HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

12 October 2016
File No. 40373-345

SUBJECT: CCR History of Construction
Pond 5
Dayton Power & Light Company
J.M. Stuart Electric Generating Station
Aberdeen, Ohio

Haley & Aldrich, Inc. (Haley & Aldrich) has assisted Dayton Power & Light Company (DP&L) with compiling the history of construction for Pond 5 at the J.M. Stuart Electric Generating Station. This work was performed in accordance with the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities, 40 CFR Part 257, specifically §257.73(c)(1).

To the extent feasible, Dayton Power & Light Co. has provided documentation supporting the history of construction. Information on the history of construction Pond 5 is presented in the following sections.

§257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Owner: Dayton Power & Light Company
745 US Route 52
P.O. Box 468
Aberdeen, OH 45101

Name of Unit: Pond 5

NID[1] ID/ODNR ID Number: OH03182/8535-003

§257.73(c)(1)(ii): The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.

Latitude: 38°38'26"
Longitude: 83°42'08"
The general facility location map is included in **Appendix 1**.

[1] National Inventory of Dams database which documents dams in the United States and is maintained by the USACE.

<u>§257.73(c)(1)(iii):</u> A statement of the purpose for which the CCR unit is being used.

Pond 5 is a CCR impoundment that receives influent from plant process including area drains, bottom ash sluicing, cooling tower blow down, and FGD blow down.

<u>§257.73(c)(1)(iv):</u> The name and size, in acres, of the watershed within which the CCR unit is located.

Watershed Name: DP&L Pond 5
Watershed Area: 42 acres

Watershed delineation and associated area are included in **Appendix 2**, from a memorandum titled, "Pond 5 Inflow Design Flood Control System Plan," by Haley & Aldrich, dated October 2016. Since the Ash Pond berms are above-grade, the watershed area corresponds to the pond boundaries shown in the figure.

<u>§257.73(c)(1)(v)</u>: A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

The description of the physical and engineering properties of the foundation and abutment materials on which Pond 5 is constructed was discussed in the following reports:

- "Bottom Ash Pond 5B Evaluation and Alternatives Analysis," by URS Corporation, dated 20 April 2001.
- "Assessment of Dam Safety, Coal Combustion Impoundments (Task 3), Final Report" by CHA, dated 26 May 2010.
- "Ash Pond 5 Embankment Evaluation" by Soil & Materials Engineering, Inc., dated 9 January 1985.

Pertinent pages from the above referenced reports providing the required information are included in **Appendix 3**.

A subsurface exploration program, including work around Pond 5, was performed as part of the CCR Rule compliance Safety Factor Assessment. The final report, entitled "Initial Safety Factor Assessment, J.M. Stuart Station, Ponds 3A, 5, 6, 7, and 10" by Haley & Aldrich, Inc., dated October 2016 details test borings and cone penetrometer soundings performed adjacent to the unit (see pages 5-7 and Appendix A). This report in its entirety is available to the public via the DP&L CCR Rule compliance website.

<u>§257.73(c)(1)(vi)</u>: A statement of the type, size, range, and physical engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction used in constructing each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

Pond 5 was constructed in **1** zone/stage.

The type, size, range, and physical engineering properties of the materials of each stage of Pond 5 as well as the method of site preparation are discussed in the following reports:

- "Bottom Ash Pond 5B Evaluation and Alternatives Analysis," by URS Corporation, dated 20 April 2001.
- "Assessment of Dam Safety, Coal Combustion Impoundments (Task 3), Final Report" by CHA, dated 26 May 2010.
- "Ash Pond 5 Embankment Evaluation" by Soil & Materials Engineering, Inc., dated 9 January 1985.

The above referenced URS report indicates the Pond 5 embankments were constructed from naturally occurring alluvial deposits varying from clays and silts to sands and gravels. These soils were obtained from local borrow sources, hauled to site, and placed and compacted in the embankments. The URS test borings drilled from the crest of the embankments encountered between 37 and 42 feet of fill. The embankment fill generally consisted of medium stiff to very stiff lean CLAY to silty CLAY with varying amounts of sand. The standard penetration test results indicate the embankment fill was systematically compacted during construction.

The approximate dates of construction for each zone/stage are as follows:

- Zone/Stage 1: approximately 1972-1973.

Pertinent pages from the above referenced reports providing the required information are included in **Appendix 4**.

§257.73(c)(1)(vii): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

Design drawings providing information listed above, as available, are included in **Appendix 5**. Should the design drawings not include information identified in 257.73(c)(1)(vii), it should be assumed that design drawings including this information are not available.

§257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

The following instrumentation exists at Pond 5:

- Five (5) Piezometers

Piezometers were initially installed as test borings and converted to piezometers to evaluate the seepage conditions through the embankment of Pond 5. The piezometers can be utilized for monitoring long-term groundwater levels and to monitor water quality. The existing instrumentation of Pond 5 is discussed the following report:

- "Ash Pond 5 Seepage Assessment" by BBC&M Engineering Inc., dated 1 April 2010.

Pertinent pages from the above referenced report providing the required information are included in **Appendix 6**.

§257.73(c)(1)(ix): Area- capacity curves for the CCR unit.

A large number of DP&L historical facility documents was provided to Haley & Aldrich by DP&L, within which no record of area-capacity curves for Pond 5 was found.

§257.73(c)(1)(x): A description of each spillway and diversion design features and capacity calculations used in their determination.

Pond 5 maintains the following spillways/diversion design features:

- Sheet pile structure with 60" corrugated metal pipe (CMP) which flows to the wet well in the filter building; and
- Wet well is designed with an overflow weir to bypass the normal filter process;
- An approximate 330 LF 36" reinforced concrete pipe (RCP) conveys water from the filter building to NPDES outfall 012.

A description of the Pond 5 spillway is discussed in the following reports:

- "Assessment of Dam Safety Coal Combustion Surface Impoundments (Task 3) Final Report" by CHA, dated 26 March 2010.
- "Dam Safety Inspection Report – J.M. Stuart Station Ash Pond 5," by Ohio Department of Natural Resources, dated 27 October 2009.

Pertinent pages from the above mentioned reports providing the required information are included in **Appendix 7**.

<u>§257.73(c)(1)(xi)</u>: The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

The construction specifications and provisions for surveillance, maintenance, and repair of Pond 5 are discussed in the following documents:

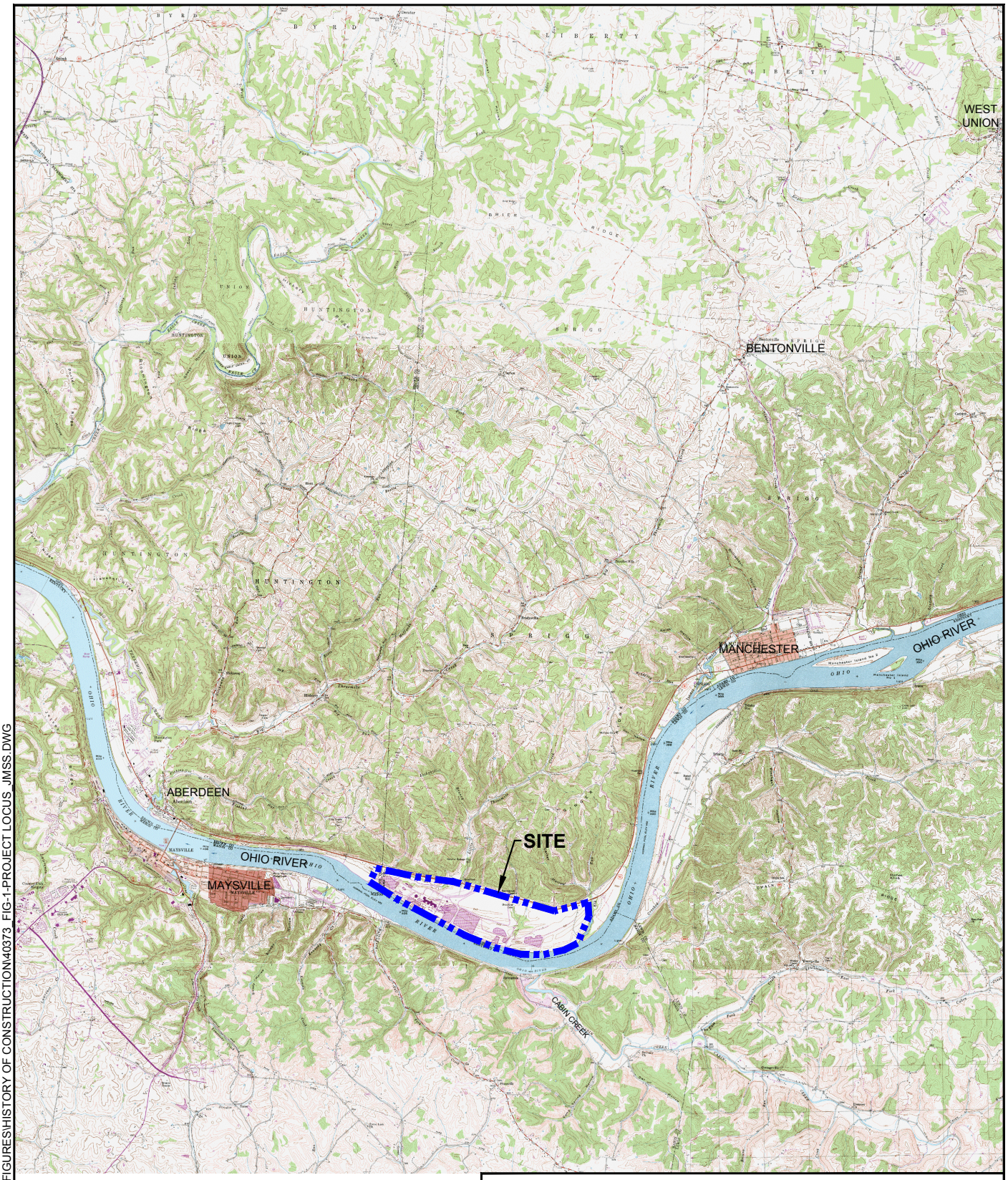
- "Operation Maintenance and Inspection Manual Ash Impoundment Dike Stuart Electric Generating Station" by DP&L, dated 8 April 2014.
- "Assessment of Dam Safety Coal Combustion Surface Impoundment (Task 3) Final Report" by CHA, dated 26 March 2010.

Pertinent pages from the above mentioned reports providing the required information are included in **Appendix 8**.

<u>§257.73(c)(1)(xii)</u>: Any record or knowledge of structural instability of the CCR unit.

There are no records or knowledge of structural instability associated with Pond 5**.**

APPENDIX 1
Site Locus



TOPO SOURCE: USGS TOPOGRAPHIC MAPS
RUSSELLVILLE, DECATUR, WEST UNION, MAYSVILLE EAST, MAYSVILLE WEST , MANCHESTER ISLANDS - OHIO
MAYS LICK, ORANGEBURG, TOLLESBORO - KENTUCKY
QUADRANGLES (2013)

HALEY ALDRICH

DAYTON POWER & LIGHT COMPANY
J. M. STUART GENERATING STATION
745 U.S. ROUTE 52
ABERDEEN, OHIO

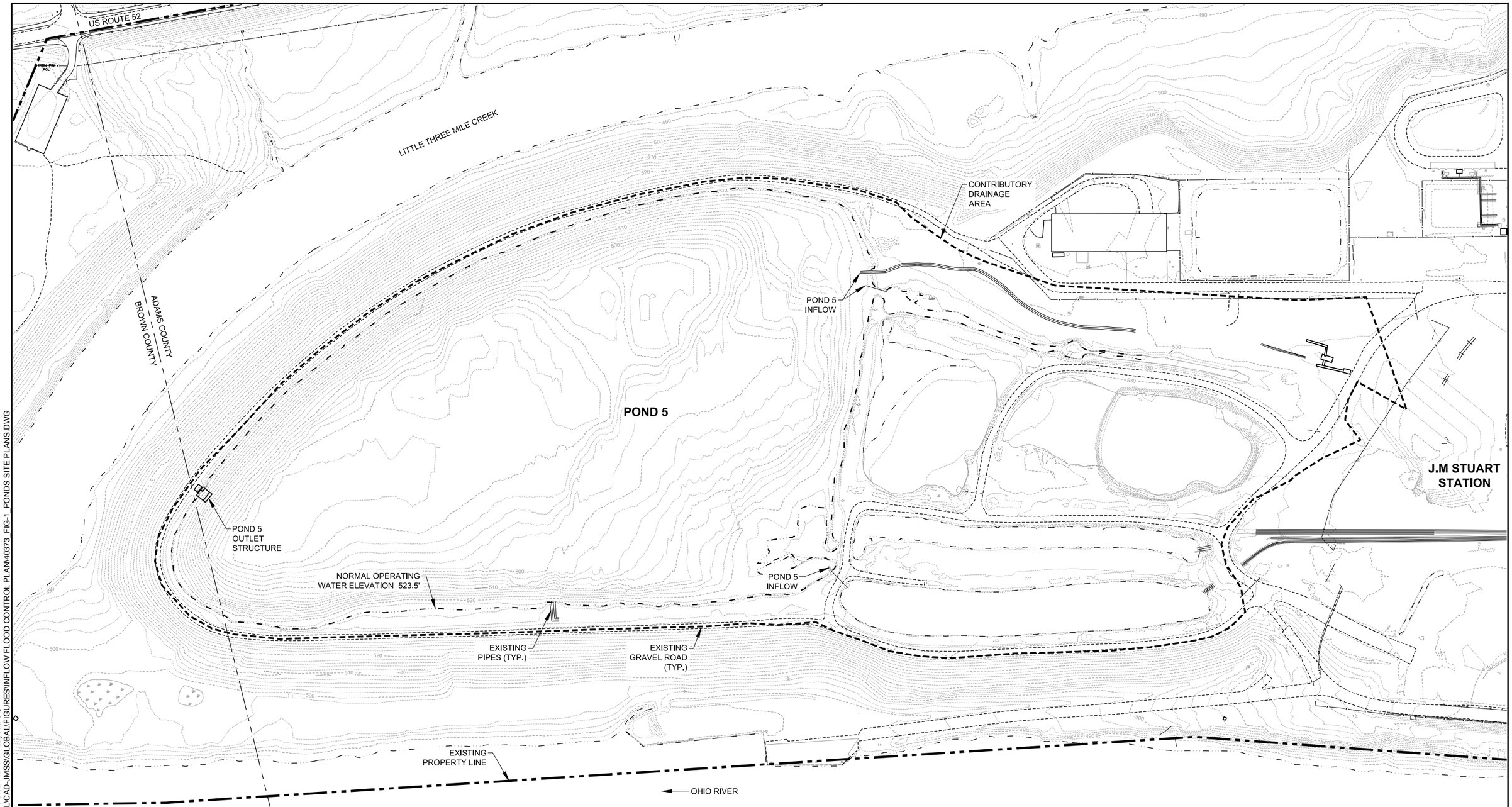
PROJECT LOCUS

APPROXIMATE SCALE: 1" = 10 000'
OCTOBER 2016

FIGURE 1

LUCAS, ANDY Printed: 9/30/2016 11:16 AM Layout: FIGURE 1
G:\40373_DP&L\CAD-JMSS\GLOBAL\FIGURES\HISTORY OF CONSTRUCTION\40373_FIG-1-PROJECT LOCUS_JMSS.DWG

APPENDIX 2
Figure 1 and Appendix from:
Pond 5 Inflow Design Flood Control System Plan
By Haley & Aldrich, Dated October 2016



LEGEND

- EXISTING PROPERTY LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING PIPES
- EXISTING GRAVEL ROAD
- NORMAL OPERATING WATER
- CONTRIBUTORY DRAINAGE AREA
- TYPICAL OPERATING WATER LEVEL

NOTES

1. TOPOGRAPHY FROM GROUND CONTROL SURVEYS DATED APRIL 2013 BY L.R. KIMBALL, AND FROM AERIAL PHOTOGRAPHY DATED APRIL 18, 2013.
   - HORIZONTAL CONTROL IS BASED ON NAD83 OH STATE PLANE DATUM.
   - VERTICAL CONTROL IS BASED ON NAVD88 DATUM, ADJUSTED IN VERTICAL TO PLANT VERTICAL.
2. TOPOGRAPHY FROM 2013 SURVEY WAS COMBINED WITH POND BATHYMETRY (POND 7 FROM 2012, POND 10 FROM 2013, PONDS 3A, 5, 6 FROM 2014).

0 200
SCALE IN FEET

HALEY ALDRICH

DAYTON POWER & LIGHT COMPANY
J.M. STUART STATION
ABERDEEN, OHIO

POND 5
SITE PLAN

SCALE: AS SHOWN
OCTOBER 2016

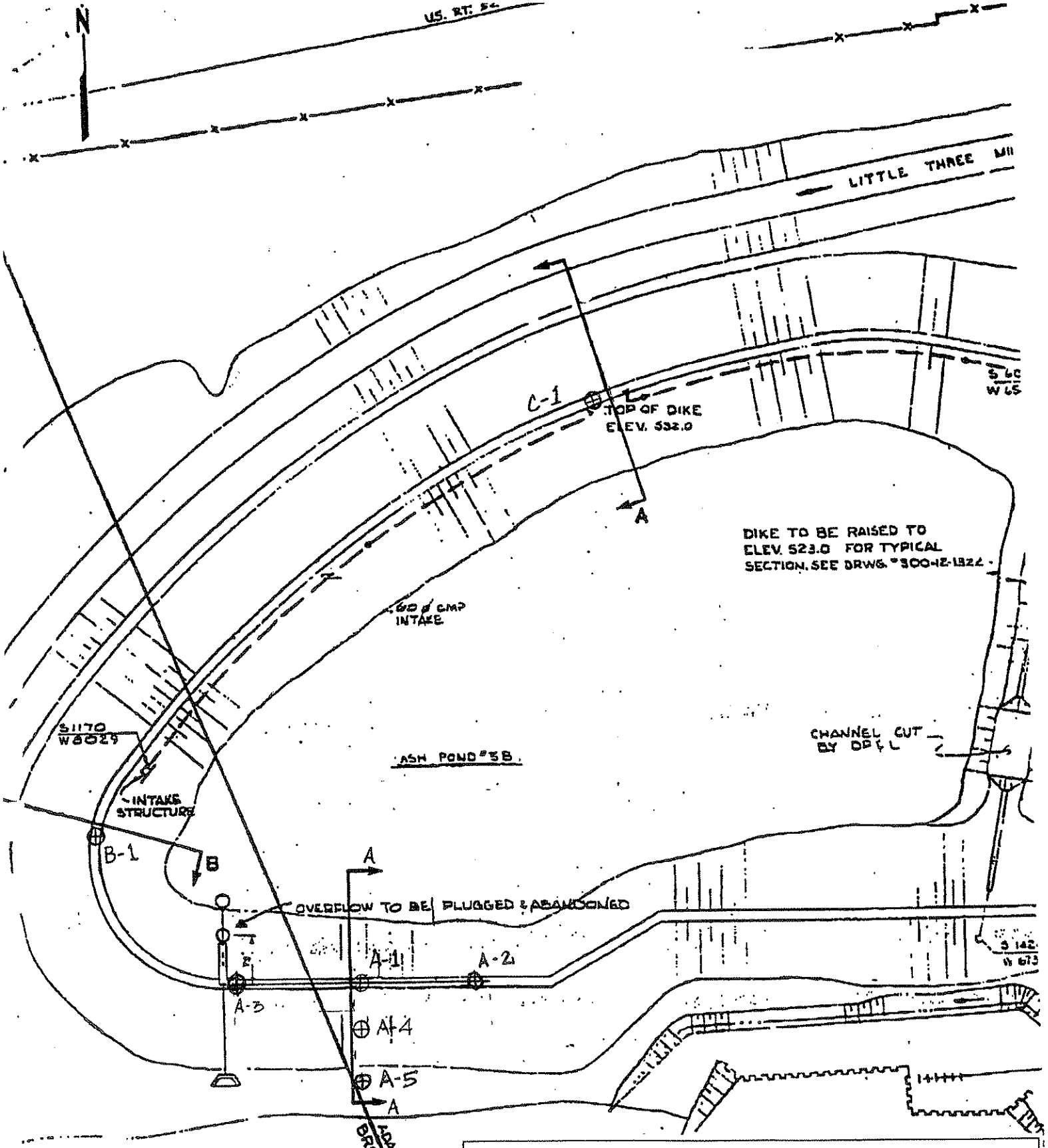
FIGURE 1

LUCAS, ANDY Printed: 7/7/2016 3:32 PM Layout: P5
\\CLECOMMON\PROJECTS\40373_DP&L\CAD-JMSS\GLOBAL\FIGURES\INFLOW FLOOD CONTROL PLAN\40373_FIG-1_PONDS SITE PLANS.DWG

