58 104.94 106.12 106.67 107.78 108.10 110.24 111.09 112.75 114.61 115.22 115.86 115.95 117.73 119.38 119.62 120.88 121.04 121.66 122.13 123.38 124.36 125.50 128.09 128.80 129.33 130.23 132.37 134.31 135.78 135.96 137.17 139.68 140.22 140.94 141.65 142.36 142.60 143.79 146.07 147.20 147.57 148.08 148.46 150.22 150.89 151.65 152.55 153.07 154.20 154.50 155.21 156.35 156.64 157.52 158.07 158.78 159.50 161.64 162.35 162.49 163.78 164.76 166.01 166.64 167.47 168.56 173.94 174.40 175.89

176.89 177.22 177.73 178.05 179.07 180.23 182.15 182.57
183.91 184.39 186.06 187.29 188.31 188.56 189.26 190.37
191.06 194.61 195.22 196.89 198.46 199.39 199.61 200.22
201.29 201.89 203.56 204.74 205.22 205.77 207.72 210.65
210.90 211.93 211.99 213.98 214.39 217.72 218.55 219.11
220.01 222.68 223.55 224.02 225.27 225.36 226.89 227.32
228.55 229.37 231.43 231.88 234.71 236.05 236.05 236.88
237.72 238.26 238.72 240.06 240.67 241.40 242.68 243.55
243.75 244.38 245.22 246.75 249.42 251.05 251.88 251.96
252.71 253.43 255.21 256.11 257.10 258.55 259.38 261.05
262.71 262.79 263.55 265.21 265.31 266.04 268.54 269.22
270.21 271.88 273.49 273.64 274.55 275.21 278.54 278.83
280.71 281.04 281.73 282.48 284.18 285.21 286.04 287.71
288.19 288.54 290.21 292.00 292.71 293.03 294.05 294.37
295.21 296.04 296.36 297.71 298.49 300.03 300.40 301.25
301.83 302.55 303.12 305.43 305.77 306.55 306.85 307.92
308.32 309.00 309.29 311.61 311.86 312.78 313.92 314.69
315.40 317.78 319.32 320.70 321.63 322.96 323.18 324.72
325.11 325.49 326.19 327.03 328.33 328.58 330.12 330.48
331.66 332.43 333.21 333.71 334.67 335.52 337.40 338.00
339.08 341.23 342.88 344.45 344.78 345.61 346.32 346.60
347.86 349.41 350.77 351.72 351.97 352.49 353.04 354.12
354.31 355.58 356.35 357.12 359.29 359.49 360.21 361.39
363.16 364.06 364.77 367.01 368.69 371.78 372.00 373.46
374.09 374.86 375.60 376.41 376.68 379.07 379.49 380.26
380.98 381.18 381.81 382.58 385.66 387.42 388.50 388.75
391.06 392.13 393.38 394.86 395.69 398.01 398.78 400.30
400.34 401.86 403.07 404.18 405.69 406.76 407.83 408.91
409.58 410.35 411.28 411.89 413.43 414.02 414.45 414.98
416.43 417.29 417.50 418.83 419.61

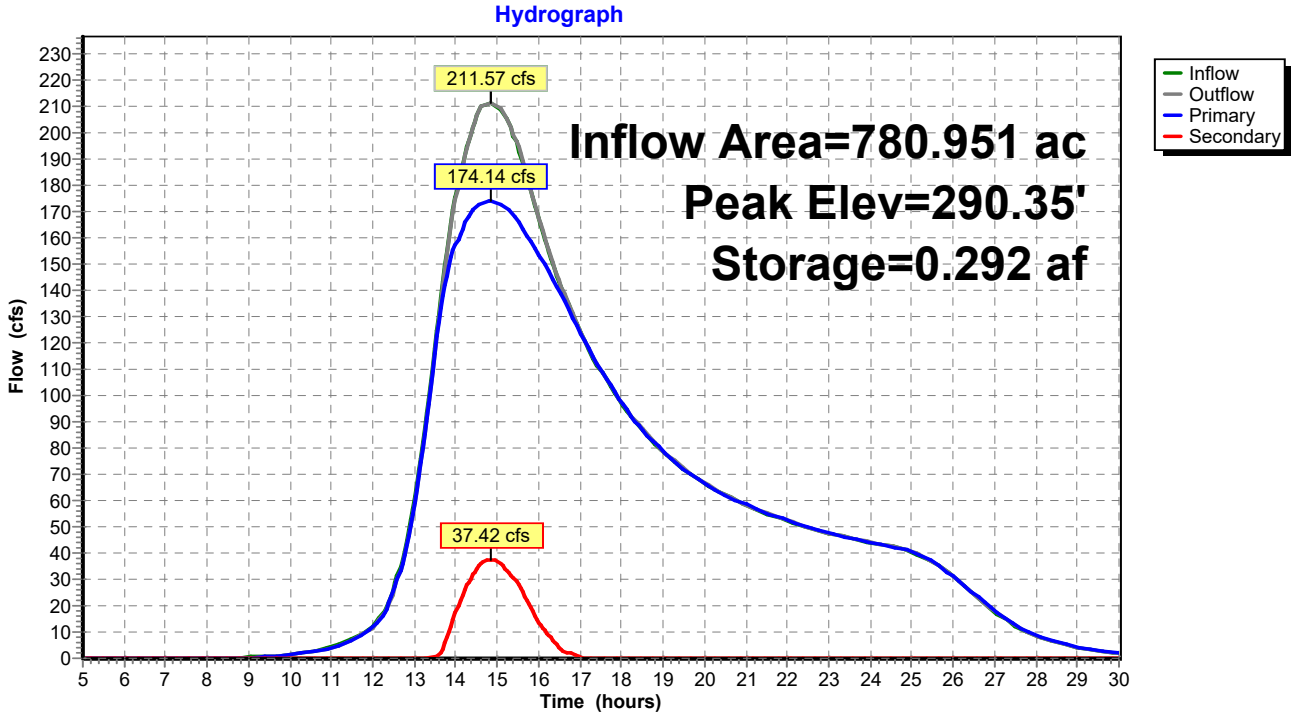
Height (feet) 17.94 17.81 17.58 16.87 16.57 15.64 15.38 14.53
14.16 14.03 13.54 13.05 12.43 12.02 12.02 11.28 11.05 10.54
9.38 8.73 8.22 7.90 7.45 7.33 6.92 6.75 6.06 5.93 5.18 5.04
4.42 3.91 3.38 2.83 2.63 2.42 2.14 1.99 1.71 1.50 1.37 1.29
1.21 1.14 1.06 1.00 0.96 0.93 0.83 0.81 0.73 0.71 0.64 0.57
0.51 0.47 0.44 0.35 0.23 0.15 0.10 0.07 0.05 0.05 0.11 0.24
0.27 0.27 0.31 0.30 0.33 0.33 0.35 0.34 0.35 0.35 0.36 0.36
0.37 0.37 0.29 0.18 0.12 0.03 0.01 0.01 0.00 0.08 0.13 0.20
0.32 0.38 0.45 0.59 0.84 0.94 1.02 1.14 1.27 1.33 1.44 1.55
1.62 1.75 1.80 1.96 2.10 2.14 2.29 2.36 2.40 2.42 2.45 2.47
2.51 2.51 2.53 2.52 2.55 2.57 2.60 2.60 2.61 2.61 2.62 2.62
2.54 2.52 2.45 2.45 2.41 2.40 2.33 2.28 2.20 2.04 2.00 1.98
1.93 1.87 1.85 1.82 1.81 1.79 1.79 1.78 1.78 1.77 1.77 1.78
1.78 1.75 1.72 1.70 1.69 1.67 1.60 1.58 1.53 1.48 1.44 1.37
1.36 1.31 1.25 1.22 1.16 1.13 1.08 1.04 0.98 0.98 0.97 0.97
0.99 1.04 1.06 1.10 1.14 1.40 1.41 1.46 1.48 1.50 1.51 1.53
1.57 1.63 1.71 1.72 1.78 1.79 1.85 1.89 1.93 1.93 1.96 1.99
2.02 2.15 2.16 2.20 2.22 2.22 2.23 2.23 2.25 2.25 2.27 2.30
2.32 2.33 2.40 2.44 2.45 2.45 2.46 2.46 2.47 2.51 2.53 2.53
2.55 2.58 2.58 2.59 2.59 2.60 2.59 2.60 2.60 2.61 2.61 2.60
2.60 2.63 2.64 2.66 2.69 2.72 2.73 2.79 2.81 2.85 2.88 2.89
2.90 2.90 2.92 2.94 3.00 3.06 3.08 3.09 3.10 3.13 3.17 3.20

3.24	3.28	3.31	3.36	3.40	3.41	3.42	3.46	3.47	3.48	3.54	3.55
3.58	3.62	3.68	3.68	3.72	3.74	3.82	3.82	3.86	3.86	3.88	3.89
3.94	3.96	3.99	4.03	4.05	4.05	4.09	4.12	4.12	4.13	4.13	4.14
4.14	4.16	4.16	4.18	4.18	4.21	4.21	4.23	4.23	4.25	4.25	4.28
4.29	4.29	4.30	4.30	4.31	4.31	4.32	4.32	4.31	4.31	4.29	4.29
4.28	4.28	4.30	4.33	4.36	4.41	4.41	4.51	4.56	4.59	4.68	4.80
5.04	5.08	5.40	5.47	5.68	5.81	5.93	6.02	6.17	6.31	6.60	6.70
6.86	7.20	7.48	7.73	7.79	7.92	8.05	8.09	8.30	8.52	8.70	8.82
8.86	8.91	8.98	9.09	9.12	9.25	9.34	9.41	9.64	9.67	9.74	9.88
10.08	10.20	10.28	10.57	10.80	11.24	11.28	11.49	11.59	11.70		
11.82	11.94	11.99	12.37	12.43	12.56	12.67	12.71	12.80	12.93		
13.41	13.69	13.85	13.88	14.22	14.36	14.53	14.74	14.85	15.18		
15.28	15.50	15.50	15.72	15.88	16.04	16.21	16.31	16.40	16.50		
16.58	16.66	16.78	16.85	17.08	17.16	17.23	17.30	17.52	17.64		
17.68	17.86	17.94									

Primary OutFlow Max=174.10 cfs @ 14.83 hrs HW=290.35' (Free Discharge)
└─**1=Prop 14ft Box Culvert** (Barrel Controls 174.10 cfs @ 5.82 fps)

Secondary OutFlow Max=36.92 cfs @ 14.83 hrs HW=290.35' (Free Discharge)
└─**2=Forbush Mill Road** (Weir Controls 36.92 cfs @ 2.04 fps)

Pond 3P: Culvert 3



Hydrograph for Pond 3P: Culvert 3

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	287.50	0.00	0.00	0.00
5.50	0.00	0.000	287.50	0.00	0.00	0.00
6.00	0.00	0.000	287.50	0.00	0.00	0.00
6.50	0.00	0.000	287.50	0.00	0.00	0.00
7.00	0.00	0.000	287.50	0.00	0.00	0.00
7.50	0.00	0.000	287.50	0.00	0.00	0.00
8.00	0.02	0.000	287.50	0.02	0.02	0.00
8.50	0.10	0.000	287.50	0.08	0.08	0.00
9.00	0.30	0.001	287.51	0.26	0.26	0.00
9.50	0.69	0.003	287.53	0.63	0.63	0.00
10.00	1.35	0.006	287.56	1.25	1.25	0.00
10.50	2.47	0.012	287.61	2.30	2.30	0.00
11.00	4.29	0.020	287.70	4.03	4.03	0.00
11.50	7.27	0.030	287.79	7.00	7.00	0.00
12.00	12.34	0.044	287.93	11.92	11.92	0.00
12.50	26.20	0.075	288.23	25.15	25.15	0.00
13.00	61.41	0.138	288.85	59.48	59.48	0.00
13.50	118.26	0.221	289.65	116.14	116.14	0.00
14.00	175.60	0.273	290.16	174.99	157.62	17.36
14.50	**206.22**	**0.289**	**290.33**	**206.06**	**171.99**	**34.08**
15.00	**210.38**	**0.291**	**290.34**	**210.43**	**173.70**	**36.73**
15.50	194.49	0.283	290.27	194.74	166.82	27.92
16.00	167.34	0.269	290.12	167.68	154.22	13.46
16.50	143.44	0.251	289.95	143.85	139.59	4.27
17.00	124.67	0.232	289.76	125.12	124.51	0.61
17.50	109.33	0.212	289.57	109.76	109.76	0.00
18.00	96.82	0.195	289.40	97.24	97.24	0.00
18.50	86.87	0.181	289.26	87.20	87.20	0.00
19.00	78.73	0.169	289.15	79.00	79.00	0.00
19.50	72.08	0.159	289.05	72.32	72.32	0.00
20.00	66.65	0.150	288.96	66.84	66.84	0.00
20.50	62.16	0.143	288.90	62.32	62.32	0.00
21.00	58.37	0.137	288.83	58.51	58.51	0.00
21.50	55.16	0.131	288.78	55.29	55.29	0.00
22.00	52.36	0.127	288.74	52.47	52.47	0.00
22.50	49.87	0.122	288.69	49.98	49.98	0.00
23.00	47.69	0.118	288.66	47.77	47.77	0.00
23.50	45.81	0.115	288.62	45.89	45.89	0.00
24.00	44.14	0.112	288.59	44.21	44.21	0.00
24.50	42.57	0.109	288.57	42.64	42.64	0.00
25.00	40.39	0.105	288.53	40.51	40.51	0.00
25.50	36.63	0.099	288.46	36.85	36.85	0.00
26.00	30.83	0.087	288.35	31.14	31.14	0.00
26.50	24.07	0.073	288.22	24.41	24.41	0.00
27.00	17.63	0.059	288.08	17.97	17.97	0.00
27.50	12.31	0.046	287.94	12.59	12.59	0.00
28.00	8.45	0.035	287.84	8.68	8.68	0.00
28.50	5.85	0.027	287.76	6.01	6.01	0.00
29.00	4.06	0.021	287.70	4.17	4.17	0.00
29.50	2.80	0.015	287.65	2.94	2.94	0.00
30.00	1.93	0.010	287.60	2.02	2.02	0.00

Summary for Pond 4P: Culvert 4

[93] Warning: Storage range exceeded by 0.25'
[58] Hint: Peaked 1.03' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	780.951 ac,	0.00% Impervious,	Inflow Depth >	1.66"	for	10-yr event
Inflow =	211.57 cfs @	14.83 hrs,	Volume=	107.838 af		
Outflow =	212.59 cfs @	14.85 hrs,	Volume=	107.756 af,	Atten= 0%,	Lag= 0.9 min
Primary =	37.17 cfs @	14.85 hrs,	Volume=	44.916 af		
Secondary =	175.41 cfs @	14.85 hrs,	Volume=	62.840 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 286.25' @ 14.85 hrs Surf.Area= 0.000 ac Storage= 1.076 af
Flood Elev= 285.22' Surf.Area= 0.000 ac Storage= 0.889 af

Plug-Flow detention time= 8.4 min calculated for 107.541 af (100% of inflow)
Center-of-Mass det. time= 7.9 min (1,076.1 - 1,068.2)

Volume	Invert	Avail.Storage	Storage Description
#1	281.50'	1.076 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
281.50	0.000
286.00	1.076

Device	Routing	Invert	Outlet Devices
#1	Primary	281.69'	**168.0" W x 4.0" H Box Prop 14ft Box Culvert** L= 39.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 281.50' / 281.69' S= -0.0048 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 4.67 sf
#2	Secondary	285.22'	**Forbrush Mill Road, C= 3.27** Offset (feet) 0.00 0.10 0.33 0.48 1.07 3.19 3.71 4.55 5.91 7.08 8.63 9.00 10.46 11.35 13.44 13.83 14.07 15.04 16.78 17.20 17.89 19.50 20.58 22.22 22.34 23.95 24.94 26.79 27.33 27.66 29.02 30.37 30.70 31.23 33.09 34.07 35.68 35.81 37.45 38.53 40.13 40.82 41.25 43.00 43.97 44.20 44.58 46.68 47.57 49.03 49.40 50.95 52.12 53.47 54.32 54.84 56.98 57.56 57.69 57.92 60.27 61.07 62.37 62.99 64.44 65.71 66.82 67.82 68.43 70.96 71.15 71.19 71.26 73.86 74.57 75.71 76.58 77.94 79.30 80.16 81.31 82.02 84.61 84.69 84.74 84.94 87.45 88.06 89.06 90.17 91.44 92.89 93.50 94.81 95.61 97.95 98.18 98.33 98.92 101.05 101.56 102.40 103.76 104.93 106.48 106.85 108.31 109.20 111.30 111.68 111.92 112.90 114.64 115.06 115.74 117.35 118.43 120.07 120.19 121.80 122.79 124.64 125.18 125.51 126.88 128.23 128.55 129.09 130.94 131.93 133.53 133.66 135.30 136.38 137.98 138.68 139.10 140.85 141.82 142.05 142.43 144.53 145.42 146.88 147.25 147.74 148.83 149.86 151.97 152.29 152.45 152.91 155.03 155.75 157.21 157.62 159.22 160.21 162.46 162.68 162.79 163.11 165.38 166.15

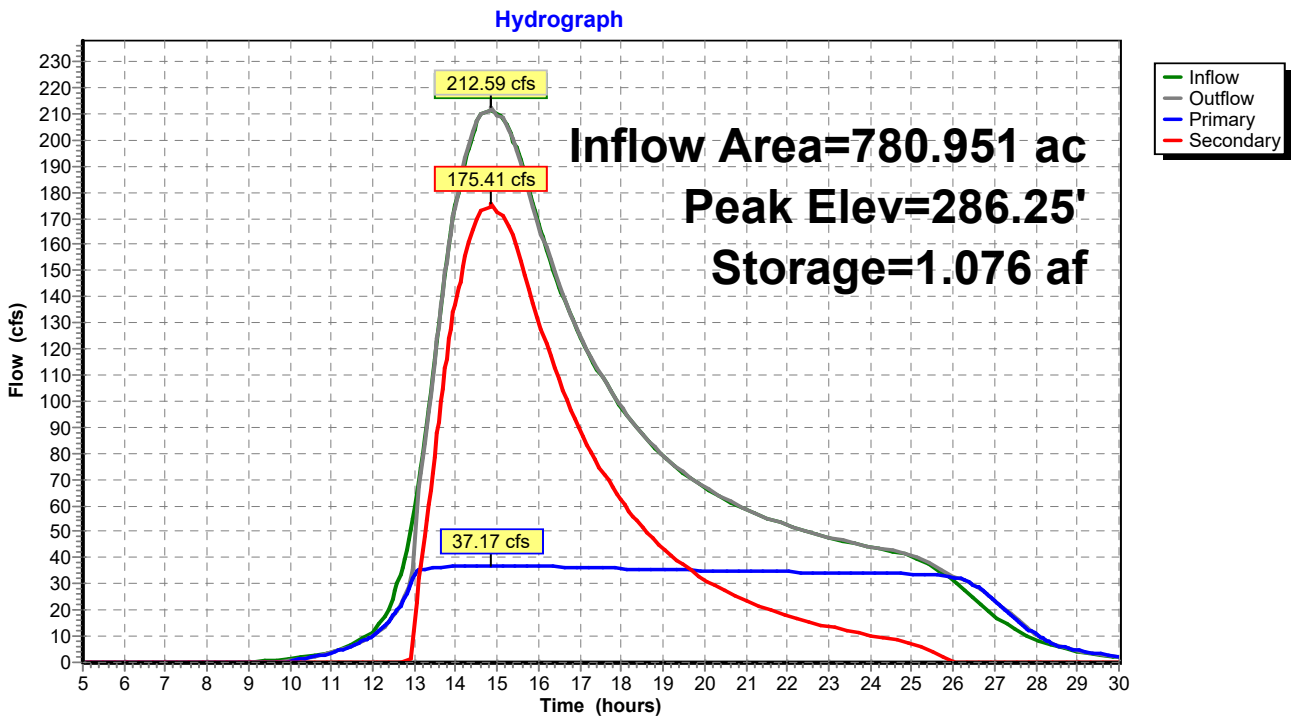
167.71	167.96	169.61	170.55	172.95	173.07	173.13	173.31
175.72	176.54	178.20	178.31	180.00	180.89	183.44	183.47
183.48	183.51	186.06	186.93	188.65	188.69	190.39	191.24
193.71	193.82	193.86	193.93	196.41	197.32	198.99	199.18
200.79	201.58	203.91	204.16	204.25	204.42	206.75	207.71
209.34	209.67	211.18	211.92	214.11	214.51	214.64	214.91
217.09	218.11	219.68	220.16	221.57	222.27	224.31	224.85
225.03	225.41	227.44	228.50	230.02	230.65	231.96	232.61
234.51	235.19	235.43	235.90	237.78	238.89	240.37	241.14
242.35	242.95	244.71	245.54	245.82	246.39	248.12	249.28
250.71	251.63	252.75	253.29	254.91	255.88	256.21	256.88
258.47	258.61	260.03	260.80	261.57	263.12	264.67	265.44
266.21	267.76	269.31	270.08	270.85	272.40	273.95	274.72
275.48	277.04	278.59	279.36	280.12	281.67	283.23	283.99
284.76	286.31	287.87	288.63	289.40	290.95	292.50	293.27
294.04	295.59	297.14	297.91	298.68	300.23	301.78	302.55
303.32	304.84	304.95	305.63	307.37	308.04	309.23	310.45
311.14	312.86	313.62					

Height (feet)	3.15	3.15	3.15	3.14	3.11	3.00	2.98	2.95	2.89	2.83	
2.80	2.80	2.77	2.76	2.77	2.77	2.77	2.76	2.72	2.71	2.70	2.58
2.57	2.50	2.52	2.46	2.43	2.41	2.39	2.39	2.37	2.36	2.36	2.35
2.34	2.32	2.25	2.25	2.18	2.14	2.09	2.06	2.07	2.03	2.02	2.01
2.01	2.00	1.98	1.96	1.96	1.94	1.92	1.91	1.90	1.90	1.88	1.87
1.87	1.86	1.83	1.81	1.78	1.78	1.75	1.72	1.70	1.68	1.66	1.61
1.60	1.60	1.60	1.54	1.52	1.50	1.46	1.43	1.38	1.38	1.35	1.34
1.31	1.31	1.31	1.31	1.27	1.26	1.25	1.24	1.23	1.22	1.23	1.22
1.22	1.25	1.25	1.25	1.25	1.23	1.23	1.22	1.19	1.17	1.14	1.15
1.13	1.13	1.14	1.13	1.13	1.13	1.11	1.11	1.10	1.06	1.05	1.02
1.05	1.02	1.01	1.01	1.01	1.00	1.00	1.00	0.99	0.97	0.96	0.94
0.93	0.91	0.91	0.90	0.94	0.93	0.93	0.96	0.97	0.97	0.96	0.95
0.94	0.94	0.92	0.92	0.92	0.91	0.94	0.93	0.93	0.94	0.94	0.94
0.95	0.94	0.95	0.94	0.96	0.96	0.96	0.96	0.93	0.94	0.93	0.92
0.91	0.90	0.87	0.87	0.87	0.86	0.81	0.80	0.78	0.77	0.75	0.75
0.76	0.76	0.76	0.76	0.73	0.73	0.70	0.71	0.68	0.68	0.67	0.67
0.67	0.67	0.67	0.64	0.59	0.61	0.57	0.53	0.55	0.55	0.55	0.56
0.58	0.59	0.57	0.59	0.58	0.56	0.60	0.60	0.60	0.60	0.54	0.55
0.54	0.58	0.58	0.60	0.63	0.63	0.63	0.63	0.59	0.59	0.55	0.60
0.58	0.58	0.58	0.58	0.57	0.56	0.53	0.50	0.46	0.47	0.44	0.43
0.44	0.44	0.44	0.44	0.44	0.44	0.42	0.42	0.41	0.39	0.36	0.34
0.34	0.32	0.29	0.28	0.25	0.24	0.22	0.18	0.14	0.12	0.11	0.08
0.05	0.04	0.03	0.03	0.02	0.01	0.00	0.00	0.01	0.01	0.02	0.13
0.28	0.33	0.28	0.30	0.48	0.58	0.61	0.74	0.82	0.90	0.90	0.99
0.97	0.97	0.98	1.03	1.05	1.08	1.09	1.19	1.19	1.30	1.75	1.91
2.23	2.55	2.71	3.11	3.15							

Primary OutFlow Max=37.17 cfs @ 14.85 hrs HW=286.25' (Free Discharge)
└─**1=Prop 14ft Box Culvert** (Inlet Controls 37.17 cfs @ 7.97 fps)

Secondary OutFlow Max=175.12 cfs @ 14.85 hrs HW=286.25' (Free Discharge)
└─**2=Forbrush Mill Road** (Weir Controls 175.12 cfs @ 2.40 fps)

Pond 4P: Culvert 4



Hydrograph for Pond 4P: Culvert 4

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	281.50	0.00	0.00	0.00
5.50	0.00	0.000	281.50	0.00	0.00	0.00
6.00	0.00	0.000	281.50	0.00	0.00	0.00
6.50	0.00	0.000	281.50	0.00	0.00	0.00
7.00	0.00	0.000	281.50	0.00	0.00	0.00
7.50	0.00	0.000	281.50	0.00	0.00	0.00
8.00	0.02	0.000	281.50	0.00	0.00	0.00
8.50	0.08	0.002	281.51	0.00	0.00	0.00
9.00	0.26	0.009	281.54	0.00	0.00	0.00
9.50	0.63	0.026	281.61	0.00	0.00	0.00
10.00	1.25	0.060	281.75	0.58	0.58	0.00
10.50	2.30	0.079	281.83	1.91	1.91	0.00
11.00	4.03	0.097	281.90	3.54	3.54	0.00
11.50	7.00	0.121	282.01	6.32	6.32	0.00
12.00	11.92	0.165	282.19	10.15	10.15	0.00
12.50	25.15	0.326	282.86	17.78	17.78	0.00
13.00	59.48	0.950	285.47	39.50	33.73	5.76
13.50	116.14	**1.076**	286.00	114.90	36.10	78.80
14.00	174.99	**1.076**	286.17	173.96	36.82	137.14
14.50	**206.06**	1.076	**286.23**	**205.03**	**37.11**	**167.92**
15.00	**210.43**	1.076	**286.24**	**209.40**	**37.15**	**172.25**
15.50	194.74	1.076	286.21	193.71	37.01	156.70
16.00	167.68	1.076	286.15	166.65	36.74	129.91
16.50	143.85	1.076	286.08	142.82	36.47	106.35
17.00	125.12	1.076	286.03	124.09	36.23	87.86
17.50	109.76	1.071	285.98	110.00	36.02	73.98
18.00	97.24	1.060	285.93	97.49	35.82	61.67
18.50	87.20	1.050	285.89	87.47	35.64	51.83
19.00	79.00	1.041	285.85	79.21	35.46	43.75
19.50	72.32	1.032	285.82	72.56	35.30	37.26
20.00	66.84	1.024	285.78	67.03	35.14	31.89
20.50	62.32	1.016	285.75	62.52	34.99	27.53
21.00	58.51	1.008	285.72	58.68	34.85	23.83
21.50	55.29	1.002	285.69	55.46	34.73	20.73
22.00	52.47	0.994	285.66	52.64	34.59	18.05
22.50	49.98	0.988	285.63	50.13	34.47	15.67
23.00	47.77	0.982	285.61	47.94	34.34	13.59
23.50	45.89	0.976	285.58	46.03	34.23	11.80
24.00	44.21	0.970	285.56	44.33	34.12	10.21
24.50	42.64	0.964	285.53	42.81	34.01	8.80
25.00	40.51	0.956	285.50	40.76	33.85	6.92
25.50	36.85	0.939	285.43	37.42	33.52	3.91
26.00	31.14	0.898	285.26	32.89	32.70	0.19
26.50	24.41	0.749	284.63	29.54	29.54	0.00
27.00	17.97	0.514	283.65	23.74	23.74	0.00
27.50	12.59	0.301	282.76	16.83	16.83	0.00
28.00	8.68	0.173	282.23	10.67	10.67	0.00
28.50	6.01	0.124	282.02	6.60	6.60	0.00
29.00	4.17	0.106	281.94	4.52	4.52	0.00
29.50	2.94	0.093	281.89	3.22	3.22	0.00
30.00	2.02	0.083	281.85	2.23	2.23	0.00

Summary for Pond 5P: Sand Culvert

[93] Warning: Storage range exceeded by 23.30'
[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 24.71' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=51)

Inflow Area =	816.682 ac,	0.00% Impervious,	Inflow Depth >	1.60"	for 10-yr event
Inflow =	214.20 cfs @	14.85 hrs,	Volume=	109.053 af	
Outflow =	215.86 cfs @	14.80 hrs,	Volume=	108.971 af,	Atten= 0%, Lag= 0.0 min
Primary =	176.54 cfs @	14.80 hrs,	Volume=	94.783 af	
Secondary =	39.33 cfs @	14.80 hrs,	Volume=	14.187 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.30' @ 14.80 hrs Surf.Area= 0.000 ac Storage= 0.637 af
Flood Elev= 245.59' Surf.Area= 0.000 ac Storage= 0.461 af

Plug-Flow detention time= 4.7 min calculated for 108.971 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (1,079.9 - 1,075.8)

Volume	Invert	Avail.Storage	Storage Description
#1	241.90'	0.637 af	**Custom Stage Data** Listed below

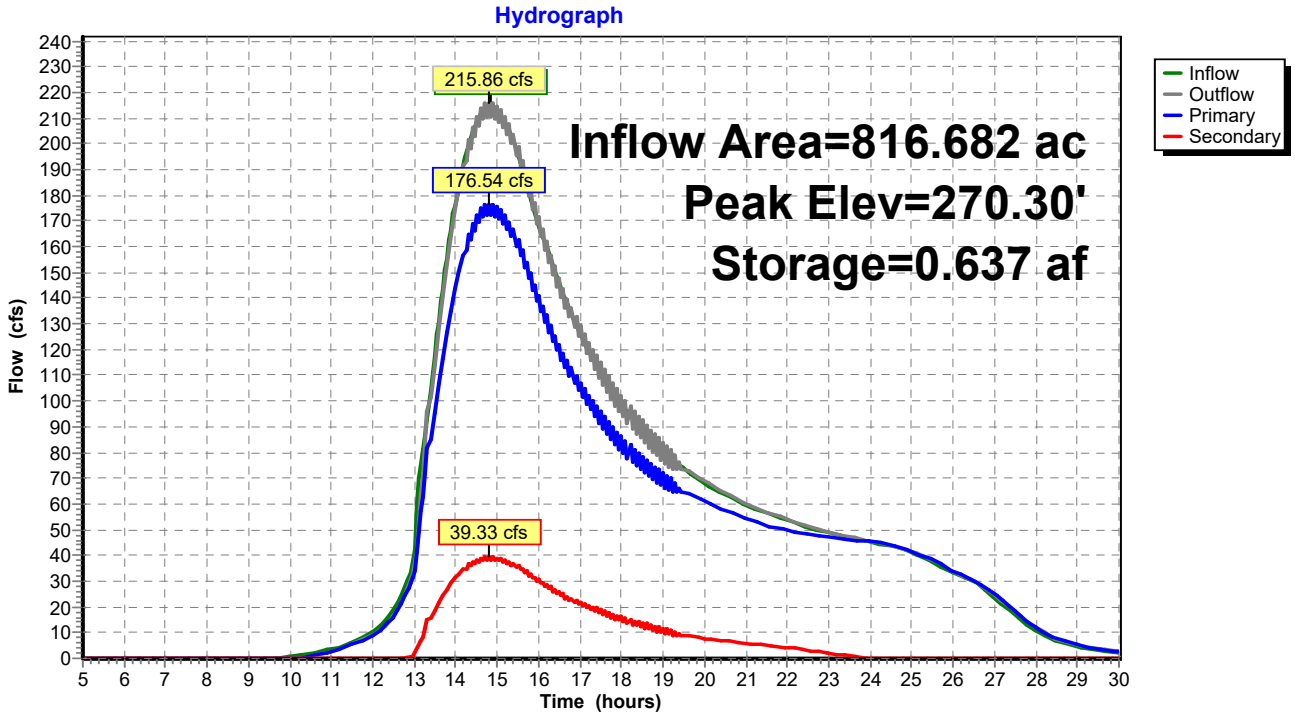
Elevation (feet)	Cum.Store (acre-feet)
241.90	0.000
247.00	0.637

Device	Routing	Invert	Outlet Devices
#1	Primary	241.90'	**36.0" Round 36" Concrete Culvert** L= 30.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.90' / 241.70' S= 0.0067 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Secondary	245.59'	**Sand Road, C= 3.27** Offset (feet) 0.00 0.42 1.87 3.41 3.66 5.17 6.41 7.31 8.47 9.41 10.97 11.76 12.41 14.63 15.06 15.41 18.29 18.36 18.41 18.92 Height (feet) 0.17 0.11 0.11 0.05 0.06 0.00 0.00 0.02 0.02 0.05 0.07 0.09 0.10 0.13 0.14 0.14 0.17 0.17 0.17 0.17

Primary OutFlow Max=176.51 cfs @ 14.80 hrs HW=270.30' (Free Discharge)
└─**1=36" Concrete Culvert** (Inlet Controls 176.51 cfs @ 24.97 fps)

Secondary OutFlow Max=39.32 cfs @ 14.80 hrs HW=270.30' (Free Discharge)
└─**2=Sand Road** (Weir Controls 39.32 cfs @ 21.25 fps)

Pond 5P: Sand Culvert



Hydrograph for Pond 5P: Sand Culvert

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	241.90	0.00	0.00	0.00
5.50	0.00	0.000	241.90	0.00	0.00	0.00
6.00	0.00	0.000	241.90	0.00	0.00	0.00
6.50	0.00	0.000	241.90	0.00	0.00	0.00
7.00	0.00	0.000	241.90	0.00	0.00	0.00
7.50	0.00	0.000	241.90	0.00	0.00	0.00
8.00	0.00	0.000	241.90	0.00	0.00	0.00
8.50	0.00	0.000	241.90	0.00	0.00	0.00
9.00	0.00	0.000	241.90	0.00	0.00	0.00
9.50	0.00	0.000	241.90	0.00	0.00	0.00
10.00	0.58	0.004	241.93	0.05	0.05	0.00
10.50	1.91	0.044	242.25	0.82	0.82	0.00
11.00	3.54	0.084	242.57	2.68	2.68	0.00
11.50	6.32	0.123	242.89	5.32	5.32	0.00
12.00	10.15	0.166	243.23	9.05	9.05	0.00
12.50	18.93	0.234	243.78	16.43	16.43	0.00
13.00	42.22	**0.372**	244.88	34.33	34.33	0.00
13.50	117.26	**0.637**	252.18	121.01	100.84	20.18
14.00	175.94	0.637	262.18	179.69	147.51	32.19
14.50	**206.77**	0.637	**269.01**	**210.52**	**172.24**	**38.28**
15.00	**210.97**	0.637	**270.02**	**214.72**	**175.62**	**39.10**
15.50	195.16	0.637	266.31	198.91	162.91	35.99
16.00	168.00	0.637	260.60	171.76	141.15	30.60
16.50	144.11	0.637	256.27	147.86	122.09	25.77
17.00	125.32	0.637	253.32	129.07	107.19	21.88
17.50	111.17	0.637	251.37	114.92	96.06	18.87
18.00	98.62	0.637	249.83	102.37	86.27	16.10
18.50	88.56	0.637	248.72	92.31	78.53	13.78
19.00	80.27	0.637	247.91	84.02	72.25	11.77
19.50	73.58	0.637	247.01	73.75	64.68	9.07
20.00	68.02	0.597	246.68	69.02	61.19	7.82
20.50	63.49	0.565	246.43	64.11	57.37	6.74
21.00	59.63	0.543	246.25	60.11	54.29	5.83
21.50	56.38	0.525	246.10	56.74	51.75	4.99
22.00	53.55	0.511	245.99	53.88	49.63	4.25
22.50	51.02	0.497	245.88	51.37	48.27	3.11
23.00	48.81	0.483	245.77	49.12	47.10	2.02
23.50	46.88	0.472	245.68	47.14	46.12	1.02
24.00	45.17	0.462	245.60	45.40	45.26	0.14
24.50	43.47	0.450	245.50	43.89	43.89	0.00
25.00	40.96	0.429	245.33	41.53	41.53	0.00
25.50	37.47	0.402	245.12	38.26	38.26	0.00
26.00	32.90	0.367	244.84	33.67	33.67	0.00
26.50	29.54	0.342	244.64	30.30	30.30	0.00
27.00	23.74	0.302	244.31	24.90	24.90	0.00
27.50	16.83	0.249	243.89	18.19	18.19	0.00
28.00	10.67	0.194	243.46	11.92	11.92	0.00
28.50	6.60	0.150	243.10	7.52	7.52	0.00
29.00	4.52	0.120	242.86	5.11	5.11	0.00
29.50	3.22	0.100	242.70	3.65	3.65	0.00
30.00	2.23	0.083	242.56	2.61	2.61	0.00

Summary for Pond 6P: 110 Culvert

Inflow Area = 915.598 ac, 0.00% Impervious, Inflow Depth > 1.47" for 10-yr event
Inflow = 220.41 cfs @ 14.80 hrs, Volume= 112.193 af
Outflow = 216.27 cfs @ 15.02 hrs, Volume= 111.784 af, Atten= 2%, Lag= 13.1 min
Primary = 216.27 cfs @ 15.02 hrs, Volume= 111.784 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 237.34' @ 15.02 hrs Surf.Area= 0.000 ac Storage= 4.721 af
Flood Elev= 238.05' Surf.Area= 0.000 ac Storage= 5.491 af

Plug-Flow detention time= 21.2 min calculated for 111.784 af (100% of inflow)
Center-of-Mass det. time= 18.8 min (1,099.8 - 1,081.0)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	5.491 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
233.00	0.000
238.05	5.491

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**120.0" W x 48.0" H Box 10' Wide Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 233.00' / 233.00' S= 0.0000 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf
#2	Secondary	238.05'	**Route 110, C= 3.27** Offset (feet) 0.00 0.77 3.09 3.35 3.53 4.31 6.28 6.71 7.38 9.04 10.07 11.67 11.80 13.43 14.55 15.96 16.78 17.31 19.74 20.07 20.14 20.25 22.82 23.50 24.54 25.58 26.85 28.34 28.83 30.21 31.09 33.12 33.57 33.85 35.16 36.61 36.92 37.41 39.36 40.28 41.70 42.12 43.64 44.88 45.99 46.99 47.64 50.28 50.35 50.39 50.59 53.15 53.71 54.57 55.91 57.06 58.66 58.86 60.42 61.42 63.15 63.78 64.18 66.01 66.93 67.13 67.44 69.69 70.49 71.74 72.45 73.85 75.20 76.03 77.20 77.96 80.32 80.56 80.72 81.44 83.47 83.92 84.61 86.23 87.27 88.90 88.99 90.63 91.74 93.19 93.99 94.50 96.87 97.26 97.34 97.48 100.02 100.70 101.77 102.77 104.06 105.53 106.06 107.41 108.29 110.35 110.77 111.04 112.29 113.80 114.13 114.64 116.56 117.48 118.93 119.31 120.84 122.07 123.22 124.20 124.83 127.51 127.55 127.58 127.72 130.34 130.91 131.80 133.10 134.27 135.85 136.09 137.63 138.61 140.38 140.98 141.37 143.14 144.13 144.34 144.67 146.88 147.70 148.96 149.64 151.05 152.40 153.25 154.41 155.15 157.54 157.77 157.91 158.57 160.67 161.12 161.83 163.42 164.48 166.12 166.18 167.84 168.94 170.41 171.19 171.69 174.00 174.45 174.55 174.70 177.21 177.91 178.99 179.96 181.26 182.72 183.28 184.62 185.48 187.57 187.98 188.23 189.42 190.99 191.33 191.87 193.75 194.69 196.16 196.51 198.05 199.26 200.45 201.40 202.02

204.74	204.76	204.78	204.85	207.53	208.12	209.03	210.29
211.47	213.05	213.32	214.83	215.80	217.61	218.19	218.56
220.27	221.32	221.54	221.90	224.07	224.90	226.19	226.83
228.26	229.59	230.48	231.61	232.34	234.77	234.97	235.10
235.70	237.86	238.33	239.06	240.62	241.68	243.35	243.37
245.04	246.13	247.64	248.40	248.89	251.13	251.64	251.76
251.93	254.40	255.11	256.22	257.16	258.47	259.91	260.51
261.83	262.67	264.80	265.18	265.43	266.55	268.18	268.54
269.09	270.94	271.90	273.38	273.70	275.25	276.45	277.67
278.61	279.21	281.96	281.97	281.98	284.72	285.32	286.25
287.48	288.68	290.24	290.54	292.04	293.00	294.83	295.39
295.75	297.40	298.51	298.75	299.12	301.27	302.11	303.41
304.02	305.46	306.78	307.70	308.82	309.54	312.00	312.18
312.29	312.83	315.05	315.53	316.29	317.81	318.89	320.56
320.58	322.25	323.32	324.87	325.60	326.08	328.26	328.83
328.96	329.16	331.59	332.32	333.45	334.35	335.67	337.11
337.74	339.03	339.86	342.03	342.39	342.62	343.68	345.38
345.74	346.32	348.13	349.10	350.61	350.89	352.46	353.65
354.90	355.81	356.40	359.11	359.16	359.17	359.19	361.92
362.53	363.48	364.67	365.88	367.43	367.77	369.24	370.19
372.06	372.60	372.94	374.53	375.70	375.96	376.35	378.46
379.31	380.64	381.21	382.67	383.97	384.93	386.03	386.73
389.22	389.38	389.49	389.96	392.24	392.74	393.51	395.00
396.10	397.76	397.80	399.45	400.51	402.09	402.81	403.27
405.39	406.03	406.17	406.38	408.78	409.52	410.67	411.54
412.88	414.30	414.96	416.24	417.05	419.25	419.59	419.81
420.81	422.57	422.95	423.54	425.32	426.31	427.83	428.08
429.66	430.84						

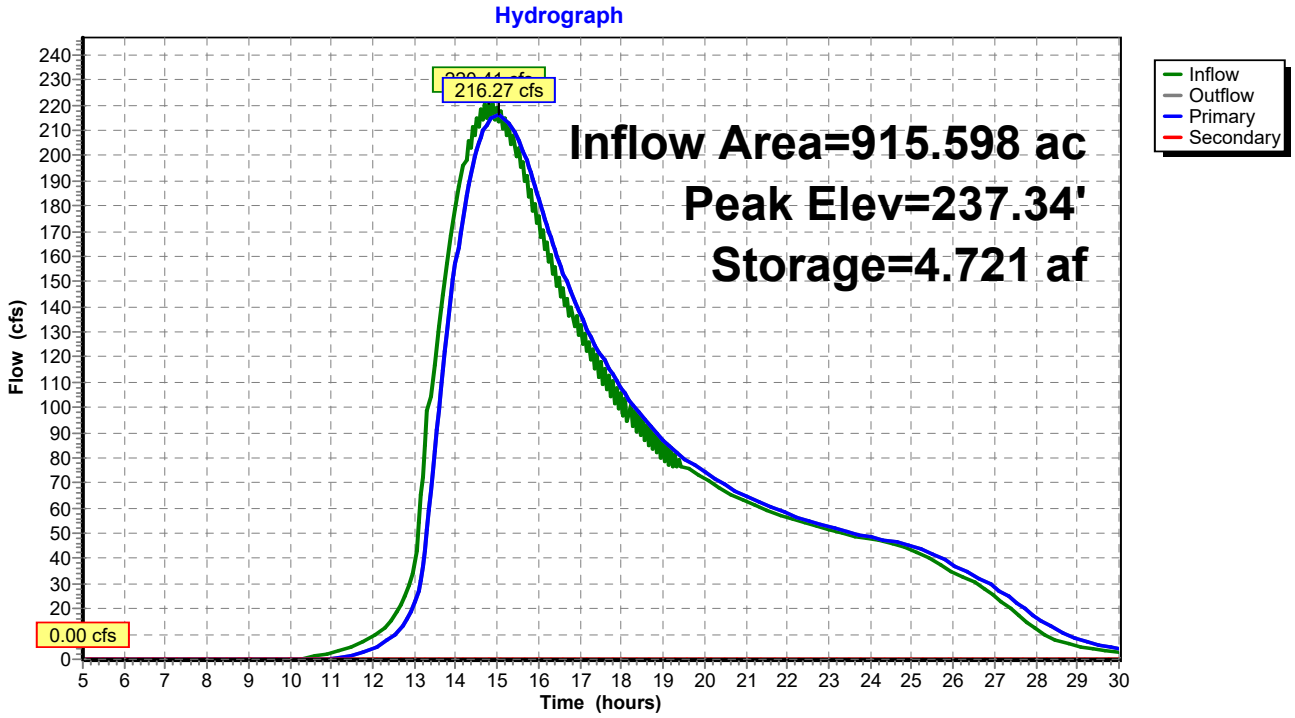
Height (feet)	0.77	0.76	0.75	0.75	0.75	0.74	0.72	0.71	0.71	0.69
0.69	0.70	0.69	0.70	0.70	0.71	0.71	0.71	0.70	0.69	0.69	0.69
0.67	0.67	0.68	0.65	0.66	0.63	0.66	0.64	0.63	0.61	0.60	0.60
0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.59	0.57	0.55	0.56	0.55
0.55	0.53	0.53	0.53	0.53	0.48	0.48	0.48	0.49	0.50	0.51	0.51
0.51	0.50	0.50	0.49	0.49	0.47	0.46	0.46	0.46	0.46	0.45	0.46
0.47	0.48	0.48	0.51	0.52	0.52	0.55	0.55	0.55	0.57	0.62	0.64
0.65	0.69	0.70	0.69	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.64
0.64	0.64	0.65	0.65	0.66	0.69	0.70	0.72	0.68	0.69	0.68	0.73
0.72	0.72	0.70	0.68	0.67	0.66	0.58	0.56	0.51	0.50	0.46	0.46
0.46	0.46	0.46	0.44	0.44	0.44	0.44	0.44	0.42	0.40	0.37	0.35
0.33	0.32	0.31	0.32	0.30	0.30	0.30	0.28	0.27	0.27	0.27	0.25
0.25	0.25	0.24	0.25	0.25	0.28	0.28	0.28	0.30	0.30	0.30	0.29
0.26	0.25	0.24	0.24	0.22	0.21	0.21	0.20	0.17	0.09	0.07	0.06
0.01	0.00	0.00	0.00	0.01	0.02	0.09	0.06	0.15	0.20	0.18	0.22
0.23	0.27	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.24	0.24	0.23
0.22	0.22	0.22	0.21	0.22	0.25	0.25	0.25	0.25	0.30	0.31	0.31
0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.28
0.28	0.28	0.28	0.27	0.29	0.27	0.27	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.26	0.26	0.27	0.27	0.29	0.33	0.31	0.35	0.35	0.34
0.34	0.34	0.33	0.33	0.33	0.33	0.31	0.31	0.32	0.30	0.31	0.30
0.32	0.31	0.32	0.29	0.29	0.29	0.29	0.28	0.27	0.28	0.28	0.28
0.27	0.27	0.27	0.26	0.25	0.24	0.24	0.20	0.20	0.20	0.21	0.22
0.24	0.27	0.30	0.30	0.32	0.32	0.32	0.37	0.37	0.37	0.38	0.38

0.38	0.38	0.31	0.32	0.34	0.34	0.36	0.40	0.40	0.43	0.42	0.36
0.36	0.36	0.35	0.32	0.31	0.31	0.31	0.31	0.30	0.31	0.31	0.31
0.33	0.34	0.34	0.37	0.38	0.38	0.38	0.40	0.40	0.40	0.41	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40
0.40	0.38	0.39	0.38	0.39	0.40	0.41	0.41	0.44	0.44	0.44	0.44
0.46	0.46	0.46	0.45	0.45	0.46	0.45	0.46	0.48	0.49	0.50	0.50
0.51	0.52	0.52	0.52	0.52	0.51	0.52	0.53	0.53	0.55	0.56	0.58
0.57	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.61
0.62	0.62	0.63	0.63	0.63	0.67	0.68	0.68	0.68	0.69	0.69	0.68
0.65	0.64	0.65	0.66	0.66	0.67	0.67	0.68	0.68	0.68	0.69	0.69
0.70	0.74	0.76	0.76	0.77	0.77	0.77					

Primary OutFlow Max=216.25 cfs @ 15.02 hrs HW=237.34' (Free Discharge)
└─**1=10' Wide Box Culvert** (Barrel Controls 216.25 cfs @ 6.64 fps)

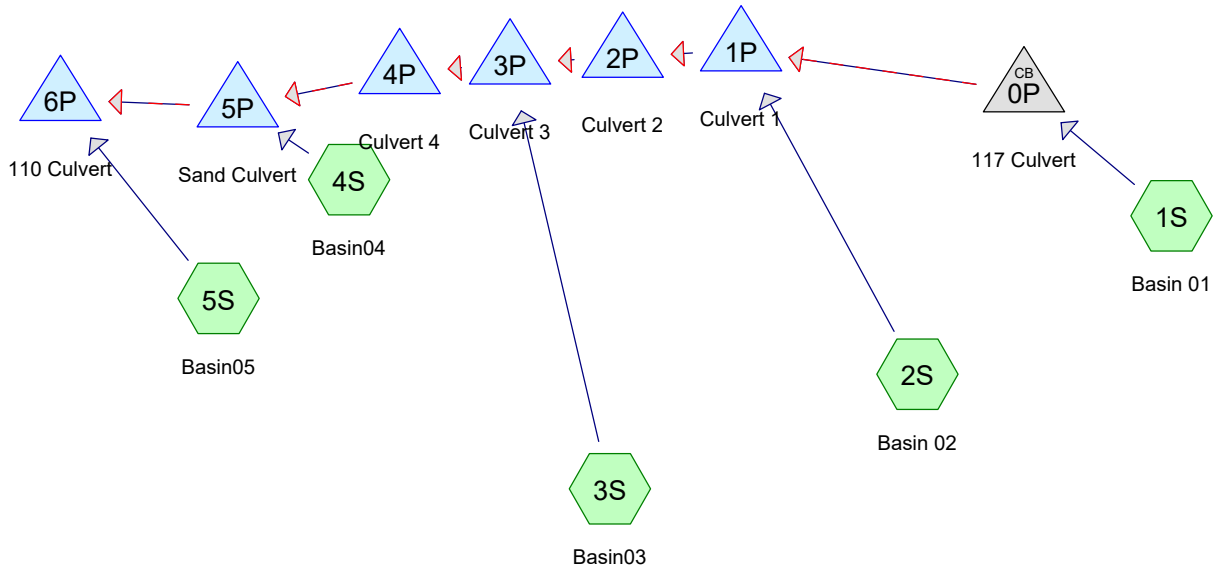
Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=233.00' (Free Discharge)
└─**2=Route 110** (Controls 0.00 cfs)

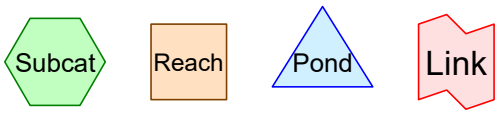
Pond 6P: 110 Culvert



Hydrograph for Pond 6P: 110 Culvert

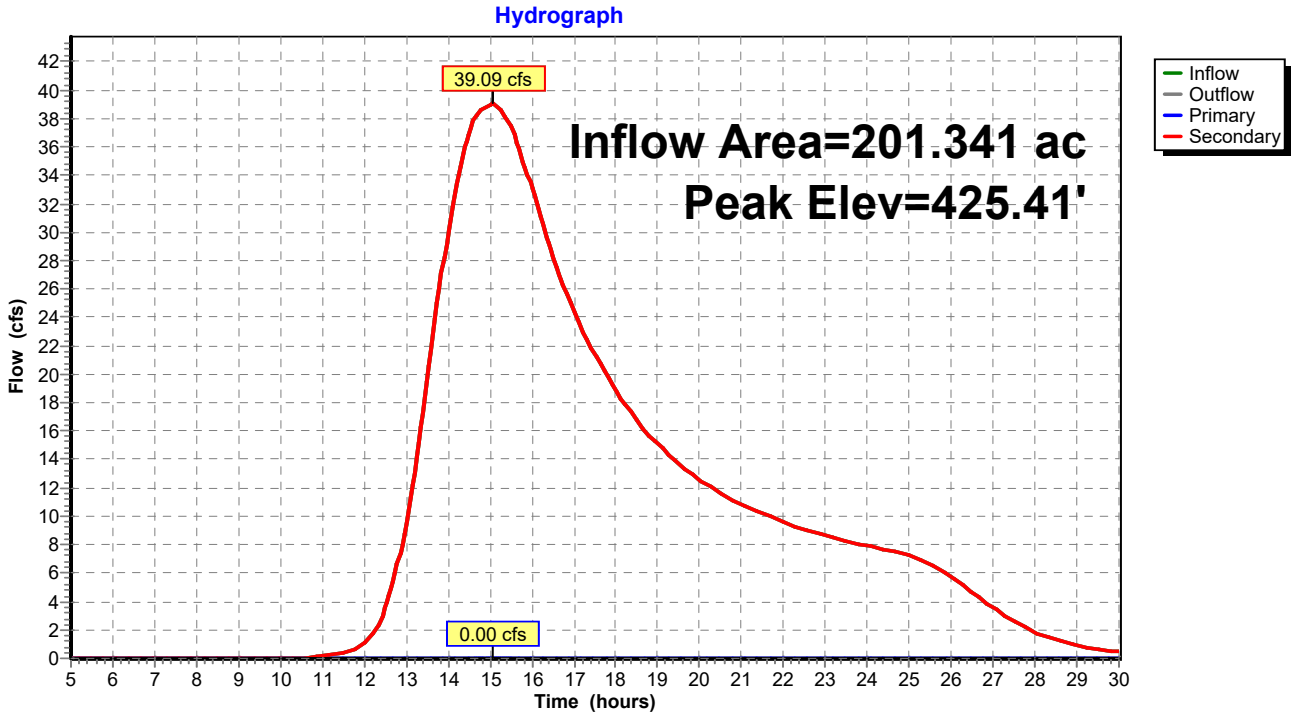
Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0.000	233.00	0.00	0.00	**0.00**
5.50	0.00	0.000	233.00	0.00	0.00	0.00
6.00	0.00	0.000	233.00	0.00	0.00	0.00
6.50	0.00	0.000	233.00	0.00	0.00	0.00
7.00	0.00	0.000	233.00	0.00	0.00	0.00
7.50	0.00	0.000	233.00	0.00	0.00	0.00
8.00	0.00	0.000	233.00	0.00	0.00	0.00
8.50	0.00	0.000	233.00	0.00	0.00	0.00
9.00	0.00	0.000	233.00	0.00	0.00	0.00
9.50	0.00	0.000	233.00	0.00	0.00	0.00
10.00	0.05	0.000	233.00	0.00	0.00	0.00
10.50	0.82	0.012	233.01	0.02	0.02	0.00
11.00	2.68	0.080	233.07	0.20	0.20	0.00
11.50	5.32	0.215	233.20	1.30	1.30	0.00
12.00	9.05	0.403	233.37	4.11	4.11	0.00
12.50	16.60	0.641	233.59	9.20	9.20	0.00
13.00	35.63	1.071	233.99	21.47	21.47	0.00
13.50	124.17	2.519	235.32	82.62	82.62	0.00
14.00	184.07	3.829	236.52	157.16	157.16	0.00
14.50	**215.16**	4.519	237.16	202.29	202.29	0.00
15.00	**219.18**	**4.721**	**237.34**	**216.26**	**216.26**	0.00
15.50	203.11	4.587	237.22	206.96	206.96	0.00
16.00	175.70	4.225	236.89	182.61	182.61	0.00
16.50	151.56	3.839	236.53	157.77	157.77	0.00
17.00	132.57	3.505	236.22	137.27	137.27	0.00
17.50	118.25	3.224	235.96	120.76	120.76	0.00
18.00	105.54	2.983	235.74	107.18	107.18	0.00
18.50	95.35	2.778	235.55	96.04	96.04	0.00
19.00	86.94	2.605	235.40	87.00	87.00	0.00
19.50	76.57	2.459	235.26	79.59	79.59	0.00
20.00	71.75	2.355	235.17	74.43	74.43	0.00
20.50	66.76	2.247	235.07	69.19	69.19	0.00
21.00	62.70	2.153	234.98	64.78	64.78	0.00
21.50	59.26	2.073	234.91	61.05	61.05	0.00
22.00	56.34	2.003	234.84	57.91	57.91	0.00
22.50	53.78	1.942	234.79	55.18	55.18	0.00
23.00	51.47	1.887	234.74	52.75	52.75	0.00
23.50	49.45	1.837	234.69	50.59	50.59	0.00
24.00	47.66	1.793	234.65	48.69	48.69	0.00
24.50	46.08	1.754	234.61	47.06	47.06	0.00
25.00	43.42	1.704	234.57	44.95	44.95	0.00
25.50	39.57	1.627	234.50	41.82	41.82	0.00
26.00	34.42	1.517	234.39	37.42	37.42	0.00
26.50	30.70	1.407	234.29	33.23	33.23	0.00
27.00	25.11	1.283	234.18	28.69	28.69	0.00
27.50	18.30	1.113	234.02	22.85	22.85	0.00
28.00	11.98	0.918	233.84	16.70	16.70	0.00
28.50	7.55	0.735	233.68	11.57	11.57	0.00
29.00	5.12	0.592	233.54	8.03	8.03	0.00
29.50	3.66	0.489	233.45	5.78	5.78	0.00
30.00	2.61	0.412	233.38	4.28	4.28	0.00



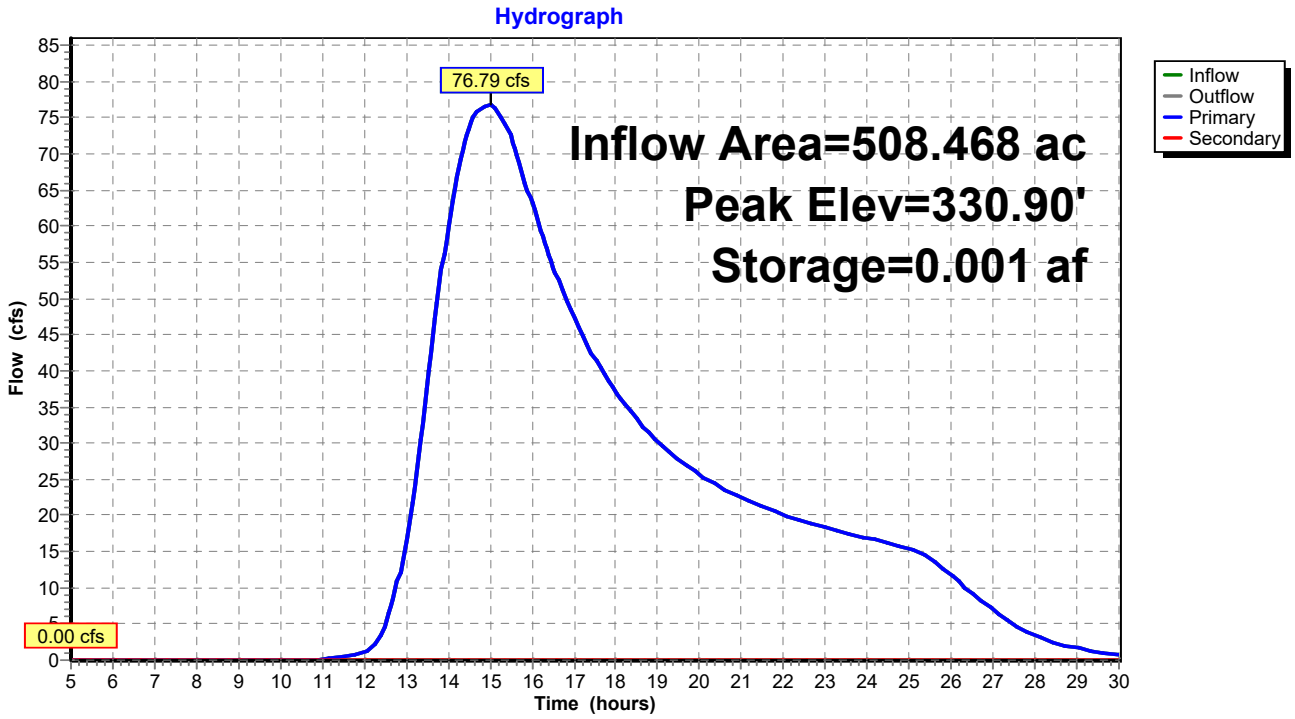


Routing Diagram for forbush_prop_alt2_bankfull
Prepared by Tighe & Bond, Printed 11/29/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

