AECOM

Submitted to
Southern Indiana
Gas & Electric Company
dba Vectren Power
Supply, Inc. (SIGECO)
One Vectren Square
Evansville, IN 47708

Submitted by
AECOM
9400 Amberglen Boulevard
Austin, Texas 78729

October 13, 2016

CCR Certification:
Initial Inflow Design Flood Control System Plan
§257.82

for the

Ash Pond

at the

A.B. Brown Generating Station

Revision 0

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Executive Summary

This Coal Combustion Residuals (CCR) Initial Inflow Design Flood Control System Plan (Inflow Flood Control Plan) for the Ash Pond at the Southern Indiana Gas & Electric Company, dba Vectren Power Supply, Inc., A.B. Brown Generating Station has been prepared in accordance with the requirements specified in the USEPA CCR Rule under 40 Code of Federal Regulations §257.82 (a). These regulations require that the specified documentation, assessments and plans for an existing CCR surface impoundment be prepared by October 17, 2016.

This Inflow Flood Control Plan meets all requirements as summarized in **Table ES-1.**

Table ES-1 – Certification Summary

Report Section	CCR Rule Reference	Requirement Summary	Requirement Met?	Comments
Initial Inflow Design Flood Control System Plan				
4.1	§257.82 (a)(1)	*Adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood*	Yes	CCR unit has the storage capacity to handle the inflow design flood
4.2	§257.82 (a)(2)	*Adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood*	Yes	The outlet devices of the CCR unit control the peak discharge from the inflow design flood
4.3	§257.82 (a)(3)	*Required Inflow design flood for Significant Hazard Potential Impoundment*	Yes	Inflow design flood utilized was the 1,000 year event
4.4	§257.82 (b)	*Discharge handled in accordance with* §257.3 – 3	Yes	CCR unit discharges in accordance with the existing NPDES permit

The Ash Pond is considered to be a significant hazard potential CCR surface impoundment, therefore per §257.82 (a)(3), the inflow design flood is the 1,000-year flood. In accordance with the requirements of §257.82 (a)(3), an Inflow Flood Control Plan was developed for the Ash Pond. This was accomplished by evaluating the effects of a 24-hour duration design storm for the 1,000-year Inflow Design Flood (IDF) to evaluate the Ash

Pond's ability to collect and control the 1,000-year IDF of 10.0 inches, under existing operational and maintenance procedures. The results for the Ash Pond indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage inflows and collect and control outflows during peak discharge conditions created by the 1,000-year IDF.

1 Introduction

1.1 Purpose of This Report

The purpose of the Initial Inflow Design Flood Control System Plan (Inflow Flood Control Plan) is to document that the requirements specified in 40 Code of Federal Regulations (CFR) §257.82 have been met to support the certification required under each of the applicable regulatory provisions for the A.B. Brown Generating Station (Brown) Ash Pond. The Ash Pond is an existing coal combustion residuals (CCR) surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the Inflow Flood Control Plan for an existing CCR surface impoundment be prepared by October 17, 2016.

The Brown station has an interconnected existing CCR surface impoundment, the Ash Pond, which consists of a lower pool and an upper pool. The following table summarizes the documentation required within the CCR Rule and the sections that specifically respond to those requirements of this plan.

Table 1-1 – CCR Rule Cross Reference Table

Report Section	Title	CCR Rule Reference
4.1	Inflow Analysis	§257.82 (a)(1)
4.2	Outflow Analysis	§257.82 (a)(2)
4.3	Inflow Design Flood	§257.82 (a)(3)
4.4	Discharge handled in accordance with *§257.3 – 3*	§257.82 (b)

Analyses completed for the hydrologic and hydraulic assessments of the Ash Pond are described in this report. Data and analyses results in the following sections are based on spillway design information shown on design drawings, topographic surveys, information about operational and maintenance procedures provided by Southern Indiana Gas & Electric Company, dba Vectren Power Supply, Inc. (SIGECO), and limited field measurements collected by AECOM. The analysis approach and results of the hydrologic and hydraulic analyses presented in the following sections were used by AECOM to confirm that the Ash Pond meets the hydrologic and hydraulic capacity requirements of the rules referenced above for CCR surface impoundments.

1.2 Brief Description of Impoundment

The Brown station is a coal-fired power plant located approximately 10 miles east of Mount Vernon in Posey County, Indiana and is owned and operated by SIGECO. The station is situated just west of the Vanderburgh-Posey County line and north of the Ohio River with the Ash Pond positioned on the east side of the generating station.

The Ash Pond was commissioned in 1978. An earthen dam was constructed across an existing valley to create the impoundment. In 2003, a second dam was constructed east of the original dam and further up the valley to increase the storage capacity. This temporarily created an upper pond and a lower pond. The upper and lower ponds were operated separately until 2016 when the upper dam was decommissioned. A 10' wide breach was installed in the upper embankment and the normal pool elevation was lowered. Currently, the upper pool and the lower pool act as one CCR unit referred to as the Ash Pond, which has a surface area of approximately 159 acres.

The lower pool dam embankment is approximately 1,540 feet long, 30 feet high, and has 3 to 1 (horizontal to vertical) side slopes covered with grassy vegetation. The embankment crest elevation is 450.9 feet[1] and has a crest width of 20 feet. An earthen buttress was constructed against the outboard slope of the dam. The buttress crest extends the length of the dam, is up to 200 feet wide and varies in elevation from 442.0 feet to 432.0 feet. The operating elevation of the pool fluctuates from 439.0 feet to 444.0 feet. However, the pool normally operates at an elevation of 441.5 feet. The surface area of the lower pool impoundment is approximately 57 acres. The surface area of the upper pool impoundment is approximately 102 acres and has a normal operating level of 450 feet. A Site Location Map showing the area surrounding the station is included as **Figure 1** of **Appendix A**. **Figure 2** in **Appendix A** presents the Brown Site Map.

1.2.1 Inflow from Plant Operations and Stormwater Runoff

The Ash Pond impoundment is operated as a zero-discharge facility during normal operating conditions. It receives and impounds sluiced ash from the plant and also recirculates water back to the plant for other necessary processes. Bottom Ash and intermittently Fly Ash are sluiced from the plant into the west side of the upper pool at a combined rate of 9.8 cubic feet per second (cfs). The lower pool receives other process flows from the plant at a combined rate of 3.6 cfs. Water is recirculated back to the plant from the lower pool pump station at a variable rate of up to 14.0 cfs. The Ash Pond is operated such that the outflow to the plant is larger than the inflow from plant processes. Therefore, there is zero-discharge from the Ash Pond outlet devices during normal operating conditions.

In addition to rain that fall directly into the ponds, there are upstream areas that contribute runoff to the impoundments. Approximately 63.5 acres drain to the upper pool from upstream areas. The lower pool receives runoff from approximately 19.7 acres upstream as well as the discharged runoff from the upper pool.

1.2.2 Outlet Structures

The upper pool has two outlet devices that are located at the southern end of the embankment. The primary outlet device is a 66-inch diameter RCP drop inlet that is lined with a 63-inch diameter HDPE pipe that has an invert elevation of 450.0 feet. The drop inlet connects to a 30-inch diameter RCP pipe lined with a 26-inch HDPE pipe that discharges into the lower pool. The secondary outlet device is a 10' wide flat bottom trapezoidal breach with 5 to 1 (horizontal to vertical) side slopes and an invert elevation of 455.0 feet. The total length of the breach is approximately 302 feet. The upper reach of the channel has a slope of 1.8% for 217 feet while the lower reach has an 8.2% slope over 85 feet. The channel discharges to the lower pool at the approximate elevation of 444.0 feet. Class II riprap, which has a median diameter of approximately 15 inches, lines the channel to prevent erosion.

[1] Unless otherwise noted, all elevations in this report are in the NAVD88 datum.

The lower pool has five outlet devices. The first outlet is the Ash Pond Discharge Line. It consists of a 1,500 gallons per minute (gpm) pump which discharges into a 12-inch HDPE pipe that goes to a chemical precipitation treatment system prior to mixing with other plant water and going to an NPDES permitted outfall. Under normal conditions, the line discharges 0.6 cfs to the treatment system. The second and third outlet devices are two sets of pumps at the lower ash pond pump station: a Low Pressure Recirculation System and a High Pressure Recirculation System. The Low Pressure Recirculation System mainly supplies water to the bottom ash and fly ash handling systems. This system is comprised of three pumps that are rated for 2,750 gpm each. All three pumps discharge into individual 8-inch diameter carbon steel pipes before combining into a common header and proceeding as a 20-inch diameter carbon steel pipeline to the plant. Typically, two pumps operate at a time. Under normal conditions, the pumps recirculate 11.0 cfs back to the plant. The High Pressure Recirculation System supplies water to the scrubber at various locations. This system is comprised of two high pressure pumps that are rated for 2,100 gpm each. Both pumps discharge into individual 8-inch diameter carbon steel pipes before combining into a common header and proceeding as a 10-inch diameter carbon steel pipeline to the plant. Typically, one pump operates at a time. Under normal conditions, the pump recirculates 2.4 cfs back to the plant. Under normal conditions (both systems in operation) two low pressure pumps and one high pressure pump are in use. The fourth outlet device is the Principal Spillway located in the center of the dam embankment and has a gooseneck inlet structure with a 36-inch RCP drop inlet that acts as an overflow weir at elevation 444.0 feet. The drop inlet connects to a 36-inch RCP pipe that discharges to a tributary at the toe of the embankment. The fifth outlet device is the Emergency Spillway, a 30 foot wide trapezoidal channel with 5 to 1 (horizontal to vertical) side slopes and an upstream invert elevation of 447.0 feet. The upper reach of the spillway channel has a slope of 0.22% for 115 feet before the channel slope steepens down the backside of the embankment and outlets to a tributary at the toe of the slope. The channel is lined with Class II rip-rap.

2 Hydrologic Analysis

2.1 Design Storm

The Ash Pond has been categorized as a Significant hazard potential CCR impoundment, which indicates that the inflow design flood is the 1,000-year return frequency design storm event. The full analysis for this classification determination is included in the *CCR Certification: Initial Hazard Potential Classification for the Ash Pond at the A.B. Brown Generating Station*.

2.2 Rainfall Data

The rainfall information used in the analysis was based on the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 2, Version 3 which provides rainfall data for storm events with average recurrence intervals ranging from 1 to 1,000 years and durations ranging from 5 minutes to 60 days. The design storm rainfall depth, obtained from the NOAA website, is 10.0 inches for the 1,000-year, 24-hour storm. The Indiana Huff Third Quartile rainfall distribution used by AECOM is appropriate to use for storms up to the 1,000-year, 24-hour flood at the project site.

2.3 Runoff Computations

The drainage areas for the Ash Pond were determined using a computer-aided design (CAD) analysis of topographic surveys completed in 2014. In addition to rain that falls directly into the pond, there are upstream areas that contribute runoff to the impoundments. Approximately 63.5 acres drain to the upper pool from upstream areas. When the upstream area is added to the 102 acres within the embankments of the impoundment, the total drainage area of the upper pool is 165.5 acres. The lower pool receives direct runoff from approximately 19.7 acres upstream and 57.2 acres within the embankments of the impoundment. Because the upper pool discharges into the lower pool, the total drainage area to the lower pool is 242.4 acres. See **Figure 3** in **Appendix A** for the Drainage Area Maps.

Runoff was calculated using the SCS Curve Number Method, where curve numbers (CN) were assigned to each subcatchment based on the type of land cover and soil type present. Using the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey, the soil type of the site was determined to be hydrologic soil group C. CN values for the land cover were selected from the CN Table available in HydroCAD. This data was obtained from the SCS NRCS Technical Release-55 (TR-55) publication. Ash, 50%-75% Grass Cover, and Water Surface land covers that are located on site were determined to have a CN value of 98, 79, and 98 respectively. A composite CN was calculated for each subcatchment area by summing the products of each CN multiplied by its percentage of the total area.

The time of concentration is commonly defined as the time required for runoff to travel from the most hydrologically distant point to the point of collection. Calculations for the time of concentration for each sub-watershed were performed in HydroCAD and are included in **Appendix B**.

Stormwater runoff from the 1000-year event into the upper pool has an inflow of 139.3 cfs and inflow volume of 119.9 acre-feet. When added to the process flow from the plant, the upper pool has a total inflow of 149.1 cfs and

200.9 acre-feet. Stormwater runoff into the lower pool (not including the discharged runoff from the upper pool) has a peak inflow of 64.8 cfs and total inflow volume of 57.5 acre-feet. Refer to **Appendix B** for HydroCAD results.

3 Hydraulic Analyses

3.1 Process Flows

The Ash Pond impoundment is operated as a zero-discharge facility during normal operating conditions. The upper pool receives process flow from the plant at a rate of 9.8 cfs. The lower pool receives process flow from the plant at a rate of 3.6 cfs as well as recirculates water back to the plant for other necessary processes at a rate of 14.0 cfs. The Ash Pond is operated such that the recirculation back to the plant is larger than the inflow from plant processes. Therefore, there is zero-discharge from the Ash Pond outlet devices during normal operating conditions.

3.2 Storage Capacity

The storage volumes for the Ash Pond were determined using a computer-aided design (CAD) analysis of topographic surveys completed in 2014. The volume of storage was calculated by estimating the incremental storage volume present for each 1 foot elevation within the updated topographic surface supplied by SIGECO representatives. The incremental storage volume was then used to calculate a cumulative storage volume and was input into HydroCAD. The volume of storage within the upper pool from normal pool elevation of 450.0 feet to the top of embankment elevation of 464.0 feet is 412.6 acre-feet. Although the lower pool normally operates at an elevation of 441.5 feet, the water surface level can fluctuate. Therefore, the maximum operating level of 444.0 feet was used as the starting water surface elevation during the hydraulic analysis. The volume of storage within the lower pool from the starting water surface elevation of 444.0 feet to the top of embankment elevation of 450.9 feet is 316.2 acre-feet. Refer to **Appendix B** for further storage volume details.

3.3 Discharge Analysis

A hydraulic model was created in HydroCAD 10.00 to assess the capacity of the pond to store and convey the storm flows. HydroCAD has the capability to evaluate each pool within the network, to respond to variable tailwater, pumping rates, permit flow loops, and reversing flows. HydroCAD routing calculations reevaluate the pond's discharge capability at each time increment, making the program an efficient and dynamic tool for this evaluation.

The analyzed scenario assumes a starting water surface elevation at the following invert elevations of each pool. The upper pool water surface elevation is 450.0 feet, and the lower pool is 444.0 feet. Therefore, the facility does not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the NPDES under section 402 of the Clean Water Act.

4 Results

The hydrologic and hydraulic conditions of Ash Pond were modeled with the peak discharge of the 1,000-year storm event and the current process flow from the plant.

Regulatory Citation: 40 CFR §257.82 (a);

- *The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.*

4.1 Inflow Analysis

Regulatory Citation: 40 CFR §257.82 (a);

- *(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflows design flood specified in paragraph (3).*

Background and Assessment

Runoff to the impoundment is added to the process flow from the plant to produce the total inflow to the Ash Pond. Using the HydroCAD model, the total inflow was stored and routed through the outlet devices of the Ash Pond to determine the peak water surface elevations.

Table 4-1 summarizes the water surface elevations of the Ash Pond prior to and after the inflow design flood.

Table 4-1 - Summary of Hydrologic and Hydraulic Analysis
1,000-Year, 24-Hour Storm

CCR Unit	Beginning WSE[1] (feet)	Peak WSE (feet)	Top of Embankment Elevation (feet)	Freeboard Above Peak WSE (feet)
Upper Pool	450.0	457.6	464.0	6.4
Lower Pool	444.0	446.8	450.9	4.1

Notes:
[1] WSE = Water Surface Elevation used for hydraulic analysis

Conclusion and Recommendation

No modifications are necessary or recommended to this unit for compliance with the CCR Rule.

As there is adequate storage within the Ash Pond to manage the inflow design flood as well as the process flow from the plant, there is no anticipated overtopping of the Ash Pond embankment, which meets the requirements in §257.82 (a)(1).

4.2 Outflow Analysis

Regulatory Citation: 40 CFR §257.82 (a);

- *(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (3) of this section.*

Background and Assessment

Runoff to the impoundment is added to the process flow from the plant to produce the total inflow to the Ash Pond. Using the HydroCAD model, the total inflow was stored and routed through the outlet devices of the Ash Pond to determine the peak flowrate and velocity through the outlet devices.

Table 4-2 summarizes the peak flowrates and velocities through each of the outlet devices.

Table 4-2 - Summary of Outlet Devices
1,000-Year, 24-Hour Storm

Outlet Device	Type and Size	Invert Elevation (feet)	Peak Flowrate (cfs)	Velocity at Peak Flowrate (fps)
Upper Pool Primary Outlet	63” HDPE drop inlet	450.0	34.9	12.3
Upper Pool Secondary Outlet	10’ wide trapezoidal breach	455.0	84.3	3.2
Lower Pool Ash Pond Discharge Line	1 – 1,500 gpm Pump	NA	0.6	NA
Lower Pool Low Pressure Recirculation System	3 – 2,750 gpm Pumps	NA	11.0	NA
Lower Pool High Pressure Recirculation System	2 – 2,100 gpm Pumps	NA	2.4	NA
Lower Pool Principal Spillway	36” RCP drop inlet with gooseneck	444.0	38.8	5.7
Lower Pool Emergency Spillway	30’ wide trapezoidal channel	447.0	0.0	0.0

Conclusion and Recommendation

No modifications are necessary or recommended to this unit for compliance with the CCR Rule.

As the Ash Pond outlet devices manage the discharge of the inflow design flood and the process flow from the plant without the peak water surface elevation overtopping the Ash Pond embankment, the pond meets the requirements in §257.82 (a)(2).

4.3 Inflow Design Flood

Regulatory Citation: 40 CFR §257.82 (a);

- *(3) The inflow design flood is:*
  - *(i) For a high hazard potential CCR surface impoundment, as determined under §257.73(a)(2), the probable maximum flood;*
  - *(ii) For a significant hazard potential CCR surface impoundment, as determined under §257.73(a)(2), the 1,000-year flood;*
  - *(iii) For a low hazard potential CCR surface impoundment, as determined under §257.73(a)(2), the 100-year flood; or*
  - *(iv) For an incised CCR surface impoundment, the 25-year flood.*

Background and Assessment

The calculations for the inflow design flood are based on the hazard potential given to the impoundment. The different classifications of the impoundment hazard potential are high, significant, and low.

Conclusion and Recommendation

As the impoundment was given a significant hazard potential, the 1,000 year design storm was utilized in the analysis, which meets the requirements in §257.82 (a)(3).

4.4 Discharge

Regulatory Citation: 40 CFR §257.82 (b);

- *Discharge from the CCR unit must be handled in accordance with the surface water requirements under: §257.3 – 3.*

Background and Assessment

The primary discharge from the pond flows through a chemical precipitation treatment system prior to mixing with other plant water and discharging to an NPDES permitted outfall. The emergency discharge from the Ash Pond outlet devices enters a tributary via a permitted NPDES outfall that leads to the Ohio River. The discharge must meet the requirements of the NDPES permit under section 402 of the Clean Water Act to meet the CCR rule.

Conclusion and Recommendation

No modifications are necessary or recommended to this unit for compliance with the CCR Rule.

Runoff discharges from the site through a permitted NPDES outfall to an unnamed tributary which travels west for approximately 0.5 miles before turning south for approximately one mile and discharging into the Ohio River. As per the current NPDES permit, all discharged water is tested for pollutants to meet the minimum regulatory requirements of the permit, and thereby meets the requirements in §257.82 (b).

5 Conclusions

The Inflow Flood Control Plan of the Ash Pond adequately manages flow into the CCR unit during and following the peak discharge of the 1,000-year frequency storm event inflow design flood. The inflow design flood control system of the Ash Pond adequately manages flow from the CCR unit to collect and control the peak discharge resulting from the 1,000-year frequency storm event inflow design flood. Therefore, the Ash Pond meets the requirements for certification.

The contents of this report, specifically **Section 1** through **Section 4**, represent the Initial Inflow Design Flood Control System Plan for this site.

6 Certification

This Certification Statement documents that the Ash Pond at the A.B. Brown Generating Station meets the Initial Inflow Design Flood Control System Plan requirements specified in 40 CFR §257.82. The Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the Initial Inflow Design Flood Control System Plan for an existing CCR surface impoundment be prepared by October 17, 2016.

CCR Unit: Southern Indiana Gas & Electric Company; A.B. Brown Generating Station; Ash Pond

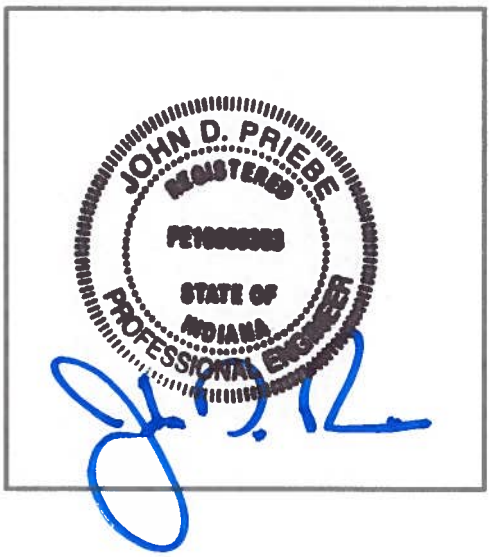
I, John Priebe, being a Registered Professional Engineer in good standing in the State of Indiana, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the Initial Inflow Design Flood Control System Plan dated October 13, 2016 meets the requirements of 40 CFR § 257.82.

JOHN D. PRIEBE

Printed Name

10/13/16

Date



7 Limitations

Background information, design basis, and other data have been furnished to AECOM by SIGECO, which AECOM has used in preparing this report. AECOM has relied on this information as furnished, and is not responsible for the accuracy of this information. Our recommendations are based on available information from previous and current investigations. These recommendations may be updated as future investigations are performed.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. The conclusions and recommendations are based on AECOM's understanding of current plant operations, maintenance, stormwater handling, and ash handling procedures at the station, as provided by SIGECO. Changes in any of these operations or procedures may invalidate the findings in this report until AECOM has had the opportunity to review the findings, and revise the report if necessary.

This hydrologic and hydraulic analysis was performed in accordance with the standard of care commonly used as state-of-practice in our profession. Specifically, our services have been performed in accordance with accepted principles and practices of the geological and geotechnical engineering profession. The conclusions presented in this report are professional opinions based on the indicated project criteria and data available at the time this report was prepared. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

While the CCR unit adequately manages the inflow design flood, SIGECO must perform routine maintenance on the CCR unit to continually manage flood events without failure. Outlet devices should be cleared of debris that could block or damage the device. Pipes and intake structures should be monitored and repaired if deterioration or deformation occurs. All grass lined slopes should be examined for erosion and repaired if damaged. Rip-rap lined channels should be inspected for stones that have shifted or bare spots that have formed. Replace rip-rap as needed.

Appendix A
Figures

Figure 1 – Location Map
Figure 2 – Site Map
Figure 3 – Drainage Area Map

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1-800-227-1376 (phone)

A.B. BROWN GENERATING STATION
MT. VERNON, IN

CCR CERTIFICATION
ASH POND

ISSUED FOR CERTIFICATION

ISSUED FOR BIDDING	DATE	BY
ISSUED FOR CONSTRUCTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE
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AECOM PROJECT NO:	60442676
DRAWN BY:	MJC
DESIGNED BY:	MJC
CHECKED BY:	TLE
DATE CREATED:	
PLOT DATE:	4/22/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

LOCATION MAP

FIGURE 1

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SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
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A.B. BROWN
GENERATING STATION
MT. VERNON, IN

CCR CERTIFICATION
ASH POND

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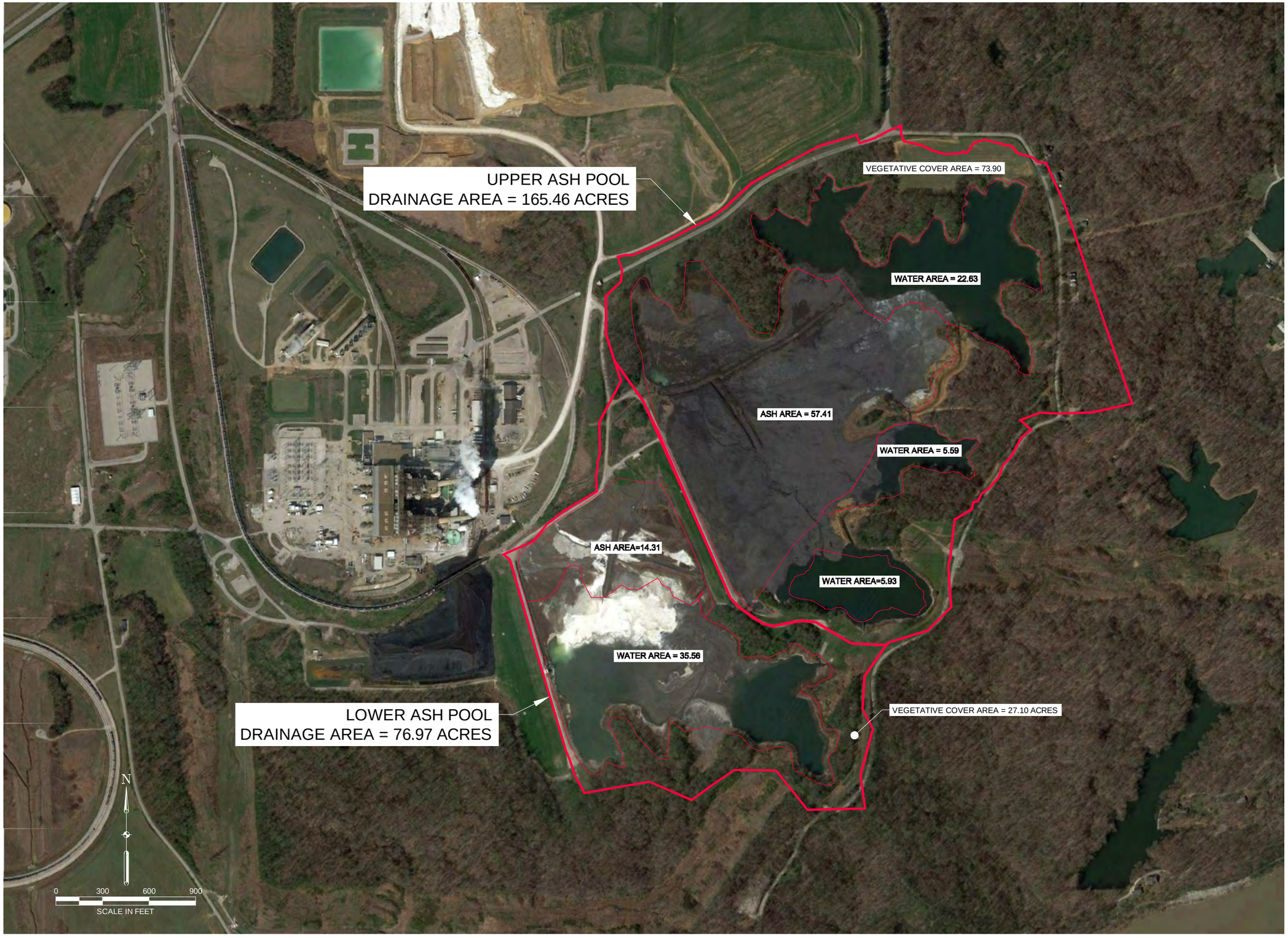
PLOT DATE:	4/22/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

SITE MAP

FIGURE 2



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A.B. BROWN GENERATING STATION
MT. VERNON, IN

CCR CERTIFICATION
ASH POND

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ISSUED FOR CONSTRUCTION	DATE	BY