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
19.711	69	Pasture/grassland/range, Fair, HSG B (P5S)
22.455	98	Water Surface, HSG B (P5S)
42.166	**84**	**TOTAL AREA**

APPENDIX 3.1
Excerpt from:
Bottom Ash Pond 5B Evaluation and Alternatives Analysis
By URS Corporation, Dated 20 April 2001
Figures 2 & 3, Appendix A, Table 1



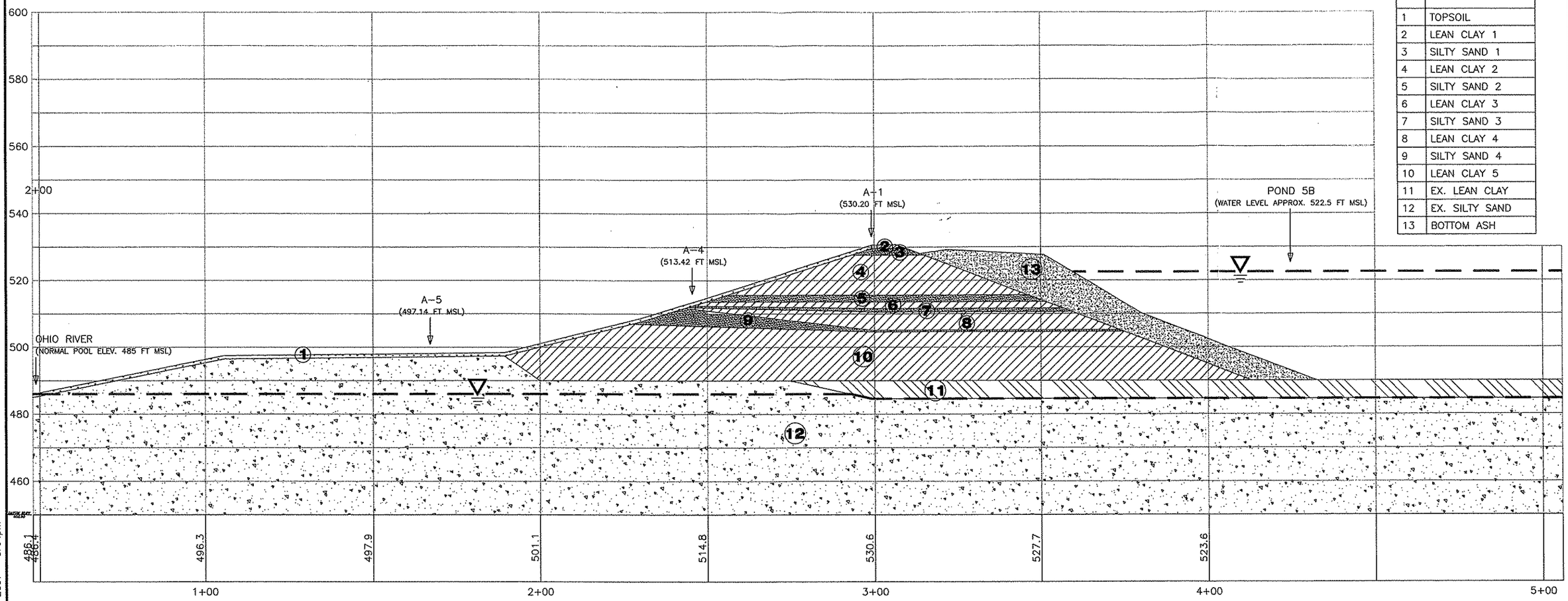
DAYTON POWER AND LIGHT
J. M. STUART GENERATING STATION

ASH POND 5 EVALUATION

GEOTECHNICAL SOIL BORING LOCATION PLAN

APPROXIMATE SCALE 1 IN.=200 FT. APRIL, 2001

FIGURE 2.



NO.	SOILS
1	TOPSOIL
2	LEAN CLAY 1
3	SILTY SAND 1
4	LEAN CLAY 2
5	SILTY SAND 2
6	LEAN CLAY 3
7	SILTY SAND 3
8	LEAN CLAY 4
9	SILTY SAND 4
10	LEAN CLAY 5
11	EX. LEAN CLAY
12	EX. SILTY SAND
13	BOTTOM ASH

SUBSURFACE CROSS-SECTION A-A'

LEGEND

WATER TABLE

0 15 30 60

APPROXIMATE SCALE IN FEET
VERTICAL AND HORIZONTAL

NOTES:

1. SUBSURAFCE CONDITIONS INTERPRETED FROM SOILS EXPLORATION.
2. SURFACE TOPOGRAPHY WAS INTERPOLATED FROM SURVEY DATA COLLECTED BY HIRSCH & ASSOCIATES.
3. GROUNDWATER WAS ENCOUNTERED AT APPROXIMATELY 517 AND 486 FT MSL IN BORINGS A-1 AND A-5, RESPECTIVELY.

REVISION 4-6-01

GENERALIZED CROSS-SECTION A-A'
JM STUART STATION - BOTTOM ASH POND 5B
DAYTON POWER AND LIGHT - ABERDEEN, OHIO

URS CORPORATION
800 WEST ST. CLAIR AVENUE
CLEVELAND, OHIO 44113
(216) 622-2400

DR. BY	MDR	SCALE	AS SHOWN	DWG. NO. 1	PROJ. NO. 8E06133
CK'D. BY	SFP	DATE	APRIL 11, 2001	FIG. NO.	3

Q:\DaytonPL\8e06133\BottomAshPond5A\slope1.dwg User:Rokoff Apr 10, 2001 - 3:04pm

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Key to Log of Boring

Elevation feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resistance, blows / 6 in.	SAMPLES: Recovery, inches	SAMPLES: Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION		FIELD NOTES AND WELL DETAILS
1	2	3	4	5	6	7	8	9	10	11

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop; "NA" indicates data not recorded.

6 **Recovery:** Percentage or length (in feet) of sample length actually recovered in sampler; "NA" indicates data not recorded.

7 **Pocket Penetrometer, tsf:** Pocket penetrometer field consistency measurement in tons per square foot (tsf).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

10 **Well or Hole Completion:** Schematic of piezometer or well installation; materials are listed alongside well schematic; graphic symbols are explained below.

11 **Field Notes and Well Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Well construction materials and installation details are also listed.

WC Water Content, in percent
LL = Liquid Limit, in percent
PL = Plastic Limit, in percent
PI = Plasticity Index, in percent
%G = Percent gravel in sieved specimen (>#4 sieve)
%S = Percent sand in sieved specimen (<#4, >#200 sieve)
%M = Percent silt in sieved specimen (<#200 sieve, >0.002 ppm)
%C = Percent clay in sieved specimen (>0.002 ppm)
%F = Percent fines in sieved specimen (<#200 sieve)

TYPICAL SOIL GRAPHIC SYMBOLS

Lean CLAY
Silty SAND
Topsoil
Silty CLAY
Silty SAND
Lean CLAY to Silty CLAY
SAND to Silty SAND
Sandy SILT to Silty SAND

TYPICAL WELL GRAPHIC SYMBOLS

Pipe in Bentonite
Concrete
Pipe in Filter Sand
#4 Silica
Bentonite Pellets
Pipe in Fine Filter Sand
Soil
Screen
Pipe in Cement Grout
Inclinometer
Pipe in Cement

TYPICAL SAMPLER GRAPHIC SYMBOLS

SPT Split Spoon
Shelby Tube

OTHER GRAPHIC SYMBOLS

First water encountered at time of drilling and sampling (ATD)
Minor change in material properties within a lithologic stratum

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-1

Sheet 1 of 2

Date(s) Drilled	1/16/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	46.0 feet
Drill Rig Type	Brainard Kilman 81 - truck mounted	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~530.2 ft
Groundwater Depth and Date Measured	@ 15.2 ft ATD 13.5 ft on 2/2/01	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	
Diameter of Hole (inches)	8-inch OD; Diameter of Well (inches): 2 inches	Type of Well Casing	PVC - .10 slot; Screen Perforation: ~43.9-3.9		
Type of Sand Pack	Silica No. 4 @ (4'-46')	Location	Pond 5, southside, top of slope above inclinometer, 36 ft West of survey Point, P5A15		

Elevation feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0						Stiff, moist, brown, sandy silty CLAY (CL-ML)		bentonite
			SS1	1 3 6 6	75	1.5 1.5 1.75	Medium dense, moist, brown, silty SAND (SM) with trace gravel		# 4 Silica
							Becomes with increasing silt/clay		
			SS2	3 6 7 8	88	1.5 2.25 4.5 4.5	Stiff, moist, brown, lean CLAY (CL) with sand, trace gravel		
525	5		SS3	4 6 7 8	88	4.5 3.5 2.5	Becomes with less gravel, with less sand		
			SS4	2 4 6 7	79	1.75 1.75 2.0 2.5			WC=21.8 LL=41; PL=23; PI=18
			SS5	3 6 6 7	88	1.75 4.25 3.25 2.5			
520	10						Becomes very stiff		
			SS6	3 7 9 11	92	3.5 4.5 4.5 4.25			
							Becomes stiff		
			SS7	2 5 6 9	88	4.25 4.5 4.5 4.5			
							Becomes gray		
515	15		SS8	2 5 13 14	83	1.0 1.5			Becomes wet at 15.2-ft
							Medium dense, wet, brown, medium to coarse, silty SAND (SM) with well graded SAND with silt and gravel (SW-SM)		%G=29.1; %S=58.2; %M=2.7; %C=9.9
							Becomes loose		
			SS9	6 5 5 13	83	1.5 4.5	Stiff to very stiff, moist, brown sandy Silty CLAY (CL-ML) with seams of fine silty SND and sandy SILT		Beginning of a 2-foot transition zone
			SS10	5 7 11 11	83	4.5	Medium dense, moist to wet, brown, fine to coarse, well graded SAND with silt (SW-SM) to silty SAND (SM) trace gravel		
510	20						Very stiff, moist, brown, lean CLAY (CL) with sand		
			SS11	5 9 10 11	100	4.5 4.5 4.5 4.5	Moist, silty SAND (SM) with gravel		Note: the outside surface of sample is wet from water in borehole going into spoon. middle of sample is moist.
							Becomes sandy silty CLAY (CL-ML) transitioning to lean CLAY (CL) with sand		
			SS12	5 7 8 10	100	4.5 3.5 2.5 4.5	Becomes with less sand		

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-1

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
505	25	SS	13	3, 7, 13, 11	83	2.75, 4.5				
								Dense, moist, dark brown, medium to fine, silty SAND (SM) trace gravel		
								Very stiff, moist, brown, sandy silty CLAY (CL-ML) trace gravel		
		SS	14	4, 7, 9, 13	96	4.5, 4.5, 4.5, 4.5		Very stiff, moist, brown to brown with gray mottling, lean CLAY (CL) with sand and occasional fine sand laminae (<1/4-inch)		
		SS	15	5, 8, 12, 14	100	3.75, 4.5, 4.5, 4.5				
500	30	SS	16	3, 8, 10, 12	96	4.5, 4.5, 3.5, 2.75		10-inch grayish brown seam		
		SS	17	2, 4, 7, 12	96	3.5, 4.5, 4.5, 4.25		Becomes very stiff		
495	35	SS	18	4, 6, 10, 11	100	3.0, 3.5, 4.5, 4.5		Becomes stiff		
		SS	19	3, 5, 8, 8	92	1.75, 2.5, 3.5, 4.25		8-inch seam with trace gravel, increased sand content		WC=11.8 LL=27; PL=16; PI=11
		SS	20	3, 6, 8, 15	96	4.0, 3.0, 2.0				
								Moist, brown, sandy silty CLAY (CL-ML) to sandy SILT (ML)		
490	40	SS	21	6, 9, 11, 11		4.0, 3.5, 3.0, 2.5		Very stiff, moist, brown and gray sandy silty CLAY (CL-ML)		
								Interbedded, stiff, moist, gray silty CLAY (CL-ML) SILT (ML) and fine SAND (SP-SM) to poorly graded SAND with silt (SP)		
		SS	22	3, 6, 5, 6	100	3.5, 2.5, 1.5, 1.5		Becomes medium stiff and sand seams become moist to wet		Soil @ 43.9 to 46 ft
485	45	SS	23	1, 3, 3, 4		1.25, 1.25, 1.25, 1.25				Bottom screen @43.9 Install monitoring point and pull augers
								End of boring at 46.0 ft bgs		
480	50									

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-1

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-2

Date(s) Drilled	1/18/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	23.7 feet
Drill Rig Type	Brainard Kilman 81 - truck mounted	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~530.5 ft
Groundwater Depth and Date Measured	Encountered @ 11.7 ft	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	Borehole backfilled with Quick Grout
Diameter of Hole (inches)	8-inch OD; Diameter of Well (inches) N/A	Type of Well Casing	N/A; Screen Perforation N/A		
Type of Sand Pack	N/A	Location	24 FT East of Survey point, P5A17 @ top of slope (~24 ft east and upwards of most eastern seepage zone on slope face)		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0							Medium stiff, moist, brown lean CLAY (CL) to silty CLAY (CL-ML)		
			SS1	2, 3, 4, 7	88	1.5, 1.5, 2.0, 4.5				
525	5		ST2		75					350 lbs down pressure to push shelby tube 11 Seconds/2 ft
			SS3	4, 7, 10, 10	88	4.0, 4.25, 4.5, 3.5		Very stiff, moist, brown lean CLAY (CL) with sand, trace gravel		
520	10							Dense, wet, brown, coarse to medium SAND (SW)		
			SS4	6, 6, 5, 6	75	4.5, 4.5		1-inch gray CLAY (CL)		
								Stiff, moist, brown silty CLAY (CL-ML) with sand to lean CLAY (CL) with sand, trace gravel		
515	15		SS5	2, 6, 7, 7	100	4.5, 4.5, 4.25				
								← Increasing gravel content		
			SS6	6, 9, 11, 17	100	4.5, 4.5		} 6-inches dense, moist, brown, coarse to fine SAND (SW) with gravel		
			SS7	4, 6, 6, 6	88	2.5, 2.5		} 6-inches dense, moist, brown, coarse to fine SAND (SW) with gravel		
510	20		SS8	2, 4, 7, 10	100	4.0, 3.5, 4.5, 4.5		← Becomes very stiff		

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-2

Elevation feet	Depth, feet	SAMPLES Type Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
		SS9	6 13 8 8	100	4.5 4.5 4.5		6-inches dense, moist, brown to dark brown, coarse to fine SAND (SW) with gravel Becomes more sandy		
							End of boring at 23.7 ft bgs		
505	25								
500	30								
495	35								
490	40								
485	45								

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-3

Date(s) Drilled **1/22/01**	Logged By **T. George**	Checked By **M.D. Rokoff**
Drilling Method **Hollow Stem Auger**	Auger Size **4-1/4-inch ID 8-inch OD**	Total Depth of Borehole **31.4 feet**
Drill Rig Type **Brainard Kilman 81 - truck mounted**	Drilling Contractor **AEP Pro Serve**	Approximate Surface Elevation **~530.5 ft**
Groundwater Depth and Date Measured **Encountered @ 27.4 FT**	Hammer Weight/ Drop (lbs./in.) **Automatic**	Backfill **Borehole backfilled with Bentonite Quick Grout**
Diameter of Hole (inches) **8-inch OD** Diameter of Well (inches) **N/A**	Type of Well Casing **N/A** Screen Perforation **N/A**	
Type of Sand Pack **N/A**	Location **~262-FT west of boring A-1 @ top of slope along road and ~20-ft east of the point @ the top of slope that is perpendicular to P5A2 Survey Point**	

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0							Stiff, moist, brown sandy lean CLAY (CL) with gravel		
			SS1	5 6 8 5	13					Gravel (1-1/2-inch) blocking shoe of split spoon
525	5							Dense, moist, brown, fine to coarse silty SAND (SM) to well-graded SAND with silt (SW-SM) with gravel		
			SS2	5 10 10 10	88			Becomes medium to coarse, moist		
520	10							Medium stiff, moist, brown, lean CLAY (CL) with sand, trace gravel		
			SS3	3 2 5 4	75	2.25 2.0 2.25				WC=23.0 LL=41; PL=23; PI=18
			SS4	1 3 4 5	83	2.5 3.0 2.5				
515	15							Becomes stiff		WC=21.9
			SS5	1 4 6 8	100	3.0 2.5 2.0				
			SS6	3 6 9 12	100	4.5 3.5 4.5 3.5				
510	20		SS7	3 7 11 14	88	4.5 4.5 4.5 4.5		Very stiff, moist, brown lean CLAY (CL) with sand, trace gravel		
			SS8	4 7 9 10	100	4.5 4.5 4.0 4.25		1-inch moist, brown, coarse to fine silty SAND (SM) with silt to well-graded SAND with silt (SW-SM) with trace gravel; 1-inch sandy lean CLAY (CL) seam		
505	25		SS9	3 8 7 8		4.5 4.5 3.0 2.0				

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
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Log of Boring A-3

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
505										
			ST10		94	4.5				Survey Point P5A2 @ 504.1-ft some seepage at inslope observed 15-ft east of P5A2
			SS11	4 7 8 14	75	2.5 4.0		Dense, wet, brown, medium to coarse, well-graded SAND with silt (SW-SM) to silty SAND (SM), trace gravel; 6-inches lean CLAY (CL) @27.8-28.3 ft		
30			SS12	3 6 8 12	88	2.0 4.25 4.5		Stiff, moist, brown, lean CLAY (CL) with sand, trace gravel		
500										
								End of boring at 31.4 ft bgs		
35										
495										
40										
490										
45										
485										
50										
480										
55										

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-3

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-4

Date(s) Drilled	1/30/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	27.9 feet
Drill Rig Type	CME 45 Rubber tracked ATV	Drilling Contractor	Midwest Env. Drill/AEP for inclinometer installation	Approximate Surface Elevation	513.4 ft
Groundwater Depth and Date Measured	Encountered @ 26.9 ft	Hammer Weight/ Drop (lbs./in.)	140 lbs / 30-inches	Backfill	Borehole backfilled with Bentonite / Grout / 6x6x5 inch protective casing
Diameter of Hole (inches)	8-inch OD; Diameter of Well (inches) N/A	Type of Well Casing	INCLINOMETER; Screen Perforation N/A		
Type of Sand Pack	N/A	Location	Pond 5 along mid slope of 1 ft below top of seepage zone (~5-ft W/4.5-ft south of survey point PSA16)		

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Inclinometer	FIELD NOTES AND WELL DETAILS
	0			0				Wet topsoil		
			SS1	0, 0, 1	50			Very loose, wet, medium to coarse, well-graded SAND with silt (SW-SM) to silty SAND (SM)		
				1		0.75		Very soft, moist, gray, lean CLAY (CL) with sand, root fragments and organics		
	2			2				Medium dense, moist to wet, brown, medium to coarse silty SAND (SM) with gravel		
			SS2	7, 6	75					
510				9						
	4			8						%G=24.7; %S=62.1; %F=13.2
			SS3	13, 13	75					
	6			16						
				4						
			SS4	3, 4	63			1-inch fine silty SAND		
				5		2.5, 3.0		Medium stiff, moist, brown and gray mottled lean CLAY (CL) with sand, trace wood fragments		
	8							Becomes without wood fragments		WC=18.3 LL=31; PL=20; PI=11
505				2						
			SS5	3, 3	63	1.5, 4.5				
				7		3.5				Shelby tube pushed @ Elv. 503.7 - 505.7
	10							Becomes with trace gravel		
				2				1-inch sandy CLAY seam (pp=1.5)		A newly drilled borehole located from A-4 as follows: 18-ft West along slope; 9-ft North up slope; pocket pen was 4.5+ on bottom of Tube
			SS6	3, 5	63	1.5, 4.5				
				9		4.5				
	12			6						
			SS7	5, 6	63	3.0, 3.25		3-inches medium dense, moist silty SAND (SM)		
500				7		3.0				
	14			5				Stiff, moist, brown, sandy SILT (ML) to fine silty SAND (SM) trace gravel		
			SS8	6, 6	63			Stiff, moist, brown with gray mottling lean CLAY (CL) with sand		
				11		4.5				
	16			3		4.5				WC=22.6
			SS9	6, 6	75	1.75		2-inches moist, organic CLAY (OL) to silty CLAY (CL-ML), trace root fibers		
				10		1.75		Stiff, moist, dark brown with gray mottling lean CLAY (CL) with sand		
	18							Becomes with fine sand partings (<1/16-inch)		
495				3						
			SS10	4, 7	63	3.25				
	20			9		3.5				