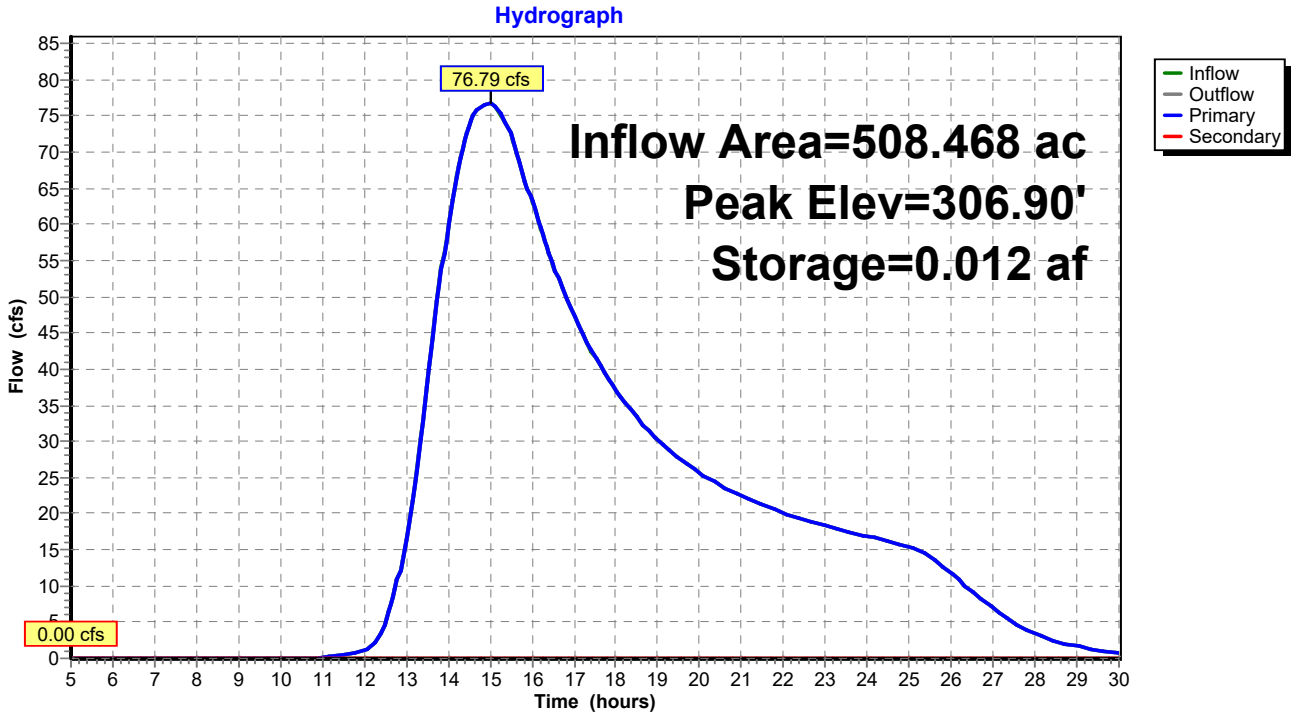
Pond 0P: 117 Culvert



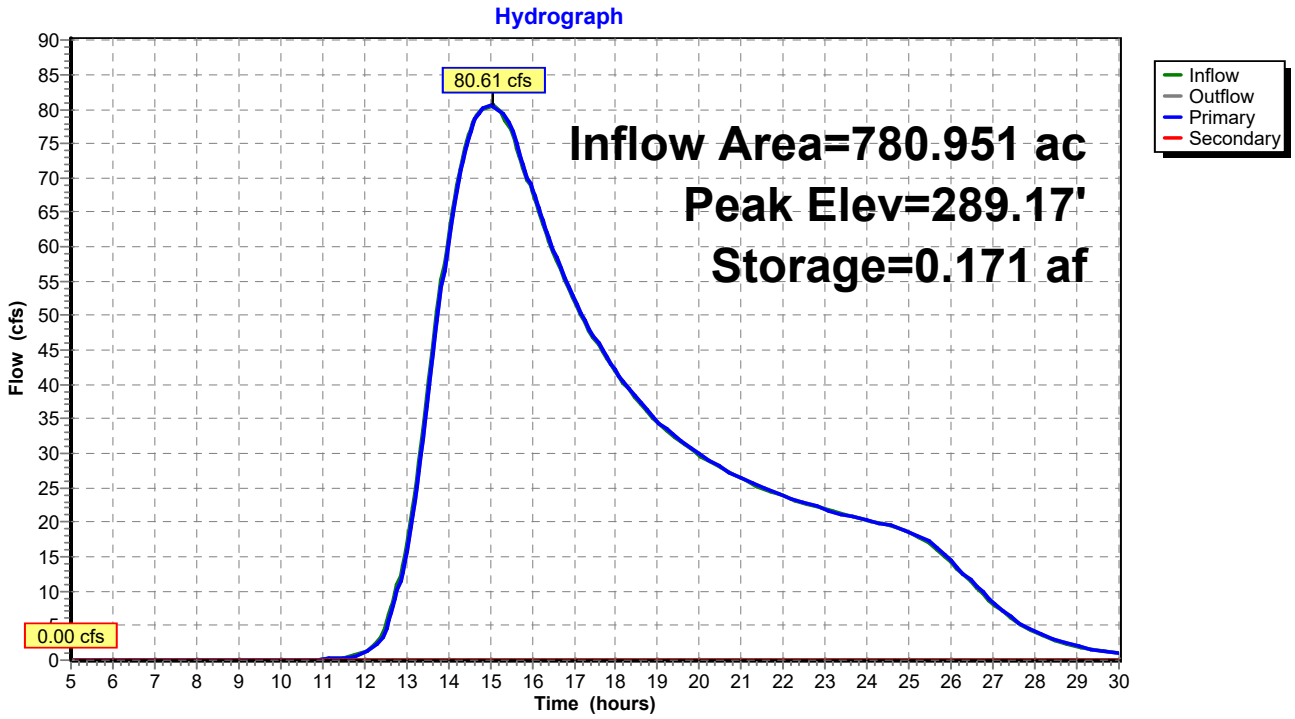
Pond 1P: Culvert 1



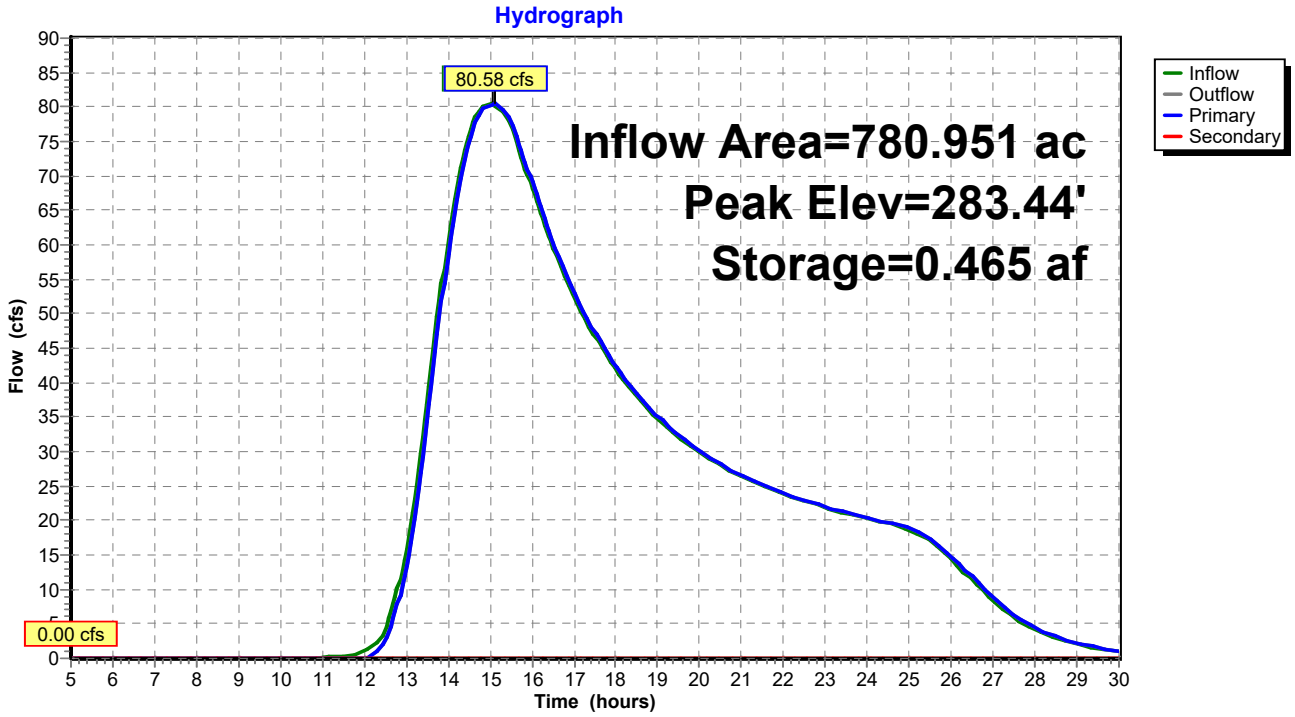
Pond 2P: Culvert 2



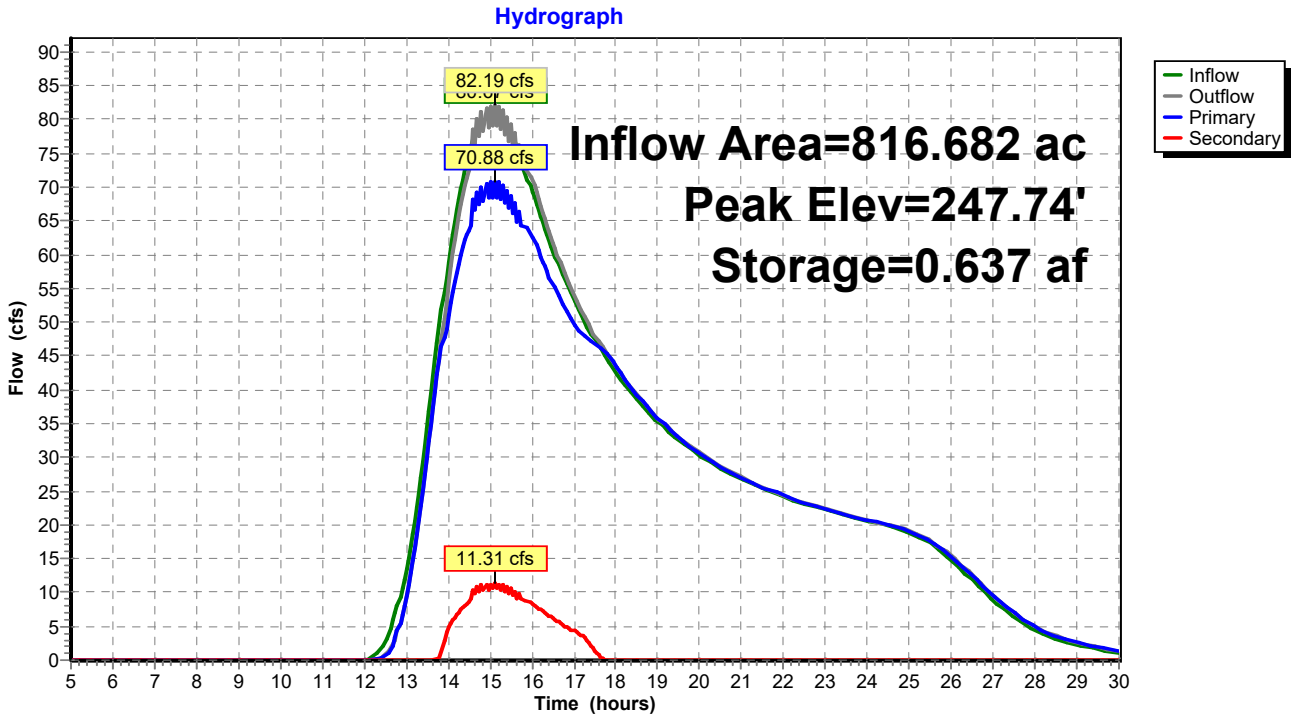
Pond 3P: Culvert 3



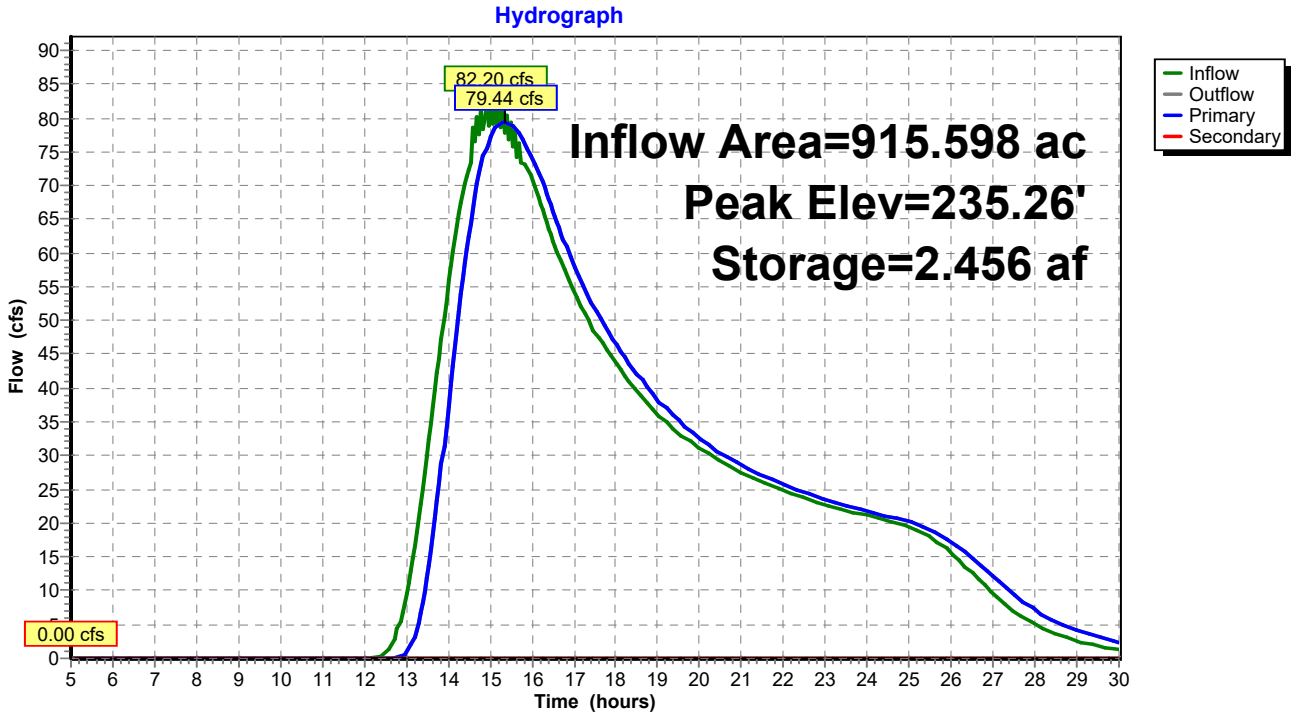
Pond 4P: Culvert 4



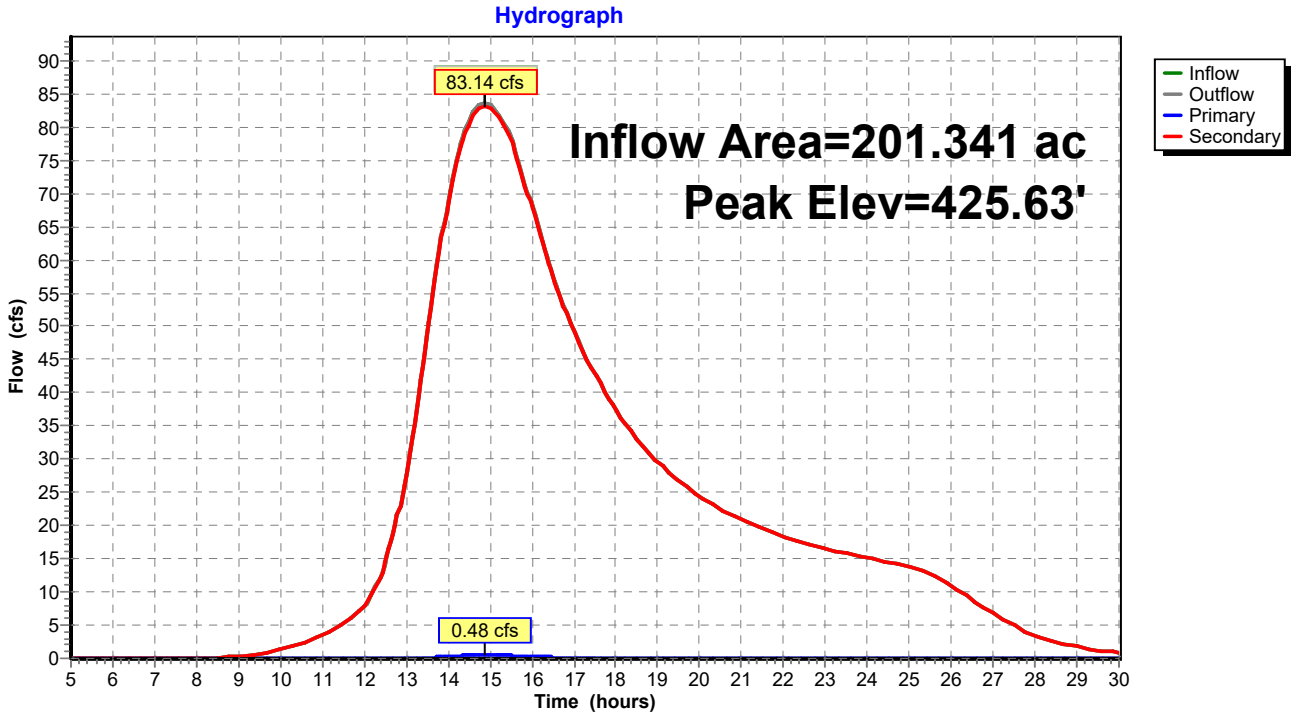
Pond 5P: Sand Culvert



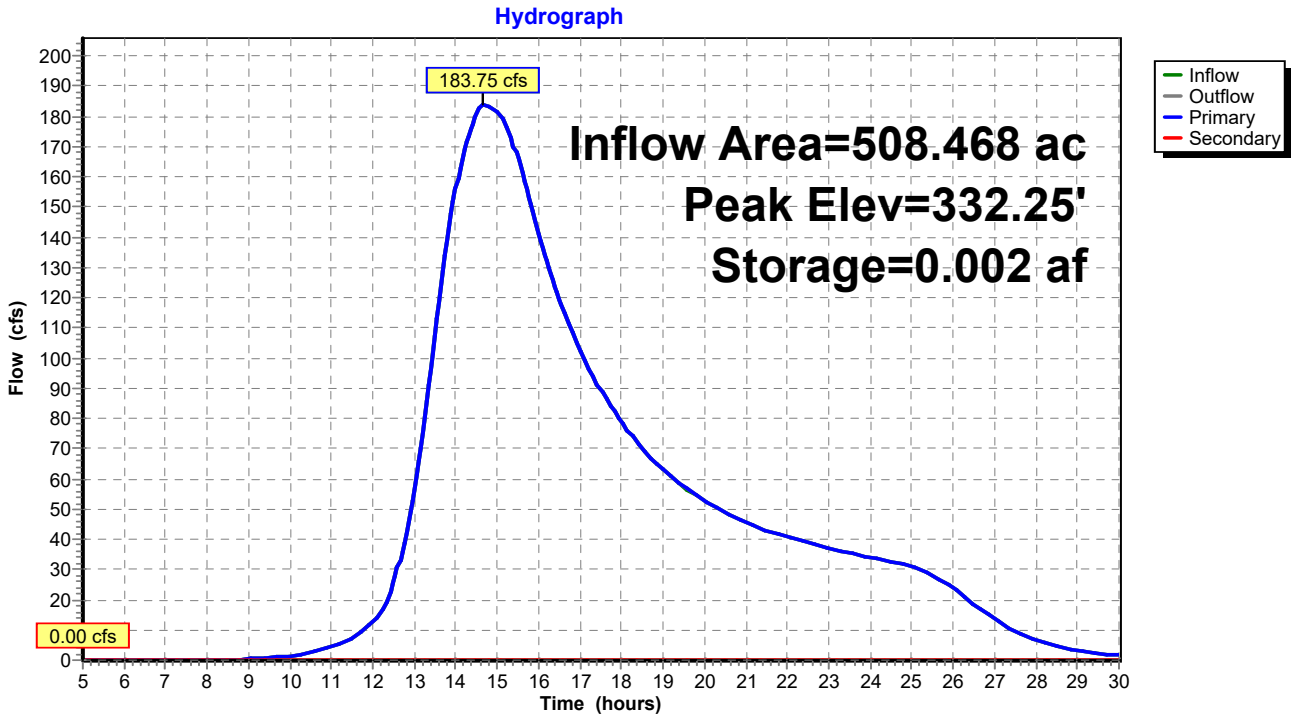
Pond 6P: 110 Culvert



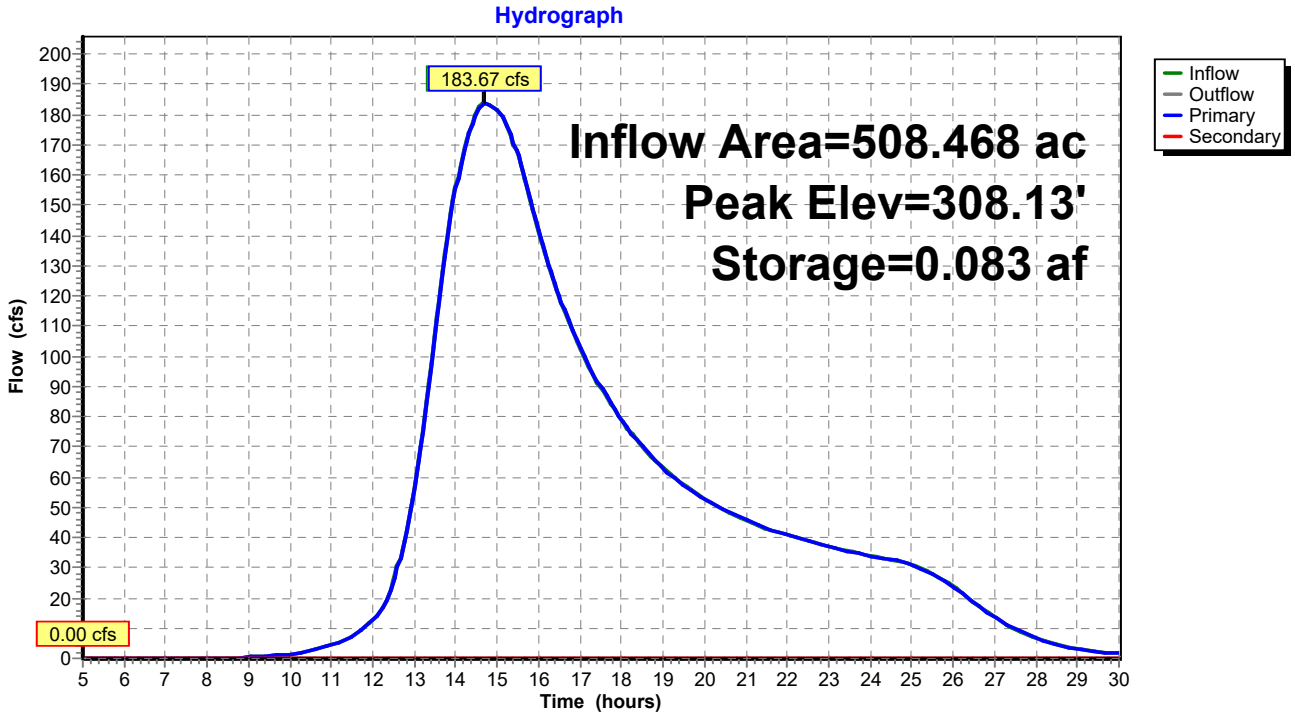
Pond 0P: 117 Culvert



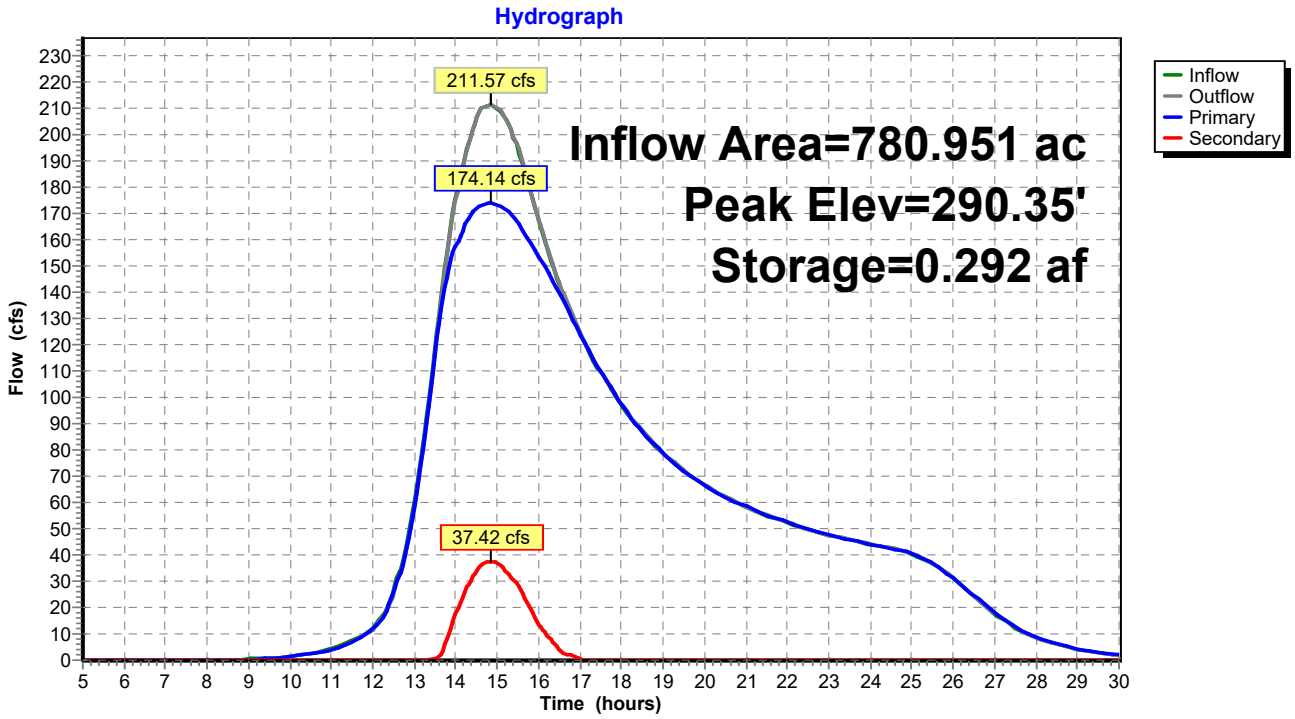
Pond 1P: Culvert 1



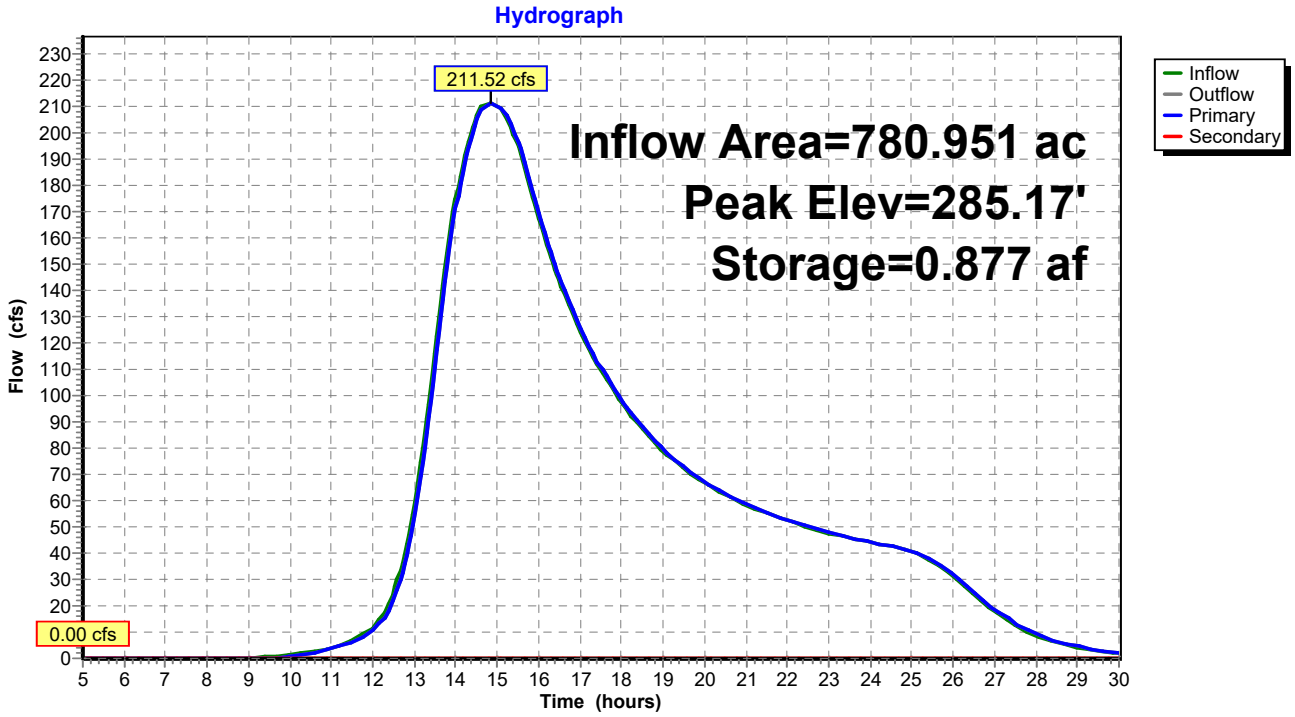
Pond 2P: Culvert 2



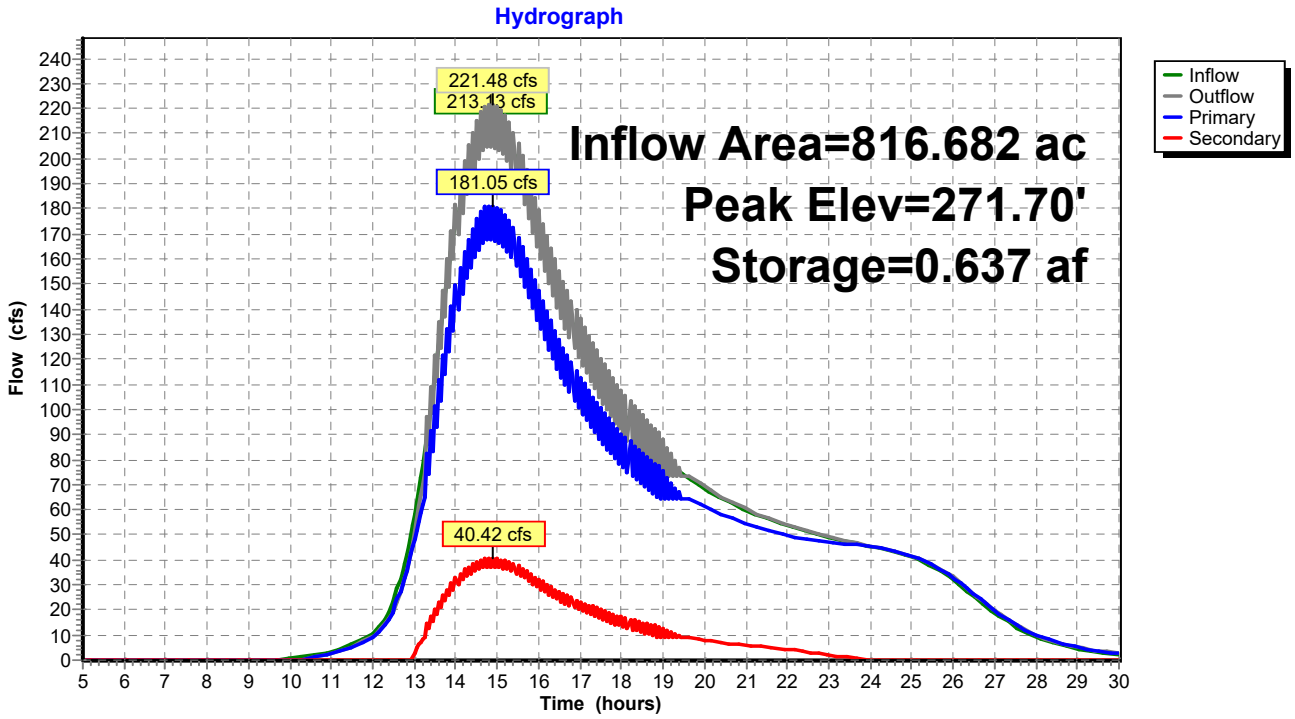
Pond 3P: Culvert 3



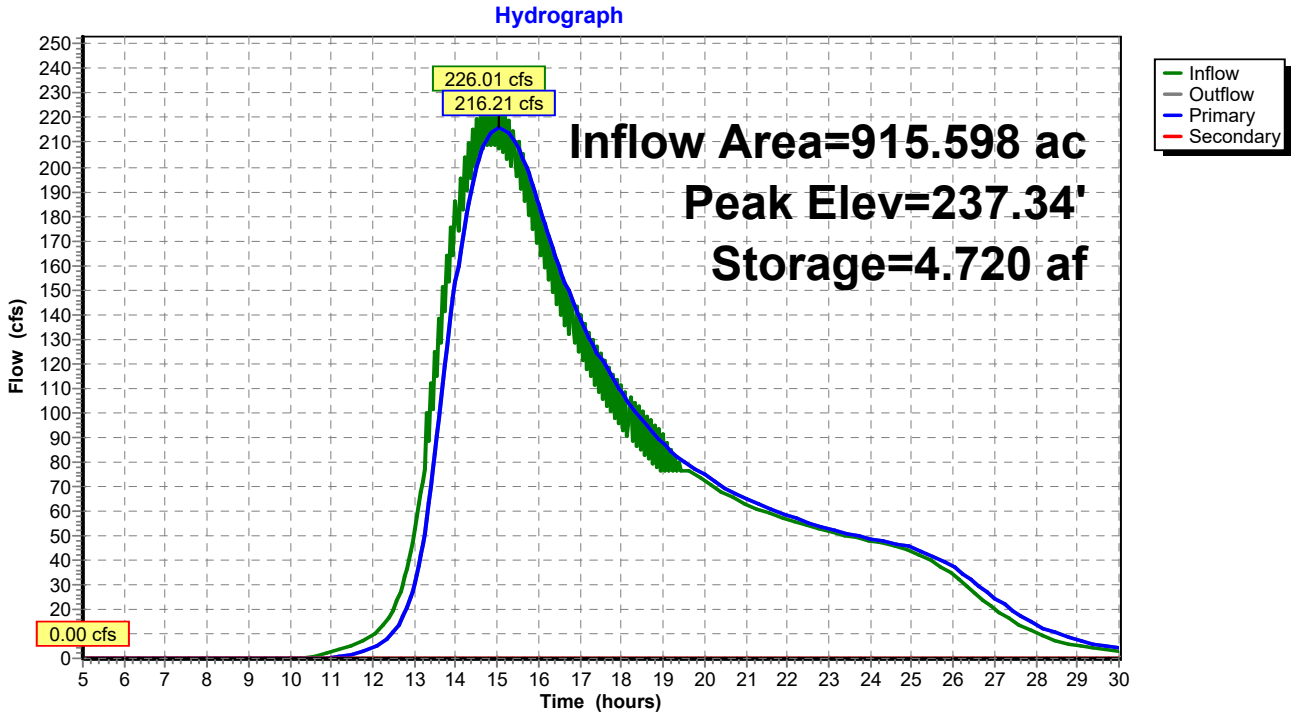
Pond 4P: Culvert 4



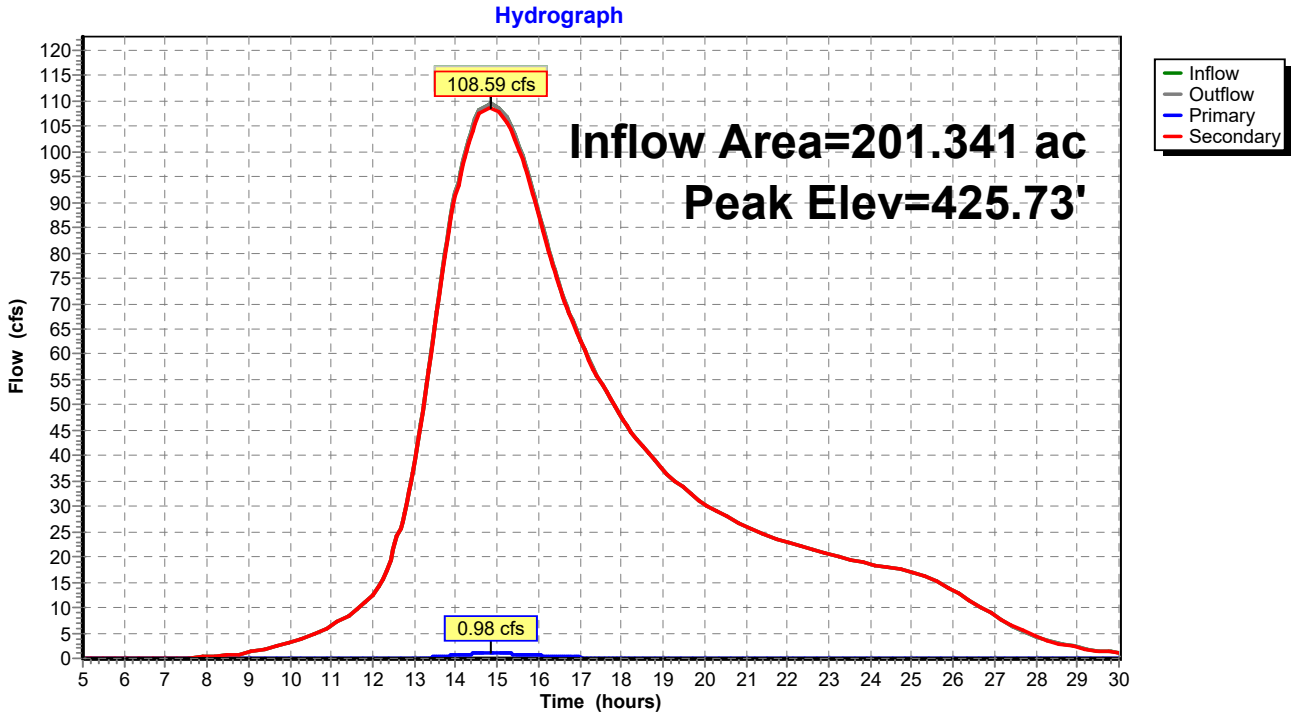
Pond 5P: Sand Culvert



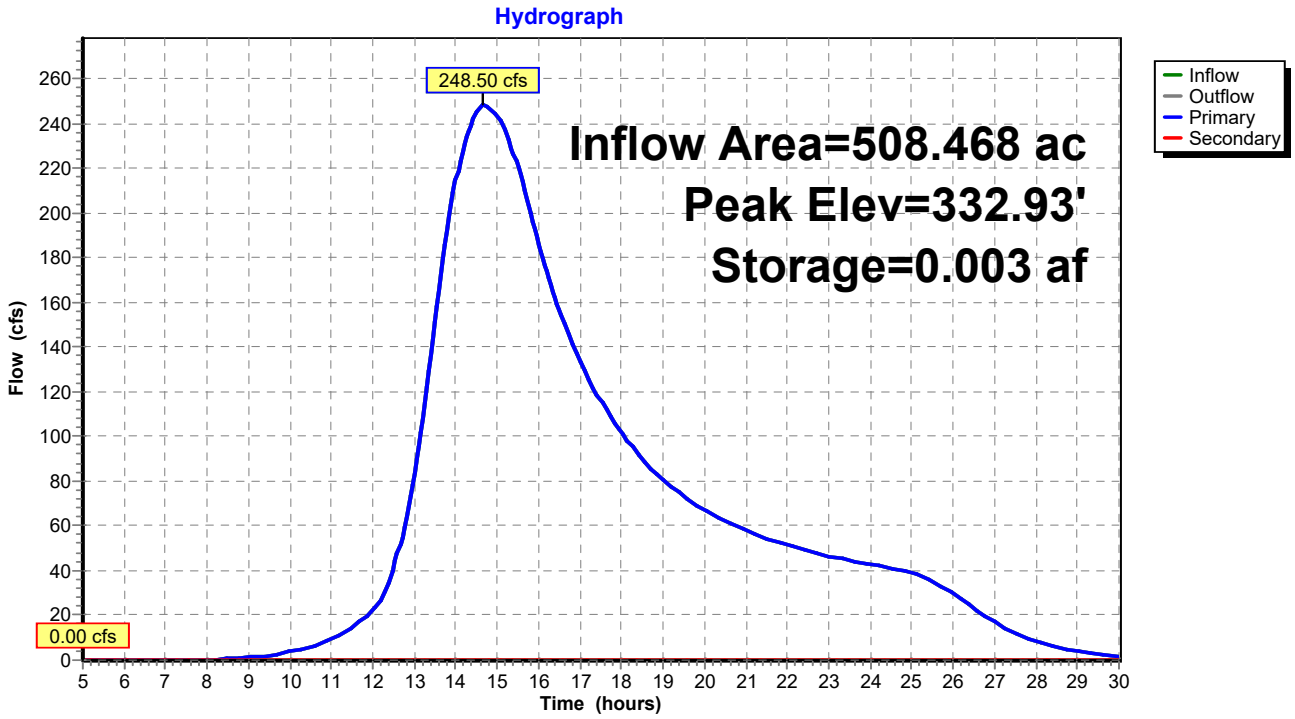
Pond 6P: 110 Culvert



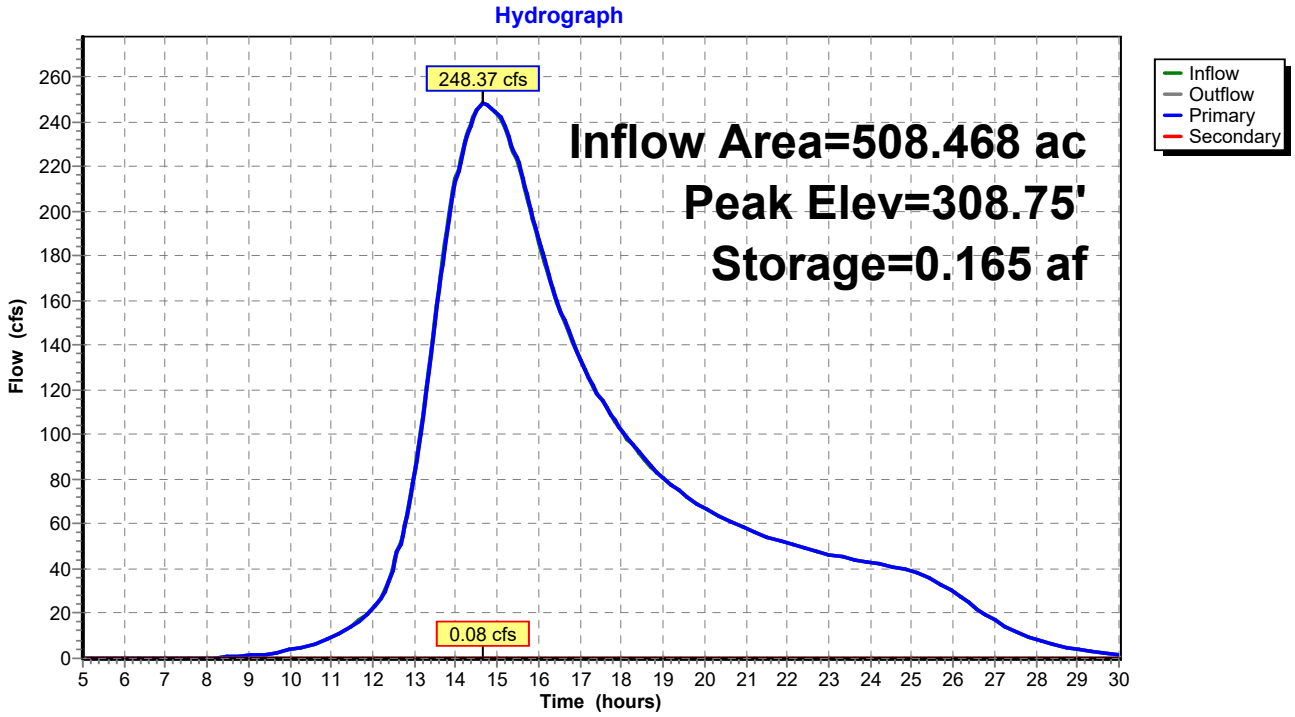
Pond 0P: 117 Culvert



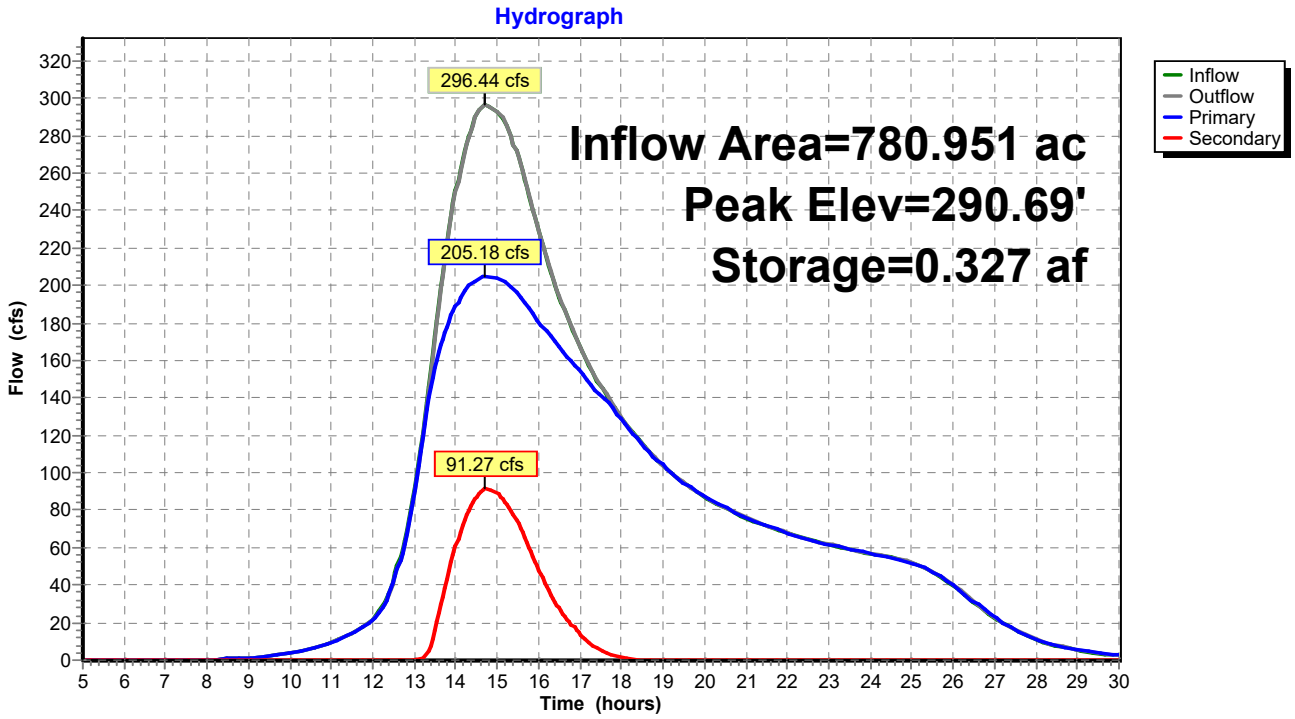
Pond 1P: Culvert 1



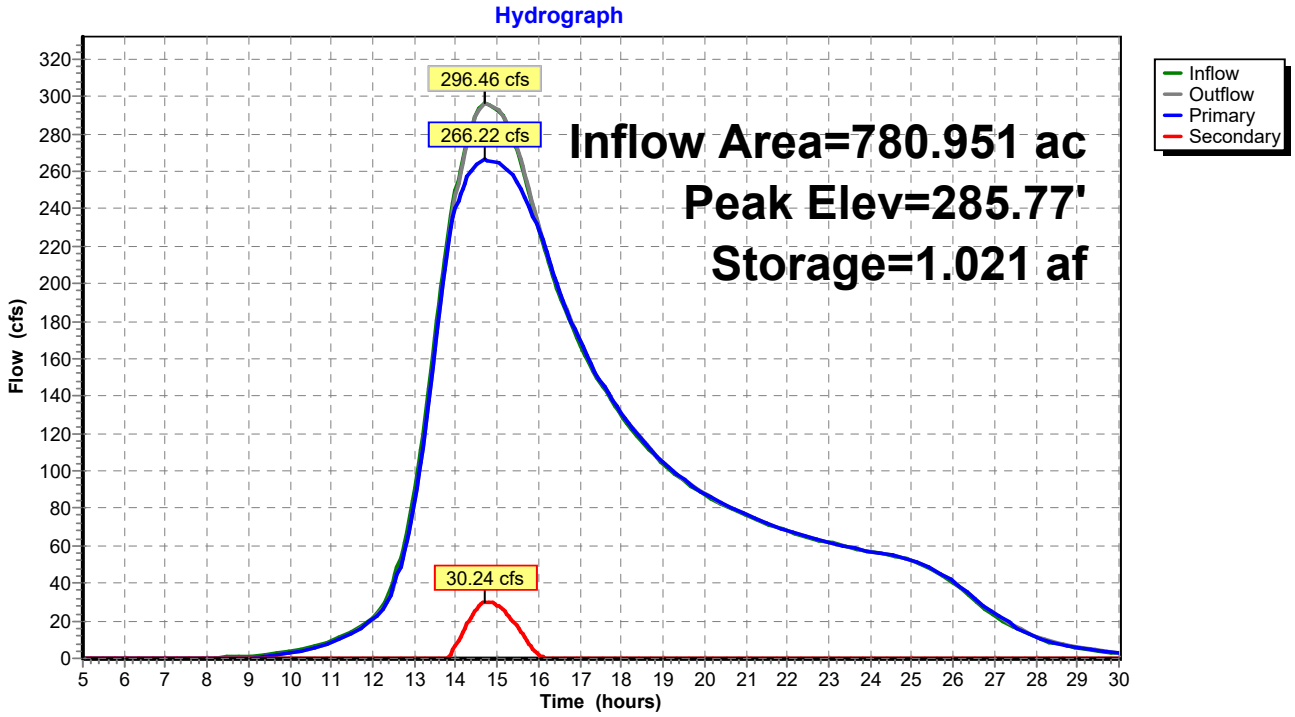
Pond 2P: Culvert 2



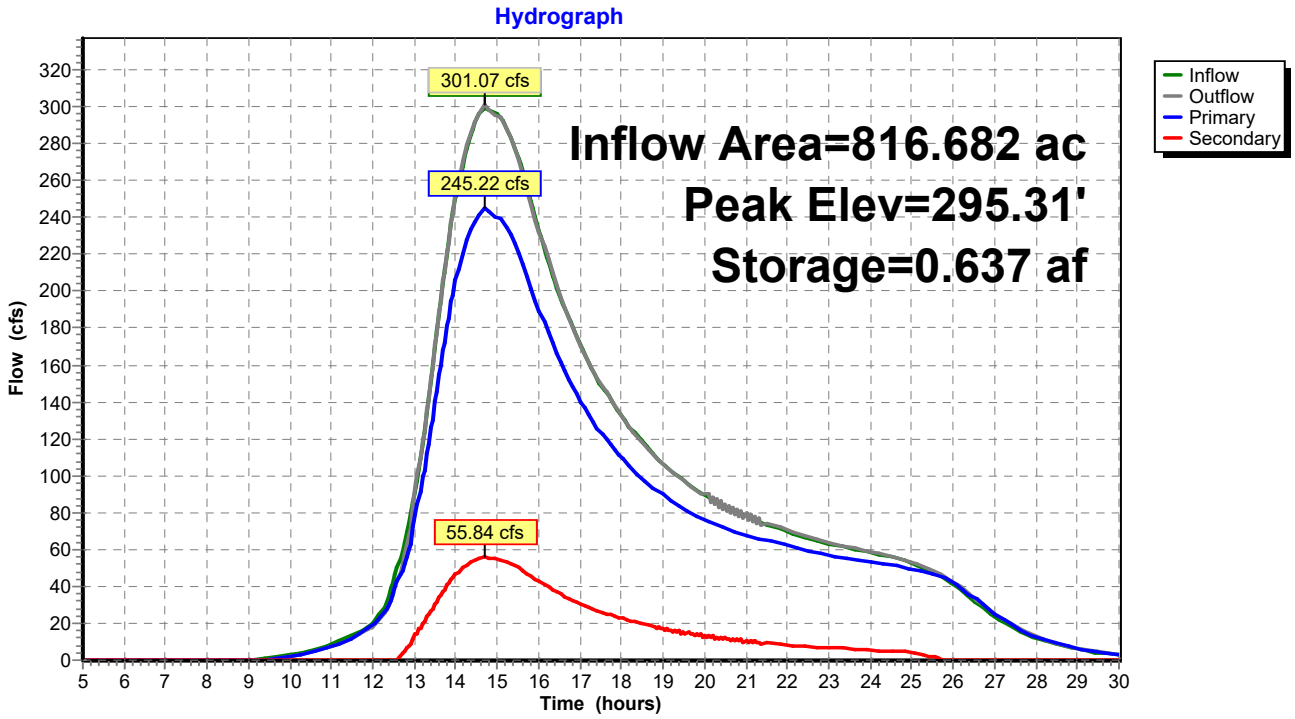
Pond 3P: Culvert 3



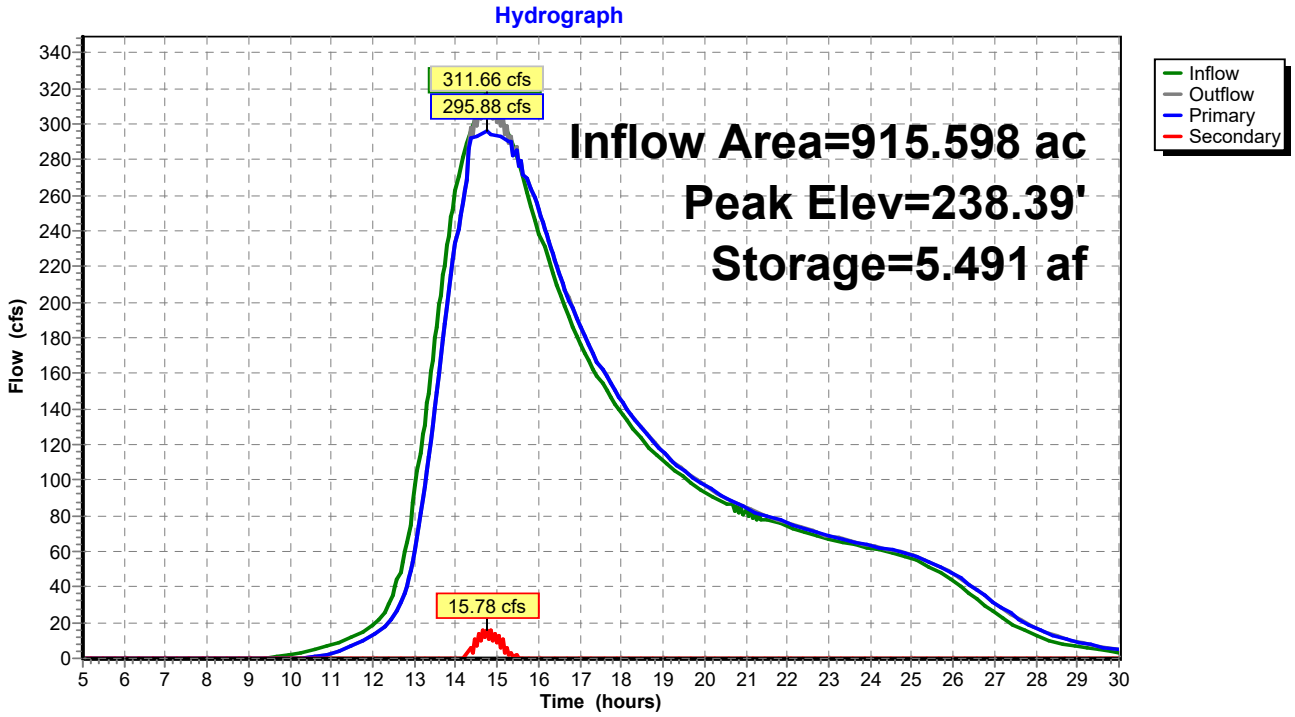
Pond 4P: Culvert 4



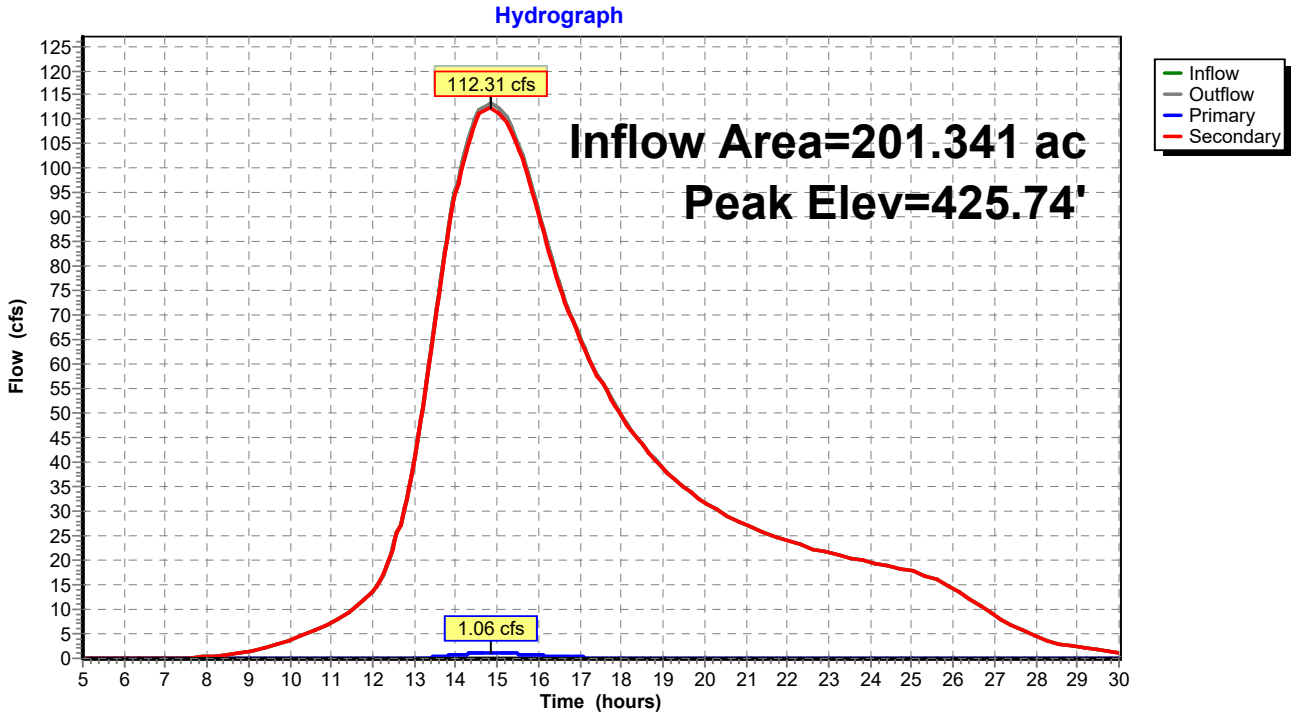
Pond 5P: Sand Culvert



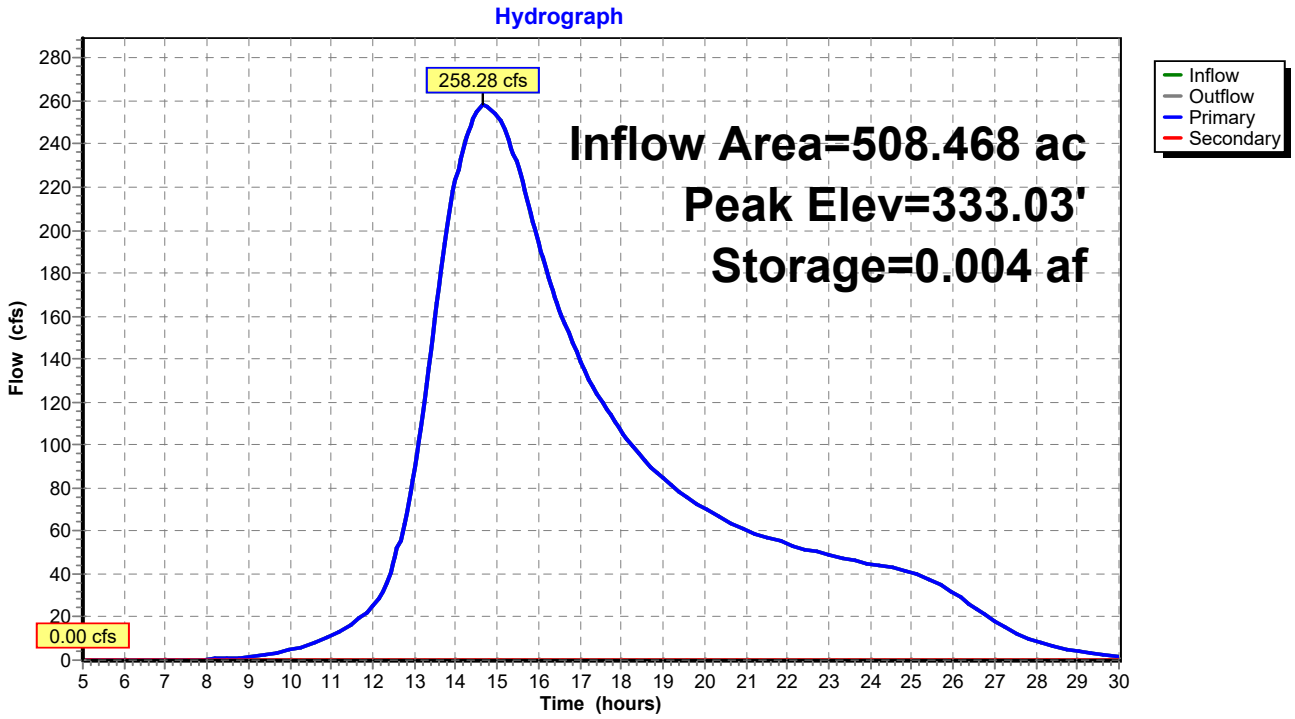
Pond 6P: 110 Culvert



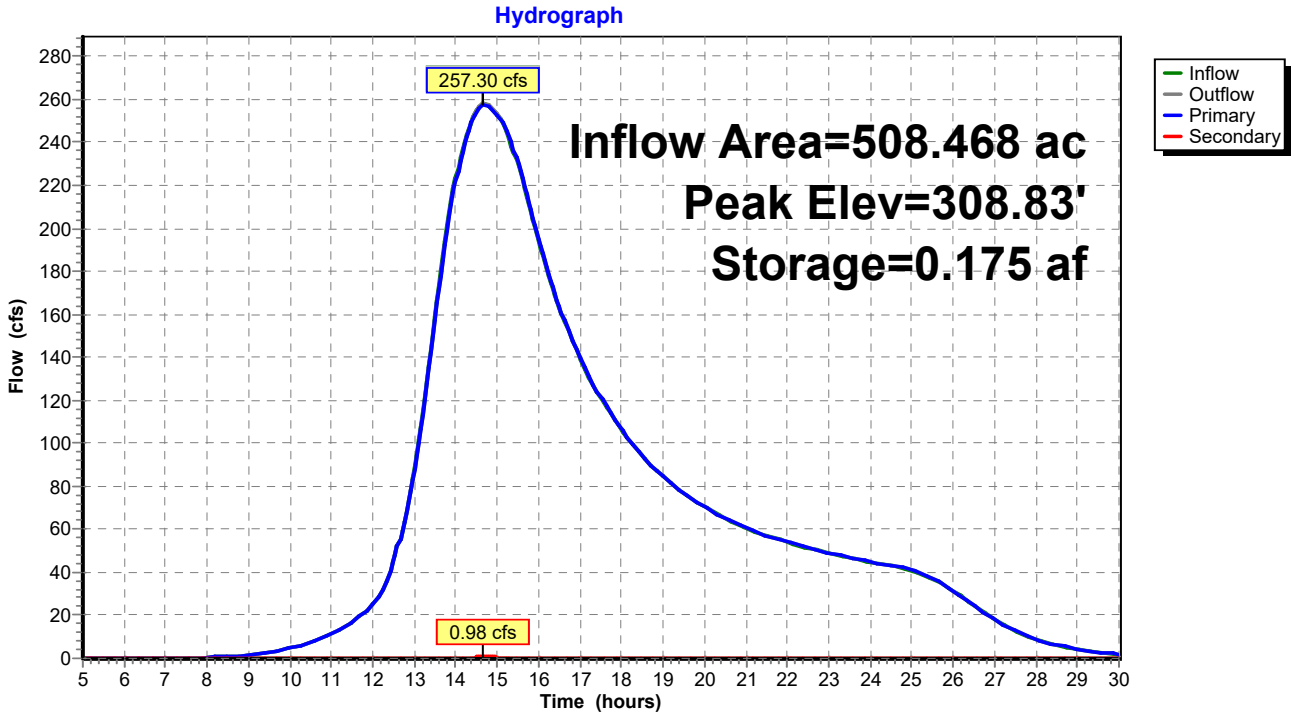
Pond 0P: 117 Culvert



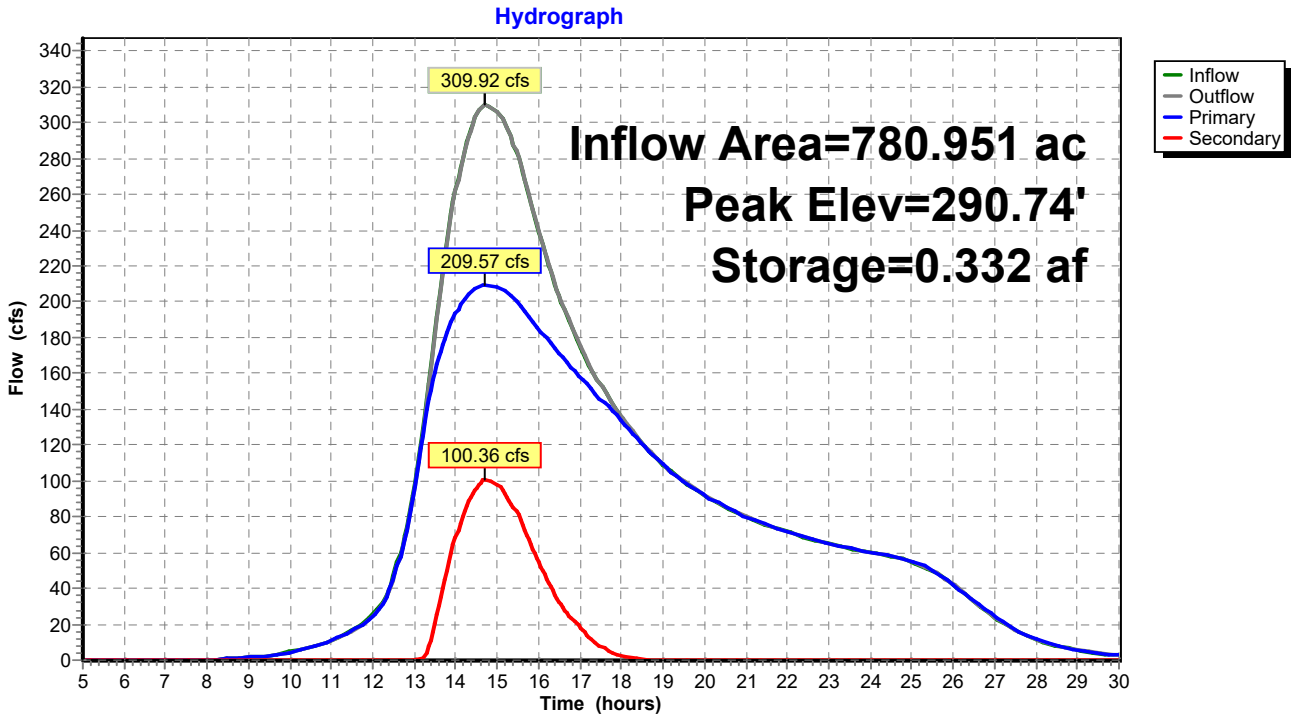
Pond 1P: Culvert 1



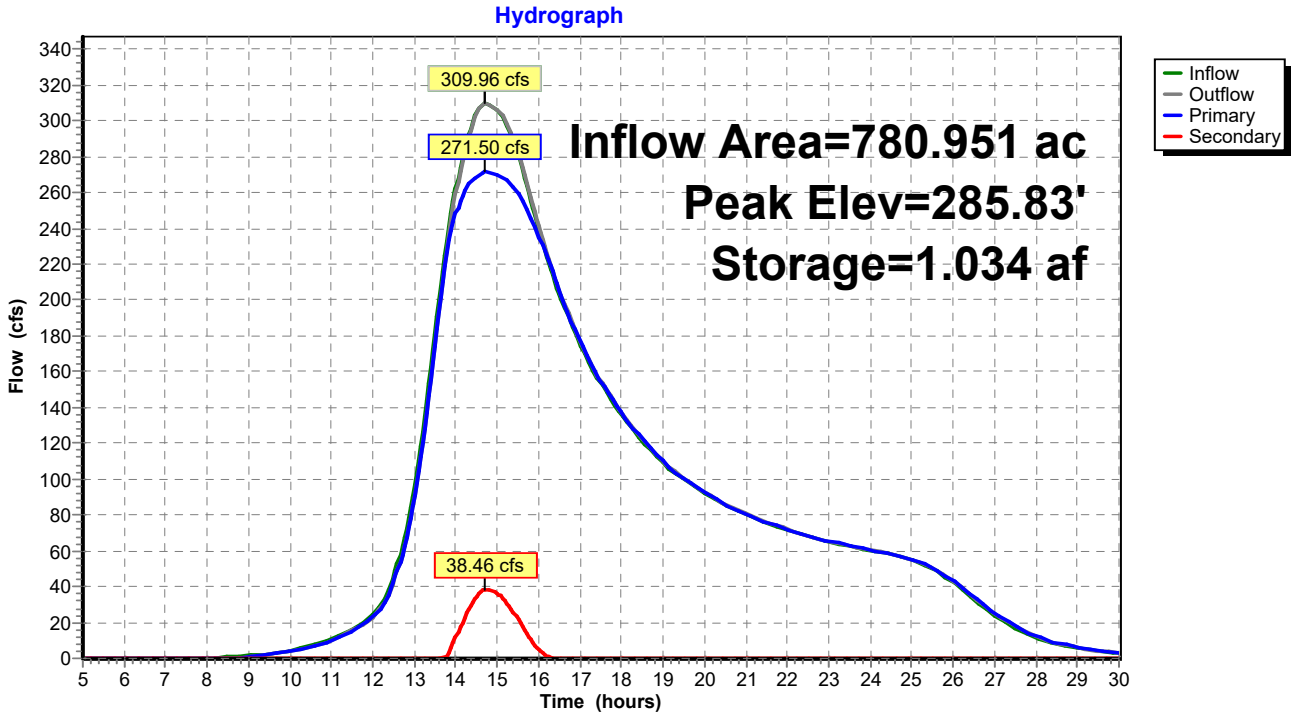
Pond 2P: Culvert 2



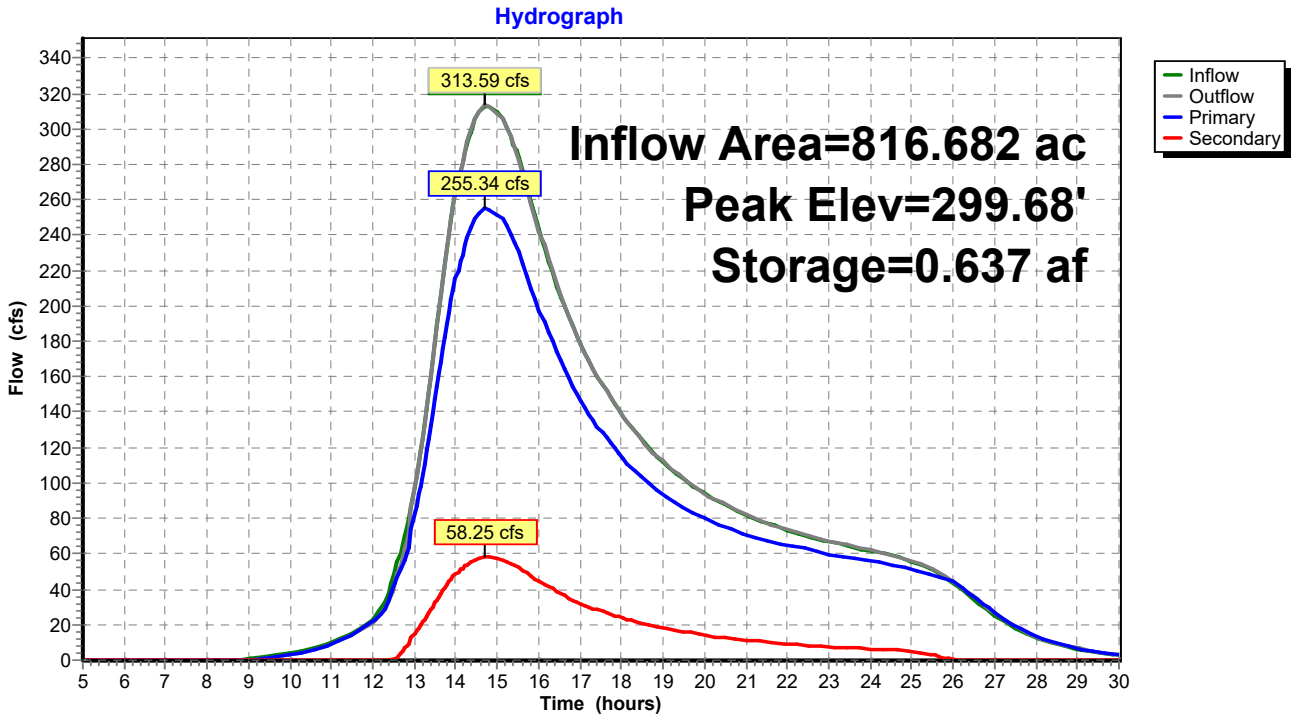
Pond 3P: Culvert 3



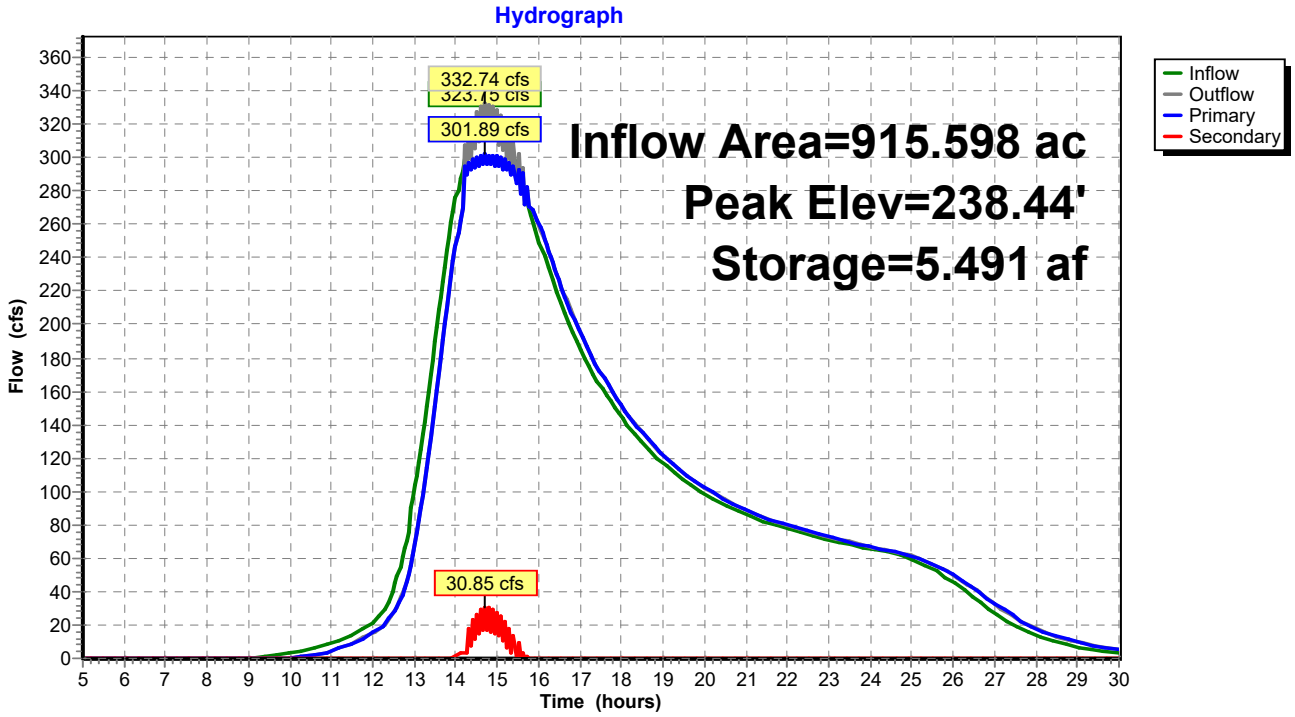
Pond 4P: Culvert 4



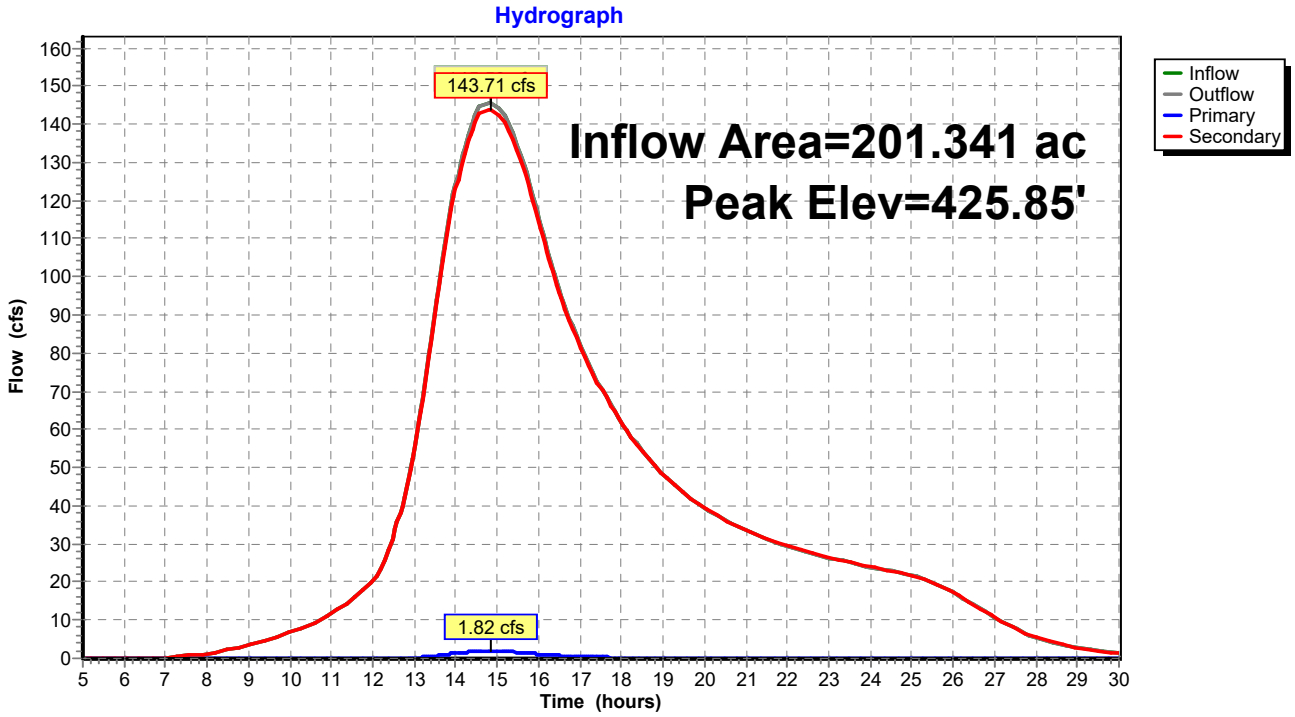
Pond 5P: Sand Culvert



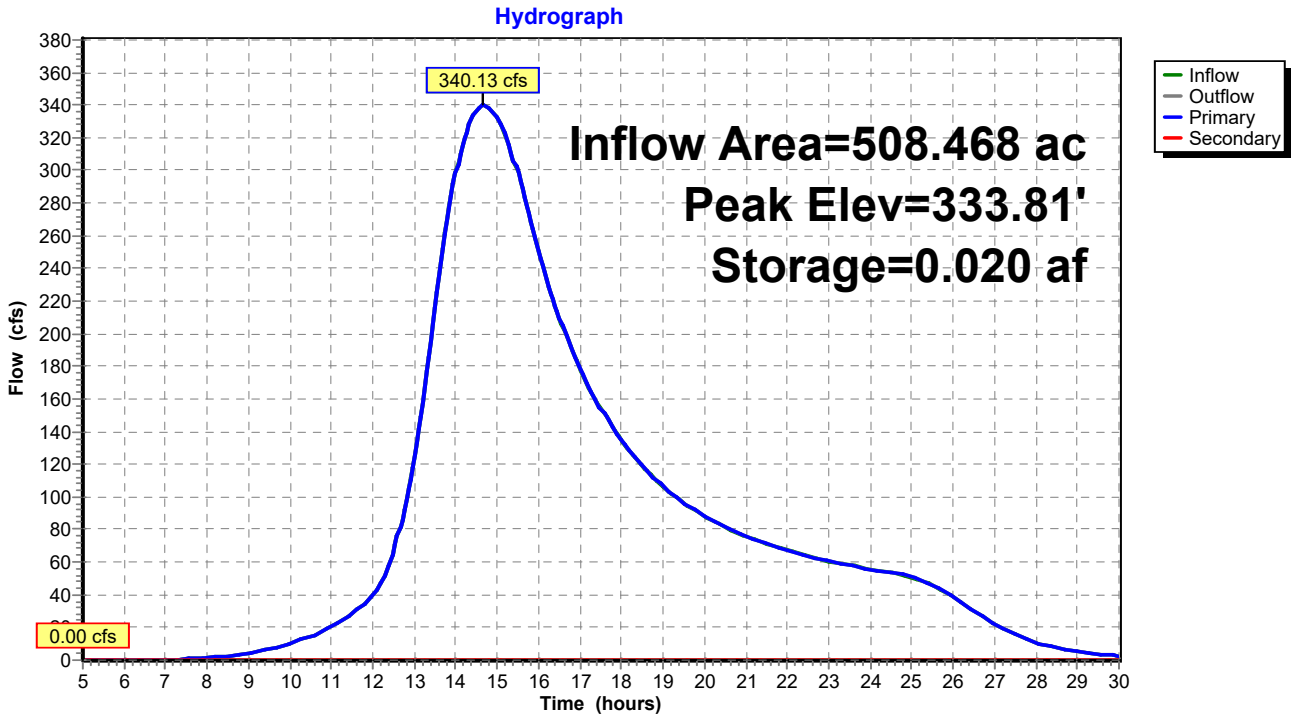
Pond 6P: 110 Culvert



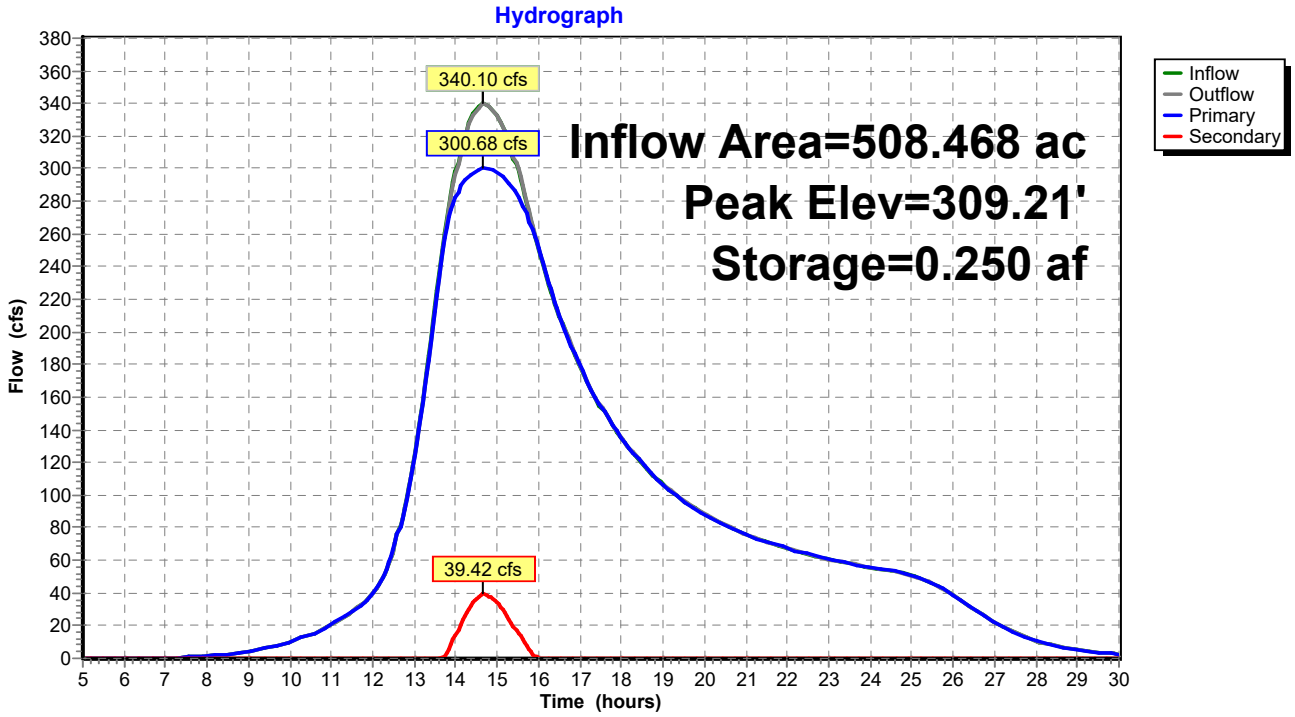
Pond 0P: 117 Culvert



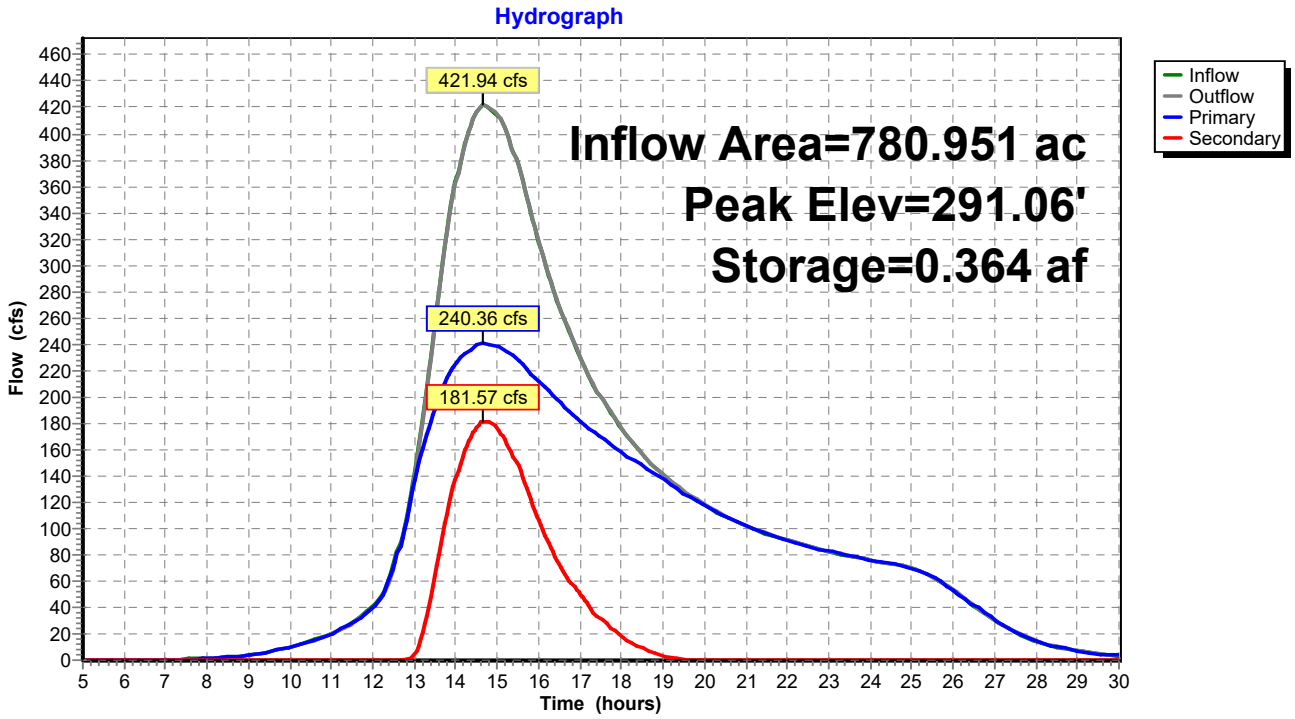
Pond 1P: Culvert 1



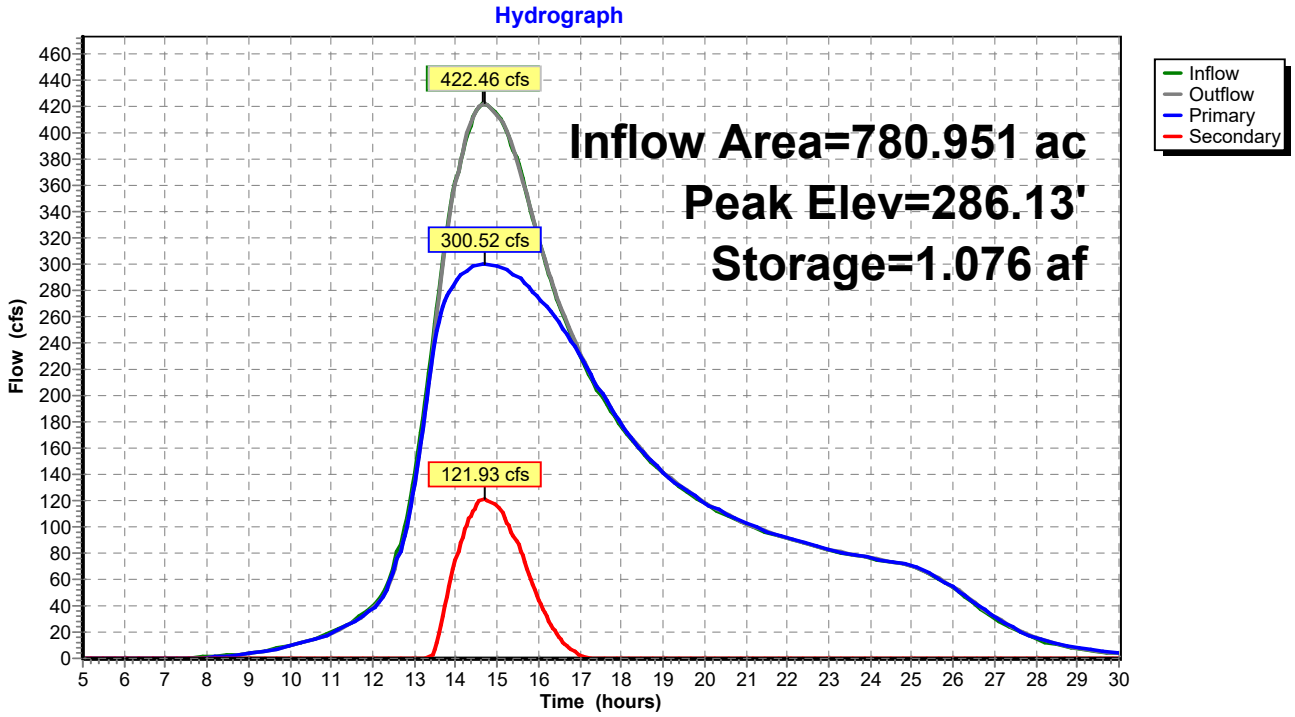
Pond 2P: Culvert 2



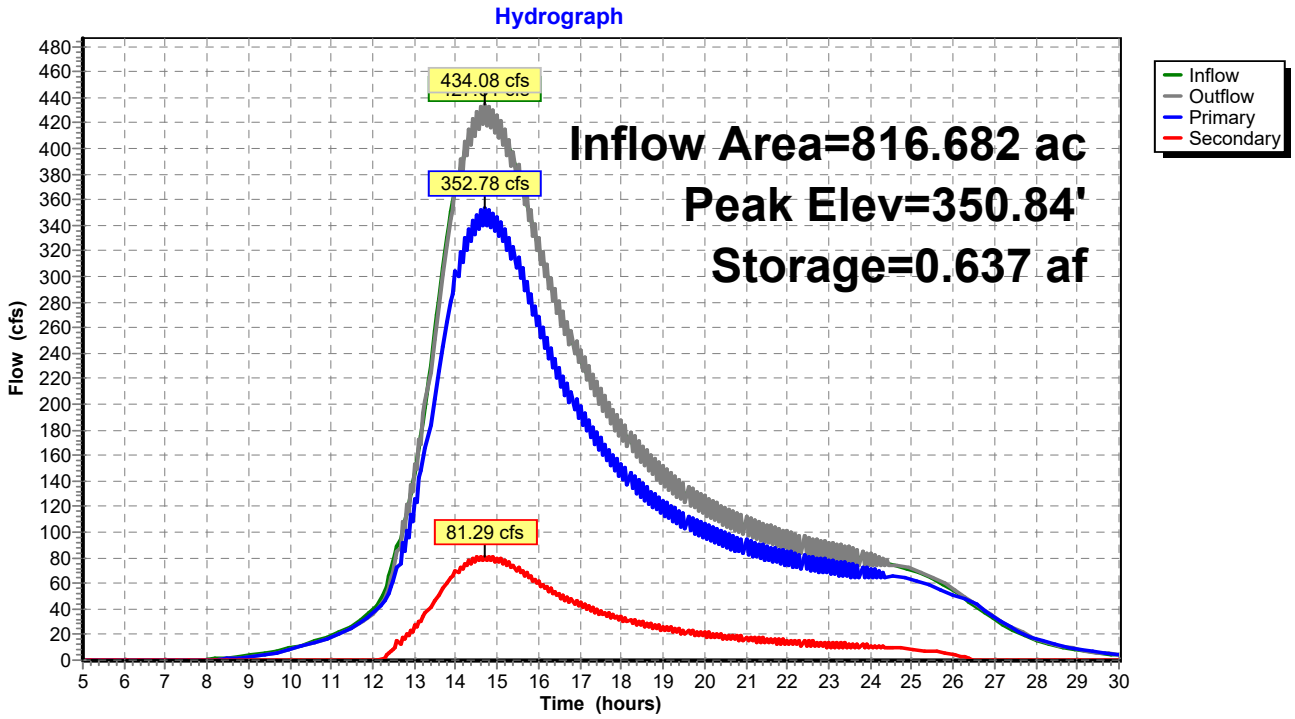
Pond 3P: Culvert 3



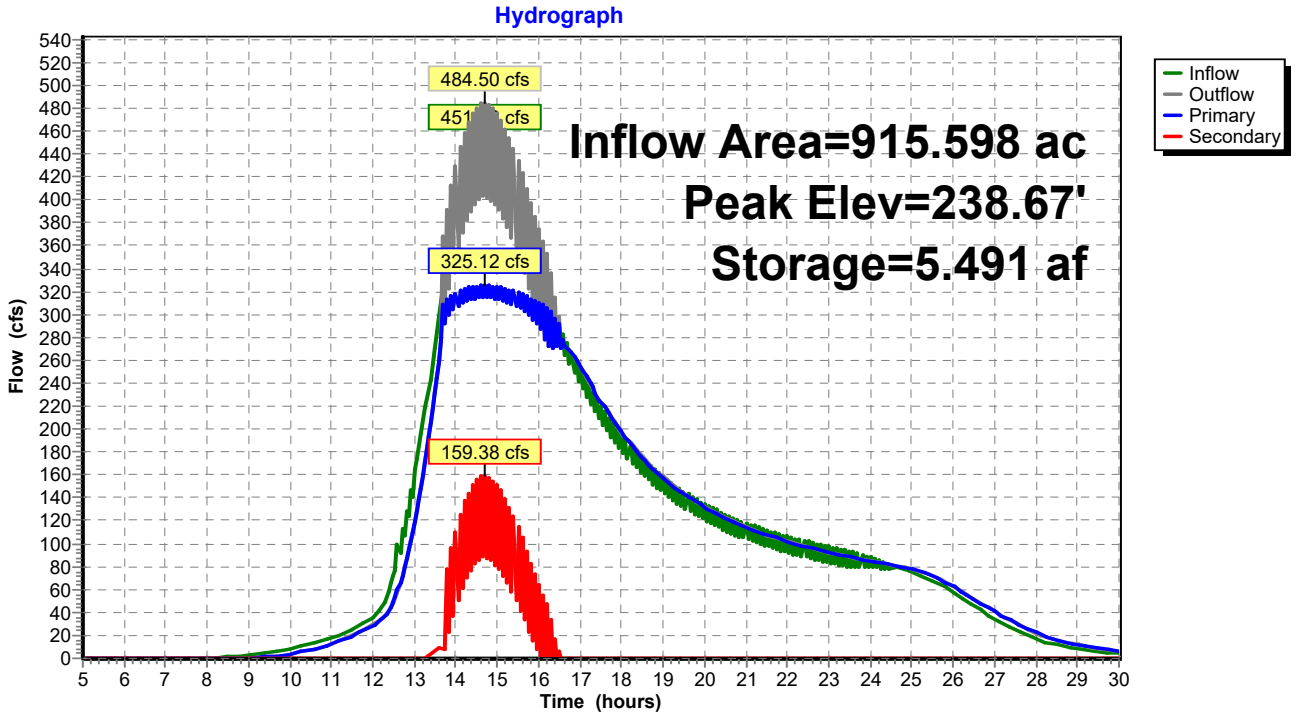
Pond 4P: Culvert 4



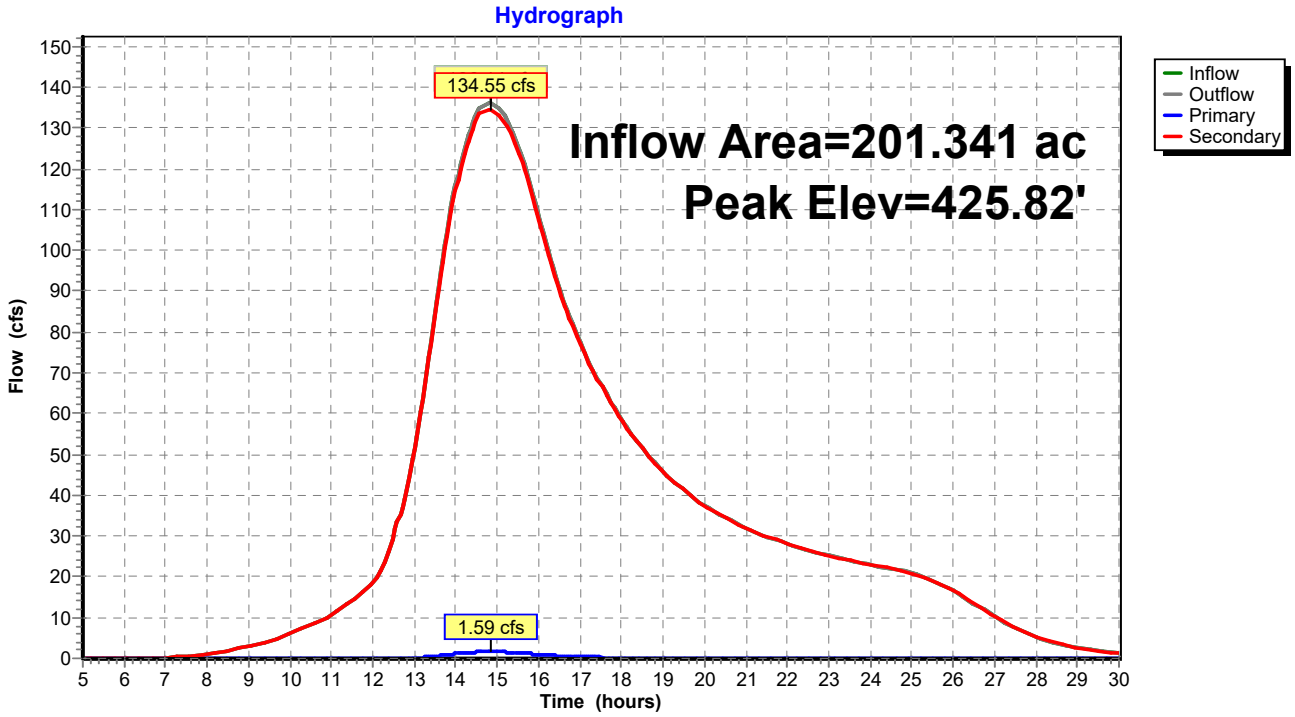
Pond 5P: Sand Culvert



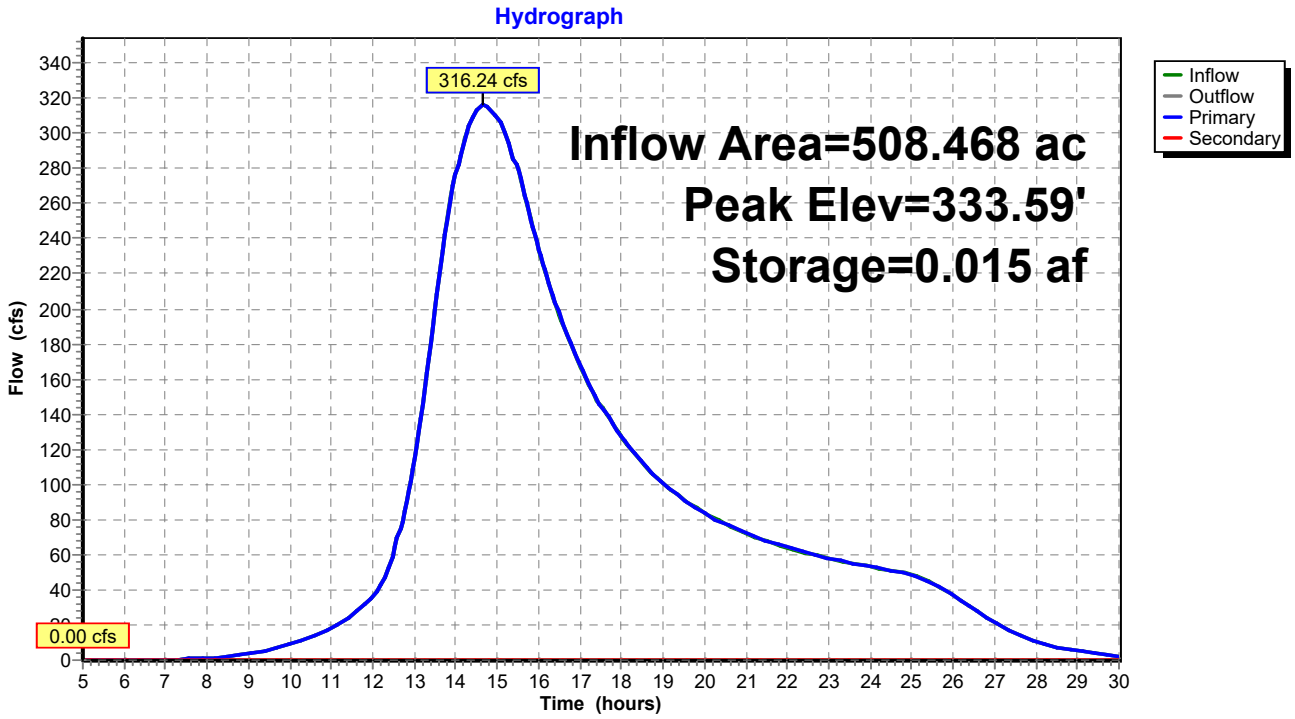
Pond 6P: 110 Culvert



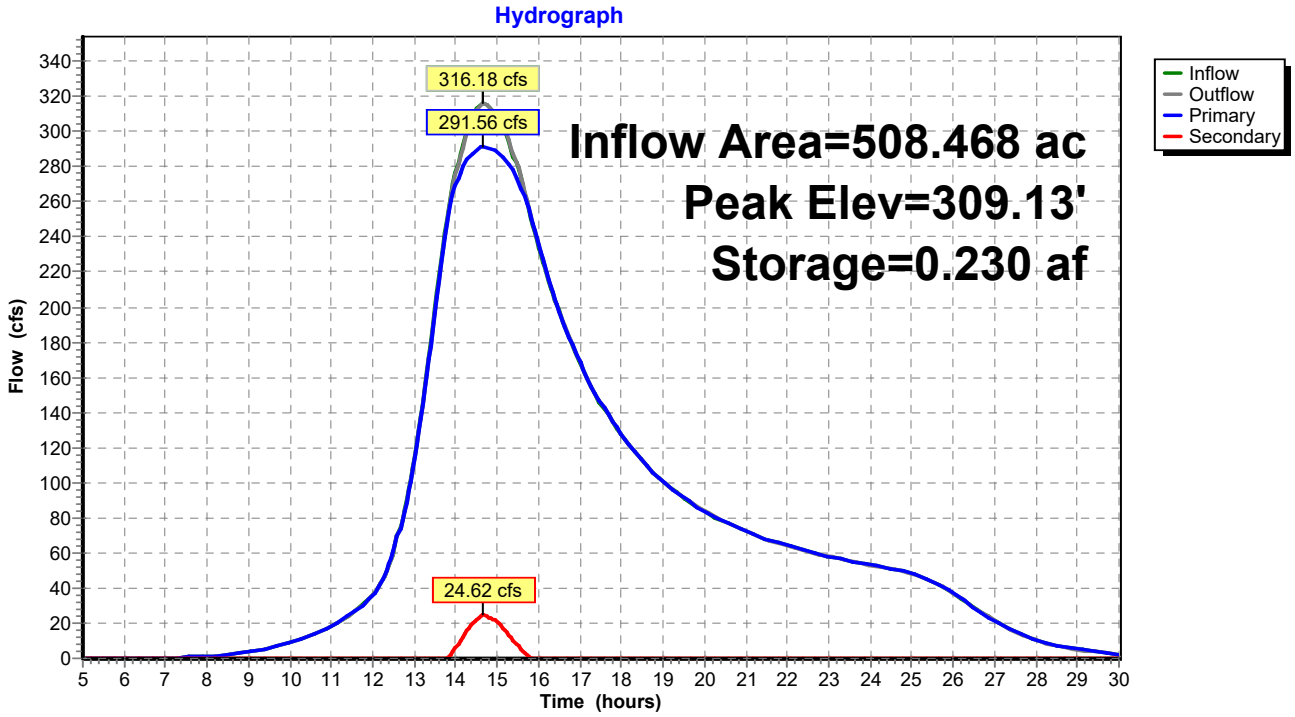
Pond 0P: 117 Culvert



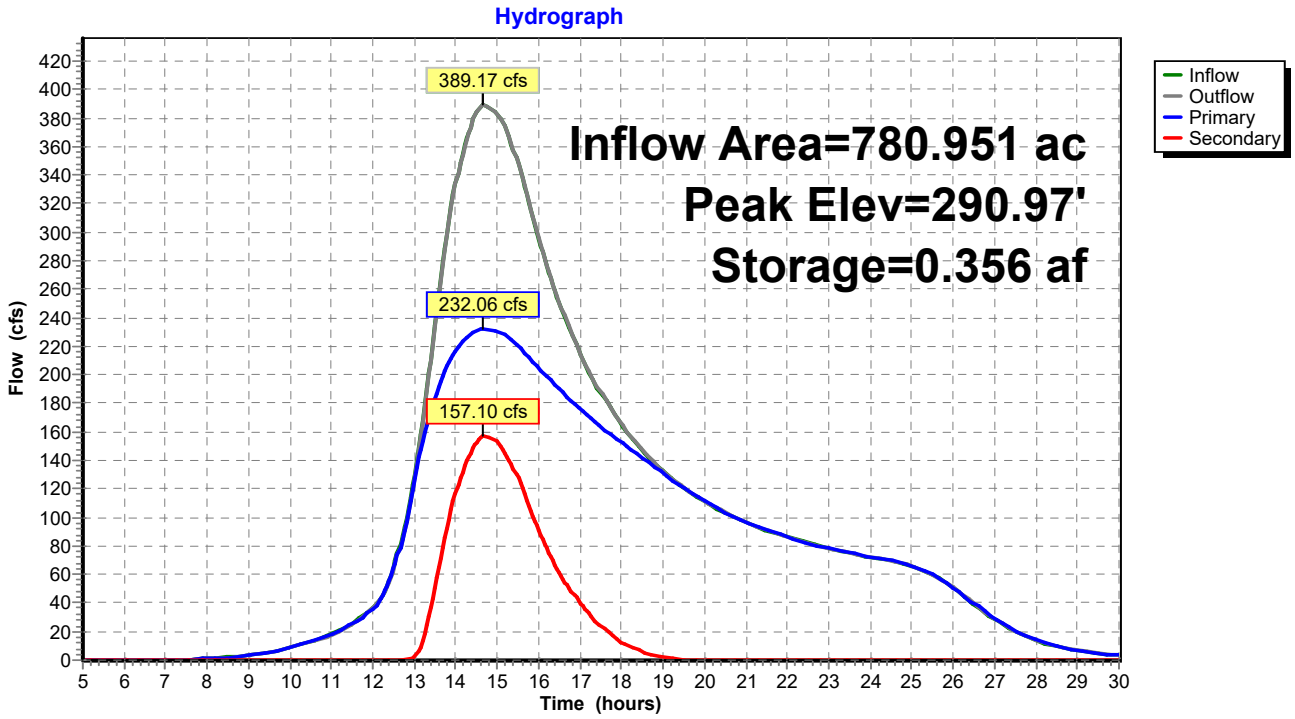
Pond 1P: Culvert 1



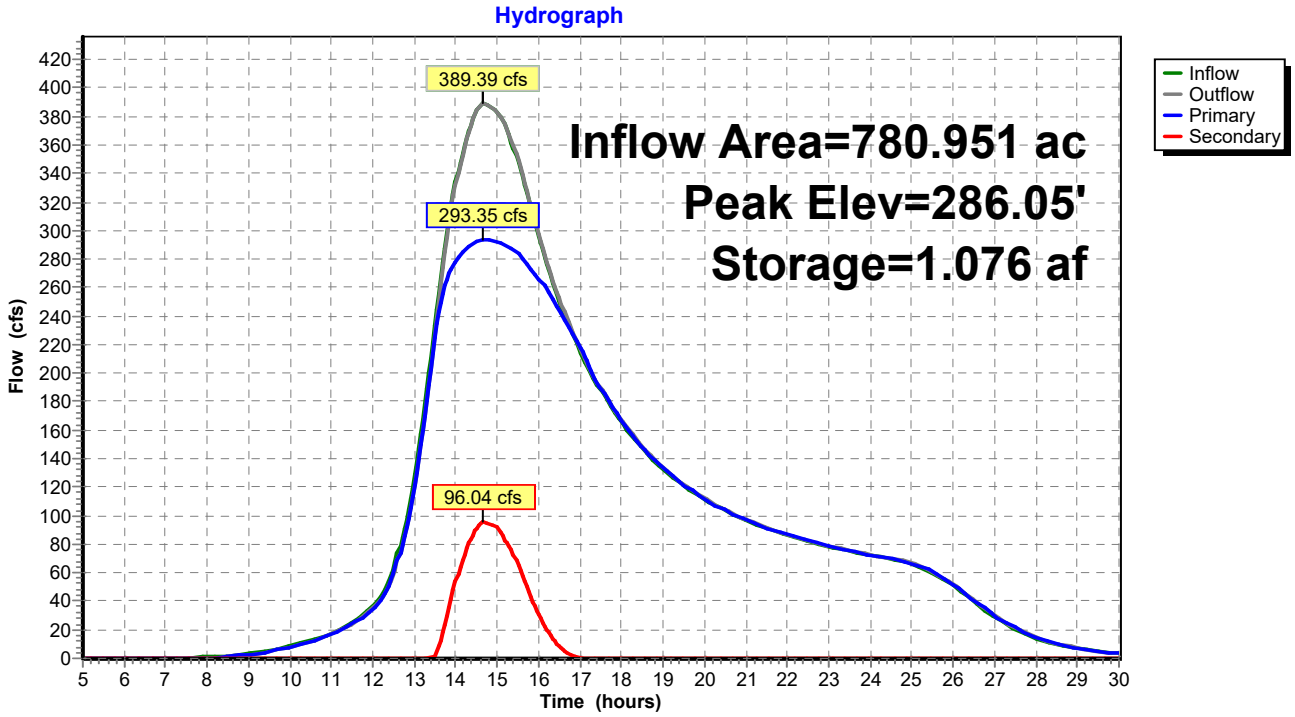
Pond 2P: Culvert 2



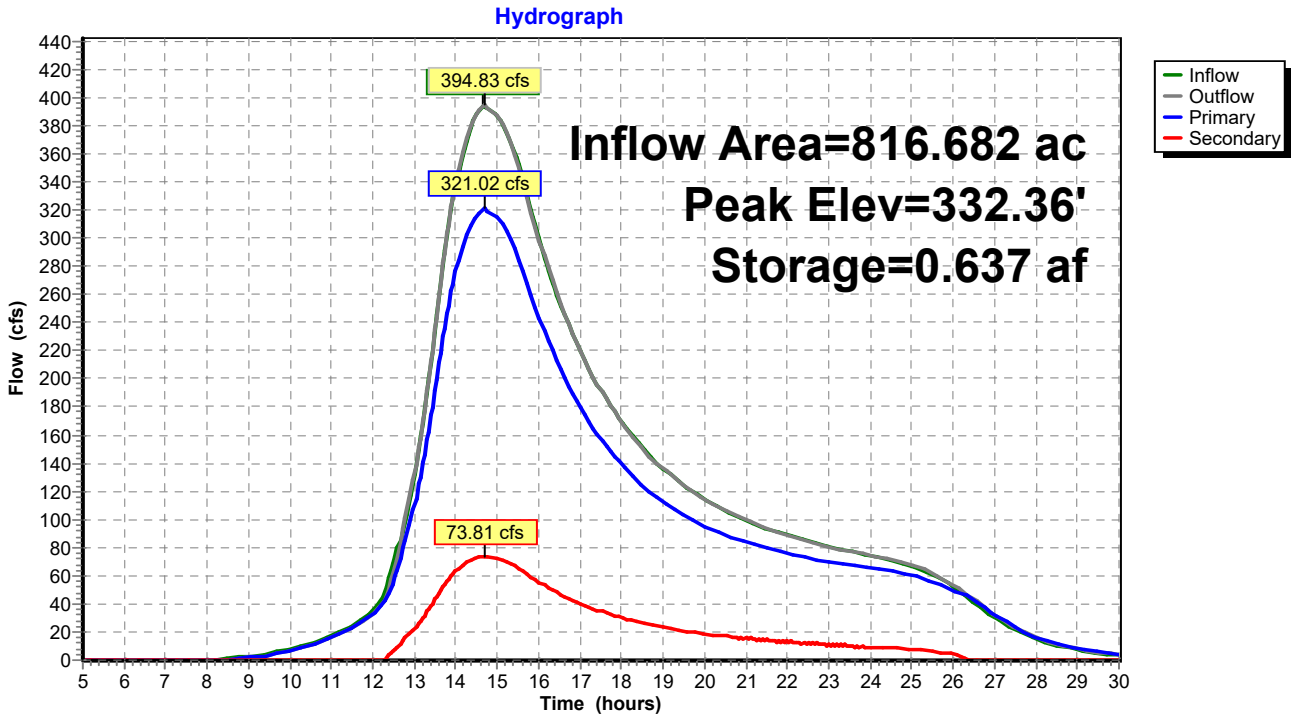
Pond 3P: Culvert 3



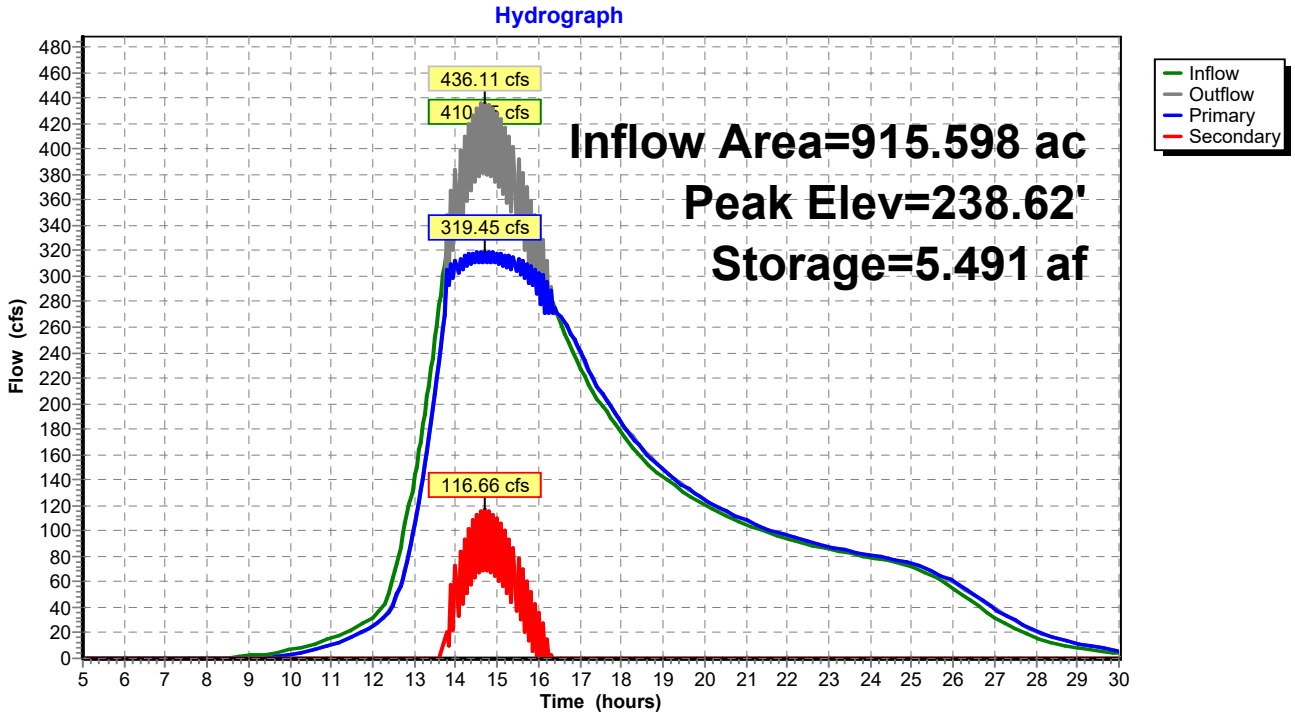
Pond 4P: Culvert 4



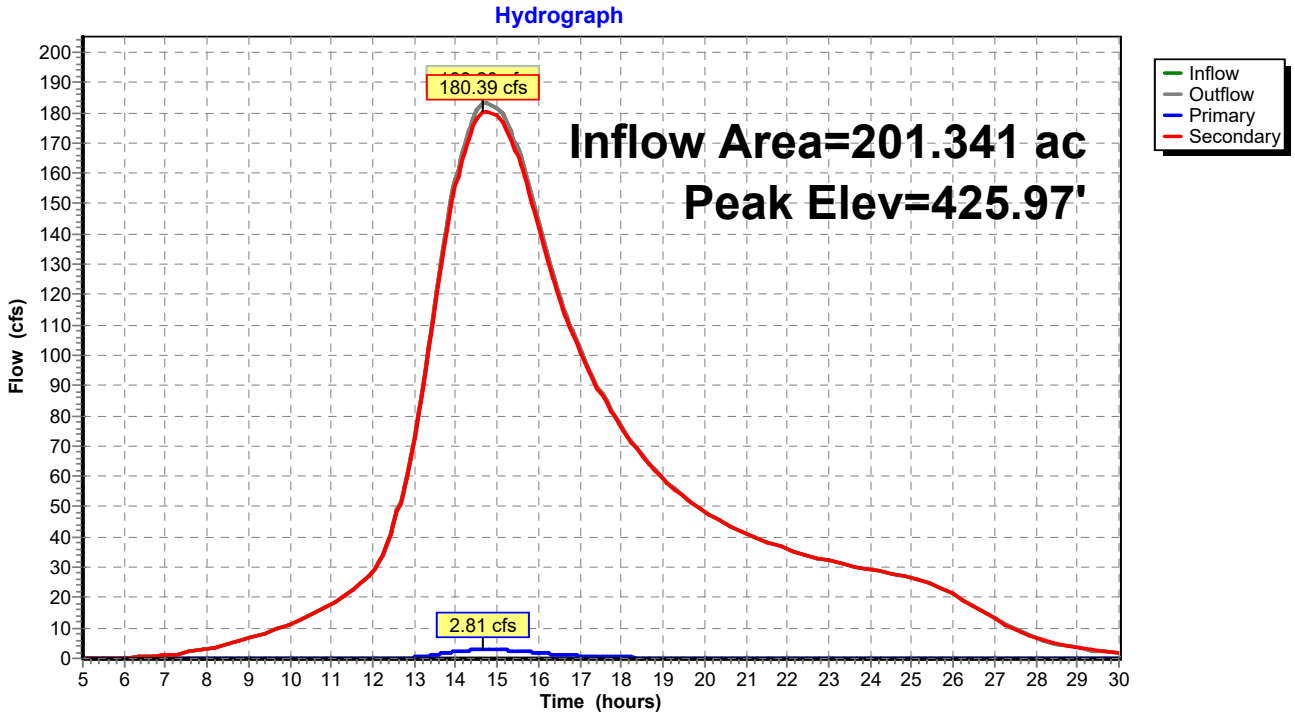
Pond 5P: Sand Culvert



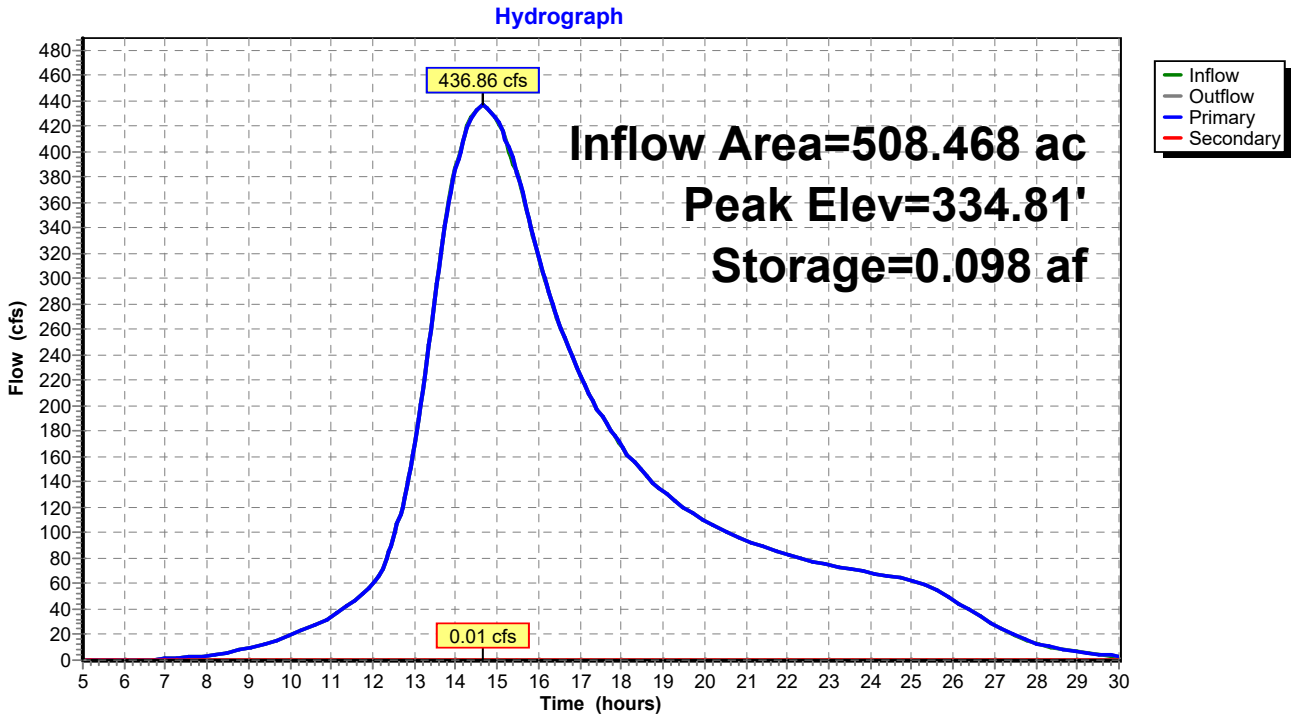
Pond 6P: 110 Culvert



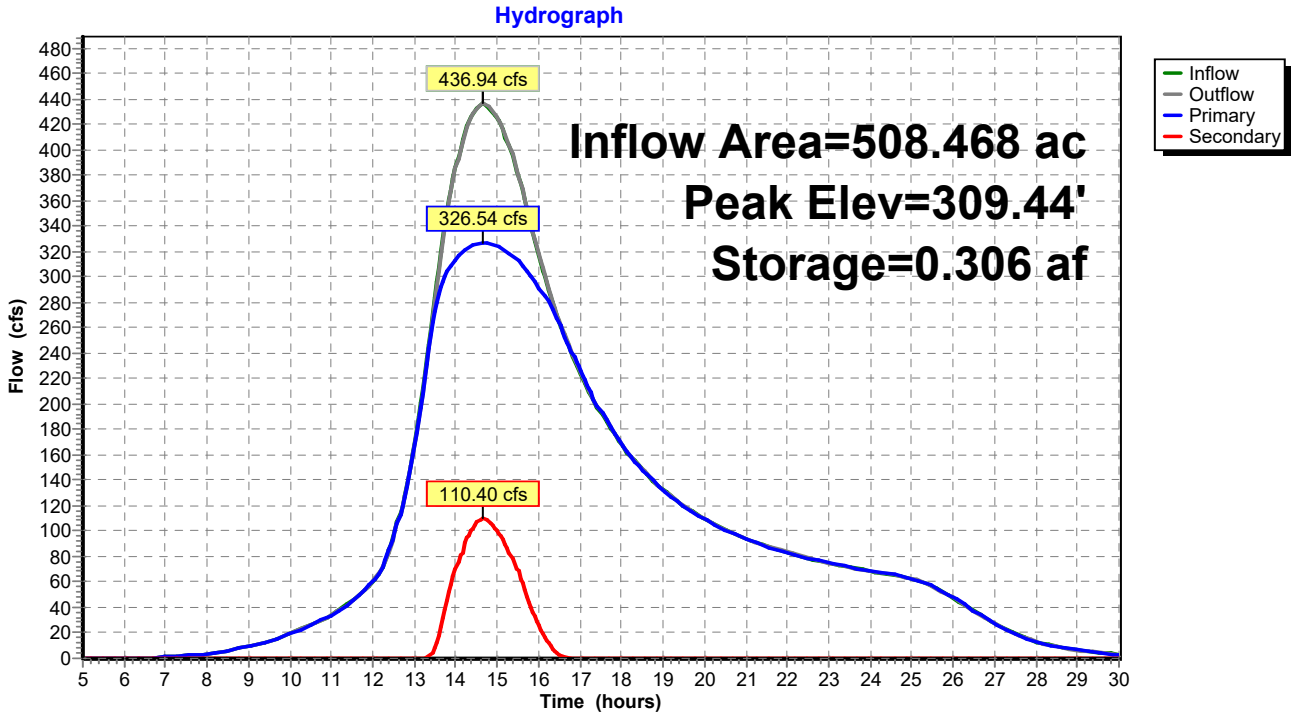
Pond 0P: 117 Culvert



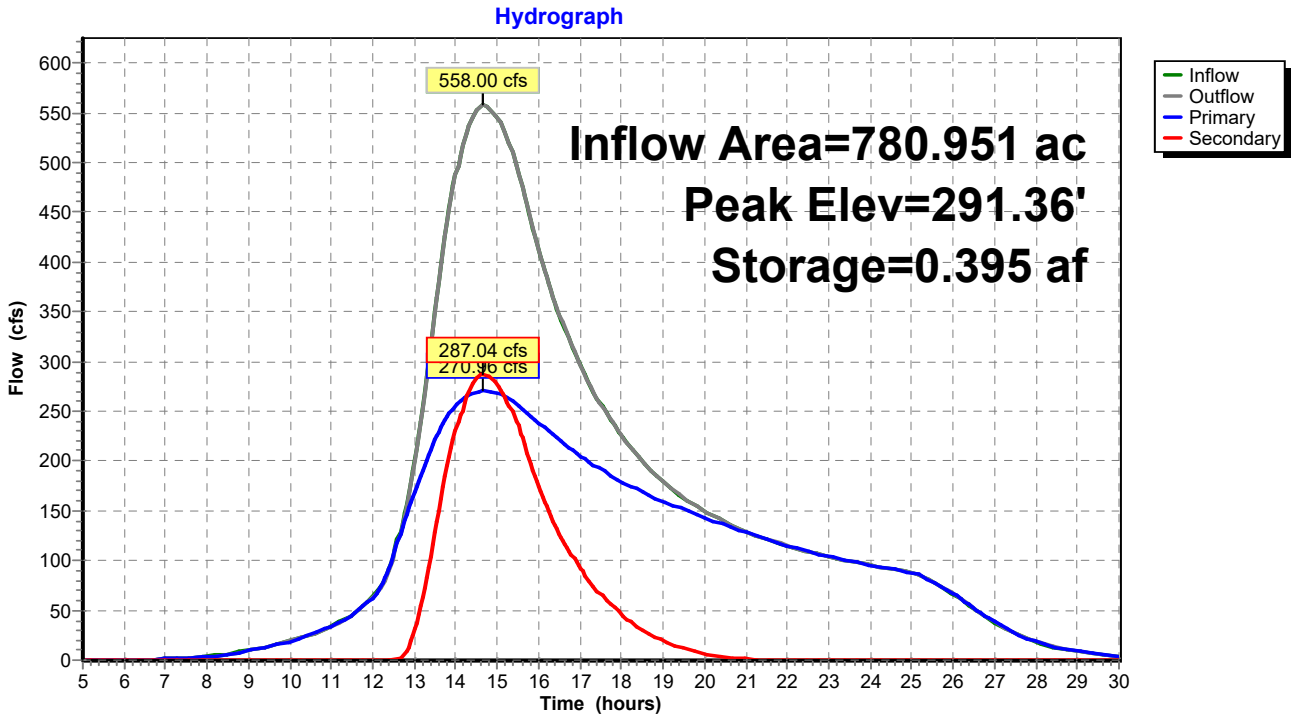
Pond 1P: Culvert 1



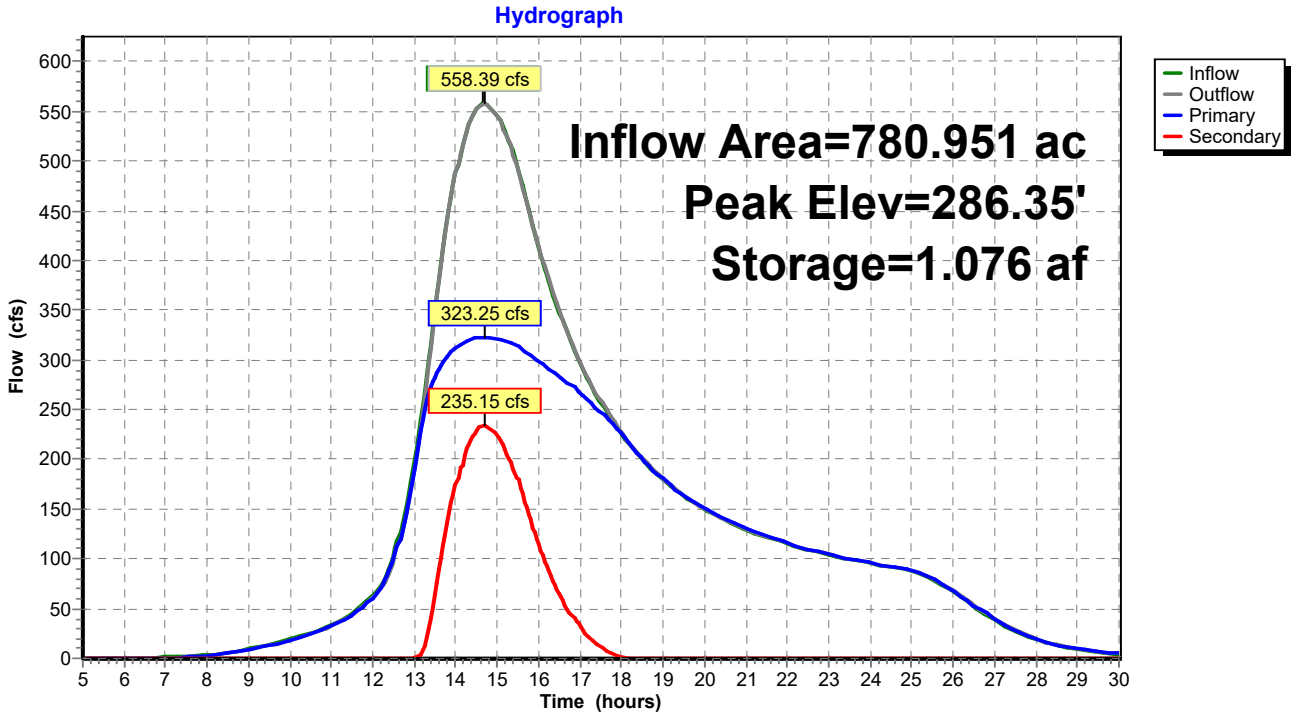
Pond 2P: Culvert 2



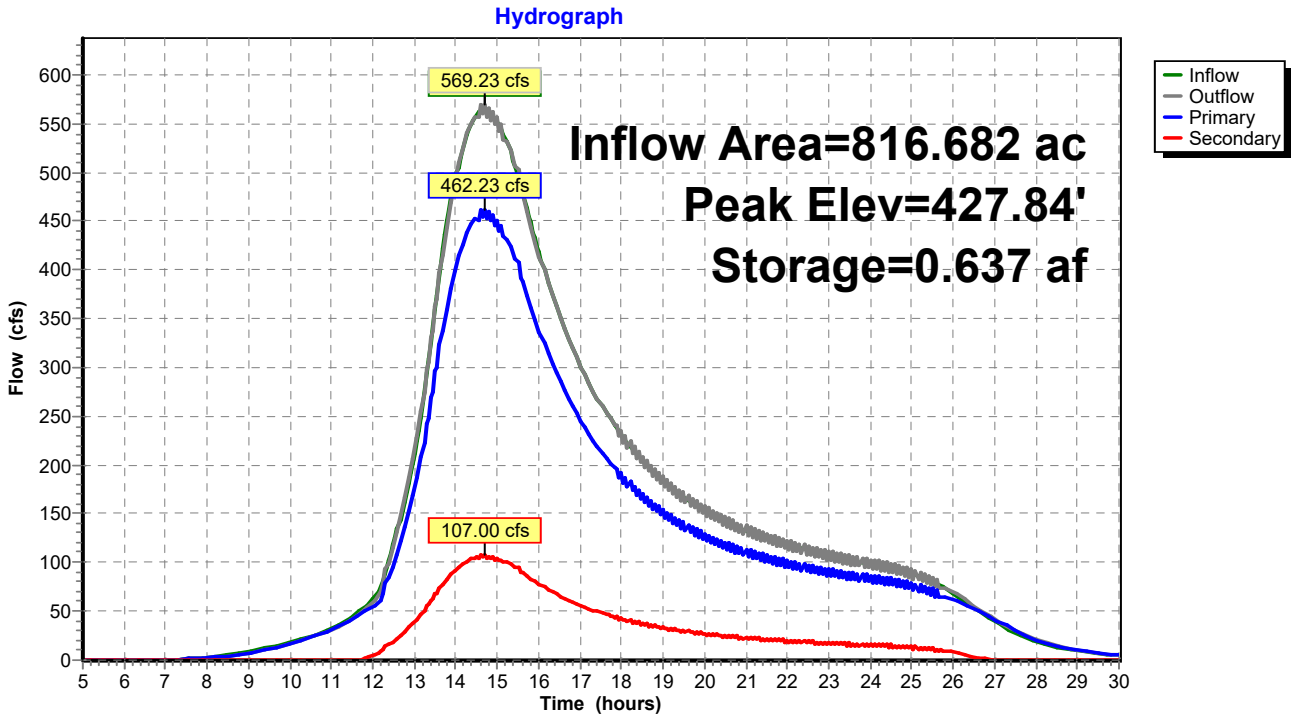
Pond 3P: Culvert 3



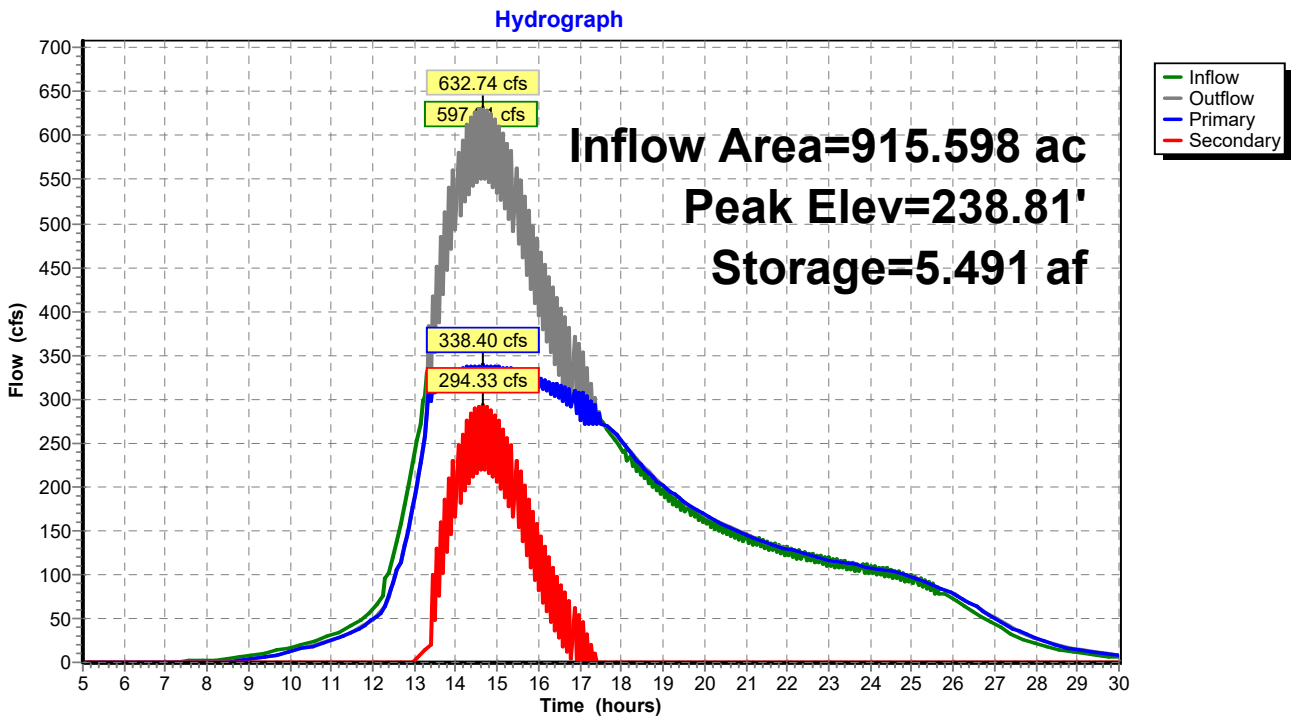
Pond 4P: Culvert 4



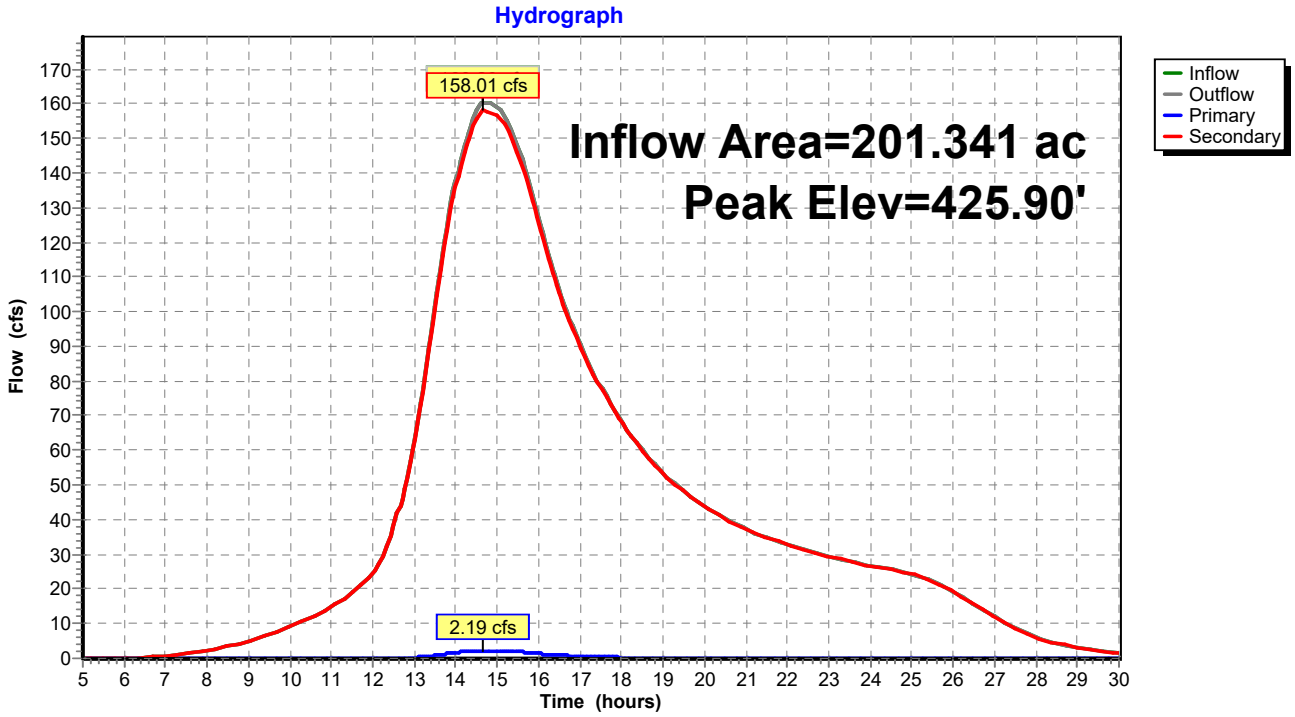
Pond 5P: Sand Culvert



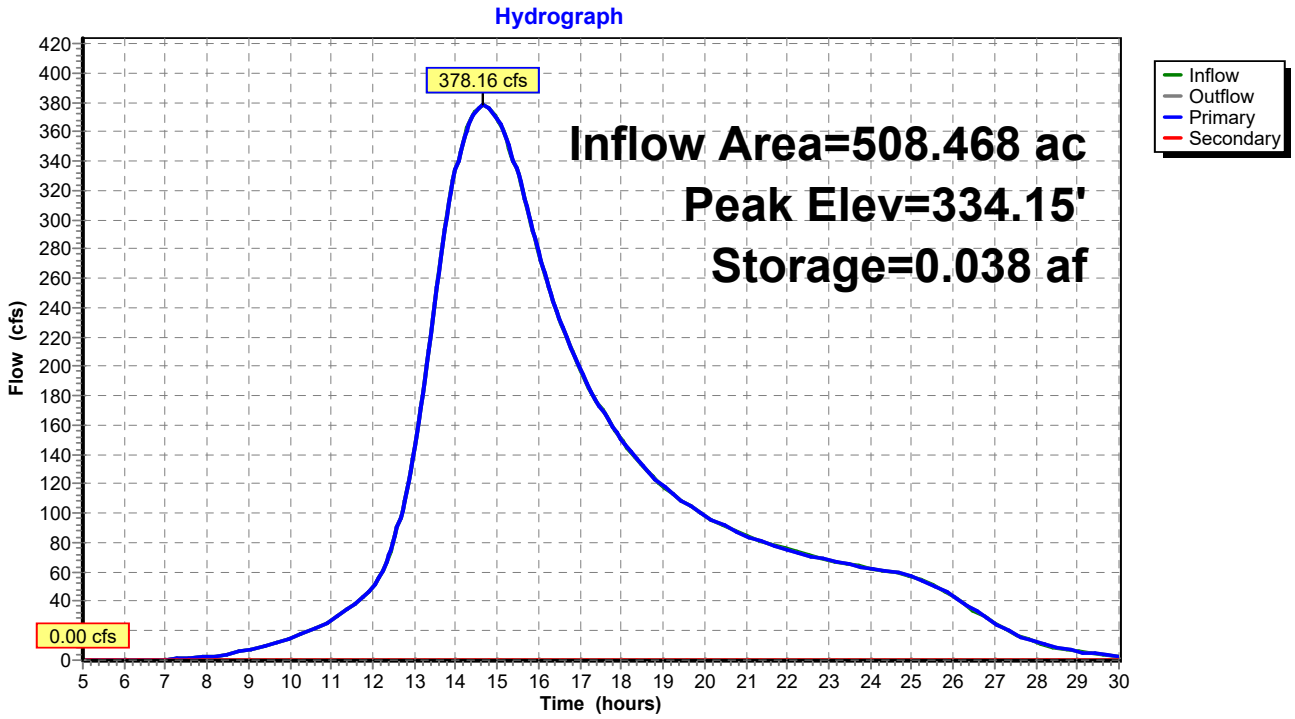
Pond 6P: 110 Culvert



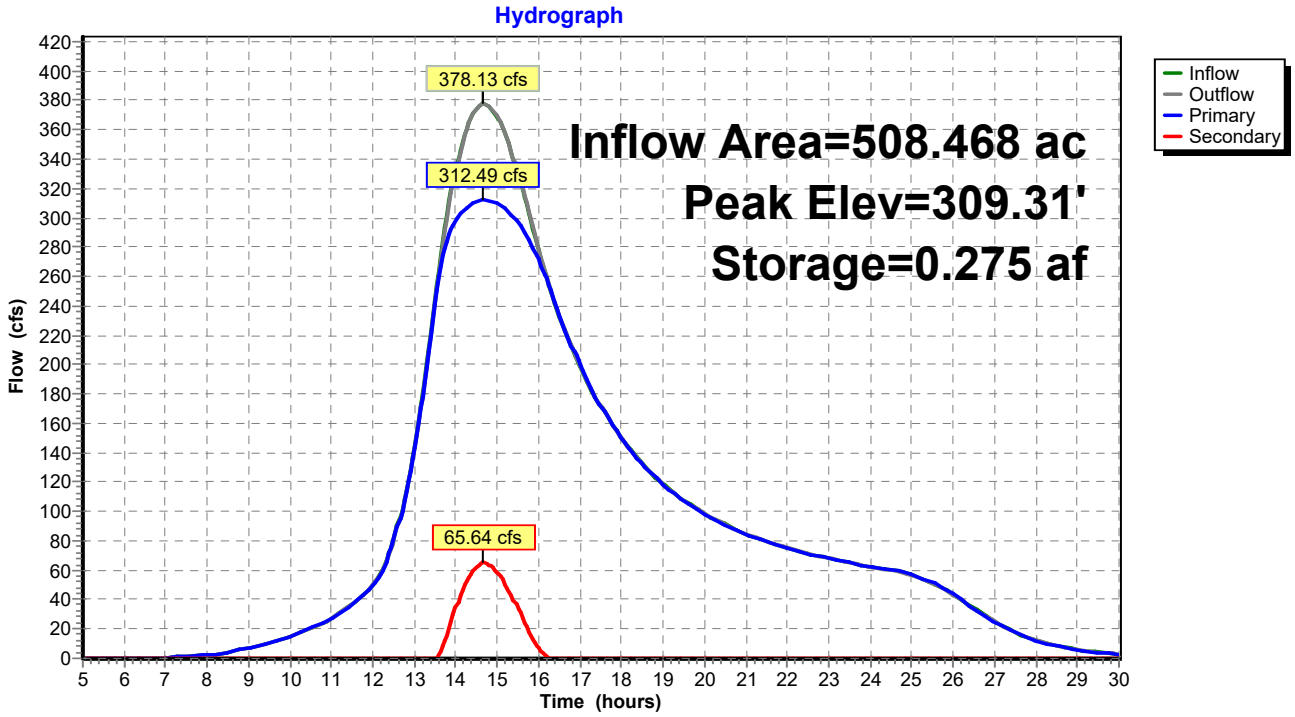
Pond 0P: 117 Culvert



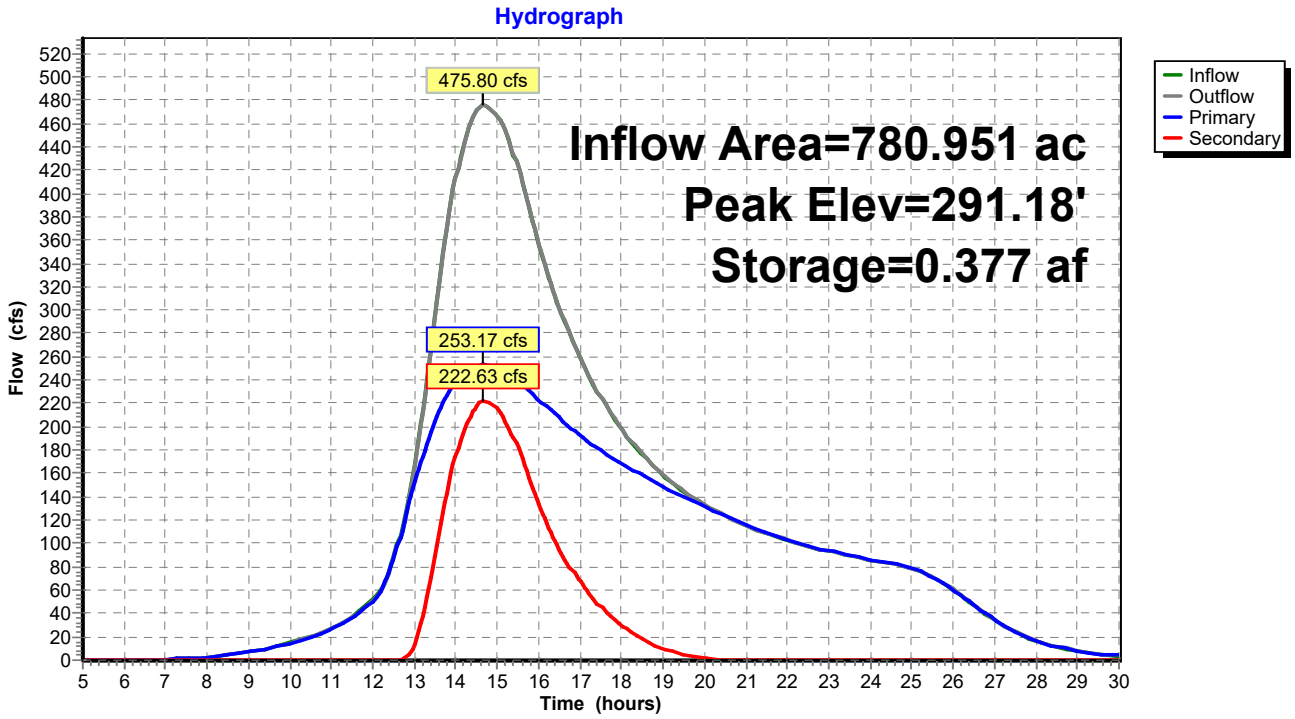
Pond 1P: Culvert 1



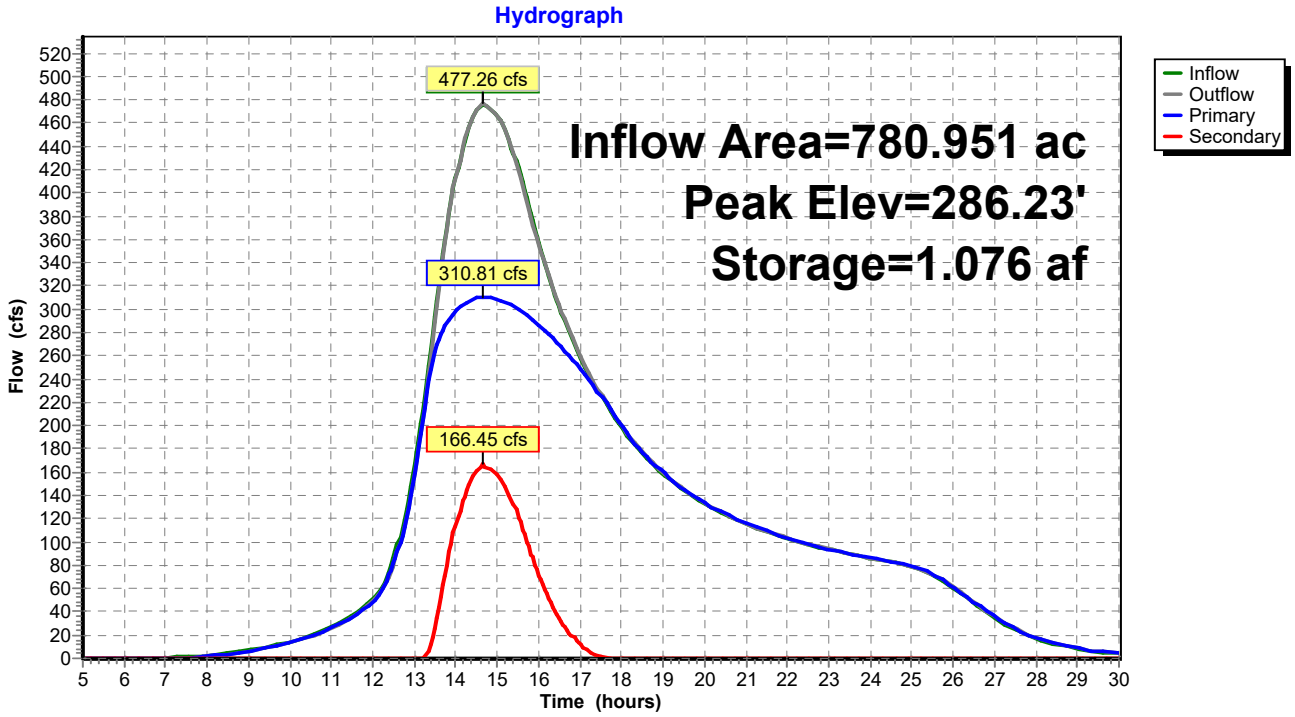
Pond 2P: Culvert 2



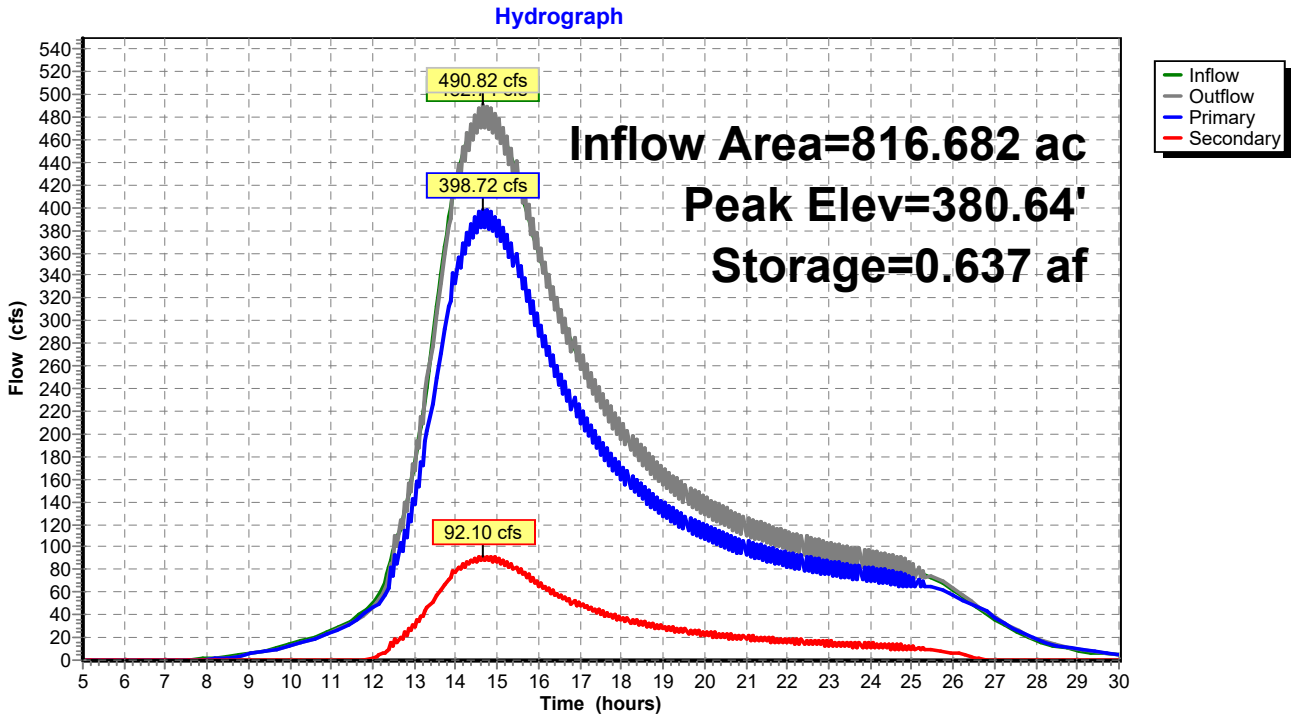
Pond 3P: Culvert 3



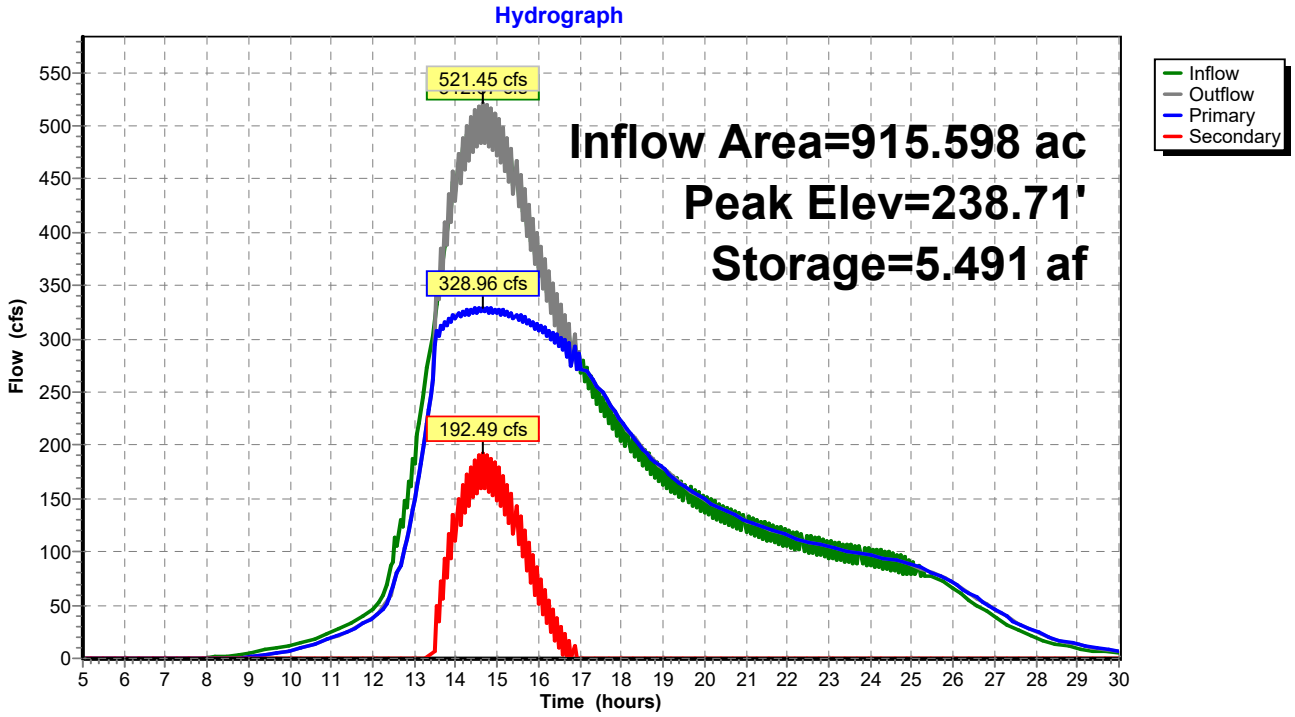
Pond 4P: Culvert 4



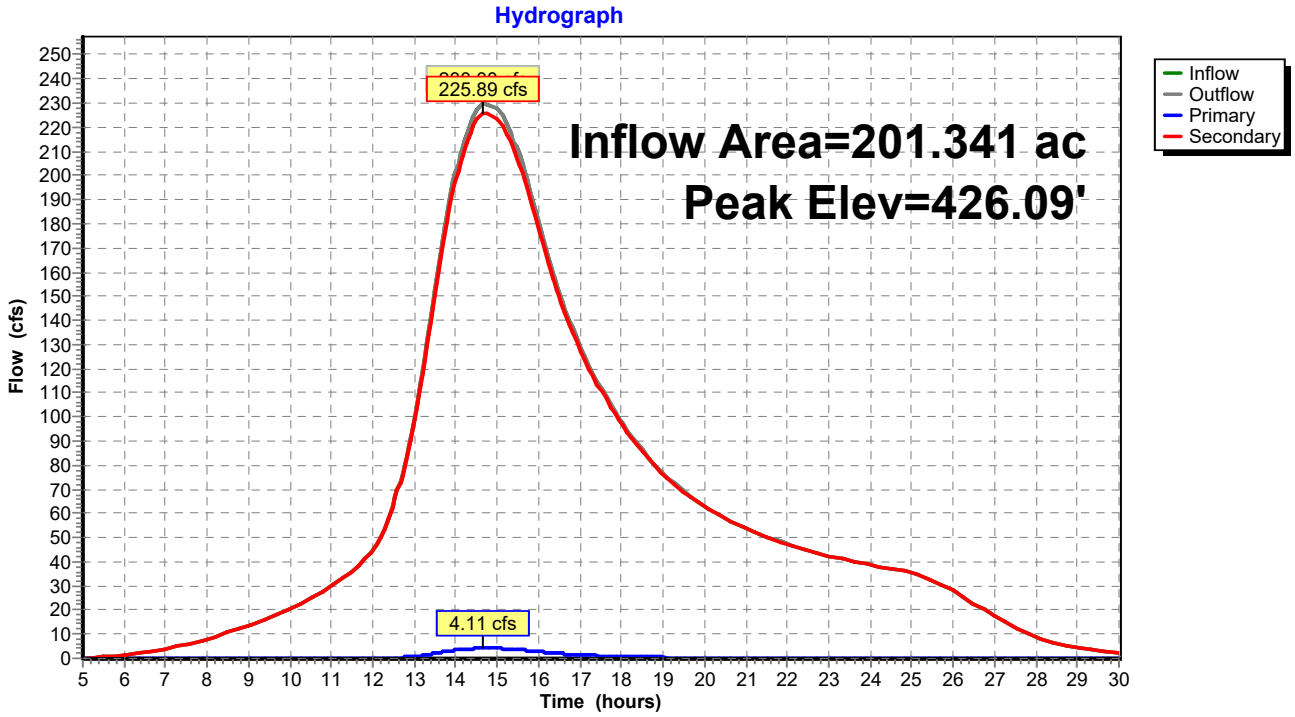
Pond 5P: Sand Culvert



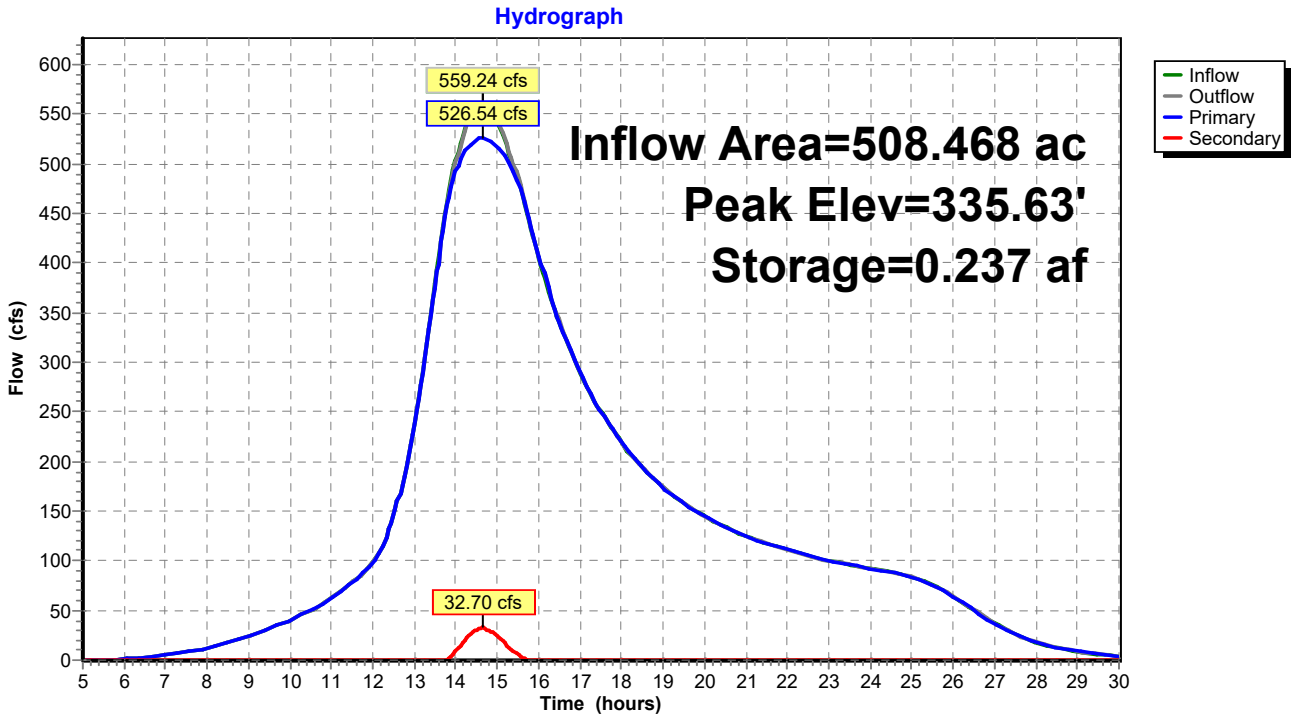
Pond 6P: 110 Culvert



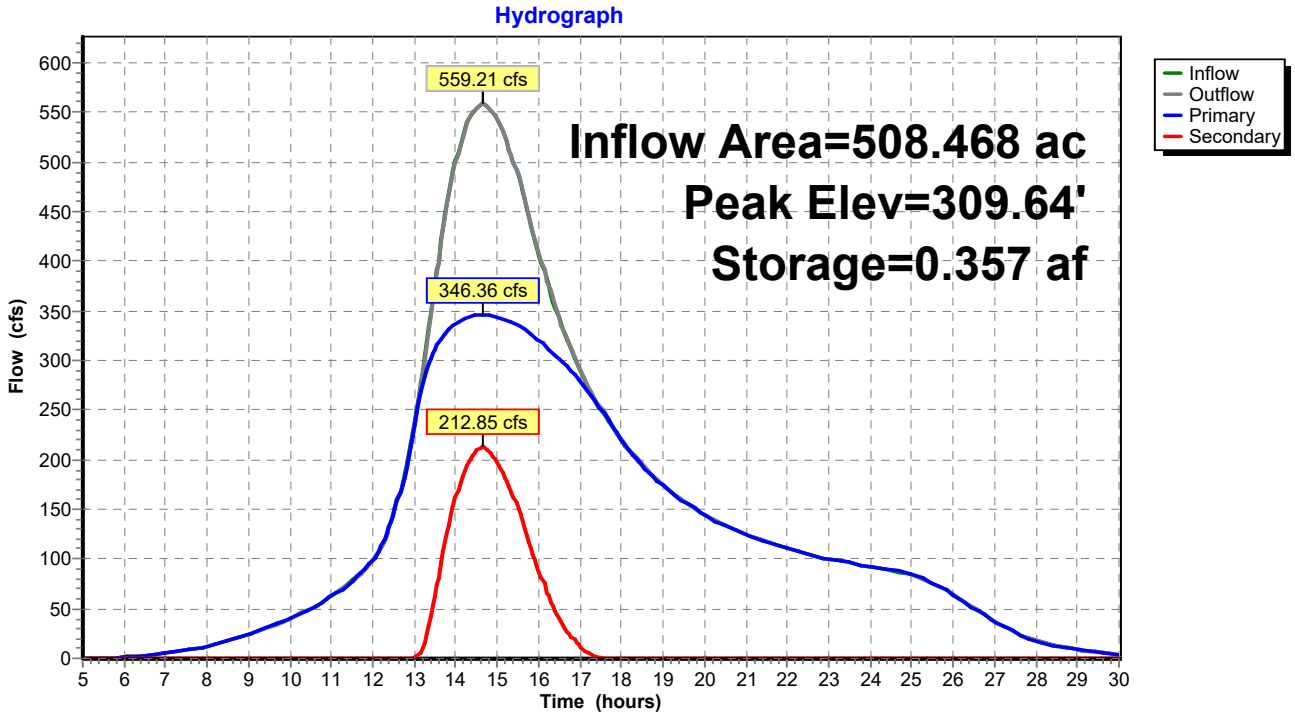
Pond 0P: 117 Culvert



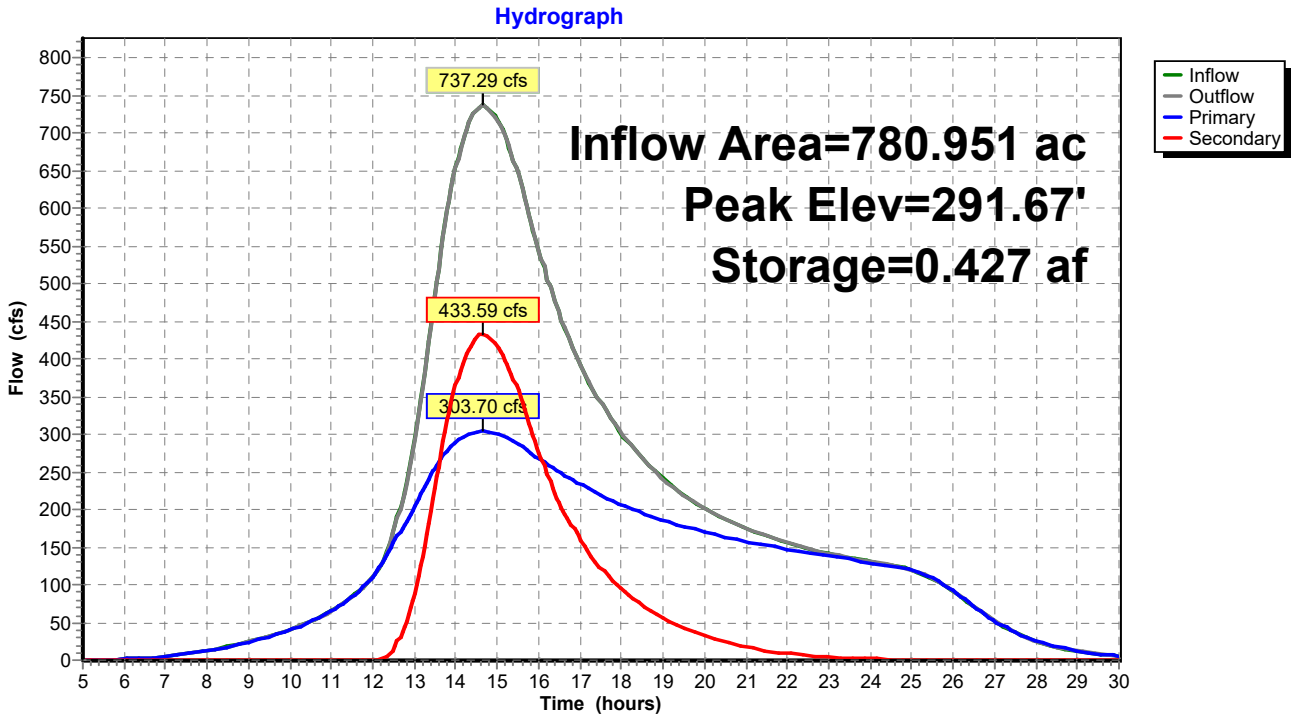
Pond 1P: Culvert 1



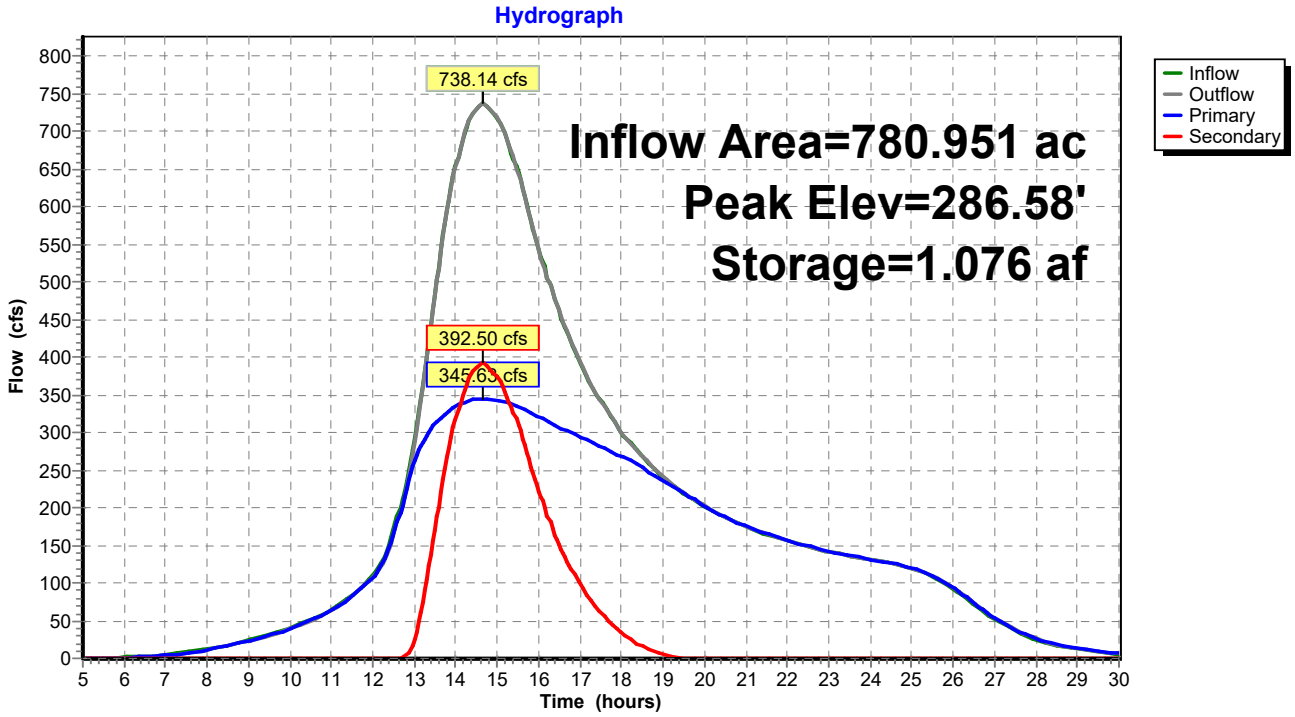
Pond 2P: Culvert 2



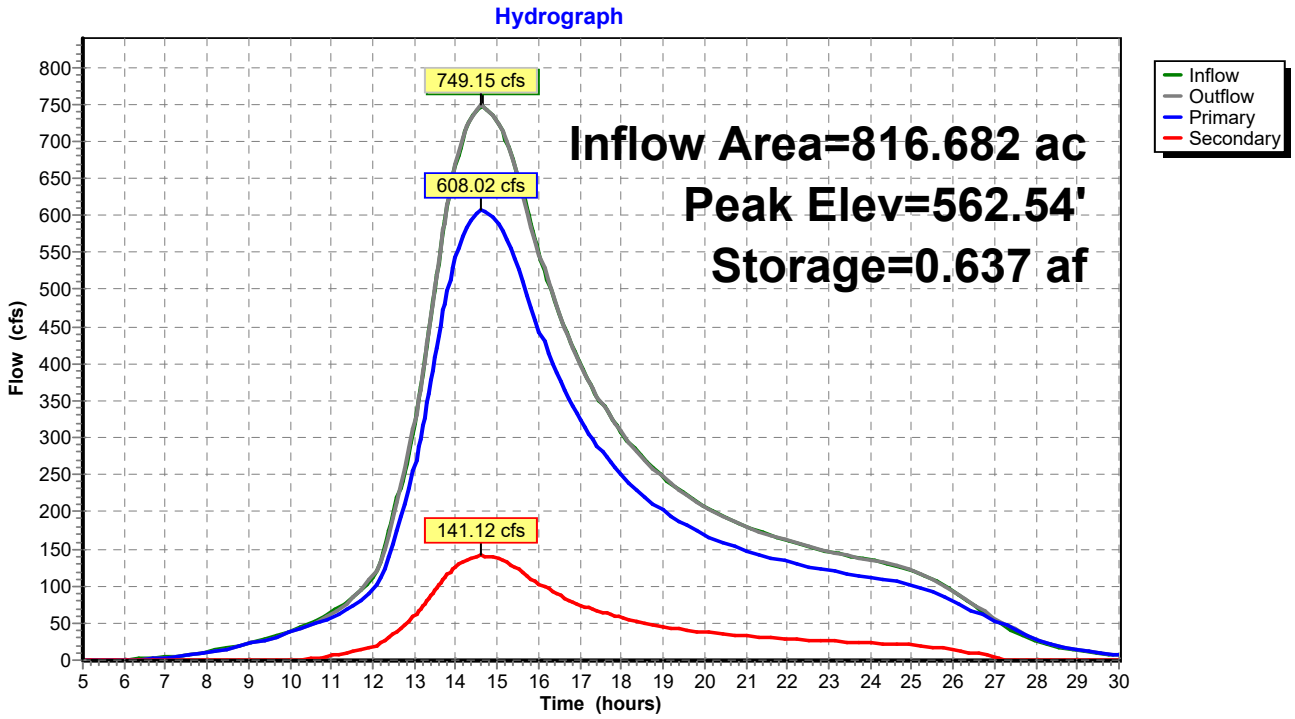
Pond 3P: Culvert 3



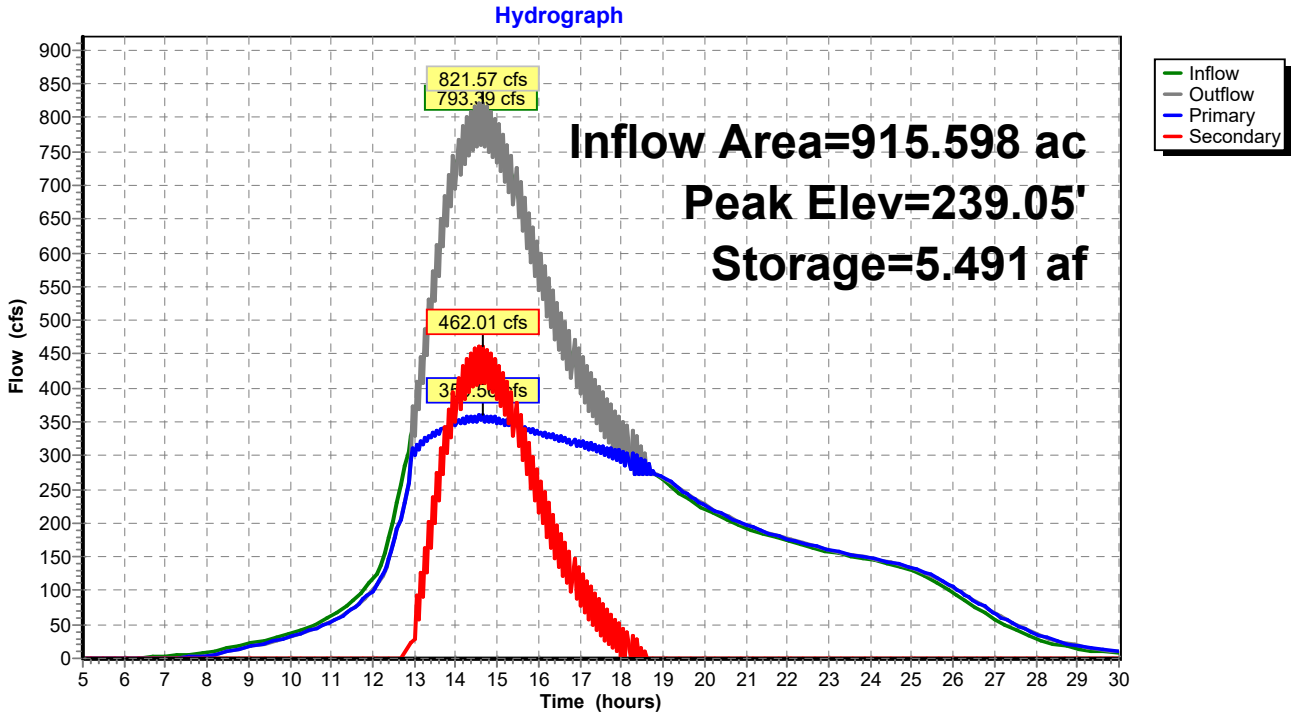
Pond 4P: Culvert 4

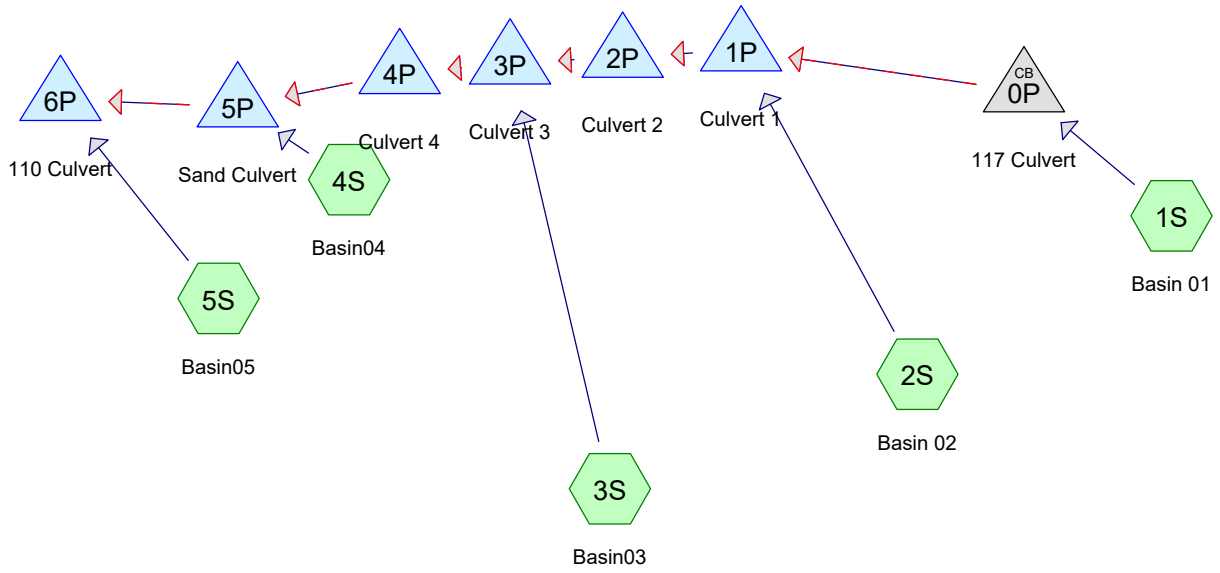


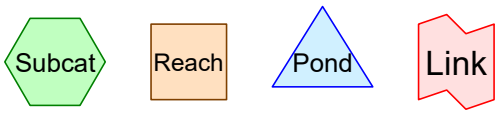
Pond 5P: Sand Culvert



Pond 6P: 110 Culvert







Routing Diagram for forbush_prop_alt3_culv2_16ft_3ftrise
Prepared by Tighe & Bond, Printed 11/29/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

Summary for Pond 0P: 117 Culvert

[58] Hint: Peaked 0.78' above defined flood level

Inflow Area =	201.341 ac,	0.00% Impervious,	Inflow Depth >	2.51"	for 10-yr event
Inflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af	
Outflow =	83.62 cfs @	14.86 hrs,	Volume=	42.171 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.48 cfs @	14.86 hrs,	Volume=	0.086 af	
Secondary =	83.14 cfs @	14.86 hrs,	Volume=	42.085 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 425.63' @ 14.86 hrs
Flood Elev= 424.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	425.40'	**48.0" Round 48" RCP Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 425.40' / 414.80' S= 0.1631 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Secondary	424.85'	**Route 117, C= 3.27** Offset (feet) 0.00 2.48 2.49 2.50 2.57 5.48 5.79 6.17 8.46 9.09 9.85 11.45 12.38 13.54 14.43 15.68 17.23 17.41 18.98 20.40 20.92 22.28 23.38 24.61 25.58 26.36 28.29 28.87 29.34 31.98 32.17 32.33 33.79 35.31 35.47 35.67 38.29 38.77 39.36 41.28 42.07 43.04 44.26 45.37 46.73 47.24 48.66 50.23 50.42 51.96 53.21 54.11 55.26 56.19 57.80 58.56 59.18 61.48 61.86 62.16 65.02 65.14 65.16 65.17 68.13 68.45 68.86 71.11 71.75 72.55 74.09 75.05 76.24 77.07 78.35 79.92 80.06 81.65 83.04 83.61 84.94 86.02 87.30 88.24 89.01 90.99 91.54 91.99 94.67 94.84 94.97 96.24 97.96 98.14 98.36 100.94 101.44 102.05 103.92 104.73 105.74 106.91 108.03 109.43 109.89 111.33 112.87 113.11 114.63 115.86 116.80 117.77 117.93 118.99 120.11 121.21 122.39 123.27 124.49 125.80 126.44 127.77 129.20 129.61 131.06 132.61 132.78 134.34 135.95 136.01 137.62 139.11 139.42 140.90 142.28 142.82 144.18 145.45 146.23 147.47 148.62 149.63 150.75 151.79 153.03 154.03 154.96 156.44 157.31 158.12 159.84 160.59 161.29 163.25 163.88 164.46 166.65 167.16 167.63 170.06 170.44 170.80 173.46 173.72 173.97 176.87 177.00 177.13 180.27 180.29 180.30 180.74 183.47 183.57 183.67 186.64 186.85 187.08 189.81 190.13 190.48 192.98 193.42 193.89 196.14 196.70 197.29 199.31 199.98 200.70 202.48 203.26 204.10 205.65 206.54 207.51 208.82 209.83 210.91 211.99 213.11 214.31 215.15 216.39 217.72 218.32 219.67 221.12 221.49 222.95 224.53 224.66 226.24 227.83 227.93 229.52 231.00 231.34 232.80 234.16 234.74 236.08 237.33 238.15 239.36 240.50 241.55 242.65 243.67 244.95 245.93 246.84 248.36 249.21 250.00 251.76 252.49 253.17 255.17 255.78 256.34 258.57 259.06 259.51 261.98 262.34 262.68 265.38 265.62 265.85 268.79 268.90 269.01 272.09 272.18 275.35 275.47 275.59 278.52 278.75 279.00 281.69 282.03 282.40 284.86 285.31 285.81 288.02 288.60 289.21 291.19 291.88 292.62 294.36 295.16

296.02 297.53 298.44 299.42 300.70 301.73 302.83 303.87
305.01 306.23 307.03 308.29 309.64 310.20 311.57 313.04
313.37 314.85 316.45 316.54 318.14 319.71 319.85 321.42
322.88 323.26 324.70 326.04 326.66 327.98 329.21 330.06
331.26 332.38 333.47 334.55 335.55 336.87 337.83 338.72
340.28 341.11 341.89 343.68 344.39 345.05 347.09 347.67
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357.52 357.73 360.70 360.80 360.89 363.45 364.06 364.09
364.11 367.23 367.37 367.51 370.40 370.65 370.92 373.57
373.93 374.32 376.74 377.21 377.73 379.90 380.50 381.13
383.07 383.78 384.54 386.24 387.06 387.94 389.41 390.34
391.34 392.58 393.41 393.66 394.35 395.45 396.73 397.52
399.11 400.94 401.39 401.49 401.66 403.87 405.25 406.25
407.87 408.64 409.11 411.02 411.14 412.97 413.40 414.09
415.78 416.83 418.16 420.30 420.54 420.70 421.35 422.93
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431.77 433.89 434.41 434.88 437.38 437.70 437.99 440.86
440.99 441.10 443.02 444.20 444.27 444.35 447.31 447.56
447.83 450.42 450.84 451.32 453.53 454.13 454.80 456.63
457.41 458.28 459.74 460.70 461.77 462.85 463.98 465.25
465.96 467.27 468.74 469.07 470.55 472.17 472.22 473.84
475.28 475.71 477.12 478.39 479.19 480.41 481.50 482.68
483.70 484.60 486.16 486.98 487.17 488.08 489.01 490.43
491.60 493.26 493.89 494.20 495.13 496.79 497.34 498.45
499.38 500.80 501.98 503.64 504.26 504.57 505.50 507.16
507.72 508.82 509.76 511.17 512.35 514.01 514.63 514.94
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533.09 534.75 535.37 535.69 536.62 538.28 538.83 539.94
540.87 542.29 543.47 545.12 545.75 546.06 546.99 547.15
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556.69 558.32 559.19 560.37 560.76 561.52 563.20 564.05
565.64 566.67 567.73 568.08 568.76 570.52 571.41 572.96
574.15 575.09 575.40 576.00 577.84 578.77 580.28 581.63
582.45 582.72 583.24 585.16 586.13 587.59 589.11 589.81
590.03 590.48

Height (feet) 11.60 11.60 11.60 11.60 11.59 11.51 11.50 11.49
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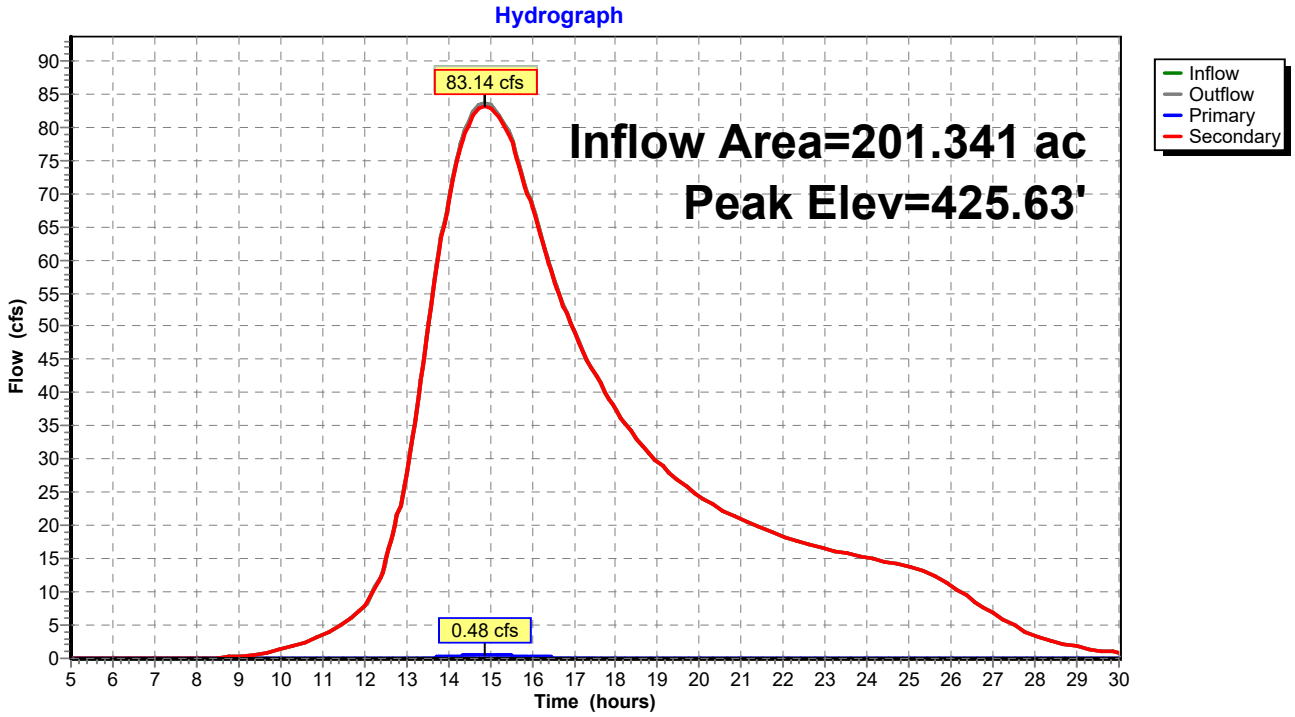
11.01 10.96 10.95 10.95 10.90 10.85 10.85 10.84 10.75 10.74
10.73 10.69 10.67 10.64 10.63 10.60 10.55 10.55 10.50 10.45
10.45 10.41 10.36 10.35 10.31 10.28 10.23 10.21 10.20 10.13
10.12 10.11 10.06 10.05 10.05 10.05 9.97 9.96 9.95 9.88 9.87
9.85 9.83 9.81 9.78 9.77 9.74 9.69 9.69 9.64 9.57 9.58 9.52
9.49 9.46 9.43 9.42 9.36 9.36 9.35 9.28 9.28 9.28 9.24 9.19
9.18 9.18 9.10 9.09 9.07 9.01 8.98 8.95 8.91 8.88 8.84 8.84
8.80 8.76 8.75 8.71 8.68 8.69 8.67 8.66 8.62 8.59 8.55 8.50
8.49 8.44 8.41 8.39 8.35 8.31 8.29 8.26 8.22 8.21 8.18 8.14
8.14 8.11 8.05 8.05 8.00 7.95 7.94 7.89 7.87 7.87 7.85 7.84
7.82 7.81 7.79 7.73 7.70 7.65 7.58 7.53 7.49 7.44 7.41 7.37
7.30 7.27 7.25 7.19 7.17 7.17 7.10 7.09 7.07 6.98 6.97 6.96
6.86 6.85 6.84 6.70 6.70 6.70 6.69 6.60 6.59 6.59 6.59 6.58

6.58	6.55	6.55	6.54	6.45	6.44	6.42	6.31	6.29	6.27	6.19	6.17
6.16	6.09	6.09	6.07	6.00	5.98	5.94	5.90	5.86	5.84	5.80	5.78
5.74	5.71	5.68	5.62	5.60	5.54	5.50	5.49	5.45	5.41	5.42	5.37
5.31	5.30	5.25	5.21	5.21	5.18	5.16	5.18	5.17	5.12	5.15	5.10
5.07	5.02	4.98	4.96	4.88	4.86	4.84	4.78	4.76	4.74	4.70	4.68
4.67	4.64	4.62	4.61	4.58	4.57	4.56	4.51	4.50	4.48	4.39	4.38
4.37	4.27	4.27	4.26	4.20	4.19	4.15	4.15	4.15	4.06	4.05	4.04
3.94	3.93	3.91	3.84	3.82	3.80	3.73	3.71	3.69	3.63	3.60	3.57
3.52	3.48	3.46	3.39	3.36	3.36	3.32	3.32	3.29	3.29	3.27	3.19
3.17	3.10	3.08	3.02	3.01	2.98	2.97	2.94	2.88	2.89	2.84	2.79
2.78	2.73	2.70	2.71	2.68	2.64	2.64	2.60	2.54	2.53	2.48	2.45
2.42	2.39	2.37	2.34	2.33	2.32	2.28	2.27	2.25	2.20	2.18	2.16
2.07	2.05	2.04	1.94	1.93	1.92	1.85	1.84	1.83	1.77	1.77	1.76
1.69	1.69	1.69	1.64	1.63	1.63	1.63	1.58	1.57	1.57	1.48	1.47
1.46	1.37	1.36	1.34	1.31	1.29	1.28	1.23	1.22	1.21	1.16	1.14
1.13	1.08	1.06	1.04	1.02	1.01	1.00	1.02	1.01	1.01	1.00	0.97
0.93	0.90	0.82	0.73	0.71	0.71	0.70	0.60	0.57	0.54	0.49	0.47
0.46	0.39	0.38	0.31	0.29	0.27	0.22	0.21	0.19	0.15	0.14	0.14
0.12	0.10	0.05	0.04	0.01	0.00	0.00	0.01	0.03	0.04	0.06	0.13
0.14	0.14	0.23	0.23	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26
0.23	0.23	0.23	0.19	0.19	0.19	0.21	0.21	0.24	0.28	0.32	0.36
0.28	0.32	0.35	0.36	0.39	0.44	0.48	0.53	0.64	0.71	0.82	0.92
0.93	1.03	1.13	1.16	1.27	1.35	1.38	1.46	1.57	1.64	1.74	1.83
1.94	2.02	2.03	2.07	2.14	2.19	2.23	2.29	2.31	2.32	2.41	2.54
2.56	2.60	2.65	2.69	2.72	2.87	2.90	2.92	3.01	3.07	3.12	3.26
3.24	3.45	3.49	3.74	3.78	3.79	3.89	3.98	4.06	4.16	4.14	4.29
4.37	4.54	4.59	4.62	4.67	4.73	4.76	4.78	4.69	4.75	4.87	5.13
5.20	5.24	5.38	5.59	5.65	5.77	5.89	6.05	6.13	6.38	6.44	6.46
6.56	6.56	6.63	6.72	6.79	6.95	7.04	7.08	7.15	7.21	7.34	7.52
7.72	7.88	7.93	8.03	8.23	8.41	8.63	8.74	8.88	8.93	9.01	9.21
9.31	9.48	9.62	9.72	9.75	9.82	10.02	10.12	10.29	10.46	10.55	
10.59	10.65	10.88	11.00	11.18	11.40	11.49	11.52	11.60			

Primary OutFlow Max=0.46 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**1=48" RCP Culvert** (Inlet Controls 0.46 cfs @ 1.62 fps)

Secondary OutFlow Max=82.70 cfs @ 14.86 hrs HW=425.63' (Free Discharge)
└─**2=Route 117** (Weir Controls 82.70 cfs @ 2.33 fps)

Pond 0P: 117 Culvert



Summary for Pond 1P: Culvert 1

[58] Hint: Peaked 1.23' above defined flood level

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.75 cfs @ 14.67 hrs, Volume= 89.852 af
Outflow = 183.67 cfs @ 14.70 hrs, Volume= 89.851 af, Atten= 0%, Lag= 1.9 min
Primary = 96.36 cfs @ 14.70 hrs, Volume= 72.896 af
Secondary = 87.31 cfs @ 14.70 hrs, Volume= 16.956 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 336.03' @ 14.70 hrs Surf.Area= 0.000 ac Storage= 0.316 af
Flood Elev= 334.80' Surf.Area= 0.000 ac Storage= 0.098 af

Plug-Flow detention time= 0.8 min calculated for 89.851 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (1,055.4 - 1,054.6)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	3.406 af	**Custom Stage Data** Listed below

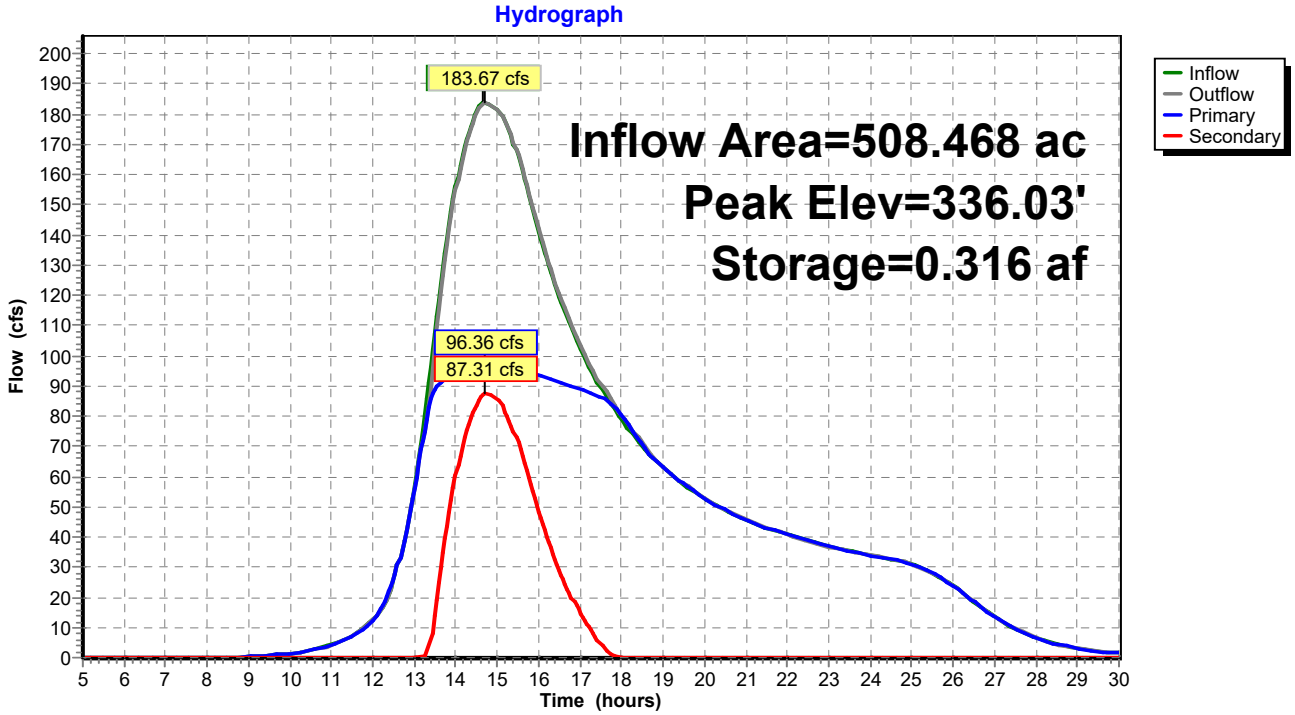
Elevation (feet)	Cum.Store (acre-feet)
329.70	0.000
333.00	0.003
334.00	0.024
335.00	0.116
336.00	0.309
337.00	0.575
338.00	0.886
339.00	1.252
340.00	1.773
341.00	2.503
342.00	3.406

Device	Routing	Invert	Outlet Devices
#1	Secondary	334.80'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.00 80.00 Height (feet) 2.00 0.00 2.00
#2	Primary	329.72'	**30.0" Round Culvert #1 - Left Barrel** L= 40.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.72' / 329.29' S= 0.0106 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#3	Primary	329.86'	**30.0" Round Culvert #1 - Right Barrel** L= 40.4' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.86' / 329.12' S= 0.0183 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf

Primary OutFlow Max=96.37 cfs @ 14.70 hrs HW=336.03' (Free Discharge)
└─**2=Culvert #1 - Left Barrel** (Barrel Controls 47.67 cfs @ 9.71 fps)
└─**3=Culvert #1 - Right Barrel** (Barrel Controls 48.70 cfs @ 9.92 fps)

Secondary OutFlow Max=87.11 cfs @ 14.70 hrs HW=336.03' (Free Discharge)
└─**1=Forbush Mill Road** (Weir Controls 87.11 cfs @ 1.45 fps)

Pond 1P: Culvert 1



Summary for Pond 2P: Culvert 2

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.12" for 10-yr event
Inflow = 183.67 cfs @ 14.70 hrs, Volume= 89.851 af
Outflow = 183.70 cfs @ 14.71 hrs, Volume= 89.851 af, Atten= 0%, Lag= 0.3 min
Primary = 183.70 cfs @ 14.71 hrs, Volume= 89.851 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 307.69' @ 14.71 hrs Surf.Area= 0.000 ac Storage= 0.050 af
Flood Elev= 308.70' Surf.Area= 0.000 ac Storage= 0.158 af

