Stantec Consulting Services Inc.
11687 Lebanon Road, Cincinnati, OH 45241

October 11, 2016
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Revision 0

Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

RE: Initial Inflow Design Flood Control System Plan
West Boiler Slag Pond
EPA Final CCR Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

1.0 PURPOSE

This letter documents Stantec's certification of the initial inflow design flood control system plan for the Clifty Creek Station's West Boiler Slag Pond. Based on this assessment, the West Boiler Slag Pond is in compliance with the initial inflow design flood control requirements in the EPA Final CCR Rule at 40 CFR 257.82(a)(3)(ii).

2.0 INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

As described in 40 CFR 257.82(c), documentation is required on how the inflow design flood control system has been designed and constructed to manage the design storm required by the hazard classification. The inflow design storm event was selected from §257.82(a)(3)(ii) as the 1000-year event based upon a hazard potential classification of significant. A rainfall amount for the 1000-year storm event (7.16 inches) was obtained from the "Precipitation Frequency Atlas of the United States, NOAA Atlas 14" using a precipitation event duration of 6 hours.

3.0 SUMMARY OF FINDINGS

The attached report presents the reservoir routing analysis of the West Boiler Slag Pond for the Probable Maximum Precipitation (PMP) event (27.6 inches in 6 hours). The resulting water surface elevations are shown in the following table. The results show that the reservoir routing for the PMP event meets the criteria; therefore, the design is also acceptable for the 1000-year event and the requirements set forth in 40 CFR 257.82(a).

Station	Facility	Inflow Design Storm	Modeled Design Storm	Peak PMP Water Surface Elevation (feet)	Minimum Embankment Elevation (feet)
Clifty Creek	West Boiler Slag Pond	1000-year storm	PMP	454	469

Re: **Initial Inflow Design Flood Control System Plan**
West Boiler Slag Pond
EPA Final CCR Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stan A. Harris, being a Professional Engineer in good standing in the State of Indiana, 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, pursuant to 40 CRR 257.82(c)(5), the inflow design flood control system plan for the Clifty Creek Station's West Boiler Slag Pond meets the requirements specified in 40 CFR 257.82(a) and (c)(1).

SIGNATURE _____ DATE 10/11/16

ADDRESS: Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, Ohio 45241

TELEPHONE: (513) 842-8200

ATTACHMENTS: Clifty Creek Station West Boiler Slag Pond Inflow Design Flood Control System Plan

10/11/16

Reservoir Routing Analysis
West Bottom Ash Pond

Clifty Creek Power Station
City of Madison
Jefferson County, Indiana

February, 2010

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Appendices

1.0 Introduction and Summary

The Clifty Creek Power Station West Bottom Ash Pond (WBAP), owned and operated by the Indiana and Kentucky Electric Corp. (IKEC), is located in the City of Madison, Indiana along the northern bank of the Ohio River. The WBAP currently serves as a settling facility for sluiced bottom ash produced at the plant. In addition to the process flows from the plant, approximately 510 acres drain to the facility. The pond is formed by natural grade to the north, east and west and a dam that runs along the bank of the Ohio River.

The WBAP Dam is not currently registered with the Indiana Department of Natural Resources (IDNR), but has been identified as a Significant Hazard Structure by American Electric Power (AEP). As part of an evaluation of the dam, Stantec Consulting Services Inc. (Stantec) has been contracted to perform a reservoir routing analysis to determine the freeboard above the design storm. Stantec developed a hydrologic model of the drainage area to determine the expected runoff and routed the flows through the pond.

The results of the reservoir routing analysis indicate that the WBAP is capable of passing flows generated from the full and 50% Probable Maximum Precipitation (PMP) events without overtopping.

