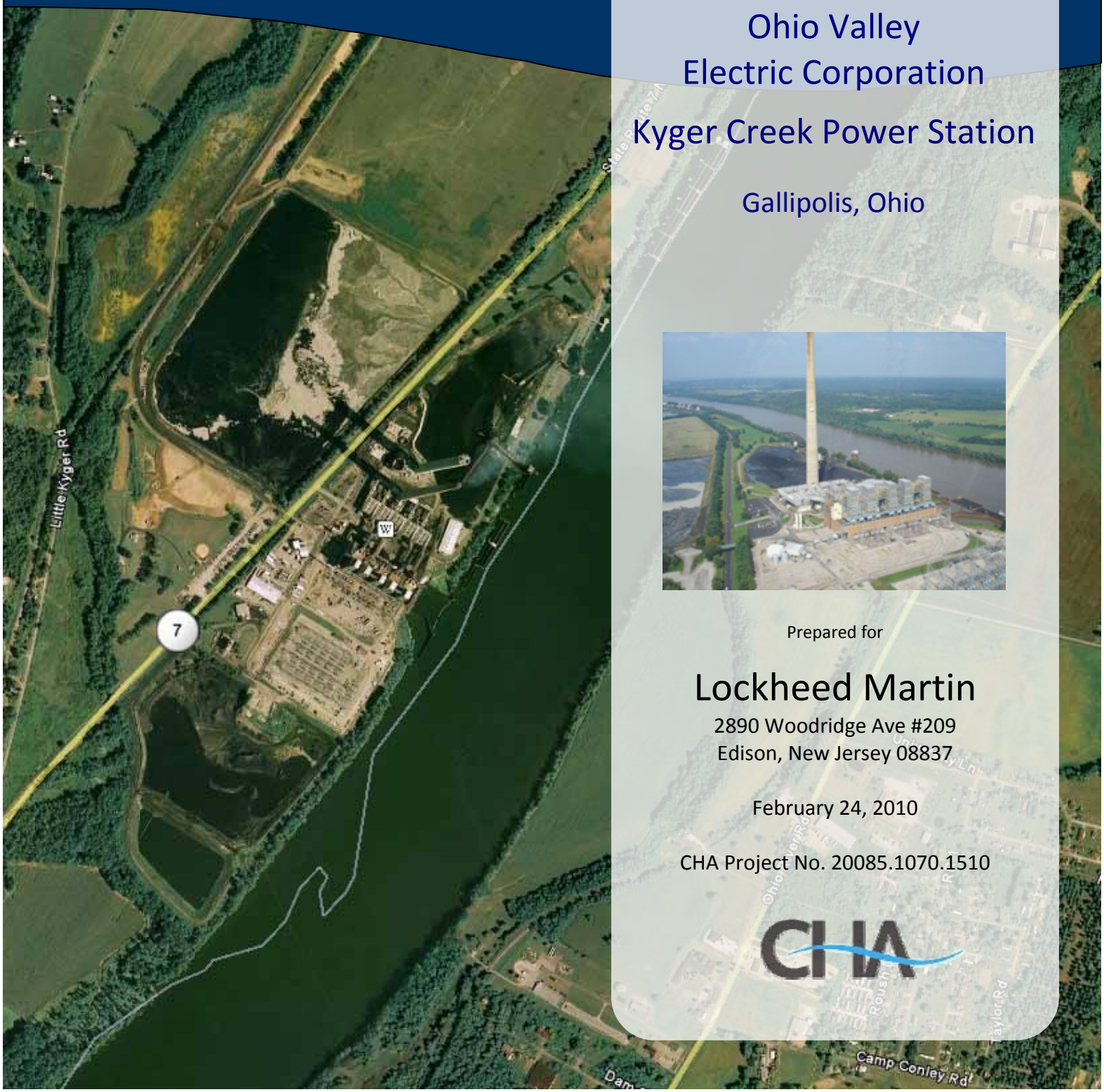
Assessment of Dam Safety of Coal Combustion Surface Impoundments (Task 3) Final Report



Ohio Valley Electric Corporation

Kyger Creek Power Station

Gallipolis, Ohio

Prepared for

Lockheed Martin

2890 Woodridge Ave #209
Edison, New Jersey 08837

February 24, 2010

CHA Project No. 20085.1070.1510

CHA

I acknowledge that the management units referenced herein:

- Bottom Ash Pond
- South Fly Ash Pond

Have been assessed on October 15, 2009

Signature: _____
Malcolm D. Hargraves, P.E.
Senior Geotechnical Engineer
Registered in the State of Ohio

Reviewer: _____
Warren A. Harris, P.E.
Geotechnical Operations Manager

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APPENDIX

Appendix A - Completed EPA Coal Combustion Dam Inspection Checklist Forms & Completed EPA Coal Combustion Waste (CCW) Impoundment Inspection Forms

1.0 INTRODUCTION & PROJECT DESCRIPTION

1.1 Introduction

CHA was contracted by Lockheed Martin (a contractor to the United State Environmental Protection Agency) to perform site assessments of selected coal combustion surface impoundments (Project #0-381 Coal Combustion Surface Impoundments/Dam Safety Inspections). As part of this contract, CHA was assigned to perform a site assessment of Ohio Valley Electric Corporation's (OVEC) Bottom Ash and South Fly Ash Pond Dams at the Kyger Creek Station, located in Gallipolis, Gallia County, Ohio as shown on Figure 1 – Project Location Map.

CHA made a site visit on October 15, 2009 to inventory coal combustion waste surface impoundments at the facility, perform visual observations of the containment dikes, and collect relevant information regarding the site assessment.

CHA Engineers Malcolm Hargraves, P.E. and Rebecca L. Filkins were accompanied by the following individuals:

Company or Organization	**Name and Title**
American Electric Power	Gary Zych, Geotechnical Engineer
American Electric Power	Shah Baig, Geotechnical Engineer
Ohio Valley Electric Corporation	Matt Smith, Environmental Affairs
Ohio Valley Electric Corporation	Donald Fulkerson, Environmental Affairs Manager
Ohio Valley Electric Corporation	Paul Hutchins, Kyger Creek Station Personnel
Ohio Valley Electric Corporation	Steve Bryant, Kyger Creek Station Personnel
Ohio Valley Electric Corporation	Gary Edwards, Kyger Creek Station Personnel
Ohio Valley Electric Corporation	Annette Hope, Kyger Creek Station Plant Manager
Ohio Dam Safety	Tina Griffin, P.E., Project Manager

1.2 Project Background

The Bottom Ash Pond Dam (ODNR File No. 8721-014, National Inventory No. OH01599) and South Fly Ash Pond Dam (ODNR File No. 8721-013, National Inventory No. OH01600) are under the jurisdiction of the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Resources – Dam Safety Program. According to the ODNR the ponds have been classified as hazard Class II Dams (ODNR Dam Classification Checklists dated February 10, 2009). The ODNR defines a Class II dam as one that should a sudden failure occur it would result in at least one of the following conditions, but loss of human life is not probable.

a. Disruption of a public water supply or wastewater treatment facility, release of health hazardous industrial or commercial waste, or other health hazards.
b. Flooding of residential, commercial, industrial, or publicly owned structures.
c. Flooding of high-value property.
d. Damage or disruption to major roads including but not limited to interstate and state highways, and the only access to residential or other critical areas such as hospitals, nursing homes, or correctional facilities as determined by the chief.
e. Damage or disruption to railroads or public utilities.
f. Damage to downstream Class I, II or III dams or levees, or other dams or levees of high value. Damage to dams or levees can include, but is not limited to, overtopping of the structure.

1.2.1 State Issued Permits

OVEC has received the following state issued permits for the Bottom Ash Pond and South Fly Ash Pond:

- **Bottom Ash Pond -** Permit No. OH0005282 (Ohio State No. OIB00005) has been issued to OVEC authorizing discharge under the National Pollutant Discharge Elimination System (NPDES) to the Ohio River in accordance with effluent limitations, monitoring requirements and other conditions set forth in the permit. The permit became effective on July 1, 2009 and will expire on January 31, 2013. (Note this permit also covers the proposed FGD scrubber system currently under construction, the South Fly Ash Pond, surface runoff locations not containing coal combustion waste, and other plant wastewater stream OVEC controlled on the site.)

- **South Fly Ash Pond -** Permit No. OH0005282 (Ohio State No. OIB00005) has been issued to OVEC authorizing discharge under the National Pollutant Discharge Elimination System (NPDES) to Kyger Creek in accordance with effluent limitations, monitoring requirements and other conditions set forth in the permit. The permit became effective on July 1, 2009 and will expire on January 31, 2013. (Note this permit also covers the proposed FGD scrubber system currently under construction, the Bottom Ash Pond, surface runoff locations not containing coal combustion waste, and other plant wastewater stream OVEC controlled on the site.)

The Ohio Environmental Protection Agency issued Permit No. 06-04916 in 1997 to install a pond closure cap above a former impoundment (North Fly Ash Pond) abutting the north dike of the South Fly Ash Pond. This action effectively limited the coal combustion disposal activities in this area to the present South Fly Ash Pond and removed the dikes around the North Fly Ash Pond from the ODNR Dam Safety inventory.

1.3 Site Description and Location

Kyger Creek Power Station is located along the Ohio River in Gallia County, Ohio, south of the town of Cheshire, Ohio. The plant currently has two process and disposal areas for the coal combustion waste products (CCW) generated at the plant, known as the Bottom Ash Pond and

the South Fly Ash Pond. A third area will be a solid waste landfill used to dispose flue gas desulfurization by-products (FGD) generated when the FGD scrubber units currently being installed come on-line. Figure 2 – Photo Plan shows the location of the Bottom Ash and the South Fly Ash Ponds. The Bottom Ash and South Fly Ash Ponds are located approximately 175 feet and 1,250 feet from the Ohio River, respectively. These areas are described in more detail in Sections 1.3.1 and 1.3.2.

An aerial photograph of the region indicating the location of the Kyger Creek Station and identifying schools, hospitals, or other critical infrastructure located within approximately five miles down gradient of the ash ponds is provided as Figure 5 – Critical Infrastructure Map.

1.3.1 Bottom Ash Pond

According to the ODNR Dam Safety Inspection Report dated February 10, 2009 the Bottom Ash Pond was designed by Sargent Lundy Engineers of Chicago, IL and was constructed by George B. Herring & Sons, Inc. of Mansfield, OH. The construction was reportedly completed in 1955. Figure 4 – Bottom Ash Pond Topo Map shows the configuration of the Bottom Ash and Clearwater Ponds.

The Bottom Ash Pond impoundment is entirely bounded by rolled earth dike with a total length of approximately 5,800 feet and a maximum height of approximately 41 feet. The width of the dike crests are 20 feet with an elevation of approximately 582 feet MSL. The interior embankment has a slope of 2.25H:1V and the exterior embankment has a slope of 2.5H:1V.

A splitter dike separating the Bottom Ash Pond and the Clearwater Pond was constructed in about 1980. The splitter dike is approximately 875 feet in length and has an embankment slope of 2.5H:1V in the area of the overflow structure and 3H:1V at all other areas. The dike reportedly consists of compacted boiler slag with a central clay core 10 feet wide. The Woodward-Clyde Consultants, Inc. Dam Safety Inspection report dated February 1985 notes that

the core is shown keyed into the bottom of the pond for a depth of 5 feet (AEP Drawing No. 15-3482B-2).