Plug-Flow detention time= 0.1 min calculated for 89.672 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (1,055.5 - 1,055.4)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	0.445 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
306.00	0.000
307.00	0.013
308.00	0.066
309.00	0.198
310.00	0.445

Device	Routing	Invert	Outlet Devices
#1	Primary	305.35'	**192.0" W x 36.0" H Box 16' Box Culvert** L= 40.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 305.35' / 304.10' S= 0.0313 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 48.00 sf
#2	Secondary	308.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 1.57 2.55 3.95 6.16 6.33 6.43 6.88 8.70 10.30 11.08 12.32 13.46 14.18 15.84 17.32 17.77 18.05 18.22 18.48 20.60 21.93 22.98 24.64 25.35 25.80 27.73 27.79 29.68 30.11 30.80 32.49 33.56 34.87 36.95 37.25 37.43 38.25 39.63 41.31 42.00 43.11 44.38 45.18 46.76 48.72 49.06 49.14 49.26 51.52 52.94 53.90 55.42 56.27 56.81 58.65 59.18 60.69 61.03 61.58 63.41 64.56 65.79 67.73 68.17 68.44 69.65 70.54 72.32 72.92 73.89 75.30 76.19 77.68 80.04 80.06 80.07 80.11 82.44 83.94 84.82 86.20 87.19 87.82 89.57 90.58 91.70 91.95 92.36 94.33 95.57 96.71 98.51 99.09 99.37 99.45 100.73 101.49 103.20 103.90 105.16 106.31 106.96 108.73 109.23 110.72 111.14 111.89 113.55 114.47 115.96 117.73 118.23 118.37 118.62 120.78 121.98 123.19 125.35 125.60 125.74 126.23 128.01 129.50 130.42 132.08 132.83 133.25 134.73 135.24 137.01 137.65 138.81 140.07 140.77 142.48 143.23 144.52 144.89 145.54 147.30 148.28 149.71 151.74 152.03 152.12 152.27 154.53 155.79 156.94 159.00 159.35 159.55 160.24 161.76

163.30	164.17	165.73	166.58	167.06	168.74	168.99	170.82
171.41	172.46	173.82	174.57	176.23	177.24	178.33	178.64
179.19	181.05	182.09	183.46	185.74	185.84	185.87	185.92
188.28	189.60	190.69	192.65	193.10	193.35	193.84	194.06
195.69	196.80	198.37	198.73	200.20	201.04	203.39	203.60
203.71	204.14	206.39	207.00	208.06	209.06	210.40	211.73
212.73	213.79	214.40	216.65	217.08	217.19	217.40	219.75
220.59	222.06	222.42	223.99	225.09	226.73	227.39	227.77
229.16	230.44	230.79	231.40	233.11	234.19	235.79	236.07
237.59	238.46	240.73	240.99	241.13	241.66	243.80	244.38
245.40	246.48	247.78	249.15	250.07	251.18	251.82	254.17
254.49	254.58	254.73	254.80	256.30	257.73	257.89	258.09
260.70	261.19	261.80	263.67	264.49	265.51	266.64	267.79
269.22	269.61	271.09	272.58	272.94	274.39	275.55	276.65
277.69	278.52	280.36	280.99	281.49	284.08	284.29	284.46
286.00	287.43	287.59	287.79	290.40	290.89	291.50	293.37
294.19	295.21	296.34	297.49	298.93	299.31	300.79	301.12
302.18	302.97	304.17	304.88	307.50	307.55	307.58	307.68
310.28	310.93	312.03	312.98	314.32	315.68	316.56	317.70
318.38	321.05	321.08	321.08	321.09	323.78	324.47	325.62
326.48	327.85	329.18	330.16	331.23	331.88	334.41	334.58
334.62	334.69	337.28	338.00	339.22	339.98	341.38	342.68
343.75	344.77	345.38	347.78	348.08	348.15	348.28	350.78
351.53	352.81	353.23					

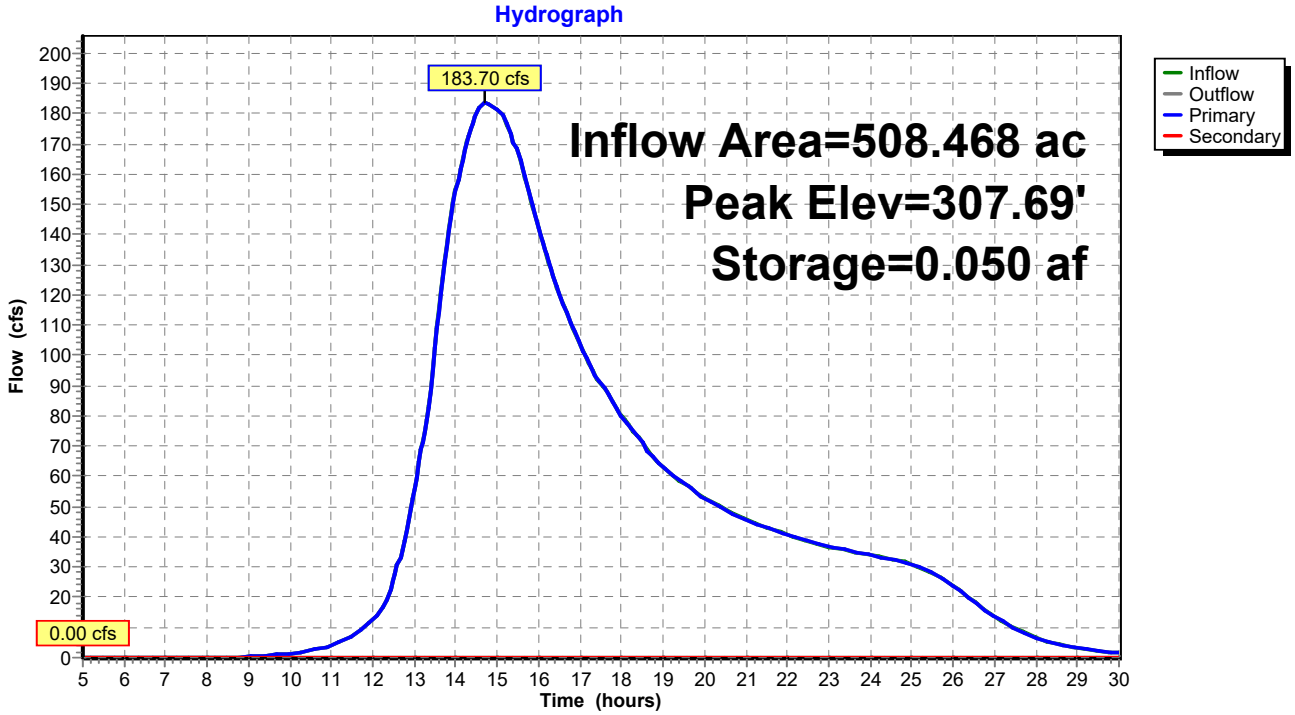
Height (feet)	3.08	2.98	2.95	2.91	2.91	2.91	2.91	2.92	2.94	2.94	
2.93	2.91	2.87	2.86	2.82	2.79	2.78	2.77	2.77	2.76	2.71	2.68
2.65	2.62	2.60	2.60	2.55	2.58	2.55	2.54	2.54	2.49	2.48	2.44
2.41	2.40	2.40	2.39	2.34	2.35	2.34	2.33	2.29	2.29	2.24	2.21
2.20	2.20	2.20	2.14	2.11	2.08	2.06	2.03	2.02	1.99	1.99	1.97
1.96	1.97	1.98	1.98	1.97	1.95	1.94	1.93	1.90	1.83	1.81	1.79
1.78	1.74	1.74	1.71	1.68	1.68	1.68	1.68	1.62	1.60	1.58	1.56
1.54	1.53	1.51	1.50	1.49	1.49	1.49	1.45	1.45	1.42	1.43	1.42
1.41	1.41	1.39	1.32	1.31	1.29	1.28	1.24	1.23	1.18	1.21	1.19
1.18	1.18	1.15	1.12	1.09	1.07	1.06	1.05	1.05	1.01	1.00	0.98
0.98	0.98	0.98	0.98	0.97	0.97	0.96	1.00	1.00	1.01	1.01	1.00
1.01	1.00	0.99	0.96	0.96	0.93	0.94	0.92	0.91	0.90	0.87	0.87
0.84	0.84	0.83	0.83	0.83	0.81	0.80	0.78	0.76	0.75	0.75	0.74
0.68	0.67	0.64	0.62	0.60	0.59	0.58	0.55	0.55	0.56	0.56	0.55
0.55	0.53	0.53	0.52	0.52	0.52	0.49	0.48	0.48	0.47	0.47	0.47
0.47	0.44	0.44	0.43	0.44	0.44	0.44	0.44	0.44	0.41	0.41	0.40
0.40	0.39	0.39	0.36	0.36	0.36	0.36	0.35	0.35	0.34	0.38	0.37
0.44	0.40	0.44	0.46	0.47	0.47	0.47	0.47	0.44	0.42	0.38	0.37
0.32	0.30	0.27	0.25	0.27	0.27	0.31	0.30	0.31	0.49	0.50	0.60
0.61	0.70	0.69	0.61	0.60	0.60	0.56	0.45	0.40	0.37	0.38	0.33
0.22	0.35	0.29	0.25	0.40	0.41	0.41	0.41	0.42	0.53	0.62	0.63
0.64	0.79	0.81	0.79	0.87	0.84	0.81	0.81	0.77	0.79	0.70	0.73
0.73	0.74	0.74	0.79	0.74	0.78	0.81	0.79	0.81	0.81	0.92	0.92
0.92	0.99	1.03	1.04	1.06	1.09	1.13	1.18	1.21	1.29	1.31	1.21
1.23	1.11	1.00	0.88	0.85	0.73	0.68	0.56	0.50	0.29	0.29	0.29
0.28	0.14	0.12	0.09	0.11	0.07	0.08	0.09	0.10	0.10	0.14	0.14
0.14	0.14	0.16	0.16	0.15	0.15	0.14	0.13	0.11	0.11	0.10	0.07
0.07	0.06	0.06	0.01	0.00	0.05	0.05	0.12	0.36	0.62	0.81	0.98

1.66 1.75 1.77 1.80 2.50 2.72 3.08 3.08

Primary OutFlow Max=183.67 cfs @ 14.71 hrs HW=307.69' (Free Discharge)
└─**1=16' Box Culvert** (Inlet Controls 183.67 cfs @ 4.91 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=306.00' (Free Discharge)
└─**2=Forbush Mill Road** (Controls 0.00 cfs)

Pond 2P: Culvert 2



Summary for Pond 3P: Culvert 3

[58] Hint: Peaked 1.36' above defined flood level

Inflow Area =	780.951 ac,	0.00% Impervious,	Inflow Depth >	1.66"	for	10-yr event
Inflow =	211.59 cfs @	14.83 hrs,	Volume=	107.848 af		
Outflow =	211.59 cfs @	14.84 hrs,	Volume=	107.770 af,	Atten= 0%,	Lag= 0.3 min
Primary =	28.45 cfs @	14.84 hrs,	Volume=	32.708 af		
Secondary =	183.14 cfs @	14.84 hrs,	Volume=	75.062 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 291.06' @ 14.84 hrs Surf.Area= 0.000 ac Storage= 0.365 af
Flood Elev= 289.70' Surf.Area= 0.000 ac Storage= 0.225 af

Plug-Flow detention time= 2.8 min calculated for 107.555 af (100% of inflow)
Center-of-Mass det. time= 2.3 min (1,069.7 - 1,067.4)

Volume	Invert	Avail.Storage	Storage Description
#1	287.50'	0.461 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
287.50	0.000
292.00	0.461

Device	Routing	Invert	Outlet Devices
#1	Primary	288.07'	**18.0" Round 18" Culvert - Left Barrel** L= 36.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.81' / 288.07' S= -0.0072 '/' Cc= 0.900 n= 0.009, Flow Area= 1.77 sf
#2	Primary	288.19'	**6.0" Round 6" Culvert - Center Barrel** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 288.19' / 287.37' S= 0.0221 '/' Cc= 0.900 n= 0.009, Flow Area= 0.20 sf
#3	Primary	287.53'	**18.0" Round 18" Culvert - Right Barrel** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.53' / 287.38' S= 0.0040 '/' Cc= 0.900 n= 0.009, Flow Area= 1.77 sf
#4	Secondary	289.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.52 1.01 2.44 3.03 4.98 5.54 7.28 8.05 8.29 9.30 10.29 11.61 12.42 12.44 13.86 14.32 15.29 17.56 18.86 19.90 20.58 21.56 21.84 22.70 23.09 24.57 24.87 26.53 26.85 28.19 29.36 30.61 31.87 32.43 32.98 33.85 34.37 35.28 35.99 36.48 36.88 37.42 38.13 38.85 39.56 40.28 41.45 43.11 43.26 44.40 44.77 45.66 46.70 47.42 48.09 48.40 49.74 51.40 52.41 53.18 53.84 55.27 56.70 58.19 60.98 61.95 62.41 63.82 63.84 64.67 65.26 65.72 65.98 66.33 67.41 67.98 68.83 68.96 69.64 71.69 74.10 75.26 77.40 78.25 79.51 79.59 80.97 81.68 82.40 83.83 84.38 85.25 86.68 88.82 89.54 90.25 91.20 92.39 92.85 93.82 94.66 95.25 96.17 96.68 98.10 99.49 99.80 101.15 102.07 102.80 103.33 104.58 104.94 106.12 106.67 107.78 108.10

110.24 111.09 112.75 114.61 115.22 115.86 115.95 117.73
119.38 119.62 120.88 121.04 121.66 122.13 123.38 124.36
125.50 128.09 128.80 129.33 130.23 132.37 134.31 135.78
135.96 137.17 139.68 140.22 140.94 141.65 142.36 142.60
143.79 146.07 147.20 147.57 148.08 148.46 150.22 150.89
151.65 152.55 153.07 154.20 154.50 155.21 156.35 156.64
157.52 158.07 158.78 159.50 161.64 162.35 162.49 163.78
164.76 166.01 166.64 167.47 168.56 173.94 174.40 175.89
176.89 177.22 177.73 178.05 179.07 180.23 182.15 182.57
183.91 184.39 186.06 187.29 188.31 188.56 189.26 190.37
191.06 194.61 195.22 196.89 198.46 199.39 199.61 200.22
201.29 201.89 203.56 204.74 205.22 205.77 207.72 210.65
210.90 211.93 211.99 213.98 214.39 217.72 218.55 219.11
220.01 222.68 223.55 224.02 225.27 225.36 226.89 227.32
228.55 229.37 231.43 231.88 234.71 236.05 236.05 236.88
237.72 238.26 238.72 240.06 240.67 241.40 242.68 243.55
243.75 244.38 245.22 246.75 249.42 251.05 251.88 251.96
252.71 253.43 255.21 256.11 257.10 258.55 259.38 261.05
262.71 262.79 263.55 265.21 265.31 266.04 268.54 269.22
270.21 271.88 273.49 273.64 274.55 275.21 278.54 278.83
280.71 281.04 281.73 282.48 284.18 285.21 286.04 287.71
288.19 288.54 290.21 292.00 292.71 293.03 294.05 294.37
295.21 296.04 296.36 297.71 298.49 300.03 300.40 301.25
301.83 302.55 303.12 305.43 305.77 306.55 306.85 307.92
308.32 309.00 309.29 311.61 311.86 312.78 313.92 314.69
315.40 317.78 319.32 320.70 321.63 322.96 323.18 324.72
325.11 325.49 326.19 327.03 328.33 328.58 330.12 330.48
331.66 332.43 333.21 333.71 334.67 335.52 337.40 338.00
339.08 341.23 342.88 344.45 344.78 345.61 346.32 346.60
347.86 349.41 350.77 351.72 351.97 352.49 353.04 354.12
354.31 355.58 356.35 357.12 359.29 359.49 360.21 361.39
363.16 364.06 364.77 367.01 368.69 371.78 372.00 373.46
374.09 374.86 375.60 376.41 376.68 379.07 379.49 380.26
380.98 381.18 381.81 382.58 385.66 387.42 388.50 388.75
391.06 392.13 393.38 394.86 395.69 398.01 398.78 400.30
400.34 401.86 403.07 404.18 405.69 406.76 407.83 408.91
409.58 410.35 411.28 411.89 413.43 414.02 414.45 414.98
416.43 417.29 417.50 418.83 419.61

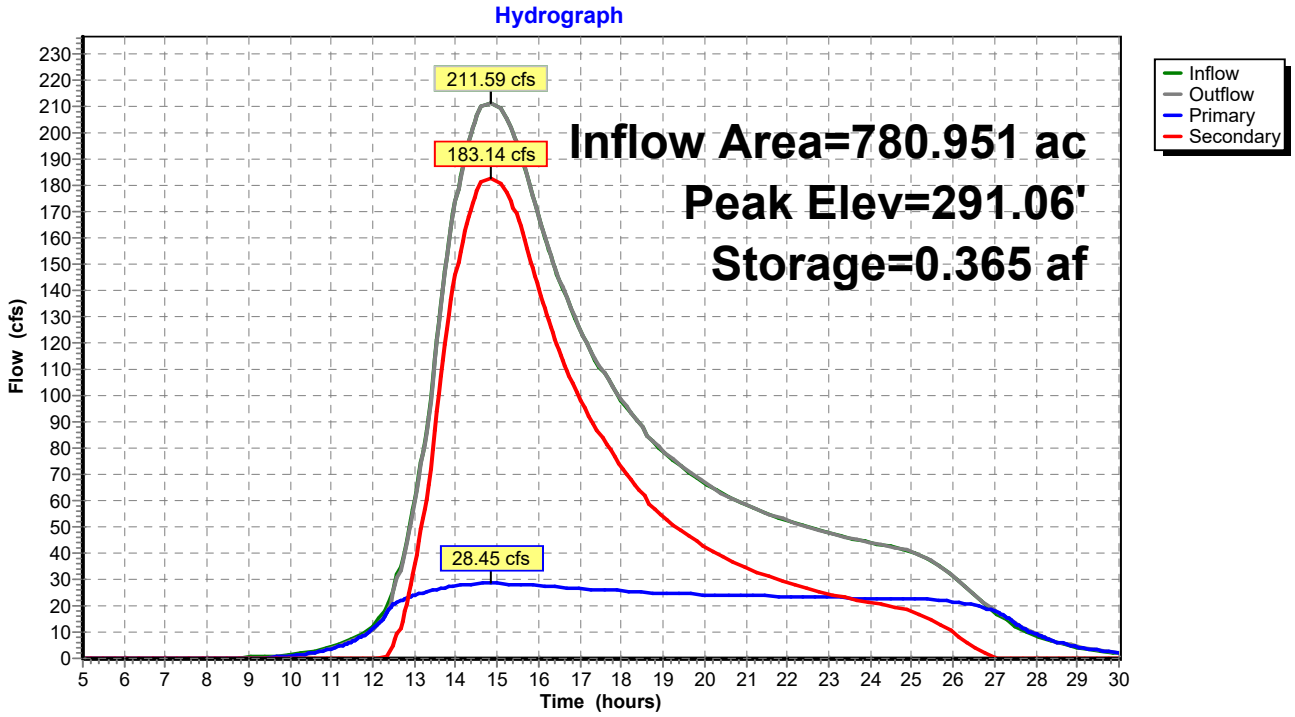
Height (feet) 17.94 17.81 17.58 16.87 16.57 15.64 15.38 14.53
14.16 14.03 13.54 13.05 12.43 12.02 12.02 11.28 11.05 10.54
9.38 8.73 8.22 7.90 7.45 7.33 6.92 6.75 6.06 5.93 5.18 5.04
4.42 3.91 3.38 2.83 2.63 2.42 2.14 1.99 1.71 1.50 1.37 1.29
1.21 1.14 1.06 1.00 0.96 0.93 0.83 0.81 0.73 0.71 0.64 0.57
0.51 0.47 0.44 0.35 0.23 0.15 0.10 0.07 0.05 0.05 0.11 0.24
0.27 0.27 0.31 0.30 0.33 0.33 0.35 0.34 0.35 0.35 0.36 0.36
0.37 0.37 0.29 0.18 0.12 0.03 0.01 0.01 0.00 0.08 0.13 0.20
0.32 0.38 0.45 0.59 0.84 0.94 1.02 1.14 1.27 1.33 1.44 1.55
1.62 1.75 1.80 1.96 2.10 2.14 2.29 2.36 2.40 2.42 2.45 2.47
2.51 2.51 2.53 2.52 2.55 2.57 2.60 2.60 2.61 2.61 2.62 2.62
2.54 2.52 2.45 2.45 2.41 2.40 2.33 2.28 2.20 2.04 2.00 1.98
1.93 1.87 1.85 1.82 1.81 1.79 1.79 1.78 1.78 1.77 1.77 1.78
1.78 1.75 1.72 1.70 1.69 1.67 1.60 1.58 1.53 1.48 1.44 1.37

1.36	1.31	1.25	1.22	1.16	1.13	1.08	1.04	0.98	0.98	0.97	0.97
0.99	1.04	1.06	1.10	1.14	1.40	1.41	1.46	1.48	1.50	1.51	1.53
1.57	1.63	1.71	1.72	1.78	1.79	1.85	1.89	1.93	1.93	1.96	1.99
2.02	2.15	2.16	2.20	2.22	2.22	2.23	2.23	2.25	2.25	2.27	2.30
2.32	2.33	2.40	2.44	2.45	2.45	2.46	2.46	2.47	2.51	2.53	2.53
2.55	2.58	2.58	2.59	2.59	2.60	2.59	2.60	2.60	2.61	2.61	2.60
2.60	2.63	2.64	2.66	2.69	2.72	2.73	2.79	2.81	2.85	2.88	2.89
2.90	2.90	2.92	2.94	3.00	3.06	3.08	3.09	3.10	3.13	3.17	3.20
3.24	3.28	3.31	3.36	3.40	3.41	3.42	3.46	3.47	3.48	3.54	3.55
3.58	3.62	3.68	3.68	3.72	3.74	3.82	3.82	3.86	3.86	3.88	3.89
3.94	3.96	3.99	4.03	4.05	4.05	4.09	4.12	4.12	4.13	4.13	4.14
4.14	4.16	4.16	4.18	4.18	4.21	4.21	4.23	4.23	4.25	4.25	4.28
4.29	4.29	4.30	4.30	4.31	4.31	4.32	4.32	4.31	4.31	4.29	4.29
4.28	4.28	4.30	4.33	4.36	4.41	4.41	4.51	4.56	4.59	4.68	4.80
5.04	5.08	5.40	5.47	5.68	5.81	5.93	6.02	6.17	6.31	6.60	6.70
6.86	7.20	7.48	7.73	7.79	7.92	8.05	8.09	8.30	8.52	8.70	8.82
8.86	8.91	8.98	9.09	9.12	9.25	9.34	9.41	9.64	9.67	9.74	9.88
10.08	10.20	10.28	10.57	10.80	11.24	11.28	11.49	11.59	11.70		
11.82	11.94	11.99	12.37	12.43	12.56	12.67	12.71	12.80	12.93		
13.41	13.69	13.85	13.88	14.22	14.36	14.53	14.74	14.85	15.18		
15.28	15.50	15.50	15.72	15.88	16.04	16.21	16.31	16.40	16.50		
16.58	16.66	16.78	16.85	17.08	17.16	17.23	17.30	17.52	17.64		
17.68	17.86	17.94									

Primary OutFlow Max=28.45 cfs @ 14.84 hrs HW=291.06' (Free Discharge)
- **1=18" Culvert - Left Barrel** (Inlet Controls 12.74 cfs @ 7.21 fps)
- **2=6" Culvert - Center Barrel** (Inlet Controls 1.53 cfs @ 7.79 fps)
- **3=18" Culvert - Right Barrel** (Inlet Controls 14.19 cfs @ 8.03 fps)

Secondary OutFlow Max=181.77 cfs @ 14.84 hrs HW=291.06' (Free Discharge)
- **4=Forbush Mill Road** (Weir Controls 181.77 cfs @ 3.06 fps)

Pond 3P: Culvert 3



Summary for Pond 4P: Culvert 4

[93] Warning: Storage range exceeded by 0.23'
[58] Hint: Peaked 1.01' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	780.951 ac,	0.00% Impervious,	Inflow Depth >	1.66"	for	10-yr event
Inflow =	211.59 cfs @	14.84 hrs,	Volume=	107.770 af		
Outflow =	212.09 cfs @	14.85 hrs,	Volume=	107.555 af,	Atten= 0%,	Lag= 0.7 min
Primary =	46.83 cfs @	14.85 hrs,	Volume=	52.367 af		
Secondary =	165.26 cfs @	14.85 hrs,	Volume=	55.189 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 286.23' @ 14.85 hrs Surf.Area= 0.000 ac Storage= 1.076 af
Flood Elev= 285.22' Surf.Area= 0.000 ac Storage= 0.889 af

Plug-Flow detention time= 8.8 min calculated for 107.555 af (100% of inflow)
Center-of-Mass det. time= 7.4 min (1,077.2 - 1,069.7)

Volume	Invert	Avail.Storage	Storage Description
#1	281.50'	1.076 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
281.50	0.000
286.00	1.076

Device	Routing	Invert	Outlet Devices
#1	Primary	281.69'	**36.0" Round 36" PVC-lined DI Culvert** L= 39.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 281.50' / 281.69' S= -0.0048 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 7.07 sf
#2	Secondary	285.22'	**Forbrush Mill Road, C= 3.27** Offset (feet) 0.00 0.10 0.33 0.48 1.07 3.19 3.71 4.55 5.91 7.08 8.63 9.00 10.46 11.35 13.44 13.83 14.07 15.04 16.78 17.20 17.89 19.50 20.58 22.22 22.34 23.95 24.94 26.79 27.33 27.66 29.02 30.37 30.70 31.23 33.09 34.07 35.68 35.81 37.45 38.53 40.13 40.82 41.25 43.00 43.97 44.20 44.58 46.68 47.57 49.03 49.40 50.95 52.12 53.47 54.32 54.84 56.98 57.56 57.69 57.92 60.27 61.07 62.37 62.99 64.44 65.71 66.82 67.82 68.43 70.96 71.15 71.19 71.26 73.86 74.57 75.71 76.58 77.94 79.30 80.16 81.31 82.02 84.61 84.69 84.74 84.94 87.45 88.06 89.06 90.17 91.44 92.89 93.50 94.81 95.61 97.95 98.18 98.33 98.92 101.05 101.56 102.40 103.76 104.93 106.48 106.85 108.31 109.20 111.30 111.68 111.92 112.90 114.64 115.06 115.74 117.35 118.43 120.07 120.19 121.80 122.79 124.64 125.18 125.51 126.88 128.23 128.55 129.09 130.94 131.93 133.53 133.66 135.30 136.38 137.98 138.68 139.10 140.85 141.82 142.05 142.43 144.53 145.42 146.88 147.25 147.74 148.83 149.86 151.97 152.29 152.45 152.91 155.03 155.75 157.21 157.62 159.22 160.21 162.46 162.68 162.79 163.11 165.38 166.15