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SHEET TITLE

DRAINAGE AREA MAP

FIGURE 3

Appendix B
Hydrologic and Hydraulic Calculations

NOAA Precipitation Data
Soils Data
Water Balance
HydroCAD Output

NOAA Precipitation Data

NOAA Atlas 14, Volume 2, Version 3
Location name: Mount Vernon, Indiana, US*
Latitude: 37.9028°, Longitude: -87.7092°
Elevation: 440 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.394 (0.360–0.433)	0.465 (0.425–0.511)	0.551 (0.503–0.604)	0.620 (0.564–0.678)	0.707 (0.640–0.773)	0.776 (0.700–0.847)	0.843 (0.757–0.919)	0.914 (0.815–0.997)	1.01 (0.893–1.10)	1.08 (0.950–1.18)
10-min	0.612 (0.559–0.672)	0.726 (0.664–0.798)	0.856 (0.782–0.939)	0.956 (0.870–1.05)	1.08 (0.979–1.18)	1.18 (1.06–1.28)	1.27 (1.14–1.38)	1.37 (1.22–1.49)	1.48 (1.31–1.62)	1.57 (1.38–1.72)
15-min	0.750 (0.685–0.824)	0.888 (0.812–0.976)	1.05 (0.960–1.15)	1.18 (1.07–1.29)	1.34 (1.21–1.46)	1.46 (1.31–1.59)	1.58 (1.42–1.72)	1.70 (1.51–1.85)	1.85 (1.64–2.02)	1.96 (1.73–2.15)
30-min	0.993 (0.907–1.09)	1.19 (1.09–1.31)	1.44 (1.31–1.58)	1.63 (1.49–1.79)	1.89 (1.71–2.06)	2.08 (1.88–2.27)	2.28 (2.04–2.48)	2.48 (2.21–2.70)	2.74 (2.43–2.99)	2.94 (2.59–3.22)
60-min	1.21 (1.11–1.33)	1.46 (1.33–1.60)	1.81 (1.65–1.98)	2.08 (1.89–2.28)	2.45 (2.22–2.68)	2.74 (2.47–2.99)	3.05 (2.73–3.32)	3.36 (3.00–3.67)	3.79 (3.36–4.14)	4.14 (3.64–4.52)
2-hr	1.46 (1.34–1.60)	1.77 (1.62–1.94)	2.21 (2.03–2.42)	2.56 (2.34–2.80)	3.05 (2.77–3.32)	3.44 (3.11–3.74)	3.84 (3.46–4.18)	4.26 (3.82–4.64)	4.85 (4.31–5.27)	5.31 (4.69–5.78)
3-hr	1.57 (1.44–1.72)	1.90 (1.74–2.08)	2.38 (2.17–2.60)	2.76 (2.52–3.02)	3.31 (3.00–3.60)	3.75 (3.38–4.08)	4.21 (3.78–4.58)	4.70 (4.20–5.11)	5.39 (4.76–5.86)	5.94 (5.22–6.46)
6-hr	1.93 (1.77–2.11)	2.33 (2.13–2.55)	2.90 (2.66–3.18)	3.37 (3.08–3.69)	4.04 (3.67–4.41)	4.59 (4.14–5.00)	5.17 (4.64–5.63)	5.78 (5.16–6.30)	6.66 (5.88–7.25)	7.37 (6.45–8.04)
12-hr	2.28 (2.09–2.49)	2.75 (2.52–3.00)	3.41 (3.13–3.72)	3.96 (3.61–4.31)	4.72 (4.30–5.13)	5.34 (4.84–5.81)	6.00 (5.41–6.52)	6.70 (5.99–7.27)	7.68 (6.80–8.34)	8.47 (7.44–9.21)
24-hr	2.74 (2.56–2.93)	3.29 (3.09–3.53)	4.10 (3.83–4.38)	4.75 (4.43–5.07)	5.65 (5.26–6.03)	6.39 (5.93–6.82)	7.16 (6.61–7.63)	7.97 (7.31–8.50)	9.10 (8.27–9.73)	10.0 (9.03–10.7)
2-day	3.25 (3.02–3.49)	3.91 (3.63–4.20)	4.86 (4.52–5.23)	5.65 (5.24–6.07)	6.77 (6.25–7.28)	7.70 (7.09–8.28)	8.70 (7.95–9.37)	9.76 (8.86–10.5)	11.3 (10.1–12.2)	12.5 (11.2–13.6)
3-day	3.46 (3.22–3.73)	4.15 (3.87–4.47)	5.15 (4.79–5.56)	5.98 (5.56–6.45)	7.19 (6.65–7.74)	8.19 (7.54–8.82)	9.27 (8.48–9.99)	10.4 (9.48–11.3)	12.1 (10.9–13.1)	13.5 (12.0–14.6)
4-day	3.67 (3.42–3.96)	4.39 (4.10–4.75)	5.44 (5.07–5.88)	6.32 (5.87–6.82)	7.61 (7.04–8.20)	8.68 (8.00–9.36)	9.84 (9.01–10.6)	11.1 (10.1–12.0)	12.9 (11.6–14.0)	14.4 (12.9–15.7)
7-day	4.27 (3.97–4.61)	5.11 (4.75–5.52)	6.31 (5.86–6.83)	7.32 (6.78–7.92)	8.78 (8.09–9.50)	10.0 (9.18–10.8)	11.3 (10.3–12.3)	12.7 (11.5–13.8)	14.8 (13.2–16.1)	16.4 (14.6–18.0)
10-day	4.81 (4.46–5.23)	5.75 (5.34–6.26)	7.11 (6.59–7.74)	8.23 (7.61–8.96)	9.85 (9.06–10.7)	11.2 (10.2–12.2)	12.6 (11.5–13.7)	14.2 (12.8–15.4)	16.4 (14.6–17.9)	18.2 (16.1–19.9)
20-day	6.63 (6.23–7.07)	7.87 (7.40–8.39)	9.43 (8.86–10.1)	10.7 (10.0–11.4)	12.4 (11.6–13.2)	13.8 (12.9–14.7)	15.2 (14.1–16.3)	16.7 (15.4–17.8)	18.7 (17.1–20.0)	20.2 (18.4–21.8)
30-day	8.17 (7.71–8.67)	9.65 (9.10–10.2)	11.4 (10.7–12.1)	12.8 (12.0–13.6)	14.7 (13.8–15.6)	16.2 (15.2–17.2)	17.7 (16.5–18.8)	19.2 (17.9–20.5)	21.3 (19.6–22.8)	22.9 (21.0–24.5)
45-day	10.2 (9.71–10.8)	12.0 (11.4–12.7)	14.1 (13.3–14.8)	15.7 (14.8–16.5)	17.8 (16.8–18.8)	19.5 (18.3–20.6)	21.2 (19.8–22.4)	22.8 (21.3–24.2)	25.1 (23.3–26.6)	26.8 (24.7–28.5)
60-day	12.2 (11.5–12.8)	14.3 (13.6–15.1)	16.6 (15.8–17.5)	18.4 (17.4–19.4)	20.8 (19.6–21.9)	22.5 (21.3–23.8)	24.3 (22.9–25.7)	26.0 (24.4–27.5)	28.2 (26.4–30.0)	29.9 (27.8–31.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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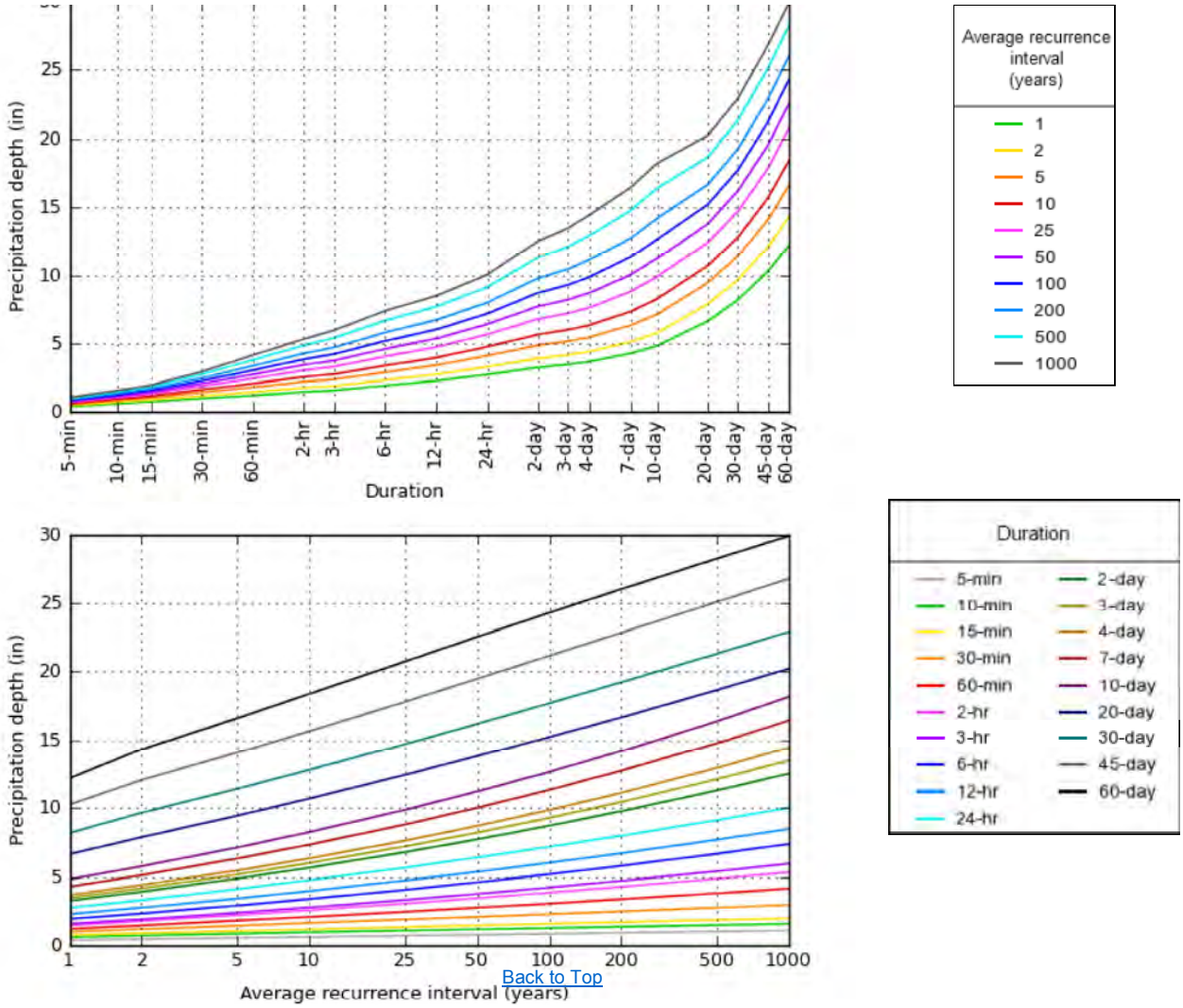
PF graphical



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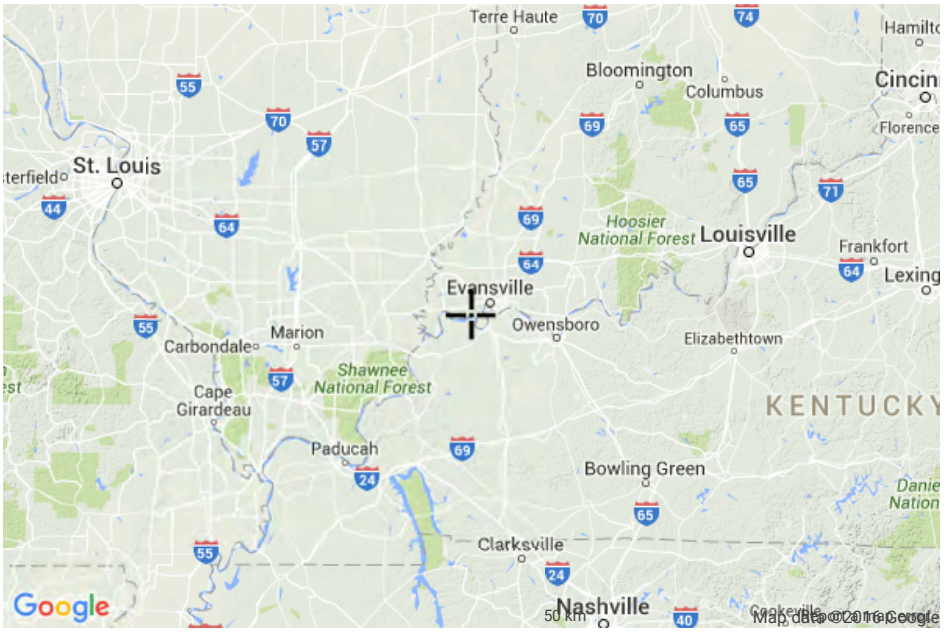
Maps & aerials

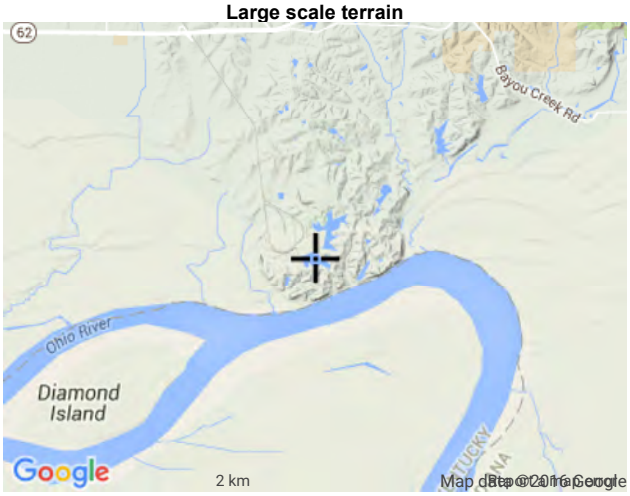
NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Thu Jun 30 17:57:02 2016

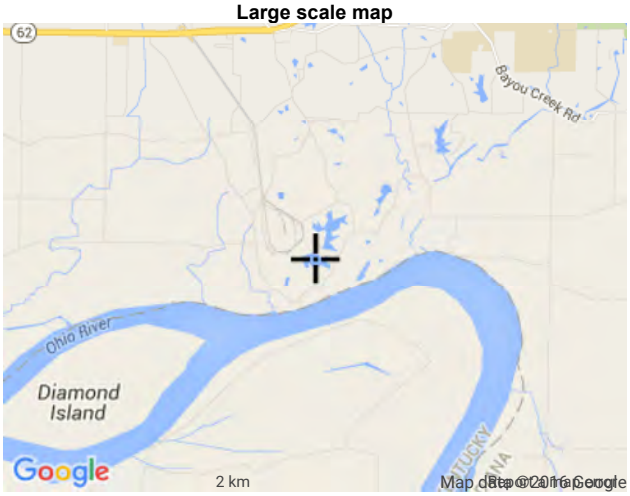
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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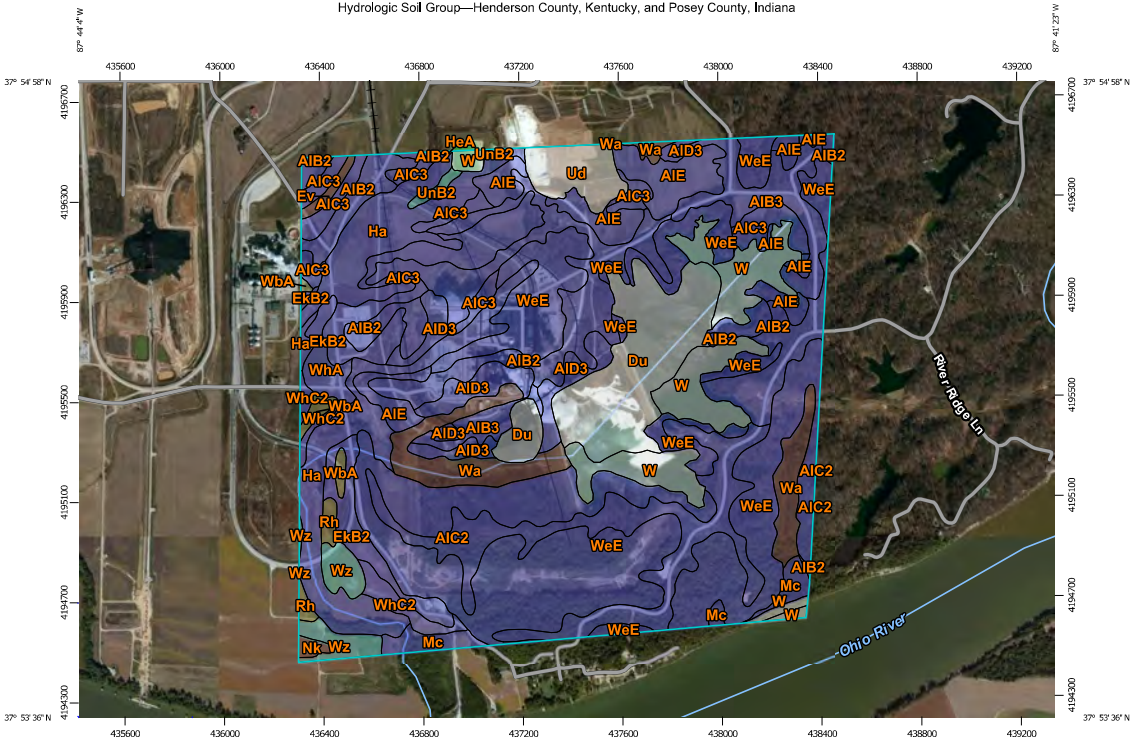
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910

Questions?: HDSC.Questions@noaa.gov

Disclaimer

Soils Data

Hydrologic Soil Group—Henderson County, Kentucky, and Posey County, Indiana



MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Henderson County, Kentucky
Survey Area Data: Version 15, Sep 15, 2015

Soil Survey Area: Posey County, Indiana
Survey Area Data: Version 15, Sep 10, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Data not available.

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Henderson County, Kentucky (KY101)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
W	Water		1.1	0.1%
Subtotals for Soil Survey Area			**1.1**	**0.1%**
Totals for Area of Interest			**1,022.6**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Posey County, Indiana (IN129)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AlB2	Alford silt loam, 2 to 6 percent slopes, eroded	B	111.3	10.9%
AlB3	Alford silt loam, 2 to 6 percent slopes, severely eroded	B	37.0	3.6%
AlC2	Alford silt loam, 6 to 12 percent slopes, eroded	B	67.5	6.6%
AlC3	Alford silt loam, 6 to 12 percent slopes, severely eroded	B	67.5	6.6%
AlD3	Alford silt loam, 12 to 18 percent slopes, severely eroded	B	33.9	3.3%
AlE	Alford silt loam, 18 to 25 percent slopes	B	49.6	4.9%
Du	Dumps, mine		75.8	7.4%
EkA	Elkinsville silt loam, 0 to 2 percent slopes, rarely flooded	B	0.3	0.0%
EkB2	Elkinsville silt loam, 2 to 6 percent slopes, eroded, rarely flooded	B	18.8	1.8%
Ev	Evansville silt loam, rarely flooded	B/D	2.9	0.3%
Ha	Haymond silt loam, wet substratum, frequently flooded	B	90.1	8.8%
HeA	Henshaw silt loam, 0 to 2 percent slopes, rarely flooded	C/D	0.2	0.0%
Mc	McAdoo silt loam, frequently flooded	B	13.0	1.3%
Nk	Newark silty clay loam, frequently flooded	B/D	2.1	0.2%

Hydrologic Soil Group— Summary by Map Unit — Posey County, Indiana (IN129)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Rh	Rahm silt loam, occasionally flooded	C/D	4.3	0.4%
Ud	Udorthents, cut and filled		19.4	1.9%
UnA	Uniontown silt loam, 0 to 2 percent slopes, rarely flooded	C	0.1	0.0%
UnB2	Uniontown silt loam, 2 to 6 percent slopes, eroded, rarely flooded	C	2.9	0.3%
W	Water		62.7	6.1%
Wa	Wakeland silt loam, frequently flooded	B/D	41.0	4.0%
WbA	Weinbach silt loam, 0 to 2 percent slopes, rarely flooded	C/D	4.7	0.5%
WeE	Wellston silt loam, 18 to 25 percent slopes	B	279.6	27.3%
WhA	Wheeling loam, 0 to 2 percent slopes, rarely flooded	B	10.2	1.0%
WhC2	Wheeling loam, 6 to 12 percent slopes, eroded, rarely flooded	B	11.4	1.1%
Wz	Woodmere silt loam, occasionally flooded	C	15.4	1.5%
Subtotals for Soil Survey Area			**1,021.5**	**99.9%**
Totals for Area of Interest			**1,022.6**	**100.0%**

Description

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

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

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

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

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

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

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

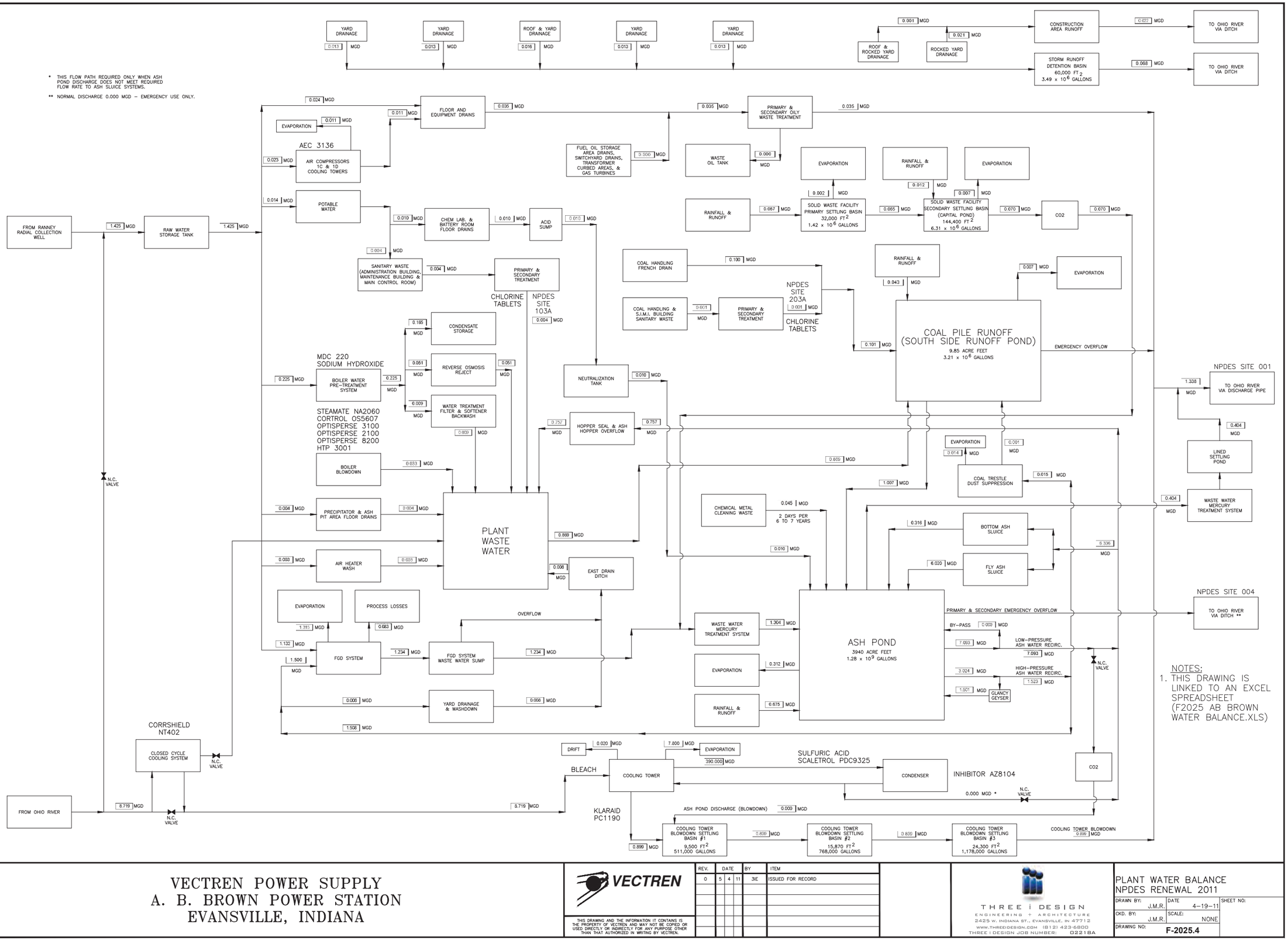
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Water Balance



VECTREN POWER SUPPLY
A. B. BROWN POWER STATION
EVANSVILLE, INDIANA

VECTREN

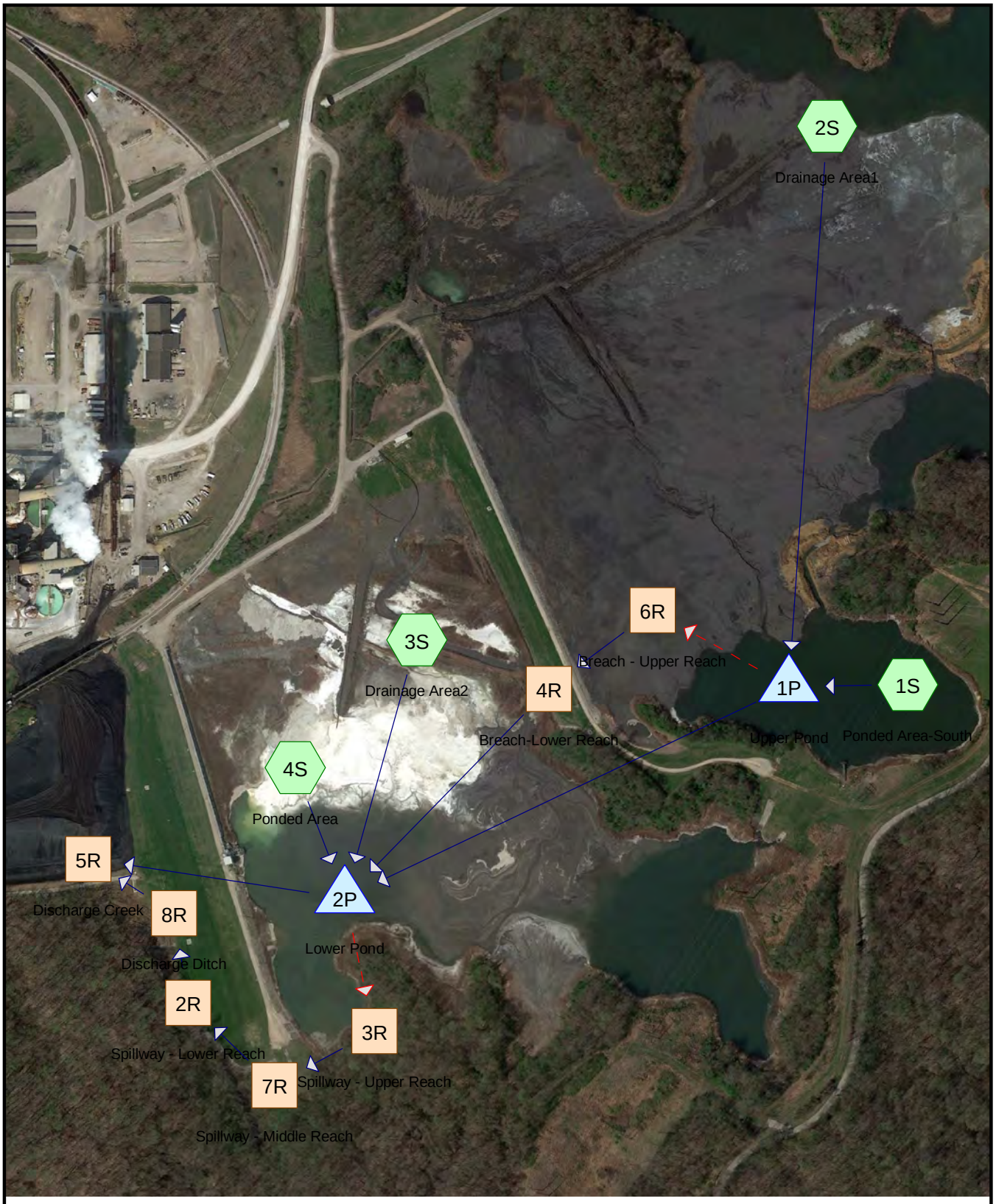
REV.	DATE	BY	ITEM
0	5 4 11	JIE	ISSUED FOR RECORD

THREE i DESIGN
ENGINEERING + ARCHITECTURE
2425 W. INDIANA ST., EVANSVILLE, IN 47712
WWW.THREEIDESIGN.COM : (812) 423-6800
THREE I DESIGN JOB NUMBER: 02218A

PLANT WATER BALANCE
NPDES RENEWAL 2011

DRAWN BY: J.M.R.	DATE: 4–19–11	SHEET NO:
CKD. BY: J.M.R.	SCALE: NONE	
DRAWING NO: F-2025.4		

HydroCAD Output Report



Routing Diagram for Brown - CCR Certification - Proposed 10ft Breach-Normal pool 441.5

Prepared by AECOM, Printed 10/7/2016

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
101.000	79	50-75% Grass cover, Fair, HSG C (2S, 3S)
71.720	98	Ash (2S, 3S)
5.930	98	Water Surface, 0% imp, HSG C (1S)
63.780	98	Water Surface, HSG C (2S, 4S)
242.430	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
170.710	HSG C	1S, 2S, 3S, 4S
0.000	HSG D	
71.720	Other	2S, 3S
242.430		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	101.000	0.000	0.000	101.000	50-75% Grass cover, Fair	2S, 3S
0.000	0.000	0.000	0.000	71.720	71.720	Ash	2S, 3S
0.000	0.000	63.780	0.000	0.000	63.780	Water Surface	2S, 4S
0.000	0.000	5.930	0.000	0.000	5.930	Water Surface, 0% imp	1S
0.000	**0.000**	**170.710**	**0.000**	**71.720**	**242.430**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	446.00	444.50	300.0	0.0050	0.011	22.8	0.0	0.0
2	2P	388.00	384.00	376.0	0.0106	0.011	36.0	0.0	0.0

Notes Listing (all nodes)

Line#	Node Number	Notes
1	2S	see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc
2	3S	see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc
3	1P	Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016
4		Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".
5	2P	Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Ponded Area-South Runoff Area=5.930 ac 0.00% Impervious Runoff Depth=9.76"
Tc=0.0 min CN=98 Runoff=5.23 cfs 4.823 af

Subcatchment 2S: Drainage Area1 Runoff Area=159.530 ac 53.68% Impervious Runoff Depth=8.66"
Flow Length=3,275' Tc=46.4 min CN=89 Runoff=134.14 cfs 115.073 af

Subcatchment 3S: Drainage Area2 Runoff Area=41.410 ac 34.56% Impervious Runoff Depth=8.28"
Flow Length=2,725' Tc=44.6 min CN=86 Runoff=34.09 cfs 28.576 af

Subcatchment 4S: Ponded Area Runoff Area=35.560 ac 100.00% Impervious Runoff Depth=9.76"
Tc=0.0 min CN=98 Runoff=31.39 cfs 28.920 af

Reach 2R: Spillway - Lower Reach Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.083 L=41.3' S=0.2814 '/' Capacity=2,424.69 cfs Outflow=0.00 cfs 0.000 af

Reach 3R: Spillway - Upper Reach Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.030 L=115.0' S=0.0022 '/' Capacity=1,333.44 cfs Outflow=0.00 cfs 0.000 af

Reach 4R: Breach-Lower Reach Avg. Flow Depth=1.16' Max Vel=4.60 fps Inflow=84.34 cfs 48.592 af
n=0.083 L=85.0' S=0.0835 '/' Capacity=1,828.45 cfs Outflow=84.34 cfs 48.592 af

Reach 5R: Discharge Creek Avg. Flow Depth=0.74' Max Vel=5.84 fps Inflow=38.78 cfs 140.286 af
n=0.040 L=800.0' S=0.0550 '/' Capacity=2,224.47 cfs Outflow=38.78 cfs 140.256 af

Reach 6R: Breach - Upper Reach Avg. Flow Depth=1.71' Max Vel=2.65 fps Inflow=84.34 cfs 48.592 af
n=0.083 L=217.0' S=0.0180 '/' Capacity=848.14 cfs Outflow=84.34 cfs 48.592 af

Reach 7R: Spillway - Middle Reach Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.083 L=18.0' S=0.1983 '/' Capacity=2,312.83 cfs Outflow=0.00 cfs 0.000 af

Reach 8R: Discharge Ditch Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.083 L=42.5' S=0.2005 '/' Capacity=2,046.70 cfs Outflow=0.00 cfs 0.000 af

Pond 1P: Upper Pond Peak Elev=457.63' Storage=54.525 af Inflow=149.05 cfs 200.895 af
Primary=34.93 cfs 150.243 af Secondary=84.34 cfs 48.592 af Outflow=119.27 cfs 198.835 af

Pond 2P: Lower Pond Peak Elev=446.78' Storage=180.979 af Inflow=170.84 cfs 256.331 af
Primary=38.78 cfs 140.286 af Secondary=0.00 cfs 0.000 af Tertiary=10.38 cfs 85.792 af Outflow=49.16 cfs 226.078 af

Total Runoff Area = 242.430 ac Runoff Volume = 177.391 af Average Runoff Depth = 8.78"
44.11% Pervious = 106.930 ac 55.89% Impervious = 135.500 ac

Summary for Subcatchment 1S: Ponded Area-South

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

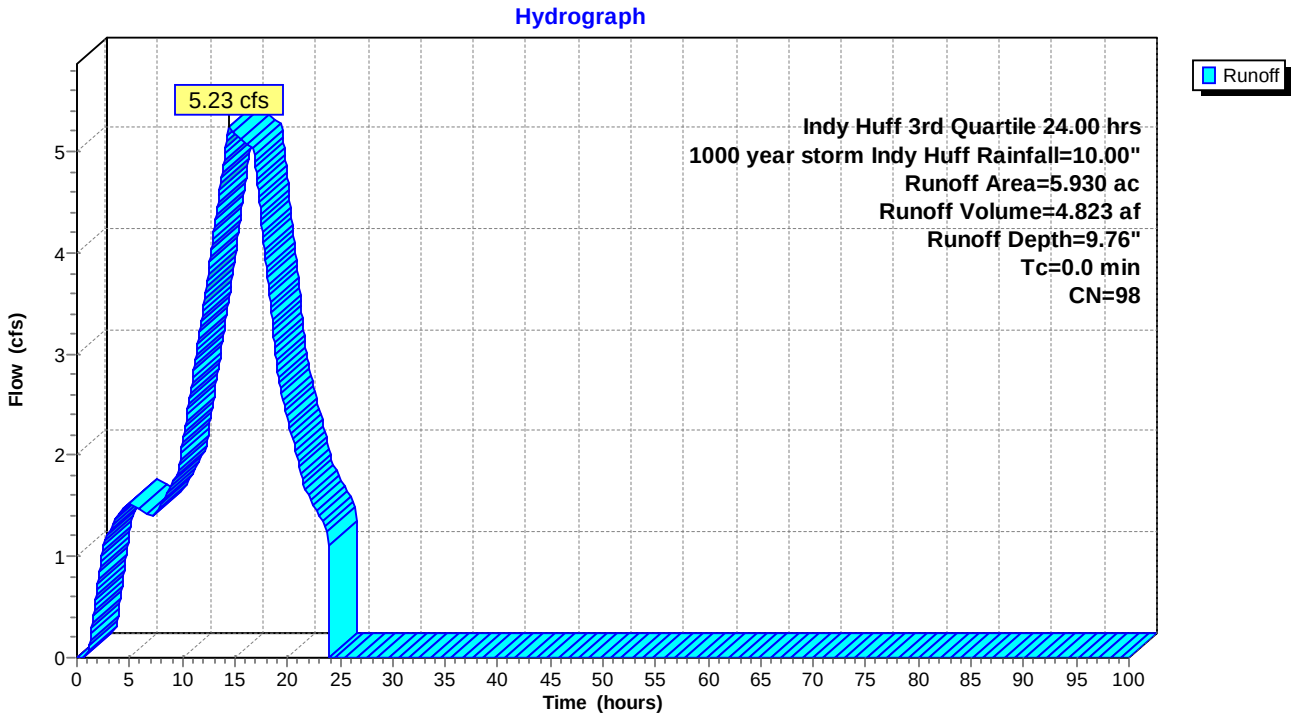
Runoff = 5.23 cfs @ 14.41 hrs, Volume= 4.823 af, Depth= 9.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 1000 year storm Indy Huff Rainfall=10.00"

Area (ac)	CN	Description
5.930	98	Water Surface, 0% imp, HSG C
5.930		100.00% Pervious Area

