

2015 DAM AND DIKE INSPECTION REPORT

GERS-15-018

**CLIFTY CREEK PLANT
MADISON, INDIANA**

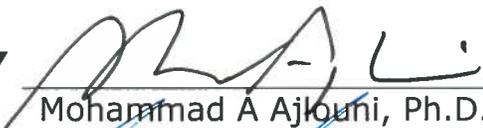
**PREPARED BY
GEOTECHNICAL ENGINEERING
AEP SERVICE CORPORATION
1 RIVERSIDE PLAZA
COLUMBUS, OHIO**

DAM & DIKE INSPECTION REPORT

WEST BOTTOM ASH POND
FLY ASH POND
GERS-15-018
REVISION 0

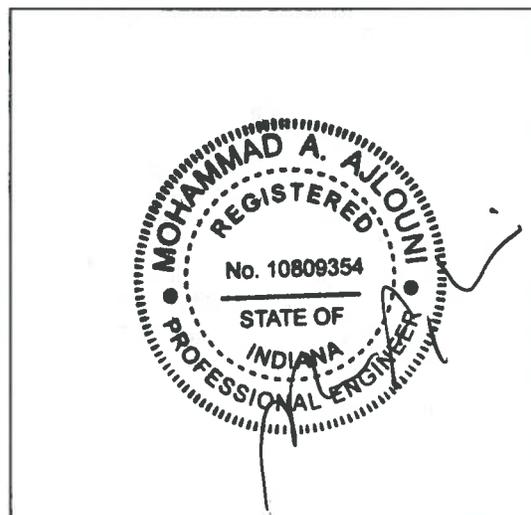
CLIFTY CREEK PLANT
MADISON, INDIANA

INSPECTION DATE September 3, 2015

PREPARED BY  DATE 9-28-2015
Mohammad A Ajlouni, Ph.D., P.E.

REVIEWED BY  DATE 9-29-2015
Timothy W, Howdyshell

APPROVED BY  DATE 10/5/2015
Gary F. Zych, P.E.
Manager – Geotechnical Engineering Services



PROFESSIONAL ENGINEER
SEAL & SIGNATURE

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1.0 INTRODUCTION

American Electric Power Service Corporation's Civil Engineering Division administers the Clifty Creek Station Dam Inspection and Maintenance Program (DIMP). As part of the DIMP, staff from the Geotechnical Engineering Services Section annually conducts dam and dike inspections. This report contains the inspection findings, observations, photographic descriptions, conclusions, and maintenance recommendations. This inspection report addresses the West Bottom Ash Pond (WBAP) and Fly Ash Pond (FAP) at the Clifty Creek Station. The East Bottom Ash Pond (EBAP) was drained, backfilled and closed in the 2014.

Mr. Danny Hunt, Plant Engineer, and Mr. Thomas R. Spurgeon, Landfill Coordinator, Clifty Creek Station provided onsite coordination for inspection activities. The inspection was performed on September 3, 2015. Weather conditions were generally good with temperature in the mid 70 to low 80 degrees Fahrenheit range, with good visibility. Observations were briefly discussed with Clifty Creek onsite personnel during and after completing the inspection.

The Clifty Creek plant is located in Madison, Indiana. Direct access to the plant is via State Route 56. The Coal Combustion By-Product (CCB) and waste water management system consists of the West Bottom Ash Pond and the Landfill Stormwater Runoff and Leachate Collection Pond /Fly Ash Pond. The East Bottom Ash Pond is no longer active for ash storage and waste water treatment and was converted to a surface water collection pond.

2.0 SUMMARY OF VISUAL OBSERVATIONS

2.1 General

The summary of the visual observations uses terms to describe the general appearance or condition of an observed item, activity or structure. Their meaning is understood as follows:

Good: A condition or activity that is generally better or slightly better than what is minimally expected or anticipated from a design or maintenance point of view.

Fair or Satisfactory A condition or activity that generally meets what is minimally expected or anticipated from a design or maintenance point of view.

Poor: A condition or activity that is generally below what is minimally expected or anticipated from a design or maintenance point of view.