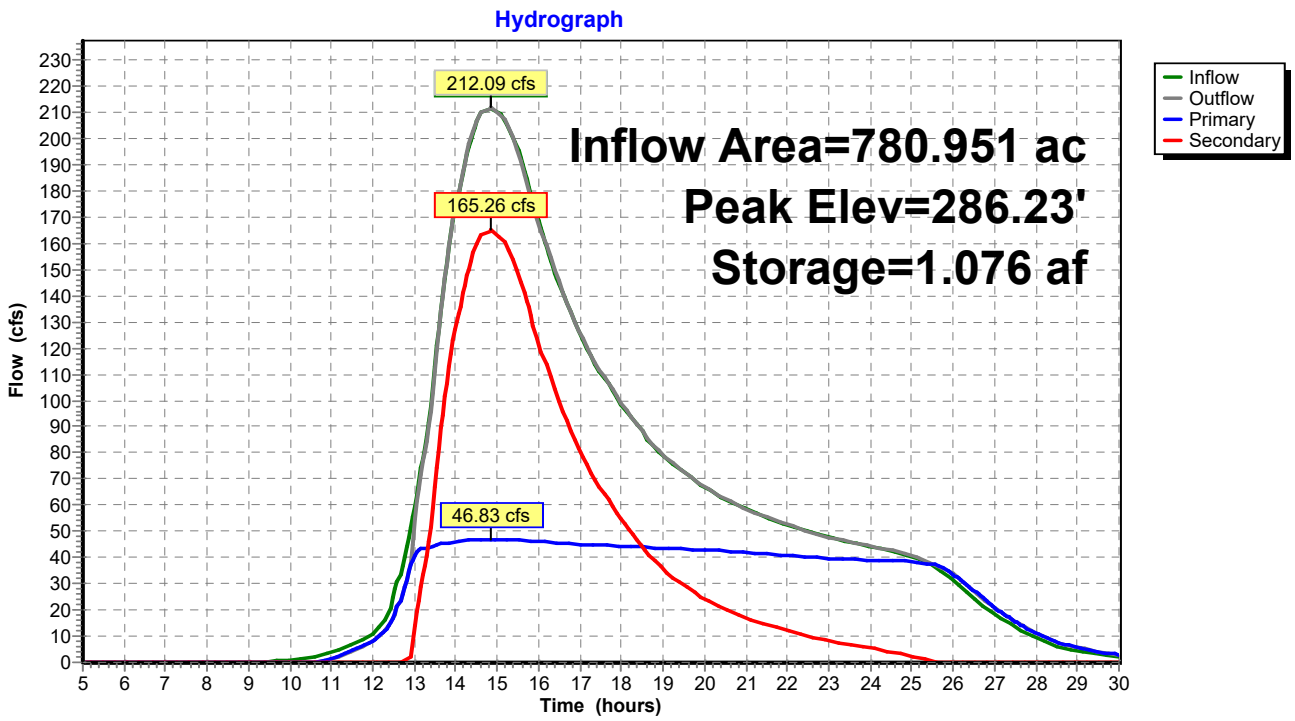
167.71	167.96	169.61	170.55	172.95	173.07	173.13	173.31
175.72	176.54	178.20	178.31	180.00	180.89	183.44	183.47
183.48	183.51	186.06	186.93	188.65	188.69	190.39	191.24
193.71	193.82	193.86	193.93	196.41	197.32	198.99	199.18
200.79	201.58	203.91	204.16	204.25	204.42	206.75	207.71
209.34	209.67	211.18	211.92	214.11	214.51	214.64	214.91
217.09	218.11	219.68	220.16	221.57	222.27	224.31	224.85
225.03	225.41	227.44	228.50	230.02	230.65	231.96	232.61
234.51	235.19	235.43	235.90	237.78	238.89	240.37	241.14
242.35	242.95	244.71	245.54	245.82	246.39	248.12	249.28
250.71	251.63	252.75	253.29	254.91	255.88	256.21	256.88
258.47	258.61	260.03	260.80	261.57	263.12	264.67	265.44
266.21	267.76	269.31	270.08	270.85	272.40	273.95	274.72
275.48	277.04	278.59	279.36	280.12	281.67	283.23	283.99
284.76	286.31	287.87	288.63	289.40	290.95	292.50	293.27
294.04	295.59	297.14	297.91	298.68	300.23	301.78	302.55
303.32	304.84	304.95	305.63	307.37	308.04	309.23	310.45
311.14	312.86	313.62					

Height (feet)	3.15	3.15	3.15	3.14	3.11	3.00	2.98	2.95	2.89	2.83	
2.80	2.80	2.77	2.76	2.77	2.77	2.77	2.76	2.72	2.71	2.70	2.58
2.57	2.50	2.52	2.46	2.43	2.41	2.39	2.39	2.37	2.36	2.36	2.35
2.34	2.32	2.25	2.25	2.18	2.14	2.09	2.06	2.07	2.03	2.02	2.01
2.01	2.00	1.98	1.96	1.96	1.94	1.92	1.91	1.90	1.90	1.88	1.87
1.87	1.86	1.83	1.81	1.78	1.78	1.75	1.72	1.70	1.68	1.66	1.61
1.60	1.60	1.60	1.54	1.52	1.50	1.46	1.43	1.38	1.38	1.35	1.34
1.31	1.31	1.31	1.31	1.27	1.26	1.25	1.24	1.23	1.22	1.23	1.22
1.22	1.25	1.25	1.25	1.25	1.23	1.23	1.22	1.19	1.17	1.14	1.15
1.13	1.13	1.14	1.13	1.13	1.13	1.11	1.11	1.10	1.06	1.05	1.02
1.05	1.02	1.01	1.01	1.01	1.00	1.00	1.00	0.99	0.97	0.96	0.94
0.93	0.91	0.91	0.90	0.94	0.93	0.93	0.96	0.97	0.97	0.96	0.95
0.94	0.94	0.92	0.92	0.92	0.91	0.94	0.93	0.93	0.94	0.94	0.94
0.95	0.94	0.95	0.94	0.96	0.96	0.96	0.96	0.93	0.94	0.93	0.92
0.91	0.90	0.87	0.87	0.87	0.86	0.81	0.80	0.78	0.77	0.75	0.75
0.76	0.76	0.76	0.76	0.73	0.73	0.70	0.71	0.68	0.68	0.67	0.67
0.67	0.67	0.67	0.64	0.59	0.61	0.57	0.53	0.55	0.55	0.55	0.56
0.58	0.59	0.57	0.59	0.58	0.56	0.60	0.60	0.60	0.60	0.54	0.55
0.54	0.58	0.58	0.60	0.63	0.63	0.63	0.63	0.59	0.59	0.55	0.60
0.58	0.58	0.58	0.58	0.57	0.56	0.53	0.50	0.46	0.47	0.44	0.43
0.44	0.44	0.44	0.44	0.44	0.44	0.42	0.42	0.41	0.39	0.36	0.34
0.34	0.32	0.29	0.28	0.25	0.24	0.22	0.18	0.14	0.12	0.11	0.08
0.05	0.04	0.03	0.03	0.02	0.01	0.00	0.00	0.01	0.01	0.02	0.13
0.28	0.33	0.28	0.30	0.48	0.58	0.61	0.74	0.82	0.90	0.90	0.99
0.97	0.97	0.98	1.03	1.05	1.08	1.09	1.19	1.19	1.30	1.75	1.91
2.23	2.55	2.71	3.11	3.15							

Primary OutFlow Max=46.83 cfs @ 14.85 hrs HW=286.23' (Free Discharge)
└─**1=36" PVC-lined DI Culvert** (Inlet Controls 46.83 cfs @ 6.63 fps)

Secondary OutFlow Max=164.84 cfs @ 14.85 hrs HW=286.23' (Free Discharge)
└─**2=Forbrush Mill Road** (Weir Controls 164.84 cfs @ 2.38 fps)

Pond 4P: Culvert 4



Summary for Pond 5P: Sand Culvert

[93] Warning: Storage range exceeded by 23.36'
[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 24.77' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=52)

Inflow Area =	816.682 ac,	0.00% Impervious,	Inflow Depth >	1.60"	for 10-yr event
Inflow =	213.71 cfs @	14.85 hrs,	Volume=	108.852 af	
Outflow =	216.09 cfs @	14.80 hrs,	Volume=	108.758 af,	Atten= 0%, Lag= 0.0 min
Primary =	176.72 cfs @	14.80 hrs,	Volume=	94.542 af	
Secondary =	39.37 cfs @	14.80 hrs,	Volume=	14.216 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 270.36' @ 14.80 hrs Surf.Area= 0.000 ac Storage= 0.637 af
Flood Elev= 245.59' Surf.Area= 0.000 ac Storage= 0.461 af

Plug-Flow detention time= 4.6 min calculated for 108.541 af (100% of inflow)
Center-of-Mass det. time= 4.1 min (1,080.9 - 1,076.8)

Volume	Invert	Avail.Storage	Storage Description
#1	241.90'	0.637 af	**Custom Stage Data** Listed below

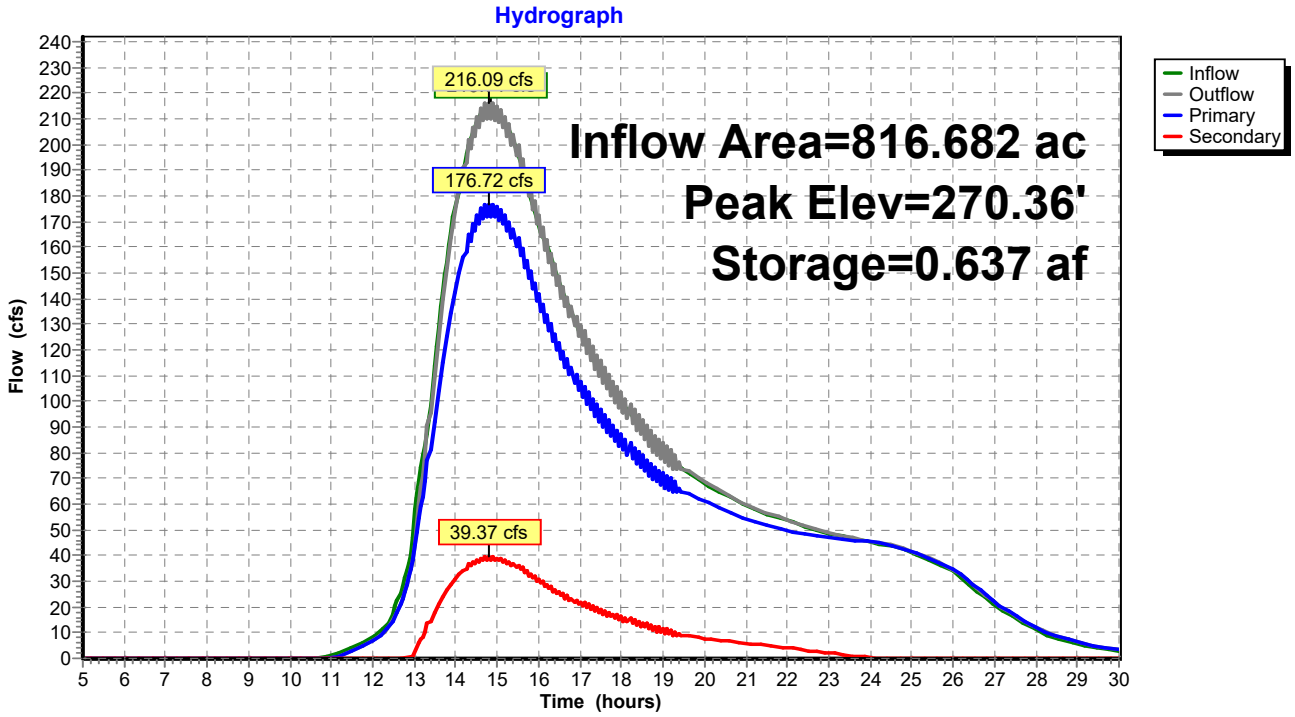
Elevation (feet)	Cum.Store (acre-feet)
241.90	0.000
247.00	0.637

Device	Routing	Invert	Outlet Devices
#1	Primary	241.90'	**36.0" Round 36" Concrete Culvert** L= 30.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.90' / 241.70' S= 0.0067 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Secondary	245.59'	**Sand Road, C= 3.27** Offset (feet) 0.00 0.42 1.87 3.41 3.66 5.17 6.41 7.31 8.47 9.41 10.97 11.76 12.41 14.63 15.06 15.41 18.29 18.36 18.41 18.92 Height (feet) 0.17 0.11 0.11 0.05 0.06 0.00 0.00 0.02 0.02 0.05 0.07 0.09 0.10 0.13 0.14 0.14 0.17 0.17 0.17 0.17

Primary OutFlow Max=176.69 cfs @ 14.80 hrs HW=270.35' (Free Discharge)
└─**1=36" Concrete Culvert** (Inlet Controls 176.69 cfs @ 25.00 fps)

Secondary OutFlow Max=39.36 cfs @ 14.80 hrs HW=270.35' (Free Discharge)
└─**2=Sand Road** (Weir Controls 39.36 cfs @ 21.27 fps)

Pond 5P: Sand Culvert



Summary for Pond 6P: 110 Culvert

Inflow Area = 915.598 ac, 0.00% Impervious, Inflow Depth > 1.47" for 10-yr event
Inflow = 220.63 cfs @ 14.80 hrs, Volume= 111.980 af
Outflow = 216.29 cfs @ 15.02 hrs, Volume= 111.532 af, Atten= 2%, Lag= 13.3 min
Primary = 216.29 cfs @ 15.02 hrs, Volume= 111.532 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 237.34' @ 15.02 hrs Surf.Area= 0.000 ac Storage= 4.722 af
Flood Elev= 238.05' Surf.Area= 0.000 ac Storage= 5.491 af

Plug-Flow detention time= 21.1 min calculated for 111.309 af (99% of inflow)
Center-of-Mass det. time= 18.5 min (1,100.4 - 1,081.9)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	5.491 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
233.00	0.000
238.05	5.491

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**120.0" W x 48.0" H Box 10' Wide Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 233.00' / 233.00' S= 0.0000 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf
#2	Secondary	238.05'	**Route 110, C= 3.27** Offset (feet) 0.00 0.77 3.09 3.35 3.53 4.31 6.28 6.71 7.38 9.04 10.07 11.67 11.80 13.43 14.55 15.96 16.78 17.31 19.74 20.07 20.14 20.25 22.82 23.50 24.54 25.58 26.85 28.34 28.83 30.21 31.09 33.12 33.57 33.85 35.16 36.61 36.92 37.41 39.36 40.28 41.70 42.12 43.64 44.88 45.99 46.99 47.64 50.28 50.35 50.39 50.59 53.15 53.71 54.57 55.91 57.06 58.66 58.86 60.42 61.42 63.15 63.78 64.18 66.01 66.93 67.13 67.44 69.69 70.49 71.74 72.45 73.85 75.20 76.03 77.20 77.96 80.32 80.56 80.72 81.44 83.47 83.92 84.61 86.23 87.27 88.90 88.99 90.63 91.74 93.19 93.99 94.50 96.87 97.26 97.34 97.48 100.02 100.70 101.77 102.77 104.06 105.53 106.06 107.41 108.29 110.35 110.77 111.04 112.29 113.80 114.13 114.64 116.56 117.48 118.93 119.31 120.84 122.07 123.22 124.20 124.83 127.51 127.55 127.58 127.72 130.34 130.91 131.80 133.10 134.27 135.85 136.09 137.63 138.61 140.38 140.98 141.37 143.14 144.13 144.34 144.67 146.88 147.70 148.96 149.64 151.05 152.40 153.25 154.41 155.15 157.54 157.77 157.91 158.57 160.67 161.12 161.83 163.42 164.48 166.12 166.18 167.84 168.94 170.41 171.19 171.69 174.00 174.45 174.55 174.70 177.21 177.91 178.99 179.96 181.26 182.72 183.28 184.62 185.48 187.57 187.98 188.23 189.42 190.99 191.33 191.87 193.75 194.69 196.16 196.51 198.05 199.26 200.45 201.40 202.02

204.74	204.76	204.78	204.85	207.53	208.12	209.03	210.29
211.47	213.05	213.32	214.83	215.80	217.61	218.19	218.56
220.27	221.32	221.54	221.90	224.07	224.90	226.19	226.83
228.26	229.59	230.48	231.61	232.34	234.77	234.97	235.10
235.70	237.86	238.33	239.06	240.62	241.68	243.35	243.37
245.04	246.13	247.64	248.40	248.89	251.13	251.64	251.76
251.93	254.40	255.11	256.22	257.16	258.47	259.91	260.51
261.83	262.67	264.80	265.18	265.43	266.55	268.18	268.54
269.09	270.94	271.90	273.38	273.70	275.25	276.45	277.67
278.61	279.21	281.96	281.97	281.98	284.72	285.32	286.25
287.48	288.68	290.24	290.54	292.04	293.00	294.83	295.39
295.75	297.40	298.51	298.75	299.12	301.27	302.11	303.41
304.02	305.46	306.78	307.70	308.82	309.54	312.00	312.18
312.29	312.83	315.05	315.53	316.29	317.81	318.89	320.56
320.58	322.25	323.32	324.87	325.60	326.08	328.26	328.83
328.96	329.16	331.59	332.32	333.45	334.35	335.67	337.11
337.74	339.03	339.86	342.03	342.39	342.62	343.68	345.38
345.74	346.32	348.13	349.10	350.61	350.89	352.46	353.65
354.90	355.81	356.40	359.11	359.16	359.17	359.19	361.92
362.53	363.48	364.67	365.88	367.43	367.77	369.24	370.19
372.06	372.60	372.94	374.53	375.70	375.96	376.35	378.46
379.31	380.64	381.21	382.67	383.97	384.93	386.03	386.73
389.22	389.38	389.49	389.96	392.24	392.74	393.51	395.00
396.10	397.76	397.80	399.45	400.51	402.09	402.81	403.27
405.39	406.03	406.17	406.38	408.78	409.52	410.67	411.54
412.88	414.30	414.96	416.24	417.05	419.25	419.59	419.81
420.81	422.57	422.95	423.54	425.32	426.31	427.83	428.08
429.66	430.84						

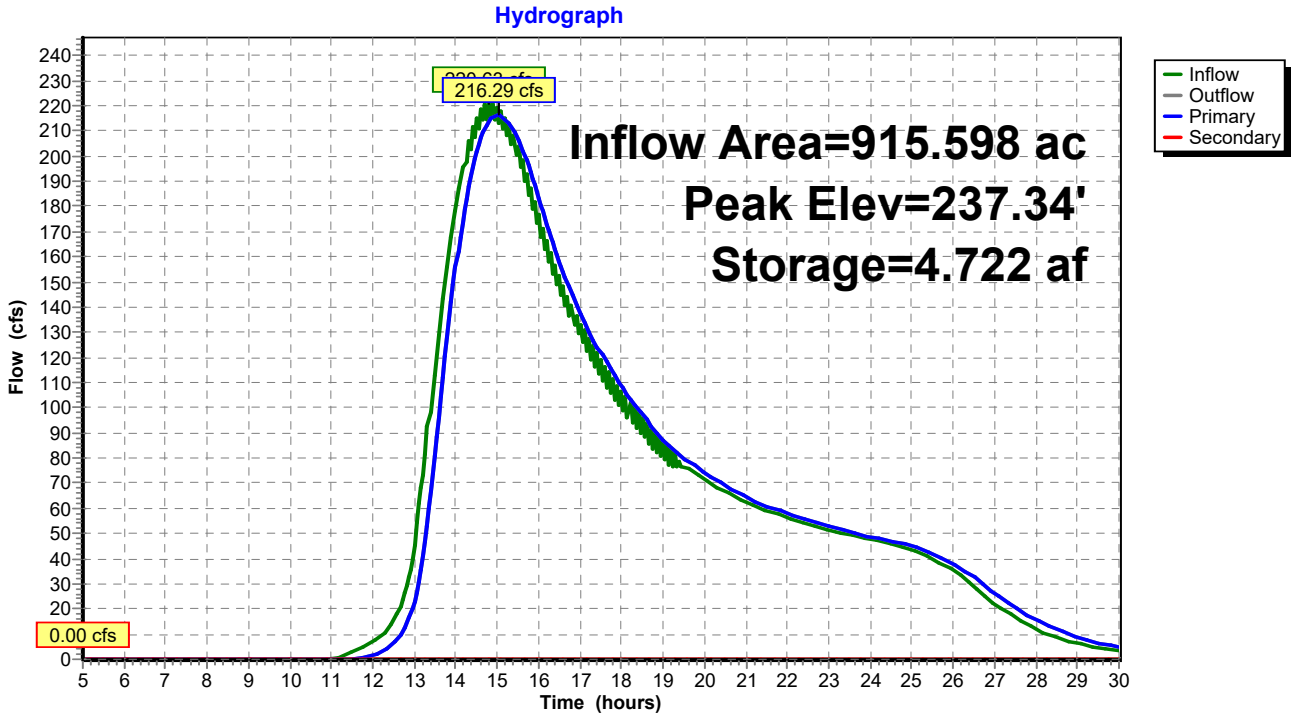
Height (feet)	0.77	0.76	0.75	0.75	0.75	0.74	0.72	0.71	0.71	0.69	
0.69	0.70	0.69	0.70	0.70	0.71	0.71	0.71	0.70	0.69	0.69	0.69
0.67	0.67	0.68	0.65	0.66	0.63	0.66	0.64	0.63	0.61	0.60	0.60
0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.59	0.57	0.55	0.56	0.55
0.55	0.53	0.53	0.53	0.53	0.48	0.48	0.48	0.49	0.50	0.51	0.51
0.51	0.50	0.50	0.49	0.49	0.47	0.46	0.46	0.46	0.46	0.45	0.46
0.47	0.48	0.48	0.51	0.52	0.52	0.55	0.55	0.55	0.57	0.62	0.64
0.65	0.69	0.70	0.69	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.64
0.64	0.64	0.65	0.65	0.66	0.69	0.70	0.72	0.68	0.69	0.68	0.73
0.72	0.72	0.70	0.68	0.67	0.66	0.58	0.56	0.51	0.50	0.46	0.46
0.46	0.46	0.46	0.44	0.44	0.44	0.44	0.44	0.42	0.40	0.37	0.35
0.33	0.32	0.31	0.32	0.30	0.30	0.30	0.28	0.27	0.27	0.27	0.25
0.25	0.25	0.24	0.25	0.25	0.28	0.28	0.28	0.30	0.30	0.30	0.29
0.26	0.25	0.24	0.24	0.22	0.21	0.21	0.20	0.17	0.09	0.07	0.06
0.01	0.00	0.00	0.00	0.01	0.02	0.09	0.06	0.15	0.20	0.18	0.22
0.23	0.27	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.24	0.24	0.23
0.22	0.22	0.22	0.21	0.22	0.25	0.25	0.25	0.25	0.30	0.31	0.31
0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.28
0.28	0.28	0.28	0.27	0.29	0.27	0.27	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.26	0.26	0.27	0.27	0.29	0.33	0.31	0.35	0.35	0.34
0.34	0.34	0.33	0.33	0.33	0.33	0.31	0.31	0.32	0.30	0.31	0.30
0.32	0.31	0.32	0.29	0.29	0.29	0.29	0.28	0.27	0.28	0.28	0.28
0.27	0.27	0.27	0.26	0.25	0.24	0.24	0.20	0.20	0.20	0.21	0.22
0.24	0.27	0.30	0.30	0.32	0.32	0.32	0.37	0.37	0.37	0.38	0.38

0.38	0.38	0.31	0.32	0.34	0.34	0.36	0.40	0.40	0.43	0.42	0.36
0.36	0.36	0.35	0.32	0.31	0.31	0.31	0.31	0.30	0.31	0.31	0.31
0.33	0.34	0.34	0.37	0.38	0.38	0.38	0.40	0.40	0.40	0.41	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40
0.40	0.38	0.39	0.38	0.39	0.40	0.41	0.41	0.44	0.44	0.44	0.44
0.46	0.46	0.46	0.45	0.45	0.46	0.45	0.46	0.48	0.49	0.50	0.50
0.51	0.52	0.52	0.52	0.52	0.51	0.52	0.53	0.53	0.55	0.56	0.58
0.57	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.61
0.62	0.62	0.63	0.63	0.63	0.67	0.68	0.68	0.68	0.69	0.69	0.68
0.65	0.64	0.65	0.66	0.66	0.67	0.67	0.68	0.68	0.68	0.69	0.69
0.70	0.74	0.76	0.76	0.77	0.77	0.77					

Primary OutFlow Max=216.26 cfs @ 15.02 hrs HW=237.34' (Free Discharge)
└─**1=10' Wide Box Culvert** (Barrel Controls 216.26 cfs @ 6.64 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=233.00' (Free Discharge)
└─**2=Route 110** (Controls 0.00 cfs)

Pond 6P: 110 Culvert



Summary for Pond 0P: 117 Culvert

[58] Hint: Peaked 0.88' above defined flood level

Inflow Area =	201.341 ac,	0.00% Impervious,	Inflow Depth >	3.27"	for 10-yr 2100 event
Inflow =	109.57 cfs @	14.84 hrs,	Volume=	54.863 af	
Outflow =	109.57 cfs @	14.84 hrs,	Volume=	54.863 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.98 cfs @	14.84 hrs,	Volume=	0.198 af	
Secondary =	108.59 cfs @	14.84 hrs,	Volume=	54.665 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 425.73' @ 14.84 hrs
Flood Elev= 424.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	425.40'	**48.0" Round 48" RCP Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 425.40' / 414.80' S= 0.1631 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf
#2	Secondary	424.85'	**Route 117, C= 3.27** Offset (feet) 0.00 2.48 2.49 2.50 2.57 5.48 5.79 6.17 8.46 9.09 9.85 11.45 12.38 13.54 14.43 15.68 17.23 17.41 18.98 20.40 20.92 22.28 23.38 24.61 25.58 26.36 28.29 28.87 29.34 31.98 32.17 32.33 33.79 35.31 35.47 35.67 38.29 38.77 39.36 41.28 42.07 43.04 44.26 45.37 46.73 47.24 48.66 50.23 50.42 51.96 53.21 54.11 55.26 56.19 57.80 58.56 59.18 61.48 61.86 62.16 65.02 65.14 65.16 65.17 68.13 68.45 68.86 71.11 71.75 72.55 74.09 75.05 76.24 77.07 78.35 79.92 80.06 81.65 83.04 83.61 84.94 86.02 87.30 88.24 89.01 90.99 91.54 91.99 94.67 94.84 94.97 96.24 97.96 98.14 98.36 100.94 101.44 102.05 103.92 104.73 105.74 106.91 108.03 109.43 109.89 111.33 112.87 113.11 114.63 115.86 116.80 117.77 117.93 118.99 120.11 121.21 122.39 123.27 124.49 125.80 126.44 127.77 129.20 129.61 131.06 132.61 132.78 134.34 135.95 136.01 137.62 139.11 139.42 140.90 142.28 142.82 144.18 145.45 146.23 147.47 148.62 149.63 150.75 151.79 153.03 154.03 154.96 156.44 157.31 158.12 159.84 160.59 161.29 163.25 163.88 164.46 166.65 167.16 167.63 170.06 170.44 170.80 173.46 173.72 173.97 176.87 177.00 177.13 180.27 180.29 180.30 180.74 183.47 183.57 183.67 186.64 186.85 187.08 189.81 190.13 190.48 192.98 193.42 193.89 196.14 196.70 197.29 199.31 199.98 200.70 202.48 203.26 204.10 205.65 206.54 207.51 208.82 209.83 210.91 211.99 213.11 214.31 215.15 216.39 217.72 218.32 219.67 221.12 221.49 222.95 224.53 224.66 226.24 227.83 227.93 229.52 231.00 231.34 232.80 234.16 234.74 236.08 237.33 238.15 239.36 240.50 241.55 242.65 243.67 244.95 245.93 246.84 248.36 249.21 250.00 251.76 252.49 253.17 255.17 255.78 256.34 258.57 259.06 259.51 261.98 262.34 262.68 265.38 265.62 265.85 268.79 268.90 269.01 272.09 272.18 275.35 275.47 275.59 278.52 278.75 279.00 281.69 282.03 282.40 284.86 285.31 285.81 288.02 288.60 289.21 291.19 291.88 292.62 294.36 295.16

296.02 297.53 298.44 299.42 300.70 301.73 302.83 303.87
305.01 306.23 307.03 308.29 309.64 310.20 311.57 313.04
313.37 314.85 316.45 316.54 318.14 319.71 319.85 321.42
322.88 323.26 324.70 326.04 326.66 327.98 329.21 330.06
331.26 332.38 333.47 334.55 335.55 336.87 337.83 338.72
340.28 341.11 341.89 343.68 344.39 345.05 347.09 347.67
348.22 350.49 350.96 351.39 353.90 354.24 354.56 357.30
357.52 357.73 360.70 360.80 360.89 363.45 364.06 364.09
364.11 367.23 367.37 367.51 370.40 370.65 370.92 373.57
373.93 374.32 376.74 377.21 377.73 379.90 380.50 381.13
383.07 383.78 384.54 386.24 387.06 387.94 389.41 390.34
391.34 392.58 393.41 393.66 394.35 395.45 396.73 397.52
399.11 400.94 401.39 401.49 401.66 403.87 405.25 406.25
407.87 408.64 409.11 411.02 411.14 412.97 413.40 414.09
415.78 416.83 418.16 420.30 420.54 420.70 421.35 422.93
424.56 425.31 426.51 427.69 428.42 429.34 430.41 431.13
431.77 433.89 434.41 434.88 437.38 437.70 437.99 440.86
440.99 441.10 443.02 444.20 444.27 444.35 447.31 447.56
447.83 450.42 450.84 451.32 453.53 454.13 454.80 456.63
457.41 458.28 459.74 460.70 461.77 462.85 463.98 465.25
465.96 467.27 468.74 469.07 470.55 472.17 472.22 473.84
475.28 475.71 477.12 478.39 479.19 480.41 481.50 482.68
483.70 484.60 486.16 486.98 487.17 488.08 489.01 490.43
491.60 493.26 493.89 494.20 495.13 496.79 497.34 498.45
499.38 500.80 501.98 503.64 504.26 504.57 505.50 507.16
507.72 508.82 509.76 511.17 512.35 514.01 514.63 514.94
515.88 517.53 518.09 519.19 520.13 521.54 522.72 524.38
525.00 525.31 526.25 527.91 528.46 529.57 530.50 531.92
533.09 534.75 535.37 535.69 536.62 538.28 538.83 539.94
540.87 542.29 543.47 545.12 545.75 546.06 546.99 547.15
548.56 549.34 551.00 551.71 553.02 553.44 554.28 555.88
556.69 558.32 559.19 560.37 560.76 561.52 563.20 564.05
565.64 566.67 567.73 568.08 568.76 570.52 571.41 572.96
574.15 575.09 575.40 576.00 577.84 578.77 580.28 581.63
582.45 582.72 583.24 585.16 586.13 587.59 589.11 589.81
590.03 590.48

Height (feet) 11.60 11.60 11.60 11.60 11.59 11.51 11.50 11.49
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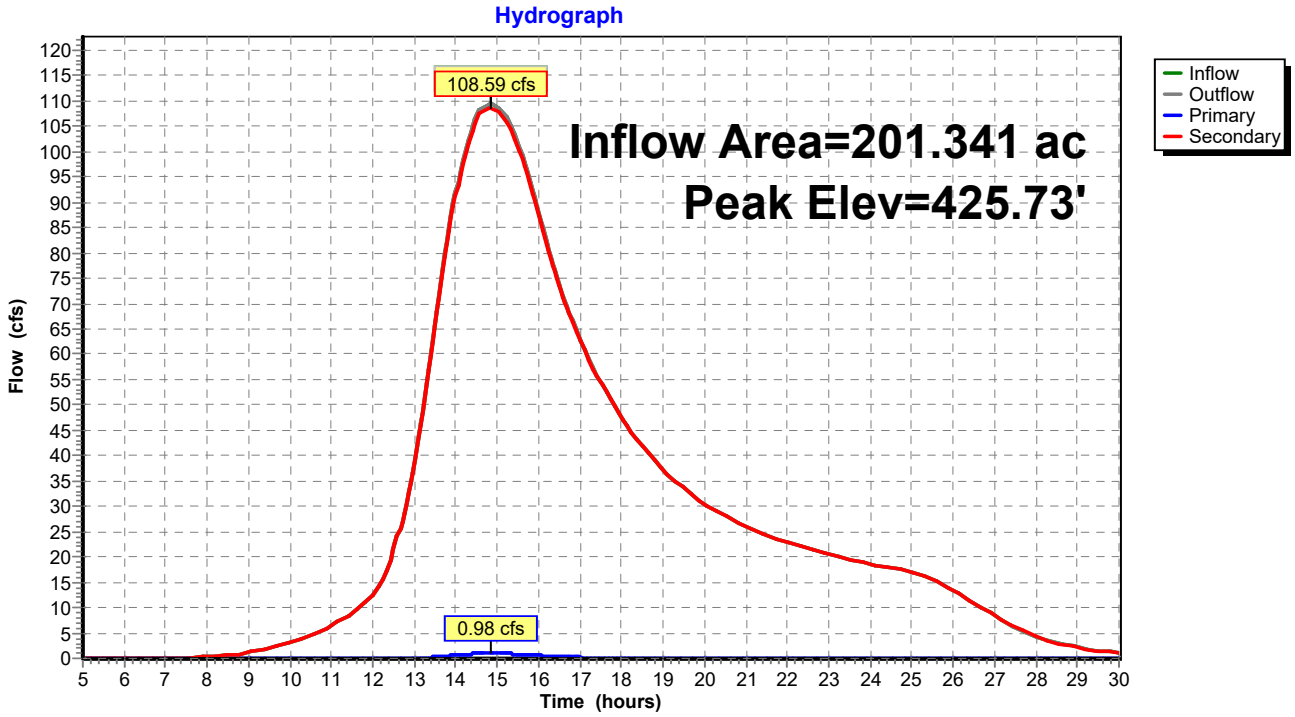
11.22 11.18 11.17 11.13 11.11 11.09 11.07 11.06 11.03 11.02
11.01 10.96 10.95 10.95 10.90 10.85 10.85 10.84 10.75 10.74
10.73 10.69 10.67 10.64 10.63 10.60 10.55 10.55 10.50 10.45
10.45 10.41 10.36 10.35 10.31 10.28 10.23 10.21 10.20 10.13
10.12 10.11 10.06 10.05 10.05 10.05 9.97 9.96 9.95 9.88 9.87
9.85 9.83 9.81 9.78 9.77 9.74 9.69 9.69 9.64 9.57 9.58 9.52
9.49 9.46 9.43 9.42 9.36 9.36 9.35 9.28 9.28 9.28 9.24 9.19
9.18 9.18 9.10 9.09 9.07 9.01 8.98 8.95 8.91 8.88 8.84 8.84
8.80 8.76 8.75 8.71 8.68 8.69 8.67 8.66 8.62 8.59 8.55 8.50
8.49 8.44 8.41 8.39 8.35 8.31 8.29 8.26 8.22 8.21 8.18 8.14
8.14 8.11 8.05 8.05 8.00 7.95 7.94 7.89 7.87 7.87 7.85 7.84
7.82 7.81 7.79 7.73 7.70 7.65 7.58 7.53 7.49 7.44 7.41 7.37
7.30 7.27 7.25 7.19 7.17 7.17 7.10 7.09 7.07 6.98 6.97 6.96
6.86 6.85 6.84 6.70 6.70 6.70 6.69 6.60 6.59 6.59 6.59 6.58

6.58	6.55	6.55	6.54	6.45	6.44	6.42	6.31	6.29	6.27	6.19	6.17
6.16	6.09	6.09	6.07	6.00	5.98	5.94	5.90	5.86	5.84	5.80	5.78
5.74	5.71	5.68	5.62	5.60	5.54	5.50	5.49	5.45	5.41	5.42	5.37
5.31	5.30	5.25	5.21	5.21	5.18	5.16	5.18	5.17	5.12	5.15	5.10
5.07	5.02	4.98	4.96	4.88	4.86	4.84	4.78	4.76	4.74	4.70	4.68
4.67	4.64	4.62	4.61	4.58	4.57	4.56	4.51	4.50	4.48	4.39	4.38
4.37	4.27	4.27	4.26	4.20	4.19	4.15	4.15	4.15	4.06	4.05	4.04
3.94	3.93	3.91	3.84	3.82	3.80	3.73	3.71	3.69	3.63	3.60	3.57
3.52	3.48	3.46	3.39	3.36	3.36	3.32	3.32	3.29	3.29	3.27	3.19
3.17	3.10	3.08	3.02	3.01	2.98	2.97	2.94	2.88	2.89	2.84	2.79
2.78	2.73	2.70	2.71	2.68	2.64	2.64	2.60	2.54	2.53	2.48	2.45
2.42	2.39	2.37	2.34	2.33	2.32	2.28	2.27	2.25	2.20	2.18	2.16
2.07	2.05	2.04	1.94	1.93	1.92	1.85	1.84	1.83	1.77	1.77	1.76
1.69	1.69	1.69	1.64	1.63	1.63	1.63	1.58	1.57	1.57	1.48	1.47
1.46	1.37	1.36	1.34	1.31	1.29	1.28	1.23	1.22	1.21	1.16	1.14
1.13	1.08	1.06	1.04	1.02	1.01	1.00	1.02	1.01	1.01	1.00	0.97
0.93	0.90	0.82	0.73	0.71	0.71	0.70	0.60	0.57	0.54	0.49	0.47
0.46	0.39	0.38	0.31	0.29	0.27	0.22	0.21	0.19	0.15	0.14	0.14
0.12	0.10	0.05	0.04	0.01	0.00	0.00	0.01	0.03	0.04	0.06	0.13
0.14	0.14	0.23	0.23	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26
0.23	0.23	0.23	0.19	0.19	0.19	0.21	0.21	0.24	0.28	0.32	0.36
0.28	0.32	0.35	0.36	0.39	0.44	0.48	0.53	0.64	0.71	0.82	0.92
0.93	1.03	1.13	1.16	1.27	1.35	1.38	1.46	1.57	1.64	1.74	1.83
1.94	2.02	2.03	2.07	2.14	2.19	2.23	2.29	2.31	2.32	2.41	2.54
2.56	2.60	2.65	2.69	2.72	2.87	2.90	2.92	3.01	3.07	3.12	3.26
3.24	3.45	3.49	3.74	3.78	3.79	3.89	3.98	4.06	4.16	4.14	4.29
4.37	4.54	4.59	4.62	4.67	4.73	4.76	4.78	4.69	4.75	4.87	5.13
5.20	5.24	5.38	5.59	5.65	5.77	5.89	6.05	6.13	6.38	6.44	6.46
6.56	6.56	6.63	6.72	6.79	6.95	7.04	7.08	7.15	7.21	7.34	7.52
7.72	7.88	7.93	8.03	8.23	8.41	8.63	8.74	8.88	8.93	9.01	9.21
9.31	9.48	9.62	9.72	9.75	9.82	10.02	10.12	10.29	10.46	10.55	
10.59	10.65	10.88	11.00	11.18	11.40	11.49	11.52	11.60			

Primary OutFlow Max=0.96 cfs @ 14.84 hrs HW=425.73' (Free Discharge)
└─**1=48" RCP Culvert** (Inlet Controls 0.96 cfs @ 1.95 fps)

Secondary OutFlow Max=108.09 cfs @ 14.84 hrs HW=425.73' (Free Discharge)
└─**2=Route 117** (Weir Controls 108.09 cfs @ 2.51 fps)

Pond 0P: 117 Culvert



Summary for Pond 1P: Culvert 1

[58] Hint: Peaked 1.52' above defined flood level

Inflow Area =	508.468 ac,	0.00% Impervious,	Inflow Depth >	2.82"	for	10-yr 2100 event
Inflow =	248.49 cfs @	14.66 hrs,	Volume=	119.514 af		
Outflow =	248.46 cfs @	14.67 hrs,	Volume=	119.513 af,	Atten= 0%,	Lag= 0.8 min
Primary =	99.57 cfs @	14.67 hrs,	Volume=	85.519 af		
Secondary =	148.89 cfs @	14.67 hrs,	Volume=	33.994 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 336.32' @ 14.67 hrs Surf.Area= 0.000 ac Storage= 0.394 af
Flood Elev= 334.80' Surf.Area= 0.000 ac Storage= 0.098 af

Plug-Flow detention time= 0.9 min calculated for 119.275 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (1,044.6 - 1,043.7)

Volume	Invert	Avail.Storage	Storage Description
#1	329.70'	3.406 af	**Custom Stage Data** Listed below

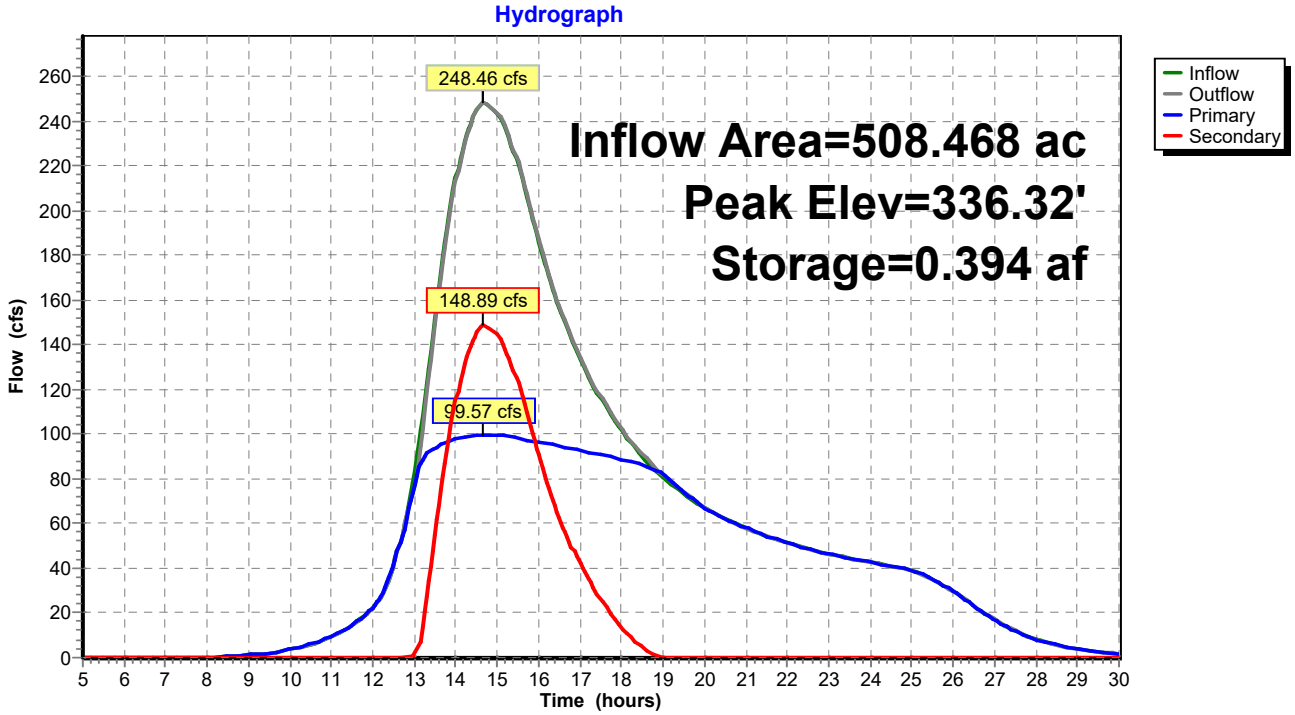
Elevation (feet)	Cum.Store (acre-feet)
329.70	0.000
333.00	0.003
334.00	0.024
335.00	0.116
336.00	0.309
337.00	0.575
338.00	0.886
339.00	1.252
340.00	1.773
341.00	2.503
342.00	3.406

Device	Routing	Invert	Outlet Devices
#1	Secondary	334.80'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.00 80.00 Height (feet) 2.00 0.00 2.00
#2	Primary	329.72'	**30.0" Round Culvert #1 - Left Barrel** L= 40.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.72' / 329.29' S= 0.0106 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf
#3	Primary	329.86'	**30.0" Round Culvert #1 - Right Barrel** L= 40.4' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 329.86' / 329.12' S= 0.0183 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 4.91 sf

Primary OutFlow Max=99.56 cfs @ 14.67 hrs HW=336.32' (Free Discharge)
└─**2=Culvert #1 - Left Barrel** (Barrel Controls 49.28 cfs @ 10.04 fps)
└─**3=Culvert #1 - Right Barrel** (Barrel Controls 50.28 cfs @ 10.24 fps)

Secondary OutFlow Max=148.48 cfs @ 14.67 hrs HW=336.32' (Free Discharge)
└─**1=Forbush Mill Road** (Weir Controls 148.48 cfs @ 1.61 fps)

Pond 1P: Culvert 1



Summary for Pond 2P: Culvert 2

Inflow Area = 508.468 ac, 0.00% Impervious, Inflow Depth > 2.82" for 10-yr 2100 event
Inflow = 248.46 cfs @ 14.67 hrs, Volume= 119.513 af
Outflow = 248.38 cfs @ 14.69 hrs, Volume= 119.513 af, Atten= 0%, Lag= 1.1 min
Primary = 248.38 cfs @ 14.69 hrs, Volume= 119.513 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 308.21' @ 14.69 hrs Surf.Area= 0.000 ac Storage= 0.094 af
Flood Elev= 308.70' Surf.Area= 0.000 ac Storage= 0.158 af

Plug-Flow detention time= 0.1 min calculated for 119.513 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (1,044.7 - 1,044.6)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	0.445 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
306.00	0.000
307.00	0.013
308.00	0.066
309.00	0.198
310.00	0.445

Device	Routing	Invert	Outlet Devices
#1	Primary	305.35'	**192.0" W x 36.0" H Box 16' Box Culvert** L= 40.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 305.35' / 304.10' S= 0.0313 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 48.00 sf
#2	Secondary	308.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 1.57 2.55 3.95 6.16 6.33 6.43 6.88 8.70 10.30 11.08 12.32 13.46 14.18 15.84 17.32 17.77 18.05 18.22 18.48 20.60 21.93 22.98 24.64 25.35 25.80 27.73 27.79 29.68 30.11 30.80 32.49 33.56 34.87 36.95 37.25 37.43 38.25 39.63 41.31 42.00 43.11 44.38 45.18 46.76 48.72 49.06 49.14 49.26 51.52 52.94 53.90 55.42 56.27 56.81 58.65 59.18 60.69 61.03 61.58 63.41 64.56 65.79 67.73 68.17 68.44 69.65 70.54 72.32 72.92 73.89 75.30 76.19 77.68 80.04 80.06 80.07 80.11 82.44 83.94 84.82 86.20 87.19 87.82 89.57 90.58 91.70 91.95 92.36 94.33 95.57 96.71 98.51 99.09 99.37 99.45 100.73 101.49 103.20 103.90 105.16 106.31 106.96 108.73 109.23 110.72 111.14 111.89 113.55 114.47 115.96 117.73 118.23 118.37 118.62 120.78 121.98 123.19 125.35 125.60 125.74 126.23 128.01 129.50 130.42 132.08 132.83 133.25 134.73 135.24 137.01 137.65 138.81 140.07 140.77 142.48 143.23 144.52 144.89 145.54 147.30 148.28 149.71 151.74 152.03 152.12 152.27 154.53 155.79 156.94 159.00 159.35 159.55 160.24 161.76 163.30 164.17 165.73 166.58 167.06 168.74 168.99 170.82 171.41 172.46 173.82 174.57 176.23 177.24 178.33 178.64

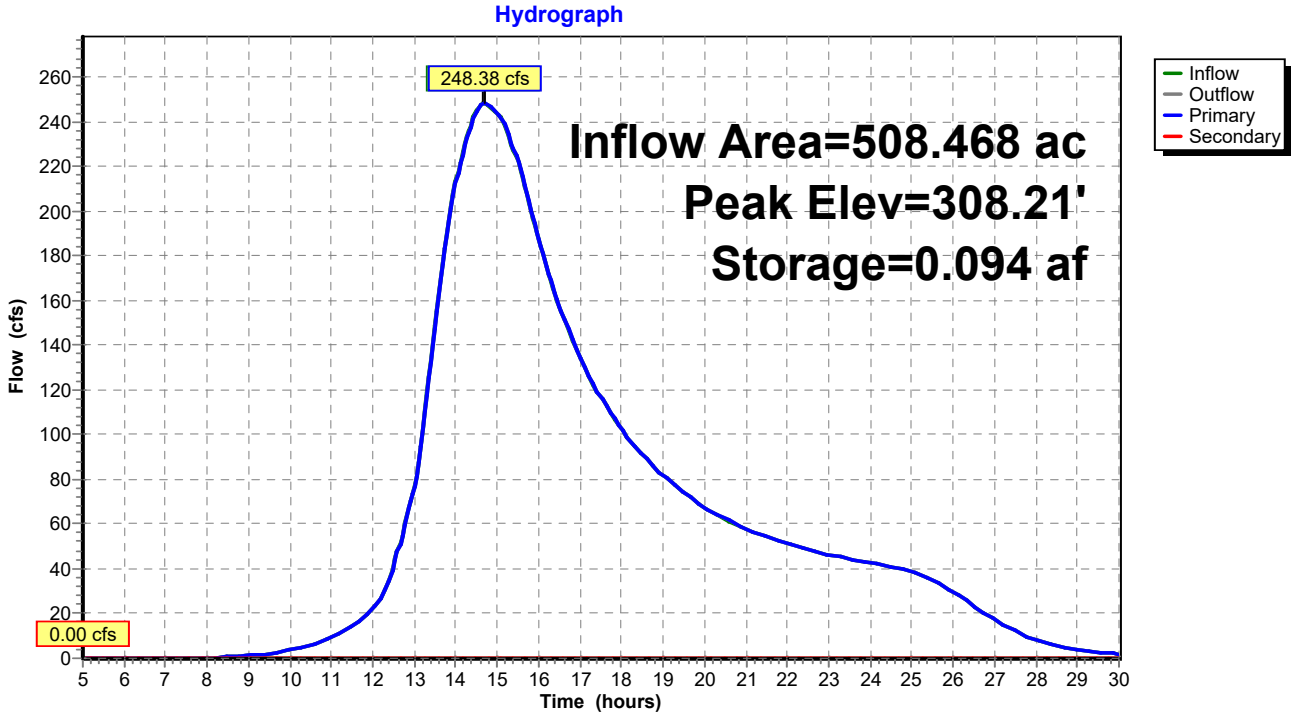
179.19 181.05 182.09 183.46 185.74 185.84 185.87 185.92
188.28 189.60 190.69 192.65 193.10 193.35 193.84 194.06
195.69 196.80 198.37 198.73 200.20 201.04 203.39 203.60
203.71 204.14 206.39 207.00 208.06 209.06 210.40 211.73
212.73 213.79 214.40 216.65 217.08 217.19 217.40 219.75
220.59 222.06 222.42 223.99 225.09 226.73 227.39 227.77
229.16 230.44 230.79 231.40 233.11 234.19 235.79 236.07
237.59 238.46 240.73 240.99 241.13 241.66 243.80 244.38
245.40 246.48 247.78 249.15 250.07 251.18 251.82 254.17
254.49 254.58 254.73 254.80 256.30 257.73 257.89 258.09
260.70 261.19 261.80 263.67 264.49 265.51 266.64 267.79
269.22 269.61 271.09 272.58 272.94 274.39 275.55 276.65
277.69 278.52 280.36 280.99 281.49 284.08 284.29 284.46
286.00 287.43 287.59 287.79 290.40 290.89 291.50 293.37
294.19 295.21 296.34 297.49 298.93 299.31 300.79 301.12
302.18 302.97 304.17 304.88 307.50 307.55 307.58 307.68
310.28 310.93 312.03 312.98 314.32 315.68 316.56 317.70
318.38 321.05 321.08 321.08 321.09 323.78 324.47 325.62
326.48 327.85 329.18 330.16 331.23 331.88 334.41 334.58
334.62 334.69 337.28 338.00 339.22 339.98 341.38 342.68
343.75 344.77 345.38 347.78 348.08 348.15 348.28 350.78
351.53 352.81 353.23

Height (feet) 3.08 2.98 2.95 2.91 2.91 2.91 2.91 2.92 2.94 2.94
2.93 2.91 2.87 2.86 2.82 2.79 2.78 2.77 2.77 2.76 2.71 2.68
2.65 2.62 2.60 2.60 2.55 2.58 2.55 2.54 2.54 2.49 2.48 2.44
2.41 2.40 2.40 2.39 2.34 2.35 2.34 2.33 2.29 2.29 2.24 2.21
2.20 2.20 2.20 2.14 2.11 2.08 2.06 2.03 2.02 1.99 1.99 1.97
1.96 1.97 1.98 1.98 1.97 1.95 1.94 1.93 1.90 1.83 1.81 1.79
1.78 1.74 1.74 1.71 1.68 1.68 1.68 1.68 1.62 1.60 1.58 1.56
1.54 1.53 1.51 1.50 1.49 1.49 1.49 1.45 1.45 1.42 1.43 1.42
1.41 1.41 1.39 1.32 1.31 1.29 1.28 1.24 1.23 1.18 1.21 1.19
1.18 1.18 1.15 1.12 1.09 1.07 1.06 1.05 1.05 1.01 1.00 0.98
0.98 0.98 0.98 0.98 0.97 0.97 0.96 1.00 1.00 1.01 1.01 1.00
1.01 1.00 0.99 0.96 0.96 0.93 0.94 0.92 0.91 0.90 0.87 0.87
0.84 0.84 0.83 0.83 0.83 0.81 0.80 0.78 0.76 0.75 0.75 0.74
0.68 0.67 0.64 0.62 0.60 0.59 0.58 0.55 0.55 0.56 0.56 0.55
0.55 0.53 0.53 0.52 0.52 0.52 0.49 0.48 0.48 0.47 0.47 0.47
0.47 0.44 0.44 0.43 0.44 0.44 0.44 0.44 0.44 0.41 0.41 0.40
0.40 0.39 0.39 0.36 0.36 0.36 0.36 0.35 0.35 0.34 0.38 0.37
0.44 0.40 0.44 0.46 0.47 0.47 0.47 0.47 0.44 0.42 0.38 0.37
0.32 0.30 0.27 0.25 0.27 0.27 0.31 0.30 0.31 0.49 0.50 0.60
0.61 0.70 0.69 0.61 0.60 0.60 0.56 0.45 0.40 0.37 0.38 0.33
0.22 0.35 0.29 0.25 0.40 0.41 0.41 0.41 0.42 0.53 0.62 0.63
0.64 0.79 0.81 0.79 0.87 0.84 0.81 0.81 0.77 0.79 0.70 0.73
0.73 0.74 0.74 0.79 0.74 0.78 0.81 0.79 0.81 0.81 0.92 0.92
0.92 0.99 1.03 1.04 1.06 1.09 1.13 1.18 1.21 1.29 1.31 1.21
1.23 1.11 1.00 0.88 0.85 0.73 0.68 0.56 0.50 0.29 0.29 0.29
0.28 0.14 0.12 0.09 0.11 0.07 0.08 0.09 0.10 0.10 0.14 0.14
0.14 0.14 0.16 0.16 0.15 0.15 0.14 0.13 0.11 0.11 0.10 0.07
0.07 0.06 0.06 0.01 0.00 0.05 0.05 0.12 0.36 0.62 0.81 0.98
1.66 1.75 1.77 1.80 2.50 2.72 3.08 3.08

Primary OutFlow Max=248.32 cfs @ 14.69 hrs HW=308.21' (Free Discharge)
└─**1=16' Box Culvert** (Inlet Controls 248.32 cfs @ 5.43 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=306.00' (Free Discharge)
└─**2=Forbush Mill Road** (Controls 0.00 cfs)

Pond 2P: Culvert 2



Summary for Pond 3P: Culvert 3

[58] Hint: Peaked 1.61' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	780.951 ac,	0.00% Impervious,	Inflow Depth >	2.26"	for	10-yr 2100 event
Inflow =	296.52 cfs @	14.71 hrs,	Volume=	147.314 af		
Outflow =	296.53 cfs @	14.71 hrs,	Volume=	147.230 af,	Atten= 0%,	Lag= 0.2 min
Primary =	29.83 cfs @	14.71 hrs,	Volume=	35.691 af		
Secondary =	266.70 cfs @	14.71 hrs,	Volume=	111.539 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 291.31' @ 14.71 hrs Surf.Area= 0.000 ac Storage= 0.390 af
Flood Elev= 289.70' Surf.Area= 0.000 ac Storage= 0.225 af

Plug-Flow detention time= 2.2 min calculated for 146.936 af (100% of inflow)
Center-of-Mass det. time= 1.8 min (1,058.2 - 1,056.3)

Volume	Invert	Avail.Storage	Storage Description
#1	287.50'	0.461 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
287.50	0.000
292.00	0.461

Device	Routing	Invert	Outlet Devices
#1	Primary	288.07'	**18.0" Round 18" Culvert - Left Barrel** L= 36.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.81' / 288.07' S= -0.0072 '/' Cc= 0.900 n= 0.009, Flow Area= 1.77 sf
#2	Primary	288.19'	**6.0" Round 6" Culvert - Center Barrel** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 288.19' / 287.37' S= 0.0221 '/' Cc= 0.900 n= 0.009, Flow Area= 0.20 sf
#3	Primary	287.53'	**18.0" Round 18" Culvert - Right Barrel** L= 37.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 287.53' / 287.38' S= 0.0040 '/' Cc= 0.900 n= 0.009, Flow Area= 1.77 sf
#4	Secondary	289.70'	**Forbush Mill Road, C= 3.27** Offset (feet) 0.00 0.52 1.01 2.44 3.03 4.98 5.54 7.28 8.05 8.29 9.30 10.29 11.61 12.42 12.44 13.86 14.32 15.29 17.56 18.86 19.90 20.58 21.56 21.84 22.70 23.09 24.57 24.87 26.53 26.85 28.19 29.36 30.61 31.87 32.43 32.98 33.85 34.37 35.28 35.99 36.48 36.88 37.42 38.13 38.85 39.56 40.28 41.45 43.11 43.26 44.40 44.77 45.66 46.70 47.42 48.09 48.40 49.74 51.40 52.41 53.18 53.84 55.27 56.70 58.19 60.98 61.95 62.41 63.82 63.84 64.67 65.26 65.72 65.98 66.33 67.41 67.98 68.83 68.96 69.64 71.69 74.10 75.26 77.40 78.25 79.51 79.59 80.97 81.68 82.40 83.83 84.38 85.25 86.68 88.82 89.54 90.25 91.20 92.39 92.85 93.82 94.66 95.25 96.17 96.68 98.10 99.49 99.80 101.15 102.07

102.80	103.33	104.58	104.94	106.12	106.67	107.78	108.10
110.24	111.09	112.75	114.61	115.22	115.86	115.95	117.73
119.38	119.62	120.88	121.04	121.66	122.13	123.38	124.36
125.50	128.09	128.80	129.33	130.23	132.37	134.31	135.78
135.96	137.17	139.68	140.22	140.94	141.65	142.36	142.60
143.79	146.07	147.20	147.57	148.08	148.46	150.22	150.89
151.65	152.55	153.07	154.20	154.50	155.21	156.35	156.64
157.52	158.07	158.78	159.50	161.64	162.35	162.49	163.78
164.76	166.01	166.64	167.47	168.56	173.94	174.40	175.89
176.89	177.22	177.73	178.05	179.07	180.23	182.15	182.57
183.91	184.39	186.06	187.29	188.31	188.56	189.26	190.37
191.06	194.61	195.22	196.89	198.46	199.39	199.61	200.22
201.29	201.89	203.56	204.74	205.22	205.77	207.72	210.65
210.90	211.93	211.99	213.98	214.39	217.72	218.55	219.11
220.01	222.68	223.55	224.02	225.27	225.36	226.89	227.32
228.55	229.37	231.43	231.88	234.71	236.05	236.05	236.88
237.72	238.26	238.72	240.06	240.67	241.40	242.68	243.55
243.75	244.38	245.22	246.75	249.42	251.05	251.88	251.96
252.71	253.43	255.21	256.11	257.10	258.55	259.38	261.05
262.71	262.79	263.55	265.21	265.31	266.04	268.54	269.22
270.21	271.88	273.49	273.64	274.55	275.21	278.54	278.83
280.71	281.04	281.73	282.48	284.18	285.21	286.04	287.71
288.19	288.54	290.21	292.00	292.71	293.03	294.05	294.37
295.21	296.04	296.36	297.71	298.49	300.03	300.40	301.25
301.83	302.55	303.12	305.43	305.77	306.55	306.85	307.92
308.32	309.00	309.29	311.61	311.86	312.78	313.92	314.69
315.40	317.78	319.32	320.70	321.63	322.96	323.18	324.72
325.11	325.49	326.19	327.03	328.33	328.58	330.12	330.48
331.66	332.43	333.21	333.71	334.67	335.52	337.40	338.00
339.08	341.23	342.88	344.45	344.78	345.61	346.32	346.60
347.86	349.41	350.77	351.72	351.97	352.49	353.04	354.12
354.31	355.58	356.35	357.12	359.29	359.49	360.21	361.39
363.16	364.06	364.77	367.01	368.69	371.78	372.00	373.46
374.09	374.86	375.60	376.41	376.68	379.07	379.49	380.26
380.98	381.18	381.81	382.58	385.66	387.42	388.50	388.75
391.06	392.13	393.38	394.86	395.69	398.01	398.78	400.30
400.34	401.86	403.07	404.18	405.69	406.76	407.83	408.91
409.58	410.35	411.28	411.89	413.43	414.02	414.45	414.98
416.43	417.29	417.50	418.83	419.61			

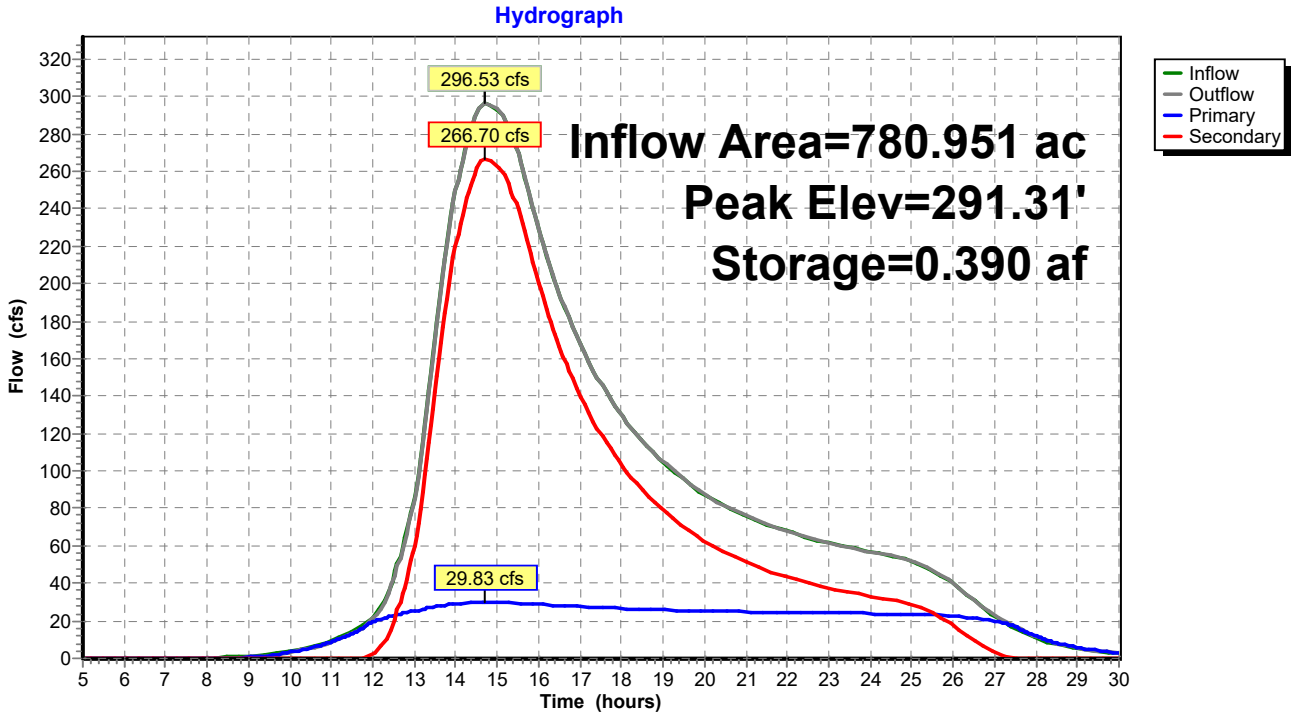
Height (feet)	17.94	17.81	17.58	16.87	16.57	15.64	15.38	14.53			
14.16	14.03	13.54	13.05	12.43	12.02	12.02	11.28	11.05	10.54		
9.38	8.73	8.22	7.90	7.45	7.33	6.92	6.75	6.06	5.93	5.18	5.04
4.42	3.91	3.38	2.83	2.63	2.42	2.14	1.99	1.71	1.50	1.37	1.29
1.21	1.14	1.06	1.00	0.96	0.93	0.83	0.81	0.73	0.71	0.64	0.57
0.51	0.47	0.44	0.35	0.23	0.15	0.10	0.07	0.05	0.05	0.11	0.24
0.27	0.27	0.31	0.30	0.33	0.33	0.35	0.34	0.35	0.35	0.36	0.36
0.37	0.37	0.29	0.18	0.12	0.03	0.01	0.01	0.00	0.08	0.13	0.20
0.32	0.38	0.45	0.59	0.84	0.94	1.02	1.14	1.27	1.33	1.44	1.55
1.62	1.75	1.80	1.96	2.10	2.14	2.29	2.36	2.40	2.42	2.45	2.47
2.51	2.51	2.53	2.52	2.55	2.57	2.60	2.60	2.61	2.61	2.62	2.62
2.54	2.52	2.45	2.45	2.41	2.40	2.33	2.28	2.20	2.04	2.00	1.98
1.93	1.87	1.85	1.82	1.81	1.79	1.79	1.78	1.78	1.77	1.77	1.78

1.78	1.75	1.72	1.70	1.69	1.67	1.60	1.58	1.53	1.48	1.44	1.37
1.36	1.31	1.25	1.22	1.16	1.13	1.08	1.04	0.98	0.98	0.97	0.97
0.99	1.04	1.06	1.10	1.14	1.40	1.41	1.46	1.48	1.50	1.51	1.53
1.57	1.63	1.71	1.72	1.78	1.79	1.85	1.89	1.93	1.93	1.96	1.99
2.02	2.15	2.16	2.20	2.22	2.22	2.23	2.23	2.25	2.25	2.27	2.30
2.32	2.33	2.40	2.44	2.45	2.45	2.46	2.46	2.47	2.51	2.53	2.53
2.55	2.58	2.58	2.59	2.59	2.60	2.59	2.60	2.60	2.61	2.61	2.60
2.60	2.63	2.64	2.66	2.69	2.72	2.73	2.79	2.81	2.85	2.88	2.89
2.90	2.90	2.92	2.94	3.00	3.06	3.08	3.09	3.10	3.13	3.17	3.20
3.24	3.28	3.31	3.36	3.40	3.41	3.42	3.46	3.47	3.48	3.54	3.55
3.58	3.62	3.68	3.68	3.72	3.74	3.82	3.82	3.86	3.86	3.88	3.89
3.94	3.96	3.99	4.03	4.05	4.05	4.09	4.12	4.12	4.13	4.13	4.14
4.14	4.16	4.16	4.18	4.18	4.21	4.21	4.23	4.23	4.25	4.25	4.28
4.29	4.29	4.30	4.30	4.31	4.31	4.32	4.32	4.31	4.31	4.29	4.29
4.28	4.28	4.30	4.33	4.36	4.41	4.41	4.51	4.56	4.59	4.68	4.80
5.04	5.08	5.40	5.47	5.68	5.81	5.93	6.02	6.17	6.31	6.60	6.70
6.86	7.20	7.48	7.73	7.79	7.92	8.05	8.09	8.30	8.52	8.70	8.82
8.86	8.91	8.98	9.09	9.12	9.25	9.34	9.41	9.64	9.67	9.74	9.88
10.08	10.20	10.28	10.57	10.80	11.24	11.28	11.49	11.59	11.70		
11.82	11.94	11.99	12.37	12.43	12.56	12.67	12.71	12.80	12.93		
13.41	13.69	13.85	13.88	14.22	14.36	14.53	14.74	14.85	15.18		
15.28	15.50	15.50	15.72	15.88	16.04	16.21	16.31	16.40	16.50		
16.58	16.66	16.78	16.85	17.08	17.16	17.23	17.30	17.52	17.64		
17.68	17.86	17.94									

Primary OutFlow Max=29.83 cfs @ 14.71 hrs HW=291.31' (Free Discharge)
- **1=18" Culvert - Left Barrel** (Inlet Controls 13.42 cfs @ 7.59 fps)
- **2=6" Culvert - Center Barrel** (Inlet Controls 1.60 cfs @ 8.15 fps)
- **3=18" Culvert - Right Barrel** (Inlet Controls 14.81 cfs @ 8.38 fps)

Secondary OutFlow Max=266.07 cfs @ 14.71 hrs HW=291.31' (Free Discharge)
- **4=Forbush Mill Road** (Weir Controls 266.07 cfs @ 3.31 fps)

Pond 3P: Culvert 3



Summary for Pond 4P: Culvert 4

[93] Warning: Storage range exceeded by 0.38'
[58] Hint: Peaked 1.16' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	780.951 ac,	0.00% Impervious,	Inflow Depth >	2.26"	for	10-yr 2100 event
Inflow =	296.53 cfs @	14.71 hrs,	Volume=	147.230 af		
Outflow =	297.58 cfs @	14.70 hrs,	Volume=	146.992 af,	Atten= 0%,	Lag= 0.0 min
Primary =	47.98 cfs @	14.70 hrs,	Volume=	56.988 af		
Secondary =	249.60 cfs @	14.70 hrs,	Volume=	90.004 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 286.38' @ 14.70 hrs Surf.Area= 0.000 ac Storage= 1.076 af
Flood Elev= 285.22' Surf.Area= 0.000 ac Storage= 0.889 af

Plug-Flow detention time= 6.9 min calculated for 146.992 af (100% of inflow)
Center-of-Mass det. time= 5.8 min (1,063.9 - 1,058.2)

Volume	Invert	Avail.Storage	Storage Description
#1	281.50'	1.076 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
281.50	0.000
286.00	1.076

Device	Routing	Invert	Outlet Devices
#1	Primary	281.69'	**36.0" Round 36" PVC-lined DI Culvert** L= 39.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 281.50' / 281.69' S= -0.0048 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 7.07 sf
#2	Secondary	285.22'	**Forbrush Mill Road, C= 3.27** Offset (feet) 0.00 0.10 0.33 0.48 1.07 3.19 3.71 4.55 5.91 7.08 8.63 9.00 10.46 11.35 13.44 13.83 14.07 15.04 16.78 17.20 17.89 19.50 20.58 22.22 22.34 23.95 24.94 26.79 27.33 27.66 29.02 30.37 30.70 31.23 33.09 34.07 35.68 35.81 37.45 38.53 40.13 40.82 41.25 43.00 43.97 44.20 44.58 46.68 47.57 49.03 49.40 50.95 52.12 53.47 54.32 54.84 56.98 57.56 57.69 57.92 60.27 61.07 62.37 62.99 64.44 65.71 66.82 67.82 68.43 70.96 71.15 71.19 71.26 73.86 74.57 75.71 76.58 77.94 79.30 80.16 81.31 82.02 84.61 84.69 84.74 84.94 87.45 88.06 89.06 90.17 91.44 92.89 93.50 94.81 95.61 97.95 98.18 98.33 98.92 101.05 101.56 102.40 103.76 104.93 106.48 106.85 108.31 109.20 111.30 111.68 111.92 112.90 114.64 115.06 115.74 117.35 118.43 120.07 120.19 121.80 122.79 124.64 125.18 125.51 126.88 128.23 128.55 129.09 130.94 131.93 133.53 133.66 135.30 136.38 137.98 138.68 139.10 140.85 141.82 142.05 142.43 144.53 145.42 146.88 147.25 147.74 148.83 149.86 151.97 152.29 152.45 152.91 155.03 155.75 157.21 157.62 159.22 160.21 162.46 162.68 162.79 163.11 165.38 166.15

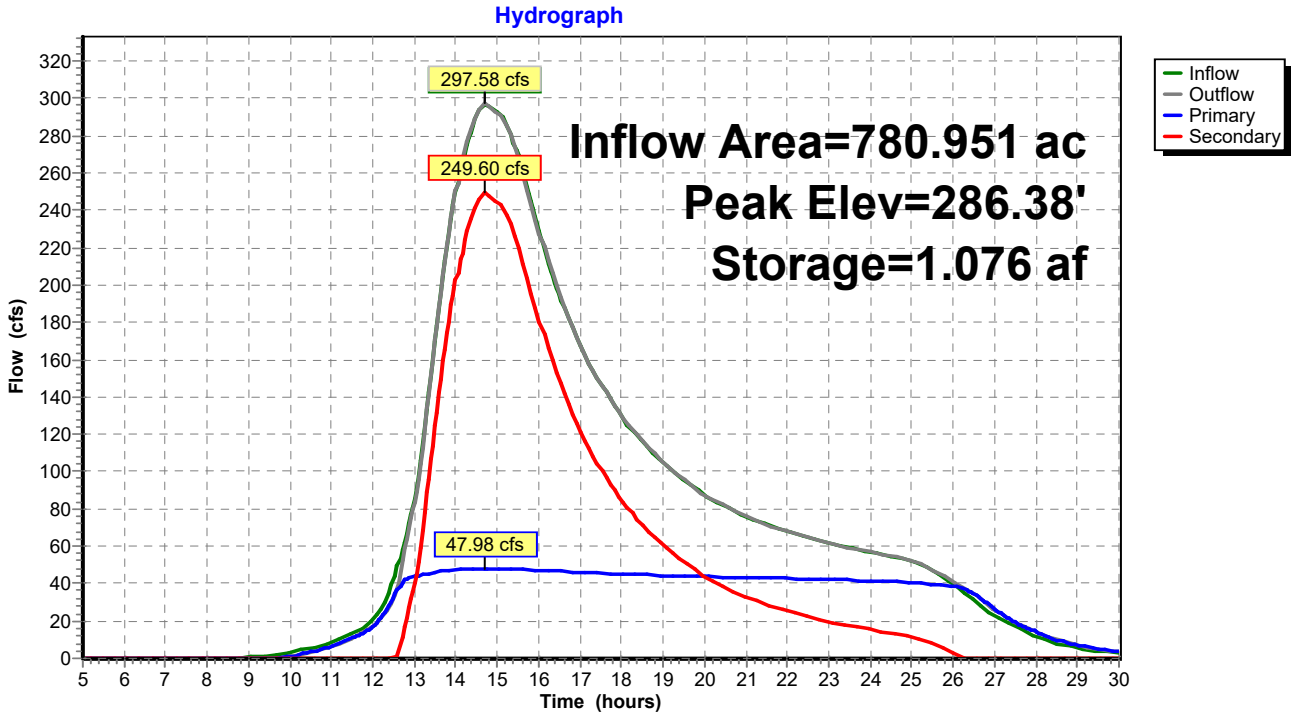
167.71	167.96	169.61	170.55	172.95	173.07	173.13	173.31
175.72	176.54	178.20	178.31	180.00	180.89	183.44	183.47
183.48	183.51	186.06	186.93	188.65	188.69	190.39	191.24
193.71	193.82	193.86	193.93	196.41	197.32	198.99	199.18
200.79	201.58	203.91	204.16	204.25	204.42	206.75	207.71
209.34	209.67	211.18	211.92	214.11	214.51	214.64	214.91
217.09	218.11	219.68	220.16	221.57	222.27	224.31	224.85
225.03	225.41	227.44	228.50	230.02	230.65	231.96	232.61
234.51	235.19	235.43	235.90	237.78	238.89	240.37	241.14
242.35	242.95	244.71	245.54	245.82	246.39	248.12	249.28
250.71	251.63	252.75	253.29	254.91	255.88	256.21	256.88
258.47	258.61	260.03	260.80	261.57	263.12	264.67	265.44
266.21	267.76	269.31	270.08	270.85	272.40	273.95	274.72
275.48	277.04	278.59	279.36	280.12	281.67	283.23	283.99
284.76	286.31	287.87	288.63	289.40	290.95	292.50	293.27
294.04	295.59	297.14	297.91	298.68	300.23	301.78	302.55
303.32	304.84	304.95	305.63	307.37	308.04	309.23	310.45
311.14	312.86	313.62					

Height (feet)	3.15	3.15	3.15	3.14	3.11	3.00	2.98	2.95	2.89	2.83		
2.80	2.80	2.77	2.76	2.77	2.77	2.77	2.76	2.72	2.71	2.70	2.58	
2.57	2.50	2.52	2.46	2.43	2.41	2.39	2.39	2.37	2.36	2.36	2.35	
2.34	2.32	2.25	2.25	2.18	2.14	2.09	2.06	2.07	2.03	2.02	2.01	
2.01	2.00	1.98	1.96	1.96	1.94	1.92	1.91	1.90	1.90	1.88	1.87	
1.87	1.86	1.83	1.81	1.78	1.78	1.75	1.72	1.70	1.68	1.66	1.61	
1.60	1.60	1.60	1.54	1.52	1.50	1.46	1.43	1.38	1.38	1.35	1.34	
1.31	1.31	1.31	1.31	1.27	1.26	1.25	1.24	1.23	1.22	1.23	1.22	
1.22	1.25	1.25	1.25	1.25	1.23	1.23	1.22	1.19	1.17	1.14	1.15	
1.13	1.13	1.14	1.13	1.13	1.13	1.11	1.11	1.10	1.06	1.05	1.02	
1.05	1.02	1.01	1.01	1.01	1.00	1.00	1.00	0.99	0.97	0.96	0.94	
0.93	0.91	0.91	0.90	0.94	0.93	0.93	0.96	0.97	0.97	0.96	0.95	
0.94	0.94	0.92	0.92	0.92	0.91	0.94	0.93	0.93	0.94	0.94	0.94	
0.95	0.94	0.95	0.94	0.96	0.96	0.96	0.96	0.93	0.94	0.93	0.92	
0.91	0.90	0.87	0.87	0.87	0.86	0.81	0.80	0.78	0.77	0.75	0.75	
0.76	0.76	0.76	0.76	0.73	0.73	0.70	0.71	0.68	0.68	0.67	0.67	
0.67	0.67	0.67	0.64	0.59	0.61	0.57	0.53	0.55	0.55	0.55	0.56	
0.58	0.59	0.57	0.59	0.58	0.56	0.60	0.60	0.60	0.60	0.54	0.55	
0.54	0.58	0.58	0.60	0.63	0.63	0.63	0.63	0.59	0.59	0.55	0.60	
0.58	0.58	0.58	0.58	0.57	0.56	0.53	0.50	0.46	0.47	0.44	0.43	
0.44	0.44	0.44	0.44	0.44	0.44	0.42	0.42	0.41	0.39	0.36	0.34	
0.34	0.32	0.29	0.28	0.25	0.24	0.22	0.18	0.14	0.12	0.11	0.08	
0.05	0.04	0.03	0.03	0.02	0.01	0.00	0.00	0.01	0.01	0.02	0.13	
0.28	0.33	0.28	0.30	0.48	0.58	0.61	0.74	0.82	0.90	0.90	0.99	
0.97	0.97	0.98	1.03	1.05	1.08	1.09	1.19	1.19	1.30	1.75	1.91	
2.23	2.55	2.71	3.11	3.15								

Primary OutFlow Max=47.98 cfs @ 14.70 hrs HW=286.38' (Free Discharge)
└─**1=36" PVC-lined DI Culvert** (Inlet Controls 47.98 cfs @ 6.79 fps)

Secondary OutFlow Max=249.48 cfs @ 14.70 hrs HW=286.38' (Free Discharge)
└─**2=Forbrush Mill Road** (Weir Controls 249.48 cfs @ 2.55 fps)

Pond 4P: Culvert 4



Summary for Pond 5P: Sand Culvert

[93] Warning: Storage range exceeded by 48.77'
[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 50.18' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=69)
[81] Warning: Exceeded Pond 4P by 9.40' @ 14.75 hrs
[81] Warning: Exceeded Pond 4P by 9.40' @ 14.75 hrs

Inflow Area =	816.682 ac,	0.00% Impervious,	Inflow Depth >	2.19"	for 10-yr 2100 event
Inflow =	300.35 cfs @	14.70 hrs,	Volume=	149.237 af	
Outflow =	302.40 cfs @	14.75 hrs,	Volume=	149.132 af,	Atten= 0%, Lag= 2.9 min
Primary =	246.30 cfs @	14.75 hrs,	Volume=	126.624 af	
Secondary =	56.10 cfs @	14.75 hrs,	Volume=	22.508 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 295.77' @ 14.75 hrs Surf.Area= 0.000 ac Storage= 0.637 af
Flood Elev= 245.59' Surf.Area= 0.000 ac Storage= 0.461 af

Plug-Flow detention time= 3.7 min calculated for 148.834 af (100% of inflow)
Center-of-Mass det. time= 3.3 min (1,066.5 - 1,063.2)

Volume	Invert	Avail.Storage	Storage Description
#1	241.90'	0.637 af	**Custom Stage Data** Listed below

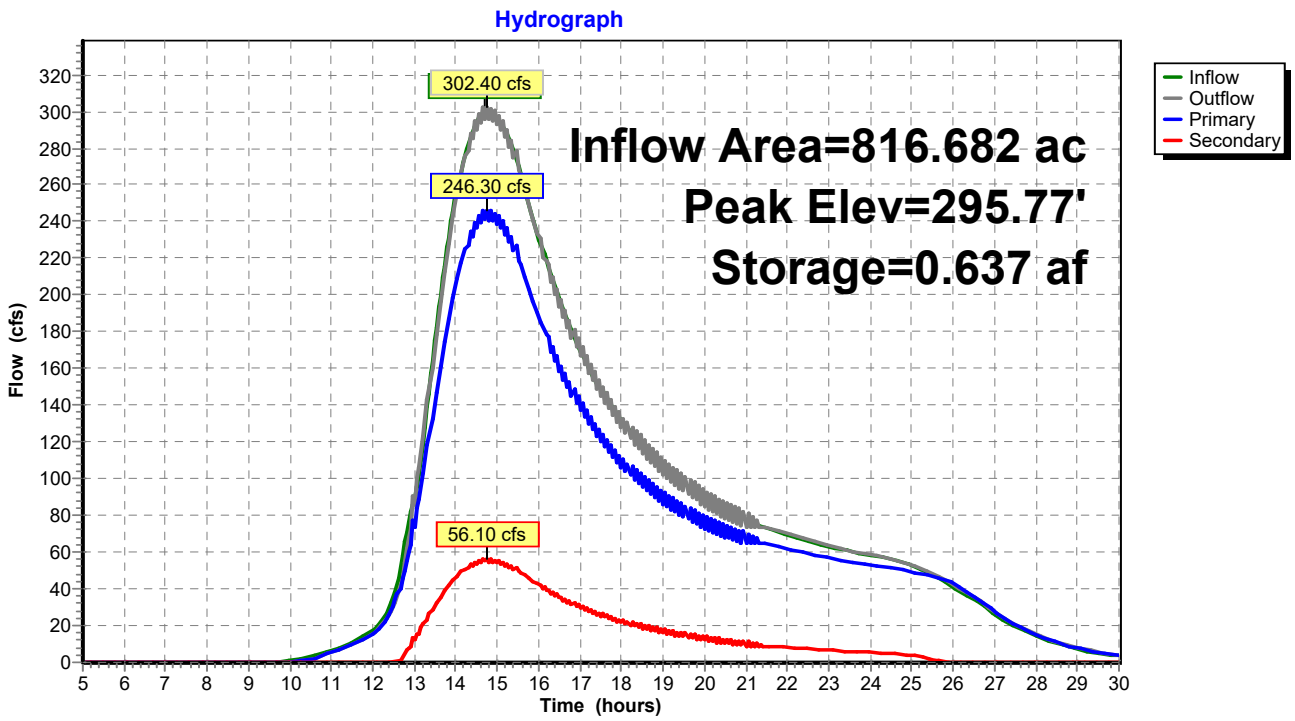
Elevation (feet)	Cum.Store (acre-feet)
241.90	0.000
247.00	0.637

Device	Routing	Invert	Outlet Devices
#1	Primary	241.90'	**36.0" Round 36" Concrete Culvert** L= 30.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 241.90' / 241.70' S= 0.0067 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 7.07 sf
#2	Secondary	245.59'	**Sand Road, C= 3.27** Offset (feet) 0.00 0.42 1.87 3.41 3.66 5.17 6.41 7.31 8.47 9.41 10.97 11.76 12.41 14.63 15.06 15.41 18.29 18.36 18.41 18.92 Height (feet) 0.17 0.11 0.11 0.05 0.06 0.00 0.00 0.02 0.02 0.05 0.07 0.09 0.10 0.13 0.14 0.14 0.17 0.17 0.17 0.17

Primary OutFlow Max=246.22 cfs @ 14.75 hrs HW=295.73' (Free Discharge)
└─**1=36" Concrete Culvert** (Inlet Controls 246.22 cfs @ 34.83 fps)

Secondary OutFlow Max=56.08 cfs @ 14.75 hrs HW=295.73' (Free Discharge)
└─**2=Sand Road** (Weir Controls 56.08 cfs @ 30.31 fps)

Pond 5P: Sand Culvert



Summary for Pond 6P: 110 Culvert

[93] Warning: Storage range exceeded by 0.35'
[58] Hint: Peaked 0.35' above defined flood level
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area =	915.598 ac,	0.00% Impervious,	Inflow Depth >	2.03"	for	10-yr 2100 event
Inflow =	311.55 cfs @	14.75 hrs,	Volume=	154.838 af		
Outflow =	316.03 cfs @	14.70 hrs,	Volume=	154.341 af,	Atten= 0%,	Lag= 0.0 min
Primary =	297.38 cfs @	14.70 hrs,	Volume=	153.483 af		
Secondary =	18.65 cfs @	14.70 hrs,	Volume=	0.858 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 238.40' @ 14.70 hrs Surf.Area= 0.000 ac Storage= 5.491 af
Flood Elev= 238.05' Surf.Area= 0.000 ac Storage= 5.491 af

Plug-Flow detention time= 18.7 min calculated for 154.033 af (99% of inflow)
Center-of-Mass det. time= 16.6 min (1,083.6 - 1,067.0)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	5.491 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
233.00	0.000
238.05	5.491

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**120.0" W x 48.0" H Box 10' Wide Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 233.00' / 233.00' S= 0.0000 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf
#2	Secondary	238.05'	**Route 110, C= 3.27** Offset (feet) 0.00 0.77 3.09 3.35 3.53 4.31 6.28 6.71 7.38 9.04 10.07 11.67 11.80 13.43 14.55 15.96 16.78 17.31 19.74 20.07 20.14 20.25 22.82 23.50 24.54 25.58 26.85 28.34 28.83 30.21 31.09 33.12 33.57 33.85 35.16 36.61 36.92 37.41 39.36 40.28 41.70 42.12 43.64 44.88 45.99 46.99 47.64 50.28 50.35 50.39 50.59 53.15 53.71 54.57 55.91 57.06 58.66 58.86 60.42 61.42 63.15 63.78 64.18 66.01 66.93 67.13 67.44 69.69 70.49 71.74 72.45 73.85 75.20 76.03 77.20 77.96 80.32 80.56 80.72 81.44 83.47 83.92 84.61 86.23 87.27 88.90 88.99 90.63 91.74 93.19 93.99 94.50 96.87 97.26 97.34 97.48 100.02 100.70 101.77 102.77 104.06 105.53 106.06 107.41 108.29 110.35 110.77 111.04 112.29 113.80 114.13 114.64 116.56 117.48 118.93 119.31 120.84 122.07 123.22 124.20 124.83 127.51 127.55 127.58 127.72 130.34 130.91 131.80 133.10 134.27 135.85 136.09 137.63 138.61 140.38 140.98 141.37 143.14 144.13 144.34 144.67 146.88 147.70 148.96 149.64 151.05 152.40 153.25 154.41 155.15 157.54 157.77 157.91 158.57 160.67 161.12 161.83 163.42 164.48 166.12 166.18 167.84 168.94

170.41	171.19	171.69	174.00	174.45	174.55	174.70	177.21
177.91	178.99	179.96	181.26	182.72	183.28	184.62	185.48
187.57	187.98	188.23	189.42	190.99	191.33	191.87	193.75
194.69	196.16	196.51	198.05	199.26	200.45	201.40	202.02
204.74	204.76	204.78	204.85	207.53	208.12	209.03	210.29
211.47	213.05	213.32	214.83	215.80	217.61	218.19	218.56
220.27	221.32	221.54	221.90	224.07	224.90	226.19	226.83
228.26	229.59	230.48	231.61	232.34	234.77	234.97	235.10
235.70	237.86	238.33	239.06	240.62	241.68	243.35	243.37
245.04	246.13	247.64	248.40	248.89	251.13	251.64	251.76
251.93	254.40	255.11	256.22	257.16	258.47	259.91	260.51
261.83	262.67	264.80	265.18	265.43	266.55	268.18	268.54
269.09	270.94	271.90	273.38	273.70	275.25	276.45	277.67
278.61	279.21	281.96	281.97	281.98	284.72	285.32	286.25
287.48	288.68	290.24	290.54	292.04	293.00	294.83	295.39
295.75	297.40	298.51	298.75	299.12	301.27	302.11	303.41
304.02	305.46	306.78	307.70	308.82	309.54	312.00	312.18
312.29	312.83	315.05	315.53	316.29	317.81	318.89	320.56
320.58	322.25	323.32	324.87	325.60	326.08	328.26	328.83
328.96	329.16	331.59	332.32	333.45	334.35	335.67	337.11
337.74	339.03	339.86	342.03	342.39	342.62	343.68	345.38
345.74	346.32	348.13	349.10	350.61	350.89	352.46	353.65
354.90	355.81	356.40	359.11	359.16	359.17	359.19	361.92
362.53	363.48	364.67	365.88	367.43	367.77	369.24	370.19
372.06	372.60	372.94	374.53	375.70	375.96	376.35	378.46
379.31	380.64	381.21	382.67	383.97	384.93	386.03	386.73
389.22	389.38	389.49	389.96	392.24	392.74	393.51	395.00
396.10	397.76	397.80	399.45	400.51	402.09	402.81	403.27
405.39	406.03	406.17	406.38	408.78	409.52	410.67	411.54
412.88	414.30	414.96	416.24	417.05	419.25	419.59	419.81
420.81	422.57	422.95	423.54	425.32	426.31	427.83	428.08
429.66	430.84						

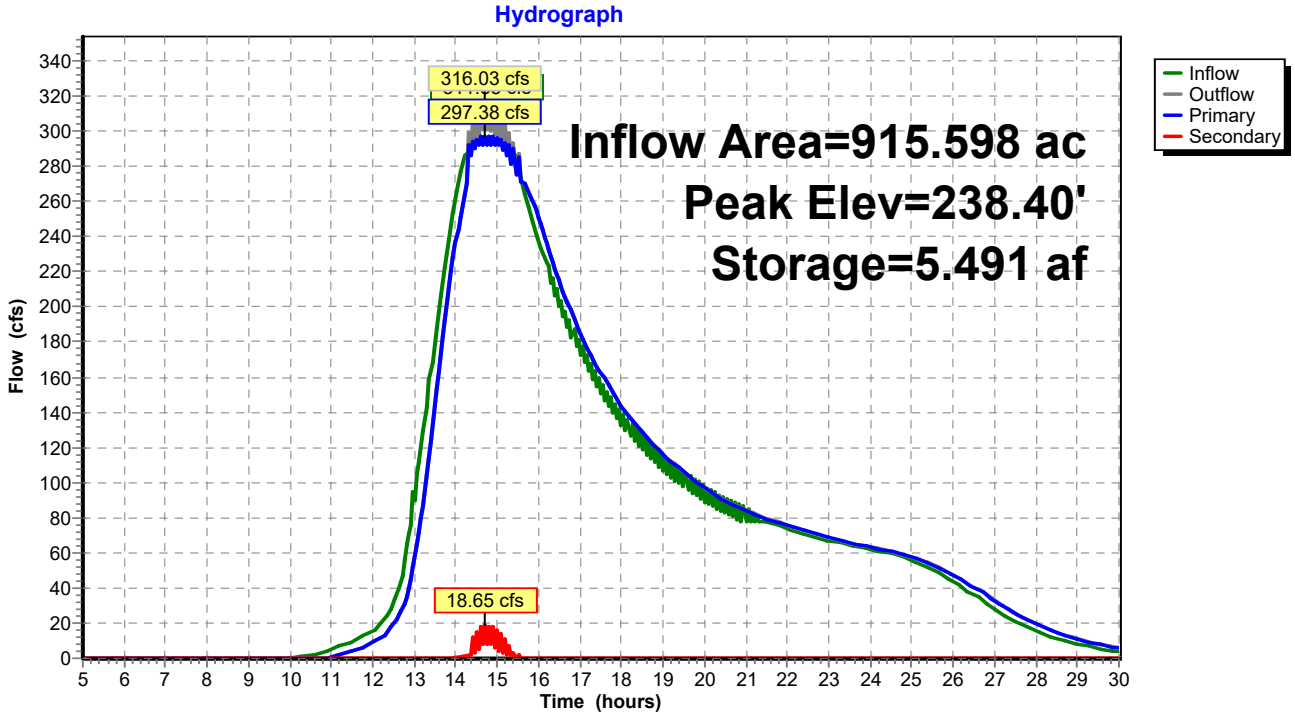
Height (feet)	0.77	0.76	0.75	0.75	0.75	0.74	0.72	0.71	0.71	0.69	
0.69	0.70	0.69	0.70	0.70	0.71	0.71	0.71	0.70	0.69	0.69	0.69
0.67	0.67	0.68	0.65	0.66	0.63	0.66	0.64	0.63	0.61	0.60	0.60
0.61	0.61	0.61	0.61	0.61	0.61	0.59	0.59	0.57	0.55	0.56	0.55
0.55	0.53	0.53	0.53	0.53	0.48	0.48	0.48	0.49	0.50	0.51	0.51
0.51	0.50	0.50	0.49	0.49	0.47	0.46	0.46	0.46	0.46	0.45	0.46
0.47	0.48	0.48	0.51	0.52	0.52	0.55	0.55	0.55	0.57	0.62	0.64
0.65	0.69	0.70	0.69	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.64
0.64	0.64	0.65	0.65	0.66	0.69	0.70	0.72	0.68	0.69	0.68	0.73
0.72	0.72	0.70	0.68	0.67	0.66	0.58	0.56	0.51	0.50	0.46	0.46
0.46	0.46	0.46	0.44	0.44	0.44	0.44	0.44	0.42	0.40	0.37	0.35
0.33	0.32	0.31	0.32	0.30	0.30	0.30	0.28	0.27	0.27	0.27	0.25
0.25	0.25	0.24	0.25	0.25	0.28	0.28	0.28	0.30	0.30	0.30	0.29
0.26	0.25	0.24	0.24	0.22	0.21	0.21	0.20	0.17	0.09	0.07	0.06
0.01	0.00	0.00	0.00	0.01	0.02	0.09	0.06	0.15	0.20	0.18	0.22
0.23	0.27	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.24	0.24	0.23
0.22	0.22	0.22	0.21	0.22	0.25	0.25	0.25	0.25	0.30	0.31	0.31
0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.28
0.28	0.28	0.28	0.27	0.29	0.27	0.27	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.26	0.26	0.27	0.27	0.29	0.33	0.31	0.35	0.35	0.34

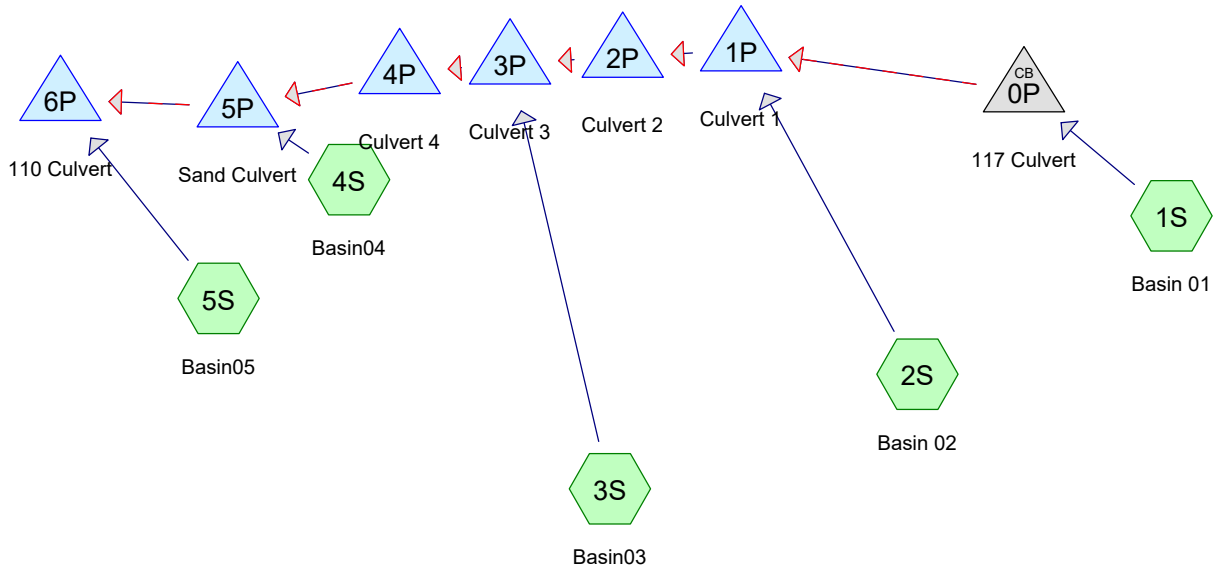
0.34	0.34	0.33	0.33	0.33	0.33	0.31	0.31	0.32	0.30	0.31	0.30
0.32	0.31	0.32	0.29	0.29	0.29	0.29	0.28	0.27	0.28	0.28	0.28
0.27	0.27	0.27	0.26	0.25	0.24	0.24	0.20	0.20	0.20	0.21	0.22
0.24	0.27	0.30	0.30	0.32	0.32	0.32	0.37	0.37	0.37	0.38	0.38
0.38	0.38	0.31	0.32	0.34	0.34	0.36	0.40	0.40	0.43	0.42	0.36
0.36	0.36	0.35	0.32	0.31	0.31	0.31	0.31	0.30	0.31	0.31	0.31
0.33	0.34	0.34	0.37	0.38	0.38	0.38	0.40	0.40	0.40	0.41	0.40
0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.40
0.40	0.38	0.39	0.38	0.39	0.40	0.41	0.41	0.44	0.44	0.44	0.44
0.46	0.46	0.46	0.45	0.45	0.46	0.45	0.46	0.48	0.49	0.50	0.50
0.51	0.52	0.52	0.52	0.52	0.51	0.52	0.53	0.53	0.55	0.56	0.58
0.57	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.62	0.61
0.62	0.62	0.63	0.63	0.63	0.67	0.68	0.68	0.68	0.69	0.69	0.68
0.65	0.64	0.65	0.66	0.66	0.67	0.67	0.68	0.68	0.68	0.69	0.69
0.70	0.74	0.76	0.76	0.77	0.77	0.77					