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

Subcatchment 1S: Ponded Area-South



Hydrograph for Subcatchment 1S: Ponded Area-South

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.03
2.00	0.19	0.06	0.74
3.00	0.41	0.24	1.23
4.00	0.65	0.46	1.42
5.00	0.91	0.71	1.53
6.00	1.17	0.96	1.47
7.00	1.42	1.20	1.40
8.00	1.66	1.44	1.53
9.00	1.94	1.71	1.71
10.00	2.25	2.02	2.09
11.00	2.65	2.42	2.76
12.00	3.18	2.94	3.44
13.00	3.82	3.58	4.19
14.00	4.58	4.34	**4.94**
15.00	5.44	5.21	**5.18**
16.00	6.31	6.07	5.09
17.00	7.15	6.91	4.83
18.00	7.88	7.64	3.87
19.00	8.44	8.20	2.91
20.00	8.88	8.64	2.37
21.00	9.24	9.00	1.94
22.00	9.53	9.29	1.61
23.00	9.78	9.54	1.40
24.00	**10.00**	**9.76**	0.60
25.00	10.00	9.76	0.00
26.00	10.00	9.76	0.00
27.00	10.00	9.76	0.00
28.00	10.00	9.76	0.00
29.00	10.00	9.76	0.00
30.00	10.00	9.76	0.00
31.00	10.00	9.76	0.00
32.00	10.00	9.76	0.00
33.00	10.00	9.76	0.00
34.00	10.00	9.76	0.00
35.00	10.00	9.76	0.00
36.00	10.00	9.76	0.00
37.00	10.00	9.76	0.00
38.00	10.00	9.76	0.00
39.00	10.00	9.76	0.00
40.00	10.00	9.76	0.00
41.00	10.00	9.76	0.00
42.00	10.00	9.76	0.00
43.00	10.00	9.76	0.00
44.00	10.00	9.76	0.00
45.00	10.00	9.76	0.00
46.00	10.00	9.76	0.00
47.00	10.00	9.76	0.00
48.00	10.00	9.76	0.00
49.00	10.00	9.76	0.00
50.00	10.00	9.76	0.00
51.00	10.00	9.76	0.00
52.00	10.00	9.76	0.00
53.00	10.00	9.76	0.00
54.00	10.00	9.76	0.00
55.00	10.00	9.76	0.00
56.00	10.00	9.76	0.00
57.00	10.00	9.76	0.00
58.00	10.00	9.76	0.00
59.00	10.00	9.76	0.00
60.00	10.00	9.76	0.00
61.00	10.00	9.76	0.00
62.00	10.00	9.76	0.00
63.00	10.00	9.76	0.00
64.00	10.00	9.76	0.00
65.00	10.00	9.76	0.00
66.00	10.00	9.76	0.00
67.00	10.00	9.76	0.00
68.00	10.00	9.76	0.00
69.00	10.00	9.76	0.00
70.00	10.00	9.76	0.00
71.00	10.00	9.76	0.00
72.00	10.00	9.76	0.00
73.00	10.00	9.76	0.00
74.00	10.00	9.76	0.00
75.00	10.00	9.76	0.00
76.00	10.00	9.76	0.00
77.00	10.00	9.76	0.00
78.00	10.00	9.76	0.00
79.00	10.00	9.76	0.00
80.00	10.00	9.76	0.00
81.00	10.00	9.76	0.00
82.00	10.00	9.76	0.00
83.00	10.00	9.76	0.00
84.00	10.00	9.76	0.00
85.00	10.00	9.76	0.00
86.00	10.00	9.76	0.00
87.00	10.00	9.76	0.00
88.00	10.00	9.76	0.00
89.00	10.00	9.76	0.00
90.00	10.00	9.76	0.00
91.00	10.00	9.76	0.00
92.00	10.00	9.76	0.00
93.00	10.00	9.76	0.00
94.00	10.00	9.76	0.00
95.00	10.00	9.76	0.00
96.00	10.00	9.76	0.00
97.00	10.00	9.76	0.00
98.00	10.00	9.76	0.00
99.00	10.00	9.76	0.00
100.00	10.00	9.76	0.00

Summary for Subcatchment 2S: Drainage Area1

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

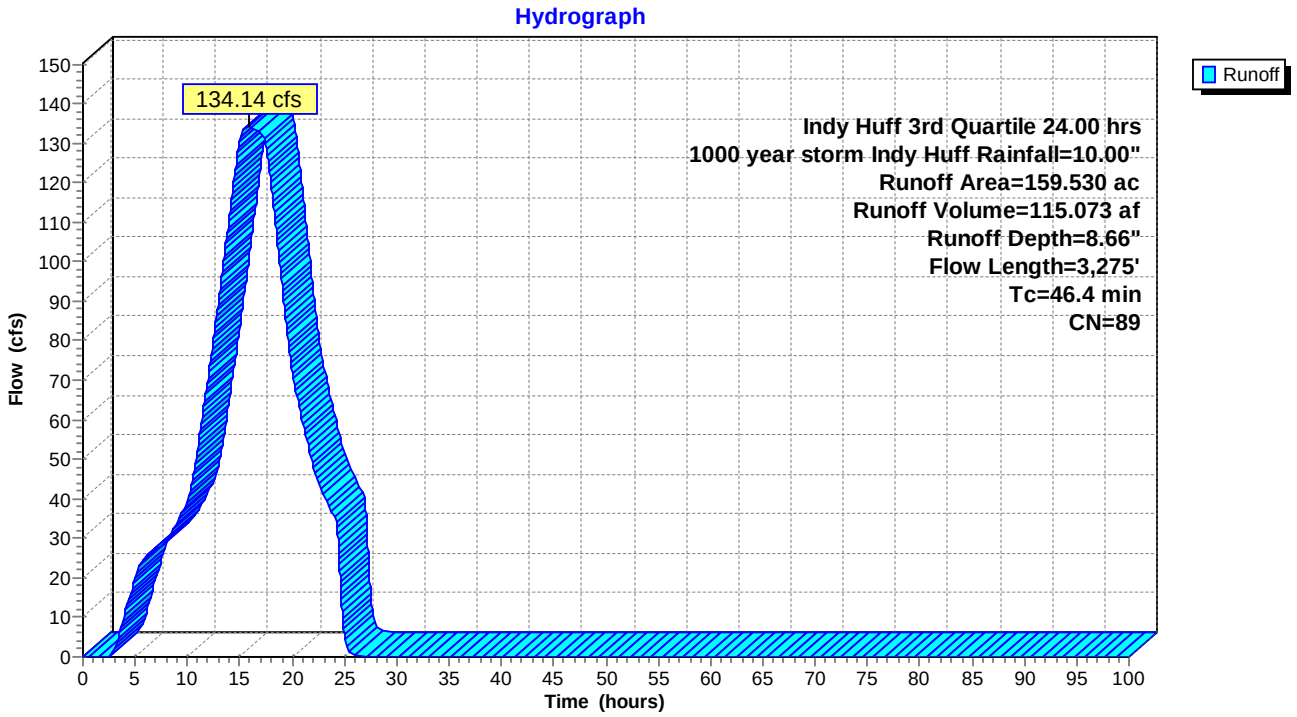
Runoff = 134.14 cfs @ 15.83 hrs, Volume= 115.073 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 1000 year storm Indy Huff Rainfall=10.00"

	Area (ac)	CN	Description
	73.900	79	50-75% Grass cover, Fair, HSG C
	22.630	98	Water Surface, HSG C
	5.590	98	Water Surface, HSG C
*	57.410	98	Ash
	159.530	89	Weighted Average
	73.900		46.32% Pervious Area
	85.630		53.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	300	0.0600	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.29"
0.8	225	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
46.4	3,275	Total			

Subcatchment 2S: Drainage Area1



Hydrograph for Subcatchment 2S: Drainage Area1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	54.00	10.00	8.66	0.00
1.00	0.05	0.00	0.00	55.00	10.00	8.66	0.00
2.00	0.19	0.00	0.00	56.00	10.00	8.66	0.00
3.00	0.41	0.02	1.47	57.00	10.00	8.66	0.00
4.00	0.65	0.10	11.00	58.00	10.00	8.66	0.00
5.00	0.91	0.23	19.89	59.00	10.00	8.66	0.00
6.00	1.17	0.40	25.43	60.00	10.00	8.66	0.00
7.00	1.42	0.57	27.54	61.00	10.00	8.66	0.00
8.00	1.66	0.76	29.18	62.00	10.00	8.66	0.00
9.00	1.94	0.98	34.18	63.00	10.00	8.66	0.00
10.00	2.25	1.24	39.84	64.00	10.00	8.66	0.00
11.00	2.65	1.59	53.47	65.00	10.00	8.66	0.00
12.00	3.18	2.06	71.42	66.00	10.00	8.66	0.00
13.00	3.82	2.65	90.65	67.00	10.00	8.66	0.00
14.00	4.58	3.37	111.44	68.00	10.00	8.66	0.00
15.00	5.44	4.20	**131.00**	69.00	10.00	8.66	0.00
16.00	6.31	5.03	**133.95**	70.00	10.00	8.66	0.00
17.00	7.15	5.85	132.72	71.00	10.00	8.66	0.00
18.00	7.88	6.56	119.48	72.00	10.00	8.66	0.00
19.00	8.44	7.12	95.01	73.00	10.00	8.66	0.00
20.00	8.88	7.55	72.27	74.00	10.00	8.66	0.00
21.00	9.24	7.90	59.72	75.00	10.00	8.66	0.00
22.00	9.53	8.19	48.44	76.00	10.00	8.66	0.00
23.00	9.78	8.44	41.15	77.00	10.00	8.66	0.00
24.00	**10.00**	**8.66**	35.75	78.00	10.00	8.66	0.00
25.00	10.00	8.66	5.67	79.00	10.00	8.66	0.00
26.00	10.00	8.66	0.20	80.00	10.00	8.66	0.00
27.00	10.00	8.66	0.00	81.00	10.00	8.66	0.00
28.00	10.00	8.66	0.00	82.00	10.00	8.66	0.00
29.00	10.00	8.66	0.00	83.00	10.00	8.66	0.00
30.00	10.00	8.66	0.00	84.00	10.00	8.66	0.00
31.00	10.00	8.66	0.00	85.00	10.00	8.66	0.00
32.00	10.00	8.66	0.00	86.00	10.00	8.66	0.00
33.00	10.00	8.66	0.00	87.00	10.00	8.66	0.00
34.00	10.00	8.66	0.00	88.00	10.00	8.66	0.00
35.00	10.00	8.66	0.00	89.00	10.00	8.66	0.00
36.00	10.00	8.66	0.00	90.00	10.00	8.66	0.00
37.00	10.00	8.66	0.00	91.00	10.00	8.66	0.00
38.00	10.00	8.66	0.00	92.00	10.00	8.66	0.00
39.00	10.00	8.66	0.00	93.00	10.00	8.66	0.00
40.00	10.00	8.66	0.00	94.00	10.00	8.66	0.00
41.00	10.00	8.66	0.00	95.00	10.00	8.66	0.00
42.00	10.00	8.66	0.00	96.00	10.00	8.66	0.00
43.00	10.00	8.66	0.00	97.00	10.00	8.66	0.00
44.00	10.00	8.66	0.00	98.00	10.00	8.66	0.00
45.00	10.00	8.66	0.00	99.00	10.00	8.66	0.00
46.00	10.00	8.66	0.00	100.00	10.00	8.66	0.00
47.00	10.00	8.66	0.00				
48.00	10.00	8.66	0.00				
49.00	10.00	8.66	0.00				
50.00	10.00	8.66	0.00				
51.00	10.00	8.66	0.00				
52.00	10.00	8.66	0.00				
53.00	10.00	8.66	0.00				

Summary for Subcatchment 3S: Drainage Area2

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

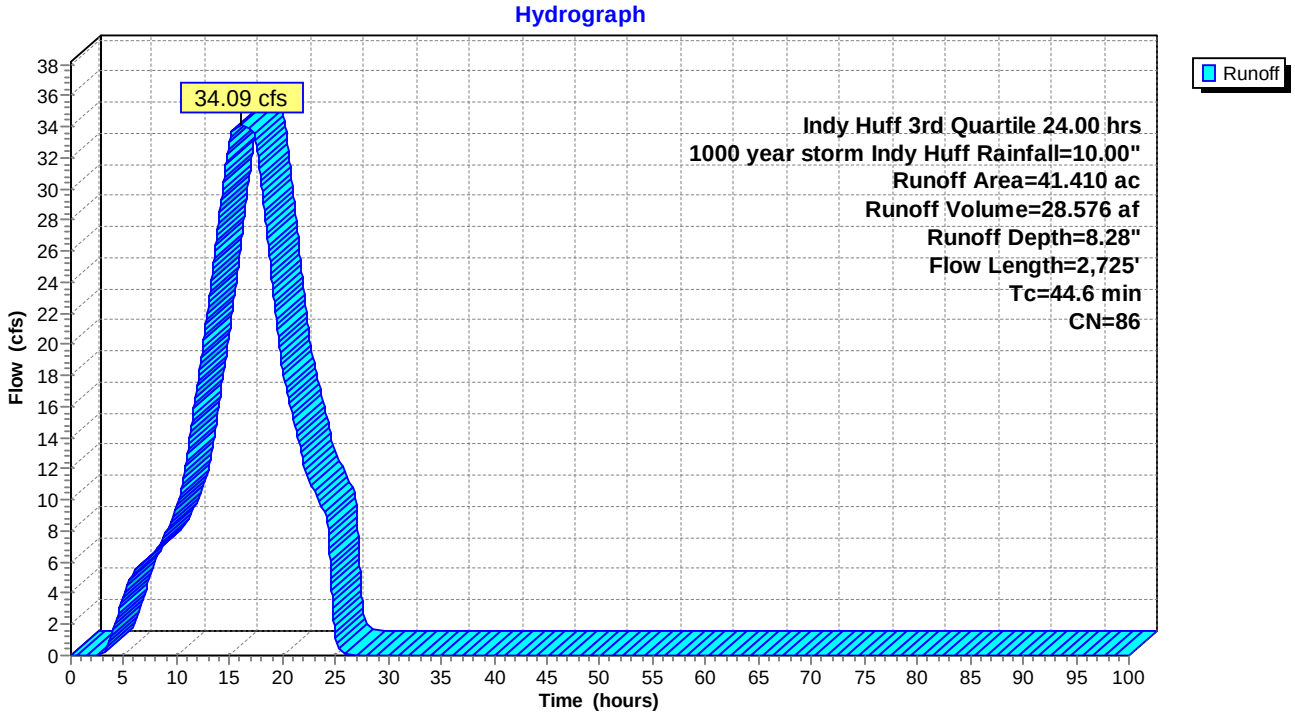
Runoff = 34.09 cfs @ 16.01 hrs, Volume= 28.576 af, Depth= 8.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 1000 year storm Indy Huff Rainfall=10.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Drainage Area2



Hydrograph for Subcatchment 3S: Drainage Area2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	54.00	10.00	8.28	0.00
1.00	0.05	0.00	0.00	55.00	10.00	8.28	0.00
2.00	0.19	0.00	0.00	56.00	10.00	8.28	0.00
3.00	0.41	0.00	0.03	57.00	10.00	8.28	0.00
4.00	0.65	0.05	1.69	58.00	10.00	8.28	0.00
5.00	0.91	0.16	3.88	59.00	10.00	8.28	0.00
6.00	1.17	0.29	5.40	60.00	10.00	8.28	0.00
7.00	1.42	0.44	6.11	61.00	10.00	8.28	0.00
8.00	1.66	0.60	6.67	62.00	10.00	8.28	0.00
9.00	1.94	0.80	8.00	63.00	10.00	8.28	0.00
10.00	2.25	1.04	9.50	64.00	10.00	8.28	0.00
11.00	2.65	1.37	13.00	65.00	10.00	8.28	0.00
12.00	3.18	1.81	17.60	66.00	10.00	8.28	0.00
13.00	3.82	2.38	22.63	67.00	10.00	8.28	0.00
14.00	4.58	3.08	28.08	68.00	10.00	8.28	0.00
15.00	5.44	3.88	33.20	69.00	10.00	8.28	0.00
16.00	6.31	4.70	**34.08**	70.00	10.00	8.28	0.00
17.00	7.15	5.51	**33.91**	71.00	10.00	8.28	0.00
18.00	7.88	6.21	30.44	72.00	10.00	8.28	0.00
19.00	8.44	6.76	24.19	73.00	10.00	8.28	0.00
20.00	8.88	7.18	18.44	74.00	10.00	8.28	0.00
21.00	9.24	7.54	15.25	75.00	10.00	8.28	0.00
22.00	9.53	7.82	12.36	76.00	10.00	8.28	0.00
23.00	9.78	8.07	10.54	77.00	10.00	8.28	0.00
24.00	**10.00**	**8.28**	9.16	78.00	10.00	8.28	0.00
25.00	10.00	8.28	1.28	79.00	10.00	8.28	0.00
26.00	10.00	8.28	0.04	80.00	10.00	8.28	0.00
27.00	10.00	8.28	0.00	81.00	10.00	8.28	0.00
28.00	10.00	8.28	0.00	82.00	10.00	8.28	0.00
29.00	10.00	8.28	0.00	83.00	10.00	8.28	0.00
30.00	10.00	8.28	0.00	84.00	10.00	8.28	0.00
31.00	10.00	8.28	0.00	85.00	10.00	8.28	0.00
32.00	10.00	8.28	0.00	86.00	10.00	8.28	0.00
33.00	10.00	8.28	0.00	87.00	10.00	8.28	0.00
34.00	10.00	8.28	0.00	88.00	10.00	8.28	0.00
35.00	10.00	8.28	0.00	89.00	10.00	8.28	0.00
36.00	10.00	8.28	0.00	90.00	10.00	8.28	0.00
37.00	10.00	8.28	0.00	91.00	10.00	8.28	0.00
38.00	10.00	8.28	0.00	92.00	10.00	8.28	0.00
39.00	10.00	8.28	0.00	93.00	10.00	8.28	0.00
40.00	10.00	8.28	0.00	94.00	10.00	8.28	0.00
41.00	10.00	8.28	0.00	95.00	10.00	8.28	0.00
42.00	10.00	8.28	0.00	96.00	10.00	8.28	0.00
43.00	10.00	8.28	0.00	97.00	10.00	8.28	0.00
44.00	10.00	8.28	0.00	98.00	10.00	8.28	0.00
45.00	10.00	8.28	0.00	99.00	10.00	8.28	0.00
46.00	10.00	8.28	0.00	100.00	10.00	8.28	0.00
47.00	10.00	8.28	0.00				
48.00	10.00	8.28	0.00				
49.00	10.00	8.28	0.00				
50.00	10.00	8.28	0.00				
51.00	10.00	8.28	0.00				
52.00	10.00	8.28	0.00				
53.00	10.00	8.28	0.00				

Summary for Subcatchment 4S: Ponded Area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

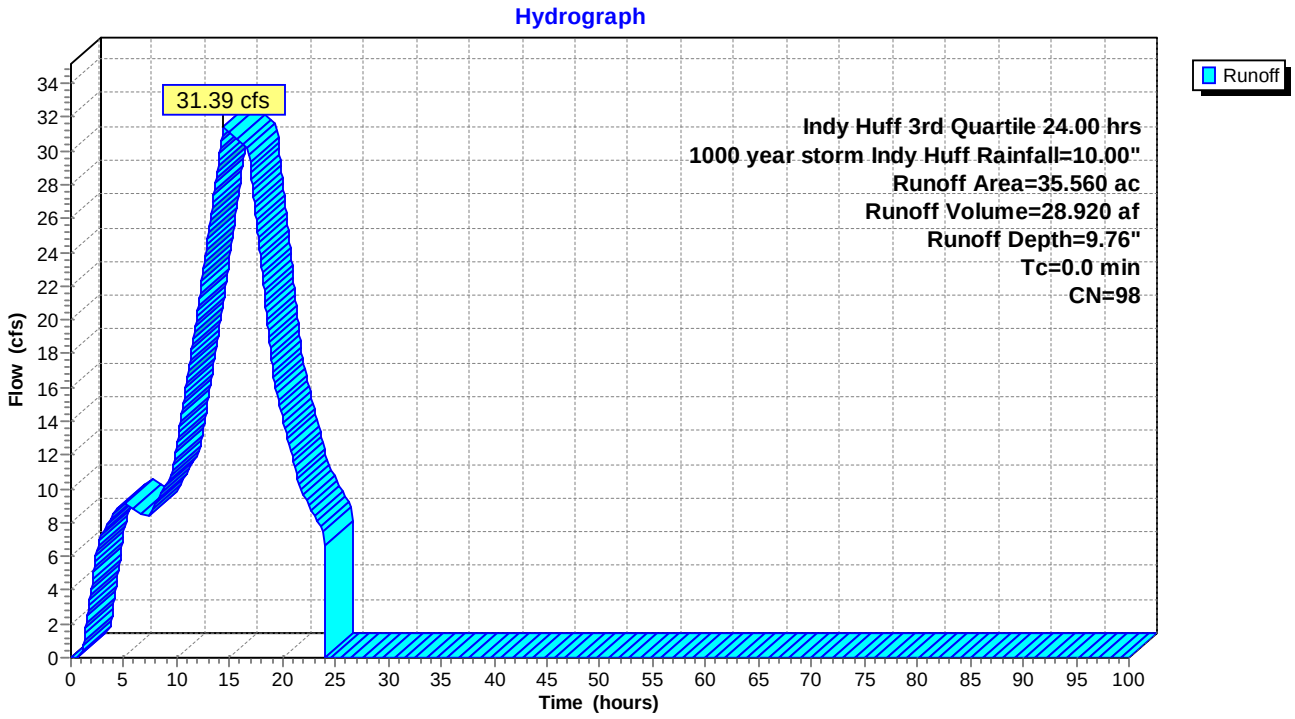
Runoff = 31.39 cfs @ 14.41 hrs, Volume= 28.920 af, Depth= 9.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 1000 year storm Indy Huff Rainfall=10.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

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

Subcatchment 4S: Ponded Area



Hydrograph for Subcatchment 4S: Ponded Area

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.19
2.00	0.19	0.06	4.43
3.00	0.41	0.24	7.36
4.00	0.65	0.46	8.53
5.00	0.91	0.71	9.18
6.00	1.17	0.96	8.82
7.00	1.42	1.20	8.39
8.00	1.66	1.44	9.17
9.00	1.94	1.71	10.25
10.00	2.25	2.02	12.52
11.00	2.65	2.42	16.57
12.00	3.18	2.94	20.64
13.00	3.82	3.58	25.12
14.00	4.58	4.34	**29.60**
15.00	5.44	5.21	**31.08**
16.00	6.31	6.07	30.54
17.00	7.15	6.91	28.97
18.00	7.88	7.64	23.20
19.00	8.44	8.20	17.44
20.00	8.88	8.64	14.23
21.00	9.24	9.00	11.65
22.00	9.53	9.29	9.62
23.00	9.78	9.54	8.41
24.00	**10.00**	**9.76**	3.60
25.00	10.00	9.76	0.00
26.00	10.00	9.76	0.00
27.00	10.00	9.76	0.00
28.00	10.00	9.76	0.00
29.00	10.00	9.76	0.00
30.00	10.00	9.76	0.00
31.00	10.00	9.76	0.00
32.00	10.00	9.76	0.00
33.00	10.00	9.76	0.00
34.00	10.00	9.76	0.00
35.00	10.00	9.76	0.00
36.00	10.00	9.76	0.00
37.00	10.00	9.76	0.00
38.00	10.00	9.76	0.00
39.00	10.00	9.76	0.00
40.00	10.00	9.76	0.00
41.00	10.00	9.76	0.00
42.00	10.00	9.76	0.00
43.00	10.00	9.76	0.00
44.00	10.00	9.76	0.00
45.00	10.00	9.76	0.00
46.00	10.00	9.76	0.00
47.00	10.00	9.76	0.00
48.00	10.00	9.76	0.00
49.00	10.00	9.76	0.00
50.00	10.00	9.76	0.00
51.00	10.00	9.76	0.00
52.00	10.00	9.76	0.00
53.00	10.00	9.76	0.00
54.00	10.00	9.76	0.00
55.00	10.00	9.76	0.00
56.00	10.00	9.76	0.00
57.00	10.00	9.76	0.00
58.00	10.00	9.76	0.00
59.00	10.00	9.76	0.00
60.00	10.00	9.76	0.00
61.00	10.00	9.76	0.00
62.00	10.00	9.76	0.00
63.00	10.00	9.76	0.00
64.00	10.00	9.76	0.00
65.00	10.00	9.76	0.00
66.00	10.00	9.76	0.00
67.00	10.00	9.76	0.00
68.00	10.00	9.76	0.00
69.00	10.00	9.76	0.00
70.00	10.00	9.76	0.00
71.00	10.00	9.76	0.00
72.00	10.00	9.76	0.00
73.00	10.00	9.76	0.00
74.00	10.00	9.76	0.00
75.00	10.00	9.76	0.00
76.00	10.00	9.76	0.00
77.00	10.00	9.76	0.00
78.00	10.00	9.76	0.00
79.00	10.00	9.76	0.00
80.00	10.00	9.76	0.00
81.00	10.00	9.76	0.00
82.00	10.00	9.76	0.00
83.00	10.00	9.76	0.00
84.00	10.00	9.76	0.00
85.00	10.00	9.76	0.00
86.00	10.00	9.76	0.00
87.00	10.00	9.76	0.00
88.00	10.00	9.76	0.00
89.00	10.00	9.76	0.00
90.00	10.00	9.76	0.00
91.00	10.00	9.76	0.00
92.00	10.00	9.76	0.00
93.00	10.00	9.76	0.00
94.00	10.00	9.76	0.00
95.00	10.00	9.76	0.00
96.00	10.00	9.76	0.00
97.00	10.00	9.76	0.00
98.00	10.00	9.76	0.00
99.00	10.00	9.76	0.00
100.00	10.00	9.76	0.00

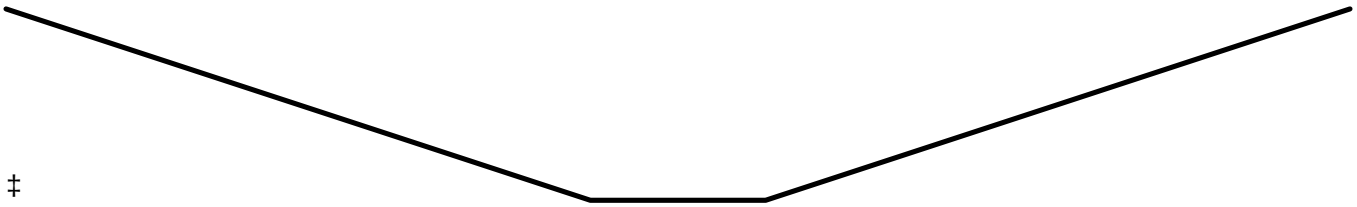
Summary for Reach 2R: Spillway - Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

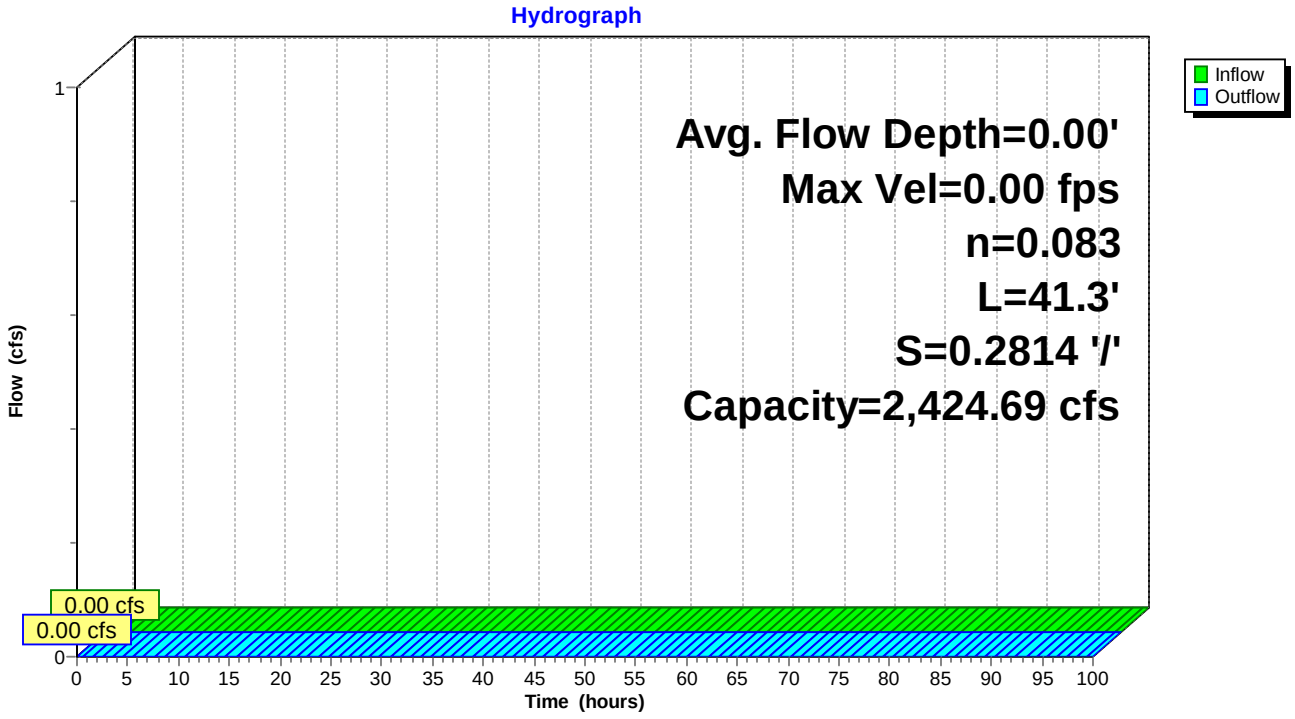
Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'

