Final Report

Upper Ash Pond Dam – A.B. Brown Station Assessment Report

Lockheed Martin
Contractor for the USEPA

September 2009

O'BRIEN & GERE

5851/44642

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Contractor for the USEPA

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September 2009

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1. Introduction

1.1. General

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December 2008, the Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of coal combustion waste (CCW) impoundments or "management units". A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations. The administration of this program is being supported by Lockheed Martin, who has authorized O'Brien & Gere to provide actual site specific impoundment assessments at selected facilities.

1.2. Project Purpose and Scope

As stated in the Request for Proposal, the purpose of this work is to provide a Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

The scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles downstream of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last five years.

- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the Upper Ash Pond Management Unit at the A.B. Brown Generating Station in Evansville, Indiana . This Southern Indiana Gas & Electric power generation facility is owned and operated by Vectren Power Supply.

2. Project/Facility Description

2.1. Identification of Management Unit

The Upper Ash Pond (Upper Pond) and its corresponding earthen dam are located at the Vectren A. B. Brown Generating facility in Mount Vernon, Posey County, Indiana (see Figure 1 Location Plan). The dam is permitted by the Indiana Department of Natural Resources (IDNR) State Permit # FW-21909. The Upper Pond was constructed upstream of the Lower Ash Pond (Lower Pond) to provide for better separation of solids and more flexibility in waste ash management. The Upper Pond was formed by building the Upper Dam, which was constructed in two phases (2003 and 2007). The impoundment area of the Upper Pond is approximately 103 acres. A Site Plan is provided as Figure 2.

2.2. Hazard potential classification

The Lower Dam has been designated by the IDNR as Significant Hazard. This classification assumes that no probable loss of human life would occur in the event of a dam failure, but potential economic or environmental impacts could result at downstream facilities. Since this determination exists for the downstream Lower Dam, it is assumed that this would be the highest hazard classification for the Upper Dam.

According to ATC (the design engineer for the Upper Dam), the emergency spillway for the Lower Dam has sufficient capacity to safely pass flows that would result from a failure of the Upper Dam. If this is the case, then such a failure would not cause any more flooding downstream of the Lower Dam than would occur during the Spillway Design Flood (SDF) event for the Lower Dam. Therefore, the Upper Dam would be considered a Low Hazard structure since its failure would not result in any economic or environmental impacts to downstream facilities. However, it would be appropriate to perform a dam breach analysis to verify the effects of an Upper Dam failure on the Lower Dam spillway system and the area downstream of the Lower Dam before officially recommending a Low Hazard classification for the Upper Dam. For the purposes of this assessment and until a breach analysis is performed to demonstrate otherwise, the Upper Dam should be considered as a Significant Hazard structure.

2.3. Upper Ash Pond Dam

As indicated above, the Upper Pond impoundment was formed by an earthen embankment constructed immediately upstream of the Lower Pond. The embankment is approximately 1100 feet long, 25 feet wide at the crest and 20 feet high (crest elevation 464 feet above MSL). Both the upstream and the downstream embankment slopes are approximately 5 horizontal to 1 vertical (5H:1V) .

The principal spillway consists of a 60-inch diameter HDPE drop inlet, inside a 66-inch reinforced concrete pipe (RCP), located approximately 800 feet east of the left (looking downstream) abutment of the embankment section. The drop inlet riser pipe discharges through a 24-inch diameter HDPE outlet pipe, housed within a 36-inch RCP. The 24-inch pipe leads to a drainage channel tributary to the Lower Pond. The drop inlet establishes a normal pool elevation of 460, which results in freeboard of 4 feet to the crest of the embankment. An ultrasonic measuring device monitors the water level in

the pond. The emergency spillway consists of a trapezoidal riprap-lined earth channel cut into the area adjacent to the principal spillway, with a 30-foot crest width at EL 461.5 and 5H:1V side slopes.

Since the Upper Pond was constructed, the Lower Pond only receives scrubber blowdown, water treatment blowdown and discharge from the Upper Pond. Liquid wastes that are sluiced into the Upper Pond include: fly ash, bottom ash boiler slag, flue gas deposits, belt filter wash down, water sump wastes, pyrites, material removed from the coal pile runoff pond (once per year), plant floor drain wash down, boiler chemical cleaning wastes (once per 7-8 years), reverse osmosis system reject and rainfall/runoff from the area surrounding the pond.

