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Final Report

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

Lockheed Martin
Contractor for the USEPA

September 2009

O'BRIEN & GERE

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5851/44642

Final Report

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

Lockheed Martin
Contractor for the USEPA

Robert R. Bowers, P.E.
Vice President

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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 of 2008, the Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of 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 Lockheed Martin 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 downgradient 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 5 years.

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- 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 Lower 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.

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2. Project/Facility Description

2.1. Identification of Management Unit

The Lower Ash Pond (Lower 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 for Location Plan). The dam is permitted by the Indiana Department of Natural Resources (IDNR) State ID # 65-7 and Permit # D-4405 Rev 1. The dam was constructed in 1978 to form an impoundment by blocking off a natural ravine. The Lower Pond is located downstream of the Upper Ash Pond (Upper Pond). The Upper Pond was formed by the Upper Dam, which was constructed in two phases (2003 and 2007). The impoundment area of the Lower Pond is approximately 53 acres. A Site Plan is provided as Figure 2.

2.2. Hazard Potential Classification

The Lower Dam has been designated by the IDNR as a Significant Hazard structure. 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.

2.3. Lower Ash Pond Dam

As indicated above, the Lower Pond was impounded by an earthen embankment constructed across a natural ravine. The embankment is approximately 1540 feet long, 20 feet wide at the crest and 70 feet high at its maximum section (crest elevation 450 feet above MSL). The upstream slope of the embankment is approximately 3 horizontal to 1 vertical (3H: 1V) above El. 420 and 5H: 1V below El. 420, and the downstream slope is approximately 3H: 1V above the berm and approximately 3.5H: 1V below the berm. The downstream slope berm is about 100 feet wide at EL 414, and the toe of the berm varies in elevation with the natural ground, with the low point at EL 400. The berm was reportedly constructed to accommodate a rail line, which has not been constructed. The design and as-built plans show a 2-foot thick sand layer located approximately 2.5 feet below the berm surface and continuing up the slope to approximately EL 432. The principal spillway system includes a 36-inch diameter reinforced concrete pipe (RCP) drop inlet, which discharges through a 36-inch diameter RCP leading to a drainage channel that is tributary to the Ohio River. Since the Upper Pond Dam was constructed, the Lower Pond only receives scrubber blowdown, water treatment blowdown and discharge from the Upper Pond. The overflow elevation of the drop inlet spillway is EL 444, which results in freeboard to the dam crest of approximately 6 feet. An ultrasonic level monitoring device monitors water level in the impoundment. A skimmer pipe system recirculates the Lower Pond water to the generating station for reuse and the Vectren staff generally maintain the pond level around EL 443; therefore, the principal spillway is not in use during normal operations. An emergency spillway consisting of a trapezoidal opening with a 30-foot bottom width at crest EL 447 and 5H: 1V side slopes was installed at the same time as the Upper Pond construction. According to Vectren staff, this emergency spillway has never been used.

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3. Records Review

3.1. General

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

Document	Author	Date
Soils Investigation	NFS/National Soil Services, Inc.	1974
Soil Boring Location Plan and Soil Profiles	Mid-Valley, Inc.	1974
Dam Design (4 Drawings)	Mid-Valley, Inc.	1975/1976
Phase I Inspection Report	US Army Corps of Engineers	1980
Seepage Investigation	Harding Lawson Associates	1982
Proposed Grout Curtain Installation	STS Consultants Ltd.	1983
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

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3.2. Design Documents

Review of the 1974 Soils Investigation Report and boring logs/soil profiles and the 1975/1976 dam design drawings revealed several issues, as follows:

- The drawings show a minimum of 3 feet of stripping of the existing ground surface and construction of a cutoff trench to a minimum 20-foot width and 5-foot depth, which indicates that appropriate foundation treatment measures were incorporated into the design.
- The layout of the Seepage Collection Zone (sand drainage layer) shown in the Soils Investigation Report is different than the layout shown in the design drawings and subsequent reports. The Soils Investigation Report envisioned a drainage system with a vertical chimney section at the upstream end of the drain, but the design drawings show a drainage layer that parallels the downstream slope and berm crest just beneath the surface.
- The Soils Investigation Report also shows the Seepage Collection Zone daylighting to the surface of the slope at its downstream end, but the design drawings show a 6" topsoil layer over the drain outlet.
- The design drawings show a system of piezometers for measurement of pore pressures during construction of the earth embankment. It is not clear if the abandoned piezometers observed during the visual inspection remain from the original construction or from the subsequent seepage analysis.
- The design drawings included a 2-foot camber in the embankment crest, such that the crest was constructed to El. 452 in the middle section and tapered to El. 450 at the abutments. Three (3) surface monuments were also shown along the crest to monitor settlement, the results of which are unknown.