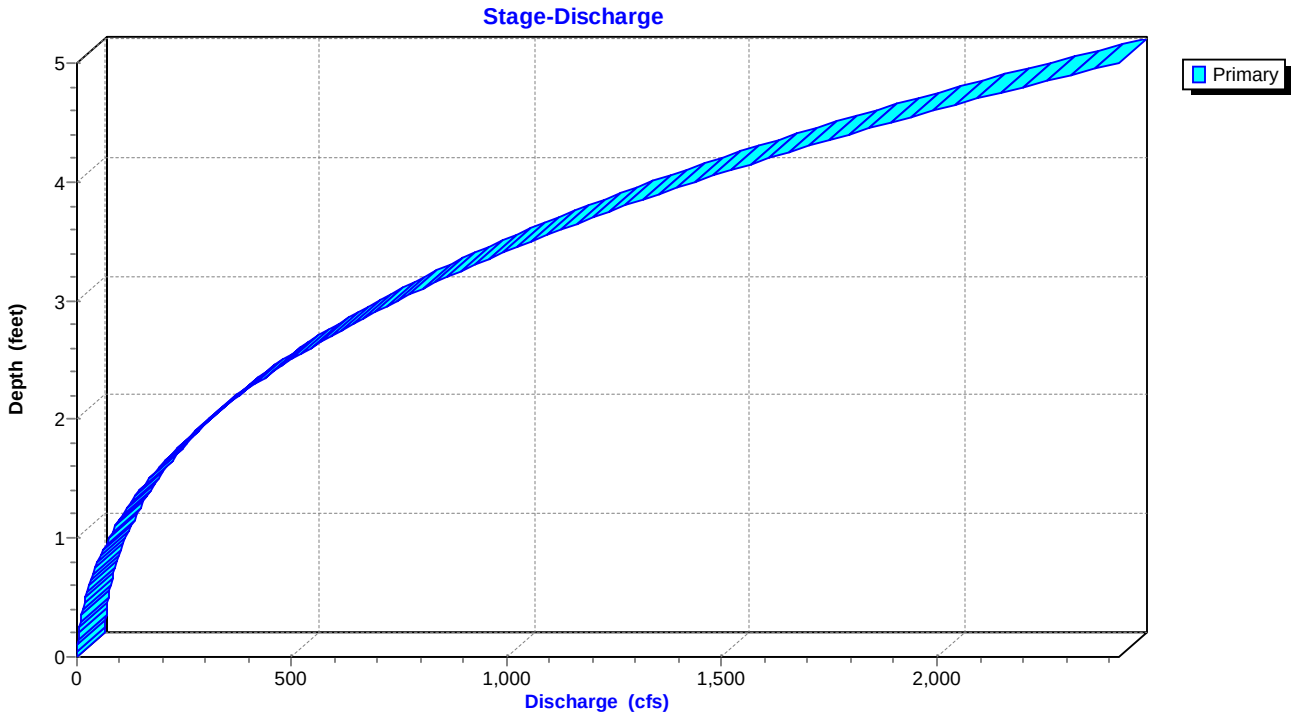


‡

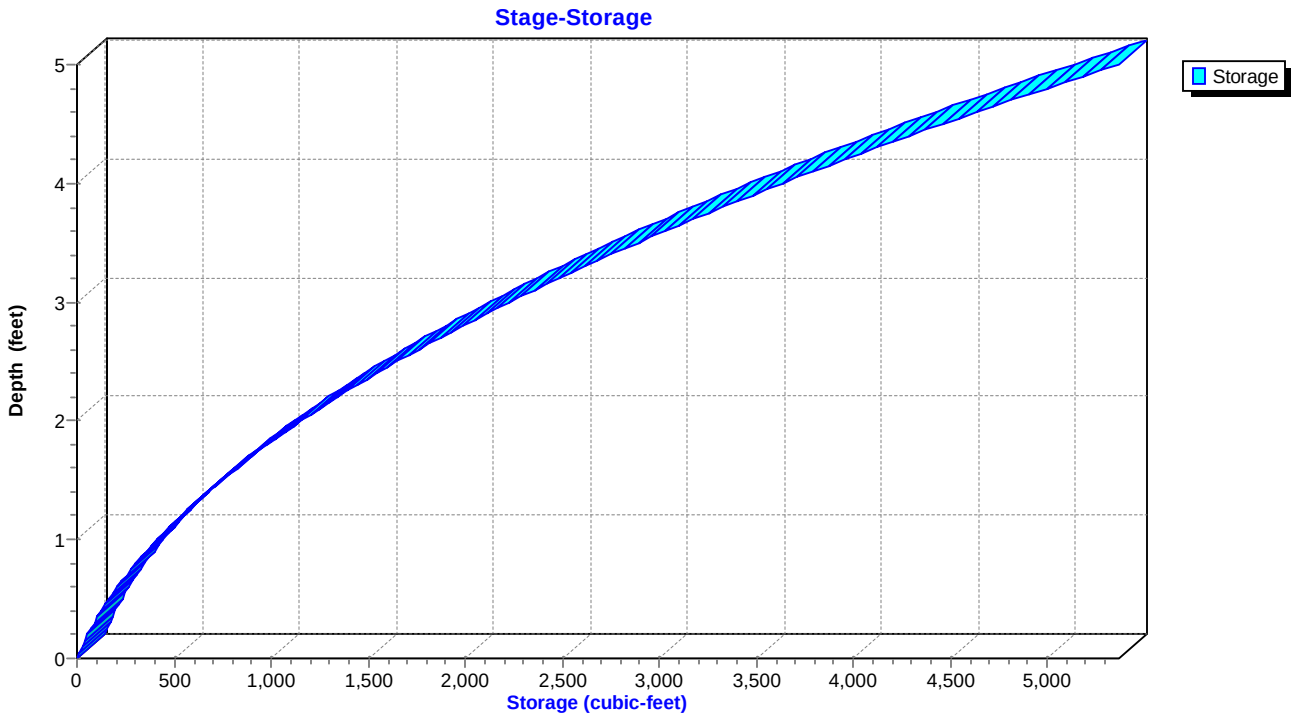
Reach 2R: Spillway - Lower Reach



Reach 2R: Spillway - Lower Reach



Reach 2R: Spillway - Lower Reach



Hydrograph for Reach 2R: Spillway - Lower Reach

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**	**442.88**	**0.00**	54.00	0.00	442.88	0.00
1.00	0.00	442.88	0.00	55.00	0.00	442.88	0.00
2.00	0.00	442.88	0.00	56.00	0.00	442.88	0.00
3.00	0.00	442.88	0.00	57.00	0.00	442.88	0.00
4.00	0.00	442.88	0.00	58.00	0.00	442.88	0.00
5.00	0.00	442.88	0.00	59.00	0.00	442.88	0.00
6.00	0.00	442.88	0.00	60.00	0.00	442.88	0.00
7.00	0.00	442.88	0.00	61.00	0.00	442.88	0.00
8.00	0.00	442.88	0.00	62.00	0.00	442.88	0.00
9.00	0.00	442.88	0.00	63.00	0.00	442.88	0.00
10.00	0.00	442.88	0.00	64.00	0.00	442.88	0.00
11.00	0.00	442.88	0.00	65.00	0.00	442.88	0.00
12.00	0.00	442.88	0.00	66.00	0.00	442.88	0.00
13.00	0.00	442.88	0.00	67.00	0.00	442.88	0.00
14.00	0.00	442.88	0.00	68.00	0.00	442.88	0.00
15.00	0.00	442.88	0.00	69.00	0.00	442.88	0.00
16.00	0.00	442.88	0.00	70.00	0.00	442.88	0.00
17.00	0.00	442.88	0.00	71.00	0.00	442.88	0.00
18.00	0.00	442.88	0.00	72.00	0.00	442.88	0.00
19.00	0.00	442.88	0.00	73.00	0.00	442.88	0.00
20.00	0.00	442.88	0.00	74.00	0.00	442.88	0.00
21.00	0.00	442.88	0.00	75.00	0.00	442.88	0.00
22.00	0.00	442.88	0.00	76.00	0.00	442.88	0.00
23.00	0.00	442.88	0.00	77.00	0.00	442.88	0.00
24.00	0.00	442.88	0.00	78.00	0.00	442.88	0.00
25.00	0.00	442.88	0.00	79.00	0.00	442.88	0.00
26.00	0.00	442.88	0.00	80.00	0.00	442.88	0.00
27.00	0.00	442.88	0.00	81.00	0.00	442.88	0.00
28.00	0.00	442.88	0.00	82.00	0.00	442.88	0.00
29.00	0.00	442.88	0.00	83.00	0.00	442.88	0.00
30.00	0.00	442.88	0.00	84.00	0.00	442.88	0.00
31.00	0.00	442.88	0.00	85.00	0.00	442.88	0.00
32.00	0.00	442.88	0.00	86.00	0.00	442.88	0.00
33.00	0.00	442.88	0.00	87.00	0.00	442.88	0.00
34.00	0.00	442.88	0.00	88.00	0.00	442.88	0.00
35.00	0.00	442.88	0.00	89.00	0.00	442.88	0.00
36.00	0.00	442.88	0.00	90.00	0.00	442.88	0.00
37.00	0.00	442.88	0.00	91.00	0.00	442.88	0.00
38.00	0.00	442.88	0.00	92.00	0.00	442.88	0.00
39.00	0.00	442.88	0.00	93.00	0.00	442.88	0.00
40.00	0.00	442.88	0.00	94.00	0.00	442.88	0.00
41.00	0.00	442.88	0.00	95.00	0.00	442.88	0.00
42.00	0.00	442.88	0.00	96.00	0.00	442.88	0.00
43.00	0.00	442.88	0.00	97.00	0.00	442.88	0.00
44.00	0.00	442.88	0.00	98.00	0.00	442.88	0.00
45.00	0.00	442.88	0.00	99.00	0.00	442.88	0.00
46.00	0.00	442.88	0.00	100.00	0.00	442.88	0.00
47.00	0.00	442.88	0.00				
48.00	0.00	442.88	0.00				
49.00	0.00	442.88	0.00				
50.00	0.00	442.88	0.00				
51.00	0.00	442.88	0.00				
52.00	0.00	442.88	0.00				
53.00	0.00	442.88	0.00				

Stage-Discharge for Reach 2R: Spillway - Lower Reach

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
442.88	0.00	0.00
442.93	1.26	0.39
442.98	1.96	1.25
443.03	2.52	2.50
443.08	3.00	4.08
443.13	3.43	6.00
443.18	3.82	8.25
443.23	4.17	10.81
443.28	4.51	13.70
443.33	4.82	16.91
443.38	5.11	20.45
443.43	5.39	24.33
443.48	5.66	28.54
443.53	5.92	33.09
443.58	6.17	37.99
443.63	6.41	43.24
443.68	6.64	48.85
443.73	6.86	54.82
443.78	7.08	61.17
443.83	7.29	67.90
443.88	7.50	75.01
443.93	7.70	82.51
443.98	7.90	90.40
444.03	8.10	98.70
444.08	8.29	107.41
444.13	8.48	116.54
444.18	8.66	126.09
444.23	8.84	136.07
444.28	9.02	146.48
444.33	9.20	157.34
444.38	9.37	168.64
444.43	9.54	180.40
444.48	9.71	192.62
444.53	9.88	205.30
444.58	10.04	218.46
444.63	10.20	232.10
444.68	10.36	246.23
444.73	10.52	260.84
444.78	10.68	275.96
444.83	10.84	291.58
444.88	10.99	307.71
444.93	11.14	324.36
444.98	11.29	341.53
445.03	11.44	359.22
445.08	11.59	377.45
445.13	11.74	396.23
445.18	11.89	415.55
445.23	12.03	435.42
445.28	12.18	455.85
445.33	12.32	476.84
445.38	12.46	498.40
445.43	12.60	520.54
445.48	12.74	543.26
445.53	12.88	566.56
445.58	13.02	590.46
445.63	13.15	614.96
445.68	13.29	640.06
445.73	13.43	665.78
445.78	13.56	692.10
445.83	13.69	719.05
445.88	13.83	746.62
445.93	13.96	774.83
445.98	14.09	803.67
446.03	14.22	833.16
446.08	14.35	863.30
446.13	14.48	894.09
446.18	14.61	925.54
446.23	14.74	957.65
446.28	14.86	990.43
446.33	14.99	1,023.89
446.38	15.11	1,058.03
446.43	15.24	1,092.86
446.48	15.36	1,128.38
446.53	15.49	1,164.59
446.58	15.61	1,201.51
446.63	15.74	1,239.14
446.68	15.86	1,277.47
446.73	15.98	1,316.53
446.78	16.10	1,356.31
446.83	16.22	1,396.82
446.88	16.34	1,438.06
446.93	16.46	1,480.04
446.98	16.58	1,522.76
447.03	16.70	1,566.23
447.08	16.82	1,610.46
447.13	16.94	1,655.44
447.18	17.05	1,701.19
447.23	17.17	1,747.71
447.28	17.29	1,795.00
447.33	17.40	1,843.07
447.38	17.52	1,891.92
447.43	17.63	1,941.57
447.48	17.75	1,992.01
447.53	17.86	2,043.24
447.58	17.98	2,095.28
447.63	18.09	2,148.13
447.68	18.20	2,201.80
447.73	18.32	2,256.28
447.78	18.43	2,311.59
447.83	18.54	2,367.72
447.88	**18.65**	**2,424.69**

Stage-Area-Storage for Reach 2R: Spillway - Lower Reach

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
442.88	0.0	0
442.93	0.3	13
442.98	0.6	26
443.03	1.0	41
443.08	1.4	56
443.13	1.8	72
443.18	2.2	89
443.23	2.6	107
443.28	3.0	126
443.33	3.5	145
443.38	4.0	165
443.43	4.5	186
443.48	5.0	208
443.53	5.6	231
443.58	6.2	254
443.63	6.8	279
443.68	7.4	304
443.73	8.0	330
443.78	8.6	357
443.83	9.3	385
443.88	10.0	413
443.93	10.7	442
443.98	11.4	472
444.03	12.2	503
444.08	13.0	535
444.13	13.8	568
444.18	14.6	601
444.23	15.4	636
444.28	16.2	671
444.33	17.1	707
444.38	18.0	743
444.43	18.9	781
444.48	19.8	819
444.53	20.8	859
444.58	21.8	899
444.63	22.8	940
444.68	23.8	981
444.73	24.8	1,024
444.78	25.8	1,067
444.83	26.9	1,111
444.88	28.0	1,156
444.93	29.1	1,202
444.98	30.2	1,249
445.03	31.4	1,296
445.08	32.6	1,345
445.13	33.8	1,394
445.18	35.0	1,444
445.23	36.2	1,495
445.28	37.4	1,546
445.33	38.7	1,599
445.38	40.0	1,652
445.43	41.3	1,706
445.48	42.6	1,761
445.53	44.0	1,817
445.58	45.4	1,873
445.63	46.8	1,931
445.68	48.2	1,989
445.73	49.6	2,048
445.78	51.0	2,108
445.83	52.5	2,169
445.88	54.0	2,230
445.93	55.5	2,293
445.98	57.0	2,356
446.03	58.6	2,420
446.08	60.2	2,485
446.13	61.8	2,550
446.18	63.4	2,617
446.23	65.0	2,684
446.28	66.6	2,752
446.33	68.3	2,821
446.38	70.0	2,891
446.43	71.7	2,962
446.48	73.4	3,033
446.53	75.2	3,105
446.58	77.0	3,178
446.63	78.8	3,252
446.68	80.6	3,327
446.73	82.4	3,403
446.78	84.2	3,479
446.83	86.1	3,556
446.88	88.0	3,634
446.93	89.9	3,713
446.98	91.8	3,793
447.03	93.8	3,874
447.08	95.8	3,955
447.13	97.8	4,037
447.18	99.8	4,120
447.23	101.8	4,204
447.28	103.8	4,289
447.33	105.9	4,374
447.38	108.0	4,460
447.43	110.1	4,548
447.48	112.2	4,636
447.53	114.4	4,724
447.58	116.6	4,814
447.63	118.8	4,904
447.68	121.0	4,996
447.73	123.2	5,088
447.78	125.4	5,181
447.83	127.7	5,274
447.88	**130.0**	**5,369**

Summary for Reach 3R: Spillway - Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

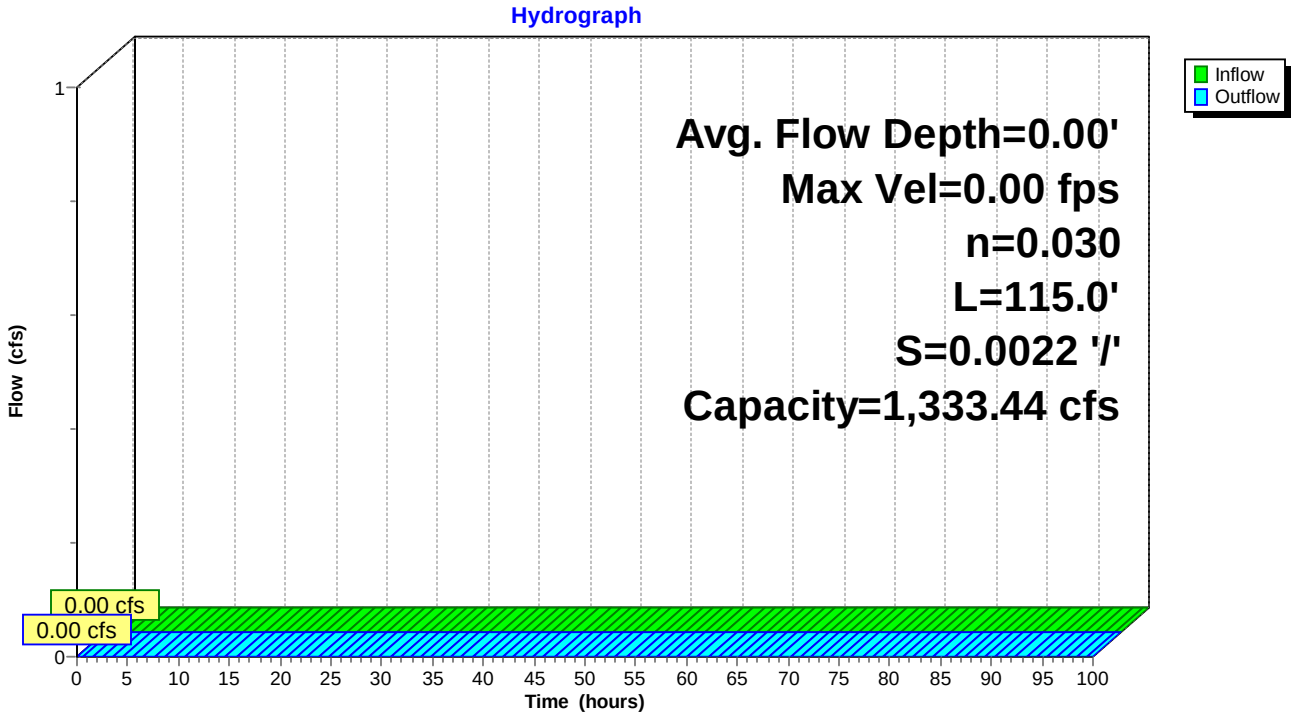
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

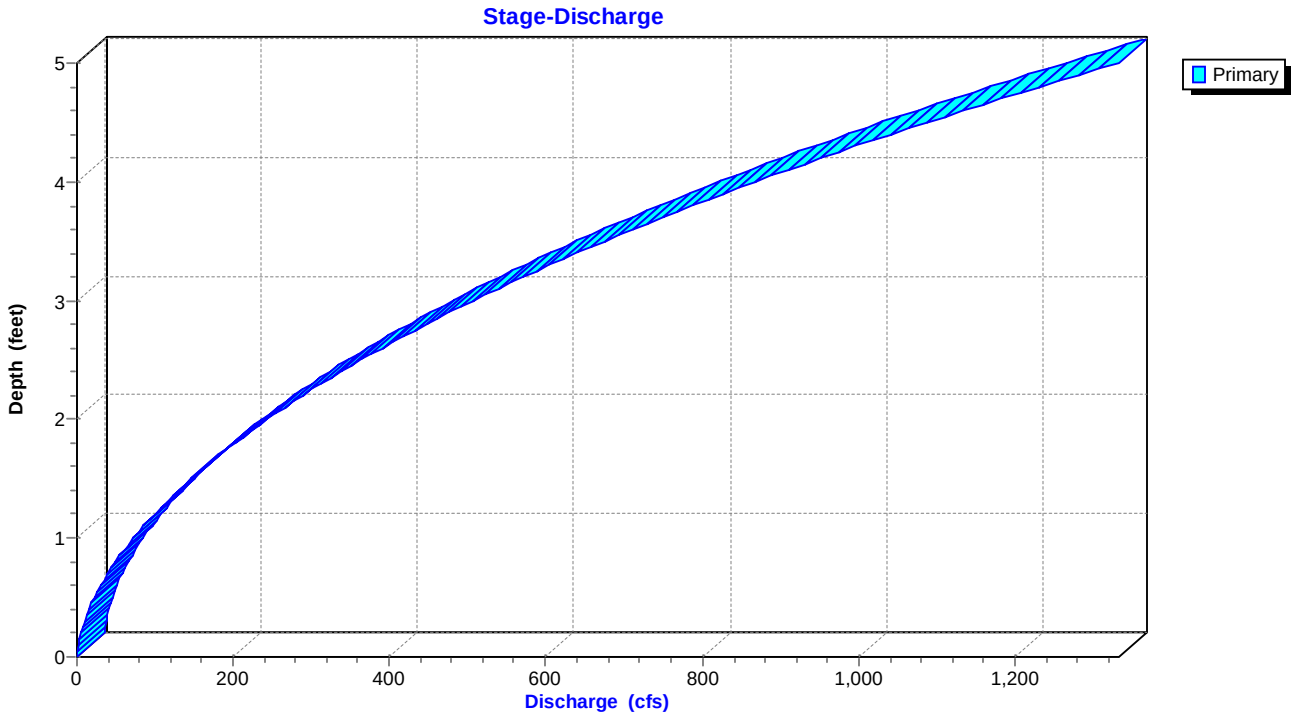
30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

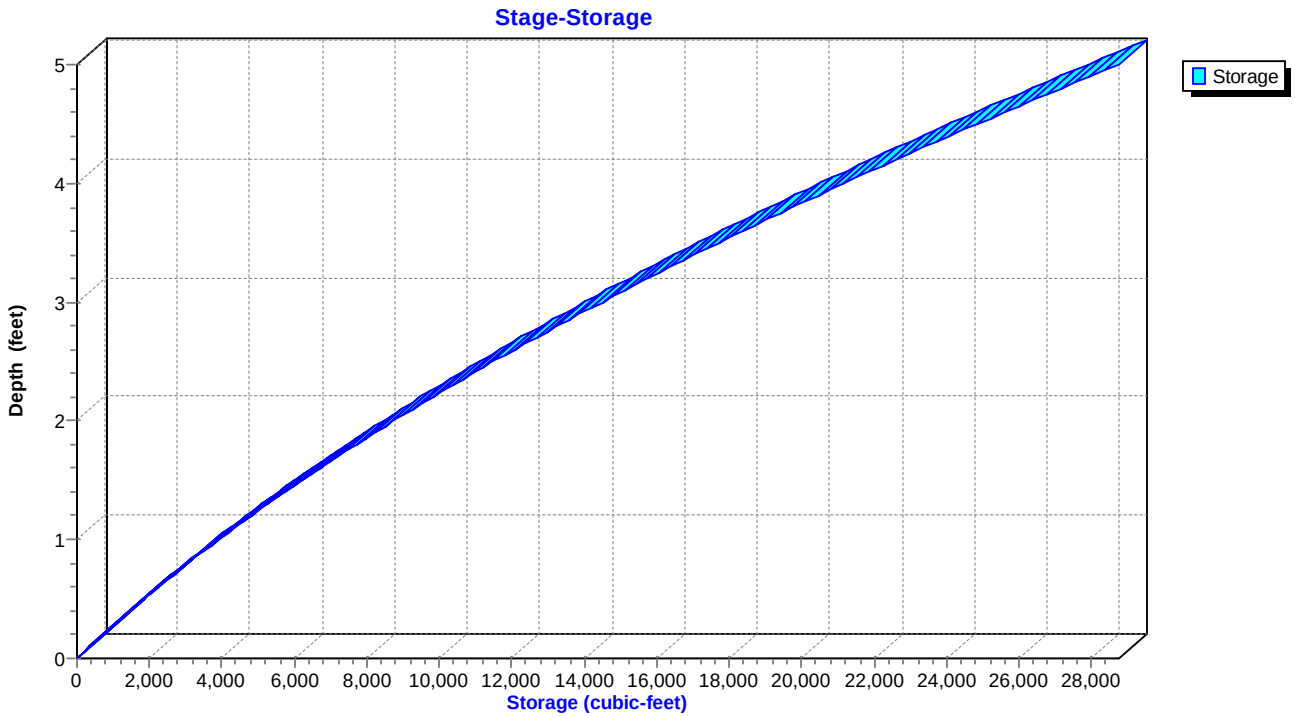
Reach 3R: Spillway - Upper Reach



Reach 3R: Spillway - Upper Reach



Reach 3R: Spillway - Upper Reach



Hydrograph for Reach 3R: Spillway - Upper Reach

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**	**447.00**	**0.00**	54.00	0.00	447.00	0.00
1.00	0.00	447.00	0.00	55.00	0.00	447.00	0.00
2.00	0.00	447.00	0.00	56.00	0.00	447.00	0.00
3.00	0.00	447.00	0.00	57.00	0.00	447.00	0.00
4.00	0.00	447.00	0.00	58.00	0.00	447.00	0.00
5.00	0.00	447.00	0.00	59.00	0.00	447.00	0.00
6.00	0.00	447.00	0.00	60.00	0.00	447.00	0.00
7.00	0.00	447.00	0.00	61.00	0.00	447.00	0.00
8.00	0.00	447.00	0.00	62.00	0.00	447.00	0.00
9.00	0.00	447.00	0.00	63.00	0.00	447.00	0.00
10.00	0.00	447.00	0.00	64.00	0.00	447.00	0.00
11.00	0.00	447.00	0.00	65.00	0.00	447.00	0.00
12.00	0.00	447.00	0.00	66.00	0.00	447.00	0.00
13.00	0.00	447.00	0.00	67.00	0.00	447.00	0.00
14.00	0.00	447.00	0.00	68.00	0.00	447.00	0.00
15.00	0.00	447.00	0.00	69.00	0.00	447.00	0.00
16.00	0.00	447.00	0.00	70.00	0.00	447.00	0.00
17.00	0.00	447.00	0.00	71.00	0.00	447.00	0.00
18.00	0.00	447.00	0.00	72.00	0.00	447.00	0.00
19.00	0.00	447.00	0.00	73.00	0.00	447.00	0.00
20.00	0.00	447.00	0.00	74.00	0.00	447.00	0.00
21.00	0.00	447.00	0.00	75.00	0.00	447.00	0.00
22.00	0.00	447.00	0.00	76.00	0.00	447.00	0.00
23.00	0.00	447.00	0.00	77.00	0.00	447.00	0.00
24.00	0.00	447.00	0.00	78.00	0.00	447.00	0.00
25.00	0.00	447.00	0.00	79.00	0.00	447.00	0.00
26.00	0.00	447.00	0.00	80.00	0.00	447.00	0.00
27.00	0.00	447.00	0.00	81.00	0.00	447.00	0.00
28.00	0.00	447.00	0.00	82.00	0.00	447.00	0.00
29.00	0.00	447.00	0.00	83.00	0.00	447.00	0.00
30.00	0.00	447.00	0.00	84.00	0.00	447.00	0.00
31.00	0.00	447.00	0.00	85.00	0.00	447.00	0.00
32.00	0.00	447.00	0.00	86.00	0.00	447.00	0.00
33.00	0.00	447.00	0.00	87.00	0.00	447.00	0.00
34.00	0.00	447.00	0.00	88.00	0.00	447.00	0.00
35.00	0.00	447.00	0.00	89.00	0.00	447.00	0.00
36.00	0.00	447.00	0.00	90.00	0.00	447.00	0.00
37.00	0.00	447.00	0.00	91.00	0.00	447.00	0.00
38.00	0.00	447.00	0.00	92.00	0.00	447.00	0.00
39.00	0.00	447.00	0.00	93.00	0.00	447.00	0.00
40.00	0.00	447.00	0.00	94.00	0.00	447.00	0.00
41.00	0.00	447.00	0.00	95.00	0.00	447.00	0.00
42.00	0.00	447.00	0.00	96.00	0.00	447.00	0.00
43.00	0.00	447.00	0.00	97.00	0.00	447.00	0.00
44.00	0.00	447.00	0.00	98.00	0.00	447.00	0.00
45.00	0.00	447.00	0.00	99.00	0.00	447.00	0.00
46.00	0.00	447.00	0.00	100.00	0.00	447.00	0.00
47.00	0.00	447.00	0.00				
48.00	0.00	447.00	0.00				
49.00	0.00	447.00	0.00				
50.00	0.00	447.00	0.00				
51.00	0.00	447.00	0.00				
52.00	0.00	447.00	0.00				
53.00	0.00	447.00	0.00				

Stage-Discharge for Reach 3R: Spillway - Upper Reach

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
447.00	0.00	0.00
447.05	0.31	0.47
447.10	0.49	1.50
447.15	0.64	2.95
447.20	0.78	4.78
447.25	0.90	6.95
447.30	1.01	9.43
447.35	1.11	12.22
447.40	1.21	15.30
447.45	1.30	18.67
447.50	1.39	22.30
447.55	1.48	26.20
447.60	1.56	30.37
447.65	1.64	34.79
447.70	1.72	39.46
447.75	1.79	44.37
447.80	1.87	49.54
447.85	1.94	54.94
447.90	2.00	60.59
447.95	2.07	66.48
448.00	2.14	72.60
448.05	2.20	78.96
448.10	2.26	85.55
448.15	2.32	92.37
448.20	2.38	99.43
448.25	2.44	106.71
448.30	2.50	114.23
448.35	2.55	121.98
448.40	2.61	129.96
448.45	2.66	138.17
448.50	2.71	146.60
448.55	2.77	155.27
448.60	2.82	164.16
448.65	2.87	173.29
448.70	2.92	182.64
448.75	2.97	192.22
448.80	3.02	202.03
448.85	3.07	212.07
448.90	3.11	222.34
448.95	3.16	232.84
449.00	3.20	243.57
449.05	3.25	254.53
449.10	3.30	265.72
449.15	3.34	277.14
449.20	3.38	288.80
449.25	3.43	300.69
449.30	3.47	312.81
449.35	3.51	325.16
449.40	3.55	337.75
449.45	3.60	350.57
449.50	3.64	363.63
449.55	3.68	376.93
449.60	3.72	390.46
449.65	3.76	404.23
449.70	3.80	418.23
449.75	3.84	432.48
449.80	3.87	446.96
449.85	3.91	461.69
449.90	3.95	476.65
449.95	3.99	491.86
450.00	4.03	507.31
450.05	4.06	523.00
450.10	4.10	538.94
450.15	4.14	555.12
450.20	4.17	571.55
450.25	4.21	588.22
450.30	4.24	605.14
450.35	4.28	622.30
450.40	4.32	639.72
450.45	4.35	657.39
450.50	4.39	675.30
450.55	4.42	693.47
450.60	4.45	711.89
450.65	4.49	730.56
450.70	4.52	749.48
450.75	4.56	768.66
450.80	4.59	788.10
450.85	4.62	807.79
450.90	4.65	827.74
450.95	4.69	847.94
451.00	4.72	868.41
451.05	4.75	889.13
451.10	4.78	910.12
451.15	4.82	931.37
451.20	4.85	952.88
451.25	4.88	974.65
451.30	4.91	996.68
451.35	4.94	1,018.99
451.40	4.97	1,041.55
451.45	5.00	1,064.39
451.50	5.03	1,087.49
451.55	5.07	1,110.86
451.60	5.10	1,134.50
451.65	5.13	1,158.41
451.70	5.16	1,182.59
451.75	5.19	1,207.05
451.80	5.22	1,231.78
451.85	5.25	1,256.78
451.90	5.28	1,282.06
451.95	5.30	1,307.61
452.00	**5.33**	**1,333.44**

Stage-Area-Storage for Reach 3R: Spillway - Upper Reach

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
447.00	0.0	0
447.05	1.5	174
447.10	3.0	350
447.15	4.6	528
447.20	6.2	708
447.25	7.8	891
447.30	9.4	1,076
447.35	11.0	1,264
447.40	12.6	1,454
447.45	14.3	1,646
447.50	16.0	1,840
447.55	17.7	2,037
447.60	19.4	2,236
447.65	21.2	2,437
447.70	23.0	2,640
447.75	24.8	2,846
447.80	26.6	3,054
447.85	28.4	3,265
447.90	30.2	3,478
447.95	32.1	3,693
448.00	34.0	3,910
448.05	35.9	4,130
448.10	37.8	4,352
448.15	39.8	4,576
448.20	41.8	4,802
448.25	43.8	5,031
448.30	45.8	5,262
448.35	47.8	5,496
448.40	49.8	5,732
448.45	51.9	5,970
448.50	54.0	6,210
448.55	56.1	6,453
448.60	58.2	6,698
448.65	60.4	6,945
448.70	62.6	7,194
448.75	64.8	7,446
448.80	67.0	7,700
448.85	69.2	7,957
448.90	71.4	8,216
448.95	73.7	8,477
449.00	76.0	8,740
449.05	78.3	9,006
449.10	80.6	9,274
449.15	83.0	9,544
449.20	85.4	9,816
449.25	87.8	10,091
449.30	90.2	10,368
449.35	92.6	10,648
449.40	95.0	10,930
449.45	97.5	11,214
449.50	100.0	11,500
449.55	102.5	11,789
449.60	105.0	12,080
449.65	107.6	12,373
449.70	110.2	12,668
449.75	112.8	12,966
449.80	115.4	13,266
449.85	118.0	13,569
449.90	120.6	13,874
449.95	123.3	14,181
450.00	126.0	14,490
450.05	128.7	14,802
450.10	131.4	15,116
450.15	134.2	15,432
450.20	137.0	15,750
450.25	139.8	16,071
450.30	142.6	16,394
450.35	145.4	16,720
450.40	148.2	17,048
450.45	151.1	17,378
450.50	154.0	17,710
450.55	156.9	18,045
450.60	159.8	18,382
450.65	162.8	18,721
450.70	165.8	19,062
450.75	168.8	19,406
450.80	171.8	19,752
450.85	174.8	20,101
450.90	177.8	20,452
450.95	180.9	20,805
451.00	184.0	21,160
451.05	187.1	21,518
451.10	190.2	21,878
451.15	193.4	22,240
451.20	196.6	22,604
451.25	199.8	22,971
451.30	203.0	23,340
451.35	206.2	23,712
451.40	209.4	24,086
451.45	212.7	24,462
451.50	216.0	24,840
451.55	219.3	25,221
451.60	222.6	25,604
451.65	226.0	25,989
451.70	229.4	26,376
451.75	232.8	26,766
451.80	236.2	27,158
451.85	239.6	27,553
451.90	243.0	27,950
451.95	246.5	28,349
452.00	**250.0**	**28,750**

Summary for Reach 4R: Breach-Lower Reach

[61] Hint: Exceeded Reach 6R outlet invert by 1.16' @ 18.57 hrs

Inflow = 84.34 cfs @ 18.56 hrs, Volume= 48.592 af
Outflow = 84.34 cfs @ 18.57 hrs, Volume= 48.592 af, Atten= 0%, Lag= 0.2 min

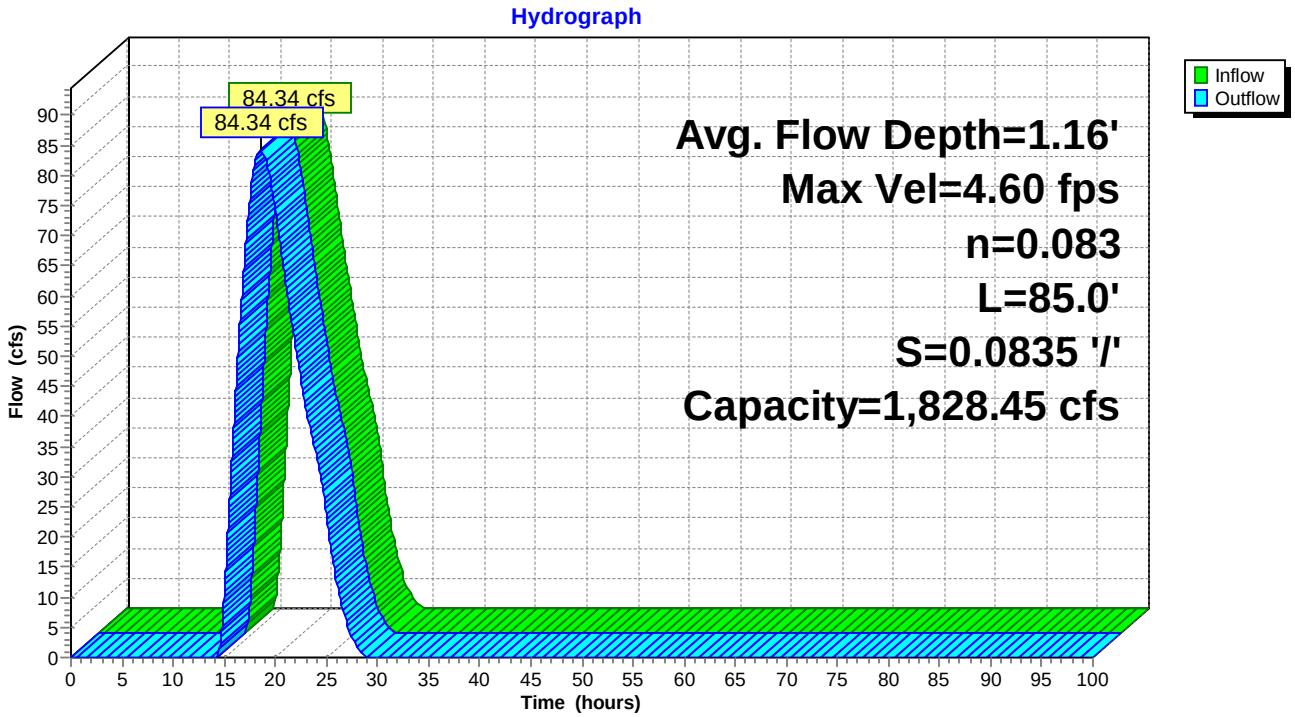
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.60 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.11 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,557 cf @ 18.57 hrs
Average Depth at Peak Storage= 1.16'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