Overflow from the Bottom Ash Pond is carried into a reinforced concrete intake structure located at the southern end of the pond near the western end of the splitter dike. The maximum pond elevation is 577 feet. The intake structure consists of a 36-inch concrete pipe with a 42-inch by 39-inch concrete riser with a maximum discharge of 215 CFS. The elevation of the spillway is 557 feet and it can be raised in increments of five feet to elevation 577 feet by the placement of concrete stop-logs within the structure. The surface area of the pond with the pool level at elevation 557 feet (principal spillway elevation) is approximately 34 acres with 512 acre-feet of storage and the surface area of the pond with the pool level at the top of the dam (elevation 582 feet) is approximately 40 acres with 1,435 acre-feet of storage. Water entering the intake structure is discharged into the Clearwater Pond through a 30-inch diameter CMP which passes through the splitter dike.

The maximum design elevation of the Clearwater Pond is 570 feet. Overflow enters another reinforced concrete intake structure located at the southeast corner of the pond and is discharged into the Ohio River through a 30-inch diameter CMP.

1.3.2 South Fly Ash Pond

The OH DNR Dam Safety Inspection Report dated February 10, 2009 notes that the South Fly Ash Pond was designed by the same engineer and constructed by same contractor as the Bottom Ash Pond. Construction of this pond was also completed in 1955. The South Fly Ash Pond is part of a larger pond that was originally constructed with a splitter dike separating the pond into the North and South Fly Ash Ponds. Figure 3 – South Fly Ash Topo Map shows the layout of the pond. The North Fly Ash Pond was capped and closed in 1997.

The South Fly Ash Pond impoundment is entirely bounded by a rolled earth dike with a total length of approximately 6,750 feet and a maximum height of approximately 40 feet. The width of the dike crests are approximately 12 feet with an elevation of approximately 590 feet. The interior embankment has a slope of 2H:1V and the exterior embankment has a slope of 2H:1V.

The principal spillway for the South Fly Ash Pond is located near the southwest corner of the pond and is constructed of reinforced concrete. The intake structure consists of a 36-inch concrete pipe with a 42-inch by 39-inch concrete riser with a maximum discharge of 220 CFS. The elevation of the spillway is 582 feet and it can be raised in increments of five feet to elevation 587 feet by the placement of concrete stop-logs. Outflow from the structure is directed through a 30-inch diameter CMP that discharges into Kyger Creek. The surface area of the pond with the pool level at elevation 582 feet (principal spillway elevation) is approximately 66 acres with 1,952 acre-feet of storage and the surface area of the pond with the pool level at the top of the dam (elevation 590 feet) is approximately 69 acres with 2,500 acre-feet of storage.

1.3.3 Other Impoundments

There are no other impoundments at the Kyger Creek Power Station.

1.4 Previously Identified Safety Issues

Based on our review of the information provided to CHA and as reported by OVEC and their engineering services provider, AEP (American Electric Power), there have been no identified safety issues related to dike stability or excessive seepage at either the Bottom Ash Pond or the South Fly Ash Pond in the last 10 years.

1.5 Site Geology

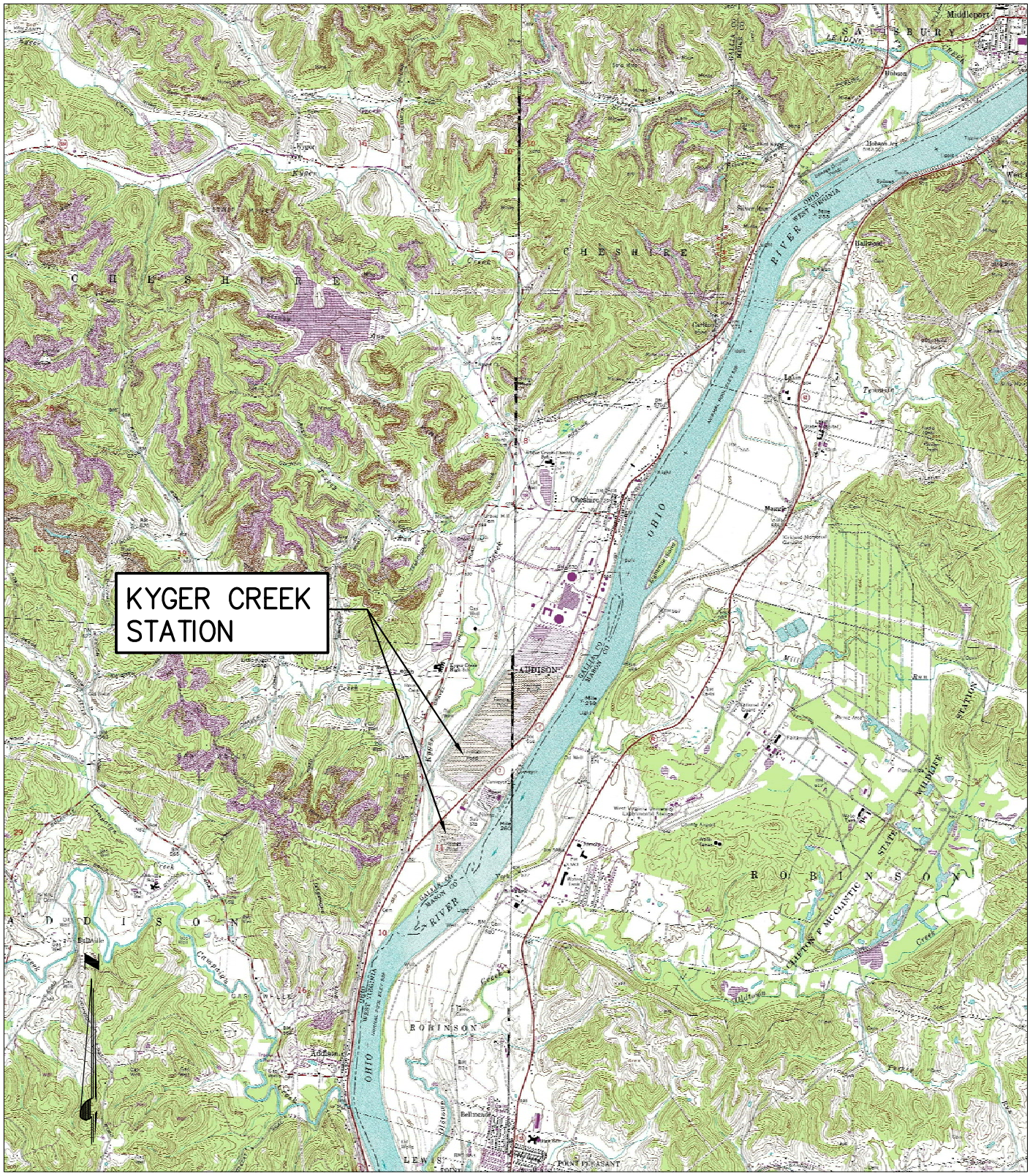
Based on a review of available surficial and bedrock geology maps, and reports by others, the site lies in an unglaciated area of Ohio in the Marietta Plateau of the Appalachian Highland physiographic province. The local geologic conditions at the impoundments and power station facility are likely to consist of alluvial silt, clay and/or sand deposited by the Ohio River and Kyger Creek floodwaters, and glacial outwash sand and gravel deposits. The bedrock below these materials in this area is mapped as part of the Conemaugh Formation, which consists predominantly of interbedded red shales, sandstones, coal and limestone.

1.6 Bibliography

CHA reviewed the following documents provided by AEP in preparing this report:

- *Report on Dam Safety Inspection Kyger Creek Fly Ash and Bottom Ash Ponds*, February 1985, Woodward-Clyde Consultants, Inc.
- *Draft Summary Report of the Dam Break Analysis of the Fly Ash Dam*, September 25, 1996, American Electric Power
- *2002 Annual Dike and Dam Inspection Report Bottom Ash and Fly Ash Complex,* August 21, 2002, American Electric Power
- *2003 Annual Dike and Dam Inspection Report Bottom Ash and Fly Ash Complex,* March 17, 2004, American Electric Power
- *2005 Annual Dike and Dam Inspection Report Bottom Ash and Fly Ash Complex,* July 21, 2006, American Electric Power
- *2007 Annual Dike and Dam Inspection Report Bottom Ash and Fly Ash Complex,* October 29, 2007, American Electric Power
- *2009 Annual Dike and Dam Inspection Report Bottom Ash and Fly Ash Complex,* May 15, 2009, Stantec Consulting Services, Inc.

- *Draft Operations, Inspection and Maintenance Manual*, Ohio Valley Electric Corporation, January 2009
- Ohio EPA Permit to Install – North Fly Ash Pond Closure, January 15, 1997
- ODNR Dam Safety Inspection Report South Fly Ash Dam, August 9, 1995
- ODNR Dam Safety Inspection Report Bottom Ash Dam, August 9, 1995
- ODNR Dam Safety Inspection Report South Fly Ash Dam, February 10, 2009
- ODNR Dam Safety Inspection Report Bottom Ash Dam, February 10, 2009
- OVEC Quarterly Pond Inspection Summary and Dam/Dike Inspection Checklist, June 16, 2009



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SITE LOCATION MAP

KYGER CREEK STATION
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 1

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-1-SITE-LOC-MAP.DWG Saved: 2/12/2010 8:31:09 AM Plotted: 2/24/2010 10:49:12 AM User: Everleth, Jennifer

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATED AUG. 2007.

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PHOTO SITE PLAN

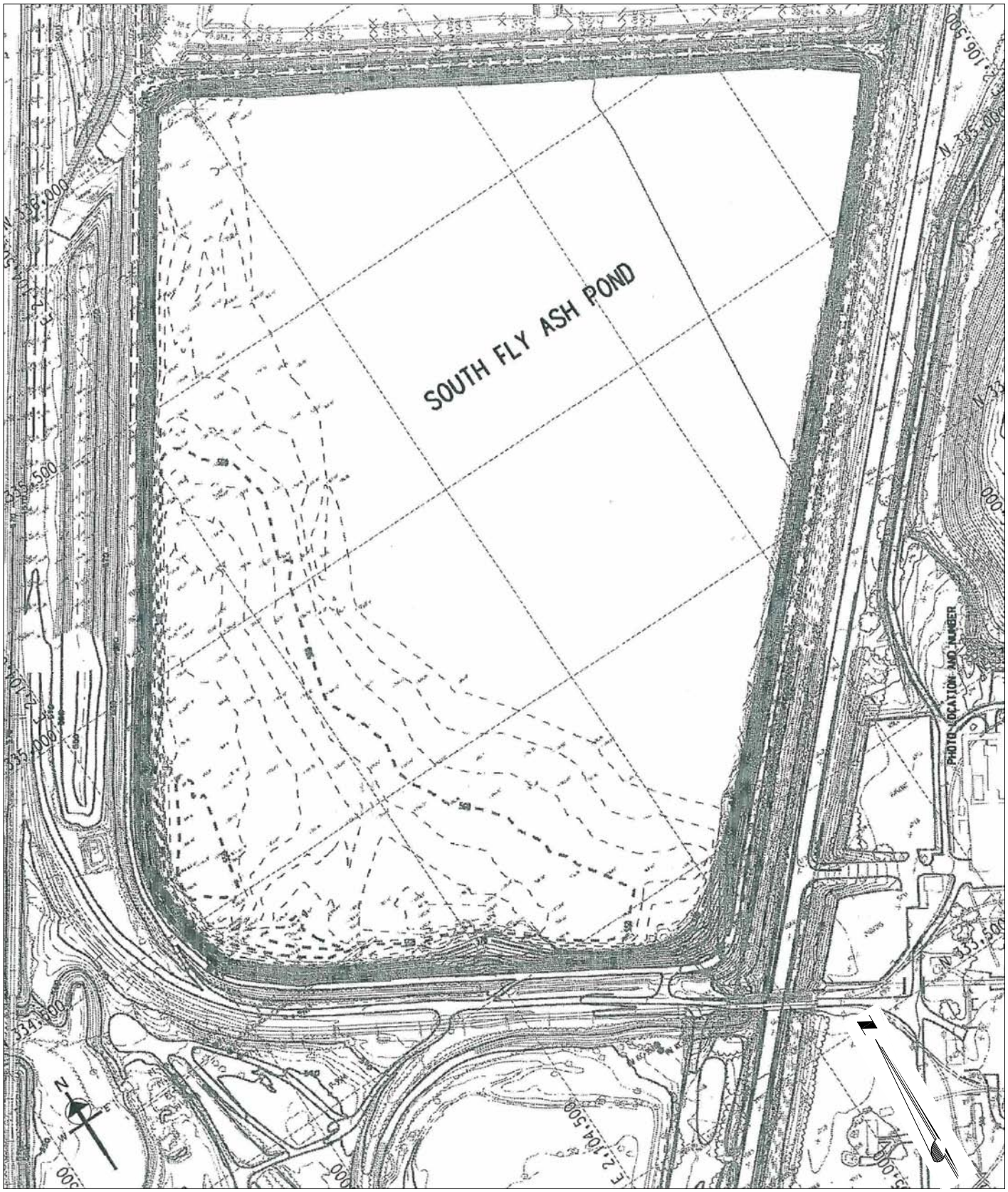
KYGER CREEK PLANT
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 2