3. Records Review

3.1. General

A review of the available records related to design, construction, operation and inspection of the Upper Pond Dam was performed as part of this assessment. The documents provided by Vectren for review are as follows:

Document	Author	Date
Construction in a Floodway Permit Application – Proposed Modifications to the Existing Ash Pond	ATC Associates, Inc.	2002
Proposed Ash Pond Modifications – Phase I (10 Drawings)	ATC Associates, Inc.	2003
Proposed Ash Pond Modifications – Phase I (Technical Specifications)	ATC Associates, Inc.	2003
Modifications to the Existing Ash Pond – Phase II of Construction (5 Drawings)	ATC Associates, Inc.	2007
Modifications to the Existing Ash Pond – Phase II (Technical Specifications)	ATC Associates, Inc.	2007
Increase Ash Pond Capacity – Phase II Survey Data (2 Drawings)	Three I Engineering, Inc.	2009
Construction Quality Control Report – Phase II	ATC Associates, Inc.	2009
Visual Site Inspection Report	ATC Associates, Inc.	2009

3.2. Design Documents

Review of the 2002 ATC Floodway Permit Application and the 2007 design drawings for the Upper Pond Dam revealed several notable items, as follows:

- The Upper Dam embankment design included an upstream zone of compacted fly ash, a central compacted cohesive soil core, and a downstream zone of compacted bottom ash. The embankment was placed over a foundation of uncompacted loose coal ash, with a biaxial geogrid to support the initial lifts of embankment placement. The embankment side slopes are 5H:1V, which is very flat by dam engineering standards and resulted in adequate safety factors for slope stability.

- During Phase I construction of the Upper Pond Dam, concerns were raised over the proposed fly ash zone and the design was subsequently modified to incorporate more natural soil and less fly ash.

- The 2002 Permit Application recognized that the loose saturated pond ash is susceptible to liquefaction under earthquake conditions and noted that "there is a possibility that the proposed embankment could be significantly damaged due to earthquake-induced liquefaction of the foundation soils." However, it also noted that this condition was acceptable to the owner since a failure of the Upper Dam would not cause any significant downstream damage and due to the low probability of a seismic event during the relatively short estimated life cycle (about 15 years) for the Upper Pond.

3.2.1. Spillway Design Flood

According to the 2002 Permit Application, the spillway system for the Upper Dam was designed to pass the Spillway Design Flood (SDF), which was established as the 50% 6-hour PMF, with more than 2 feet of freeboard at the peak SDF elevation (El. 461.72 vs. top of dam El. 464).

3.2.2. Stability Analysis

Slope stability analysis results for the Upper Dam are included in the 2002 Permit Application. These analyses were performed for the following loading conditions:

- Static steady-state seepage
- End-of-construction
- Earthquake

The calculated safety factors of 2.46 for the steady state seepage condition, 1.34 for the end-of-construction case, and 1.16 for earthquake loading exceed the typical minimum allowable safety factors for these loading conditions. However, the earthquake loading condition does not account for liquefaction potential, which was discussed in Section 3.2 above.

3.2.3. Summary of Design Modifications

The only design modification noted in our review of the available documents is the substitution of natural soils for portions of the embankment that were designed as Fly Ash and Bottom Ash zones. Several repairs were undertaken to correct deficiencies identified in the recent ATC inspection report, but these are considered to be maintenance items rather than modifications.

3.2.4. Instrumentation

The available documents do not contain any information regarding installation of instrumentation for the Upper Pond Dam, therefore, it is presumed that there is none. The Three I Engineering, Inc. drawings provide measured elevations taken at survey points along the Upper Dam, but it is not known if these points were established with fixed monuments or any sort of grid system. The surveyed elevations indicate that some settlement of the embankment may have occurred, but no interpretation of the results was provided in any of the documents that we reviewed.

3.3. Previous Inspections/Analyses

The previous analyses that were presented in the available reports are described in the Spillway Design Flood and the Stability Analysis subsections above. It is our understanding that IDNR Dam Safety has not inspected the Upper Dam during its most recent site inspections; therefore, the only inspection report that addresses the Upper Dam is the 2009 ATC report. This report concluded that the dam is in satisfactory condition and only recommended minor repairs and maintenance measures (primarily embankment erosion repairs).

3.4. Operator Interviews

During the inspection, Vectren representatives described the general operations of the facility. It appears that these operations are consistent with standard dam safety practices. According to Vectren, maintenance personnel perform quarterly inspections of the dam and appurtenant structures.

4. Visual Inspection

4.1. General

On June 3 2009, the following individuals were present to visually inspect the Upper Ash Pond Dam (Upper Dam):

- Randy Simons – Vectren
- Lisa Messinger – Vectren
- Jim Peckenpaugh – Vectren
- Jim Kohler – USEPA
- George Ritchotte – IDEM
- Bob Bowers – O'Brien & Gere
- Rob Ganley – O'Brien & Gere

The weather on the date of the inspection was overcast and approximately 75 degrees. A field checklist was prepared by O'Brien & Gere to summarize the visual inspection and is included as Appendix A. Photographs were taken by both USEPA and O'Brien & Gere; an electronic copy of both photo sets was provided to Vectren after the visual inspection. Pertinent photos taken by O'Brien & Gere are included as Appendix B.