Minor: A reference to an observed item (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is normal or desired, but which is not currently causing concern from a structure safety or stability point of view.

Significant: A reference to an observed item (e.g. erosion, seepage, vegetation, etc.) where the current maintenance program has neglected to improve the condition. Usually, conditions that have been previously identified in the previous inspections, but have not yet been corrected.

Excessive: A reference to an observed item (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below or worse than what is normal or desired, and which may have affected the ability of the observer to properly evaluate the structure or particular area being observed or which may be a concern from a structure safety or stability point of view.

Results of the visual inspection performed on September 3, 2015, are summarized below, with inspection photographs included in Appendices A, and B. An assessment of instrumentation data is also included in Section 3.0 of the report with measured data and location information provided in Appendix C.

2.2 West Bottom Ash Pond

– See Appendix A for Photographs

The West Bottom Ash Pond (WBAP) is used for the storage of bottom ash generated from all six generating Units. It consists of a single dike that is approximately 2,000 feet long and is approximately 35 feet high.

During the past year, the approximate minimum, maximum, and present depth of the impounded water was approximately 14ft, 15ft, and 14ft, respectively (elevation was approximately 447, 448, and 447, respectively). The approximate minimum, maximum, and present average depth of the impounded bottom ash was approximately 6ft (elevation 439.0).

The storage capacity of the WBAP at the time of the inspection is 1246 ac-ft;

The approximate volume of the impounded water at the time of the inspection was 415.4 ac-ft. The approximate volume of the impounded bottom ash at the time of the inspection was 553.9 ac-ft.

In general, the interior and exterior slopes of the dike appear to be in fair and stable condition. No significant change to the exterior slope was noted from the previous inspection. No significant settlement or misalignment was observed. Seeps were not observed during the inspection. No animal burrows were observed during the inspection.

1. Photograph No. 1 illustrates a typical overview of the dike crest. The crest appears to be in good and stable condition. Signs of settlement, misalignment and cracking were not observed.
2. Photograph No. 2 and Photograph No. 3 illustrate the condition of the interior slopes at the settling end of the pond and the present extent of boiler slag buildup. The interior slope of the east dike at this end of the pond appeared to be in fair and stable condition. Photograph No. 3 shows an area of significant erosion on the interior slope.
3. Photograph No. 5 provides an overview of the extent of the filtering vegetation within the clear water end of the pond. It was noted that the propagation of that filtering vegetation has not progressed to any significant extent since the last inspection.
4. Photograph 6 through Photograph 9 show the general condition of the crest and the interior slope of the west end of the south dike.
5. Photograph No. 10 shows the overflow structure and the interior slopes of the dike.
6. Photograph No. 11 and Photograph No. 12 show the excessive vegetation along the exterior slope at the northeast end of the dike.
7. Photograph No. 13, Photograph No. 14 and Photograph No. 15 show the general condition of the crest and the exterior slope of the west end of the south dike. No wet areas were noted during this inspection. The slope appeared in good and stable condition.
8. The overflow discharge structure walkway, railings, metal decking, and visible concrete were found to be in good, functional condition. Photographs No. 16, No.

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17, and No.18 illustrate the access metal walkway, metal deck, spare stop logs and interior of the overflow discharge structure.

9. Photograph No. 19 shows the accumulation of significant wood derbies carried by the river during flooding events above the discharge pipe.
10. Photograph No. 20 Photograph No. 21 and Photograph No. 22 show the typical condition of the discharge pipe and outlet channel. Significant wood derbies carried by the river during flooding events. Erosion at the confluence of the channel and the river was consistent with the conditions observed in the past years. The channel and outlet pipe were observed to be in good condition and were unobstructed and flowing steadily.

2.3 Fly Ash Pond Dam

– See Appendix B for Photographs

Two dams were initially constructed to form the Fly Ash Pond (FAP). Those dams are commonly referred to as the North Fly Ash Dam and the South Fly Ash Dam. Initially, the fly ash was sluiced to the Pond in a slurry form. Subsequently, a Type III landfill was constructed over a significant portion of the pond and dry fly ash was placed in that landfill. With that construction, the North Fly Ash Dam became an integral part of the landfill and no longer functions as a dam. As part of the flue gas desulfurization project, that landfill was redesigned and permitted as a Type I landfill so that synthetic gypsum can be disposed of along with the dry fly ash. The remaining portion of the FAP now serves as a stormwater collection basin.