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-2_5-PHOTO-SITE_CRIT-PLAN.DWG Saved: 2/12/2010 8:28:05 AM PLotted: 2/12/2010 8:33:12 AM User: Gray, Timmolyn



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SOUTH FLY ASH POND TOPO MAP

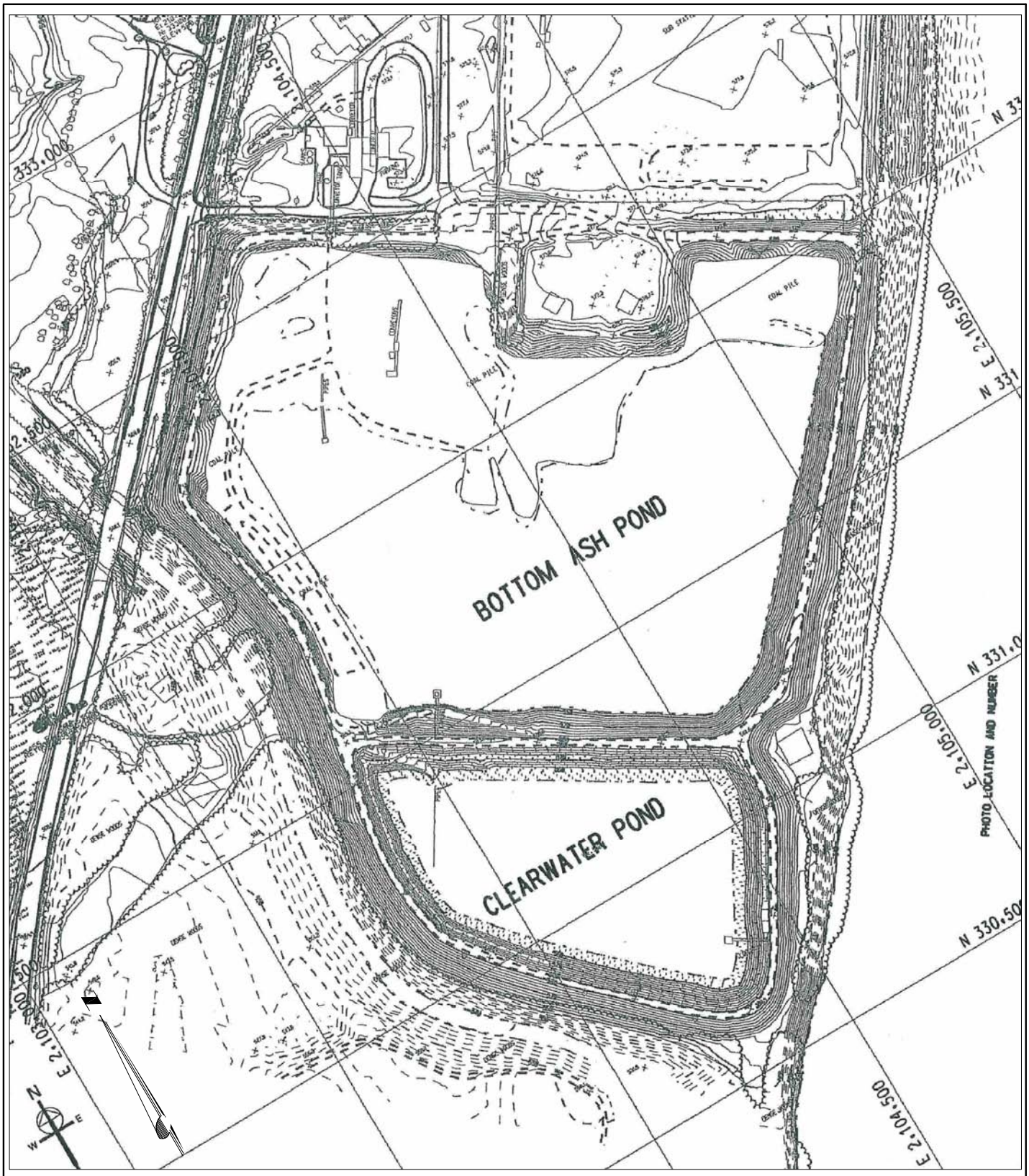
KYGER CREEK PLANT
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 3

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-3_4-TOPO-MAP.DWG Saved: 2/12/2010 8:27:14 AM PLotted: 2/12/2010 8:33:45 AM User: Gray, Timmolyn



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BOTTOM ASH POND TOPO MAP

KYGER CREEK PLANT
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 4

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-3_4-TOPO-MAP.DWG Saved: 2/12/2010 8:27:14 AM PLotted: 2/12/2010 8:34:10 AM User: Gray, Timmolyn

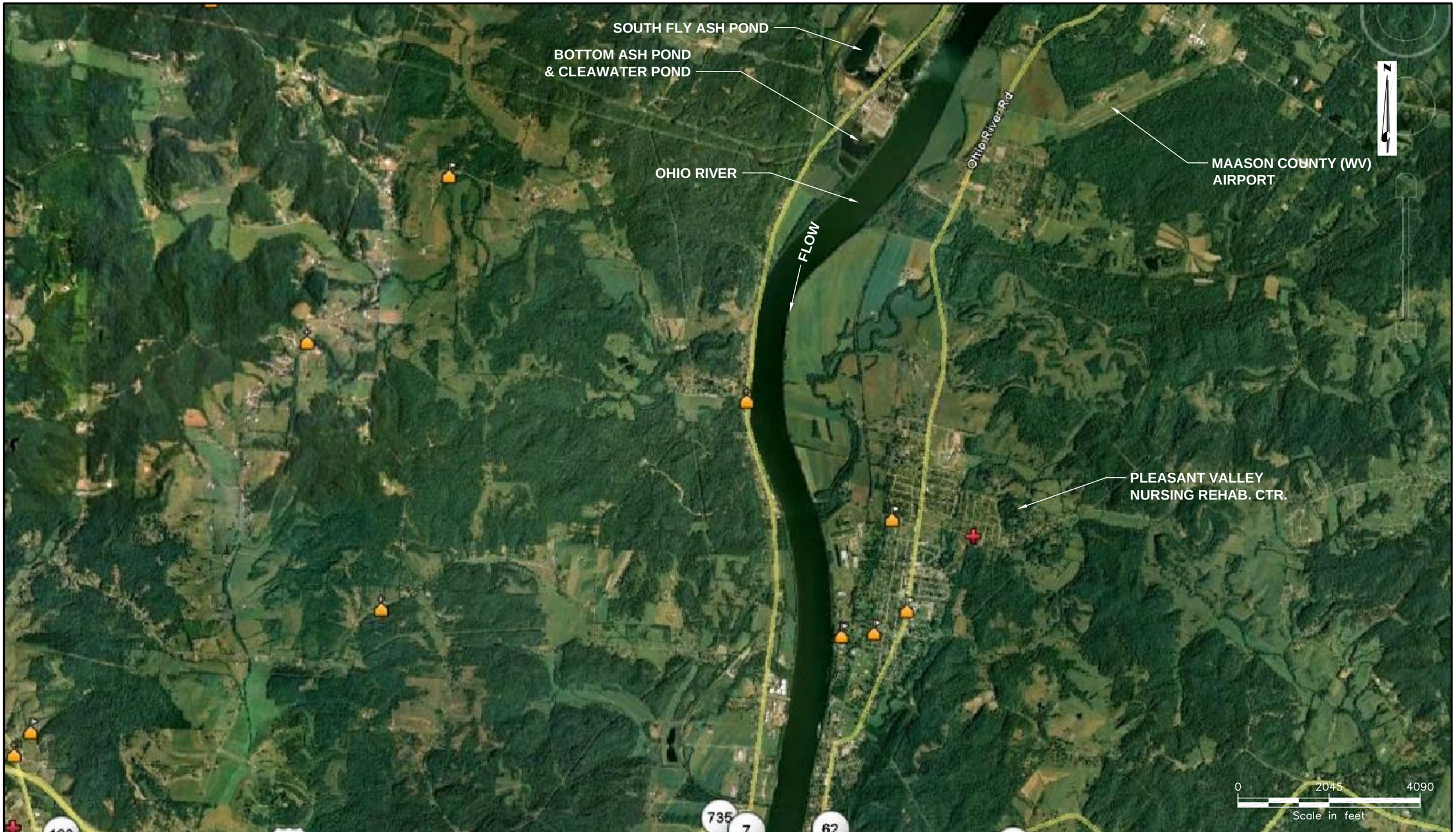

IMAGE REFERENCE: GOOGLE EARTH, IMAGE DATED AUG 2007.

LEGEND

62 STREET, HIGHWAY

HOSPITAL

SCHOOL

CHURCH

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CRITICAL INFRASTRUCTURE MAP

KYGER CREEK PLANT
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 5

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-2_5-PHOTO-SITE_CRIT-PLAN.DWG Saved: 2/24/2010 9:32:59 AM Plotted: 2/24/2010 9:33:55 AM User: Gray, Timmolyn

2.0 FIELD ASSESSMENT

2.1 Visual Observations

CHA performed visual observations of the Bottom Ash Pond dikes and South Fly Ash Pond dikes following the general procedures and considerations contained in FEMA's *Federal Guidelines for Dam Safety* (April 2004), and FERC Part 12 Subpart D to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist Form, prepared by the US Environmental Protection Agency, was completed on-site during the site visit for each impoundment. A copy of the completed form was submitted via email to a Lockheed Martin representative following the site visit to the Kyger Creek Plant. Copies of the completed forms are included in Appendix A of this report. Photo logs and Site Photo Location Maps (Figures 6A and 6B) for the Bottom Ash Pond and South Fly Ash Pond are located at the end of Section 2.4.

CHA's visual observations were made on October 15, 2009. The weather prior to and during the site assessment was cloudy and rainy with a daytime high temperatures of 49 degrees Fahrenheit and a low temperature of 44 degrees Fahrenheit. Prior to the days we made our visual observations, the following approximate rainfall amounts occurred (as reported by www.weather.com).