2.0 Hydrology

A HEC-HMS (Reference 1) model was developed to estimate the hydrologic response, or runoff from a rainfall event, of the WBAP drainage area. The Natural Resources Conservation Service (NRCS) National Engineering Handbook (NEH) Part 630 – Hydrology methodology was selected to determine rainfall-runoff relationships in the model (Reference 2). The watershed contributing to the WBAP was delineated and divided into sub-watersheds. Due to active construction of the Coal Combustion Byproducts landfill located within the WBAP drainage area, the final configuration of the landfill was used in this analysis. This configuration results in the most flow diverted to the facility and a more conservative analysis. The hydrologic properties of the modeled sub-watersheds, including curve numbers, times of concentration and lag times, were determined using the methodology outlined in TR-55 (Reference 3). Hydrologic properties of the watershed are listed in Table 1.

Table 1. Hydrologic Model Parameters

Sub-Watershed No.	Area (miles ^{2})	Curve Number	Time of Concentration (minutes)	Lag Time (minutes)
SB4	0.155	76	28.7	17.2
SB5	0.290	77	62.7	37.6
SB12	0.015	86	25.7	15.4
SB13	0.005	86	6.6	4.0
SB14	0.013	86	7.4	4.4
SB15	0.005	86	12.6	7.6
SB23	0.061	86	26.8	16.1
SB24	0.043	73	28.4	17.0
SB25	0.010	86	6.0	3.6
SB26	0.010	86	6.0	3.6
Side Hill	0.032	73	14.8	8.9
Pond	0.158	-	-	-

As part of the Flue Gas Desulfurization (FGD) project, sluiced bottom ash flows from Clifty Creek Power Station to the West Bottom Ash Pond have increased from 3 MGD to 20 MGD (30.9 cfs). These process flows were added as a baseflow to the model.

A 50% PMP rainfall event was evaluated as the design storm for the WBAP in accordance with IDNR's *General Guidelines for New Dams and Improvements to Existing Dams in Indiana* (Reference 4) based on a significant hazard classification. Since IDNR has not classified the WBAP, a full PMP rainfall event, corresponding to a high hazard classification, was also evaluated. A 6-hour Soil Conservation Service (SCS) Type B distribution was used based on IDNR's recommendations (Reference 4). Rainfall data input into the model, including the 6-hour rainfall depth of 27.6 inches, for the PMP storm event was obtained from the National Weather

Service (Reference 5). The resultant watershed runoff hydrograph is presented in Appendix B. A drawing of the watershed layout is provided in Appendix A.

3.0 Reservoir Routing

Following the development of runoff parameters, the subsequent flows were routed through the reservoir. The WBAP storage, principal spillway and embankment characteristics were input into the HEC-HMS model to perform the reservoir routing analyses.

3.1 STAGE-STORAGE INFORMATION

The stage-storage information input into the model was used in the determination of the water level in the reservoir. The stage-storage data was calculated from 2005 topographic mapping provided by AEP (Reference 6). Table 2 lists the cumulative storage volume for a given elevation.

Table 2. WBAP Stage-Storage

Elevation (feet)	Storage (acre-feet)
433	0.0
435	161.4
437	324.4
439	488.9
441	654.9
443	822.5
445	991.6
447	1,162.2
449	1,334.4
451	1,508.1
453	1,683.4
455	1,860.2
457	2,038.6
459	2,218.5
461	2,399.9
463	2,582.9
465	2,767.4
467	2,953.4
469	3,141.0
471	3,330.1
473	3,520.8
475	3,713.0

3.2 DAM EMBANKMENT

The 2-foot contour interval topographic data (Reference 6) provided by AEP indicates that the crest elevation of the dam varies between 470 and 472 feet. A recent dam assessment report