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-4

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Project: DP&L, Pond 5A Investigation
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Log of Boring A-4

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Inclinometer	FIELD NOTES AND WELL DETAILS
	20			4				Stiff, moist, dark brown with gray mottling lean CLAY (CL) with sand		
			SS11	5	75	3.5				
				7		2.5		Becomes trace black, decayed organic fiber		
				11		2.5				
	22			7				Loose, moist, greenish-brown interbedded, fine silty SAND (SM) to sandy SILT (ML)		
			SS12	4	50			Becomes gray		
490				4						
	24			4				Becomes trace inclined organic seams (<1/8-inch)		
				2						
			SS13	2	100					
				4				6-inches SILT (ML) with organics		
	26			4						
				2						
			SS14	2	100			Loose, wet, gray, medium to fine SAND with silt (SP-SM) to silty sand (SM)		
				4						
				4						
	28							End of Boring at 27.9 ft bgs		
485										
	30									
	32									
480										
	34									
	36									
	38									
475										
	40									
	42									

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-4

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
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Log of Boring A-5

Sheet 1 of 1

Date(s) Drilled **1/30/01**	Logged By **T. George**	Checked By **M.D. Rokoff**
Drilling Method **Hollow Stem Auger**	Auger Size **4-1/4-inch ID 8-inch OD**	Total Depth of Borehole **14.2 feet**
Drill Rig Type **CME 45 Rubber tracked ATV**	Drilling Contractor **Midwest Environmental Drilling**	Approximate Surface Elevation **497.10 ft**
Groundwater Depth and Date Measured **11.0 ft ATD on 2/2/01** **11.2 ft**	Hammer Weight/ Drop (lbs./in.) **140 lbs / 30-inches**	Backfill
Diameter of Hole (inches) **8-inch OD** Diameter of Well (inches) **2 inches**	Type of Well Casing **PVC** Screen Perforation **0.10-inch slot**	
Type of Sand Pack **Silica No. 4 @ (14.1-3.2 ft)**	Location **22-ft down or South / 28-ft west of Survey point P5A12 (toe) located in close alighment with A-4 and A-1, perpendicular to slope**	

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
	0			2				Topsoil		Concrete
			SS1	2 3 4	100			Loose, moist, dark brown, silty SAND (SM) to sandy SILT (ML) with organics		Bentonite pellets
495	2			4				Becomes laminated without organics		
			SS2	4 4 5	75			Light brown, fine silty SAND (SM) with laminations		Riser @ 4.2 - 2.83 Screen @ 14.1 - 4.2
	4			2				Becomes interbedded gray, fine silty SAND (SM+SP-SM) and brown fine sandy SILT (ML)		
			SS3	3 2 2	75					
	6			2				Loose, brown, fine, poorly graded SAND with silt (SP-SM) with coalaceous laminations		
490			SS4	3 2 2	50					
	8			3						%G=0.0; %S=90.9; %F=9.1
			SS5	3 3 2	50					
	10			3						
			SS6	3 3 2	50			Becomes wet (unsaturated)		
485	12			2				Becomes very loose, wet (saturated)		
			SS7	2 2 4	75					
	14							End of boring at 14.2 ft bgs		
	16									

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-5

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
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Log of Boring B-1

Date(s) Drilled	1/16/01 / 1/17/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	46.0 feet
Drill Rig Type	Brainard Kilman 81 - truck mount	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~530.2 ft
Groundwater Depth and Date Measured	23.5 ft ATD on 2/2/01 — 19.57 ft	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	
Diameter of Hole (inches)	8-inch OD — Diameter of Well (inches) 2 inches	Type of Well Casing	PVC — Screen Perforation 0.10-inch slot/	30.5-21.5	
Type of Sand Pack	Silica No. 4 @ (31.2-19.5 ft)	Location	76-ft along road from survey point P5B15; directly upslope from Piezometer P5B10; 68.5-ft from P5B15		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0							5-inches Topsoil		Borehole drilled to 46-ft, then grouted to surface. Another borehole drilled 3-ft North of original borehole in order to set monitor point. PVC pipe was encountered at 2nd borehole, which was then grouted.
			SS1	1 2 3 3	58	0.5 1.5 1.5		Medium stiff, moist, brown silty CLAY (CL-ML) to lean CLAY (CL) with sand and silt		
								Becomes brown and dark brown		
			SS2	2 2 5 5	92	1.75 3.5 3.5				Bentonite grout 1.0 - 16.8 ft
525	5									A third boreholee was drilled 7.5-ft Southeast of original borehole. The monitoring point was set there.
			SS3	2 4 5 8	100	1.75 4.5 3.5		Stiff, moist, brown lean CLAY (CL) with sand		
520	10									
			SS4	2 3 6 8	92	2.0 2.0 3.5 4.0		Becomes brown and gray and trace gravel		WC=18.1 LL=35; PL=20; PI=15
515	15									
			SS5	3 6 8 9	92	4.0 4.0 3.75 3.75				Bentonite 16.8 - 19.4
			SS6	2 5 6 10	92	2.5 4.25 4.5				No. 4 Sand
510	20							Very stiff, moist, brown silty CLAY (CL-ML) with sand to lean CLAY (CL) with sand, trace gravel		
			SS7	4 8 10 10	100	4.5 4.5 4.5 4.5		with increased gravel		

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Project: DP&L, Pond 5A Investigation
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Log of Boring B-1

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
		SS	SS8	2 5 6 12	88	4.25 4.5 4.5		Stiff, moist, brown lean CLAY (CL) with sand 1-inch wet, coarse to medium sand		
505	25	SS	SS9	3 7 7 8	75	1.75 3.25		1-inch wet, medium sand 6-inch seam of wet, medium to fine SANDwith silt (SP-SM) to silty SAND (SM) with trace gravel Becomes very stiff 1-4-inch fine sand seam		
		SS	SS10	3 9 11 11	75	2.0 4.5		6-inch seam of wet, fine to coarse SAND with silt (SW-SP) to silty SAND (SM) trace gravel Loose, wet, brown, coarse to fine, well-graded SAND with silt (SW-SM) to silty SAND (SM), trace gravel		3-inch CLAY-SAND transition zone (wet) %G=7.2; %S=71.7; %F=21.1
		SS	SS11	2 4 5 5	88	4.0		2-inch seam sandy lean CLAY (CL) Stiff, moist, brown lean CLAY (CL) with sand		Transition SAND to CLAY
500	30	SS	SS12	3 10 13 11	83	2.25		Very stiff, moist, brown sandy SILT (ML)		Monitoring point installed 7.5-ft Southeast of borehole
		SS	SS13	2 4 6 9	92	3.75 2.75 2.25		Stiff, moist, brown, lean CLAY (CL) with sand 1/2-inch sand seam 1/2-inch sand seam Becomes very stiff		Transitions to lean CLAY
495	35	SS	SS14	3 6 10 12	100	2.25 3.75 3.25 2.5		1-inch seam gray lean CLAY (CL) with trace gravel Becomes with increasing sand		
		SS	SS15	3 8 11 9	100	1.75 3.25 3.0		Wet, brown, coarse to fine SAND with silt (SW-SM), with gravel to silty SAND (SM) Very stiff, moist, dark brown lean CLAY (CL) with sand, trace root fibers [NATURAL ALLUVIUM] Becomes stiff, light brown		
		SS	SS16	3 3 6 9	100	1.0 1.5 3.0 2.75		Becomes with trace gravel		
490	40	SS	SS17	3 6 8 10	100	3.5 2.75 2.25 1.75		Color grades from dark brown to gray Becomes very stiff		
		SS	SS18	2 5 12 12	100	1.0 3.75 1.5		Medium dense, wet, dark brown, medium to fine SAND with silt (SP-SM) to silty SAND (SM) Very stiff, moist, gray lean CLAY (CL) with sand, trace gravel		
485	45	SS	SS19	5 9 14 11	100	3.0 2.0		Wet, brown and gray, coarse to medium silty SAND (SM) Moist, brown and gray, sandy lean CLAY (CL) to lean CLAY (CL) with sand End of Boring at 46.0 ft bgs		

Report: ENV_13W_DPL File: DPL_P5.GPJ 4/12/2001 B-1

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring C-1

Date(s) Drilled	1/17/01 / 1/18/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	44.6 feet
Drill Rig Type	Brainard Kilman 81 - truck mount	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~531.0 ft
Groundwater Depth and Date Measured	14.4 ft ATD/10.3 ft on 1/24/01 11.44 ft on 2/2/01	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	
Diameter of Hole (inches)	8-inch OD	Diameter of Well (inches)	2 inches	Type of Well Casing: PVC	Screen Perforation: 0.10 inch slot
Type of Sand Pack	Silica No. 4 @ (25-13.2 ft)	Location	Piezometer relocated 2.5 ft east of (original) borehole/North side of Pond 5 - upslope from P5C10/~38 ft east of survey point P5C6, @ top of slope		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
	0							Stiff, moist, brown lean CLAY (CL) with sand, trace gravel		Grout - Original borehole grouted after completion. Additional borehole located 2.5-feet East of original borehole, was drilled to 25-ft in order to set piezometer
530										
	2		SS1	3, 5, 5, 4	88	2.25, 2.5, 2.75		1-inch moist sand seam		
	4									
525	6									
			SS2	7, 13, 13, 13	88			Medium dense, moist, brown, medium to fine, poorly graded SAND with silt (SP-SM), trace gravel		
	8									Transitions to a silty SAND (SM)
			SS3	3, 5, 5, 7	96	3.25, 2.5		Stiff, moist, brown, lean CLAY (CL) with sand Medium stiff, moist, brown sandy SILT (ML) to silty SAND (SM)		
	10									
520			SS4	3, 3, 5, 14	100	2.0, 2.5, 4.5		Transition to silty CLAY (CL-ML) with sand Stiff, moist, brown lean CLAY (CL) with sand, trace gravel		Bentonite
	12									Transition to silty CLAY (CL-ML)
			SS5	3, 10, 8, 10	88			Medium dense, moist, brown, medium to fine silty SAND (SM) to poorly graded SAND with silt (SP-SM)		Sand
	14							5-inches moist, sandy silty CLAY (CL-ML) with gravel Becomes wet Becomes medium to coarse SAND (SP) trace gravel		
			SS6	4, 10, 13, 9	88					
515	16							2-inch sandy SILT (ML) seam Becomes wet, medium to coarse silty SAND (SM) to well-graded SAND with silt (SW-SM) with gravel		%G=19.2; %S=55.7; %F=25.1
			SS7	2, 5, 10, 10	71					
	18							Becomes moist, sandy SILT (ML) with coal fragments		

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
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Log of Boring C-1

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
				5						
				11				Becomes wet silty SAND (SM)		
			SS8	9	83					
	20			7				6-inch moist sandy SILT (ML) with gravel		
				5				10-inches stiff, moist, brown lean CLAY (CL)		
510				13				Becomes medium coarse with gravel		
			SS9	10	100	2.75				
	22			12				4-inches wet sandy silty SAND to sandy SILT		
				5				Medium dense, wet, brown, medium to coarse silty SAND (SM) with gravel to well-graded SAND and SILT (SP-SM)		
				12						
			SS10	11	100			4-inches coarse to medium, well-graded SAND with silt to silty SAND (SP-SM) with gravel		
	24			9						Screen @ 24.3-ft; Bottom @ 24.6; Sand @ 24.6-25.0
				2				Becomes loose, moist to wet		
				4				4-inch lean CLAY (CL) with sand		
			SS11	6	100	1.75				
505	26			12						
				3				4-inch lean CLAY (CL) with sand 2-inch medium to fine, poorly graded SAND with silt (SP-SM)		
				4						
			SS12	4	100	1.75		Medium stiff, moist, grayish brown lean CLAY (CL) with sand, trace gravel, trace organics		
	28			7						
				4		1.0				
				8				4-inches wet, coarse to fine SAND		
			SS13	8	100					
	30			10		3.5		4-inches medium dense, wet, brown clayey SAND (SC)		
				5						
500				8		1.75		Becomes very stiff to stiff, grayish-brown		
			SS14	8	75	2.25		2-inches medium to fine SAND		
	32			11		1.75		Becomes brown		
				3		1.5				WC=27.5 LL=49; PL=24; PI=25
				3		1.0		Becomes medium stiff and gray		
			SS15	5	100	1.25				
	34			7		1.25				
				3		2.0		Becomes very stiff		WC=15.2
				6		2.75				
			SS16	10	100	3.0				
495	36			12		2.5				
				2		3.0				WC=22.8
				6		4.25				
			SS17	10	100	3.0				
	38			12		2.0				
				3		2.0				
				6		2.0				
			SS18	10	100	2.75				
	40									

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
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Log of Boring C-1

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
490				12				6-inch seam medium dense, moist, gray, medium to fine silty SAND (SM)		
				6						
			SS19	12	100			Very stiff, moist, brown, sandy SILT (ML) to fine silty SAND (SM)		
	42			14						
				16				Becomes interbedded with loose, moist to wet, brown, fine, silty SAND (SM) to sandy SILT (ML) and silty CLAY (CL-ML)		
				4						
			SS20	4	100					
	44			3						
				2						
								End of Boring at 44.6 ft bgs		
485	46									
	48									
	50									
480										
	52									
	54									
475	56									
	58									
	60									
470										
	62									

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Table I - Summary of Laboratory Test Data
Project: Pond 5A Slope Investigation
Project Number: 38.08E06133.09
Date: March 26, 2001

Sample Identification	Water Content, %	Atterberg Limits				Particle-Size Analysis				
		Liquid Limit	Plastic Limit	Plasticity Index	Liquid Limit (oven dry)	% < U.S. No. 4 sieve	% < U.S. No. 10 sieve	% < U.S. No. 40 sieve	% < U.S. No. 200 sieve	% < 0.002 mm
Borehole A-1 @ 6-8'	21.8	41	23	18						
Borehole A-1 @ 14-16'						70.9	56.7	26.7	12.6	9.9
Borehole A-1 @ 36-38'	11.8	27	16	11						
Borehole A-3 @ 11.5-13.5'	23.0	41	23	18						
Borehole A-3 @ 15.5-17.5'	21.9									
Borehole A-4 @ 4-6'						75.3	58.7	26.7	13.2	
Borehole A-4 @ 8-10'	18.3	31	20	11						
Borehole A-4 @ 36-38'										
Borehole A-4 @ 16-18'	22.6									
Borehole A-5 @ 8-10'						100	99.7	97.6	9.1	
Borehole B-1 @ 11-13'	18.1	35	20	15						
Borehole B-1 @ 28-30'						92.8	86.4	48.8	21.1	
Borehole C-1 @ 16.5-18.5'						80.8	75.1	43.6	25.1	
Borehole C-1 @ 32.5-34.5'	27.5	49	24	25	44					
Borehole C-1 @ 34.5-36.5'	15.2									
Borehole C-1 @ 36.5-38.5'	22.8									

APPENDIX 3.2
Excerpt from:
Assessment of Dam Safety Coal Combustion Surface Impoundments (Task 3)
Final Report
By CHA, Dated 26 March 2010
Pages 104-105

foot-thick and 40-foot-wide sand drainage blanket is indicated at the base of the downstream slope.

Clearing and grading specifications address vegetation, rubbish, deleterious material, "structures scheduled for demolition" removal and disposal, formation of fill areas, subgrade preparation, and compaction requirements (90% of the maximum modified Proctor dry density). These specifications and drawing do not, however, indicate if the existing dikes were scheduled for demolition, or if the ash was considered deleterious and subsequently stripped or excavated from beneath the dikes,. Given that the available stability analyses for Pond 3A include the impounded ash below the dike section, it is highly likely that the impounded ash was allowed to remain in place. Additional comments related to this foundation condition and liquefaction potential appear in Section 4 of this document.

3.4.2 Foundation Conditions – Ponds 5, 6, and 7/7A

CHA was not provided with geotechnical subsurface information for Ponds 5, 6, and 7/7A. However, several record drawings related to construction of the ash ponds at the site were made available. The information provided is described below in chronological order as it relates to the aforementioned ponds.

Drawings 300-12-1020, -1022, and -1023 (1966) are related to construction of the Station, an ash pond west of the plant, and a coal storage area and ash disposal area east of the plant. The cross section on the 1966 drawings implies that the Station buildings are supported on pile foundations. The notes on the 1966 drawings provide the following information regarding construction of the dikes:

- The area shall be stripped of "all fences, timber, stumps, structures, or other obstructions, and striped of topsoil, unsuitable or excessively wet earth, vegetation, stubble, surface trash, and perishable matter of all sorts."
- Embankment fill material shall be excavated from the borrow areas on the site.

- Fill material shall have a maximum particle size of 6 inches and stone shall not constitute more than 20 percent of the volume.
- No brush, roots, ice, snow, perishable, or other unsuitable shall be included in the fill material.
- Embankments shall be constructed in horizontal 8-inch-thick layers "insofar as is feasible".
- Fill must be compacted to 90 percent of the maximum dry density as determined by the modified Proctor method.
- Fill shall not be placed on excessively wet or frozen subgrade.

Drawing 300-13-1143 (1969) shows plan and sections views for Ash Pond 5. Ash Pond 5 was constructed within the ash pond located west of the power plant shown on the 1966 drawings. Notes on the 1969 drawing indicate that existing muck is to be removed to the top of the compacted clay and replaced with compacted backfill. Specifications for the backfill gradation or compaction requirements are not provided on this drawing.

Drawing 300-12-1020A (1972) shows a site plan and sections for Ash Ponds 6 and 7. Section A-A indicates that the western dike is to be constructed by placing additional fill above the existing ash pond dike. Sections B-B and C-C indicate that riprap was to be placed on the upstream side of the dikes.

3.4.3 Foundation Conditions – Pond 10

The subsurface investigation for Pond 10 and the immediate area around it consisted of eighteen (18) geotechnical soil borings, four (4) Geoprobe™ borings, and three (3) test pits. Figures 13A and 13B depict the boring locations and a summary of selected soil logs for the borings performed for the investigation. The soil profile beneath the pond and dike areas generally consisted of up to 1 foot of topsoil with occasional miscellaneous fill and granular deposits to depths ranging from 2 to 4 feet below the surface. These surficial materials were encountered

APPENDIX 3.3
Excerpt from:
Ash Pond 5 Embankment Evaluation
By Soil & Materials Engineering, Inc., Dated 9 January 1985
Pages 5-8

SUBSURFACE CONDITIONS

Cross sections of the existing slope in the three seepage areas are shown on Figures 2 and 3, Appendix II. The test borings and piezometers are shown at their appropriate locations and elevations on the sections.

Borings 2, 8, and 14 drilled along the outboard edge of the embankment crest encountered fill soil extending to approximately 30 to 40 ft. below present grades. The fill material used to construct the embankment is a heterogeneous mixture of clay, silt, sand, and fine gravel. Textural descriptions of the fill are silty clay, sandy silty clay, sandy clayey silt, sandy silt and silty fine to coarse sand and gravel. As can be noted from the boring logs, stratification of the fill is apparent, i.e., the soil was spread in generally horizontal lifts during construction. Most significant in review of the boring logs is the presence of distinct layers of sand and fine gravel. The more pronounced of these layers are identified with code symbols on the cross sections, Figure 2 and 3. Typically the granular layers are less than about 1 ft.; however, thicker zones (6 to 7 ft.) were noted.

