Luminant

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Dr.
Collinsville, IL 62234

October 25, 2021

Illinois Environmental Protection Agency
DWPC – Permits MC #15
Attn: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: Baldwin Power Plant Fly Ash Pond System; IEPA ID # W1578510001-01, 02, 03

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Dynegy Midwest Generation, LLC (DMG) is submitting an operating permit application for the Baldwin Power Plant Fly Ash Pond System (IEPA Unit ID# W1578510001-01, 02, 03). One hardcopy and one digital copy are provided with this submittal.

The permit application was prepared in accordance with 35 I.A.C. § 845.230(d)(2) (Existing, Inactive and Inactive Closed CCR Surface Impoundment that have completed an Agency approved closure before July 30, 2021). This submittal includes the completed permit forms as required by § 845.210.

Sincerely,

Cynthia Vodopivec
SVP-Environmental Health and Safety

Enclosures

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

INITIAL OPERATING PERMIT

BALDWIN POWER PLANT FLY ASH SYSTEM

Prepared by

425 South Woods Mill Road, Suite 300
St. Louis, MO 63017

October 25, 2021

ATTACHMENTS

Attachment A	Legal Description (845.210)
Attachment B	History of Construction (845.220)
Attachment E	Permanent Markers (845.130)
Attachment H	Hydrogeologic Site Characterization (845.620)
Attachment I	Groundwater Sampling and Analysis Plan
Attachment J	Slope Maintenance (845.230)
Attachment K	Initial Post Closure Care Plan (845.780)
Attachment M	History of Known Groundwater Exceedances (845.600)
Attachment N	Financial Assurance Requirements (845.900)

1. INTRODUCTION

Dynegy Midwest Generation, LLC (DMG) is the owner of the coal-fired Baldwin Power Plant (Plant) located in Randolph County near Baldwin, Illinois. The IEPA assigned identification numbers assigned to the Baldwin Fly Ash System are:W1578510001-01, 02, 03. The National Inventory of Dams (NID) number assigned for the Baldwin Fly Ash System by the Illinois Department of Natural Resources (IDNR) is IL50721.

This initial operating permit application was developed in accordance with 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This initial operating permit application is for the Baldwin Fly Ash System.

1.1. Facility Information

> <u>*Section 845.210(b)(1):*</u> *All permit applications must contain the name, address, email address and telephone number of the operator, or duly authorized agent, and the property owner to whom all inquiries and correspondence shall be addressed.*

Facility:	Baldwin Fly Ash System Baldwin Power Plant 10901 Baldwin Road Baldwin, IL 62217
Owner/Operator:	Dynegy Midwest Generation, LLC 1500 Eastport Plaza Drive Collinsville, Illinois 62234

1.2. Owner Signatures

Section 845.210(b)(2): All permit applications must be signed by the owner, operator or a duly authorized agent of the operator.

The owner of the Baldwin Power Plant is a corporation.

Section 845.210(b)(3): An application submitted by a corporation must be signed by a principal executive officer of at least the level of vice president, or his or her duly authorized representative, if that representative is responsible for the overall operation of the facility described in the application form.

The signature of Cynthia Vodopivec on behalf of Dynegy Midwest Generation, LLC can be found in the permit applications located in Section 3.

1.3. Legal Description

Section 845.210(c): All permit applications must contain a legal description of the facility boundary and a description of the boundaries of all units included in the facility.

A legal description has been developed in compliance with Section 845.210(c) and is included in Attachment A.

1.4. Previous Assessments

Section 845.210(d): Previous Assessments, Investigations Plans, and Programs

Previous assessments were performed in accordance with 40 CFR § 257 and are referenced within the permit application and included in the appropriate Attachment.

Section 845.210(d)(1): The Agency may approve the use of any hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan, bearing the seal and signature of an Illinois Licensed Professional Geologist or Licensed Professional Engineer, completed before April 21, 2021 to satisfy the requirements of this Part.

A previous hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan have been completed with a seal from an Illinois Licensed Professional Geologist or Licensed Professional Engineer. However, field investigations have been completed that supplement that work that will be utilized in the following sections of this report.

> Section 845.210(d)(2): *For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and Section 845.340 (Unstable Areas) provided that the previously completed assessments meet the applicable requirements of those Sections.*

No previous assessments are included in the Baldwin Fly Ash system permit application.

> Section 845.210(d)(3): *For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed assessment to serve as the initial assessment required by Section 845.440 (Hazard Potential Classification Assessment), Section 845.450 (Structural Stability Assessment) and Section 845.460 (Safety Factor Assessment) provided that the previously completed assessment: A) Was not completed more than five years ago; and B) Meets the applicable requirements of those Sections.*

No previous assessments are included in the Baldwin Fly Ash system permit application.

> Section 845.210(d)(4): *For inactive closed CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a post-closure care plan previously approved by the Agency.*

No post-closure care plan was previously approved by the Agency.

2. OPERATING PERMIT

2.1. Initial Operating Permit

> Section 845.230(d): *Initial Operating Permit for Existing, Inactive and Inactive Closed CCR Surface Impoundments*

The Baldwin Fly Ash System as defined by IEPA is a closed inactive CCR surface impoundment that has not completed post-closure care. Per Part 845, DMG is submitting an initial operating permit application to IEPA by October 31, 2021. The permit applications (CCR-1 and CCR-2OE) are provided in Section 3.

The following sections contain information or references to documents required for the Operating Permit application (Section 845.230(d)(3)).

2.2. History of Construction

> Section 845.230(d)(2)(A): *The history of construction specified in Section 845.220(a)(1);*

The history of construction prepared in 2016 pursuant to 40 CFR § 257.73(c) is provided in Attachment B.

2.3. Permanent Markers

> Section 845.230(d)(2)(E): *Evidence of permanent markers required by Section 845.130 have been installed;*

Evidence of permanent markers at the Baldwin Fly Ash System as required by Section 845.130 is provided in Attachment E.

2.4. Slope Maintenance

> Section 845.230(d)(2)(F): *Documentation that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in Section 845.430;*

The Baldwin Fly Ash System is not incised. Documentation of slope protection as required by Section 845.430 is provided in Attachment J.

2.5. Groundwater Monitoring

Section 845.230(d)(2)(I): Groundwater monitoring information:

The groundwater monitoring information for the Baldwin Fly Ash System are described in the following sections.

Section 845.230(d)(2)(I)(i): Hydrogeologic site characterization (see Section 845.620);

Hydrogeologic site characterization for the Baldwin Fly Ash System are provided in Attachment H.

Section 845.230(d)(2)(I)(ii): Design and construction plans of a groundwater monitoring system (see Section 845.630);

Design and construction plans of a groundwater monitoring system are provided in Attachment I.

Section 845.230(d)(2)(I)(iii): A groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data (see Section 845.640); and

A groundwater sampling and analysis program that meets the requirements of Section 845.640 is provided in Attachment I.

Section 845.230(d)(2)(I)(iv): Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well (see Section 845.650(b));

A proposed groundwater monitoring program that meets the requirements of Section 845.650(b) is provided in Attachment I.

2.6. Initial Post-Closure Care Plan

Section 845.230(d)(2)(K): Initial written post-closure care plan, if applicable (see Section 845.780(d));

The Baldwin Fly Ash System was closed by capping the CCR in place. The initial post closure care plan was developed in accordance with Section 845.780 and is provided in Attachment K.

2.7. History of Groundwater Exceedances

> <u>*Section 845.230(d)(2)(M):*</u> *History of known exceedances of the groundwater protection standards in Section 845.600, and any corrective action taken to remediate the groundwater;*

A history of known exceedances and any corrective action taken is provided in Attachment M.

2.8. Financial Assurance Requirements

> <u>*Section 845.230(d)(2)(N):*</u> *A certification that the owner or operator meets the financial assurance requirements of Subpart I;*

A certification meeting the requirement of Section 845.230(d)(2)(N) stating that the Owner meets the financial assurance requirements of *Subpart I* is provided in Attachment N.

3. PERMIT APPLICATION

All permit applications must be made on the forms prescribed by the Agency and must be mailed or delivered to the address designated by the Agency on the forms. The permit applications (CCR-1 and CCR-2OE) are provided below.

Form CCR 1	Illinois Environmental Protection Agency CCR Surface Impoundment Permit Application Form CCR 1 – General Provisions

Bureau of Water ID Number: W1578510001-01,02,03 **CCR Permit Number:** Initial Permit **Facility Name:** Baldwin Power Plant	For IEPA Use Only

SECTION 1: FACILITY, OPERATOR, AND OWNER INFORMATION (35 Ill. Adm. Code 845.210(b))

Facility, Operator, and Owner Information

1.1	Facility Name		
	Baldwin Power Plant		
1.2	Illinois EPA CCR Permit Number (if applicable)		
	Initial Permit		
1.3	Facility Contact Information		
	Name (first and last) Phil Morris	Title Senior Director - Environmental	Phone Number 618-343-7794
	Email address phil.morris@vistracorp.com		
1.4	Facility Mailing Address		
	Street or P.O. box 1500 Eastport Plaza Dr		
	City or town Collinsville	State IL	Zip Code 62234
1.5	Facility Location		
	Street, route number, or other specific identifier 10901 Baldwin Road		
	County name Randolph	County code (if known)	
	City or town Baldwin	State Illinois	Zip Code 62217
1.6	Name of Owner/Operator		
	Dynegy Midwest Generation, LLC		

Facility, Operator, and Owner Info				
1.7	Owner/Operator Contact Information			
	Name (first and last) Phil Morris	Title Senior Director - Environmental	Phone Number 618-343-7794	
	Email address phil.morris@vistracorp.com			
1.8	Owner/Operator Mailing Address			
	Street or P.O. box 1500 Eastport Plaza Dr			
	City or town Collinsville	State IL	Zip Code 62234	

SECTION 2: LEGAL DESCRIPTION (35 Ill. Adm. Code 845.210(c))

Legal Description		
2.1	Legal Description of the facility boundary	
	See Attachment A.	

SECTION 3: PUBLICLY ACCESSIBLE INTERNET SITE REQUIREMENTS (35 Ill. Adm. Code 845.810)

Internet Site				
3.1	Web Address(es) to publicly accessible internet site(s) (CCR website)			
	www.luminant.com/illinois-ccr/			
3.2	Is/are the website(s) titled "Illinois CCR Rule Compliance Data and Information"			
	☑	Yes	☐	No

SECTION 4: IMPOUNDMENT IDENTIFICATION

Impoundment Identification			
4.1	List all the impoundment identification numbers for your facility and check the corresponding box to indicate that you have attached a written description for each impoundment.		
	W1578510001-01 (see Attachment A)	☑	Attached written description
	W1578510001-02 (see Attachment A)	☑	Attached written description
	W1578510001-03 (see Attachment A)	☑	Attached written description
		☐	Attached written description
		☐	Attached written description
		☐	Attached written description

			☐	Attached written description
			☐	Attached written description
			☐	Attached written description
			☐	Attached written description

SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

Checklist and Certification Statement

5.1 In Column 1 below, mark the sections of Form 1 that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing.

Column 1		Column 2	
Section 1: Facility, Operator, and Owner Information	☑	w/attachments	☐
Section 2: Legal Description	☑	w/attachments	☑
Section 3: Publicly Accessible Internet Site Requirement	☑	w/attachments	☐
Section 4: Impoundment Identification	☑	w/attachments	☑

5.2 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name (print or type first and last name) of Owner/Operator	Official Title
Cynthia Vodopivec	SVP - Environmental
Signature: Cynthia E. Vodopivec (signed)	Date Signed: 10/25/2021

Form CCR 2OE	Illinois Environmental Protection Agency CCR Surface Impoundment Permit Application Form CCR 2OE – Initial Operating Permit for Existing or Inactive CCR Surface Impoundment Where an Agency-approved Closure Has Been Completed Before July 30, 2021

Bureau of Water ID Number: W1578510001-01,02,03 **CCR Permit Number:** Initial Permit Initial Permit **Facility Name:** Baldwin Power Plant Initial Permit	For IEPA Use Only

SECTION 1: CONSTRUCTION HISTORY (35 Ill. Adm. Code 845.220 and 35 Ill. Adm. Code 845.230)

Construction History

1.1	CCR surface impoundment name.	
	Fly Ash Pond System	
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).	
	W1578510001 - 01, 02 03	
1.3	Describe the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210 (c)).	
	See Attachment A	
1.4	State the purpose for which the CCR surface impoundment is being used.	
	See Attachment B	
1.5	How long has the CCR surface impoundment been in operation?	
	See Attachment B	
1.6	List the types of CCR that have been placed in the CCR surface impoundment.	
	See Attachment B	
1.7	List the name of the watershed within which the CCR surface impoundment is located.	
	See Attachment B	
1.8	What is the size in acres of the watershed within which the CCR surface impoundment is located?	
	See Attachment B	
1.9	Check the corresponding boxes to indicate that you have attached the following:	
	✔	A description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.

Construction History		☑	A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment.
		☑	A statement of the method of site preparation and construction of each zone of the CCR surface impoundment.
		☑	A statement of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.
		☑	Drawings satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).
		☑	A description of the type, purpose, and location of existing instrumentation.
		☑	Area Capacity Curves for the CCR Impoundment.
		☑	A description of each spillway and diversion design features and capacities and provide the calculations used in their determination.
		☑	The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.
	1.10.1	Is there any record or knowledge of structural instability of the CCR surface impoundment?	
		☑ Yes	☐ No
	1.10.2	If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability.	
		See Attachment B - History of Construction	

SECTION 2: ATTACHMENTS

Attachments	2.1	Check the corresponding boxes to indicate that you have attached the following:	
		☑	Evidence that the permanent markers required by 35 Ill. Adm. Code 845.130 have been installed.
		☑	Documentation demonstrating that the CCR surface impoundment, if not incised, will be operated and maintained with one of the forms of slope protection specified in 35 Ill. Adm. Code 845.430.
		☐	Emergency Action Plan and accompanying certification required by 35 Ill. Adm. Code 845.520(e).
		☑	Written post-closure care plan, if applicable (see 35 Ill. Adm. Code 845.780(d)).
		☑	History of known exceedances of the groundwater protection standards in 35 Ill. Adm. Code 845.600, and any corrective action taken to remediate the groundwater.

SECTION 3: GROUNDWATER MONITORING

	3.1	Check the corresponding boxes to indicate whether you have attached the following groundwater monitoring information:	
		☑	A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620.

Groundwater		✔	Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630.
		✔	A groundwater sampling and analysis program that includes section of the statistical procedures to be used for evaluating groundwater monitoring data, required by 35 Ill. Adm. Code 845.640.
		✔	Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background and downgradient well, required by 35 Ill. Adm. Code 845.650(b).

ATTACHMENT A

LEGAL DESCRIPTION

October 2021

DYNEGY MIDWEST GENERATION, LLC.
BALDWIN ENERGY COMPLEX

Luminant

RESTRICTED USE AREA BOUNDARY CORNERS SET				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1000	558099.27	2386252.87	0.00	NOT SET
1001	557997.15	2386239.41	438.03	SET I.P.
1002	554411.84	2385766.91	435.95	SET I.P.
1003	553565.22	2384563.53	0.00	NOT SET
1004	554393.69	2380743.66	421.28	SET I.P.
1005	554452.32	2380756.38	421.88	SET I.P.
1006	554609.17	2380033.19	425.35	SET I.P.
1007	554692.24	2380051.21	428.47	SET I.P.
1008	554741.38	2380256.97	429.37	SET I.P.
1009	555276.51	2380560.02	420.34	SET I.P.
1010	555395.00	2380545.00	410.63	SET I.P.
1011	556148.45	2382673.53	432.53	SET I.P.
1012	555439.18	2384460.16	456.33	SET I.P.
1013	555587.51	2384814.85	457.91	SET SPIKE NAIL
1014	557500.00	2385625.00	461.05	SET I.P.
1015	557850.04	2385679.81	461.18	SET I.P.
1016	558066.67	2386043.45	439.87	SET I.P.

SURVEY PERFORMED ON APRIL 9, 2021

N
0' 400' 800'

LEGEND

SECTION LINE
RESTRICTED USE BOUNDARY
● FOUND SURVEY MARKER AS NOTED
○ SET 5/8" IRON REBAR (UNLESS OTHERWISE NOTED)

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH APRIL 9, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.

CONTROL CORNERS AND WELLS				
Point #	Northing	Easting	Elevation	Description
558	558186.76	2379153.13	427.99	FOUND I.P.
2001	558088.80	2387102.75	441.46	FOUND PK NAIL
2002	555415.58	2387061.32	454.17	FOUND I.P.
2005	555533.52	2379125.44	422.82	FOUND I.P.
2008	560842.70	2379172.83	424.09	FOUND I.P.
3209	560750.15	2387149.86	435.66	FOUND PIPE
5001	558867.47	2388512.38	451.01	MW-306
5002	554194.24	2386609.22	453.04	MW-304
5003	556586.30	2385208.50	457.28	MW-383
5004	555445.72	2384518.91	456.78	MW-384
5005	555865.41	2381901.76	425.92	MW-390
5006	555581.74	2381170.93	422.65	MW-366
5007	555101.10	2380477.23	424.10	MW-391
5008	554435.21	2380838.65	420.35	MW-375
5009	554198.54	2381923.80	418.58	MW-377

Land Description of the Baldwin Energy Complex
Closed Fly Ash Pond Restricted Use Area
263.05 Acres

Part of the Southeast Quarter of Section 9, Part of the South Half of Section 10, Part of the North Half of Section 15 and Part of the Northeast Quarter of Section 16 in Township 4 South, Range 7 West of the Third Principal Meridian, Randolph County, Illinois and being more particularly described as follows:

Commencing at the Iron Pin at the Center of Section 9 from which bears an Iron pin at the North Quarter corner of Section 9, North 0 degrees 25 minutes 30 seconds East a distance of 2656.02 feet and from which also bears an Iron Pin at the South Quarter corner of section 9, South 0 degrees 35 minutes 53 seconds West a distance of 2653.39 feet; thence from said commencement point at the center of Section 9 along a line bearing South 89 degrees 17 minutes 38 seconds East a distance of 7950.22 feet to the PK nail at the East Quarter corner of Section 10 from which bears an Iron Pipe at the Northeast corner of Section 10, North 1 degrees 00 minutes 51 seconds East a distance of 2661.77 feet and from which also bears a pinched Pipe at the Southeast corner of Section 10, South 0 degrees 53 minutes 16 seconds West a distance of 2673.54 feet; thence from said PK nail at the East Quarter corner of Section 10, North 89 degrees 17 minutes 38 seconds West a distance of 849.95 feet; thence South 7 degrees 30 minutes 27 seconds West a distance of 103.00 feet to the Point of Beginning of the Tract described herein; thence South 7 degrees 30 minutes 27 seconds West a distance of 3616.31 feet; thence along a curve to the right having a radius of 1000.00 feet, a curve length of 1653.34 feet and having a chord bearing South 54 degrees 52 minutes 20 seconds West a chord distance of 1471.36 feet; thence North 77 degrees 45 minutes 47 seconds West a distance of 3908.68 feet; thence North 12 degrees 14 minutes 13 seconds East a distance of 60.00 feet; thence North 77 degrees 45 minutes 47 seconds West a distance of 740.00 feet; thence North 12 degrees 14 minutes 13 seconds East a distance of 85.00 feet; thence North 76 degrees 34 minutes 11 seconds East a distance of 211.55 feet; thence North 29 degrees 31 minutes 23 seconds East a distance of 614.98 feet; thence North 7 degrees 13 minutes 22 seconds West a distance of 119.44 feet; thence North 70 degrees 30 minutes 26 seconds East a distance of 2257.95 feet; thence South 68 degrees 20 minutes 52 seconds East a distance of 1922.27 feet; thence along a curve to the left having a radius of 275.00 feet, a curve length of 425.70 feet and having a chord bearing North 67 degrees 18 minutes 19 seconds East a chord distance of 384.45 feet; thence North 22 degrees 57 minutes 29 seconds East a distance of 2077.01 feet; thence North 8 degrees 53 minutes 57 seconds East a distance of 354.31 feet; thence along a curve to the right having a radius of 275.00 feet, a curve length of 483.01 feet and having a chord bearing North 59 degrees 13 minutes 00 seconds East a chord distance of 423.28 feet; thence South 70 degrees 27 minutes 58 seconds East a distance of 207.93 feet to the Point of Beginning and containing 263.05 Acres.

SURVEYOR CERTIFICATE:
THIS IS TO CERTIFY THAT WE, INGENAE, LLC, HAVE AT THE REQUEST OF AND FOR THE EXCLUSIVE USE OF VISTRA CORP., PERFORMED A SURVEY OF THE TRACT AS SHOWN HEREON AND THAT THIS IS A TRUE REPRESENTATION OF THAT SURVEY. THIS PLAT AND THE SURVEY FROM WHICH IT IS BASED WERE DONE IN ACCORDANCE WITH THE "MINIMUM STANDARDS OF PRACTICE" FOR LAND SURVEYING IN THE STATE OF ILLINOIS.

INGENAE, LLC
PROFESSIONAL DESIGN FIRM
LICENSE NO. 184.007588-0010

STATE OF ILLINOIS MICHAEL J. GRAMINSKI 35-2901 REGISTERED LAND SURVEYOR

May 4th 2021

MICHAEL J. GRAMINSKI, I.P.L.S. NO. 035.002901 ***DATE***
EXPIRES: 11/30/2022

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:	Date:
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

Project Name & Location:

BALDWIN
ENERGY COMPLEX
10901 BALDWIN RD.
BALDWIN, IL 62217

Drawing Name:
CLOSED FLY ASH POND RESTRICTED USE BOUNDARY EXHIBIT

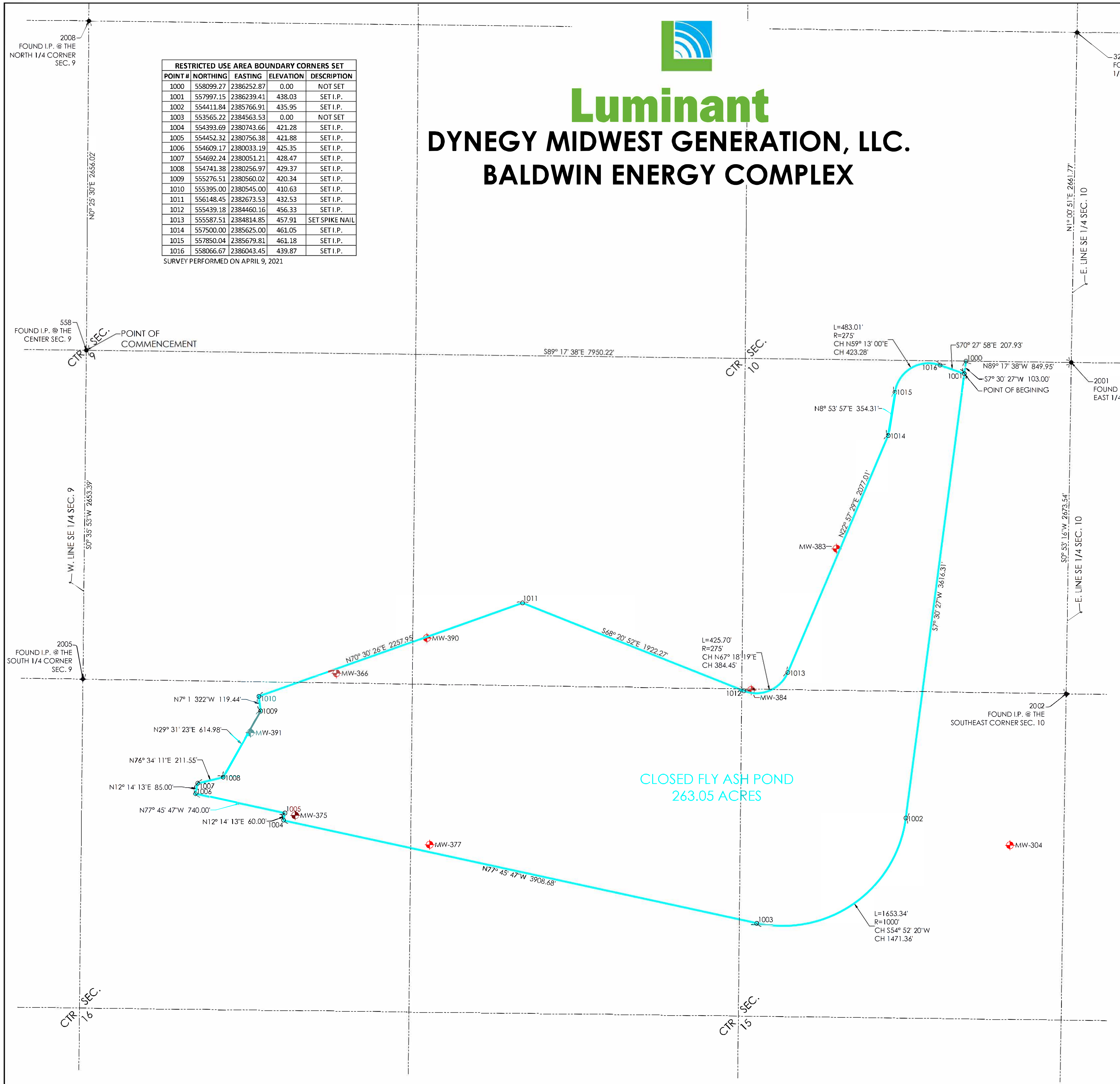
Date: 5/4/2021
Project No.:
Type: SITE
Drawing No.: 1
Drawn By: CB
Approved By: MG
Scale: AS NOTED

Luminant

DYNEGY MIDWEST GENERATION, LLC.
BALDWIN ENERGY COMPLEX

RESTRICTED USE AREA BOUNDARY CORNERS SET				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1000	558099.27	2386252.87	0.00	NOT SET
1001	557997.15	2386239.41	438.03	SET I.P.
1002	554411.84	2385766.91	435.95	SET I.P.
1003	553565.22	2384563.53	0.00	NOT SET
1004	554393.69	2380743.66	421.28	SET I.P.
1005	554452.32	2380756.38	421.88	SET I.P.
1006	554609.17	2380033.19	425.35	SET I.P.
1007	554692.24	2380051.21	428.47	SET I.P.
1008	554741.38	2380256.97	429.37	SET I.P.
1009	555276.51	2380560.02	420.34	SET I.P.
1010	555395.00	2380545.00	410.63	SET I.P.
1011	556148.45	2382673.53	432.53	SET I.P.
1012	555439.18	2384460.16	456.33	SET I.P.
1013	555587.51	2384814.85	457.91	SET SPIKE NAIL
1014	557500.00	2385625.00	461.05	SET I.P.
1015	557850.04	2385679.81	461.18	SET I.P.
1016	558066.67	2386043.45	439.87	SET I.P.

SURVEY PERFORMED ON APRIL 9, 2021



LEGEND
- SECTION LINE
- RESTRICTED USE BOUNDARY
- ● FOUND SURVEY MARKER AS NOTED
- ○ SET 5/8" IRON REBAR (UNLESS OTHERWISE NOTED)

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH APRIL 9, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.

CONTROL CORNERS AND WELLS				
Point #	Northing	Easting	Elevation	Description
558	558186.76	2379153.13	427.99	FOUND I.P.
2001	558088.80	2387102.75	441.46	FOUND PK NAIL
2002	555415.58	2387061.32	454.17	FOUND I.P.
2005	555533.52	2379125.44	422.82	FOUND I.P.
2008	560842.70	2379172.83	424.09	FOUND I.P.
3209	560750.15	2387149.86	435.66	FOUND PIPE
5001	558867.47	2388512.38	451.01	MW-306
5002	554194.24	2386609.22	453.04	MW-304
5003	556586.30	2385208.50	457.28	MW-383
5004	555445.72	2384518.91	456.78	MW-384
5005	555865.41	2381901.76	425.92	MW-390
5006	555581.74	2381170.93	422.65	MW-366
5007	555101.10	2380477.23	424.10	MW-391
5008	554435.21	2380838.65	420.35	MW-375
5009	554198.54	2381923.80	418.58	MW-377

Land Description of the Baldwin Energy Complex
Closed Fly Ash Pond Restricted Use Area
263.05 Acres

Part of the Southeast Quarter of Section 9, Part of the South Half of Section 10, Part of the North Half of Section 15 and Part of the Northeast Quarter of Section 16 in Township 4 South, Range 7 West of the Third Principal Meridian, Randolph County, Illinois and being more particularly described as follows:

Commencing at the Iron Pin at the Center of Section 9 from which bears an Iron pin at the North Quarter corner of Section 9, North 0 degrees 25 minutes 30 seconds East a distance of 2656.02 feet and from which also bears an Iron Pin at the South Quarter corner of section 9, South 0 degrees 35 minutes 53 seconds West a distance of 2653.39 feet; thence from said commencement point at the center of Section 9 along a line bearing South 89 degrees 17 minutes 38 seconds East a distance of 7950.22 feet to the PK nail at the East Quarter corner of Section 10 from which bears an Iron Pipe at the Northeast corner of Section 10, North 1 degrees 00 minutes 51 seconds East a distance of 2661.77 feet and from which also bears a pinched Pipe at the Southeast corner of Section 10, South 0 degrees 53 minutes 16 seconds West a distance of 2673.54 feet; thence from said PK nail at the East Quarter corner of Section 10, North 89 degrees 17 minutes 38 seconds West a distance of 849.95 feet; thence South 7 degrees 30 minutes 27 seconds West a distance of 103.00 feet to the Point of Beginning of the Tract described herein; thence South 7 degrees 30 minutes 27 seconds West a distance of 3616.31 feet; thence along a curve to the right having a radius of 1000.00 feet, a curve length of 1653.34 feet and having a chord bearing South 54 degrees 52 minutes 20 seconds West a chord distance of 1471.36 feet; thence North 77 degrees 45 minutes 47 seconds West a distance of 3908.68 feet; thence North 12 degrees 14 minutes 13 seconds East a distance of 60.00 feet; thence North 77 degrees 45 minutes 47 seconds West a distance of 740.00 feet; thence North 12 degrees 14 minutes 13 seconds East a distance of 85.00 feet; thence North 76 degrees 34 minutes 11 seconds East a distance of 211.55 feet; thence North 29 degrees 31 minutes 23 seconds East a distance of 614.98 feet; thence North 7 degrees 13 minutes 22 seconds West a distance of 119.44 feet; thence North 70 degrees 30 minutes 26 seconds East a distance of 2257.95 feet; thence South 68 degrees 20 minutes 52 seconds East a distance of 1922.27 feet; thence along a curve to the left having a radius of 275.00 feet, a curve length of 425.70 feet and having a chord bearing North 67 degrees 18 minutes 19 seconds East a chord distance of 384.45 feet; thence North 22 degrees 57 minutes 29 seconds East a distance of 2077.01 feet; thence North 8 degrees 53 minutes 57 seconds East a distance of 354.31 feet; thence along a curve to the right having a radius of 275.00 feet, a curve length of 483.01 feet and having a chord bearing North 59 degrees 13 minutes 00 seconds East a chord distance of 423.28 feet; thence South 70 degrees 27 minutes 58 seconds East a distance of 207.93 feet to the Point of Beginning and containing 263.05 Acres.

SURVEYOR CERTIFICATE:
THIS IS TO CERTIFY THAT WE, INGENAE, LLC, HAVE AT THE REQUEST OF AND FOR THE EXCLUSIVE USE OF VISTRA CORP., PERFORMED A SURVEY OF THE TRACT AS SHOWN HEREON AND THAT THIS IS A TRUE REPRESENTATION OF THAT SURVEY. THIS PLAT AND THE SURVEY FROM WHICH IT IS BASED WERE DONE IN ACCORDANCE WITH THE "MINIMUM STANDARDS OF PRACTICE" FOR LAND SURVEYING IN THE STATE OF ILLINOIS.

INGENAE, LLC
PROFESSIONAL DESIGN FIRM
LICENSE NO. 184.007588-0010

STATE OF ILLINOIS — MICHAEL J. GRAMINSKI 35-2901 — REGISTERED LAND SURVEYOR

May 4th 2021

MICHAEL J. GRAMINSKI, I.P.L.S. NO. 035.002901 ***DATE***
EXPIRES: 11/30/2022

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:	Date:
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

Project Name & Location:

BALDWIN
ENERGY COMPLEX
10901 BALDWIN RD.
BALDWIN, IL 62217

DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:
CLOSED FLY ASH POND RESTRICTED USE BOUNDARY EXHIBIT

Date: 5/4/2021	Project No.
Type: SITE	Drawing No. 1
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

ATTACHMENT B

AECOM

October 2016

Dynegy Midwest Generation, LLC
10901 Baldwin Road
Baldwin, IL 62217

RE: History of Construction
USEPA Final CCR Rule, 40 CFR § 257.73(c)
Baldwin Energy Complex
Baldwin, Illinois

On behalf of Dynegy Midwest Generation, LLC, AECOM has prepared the following history of construction for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond at the Baldwin Energy Complex in accordance with 40 CFR § 257.73(c).

BACKGROUND

40 CFR § 257.73(c)(1) requires the owner or operator of an existing coal combustion residual (CCR) surface impoundment that either (1) has a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) has a height of 20 feet or more to compile a history of construction by October 17, 2016 that contains, to the extent feasible, the information specified in 40 CFR § 257.73(c)(1)(i)–(xii).

The history of construction presented herein was compiled based on existing documentation, to the extent that it is reasonably and readily available (see 80 Fed. Reg. 21302, 21380 [April 17, 2015]) and AECOM site experience. AECOM's document review included construction drawings, geotechnical investigations, observation reports, instrument monitoring reports, construction specifications, operation and maintenance information, etc. for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond at the Baldwin Energy Complex.

HISTORY OF CONSTRUCTION

§ 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:	Dynegy Midwest Generation, LLC
Address:	1500 Eastport Plaza Drive Collinsville, IL 62234
CCR Units:	Old East Fly Ash Pond East Fly Ash Pond West Fly Ash Pond Bottom Ash Pond

The above named CCR units do not have a state assigned identification number.

§ 257.73(c)(1)(ii): The location of the CCR unit identified on the most recent USGS $7^1/_2$ or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.

The locations of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond have been identified on an USGS 7-1/2 minute topographic quadrangle map in **Appendix A**.

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

The following captures the purpose of each CCR unit:

- The Old East Fly Ash Pond (inactive) was used to store and dispose of fly ash.
- The East Fly Ash Pond (inactive) was used to store and dispose of fly ash.
- The West Fly Ash Pond is being used to store and dispose of dry-stacked fly ash and to clarify CCR contact stormwater prior to discharge in accordance with the station’s NPDES permit.
- The Bottom Ash Pond is being used to store and dispose of sluiced bottom ash, with bottom ash mined for beneficial use, to temporarily store spray dry absorption (SDA) waste, and to clarify plant process water, including other non-CCR station process wastewaters, prior to discharge in accordance with the station’s NPDES permit.

Notice of intent to close the Old East Fly Ash Pond and East Fly Ash Pond was provided in November, 2015. Notice of intent to close the West Fly Ash Pond was provided in October, 2016.[1]

[1] This history of construction report was prepared on a facility-wide basis for CCR surface impoundments at the Baldwin Energy Complex. The inclusion of the Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond in this history of construction report does not concede and should not be construed to concede that the Old

§ 257.73(c)(1)(iv): The name and size in acres of the watershed where the CCR unit is located.

The Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are located at the northern edge of the Baldwin Lake-Kaskaskia River Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071402040908 and a drainage area of 17,034 acres. The Baldwin Lake-Kaskaskia River Watershed is located within the Kaskaskia River Watershed (HUC: 0714020409) (USGS, 2016).

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

Physical properties of the foundation materials for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are described from top to bottom in this paragraph. The area encompassing the ash ponds is immediately to the east of the alluvial plain of the Kaskaskia River. The uppermost material is a 5 to 10-foot-thick layer of loess described as low to medium plastic silty clay. The loess is underlain by a 5 to 20-foot thick zone of glacio-lacustrine and glacial till soils. The upper portion of the zone is typically glacio-lacustrine, a stiff to very stiff, low to medium plastic clay with occasional sand and silt zones. This grades downward to glacial till which is a very stiff to hard, medium plastic clay with varying amounts of sand and gravel. Within the glacial till random pockets of sand and gravel were encountered. The glacial till is underlain by a layer of either moderate to highly weathered limestone or a very stiff to hard, high plastic residual clay (decomposed shale). Bedrock exists below the till or residual clay and consists primarily of weathered clay shale with interbedded limestone.

An alluvium layer of low-strength silt/clay mixture with trace sand and organics (creek deposit) was found at the southern end of the West Fly Ash Pond, which lies on a former creek channel. A layer of sand was found under the northern embankment of the West Fly Ash Pond and East Fly Ash Pond and in the northern portion of the Bottom Ash Pond. An available summary of the engineering properties of the foundation materials is presented in **Table 1** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 1. Summary of Foundation and Abutment Material Engineering Properties

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Alluvium	115	100	28	1,500	0
Loess	120	100	28	1,500	0
Glacio-lacustrine/Till	120	1,000	20	2,000	0
Residual Clay	120	100	28	2,000	0
Shale	125	1,000	28	4000	0

East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond are subject to the Design Criteria or all Operating Criteria in the CCR Rule.

The abutment materials for the Bottom Ash Pond consist of recompacted loess. Physical properties of the loess are described as low to medium plastic silty clay. The Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond are enclosed impoundments with dikes and do not have abutments. An available summary of the engineering properties of the abutment materials is presented in **Table 1** above.

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

The physical properties of the materials used for initial embankment construction and embankment raise construction (where applicable) of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond generally consist of low to medium plastic clay and silty clay with zones of high plastic clay (typically recompacted loess). An available summary of the engineering properties of the construction materials is presented in **Table 2** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 2. Summary of Construction Material Engineering Properties

Material Description	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
1969 Dike Construction	115	100	28	1,500	0
1989 Dike Construction	115	100	28	2,000	0

Site preparation and construction of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond were completed in accordance with the applicable construction specification (see §257.73(c)(1)(xi) below for corresponding construction specifications).

The approximate dates of construction of each successive stage of construction of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are provided in **Table 3** below.

Table 3. Approximate dates of construction of each successive stage of construction.

Date	Event
1969	Construction of Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond external perimeter embankment
1979	Construction of East Fly Ash Pond and West Fly Ash Pond northern embankment
1989	Inboard perimeter raise of the entire East Fly Ash Pond and West Fly Ash Pond
1995	Construction of interior dike between the East Fly Ash Pond and West Fly Ash Pond
1999	Raise of interior dike between the East Fly Ash Pond and West Fly Ash Pond; replacement of outlet pipe from the West Fly Ash Pond to the Secondary Pond
2012	Modification of Bottom Ash Pond embankment (original construction date unknown)

§ 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.

Drawings that contain items pertaining to the requested information for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are listed in **Table 4** below. Items marked as "Not Available" are items not found during a review of the reasonably and readily available record documentation.

Table 4. List of drawings containing items pertaining to the information requested in § 257.73(c)(1)(vii).

	Old East Fly Ash Pond	East Fly Ash Pond	West Fly Ash Pond	Bottom Ash Pond
Dimensional plan view (all zones)	E-BAL1-B39	E-BAL1-B38, E-BAL1-C119	E-BAL1-B38, E-BAL1-C119	BAL1-C1033
Dimensional cross sections	E-BAL1-B39	E-BAL1-B38, CE-BAL1-B1488	E-BAL1-B38, CE-BAL1-B1488	BAL1-C1035
Foundation Improvements	E-BAL1-B39	E-BAL1-B38	E-BAL1-B38	BAL1-C1035
Drainage Provisions	Not Applicable	Not Applicable	E-BAL1-M1077-1	BAL1-C1033
Spillways and Outlets	Not Applicable	E-BAL1-C120, E-BAL1-C122	E-BAL1-C127	BAL1-C1033, BAL1-C1035, BAL1-C1038
Diversion Ditches	E-BAL1-B39	E-BAL1-B38	E-BAL1-B38	BAL1-C1033, BAL1-C1037
Instrument Locations	Figure 2	Figure 2	Figure 2	Figure 2
Slope Protection	E-BAL1-B39	E-BAL1-B38	E-BAL1-B38	BAL1-C1034, BAL1-C1036
Normal Operating Pool Elevation	Not Available	Not Available	Not Available	BAL1-C1035
Maximum Pool Elevation	Not Available	Not Available	Not Available	BAL1-C1035
Approximate Maximum Depth of CCR in 2016	23 feet	44 feet	21 feet	43 feet

All drawings referenced in **Table 4** above can be found in **Appendix B** and **Appendix C**.

Based on the review of the drawings listed above, no natural or manmade features that could adversely affect operation of these CCR units due to malfunction or mis-operation were identified.

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

Existing instrumentation consists of slope inclinometers and vibrating-wire piezometers installed within the southern embankment of the West Fly Ash Pond near the location of the 1995 slope movement (see § 257.73(c)(1)(xii) below). Additional vibrating-wire piezometers were later installed in 2015 throughout the Old East Fly Ash Pond, East Fly Ash Pond, and

Bottom Ash Pond. The purpose of the slope inclinometers is to measure subsurface movements and deformations. The purpose of the piezometers is to measure the pore water pressures within the embankment. There are two (2) existing slope inclinometers and eighteen (18) existing piezometers within the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond. A location map of the existing instrumentation is presented in **Appendix C**.

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

The area-capacity curves for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are presented in **Figures 1** to **3** below. "Area-capacity curves", as defined by 40 CFR § 257.53, "means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations."

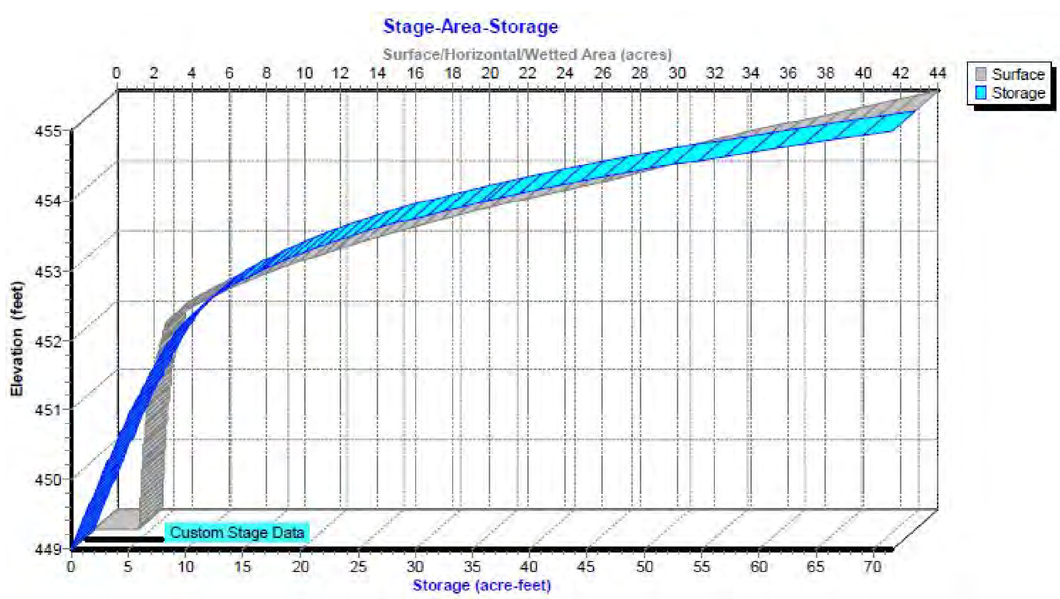


Figure 1. Area-capacity curve for the Old East Fly Ash Pond and East Fly Ash Pond

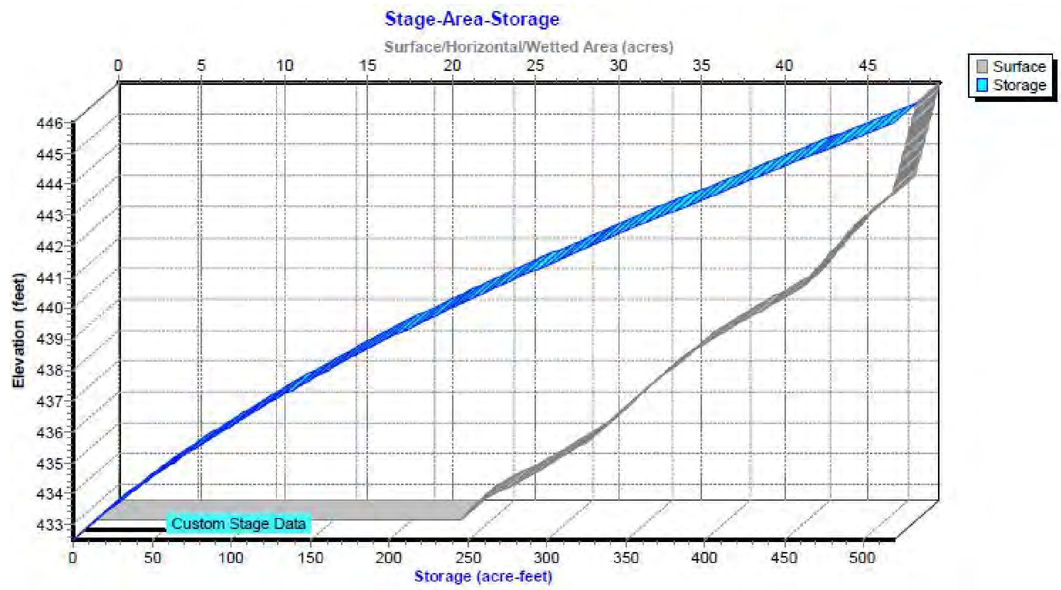


Figure 2. Area-capacity curve for West Fly Ash Pond

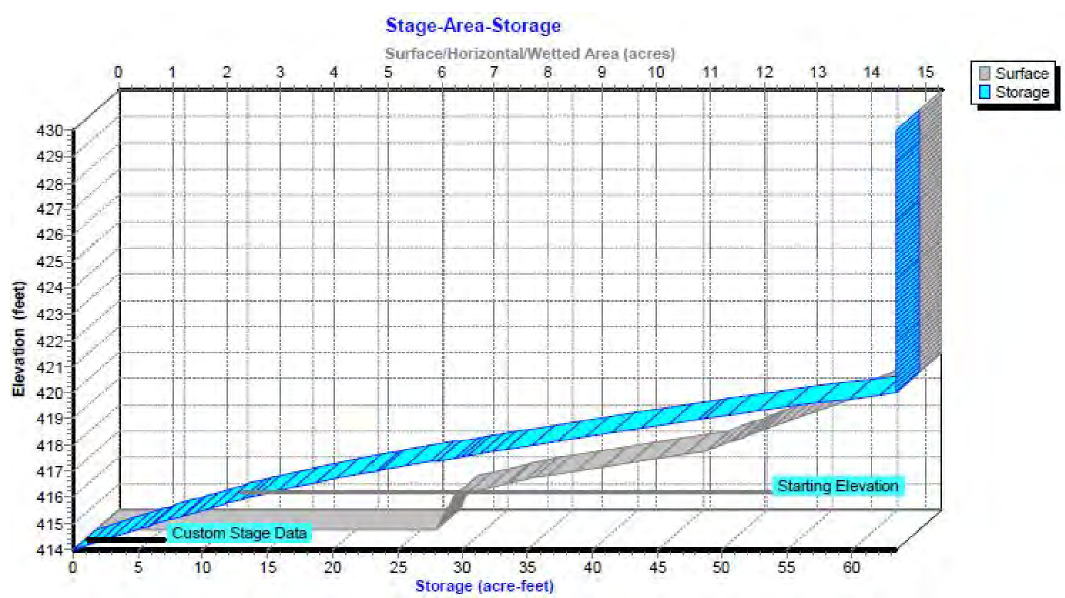


Figure 3. Area-capacity curve for Bottom Ash Pond

The area-capacity curves shown were taken from the pond modeling analysis. Actual pond capacity is limited to the approximate berm elevation listed in **Table 3** below. Any information above berm elevation should be disregarded.

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

Stormwater flow from the Old East Fly Ash Pond and East Fly Ash Pond is controlled by a series of five (5) 12-inch diameter (dia.) ductile iron pipe (DIP) risers and is diverted into the

West Fly Ash Pond. The separator dike in between the East Fly Ash Pond and the West Fly Ash Pond also contains an overflow emergency spillway armored with rip rap with an approximate invert at El. 453 feet. Unless otherwise mentioned, all elevations listed in the report are in the NAVD88 datum.

The West Fly Ash Pond contains a 36-inch dia. DIP culvert that discharges into the Secondary Pond. However, the inlet elevation of 432.5 feet is above the normal pool elevation of 424.3 feet; therefore, the pipe acts as an overflow spillway during heavy rain events. During normal operations, water from the West Fly Ash Pond is pumped through a 10-inch dia. high-density polyethylene (HDPE) pipe into the Bottom Ash Pond.

The Bottom Ash Pond contains a drop inlet spillway that discharges to the Secondary Pond via a 30-inch dia. HDPE pipe. The Bottom Ash Pond also contains a pumping station that discharges into the Cooling Pond via two 18-inch dia. HDPE pipes during heavy rain events. The pumping station consists of four pumps, two of which turn on at El. 417.4 feet and two which turn on at El. 417.6 feet. The pumps turn off again when the water level in the impoundment drops to El. 417.2 feet. In 2016 the discharge capacity of the Bottom Ash Pond was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The model results indicates that the Bottom Ash Pond emergency spillway will activate during the 1,000-year, 24-hour storm event. The results of the HydroCAD 10 analysis are presented below in **Table 5**.

Table 5. Results of HydroCAD 10 analysis

	Bottom Ash Pond
Approximate Minimum Berm Elevation[1] (ft)	419.0
Approximate Emergency Spillway Elevation[1] (ft)	417.7
Starting Pool Elevation[1] (ft)	415.8
Peak Elevation[1] (ft)	418.7
Time to Peak (hr)	16.8
Surface Area (ac)	13.7
Storage[2] (ac-ft)	32.7

Note: 1. Elevations are based on NAVD88 datum

2. Storage given is from Starting Pool Elevation to Peak Elevation.

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

The construction specification for the Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond are located in the document titled *Specification T-2226* (presented in **Appendix D**). As indicated on the construction drawings, the construction specification for the Bottom Ash Pond is located in the document titled *Specification H-3026*, but that document is not reasonably and readily available.

The provisions for surveillance, maintenance, and repair of the East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are available in *Baldwin Ash Pond; IDNR Dam Safety Operating and Maintenance Plan* (2013) (presented in **Appendix E**).

The operations and maintenance plans for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are currently being revised by Dynegy Midwest Generation, LLC. This section will be updated when the new operations and maintenance plans are available.

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

In February 1995, a slide occurred on the southern embankment of the West Fly Ash Pond. The slide was first observed as a 10-inch wide scarp which progressively grew larger. After discovering the slide, an investigation was performed by Woodward-Clyde Consultants, Inc. and the pond elevation was lowered. As a further preventive measure, approximately 600 linear feet of the southern embankment crest was removed to reduce the driving forces acting within the slide area. A separator dike was constructed in between the East Fly Ash Pond and West Fly Ash Pond to allow for normal operations of the East Fly Ash Pond and a lowered normal pool level in the West Fly Ash Pond. Following the remedial actions, slope inclinometer readings showed that subsurface movement was insignificant and it was concluded that the remedial actions were successful. The slope movement did not result in any known release of CCR material. The *Final Report of Geotechnical Investigation* by Woodward-Clyde Consultants, Inc. (1995) is presented in **Appendix F**.

A separate surficial slope movement occurred in 2011 on the northwest embankment of the West Fly Ash Pond. The soil movement was investigated by URS and was believed to be caused by recent heavy rains. The entire slide mass was removed and replacement material was compacted and graded to match the adjacent embankment slopes. Information about this event can be found in the 2011 letter by URS presented in **Appendix G**. A similar movement of surficial soil occurred in 2015 further east from the 2011 location and was repaired in the same fashion. Photos from the 2015 surficial movement are provided in **Appendix H**.

There is no record or knowledge of structural instability of the Old East Fly Ash Pond, East Fly Ash Pond, and Bottom Ash Pond at the Baldwin Energy Complex.

LIMITATIONS

The signature of AECOM's authorized representative on this document represents that to the best of AECOM's knowledge, information and belief in the exercise of its professional judgment, it is AECOM's professional opinion that the aforementioned information is accurate as of the date of such signature. Any recommendation, opinion or decisions by AECOM are made on the basis of AECOM's experience, qualifications and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data and that actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

Sincerely,

Claudia Prado
Project Manager

Victor Modeer, P.E., D.GE
Senior Project Manager

AECOM

REFERENCES

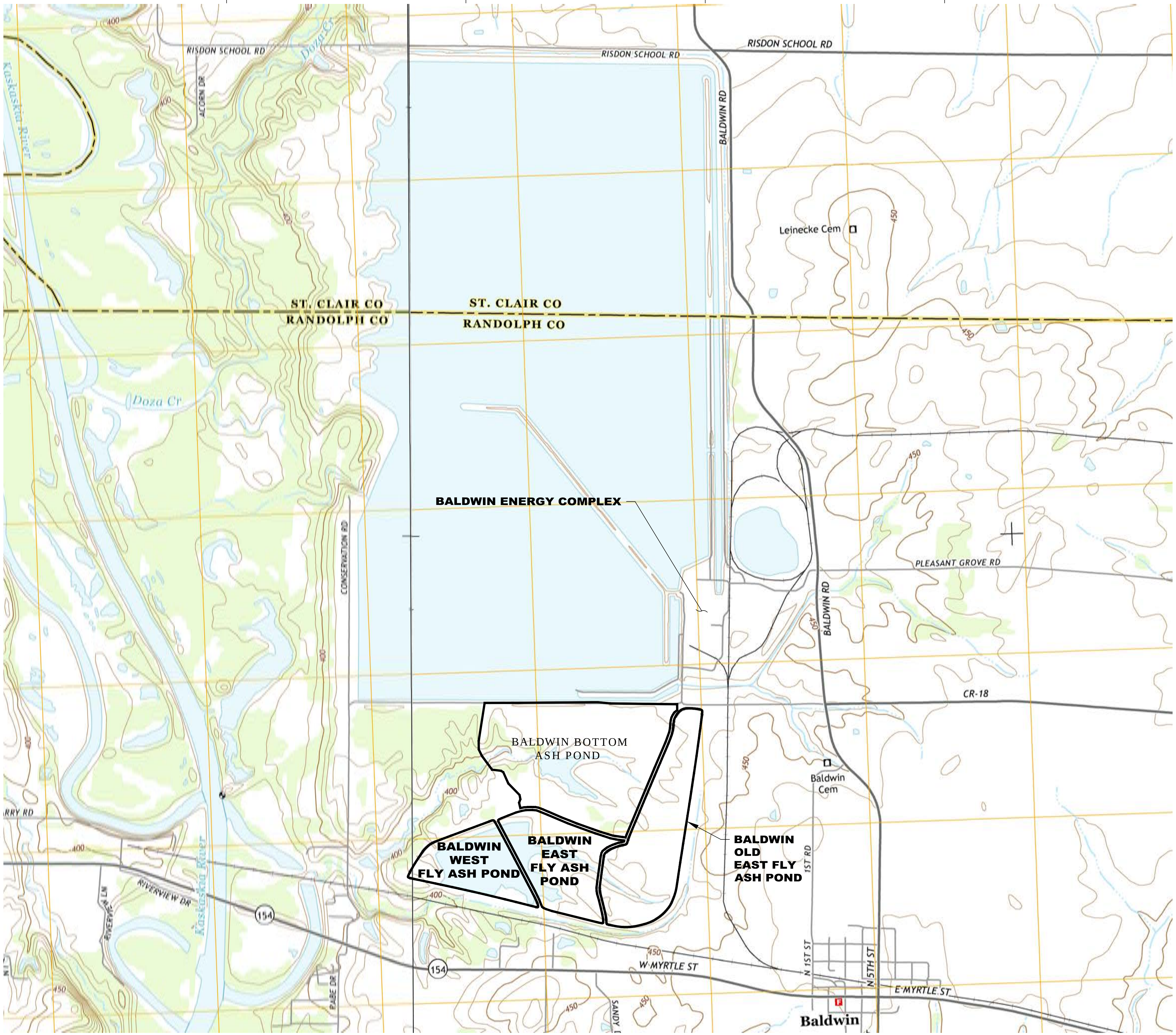
United States Environmental Protection Agency (USEPA). (2015). *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule.* 40 CFR Parts 257 and 261, 80 Fed. Reg. 21302, 21380 April 17, 2015.

United States Geological Survey (USGS). (2016). The National Map Viewer. http://viewer.nationalmap.gov/viewer/. USGS data first accessed in March of 2016.

APPENDICES

Appendix A: History of Construction Vicinity Map
Appendix B: Baldwin Energy Complex Drawings
Appendix C: Baldwin Energy Complex Piezometer and Inclinometer Locations
Appendix D: Specification T-2226
Appendix E: Baldwin Ash Pond; IDNR Dam Safety Operating and Maintenance Plan (2013)
Appendix F: Final Report of Geotechnical Investigation, Baldwin Power Station, Fly Ash Pond South Dike, Baldwin, Illinois, Woodward-Clyde Consultants, Inc. (1995)
Appendix G: Observation of Slope Movement at Fly Ash Pond, Baldwin Energy Complex, Baldwin, Illinois, URS (2011)
Appendix H: Photos from the 2015 surficial movement

Appendix A: History of Construction Vicinity Map



LEGEND

CCR UNITS

SOURCE□
MAP PROVIDED FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF RED BUD, ILLINOIS AND BALDWIN, ILLINOIS, REVISED 2015.

QUADRANGLE LOCATION

N

0 1000 2000 3000
SCALE IN FEET

AECOM
1001 H□h□□d□ P□□□ Dr□□, S□t□ 300
St. L□□□, M□, 63110
314 429 0100 (□h□□□)
314 429 0462 (□□□)

D□□□□□ M□d□□□t G□□□r□t□□□, LLC
10901 B□d□□□R□□d
B□d□□□, IL 62217

HISTORY OF CONSTRUCTION

BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

ISSUED FOR BIDDING DATE BY

ISSUED FOR CONSTRUCTION DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO□	60489731
DRAWN BY□	DJD
DESIGNED BY□	DJD
CHECKED BY□	MN
DATE CREATED□	2016 04 13
PLOT DATE□	
SCALE□	1" □1000□
ACAD VER□	2014

SHEET TITLE

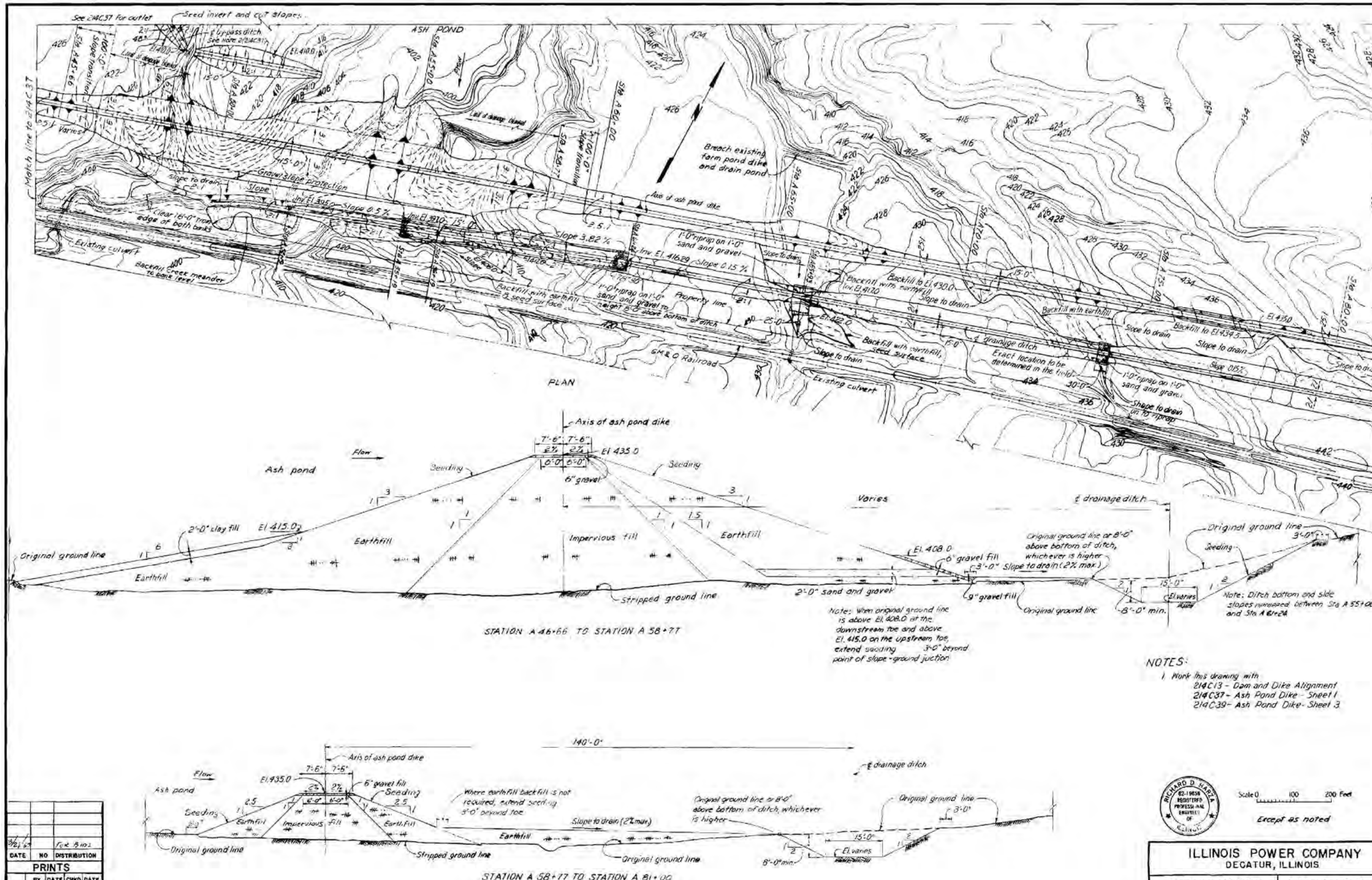
HISTORY OF CONSTRUCTION VICINITY MAP

01

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\1_Baldwin\References\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Baldwin)_without non-CCR Units.dwg NANAK, MATT, 8/22/2016 11:37 AM

Appendix B: Baldwin Energy Complex Drawings

1. “Ash Pond Dike Sheet 2”, Drawing No. E-BAL1-B38, Revision A, 18 November, 1969, Sargent & Lundy Engineers.
2. “Ash Pond Dike Sheet 3”, Drawing No. E-BAL1-B39, Revision A, 18 November, 1969, Sargent & Lundy Engineers.
3. “Primary Ash Pond Site Plan, Vertical Extension of Intermediate Embankment”, Drawing No. E-BAL1-C119, Revision 3, 27 January, 2000, Illinois Power Company.
4. “Plan and Profile, Vertical Extension of Intermediate Embankment”, Drawing No. E-BAL1-C120, Revision 1, 27 January, 2000, Illinois Power Company.
5. “Miscellaneous Details of Intermediate Embankment, Vertical Extension of Intermediate Embankment”, Drawing No. E-BAL1-C122, Revision 3, 27 January, 2000, Illinois Power Company.
6. “Bottom Ash Pond Dike Improvements, Grading and Drainage Plan”, Drawing No. C1033, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
7. “Bottom Ash Pond Dike Improvements, Surfacing Plan”, Drawing No. C1034, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
8. “Bottom Ash Pond Dike Improvements, Grading Sections”, Drawing No. C1035, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
9. “Bottom Ash Pond Dike Improvements, Grading and Surfacing Details”, Drawing No. C1036, Revision 0, 28, November, 2012, Sargent & Lundy, LLC.
10. “Bottom Ash Pond Dike Improvements, Storm and Erosion Control Details Sheet 1”, Drawing No. C1037, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
11. “Bottom Ash Pond Dike Improvements, Storm and Erosion Control Details Sheet 2”, Drawing No. C1038, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
12. “Final Outlet Pipe Replacement, Primary Ash Pond”, Drawing No. E-BAL1-C127, Revision 2, 27 January, 2000, Illinois Power Company.
13. “Partial Plot Plan, Pond Ash Piping”, Drawing No. E-BAL1-M1077-1, Revision 0, 28 June, 2000, Illinois Power Company.



ASH POND DIKE SECTIONS
1" = 10'-0"

NOTES:
1. Work this drawing with
214C13 - Dam and Dike Alignment
214C37 - Ash Pond Dike - Sheet 1
214C39 - Ash Pond Dike - Sheet 3

Scale 0 100 200 Feet
Except as noted

ILLINOIS POWER COMPANY
DECATUR, ILLINOIS

BALDWIN STATION | COOLING RESERVOIR

ASH POND DIKE
SHEET 2

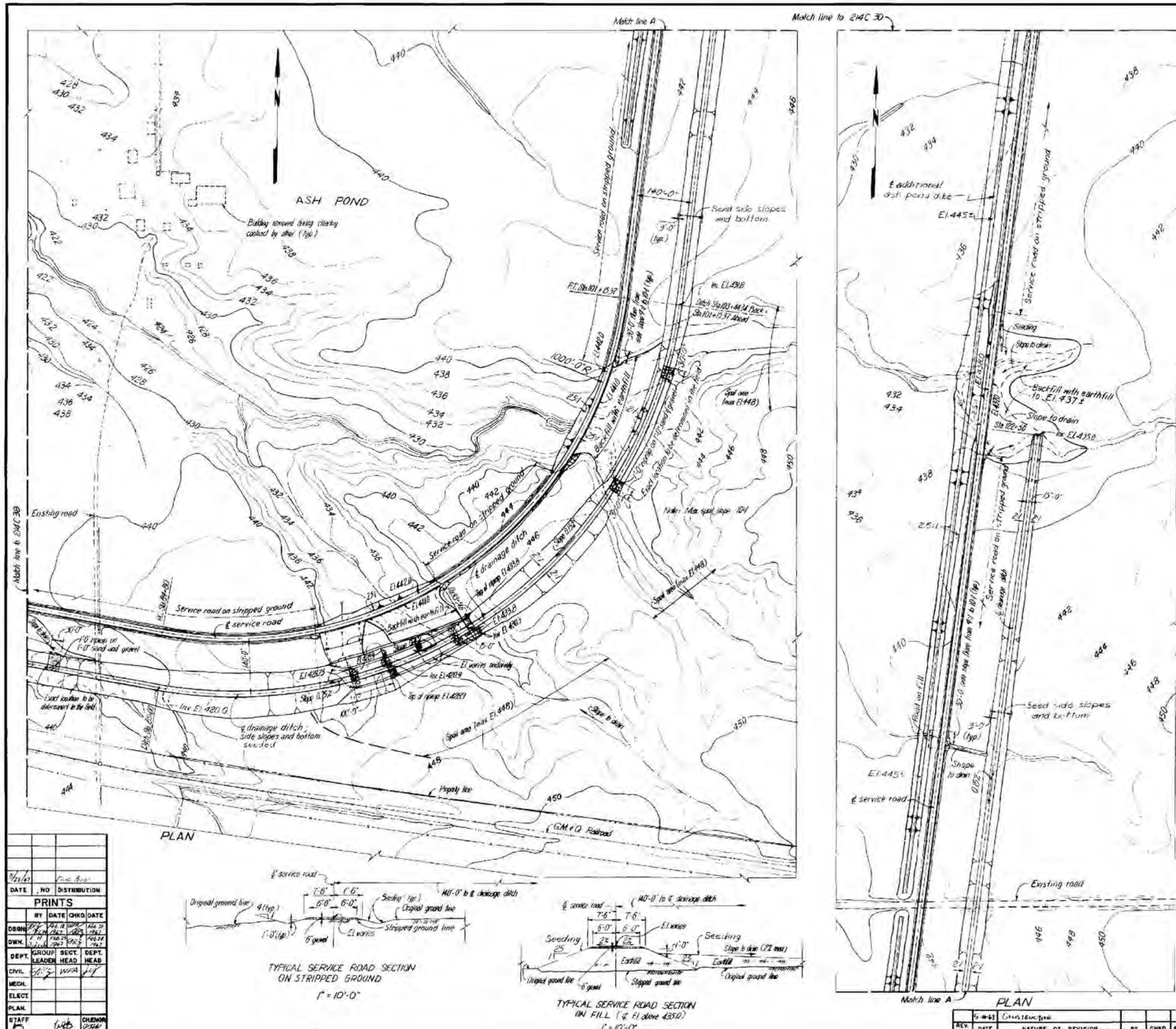
SARGENT & LUNDY ENGINEERS	HARZA ENGINEERING COMPANY			
CHICAGO, ILLINOIS	DATE MAR 16, 1967	DWG. NO.		

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
A		AS BUILT			
		CONSTRUCTION			

S&L B-38 HEC 214C38

PRINTS				
DATE	NO	DISTRIBUTION		
	BY	DATE	CHKD.	DATE
DSGN.				
DWN.				
DEPT.	GROUP LEADER	SECT. HEAD	DEPT. HEAD	
CIVIL				
MECH.				
ELECT.				
PLAN.				
STAFF				

38



NOTES:

1. Work this drawing with: 214C 13 Dam and Dike Alignment; 214C 30 Intake; 214C 38 Ash Pond Dike - Sheet 2

Scale 0 — 100 — 200 Feet. Except as noted

RICHARD D. HARZA 62-19656 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

ILLINOIS POWER COMPANY

DECATUR, ILLINOIS

BALDWIN STATION | COOLING RESERVOIR

ASH POND DIKE

SHEET 3

SARGENT & LUNDY ENGINEERS	HARZA ENGINEERING COMPANY APPROVED Richard D. Harza
CHICAGO, ILLINOIS	DATE MAR 16, 1967 / DWG. NO.
	S&L B-39 / HFC 214C39

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
A		AS BUILT			

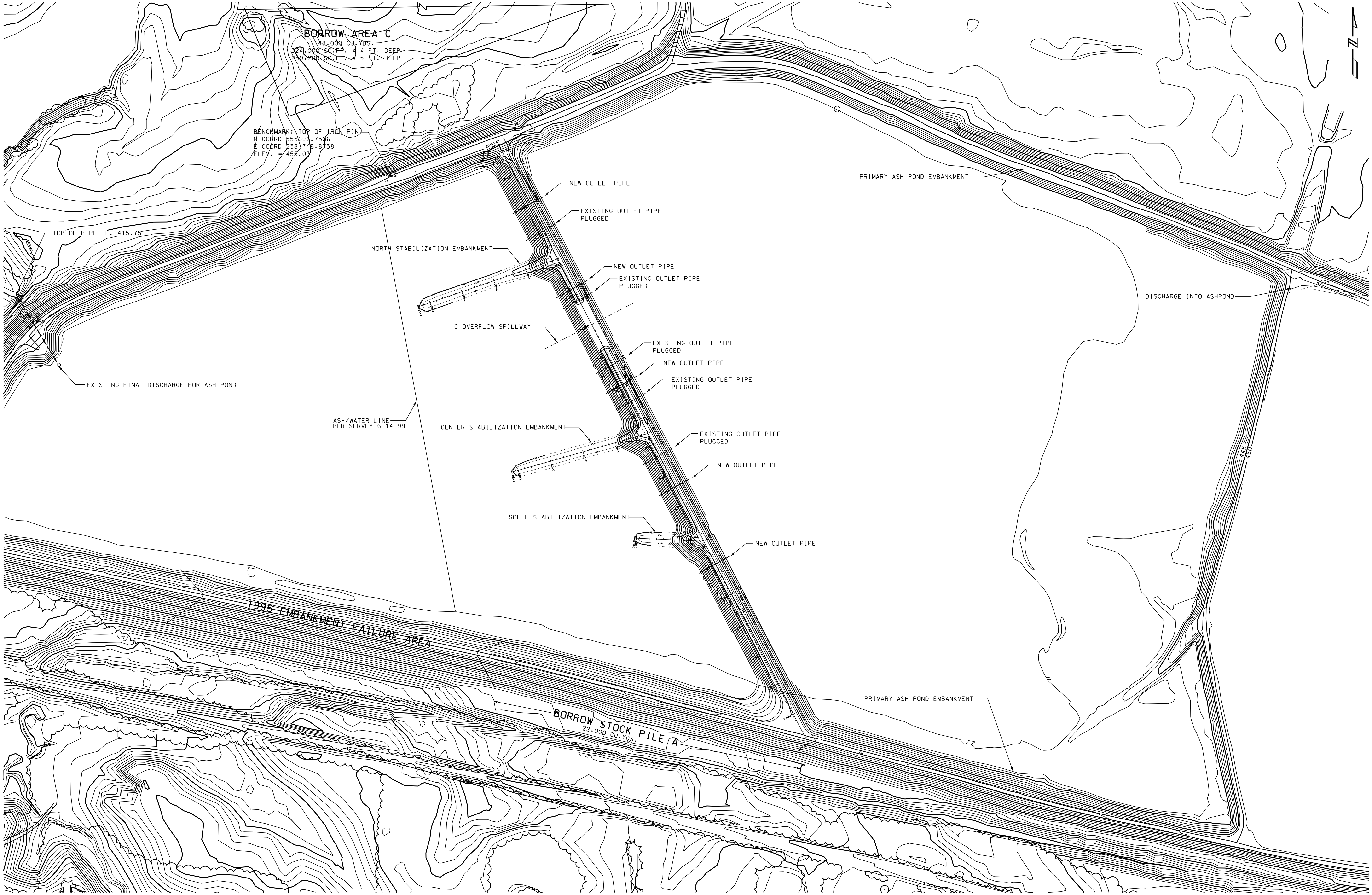
DATE	NO	DISTRIBUTION
3/21/67		

PRINTS

	BY	DATE	CHKD.	DATE
DSGN.		Feb. 18 1967		Feb. 21 1967
DWN.		FEB 24 1967		Feb 24 1967

DEPT.	GROUP LEADER	SECT. HEAD	DEPT. HEAD
CIVIL		WFA	
MECH.			
ELECT.			
PLAN.			
STAFF			CH. ENGR.

JAN 11 1967 JAN 20 1967 FEB 6 1967 FEB 14 1967 FEB 23 1967 FEB 24 1967 FEB 27 1967 FEB 28 1967 MAR 2 1967 MAR 17 1967



E-BAL1-C119

REVISION STATUS: ☐-CONSTRUCTION ○-RECORD

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
1	10-4-99	GBD	REMOVED BORROW STOCK PILE B	RCW	RCW	RCW							
2	10-5-99	GBD	ADDED BORROW AREA INFORMATION	RCW	RCW	RCW							
3	01-27-00	MEC	AS-BUILT - INTERMEDIATE EMBANKMENT. VERTICAL. EXTENTION 1999	RCW	RCW	RCW							

NOTES

REFERENCES

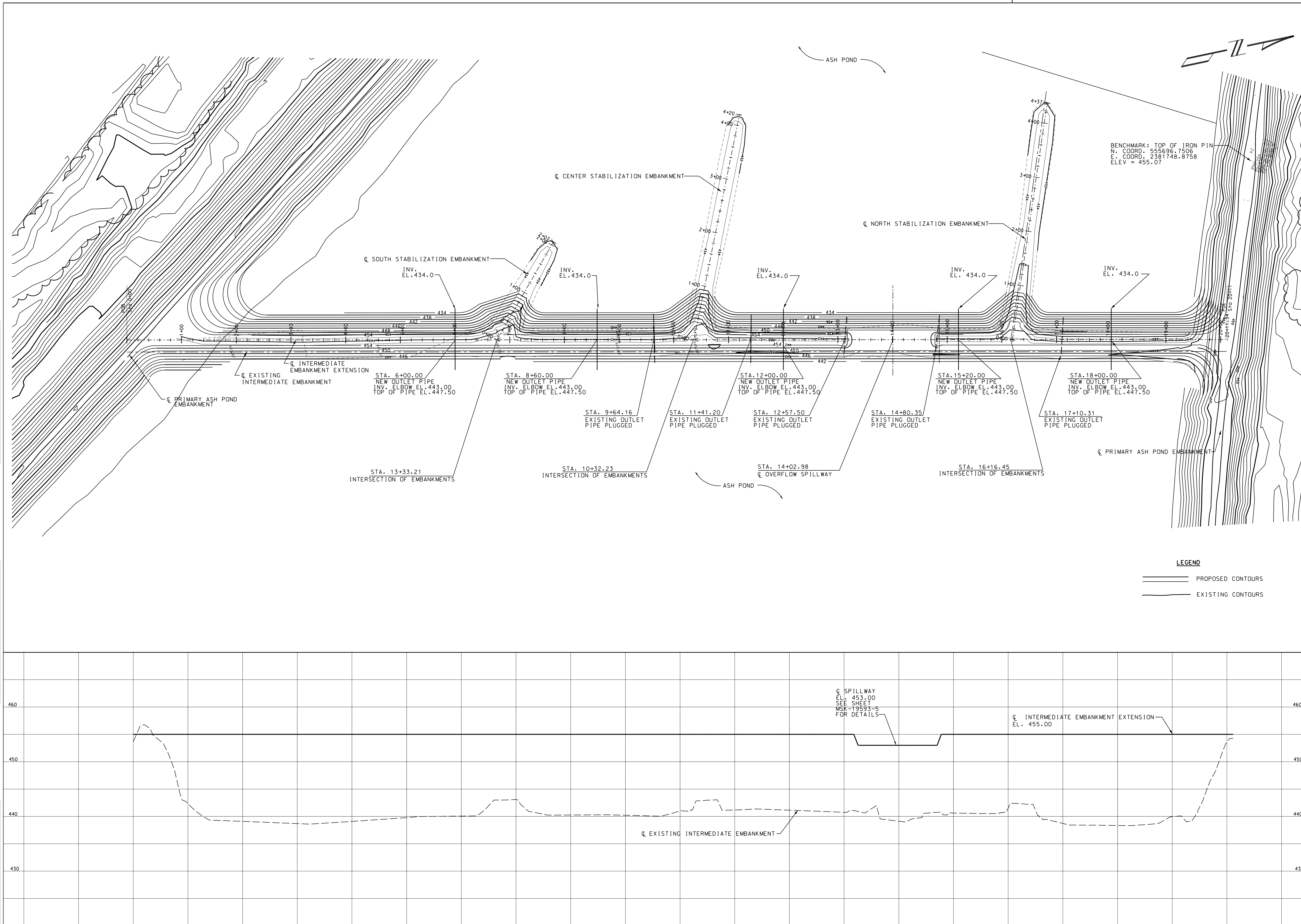
ILLINOIS POWER COMPANY
DECATUR

PRIMARY ASH POND SITE PLAN
VERTICAL EXTENSION OF INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

DR RKF	CAD RKF	DATE 7-20-99
OK RCW	CKD	SCALE 1"=100'
APP	PLOTTED 2-14-2000	E-BAL1-C119
APP		

COMPUTER DWG. - DO NOT REVISE MANUALLY

SAG TEMPLATE NO'S.



NO	DATE	REVISIONS DESCRIPTION	BY	APP
1	01-27-00	AS-BUILT - INTERMED. EMBNK. VERTICAL. EXTENTION. 1999	MEC	RCW

Scanned by Illinois Power Company-1995

REVISION STATUS: ☐-CONSTRUCTION ☐-RECORD

ILLINOIS POWER COMPANY
DECATUR

DR. | TR. | CKD. | DK. | APP. | DATE | SCALE:

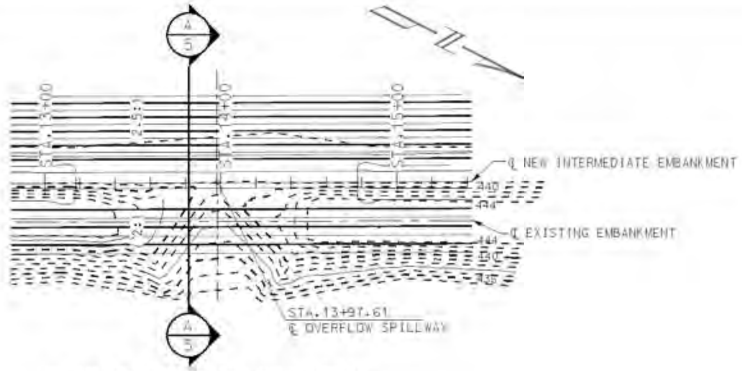
REV. NO. 1

INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

PLOTTED 2-14-2000

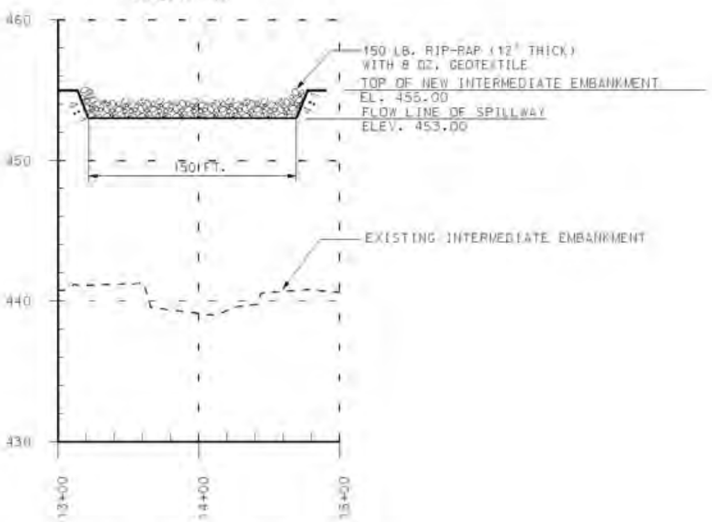
PLAN AND PROFILE
VERTICAL EXTENSION OF INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

DRAWING NUMBER E-BAL1-C120



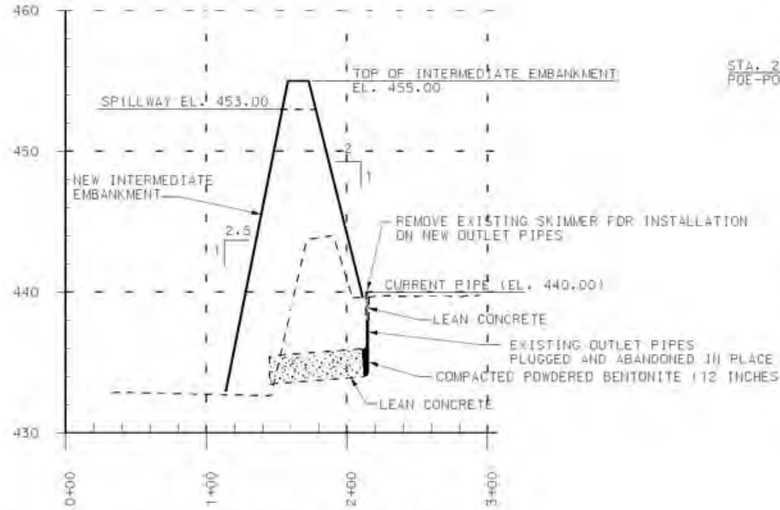
PLAN OF OVERFLOW SPILLWAY

SCALE: 1"=40'



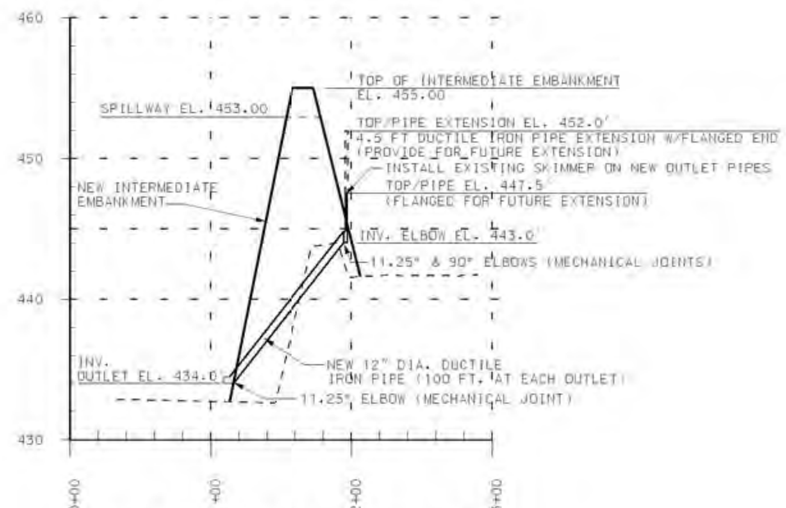
PROFILE OF OVERFLOW SPILLWAY

SCALE: 1"=50' HORZ
1"=5' VERT



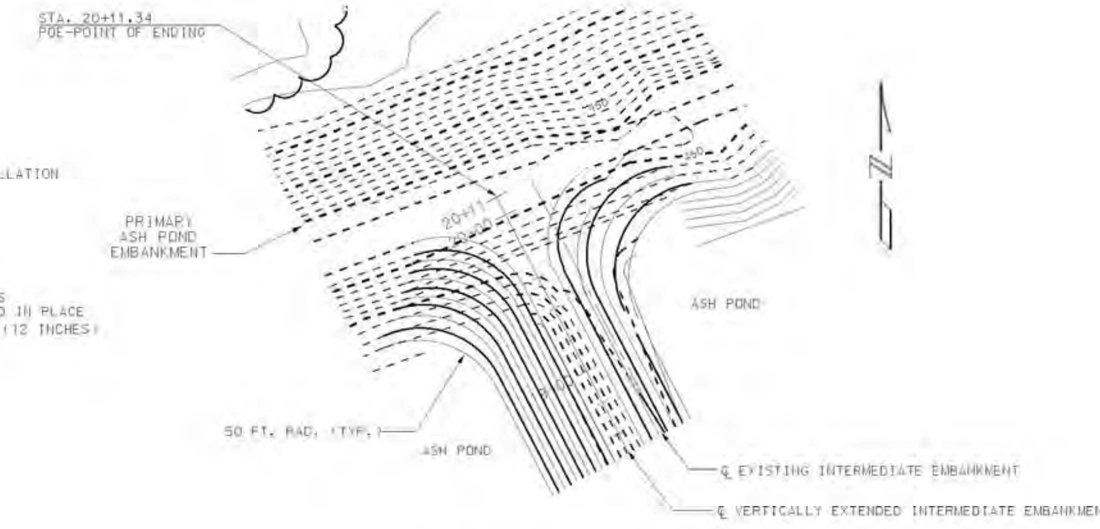
SECTION THRU EXISTING OUTLET PIPES (TYP.)

SCALE: 1"=50' HORZ
1"=5' VERT

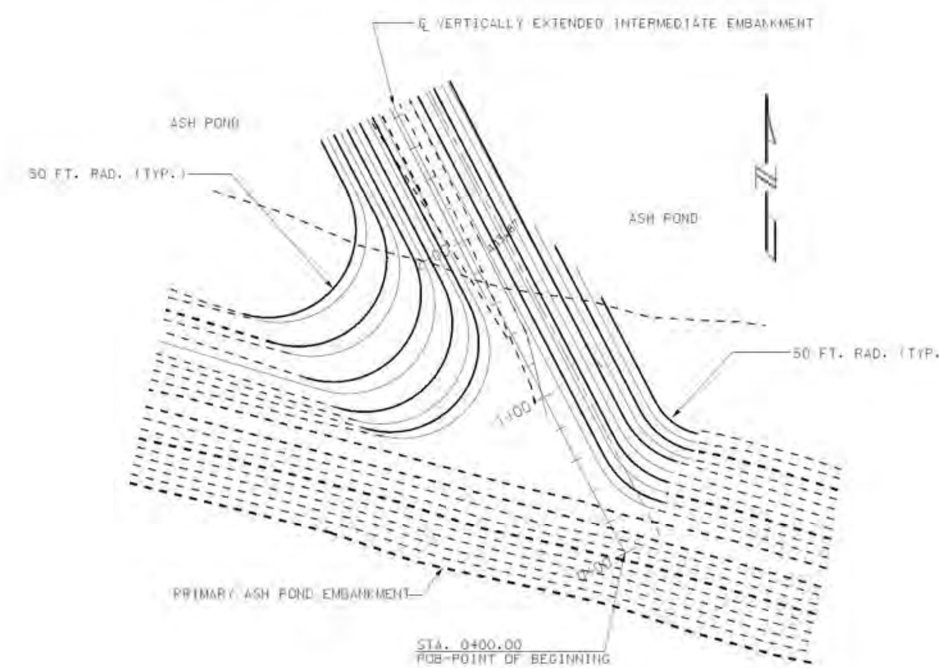


SECTION THRU NEW OUTLET PIPES (TYP.)

SCALE: 1"=50' HORZ
1"=5' VERT

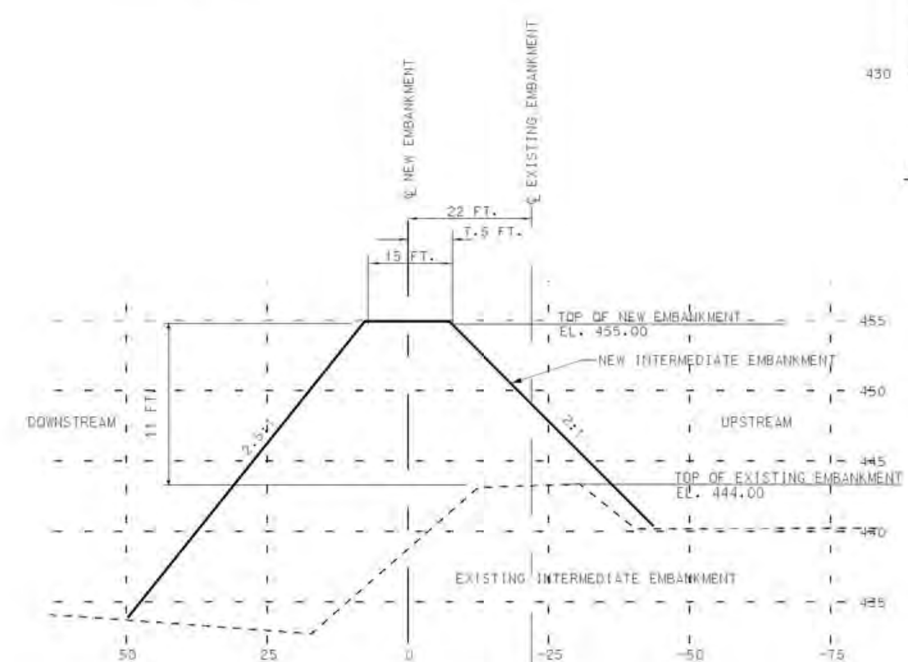


DETAIL OF NORTH END OF INTERMEDIATE EMBANKMENT



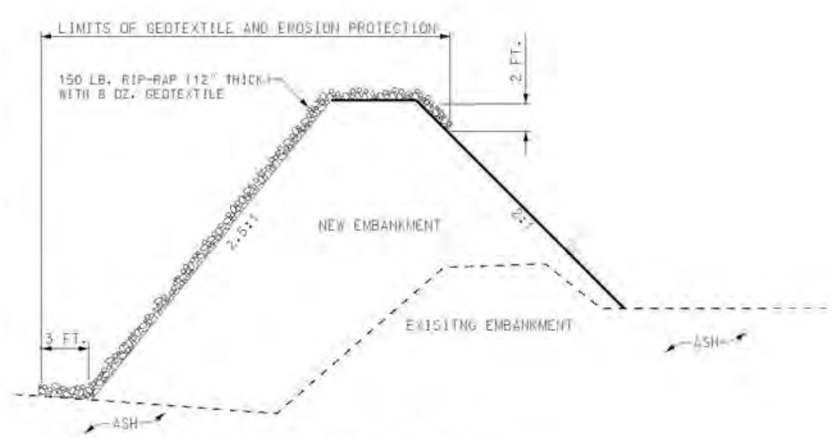
DETAIL OF SOUTH END OF INTERMEDIATE EMBANKMENT

SCALE: 1"=40'



TYPICAL SECTION THRU INTERMEDIATE EMBANKMENT

SCALE: 1"=50' HORZ
1"=5' VERT



A/5 SECTION A-A

SCALE: 1"=50' HORZ
1"=5' VERT

REVISION STATUS: ☐-CONSTRUCTION ○-RECORD

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
1	10-4-99	GBD	REMOVED REVETMENT AND GEOTEXTILE REINFORCING LAYERS	RCW	RCW	RCW							
2	10-6-99	GBD	CHANGED PIPE EXTENSION INFORMATION	RCW	RCW	RCW							
3	01-27-00	MEC	AS-BUILT - INTERMEDIATE EMBANKMENT. VERTICAL. EXTENTION 1999	RCW	RCW	RCW							

NOTES

REFERENCES

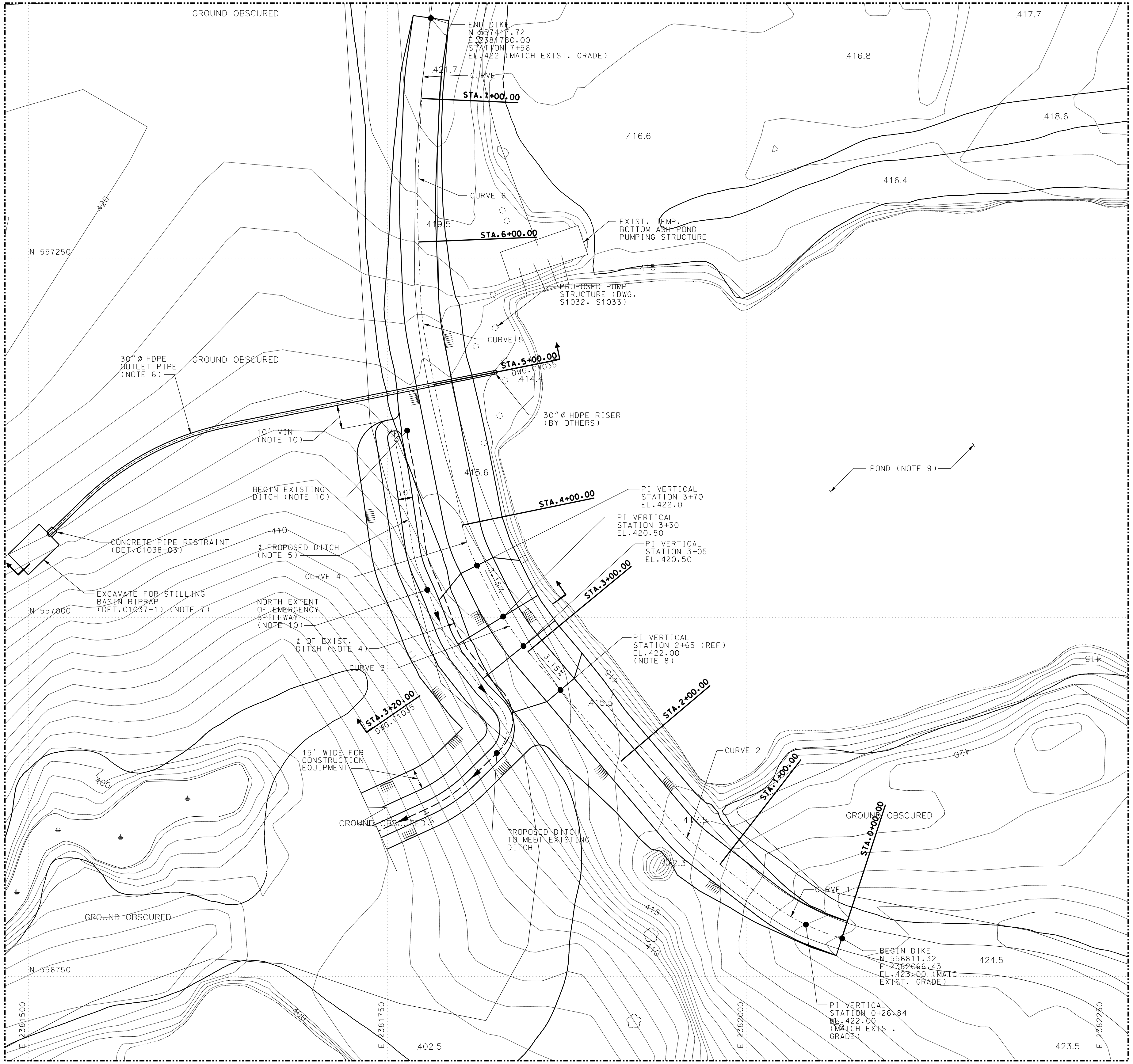
ILLINOIS POWER COMPANY
DECATUR

MISCELLANEOUS DETAILS OF INTERMEDIATE EMBANKMENT
VERTICAL EXTENSION OF INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

DR RKF	CAD RKF/MEC	DATE 7-22-99
CK RCW	CKD	SCALE
APP	PLOTTED 2-14-2000	E-BAL1-C122
APP		

E-BAL1-C122

	A	B	C	D	



BERM HORIZONTAL ALIGNMENT SCHEDULE			
CURVE NO.	POINT OF CURVATURE (STATION)	POINT OF TANGENT (STATION)	RADIUS OF CURVE (FT)
CURVE 1	0+00.0	0+59.7	158
CURVE 2	1+19.0	1+39.9	100
CURVE 3	2+97.5	3+46.9	200
CURVE 4	3+74.6	4+00.8	100
CURVE 5	5+29.7	5+60.7	200
CURVE 6	6+05.6	6+47.6	500
CURVE 7	7+05.1	7+24.9	200

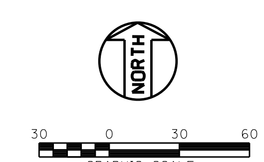
(ADJUST FOR CURRENT IN-FIELD CONDITIONS)

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. THE LOWEST ELEVATION OF THE DIKE AND THE WATER ELEVATION PER THE AERIAL SURVEY (REFERENCED HEREIN) IS 415.5FT AND 412.6FT RESPECTIVELY, OR 2.9 FEET DIFFERENCE. THE PUMP STRUCTURE FLOOR, WHICH HAS ALREADY BEEN INSTALLED ON THE SITE IS AT ELEVATION 423.0FT (REFER TO "S" SERIES DRAWINGS ATTACHED HEREIN) THE ELEVATION DIFFERENCE BETWEEN THE PROPOSED PUMP STRUCTURE FLOOR ELEVATION AND THE LOWEST ELEVATION OF THE DIKE WAS SHOT (SURVEYED) IN THE FIELD AND DETERMINED TO BE 5.31FT (REFER TO CALC BA-APS-C-1). ALL PROPOSED ELEVATIONS AND EXISTING ELEVATIONS INDICATED ON THESE "C" DRAWINGS ARE BASED ON THE TOP OF THE PROPOSED PUMP STRUCTURE FLOOR ELEVATION OF 423.0FT AND A 5.31FT ELEVATION DIFFERENCE BETWEEN THE PROPOSED PUMP STRUCTURE AND TOP OF EXISTING DIKE ELEVATION. CONTACT THE OWNER FOR BENCHMARK INFORMATION.
3. BASED ON FIELD OBSERVATIONS AND AS NOTED IN TOPOGRAPHIC SURVEY, DUE TO FOLIAGE OBSCURING THE GROUND ON THE REFERENCED AIR SURVEY, THE CONTOURS IN HEAVILY VEGETATED AREAS ARE ESTIMATED. THE DIKE LAYOUT ON THIS DRAWING IS BASED ON THE CONTOURS PROVIDED. THE ELEVATIONS ARE BASED ON A FIELD SURVEY (REFER TO NOTE 2). FIELD ADJUSTMENTS MAY BE REQUIRED DURING CONSTRUCTION BASED ON ACTUAL CONTOUR ELEVATIONS. ALL ADJUSTMENTS MUST BE REVIEWED BY THE OWNER PRIOR TO INSTALLATION.
4. EXISTING DITCH LOCATION IS ESTIMATED BASED ON FIELD OBSERVATIONS (REFER TO NOTES 2 AND 3).
5. PROPOSED DITCH SHALL BE INSTALLED AT THE BASE OF THE TOE OF FILL SLOPE. THE DITCH SHALL HAVE A CONSISTENT WIDTH AND DEPTH AS INDICATED ON PLAN AND DETAILS AND SLOPED AT 0.5% MINIMUM TO THE DOWNSTREAM POND APPROXIMATELY 1000' AWAY. THE PROPOSED DITCH INVERT ELEVATION SHALL MATCH THE EXISTING FLOW LINE OF THE EXISTING DITCH.
6. INSTALL 30 INCH DIAMETER HDPE OUTLET PIPE IN SAME LOCATION AND INVERT ELEVATIONS OF EXISTING 36 INCH DIAMETER CMP PIPE. THE GROUND SURFACE UNDER THE PIPE SHALL BE LEVEL LATERALLY AND SLOPED UNIFORMLY IN THE LONGITUDINAL DIRECTION FROM THE PIPE/DIKE DAY LIGHT POINT TO THE END OF THE PIPE AT THE DOWNSTREAM PIPE DISCHARGE POINT. THE ROUTE SHALL BE FREE OF SHARP ROCKS OR OTHER HARD OBJECTS. REFER TO DETAIL C-1037-03 FOR CULVERT BEDDING AND BACKFILL REQUIREMENTS.
7. PIPE TERMINATION POINT TO BE DETERMINED BY OWNER. MAINTAIN A 2% MINIMUM SLOPE IN OUTLET PIPE.
8. EMERGENCY SPILLWAY SHALL BE LOCATED IN THE FIELD SUCH THAT THE ENTIRE SPILLWAY IS PLACED WITHIN THE LIMITS OF THE DITCH.
9. THE WATER ELEVATION DURING NORMAL OPERATING CONDITIONS SHALL BE MAINTAINED AT MAXIMUM WATER SURFACE ELEVATION 417.6 FT.
10. PROPOSED DITCH SHALL BEGIN AT THE NORTH EXTENT OF THE EMERGENCY SPILLWAY OR THE EXISTING UPSTREAM DITCH LOACTION, WHICHEVER RESULTS IN THE LONGEST DITCH. DITCH INVERT SHALL MATCH EXISTING DITCH INVERT ELEVATION.