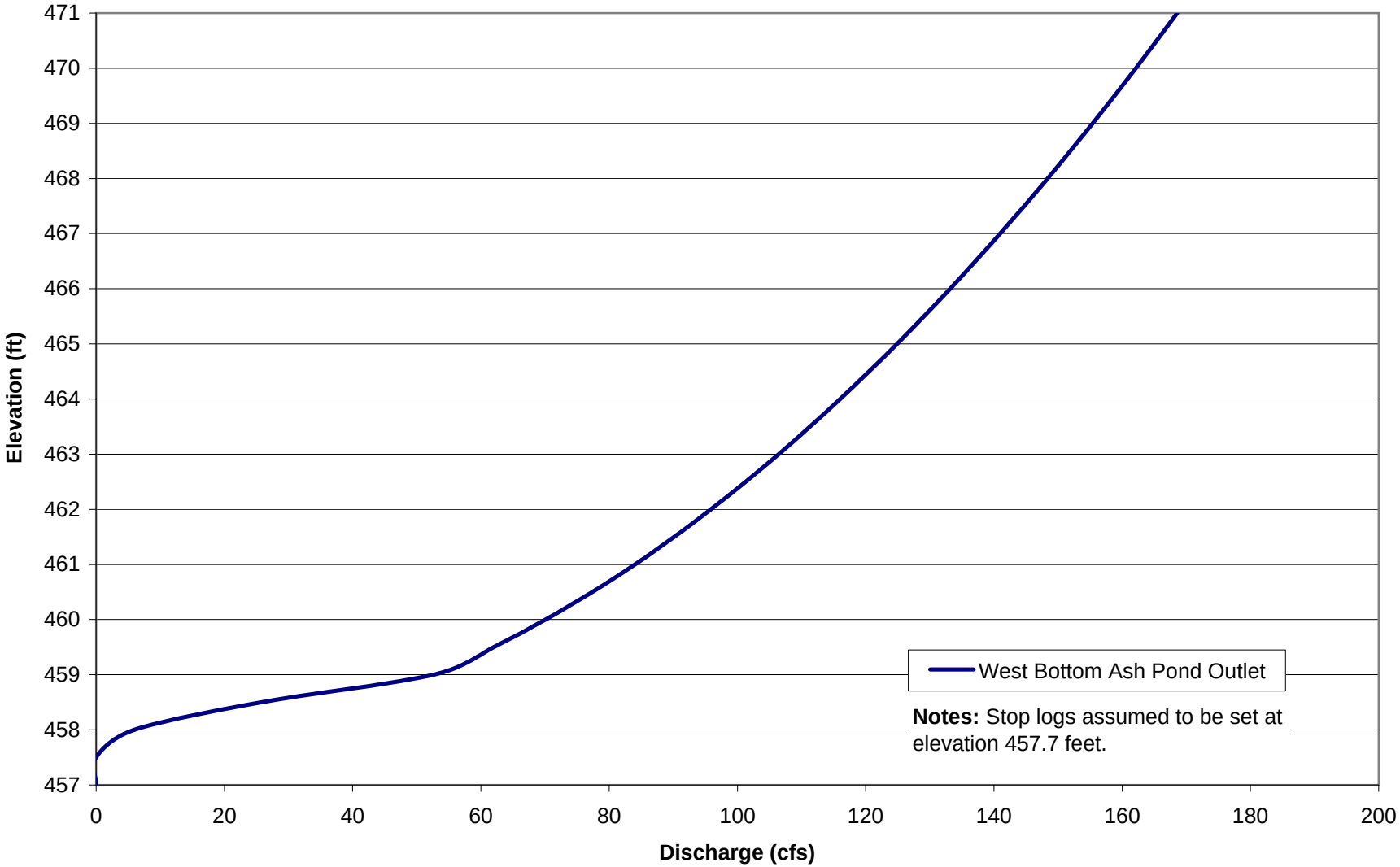
dated September 14, 2009 prepared by GZA GeoEnvironmental Inc. stated that the low spot on the dam crest is at an elevation of 469 feet (Reference 8).