Atterberg Limits and gradation analyses were performed on representative fill samples to determine their physical properties and to permit classification in accordance with the Unified Soil Classification System (USCS). The individual test

results and classifications are summarized on Table 2, Appendix 1.

Fill materials used to construct the embankment can be divided into two general categories, cohesive and non-cohesive, based upon the USCS classification. Cohesive materials have classifications CL and CL-ML, and textural descriptions silty clay and clayey silt. Typical properties of these soils, based upon Atterberg Limits and gradation analyses, are as follows:

	Range	Average
Liquid Limit (%)	27-37	32
Plasticity Index (%)	8-21	14
Gravel (%)	0-2	1
Sand (%)	19-35	25
Silty (%)	40-56	49
Clay (%)	22-27	25

Triaxial (UU) shear strength of the cohesive type fill materials range from about 2.5 to 4.5 tons per square foot (tsf) at confining pressures of 25 to 45 pounds per square inch (psi). The effective angle of internal friction of the cohesive fill is approximately 25 degrees with effective cohesion 325 pounds per square foot (psf).

The non-cohesive type fill materials have classifications SM and SC-SM, sand with some gravel, silt and clay fines. Based upon gradation analyses performed in the laboratory, typical

composition of this type of fill soil is as follows:

	Range	Average
Gravel (%)	5-27	17
Sand (%)	49-72	62
Silt & Clay (%)	9-43	21

The silt and clay fines are typically non-plastic to slightly plastic. The triaxial (UU) compressive strength of one sample of silty sand was 2.4 tsf at a confining pressure of 15 psi.

The natural soils underlying the embankment fill are typically silty clay and sandy silt. Within the depths explored these soils are medium stiff in consistency. The angle of internal friction on one tested sample of the original ground was 28 degrees with effective cohesion about 650 psf.

Water levels in the piezometers were measured for four consecutive weeks following installation. The water level elevations are summarized on Table 1, Appendix I. On the cross sections, Figures 2 and 3, Appendix II, are shown the stabilized piezometric levels at each boring location. Also shown on the cross sections is the assumed phreatic surface through the embankment. The construction of the phreatic surface line is based upon theoretical evaluation and observations of seepage on the outboard face. Where piezometric levels are below the assumed phreatic surface (e.g. borings 2 and 8) water movement through the permeable sand zones is occurring and it is assumed

that no porewater pressure is developed. Where pieziometric levels approximate the phreatic surface (Section C, Figure 3), water movement is retarded and pore pressure is developed.

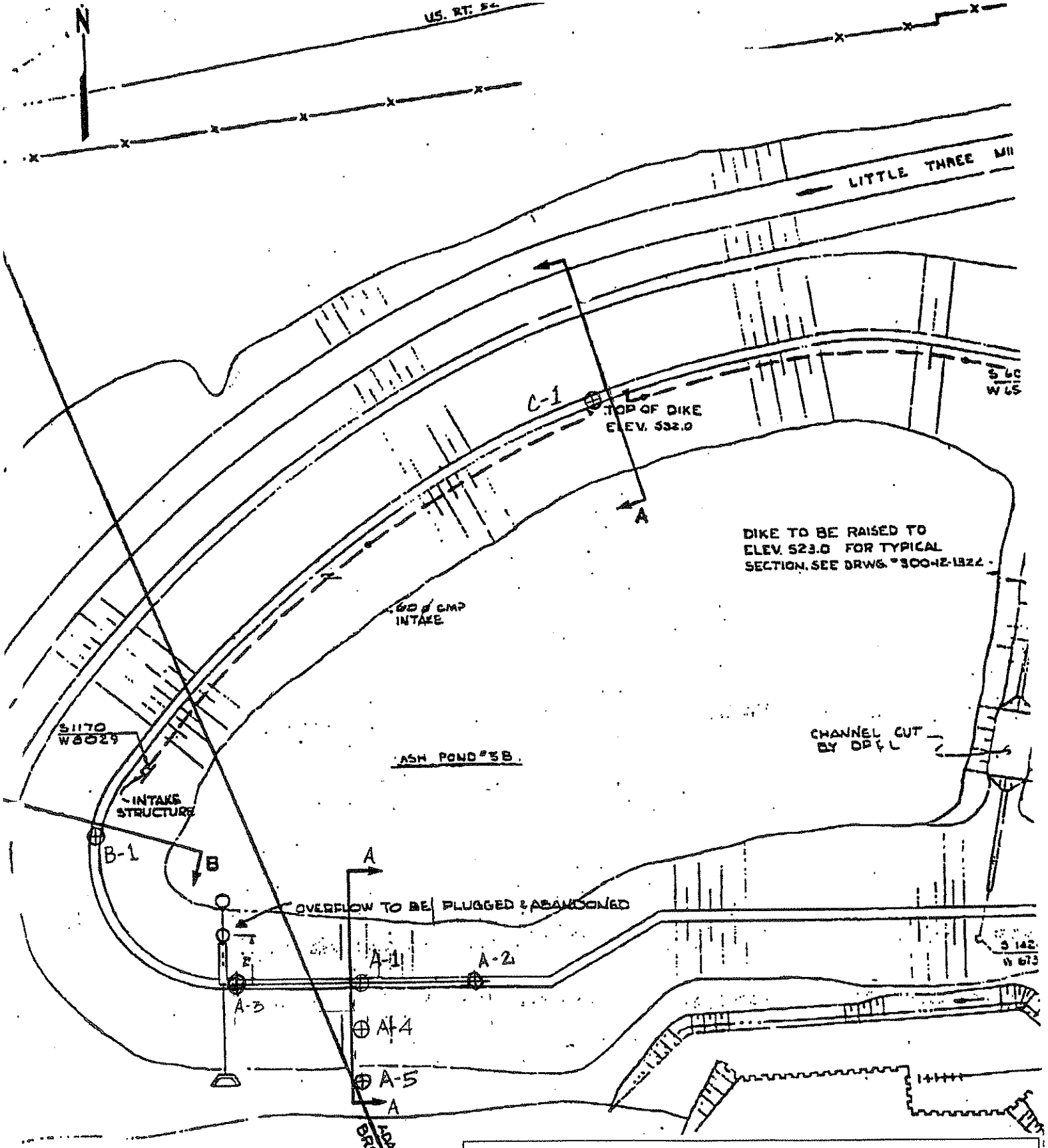
STABILITY ANALYSIS

Based upon conditions encountered in the test borings, the embankment was constructed of locally available materials naturally occurring in the alluvial flood plain of the Ohio River Valley. Penetration resistances and laboratory shear strength tests indicate that the embankment was constructed in an engineered manner, i.e., the fill was apparently placed in lifts with each lift compacted prior to placement of subsequent lifts.

Stability analyses were performed for embankment cross section B using the Modified Bishop technique and a computer source routine developed by the Kentucky Department of Transportation. This analysis technique assumes a circular rotational failure mode.

For the analyses, the embankment fill is assumed to be a homogeneous mass. Shear strength parameters assigned to the fill in the analyses are based upon consolidated undrained triaxial tests with pore pressure measurements. The theoretical phreatic surface as shown on Section B was modeled in the analyses.

APPENDIX 4.1
Excerpt from:
Bottom Ash Pond 5B Evaluation and Alternatives Analysis
By URS Corporation, Dated 20 April 2001
Figures 2 & 3, Appendix A, Table 1



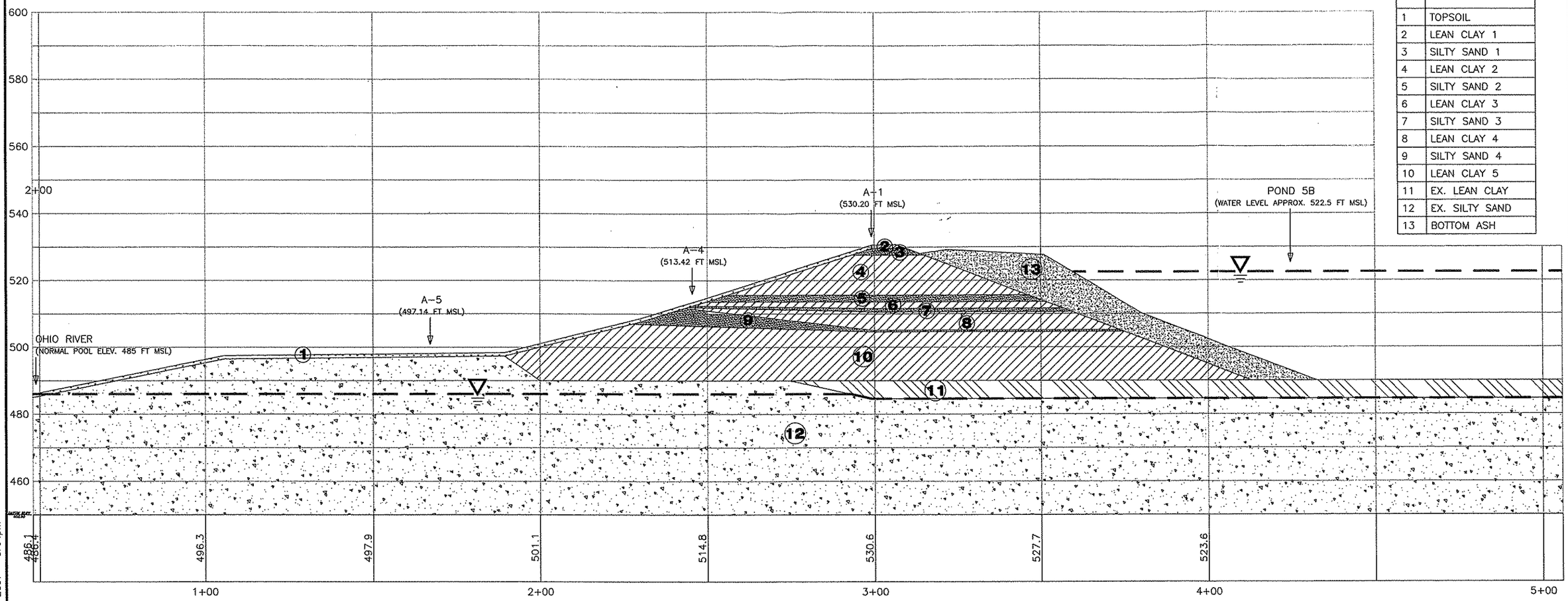
DAYTON POWER AND LIGHT
J. M. STUART GENERATING STATION

ASH POND 5 EVALUATION

GEOTECHNICAL SOIL BORING LOCATION PLAN

APPROXIMATE SCALE 1 IN.=200 FT. APRIL, 2001

FIGURE 2.



NO.	SOILS
1	TOPSOIL
2	LEAN CLAY 1
3	SILTY SAND 1
4	LEAN CLAY 2
5	SILTY SAND 2
6	LEAN CLAY 3
7	SILTY SAND 3
8	LEAN CLAY 4
9	SILTY SAND 4
10	LEAN CLAY 5
11	EX. LEAN CLAY
12	EX. SILTY SAND
13	BOTTOM ASH

SUBSURFACE CROSS-SECTION A-A'

LEGEND

WATER TABLE

0 15 30 60

APPROXIMATE SCALE IN FEET
VERTICAL AND HORIZONTAL

NOTES:

1. SUBSURAFCE CONDITIONS INTERPRETED FROM SOILS EXPLORATION.
2. SURFACE TOPOGRAPHY WAS INTERPOLATED FROM SURVEY DATA COLLECTED BY HIRSCH & ASSOCIATES.
3. GROUNDWATER WAS ENCOUNTERED AT APPROXIMATELY 517 AND 486 FT MSL IN BORINGS A-1 AND A-5, RESPECTIVELY.

REVISION 4-6-01

GENERALIZED CROSS-SECTION A-A'
JM STUART STATION - BOTTOM ASH POND 5B
DAYTON POWER AND LIGHT - ABERDEEN, OHIO

URS CORPORATION
800 WEST ST. CLAIR AVENUE
CLEVELAND, OHIO 44113
(216) 622-2400

DR. BY	MDR	SCALE	AS SHOWN	DWG. NO. 1	PROJ. NO. 8E06133
CK'D. BY	SFP	DATE	APRIL 11, 2001	FIG. NO.	3

Q:\DaytonPL\8e06133\BottomAshPond5A\slope1.dwg User:Rokoff Apr 10, 2001 - 3:04pm

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Key to Log of Boring

Elevation feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resistance, blows / 6 in.	SAMPLES: Recovery, inches	SAMPLES: Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION		FIELD NOTES AND WELL DETAILS
1	2	3	4	5	6	7	8	9	10	11

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop; "NA" indicates data not recorded.

6 **Recovery:** Percentage or length (in feet) of sample length actually recovered in sampler; "NA" indicates data not recorded.

7 **Pocket Penetrometer, tsf:** Pocket penetrometer field consistency measurement in tons per square foot (tsf).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

10 **Well or Hole Completion:** Schematic of piezometer or well installation; materials are listed alongside well schematic; graphic symbols are explained below.

11 **Field Notes and Well Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Well construction materials and installation details are also listed.

WC Water Content, in percent
LL = Liquid Limit, in percent
PL = Plastic Limit, in percent
PI = Plasticity Index, in percent
%G = Percent gravel in sieved specimen (>#4 sieve)
%S = Percent sand in sieved specimen (<#4, >#200 sieve)
%M = Percent silt in sieved specimen (<#200 sieve, >0.002 ppm)
%C = Percent clay in sieved specimen (>0.002 ppm)
%F = Percent fines in sieved specimen (<#200 sieve)

TYPICAL SOIL GRAPHIC SYMBOLS

Lean CLAY
Silty SAND
Topsoil
Silty CLAY
Silty SAND
Lean CLAY to Silty CLAY
SAND to Silty SAND
Sandy SILT to Silty SAND

TYPICAL WELL GRAPHIC SYMBOLS

Pipe in Bentonite
Concrete
Pipe in Filter Sand
#4 Silica
Bentonite Pellets
Pipe in Fine Filter Sand
Soil
Screen
Pipe in Cement Grout
Inclinometer
Pipe in Cement

TYPICAL SAMPLER GRAPHIC SYMBOLS

SPT Split Spoon
Shelby Tube

OTHER GRAPHIC SYMBOLS

First water encountered at time of drilling and sampling (ATD)
Minor change in material properties within a lithologic stratum

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-1

Sheet 1 of 2

Date(s) Drilled	1/16/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	46.0 feet
Drill Rig Type	Brainard Kilman 81 - truck mounted	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~530.2 ft
Groundwater Depth and Date Measured	@ 15.2 ft ATD 13.5 ft on 2/2/01	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	
Diameter of Hole (inches)	8-inch OD; Diameter of Well (inches): 2 inches	Type of Well Casing	PVC - .10 slot; Screen Perforation: ~43.9-3.9		
Type of Sand Pack	Silica No. 4 @ (4'-46')	Location	Pond 5, southside, top of slope above inclinometer, 36 ft West of survey Point, P5A15		

Elevation feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0						Stiff, moist, brown, sandy silty CLAY (CL-ML)		bentonite
			SS1	1 3 6 6	75	1.5 1.5 1.75	Medium dense, moist, brown, silty SAND (SM) with trace gravel		# 4 Silica
							Becomes with increasing silt/clay		
			SS2	3 6 7 8	88	1.5 2.25 4.5 4.5	Stiff, moist, brown, lean CLAY (CL) with sand, trace gravel		
525	5		SS3	4 6 7 8	88	4.5 3.5 2.5	Becomes with less gravel, with less sand		
			SS4	2 4 6 7	79	1.75 1.75 2.0 2.5			WC=21.8 LL=41; PL=23; PI=18
			SS5	3 6 6 7	88	1.75 4.25 3.25 2.5			
520	10						Becomes very stiff		
			SS6	3 7 9 11	92	3.5 4.5 4.5 4.25			
							Becomes stiff		
			SS7	2 5 6 9	88	4.25 4.5 4.5 4.5			
							Becomes gray		
515	15		SS8	2 5 13 14	83	1.0 1.5			Becomes wet at 15.2-ft
							Medium dense, wet, brown, medium to coarse, silty SAND (SM) with well graded SAND with silt and gravel (SW-SM)		%G=29.1; %S=58.2; %M=2.7; %C=9.9
							Becomes loose		
			SS9	6 5 5 13	83	1.5 4.5	Stiff to very stiff, moist, brown sandy Silty CLAY (CL-ML) with seams of fine silty SND and sandy SILT		Beginning of a 2-foot transition zone
			SS10	5 7 11 11	83	4.5	Medium dense, moist to wet, brown, fine to coarse, well graded SAND with silt (SW-SM) to silty SAND (SM) trace gravel		
510	20						Very stiff, moist, brown, lean CLAY (CL) with sand		
			SS11	5 9 10 11	100	4.5 4.5 4.5 4.5	Moist, silty SAND (SM) with gravel		Note: the outside surface of sample is wet from water in borehole going into spoon. middle of sample is moist.
							Becomes sandy silty CLAY (CL-ML) transitioning to lean CLAY (CL) with sand		
			SS12	5 7 8 10	100	4.5 3.5 2.5 4.5	Becomes with less sand		

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Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-1

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
505	25	SS	13	3, 7, 13, 11	83	2.75, 4.5				
								Dense, moist, dark brown, medium to fine, silty SAND (SM) trace gravel		
								Very stiff, moist, brown, sandy silty CLAY (CL-ML) trace gravel		
		SS	14	4, 7, 9, 13	96	4.5, 4.5, 4.5, 4.5		Very stiff, moist, brown to brown with gray mottling, lean CLAY (CL) with sand and occasional fine sand laminae (<1/4-inch)		
		SS	15	5, 8, 12, 14	100	3.75, 4.5, 4.5, 4.5				
500	30	SS	16	3, 8, 10, 12	96	4.5, 4.5, 3.5, 2.75		10-inch grayish brown seam		
		SS	17	2, 4, 7, 12	96	3.5, 4.5, 4.5, 4.25		Becomes very stiff		
495	35	SS	18	4, 6, 10, 11	100	3.0, 3.5, 4.5, 4.5		Becomes stiff		
		SS	19	3, 5, 8, 8	92	1.75, 2.5, 3.5, 4.25		8-inch seam with trace gravel, increased sand content		WC=11.8 LL=27; PL=16; PI=11
		SS	20	3, 6, 8, 15	96	4.0, 3.0, 2.0				
								Moist, brown, sandy silty CLAY (CL-ML) to sandy SILT (ML)		
490	40	SS	21	6, 9, 11, 11		4.0, 3.5, 3.0, 2.5		Very stiff, moist, brown and gray sandy silty CLAY (CL-ML)		
								Interbedded, stiff, moist, gray silty CLAY (CL-ML) SILT (ML) and fine SAND (SP-SM) to poorly graded SAND with silt (SP)		
		SS	22	3, 6, 5, 6	100	3.5, 2.5, 1.5, 1.5		Becomes medium stiff and sand seams become moist to wet		Soil @ 43.9 to 46 ft
485	45	SS	23	1, 3, 3, 4		1.25, 1.25, 1.25, 1.25				Bottom screen @43.9 Install monitoring point and pull augers
								End of boring at 46.0 ft bgs		
480	50									