4.2. Summary of Findings

Vectren had recently retained ATC Associates (ATC) to perform a visual inspection of both ash dams, which was conducted in March 2009. Results of this inspection were reviewed by O'Brien & Gere prior to the visual inspection. Many of the recommendations presented in the ATC report had already been addressed by Vectren prior to this visual inspection. Comments related to the improvements that have been implemented are provided herein. During the visual inspection of the Upper Pond Dam, the crest and portions of the upstream and downstream embankments were walked and representative features observed. These features are described below.

Spillway System - The principal spillway, which consists of a 60-inch diameter RCP drop inlet at El. 460 with a 24-inch diameter outlet pipe, was discharging at the time of inspection. The outlet pipe discharges into a rock-lined channel which leads to the Lower Pond. The emergency spillway is a 30-foot wide trapezoidal earth channel with 5H:1V side slopes and a crest elevation of 461.5. Both portions of the spillway system appeared to be in good condition; however, some overgrowth of vegetation was observed in the emergency spillway outlet channel.

Upper Pond – The dam crest is lined with crushed stone and appeared to be in good condition. Fly ash from the generating station was discharging as a black-ish stream from a pipe on the embankment into the southwestern part of the pond. The bottom ash pipe adjacent to the fly ash discharge pipe was not flowing. The surface of the pond in the vicinity of the ash discharge pipes had a solidified black residue from the ash material. Influent from the fly ash line flows over the solidified material towards the principal spillway outlet in the southeast corner area of the pond.

Earth Embankment - The crest and upstream embankment slope appear to be in generally good condition, with some repairs related to the ATC report recommendations noticeable. The upper portion of the slope is lined with riprap, which appears to be providing adequate erosion protection.

Downstream Slope - The downstream embankment slope appears to be in satisfactory condition, also with repairs related to the ATC report recommendations noticeable. Erosion gullies that had developed from storm runoff had been filled with earth, seeded and mulched; however, additional gullies were forming at the base of the straw mat component of the repair work. The downstream toe of the Upper Dam terminates at the edge of the Lower Pond, such that the toe is slightly submerged. The principal spillway outlet from the Upper Pond discharges into the eastern end of the Lower Pond and, at the time of inspection, flow was entering the Lower Pond from the Upper Pond. At one location, the scrubber blowdown outlet channel along the edge of the Lower Pond has caused some erosion of the channel edge in the general vicinity of the downstream toe of the Upper Dam.

5. Conclusions

In general, the Upper Pond Dam appears to be in satisfactory condition and is well-maintained, as demonstrated by the erosion repairs that were completed shortly after the ATC inspection report was issued. Based on our visual inspection of the dam and appurtenant structures and our review of the available drawings and reports, our conclusions regarding the major features of the dam are as follows:

1. Earth Embankment – The earth embankment appears to be in fairly good condition. The crest does not exhibit any obvious signs of settlement and the upstream and downstream slopes are flatter than most dams, which enhances the stability of the embankment. However, the results of the elevation monitoring conducted recently is not clear from the available records and should be reviewed. Three other issues should also be considered during future inspections/evaluations of the dam:

- Continuing erosion of the downstream slope could lead to reduced stability of the embankment in the future. The cause of this condition should be investigated and further remedial action should be taken.

- Although not a likely scenario, the potential for liquefaction of the foundation during seismic activity raises a dam safety concern. Consideration should be given to the development of safeguards against the consequences of foundation liquefaction.

- Erosion of the scrubber blowdown outlet channel could eventually encroach on the downstream toe of the Upper Dam; this condition should be monitored.

2. Spillway System – The drop inlet principal spillway appears to be in good condition and functioning as designed. The trash rack for the drop inlet opening is somewhat smaller than typical spillway racks, but should be adequate for the limited amount of runoff experienced by the Upper Pond. The emergency spillway also appears to be in good condition, with a riprap cover that should adequately protect the outlet channel against erosion during heavy flows. Some overgrowth of vegetation is evident in the outlet channel, but should not significantly inhibit flow through the spillway.

6. Recommendations

Based on the above conclusions, O'Brien & Gere recommends some further dam safety evaluations and potential upgrades/repairs. These recommendations are grouped into the following categories, based on the urgency and nature of the issues to be addressed.

6.1. Urgent Action Items

None of the recommended evaluations and/or improvements are considered to be urgent, since the issues identified above do not appear to threaten the integrity of the dam in the short term.