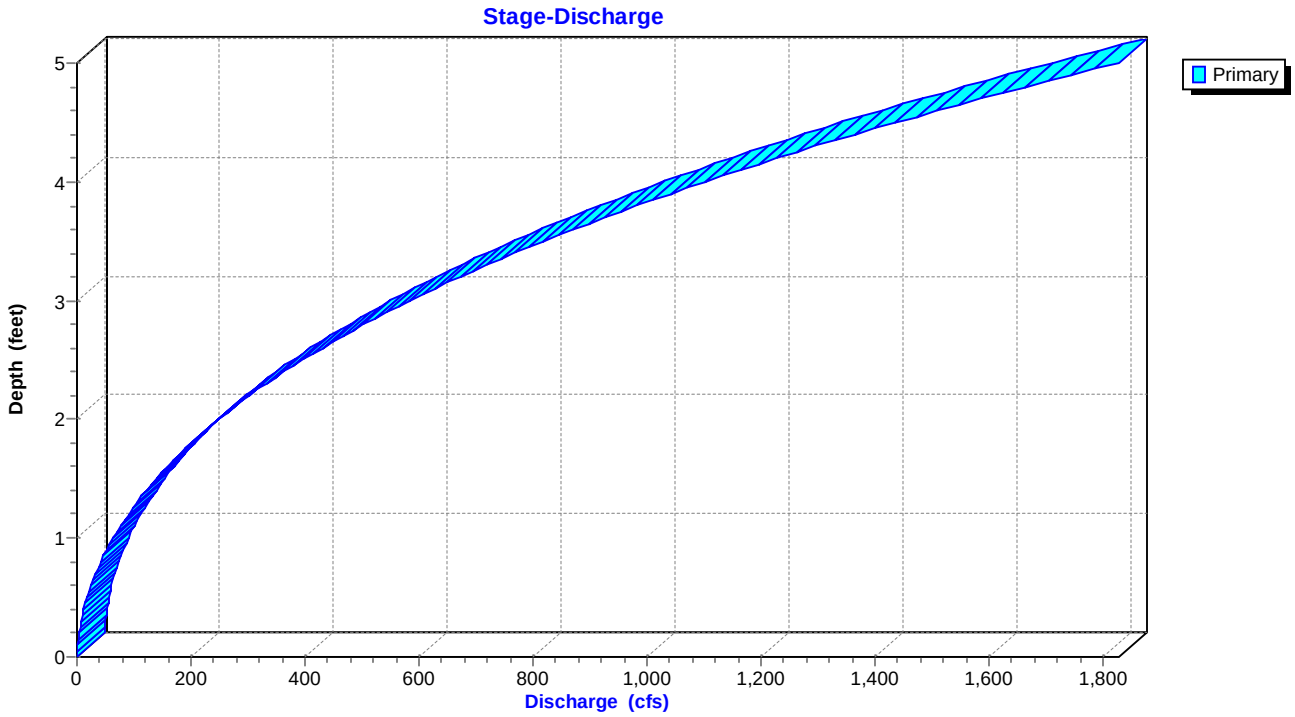
10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

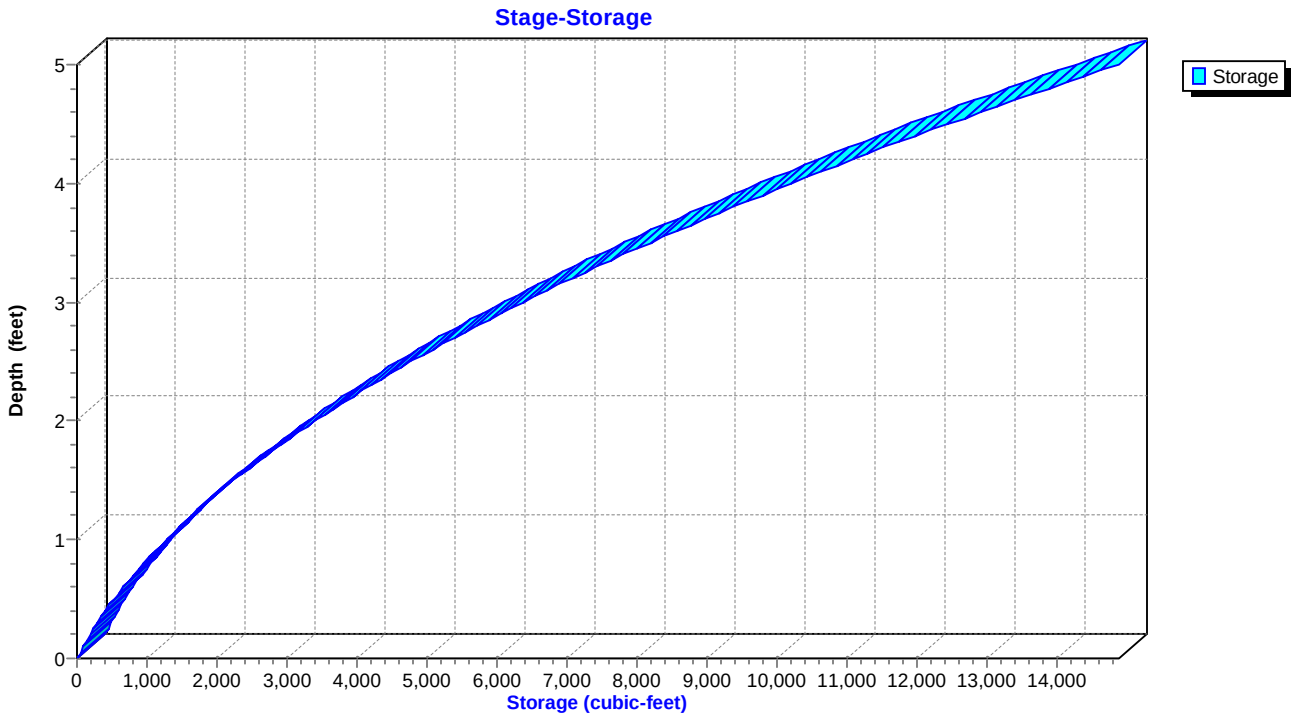
Reach 4R: Breach-Lower Reach



Reach 4R: Breach-Lower Reach



Reach 4R: Breach-Lower Reach



Hydrograph for Reach 4R: Breach-Lower Reach

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
0.00	0.00	0	451.10	0.00
2.00	0.00	0	451.10	0.00
4.00	0.00	0	451.10	0.00
6.00	0.00	0	451.10	0.00
8.00	0.00	0	451.10	0.00
10.00	0.00	0	451.10	0.00
12.00	0.00	0	451.10	0.00
14.00	0.00	0	451.10	0.00
16.00	40.24	922	451.88	40.10
18.00	**82.11**	**1,527**	**452.24**	**82.08**
20.00	**74.08**	**1,420**	**452.18**	**74.12**
22.00	51.27	1,095	451.99	51.31
24.00	33.52	815	451.81	33.56
26.00	12.34	414	451.50	12.39
28.00	1.64	112	451.22	1.67
30.00	0.00	0	451.10	0.00
32.00	0.00	0	451.10	0.00
34.00	0.00	0	451.10	0.00
36.00	0.00	0	451.10	0.00
38.00	0.00	0	451.10	0.00
40.00	0.00	0	451.10	0.00
42.00	0.00	0	451.10	0.00
44.00	0.00	0	451.10	0.00
46.00	0.00	0	451.10	0.00
48.00	0.00	0	451.10	0.00
50.00	0.00	0	451.10	0.00
52.00	0.00	0	451.10	0.00
54.00	0.00	0	451.10	0.00
56.00	0.00	0	451.10	0.00
58.00	0.00	0	451.10	0.00
60.00	0.00	0	451.10	0.00
62.00	0.00	0	451.10	0.00
64.00	0.00	0	451.10	0.00
66.00	0.00	0	451.10	0.00
68.00	0.00	0	451.10	0.00
70.00	0.00	0	451.10	0.00
72.00	0.00	0	451.10	0.00
74.00	0.00	0	451.10	0.00
76.00	0.00	0	451.10	0.00
78.00	0.00	0	451.10	0.00
80.00	0.00	0	451.10	0.00
82.00	0.00	0	451.10	0.00
84.00	0.00	0	451.10	0.00
86.00	0.00	0	451.10	0.00
88.00	0.00	0	451.10	0.00
90.00	0.00	0	451.10	0.00
92.00	0.00	0	451.10	0.00
94.00	0.00	0	451.10	0.00
96.00	0.00	0	451.10	0.00
98.00	0.00	0	451.10	0.00
100.00	0.00	0	451.10	0.00

Stage-Discharge for Reach 4R: Breach-Lower Reach

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
451.10	0.00	0.00
451.15	0.69	0.35
451.20	1.08	1.13
451.25	1.39	2.25
451.30	1.67	3.67
451.35	1.91	5.37
451.40	2.13	7.35
451.45	2.33	9.60
451.50	2.53	12.12
451.55	2.70	14.91
451.60	2.87	17.96
451.65	3.04	21.28
451.70	3.19	24.88
451.75	3.34	28.74
451.80	3.48	32.88
451.85	3.62	37.30
451.90	3.75	41.99
451.95	3.88	46.97
452.00	4.00	52.24
452.05	4.12	57.80
452.10	4.24	63.65
452.15	4.36	69.80
452.20	4.47	76.25
452.25	4.58	83.01
452.30	4.69	90.08
452.35	4.80	97.46
452.40	4.90	105.16
452.45	5.01	113.18
452.50	5.11	121.53
452.55	5.21	130.21
452.60	5.30	139.22
452.65	5.40	148.57
452.70	5.49	158.26
452.75	5.59	168.29
452.80	5.68	178.68
452.85	5.77	189.41
452.90	5.86	200.51
452.95	5.95	211.97
453.00	6.04	223.79
453.05	6.13	235.98
453.10	6.21	248.55
453.15	6.30	261.50
453.20	6.38	274.82
453.25	6.47	288.53
453.30	6.55	302.63
453.35	6.63	317.13
453.40	6.71	332.02
453.45	6.79	347.31
453.50	6.88	363.00
453.55	6.95	379.11
453.60	7.03	395.63
453.65	7.11	412.56
453.70	7.19	429.91
453.75	7.27	447.69
453.80	7.34	465.90
453.85	7.42	484.54
453.90	7.49	503.61
453.95	7.57	523.12
454.00	7.64	543.07
454.05	7.72	563.47
454.10	7.79	584.32
454.15	7.86	605.63
454.20	7.94	627.39
454.25	8.01	649.61
454.30	8.08	672.30
454.35	8.15	695.46
454.40	8.22	719.09
454.45	8.29	743.19
454.50	8.36	767.77
454.55	8.43	792.84
454.60	8.50	818.39
454.65	8.57	844.43
454.70	8.64	870.97
454.75	8.71	898.00
454.80	8.78	925.54
454.85	8.84	953.58
454.90	8.91	982.12
454.95	8.98	1,011.18
455.00	9.05	1,040.75
455.05	9.11	1,070.84
455.10	9.18	1,101.45
455.15	9.24	1,132.59
455.20	9.31	1,164.25
455.25	9.38	1,196.45
455.30	9.44	1,229.18
455.35	9.51	1,262.45
455.40	9.57	1,296.26
455.45	9.63	1,330.62
455.50	9.70	1,365.53
455.55	9.76	1,400.99
455.60	9.83	1,437.00
455.65	9.89	1,473.58
455.70	9.95	1,510.72
455.75	10.01	1,548.42
455.80	10.08	1,586.69
455.85	10.14	1,625.53
455.90	10.20	1,664.95
455.95	10.26	1,704.95
456.00	10.33	1,745.53
456.05	10.39	1,786.70
456.10	**10.45**	**1,828.45**

Stage-Area-Storage for Reach 4R: Breach-Lower Reach

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
451.10	0.0	0
451.15	0.5	44
451.20	1.1	89
451.25	1.6	137
451.30	2.2	187
451.35	2.8	239
451.40	3.4	293
451.45	4.1	350
451.50	4.8	408
451.55	5.5	469
451.60	6.3	531
451.65	7.0	596
451.70	7.8	663
451.75	8.6	732
451.80	9.5	803
451.85	10.3	877
451.90	11.2	952
451.95	12.1	1,030
452.00	13.1	1,109
452.05	14.0	1,191
452.10	15.0	1,275
452.15	16.0	1,361
452.20	17.1	1,449
452.25	18.1	1,540
452.30	19.2	1,632
452.35	20.3	1,727
452.40	21.4	1,823
452.45	22.6	1,922
452.50	23.8	2,023
452.55	25.0	2,126
452.60	26.3	2,231
452.65	27.5	2,339
452.70	28.8	2,448
452.75	30.1	2,560
452.80	31.4	2,673
452.85	32.8	2,789
452.90	34.2	2,907
452.95	35.6	3,027
453.00	37.1	3,149
453.05	38.5	3,274
453.10	40.0	3,400
453.15	41.5	3,529
453.20	43.1	3,659
453.25	44.6	3,792
453.30	46.2	3,927
453.35	47.8	4,064
453.40	49.5	4,203
453.45	51.1	4,345
453.50	52.8	4,488
453.55	54.5	4,634
453.60	56.3	4,781
453.65	58.0	4,931
453.70	59.8	5,083
453.75	61.6	5,237
453.80	63.5	5,393
453.85	65.3	5,552
453.90	67.2	5,712
453.95	69.1	5,875
454.00	71.0	6,039
454.05	73.0	6,206
454.10	75.0	6,375
454.15	77.0	6,546
454.20	79.0	6,719
454.25	81.1	6,895
454.30	83.2	7,072
454.35	85.3	7,252
454.40	87.5	7,433
454.45	89.6	7,617
454.50	91.8	7,803
454.55	94.0	7,991
454.60	96.3	8,181
454.65	98.5	8,374
454.70	100.8	8,568
454.75	103.1	8,765
454.80	105.5	8,963
454.85	107.8	9,164
454.90	110.2	9,367
454.95	112.6	9,572
455.00	115.0	9,779
455.05	117.5	9,989
455.10	120.0	10,200
455.15	122.5	10,414
455.20	125.0	10,629
455.25	127.6	10,847
455.30	130.2	11,067
455.35	132.8	11,289
455.40	135.4	11,513
455.45	138.1	11,740
455.50	140.8	11,968
455.55	143.5	12,199
455.60	146.3	12,431
455.65	149.0	12,666
455.70	151.8	12,903
455.75	154.6	13,142
455.80	157.5	13,383
455.85	160.3	13,627
455.90	163.2	13,872
455.95	166.1	14,120
456.00	169.1	14,369
456.05	172.0	14,621
456.10	**175.0**	**14,875**

Summary for Reach 5R: Discharge Creek

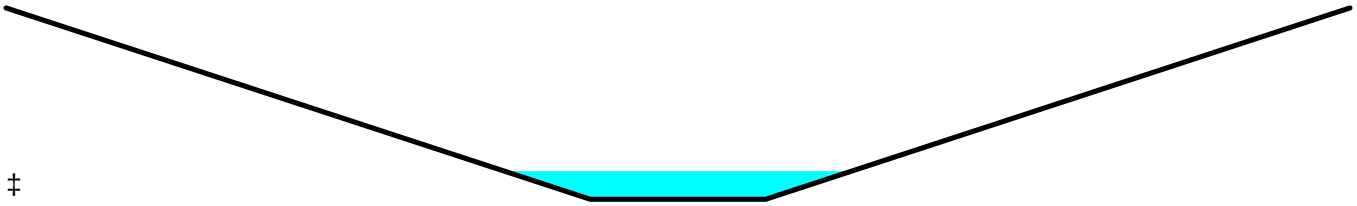
[62] Hint: Exceeded Reach 8R OUTLET depth by 6.00' @ 25.53 hrs

Inflow Area = 242.430 ac, 55.89% Impervious, Inflow Depth > 6.94" for 1000 year storm Indy Huff event
Inflow = 38.78 cfs @ 25.51 hrs, Volume= 140.286 af
Outflow = 38.78 cfs @ 25.53 hrs, Volume= 140.256 af, Atten= 0%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.84 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 4.26 fps, Avg. Travel Time= 3.1 min

Peak Storage= 5,313 cf @ 25.53 hrs
Average Depth at Peak Storage= 0.74'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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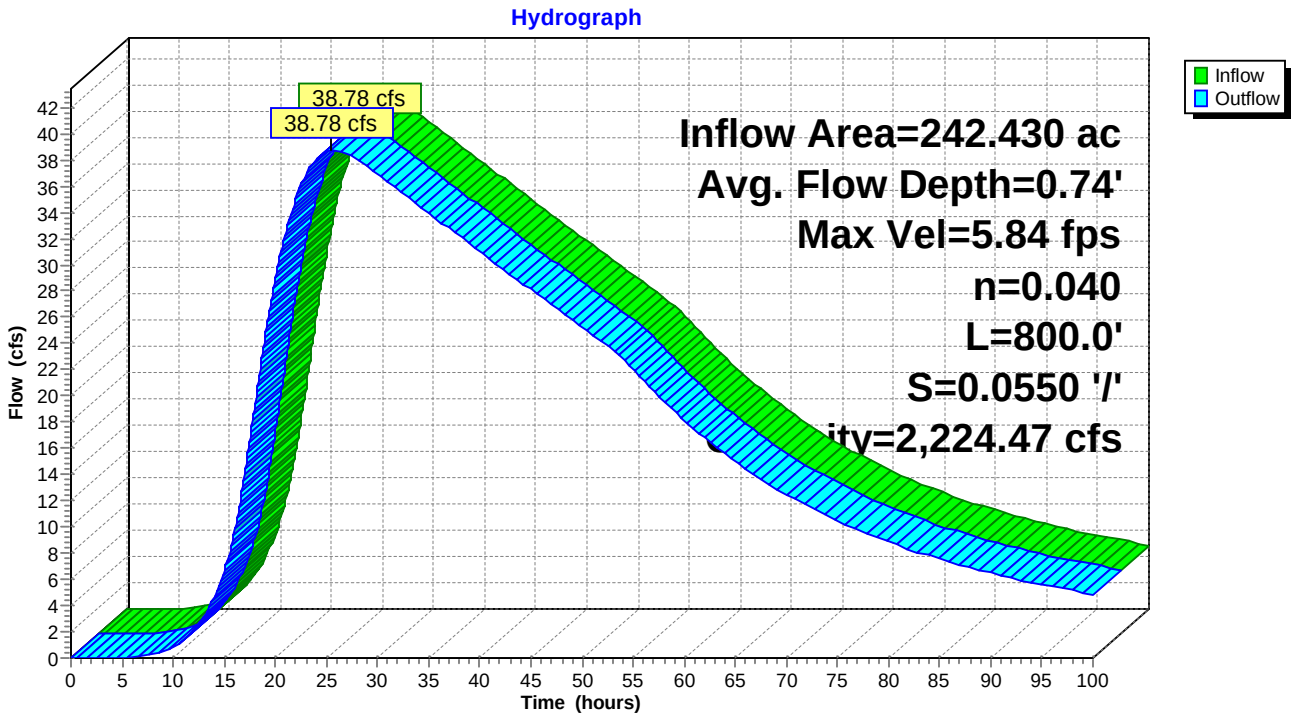
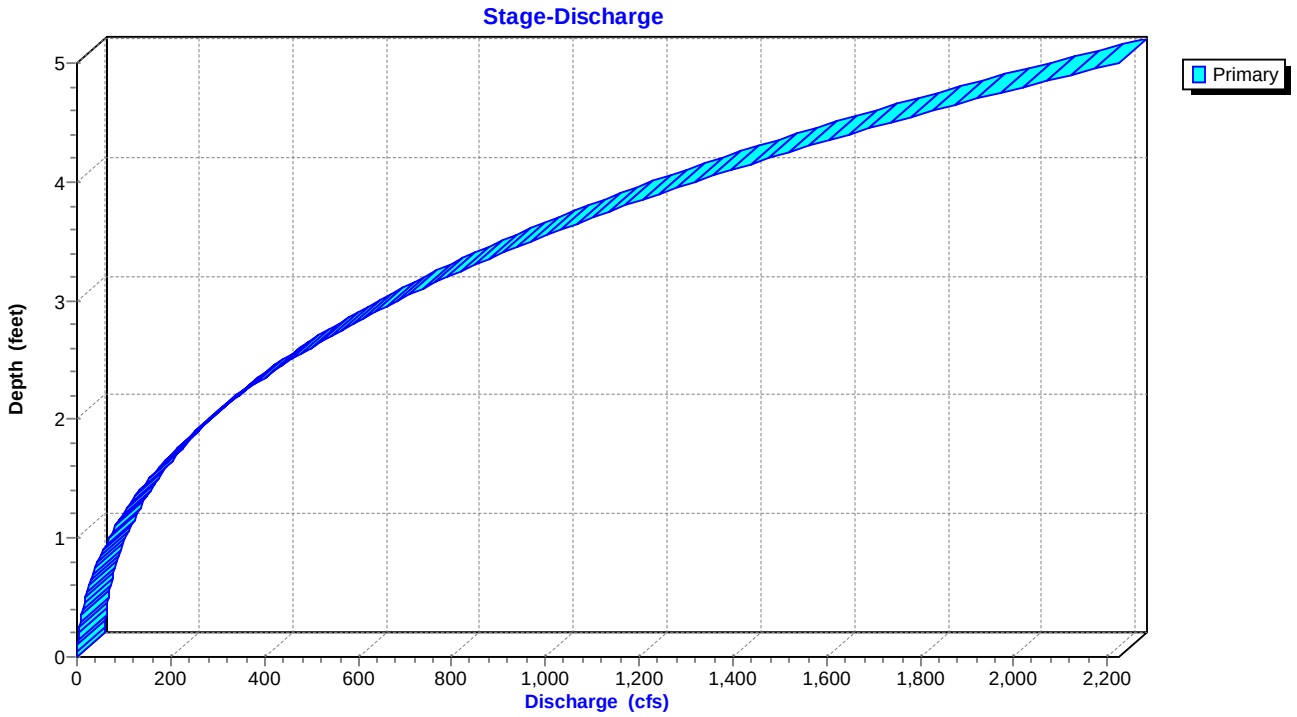
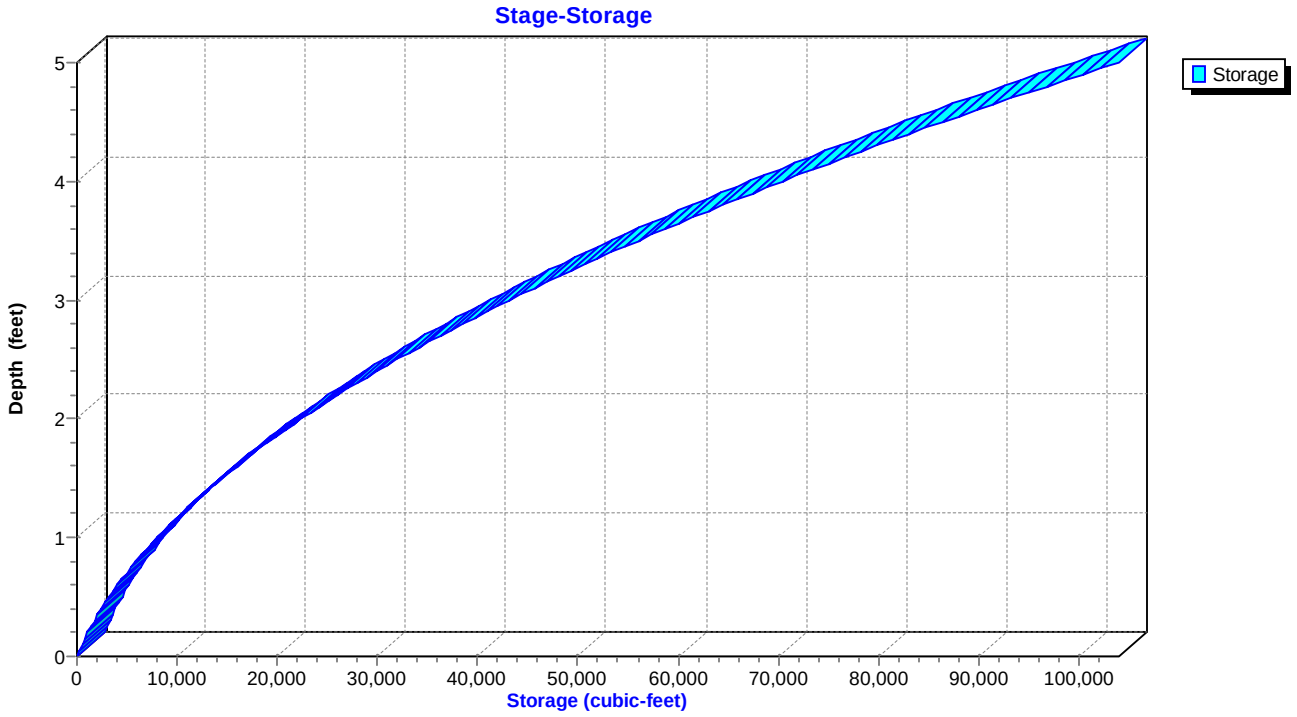
Reach 5R: Discharge Creek



Reach 5R: Discharge Creek



Reach 5R: Discharge Creek



Hydrograph for Reach 5R: Discharge Creek

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
0.00	0.00	0	428.00	0.00
2.00	0.00	0	428.00	0.00
4.00	0.00	0	428.00	0.00
6.00	0.06	30	428.01	0.04
8.00	0.32	195	428.04	0.28
10.00	0.88	410	428.08	0.84
12.00	2.11	732	428.14	2.05
14.00	4.67	1,237	428.22	4.59
16.00	9.83	2,036	428.34	9.68
18.00	19.47	3,262	428.51	19.30
20.00	29.08	4,325	428.63	28.96
22.00	35.07	4,944	428.70	35.02
24.00	**38.17**	**5,250**	**428.73**	**38.14**
26.00	**38.74**	**5,309**	**428.74**	**38.74**
28.00	38.01	5,239	428.73	38.02
30.00	36.89	5,129	428.72	36.90
32.00	35.72	5,015	428.71	35.73
34.00	34.54	4,898	428.70	34.56
36.00	33.36	4,779	428.68	33.38
38.00	32.18	4,659	428.67	32.20
40.00	31.00	4,539	428.66	31.01
42.00	29.82	4,418	428.64	29.84
44.00	28.66	4,295	428.63	28.67
46.00	27.50	4,173	428.62	27.52
48.00	26.37	4,053	428.60	26.38
50.00	25.25	3,931	428.59	25.26
52.00	24.15	3,811	428.57	24.16
54.00	22.80	3,663	428.56	22.82
56.00	21.19	3,481	428.53	21.21
58.00	19.61	3,300	428.51	19.64
60.00	18.15	3,128	428.49	18.17
62.00	16.80	2,965	428.47	16.82
64.00	15.56	2,816	428.45	15.58
66.00	14.44	2,673	428.43	14.46
68.00	13.41	2,541	428.41	13.43
70.00	12.47	2,421	428.40	12.49
72.00	11.61	2,304	428.38	11.63
74.00	10.83	2,198	428.37	10.84
76.00	10.11	2,100	428.35	10.12
78.00	9.45	2,006	428.34	9.47
80.00	8.85	1,917	428.33	8.86
82.00	8.29	1,836	428.32	8.30
84.00	7.78	1,761	428.30	7.79
86.00	7.31	1,689	428.29	7.32
88.00	6.88	1,620	428.28	6.89
90.00	6.47	1,556	428.27	6.48
92.00	6.10	1,496	428.26	6.11
94.00	5.76	1,441	428.26	5.77
96.00	5.44	1,389	428.25	5.45
98.00	5.14	1,337	428.24	5.15
100.00	4.87	1,288	428.23	4.87

Stage-Discharge for Reach 5R: Discharge Creek

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
428.00	0.00	0.00
428.05	1.16	0.36
428.10	1.80	1.15
428.15	2.31	2.29
428.20	2.75	3.75
428.25	3.15	5.51
428.30	3.50	7.57
428.35	3.83	9.92
428.40	4.13	12.57
428.45	4.42	15.52
428.50	4.69	18.77
428.55	4.95	22.32
428.60	5.19	26.18
428.65	5.43	30.36
428.70	5.66	34.85
428.75	5.88	39.67
428.80	6.09	44.82
428.85	6.30	50.30
428.90	6.50	56.12
428.95	6.69	62.29
429.00	6.88	68.81
429.05	7.07	75.69
429.10	7.25	82.94
429.15	7.43	90.55
429.20	7.60	98.54
429.25	7.78	106.92
429.30	7.94	115.68
429.35	8.11	124.83
429.40	8.27	134.39
429.45	8.44	144.34
429.50	8.60	154.71
429.55	8.75	165.50
429.60	8.91	176.71
429.65	9.06	188.35
429.70	9.21	200.42
429.75	9.36	212.94
429.80	9.51	225.90
429.85	9.65	239.31
429.90	9.80	253.17
429.95	9.94	267.50
430.00	10.08	282.30
430.05	10.22	297.57
430.10	10.36	313.32
430.15	10.50	329.56
430.20	10.64	346.29
430.25	10.77	363.51
430.30	10.90	381.23
430.35	11.04	399.46
430.40	11.17	418.20
430.45	11.30	437.46
430.50	11.43	457.25
430.55	11.56	477.56
430.60	11.69	498.40
430.65	11.82	519.78
430.70	11.94	541.71
430.75	12.07	564.18
430.80	12.19	587.21
430.85	12.32	610.80
430.90	12.44	634.95
430.95	12.56	659.68
431.00	12.68	684.97
431.05	12.81	710.85
431.10	12.93	737.31
431.15	13.05	764.36
431.20	13.17	792.01
431.25	13.28	820.26
431.30	13.40	849.11
431.35	13.52	878.57
431.40	13.64	908.65
431.45	13.75	939.35
431.50	13.87	970.67
431.55	13.98	1,002.62
431.60	14.10	1,035.21
431.65	14.21	1,068.43
431.70	14.32	1,102.30
431.75	14.44	1,136.82
431.80	14.55	1,171.99
431.85	14.66	1,207.82
431.90	14.77	1,244.31
431.95	14.88	1,281.48
432.00	14.99	1,319.31
432.05	15.10	1,357.82
432.10	15.21	1,397.02
432.15	15.32	1,436.90
432.20	15.43	1,477.47
432.25	15.54	1,518.74
432.30	15.64	1,560.72
432.35	15.75	1,603.39
432.40	15.86	1,646.78
432.45	15.97	1,690.88
432.50	16.07	1,735.70
432.55	16.18	1,781.25
432.60	16.28	1,827.52
432.65	16.39	1,874.53
432.70	16.49	1,922.27
432.75	16.60	1,970.76
432.80	16.70	2,019.99
432.85	16.80	2,069.97
432.90	16.91	2,120.71
432.95	17.01	2,172.21
433.00	**17.11**	**2,224.47**