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-1

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-2

Date(s) Drilled	1/18/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	23.7 feet
Drill Rig Type	Brainard Kilman 81 - truck mounted	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~530.5 ft
Groundwater Depth and Date Measured	Encountered @ 11.7 ft	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	Borehole backfilled with Quick Grout
Diameter of Hole (inches)	8-inch OD; Diameter of Well (inches) N/A	Type of Well Casing	N/A; Screen Perforation N/A		
Type of Sand Pack	N/A	Location	24 FT East of Survey point, P5A17 @ top of slope (~24 ft east and upwards of most eastern seepage zone on slope face)		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0							Medium stiff, moist, brown lean CLAY (CL) to silty CLAY (CL-ML)		
			SS1	2, 3, 4, 7	88	1.5, 1.5, 2.0, 4.5				
525	5		ST2		75					350 lbs down pressure to push shelby tube 11 Seconds/2 ft
			SS3	4, 7, 10, 10	88	4.0, 4.25, 4.5, 3.5		Very stiff, moist, brown lean CLAY (CL) with sand, trace gravel		
520	10							Dense, wet, brown, coarse to medium SAND (SW)		
			SS4	6, 6, 5, 6	75	4.5, 4.5		1-inch gray CLAY (CL)		
								Stiff, moist, brown silty CLAY (CL-ML) with sand to lean CLAY (CL) with sand, trace gravel		
515	15		SS5	2, 6, 7, 7	100	4.5, 4.5, 4.25				
								← Increasing gravel content		
			SS6	6, 9, 11, 17	100	4.5, 4.5		} 6-inches dense, moist, brown, coarse to fine SAND (SW) with gravel		
			SS7	4, 6, 6, 6	88	2.5, 2.5		} 6-inches dense, moist, brown, coarse to fine SAND (SW) with gravel		
510	20		SS8	2, 4, 7, 10	100	4.0, 3.5, 4.5, 4.5		← Becomes very stiff		

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-2

Elevation feet	Depth, feet	SAMPLES Type Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
		SS9	6 13 8 8	100	4.5 4.5 4.5		6-inches dense, moist, brown to dark brown, coarse to fine SAND (SW) with gravel Becomes more sandy		
							End of boring at 23.7 ft bgs		
505	25								
500	30								
495	35								
490	40								
485	45								

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-3

Date(s) Drilled **1/22/01**	Logged By **T. George**	Checked By **M.D. Rokoff**
Drilling Method **Hollow Stem Auger**	Auger Size **4-1/4-inch ID 8-inch OD**	Total Depth of Borehole **31.4 feet**
Drill Rig Type **Brainard Kilman 81 - truck mounted**	Drilling Contractor **AEP Pro Serve**	Approximate Surface Elevation **~530.5 ft**
Groundwater Depth and Date Measured **Encountered @ 27.4 FT**	Hammer Weight/ Drop (lbs./in.) **Automatic**	Backfill **Borehole backfilled with Bentonite Quick Grout**
Diameter of Hole (inches) **8-inch OD** Diameter of Well (inches) **N/A**	Type of Well Casing **N/A** Screen Perforation **N/A**	
Type of Sand Pack **N/A**	Location **~262-FT west of boring A-1 @ top of slope along road and ~20-ft east of the point @ the top of slope that is perpendicular to P5A2 Survey Point**	

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0							Stiff, moist, brown sandy lean CLAY (CL) with gravel		
			SS1	5 6 8 5	13					Gravel (1-1/2-inch) blocking shoe of split spoon
525	5							Dense, moist, brown, fine to coarse silty SAND (SM) to well-graded SAND with silt (SW-SM) with gravel		
			SS2	5 10 10 10	88			Becomes medium to coarse, moist		
520	10							Medium stiff, moist, brown, lean CLAY (CL) with sand, trace gravel		
			SS3	3 2 5 4	75	2.25 2.0 2.25				WC=23.0 LL=41; PL=23; PI=18
			SS4	1 3 4 5	83	2.5 3.0 2.5				
515	15							Becomes stiff		WC=21.9
			SS5	1 4 6 8	100	3.0 2.5 2.0				
			SS6	3 6 9 12	100	4.5 3.5 4.5 3.5				
510	20		SS7	3 7 11 14	88	4.5 4.5 4.5 4.5		Very stiff, moist, brown lean CLAY (CL) with sand, trace gravel		
			SS8	4 7 9 10	100	4.5 4.5 4.0 4.25		1-inch moist, brown, coarse to fine silty SAND (SM) with silt to well-graded SAND with silt (SW-SM) with trace gravel; 1-inch sandy lean CLAY (CL) seam		
505	25		SS9	3 8 7 8		4.5 4.5 3.0 2.0				

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-3

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
505										
			ST10		94	4.5				Survey Point P5A2 @ 504.1-ft some seepage at inslope observed 15-ft east of P5A2
			SS11	4 7 8 14	75	2.5 4.0		Dense, wet, brown, medium to coarse, well-graded SAND with silt (SW-SM) to silty SAND (SM), trace gravel; 6-inches lean CLAY (CL) @27.8-28.3 ft		
30			SS12	3 6 8 12	88	2.0 4.25 4.5		Stiff, moist, brown, lean CLAY (CL) with sand, trace gravel		
500										
								End of boring at 31.4 ft bgs		
35										
495										
40										
490										
45										
485										
50										
480										
55										

Report: ENV_13W_DPL; File: DPL_P5.GPJ; 4/12/2001 A-3

URS

Project: DP&L, Pond 5A Investigation
Project Location: Aberdeen, Ohio
Project Number: 38-08E06133.09

Log of Boring A-4

Date(s) Drilled	1/30/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	27.9 feet
Drill Rig Type	CME 45 Rubber tracked ATV	Drilling Contractor	Midwest Env. Drill/AEP for inclinometer installation	Approximate Surface Elevation	513.4 ft
Groundwater Depth and Date Measured	Encountered @ 26.9 ft	Hammer Weight/ Drop (lbs./in.)	140 lbs / 30-inches	Backfill	Borehole backfilled with Bentonite / Grout / 6x6x5 inch protective casing
Diameter of Hole (inches)	8-inch OD; Diameter of Well (inches) N/A	Type of Well Casing	INCLINOMETER; Screen Perforation N/A		
Type of Sand Pack	N/A	Location	Pond 5 along mid slope of 1 ft below top of seepage zone (~5-ft W/4.5-ft south of survey point PSA16)		

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Inclinometer	FIELD NOTES AND WELL DETAILS
	0			0				Wet topsoil		
			SS1	0, 0, 1	50			Very loose, wet, medium to coarse, well-graded SAND with silt (SW-SM) to silty SAND (SM)		
				1		0.75		Very soft, moist, gray, lean CLAY (CL) with sand, root fragments and organics		
	2			2				Medium dense, moist to wet, brown, medium to coarse silty SAND (SM) with gravel		
			SS2	7, 6	75					
510				9						
	4			8						%G=24.7; %S=62.1; %F=13.2
			SS3	13, 13	75					
	6			16						
				4						
			SS4	3, 4	63			1-inch fine silty SAND		
				5		2.5, 3.0		Medium stiff, moist, brown and gray mottled lean CLAY (CL) with sand, trace wood fragments		
	8							Becomes without wood fragments		WC=18.3 LL=31; PL=20; PI=11
505				2						
			SS5	3, 3	63	1.5, 4.5				
				7		3.5				Shelby tube pushed @ Elv. 503.7 - 505.7
	10							Becomes with trace gravel		
				2				1-inch sandy CLAY seam (pp=1.5)		A newly drilled borehole located from A-4 as follows: 18-ft West along slope; 9-ft North up slope; pocket pen was 4.5+ on bottom of Tube
			SS6	3, 5	63	1.5, 4.5				
				9		4.5				
	12			6						
			SS7	5, 6	63	3.0, 3.25		3-inches medium dense, moist silty SAND (SM)		
500				7		3.0				
	14			5				Stiff, moist, brown, sandy SILT (ML) to fine silty SAND (SM) trace gravel		
			SS8	6, 6	63			Stiff, moist, brown with gray mottling lean CLAY (CL) with sand		
				11		4.5				
	16			3		4.5				WC=22.6
			SS9	6, 6	75	1.75		2-inches moist, organic CLAY (OL) to silty CLAY (CL-ML), trace root fibers		
				10		1.75		Stiff, moist, dark brown with gray mottling lean CLAY (CL) with sand		
	18							Becomes with fine sand partings (<1/16-inch)		
495				3						
			SS10	4, 7	63	3.25				
	20			9		3.5				

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Log of Boring A-4

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Inclinometer	FIELD NOTES AND WELL DETAILS
	20			4				Stiff, moist, dark brown with gray mottling lean CLAY (CL) with sand		
			SS11	5	75	3.5				
				7		2.5		Becomes trace black, decayed organic fiber		
				11		2.5				
	22			7				Loose, moist, greenish-brown interbedded, fine silty SAND (SM) to sandy SILT (ML)		
			SS12	4	50			Becomes gray		
490				4						
	24			4				Becomes trace inclined organic seams (<1/8-inch)		
				2						
			SS13	2	100					
				4				6-inches SILT (ML) with organics		
	26			4						
				2						
			SS14	2	100			Loose, wet, gray, medium to fine SAND with silt (SP-SM) to silty sand (SM)		
				4						
				4						
	28							End of Boring at 27.9 ft bgs		
485										
	30									
	32									
480										
	34									
	36									
	38									
475										
	40									
	42									

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Log of Boring A-5

Sheet 1 of 1

Date(s) Drilled **1/30/01**	Logged By **T. George**	Checked By **M.D. Rokoff**
Drilling Method **Hollow Stem Auger**	Auger Size **4-1/4-inch ID 8-inch OD**	Total Depth of Borehole **14.2 feet**
Drill Rig Type **CME 45 Rubber tracked ATV**	Drilling Contractor **Midwest Environmental Drilling**	Approximate Surface Elevation **497.10 ft**
Groundwater Depth and Date Measured **11.0 ft ATD on 2/2/01** **11.2 ft**	Hammer Weight/ Drop (lbs./in.) **140 lbs / 30-inches**	Backfill
Diameter of Hole (inches) **8-inch OD** Diameter of Well (inches) **2 inches**	Type of Well Casing **PVC** Screen Perforation **0.10-inch slot**	
Type of Sand Pack **Silica No. 4 @ (14.1-3.2 ft)**	Location **22-ft down or South / 28-ft west of Survey point P5A12 (toe) located in close alighment with A-4 and A-1, perpendicular to slope**	

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
	0			2				Topsoil		Concrete
			SS1	2 3 4	100			Loose, moist, dark brown, silty SAND (SM) to sandy SILT (ML) with organics		Bentonite pellets
495	2			4				Becomes laminated without organics		
			SS2	4 4 5	75			Light brown, fine silty SAND (SM) with laminations		Riser @ 4.2 - 2.83 Screen @ 14.1 - 4.2
	4			2				Becomes interbedded gray, fine silty SAND (SM+SP-SM) and brown fine sandy SILT (ML)		
			SS3	3 2 2	75					
	6			2				Loose, brown, fine, poorly graded SAND with silt (SP-SM) with coalaceous laminations		
490			SS4	3 2 2	50					
	8			3						%G=0.0; %S=90.9; %F=9.1
			SS5	3 3 2	50					
	10			3						
			SS6	3 3 2	50			Becomes wet (unsaturated)		
485	12			2				Becomes very loose, wet (saturated)		
			SS7	2 2 4	75					
	14							End of boring at 14.2 ft bgs		
	16									

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Log of Boring B-1

Date(s) Drilled	1/16/01 / 1/17/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	46.0 feet
Drill Rig Type	Brainard Kilman 81 - truck mount	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~530.2 ft
Groundwater Depth and Date Measured	23.5 ft ATD on 2/2/01 — 19.57 ft	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	
Diameter of Hole (inches)	8-inch OD — Diameter of Well (inches) 2 inches	Type of Well Casing	PVC — Screen Perforation 0.10-inch slot/	30.5-21.5	
Type of Sand Pack	Silica No. 4 @ (31.2-19.5 ft)	Location	76-ft along road from survey point P5B15; directly upslope from Piezometer P5B10; 68.5-ft from P5B15		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
530	0							5-inches Topsoil		Borehole drilled to 46-ft, then grouted to surface. Another borehole drilled 3-ft North of original borehole in order to set monitor point. PVC pipe was encountered at 2nd borehole, which was then grouted.
			SS1	1 2 3 3	58	0.5 1.5 1.5		Medium stiff, moist, brown silty CLAY (CL-ML) to lean CLAY (CL) with sand and silt		
								Becomes brown and dark brown		
			SS2	2 2 5 5	92	1.75 3.5 3.5				Bentonite grout 1.0 - 16.8 ft
525	5									A third boreholee was drilled 7.5-ft Southeast of original borehole. The monitoring point was set there.
			SS3	2 4 5 8	100	1.75 4.5 3.5		Stiff, moist, brown lean CLAY (CL) with sand		
520	10									
			SS4	2 3 6 8	92	2.0 2.0 3.5 4.0		Becomes brown and gray and trace gravel		WC=18.1 LL=35; PL=20; PI=15
515	15									
			SS5	3 6 8 9	92	4.0 4.0 3.75 3.75				Bentonite 16.8 - 19.4
			SS6	2 5 6 10	92	2.5 4.25 4.5				No. 4 Sand
510	20							Very stiff, moist, brown silty CLAY (CL-ML) with sand to lean CLAY (CL) with sand, trace gravel		
			SS7	4 8 10 10	100	4.5 4.5 4.5 4.5		with increased gravel		

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Log of Boring B-1

Elevation feet	Depth, feet	Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
		SS	SS8	2 5 6 12	88	4.25 4.5 4.5		Stiff, moist, brown lean CLAY (CL) with sand 1-inch wet, coarse to medium sand		
505	25	SS	SS9	3 7 7 8	75	1.75 3.25		1-inch wet, medium sand 6-inch seam of wet, medium to fine SANDwith silt (SP-SM) to silty SAND (SM) with trace gravel Becomes very stiff 1-4-inch fine sand seam		
		SS	SS10	3 9 11 11	75	2.0 4.5		6-inch seam of wet, fine to coarse SAND with silt (SW-SP) to silty SAND (SM) trace gravel Loose, wet, brown, coarse to fine, well-graded SAND with silt (SW-SM) to silty SAND (SM), trace gravel		3-inch CLAY-SAND transition zone (wet) %G=7.2; %S=71.7; %F=21.1
		SS	SS11	2 4 5 5	88	4.0		2-inch seam sandy lean CLAY (CL) Stiff, moist, brown lean CLAY (CL) with sand		Transition SAND to CLAY
500	30	SS	SS12	3 10 13 11	83	2.25		Very stiff, moist, brown sandy SILT (ML)		Monitoring point installed 7.5-ft Southeast of borehole
		SS	SS13	2 4 6 9	92	3.75 2.75 2.25		Stiff, moist, brown, lean CLAY (CL) with sand 1/2-inch sand seam 1/2-inch sand seam Becomes very stiff		Transitions to lean CLAY
495	35	SS	SS14	3 6 10 12	100	2.25 3.75 3.25 2.5		1-inch seam gray lean CLAY (CL) with trace gravel Becomes with increasing sand		
		SS	SS15	3 8 11 9	100	1.75 3.25 3.0		Wet, brown, coarse to fine SAND with silt (SW-SM), with gravel to silty SAND (SM) Very stiff, moist, dark brown lean CLAY (CL) with sand, trace root fibers [NATURAL ALLUVIUM] Becomes stiff, light brown		
		SS	SS16	3 3 6 9	100	1.0 1.5 3.0 2.75		Becomes with trace gravel		
490	40	SS	SS17	3 6 8 10	100	3.5 2.75 2.25 1.75		Color grades from dark brown to gray Becomes very stiff		
		SS	SS18	2 5 12 12	100	1.0 3.75 1.5		Medium dense, wet, dark brown, medium to fine SAND with silt (SP-SM) to silty SAND (SM) Very stiff, moist, gray lean CLAY (CL) with sand, trace gravel		
485	45	SS	SS19	5 9 14 11	100	3.0 2.0		Wet, brown and gray, coarse to medium silty SAND (SM) Moist, brown and gray, sandy lean CLAY (CL) to lean CLAY (CL) with sand End of Boring at 46.0 ft bgs		

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Log of Boring C-1

Date(s) Drilled	1/17/01 / 1/18/01	Logged By	T. George	Checked By	M.D. Rokoff
Drilling Method	Hollow Stem Auger	Auger Size	4-1/4-inch ID 8-inch OD	Total Depth of Borehole	44.6 feet
Drill Rig Type	Brainard Kilman 81 - truck mount	Drilling Contractor	AEP Pro Serve	Approximate Surface Elevation	~531.0 ft
Groundwater Depth and Date Measured	14.4 ft ATD/10.3 ft on 1/24/01 11.44 ft on 2/2/01	Hammer Weight/ Drop (lbs./in.)	Automatic	Backfill	
Diameter of Hole (inches)	8-inch OD	Diameter of Well (inches)	2 inches	Type of Well Casing: PVC	Screen Perforation: 0.10 inch slot
Type of Sand Pack	Silica No. 4 @ (25-13.2 ft)	Location	Piezometer relocated 2.5 ft east of (original) borehole/North side of Pond 5 - upslope from P5C10/~38 ft east of survey point P5C6, @ top of slope		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
	0							Stiff, moist, brown lean CLAY (CL) with sand, trace gravel		Grout - Original borehole grouted after completion. Additional borehole located 2.5-feet East of original borehole, was drilled to 25-ft in order to set piezometer
530										
	2		SS1	3, 5, 5, 4	88	2.25, 2.5, 2.75		1-inch moist sand seam		
	4									
525	6									
			SS2	7, 13, 13, 13	88			Medium dense, moist, brown, medium to fine, poorly graded SAND with silt (SP-SM), trace gravel		
	8									Transitions to a silty SAND (SM)
			SS3	3, 5, 5, 7	96	3.25, 2.5		Stiff, moist, brown, lean CLAY (CL) with sand Medium stiff, moist, brown sandy SILT (ML) to silty SAND (SM)		
	10									
520			SS4	3, 3, 5, 14	100	2.0, 2.5, 4.5		Transition to silty CLAY (CL-ML) with sand Stiff, moist, brown lean CLAY (CL) with sand, trace gravel		Bentonite
	12									Transition to silty CLAY (CL-ML)
			SS5	3, 10, 8, 10	88			Medium dense, moist, brown, medium to fine silty SAND (SM) to poorly graded SAND with silt (SP-SM)		Sand
	14							5-inches moist, sandy silty CLAY (CL-ML) with gravel Becomes wet Becomes medium to coarse SAND (SP) trace gravel		
			SS6	4, 10, 13, 9	88					
515	16							2-inch sandy SILT (ML) seam Becomes wet, medium to coarse silty SAND (SM) to well-graded SAND with silt (SW-SM) with gravel		%G=19.2; %S=55.7; %F=25.1
			SS7	2, 5, 10, 10	71					
	18							Becomes moist, sandy SILT (ML) with coal fragments		

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Log of Boring C-1

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Penetrometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
				5						
				11				Becomes wet silty SAND (SM)		
			SS8	9	83					
	20			7				6-inch moist sandy SILT (ML) with gravel		
				5				10-inches stiff, moist, brown lean CLAY (CL)		
510				13				Becomes medium coarse with gravel		
			SS9	10	100	2.75				
	22			12				4-inches wet sandy silty SAND to sandy SILT		
				5				Medium dense, wet, brown, medium to coarse silty SAND (SM) with gravel to well-graded SAND and SILT (SP-SM)		
				12						
			SS10	11	100			4-inches coarse to medium, well-graded SAND with silt to silty SAND (SP-SM) with gravel		
	24			9						Screen @ 24.3-ft; Bottom @ 24.6; Sand @ 24.6-25.0
				2				Becomes loose, moist to wet		
				4				4-inch lean CLAY (CL) with sand		
			SS11	6	100	1.75				
505	26			12						
				3				4-inch lean CLAY (CL) with sand 2-inch medium to fine, poorly graded SAND with silt (SP-SM)		
				4						
			SS12	4	100	1.75		Medium stiff, moist, grayish brown lean CLAY (CL) with sand, trace gravel, trace organics		
	28			7						
				4		1.0				
				8				4-inches wet, coarse to fine SAND		
			SS13	8	100					
	30			10		3.5		4-inches medium dense, wet, brown clayey SAND (SC)		
				5						
500				8		1.75		Becomes very stiff to stiff, grayish-brown		
			SS14	8	75	2.25		2-inches medium to fine SAND		
	32			11		1.75		Becomes brown		
				3		1.5				WC=27.5 LL=49; PL=24; PI=25
				3		1.0		Becomes medium stiff and gray		
			SS15	5	100	1.25				
	34			7		1.25				
				3		2.0		Becomes very stiff		WC=15.2
				6		2.75				
			SS16	10	100	3.0				
495	36			12		2.5				
				2		3.0				WC=22.8
				6		4.25				
			SS17	10	100	3.0				
	38			12		2.0				
				3		2.0				
				6		2.0				
			SS18	10	100	2.75				
	40									

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Log of Boring C-1

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / 6 in.	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION	Well or Hole Completion	FIELD NOTES AND WELL DETAILS
490				12				6-inch seam medium dense, moist, gray, medium to fine silty SAND (SM)		
				6						
			SS19	12	100			Very stiff, moist, brown, sandy SILT (ML) to fine silty SAND (SM)		
	42			14						
				16				Becomes interbedded with loose, moist to wet, brown, fine, silty SAND (SM) to sandy SILT (ML) and silty CLAY (CL-ML)		
				4						
			SS20	4	100					
	44			3						
				2						
								End of Boring at 44.6 ft bgs		
485	46									
	48									
	50									
480										
	52									
	54									
475	56									
	58									
	60									
470										
	62									

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Table I - Summary of Laboratory Test Data
Project: Pond 5A Slope Investigation
Project Number: 38.08E06133.09
Date: March 26, 2001

Sample Identification	Water Content, %	Atterberg Limits				Particle-Size Analysis				
		Liquid Limit	Plastic Limit	Plasticity Index	Liquid Limit (oven dry)	% < U.S. No. 4 sieve	% < U.S. No. 10 sieve	% < U.S. No. 40 sieve	% < U.S. No. 200 sieve	% < 0.002 mm
Borehole A-1 @ 6-8'	21.8	41	23	18						
Borehole A-1 @ 14-16'						70.9	56.7	26.7	12.6	9.9
Borehole A-1 @ 36-38'	11.8	27	16	11						
Borehole A-3 @ 11.5-13.5'	23.0	41	23	18						
Borehole A-3 @ 15.5-17.5'	21.9									
Borehole A-4 @ 4-6'						75.3	58.7	26.7	13.2	
Borehole A-4 @ 8-10'	18.3	31	20	11						
Borehole A-4 @ 36-38'										
Borehole A-4 @ 16-18'	22.6									
Borehole A-5 @ 8-10'						100	99.7	97.6	9.1	
Borehole B-1 @ 11-13'	18.1	35	20	15						
Borehole B-1 @ 28-30'						92.8	86.4	48.8	21.1	
Borehole C-1 @ 16.5-18.5'						80.8	75.1	43.6	25.1	
Borehole C-1 @ 32.5-34.5'	27.5	49	24	25	44					
Borehole C-1 @ 34.5-36.5'	15.2									
Borehole C-1 @ 36.5-38.5'	22.8									

APPENDIX 4.2
Excerpt from:
Assessment of Dam Safety Coal Combustion Surface Impoundments (Task 3)
Final Report
By CHA, Dated 26 March 2010
Pages 104-105

foot-thick and 40-foot-wide sand drainage blanket is indicated at the base of the downstream slope.