3.2.1. Spillway Design Flood

During our review of the design documents, we were not able to uncover any information related to spillway design. The Soils Investigation Report states that "The spillway consists of an overflow weir and collection basin, discharging through a 78 inch diameter corrugated pipe." However, the spillway system shown in the design drawings (and actually constructed) is a 36" diameter reinforced concrete riser and outlet pipe. No documentation appears to be available regarding the change in design concept between the Soils Investigation Report and the design drawings.

The 2002 Permit Application (ATC) includes hydrologic/hydraulic analyses of both dams and states that the Spillway Design Flood (SDF) was established as the 50% 6-hour Probable Maximum Precipitation (PMP) of 14.2 inches with NRCS Type B distribution, which was accepted by the IDNR – Division of Water in 2002. The storm flows were modeled by means of SEDCAD4, which is not a computer model that is commonly used in the dam safety industry. However, we contacted Suzanne Delay of the IDNR who confirmed that this methodology had been accepted by the Division of Water, although she could not recall the actual circumstances of this acceptance.

3.2.2. Seepage and Stability Analyses

The 1974 Harding Lawson Associates (HLA) report provided a summary of extensive seepage investigations performed for the Lower Ash Pond Dam. These investigations addressed three main areas: the coal hopper area at the right abutment, the main embankment and the coal storage area. The report concluded the following:

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- Coal Hopper Area - Ground water problems in the coal hopper area are due to reservoir seepage through the upper bedrock layers at the right abutment. The appropriate remedial treatment for reducing seepage in this area would be grouting of the bedrock.
- Coal Storage Area - High ground water levels in the coal storage area are due primarily due to poor drainage conditions. A blanket drain underlain by a series of drainage pipes would assist with this problem after the seepage cutoff system described above is installed.
- Main Embankment - Although seepage through the main embankment does not appear to significant, two measures should be considered to reduce the potential for development of excess pore pressures and seepage within the embankment. These would include placement of a trench drain along the outlet from the Seepage Collection Zone and installation of several new piezometers and monitoring of the new and any existing operable piezometers.

The 1983 report by STS Consultants summarized field construction services provided during the proposed installation of a grout curtain at the right abutment; however, according to the report, questions regarding the effectiveness of this grout curtain arose during the construction process and the program was abandoned. Based on the available records, it does not appear that any of the other seepage mitigation measures recommended by HLA were ever implemented.

Slope stability analyses were performed for the Soils Investigation of the Lower Dam in 1974. These analyses were based on existing foundation conditions and properties obtained from lab testing of remolded soil samples intended to simulate the constructed embankment conditions. These analyses resulted in safety factors that meet current criteria for slope stability, even under somewhat conservative loading conditions. In 1982, HLA performed new stability analyses for the section near the right abutment where the downstream slope had been steepened for construction of a turnaround at the right abutment. These analyses indicated that this embankment section met stability criteria. The HLA report also noted that soil strengths obtained from lab testing of samples taken during their subsurface investigation were higher than the values assumed in the original analyses, further substantiating the conservatism of the embankment design.

3.2.3. Summary of Design Modifications

The only design modifications noted in the available records since the original construction of the Lower Pond Dam are the drainage system installed in the Coal Hopper area and the installation of the emergency spillway at the left abutment, which was implemented in conjunction with the construction of the Upper Pond Dam in 2003. This emergency spillway provides additional discharge capacity for the Lower Pond which would allow for passing of flows that would result from an extreme storm event (greater than the 50% 6-hour PMP) or from a failure of the Upper Pond Dam. According to the 2002 ATC Permit Application report, the SDF (peak El. 446.76) would not activate the emergency spillway (crest El. 447).

3.2.4. Instrumentation

As noted above, the available records indicate that 27 pneumatic piezometers were installed prior to construction of the Lower Ash Pond Dam to monitor pore pressures in the foundation and the earth embankment during construction. However, HLA reported that 1/3 of these piezometers were not operable in 1982 and that the brittleness of the plastic tubing was causing these piezometers to deteriorate rapidly. During its 1982 seepage investigation, HLA installed seven (7) additional “open

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standpipe" piezometers in the vicinity of the right abutment to monitor seepage conditions in the Coal Hopper area. It is believed that these are the piezometers that were observed during the visual inspection. According to Vectren personnel, none of these piezometers appear to be operable and water level readings have not been taken in recent years.

In addition, the design drawings show 3 surface monuments to be installed for monitoring of settlement of the crest of the embankment. These monuments were not observed during the visual inspection and it is not known if these monuments were actually installed or if readings were taken after construction was completed.

3.3. Previous Inspections/Analyses

The previous analyses that were presented in the available reports are described in the Spillway Design Flood and the Seepage and Stability Analyses subsections above. The 2009 ATC Inspection Report included an appendix with the most recent IDNR inspection reports. All of these reports indicated that the Lower Ash Pond Dam appears to be in satisfactory condition and recommended only minor repairs and maintenance measures. The ATC report also recommended further study and remedial measures to reduce/eliminate the ponding of water on the berm and the saturation of the downstream slope of the berm.