6.2. Long Term Improvement/Maintenance Items

Several further studies should be performed and, depending on the results of the studies, consideration should be given to long-term dam safety improvements. The issues to be addressed are as follows:

1. The effectiveness of the erosion repairs along the downstream slope of the dam should be evaluated once the grass vegetation has become adequately established in these areas. If the erosion persists, consideration should be given to use of better topsoil, placement of more erosion-resistant vegetation, regrading of the crest to promote more uniform runoff, use of turf reinforcement matting and/or placement of stone/rock along the lower portion of the slope.

2. The potential liquefaction issue should be investigated to establish a procedure for monitoring and/or protection against the consequences of foundation liquefaction during a seismic event. The procedure may be as simple as inspection of the earth embankment during or immediately after any measurable earthquake, but some measures should be implemented to address this issue.

3. The vegetation in the emergency spillway outlet channel should be removed to prevent further overgrowth and possible future blockage of the outflow path.

6.3. Monitoring and Future Inspection

The survey point data obtained by Three I Engineering should be reviewed to determine if the results are relevant to embankment settlement and if further monitoring should be undertaken. Such monitoring may already be part of an existing inspection and maintenance plan, but the available documentation is not clear on this issue.

The erosion along the edge of the scrubber blowdown outlet channel should be monitored during future inspections to verify that the erosion does not impact the downstream toe of the Upper Dam.

6.4. Recommended Schedule for Completion of Action Items

As noted above, the erosion repair effectiveness should be evaluated after the new grass cover has become established, which will probably not be until at least October. The other issues should be addressed within the next 12 to 18 months, with recommended improvements to be implemented within the next 2 to 3 years.

6.5. Certification Statement

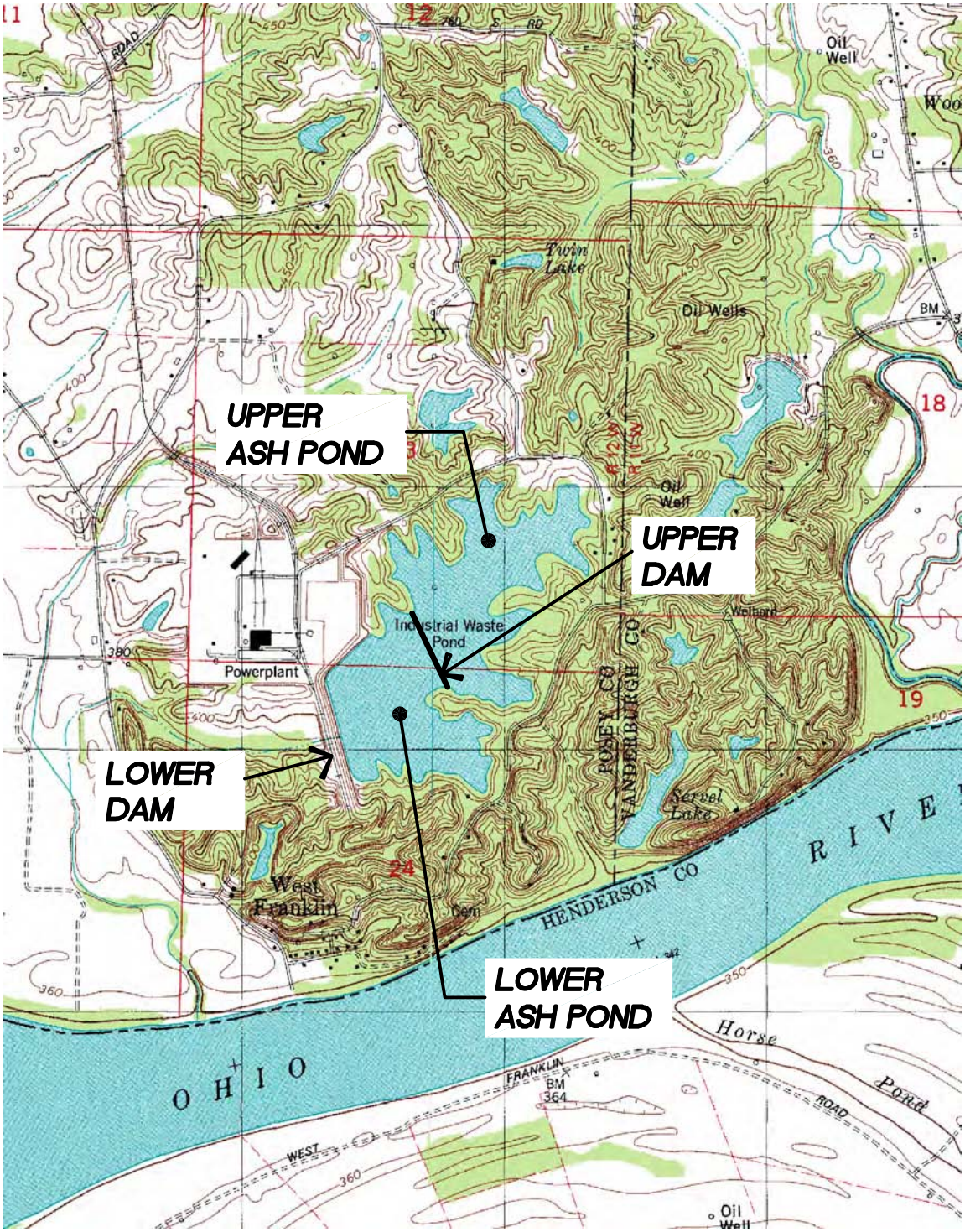
I acknowledge that the Upper Ash Pond Management Unit referenced herein was personally inspected by me on June 3, 2009 and was found to be in the following condition:

SATISFACTORY
FAIR
POOR
UNSATISFACTORY

Signature: Robert C. Ganley

Robert C. Ganley, PE — September 11, 2009
Date

FIGURE 1



A.B. BROWN GENERATING STATION
UPPER AND LOWER ASH POND DAMS

LOCATION PLAN

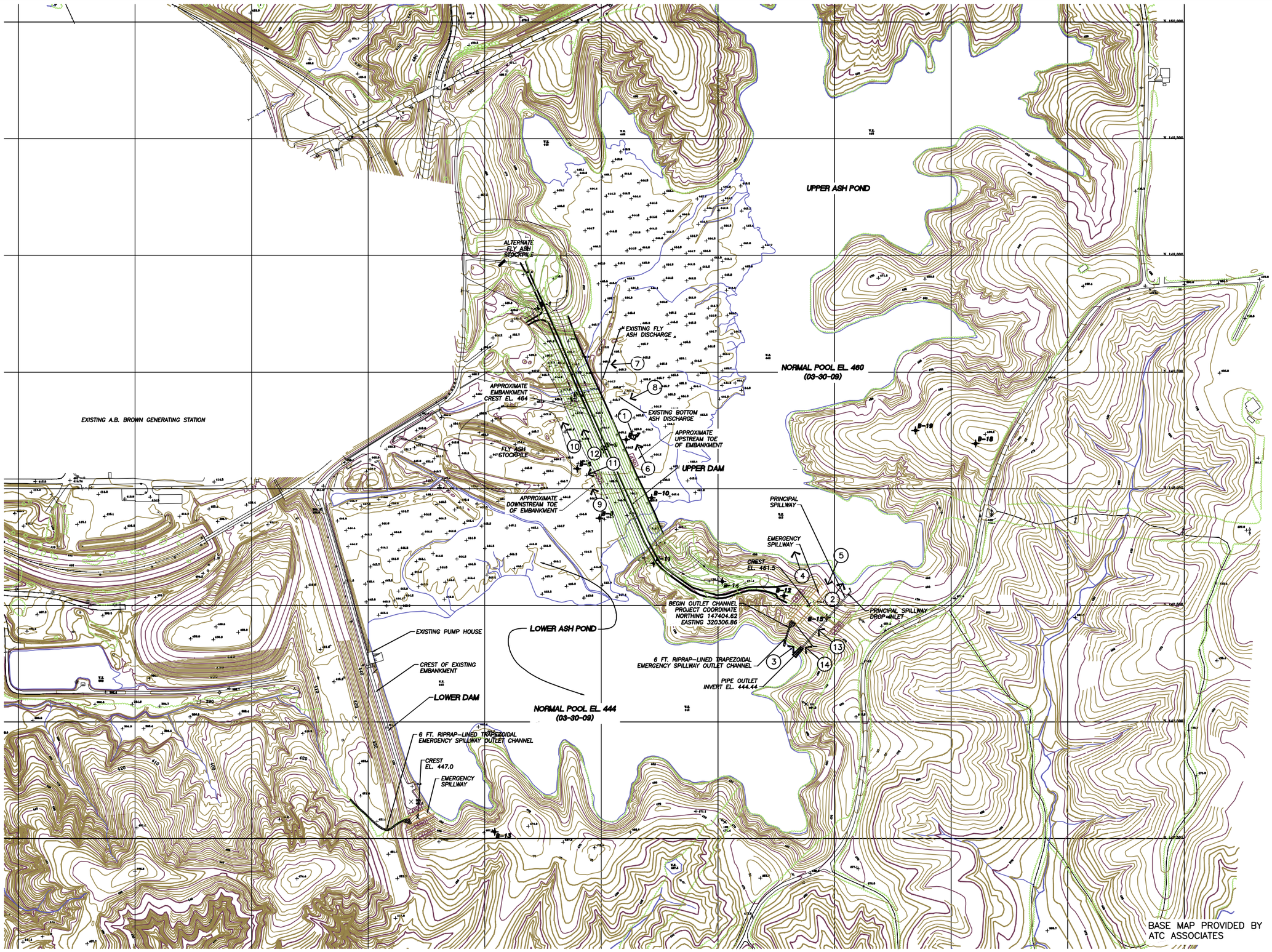
NOT TO SCALE

5851.44642-001
JULY 2009

O'BRIEN & GERE

2009 © O'Brien & Gere Engineers, Inc.