REFERENCE DRAWINGS

S1032	ASH POND STRUCTURE PLANS, SECTIONS AND DETAILS
S1033	ASH POND STRUCTURE SECTIONS AND DETAILS
C1035	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING SECTIONS
C1036	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND SURFACING DETAILS
C1037	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 1
C1038	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 2
040212	AERIAL SURVEY BY HENDERSON AERIAL SURVEYS, INC. ON 04-02-12



UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

Sargent & Lundy LLC

CAD FILE: C1033.DGN

REFERENCE DRAWINGS

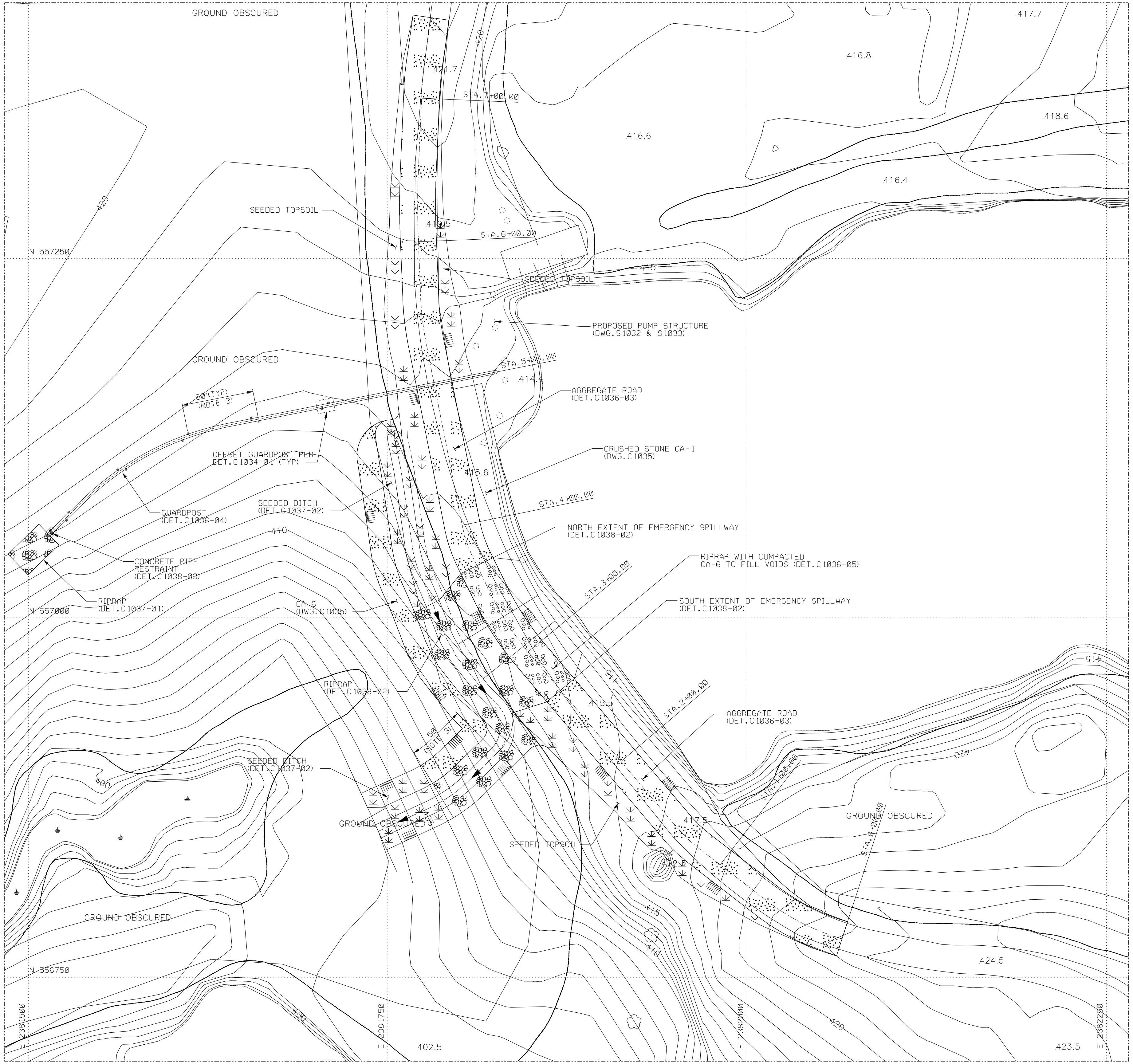
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD. P.S.# 49427	C.FLAMINI	T. PITSCH							

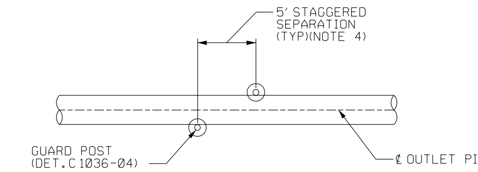
SCALE: 1"=30'-0"	
DWN. ALS	DATE 10-04-2012
CHK. T.M.P.	DATE 10-04-2012
APPV. D.J.D.	DATE 10-04-2012

DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND DRAINAGE PLAN BALDWIN ENERGY COMPLEX UNIT 2 DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1033
REV. 0





GUARD POST SEPARATION

DETAIL C1034-01

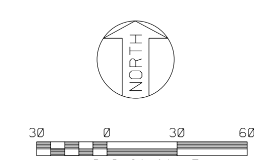
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. CONTOUR ELEVATIONS INDICATED ON PLAN ARE APPROXIMATE REFER TO NOTES ON DRAWING C-1033.
3. PLACE RIPRAP SURFACING IN SWALE 50FT BEYOND FLUME EXIT.
4. INSTALL GUARDPOST ON EACH SIDE OF CULVERT AT 50FT SPACINGS, OR AS NECESSARY IN FIELD TO LIMIT THE MOVEMENT BETWEEN TREES. GUARDPOST SHALL BE INSTALLED IN A STAGGERED PATTERN AS INDICATED ON PLAN TO CONTROL THE DIRECTION OF PIPE DEFLECTION DUE TO THERMAL EXPANSION.

REFERENCE DRAWINGS

S1032	ASH POND STRUCTURE PLANS, SECTIONS AND DETAILS
S1033	ASH POND STRUCTURE SECTIONS AND DETAILS
C1035	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING SECTIONS
C1036	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND SURFACING DETAILS
C1037	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 1
C1038	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 2
040212	AERIAL SURVEY BY HENDRESON AERIAL SURVEYS, INC. ON 04-02-12



UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

Sargent & Lundy LLC

CAD FILE: C1034.DGN

REFERENCE DRAWINGS

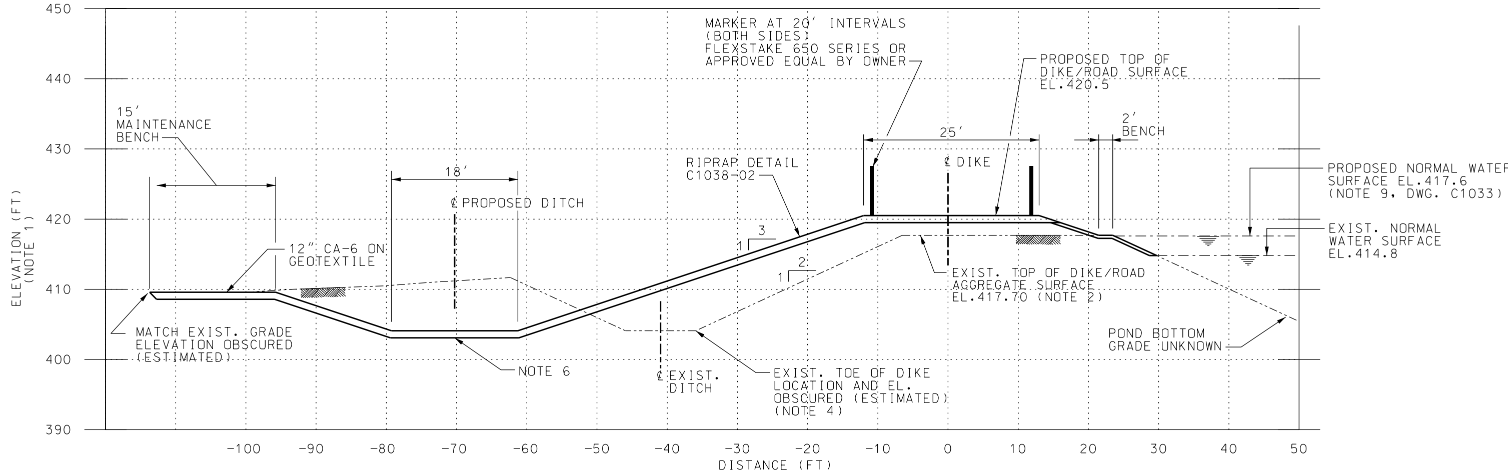
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD. P.S.# 49427	C. FLAMINI	T. PITSCH							

SCALE: 1"=30'-0"	
DWN. ALS	DATE 10-04-2012
CHK. T.M.P.	DATE 10-04-2012
APPV. D.J.D.	DATE 10-04-2012

DYNEGY

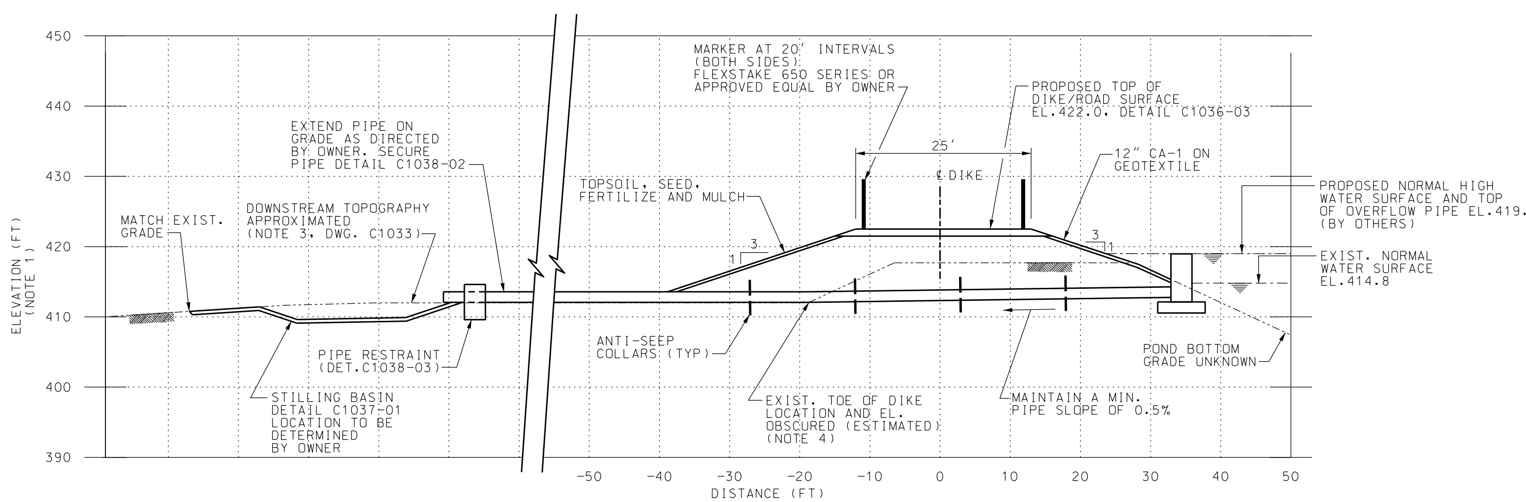
BOTTOM ASH POND DIKE IMPROVEMENTS
SURFACING PLAN
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1034
REV. 0



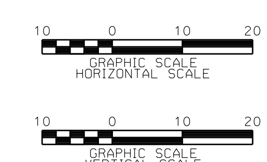
SECTION 3+20.00

AT EMERGENCY SPILLWAY



SECTION 5+00.00

AT OVERFLOW PIPE



NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. REFER TO NOTES 2 ON DRAWING C1033 FOR CLARIFICATION ON ELEVATIONS PROVIDED ON THIS DRAWING.
3. REMOVE AND DISPOSE OF EXISTING GRANULAR SURFACING, DELETERIOUS MATERIAL, VEGETATION, ROOTS, AND SOIL NOT MEETING FILL REQUIREMENTS IN SPECIFICATION SECTION 312201 PARAGRAPH 201.2b FROM WATER SURFACE TO DOWNSTREAM TOE OF DIKE AND TO DOWNSTREAM EXTENT OF OVERFLOW DITCH AND MAINTENANCE BENCH. UNTIL CLAY SUBGRADE IS EXPOSED PRIOR TO PLACING FILL (REFER TO DETAIL C1036-01).
4. ELEVATION AND LOCATION OF EXISTING DITCH IS ESTIMATED (SEE NOTE 3 ON DWG. C1033).
5. ELEVATIONS ON SECTIONS BASED ON CONTRACTOR'S DATUM WHERE TOP OF NEW PUMP STRUCTURE IS AT EL.423.0
6. THE PROPOSED DITCH INVERT ELEVATION SHALL MATCH THE INVERT ELEVATION OF THE EXISTING DITCH.

REFERENCE DRAWINGS

C1033	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND DRAINAGE PLAN

Sargent & Lundy LLC

CAD FILE: C1035.DGN

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD. P.S.# 49427	C. FLAMINI	T. PITSCH	

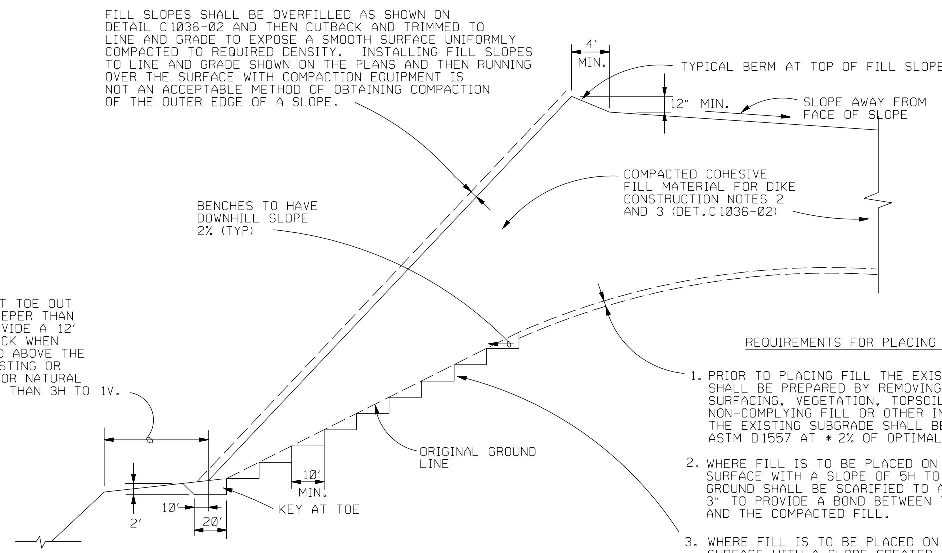
SCALE: AS NOTED
DWN. ALS DATE 10-04-2012
CHK. T.M.P. DATE 10-04-2012
APPV. D.J.D. DATE 10-04-2012

DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS
GRADING SECTIONS
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1035 REV. 0

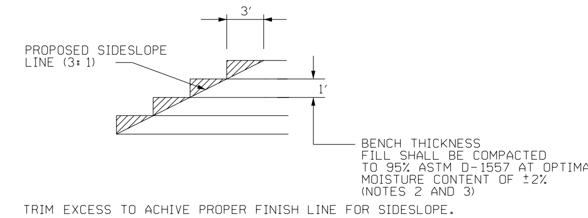
A | B | C | D



REQUIREMENTS FOR PLACING FILL

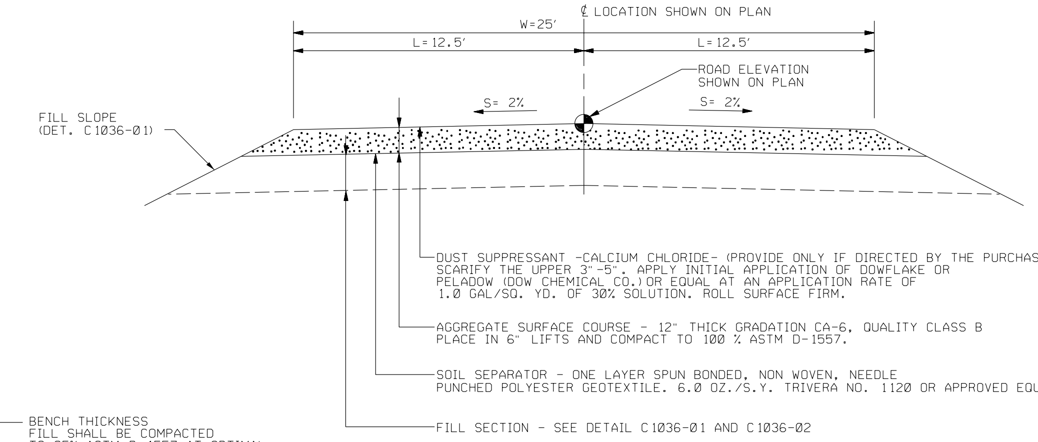
1. PRIOR TO PLACING FILL THE EXISTING GROUND SHALL BE PREPARED BY REMOVING CRUSHED STONE SURFACING, VEGETATION, TOPSOIL AND ANY OTHER NON-COMPLYING FILL OR OTHER INCOMPETENT MATERIAL. THE EXISTING SUBGRADE SHALL BE COMPACTED TO 95% ASTM D1557 AT ± 2% OF OPTIMAL MOISTURE CONTENT.
2. WHERE FILL IS TO BE PLACED ON AN EXISTING GROUND SURFACE WITH A SLOPE OF 5H TO 1V OR LESS, THE GROUND SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 3" TO PROVIDE A BOND BETWEEN THE INSITU MATERIAL AND THE COMPACTED FILL.
3. WHERE FILL IS TO BE PLACED ON AN EXISTING GROUND SURFACE WITH A SLOPE GREATER THAN 5H TO 1V THE FILL SHALL BE KEYED IN AT THE TOE AND CONTINUOUSLY BENCHED INTO THE NATURAL SLOPE. BENCHES SHALL SLOPE DOWNHILL 2% IN CROSS-SECTION AND SHALL BE LEVEL LONGITUDINALLY FOLLOWING THE NATURAL CONTOURS. MATERIAL CUT FROM BENCHES SHALL BE MIXED WITH COMPACTED FILL AND RECOMPACTED.

TYPICAL DETAIL
PLACEMENT OF FILL ON A SLOPE
DETAIL C1036-01
N.T.S.

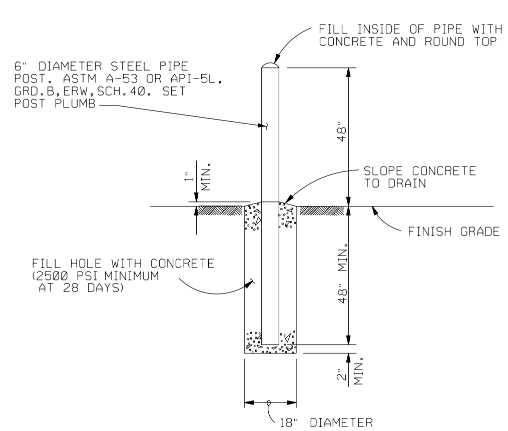


TRIM EXCESS TO ACHIVE PROPER FINISH LINE FOR SIDESLOPE.

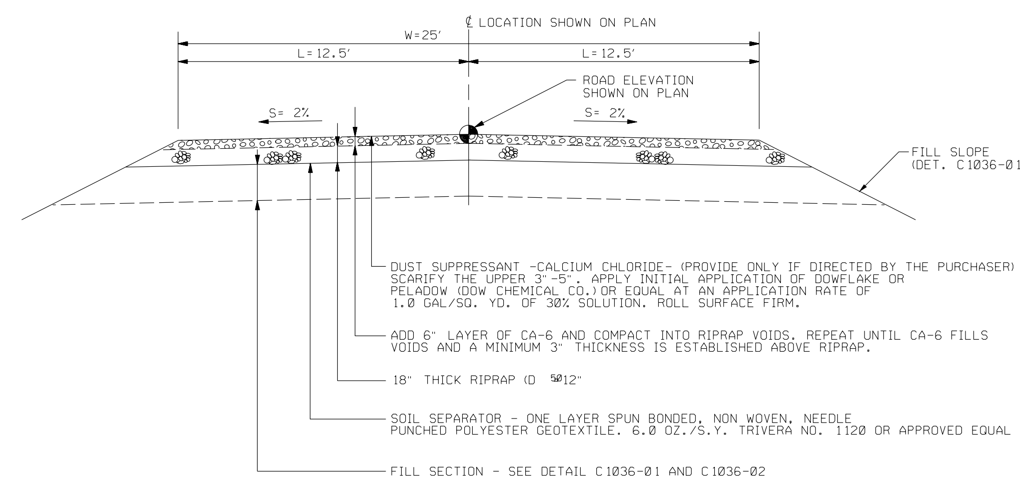
ENLARGED DETAIL A
BENCHES, TRIMMING AND SIDESLOPE COMPACTION
DETAIL C1036-02
N.T.S.



TYPICAL SECTION
AGGREGATE SURFACED PERMANENT ROAD
SECTION C1036-03
N.T.S.



GUARD POST
DETAIL C1036-04
N.T.S.



AGGREGATE SURFACED PERMANENT
ROAD IN EMERGENCY SPILLWAY
SECTION C1036-05
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. COHESIVE MATERIAL SHALL CONTAIN NOT MORE THAN 1 PERCENT ORGANIC OR OTHER DELETERIOUS MATERIAL, SHALL HAVE A MAXIMUM PARTICLE SIZE OF 2 INCHES AND SHALL HAVE ATTERBERG LIMITS ABOVE THE "A" LINE WITH A LIQUID LIMIT OF LESS THAN 40 AND A PLASTICITY INDEX LESS THAN 25. ACCEPTABLE SOILS ARE CLASSIFIED AS FINE-GRAINED SOILS IN THE UNITED SOIL CLASSIFICATION SYSTEM ASTM D2487. CLASSIFICATION IS CL.
3. AFTER COMPLETION OF A LIFT IS ACHIEVED, THE SURFACE SHALL BE SUFFICIENTLY ROUGHENED TO CREATE A BOND FOR THE NEXT SUCCEEDING LIFT.

REFERENCE DRAWINGS

C1032	BOTTOM ASH POND DIKE IMPROVEMENTS EROSION CONTROL PLAN

Sargent & Lundy LLC

CAD FILE: C1036.DGN

REFERENCE DRAWINGS

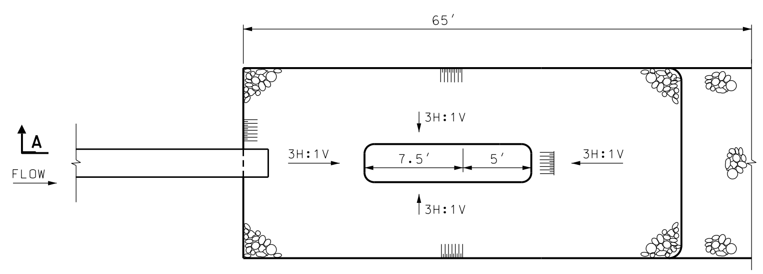
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C. FLAMINI	T. PITSCH							

SCALE: NONE
DWN. ALS DATE 10-04-2012
CHK. T.M.P. DATE 10-04-2012
APPV. D.J.D. DATE 10-04-2012

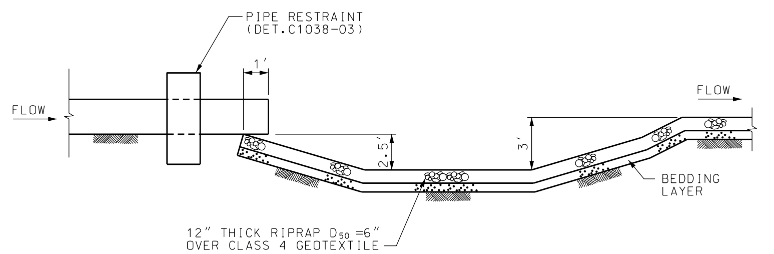
DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS
GRADING AND SURFACING DETAILS
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1036 REV. 0

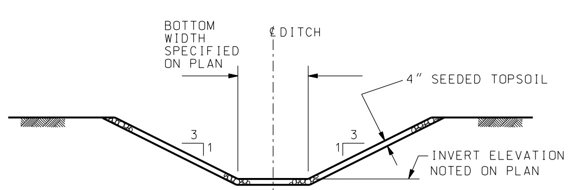


PLAN

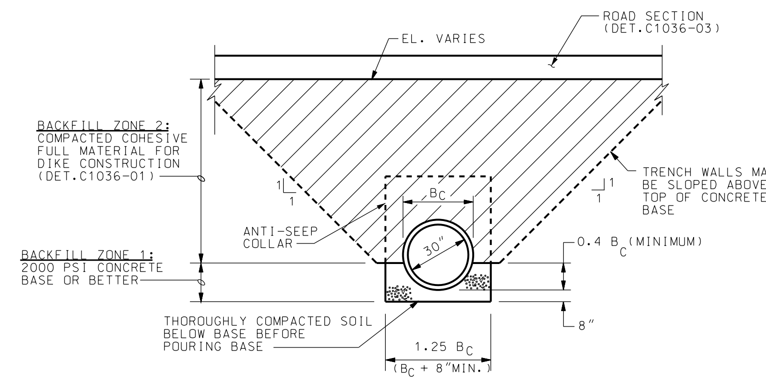


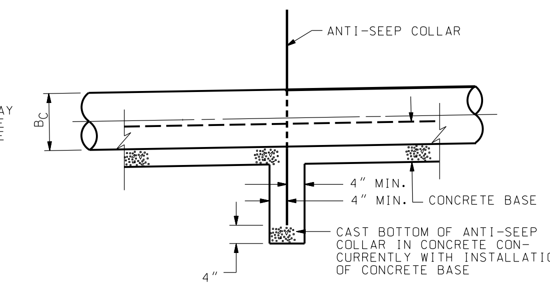
SECTION A

PROTECTION AT CULVERT IN AN UNDEFINED CHANNEL STILLING BASIN
DETAIL C1037-01
N.T.S.



SEEDED DITCH
DETAIL C1037-02
N.T.S.





SINGLE PIPE BEDDING AND BACKFILL REQUIREMENTS
DETAIL C1037-03
N.T.S.

NOTES PERTAINING TO OUTLET BEDDING AND BACKFILL DETAIL C1037-03

1. BEDDING AND BACKFILL MATERIAL SPECIFICATIONS

A. SELECT GRANULAR MATERIAL
"SELECT GRANULAR MATERIAL" SHALL CONSIST OF WELL GRADED SAND, STONE, CRUSHED STONE, PIT RUN GRAVEL, OR CRUSHED GRAVEL WITH A MAXIMUM STONE OF 3/4" Ø, FREE FROM EXCESS OF SOFT AND UNSOUND PARTICLES AND OTHER OBJECTIONABLE MATTER.

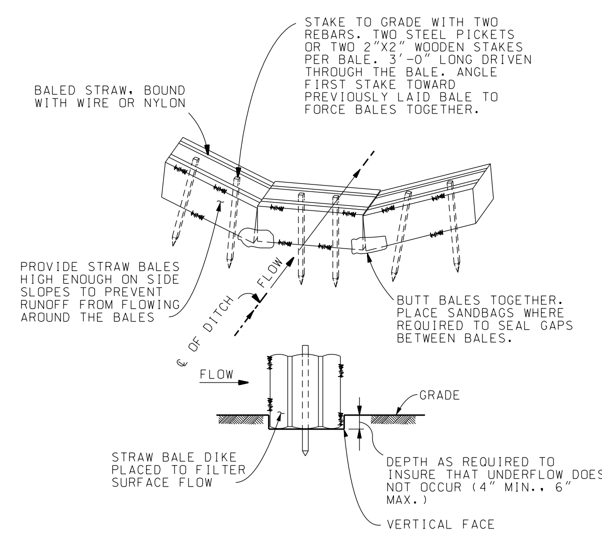
ACCEPTABLE GRADATIONS ARE:
ASTM C-33 - FINE CONCRETE AGGREGATE (WELL GRADED SAND)
ASTM C-33 - GRADATION NO.67 OR GRADATION NO.7 GRADATION SIMILAR TO WELL GRADED FINE ROAD BASE MATERIAL; I.E. ASTM D-1241, GRADATION C AND GRADATION D.

B. GRANULAR BEDDING MATERIAL
MATERIAL FOR "GRANULAR BEDDING MATERIAL" SHALL CONSIST OF WELL GRADED STONE SCREENINGS, CRUSHED STONE, PIT RUN GRAVEL, OR WASHED GRAVEL WITH A MAXIMUM STONE SIZE OF 1/2" Ø FOR BEDDING FOR PLASTIC PIPE, OR 3/4" Ø FOR BEDDING OTHER TYPES OF PIPE, FREE FROM EXCESS OF SOFT AND UNSOUND PARTICLES AND OTHER OBJECTIONABLE MATTER. THE FOLLOWING GRADATIONS ARE ACCEPTABLE:

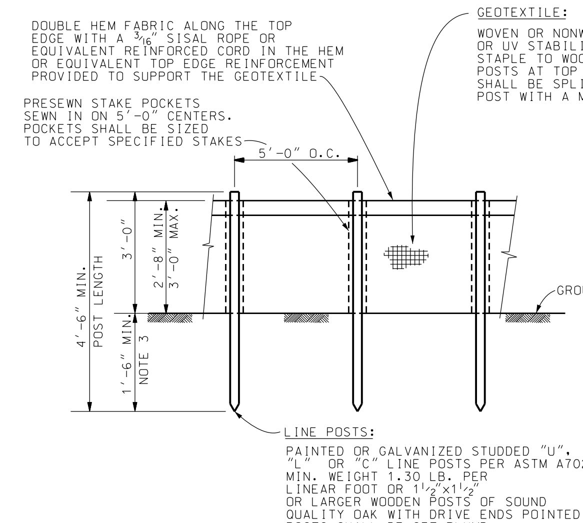
US STANDARD SIEVE SIZE	PERCENT PASSING ASTM C-33 GRADATION NO.67	ASTM C-33 GRADATION 7
1"	100	-
3/4"	90-100	100
1/2"	-	90-100
3/8"	20-55	40-70
NO.4	0-10	0-15
NO.8	0-5	0-5

2. SOFT TRENCH BOTTOM

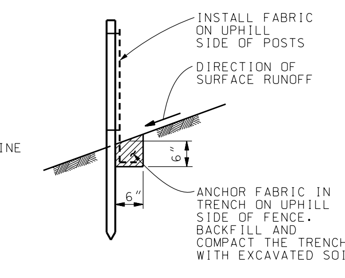
IF THE BOTTOM OF THE TRENCH IS SOFT, OVER EXCAVATE UP TO 2'-0" MINIMUM, AND REPLACE WITH "GRANULAR BEDDING MATERIAL" COMPACTED TO 90% ASTM D1557.



STRAW BALE EROSION CHECK FOR TRAPEZOIDAL DITCH (TYPICAL DETAIL)
DETAIL C1037-04
N.T.S.



FRONT ELEVATION



CROSS-SECTION

NOTES:

1. AFTER INSTALLATION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE FENCE. THE CONTRACTOR SHALL INSPECT FENCES AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. CONTRACTOR IS RESPONSIBLE FOR REMOVING AND REPLACING SILT FENCING NOT FUNCTIONING DUE TO CLOGGING, DAMAGE OR DETERIORATION.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND DISPOSAL OF FENCING WHEN, AS DETERMINED BY THE OWNER, THE FENCING IS NO LONGER NEEDED.
3. WHERE 18" DEPTH IS IMPOSSIBLE TO ACHIEVE THE POSTS SHALL BE SECURED TO PREVENT OVERTURNING OF THE FENCE DUE TO SEDIMENT LOAD.

SELF-SUPPORTING SILT FENCE (TYPICAL DETAIL)
DETAIL C1037-05
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. SEED MIXTURE SHALL BE A TYPE AND MIXTURE MEETING THE REQUIREMENTS OF ILLINOIS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATION FOR ROAD AND BRIDGE CONSTRICTION SECTION 250.

REFERENCE DRAWINGS

C1032	BOTTOM ASH POND DIKE IMPROVEMENTS EROSION CONTROL PLAN
C1033	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND DRAINAGE PLAN

Sargent & Lundy LLC

CAD FILE: C1037.DGN

REFERENCE DRAWINGS

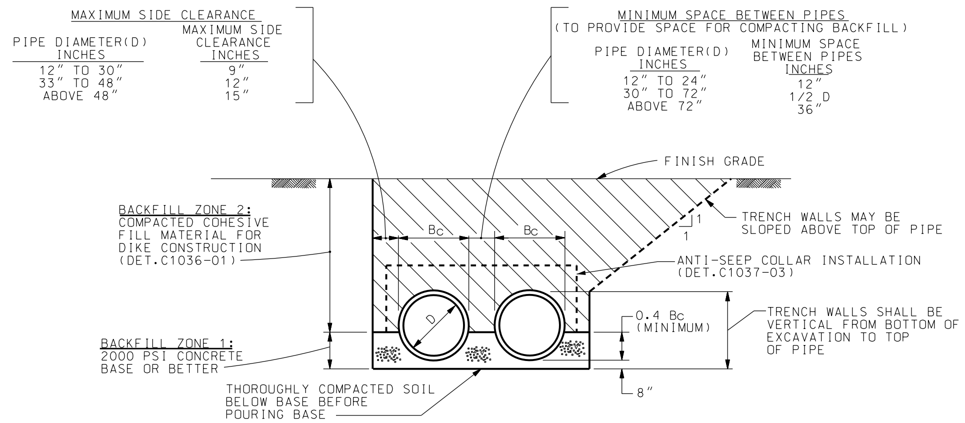
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C. FLAMINI	T. PITSCH							

SCALE: NONE		
DWN. ALS	DATE 10-04-2012	
CHK. T.M.P.	DATE 10-04-2012	
APPV. D.J.D.	DATE 10-04-2012	

DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS
STORM AND EROSION CONTROL DETAILS SHEET 1
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

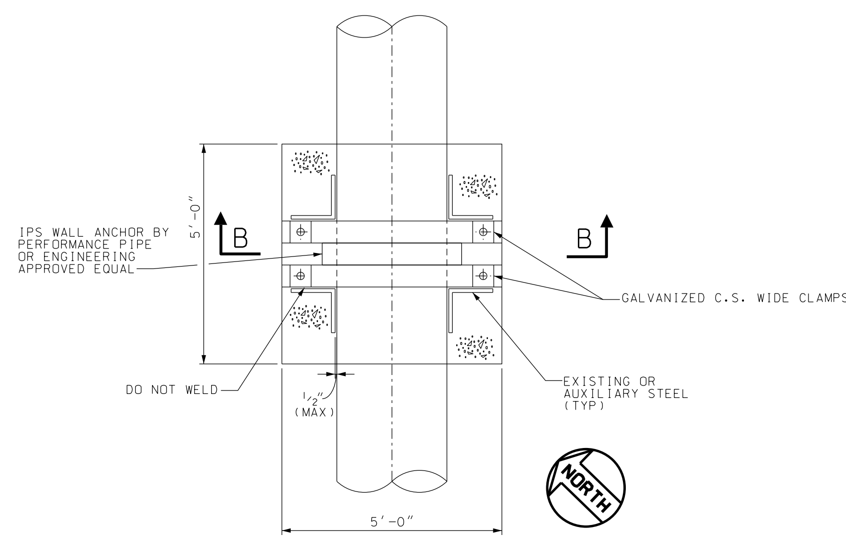
PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1037
REV. 0



MULTIPLE PIPE BEDDING AND BACKFILL REQUIREMENTS

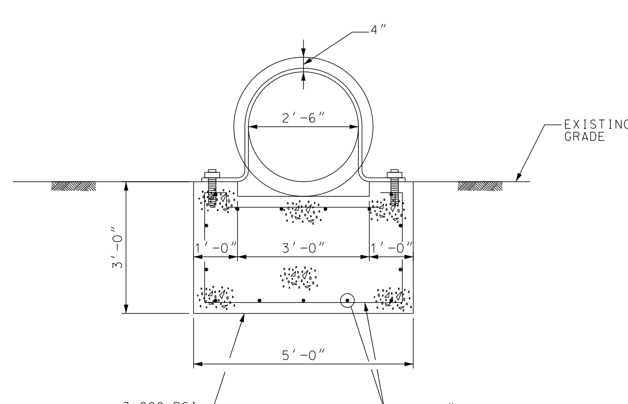
DETAIL C1038-01

N.T.S.



PLAN

N.T.S.

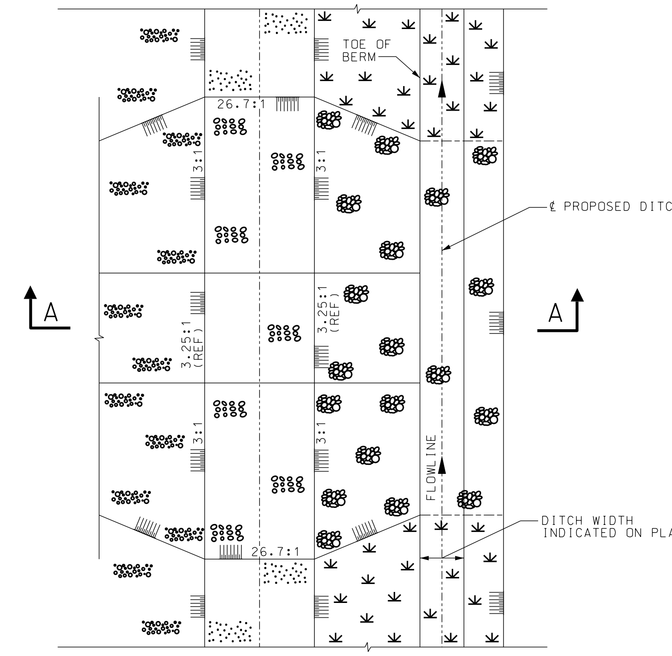


SECTION B

PIPE RESTRAINT

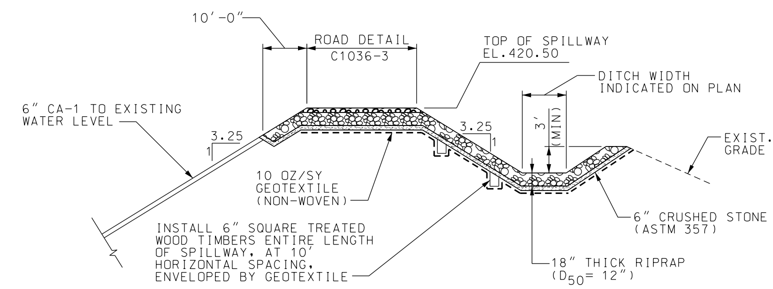
DETAIL C1038-03

N.T.S.



PLAN

N.T.S.

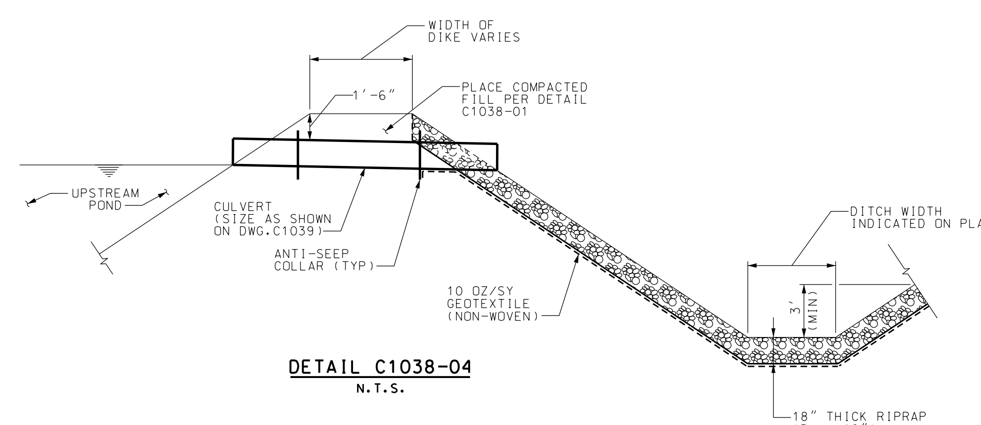


SECTION A

EMERGENCY SPILLWAY AND FLOW SPREADER

DETAIL C1038-02

N.T.S.



DETAIL C1038-04

N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.

REFERENCE DRAWINGS

C1033	BOTTOM ASH POND DIKE EROSION CONTROL PLAN
C1034	BOTTOM ASH POND DIKE IMPROVEMENTS SURFACING PLAN

Sargent & Lundy LLC

CAD FILE: C1038.DGN

REFERENCE DRAWINGS

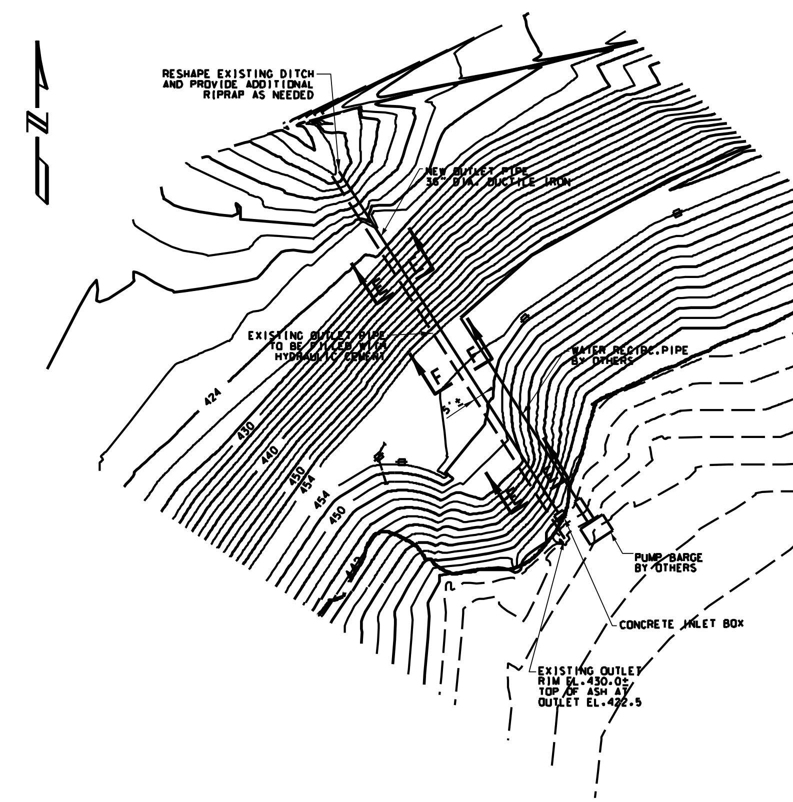
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C. FLAMINI	T. PITSCH							

SCALE: NONE		
DWN. ALS	DATE 10-04-2012	
CHK. T.M.P.	DATE 10-04-2012	
APPV. D.J.D.	DATE 10-04-2012	

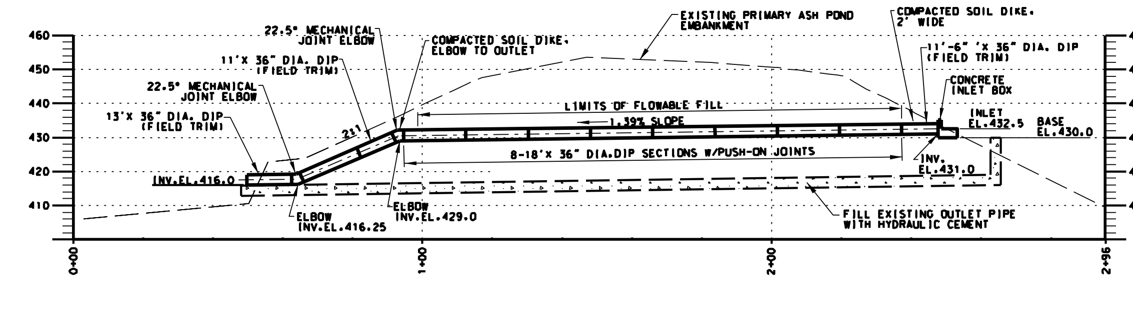
DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS
STORM AND EROSION CONTROL DETAILS SHEET 2
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1038
REV. 0

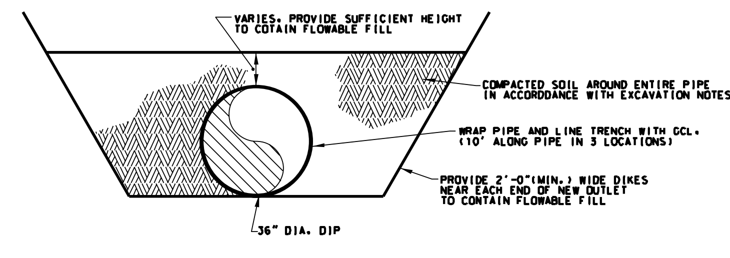


DETAIL OF FINAL DISCHARGE PIPE



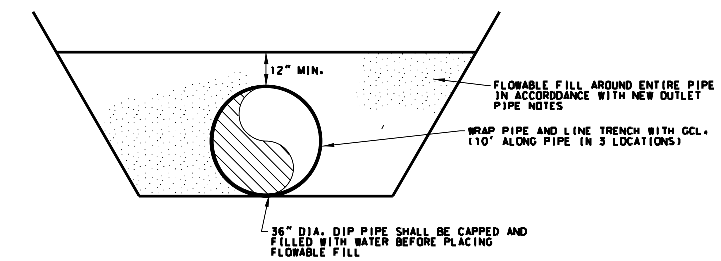
SECTION THRU FINAL DISCHARGE PIPE

SCALE: 1"=20' HORZ : 1"=20' VERT



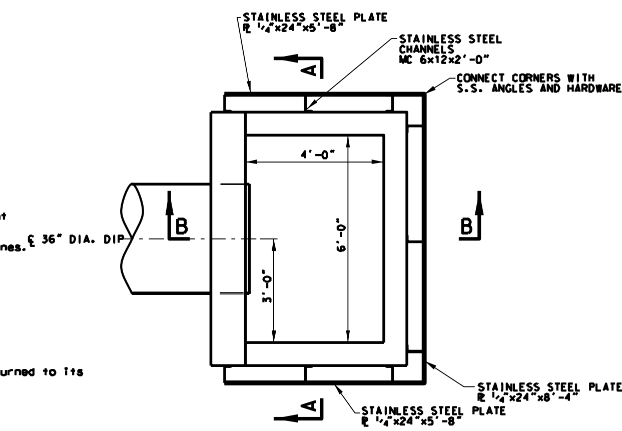
SECTION "E-E"

N.T.S.

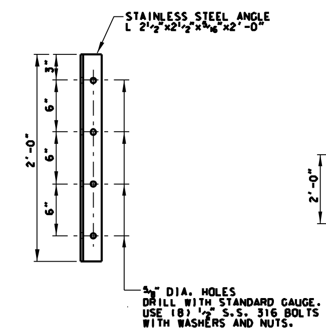


SECTION "F-F"

N.T.S.

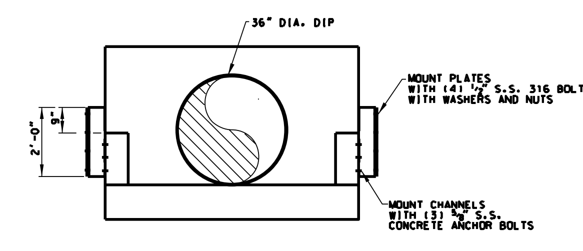


PLAN VIEW

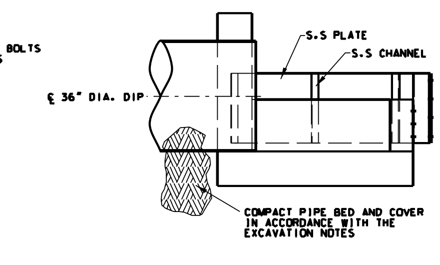


S.S. CORNER ANGLES

SCALE: 1 1/2"= 1'-0"



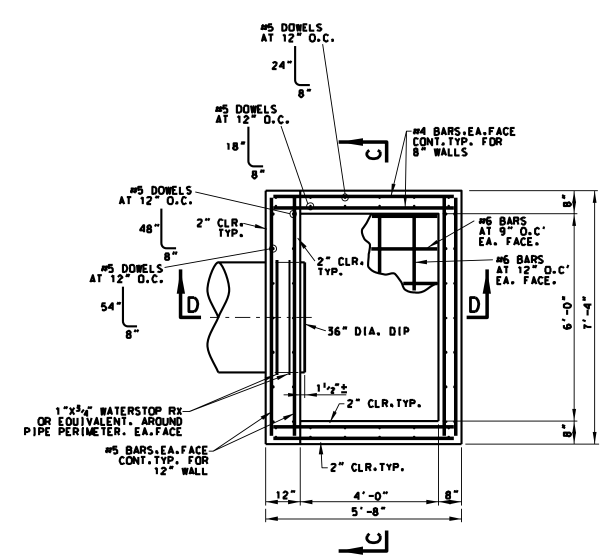
SECTION "A-A"



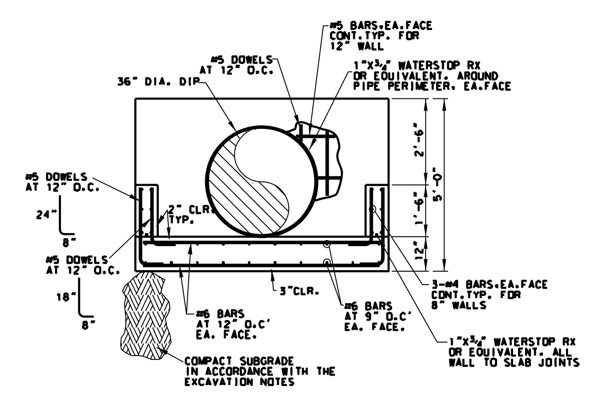
SECTION "B-B"

ASSEMBLY - CONCRETE INLET BOX AND SKIMMER

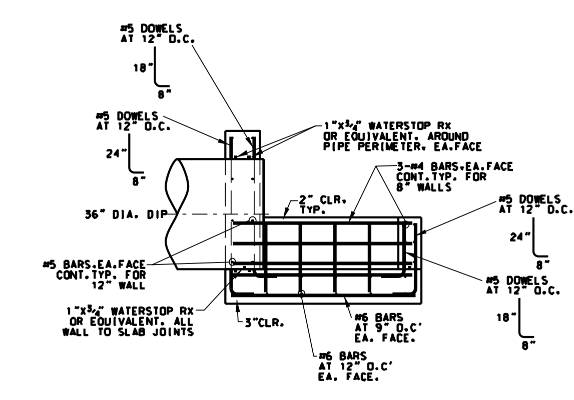
SCALE: 1/2"= 1'-0"



PLAN VIEW



SECTION "C-C"



SECTION "D-D"

REINFORCING DETAILS - CONCRETE INLET BOX

SCALE: 1/2"= 1'-0"

CONSTRUCTION NOTES and SPECIFICATIONS

GENERAL

Except as noted otherwise, the Contractor shall furnish all labor, material, tools, and equipment necessary for concrete work shown on the drawings and specified herein.

All work shall be performed in accordance with applicable ACI, OSHA and other applicable guidelines. This work shall also be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman experienced in concrete work, earthwork and general construction activities.

The General Conditions, Safety and Environmental Performance, Earthwork, Riprap, Seeding and Permits sections of the previously provided SPECIFICATION FOR VERTICAL EXTENSION OF EXISTING INTERMEDIATE EMBANKMENT AT PRIMARY ASH POND are applicable to this additional work and shall be considered as part of these Construction Notes and Specifications.

EXCAVATION

All excavated materials shall be stockpiled on-site for re-use. All affected areas shall be returned to its former condition.

Compaction requirements for all phases of the work shall be 95% or greater of the maximum dry density and within ±3% of the optimum moisture content as determined by ASTM D698 (commonly referred to as the Standard Proctor test).

REINFORCING

Reinforcing bars shall conform to ASTM A615, Grade 60 unless otherwise noted on the foundation drawings. All reinforcing shall be free from hard rust, dirt and oil.

All bars shall be bent accurately, placed in position as shown on the drawings, securely tied with #16 gauge black, annealed wire at all intersections, and securely held in place by spacers, chairs, or other approved supports in accordance with ACI 315R. At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud, or other coatings, which will destroy or reduce the concrete bond. Unless otherwise shown on the drawings or specified, the spacing, amount of concrete coverage, splicing, and bending of reinforcing steel shall conform to the requirements of ACI 318. All steel shall have a minimum of 3" concrete cover unless otherwise noted on drawings.

CONCRETE MIXES

Two concrete mixes shall be needed for this project. These are for the concrete inlet box and for the existing outlet pipe plug. The concrete mix designs to be used on the project shall be supplied to the Company by the Contractor 3 days prior to any concrete placement at the job site. All materials incorporated into the concrete mix shall be identified by brand name, gradation, and the supplier.

Type II Portland cement shall be used for the concrete inlet structure. The plug for the existing outlet structure shall consist of hydraulic cement. Type K, M or S Portland cement shall be used in the hydraulic cement plug.

All concrete shall have a minimum compressive strength of 4000 psi at 28 days. Both mixes shall have a maximum water cement ratio of 0.45 (by weight).

All concrete shall have 5 to 7 per cent entrained air.

Concrete for the inlet box shall have a slump of 3 to 4 inches. Concrete for the existing outlet pipe plug shall have a slump of 1 to 2 inches without plasticizer.

Water-reducing admixtures may be used to help meet the above concrete mixture specifications. following admixture manufacturer recommendations.

Ready-Mixed concrete shall be used for all concrete. It shall be mixed and delivered in accordance with the requirements set forth in ASTM C94. The concrete for the outlet pipe plug shall have plasticizer added at the site just prior to final mixing and placement. Final mixing shall be sufficient to fully incorporate plasticizer.

The concrete for the existing outlet pipe plug shall be pumped into the pipe. A tremie tube or hose shall be used to ensure that the concrete fills the entire pipe. Additionally, concrete for the plug shall be placed/pumped continuously until the entire outlet structure is filled. No delays between concrete deliveries shall be allowed.

CONCRETE FINISHES ON EXPOSED SURFACES

Exposed formed surfaces shall be rubbed to the extent of removing small irregularities. Minor voids may be filled with cement mortar. The surface shall not be brush-coated with a cement paste after rubbing.

NEW OUTLET PIPE

Contractor shall install a new outlet pipe through the existing primary ash pond embankment.

Pipe material shall be 36-inch ductile iron pipe, 150-psi pressure class.

The new outlet will consist of approximately 200 feet of straight run pipe and two 22.5° elbows.

Inlet, outlet and elbow invert elevations are shown on the project plans.

Buried, straight run pipe sections shall have push-on joints.

All elbows shall be mechanical joints.

Flowable fill shall be installed as shown on the "Section Thru Final Discharge Pipe".

Flowable fill shall consist of a low strength concrete with a max.compressive strength of 300 psi.

Pipe shall be capped and filled with water before placing flowable fill

Geocomposite Liner (GCL) shall be Claymax 200R, Bentomat ST, or equivalent.

REVISION STATUS: □-CONSTRUCTION ○-RECORD

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
(1)	10-29-99	DEC	ADDED FLOWABLE FILL DETAILS	RCW	RCW	RCW							
(2)	01-27-00	MEC	AS-BUILT - INTERMEDIATE EMBANKMENT, VERTICAL, EXTENTION 1999	RCW	RCW	RCW							

NOTES

REFERENCES

ILLINOIS POWER COMPANY
DECATUR

FINAL OUTLET PIPE REPLACEMENT
PRIMARY ASH POND
BALDWIN POWER STATION

DR RKF	CAD RKF	DATE 7-22-99
CK RCW	CKD	SCALE 1"=40'
APP	PLOTTED 2-14-2000	E-BAL1-C127
APP		

E-BAL1-C127

PLOT SCALE=40

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
⓪	06/28/2000	A.T	RECORD REVISION	W.B	R.O	——					W.B	R.O	——

NOTES

1.- ALL DIMENSIONS SHOWN SHALL BE ADJUSTED BY CONTRACTOR TO SUIT INSTALLATION AND FABRICATION TOLERANCES.

REFERENCES

1.- M-2425 FLOW DIAGRAM
2.- M-1077-2 BARGE PUMP PIPING
3.- M-1077-3 WATER PIPING TO MIXING HEAD
4.- (UCC) 510-54671-26 & 27 (SHT. 1 OF 4)

REVISION STATUS
☐ -CONSTRUCTION
○ -RECORD

ILLINOIS POWER COMPANY
DECATUR

PARTIAL PLOT PLAN
POND ASH PIPING
BALDWIN UNIT 1, 2 AND 3

DR	CAD	DATE 11-24-99
OK	CKD	SCALE 1"=300'-0"
APP	PLOTTED	E-BAL 1-M1077-1
APP		

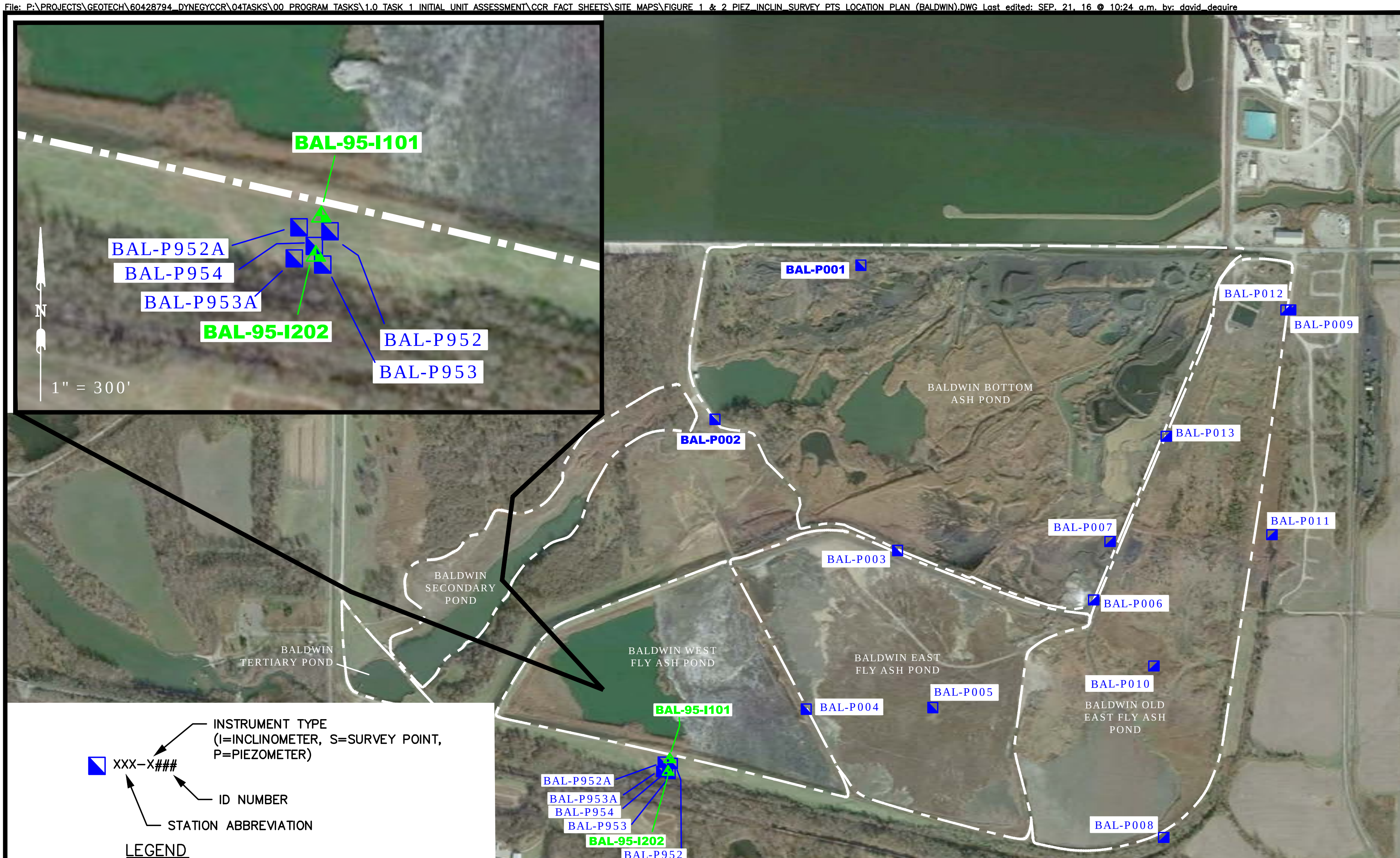
FILENAME: M1077-1.DGN

COMPUTER DWG. - DO NOT REVISE MANUALLY

AECOM

Appendix C: Baldwin Energy Complex Piezometer and Inclinometer Locations

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00_PROGRAM_TASKS\1.0_TASK_1_INITIAL_UNIT_ASSESSMENT\CCR_FACT_SHEETS\SITE_MAPS\FIGURE_1_&_2_PIEZ_INCLIN_SURVEY_PTS_LOCATION_PLAN_(BALDWIN).DWG Last edited: SEP. 21, 16 @ 10:24 a.m. by: david_dequire



XXX–X###

INSTRUMENT TYPE (I=INCLINOMETER, S=SURVEY POINT, P=PIEZOMETER)

ID NUMBER

STATION ABBREVIATION

LEGEND

INCLINOMETER LOCATION

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

0 1000

APPROXIMATE SCALE FEET

N

DYNEGY MIDWEST GENERATION LLC	PROJECT NO. 60440739

AECOM

DRN. BY:djd November 2015 DSGN. BY:djd CHKD. BY:kmb	Baldwin Ash Pond Complex Piezometer and Inclinometer Locations	FIG. NO. 2

AECOM

Appendix D: Specification T-2226

SARGENT & LUNDY
ENGINEERS
CHICAGO

EXHIBIT "B-1"

May 9, 1967

ADDENDUM NO. 1

TO

SPECIFICATION T-2226

(DATED MARCH 28, 1967)

FOR

COOLING RESERVOIR AND ASH POND WORK

BALDWIN POWER STATION - UNIT 1

ILLINOIS POWER COMPANY

With reference to the above Specification, the following revisions shall apply:

1. Proposal Data Form: The following shall apply:

   A. Page 2, Item A4: Insert the words "liming and" before the work "fertilizing".

   B. Page 4, Item L6: For sub-items b, c and d, revise the figures 1/4", 3/8" and 1/2" deep to 1/2", 3/4" and 1" deep, respectively.

   C. Page 7: This page has been revised May 8, 1967, and extra copies are attached. Revision consists of additions to Item 3, Schedule of Work. Also see Item 4D of this Addendum No. 1.

   ALL ADDENDUM ITEMS FOLLOWING COVER REVISIONS TO SPECIFICATION

2. Page 1-1, Article 1-04C, Work Furnished and Installed, or Performed: The following shall apply:

   A. Paragraph C: Revise end of paragraph to read:

      , subdivided as indicated and subject to Base Bid Schedule of Work and Alternate 1 and Alternate 2 Schedules as indicated in Article 1-05:

   B. Subparagraph b, Ash Pond: Revise "culverts" on last line to read "out fall structures".

3. Page 1-2, Paragraph D, Work By Others: Add a new Item c as follows:

   c. Preliminary site work.

4. <u>Starting on Page 1-2, Article 1-05, Schedule of Work</u>: The following shall apply:

   A. <u>Paragraph A, Subparagraph a</u>: In second line, revise "three (3)" to read "two (2)".

   B. <u>Page 1-3, Top of Page</u>: Revise present Item (3), the portion of .... to new Item (2); revise present Item (2), Work on dam and spillways.... to new Subparagraph b; revise present Subparagraphs b and c to new Subparagraphs c and d; and in new Subparagraph d, revise "three (3)" to read "two (2)".

   C. <u>Page 1-3, Paragraph B</u>: Revise entire paragraph to read:

      B. Schedule Dates for Base Bid:

         a. In accordance with foregoing requirements, Contractor shall perform the WORK in accordance with following schedule:

ITEMS	BY DATES BELOW
a. Start WORK at site	May 25, 1967
b. Install observation wells	Before creek at dam site is permanently closed.
e. Complete all WORK, except final seeding (providing that work on dam and spillway is authorized by July 1, 1967, and that Access Pending areas are released for work by October 2, 1967)	December 1, 1967
f. Complete final seeding, subject to conditions indicated in Article 1-05C	May 1, 1968

   D. <u>Page 1-4</u>: Revise Paragraphs C through G to read:

      C. Alternate 1 - Release of Access Pending Areas by ~~May~~ June 1, 1968: Release of Access Pending areas may be delayed beyond October 2, 1967. Contractor shall state, as set forth in Item 3 of the Proposal Data form, the dates by which he would complete work for these two areas, and dates for completing final seeding for these two areas, if these two areas are released by ~~May~~ June 1, 1968.

      D. Alternate 2 - Release of WORK after ~~May~~ June 1, 1968: If any area of WORK is not released to Contractor by ~~May~~ June 1, 1968 and Purchaser does not delete that portion of WORK from the Contract, Contractor will be granted a time extension and an equitable adjustment to the FIRM LUMP SUM PRICE to reflect costs incurred by Contractor due to the delay of portions of WORK beyond ~~May~~ June 1, 1968.

E. Contractor's Schedule of WORK: Within one week after notification of award of Contract, Contractor shall submit, in duplicate, a schedule graphically representing starting and completion dates of each phase of the WORK.

F. Work by Others: Related work by others is scheduled as follows:

ITEMS	BY DATES BELOW
a. Complete initial site clearing	April 15, 1967
b. Earthwork and grading for roadway embankment between river pump house and reservoir area:	
(1) Start WORK	April 15, 1967
(2) Complete WORK	August 1, 1967
c. Preliminary Site Work:	
(1) Start WORK	March 15, 1967
(2) Complete WORK	November 1, 1967

5. Page 1-7, Article 1-09: Revise entire Article to read:

1-09. LINES AND GRADES
As specified in Article 3 of Form 1714. The property lines from which the axes shall be located are indicated on the E. M. Webb Property Line Maps listed in Article 2-03.

6. Page 2-2, under Article 2-02A: Revise title of Drawing B-57 to read:

B-57 Drainage Structure To Doza Creek

7. Page 2-3, Article 2-03, Survey Drawings: In Paragraph B, Item a, revise title to read:

a. Watershed Area NW of Baldwin:

Sheets 1, 2, 2A, 3, 3A, 4, 4A and 5 of 5

8. Page 3-1, Article 3-03B, Initial Clearing Contract: Revise "1'-0" above" to read "at".

9. Page 3-6, under Article 3-06Bd: Revise 3-10 after "Article" in last line to read "5-03".

10. Page 4-1, Article 4-01, Scope: Revise listing for Article 4-03 to read:

    4-03. Liming and Fertilizing:

11. Page 4-1, Article 4-03: Revise heading to read:

    4-03. LIMING AND FERTILIZING

12. Page 5-2, Article 5-03, Portland Cement Concrete Work: The following shall apply:

    A. Paragraph D, Splice Requirements for Reinforcing Bars: In third line, after ACI 318, insert the words ", or those indicated on drawings,".

    B. Paragraph F, Formwork: In third line, delete the words "in curing and".

13. Page 5-4, Paragraph K, Mud Slab: Revise first sentence to read:

    A concrete mud slab, 3 inches thick, shall be placed over foundation of spillway where indicated on drawings.

14. Page 5-6, under Paragraph N, Control Joints: In Subparagraph b, second line, insert "wall" before "control joints".

15. Page 6-2, under Article 6-04: The following shall apply:

    A. Paragraph E, Rubber Sealant Closures: Revise Subparagraph a to read:

       a. Conform to applicable requirements of Form 1755, except depth of sealant in joints shall be equal to width of joint.

    B. Paragraph F, Rubber Control Joint Strips: In second line, insert the word "wall" before "control joints".

16. Page 6-6, under Article 6-09C, Installation: Revise Subparagraph d to read:

    d. Backfill: As specified in Article 7.6 of Form 1714 and as indicated on drawings.

Bidder shall state in his proposal that provisions of this Addendum No. 1 have been covered.

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

TABLE OF CONTENTS

TABLE OF CONTENTS, Cont.

Where Specification is revised by Addendum notation in margin indicates Addendum number and Addendum item which pertains.

SPECIFICATION FOR
COOLING RESERVOIR AND ASH POND

SECTION 1 - SPECIAL CONDITIONS

1-01. PURCHASER: ILLINOIS POWER COMPANY.

1-02. NAME OF PROJECT: BALDWIN POWER STATION - UNIT 1.

1-03. LOCATION OF PROJECT
Near Baldwin, Illinois

1-04. SCOPE OF WORK

A. Contractor shall perform the following WORK for and at the above Station site:

COOLING RESERVOIR AND ASH POND WORK, complete as indicated on drawings and as hereinafter specified.

B. Specification Sections: For convenience of reference, this Specification covering the WORK consists of 6 sections, as indicated in the Table of Contents which forms a part hereof.

C. WORK FURNISHED AND INSTALLED, OR PERFORMED: Contractor shall furnish, deliver, and unload materials for, shall store and remove materials from storage for, and shall construct, erect, install and/or perform and finish the following WORK, subdivided as indicated: ADD.1 Item 2

a. Cooling Reservoir: The portion of the WORK for the Cooling Reservoir will include the following major features: Earth dam, concrete spillways, earth dikes around and within the Cooling Reservoir, grading within the Cooling Reservoir, intake, discharge and drainage channels, drainage ditches around the Cooling Reservoir, concrete box culvert in ditch to Doza Creek, and gravel service roads providing access to and along the crest of the Cooling Reservoir dam and dikes.

b. Ash Pond: The portion of the WORK for the Ash Pond will include the following major features: Earth dikes on two sides of the Ash Pond, corrugated metal and timber outfall structures, earth-rock dikes at outfall structures,and gravel service road providing access to dikes and culverts. ADD.1 Item 2

c. The foregoing WORK includes the following:

(1) Completion of clearing and grubbing (including disposal of material) of areas for embankments, spillway, outfall structures, channels, dikes, reservoir gradings, drainage ditches, service road, and borrow areas.

(2) Diversion and care of water, including temporary cofferdams, channels, flumes, drains, sumps, pumps and all other temporary facilities required to perform the WORK in the dry, and including removal of all such temporary facilities.

(3) Excavation for embankments, spillways, outfall structures, channels, ditches, reservoir grading, and excavation from borrow areas.

(4) Compacted fill for dam and dikes, etc., including foundation preparation, impervious fill, earthfill, sand and gravel fill, gravel fill, riprap, topsoil, seeding, etc.

(5) Concrete spillway and other miscellaneous concrete work.

(6) Gravel service road including foundation preparation and gravel for road on crest of dikes and for access roads to dikes.

(7) All other work as indicated on drawings, as herein specified or as required to properly complete the WORK.

D. WORK BY OTHERS: The following related work will be furnished and delivered, or furnished and installed, or performed, by others:

a. Initial site clearing, consisting of the following:

(1) Cutting all trees 1" in diameter or larger level with existing grade elevations, in Reservoir area, Ash Pond area and Plant area.

(2) Knocking over or cutting of all trees 1" in diameter or larger in dike and dam area.

(3) Disposal and/or burning of all cut and/or knocked down trees, bushes, brush and loose vegetation.

b. Earthwork and grading for roadway embankment between river pump house and reservoir area. ADD.1 Item 3

1-05. SCHEDULE OF WORK

A. General Release of Areas for WORK:

a. It will not be possible for Purchaser to immediately release all areas for the WORK to Contractor since three (3) areas within the limits of WORK will not be owned by Purchaser at the time the WORK begins. These areas, identified on the drawings as "Access pending", are as follows: ADD.1 Item 4

(1) The portion of the Cooling Reservoir including dikes, reservoir grading, and borrow area in the southwest corner of the Cooling Reservoir.

(2) Work on dam and spillways cannot start until Purchaser has secured a flood easement for "Access Pending" areas.

(3) The portion of the ash pond, including dikes, in the northwest corner of the Ash Pond. ADD.1 Item 4

b. Until arrangements have been completed by Purchaser to secure these pieces of property, Contractor shall neither trespass nor perform any work on these pieces of property without securing written approval from Purchaser to proceed with work in these areas.

c. Contractor shall include in the FIRM LUMP SUM PRICE AND FIRM UNIT PRICES all costs which may result from delays in completing the WORK in these three (3) areas.

B. Scheduled Dates:

a. In accordance with foregoing requirements, Contractor shall perform the WORK in accordance with following schedule: ADD.1 Item 4

	ITEM	BY DATES BELOW
a.	Start WORK for Cooling Reservoir....	May 1, 1967
b.	Start WORK for Ash Pond.............	June 1, 1967
c.	Install observation wells...........	Before creek at dam site is permanently closed
d.	Installation of Closure Dike at southeast corner of Cooling Reservoir.........................	Shall be last portion of Cooling Reservoir dike system constructed unless otherwise approved by Purchaser. Do not place any fill for dike before authorization received from Purchaser.
e.	Complete all WORK, except final seeding (providing that areas not owned by Purchaser at time construction is started are released for work by October 1, 1967).......	December 1, 1967
f.	Complete final seeding, subject to conditions indicated in Article 1-05C	May 1, 1968

C. Extension of Scheduled Dates: Should there be any delay in release of areas for WORK that are not owned by Purchaser at time WORK begins, the Scheduled Dates will be extended in accordance with the following provisions providing that the particular areas are released to Contractor for the WORK before May 1, 1968: ADD.1 Item 4

a. If area in southwest corner of Cooling Reservoir has not been released by October 1, 1967, the date for completing WORK in this area will be extended to July 1, 1968.

b. If area in northwest corner of Ash Pond has not been released by November 1, 1967, the date for completing WORK in this area will be extended to June 1, 1968.

D. The date for completing final seeding in areas released after October 1, 1967 will be extended to September 15, 1968 or the end of the first final seeding period following temporary seeding. ADD.1 Item 4

E. Release of WORK after May 1, 1968: If any area of WORK is not released to Contractor by May 1, 1968 and Purchaser does not delete that portion of WORK from the Contract, Contractor will be granted a time extension and an equitable adjustment to the FIRM LUMP SUM PRICE to reflect costs incurred by Contractor due to the delay of portions of WORK beyond May 1, 1968. ADD.1 Item 4

F. Contractor's Schedule of WORK: Within one week after notification of award of Contract, Contractor shall submit, in duplicate, a schedule graphically representing starting and completion dates of each phase of the WORK. ADD.1 Item 4

G. Work by Others: Related work by others is scheduled as follows: ADD.1 Item 4

ITEM	BY DATES BELOW
a. Complete initial site clearing..........	April 15, 1967
b. Earthwork and grading for roadway embankment between river pump house and reservoir area:	
(1) Start Work	April 15, 1967
(2) Complete Work....................	August 1, 1967

1-06. SPECIFIED PRODUCTS AND SUBSTITUTIONS

The BASE BID shall not contain substitutions for Specified Products; see Standard Requirements Form 1707.

1-07. DEFINITIONS

A. See Standard List, Form 1708.

B. Harza Engineering Company is acting as the subcontractor to Sargent & Lundy for design of the WORK under this Specification T-2226.

C. Wherever the terms "approved", "as approved", "satisfactory", "as requested", or other similar terms are used in this Specification, they shall mean "as approved, etc., by the Consulting Engineers", unless otherwise specifically stated.

D. Contractor is herewith designated as the Reservoir Contractor.

1-08. JOB CONDITIONS

A. Examination of Site:

a. Contractor shall visit site during Bid Period to familiarize himself with conditions under which WORK required to be done.

b. Contractor shall consult with Purchaser's Construction Department as to means of access to site of WORK and methods to be used in unloading and bringing materials and equipment onto site.

c. Contractor's plea of ignorance of existing or foreseeable conditions which will create difficulties or hindrances in execution of WORK not acceptable as excuse for any failure on part of Contractor to fulfill in every detail all requirements of Specification and/or drawings. Furthermore, Contractor's plea of ignorance not acceptable as basis for any claim whatsoever for additional or extra compensation.

B. Railroad Facilities: The Gulf, Mobile and Ohio Railroad passes through Baldwin. At present there is no railroad sidetrack at the site.

C. Highway Access:

a. Illinois State Highway 154 passes through Baldwin, and an approved secondary road runs north from Baldwin near the eastern edge of the site.

b. Access roads into and within the site area, if required, shall be furnished and installed by Contractor at his own expense, and shall be located and shall be of construction as approved or as requested by Purchaser.

D. Utilities: Contractor shall provide all necessary electricity, water and compressed air required for his WORK.

E. Toilet Facilities:

a. Contractor shall provide own temporary sanitary toilet facilities required for own work.

b. Contractor shall maintain all toilet facilities in a clean condition whether or not used by other than own employees, provide all necessary towels, paper, etc., and repair and maintain such facilities if and as requested.

F. Office and Storage:

a. Purchaser will provide, free of charge, suitable space for location of Contractor's office, shops and warehouses and for storage of materials and equipment.

b. Purchaser will designate areas available for such use at time Contractor visits job site during bid period. Contractor shall provide any additional facilities required for own use.

c. Contractor shall provide and maintain temporary buildings and associated electrical work required for own use.

d. Prior to erection of any temporary buildings, Contractor shall submit plans to Purchaser's representative for general approval of materials and appearance.

G. Burning of Debris on Premises: Will be permitted, subject to requirements of Article 4.5.2 of Form 1714.

H. Fire Protection: Provide, as specified in Article 4.5.2.5 of Form 1714.

I. Temporary Barricades: The Contractor shall provide all temporary barricades as required for safety.

J. Temporary Heat:

a. Contractor shall provide and maintain all temporary heating and temporary enclosures as required to insure continuous, efficient and uninterrupted execution of WORK.

b. Temporary enclosures shall be weathertight and shall provide for proper access to all work.

c. Temporary heating equipment, operation and maintenance thereof, shall be such as to cause no fire hazard.

K. Identification and Admittance of Workmen: Purchaser's Gate Officers will not be permitted to admit Contractor's or his subcontractors' employees until they have been identified by Contractor's or his subcontractors' delegated representative on the WORK.

L. Station Rules: Abide by any/all rules Purchaser may have in effect at station site pertaining to handling of men, equipment and materials.

M. Removal of Temporary Facilities: Contractor shall remove temporary facilities provided on premises for own use at termination of their usefulness or termination of WORK, or when requested, and shall leave premises in condition satisfactory to Purchaser's representative in every respect.

1-09. LINES AND GRADES

As specified in Article 3 of Form 1714. ADD.1 Item 3

1-10. PROTECTION

Contractor is responsible for protecting all facilities and work in vicinity from damage from his operations. The following are particularly called to his attention:

A. Numerous cased oil, gas, and water wells; various public utility lines; tracks of the Gulf, Mobile, and Ohio Railroad, State Highway Route 154; etc. are within or immediately adjacent to reservoir area.

B. In addition, all or portions of three farms are in the area of the WORK that will not be made immediately available to Contractor. These farms will probably be maintained in operation during the progress of the WORK.

C. Contractor shall provide all necessary protection, as required, as approved, or as requested, to prevent damage to any portions of cased wells, utilities, farms, railroad tracks or highways, and to prevent any interruption of utility or railway services.

D. Contractor shall exercise extreme care to protect all fences outside of areas released for WORK, and to keep farm fence gates closed so as not to permit escape of farm animals.

E. Contractor shall pay costs of any damages arising from Contractor's acts of omission or commission with respect to these requirements.

1-11. MAINTENANCE OF EXISTING ROADS ON PURCHASER'S PROPERTY

A. Maintain all existing roads at site which are indicated to remain as permanent roads, and which are used by Contractor during course of WORK. Provide maintenance as required, as approved and/or requested, and satisfactory to Purchaser in every respect.

B. Provide temporary bridges, as approved and/or as requested, across all road openings which Contractor cuts for WORK and which interfere with movement of traffic (as determined by Purchaser's representative) at site.

C. Replace portions of existing roads cut by Contractor in accordance with requirements hereinafter specified in Section 3.

1-12. PERMITS

A. Purchaser will obtain all State, County, Township and City permits for the WORK.

B. Contractor shall obtain, at his own expense, all other permits required for the WORK in accordance with Article 11 of Purchaser's General Conditions. Contractor shall arrange with Purchaser for Purchaser's representative to accompany Contractor in securing all such permits.

1-13. PERFORMANCE OF WORK

A. The WORK shall be performed using a normal work week of eight hours per day, five days per week, Monday through Friday. However, Contractor in performing the WORK shall adequately man the job and work such hours per day and days per week as may be necessary to meet the construction schedule, such overtime to be at no additional cost to Purchaser.

B. In the event Contractor determines it necessary to schedule his work force more than eight hours per day for five days per week Monday through Friday, he shall consult in advance with Purchaser's representative to make certain that such a schedule will not conflict with other WORK at the job site. Contractor shall bear all costs that may be incurred in procuring and/or maintaining the necessary labor force on the job, including such items as overtime, bonus or premium time, and transportation and living expenses.

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

SECTION 2 - DRAWINGS, SUPPLEMENTS AND STANDARD SPECIFICATIONS

2-01. SCOPE

This section of the Specification includes the following, under the Article numbers indicated, which shall apply to the WORK:

2-02. List of Design Drawings (Consulting Engineers')
2-03. List of Survey Drawings
2-04. List of Supplements and Standard Specifications
2-05. Requirements for Contractor's Shop Drawings
2-06. Requirements for Samples

2-02. DESIGN DRAWINGS (CONSULTING ENGINEERS')

A. The following design drawings by Harza Engineering Company and the Consulting Engineers, dated or revised March 28, 1967, form a part hereof:

C12 Location and Project Plan
C13 Dam & Dike Alignment
C14 Location of Exploration, Borrow, and Grading
C15 Boring Logs - Sheet 1
C16 Boring Logs - Sheet 2
C17 Boring Logs - Sheet 3
C18 Boring Logs - Sheet 4
C19 Boring Logs - Sheet 5
C20 Boring Logs - Sheet 6
C21 Boring Logs - Sheet 7
C22 Test Pits & Trenches - Sheet 1
C23 Test Pits & Trenches - Sheet 2
C24 Laboratory Data - Sheet 1
C25 Laboratory Data - Sheet 2
C26 West Dike - Sheet 1
C27 West Dike - Sheet 2
C28 West Dike - Sheet 3
C29 South Dike
C30 Intake Channel
C31 East Dike - Sheet 1

C32 East Dike - Sheet 2

C33 East Dike - Sheet 3

C34 North Dike

C35 Drainage Ditch to Doza Creek

C36 Baffle Dike

C37 Ash Pond Dike - Sheet 1

C38 Ash Pond Dike - Sheet 2

C39 Ash Pond Dike - Sheet 3

C40 Ash Pond Dike - Sheet 4

C41 Dam - Plan

C42 Dam - Sections & Details

C43 Dam & Spillway Excavation

C44 Spillway - Plan & Sections

C45 Spillway - Sections

C46 Spillway - Details

C47 Spillway - Reinforcement - Sheet 1

C48 Spillway - Reinforcement - Sheet 2

B-57 Drainage Structure - Plan and Sections

B-60 Ash Pond Outfall Structures ADD. 1 Item 6

B. The following design drawings by the Consulting Engineers form a part hereof for reference only:

a. General:

B-1 Plan of Test Boring and Initial Site Clearing - Sh 1

B-2 Plan of Test Boring and Initial Site Clearing - Sh 2

B-3 Logs of Test Borings - Sh 1

B-4 Logs of Test Borings - Sh 2

B-5 Logs of Test Borings - Sh 3

B-6 Logs of Test Borings - Sh 4

B-8 Location Plan - Sheet 1

B-9 Location Plan - Sheet 2

b. Preliminary Work Contract:

B-53 Initial Site Development Plan - Plant Area - Sheet 1 - Unit 1

B-54 Initial Site Development Plant Area - Sheet 2 - Unit 1

c. River Pump House Contract:

B-69 River Pump House - Roadway and Grading - Plan

B-70 River Pump House - Roadway and Grading - Sections

2-03. SURVEY DRAWINGS

The following survey drawings are available for reference inspection at the offices of the Consulting Engineers, and prints will be issued to Contractor, after award of Contract, if Contractor so requests:

A. Property Line Maps by E. M. Webb:

Sheet 0 through Sheet 9 - Land Survey Plat

B. Aerial Topographic Survey Drawings by Clyde E. Williams & Associates, Inc., compiled by photogrammetric methods:

a. Watershed Area North of Baldwin:
Sheets 1, 2, 2A, 3, 3A, 4, 4A and 5 of 5 — ADD.1 / Item 7

b. Plant Site and Dike Area North:
Sheets 1 and 2 of 2

c. Baldwin Dam Site and Northwest Dike Area:
Sheet 1 of 1

2-04. SUPPLEMENTS, STANDARD SPECIFICATIONS

A. The following are attached hereto and form a part hereof:

a. Supplements:

(1) Form 303-IPCo. General Conditions (12-23-66).
(2) Purchaser's Contract Insurance Provisions dated 4-18-67. These provisions shall prevail in the event of any conflict with corresponding provisions of the General Conditions (Form 303-IPCo). *
(3) Purchaser's Statement of Policy - Field Labor Contracts (11-15-61).

b. Building Standard Specifications:

(1) Form 1701-E - Standard Specification for Welding in Building Construction.

(2) Form 1707-B - Standard Requirements for Specified Products and List of Approved Manufacturers.

(3) Form 1708 - Standard List of Definitions and Reference Publications.

(4) Form 1714 - Standard Specification for Earthwork.

(5) Form 1715-Q - Standard Specification for Concrete Work.

(6) Form 1737-B - Standard Specification for Anchor Bolts.

(7) Form 1742-E - Standard Specification for Miscellaneous Metalwork, Building Work and Embedded Work.

(8) Form 1743-B - Standard Specifications for Crib House Grills, Stop Logs and Gates.

(9) Form 1746-K - Standard Specification for Plumbing Work (pages 1 through 15 only - no Standard Drawings).

(10) Form 1755 - Standard Specification for Rubber Sealants.

(11) Form 1760 - Standard Specification for Carpentry and Millwork.

(12) Form 1790-E - Standard Specification for Prime Coat Painting.

B. Reference to foregoing Standard Specifications elsewhere in this Job Specification and on drawings do not include letter suffix (which indicates latest revision) after form number.

C. In the event of variation between the foregoing Standard Specifications, and the Job Specification or Design Drawings, the Job Specification and Design Drawings shall govern.

2-05. <u>SHOP DRAWINGS (CONTRACTOR'S)</u>

A. Submit shop drawings for approval as follows:

a. As specified in the respective Standard Specifications.

b. Five (5) sets of shop drawings for all fabricated materials included in the WORK, and for which shop drawings are not specified elsewhere.

B. Submit drawings and receive approval of the Consulting Engineers prior to starting any work relating to said drawings.

C. After final approval of the above required drawings, furnish the Consulting Engineers with seven (7) complete sets of approved shop drawings.

2-06. <u>REQUIREMENTS FOR SAMPLES</u>

A. Submit in accordance with Form 1707.

B. Address samples and containers to following:

a. Samples to Purchaser:

Illinois Power Company
500 South 27th Street
Decatur, Illinois
Attention: Mr. A. Kraakevik, Vice President

b. Samples to Sargent & Lundy:

Sargent & Lundy, Engineers
140 South Dearborn Street
Chicago, Illinois 60603
Attention: Mr. S. Rurka

C. Products for which samples are required are hereinafter listed in the last Article of applicable Sections, and these Sections are identified in the Index by the notation "Samples Required".

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

SECTION 3 - CLEARING, DEMOLITION, ALTERATION AND EARTHWORK

3-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

- 3-02. Physical Data
- 3-03. Clearing, Grubbing, Demolition and Alteration Work
- 3-04. Diversion and Care of Water
- 3-05. Excavation
- 3-06. Fill
- 3-07. Laboratory Control for Fill Compaction
- 3-08. Instrumentation.

3-02. PHYSICAL DATA

Physical data indicated on drawings, including topography, boring logs, and laboratory soil test results are furnished for information only, and it is expressly understood that neither Purchaser nor the Consulting Engineers will be responsible for any interpretation or conclusion therefrom. Driller's logs for all borings made at the site and detailed results of laboratory soil tests are available for inspection at the Chicago office of the Consulting Engineers. In addition to the borings made for this WORK, additional borings were made in the area of the Power Station for purpose of plant foundation design. The location and the logs for these supplemental borings are also available for inspection at the Chicago office of the Consulting Engineers. Contractor will be allowed, at his own expense, to collect his own physical data.

3-03. CLEARING, GRUBBING, DEMOLITION AND ALTERATION WORK

A. Scope: Contractor shall complete clearing, and shall grub areas on which the embankments, spillway, outfall structures, drainage ditches, and service roadways will be built and shall complete clearing of areas behind dikes where fill will be placed to raise natural ground level. These requirements do not pertain to clearing and grubbing of borrow areas and Contractor's work areas.

B. Initial Clearing Contract: Initial clearing operations have been conducted within the cooling reservoir area up to property lines or clearing limits indicated on drawings. Trees have generally been cut off 1'-0" above ground level. The uncleared area in ADD. 1 Item 8 southwest corner of cooling reservoir, where access is pending, will be cleared by the Initial Site Clearing Contractor as soon as access can be arranged. Where additional clearing is required to construct the WORK, it shall be performed in accordance with the following paragraph "Additional Clearing."

C. Additional Clearing: Where additional clearing is necessary to construct the WORK, conform to applicable requirements of Article 4 of Form 1714, and to following requirements:

a. No clearing shall be done outside of area necessary to construct the WORK without specific approval.

b. Purchaser reserves right to designate any vegetation to be carefully protected from damage by Contractor's operations.

c. Trees: Remove by either cutting within 6" above ground or by uprooting. If trees are uprooted, backfill holes with compacted earthfill as specified in Article 3-06.

d. Grubbing: As specified in Article 4.4 of Form 1714. Contractor shall grub all areas under structures and as indicated on drawings. Explosives may be used. Holes formed by grubbing operations shall be filled with compacted earthfill as specified in Article 3-06.

e. Disposal: As specified in Article 4.5 of Form 1714, except that buried material shall have 2'-0" of cover.

D. Demolition Work:

a. Purchaser may elect to sell certain existing buildings for removal from site. Contractor shall check with Purchaser's representative during visit to site to determine extent of these operations.

b. Contractor shall remove all other existing buildings and fences down to ground level. Foundations need not be removed, but shall be filled to ground level with compacted earthfill as specified in Article 3-06.

E. Altering of Existing Well Casings:

a. A number of cased gas, oil, and water wells are located on Purchaser's property. As indicated on drawings, some of these are located in areas of required excavation or grading. Precautions shall be taken to prevent hitting these wells with construction equipment during excavation or hauling operations in the vicinity.

b. When adjacent ground has been excavated to grade, well casings shall be cut off to grade upon approval of Purchaser's representative. Although wells are plugged, there is a possibility that gas could escape through the plug and provide a potential source of danger should casing be penetrated with a cutting torch. In this regard, casings of all altered wells shall first be vented by removing the cap and/or by making a vent hole with an electric drill bit soaked with oil or water.

c. The wells will be replugged by others under the direction of the Purchaser. The Contractor shall permit unrestricted access to the wells for this purpose.

3-04. DIVERSION AND CARE OF WATER

A. General: Contractor shall construct and maintain all necessary cofferdams, channels, flumes, drains, and sumps, and shall furnish, install, and operate all pumps needed for diversion and care of water from any source so that all work can be performed in the dry.

B. Approval of Plans: Contractor's plans for diversion and care of water shall be subject to approval by Purchaser.

C. Responsibility: Contractor shall be responsible for all diversion and care of water and shall repair at his own expense any damage to foundation or structures caused by water from any source regardless of previous approval.

D. Responsibility for Restriction of Natural Drainage by Dikes:

a. Contractor shall not place any fill for dikes across routes of natural drainage until provisions are made to drain surface runoff into reservoir or into drainage ditches forming part of the WORK.

b. No surface runoff shall be ponded or restricted to a greater degree than would have occurred naturally either before the beginning of construction or after completion of the WORK, unless approved by Purchaser.

c. Should ponding or restriction of surface runoff result in water being backed up onto property not owned by Purchaser or onto Purchaser's property where work by other contractors is either under way or completed or where materials or equipment are being stored, all damages resulting therefrom shall be responsibility of Contractor.

E. Temporary Slopes: Temporary construction slopes in excavation or in fill used for diversion channels or cofferdams within an area from 200 feet upstream to 200 feet downstream of center line of dam shall not be steeper than 4 horizontal to 1 vertical, except as indicated on drawings or as approved.

F. Unwatering: Unwatering shall be accomplished in a manner that will prevent loss of fines from the foundation, will maintain stability of excavated slopes and bottoms of trenches, and will result in all construction operations to be performed in the dry except in approved sumps.

3-05. EXCAVATION

A. Scope: Contractor shall perform all excavation for embankments, spillway, outfall structures, service roads, intake, discharge, and drainage channel, drainage ditches and culverts. Excavation shall conform to applicable requirements of Article 5 of Form 1714, and to requirements hereinafter specified.

B. Definitions:

a. Stripping is defined as removal of sod, topsoil and rubbish in areas indicated on drawings and in borrow areas.

b. Common excavation is defined as all excavation not otherwise defined as stripping, rock excavation, dental excavation, or borrow excavation.

c. Rock excavation is defined as excavation of all solid rock in place which cannot be removed by hand, power shovel, dragline, ripping, or earth moving equipment without continuous and systematic blasting, barring, or wedging. Removal of boulders or individual loose rock, one cubic yard or more in volume, will be classified as rock excavation.

d. Dental excavation is defined as excavation consisting of removal of rock fragments or decomposed materials from seams, joints and solution channels beyond lines of excavation when such removal requires use of hand tools and hand methods. Extent of dental excavation is expected to be small and shall be as requested by Purchaser's representative.

e. Borrow excavation is defined as all excavation in borrow areas, except stripping.

C. Procedures: Excavation may be accomplished by any method and by use of any excavation and hauling equipment adapted to the work. Blasting may be used, subject to requirements of Article 5.11 of Form 1714. All necessary precautions shall be taken to preserve material below bottom of spillway excavation in undisturbed condition. Any damage to work due to Contractor's operations, including disturbance of material beyond lines of excavation, shall be repaired where requested in a manner as approved, and by and at expense of Contractor. Methods of dental excavation shall be such as to avoid fracturing of rock adjacent to material being removed.

D. Limits: All excavation shall be performed to lines and grades indicated on drawings or as requested. Any over-excavation or excess excavation, not requested by Purchaser, shall be at expense of Contractor.

E. Repair of Over-Excavation: Where required or requested to complete work, over-excavation shall be backfilled with materials furnished and placed at expense of Contractor. Underneath embankments, backfill shall consist of impervious fill placed in accordance with Article 3-06. Underneath the portion of the spillway upstream of the drainage blanket, backfill shall consist of impervious fill, placed at optimum moisture content and compacted to 100% standard Proctor maximum density. Downstream of the spillway control structure but upstream of the portion of the stilling basin on rock, backfill shall consist of sand and gravel compacted to 70% relative density. Where rock beneath the stilling basin is over-excavated, backfill shall consist of concrete.

F. Foundation Protection: Finished excavated surfaces shall be protected against damage by movements of construction equipment or other causes. As far as practicable, excavated surfaces shall be protected against erosion by surface runoff. Finished grade on which concrete structures will be placed shall be covered with a drainage blanket or a 3-inch protective concrete layer (mud slab) where indicated on drawings within 24 hours after excavating. Drainage blanket shall also be covered with a mud slab. No traffic shall be allowed on final excavated surface until protective concrete layer (mud slab) has been placed and properly cured. This procedure may be carried out in sections in order to facilitate work.

G. Excavated Materials: Suitable excavated materials may be used as fill or as topsoil if usable and approved. Material excavated from the dam core trench shall be used only as random fill unless otherwise approved. Material may be placed either immediately or may be stockpiled first. Excess excavated material or unsuitable material shall be disposed of in spoil areas within the reservoir where indicated on drawings, in abandoned portions of borrow areas below elevation 425.0, or as approved. Disposal banks shall be sloped to drain and shall not interfere with natural drainage from surrounding land.

H. Borrow Areas: All fill not available from required excavation shall be taken from borrow areas as indicated on drawings or as otherwise approved. Fill for dam shall come from dam and spillway excavation, from Borrow Area A, and from approved required excavation. Purchaser does not guarantee that all material within designated borrow areas will meet requirements of the Specification. Selective loading and placing might be required to produce required quality and uniformity of fill in embankments. At all times during operations in borrow areas, Contractor shall maintain adequate drainage to nearest natural drainage outlet. Sand, gravel, riprap, and rockfill shall not come from areas within Purchaser's property unless otherwise approved.

3-06. <u>FILL</u>

A. Scope: Contractor shall prepare the foundation, furnish, place and compact all fill, and maintain structures in a satisfactory condition at all times until acceptance of the WORK.

B. Foundation Preparation:

a. No material shall be placed until the foundation therefor has been unwatered and suitably prepared and has been approved.

b. Except for areas of abutment blanketing at dam, the earth foundation shall be prepared by leveling and scarifying to a depth of 2 inches. Surface material shall be compacted with, and as part of, the first layer of fill as herein specified for subsequent layers of fill. All existing cavities in foundation shall be filled with compacted earthfill.

c. Areas of abutment blanketing shall be scarified to a depth of 6 inches and compacted with a tamping roller. Where depressions exist, such as holes left from grubbing operations or narrow erosion gullies, they shall be filled with impervious fill and scarified to a depth of 2 inches.

d. Rock surface on bottom of core trench shall be the top of alternating limestone and shale. Contractor shall remove all loose blocks and fragments by barring, prying, and employment of other hand methods which will not further fracture the rock. Rock surface shall be free of overhangs. Local fractured zones shall be removed by dental excavation methods, and backfilled with dental concrete. Dental concrete shall conform to requirements for Class AA concrete in accordance with Article 3-10. ADD. 1 Item 9

e. Subgrade under the portion of gravel service roads placed on stripped ground surface shall be scarified to a depth of 4 inches and compacted with heavy pneumatic tired rollers as specified in Article 3-06 Fa "Moisture Content and Compaction - Impervious Fill and Earthfill". To provide a reasonably firm and smooth foundation for overlying gravel surface, grading or rolling with a smooth cylindrical roller may be required.

C. Materials:

a. Impervious Fill: Impervious fill shall consist of fine grained soil as obtained from required excavation or the borrow areas indicated on drawings. Impervious fill shall contain at least 50% material passing No. 200 U. S. Standard Sieve. It shall not contain cobbles or broken rock larger than 5 inches nor shall it contain more than 1% organic material.

b. Clay Fill: Clay fill, used as slope protection on Baffle Dike, shall consist of cohesive, fine grained soil classified by the United Soil Classification System as CL. It shall contain not more than 1% organic material.

c. Earthfill: Earthfill shall consist of fine and/or coarse grained soil from required excavation and borrow areas indicated on drawings. Earthfill shall not contain cobbles or broken rock larger than 5 inches nor shall it contain more than 1% organic material.

d. Random Fill: Random fill shall consist of any soil from required excavation and borrow areas indicated on drawings providing that it does not contain more than 5% organic material.

e. Sand and Gravel Fill: Sand and gravel fill shall consist of a clean, well graded mixture of sand and gravel, crushed stone or crushed gravel conforming to following gradation limits:

(1) Maximum Size: 3 inches.
(2) Between 65% and 85% shall pass 1½ inch U. S. Standard Sieve.
(3) Between 40% and 60% shall pass No. 4 U. S. Standard Sieve.

(4) Between 20% and 35% shall pass No. 30 U. S. Standard Sieve.

(5) Between 15% and 25% shall pass No. 50 U. S. Standard Sieve.

(6) Less than 15% shall pass No. 100 U. S. Standard Sieve.

(7) Less than 5% shall pass No. 200 U. S. Standard Sieve.

f. Gravel for Service Roads: Gravel for service roads on crest of dam, dikes, and elsewhere shall consist of gravel, crushed gravel or crushed stone meeting requirements of Section 29 (Gravel or Crushed Stone Base Course) of the State of Illinois Division of Highways' Standard Specification for Road and Bridge Construction.

g. Gravel Fill: Shall consist of gravel, crushed stone or crushed gravel, reasonably well graded from No. 4 U. S. Standard Sieve to 3 inches. Not more than 15% shall pass No. 4 sieve and not more than 5% shall pass No. 200 sieve.

h. Gravel Drain: Gravel for gravel drain under spillway shall meet criteria specified in ASTM C337 for coarse concrete aggregate. 3/4 inch to No. 4.

i. Riprap:

(1) Riprap shall consist of quarried stone, or other stone, free from structural defects and of approved quality. Stone containing shale, unsound sandstone or any other material which will readily disintegrate under handling and placing or weathering, shall not be used. Any stone which is free from incipient fractures and seams and has given evidence of ability to withstand weathering after long exposure to the elements shall be considered suitable for this purpose. Upon presentation of satisfactory evidence of ability to withstand weathering, such stone may be used without laboratory testing. In case newly quarried stone or stone of questionable weathering quality is proposed, it shall be subjected to the sodium sulphate soundness test and shall show a loss, after five cycles, of not more than 25%. Materials failing this test may be approved if, when subjected to fifty cycles of freezing and thawing, it has a loss not greater than 25%. Soundness method AASHO T104 (ASTM C88), "Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate" or T103, "Method of Test for Soundness of Aggregates by Freezing and Thawing" shall be used. The moist unit weight of riprap shall not be less than 140 pounds per cubic foot.

(2) Riprap shall be reasonably well graded with a gradation conforming to following weight limits (in pounds) for the particular layer thickness:

	Layer Thickness	At least 50% Larger Than	Maximum Size	Minimum Size
(a)	12 inches	40	150	5
(b)	18 inches	90	350	10
(c)	24 inches	160	650	20

(d) The shortest dimension of any stone shall be not less than 1/3 of the longest dimension.

j. Rockfill: Rockfill shall consist of quarried stone or other stone that meets requirements for a 12 inch layer of riprap as specified foregoing.

k. Topsoil: Topsoil shall be obtained from approved stockpiles of materials from stripping for dam, dikes, spillway, borrow areas, reservoir grading or other required excavation, and from other approved areas within limits of reservoir and ash pond. Material shall contain the most fertile loam available from approved sources. Material shall be free from excessive quantities of grass, roots, weeds, sticks, stones, or other objectionable materials.

l. Temporary Slope Protection: Upstream portion of dam below riprap shall be protected from reservoir wave action during reservoir filling by a 12 inch layer of temporary slope protection. This layer shall consist of either clay fill or gravel fill as specified foregoing or rock from required excavation or quarry operations. If rock is used, it does not have to meet the quality requirements for riprap providing that it will not readily disintegrate under handling and placing or during three years of weathering.

D. Equipment:

a. Compaction Equipment: Equipment to be used for constructing various types of fill may consist of any type normally considered suitable to construct embankments for dams or major highways. Main compaction equipment, including heavy pneumatic tired rollers, tamping rollers, segmented pad rollers, vibratory compactors, shall be subject to approval of Purchaser's representative.

b. In addition to the foregoing equipment, Contractor shall have the following equipment available at the WORK:

(1) Power tampers to be used for compaction of material in areas where it is impractical to use a roller or tractor.

(2) A plain cylindrical roller, weighing not less than 1,000 lbs. per lineal foot for rolling the surface of fill smooth for drainage in case of heavy precipitation.

(3) Discs, harrows, and motor graders for drying and maintaining fill.

E. Placing:

a. General. Fills shall be placed to lines and grades indicated on drawings. No brush, roots, sod, or other perishable or unsuitable materials shall be placed in fills. No material shall be placed when either fill material or foundation is frozen.

b. Placing Impervious Fill, Earthfill, and Random Fill.

(1) Fill materials shall be placed in continuous, approximately horizontal layers with moisture content and thickness as specified in Article 3-06F, "Moisture Control and Compaction." Embankments shall be maintained approximately level but with sufficient slope to assure rapid runoff of rainfall.

(2) Distribution and gradation of materials throughout rolled fill shall be such that fill will be free from lenses, pockets, streaks, or layers of material differing materially in texture or gradation from surrounding material. Combined excavation and placing operations shall be such that materials when compacted in the fill will be blended sufficiently to secure the best practicable degree of compaction, impermeability, and stability. Travel on the fill shall be satisfactorily controlled to prevent tracking or cutting fill.

(3) Successive loads of material shall be dumped so as to produce the best practicable distribution of material, and for this purpose locations in earthfill where individual loads shall be deposited may be designated, to the end that more clayey materials shall be placed in areas adjacent to center of embankments and less clayey materials placed toward outside slopes. If the surface of any layer of rolled fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, or has formed a hard overcompacted crust from traffic, it shall be moistened or both moistened and scarified as required before the succeeding layer of material is placed.

(4) When rain is expected, and at the end of each working day, fill shall be rolled with a plain cylindrical roller to form a smooth surface with sufficient slope to cause rapid runoff of rainwater. Before resuming placement, this surface shall be scarified. If, in the opinion of Purchaser's representative, the rolled surface of any layer of earthfill in place is too wet for proper compaction of fill thereon, it shall be removed, allowed to dry, or shall be worked with a harrow, scarifier or other suitable equipment, to reduce water content to the required amount, and then shall be recompacted before the next succeeding layer of fill is placed.

(5) All openings through embankments required for construction and temporary drainage purposes shall be subject to approval, and such openings, if approved, shall be constructed so that side slopes are not steeper than 4 horizontal to 1 vertical. Approach or construction ramps on Cooling Reservoir or Ash Pond face shall be removed and those on outside face shall be removed and/or trimmed, as requested.

c. Placing Impervious Fill on Rock Surface at Bottom of Core Trench:

(1) Immediately prior to placement of impervious fill, rock surface at bottom of core trench shall be thoroughly cleaned of dirt and debris by streams of high pressure air and/or by brooms. Surface shall then be moistened but shall be free of running or standing water. A ½ inch minimum thickness of slush grout shall be broomed onto the cleaned surface of rock. Slush grout shall consist of a mixture of two parts soil to one part cement with a water-cement ratio of about 0.55 by weight. After slush grout has been applied and while it is still plastic and before it has taken an initial set, impervious fill shall be placed and compacted.

(2) Impervious fill shall be hand placed into depressions in foundation area and on top of slush grout and compacted by power tampers until fill is built up over the area to a depth sufficient for operation of roller equipment. Depth of hand placed layers shall be 4 inches and material shall be compacted to the density required for impervious fill under paragraph 3-06F, "Moisture Control and Compaction."

d. Placing Clay Fill Blanket on Baffle Dike:

(1) The layer of clay fill on each side of Baffle Dike may be placed as the earthfill portion of dike is being constructed or it may be placed on the slope of the completed earthfill embankment.

(2) If the surface of any layer of clay fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, or has formed a hard over-compacted crust from traffic, it shall be moistened or both moistened and scarified before the succeeding layer of material is placed.

(3) When rain is expected, and at the end of each working day, clay fill shall be rolled with a plain cylindrical roller to form a smooth surface to cause rapid runoff of rainwater.

e. Placing Sand and Gravel Fill, Gravel Fill and Gravel Drain:

(1) Drawings indicate thicknesses of sand and gravel fill, gravel fill, and gravel drain to be placed in various portions of the WORK.

(2) Method of placing shall be such as not to disturb the foundation on which sand and gravel or gravel layers are placed to the point that drainage efficiency of layer is impaired. Method of loading, hauling and placing shall be such that a uniform, unsegregated layer is obtained.