Stage-Area-Storage for Reach 5R: Discharge Creek

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
428.00	0.0	0
428.05	0.3	248
428.10	0.6	512
428.15	1.0	792
428.20	1.4	1,088
428.25	1.8	1,400
428.30	2.2	1,728
428.35	2.6	2,072
428.40	3.0	2,432
428.45	3.5	2,808
428.50	4.0	3,200
428.55	4.5	3,608
428.60	5.0	4,032
428.65	5.6	4,472
428.70	6.2	4,928
428.75	6.8	5,400
428.80	7.4	5,888
428.85	8.0	6,392
428.90	8.6	6,912
428.95	9.3	7,448
429.00	10.0	8,000
429.05	10.7	8,568
429.10	11.4	9,152
429.15	12.2	9,752
429.20	13.0	10,368
429.25	13.8	11,000
429.30	14.6	11,648
429.35	15.4	12,312
429.40	16.2	12,992
429.45	17.1	13,688
429.50	18.0	14,400
429.55	18.9	15,128
429.60	19.8	15,872
429.65	20.8	16,632
429.70	21.8	17,408
429.75	22.8	18,200
429.80	23.8	19,008
429.85	24.8	19,832
429.90	25.8	20,672
429.95	26.9	21,528
430.00	28.0	22,400
430.05	29.1	23,288
430.10	30.2	24,192
430.15	31.4	25,112
430.20	32.6	26,048
430.25	33.8	27,000
430.30	35.0	27,968
430.35	36.2	28,952
430.40	37.4	29,952
430.45	38.7	30,968
430.50	40.0	32,000
430.55	41.3	33,048
430.60	42.6	34,112
430.65	44.0	35,192
430.70	45.4	36,288
430.75	46.8	37,400
430.80	48.2	38,528
430.85	49.6	39,672
430.90	51.0	40,832
430.95	52.5	42,008
431.00	54.0	43,200
431.05	55.5	44,408
431.10	57.0	45,632
431.15	58.6	46,872
431.20	60.2	48,128
431.25	61.8	49,400
431.30	63.4	50,688
431.35	65.0	51,992
431.40	66.6	53,312
431.45	68.3	54,648
431.50	70.0	56,000
431.55	71.7	57,368
431.60	73.4	58,752
431.65	75.2	60,152
431.70	77.0	61,568
431.75	78.8	63,000
431.80	80.6	64,448
431.85	82.4	65,912
431.90	84.2	67,392
431.95	86.1	68,888
432.00	88.0	70,400
432.05	89.9	71,928
432.10	91.8	73,472
432.15	93.8	75,032
432.20	95.8	76,608
432.25	97.8	78,200
432.30	99.8	79,808
432.35	101.8	81,432
432.40	103.8	83,072
432.45	105.9	84,728
432.50	108.0	86,400
432.55	110.1	88,088
432.60	112.2	89,792
432.65	114.4	91,512
432.70	116.6	93,248
432.75	118.8	95,000
432.80	121.0	96,768
432.85	123.2	98,552
432.90	125.4	100,352
432.95	127.7	102,168
433.00	**130.0**	**104,000**

Summary for Reach 6R: Breach - Upper Reach

[80] Warning: Exceeded Pond 1P by 1.11' @ 34.06 hrs (0.00 cfs 0.001 af)

Inflow = 84.34 cfs @ 18.55 hrs, Volume= 48.592 af
Outflow = 84.34 cfs @ 18.56 hrs, Volume= 48.592 af, Atten= 0%, Lag= 1.0 min

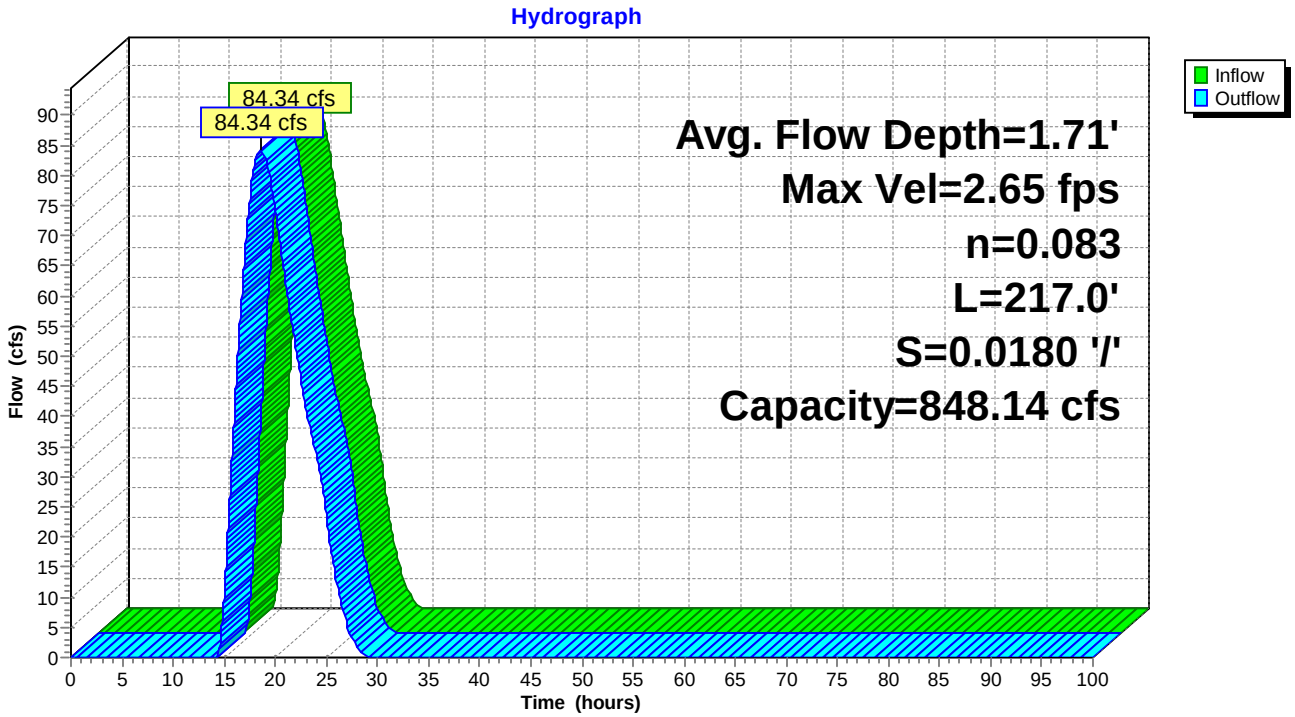
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.65 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.79 fps, Avg. Travel Time= 2.0 min

Peak Storage= 6,911 cf @ 18.56 hrs
Average Depth at Peak Storage= 1.71'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

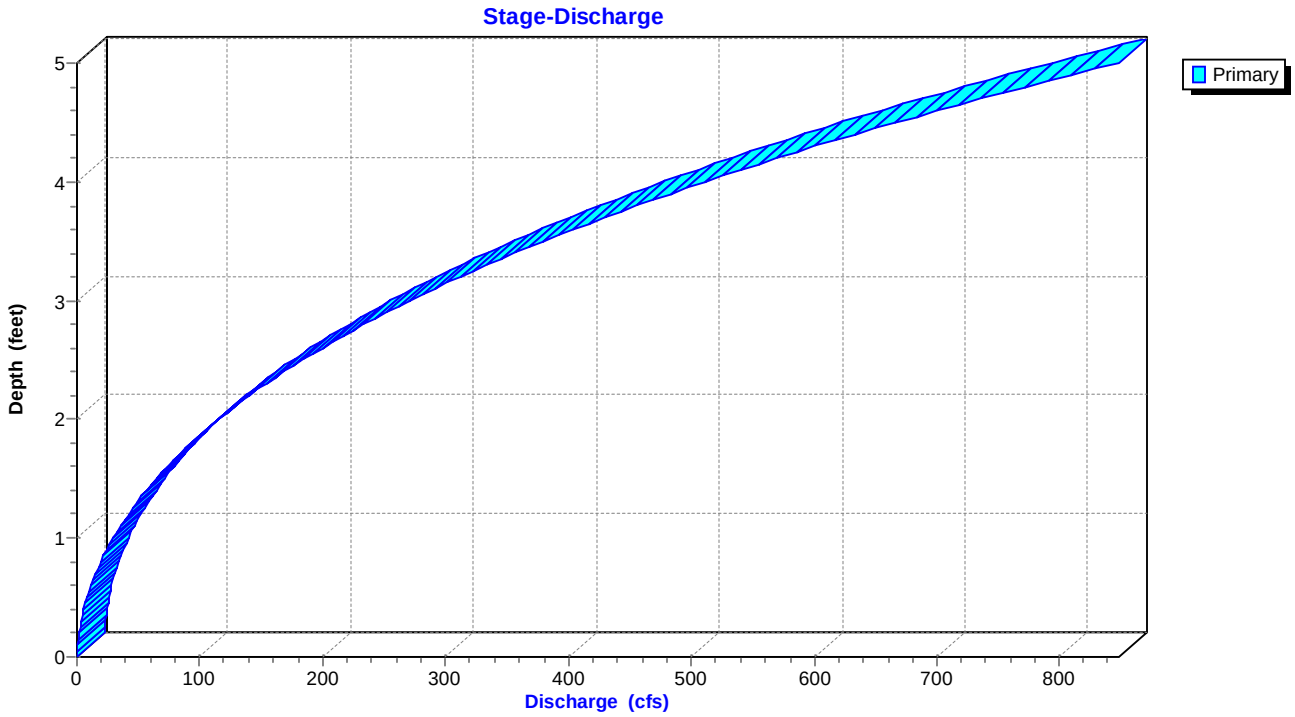
10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

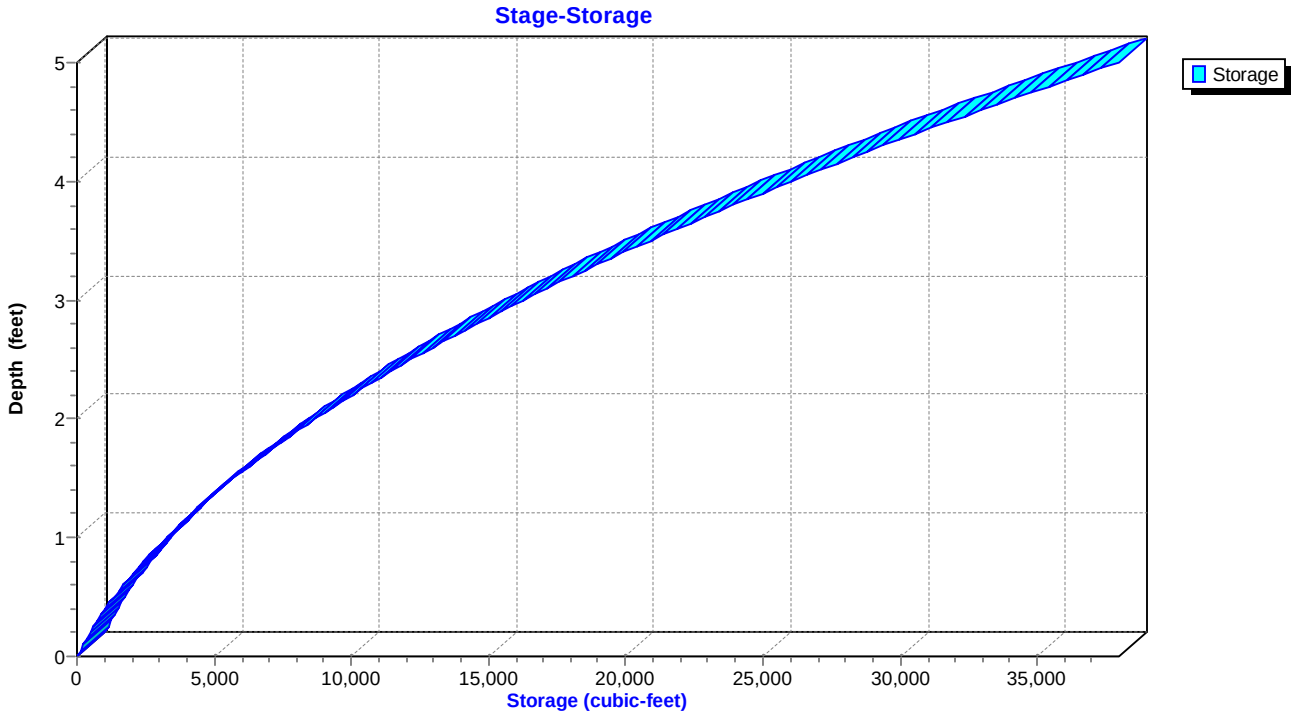
Reach 6R: Breach - Upper Reach



Reach 6R: Breach - Upper Reach



Reach 6R: Breach - Upper Reach



Hydrograph for Reach 6R: Breach - Upper Reach

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)
0.00	0.00	0	455.00	0.00
2.00	0.00	0	455.00	0.00
4.00	0.00	0	455.00	0.00
6.00	0.00	0	455.00	0.00
8.00	0.00	0	455.00	0.00
10.00	0.00	0	455.00	0.00
12.00	0.00	0	455.00	0.00
14.00	0.00	0	455.00	0.00
16.00	40.84	4,055	456.18	40.24
18.00	**82.24**	**6,778**	**456.69**	**82.11**
20.00	**73.88**	**6,291**	**456.61**	**74.08**
22.00	51.07	4,823	456.33	51.27
24.00	33.37	3,561	456.07	33.52
26.00	12.10	1,771	455.62	12.34
28.00	1.49	465	455.20	1.64
30.00	0.00	0	455.00	0.00
32.00	0.00	0	455.00	0.00
34.00	0.00	0	455.00	0.00
36.00	0.00	0	455.00	0.00
38.00	0.00	0	455.00	0.00
40.00	0.00	0	455.00	0.00
42.00	0.00	0	455.00	0.00
44.00	0.00	0	455.00	0.00
46.00	0.00	0	455.00	0.00
48.00	0.00	0	455.00	0.00
50.00	0.00	0	455.00	0.00
52.00	0.00	0	455.00	0.00
54.00	0.00	0	455.00	0.00
56.00	0.00	0	455.00	0.00
58.00	0.00	0	455.00	0.00
60.00	0.00	0	455.00	0.00
62.00	0.00	0	455.00	0.00
64.00	0.00	0	455.00	0.00
66.00	0.00	0	455.00	0.00
68.00	0.00	0	455.00	0.00
70.00	0.00	0	455.00	0.00
72.00	0.00	0	455.00	0.00
74.00	0.00	0	455.00	0.00
76.00	0.00	0	455.00	0.00
78.00	0.00	0	455.00	0.00
80.00	0.00	0	455.00	0.00
82.00	0.00	0	455.00	0.00
84.00	0.00	0	455.00	0.00
86.00	0.00	0	455.00	0.00
88.00	0.00	0	455.00	0.00
90.00	0.00	0	455.00	0.00
92.00	0.00	0	455.00	0.00
94.00	0.00	0	455.00	0.00
96.00	0.00	0	455.00	0.00
98.00	0.00	0	455.00	0.00
100.00	0.00	0	455.00	0.00

Stage-Discharge for Reach 6R: Breach - Upper Reach

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
455.00	0.00	0.00
455.05	0.32	0.16
455.10	0.50	0.53
455.15	0.65	1.04
455.20	0.77	1.70
455.25	0.89	2.49
455.30	0.99	3.41
455.35	1.08	4.45
455.40	1.17	5.62
455.45	1.25	6.92
455.50	1.33	8.33
455.55	1.41	9.87
455.60	1.48	11.54
455.65	1.55	13.33
455.70	1.61	15.25
455.75	1.68	17.30
455.80	1.74	19.48
455.85	1.80	21.79
455.90	1.86	24.23
455.95	1.91	26.81
456.00	1.97	29.52
456.05	2.02	32.38
456.10	2.07	35.37
456.15	2.13	38.51
456.20	2.18	41.78
456.25	2.23	45.21
456.30	2.27	48.78
456.35	2.32	52.50
456.40	2.37	56.37
456.45	2.41	60.40
456.50	2.46	64.58
456.55	2.50	68.91
456.60	2.55	73.41
456.65	2.59	78.06
456.70	2.64	82.88
456.75	2.68	87.86
456.80	2.72	93.01
456.85	2.76	98.32
456.90	2.80	103.81
456.95	2.84	109.46
457.00	2.88	115.29
457.05	2.92	121.30
457.10	2.96	127.48
457.15	3.00	133.84
457.20	3.04	140.38
457.25	3.08	147.10
457.30	3.11	154.01
457.35	3.15	161.10
457.40	3.19	168.38
457.45	3.23	175.85
457.50	3.26	183.51
457.55	3.30	191.37
457.60	3.33	199.42
457.65	3.37	207.66
457.70	3.41	216.11
457.75	3.44	224.75
457.80	3.48	233.60
457.85	3.51	242.65
457.90	3.55	251.91
457.95	3.58	261.37
458.00	3.61	271.04
458.05	3.65	280.92
458.10	3.68	291.02
458.15	3.71	301.33
458.20	3.75	311.85
458.25	3.78	322.59
458.30	3.81	333.55
458.35	3.85	344.73
458.40	3.88	356.14
458.45	3.91	367.76
458.50	3.94	379.62
458.55	3.98	391.70
458.60	4.01	404.00
458.65	4.04	416.54
458.70	4.07	429.32
458.75	4.10	442.32
458.80	4.13	455.56
458.85	4.17	469.04
458.90	4.20	482.76
458.95	4.23	496.71
459.00	4.26	510.91
459.05	4.29	525.36
459.10	4.32	540.04
459.15	4.35	554.98
459.20	4.38	570.16
459.25	4.41	585.59
459.30	4.44	601.28
459.35	4.47	617.22
459.40	4.50	633.41
459.45	4.53	649.86
459.50	4.56	666.56
459.55	4.59	683.53
459.60	4.62	700.75
459.65	4.65	718.24
459.70	4.67	735.99
459.75	4.70	754.01
459.80	4.73	772.30
459.85	4.76	790.85
459.90	4.79	809.67
459.95	4.82	828.77
460.00	**4.85**	**848.14**

Stage-Area-Storage for Reach 6R: Breach - Upper Reach

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
455.00	0.0	0
455.05	0.5	111
455.10	1.1	228
455.15	1.6	350
455.20	2.2	477
455.25	2.8	610
455.30	3.4	749
455.35	4.1	892
455.40	4.8	1,042
455.45	5.5	1,196
455.50	6.3	1,356
455.55	7.0	1,522
455.60	7.8	1,693
455.65	8.6	1,869
455.70	9.5	2,051
455.75	10.3	2,238
455.80	11.2	2,430
455.85	12.1	2,628
455.90	13.1	2,832
455.95	14.0	3,041
456.00	15.0	3,255
456.05	16.0	3,475
456.10	17.1	3,700
456.15	18.1	3,930
456.20	19.2	4,166
456.25	20.3	4,408
456.30	21.4	4,655
456.35	22.6	4,907
456.40	23.8	5,165
456.45	25.0	5,428
456.50	26.3	5,696
456.55	27.5	5,970
456.60	28.8	6,250
456.65	30.1	6,534
456.70	31.4	6,825
456.75	32.8	7,120
456.80	34.2	7,421
456.85	35.6	7,728
456.90	37.1	8,040
456.95	38.5	8,357
457.00	40.0	8,680
457.05	41.5	9,008
457.10	43.1	9,342
457.15	44.6	9,681
457.20	46.2	10,025
457.25	47.8	10,375
457.30	49.5	10,731
457.35	51.1	11,091
457.40	52.8	11,458
457.45	54.5	11,829
457.50	56.3	12,206
457.55	58.0	12,589
457.60	59.8	12,977
457.65	61.6	13,370
457.70	63.5	13,769
457.75	65.3	14,173
457.80	67.2	14,582
457.85	69.1	14,997
457.90	71.0	15,418
457.95	73.0	15,844
458.00	75.0	16,275
458.05	77.0	16,712
458.10	79.0	17,154
458.15	81.1	17,601
458.20	83.2	18,054
458.25	85.3	18,513
458.30	87.5	18,977
458.35	89.6	19,446
458.40	91.8	19,921
458.45	94.0	20,401
458.50	96.3	20,886
458.55	98.5	21,377
458.60	100.8	21,874
458.65	103.1	22,375
458.70	105.5	22,883
458.75	107.8	23,395
458.80	110.2	23,913
458.85	112.6	24,437
458.90	115.0	24,966
458.95	117.5	25,500
459.00	120.0	26,040
459.05	122.5	26,585
459.10	125.0	27,136
459.15	127.6	27,692
459.20	130.2	28,253
459.25	132.8	28,820
459.30	135.4	29,393
459.35	138.1	29,970
459.40	140.8	30,554
459.45	143.5	31,142
459.50	146.3	31,736
459.55	149.0	32,336
459.60	151.8	32,941
459.65	154.6	33,551
459.70	157.5	34,167
459.75	160.3	34,788
459.80	163.2	35,414
459.85	166.1	36,046
459.90	169.1	36,684
459.95	172.0	37,327
460.00	**175.0**	**37,975**

Summary for Reach 7R: Spillway - Middle Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

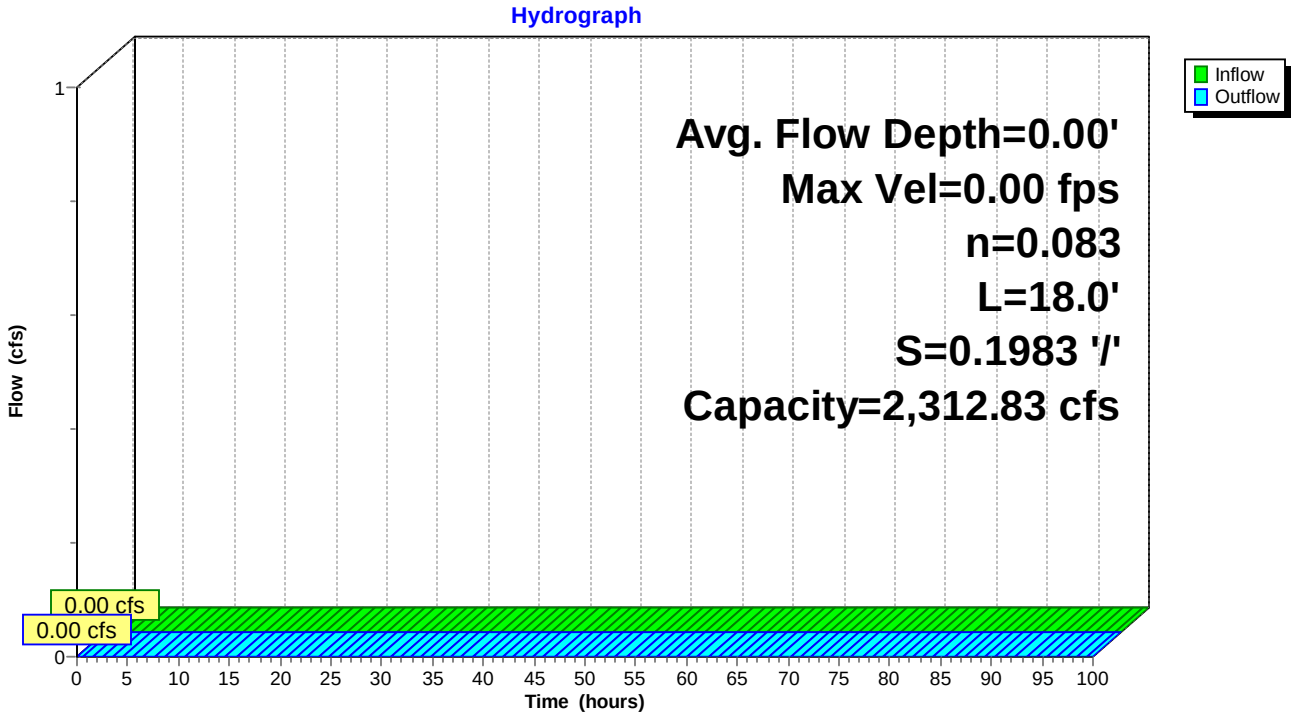
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

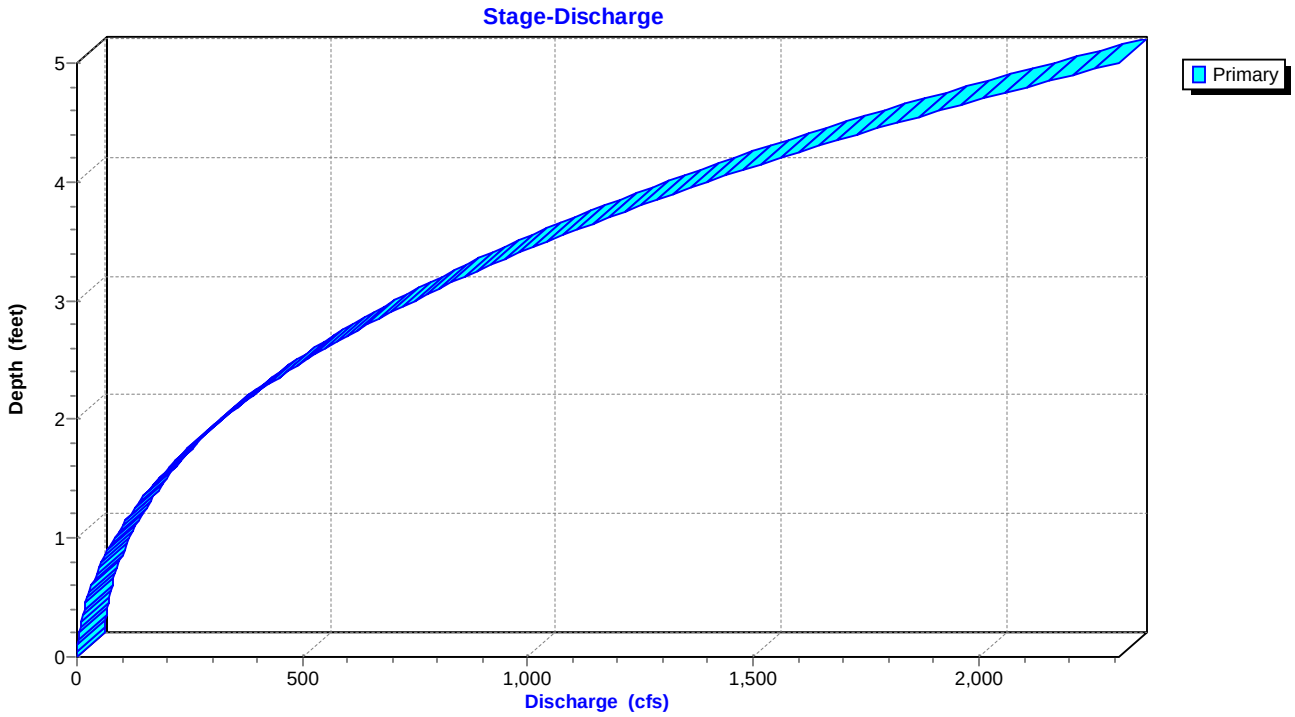
8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

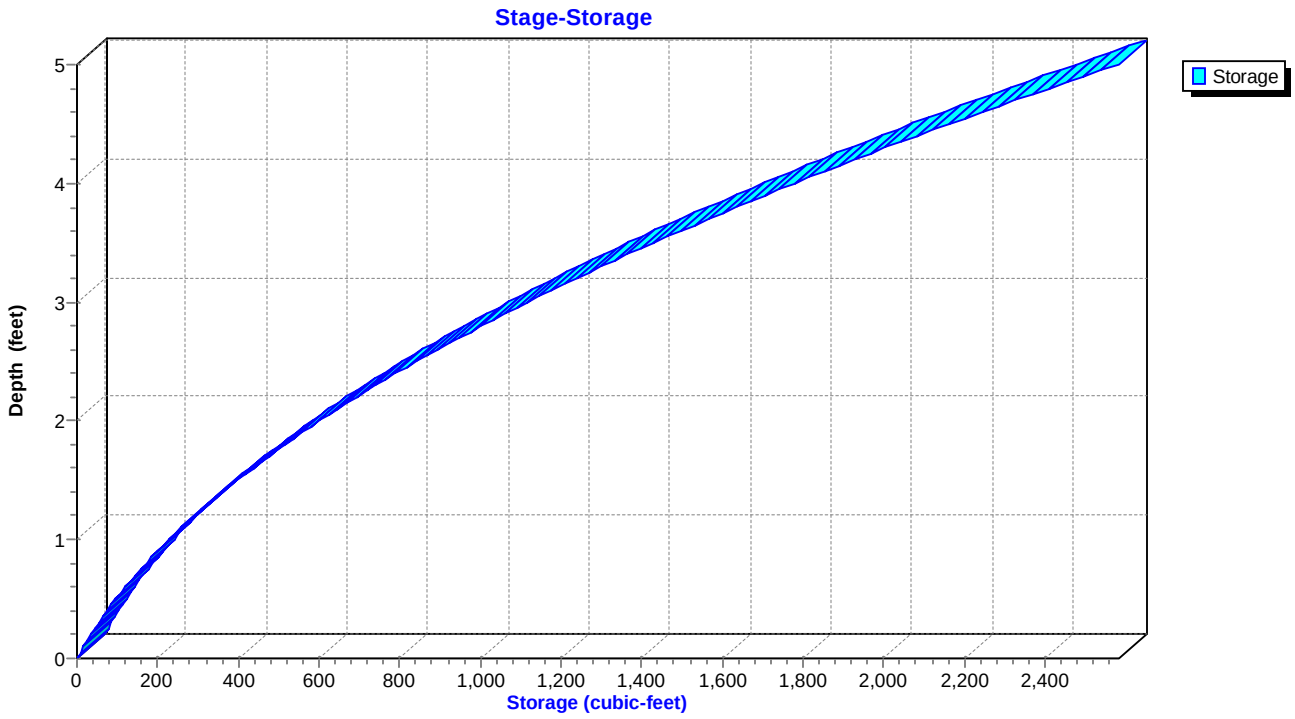
Reach 7R: Spillway - Middle Reach



Reach 7R: Spillway - Middle Reach



Reach 7R: Spillway - Middle Reach



Hydrograph for Reach 7R: Spillway - Middle Reach

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**	**446.45**	**0.00**	54.00	0.00	446.45	0.00
1.00	0.00	446.45	0.00	55.00	0.00	446.45	0.00
2.00	0.00	446.45	0.00	56.00	0.00	446.45	0.00
3.00	0.00	446.45	0.00	57.00	0.00	446.45	0.00
4.00	0.00	446.45	0.00	58.00	0.00	446.45	0.00
5.00	0.00	446.45	0.00	59.00	0.00	446.45	0.00
6.00	0.00	446.45	0.00	60.00	0.00	446.45	0.00
7.00	0.00	446.45	0.00	61.00	0.00	446.45	0.00
8.00	0.00	446.45	0.00	62.00	0.00	446.45	0.00
9.00	0.00	446.45	0.00	63.00	0.00	446.45	0.00
10.00	0.00	446.45	0.00	64.00	0.00	446.45	0.00
11.00	0.00	446.45	0.00	65.00	0.00	446.45	0.00
12.00	0.00	446.45	0.00	66.00	0.00	446.45	0.00
13.00	0.00	446.45	0.00	67.00	0.00	446.45	0.00
14.00	0.00	446.45	0.00	68.00	0.00	446.45	0.00
15.00	0.00	446.45	0.00	69.00	0.00	446.45	0.00
16.00	0.00	446.45	0.00	70.00	0.00	446.45	0.00
17.00	0.00	446.45	0.00	71.00	0.00	446.45	0.00
18.00	0.00	446.45	0.00	72.00	0.00	446.45	0.00
19.00	0.00	446.45	0.00	73.00	0.00	446.45	0.00
20.00	0.00	446.45	0.00	74.00	0.00	446.45	0.00
21.00	0.00	446.45	0.00	75.00	0.00	446.45	0.00
22.00	0.00	446.45	0.00	76.00	0.00	446.45	0.00
23.00	0.00	446.45	0.00	77.00	0.00	446.45	0.00
24.00	0.00	446.45	0.00	78.00	0.00	446.45	0.00
25.00	0.00	446.45	0.00	79.00	0.00	446.45	0.00
26.00	0.00	446.45	0.00	80.00	0.00	446.45	0.00
27.00	0.00	446.45	0.00	81.00	0.00	446.45	0.00
28.00	0.00	446.45	0.00	82.00	0.00	446.45	0.00
29.00	0.00	446.45	0.00	83.00	0.00	446.45	0.00
30.00	0.00	446.45	0.00	84.00	0.00	446.45	0.00
31.00	0.00	446.45	0.00	85.00	0.00	446.45	0.00
32.00	0.00	446.45	0.00	86.00	0.00	446.45	0.00
33.00	0.00	446.45	0.00	87.00	0.00	446.45	0.00
34.00	0.00	446.45	0.00	88.00	0.00	446.45	0.00
35.00	0.00	446.45	0.00	89.00	0.00	446.45	0.00
36.00	0.00	446.45	0.00	90.00	0.00	446.45	0.00
37.00	0.00	446.45	0.00	91.00	0.00	446.45	0.00
38.00	0.00	446.45	0.00	92.00	0.00	446.45	0.00
39.00	0.00	446.45	0.00	93.00	0.00	446.45	0.00
40.00	0.00	446.45	0.00	94.00	0.00	446.45	0.00
41.00	0.00	446.45	0.00	95.00	0.00	446.45	0.00
42.00	0.00	446.45	0.00	96.00	0.00	446.45	0.00
43.00	0.00	446.45	0.00	97.00	0.00	446.45	0.00
44.00	0.00	446.45	0.00	98.00	0.00	446.45	0.00
45.00	0.00	446.45	0.00	99.00	0.00	446.45	0.00
46.00	0.00	446.45	0.00	100.00	0.00	446.45	0.00
47.00	0.00	446.45	0.00				
48.00	0.00	446.45	0.00				
49.00	0.00	446.45	0.00				
50.00	0.00	446.45	0.00				
51.00	0.00	446.45	0.00				
52.00	0.00	446.45	0.00				
53.00	0.00	446.45	0.00				