Clearing and grading specifications address vegetation, rubbish, deleterious material, "structures scheduled for demolition" removal and disposal, formation of fill areas, subgrade preparation, and compaction requirements (90% of the maximum modified Proctor dry density). These specifications and drawing do not, however, indicate if the existing dikes were scheduled for demolition, or if the ash was considered deleterious and subsequently stripped or excavated from beneath the dikes,. Given that the available stability analyses for Pond 3A include the impounded ash below the dike section, it is highly likely that the impounded ash was allowed to remain in place. Additional comments related to this foundation condition and liquefaction potential appear in Section 4 of this document.

3.4.2 Foundation Conditions – Ponds 5, 6, and 7/7A

CHA was not provided with geotechnical subsurface information for Ponds 5, 6, and 7/7A. However, several record drawings related to construction of the ash ponds at the site were made available. The information provided is described below in chronological order as it relates to the aforementioned ponds.

Drawings 300-12-1020, -1022, and -1023 (1966) are related to construction of the Station, an ash pond west of the plant, and a coal storage area and ash disposal area east of the plant. The cross section on the 1966 drawings implies that the Station buildings are supported on pile foundations. The notes on the 1966 drawings provide the following information regarding construction of the dikes:

- The area shall be stripped of "all fences, timber, stumps, structures, or other obstructions, and striped of topsoil, unsuitable or excessively wet earth, vegetation, stubble, surface trash, and perishable matter of all sorts."
- Embankment fill material shall be excavated from the borrow areas on the site.

- Fill material shall have a maximum particle size of 6 inches and stone shall not constitute more than 20 percent of the volume.
- No brush, roots, ice, snow, perishable, or other unsuitable shall be included in the fill material.
- Embankments shall be constructed in horizontal 8-inch-thick layers "insofar as is feasible".
- Fill must be compacted to 90 percent of the maximum dry density as determined by the modified Proctor method.
- Fill shall not be placed on excessively wet or frozen subgrade.

Drawing 300-13-1143 (1969) shows plan and sections views for Ash Pond 5. Ash Pond 5 was constructed within the ash pond located west of the power plant shown on the 1966 drawings. Notes on the 1969 drawing indicate that existing muck is to be removed to the top of the compacted clay and replaced with compacted backfill. Specifications for the backfill gradation or compaction requirements are not provided on this drawing.

Drawing 300-12-1020A (1972) shows a site plan and sections for Ash Ponds 6 and 7. Section A-A indicates that the western dike is to be constructed by placing additional fill above the existing ash pond dike. Sections B-B and C-C indicate that riprap was to be placed on the upstream side of the dikes.

3.4.3 Foundation Conditions – Pond 10

The subsurface investigation for Pond 10 and the immediate area around it consisted of eighteen (18) geotechnical soil borings, four (4) Geoprobe™ borings, and three (3) test pits. Figures 13A and 13B depict the boring locations and a summary of selected soil logs for the borings performed for the investigation. The soil profile beneath the pond and dike areas generally consisted of up to 1 foot of topsoil with occasional miscellaneous fill and granular deposits to depths ranging from 2 to 4 feet below the surface. These surficial materials were encountered

APPENDIX 4.3
Excerpt from:
Ash Pond 5 Embankment Evaluation
By Soil & Materials Engineering, Inc., Dated 9 January 1985
Pages 5-8

SUBSURFACE CONDITIONS

Cross sections of the existing slope in the three seepage areas are shown on Figures 2 and 3, Appendix II. The test borings and piezometers are shown at their appropriate locations and elevations on the sections.

Borings 2, 8, and 14 drilled along the outboard edge of the embankment crest encountered fill soil extending to approximately 30 to 40 ft. below present grades. The fill material used to construct the embankment is a heterogeneous mixture of clay, silt, sand, and fine gravel. Textural descriptions of the fill are silty clay, sandy silty clay, sandy clayey silt, sandy silt and silty fine to coarse sand and gravel. As can be noted from the boring logs, stratification of the fill is apparent, i.e., the soil was spread in generally horizontal lifts during construction. Most significant in review of the boring logs is the presence of distinct layers of sand and fine gravel. The more pronounced of these layers are identified with code symbols on the cross sections, Figure 2 and 3. Typically the granular layers are less than about 1 ft.; however, thicker zones (6 to 7 ft.) were noted.

Atterberg Limits and gradation analyses were performed on representative fill samples to determine their physical properties and to permit classification in accordance with the Unified Soil Classification System (USCS). The individual test

results and classifications are summarized on Table 2, Appendix 1.

Fill materials used to construct the embankment can be divided into two general categories, cohesive and non-cohesive, based upon the USCS classification. Cohesive materials have classifications CL and CL-ML, and textural descriptions silty clay and clayey silt. Typical properties of these soils, based upon Atterberg Limits and gradation analyses, are as follows:

	Range	Average
Liquid Limit (%)	27-37	32
Plasticity Index (%)	8-21	14
Gravel (%)	0-2	1
Sand (%)	19-35	25
Silty (%)	40-56	49
Clay (%)	22-27	25

Triaxial (UU) shear strength of the cohesive type fill materials range from about 2.5 to 4.5 tons per square foot (tsf) at confining pressures of 25 to 45 pounds per square inch (psi). The effective angle of internal friction of the cohesive fill is approximately 25 degrees with effective cohesion 325 pounds per square foot (psf).

The non-cohesive type fill materials have classifications SM and SC-SM, sand with some gravel, silt and clay fines. Based upon gradation analyses performed in the laboratory, typical

composition of this type of fill soil is as follows:

	Range	Average
Gravel (%)	5-27	17
Sand (%)	49-72	62
Silt & Clay (%)	9-43	21

The silt and clay fines are typically non-plastic to slightly plastic. The triaxial (UU) compressive strength of one sample of silty sand was 2.4 tsf at a confining pressure of 15 psi.

The natural soils underlying the embankment fill are typically silty clay and sandy silt. Within the depths explored these soils are medium stiff in consistency. The angle of internal friction on one tested sample of the original ground was 28 degrees with effective cohesion about 650 psf.

Water levels in the piezometers were measured for four consecutive weeks following installation. The water level elevations are summarized on Table 1, Appendix I. On the cross sections, Figures 2 and 3, Appendix II, are shown the stabilized piezometric levels at each boring location. Also shown on the cross sections is the assumed phreatic surface through the embankment. The construction of the phreatic surface line is based upon theoretical evaluation and observations of seepage on the outboard face. Where piezometric levels are below the assumed phreatic surface (e.g. borings 2 and 8) water movement through the permeable sand zones is occurring and it is assumed

that no porewater pressure is developed. Where pieziometric levels approximate the phreatic surface (Section C, Figure 3), water movement is retarded and pore pressure is developed.

STABILITY ANALYSIS

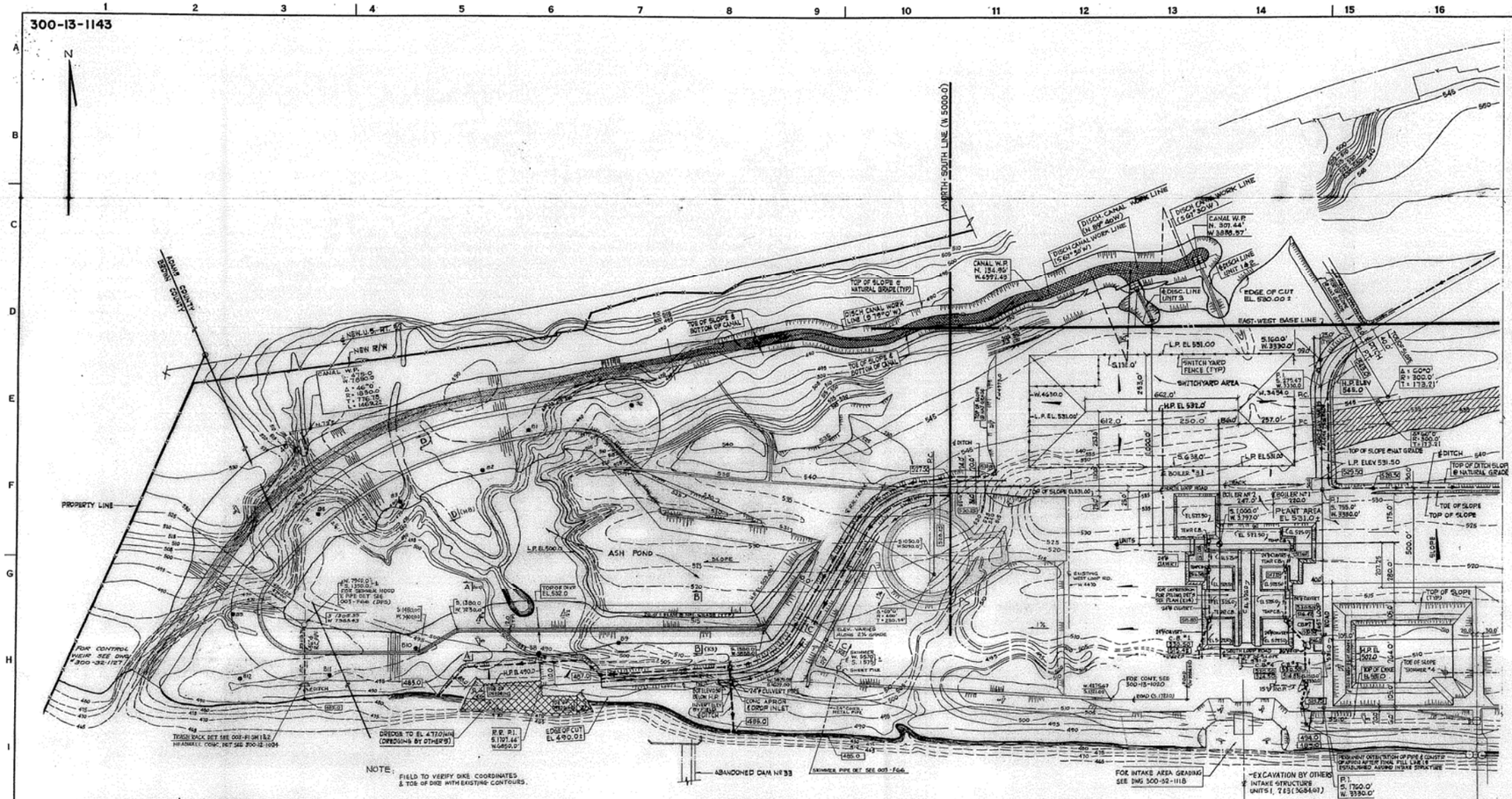
Based upon conditions encountered in the test borings, the embankment was constructed of locally available materials naturally occurring in the alluvial flood plain of the Ohio River Valley. Penetration resistances and laboratory shear strength tests indicate that the embankment was constructed in an engineered manner, i.e., the fill was apparently placed in lifts with each lift compacted prior to placement of subsequent lifts.

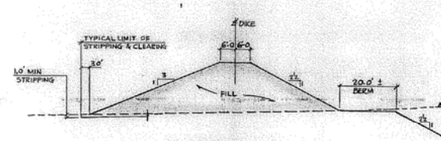
Stability analyses were performed for embankment cross section B using the Modified Bishop technique and a computer source routine developed by the Kentucky Department of Transportation. This analysis technique assumes a circular rotational failure mode.

For the analyses, the embankment fill is assumed to be a homogeneous mass. Shear strength parameters assigned to the fill in the analyses are based upon consolidated undrained triaxial tests with pore pressure measurements. The theoretical phreatic surface as shown on Section B was modeled in the analyses.

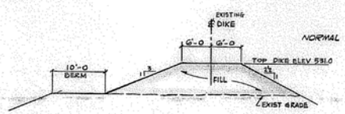
APPENDIX 5
Design Drawings
By Ebasco Services, Inc., Dated 9 January 1969

300-13-1143

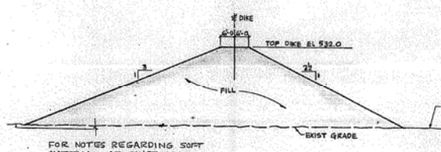




SECT B-B (H8)
1" = 20'-0

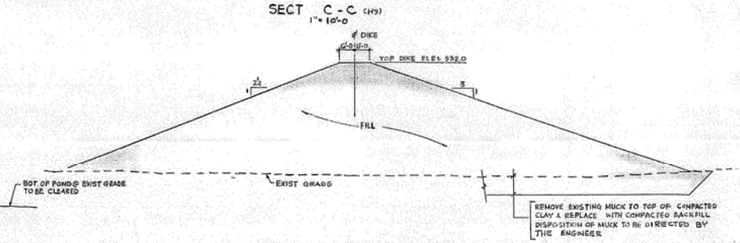


SECT C-C (H9)
1" = 10'-0



FOR NOTES REGARDING SOFT MATERIAL AT EXIST GRADE SEE SECT D-D (M9)

SECT A-A (G5)
1" = 20'-0



SECT D-D (C5)
1" = 20'-0

SCHEDULE OF BORINGS

BORING NO	COORDINATES SOUTH	COORDINATES WEST
B1	470.0	6910.0
B2	650.0	7125.0
B3	790.0	7485.0
B4	560.0	7850.0
B5	1310.0	8135.0
B6	355.0	6440.0
B7	1175.0	7925.0
B8	1495.0	6860.0
B9	1445.0	6900.0
B10	1485.0	7590.0
B11	1595.0	7805.0
B12	1810.0	8100.0

QUANTITIES (NET, BY FIELD UNLESS NOTED)

AREA	I-O STRIPPING	EXCAVATION	* FILL
ASH DISPOSAL AREA INCLUD DIKES	78,400 CU YDS	510,000 CU YDS	772,000 CU YDS

* FILL QUANTITIES INCLUDE FILLING I-O STRIPPING VOID AND 10% SHRINKAGE

MAX ASH DISPOSAL VOLUME 1,700,000 CU YDS

EXISTING ASH DISPOSAL POND:
FILL 101,220 CU YDS
MAX ASH DISPOSAL VOLUME 476,210 CU YDS — SEE 005-F56-3 (DPS)

36"ϕ SKIMMER HOOD 1 REQD
36"ϕ REINF CONC PIPE (ASTM C-76 TYP II) 250 LIN FT

NOTES

CLEARING EXCAVATION, BACKFILL & DIKES, SHALL BE IN ACCORDANCE WITH SPECIFICATION DAY-JMZ-CH2 LATEST REVISION
FOR ADDITIONAL NOTES SEE 300-12-1020.

REFERENCE DRAWINGS

LIST OF DRAWINGS	300-13-1000
SITE GENERAL GRADING - SH 1 (UNIT #2)	300-12-1020
C.W.S. DISCHARGE CANAL (UNIT #2)	300-32-1117
SITE GENERAL GRADING - SH 2 (UNIT #2)	300-12-1021
CONSTRUCTION PLANT SITE PLAN ASH PIT WEST OF UNIT #3 (DPS)	005-F56-3
SITE GENERAL GRADING - SH 5 (UNIT #2)	300-12-1024
DISCHARGE CANAL CONTROL STRUCTURE	300-32-1127

REVISIONS

No.	Date	Description
1	6-26-69	REV. UNIT #3 ASH POND & SWITCHYARD (H9)
2	6-26-69	REV. WEST LEVEE OF ASH POND (H8) & ADD CONT. POND DISCHARGE & EXC. TENDED DISCHARGE CANAL TO CONTROL WEIR.
3	7-9-69	REVISED ASH POND DIKE
4	1-9-69	REVISED ASH POND DIKE & ADDED INTAKE INSTALLATION

EBASCO REF. NO. G-198827

EBASCO SERVICES INCORPORATED NEW YORK

TITLE: ASH POND PLAN

FOR: J. M. STUART ELECTRIC GENERATING STATION
1972—600,000 KW INSTALLATION—UNIT NO. 3

SCALE: 1" = 200' UNLESS NOTED	DIV. CONC-HYD	PROJECT	70059
DRAWN YANG	11-14-68	APPROVED	12-18-68
CHECKED BRUNO	11-27-68	APPROVED	1-9-69
ENGINEER		APPROVED	

THE CINCINNATI GAS & ELECTRIC CO.
COLUMBUS AND SOUTHERN OHIO ELECTRIC CO.
THE DAYTON POWER AND LIGHT COMPANY

300-13-1143
SHEET OF SHEETS
FILE

APPENDIX 6
Excerpt from:
Ash Pond 5 Embankment Evaluation
By Soil & Materials Engineering, Inc., Dated 9 January 1985
Pages 1-4, Figure 1

Crest

The crest was topped with an aggregate surface and many potholes were observed. Based on observations made by CHA, the crest width was measured to be approximately 23 feet and 12 feet on the north and south dikes, respectively. Based on the 2005 Site Mapping and GPS data collected from the site, the crest Elevation varies from approximately 529 to 530 feet.

Blanket Drain

Based on a review of the limited project plans provided, no indication of a blanket drain system was shown. In the field, no evidence of a subsurface drainage system was observed.

INSTRUMENTATION

As part of their 2001 investigation, URS installed 5 observations wells, designated A-1, A-5, B-1, B-2 and C-1. The boring log for C-1 indicates a monitoring well was installed at this location, however, BBCM could not locate this well and instrumentation data has not been collected. Although a boring log is not available for B-2, BBCM located this well near the toe of the slope near Boring HS-B-3. For the other wells, information concerning the screen length and sand pack is included on the boring logs. In addition to the observation wells, one inclinometer casing was installed in Boring A-4. No information is available as to this instrumentation prior to 2009. Beginning on December 18, 2009, MACTEC Engineering and Consulting began monitoring the inclinometer casing and the observation wells on a weekly basis. A copy of MACTEC's most recent data summary report is including in Appendix C.

