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December 9, 2016

Tennessee Valley Authority
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Initial Inflow Design Flood Control System Plan
Ash Disposal Area 4
EPA Final CCR Rule
TVA Colbert Fossil Plant
Colbert County, Tennessee

1.0 PURPOSE

This letter documents AECOM's certification of the initial inflow design flood control system plan for the TVA Colbert Fossil (COF) Plant's Ash Disposal Area 4. Based on the assessment, Ash Disposal Area 4 complies with the inflow design flood control requirements in the Final CCR Rule 40 CFR 257.82.

2.0 INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

As described in 40 CFR 257.82(c), an inflow design flood control system plan must be prepared to document how the inflow design flood control system has been designed and constructed to manage the design storm required by the hazard classification. Based on Hazard Potential Classification Ash Disposal Area 4 has been assigned a significant hazard potential classification rating. Thus, the 1000 year storm event was selected from §257.82(a)(3) as the inflow design storm flood event based upon a hazard potential classification.

3.0 SUMMARY OF FINDINGS

The attached plan presents the analysis of the inflow design flood control system for Ash Disposal Area 4. The resulting water surface elevations are shown in the following table. The plan and results show that the impoundment meets the requirements set forth in 40 CFR 257.82(a) and (b).

Plant	Facility	Inflow Design Storm	Water Surface Elevation (feet)	Minimum Embankment Elevation (feet)
COF	Ash Disposal Area 4	1000 year	452.3	5.7

AECOM

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Michael J. Stepic, PE, being a Professional Engineer in good standing in the State of Alabama do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below; and
3. that the inflow design flood control system plan for the TVA Colbert Fossil Plant's Ash Disposal Area 4 meets the requirements specified in 40 CFR 257.82(a), (b), and (c)(1).

SIGNATURE _____ DATE 12/9/16

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ATTACHMENTS: Initial Inflow Design Flood Control System Plan (40 CFR 257.8) For Coal Combustion Residuals (CCR) - Existing Surface Impoundments
TVA – Ash Disposal Area 4, Colbert Fossil Plant, Colbert County, Alabama

COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

TENNESSEE VALLEY AUTHORITY – ASH DISPOSAL AREA 4
COLBERT FOSSIL PLANT
COLBERT COUNTY, ALABAMA

INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN (40 CFR §257.82) FOR COAL COMBUSTION RESIDUALS (CCR)

EXISTING SURFACE IMPOUNDMENT

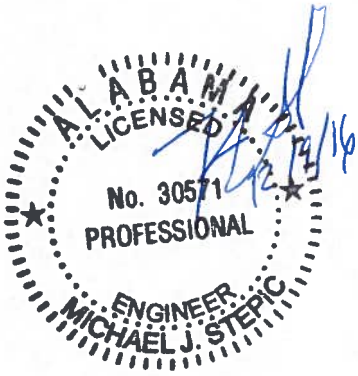
DRAFT FINAL

Prepared for

TVA

Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402-2801

December 9, 2016



Prepared by

AECOM

TABLE OF CONTENTS

1.0 BACKGROUND 3

1.1 Site Location 4
1.2 Site History 4

2.0 EXISTING CONDITIONS - §257.82(a)(1) 5

3.0 METHODS / DESIGN CRITERIA 6

4.0 CALCULATION RESULTS - §257.82(a)(2) 7

5.0 CONCLUSIONS 8

6.0 REFERENCES 8

TABLES

Table 1: Rainfall Depth for Analyzed Storm

Table 2: Ash Disposal Area 4 Estimated Peak Inflow and Estimated Peak Pool Elevation

FIGURES

Figure 1: Site Overview

Figure 2: Limits of Ash Disposal Area 4 Drainage Area

APPENDICES

Appendix A HEC-HMS Output

1.0 BACKGROUND

This plan outlines compliance to **Rule § 257.82** of the EPA Final CCR Rule.

The owner or operator of an existing CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in **Rule §257.82 (a),** which is directly stated below for clarity.

Rule §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 inflow design flood.

Rule §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.

Rule §257.82(a)(3): The inflow design flood is:

(i): For a high hazard potential CCR surface impoundment, the probable maximum flood;

(ii): For a significant hazard potential CCR surface impoundment, the 1,000-year flood;

(iii): For a low hazard potential CCR surface impoundment, the 100-year flood; or

(iv): For an incised CCR surface impoundment, the 25-year flood.