FIGURE 2



BASE MAP PROVIDED BY ATC ASSOCIATES

1"=200' 200 0 200

LEGEND:

- EXISTING TOPOGRAPHY
- PROPOSED TOPOGRAPHY
- BENCHMARK
- B-1 BORING SYMBOL
- RIPRAP SYMBOL
- 7 PHOTO LOCATION (ARROW SHOWS ORIENTATION)

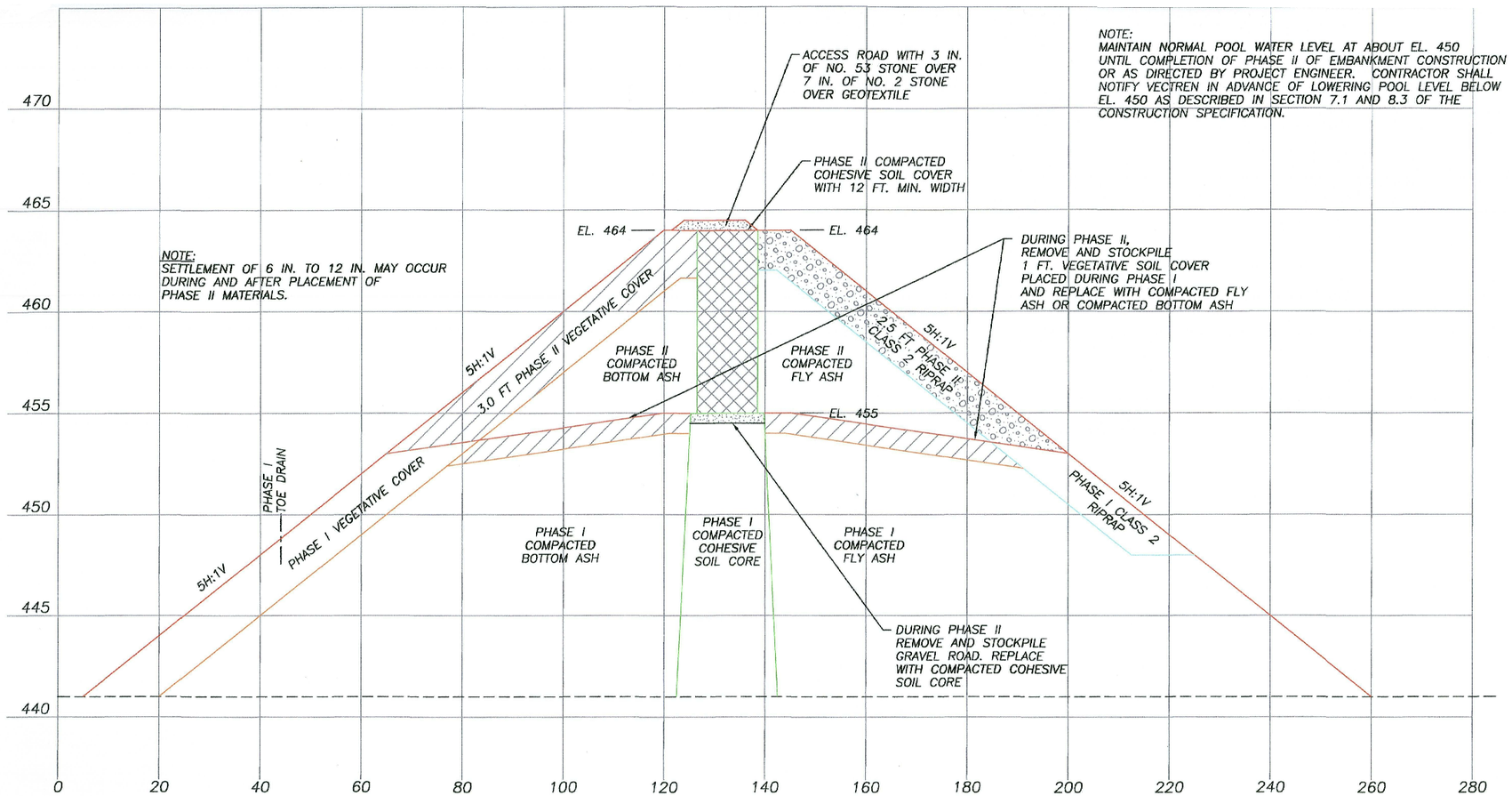
A.B. BROWN GENERATING STATION UPPER ASH POND DAM

SITE PLAN

FILE NO. 5851.44642-003
JULY 2009

O'BRIEN & GERE

2009 © O'Brien & Gere Engineers, Inc.