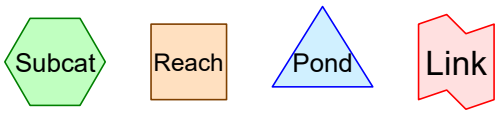
Primary OutFlow Max=297.39 cfs @ 14.70 hrs HW=238.40' (Free Discharge)
└─**1=10' Wide Box Culvert** (Barrel Controls 297.39 cfs @ 7.43 fps)

Secondary OutFlow Max=18.04 cfs @ 14.70 hrs HW=238.40' (Free Discharge)
└─**2=Route 110** (Weir Controls 18.04 cfs @ 1.08 fps)

Pond 6P: 110 Culvert

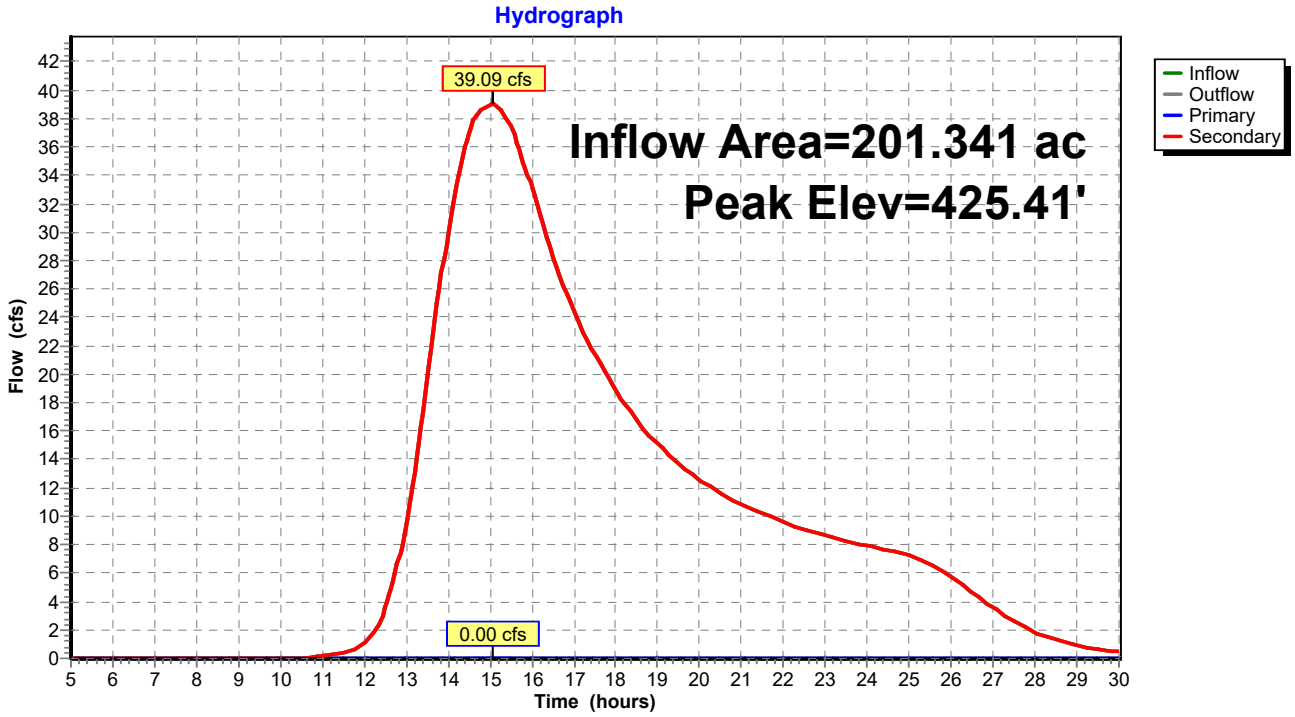




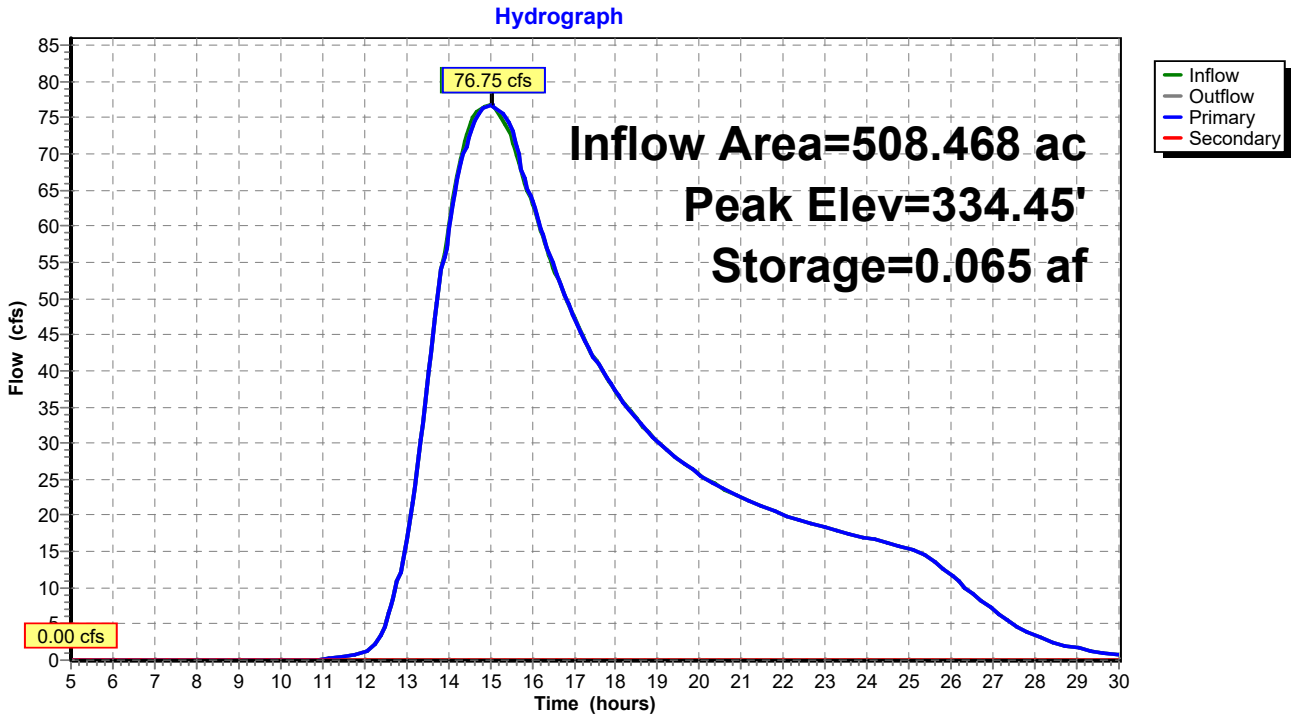


Routing Diagram for forbush_prop_alt3_culv2_16ft_3ftrise
Prepared by Tighe & Bond, Printed 11/29/2022
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