According to **Rule §257.82(b)**, discharge from the CCR unit must be handled in accordance with the surface water requirements under **§257.3-3.**

Section **§257.82(c)(1)** states that the owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs **(c)(3)** and **(4)**. The plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of the section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record.

Section **§257.82(c)(2)** allows amendments to the written inflow design flood control system plan at any time and requires amendments to the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect. The revised plan must be placed in the facility's operating record.

Section **§257.82(c)(3)** requires that the initial inflow design flood control system plan be completed no later than October 17, 2016.

Section **§257.82(c)(4)** states that the owner or operator must prepare periodic inflow design flood control system plans every five years.

Section **§257.82(c)(5)** requires a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of **Rule §257.82**.

According to **Rule §257.82(d)**, the owner or operator must comply with recordkeeping, notification, and internet requirements specified elsewhere in the Rule.

1.1 SITE LOCATION

TVA owns and operates the Colbert Fossil Plant (COF) facility in Tuscumbia, Alabama. The COF facility is located at 900 Steam Plant Road in Colbert County, Alabama on the south bank of the Tennessee River, approximately 12 miles west of the center of the City of Tuscumbia. The property occupies approximately 1,360 acres of land. Ash Disposal Area 4 is located in the southwest corner of the COF, and is bordered by Cane Creek on the east side, US Route 72 on the south side, and hilly and grassy areas on the west.

The COF ceased coal burning operations on March 23, 2016. Ash Disposal Area 4 historically managed CCR material, and received approximately 30,000 tons of sluiced bottom ash on average per year. As a result of Plant closure, bottom ash is no longer actively sluiced to Ash Disposal Area 4. Ash Disposal Area 4 is considered to be an inactive surface impoundment and closure activities are scheduled to begin during December 2016. Ash Disposal Area 4, currently receives plant process waters, grey water and waters from the Coal Yard Runoff Pond. . An internal divider dike separates the main impoundment area from the stilling area located on the north end of the impoundment.

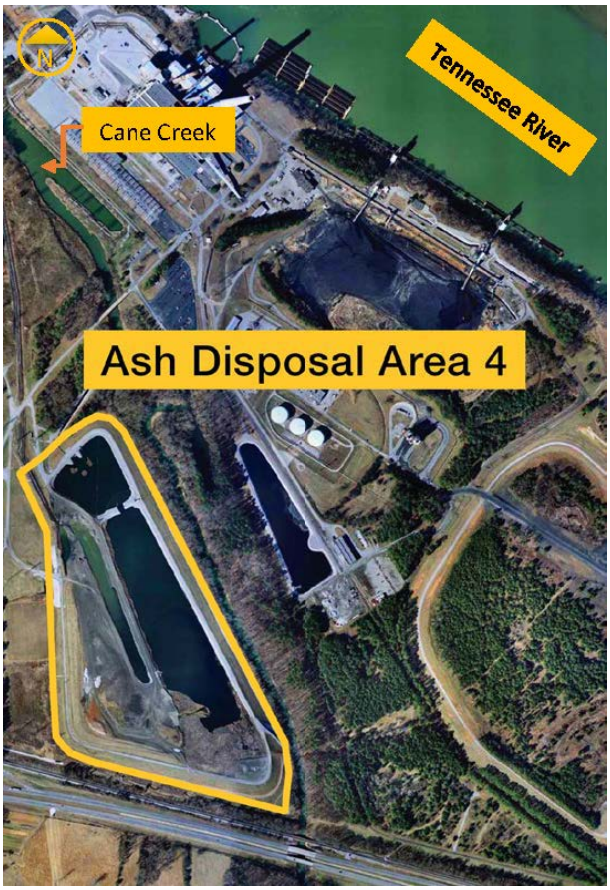


Figure 1 – Site Overview

1.2 SITE HISTORY

The pond was originally constructed in 1972, the surrounding clayey dikes were approximately 20 feet high on the north, east and south sides, and somewhat shorter on the west side of the pond, with an average crest elevation of 440 ft msl. In 1984, the dikes were raised by approximately 20 feet, and clay fill material was placed on the inboard side and on top of ash deposits. This work increased the average crest elevation from 440 ft. to 460 ft. According to TVA's 2010 aerial survey, the average crest elevation is approximately 462.9 ft.

During 2010 and 2011, the existing spillway riser structures were abandoned and a replacement spillway and associated siphon structure was constructed. During that time, an 800 foot long segment of the northeastern dike crest was lowered to elevation 458 to provide an emergency spillway and eliminate the "High Hazard" classification. Both of these projects also facilitated the lowering of the normal pool in Ash Disposal Area 4 from elevation 456 to elevation 453.