(3) All fine grained soil that accumulates on surface of sand and gravel fill during construction operations shall be removed before subsequent layers are placed.

f. Placing Gravel for Service Roads: Gravel service roads shall be 6 inches thick and shall be placed in accordance with requirements of Section 29 (Gravel or Crushed Stone Base Course) of the State of Illinois Division of Highways' Standard Specification for Road and Bridge Construction, with the exceptions indicated in Article 3-06F, "Moisture Control and Compaction".

g. Placing Riprap:

(1) Riprap may be placed by dumping and shall be placed on face of sand and gravel layer to the lines and grades indicated on drawings. Placement operations, including handling, stockpiling and transporting, shall be accomplished in such manner as to produce a reasonably well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stones and clusters of large stones and having a reasonably regular finished surface.

(2) Riprap shall be placed to its full course thickness in one operation, when placed in a layer, and in such manner as to avoid displacing underlying sand and gravel layer more than 3 inches. In no case, however, shall a bulldozer be used in shaping the riprap slope. Average thickness of any layer shall not be less than the full specified thickness required. A tolerance of plus or minus 2 inches from slope lines and grades indicated on drawings will be allowed in the finished surface for riprap in the layer 12 inches thick. A tolerance of plus or minus 3 inches will be allowed in the finished surface for riprap in the layer 18 inches thick. For either layer thickness, extremes of such tolerance shall not occur within areas of less than 100 square feet. Handplacing to a limited extent may be required but only to the extent necessary to secure results specified foregoing.

h. Placing Rockfill: Rockfill shall be placed by dumping to lines and grades indicated on drawings. Placement operations, including hauling, stockpiling, and transporting shall be accomplished in such manner as to produce a reasonable well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stones and clusters of large stones.

i. Placing Topsoil: Areas to receive topsoil shall be brought to within 4 inches of prescribed final cross-section at all points and finished smooth and uniform before topsoil is applied. Topsoil shall be evenly placed and spread over graded area and rolled, in accordance with paragraph 110.3 of the State of Illinois Division of Highways' "Standard Specification for Road and Bridge Construction."

j. Placing Temporary Slope Protection: Temporary slope protection shall be placed and compacted as specified above for either clay fill, gravel fill or riprap depending on the particular material used.

F. Moisture Control and Compaction:

a. Impervious Fill and Earthfill: Impervious fill and earthfill shall immediately before compaction, have a water content not less than 2% below nor more than 4% above standard Proctor optimum moisture content. Impervious fill and earthfill shall be compacted using a maximum uncompacted layer thickness of 12 inches with either a tamping roller, a heavy pneumatic tired roller or a segmented pad roller to a density of at least 95% standard Proctor maximum density. The only exception to this is for impervious fill beneath and within 15 ft. of spillway which shall be compacted to a density of at least 100% standard Proctor maximum density. In confined areas which cannot be compacted by rollers, equivalent compaction shall be obtained by using power tampers or other approved methods using a maximum uncompacted layer of 4 inches.

b. Clay Fill: Clay fill shall, immediately before compaction, have a water content not less than standard Proctor optimum moisture content nor more than 4% above standard Proctor optimum moisture content. Clay fill shall be compacted using a maximum uncompacted layer thickness of 12 inches with either a tamping roller, a heavy pneumatic tired roller or a segmented pad roller to an average density of at least 95% standard Proctor maximum density for each 1000 cubic yards placed; however, in no case shall density be less than 90% standard Proctor maximum density. After the final layer of clay fill has been compacted, the surface shall be rolled smooth by use of a plain cylindrical roller.

c. Random Fill: Random fill shall, after placing, but before compacting, have a water content not less than 2% below nor more than 6% above standard Proctor optimum moisture content. Random fill shall be compacted using a maximum uncompacted layer thickness of 12 inches with either a tamping roller, a heavy pneumatic tired roller, a segmented pad roller or crawler type tractor to a density of at least 90% standard Proctor maximum density.

d. Sand and Gravel Fill; Gravel Fill, and Gravel Drains:

(1) Sand and gravel fill for drainage blankets under dam, spillway and a portion of the dike system and the gravel drain shall be placed in layers not to exceed 12 inches in thickness after compaction. Sand and gravel shall be thoroughly wet before placing to insure proper compaction. No sprinkling in place will be allowed.

(2) The portion of sand and gravel fill and the gravel drain used for drainage blankets shall be compacted with either a heavy pneumatic tired roller, a vibratory compactor or hand tampers to a density of at least 70% relative density.

(3) Moisture conditioning and compaction of the portion of sand and gravel used as riprap bedding or as channel slope protection and gravel fill will not be required.

e. Gravel for Service Roads: The gravel, crushed stone or crushed gravel used as gravel roadway material shall be moisture conditioned and compacted as specified under Construction Methods (Type A) in Section 29 (Gravel or Crushed Stone Base Coarse) of the State of Illinois, Division of Highways' Standard Specification for Road and Bridge Construction, with the exceptions that layer thickness after compaction may be 6 inches and that vibratory compactors may be used.

f. Rockfill: Rockfill shall be hosed with water during dumping and just prior to compaction. Compaction shall consist of one pass of a crawler type tractor or vibratory compactor.

G. Blanketing of Abutments of the Dam:

a. Where stripped ground is to be covered with an impervious fill blanket, Contractor shall:

(1) Scarify stripped ground surface to a depth of 4 inches.

(2) Compact scarified ground with four passes of a tamping or segmented pad roller.

(3) Place and compact impervious fill blanket as specified foregoing for impervious fill.

(4) Provide a reasonably smooth, dense surface by compacting surface of the top layer of fill with a rubber tired roller or plain cylindrical roller.

b. Where stripped ground is only to be compacted, Contractor shall:

(1) Scarify stripped ground to a depth of 4 inches.

(2) Compact scarified ground with four passes of a tamping roller.

(3) Provide a reasonably smooth, dense surface by compacting the surface with a rubber tired roller or a plain cylindrical roller.

3-07. LABORATORY CONTROL FOR FILL COMPACTION

Verification tests will be performed by a Testing Laboratory retained by Purchaser to ensure compliance with compaction requirements of these specifications. Contractor shall provide unskilled labor and shall otherwise assist Purchaser's representative in having these verification tests made.

3-08. INSTRUMENTATION

Contractor shall furnish and install 15 surface settlement monuments as indicated on drawings. In addition, Contractor shall install 16 observation wells as indicated on drawings and as specified in Article 6-05.

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

SECTION 4 - SEEDING WORK

4-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicate), or as required to properly complete the WORK:

4-02. General — ADD.1 Item 10

4-03. Fertilizing

4-04. Seeding and Mulching

4-02. GENERAL

A. Contractor shall furnish all materials and perform all operations for both temporary and final seeding to produce a uniform stand of healthy grass where drawings indicate seeded surfaces and/or seeded topsoil.

B. Temporary Seeding and Final Seeding: Temporary seeding, as used herein, covers all items incident to the sowing of the grain or cover crop. Final seeding as used herein covers all items incident to the sowing of grass-seed mixtures for a permanent turf crop.

C. Lines and Grades: Ground preparation shall conform to requirements of Article 110.3 (b) Standard Specifications for Roads and Bridges Construction of Highways State of Illinois. Contractor shall grade the surface as required to assure a neat finished appearance to the lines and grades indicated on drawings.

4-03. FERTILIZING

A. Liming: Agricultural ground lime, conforming to requirements of paragraph 130.6 (Agricultural Ground Lime stone) of the State of Illinois, Division of Highways' "Standard Specifications for Road and Bridge Construction", shall be thoroughly mixed, at the rate of 2 tons per acre, with surface soil before completion of ground preparations. — ADD.1 Item 11

B. Fertilizer:

a. Fertilizer shall consist of Nitrogen, Phosphate and Potassium nutrients.

b. Fertilizer shall be applied at such rate that each acre will receive the following amounts of available units:

(1) Nitrogen 60 pounds

(2) Phosphate (P_2O_5) 100 pounds

(3) Potassium (K_2O) 100 pounds

c. Fertilizer can be placed during ground preparation or mixed with and placed with seed and mulch during final seeding.

d. Condition of fertilizer prior to placing shall be as approved by Purchaser.

4-04. SEEDING AND MULCHING

A. Seed:

a. All seed used shall conform to requirements of paragraph 130.3 (Seeds) of the State of Illinois, Division of Highways', "Standard Specifications for Road and Bridge Construction".

b. Maximum depth of planting shall be 1/2 inch.

c. Seed for temporary cover shall consist of rye grass applied at the rate of 40 pounds per acre.

d. Final seeding where surface is essentially level shall consist of a mixture of the following seeds in the amounts indicated:

Type of Seed in Mixture	Pounds per Acre
(1) Fescue (Kentucky 31 or Alta)	15
(2) Rye Grass, perennial	15
(3) Red Top, solid	8
(4) Lincoln Brome	15
(5) Clover, Alsike (inoculated)	5

e. Final seeding where slopes exceed 4 horizontal to 1 vertical shall consist of a mixture of the following seeds in the amount indicated:

Type of Seed in Mixture	Pounds per Acre
(1) Fescue (Kentucky 31 or Alta)	20
(2) Rye Grass, perennial (cover crop)	15
(3) Red Top, solid	8
(4) Vetch	15
(5) Lincoln Brome	15
(6) Clover, Alsike (inoculated)	5

B. Mulch:

a. Fine mulch, similar or equal to Silva-Fiber as produced by

Weyerhaeuser Company, Tacoma, Washington, shall be placed on any area seeded at the rate of at least 1200 pounds per acre.

b. A course mulch, similar or equal to Slope Protection Blanket as produced by American Excelsior Company, Chicago, Illinois (not necessarily in blanket form) shall be placed on top of the fine mulch at the rate of at least 3000 pounds per acre on all areas with slopes exceeding 4 horizontal to 1 vertical.

c. Mulch shall be smolder resistant and non-toxic to vegetation. It shall not prevent germination of seeds or be injurious to Personnel applying it.

C. Seeding and Mulching:

a. Temporary seeding:

(1) If final seeding cannot be completed during the specified time, Contractor may apply a temporary cover of Rye Grass to help prevent soil from eroding. Rye Grass seed shall be applied at the rate of 40 pounds per acre and may be applied without fertilizer or mulch.

(2) Rye Grass used for temporary seeding shall be uniformly distributed by use of a farm grass seeder.

b. Final Seeding:

(1) Final seeding shall be performed in accordance with paragraph 110.4 (Final Seeding) of the State of Illinois, Division of Highways' "Standard Specifications for Road and Bridge Construction" except for the first sentence in 110.4 (a) seeding time, and 110.4 (c) Fertilizer and Liming.

(2) Final seeding shall be performed between April 15 to June 15 or between August 15 to September 15.

(3) Inoculant shall be applied to vetch seed at suppliers recommended rate at time of seeding. Inoculant shall be applied at three times suppliers recommended rate if vetch seed is mixed with mulch and applied with hydraulic seeder.

c. Mulching: Fine or coarse mulching shall be uniformly distributed over the area at seeding time, using power mulching equipment. Fine mulch may be mixed with the seed and applied with a hydraulic seeder. If the slope being seeded is steeper than 4.0 horizontal to 1.0 vertical, in which case both fine and coarse mulch are to be placed on the slope, mulches shall be distributed separately with the fine mulch placed first.

d. Except as otherwise specified foregoing, methods of preparation of seed beds, fertilizing, mulching, seeding, sprinkling, maintaining, repair, and reseeding as required, will be at option of Contractor. Work shall be considered completed after a uniform and dense stand of healthy grass, free from bare spots and gullies formed by erosion, has been produced in accordance with these specifications.

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

SECTION 5 - CONCRETE WORK

5-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

5-02. Asphaltic Concrete Gutters

5-03. Portland Cement Concrete Work

5-02. ASPHALTIC CONCRETE GUTTERS

A. Scope: Contractor shall prepare the foundation and shall furnish and place asphaltic concrete gutters indicated on drawings.

B. Foundation Preparation: Just prior to placing gutters, Contractor shall shape the natural ground or the fill or excavation surface to be covered by asphaltic concrete gutters as indicated on drawings or as otherwise requested. This shaped surface shall be compacted thoroughly and finished to a smooth, firm surface. All soft and yielding or other unsuitable material shall be removed and earthfill as specified in Article 3-06, "Fill", shall be substituted.

C. Materials:

a. Asphalt cement: Asphalt cement shall conform to ASTM D946 "Specification for Asphalt Cement for Use in Pavement Construction." The penetration grade shall be either 60 to 70 or 85 to 100. The amount of asphalt cement to be used in mixture shall be from 6% to 8% of the weight of dry aggregate.

b. Aggregate: Shall consist of a clean, well graded mixture of fine and course aggregate with a maximum size of 3/4 inch conforming to requirements specified in ASTM C33.

D. Preparing Mixture:

a. Mixing shall be done in an approved pugmill type mixer. Pug mill type mixer may be either batch or continuous type.

b. Unless otherwise approved, the asphalt plant supplying asphaltic concrete shall conform to requirements of ASTM D995 "Specification for Requirements for Mixing Plants for Hot Laid Bituminous Paving Mixtures".

E. Placing Mixture:

a. Mixture shall be placed on prepared bed only when foundation is dry and temperature is above 60° F.

b. Mixture shall be placed in one course, compacted to a uniform thickness. Curbs shall be formed as necessary and placed with adjacent paving to form monolithic construction.

c. The course shall be smoothed by raking or screeding and shall be thoroughly compacted by rolling with a power or hand-operated plain cylindrical roller weighing not less than 300 pounds. Curbs and areas that cannot be reached with rollers may be compacted with hand tampers.

d. After compaction, gutters shall be of thickness and cross section indicated on drawings. They shall be smooth and even and of a dense and uniform texture.

5-03. PORTLAND CEMENT CONCRETE WORK

A. Conform to applicable requirements of Standard Specification Form 1715 and to requirements hereinafter specified.

B. Concrete: Class AA (air-entrained) for all work unless otherwise indicated.

C. Cement: After brand and source of cement have initially been approved, changing of brands or source will not be permitted.

D. Splice Requirements for Reinforcing Bars: In place of splice requirements specified in Item (2), Table 15-29, Page 15-6 of Form 1715, splice requirements of ACI 318 shall govern. Reinforcing shop drawing setting plans for the work shall also clearly indicate length of lap for each bar. ADD. 1 Item 12

E. Services of Testing Laboratory: Will be furnished by Purchaser, as specified in Article 9 of Form 1715.

F. Formwork: As specified in Articles 5 and 13 of Form 1715, with additional requirement that forms shall be removed as soon as practicable to avoid delay in curing and in repair of surface irregularities. ADD. 1 Item 12

G. Consolidation of Concrete: As specified in Article 10.4.5 of Form 1715 and as follows:

a. Concrete shall be placed with the aid of mechanical vibrating equipment, supplemented by hand spading and tamping.

b. Vibrating equipment shall be of the internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Internal vibrators shall maintain a frequency when submerged in concrete of not less than 7000 impulses per minute. In locations adjacent to formed surfaces, concrete shall be vibrated sufficiently until entrapped air bubbles between concrete and forms have had time to emerge from the concrete. Form or surface vibrators shall not be used unless specifically approved.

c. Duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. In consolidating each layer of concrete, vibrator shall be operated in a near vertical position, and vibrating head shall be allowed to penetrate under the action of its own weight and revibrate the concrete in the upper portion of underlying layer. Additional concrete shall not be placed until concrete previously placed has been vibrated thoroughly as specified or requested.

H. Time between Pours: Time between pours shall be defined as the time elapsing from end of striking off one pour to start of placing next one. Unless otherwise requested or approved, minimum time elapsing between adjacent pours shall be not less than 72 hours. Minimum time elapsing between placing successive lifts shall be 72 hours.

I. Time of Pouring the Ogee Section: To insure that final elevation of crest of spillway ogee section will be at normal reservoir elevation, the ogee section shall not be poured until 30 days after remainder of control structure of spillway has been poured and until 30 days after portions of the dam adjacent to spillway control structure have been placed.

J. Curing: As specified in Article 12 of Form 1715, and as follows:

a. All concrete surfaces on or against which concrete is to be placed shall be moist cured. Curing period shall be at least seven consecutive days, except for adjacent or successive pours as hereinbefore specified. All other surfaces shall be either moist cured for seven days or shall be covered with a curing compound. Before actual placement of each pour begins, Contractor shall have on hand and ready to install all equipment and materials needed for curing.

b. Moist curing shall be accomplished as follows:

(1) A continuous (not intermittent) application of water by a system of perforated pipes, mechanical sprinklers, or porous hose.

(2) Or by covering concrete with a 2-inch layer of saturated sand or other material kept wet continuously.

(3) Water for curing shall be clean and free from any element which might cause objectionable staining or discoloration of the concrete.

c. Membrane Curing: As specified in Article 12.4 of Form 1715, and as follows:

(1) Compound shall be applied by spraying in one coat to provide a continuous, uniform membrane over entire area. Coverage shall not exceed 150 square feet per gallon, and on rough areas coverage shall be decreased as necessary.

(2) When curing compound is used on unformed surfaces, application shall be made immediately after finishing operations. When curing compound is used on formed surfaces, surfaces shall be moistened with a light spray of water immediately after forms are removed, and shall be kept wet until surfaces will not absorb more moisture. As soon as surface film of moisture disappears, but while surface still has a damp appearance, curing compound shall be applied. Special care shall be taken to insure ample coverage at edges, corners, and rough spots.

(3) After curing compound has been applied and surface is dry to touch, any required repair of concrete shall be performed. Each repair, after being finished, shall be moistened and coated as specified herein.

(4) Traffic and other operations by Contractor shall be such as to avoid damage to coatings of wiring compound for a period of not less than 14 days. Where it is impossible, because of construction operations, to avoid traffic over surfaces coated with curing compound, membrane shall be protected by a covering of sand or earth not less than one inch in thickness at all times. Protective cover shall not be placed until curing compound is completely dry. Before final acceptance of work, Contractor shall remove all sand or earth in an approved manner. Any curing membrane that is damaged or that peels from concrete surfaces shall be repaired without delay.

K. Mud Slab: A concrete mud slab, 3 inches thick, shall be placed over entire foundation of spillway. Mud slab shall be placed immediately following final excavation to grade for upper part of spillway, and immediately following placement of sand and gravel fill in lower part of spillway. A polyethylene membrane, not less than 0.006" in thickness, shall be placed on top of the sand and gravel or gravel drain, whichever is higher, fill to prevent penetration of concrete paste into the drainage blanket. Concrete mix for mud slab shall be as approved. ADD.1 Item 13

L. Construction Joint Cleaning and Roughening:

a. Cleaning Horizontal Joints: Horizontal construction joints on lifts with relatively open and accessible surfaces may be prepared for receiving next lift by either wet sandblasting or by cutting with an air-water jet, as specified following:

(1) Air-water cutting. Air-water cutting of a construction joint shall be performed after initial set has taken place but before concrete has obtained its final set. Surface shall be cut with a high-pressure air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut edges of larger particles of aggregate. After cutting, surface shall be washed and rinsed as long as there is any trace of cloudiness of wash water.

(2) Wet sandblasting. When employed in preparation of construction joints, wet sandblasting shall be performed immediately before placing following lift. Operation shall be continued until all unsatisfactory concrete, and all laitance, coating, stains, debris, and other foreign materials are removed. Surface of concrete shall then be washed thoroughly to remove all loose material.

(3) If surface of a lift is congested with reinforcing steel, is relatively inaccessible, or if for any other reason Purchaser's representative considers it undesirable to disturb surface of a lift before final set has taken place, surface cutting by means of air-water jets will not be permitted and use of wet sandblasting or light bush hammering will be required.

b. Cleaning Vertical Construction Joints. Vertical construction joints shall be cleaned by wet sandblasting, as hereinbefore specified, or by light bush hammering.

M. Contraction and Expansion Joints: Contraction and expansion joints shall be located respectively in floor and wall of spillway, as indicated on drawings. Direction of keys in floor slab only may be reversed upon approval. Waterstops (see Article 6-04) shall be center dumbbell type. Pre-molded filler (see Article 6-04) shall be placed as indicated on drawings. All faces of joint not covered with a pre-molded filler shall be coated generously to break bond. Curing compound may be used to break bond. Rubber sealant (see Article 6-04) shall be applied in all permanently exposed expansion joints.

N. Control Joints:

a. Control joints shall be constructed as indicated on drawings.

One-half of all reinforcement shall be cut at each control joint. Corrugated metal strips (see Article 6-04) shall be securely fastened to reinforcement and shall be coated on one side to break bond. Flat dumbbell waterstops (See Article 6-04) shall be installed as indicated on drawings. It will be at option of Contractor whether to place concrete continuously through joint or whether to interrupt placing and to form a construction control joint.

b. Rubber control joint strips (see Article 6-04) shall be used at exposed faces of all control joints. ADD.1 Item 14

O. Finishes and Finishing:

a. General: Types of finishes to be given various surfaces shall be as specified herein or as indicated on drawings. Surface irregularities are classified as "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing or lining or form sections, or by loose knots in forms or otherwise defective form lumber, will be considered as abrupt irregularities, and will be tested by direct measurement. All other irregularities will be considered as gradual irregularities and will be tested by template. Length of template will be 5 feet for testing of formed surfaces and 10 feet for testing of unformed surfaces. Honeycomb is not considered an irregularity and shall be repaired without cost to Purchaser, wherever it occurs. Contractor shall clean all exposed surfaces of unsightly encrustations and stains.

b. Formed Surfaces Other Than Water Passages:

(1) Surfaces Backfilled: Surfaces upon or against which backfill or concrete is to be placed will require no treatment after form removal except repair of honeycomb and other defective concrete, and specified curing. Corrections or surface irregularities will be required for depressions only, and only for those which impair structural properties of work.

(2) Exposed Surfaces: Exposed surfaces will require no treatment other than that needed for repair of honeycomb and other defective concrete, and specified curing. Surface irregularities shall not exceed 1/4 inch for abrupt irregularities and 1/2 inch for gradual irregularities.

c. Formed Water Passages: Formed surfaces of water passages need no surface treatment other than that needed for repair of honeycomb and other defective concrete, and specified curing. Abrupt irregularities shall not exceed 1/8 inch.

Gradual irregularities shall not exceed 1/4 inch. As an exception to the foregoing, abrupt irregularities normal to direction of flow (with low side upstream of high side) shall be ground smooth.

d. Unformed Surfaces: Types of finish for unformed concrete surfaces are indicated as screed and float. Finishing of unformed concrete surfaces shall be performed by skilled workmen. Surfaces shall be sloped for drainage where indicated on drawings or as requested. Surfaces which will be exposed to weather and which would normally be level, shall be sloped for drainage. Unless use of other slopes or level surfaces is indicated on drawings or otherwise directed, narrow surfaces such as tops of walls and curbs, shall be sloped approximately 3%. Types of finish shall apply as follows:

(1) Screed Finish: Screed finish shall be applied to unformed surfaces that will be covered by backfill. Screed finish shall also be used as first stage of float finishes. Finishing operations shall consist of sufficient leveling to required grade and screeding to produce even, uniform surfaces. Gradual surface irregularities shall be such as not to impair structural properties of work.

(2) Float Finish: Float finish shall be applied to unformed surfaces not permanently concealed by backfill or concrete. Floating may be performed by use of hand or power driven equipment. Floating shall be started as soon as screeded surface has stiffened sufficiently, and shall be minimum necessary to produce a surface free from screed marks and uniform in texture. Gradual surface irregularities shall not exceed 1/4 inch. Joints and edges shall be tooled where indicated on drawings or where requested. Abrupt irregularities normal to direction of flow shall be ground smooth in spillway crest and ogee and apron or where requested.

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

SECTION 6 - MISCELLANEOUS METALWORK, EMBEDDED WORK AND MISCELLANEOUS WORK

6-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicate), or as required to properly complete the WORK:

6-02. Services of Testing Laboratory
6-03. Welding
6-04. Miscellaneous Metalwork and Embedded Work
6-05. Observation Wells
6-06. Spillway Stop Log Assembly and Bridge Guard Railing
6-07. Spillway Anchor Bars
6-08. Cast Iron Pipe Drains
6-09. Corrugated Metal Pipe Culverts
6-10. Ash Pond Outfall Structures
6-11. Galvanizing
6-12. Cleaning and Painting
6-13. Samples Required

6-02. SERVICES OF TESTING LABORATORY

Will be furnished by Purchaser for inspection of welding, as specified in Article 10 of Form 1701, where deemed necessary by Purchaser and/or the Consulting Engineers.

6-03. WELDING

As specified in Article 8.5 of Form 1742.

6-04. MISCELLANEOUS METALWORK AND EMBEDDED WORK

A. Conform to applicable requirements following Standard Specifications, and to requirements hereinafter specified:

a. Form 1701.

b. Form 1737.

c. Form 1742.

d. Form 1743.

B. Include all applicable work included under Article 4 of Form 1742. Galvanize all ferrous metal, except cast iron and unless otherwise indicated, as specified in Article 6-06.

C. Waterstops:

a. Type and Size: As specified in Article 10.1 of Form 1742.

b. Continuous strips without field splices are preferred, although field splicing in accordance with manufacturer's recommendations, using special fittings and rubber cement, will be allowed. Bends shall have a radius of not less than 6 inches.

D. Premolded Joint Fillers for Expansion Joints:

a. Type: Sponge rubber, as specified in Article 18.1 of Form 1742.

b. Fillers shall be cut and installed as indicated on drawings, with removable strips to provide for rubber sealant closures in joints on all exposed faces.

E. Rubber Sealant Closures:

a. Conform to applicable requirements of Form 1755. ADD.1 Item 15

b. Provide Type A, Thiokol base, for all uses.

c. Color: To match color of adjacent surfaces as closely as possible, unless otherwise indicated.

d. Bond Breaker: Before priming surfaces to receive rubber sealant, cover top of premolded surfaces with plain kraft paper (do <u>not</u> use any adhesive type material) to serve as a bond breaker between rubber sealant and pre-molded joint fillers.

F. Rubber Control Joint Strips: A rubber control joint strip shall be used at exposed faces of all control joints. This filler shall be as indicated on drawings and as manufactured by Williams Form Engineering Corporation. Installation nails shall be clipped flush with outside surface of filler after stripping of form work. ADD.1 Item 15

G. Corrugated Sheet Metal: Corrugated sheet metal installed at all control joints as indicated on drawings shall consist of galvanized 22 gauge steel sheets with a depth of 3/4 inch. Galvanizing shall conform to ASTM A93, using a coating class of 1.25 ounce per square foot. Sheets shall be cut to required widths with no lateral lapping permitted.

6-05. OBSERVATION WELLS

A. Scope: Contractor shall furnish, fabricate and install observation wells as indicated on drawings.

B. Materials:

a. Well Screens: Type 304 Stainless Steel and of the wire wrapped type similar to the drive point as manufactured by Edward E. Johnson, Inc., St. Paul, Minnesota. Length of screen shall be 24 inches. Slot openings shall be 0.010 inch. Outside diameter of drive point shall not exceed 2 inches.

b. Riser Pipe: Standard 1¼ inch galvanized steel pipe. Couplings shall be galvanized. Pipe shall be fitted with a standard galvanized pipe cap with 1/16 inch air hole.

c. Sand Pack: The sand pack around well screen shall be clean, well-graded, fine to coarse sand with a gradation conforming to ASTM C33 for fine concrete aggregate. Sand with a finer gradation, as approved, may be used, providing that less than 85% passes No. 30 U. S. Standard Sieve.

d. Clay Seal: Shall consist of material conforming to requirements for clay fill in Article 3-06, "Fill" or a mixture of sand and bentonite.

C. Installation: Observation wells shall be installed in drill holes as specified following and as indicated on drawings:

a. Drilling: Holes for observation wells shall be drilled to depths indicated on drawings by any rotary drilling method using equipment approved by Purchaser's representative, which will insure proper placement of well screen, riser pipe, and sand pack. Hole diameter shall be determined by Contractor but shall not be less than 4 inches. Drilling muds shall not be used. When drilling below ground water table, Contractor shall keep water level in drill hole above ground water level at all times. Where necessary to keep drill hole open, steel casing with a minimum inside diameter of 4 inches shall be used and casing raised as installation progresses. During drilling for installation of observation wells, Contractor shall take representative jar samples of overburden at 5 foot intervals or closer where there is a distinct change in strata. Holes shall be logged by Contractor and logs shall be submitted to Purchaser's representative.

b. Placement of Well Screen, Riser Pipe and Sand Pack: Prior to placing well screen and riser pipe, sand pack material shall be placed at bottom of well as indicated on drawings. Assembled riser pipe and screen shall then be placed in hole as indicated on drawings so as to avoid jarring impacts and to assure that assembly is not damaged or displaced. Top of riser pipe shall be held at designated elevation during placement of sand pack. The sand pack material shall be added to level indicated on drawings, withdrawing any casing as necessary.

c. Placement of Clay Seal: Clay fill shall be placed to form a clay seal as indicated on drawings, with sufficient hand tamping to assure an impervious seal.

d. Alignment: Each completed well shall be reasonably straight and plumb, with screen and riser pipe centered in drilled hole.

e. Washing: After well has been backfilled, well shall be washed with water or water and air for at least five minutes.

6-06. SPILLWAY STOP LOG ASSEMBLY AND BRIDGE GUARD RAILING

Conform to applicable requirements of Articles 6-02 through 6-04, and to following

A. Galvanized Pipe: ASTM A120 "Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses".

B. Treated Select Structural Grade Timber, Rough Sawn: Section 125 (Timber and Preservative Treatment) of State of Illinois, Division of Highways' "Standard Specifications for Road and Bridge Construction".

C. Cable: The cable fastened to stop logs shall be nylon coated, galvanized aircraft cable as indicated in Catalog No. 72 of McMaster-Carr Supply Co., Chicago, Illinois.

D. Handwheel: The handwheel shall be fabricated entirely from metal. It may be either purchased or fabricated by Contractor, and shall include a secure means of locking the wheel in any position.

E. Flexible Beam Guardrail: As specified in Article 20.9 of Form 1742, and as follows:

a. Metal Thickness: 12 gauge

b. Railing Terminals: Provide standard terminal sections.

6-07. SPILLWAY ANCHOR BARS

A. Scope: Contractor shall drill holes and furnish and install reinforcing bars for spillway anchor bars.

B. Installation: After drilling, anchor bar holes shall be washed and blown out with an air jet until no water or dirt remains in holes. If anchor bars are not to be grouted in place immediately, holes shall be tightly plugged and again washed and cleaned immediately prior to placing and grouting of bars. At time of placing, the hole shall be partially filled with a thoroughly mixed, thick sand-cement grout, having a water-cement ratio of less than 0.9 by volume (0.6 by weight) and a sand-cement ratio of 3 (by weight). The reinforcing bar used as the anchor bar shall be forced into place while being vibrated by a concrete vibrating machine after which any remaining void shall be filled with grout. The entire grouting procedure shall be subject to approval. Grouting of bars shall be done not less than six days in advance of their embedment in concrete. Any bars which are found to be loose after grout has set up shall be removed and reset at no additional cost to Purchaser. Holes into which water is seeping or running shall be grouted upward from the bottom by means of a tremie pipe to prevent dilution of grout.

6-08. CAST IRON PIPE DRAINS

Conform to applicable requirements of Form 1746 and to following:

A. Pipe and Fittings: Cast iron bell and spigot, as specified in Article 4J of Form 1746. Pipe and fittings shall be Class A.

B. Installation:

a. Underneath upstream end of stilling basin floor slab, within gravel drain material, pipe shall be laid with open joints. Ends shall be centered in bell ends of Tee sections, leaving sufficient room for free passage of water but preventing gravel from entering pipe. Outer ends of pipe shall be closed by cast iron plugs or gratings retaining gravel fill.

b. Where located in concrete, joints shall be packed and caulked thoroughly and pipe shall be firmly supported to prevent movement during concrete placing operations.

c. Care shall be taken to avoid clogging of pipe during progress of work. Wooden plugs shall be provided and placed in any temporary openings and in permanent drain outlets. Wood plugs shall be removed after spillway has been completed and all debris has been cleaned out. If any drain should become plugged, it shall be cleaned out in an approved manner, or shall be replaced by and at the expense of Contractor.

6-09. CORRUGATED METAL PIPE CULVERTS

A. Scope: Contractor shall furnish and install all corrugated metal pipe (CMP) culverts and shall place all crushed rock, riprap, and concrete at entrances and exits of culverts as shown on the drawings. Conform to applicable requirements of Form 1746 and to requirements hereinafter specified.

B. Pipe: Double bituminous coated corrugated metal pipe as specified in Article 9 of Form 1746, with addition that pipe also be bituminous paved.

C. Installation: As specified in Article 9 of Form 1746, and as follows:

a. Camber Pipe 1% of height of future overlying fill, unless otherwise indicated.

b. Install piping in trenches excavated through partially completed embankments. Depth of trenches shall be at least 1½ times pipe diameter, and width of trenches shall be about 2 feet wider than pipe diameter.

c. Bed piping to 20 or 25% of its circumference in base foundation.

d. Backfill: As specified in Article 7.6 of Form 1714 and Article 9 of Form 1746. ADD.1 Item 16

6-10. ASH POND OUTFALL STRUCTURES

A. Scope: Contractor shall furnish and install all material comprising the ash pond outfall structures as indicated on drawings. This includes timber access bridge and inlet support frame, concrete work, and corrugated metal pipe for each of the two outfall structures under ash pond dikes.

B. Materials and Installation:

a. Lumber: Preservative Treated Douglas Fir or Yellow Pine as specified in Form 1760.

b. Anchor Bolts, Angles, Nails, Fasteners, and other Materials: Anchor bolts shall conform to applicable requirements of Form 1737. All angles, nails, fasteners, and other metal work shall be hot dipped galvanized.

c. Concrete Work: As specified in Section 5.

d. Corrugated Metal Pipe: As specified in Article 6-09.

6-11. GALVANIZING

As specified in Article 24 of Form 1742.

6-12. CLEANING AND PAINTING

A. Shop Work: As specified in Article 25 of Form 1742.

B. Field Work: Provide as specified in Articles 11, 12, 13, 14 and 17 of Form 1790, as applicable.

6-13. SAMPLES REQUIRED

Submit samples for following materials specified in this Section 6:

A. Waterstops: Standard sample.

B. Expansion Joint Filler: Standard sample.

AECOM

Appendix E: Baldwin Ash Pond; IDNR Dam Safety Operating and Maintenance Plan

DYNEGY MIDWEST GENERATION, LLC

BALDWIN ENERGY COMPLEX

Baldwin, Illinois

Randolph County

BALDWIN ASH POND

IDNR DAM SAFETY

OPERATING AND MAINTENANCE PLAN

IDNR Dam Identification No. N/A
IDNR Permit No. N/A

October 2013

TABLE OF CONTENTS

1.0 OPERATING PLAN

1.1 Emergency Telephone Numbers

The function of the Baldwin ash pond is for ash disposal for the station. This station is staffed with a full operation crew 24 hours/day, 365 days per year. The first notice of any type emergency to the dam or any portion of the embankments shall be made to the Shift Supervisor on duty (618-785-2294). It shall be the responsibility of the Shift Supervisor on duty to notify:

- Bob Kipp; Managing Director (618-785-3212; Bob.Kipp@dynegy.com);

- Tom Buelter; BEC Production Director, (618-785-3259; Tom.Buelter@dynegy.com);

- Don Crone, Manager Environment & Chemistry (618-785-3244; Donald.Crone@dynegy.com); and

- Nathan Rietz, Manager - Fueling (618-785-2611; Nathan.Reitz@dynegy.com).

One of the above designated personnel shall notify the following state government officials of an emergency condition as well as the following county personnel:

- Illinois Department of Natural Resources; Office of Water Resources; Division of Water Resources Management, Dam Safety Section, Dam Safety Engineers (217-782-3863)

- Illinois Emergency Management Agency, 24-hour service (217-782-7860)

- Randolph County Local Emergency Services & Disaster Agency (ESDA); (618-826-5000, ext. 227; 618-853-2656)

- St. Clair County Local Emergency Services & Disaster Agency (ESDA); (618-277-3012)

The following Dynegy Midwest Generation, LLC and Dynegy Operating Company personnel should then be notified:

- Dan Thompson, Vice President – DMG LLC (618-343-7822; Daniel.P.Thompson@dynegy.com)

- Jeff Biethman, Director Project Engineering (618-343-7742; Jeff.Biethman@dynegy.com)

- Rick Diericx; Senior Director – DOC Environmental Compliance (618-343-7761, 217-519-4034; Rick.Diericx@dynegy.com)

1.2 Responsible Party

The Managing Director and his staff shall be responsible for the operations and maintenance of the Baldwin ash pond. They shall be assisted in areas of inspection, maintenance, and operation, as required, through a contract with an appropriate qualified engineering firm.

1.3 General Description

The ash pond system consists of multiple structures, adjacent to each other. The bottom ash disposal is located on the northeast part of the system. The inactive fly ash pond is located at the southeast end of the system. The active fly ash pond contains a splitter dike and is located to the west. The eastern portion of the active fly ash pond, referred to as the the active primary fly ash pond, is essentially full. The western part of the active fly ash pond is currently in use and is referred to as the active secondary fly ash pond.

The original embankment was constructed in 1969. An inboard embankment raise of the secondary fly ash pond was constructed in 1989. The dikes were constructed mainly using clay from a nearby borrow source. Bottom ash was used to support the 1989 embankment raise on the sluiced fly ash, within the pond interior.

The ground surface varies, with embankment heights ranging from 20 to 60 feet. The elevation of the embankment crests appear to be El. 456 feet, except along the south embankment where the 1995 slide occurred.

Along this section of the 1995 slide, the embankment crest has been lowered to approximately El. 434 feet. A blanket drain was installed at the downstream toe, during the repair phase of the 1995 slide. Also, as a result of the 1995 slide, the water level was lowered to El. 430; and, soil was excavated from the top of the slide. One functional inclinometer and five piezometers, installed in 1995 in the slide area, are periodically monitored.

Water from the ash ponds is directed to a series of settling ponds, at the southwest corner of the site. Drop inlets and pipes also are used to convey water from the eastern part of the active secondary pond to the western side.

Spillways are not installed. However, one seepage berm is located at the final pond.

A pumping station is installed between the bottom ash pond and the secondary pond and is used to pump the bottom slag and bottom ash pond to the cooling pond, when the bottom slag and bottom ash pond reach a certain elevation.

1.4 Ash Pond Monitoring

Weekly Surveillance and Inspection

Inspections shall be made of the dams and outfall structure by BEC personnel.

Quarterly Inspection

Inspections shall be made quarterly by BEC personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration.

Annual Inspection and Surveillance

The annual inspection of the dam and embankments shall be made in the fall of each year by a licensed professional engineer, experienced in performing such inspections. This inspection shall be followed by a verbal and written list of recommendations. Based on the findings and recommendations of the inspection, corrective action shall be taken by the BEC staff, as required, to assure safe and continued operation of the cooling pond.

Procedures and the methods of correction shall be performed in accordance with the recommendations of the professional engineer and as outlined in the maintenance portion of this report. Copies of this engineer's report, along with a listing of the corrective action taken, shall be forwarded to the Environmental Compliance Group office in Collinsville, Illinois. Because the berm is unpermitted, the reports will not be submitted to the Illinois Department of Natural Resources, Office of Water Resources, Division of Water Resources Management in Springfield, IL.

2.0 EMERGENCY ACTION PLAN

A separate Emergency Action Plan (EAP) is currently being prepared. The separate EAP shall be used for emergency response at this facility.

3.0 MAINTENANCE

3.1 General

Regular inspections and repairs as required of the dam, outfall structure, and embankments. These inspections, along with the review and recommendations made by the licensed professional engineer, shall be the basis for all maintenance activities.

3.2 Vegetation

In order to protect and retain vegetation on the slopes of the dam and embankments, fertilizing and reseeding shall take place in damaged or barren areas. This shall be conducted as soon as appropriate after being discovered. Trees and shrubs observed during the inspections shall be cut and removed from the dam, embankments, and spillway.

Routine mowing shall be conducted as needed on the crest of the embankments to facilitate inspections.

3.3 Earth Embankment Seeding

Barren or damaged areas shall be seeded as soon as possible after discovery. Damaged areas shall be filled with topsoil, limed, fertilized, and seeded with tall fescue (18-24”) or smooth brome.

3.4 Method to Ensure Adequate Visual Inspection of the Ash Pond Embankments

The embankments shall be burned if needed to facilitate visual inspection. Utilize a team to walk the embankment to inspect for animal burrows, sloughing, cracks, woody vegetation, and other factors that may threaten the integrity of the cooling pond embankment.

3.5 Animal Damage and Repairs

Animal burrows and holes discovered during inspections shall be backfilled with clay and compacted. Special attention shall be given to animal burrows in the embankments and dam.

3.6 Restriction of Unauthorized Vehicles

The embankments and dam approaches shall be fenced, and signs shall be posted to prevent unauthorized travel on the roadways and slopes.

3.7 Instrumentation

One functional inclinometer and five piezometers, installed in 1995 in the slide area, are periodically monitored - on a semi-annual basis and with formal report submittals - to monitor for any evidence of significant berm movement or settlement.

4.0 Inspection Checklists

The following Inspection checklists should be used during the weekly and quarterly inspections. Beginning in July 2013, formal documentation using these forms will be required.

Baldwin Energy Complex
Ash Pond
***Weekly* Inspection Form**

Dam Location: Baldwin Energy Complex; Randolph County

Owner: Dynegy Midwest Generation, LLC

Permit No.: Unpermitted **Class of Dam:** N/A

Type of Dam: Earthen embankment

Type of Spillway: Drop inlet

Date Inspected: ______________________

Weather Conditions: ____

Pool Elevation: ______________________

Inspection Personnel:

___________________________________ ______________________

Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

Condition Codes:

NE	-	No evidence of a problem.
GC	-	Good condition
MM	-	Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled.
IM	-	Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within one month.
EC	-	Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam. Emergency measures to be implemented as instructed by engineering; such as pool draw down or stoppage of downstream road and rail traffic.
OB	-	Condition requires regular observation to ensure that the condition does not become worse.
NA	-	Not applicable to this dam.
NI	-	Not inspected – (list the reason for non-inspection)

Baldwin Energy Complex
Ash Pond
***Quarterly* Inspection Form**

Dam Location: Baldwin Energy Complex; Randolph County______________________
Owner:_ Dynegy Midwest Generation, LLC__________________
Permit No.: Unpermitted **Class of Dam:** N/A
Type of Dam: Earthen embankment________________
Type of Spillway: **Drop inlet________**

Date Inspected: ________________________
Weather Conditions: ____

Pool Elevation: ________________________
Inspection Personnel:

______________________________________ ________________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Downstream Fill Slopes		
Upstream Fill Slopes		
Unusual Movement or Cracking at or Beyond Toe		
Seepage (Condition/Color)		
Vegetative Cover (Tree growth)		
Animal Damage		
Embankment Erosion		
Water Passages		
Structural Cracking		
Outfall Structures		
Other		

Condition Codes:

NE	-	No evidence of a problem.
GC	-	Good condition
MM	-	Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled.
IM	-	Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within one month.
EC	-	Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam. Emergency measures to be implemented as instructed by engineering; such as pool draw down or stoppage of downstream road and rail traffic.
OB	-	Condition requires regular observation to ensure that the condition does not become worse.
NA	-	Not applicable to this dam.
NI	-	Not inspected – (list the reason for non-inspection)

AECOM

Appendix F: Final Report of Geotechnical Investigation, Baldwin Power Station, Fly Ash Pond South Dike, Baldwin, Illinois, Woodward-Clyde Consultants, Inc. (1995)

September 7, 1995
5E08560

Mr. Jeffrey E. Lamb
Senior Project Manager
Illinois Power Company
500 South 27th Street
Decatur, IL 62525

Subject: **Final Report of Geotechnical Investigation**
Baldwin Power Station
Fly Ash Pond South Dike
Baldwin, Illinois
Illinois Power Purchase Order P0900881

Dear Jeff:

This letter transmits our final report for the investigation of the ash pond dike slope failure at the Baldwin Power Station. The report provides our evaluation of the cause of the failure and recommends repair measures. This report supersedes the draft report of June 23, 1995.

We appreciate the opportunity to work with you on this challenging project and will call you to discuss the report within a few days.

Very truly yours,

Thomas L. Cooling, P.E.
Senior Associate

Melvin I. Esrig/mlr

Melvin I. Esrig, P.E., Ph.D.
Senior Consultant

TLC/MIE:mlr

Attachment

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

The slide occurred in February 1995 on the ash pond south dike over a distance of about 500 lineal feet at a location where the dike is the tallest (55 ft) and crossed a former creek. The dike was constructed in two phases; a 35 ft high compacted clay dike built in 1969, and a 20 ft high "raise" constructed in 1989 on the upstream slope of the older dike. The 1989 raise consists of two materials: 1) bottom ash placed underwater extending to the crest of the older dike, and 2) compacted clay above the bottom ash extending to the current crest. A former haul road consisting of lime treated bottom ash and gravel exists at the crest of the old dike and is hydraulically connected to the bottom ash fill. Both clay dikes were well compacted; the bottom ash is very loose due to underwater placement.

Foundation Materials

The dike rests on a foundation of stiff clayey soils about 20 ft to 30 ft thick overlying weathered shale and limestone bedrock. Over time the surface of the shale has weathered to high plastic clay containing fissures and zones of weakness (slickensides) along which movement has occurred in the past (perhaps ancient landslides). A thin stratum of locally water-washed decomposed limestone and/or glacial till overlies this high plastic clay.

Cause of Slide

The overall slide consists of two portions: shallow and deep. The shallow portion occurred at the contact of the upper clay dike and bottom ash and caused significant damage to the 1989 raise.

The deep slide was not visually apparent at first, but was detected by deep instrumentation. The deep failure plane is located about 70 ft below the existing crest elevation at about the top of the fissured high plastic clay noted above. Prior to raising the pond level in October 1994, the dike was probably close to failure due to the low strength of the clay on the deep failure plane. When the pond level was raised, the deep failure was believed to be initiated by water pressure in the pervious water-washed zone directly above the high plastic clay. It is hypothesized that movement of the dike on the deep failure plane then formed a crack that extended through the clay dikes and bottom ash. As the crack widened, it created a void that was filled by soil and bottom ash migrating into it. This resulted in the upper dike settling. Concurrently the bottom ash and granular haul road permitted hydrostatic pressure equal to the pond head to develop beneath the toe of the upper clay dike. This water pressure lifted the toe allowing the upper clay dike to move laterally. Finally, rainwater in the tension cracks of the failed upper dike aggravated further movement. Lowering of the pond by 6 ft reduced the rate of movement significantly.

Earthquake Considerations

Baldwin is in an area of moderate seismicity. Due to its loose condition, the bottom ash could lose significant strength during earthquake shaking. Such a strength loss, termed liquefaction, could result in post earthquake settlement cracking of the upper dike, failure of the upstream slope of the 1989 raise and probable breaching of the dike where the raise is underlain by significant amounts of bottom ash.

Stability of the Remainder of the South Dike at Full Pond Head

Potential for deep failure (similar to the current failure) exists where the dike is higher than about 35 feet. In addition, the potential for shallow failure exists where bottom ash extends near the downstream slope of the dike. In both areas, the potential exists for earthquake induced liquefaction of the bottom ash.

Interim Repairs

To stabilize the slide area until the permanent repairs can be made, 20+ feet of soil was removed at the crest of the dike for about 600 lineal to reduce the driving forces of the slide. The excavated soil was stockpiled away from the slide area along the downstream toe of the dike for future reuse. This work, completed in July 1995, arrested the slide which had been moving at a rate of about 1/4 inch per day.

Repair Options

Analysis indicates that the most cost-effective method to stabilize the slide is to reduce the water pressure on the failure plane by draining the water-washed zone. Three primary remedial options were developed, two of which focused on drainage. The third option involved rebuilding the dike about 150 ft downstream of its present location. Key details of the three options are summarized below:

OPTION	KEY ELEMENTS	ESTIMATED COST (millions)	REMARKS
Parallel Wall	Cutoff wall, two drain walls pumps in drain walls	$4.3	Lowers groundwater level by pumping from drain walls. Preferred option by IP
Translated Dike	New dike 150 ft downstream of existing dike	$6.1[1]	Passive system (no pumps). May need right of way
HDPE wall	Impermeable cutoff wall of HDPE in center of dike	$5.7	Passive system, lowers groundwater level by very impermeable cutoff wall

[1] Does not include cost of additional right-of-way.

Parallel Wall - the Preferred Option

The Parallel Wall option is preferred by Illinois Power primarily due to cost and because the dike can be maintained along its current alignment with its current shape. Key elements of the Parallel Wall option for areas of potential deep and shallow failure are as follows:

Areas of potential deep failure (1,200 lineal feet)

- A soil-bentonite cutoff wall parallel to the dike constructed near the upstream toe of the dike to cutoff flow through the bottom ash.

- A "drain wall" consisting of drainage backfill such as coarse sand constructed by slurry trench methods using a biodegradable slurry to form a continuous drain. The drain wall will be located downstream of the cutoff wall to intercept seepage along the water-washed layer and seepage that penetrates the cutoff wall. The drain wall will extend about 60 feet deep and will include three pumps that will remove seepage collected by the drain wall. The pumps will operate continuously, but the amount of water to be pumped should be small (a few hundred gallons per minute) because the upstream cutoff wall should significantly retard seepage. During pond closure, a gravity system can be installed to replace the pumps. Pumping is also expected to mitigate the potential for liquefaction of the bottom ash.

- A shallow (25 ft deep) drain wall near the toe of the dike to collect and remove seepage that recharges from the stream. Pumps will be installed in this drain wall, but again the amount of water to be pumped should be small.

- Clay fill to restore the dike to its shape before failure. The clay can be placed when the water pressure at the failure plane has sufficiently drained based on field piezometers measurements.

Areas of Potential Shallow Failure (1,200 lineal feet)

- A soil-bentonite cutoff wall located upstream of the toe of the dike and extending through the bottom ash. This wall will be a continuation of the cutoff wall located in the area of potential deep failure.

- A series of three wells within the bottom ash located immediately downstream of the cutoff wall. The wells will be pumped to drain the bottom ash in order to control the head below the upper clay dike and mitigate the potential for shallow failure as the pond level is raised. Pumping should also mitigate the potential for liquefaction of the bottom ash. Again, the amount of water to be pumped should be small due to the cutoff wall.

Construction Schedule

A tentative construction schedule is to install the cutoff wall, drain walls, and pumps during the Spring and Summer of 1996. The clay fill to restore the dike to its original shape could be done the following Summer or Fall. This would allow about one year for drainage to occur.

Instrumentation

After the repairs are made, instrumentation should be installed within the dike to monitor its performance, especially as the pond level is raised.

Risk

Due to the uncertainties involved, stabilization of landslides involves a greater degree of risk than conventional design. Consequently, the preferred repair involves some risk of poor performance. This risk could be reduced by more conservative design which would involve greater design and construction cost.

FINAL REPORT OF GEOTECHNICAL INVESTIGATION
BALDWIN POWER STATION
FLY ASH POND SOUTH DIKE
BALDWIN, ILLINOIS

1.0 INTRODUCTION

1.1 SCOPE

This report presents results of the geotechnical investigation of the slope failure of the south ash pond dike at Illinois Power's Baldwin Power Station near Baldwin, Illinois (Figure 1). Woodward-Clyde Consultants (WCC) performed this work in general compliance with our proposal of March 29, 1995 and change order request of April 28, 1995. The study was performed under Illinois Power Company Purchase Order number P0900881 dated May 5, 1995. The purpose of the investigation was to address the following key issues:

1. The cause of slope failure.

2. Stability of the remainder of the south dike at the full pond elevation.

3. Recommendations to repair the dike to permit its operation at the full pond elevation.

A draft report was issued June 23, 1995. Subsequently, a meeting of WCC senior-level engineering and construction personnel was held July 21, 1995, at the plant site in an effort to develop other, more cost-effective, repair options than those recommended in the draft report. Two additional repair options, including the 'Parallel Wall" option currently favored by Illinois Power, were developed at the meeting and are discussed and described herein. This report supersedes the June 23, 1995, draft version.

1.2 BACKGROUND

We understand that the original dike forming the 60-acre ash pond was built in the late 1960's. At that time, the dike was built to a crest elevation of about 435±, resulting in maximum height of about 40± ft. The highest portion of the dike, which is in the area of failure, was situated in a former north-south trending stream channel. The dike was raised in 1989 by constructing an addition on the upstream (north) side. Construction was performed and costs reduced by the placement of bottom ash from pond bottom (el. 400±) up to the crest of the existing dike at about el. 435. Clay was placed above the ash from el. 435± to the current crest elevation of 456± as shown in Figure 2. Thus, a lower, original dike and an upper, new dike was formed. In the area of the slope failure, the pond has accumulated only a small quantity of fly ash. The normal pool elevation has been maintained during recent years at about el. 432. In October 1994, the pool was raised 6 ft to about el. 438 and maintained there until it was dropped in March 1995.

The following is a chronology of key events relating to the slide:

- February 22, 1995 - 150 ft long crack and a vertical drop in crest elevation (scarp) was found at the crest near Station 2+00[1] and noted by IP personnel. Vertical displacement at the crack, 10 inches.

- March 4 - Vertical displacement at crest scarp, 18 inches.

- March 7 - Vertical displacement at crest scarp, 3 ft. Large crack also noted 60 ft downslope from the crest on the downstream face parallel to the crest. Heavy rains evening of March 6 and morning of March 7.

---

[1] Refers to dike stationing established for this study.

*All elevations are in feet and are in NGVD datum.

- March 8 - First visit by WCC. Length of slide is 300 ft, vertical displacement of crest scarp is 3 ft. Crack 60 ft downslope (mid-slope scarp) is about 180 ft long with 1.5 to 2 ft vertical displacement.

- March 13 - Illinois Power begins lowering pond level at a rate of 0.5 inch per hour.

- March 14 - Second WCC visit. 150 ft long crack has formed west of crest scarp. Vertical displacement at crest scarp is 4 ft. Vertical displacement at mid-slope scarp is 3 ft; water visible in mid-slope scarp.

- March 20 - Water level has now been dropped by 6 ft to about el. 436. Movement of slide appears negligible. Heavy rains in late March and April cause some small additional movement.

- April 21 - Inclinometers show that a deep slide is occurring below the dike on a failure plane near el. 385, about 15 ft below the level of the ground surface at the toe of the dike.

- May and June - Crack propagates slowly westward at crest. Failed area about 500 ft long by June 9. Inclinometers indicate the slide is moving laterally at about 1/4 in. per day.

- June and July - Approximately 22 ft of soil was removed from the slide area as an interim repair. Movement along the failure plane during August has been negligible.

2.0
RECORDS REVIEW

As part of our investigation, WCC reviewed design drawings and construction records provided by IP which addressed the original dike construction and the subsequent raise.

A summary list of the records received and reviewed include:

- As-built drawings for the original embankment construction dated November 18, 1969

- Plan and Section Drawings of the proposed south dike embankment addition dated 1-6-81. (However, these design drawings for the proposed south dike addition do not match the 1988 construction drawings and records. The 1981 drawings show the raise made of clay and on the downstream face of the 1969 dike. The 1988 drawings show the raise consisting of clay and bottom ash and situated on the upstream face of the 1969 dike).

- A plan of the South Dike Addition dated May 14, 1986

- Earthwork cut/fill cross-sections dated April 15, 1988

- Specifications for South Dike Addition (W.O. 24579) dated May 1988

- Soil boring and soils testing letter report prepared by Professional Services Industries (PSI) dated August 19, 1988

- Partial soils test data (moisture-density relationship tests) performed by PSI dated August 1988.

2.1 ORIGINAL DIKE DESIGN AND CONSTRUCTION

The original dike was constructed during November 1969 using "earthfill" and "impervious fill" material as shown in the drawings. We presume both types of material were actually low plastic clay fill obtained on-site within the present pond area. The original embankment section had a 15-ft wide crest and 3H:1V side slopes between Station 46+66 and 58+77. (Dike stationing refers to stationing for the original dike construction as shown on construction drawings. The failure area is between Station 50+00 and 57+00.) The crest elevation was el. 435±.

Between Stations 46+66 and 58+77, a 6-inch thick gravel erosion protection layer was placed on the downstream slope surface of the dike between el. 408 ft and 400 ft. A 2-ft thick horizontal sand and gravel blanket drain was placed at the embankment toe and extended approximately 50 ft upstream beneath the embankment. A flat-bottomed drainage ditch was built about 40 ft downstream of the embankment toe. From the embankment toe, the ground surface was sloped at approximately 2 percent towards the drainage ditch. Upstream of the upstream toe at el. 415, the embankment slope transitions at a 6H:1V slope.

Between Station 58+77 and Station 81+00, the side slope changes to 2.5H:1V and the blanket drain was eliminated.

The top of the dike had a 6-inch thick layer of bottom ash surfacing along its entire length.

No construction records were provided documenting placement and compaction of 1969 embankment fill, although tests in this study show that it appears to be well compacted.

2.2 1989 DIKE RAISE DESIGN AND CONSTRUCTION

In 1989, the raise was constructed by first end-dumping bottom ash into the pond against the upstream slope of the embankment and over the fly ash deposited on the pond bottom. The bottom ash created a working platform above the water (Figure 3). The maximum total thickness of this bottom ash material is estimated to be approximately 35 ft. A haul road was built along the top of the original embankment to facilitate construction of the bottom ash working platform. It was constructed by placing a driving surface of bottom ash along the crest of the dike and stabilizing the ash with lime and fly ash. A pozzolonic reaction occurred between the bottom ash and the lime/fly ash, creating a surface resembling a weak concrete. The surface of the bottom ash working platform was placed against the upstream face to el. 436 ft, or approximately 1 ft above the roadway crest. The design indicated that the ash was to be placed to el. 434 ft, or approximately 1 ft below the top of the roadway (Figure 2). The fact that the bottom ash was placed to a level above the crest of the lower dike, plus the presence of the stabilized bottom ash roadway, are important factors in the failure, as noted later.

Within the water-inundated area, between approximately Stations 46+50 and Station 75+00, clay fill was placed directly on the surface of the bottom ash working platform to the crest of the present upper dike (el. 456), a height 20± ft above the original embankment crest.

The downstream slope of the addition was placed as an uninterrupted extension of the original 3H:1V downstream embankment face. (Survey data show that the actual slope is somewhat steeper, about 2.77H:1V) This resulted in the centerline of the upper dike being set back in the upstream direction approximately 60 ft from the original dike centerline. The remainder of the embankment section consisted of a 16 ft wide crest and an upstream face with a 2.5H:1V slope to the top of the bottom ash working platform.

To the east of Station 75+00, the height of the original dike was relatively small and resulted in the toe of the dike being setback relative to the toe of the higher portion of the dike further to the west. Between Station 65+00 and Station 74+00, a transition section was constructed where the dike centerline moved from the setback position to a position to coincide with the original dike centerline (Figure 4). The added height of the addition over the original embankment centerline results in an absence of a setback in the toe of the eastern portion of the embankment relative to the western portion. The cross-sectional template of the eastern portion of the dike matched that of the western portion. Compacted fill within the transition section and that further to the east consisted of clay and was placed directly on the existing ground surface.

Construction records indicate that the bottom ash (type "B" fill) on the upstream side of the lower dike was not compacted except for the top 12 inches, which was compacted to 90 percent of its maximum dry density according to ASTM D698.

The fill for the 1989 raise was borrowed from an area north of the ash pond north dike. It was generally silty clay, although some clayey silt was also used. It was reportedly compacted in lifts to 95 percent of its maximum dry density according to ASTM D698. Field density tests by PSI indicate that the specified level of compaction was achieved for all materials tested, although the actual test locations are difficult to verify.

3.0
SITE GEOLOGY

The site is geologically located upon the western flank of the Illinois Basin as shown in Figure 5. This structure defines both the structural geology and stratigraphy of the region. The Illinois Basin developed as a gradual down-warping of the earth's crust beginning in Cambrian time and continuing through the Pennsylvanian time period. Sediments accumulated within this trough from the advance and regression of ancient seas. The uppermost, Pennsylvanian-aged, sedimentary materials consist of interbedded limestones, claystones, shales, sandstones, and coals. These materials comprise the near-surface bedrock of the Spoon Formation that unconformably underlies the overburden materials at this site. Units of the Spoon Formation within the stratigraphic column encountered at the site include the following members: Vergennes Sandstone Member, Stonefort Limestone Member, Wise Ridge Coal Member, Creal Springs Limestone Member, Granger Sandstone Member, Cheltenham Clay Member, Curlew Limestone Member, Seville Limestone Member, and Assumption Coal Member. These units are typically thin, generally less than 2 feet in individual thickness, and are discontinuous in lateral extent. The Cheltenham Clay Member is of particular interest. It is comprised of the thinning out and merging of several underclay units where the coals, which typically overlie the underclays, are absent. These underclays are composed of high percentages of highly plastic clay minerals that are typically highly expansive and exhibit low shear strength as a result of water softening. All the sedimentary units encountered at the site are moderately to completely weathered due to water softening.

The deep-seated failure in the dike foundation occurred in a shale bed at the top of the sedimentary units. Water softening and weathering of the shale over geologic time reduced the shale strength and thereby contributed to the failure.

The surface topography and morphology of the site is controlled by surface deposits of glacio-fluvial and glacio-lacustrine origin. The Illinoisan aged, Vandalia till of the Glasford Formation was deposited unconformably as an end moraine on the Pennsylvanian-aged bedrock by the retreat of the glacier. The till is comprised of undifferentiated sand, silt, and clay materials. Near the end of the Wisconsinian period, the area adjacent to the Kaskaskia River became temporarily choked with excess sediment load creating a glacial lake. Mapping by the Illinois State Geological Survey indicates the glacial lake was located adjacent to the Kaskaskia River with the blockage occurring at a location within the immediate vicinity of the Baldwin Reservoir. Fine-grained sediments, light gray silts and clays of the Equality formation, were deposited within this slackwater area. Stream flows eventually cut through the sediment blockage and permitted the draining of the lake bed. The inundation of large areas by the glacial lake permitted deep-seated water softening of the clay based materials of the Pennsylvanian shales. Wind-blown, silty clay (loess) deposits 5 to 10 ft in thickness cover sediments of both the Glasford and Equality Formations. These wind-blown materials are classified as the Peoria Loess and Roxana Silt Formations. They form the present day, native surface soils.

3.1 REGIONAL SEISMIC SETTING

The geologic framework of southern Illinois is dominated by the Illinois basin to the east, the Ozark Uplift in southeastern Missouri, and the Mississippi embayment to the south along the Arkansas-Tennessee border. Within the Mississippi embayment to the south of the Illinois basin lies an ancient rift complex, which did not develop sufficiently to separate the continent, but caused the crust of the earth in that region to be greatly fractured and weakened. This rift complex is located in the region called New Madrid, where Missouri, Illinois, Kentucky, Tennessee, and Arkansas converge.

The New Madrid region has been the most seismically active region of central and eastern North America during historical times. In the winter of 1811-1812, three of the largest earthquakes known to occur in the interior of a tectonic plate shook the New Madrid region. These events were felt as far away as New England, a distance of over 1,000 miles. Although instrumental data are not available, a study of damage and felt effects by Nuttli (1973)[2] indicates that the events of December 16, 1811, January 23, 1812, and February 7, 1812 had surface-wave magnitudes (M_s) of about 8.6, 8.4, and 8.7, respectively. Current monitoring indicates that earthquakes of smaller magnitudes continually shake Southern Illinois.

---

[2] Nuttli, O.W. (1973). "The Mississippi Valley earthquakes of 1811 and 1812: Intensities, ground motion and magnitudes," Bulletin of the Seismological Society of America, Vol. 63, No. 1, pp. 227-248.

A regional map indicating the epicentral locations of earthquakes having surface wave magnitudes (M_s) of 5 or more from 1811 to 1993 is shown in Figure 6. Superimposed on this figure are the acceleration contours having a 90 percent probability of not being exceeded in 50 years based on USGS data (NEHRP, 1988). This map is also used by Illinois DOT for design of bridges. The acceleration contours correspond to a return period of about 475 years and indicate bedrock acceleration at the site of about of 0.12g. For a larger return period such as 2500 years (considered the "maximum credible" level of shaking by the Uniform Building Code), the estimated bedrock acceleration according to NEHRP is 0.25g. For purposes of this study, we have used an acceleration of 0.12g. IDOT Division of Water Resources considers the site to be in Seismic Zone 2 corresponding to a "moderate probability of damage."

4.0
FIELD INVESTIGATION

The field investigation was conducted in two phases. The first phase was completed between March 17 and April 14, 1995, during which a total of 15 conventional test borings, 23 piezocone penetrometer soundings (CPTU) and 8 exploratory test pits were made. After completion of four of the borings, inclinometer casings were installed to measure lateral movement at depth. In addition, one conventional standpipe piezometer and 4 vibrating wire piezometers were installed to measure pore water pressures.

The exploration was concentrated in the slide area. Exploratory locations were selected along the crest of the existing dike and along the downstream slope, as shown in Figure 7. Borings and CPTU soundings were generally conducted to refusal and varied in depth from approximately 15 to 80 ft. A total of 8 test pits were excavated on the downstream slope of the dike, both in and outside the failure area, to visually assess conditions within the dike. Test pits were generally located at the elevation of the mid slope scarp because soils in that area were originally suspected of being the cause of the failure.

Outside the failure area, borings and CPTU soundings were performed only along the center line of the dike in alternating fashion at horizontal spacings of approximately 250 ft, as shown in Figure 4. Generalized subsurface profiles along the centerline of the dike and normal to the dike through the failed area are given in Figures 4 and 8, respectively.

After completion of the borings in mid-April, inclinometer readings indicated that a deep failure was occurring at approximately el. 385, i.e., approximately 70 ft below the crest of the dike. To further investigate this area, a second phase of explorations was performed from May 3 to May 19, 1995. Two additional borings (B-101 and B-102) with inclinometers and five additional vibrating wire piezometers (P-2A, P-3A, P-4, P-5A, and P-7) were installed. The vibrating wire piezometers were installed at the elevation of the suspected failure plane both within the failed area and outside the failed area to compare pore pressures in those two general locations. Borings B-101 and B-102 were advanced into bedrock by NX coring or a Pitcher Sampler to evaluate quality of bedrock.

Details of the field investigation are given in Appendix A along with the detailed boring logs, CPTU logs, and test pit logs. Inclinometer and vibrating wire piezometer data are given in Appendix C.

5.0
LABORATORY TESTING

Laboratory tests were performed to evaluate the index and engineering properties of subsurface materials. Initially, we suspected that the upper fill materials may have been improperly compacted. Consequently, a significant number of density tests and liquid and plastic limit tests were performed on the dike fill materials, principally the new (1989) dike. Laboratory compaction tests were also performed; two on soil from the new dike and two on soil from the old dike. Gradation and specific gravity tests were performed on the ash material. Finally, consolidated-undrained triaxial tests with pore pressure measurements were made to estimate the undrained and drained strength of the dike materials and certain foundation materials. Direct shear tests were performed on soil samples near the deep failure plane. Testing was concentrated on samples from the failure area; more limited tests were performed outside the failure area. Results of the laboratory tests are given in Appendix B.

6.0
SITE AND SUBSURFACE CONDITIONS

6.1 SURFACE OBSERVATIONS

Initial observations of the slide made in mid-March 1995 indicated significant movement and failure in the new portion of the dike, i.e., the portion above el. 435±, which was constructed in 1989. The ground surface of the failed area appeared to have settled and rotated downward and outward. As noted previously, the main scarp with the largest offset (4 ft in mid-March) was located in the crest of the dike approximately between Stations 1+00 and 3+00. (See photograph 1 in Appendix A.) A crack at the crest was also visible between approximately Stations 0-50 to 1+00 with minimal vertical offset. By June, however, about 1 ft of vertical offset had developed along this crack and it had extended westward to near Station -1+00. At the east end of the slide, the main scarp at the crest turned downstream and extended to nearly the toe. A crack about 50 ft long developed at the southeast corner of the slide and joined the scarp extending down the slope (Figure 7). On the westside, the crest scarp stopped on the downstream slope only a few feet below the roadway at the crest.

Another major feature of the slide was the mid-slope scarp, which developed parallel to the crest at the crest elevation of the original dike, i.e., el. 435±. Soil on the downslope side of the midslope scarp was lifted vertically 2 to 3 ft. It appeared that the upper portion of the dike moved downward and rotated such that it slid slightly beneath the surficial soil at the face of the original dike below el. 435 (see photograph No. 2 and Appendix A). Test pits confirmed this mode of movement.

Except for the crack noted at the southeast corner of the failure, there were no obvious signs of movement below the midslope scarp in March. This crack was judged to be a secondary crack related to the movement of the soil above. No other signs of movement on the lower portion of the dike such as bulging at the toe, significant cracking or movement of trees were noticed in early March.

Inclinometer readings on April 21 indicated that a deep slide was occurring about 70 ft beneath the crest of the dike (el. 385±). Surface observations were made on April 22 to visually check for signs of movement of the old dike. We suspected that the dike was moving laterally into the creek south of the dike, however, no signs of movements were apparent. Later observations in May suggested that the movement was into the creek and that the creek was eroding the toe of the dike and washing it downstream. Heavy rains during April and May aggravated the movements and caused cracks at the crest and elsewhere to widen.

6.2 TEST PIT OBSERVATIONS

Test Pits TP-1 and 2 were hand excavated about 1 ft deep north of the north toe of the upper dike to obtain samples of bottom ash for testing. Test Pits TP-3, 4, and 5 were machine excavated in the failed area across the midslope scarp. Test Pits TP-6 and 7 were excavated outside the failure area at a comparable elevation to TP-3 through 5 to compare conditions outside the failed area to those in the failed area. TP-8 was excavated across the crack at the southeast portion of the failure area. Test pit locations are shown in plan on Figures 4 and 7. Test pit logs and photographs are given in Appendix A.

6.2.1 Test Pits Through Failed Area (TP-3, 4, and 5)

Test pits confirmed that a 1± ft thick granular zone near el. 435 separated the upper and lower portions of the dike and extended to near the downstream face. This zone was presumably the old haul road and consisted chiefly of bottom ash and gravel, with some fly ash and clay. It was apparently lime treated in some areas, making it difficult to excavate (see test pit logs TP-3, 4, and 5 in Appendix A and photos 4, 5, and 6 in Appendix A). This zone was sheared vertically at the midslope scarp and the downslope portion was lifted upward a foot or more with respect to the upslope portion. Water was seen observed from the granular zone indicating that it was relatively permeable with respect to the clays above and below (Photo 7 in Appendix A). In some trenches, the midslope scarp was traced vertically to the bottom of the trench. It was 2 to 3 inches wide and filled with soft clay.

The test pits also verified that the older and newer portions of the dike consist generally of compacted low to medium plastic clay in a stiff to very stiff condition.

Test Pit TP-8 at the southeast portion of the failure area indicates stiff to very stiff low plastic clay fill. The crack at the ground surface extended vertically downward to the bottom of the test pit. It was one to two inches wide and contained very soft clay.

6.2.2 Test Pits Outside the Failed Area

Test Pits TP-6 and 7 were located west and east of the failed area, respectively. Both test pits encountered the old haul road material at the contact between the upper and lower portions of the dike (Photos 8 and 9). No seepage, however, was noted from this zone as it was in the trenches of the failed area. This zone in the non-failed area appeared to be stronger, perhaps treated with more lime than in other areas, causing it also to be less permeable. The granular layer in Test Pits TP-6 and 7 was also nearly level, since it had not been displaced by the slide as in the failed area. The clay fill of the upper and lower dikes was similar in the non-failed areas. At Test Pit TP-6, it appeared that the upper 3 ft of soil was poorly compacted. We suspect this soil was spread over the surface of the slope to regrade and smooth the transition between the old and new dikes.

6.3 SOIL CONDITIONS

Explorations revealed nine key materials comprising the dike and its foundation, as described below and shown graphically in Figures 4 and 8. Key geotechnical data are given in Table 1.

6.3.1 Dike Materials

New Dike

The new dike is composed of generally to medium plastic clays and silty clays with occasional zones of high plastic clay. The undrained shear strength of these materials is generally greater than 1.0 tsf. Two laboratory compaction tests (ASTM D-698) indicate an average maximum dry density of 106.1 pcf and optimum water content of 20 percent. Dry densities determined from

Shelby tube samples were compared with the maximum dry density from the compaction test to determine the percent compaction of the embankment. In general, compaction met or exceeded the 95 percent design criterion, as shown in Figure 9.

Old Dike

Materials of the old dike are similar to the new and consist generally of low and medium plastic clays. The undrained shear strength is typically about 1.0 tsf. The laboratory maximum dry density is 102.4 pcf and the average optimum water content is 22 percent. Based on dry density data from the borings, the lower dike was also generally compacted in excess of 95 percent, as indicated in Figure 9.

Bottom Ash

The bottom ash beneath the new dike has the gradation of medium to coarse sand with traces of fine gravel and contains less than 5 percent silt-size or finer material. The upper two to three feet has generally been well compacted and/or lime treated, causing it to be very strong. In some cases, cone penetration equipment met refusal on top of the bottom ash. Below the upper two to three feet, however, the bottom ash is loose to very loose with Standard Penetration test N-values of about 5. This is consistent with loose placement under water.

6.3.2 Foundation Materials

The native soils forming the dike foundation consist of alluvium, loess, glacio-lacustrine and glacial till deposits, residual high plastic clay (decomposed shale), and interbedded shale and limestone bedrock.

Alluvium (Creek Deposit)

As noted, the failure area occupies a former stream channel. Consequently, the soils directly below that area are alluvium approximately 5 ft thick which can be characterized as a gray clayey silt and silty clay with traces of silty sand and black organics. The alluvium generally has a stiff to very stiff consistency with an undrained shear strength of about of 1.0 tsf.

Loess

Outside of the area occupied by the stream channel, the dike is directly underlain by 5 to 10 ft of loess, a wind deposited silt which has weathered in place to a low to medium plastic silty clay. It is typically brown in color and has a firm to stiff consistency. The existing dam materials are constructed primarily of compacted loess since this was the most probable material exposed at shallow depth in the borrow area. The loess was not found in the borings drilled within the old stream channel.

Glacio-Lacustrine Soils and Glacial Till

The loess and alluvium is underlain by a 5 to 20 ft thick zone of glacio-lacustrine and glacial till soils. The upper portion of the zone is typically glacio-lacustrine, a stiff to very stiff low to medium plastic clay with occasional sand and silty zones. This grades downward to glacial till which is a very stiff to hard medium plastic clay with varying amounts of sand and gravel. Within the glacial till, random pockets of sand and gravel were encountered.

Residual Clay

The glacial till rests upon either a thin moderate to highly weathered limestone stratum or a very stiff to hard high plastic residual clay (decomposed shale) which has formed in-place from weathering of the underlying shale. Inclinometer data indicate that the deep failure is occurring at the contact between the till and the underlying soil or rock. Direct shear tests on samples of the residual clay indicated a residual (large displacement) friction angle of 12^{o}. In Piezometer P-4, a thin zone of gravel that appeared to have had the fine matrix surrounding it washed away by flowing water was encountered at the suspected depth of the failure plane. Borings generally encountered a mixture of silt, clay, and gravel at this contact which may be decomposed limestone bedrock or glacial till that has been sheared by this or past slides.

Limestone and Shale Bedrock

Bedrock exists below the till or residual clay and consists primarily of weathered clay shale with interbedded limestone. Limestone beds are thin, usually less than 1 ft, and slightly to moderately weathered. The upper portion of the shale is clayey, high plastic, highly weathered with low strength, especially along the bedding planes. Slickensides (shiny surfaces of earlier movements) are visible in some samples. Weathering decreases somewhat with depth.

6.4 GROUNDWATER

A total of ten piezometers were installed to measure pore pressure at various depths within and below the dike. With the exception of Piezometer P-1, all were vibrating wire piezometers so the response time would be short in the clayey soils of the embankment and foundation. Piezometer P-1 was a standpipe piezometer installed in the bottom ash to measure pond level. Piezometer P-6 was then installed adjacent to P-1 to a depth of several feet above the bottom ash. Piezometers P-2 and P-3 were installed prior to detection of the deep failure and were installed above the failure zone in either the old dike or the underlying creek deposit. Later, Piezometers P-2A, P-4, and P-3A were installed in the failed area at about the depth of the failure plane. P-5 was located outside the failure area at a comparable depth as P-2 installed within the failure zone. Later, after the deep failure plane was recognized, Piezometers P-5A and P-7 were installed outside the failure area to an equivalent elevation as the failure plane.

The shallow and deep piezometers show different pore pressures, suggesting two groundwater regimes; one in the embankment related to flow through the bottom ash and another in the foundation at depth (Figure 10). At the toe and within the failed area, the pore pressures near the failure plane are higher than those in the embankment, probably because of the presence of the blanket drain.

Outside the failure area, the deep piezometers show water levels similar to those of the deep piezometers in the failed area. The shallow piezometers, however, show a lower head in the unfailed area than in the failed area. This suggests that the ash may be less pervious, perhaps due to lime treatment, producing significant head loss to begin further from the downstream face in the unfailed area than in the failed area. Piezometer data are summarized in Table 2.

6.5 INCLINOMETER AND CRACK SETTLEMENT GAUGE DATA

Inclinometer data are plotted on Figure 11 and indicate that movement near the crest of the dike is occurring at the contact of upper dike and the ash. Further downstream failure is occurring near el. 385, at about the contact between the till and high plastic clay. Inclinometers B-11A and B-12, indicate that movement appears to be occurring in a very thin zone. In the inclinometers in Borings B-101 and B-102, movement occurred over a greater depth. The latter two inclinometers were installed about a month after B-11A and B-12.

Illinois Power installed several crack gauges across the main scarp and mid-slope scarp. The first group were installed in early March when movement was first noted, and a second group was installed after April 21, when the deep slide was noted. Results of these data are presented in Appendix C and on Figure 17. They indicate an average daily settlement of approximately 2.7 inches per day in early March 1995 prior to lowering the pond level 6 ft. The rate of movement dropped to 0.3 inch per day during late April and May. This was comparable to the rate of horizontal movement observed in the inclinometers for that time period. Therefore, lowering the water level 6 ft resulted in about a tenfold reduction in the rate of movement. Movement after the interim repair was negligible as shown in Figure 17.

7.0
DISCUSSION

7.1 CAUSE OF THE FAILURE

Data indicate that initially two slides occurred, one in the upper dike at its contact with the bottom ash, the second in the foundation on the residual clay. Slide movement is very sensitive to water pressures; therefore, lowering the pond 6 ft appeared to reduce the rate of movement by a factor of 10. After lowering the pond, the vertical settlements that were being measured became nearly imperceptible without instrumentation..

Our initial premise of the cause of failure was poor compaction of the upper dike. Test data showed, however, that the upper dike was generally well compacted and had relatively high strength. There was some suspicion of a low strength material at the base of the upper dike, however, none was found.

Another premise was that the pervious haul road fill found in the failure area was an avenue for water to travel from the ash to the face of the dike and to produce pond level hydrostatic head near the toe of the upper dike. This pressure certainly reduced the strength at the toe of the upper dike but calculations did not indicate that failure should occur for a 6 ft head difference.

When the deep failure was detected, we backfigured the strength along the failure plane assuming water pressures on the failure surface equal to the pond level at el. 438±, the level when failure first occurred. The backfigured friction angle was 15.5 degrees, assuming no cohesion. This low friction angle is consistent with residual (large displacement) friction angles measured in fissured or slickensided high plastic clays and shale such as found at the Baldwin Plant. Such low residual friction angles can develop over time as movement occurs or can be the result of movements that have occurred in the past, such as by former slides, shrinkage or swelling, or stress relief. The geologic history of the area, the overriding of the area by a glacier followed by inundation by a former glacial lake provided the opportunity for such stress relief and for softening of the residual clay and shale. This may have caused an ancient slide in this area or at least produced significant enough movements to reach the residual strength. Compounding the problem of low strength clay (decomposed shale) was the presence of a thin "washed out" zone immediately above the clay. This relatively pervious zone, that appears to have been created by water-washing, allowed pore pressures from the pond to develop at the failure plane. It is clear from the piezometer readings that pore water pressures nearly equal to pond level were (and are) present on the failure surface.

Based on the information to date, we believe the failure occurred as follows:

1. The original dike was near failure prior to raising the water level in October 1994 due to progressive failure or past movement on the low strength clay on the deep failure plane.

2. After the pond level was raised 6 ft, the water-washed zone directly above the failure plane allowed additional head to develop which initiated the failure along the low strength clay. The time needed for the development of these water pressures is unclear because the continuity and permeability of the water-washed zone is unknown. This may account for the delay from October 1994 to February 1995 for the failure to become apparent.

3. As lateral movement occurred, the dike cracked to the depth at the deep failure surface along a near-vertical failure plane within and below the crest. Soil and bottom ash migrated into the resulting crack which allowed a void to develop below the upper dike.

4. After enough movement and loss of ground had occurred, the upper clay dike slumped down to fill the resulting void caused by continued movement. Concurrently, hydrostatic pressure in the bottom ash lifted the toe of the upper dike, allowing the upper dike to slide horizontally below the failed toe area. This created the mid-slope scarp.

5. Lowering the water table slowed the rate of movement but did not stop it. Continuing lateral movement created void space resulting in loss of ground and continued settlement of the failed area.

During this entire process, the heavy Spring rains filled cracks in the failed dike thereby adding to the movement.

7.2 ESTIMATED PERFORMANCE OF THE REMAINDER OF THE SOUTH DIKE

Two potential modes of failure are possible along the south dike similar to those that occurred in the failed area. These are: 1) deep seated failure on the high plastic clay and 2) shallow failures due to hydrostatic pressure in the bottom ash causing uplift of the upper dike.

7.2.1 Areas of Potential Deep Failure

To evaluate the potential for deep failures, we calculated slope stability factors of safety at various locations along the dike, assuming a weak layer at depth. Our calculations indicate that where the height of dike is less than approximately 35 ft, deep failure is unlikely. Based on this, it appears that the potential for deep failure is greatest between stations -6-50 and 5+50 (approximately 1,200 lineal feet).

7.2.2 Areas of Potential Shallow Failure

Shallow failure at full pond head is possible along those portions of the dike where bottom ash is present and near the downstream face. Test borings encountered bottom ash from the west end of the dike to approximately Station 14+00. Design cross sections show ash extending near the face to about Station 13+00. Based on these data, we estimate that failure of the upper portion of the dike due to hydrostatic pressure in the ash could extend from the west end of the dike to about Station 14+00.

7.3 LIQUEFACTION POTENTIAL

Another concern with the bottom ash is the potential for liquefaction; the temporary loss of strength in saturated granular materials due to earthquake shaking. Liquefaction would cause compaction at the bottom ash, settlement and cracking of the upper dike bearing on the ash and the potential for rain-induced lateral movement. We evaluated liquefaction potential based on a bedrock acceleration of 0.12g and a corresponding earthquake magnitude of 6.5. Based on this level of shaking and the strength of the ash estimated from the Standard Penetration Test and cone penetrometer, it is very likely that liquefaction would occur in the bottom ash. For higher levels of shaking, the probability of liquefaction occurring increases.

The consequences of liquefaction vary depending on the water level and the thickness of fly ash within the pond. As a minimum, liquefaction would cause densification of the bottom ash and settlement and cracking of the upper clay dike. With water at the full pond elevation (el. 454±) and no fly ash as a stabilizing berm, stability analysis indicates that failure of the upstream slope of the pond is probable. This type of failure would extend to the downstream face and likely cause breaching of the dike and loss of water. On the other hand, the potential for failure of the upstream face and breaching of the dike is lower if the fly ash level is near the pond level. To reduce the potential for breaching of the dike due to liquefaction, it is believed necessary to strengthen the ash or closely control the fly ash and water levels. To be conservative, we recommend that the loose bottom ash be strengthened (or drained) to minimize the risk of liquefaction regardless of pond level. Our remedial design assumes that IP wishes to follow such an approach.

8.0
STABILITY AND SEEPAGE ANALYSES

8.1 STABILITY ANALYSIS

Our stability analyses consisted of the following three distinct tasks:

1. During the first task, we attempted to evaluate the material strengths necessary to cause the observed slope failure of the south dike.

2. The second task involved using these strengths in the analysis to determine the recommended repairs to the slide.

3. The third task involved the analysis of liquefaction potential of the upstream slope of the upper dike.

The computer program UTEXAS3, which is based on the Spencer Method, was used to conduct the analyses.

Strength parameters used in the analyses for the dike system and foundation were estimated using laboratory test results, experience, and engineering judgment. The strength parameters are presented in Table 3.

The dikes, alluvium, and loess were assigned the same strength characteristics based on (1) evaluation of triaxial tests conducted on material from the dikes, alluvium, and loess, and (2) the assumption that the dike system was constructed using loess. The remaining materials were assigned strengths based on index property tests, unconfined compression test, CPT data, and judgment.

Task A - Failure Plane Strength

A back-calculation was conducted to estimate the material strength at the failure plane. Complete strength was applied to each soil type while the strength of a thin soil layer at the estimated elevation of the failure plane was varied in order to develop a factor of safety at unity. The analyses estimated that a material with a friction angle of approximately 15.5 degrees and no cohesion could cause a wedge shaped failure of the dike system. The basic geometry assumed during the back-calculation stability analyses is presented on Figure 12. The failure plane predicted by UTEXAS3 is presented on Figure 13.

Task B - Repair Stability

Stability analyses were completed for the slide repair designs in general accordance with procedures outlined in the Illinois Department of Transportation publication Procedural Guidelines for Preparation of Technical Data to be Included in Applications for Permits for Construction and Maintenance of Dams, January 1993. Selected cases including steady state, end of construction, and earthquake loading were evaluated for areas of (1) potential deep sliding, and (2) potential shallow sliding for the three primary repair options. The resulting factors of safety are presented in Appendices D, E, and F, which discuss each primary repair option.

Task C - Liquefaction Potential

Liquefaction potential of the impounded bottom ash is significant considering the nature of the bottom ash and the pond level. A stability analysis was conducted to evaluate the potential for a failure of the upstream slope due to liquefaction of the bottom ash.

Based on published data for clean sands, the liquefied bottom ash was estimated to have a residual strength during liquefaction of approximately 100 pounds per square foot. Considering the strength of the bottom ash and the undrained strength of the remaining materials, the stability results indicate that slope failure is very likely as shown in Figure 14. Such a failure could result in breaching the dike and loss of fly ash and water.

8.2 SEEPAGE ANALYSIS

We conducted seepage analyses for the primary slide repair options using the finite element program SEEP/W (Version 3, 1994) by GEO-SLOPE International, Ltd.

Seepage Model and Analyses

Based on the results of the exploratory investigation and the elements of the slide repair options, the site stratigraphy was separated into 15 different materials which were used in the analyses.

The stratigraphy of the dike system and foundation (exclusive of repair elements) consisted of eight material types. The materials included: (1) 1989 Dike, (2) Bottom Ash, (3) 1969 Dike, (4) Alluvium (creek deposit), (5) Glacial Till, (6) Permeable Residual Clay, (7) Residual Clay, and (8) Weathered Shale. The slide repair elements consisted of the remaining 7 material types. All materials were assumed to be isotropic and homogeneous. The specific material properties are discussed below and summarized in Table 4.

1. The 1989 dike material is classified as a low to medium plastic clay or silty clay with occasional zones of high plastic clay.

2. The bottom ash is classified as a medium to coarse sand with traces of fine gravel and contains less than 5 percent fines.

3. The 1969 dike material consisted of low to medium plastic clays.

4. The alluvial material consisted of a stiff to very stiff gray clayey silt and silty clay with traces of silty sand and organics.

5. The glacial till consisted of a stiff to very stiff medium to high plastic clay with occasional sand and silty zones. This material grades downward to a very stiff to hard medium plastic clay with varying amounts of sand and gravel. The material was assumed to be homogeneous.

6. Based on vibrating wire piezometers screened across the estimated failure plane, a permeable water washed zone of silt, clay, and gravel termed "permeable" residual clay lies between the glacial till and less permeable residual clay. This is the suspected permeable zone that allowed excess head to develop below the downstream toe.

7. The residual clay is characterized as high plastic clay.

8. The weathered shale consisted primarily of clay shale with interbedded limestone. The upper portion of the shale is clayey, high plastic, highly weathered with low strength, especially along the bedding planes. The material was assumed to be homogeneous.

The slide repair elements consisted of various materials that were combined differently for the various repair options. The repair elements included; soil-bentonite wall, drain wall, HDPE wall, cement-bentonite wall, drain wall, lime/fly ash injected bottom ash, and light-weight fill. The properties of these materials assumed for analysis are given in Table 4.

The phreatic surface upstream of the dike system was assumed to be two feet below the dike crest (el. 454±). At the downstream toe, the phreatic surface was assumed to match the flow line of the creek at el. 395± unless it was artificially lowered by pumping.

9.0
COST ESTIMATES

Cost estimates made for the various repair options are based on approximate quantities determined from existing drawings and topographic information plus subsurface information determined from the borings and CPT soundings.

All estimates include a 15 percent allowance for overhead and profit, 15 percent for engineering services (design and construction monitoring), and a 20 percent contingency.

Unit prices were determined based on information from Illinois Power, contractors, material suppliers, Means 1994 Cost Estimating Guide, and judgment. A summary of the key unit prices assumed is given in Table 5.

10.0
REMEDIAL DESIGN

Remedial designs address three potential modes of failure:

1. Deep failure in the foundation
2. Shallow failure in the bottom ash due to excess hydrostatic pressure
3. Liquefaction-induced failure in the bottom ash.

Different repairs are recommended for each potential failure mode as discussed below.

10.1 FAILED AREA AND POTENTIAL DEEP SLIDE AREAS (Station -6-50 to 5+50)

Two general categories of repair techniques exist: 1) those that strengthen soil along the failure plane, and 2) those that reduce the forces causing instability (decrease the driving forces and/or increase the resisting forces).

Methods to increase the strength along the failure plane include drainage to reduce hydrostatic pressure, the removal and replacement of the failure plane materials, or mechanical strengthening of the failure zone. Such strengthening could involve construction of a shear key extending below the failure plane or by use of structural elements, such as drilled piers, stone columns, or tiedback retaining walls. Because of the low frictional resistance along the failure surface and, therefore, the large force needed to restrain the slide, drainage is more economical than the other approaches and is a very common technique. Also, the slide appears very sensitive to changes in water pressure as shown by the significant reduction in the rate of movement that followed the lowering of the pond level 6 ft.

The significant increase in the calculated Factor of Safety that results from lowering the water table below the downstream slope is shown in Figure 15. This figure indicates that lowering the water table about 8 ft is equivalent to constructing a large toe berm and the use of lightweight fill (as discussed with the HDPE option in Appendix F). Due to the significant benefit of lowering the water level below the downstream slope, repair options focused heavily on drainage.

The second repair category, i.e., methods to reduce driving forces, generally involves grading to flatten the slope, the removal of material from the crest, or the placement of material near the toe.

We considered the above techniques either alone or in combination, to develop the remedial options. We selected the target factors of safety similar to those required by the IDOT Division of Water Resources, as follows.

	Condition	Target Slope Stability Factor of Safety
1.	Steady state seepage, full pond head	1.5
2.	End of construction, full pond head	1.4
3.	Earthquake (acceleration 0.12g), full pond head,	1.0
	downstream slope	1.0
	Upstream slope (no liquefaction)	1.0

10.2 REMEDIAL OPTIONS CONSIDERED

Three primary options for repair of the potential deep failure areas were developed along with several secondary options that were briefly considered but not pursued due to obvious deficiencies. The three major options are named as follows:

- Parallel Wall Option (The preferred option)
- Translated Dike Option
- HDPE Wall

The first two options were developed in our meeting of July 21, 1995: the last option, HDPE Wall, was originally proposed as the recommended option in our draft report of June 23, 1995. Each of these three primary options are summarized in the discussion below, but details of each are included in Appendices D, E, and F, respectively. A summary of the options indicating estimated costs, advantages and disadvantages is given in Table 6.

10.2.1 Parallel Wall Option

This is the favored option of Illinois Power and consequently the one developed in most detail. It is preferred because it involves significantly less cost than the others, and will maintain the current alignment and shape of the south dike. A typical cross-section of this repair option is shown on Figure D-1.

The intent is to cut off flow below the dike and lower the water level below the downstream slope to el. 385$\pm$, i.e., the elevation of the failure plane. By controlling the downstream groundwater level, the dike can be reconstructed with conventional earth materials along its current alignment. Key elements of this option are shown graphically in Appendix D and are discussed as follows.

1. A soil bentonite cutoff wall upstream of the existing dike to cutoff the flow through the bottom ash.

2. A "drain wall" installed downstream of the cutoff wall by slurry trench techniques and extending about 5 ft below the failure plane elevation. The drain wall will be backfilled with pervious material and three small wells will be installed within the drain wall to pump water out.

3. A shallow drain wall near the toe of the slope, extending 5 ft $\pm$ below the failure plane elevation. Again three small pumps, will remove water collected by the drain wall.

When the ground water has been lowered sufficiently below the downstream slope (as determined by pore pressure measurements), the compacted clay fill for the dike can be replaced to the configuration prior to slope failure.

The key advantages to this option are cost and the maintenance of the dike along its current alignment, i.e., not shifted up or downstream. The primary disadvantage of this alternate is that pumping will be required throughout the life of the pond until closure, at which time a gravity drain can be constructed. The amount of pumping, however, should be small; a few hundred gallons per minute or less because the soil-bentonite cutoff wall greatly reduces flow through the bottom ash. Another potential disadvantage of this option is that the rate of water table lowering is uncertain due to the variability in permeability and thickness of the water washed zone above the failure plane which this option intends to drain. Therefore there is some risk that additional measures such as a toe berm, or intermediate sand drains may be needed to provide additional stability. We anticipate constructing the cutoff and drain walls in the Spring and Summer of 1996, and replacing the compacted fill approximately one year later in the Summer or Fall of 1997. This would allow approximately one year to lower the ground water level to the desired elevation. During this time, pore pressure measurements will be made. Further details of this option are given in Appendix D.

10.2.2 Translated Dike Option

This option involves building a new dike in the deep failure area approximately 150 ft downstream of the existing dike. This will require the new dike to straddle the creek and necessitate the construction of a large box culvert as shown in Appendix E, Figure E-1. The new dike would be constructed of clay obtained on-site. Foundation drainage would be provided by a drain wall that will flow by artesian pressure, (i.e., no pumps) up into a gravel blanket drain. In addition, a chimney drain is included within the dike to collect seepage through the embankment. The advantage of this option is that it would be passive, i.e., no pumps or significant maintenance would be required after construction. The disadvantages of this option are the significantly higher cost than the parallel wall option, and additional right-of-way may be required for its construction. Details are given in Appendix E.

10.2.3 HDPE Wall

This was the recommended option given in our draft report of June 23, 1995. The objective is to cut off seepage below the downstream slope of the dike with a very low permeability wall along the center line of the dike. Due to potential recharge of water from the stream however, the cutoff is not likely to be fully effective and, therefore, a stabilizing toe berm and use of lightweight fill to rebuild the slope would be required to achieve the desired factor of safety. (See Figure F-1 , Appendix F) In addition, it would be necessary to lime/fly ash inject the bottom ash below the upstream portion of the dike to mitigate liquefaction.

Key elements of this option included the following:

1. HDPE cutoff wall within a cement-bentonite slurry wall
2. Inclined sand filled pressure relief wells
3. A coarse rock toe berm
4. Lightweight fill
5. Lime/fly ash stabilized bottom ash

The advantages of this option are; it is passive, and would maintain the dike along its current alignment. Major disadvantages, however, include cost, use of fly ash backfill that may entail significant environmental constraints, and need for a toe berm. Details are given in Appendix F.

10.2.4 Secondary Options

Several other options were also considered, but after a brief review, were not developed further. These options were; key trench, regrading, and use of drill piers. Key trench and regrading options are shown schematically and approximate cost estimates are given in Appendix G. The drill pier option was not developed far enough to include cost. Each of these options are discussed briefly below.

Key Trench

This involved removing the upper slide material and most of the lower slide and constructing a key trench through the shale. It would also involve a cutoff wall and injection of the fly ash. The disadvantage of this approach was the risk of slope failure during construction and the high cost.

Regrading

This option included regrading to flatten the slope to 5H:1V and moving the crest upstream into the ash pond. This would still require a cutoff wall, but probably eliminate the toe berm. We did not pursue this further due to cost and construction difficulty.

Drilled Piers

We also considered use of drilled piers to key the slide to the underlying material, but preliminary calculations indicated that the cost would be excessive. During the course of the work, it became obvious that due to the low friction angle along the failure plane, control of water pressures was the only practical and economical option to significantly increase stability.

10.3 REMEDIAL DESIGN FOR AREAS OF POTENTIAL SHALLOW SLIDES

Two potential problems exist where the bottom ash is present between the upper and lower dikes and beneath the upper dike, even outside of the area where potential deep failure can occur. The two problems are:

- The potential for shallow slides as the pond level is raised.
- The potential for liquefaction of the bottom ash during earthquake shaking and potential failure of the dike.

These could be eliminated by removal and replacement of the bottom ash with compacted clay fill. This, however, would be expensive since it would require removal and replacement of the existing dike and would produce significant difficulty controlling the pond water level while replacing the bottom ash. Therefore, other measures are needed.

10.3.1 Mitigation of Shallow Slides

To mitigate the potential for slope failure as the pond level is raised, it will be necessary to control the hydrostatic pressure in the bottom ash beneath the downstream slope of the 1989 dike. A practical way to do this is by the installation of a cutoff wall extending through the 1989 dike into the older dike or clay foundation soils. Either soil-bentonite or cement-bentonite is feasible, however, soil-bentonite is less expensive. A cutoff wall is recommended for both the parallel wall and HDPE wall options. In addition to the cutoff wall, a small gravity drain such as a French drain, is needed to collect the small amount of water that passes through the cutoff wall and the clay fill.

10.3.2 Liquefaction Mitigation

We considered two approaches to liquefaction mitigation; 1) Strengthening the bottom ash by lime/fly ash slurry injection, or 2) draining the bottom ash using wells. The first option, lime/fly ash slurry injection, is intended to give the bottom ash cohesion. Specialty contractors quoted a cost of about $3.50 per cubic yard of treated material for lime/fly ash injection. A test section would be needed at the outset of work to determine the actual quantity of lime/fly ash needed to achieve the desired strength. Illinois Power expressed concern about the potential for increasing pH of the pond with a lime/fly ash slurry injection. To preclude changes of pH, it may be possible to inject the lime/fly ash slurry after installation of a cutoff wall. However, careful monitoring of pressures will be needed to prevent damaging the wall. The lime/fly ash injection is a passive system, i.e., no pumping is required. We considered it in conjunction with HDPE wall approach and the other passive approach of the translated dike.

The second option is the installation of wells to drain the bottom ash after construction of the cutoff wall. This is an active approach which would require continuous pumping over the life of the pond. However, with a cutoff wall in place, the quantity of pumping would be small. This approach was included with the parallel wall option, which is also an active approach.

10.4 INSTRUMENTATION

After the slide area is repaired, we recommended that instrumentation be used to monitor the slope performance, especially as the pond level is raised. Instrumentation should include piezometers, surface monuments, and inclinometers. The final number, locations, and details can be determined in final design.

11.0
INTERIM REPAIRS

In late June and July, 1995, interim repairs were done to arrest the movement of the slide which was then moving at a rate of approximately 1/4 inch per day. Interim repairs involved removal of approximately 20 ft of earth fill at the top of the slide as shown in Figure 16. After the interim repairs were completed, two inclinometers were installed on the slide area to monitor further movement. Both inclinometers show that movement to date has been insignificant and within the error of the instruments. Therefore, we conclude that the interim repairs were successful. A plot of the rate of movement of the slide during the spring and summer of 1995 is shown in Figure 17 .

12.0
CONCLUSIONS AND RECOMMENDATIONS

1. At the location of the failure, the dike is about 55 ft high and is located in the former stream channel of a creek which traversed the area prior to dike construction. The dike is composed of three key components; a 35-ft high compacted clay dike constructed in 1969, bottom ash which was placed through water in the pond and brought to the crest elevation of the 1969 dike, and a new clay dike in 1989 placed atop the bottom ash and 1969 dike.

2. In the failure area, an old haul road consisting of bottom ash, fly ash, gravel, and clay extends to the downstream face of the dike and is hydraulically connected to the bottom ash. This haul road allowed water pressure equal to the level in the pond to be felt near the toe of the upper clay dike at the downstream face. Data indicate that the clay fill in both the old and new dike is strong and generally well compacted. The entire dike rests on a foundation of natural soils, generally clay, which overlie weathered shale bedrock interbedded with thin strata of limestone. Over time, the weathered shale surface has softened into a highly plastic clay, with weakened zones possibly due to ancient landslides during geologic time.

3. Data indicate that two slides have occurred; an upper slide occurring near the base of the upper dike and bottom ash, and a deeper slide occurring about 70 ft below the dike crest on a stratum of highly plastic clay. We believe the failure first occurred on the deep slide plane along a zone of weakness, perhaps part of an ancient landslide. The failure was aggravated by excess water pressure along a thin, permeable zone of granular material directly above the high plastic clay layer. Movement of the dike on the deep failure plane opened a crack through the dike below the crest. As lateral movement continued the crack widened creating a void. Migration of bottom ash and soil into the resulting void allowed the upper dike to settle. Uplift pressure developed at the toe of the upper dike due to the bottom ash and old haul road. This lifted the toe allowing the upper portion of the dike to slide laterally below the uplifted toe as it settled.

4. The bottom ash is very loose and susceptible to significant strength loss during earthquake shaking caused by liquefaction. Liquefaction can result in failure of the upstream slope of the upper portion of the dike. This could result in breaching of the dike and loss of water.

5. Our analysis indicates that the potential for failure of the upper portion of the dike exists at full reservoir head due to water pressure in the relatively permeable bottom ash underlying the less permeable clay dike. We believe that such potential failures are possible for approximately 2,400 lineal feet of the dike, if left as is.

6. Analysis indicates that the most effective means to stabilize the deep slide area is to lower the groundwater elevation below the downstream slope of the dike. Three primary options were developed to stabilize the deep slide area; two of the options involve groundwater control, the other involves rebuilding the dike downstream of the present location. These three options are:

OPTION	KEY ELEMENTS	ESTIMATED COST (millions)	REMARKS
Parallel Wall	Cutoff wall, two drain walls pumps in drain walls	$4.3	Lowers groundwater level by pumping from drain walls. Preferred option by IP.
Translated Dike	New dike 150 ft downstream of existing dike	$6.1[1]	Passive system (no pumps). May need more right of way.
HDPE wall	Impermeable cutoff wall of HDPE in center of dike	$5.7	Passive system, lowers groundwater level by very impermeable cutoff wall.

[1] Does not include cost of additional right-of-way.

7. The Parallel Wall option is preferred by Illinois Power due to cost and because the dike can be maintained on its current alignment with its current configuration. The option requires continuous pumping while the pond is in operation, however, the amount of water to be pumped should be small (a few hundred gallons per minute) due to the cutoff wall which restricts flow through the permeable bottom ash. When the water level is lowered sufficiently, as determined by piezometers, the clay fill can be replaced and the pond put back into full operation. A year between installation of the drainage measures and replacement of the clay fill is recommended to allow time for drainage.

8. In areas of potential shallow failure a cutoff wall is recommended through the bottom ash to control hydrostatic pressure below the upper clay dike. Two methods were considered to mitigate liquefaction in areas of potential shallow failure; 1) strengthen the bottom ash by lime/fly ash slurry injection, and 2) drain the ash by small pumps. The later approach (preferred by Illinois Power) is the more economical and is similar to the pumping concept used with the Parallel Wall option in areas of deep failure.

9. Following remedial construction, we recommend that instrumentation including inclinometers, surface monuments, and piezometers be used to monitor performance of the repaired south dike. Monitoring is very important to verify that the drainage measures are effective. If not, additional measures may be needed.

13.0
CONTINUITY OF GEOTECHNICAL ENGINEERING SERVICES

The geotechnical investigation and this report are the first steps in the evaluation of subsurface conditions and remedial design. Because actual subsurface conditions can vary from those inferred from the exploration, it is essential that the geotechnical engineer of record be present on-site during remedial construction to confirm that the subsurface soil and groundwater conditions match the design assumptions. Consequently, we recommend that WCC be retained to document remedial construction. We also recommend that we be involved with the design of the remedial measures and during development of the plans and specifications related to our work to verify that our recommendations have been properly interpreted and incorporated into the final design.

14.0
LIMITATIONS

The evaluation and design of remedial measures to stabilize landslides involve a significant number of uncertainties. While we believe that our exploration program has been detailed enough to identify key subsurface conditions, it is possible that unknown conditions exist between the exploratory locations. Changes in groundwater conditions can also occur over time. These possible unknown conditions could aggravate sliding and adversely affect the mitigation design. Therefore, even with remedial measures installed, there is some risk of future movement and potential dike failure.