Stage-Discharge for Reach 7R: Spillway - Middle Reach

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
446.45	0.00	0.00
446.50	1.07	0.47
446.55	1.67	1.52
446.60	2.15	3.00
446.65	2.58	4.89
446.70	2.95	7.16
446.75	3.30	9.79
446.80	3.61	12.77
446.85	3.91	16.11
446.90	4.19	19.79
446.95	4.45	23.82
447.00	4.70	28.19
447.05	4.94	32.91
447.10	5.17	37.99
447.15	5.39	43.41
447.20	5.61	49.19
447.25	5.81	55.33
447.30	6.01	61.83
447.35	6.21	68.70
447.40	6.39	75.94
447.45	6.58	83.55
447.50	6.76	91.54
447.55	6.93	99.91
447.60	7.10	108.67
447.65	7.27	117.82
447.70	7.44	127.37
447.75	7.60	137.32
447.80	7.76	147.68
447.85	7.91	158.44
447.90	8.07	169.62
447.95	8.22	181.23
448.00	8.37	193.25
448.05	8.51	205.71
448.10	8.66	218.60
448.15	8.80	231.93
448.20	8.94	245.70
448.25	9.08	259.92
448.30	9.22	274.60
448.35	9.36	289.73
448.40	9.49	305.33
448.45	9.62	321.39
448.50	9.75	337.93
448.55	9.88	354.94
448.60	10.01	372.44
448.65	10.14	390.42
448.70	10.27	408.89
448.75	10.39	427.86
448.80	10.52	447.33
448.85	10.64	467.31
448.90	10.76	487.80
448.95	10.88	508.79
449.00	11.00	530.31
449.05	11.12	552.36
449.10	11.24	574.93
449.15	11.36	598.03
449.20	11.48	621.67
449.25	11.59	645.86
449.30	11.71	670.59
449.35	11.82	695.87
449.40	11.93	721.70
449.45	12.05	748.10
449.50	12.16	775.06
449.55	12.27	802.59
449.60	12.38	830.69
449.65	12.49	859.37
449.70	12.60	888.63
449.75	12.71	918.48
449.80	12.82	948.92
449.85	12.92	979.96
449.90	13.03	1,011.59
449.95	13.14	1,043.83
450.00	13.24	1,076.68
450.05	13.35	1,110.14
450.10	13.45	1,144.22
450.15	13.56	1,178.92
450.20	13.66	1,214.24
450.25	13.77	1,250.19
450.30	13.87	1,286.78
450.35	13.97	1,324.00
450.40	14.07	1,361.87
450.45	14.17	1,400.39
450.50	14.27	1,439.55
450.55	14.38	1,479.37
450.60	14.48	1,519.85
450.65	14.58	1,560.99
450.70	14.67	1,602.80
450.75	14.77	1,645.29
450.80	14.87	1,688.44
450.85	14.97	1,732.28
450.90	15.07	1,776.80
450.95	15.16	1,822.01
451.00	15.26	1,867.91
451.05	15.36	1,914.51
451.10	15.45	1,961.81
451.15	15.55	2,009.81
451.20	15.65	2,058.52
451.25	15.74	2,107.94
451.30	15.84	2,158.08
451.35	15.93	2,208.94
451.40	16.02	2,260.52
451.45	**16.12**	**2,312.83**

Stage-Area-Storage for Reach 7R: Spillway - Middle Reach

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
446.45	0.0	0
446.50	0.4	8
446.55	0.9	16
446.60	1.4	25
446.65	1.9	34
446.70	2.4	44
446.75	3.0	53
446.80	3.5	64
446.85	4.1	74
446.90	4.7	85
446.95	5.3	96
447.00	6.0	108
447.05	6.7	120
447.10	7.3	132
447.15	8.1	145
447.20	8.8	158
447.25	9.5	171
447.30	10.3	185
447.35	11.1	199
447.40	11.9	214
447.45	12.7	229
447.50	13.5	244
447.55	14.4	259
447.60	15.3	275
447.65	16.2	292
447.70	17.1	308
447.75	18.1	325
447.80	19.0	343
447.85	20.0	360
447.90	21.0	378
447.95	22.0	397
448.00	23.1	416
448.05	24.2	435
448.10	25.2	454
448.15	26.3	474
448.20	27.5	495
448.25	28.6	515
448.30	29.8	536
448.35	31.0	557
448.40	32.2	579
448.45	33.4	601
448.50	34.6	624
448.55	35.9	646
448.60	37.2	670
448.65	38.5	693
448.70	39.8	717
448.75	41.2	741
448.80	42.5	766
448.85	43.9	791
448.90	45.3	816
448.95	46.8	842
449.00	48.2	868
449.05	49.7	894
449.10	51.1	921
449.15	52.7	948
449.20	54.2	975
449.25	55.7	1,003
449.30	57.3	1,031
449.35	58.9	1,060
449.40	60.5	1,089
449.45	62.1	1,118
449.50	63.7	1,147
449.55	65.4	1,177
449.60	67.1	1,208
449.65	68.8	1,238
449.70	70.5	1,269
449.75	72.3	1,301
449.80	74.0	1,333
449.85	75.8	1,365
449.90	77.6	1,397
449.95	79.5	1,430
450.00	81.3	1,463
450.05	83.2	1,497
450.10	85.0	1,531
450.15	87.0	1,565
450.20	88.9	1,600
450.25	90.8	1,635
450.30	92.8	1,670
450.35	94.8	1,706
450.40	96.8	1,742
450.45	98.8	1,778
450.50	100.8	1,815
450.55	102.9	1,852
450.60	105.0	1,890
450.65	107.1	1,928
450.70	109.2	1,966
450.75	111.4	2,005
450.80	113.5	2,044
450.85	115.7	2,083
450.90	117.9	2,123
450.95	120.2	2,163
451.00	122.4	2,203
451.05	124.7	2,244
451.10	126.9	2,285
451.15	129.3	2,327
451.20	131.6	2,368
451.25	133.9	2,411
451.30	136.3	2,453
451.35	138.7	2,496
451.40	141.1	2,539
451.45	**143.5**	**2,583**

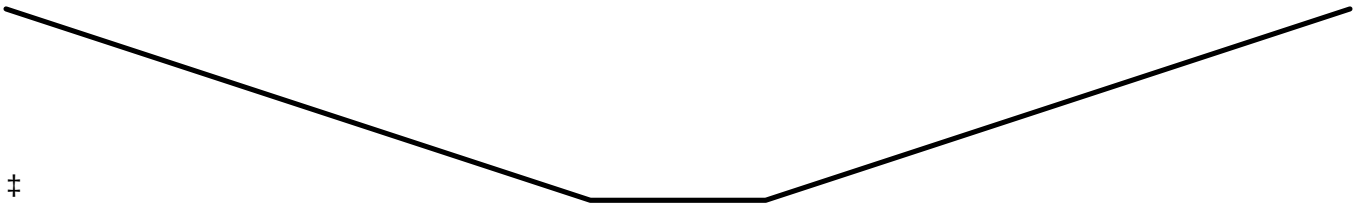
Summary for Reach 8R: Discharge Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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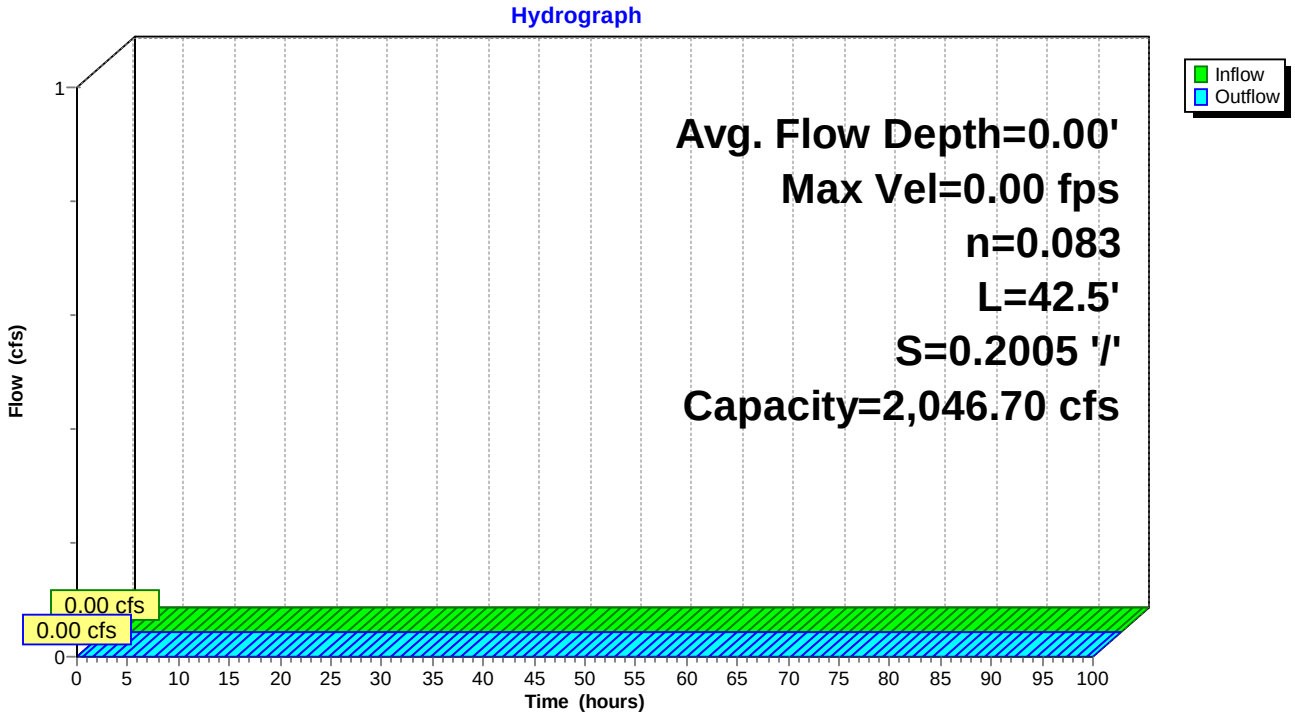
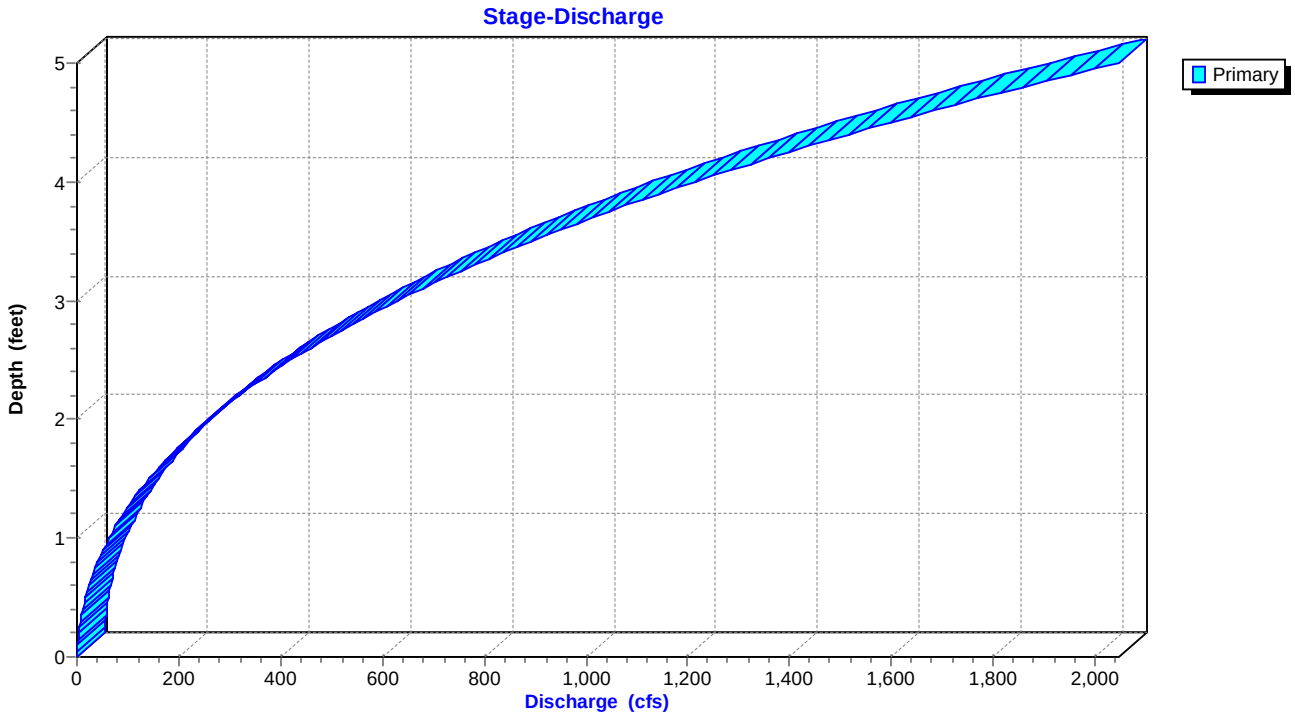
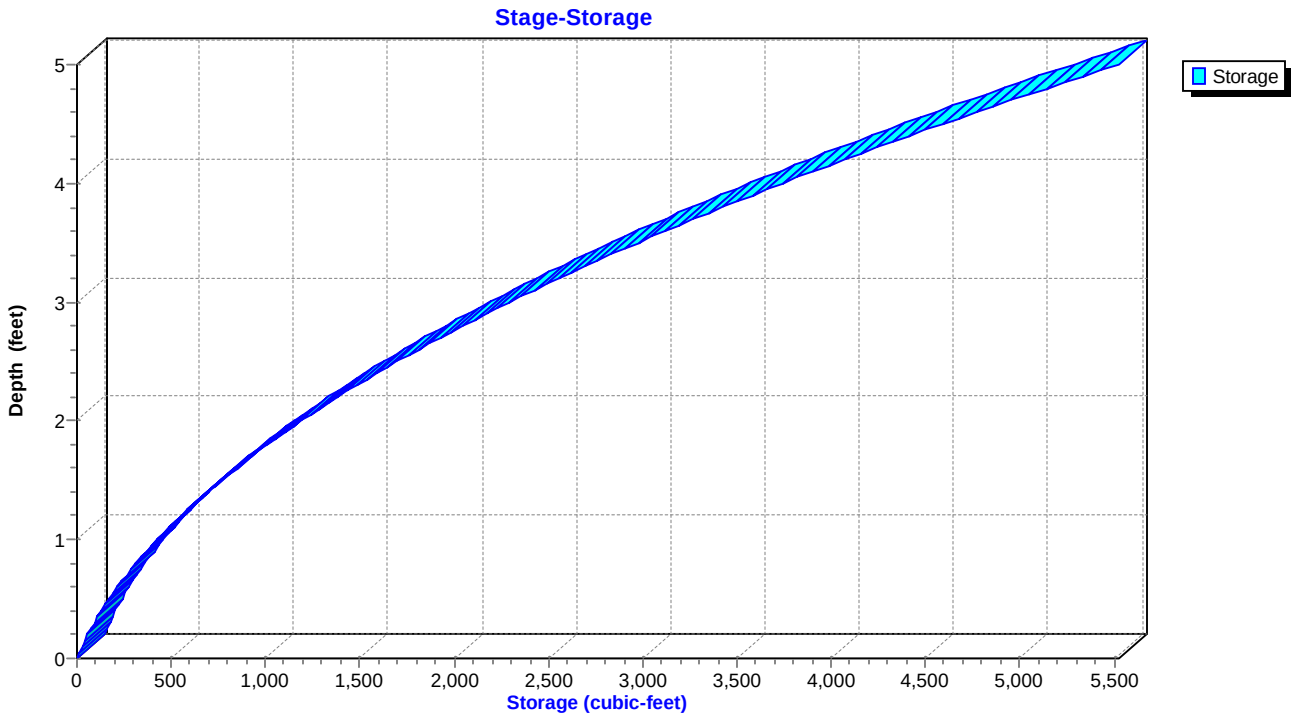
Reach 8R: Discharge Ditch



Reach 8R: Discharge Ditch



Reach 8R: Discharge Ditch



Hydrograph for Reach 8R: Discharge Ditch

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**	**431.26**	**0.00**	54.00	0.00	431.26	0.00
1.00	0.00	431.26	0.00	55.00	0.00	431.26	0.00
2.00	0.00	431.26	0.00	56.00	0.00	431.26	0.00
3.00	0.00	431.26	0.00	57.00	0.00	431.26	0.00
4.00	0.00	431.26	0.00	58.00	0.00	431.26	0.00
5.00	0.00	431.26	0.00	59.00	0.00	431.26	0.00
6.00	0.00	431.26	0.00	60.00	0.00	431.26	0.00
7.00	0.00	431.26	0.00	61.00	0.00	431.26	0.00
8.00	0.00	431.26	0.00	62.00	0.00	431.26	0.00
9.00	0.00	431.26	0.00	63.00	0.00	431.26	0.00
10.00	0.00	431.26	0.00	64.00	0.00	431.26	0.00
11.00	0.00	431.26	0.00	65.00	0.00	431.26	0.00
12.00	0.00	431.26	0.00	66.00	0.00	431.26	0.00
13.00	0.00	431.26	0.00	67.00	0.00	431.26	0.00
14.00	0.00	431.26	0.00	68.00	0.00	431.26	0.00
15.00	0.00	431.26	0.00	69.00	0.00	431.26	0.00
16.00	0.00	431.26	0.00	70.00	0.00	431.26	0.00
17.00	0.00	431.26	0.00	71.00	0.00	431.26	0.00
18.00	0.00	431.26	0.00	72.00	0.00	431.26	0.00
19.00	0.00	431.26	0.00	73.00	0.00	431.26	0.00
20.00	0.00	431.26	0.00	74.00	0.00	431.26	0.00
21.00	0.00	431.26	0.00	75.00	0.00	431.26	0.00
22.00	0.00	431.26	0.00	76.00	0.00	431.26	0.00
23.00	0.00	431.26	0.00	77.00	0.00	431.26	0.00
24.00	0.00	431.26	0.00	78.00	0.00	431.26	0.00
25.00	0.00	431.26	0.00	79.00	0.00	431.26	0.00
26.00	0.00	431.26	0.00	80.00	0.00	431.26	0.00
27.00	0.00	431.26	0.00	81.00	0.00	431.26	0.00
28.00	0.00	431.26	0.00	82.00	0.00	431.26	0.00
29.00	0.00	431.26	0.00	83.00	0.00	431.26	0.00
30.00	0.00	431.26	0.00	84.00	0.00	431.26	0.00
31.00	0.00	431.26	0.00	85.00	0.00	431.26	0.00
32.00	0.00	431.26	0.00	86.00	0.00	431.26	0.00
33.00	0.00	431.26	0.00	87.00	0.00	431.26	0.00
34.00	0.00	431.26	0.00	88.00	0.00	431.26	0.00
35.00	0.00	431.26	0.00	89.00	0.00	431.26	0.00
36.00	0.00	431.26	0.00	90.00	0.00	431.26	0.00
37.00	0.00	431.26	0.00	91.00	0.00	431.26	0.00
38.00	0.00	431.26	0.00	92.00	0.00	431.26	0.00
39.00	0.00	431.26	0.00	93.00	0.00	431.26	0.00
40.00	0.00	431.26	0.00	94.00	0.00	431.26	0.00
41.00	0.00	431.26	0.00	95.00	0.00	431.26	0.00
42.00	0.00	431.26	0.00	96.00	0.00	431.26	0.00
43.00	0.00	431.26	0.00	97.00	0.00	431.26	0.00
44.00	0.00	431.26	0.00	98.00	0.00	431.26	0.00
45.00	0.00	431.26	0.00	99.00	0.00	431.26	0.00
46.00	0.00	431.26	0.00	100.00	0.00	431.26	0.00
47.00	0.00	431.26	0.00				
48.00	0.00	431.26	0.00				
49.00	0.00	431.26	0.00				
50.00	0.00	431.26	0.00				
51.00	0.00	431.26	0.00				
52.00	0.00	431.26	0.00				
53.00	0.00	431.26	0.00				

Stage-Discharge for Reach 8R: Discharge Ditch

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
431.26	0.00	0.00
431.31	1.06	0.33
431.36	1.65	1.06
431.41	2.13	2.11
431.46	2.53	3.45
431.51	2.90	5.07
431.56	3.22	6.96
431.61	3.52	9.13
431.66	3.80	11.57
431.71	4.07	14.28
431.76	4.32	17.27
431.81	4.55	20.53
431.86	4.78	24.09
431.91	5.00	27.93
431.96	5.21	32.06
432.01	5.41	36.50
432.06	5.60	41.23
432.11	5.79	46.28
432.16	5.98	51.64
432.21	6.16	57.31
432.26	6.33	63.31
432.31	6.50	69.64
432.36	6.67	76.31
432.41	6.83	83.32
432.46	7.00	90.67
432.51	7.15	98.37
432.56	7.31	106.43
432.61	7.46	114.86
432.66	7.61	123.65
432.71	7.76	132.81
432.76	7.91	142.35
432.81	8.05	152.28
432.86	8.20	162.59
432.91	8.34	173.30
432.96	8.47	184.41
433.01	8.61	195.92
433.06	8.75	207.84
433.11	8.88	220.18
433.16	9.01	232.94
433.21	9.15	246.12
433.26	9.28	259.74
433.31	9.41	273.79
433.36	9.53	288.28
433.41	9.66	303.22
433.46	9.79	318.61
433.51	9.91	334.46
433.56	10.03	350.76
433.61	10.16	367.54
433.66	10.28	384.78
433.71	10.40	402.50
433.76	10.52	420.70
433.81	10.64	439.39
433.86	10.75	458.57
433.91	10.87	478.24
433.96	10.99	498.41
434.01	11.10	519.09
434.06	11.22	540.28
434.11	11.33	561.99
434.16	11.45	584.21
434.21	11.56	606.95
434.26	11.67	630.23
434.31	11.78	654.04
434.36	11.89	678.39
434.41	12.00	703.28
434.46	12.11	728.71
434.51	12.22	754.70
434.56	12.33	781.25
434.61	12.44	808.36
434.66	12.55	836.03
434.71	12.65	864.27
434.76	12.76	893.09
434.81	12.86	922.49
434.86	12.97	952.47
434.91	13.07	983.04
434.96	13.18	1,014.20
435.01	13.28	1,045.96
435.06	13.39	1,078.33
435.11	13.49	1,111.29
435.16	13.59	1,144.87
435.21	13.69	1,179.06
435.26	13.79	1,213.87
435.31	13.90	1,249.31
435.36	14.00	1,285.37
435.41	14.10	1,322.06
435.46	14.20	1,359.40
435.51	14.30	1,397.37
435.56	14.39	1,435.98
435.61	14.49	1,475.25
435.66	14.59	1,515.17
435.71	14.69	1,555.75
435.76	14.79	1,596.98
435.81	14.88	1,638.89
435.86	14.98	1,681.46
435.91	15.08	1,724.71
435.96	15.17	1,768.64
436.01	15.27	1,813.25
436.06	15.37	1,858.55
436.11	15.46	1,904.54
436.16	15.56	1,951.22
436.21	15.65	1,998.61
436.26	**15.74**	**2,046.70**

Stage-Area-Storage for Reach 8R: Discharge Ditch

Elevation (feet)	End-Area (sq-ft)	Storage (cubic-feet)
431.26	0.0	0
431.31	0.3	13
431.36	0.6	27
431.41	1.0	42
431.46	1.4	58
431.51	1.8	74
431.56	2.2	92
431.61	2.6	110
431.66	3.0	129
431.71	3.5	149
431.76	4.0	170
431.81	4.5	192
431.86	5.0	214
431.91	5.6	238
431.96	6.2	262
432.01	6.8	287
432.06	7.4	313
432.11	8.0	340
432.16	8.6	367
432.21	9.3	396
432.26	10.0	425
432.31	10.7	455
432.36	11.4	486
432.41	12.2	518
432.46	13.0	551
432.51	13.8	584
432.56	14.6	619
432.61	15.4	654
432.66	16.2	690
432.71	17.1	727
432.76	18.0	765
432.81	18.9	804
432.86	19.8	843
432.91	20.8	884
432.96	21.8	925
433.01	22.8	967
433.06	23.8	1,010
433.11	24.8	1,054
433.16	25.8	1,098
433.21	26.9	1,144
433.26	28.0	1,190
433.31	29.1	1,237
433.36	30.2	1,285
433.41	31.4	1,334
433.46	32.6	1,384
433.51	33.8	1,434
433.56	35.0	1,486
433.61	36.2	1,538
433.66	37.4	1,591
433.71	38.7	1,645
433.76	40.0	1,700
433.81	41.3	1,756
433.86	42.6	1,812
433.91	44.0	1,870
433.96	45.4	1,928
434.01	46.8	1,987
434.06	48.2	2,047
434.11	49.6	2,108
434.16	51.0	2,169
434.21	52.5	2,232
434.26	54.0	2,295
434.31	55.5	2,359
434.36	57.0	2,424
434.41	58.6	2,490
434.46	60.2	2,557
434.51	61.8	2,624
434.56	63.4	2,693
434.61	65.0	2,762
434.66	66.6	2,832
434.71	68.3	2,903
434.76	70.0	2,975
434.81	71.7	3,048
434.86	73.4	3,121
434.91	75.2	3,196
434.96	77.0	3,271
435.01	78.8	3,347
435.06	80.6	3,424
435.11	82.4	3,502
435.16	84.2	3,580
435.21	86.1	3,660
435.26	88.0	3,740
435.31	89.9	3,821
435.36	91.8	3,903
435.41	93.8	3,986
435.46	95.8	4,070
435.51	97.8	4,154
435.56	99.8	4,240
435.61	101.8	4,326
435.66	103.8	4,413
435.71	105.9	4,501
435.76	108.0	4,590
435.81	110.1	4,680
435.86	112.2	4,770
435.91	114.4	4,862
435.96	116.6	4,954
436.01	118.8	5,047
436.06	121.0	5,141
436.11	123.2	5,236
436.16	125.4	5,331
436.21	127.7	5,428
436.26	**130.0**	**5,525**

Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow Area = 165.460 ac, 51.75% Impervious, Inflow Depth > 14.57" for 1000 year storm Indy Huff event
Inflow = 149.05 cfs @ 15.83 hrs, Volume= 200.895 af, Incl. 9.80 cfs Base Flow
Outflow = 119.27 cfs @ 18.55 hrs, Volume= 198.835 af, Atten= 20%, Lag= 163.0 min
Primary = 34.93 cfs @ 18.55 hrs, Volume= 150.243 af
Secondary = 84.34 cfs @ 18.55 hrs, Volume= 48.592 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Peak Elev= 457.63' @ 18.55 hrs Surf.Area= 8.496 ac Storage= 54.525 af

Plug-Flow detention time= 387.6 min calculated for 198.831 af (99% of inflow)
Center-of-Mass det. time= 344.4 min (2,109.5 - 1,765.1)

Volume	Invert	Avail.Storage	Storage Description
#1	450.00'	623.838 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
450.00	5.930	2,302.0	0.000	0.000	5.930
452.00	6.510	2,396.0	12.435	12.435	6.744
454.00	7.180	2,562.0	13.685	26.120	8.252
456.00	7.870	2,639.0	15.045	41.165	8.993
458.00	8.640	2,654.0	16.504	57.669	9.182
460.00	38.590	14,828.0	43.660	101.329	397.983
462.00	87.060	15,213.0	122.408	223.737	419.123
464.00	102.000	17,170.0	188.863	412.600	534.899
466.00	109.280	16,465.0	211.238	623.838	578.226

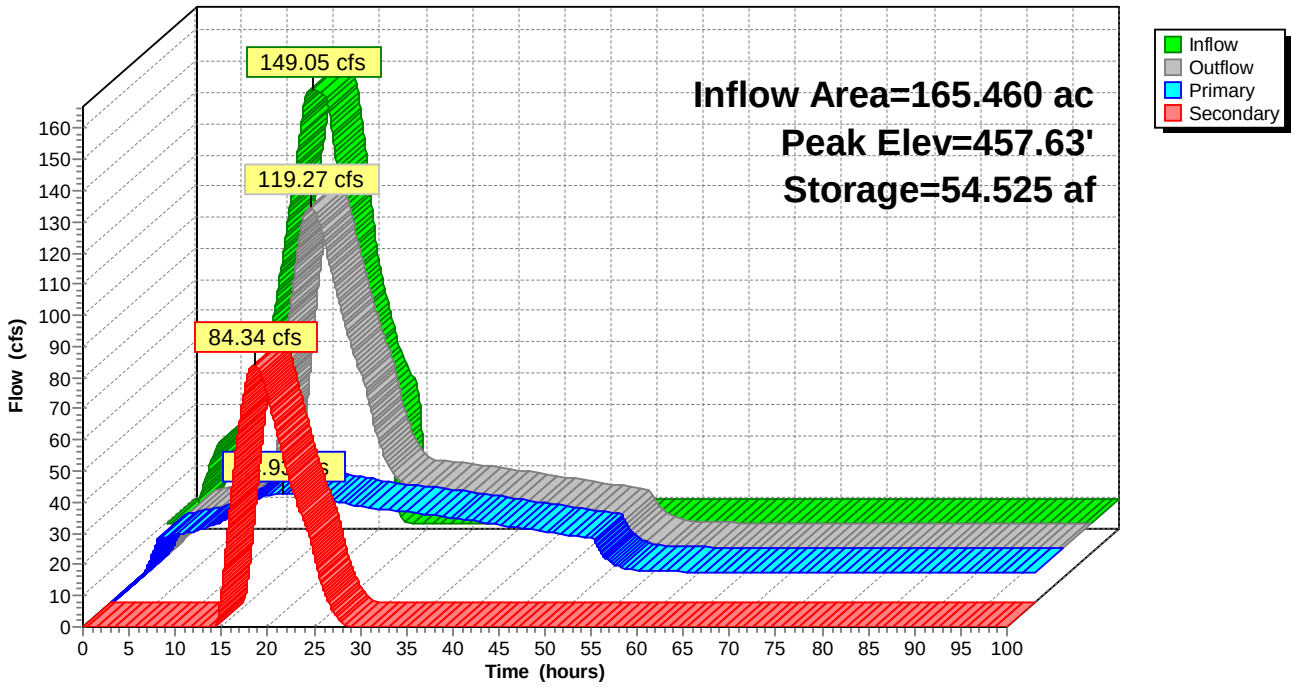
Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=34.93 cfs @ 18.55 hrs HW=457.63' TW=445.91' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 34.93 cfs @ 12.32 fps)
↑—**2=Orifice/Grate** (Passes 34.93 cfs of 232.44 cfs potential flow)

Secondary OutFlow Max=84.34 cfs @ 18.55 hrs HW=457.63' TW=456.71' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Weir Controls 84.34 cfs @ 3.20 fps)