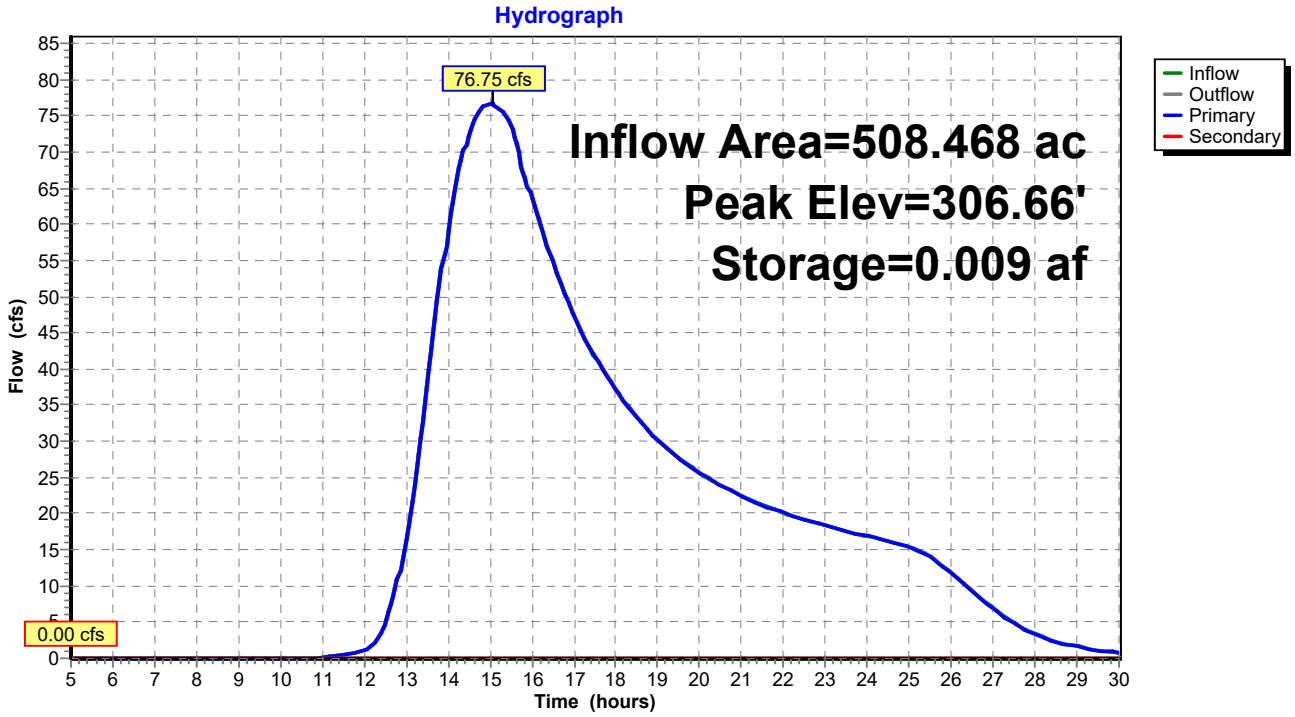
Pond 0P: 117 Culvert



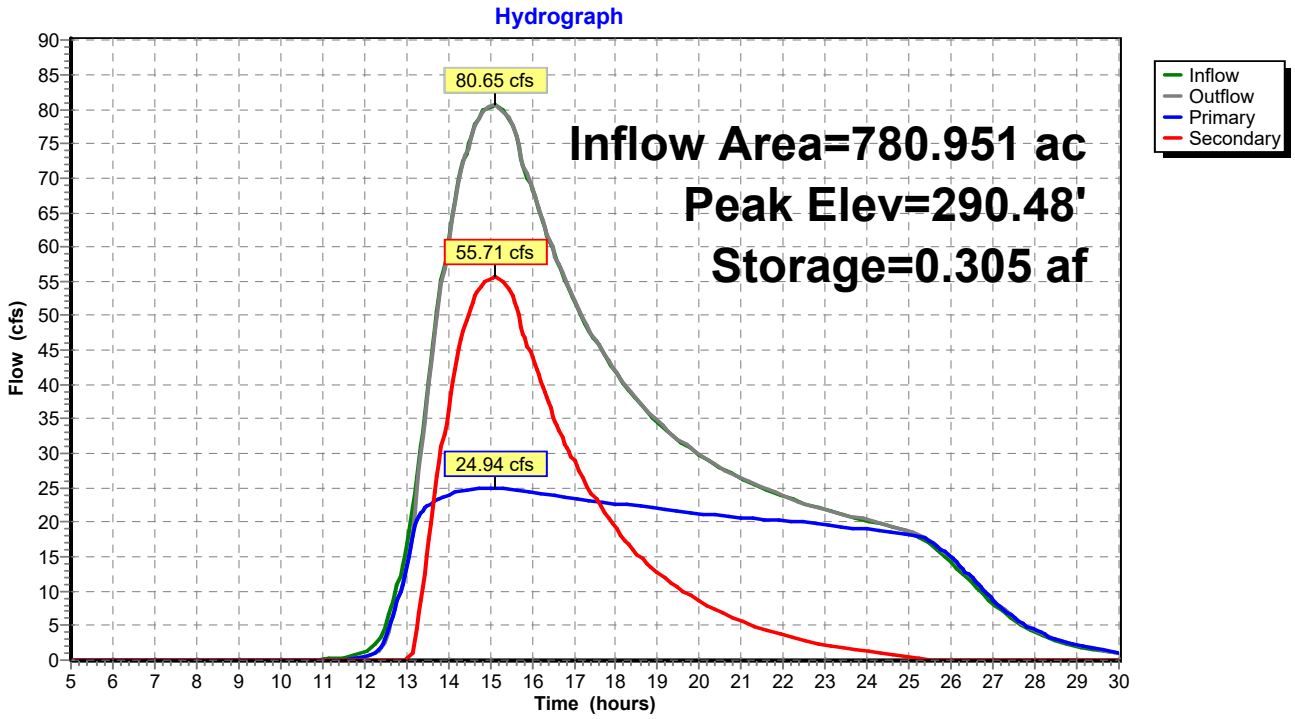
Pond 1P: Culvert 1



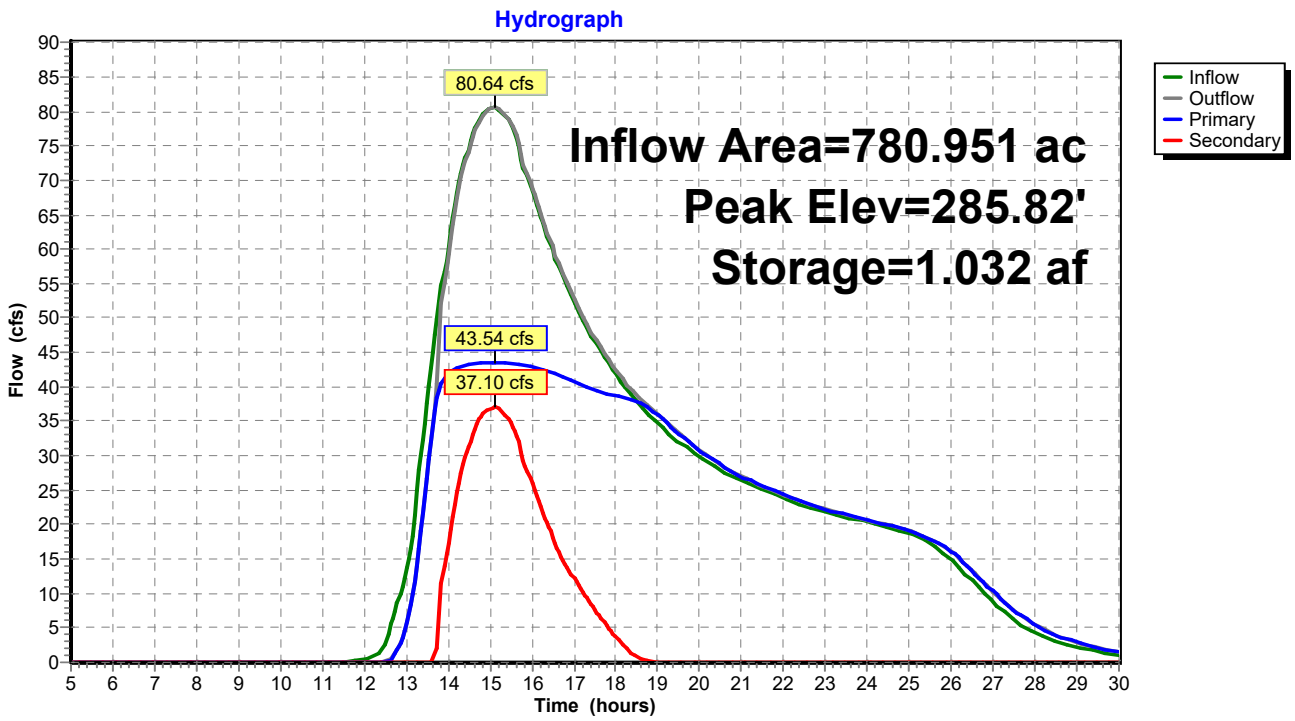
Pond 2P: Culvert 2



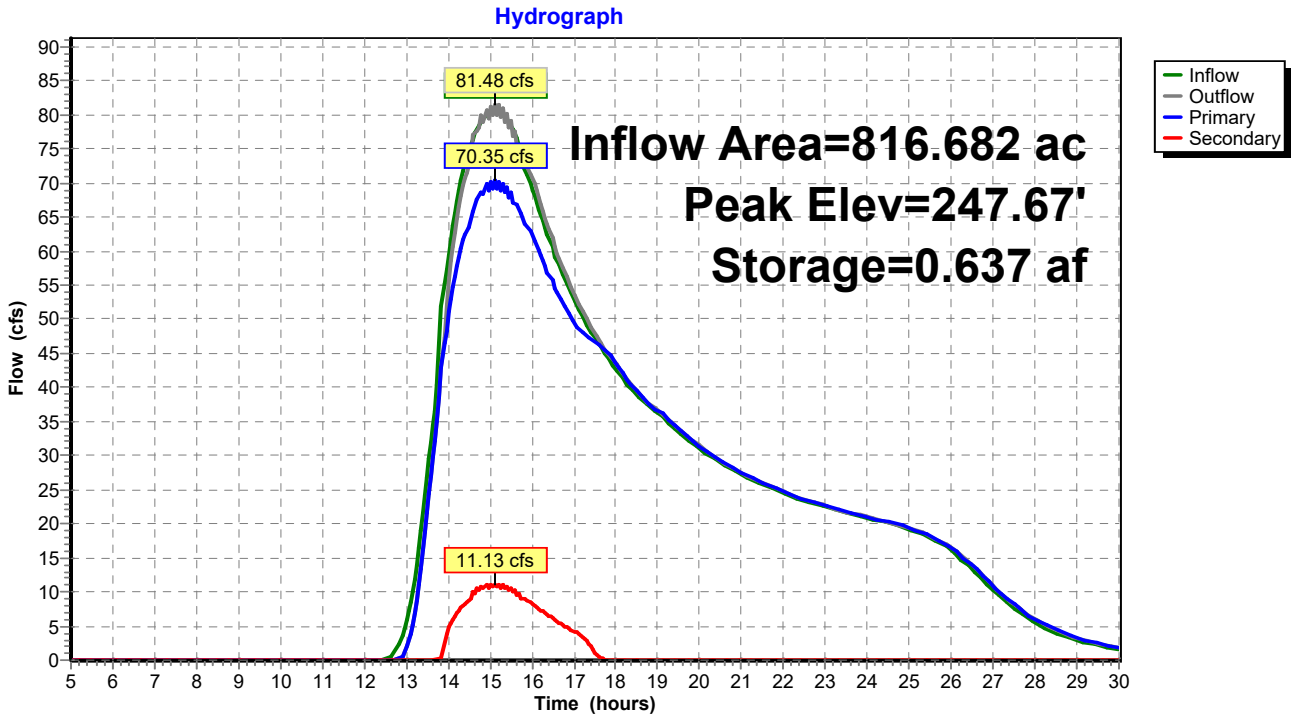
Pond 3P: Culvert 3



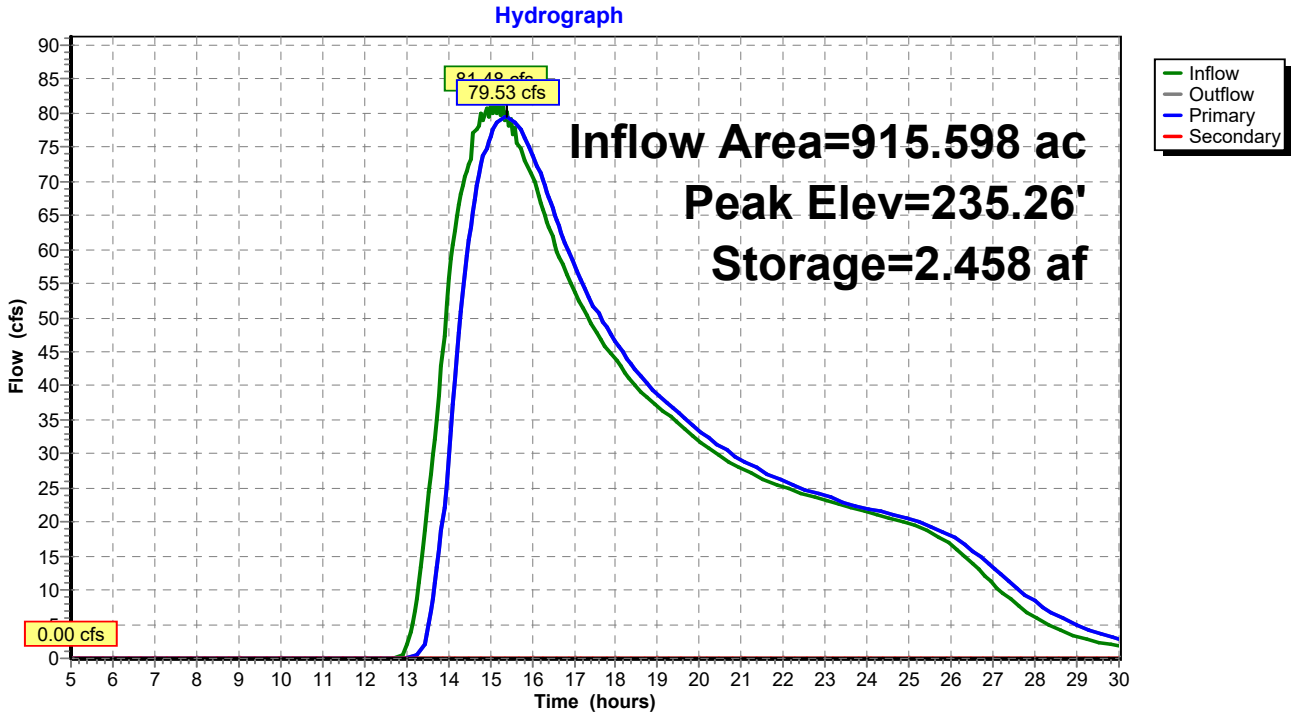
Pond 4P: Culvert 4



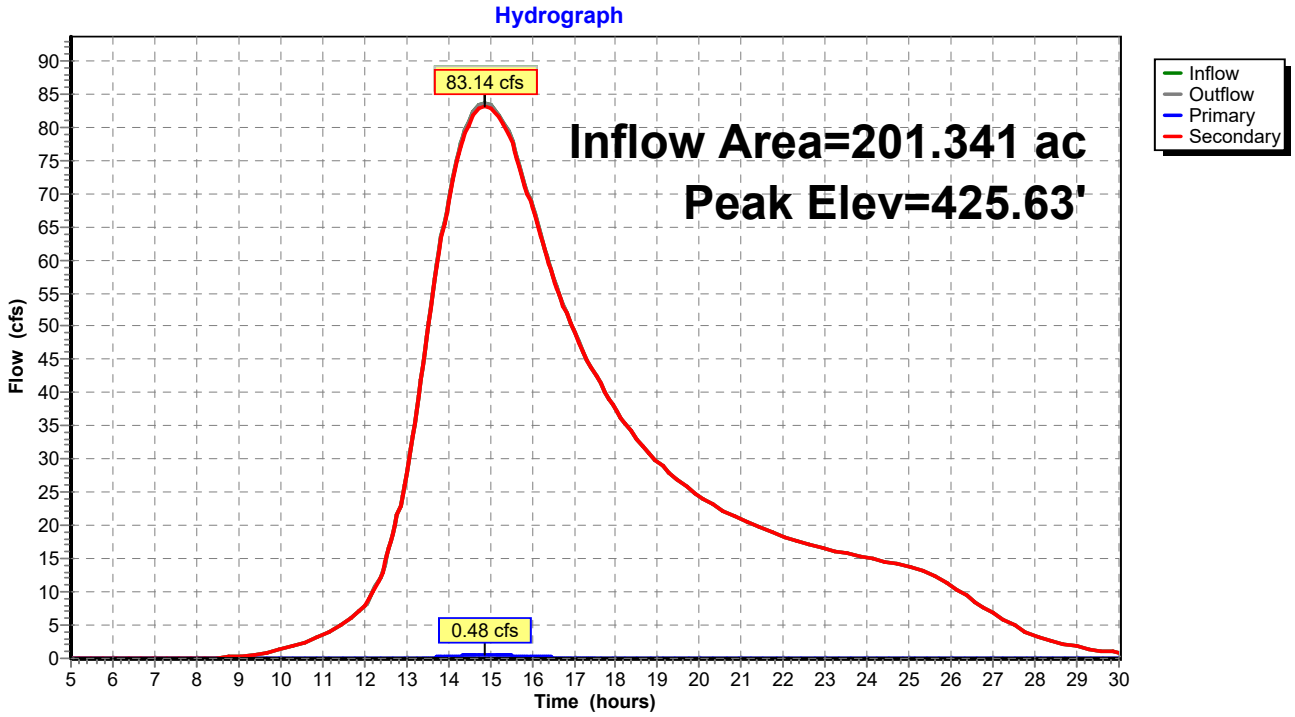
Pond 5P: Sand Culvert



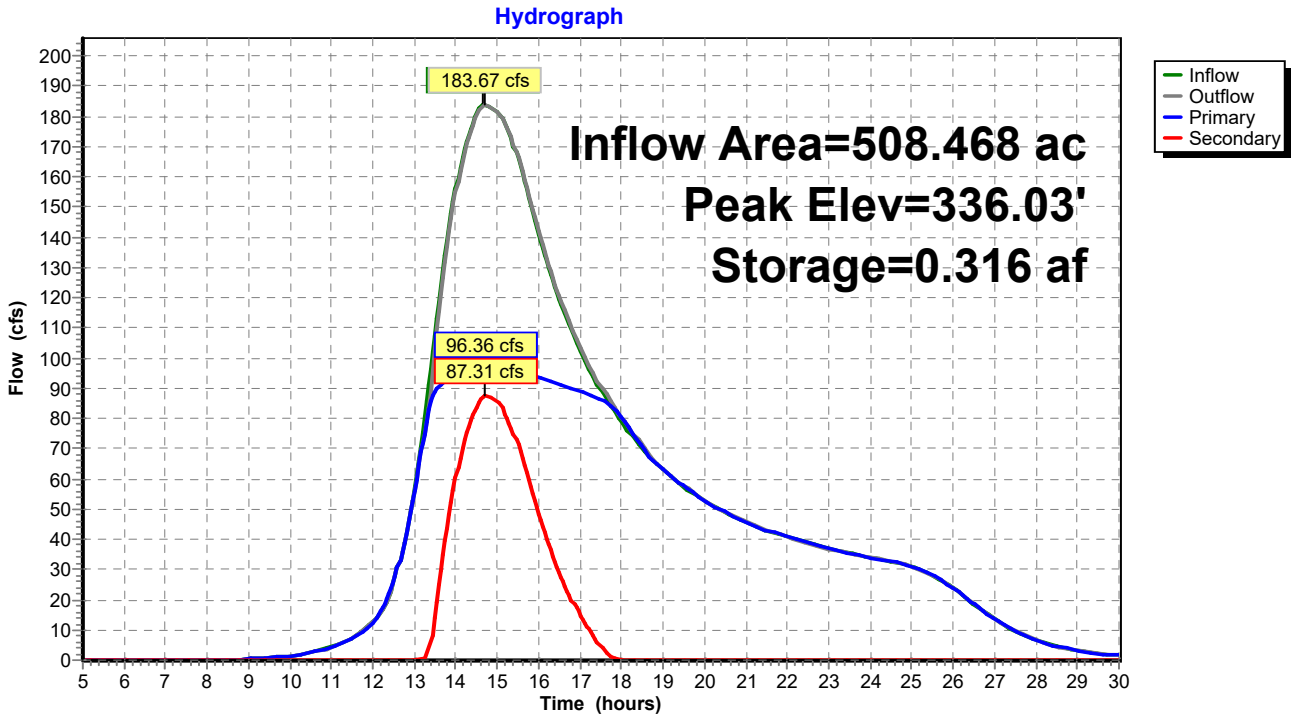
Pond 6P: 110 Culvert



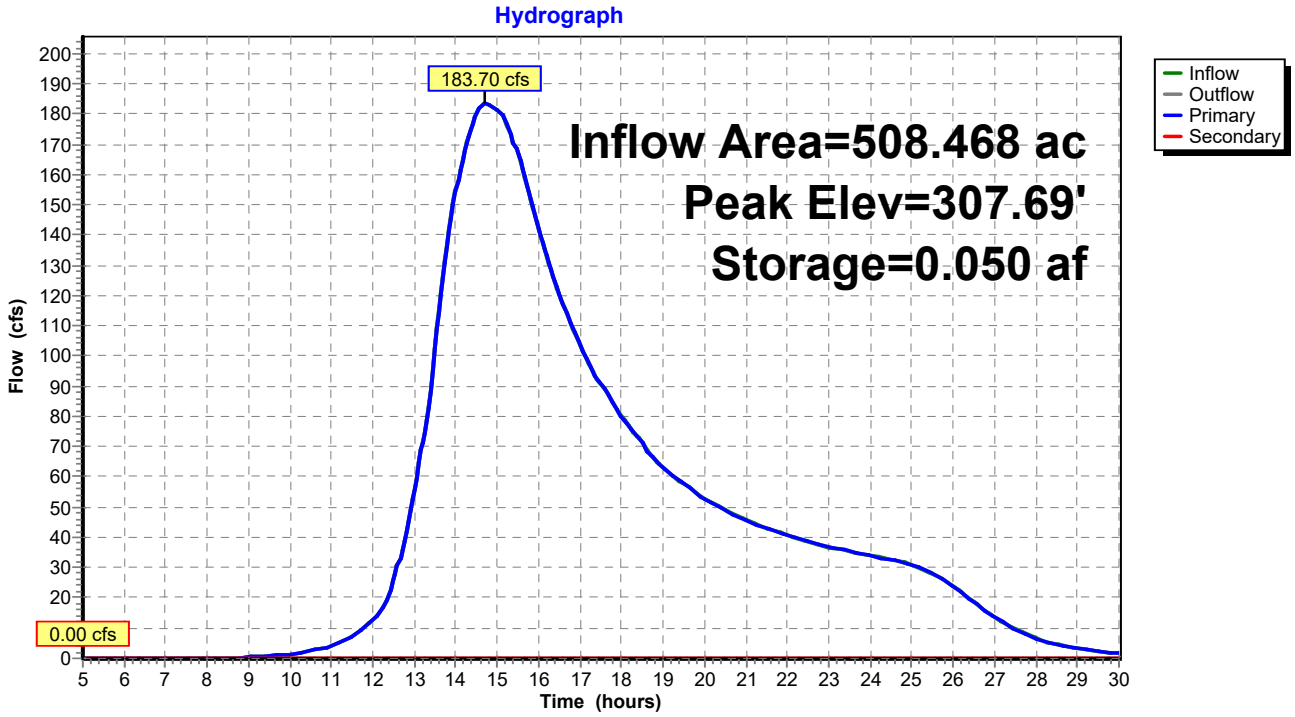
Pond 0P: 117 Culvert



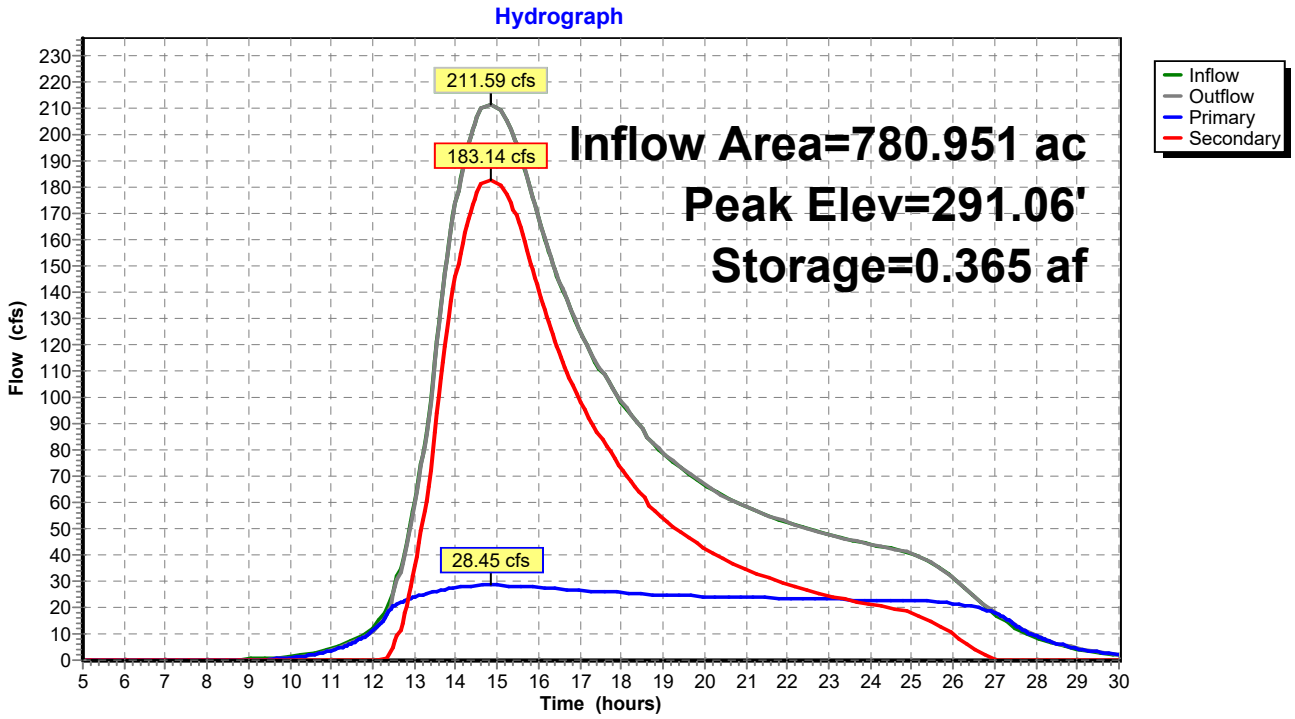
Pond 1P: Culvert 1



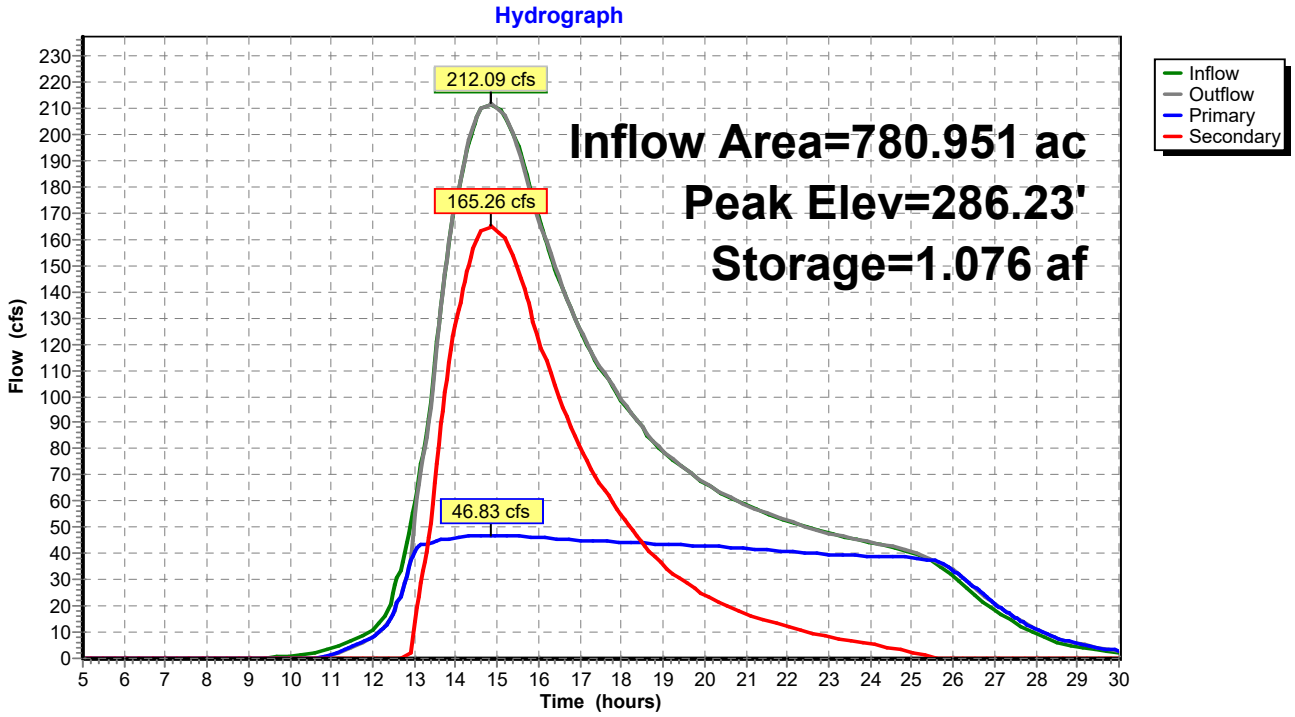
Pond 2P: Culvert 2



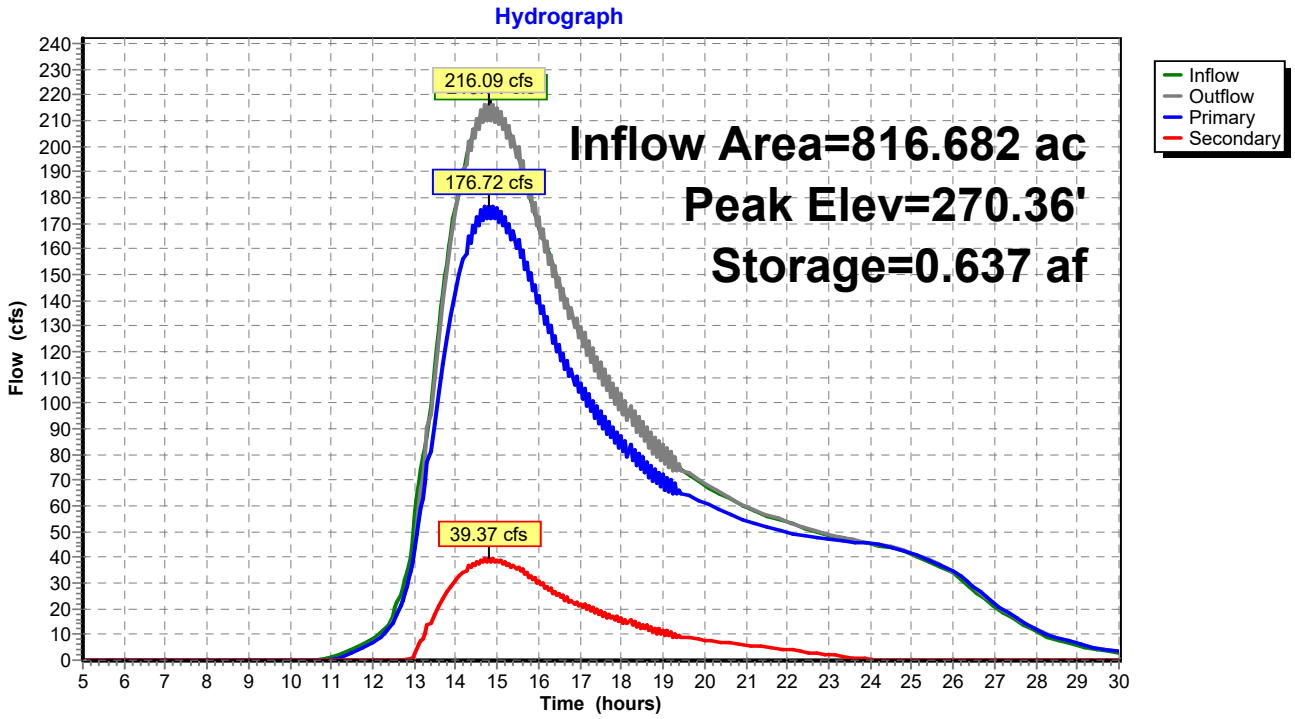
Pond 3P: Culvert 3



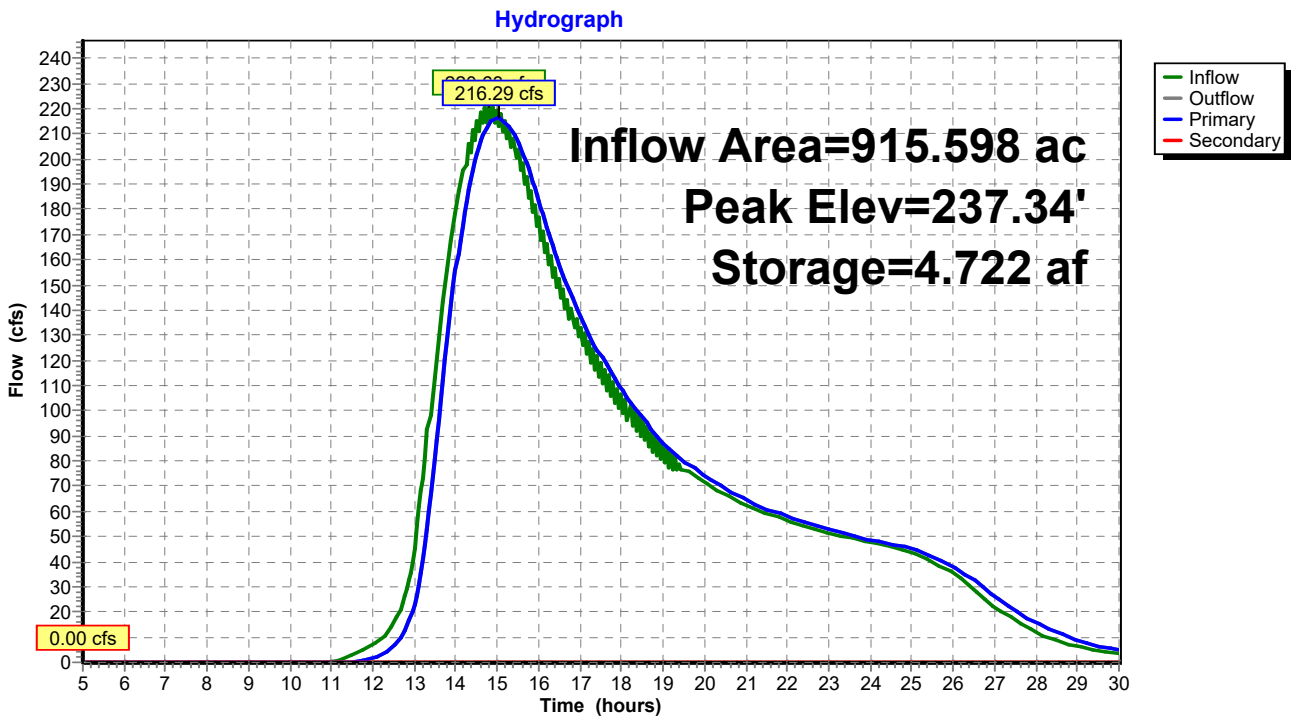
Pond 4P: Culvert 4



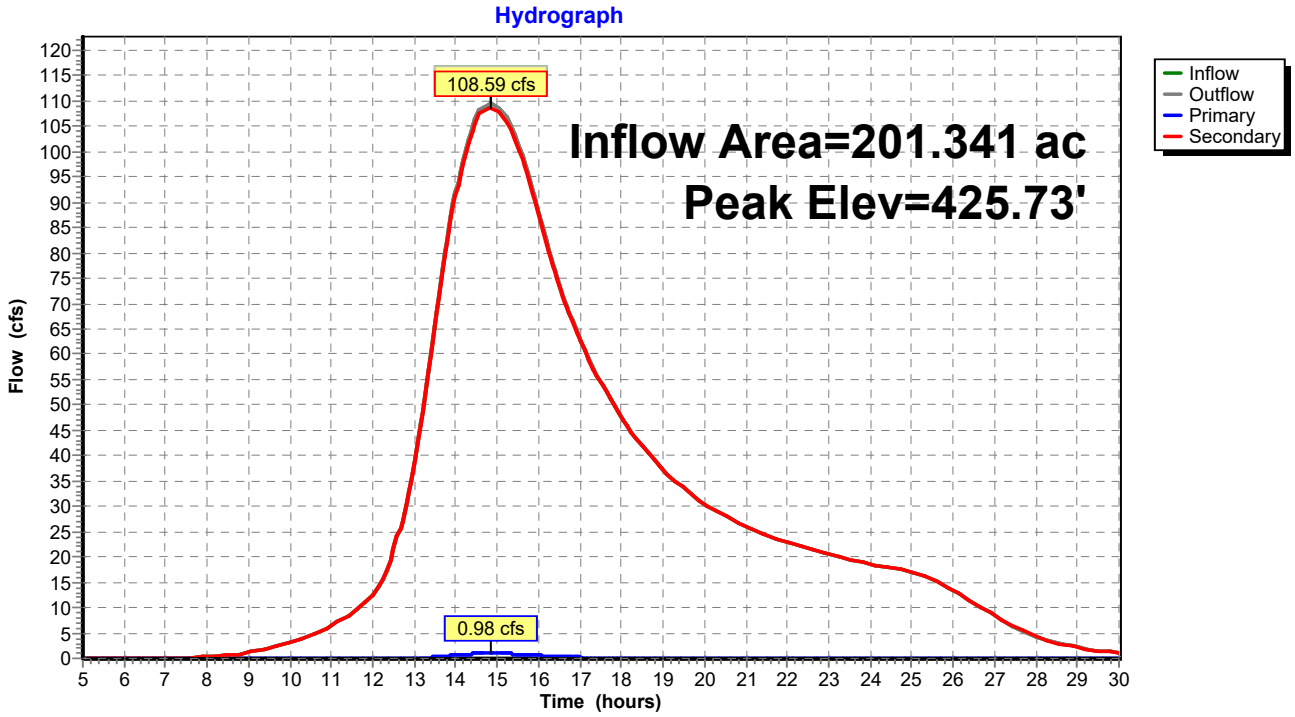
Pond 5P: Sand Culvert



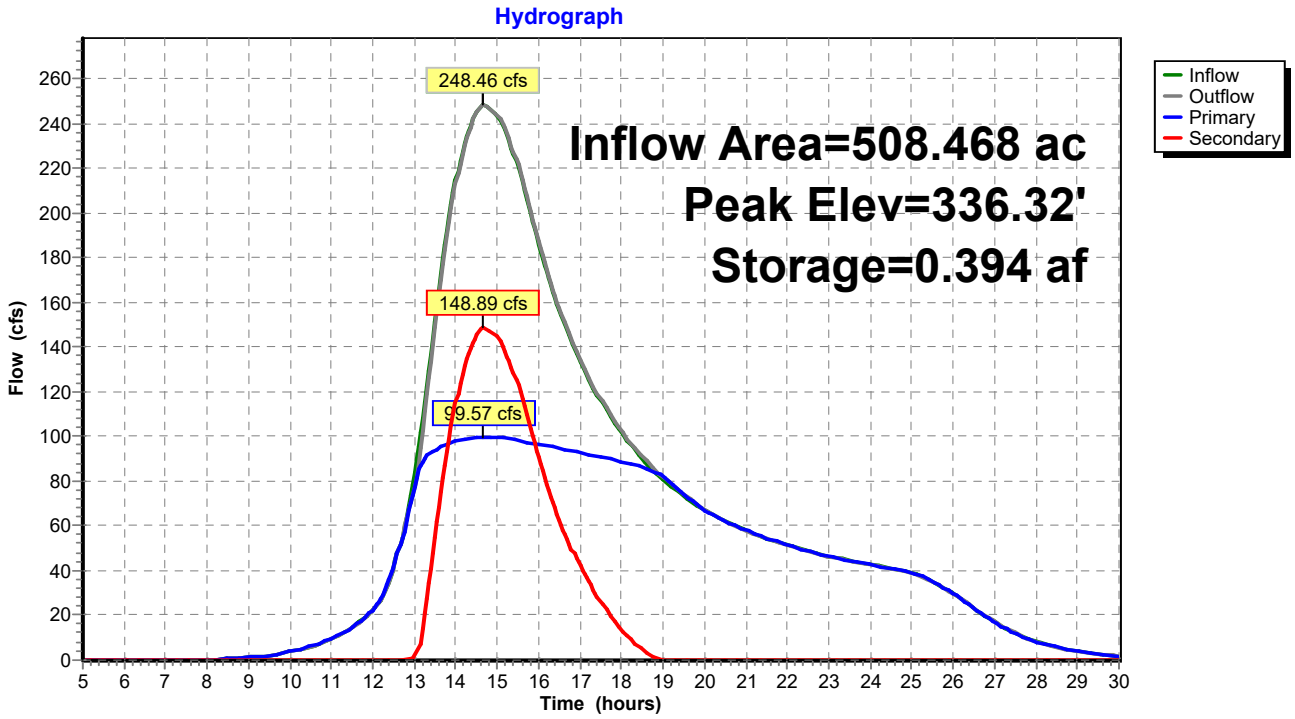
Pond 6P: 110 Culvert



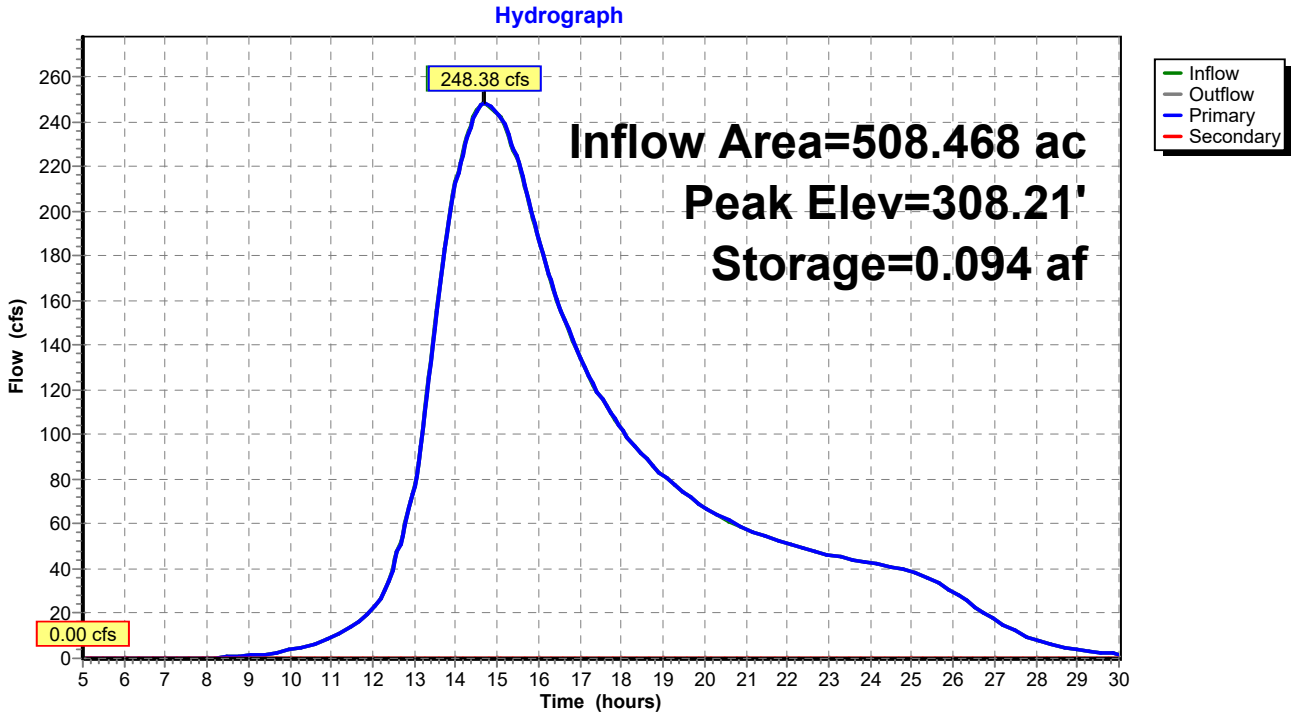
Pond 0P: 117 Culvert



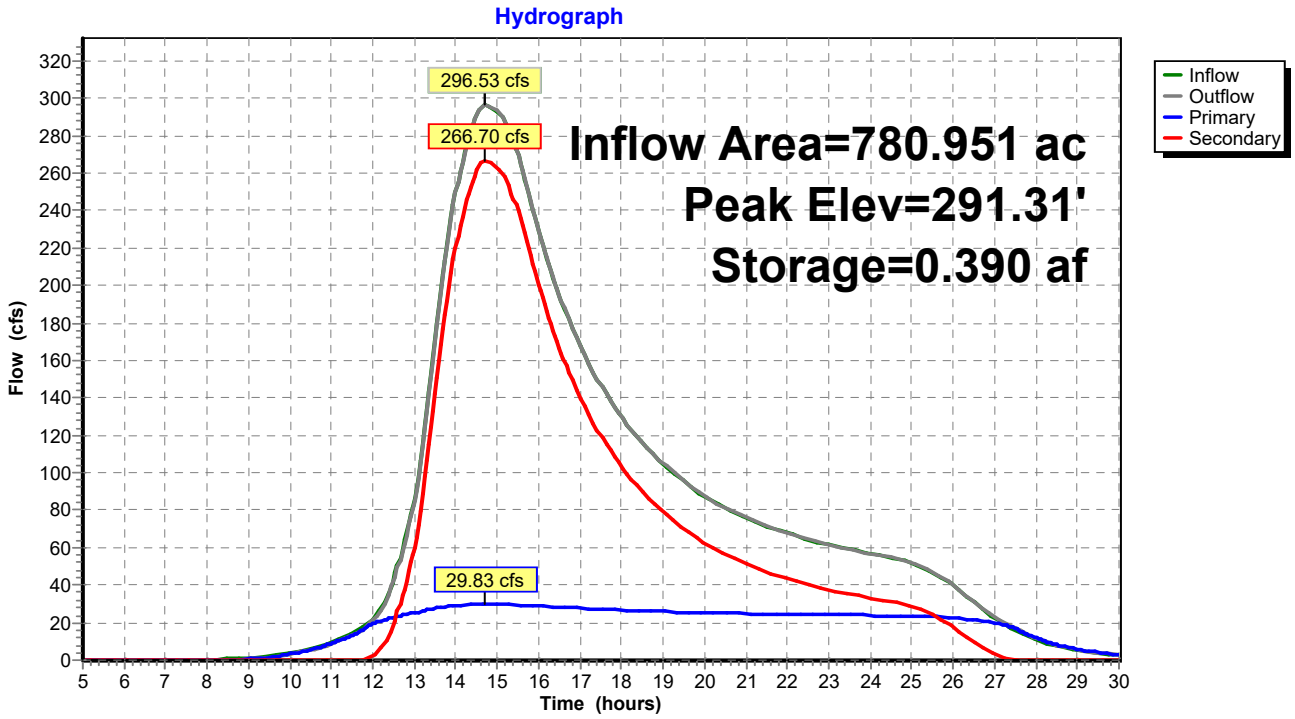
Pond 1P: Culvert 1



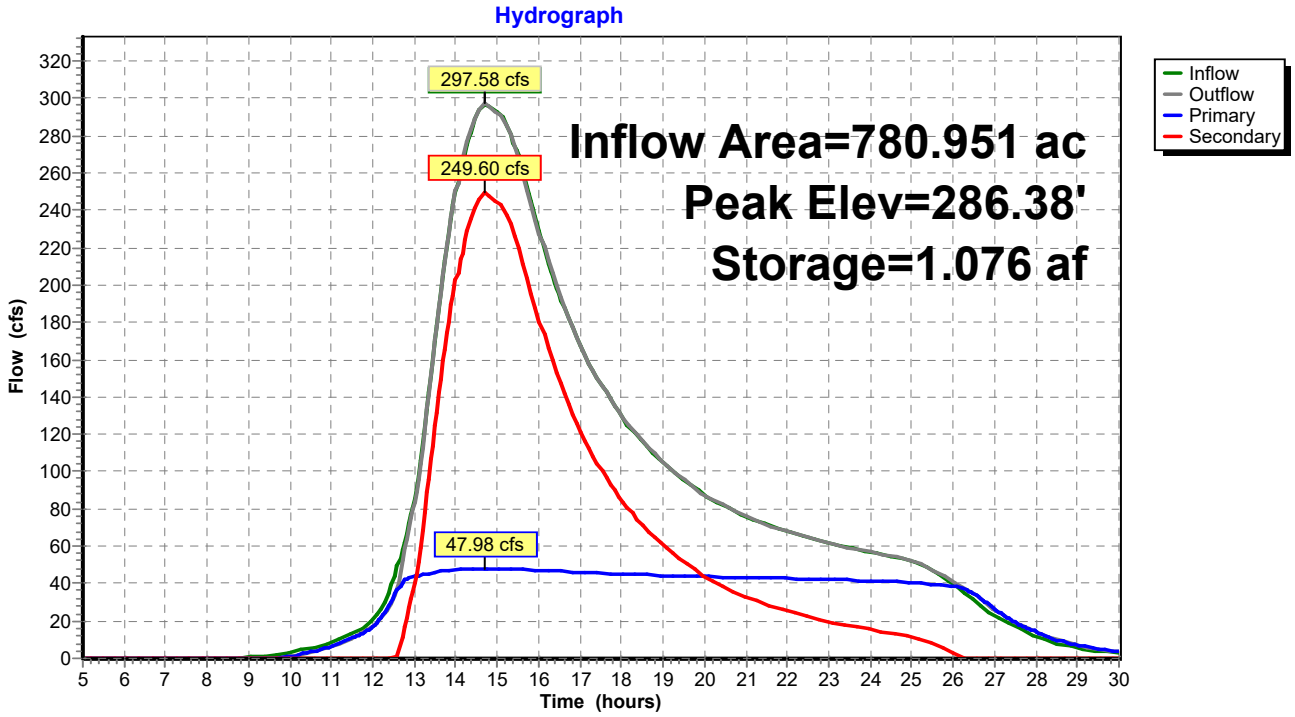
Pond 2P: Culvert 2



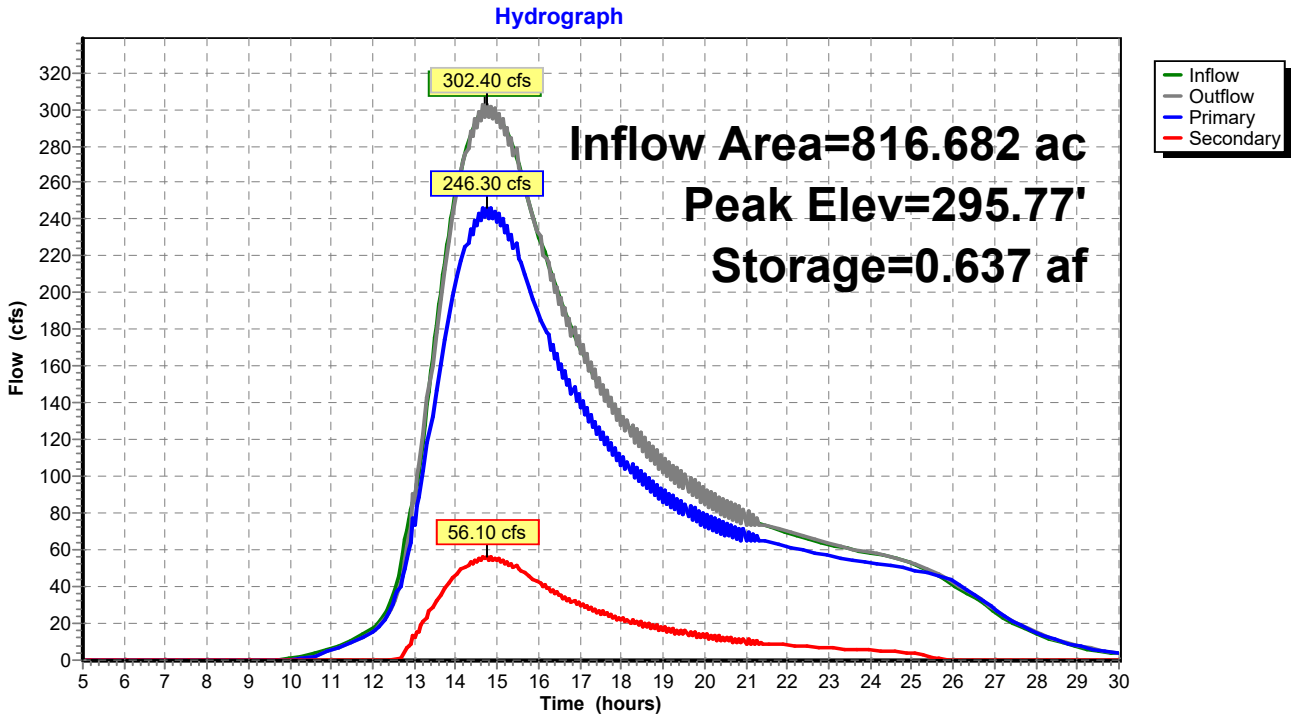
Pond 3P: Culvert 3



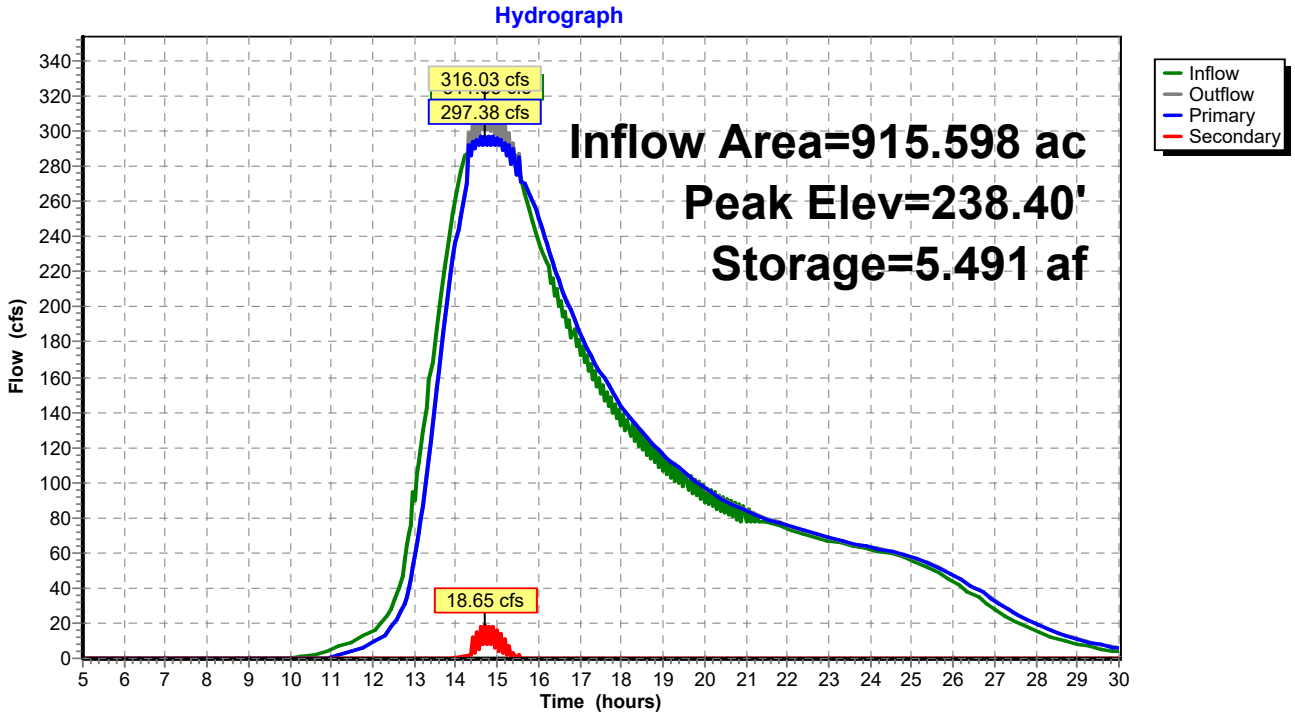
Pond 4P: Culvert 4



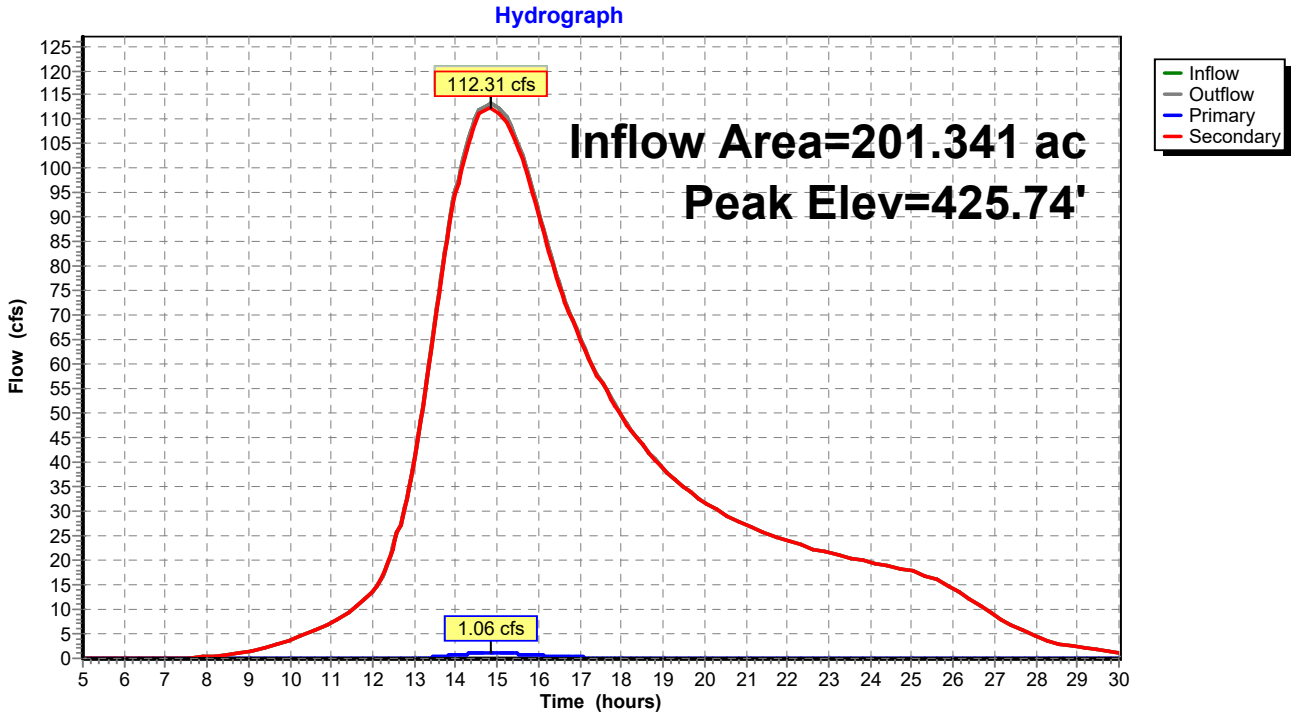
Pond 5P: Sand Culvert



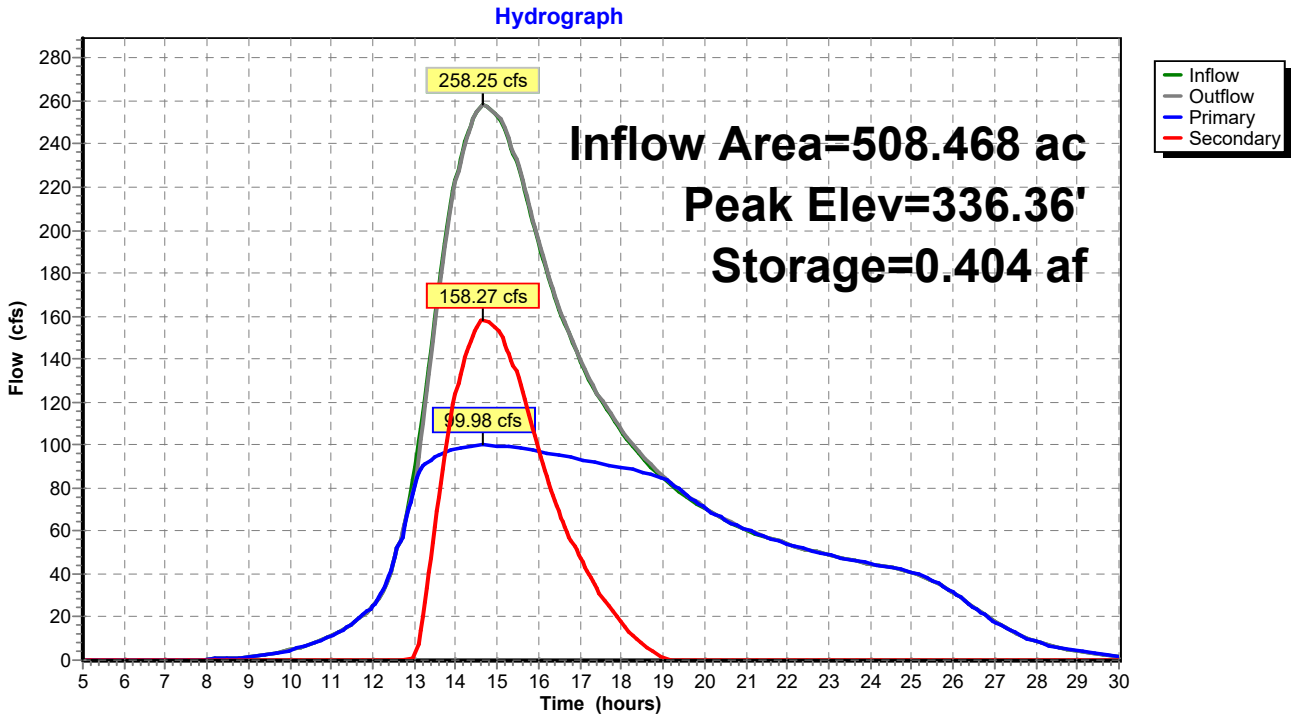
Pond 6P: 110 Culvert



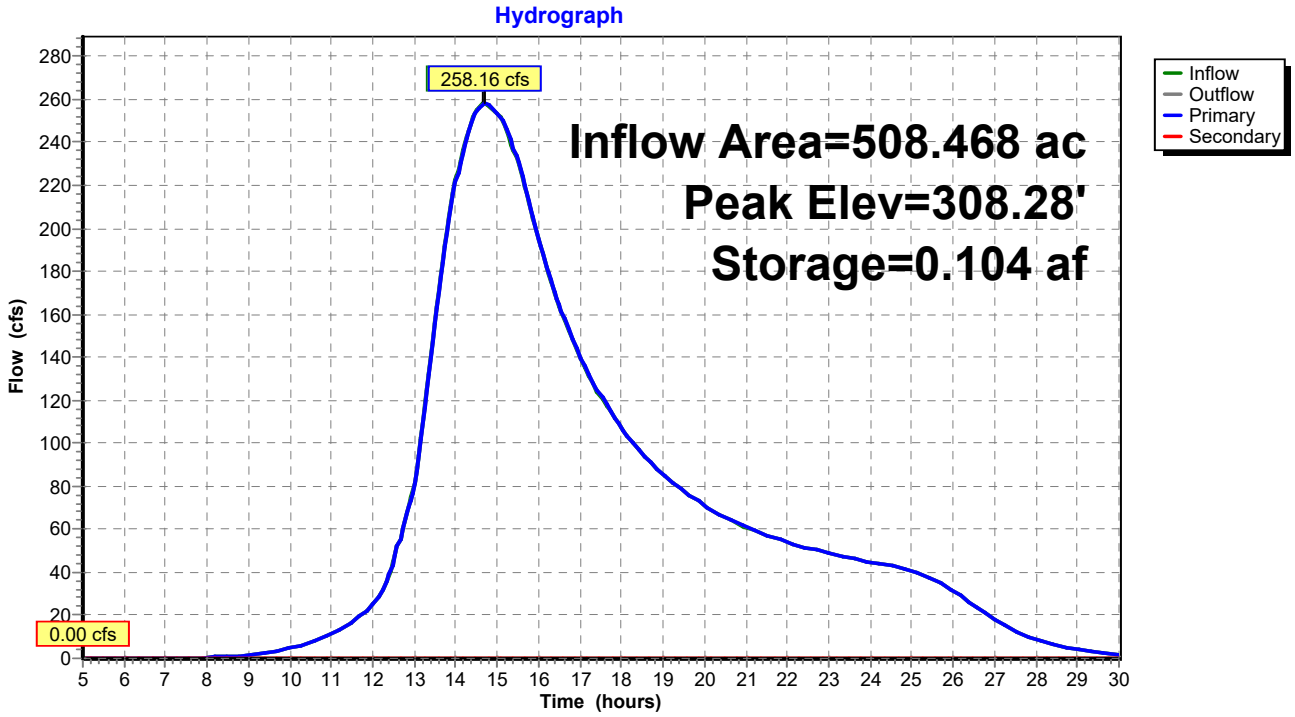
Pond 0P: 117 Culvert



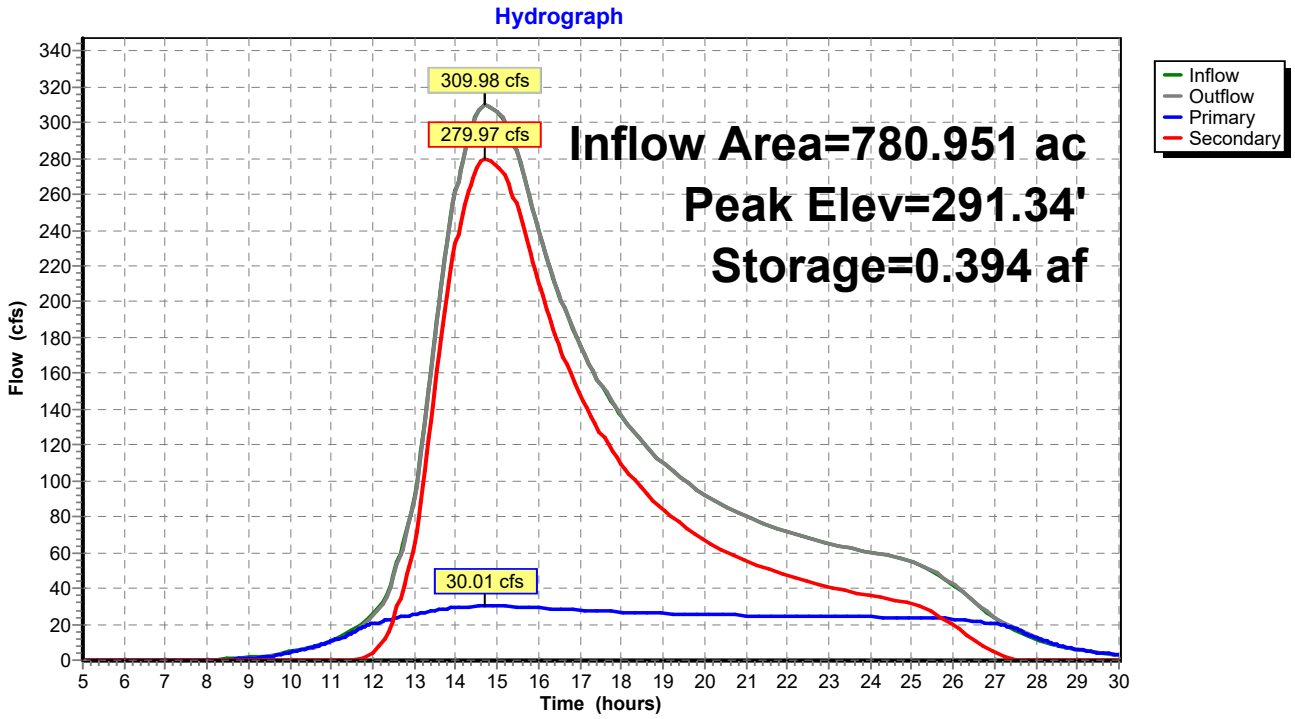
Pond 1P: Culvert 1



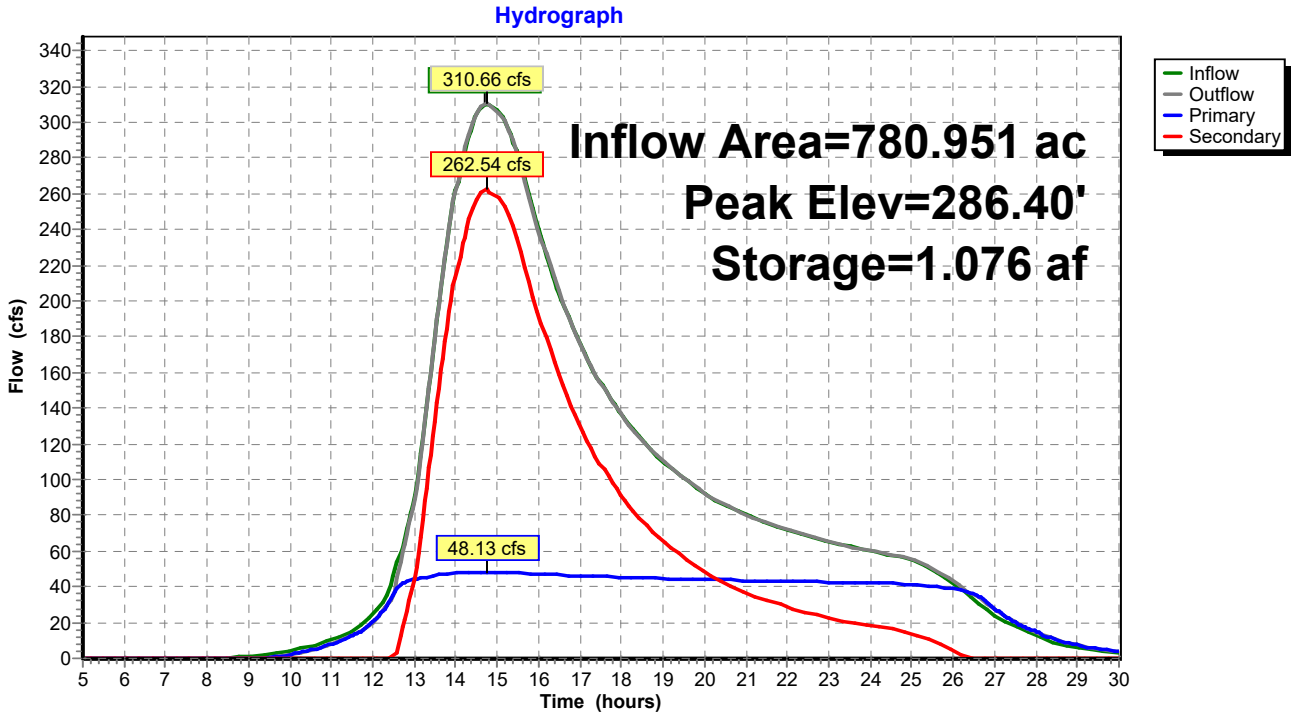
Pond 2P: Culvert 2



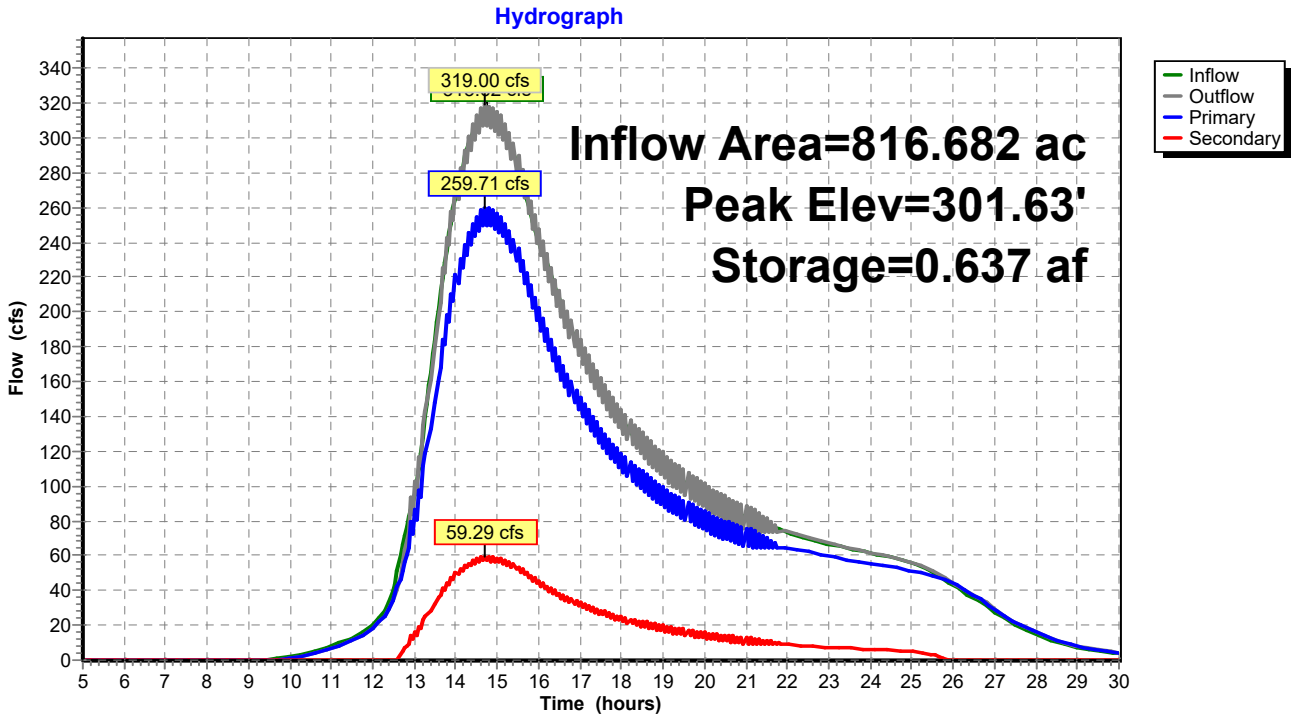
Pond 3P: Culvert 3



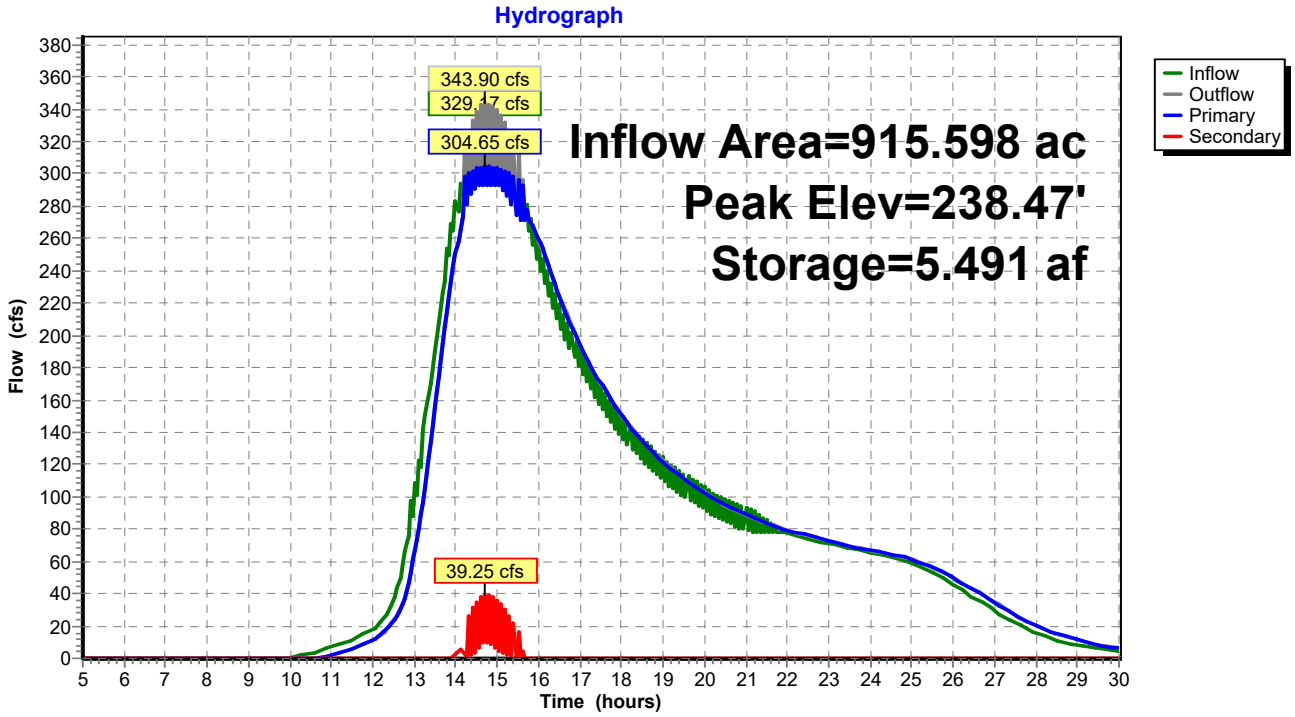
Pond 4P: Culvert 4



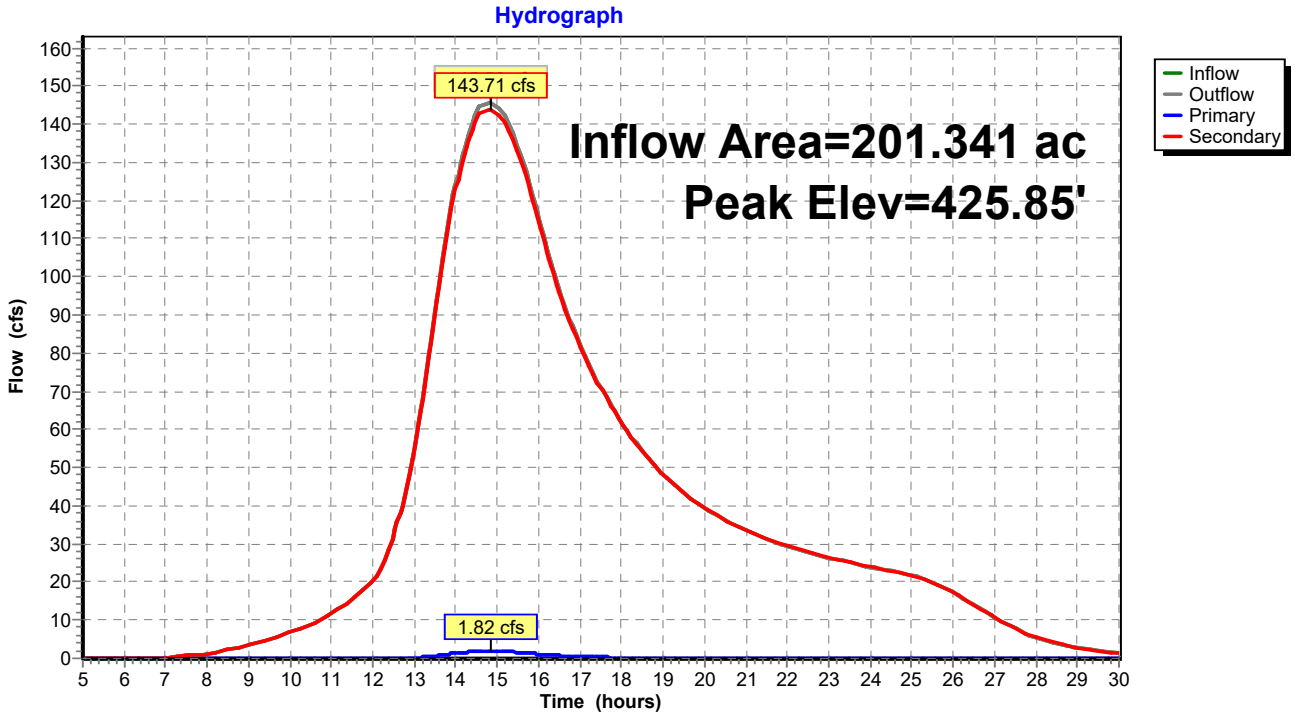
Pond 5P: Sand Culvert



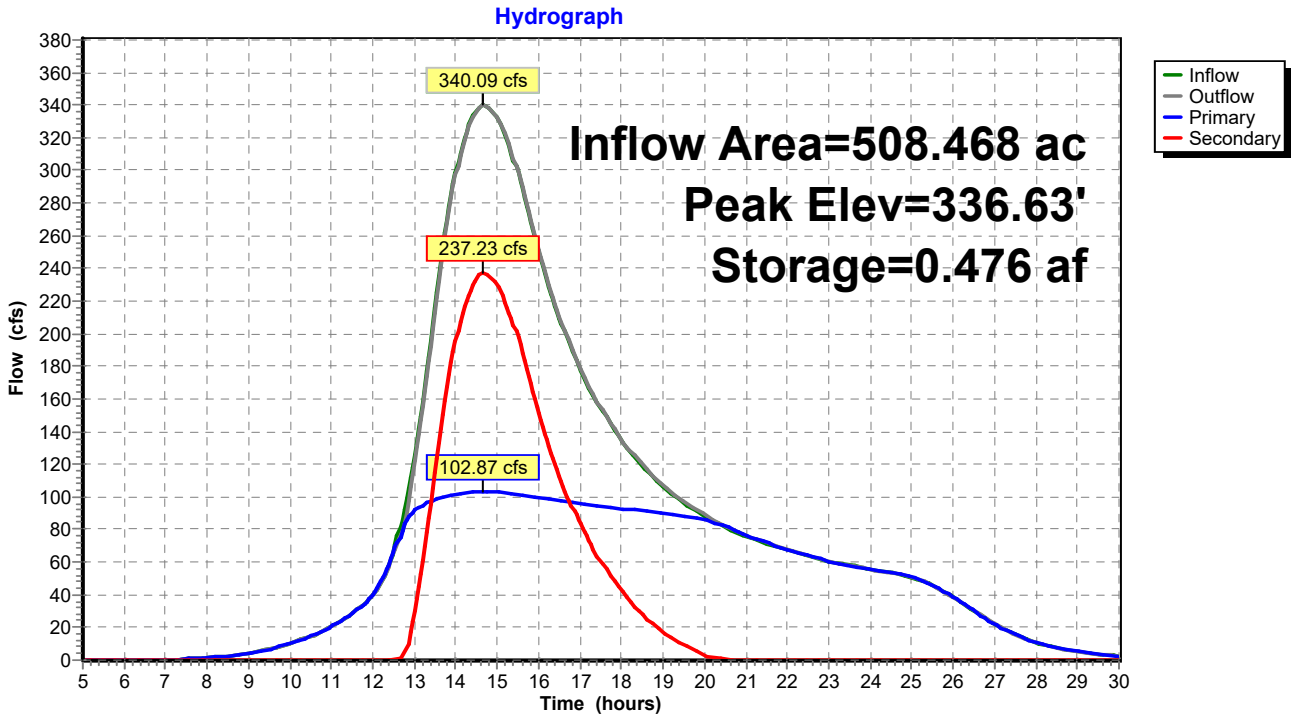
Pond 6P: 110 Culvert



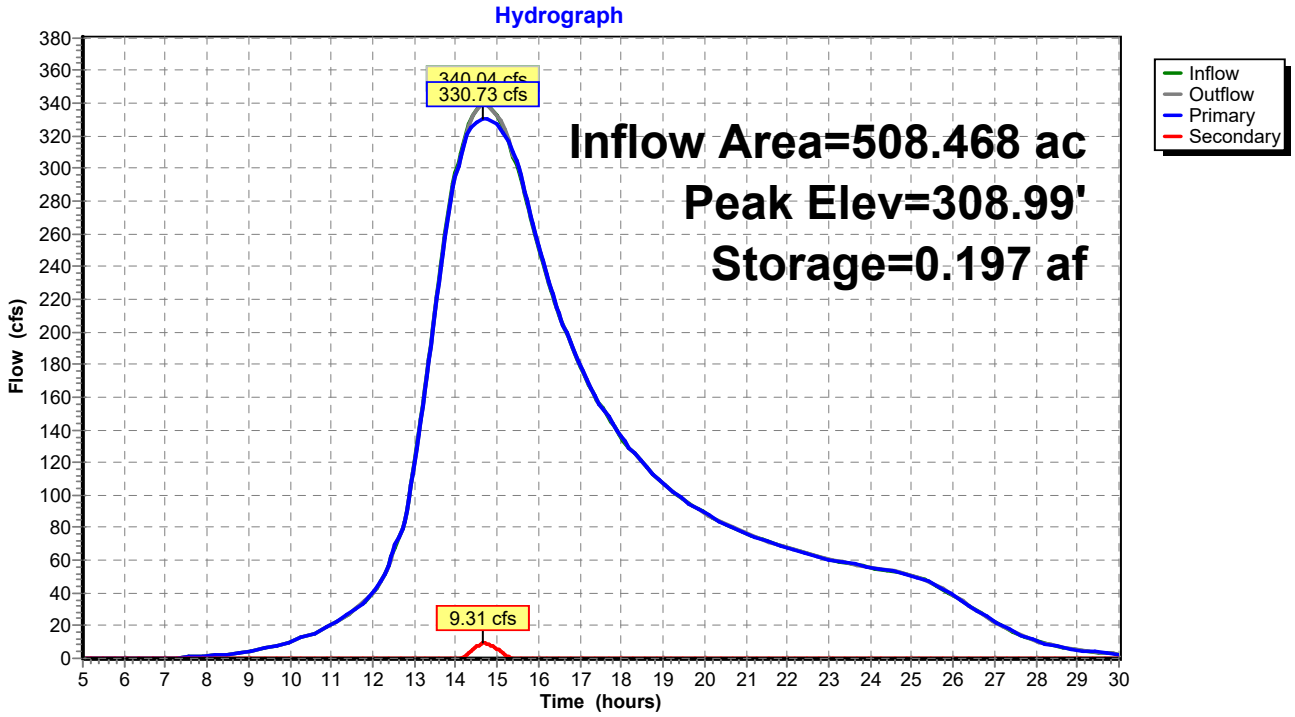
Pond 0P: 117 Culvert



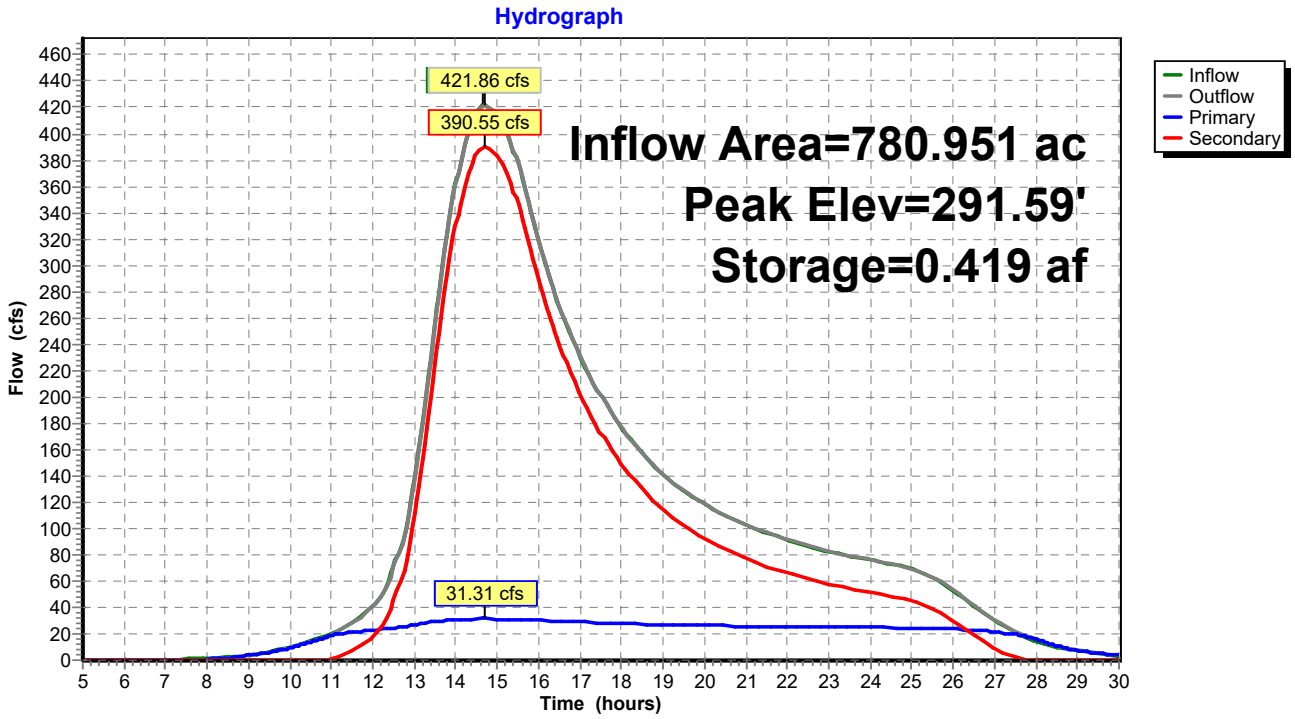
Pond 1P: Culvert 1



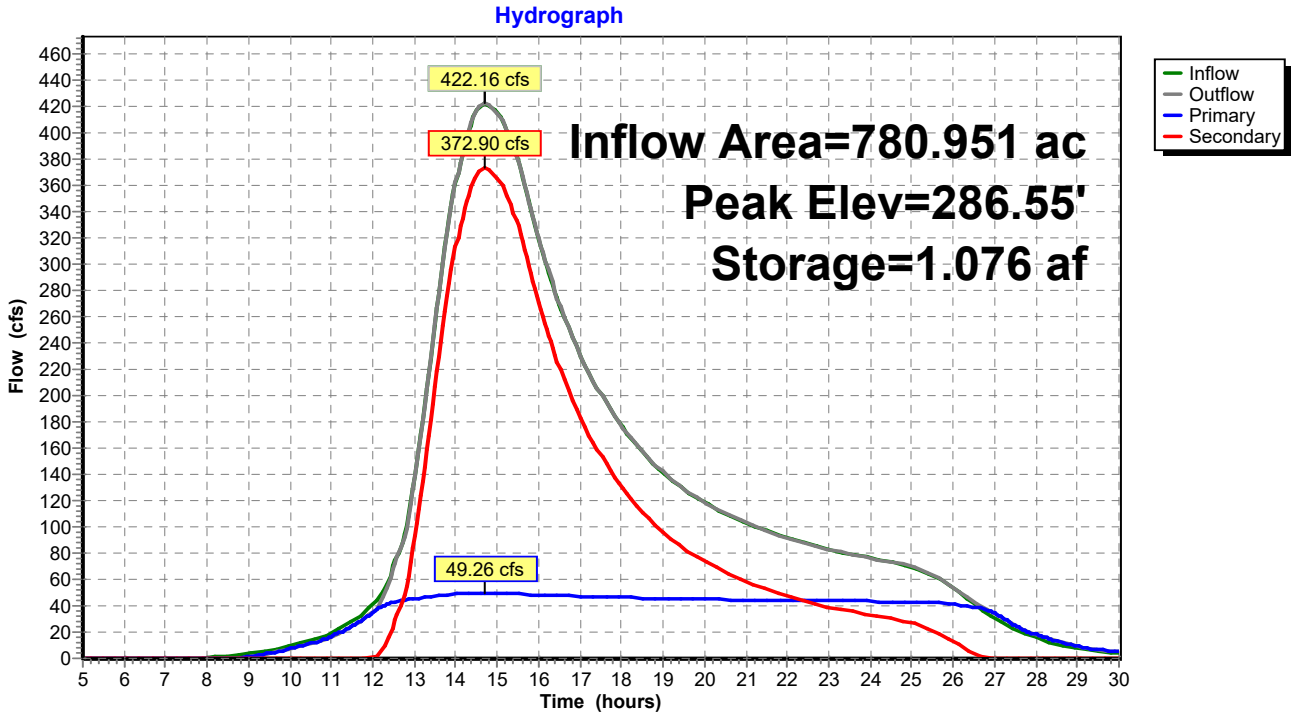
Pond 2P: Culvert 2



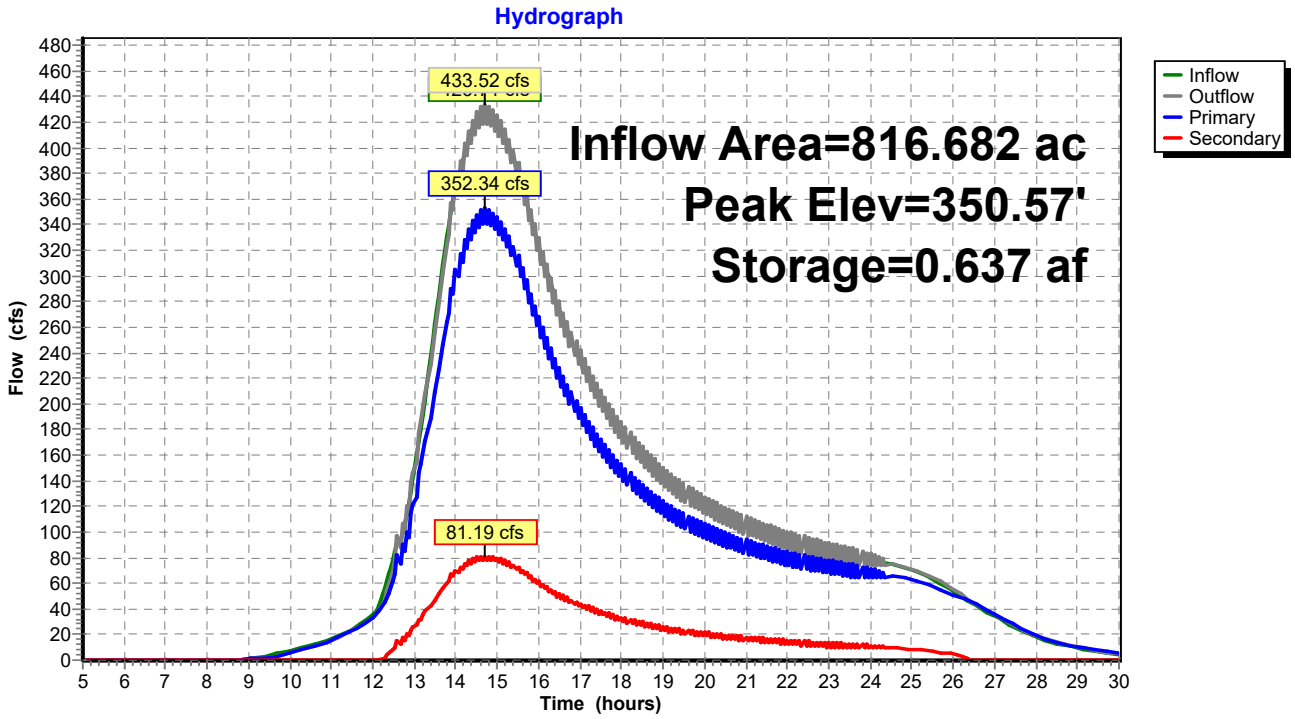
Pond 3P: Culvert 3



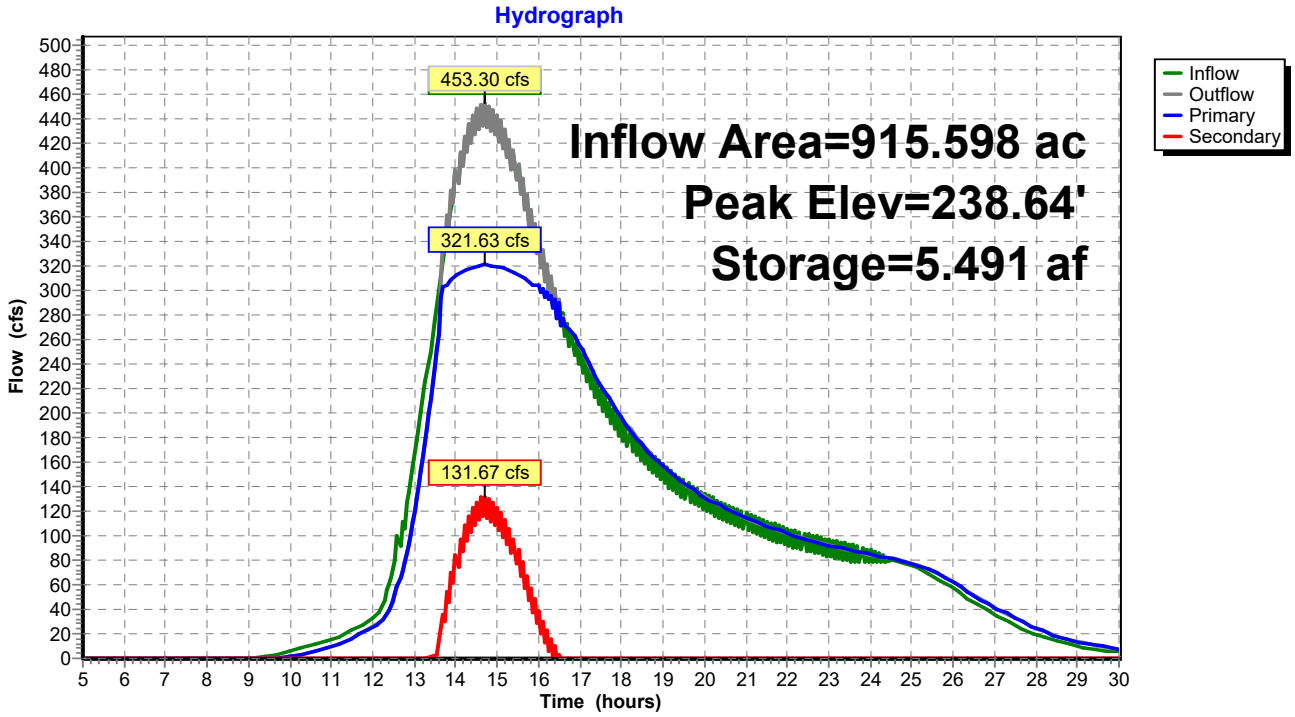
Pond 4P: Culvert 4



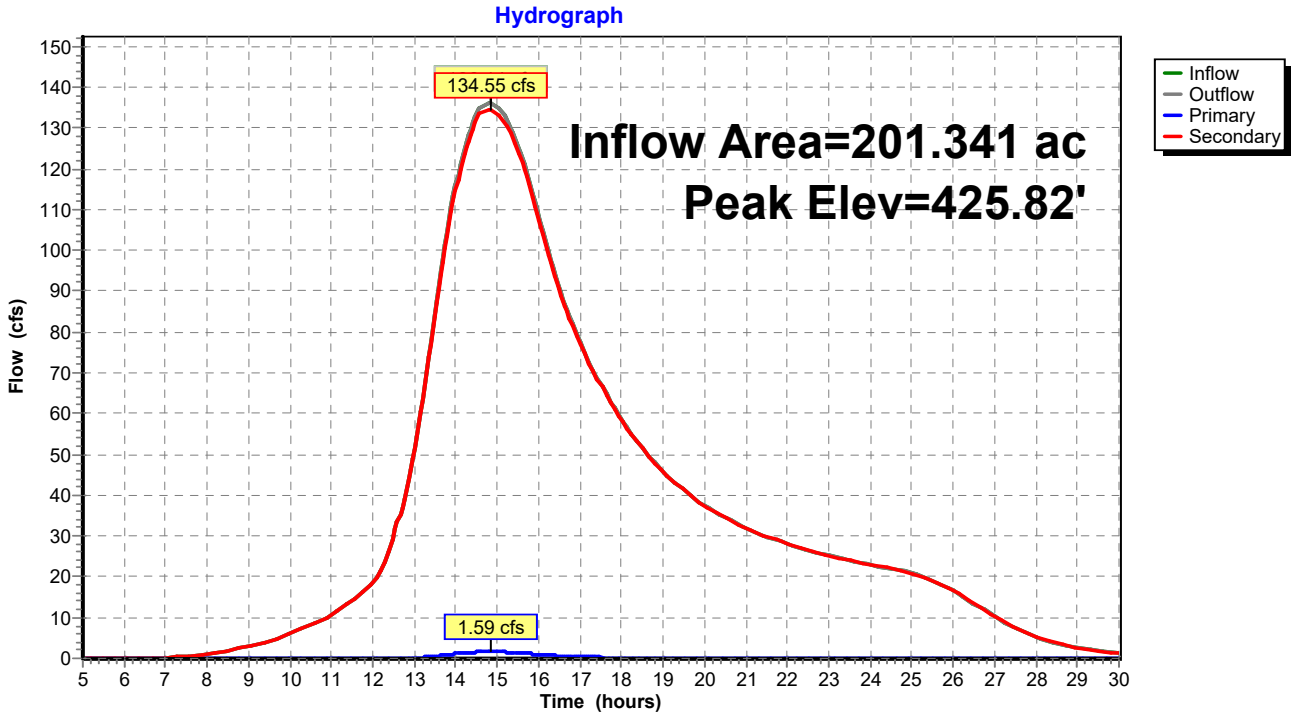
Pond 5P: Sand Culvert



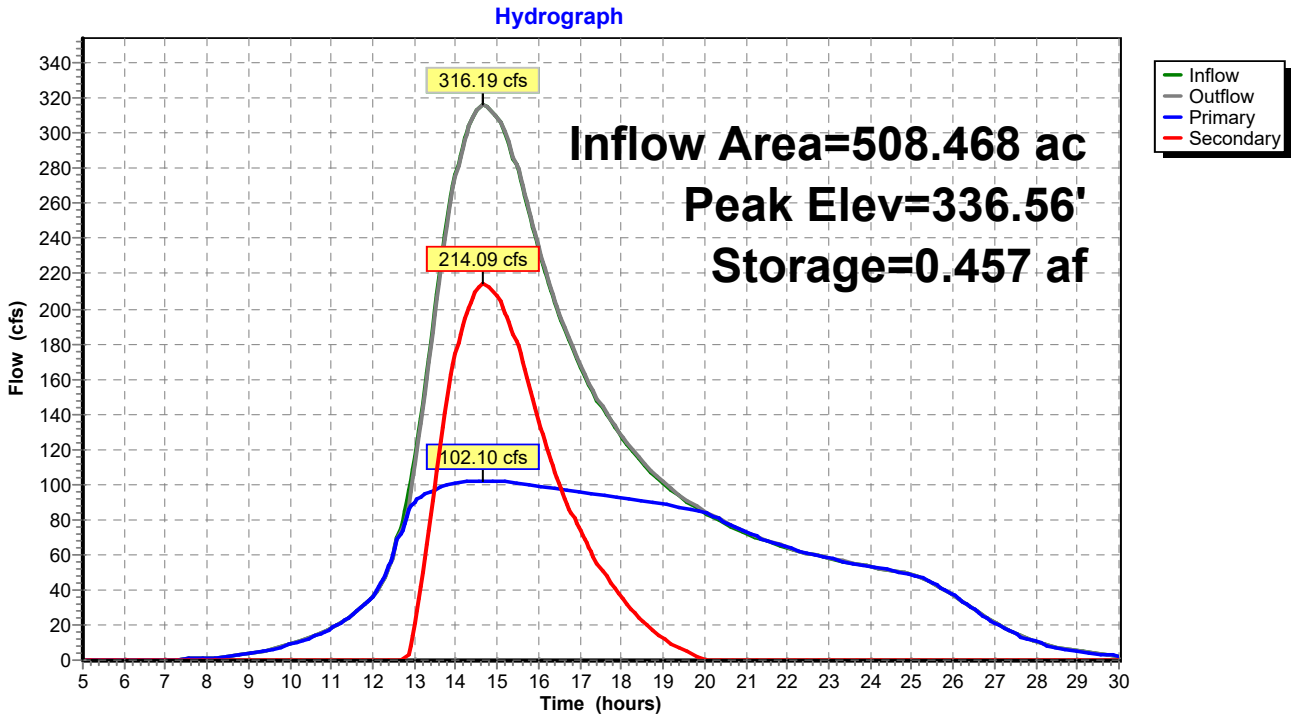
Pond 6P: 110 Culvert



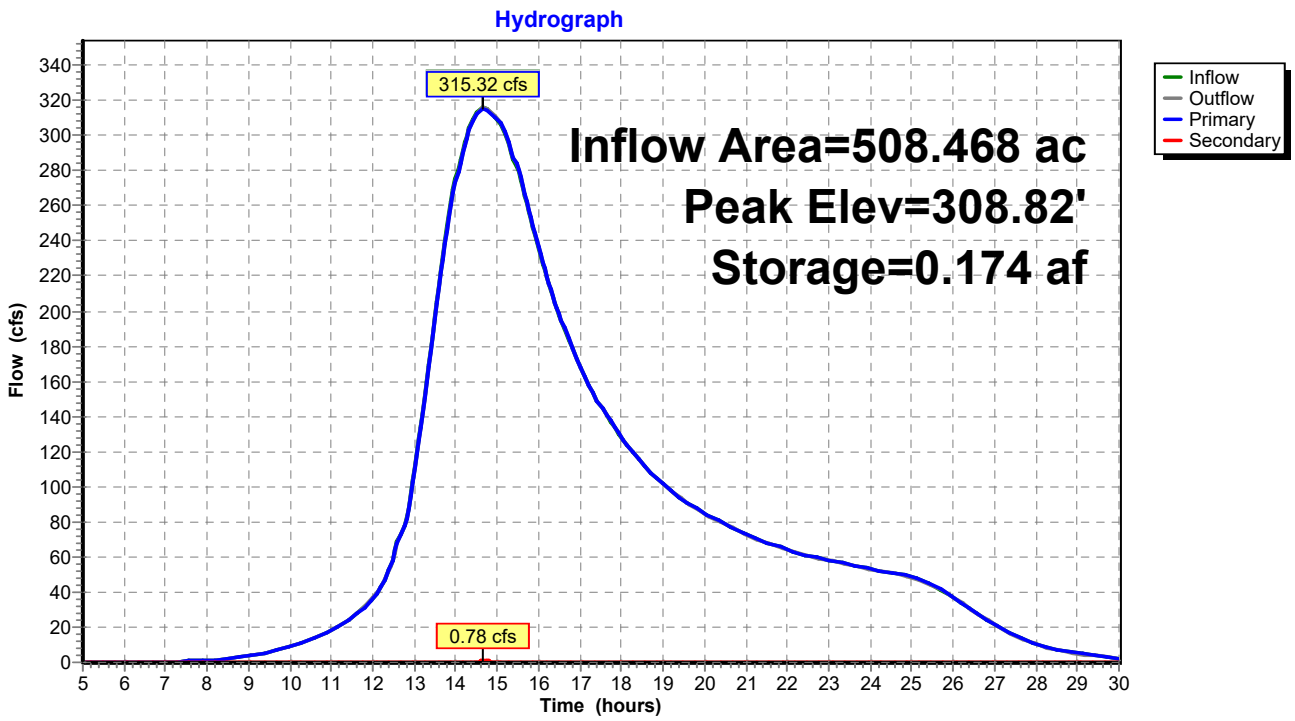
Pond 0P: 117 Culvert



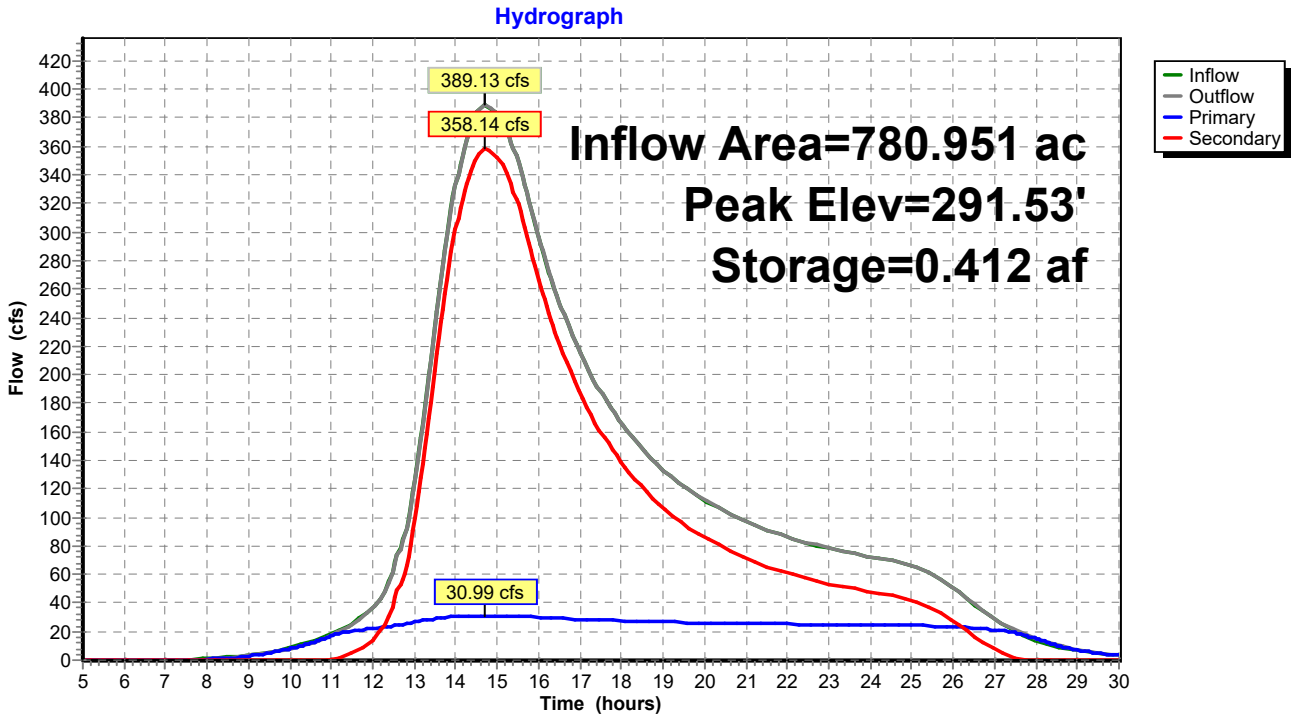
Pond 1P: Culvert 1



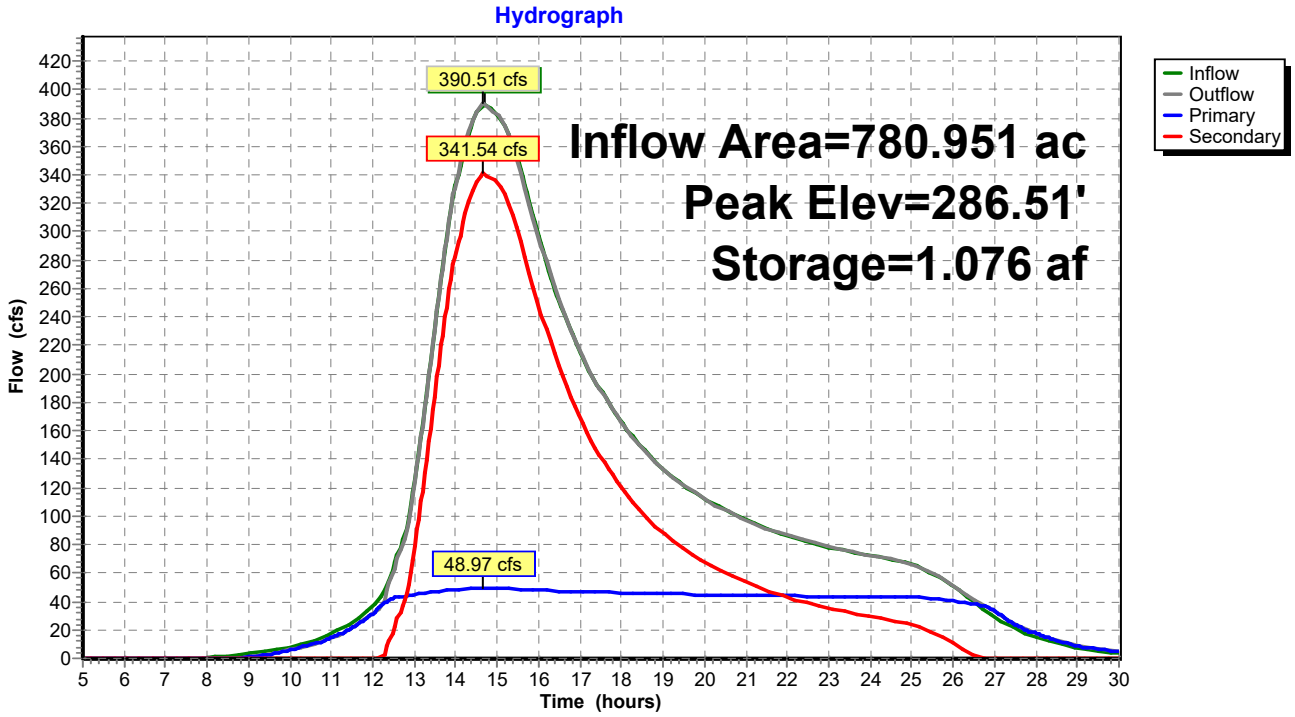
Pond 2P: Culvert 2



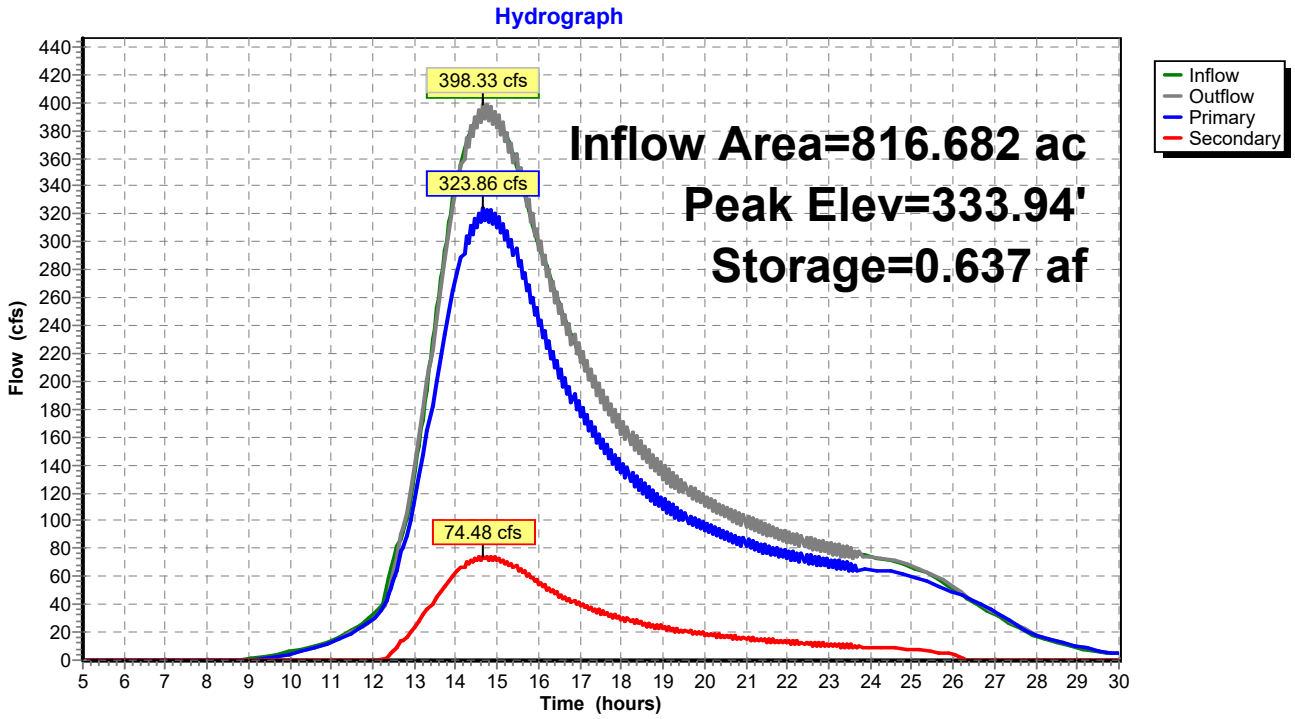
Pond 3P: Culvert 3



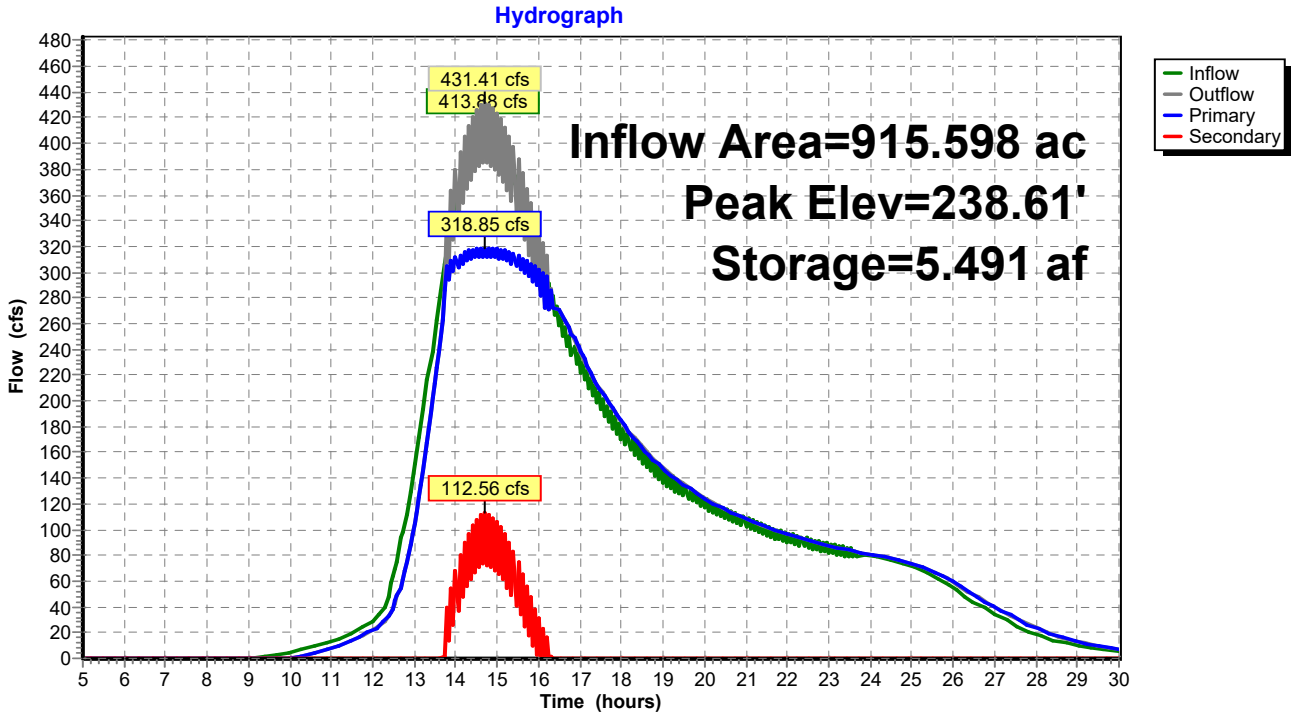
Pond 4P: Culvert 4



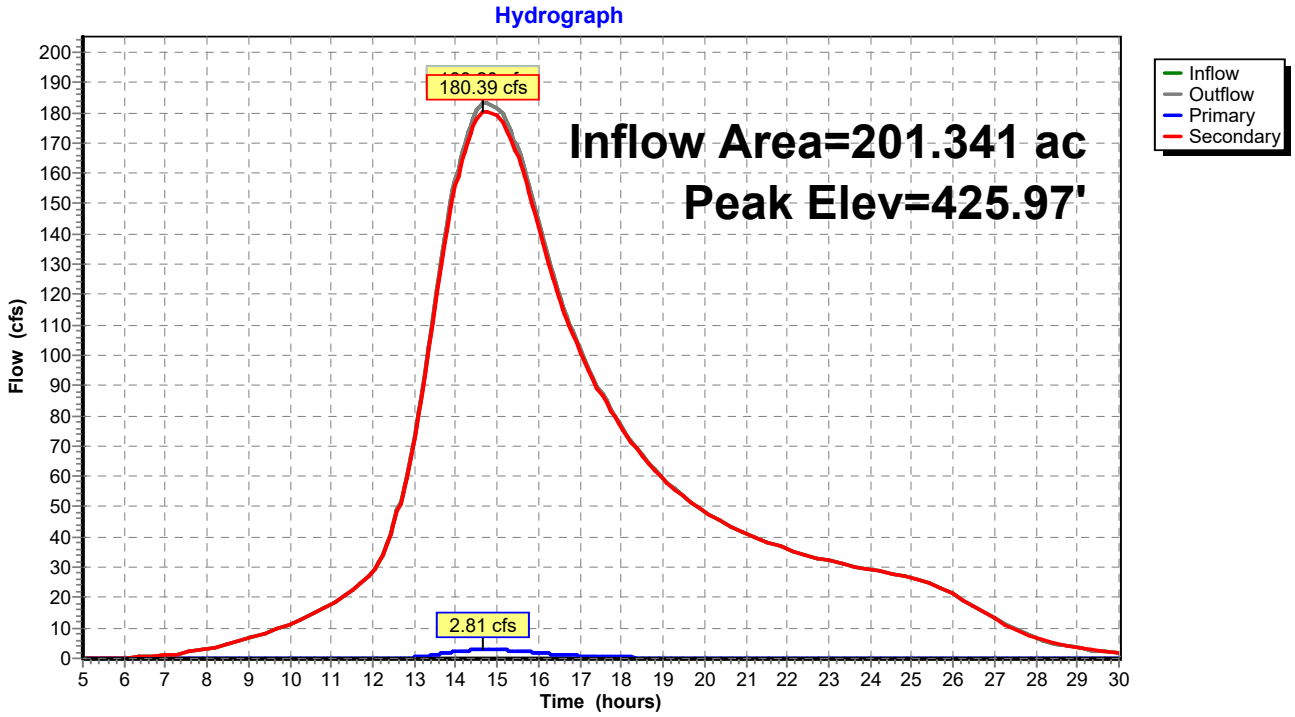
Pond 5P: Sand Culvert



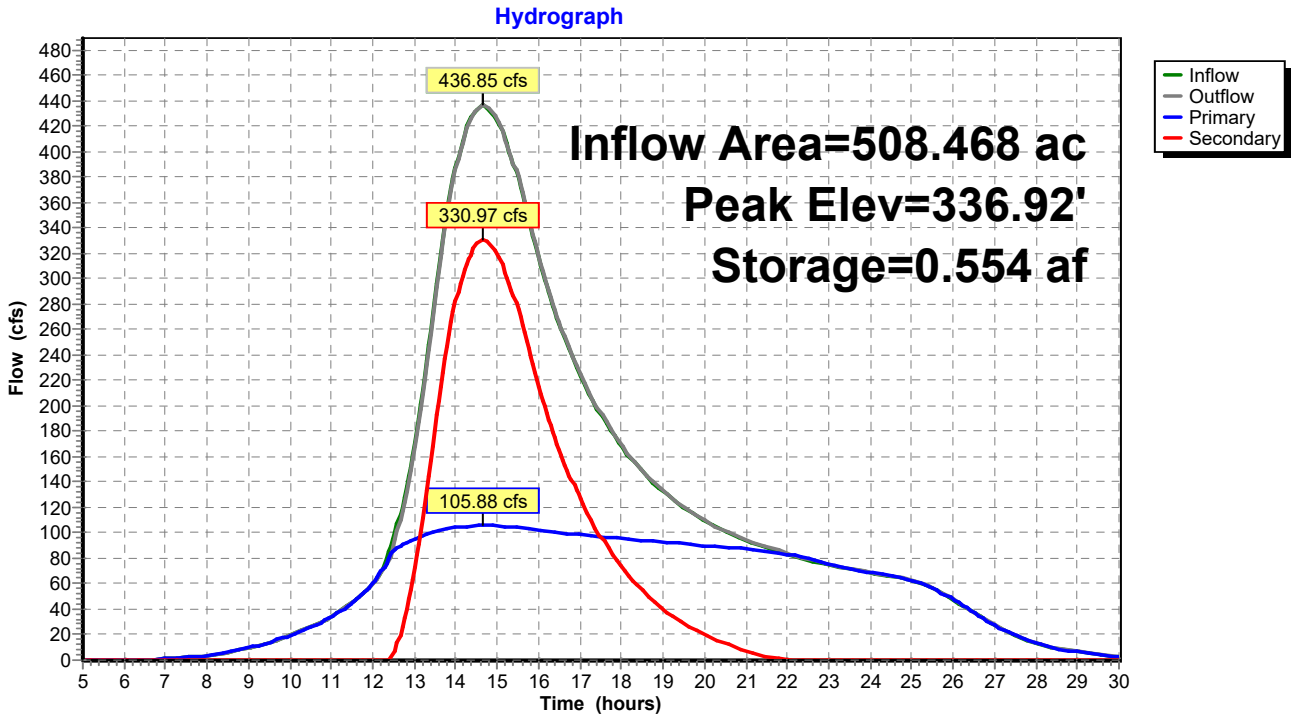
Pond 6P: 110 Culvert



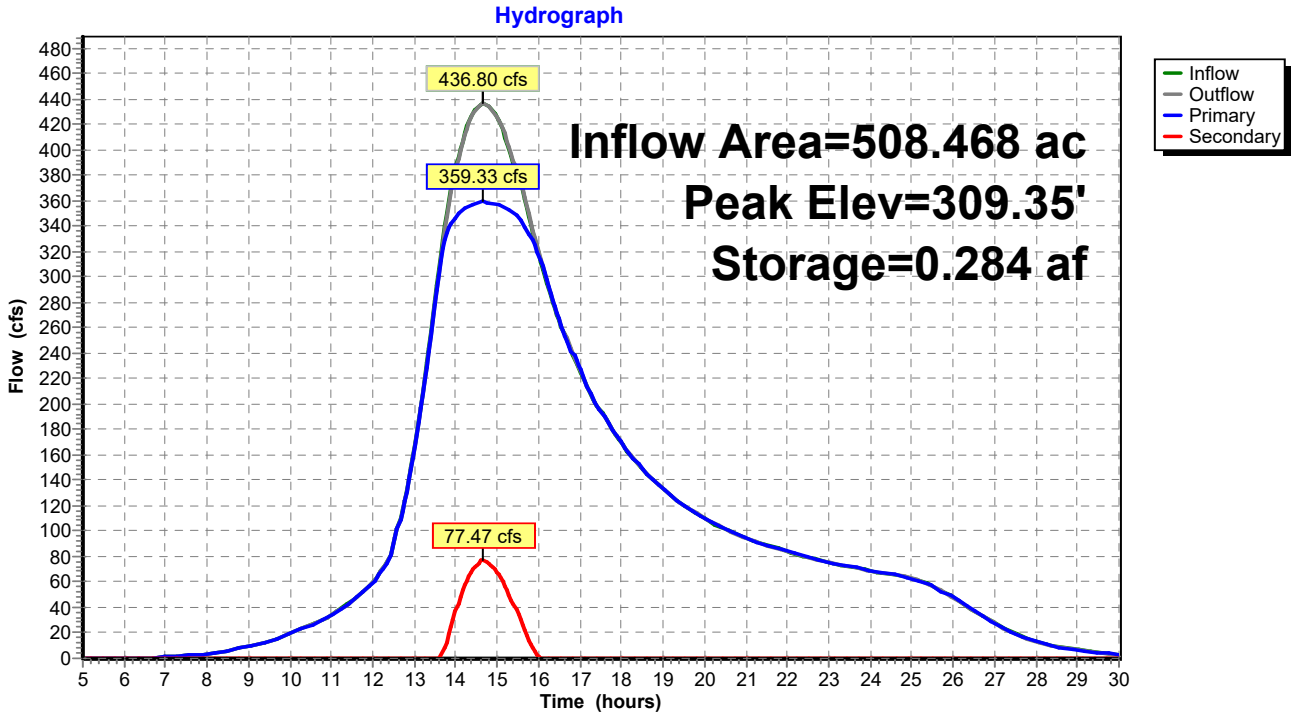
Pond 0P: 117 Culvert



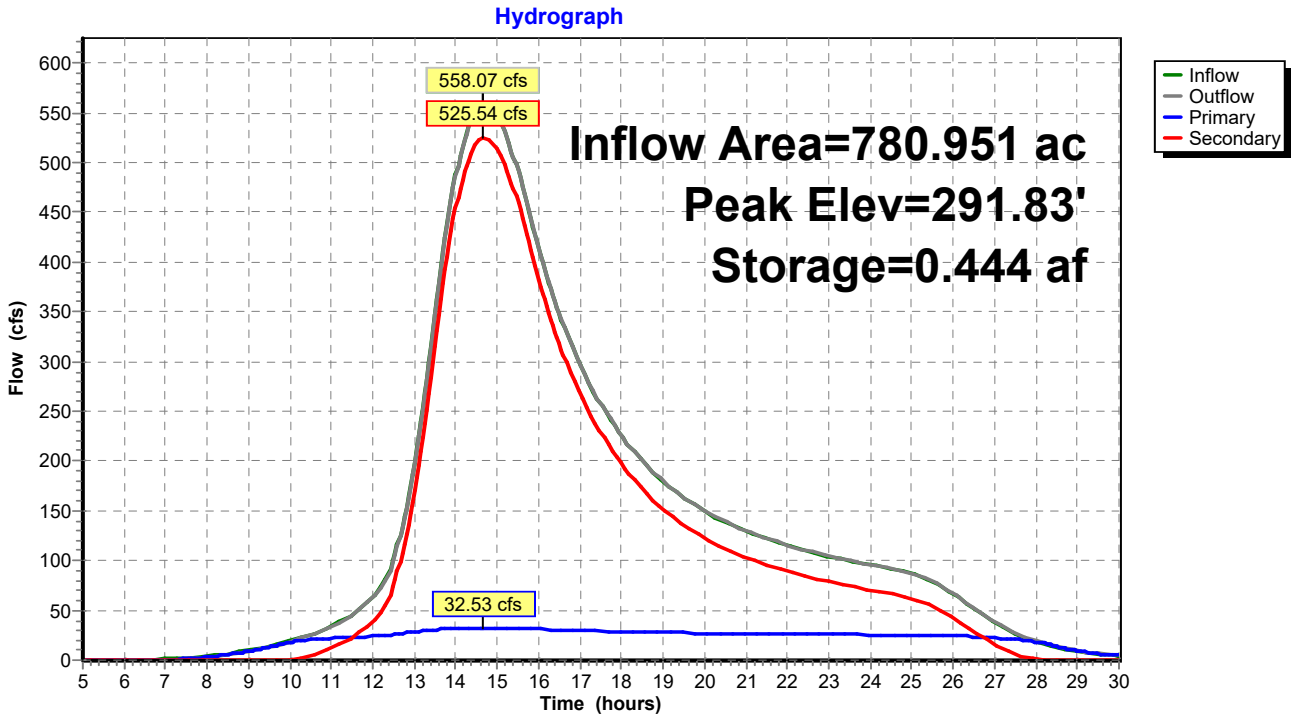
Pond 1P: Culvert 1



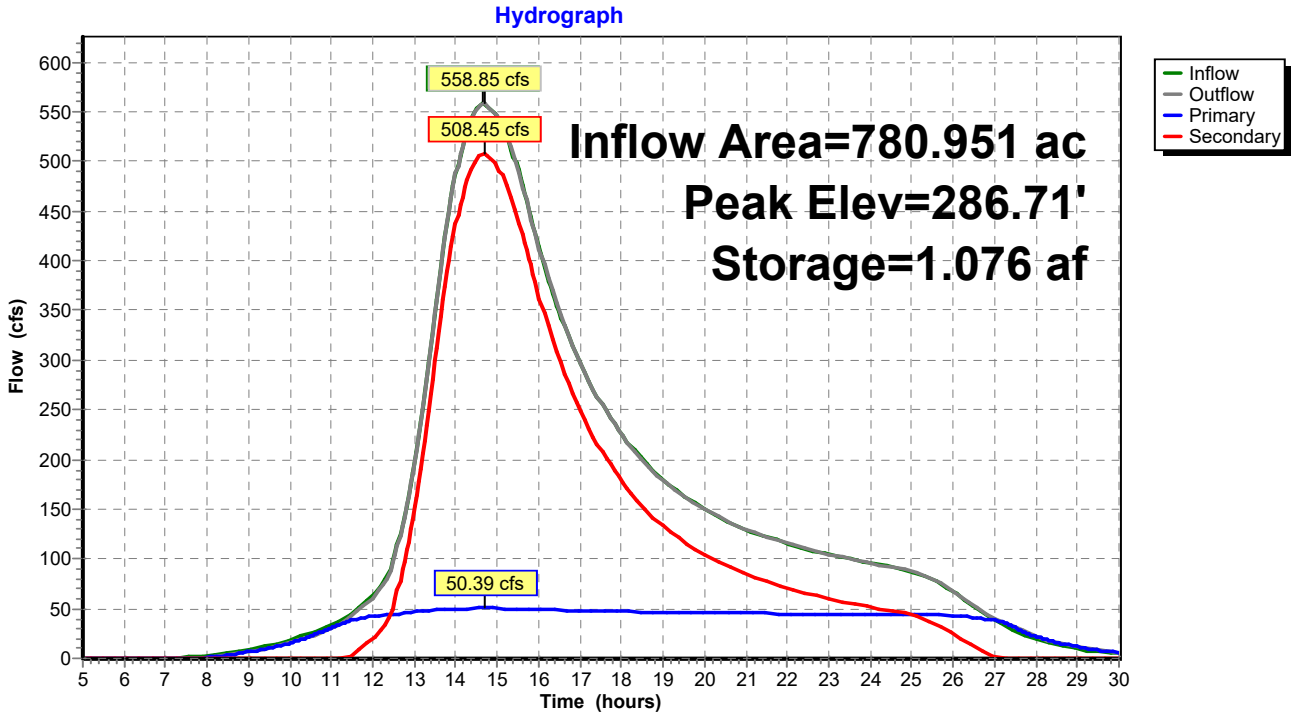
Pond 2P: Culvert 2



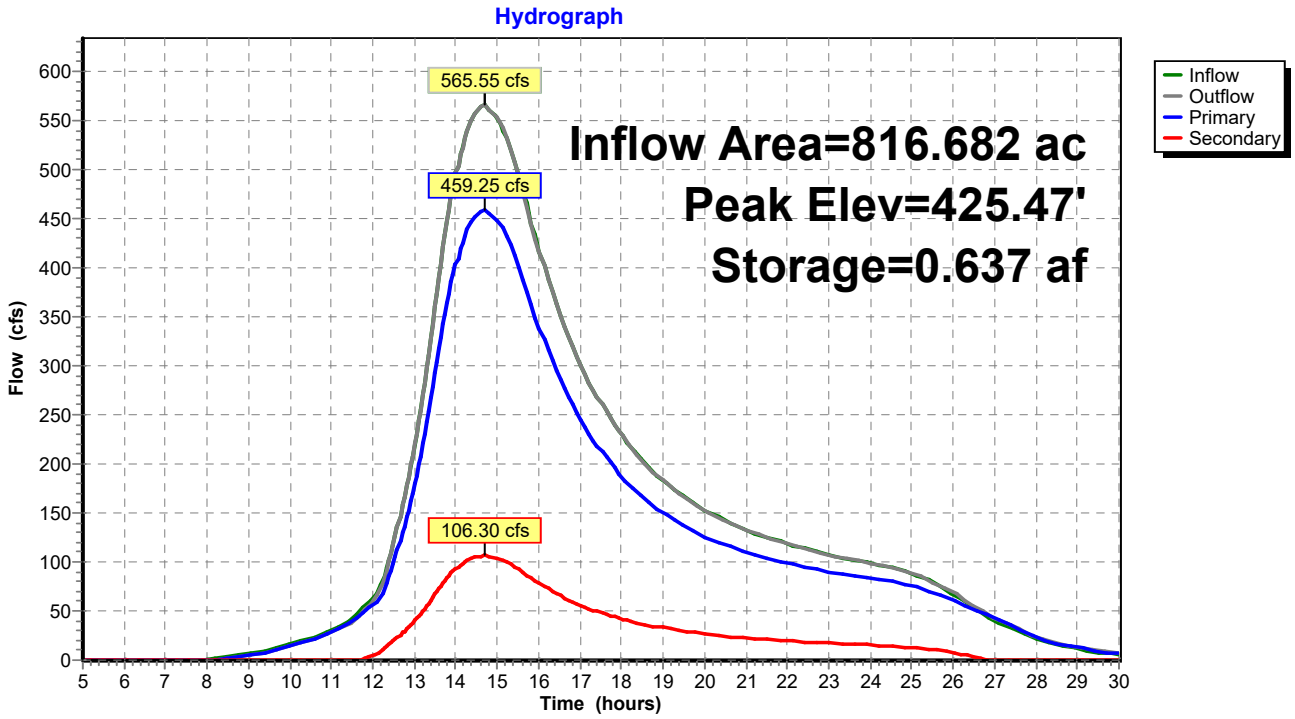
Pond 3P: Culvert 3



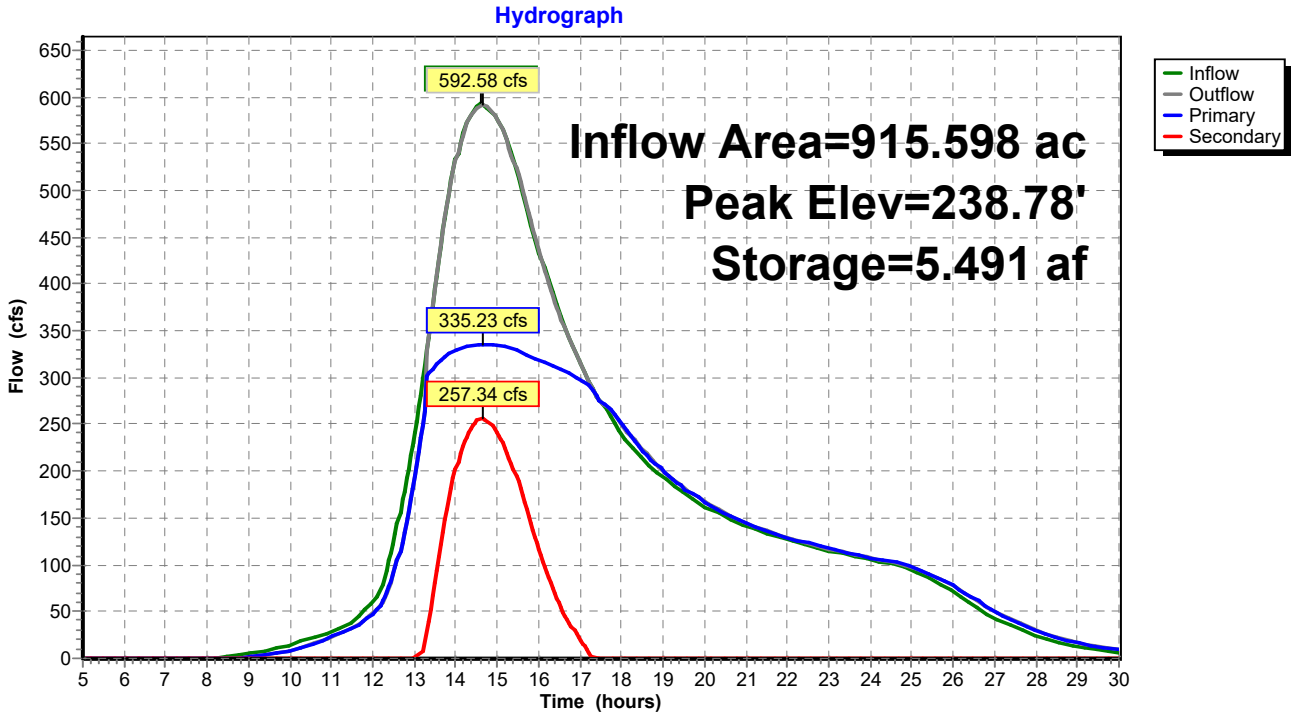
Pond 4P: Culvert 4



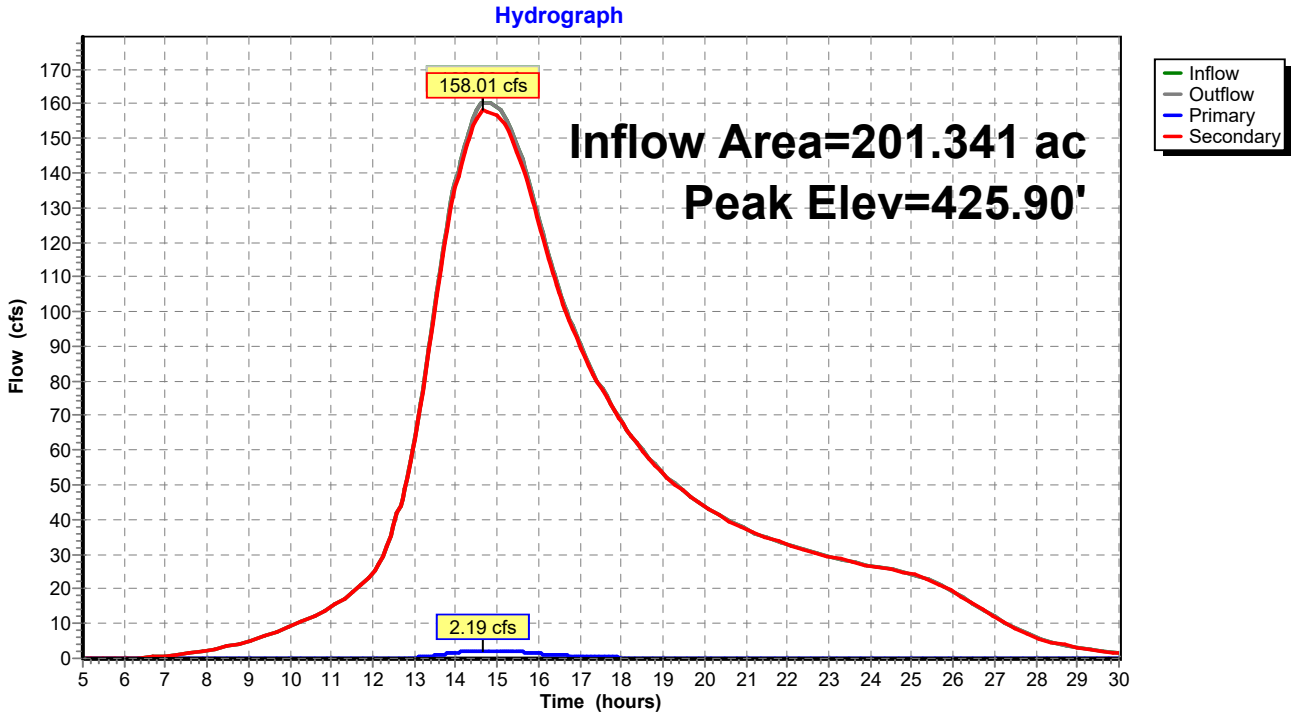
Pond 5P: Sand Culvert



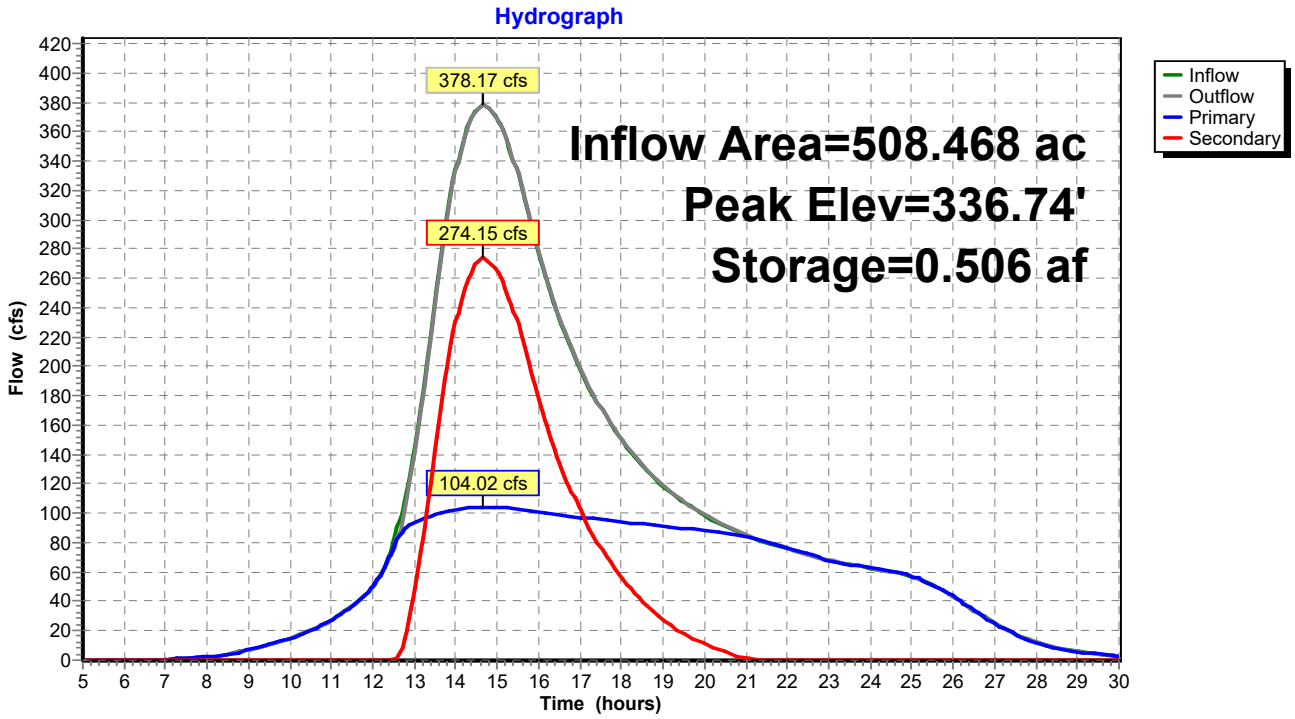
Pond 6P: 110 Culvert



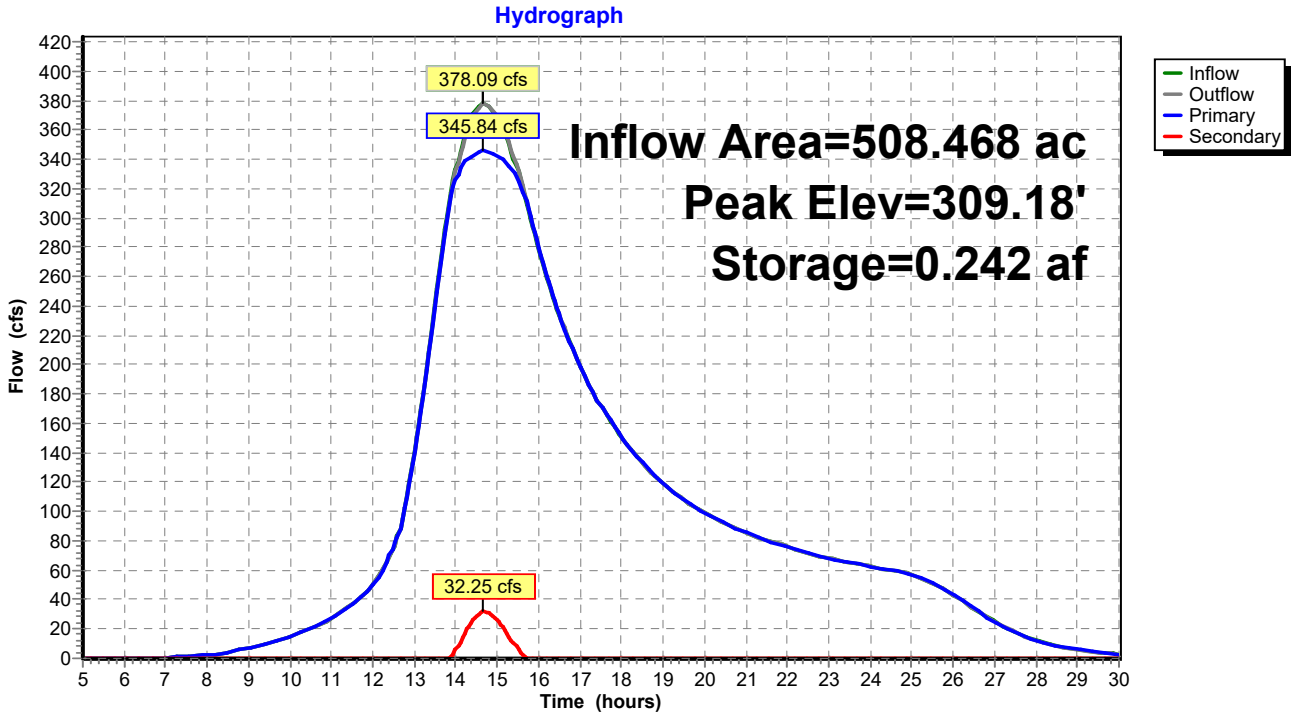
Pond 0P: 117 Culvert



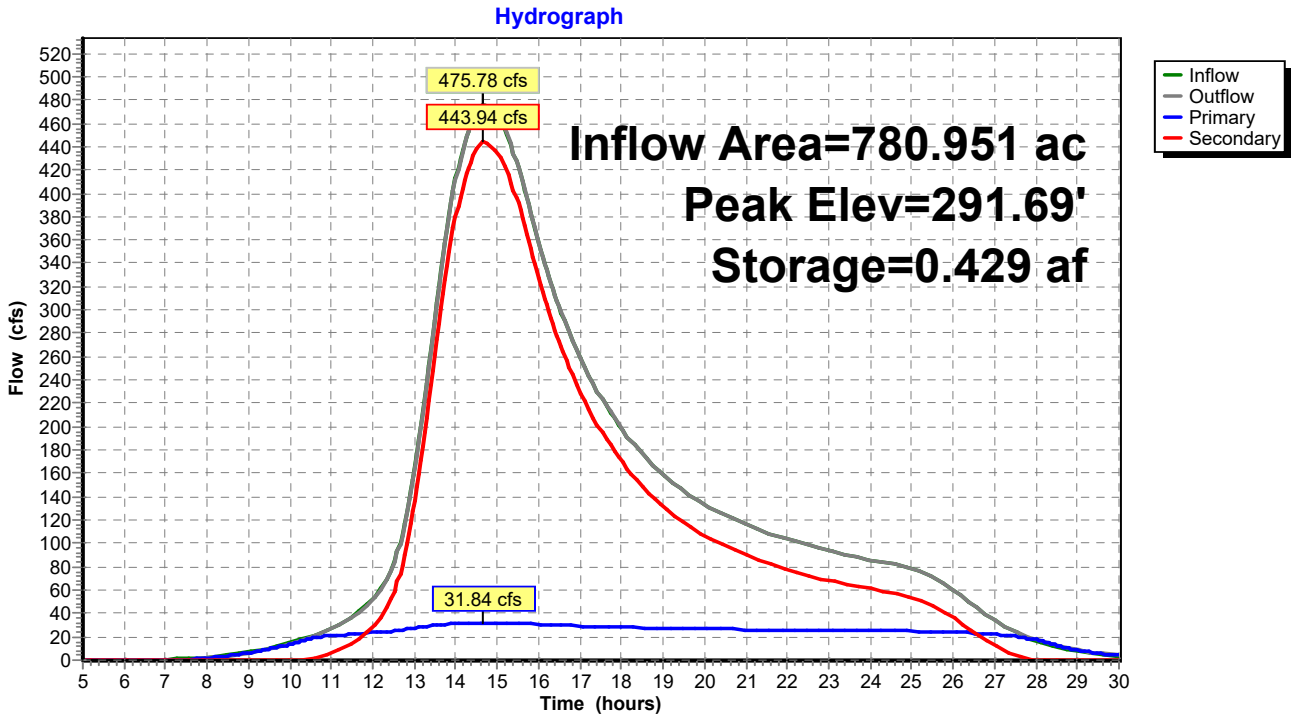
Pond 1P: Culvert 1



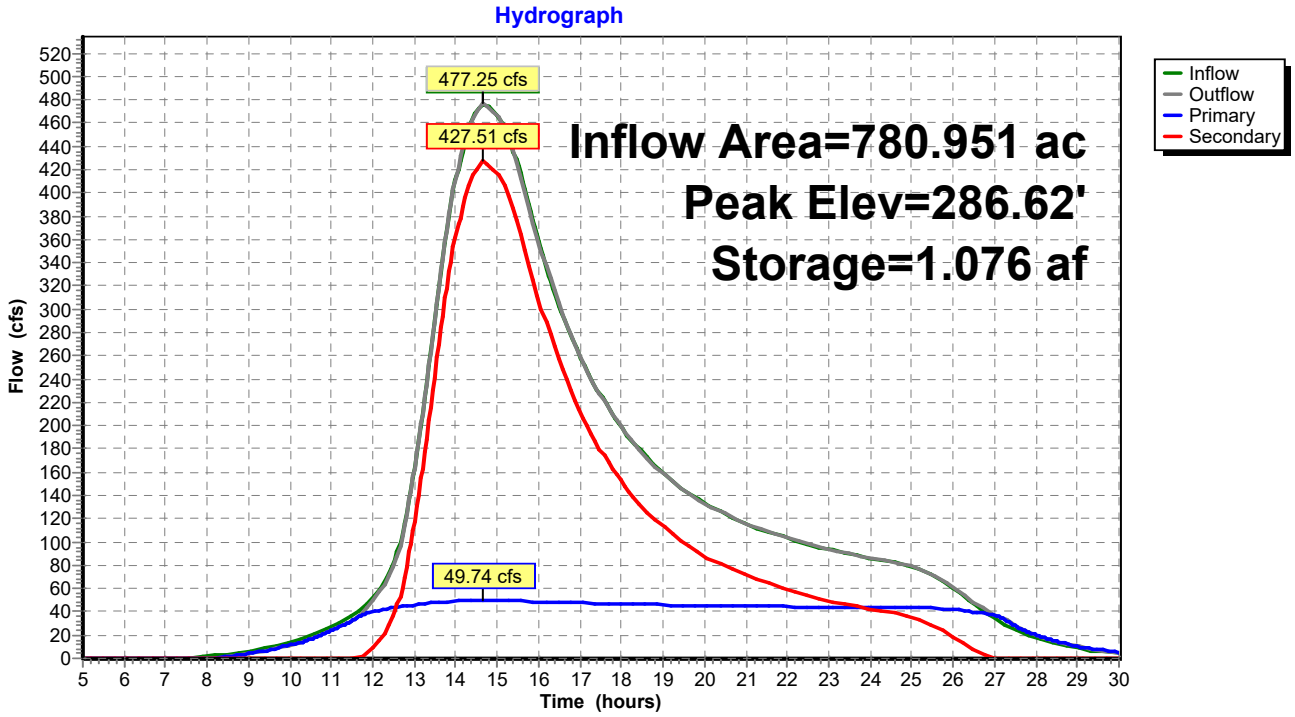
Pond 2P: Culvert 2



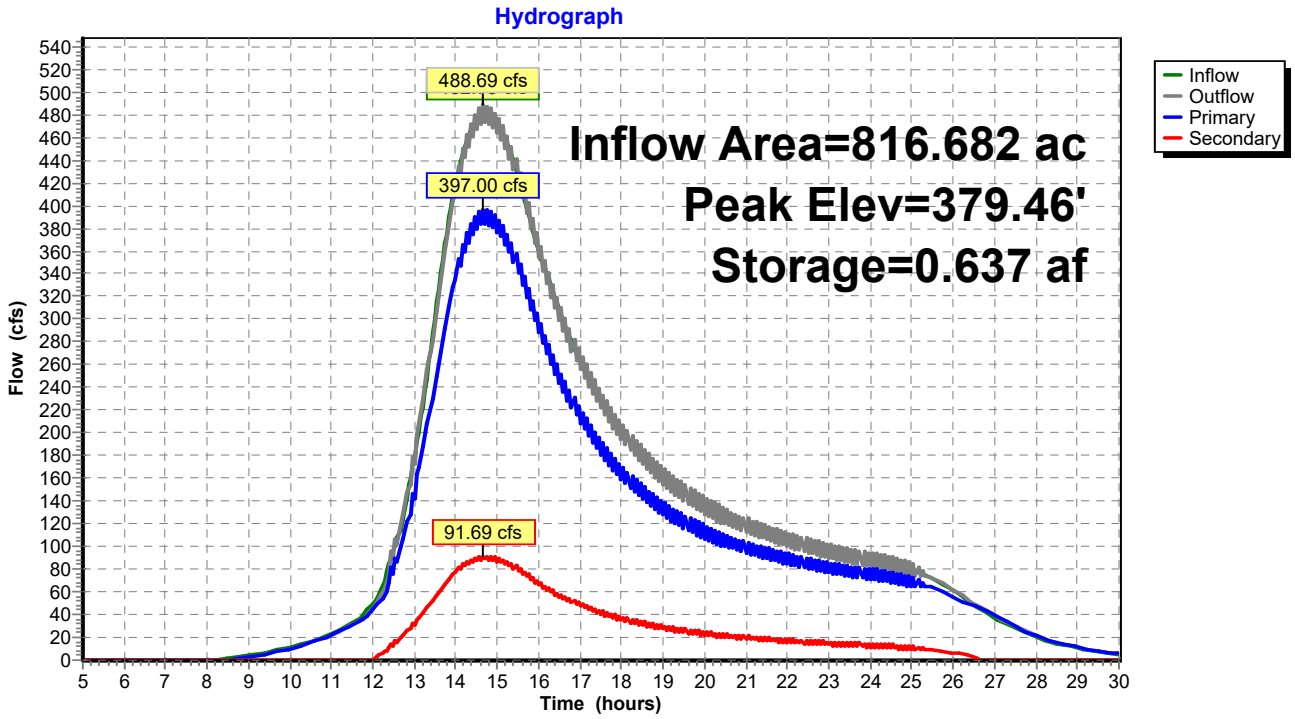
Pond 3P: Culvert 3



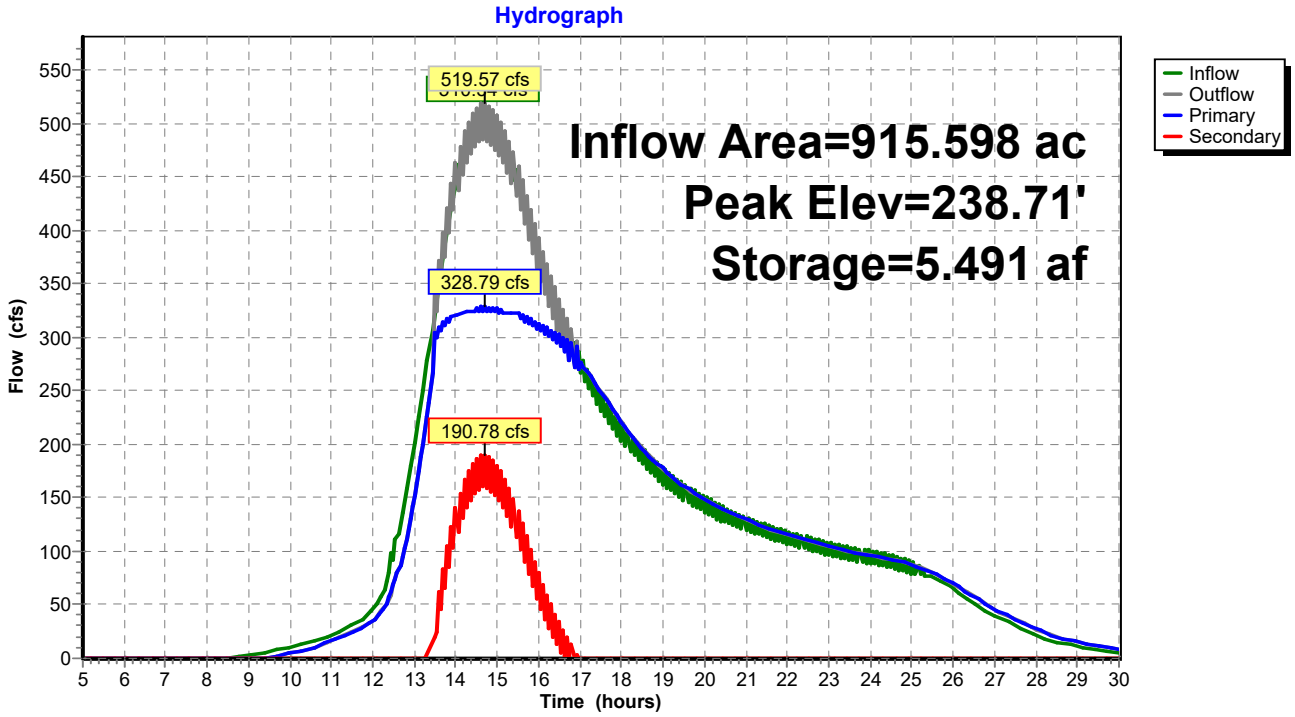
Pond 4P: Culvert 4



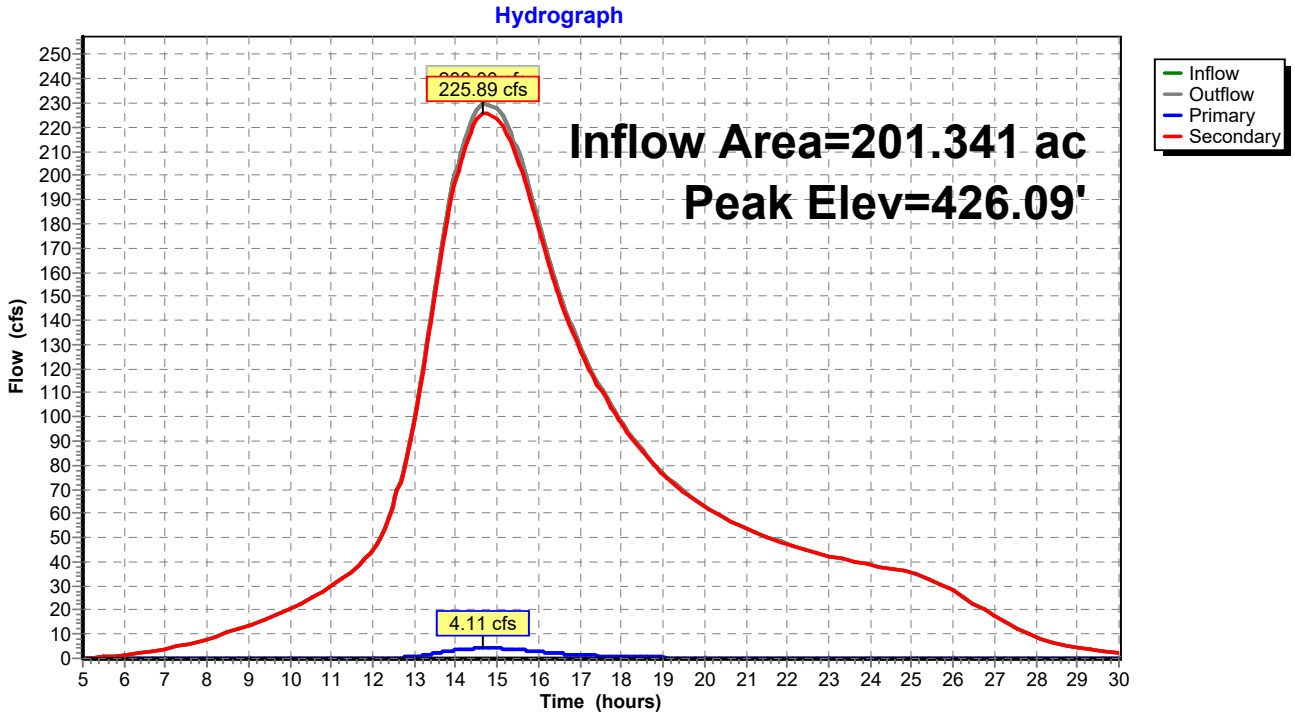
Pond 5P: Sand Culvert



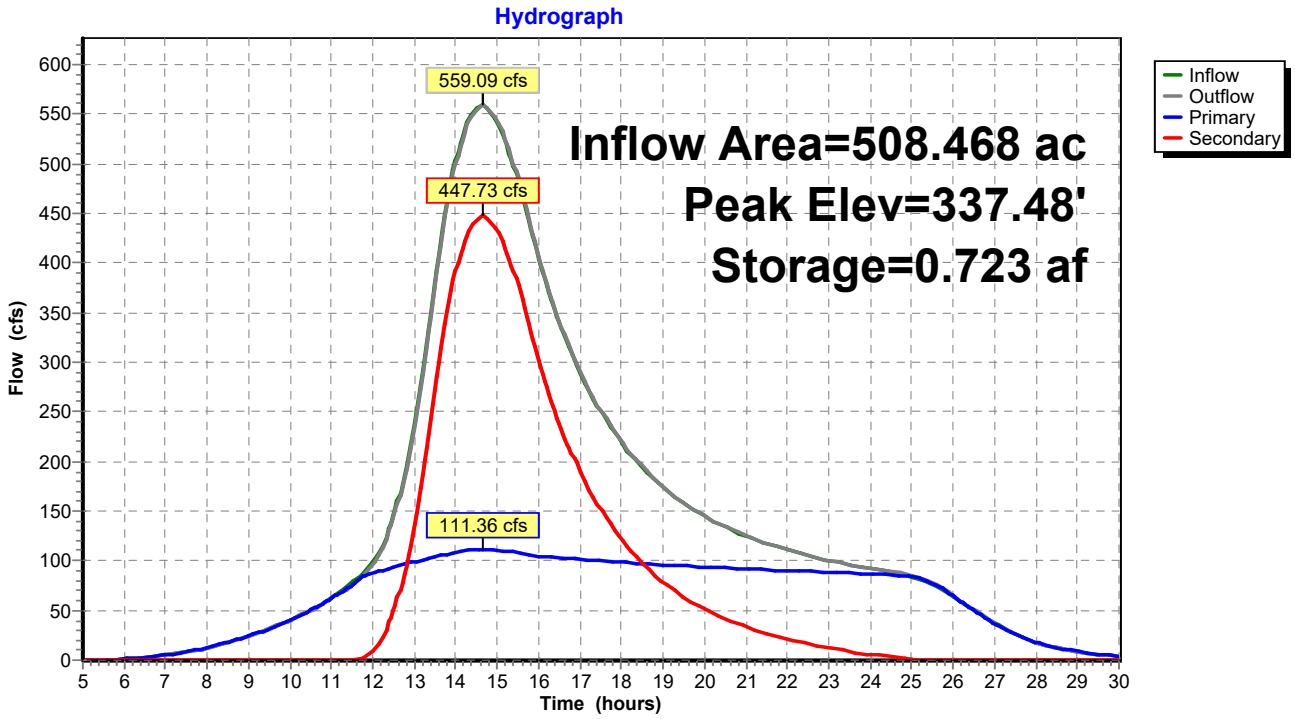
Pond 6P: 110 Culvert



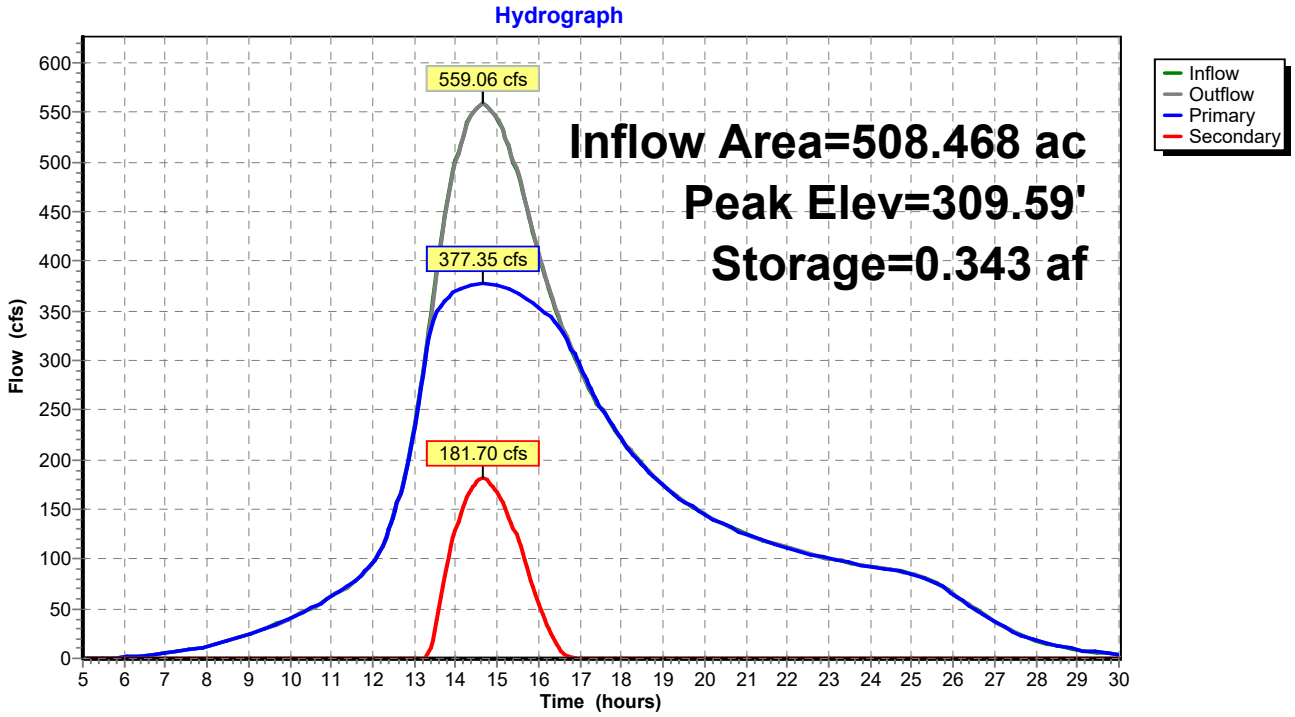
Pond 0P: 117 Culvert



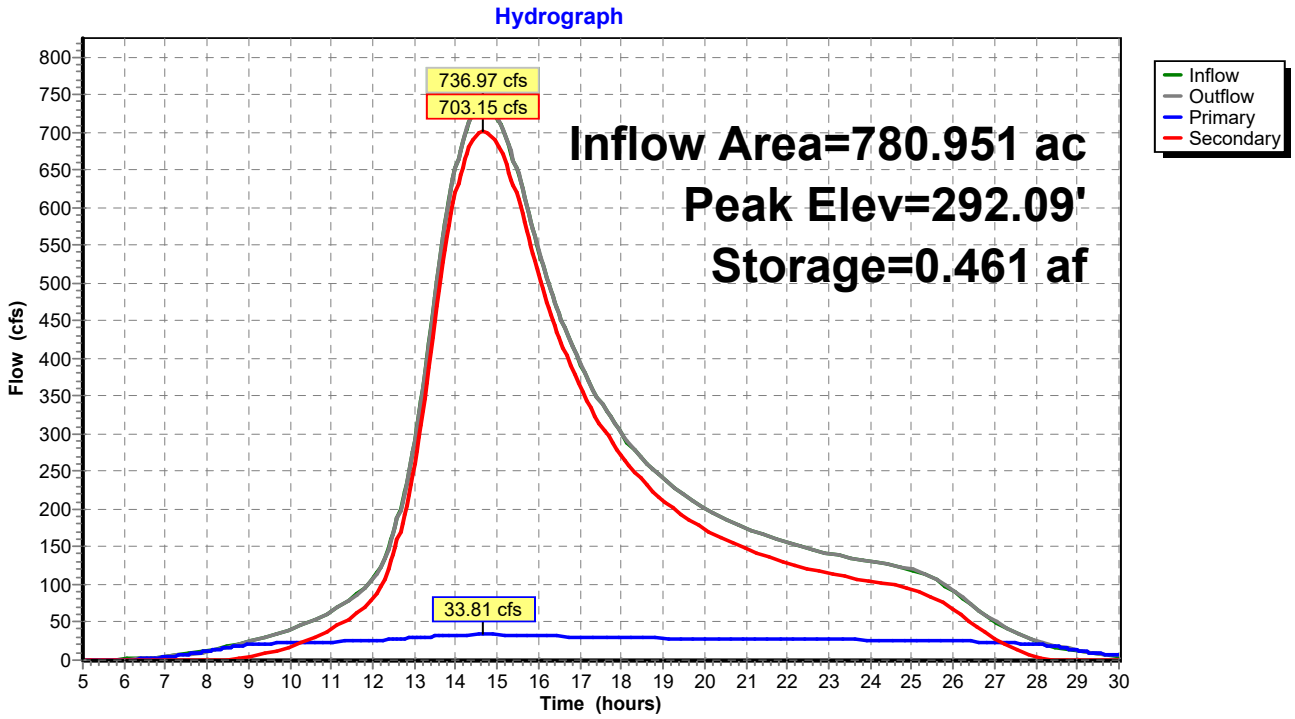
Pond 1P: Culvert 1



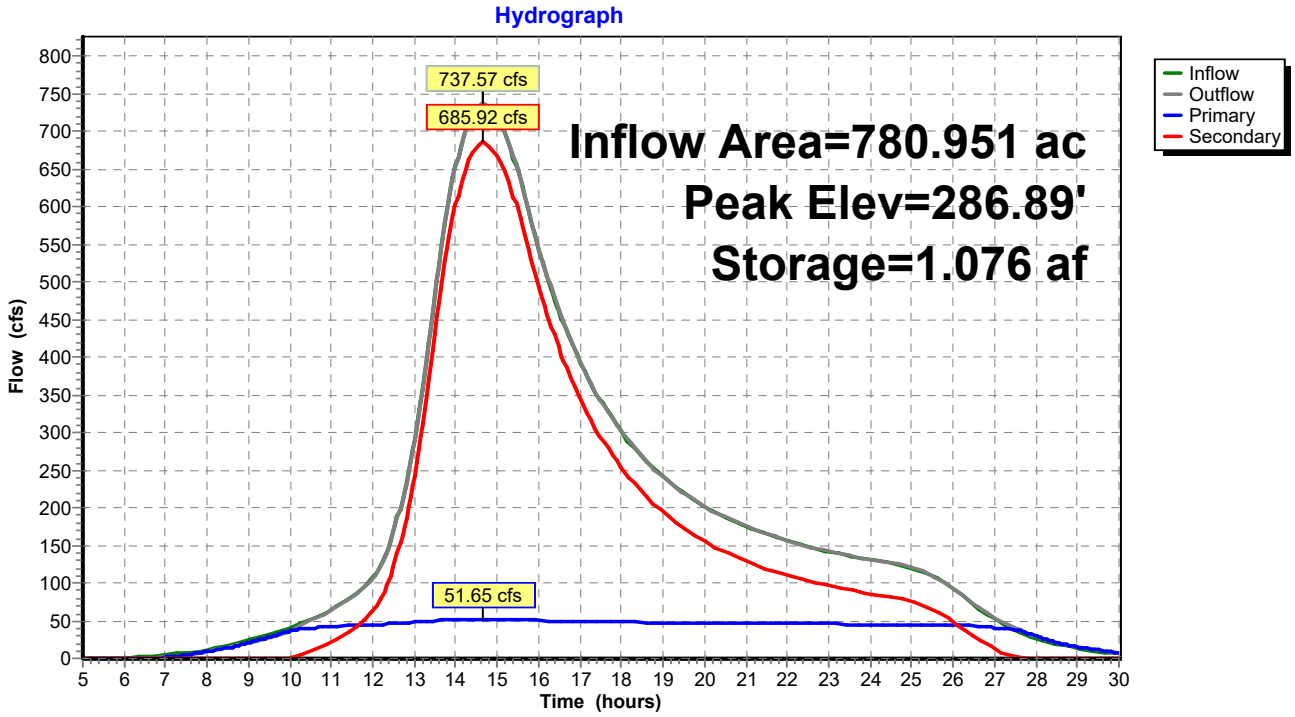
Pond 2P: Culvert 2



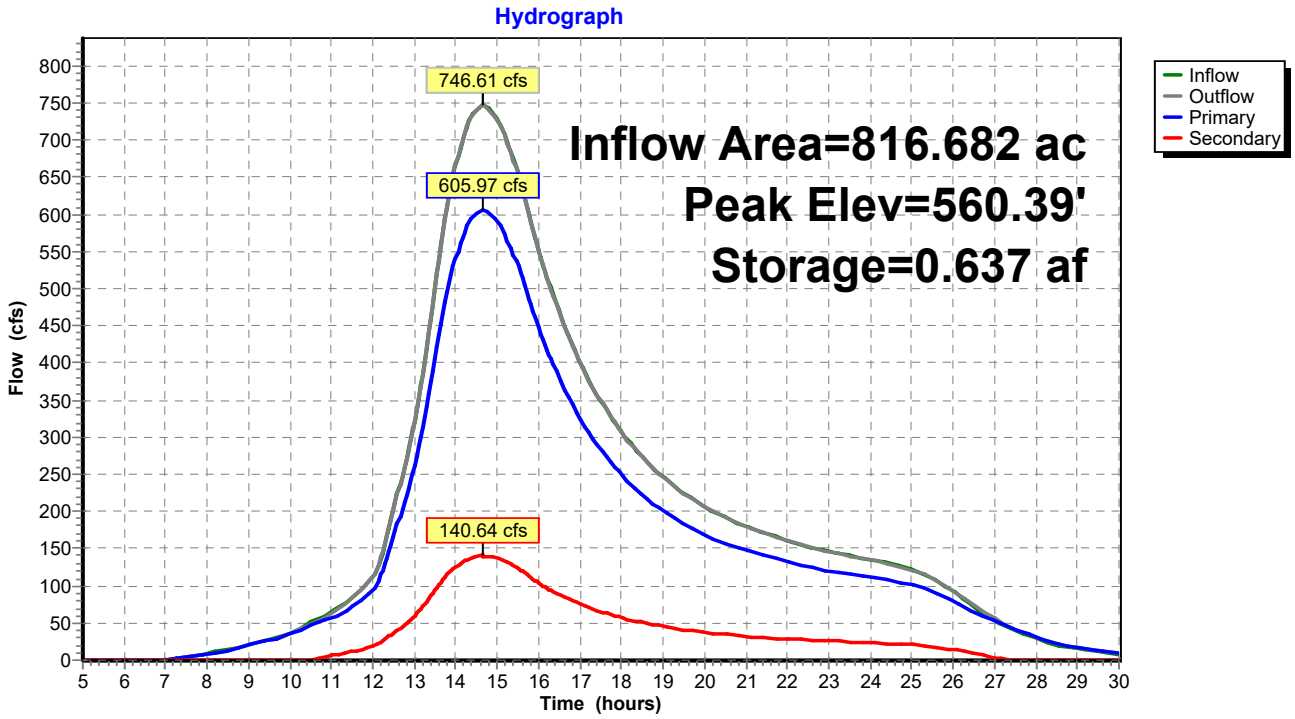
Pond 3P: Culvert 3



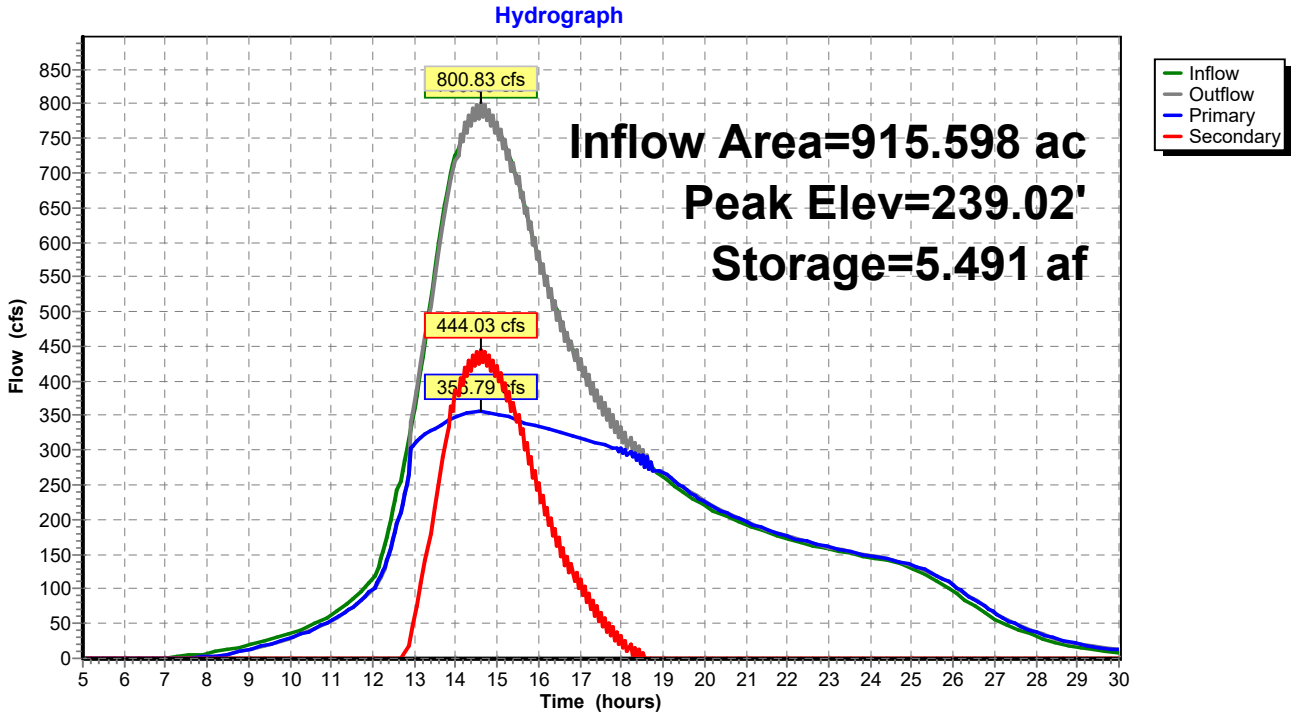
Pond 4P: Culvert 4



Pond 5P: Sand Culvert



Pond 6P: 110 Culvert



Row Labels	Areas (Acres)	Curve Number / Average CN
Basin01	**201.341**	
A	**3.254**	**50.1**
Bare Land	0.026	77.0
Deciduous Forest	1.521	30.0
Developed Open Space	0.411	49.0
Evergreen Forest	0.879	30.0
Impervious	0.134	83.0
Palustrine Emergent Wetland	0.119	48.0
Palustrine Forested Wetland	0.142	48.0
Water	0.021	98.0
B	**39.182**	**67.6**
Bare Land	0.041	86.0
Cultivated	1.053	78.0
Deciduous Forest	11.031	55.0
Developed Open Space	6.243	69.0
Evergreen Forest	16.270	55.0
Grassland	0.595	61.0
Impervious	2.683	89.0
Palustrine Forested Wetland	0.285	67.0
Pasture/Hay	0.004	69.0
Scrub/Shrub	0.978	56.0
C	**64.992**	**78.7**
Cultivated	5.186	85.0
Deciduous Forest	16.922	70.0
Developed Open Space	14.426	79.0
Evergreen Forest	11.229	70.0
Grassland	0.962	74.0
Impervious	8.659	92.0
Palustrine Forested Wetland	4.624	77.0
Pasture/Hay	2.764	79.0
Scrub/Shrub	0.221	70.0
D	**93.914**	**82.8**
Bare Land	0.072	94.0
Cultivated	28.950	89.0
Deciduous Forest	19.589	77.0
Developed Open Space	9.406	84.0
Evergreen Forest	7.657	77.0
Grassland	2.541	80.0
Impervious	6.714	93.0
Palustrine Emergent Wetland	0.648	83.0
Palustrine Forested Wetland	12.559	83.0
Palustrine Scrub/Shrub Wetland	0.678	83.0
Pasture/Hay	2.916	84.0
Scrub/Shrub	1.805	77.0
Water	0.380	98.0

Row Labels	Areas (Acres)	Curve Number / Average CN
Basin02	**307.127**	
A	**79.489**	**44.7**
Bare Land	2.111	77.0
Deciduous Forest	27.723	30.0
Developed Open Space	10.996	49.0
Evergreen Forest	22.903	30.0
Grassland	3.062	39.0
Impervious	6.187	83.0
Palustrine Emergent Wetland	0.050	48.0
Palustrine Forested Wetland	1.673	48.0
Scrub/Shrub	3.918	35.0
Water	0.865	98.0
B	**36.813**	**65.3**
Cultivated	2.507	78.0
Deciduous Forest	10.488	55.0
Developed Open Space	5.619	69.0
Evergreen Forest	6.402	55.0
Grassland	0.351	61.0
Impervious	3.323	89.0
Palustrine Emergent Wetland	0.043	67.0
Palustrine Forested Wetland	6.378	67.0
Pasture/Hay	1.664	69.0
Water	0.038	98.0
C	**85.408**	**77.0**
Cultivated	22.444	85.0
Deciduous Forest	21.857	70.0
Developed Open Space	10.089	79.0
Evergreen Forest	13.601	70.0
Grassland	5.113	74.0
Impervious	6.276	92.0
Palustrine Emergent Wetland	0.225	77.0
Palustrine Forested Wetland	1.359	77.0
Palustrine Scrub/Shrub Wetland	0.219	77.0
Pasture/Hay	1.237	79.0
Scrub/Shrub	2.967	70.0
Water	0.021	98.0
D	**105.418**	**82.1**
Bare Land	0.031	94.0
Cultivated	43.600	89.0
Deciduous Forest	14.806	77.0
Developed Open Space	3.573	84.0
Evergreen Forest	14.486	77.0
Grassland	3.101	80.0
Impervious	6.628	93.0
Palustrine Emergent Wetland	1.388	83.0

Row Labels	Areas (Acres)	Curve Number / Average CN
Palustrine Forested Wetland	7.598	83.0
Palustrine Scrub/Shrub Wetland	2.653	83.0
Pasture/Hay	3.646	84.0
Scrub/Shrub	3.548	77.0
Water	0.361	98.0
Basin03	**272.483**	
A	**131.405**	**43.3**
Bare Land	0.921	77.0
Deciduous Forest	56.260	30.0
Developed Open Space	5.833	49.0
Evergreen Forest	38.213	30.0
Grassland	21.184	39.0
Impervious	3.888	83.0
Palustrine Emergent Wetland	0.034	48.0
Palustrine Forested Wetland	3.139	48.0
Pasture/Hay	1.455	49.0
Scrub/Shrub	0.384	35.0
Water	0.095	98.0
B	**63.568**	**65.0**
Bare Land	0.011	86.0
Deciduous Forest	20.097	55.0
Developed Open Space	5.304	69.0
Evergreen Forest	26.509	55.0
Grassland	2.141	61.0
Impervious	3.241	89.0
Palustrine Forested Wetland	4.979	67.0
Pasture/Hay	1.270	69.0
Water	0.016	98.0
C	**58.611**	**77.9**
Deciduous Forest	9.667	70.0
Developed Open Space	3.732	79.0
Evergreen Forest	23.542	70.0
Grassland	4.556	74.0
Impervious	4.058	92.0
Palustrine Aquatic Bed	0.014	98.0
Palustrine Emergent Wetland	1.110	77.0
Palustrine Forested Wetland	7.754	77.0
Pasture/Hay	4.172	79.0
Water	0.006	98.0
D	**18.899**	**82.0**
Bare Land	0.010	94.0
Deciduous Forest	1.561	77.0
Developed Open Space	2.687	84.0
Evergreen Forest	0.940	77.0
Grassland	7.433	80.0

Row Labels	Areas (Acres)	Curve Number / Average CN
Impervious	0.745	93.0
Palustrine Forested Wetland	0.412	83.0
Pasture/Hay	3.459	84.0
Water	1.653	98.0
Basin04	**35.731**	
A	**24.427**	**42.5**
Bare Land	0.123	77.0
Deciduous Forest	6.827	30.0
Developed Open Space	0.713	49.0
Evergreen Forest	11.953	30.0
Grassland	1.205	39.0
Impervious	0.633	83.0
Palustrine Forested Wetland	2.007	48.0
Pasture/Hay	0.237	49.0
Scrub/Shrub	0.730	35.0
B	**11.305**	**71.6**
Bare Land	0.040	86.0
Deciduous Forest	0.778	55.0
Developed Open Space	0.183	69.0
Evergreen Forest	0.251	55.0
Impervious	0.642	89.0
Palustrine Forested Wetland	5.402	67.0
Pasture/Hay	4.010	69.0
Basin05	**98.916**	**50.6**
A	**77.311**	**38.7**
Bare Land	0.078	77.0
Cultivated	2.599	67.0
Deciduous Forest	17.632	30.0
Developed Open Space	4.141	49.0
Evergreen Forest	44.105	30.0
Grassland	2.832	39.0
Impervious	4.826	83.0
Palustrine Forested Wetland	0.006	48.0
Pasture/Hay	1.091	49.0
B	**20.227**	**73.2**
Bare Land	0.040	86.0
Cultivated	12.292	78.0
Deciduous Forest	1.787	55.0
Developed Open Space	0.178	69.0
Evergreen Forest	1.219	55.0
Grassland	1.220	61.0
Impervious	2.230	89.0
Palustrine Forested Wetland	0.017	67.0
Pasture/Hay	1.236	69.0
Scrub/Shrub	0.007	56.0