SUMMARY OF TYPICAL AND ASSUMED MATERIAL PROPERTIES

Generalized Material Type	TYPICAL MATERIAL VALUES					ASSUMED DESIGN VALUES FOR ANALYSES					
	Atterberg Limits		Water Content, %	Blow Count (N)	Undrained Shear Strength, tsf	Total Unit Weight, pcf	Drained Strengths		Undrained Strengths		Permeability, cm/sec
	LL	PL					Cohesion, psf	Friction Angle	Cohesion, psf	Friction Angle	
DIKE:											
1989 Dike	40 - 50	17 - 22	15 - 25		>1.0	115.0	100	28	2,000	0	5.0E-06
Bottom Ash	NP	NP		5		97.0	0	30	0	30	1.0E-02
1969 Dike	40 - 50	17 - 22	20 - 25		1.0	115.0	100	28	1,500	0	5.0E-06
Lime Treated Ash*	-	-	-	-	-	97.0	0	30	0	30	1.0E-03
Light Weight Fill*	-	-	-	-	-	95.0	0	35	0	35	1.0E-03
FOUNDATION:											
Alluvium	-	-	20 - 30		0.7 - 1.1	115.0	100	28	1,500	0	1.0E-06
Loess	30 - 40	17 - 24	20 - 25	7 - 15	0.5 - 1.5	120.0	100	28	1,500	0	-
Glacio-lacustrine / Till	35 - 45	15 - 20	15 - 30	10 - 22	1.2 - 2.2	120.0	1,000	20	2,000	0	1.0E-07
Failure Plane	50 - 75	30 - 40	-	-	-	120.0	0	14	0	14	-
Residual Clay	45 - 55	25 - 35	18 - 21	11 - 38	1.5 - 2.5	120.0	100	28	2,000	0	1.0E-07
Shale	45 - 55	25 - 35	23	24 - ref.	>2	125.0	1,000	20	2,000	0	1.0E-07

* Materials included as part of the suggested slide repair

Piezometer Data

Illinois Power Levee Landslide
5E08560
Piezometer Data

		Apr-95 Factory Calibration	4/12/95	4/13/95	4/14/95	4/18/95	4/21/95	4/24/95	4/28/95	5/1/95	5/4/95	5/8/95	5/11/94	5/15/95	5/19/95	5/23/95	5/25/95	5/30/95	6/2/95	6/9/95	7/19/95	8/25/95
Standpipe																						
P-1	Depth (ft)	21.4			21.40	21.18	21.23	21.15	21.15	21.08	21.1	21.05	20.9		21.15	20.82	20.6 Piezometer Sheared Off					
Vibrating Wire																						
P-2	Voltage	11697		11645	10744	9870	9956	10008	10067	10127	10177	10269	10387	10540	10604	10582	10580	10600	10614	10650	10838	10916
(25 ft)	Pressure(psi)			0	6.47	12.74	12.13	11.75	11.33	10.90	10.54	9.88	9.03	7.93	7.47	7.63	7.65	7.50	7.40	7.14	5.79	5.23
	Feet of Water			0	14.92	29.40	27.97	27.11	26.13	25.14	24.31	22.79	20.83	18.30	17.24	17.61	17.64	17.31	17.08	16.48	13.37	12.07
	Elevation (ft)			50	65	79	78	77	76	75	74	72	70	68	67	67	67	67	67	66	63	62
P-2A	Voltage	9149												8368	8531	8369	8368	8364	8373	8373	8387	8365
(41.5 ft)	Pressure(psi)													12.61	9.98	12.60	12.61	12.68	12.53	12.53	12.31	12.66
	Feet of Water													29.10	23.03	29.06	29.10	29.25	28.91	28.91	28.39	29.21
	Elevation (ft)													62	56	62	62	62	62	62	61	62
P-3	Voltage	11454		11410	10990	10827	10800	10782	10800	10834	10851	10938	11008	11016	10896	10891	10885	10864	10895	10891	10950	10964
(10 ft)	Pressure(psi)			0	2.93	4.07	4.26	4.38	4.26	4.02	3.90	3.29	2.80	2.75	3.59	3.62	3.66	3.81	3.59	3.62	3.21	3.11
	Feet of Water			0	6.76	9.38	9.82	10.11	9.82	9.27	9.00	7.60	6.47	6.34	8.27	8.35	8.45	8.79	8.29	8.35	7.40	7.18
	Elevation (ft)			41	48	50	51	51	51	50	50	48	47	47	49	49	49	50	49	49	48	48
P-3A	Voltage	9309													8563	8574	8570	8571	8578	8576	8587	8578
(22.2 ft)	Pressure(psi)														11.50	11.33	11.40	11.38	11.27	11.30	11.13	11.27
	Feet of Water														26.54	26.15	26.29	26.25	26.00	26.08	25.68	26.00
	Elevation (ft)														55	55	55	55	55	55	54	55
P-4	Voltage	9225												8569	8572	8570	8570	8566	8572	8570	8578	8566
(30.8 ft)	Pressure(psi)													12.61	12.55	12.59	12.59	12.67	12.55	12.59	12.44	12.67
	Feet of Water													29.09	28.96	29.05	29.05	29.22	28.96	29.05	28.70	29.22
	Elevation (ft)													57	57	57	57	57	57	57	57	57
P-5	Voltage	10093		10051	9224	9136	9118	9100	9114	9153	9160	9170	9185	9128	9098	9115	9099	9092	9112	9111	9140	9091
(25 ft)	Pressure(psi)			0	5.79	6.40	6.53	6.65	6.56	6.28	6.23	6.16	6.06	6.46	6.67	6.55	6.66	6.71	6.57	6.58	6.37	6.72
	Feet of Water			0	13.35	14.77	15.06	15.35	15.12	14.49	14.38	14.22	13.98	14.90	15.38	15.11	15.37	15.48	15.16	15.17	14.70	15.49
	Elevation (ft)			50	63	65	65	65	65	64	64	64	64	65	65	65	65	65	65	65	65	65
P-5A	Voltage	9447												8542	8531	8540	8533	8533	8542	8543	8564	8547
(45 ft)	Pressure(psi)													15.44	15.62	15.47	15.59	15.59	15.44	15.42	15.07	15.35
	Feet of Water													35.62	36.05	35.70	35.97	35.97	35.62	35.58	34.76	35.42
	Elevation (ft)													66	66	66	66	66	66	66	65	65
P-6	Voltage	11256	11261		11420	11342	11345	11329	11336	11350	11365	11376	11387	11388	11386	11392	11434	11459	11365	11320	Eliminated	
(18 ft)	Pressure(psi)		0		-1.13	-0.58	-0.60	-0.49	-0.53	-0.63	-0.74	-0.82	-0.90	-0.89	-0.89	-0.93	-1.23	-1.41	-0.74	-0.42		
	Feet of Water		0		-2.62	-1.33	-1.38	-1.12	-1.23	-1.46	-1.71	-1.89	-2.07	-2.06	-2.06	-2.16	-2.85	-3.26	-1.71	-0.97		
	Elevation (ft)		80		78	79	79	79	79	79	78	78	78	78	78	78	77	77	78	79		
P-7	Voltage	9324													8572	8584	8573	8576	8586	8585	8592	8584
(26.4 ft)	Pressure(psi)														12.75	12.54	12.73	12.68	12.51	12.52	12.40	12.54
	Feet of Water														29.41	28.93	29.37	29.25	28.85	28.89	28.62	28.93
	Elevation (ft)														54	54	54	54	53	53	53	54

NOTE: Negative pressures may not indicate true water elevations.

TABLE 2

TABLE 3
SUMMARY OF ASSUMED MATERIAL PROPERTIES FOR STABILITY ANALYSIS

Generalized Material Type	Total Unit Weight, pcf	Drained Strengths		Undrained Strengths		Source
		Cohesion, psf	Friction Angle	Cohesion, psf	Friction Angle	
DIKE:						
1989 Dike	115.0	100	28	2,000	0	Triaxial Test Results (CIU, UU), judgement
Bottom Ash	97.0	0	30	0	30	Experience, judgement
1969 Dike	115.0	100	28	1,500	0	Triaxial Test Results (CIU, UU), judgement
Gravel Road*	125.0	0	42	-	-	Judgement
Cemented Ash*	125.0	0	42	-	-	Judgement
Lime Treated Ash**	97.0	0	30	0	30	Experience, judgement
Light Weight Fill**	95.0	0	35	0	35	Experience, judgement
FOUNDATION:						
Alluvium	115.0	100	28	1,500	0	Triaxial Test Results (CIU, UU), judgement
Loess***	120.0	100	28	1,500	0	Triaxial Test Results (CIU, UU), judgement
Glacio-lacustrine / Till	120.0	1,000	20	2,000	0	Experience, judgement
Failure Plane	120.0	0	14	0	14	Back-calculation, judgement
Residual Clay	120.0	100	28	2,000	0	Experience, judgement
Shale	125.0	1,000	20	2,000	0	Experience, judgement

* Materials included as features to back-calculation geometry
** Materials included as features to slide repair geometry
*** Material included as a feature to shallow slide area geometry

TABLE 4
SUMMARY OF ASSUMED MATERIAL PROPERTIES FOR PERMEABILITY ANALYSIS

Generalized Material Type	Permeability, cm/sec	Source
DIKE:		
1989 Dike	5.0E-06	Experience, previous test data on similar compacted clays
Bottom Ash	1.0E-02	Experience, judgement
1969 Dike	5.0E-06	Experience, previous test data on similar compacted clays
FOUNDATION:		
Alluvium	1.0E-06	Experience, previous test data on similar compacted clays
Glacio-lacustrine / Till	1.0E-07	Experience, judgement
Permeable Residual Clay	1.0E-05	Judgement, vibrating-tip piezometers
Residual Clay	1.0E-07	Experience, judgement
Shale	1.0E-07	Experience, judgement
REPAIR FEATURES:		
Lime Treated Ash	1.0E-03	Experience, judgement
Light Weight Fill	1.0E-03	Experience, judgement
Geomembrane Wall	1.0E-12	GUNDLE
Inclined Drains	1.0E-03	Experience, judgement
Soil-Bentonite Wall	1.0E-06	Experience, judgement
Drain Wall	1.0E-03	Experience, judgement
Cement-Bentonite Wall	1.0E-06	Experience, judgement

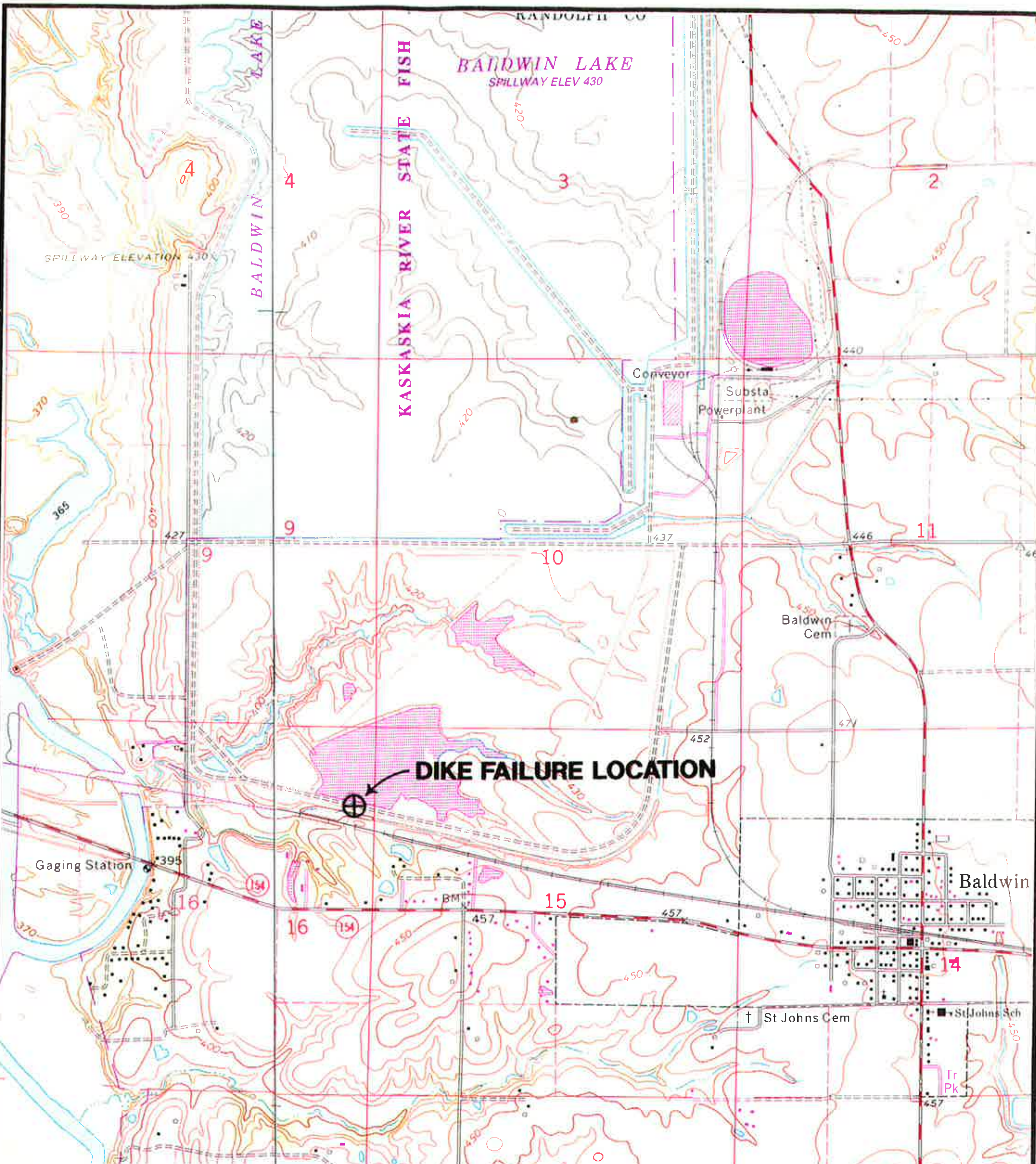
SUMMARY OF KEY UNIT PRICES USED IN COST ESTIMATES

Description	Unit Price ($)	Unit	Source
1. HDPE wall "GundWall" in cement-bentonite slurry wall	10.50	Ft^2	Slurry Walls, Inc. 301/934-1846
2. Cement-bentonite slurry wall	4.25	Ft^2	Slurry Walls, Inc. 301/934-1846
3. Inclined wells	40.00	L.F.	Warren-George Drilling 201/433-9797
4. Lime fly ash injection of bottom ash	3.50	c.y. of treated soil	Woodbine-GKN/Hayward-Baker
5. Excavate soil in slide area and recompact	5.00	c.y.	Illinois Power
6. Excavate soil and stockpile	2.50	c.y.	Judgment
7. Drain rock or shot rock	15.00	c.y.	Rogers Ready Mix 618/282-3844
8. Seed and mulch	0.50	s.y.	Means Guide, 1994
9. Strip topsoil	0.90	c.y.	Means Guide, 1994
10. Lime stabilized fly ash (lightweight fill)	5.00	c.y.	Judgment
11. Soil-bentonite slurry wall	4.00	s.f.	Geo-Con 817/383-1400
12. Drain wall	9.00	s.f.	Geo-Con 817/383-1400
13. 8 by 10 Box culvert	600.00	L.F.	Means Guide, 1994
14. Vertical wells, pumps, warning system	15,000.00	each	Layne-Western 314/343-3700

SUMMARY OF PRIMARY REPAIR OPTIONS

Option	Estimated Cost (millions)	*Design Intent*/Key Elements		Advantages	Disadvantages
		Deep Failure Areas	Shallow Failure Areas		
Parallel Wall	$4.3	*Lower groundwater elevation below downstream slope with drains/pumps.* • Upstream cutoff wall • Upstream drain wall • Downstream drain wall • Pumps within drain walls	*Drain bottom ash by cutoff wall and pumps to mitigate shallow failure and liquefaction.* • Upstream cutoff wall • Pumps in bottom ash	• Lowest cost • Maintain dike alignment • Maintain dike shape	• Continuous pumping (active system)
Translated Dike	$6.1 (w/o additional R.O.W.)	*Build new dike downstream of failure area and without bottom ash fill.* • New clay dike • Drain wall below new dike	*Cutoff flow through bottom ash with cutoff wall. Mitigate liquefaction by lime/fly ash injection to strengthen bottom ash.* • Cutoff wall • Lime/fly ash inject bottom ash • French drain	• Passive system (no pumping)	• High cost • May need additional R.O.W.
HDPE Wall	$5.7	*Lower groundwater level below downstream slope with very impervious wall. Use lightweight fill and toe berm to supplement drainage.* • Centerline HDPE wall • Inclined wells • Lightweight (fly ash) fill • Rock toe berm	*Cutoff flow through bottom ash with cutoff wall. Mitigate liquefaction by lime/fly ash injection to strengthen bottom ash.* • Centerline cutoff wall • Lime/fly ash inject bottom ash • French drain	• Passive system (no pumping) • Maintain dike alignment and shape	• Cost • Complicated construction • Environmental concerns with fly ash fill

TABLE 6



Reference Drawing taken from USGS topographic map N38Ø7.5–W8952.5/7.5 & N38Ø7.5–W8945/7.5

Ø 1
SCALE MILE

ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO. 5EØ856Ø

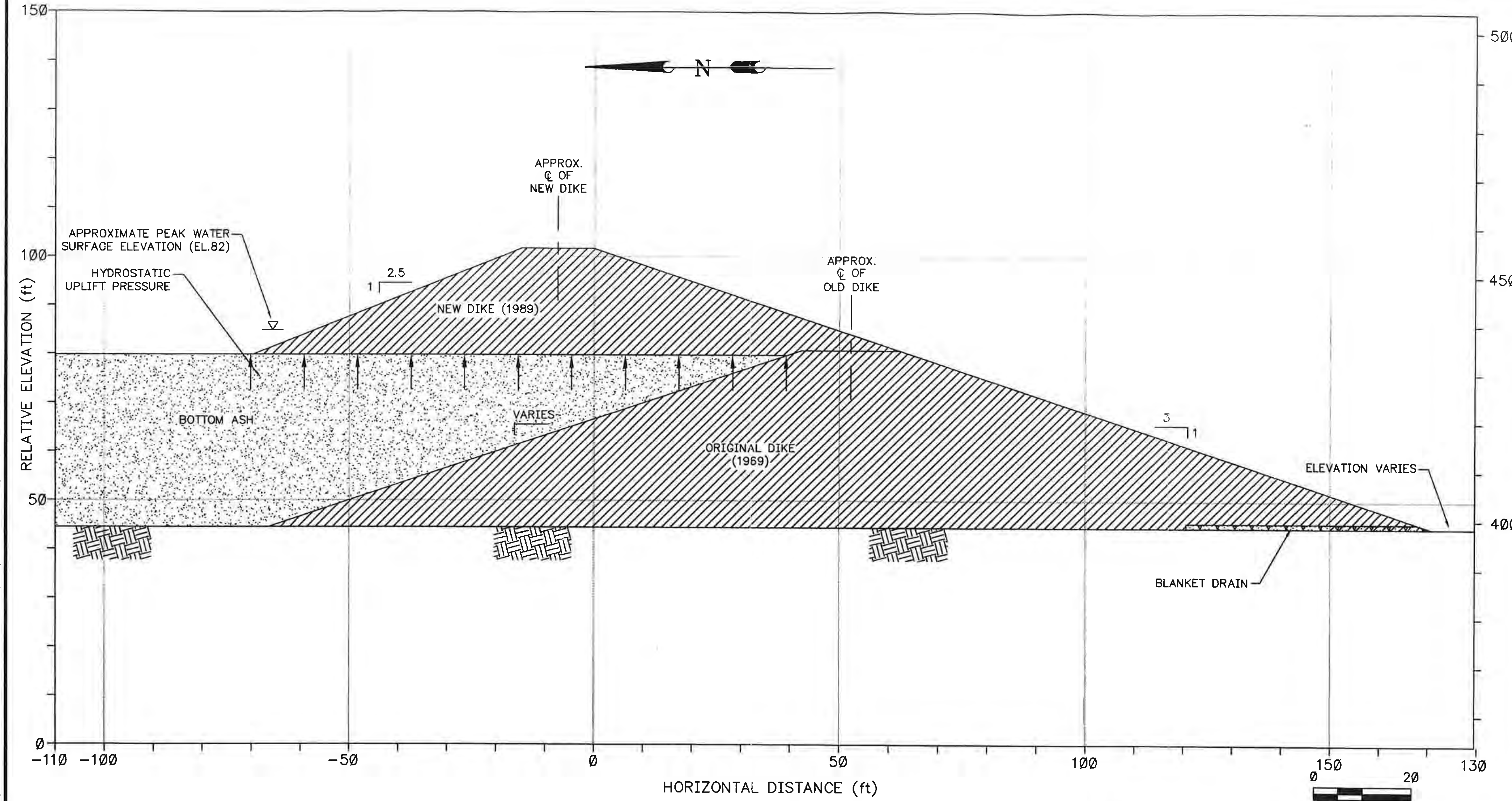
Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 5/22/95
DSGN. BY: gaz
CHKD. BY: KMB 6/23/95

Vicinity Map

FIG. NO. 1

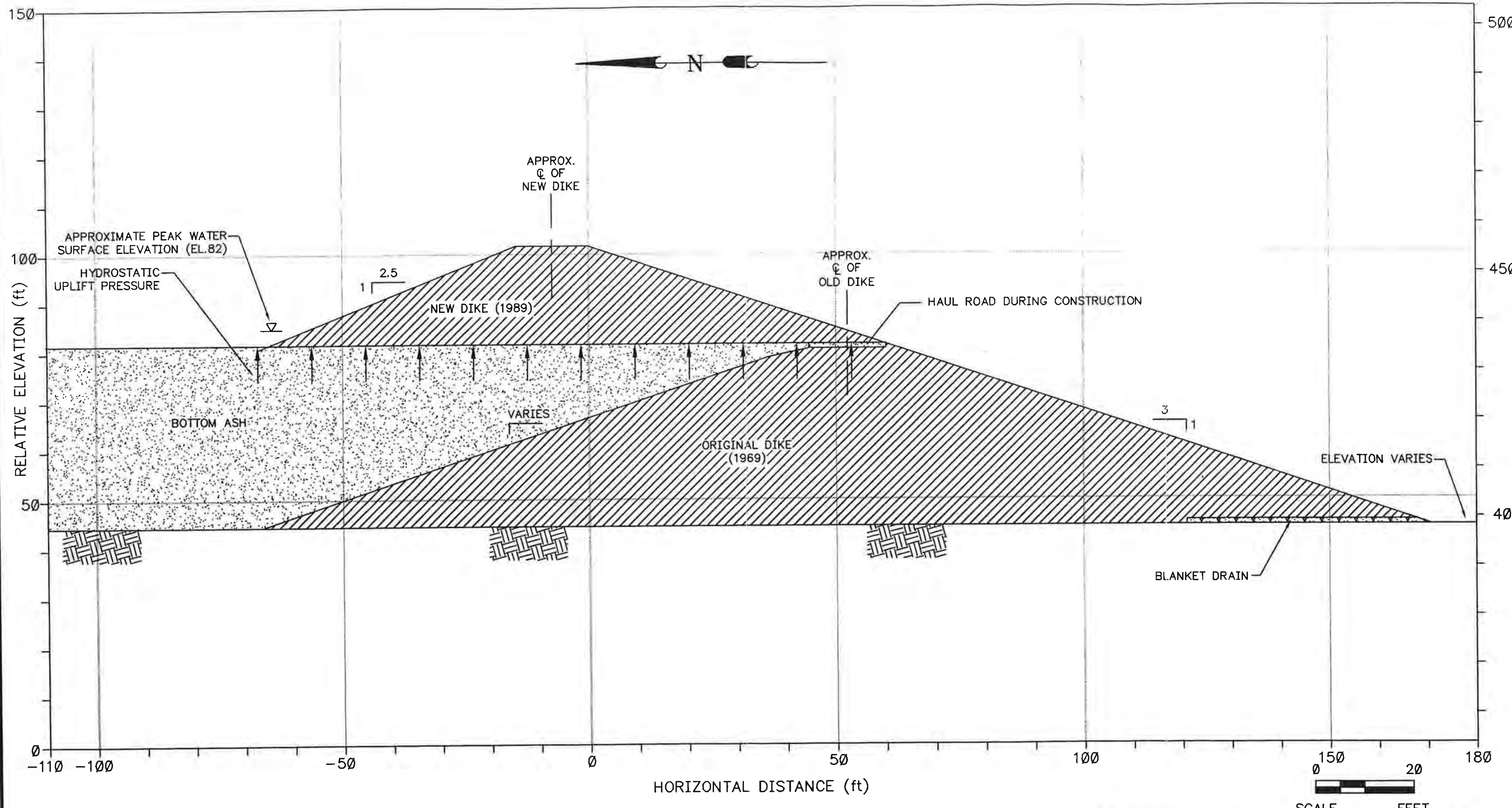
File: F:\5E... \TASK240\VCNTYMAP.DWG Last edited: 06/09/95 @ 11:14 ... @ WCC–ST.LOUIS



Note: This typical cross section is based on the construction drawings and records provided by Illinois Power.

File: F:\5E08560\TASK240\ASDGNSEC.DWG Last edited: 06/22/95 @ 6:15 p.m. @ WCC-ST.LOUIS

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/22/95 DSGN. BY: gaz CHKD. BY: JMB 6/23/95	As Designed Section in Failed Area
FIG. NO.	2



Note: This typical cross section is based on the construction drawings and records provided by Illinois Power.

ILLINOIS POWER
BALDWIN STATION SOUTH ASH POND DIKE
BALDWIN, IL.

PROJECT NO. 5E08560

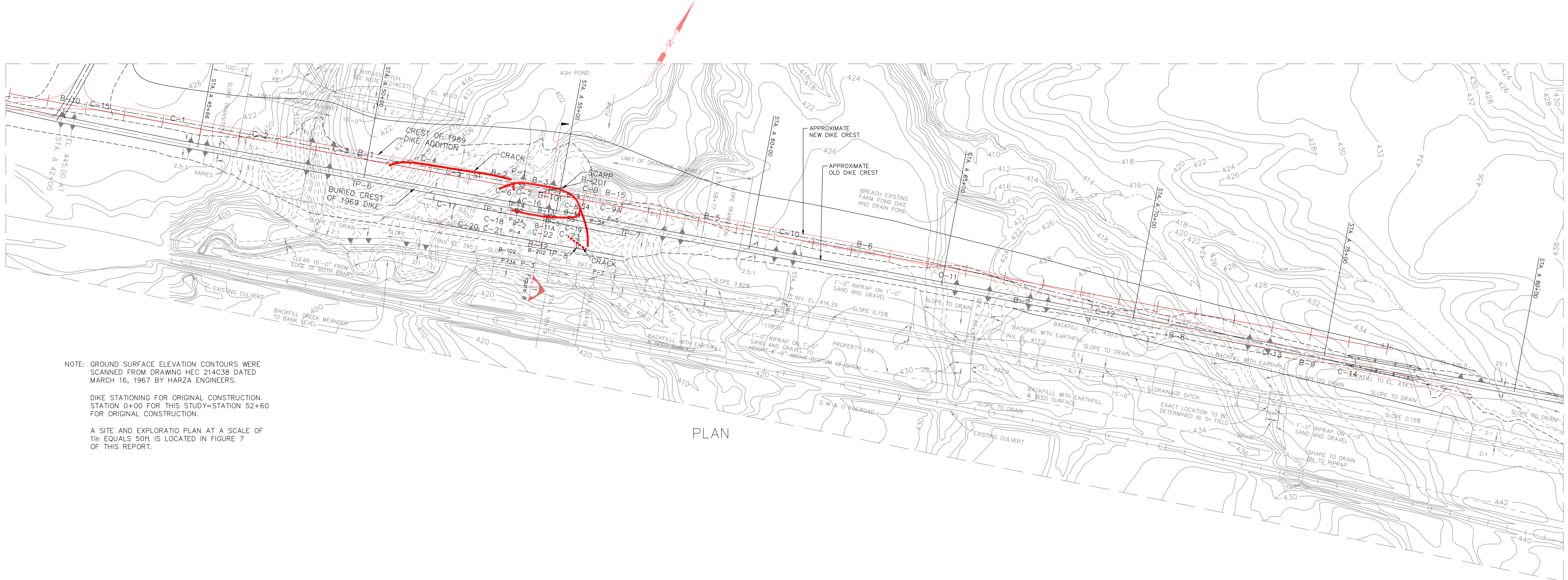
Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 5/22/95
DSGN. BY: gaz
CHKD. BY: KMB 6/23/95

As Built Section in Failed Area

FIG. NO. 3

File: F:\5E08560\TASK240\ASBLTSEC.DWG Last edited: 06/22/95 @ 6:28 p.m. @ WCC-ST.LOUIS

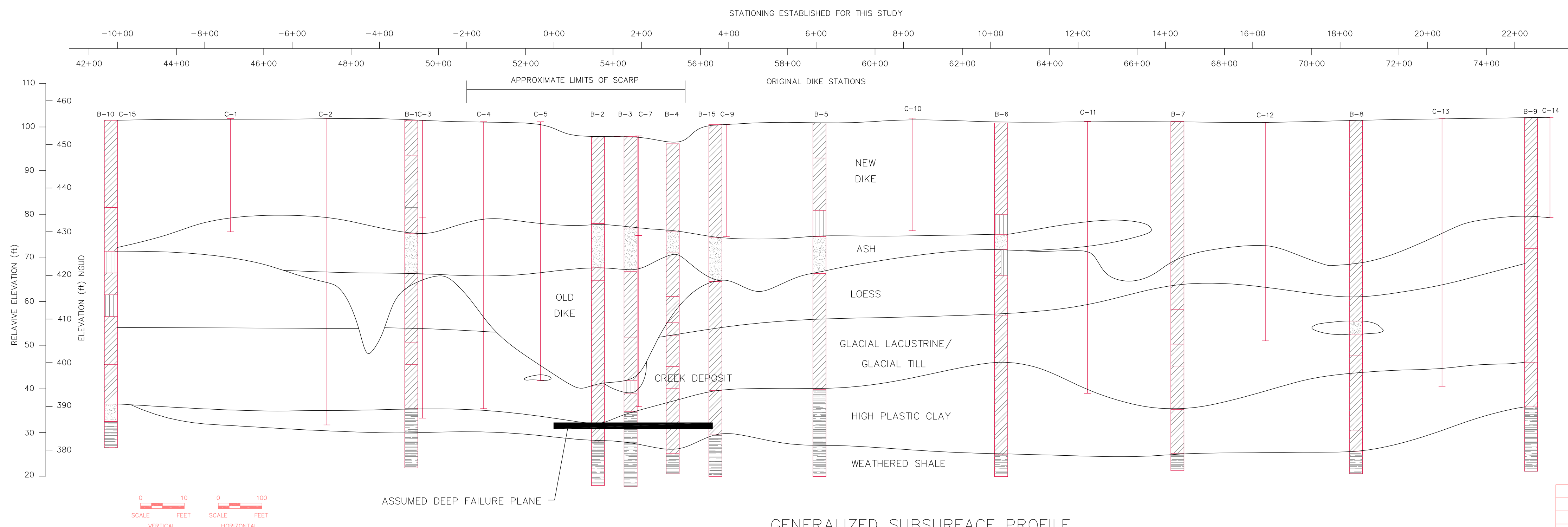


NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION.

A SITE AND EXPLORATIO PLAN AT A SCALE OF 1in EQUALS 50ft IS LOCATED IN FIGURE 7 OF THIS REPORT.

PLAN



GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF NEW DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU (CONE PENETRATION TEST)
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.

Revision No.	Description	Date	By	App.

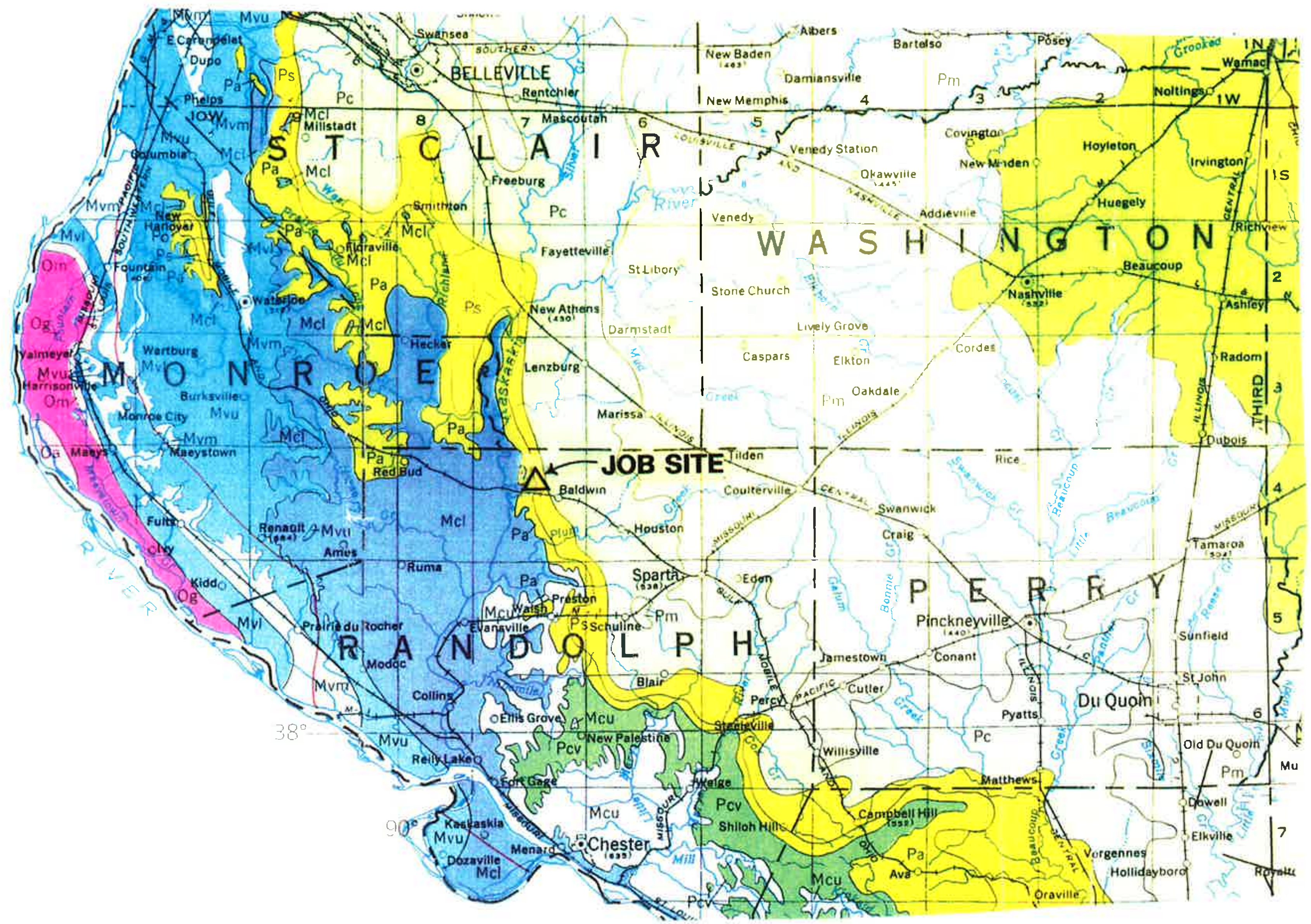
REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE

Date: 4/10/95	Project Number: 5E08560	Figure Number: 4
Drawn by: kdw	Design by: gaz	Checked by:

Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment



Glacial Boundaries

Wisconsinan

- Late Woodfordian
- Middle Woodfordian
- Early Woodfordian
- Altonian

Illinoian

Kansan

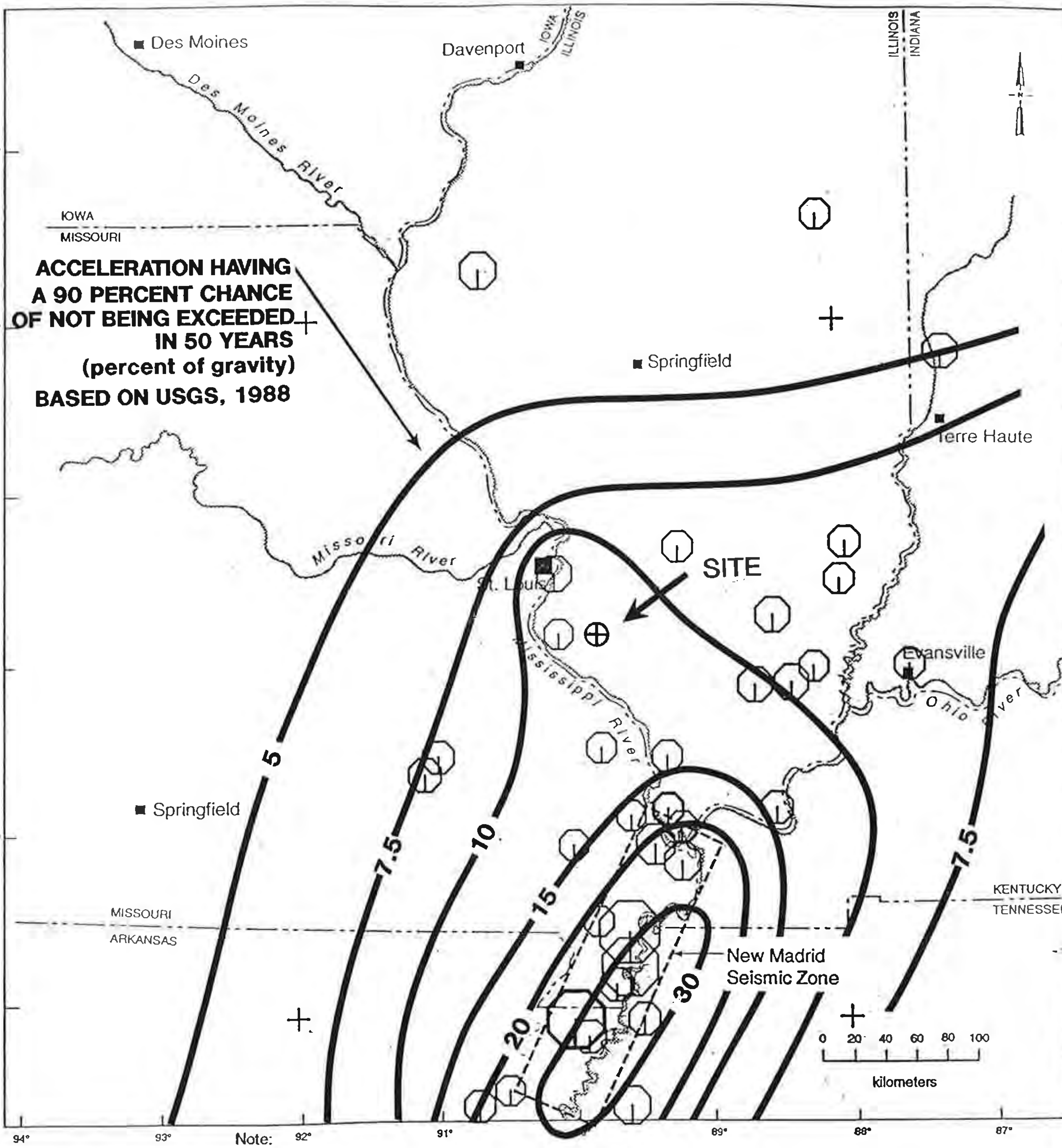
PENNSYLVANIAN

Pc	Carbondale
Ps	Spoon (includes Pa in northeast)
Pa	Abbott
Pcv	Caseyville

MISSISSIPPIAN

Mcu	Upper Chesterian (Grove Church-Tar Springs)
Mcl	Lower Chesterian (Glen Dean-Renault)
Mvu	Upper Valmeyeran (Aux Vases, Ste. Genevieve, St. Louis)

Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment 2318 Millpark Drive Maryland Heights, Missouri 63043	ILLINOIS POWER FLY ASH SEDIMENTATION POND BEDROCK STRATIGRAPHY	PROJECT NO: 5E08560 DATE: 5/25/95	CHK'D BY: TKD FIGURE 5



Note:

Epicenter data from National Earthquake Information Center.

Magnitude

5.0

6.0

7.0

8.0

ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO. 5EØ856Ø

Woodward-Clyde Consultants

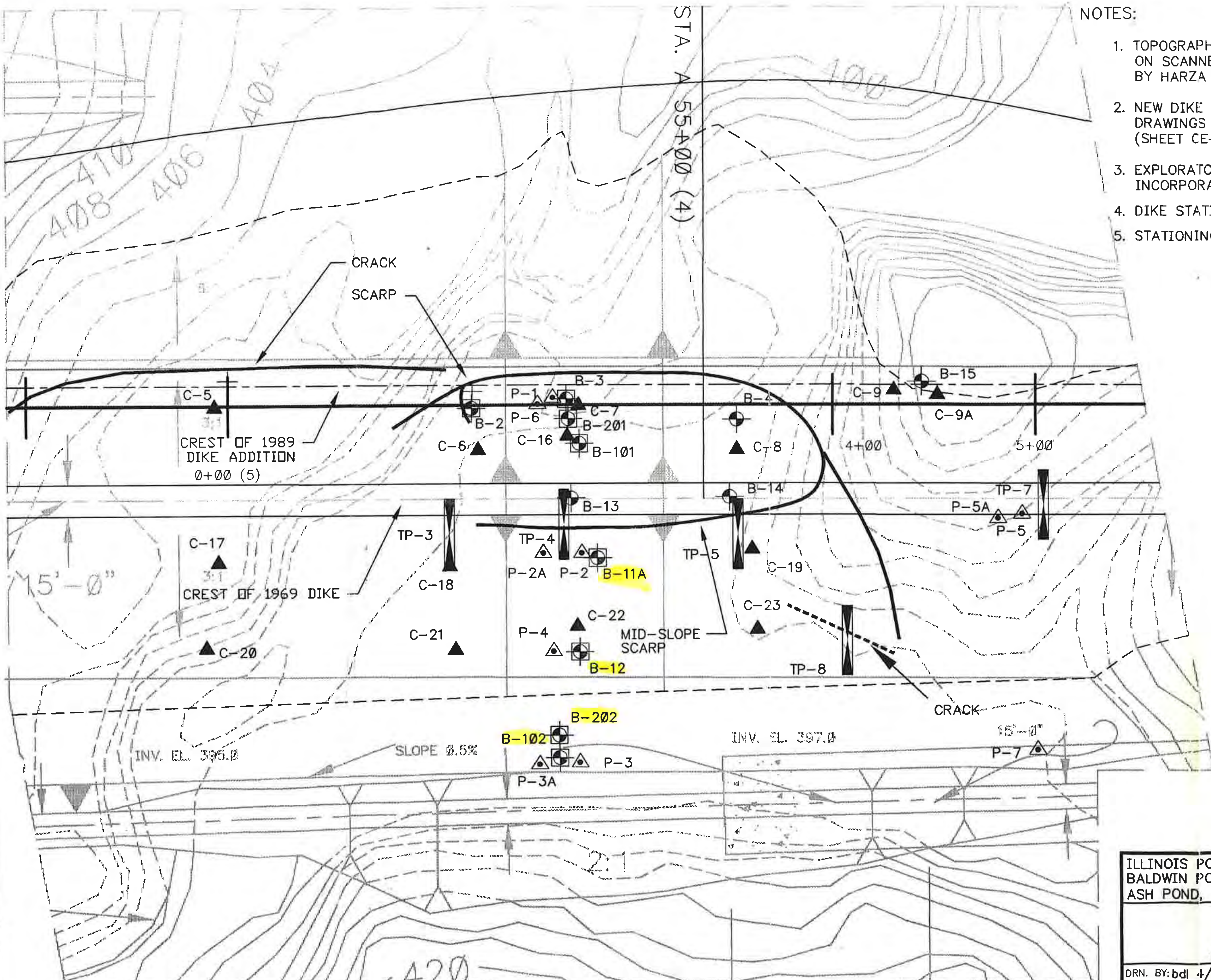
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 5/22/95
DSGN. BY: gaz
CHKD. BY:

Estimated Bedrock Acceleration

FIG. NO. 6

File: F:\5E08560\TASK240\ACCONMAP.DWG Last edited: 06/05/95 @ 10:11 a.m. @ WCC-ST.LOUIS



NOTES:

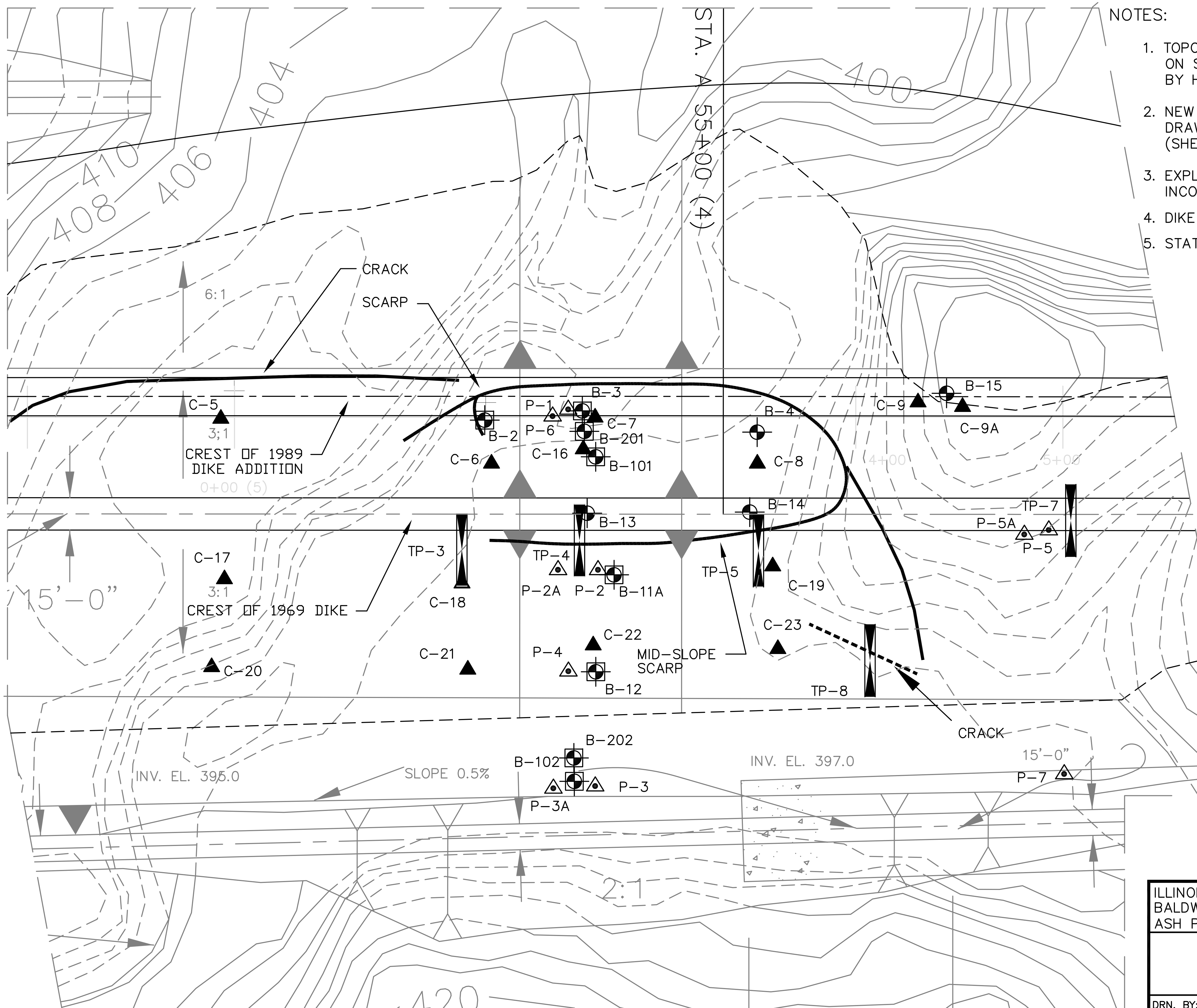
1. TOPOGRAPHY AND OLD DIKE FOOTPRINT BASED ON SCANNED IMAGE FROM CONSTRUCTION DRAWINGS BY HARZA ENGINEERING COMPANY (SHEET 2),(NOV. 18, 1969).
2. NEW DIKE FOOTPRINT BASED ON CONSTRUCTION DRAWINGS PROVIDED BY ILLINOIS POWER COMPANY (SHEET CE-BAL1-B15-03X),(MAY 14, 1986).
3. EXPLORATORY LOCATIONS SURVEYED BY FREESEN INCORPORATED.
4. DIKE STATIONING FOR ORIGINAL CONSTRUTION
5. STATIONING FOR THIS STUDY

LEGEND

- ▲ CPTU
- BORING
- TEST PIT
- PIEZOMETER
- BORING WITH INCLINOMETER

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/27/95 DSGN. BY: gaz CHKD. BY: BMB 8/30/95	SITE AND EXPLORATION PLAN IN FAILED AREA
FIG. NO.	7

File: F:\5E08560\TASK240\SCRPPLAN.DWG Last edited: 08/24/95 @ 4:48 p.m. @ WCC-ST.LOUIS



NOTES:

1. TOPOGRAPHY AND OLD DIKE FOOTPRINT BASED ON SCANNED IMAGE FROM CONSTRUCTION DRAWINGS BY HARZA ENGINEERING COMPANY (SHEET 2),(NOV. 18, 1969).
2. NEW DIKE FOOTPRINT BASED ON CONSTRUCTION DRAWINGS PROVIDED BY ILLINOIS POWER COMPANY (SHEET CE–BAL1–B15–03X),(MAY 14, 1986).
3. EXPLORATORY LOCATIONS SURVEYED BY FREESEN INCORPORATED.
4. DIKE STATIONING FOR ORIGINAL CONSTRUTION
5. STATIONING FOR THIS STUDY

LEGEND

- ▲ CPTU
- BORING
- TEST PIT
- PIEZOMETER
- BORING WITH INCLINOMETER

0 50
SCALE FEET

N

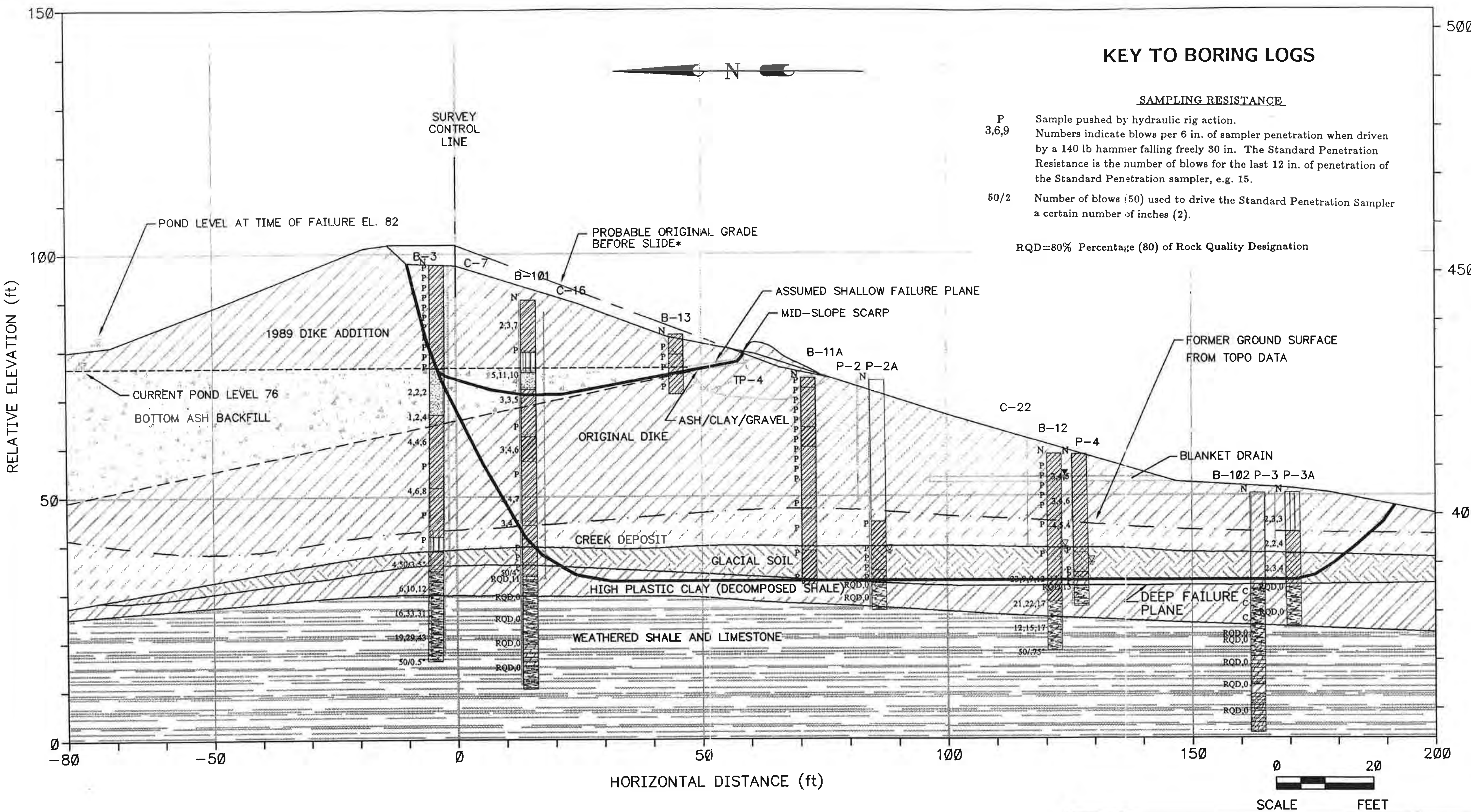
ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560

Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 4/27/95 DSGN. BY: gaz CHKD. BY:	SITE AND EXPLORATION PLAN IN FAILED AREA	FIG. NO. 7

File: F:\5E08560\TASK240\SCRPPLAN.DWG Last edited: 08/24/95 @ 4:48 p.m. @ WCC–ST.LOUIS

File: F:\5E08560\TASK240\SECTHSLD.DWG Last edited: 06/23/95 @ 1:59 p.m. @ WCC-ST.LOUIS



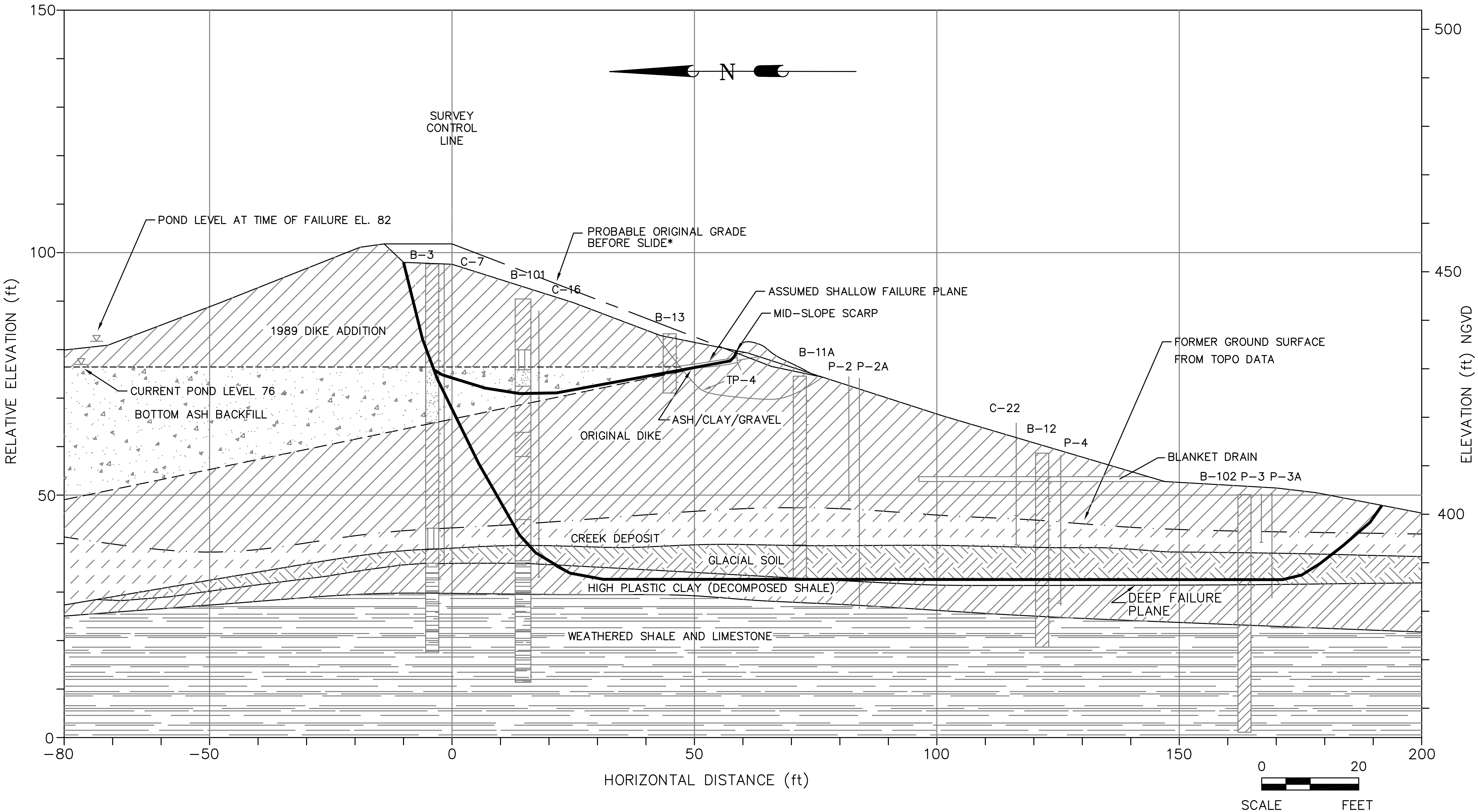
Notes:

1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 10/23/95	Generalized Section Through Center of Failure — FIG. NO. 8



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

LEGEND
- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE

ILLINOIS POWER
BALDWIN STATION SOUTH ASH POND DIKE
BALDWIN, IL.

PROJECT NO. 5E08560

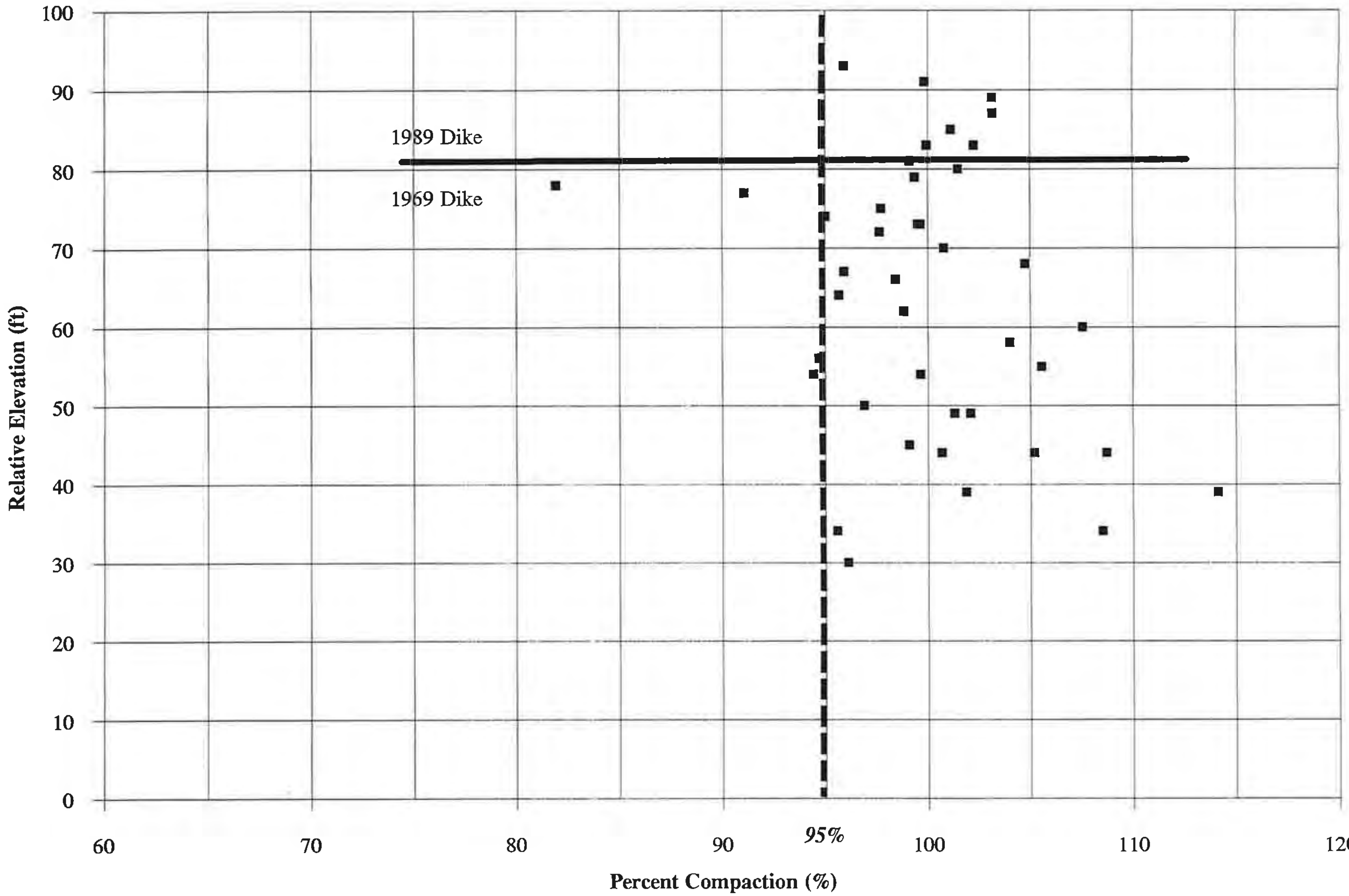
Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 4/20/95
DSGN. BY: gaz
CHKD. BY:

Generalized Section Through Center of Failure

FIG. NO. 8

RESULTS OF ESTIMATED COMPACTION FOR DIKES

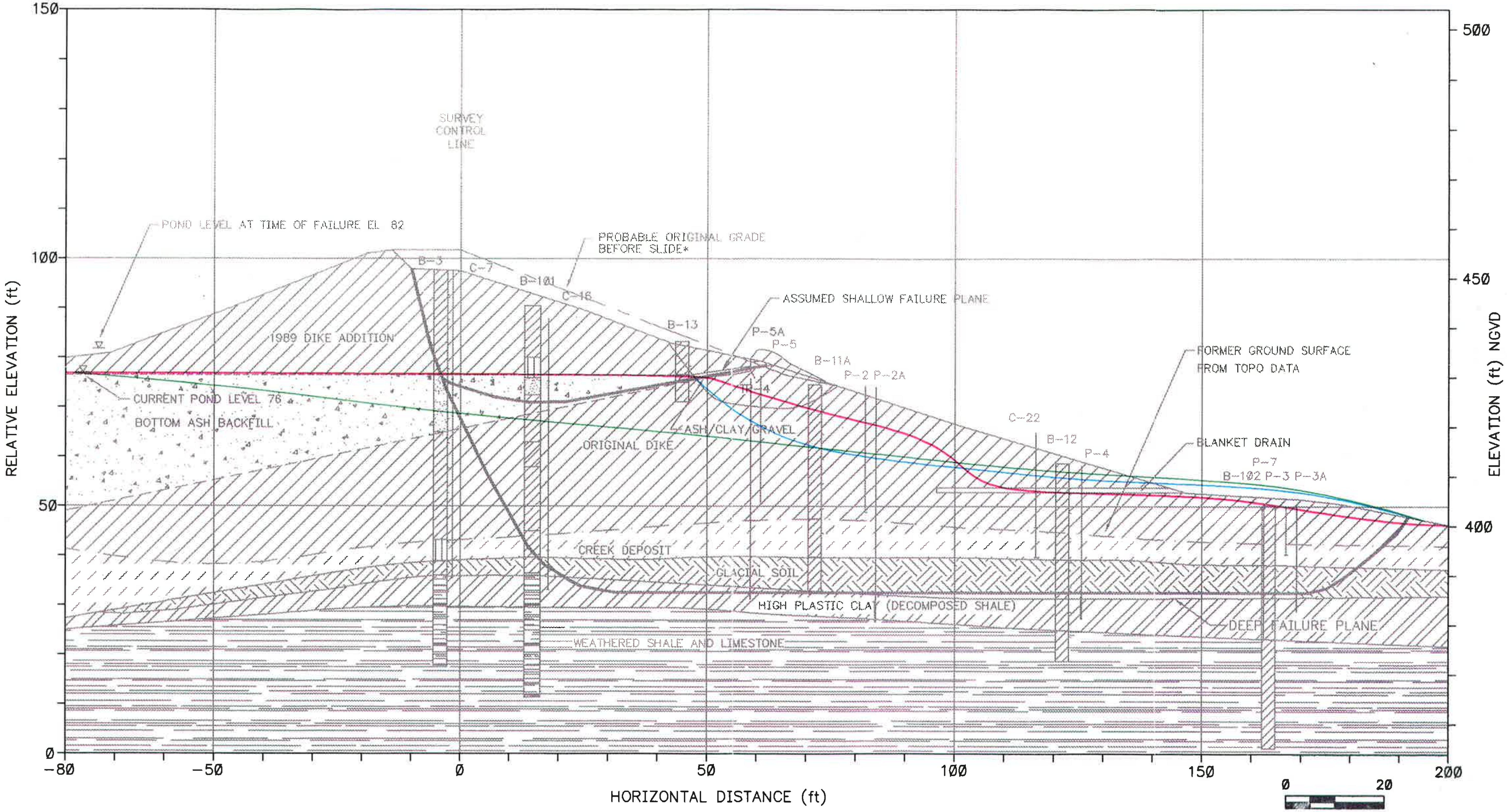


DENSITY.XLS Chart 1

Woodward-Clyde Consultants

FIGURE 9

File: F:\5E08560\TASK240\PIEZHEAD.DWG Last edited: 06/08/95 @ 09:41 a.m. @ WCC-ST.LOUIS



WATER LEVELS FROM PIEZOMETERS

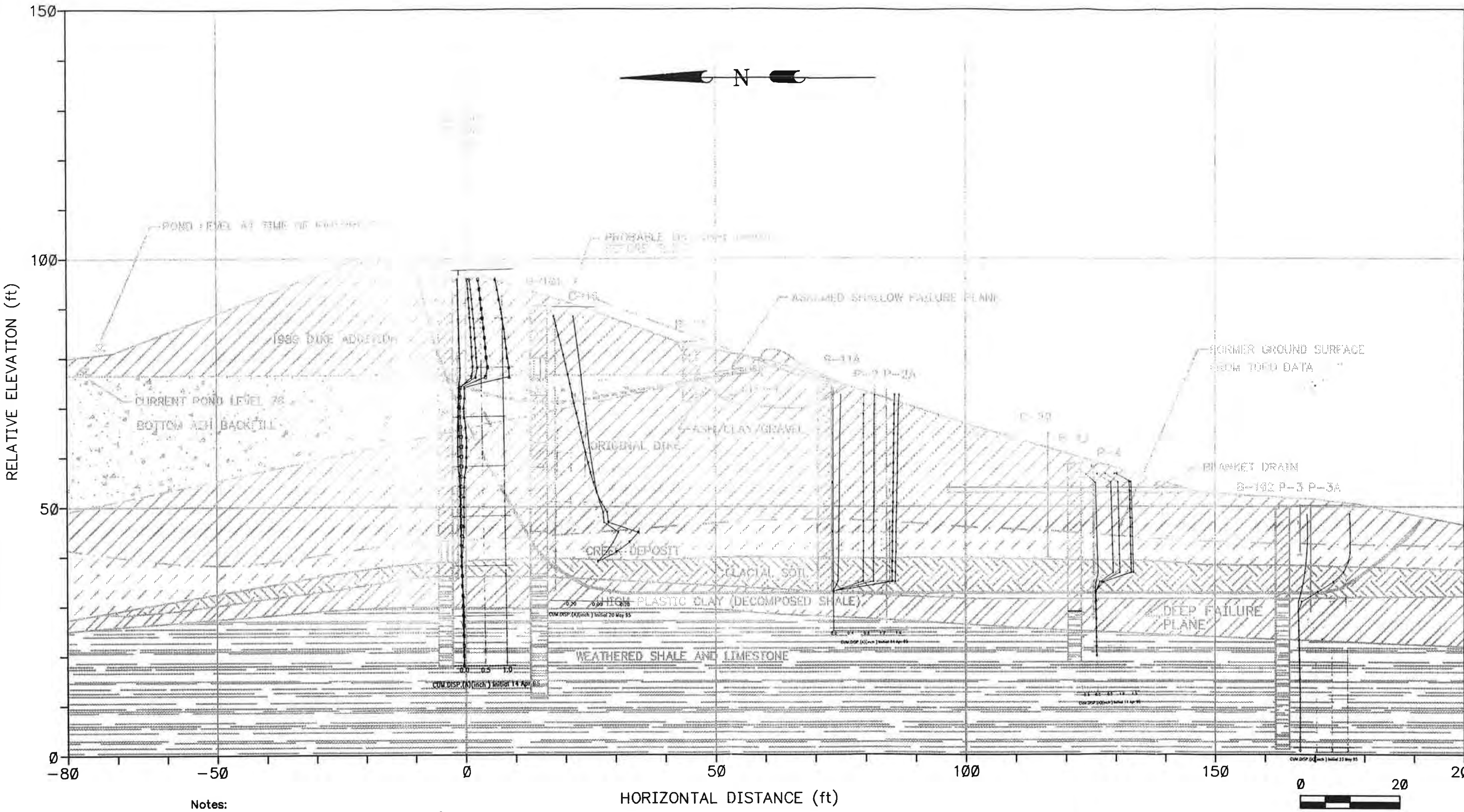
WITHIN FAILURE ZONE:
- SHALLOW PIEZOMETERS
- DEEP PIEZOMETERS (ON FAILURE PLANE)

OUTSIDE FAILURE (SHALLOW AND DEEP PIEZOMETERS)

Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: JMB 6/23/95	Piezometeric Heads in Dam and Foundation
FIG. NO.	10

File: F:\5E0850\TASK240\INCLDATA.DWG Last edited: 06/23/95 @ 2:08 p.m. @ WCC-ST.LOUIS



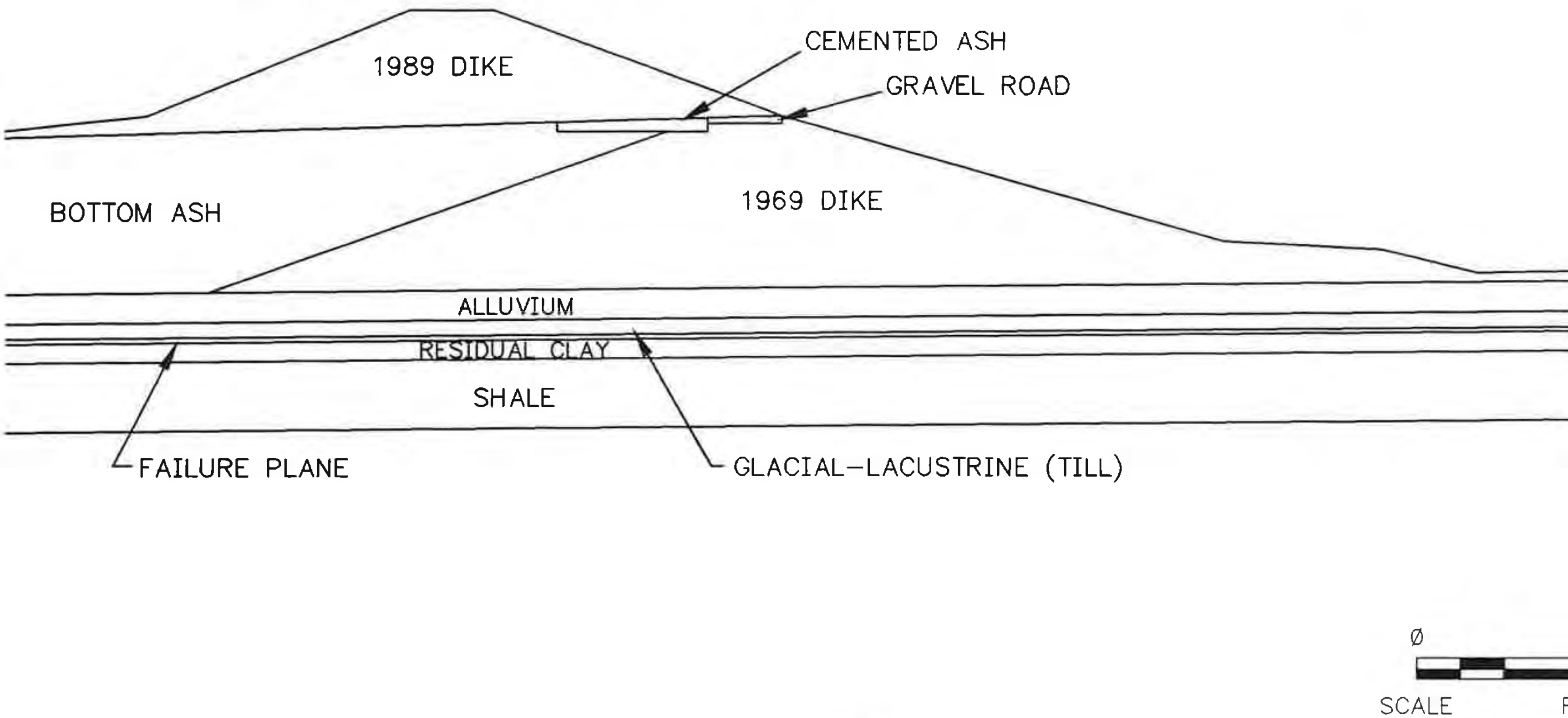
Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.
3. Inclinometers B–11A and B–12 installed in April 1995; B–101 and B–102 install in May 1995.
4. During second reading of B–101, inclinometer probe would not go past 52ft deep. All future readings referenced to that depth. Bottom of inclinometer was moving laterally.

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 6/23/95	Inclinometer Data	FIG. NO. 11

BASIC GEOMETERY FOR BACK CALCULATION



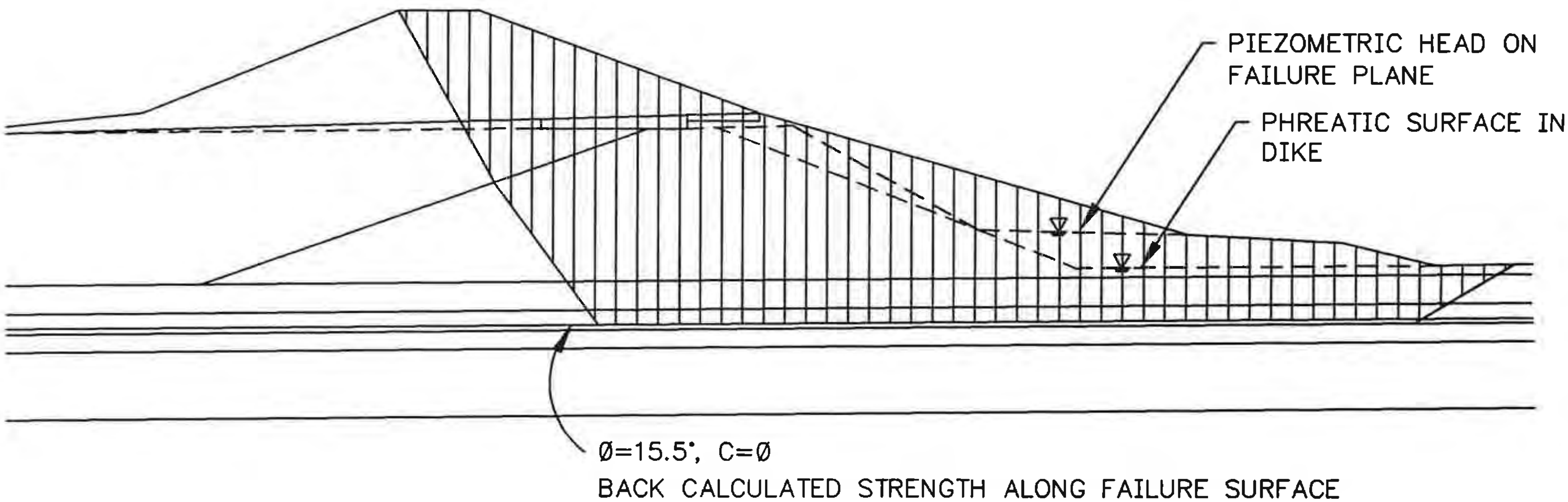
ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5EØ856Ø

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 8/28/95 DSGN. BY: kmb CHKD. BY: KMB 8/30/95	Basic Geometry for Back Calculation	FIG. NO. 12

File: F:\5E08560\TASK700\FIG12.DWG Last edited: 08/30/95 @ 11:44 a.m. @ WCC-ST.LOUIS

BACK CALCULATION FAILURE PLANE
STEADY STATE CONDITION

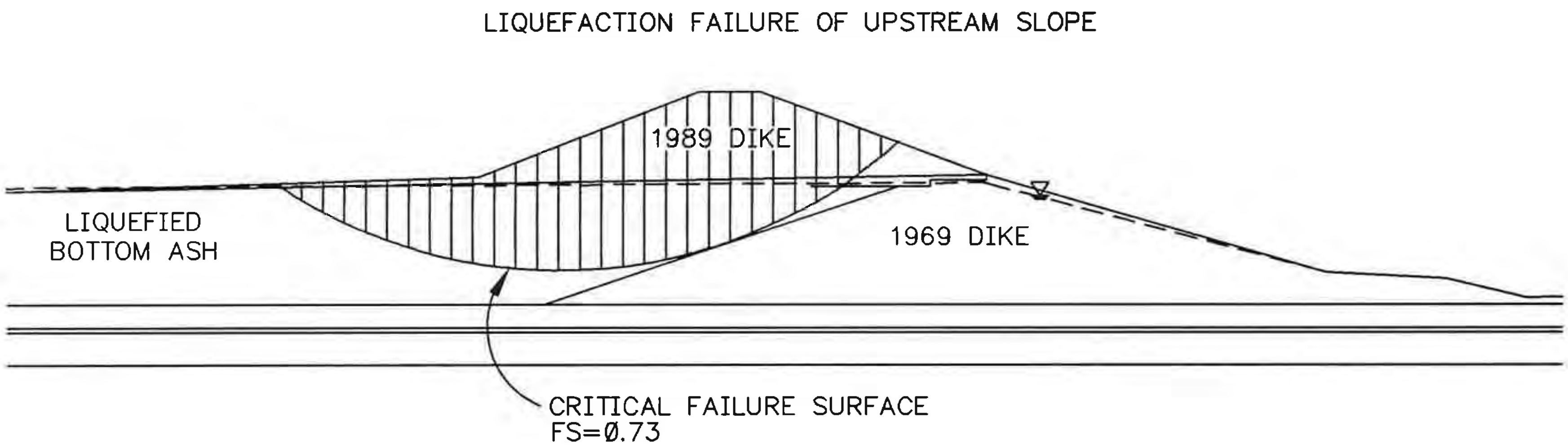


ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5EØ856Ø

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 8/28/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	Back Calculation Failure Plane Steady State Condition	FIG. NO. 13

File: F:\5E08560\TASK700\FIG13.DWG Last edited: 09/06/95 @ 1:31 p.m. @ WCC-ST.LOUIS



Ø 40
SCALE FEET

ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO.
5EØ856Ø

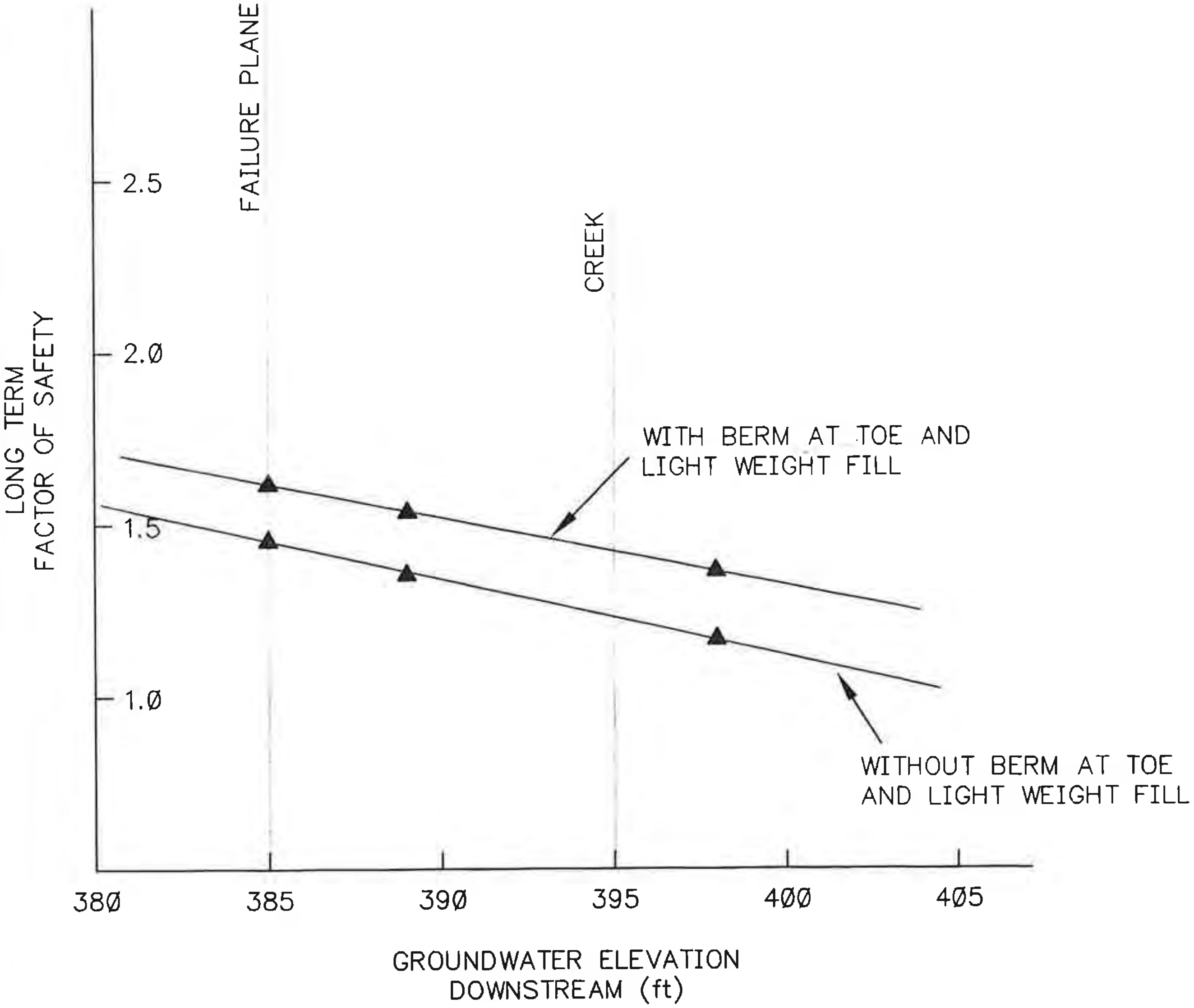
Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 8/28/95
DSGN. BY: kmb
CHKD. BY: KMB 9-6-95

Liquefaction of Upstream Slope

FIG. NO.
14

File: F:\5E08560\TASK700\FIG14.DWG Last edited: 09/06/95 @ 1:39 p.m. @ WCC-ST.LOUIS



ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO. 5E08560

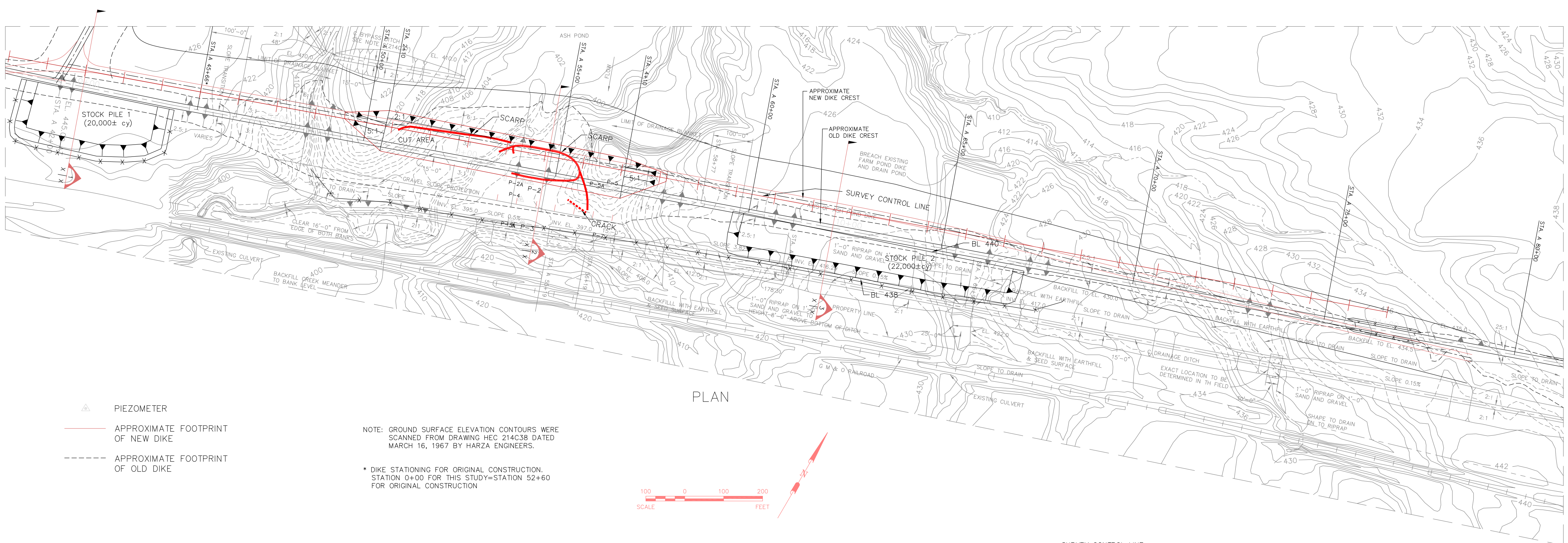
Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

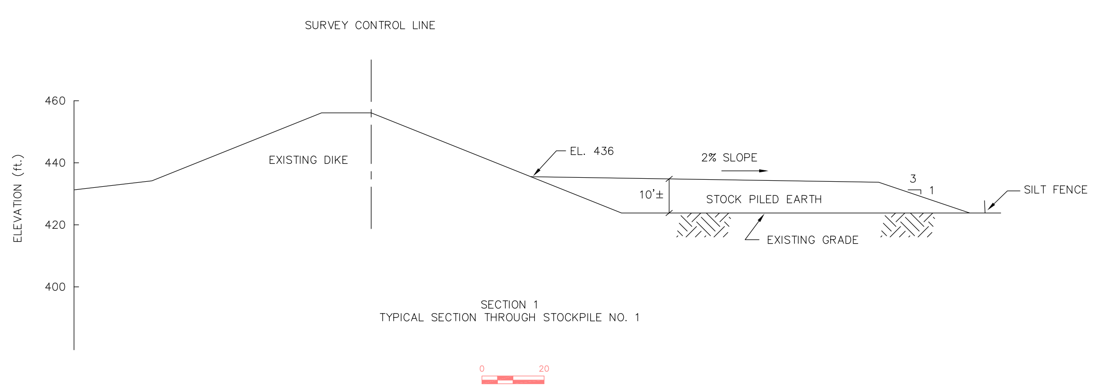
DRN. BY: bdl 8/25/95
DSGN. BY: kmb
CHKD. BY: KMR 8/31/95

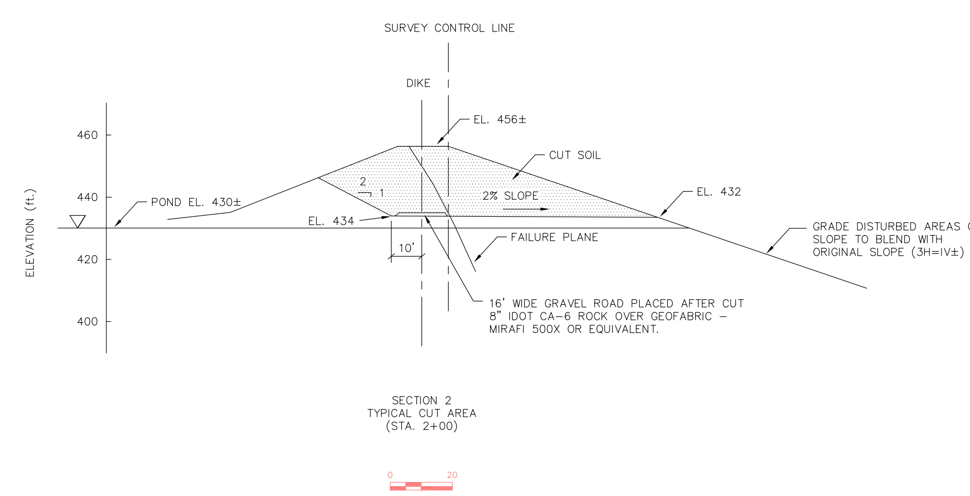
Factor of Safety Chart

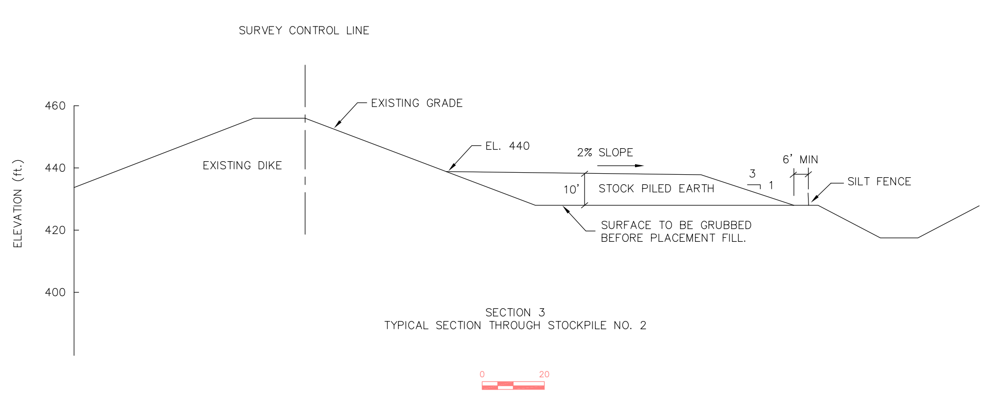
FIG. NO. 15

File: F:\5E08560\TASK700\GRAPH.DWG Last edited: 08/31/95 @ 1:41 p.m. @ WCC-ST.LOUIS









NOTES:
1. STRIP VEGETATION AND TOP SOIL PRIOR TO FILL PLACEMENT. STOCKPILE TOPSOIL SEPARATELY FROM EARTH.
2. PLACE STOCKPILE IN 12in LIFTS, COMPACT BY TRAFFICKING WITH HAULING AND SPREADING EQUIPMENT.
3. SLOPE FILL AREAS TO DRAIN.
4. SEED STOCKPILE AREAS, CUT AREAS, AND DISTURBED AREAS ON DOWNSTREAM SLOPE WITH CLASS 3 TYPE SEEDING MIXTURE PER SECTION 250, IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, JULY 1, 1994. PROTECT SEEDED AREAS BY MULCHING PER IDOT STANDARD 251.03, METHOD 2.
5. PLACE AND MAINTAIN SILT FENCE, DOWNSLOPE OF WORK AREAS. SILT FENCES TO BE MIRAFI 100X OR EQUIVALENT.
6. LIMITS OF CUT AREA ARE APPROXIMATE, MAY BE FIELD ADJUSTED.

Revision No.	Description	Date	By	App.

REVISIONS

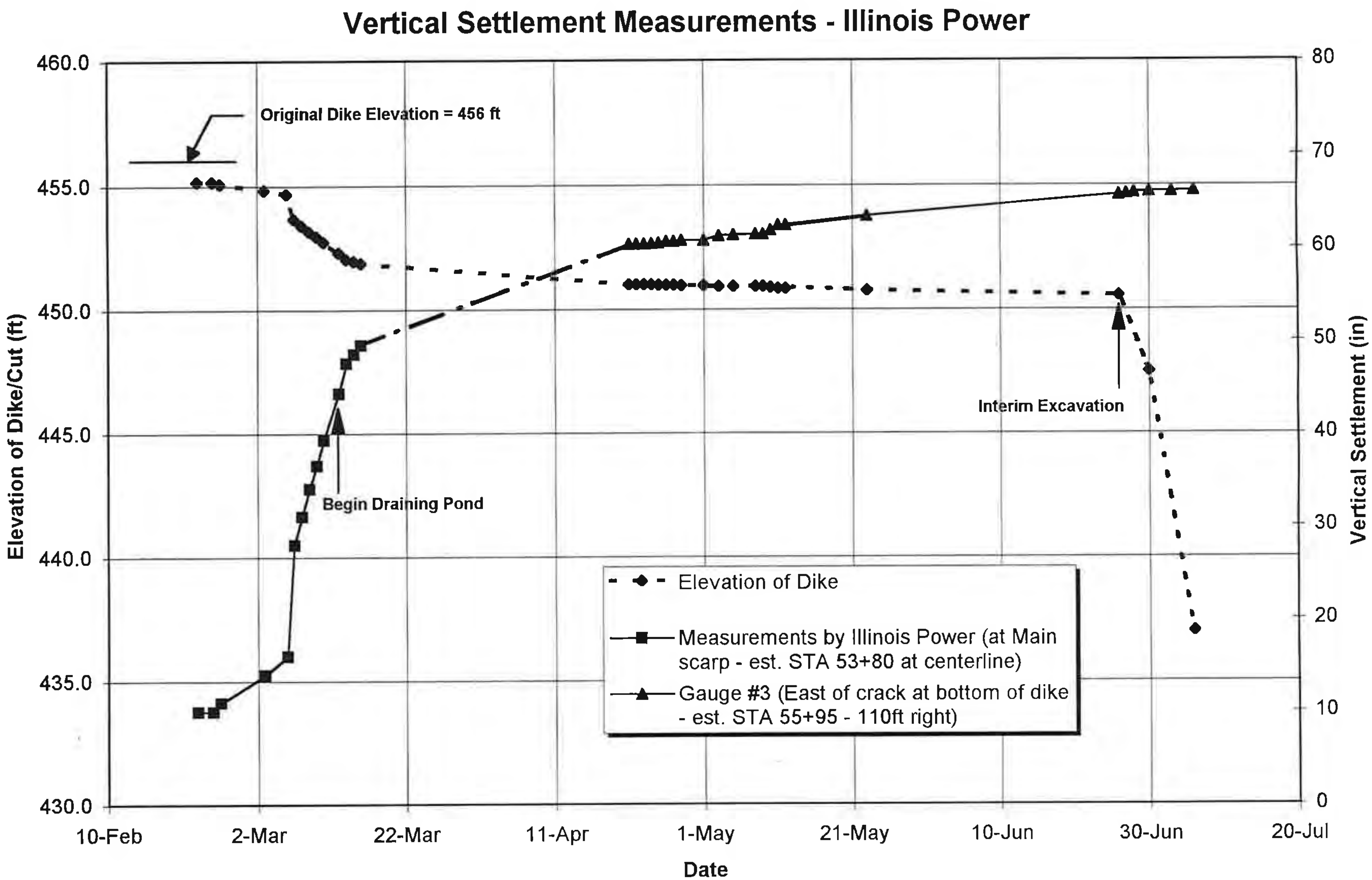
ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
INTERIM REPAIR

Date: 4/10/95	Project Number: 5E08560	Figure Number: 16
Drawn by: kdw	Design by: gaz	Checked by:

Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment

File: F:\5E08560\TASK240\INTERMIN.DWG Last edited: 06/23/95 @ 11:51 a.m. @ WCC–ST.LOUIS



Vertical Settlement Measurements - Illinois Power
Original Dike Elevation = 456 ft
Begin Draining Pond
Interim Excavation
Elevation of Dike
Measurements by Illinois Power (at Main scarp - est. STA 53+80 at centerline)
Gauge #3 (East of crack at bottom of dike - est. STA 55+95 - 110ft right)
Elevation of Dike/Cut (ft)
Vertical Settlement (in)
Date
460.0
455.0
450.0
445.0
440.0
435.0
430.0
80
70
60
50
40
30
20
10
0
10-Feb
2-Mar
22-Mar
11-Apr
1-May
21-May
10-Jun
30-Jun
20-Jul

Figure 17

APPENDIX A

FIELD INVESTIGATION

A-1 PHOTOGRAPHS

A-2 TEST PITS

A-3 BORINGS

A-4 PIEZOCONE SOUNDINGS

APPENDIX A
FIELD INVESTIGATION

APPENDIX A-1 - PHOTOGRAPHS

Woodward-Clyde personnel used photographs to document the site conditions in March and April 1995. The content of the photographs include test pits and the area surrounding the failure scarp. Each photograph contains a description concerning the content of the photograph. The photographs are presented in this appendix as Figures A-1-1 through A-1-10.

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

4/7/95 — Looking west over scarp at crest of slide. (21 March 1995). Rig working on Boring B-2.

4/7/95 — Looking east over scarp at crest. Piezometer P-1 in foreground. (21 March 1995) — **A-1-1**

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

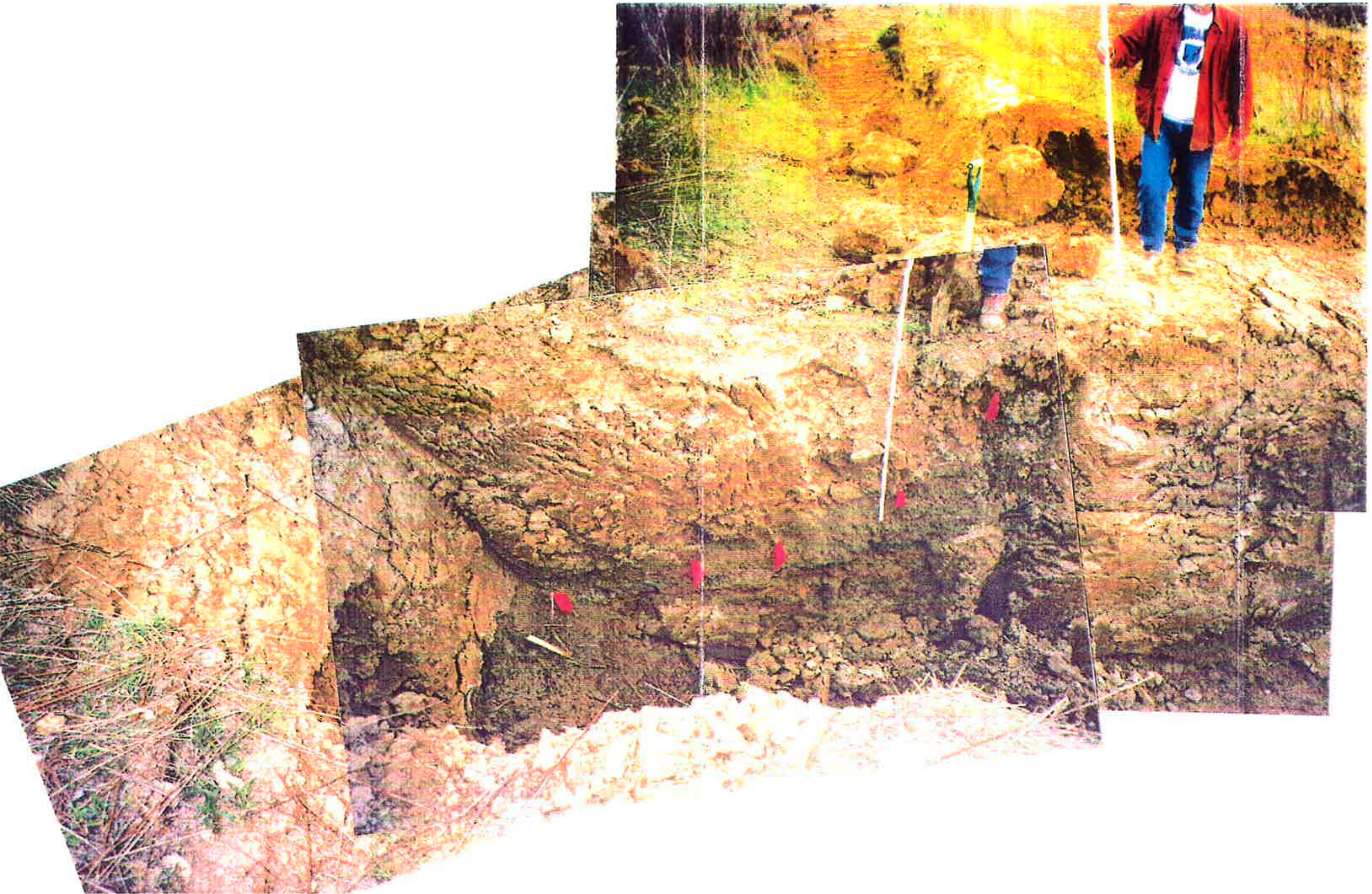
4/7/95	Looking southwest across slide from crest on east edge of slide. Midslope scarp at center. Test pits TP-4 and TP-5 open (21 March 1995)	

4/7/95	Looking southeast across slide area from crest at west edge of slide. Note midslope scarp running diagonally across photo. Test pit TP-4 behind man. (21 March 1995)	A-1-2

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

4/7/95	Both photos show scrap at lower east edge of slide; looking east from about midheight of slope. (21 March 1995)	A-1-3

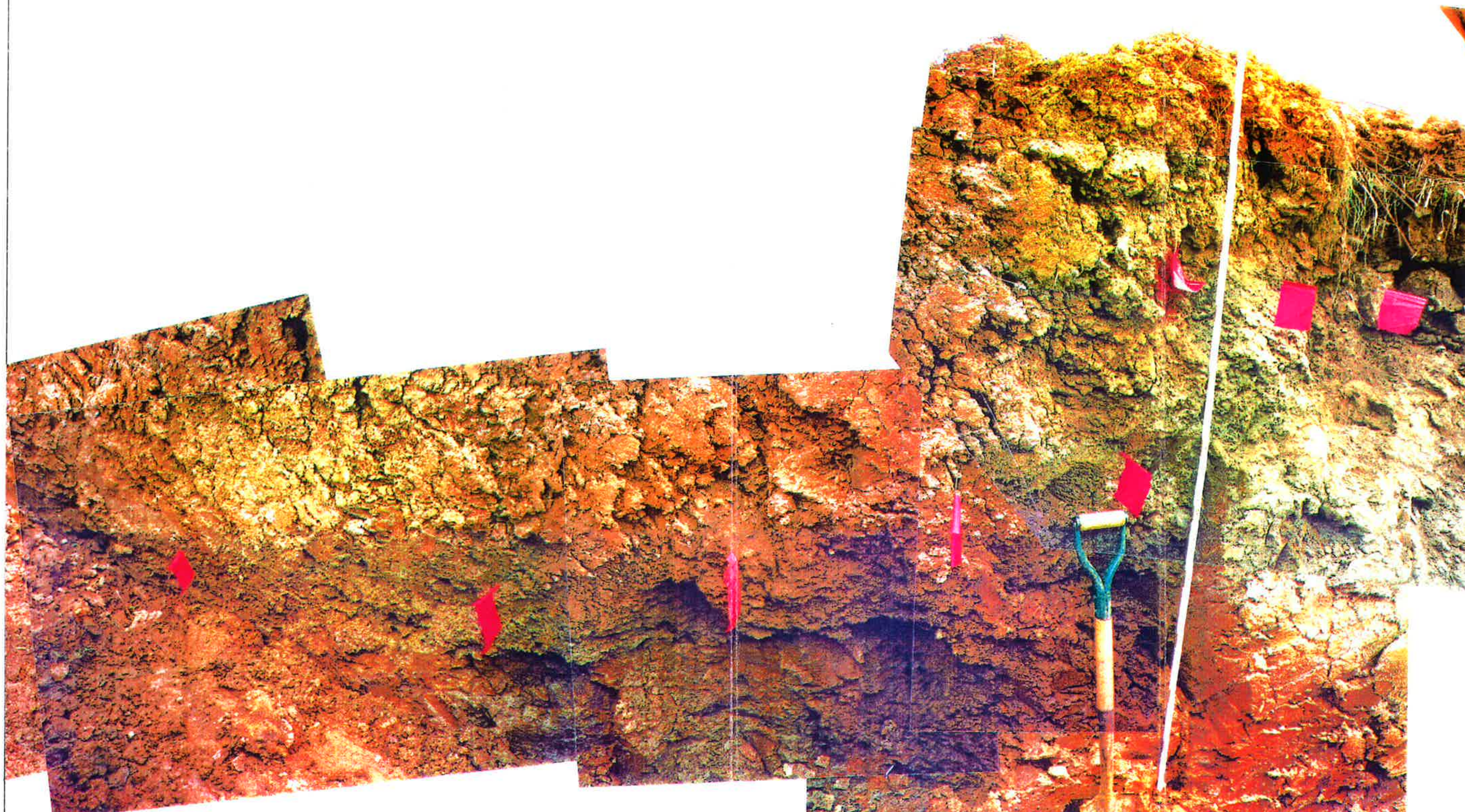
PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike



PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

4/7/95	Test Pit TP-4: East face. Note zone of fly ash/bottom ash, gravel and clay. Midslope scarp visible in center of photo. Could not trace scarp deeper than about 3 ft. below grade. Seepage at north face in pervious zone when trench opened. (20 March 95)	A-1-5

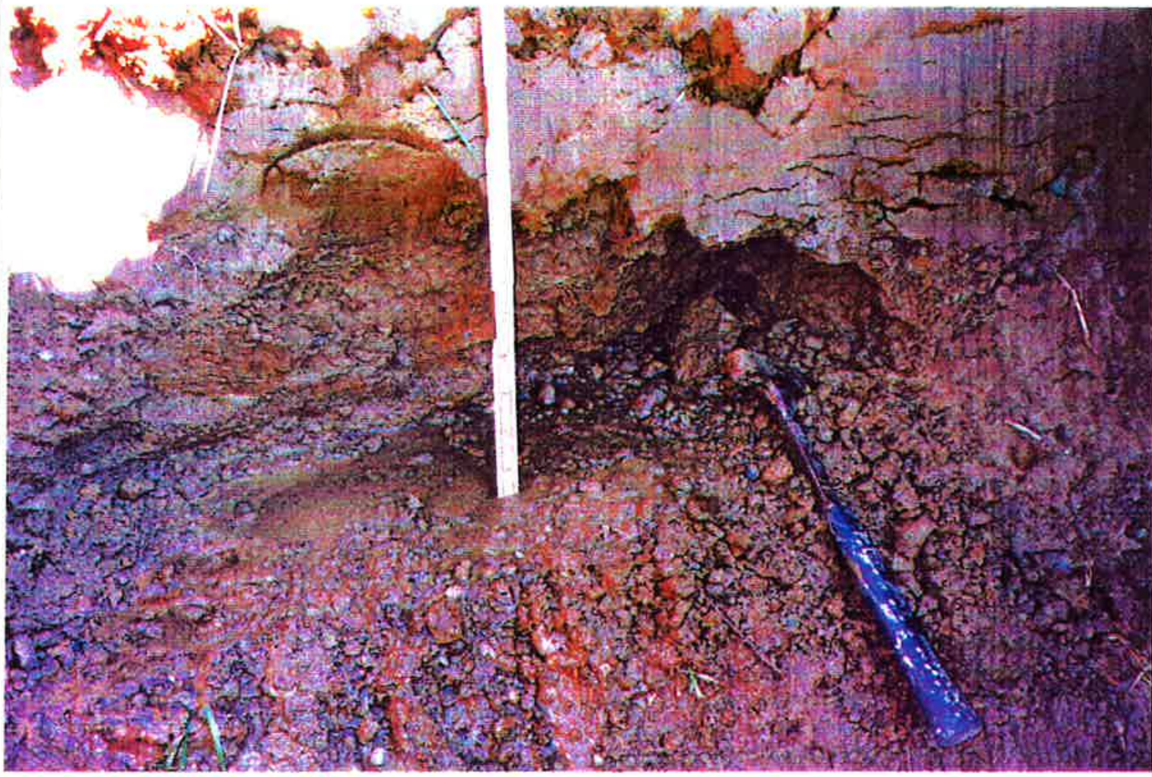
PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike



4/7/95

Test Pit TP-5: Panorama of east face looking from north (left) to east (at location of shovel). Flags are at top of pervious fly ash/bottom ash, gravel and clay zone. Rule is at midslope scarp. Note that a portion of the right zone (downslope) of scarp is lifted above portion on the left (upslope). Scarp extends below the pervious zone at right of rule. Seepage was noted at the north end of the pervious zone when the trench was opened 20 March 1995. (photo taken 22 March 19995).