During May 2016, all stop logs were removed from the spillway structure to lower the pond operating level. Currently a water elevation (ELE 449) lower than the spillway inverts is maintained through the usage of siphons and pumps.

2.0 EXISTING CONDITIONS - §257.82(a)(1)

Under existing conditions, the drainage area for Ash Disposal Area 4 is approximately 50.9 acres. The drainage area consists of only the impoundment area as there are no run-on flows from outside of the pond's perimeter dikes. Ash Disposal Area 4 received sluiced bottom ash from plant process pipes that enter the impoundment near the northwest corner. Water flowed through an open channel along the bottom ash stack and into the main impoundment area. From the main impoundment area, water flowed through a section of the internal divider dike and into the stilling area. From there, water discharges through the spillway or siphon structures into a concrete channel that discharges into Cane Creek to the north of the impoundment. The discharge is authorized by National Pollutant Discharge Elimination System (NPDES) Permit No. AL0003867, at Outfall No. 001.

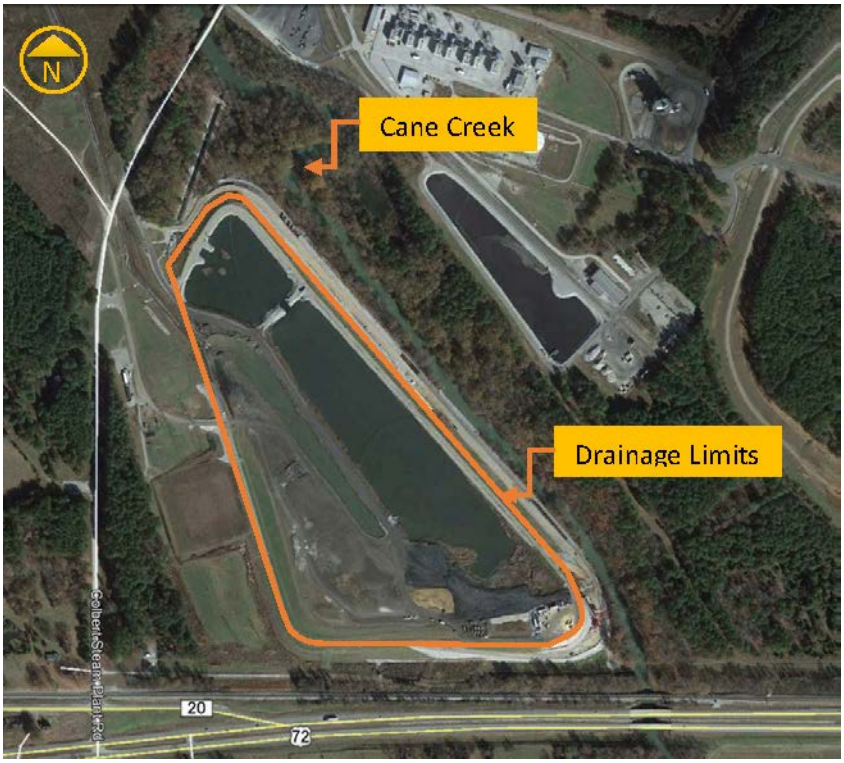


Figure 2 - Limits of Ash Disposal Area 4 Drainage Area

The primary spillway for Disposal Area 4 consists of a four-bay outlet structure. Each bay contains a 96-inch diameter (cut in half) corrugated metal pipe (CMP) skimmer, stop log weir, and a 30-inch high density polyethylene (HDPE) pipe. The primary spillway discharges to concrete channel and ultimately into Cane Creek. Disposal Area 4 is equipped with an emergency spillway that consists of an 800 ft. long lowered dike section with an elevation of 458.0 ft.

3.0 METHODS / DESIGN CRITERIA

AECOM was contracted by TVA to conduct a hydrologic and hydraulic modeling analysis of Ash Disposal Area 4 per the new EPA Coal Combustion Residual regulations (40 CFR Part 257.82). Based on a Hazard Potential Classification Assessment, Ash Disposal Area 4 is considered a significant hazard unit. Based on this classification, the regulations require that the ponds safely store and convey the 1000-yr storm event in addition to normal process flow conditions (40 CFR Part 257.82(a)(3)(ii)).

To assess the capacity of the ponds to store and convey the storm flows, a hydraulic model was created in HEC-HMS. HEC-HMS is a deterministic model and as such, assumes boundary conditions, initial conditions, and parameters of the model elements are exactly known. The model incorporates model element characteristics and meteorological data to calculate infiltration losses, runoff, and reservoir storage and flow conditions. The model was developed based upon Aerial LiDAR data and plans provided by TVA.