Table 1– Approximate Precipitation Prior to Site Visit

Dates of Site Visits – October 15, 2009		
Day	**Date**	**Precipitation (inches)**
Wednesday	October 7, 2009	0.00
Thursday	October 8, 2009	0.36
Friday	October 9, 2009	0.64
Saturday	October 10, 2009	0.00
Sunday	October 11, 2009	0.00
Monday	October 12, 2009	0.00
Tuesday	October 13, 2009	0.00
Wednesday	October 14, 2009	0.51
Thursday	October 15, 2009	0.05
Total	**Week Prior to Site Visit**	**1.56**

2.2 Visual Observation – Bottom Ash Pond

CHA performed visual observations of the north, south, east, west and splitter dikes of the Bottom Ash Pond and the outlet structure. In general, the dikes do not show signs of changes in their horizontal alignments. No evidence of prior releases, failures or patchwork on the dikes was observed at the time of the site visit. Our field observations for this impoundment are provided in Sections 2.2.1 and 2.2.2.

2.2.1 Bottom Ash Pond – Crest and Embankments

At the time of the site visit, the north dike was not actively impounding water. An access road runs the length of the crest of the north dike (Photo No. 12), which runs parallel to the plant. The interior embankment slope is generally covered by granular material and sparsely vegetated, with occasional erosion features observed (Photo Nos. 6, 9, 10, and 11). Heavier vegetation was noted near the transmission towers on the interior embankment slope (Photo Nos. 7 and 8). The exterior slope of the north dike was observed to be moderately to heavily vegetated (Photo Nos. 2, 3, 5). The dike is only 5 to 8 feet in height at the north end where it is predominantly incised (Photo No. 1). No slumps or bulges were observed in the interior or exterior embankment slopes.

The crest and interior embankment slope of the west dike was observed to be gravel and bottom ash covered (Photo No. 15 and 16). The exterior embankment slope was noted to be moderately to heavily vegetated (Photo Nos. 13 and 14). Occasional erosion rills were observed in the interior embankment slope surface from concentrated stormwater runoff from the crest. The exterior embankment slope toe terminated at the State Route 7 right-of-way where a change in vegetation from field grasses, leafy weeds, and brush to maintained grass occurs (Photo No. 14). Probing in these areas revealed relatively firm conditions. Heavy vegetation, including isolated woody vegetation, present on the embankment slope at the time of the site assessment hindered closer inspection of the slope. In areas that could be observed, scarps, sloughs, toe bulges were

not evident on the exterior slope; however an isolated rodent burrow was noted near the crest of the exterior slope (Photo No. 17).

An access road runs the length of the crest of the south dike (Photo No. 21). The interior slope of this dike is generally vegetated with occasional erosion features observed (Photo No. 22). The exterior embankment was noted to be moderately vegetated for the top ¼ to ⅓ portion of the slope and more heavily vegetated, with brush, bushes, and briars below this level, extending to the toe of the slope (Photo Nos. 20, 23, and 24). Smaller juvenile trees, about 3 to 5 inches in diameter, were observed in isolated areas of the heavy vegetation and larger, mature trees, about 24 to 30 inches in diameter, were observed near the toe of the slope along Kyger Creek (Photo Nos. 18). Several trees were observed to curve toward the dike crest and away from the creek (Photo Nos. 19). Loss of grass cover was also observed on the exterior embankment slope (Photo Nos. 26 and 27).

The crest of the separator dike was measured to be approximately 31 feet wide, which is about 10 feet wider than shown in the original site drawings. The embankments of the separator dike are generally covered with granular material and are sparsely to mildly vegetated (Photo Nos. 29, 30, and 31). Erosion features were observed on the embankment slopes (Photo No. 32).

The east dike runs parallel to the Ohio River (Photo No. 38). The interior embankment slope is generally covered with granular material and sparsely to mildly vegetated with occasional erosion features (Photo Nos. 35, 39, and 41). Areas were observed where erosion and undercutting of bottom ash material at the crest has occurred where it appears to have been over-built due to grading activities (Photo No. 40). The exterior embankment slope was observed to be moderately vegetated along the top ¼ to ⅓ portion of the slope and more heavily vegetated, with brush, bushes, briars and trees, nearer to the toe (Photo Nos. 34, 36, and 37). Mature trees, approximately 24 to 30 inches in diameter, were observed near the toe along the Ohio River. There was an area of exposed slope where there has been a loss of vegetation cover and erosion rills have developed (Photo Nos. 41 and 42) along the east dike exterior slope.

2.2.2 Bottom Ash Pond Outlet Control Structures

Overflow from the Bottom Ash Pond is carried into a reinforced concrete intake structure located at the southern end of the pond near the western end of the splitter dike (Photo No. 43). The intake was submerged at the time of the site visit. The intake structure consists of a 36-inch concrete pipe with a 42-inch by 39-inch concrete riser. Water entering the intake structure is discharged into the Clearwater Pond through a 30-inch diameter CMP which passes through the east dike. At the time of the site visit the water elevation in the Bottom Ash Pond was at approximately 557 feet, leaving about 25 feet of freeboard.

Overflow from the Clearwater Pond enters another reinforced concrete intake structure located at the southeast corner of the pond (Photo No. 28) and is discharged into the Ohio River through a 30-inch diameter CMP (Photo No. 25). The intake was submerged at the time of the site visit.

2.3 Visual Observation – South Fly Ash Pond

CHA performed visual observations of the west, south, east, and north dikes of the South Fly Ash Pond and the outlet structure. In general, the dikes do not show signs of changes in their horizontal alignments. No evidence of prior releases, failures or patchwork on the dikes was observed at the time of the site visit. Our field observations for this impoundment are provided in Sections 2.3.1 and 2.3.2.

An access road runs the length of the crest of the west dike (Photo No. 44). The interior and exterior embankment slope surfaces of the west dike are predominantly covered with granular materials with numerous cobble sized rock fragments. The interior slope had sparse to moderate vegetation (Photo No. 45). Erosion rills were observed on both the interior and exterior embankment slopes (Photo No. 46). The exterior embankment slope was observed to have moderate to heavy vegetation (Photo No. 49) with an isolated small slump, an isolated grassed

over slough (Photo No. 52), and an isolated abandoned rodent hole (Photo No. 51). The toe of the dike has rock protection at the ditch line.

An access road runs the length of the south dike crest (Photo No. 56). The interior embankment slope is generally covered with granular material and is sparsely to moderately vegetated. Occasional erosion features were noted. The exterior embankment slope was noted to be covered with moderate to heavy vegetation (Photo No. 57). An animal burrow and erosion rills were noted on the slope (Photo Nos. 58 and 59). The drainage ditch at the toe of the embankment slope was blocked with soil and gravel material and appeared rutted probably from maintenance activities (Photo No. 60).

An access road also runs the length of the east dike crest (Photo No. 64). Little to no vegetation cover was observed on the interior embankment slope of the east dike (Photo Nos. 61 and 66). Heavy vegetation and mature trees cover the downstream slope (Photo Nos. 62 and 63). Minor erosion features resulting from concentrated run-off were observed on both the interior and exterior embankment slopes. Sluice lines run along the exterior side of the crest (Photo No. 64).

There is an access road which runs the length of the north dike (Photo No. 68). The interior embankment slope is covered with granular material with moderate vegetation (Photo Nos. 68, and 69) which tapers off closer to the pond and sluiced ash surface as shown in Photo No. 70. The exterior embankment slope is part of the closed landfill area for the North Fly Ash Pond. Moderate vegetation was observed in this location.

2.3.1 South Fly Ash Pond Outlet Control Structure

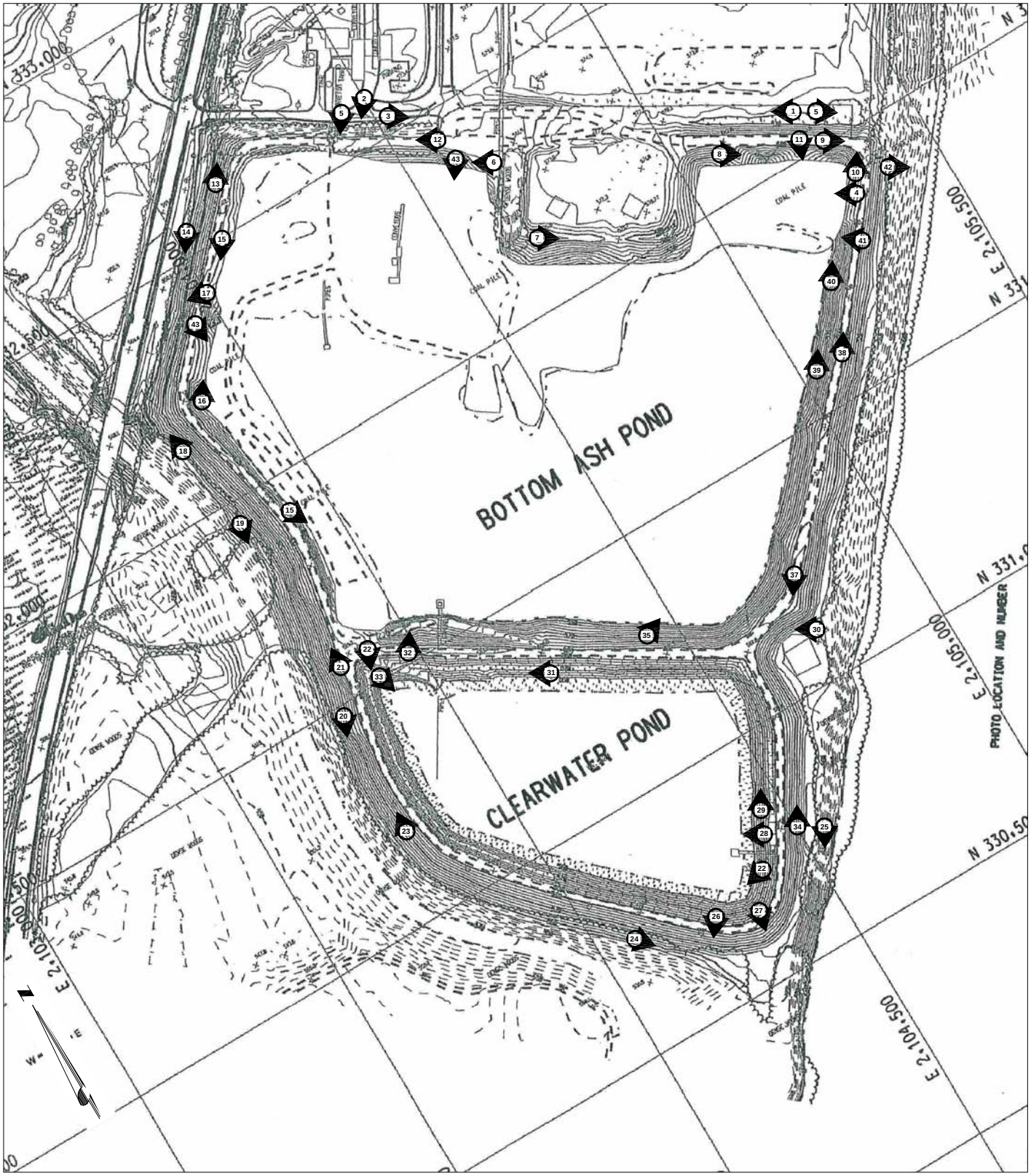
The principal spillway for the South Fly Ash Pond is located near the southwest corner of the pond and is constructed of reinforced concrete (Photo No. 47). The intake structure consists of a 36-inch concrete pipe with a 42-inch by 39-inch concrete riser. Outflow from the structure is directed through a 30-inch diameter CMP that discharges into Kyger Creek (Photo Nos. 71 and

72). At the time of the site visit the water elevation in the South Fly Ash Pond was at approximately 582 feet, leaving about 8 feet of freeboard.

2.4 Monitoring Instrumentation

According to the Draft Operation, Inspection and Maintenance Manual for the OVEC Kyger Creek Plant dated January 2009 there are 14 monitoring wells in service for measurement of water table levels at various points around the South Fly Ash Pond and the closed North Fly Ash Pond. The wells are reportedly measured semiannually. CHA was not provided with recorded data for the wells to review.