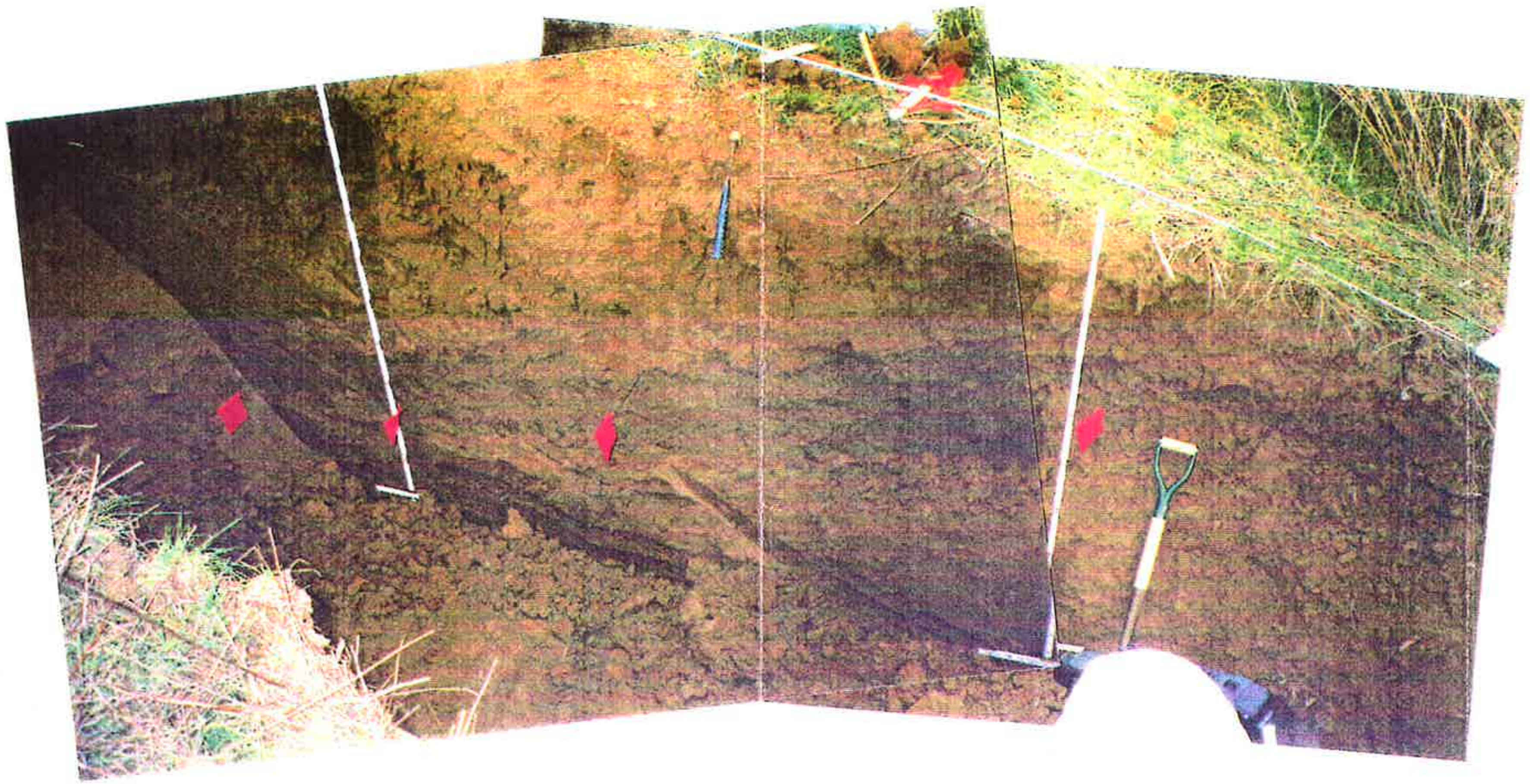
A-1-6



4/7/95	Seepage from the pervious fly ash/bottom ash, gravel and clay zone into the north end of Test Pit TP-5 shortly after excavation. (20 March 1995). Rockpick needed to excavate this zone due to cementation (lime treatment?)	A-1-7

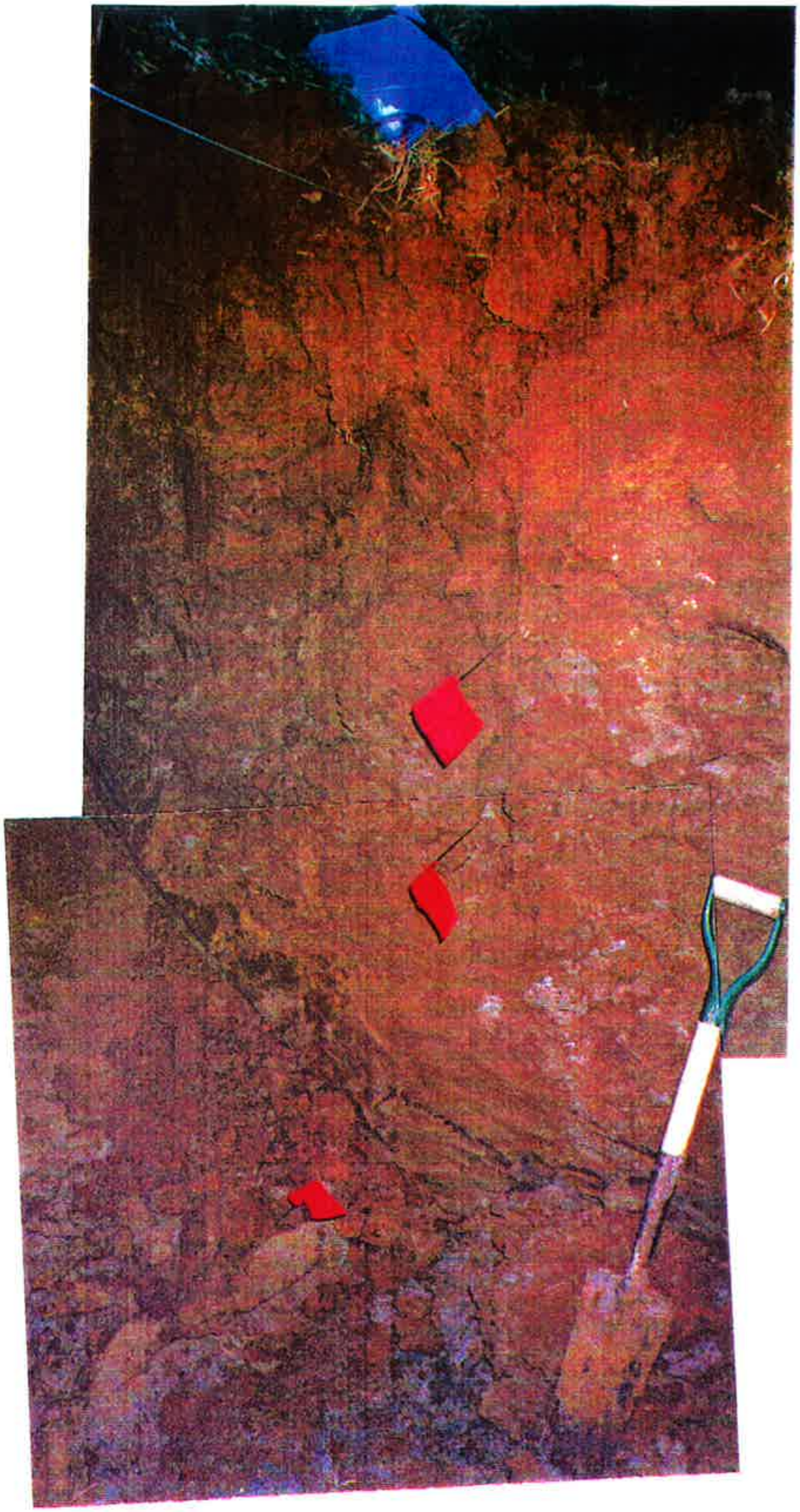
PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

4/7/95	Test Pit TP-6: Looking Northeast. Note zone of fly ash/bottom ash, gravel and clay. North end of this zone is lime treated and hard. No seepage visible. (22 Mar 95)	A-1-8



Test Pit TP-7: East face looking northeast. Note zone of fly ash/bottom ash, gravel and clay. Northern portion of this zone is lime treated and hard. No seepage. (22 March 95)

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike



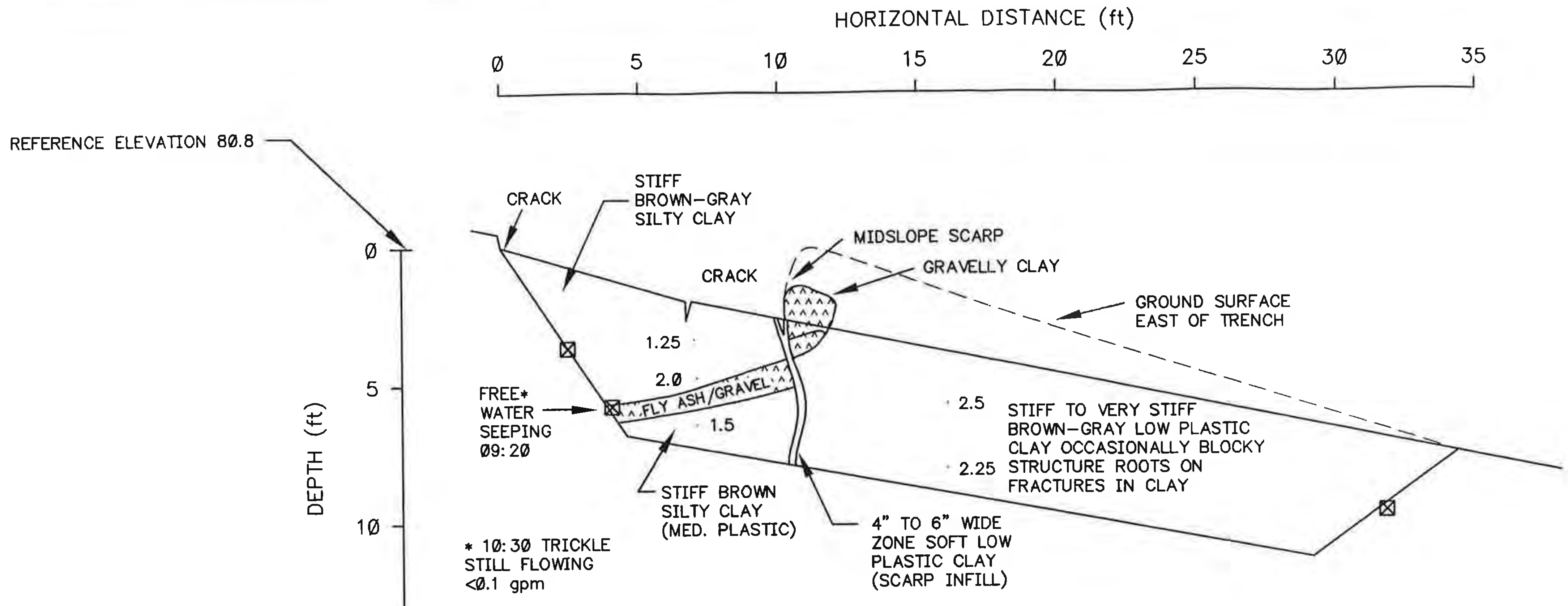
4/7/95

Test Pit TP-8: East face. Flags trace scarp to bottom. Scarp zone consists of very soft clay zone 1 to 2 in. wide. Soil on either side is very stiff clay.

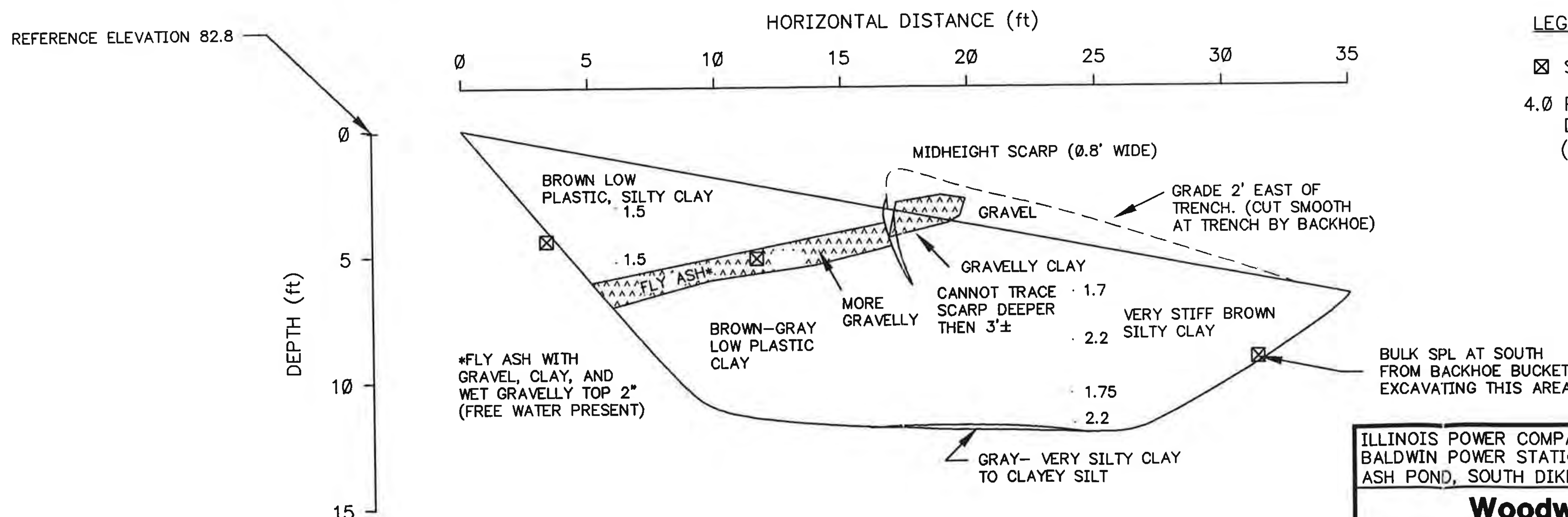
A-1-10

APPENDIX A-2 - TEST PITS

A total of 8 test pits were excavated between March 20, 1995 and March 22, 1995 using a track-mounted Caterpillar backhoe equipped with a 48-inch wide, 2.5 cubic yard bucket. The test pits were positioned to intercept the potential failure surfaces, both within and outside of the observable failure areas. Detailed logs of the test pits are included in Figures A-2-1 through A-2-3.



TEST PIT 3 EAST FACE
(EXCAVATED MARCH 21, 1995)



TEST PIT 4 LOOKING EAST
(EXCAVATED MARCH 20, 1995)

LEGEND

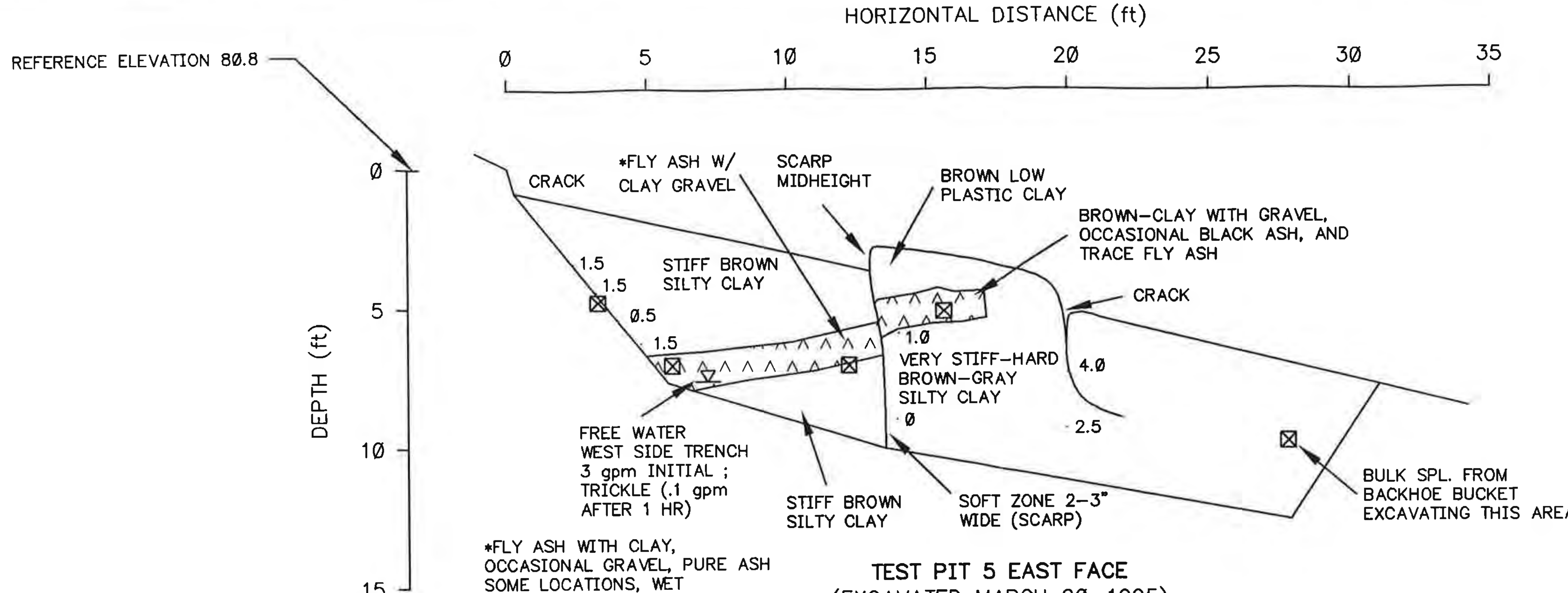
⊠ SOIL SAMPLE

4.0 POCKET PENETROMETER DIRECT READING (UNCONFINED COMPRESSIVE STRENGTH, TSF)

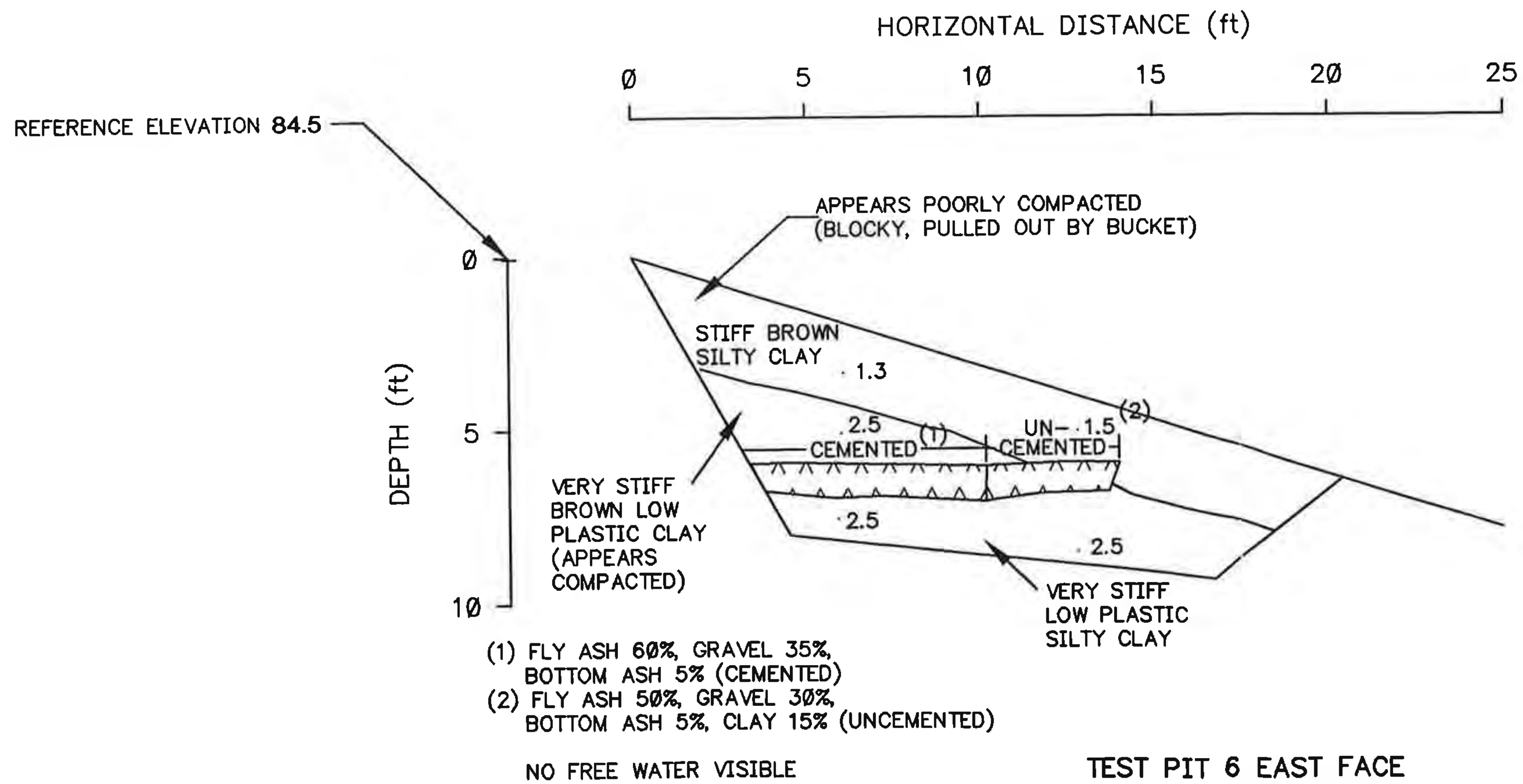
SCALE 0 5 FEET

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/25/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	TEST PIT LOGS TP-3, TP-4 — FIG. NO. A-2-1

File: F:\5E08560\TASK240\TESTPIT3.DWG Last edited: 09/06/95 @ 3:53 p.m. @ WCC-ST.LOUIS



TEST PIT 5 EAST FACE
(EXCAVATED MARCH 2Ø, 1995)



TEST PIT 6 EAST FACE
(EXCAVATED MARCH 22, 1995)

LEGEND

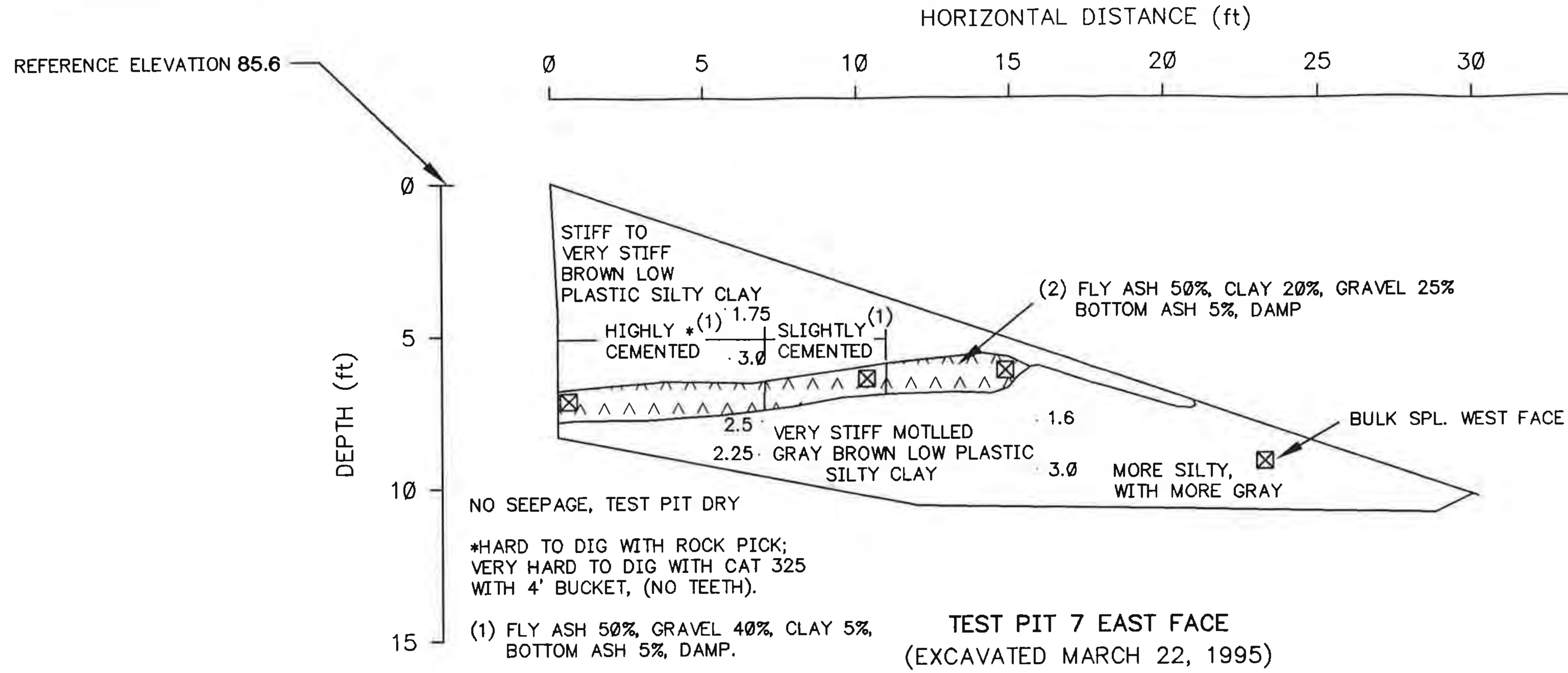
⊠ SOIL SAMPLE

4.Ø POCKET PENETROMETER DIRECT READING (UNCONFINED COMPRESSIVE STRENGTH, TSF)

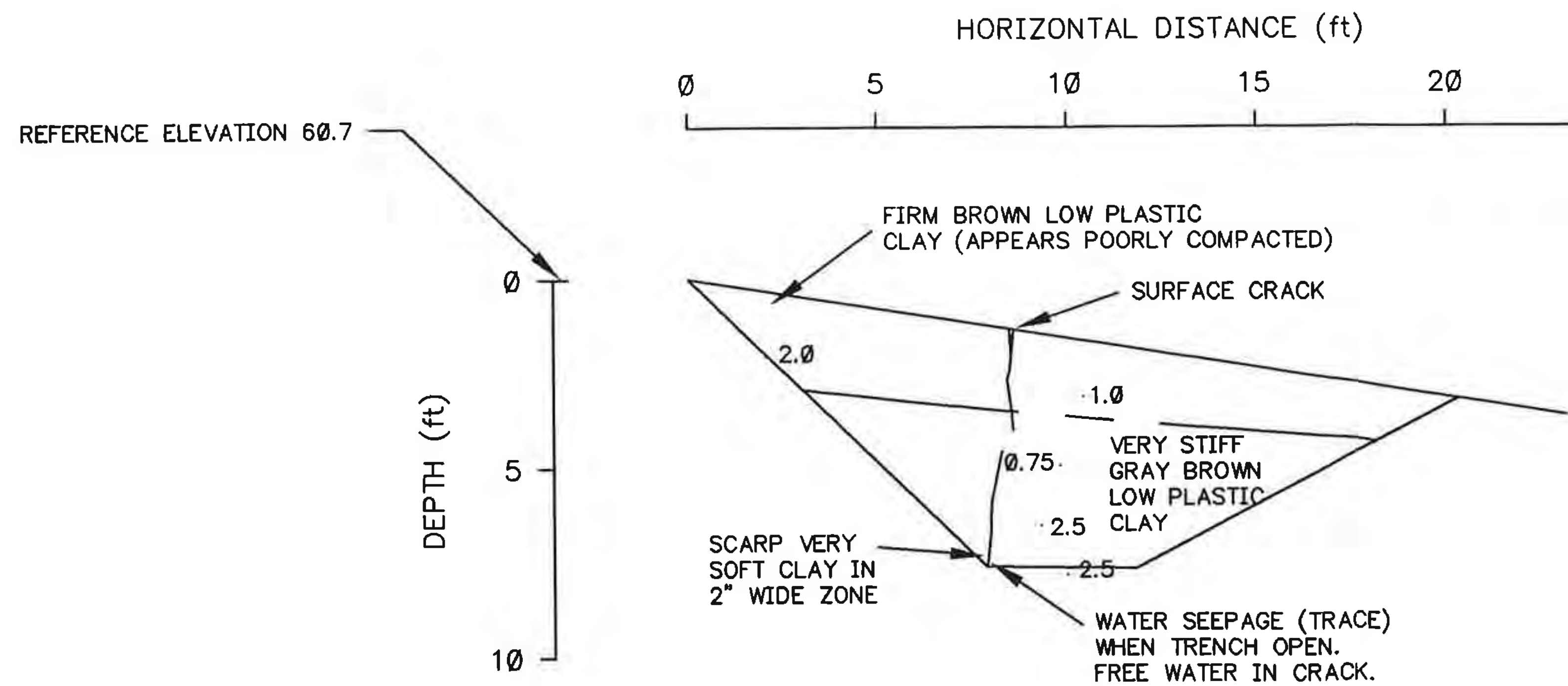
SCALE Ø 5 FEET

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5EØ856Ø
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/25/95 DSGN. BY: gaz CHKD. BY: KMA 9-6-95	TEST PIT LOGS TP-5, TP-6 — FIG. NO. A-2-2

File: F:\5E08560\TASK240\TESTPIT5.DWG Last edited: 09/06/95 @ 3:55 p.m. @ WCC-ST.LOUIS



TEST PIT 7 EAST FACE
(EXCAVATED MARCH 22, 1995)



TEST PIT 8 EAST FACE
(EXCAVATED MARCH 22, 1995)

LEGEND

⊠ SOIL SAMPLE

4.0 POCKET PENETROMETER DIRECT READING (UNCONFINED COMPRESSIVE STRENGTH, TSF)

SCALE 0 5 FEET

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/26/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	TEST PIT LOGS TP-7, TP-8 — FIG. NO. A-2-3

File: F:\5E08560\TASK240\TESTPIT7.DWG Last edited: 09/06/95 @ 3:58 p.m. @ WCC-ST.LOUIS

APPENDIX A-3 - BORINGS

Seven of the 15 borings (B-1, B-5, B-6, B-7, B-8, B-9, and B-15) were made with a Dietrich 120 drill rig, owned and operated by Midwest Engineering Services, Inc. of Champagne. Two borings (B-101 and B-102) and five piezometers (P-2A, P-3A, P-4, P-5A, and P-7) were made with a CME-750 all terrain drill rig, owned and operated by Roberts Environmental Drilling, Inc. of Millstadt, Illinois. All of the other explorations and instrumentation installations were made by a CME-750 all terrain drill rig, owned and operated by Layne-Western Company, Inc. of St. Louis. Layne-Western had two drill rigs on site for a period of two days, but they removed one rig to take it to another site. The drill rigs were under subcontract to WCC.

The borings were advanced through the soil using either 4-in. O.D. continuous flight auger (CFA), 4.25-in. I.D. hollow stem auger (HSA), 6.25-in. I.D. HSA, or rotary wash with a 5-in diameter tri-cone bit. The depths of the borings ranged from approximately 10 to 80 feet. Surveyed locations (station, offset, and elevation) for the borings of the first phase were provided to WCC by Illinois Power. The locations for the second phase borings was estimated based upon the survey information that was provided.

Samples of subsurface materials were obtained at about 5-ft intervals using three types of samplers: 1) a hydraulically pushed, 2-in. I.D., thick-walled liner-tube sampler (modified California sampler); 2) a 2-in. O.D. split-spoon sampler driven by a 140-lb. hammer in conjunction with a Standard Penetration Test (ASTM D-1586), and 3) hydraulically pushed 3-in. diameter thin-walled Shelby tubes. Some shelby tubes were obtained using a fixed piston sampler.

The borings were logged in the field based upon recovered samples, cuttings, and drilling characteristics. Boring logs were subsequently modified as appropriate based on laboratory test results. Detailed boring logs are included as Figures A-3-1 through A-3-23 of this appendix.

KEY TO BORING LOGS

Category	Graphic Symbol	Description	USC Class.
GRAVEL		GRAVEL with little or no fines	GP or GW
GRAVEL		Silty GRAVEL	GM
GRAVEL		Clayey GRAVEL	GC
SAND		SAND with little or no fines	SP or SW
SAND		Silty SAND	SM
SAND		Clayey SAND	SC
LOW PLASTIC SILTS AND CLAYS		Inorganic low plastic SILT	ML
LOW PLASTIC SILTS AND CLAYS		Inorganic low plastic CLAY	CL
LOW PLASTIC SILTS AND CLAYS		Silty	CL
LOW PLASTIC SILTS AND CLAYS		Sandy	CL
LOW PLASTIC SILTS AND CLAYS		Gravelly	CL
LOW PLASTIC SILTS AND CLAYS		Organic low plastic SILT or CLAY	OL
HIGH PLASTIC SILTS AND CLAYS		Inorganic high plastic SILT	MH
HIGH PLASTIC SILTS AND CLAYS		Inorganic high plastic CLAY	CH
HIGH PLASTIC SILTS AND CLAYS		Organic high plastic SILT or CLAY	OH
		Peat and other highly organic soils	PT
ROCKS		LIMESTONE	
ROCKS		SHALE	
ROCKS		SANDSTONE	
ROCKS		SILTSTONE	
SURFACE MATERIALS		Topsoil or pavement	
SURFACE MATERIALS		FILL	

TERMS DESCRIBING CONSISTENCY OR CONDITION

Coarse grained soils (major portion retained on No. 200 sieve): Includes gravels and sands. Condition is rated according to the Standard Penetration Resistance, as shown below.

Descriptive Term	Blows per Foot
Very loose	0 - 5
Loose	5 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	Greater than 50

Fine grained soils (major portion passing No. 200 sieve): Includes clays and silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	Unconfined Compressive Strength, tons/sq.ft	Hand Test
Very soft	less than 0.25	Extrudes between fingers
Soft	0.25 - 0.50	Molded by slight pressure
Firm	0.50 - 1.00	Molded by strong pressure
Stiff	1.00 - 2.00	Indented by thumb
Very stiff	2.00 - 4.00	Indented by thumbnail
Hard	4.00 and higher	Difficult to indent

LEGEND AND NOMENCLATURE

Symbol	Meaning
	Standard Penetration Sample
	Liner-tube sample, obtained by penetration of thick wall sampler containing 2 in. diameter liner-tubes (California sampler).
	Undisturbed sample, obtained by penetration of minimal 3 in. diameter, thin wall tube or, where indicated, fixed-piston sampling head.
	NX core.
PP,tsf	Unconfined compressive strength in tsf estimated with pocket penetrometer.
TV,tsf	Undrained shear strength in tsf estimated with torvane.
NMC,%	Natural Moisture Content, %
LL	Liquid Limit
PI	Plasticity Index
Qu, ksf	Unconfined Compressive Strength (Laboratory), ksf
RQD=80%	Percentage (80) of Rock Quality Designation
▽	Depth Groundwater enters at time of drilling.
▼	Groundwater Level at some specified time after drilling.

SAMPLING RESISTANCE

P	Sample pushed by hydraulic rig action.
3 6 9	Numbers indicate blows per 6 in. of sampler penetration when driven by a 140 lb hammer falling freely 30 in. The Standard Penetration Resistance is the number of blows for the last 12 in. of penetration of the Standard Penetration sampler, e.g. 15.
15	Standard Penetration Resistance
50/2	Number of blows (50) used to drive the Standard Penetration Sampler a certain number of inches (2).

ABBREVIATIONS USED UNDER "FIELD NOTES"

HSA = Hollow Stem Auger
CFA = Continuous Flight Auger
ATD = At Time of Drilling
AD = After Drilling
DWL = Drill Water Loss
DWR = Drill Water Return

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm, damp, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition (SPT used automatic hammer)
5		P	100						17			7.8	
				Very stiff, wet to moist, reddish-brown, medium plastic, Silty CLAY (CH)(Fill)	94.1 / 7.5								
10		P	100				3.4	1.3	27	61	40		
15		P	83						15			7.2	
20		P	83	Moist, low plastic, Silty CLAY (CL)(Fill)	81.6 / 20.0				19				Sample appeared to be slough

Completion Depth: 80.2 Ft. Water Depth: ____ ft., After ____ hrs.
Project No.: 5E08560 ____ ft., After ____ hrs.
Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.
Drilling Contractor: Midwest Eng. Service Logged by: K. Berry

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		1 3 5	67	Loose, wet, black, bottom ash (SP)(Fill)	76.4 25.2								
30		1 2 2	78										
					67.6 34.0								
35		2 5 6	56	Firm, damp to moist, mottled reddish-brown/light brownish-gray, low plastic, Silty CLAY (CL)(Fill)					19				Driller reported a change in material at 34.0 feet Original Dike
40		P	33						25				Sample appeared to be mostly slough
45		P	56				0.8	0.9	23	44	27		
					51.6								

Completion Depth: 80.2 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng. Service

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

Figure No. A-3-1

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		2 3 3	100	Firm, moist, reddish-brown, low plastic, silty CLAY (CL)	50.0				14				
					46.6								
55		P	100	Soft, moist to wet, light brown, Silty CLAY (CL)	55.0				26				Approximate top of natural ground Peoria Loess
60		3 5 5	100						30				
					36.6								Equality/Glasford Formation Driller reported stiff material with trace gravel 63.5-64.5 feet
65		4 8 10	100	Stiff to hard, moist, light gray, highly weathered SHALE	65.0				25				SHALE Spoon Formation
70		14 21 24	100	Grades some purple, highly weathered shale					19				

Completion Depth: 80.2 Ft. Water Depth: ___ ft., After ___ hrs.

Project No.: 5E08560 ___ ft., After ___ hrs.

Project Name: Illinois Power/Baldwin Power Station ___ ft., After ___ hrs.

Drilling Contractor: Midwest Eng. Service Logged by: K. Berry

Woodward-Clyde Consultants

Figure No. A-3-1

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		7 15 21	100	Light brown, highly weathered SHALE	21.6 80.0				23				
80		100/2.2		LIMESTONE	21.4 80.2								
				Bottom of boring at 80.2 feet									
85													
90													
95													

Completion Depth: 80.2 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng. Service

Water Depth: ___ ft., After ___ hrs.
___ ft., After ___ hrs.
___ ft., After ___ hrs.
Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Very stiff, moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 6-1/4 inch I.D. HSA (SPT used automatic hammer) 1989 Dike Addition
5		P	94				2.4	1.6	20	37	20		(sample may be disturbed)
10		P	100	Becomes stiff			1.9	0.9	21	44	26		
15		P	94	Becomes mottled reddish-brown/light brownish-gray			2.8	0.9	22	44	25		
				Becomes high plastic	78.9 / 19.0								
20		P	83				1.5	0.8	26	55	34		
				Very loose, wet, black, bottom ash (SP)(Fill)	76.9 / 21.0								Switched to mud rotary with 4 inch tricone bit (modified to 5 inches)

Completion Depth: 79.7 Ft. Water Depth: ______ ft., After ______ hrs.
Project No.: 5E08560 ______ ft., After ______ hrs.
Project Name: Illinois Power/Baldwin Power Station ______ ft., After ______ hrs.
Drilling Contractor: Layne-Western Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		2 2 2	33	SAME: Very loose, wet, black, bottom ash (SP)(Fill)					28				Ash FILL (similar to sand)
30		2 2 2	56	Soft, moist, gray, low plastic SILT and CLAY (CL)(Fill)	68.1 29.8				23				Appears to be a transition zone Original dike
				Firm to stiff, moist, brown/mottled brown and brownish-gray, low plastic CLAY (CL)(Fill)	65.4 32.5								
35		4 3 6	56						23				Advanced augers to 35 feet due to sloughing problem when trying to sample at 40 feet
40		P	96	Becomes very stiff, reddish-brown			2.1	0.8	32	49	30		Began using fixed piston sampler
45		P	100	Becomes very stiff to hard			2.9	1.6	18	38	20		

Completion Depth: 79.7 Ft. Water Depth: ____ ft., After ____ hrs.
Project No.: 5E08560 ____ ft., After ____ hrs.
Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.
Drilling Contractor: Layne-Western Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50	P	100	SAME: Very stiff, moist, reddish-brown, low plastic CLAY (CL) (Fill)		3.1	1.8	23	51	31		Boring had problems with the clay "squeezing" in at 35 feet
											Advanced augers to 50 fee
55	P	100			1.9	0.7	21	34	16		
			Small wood fragments, grass and roots	41.3 / 56.6							
			Very stiff, moist, mottled reddish-brown and light gray, low plastic, silty CLAY (CL)								Approximate top of natural ground Peoria Loess
											Continued having problems getting steel to go back down the boring
60	P	100			2.1 1.5	0.9	18	35	20		
65	P	100			>4.5	0.8	25	34	15		
			Hard, moist, light gray, high plastic CLAY (CH); with little sand	32.4 / 65.5							Excess recovery was slough Tube refusal at 65.5 feet Driller reported hard drilling to 66.9 feet Glasford/Equality Formation
70	15 25 18	83	Light brown to gray, highly weathered SHALE; with some silt and sand	28.4 / 69.5			22				Spoon Formation

Completion Depth: 79.7 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		21 42 36	100	SAME: Light brown to gray, highly weathered SHALE; with some silt and sand									
80		50/2.5"	80	Bottom of boring at 79.7 feet	18.2 79.7								SPT was bouncing Inclinometer installed
85													
90													
95													

Completion Depth: 79.7 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0	P	71	Stiff to hard, damp to moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)		2.4	0.7	24				Boring advanced using 4-1/4 inch I.D. HSA Shelby tube samples taken with fixed piston sampler 1989 Dike Addition
	P	71			3.0	0.9	20				
	P	88	Becomes damp		3.2	1.4	18				
5	P	100			4.8	1.8	17				
	P	100			3.6	1.9	18	43	25		
10	P	100			4.8	2.3	18				
	P	96			2.9	1.2	18	37	19		
			Trace gravel								
	P	100			3.8	1.0	20	44	26		
15			Becomes brown								
	P	58			2.8	0.9	17	46	25		
			Becomes gray with fly ash								
	P	100			1.9	0.8	23	47	27		
			Becomes brown and gray								
20	P	88		77.0	4.4	0.3	18				
			Loose, moist, black, bottom ash (SP)(Fill)	21.0							Mixed mud to fill augers

Completion Depth: 80.5 Ft.
Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		2 2 2	50	Very loose, wet, black, bottom ash (SP)(Fill)					18				
30		1 2 4	39	Firm, moist, gray, low plastic, Silty CLAY (CL)(Fill)	67.8 30.2				22				Original dike
35		4 4 6	67	Becomes brown and gray					25				Stopped using mud
40		P	17						20	44	26		Sample in a jar
45		4 6 8	67	Firm to stiff, moist, reddish-brown with trace gray, low plastic, silty CLAY (CL)	53.0 45.0								Approximate Top of Natural Ground Peoria Loess

Completion Depth: 80.5 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	Firm to stiff, moist, gray, low plastic, silty CLAY (CL)	43.0								Peoria Loess
55		P	0	Stiff, wet, light gray, non-plastic, sandy SILT (ML)	55.0 40.0								Pushed a split spoon to get a sample Equality/Glasford Formation
				Stiff to very stiff, moist, brown, low plastic, silty CLAY (CL); with trace gravel	58.0								Driller reported material change at 58.0 feet
60		4 50/3.5"	100	Becomes reddish-brown	36.0								SPT bouncing after 8 inches
				Stiff to hard, damp to moist, light green/light brown/gray, highly weathered SHALE	62.0								Spoon Formation
				9 inches cobble									
65		6 10 12	33										
70		16 33 31	83	Becomes purple then orangish-brown									

Completion Depth: 80.5 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		19 29 43	100	Damp to moist, green, highly weathered SHALE									
80		50/0.5'	0		17.5								Driller reported hard material Installed inclinometer
				Bottom of boring at 80.5 feet	80.5								
85													
90													
95													

Completion Depth: 80.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

Figure No. A-3-4

LOG of BORING No. B-04

Sheet 1 of 3

DATE 4/11/95 SURFACE ELEVATION, FT 94.0 DATUM TBM=100 STA./OFFSET 2+52/11'RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm to stiff, moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	67						20				
10		P	83						17	43	25		1 inch zone of brown high plastic clay in shoe
15		P	75										Sample slid
				Becomes gray (mixed with fly ash)									
20		P	8	Loose, wet, black, bottom ash (SP)(Fill)	73.9 / 20.1								Placed a plug inside augers
25		1	39	Soft, moist to wet, green, medium plastic	69.0 / 25.0				27	50	31		Brown, silty clay in shoe

Completion Depth: 75.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

6/14/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-04

DATE 4/11/95 SURFACE ELEVATION, FT 94.0 DATUM TBM=100 STA./OFFSET 2+52/11'RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
		2 3		CLAY (CL)(Fill)									Original dike
30		2 4 5	50	Firm, moist, brown, low plastic, silty CLAY (CL)(Fill)					20	42	22		
35		P	100	Becomes stiff, mottled brown and light gray					16	42	22	2.7	
40		P	88		53.7		1.3						
				Stiff, moist, brown, low plastic, silty CLAY (CL)	40.3								Approximate top of natural ground
					51.0								
				Becoming light reddish-brown; with trace roots, oxidation	43.0								Peoria Loess
45		- 5 7	100						23				First 6 inches of SPT - rods fell down boring
					44.0								
50		P	100	Firm, moist, mottled orangish-brown and gray, high plastic CLAY (CH)	50.0								

Completion Depth: 75.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ______ ft., After ______ hrs.

______ ft., After ______ hrs.

______ ft., After ______ hrs.

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-04

DATE 4/11/95 SURFACE ELEVATION, FT 94.0 DATUM TBM=100 STA./OFFSET 2+52/11'RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
					39.0								
55		P	100	Firm, moist, orangish-brown, low plastic, silty CLAY (CL); with trace gravel	55.0				24				Rods slid into boring Glasford Formation Driller reported hard drilling at 57.0 feet
					34.0								
60		14 20 12	83	Very stiff to hard, moist, light brown, severely weathered CLAY-SHALE; with some gravel	60.0				19				Spoon Formation Gray, high plastic clay in shoe
65		25 22 18	89						12				Appeared to be decomposing rock Maroon, high plastic clay in shoe
70		22 25 28	100	Hard, moist, light gray, highly weathered SHALE					19				
75		50/1.5"	50		18.5				27				
				Bottom of boring at 75.5 feet	75.5								Auger refusal at 75.5 feet

Completion Depth: 75.5 Ft.
Water Depth: ____ ft., After ____ hrs.
Project No.: 5E08560 ____ ft., After ____ hrs.
Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.
Drilling Contractor: Layne-Western Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Damp, reddish-brown, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4inch I.D. HSA without a center plug 1989 Dike Addition
5		P	100										
				Very stiff, damp, reddish-brown, high plastic, Silty CLAY (CH)	93.6 / 7.5								
10		P	50				2.1	1.0	21				
15		P	83	Becomes brown									
20		P	100	Very stiff, damp, light gray, Clayey SILT (ML)	81.1 / 20.0		3.6	1.2	17				

Completion Depth: 81.3 Ft. Water Depth: 28.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	67		75.6								
				Loose, wet, black, bottom ash (SP)(Fill) ▽	25.5								
30		1 3 2	67						22				Placed a plug in augers before advancing
					67.1								
				Soft to firm, moist, orangish-brown, medium plastic CLAY (CL); with trace roots (Fill)	34.0								Driller reported material change at 34.0 feet Original Dike
35		4 4 6	83										
					61.1								
40		P	0	Firm, moist, orangish-brown, medium plastic CLAY (CL)	40.0								Approximate top of natural ground Peoria Loess
45		P	8	Becomes light reddish-brown									

Completion Depth: 81.3 Ft. Water Depth: 28.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		3 4 6	100	Firm, moist, brown and gray, medium plastic CLAY (CL)					20				Equality/Glasford Formation
55		P	100	Grades trace sand									
60		8 13 15	100	Very stiff to stiff, damp, gray and light green, highly weathered SHALE	41.1 60.0								Spoon Formation
65		5 8 14	100	Becomes stiff, light green 65.7 feet - 1 inch coal layer									
70		3 4 14	100	Becomes light brown 1/2 inch coal layer Becomes light gray					23				6 inches cobble (almost auger refusal) Possible slough/disturbance first 6 inches of SPT

Completion Depth: 81.3 Ft.

Water Depth: 28.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

Figure No. A-3-5

LOG of BORING No. B-05

Sheet 4 of 4

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		15 35 59	100	Hard, dry, light gray SHALE									
80		11 45 55	100		19.8								
				Bottom of boring at 81.3 feet	81.3								
85													
90													
95													

Completion Depth: 81.3 Ft. Water Depth: 28.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, damp, reddish-brown, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA without a center plug 1989 Dike Addition
5		P	8										Sample in a jar
10		P	100						17			5.8	
15		P	75						18	47	29		
20		P	50		81.2		3.6	1.2	17				Shelby tube refusal
				Very stiff, dry, gray SILT (ML)(Fill)	20.5								
													Black fine gravel (ash) in cuttings
					76.7								

Completion Depth: 81.5 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		3 3 4	78	Loose, wet, black, bottom ash (SP)(Fill)	25.0				25				A plug was placed in augers
					72.7								
				Stiff, damp to moist, gray, Clayey SILT (CL-ML); with oxidation (Fill)	29.0								Driller stated possible material change at 29.0 feet - Original dike
30		5 7 8	100	Becomes light brown									
					66.7								
35		P	67	Moist, gray, low plastic CLAY (CL)	35.0				21			1.4	(sample was possibly slough)
40		P	100	Becomes light reddish-brown; with oxidation					23				
					58.2								
				Firm, moist, brown and gray, high plastic CLAY (CH)	43.5								Approximate top of natural ground Peoria Loess Repushed 8 inches for recovery of a sample but only recovered a little slough
45		P	0										

Completion Depth: 81.5 Ft. Water Depth: ____ ft., After ____ hrs.
Project No.: 5E08560 ____ ft., After ____ hrs.
Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.
Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	67	Becoming light gray; with oxidation					20			3.6	
55		6 10 15	100	Becomes orangish-brown									
					41.7								
60		7 13 25	100	Very stiff to hard, light brown and light gray, high plastic CLAY (CH)	60.0								Equality/Glasford Formation
65		6 12 18	100	Becomes brown					22				
70		6 15 76	100	With some chert					16				Driller reported a hard zone at 71.0 feet
					26.7								

Completion Depth: 81.5 Ft. Water Depth: ______ ft., After ______ hrs.

Project No.: 5E08560 ______ ft., After ______ hrs.

Project Name: Illinois Power/Baldwin Power Station ______ ft., After ______ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		7 22 33	100	Hard, light brown to light green, highly weathered SHALE	75.0								Spoon Formation Driller reported very hard drilling at 78.5 feet
80		8 15 40	100	Becomes light green and gray	20.2								
				Bottom of boring at 81.5 feet	81.5								
85													
90													
95													

Completion Depth: 81.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ______ ft., After ______ hrs.

______ ft., After ______ hrs.

______ ft., After ______ hrs.

Logged by: K. Berry

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm to stiff, damp, brown, low plastic, Silty CLAY (CL) (Fill)									Boring advanced using 3-1/4 inch I.D. HSA without a center plug 1989 Dike Addition
5		P	100										
10		P	54	Becomes reddish-brown			4.1	1.3	18				
15		P	100										
20		P	83	Trace fly ash					21			8.1	
													Black fine gravel fragments in cuttings

Completion Depth: 80.9 Ft. Water Depth: ___ ft., After ___ hrs.

Project No.: 5E08560 ___ ft., After ___ hrs.

Project Name: Illinois Power/Baldwin Power Station ___ ft., After ___ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		3 6 7	78	SAME: Brown and reddish-brown, Silty CLAY (CL) (Fill)					15				Original dike
30		P	83	Becoming moist					17			7.3	
35		P	65	Becomes gray with oxidation			2.6	0.8	25				
40		P	83		59.5				22			4.4	
				Stiff, moist, gray, medium plastic CLAY (CL); trace gravel	42.5								Top of natural ground Peoria Loess
45		4 5 7	100										
													Driller reported softer drilling
					52.0								

Completion Depth: 80.9 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	Firm, moist, brownish-gray, high plastic CLAY (CH); with trace organics and gravel	50.0				18				Sand in shoe; Driller reported a cobble at 54 feet
					47.0								
55		5 9 10	100	Very stiff, moist, reddish-brown, low plastic, silty CLAY (CL)	55.0								Sample appeared to be mostly slough? - steel at correct depth
60		10 13 15	6										Sample was slough; Driller reports soft drilling
					37.0								
65		6 5 6	97	Stiff, moist, light reddish-brown, high plastic CLAY (CH)	65.0				22				Equality/Glasford Formation
70		P	8										Sample in a jar (sample from shoe)
					27.0								

Completion Depth: 80.9 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		16 12 12	67	Very stiff to hard, damp, light green, highly weathered SHALE	75.0								Spoon Formation
													Driller reported a cobble at 78 feet
80		44 56/5"	78	Possible weathered limestone	21.1				18				
				Bottom of boring at 80.9 feet	80.9								SPT stiffened up after 3 inches
85													
90													
95													

Completion Depth: 80.9 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

Figure No. A-3-8

LOG of BORING No. B-08

Sheet 1 of 4

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm to very stiff, moist, brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	100						17			6.1	
10		P	100						18			6.1	
15		P	100	Grades trace ash (black sand)(Fill)					16				
20		P	50				2.4	0.9	25	46	24		

Completion Depth: 81.5 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-08

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		4 7 10	100	SAME: Brown, Silty CLAY (CL)(Fill)					15				Original Dike
30		P	100						16			6.8	
35		3 4 6	100	Becoming mottled reddish-brown/light gray					19				
40		P	67						20			3.2	
45		2 4 3	100	Becoming orangish-brown	56.4 / 45.6				31				
				Loose, wet, orangish-brown, medium to fine sand (SP); with trace silt	54.0 / 48.0								
				Stiff, damp to moist, multi-colored reddish-brown, light brown, gray, orangish-brown, med. plastic CLAY(CL)									Approximate top of natural ground

Completion Depth: 81.5 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services

Water Depth: ___ ft., After ___ hrs.
___ ft., After ___ hrs.
___ ft., After ___ hrs.
Logged by: K. Berry

Woodward-Clyde Consultants

Figure No. A-3-8

LOG of BORING No. B-08

Sheet 3 of 4

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		5 6 9	100	SAME: Firm to stiff, damp to moist, reddish-brown, light brown, gray, medium plastic CLAY (CL)	49.0				20				Trace coal in shoe
				Firm to stiff, moist, light reddish-brown, low plastic, silty CLAY (CL)	53.0								Approximate top of natural ground Peoria Loess
55		P	67						19				Sample was mostly slough
60		4 5 8	100	Becoming light gray, medium plastic					23				Equality/Glasford Formation
65		P	8		32.0								Sample was slough
70		4 6 8	100	Firm to stiff, moist, brown, high plastic CLAY (CH) Becomes gray	70.0 27.0				21				Glasford Formation

Completion Depth: 81.5 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-08

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		11 16 26	100	Very stiff to hard, light gray, highly weathered SHALE	75.0				20				Spoon Formation
80		11 22 31	100	Becomes gray	20.5				21				
				Bottom of boring at 81.5 feet	81.5								
85													
90													
95													

Completion Depth: 81.5 Ft.
Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services
Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, moist, brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	100						22				
				Becoming dark brown (possibly mixed with ash)(Fill)									
10		P	75	Becomes mottled brown/brownish-gray (Fill)			4.1	1.5	22	50	30		
15		P	100						18				Sample contained some duct tape Clay appears to be mixed with fly ash at 15.5 feet
20		P	75	Becomes mottled reddish-brown/light gray	82.7 / 20.0								Original Dike
				Becomes gray									

Completion Depth: 80.8 Ft. Water Depth: 45.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		4 4 6	78	Firm to stiff, mottled reddish-brown/light gray, silty CLAY (CL)					24				
30		1 3 4	83	Becoming soft, silty; some organic material	72.7 30.0				20				
35		P	83						20			3.7	Sample had the appearance of slough
40		P	100	Becoming firm to stiff, orangish-brown			1.0	0.5	23	34	16		Tube was pushed approximately 2-3 inches too far
													Trace gravel, coal 2 thin sand layers
45		6 9 12	100	▽									
				Moist, orangish-brown, low plastic, Silty CLAY (CL)	56.7 46.0								Approximate top of natural ground Peoria Loess

Completion Depth: 80.8 Ft.
Water Depth: 45.0 ft., After ATD hrs.
ft., After hrs.
ft., After hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	PP, TSF	TV, TSF	LL	PI	Qu, KSF	FIELD NOTES
50	7 10 10	83	Becoming light reddish-brown with little gravel		17						
				47.7							Driller reported a boulder at 54-56 feet
55	11 5 9	100	Firm to stiff, moist, orangish-brown, high plastic CLAY (CH) Becoming stiff to very stiff, light gray	55.0	23						Glasford/Equality Formation Driller reported stiffer drilling
60	6 13 12	0			14						Driller reported top 1/2 of run being hard
65	14 51 50/3.5"	100		37.2							
			Hard, dark gray, weathered SHALE	65.5							Spoon Formation
70	30 43 64	17			25						

Completion Depth: 80.8 Ft.

Water Depth: 45.0 ft., After ATD hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		26	100	Hard, damp, gray, clayey weathered SHALE					16				
		25											
		30											
80		38			21.9				11				
		62/2.5		Bottom of boring at 80.8 feet	80.8								
85													
90													
95													

Completion Depth: 80.8 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services

Water Depth: 45.0 ft., After ATD hrs.
ft., After hrs.
ft., After hrs.
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-10

DATE 3/27/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET -10+09/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm, moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	100						23				
10		P	83	Becoming mottled with light brownish-gray					15				
15		P	100				>4.5	1.7	15	42	24		Shelby refusal
20		26 33 32	89	Becoming hard with some ash (sand); trace gravel					11				
25		5	78	Firm to stiff, moist, light gray, low					24	43	25		

Completion Depth: 75.1 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-10

DATE 3/27/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET -10+09/0

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
	5 10		plastic, Silty CLAY (CL); with 1 inch ash zone (Fill)	71.9							
30	P	100	Hard, damp, light brownish-gray, Clayey SILT (ML)	30.0 66.9			19			5.8	Sampler refusal Original Dike
35	2 6 7	100	Firm to stiff, moist, mottled reddish-brown/light brown, low plastic, Silty CLAY (CL)	35.0 61.9			22				
40	P	100	Firm, moist, light brown, Clayey SILT (ML)	40.0 56.9			26	32	8		Approximate top of natural ground Peoria Loess
45	P	100	Stiff, wet, light brown to brown, low plastic, Silty CLAY (CL)	45.0	1.4	0.9	24	32	14		Water at approximately 45.0 feet
50	P	100					25	40	22	1.9	

Completion Depth: 75.1 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western

Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.
Logged by: K. Berry

Figure No. A-3-10

LOG of BORING No. B-10

Sheet 3 of 3

DATE 3/27/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET -10+09/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
					46.9								
55		P	100	Stiff, moist, high plastic CLAY (CH)	55.0				19	57	42	6.3	Glasford/Equality Formation
60		P	17						27				Sample in jar
					37.9								
				Medium dense to dense, wet, brown SAND (SW); with trace silt	64.0								Driller reported very soft material at 64.0 feet
65		10 12 20	100	1/2 inch clay layer					14				Sand flowed into augers. Switched to rotary wash with 3 7/8 inch tricone bit
					33.9								
				Hard, dark brown, highly weathered SHALE	68.0								Approximate top of rock SHALE Spoon Formation
70		17 28 45	67						24	52	24		
					26.8								
75		50/1.5"	0	Bottom of boring at 75.1 feet	75.1								

Completion Depth: 75.1 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: K. Berry

Figure No. A-3-11

LOG of BORING No. B-11A

DATE 4/5/95 SURFACE ELEVATION, FT 74.5 DATUM TBM=100 STA./OFFSET 1+81/74 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0		P	92	Soft, damp, reddish-brown, Silty CLAY (CL); with organic roots (Fill)			0.3						Original Dike
					72.5								
		P	54	Very stiff to hard, damp, reddish-gray with black specks, Silty CLAY (CL)(Fill)	2.0		2.3						
		P	100				3.6	1.8	20	39	18		
5				Becoming reddish-brown									
		P	54	Becoming moist, reddish-brown			2.6	1.6	21				
		P	63				1.5		25	47	26		Pushed twice Started using Fixed Piston Sampler
					64.5								
10		P	71	Becoming reddish-brown with gray, high plastic CLAY (CH)(Fill)	10.0		3.1	1.7	23	52	29		
		P	79				2.3	1.3	24				
					60.5								
		P	75	Very stiff, moist, reddish-brown-gray, low plastic CLAY (CL); with trace sand (Fill)	14.0		2.3	1.7	20				
15													
		P	75	Becoming gray with reddish-brown; trace sand			2.8	1.7	20				
		P	88				2.0	1.4	20	45	26		
20		P	100				2.3	1.2	21	47	29		

Completion Depth: 42.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: J. Oldham

Woodward-Clyde Consultants

LOG of BORING No. B-11A

DATE 4/5/95 SURFACE ELEVATION, FT 74.5 DATUM TBM=100 STA./OFFSET 1+81/74 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	79	Stiff, moist, dark gray, low plastic, silty CLAY (CL); with organic roots			1.9	0.9	20	49	28		Approximate top of natural ground
30		P	100	Stiff, moist, gray with reddish-brown sand and organics wood			1.9	0.9	21	29	12		
					39.5								
35		P	96	Stiff, reddish-brown, high plastic CLAY (CH); with sand and gravel	35.0		1.9	1.0	13				Equality/Glasford Formation
40		P	69	Becomes hard			1.9	0.9	26				Shelby refusal
					32.5								
				Bottom of boring at 42.0 feet	42.0								2 inch S/S - 75 for 1.5 inches Auger refusal Set Inclinometer at 42.0 feet
45													

Completion Depth: 42.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: J. Oldham

LOG of BORING No. B-12

DATE 4/6/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+75/123 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, moist, mottled orangish-brown and gray, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA Original Dike
		P	75				1.8						
		P	63	▼			1.8	1.0	23				
5				Becoming mottled brown and gray									
		P	96	Trace fine sand at bottom of tube			1.3						
		P	100				1.2	0.7	31	61	39		
10		P	63	Becoming very stiff			2.0						
		P	92		43.7		2.6	0.8	18				
15				Very stiff, moist, mottled brown and gray, low plastic, Silty CLAY (CL); trace organics	15.0								Approximate top of natural ground Peoria Loess
				▽									
20		P	100				2.5						
				trace fine gravel									
					33.7								

Completion Depth: 40.1 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: 19.0 ft., After ATD hrs.

4.5 ft., After 1.0 hrs.

ft., After hrs.

Logged by: K. Berry

LOG of BORING No. B-12

DATE 4/6/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+75/123 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		23 9 9 12	63	Stiff, damp to dry, brown and gray, high plastic CLAY (CH)	25.0				20	46	23		Shelby tube refusal at 25.0 feet Glasford/Equality Formation
					28.7								
30		21 22 17	72	Hard, moist, light green, severely weathered CLAY-SHALE	30.0				22	47	23		Spoon Formation
35		12 15 17	100	Becoming highly weathered									
					18.6								
40		50/.75"	0	Bottom of boring at 40.1 feet	40.1								Auger and SPT refusal Inclinometer installed to a depth of 40.0 feet
45													

Completion Depth: 40.1 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western

Water Depth: 19.0 ft., After ATD hrs.
4.5 ft., After 1.0 hrs.
ft., After hrs.
Logged by: K. Berry

Figure No. A-3-13

LOG of BORING No. B-13

Sheet 1 of 1

DATE 4/4/95 SURFACE ELEVATION, FT 83.3 DATUM TBM=100 STA./OFFSET 1+69/46 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, damp, reddish-brown, Silty CLAY (CL)(Fill)									1989 Dike Addition
		P	79				1.8						
					79.3								
		P	100	Very stiff, moist, sandy, Silty CLAY (CL)(Fill)	4.0		2.1	0.7	21				
5													Original Dike
		P	83				2.4	0.7	23				
		P	96	Becoming damp, reddish-brown with gray			2.8						Tube refusal
10		P	100				3.3						
					71.3								
				Bottom of boring at 12.0 feet	12.0								
15													
20													

Completion Depth: 12.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: J. Oldham

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-14

DATE 4/5/95 SURFACE ELEVATION, FT 80.2 DATUM TBM=100 STA./OFFSET 2+51/49 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0		P	83	Very stiff, damp, reddish-brown, Silty CLAY (CL); with sand and organics, grass (fill)			2.8						Original Dike
		P	42				3.0						
		P	79	Becoming reddish-brown with gray			1.8	0.6	27				
5													
		P	83				3.4	0.9	24				
		P	63				2.3						
				Becoming gray	70.2								
10				Bottom of boring at 10.0 feet	10.0								
15													
20													

Completion Depth: 10.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: J. Oldham

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0			Stiff, damp to moist, low plastic, Silty CLAY (CL)(Fill)								Boring advanced using 3-1/4 inch I.D. HSA without center plug 1989 Dike Addition
5	P	100					16				
10	3 5 7	100					17				
15	P	65									
20	P	67	Becomes mottled reddish-brown/gray				16			0.0	

Completion Depth: 81.5 Ft.
Water Depth: 32.0 ft., After ATD hrs.
Project No.: 5E08560
ft., After hrs.
Project Name: Illinois Power/Baldwin Power Station
ft., After hrs.
Drilling Contractor: Midwest Eng.Services
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25	1 5 7	67	Loose to medium dense, moist to wet, black, bottom ash (SP)	76.4 25.5			20				
30	3 3 3	67					19				
35	2 2 3	67	Firm to stiff, moist, gray, low plastic CLAY (CL); with oxidation	66.4 35.5			24				Original Dike
40	P	100			2.5						
45	P	100	Firm, moist, reddish-brown, medium plastic CLAY (CL); with oxidation	56.9 45.0			24				Approximate top of natural ground Peoria Loess

Completion Depth: 81.5 Ft.

Water Depth: 32.0 ft., After ATD hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		3 3 4	100	SAME: Firm, moist, reddish brown, medium plastic CLAY (CL); with oxidation					24				Peoria Loess
55		P	100	Becoming more plastic					22				
60		2 1 3 4	100	Soft to firm, moist, mottled orangish-brown and gray, high plastic CLAY (CH); with trace gravel	41.9 60.0				26				Glasford/Equality Formation 6 inches slough
65		P	50						37				
70		7 12 19	100	Very stiff to hard, light green, highly weathered SHALE	31.9 70.0				23				Spoon Formation

Completion Depth: 81.5 Ft.

Water Depth: 32.0 ft., After ATD hrs.

Project No.: 5E08560

ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station

ft., After hrs.

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		7 20 33	100	Light green, highly weathered SHALE									
80		1 6 27	100	Becomes brown; weathered SHALE	20.4								6 inches of slough in boring
				Bottom of boring at 81.5	81.5								
85													
90													
95													

Completion Depth: 81.5 Ft.

Water Depth: 32.0 ft., After ATD hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, damp, reddish-brown, low plastic, Silty CLAY (CL) (Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		2 3 7	97										
10		P	100		77.5								
				Damp, gray, clayey Silt (ML); with trace organics	10.5								
					73.4								
15		5 11 10	72	Medium dense, wet, black ash (medium to coarse sand size) (SP)	14.6								
					70.0								
				Firm to stiff, moist, orangish-brown and gray, low plastic, Silty CLAY (CL); with trace gravel (Fill)	18.0								Original Dike
20		3 3 5	67										Driller reported a material change at 21.0 feet

Completion Depth: 79.0 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	0										
					60.5								
				Stiff, moist, light gray and brown, high plastic CLAY (CH)	27.5								
30		3 4 6	67										
					55.5								
				Very stiff, moist, light gray, low plastic CLAY (CL); with oxidation	32.5								
35		P	100				3.0						
40		5 4 7	100	Becomes reddish-brown									Approximate top of natural ground Peoria Loess
45		3 4 5	83		42.5								
				Firm, moist, light gray, Silty CLAY (CL); with organics	45.5								Glasford/Equality Formation Alluvium

Completion Depth: 79.0 Ft. Water Depth: ______ ft., After ______ hrs.

Project No.: 5E08560 ______ ft., After ______ hrs.

Project Name: Illinois Power/Baldwin Power Station ______ ft., After ______ hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	Stiff to very stiff, moist, mottled orangish brown/gray, low to medium plastic CLAY (CL); with trace gravel			1.0						Till
		P	100				4.0						
		P	100				>4.5						Tube refusal at 53.0 feet
55		50/4"	100	Becomes hard, with sand and gravel(highly weathered shale and sandstone)	32.0								Spoon Formation Tube refusal at 54.5 feet SPT advanced 4 inches in 2 blows, then bounced
		RQD 11	100	Gray, slightly weathered LIMESTONE	56.0								Switched to coring with NX core barrel
				Gray, highly weathered CLAY-SHALE; fissured with calcareous zones	31.4 / 56.6								Core Run #1 Start: 55.0 feet Stop: 59.5 feet DWR: 90%
60		RQD 0	31	59.2 feet - Orange sand, clay and gravel; decomposed limestone	28.8 / 59.2								Core Run #2 Start: 59.5 feet Stop: 64.0 feet DWR: 95% Driller had problem with silt in casing
65		RQD 0	13	Green, highly weathered, high plastic CLAY-SHALE; with oxidation	24.5 / 63.5								Core Run #3 Start: 64.0 feet Stop: 69.0 feet DWR: 90%
70		RQD 0	100	Damp to moist, highly weathered shale (clayey silt - ML)	18.1 / 69.9								Reamed to 71.7 feet
		RQD	40	Gray, fine grained, thinly bedded, slightly weathered LIMESTONE; strong with shale partings 71.7 feet - Moderately weathered for 0.7 feet	13.6 / 74.4								Core Run #4 Start: 71.7 feet Stop: 74.0 feet DWR: 90% Driller reported clay seams

Completion Depth: 79.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		0		72.0 feet - Hard clay for 0.2 feet 73.6 feet - Moderately fractured with stiff clay for 0.3 feet 74.0 feet - 0.2 feet limestone 74.2 feet - 0.3 feet gray clay and limestone									Core Run #5 Start: 74.0 Stop: 79.0 DWR: 80% Had to extrude sample with A-rod
				74.5 feet - Dark gray to black, weathered SHALE	9.3 78.7								Driller reported that last 2 inches felt like limestone (not recovered)
80				Weathered limestone at 78.7 feet	9.0 79.0								Inclinometer installed
				Bottom of boring at 79.0 feet									
85													
90													
95													

Completion Depth: 79.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

LOG of BORING No. B-102

DATE 5/17/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+67/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				(Refer to log of Piezometer P-03A)									Boring advanced using 5-7/8 inch tricone bit with rotary wash
				Bottom Overburden	32.1 / 18.7								
				LIMESTONE	31.1 / 19.7								
20		C	84	Hard, light gray, moderately weathered CLAY-SHALE	28.6 / 22.2								Complete tricone at 19.7 feet Begin Pitcher Sampler Run #1 Start: 19.7 feet Stop: 22.2 feet
		C	100	Very stiff to hard, greenish-gray, severely to completely weathered CLAY-SHALE									Run #2 Start: 22.2 feet Stop: 25.0 feet
25		C	36	Limestone stringer at 25.2 feet									Run #3

Completion Depth: 49.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Roberts Env. Logged by: T. Deddens

Woodward-Clyde Consultants

LOG of BORING No. B-102

DATE 5/17/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+67/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
													Start: 25.2 feet Stop: 28.0 feet
30		RQD 0 RQD 0	100 100										NX Core Barrel Core Run #4 Start: 28.3 feet Stop: 29.6 feet Core Run #5 Start: 29.6 feet Stop: 34.0 feet
					17.5 33.3								
35		RQD 0	91	Dark gray, crystalline, moderately weathered LIMESTONE; with numerous horizontal joints	15.9 34.9								Core Run #6 Start: 34.0 feet Stop: 38.5 feet
				Soft to medium stiff, greenish-gray, severely to completely weathered CLAY-SHALE	15.1 35.7								
				Dark gray, crystalline, severely weathered, highly fractured LIMESTONE; with seam of greenish-gray clay	12.9 37.9								
		RQD 0	55	Soft, greenish-gray, completely weathered CLAY-SHALE; with limestone fragments	11.9 38.9								Core Run #7 Start: 38.5 feet Stop: 44.0 feet
40				Soft to hard, dark gray, moderately to completely weathered CLAY-SHALE	11.7 39.1								
				Absent, wash away	9.9 40.9								
				Soft to hard, dark gray, moderately to completely weathered, fissile CLAY-SHALE	7.5 43.3								
		RQD 0	88	Dark gray, shaley, slightly weathered, thin bedded LIMESTONE	6.8 44.0								Core Run #8 Start: 44.0 feet Stop: 49.0 feet
45				Dark gray, very weathered SHALE	6.2 44.6								
				Dark gray, shaley, moderately weathered LIMESTONE	5.4 45.4								
				Dark gray, moderately to severely weathered, limey CLAY-SHALE	3.9 46.9								
				Dark gray, moderately weathered, thin bedded LIMESTONE; with dark gray shale seam	1.8 49.0								Inclinometer installed
50				Bottom of boring at 49.0 feet									

Completion Depth: 49.0 Ft.
Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: T. Deddens

LOG of BORING No. P-02A

DATE 5/10/95 SURFACE ELEVATION, FT 74.6 DATUM TBM=100 STA./OFFSET 1+56/76RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Boring not sampled 0 - 29.0 feet (See Log of Boring B-11A)									Boring advanced using 4-1/4 inch I.D. HSA
5													
10													
15													
20													

Completion Depth: 47.0 Ft.
Water Depth: 35.0 ft., After ATD hrs.
Project No.: 5E08560
ft., After hrs.
Project Name: Illinois Power/Baldwin Power Station
ft., After hrs.
Drilling Contractor: Roberts Env.
Logged by: K. Berry

Woodward-Clyde Consultants

Figure No. A-3-18

LOG of BORING No. P-02A

Sheet 2 of 2

DATE 5/10/95 SURFACE ELEVATION, FT 74.6 DATUM TBM=100 STA./OFFSET 1+56/76RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25													
					45.6								
		P	21	Stiff to very stiff, moist, orange and gray, high plastic CLAY (CH); with trace gravel	29.0								(No pp - sample slid) Glacial Soils
30													
		P	100				1.5						
35				∇									
		P	100	Becomes very stiff, light brown; with little sand			3.0						
		P	100		35.6		>4.5		28	59	33		
				Hard, high plastic CLAY (CH) (highly weathered shale)	39.0								Spoon Formation Driller reported stiff material at 39.5 feet
40		P	0		33.1								
		RQD 0	80	Highly weathered LIMESTONE	41.5								Auger refusal at 41.5 feet Switched to rotary wash with NX core (new shale carbide bit) Core Run #1 Start: 41.5 feet Stop: 44.0 feet DWR: 95%
				Brown and gray, high plastic, highly weathered SHALE; with trace sand and gravel Possible slickenside at 43.0 feet	32.5 42.1								
		RQD 0	86										Core Run #2 Start: 44.0 feet Stop: 47.0 feet DWR: 95%
45					27.6								
				Bottom of boring at 47.0 feet	47.0								Driller reported 75% DWR at 46.0 feet Piezometer installed

Completion Depth: 47.0 Ft.

Water Depth: 35.0 ft., After ATD hrs.

Project No.: 5E08560

ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station

ft., After hrs.

Drilling Contractor: Roberts Env.

Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. P-03

DATE 4/13/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+57/3LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Medium stiff, moist, brown, low plastic, silty CLAY (CL) to clayey silt									Boring advanced using 4-inch diameter CFA
		P	92				0.0						
5				Becomes very soft, wet, gray; with some sand									
				▽									
		P	100				2.3						
				Becomes stiff, gray and orangish-brown	40.8								
10				Bottom of Boring at 10.0 feet	10.0								Piezometer installed 4 feet west
15													
20													

Completion Depth: 10.0 Ft.
Water Depth: 7.0 ft., After ATD hrs.
ft., After hrs.
ft., After hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western
Logged by: K. Berry

LOG of BORING No. P-03A

DATE 5/15/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+56/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm, moist to wet, medium gray, low plastic, Clayey SILT (ML); trace roots, wet, pocket of medium sand									Boring advanced using 4-1/4 inch I.D. HSA Fill
5		2 3 3	100		42.8								
				Firm, moist to wet, medium gray, medium to high plastic, Silty CLAY (CL); with 6-inch layer of fine grained, silty sand	8.0								Alluvium
10		2 2 4	100		38.3								
				Firm, moist, light gray, medium to high plastic, Silty CLAY (CL); with mottles of tan, sandy clay, trace coarse to medium sand	12.5								Glacio-Lacustrine/Till
15		2 3 4	100		32.1								
		RQD 0	84	Dark gray, moderately weathered LIMESTONE	18.7 31.5								Switched to NX core barrel Core Run #1 Start: 18.8 feet Stop: 23.8 feet Spoon Formation
20				Dark gray, severely weathered SHALE 0.2 feet Limestone at 20.0 feet	19.3								
		RQD 0	38	Trace gravel, shale becomes greenish-gray at 23.8 feet									Core Run #2 Start: 23.8 feet

Completion Depth: 27.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Roberts Env. Logged by: T. Deddens

LOG of BORING No. P-03A

DATE 5/15/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+56/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25													Stop: 27.0 feet
				Becomes maroon	23.8								
				Bottom of boring at 27.0 feet	27.0								Piezometer installed
30													
35													
40													
45													

Completion Depth: 27.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: T. Deddens

LOG of BORING No. P-04

DATE 5/11/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+65/122RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0			Medium stiff, moist, brown, low plastic CLAY (CL) (Fill)								Boring advanced using 4-1/4" I.D. HSA
5	3 4 5	78									
10	3 4 6	72	Becomes gray, more silty								
15	4 5 4	100									
	P	100		38.7 / 20.0	0.8						
20			Stiff to very stiff, moist to wet, brown, medium plastic, Silty CLAY (CL); some fine gravel, coarse sand, trace medium to fine sand ▽								Glacial Soils
	P	100		34.7 / 24.0	2.5	1.8	16	29	13		Driller reported stiffer material at approximately 24.5 feet
	P	100	Firm to stiff, orange-brown, high plastic,		0.5	0.7		73	36		

Completion Depth: 30.8 Ft. Water Depth: 22.0 ft., After ATD hrs.
Project No.: 5E08560 ft., After hrs.
Project Name: Illinois Power/Baldwin Power Station ft., After hrs.
Drilling Contractor: Roberts Env. Logged by: K. Berry

LOG of BORING No. P-04

DATE 5/11/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+65/122RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	100	CLAY (CH); trace fine gravel, coarse sand	33.7 / 25.0								Driller reported hard material at 25.0 feet
		RQD 13	93	Moist, orange, silty CLAY (CL); with rock fragments	32.9 / 25.8		1.0-3.5						Probable shear zone at 23.9 feet
				25.8 - 26.9: LIMESTONE	31.8 / 26.9								Appeared to be weathered rock
				26.9 - 27.2: Probable clay (no recovery)	31.5 / 27.2								Driller reported a 4 inch soft zone at 26.8 feet
				Damp, green, high plastic, highly weathered CLAY-SHALE; with silt and oxidation	28.2 / 30.5								Core Run #1 Start: 25.8 feet Stop: 26.3 feet DWR: 90%
30				Becomes highly weathered LIMESTONE	27.9 / 30.8								Changed from carbide bit to a surface set bit
				Bottom of boring at 30.8 feet									Core Run #2 Start: 26.3 Stop: 30.8 DWR: 90% Piezometer installed
35													
40													
45													

Completion Depth: 30.8 Ft.

Water Depth: 22.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: K. Berry

LOG of BORING No. P-05A

DATE 5/11/95 SURFACE ELEVATION, FT 75.0 DATUM TBM=100 STA./OFFSET 3+83/55RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, moist, low to medium plastic CLAY (CL) (Fill)									Boring advanced using 4-1/4 inch I.D. HSA Original Dike
5		2 4 6	78										
10		3 4 7	83	Becoming stiff, medium plastic CLAY (CL)									
15		3 6 6	100		60.3								
				Stiff, moist, gray, medium plastic CLAY (CL); with trace oxidation	14.7								
					57.5								
				Stiff, moist, brown, medium plastic CLAY (CL); with trace fine roots	17.5								Approximate top of natural ground Peoria Loess
20		4 4 7	100										
		4	100	Firm to stiff, moist, gray, low plastic, Silty CLAY (CL); with little oxidation									Light reddish-brown in shoe

Completion Depth: 45.5 Ft.

Water Depth: 29.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. P-05A

DATE 5/11/95 SURFACE ELEVATION, FT 75.0 DATUM TBM=100 STA./OFFSET 3+83/55RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		4 4			47.5								Glacial Soils
		3 4 4	100	Soft to medium stiff, moist, orangish-brown, low plastic, silty CLAY (CL); with trace fine sand, pebbles ∇	27.5 41.0								
30													
35		4 5 8	100	Stiff, moist, light brown, medium to high plastic CLAY (CL); with trace sand (1/2 inch rounded pebbles)	34.0 37.8								Till Sandstone in shoe (in jar)
40		9 18 50/2"	67	Very stiff to hard, damp, orangish-brown, low plastic CLAY (CL)	37.2 33.5								Spoon Formation Driller reported stiff material at 38.5 feet Clay had structure to it Driller reported approximately 6 inches of highly fractured rock at 40.2 feet
45		10 14 19	67	Hard, damp, light green, high plastic CLAY (CH); with trace sand	41.5 29.5								Gravel-sized, severely weathered limestone, then shale in shoe (shale on bottom)
				Bottom of boring at 45.5 feet	45.5								Advanced augers to 45.5 for permeability test Piezometer installed

Completion Depth: 45.5 Ft. Water Depth: 29.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

Woodward-Clyde Consultants

Figure No. A-3-23

LOG of BORING No. P-07

DATE 5/15/95 SURFACE ELEVATION, FT 51.0 DATUM TBM=100 STA./OFFSET 4+01/172RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Moist, brown, Silty CLAY (CL)	47.0								Boring advanced using 4 1/4 inch I.D. HSA
5		3 4 5	72	Stiff, moist, greenish-gray, medium to high plastic CLAY (CL/CH); with trace organics	4.0 44.0								Alluvium
10		3 5 6	100	Medium stiff, moist, mottled orangish brown, low plastic, silty clay and gray, high plastic CLAY (CL/CH); with little sand	7.0 39.0								(TILL)
15		4 6 8	100	Stiff, moist, light brown, high plastic CLAY (CH); with little sand, fine pebbles	12.0								(TILL)
20		P	100	Becomes mottled gray and brown	29.0		1.5						
		7	100	Dry to damp, light gray, high plastic CLAY (highly weathered shale)	22.0								21.8 - 22.1 feet: driller reported possible rock Becomes green in shoe

Completion Depth: 27.0 Ft. Water Depth: 14.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. P-07

DATE 5/15/95 SURFACE ELEVATION, FT 51.0 DATUM TBM=100 STA./OFFSET 4+01/172RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		17 16			24.0								
				Bottom of boring at 27.0 feet	27.0								Permeability test at 27.0 feet Installed piezometer
30													
35													
40													
45													

Completion Depth: 27.0 Ft. Water Depth: 14.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

APPENDIX A-4 - PIEZOCONE SOUNDINGS

The 23 cone penetration tests were performed with a 10-ton electronic subtraction cone equipped with a pore pressure transducer. The cones have a tip area of 10 cm^2 and a friction sleeve area of 150 cm^2. The pore pressure transducer is located directly behind the tip. The cone was advanced in the field by hydraulic pushing from a drill rig at a rate of 1 inch per second. Data was collected at a 5 cm vertical interval. The Cone Penetration Test (CPT) was performed in accordance with ASTM D-3441. Plotted results of the CPT tests are included as Figures A-4-1 through A-4-23 of this appendix. Data Tables from the CPT tests are given after each CPT plot.

WOODWARD-CLYDE CONSULTANTS

CPT-1

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

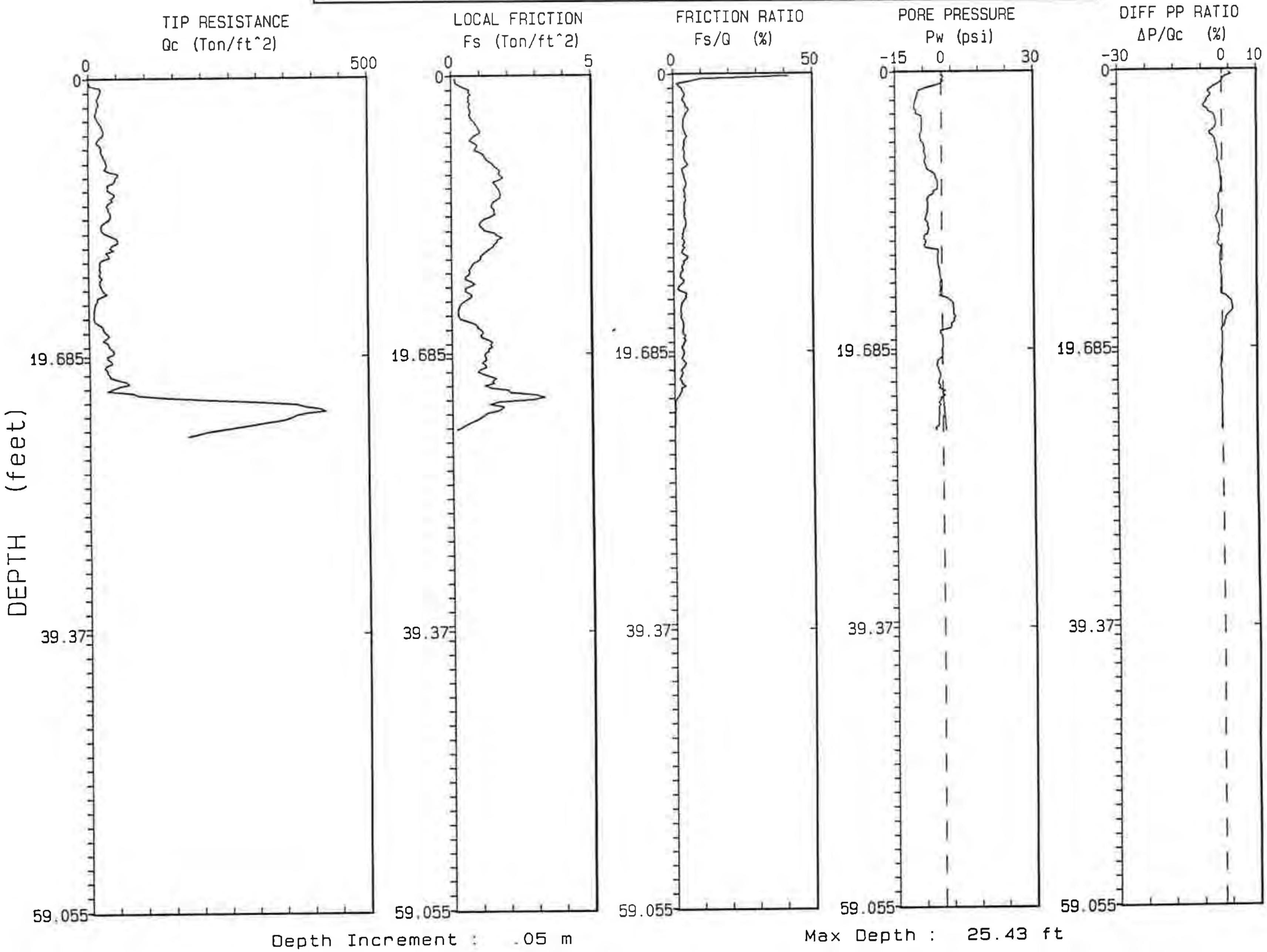


FIG. A-4-1

WOODWARD-CLYDE CONSULTANTS

CPT-1

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	11.37	0.30	2.68	0.03	silty clay to clay	UNDFND	UNDFD	7	.6
0.60	2	16.80	0.63	3.74	0.09	silty clay to clay	UNDFND	UNDFD	11	.9
0.95	3	14.66	0.67	4.55	0.15	clay	UNDFND	UNDFD	14	.8
1.25	4	24.68	0.93	3.77	0.22	silty clay to clay	UNDFND	UNDFD	16	1.4
1.55	5	18.98	0.79	4.17	0.28	silty clay to clay	UNDFND	UNDFD	12	1.1
1.85	6	28.70	1.13	3.93	0.33	silty clay to clay	UNDFND	UNDFD	18	1.6
2.15	7	41.52	1.64	3.94	0.39	clayey silt to silty clay	UNDFND	UNDFD	20	2.4
2.45	8	39.12	1.65	4.22	0.45	silty clay to clay	UNDFND	UNDFD	25	2.2
2.75	9	40.57	1.66	4.10	0.51	silty clay to clay	UNDFND	UNDFD	26	2.3
3.05	10	37.12	1.47	3.97	0.57	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
3.35	11	25.73	1.09	4.24	0.63	silty clay to clay	UNDFND	UNDFD	16	1.4
3.65	12	45.22	1.62	3.57	0.69	clayey silt to silty clay	UNDFND	UNDFD	22	2.6
3.95	13	32.63	1.19	3.66	0.75	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
4.25	14	19.68	0.73	3.71	0.81	silty clay to clay	UNDFND	UNDFD	13	1.1
4.55	15	21.73	0.64	2.94	0.87	clayey silt to silty clay	UNDFND	UNDFD	10	1.2
4.85	16	21.27	0.58	2.75	0.93	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.15	17	9.88	0.28	2.88	0.98	silty clay to clay	UNDFND	UNDFD	6	.5
5.45	18	19.00	0.61	3.19	1.04	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
5.75	19	32.30	1.15	3.57	1.10	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
6.05	20	38.63	1.28	3.32	1.16	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
6.40	21	33.97	1.11	3.26	1.23	clayey silt to silty clay	UNDFND	UNDFD	16	1.9
6.70	22	52.85	1.34	2.54	1.29	sandy silt to clayey silt	UNDFND	UNDFD	20	3.0
7.00	23	140.12	2.43	1.74	1.35	sand to silty sand	70-80	40-42	34	UNDEFINED
7.35	24	387.83	1.50	0.39	1.39	gravelly sand to sand	>90	44-46	>50	UNDEFINED
7.65	25	279.07	0.58	0.21	1.42	gravelly sand to sand	>90	42-44	45	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-1

WOODWARD-CLYDE CONSULTANTS

CPT-2

Operator:	**J. Oldham**	**CPT Date:**	**3/28/95**
Page:	**1/2**	**Location:**	**Baldwin**
Cone Used:	**243**	**Job Number:**	**5E08560**

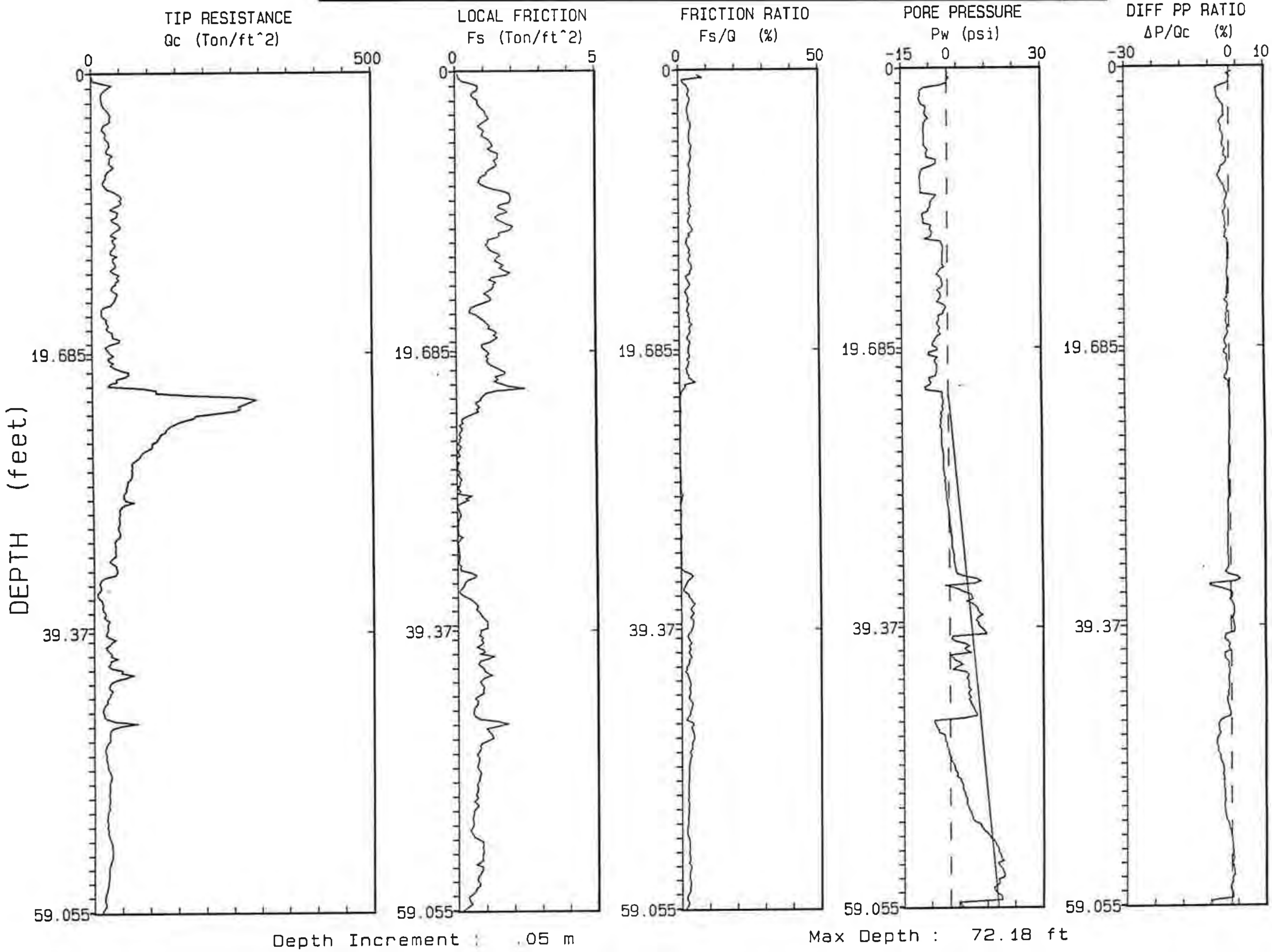
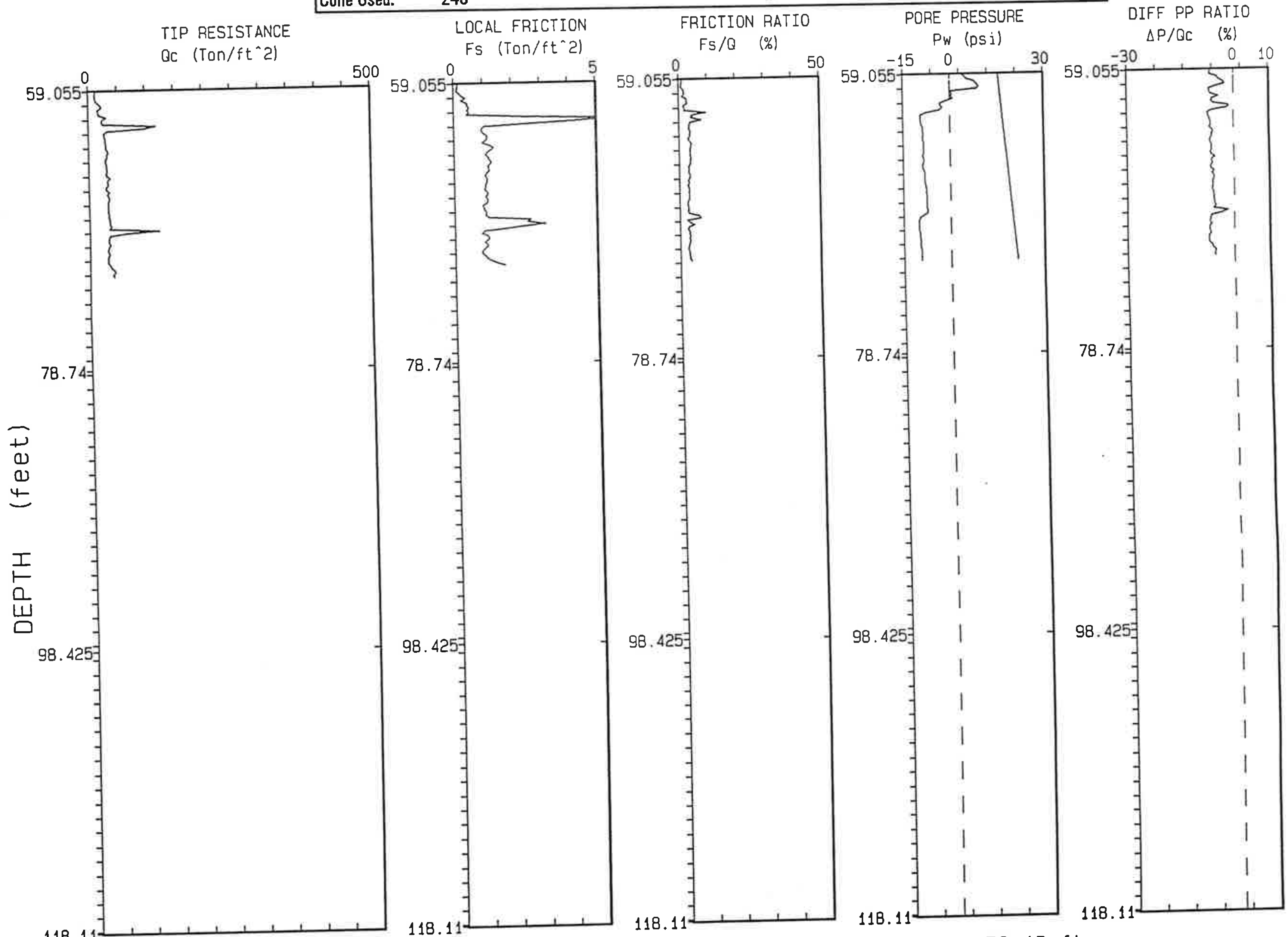


FIG. A-4-2

WOODWARD-CLYDE CONSULTANTS

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 72.18 ft

FIG. A-4-2

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

:PTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	14.55	0.33	2.29	0.03	clayey silt to silty clay	UNDFND	UNDFD	7	.8
0.60	2	18.98	0.70	3.69	0.09	silty clay to clay	UNDFND	UNDFD	12	1.1
0.95	3	28.16	0.96	3.42	0.15	clayey silt to silty clay	UNDFND	UNDFD	13	1.6
1.25	4	24.57	0.98	3.99	0.22	silty clay to clay	UNDFND	UNDFD	16	1.4
1.55	5	28.02	1.10	3.92	0.28	silty clay to clay	UNDFND	UNDFD	18	1.6
1.85	6	31.35	1.38	4.40	0.33	silty clay to clay	UNDFND	UNDFD	20	1.8
2.15	7	32.65	1.32	4.06	0.39	silty clay to clay	UNDFND	UNDFD	21	1.8
2.45	8	23.52	0.94	4.00	0.45	silty clay to clay	UNDFND	UNDFD	15	1.3
2.75	9	48.83	1.82	3.73	0.51	clayey silt to silty clay	UNDFND	UNDFD	23	2.8
3.05	10	43.05	1.68	3.91	0.57	clayey silt to silty clay	UNDFND	UNDFD	21	2.4
3.35	11	44.15	1.73	3.92	0.63	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
3.65	12	38.48	1.46	3.79	0.69	clayey silt to silty clay	UNDFND	UNDFD	18	2.2
3.95	13	37.63	1.31	3.47	0.75	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
4.25	14	38.48	1.56	4.06	0.81	silty clay to clay	UNDFND	UNDFD	25	2.2
4.55	15	43.65	1.49	3.42	0.87	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
4.85	16	40.38	1.19	2.95	0.93	sandy silt to clayey silt	UNDFND	UNDFD	15	2.3
5.15	17	23.40	0.74	3.17	0.98	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
5.45	18	25.45	0.96	3.76	1.04	silty clay to clay	UNDFND	UNDFD	16	1.4
5.75	19	39.15	1.34	3.43	1.10	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
6.05	20	30.18	1.04	3.45	1.16	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
6.40	21	40.23	1.23	3.06	1.23	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
6.70	22	44.60	1.54	3.44	1.29	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
[illegible]00	23	174.40	1.42	0.82	1.35	sand	70-80	42-44	33	UNDEFINED
[illegible]5	24	247.71	0.73	0.29	1.39	gravelly sand to sand	80-90	42-44	40	UNDEFINED
7.65	25	150.20	0.21	0.14	1.42	sand	70-80	40-42	29	UNDEFINED
7.95	26	117.15	0.12	0.10	1.45	sand	60-70	40-42	22	UNDEFINED
8.25	27	92.93	0.08	0.09	1.48	sand	50-60	38-40	18	UNDEFINED
8.55	28	71.08	0.02	0.03	1.51	sand	50-60	36-38	14	UNDEFINED
8.85	29	64.68	0.10	0.15	1.54	sand to silty sand	40-50	36-38	15	UNDEFINED
9.15	30	56.80	0.19	0.33	1.57	sand to silty sand	40-50	36-38	14	UNDEFINED
9.45	31	53.55	0.12	0.23	1.59	sand to silty sand	40-50	34-36	13	UNDEFINED
9.75	32	45.60	0.06	0.13	1.62	sand to silty sand	<40	34-36	11	UNDEFINED
10.05	33	43.78	0.06	0.13	1.65	sand to silty sand	<40	32-34	10	UNDEFINED
10.35	34	38.82	0.04	0.10	1.68	sand to silty sand	<40	32-34	9	UNDEFINED
10.65	35	35.85	0.07	0.20	1.71	sand to silty sand	<40	32-34	9	UNDEFINED
10.95	36	22.08	0.41	1.84	1.74	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
11.25	37	8.70	0.15	1.68	1.76	clayey silt to silty clay	UNDFND	UNDFD	4	.3
11.55	38	15.45	0.59	3.84	1.79	silty clay to clay	UNDFND	UNDFD	10	.7