Table 1 shows the storm that was analyzed. The 6-hour, 1000-year precipitation depth was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 2, Version 3.

Table 1: Rainfall Depth for Analyzed Storm

Reoccurrence Interval	Storm Duration	Rainfall Depth	Storm Distribution
1,000 year	6 hour	7.31 Inches	SCS Type II

The Soil Conservation Service (SCS) Type II distribution for average conditions was selected. SCS Curve Number method was used for estimating infiltration losses. SCS Unit hydrograph was used to transform precipitation into runoff for each subbasin. The pond routing method used was an outflow curve.

A base flow of approximately 8.4 million gallons per day (MGD) or approximately 13 cubic feet per second (cfs), taken from the station NPDES permit, AL0003867, at Outfall 001. At the time of this report, the actual surveyed starting water surface elevation (WSE) is approximately 449.0 ft. The existing stoplogs in the spillway structure have been removed, and this WSE is maintained by siphons. To be conservative, AECOM began the evaluation by modelling a sunny day analysis using only the existing spillway structure (without these siphons) to control the WSE. The base flow described above was used to calibrate the model. Results of the calibration indicated that the starting WSE of 451.14 ft. is to be used for both the main and stilling ponds. The WSE of Cane Creek was assumed to be at 426.0 ft., corresponding to the 100-year flood elevation of the Tennessee River.

All structure dimensions and invert elevations are modeled using the best available information under operating conditions of the COF. Existing topographic and survey information for Ash Disposal Area 4 was provided by TVA. Drainage areas, volumes, and other site geometry were determined using the AutoCAD Civil 3D software package in conjunction with survey data provided by TVA.

A detailed H&H modeling summary of Ash Disposal Area 4 is provided in **Appendix A**. Computer model outputs provided demonstrate performance of the existing pond during the design storm event.

4.0 CALCULATION RESULTS - §257.82(a)(2)

Table 2 provides results for the 1000-yr 6-hr storm being run through Ash Disposal Area 4 with existing outlet structures in use. Inflow and outflow hydrographs can be found **Appendix A**.

Table 2: Ash Disposal Area 4 Estimated Peak Inflow and Estimated Peak Pool Elevation

Reoccurrence Interval	Storm Duration	Peak Inflow	Peak Pool Elevation	Notes
1,000 year	6 hour	566.2 cfs	452.3 ft	5.7 ft. of freeboard remaining

5.0 CONCLUSIONS

The modeling results indicate the ponds would not overtop during a 1000-year, 6-hour design storm. The inflow design flood control system adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood. Discharge is handled in accordance with the surface water requirements under Final CCR Rule 40 CFR 257.82.

6.0 REFERENCES

1. Environmental Protection Agency, “Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities”, Federal Register, April 17, 2015.
2. AECOM, Ash Disposal Area 4, History of Construction 257.73(c)(1) prepared for CCR Certification, 2016
3. Stantec Consulting Services Inc., Hazard Potential Classification Assessment, Ash Disposal Area 4, 2016
4. National Oceanic and Atmospheric Administration, Atlas 14, Volume 2, Version 3; 2016
5. Tennessee Valley Authority, Colbert Fossil Plant Flow, NPDES Permit No. AL7640006675, 2009
6. United States Army Corps of Engineers, Hydrologic Modeling System (HEC-HMS), Version 4.0, 2016.