In addition, there is an on-line flow measurement device in the Clearwater Pond intake tower and an on-line flow measurement device at the discharge conduit at the South Fly Ash Pond.



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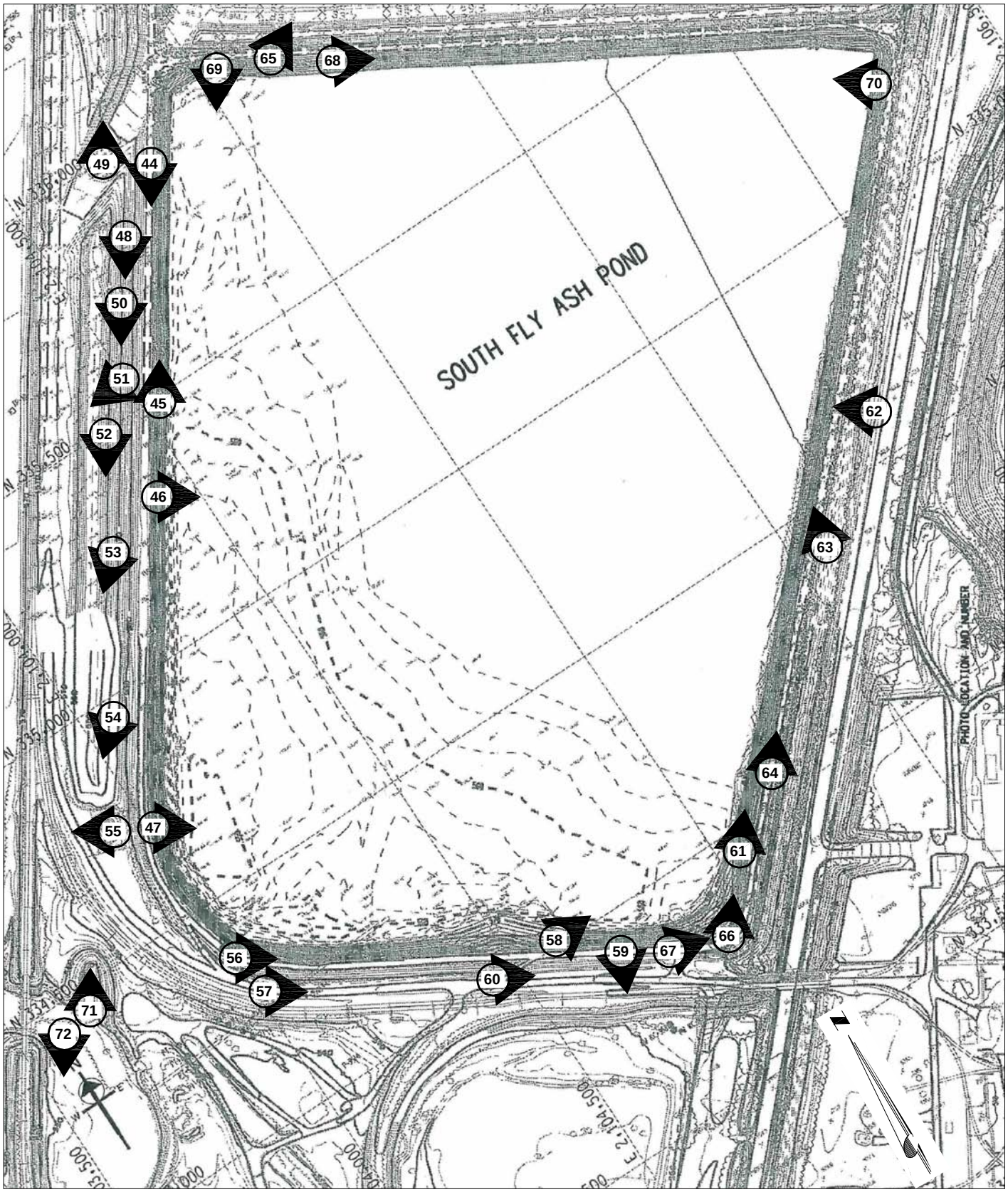
BOTTOM ASH POND PHOTO LOCATION MAP
KYGER CREEK PLANT
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 6A

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-3_4-TOPO-MAP.DWG Saved: 2/12/2010 8:27:14 AM Plotted: 2/12/2010 8:34:23 AM User: Gray, Timmolyn



SCALE: 1"=300'

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SOUTH FLY ASH POND PHOTO LOCATION MAP
KYGER CREEK PLANT
OHIO VALLEY ELECTRIC CORP.
GALLIPOLIS, OHIO

PROJECT NO. 20085.1070

DATE: 02/2010

FIGURE 6B

File: K:\20085\CADD\ACAD\FIGURES\1070 KYGER CREEK STATION\1070 FIG-3_4-TOPO-MAP.DWG Saved: 2/12/2010 8:37:19 AM PLotted: 2/12/2010 8:38:28 AM User: Gray, Timmolyn

1

Exterior slope of north dike, looking west. Dike is approximately
5 to 8 feet high in this location where the pond is predominantly incised.

2

Exterior slope of north dike. This area does not currently impound water.

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3

Exterior slope of north dike, looking east. Trees and heavy vegetation was observed.

4

Looking across the northern end of the Bottom Ash Pond at the north dike.

5

Exterior slope of north dike where sluice pipes enter the pond, looking east.
Moderate to heavy woody vegetation was observed.

6

Interior slope and crest of north dike at northeast corner of the pond,
looking west. Left side of photo is bottom ash stockpiling area.

7

Interior slope of north dike, looking east.

8

Interior slope of north dike, looking east.

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9

Interior slope and crest of north dike at northeast corner of pond, looking east. This area does not actively impound water.

10

Sluice lines entering the Bottom Ash Pond in the northeast corner of the pond, facing northwest.

11

Erosion rills on interior slope of north dike.

12

Crest of north dike, facing northwest.

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13

Exterior slope of west dike, looking north.

14

Exterior slope of west dike, looking south. Note moderate to heavy vegetation.

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15

Crest of west dike, looking south. The separator dike forming the Clearwater Pond is visible in the distance.

16

Interior slope of west dike and bottom ash processing area, looking north.

17

Animal burrow on the exterior slope of the west dike.

18

Toe of the exterior slope of south dike, looking west. Note trees and heavy vegetation and Kyger Creek adjacent to the slope toe. There is approximately 12 feet to the creek from the toe.

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19

Toe of exterior slope of south dike, facing east. Note curvature of trees towards the dike.

20

Exterior slope of south dike, looking east. Note heavy brush and vegetation.

21

Exterior slope and crest of south dike, looking north.

22

Interior slope of south dike, facing south.

23

Exterior slope of south dike (Clearwater Pond section), looking west.

24

Exterior slope of south dike (Clearwater Pond section), looking east.

25

36-inch diameter Bottom Ash Pond outlet.

26

Loss of groundcover and some erosion of exterior slope of south dike.

27

Loss of groundcover and some erosion of exterior slope of south dike.

28

Clearwater Pond outfall structure.

29

Interior slope of Clearwater Pond (south dike), looking northeast.

30

Crest of splitter dike and interior slope of Bottom Ash Pond, looking northwest.

31

Crest of splitter dike and interior slope of Clearwater Pond, looking northwest.

32

Crest of splitter dike and interior slope of Bottom Ash Pond, looking north.

33

Clearwater Pond, facing southwest.

34

Exterior slope of east dike (Clearwater Pond section), looking north.

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35

Looking east across Bottom Ash Pond at the east dike.

36

Area of rock slope protection/drain on exterior slope of east dike. Slope protection placed where slope steepened in area of transmission tower.

37

East dike exterior slope, looking south. Note rock slope protection/drain in this area is generally obscured by vegetation.

38

East dike crest and exterior slope, looking north.

39

East dike interior slope, looking north. Note isolated woody vegetation on slope.

40

East dike and interior slope, looking north. Note erosion and undercutting of bottom ash material at the crest. Brush vegetation was also evident.

41

Erosion rills and isolated vegetation cover on interior slope of east dike.

42

Loss of vegetation cover and erosion rills on exterior slope of the east dike.

43

Overflow structure, looking south.

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44

West dike crest and interior slope, looking south.

45

Loss of groundcover and erosion observed on interior slope of west dike.

46

Erosion rills and loss of groundcover on interior slope of west dike.

47

South Fly Ash Pond outlet structure, looking southeast.

48

West dike exterior slope, looking south.

49

West dike exterior slope, looking north. Note moderate to heavy vegetation.

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50

West dike exterior slope, looking south. Standing water observed in rock lined ditch at toe.

51

Possible animal burrow in west dike exterior slope.

52

Small scarp/slough in west dike exterior slope.

53

Exterior slope of west dike, looking south. Drainage feature at toe was collecting water during site visit.

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54

Drainage ditch near South Fly Ash Pond outlet. Note pooling water and heavy vegetation.

55

South Fly Ash Pond outlet headwall. Outlet partially submerged during site visit.

56

South dike crest, facing southeast.

57

Exterior slope of south dike. Note vegetation on slope and ditch line between the slope toe and access drive.

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58

Small, isolated animal burrow on interior slope of the south dike.

59

Rill in exterior slope of south dike created by concentrated run-off from the maintenance road along the crest of dike.

60

Water pooling in ditch line at toe of south dike. Water is due to recent heavy rainfall and poor drainage.

61

Interior slope of east dike, looking north. Slope is covered predominately with ash with little vegetation.

62

Looking west from the toe of the east dike towards the crest of the dike along the exterior slope.

63

Tree growth and vegetation on the east dike exterior slope, looking north.

64

Crest of east dike, facing north. Note pipeline trace and trees on lower portion of the slope.

65

Looking northeast across the closed and capped North Fly Ash Pond.

66

Interior slope of east dike, facing northeast.

67

Sluice lines entering the South Flay Ash Pond at the southeast corner of the pond, facing east.

68

Crest and interior slope of north dike, looking east. Slope is covered with bottom ash and vegetation.

69

Bottom ash and erosion rills observed in the ash covering the interior slope of the north dike.

70

Interior slope of north dike, looking northwest.

71

Outfall, facing north.

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72

Confluence of the South Fly Ash Pond effluent (left) and Kyger Creek (right).

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3.0 DATA EVALUATION

3.1 Design Assumptions

CHA has reviewed the design assumptions related to the design and analysis of the stability and hydraulic adequacy of the Bottom Ash Pond and South Fly Ash Pond available at the time of our site visits and provided to us by OVEC. The design assumptions are listed in the following sections.

3.2 Hydrologic and Hydraulic Design

The impoundments for all Bottom Ash Pond and the South Fly Ash Pond qualify under the Class II Hazard Classification in the State of Ohio. Ohio Administrative Code Rule 1501:21-13-02 states that the minimum design flood for Class II dams is 50% of the probable maximum flood (PMF) or the critical flood. The regulations note that the minimum critical flood shall be 20% of the probable maximum flood for a Class II dam.

Ohio Administrative Code Rule 1501:21-13-07 requires that an up-ground reservoir have sufficient freeboard to prevent overtopping of the embankment crest. For Class II dams that are up-ground reservoirs, the minimum elevation of the embankment crest shall be at least five (5) feet higher than the elevation of the designed maximum operating pool level unless otherwise approved. In addition, every up-ground reservoir shall have an overflow or other device to preclude overfilling the reservoir during normal filling operations.

CHA performed Hydrologic and Hydraulic (H&H) Analyses for the Bottom Ash Pond, Clearwater Pond and South Fly Ash Ponds. The analysis was used to evaluate if the basins will adequately store 50% of the volume generated during the Probable Maximum Flood (PMF) event.