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-2

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH s)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	22.70	0.90	3.96	1.82	silty clay to clay	UNDFND	UNDFD	14	1.2
12.15	40	26.57	0.88	3.29	1.85	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.45	41	27.13	0.83	3.05	1.88	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.80	42	33.99	0.90	2.64	1.91	sandy silt to clayey silt	UNDFND	UNDFD	13	1.8
13.10	43	46.10	0.95	2.06	1.94	sandy silt to clayey silt	UNDFND	UNDFD	18	2.5
13.40	44	28.12	0.85	3.01	1.97	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
13.75	45	18.39	0.61	3.31	2.00	clayey silt to silty clay	UNDFND	UNDFD	9	.9
14.05	46	38.88	1.08	2.78	2.03	sandy silt to clayey silt	UNDFND	UNDFD	15	2.1
14.35	47	27.25	1.11	4.09	2.06	silty clay to clay	UNDFND	UNDFD	17	1.4
14.65	48	20.83	0.74	3.57	2.09	silty clay to clay	UNDFND	UNDFD	13	1.0
14.95	49	23.93	0.70	2.93	2.11	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
15.25	50	28.98	0.74	2.55	2.14	sandy silt to clayey silt	UNDFND	UNDFD	11	1.5
15.55	51	26.50	0.65	2.45	2.17	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
15.85	52	25.25	0.61	2.40	2.20	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.15	53	22.85	0.52	2.27	2.23	sandy silt to clayey silt	UNDFND	UNDFD	9	1.1
16.45	54	25.93	0.52	2.00	2.26	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.75	55	31.62	0.86	2.72	2.28	sandy silt to clayey silt	UNDFND	UNDFD	12	1.6
17.05	56	28.60	0.80	2.78	2.31	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
17.35	57	25.53	0.74	2.90	2.34	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
17.65	58	21.55	0.63	2.91	2.37	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
17.95	59	18.20	0.38	2.08	2.40	clayey silt to silty clay	UNDFND	UNDFD	9	.8
18.25	60	13.08	0.17	1.28	2.43	sandy silt to clayey silt	UNDFND	UNDFD	5	.5
18.55	61	20.85	0.44	2.09	2.45	sandy silt to clayey silt	UNDFND	UNDFD	8	1.0
.85	62	53.92	2.64	4.91	2.48	silty clay to clay	UNDFND	UNDFD	34	2.9
.20	63	28.20	1.06	3.76	2.51	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
19.50	64	30.68	1.19	3.89	2.54	silty clay to clay	UNDFND	UNDFD	20	1.5
19.80	65	30.52	1.21	3.98	2.57	silty clay to clay	UNDFND	UNDFD	19	1.5
20.15	66	32.63	1.13	3.45	2.60	clayey silt to silty clay	UNDFND	UNDFD	16	1.6
20.45	67	33.40	1.11	3.32	2.63	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
20.75	68	33.62	1.07	3.18	2.66	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.05	69	55.33	2.17	3.92	2.69	clayey silt to silty clay	UNDFND	UNDFD	27	3.0
21.35	70	33.47	1.20	3.59	2.72	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.65	71	32.18	1.03	3.20	2.75	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
21.95	72	38.10	1.11	2.91	2.77	sandy silt to clayey silt	UNDFND	UNDFD	15	1.9

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-2

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	22.70	0.90	3.96	1.82	silty clay to clay	UNDFND	UNDFD	14	1.2
12.15	40	26.57	0.88	3.29	1.85	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.45	41	27.13	0.83	3.05	1.88	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.80	42	33.99	0.90	2.64	1.91	sandy silt to clayey silt	UNDFND	UNDFD	13	1.8
13.10	43	46.10	0.95	2.06	1.94	sandy silt to clayey silt	UNDFND	UNDFD	18	2.5
13.40	44	28.12	0.85	3.01	1.97	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
13.75	45	18.39	0.61	3.31	2.00	clayey silt to silty clay	UNDFND	UNDFD	9	.9
14.05	46	38.88	1.08	2.78	2.03	sandy silt to clayey silt	UNDFND	UNDFD	15	2.1
14.35	47	27.25	1.11	4.09	2.06	silty clay to clay	UNDFND	UNDFD	17	1.4
14.65	48	20.83	0.74	3.57	2.09	silty clay to clay	UNDFND	UNDFD	13	1.0
14.95	49	23.93	0.70	2.93	2.11	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
15.25	50	28.98	0.74	2.55	2.14	sandy silt to clayey silt	UNDFND	UNDFD	11	1.5
15.55	51	26.50	0.65	2.45	2.17	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
15.85	52	25.25	0.61	2.40	2.20	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.15	53	22.85	0.52	2.27	2.23	sandy silt to clayey silt	UNDFND	UNDFD	9	1.1
16.45	54	25.93	0.52	2.00	2.26	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.75	55	31.62	0.86	2.72	2.28	sandy silt to clayey silt	UNDFND	UNDFD	12	1.6
17.05	56	28.60	0.80	2.78	2.31	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
17.35	57	25.53	0.74	2.90	2.34	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
17.65	58	21.55	0.63	2.91	2.37	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
17.95	59	18.20	0.38	2.08	2.40	clayey silt to silty clay	UNDFND	UNDFD	9	.8
18.25	60	13.08	0.17	1.28	2.43	sandy silt to clayey silt	UNDFND	UNDFD	5	.5
18.55	61	20.85	0.44	2.09	2.45	sandy silt to clayey silt	UNDFND	UNDFD	8	1.0
18.85	62	53.92	2.64	4.91	2.48	silty clay to clay	UNDFND	UNDFD	34	2.9
19.20	63	28.20	1.06	3.76	2.51	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
19.50	64	30.68	1.19	3.89	2.54	silty clay to clay	UNDFND	UNDFD	20	1.5
19.80	65	30.52	1.21	3.98	2.57	silty clay to clay	UNDFND	UNDFD	19	1.5
20.15	66	32.63	1.13	3.45	2.60	clayey silt to silty clay	UNDFND	UNDFD	16	1.6
20.45	67	33.40	1.11	3.32	2.63	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
20.75	68	33.62	1.07	3.18	2.66	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.05	69	55.33	2.17	3.92	2.69	clayey silt to silty clay	UNDFND	UNDFD	27	3.0
21.35	70	33.47	1.20	3.59	2.72	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.65	71	32.18	1.03	3.20	2.75	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
21.95	72	38.10	1.11	2.91	2.77	sandy silt to clayey silt	UNDFND	UNDFD	15	1.9

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

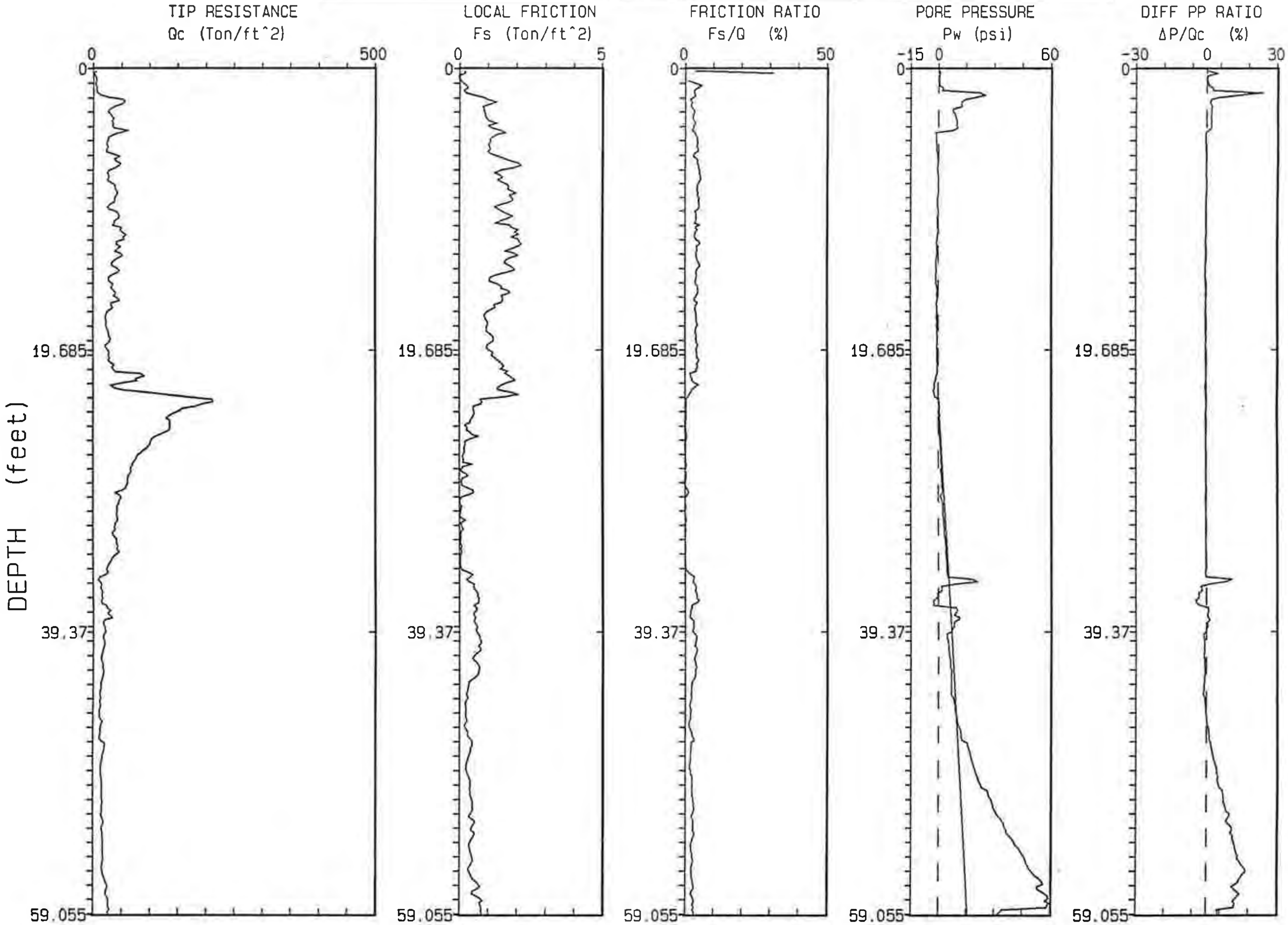
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-2

WOODWARD-CLYDE CONSULTANTS

CPT-3

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 67.75 ft

FIG. A-4-3

WOODWARD-CLYDE CONSULTANTS

CPT-3

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

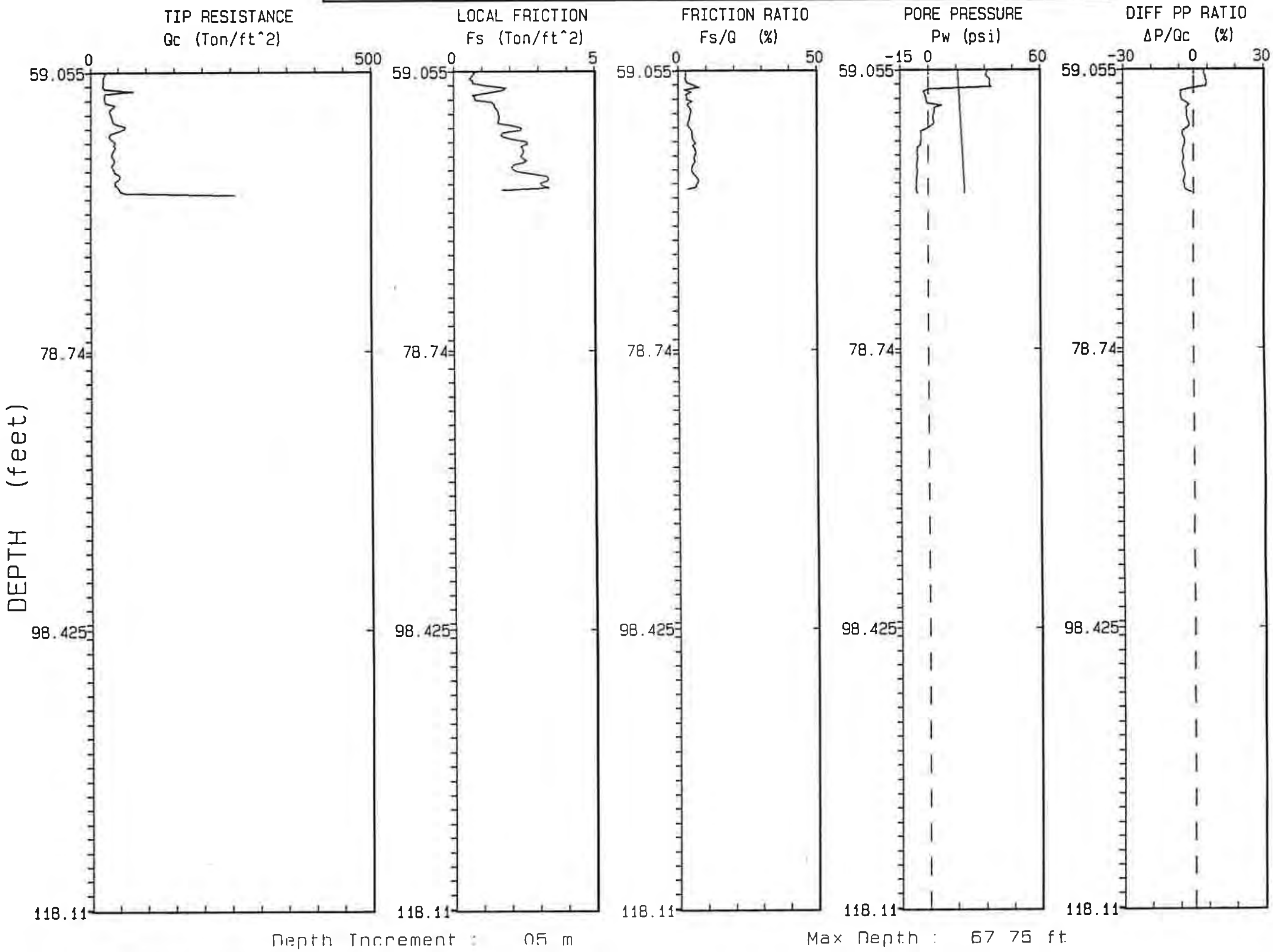


FIG. A-4-3

WOODWARD-CLYDE CONSULTANTS

CPT-3

Operator: J. Oldham		CPT Date:	3/27/95
Page: 1/2		Location:	Baldwin
Cone Used: 243		Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	3.95	0.09	2.19	0.03	clay	UNDFND	UNDFD	4	.2
0.60	2	10.50	0.37	3.55	0.09	clay	UNDFND	UNDFD	10	.6
0.95	3	39.91	0.96	2.42	0.15	sandy silt to clayey silt	UNDFND	UNDFD	15	2.3
1.25	4	34.28	1.05	3.05	0.22	clayey silt to silty clay	UNDFND	UNDFD	16	2.0
1.55	5	36.38	1.26	3.47	0.28	clayey silt to silty clay	UNDFND	UNDFD	17	2.1
1.85	6	28.98	1.09	3.76	0.33	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
2.15	7	39.25	1.81	4.62	0.39	silty clay to clay	UNDFND	UNDFD	25	2.2
2.45	8	28.33	1.44	5.07	0.45	clay	UNDFND	UNDFD	27	1.6
2.75	9	39.83	1.79	4.50	0.51	silty clay to clay	UNDFND	UNDFD	25	2.3
3.05	10	32.97	1.52	4.61	0.57	silty clay to clay	UNDFND	UNDFD	21	1.9
3.35	11	40.12	1.61	4.01	0.63	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
3.65	12	52.45	1.95	3.72	0.69	clayey silt to silty clay	UNDFND	UNDFD	25	3.0
3.95	13	43.42	1.93	4.46	0.75	silty clay to clay	UNDFND	UNDFD	28	2.5
4.25	14	39.48	1.77	4.47	0.81	silty clay to clay	UNDFND	UNDFD	25	2.2
4.55	15	34.07	1.35	3.97	0.87	silty clay to clay	UNDFND	UNDFD	22	1.9
4.85	16	35.17	1.53	4.36	0.93	silty clay to clay	UNDFND	UNDFD	22	2.0
5.15	17	36.28	1.33	3.68	0.98	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
5.45	18	22.42	0.93	4.14	1.04	silty clay to clay	UNDFND	UNDFD	14	1.2
5.75	19	26.65	1.04	3.91	1.10	silty clay to clay	UNDFND	UNDFD	17	1.5
6.05	20	25.43	1.06	4.18	1.16	silty clay to clay	UNDFND	UNDFD	16	1.4
6.40	21	30.87	1.36	4.40	1.23	silty clay to clay	UNDFND	UNDFD	20	1.7
6.70	22	69.72	1.75	2.51	1.29	sandy silt to clayey silt	UNDFND	UNDFD	27	4.0
7.00	23	86.48	1.60	1.84	1.35	silty sand to sandy silt	50-60	38-40	28	UNDEFINED
7.35	24	178.20	0.60	0.34	1.39	sand	70-80	42-44	34	UNDEFINED
7.65	25	133.95	0.35	0.26	1.42	sand	60-70	40-42	26	UNDEFINED
7.95	26	115.47	0.39	0.34	1.45	sand	60-70	40-42	22	UNDEFINED
8.25	27	89.82	0.16	0.18	1.48	sand	50-60	38-40	17	UNDEFINED
8.55	28	69.77	0.16	0.23	1.51	sand to silty sand	50-60	36-38	17	UNDEFINED
8.85	29	62.20	0.14	0.23	1.54	sand to silty sand	40-50	36-38	15	UNDEFINED
9.15	30	50.35	0.29	0.57	1.57	sand to silty sand	40-50	34-36	12	UNDEFINED
9.45	31	43.67	0.04	0.09	1.59	sand to silty sand	<40	32-34	10	UNDEFINED
9.75	32	41.32	0.07	0.18	1.62	sand to silty sand	<40	32-34	10	UNDEFINED
10.05	33	37.53	0.07	0.18	1.65	sand to silty sand	<40	32-34	9	UNDEFINED
10.35	34	42.67	0.06	0.13	1.68	sand to silty sand	<40	32-34	10	UNDEFINED
10.65	35	30.37	0.04	0.13	1.71	silty sand to sandy silt	<40	30-32	10	UNDEFINED
10.95	36	17.42	0.31	1.77	1.74	sandy silt to clayey silt	UNDFND	UNDFD	7	.8
11.25	37	14.65	0.57	3.88	1.76	silty clay to clay	UNDFND	UNDFD	9	.7
11.55	38	20.52	0.62	3.00	1.79	clayey silt to silty clay	UNDFND	UNDFD	10	1.0

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-3

CPT-3

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	23.85	0.54	2.25	1.82	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
12.15	40	19.32	0.65	3.37	1.85	clayey silt to silty clay	UNDFND	UNDFD	9	.9
12.45	41	17.92	0.70	3.93	1.88	silty clay to clay	UNDFND	UNDFD	11	.9
12.80	42	15.80	0.59	3.74	1.91	silty clay to clay	UNDFND	UNDFD	10	.7
13.10	43	15.35	0.50	3.23	1.94	silty clay to clay	UNDFND	UNDFD	10	.7
13.40	44	12.63	0.28	2.22	1.97	clayey silt to silty clay	UNDFND	UNDFD	6	.5
13.75	45	11.56	0.22	1.88	2.00	clayey silt to silty clay	UNDFND	UNDFD	6	.5
14.05	46	13.08	0.22	1.68	2.03	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.35	47	13.65	0.34	2.51	2.06	clayey silt to silty clay	UNDFND	UNDFD	7	.6
14.65	48	18.12	0.37	2.05	2.09	clayey silt to silty clay	UNDFND	UNDFD	9	.8
14.95	49	14.12	0.25	1.77	2.11	clayey silt to silty clay	UNDFND	UNDFD	7	.6
15.25	50	14.65	0.34	2.31	2.14	clayey silt to silty clay	UNDFND	UNDFD	7	.6
15.55	51	15.27	0.38	2.49	2.17	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.85	52	15.17	0.44	2.87	2.20	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.15	53	16.27	0.43	2.67	2.23	clayey silt to silty clay	UNDFND	UNDFD	8	.7
16.45	54	16.42	0.45	2.72	2.26	clayey silt to silty clay	UNDFND	UNDFD	8	.7
16.75	55	17.07	0.38	2.20	2.28	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.05	56	16.15	0.38	2.36	2.31	clayey silt to silty clay	UNDFND	UNDFD	8	.7
17.35	57	19.63	0.49	2.48	2.34	clayey silt to silty clay	UNDFND	UNDFD	9	.9
17.65	58	23.40	0.59	2.53	2.37	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
17.95	59	26.37	0.76	2.87	2.40	clayey silt to silty clay	UNDFND	UNDFD	13	1.3
18.25	60	23.67	0.67	2.83	2.43	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
18.55	61	33.03	1.23	3.71	2.45	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
18.85	62	34.13	1.34	3.92	2.48	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
19.20	63	46.39	1.78	3.83	2.51	clayey silt to silty clay	UNDFND	UNDFD	22	2.5
19.50	64	39.83	2.03	5.09	2.54	clay	UNDFND	UNDFD	38	2.1
19.80	65	40.88	2.45	6.00	2.57	clay	UNDFND	UNDFD	39	2.1
20.15	66	41.96	2.29	5.45	2.60	clay	UNDFND	UNDFD	40	2.2
20.45	67	48.98	3.17	6.47	2.63	clay	UNDFND	UNDFD	47	2.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

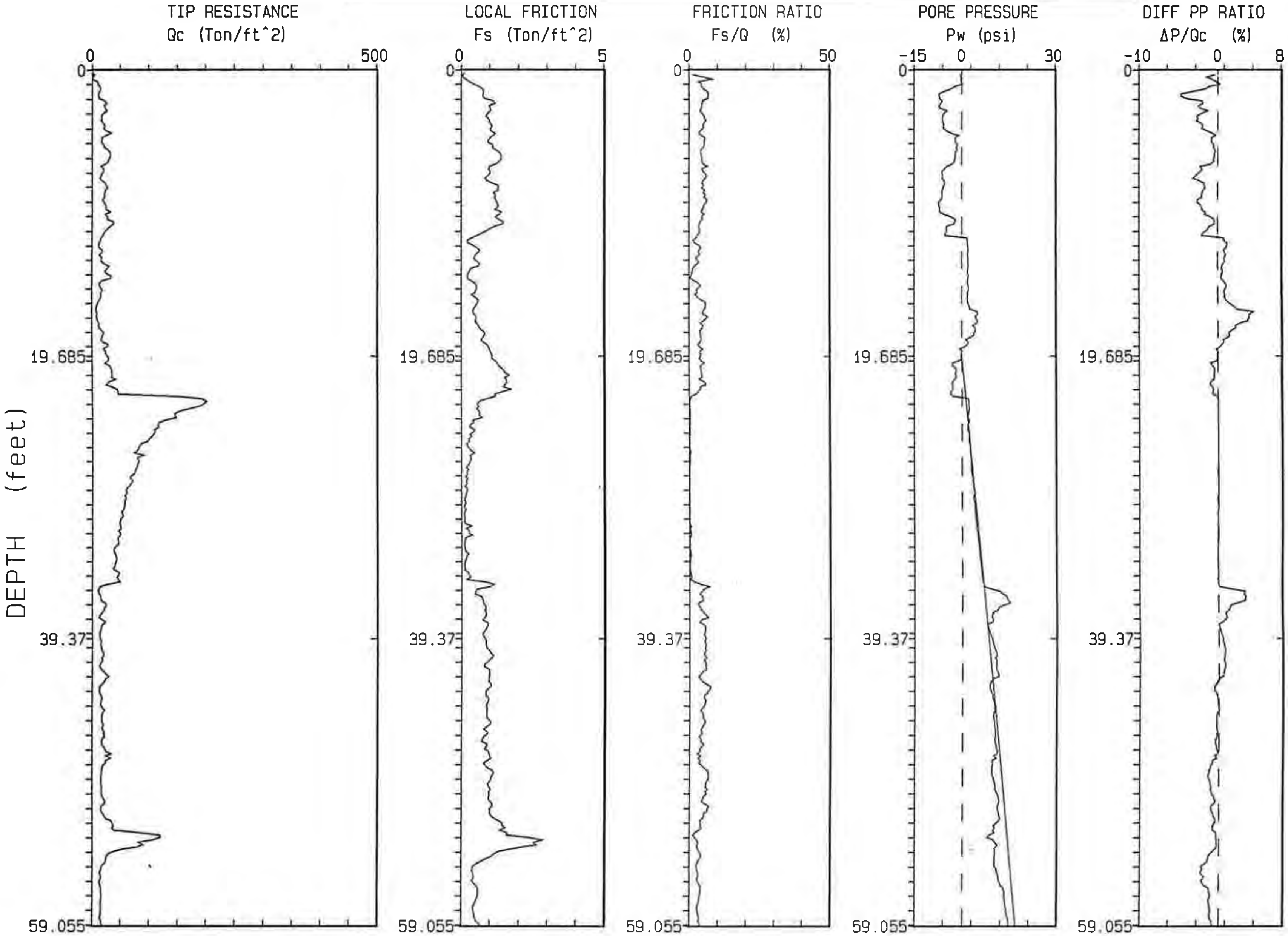
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-3

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

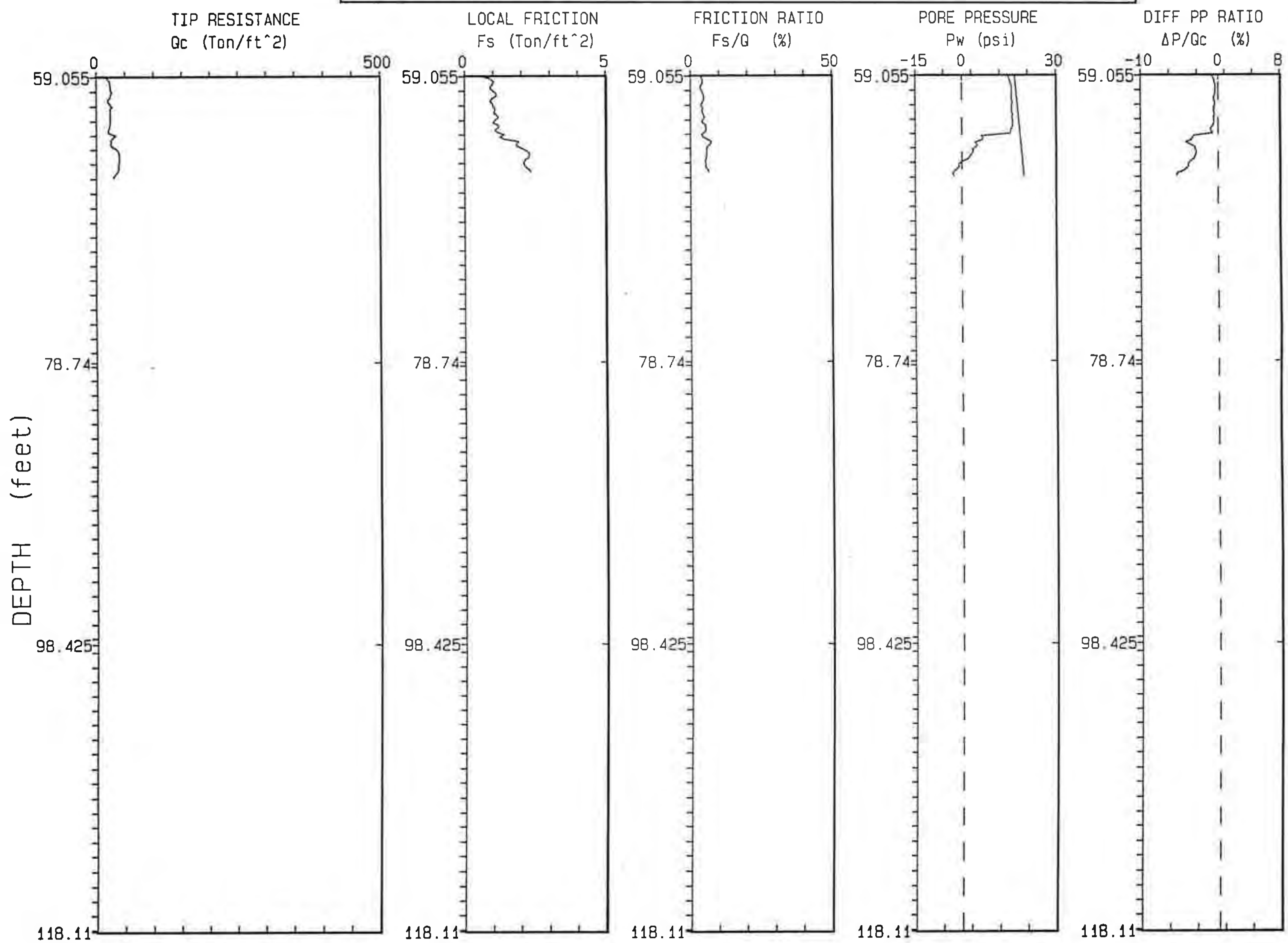
Max Depth : 65.94 ft

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 65.94 ft

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	4.33	0.18	4.27	0.03	clay	UNDFND	UNDFD	4	.2
0.60	2	12.67	0.76	5.97	0.09	clay	UNDFND	UNDFD	12	.7
0.95	3	22.00	1.02	4.65	0.15	clay	UNDFND	UNDFD	21	1.2
1.25	4	20.00	1.01	5.07	0.22	clay	UNDFND	UNDFD	19	1.1
1.55	5	22.17	1.06	4.77	0.28	clay	UNDFND	UNDFD	21	1.2
1.85	6	28.67	1.29	4.50	0.33	silty clay to clay	UNDFND	UNDFD	18	1.6
2.15	7	20.50	1.08	5.24	0.39	clay	UNDFND	UNDFD	20	1.1
2.45	8	20.50	1.05	5.13	0.45	clay	UNDFND	UNDFD	20	1.1
2.75	9	21.17	1.21	5.69	0.51	clay	UNDFND	UNDFD	20	1.2
3.05	10	26.33	1.28	4.87	0.57	clay	UNDFND	UNDFD	25	1.5
3.35	11	30.67	1.21	3.93	0.63	silty clay to clay	UNDFND	UNDFD	20	1.7
3.65	12	15.50	0.41	2.68	0.69	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	16.17	0.53	3.29	0.75	silty clay to clay	UNDFND	UNDFD	10	.9
4.25	14	24.33	0.44	1.80	0.81	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
4.55	15	21.50	0.39	1.81	0.87	sandy silt to clayey silt	UNDFND	UNDFD	8	1.2
4.85	16	15.17	0.50	3.27	0.93	silty clay to clay	UNDFND	UNDFD	10	.8
5.15	17	8.33	0.47	5.60	0.98	clay	UNDFND	UNDFD	8	.4
5.45	18	12.67	0.59	4.62	1.04	clay	UNDFND	UNDFD	12	.6
5.75	19	20.50	0.78	3.83	1.10	silty clay to clay	UNDFND	UNDFD	13	1.1
6.05	20	25.50	1.03	4.03	1.16	silty clay to clay	UNDFND	UNDFD	16	1.4
6.40	21	31.57	1.41	4.46	1.23	silty clay to clay	UNDFND	UNDFD	20	1.7
6.70	22	34.83	1.57	4.49	1.29	silty clay to clay	UNDFND	UNDFD	22	1.9
7.00	23	139.33	0.98	0.70	1.35	sand	70-80	40-42	27	UNDEFINED
7.35	24	155.00	0.60	0.38	1.39	sand	70-80	40-42	30	UNDEFINED
7.65	25	112.67	0.38	0.33	1.42	sand	60-70	40-42	22	UNDEFINED
7.95	26	91.33	0.26	0.29	1.45	sand	50-60	38-40	17	UNDEFINED
8.25	27	81.33	0.35	0.42	1.48	sand to silty sand	50-60	38-40	19	UNDEFINED
8.55	28	75.33	0.20	0.27	1.51	sand to silty sand	50-60	36-38	18	UNDEFINED
8.85	29	65.33	0.18	0.27	1.54	sand to silty sand	40-50	36-38	16	UNDEFINED
9.15	30	58.50	0.13	0.23	1.57	sand to silty sand	40-50	36-38	14	UNDEFINED
9.45	31	53.50	0.11	0.21	1.59	sand to silty sand	40-50	34-36	13	UNDEFINED
9.75	32	49.33	0.22	0.44	1.62	sand to silty sand	<40	34-36	12	UNDEFINED
10.05	33	45.67	0.16	0.36	1.65	sand to silty sand	<40	34-36	11	UNDEFINED
10.35	34	40.83	0.16	0.40	1.68	silty sand to sandy silt	<40	32-34	13	UNDEFINED
10.65	35	42.33	0.15	0.35	1.71	sand to silty sand	<40	32-34	10	UNDEFINED
10.95	36	32.33	0.67	2.07	1.74	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
11.25	37	15.67	0.65	4.16	1.76	clay	UNDFND	UNDFD	15	.7
11.55	38	18.17	0.84	4.63	1.79	clay	UNDFND	UNDFD	17	.9

Dr - All sands (Jamiolkowski et al. 1985)　　PHI - Robertson and Campanella 1983　　Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	17.50	0.85	4.85	1.82	clay	UNDFND	UNDFD	17	.8
12.15	40	14.67	0.82	5.59	1.85	clay	UNDFND	UNDFD	14	.7
12.45	41	18.17	1.01	5.55	1.88	clay	UNDFND	UNDFD	17	.9
12.80	42	19.43	0.92	4.75	1.91	clay	UNDFND	UNDFD	19	.9
13.10	43	17.17	0.97	5.64	1.94	clay	UNDFND	UNDFD	16	.8
13.40	44	16.00	0.89	5.57	1.97	clay	UNDFND	UNDFD	15	.7
13.75	45	18.86	0.92	4.88	2.00	clay	UNDFND	UNDFD	18	.9
14.05	46	20.17	0.87	4.32	2.03	clay	UNDFND	UNDFD	19	1.0
14.35	47	20.17	0.83	4.09	2.06	silty clay to clay	UNDFND	UNDFD	13	1.0
14.65	48	26.33	0.92	3.50	2.09	clayey silt to silty clay	UNDFND	UNDFD	13	1.3
14.95	49	16.50	1.04	6.32	2.11	clay	UNDFND	UNDFD	16	.7
15.25	50	16.33	0.96	5.89	2.14	clay	UNDFND	UNDFD	16	.7
15.55	51	19.00	1.01	5.32	2.17	clay	UNDFND	UNDFD	18	.9
15.85	52	25.00	1.15	4.60	2.20	clay	UNDFND	UNDFD	24	1.2
16.15	53	72.67	1.63	2.24	2.23	silty sand to sandy silt	40-50	34-36	23	UNDEFINED
16.45	54	74.33	2.17	2.92	2.26	sandy silt to clayey silt	UNDFND	UNDFD	28	4.1
16.75	55	22.83	0.78	3.41	2.28	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
17.05	56	14.17	0.41	2.88	2.31	clayey silt to silty clay	UNDFND	UNDFD	7	.6
17.35	57	14.67	0.56	3.81	2.34	silty clay to clay	UNDFND	UNDFD	9	.6
17.65	58	15.17	0.48	3.15	2.37	silty clay to clay	UNDFND	UNDFD	10	.6
17.95	59	15.00	0.50	3.31	2.40	silty clay to clay	UNDFND	UNDFD	10	.6
18.25	60	22.83	0.89	3.92	2.43	silty clay to clay	UNDFND	UNDFD	15	1.1
18.55	61	23.17	1.01	4.38	2.45	clay	UNDFND	UNDFD	22	1.1
18.85	62	25.00	1.08	4.33	2.48	silty clay to clay	UNDFND	UNDFD	16	1.2
19.20	63	24.29	1.16	4.78	2.51	clay	UNDFND	UNDFD	23	1.2
19.50	64	28.00	1.71	6.11	2.54	clay	UNDFND	UNDFD	27	1.4
19.80	65	39.33	2.20	5.60	2.57	clay	UNDFND	UNDFD	38	2.0
0.00	0	30.14	1.27	4.23	1.65	silty clay to clay	UNDFND	UNDFD	19	1.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

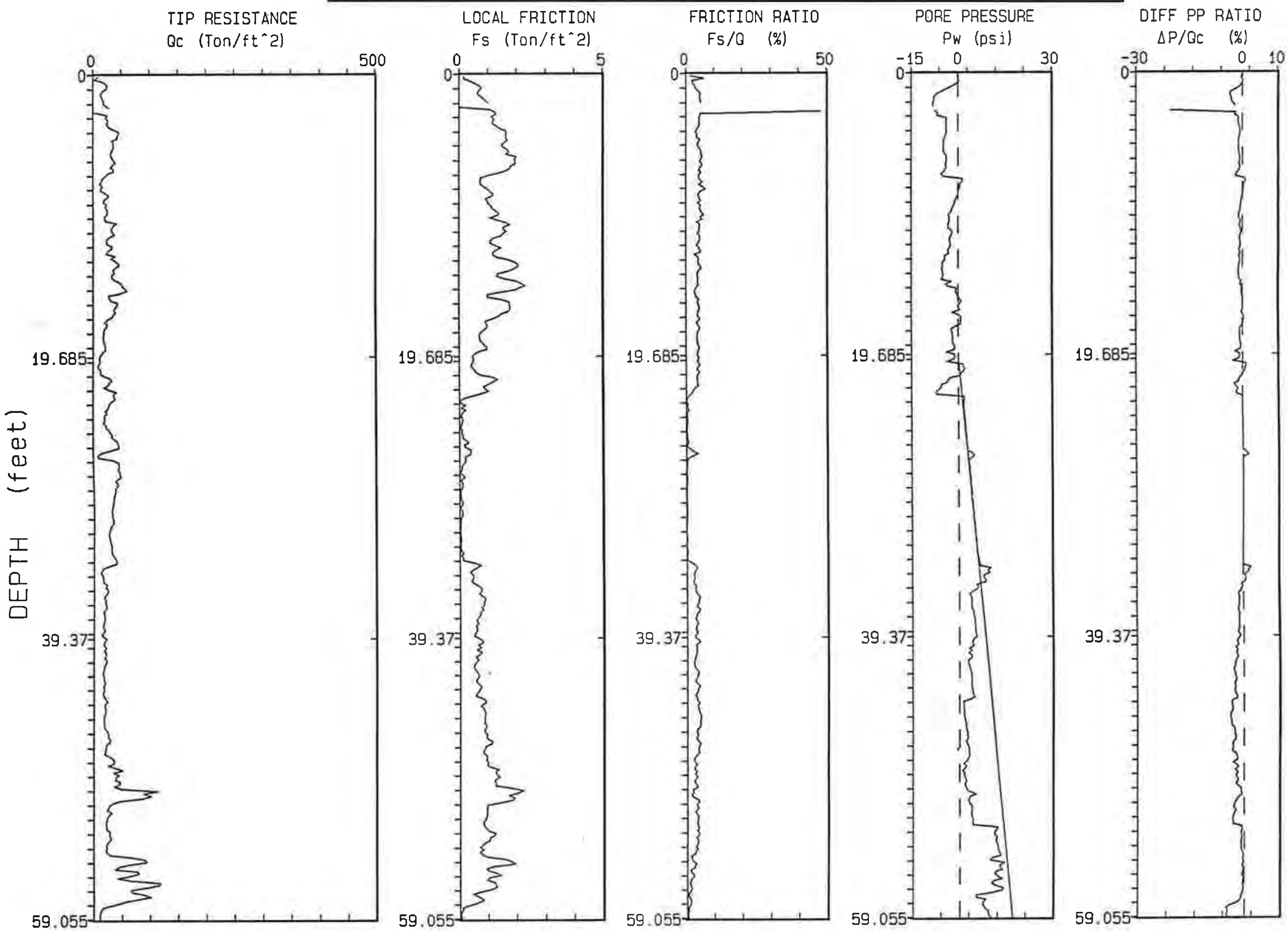
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : 05 m

Max Depth : 59.38 ft

FIG. A-4-5

WOODWARD-CLYDE CONSULTANTS

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

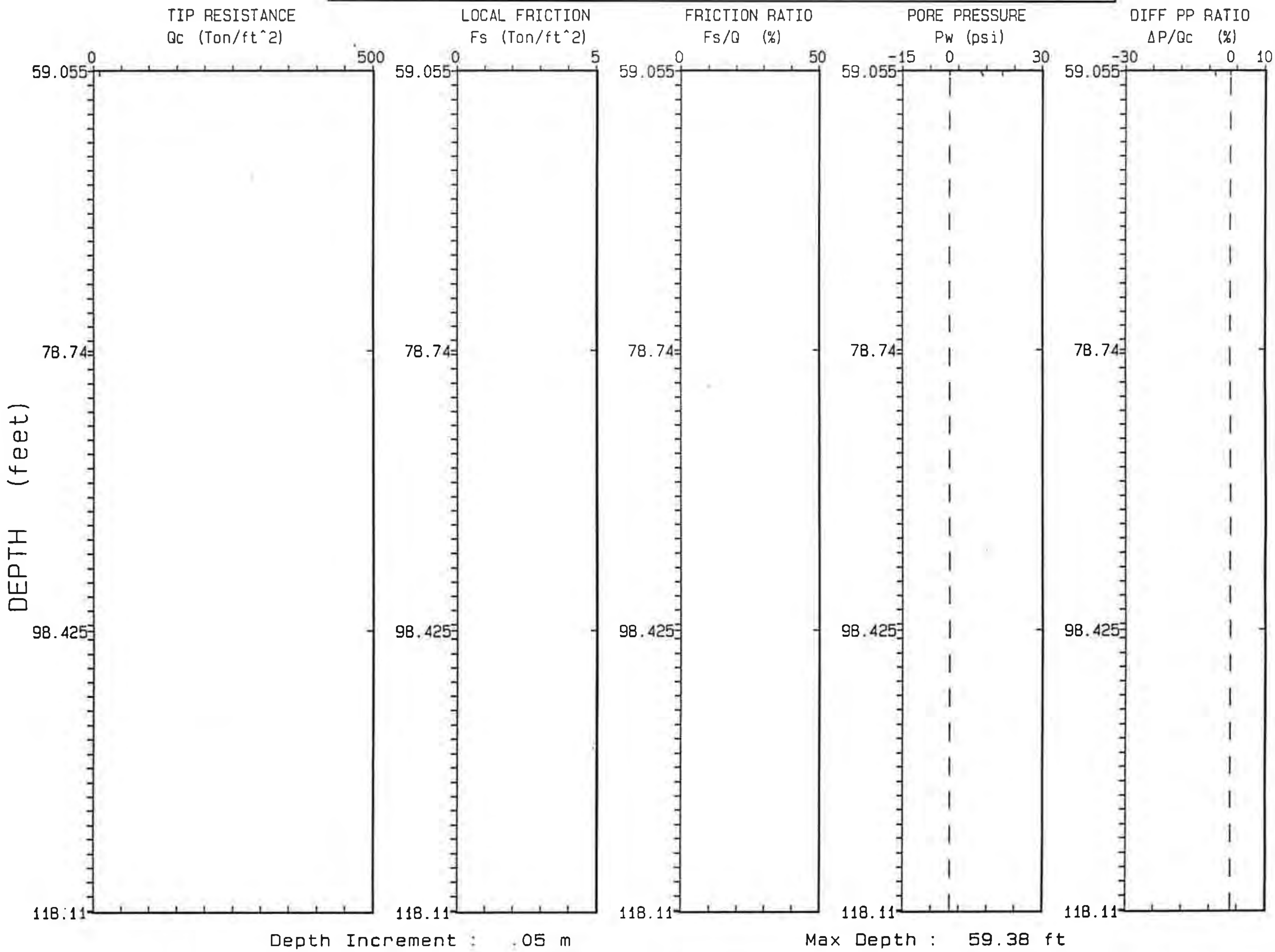


FIG. A-4-5

WOODWARD-CLYDE CONSULTANTS

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	16.75	0.47	2.82	0.03	clayey silt to silty clay	UNDFND	UNDFD	8	.9
0.60	2	16.10	0.81	5.01	0.09	clay	UNDFND	UNDFD	15	.9
0.95	3	17.81	0.85	4.76	0.15	clay	UNDFND	UNDFD	17	1.0
1.25	4	33.68	1.40	4.15	0.22	silty clay to clay	UNDFND	UNDFD	22	1.9
1.55	5	37.57	1.60	4.26	0.28	silty clay to clay	UNDFND	UNDFD	24	2.1
1.85	6	34.10	1.83	5.36	0.33	clay	UNDFND	UNDFD	33	1.9
2.15	7	30.53	1.59	5.22	0.39	clay	UNDFND	UNDFD	29	1.7
2.45	8	14.78	0.83	5.60	0.45	clay	UNDFND	UNDFD	14	.8
2.75	9	22.62	1.07	4.72	0.51	clay	UNDFND	UNDFD	22	1.3
3.05	10	22.58	1.22	5.41	0.57	clay	UNDFND	UNDFD	22	1.2
3.35	11	32.78	1.58	4.83	0.63	clay	UNDFND	UNDFD	31	1.8
3.65	12	28.40	1.28	4.50	0.69	silty clay to clay	UNDFND	UNDFD	18	1.6
3.95	13	31.03	1.37	4.40	0.75	silty clay to clay	UNDFND	UNDFD	20	1.7
4.25	14	38.97	1.83	4.69	0.81	silty clay to clay	UNDFND	UNDFD	25	2.2
4.55	15	45.75	1.91	4.18	0.87	clayey silt to silty clay	UNDFND	UNDFD	22	2.6
4.85	16	39.52	1.42	3.59	0.93	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
5.15	17	37.10	1.65	4.44	0.98	silty clay to clay	UNDFND	UNDFD	24	2.1
5.45	18	21.50	0.97	4.49	1.01	clay	UNDFND	UNDFD	21	1.2
5.75	19	18.80	0.76	4.02	1.04	silty clay to clay	UNDFND	UNDFD	12	1.0
6.05	20	15.27	0.69	4.49	1.07	clay	UNDFND	UNDFD	15	.8
6.40	21	12.40	0.53	4.30	1.10	clay	UNDFND	UNDFD	12	.6
6.70	22	27.37	1.07	3.92	1.13	silty clay to clay	UNDFND	UNDFD	17	1.5
7.00	23	35.23	0.41	1.17	1.16	silty sand to sandy silt	<40	34-36	11	UNDEFINED
7.35	24	22.71	0.12	0.54	1.19	silty sand to sandy silt	<40	30-32	7	UNDEFINED
7.65	25	25.62	0.07	0.29	1.22	silty sand to sandy silt	<40	32-34	8	UNDEFINED
7.95	26	41.02	0.20	0.49	1.25	silty sand to sandy silt	<40	34-36	13	UNDEFINED
8.25	27	23.37	0.29	1.23	1.28	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
8.55	28	45.72	0.08	0.18	1.31	sand to silty sand	40-50	34-36	11	UNDEFINED
8.85	29	40.62	0.09	0.23	1.33	sand to silty sand	<40	34-36	10	UNDEFINED
9.15	30	35.10	0.06	0.17	1.36	sand to silty sand	<40	32-34	8	UNDEFINED
9.45	31	31.92	0.07	0.21	1.39	silty sand to sandy silt	<40	32-34	10	UNDEFINED
9.75	32	29.70	0.03	0.10	1.42	silty sand to sandy silt	<40	32-34	9	UNDEFINED
10.05	33	29.03	0.03	0.11	1.45	silty sand to sandy silt	<40	30-32	9	UNDEFINED
10.35	34	34.77	0.09	0.25	1.47	silty sand to sandy silt	<40	32-34	11	UNDEFINED
10.65	35	20.65	0.52	2.51	1.50	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
10.95	36	19.68	0.55	2.79	1.53	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
11.25	37	20.48	0.80	3.88	1.56	silty clay to clay	UNDFND	UNDFD	13	1.0
11.55	38	19.55	0.75	3.86	1.59	silty clay to clay	UNDFND	UNDFD	12	1.0

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-5

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	17.57	0.60	3.42	1.62	silty clay to clay	UNDFND	UNDFD	11	.8
12.15	40	17.85	0.64	3.60	1.64	silty clay to clay	UNDFND	UNDFD	11	.9
12.45	41	20.60	0.66	3.22	1.67	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
12.80	42	18.09	0.56	3.10	1.70	clayey silt to silty clay	UNDFND	UNDFD	9	.9
13.10	43	17.87	0.65	3.65	1.73	silty clay to clay	UNDFND	UNDFD	11	.9
13.40	44	19.42	0.72	3.70	1.76	silty clay to clay	UNDFND	UNDFD	12	.9
13.75	45	19.13	0.84	4.38	1.79	clay	UNDFND	UNDFD	18	.9
14.05	46	21.45	0.89	4.14	1.82	silty clay to clay	UNDFND	UNDFD	14	1.1
14.35	47	24.33	0.98	4.01	1.85	silty clay to clay	UNDFND	UNDFD	16	1.2
14.65	48	28.50	0.91	3.18	1.88	clayey silt to silty clay	UNDFND	UNDFD	14	1.5
14.95	49	38.78	1.21	3.12	1.91	clayey silt to silty clay	UNDFND	UNDFD	19	2.1
15.25	50	53.98	1.50	2.77	1.94	sandy silt to clayey silt	UNDFND	UNDFD	21	3.0
15.55	51	63.87	1.64	2.57	1.97	sandy silt to clayey silt	UNDFND	UNDFD	24	3.5
15.85	52	25.35	0.93	3.67	1.99	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
16.15	53	24.28	0.95	3.90	2.02	silty clay to clay	UNDFND	UNDFD	16	1.2
16.45	54	25.42	0.94	3.68	2.05	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
16.75	55	54.72	1.11	2.02	2.08	sandy silt to clayey silt	UNDFND	UNDFD	21	3.0
17.05	56	61.12	1.30	2.12	2.11	sandy silt to clayey silt	UNDFND	UNDFD	23	3.3
17.35	57	83.40	1.14	1.36	2.14	silty sand to sandy silt	50-60	36-38	27	UNDEFINED
17.65	58	73.08	0.67	0.92	2.16	sand to silty sand	40-50	34-36	18	UNDEFINED
17.95	59	14.03	0.10	0.68	2.19	sandy silt to clayey silt	UNDFND	UNDFD	5	.6

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

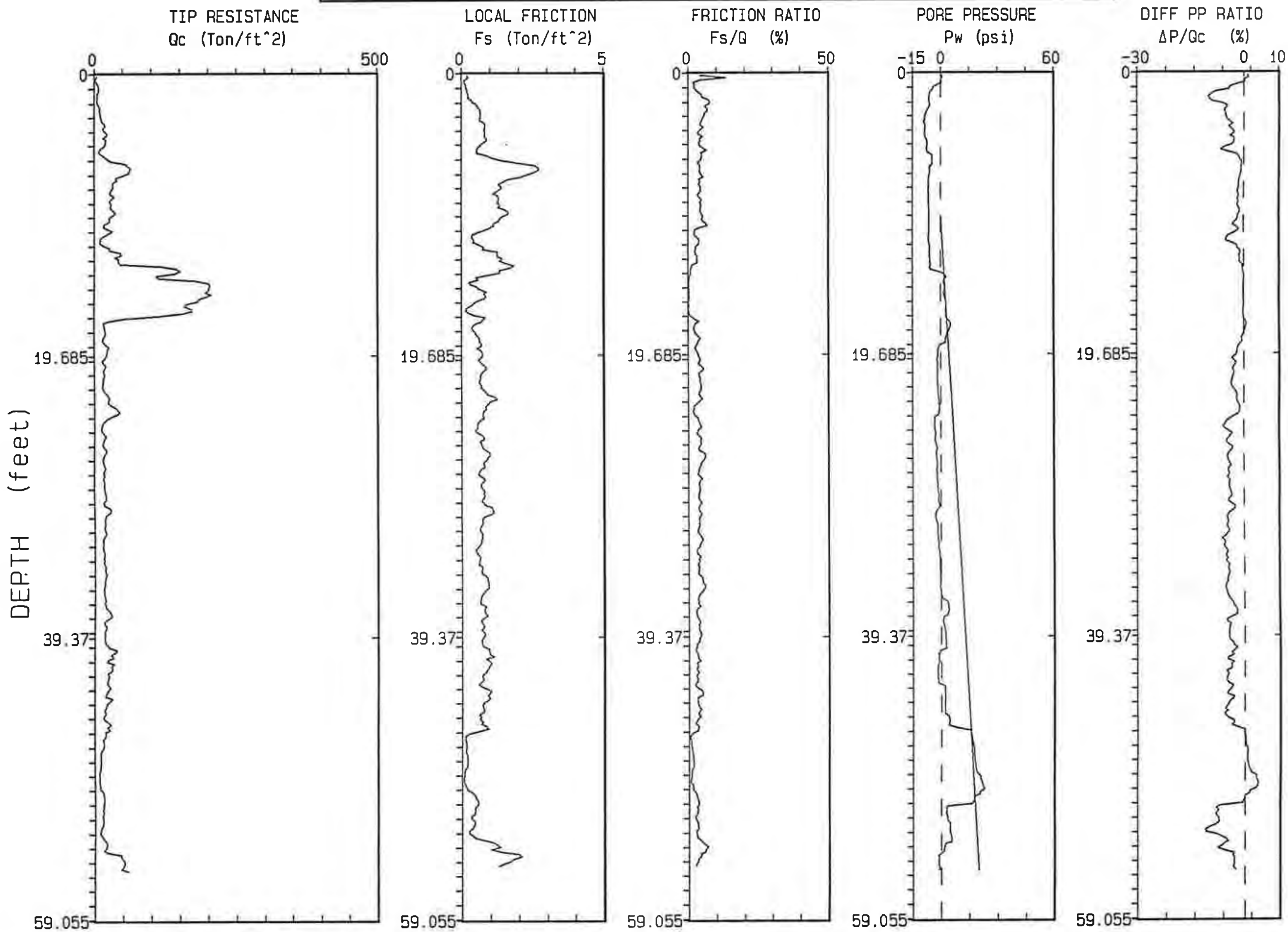
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-5

WOODWARD-CLYDE CONSULTANTS

CPT-6

Operator: J. Oldham		CPT Date:	3/28/95
Page: 1/1		Location:	Baldwin
Cone Used: 243		Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 55.61 ft

FIG. A-4-6

WOODWARD-CLYDE CONSULTANTS

CPT-6

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	4.68	0.15	3.27	0.03	clay	UNDFND	UNDFD	4	.2
0.60	2	5.33	0.27	5.00	0.09	clay	UNDFND	UNDFD	5	.3
0.95	3	10.07	0.62	6.13	0.15	clay	UNDFND	UNDFD	10	.5
1.25	4	17.42	0.78	4.47	0.22	clay	UNDFND	UNDFD	17	1.0
1.55	5	18.67	0.79	4.21	0.28	clay	UNDFND	UNDFD	18	1.0
1.85	6	16.82	0.83	4.94	0.33	clay	UNDFND	UNDFD	16	.9
2.15	7	59.07	2.46	4.16	0.39	clayey silt to silty clay	UNDFND	UNDFD	28	3.4
2.45	8	34.67	1.53	4.42	0.45	silty clay to clay	UNDFND	UNDFD	22	2.0
2.75	9	29.83	1.24	4.16	0.51	silty clay to clay	UNDFND	UNDFD	19	1.7
3.05	10	31.55	1.46	4.64	0.57	silty clay to clay	UNDFND	UNDFD	20	1.8
3.35	11	23.72	1.09	4.61	0.61	clay	UNDFND	UNDFD	23	1.3
3.65	12	15.12	0.46	3.04	0.64	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	38.42	1.12	2.91	0.67	sandy silt to clayey silt	UNDFND	UNDFD	15	2.2
4.25	14	107.78	1.51	1.40	0.69	sand to silty sand	70-80	42-44	26	UNDEFINED
4.55	15	167.65	0.52	0.31	0.72	sand	80-90	44-46	32	UNDEFINED
4.85	16	193.57	0.75	0.39	0.75	sand	80-90	44-46	37	UNDEFINED
5.15	17	154.75	0.29	0.19	0.78	sand	80-90	44-46	30	UNDEFINED
5.45	18	25.63	0.58	2.25	0.81	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
5.75	19	17.62	0.58	3.27	0.84	clayey silt to silty clay	UNDFND	UNDFD	8	.9
6.05	20	21.95	0.67	3.07	0.86	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
6.40	21	16.86	0.74	4.39	0.89	clay	UNDFND	UNDFD	16	.9
6.70	22	15.27	0.65	4.29	0.93	clay	UNDFND	UNDFD	15	.8
7.00	23	22.88	0.99	4.32	0.95	silty clay to clay	UNDFND	UNDFD	15	1.2
7.35	24	35.09	0.81	2.31	0.98	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
7.65	25	14.22	0.55	3.89	1.02	silty clay to clay	UNDFND	UNDFD	9	.7
7.95	26	17.02	0.71	4.20	1.04	clay	UNDFND	UNDFD	16	.9
8.25	27	17.72	0.89	5.01	1.07	clay	UNDFND	UNDFD	17	.9
8.55	28	17.45	0.70	4.00	1.10	silty clay to clay	UNDFND	UNDFD	11	.9
8.85	29	17.23	0.72	4.17	1.13	clay	UNDFND	UNDFD	17	.9
9.15	30	18.72	0.76	4.07	1.16	silty clay to clay	UNDFND	UNDFD	12	.9
9.45	31	23.72	0.97	4.11	1.19	silty clay to clay	UNDFND	UNDFD	15	1.2
9.75	32	18.35	0.68	3.73	1.21	silty clay to clay	UNDFND	UNDFD	12	.9
10.05	33	15.97	0.68	4.28	1.24	clay	UNDFND	UNDFD	15	.8
10.35	34	16.00	0.56	3.52	1.27	silty clay to clay	UNDFND	UNDFD	10	.8
10.65	35	18.30	0.67	3.64	1.30	silty clay to clay	UNDFND	UNDFD	12	.9
10.95	36	17.43	0.90	5.18	1.33	clay	UNDFND	UNDFD	17	.9
11.25	37	17.40	0.70	4.01	1.36	silty clay to clay	UNDFND	UNDFD	11	.8
11.55	38	24.77	0.79	3.20	1.38	clayey silt to silty clay	UNDFND	UNDFD	12	1.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-6

CPT-6

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	19.40	0.72	3.70	1.41	silty clay to clay	UNDFND	UNDFD	12	1.0
12.15	40	18.97	0.73	3.86	1.44	silty clay to clay	UNDFND	UNDFD	12	.9
12.45	41	31.38	0.93	2.97	1.47	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
12.80	42	27.89	0.89	3.19	1.50	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
13.10	43	24.57	0.71	2.88	1.53	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
13.40	44	23.67	0.92	3.89	1.56	silty clay to clay	UNDFND	UNDFD	15	1.2
13.75	45	18.07	0.68	3.78	1.59	silty clay to clay	UNDFND	UNDFD	12	.9
14.05	46	23.87	0.66	2.76	1.62	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
14.35	47	15.33	0.13	0.84	1.65	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
14.65	48	11.33	0.17	1.49	1.68	clayey silt to silty clay	UNDFND	UNDFD	5	.4
14.95	49	9.10	0.12	1.32	1.70	clayey silt to silty clay	UNDFND	UNDFD	4	.3
15.25	50	9.57	0.12	1.22	1.73	clayey silt to silty clay	UNDFND	UNDFD	5	.3
15.55	51	15.60	0.48	3.10	1.76	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.85	52	14.35	0.41	2.88	1.79	clayey silt to silty clay	UNDFND	UNDFD	7	.6
16.15	53	11.62	0.36	3.10	1.82	silty clay to clay	UNDFND	UNDFD	7	.4
16.45	54	18.17	0.89	4.88	1.85	clay	UNDFND	UNDFD	17	.8
16.75	55	39.35	1.65	4.21	1.87	silty clay to clay	UNDFND	UNDFD	25	2.1

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-6

WOODWARD-CLYDE CONSULTANTS

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

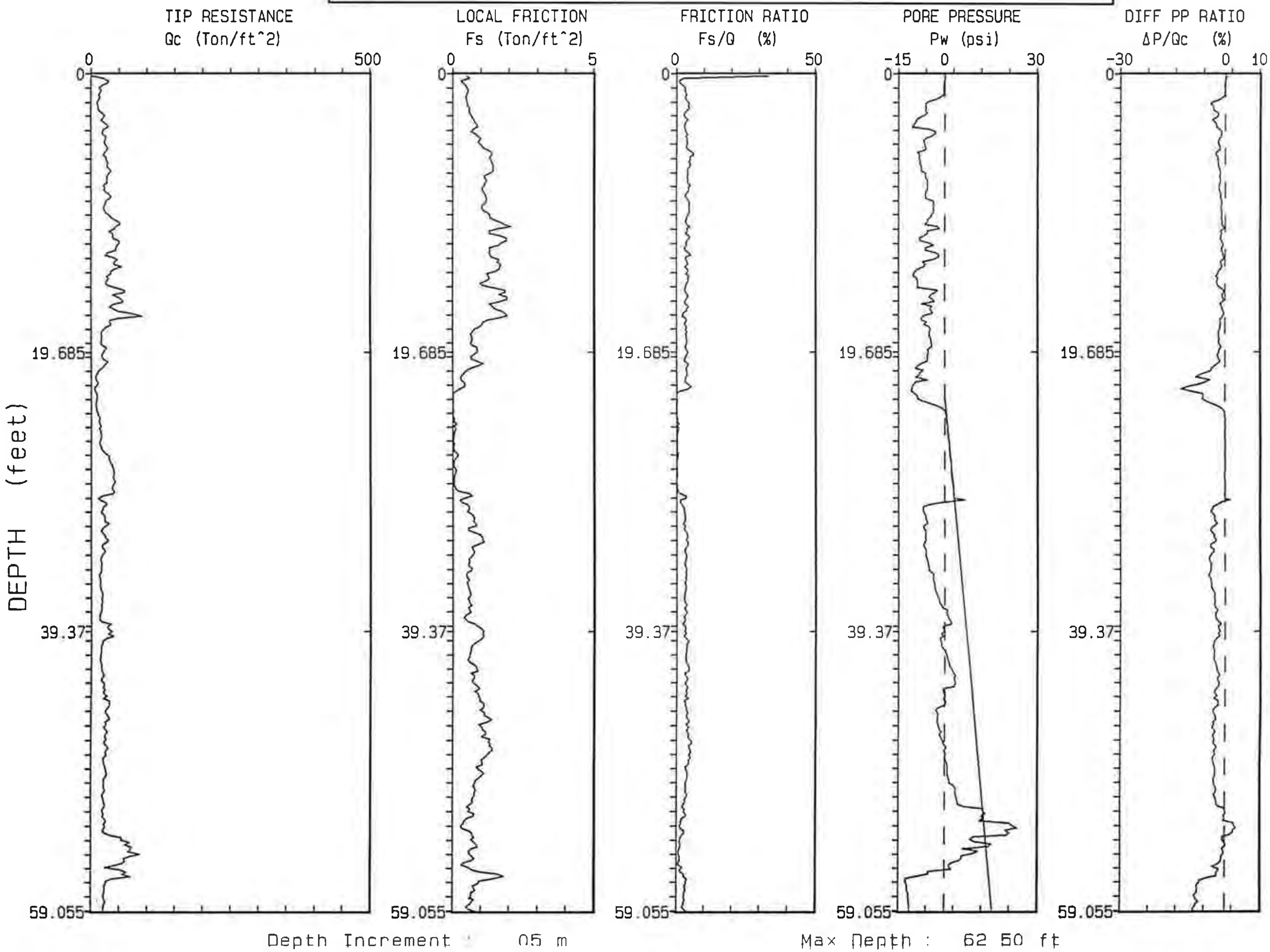
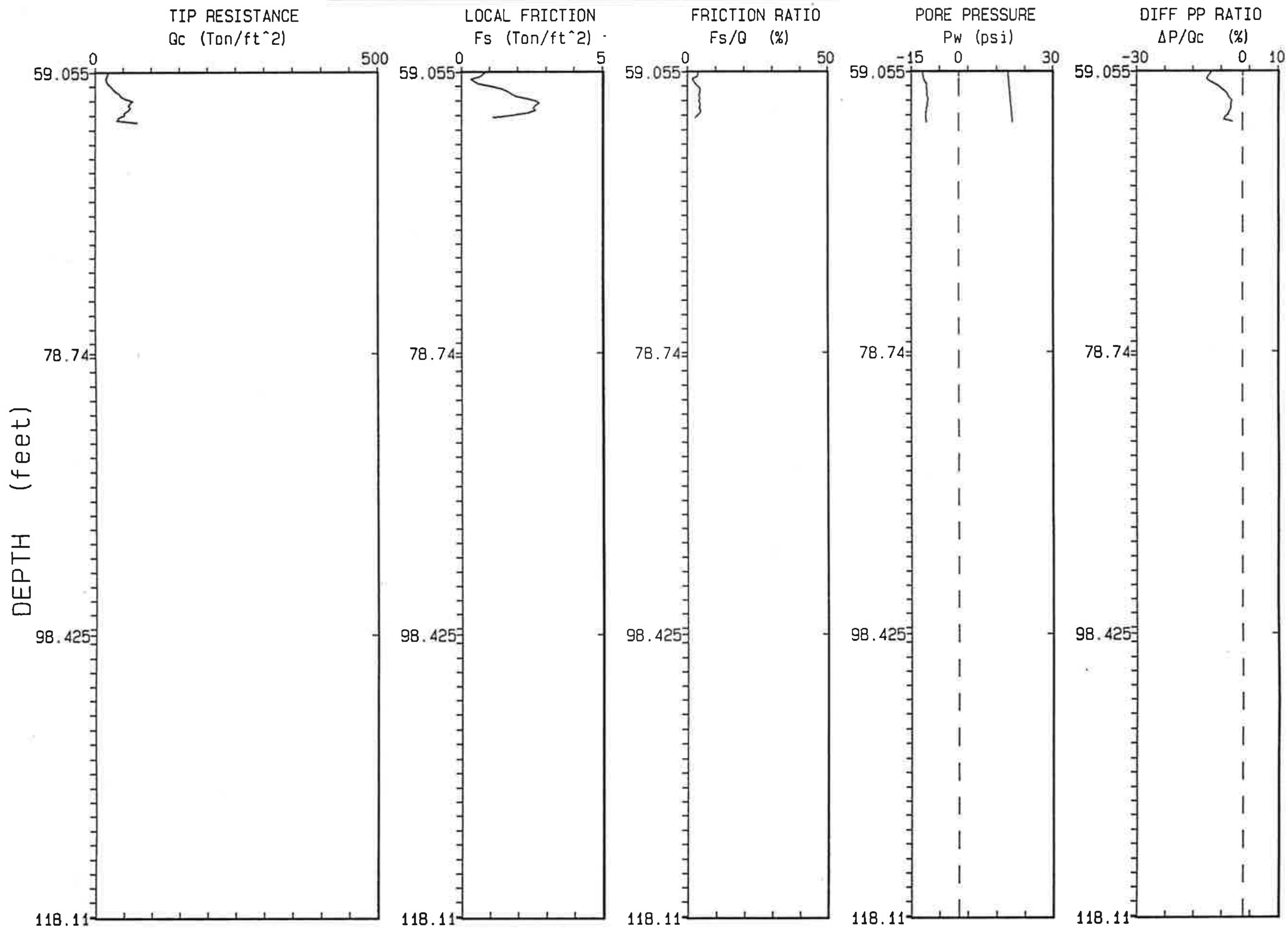


FIG. A-4-7

WOODWARD-CLYDE CONSULTANTS

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 62.50 ft

FIG. A-4-7

WOODWARD-CLYDE CONSULTANTS

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	19.87	0.46	2.29	0.03	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
0.60	2	14.48	0.50	3.43	0.09	silty clay to clay	UNDFND	UNDFD	9	.8
0.95	3	16.86	0.59	3.49	0.15	silty clay to clay	UNDFND	UNDFD	11	.9
1.25	4	24.00	0.77	3.22	0.22	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
1.55	5	24.88	0.92	3.71	0.28	silty clay to clay	UNDFND	UNDFD	16	1.4
1.85	6	26.55	1.30	4.88	0.33	clay	UNDFND	UNDFD	25	1.5
2.15	7	31.48	1.40	4.46	0.39	silty clay to clay	UNDFND	UNDFD	20	1.8
2.45	8	27.08	1.13	4.19	0.45	silty clay to clay	UNDFND	UNDFD	17	1.5
2.75	9	29.62	1.13	3.82	0.51	silty clay to clay	UNDFND	UNDFD	19	1.7
3.05	10	25.87	1.15	4.43	0.57	silty clay to clay	UNDFND	UNDFD	17	1.4
3.35	11	44.28	1.66	3.75	0.63	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
3.65	12	41.62	1.63	3.93	0.69	clayey silt to silty clay	UNDFND	UNDFD	20	2.4
3.95	13	37.67	1.38	3.65	0.75	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
4.25	14	43.83	1.63	3.71	0.81	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
4.55	15	30.05	1.17	3.89	0.87	silty clay to clay	UNDFND	UNDFD	19	1.7
4.85	16	51.15	1.77	3.46	0.93	clayey silt to silty clay	UNDFND	UNDFD	24	2.9
5.15	17	49.08	1.58	3.23	0.98	clayey silt to silty clay	UNDFND	UNDFD	24	2.8
5.45	18	44.93	1.30	2.90	1.04	sandy silt to clayey silt	UNDFND	UNDFD	17	2.5
5.75	19	19.02	0.68	3.59	1.10	silty clay to clay	UNDFND	UNDFD	12	1.0
6.05	20	21.93	0.79	3.58	1.16	silty clay to clay	UNDFND	UNDFD	14	1.2
6.40	21	21.56	0.74	3.44	1.23	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
6.70	22	9.80	0.35	3.59	1.29	clay	UNDFND	UNDFD	9	.5
7.00	23	8.68	0.13	1.48	1.35	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.35	24	9.96	0.01	0.07	1.39	sensitive fine grained	UNDFND	UNDFD	5	.5
7.65	25	15.15	0.07	0.45	1.42	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
7.95	26	17.25	0.04	0.22	1.45	silty sand to sandy silt	<40	<30	6	UNDEFINED
8.25	27	22.12	0.08	0.38	1.48	silty sand to sandy silt	<40	30-32	7	UNDEFINED
8.55	28	36.07	0.07	0.19	1.51	sand to silty sand	<40	32-34	9	UNDEFINED
8.85	29	40.85	0.06	0.16	1.54	sand to silty sand	<40	32-34	10	UNDEFINED
9.15	30	31.22	0.34	1.09	1.57	silty sand to sandy silt	<40	30-32	10	UNDEFINED
9.45	31	21.87	0.46	2.10	1.59	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
9.75	32	25.70	0.75	2.93	1.62	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
10.05	33	23.43	0.82	3.51	1.65	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
10.35	34	22.87	0.81	3.54	1.68	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
10.65	35	18.05	0.60	3.32	1.71	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.95	36	15.85	0.53	3.35	1.74	silty clay to clay	UNDFND	UNDFD	10	.8
11.25	37	18.23	0.58	3.20	1.76	clayey silt to silty clay	UNDFND	UNDFD	9	.9
11.55	38	18.78	0.58	3.11	1.79	clayey silt to silty clay	UNDFND	UNDFD	9	.9

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-7

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	19.52	0.55	2.79	1.82	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
12.15	40	32.48	1.03	3.16	1.85	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
12.45	41	18.65	0.71	3.83	1.88	silty clay to clay	UNDFND	UNDFD	12	.9
12.80	42	17.33	0.67	3.85	1.91	silty clay to clay	UNDFND	UNDFD	11	.8
13.10	43	20.53	0.74	3.61	1.94	silty clay to clay	UNDFND	UNDFD	13	1.0
13.40	44	24.32	0.87	3.59	1.97	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
13.75	45	29.00	1.04	3.58	2.00	clayey silt to silty clay	UNDFND	UNDFD	14	1.5
14.05	46	28.35	1.16	4.08	2.03	silty clay to clay	UNDFND	UNDFD	18	1.5
14.35	47	26.25	1.16	4.42	2.06	silty clay to clay	UNDFND	UNDFD	17	1.3
14.65	48	27.08	1.32	4.88	2.09	clay	UNDFND	UNDFD	26	1.4
14.95	49	24.02	1.00	4.15	2.11	silty clay to clay	UNDFND	UNDFD	15	1.2
15.25	50	25.15	0.94	3.75	2.14	silty clay to clay	UNDFND	UNDFD	16	1.3
15.55	51	22.03	0.76	3.47	2.17	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
15.85	52	22.57	0.61	2.71	2.20	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
16.15	53	23.63	0.51	2.15	2.23	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
16.45	54	35.63	0.62	1.74	2.26	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
16.75	55	70.77	0.72	1.02	2.28	sand to silty sand	40-50	34-36	17	UNDEFINED
17.05	56	52.55	0.57	1.09	2.31	silty sand to sandy silt	<40	32-34	17	UNDEFINED
17.35	57	51.10	1.24	2.42	2.34	sandy silt to clayey silt	UNDFND	UNDFD	20	2.8
17.65	58	24.20	0.75	3.10	2.37	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
17.95	59	23.33	0.62	2.64	2.40	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
18.25	60	21.05	0.62	2.93	2.43	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
18.55	61	39.82	1.69	4.24	2.45	silty clay to clay	UNDFND	UNDFD	25	2.1
18.85	62	59.52	2.60	4.37	2.48	clayey silt to silty clay	UNDFND	UNDFD	29	3.2

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-7

WOODWARD-CLYDE CONSULTANTS

CPT-8

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

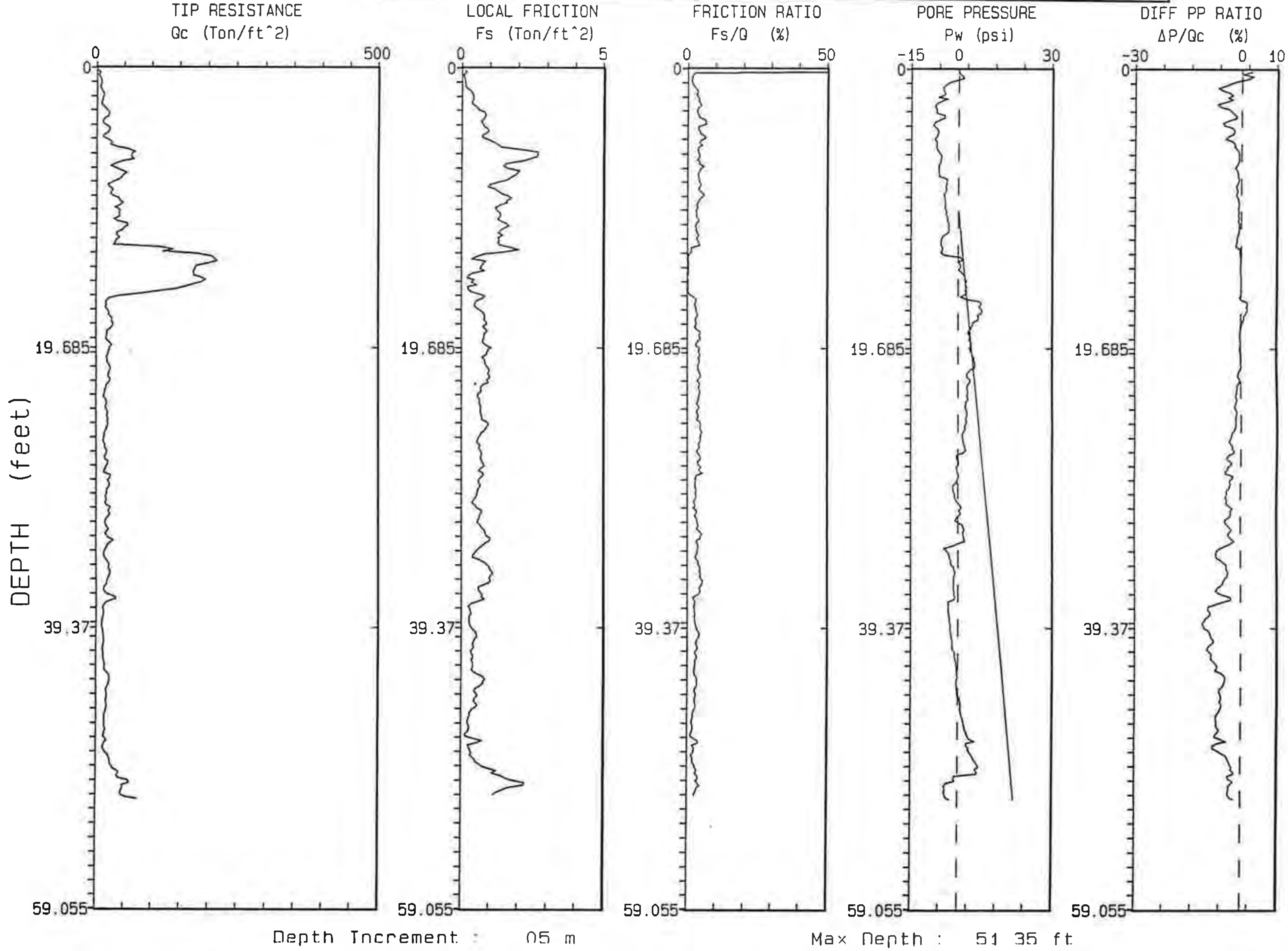


FIG. A-4-8

WOODWARD-CLYDE CONSULTANTS

CPT-8

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	4.97	0.10	2.01	0.03	silty clay to clay	UNDFND	UNDFD	3	.2
0.60	2	8.73	0.27	3.05	0.09	silty clay to clay	UNDFND	UNDFD	6	.5
0.95	3	12.90	0.50	3.85	0.15	clay	UNDFND	UNDFD	12	.7
1.25	4	16.20	0.78	4.78	0.22	clay	UNDFND	UNDFD	16	.9
1.55	5	18.57	0.87	4.70	0.28	clay	UNDFND	UNDFD	18	1.0
1.85	6	46.72	1.88	4.02	0.33	clayey silt to silty clay	UNDFND	UNDFD	22	2.7
2.15	7	45.98	1.96	4.26	0.39	silty clay to clay	UNDFND	UNDFD	29	2.6
2.45	8	42.95	1.75	4.07	0.45	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
2.75	9	25.48	1.24	4.88	0.51	clay	UNDFND	UNDFD	24	1.4
3.05	10	40.70	1.46	3.60	0.57	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
3.35	11	41.12	1.40	3.40	0.61	clayey silt to silty clay	UNDFND	UNDFD	20	2.3
3.65	12	43.78	1.43	3.27	0.64	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
3.95	13	78.80	1.56	1.97	0.67	silty sand to sandy silt	60-70	40-42	25	UNDEFINED
4.25	14	198.35	0.68	0.34	0.69	sand	>90	44-46	38	UNDEFINED
4.55	15	180.42	0.47	0.26	0.72	sand	80-90	44-46	35	UNDEFINED
4.85	16	141.40	0.38	0.27	0.75	sand	80-90	42-44	27	UNDEFINED
5.15	17	22.33	0.60	2.68	0.78	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
5.45	18	25.12	0.80	3.17	0.81	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
5.75	19	23.58	0.85	3.59	0.84	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
6.05	20	22.97	0.86	3.76	0.86	silty clay to clay	UNDFND	UNDFD	15	1.2
6.40	21	20.80	0.85	4.09	0.89	silty clay to clay	UNDFND	UNDFD	13	1.1
6.70	22	23.52	0.96	4.10	0.93	silty clay to clay	UNDFND	UNDFD	15	1.3
7.00	23	17.22	0.73	4.21	0.95	clay	UNDFND	UNDFD	16	.9
7.35	24	16.79	0.64	3.80	0.98	silty clay to clay	UNDFND	UNDFD	11	.9
7.65	25	20.07	0.78	3.87	1.02	silty clay to clay	UNDFND	UNDFD	13	1.0
7.95	26	15.75	0.75	4.75	1.04	clay	UNDFND	UNDFD	15	.8
8.25	27	15.73	0.63	4.01	1.07	silty clay to clay	UNDFND	UNDFD	10	.8
8.55	28	17.42	0.73	4.20	1.10	clay	UNDFND	UNDFD	17	.9
8.85	29	18.87	0.69	3.64	1.13	silty clay to clay	UNDFND	UNDFD	12	1.0
9.15	30	20.65	0.60	2.90	1.16	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
9.45	31	18.37	0.47	2.53	1.19	clayey silt to silty clay	UNDFND	UNDFD	9	.9
9.75	32	20.55	0.64	3.12	1.21	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
10.05	33	18.80	0.77	4.11	1.24	silty clay to clay	UNDFND	UNDFD	12	.9
10.35	34	22.22	0.82	3.68	1.27	silty clay to clay	UNDFND	UNDFD	14	1.1
10.65	35	16.93	0.59	3.48	1.30	silty clay to clay	UNDFND	UNDFD	11	.8
10.95	36	22.60	1.03	4.57	1.33	clay	UNDFND	UNDFD	22	1.2
11.25	37	15.95	0.77	4.85	1.36	clay	UNDFND	UNDFD	15	.8
11.55	38	22.67	0.58	2.56	1.38	clayey silt to silty clay	UNDFND	UNDFD	11	1.2

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-8

CPT-8

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	11.80	0.31	2.59	1.41	silty clay to clay	UNDFND	UNDFD	8	.5
12.15	40	11.35	0.40	3.56	1.44	silty clay to clay	UNDFND	UNDFD	7	.5
12.45	41	12.85	0.44	3.44	1.47	silty clay to clay	UNDFND	UNDFD	8	.6
12.80	42	13.29	0.38	2.89	1.50	silty clay to clay	UNDFND	UNDFD	8	.6
13.10	43	19.72	0.57	2.91	1.53	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
13.40	44	19.97	0.62	3.09	1.56	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
13.75	45	18.09	0.49	2.71	1.59	clayey silt to silty clay	UNDFND	UNDFD	9	.9
14.05	46	14.62	0.26	1.80	1.62	clayey silt to silty clay	UNDFND	UNDFD	7	.6
14.35	47	14.47	0.26	1.76	1.65	clayey silt to silty clay	UNDFND	UNDFD	7	.6
14.65	48	14.88	0.44	2.92	1.68	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.95	49	24.72	0.52	2.10	1.70	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
15.25	50	40.57	1.37	3.37	1.73	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
15.55	51	48.25	1.66	3.44	1.76	clayey silt to silty clay	UNDFND	UNDFD	23	2.6

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

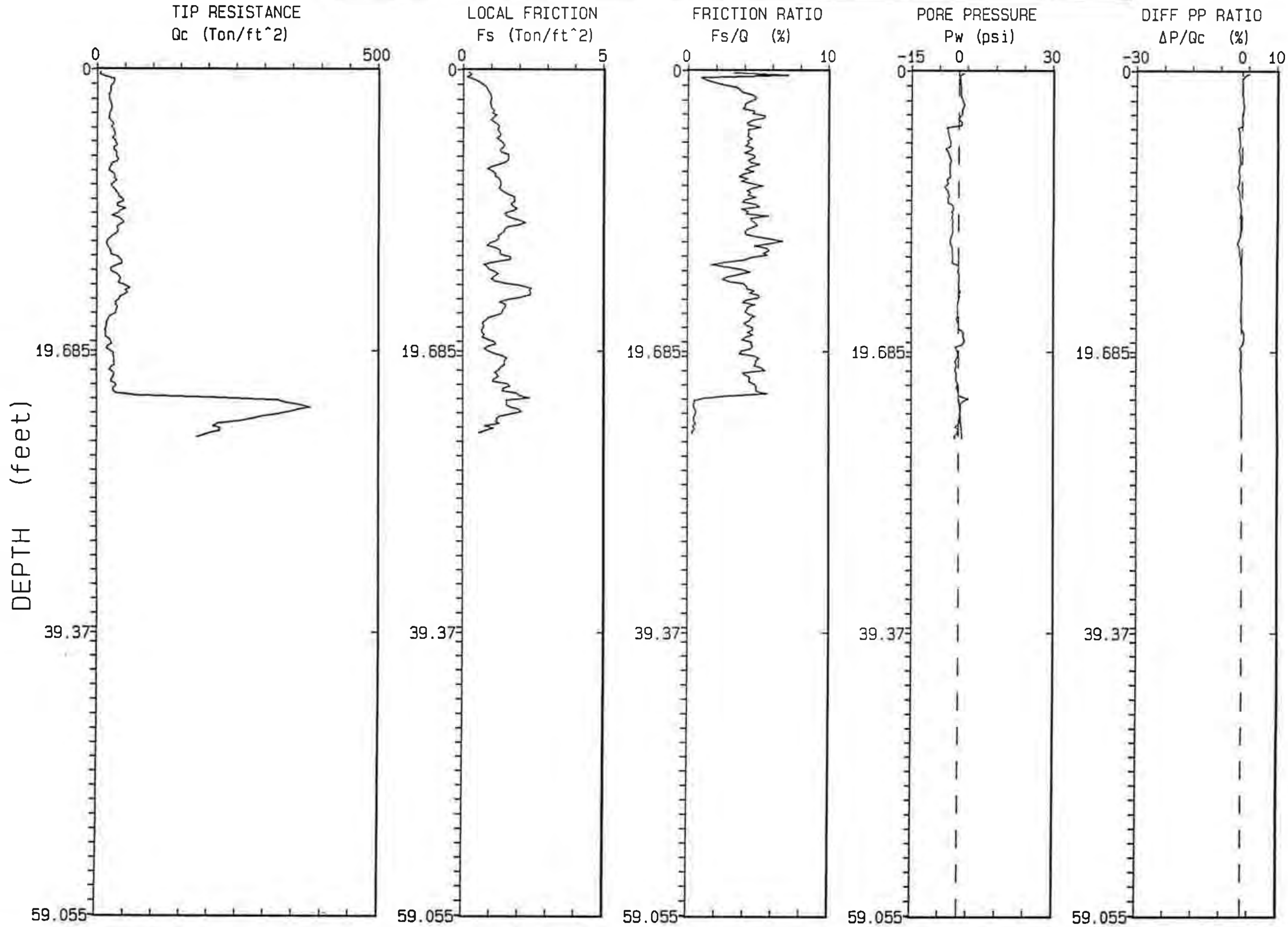
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-8

WOODWARD-CLYDE CONSULTANTS

CPT-9

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m Max Depth : 25.75 ft

FIG. A-4-9

WOODWARD-CLYDE CONSULTANTS

CPT-9

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	18.65	0.38	2.01	0.03	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
0.60	2	22.30	0.92	4.12	0.09	silty clay to clay	UNDFND	UNDFD	14	1.3
0.95	3	23.46	1.03	4.40	0.15	clay	UNDFND	UNDFD	22	1.3
1.25	4	25.03	1.15	4.58	0.22	clay	UNDFND	UNDFD	24	1.4
1.55	5	30.45	1.31	4.30	0.28	silty clay to clay	UNDFND	UNDFD	19	1.7
1.85	6	32.97	1.46	4.42	0.33	silty clay to clay	UNDFND	UNDFD	21	1.9
2.15	7	27.73	1.24	4.48	0.39	silty clay to clay	UNDFND	UNDFD	18	1.6
2.45	8	30.00	1.26	4.20	0.45	silty clay to clay	UNDFND	UNDFD	19	1.7
2.75	9	35.77	1.56	4.37	0.51	silty clay to clay	UNDFND	UNDFD	23	2.0
3.05	10	40.87	1.75	4.27	0.57	silty clay to clay	UNDFND	UNDFD	26	2.3
3.35	11	38.52	1.84	4.78	0.63	silty clay to clay	UNDFND	UNDFD	25	2.2
3.65	12	28.40	1.34	4.70	0.69	clay	UNDFND	UNDFD	27	1.6
3.95	13	21.23	1.17	5.51	0.75	clay	UNDFND	UNDFD	20	1.2
4.25	14	36.90	1.19	3.22	0.81	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
4.55	15	36.18	1.19	3.29	0.87	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
4.85	16	50.07	2.28	4.55	0.93	silty clay to clay	UNDFND	UNDFD	32	2.8
5.15	17	34.60	1.46	4.21	0.98	silty clay to clay	UNDFND	UNDFD	22	1.9
5.45	18	21.42	0.93	4.36	1.04	clay	UNDFND	UNDFD	21	1.1
5.75	19	16.98	0.73	4.29	1.10	clay	UNDFND	UNDFD	16	.9
6.05	20	23.70	1.00	4.20	1.16	silty clay to clay	UNDFND	UNDFD	15	1.3
6.40	21	28.67	1.42	4.95	1.23	clay	UNDFND	UNDFD	27	1.6
6.70	22	28.60	1.23	4.29	1.29	silty clay to clay	UNDFND	UNDFD	18	1.6
7.00	23	68.45	1.80	2.62	1.35	sandy silt to clayey silt	UNDFND	UNDFD	26	3.9
7.35	24	347.31	1.73	0.50	1.39	gravelly sand to sand	>90	44-46	>50	UNDEFINED
7.65	25	244.85	1.14	0.46	1.42	sand	80-90	42-44	47	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

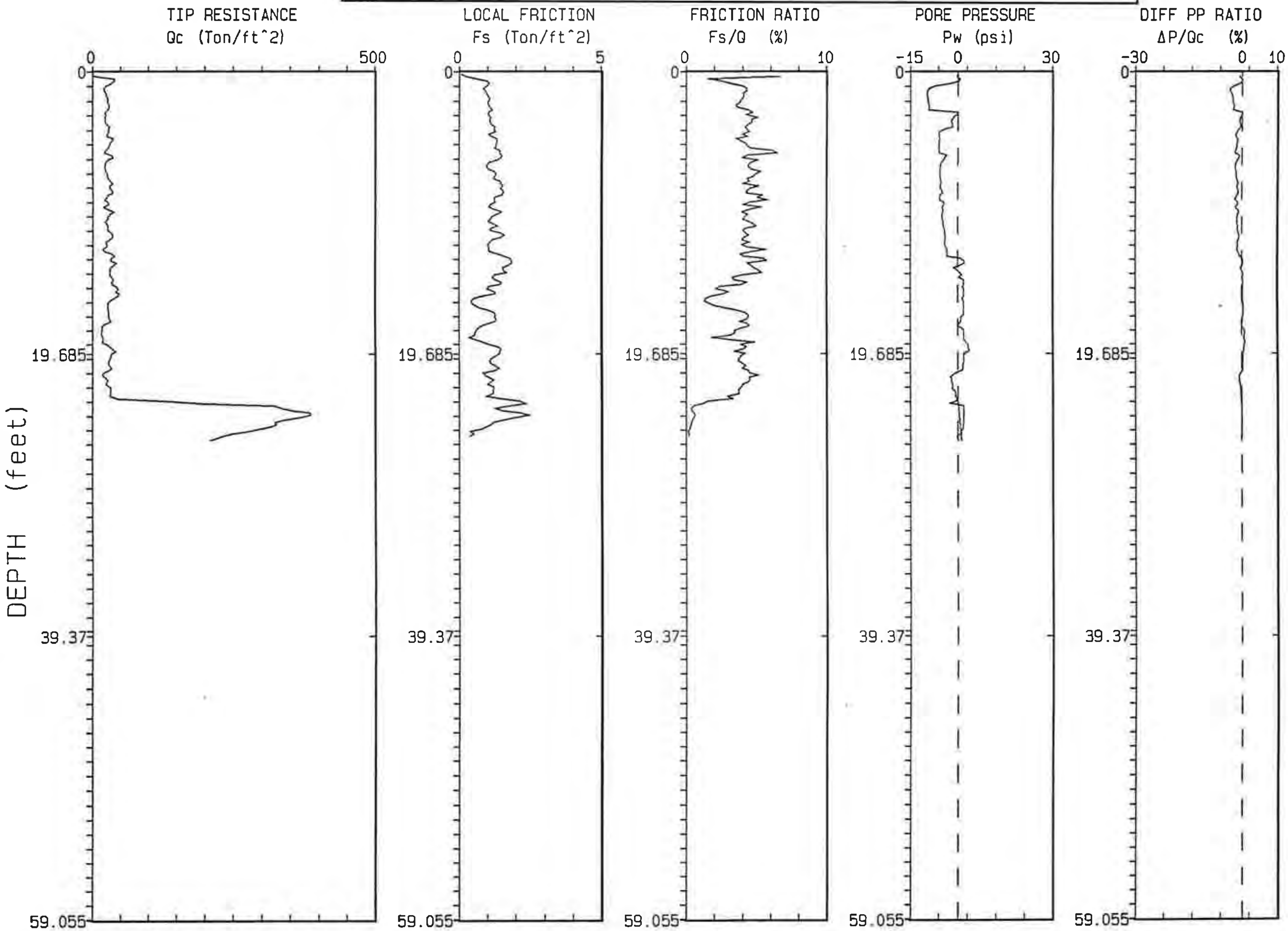
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-9

WOODWARD-CLYDE CONSULTANTS

CPT-9A

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 25.75 ft

FIG. A-4-9A

WOODWARD-CLYDE CONSULTANTS

CPT-9A

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	23.00	0.66	2.86	0.03	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
0.60	2	23.98	0.98	4.07	0.09	silty clay to clay	UNDFND	UNDFD	15	1.4
0.95	3	25.73	1.07	4.16	0.15	silty clay to clay	UNDFND	UNDFD	16	1.5
1.25	4	26.52	1.18	4.46	0.22	silty clay to clay	UNDFND	UNDFD	17	1.5
1.55	5	30.80	1.24	4.03	0.28	silty clay to clay	UNDFND	UNDFD	20	1.7
1.85	6	28.43	1.40	4.94	0.33	clay	UNDFND	UNDFD	27	1.6
2.15	7	23.23	1.10	4.73	0.39	clay	UNDFND	UNDFD	22	1.3
2.45	8	30.72	1.40	4.54	0.45	silty clay to clay	UNDFND	UNDFD	20	1.7
2.75	9	28.98	1.40	4.81	0.51	clay	UNDFND	UNDFD	28	1.6
3.05	10	28.52	1.23	4.33	0.57	silty clay to clay	UNDFND	UNDFD	18	1.6
3.35	11	26.05	1.15	4.41	0.63	silty clay to clay	UNDFND	UNDFD	17	1.4
3.65	12	30.73	1.29	4.21	0.69	silty clay to clay	UNDFND	UNDFD	20	1.7
3.95	13	28.87	1.33	4.60	0.75	clay	UNDFND	UNDFD	28	1.6
4.25	14	34.35	1.70	4.96	0.81	clay	UNDFND	UNDFD	33	1.9
4.55	15	36.13	1.27	3.51	0.87	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
4.85	16	41.83	0.89	2.12	0.93	sandy silt to clayey silt	UNDFND	UNDFD	16	2.4
5.15	17	28.28	0.88	3.10	0.98	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
5.45	18	25.02	1.05	4.19	1.04	silty clay to clay	UNDFND	UNDFD	16	1.4
5.75	19	17.28	0.57	3.31	1.10	silty clay to clay	UNDFND	UNDFD	11	.9
6.05	20	34.02	1.34	3.94	1.16	silty clay to clay	UNDFND	UNDFD	22	1.9
6.40	21	28.66	1.16	4.05	1.23	silty clay to clay	UNDFND	UNDFD	18	1.6
6.70	22	24.92	1.08	4.34	1.29	silty clay to clay	UNDFND	UNDFD	16	1.3
7.00	23	51.42	1.36	2.65	1.35	sandy silt to clayey silt	UNDFND	UNDFD	20	2.9
7.35	24	334.57	1.93	0.58	1.39	gravelly sand to sand	>90	44-46	>50	UNDEFINED
7.65	25	312.05	1.01	0.32	1.42	gravelly sand to sand	>90	44-46	50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

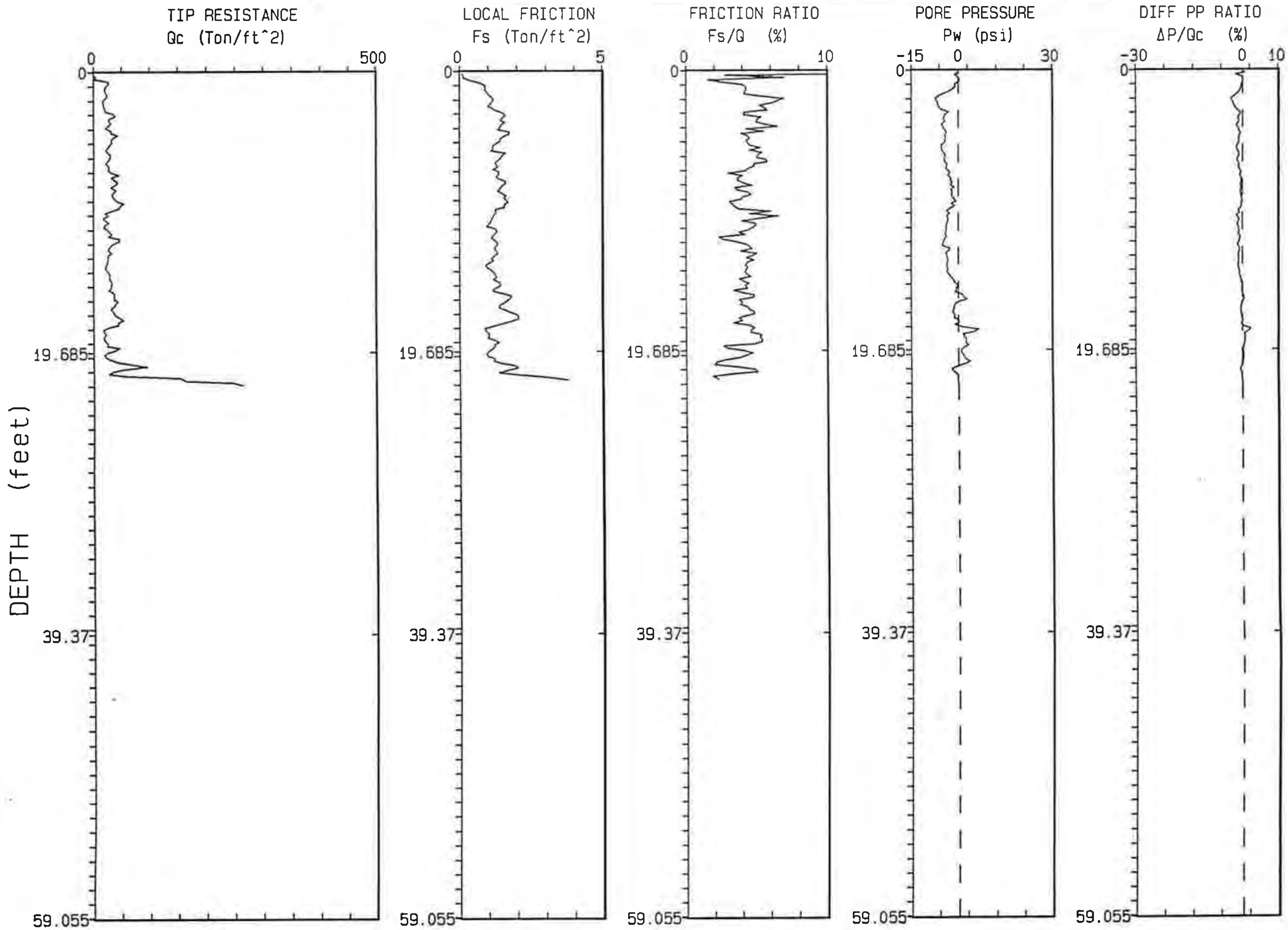
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-9A

WOODWARD-CLYDE CONSULTANTS

CPT-10

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	233	Job Number:	5E08560



Depth Increment : 05 m

Max Depth : 21.98 ft

FIG. A-4-10

WOODWARD-CLYDE CONSULTANTS

CPT-10

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	13.50	0.39	2.88	0.03	silty clay to clay	UNDFND	UNDFD	9	.7
0.60	2	21.12	1.01	4.78	0.09	clay	UNDFND	UNDFD	20	1.2
0.95	3	24.70	1.25	5.08	0.15	clay	UNDFND	UNDFD	24	1.4
1.25	4	27.75	1.45	5.22	0.22	clay	UNDFND	UNDFD	27	1.6
1.55	5	33.93	1.52	4.49	0.28	silty clay to clay	UNDFND	UNDFD	22	1.9
1.85	6	26.55	1.33	5.00	0.33	clay	UNDFND	UNDFD	25	1.5
2.15	7	26.47	1.30	4.91	0.39	clay	UNDFND	UNDFD	25	1.5
2.45	8	38.08	1.46	3.82	0.45	clayey silt to silty clay	UNDFND	UNDFD	18	2.2
2.75	9	37.45	1.51	4.02	0.51	silty clay to clay	UNDFND	UNDFD	24	2.1
3.05	10	37.85	1.43	3.78	0.57	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
3.35	11	21.95	1.09	4.98	0.63	clay	UNDFND	UNDFD	21	1.2
3.65	12	36.65	1.23	3.36	0.69	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
3.95	13	28.22	1.27	4.50	0.75	silty clay to clay	UNDFND	UNDFD	18	1.6
4.25	14	24.05	1.06	4.40	0.81	clay	UNDFND	UNDFD	23	1.3
4.55	15	30.22	1.29	4.27	0.87	silty clay to clay	UNDFND	UNDFD	19	1.7
4.85	16	34.28	1.47	4.29	0.93	silty clay to clay	UNDFND	UNDFD	22	1.9
5.15	17	37.22	1.57	4.22	0.98	silty clay to clay	UNDFND	UNDFD	24	2.1
5.45	18	43.20	1.76	4.08	1.04	clayey silt to silty clay	UNDFND	UNDFD	21	2.4
5.75	19	20.03	1.01	5.03	1.10	clay	UNDFND	UNDFD	19	1.1
6.05	20	29.87	1.15	3.84	1.16	silty clay to clay	UNDFND	UNDFD	19	1.6
6.40	21	49.76	1.49	3.00	1.23	sandy silt to clayey silt	UNDFND	UNDFD	19	2.8
6.70	22	151.97	1.68	1.11	1.29	sand to silty sand	70-80	40-42	36	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