TYPICAL EMBANKMENT CROSS SECTION

HORIZONTAL SCALE: 3/4" = 20'-0"
VERTICAL SCALE: 3/4" = 5'-0"

REFERENCE: ATC ASSOCIATES INC., DRAWING NO. G-1469, SHEET NO. 5, TYPICAL DETAILS, MODIFICATIONS TO THE EXISTING ASH POND – PHASE II OF CONSTRUCTION, JUNE 8, 2007.

US EPA &
LOCKHEED MARTIN

COAL COMBUSTION WASTE
IMPOUNDMENT INSPECTIONS

EVANSVILLE, INDIANA

AB BROWN
POWER PLANT
UPPER EMBANKMENT
SECTION

3/4"=1'-0" 1 0 1

VERTICAL EXAGGERATION = 4X

FILE NO. 5851/44642-002C
JULY 2009

O'BRIEN & GERE

2009 © O'Brien & Gere Engineers, Inc.

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07/06/09

APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Vectren A.B. Brown Station	Date: June 3-4, 2009
Unit Name: Upper Ash Pond	Operator's Name: Vectren Power Supply
Unit I.D.:	Hazard Potential Classification: High Significant Low
Inspector's Name: Robert Ganley - Robert Bowers	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Quarterly		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	460		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	460		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	461.5		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	464		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		NA	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # 0052191 INSPECTOR Robert Ganley/Robert Bowers
Date June 3-4, 2009

Impoundment Name Upper Ash Pond
Impoundment Company Vectren Power Supply
EPA Region V
State Agency (Field Office) Addresss IDNR 402 West Washington Street
Indianapolis, IN 46204

Name of Impoundment Upper Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Coal Ash Impoundment

Nearest Downstream Town : Name Mount Vernon, IN
Distance from the impoundment 7 Miles
Impoundment Location:
Longitude 87 Degrees 42 Minutes _____ Seconds
Latitude 37 Degrees 54 Minutes _____ Seconds
State IN County Posey

Does a state agency regulate this impoundment? YES X NO _____

If So Which State Agency? IDNR

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

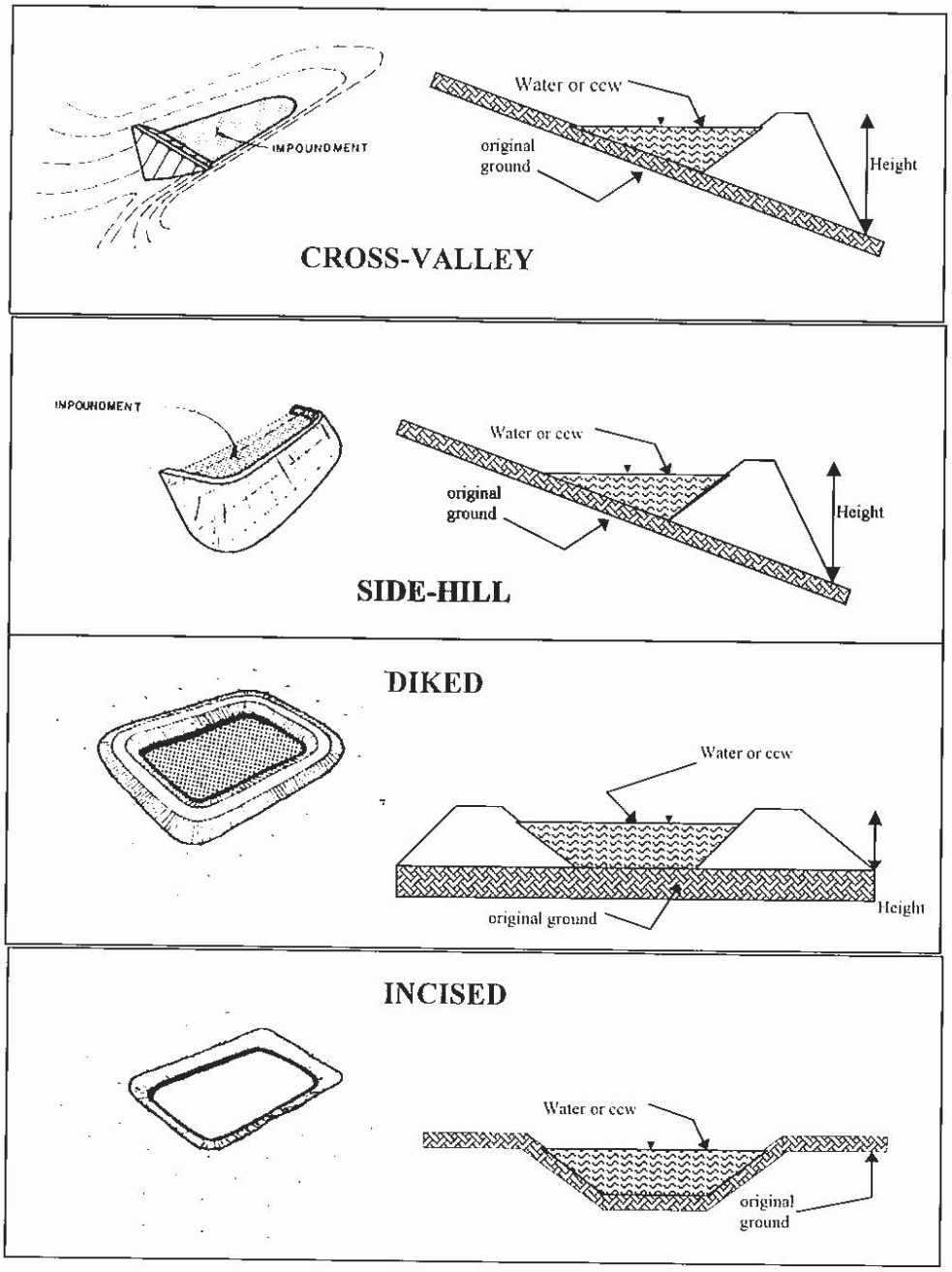
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Same classification as Lower Ash Pond Dam, located immediately downstream.