3.4. Operator Interviews

During the visual inspection, Vectren representatives described the general operations of the facility. As noted above, they stated that the pond level is generally maintained about one foot (El. 443+/-**)** below the overflow elevation of the drop inlet (principal) spillway, such that the principal spillway is only activated during major storm conditions.

3.5. Site Geology

The 1982 HLA report states that site soil deposits consist of loess and lacustrine facies of the Atherton formation in Indiana and are Pleistocene and Recent aged and composed of silt, clay and sand sized materials. The site area has not been subjected to glaciation. Underlying bedrock consists of the Pennsylvanian aged lower part of the McLeansboro group composed of shale, siltstone, sandstone, limestone and thin coal strata, with a total thickness of 200 to 350 feet. Bedrock in the area dips regionally in a western direction. A normal fault trending northeast-southwest has been mapped about two miles northwest of the site.

The report also states that the project site is located within Zone 3 of the Seismic Zone Map of the Contiguous States and that it could experience major damage in the event of seismic activity.

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4. Visual Inspection

4.1. General

On June 4, 2009, the following individuals were present to visually inspect the Lower Ash Pond Dam:

- Lisa Messinger – Vectren
- Jim Peckenpaugh – Vectren
- Jeff Collier – 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 cloudy and approximately 65 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 pond 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 Lower Pond Dam, the crest and downstream slope of the dam were walked and representative features observed. These features are described below.

Spillway System - The principal spillway, which consists of an upper 36-inch diameter gooseneck metal pipe connected to a 36" RCP riser and outlet pipe, was not discharging. According to Vectren staff, they maintain the pond level below the spillway inlet by pumping water to the generating station for reuse. The recirculation pumping station is located adjacent to the principal spillway. The pond level was also about 4 feet below the crest of the emergency spillway on the dates of the inspections. According to Vectren staff, this spillway has never been activated, which is to be expected since it is above the SDF level. Reed-like vegetation was observed growing in the emergency spillway channel; however, according to the Vectren staff, this vegetation had been cleared fairly recently and had re-established itself in a short period of time.

Lower Pond – The crest of the dam was lined with crushed stone and appeared to be in good condition. The upper (NE) end of the Lower Pond adjoins the downstream toe of the Upper Ash Pond Dam. The outlet from the Upper Pond is located in the eastern end of the Lower Pond. At the time of the inspections, flow was entering the Lower Pond from the Upper Pond. The scrubber blowdown from the generating station was discharging as a white-ish stream into the NE part of the pond. The

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eastern end of the pond had a solidified white-ish residue from the scrubber waste. The NW part of the pond has a black-ish ash-like residue which had solidified and occupied a portion of the pond, similar to the white-ish residue to the east. The black-ish area was solid enough that a bulldozer was parked on it during the inspection.

Upstream Slope - A portion of the upstream slope of the embankment had smaller stone, rather than the rip rap which was placed on the majority of the embankment. This area appeared to be intended for access, possibly related to the pond dredge line. Significant reed-like vegetation (phragmites) was also observed along the water line in the vicinity of the principal spillway, precluding visual inspection of the upstream embankment.

Downstream Slope - The downstream slope of the embankment is comprised of two levels, separated by an approximate 100-foot wide berm. The upper portion of the slope appeared to be in generally good condition, with some erosion repairs related to the ATC report noticeable. The lower portion of the slope had several areas where soft, saturated earth was evident. Ruts from tire tracks were noted in some of these areas and water tended to deposit in the ruts. It is unknown if the wet areas are a result of seepage through the embankment or from inadequate drainage of the berm surface. An area to the north end appeared to have some miscellaneous rip rap deposited, as well as vegetation around a utility pole. At the toe of the slope, the outlet from the principal spillway was observed with some minor leakage occurring through the pipe. Trees are growing on the lower part of the embankment slope, to the south of the principal spillway outlet channel.

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5. Conclusions

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

1. Earth Embankment – The earth embankment appears to be in good condition. The upstream and downstream slopes are relatively flat, the crest and downstream slope are well-maintained and the downstream berm provides an added measure of stability. However, several conditions need to be further evaluated and repairs/upgrades should be considered. These include:

    - The phragmites vegetation growing from the upstream slope in the vicinity of the normal pool elevation obscures the slope and inhibits thorough inspection of the embankment in this area.
    - The saturated areas on the lower portion of the downstream slope appear to be a result of drainage from the Seepage Collection Zone; however, it is not clear as to whether the flow from this drainage system is due to seepage through the embankment or from rain water seeping through the ground surface and into the Seepage Collection Zone. This saturation can reduce the stability of the lower slope and create maintenance difficulties which; therefore, further investigation of this situation should be conducted.
    - Ponding of water on the berm surface indicates that the berm does not have sufficient slope for adequate drainage.
    - Trees growing from the lower portion of the downstream slope (to the south of the outlet channel) could threaten the integrity of the embankment, since they could be uprooted during storm conditions with significant displacement of the earth around the roots.