3.3 PRINCIPAL SPILLWAY

The WBAP spillway is a reinforced concrete box riser structure. One side of the structure has a 3-foot wide opening which acts as a weir and allows for adjustment of the water level using stop logs. The riser structure outlets to the Ohio River at elevation 426.8 feet through a 36-inch diameter, 450-foot long reinforced concrete pipe. The existing elevation of the weir provided by AEP was 442 feet. In order to account for the full range of possible water surface elevations, the principal spillway was modeled assuming the maximum stop log position of 457.7 feet. A rating curve was developed for the principal spillway and input into the HEC-HMS model to replicate the hydraulic behavior of the spillway. The rating curve of the principal spillway used in the reservoir routing models, provided in Figure 1, assumes a normal high water surface elevation of 432.8 on the Ohio River. The WBAP does not have an emergency spillway, therefore none was modeled.

FIGURE 1

West Bottom Ash Pond Rating Curve



4.0 Results

The reservoir routing model indicates that, with the stop logs set to the maximum elevation of 457.7 feet, the WBAP peak PMP and 50% PMP water surface elevations were 468.4 and 462.8 feet respectively. Based on a minimum crest elevation of 469 feet, the results of the reservoir routing analysis indicate that the WBAP dam is currently capable of passing flows generated from the PMP and 50% PMP while maintaining a minimum freeboard of 0.4 and 5.2 feet, respectively. With the rating curve and normal pool elevation adjusted to reflect the current stop log elevation setting of 442 feet, the model estimated the peak PMP and 50% PMP water surface elevations to be 454 and 447.5 feet, respectively. The modeled freeboard of the WBAP ranges from 15 to 0.4 feet for the PMP and 21 to 5.2 feet for the 50% PMP depending on the settings of the stop logs in the outlet structure.

5.0 Bibliography and References

1. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-HMS Hydrology Modeling System, Version 3.1.0 Davis, California, May 2003.

2. Natural Resources Conservation Service, National Engineering Handbook (NEH) Section 4: Hydrology, September 1997.

3. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, January 1975.

4. Indiana Department of Natural Resources, General Guidelines for New Dams and Improvements to Existing Dams in Indiana, 2001.`

5. National Oceanic and Atmospheric Administration, Office of Hydrology, National Weather Service, Hydrometeorlogical Report No. 51, Maximum Precipitation Estimates, United States East of the 105th Meridian, June 1978. Reprinted August 1980.

6. Henderson Aerial Surveys Inc., Clifty Creek East Pond NAVD 27/NAVD88 in South, (2 foot contours), aerial photography exposed on 4/16/2005.

7. Indiana Kentucky Electric Corp, Clifty Creek Plant, Plot Plan. Drawings: Dwg. 16-3002A-3, 16-3002-5, Sheets 2 and 3 of 5, August 19, 1953.

8. GZA GeoEnvironmental, Inc. (GZA)," Dam Assessment Report, Clifty Creek Station, West Bottom Ash Pond," Inspection Date: June 10 -11, 2009, Report Date: September 14, 2009.

Appendix A

Watershed Layout

Notes:

1. *Aerial photography provided by the USDA's Farm Service Agency (FSA).*
2. *Topographic data developed from Madison West, USGS, 7 1/2 -minute topographic Quadrangle and supplemented by data provided by I.K.E.C.*

SB4
SB5
SB25
SB26
SB12
SB13
SB14
SB15
SB23
SB24
Pond
Side Hill
CLIFTY CREEK
CLIFTY CREEK POWER STATION
WEST BOTTOM ASH POND
PRINCIPAL SPILLWAY
OHIO RIVER

Legend

Drainage Channels

Drainage Areas

LRCP Watershed

WBAP Watershed

Topography

Proposed Contours

Existing Contours

N

0 400 800 Feet

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Stantec

FINAL CONDITIONS WATERSHED

APPENDIX A
WEST BOTTOM ASH POND
CLIFTY CREEK POWER STATION
MADISON, INDIANA

PROJECT NO.	175539021
DATE	FEBRUARY, 2010
DRAWN BY	KAS
CHECKED BY	JRM
CHECKED BY	
SCALE	1" = 400'
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SHEET