CONFIGURATION:



X Cross-Valley
____ Side-Hill
____ Diked
____ Incised (form completion optional)
____ Combination Incised/Diked

Embankment Height 22 feet
Pool Area 103 acres
Current Freeboard 4 feet

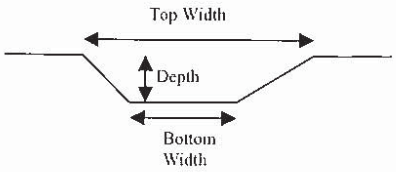
Embankment Material fly ash, bottom ash, silt, clay
Liner None
Liner Permeability NA

TYPE OF OUTLET (Mark all that apply)

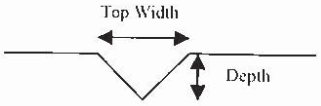
X **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

2.5' depth
30' bottom (or average) width
55' top width

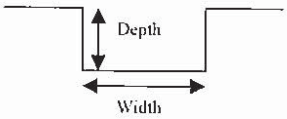
TRAPEZOIDAL



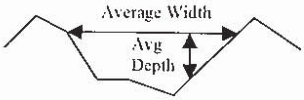
TRIANGULAR



RECTANGULAR

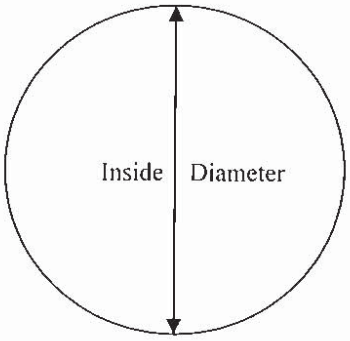


IRREGULAR



X **Outlet**

24" inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
X plastic (hdpe, pvc, etc.)
_____ other (specify) _____

Is water flowing through the outlet? YES X NO _____

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By ATC Associates, Inc.

Has there ever been a failure at this site? YES _____ NO X

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES _____ NO X

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO X

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

APPENDIX B

Photographs

Photo 1- Upper Ash Pond Dam Crest Looking South

Photo 2- Principal Spillway Drop Inlet

Photo 3- Principal Spillway Outlet

Photo 4- Upper Ash Pond Looking Northwest

Photo 5- Upstream Embankment Looking West Near Principal Spillway. Note Repairs on Embankment

Photo 6- Dam Crest and Upstream Rip-Rapped Embankment Looking Northwest

Photo 7- Southwest Area of Ash Pond with Fly Ash Discharge and Solidified Waste Material

Photo 8- Southwest Area of Ash Pond with Bottom Ash Discharge Pipes and Solidified Waste Material

Photo 9- Downstream Embankment Area Looking Northwest. Note Repaired Areas

Photo 10- Downstream Embankment Area Looking Northwest. Note Repaired Areas

Photo 11- Downstream Embankment Area Looking South. Note Repaired Area and Lower Pond

Photo 12- Downstream Embankment Area Looking Northwest. Note repaired Area and Lower Pond with Channel for White-ish Scrubber Blowdown at Toe of Upper Dam Embankment

Photo 13- Crest of Upper Ash Pond Dam at Emergency Spillway Looking Northwest

Photo 14- Emergency Spillway Looking West. Note Vegetation Growth in Spillway