The inclinometer readings do not reveal any evidence of a deep seated failure. Minor movement within a few feet of the ground surface has been detected by the inclinometer but it is likely that this is associated with seasonal freeze-thaw effects. The water level readings have been incorporated into the cross-sections included in Appendix A. For the upper wells, levels in A-1 range between Elevations 517.2 feet and 518.2 feet while levels in B-1 were approximately 6 feet lower ranging in Elevation between 510.4 feet and 511.5 feet. It should be noted that these levels are approximately 3 feet higher than the upper limits of seepage identified on the outboard slope face. The lower wells (A-5 and B-2) generally indicate water levels somewhat above the water level in the river. It should be noted that these wells were underwater while BBCM was on site.

GENERAL SUBSURFACE CONDITIONS

The subsurface conditions, as encountered in the URS and BBCM borings, are described briefly below. Additionally, cross-sections through the embankment at Seepage Areas A, B and C depicting the subsurface conditions are included in Appendix A.

The URS borings performed from the crest and into the natural soils (A-1, B-1 and C-1) encountered between 37 and 41 feet of embankment fill consisting generally of stiff to hard brown silty clay containing varying amounts of sand. As this layer is of principal interest relative to the observed seepage, it is discussed in more detail later in this report.

Underlying the embankment fill, alluvial soils consisting of interbedded silt, clay and fine sand were encountered in the borings. Samples within this stratum exhibiting cohesion were typically

REFERENCE: J.M. STUART STATION 2005 SITE MAPPING

LITTLE THREE MILE CREEK

POND 5

TP-B-2
TP-B-1
B-2
HS-B-3
B-1
A-3
A-1
A-2
A-4
TP-A-2
TP-A-2
A-5
HS-C-2
TP-C-1
C-1
TP-C-2
TP-D-2
TP-D-1

ADAMS COUNTY
BROWN COUNTY

OHIO RIVER

0 100' 200'
SCALE IN FEET

LEGEND

HS-B-3 — HAND SAMPLING BORING NUMBER AND LOCATION

TP-A-1 — SHALLOW TEST PIT NUMBER AND LOCATION

A-1 — BORING NUMBER AND LOCATION (APPROXIMATE) URS 2001 INVESTIGATION

A 3|4 — CROSS SECTION LOCATION
Section Identifier
Section Taken / Section Shown

Date	No.	Revision Description	Approved By

Drawn By:	AJS
Designed By:	MTR
Approved By:	MGR
Drawing Scale:	1" = 100'
Plot Scale:	1:1
Date Last Updated:	3-31-2010

PLAN OF BORINGS
Ash Impoundment Study
Phase 1: Pond 5 Seepage Investigation

J.M. Stuart Station
Adams County, Ohio

Dayton Power and Light
Aberdeen, Ohio

BBCM
SOLUTIONS TO BUILD ON
Columbus: (614) 793-2226 Cincinnati: (513) 771-8471
Cleveland: (216) 901-1000 Dayton: (937) 424-1011

This drawing is the property of BBCM Engineering, Inc, and is loaned upon the condition that it is not used for any purpose detrimental to their interest

PLATE 3 of -

Project Number: 011-12608-000

Image:
Image Name: - Pond 3,5,6,7 Topo.dwg - 011-12608-000 Seepage Investigation - - GPS.dwg
File Last Updated: Mar 31, 2010
Plot Date: Mar 31, 2010 By: mcmcnello
BBCM FileName: I:\DEPTS\CADD\Drawings\Projects\011-12608-000\CAA_3D\011-12608-000 Pond 5 Plan of Explorations.dwg Layout: POB

APPENDIX 7.1
Excerpt from:
Assessment of Dam Safety Coal Combustion Surface Impoundments (Task 3)
Final Report
By CHA, Dated 26 March 2010
Pages 5, 6, 29

El. 554, roughly equal to the maximum weir plate elevation of 553.5 DP&L has indicated in correspondences available after the site visit was completed. According to DP&L, the water level in Pond 3A does not reach the maximum possible pool elevation because fly ash sluicing is rotated among three ponds. Water entering the intake structure is discharged into a channel at the northwestern corner of Pond 6, where it conveys water into Pond 6. At the time of CHA's site visit, ash was not being actively sluiced into the pond and the water level in the pond was significantly below the spillway invert to accommodate ash excavation for landfilling. Due to the way the pond was constructed, free water that presently collects in the base of the inactive basin has to pumped up to the outlet structure to reach the invert elevation at 547.0, approximately 15 to 18 feet above the basin floor.

1.3.2 Pond 5

It appears that the 1968 drawing provided by DP&L is a grading plan for Pond 5A. Figures 5A and 5B show the plan view and selected sections from the 1968 drawing. The ODNR Dam Inventory sheet reports that the dikes were designed by DP&L. DP&L reported to the EPA that pond was commissioned circa 1975. This impoundment receives bottom ash, cooling tower and FGD blow-down, and miscellaneous plant waste water.

Pond 5 is entirely bounded by earth dikes with a total length of approximately 4,200 feet and a maximum height of approximately 41 feet. The width of the dike crests are 22 feet. A discrepancy was noted between the top of dike elevation shown on the 1968 drawing (El. 532.0) and the crest elevation reported on the Ohio Dam Inventory Sheet (El. 529). The upstream side of the embankment slopes at 2.2H:1V and downstream side of the embankment has a slope of 3H:1V as shown on Sections A-A, B-B, and D-D included herein in Figure 5B.

Material enters Pond 5 through a series of pipes and interior channels along the east side of the pond. An interior dike has been constructed to facilitate ash and waste settling in the eastern third of the pond, forming an ash delta and processing area and creating an open pond in the

remaining pond area. The maximum pond elevation, based on the Ohio DIS and assuming a 5-foot freeboard is maintained as required by ODNR, is 524 feet. The surface area of the pond is approximately 34 acres and has a maximum capacity of 2,300,000 CY. A concrete wet well structure with metal sheeting and skimmer forms the outlet for the pond and is currently set at approximately El. 525, the present operating pool elevation. Water entering the intake structure is discharged into the water treatment plant.

1.3.3 Ponds 6 and 7/7A

The 1972 drawing provided by DP&L shows grading and dike cross section information for Ponds 6 and 7. Figures 6A and 6B show the plan view and sections from the 1972 drawing. DP&L reported to the EPA that Ponds 6 and 7 were constructed c. 1977 and Pond 7A was constructed c. 1977. Pond 6 receives ash pond discharge and ash landfill storm water. Pond 7 receives fly ash and Pond 7A is utilized for final polishing.

Table 2 provides a summary of the pond configuration information for Ponds 6 and 7/7A.

Table 2 - Ponds 6 and 7/7A

Ash Pond	Dike Length (feet)	Maximum Height (feet)	Area (acres)	Storage Capacity (CY)
6	3,400	31.5	37	2,500,000
7	3,150	33.5	37	2,500,000
7A			3	61,900

The northern side of Pond 6 is incised. Based upon the physical site assessment, the western edge of Ponds 6 and 7 appears to be partially incised, with a crest at least 16 feet wide. Plans indicate that the crest elevation along this western edge varies from El. 531.5 on the southern end to El. 533.5 on the northern end (Figure 6A). This area also carries a gravel access drive and forms part of the foundation for the Pond 3A eastern dike. It is unclear from the drawings how

In addition to the seeps and resulting softened slope areas, scarp areas were observed on the south side of the pond and western extremity of the pond. A scarp on the south dike (Photo 13) occurred along a heavily vegetated, over-steepened portion of the dike adjacent to a haul road drainage ditch. It measured roughly 52 feet in length along the dike centerline. The scarp encountered on the west end of the pond measured approximately 30 feet in length and appeared to occur in a location of softer soil (Photo 14). Standing water was observed in this scarp and the soft soil in the area of the scarp is likely the result of seepage at this location.

2.2.2 Pond 5 Outlet Structures

Near the west end of the pond, an outlet structure was observed (Photos 8 and 9). It appeared to be a concrete drop inlet intake structure with metal sheeting and a skimmer to keep debris from fouling the structure. The outlet structure appeared to be operating properly. The observed location of the outlet structure differs from the location shown on the 1968 drawing.

2.3 Visual Observations– Pond 10

CHA performed visual observations of the Pond 10 embankment and outlet structures. Selected pictures are shown in Photos 25 through 38.

2.3.1 Pond 10 - Embankments and Crest

Pond 10 was the most recently constructed pond. At the time of the site visit, the pond was inactive with a shallow pool of water at the south end of the pond as seen in Photo 25. Most of the collected ash was excavated to landfill during the summer; some ash remains at the north end of the pond as seen in Photo 26.

The dikes and crest areas of Pond 10 do not show signs of changes in their horizontal alignments from the proposed alignments. The crest was measured to be approximately 17 feet wide and is

APPENDIX 7.2
Dam Inventory Sheet from:
Dam Safety Inspection Report – J.M. Stuart Station Ash Pond 3A
By Ohio Department of Natural Resources, Dated 27 October 2009

Dam Inventory Sheet

Name: JM STUART STATION ASH POND NO. 5
File No: 8535-003
National #:
Reservoir:
Permit No.: EXEMPT
Class (Ht-Vol): II (II - II)

Owner Information

Owner: Dayton Power & Light Company
Owner Type: Utility
Address: US Route 52, POB 468
Multi-Dams: Yes: 8, Class I:1
Parcel No.:
City: Aberdeen **State:** OH **Zip:** 45101
Contact: Craig Spangler **Phone No.:** 937/549-2641

Location Information

County: Adams **Latitude Deg.:** 38 **Min.:** 38 **Sec.:** 26
Township: Sprigg **Longitude Deg.:** 83 **Min.:** 42 **Sec.:** 8
Stream Ohio River - Offstream
Nearest Affected Community: Maysville, Ky
Community's Distance from Dam (miles):
USGS Quad.: Maysville East, Ky-oh **USGS Basin No.:** 05090201

Design/Construction Information

Designed By: Dayton Power & Light Co.
Constructed By:
Completed: **Plan Available:** **At:**
Failure/Incident/Breach:

Structure Information

Purpose: Waste Retention
Type of Impound.: Upground
Type of Structure: Earthfill
Drainage Area (sq. miles): 0.05 **or (acres):** 34

Embankment Data

Length (ft): 4200 **Upstream Slope:** 2.5H:1V
Height (ft): 41 **Downstream Slope:** 3H:1V
Top Width (ft): 22 **Volume of Fill (cub. yds.):**

Spillway Outlet Works Data

Lake Drain: NONE
Principal: DROP STRUCTURE TO CMP (3-FT-DIA) TO WATER TREATMENT PLANT
Emergency: NONE
Maximum Spillway Discharge (cfs) **Design Flood:** 0.50 **Flood Capacity** 0.50

Dam Reservoir Data	Elevation (ft-MSL)*	Area (acres)	Storage (acre-feet)
Top of Dam:	529	34	1094
Emergency Spillway:			
Principal Spillway:	522	32	
Streambed:	488		
Foundation:			

*Elevations are not necessarily related to a USGS benchmark

Inspection Information

Inspection History: 10/27/2009 KRB
Phase I:
Other Visits:

Next Planned Inspection: 2007-2008 A - by Basin

Operation Information/Remarks

Originally unclassed; changed to Class II Oct 2009

Emergency Action Plan: No **Format:** **OMI:** No
Annual Fee: $276.00 **Last Entry:** 5/17/2010

APPENDIX 8.1
Excerpt from:
Operation Maintenance and Inspection Manual Ash Impoundment Dike Stuart Electric Generating Station
By DP&L, Dated October 2012
Pages 1-4, 8-11, Appendix C

OPERATION MAINTENANCE AND INSPECTION MANUAL

ASH IMPOUNDMENT DIKE

STUART ELECTRIC GENERATING STATION

ODNR FILE No.

POND 3A	POND 5	POND 6	POND 7	POND 10
8535-012	8535-003	8535-013	8535-002	8535-011

SPRIGG TOWNSHIP, ADAMS COUNTY
CLASS 2

OWNER:

DAYTON POWER & LIGHT COMPANY
745 U.S. ROUTE 52
MANCHESTER, OH 45144

(937) 549-2641 TEL
(937) 549-4281 FAX

PREPARED BY:

The Dayton Power & Light Company

Revised
April 8, 2014

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1.2 GENERAL ARRANGEMENT 2

2.0 OPERATION ..... 8~~8~~

3.0 MAINTENANCE ..... 9~~9~~

3.1 SAFE RATE DRAWDOWN PLAN ..... 9~~9~~

4.0 INSPECTION ..... 9~~9~~

5.0 RESPONSIBILITIES ..... 10~~10~~

6.0 APPENDICIES ..... 11~~11~~

Figure 1.1 Location Map

Figure 1.2 Facility Map

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Appendix A References

Appendix B Arrangement Drawings

Appendix C **Inspection Forms**

Form 1 Rainfall Monitoring

Form 2 Monthly & Biannual Monitoring

Form 3 Dam Maintenance Record

Master document located in:

G:\Central Services\Equipment - System Owners\Ponds-Landfills\Stuart\OM&I Manual Stuart RA.doc

1.0 DESCRIPTION OF FACILITY

1.1 LOCATION

DP&L has 5 impoundments located at the J.M. Stuart Station in Sprigg Township, Adams County, Ohio as shown on Figure 1.1, Location Map and Figure 1.2, Facility Map. The purpose of this manual is to increase the safety of the impoundments by defining the procedures for operating, maintaining and inspecting the dams on a regular basis. The facility's characteristics are shown in Section 1.2's tables. The Operation, Maintenance & Inspection Manual (OM&I Manual) was prepared as required by OAC 1501:21-15-06.

Figure 1.1, Location Map

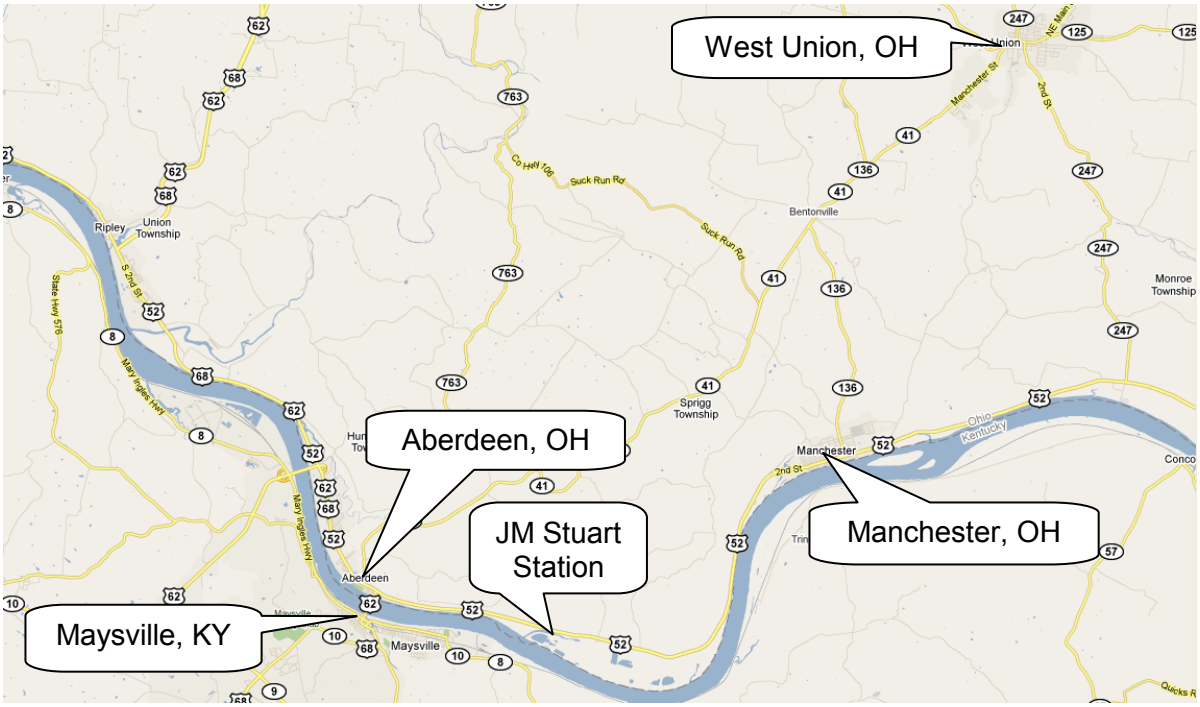
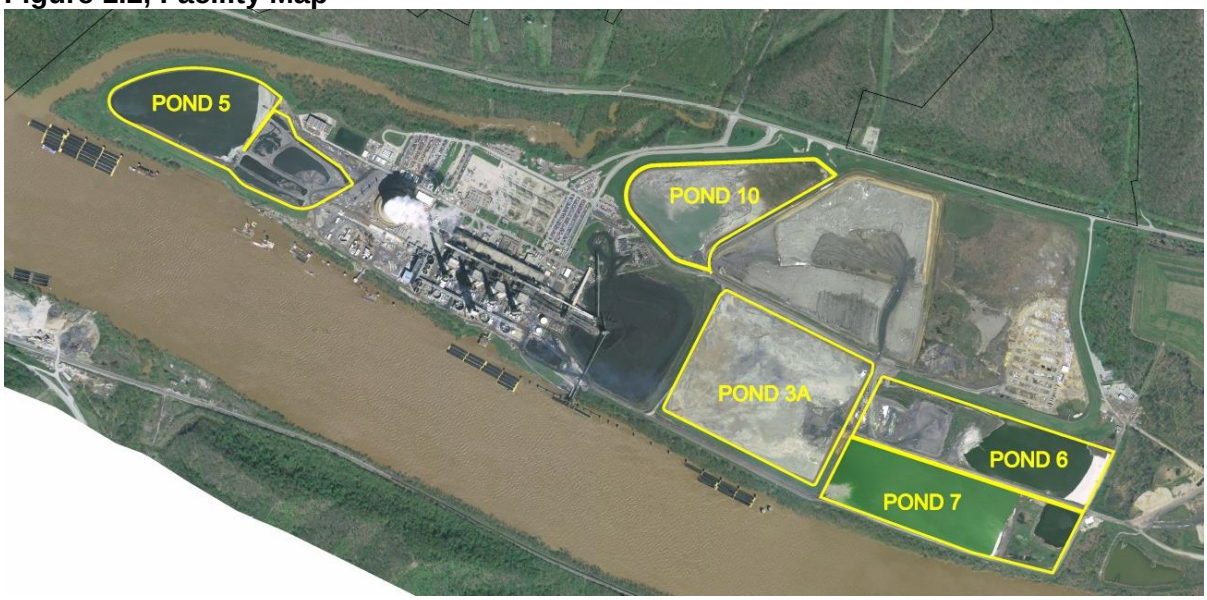


Figure 1.2, Facility Map



1.2 GENERAL ARRANGEMENT

Ponds 3A, 7 and 10 are primary fly ash settling ponds. They receive ash sluiced from the fly ash collection system from the plant. Pond 6 receives water from plant sumps and ash sluice water from the above mentioned ponds. Under normal operation only one of the three ash sluice ponds will discharge water at any given time. Pond 5 is divided into two sections. The east section contains primary settling lagoons for bottom ash and other plant area drainage sumps.

In 2012 a survey of the crest of the ponds was performed. The elevations in this document have been revised to reflect these elevations which are now referenced to the NAVD 1983.

1.2.1 Ash Pond 3A – ODNR File No. 8535-012

Ash pond 3A is an upland reservoir that was constructed in c1978 under ODNR Permit No. 77-97. A portion of this pond is constructed over the previously closed and abandoned Pond 3 which was capped with 2' of cohesive material. In 2010-11 a new liner was installed in the bottom consisting of 2 ft of 10^{-7} clay. The dam is constructed with a solid clay core. This pond is used for settling wet sluiced fly ash produced from the combustion of coal in the station generating units. The pond has an area of 52.7 acres at the crest, is 26 ft deep and has a volume of 1,257 acre-ft (427 million gal.) to the crest. This pond is periodically drained and the settled fly ash excavated which is then sent to a dry ash landfill.