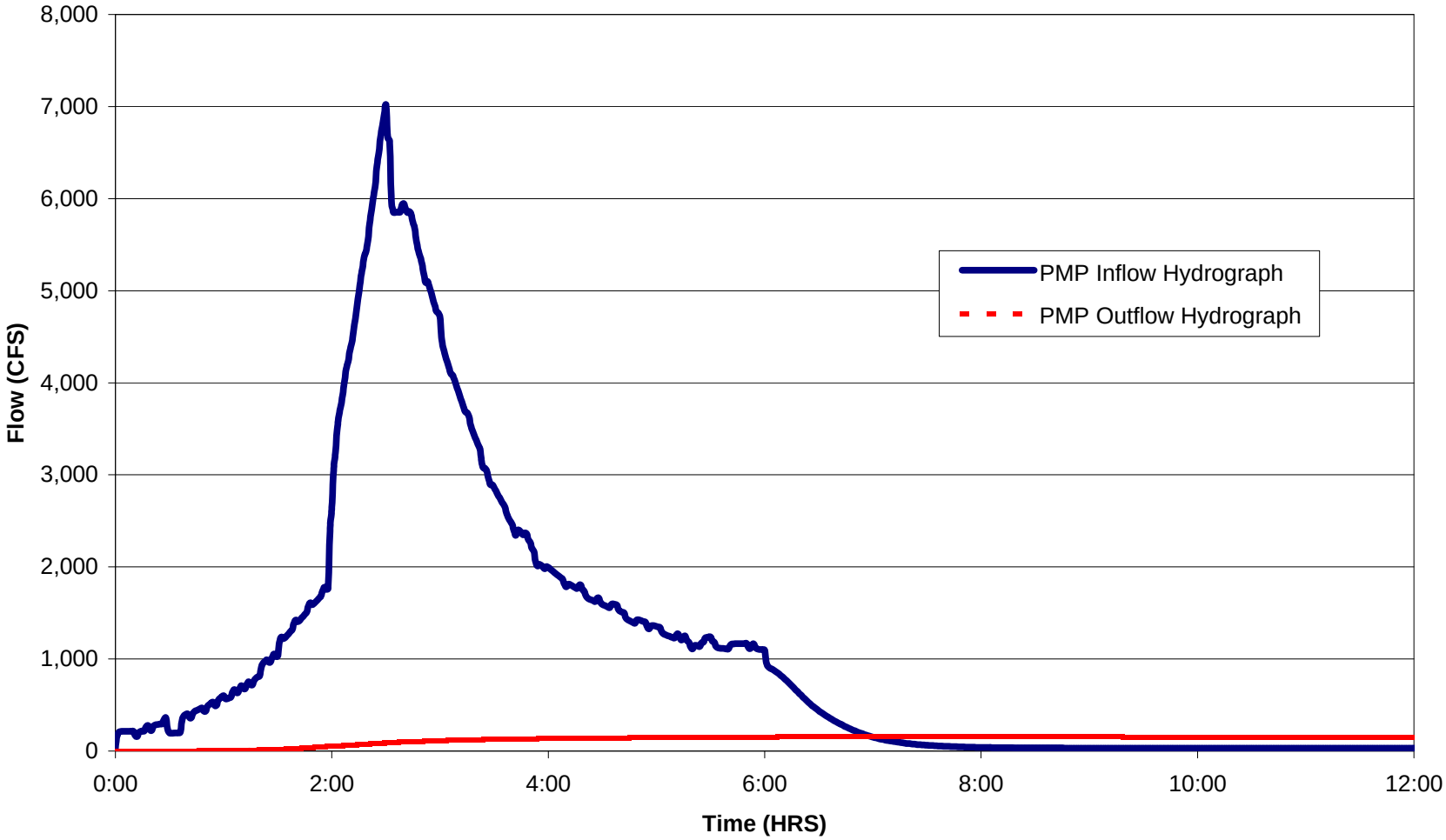
1 OF 1

Appendix B

Hydrographs

APPENDIX B -

WBAP PMP Hydrographs



APPENDIX B -

WBAP 50 % PMP Hydrographs