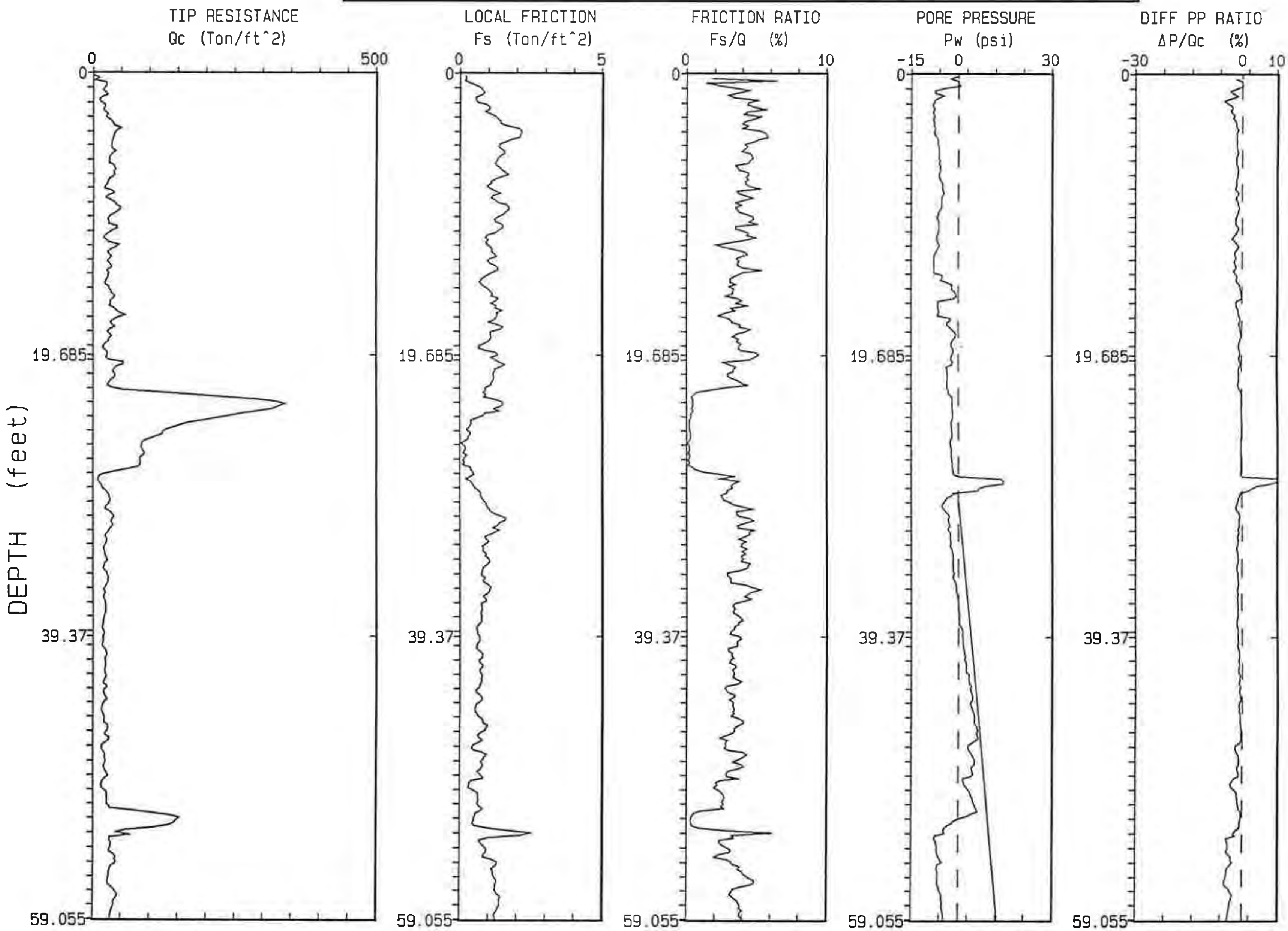
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-10

WOODWARD-CLYDE CONSULTANTS

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

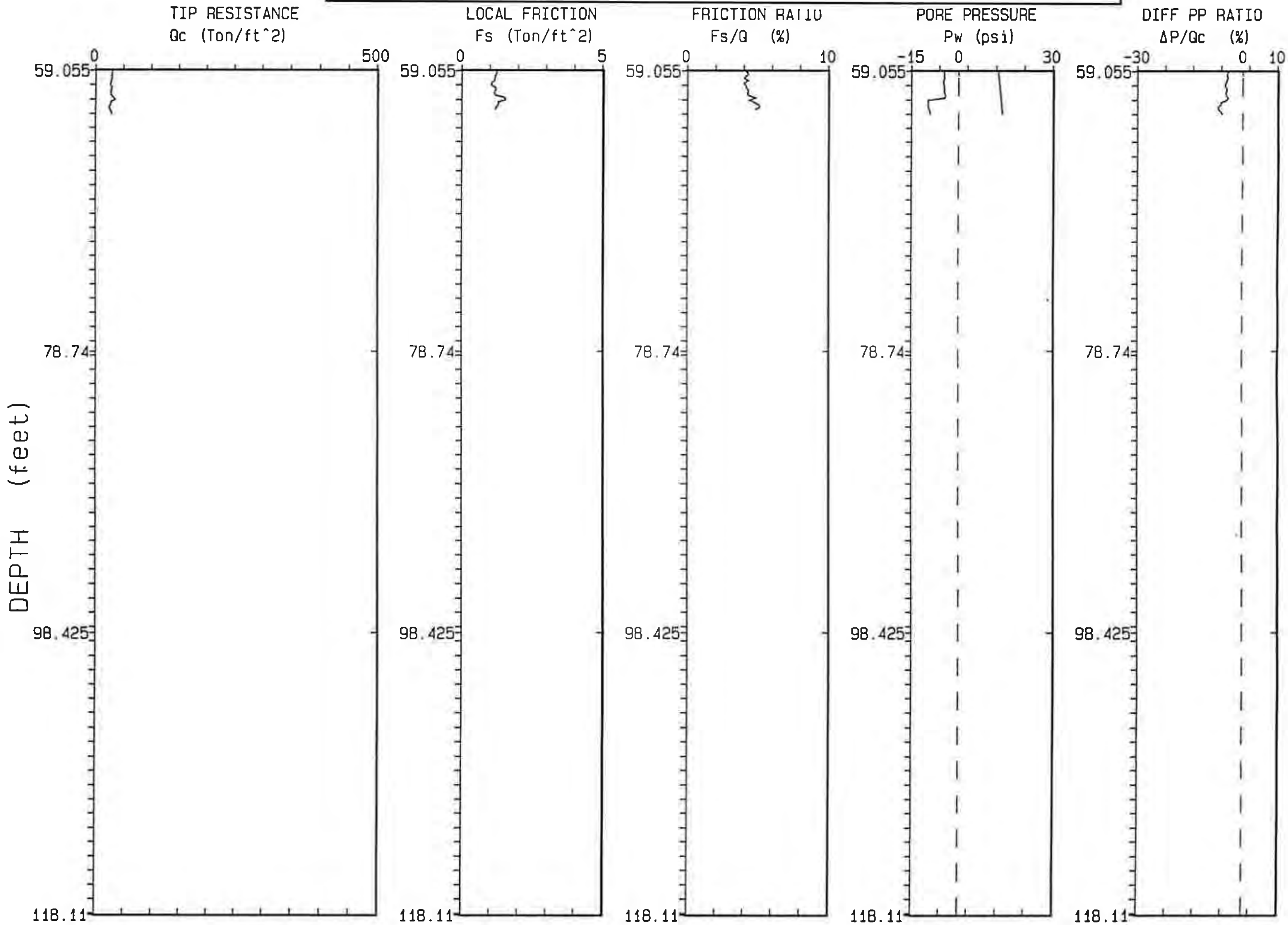
Max Depth : 62.01 ft

FIG. A-4-11

WOODWARD-CLYDE CONSULTANTS

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 62.01 ft

FIG. A-4-11

WOODWARD-CLYDE CONSULTANTS

CPT-11

Operator:	J. Oldham		CPT Date:	4/3/95
Page:	1/2		Location:	Baldwin
Cone Used:	243		Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	13.97	0.37	2.63	0.03	clayey silt to silty clay	UNDFND	UNDFD	7	.8
0.60	2	17.87	0.69	3.87	0.09	silty clay to clay	UNDFND	UNDFD	11	1.0
0.95	3	22.44	1.07	4.77	0.15	clay	UNDFND	UNDFD	21	1.3
1.25	4	39.52	1.81	4.57	0.22	silty clay to clay	UNDFND	UNDFD	25	2.3
1.55	5	34.40	1.73	5.03	0.28	clay	UNDFND	UNDFD	33	2.0
1.85	6	32.37	1.43	4.41	0.33	silty clay to clay	UNDFND	UNDFD	21	1.8
2.15	7	35.85	1.44	4.01	0.39	silty clay to clay	UNDFND	UNDFD	23	2.0
2.45	8	25.63	1.14	4.46	0.45	clay	UNDFND	UNDFD	25	1.4
2.75	9	31.70	1.24	3.92	0.51	silty clay to clay	UNDFND	UNDFD	20	1.8
3.05	10	40.28	1.58	3.93	0.57	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
3.35	11	33.30	1.37	4.11	0.63	silty clay to clay	UNDFND	UNDFD	21	1.9
3.65	12	27.72	0.99	3.56	0.69	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
3.95	13	31.67	1.15	3.63	0.75	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
4.25	14	28.82	1.17	4.07	0.81	silty clay to clay	UNDFND	UNDFD	18	1.6
4.55	15	24.85	0.82	3.29	0.87	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
4.85	16	33.87	1.15	3.39	0.93	clayey silt to silty clay	UNDFND	UNDFD	16	1.9
5.15	17	41.03	1.28	3.11	0.98	clayey silt to silty clay	UNDFND	UNDFD	20	2.3
5.45	18	35.78	1.27	3.56	1.04	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
5.75	19	27.72	1.02	3.68	1.10	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
6.05	20	21.93	0.98	4.46	1.16	clay	UNDFND	UNDFD	21	1.2
6.40	21	40.70	1.31	3.22	1.23	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
6.70	22	31.85	1.09	3.43	1.29	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
7.00	23	197.10	1.02	0.52	1.35	sand	80-90	42-44	38	UNDEFINED
7.35	24	285.84	1.11	0.39	1.41	gravelly sand to sand	>90	44-46	46	UNDEFINED
7.65	25	152.78	0.33	0.22	1.48	sand	70-80	40-42	29	UNDEFINED
7.95	26	99.30	0.22	0.22	1.54	sand	60-70	38-40	19	UNDEFINED
8.25	27	86.78	0.16	0.18	1.59	sand	50-60	38-40	17	UNDEFINED
8.55	28	61.58	0.32	0.52	1.65	sand to silty sand	40-50	36-38	15	UNDEFINED
8.85	29	12.35	0.40	3.26	1.71	silty clay to clay	UNDFND	UNDFD	8	.6
9.15	30	27.57	0.76	2.76	1.77	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
9.45	31	28.85	1.10	3.80	1.80	silty clay to clay	UNDFND	UNDFD	18	1.5
9.75	32	32.57	1.40	4.29	1.83	silty clay to clay	UNDFND	UNDFD	21	1.8
10.05	33	23.88	1.00	4.21	1.86	silty clay to clay	UNDFND	UNDFD	15	1.2
10.35	34	21.32	0.87	4.08	1.88	silty clay to clay	UNDFND	UNDFD	14	1.1
10.65	35	22.23	0.88	3.95	1.91	silty clay to clay	UNDFND	UNDFD	14	1.1
10.95	36	25.53	0.89	3.50	1.94	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
11.25	37	20.53	0.93	4.53	1.97	clay	UNDFND	UNDFD	20	1.0
11.55	38	22.20	0.76	3.42	2.00	clayey silt to silty clay	UNDFND	UNDFD	11	1.1

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-11

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	18.37	0.68	3.71	2.03	silty clay to clay	UNDFND	UNDFD	12	.9
12.15	40	18.60	0.65	3.52	2.05	silty clay to clay	UNDFND	UNDFD	12	.9
12.45	41	21.75	0.70	3.23	2.08	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
12.80	42	22.00	0.73	3.33	2.11	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
13.10	43	22.02	0.73	3.30	2.14	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
13.40	44	21.58	0.69	3.19	2.17	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
13.75	45	17.74	0.60	3.40	2.20	silty clay to clay	UNDFND	UNDFD	11	.8
14.05	46	23.33	0.85	3.65	2.23	silty clay to clay	UNDFND	UNDFD	15	1.2
14.35	47	22.00	0.60	2.73	2.26	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
14.65	48	20.37	0.77	3.76	2.29	silty clay to clay	UNDFND	UNDFD	13	1.0
14.95	49	22.33	0.74	3.31	2.32	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
15.25	50	17.42	0.44	2.52	2.35	clayey silt to silty clay	UNDFND	UNDFD	8	.8
15.55	51	24.38	0.63	2.60	2.38	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
15.85	52	89.13	0.63	0.70	2.40	sand to silty sand	50-60	36-38	21	UNDEFINED
16.15	53	105.23	1.08	1.03	2.43	sand to silty sand	50-60	36-38	25	UNDEFINED
16.45	54	36.48	1.04	2.86	2.46	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
16.75	55	35.78	0.98	2.74	2.49	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
17.05	56	31.07	1.19	3.83	2.52	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
17.35	57	29.63	1.25	4.21	2.55	silty clay to clay	UNDFND	UNDFD	19	1.5
17.65	58	40.28	1.37	3.39	2.57	clayey silt to silty clay	UNDFND	UNDFD	19	2.1
17.95	59	33.37	1.29	3.85	2.60	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
18.25	60	28.25	1.17	4.16	2.63	silty clay to clay	UNDFND	UNDFD	18	1.4
18.55	61	27.88	1.21	4.35	2.66	silty clay to clay	UNDFND	UNDFD	18	1.4
18.85	62	27.30	1.09	4.00	2.69	silty clay to clay	UNDFND	UNDFD	17	1.3

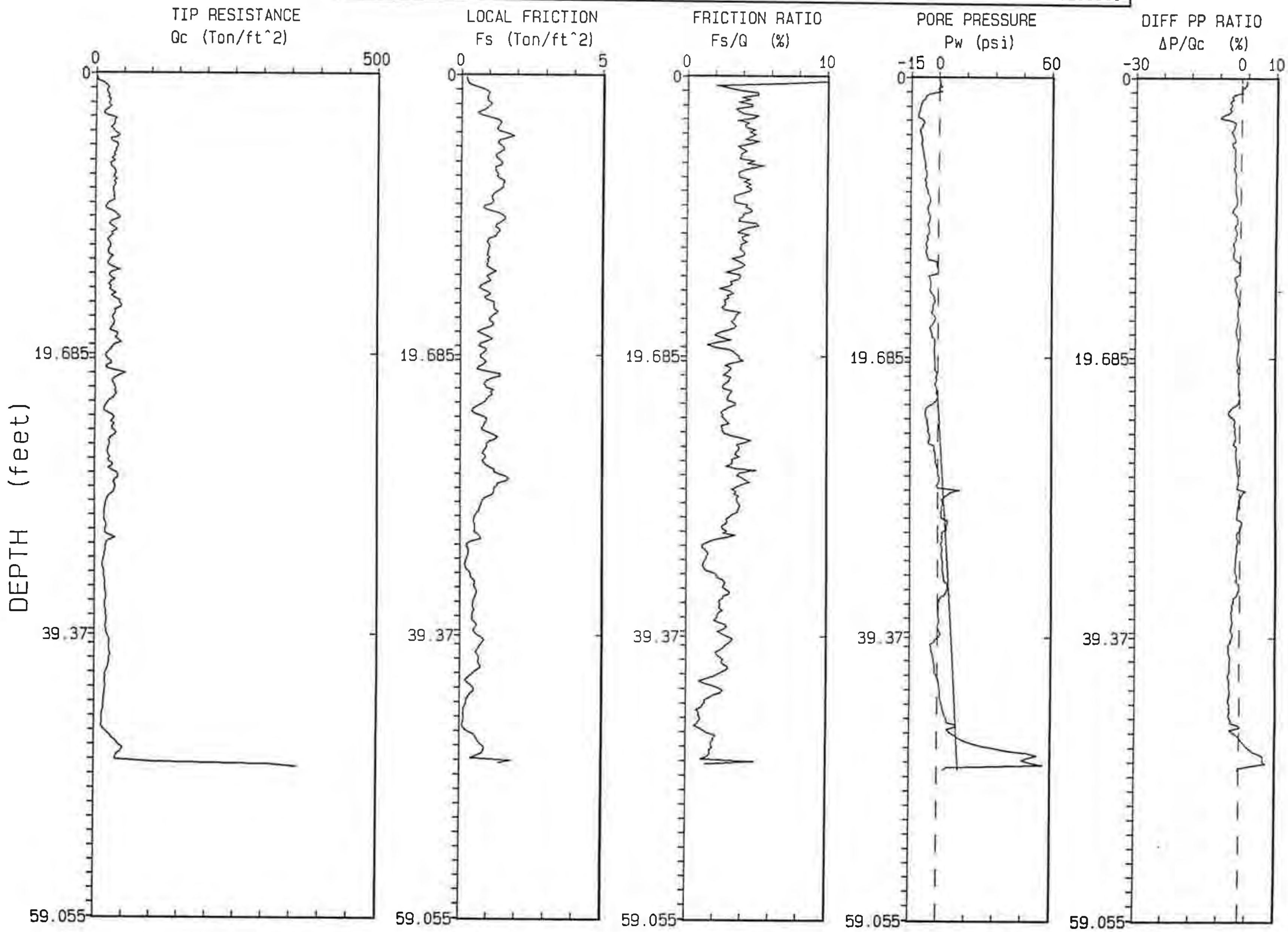
Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-12

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 48.56 ft

FIG. A-4-12

WOODWARD-CLYDE CONSULTANTS

CPT-12

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	9.97	0.37	3.74	0.03	clay	UNDFND	UNDFD	10	.5
0.60	2	22.08	0.97	4.41	0.09	clay	UNDFND	UNDFD	21	1.2
0.95	3	22.60	0.91	4.05	0.15	silty clay to clay	UNDFND	UNDFD	14	1.3
1.25	4	31.50	1.41	4.49	0.22	silty clay to clay	UNDFND	UNDFD	20	1.8
1.55	5	35.72	1.52	4.26	0.28	silty clay to clay	UNDFND	UNDFD	23	2.0
1.85	6	33.33	1.38	4.13	0.33	silty clay to clay	UNDFND	UNDFD	21	1.9
2.15	7	31.27	1.30	4.15	0.39	silty clay to clay	UNDFND	UNDFD	20	1.8
2.45	8	33.38	1.47	4.40	0.45	silty clay to clay	UNDFND	UNDFD	21	1.9
2.75	9	31.68	1.14	3.61	0.51	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
3.05	10	29.00	1.20	4.13	0.57	silty clay to clay	UNDFND	UNDFD	19	1.6
3.35	11	32.95	1.38	4.18	0.63	silty clay to clay	UNDFND	UNDFD	21	1.9
3.65	12	26.70	1.09	4.08	0.69	silty clay to clay	UNDFND	UNDFD	17	1.5
3.95	13	26.12	0.99	3.78	0.75	silty clay to clay	UNDFND	UNDFD	17	1.4
4.25	14	29.52	1.06	3.59	0.81	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
4.55	15	27.78	0.89	3.21	0.87	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
4.85	16	33.20	0.98	2.96	0.93	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
5.15	17	39.48	1.23	3.12	0.98	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
5.45	18	31.38	1.04	3.33	1.04	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
5.75	19	38.73	0.88	2.27	1.10	sandy silt to clayey silt	UNDFND	UNDFD	15	2.2
6.05	20	25.53	0.79	3.11	1.16	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
6.40	21	29.26	0.89	3.05	1.23	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
6.70	22	35.57	1.03	2.89	1.29	sandy silt to clayey silt	UNDFND	UNDFD	14	2.0
7.00	23	33.37	1.04	3.11	1.35	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
7.35	24	22.27	0.63	2.81	1.39	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
7.65	25	31.72	0.86	2.72	1.42	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
7.95	26	29.02	1.12	3.87	1.45	silty clay to clay	UNDFND	UNDFD	19	1.6
8.25	27	24.10	0.85	3.53	1.48	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
8.55	28	30.58	1.11	3.64	1.51	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
8.85	29	37.48	1.49	3.97	1.54	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
9.15	30	27.77	1.00	3.61	1.57	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
9.45	31	18.12	0.65	3.59	1.59	silty clay to clay	UNDFND	UNDFD	12	.9
9.75	32	18.35	0.51	2.78	1.62	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.05	33	24.47	0.54	2.19	1.65	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
10.35	34	18.45	0.26	1.40	1.68	sandy silt to clayey silt	UNDFND	UNDFD	7	.9
10.65	35	14.93	0.21	1.41	1.71	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
10.95	36	17.88	0.46	2.55	1.74	clayey silt to silty clay	UNDFND	UNDFD	9	.9
11.25	37	19.83	0.55	2.76	1.76	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
11.55	38	19.40	0.46	2.38	1.79	clayey silt to silty clay	UNDFND	UNDFD	9	1.0

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-12

CPT-12

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	20.43	0.51	2.50	1.82	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
12.15	40	23.32	0.68	2.93	1.85	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
12.45	41	26.52	0.65	2.45	1.88	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
12.80	42	24.27	0.65	2.69	1.91	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
13.10	43	19.22	0.33	1.71	1.94	sandy silt to clayey silt	UNDFND	UNDFD	7	.9
13.40	44	17.70	0.34	1.94	1.97	clayey silt to silty clay	UNDFND	UNDFD	8	.8
13.75	45	14.76	0.15	0.98	2.00	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
14.05	46	14.88	0.16	1.10	2.03	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
14.35	47	34.83	0.67	1.93	2.06	sandy silt to clayey silt	UNDFND	UNDFD	13	1.8
14.65	48	43.08	0.90	2.08	2.09	sandy silt to clayey silt	UNDFND	UNDFD	17	2.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

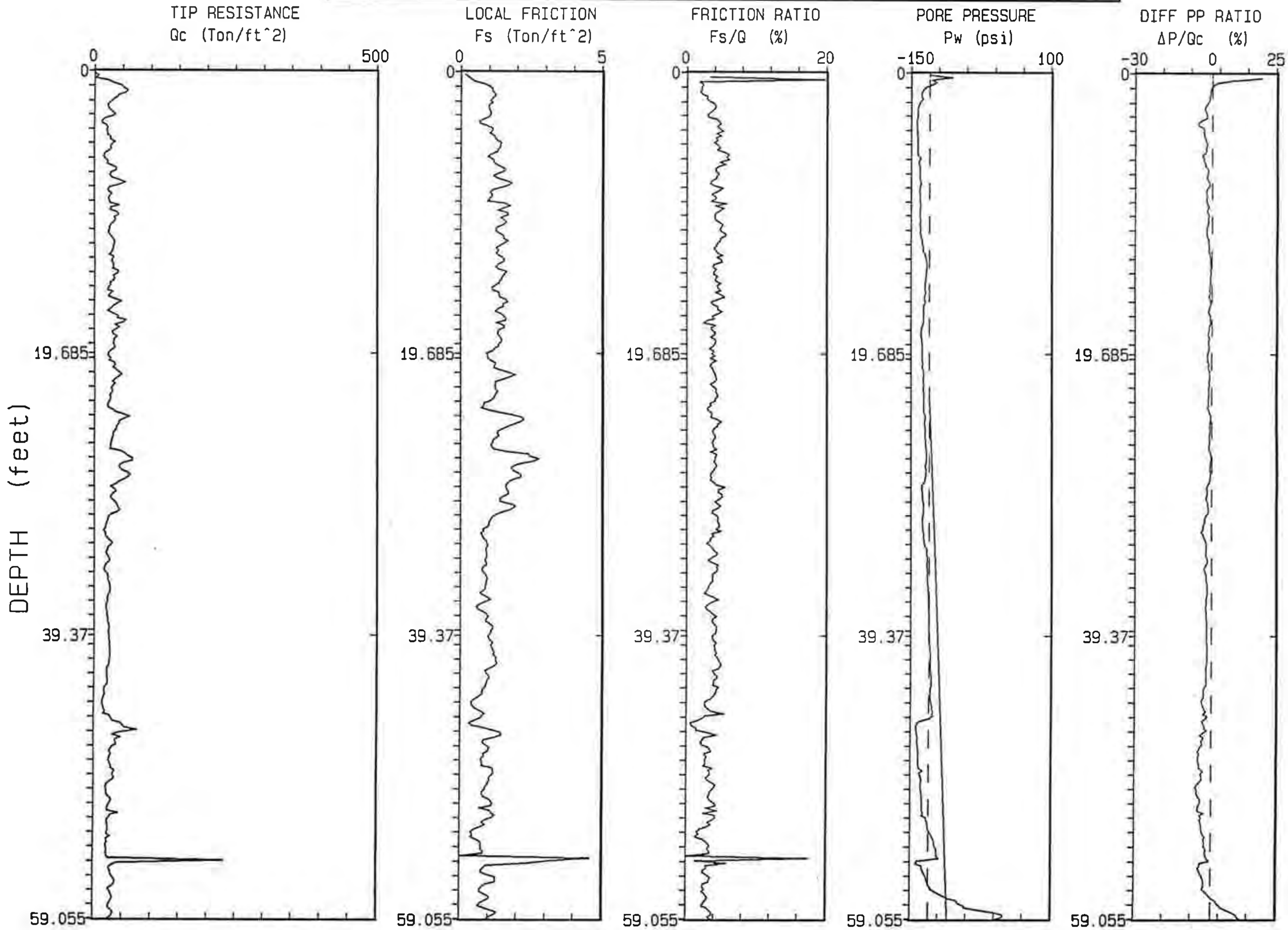
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-12

WOODWARD-CLYDE CONSULTANTS

CPT-13

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

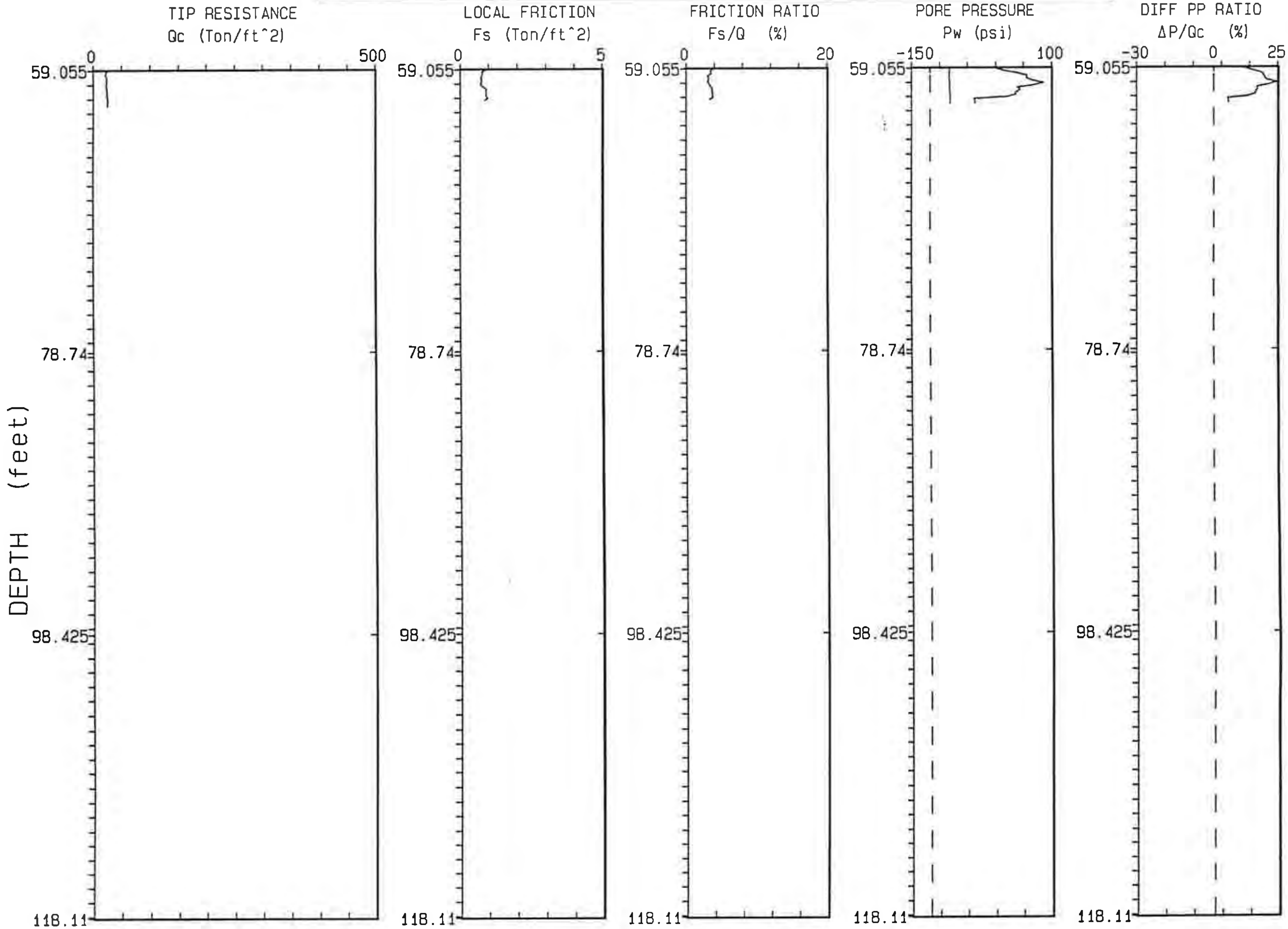
Max Depth : 61.52 ft

FIG. A-4-13

WOODWARD-CLYDE CONSULTANTS

CPT-13

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : 05 m

Max Depth : 61.52 ft

FIG. A-4-13

WOODWARD-CLYDE CONSULTANTS

CPT-13

Operator: J. Oldham		CPT Date:	4/4/95
Page: 1/2		Location:	Baldwin
Cone Used: 243		Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	19.20	0.51	2.63	0.03	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
0.60	2	46.05	1.13	2.46	0.09	sandy silt to clayey silt	UNDFND	UNDFD	18	2.7
0.95	3	28.76	1.02	3.55	0.15	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
1.25	4	18.95	0.89	4.71	0.22	clay	UNDFND	UNDFD	18	1.1
1.55	5	28.47	1.24	4.36	0.28	silty clay to clay	UNDFND	UNDFD	18	1.6
1.85	6	22.42	1.19	5.29	0.33	clay	UNDFND	UNDFD	21	1.2
2.15	7	30.02	1.37	4.55	0.39	silty clay to clay	UNDFND	UNDFD	19	1.7
2.45	8	37.40	1.48	3.97	0.45	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
2.75	9	26.12	1.05	4.02	0.51	silty clay to clay	UNDFND	UNDFD	17	1.5
3.05	10	34.80	1.59	4.56	0.57	silty clay to clay	UNDFND	UNDFD	22	2.0
3.35	11	31.25	1.44	4.60	0.63	silty clay to clay	UNDFND	UNDFD	20	1.8
3.65	12	29.72	1.49	5.00	0.69	clay	UNDFND	UNDFD	28	1.7
3.95	13	30.75	1.34	4.36	0.75	silty clay to clay	UNDFND	UNDFD	20	1.7
4.25	14	33.43	1.43	4.27	0.81	silty clay to clay	UNDFND	UNDFD	21	1.9
4.55	15	32.77	1.40	4.27	0.87	silty clay to clay	UNDFND	UNDFD	21	1.8
4.85	16	28.00	1.32	4.72	0.93	clay	UNDFND	UNDFD	27	1.5
5.15	17	34.30	1.44	4.19	0.98	silty clay to clay	UNDFND	UNDFD	22	1.9
5.45	18	44.83	1.51	3.37	1.04	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
5.75	19	35.15	1.38	3.91	1.10	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
6.05	20	30.43	1.14	3.74	1.16	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
6.40	21	33.61	1.24	3.69	1.23	clayey silt to silty clay	UNDFND	UNDFD	16	1.9
6.70	22	37.50	1.49	3.97	1.29	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
7.00	23	28.20	1.19	4.23	1.35	silty clay to clay	UNDFND	UNDFD	18	1.5
7.35	24	36.13	1.23	3.41	1.39	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
7.65	25	41.72	1.80	4.32	1.42	silty clay to clay	UNDFND	UNDFD	27	2.3
7.95	26	31.10	1.21	3.89	1.45	silty clay to clay	UNDFND	UNDFD	20	1.7
8.25	27	47.50	1.91	4.03	1.48	clayey silt to silty clay	UNDFND	UNDFD	23	2.7
8.55	28	52.32	2.06	3.93	1.51	clayey silt to silty clay	UNDFND	UNDFD	25	2.9
8.85	29	47.60	1.83	3.84	1.54	clayey silt to silty clay	UNDFND	UNDFD	23	2.6
9.15	30	33.20	1.55	4.67	1.57	silty clay to clay	UNDFND	UNDFD	21	1.8
9.45	31	38.80	1.64	4.23	1.59	silty clay to clay	UNDFND	UNDFD	25	2.1
9.75	32	21.67	0.98	4.52	1.62	clay	UNDFND	UNDFD	21	1.1
10.05	33	22.73	0.82	3.59	1.65	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
10.35	34	23.67	0.91	3.86	1.68	silty clay to clay	UNDFND	UNDFD	15	1.2
10.65	35	20.95	0.83	3.97	1.71	silty clay to clay	UNDFND	UNDFD	13	1.1
10.95	36	25.03	0.90	3.58	1.74	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
11.25	37	25.85	0.86	3.31	1.76	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
11.55	38	22.15	0.73	3.31	1.79	clayey silt to silty clay	UNDFND	UNDFD	11	1.1

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-13

CPT-13

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	24.65	1.00	4.07	1.82	silty clay to clay	UNDFND	UNDFD	16	1.3
12.15	40	26.02	1.05	4.02	1.85	silty clay to clay	UNDFND	UNDFD	17	1.3
12.45	41	27.68	1.15	4.15	1.88	silty clay to clay	UNDFND	UNDFD	18	1.4
12.80	42	24.70	1.11	4.50	1.91	clay	UNDFND	UNDFD	24	1.3
13.10	43	22.42	0.93	4.16	1.94	silty clay to clay	UNDFND	UNDFD	14	1.1
13.40	44	16.93	0.64	3.79	1.97	silty clay to clay	UNDFND	UNDFD	11	.8
13.75	45	20.26	0.63	3.12	2.00	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
14.05	46	51.07	0.75	1.48	2.03	silty sand to sandy silt	<40	32-34	16	UNDEFINED
14.35	47	37.92	1.03	2.72	2.06	sandy silt to clayey silt	UNDFND	UNDFD	15	2.0
14.65	48	28.20	0.85	3.00	2.09	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
14.95	49	32.20	1.02	3.17	2.11	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
15.25	50	27.53	0.96	3.48	2.14	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
15.55	51	26.58	0.94	3.52	2.17	clayey silt to silty clay	UNDFND	UNDFD	13	1.3
15.85	52	29.10	1.05	3.62	2.20	clayey silt to silty clay	UNDFND	UNDFD	14	1.5
16.15	53	24.73	0.70	2.82	2.23	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
16.45	54	24.55	0.60	2.46	2.26	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
16.75	55	58.37	1.70	2.91	2.28	sandy silt to clayey silt	UNDFND	UNDFD	22	3.2
17.05	56	32.35	1.11	3.42	2.31	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
17.35	57	34.47	1.03	2.98	2.34	clayey silt to silty clay	UNDFND	UNDFD	17	1.8
17.65	58	31.53	0.87	2.76	2.37	sandy silt to clayey silt	UNDFND	UNDFD	12	1.6
17.95	59	30.88	1.02	3.30	2.40	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
18.25	60	23.25	0.78	3.35	2.43	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
18.55	61	23.98	0.86	3.59	2.45	clayey silt to silty clay	UNDFND	UNDFD	11	1.1

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

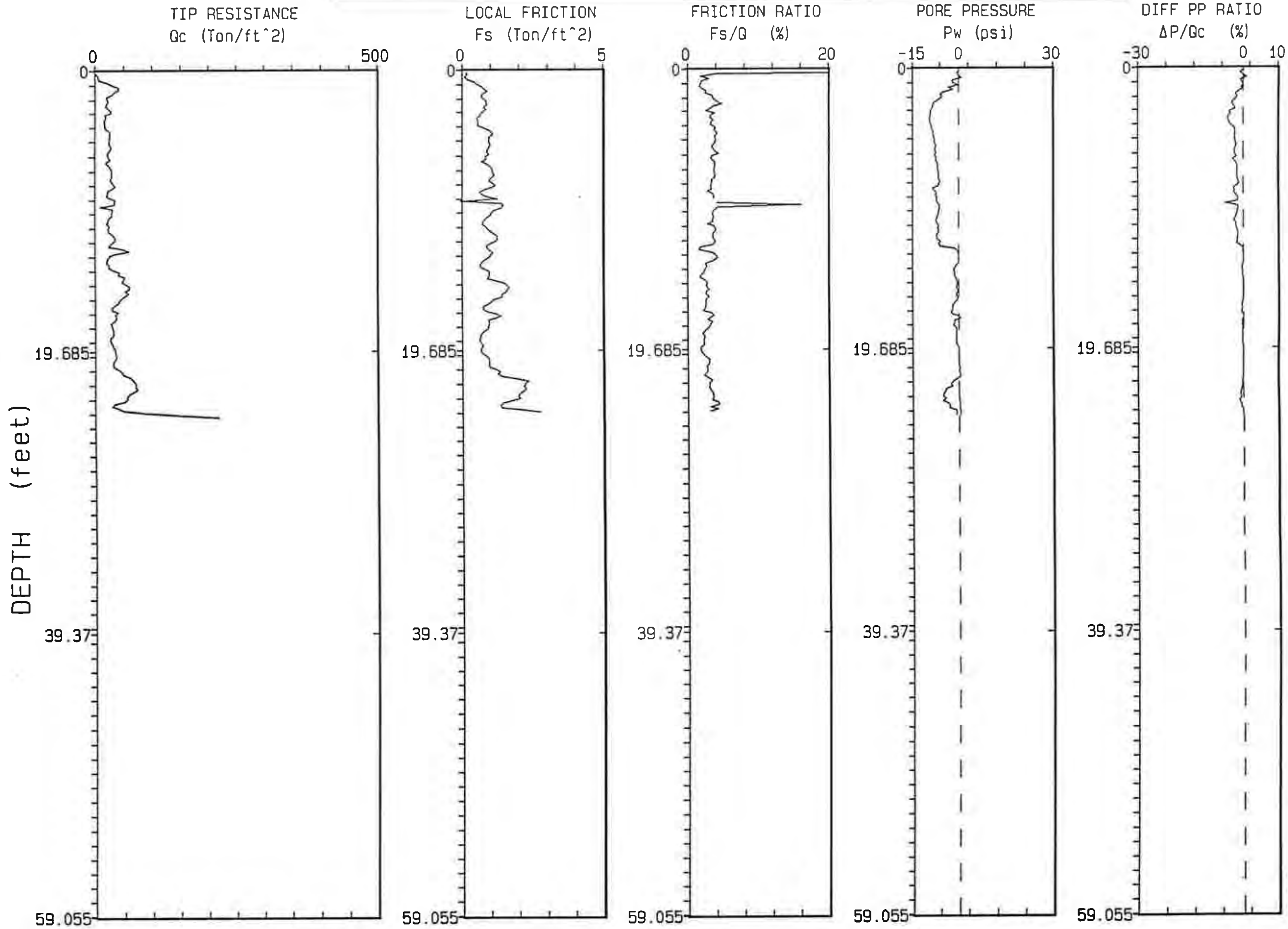
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A–4–13

WOODWARD-CLYDE CONSULTANTS

CPT-14

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 24.28 ft

FIG. A-4-14

WOODWARD-CLYDE CONSULTANTS

CPT-14

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	11.07	0.26	2.37	0.03	clayey silt to silty clay	UNDFND	UNDFD	5	.6
0.60	2	30.45	0.75	2.46	0.09	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
0.95	3	21.80	0.79	3.64	0.15	silty clay to clay	UNDFND	UNDFD	14	1.2
1.25	4	17.18	0.59	3.43	0.22	silty clay to clay	UNDFND	UNDFD	11	.9
1.55	5	24.95	0.98	3.94	0.28	silty clay to clay	UNDFND	UNDFD	16	1.4
1.85	6	24.40	0.91	3.71	0.33	silty clay to clay	UNDFND	UNDFD	16	1.4
2.15	7	24.85	0.92	3.70	0.39	silty clay to clay	UNDFND	UNDFD	16	1.4
2.45	8	29.87	1.07	3.59	0.45	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
2.75	9	25.37	0.87	3.41	0.51	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
3.05	10	27.53	1.05	3.81	0.57	silty clay to clay	UNDFND	UNDFD	18	1.5
3.35	11	23.58	0.82	3.47	0.63	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
3.65	12	29.80	1.11	3.74	0.69	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
3.95	13	36.43	0.97	2.67	0.75	sandy silt to clayey silt	UNDFND	UNDFD	14	2.0
4.25	14	23.93	0.76	3.17	0.81	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
4.55	15	46.78	1.07	2.28	0.87	sandy silt to clayey silt	UNDFND	UNDFD	18	2.7
4.85	16	54.43	1.52	2.80	0.93	sandy silt to clayey silt	UNDFND	UNDFD	21	3.1
5.15	17	35.57	0.89	2.51	0.98	sandy silt to clayey silt	UNDFND	UNDFD	14	2.0
5.45	18	32.57	1.10	3.37	1.04	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
5.75	19	29.57	0.75	2.53	1.10	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
6.05	20	32.17	0.69	2.13	1.16	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
6.40	21	34.87	0.96	2.76	1.23	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
6.70	22	60.37	1.75	2.90	1.29	sandy silt to clayey silt	UNDFND	UNDFD	23	3.4
7.00	23	63.65	2.11	3.31	1.35	sandy silt to clayey silt	UNDFND	UNDFD	24	3.6
7.35	24	62.71	1.53	2.44	1.39	sandy silt to clayey silt	UNDFND	UNDFD	24	3.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

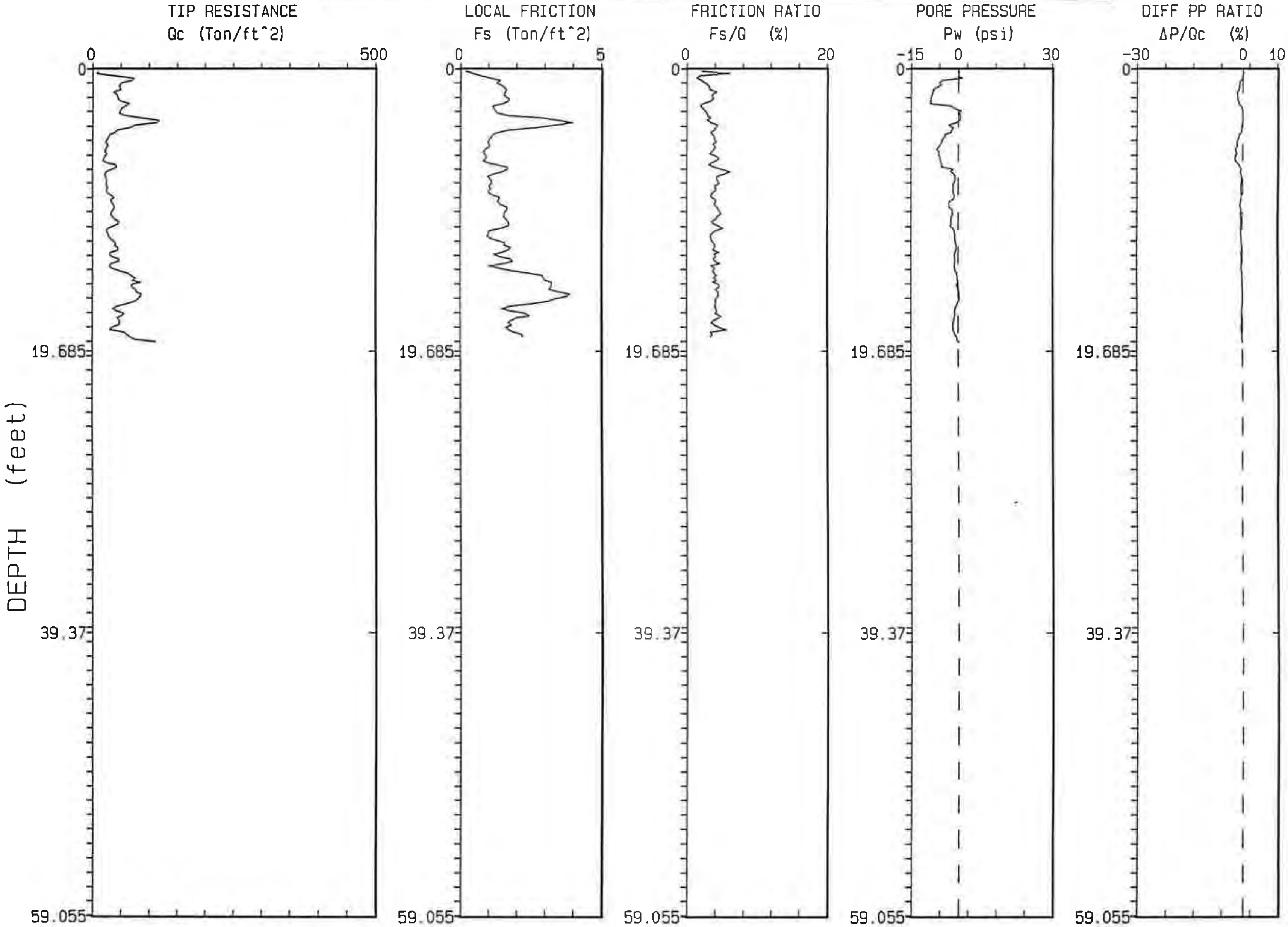
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-14

WOODWARD-CLYDE CONSULTANTS

CPT-15

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 19.03 ft

FIG. A-4-15

WOODWARD-CLYDE CONSULTANTS

CPT-15

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	41.22	0.85	2.07	0.03	sandy silt to clayey silt	UNDFND	UNDFD	16	2.4
0.60	2	44.60	1.56	3.50	0.09	clayey silt to silty clay	UNDFND	UNDFD	21	2.6
0.95	3	51.91	1.41	2.71	0.15	sandy silt to clayey silt	UNDFND	UNDFD	20	3.0
1.25	4	85.55	3.01	3.52	0.22	sandy silt to clayey silt	UNDFND	UNDFD	33	5.0
1.55	5	31.70	1.21	3.83	0.28	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
1.85	6	24.42	0.92	3.77	0.33	silty clay to clay	UNDFND	UNDFD	16	1.4
2.15	7	30.33	1.22	4.02	0.39	silty clay to clay	UNDFND	UNDFD	19	1.7
2.45	8	23.83	1.16	4.88	0.45	clay	UNDFND	UNDFD	23	1.3
2.75	9	29.25	1.12	3.83	0.51	silty clay to clay	UNDFND	UNDFD	19	1.6
3.05	10	35.07	1.51	4.31	0.57	silty clay to clay	UNDFND	UNDFD	22	2.0
3.35	11	39.23	1.64	4.18	0.63	silty clay to clay	UNDFND	UNDFD	25	2.2
3.65	12	29.32	1.13	3.86	0.69	silty clay to clay	UNDFND	UNDFD	19	1.6
3.95	13	38.77	1.56	4.02	0.75	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
4.25	14	37.22	1.51	4.06	0.81	silty clay to clay	UNDFND	UNDFD	24	2.1
4.55	15	67.98	2.71	3.99	0.87	clayey silt to silty clay	UNDFND	UNDFD	33	3.9
4.85	16	77.35	3.46	4.48	0.93	clayey silt to silty clay	UNDFND	UNDFD	37	4.4
5.15	17	56.75	2.37	4.17	0.98	clayey silt to silty clay	UNDFND	UNDFD	27	3.2
5.45	18	48.88	2.04	4.16	1.04	clayey silt to silty clay	UNDFND	UNDFD	23	2.8
5.75	19	53.88	1.62	3.00	1.10	sandy silt to clayey silt	UNDFND	UNDFD	21	3.1

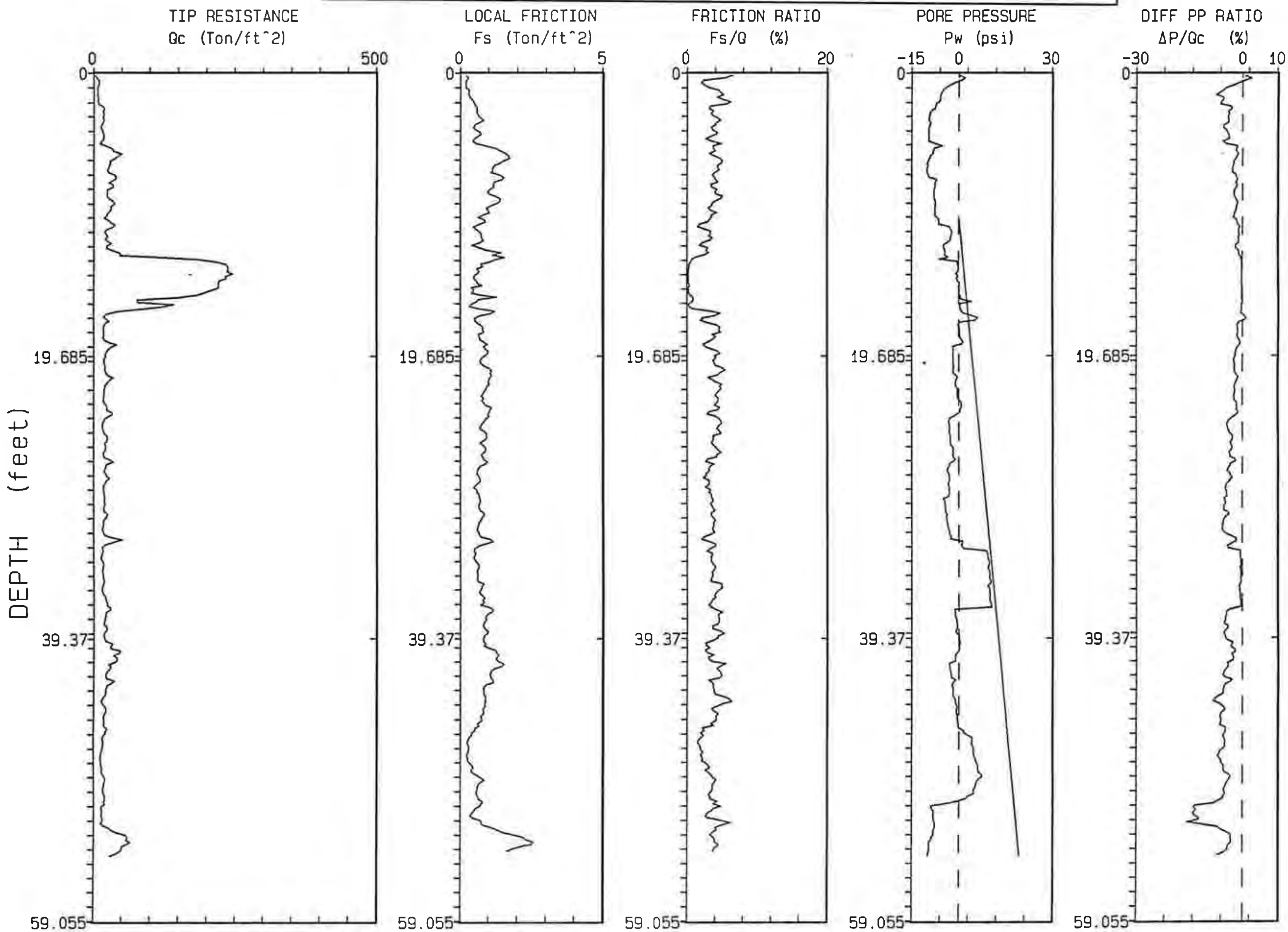
Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-16

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m   Max Depth : 54.46 ft

FIG. A-4-16

WOODWARD-CLYDE CONSULTANTS

CPT-16

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	6.82	0.21	3.15	0.03	clay	UNDFND	UNDFD	7	.3
0.60	2	7.15	0.36	5.03	0.09	clay	UNDFND	UNDFD	7	.4
0.95	3	16.04	0.60	3.76	0.15	silty clay to clay	UNDFND	UNDFD	10	.9
1.25	4	15.15	0.62	4.08	0.22	clay	UNDFND	UNDFD	15	.8
1.55	5	17.32	0.62	3.60	0.28	silty clay to clay	UNDFND	UNDFD	11	1.0
1.85	6	38.12	1.53	4.02	0.33	clayey silt to silty clay	UNDFND	UNDFD	18	2.2
2.15	7	28.85	1.23	4.26	0.39	silty clay to clay	UNDFND	UNDFD	18	1.6
2.45	8	32.72	1.27	3.88	0.45	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
2.75	9	29.08	1.22	4.21	0.51	silty clay to clay	UNDFND	UNDFD	19	1.6
3.05	10	26.22	0.92	3.50	0.57	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
3.35	11	28.72	0.68	2.38	0.61	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
3.65	12	24.72	0.70	2.81	0.64	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
3.95	13	78.08	1.17	1.50	0.67	silty sand to sandy silt	60-70	40-42	25	UNDEFINED
4.25	14	234.65	0.74	0.32	0.69	sand	>90	46-48	45	UNDEFINED
4.55	15	225.22	0.56	0.25	0.72	gravelly sand to sand	>90	44-46	36	UNDEFINED
4.85	16	148.77	0.68	0.46	0.75	sand	80-90	44-46	28	UNDEFINED
5.15	17	70.82	0.74	1.04	0.78	sand to silty sand	60-70	40-42	17	UNDEFINED
5.45	18	20.58	0.66	3.20	0.81	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.75	19	23.00	0.77	3.36	0.84	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
6.05	20	23.38	0.88	3.76	0.86	silty clay to clay	UNDFND	UNDFD	15	1.3
6.40	21	20.79	0.93	4.46	0.89	clay	UNDFND	UNDFD	20	1.1
6.70	22	24.60	0.98	4.00	0.93	silty clay to clay	UNDFND	UNDFD	16	1.3
7.00	23	18.63	0.80	4.29	0.95	clay	UNDFND	UNDFD	18	1.0
7.35	24	26.01	0.99	3.81	0.98	silty clay to clay	UNDFND	UNDFD	17	1.4
7.65	25	17.07	0.79	4.66	1.02	clay	UNDFND	UNDFD	16	.9
7.95	26	22.53	0.85	3.77	1.04	silty clay to clay	UNDFND	UNDFD	14	1.2
8.25	27	23.23	0.85	3.64	1.07	silty clay to clay	UNDFND	UNDFD	15	1.2
8.55	28	21.60	0.68	3.15	1.10	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
8.85	29	21.08	0.61	2.89	1.13	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
9.15	30	19.38	0.67	3.46	1.16	silty clay to clay	UNDFND	UNDFD	12	1.0
9.45	31	20.52	0.75	3.66	1.19	silty clay to clay	UNDFND	UNDFD	13	1.0
9.75	32	17.18	0.66	3.82	1.21	silty clay to clay	UNDFND	UNDFD	11	.8
10.05	33	29.28	0.86	2.94	1.24	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
10.35	34	15.23	0.51	3.35	1.27	silty clay to clay	UNDFND	UNDFD	10	.7
10.65	35	16.67	0.63	3.78	1.30	silty clay to clay	UNDFND	UNDFD	11	.8
10.95	36	16.87	0.70	4.15	1.33	clay	UNDFND	UNDFD	16	.8
11.25	37	20.28	0.79	3.88	1.36	silty clay to clay	UNDFND	UNDFD	13	1.0
11.55	38	24.18	0.98	4.06	1.38	silty clay to clay	UNDFND	UNDFD	15	1.2

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-16

CPT-16

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	20.70	0.88	4.23	1.41	silty clay to clay	UNDFND	UNDFD	13	1.0
12.15	40	23.87	0.87	3.63	1.44	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
12.45	41	40.33	1.25	3.09	1.47	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
12.80	42	27.51	1.26	4.59	1.50	clay	UNDFND	UNDFD	26	1.4
13.10	43	26.73	1.00	3.73	1.53	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
13.40	44	17.68	0.88	4.96	1.56	clay	UNDFND	UNDFD	17	.8
13.75	45	19.67	0.80	4.06	1.59	silty clay to clay	UNDFND	UNDFD	13	1.0
14.05	46	19.77	0.52	2.65	1.62	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
14.35	47	16.30	0.28	1.74	1.65	clayey silt to silty clay	UNDFND	UNDFD	8	.7
14.65	48	12.60	0.28	2.21	1.68	clayey silt to silty clay	UNDFND	UNDFD	6	.5
14.95	49	15.80	0.51	3.23	1.70	silty clay to clay	UNDFND	UNDFD	10	.7
15.25	50	18.07	0.67	3.72	1.73	silty clay to clay	UNDFND	UNDFD	12	.8
15.55	51	18.33	0.68	3.70	1.76	silty clay to clay	UNDFND	UNDFD	12	.9
15.85	52	14.38	0.49	3.44	1.79	silty clay to clay	UNDFND	UNDFD	9	.6
16.15	53	31.10	1.23	3.96	1.82	silty clay to clay	UNDFND	UNDFD	20	1.6
16.45	54	56.48	2.27	4.02	1.85	clayey silt to silty clay	UNDFND	UNDFD	27	3.1

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-16

WOODWARD-CLYDE CONSULTANTS

CPT-17

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

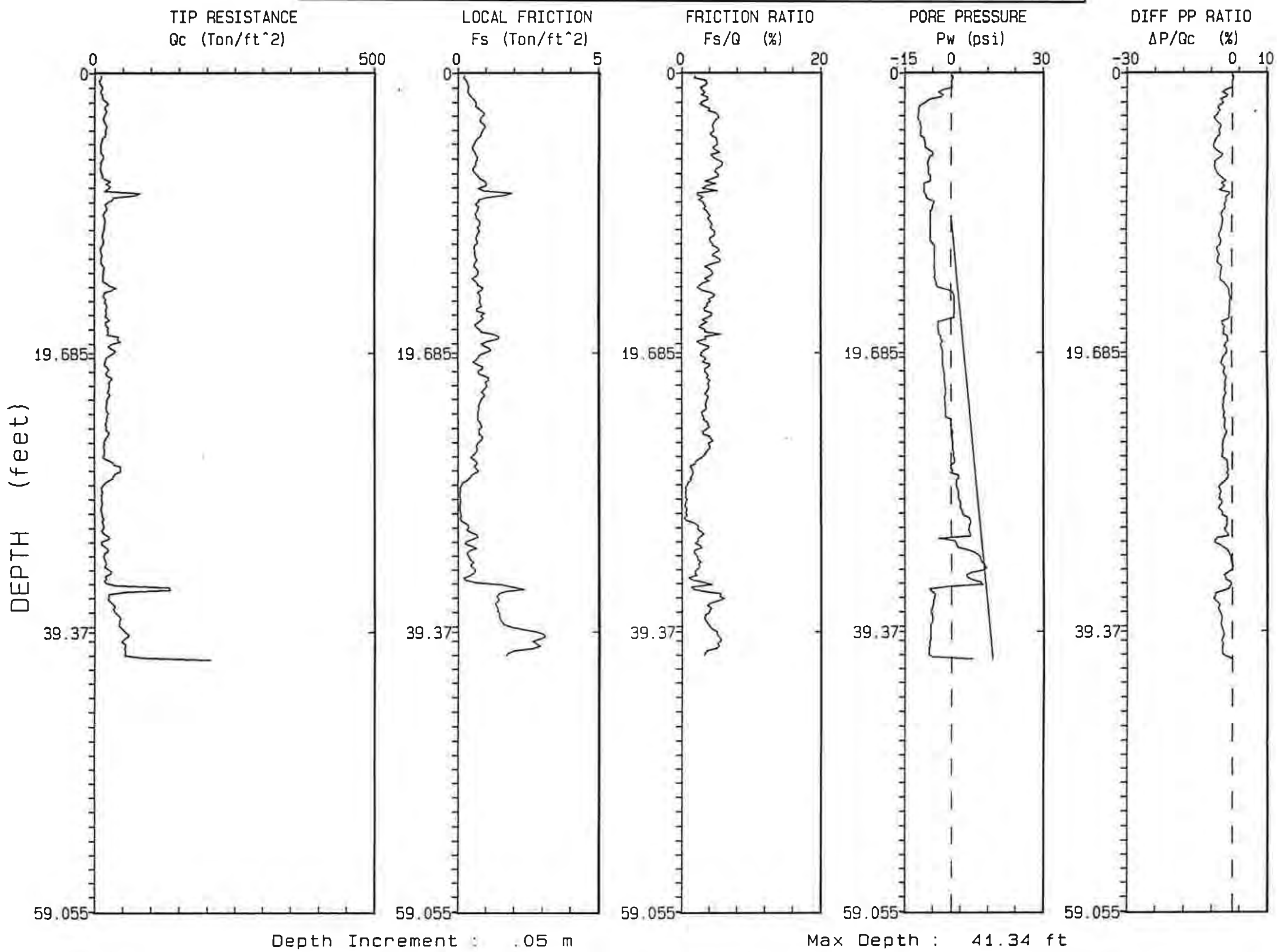


FIG. A-4-17

WOODWARD-CLYDE CONSULTANTS

CPT-17

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	10.58	0.29	2.75	0.03	silty clay to clay	UNDFND	UNDFD	7	.6
0.60	2	14.35	0.47	3.25	0.09	silty clay to clay	UNDFND	UNDFD	9	.8
0.95	3	19.16	0.78	4.07	0.15	silty clay to clay	UNDFND	UNDFD	12	1.1
1.25	4	18.90	0.87	4.63	0.22	clay	UNDFND	UNDFD	18	1.0
1.55	5	14.60	0.69	4.73	0.28	clay	UNDFND	UNDFD	14	.8
1.85	6	12.67	0.61	4.81	0.33	clay	UNDFND	UNDFD	12	.7
2.15	7	11.10	0.60	5.42	0.39	clay	UNDFND	UNDFD	11	.6
2.45	8	22.05	0.87	3.95	0.45	silty clay to clay	UNDFND	UNDFD	14	1.2
2.75	9	43.12	1.18	2.75	0.51	sandy silt to clayey silt	UNDFND	UNDFD	17	2.5
3.05	10	18.67	0.67	3.60	0.57	silty clay to clay	UNDFND	UNDFD	12	1.0
3.35	11	17.65	0.74	4.19	0.61	clay	UNDFND	UNDFD	17	1.0
3.65	12	15.30	0.69	4.52	0.64	clay	UNDFND	UNDFD	15	.8
3.95	13	12.13	0.60	4.96	0.67	clay	UNDFND	UNDFD	12	.6
4.25	14	14.63	0.65	4.45	0.69	clay	UNDFND	UNDFD	14	.8
4.55	15	18.45	0.65	3.54	0.72	silty clay to clay	UNDFND	UNDFD	12	1.0
4.85	16	22.80	0.81	3.53	0.75	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
5.15	17	20.87	0.79	3.80	0.78	silty clay to clay	UNDFND	UNDFD	13	1.1
5.45	18	22.65	0.76	3.37	0.81	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
5.75	19	33.25	1.15	3.45	0.84	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
6.05	20	30.10	0.98	3.25	0.86	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
6.40	21	20.54	0.72	3.52	0.89	silty clay to clay	UNDFND	UNDFD	13	1.1
6.70	22	25.35	0.97	3.83	0.93	silty clay to clay	UNDFND	UNDFD	16	1.4
7.00	23	24.70	0.92	3.73	0.95	silty clay to clay	UNDFND	UNDFD	16	1.3
7.35	24	22.19	0.74	3.33	0.98	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
7.65	25	21.37	0.77	3.60	1.02	silty clay to clay	UNDFND	UNDFD	14	1.1
7.95	26	21.05	0.79	3.74	1.04	silty clay to clay	UNDFND	UNDFD	13	1.1
8.25	27	16.78	0.60	3.60	1.07	silty clay to clay	UNDFND	UNDFD	11	.8
8.55	28	38.02	0.65	1.71	1.10	sandy silt to clayey silt	UNDFND	UNDFD	15	2.1
8.85	29	26.70	0.35	1.31	1.13	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
9.15	30	12.62	0.07	0.59	1.16	sandy silt to clayey silt	UNDFND	UNDFD	5	.6
9.45	31	12.80	0.07	0.57	1.19	sandy silt to clayey silt	UNDFND	UNDFD	5	.6
9.75	32	15.02	0.21	1.43	1.21	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
10.05	33	18.38	0.49	2.67	1.24	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.35	34	18.55	0.42	2.24	1.27	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.65	35	19.83	0.49	2.49	1.30	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
10.95	36	22.60	0.45	2.00	1.33	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
11.25	37	68.15	1.74	2.56	1.36	sandy silt to clayey silt	UNDFND	UNDFD	26	3.8
11.55	38	31.18	1.41	4.51	1.38	silty clay to clay	UNDFND	UNDFD	20	1.7

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-17

CPT-17

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	42.95	1.54	3.58	1.41	clayey silt to silty clay	UNDFND	UNDFD	21	2.3
12.15	40	53.22	2.67	5.01	1.44	silty clay to clay	UNDFND	UNDFD	34	2.9
12.45	41	52.60	2.47	4.69	1.47	silty clay to clay	UNDFND	UNDFD	34	2.9

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

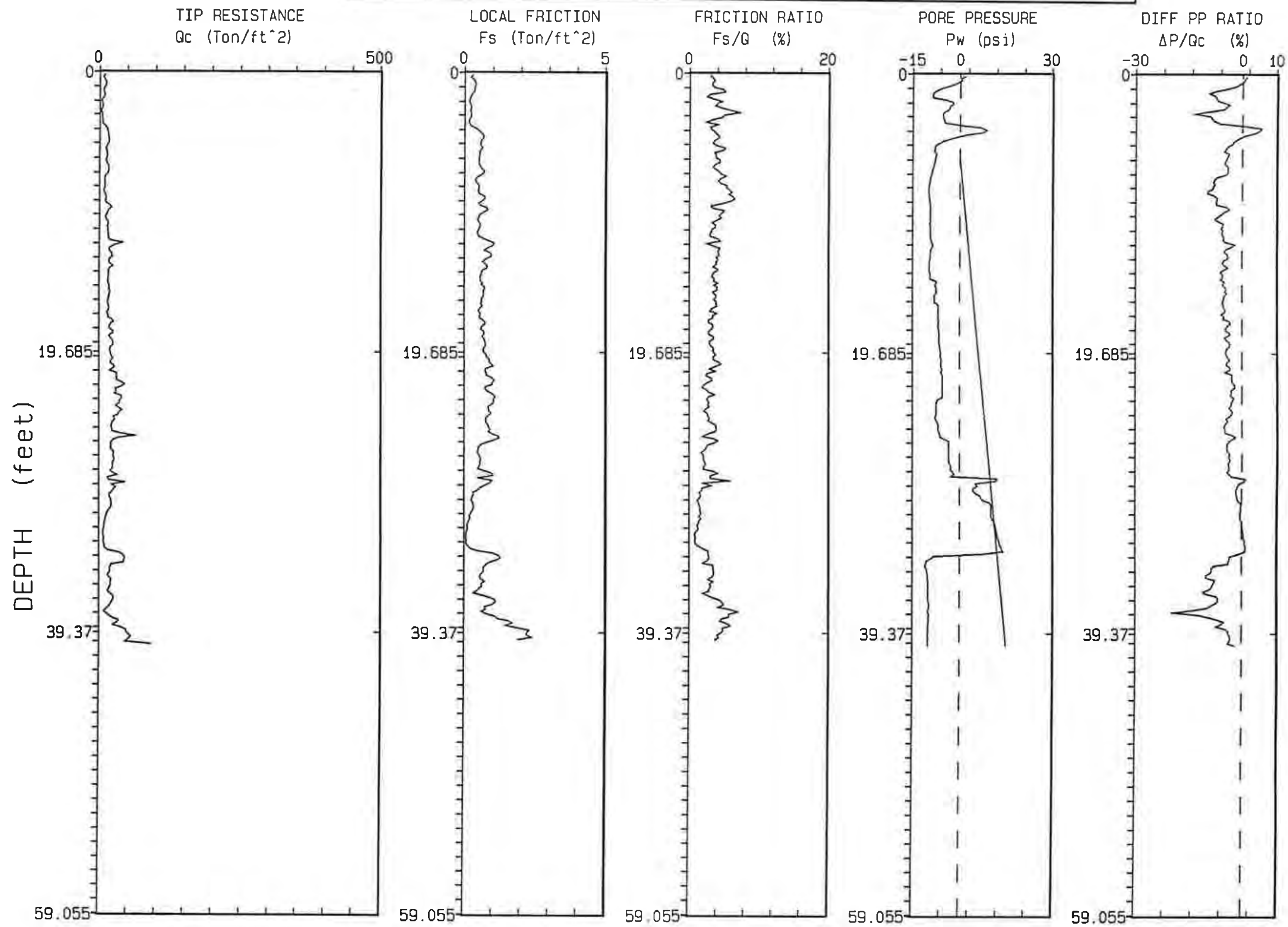
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-17

WOODWARD-CLYDE CONSULTANTS

CPT-18

Operator:	J. Oldham	**CPT Date:**	3/29/95
Page:	1/1	**Location:**	Baldwin
Cone Used:	243	**Job Number:**	5E08560



Depth Increment : .05 m

Max Depth : 40.19 ft

FIG. A-4-18

WOODWARD-CLYDE CONSULTANTS

CPT-18

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	9.27	0.31	3.34	0.03	clay	UNDFND	UNDFD	9	.5
0.60	2	6.35	0.24	3.78	0.09	clay	UNDFND	UNDFD	6	.3
0.95	3	4.21	0.20	4.77	0.15	clay	UNDFND	UNDFD	4	.2
1.25	4	8.40	0.27	3.24	0.22	clay	UNDFND	UNDFD	8	.4
1.55	5	15.67	0.60	3.85	0.28	silty clay to clay	UNDFND	UNDFD	10	.9
1.85	6	12.75	0.54	4.23	0.33	clay	UNDFND	UNDFD	12	.7
2.15	7	14.83	0.59	3.96	0.39	silty clay to clay	UNDFND	UNDFD	9	.8
2.45	8	9.47	0.46	4.88	0.42	clay	UNDFND	UNDFD	9	.5
2.75	9	9.73	0.59	6.07	0.45	clay	UNDFND	UNDFD	9	.5
3.05	10	15.53	0.64	4.13	0.48	clay	UNDFND	UNDFD	15	.8
3.35	11	13.72	0.51	3.72	0.51	silty clay to clay	UNDFND	UNDFD	9	.7
3.65	12	20.60	0.66	3.20	0.54	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
3.95	13	21.90	0.88	4.02	0.56	silty clay to clay	UNDFND	UNDFD	14	1.2
4.25	14	18.65	0.71	3.83	0.59	silty clay to clay	UNDFND	UNDFD	12	1.0
4.55	15	16.40	0.58	3.56	0.62	silty clay to clay	UNDFND	UNDFD	10	.9
4.85	16	17.72	0.66	3.74	0.65	silty clay to clay	UNDFND	UNDFD	11	.9
5.15	17	15.78	0.57	3.61	0.68	silty clay to clay	UNDFND	UNDFD	10	.8
5.45	18	19.97	0.63	3.15	0.71	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.75	19	21.68	0.67	3.08	0.73	clayey silt to silty clay	UNDFND	UNDFD	10	1.2
6.05	20	21.38	0.72	3.37	0.76	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
6.40	21	22.94	0.85	3.70	0.79	silty clay to clay	UNDFND	UNDFD	15	1.2
6.70	22	34.80	0.92	2.65	0.82	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
7.00	23	34.52	0.91	2.63	0.85	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
7.35	24	35.40	0.92	2.59	0.88	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
7.65	25	24.05	0.81	3.38	0.91	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
7.95	26	34.65	1.01	2.91	0.94	clayey silt to silty clay	UNDFND	UNDFD	17	1.9
8.25	27	23.58	0.51	2.16	0.97	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
8.55	28	24.33	0.57	2.35	1.00	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
8.85	29	26.50	0.85	3.20	1.03	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
9.15	30	22.62	0.37	1.61	1.05	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
9.45	31	19.10	0.28	1.48	1.08	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
9.75	32	10.60	0.15	1.40	1.11	clayey silt to silty clay	UNDFND	UNDFD	5	.5
10.05	33	8.17	0.08	0.92	1.14	clayey silt to silty clay	UNDFND	UNDFD	4	.3
10.35	34	20.77	0.51	2.47	1.17	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
10.65	35	32.37	0.89	2.76	1.20	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
10.95	36	19.08	0.62	3.24	1.22	clayey silt to silty clay	UNDFND	UNDFD	9	.9
11.25	37	19.92	0.58	2.91	1.25	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
11.55	38	17.67	0.88	4.99	1.28	clay	UNDFND	UNDFD	17	.9

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-18

CPT-18

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	24.92	1.30	5.22	1.31	clay	UNDFND	UNDFD	24	1.3
12.15	40	49.58	2.16	4.35	1.34	silty clay to clay	UNDFND	UNDFD	32	2.7

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-19

Operator:	J. Oldham	**CPT Date:**	3/30/95
Page:	1/1	**Location:**	Baldwin
Cone Used:	243	**Job Number:**	5E08560

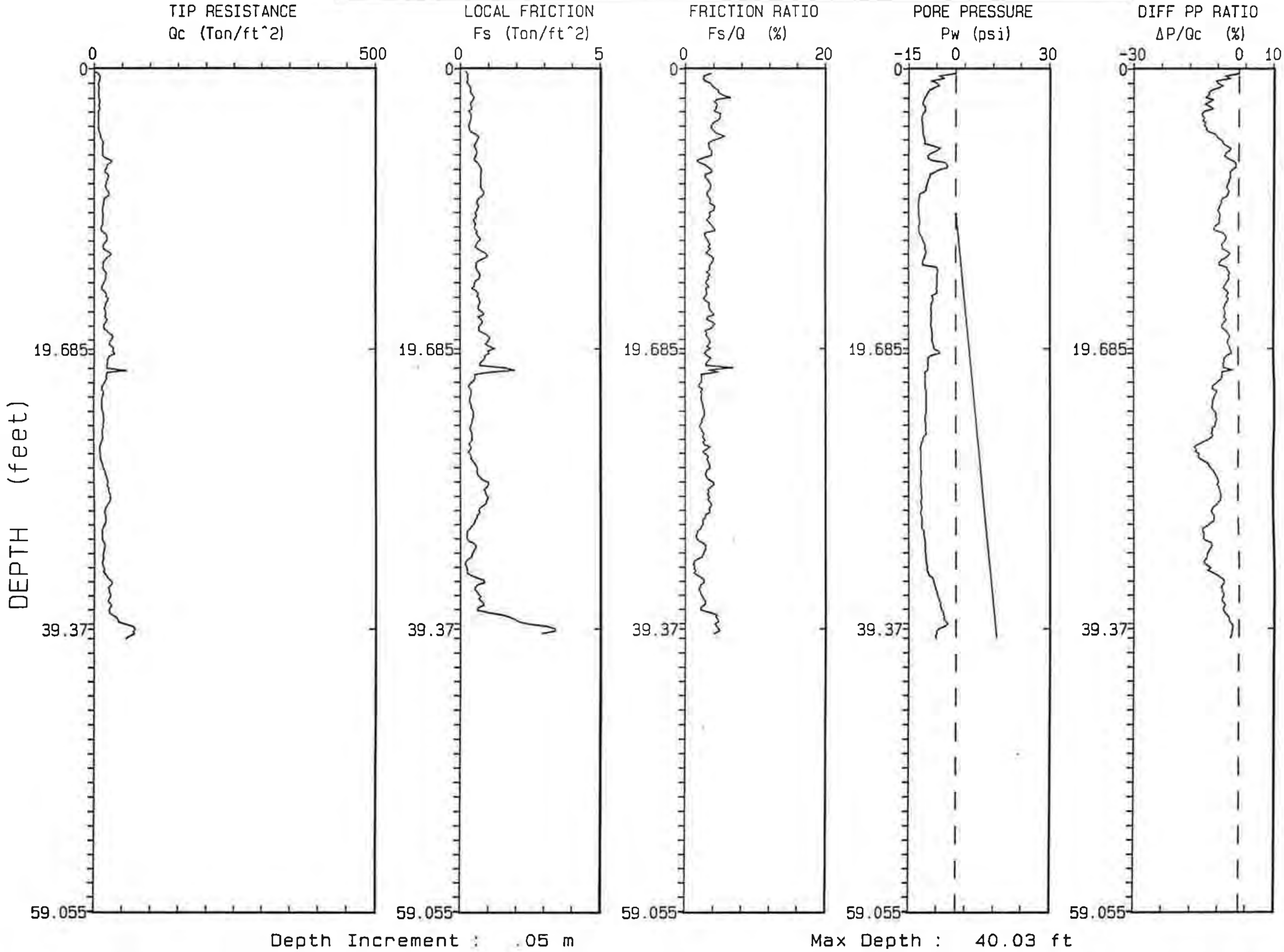


FIG. A-4-19

CPT-19

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	6.97	0.24	3.41	0.03	clay	UNDFND	UNDFD	7	.4
0.60	2	7.88	0.38	4.81	0.09	clay	UNDFND	UNDFD	8	.4
0.95	3	8.44	0.37	4.40	0.15	clay	UNDFND	UNDFD	8	.4
1.25	4	7.80	0.33	4.28	0.22	clay	UNDFND	UNDFD	7	.4
1.55	5	11.30	0.51	4.47	0.28	clay	UNDFND	UNDFD	11	.6
1.85	6	15.28	0.54	3.52	0.33	silty clay to clay	UNDFND	UNDFD	10	.8
2.15	7	24.22	0.62	2.57	0.39	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
2.45	8	22.50	0.73	3.25	0.45	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
2.75	9	22.72	0.76	3.33	0.51	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
3.05	10	15.72	0.59	3.79	0.57	silty clay to clay	UNDFND	UNDFD	10	.8
3.35	11	15.02	0.52	3.47	0.61	silty clay to clay	UNDFND	UNDFD	10	.8
3.65	12	18.67	0.61	3.26	0.64	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
3.95	13	20.52	0.67	3.25	0.67	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
4.25	14	18.97	0.71	3.72	0.69	silty clay to clay	UNDFND	UNDFD	12	1.0
4.55	15	19.37	0.63	3.26	0.72	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
4.85	16	17.38	0.53	3.06	0.75	clayey silt to silty clay	UNDFND	UNDFD	8	.9
5.15	17	20.95	0.67	3.18	0.78	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.45	18	20.40	0.75	3.70	0.81	silty clay to clay	UNDFND	UNDFD	13	1.1
5.75	19	25.08	0.81	3.22	0.84	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
6.05	20	30.43	1.01	3.31	0.86	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
6.40	21	25.74	0.93	3.59	0.89	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
6.70	22	27.43	0.83	3.01	0.93	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
7.00	23	15.58	0.34	2.18	0.95	clayey silt to silty clay	UNDFND	UNDFD	7	.8
7.35	24	14.99	0.38	2.54	0.98	clayey silt to silty clay	UNDFND	UNDFD	7	.7
7.65	25	17.38	0.41	2.35	1.02	clayey silt to silty clay	UNDFND	UNDFD	8	.9
7.95	26	15.38	0.39	2.53	1.04	clayey silt to silty clay	UNDFND	UNDFD	7	.8
8.25	27	11.37	0.33	2.87	1.07	silty clay to clay	UNDFND	UNDFD	7	.5
8.55	28	14.43	0.48	3.32	1.10	silty clay to clay	UNDFND	UNDFD	9	.7
8.85	29	22.05	0.71	3.24	1.13	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
9.15	30	26.38	0.91	3.47	1.16	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
9.45	31	23.65	0.82	3.45	1.19	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
9.75	32	19.73	0.55	2.79	1.21	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
10.05	33	14.62	0.27	1.85	1.24	clayey silt to silty clay	UNDFND	UNDFD	7	.7
10.35	34	17.18	0.45	2.61	1.27	clayey silt to silty clay	UNDFND	UNDFD	8	.8
10.65	35	15.32	0.26	1.72	1.30	clayey silt to silty clay	UNDFND	UNDFD	7	.7
10.95	36	21.60	0.41	1.92	1.33	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
11.25	37	27.83	0.61	2.19	1.36	sandy silt to clayey silt	UNDFND	UNDFD	11	1.5
11.55	38	27.73	0.72	2.59	1.38	sandy silt to clayey silt	UNDFND	UNDFD	11	1.4

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-19

CPT-19

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	35.52	1.46	4.10	1.41	silty clay to clay	UNDFND	UNDFD	23	1.9
12.15	40	66.70	2.52	3.78	1.44	clayey silt to silty clay	UNDFND	UNDFD	32	3.7

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-19

WOODWARD-CLYDE CONSULTANTS

CPT-20

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

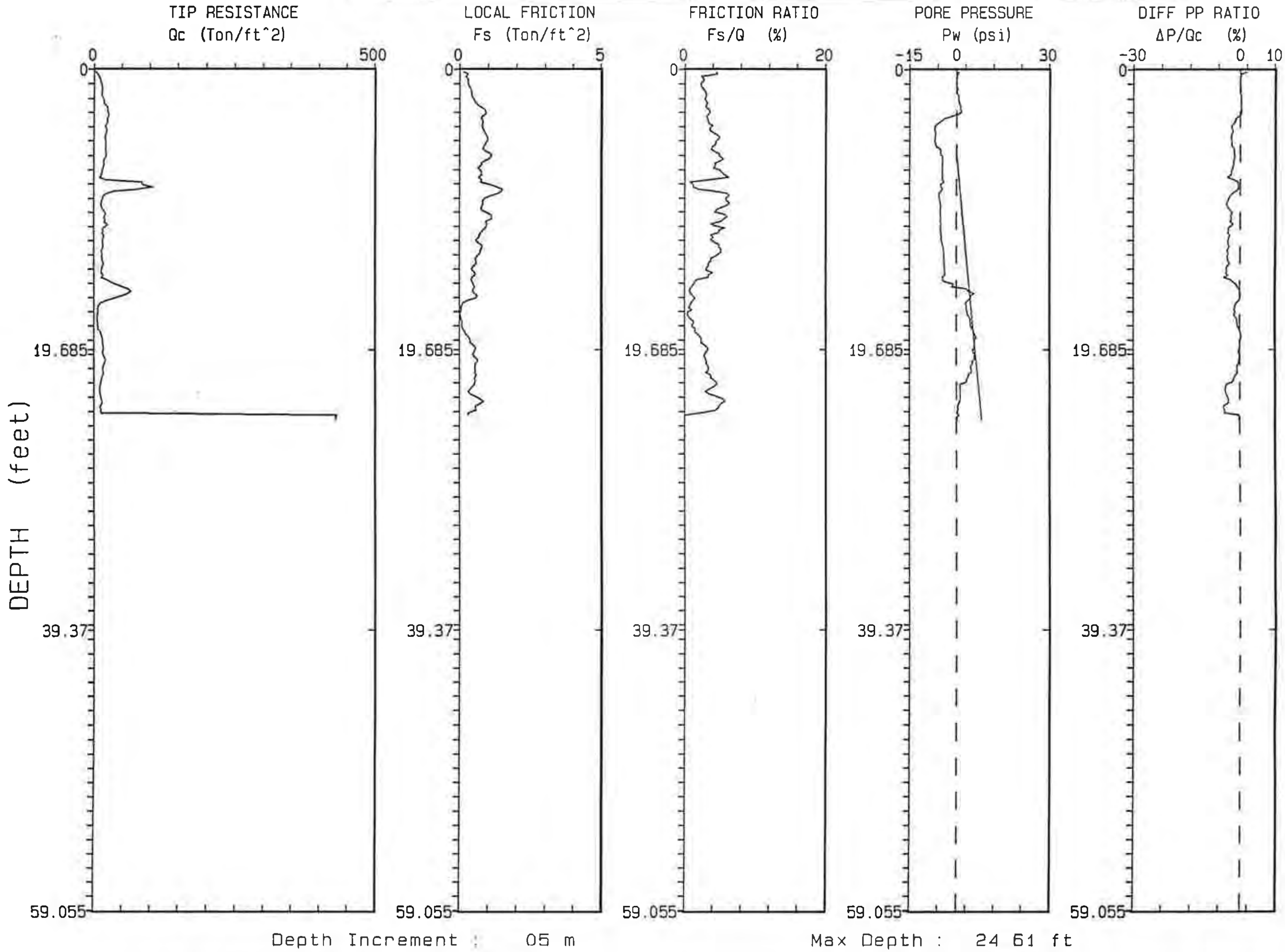


FIG. A-4-20

WOODWARD-CLYDE CONSULTANTS

CPT-20

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	8.68	0.25	2.82	0.03	silty clay to clay	UNDFND	UNDFD	6	.5
0.60	2	14.27	0.40	2.81	0.09	clayey silt to silty clay	UNDFND	UNDFD	7	.8
0.95	3	22.29	0.73	3.28	0.15	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
1.25	4	23.03	0.79	3.44	0.22	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
1.55	5	21.10	0.92	4.38	0.28	clay	UNDFND	UNDFD	20	1.2
1.85	6	21.30	0.94	4.41	0.33	clay	UNDFND	UNDFD	20	1.2
2.15	7	16.73	0.79	4.74	0.39	clay	UNDFND	UNDFD	16	.9
2.45	8	38.47	0.79	2.06	0.42	sandy silt to clayey silt	UNDFND	UNDFD	15	2.2
2.75	9	44.78	1.26	2.80	0.45	sandy silt to clayey silt	UNDFND	UNDFD	17	2.6
3.05	10	15.35	0.81	5.26	0.48	clay	UNDFND	UNDFD	15	.8
3.35	11	20.52	1.03	5.00	0.51	clay	UNDFND	UNDFD	20	1.1
3.65	12	16.18	0.72	4.47	0.54	clay	UNDFND	UNDFD	16	.9
3.95	13	14.88	0.72	4.84	0.56	clay	UNDFND	UNDFD	14	.8
4.25	14	14.83	0.54	3.66	0.59	silty clay to clay	UNDFND	UNDFD	9	.8
4.55	15	18.28	0.47	2.55	0.62	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
4.85	16	54.15	0.52	0.96	0.65	silty sand to sandy silt	50-60	40-42	17	UNDEFINED
5.15	17	15.15	0.18	1.20	0.68	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
5.45	18	6.22	0.05	0.79	0.71	sensitive fine grained	UNDFND	UNDFD	3	.3
5.75	19	10.88	0.20	1.80	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.05	20	16.12	0.47	2.90	0.76	clayey silt to silty clay	UNDFND	UNDFD	8	.8
6.40	21	17.64	0.55	3.09	0.79	clayey silt to silty clay	UNDFND	UNDFD	8	.9
6.70	22	14.45	0.53	3.70	0.82	silty clay to clay	UNDFND	UNDFD	9	.7
7.00	23	10.83	0.43	3.94	0.85	clay	UNDFND	UNDFD	10	.5
7.35	24	12.87	0.61	4.70	0.88	clay	UNDFND	UNDFD	12	.6

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

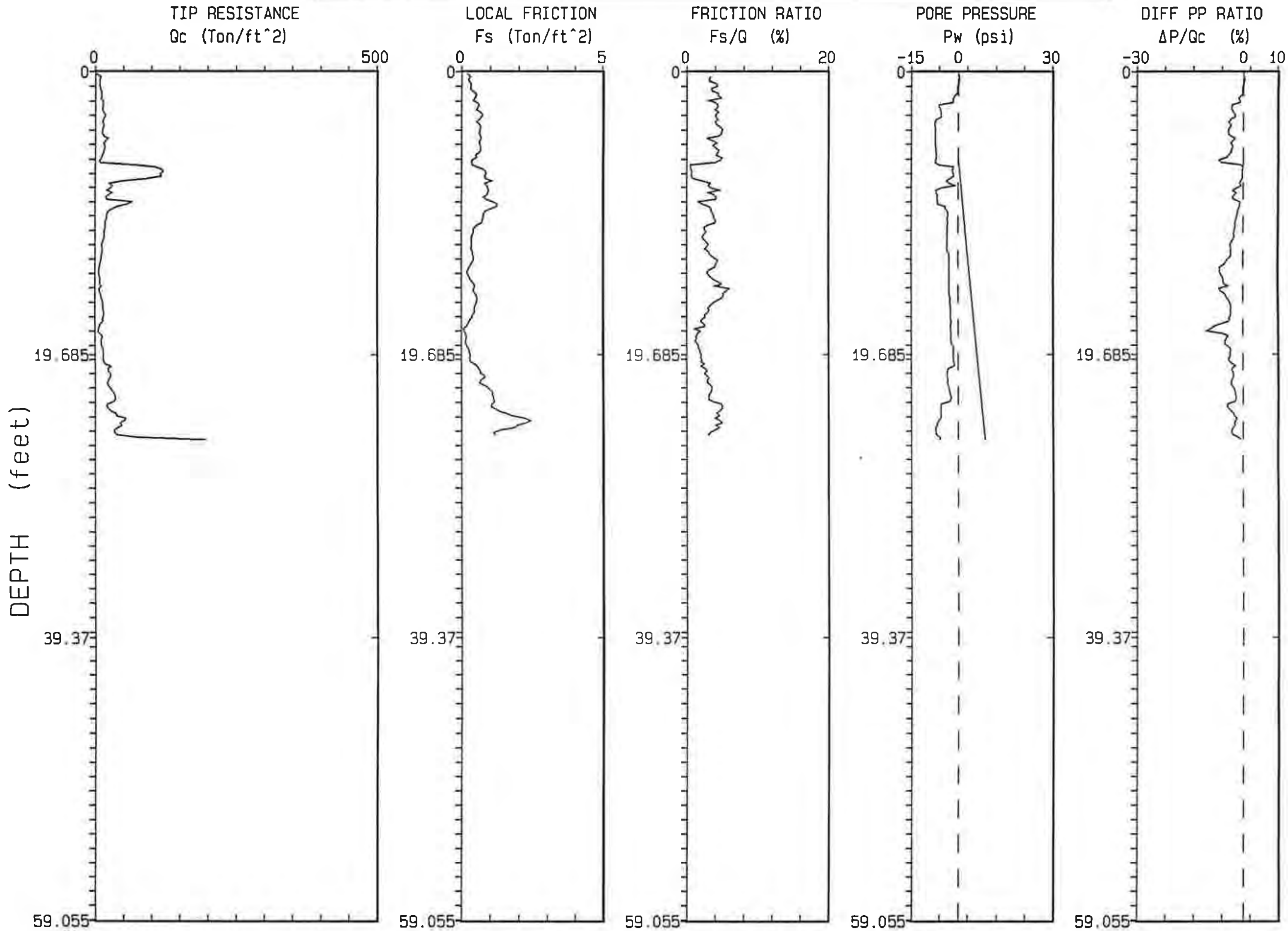
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-20

WOODWARD-CLYDE CONSULTANTS

CPT-21

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m   Max Depth : 25.59 ft

FIG. A-4-21

WOODWARD-CLYDE CONSULTANTS

CPT-21

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	6.72	0.28	4.13	0.03	clay	UNDFND	UNDFD	6	.3
0.60	2	10.83	0.43	3.93	0.09	clay	UNDFND	UNDFD	10	.6
0.95	3	14.66	0.61	4.18	0.15	clay	UNDFND	UNDFD	14	.8
1.25	4	13.63	0.62	4.53	0.22	clay	UNDFND	UNDFD	13	.7
1.55	5	16.78	0.65	3.84	0.28	silty clay to clay	UNDFND	UNDFD	11	.9
1.85	6	12.48	0.55	4.41	0.33	clay	UNDFND	UNDFD	12	.7
2.15	7	90.07	0.62	0.69	0.39	sand to silty sand	70-80	44-46	22	UNDEFINED
2.45	8	56.38	0.89	1.57	0.42	silty sand to sandy silt	60-70	42-44	18	UNDEFINED
2.75	9	30.02	0.91	3.04	0.45	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
3.05	10	31.53	0.97	3.07	0.48	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
3.35	11	17.72	0.59	3.30	0.51	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
3.65	12	14.55	0.37	2.56	0.54	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	11.88	0.38	3.17	0.56	silty clay to clay	UNDFND	UNDFD	8	.6
4.25	14	7.63	0.29	3.80	0.59	clay	UNDFND	UNDFD	7	.4
4.55	15	8.77	0.35	3.96	0.62	clay	UNDFND	UNDFD	8	.4
4.85	16	9.68	0.49	5.06	0.65	clay	UNDFND	UNDFD	9	.5
5.15	17	14.50	0.45	3.12	0.68	silty clay to clay	UNDFND	UNDFD	9	.7
5.45	18	10.22	0.23	2.20	0.71	clayey silt to silty clay	UNDFND	UNDFD	5	.5
5.75	19	10.07	0.14	1.43	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.05	20	14.02	0.26	1.83	0.76	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.40	21	20.79	0.50	2.42	0.79	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
6.70	22	24.25	0.76	3.13	0.82	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
7.00	23	32.77	1.09	3.32	0.85	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
7.35	24	32.07	1.45	4.52	0.88	silty clay to clay	UNDFND	UNDFD	20	1.8
7.65	25	41.78	1.82	4.36	0.91	silty clay to clay	UNDFND	UNDFD	27	2.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

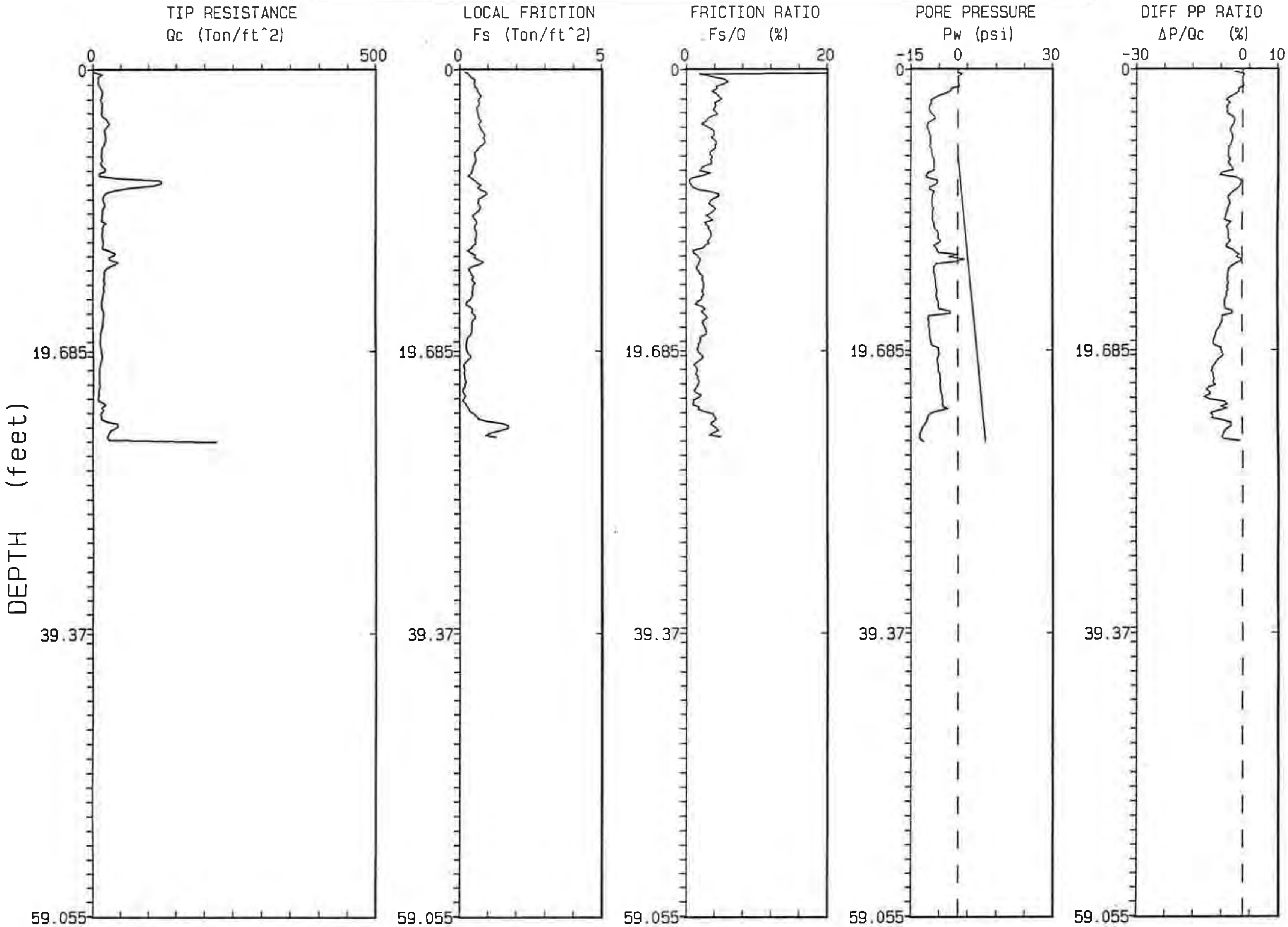
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-21

WOODWARD-CLYDE CONSULTANTS

CPT-22

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 26.08 ft

FIG. A-4-22

WOODWARD-CLYDE CONSULTANTS

CPT-22

Operator:	J. Oldham		CPT Date:	3/31/95
Page:	1/1		Location:	Baldwin
Cone Used:	243		Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	9.10	0.40	4.43	0.03	clay	UNDFND	UNDFD	9	.5
0.60	2	15.17	0.66	4.33	0.09	clay	UNDFND	UNDFD	15	.8
0.95	3	15.43	0.65	4.19	0.15	clay	UNDFND	UNDFD	15	.8
1.25	4	24.57	0.71	2.90	0.22	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
1.55	5	21.73	0.86	3.96	0.28	silty clay to clay	UNDFND	UNDFD	14	1.2
1.85	6	16.27	0.62	3.83	0.33	silty clay to clay	UNDFND	UNDFD	10	.9
2.15	7	17.92	0.50	2.79	0.39	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
2.45	8	71.20	0.51	0.72	0.42	sand to silty sand	60-70	42-44	17	UNDEFINED
2.75	9	31.97	0.80	2.50	0.45	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
3.05	10	18.17	0.66	3.66	0.48	silty clay to clay	UNDFND	UNDFD	12	1.0
3.35	11	17.28	0.54	3.14	0.51	clayey silt to silty clay	UNDFND	UNDFD	8	.9
3.65	12	16.95	0.57	3.37	0.54	silty clay to clay	UNDFND	UNDFD	11	.9
3.95	13	26.43	0.46	1.72	0.56	sandy silt to clayey silt	UNDFND	UNDFD	10	1.5
4.25	14	32.40	0.58	1.79	0.59	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
4.55	15	20.38	0.46	2.24	0.62	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
4.85	16	18.98	0.46	2.40	0.65	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
5.15	17	16.88	0.35	2.09	0.68	clayey silt to silty clay	UNDFND	UNDFD	8	.9
5.45	18	18.38	0.49	2.66	0.71	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
5.75	19	14.37	0.37	2.55	0.73	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.05	20	13.97	0.25	1.79	0.76	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.40	21	13.26	0.24	1.84	0.79	clayey silt to silty clay	UNDFND	UNDFD	6	.7
6.70	22	11.20	0.18	1.60	0.82	clayey silt to silty clay	UNDFND	UNDFD	5	.5
7.00	23	10.03	0.16	1.55	0.85	clayey silt to silty clay	UNDFND	UNDFD	5	.5
7.35	24	16.29	0.29	1.77	0.88	clayey silt to silty clay	UNDFND	UNDFD	8	.8
7.65	25	30.65	1.20	3.91	0.91	silty clay to clay	UNDFND	UNDFD	20	1.7
7.95	26	60.65	0.78	1.29	0.94	silty sand to sandy silt	50-60	38-40	19	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-22

WOODWARD-CLYDE CONSULTANTS

CPT-23

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

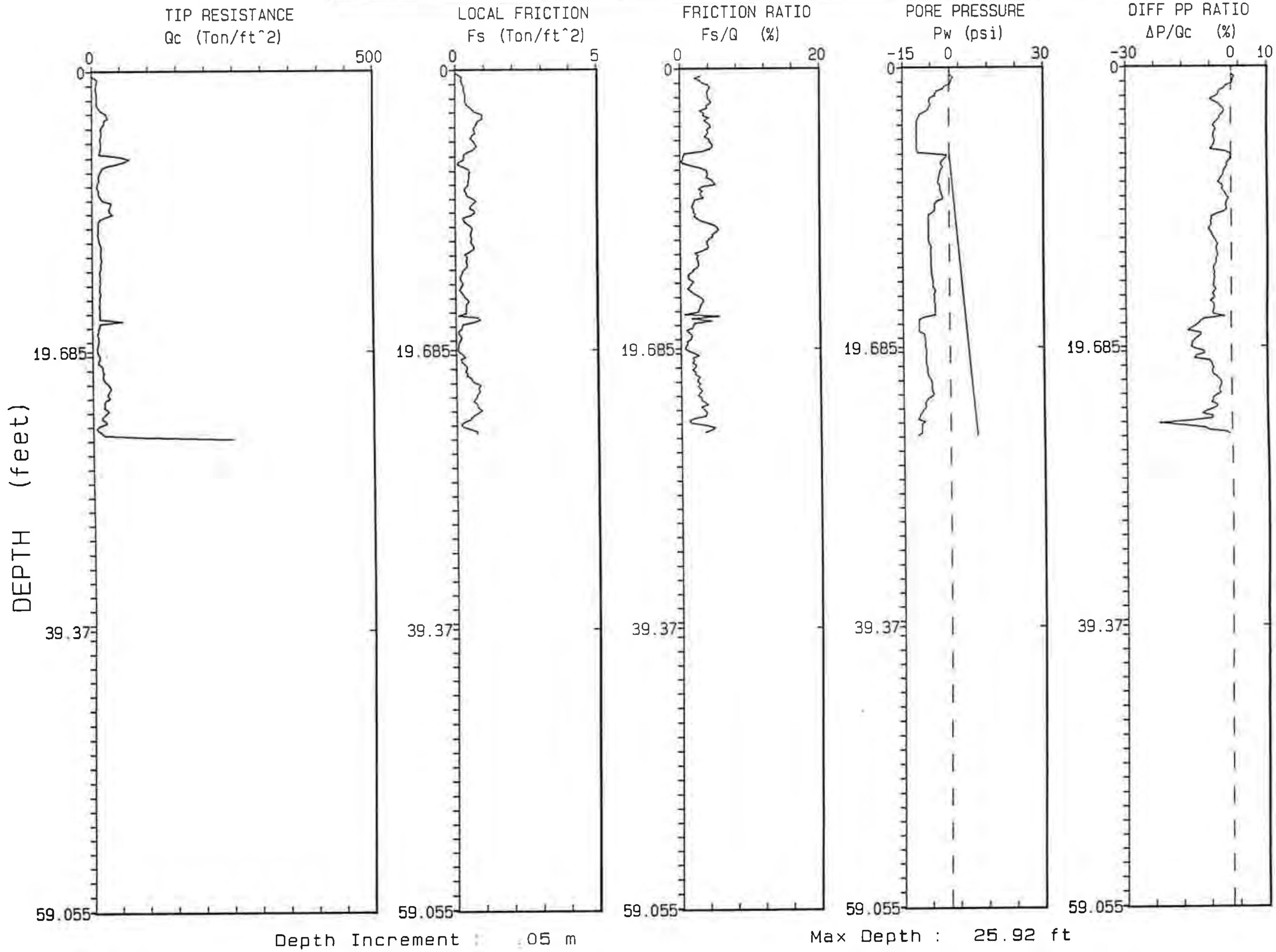


FIG. A-4-23

WOODWARD-CLYDE CONSULTANTS

CPT-23

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	5.55	0.17	3.14	0.03	clay	UNDFND	UNDFD	5	.3
0.60	2	8.07	0.33	4.05	0.09	clay	UNDFND	UNDFD	8	.4
0.95	3	15.29	0.55	3.61	0.15	silty clay to clay	UNDFND	UNDFD	10	.8
1.25	4	20.70	0.79	3.84	0.22	silty clay to clay	UNDFND	UNDFD	13	1.2
1.55	5	16.08	0.64	3.96	0.28	silty clay to clay	UNDFND	UNDFD	10	.9
1.85	6	29.07	0.51	1.76	0.33	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
2.15	7	29.58	0.29	0.97	0.39	silty sand to sandy silt	40-50	38-40	9	UNDEFINED
2.45	8	10.93	0.47	4.25	0.42	clay	UNDFND	UNDFD	10	.6
2.75	9	14.08	0.43	3.06	0.45	silty clay to clay	UNDFND	UNDFD	9	.7
3.05	10	33.20	0.63	1.89	0.48	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
3.35	11	14.17	0.41	2.91	0.51	clayey silt to silty clay	UNDFND	UNDFD	7	.7
3.65	12	11.50	0.56	4.84	0.54	clay	UNDFND	UNDFD	11	.6
3.95	13	15.62	0.54	3.45	0.56	silty clay to clay	UNDFND	UNDFD	10	.8
4.25	14	15.63	0.39	2.49	0.59	clayey silt to silty clay	UNDFND	UNDFD	7	.8
4.55	15	13.92	0.21	1.50	0.62	clayey silt to silty clay	UNDFND	UNDFD	7	.7
4.85	16	13.77	0.22	1.61	0.65	clayey silt to silty clay	UNDFND	UNDFD	7	.7
5.15	17	13.55	0.40	2.92	0.68	silty clay to clay	UNDFND	UNDFD	9	.7
5.45	18	20.27	0.49	2.42	0.71	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.75	19	10.68	0.16	1.49	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.05	20	9.33	0.09	0.97	0.76	clayey silt to silty clay	UNDFND	UNDFD	4	.4
6.40	21	14.03	0.28	1.98	0.79	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.70	22	21.33	0.47	2.20	0.82	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
7.00	23	29.63	0.78	2.64	0.85	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
7.35	24	22.91	0.74	3.21	0.88	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
7.65	25	16.18	0.38	2.32	0.91	clayey silt to silty clay	UNDFND	UNDFD	8	.8

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-23

APPENDIX B

LABORATORY TESTING

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed to characterize the index and engineering properties of the subsurface soils. Index tests consisted of visual classification, water content, dry unit weight, and liquid and plastic limits. Engineering property tests consisted of a direct shear test, unconfined compression tests, unconsolidated-undrained (UU) triaxial compression tests, and consolidated-undrained (CIU) triaxial compression tests. The direct shear test was extended to determine the residual strength.