During the past year, the approximate minimum, maximum, and present depth of the impounded water was approximately 8 ft (elevation 484). The approximate minimum, maximum, and present depth of the impounded fly ash was approximately 45 ft (elevation 475).

The storage capacity of the FAP at the time of the inspection is 575.1 ac-ft;

The approximate volume of the impounded water at the time of the inspection was 343.4 ac-ft yards. The approximate volume of the impounded fly ash at the time of the inspection was 1,200 ac-ft.

Overall, the exterior slope is well vegetated and in stable condition. There were no signs of new sloughing, depressions or areas of wetness and no seeps were apparent. Control of surface vegetation was considered satisfactory. The spillway outlet and discharge channel appear to have no obstructions or increased vegetation growth, however, flow was minimal at the time of the inspection. The slip previously observed near the left abutment appeared to have stabilized. Even though the slip would not have an adverse effect on the integrity of the dam (since at that location the dam crest is very wide), re-grading of the area to establish uniform slope was discussed.

1. Photographs Nos. 1, 2 and 3 show the generally good condition of the crest of the dam. Signs of misalignment and settlement were not observed. Minor surface cracks in the pavement were observed. Those cracks are attributed to the age of the pavement and the effects from weathering.
2. Photographs Nos. 4, 5 and 6 provide overviews of the interior slope of the dam above the operating pool. Vegetation control is considered fair and erosion due to wave action was not observed. Overall the slope was found to be in good and stable condition.

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3. Photographs No's. 7 through 11 are all overviews of various areas of the exterior face of the dam as further described with each photograph. Throughout, vegetation control is acceptable. No visible change was observed from previous inspections. In general, the exterior slope appeared to be in good and stable condition.
4. Photograph No.12 is an overview of the principal spillway decant structure. Vegetation control was observed to be good. The decant structure appeared to be functioning properly and was free of obstructions.
5. Photographs Nos. 13 and 14 are overviews of the principal spillway outlet channel. The channel is not unobstructed with minimal flow at the time of the inspection.

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3.0 ASSESSMENT OF RECENT INSTRUMENTATION DATA

The pond water levels were measured during the inspection. This data is summarized below, along with the water levels measured during previous annual inspections. Personnel from the Plant perform quarterly inspections and record pond levels and facility conditions.

Pond Name	Pond Elevation (Ft.)				
	3 Sep. 2015	14 Aug. 2014	2 Oct. 2013	18 Oct. 2012	25 Oct. 2011
WBAP	447.0'	447.5'	444.5'	445'	444.9'
FAP	483.6'	487'	487'	488'	487.8'

There are piezometers and monitoring wells installed in and around the FAP dam as well as the WBAP dike. Plan views showing the location of those piezometers and monitoring wells can be found in Appendix C along with plots of the historical static water levels for each location.

A review of the data contained on the WBAP static water elevation plot showed that all piezometers exhibit consistent water elevations. PZ-1 is a piezometer located at the crest of the constructed dike (shown as B-1 on location plan) which was dry for readings in 2015. PZ-2 is a piezometer located along a bench near the downstream toe of the constructed dike (shown as B-2 on location plan) which was damaged. PZ-3 is a piezometer located at the crest of the constructed dike (shown as B-3 on location plan). PZ-4 is a piezometer located along a bench near the downstream toe of the constructed dike (shown as B-4 on location plan). PZ-5 is a piezometer located at the crest of the constructed dike (B-5 on location plan).

A review of the FAP static water elevation plot indicates that two of the piezometers (SP-84-1 and SP-84-6) located along the crest of the dam historically exhibit consistent water elevations. Further review of the static water elevation plot indicates that the static water levels for the other piezometers and monitoring wells generally fluctuate as a result of the fluctuations in the pool and the river elevations.