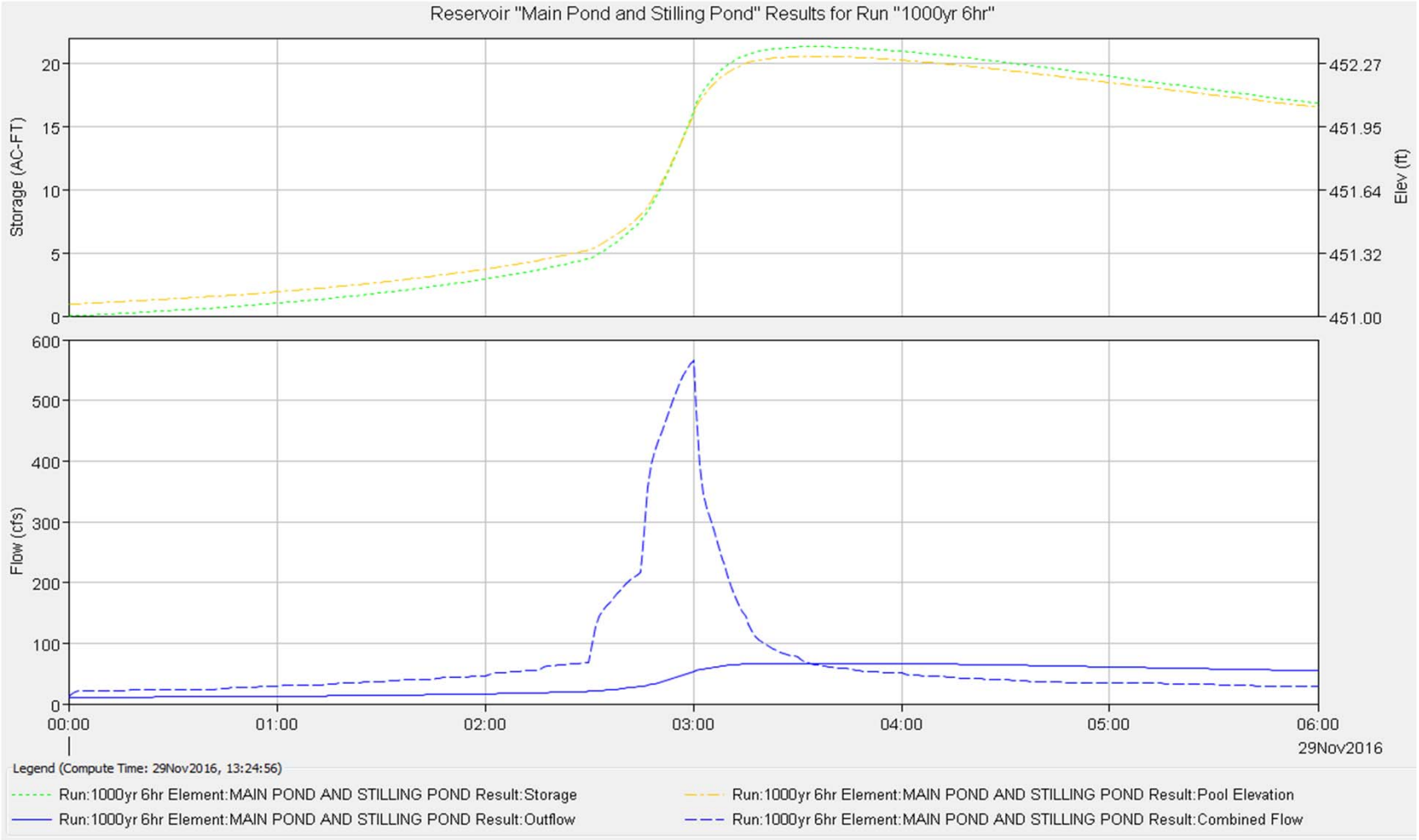
APPENDIX A
HEC-HMS OUTPUT

Project: TVA Colbert Fossil | Simulation Run: 1000yr 6hr

Start of Run:	29Nov2016, 00:00	Basin Model:	Ash Disposal Area 4
End of Run:	29Nov2016, 06:00	Meteorologic Model:	1000yr 6hr
Compute Time:	29Nov2016, 13:24:56	Control Specifications:	6hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
2S	0.03875	258.5	29Nov2016, 03:02	6.78
1S	0.031875	235.3	29Nov2016, 02:56	7.3
10S	0.0089	78.7	29Nov2016, 02:55	20.89
Main Pond and Stilling Pond	0.079525	65.9	29Nov2016, 03:17	4.6
Cane Creek	0.079525	0	29Nov2016, 00:00	0

Main Pond and Stilling Pond
1000yr 6hr



Main Pond and Stilling Pond
1000yr 6hr

Project: TVA Colbert Fossil
Simulation Run: 1000yr 6hr Reservoir: Main Pond and Stilling Pond

Start of Run:	29Nov2016, 00:00	Basin Model:	Ash Disposal Area 4
End of Run:	29Nov2016, 06:00	Meteorologic Model:	1000yr 6-hr
Compute Time:	29Nov2016, 14:58:43	Control Specifications:	6hr

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	566.2 (CFS)	Date/Time of Peak Inflow :	29Nov2016, 03:00
Peak Outflow :	65.9 (CFS)	Date/Time of Peak Outflow :	29Nov2016, 03:11
Total Inflow :	8.57 (IN)	Peak Storage :	22.0 (AC-FT)
Total Outflow :	4.80 (IN)	Peak Elevation :	452.3 (FT)