A sand curtain drain was installed along the toe of the south dam to alleviate water in the pond 3 below this structure as indicated in drawing 300-46-1109.

The inlets for this pond are 5 HDPE pipes entering the pond typically in the southwest corner. Sluice lines are moved as the pond fills with solids. The Maximum Operating Level of this pond is 3 ft below the crest. The outlet is a concrete structure with removable stop logs to control the level and facilitate dewatering the pond for cleaning. Effluent is conveyed from this structure to pond 6 through a 30" reinforced concrete pipe.

During the normal excavation process the dam on the east side is breeched to facilitate ash hauling. Repair of the breech at the end of the excavation cycle shall be monitored and by a qualified technician under the supervision of a Professional Engineer.

Table 1.1 – Pond 3A Properties

Item	Description
IDENTIFICATION	
ODNR File Number	8535-012 / 77-97
LOCATION	
State	Ohio
County	Adams
Township	Sprigg
Stream	Ohio River
USGS Quadrangle Map	Maysville east, KY-Ohio
Community Distance from Dam	4 miles, Aberdeen, Ohio / Maysville, KY
DESIGN/CONSTRUCTION INFORMATION	
Original Designer	Bowser Mourner
Date Completed	1978
Contractor	Ucon Construction Co.
Purpose of Dam	Industrial
Type of Impoundment	Up ground
Type of Structure	Earth fill

Area at Crest	52.7 acres
Entire Length of Dam	4,496ft
Bottom of Pond [1, 2]	El 531 ft.
Maximum Height	24.6 ft
Top Berm Width	10.0 ft
Top of Dam	El 555.6 ft
Maximum Operating Level	El 552.6 ft
Freeboard	3.0 ft
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope [1, 2]	2.5H:1V
INLETS	
Fly Ash System	Starting in the southwest corner HDPE pipes are moved as needed to manage filling of the pond.
OUTLETS	
Outlet structure	Northeast corner, Latitude = 38° 38' 4.6" N; Longitude = 83° 40' 48.2 W Concrete structure with stop logs to adjust water level discharging through a 24" RCP into Pond 6
Emergency Spillway	None.

1.2.2 Pond 5 – ODNR File No. 8535-003

Pond 5 is an upland reservoir that was constructed in c1970. Inverted filters were added in 2010 at 5 seepage locations. This pond receives influent from plant processes including area drains, bottom ash sluicing, and FGD blow down. These influents are routed into settling bays in the eastern portion of the pond which discharge into the remaining portion of the pond. The pond has an area of 39 acres at the crest, is 40ft deep and has a volume of 1,110 acre-ft to the crest including the permanently filled portion of the pond. This pond is vital to the operation of the plant and cannot be drained without shutting the station down. The Maximum Operating Level of this pond is 5 ft below the crest. The outlet is constructed of driven sheet piling and is routed via a 4ft diameter corrugated metal pipe to the waste water treatment building. In this building effluent is filtered in rapid sand filters with a walnut shell filter media. There is also an emergency overflow weir (elevation 723.82') in this building which will bypass the filters if the level is up to 5½ ft below the crest.

Table 1.2 – Pond 5 Properties

Item	Description
IDENTIFICATION	
ODNR File Number	8535-003
LOCATION	
State	Ohio
County	Adams
Township	Sprigg
Stream	Ohio River
USGS Quadrangle Map	Maysville east, KY-Ohio
Community Distance from Dam	4 miles, Aberdeen, Ohio / Maysville, KY
DESIGN/CONSTRUCTION INFORMATION	
Original Designer	Ebasco Services, Inc, Atlanta, GA
Date Completed	1968
Contractor	
Purpose of Dam	Industrial

Type of Impoundment	Up ground reservoir
Type of Structure	Earth fill
Area at Crest	39 acres
Entire Length of Dam	4,260ft
Bottom of Pond [1, 2]	El 498 ft.
Maximum Height	34.0 ft
Top Berm Width	10.0 ft
Top of Dam	El 529.30 ft
Maximum Operating Level (Posted)	523.50 ft
Maximum Operating Level	524.30ft
Freeboard	5.0 ft
Upstream Slope [1, 2]	2.5H:1V
Downstream Slope [1, 2]	2.5H:1V
INLETS	
Bottom Ash	Northeast or northwest settling lagoon
FGD Area Sumps	Southern settling lagoon
Plant area sumps	Center settling lagoon
OUTLETS	
Outlet structure	West end, Latitude = 38° 38' 31.8" N; Longitude = 83° 43' 21.8 W sheet pile structure with a 36: CMP which flows to the wet well in the filter building
Emergency Spillway	The wet well is designed with an overflow weir (elevation 523.82 ft) that bypasses the normal filter process.

1.2.3 Ash Pond 6 – ODNR File No. 8535-013

Pond 6 is a partially incised, upland reservoir that was constructed in 1973 as an ash sluice pond. The pond was partially re-excavated in c1983 to elevation 523.0 (indicated on drawing 300-46-1101 as 6A) and now serves as a collection pond for ash sluicing water from ponds 3A, 7 and 10, coal storage area drainage, and landfill 11 stormwater, contact water and leachate. The original pond has an area of 36.7 acres at the crest, is 31 ft deep(the re-excavated depth is 10.5 ft) and has a volume of 1,390 acre-ft to the crest. 18.6 acres of this pond are permanently filled leaving an operating area of 18.1 acres and volume of 308 acre-ft to the crest. The Maximum Operating Level of this pond is 3 ft below the crest.

The outlet is a concrete structure with adjustable weirs which discharges through the pH treatment building into the 7A portion of pond 7. A stand pipe with a sluice gate is located along the east dam which discharges to NPDES outfall 013. The elevation of this stand pipe is 530.32 ft per the 2013 survey. (Drawing 300-46-1315 sheet 1 indicates that the elevation of this standpipe is 530.50.)

The east dam (the only exposed dam) was rehabilitated and re-graded in 2010. A piezometer was also installed in this dam at that time.

Table 1.3 – Pond 6 Properties

Item	Description
IDENTIFICATION	
ODNR File Number	8535-013
LOCATION	
State	Ohio

2.0 OPERATION

Specific procedures for operation of mechanical equipment are as follows:

Table 2.1		
Frequency (Min.)	**Personnel**	**Maintenance Item**
Continuously	Owner's Representative	Monitor water levels and operation of filter system
		Monitor water levels
Semiannually	Owner's Representative	Exercise pond 6 weir gates to ensure operability.
		Exercise pond 10 sluice gate. Sluice gate shall otherwise be locked in the open position.

3.0 MAINTENANCE

Table 3.1 lists the type and frequency of the maintenance activities to be performed at the dam.

Table 3.1		
Frequency (Min.)	**Personnel**	**Maintenance Item**
Semi Annually	Owner's Representative	All broadleaf vegetation on the dam shall be sprayed with a broadleaf herbicide or cut and treated to prevent re-growth. This includes trees, shrubs and all other woody plants.
		Lubricate and inspect pond 6 weir gates.
		Lubricate and test operate Pond 10 discharge vlave
As Needed	Owner's Representative	• Repair erosion and re-establish proper vegetative cover. Reseeding of bare or eroded areas should be performed immediately to allow re-vegetation. The seed mixture shall meet the species requirement of ODOT 659.09 class 2 or class 3B. All alternates must be approved by ODNR. • Mow the grass to maintain a height of less than 12". • Make repairs to all structures and elements as required. • All rodent damage shall be repaired immediately by filling the burrows or holes utilizing the mud packing method. (*To backfill a burrow, place a length of metal stove pipe or PVC in a vertical position over the entrance to the burrow and fill with slurry clay and cement. After the burrow is filled, the pipe should be removed and dry earth tamped into the burrow entrance and the vegetation re-established.)* • Maintain a permanent record of all maintenance actions. Maintenance records may be maintained on Form 3 or maintained in an electronic maintenance management system.

3.1 SAFE DRAWDOWN RATE PLAN

The following section includes the method to be used for drawing the impoundment down under emergency conditions. Drawdown should be limited to 12" per week for normal operation and 6" per day for emergencies. Excessive drawdown can cause sloughing or slides of the upstream face of the dam.

For 3A and 10 the level should be lowered by removing stop logs to maintain the safe drawdown rate. Once the bottom of the outlet structure is reached, portable pumps shall be used to lower the level further. The water level in pond 7 must be lowered with portable pumps. Ponds 5 and 6 are critical to plant operation and cannot be lowered beyond the normal operating range without shutting the plant down. If an emergency necessitates that this be done the ponds will have to be drained with portable pumps. When possible pumps used for drawdown should be discharged into other ponds or the pond normal outfall.

4.0 INSPECTION

DP&L shall perform three types of inspections. Two periodic inspections include monthly and biannual. The third type is monitoring as needed during and after heavy rainfall events. Table 3.1 lists the type and frequency of the inspection activities to be performed at the dam. Inspection forms are included under Appendix A. DP&L's operations representative or operations contractor may complete the monthly inspections. The biannual (every 6 months) inspections should be completed by a person qualified Dam Safety and may be performed

by DP&L personnel or a Registered Professional Engineer. Inspections shall be documented on the forms provided with this manual.

Table 4.1

Frequency	Personnel	Inspection Item	Form No. or Reference
As Needed (After heavy rainfall event such as 2" in a 24 hour period)	Owner's Representative (Operations Shift Supervisor)	Monitor the rainfall at NOAA, National Weather Service or KYmesonet weather station in Mason County,	Form No. 1 www.nws.noaa.gov www.kymesonet.org
		Flow though overflow pipe	
		Water level of the impoundment	
Monthly *(Visual Observation)*	Owner's Representative (Plant Operations)	Seepage and/or wet areas	Form No. 2
		Flow through spillway or outlet pipe	
		Water level of the impoundment	
		Slides and cracks	
		Rodent activity along the waterline	
		Vandalism	
Biannually *(Visual Observation)*	Owner's Representative or consultant PE or other qualification. (Central Services)	Slope protection	Form No. 2
		Condition of earthen dam	
		Outfall discharge to plunge pool area	
		Condition of vertical riser and culvert *(visual)*	
		Pond drain and valve *(operational)*	
		Review dam maintenance records	
Periodic 5 years *(Visual Observation)*	ODNR/Division of Soil & Water Resources/Dam Safety Engineering Program	Engineer's Safety Inspection Checklist	Form provided by ODNR

5.0 RESPONSIBILITIES

Plant Manager

The Plant Manager is responsible for implementation of this manual. The Plant Manager or designee shall also be responsible for the annual review and revision of this manual.

Plant Commodities Manager

The Plant Commodities Manager or designee is responsible for the maintenance of the facility and record keeping of all maintenance activities.

Material Handling Shift Supervisor

The Shift Supervisors are responsible for the routine monthly inspections included those after a significant rainfall and monthly and adherence to operational practices. Supervisors are also responsible for periodic operation of drain valves. The shift supervisor may designate others to perform these suties

Central Services Engineer

The Central Services Engineer is responsible for conducting the semi-annual inspections and coordinating with ODNR for compliance of deficiencies and 5-year inspections.

6.0 APPENDICIES

APPENDIX A

Reference Drawings used in this manual.

APPENDIX B

Future Arrangement Drawings

APPENDIX C

Inspection forms.

APPENDIX C

INSPECTION FORMS

FORM 1

RAINFALL MONITORING

This form should record all inspections triggered by significant rainfall events (greater than 2” in a 24 hour period) in the area. The National Weather Service (NOAA) web site is useful for monitoring these events. Note any significant decrease of freeboard or obstructions to flow in the outlet structures.

POST RAINFALL EVENT MONITORING FORM				
DATE (M/D/Y)	PERSONNEL NAME	RAINFALL (in)	ESTIMATED FREEBOARD (ft)	COMMENTS

FORM 2

Stuart Station Pond _____
Dam Inspection Report
ODNR File No. _____

MONTHLY/SEMIANNUAL INSPECTION FORM

Where appropriate, indicate conditions below as "**none**" or "**acceptable**" if no further action is required. Check "**repair**", "**monitor**", or "**investigate**" if further action is required. Obvious problems will require repair. Monitoring will be recommended if there is potential for a problem to occur in the future. Investigation is necessary if the reason that the problem is occurring is not obvious. More than one box may be checked if necessary. The locations of any observed conditions can be noted on photographs.

CONDITIONS AT THE TIME OF INSPECTION			
DATE		INSPECTED BY:	

AREA	ITEM	OBSERVATIONS	ACTION		
			REPAIR	MONITOR	INVESTIGATE
DAM EMBANKMENT					
BOTTOM ASH UPSTREAM SLOPE	VEGETATION/TREES/ BRUSH				
	RODENT BURROWS				
	RIPRAP				
	BREACHING/SLIDES/ CRACKS				
	UNDERMINING/ EROSION				
	OTHER				
FLY ASH UPSTREAM SLOPE	VEGETATION/TREES/ BRUSH				
	RODENT BURROWS				
	RIPRAP				
	BREACHING/SLIDES/ CRACKS				
	UNDERMINING/ EROSION				
	OTHER				
CREST	RUTS/EROSION				
	CRACKS/ SETTLEMENT				
	OTHER				

DOWNSTREAM SLOPE	VEGETATION/TREES/ BRUSH				
	RODENT BURROWS				
	SLOUGHS/SLIDES/ CRACKS				
	SEEPAGE/WETNESS				
	OTHER				
TOE	CRACKS/SLUMPS				
	SEEPAGE/WETNESS				
	OTHER				
INFLUENT/EFFLUENT STRUCTURES					
INLET STRUCTURE	OBSTRUCTIONS				
	DETERIORIATION				
	ACCESS/GRATING				
	OTHER				
OUTLET STRUCTURE	OBSTRUCTIONS				
	DETERIORIATION/ SEEPAGE				
	UNDERMINING				
	ACCESS/GRATING				
	OTHER				

FORM 3

Stuart Station Pond _____ **Dam Maintenance Report** **ODNR File No. _____**		
DAM MAINTENANCE RECORD FORM		
This form may be used to record all maintenance tasks performed including preventative maintenance, corrective maintenance and emergency maintenance.		
DATE	WORK ORDER NO.	ACTION

Alternate spreadsheet used in lieu of this form. A mowing log is kept separately.

APPENDIX 8.2
Excerpt from:
Assessment of Dam Safety Coal Combustion Surface Impoundment (Task 3) Final Report
By CHA, Dated 26 March 2010
Pages 106-110

above approximately 1 to 12 feet of fine grained, generally cohesive alluvial deposits comprising medium stiff to hard clay, silty clay and silt. Granular alluvial deposits comprising silty and clayey sand to poorly graded and well graded sand with gravel at lower elevations was evident below the cohesive soils. This granular deposit was divided into an upper and lower zone. Very loose to medium dense conditions were apparent in the upper zone noted to between 9 and 25 feet below grade, and loose to very dense conditions in the deeper, cleaner sand with gravel noted to more than 100 feet below grade. Under seismic load conditions, the very loose to loose sand and silty sand soils in evident in the upper zone closest to the dike foundation may be susceptible to liquefaction behavior during which they lose shear strength and flow like a viscous liquid. Additional discussion regarding liquefaction appears in Section 4 of this report.

A generalized cross section of Pond 10 and its associated dikes (Figure 13C) indicates that the dikes are founded above the cohesive alluvium and the basin bottom is in the upper granular alluvium comprising silty to clayey sand. Available specifications indicate that the dike foundation was to be "stripped to the depths required to remove vegetative matter, roots, and other perishable, loose, or objectionable material". This directive would likely address the topsoil and miscellaneous fill materials encountered in the surficial zone in the foundation area. Furthermore, the foundation soils were to be proof rolled to delineate soft or yielding subgrade. Any poor subgrade conditions exposed in the field was to be excavated and replaced with the appropriate compacted material for the foundation location.

3.5 Operations & Maintenance

DP&L provided CHA with a copy of the Operations, Maintenance, and Inspection Manual (OMI) and a copy of the Emergency Action Plan (EAP), both dated May 15, 2000. A copy of Addendum No.1 to the OMI dated December 20. 2001 was also included with the DP&L submittal. These items address Pond 10, the most recent impoundment commissioned at the site. Tasks required under the OMI are supposed to be performed by J.M. Stuart plant personnel and address the following:

- Operation of Reservoir – Discharge fly ash/water slurry into the pond at a location away from the outlet structure and allow ash to settle/decant. Add stop logs as ash levels rise to prevent ash flow through outlet structure.
    - Initial filling of Ash Pond 10
    - Installation of stop logs

- Dike Inspections – Outlines field inspection schedule and highlights critical items.
    - Inspection procedures and general inspection recommendations
    - Featured inspection items – Addendum No.1 adds discharge pipe, sand toe drain, and abutment areas with Pond 8W (now Landfill 11) dike to list
    - Repair Order/Work Performed Items

- Maintenance Items – Identifies appurtenant structures needed for effective operation and important dam safety concepts. A Dike Inspection Checklist along with a dike inspection plan and site operation schematic are included as a part of this OMI.
    - Concrete/Steel Structures and associated mechanisms
    - Skimmer, Walkway, and Safety Barriers
    - Crest and Access Roads
    - Vegetation and Rodent Control
    - Debris/Obstructions in Outlet Structure
    - Erosion
    - Seepage
    - Cracks/slides/slumps and gross deformations

- Emergency Procedures – Emergent or critical problems beyond routine maintenance. Separates them into two categories
    - Non-Failure or Potential Failure
    - Imminent or Failure has Occurred

Based upon conversations during our site visit, we understand that Plant personnel make visual observations on a daily basis during the course of their work on-site. However, a formal documented inspection procedure is not in place.

The Emergency Action Plan (EAP) for Pond 10 includes the following items:

- Communication Flow Charts for the type of emergency situation.
  - Non-Failure/Potential Failure – Flow Chart II
  - Failure Imminent/Failure Occurred – Flow Chart III
  - Flow Chart I is a general communication flow chart.

- Emergency Criteria to establish the level of deficiency and determine if a company or public notification is warranted.
  - Minor, Non-Emergency – Typically a maintenance issue
  - Serious Deficiency - Non-Failure/Potential Failure, requires immediate repair and company alert
  - Emergent Deficiency – Failure Imminent/Failure Occurred, requires public alert

- Personnel Responsibilities – Delegates specific responsibilities during an emergency situation
  - Notification Responsibility – critical communication with required personnel and agencies.
  - Evacuation Responsibility –if US 52 is threatened
  - Security, Follow-up, and Duration Responsibility
  - EAP Coordinator – EAP revision, training, etc.

In addition to the items listed above, the EAP for Pond 10 also included an inundation map showing the extent of an ash flow from the pond should a breach occur, site specific concerns associated with U.S. 52, and the EAP approval from the Adams County Emergency Action Agency.

3.6 Inspections

3.6.1 State 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. 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.

Representatives of the ODNR Dam Safety Program inspected Ash Pond 10 structures on June 12, 2008 and their observations were summarized in a Dam Safety Inspection Report. The report included required remedial measures based on observation made during the inspection, calculations performed, and requirements of the Ohio Administrative Code. The Dam Safety Inspection Report identified the following required remedial measures:

- Remove trees growing in the rip-rap at the toe of the northeast embankment.
- Establish a regular mowing routine to permit inspection of the upstream slope.
- Keep detailed records of quarterly inspections by site personnel using the checklists included in the Operations, Maintenance, & Inspection Manual.

Representatives of the ODNR Dam Safety Program accompanied CHA and site representatives during CHA's site assessment on October 27, 2009 and October 28, 2009. Subsequently, ODNR issued a letter to DP&L on November 5, 2009 indicating that a Professional Engineer must be engaged to investigate observed seepage and corresponding stability of the dike at Ash Pond 5. ODNR indicated that the investigation must be completed within six months of the date of their letter.

3.6.2 Inspections by Engineering Consultants

DP&L's letter to the USEPA responding to the request for information indicates that Civil & Environmental Consultants performed an assessment of Ash Ponds 3A, 5, 6, 7, 7A, and 10 in 2009 and that no significant issues were identified at the time of the inspection. CHA has not been provided with a copy of the inspection report.