Row Labels	Areas (Acres)	Curve Number / Average CN
C	**1.378**	**81.2**
Cultivated	0.562	85.0
Deciduous Forest	0.184	70.0
Developed Open Space	0.232	79.0
Grassland	0.237	74.0
Impervious	0.117	92.0
Pasture/Hay	0.046	79.0

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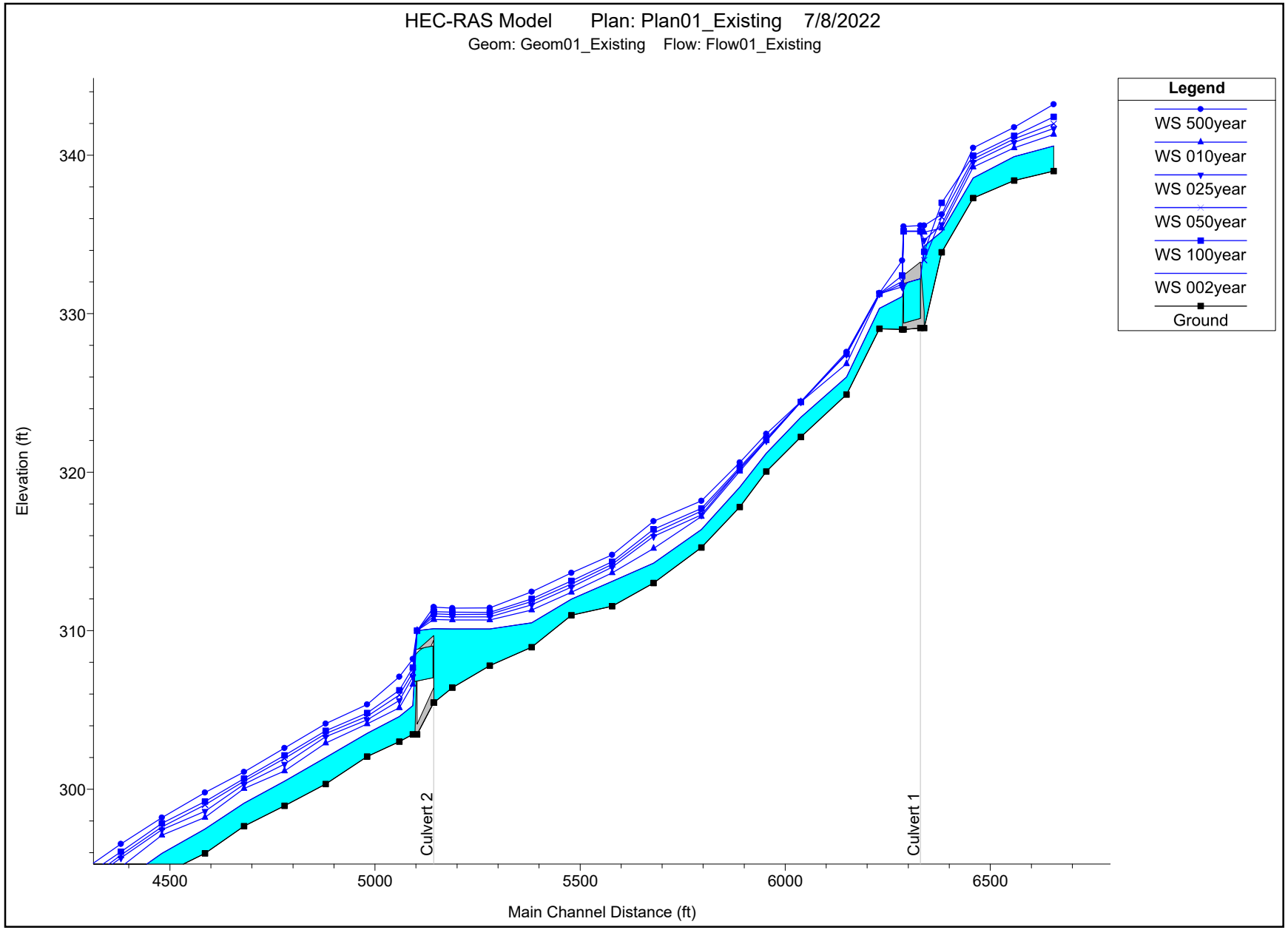
ATTACHMENT C

HEC-RAS Hydraulic Model Results

EXISTING CONDITIONS



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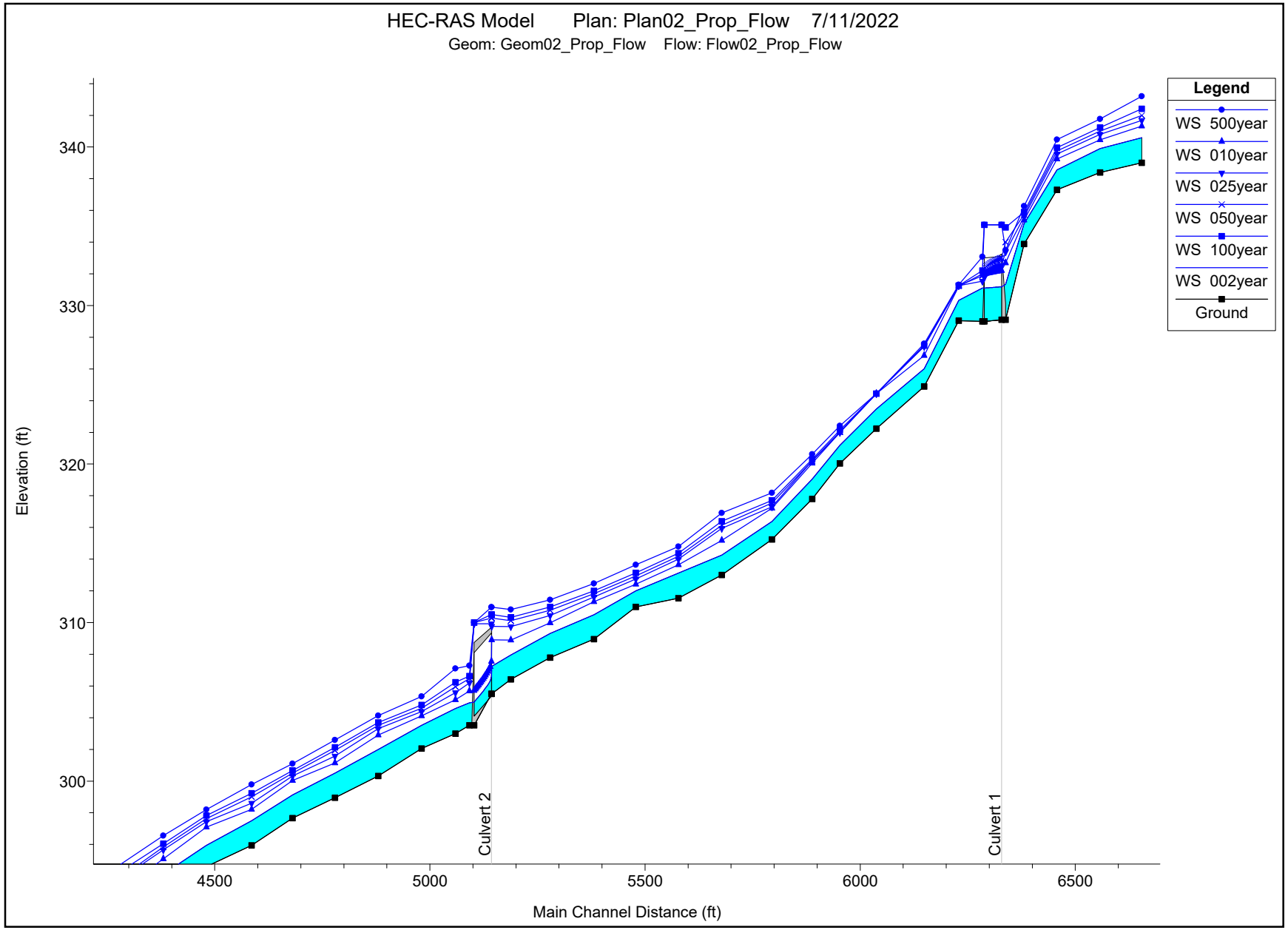

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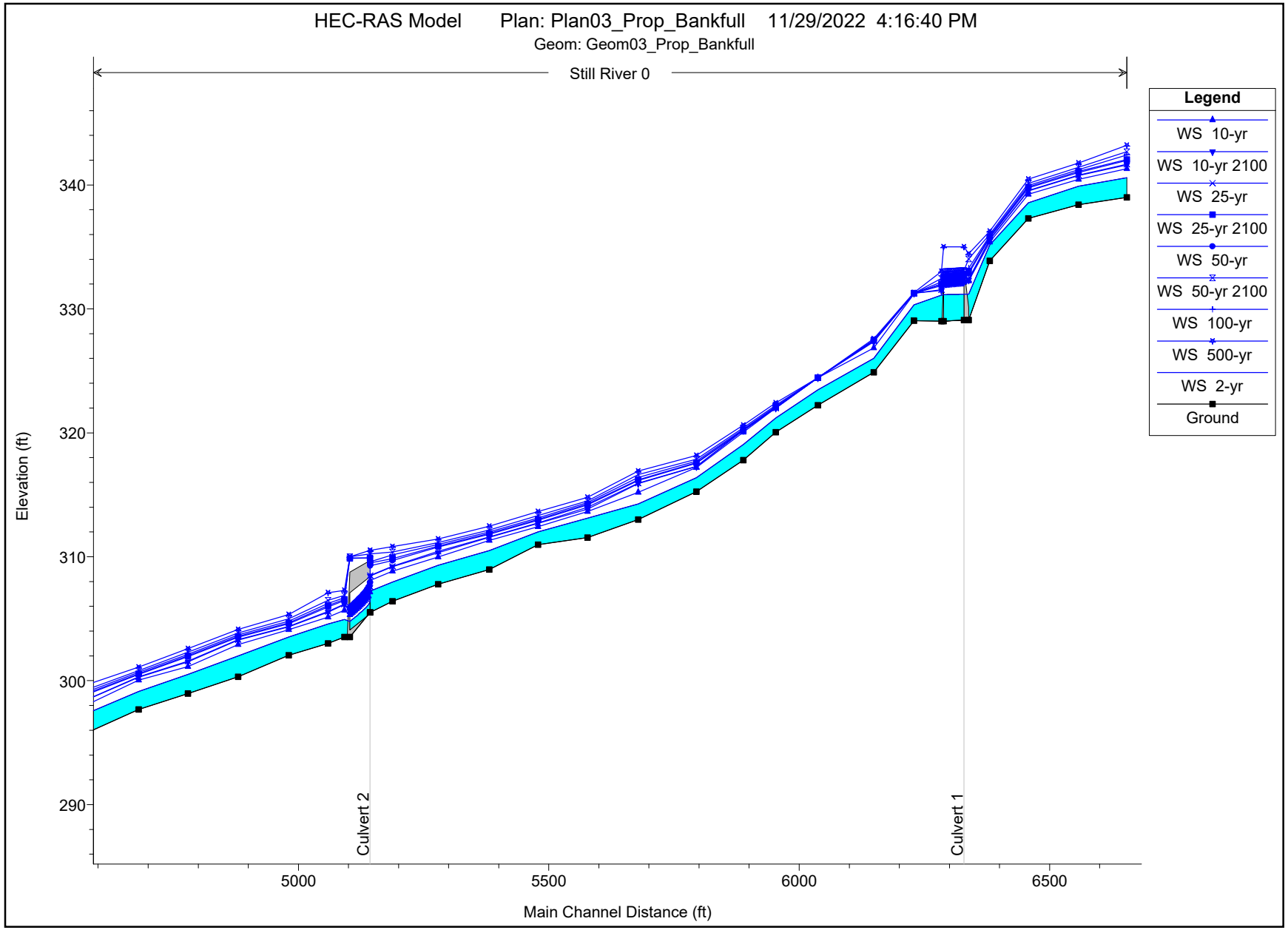

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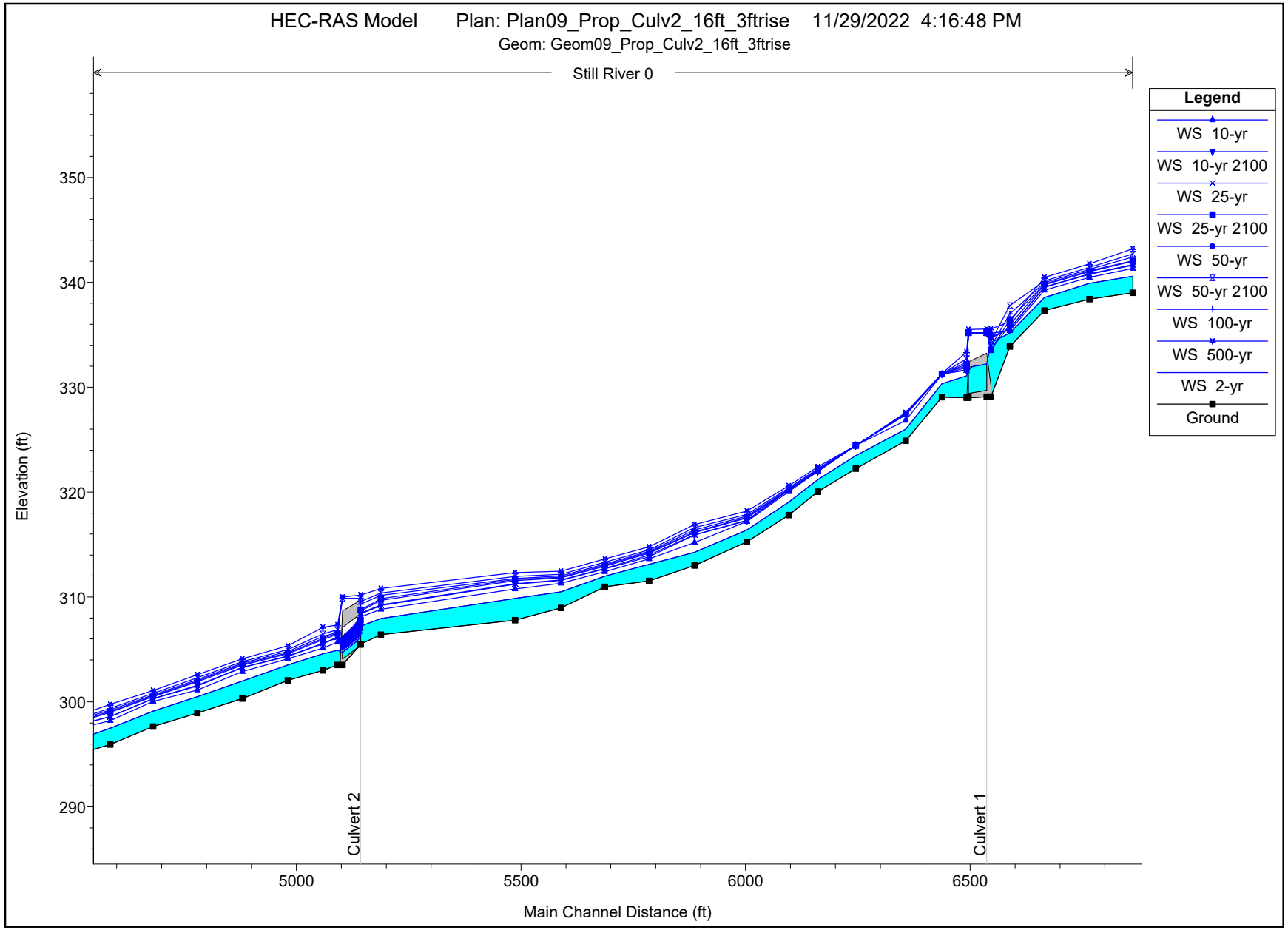

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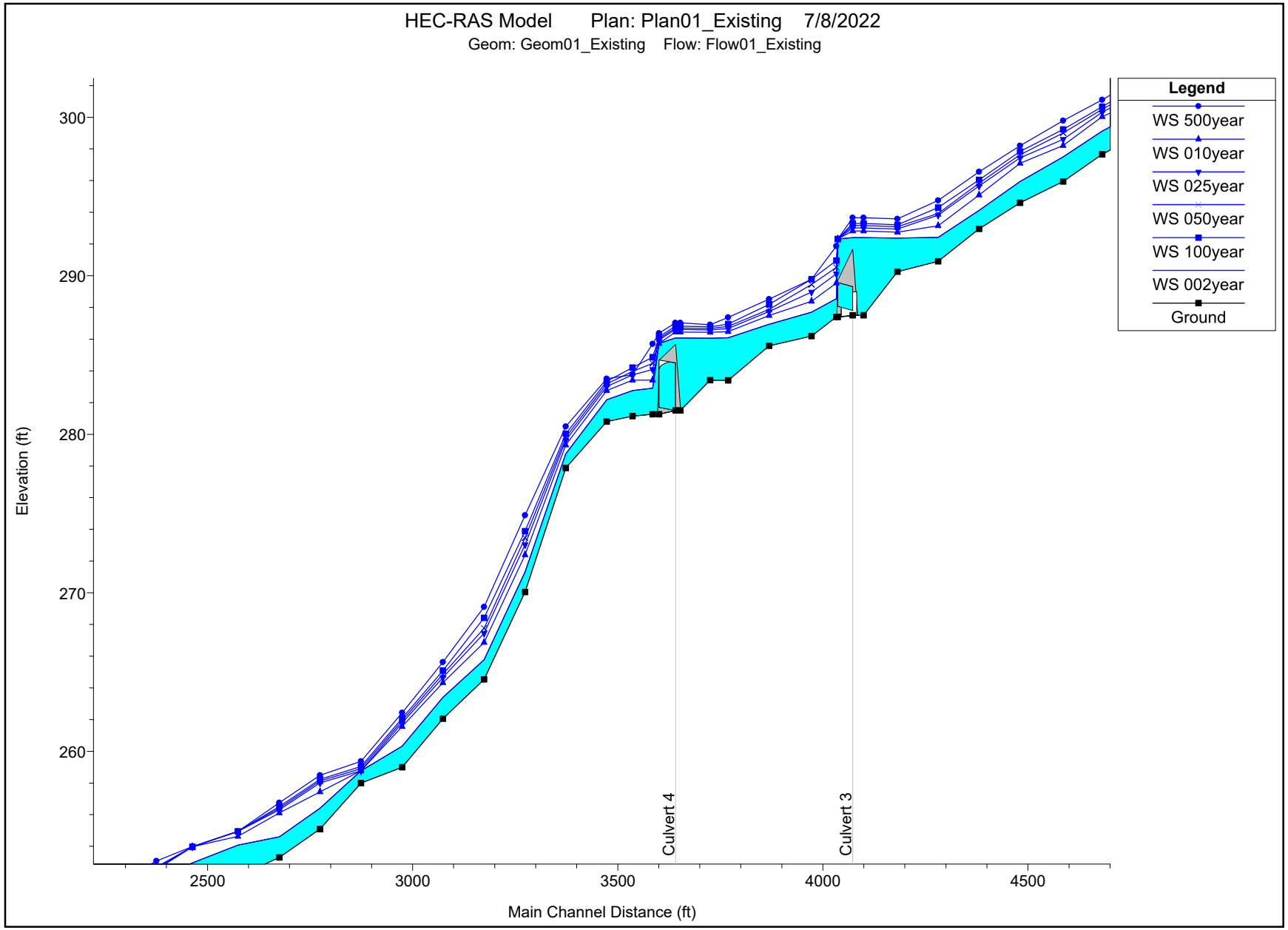

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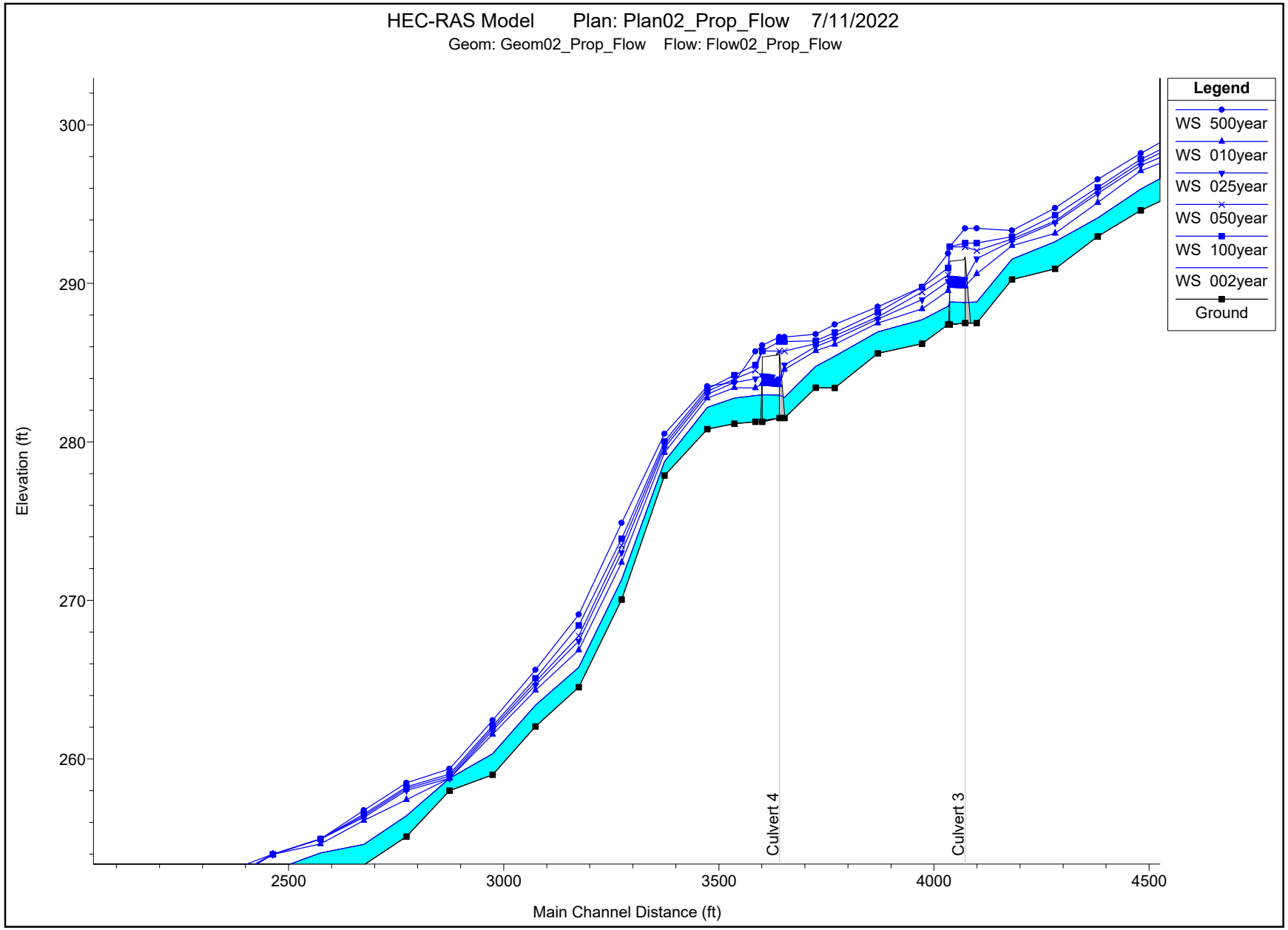

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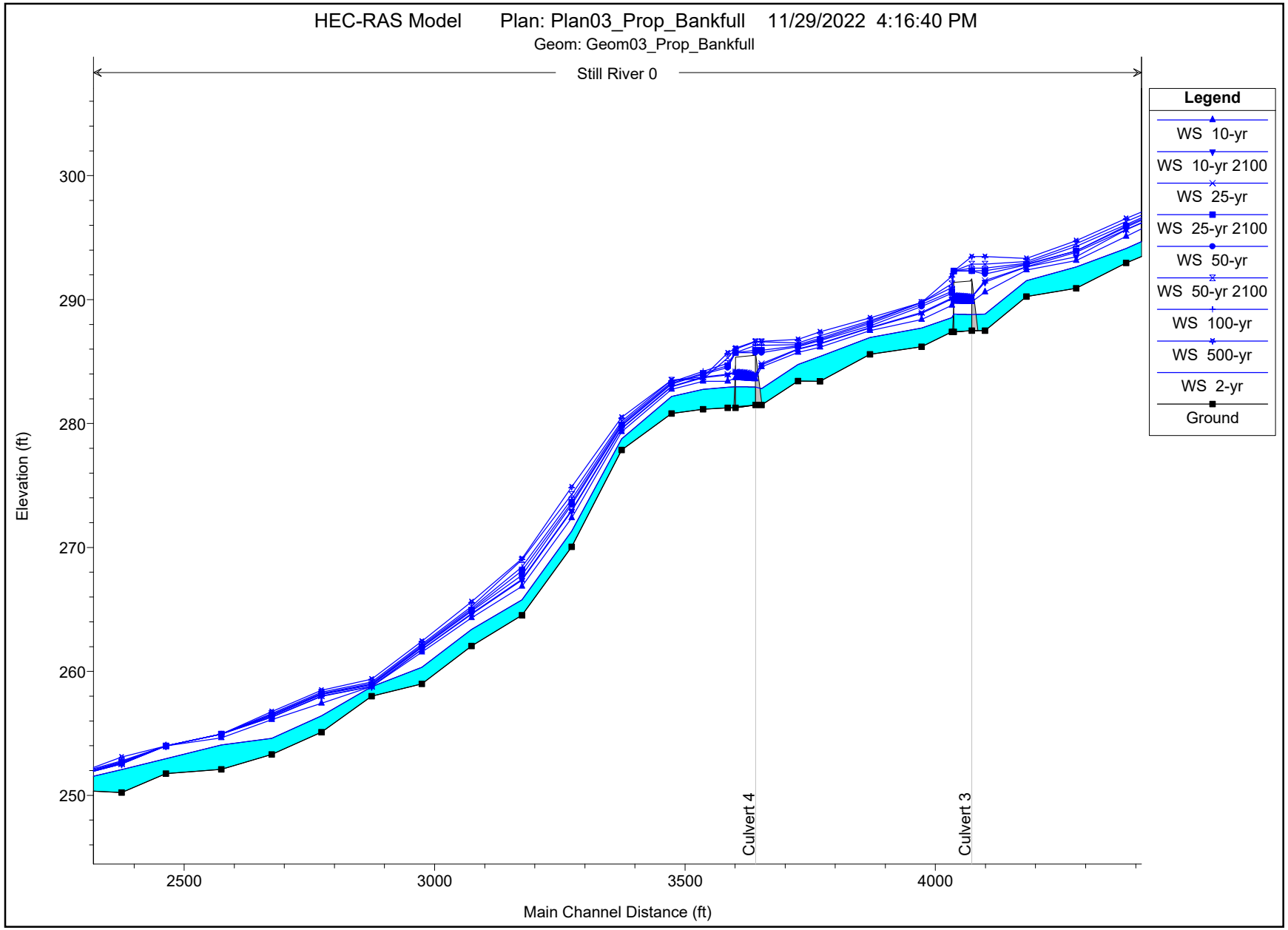

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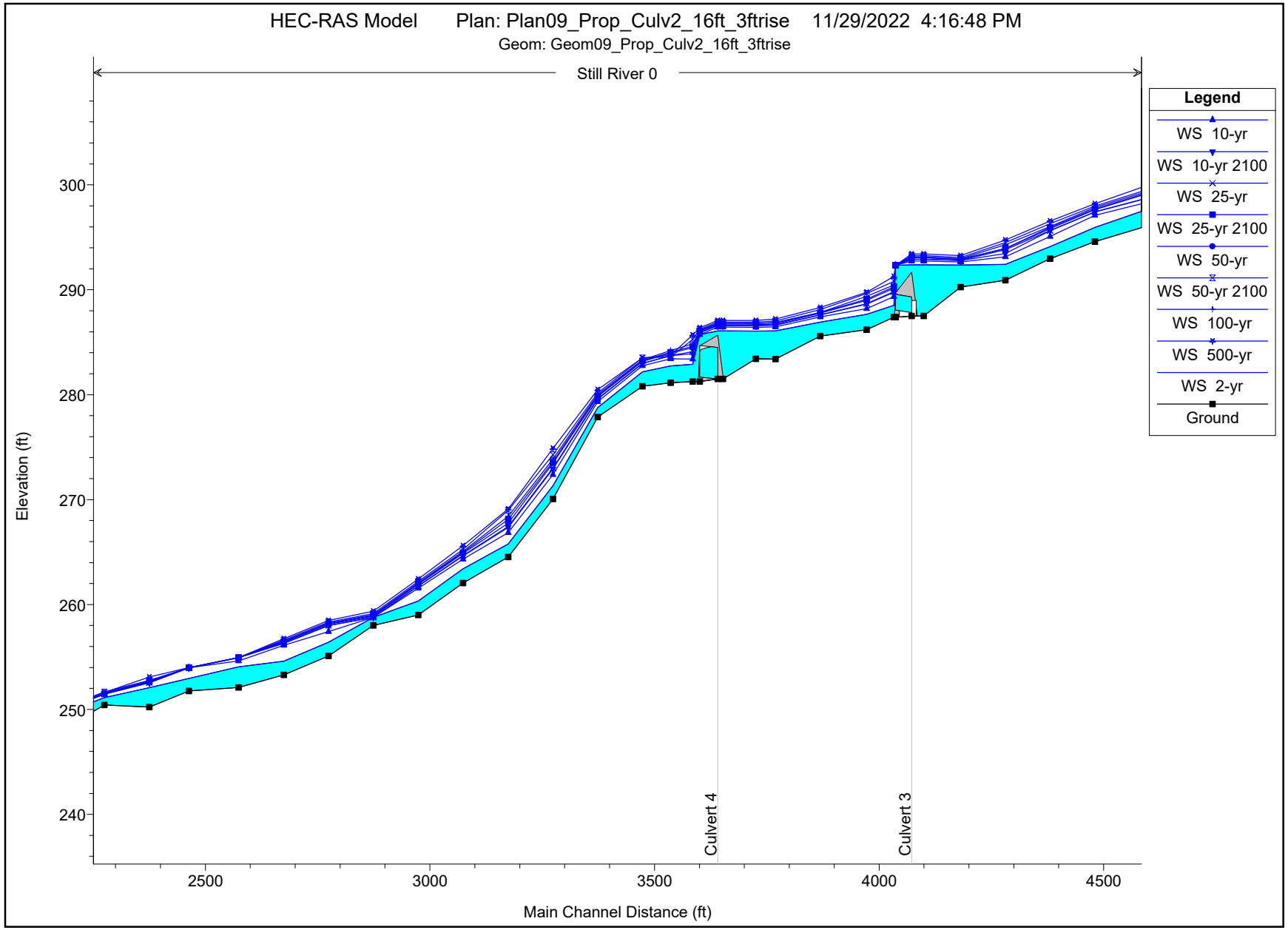

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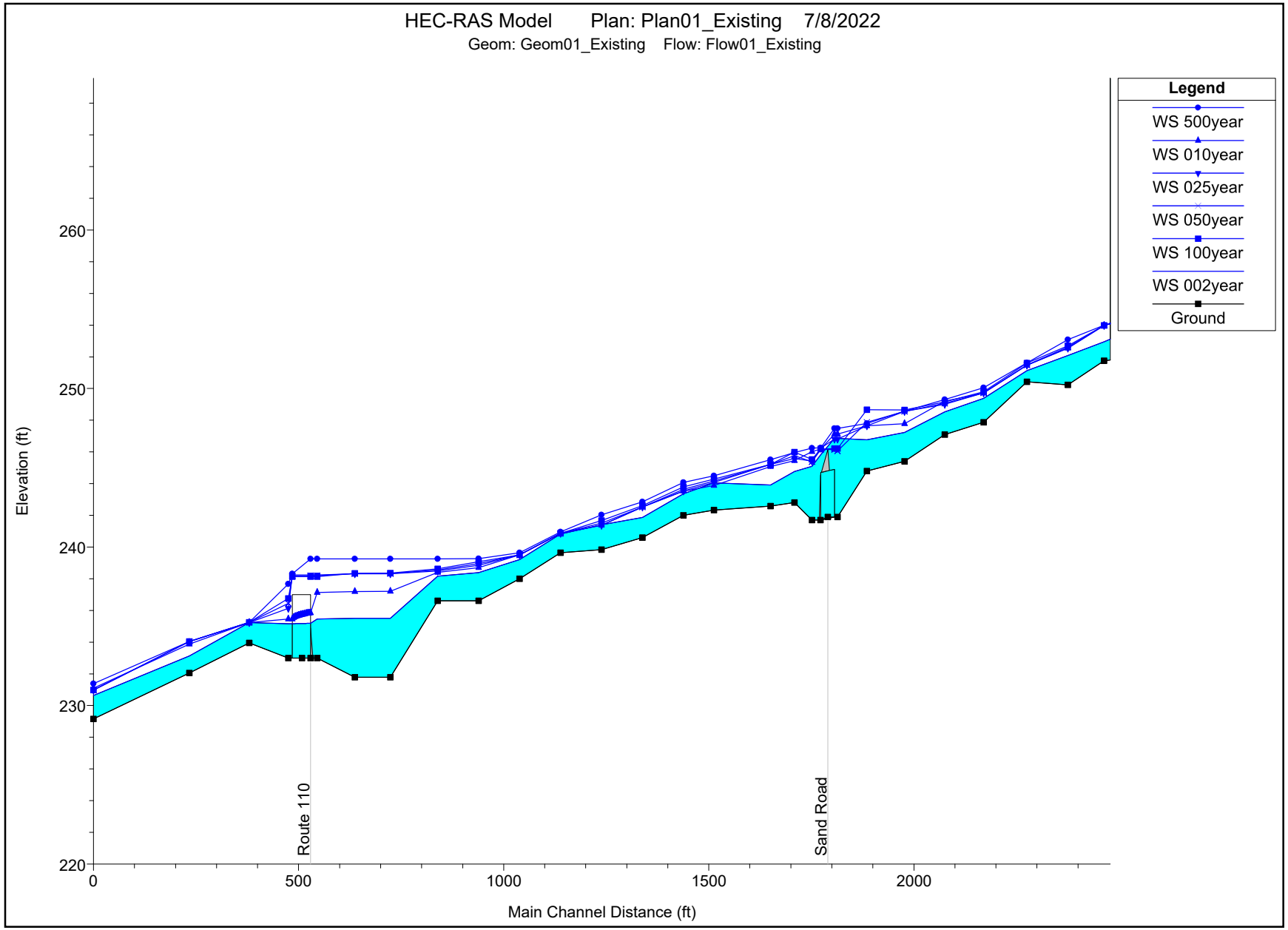

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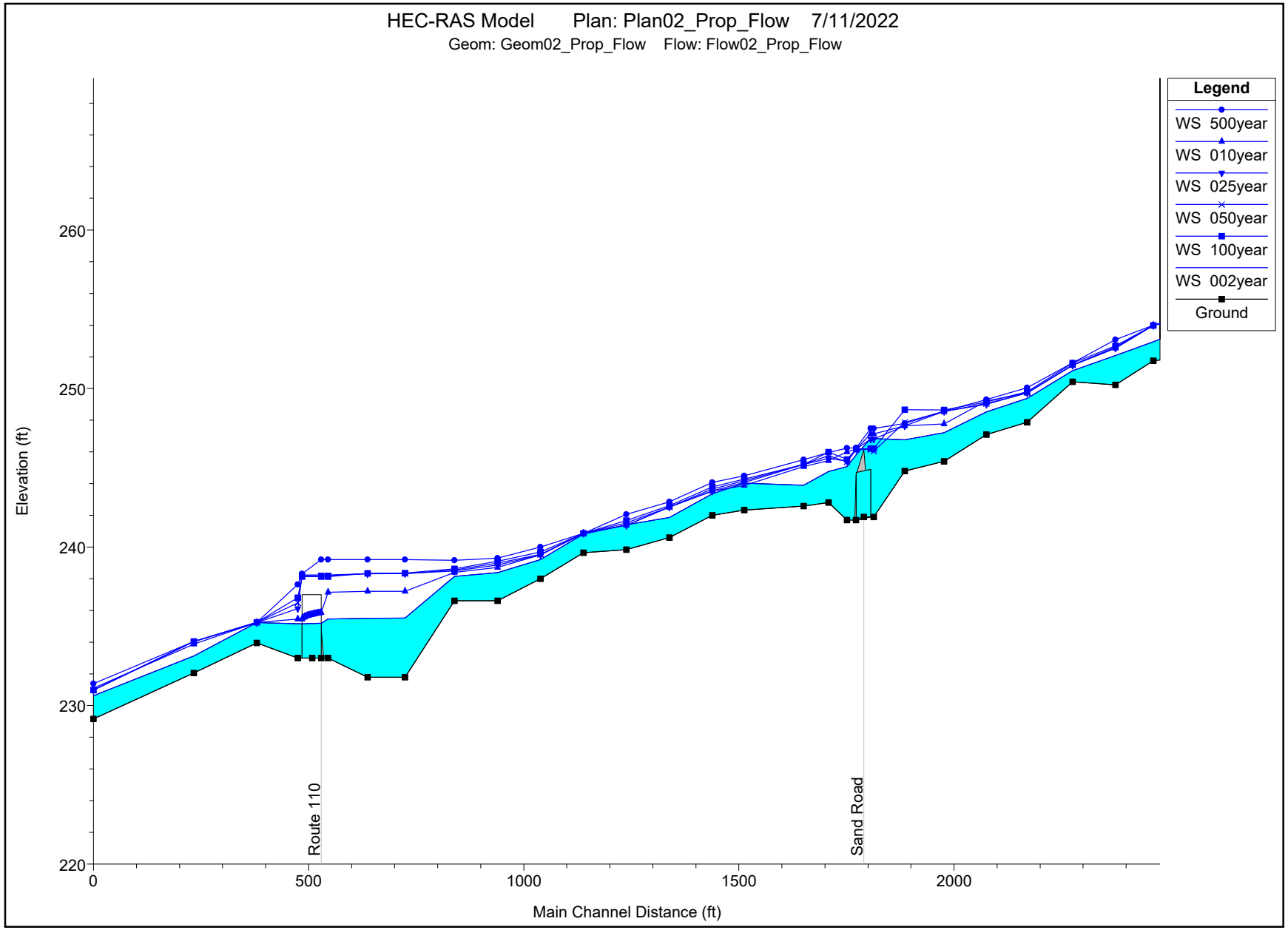

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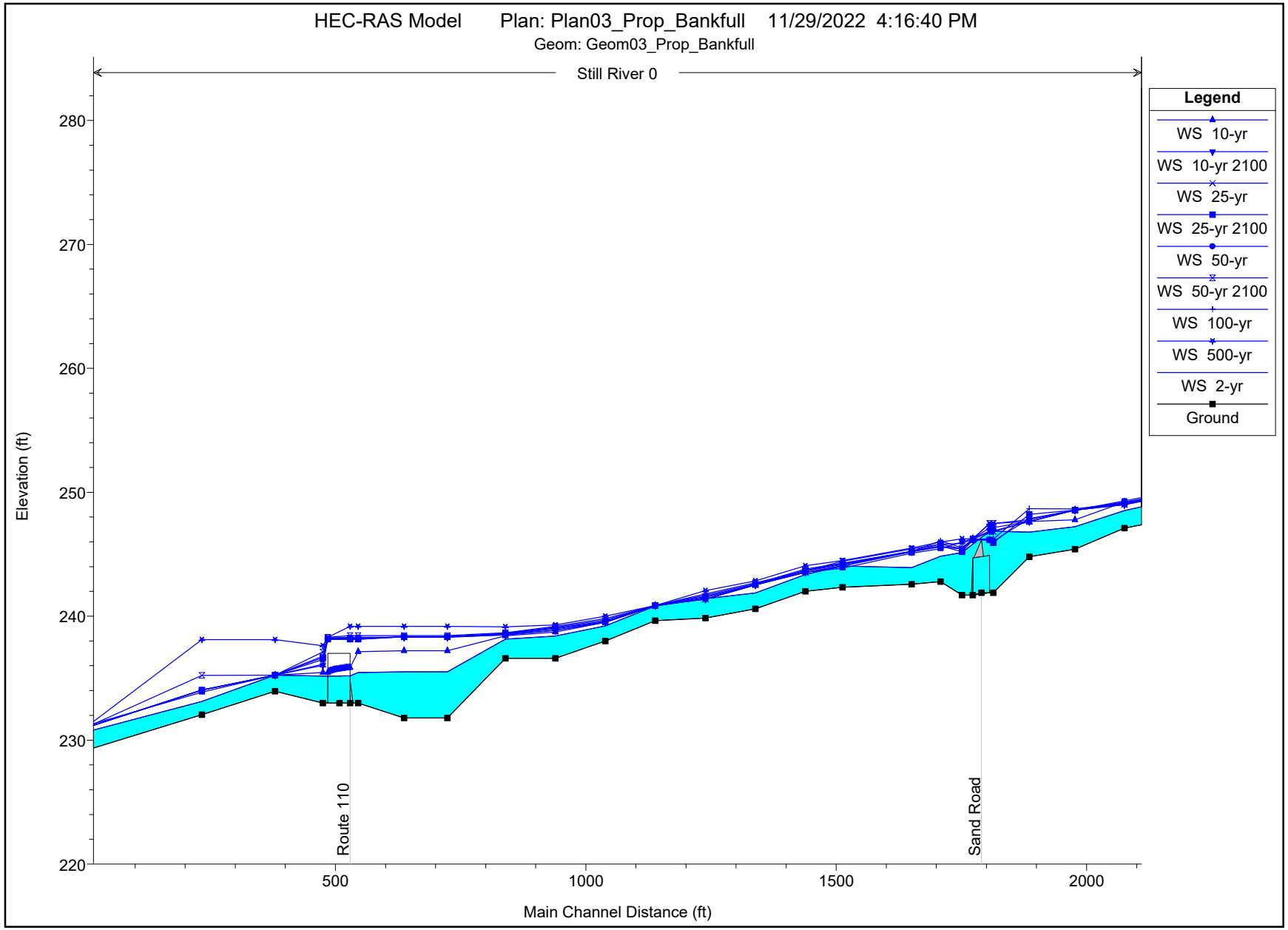

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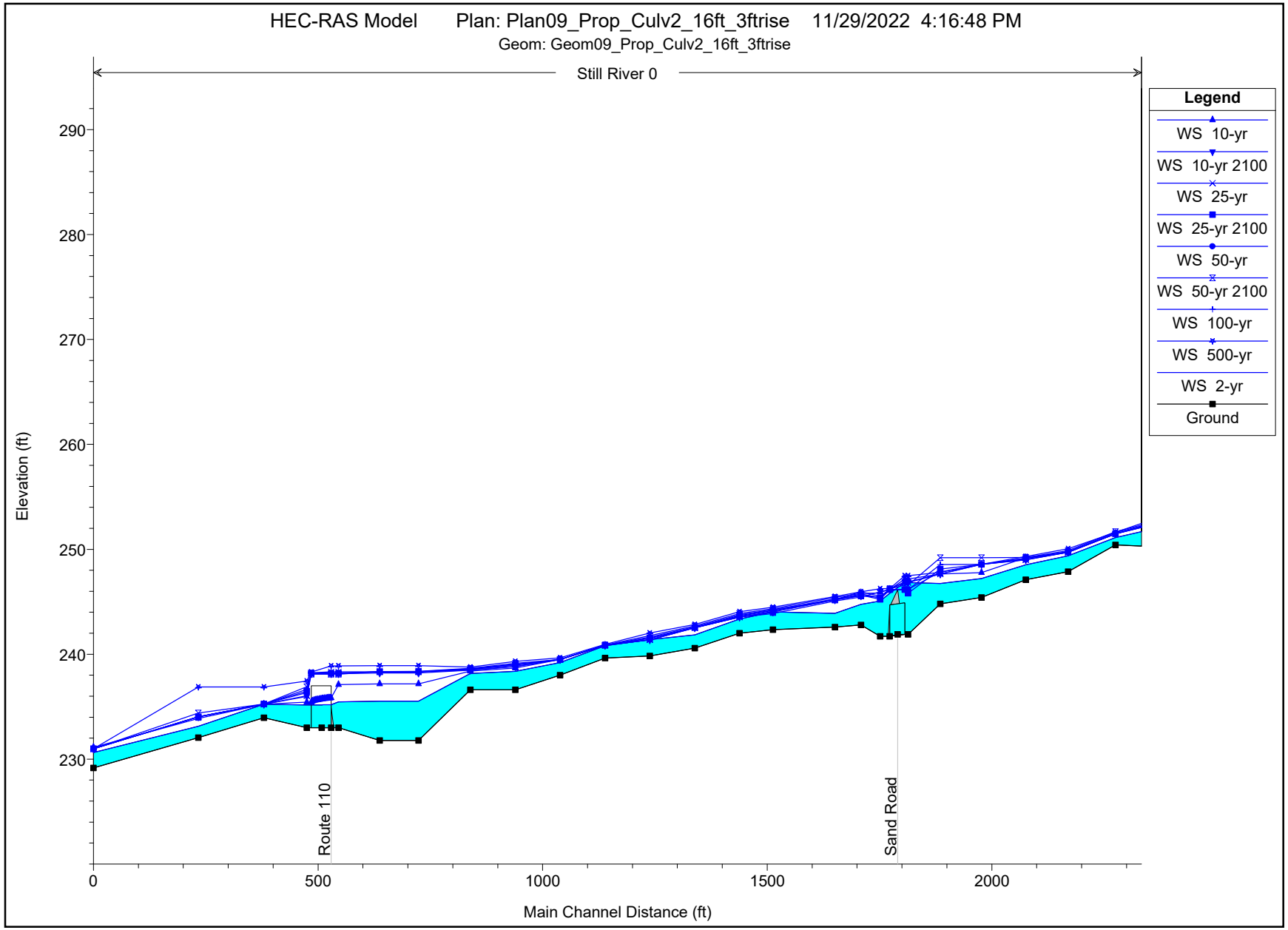

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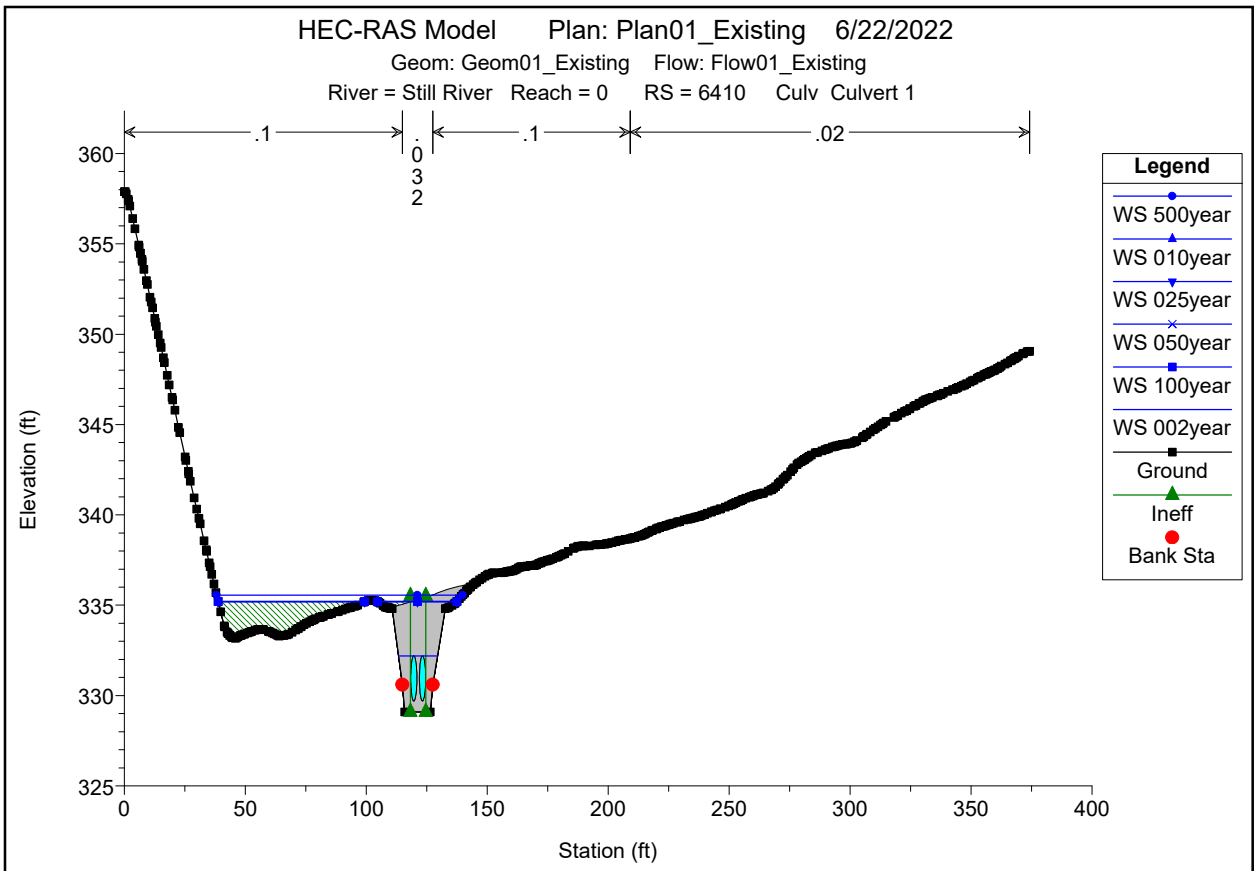

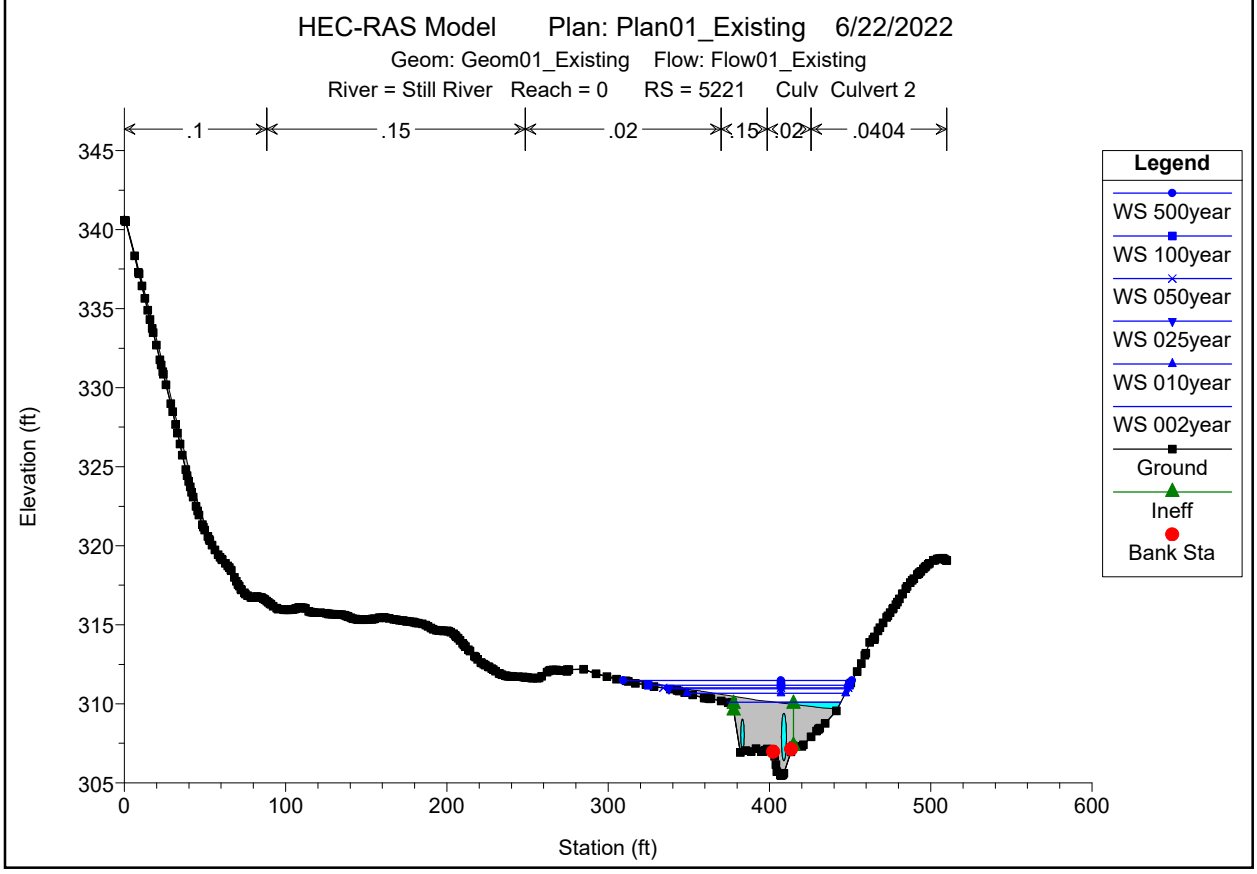

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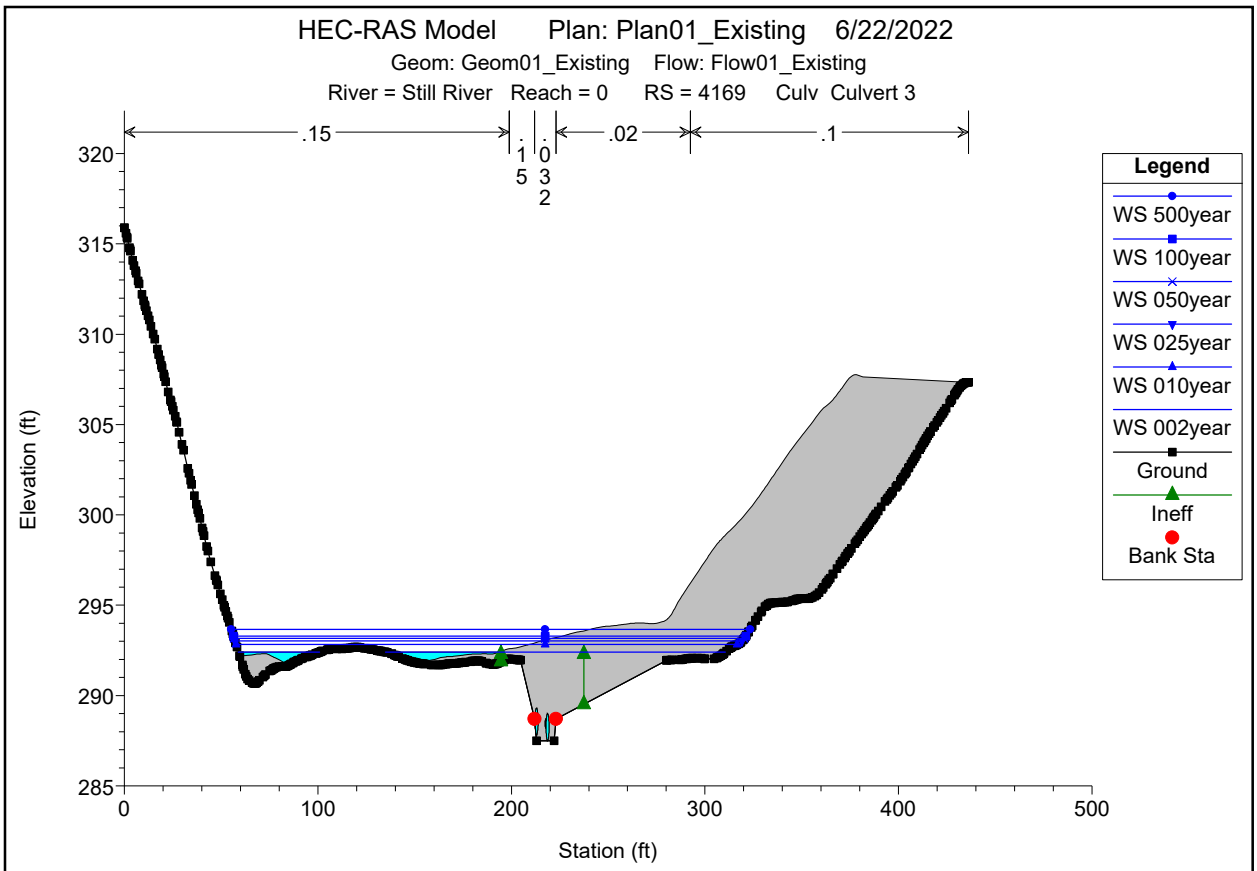

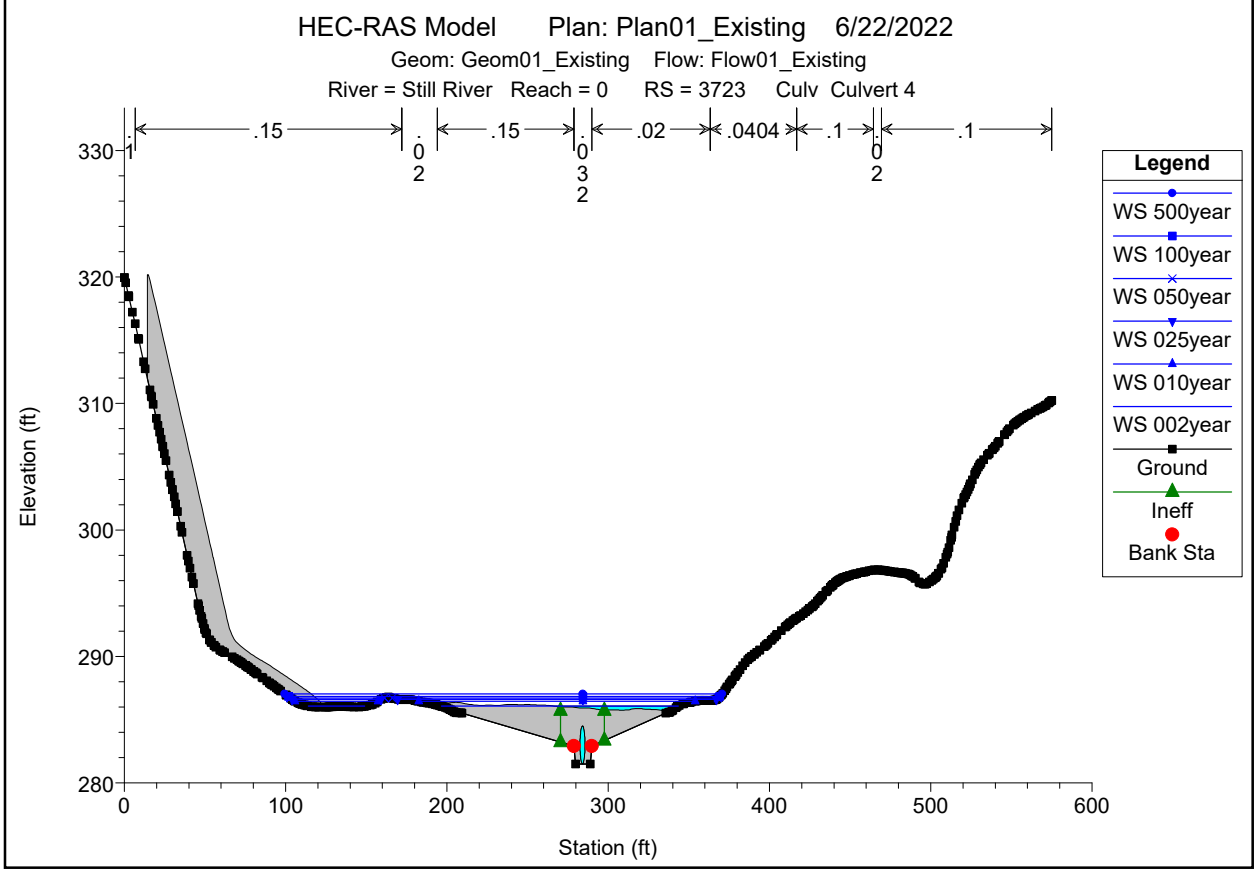

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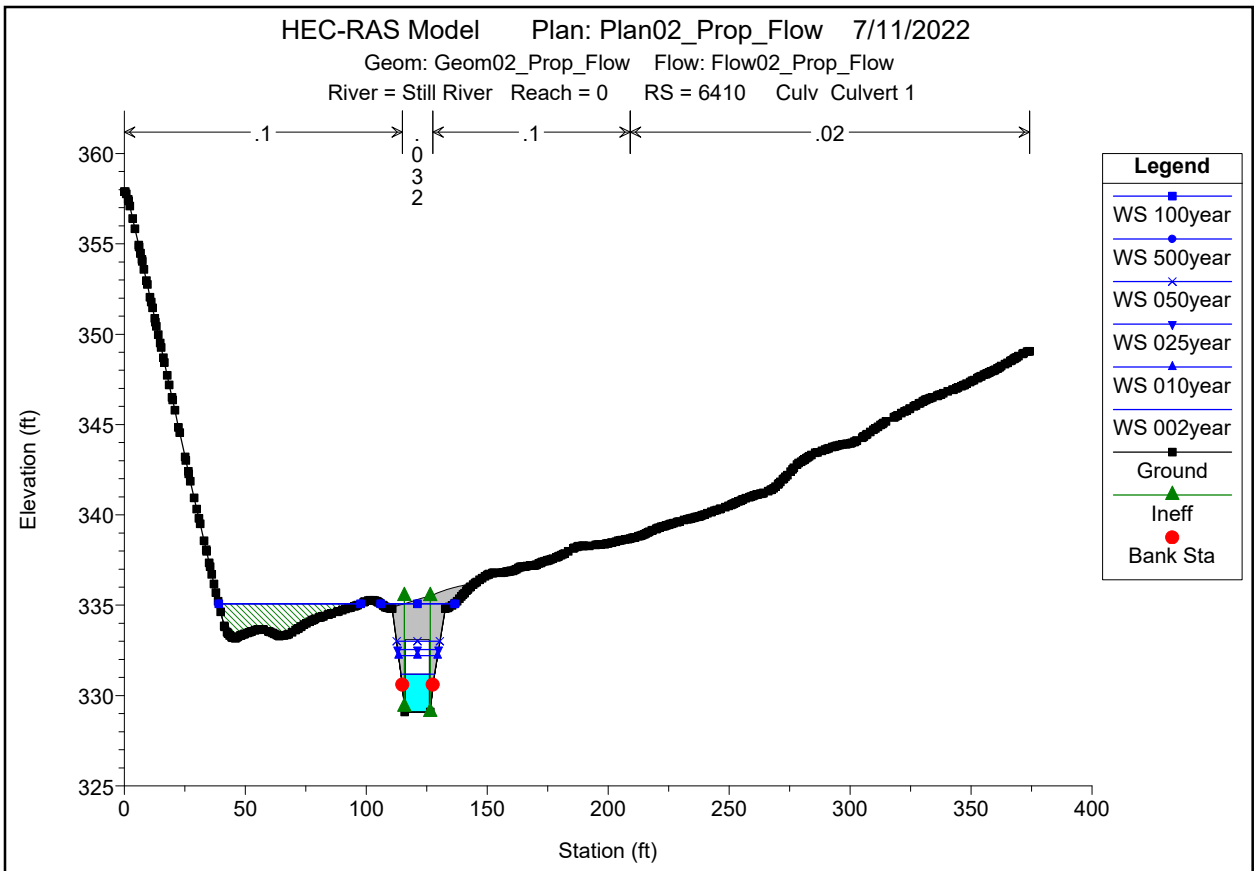

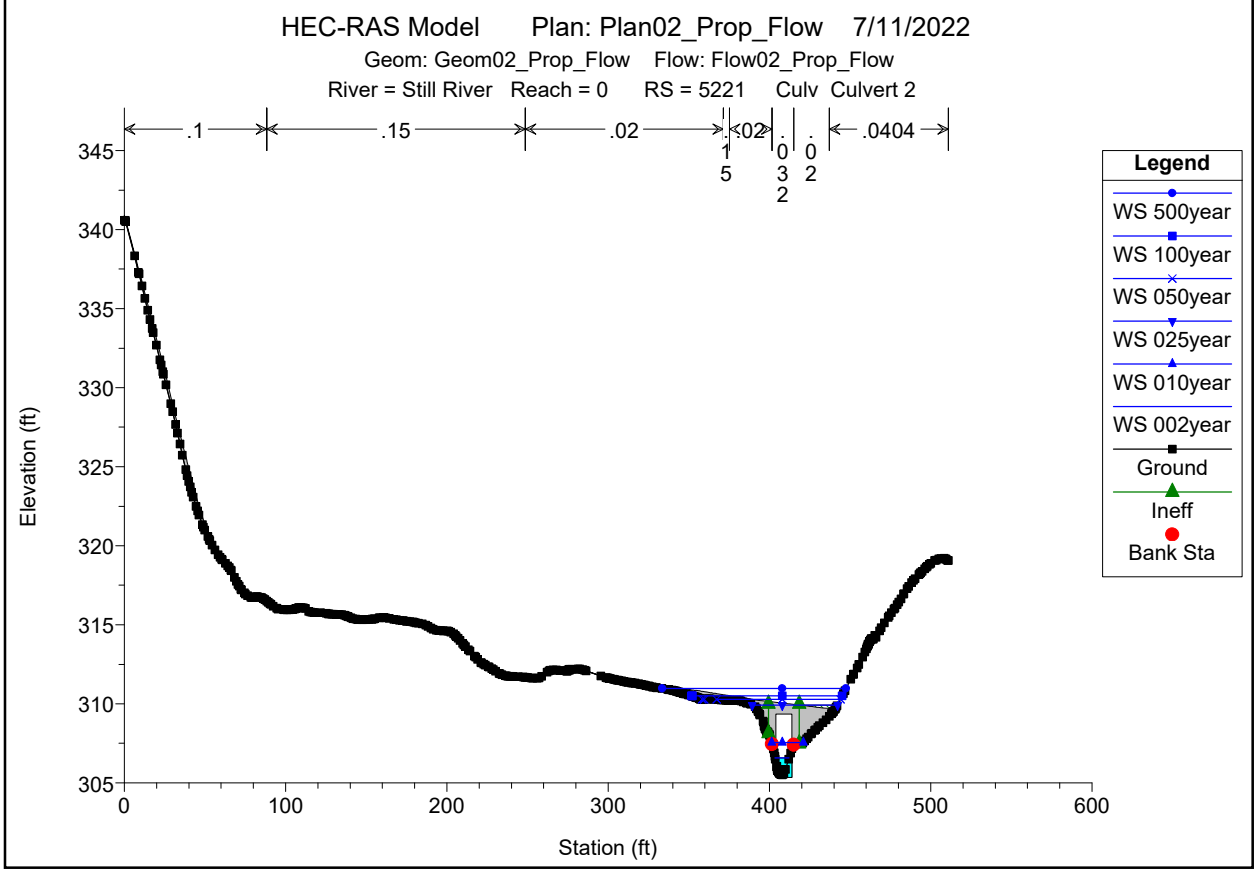

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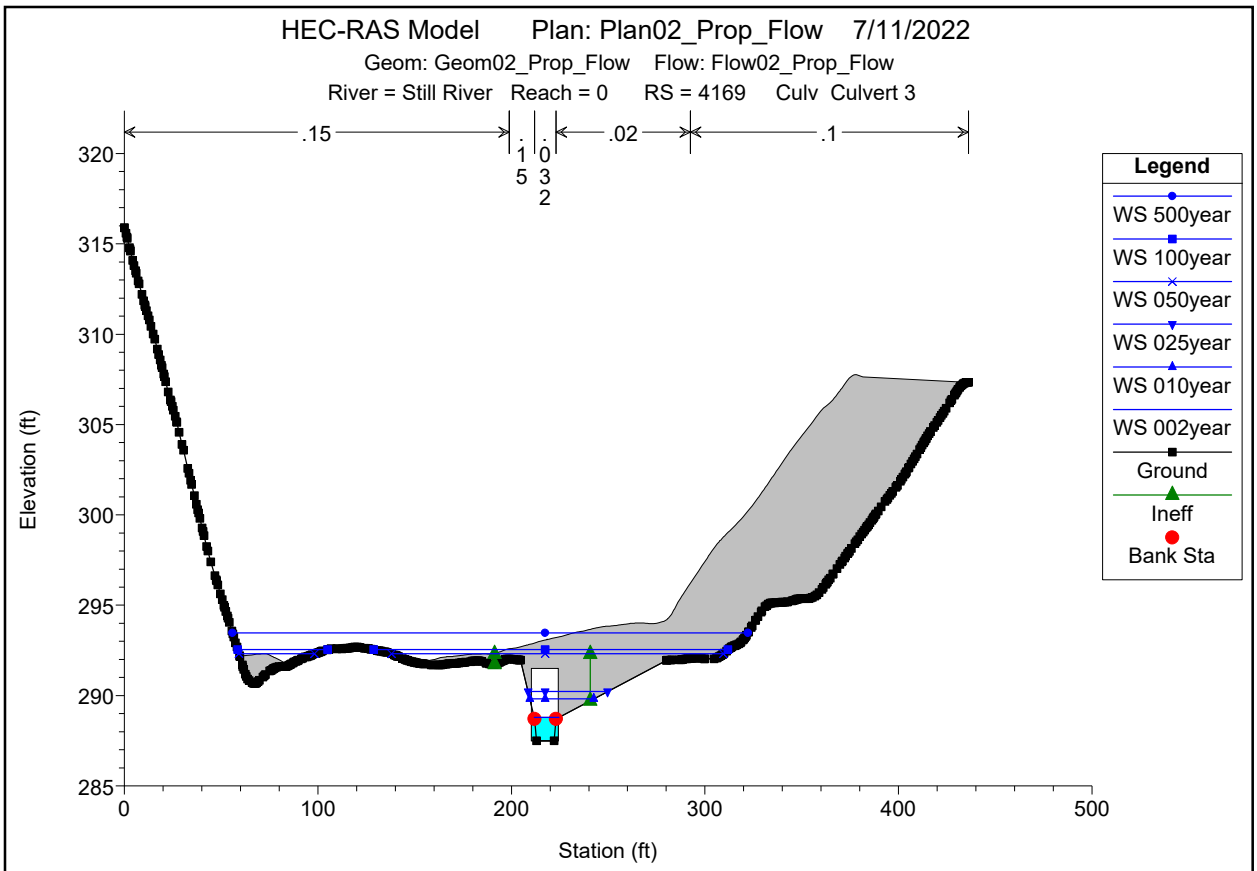

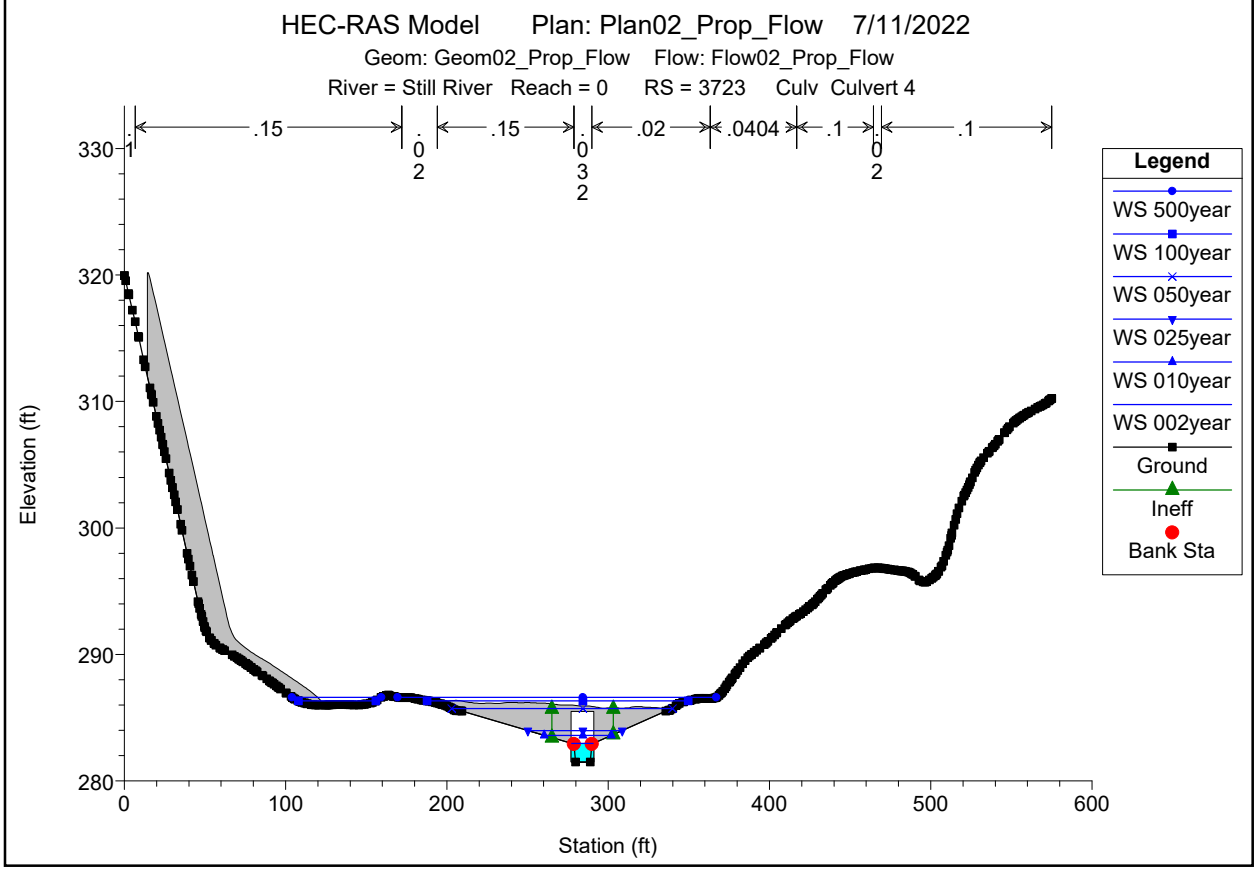

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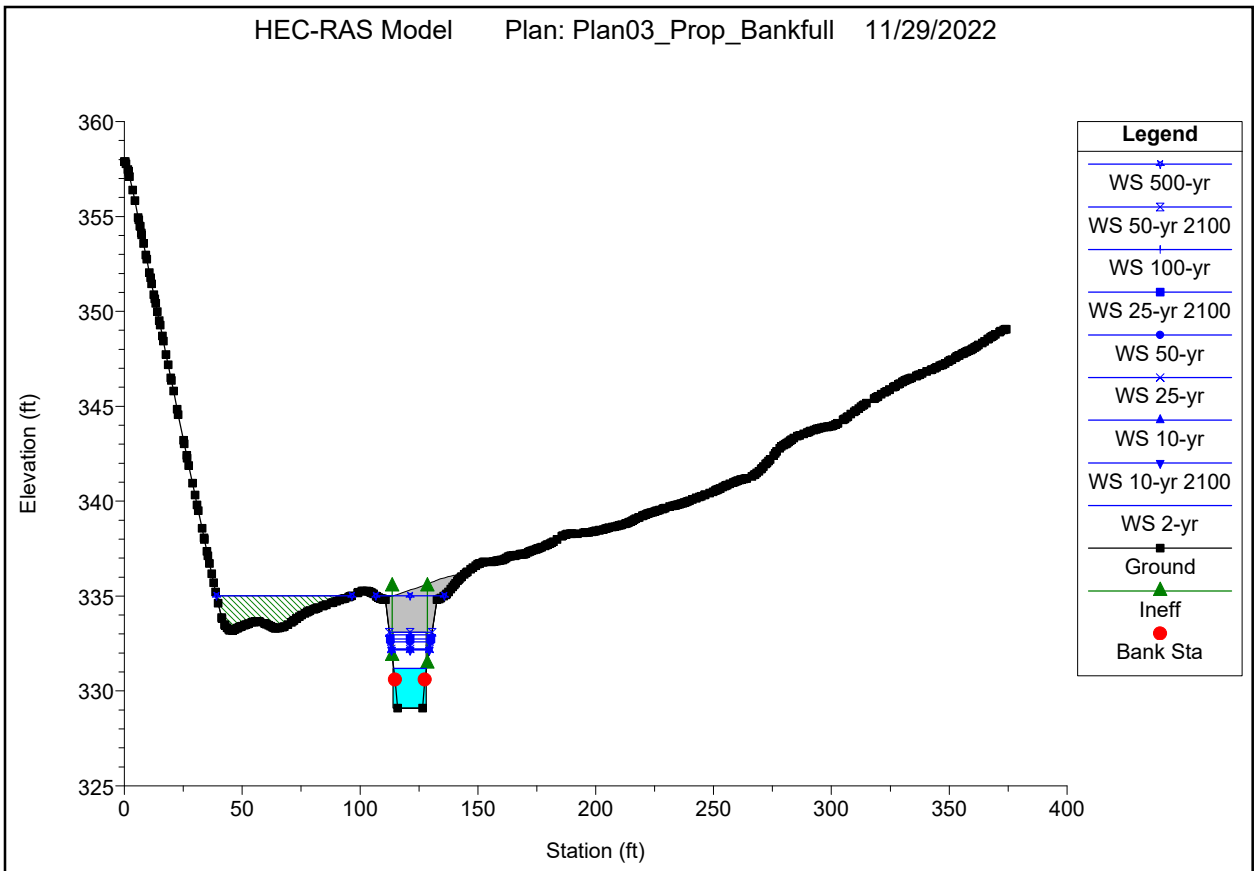

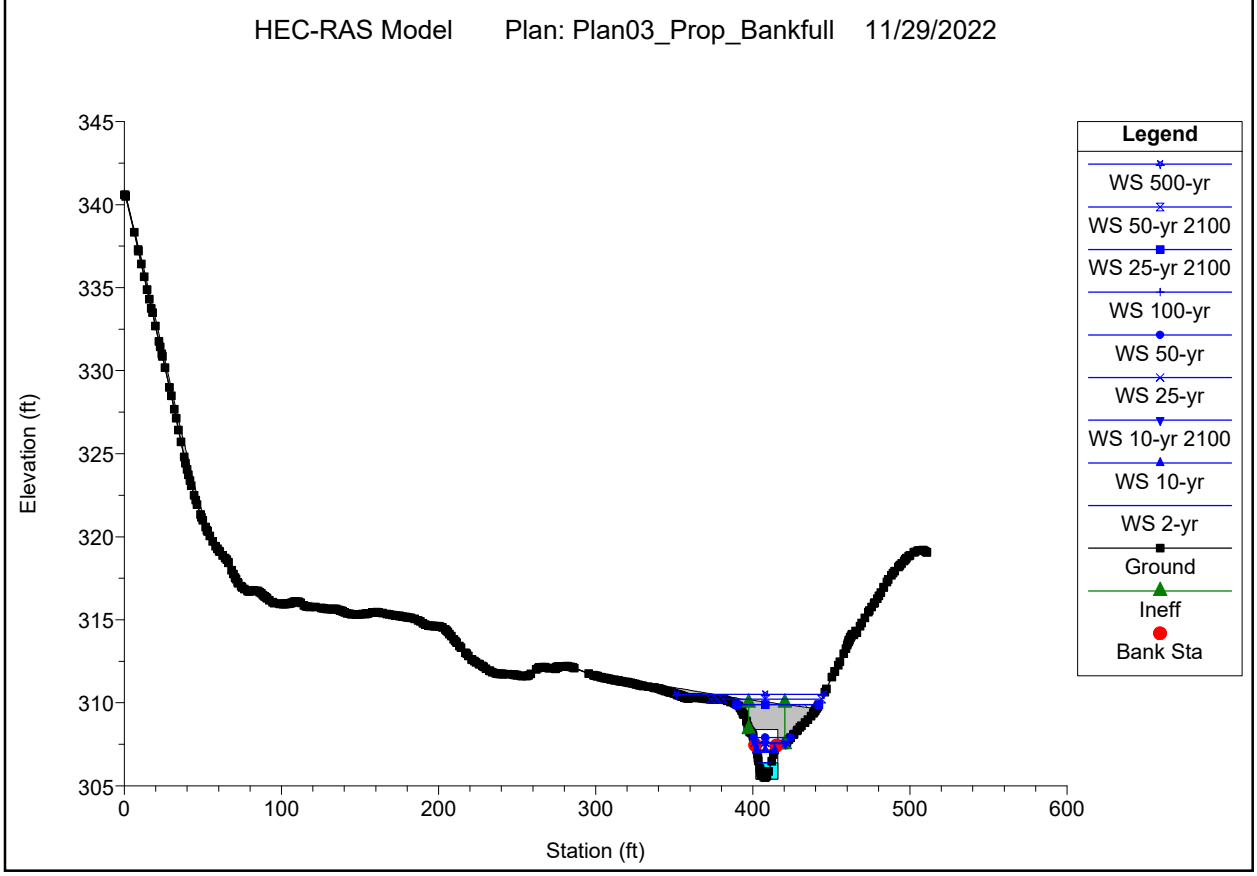

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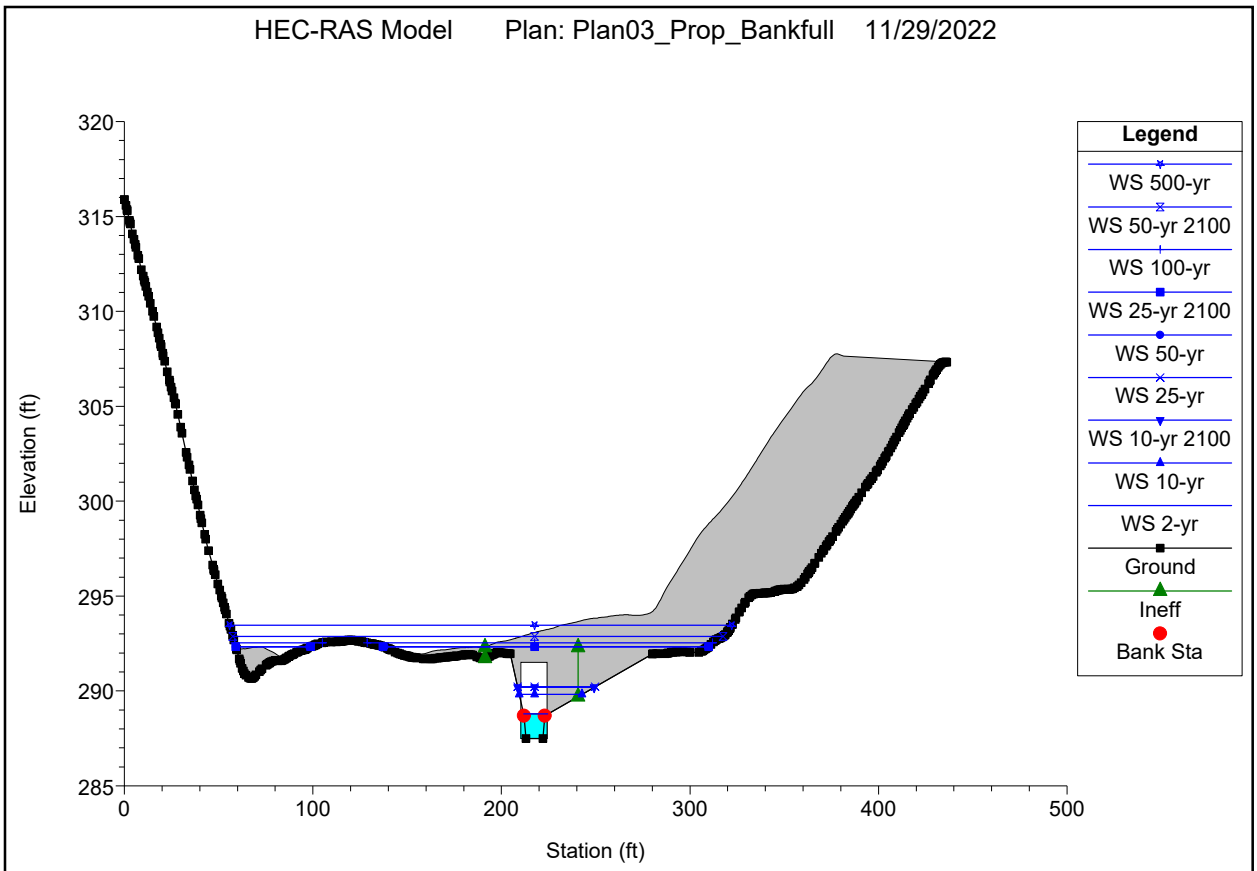

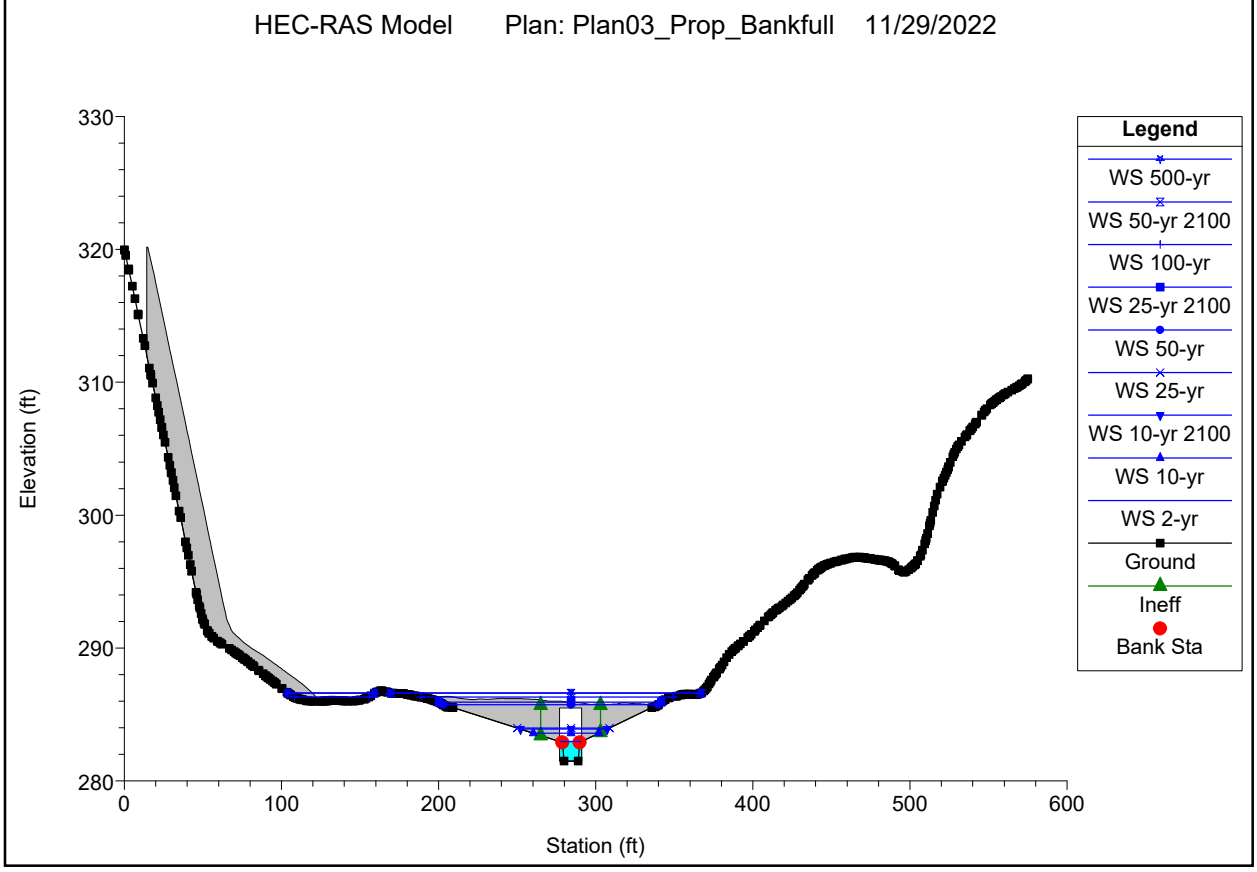

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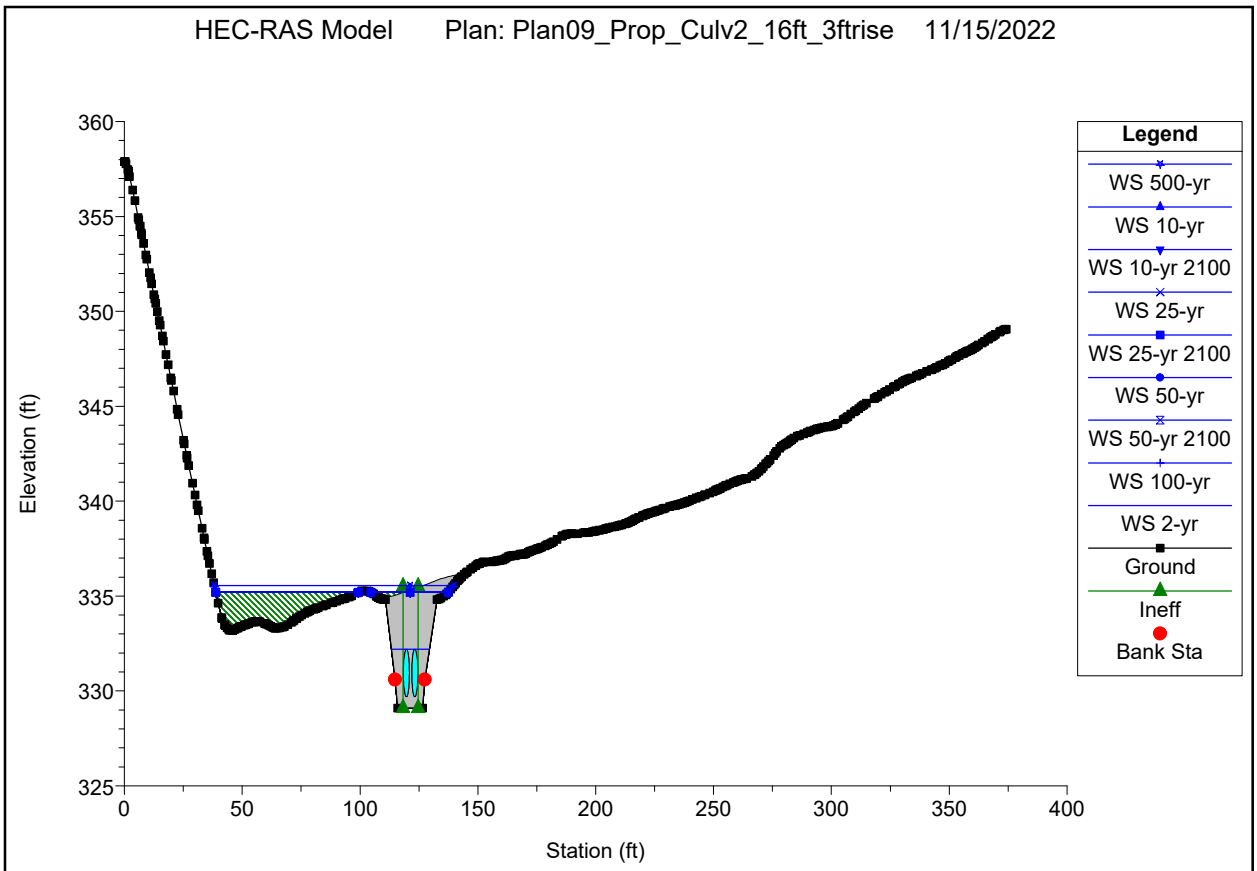

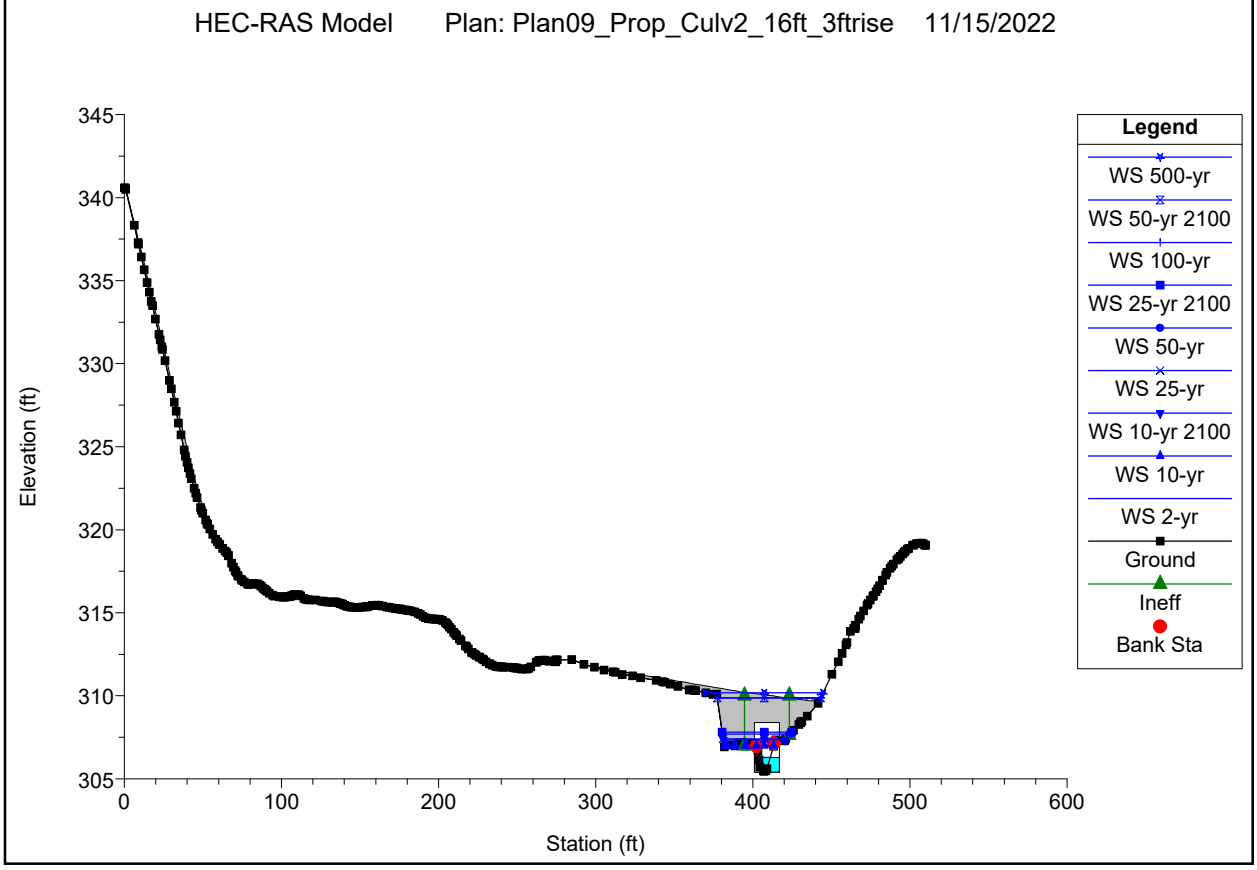

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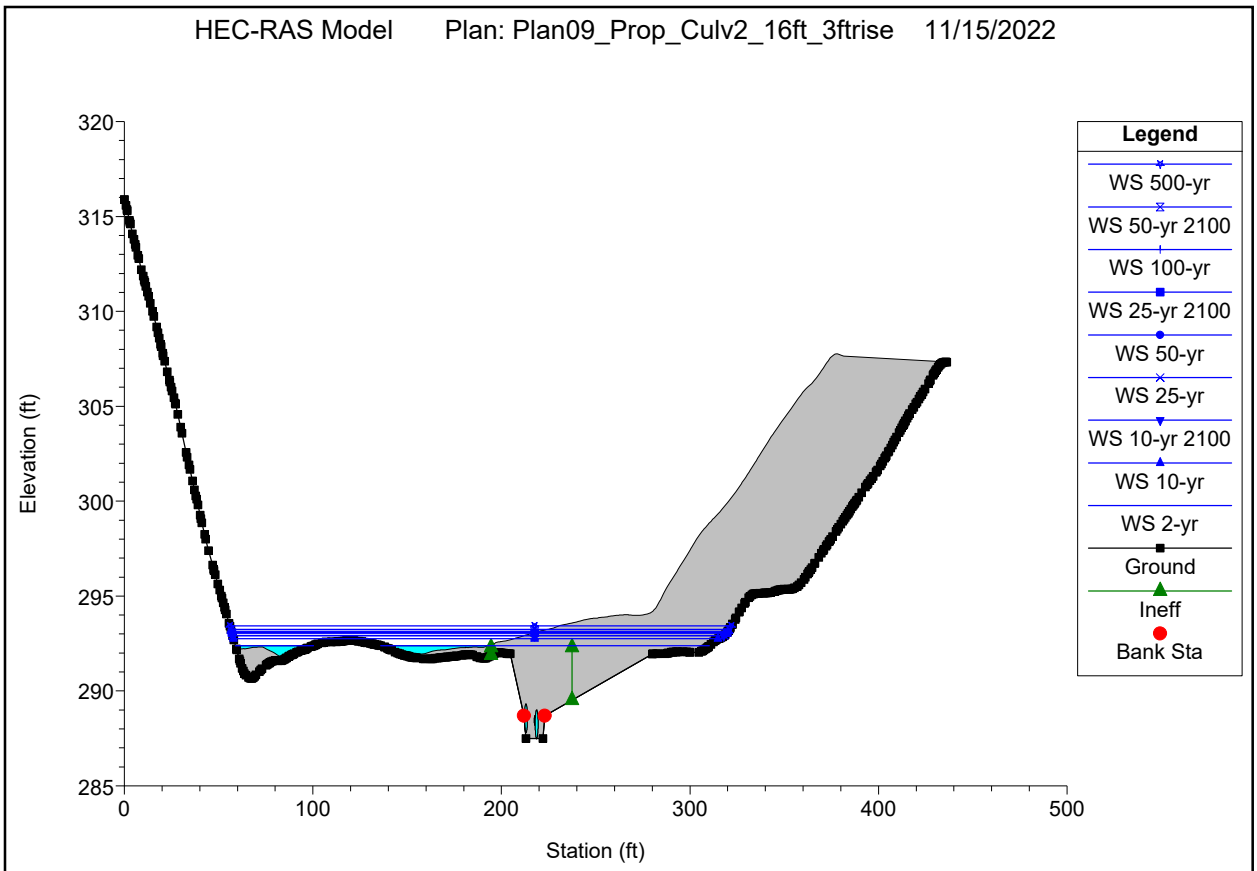