2. Principal Spillway – The principal spillway consists of a 36” reinforced concrete riser and outlet pipe with a metal gooseneck drop inlet that appears to be in good condition. The Vectren staff maintains the pond level about one foot below the overflow elevation of the drop inlet, therefore, the principal spillway was not flowing on the dates of the inspections. Some minor leakage was evident at the outlet end of the pipe; however, the source of this leakage could not be ascertained and this condition may have been a result of ponded water at the toe of the dam infiltrating the pipe and subsequently receding.

3. Emergency Spillway – The emergency spillway appears to be in satisfactory condition; however, reed-like vegetation growing in the outlet channel could impede flow in the event of a major storm. According to Vectren representatives, the emergency spillway has not been activated since its construction in 2003, which is consistent with the hydrologic/hydraulic analyses that indicate that the peak SDF (50% of 6-hour PMF) pond elevation would be below the emergency spillway crest.

4. Review of Previous Drawings and Reports – Several observations and analyses presented in past reports should be considered during future evaluations of the dam, as follows:

    - In addition to the saturated slope areas created by the Seepage Collection Zone, the 1982 HLA Seepage Investigation report identified potential seepage problems in the Coal Hopper

and Coal Storage areas. Bedrock seepage had been encountered in the Coal Hopper location as far back as the original filling of the pond and a French drain was installed in 1979 to alleviate this condition. A grouting program was also recommended to further mitigate this seepage. The grouting program was initiated in 1983, but subsequently abandoned due to concerns over the effectiveness of the program. It is our understanding that a surface drainage system was installed in the Coal Hopper area and that the fly ash lines were redirected to deposit sufficient ash to cut off seepage into this area. The combination of these measures appears to have mitigated the seepage problem; however, the available records do not document this issue.

- The original drawings and past reports describe the installation of piezometers, initially for monitoring pore pressures during construction and, later, for monitoring of the effectiveness of the proposed seepage control system. The piezometers that still remain in the embankment are reported to be inoperable, such that a means for measurement of phreatic water levels and pore pressures within the embankment is not available.

- The SDF computations presented in the 2002 ATC Permit Application are based on SEDCAD4, which is not a traditional modeling program in the dam safety industry. The preferred computer model for routing of PMF-magnitude events through a reservoir and dam is the USACE HEC-1 program or similar. However, if the methodology presented in the 2002 report is acceptable to Vectren and IDNR Dam Safety, then we see no reason to revise the analysis.

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6. Recommendations

Based on the findings of our visual inspection and review of the available historical documents for the Lower Ash Pond Dam, O'Brien & Gere is recommending some further dam safety evaluations and possible remedial actions. These recommendations are grouped into the following categories, based on the urgency and nature of the issue to be addressed.

6.1. Urgent Action Items

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the dam in the near term. However, it is recommended that further investigation of the seepage issues be undertaken within the next six (6) months.

6.2. Long Term Improvement/Maintenance Items

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

1. The records should be reviewed for documentation of the seepage mitigation measures implemented in the Coal Hopper area and any monitoring of the effectiveness of these measures. If adequate documentation does not exist, the chronology of these events should be recorded in the next inspection report or in a separate report.

2. Depending on the results of the seepage investigation described above, a drain outlet system should be designed to allow free drainage from the Seepage Collection Zone and collection/conveyance of the seepage flow. The berm surface should also be regraded as necessary to promote drainage of rainfall runoff and to minimize infiltration of surface water into the Seepage Collection Zone.

3. Evaluation of alternate methods for removal of the reed-like vegetation and phragmites growing from the upstream slope of the embankment and in the emergency spillway outlet channel should be conducted. Consideration should also be given to removal of the trees growing from the lower downstream slope of the embankment, to the left (south) of the principal spillway outlet channel.

4. The methodology for computation of the SDF should be reviewed and verified with IDNR Dam Safety (if necessary). A hydraulic evaluation should also be performed to confirm the capability of the Lower Dam spillway system to safely pass the flow that would result from a failure of the Upper Dam.

5. The purpose of the utility pole on the downstream slope and the riprap pile around it should be investigated and, if not serving any purpose, consideration should be given to removing these features that disturb the uniformity of the slope.

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6.3. Monitoring and Future Inspection

In conjunction with the seepage investigation recommended above, piezometers should be installed at various stations to allow for measurement of the phreatic surface and for future monitoring of pore pressures within the embankment. One row of piezometers should be located in the vicinity of the saturated downstream slope to evaluate if any seepage through the embankment is occurring in this area. Soil samples should also be obtained and compared to previous boring logs to assess the existence of any pervious zones that would be conducive to seepage and to establish the need for any updated slope stability analyses.

A regular dam safety inspection program should be established and consideration should be given to development of an O&M Plan that would establish a firm schedule for operations, maintenance and inspection activities.