The Probable Maximum Precipitation (PMP) was generated (27.01 inches) using basin characteristics, information gathered from HMR-51 and 52, and the HMR Boss Program. Unit hydrographs were set up using PondPack modeling software program, based on the calculated time of concentration and curve numbers, using TR-55 Methodologies. Hydrographs were then multiplied by the PMP to determine the PMF event. In conformance with the requirements, the hydrograph was multiplied by 0.50 to develop the 50% PMF event.

Information for each dam was provided in National Dam Inventory Sheets and the 1985 Dam Safety Inspection Report prepared by Woodward-Clyde Consultants Inc. The information and assumptions were used to generate hydrographs and determine storage capacity for each impoundment. Based on the data available, it was assumed for this analysis that the Bottom Ash Pond complex had been divided into two ponds (Bottom Ash Pond and Clearwater Pond). Based on the current sizes and layout of both pond features, each pond exhibits approximately 25ft of freeboard at normal pool conditions. The Bottom Ash Pond is currently being dredged and filled and therefore was assumed to have a reduced storage capacity. As survey and topographic contours were limited for both ponds, the areas and volumes were generated from available survey, recent aerial photographs, and the Dam Inventory Sheets. Contours were generated based on embankment data and a recent site visit. Limited information was available regarding the outlet structures to each pond. Therefore, volumes for 50% of the PMF were generated and elevations were interpolated for the predicted water surface elevation. Based on the existing amount of storage available, each pond is estimated to be capable of storing the volume generated from the 50% PMF event on top of the normal pool elevation without overtopping.

The South Fly Ash Pond is also currently being dredged and filled and therefore was assumed to have a reduced storage capacity. The areas and volumes were generated from available survey, recent aerial photographs, and the Dam Inventory Sheets. Contours were generated based on embankment data and a recent site visit. Limited information was available regarding the outlet structure of the pond. Therefore, the volume for 50% of the PMF was generated and elevations interpolated for the predicted water surface elevation. Based on the existing amount of storage

available, the pond is estimated to be capable of storing the volume generated from the 50% PMF event on top of the normal pool elevation without overtopping.

Table 2 - Summary of Hydrologic and Hydraulic Assessment

Pond	Drainage Area (acres)	Peak Flow Rate In (cfs)	Peak Flow Rate Out (cfs)*	Top of Pond Elev. (feet)	Free - board (feet)	Normal Pool Elevation (feet)	50% PMF Storage Vol. (ac-ft)	50% PMF Storage Peak Elevation (ft)
Bottom Ash	32.3	300.6	0.0	582.0	22.7	557.0	34.6	559.3
Clear-water	9.9	92.3	0.0	582.0	23.4	557.0	10.8	558.6
South Fly Ash	67.3	627.1	0.0	590.0	6.0	582.0	72.9	584.0

*For this analysis it was assumed that there was no outflow from the existing basins.

As summarized in Table 2 it appears that the Bottom Ash Pond, Clearwater Pond and South Fly Ash Ponds will adequately store 50% of the volume generated during the Probable Maximum Flood (PMF).

3.3 Structural Adequacy & Stability

In regards to evaluating the structural adequacy and stability of dams, the ODNR, Division of Soil and Water Resources, Dam Safety Program recognizes "design procedures that have been established by the United States Army Corps of Engineers, the United States Department of Interior, Interior Bureau of Reclamation, the Federal Energy Regulatory Commission, The United States Natural Resources Conservation Service, and others that are generally accepted as sound engineering practice, will be acceptable to the Chief." Table 3 outlines minimum required factors of safety as outlined by the U.S. Army Corps of Engineers (USACOE) in EM 1110-2-1902, Table 3-1 and seismic factors of safety discussed in the FEMA Federal Guidelines for Dam Safety, Earthquake Analyses and Design of Dams (pgs. 31, 32 and 38, May 2005). The guidance values for minimum factor of safety are provided in Table 3. It should be noted that

the recommended minimum values shown below are typically for new construction, and that the Army Corps of Engineers allows lower calculated safety factors for existing structures that have been in service and subject to long term observations of actual performance and routine periodic maintenance.

Table 3 - Minimum Safety Factors Required

Load Case	Required Minimum Factor of Safety
Steady State Conditions at Present Pool or Maximum Storage Pool Elevation	1.5
Rapid Draw-Down Conditions from Present Pool Elevation	1.3
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Conditions from Present Pool Elevation	1.0
Liquefaction	1.3

CHA was not provided with information regarding stability analyses performed for the Bottom Ash Pond and the South Fly Ash Pond. Without having received typical cross sections of the impoundments and subsurface soil and foundation information CHA was unable to perform a preliminary stability analyses for dikes. Our recommendation that subsurface investigations and stability analyses be performed for both the Bottom Ash Pond and South Fly Ash Pond is discussed in Section 4.5.

3.4 Foundation Conditions

No detailed information was available in the OEVC files related to the original construction of the Bottom Ash Pond and the South Fly Ash Pond. The Woodward-Clyde Consultants, Inc. Dam Safety Inspection Report for the Kyger Creek Fly Ash and Bottom Ash Ponds dated February 1985 notes that a plant foundation investigation report was submitted by Arthur and Leo Casagrande (ALC) and dated January 19, 1953 (preliminary) and April 24, 1953 (supplementary). ALC reportedly obtained soil and rock samples from 72 borings drilled along the Ohio River and across State Route 7. From Woodward-Clyde Consultants, Inc.'s examination of the boring plan, it appears that 15 borings drilled on the western side of Route 7

(borings numbered 58 to 72) lie within or near the boundaries of the South Fly Ash Pond. These borings indicated that the original ground surface elevation ranged from about 555 feet to 561 feet. Bedrock in the general area was located between elevation 497.4 feet and 494.2 feet (as indicated by borings 33 and 36, respectively).

The Woodward-Clyde Consultants, Inc. report goes on to say that the data from all 15 borings indicates that stiff clay with lenses of sand underlies the South Fly Ash Pond. The thickness ranged from 16 feet to more than 20 feet, the limit of the deepest boring. Based on the results of the other borings east of Route 7, a granular stratum of sands and gravels most likely underlies the clay and extends to the top of rock. No water was found in any of the borings after a 24-hour period.

The Woodward-Clyde Consultants, Inc. report also notes that there was no information available to confirm that an impervious anti-seepage blanket or other measures have been placed within the ponds.

3.4.1 Documentation of Foundation Preparations

No detailed information was available in the OEVC files related to the original construction of the Bottom Ash Pond and the South Fly Ash Pond.

3.5 Operations & Maintenance

OVEC has prepared a Draft Operations, Inspection and Maintenance Manual for the Kyger Creek Plant - South Flay Ash Pond Dam and Bottom Ash Pond Dam dated January 2009. The manual provides the following:

- Project and Site Descriptions;
- Principal Spillway Characteristics;

- Monitoring and Instrumentation Information;
- Discharge Measurements;
- Summary of Dam Inspection and Maintenance Program; and
- Emergency Procedures.

The manual notes that American Electric Power Service Corporation (AEPSC) operates a Dam Inspection and Maintenance Program (DIMP) for water and ash impounding embankments throughout the AEP System. The Kyger Creek Plant's Bottom Ash and South Fly Ash Ponds are part of this program. The main objective of the program is to monitor the condition and the performance of the dams and to maintain the dams and spillway system in sound working condition. Tasks required under the program are performed by OVEC plant personnel, AEP personnel and outside consultants. The DIMP consists of the following elements:

- Conducting scheduled and unscheduled field inspections to check for signs of malfunction and to read geotechnical instrumentation;
- Graphically plot and interpret field measurements;
- Perform regularly scheduled and routine maintenance work on the dams and appurtenances;
- Investigate problems as they develop;
- Design and implement preventative and remedial measures, as required;
- Activate the EAP in the event that an emergency condition is detected.

The manual outlines that field inspections should be conducted as follows:

- Quarterly, unless otherwise directed by the OVEC engineering division;
- Between 24 and 48 hours after placing three or more stop-logs in an overflow structure;
- Within 24 hours of each rainfall event which results in 2 or more inches of rain in 24 hours.

CHA was provided with a copy of the second quarter Kyger Creek Station Dam/Dike Inspection Checklist dated June 16, 2009. Along with the checklist a map was provided indicating the locations were the conditions were observed. The following conditions were noted on the June 2009 checklist:

- No seepage was observed around the South Fly Ash Pond, Bottom Ash Pond or Clearwater Pond.
- A couple of areas were noted that may need to be sprayed on the interior and exterior embankment slopes of the South Fly Ash for vegetation control.
- Trees were noted on the exterior slope of the South Fly Ash Pond adjacent to Route 7.
- A slide on the interior embankment slope of the South Fly Ash Pond.
- The exterior slope of the South Fly Ash Pond was disturbed by the fly ash test.
- A dip in the northwest corner on the top of the dike was observed and thought to be due to construction traffic.
- Outfall No. 602 was observed to have some erosion.
- Slight erosion was noted at the east side of the Bottom Ash Pond at the crest of the interior embankment slope.
- Erosion was noted in the northwest corner of the Clearwater Pond erosion noted.
- Corners of both the Bottom Ash Pond and the Clearwater Pond need to be sprayed again for vegetation control.
- Heavy brush and trees were noted from the toe of the embankment slope to the river along the east side of the Clearwater Pond and Bottom Ash Pond.
- It was observed that the access path to the Clearwater Pond outlet needed to be cleared.

CHA was also provided with Dike and Dam Inspection Reports for the Bottom Ash Pond and South Fly Ash Pond from 2002, 2003, 2005, 2007 and 2009. The 2009 Dike and Dam Inspection Report was prepared by Stantec Consulting Services, Inc. The report outlined the following deficiencies:

Bottom Ash Pond

- Most areas had some minor erosion occurring on the interior and exterior embankment slopes.
- Numerous large mature trees were observed on the exterior slopes and toes of the southeastern, southwestern and northern dikes.
- Slopes should be mowed at least annually to allow for proper monitoring.

Clearwater Pond

- Numerous large mature trees were observed on the exterior slopes and toes of all the dikes.
- Slopes should be mowed at least annually to allow for proper monitoring.
- A large rodent hole (16-inch diameter) was observed at the toe of the eastern slope of the Clearwater Pond.

South Fly Ash Pond

- Previous evaluations have identified seepage and/or wet areas at the exterior embankment slope toe of the southwestern dike directly below the two fly ash influent pipes installed several years ago. This area was evaluated during the site visit and no seepage or wet area was located. It was recommended that the area be monitored to identify changes in conditions.
- The irregular discharge observed at the outlet of the decant structure should be evaluated to determine if damage has occurred to the pipe or the surrounding dike. Due to the critical nature of this structure, any damage should be immediately repaired.
- The original overflow structure that connected the North Fly Ash Pond to the South Fly Ash Pond should be evaluated to determine if it was properly abandoned. If needed, abandonment should be performed.
- The walkway access to the fly ash discharge structure in the eastern portion of the pond is in poor condition with portions of the walkway deteriorated, supports eroded and handrails missing.

- A depression on the crest at the north corner of the pond was observed. If this section of the crest is not used as an emergency spillway, than the depressed area should be filled with compatible material and compacted.
- Most areas had some minor erosion occurring on the interior embankment slopes.
- Numerous large mature trees were observed on the exterior slope of the southeastern dike. It was recommended that the tress be removed during future maintenance activities if signs of instability are observed. It was recommended that quarterly inspections be performed of the trees over the slopes and that notes be made in the quarterly inspection report.
- Slopes should be mowed at least annually to allow for proper monitoring.
- Several minor depressions (approx. 5 feet square by 1 foot deep) were observed at several locations on the exterior embankment slope of the northwestern dike. The depressions appeared to be stable and no signs of seepage were observed.
- Medium size rodent holes were observed near the toe of the northwestern dike.
- Several minor potholes and rutting were observed on the crest.