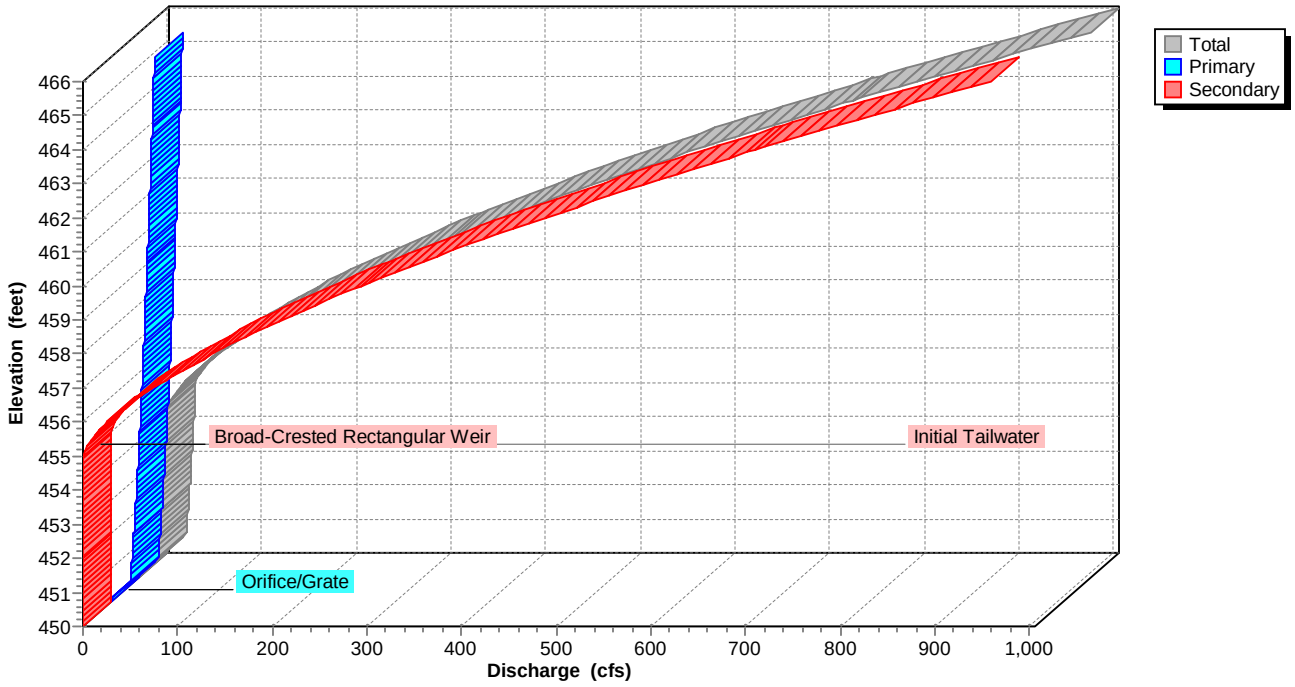
Pond 1P: Upper Pond

Hydrograph

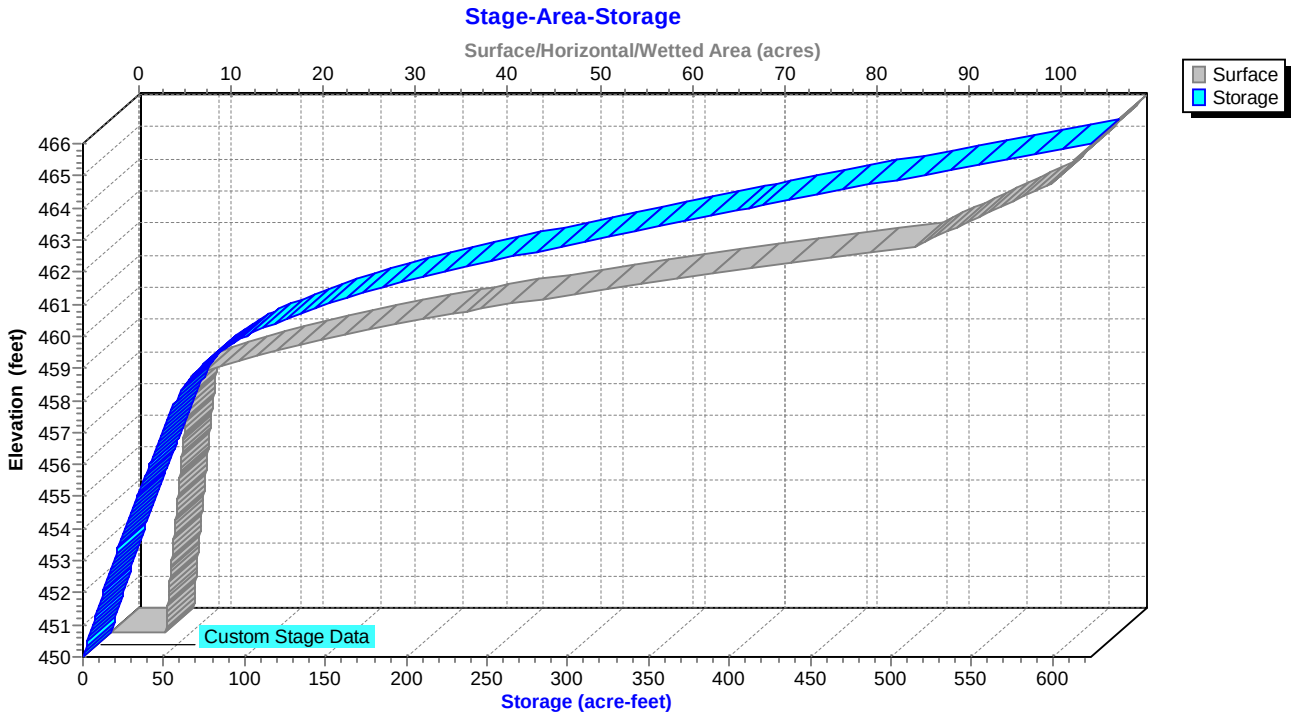


Pond 1P: Upper Pond

Stage-Discharge



Pond 1P: Upper Pond



Hydrograph for Pond 1P: Upper Pond

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
0.00	9.80	0.004	450.00	0.00	0.00	0.00
2.00	10.54	1.289	450.22	4.88	4.88	0.00
4.00	22.23	2.349	450.39	11.91	11.91	0.00
6.00	36.70	4.419	450.73	20.96	20.96	0.00
8.00	40.51	7.241	451.19	22.19	22.19	0.00
10.00	51.73	11.023	451.78	23.69	23.69	0.00
12.00	84.66	17.941	452.83	26.13	26.13	0.00
14.00	**126.17**	30.673	454.62	29.86	29.86	0.00
16.00	**148.84**	46.593	456.68	74.25	33.41	40.84
18.00	133.15	**54.173**	**457.59**	**117.11**	**34.87**	**82.24**
20.00	84.45	**52.796**	**457.43**	**108.49**	**34.61**	**73.88**
22.00	59.84	48.696	456.94	84.63	33.57	51.07
24.00	46.16	45.063	456.49	65.92	32.54	33.37
26.00	10.00	39.611	455.80	43.41	31.31	12.10
28.00	9.80	35.175	455.23	31.87	30.37	1.49
30.00	9.80	31.790	454.78	29.68	29.68	0.00
32.00	9.80	28.561	454.34	28.99	28.99	0.00
34.00	9.80	25.446	453.91	28.29	28.29	0.00
36.00	9.80	22.449	453.48	27.55	27.55	0.00
38.00	9.80	19.588	453.07	26.66	26.66	0.00
40.00	9.80	16.874	452.67	25.78	25.78	0.00
42.00	9.80	14.306	452.29	24.89	24.89	0.00
44.00	9.80	11.884	451.92	24.02	24.02	0.00
46.00	9.80	9.607	451.56	23.14	23.14	0.00
48.00	9.80	7.472	451.22	22.28	22.28	0.00
50.00	9.80	5.480	450.90	21.43	21.43	0.00
52.00	9.80	3.626	450.60	20.60	20.60	0.00
54.00	9.80	2.502	450.42	13.08	13.08	0.00
56.00	9.80	2.193	450.37	10.75	10.75	0.00
58.00	9.80	2.101	450.35	10.09	10.09	0.00
60.00	9.80	2.073	450.35	9.89	9.89	0.00
62.00	9.80	2.064	450.35	9.83	9.83	0.00
64.00	9.80	2.061	450.34	9.81	9.81	0.00
66.00	9.80	2.060	450.34	9.80	9.80	0.00
68.00	9.80	2.060	450.34	9.80	9.80	0.00
70.00	9.80	2.060	450.34	9.80	9.80	0.00
72.00	9.80	2.060	450.34	9.80	9.80	0.00
74.00	9.80	2.060	450.34	9.80	9.80	0.00
76.00	9.80	2.060	450.34	9.80	9.80	0.00
78.00	9.80	2.060	450.34	9.80	9.80	0.00
80.00	9.80	2.060	450.34	9.80	9.80	0.00
82.00	9.80	2.060	450.34	9.80	9.80	0.00
84.00	9.80	2.060	450.34	9.80	9.80	0.00
86.00	9.80	2.060	450.34	9.80	9.80	0.00
88.00	9.80	2.060	450.34	9.80	9.80	0.00
90.00	9.80	2.060	450.34	9.80	9.80	0.00
92.00	9.80	2.060	450.34	9.80	9.80	0.00
94.00	9.80	2.060	450.34	9.80	9.80	0.00
96.00	9.80	2.060	450.34	9.80	9.80	0.00
98.00	9.80	2.060	450.34	9.80	9.80	0.00
100.00	9.80	2.060	450.34	9.80	9.80	0.00

Stage-Discharge for Pond 1P: Upper Pond

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
450.00	0.00	0.00	0.00
450.20	4.33	4.33	0.00
450.40	12.26	12.26	0.00
450.60	20.59	20.59	0.00
450.80	21.15	21.15	0.00
451.00	21.69	21.69	0.00
451.20	22.22	22.22	0.00
451.40	22.74	22.74	0.00
451.60	23.24	23.24	0.00
451.80	23.74	23.74	0.00
452.00	24.22	24.22	0.00
452.20	24.69	24.69	0.00
452.40	25.16	25.16	0.00
452.60	25.62	25.62	0.00
452.80	26.07	26.07	0.00
453.00	26.51	26.51	0.00
453.20	26.94	26.94	0.00
453.40	27.37	27.37	0.00
453.60	27.79	27.79	0.00
453.80	28.21	28.21	0.00
454.00	28.62	28.62	0.00
454.20	29.02	29.02	0.00
454.40	29.42	29.42	0.00
454.60	29.81	29.81	0.00
454.80	30.20	30.20	0.00
455.00	30.56	30.56	0.00
455.20	33.31	30.92	2.40
455.40	38.10	31.27	6.83
455.60	44.16	31.61	12.55
455.80	50.84	31.95	18.89
456.00	58.59	32.29	26.30
456.20	67.33	32.63	34.70
456.40	76.69	32.96	43.73
456.60	86.51	33.28	53.23
456.80	97.12	33.61	63.51
457.00	108.32	33.93	74.39
457.20	120.07	34.25	85.82
457.40	132.35	34.57	97.79
457.60	145.14	34.88	110.26
457.80	158.41	35.19	123.22
458.00	172.15	35.50	136.66
458.20	186.35	35.80	150.55
458.40	200.98	36.10	164.88
458.60	216.04	36.40	179.64
458.80	231.52	36.70	194.82
459.00	247.39	36.99	210.40
459.20	263.66	37.29	226.38
459.40	280.31	37.58	242.74
459.60	297.34	37.86	259.47
459.80	314.73	38.15	276.58
460.00	332.48	38.43	294.04
460.20	350.58	38.72	311.86
460.40	369.02	38.99	330.02
460.60	387.80	39.27	348.53
460.80	406.91	39.55	367.36
461.00	426.35	39.82	386.53
461.20	446.11	40.09	406.02
461.40	466.18	40.36	425.82
461.60	486.57	40.63	445.94
461.80	507.26	40.90	466.36
462.00	528.25	41.16	487.08
462.20	549.53	41.43	508.11
462.40	571.11	41.69	529.42
462.60	592.98	41.95	551.03
462.80	615.13	42.21	572.92
463.00	637.56	42.46	595.10
463.20	660.27	42.72	617.56
463.40	683.26	42.97	640.29
463.60	706.51	43.22	663.29
463.80	730.03	43.47	686.56
464.00	753.82	43.72	710.10
464.20	777.87	43.97	733.90
464.40	802.18	44.22	757.96
464.60	826.74	44.46	782.28
464.80	851.56	44.70	806.85
465.00	876.63	44.95	831.68
465.20	901.94	45.19	856.75
465.40	927.50	45.43	882.08
465.60	953.31	45.67	907.64
465.80	979.35	45.90	933.45
466.00	**1,005.64**	**46.14**	**959.50**

Stage-Area-Storage for Pond 1P: Upper Pond

Elevation (feet)	Surface (acres)	Storage (acre-feet)
450.00	5.930	0.000
450.20	5.987	1.192
450.40	6.044	2.395
450.60	6.101	3.609
450.80	6.159	4.835
451.00	6.217	6.073
451.20	6.275	7.322
451.40	6.333	8.583
451.60	6.392	9.855
451.80	6.451	11.139
452.00	6.510	12.435
452.20	6.576	13.744
452.40	6.641	15.066
452.60	6.708	16.401
452.80	6.774	17.749
453.00	6.841	19.110
453.20	6.908	20.485
453.40	6.976	21.874
453.60	7.043	23.275
453.80	7.112	24.691
454.00	7.180	26.120
454.20	7.248	27.563
454.40	7.315	29.019
454.60	7.384	30.489
454.80	7.452	31.973
455.00	7.521	33.470
455.20	7.590	34.981
455.40	7.660	36.506
455.60	7.729	38.045
455.80	7.800	39.598
456.00	7.870	41.165
456.20	7.945	42.746
456.40	8.021	44.343
456.60	8.097	45.955
456.80	8.174	47.582
457.00	8.251	49.224
457.20	8.328	50.882
457.40	8.405	52.555
457.60	8.483	54.244
457.80	8.561	55.949
458.00	8.640	57.669
458.20	10.671	59.596
458.40	12.916	61.951
458.60	15.376	64.777
458.80	18.049	68.116
459.00	20.937	72.011
459.20	24.039	76.505
459.40	27.356	81.641
459.60	30.886	87.462
459.80	34.631	94.010
460.00	38.590	101.329
460.20	42.562	109.441
460.40	46.728	118.366
460.60	51.089	128.145
460.80	55.644	138.815
461.00	60.394	150.415
461.20	65.338	162.985
461.40	70.477	176.563
461.60	75.810	191.189
461.80	81.338	206.900
462.00	87.060	223.737
462.20	88.501	241.293
462.40	89.953	259.138
462.60	91.418	277.275
462.80	92.894	295.706
463.00	94.382	314.433
463.20	95.882	333.460
463.40	97.394	352.787
463.60	98.917	372.418
463.80	100.453	392.355
464.00	102.000	412.600
464.20	102.717	433.071
464.40	103.436	453.687
464.60	104.158	474.446
464.80	104.882	495.350
465.00	105.609	516.399
465.20	106.338	537.594
465.40	107.070	558.934
465.60	107.804	580.422
465.80	108.541	602.056
466.00	**109.280**	**623.838**

Summary for Pond 2P: Lower Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

[62] Hint: Exceeded Reach 4R OUTLET depth by 2.69' @ 29.04 hrs

Inflow Area = 242.430 ac, 55.89% Impervious, Inflow Depth > 12.69" for 1000 year storm Indy Huff event
Inflow = 170.84 cfs @ 17.79 hrs, Volume= 256.331 af
Outflow = 49.16 cfs @ 25.51 hrs, Volume= 226.078 af, Atten= 71%, Lag= 462.6 min
Primary = 38.78 cfs @ 25.51 hrs, Volume= 140.286 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 25.51 hrs, Volume= 85.792 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 444.00' Surf.Area= 35.560 ac Storage= 70.663 af
Peak Elev= 446.78' @ 25.51 hrs Surf.Area= 44.072 ac Storage= 180.979 af (110.316 af above start)

Plug-Flow detention time= 2,545.7 min calculated for 155.415 af (61% of inflow)
Center-of-Mass det. time= 985.7 min (2,822.8 - 1,837.1)

Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	448.369 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
441.00	13.490	6,615.0	0.000	0.000	13.490
442.00	19.460	6,302.0	16.384	16.384	20.877
443.00	26.970	6,053.0	23.113	39.497	26.499
444.00	35.560	7,688.0	31.166	70.663	67.543
446.00	41.520	8,222.0	77.003	147.666	83.068
448.00	48.230	9,440.0	89.666	237.333	122.369
450.00	52.820	9,348.0	101.015	338.348	125.557
452.00	57.230	9,205.0	110.021	448.369	130.422

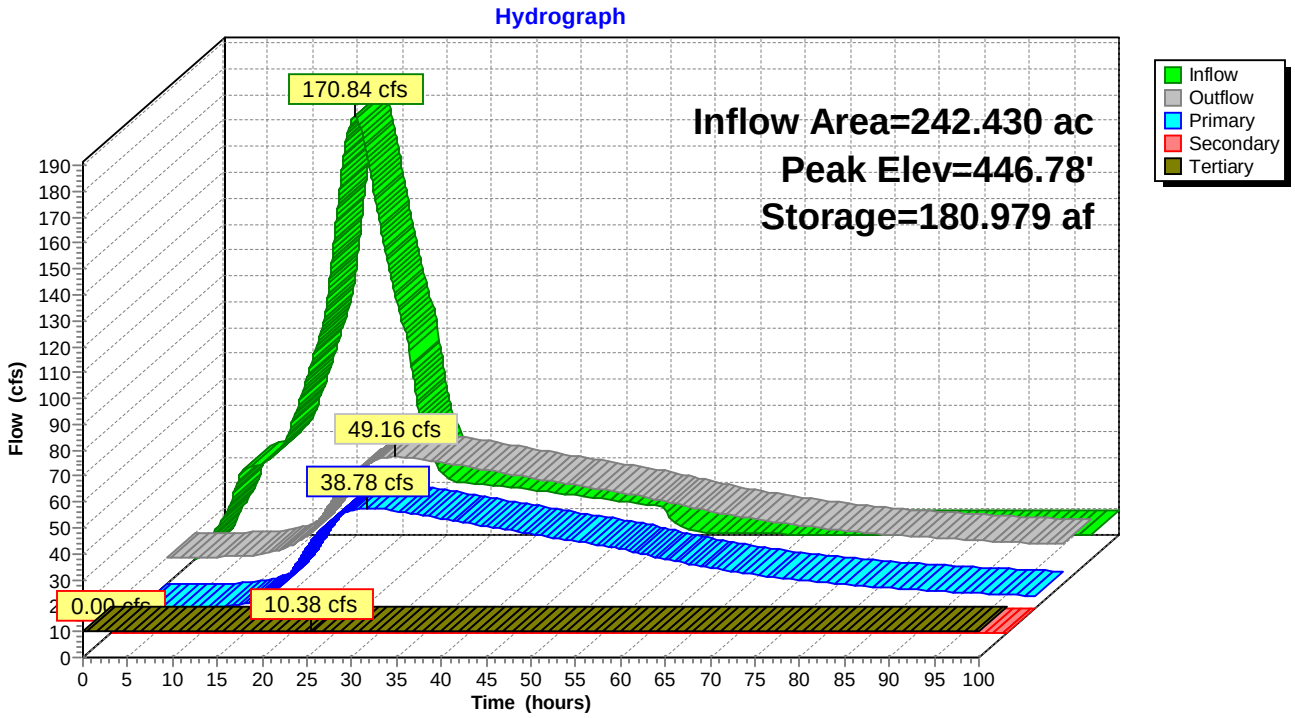
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	441.50'	**Pump** Discharges@450.90' Turns Off@441.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=38.78 cfs @ 25.51 hrs HW=446.78' TW=428.74' (Dynamic Tailwater)
└─**1=Culvert** (Passes 38.78 cfs of 135.65 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 38.78 cfs @ 5.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=444.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

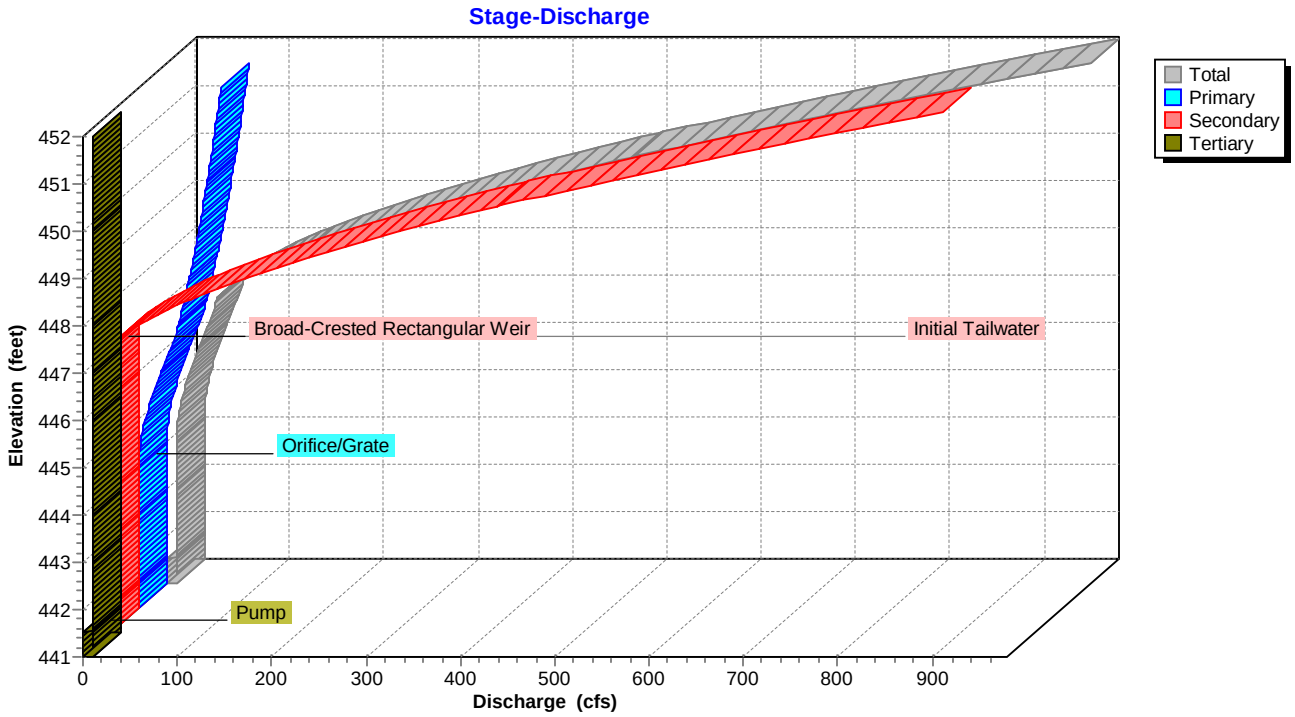
Tertiary OutFlow Max=10.38 cfs @ 25.51 hrs HW=446.78' (Free Discharge)
└─**4=Pump** (Pump Controls 10.38 cfs)

Pond 2P: Lower Pond



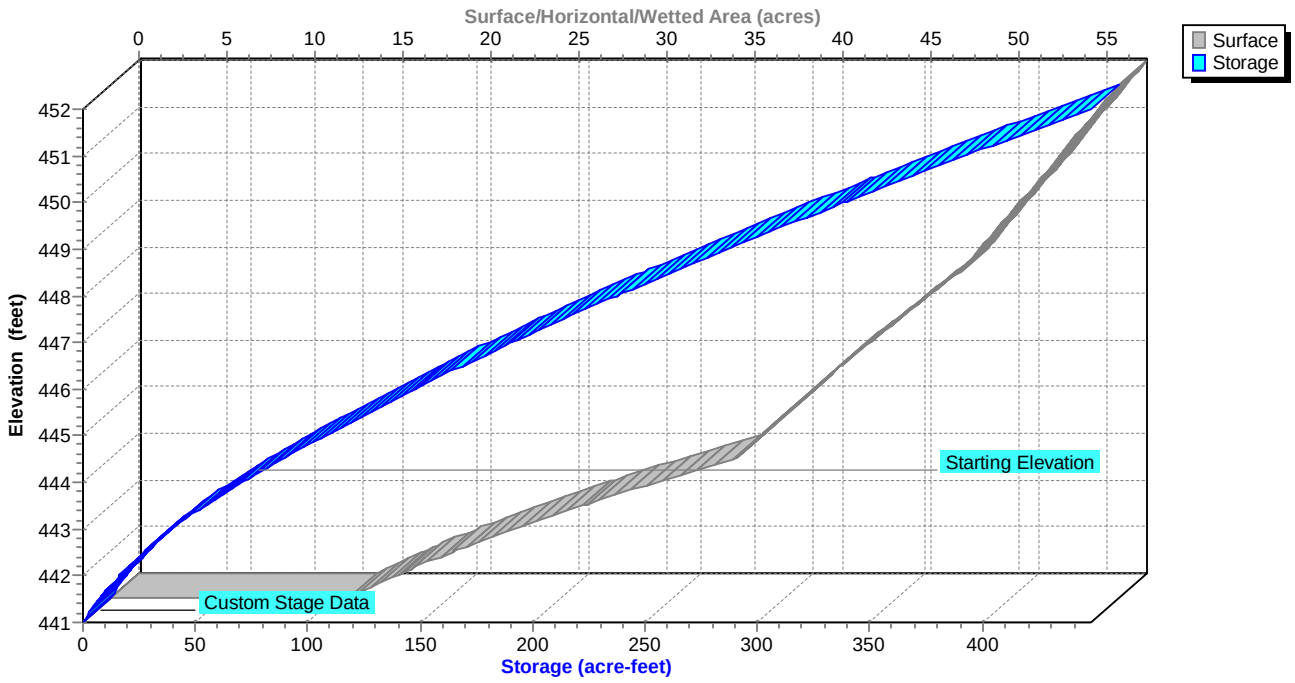
Pond 2P: Lower Pond

Stage-Discharge



Pond 2P: Lower Pond

Stage-Area-Storage



Hydrograph for Pond 2P: Lower Pond

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)	Tertiary (cfs)
0.00	0.00	70.663	444.00	10.38	0.00	**0.00**	10.38
2.00	9.31	69.493	443.97	10.38	0.00	0.00	10.38
4.00	22.14	70.287	443.99	10.38	0.00	0.00	10.38
6.00	35.17	73.669	444.08	10.44	0.06	0.00	10.38
8.00	38.02	77.920	444.20	10.70	0.32	0.00	10.38
10.00	45.71	82.936	444.34	11.26	0.88	0.00	10.38
12.00	64.37	90.000	444.53	12.48	2.11	0.00	10.38
14.00	87.54	100.265	444.81	15.05	4.67	0.00	10.38
16.00	**138.15**	115.375	445.20	20.21	9.83	0.00	10.38
18.00	**170.58**	137.800	445.76	29.85	19.47	0.00	10.38
20.00	141.41	158.228	446.25	39.46	29.08	0.00	10.38
22.00	106.87	171.603	446.56	45.45	35.07	0.00	10.38
24.00	78.86	**179.312**	**446.74**	**48.55**	**38.17**	0.00	**10.38**
26.00	43.74	**180.864**	**446.78**	**49.12**	**38.74**	0.00	**10.38**
28.00	32.04	178.893	446.73	48.39	38.01	0.00	10.38
30.00	29.68	176.003	446.67	47.27	36.89	0.00	10.38
32.00	28.99	173.136	446.60	46.10	35.72	0.00	10.38
34.00	28.29	170.348	446.54	44.92	34.54	0.00	10.38
36.00	27.55	167.639	446.47	43.74	33.36	0.00	10.38
38.00	26.66	164.987	446.41	42.56	32.18	0.00	10.38
40.00	25.78	162.384	446.35	41.38	31.00	0.00	10.38
42.00	24.89	159.829	446.29	40.20	29.82	0.00	10.38
44.00	24.02	157.323	446.23	39.04	28.66	0.00	10.38
46.00	23.14	154.863	446.17	37.88	27.50	0.00	10.38
48.00	22.28	152.450	446.11	36.75	26.37	0.00	10.38
50.00	21.43	150.081	446.06	35.63	25.25	0.00	10.38
52.00	20.60	147.757	446.00	34.53	24.15	0.00	10.38
54.00	13.08	144.898	445.93	33.18	22.80	0.00	10.38
56.00	10.75	141.476	445.85	31.57	21.19	0.00	10.38
58.00	10.09	138.102	445.77	29.99	19.61	0.00	10.38
60.00	9.89	134.915	445.69	28.53	18.15	0.00	10.38
62.00	9.83	131.941	445.62	27.18	16.80	0.00	10.38
64.00	9.81	129.175	445.55	25.94	15.56	0.00	10.38
66.00	9.80	126.602	445.48	24.82	14.44	0.00	10.38
68.00	9.80	124.206	445.42	23.79	13.41	0.00	10.38
70.00	9.80	121.973	445.37	22.85	12.47	0.00	10.38
72.00	9.80	119.887	445.31	21.99	11.61	0.00	10.38
74.00	9.80	117.938	445.26	21.21	10.83	0.00	10.38
76.00	9.80	116.112	445.22	20.49	10.11	0.00	10.38
78.00	9.80	114.400	445.17	19.83	9.45	0.00	10.38
80.00	9.80	112.792	445.13	19.23	8.85	0.00	10.38
82.00	9.80	111.281	445.09	18.67	8.29	0.00	10.38
84.00	9.80	109.857	445.06	18.16	7.78	0.00	10.38
86.00	9.80	108.514	445.02	17.69	7.31	0.00	10.38
88.00	9.80	107.246	444.99	17.26	6.88	0.00	10.38
90.00	9.80	106.047	444.96	16.85	6.47	0.00	10.38
92.00	9.80	104.912	444.93	16.48	6.10	0.00	10.38
94.00	9.80	103.837	444.90	16.14	5.76	0.00	10.38
96.00	9.80	102.815	444.87	15.82	5.44	0.00	10.38
98.00	9.80	101.845	444.85	15.52	5.14	0.00	10.38
100.00	9.80	100.922	444.82	15.25	4.87	0.00	10.38

Stage-Discharge for Pond 2P: Lower Pond

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)	Tertiary (cfs)
441.00	0.00	0.00	0.00	0.00
441.30	0.00	0.00	0.00	0.00
441.60	10.38	0.00	0.00	10.38
441.90	10.38	0.00	0.00	10.38
442.20	10.38	0.00	0.00	10.38
442.50	10.38	0.00	0.00	10.38
442.80	10.38	0.00	0.00	10.38
443.10	10.38	0.00	0.00	10.38
443.40	10.38	0.00	0.00	10.38
443.70	10.38	0.00	0.00	10.38
444.00	10.38	0.00	0.00	10.38
444.30	11.07	0.69	0.00	10.38
444.60	13.03	2.65	0.00	10.38
444.90	16.14	5.76	0.00	10.38
445.20	20.23	9.85	0.00	10.38
445.50	25.12	14.74	0.00	10.38
445.80	30.61	20.23	0.00	10.38
446.10	36.46	26.08	0.00	10.38
446.40	42.36	31.98	0.00	10.38
446.70	47.87	37.49	0.00	10.38
447.00	52.06	41.68	0.00	10.38
447.30	69.30	45.66	13.26	10.38
447.60	97.35	49.32	37.65	10.38
447.90	130.60	52.73	67.49	10.38
448.20	170.42	55.93	104.11	10.38
448.50	214.55	58.95	145.22	10.38
448.80	262.75	61.83	190.54	10.38
449.10	315.06	64.58	240.11	10.38
449.40	370.95	67.21	293.36	10.38
449.70	430.17	69.75	350.04	10.38
450.00	492.56	72.20	409.98	10.38
450.30	557.93	74.57	472.99	10.38
450.60	626.17	76.86	538.93	10.38
450.90	697.15	79.09	607.68	**10.38**
451.20	770.76	81.26	679.13	10.38
451.50	846.92	83.37	753.17	10.38
451.80	**925.54**	**85.43**	**829.73**	10.38

Stage-Area-Storage for Pond 2P: Lower Pond

Elevation (feet)	Surface (acres)	Storage (acre-feet)
441.00	13.490	0.000
441.15	14.316	2.085
441.30	15.166	4.296
441.45	16.042	6.636
441.60	16.941	9.110
441.75	17.865	11.720
441.90	18.814	14.471
442.05	19.806	17.366
442.20	20.864	20.416
442.35	21.949	23.626
442.50	23.062	27.002
442.65	24.202	30.546
442.80	25.370	34.264
442.95	26.565	38.159
443.10	27.776	42.234
443.25	29.006	46.493
443.40	30.264	50.938
443.55	31.548	55.573
443.70	32.859	60.403
443.85	34.196	65.432
444.00	35.560	70.663
444.15	35.991	76.030
444.30	36.425	81.461
444.45	36.861	86.957
444.60	37.300	92.519
444.75	37.741	98.147
444.90	38.185	103.842
445.05	38.631	109.603
445.20	39.081	115.431
445.35	39.532	121.327
445.50	39.987	127.291
445.65	40.444	133.323
445.80	40.903	139.424
445.95	41.365	145.594
446.10	41.844	151.835
446.25	42.331	158.148
446.40	42.822	164.534
446.55	43.315	170.994
446.70	43.811	177.529
446.85	44.310	184.138
447.00	44.812	190.822
447.15	45.317	197.582
447.30	45.824	204.417
447.45	46.335	211.329
447.60	46.848	218.318
447.75	47.364	225.384
447.90	47.883	232.527
448.05	48.342	239.747
448.20	48.680	247.024
448.35	49.018	254.351
448.50	49.358	261.729
448.65	49.699	269.158
448.80	50.041	276.639
448.95	50.384	284.171
449.10	50.729	291.754
449.25	51.074	299.389
449.40	51.421	307.077
449.55	51.769	314.816
449.70	52.118	322.607
449.85	52.469	330.451
450.00	52.820	338.348
450.15	53.145	346.295
450.30	53.470	354.291
450.45	53.797	362.336
450.60	54.124	370.431
450.75	54.453	378.574
450.90	54.783	386.766
451.05	55.113	395.009
451.20	55.445	403.300
451.35	55.777	411.642
451.50	56.111	420.034
451.65	56.445	428.475
451.80	56.781	436.967
451.95	**57.118**	**445.510**

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