6.4. Recommended Schedule for Completion of Action Items

As noted above, the seepage investigation should be initiated within the next six (6) months, if possible. The other recommended evaluations should be completed within the next twelve (12) to eighteen (18) months, with resulting improvements implemented within the next two (2) to three (3) years.

6.5. Certification Statement

I acknowledge that the Lower Ash Pond Dam management unit referenced herein was personally inspected by me on June 4, 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

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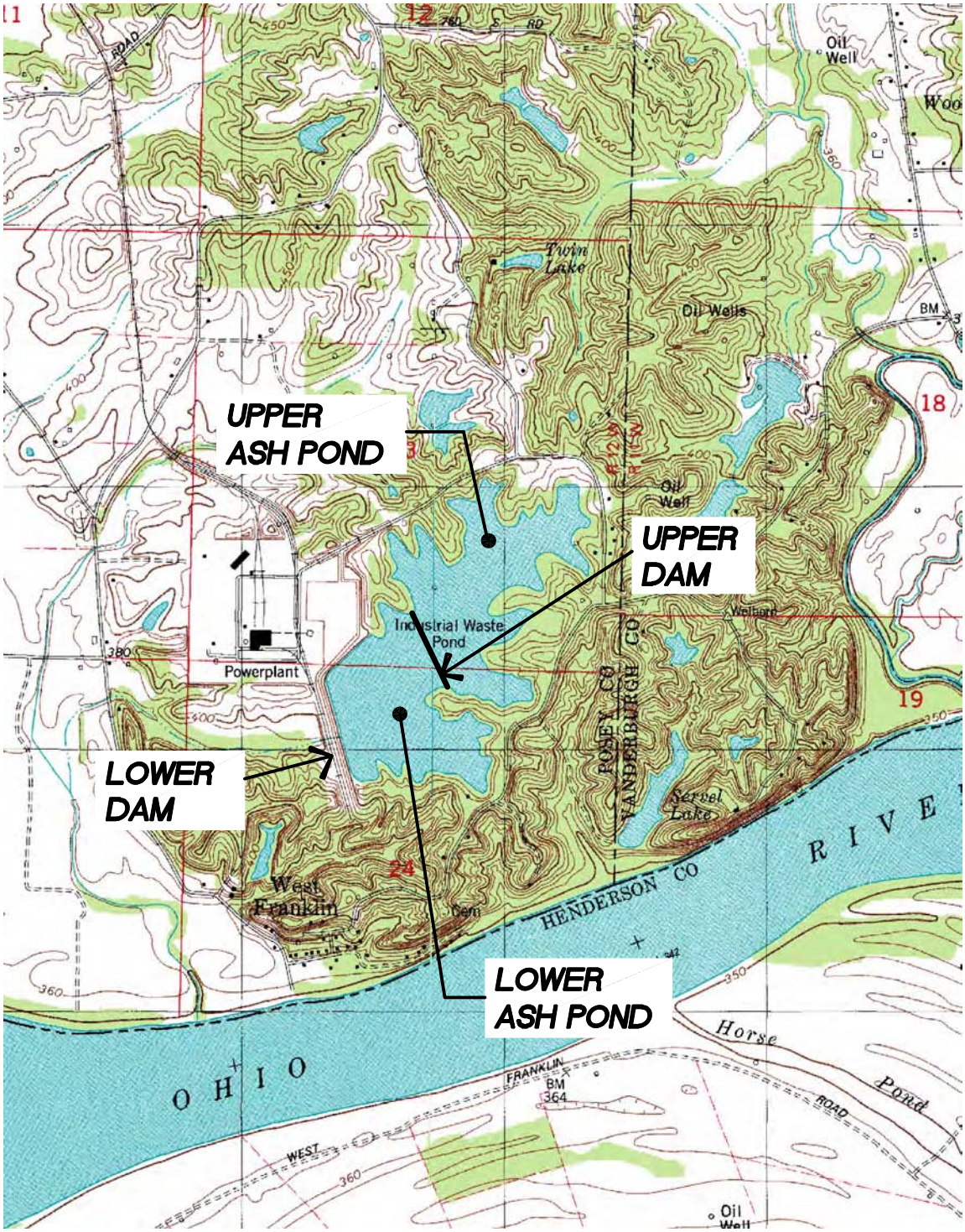
FIGURE 1