3.5.1 State of Ohio Inspections

Ohio Revised Code Section 1521.062 states that the owners of dams must monitor, maintain, and operate their dams safely. The owner is to maintain a safe structure and appurtenances through inspection, maintenance, and operation.

Representatives of the ODNR Dam Safety Program inspected Bottom Ash Pond and South Fly Ash Pond structures on February 10, 2009. Dam Safety Inspection Reports were provided to OVEC following the department's site visit. The reports included required remedial measures based on observation made during the inspection, calculations performed and requirements of the Ohio Administrative Code. A summary of the required remedial measures outlined in the 2008 inspection reports is provided in Table 4. For Engineering Repairs and Investigations the dam owner must retain the services of a professional engineer to address the plans, specification,

investigative reports, and other supporting documentation. The owner is required to complete the items within five (5) years. Owner repairs may be performed by the dam owner or by a hired contractor.

Table 4 – Summary of Required Remedial Measures

Bottom Ash Pond
Engineering Repairs and Investigations
None noted.
Owner Repairs
1. Remove trees and brush from the interior of the northwest embankment, entire exterior slope, and the crest of the northeast embankment. Small, sparse brush appeared to be becoming established in many areas on both the interior and exterior slopes; continue to mow the embankment at regular intervals to prevent the establishment of brush on all embankment surfaces. Remove trees and brush from growing within 10 feet of the effluent pipe outlet.
South Fly Ash Pond
Engineering Repairs and Investigations
None noted.
Owner Repairs
1. Remove trees and brush from the interior of the southeast embankment and remove brush from the northwest interior embankment slope. Small, sparse brush appeared to be becoming established in many areas on both the exterior slopes; continue to mow the embankment at regular intervals to prevent the establishment of brush on all embankment surfaces.
2. Repair low area on the crest near the north corner of the embankment. At the time of this inspection, this area appeared approximately two feet low.

4.0 CONCLUSIONS/RECOMMENDATIONS

4.1 Acknowledgement of Management Unit Condition

I acknowledge that the management units referenced herein were personally inspected by me and were found to be in the following condition: **Poor.**

A management unit found to be in poor condition is defined as one in which a safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. **Poor also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.** In the area of the Bottom Ash Pond and the South Fly Ash Pond, limited data was available to determine the stability under the required loading conditions.

CHA's assessment of the Bottom Ash Pond and South Fly Ash Pond embankments indicate that they are in poor condition. As described in the following sections, maintenance and monitoring will further enhance the condition of these dams.

4.2 Maintaining Vegetation Growth

Trees and brush should be cleared from all of the interior and exterior slopes of all the Bottom Ash and South Fly Ash Pond dikes. Tree roots can allow for seepage of the retained water through the dikes, which could lead to internal erosion. Internal erosion could weaken the dikes and cause slope failures.

Additionally, the uprooting of trees during storms can create large voids in the embankments that are then susceptible to erosion. Considering the progressive erosion that could occur during a storm which blows the tree over during heavy rains (i.e., hurricane type storm systems) progressive erosion could potentially result in enough loss of soil from the dike to create an

unstable situation, which if failure occurs could result in a release of ash. CHA recommends that vegetation be cut on a regular basis to ensure that adequate visual observations are being made by during routine inspections.

4.3 Erosion Protection and Repair

Erosion rills and subsequent loss of grass cover were observed on multiple embankment slopes of the Bottom Ash Pond and South Fly Ash Pond as discussed in Sections 2.2.1 and 2.3.1. Thinning and loss of grass cover due to concentrated flow was noted on the embankment slopes. CHA recommends repairing these areas by filling all rills with compacted material and re-seeding to establish grass where applicable (i.e. exterior embankment slopes).

4.4 Animal Control

Evidence of animal burrows was observed on the exterior dike of Bottom Ash Pond and the South Fly Ash Pond. CHA recommends OVEC personnel make note of areas disturbed by animal activity, trap animals, and make repairs to areas to protect the integrity of the dikes. Although not seen on other dikes, vegetation cover hides these features.

4.5 Stability Analysis

It is recommended that detailed stability analyses be performed for the Bottom Ash Pond and South Fly Ash Pond. CHA was not provided with information regarding stability analyses performed prior to or following construction of the ponds nor was information regarding properties of the embankment and foundation soils provided.

The stability analyses for each pond should include a subsurface investigation to determine existing soil parameters in the embankments and foundation soils and the installation of

piezometers to determine the current pheratic surface. Loading conditions that should be modeled should include those listed in Table 3, Section 3.3.

5.0 CLOSING

The information presented in this report is based on visual field observations, review of reports by others and this limited knowledge of the history of the Kyger Creek Power Station surface impoundments. The recommendations presented are based, in part, on project information available at the time of this report. No other warranty, expressed or implied is made. Should additional information or changes in field conditions occur, the conclusions and recommendations provided in this report should be re-evaluated by an experienced engineer.

APPENDIX A

Completed EPA Coal Combustion Dam Inspection Checklist Forms

&

Completed EPA Coal Combustion Waste (CCW) Impoundment Inspection Forms

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Kyger Creek Power Station	Date:	October 15, 2009
Unit Name:	Kyger Creek Bottom Ash Pond	Operator's Name:	Ohio Valley Electric Corporation
Unit I.D.:	OH01599	Hazard Potential Classification:	(High) Significant Low
Inspector's Name:	Malcolm D. Hargraves P.E. /Rebecca Filkins		

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?	annually		18. Sloughing or bulging on slopes?		x
2. Pool elevation (operator records)?	557		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	557		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	n/a		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	582		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	n/a		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)?	n/a		From underdrain?	n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)	x		At isolated points on embankment slopes?	see	note
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?	see	note
12. Are decant trashracks clear and in place?	x		From downstream foundation area?	see	note
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?	see	note
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

"n/a" = Not available/Not applicable.

1 AEP provides engineering services for Ohio Valley Electric and inspects annually.

9 Trees up to 24" to 30" in diameter noted near north dike crest; outboard slopes of east, north, south, and southwest dikes are heavily vegetated.

16 Spillway/decant inlets and outlet beneath separator dike to clear basin are submerged; river outlet is clear.

19 Isolated erosion rills and loss of vegetative cover were noted on the east dike inboard and outboard slope.

21 Due to recent rain and runoff, widespread seepage would not be readily observable unless heavy or ash laden.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0005282 INSPECTOR Hargraves/Filkins

Date October 15, 2009

Impoundment Name Kyger Creek Bottom Ash Pond

Impoundment Company Ohio Valley Electric Corporation

EPA Region 5

State Agency (Field Office) Addresss Ohio EPA Southeast District Office
2195 Front Street; Logan, Ohio 43138-8687

Name of Impoundment Kyger Creek Bottom Ash Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update x

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

IMPOUNDMENT FUNCTION: Bottom Ash

Nearest Downstream Town : Name Addison, Ohio

Distance from the impoundment 0.6 miles

Impoundment Location:

Longitude 82 Degrees 7 Minutes 58 Seconds

Latitude 38 Degrees 54 Minutes 37 Seconds

State Ohio County Gallia

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

If So Which State Agency? ODNR-Division of Water

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.

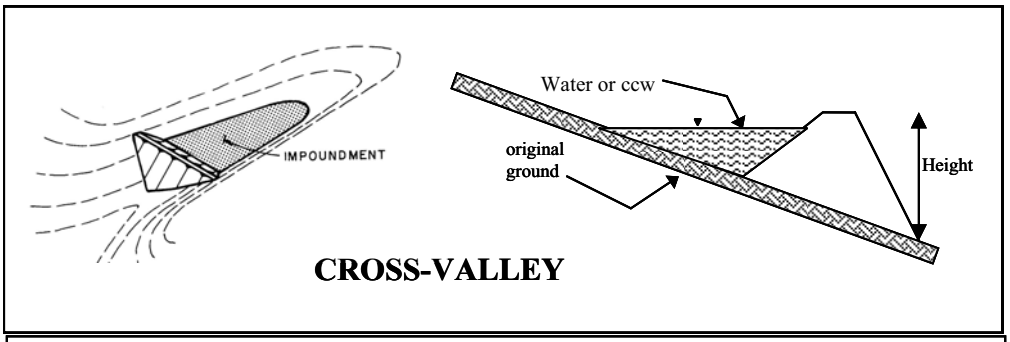
_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

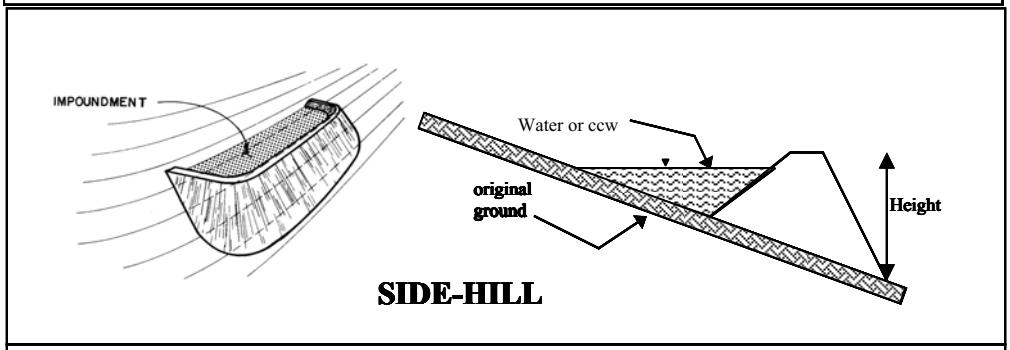
x_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

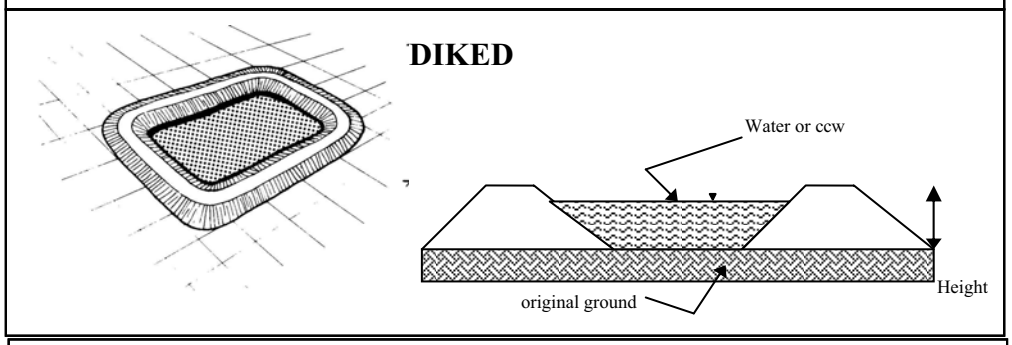
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

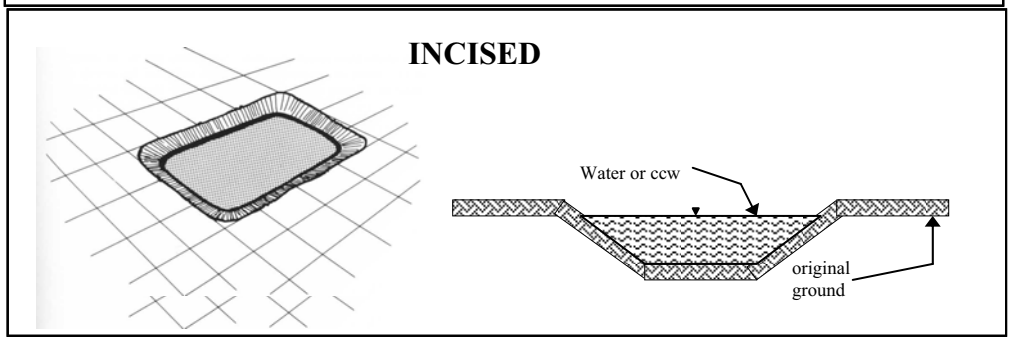
In the event of a failure under full pool at elevation 582, the waste would impact the Kyger Creek Plant facilities to the north and Ohio Route 7 to the west, potentially endangering Kyger Creek plant employees and vehicular traffic. A breach wave would also impact Kyger Creek to the south and the Ohio River to the east.