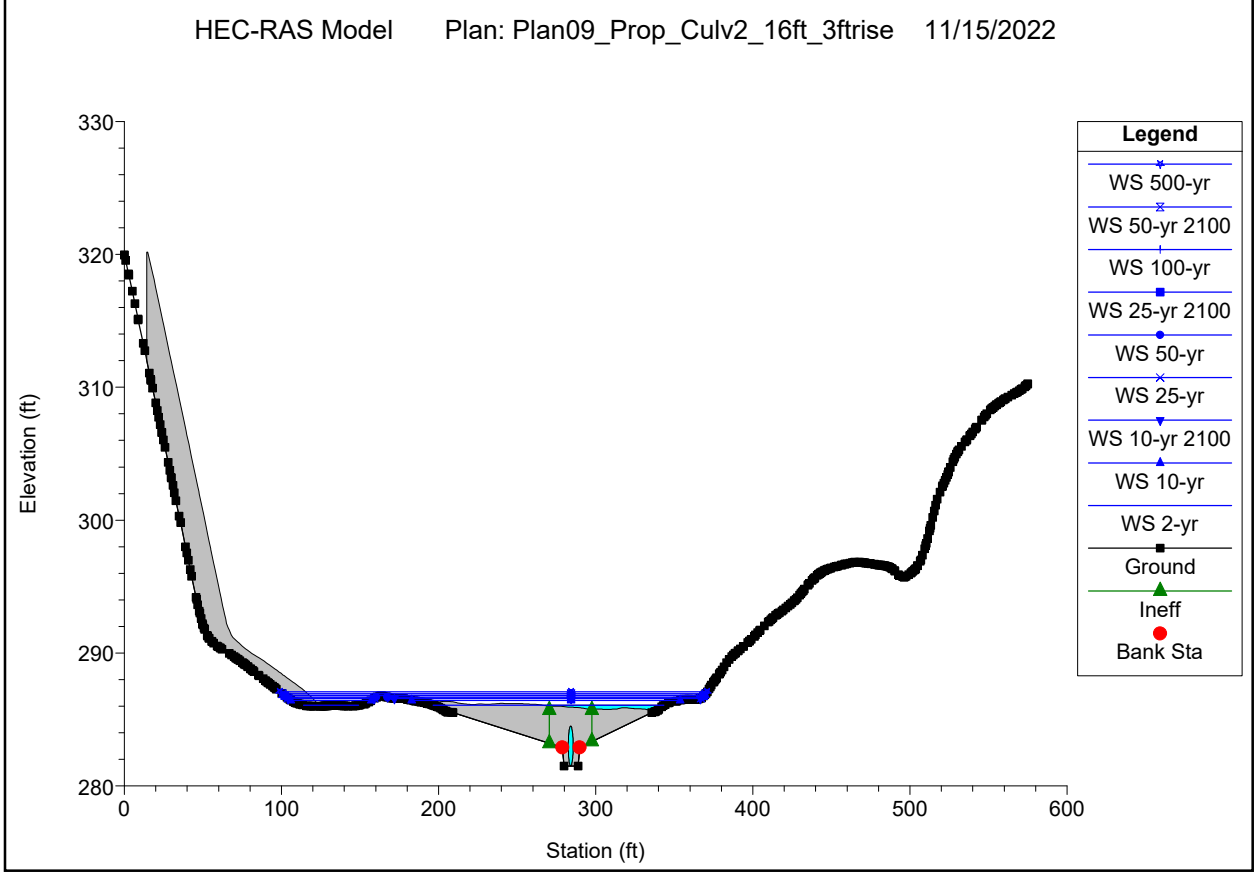

Table C-1
Existing Conditions HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6760	2-yr	76.79	339	340.59		340.93	0.0071	4.75	17.99	18.53	0.69		
6760	10-yr	183.75	339	341.32	341.21	342.08	0.0097	7.24	33.66	24.4	0.86		
6760	10-yr 2100	248.49	339	341.62	341.62	342.63	0.011	8.4	41.54	26.76	0.93		
6760	25-yr	258.27	339	341.68	341.68	342.71	0.0109	8.5	43.15	27.25	0.93		
6760	25-yr 2100	340.11	339	342.06	342.06	343.31	0.0114	9.52	53.89	30.29	0.98		
6760	50-yr	316.21	339	341.99	341.99	343.14	0.0107	9.1	51.87	29.69	0.95		
6760	50-yr 2100	436.89	339	342.69	342.69	343.93	0.009	9.65	77.08	40.44	0.9		
6760	100-yr	378.18	339	342.41	342.41	343.59	0.0093	9.27	66.26	37.8	0.9		
6760	500-yr	559.29	339	343.2	343.2	344.57	0.0087	10.34	99.04	45.07	0.9		
6664	2-yr	76.75	338.4	339.9	339.78	340.22	0.0075	4.71	24.1	42.37	0.7		
6664	10-yr	183.67	338.4	340.46	340.46	341.06	0.0104	6.92	49.04	46.61	0.87		
6664	10-yr 2100	248.46	338.4	340.76	340.76	341.46	0.0105	7.65	63.3	48.73	0.9		
6664	25-yr	258.25	338.4	340.8	340.8	341.51	0.0106	7.76	65.17	49	0.9		
6664	25-yr 2100	340.09	338.4	341.09	341.09	341.94	0.0111	8.64	79.79	50.95	0.95		
6664	50-yr	316.19	338.4	341.01	341.01	341.82	0.0108	8.35	76.09	50.42	0.93		
6664	50-yr 2100	436.85	338.4	341.42	341.42	342.39	0.0112	9.4	97.23	53.67	0.97		
6664	100-yr	378.17	338.4	341.23	341.23	342.12	0.0111	8.94	86.9	52.02	0.96		
6664	500-yr	559.09	338.4	341.76	341.76	342.9	0.0118	10.38	116.09	77.84	1.01		
6564	2-yr	76.75	337.3	338.56	338.56	339.13	0.0161	6.07	12.75	31.58	1		
6564	10-yr	183.67	337.3	339.25	339.25	339.8	0.0109	6.82	53.32	53.23	0.89		
6564	10-yr 2100	248.46	337.3	339.51	339.51	340.16	0.0114	7.6	67.58	55.21	0.93		
6564	25-yr	258.25	337.3	339.55	339.55	340.21	0.0114	7.71	69.65	55.49	0.93		
6564	25-yr 2100	340.09	337.3	339.83	339.83	340.6	0.0118	8.51	85.64	57.42	0.96		
6564	50-yr	316.19	337.3	339.76	339.76	340.49	0.0115	8.25	81.57	56.95	0.95		
6564	50-yr 2100	436.85	337.3	340.13	340.13	341.01	0.0119	9.27	103.43	59.42	0.99		
6564	100-yr	378.17	337.3	339.95	339.95	340.77	0.0119	8.83	92.72	58.22	0.98		
6564	500-yr	559.09	337.3	340.46	340.46	341.48	0.0123	10.15	123.28	61.47	1.02		
6487	2-yr	76.75	333.9	335.17	335.17	335.69	0.014	5.77	14.3	73.93	0.93		
6487	10-yr	183.67	333.9	335.39	335.39	335.79	0.0146	6.61	67.74	79.56	0.98		
6487	10-yr 2100	248.46	333.9	335.58	335.58	336.05	0.0153	7.35	83.24	81.22	1.03		
6487	25-yr	258.25	333.9	335.61	335.61	336.09	0.0155	7.48	85.09	81.38	1.04		
6487	25-yr 2100	340.09	333.9	336.44	335.82	336.67	0.0048	5.48	154.97	85.31	0.62		
6487	50-yr	316.19	333.9	335.94	335.76	336.33	0.0105	6.98	112.56	83	0.88		
6487	50-yr 2100	436.85	333.9	337.78	336.03	337.89	0.0015	4.05	273.11	91.99	0.37		
6487	100-yr	378.17	333.9	336.98	335.9	337.14	0.0027	4.7	201.67	87.67	0.48		
6487	500-yr	559.09	333.9	336.27	336.27	337.03	0.0175	9.97	139.82	84.51	1.16		
6445	2-yr	76.75	329.1	334.26	330.75	334.35	0.0003	2.34	32.82	59.48	0.18		
6445	10-yr	183.67	329.1	335.14	332.07	335.5	0.001	4.78	38.44	91.32	0.34		
6445	10-yr 2100	248.46	329.1	334.76	332.72	335.5	0.0022	6.9	35.99	72.97	0.51		
6445	25-yr	258.25	329.1	334.67	332.81	335.5	0.0025	7.29	35.45	70.73	0.54		
6445	25-yr 2100	340.09	329.1	333.55	333.55	335.79	0.0091	12.01	28.32	40.03	1		
6445	50-yr	316.19	329.1	333.58	333.36	335.49	0.0077	11.1	28.48	41.54	0.93		
6445	50-yr 2100	436.85	329.1	334.36	334.36	337.01	0.0086	13.05	33.48	62.24	1		
6445	100-yr	378.17	329.1	333.89	333.89	336.28	0.0088	12.4	30.5	52.7	1		
6445	500-yr	559.09	329.1	335.57	335.31	336	0.0015	5.77	212.33	101.76	0.4		
6410	2-yr	76.75										7.82	8.74
6410	10-yr	183.67										9.16	9.18
6410	10-yr 2100	248.46										9.27	9.83
6410	25-yr	258.25										9.27	9.76
6410	25-yr 2100	340.09										8.14	8.14
6410	50-yr	316.19										8.6	8.6
6410	50-yr 2100	436.85										6.46	6.46
6410	100-yr	378.17										7.37	7.37
6410	500-yr	559.09										4.49	4.49
6391	2-yr	76.75	329	331.08	330.23	331.27	0.0024	3.5	23.82	30.97	0.43		
6391	10-yr	183.67	329	331.87	331.15	332.41	0.0044	5.96	34.55	48.53	0.63		
6391	10-yr 2100	248.46	329	331.6	331.6	332.82	0.0114	8.93	30.93	42.61	0.99		
6391	25-yr	258.25	329	331.66	331.66	332.92	0.0115	9.09	31.67	43.81	0.99		
6391	25-yr 2100	340.09	329	332.17	332.17	333.67	0.0108	9.95	38.59	55.14	0.99		
6391	50-yr	316.19	329	332.02	332.02	333.46	0.0111	9.74	36.5	51.71	1		

Table C-1
Existing Conditions HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6391	50-yr 2100	436.85	329	332.72	332.72	334.49	0.0103	10.81	46.03	105.84	1		
6391	100-yr	378.17	329	332.39	332.39	334	0.0106	10.31	41.58	60.02	1		
6391	500-yr	559.09	329	333.36	333.36	335.44	0.0098	11.74	54.65	164.63	1		
6336	2-yr	76.75	329.1	330.33	330.33	330.88	0.0155	5.98	13.36	67.72	0.98		
6336	10-yr	183.67	329.1	331.21	331.21	331.98	0.0111	7.37	45.8	110.02	0.91		
6336	10-yr 2100	248.46	329.1	331.26	331.26	331.42	0.0044	4.73	164.89	114.44	0.58		
6336	25-yr	258.25	329.1	331.26	331.26	331.43	0.0048	4.92	164.89	114.44	0.6		
6336	25-yr 2100	340.09	329.1	331.26	331.26	331.56	0.0083	6.47	164.89	114.44	0.79		
6336	50-yr	316.19	329.1	331.26	331.26	331.52	0.0072	6.02	164.89	114.44	0.73		
6336	50-yr 2100	436.85	329.1	331.27	331.27	331.76	0.0135	8.28	165.74	114.57	1.01		
6336	100-yr	378.17	329.1	331.26	331.26	331.63	0.0103	7.2	164.89	114.44	0.88		
6336	500-yr	559.09	329.1	331.31	331.31	332.07	0.0205	10.33	170.6	115.27	1.24		
6255	2-yr	76.75	324.9	326.01	326.01	326.52	0.0159	5.72	13.42	90.91	0.99		
6255	10-yr	183.67	324.9	326.85	326.85	327.72	0.0128	7.52	27.07	131.64	0.97		
6255	10-yr 2100	248.46	324.9	327.35	327.35	328.27	0.0101	7.82	43.26	166.04	0.9		
6255	25-yr	258.25	324.9	327.43	327.43	328.34	0.0097	7.82	46.89	171.34	0.88		
6255	25-yr 2100	340.09	324.9	327.47	327.47	327.74	0.0049	5.63	217.46	176.45	0.63		
6255	50-yr	316.19	324.9	327.47	327.47	327.7	0.0042	5.23	217.47	176.45	0.59		
6255	50-yr 2100	436.85	324.9	327.48	327.48	327.92	0.0079	7.19	218.78	176.49	0.8		
6255	100-yr	378.17	324.9	327.47	327.47	327.8	0.006	6.26	217.46	176.45	0.7		
6255	500-yr	559.09	324.9	327.58	327.58	328.18	0.0107	8.56	236.75	177.06	0.94		
6142	2-yr	76.75	322.2	323.47	323.47	324.03	0.0164	6.05	12.7	78.62	1		
6142	10-yr	183.67	322.2	324.44	324.44	324.47	0.001	2.29	156.96	167.42	0.28		
6142	10-yr 2100	248.46	322.2	324.44	324.44	324.5	0.0019	3.1	156.94	167.41	0.38		
6142	25-yr	258.25	322.2	324.44	324.44	324.51	0.002	3.22	156.94	167.41	0.39		
6142	25-yr 2100	340.09	322.2	324.44	324.44	324.56	0.0035	4.24	156.94	167.4	0.52		
6142	50-yr	316.19	322.2	324.44	324.44	324.54	0.0031	3.94	156.94	167.41	0.48		
6142	50-yr 2100	436.85	322.2	324.44	324.44	324.63	0.0058	5.45	156.94	167.4	0.66		
6142	100-yr	378.17	322.2	324.44	324.44	324.59	0.0044	4.72	156.94	167.4	0.57		
6142	500-yr	559.09	322.2	324.45	324.45	324.76	0.0094	6.93	158.2	168.73	0.84		
6058	2-yr	76.75	320	321.19	321.19	321.72	0.0162	5.83	13.17	92.89	1		
6058	10-yr	183.67	320	321.99	321.99	322.14	0.004	4.22	176.09	194.61	0.55		
6058	10-yr 2100	248.46	320	321.99	321.99	322.26	0.0074	5.71	176.07	194.6	0.74		
6058	25-yr	258.25	320	321.99	321.99	322.29	0.008	5.93	176.07	194.6	0.77		
6058	25-yr 2100	340.09	320	322.07	322.07	322.49	0.0111	7.2	192.02	195.82	0.91		
6058	50-yr	316.19	320	322.02	322.02	322.43	0.0109	7.03	182.3	195.05	0.9		
6058	50-yr 2100	436.85	320	322.23	322.23	322.72	0.0123	7.99	223.73	197.96	0.97		
6058	100-yr	378.17	320	322.14	322.14	322.58	0.0115	7.52	205.17	196.69	0.94		
6058	500-yr	559.09	320	322.42	322.42	322.97	0.0133	8.81	260.74	200.41	1.03		
5994	2-yr	76.75	317.8	319.06	319.06	319.63	0.0161	6.06	12.69	45.58	1		
5994	10-yr	183.67	317.8	320.05	320.05	320.85	0.0103	7.35	39.92	179.86	0.89		
5994	10-yr 2100	248.46	317.8	320.2	320.2	320.46	0.0051	5.42	189.75	189.72	0.63		
5994	25-yr	258.25	317.8	320.2	320.2	320.48	0.0056	5.64	189.75	189.72	0.66		
5994	25-yr 2100	340.09	317.8	320.21	320.21	320.68	0.0094	7.36	191.64	189.97	0.86		
5994	50-yr	316.19	317.8	320.21	320.21	320.61	0.0082	6.86	191.16	189.91	0.8		
5994	50-yr 2100	436.85	317.8	320.41	320.41	320.92	0.01	8.01	229.43	194.73	0.89		
5994	100-yr	378.17	317.8	320.3	320.3	320.78	0.0094	7.55	209.41	192.55	0.86		
5994	500-yr	559.09	317.8	320.61	320.61	321.19	0.0108	8.78	269.98	198.15	0.94		
5900	2-yr	76.75	315.3	316.39	316.39	316.91	0.0162	5.78	13.27	45.57	1		
5900	10-yr	183.67	315.3	317.21	317.21	317.58	0.0073	5.67	84.37	89.8	0.73		
5900	10-yr 2100	248.46	315.3	317.27	317.27	317.88	0.0116	7.34	89.17	92.75	0.93		
5900	25-yr	258.25	315.3	317.3	317.3	317.93	0.0117	7.45	91.8	94.63	0.94		
5900	25-yr 2100	340.09	315.3	317.61	317.61	318.27	0.0109	7.91	126.74	110.73	0.93		
5900	50-yr	316.19	315.3	317.53	317.53	318.18	0.0109	7.74	118.22	109.33	0.92		
5900	50-yr 2100	436.85	315.3	317.88	317.88	318.62	0.0112	8.63	156.68	115.87	0.96		
5900	100-yr	378.17	315.3	317.71	317.71	318.41	0.0111	8.24	138.16	112.62	0.94		
5900	500-yr	559.09	315.3	318.19	318.19	319.04	0.0113	9.39	194.92	125.88	0.98		
5784	2-yr	76.75	313	314.26	314.26	314.83	0.0164	6.09	12.62	11.79	1		

Table C-1
Existing Conditions HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
5784	10-yr	183.67	313	315.19	315.19	316.11	0.0122	7.8	30.58	26.16	0.95		
5784	10-yr 2100	248.46	313	315.91	315.91	316.54	0.0064	6.91	92.57	115.29	0.73		
5784	25-yr	258.25	313	315.94	315.94	316.59	0.0066	7.03	96.48	116.1	0.74		
5784	25-yr 2100	340.09	313	316.22	316.22	316.96	0.0071	7.8	129.92	124.29	0.78		
5784	50-yr	316.19	313	316.15	316.15	316.86	0.0069	7.57	121	121.61	0.77		
5784	50-yr 2100	436.85	313	316.62	316.62	317.32	0.0063	7.97	186.23	152.04	0.75		
5784	100-yr	378.17	313	316.39	316.39	317.12	0.0068	7.88	152.14	133.05	0.77		
5784	500-yr	559.09	313	316.91	316.91	317.68	0.0067	8.68	231.96	164.75	0.79		
5683	2-yr	76.75	311.5	313.12	313.05	313.41	0.0084	4.55	24.45	46.16	0.75		
5683	10-yr	183.67	311.5	313.65	313.65	314.16	0.0098	6.35	55.25	69.89	0.86		
5683	10-yr 2100	248.46	311.5	313.85	313.85	314.49	0.011	7.25	71.79	91.05	0.93		
5683	25-yr	258.25	311.5	314	314	314.56	0.0087	6.78	87.04	105.48	0.84		
5683	25-yr 2100	340.09	311.5	314.27	314.27	314.87	0.0085	7.28	117	114.82	0.85		
5683	50-yr	316.19	311.5	314.19	314.19	314.79	0.0087	7.19	107.71	113.09	0.85		
5683	50-yr 2100	436.85	311.5	314.5	314.5	315.2	0.009	7.98	144.15	118.91	0.88		
5683	100-yr	378.17	311.5	314.37	314.37	315.01	0.0086	7.54	128.61	116.58	0.86		
5683	500-yr	559.09	311.5	314.79	314.79	315.55	0.009	8.58	179.54	126.91	0.9		
5584	2-yr	76.75	311	312	312	312.36	0.0136	4.96	21.7	89.56	0.93		
5584	10-yr	183.67	311	312.42	312.25	312.72	0.0096	5.39	93.28	94.92	0.83		
5584	10-yr 2100	248.46	311	312.7	312.45	313.03	0.0085	5.78	120.23	97.04	0.81		
5584	25-yr	258.25	311	312.74	312.48	313.07	0.0084	5.85	123.72	97.32	0.81		
5584	25-yr 2100	340.09	311	313.03	312.68	313.41	0.0081	6.38	151.88	99.74	0.81		
5584	50-yr	316.19	311	312.94	312.63	313.31	0.0083	6.27	142.89	98.97	0.82		
5584	50-yr 2100	436.85	311	313.32	312.92	313.77	0.008	6.99	181.46	103.77	0.83		
5584	100-yr	378.17	311	313.14	312.79	313.56	0.0081	6.63	163.47	100.85	0.82		
5584	500-yr	559.09	311	313.64	313.18	314.19	0.0081	7.71	216.79	111.39	0.86		
5486	2-yr	76.75	309	310.5	310.5	311	0.0134	5.71	15.27	37.65	0.94		
5486	10-yr	183.67	309	311.32	311.32	311.83	0.0083	6.44	77.08	95.82	0.81		
5486	10-yr 2100	248.46	309	311.57	311.57	312.17	0.0088	7.17	102.24	101.19	0.85		
5486	25-yr	258.25	309	311.61	311.61	312.21	0.0087	7.24	106.28	101.92	0.85		
5486	25-yr 2100	340.09	309	311.89	311.89	312.56	0.009	7.91	135.08	106.29	0.87		
5486	50-yr	316.19	309	311.83	311.83	312.46	0.0086	7.64	128.99	105.53	0.85		
5486	50-yr 2100	436.85	309	312.16	312.16	312.91	0.0092	8.61	164.95	110.19	0.9		
5486	100-yr	378.17	309	312.01	312.01	312.7	0.009	8.16	147.99	108.01	0.88		
5486	500-yr	559.09	309	312.46	312.46	313.3	0.0097	9.42	197.92	114.41	0.94		
5384	2-yr	76.75	307.8	310.22		310.3	0.0011	2.4	58.71	63.93	0.3		
5384	10-yr	183.67	307.8	310.94		311.12	0.0018	3.77	136.4	127.44	0.4		
5384	10-yr 2100	248.46	307.8	311.23		311.45	0.0021	4.34	173.26	132.5	0.44		
5384	25-yr	258.25	307.8	311.27		311.5	0.0021	4.4	179.34	133.27	0.44		
5384	25-yr 2100	340.09	307.8	311.56		311.84	0.0024	5	218.59	138.86	0.48		
5384	50-yr	316.19	307.8	311.49		311.74	0.0023	4.83	208.04	137.44	0.47		
5384	50-yr 2100	436.85	307.8	311.84		312.17	0.0027	5.62	258.27	144.07	0.52		
5384	100-yr	378.17	307.8	311.69		311.98	0.0025	5.23	236.9	141.53	0.49		
5384	500-yr	559.09	307.8	312.18		312.56	0.003	6.21	307.32	148.09	0.55		
5293	2-yr	76.75	306.4	310.11	307.96	310.14	0.0003	1.67	95.72	56.81	0.16		
5293	10-yr	183.67	306.4	310.69	308.83	310.78	0.0007	2.92	131.91	69.75	0.26		
5293	10-yr 2100	248.46	306.4	310.87	309.19	311	0.001	3.62	145.73	80.04	0.31		
5293	25-yr	258.25	306.4	310.91	309.25	311.04	0.001	3.67	148.94	81.47	0.32		
5293	25-yr 2100	340.09	306.4	311.1	309.85	311.28	0.0014	4.32	165.04	87.87	0.37		
5293	50-yr	316.19	306.4	311.05	309.69	311.22	0.0012	4.13	161.12	86.46	0.35		
5293	50-yr 2100	436.85	306.4	311.25	310.39	311.49	0.0018	5.08	178.5	92.56	0.42		
5293	100-yr	378.17	306.4	311.21	310.16	311.41	0.0014	4.48	175.5	91.52	0.37		
5293	500-yr	559.09	306.4	311.48	310.82	311.78	0.0021	5.76	201.59	106.16	0.47		

Table C-2
Alternative 1: Proposed 9.9-foot Wide Culverts and 14-foot Span Bridges HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6760	2-yr	76.79	339	340.59		340.93	0.0071	4.76	17.98	18.52	0.69		
6760	10-yr	183.75	339	341.32	341.21	342.08	0.0097	7.24	33.68	24.41	0.86		
6760	10-yr 2100	248.49	339	341.62	341.62	342.63	0.011	8.4	41.54	26.76	0.93		
6760	25-yr	258.27	339	341.68	341.68	342.71	0.0109	8.5	43.15	27.25	0.93		
6760	25-yr 2100	340.11	339	342.06	342.06	343.31	0.0114	9.52	53.89	30.29	0.98		
6760	50-yr	316.21	339	341.99	341.99	343.14	0.0107	9.1	51.87	29.69	0.95		
6760	50-yr 2100	436.89	339	342.69	342.69	343.93	0.009	9.65	77.08	40.44	0.9		
6760	100-yr	378.18	339	342.41	342.41	343.59	0.0093	9.27	66.26	37.8	0.9		
6760	500-yr	559.29	339	343.2	343.2	344.57	0.0087	10.34	99.04	45.07	0.9		
6664	2-yr	76.79	338.4	339.9	339.78	340.22	0.0075	4.69	24.23	42.4	0.7		
6664	10-yr	183.75	338.4	340.46	340.46	341.07	0.0104	6.93	49.03	46.6	0.88		
6664	10-yr 2100	248.49	338.4	340.76	340.76	341.46	0.0105	7.65	63.32	48.74	0.9		
6664	25-yr	258.27	338.4	340.8	340.8	341.51	0.0106	7.76	65.17	49	0.9		
6664	25-yr 2100	340.11	338.4	341.11	341.11	341.94	0.0108	8.56	80.66	51.08	0.94		
6664	50-yr	316.21	338.4	341.01	341.01	341.82	0.0108	8.36	76.07	50.41	0.93		
6664	50-yr 2100	436.89	338.4	341.42	341.42	342.39	0.0112	9.4	97.23	53.67	0.97		
6664	100-yr	378.18	338.4	341.23	341.23	342.12	0.011	8.91	87.2	52.07	0.95		
6664	500-yr	559.29	338.4	341.76	341.76	342.9	0.0118	10.38	116.12	77.88	1.01		
6564	2-yr	76.79	337.3	338.56	338.56	339.13	0.0162	6.08	12.73	31.53	1		
6564	10-yr	183.75	337.3	339.25	339.25	339.8	0.0109	6.82	53.32	53.23	0.89		
6564	10-yr 2100	248.49	337.3	339.51	339.51	340.16	0.0114	7.61	67.49	55.2	0.93		
6564	25-yr	258.27	337.3	339.55	339.55	340.21	0.0113	7.68	70	55.54	0.92		
6564	25-yr 2100	340.11	337.3	339.84	339.84	340.6	0.0116	8.47	86.1	57.47	0.96		
6564	50-yr	316.21	337.3	339.76	339.76	340.49	0.0116	8.26	81.5	56.94	0.95		
6564	50-yr 2100	436.89	337.3	340.14	340.14	341.01	0.0119	9.26	103.47	59.42	0.99		
6564	100-yr	378.18	337.3	339.96	339.96	340.77	0.0117	8.79	93.13	58.27	0.97		
6564	500-yr	559.29	337.3	340.47	340.47	341.48	0.0123	10.14	123.43	61.48	1.02		
6487	2-yr	76.79	333.9	335.17	335.17	335.69	0.0142	5.8	14.18	73.64	0.94		
6487	10-yr	183.75	333.9	335.4	335.4	335.79	0.0143	6.56	68.3	79.61	0.97		
6487	10-yr 2100	248.49	333.9	335.58	335.58	336.05	0.0153	7.35	83.24	81.22	1.03		
6487	25-yr	258.27	333.9	335.61	335.61	336.09	0.0155	7.48	85.09	81.38	1.04		
6487	25-yr 2100	340.11	333.9	335.81	335.81	336.38	0.0162	8.27	101.94	82.38	1.08		
6487	50-yr	316.21	333.9	335.76	335.76	336.3	0.0159	8.04	97.35	82.11	1.07		
6487	50-yr 2100	436.89	333.9	336.03	336.03	336.68	0.0168	9.08	119.76	83.4	1.12		
6487	100-yr	378.18	333.9	335.9	335.9	336.5	0.0165	8.62	108.91	82.79	1.1		
6487	500-yr	559.29	333.9	336.27	336.27	337.03	0.0175	9.98	139.82	84.51	1.17		
6445	2-yr	76.79	329.1	331.34	330.27	331.5	0.0016	3.18	24.12	14.25	0.37		
6445	10-yr	183.75	329.1	332.69	331.2	333.04	0.0019	4.76	38.6	17.23	0.44		
6445	10-yr 2100	248.5	329.1	333.29	331.65	333.76	0.0021	5.52	45.03	22.16	0.48		
6445	25-yr	258.23	329.1	333.39	331.72	333.88	0.0021	5.59	46.18	30.56	0.48		
6445	25-yr 2100	339.96	329.1	334.37	332.25	334.93	0.0018	5.99	56.73	62.46	0.46		
6445	50-yr	316.17	329.1	334.01	332.09	334.56	0.002	5.99	52.77	54.53	0.48		
6445	50-yr 2100	436.84	329.1	334.66	332.82	335.49	0.0026	7.3	59.82	70.39	0.55		
6445	100-yr	378.12	329.1	334.94	332.47	335.5	0.0016	6.02	62.76	82.97	0.44		
6445	500-yr	559.25	329.1	333.49	333.49	335.67	0.0092	11.85	47.19	36.31	1		
6410	2-yr	76.79										3.72	3.69
6410	10-yr	183.75										5.96	6.17
6410	10-yr 2100	248.5										7.47	9.31
6410	25-yr	258.23										7.58	9.43
6410	25-yr 2100	339.96										8.58	10.34
6410	50-yr	316.17										8.17	10.09
6410	50-yr 2100	436.84										9.39	10.65
6410	100-yr	378.12										9.39	10.65
6410	500-yr	559.25										6.03	6.03
6391	2-yr	76.79	329	331.1	330.18	331.26	0.0021	3.19	28.19	31.53	0.39		
6391	10-yr	183.75	329	332.01	331.07	332.4	0.0034	5.15	44.4	51.53	0.53		
6391	10-yr 2100	248.5	329	331.5	331.5	332.59	0.0121	8.52	35.3	40.3	0.96		
6391	25-yr	258.23	329	331.54	331.54	332.68	0.0122	8.68	36.12	41.31	0.97		
6391	25-yr 2100	339.96	329	332.01	332.01	333.36	0.0116	9.51	44.48	51.63	0.98		
6391	50-yr	316.17	329	331.88	331.88	333.16	0.0118	9.3	42.07	48.65	0.98		

Table C-2
Alternative 1: Proposed 9.9-foot Wide Culverts and 14-foot Span Bridges HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6391	50-yr 2100	436.84	329	332.5	332.5	334.09	0.0113	10.39	53.23	82.28	0.99		
6391	100-yr	378.12	329	332.21	332.21	333.65	0.0115	9.88	48	55.98	0.98		
6391	500-yr	559.25	329	333.07	333.07	334.94	0.0109	11.31	63.44	146.77	1		
6336	2-yr	76.79	329.1	330.33	330.33	330.88	0.0155	5.99	13.36	67.71	0.98		
6336	10-yr	183.75	329.1	331.21	331.21	331.98	0.0111	7.37	45.8	110.02	0.91		
6336	10-yr 2100	248.5	329.1	331.26	331.26	331.42	0.0044	4.73	164.89	114.44	0.58		
6336	25-yr	258.23	329.1	331.26	331.26	331.43	0.0048	4.91	164.89	114.44	0.6		
6336	25-yr 2100	339.96	329.1	331.26	331.26	331.56	0.0083	6.47	164.89	114.44	0.79		
6336	50-yr	316.17	329.1	331.26	331.26	331.52	0.0072	6.02	164.89	114.44	0.73		
6336	50-yr 2100	436.84	329.1	331.27	331.27	331.76	0.0135	8.28	165.74	114.57	1.01		
6336	100-yr	378.12	329.1	331.26	331.26	331.63	0.0103	7.2	164.89	114.44	0.88		
6336	500-yr	559.25	329.1	331.31	331.31	332.08	0.0204	10.31	170.95	115.32	1.24		
6255	2-yr	76.79	324.9	326.01	326.01	326.52	0.0163	5.76	13.33	89.19	1		
6255	10-yr	183.75	324.9	326.85	326.85	327.72	0.0128	7.52	27.07	131.64	0.97		
6255	10-yr 2100	248.5	324.9	327.35	327.35	328.27	0.0101	7.82	43.21	165.94	0.9		
6255	25-yr	258.23	324.9	327.42	327.42	328.34	0.0097	7.83	46.76	171.23	0.88		
6255	25-yr 2100	339.96	324.9	327.47	327.47	327.74	0.0049	5.63	217.46	176.45	0.63		
6255	50-yr	316.17	324.9	327.47	327.47	327.7	0.0042	5.23	217.47	176.45	0.59		
6255	50-yr 2100	436.84	324.9	327.48	327.48	327.92	0.0079	7.19	218.78	176.49	0.8		
6255	100-yr	378.12	324.9	327.47	327.47	327.8	0.006	6.26	217.46	176.45	0.7		
6255	500-yr	559.25	324.9	327.59	327.59	328.18	0.0105	8.51	238.27	177.11	0.93		
6142	2-yr	76.79	322.2	323.47	323.47	324.03	0.0163	6.03	12.73	78.84	1		
6142	10-yr	183.75	322.2	324.44	324.44	324.47	0.001	2.29	156.96	167.42	0.28		
6142	10-yr 2100	248.5	322.2	324.44	324.44	324.5	0.0019	3.1	156.94	167.41	0.38		
6142	25-yr	258.23	322.2	324.44	324.44	324.51	0.002	3.22	156.94	167.41	0.39		
6142	25-yr 2100	339.96	322.2	324.44	324.44	324.56	0.0035	4.24	156.94	167.4	0.52		
6142	50-yr	316.17	322.2	324.44	324.44	324.54	0.003	3.94	156.94	167.41	0.48		
6142	50-yr 2100	436.84	322.2	324.44	324.44	324.63	0.0058	5.45	156.94	167.4	0.66		
6142	100-yr	378.12	322.2	324.44	324.44	324.59	0.0044	4.71	156.94	167.4	0.57		
6142	500-yr	559.25	322.2	324.45	324.45	324.76	0.0094	6.93	158.2	168.73	0.84		
6058	2-yr	76.79	320	321.19	321.19	321.72	0.0163	5.84	13.17	92.89	1		
6058	10-yr	183.75	320	321.99	321.99	322.14	0.004	4.22	176.09	194.61	0.55		
6058	10-yr 2100	248.5	320	321.99	321.99	322.26	0.0074	5.71	176.07	194.6	0.74		
6058	25-yr	258.23	320	321.99	321.99	322.29	0.008	5.93	176.07	194.6	0.77		
6058	25-yr 2100	339.96	320	322.07	322.07	322.49	0.0113	7.24	190.83	195.75	0.92		
6058	50-yr	316.17	320	322.02	322.02	322.43	0.011	7.04	182.06	195.04	0.9		
6058	50-yr 2100	436.84	320	322.23	322.23	322.72	0.0123	8	223.48	197.94	0.97		
6058	100-yr	378.12	320	322.14	322.14	322.58	0.0115	7.52	205.19	196.69	0.94		
6058	500-yr	559.25	320	322.42	322.42	322.98	0.0133	8.81	260.7	200.41	1.03		
5994	2-yr	76.79	317.8	319.06	319.06	319.63	0.0161	6.06	12.7	45.61	1		
5994	10-yr	183.75	317.8	320.05	320.05	320.85	0.0103	7.36	39.91	179.84	0.89		
5994	10-yr 2100	248.5	317.8	320.2	320.2	320.46	0.0051	5.42	189.75	189.72	0.63		
5994	25-yr	258.23	317.8	320.2	320.2	320.48	0.0056	5.64	189.75	189.72	0.66		
5994	25-yr 2100	339.96	317.8	320.22	320.22	320.68	0.0092	7.3	193.22	190.28	0.85		
5994	50-yr	316.17	317.8	320.21	320.21	320.61	0.0082	6.85	191.16	189.91	0.8		
5994	50-yr 2100	436.84	317.8	320.41	320.41	320.92	0.01	8.01	229.67	194.75	0.89		
5994	100-yr	378.12	317.8	320.3	320.3	320.78	0.0094	7.55	209.55	192.57	0.86		
5994	500-yr	559.25	317.8	320.61	320.61	321.19	0.0108	8.77	270.35	198.18	0.94		
5900	2-yr	76.79	315.3	316.38	316.38	316.91	0.0162	5.79	13.27	45.57	1		
5900	10-yr	183.75	315.3	317.21	317.21	317.58	0.0073	5.67	84.37	89.8	0.73		
5900	10-yr 2100	248.5	315.3	317.27	317.27	317.88	0.0116	7.34	89.17	92.75	0.93		
5900	25-yr	258.23	315.3	317.3	317.3	317.93	0.0117	7.45	91.8	94.63	0.94		
5900	25-yr 2100	339.96	315.3	317.61	317.61	318.27	0.0109	7.92	126.46	110.68	0.93		
5900	50-yr	316.17	315.3	317.54	317.54	318.18	0.0107	7.69	119.26	109.49	0.91		
5900	50-yr 2100	436.84	315.3	317.88	317.88	318.62	0.0112	8.63	156.83	115.89	0.96		
5900	100-yr	378.12	315.3	317.71	317.71	318.41	0.0111	8.24	138.16	112.62	0.94		
5900	500-yr	559.25	315.3	318.19	318.19	319.04	0.0115	9.43	194.04	125.7	0.99		
5784	2-yr	76.79	313	314.26	314.26	314.83	0.0164	6.09	12.62	11.8	1		

Table C-2
Alternative 1: Proposed 9.9-foot Wide Culverts and 14-foot Span Bridges HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
5784	10-yr	183.75	313	315.19	315.19	316.11	0.0122	7.81	30.59	26.17	0.95		
5784	10-yr 2100	248.5	313	315.91	315.91	316.54	0.0064	6.91	92.59	115.29	0.73		
5784	25-yr	258.23	313	315.94	315.94	316.59	0.0066	7.03	96.48	116.1	0.74		
5784	25-yr 2100	339.96	313	316.22	316.22	316.96	0.0071	7.8	129.92	124.29	0.78		
5784	50-yr	316.17	313	316.15	316.15	316.86	0.0069	7.57	120.96	121.59	0.77		
5784	50-yr 2100	436.84	313	316.62	316.62	317.32	0.0063	7.97	186.22	152.04	0.75		
5784	100-yr	378.12	313	316.39	316.39	317.12	0.0068	7.88	152.12	133.05	0.77		
5784	500-yr	559.25	313	316.91	316.91	317.68	0.0067	8.68	232.01	164.77	0.79		
5683	2-yr	76.79	311.5	313.12	313.05	313.41	0.0084	4.55	24.5	46.17	0.75		
5683	10-yr	183.75	311.5	313.65	313.65	314.16	0.0098	6.35	55.28	69.91	0.86		
5683	10-yr 2100	248.5	311.5	313.84	313.84	314.5	0.0112	7.29	71.02	90.28	0.94		
5683	25-yr	258.23	311.5	314	314	314.56	0.0087	6.78	87.04	105.48	0.84		
5683	25-yr 2100	339.96	311.5	314.27	314.27	314.87	0.0085	7.28	116.95	114.81	0.85		
5683	50-yr	316.17	311.5	314.19	314.19	314.79	0.0087	7.19	107.71	113.09	0.85		
5683	50-yr 2100	436.84	311.5	314.5	314.5	315.2	0.009	7.98	144.14	118.91	0.88		
5683	100-yr	378.12	311.5	314.37	314.37	315.01	0.0086	7.54	128.59	116.58	0.86		
5683	500-yr	559.25	311.5	314.79	314.79	315.55	0.009	8.58	179.55	126.92	0.9		
5584	2-yr	76.79	311	312	312	312.36	0.0137	4.96	21.68	89.53	0.93		
5584	10-yr	183.75	311	312.42	312.25	312.72	0.0095	5.39	93.45	94.93	0.83		
5584	10-yr 2100	248.5	311	312.7	312.45	313.03	0.0085	5.78	120.12	97.03	0.81		
5584	25-yr	258.23	311	312.74	312.48	313.07	0.0084	5.84	123.9	97.33	0.81		
5584	25-yr 2100	339.96	311	313.02	312.69	313.41	0.0082	6.41	151.02	99.67	0.82		
5584	50-yr	316.17	311	312.94	312.63	313.31	0.0083	6.26	143.15	99	0.82		
5584	50-yr 2100	436.84	311	313.32	312.93	313.78	0.008	6.98	181.64	103.81	0.83		
5584	100-yr	378.12	311	313.14	312.79	313.56	0.0081	6.63	163.43	100.85	0.82		
5584	500-yr	559.25	311	313.64	313.19	314.19	0.0081	7.71	216.72	111.38	0.86		
5486	2-yr	76.79	309	310.5	310.5	311	0.0135	5.73	15.22	37.58	0.94		
5486	10-yr	183.75	309	311.31	311.31	311.83	0.0084	6.45	76.9	95.78	0.81		
5486	10-yr 2100	248.5	309	311.57	311.57	312.17	0.0087	7.16	102.45	101.23	0.84		
5486	25-yr	258.23	309	311.61	311.61	312.21	0.0088	7.26	105.97	101.86	0.85		
5486	25-yr 2100	339.96	309	311.9	311.9	312.56	0.0088	7.85	136.35	106.46	0.87		
5486	50-yr	316.17	309	311.83	311.83	312.46	0.0087	7.66	128.56	105.48	0.86		
5486	50-yr 2100	436.84	309	312.16	312.16	312.91	0.0093	8.62	164.65	110.15	0.91		
5486	100-yr	378.12	309	312.01	312.01	312.7	0.009	8.16	148	108.01	0.88		
5486	500-yr	559.25	309	312.46	312.46	313.3	0.0097	9.42	198.15	114.44	0.94		
5384	2-yr	76.79	307.8	309.31	309.16	309.67	0.0095	4.8	17.31	25.22	0.8		
5384	10-yr	183.75	307.8	309.99	309.99	310.64	0.01	6.71	45.84	53.13	0.88		
5384	10-yr 2100	248.5	307.8	310.29	310.29	311.06	0.01	7.45	63.52	80.1	0.91		
5384	25-yr	258.23	307.8	310.45	310.45	311.15	0.0084	7.14	77.42	92.97	0.84		
5384	25-yr 2100	339.96	307.8	310.86	310.86	311.55	0.007	7.33	126.38	126.13	0.79		
5384	50-yr	316.17	307.8	310.78	310.78	311.45	0.007	7.19	115.99	124.69	0.79		
5384	50-yr 2100	436.84	307.8	311.14	311.14	311.9	0.0074	8.02	161.31	130.98	0.82		
5384	100-yr	378.12	307.8	310.99	310.99	311.69	0.007	7.56	142.05	128.27	0.8		
5384	500-yr	559.25	307.8	311.44	311.44	312.29	0.0077	8.75	201.35	136.53	0.86		
5293	2-yr	76.79	306.4	307.96	307.96	308.56	0.0154	6.21	12.38	27.03	1		
5293	10-yr	183.75	306.4	308.9	308.83	309.62	0.0098	7.28	45.51	33.38	0.88		
5293	10-yr 2100	248.5	306.4	309.67	309.2	310.25	0.0056	6.74	73.76	43.92	0.7		
5293	25-yr	258.23	306.4	309.75	309.25	310.32	0.0054	6.77	77.06	46.03	0.69		
5293	25-yr 2100	339.96	306.4	310.21	309.93	310.78	0.0048	7.01	101.61	58.57	0.66		
5293	50-yr	316.17	306.4	310.12	309.69	310.68	0.0047	6.84	96.59	57.2	0.66		
5293	50-yr 2100	436.84	306.4	310.49	310.39	311.14	0.0052	7.69	119.07	64.49	0.7		
5293	100-yr	378.12	306.4	310.33	310.16	310.93	0.005	7.31	108.54	60.43	0.68		
5293	500-yr	559.25	306.4	310.82	310.82	311.54	0.0055	8.38	141.77	78.28	0.73		

Table C-3
Alternative 2: Proposed 14-foot Span Bridges HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6760	2-yr	76.79	339	340.59		340.93	0.0071	4.76	17.98	18.52	0.69		
6760	10-yr	183.75	339	341.32	341.21	342.08	0.0097	7.24	33.68	24.41	0.86		
6760	10-yr 2100	248.49	339	341.62	341.62	342.63	0.011	8.4	41.54	26.76	0.93		
6760	25-yr	258.27	339	341.68	341.68	342.71	0.0109	8.5	43.15	27.25	0.93		
6760	25-yr 2100	340.11	339	342.06	342.06	343.31	0.0114	9.52	53.89	30.29	0.98		
6760	50-yr	316.21	339	341.99	341.99	343.14	0.0107	9.1	51.87	29.69	0.95		
6760	50-yr 2100	436.89	339	342.69	342.69	343.93	0.009	9.65	77.08	40.44	0.9		
6760	100-yr	378.18	339	342.41	342.41	343.59	0.0093	9.27	66.26	37.8	0.9		
6760	500-yr	559.29	339	343.2	343.2	344.57	0.0087	10.34	99.04	45.07	0.9		
6664	2-yr	76.79	338.4	339.9	339.78	340.22	0.0075	4.69	24.23	42.4	0.7		
6664	10-yr	183.75	338.4	340.46	340.46	341.07	0.0104	6.93	49.03	46.6	0.88		
6664	10-yr 2100	248.49	338.4	340.76	340.76	341.46	0.0105	7.65	63.32	48.74	0.9		
6664	25-yr	258.27	338.4	340.8	340.8	341.51	0.0106	7.76	65.17	49	0.9		
6664	25-yr 2100	340.11	338.4	341.11	341.11	341.94	0.0108	8.56	80.66	51.08	0.94		
6664	50-yr	316.21	338.4	341.01	341.01	341.82	0.0108	8.36	76.07	50.41	0.93		
6664	50-yr 2100	436.89	338.4	341.42	341.42	342.39	0.0112	9.4	97.23	53.67	0.97		
6664	100-yr	378.18	338.4	341.23	341.23	342.12	0.011	8.91	87.2	52.07	0.95		
6664	500-yr	559.29	338.4	341.76	341.76	342.9	0.0118	10.38	116.12	77.88	1.01		
6564	2-yr	76.79	337.3	338.56	338.56	339.13	0.0162	6.08	12.73	31.53	1		
6564	10-yr	183.75	337.3	339.25	339.25	339.8	0.0109	6.82	53.32	53.23	0.89		
6564	10-yr 2100	248.49	337.3	339.51	339.51	340.16	0.0114	7.61	67.49	55.2	0.93		
6564	25-yr	258.27	337.3	339.55	339.55	340.21	0.0113	7.68	70	55.54	0.92		
6564	25-yr 2100	340.11	337.3	339.84	339.84	340.6	0.0116	8.47	86.1	57.47	0.96		
6564	50-yr	316.21	337.3	339.76	339.76	340.49	0.0116	8.26	81.5	56.94	0.95		
6564	50-yr 2100	436.89	337.3	340.14	340.14	341.01	0.0119	9.26	103.47	59.42	0.99		
6564	100-yr	378.18	337.3	339.96	339.96	340.77	0.0117	8.79	93.13	58.27	0.97		
6564	500-yr	559.29	337.3	340.47	340.47	341.48	0.0123	10.14	123.43	61.48	1.02		
6487	2-yr	76.79	333.9	335.17	335.17	335.69	0.0142	5.8	14.18	73.64	0.94		
6487	10-yr	183.75	333.9	335.4	335.4	335.79	0.0143	6.56	68.3	79.61	0.97		
6487	10-yr 2100	248.49	333.9	335.58	335.58	336.05	0.0153	7.35	83.24	81.22	1.03		
6487	25-yr	258.27	333.9	335.61	335.61	336.09	0.0155	7.48	85.09	81.38	1.04		
6487	25-yr 2100	340.11	333.9	335.81	335.81	336.38	0.0162	8.27	101.94	82.38	1.08		
6487	50-yr	316.21	333.9	335.76	335.76	336.3	0.0159	8.04	97.35	82.11	1.07		
6487	50-yr 2100	436.89	333.9	336.03	336.03	336.68	0.0168	9.08	119.76	83.4	1.12		
6487	100-yr	378.18	333.9	335.9	335.9	336.5	0.0165	8.62	108.91	82.79	1.1		
6487	500-yr	559.29	333.9	336.27	336.27	337.03	0.0175	9.98	139.82	84.51	1.17		
6445	2-yr	76.79	329.1	331.19	330.25	331.34	0.0021	3.09	25.22	13.91	0.39		
6445	10-yr	183.75	329.1	332.26	331.1	332.61	0.0028	4.75	40.84	16.27	0.48		
6445	10-yr 2100	248.5	329.1	332.34	331.53	332.94	0.0047	6.26	42.04	16.45	0.62		
6445	25-yr	258.28	329.1	332.41	331.59	333.03	0.0047	6.34	43.16	16.62	0.63		
6445	25-yr 2100	340.13	329.1	333.03	332.07	333.77	0.0045	6.98	52.25	17.97	0.63		
6445	50-yr	316.24	329.1	332.85	331.92	333.56	0.0045	6.81	49.69	17.59	0.63		
6445	50-yr 2100	436.86	329.1	334.04	332.57	334.79	0.0033	7.04	67.33	55.15	0.56		
6445	100-yr	378.16	329.1	333.29	332.28	334.09	0.0044	7.24	56.21	22.42	0.63		
6445	500-yr	559.24	329.1	334.46	333.15	335.5	0.0041	8.27	73.55	64.67	0.64		
6410	2-yr	76.79										2.63	2.55
6410	10-yr	183.75										4.26	4.2
6410	10-yr 2100	248.5										5.8	5.9
6410	25-yr	258.28										5.91	6.01
6410	25-yr 2100	340.13										6.69	6.85
6410	50-yr	316.24										6.47	6.62
6410	50-yr 2100	436.86										7.8	7.8
6410	100-yr	378.16										7.01	7.21
6410	500-yr	559.24										7.33	7.33
6391	2-yr	76.79	329	331.1	330.18	331.25	0.0021	3.16	30.14	31.56	0.39		
6391	10-yr	183.75	329	332.03	331.09	332.4	0.0032	4.99	50.63	52.13	0.51		
6391	10-yr 2100	248.5	329	331.5	331.5	332.55	0.0117	8.4	38.9	40.35	0.95		
6391	25-yr	258.28	329	331.56	331.56	332.63	0.0117	8.52	40.1	41.56	0.95		
6391	25-yr 2100	340.13	329	331.99	331.99	333.27	0.0114	9.37	49.77	51.26	0.97		
6391	50-yr	316.24	329	331.87	331.87	333.09	0.0115	9.14	47.04	48.53	0.96		
6391	50-yr 2100	436.86	329	332.47	332.47	333.97	0.011	10.2	60.26	79.55	0.98		
6391	100-yr	378.16	329	332.18	332.18	333.55	0.0114	9.75	53.77	55.28	0.98		
6391	500-yr	559.24	329	333.02	333.02	334.77	0.0107	11.11	72.24	132.21	0.99		
6336	2-yr	76.79	329.1	330.33	330.33	330.88	0.0155	5.99	13.36	67.71	0.98		
6336	10-yr	183.75	329.1	331.21	331.21	331.98	0.0111	7.37	45.8	110.02	0.91		
6336	10-yr 2100	248.5	329.1	331.26	331.26	331.42	0.0044	4.73	164.89	114.44	0.58		

Table C-3
Alternative 2: Proposed 14-foot Span Bridges HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6336	25-yr	258.28	329.1	331.26	331.26	331.43	0.0048	4.92	164.89	114.44	0.6		
6336	25-yr 2100	340.13	329.1	331.26	331.26	331.56	0.0083	6.47	164.89	114.44	0.79		
6336	50-yr	316.24	329.1	331.26	331.26	331.52	0.0072	6.02	164.89	114.44	0.73		
6336	50-yr 2100	436.86	329.1	331.27	331.27	331.76	0.0135	8.28	165.74	114.57	1.01		
6336	100-yr	378.16	329.1	331.26	331.26	331.63	0.0103	7.2	164.89	114.44	0.88		
6336	500-yr	559.24	329.1	331.32	331.32	332.08	0.0203	10.28	171.52	115.4	1.23		
6255	2-yr	76.79	324.9	326.01	326.01	326.52	0.0163	5.76	13.33	89.19	1		
6255	10-yr	183.75	324.9	326.85	326.85	327.72	0.0128	7.52	27.07	131.64	0.97		
6255	10-yr 2100	248.5	324.9	327.35	327.35	328.27	0.0101	7.82	43.21	165.94	0.9		
6255	25-yr	258.28	324.9	327.43	327.43	328.34	0.0097	7.82	46.89	171.34	0.88		
6255	25-yr 2100	340.13	324.9	327.47	327.47	327.74	0.0049	5.63	217.46	176.45	0.63		
6255	50-yr	316.24	324.9	327.47	327.47	327.7	0.0042	5.23	217.47	176.45	0.59		
6255	50-yr 2100	436.86	324.9	327.48	327.48	327.92	0.0079	7.19	218.78	176.49	0.8		
6255	100-yr	378.16	324.9	327.47	327.47	327.8	0.006	6.26	217.46	176.45	0.7		
6255	500-yr	559.24	324.9	327.59	327.59	328.18	0.0105	8.51	238.26	177.11	0.93		
6142	2-yr	76.79	322.2	323.47	323.47	324.03	0.0163	6.03	12.73	78.84	1		
6142	10-yr	183.75	322.2	324.44	324.44	324.47	0.001	2.29	156.96	167.42	0.28		
6142	10-yr 2100	248.5	322.2	324.44	324.44	324.5	0.0019	3.1	156.94	167.41	0.38		
6142	25-yr	258.28	322.2	324.44	324.44	324.51	0.002	3.22	156.94	167.41	0.39		
6142	25-yr 2100	340.13	322.2	324.44	324.44	324.56	0.0035	4.24	156.94	167.4	0.52		
6142	50-yr	316.24	322.2	324.44	324.44	324.54	0.0031	3.94	156.94	167.41	0.48		
6142	50-yr 2100	436.86	322.2	324.44	324.44	324.63	0.0058	5.45	156.94	167.4	0.66		
6142	100-yr	378.16	322.2	324.44	324.44	324.59	0.0044	4.71	156.94	167.4	0.57		
6142	500-yr	559.24	322.2	324.45	324.45	324.76	0.0094	6.93	158.2	168.73	0.84		
6058	2-yr	76.79	320	321.19	321.19	321.72	0.0163	5.84	13.17	92.89	1		
6058	10-yr	183.75	320	321.99	321.99	322.14	0.004	4.22	176.09	194.61	0.55		
6058	10-yr 2100	248.5	320	321.99	321.99	322.26	0.0074	5.71	176.07	194.6	0.74		
6058	25-yr	258.28	320	321.99	321.99	322.29	0.008	5.93	176.07	194.6	0.77		
6058	25-yr 2100	340.13	320	322.07	322.07	322.49	0.0111	7.21	191.91	195.82	0.91		
6058	50-yr	316.24	320	322.03	322.03	322.43	0.0108	7	183.1	195.11	0.9		
6058	50-yr 2100	436.86	320	322.23	322.23	322.72	0.0123	7.99	223.82	197.96	0.97		
6058	100-yr	378.16	320	322.14	322.14	322.58	0.0116	7.54	204.68	196.66	0.94		
6058	500-yr	559.24	320	322.42	322.42	322.97	0.0133	8.8	261.06	200.43	1.03		
5994	2-yr	76.79	317.8	319.06	319.06	319.63	0.0161	6.06	12.7	45.61	1		
5994	10-yr	183.75	317.8	320.05	320.05	320.85	0.0103	7.36	39.91	179.84	0.89		
5994	10-yr 2100	248.5	317.8	320.2	320.2	320.46	0.0051	5.42	189.75	189.72	0.63		
5994	25-yr	258.28	317.8	320.2	320.2	320.48	0.0056	5.64	189.75	189.72	0.66		
5994	25-yr 2100	340.13	317.8	320.22	320.22	320.68	0.0092	7.3	193.22	190.28	0.85		
5994	50-yr	316.24	317.8	320.21	320.21	320.61	0.0082	6.86	191.16	189.91	0.8		
5994	50-yr 2100	436.86	317.8	320.41	320.41	320.92	0.01	8.02	229.35	194.72	0.89		
5994	100-yr	378.16	317.8	320.3	320.3	320.78	0.0094	7.55	209.41	192.55	0.86		
5994	500-yr	559.24	317.8	320.61	320.61	321.19	0.0108	8.78	270.06	198.15	0.94		
5900	2-yr	76.79	315.3	316.38	316.38	316.91	0.0162	5.79	13.27	45.57	1		
5900	10-yr	183.75	315.3	317.21	317.21	317.58	0.0073	5.67	84.37	89.8	0.73		
5900	10-yr 2100	248.5	315.3	317.27	317.27	317.88	0.0116	7.34	89.17	92.75	0.93		
5900	25-yr	258.28	315.3	317.3	317.3	317.93	0.0117	7.45	91.8	94.63	0.94		
5900	25-yr 2100	340.13	315.3	317.61	317.61	318.27	0.0109	7.9	126.94	110.76	0.92		
5900	50-yr	316.24	315.3	317.54	317.54	318.18	0.0108	7.71	119	109.45	0.92		
5900	50-yr 2100	436.86	315.3	317.88	317.88	318.62	0.0112	8.63	156.67	115.86	0.96		
5900	100-yr	378.16	315.3	317.71	317.71	318.41	0.0112	8.24	138.12	112.61	0.94		
5900	500-yr	559.24	315.3	318.19	318.19	319.04	0.0115	9.43	194.04	125.7	0.99		
5784	2-yr	76.79	313	314.26	314.26	314.83	0.0164	6.09	12.62	11.8	1		
5784	10-yr	183.75	313	315.19	315.19	316.11	0.0122	7.81	30.59	26.17	0.95		
5784	10-yr 2100	248.5	313	315.91	315.91	316.54	0.0064	6.91	92.59	115.29	0.73		
5784	25-yr	258.28	313	315.94	315.94	316.59	0.0065	7.02	96.68	116.14	0.74		
5784	25-yr 2100	340.13	313	316.22	316.22	316.96	0.0071	7.8	129.95	124.3	0.78		
5784	50-yr	316.24	313	316.15	316.15	316.86	0.0069	7.57	121.01	121.62	0.77		
5784	50-yr 2100	436.86	313	316.62	316.62	317.32	0.0063	7.97	186.24	152.04	0.75		
5784	100-yr	378.16	313	316.39	316.39	317.12	0.0068	7.88	152.15	133.06	0.77		
5784	500-yr	559.24	313	316.91	316.91	317.68	0.0067	8.68	232	164.76	0.79		
5683	2-yr	76.79	311.5	313.12	313.05	313.41	0.0084	4.55	24.5	46.17	0.75		
5683	10-yr	183.75	311.5	313.65	313.65	314.16	0.0098	6.35	55.28	69.91	0.86		
5683	10-yr 2100	248.5	311.5	313.84	313.84	314.5	0.0112	7.29	71.02	90.28	0.94		
5683	25-yr	258.28	311.5	314	314	314.56	0.0087	6.78	87.04	105.48	0.84		
5683	25-yr 2100	340.13	311.5	314.27	314.27	314.87	0.0085	7.28	117.02	114.82	0.85		

Table C-3
Alternative 2: Proposed 14-foot Span Bridges HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
5683	50-yr	316.24	311.5	314.19	314.19	314.79	0.0087	7.19	107.73	113.09	0.85		
5683	50-yr 2100	436.86	311.5	314.5	314.5	315.2	0.009	7.98	144.15	118.91	0.88		
5683	100-yr	378.16	311.5	314.37	314.37	315.01	0.0086	7.54	128.59	116.58	0.86		
5683	500-yr	559.24	311.5	314.79	314.79	315.55	0.009	8.58	179.55	126.92	0.9		
5584	2-yr	76.79	311	312	312	312.36	0.0137	4.96	21.68	89.53	0.93		
5584	10-yr	183.75	311	312.42	312.25	312.72	0.0095	5.39	93.45	94.93	0.83		
5584	10-yr 2100	248.5	311	312.7	312.45	313.03	0.0085	5.78	120.12	97.03	0.81		
5584	25-yr	258.28	311	312.74	312.48	313.07	0.0084	5.85	123.65	97.31	0.81		
5584	25-yr 2100	340.13	311	313.02	312.69	313.41	0.0082	6.4	151.18	99.69	0.82		
5584	50-yr	316.24	311	312.94	312.63	313.31	0.0082	6.25	143.36	99.02	0.82		
5584	50-yr 2100	436.86	311	313.32	312.93	313.77	0.008	6.99	181.44	103.77	0.83		
5584	100-yr	378.16	311	313.14	312.79	313.56	0.0081	6.63	163.4	100.84	0.82		
5584	500-yr	559.24	311	313.64	313.18	314.19	0.0081	7.71	216.81	111.39	0.86		
5486	2-yr	76.79	309	310.5	310.5	311	0.0135	5.73	15.22	37.58	0.94		
5486	10-yr	183.75	309	311.31	311.31	311.83	0.0084	6.45	76.9	95.78	0.81		
5486	10-yr 2100	248.5	309	311.57	311.57	312.17	0.0087	7.16	102.45	101.23	0.84		
5486	25-yr	258.28	309	311.61	311.61	312.21	0.0087	7.24	106.41	101.94	0.85		
5486	25-yr 2100	340.13	309	311.9	311.9	312.56	0.0088	7.86	136.24	106.44	0.87		
5486	50-yr	316.24	309	311.82	311.82	312.46	0.0087	7.67	128.29	105.45	0.86		
5486	50-yr 2100	436.86	309	312.17	312.17	312.91	0.0092	8.6	165.27	110.24	0.9		
5486	100-yr	378.16	309	312.01	312.01	312.7	0.0089	8.16	148.1	108.03	0.88		
5486	500-yr	559.24	309	312.46	312.46	313.3	0.0097	9.42	197.99	114.42	0.94		
5384	2-yr	76.79	307.8	309.31	309.16	309.67	0.0095	4.8	17.31	25.22	0.8		
5384	10-yr	183.75	307.8	309.99	309.99	310.64	0.01	6.71	45.84	53.13	0.88		
5384	10-yr 2100	248.5	307.8	310.33	310.29	311.1	0.0096	7.4	66.99	86.24	0.89		
5384	25-yr	258.28	307.8	310.45	310.45	311.15	0.0084	7.14	77.44	92.99	0.84		
5384	25-yr 2100	340.13	307.8	310.86	310.86	311.55	0.007	7.33	126.4	126.14	0.79		
5384	50-yr	316.24	307.8	310.78	310.78	311.45	0.007	7.19	116.03	124.7	0.79		
5384	50-yr 2100	436.86	307.8	311.15	311.15	311.9	0.0072	7.94	163.58	131.28	0.81		
5384	100-yr	378.16	307.8	310.99	310.99	311.69	0.007	7.56	142.06	128.27	0.8		
5384	500-yr	559.24	307.8	311.44	311.44	312.29	0.0077	8.75	201.34	136.53	0.86		
5293	2-yr	76.79	306.4	307.96	307.96	308.56	0.0154	6.21	12.38	27.03	1		
5293	10-yr	183.75	306.4	308.83	308.83	309.62	0.0111	7.58	43.21	33.12	0.93		
5293	10-yr 2100	248.5	306.4	309.2	309.2	310.14	0.0111	8.43	55.58	34.53	0.95		
5293	25-yr	258.28	306.4	309.24	309.24	310.21	0.0111	8.56	57.2	34.72	0.96		
5293	25-yr 2100	340.13	306.4	309.86	309.86	310.74	0.0081	8.44	82.34	48.98	0.84		
5293	50-yr	316.24	306.4	309.69	309.69	310.61	0.0088	8.5	74.67	44.36	0.87		
5293	50-yr 2100	436.86	306.4	310.39	310.39	311.13	0.0061	8.16	112.2	61.94	0.75		
5293	100-yr	378.16	306.4	310.16	310.16	310.91	0.0064	8.02	98.66	57.89	0.77		
5293	500-yr	559.24	306.4	310.82	310.82	311.54	0.0055	8.37	141.79	78.29	0.73		

Table C-4
Alternative 3: Proposed 16-foot Span Bridge at Crossing 2 HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6760	2-yr	76.79	339	340.59		340.93	0.0071	4.76	17.98	18.52	0.69		
6760	10-yr	183.75	339	341.32	341.21	342.08	0.0097	7.24	33.68	24.41	0.86		
6760	10-yr 2100	248.49	339	341.62	341.62	342.63	0.011	8.4	41.54	26.76	0.93		
6760	25-yr	258.27	339	341.68	341.68	342.71	0.0109	8.5	43.15	27.25	0.93		
6760	25-yr 2100	340.11	339	342.06	342.06	343.31	0.0114	9.52	53.89	30.29	0.98		
6760	50-yr	316.21	339	341.99	341.99	343.14	0.0107	9.1	51.87	29.69	0.95		
6760	50-yr 2100	436.89	339	342.69	342.69	343.93	0.009	9.65	77.08	40.44	0.9		
6760	100-yr	378.18	339	342.41	342.41	343.59	0.0093	9.27	66.26	37.8	0.9		
6760	500-yr	559.29	339	343.2	343.2	344.57	0.0087	10.34	99.04	45.07	0.9		
6664	2-yr	76.79	338.4	339.9	339.78	340.22	0.0075	4.69	24.23	42.4	0.7		
6664	10-yr	183.75	338.4	340.46	340.46	341.07	0.0104	6.93	49.03	46.6	0.88		
6664	10-yr 2100	248.49	338.4	340.76	340.76	341.46	0.0105	7.65	63.32	48.74	0.9		
6664	25-yr	258.27	338.4	340.8	340.8	341.51	0.0106	7.76	65.17	49	0.9		
6664	25-yr 2100	340.11	338.4	341.11	341.11	341.94	0.0108	8.56	80.66	51.08	0.94		
6664	50-yr	316.21	338.4	341.01	341.01	341.82	0.0108	8.36	76.07	50.41	0.93		
6664	50-yr 2100	436.89	338.4	341.42	341.42	342.39	0.0112	9.4	97.23	53.67	0.97		
6664	100-yr	378.18	338.4	341.23	341.23	342.12	0.011	8.91	87.2	52.07	0.95		
6664	500-yr	559.29	338.4	341.76	341.76	342.9	0.0118	10.38	116.12	77.88	1.01		
6564	2-yr	76.79	337.3	338.56	338.56	339.13	0.0162	6.08	12.73	31.53	1		
6564	10-yr	183.75	337.3	339.25	339.25	339.8	0.0109	6.82	53.32	53.23	0.89		
6564	10-yr 2100	248.49	337.3	339.51	339.51	340.16	0.0114	7.61	67.49	55.2	0.93		
6564	25-yr	258.27	337.3	339.55	339.55	340.21	0.0113	7.68	70	55.54	0.92		
6564	25-yr 2100	340.11	337.3	339.84	339.84	340.6	0.0116	8.47	86.1	57.47	0.96		
6564	50-yr	316.21	337.3	339.76	339.76	340.49	0.0116	8.26	81.5	56.94	0.95		
6564	50-yr 2100	436.89	337.3	340.14	340.14	341.01	0.0119	9.26	103.47	59.42	0.99		
6564	100-yr	378.18	337.3	339.96	339.96	340.77	0.0117	8.79	93.13	58.27	0.97		
6564	500-yr	559.29	337.3	340.47	340.47	341.48	0.0123	10.14	123.43	61.48	1.02		
6487	2-yr	76.79	333.9	335.17	335.17	335.69	0.0142	5.8	14.18	73.64	0.94		
6487	10-yr	183.75	333.9	335.4	335.4	335.79	0.0143	6.56	68.3	79.61	0.97		
6487	10-yr 2100	248.49	333.9	335.58	335.58	336.05	0.0153	7.35	83.24	81.22	1.03		
6487	25-yr	258.27	333.9	335.61	335.61	336.09	0.0155	7.48	85.09	81.38	1.04		
6487	25-yr 2100	340.11	333.9	336.45	335.81	336.67	0.0048	5.48	155	85.31	0.62		
6487	50-yr	316.21	333.9	335.95	335.76	336.34	0.0103	6.94	113.22	83.03	0.87		
6487	50-yr 2100	436.89	333.9	337.78	336.03	337.9	0.0015	4.05	273.23	91.99	0.37		
6487	100-yr	378.18	333.9	336.98	335.9	337.14	0.0027	4.7	201.65	87.67	0.48		
6487	500-yr	559.29	333.9	336.27	336.27	337.03	0.0175	9.98	139.82	84.51	1.17		
6445	2-yr	76.79	329.1	334.26	330.75	334.35	0.0003	2.34	32.84	59.56	0.18		
6445	10-yr	183.75	329.1	335.14	332.06	335.5	0.001	4.78	38.44	91.31	0.34		
6445	10-yr 2100	248.49	329.1	334.76	332.72	335.5	0.0022	6.91	35.99	72.95	0.51		
6445	25-yr	258.27	329.1	334.67	332.81	335.5	0.0025	7.29	35.45	70.75	0.54		
6445	25-yr 2100	340.11	329.1	333.55	333.55	335.79	0.0091	12.01	28.32	40.03	1		
6445	50-yr	316.21	329.1	333.56	333.35	335.49	0.0078	11.15	28.37	40.45	0.93		
6445	50-yr 2100	436.89	329.1	334.36	334.36	337.01	0.0086	13.05	33.47	62.19	1		
6445	100-yr	378.18	329.1	333.9	333.9	336.28	0.0088	12.4	30.5	52.72	1		
6445	500-yr	559.29	329.1	335.56	335.32	335.99	0.0016	5.8	210.45	101.61	0.41		
6410	2-yr	76.79										7.82	8.75
6410	10-yr	183.75										9.16	9.17
6410	10-yr 2100	248.49										9.27	9.83
6410	25-yr	258.27										9.26	9.72
6410	25-yr 2100	340.11										8.14	8.14
6410	50-yr	316.21										8.6	8.6
6410	50-yr 2100	436.89										6.52	6.52
6410	100-yr	378.18										7.37	7.37
6410	500-yr	559.29										4.44	4.44
6391	2-yr	76.79	329	331.08	330.23	331.27	0.0024	3.5	23.84	30.99	0.43		
6391	10-yr	183.75	329	331.87	331.15	332.41	0.0044	5.96	34.56	48.54	0.63		
6391	10-yr 2100	248.49	329	331.61	331.61	332.82	0.0113	8.91	31.02	42.75	0.98		
6391	25-yr	258.27	329	331.67	331.67	332.92	0.0113	9.06	31.78	43.99	0.99		
6391	25-yr 2100	340.11	329	332.18	332.18	333.67	0.0107	9.92	38.69	55.3	0.99		
6391	50-yr	316.21	329	332.03	332.03	333.46	0.0109	9.7	36.68	52.01	0.99		
6391	50-yr 2100	436.89	329	332.72	332.72	334.49	0.0103	10.83	45.97	105.53	1		
6391	100-yr	378.18	329	332.39	332.39	334	0.0106	10.3	41.6	60.07	0.99		
6391	500-yr	559.29	329	333.36	333.36	335.44	0.0098	11.75	54.62	164.6	1		
6336	2-yr	76.79	329.1	330.33	330.33	330.88	0.0155	5.99	13.36	67.71	0.98		
6336	10-yr	183.75	329.1	331.21	331.21	331.98	0.0111	7.37	45.8	110.02	0.91		
6336	10-yr 2100	248.49	329.1	331.26	331.26	331.42	0.0044	4.73	164.89	114.44	0.58		

Table C-4
Alternative 3: Proposed 16-foot Span Bridge at Crossing 2 HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
6336	25-yr	258.27	329.1	331.26	331.26	331.43	0.0048	4.92	164.89	114.44	0.6		
6336	25-yr 2100	340.11	329.1	331.26	331.26	331.56	0.0083	6.47	164.89	114.44	0.79		
6336	50-yr	316.21	329.1	331.26	331.26	331.52	0.0072	6.02	164.89	114.44	0.73		
6336	50-yr 2100	436.89	329.1	331.27	331.27	331.76	0.0136	8.28	165.74	114.57	1.01		
6336	100-yr	378.18	329.1	331.26	331.26	331.63	0.0103	7.2	164.89	114.44	0.88		
6336	500-yr	559.29	329.1	331.31	331.31	332.08	0.0206	10.33	170.6	115.27	1.24		
6255	2-yr	76.79	324.9	326.01	326.01	326.52	0.0163	5.76	13.33	89.19	1		
6255	10-yr	183.75	324.9	326.85	326.85	327.72	0.0128	7.52	27.07	131.64	0.97		
6255	10-yr 2100	248.49	324.9	327.35	327.35	328.27	0.0101	7.82	43.26	166.04	0.9		
6255	25-yr	258.27	324.9	327.43	327.43	328.34	0.0097	7.82	46.89	171.34	0.88		
6255	25-yr 2100	340.11	324.9	327.47	327.47	327.74	0.0049	5.63	217.46	176.45	0.63		
6255	50-yr	316.21	324.9	327.47	327.47	327.7	0.0042	5.23	217.47	176.45	0.59		
6255	50-yr 2100	436.89	324.9	327.48	327.48	327.92	0.0079	7.19	218.78	176.49	0.8		
6255	100-yr	378.18	324.9	327.47	327.47	327.8	0.006	6.26	217.46	176.45	0.7		
6255	500-yr	559.29	324.9	327.59	327.59	328.18	0.0105	8.51	238.28	177.11	0.93		
6142	2-yr	76.79	322.2	323.47	323.47	324.03	0.0163	6.03	12.73	78.84	1		
6142	10-yr	183.75	322.2	324.44	324.44	324.47	0.001	2.29	156.96	167.42	0.28		
6142	10-yr 2100	248.49	322.2	324.44	324.44	324.5	0.0019	3.1	156.94	167.41	0.38		
6142	25-yr	258.27	322.2	324.44	324.44	324.51	0.002	3.22	156.94	167.41	0.39		
6142	25-yr 2100	340.11	322.2	324.44	324.44	324.56	0.0035	4.24	156.94	167.4	0.52		
6142	50-yr	316.21	322.2	324.44	324.44	324.54	0.0031	3.94	156.94	167.41	0.48		
6142	50-yr 2100	436.89	322.2	324.44	324.44	324.63	0.0058	5.45	156.94	167.4	0.66		
6142	100-yr	378.18	322.2	324.44	324.44	324.59	0.0044	4.72	156.94	167.4	0.57		
6142	500-yr	559.29	322.2	324.45	324.45	324.76	0.0094	6.93	158.2	168.73	0.84		
6058	2-yr	76.79	320	321.19	321.19	321.72	0.0163	5.84	13.17	92.89	1		
6058	10-yr	183.75	320	321.99	321.99	322.14	0.004	4.22	176.09	194.61	0.55		
6058	10-yr 2100	248.49	320	321.99	321.99	322.26	0.0074	5.71	176.07	194.6	0.74		
6058	25-yr	258.27	320	321.99	321.99	322.29	0.008	5.93	176.07	194.6	0.77		
6058	25-yr 2100	340.11	320	322.07	322.07	322.49	0.0111	7.2	192.08	195.83	0.91		
6058	50-yr	316.21	320	322.02	322.02	322.43	0.0109	7.02	182.61	195.08	0.9		
6058	50-yr 2100	436.89	320	322.23	322.23	322.72	0.0123	8	223.48	197.94	0.97		
6058	100-yr	378.18	320	322.14	322.14	322.58	0.0115	7.51	205.44	196.71	0.93		
6058	500-yr	559.29	320	322.42	322.42	322.98	0.0133	8.82	260.51	200.4	1.03		
5994	2-yr	76.79	317.8	319.06	319.06	319.63	0.0161	6.06	12.7	45.61	1		
5994	10-yr	183.75	317.8	320.05	320.05	320.85	0.0103	7.36	39.91	179.84	0.89		
5994	10-yr 2100	248.49	317.8	320.2	320.2	320.46	0.0051	5.42	189.75	189.72	0.63		
5994	25-yr	258.27	317.8	320.2	320.2	320.48	0.0056	5.64	189.75	189.72	0.66		
5994	25-yr 2100	340.11	317.8	320.21	320.21	320.68	0.0094	7.34	192.06	190.06	0.85		
5994	50-yr	316.21	317.8	320.21	320.21	320.61	0.0082	6.86	191.16	189.91	0.8		
5994	50-yr 2100	436.89	317.8	320.4	320.4	320.92	0.01	8.02	229.17	194.7	0.9		
5994	100-yr	378.18	317.8	320.3	320.3	320.78	0.0094	7.55	209.55	192.57	0.86		
5994	500-yr	559.29	317.8	320.61	320.61	321.19	0.0108	8.79	269.87	198.14	0.94		
5900	2-yr	76.79	315.3	316.38	316.38	316.91	0.0162	5.79	13.27	45.57	1		
5900	10-yr	183.75	315.3	317.21	317.21	317.58	0.0073	5.67	84.37	89.8	0.73		
5900	10-yr 2100	248.49	315.3	317.27	317.27	317.88	0.0116	7.34	89.17	92.75	0.93		
5900	25-yr	258.27	315.3	317.3	317.3	317.93	0.0117	7.45	91.8	94.63	0.94		
5900	25-yr 2100	340.11	315.3	317.61	317.61	318.27	0.0108	7.89	127.2	110.81	0.92		
5900	50-yr	316.21	315.3	317.54	317.54	318.18	0.0108	7.71	118.93	109.44	0.92		
5900	50-yr 2100	436.89	315.3	317.87	317.87	318.62	0.0112	8.64	156.49	115.83	0.96		
5900	100-yr	378.18	315.3	317.71	317.71	318.41	0.0111	8.24	138.16	112.62	0.94		
5900	500-yr	559.29	315.3	318.19	318.19	319.04	0.0115	9.43	194.04	125.7	0.99		
5784	2-yr	76.79	313	314.26	314.26	314.83	0.0164	6.09	12.62	11.8	1		
5784	10-yr	183.75	313	315.19	315.19	316.11	0.0122	7.81	30.59	26.17	0.95		
5784	10-yr 2100	248.49	313	315.91	315.91	316.54	0.0064	6.91	92.59	115.29	0.73		
5784	25-yr	258.27	313	315.94	315.94	316.59	0.0066	7.03	96.52	116.11	0.74		
5784	25-yr 2100	340.11	313	316.22	316.22	316.96	0.0071	7.8	129.96	124.3	0.78		
5784	50-yr	316.21	313	316.15	316.15	316.86	0.0069	7.57	121.02	121.63	0.77		
5784	50-yr 2100	436.89	313	316.62	316.62	317.32	0.0063	7.97	186.26	152.05	0.75		
5784	100-yr	378.18	313	316.39	316.39	317.12	0.0068	7.88	152.21	133.08	0.77		
5784	500-yr	559.29	313	316.91	316.91	317.68	0.0067	8.68	232.01	164.77	0.79		
5683	2-yr	76.79	311.5	313.12	313.05	313.41	0.0084	4.55	24.5	46.17	0.75		
5683	10-yr	183.75	311.5	313.65	313.65	314.16	0.0098	6.35	55.28	69.91	0.86		
5683	10-yr 2100	248.49	311.5	313.84	313.84	314.5	0.0112	7.3	71.01	90.27	0.94		
5683	25-yr	258.27	311.5	314	314	314.56	0.0087	6.78	87.05	105.48	0.84		
5683	25-yr 2100	340.11	311.5	314.27	314.27	314.87	0.0085	7.28	117	114.82	0.85		

Table C-4
Alternative 3: Proposed 16-foot Span Bridge at Crossing 2 HEC-RAS Results

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
5683	50-yr	316.21	311.5	314.19	314.19	314.79	0.0087	7.19	107.72	113.09	0.85		
5683	50-yr 2100	436.89	311.5	314.5	314.5	315.2	0.009	7.98	144.15	118.91	0.88		
5683	100-yr	378.18	311.5	314.35	314.35	315.01	0.0089	7.62	126.87	116.32	0.87		
5683	500-yr	559.29	311.5	314.79	314.79	315.55	0.009	8.58	179.58	126.92	0.9		
5584	2-yr	76.79	311	312	312	312.36	0.0137	4.96	21.68	89.53	0.93		
5584	10-yr	183.75	311	312.42	312.25	312.72	0.0095	5.39	93.45	94.93	0.83		
5584	10-yr 2100	248.49	311	312.7	312.45	313.03	0.0086	5.8	119.7	96.99	0.81		
5584	25-yr	258.27	311	312.74	312.47	313.07	0.0085	5.86	123.37	97.29	0.81		
5584	25-yr 2100	340.11	311	313.02	312.69	313.41	0.0081	6.39	151.44	99.71	0.82		
5584	50-yr	316.21	311	312.94	312.63	313.31	0.0082	6.25	143.4	99.02	0.82		
5584	50-yr 2100	436.89	311	313.32	312.93	313.77	0.008	6.99	181.39	103.76	0.83		
5584	100-yr	378.18	311	313.14	312.79	313.56	0.008	6.63	163.53	100.86	0.82		
5584	500-yr	559.29	311	313.64	313.18	314.19	0.0081	7.71	216.87	111.4	0.86		
5486	2-yr	76.79	309	310.5	310.5	311	0.0135	5.73	15.22	37.58	0.94		
5486	10-yr	183.75	309	311.31	311.31	311.83	0.0084	6.45	76.9	95.78	0.81		
5486	10-yr 2100	248.49	309	311.58	311.58	312.17	0.0086	7.12	103.12	101.35	0.84		
5486	25-yr	258.27	309	311.62	311.62	312.21	0.0086	7.21	106.84	102.01	0.84		
5486	25-yr 2100	340.11	309	311.89	311.89	312.56	0.0088	7.88	135.81	106.38	0.87		
5486	50-yr	316.21	309	311.82	311.82	312.46	0.0087	7.68	128.19	105.44	0.86		
5486	50-yr 2100	436.89	309	312.16	312.16	312.91	0.0092	8.6	165.12	110.22	0.9		
5486	100-yr	378.18	309	312.01	312.01	312.7	0.009	8.17	147.88	108	0.88		
5486	500-yr	559.29	309	312.46	312.46	313.3	0.0097	9.42	197.94	114.41	0.94		
5384	2-yr	76.79	307.8	309.87		310.01	0.0022	3.05	39.74	52.69	0.41		
5384	10-yr	183.75	307.8	310.78		311	0.0024	4.19	115.25	124.56	0.46		
5384	10-yr 2100	248.49	307.8	311.21		311.44	0.0021	4.37	171.31	132.26	0.44		
5384	25-yr	258.27	307.8	311.28		311.5	0.0021	4.39	179.63	133.31	0.44		
5384	25-yr 2100	340.11	307.8	311.67		311.91	0.0021	4.76	233.15	141	0.45		
5384	50-yr	316.21	307.8	311.56		311.8	0.0021	4.65	218.88	138.9	0.45		
5384	50-yr 2100	436.89	307.8	311.96		312.25	0.0024	5.33	275.2	145.79	0.48		
5384	100-yr	378.18	307.8	311.76		312.03	0.0023	5.06	246.67	142.86	0.47		
5384	500-yr	559.29	307.8	312.33		312.65	0.0025	5.85	329.36	149.48	0.51		
5293	2-yr	76.79	306.4	307.96	307.96	308.56	0.0154	6.21	12.38	27.03	1		
5293	10-yr	183.75	306.4	308.83	308.83	309.62	0.0111	7.58	43.21	33.12	0.93		
5293	10-yr 2100	248.49	306.4	309.2	309.2	310.14	0.011	8.43	55.61	34.54	0.95		
5293	25-yr	258.27	306.4	309.25	309.25	310.21	0.0111	8.54	57.37	34.74	0.95		
5293	25-yr 2100	340.11	306.4	309.85	309.85	310.74	0.0082	8.49	81.78	48.63	0.85		
5293	50-yr	316.21	306.4	309.69	309.69	310.61	0.0088	8.51	74.52	44.27	0.88		
5293	50-yr 2100	436.89	306.4	310.39	310.39	311.13	0.0061	8.16	112.26	61.98	0.75		
5293	100-yr	378.18	306.4	310.16	310.16	310.91	0.0064	8.02	98.67	57.9	0.77		
5293	500-yr	559.29	306.4	310.82	310.82	311.54	0.0055	8.36	142.01	78.38	0.73		

ATTACHMENT D

Planning Level Opinion of Probable Construction Costs

Opinion of Probable Construction Cost - Planning Level Alternative 1
Forbush Mill Road over Still River Culvert Replacement
Town of Bolton, MA
Precast Box Culvert - 9.9 FT Span

ITEM	DESCRIPTION	QTY	UNITS	UNIT PRICE	AMOUNT
101.	Clearing and Grubbing	0.30	A	$ 55,000.00	$ 16,500.00
103.	Tree Removed (Diameter 9" to 24")	2	EA	$ 2,000.00	$ 4,000.00
104.	Tree Removed (Diameter Over 24")	1	EA	$ 3,500.00	$ 3,500.00
113.1	Existing Culvert Disposal	1	LS	$ 20,000.00	$ 20,000.00
120.	Earth Excavation	310	CY	$ 50.00	$ 15,500.00
140.	Bridge Excavation	220	CY	$ 65.00	$ 14,300.00
150.	Ordinary Borrow	470	CY	$ 45.00	$ 21,150.00
151.	Gravel Borrow	280	CY	$ 50.00	$ 14,000.00
151.2	Gravel Borrow for Backfilling Structures and Pipes	60	CY	$ 60.00	$ 3,600.00
156.1	Crushed Stone for Bridge Foundations	50	TON	$ 70.00	$ 3,500.00
170.	Fine Grading and Compacting	670	SY	$ 10.00	$ 6,700.00
415.2	Pavement Fine Milling	60	SY	$ 25.00	$ 1,500.00
460.	Hot Mix Asphalt for Local Streets	200	TON	$ 200.00	$ 40,000.00
482.3	Sawcutting Asphalt Pavement	40	FT	$ 10.00	$ 400.00
620.12	Guardrail, TL-2 (Single Faced)	240	FT	$ 60.00	$ 14,400.00
627.82	Guardrail Tangent End Treatment, TL-2	2	EA	$ 5,500.00	$ 11,000.00
627.92	Guardrail Flared End Treatment, TL-2	2	EA	$ 4,750.00	$ 9,500.00
628.24	Transition to Bridge Rail	0	EA	$ 6,500.00	$ -
748.	Mobilization	1	LS	$ 30,000.00	$ 30,000.00
751.	Loam for Roadsides	160	CY	$ 80.00	$ 12,800.00
765.	Seeding	1200	SY	$ 3.00	$ 3,600.00
767.12	Compost Filter Tubes	600	FT	$ 12.00	$ 7,200.00
769.	Pavement Milling Mulch Under Guardrail	340	FT	$ 10.00	$ 3,400.00
771.	Tree Planting	3	EA	$ 3,000.00	$ 9,000.00
850.	Operations for Temporary Traffic Control	1	LS	$ 20,000.00	$ 20,000.00
860.104	4 Inch Reflectorized White Line (Painted)	500	FT	$ 2.00	$ 1,000.00
861.104	4 Inch Reflectorized Yellow Line (Painted)	500	FT	$ 2.00	$ 1,000.00
965.	Membrane Waterproofing for Bridge Decks	600	SF	$ 14.00	$ 8,400.00
970.	Damp-proofing	1000	SF	$ 5.00	$ 5,000.00
983.1	Riprap	20	CY	$ 100.00	$ 2,000.00
983.2	Streambed Material	70	CY	$ 70.00	$ 4,900.00
986.2	Modified Rockfill	80	CY	$ 140.00	$ 11,200.00
991.1	Control of Water - Structure No. 1	1	LS	$ 25,000.00	$ 25,000.00
995.01	Bridge Structure, Bridge No. 1	1	LS	$ 340,000.00	$ 340,000.00
999.5	Monthly Price Adjustment for HMA Mixtures	1	ALL	$ 2,000.00	$ 2,000.00
999.6	Monthly Price Adjustment for Diesel Fuel	1	ALL	$ 2,000.00	$ 2,000.00
999.7	Monthly Price Adjustment for Gasoline	1	ALL	$ 2,000.00	$ 2,000.00
999.8	Monthly Price Adjustment for Reinforcing Steel	1	ALL	$ 2,000.00	$ 2,000.00
999.9	Monthly Price Adjustment for Portland Cement Concrete	1	ALL	$ 1,000.00	$ 1,000.00
				SUBTOTAL	**$ 693,050**
	Project Contingency		10%		$ 69,400
	Material and Bidding Escalation Contingency (Bid Fall 2023)		15%		$ 104,000
	Construction Phase Services		10%		$ 69,400
				TOTAL	**$ 935,850**
				USE	**$ 940,000**

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Opinion of Probable Construction Cost - Planning Level Alternative 2
Forbush Mill Road over Still River Culvert Replacement
Town of Bolton, MA
Precast Concrete Rigid Frame - 14 FT Span

ITEM	DESCRIPTION	QTY	UNITS	UNIT PRICE	AMOUNT
101.	Clearing and Grubbing	0.30	A	$ 55,000.00	$ 16,500.00
103.	Tree Removed (Diameter 9" to 24")	2	EA	$ 2,000.00	$ 4,000.00
104.	Tree Removed (Diameter Over 24")	1	EA	$ 3,500.00	$ 3,500.00
113.1	Existing Culvert Disposal	1	LS	$ 20,000.00	$ 20,000.00
120.	Earth Excavation	310	CY	$ 50.00	$ 15,500.00
140.	Bridge Excavation	400	CY	$ 65.00	$ 26,000.00
150.	Ordinary Borrow	80	CY	$ 45.00	$ 3,600.00
151.	Gravel Borrow	280	CY	$ 50.00	$ 14,000.00
151.2	Gravel Borrow for Backfilling Structures and Pipes	200	CY	$ 60.00	$ 12,000.00
156.1	Crushed Stone for Bridge Foundations	80	TON	$ 70.00	$ 5,600.00
170.	Fine Grading and Compacting	670	SY	$ 10.00	$ 6,700.00
415.2	Pavement Fine Milling	60	SY	$ 25.00	$ 1,500.00
460.	Hot Mix Asphalt for Local Streets	200	TON	$ 200.00	$ 40,000.00
482.3	Sawcutting Asphalt Pavement	40	FT	$ 10.00	$ 400.00
620.12	Guardrail, TL-2 (Single Faced)	80	FT	$ 60.00	$ 4,800.00
627.82	Guardrail Tangent End Treatment, TL-2	2	EA	$ 5,500.00	$ 11,000.00
627.92	Guardrail Flared End Treatment, TL-2	2	EA	$ 4,750.00	$ 9,500.00
628.24	Transition to Bridge Rail	4	EA	$ 6,500.00	$ 26,000.00
748.	Mobilization	1	LS	$ 30,000.00	$ 30,000.00
751.	Loam for Roadsides	160	CY	$ 80.00	$ 12,800.00
765.	Seeding	1200	SY	$ 3.00	$ 3,600.00
767.12	Compost Filter Tubes	600	FT	$ 12.00	$ 7,200.00
769.	Pavement Milling Mulch Under Guardrail	310	FT	$ 10.00	$ 3,100.00
771.	Tree Planting	3	EA	$ 3,000.00	$ 9,000.00
850.	Operations for Temporary Traffic Control	1	LS	$ 20,000.00	$ 20,000.00
860.104	4 Inch Reflectorized White Line (Painted)	500	FT	$ 2.00	$ 1,000.00
861.104	4 Inch Reflectorized Yellow Line (Painted)	500	FT	$ 2.00	$ 1,000.00
965.	Membrane Waterproofing for Bridge Decks	620	SF	$ 14.00	$ 8,680.00
970.	Damp-proofing	1000	SF	$ 5.00	$ 5,000.00
983.1	Riprap	140	CY	$ 100.00	$ 14,000.00
983.2	Streambed Material	50	CY	$ 70.00	$ 3,500.00
986.2	Modified Rockfill	80	CY	$ 140.00	$ 11,200.00
991.1	Control of Water - Structure No. 1	1	LS	$ 25,000.00	$ 25,000.00
995.01	Bridge Structure, Bridge No. 1	1	LS	$ 550,000.00	$ 550,000.00
999.5	Monthly Price Adjustment for HMA Mixtures	1	ALL	$ 2,000.00	$ 2,000.00
999.6	Monthly Price Adjustment for Diesel Fuel	1	ALL	$ 2,000.00	$ 2,000.00
999.7	Monthly Price Adjustment for Gasoline	1	ALL	$ 2,000.00	$ 2,000.00
999.8	Monthly Price Adjustment for Reinforcing Steel	1	ALL	$ 2,000.00	$ 2,000.00
999.9	Monthly Price Adjustment for Portland Cement Concrete	1	ALL	$ 1,000.00	$ 1,000.00
				SUBTOTAL	**$ 934,680**
	Project Contingency		10%		$ 93,500
	Material and Bidding Escalation Contingency (Bid Fall 2023)		15%		$ 140,300
	Construction Phase Services		10%		$ 93,500
				TOTAL	**$ 1,261,980**
				USE	**$ 1,270,000**

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Opinion of Probable Construction Cost - Alternative 3
Forbush Mill Road over Still River Culvert Replacement
Town of Bolton, MA
Precast Concrete Rigid Frame - 16 FT Span

ITEM	DESCRIPTION	QTY	UNITS	UNIT PRICE	AMOUNT
101.	Clearing and Grubbing	0.30	A	$ 55,000.00	$ 16,500.00
103.	Tree Removed (Diameter 9" to 24")	2	EA	$ 2,000.00	$ 4,000.00
104.	Tree Removed (Diameter Over 24")	1	EA	$ 3,500.00	$ 3,500.00
113.1	Existing Culvert Disposal	1	LS	$ 20,000.00	$ 20,000.00
120.	Earth Excavation	310	CY	$ 50.00	$ 15,500.00
140.	Bridge Excavation	420	CY	$ 65.00	$ 27,300.00
150.	Ordinary Borrow	80	CY	$ 45.00	$ 3,600.00
151.	Gravel Borrow	280	CY	$ 50.00	$ 14,000.00
151.2	Gravel Borrow for Backfilling Structures and Pipes	200	CY	$ 60.00	$ 12,000.00
156.1	Crushed Stone for Bridge Foundations	90	TON	$ 70.00	$ 6,300.00
170.	Fine Grading and Compacting	670	SY	$ 10.00	$ 6,700.00
415.2	Pavement Fine Milling	60	SY	$ 25.00	$ 1,500.00
460.	Hot Mix Asphalt for Local Streets	200	TON	$ 200.00	$ 40,000.00
482.3	Sawcutting Asphalt Pavement	40	FT	$ 10.00	$ 400.00
620.12	Guardrail, TL-2 (Single Faced)	80	FT	$ 60.00	$ 4,800.00
627.82	Guardrail Tangent End Treatment, TL-2	2	EA	$ 5,500.00	$ 11,000.00
627.92	Guardrail Flared End Treatment, TL-2	2	EA	$ 4,750.00	$ 9,500.00
628.24	Transition to Bridge Rail	4	EA	$ 6,500.00	$ 26,000.00
748.	Mobilization	1	LS	$ 30,000.00	$ 30,000.00
751.	Loam for Roadsides	160	CY	$ 80.00	$ 12,800.00
765.	Seeding	1200	SY	$ 3.00	$ 3,600.00
767.12	Compost Filter Tubes	600	FT	$ 12.00	$ 7,200.00
769.	Pavement Milling Mulch Under Guardrail	310	FT	$ 10.00	$ 3,100.00
771.	Tree Planting	3	EA	$ 3,000.00	$ 9,000.00
850.	Operations for Temporary Traffic Control	1	LS	$ 20,000.00	$ 20,000.00
860.104	4 Inch Reflectorized White Line (Painted)	500	FT	$ 2.00	$ 1,000.00
861.104	4 Inch Reflectorized Yellow Line (Painted)	500	FT	$ 2.00	$ 1,000.00
965.	Membrane Waterproofing for Bridge Decks	660	SF	$ 14.00	$ 9,240.00
970.	Damp-proofing	1000	SF	$ 5.00	$ 5,000.00
983.1	Riprap	160	CY	$ 100.00	$ 16,000.00
983.2	Streambed Material	60	CY	$ 70.00	$ 4,200.00
986.2	Modified Rockfill	80	CY	$ 140.00	$ 11,200.00
991.1	Control of Water - Structure No. 1	1	LS	$ 25,000.00	$ 25,000.00
995.01	Bridge Structure, Bridge No. 1	1	LS	$ 570,000.00	$ 570,000.00
999.5	Monthly Price Adjustment for HMA Mixtures	1	ALL	$ 2,000.00	$ 2,000.00
999.6	Monthly Price Adjustment for Diesel Fuel	1	ALL	$ 2,000.00	$ 2,000.00
999.7	Monthly Price Adjustment for Gasoline	1	ALL	$ 2,000.00	$ 2,000.00
999.8	Monthly Price Adjustment for Reinforcing Steel	1	ALL	$ 2,000.00	$ 2,000.00
999.9	Monthly Price Adjustment for Portland Cement Concrete	1	ALL	$ 1,000.00	$ 1,000.00
				SUBTOTAL	**$ 959,940**
	Project Contingency		10%		$ 96,000
	Material and Bidding Escalation Contingency (Bid Fall 2023)		15%		$ 144,000
	Construction Phase Services		10%		$ 96,000
				TOTAL	**$ 1,295,940**
				USE	**$ 1,300,000**

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