4.0 CONCLUSIONS

4.1 West Bottom Ash Pond

Overall, the earthen embankment forming the West Bottom Ash Pond is considered to be in good condition given the recent improvements related to tree clearing, stump removal, grading and erosion protection.

4.2 Fly Ash Dam

Overall, the Fly Ash Pond Dam is in good condition. The vegetation along the downstream slope was in acceptable conditions. The upstream slope appeared stable and was well maintained. The inlet and outlet of the discharge structure are in fair condition.

5.0 RECOMMENDATIONS- General Maintenance and Monitoring Conditions

5.1 Overall

1. Continue annual clearing and mowing of all dikes with vegetation control to prevent the growth of excessive woody plants and brush.
2. Continue removal of vegetation from within all stairways, including sufficient areas on either side of the stairs. Continue to remove all vegetation growing through and around all floating structures.
3. Continue following the requirements outlined in the AEPSC Dam and Dike Inspection and Maintenance Program Circular Letter and submit Quarterly Inspection Reports along with Instrumentation data to Mohammad Ajlouni within one month of the end of the quarter.

5.2 Fly Ash Pond

1. Continue current maintenance practices.

5.3 West Bottom Ash Pond

1. Continue current maintenance practices.
2. An evaluation of the use of the remotely controlled mower recently purchased by the plant should be conducted since the tracks are apparently disturbing the inboard slopes mainly built with bottom ash.