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

LOCATION PLAN

NOT TO SCALE

5851.44642-001
JULY 2009

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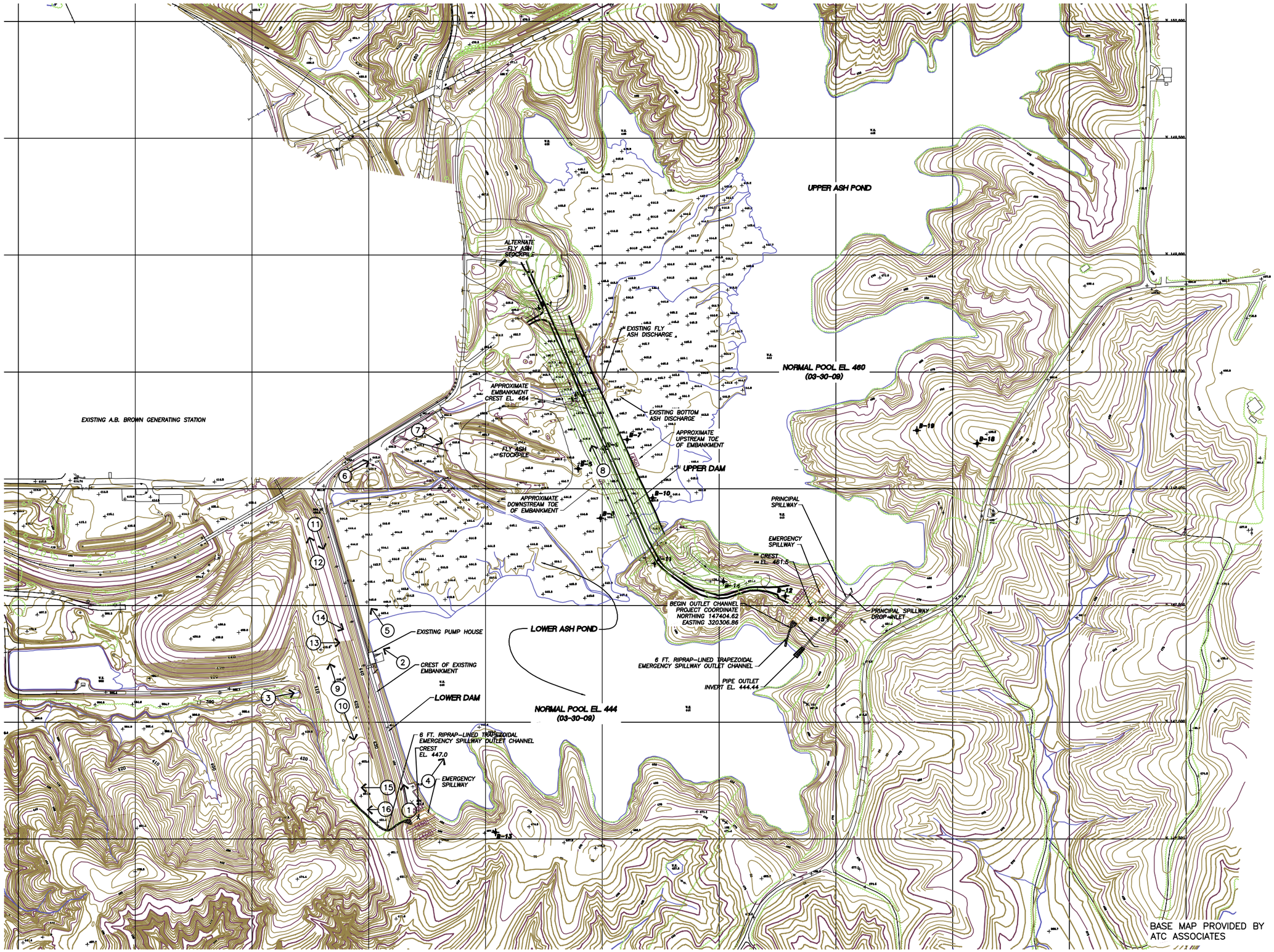
FIGURE 2