CONFIGURATION:









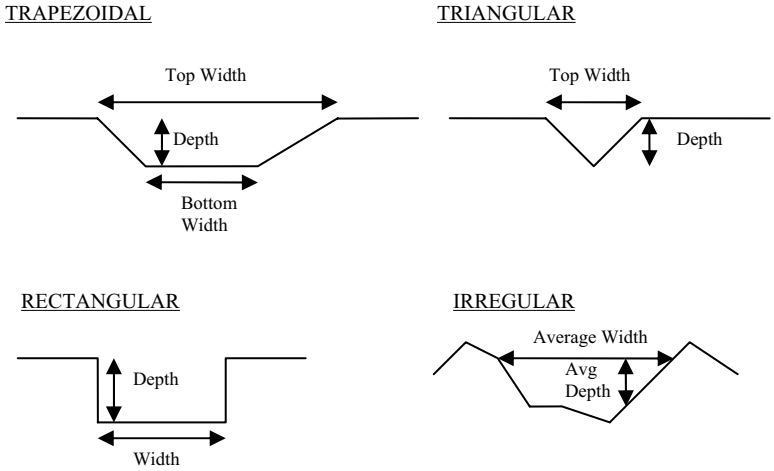
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 41 feet Embankment Material Earthfill
Pool Area 34 acres Liner none
Current Freeboard approx. 25 feet Liner Permeability n/a

TYPE OF OUTLET (Mark all that apply)

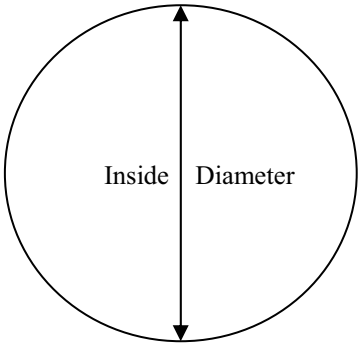
n/a **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width
_____



x **Outlet**

36 inside diameter



Material
_____ corrugated metal
_____ welded steel
x concrete
_____ 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 Sargent Lundy Engineers, Chicago, Illinois

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

If So When? n/a_____

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 :

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Kyger Creek Power Station	Date:	October 15, 2009
Unit Name:	Kyger Creek South Fly Ash Pond	Operator's Name:	Ohio Valley Electric Corporation
Unit I.D.:	OH01600	Hazard Potential Classification:	(High) Significant Low
Inspector's Name:	Malcolm D. Hargraves P.E./Rebecca Filkins		

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?	annually		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	582		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	582		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	n/a		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	590		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	n/a		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)?	n/a		From underdrain?	n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)	x		At isolated points on embankment slopes?	see	note
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?	see	note
12. Are decant trashracks clear and in place?	x		From downstream foundation area?	see	note
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?	see	note
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?	see	note	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

"n/a" = Not available/Not applicable.

1 AEP provides engineering services for Ohio Valley Electric and inspects annually.

9 Large trees up to 30" in diameter were observed growing on the bottom 1/2 to 2/3 of the east dike.

16, 21 Due to recent rain, the outlet was partially submerged in the drainage swale adjacent to the dike. Furthermore, widespread seepage would not be readily observable unless heavy or ash laden.

18 Isolated sloughs, undulations observed on west dike adjacent to drainage swale.

20 Effluent had gray tint to it.

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0005282 INSPECTOR Hargraves/Filkins
Date October 15, 2009

Impoundment Name Kyger Creek South Fly Ash Pond
Impoundment Company Ohio Valley Electric Corporation
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southeast District Office
2195 Front Street; Logan, Ohio 43138-8687
Name of Impoundment Kyger Creek South Fly Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update x

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

IMPOUNDMENT FUNCTION: Fly Ash

Nearest Downstream Town : Name Addison, Ohio
Distance from the impoundment 1.9 miles
Impoundment Location:
Longitude 82 Degrees 7 Minutes 50 Seconds
Latitude 38 Degrees 55 Minutes 8 Seconds
State Ohio County Gallia

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

If So Which State Agency? ODNR-Division of Water

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.

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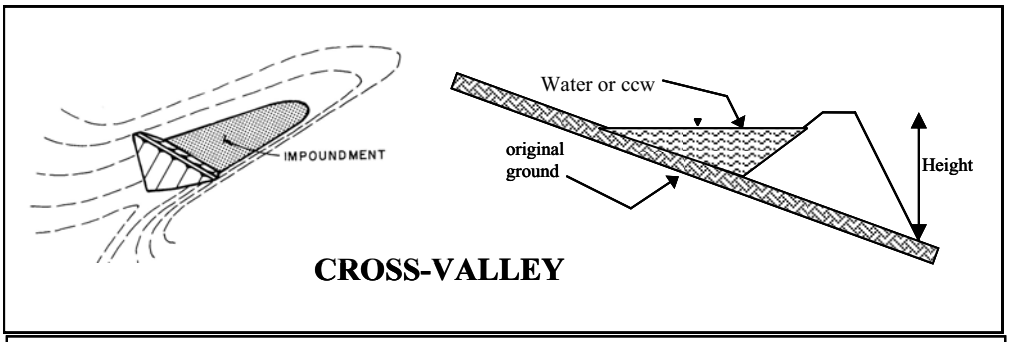
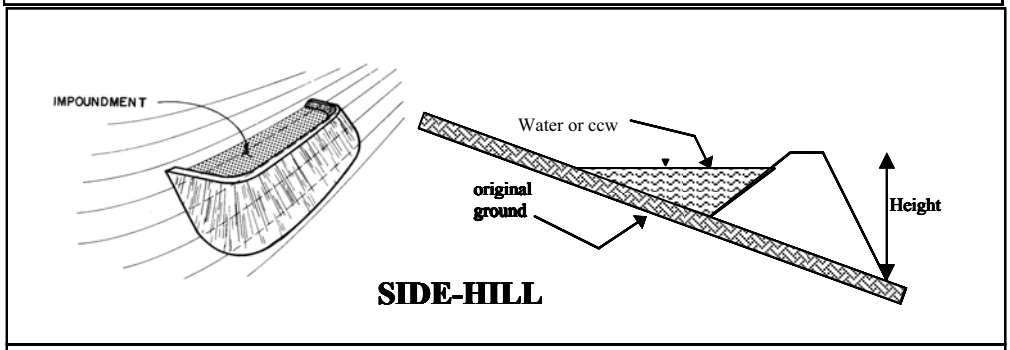
x_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

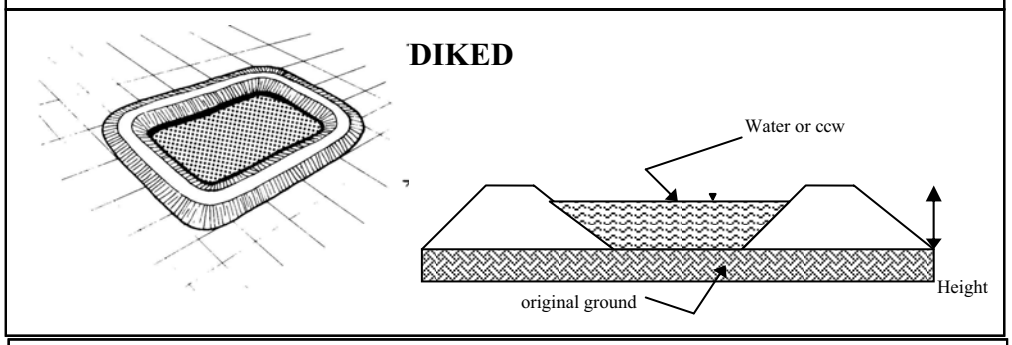
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

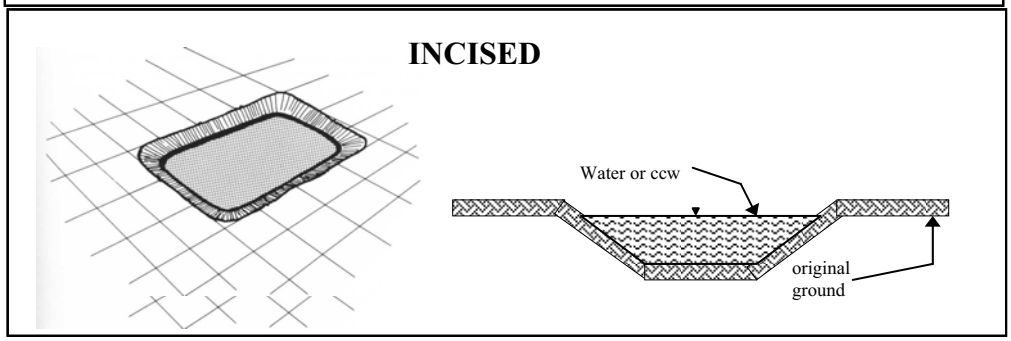
In the event of a failure under full pool at elevation 590, the waste would impact the Kyger Creek Plant facilities and Ohio Route 7 to the east, potentially endangering Kyger Creek plant employees and vehicular traffic. A breach wave would also impact Kyger Creek and likely the Ohio River.

CONFIGURATION:









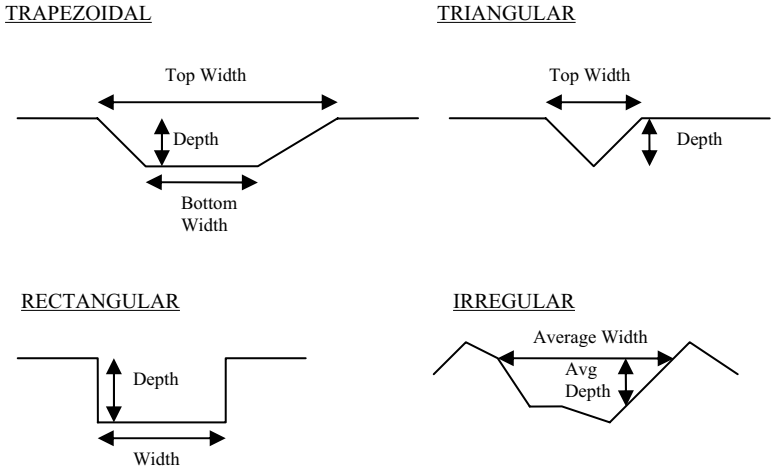
_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 40 feet Embankment Material Earthfill
Pool Area 66 acres Liner none
Current Freeboard approx. 8 feet Liner Permeability n/a

TYPE OF OUTLET (Mark all that apply)

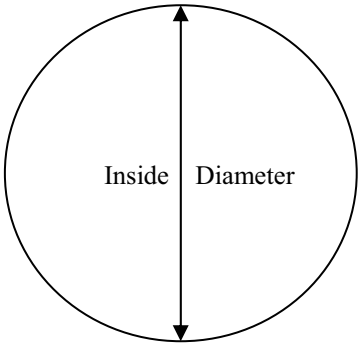
n/a **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width
_____



x **Outlet**

36 inside diameter



Material
_____ corrugated metal
_____ welded steel
x concrete
_____ 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 Sargent Lundy Engineers, Chicago, Illinois

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

If So When? n/a_____

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 :