6.0 RECOMMENDATIONS- Remedial Actions/Repairs

6.1 Fly Ash Pond

1. Continue monitoring the slip on the southeastern exterior slope as part of the quarterly inspections.

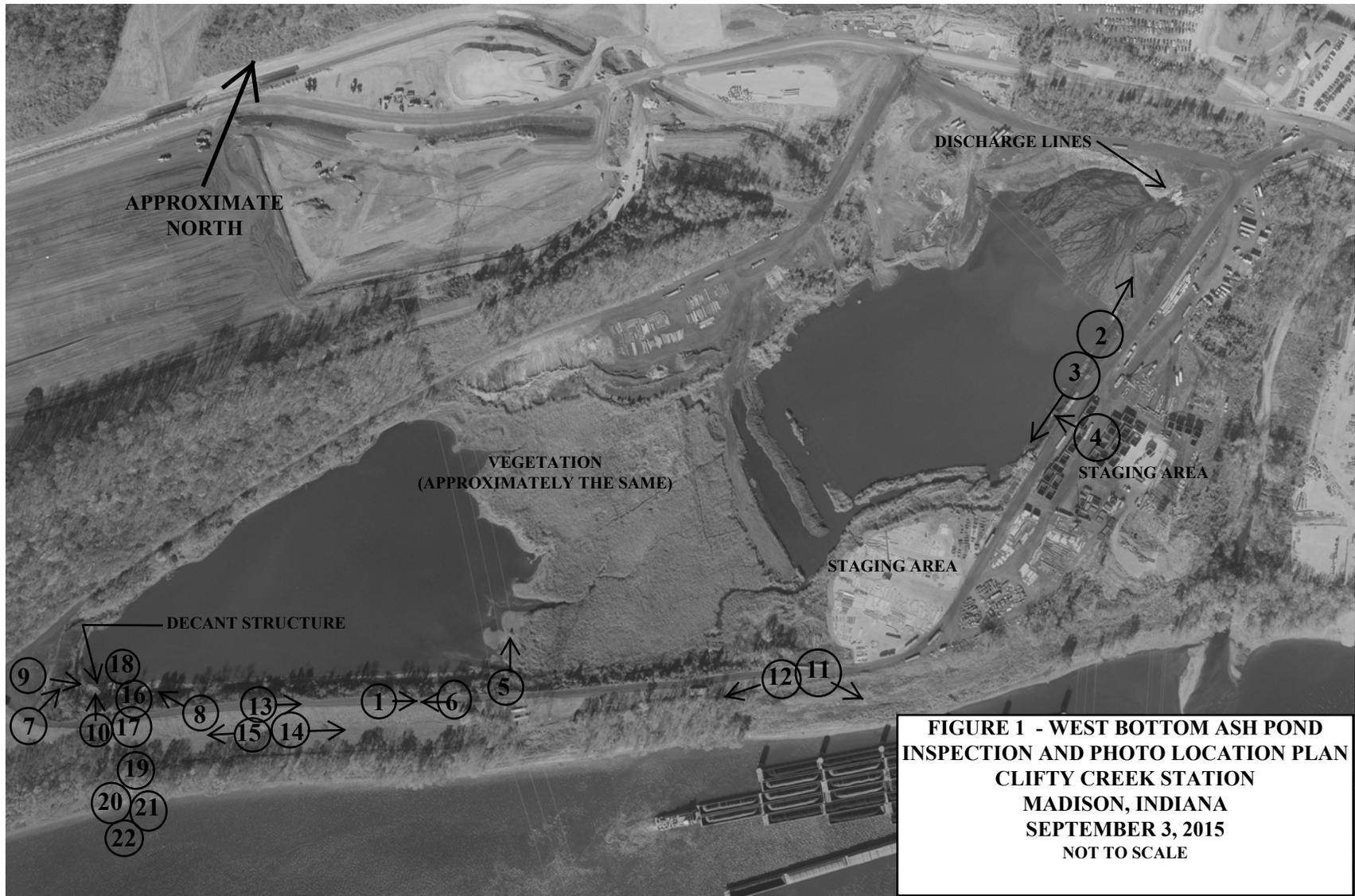
6.2 West Bottom Ash Pond

1. None

In general, routine inspections, monitoring and maintenance by plant personnel should continue. If you have any questions with regard to this report, please do not hesitate to contact Mohammad Ajlouni at 614-716-2939 or Gary Zych at 614-716-2917.

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FIGURES



**FIGURE 2 - FLY ASH POND
INSPECTION AND PHOTO LOCATION PLAN
CLIFTY CREEK STATION
MADISON, INDIANA
SEPTEMBER 3, 2015
NOT TO SCALE**

↑
**APPROXIMATE
NORTH**



OHIO RIVER

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APPENDICIES

APPENDIX A

**CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 1

West Bottom Ash Pond Dike
From Crest Looking Northeast

Overview of Crest



Photo No. 2

West Bottom Ash Pond Dike –
Interior Slope at North End
Looking Toward Discharge Lines



Photo No. 3

West Bottom Ash Pond Dike –
Interior Slope at North End
Looking South

Significant Erosion Caused By
Stormwater Runoff From
Roadway backfilled with concrete
debris

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 4

West Bottom Ash Pond – Near
North End of Interior Slope

General Overview



Photo No. 5

West Bottom Ash Pond Interior
Adjacent To Transmission Tower
Looking North Across Pond

General Overview of Vegetation
Propagation



Photo No. 6

West Bottom Ash Pond Dike –
Interior Slope From Near
Transmission Tower Looking
Southwest From Crest

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 7

West Bottom Ash Pond Dike –
Interior Slope Looking Northeast
From Crest.

Overview of General Condition



Photo No. 8

West Bottom Ash Pond Dike –
Interior Slope Looking West From
toe of slope

Overview of General Condition



Photo No. 9

West Bottom Ash Pond Dike –
Interior Slope Looking Northeast
From Crest

Overview of General Condition

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 10

West Bottom Ash Pond Dike –
Interior Slope Looking Northwest
From Crest

Overview of General Condition



Photo No. 11

West Bottom Ash Pond Dike –
Exterior Slope From Crest
Looking East

Overview of Excessive Vegetation



Photo No. 12

West Bottom Ash Pond Dike –
Exterior Slope From Crest
Looking Southwest

Overview of Excessive Vegetation

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 13
West Bottom Ash Pond Dike –
Crest From Top Looking
Northeast

General Condition



Photo No. 14
West Bottom Ash Pond Dike –
Exterior Slope From Toe Looking
East

Overview of Vegetation and
General Condition



Photo No. 15
West Bottom Ash Pond Dike
Exterior Slope From Toe Looking
Southwest

Overview of Vegetation and
General Condition

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 16

West Bottom Ash Pond Principal Spillway Access Stairs and Decant Structure

Overview of General Condition



Photo No. 17

West Bottom Ash Pond Principal Spillway Access Stairs and Decant Structure

Spare stop logs stacked next to the overflow structure.