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 LOWER ASH POND DAM

SITE PLAN

BASE MAP PROVIDED BY ATC ASSOCIATES

FILE NO. 5851.44642-002
JULY 2009

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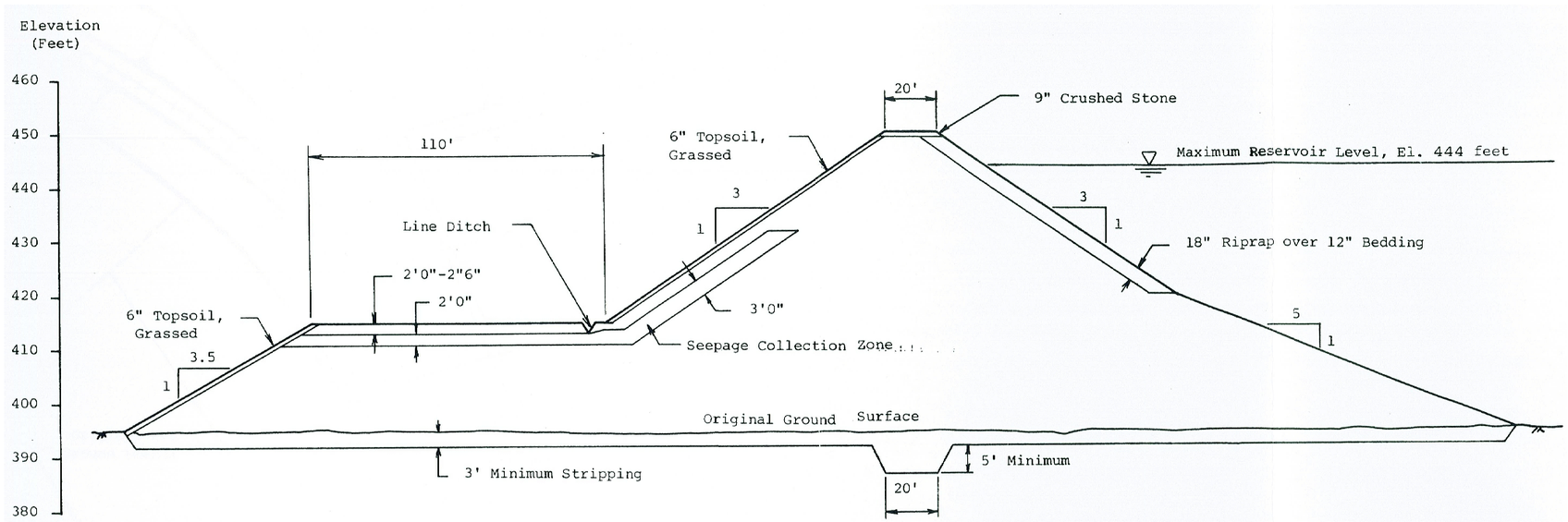
FIGURE 3



Reference: Mid-Valley, Inc., Drawing No. G-1452-1, Dam Sections and Details, January 24, 1975.

HORIZONTAL SCALE: 3/4" = 40'-0"
VERTICAL SCALE: 3/4" = 20'-0"

US EPA &
LOCKHEED MARTIN

COAL COMBUSTION WASTE
IMPOUNDMENT INSPECTIONS

EVANSVILLE, INDIANA

AB BROWN POWER PLANT LOWER EMBANKMENT SECTION

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

VERTICAL EXAGGERATION = 2X

FILE NO. 5851/44642-003C
JULY 2009

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07/06/09

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: Vectren A.B. Brown Station	Date: June 3-4, 2009
Unit Name: Lower 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)?	443		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	444		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	447		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	450		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?		NA
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
9	Trees along lower downstream slope SE of pumping station.
21	Saturated areas indicate potential seepage on SW area of lower slope.

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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 Lower 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 Lower 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 47.4 Seconds
Latitude 37 Degrees 54 Minutes 17.6 Seconds
State IN County Posey

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

If So Which State Agency? IDNR

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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:

Economic loss.

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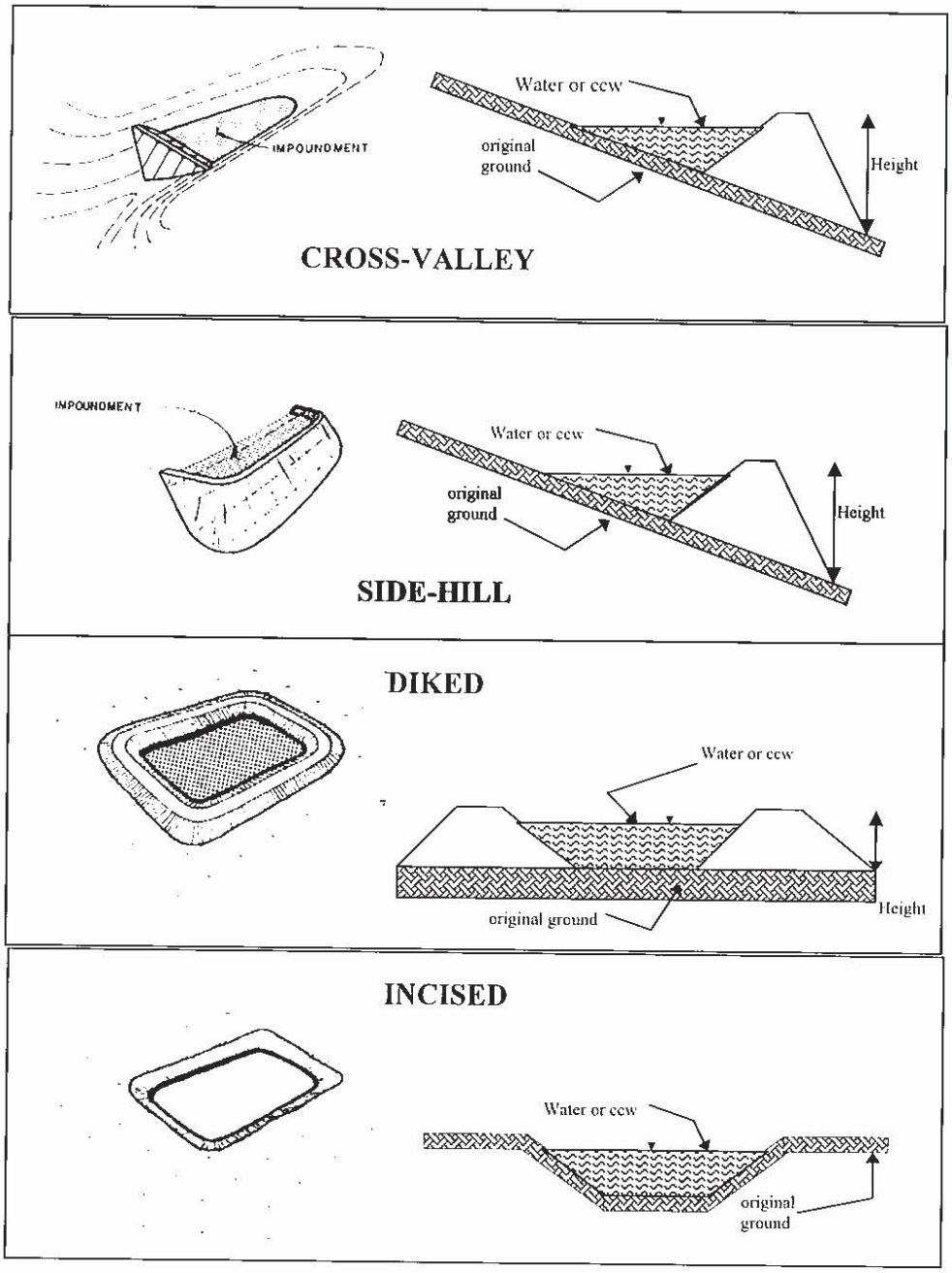
CONFIGURATION:



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

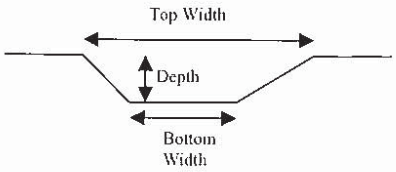
Embankment Height 68 feet
Pool Area 53 acres
Current Freeboard 7 feet

Embankment Material clay, silty clay, sandy clay
Liner None
Liner Permeability NA

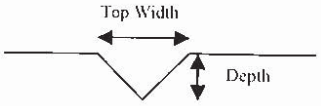
TYPE OF OUTLET (Mark all that apply)

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

TRAPEZOIDAL

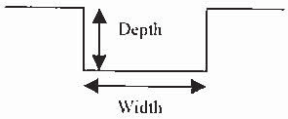


TRIANGULAR

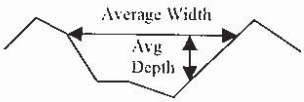


3' depth
30' bottom (or average) width
60' top width

RECTANGULAR

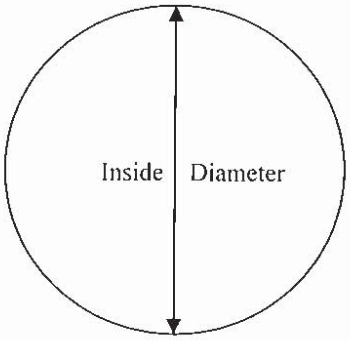


IRREGULAR



X **Outlet**

36" inside diameter



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

Is water flowing through the outlet? YES ____ NO X

____ **No Outlet**

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

The Impoundment was Designed By Mid Valley, Inc.

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

If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____
However, past reports and current site inspection indicate seepage issues.

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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 : _____

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APPENDIX A

Visual Inspection Checklist

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APPENDIX B

Photographs

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Photo 1- Lower Ash Pond Dam Crest Looking North

Photo 2- Principal Spillway Goose Neck Inlet. Note Vegetation on Embankment

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Photo 3- Principal Spillway Outlet

Photo 4- Lower Ash Pond Looking Northeast. Note White Residue from Scrubber Blowdown

Photo 5- Upstream Embankment Looking North. Note Vegetation on Embankment

Photo 6- Northwest Area of Downstream Embankment

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Photo 7- Northern Area of Ash Pond with Solidified Material

Photo 8- Northern Area of Ash Pond with Channel for White-ish Scrubber Blowdown

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Photo 9- Lower Embankment Berm Area Looking North

Photo 10- Lower Embankment Berm Area Looking South. Note Repaired Area

Photo 11- Upper Area of Downstream Embankment Looking South. Note Repaired Area Adjacent to Coal Pile and Random Rip Rap and Vegetation near Utility Pole

Photo 12- Repaired Area on Berm Looking North. Note Tire Rut in Repaired Area

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Photo 13- Wet Area on Berm Looking North

Photo 14- Wet and Eroded Area on Lower Slope Below Berm Looking East

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Photo 15- Emergency Spillway Looking West. Note Vegetation Growth in Spillway Outlet Channel

Photo 16- Emergency Spillway Looking West. Note Tree Growth on Lower Embankment Area Adjacent to Spillway Outlet Channel