Photo No.18

West Bottom Ash Pond Principal Spillway Access Stairs and Decant Structure

Interior of the overflow discharge structure

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 19

West Bottom Ash Pond Principal Spillway Pipe Upstream of the Outlet Channel.

Significant wood debris carried by the river during flooding events



Photo No. 20

West Bottom Ash Pond Principal Spillway Pipe Discharge

General Condition of End of Pipe and Outlet Channel

Significant wood debris carried by the river during flooding events



Photo No. 21

West Bottom Ash Pond Principal Spillway Pipe Discharge

General Condition of End of Pipe and Outlet Channel – Looking Toward River

Significant wood debris carried by the river during flooding events

**APPENDIX A
CLIFTY CREEK WEST BOTTOM ASH POND
DIKE INSPECTION PHOTOGRAPHS**



Photo No. 22

West Bottom Ash Pond Principal
Spillway Outlet Channel at
Confluence with Ohio River

Current Condition of Non-
Vegetated Slopes – No Significant
Change Since Last Inspection

APPENDIX B

**CLIFTY CREEK FLY ASH POND
DAM INSPECTION PHOTOGRAPHS**

**APPENDIX B
CLIFTY CREEK FLY ASH POND
DAM INSPECTION PHOTOGRAPHS**



Photo No. 1

Fly Ash Pond Dam From Crest
Looking Northeast Across Saddle
Dam

General Overview



Photo No. 2

Fly Ash Pond Dam From Crest
Looking Southwest

General Overview



Photo No. 3

Fly Ash Pond Dam From Crest
Looking East

General Overview

**APPENDIX B
CLIFTY CREEK FLY ASH POND
DAM INSPECTION PHOTOGRAPHS**



Photo No. 4

Fly Ash Pond Dam From Crest
Looking North

Overview of Current Operating
Pool and Vegetation Conditions
on Interior Slope Adjacent to
Saddle Dam



Photo No. 5

Fly Ash Pond Dam From Up
Stream Slope

Overview of Current Operating
Pool and Vegetation Conditions
on Interior Slope



Photo No. 6

Fly Ash Pond Dam From Up
Stream Slope

Overview of Vegetation and
General Conditions

**APPENDIX B
CLIFTY CREEK FLY ASH POND
DAM INSPECTION PHOTOGRAPHS**



Photo No. 7

Fly Ash Pond Dam From Roadway Leading to Crest Looking Northeast

Overview of Vegetation Management and General Condition



Photo No. 8

Fly Ash Pond Dam From Toe Slope Looking Southwest

Overview of Vegetation and General Conditions



Photo No. 9

Fly Ash Pond Dam Adjacent To Toe of Slope Looking East

Overview of Vegetation and General Conditions

**APPENDIX B
CLIFTY CREEK FLY ASH POND
DAM INSPECTION PHOTOGRAPHS**



Photo No. 10

Fly Ash Pond Dam Adjacent To
Toe of Slope Looking Southwest

Overview of Vegetation and
General Conditions



Photo No. 11

Fly Ash Pond Dam From Top of
Slope In Right Groin Looking
East

Overview of Vegetation and
General Conditions



Photo No. 12

Fly Ash Pond Principal Spillway
Structure

General Overview

**APPENDIX B
CLIFTY CREEK FLY ASH POND
DAM INSPECTION PHOTOGRAPHS**



Photo No. 13

Fly Ash Pond Principal Spillway Outlet

General Overview –Backwater has been minimized since last inspection.



Photo No. 14

Fly Ash Pond Principal Spillway Outlet Channel Looking Downstream

General Overview

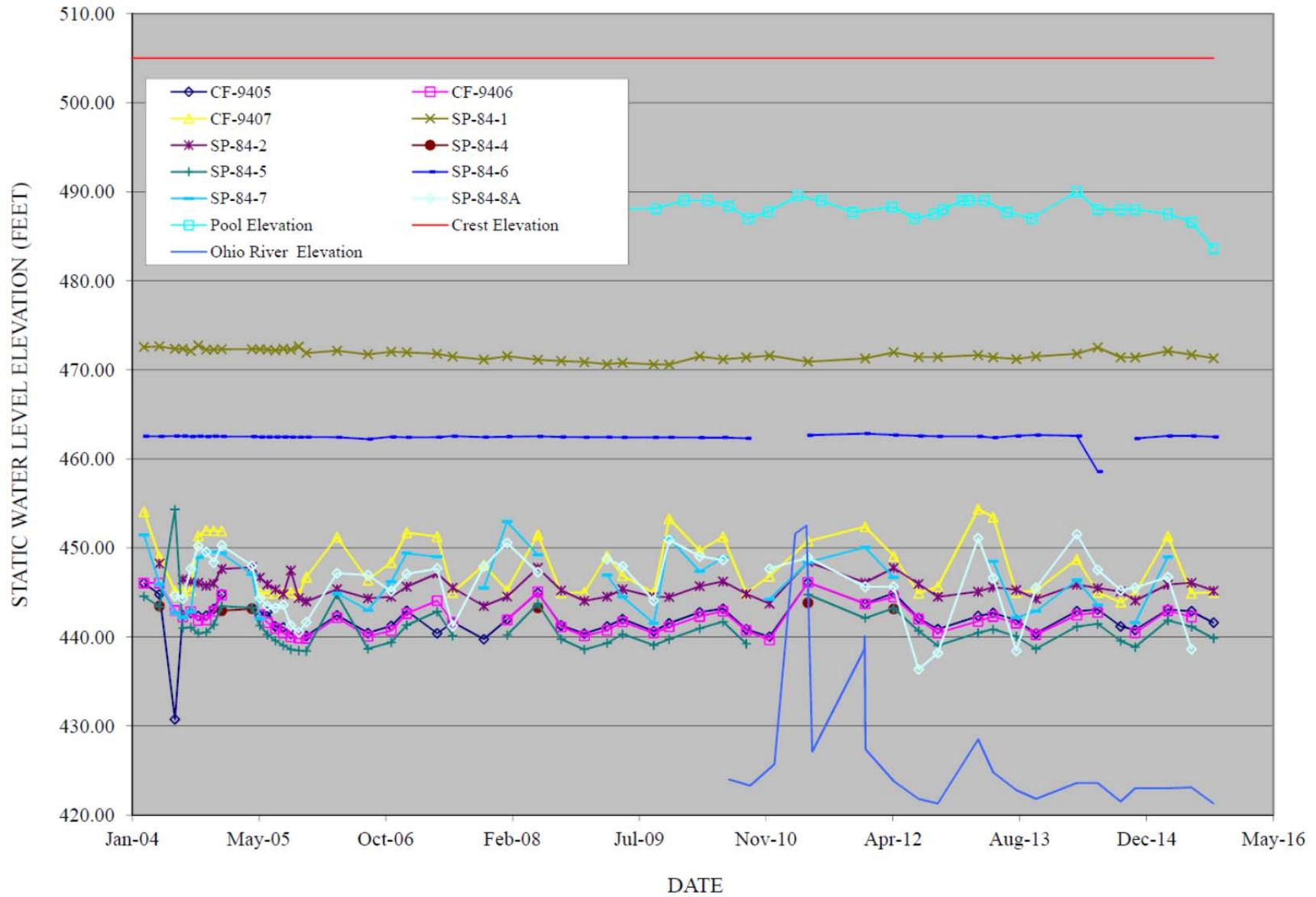
APPENDIX C

INSTRUMENTATION DATA

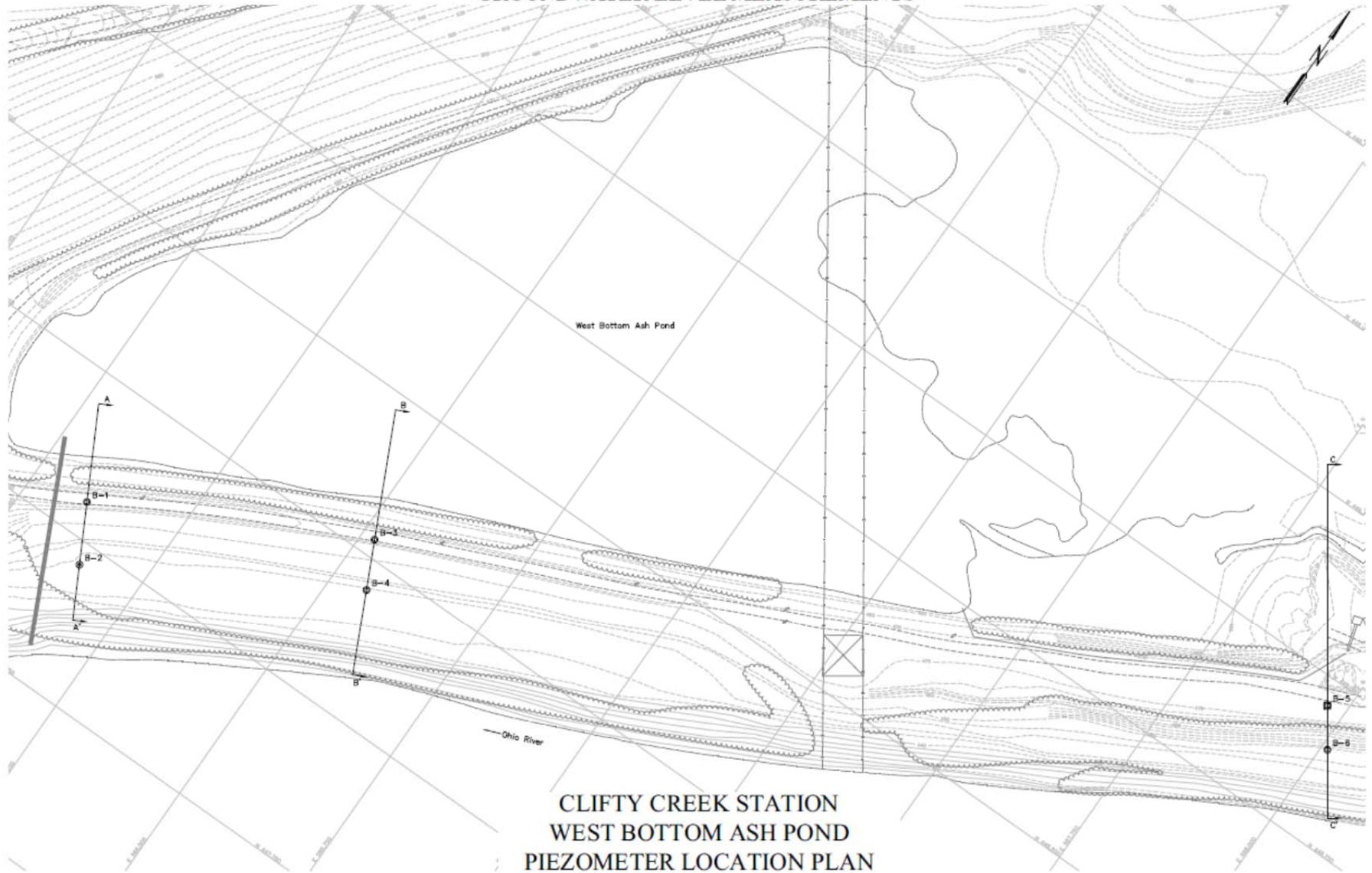
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CLIFTY CREEK STATION - FLY ASH POND DAM GROUNDWATER LEVEL MEASUREMENTS



CLIFTY CREEK STATION - FLY ASH POND DAM GROUNDWATER LEVEL MEASUREMENTS



LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core

SCALE: 1"=25'

0 25 50 100 FEET
GRAPHIC SCALE

CLIFY CREEK STATION - WEST BOTTOM ASH POND DIKE
GROUNDWATER LEVEL MEASUREMENTS