Results of the laboratory tests are summarized and given in Tables B-1 through B-3 in this appendix, and appear on the detailed boring logs. Plots of the grain size distributions are shown in Figures B-1 through B-6. Compaction curves are included as Figures B-7 through B-10. Consolidated drained triaxial test results for drained peak strength are given in Figures B-11 through B-14. Direct shear test results are shown in Figures B-15 and B-16.

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-01	5.0	CL	17				7.8	11.7	
B-01	10.0	CH	27		61	21			
B-01	15.0	CL	15				7.2	11.2	
B-01	20.0	CL	19						
B-01	35.0	CL	19						
B-01	40.0	CL	25						
B-01	45.0	CL	23		44	17			
B-01	50.0	CL	14						
B-01	55.0	CL	26						
B-01	60.0	CL	30						
B-01	65.0	CL	25						
B-01	70.0	CL	19						
B-01	75.0	CL	23						
B-02	5.0	CL	20		37	17			
B-02	10.0	CL	21		44	18			
B-02	15.0	CL	22		44	19			
B-02	20.0	CH	26		55	21			
B-02	24.5	SP	28						
B-02	29.5	CL	23						
B-02	34.5	CL	23						
B-02	39.5	CL	32		49	19			
B-02	44.5	CL	18		38	18			
B-02	49.5	CH	23		51	20			
B-02	54.5	CL	21		34	18			
B-02	59.5	CL	18		35	15			
B-02	64.5	CL	25		34	19			
B-02	69.5	CL	22						
B-03	0.0		24						
B-03	2.0		20						
B-03	4.0		18						
B-03	6.0		17						
B-03	8.0	CL	18		43	18			
B-03	10.0		18						
B-03	12.0	CL	18		37	18			
B-03	14.0	CL	20		44	18			
B-03	16.0	CL	17		46	21			
B-03	18.0	CL	23		47	21			
B-03	20.0	SM	18						
B-03	25.0		18						
B-03	30.0	CL	22						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-03	35.0	CH	25						
B-03	40.0	CL	20		44	18			
B-03	45.0	CH							
B-03	55.0	ML							
B-03	60.0	CH							
B-03	65.0	CH							
B-03	75.0	CH							
B-04	5.0	CL	20						
B-04	10.0	CL	17		43	18			
B-04	25.0	ML	27		50	20			
B-04	30.0	CL	20		42	20			
B-04	35.0	CL	16	111	42	20	2.7	15.0	
B-04	45.0	CL	23						
B-04	55.0	CH	24						
B-04	60.0		19						
B-04	65.0		12						
B-04	70.0	CH	19						
B-04	75.0	CH	27						
B-05	10.0		21						
B-05	20.0		17						
B-05	30.0		22						
B-05	35.0	CH							
B-05	50.0	CH	20						
B-05	60.0	CH							
B-05	65.0	CH							
B-05	70.0	CH	23						
B-05	75.0	CH							
B-06	5.0	CL							
B-06	10.0	CL	17	116			5.8	15.1	
B-06	15.0	CL	18		47	18			
B-06	20.0		17						
B-06	25.0		25						
B-06	30.0	CL							
B-06	35.0	CL	21	109			1.4	15.0	
B-06	40.0	CL	23						
B-06	50.0	CH	20	111			3.6	11.1	
B-06	55.0	CH							
B-06	60.0	CH							
B-06	65.0	CH	22						
B-06	70.0		16						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-06	75.0	CH							
B-07	5.0	CL							
B-07	10.0		18						
B-07	15.0	CL							
B-07	20.0	CL	21	116			8.1	13.5	
B-07	25.0	CL	15						
B-07	30.0	CL	17	117			7.3	14.9	
B-07	35.0		25						
B-07	40.0	CL	22	108			4.4	3.9	
B-07	45.0	CL							
B-07	50.0	CL	18						
B-07	55.0	CL							
B-07	65.0	CH	22						
B-07	70.0	CL							
B-07	75.0	CH							
B-07	80.0	CH	18						
B-08	5.0	CL	17				6.1	14.9	
B-08	10.0	CL	18				6.1	14.8	
B-08	15.0	CL	16						
B-08	20.0	CL	25		46	22			
B-08	25.0	CL	15						
B-08	30.0		16	111			6.8	11.1	
B-08	35.0	CL	19						
B-08	40.0		20	106			3.2	6.0	
B-08	45.0	SP	31						
B-08	50.0		20						
B-08	55.0	CL	19						
B-08	60.0	CL	23						
B-08	70.0	CL	21						
B-08	75.0		20						
B-08	80.0	CL	21						
B-09	5.0		22	104					
B-09	10.0	CH	22		50	20			
B-09	15.0		18	79					
B-09	25.0	CL	24						
B-09	30.0	CL	20						
B-09	35.0		20	110			3.7	13.8	
B-09	40.0	CL	23		34	18			
B-09	50.0	CL	17						
B-09	55.0	CL	23						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-09	60.0	CL	14						
B-09	70.0		25						
B-09	75.0	CL	16						
B-09	80.0	CL	11						
B-10	5.0	CL	23						
B-10	10.0	CL	15	114					
B-10	15.0	CL	15		42	18			
B-10	20.0	CL	11						
B-10	25.0	CL	24		43	18			
B-10	30.0	CL	19	107			5.8	11.6	
B-10	35.0	CL	22						
B-10	40.0	ML	26		32	24			
B-10	45.0	CL	24		32	18			
B-10	50.0	CL	25	97	40	18	1.9	11.3	
B-10	55.0	CH	19	107	57	15	6.3	15.5	
B-10	60.0	CL	27						
B-10	65.0	SM	14						
B-10	70.0	CH	24		52	28			
B-11A	4.0	CL	20		39	21			
B-11A	6.0		21						
B-11A	8.0	CL	25		47	21			
B-11A	10.0	CH	23		52	23			
B-11A	12.0		24						
B-11A	14.0		20						
B-11A	16.0		20						
B-11A	18.0	CL	20		45	19			
B-11A	20.0		21		47	18			
B-11A	25.0	CL	20		49	21			
B-11A	30.0	CL	21		29	17			
B-11A	35.0		13						
B-11A	40.0		26						
B-12	4.0		23						
B-12	8.0	CH	31		61	22			
B-12	14.0		18						
B-12	25.0	CL	20		46	23			
B-12	30.0	CL	22		47	24			
B-13	4.0		21						
B-13	6.0		23						
B-14	4.0		27						
B-14	6.0		24						

TABLE B-1

SUMMARY OF LABORATORY TEST DATA

Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-15	5.0	CH	16						
B-15	10.0	CL	17						
B-15	20.0	CL	16	101			0.0	0.0	
B-15	25.0		20						
B-15	30.0		19						
B-15	35.0	CL	24						
B-15	45.0	CL	24						
B-15	50.0		24						
B-15	55.0		22						
B-15	60.0	CH	26						
B-15	65.0	CH	37						
B-15	70.0	CH	23						
B-15	75.0	CH							
B-15	80.0	CH							
P-02A	38.0	CH	28		59	26			
P-04	23.0	CL	16		29	16			
P-04	24.0	CH			73	37			

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH: TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	REMARKS
B-1	S-2	10-12								126.2						
B-1	S-2	11.9	26.6	61	21	40	CH				1.3	3.4				
B-1	S-9	45-47								119.8						
B-1	S-9	46.9	22.6	44	17	27	CL				0.8	0.9				
B-2	S-1	5-7								117.0						
B-2	S-1	6.9	19.6	37	17	20	CL				1.6	2.4				
B-2	S-2	10-12								127.9						
B-2	S-2	11.9	20.6	44	18	26	CL	92.9	34		0.9	1.9				
B-2	S-3	15-17								102.1						
B-2	S-3	16.9	21.7	44	19	25	CL				0.9	2.8				
B-2	S-4	20-22								114.7						
B-2	S-4	20.05	17.9								1.6	>4.5				
B-2	S-4	20.2					CH	95.0	34	128.7						
B-2	S-4	20.65	26.3	55	21	34	CH				0.8	1.5				
B-2	S-4	20.8	17.7													Bot. Ash
B-2	S-4	21.0								117.7						Bot. Ash
B-2	S-8	39.5-41.5								128.0						
B-2	S-8	41.4	32.4	49	19	30	CL				0.8	2.1				
B-2	S-9	44.5-46.5								122.4						
B-2	S-9	46.4	18.0	38	18	20	CL				1.6	2.9				
B-2	S-10	49.5-51.5								126.7						
B-2	S-10	51.4	22.9	51	20	31	CH				1.8	3.1				
B-2	S-11	54.5-56.5								126.3						
B-2	S-11	56.4	21.1	34	18	16	CL				0.7	1.9				
B-2	S-12	59.5-61.5								131.0						
B-2	S-12	61.4	17.9	35	15	20	CL				0.9	2.1				
B-2	S-13	64.5-65.5								122.8						
B-2	S-13	64.4	24.8	34	19	15	CL				0.8	>4.5				

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH: TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	REMARKS
B-3	S-1	0-2								126.2						
B-3	S-1	1.9	24.0								0.7	2.4				
B-3	S-2	2-4								126.9						
B-3	S-2	3.9	19.8								0.9	3.0				
B-3	S-3	4-6								129.0						
B-3	S-3	5.9	17.9								1.4	3.2				
B-3	S-4	6-8								128.5						
B-3	S-4	7.9	17.4								1.8	4.8				
B-3	S-5	8-10								126.7						
B-3	S-5	8.2	18.1								1.5	2.6				
B-3	S-5	8.55	17.3	44	19	25	CL			123.0			CIU'-C @5psi			
B-3	S-5	8.8	16.4								2.5	4.8				
B-3	S-5	9.0	17.8	41	17	24	CL			131.5			CIU'-C @10psi			
B-3	S-5	9.35	18.4								2.3	4.3				
B-3	S-5	9.9	17.7								1.4	2.8				
B-3	S-6	10-12								127.8						
B-3	S-6	10.2	19.5								2.3	>5				
B-3	S-6	10.75	15.9								2.3	4.8				
B-3	S-6	11.1	18.0							128.1			CIU'-C @15psi			
B-3	S-6	11.35	17.9								2.2	4.8				
B-3	S-7	12-14								124.3						
B-3	S-7	13.9	18.2	37	18	19	CL				1.2	2.9				
B-3	S-8	14-16								122.5						
B-3	S-8	14.2	20.4								0.9	4.2				
B-3	S-8	14.35	19.9	44	18	26	CL	96.9	29	129.1			UU @13psi	44.5	13.4	
B-3	S-8	14.75	16.2								0.9	3.3				
B-3	S-8	15.35	19.0								1.2	3.9				
B-3	S-8	15.95	15.9													
B-3	S-9	16-18								109.3						

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS								STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-3	S-9	16.25	17.3								1.0	3.1				
B-3	S-9	16.5	18.7	46	21	25	CL			124.0			CIU'-C @10psi			
B-3	S-9	16.8	17.1								0.7	2.6				
B-3	S-10	18-20								121.7			CIU'-C @11.5,20psi			
B-3	S-10	18.15	21.6								0.7	1.8				
B-3	S-10	18.8	22.6								1.0	2.1				
B-3	S-10	19.1	23.4	52	22	30	CH			124.2			CIU'-C @15psi			
B-3	S-10	19.4	24.2								0.8	1.8				
B-3	S-10	19.65	21.4	42	19	23	CL	88.6	21	126.1			CIU'-C @20psi			
B-3	S-11	20-22								119.9						
B-3	S-11	21.9	17.5		np		SM				0.3	4.4				
B-3	S-17	50-52														
B-5	S-2	10-12								128.5						
B-5	S-2	11.9	21.1								1.0	2.1				Bot. Ash
B-6	S-4	20-22								134.9						
B-6	S-4	21.9	17.2								1.2	3.6				
B-7	S-2	10-12								121.9						
B-7	S-2	11.9	17.5								1.3	4.1				
B-7	S-7	35-37								120.3						
B-7	S-7	36.9	24.7								0.8	2.6				
B-8	S-4	20-22								136.0						
B-8	S-4	21.9	24.5	46	22	24	CL				0.9	2.4				
B-9	S-2	10-12								126.5						
B-9	S-2	11.9	22.2	50	20	30	CH				1.5	4.1				
B-9	S-8	40-42								124.3						

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS								STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-9	S-8	41.9	22.7	34	18	16	CL				0.5	1.0				
B-10	S-3	15-16.5								127.3						
B-10	S-3	16.4	15.0	42	18	24	CL				1.7	>4.5				
B-10	S-9	45-47								127.6						
B-10	S-9	46.9	24.3	32	18	14	CL				0.9	1.4				
B-11	S-1	1-5														
B-11A	S-1	0-2														
B-11A	S-2	2-4														
B-11A	S-3	4-6								123.3						
B-11A	S-3	5.9	19.5	39	21	18	CL				1.8	3.6				
B-11A	S-4	6-8								129.7						
B-11A	S-4	7.9	20.9								1.6	2.6				
B-11A	S-5	8-10								121.9						
B-11A	S-5	8.5	24.1													
B-11A	S-5	8.65	24.0								0.8	1.8				
B-11A	S-5	8.95	24.7	47	21	26	CL			125.7			UU @8.5psi	20.5	15	
B-11A	S-5	9.9	25.7								1.1	1.9				
B-11A	S-6	10-12								120.4						
B-11A	S-6	11.9	22.9	52	23	29	CH				1.7	3.1				
B-11A	S-7	12-14								125.9						
B-11A	S-7	13.9	24.4								1.3					
B-11A	S-8	14-16								131.8						
B-11A	S-8	15.9	19.7								1.7					
B-11A	S-9	16-18								128.1						
B-11A	S-9	17.9	20.3								1.7					
B-11A	S-10	18-20								118.1						
B-11A	S-10	18.55	23.8													

Prepared by: CMT Reviewed by: [illegible] Date: 6/7/95

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS								STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-11A	S-10	18.85	19.8								1.4	2.0				
B-11A	S-10	19.15	20.0	45	19	26	CL			129.7			UU @10psi	32.0	15	
B-11A	S-10	19.5	19.9													
B-11A	S-11	20-22								138.4						
B-11A	S-11	20.15	21.1								0.8	1.8				
B-11A	S-11	20.35	19.6	45	18	27	CL			130.4			CIU'-C @10psi			
B-11A	S-11	20.7	16.8								1.2	2.8				
B-11A	S-11	21.25	20.0								1.2	2.5				
B-11A	S-11	21.6	25.2	49	18	31	CL			128.9			CIU'-C @20psi			
B-11A	S-11	21.9														
B-11A	S-12	25-27								124.9						
B-11A	S-12	25.05	23.5								0.8	2.3				
B-11A	S-12	25.36	21.2							128.2			CIU'-C @10psi			
B-11A	S-12	25.6	19.0								1.3	4.2				
B-11A	S-12	25.75	20.1													
B-11A	S-12	26.07	20.7	49	21	28	CL			128.4			CIU'-C @30psi			
B-11A	S-12	26.45	18.8								1.6	4.5				Organics
B-11A	S-12	26.9	19.5								0.9	1.9				
B-11A	S-13	30-32								124.2						Wood frag.
B-11A	S-13	30.7	22.5	36	16	20	CL			127.2			CIU'-C @20psi			
B-11A	S-13	30.45	22.4								0.8	1.8				
B-11A	S-13	31	21.1								0.9	1.9				
B-11A	S-13	31.35	20.7	29	17	12	CL			130.0			UU @26psi	23.4	15	
B-11A	S-13	31.75	20.9													
B-11A	S-14	35-37								132.5						Organics
B-11A	S-14	36.9	13.4								1.0	1.9				
B-11A	S-15	40-42								123.5						
B-11A	S-15	41.9	26.2								0.9	1.9				
B-12	S-1	2-4														

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS								STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-12	S-2	4-6								125.8						
B-12	S-2	5.9	23.3								1.0	1.8				
B-12	S-3	6-8														
B-12	S-4	8-10								130.0						
B-12	S-4	9.9	31.0	61	22	39	CH				0.7	1.2				
B-12	S-5	10-12														
B-12	S-6	12-14														
B-12	S-7	14-16								131.8						
B-12	S-7	15.9	18.4								0.8	2.6				
B-13	S-1	2-4														
B-13	S-2	4-6								126.2						
B-13	S-2	4.05	24.7								0.6	1.3				
B-13	S-2	4.65	17.7								0.5	1.9				
B-13	S-2	5.25	22.5								0.5	2.0				
B-13	S-2	5.85	17.6								1.1	3.2				
B-13	S-3	6-8								117.8						
B-13	S-3	6.05	22.8								0.7	1.6				
B-13	S-3	6.65	22.1								0.6	3.1				
B-13	S-3	7.22	22.2													
B-13	S-3	7.85	23.4													
B-13	S-4	8-10														
B-13	S-5	10-12														
B-14	S-1	0-2														
B-14	S-2	2-4														
B-14	S-3	4-6								114.3						Organics
B-14	S-3	4.1	26.6								0.6	1.4				
B-14	S-3	4.64	31.0								0.2	0.8				
B-14	S-3	5.3	23.8								0.9	3.2				

Prepared by: CMT Reviewed by: JJ Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	REMARKS
B-14	S-4	6-8								123.4						
B-14	S-4	6.05	26.4								0.5	1.2				
B-14	S-4	6.65	27.7								0.9	2.1				
B-14	S-4	7.25	22.9								0.9	3.3				
B-14	S-4	7.9	24.1								0.8	3.2				
B-15	S-3	15-17														
B-15	S-8	40-42														
B-101	S-10	49.5-51.5								133.1						
B-101	S-11	51.5-53.5								130.1						
B-101	S-12	53.5-55.5								128.7						
B-101	S-12	54.25	23.7							125.5			DS			Slickenslides
P-2A	S-4	38-40								124.2						
P-2A	S-4	38.2		31	14	17	CL	73.9	22							
P-2A	S-4	38.4	15.5													
P-2A	S-4	38.5	23.2													@ ext. interface
P-2A	S-4	38.5	27.7	59	26	33	CH									@ int. interface
P-2A	S-4	38.6	39.1													
P-2A	S-4	38.75		65	38	27	MH	97.3	59							
73.9																
P-4	S-5	23-25								126.9						
P-4	S-5	23.7	15.9	29	16	13	CL	70.4	19		1.8	2.5				above shear
P-4	S-5	23.9	22.4					70.5	26							shear zone
P-4	S-5	24.2	44.2	73	37	36	CH	93.9	68		0.7	0.5				below shear

Note: (1) Plasticity of fines for USCS symbol based on visual observation unless Atterberg limits reported.

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

Project No.: 5E08560-230 File: INDX2.XLS

TABLE B-3

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS							COMPACTION							REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	SPECIFIC GRAVITY (-4 mat'l)	ASTM STD.	OPT. WATER CONTENT (%)	MAX. DRY UNIT WGT. (pcf)	- 3/8	- 3/4	PREP wet	PREP dry	
TP-1		0-1							2.642								
TP-2		0-1	17.8				SP-SM	5.0									
TP-3	N End	1 of 3	23.0														
TP-3	N End	2 of 3	24.3	40	18	22	CL										
TP-3	N End	3 of 3	24.4														
TP-3	N End	COMP	23.3							D698-91	19.9	105.8	X		X		
TP-3	S End	1 of 3	26.4														
TP-3	S End	2 of 3	24.1														
TP-3	S End	3 of 3	28.4														
TP-3	S End	COMP	24.4	50	20	30	CL			D698-91	22.9	100.8	X		X		
TP-4	11.5'S E Face	3.1	22.9				CL	55.8									
TP-4	N End	1 of 2	22.4	41	18	23	CL										
TP-4	N End	2 of 2	21.9														
TP-4	S End	7'	24.6														
TP-4	S End	2 of 2 7'	23.8														
TP-5	15.5'SE		14.3				CL	63.7									
TP-5	5'S of N End	5'	18.8				CL	66.4									
TP-5	5.8'S	1.5					CL	61.0									
TP-5	E Face	12'S	23.7				CL	67.1									
TP-5	N End	1 of 2 4'	26.0														
TP-5	N End	2 of 2 4'	21.7														
TP-5	N End	COMP 4'	22.3	42	18	24	CL			D698-91	20.0	106.4	X		X		
TP-5	S End	1 of 2	20.0														
TP-5	S End	2 of 2	19.3														
TP-5	S End	COMP	20.4	47	19	28	CL			D698-91	20.7	104.0	X		X		
TP-5	W Wall 12'S	3.5															
TP-7	Bag 1	3.2	21.8				CL	50.2									
TP-7	Bag 2	1.4	12.9				SC	48.6									
TP-7	Bag 3	6	17.4				CL	66.4									
TP-7	New fill	1 of 2	24.7	51	22	29	CH										

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

Project No.: 5E08560-230 File: INDX2.XLS

TABLE B-3

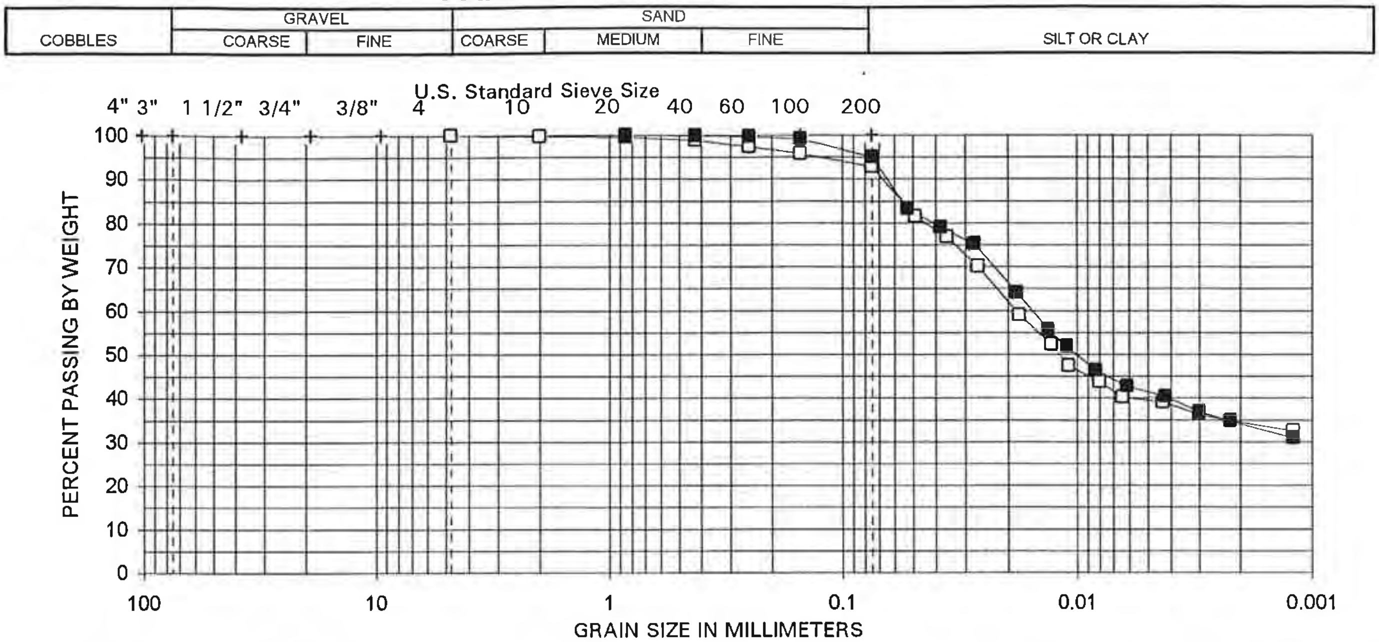
LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS							COMPACTION							REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	SPECIFIC GRAVITY (-4 mat'l)	ASTM STD.	OPT. WATER CONTENT (%)	MAX . DRY UNIT WGT. (pcf)	- 3/8	- 3/4	PREP wet	PREP dry	
TP-7	New fill	2 of 2	23.3														
TP-7	Old fill	1 of 2	21.6														
TP-7	Old fill	2 of 2	22.3	48	21	27	CL										

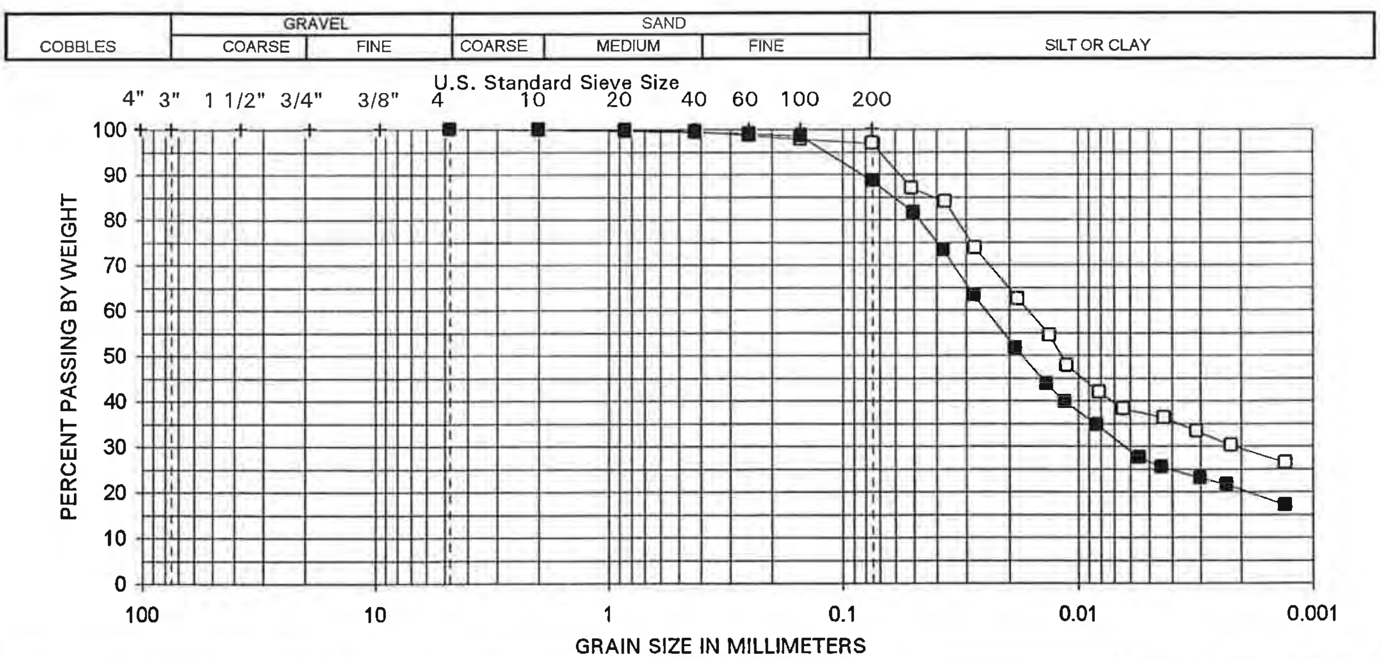
Note: (1) Plasticity of fines for USCS symbol based on visual observation unless Atterberg limits reported.

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
B-2	S-2	10-12	□	CL, brown plastic silty CLAY, trace m-f sand; mica noted.	20.6	44	18
B-2	S-4	20.2	■	CH, brown plastic silty CLAY, trace f. sand; mica noted.	---	---	---



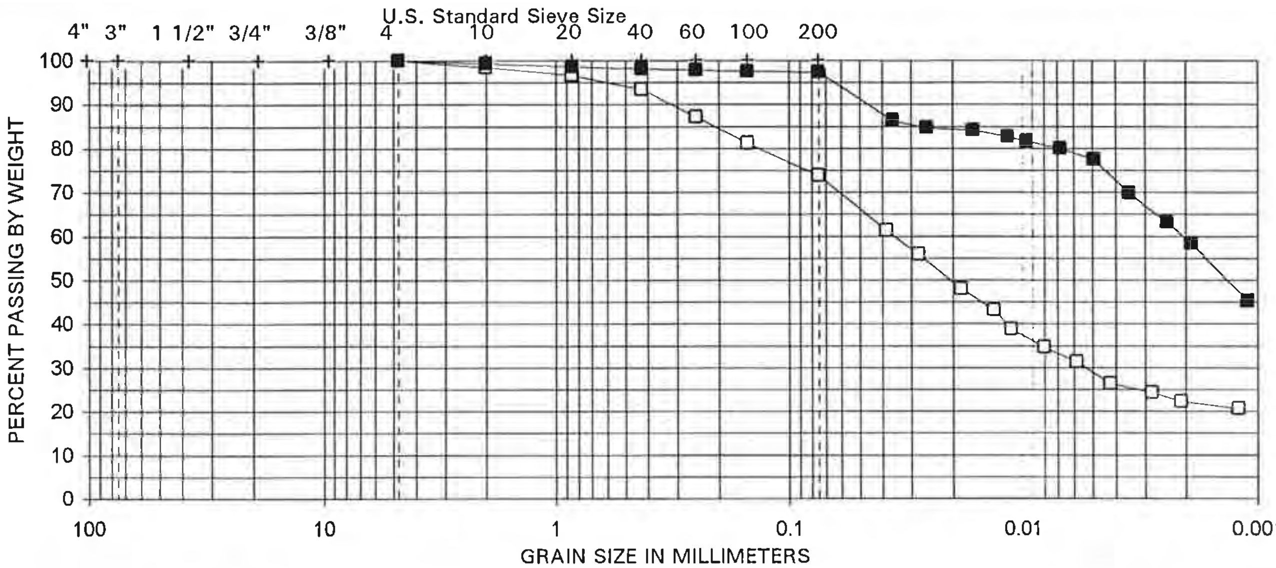
BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
B-3	S-8	14.35	□	CL, brown plastic silty CLAY, trace f. sand; mica noted.	19.9	44	18
B-3	S-10	19.65	■	CL, brown plastic silty CLAY, trace f. sand; mica noted.	21.4	42	19

File: SIEV1A.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 5/25/95

Figure B-1

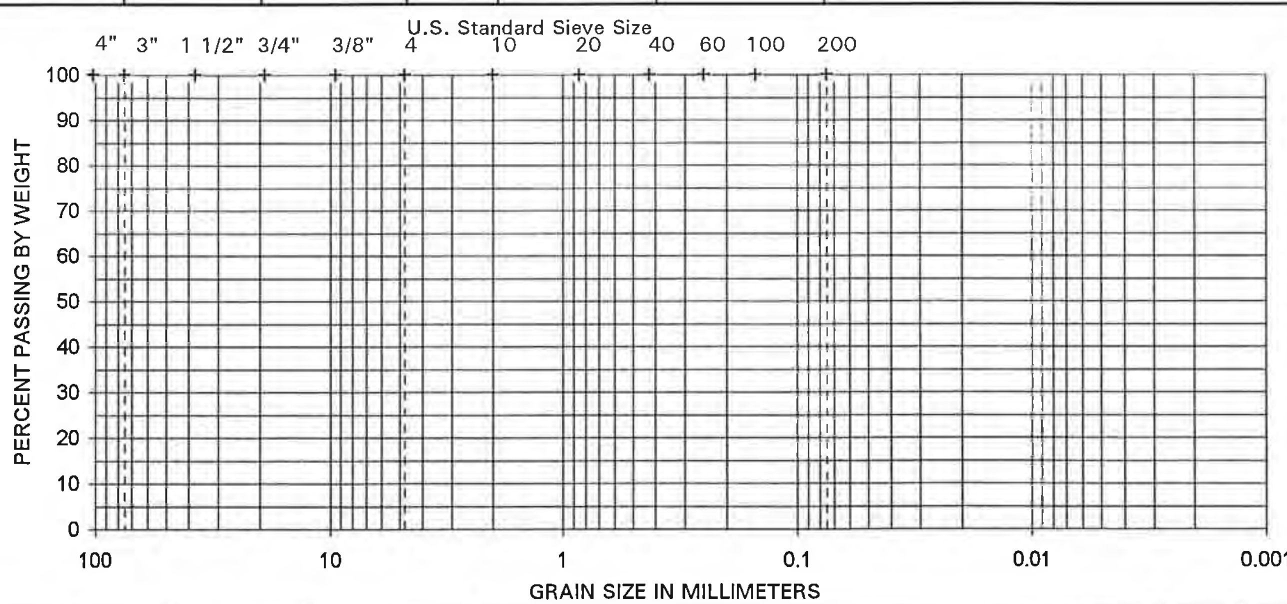
PARTICLE-SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
P-2A	4-A	38.2	□	CL, brown medium plastic silty CLAY, some f. sand, trace	---	31	14
				c-m sand; mica noted.			
P-2A	4-B	38.75	■	MH, mottled green, brown and orange plastic clayey SILT,	---	65	38
				trace m-f sand; mica noted.			

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

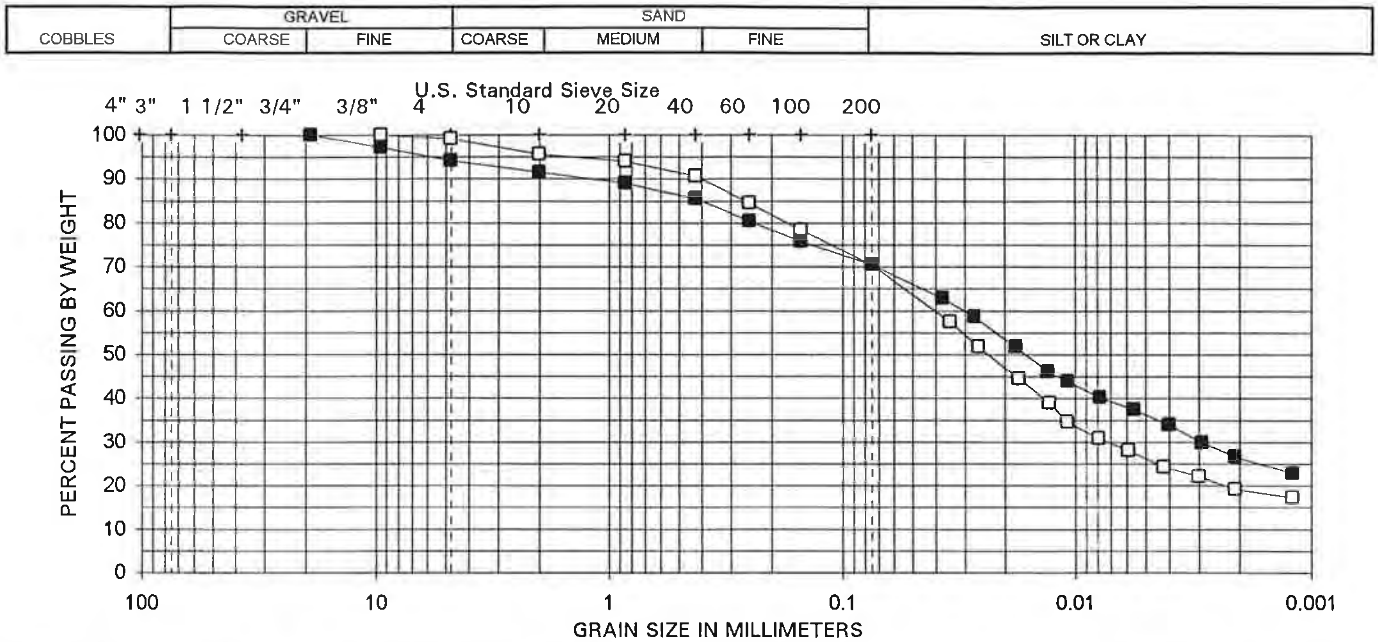


BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
---	---	---	□		---	---	---
---	---	---	■		---	---	---

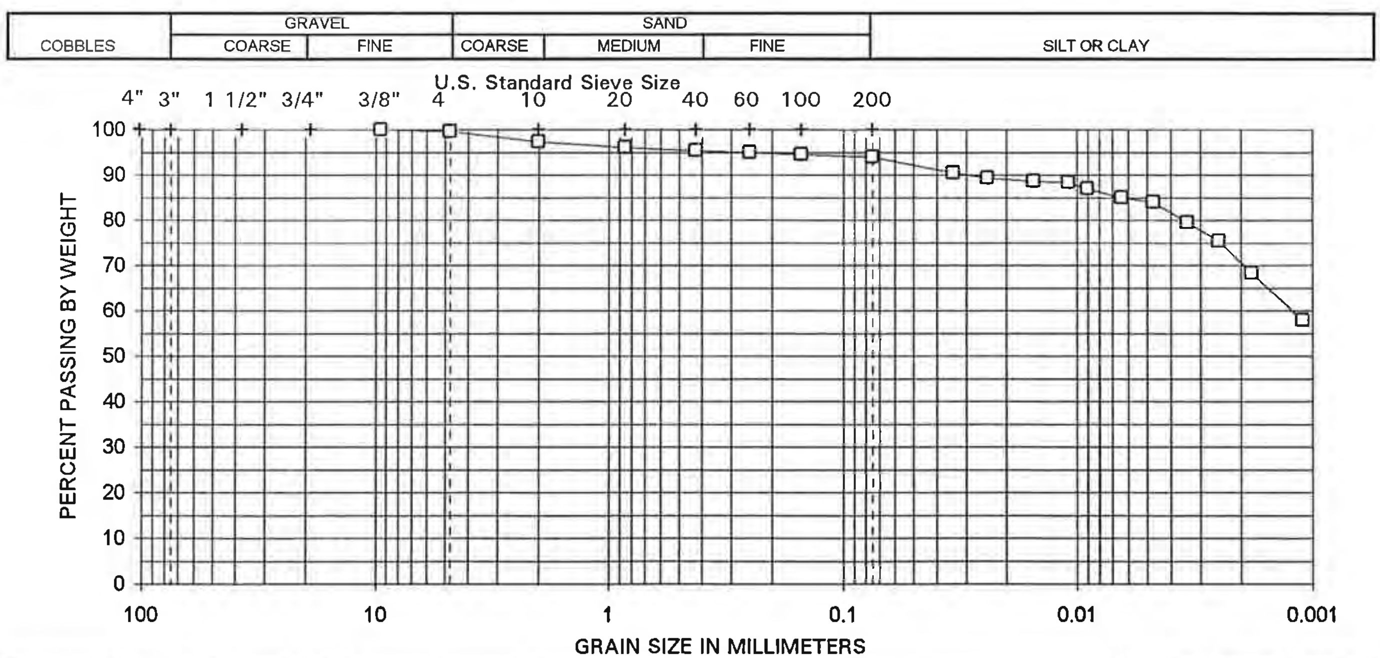
File: SIEV1C.XLS Project No.: 5E08560-230 Plotted by: EK Reviewed by: ________ Date: 6/5/95

Figure B-2

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
P-4	S-5	---	□	CL, brown medium plastic silty CLAY, some c-f sand; mica	15.9	29	16
Above shear zone				noted.			
P-4	S-5	23.9	■		22.4	---	---
Shear zone							

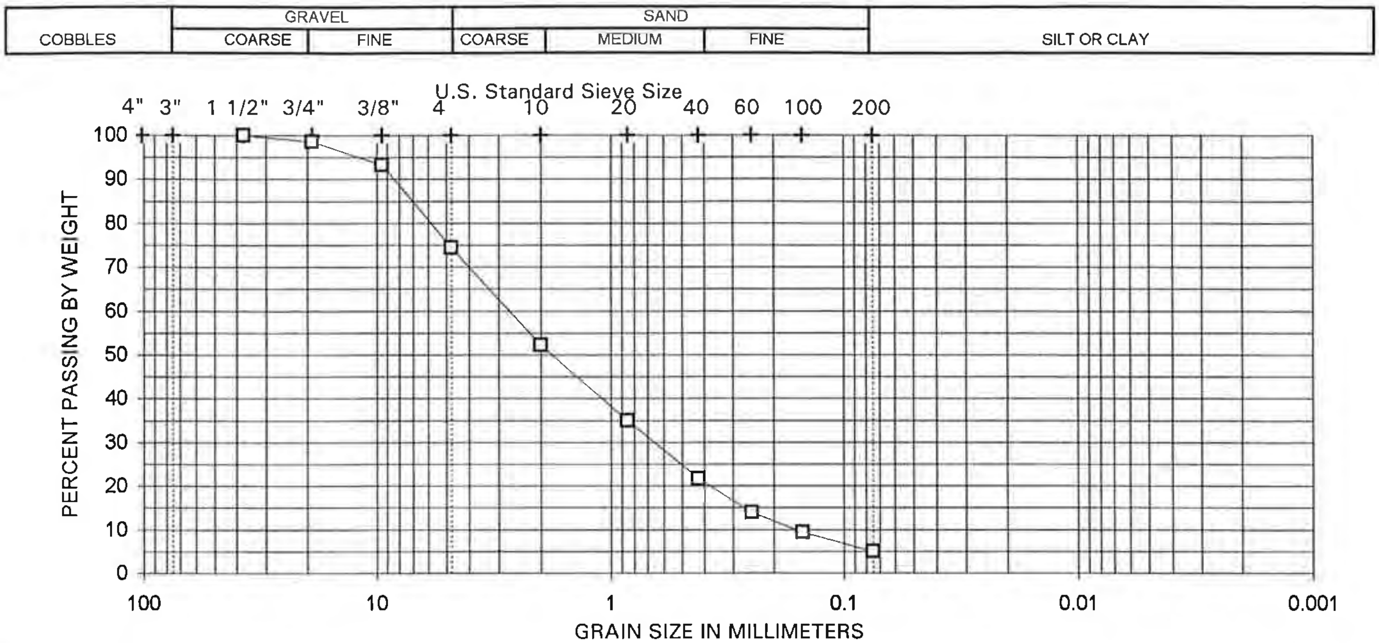


BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
P-4	S-5	---	□	MH, brown plastic clayey SILT, trace c-f sand; mica noted.	44.2	73	37
Below shear zone							
---	---	---	■		---	---	---

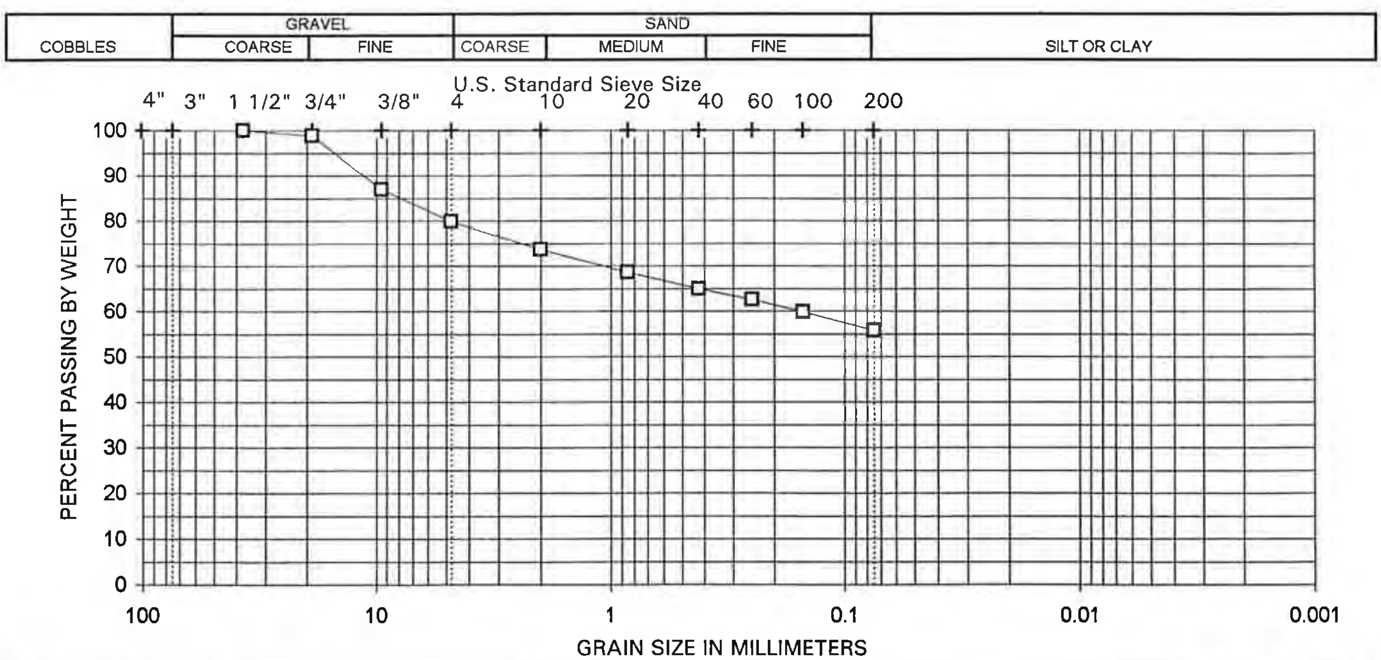
File: SIEV1B.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: [signature] Date: 5/30/95

Figure B-3

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-2	---	0-1	□	SP-SM, brown c-f SAND, some f. gravel, trace c. gravel and	17.8	---	---
				silt; bottom ash material noted.			
---	---	---	■		---	---	---

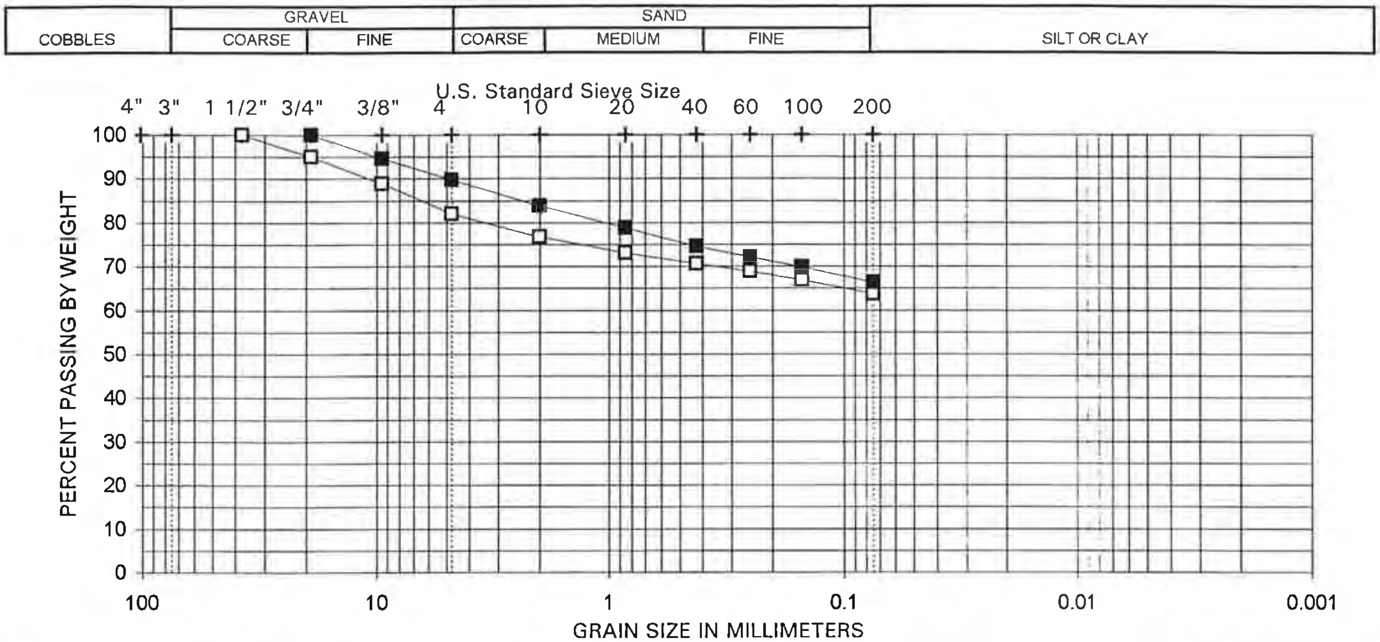


BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-4	11.5' S	3.1	□	CL, brown plastic silty CLAY, some f. gravel and c-f sand,	22.9	---	---
				trace c. gravel; bottom ash material noted.			
---	—	---	■		---	---	---

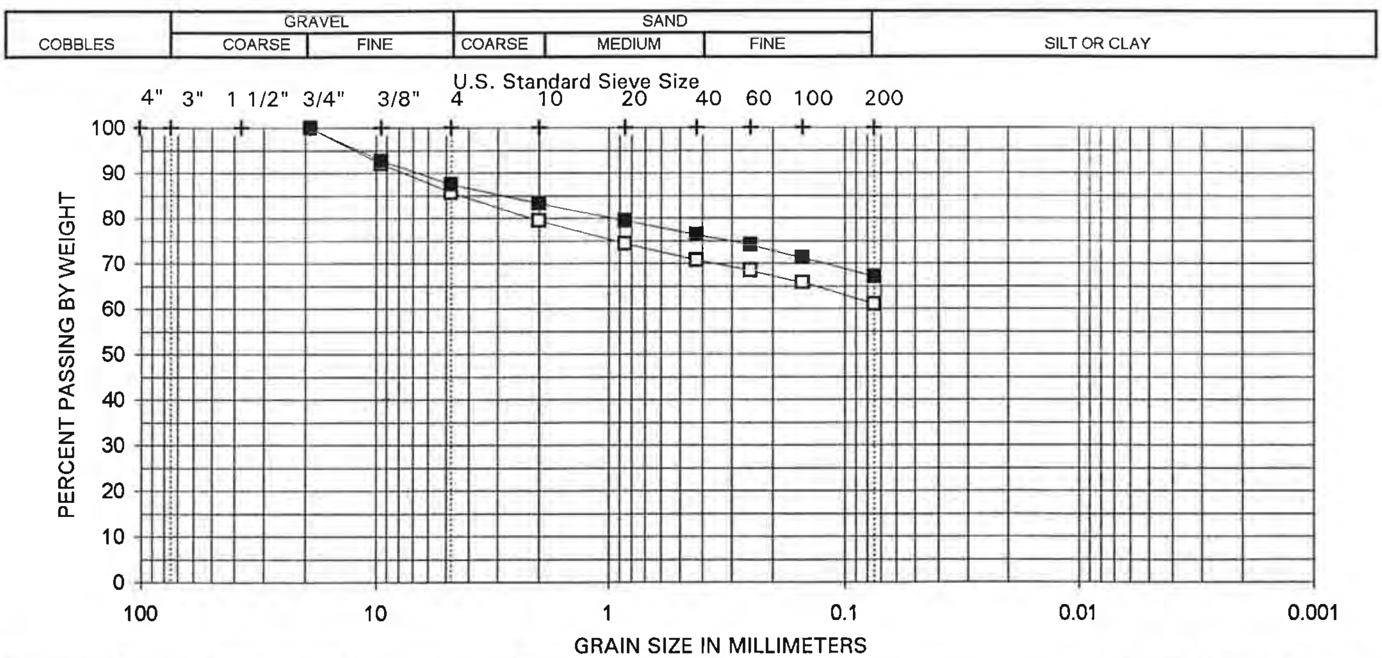
File: SIEV2A.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 3/31/95

Figure B-4

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-5	15.5' SE	---	□	CL, brown plastic CLAY, some gravel and c-f sand; bottom	14.3	---	---
				ash material noted.			
TP-5	5' S of N End	5	■	CL, brown plastic CLAY, some c-f sand, trace f. gravel;	18.8	---	---
				bottom ash material noted.			



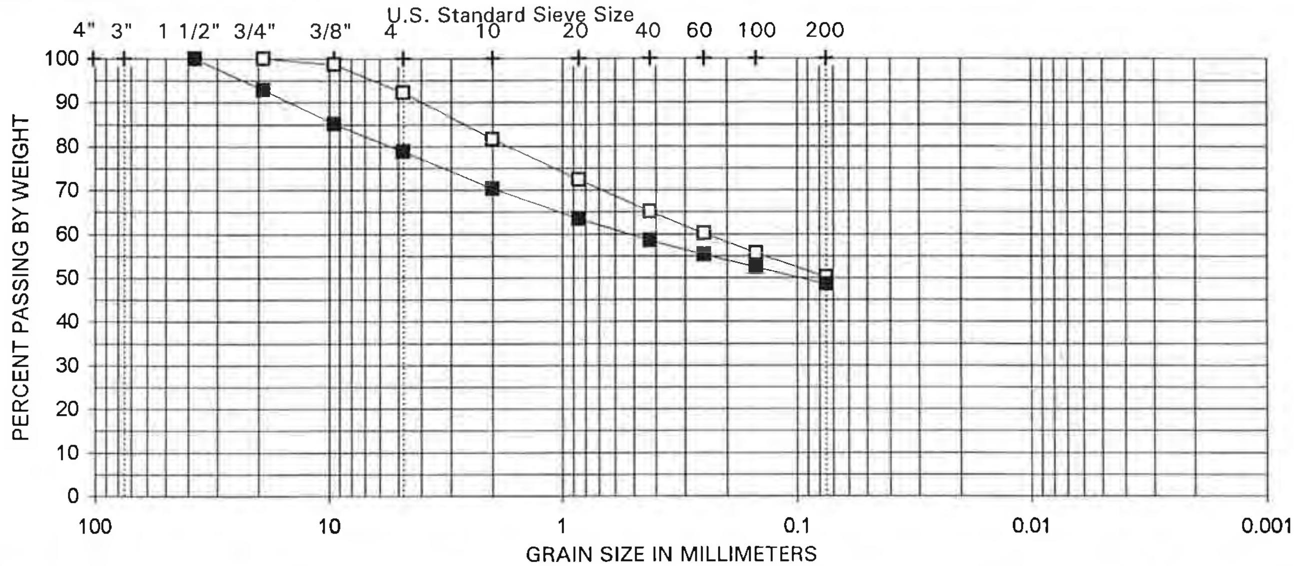
BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-5	5.8' S	1.5	□	CL, brown plastic CLAY, some f. gravel and c-f sand;	---	---	---
				bottom ash material noted.			
TP-5	E Face 12'S		■	CL, brown plastic CLAY, some f. gravel and c-f sand;	23.7	---	---
				bottom ash material noted.			

File: SIEV2B.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 3/31/95

Figure B-5

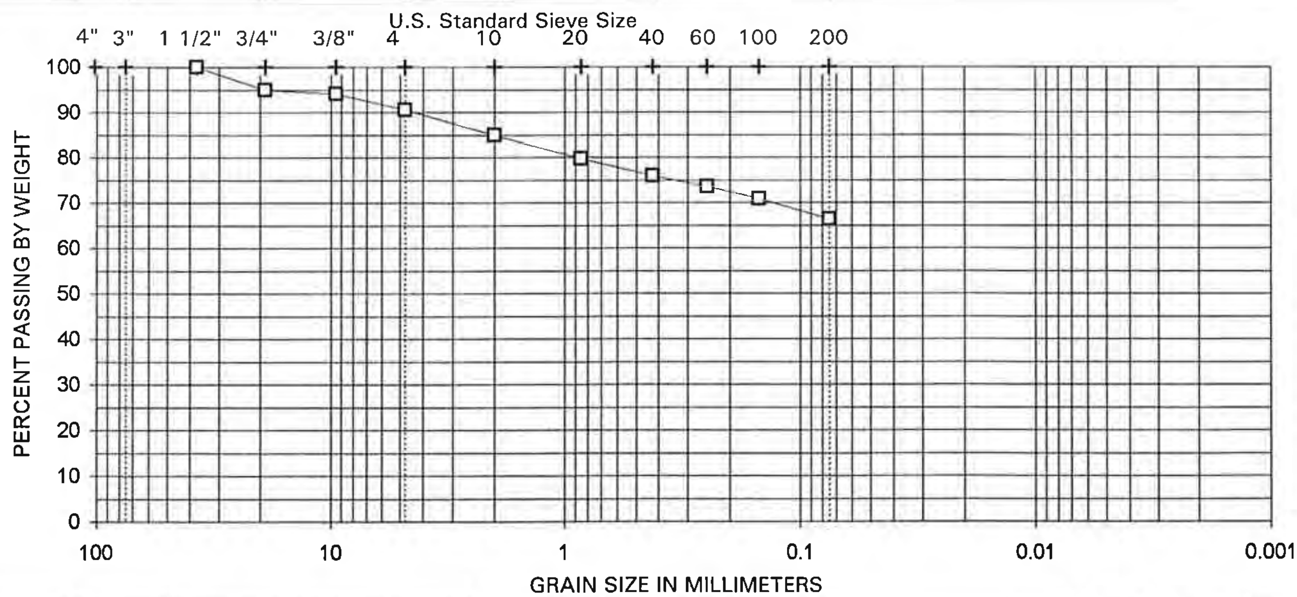
PARTICLE-SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-7	Bag 1	3.2	□	CL, brown plastic c-f sandy CLAY, trace f. gravel; bottom	21.8	---	---
				ash material noted.			
TP-7	Bag 2	1.4	■	SC, brown clayey c-f SAND, some gravel; bottom ash	12.9	---	---
				material noted.			

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-7	Bag 3	6	□	CL, brown plastic CLAY, some c-f sand, trace gravel; bottom	17.4	---	---
				ash material noted.			
---	---	---	■		---	---	---

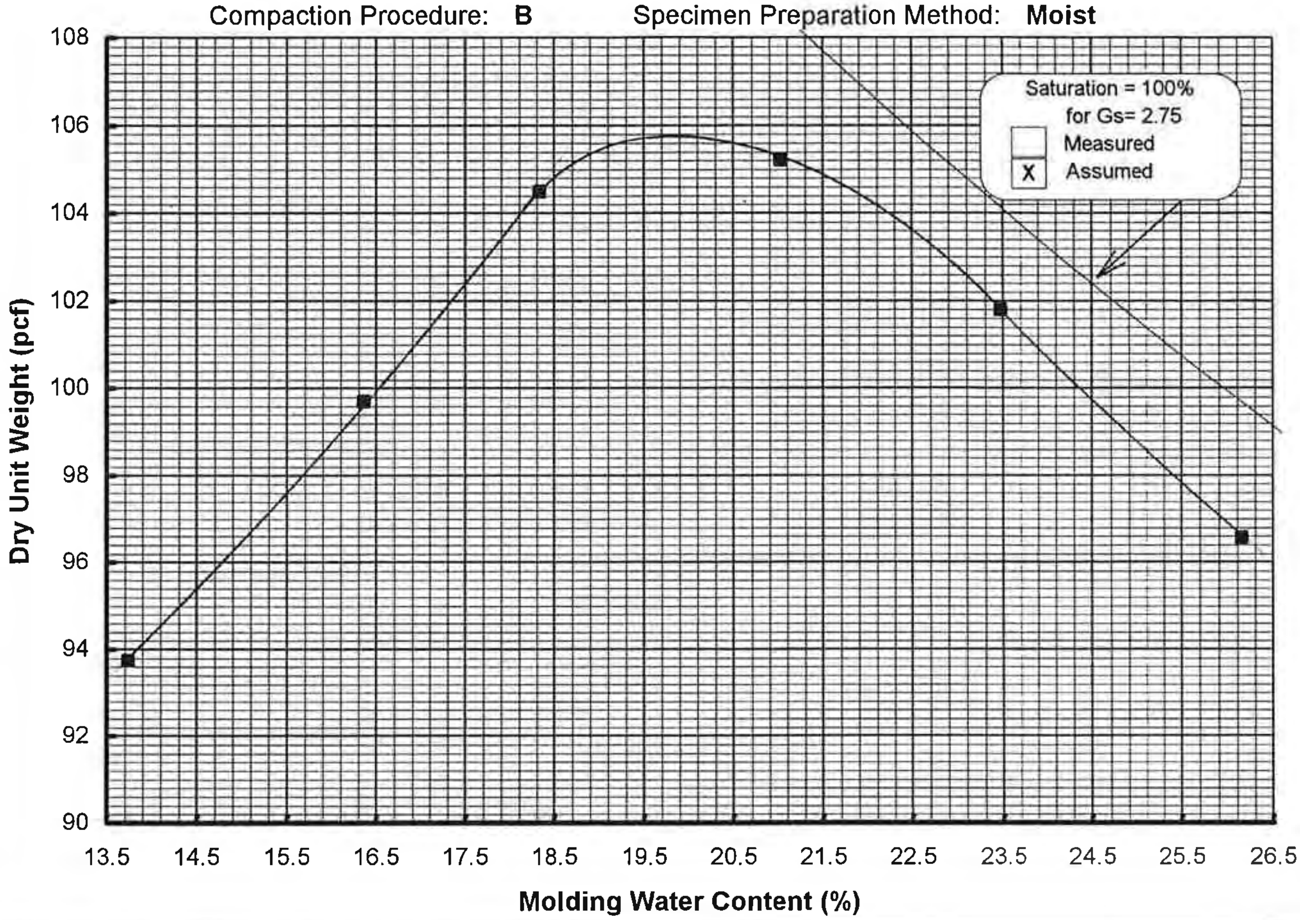
File: SIEV2C.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 3/31/95

Figure B-6

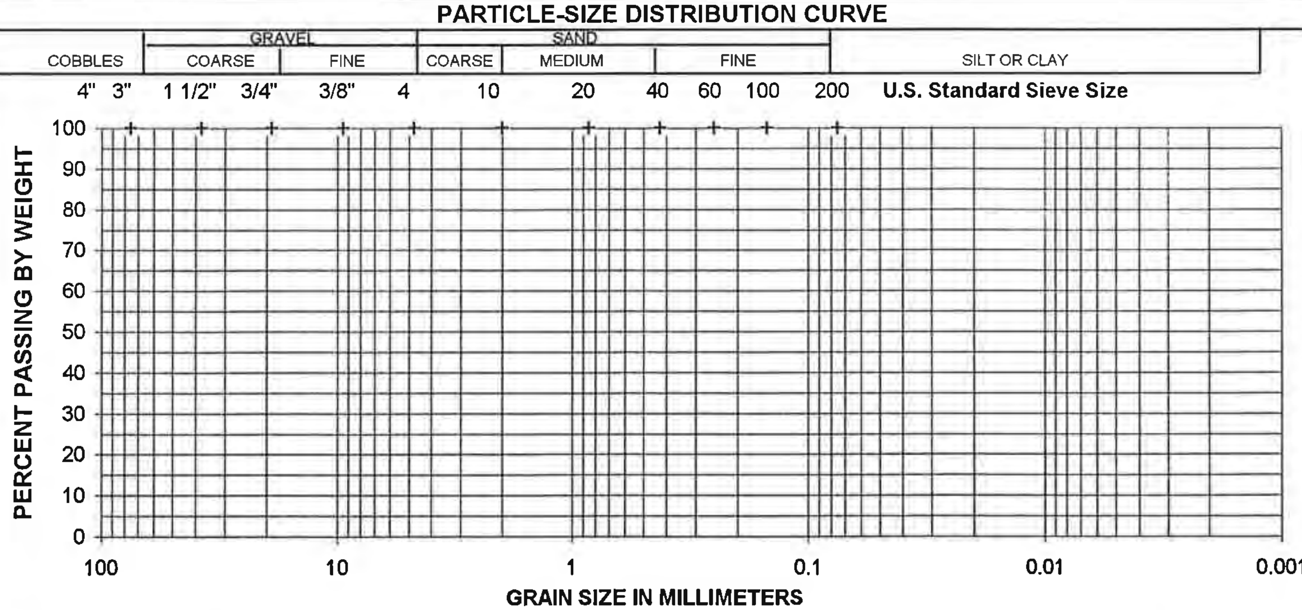
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ❍ Representative of entire sample △ Representative of compacted specimen ☐ Representative of compacted specimen and entire sample

Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-3 N End Comp			19.9	105.8			CL, brown plastic silty CLAY, trace f. sand.

PROJECT NAME:
PROJECT NUMBER: 5E08560-230

COMPACTION AND INDEX PROPERTY DATA

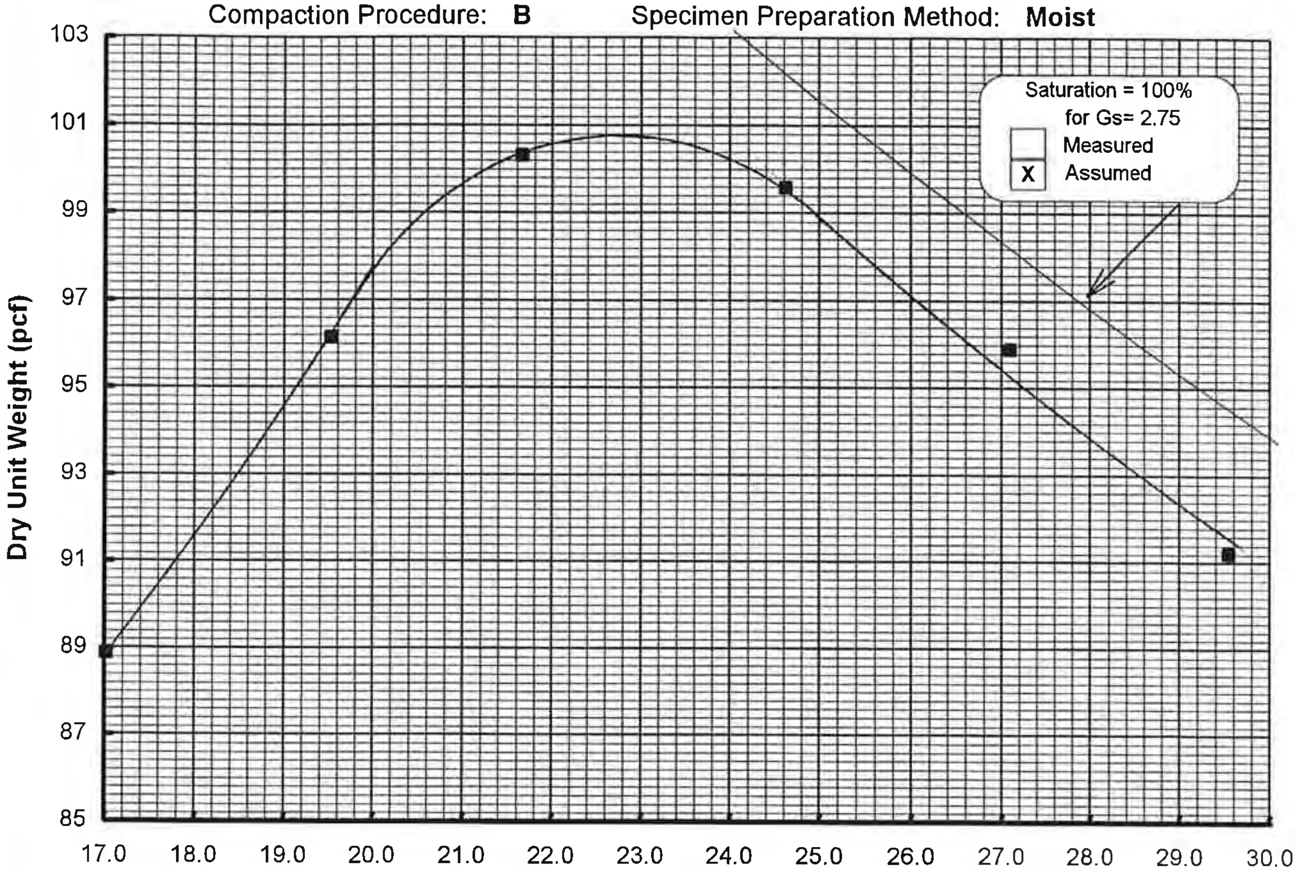
FIGURE No. B-7

SR-400 (1/95) (EWR) COMP2C.XLS **WOODWARD-CLYDE CONSULTANTS**

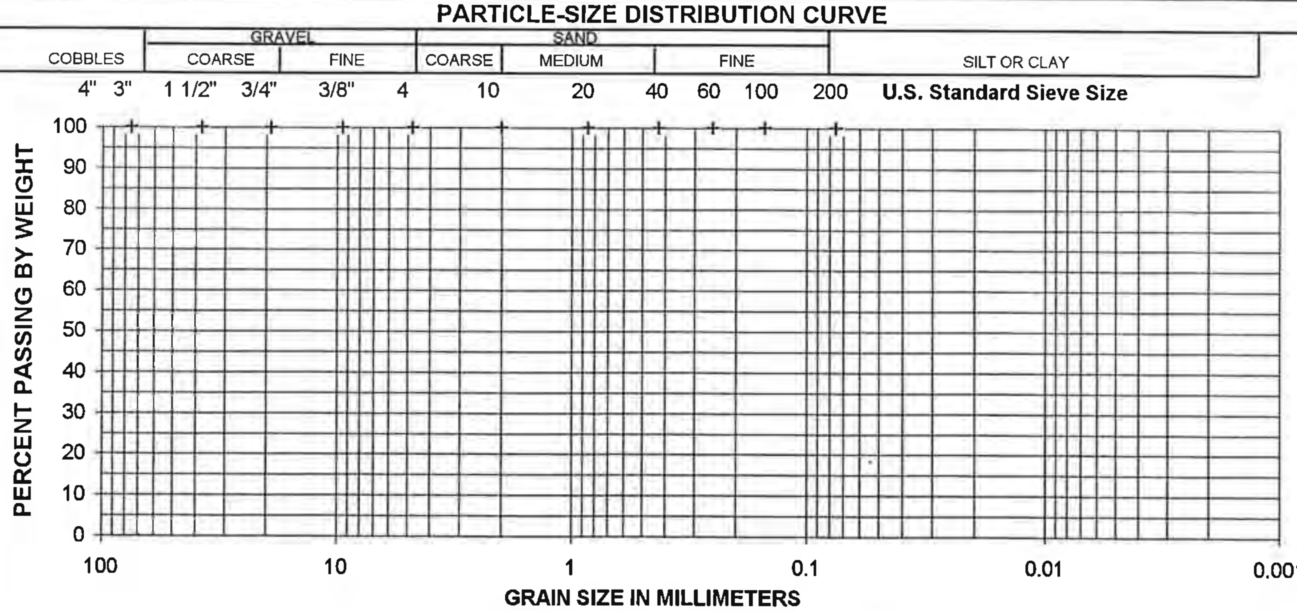
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ○ Representative of entire sample △ Representative of compacted specimen □ Representative of compacted specimen and entire sample

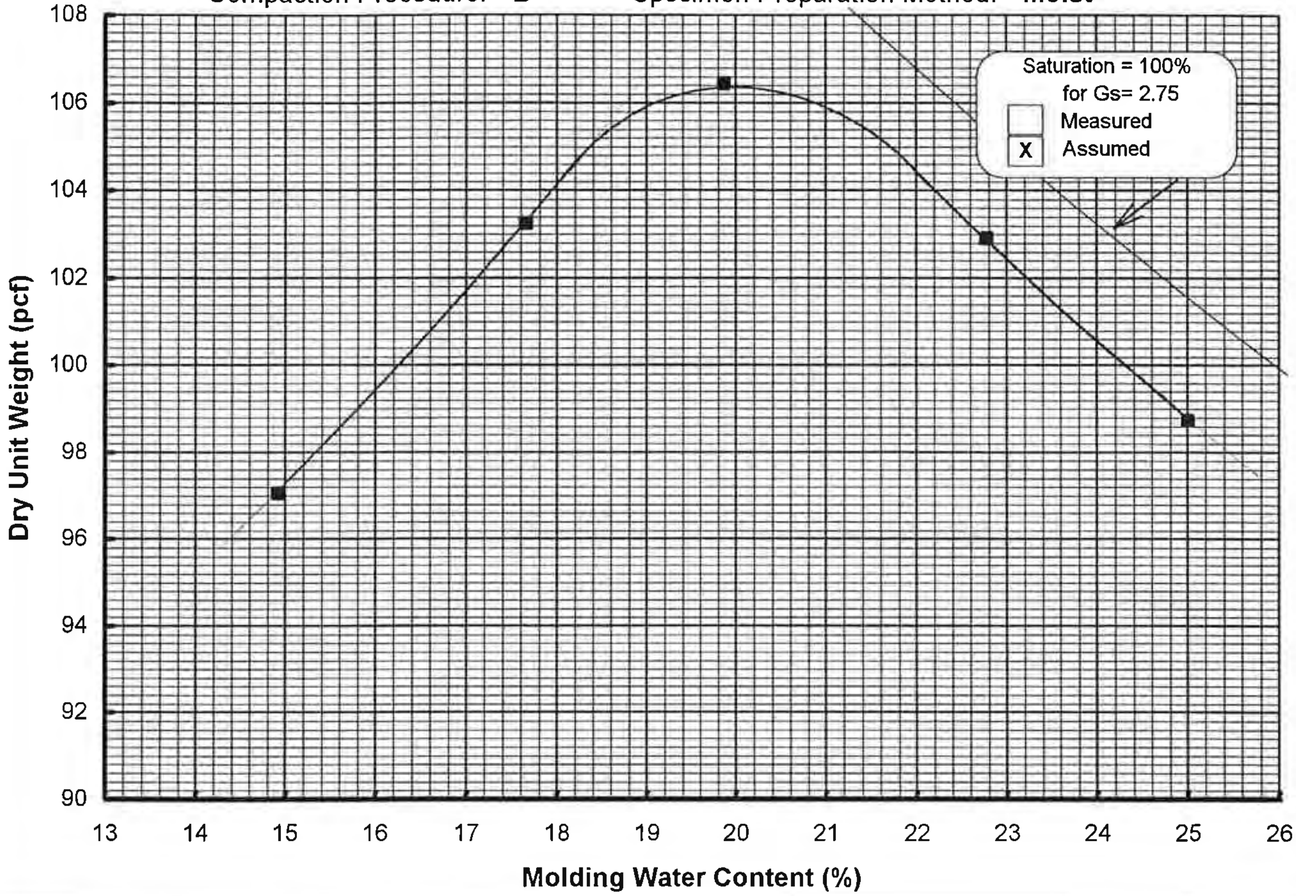
Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-3 S End Comp			22.9	100.8	50	30	CL, light brown plastic CLAY, trace f. sand.

PROJECT NAME: **PROJECT NUMBER:** 5E08560-230	**COMPACTION AND INDEX PROPERTY DATA**	**FIGURE No.** B-8

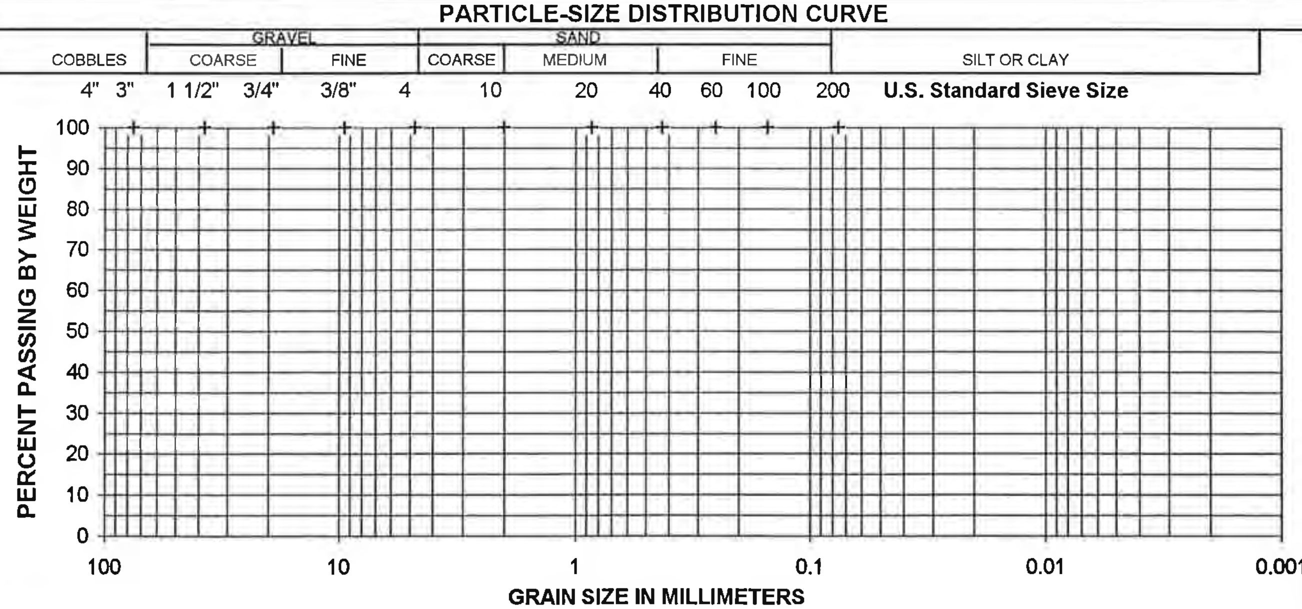
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ○ Representative of entire sample Δ Representative of compacted specimen □ Representative of compacted specimen and entire sample

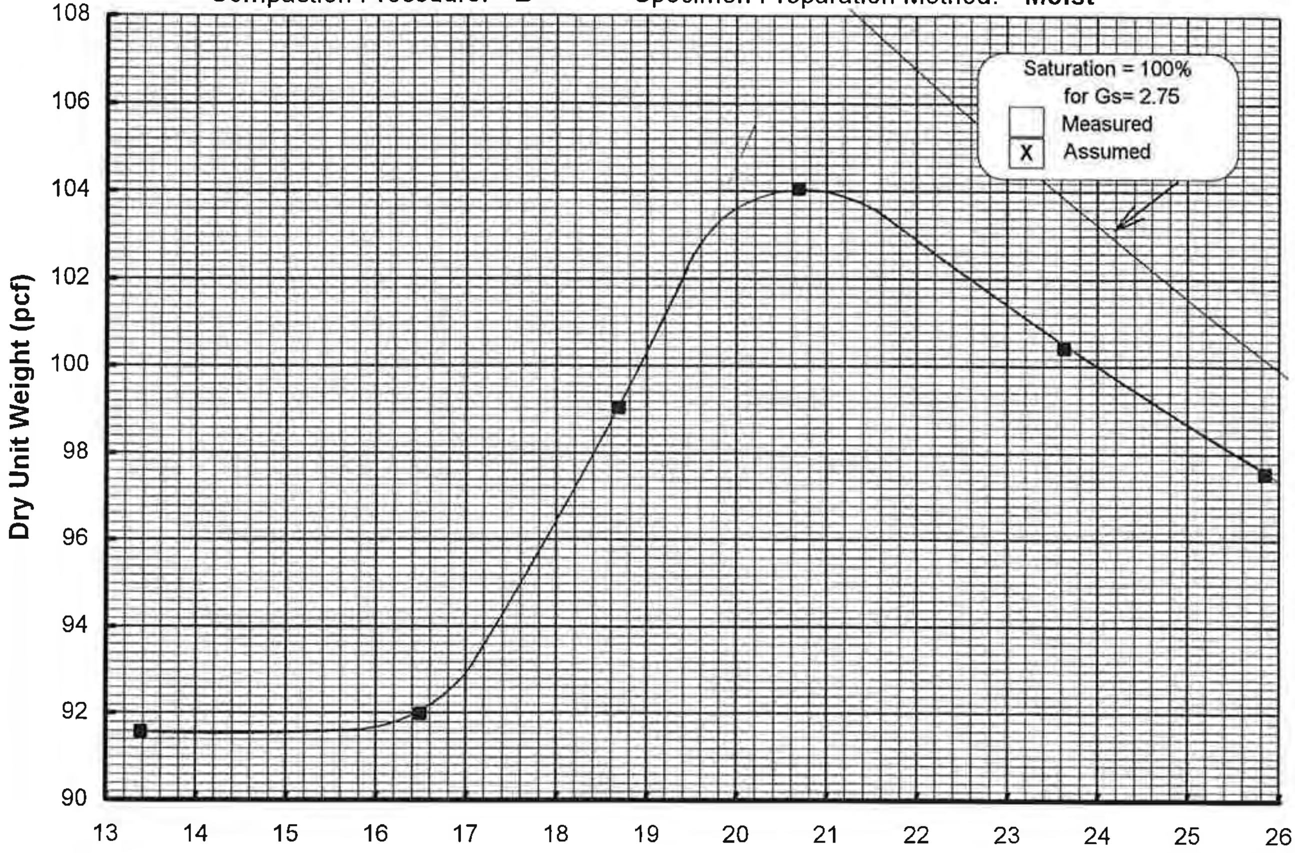
Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-5 N End Comp			20.0	106.4	42	24	CL, brown plastic silty CLAY, trace f. sand.

PROJECT NAME: **PROJECT NUMBER:** 5E08560-230	**COMPACTION AND INDEX PROPERTY DATA**	**FIGURE No. B-9**

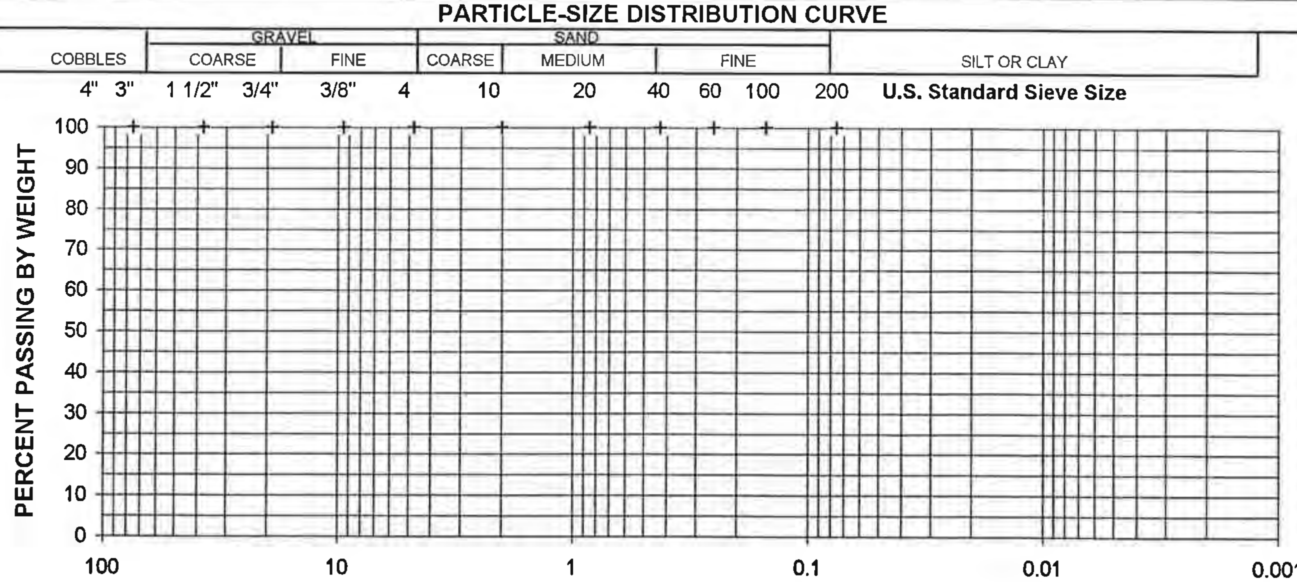
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



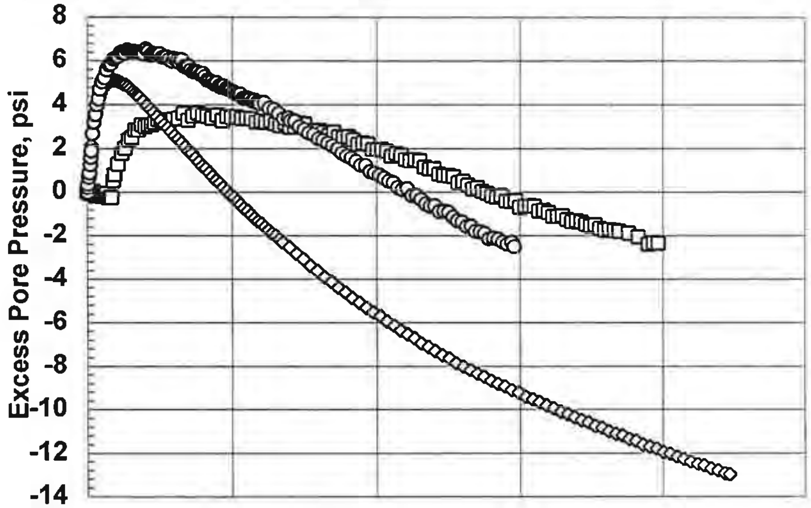
PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ❍ Representative of entire sample Δ Representative of compacted specimen ☐ Representative of compacted specimen and entire sample

Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-5 S End Comp			20.7	104.0	47	28	CL, brown plastic silty CLAY, trace m-f sand.

PROJECT NAME: **PROJECT NUMBER:** 5E08560-230	**COMPACTION AND INDEX PROPERTY DATA**	**FIGURE No.** B-10

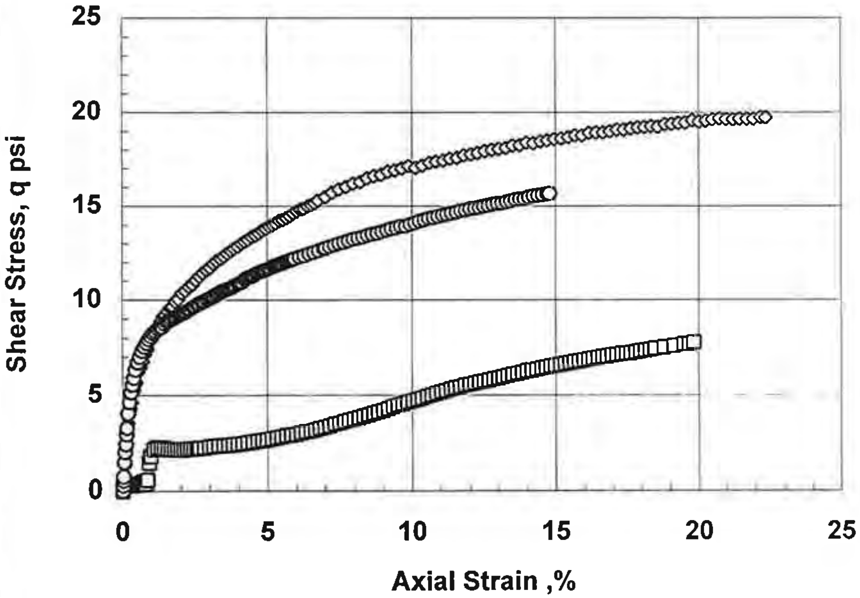


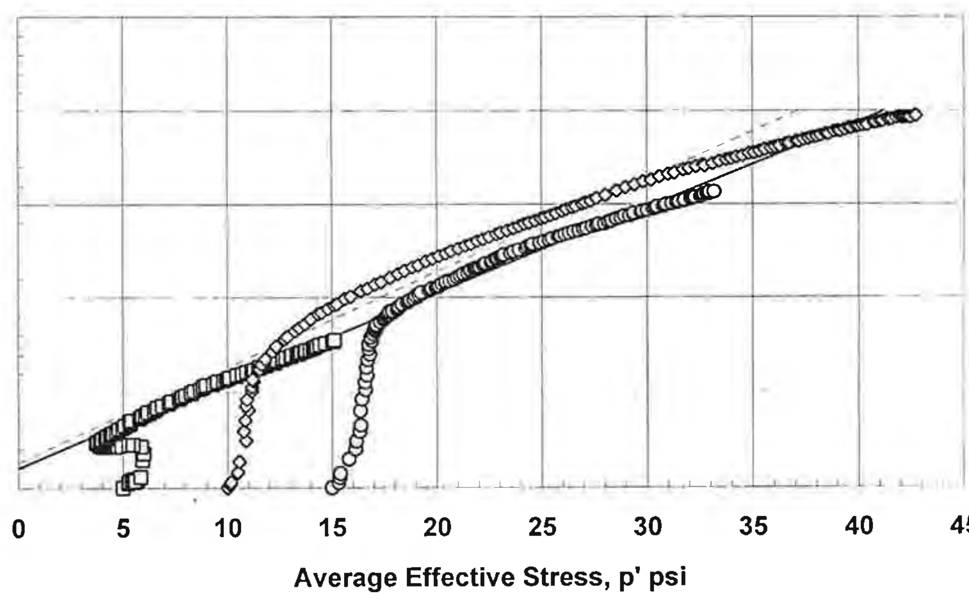
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1191	B-3	S-5	8.55	17.3	123.0	5.0	44	25
◊	T-1194	B-3	S-5	9	17.8	131.5	10.0	41	24
○	T-1192	B-3	S-6	11	18.0	128.1	15.0	---	---

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
——	15% strain	1.016	27.4
- - -	Peak Obliquity	1.295	30.2



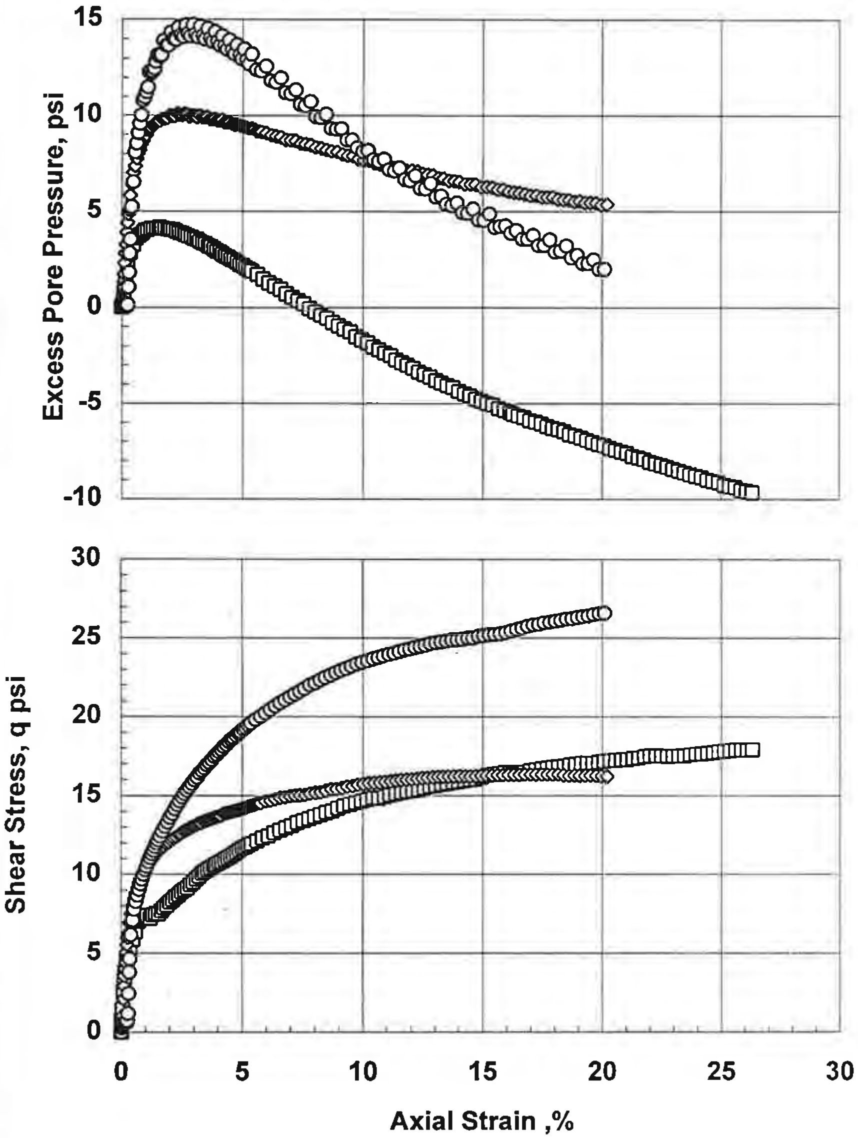


Test by:
Prepared by: CMT
Checked by: GT

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 1

6/7/95

Figure B-11

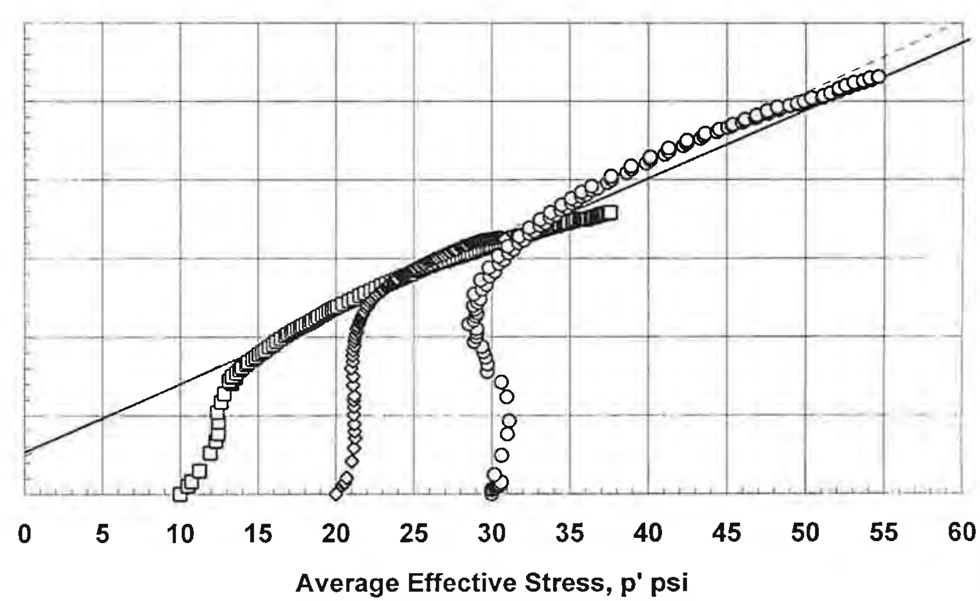


LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1199	B-11A	S-12	25	21.2	128.1	10.0	---	---
◊	T-1201	B-11A	S-13	31	22.5	127.2	20.0	36	20
○	T-1200	B-11A	S-12	26	20.7	128.4	30.0	49	28

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
——	15% strain	2.66	25.8
- - - -	Peak Obliquity	2.415	27.6



Test by:

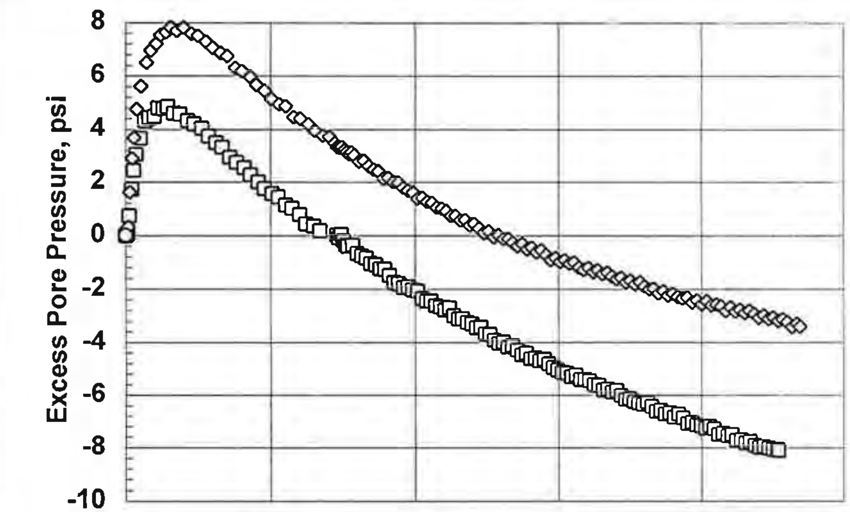
Prepared by: CMT

Checked by: GT

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 4

6/7/95

Figure B-12

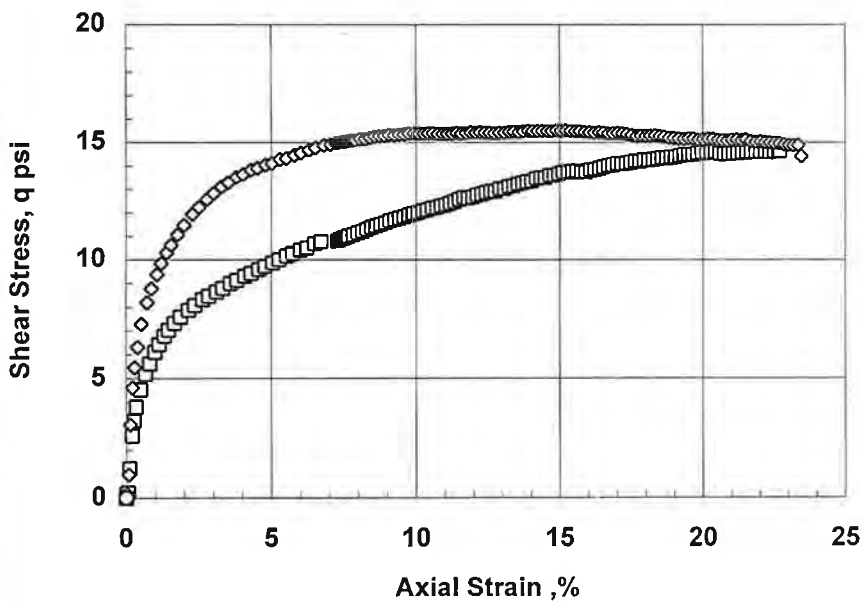


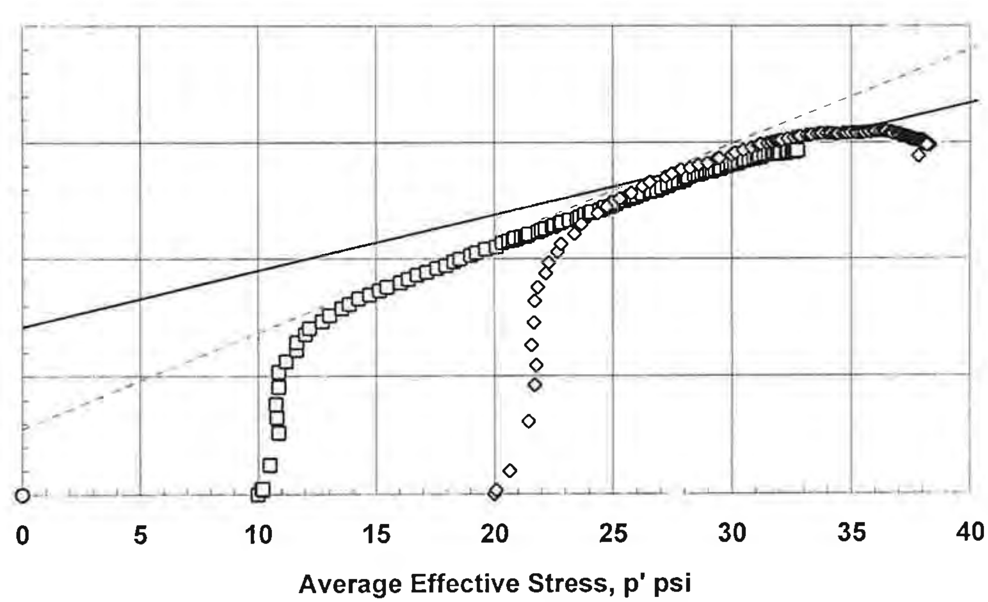
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1203	B-11A	S-11	20	19.6	130.4	10.0	46	21
◊	T-1202	B-11A	S-11	22	25.2	128.8	20.0	52	30
○	---	---	---	---	---	---	---	---	---

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
———	15% strain	7.082	13.9
- - - - -	Peak Obliquity	2.796	23.9





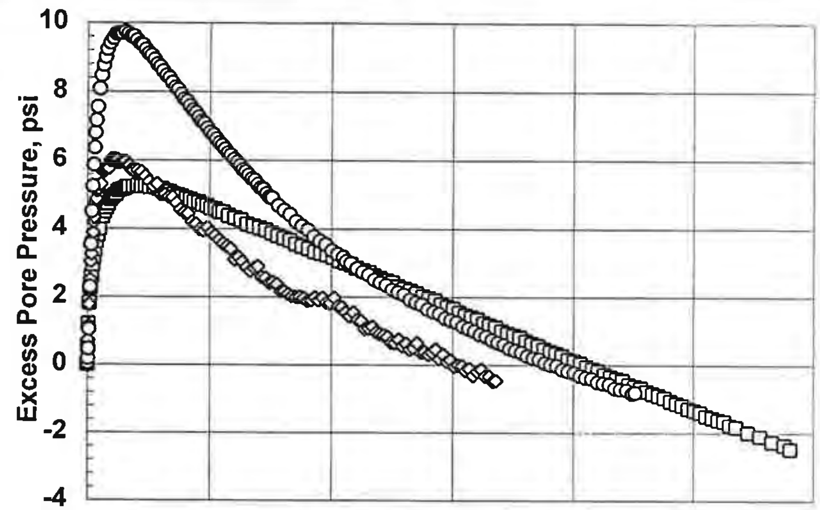
Prepared by: CMT

Checked by: GS

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 3

6/7/95

Figure B-13

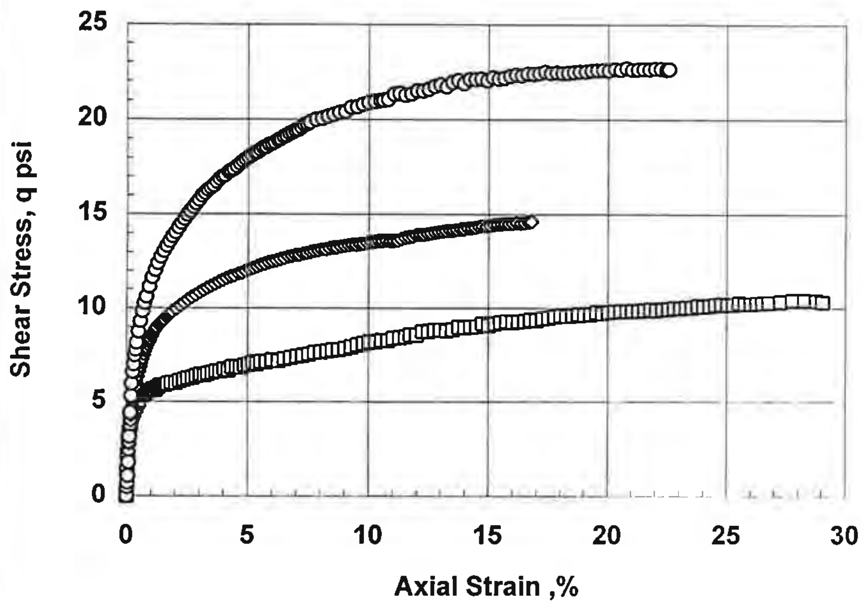


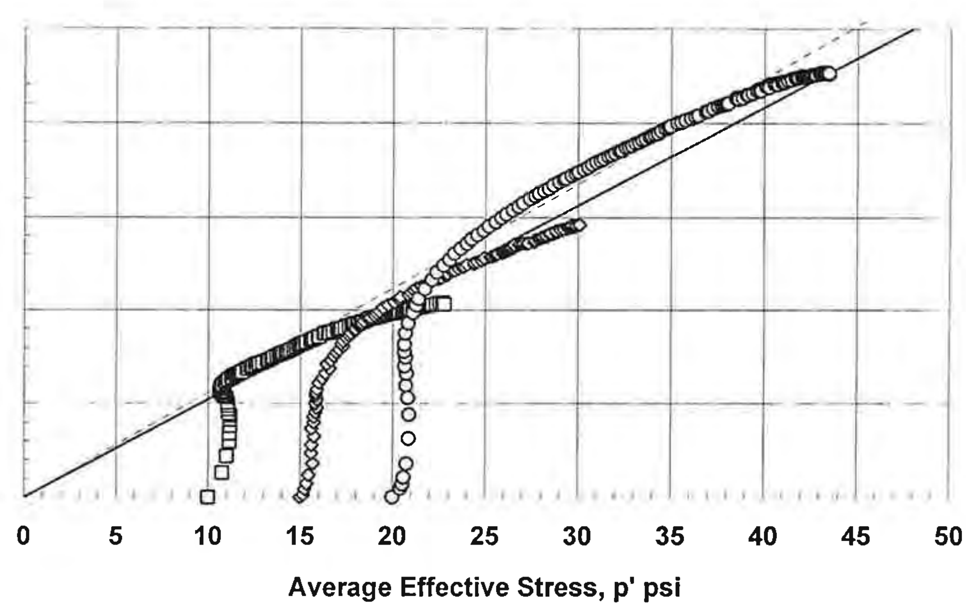
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1190	B-3	S-9	17	18.7	124.0	10.0	46	25
◊	T-1195	B-3	S-10	19	23.4	124.1	15.0	52	30
○	T-1193	B-3	S-10	20	21.4	126.1	20.0	42	23

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
	15% strain	0	31.4
	Peak Obliquity	0	34





Test by:
Prepared by: CMT
Checked by: GT

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 2

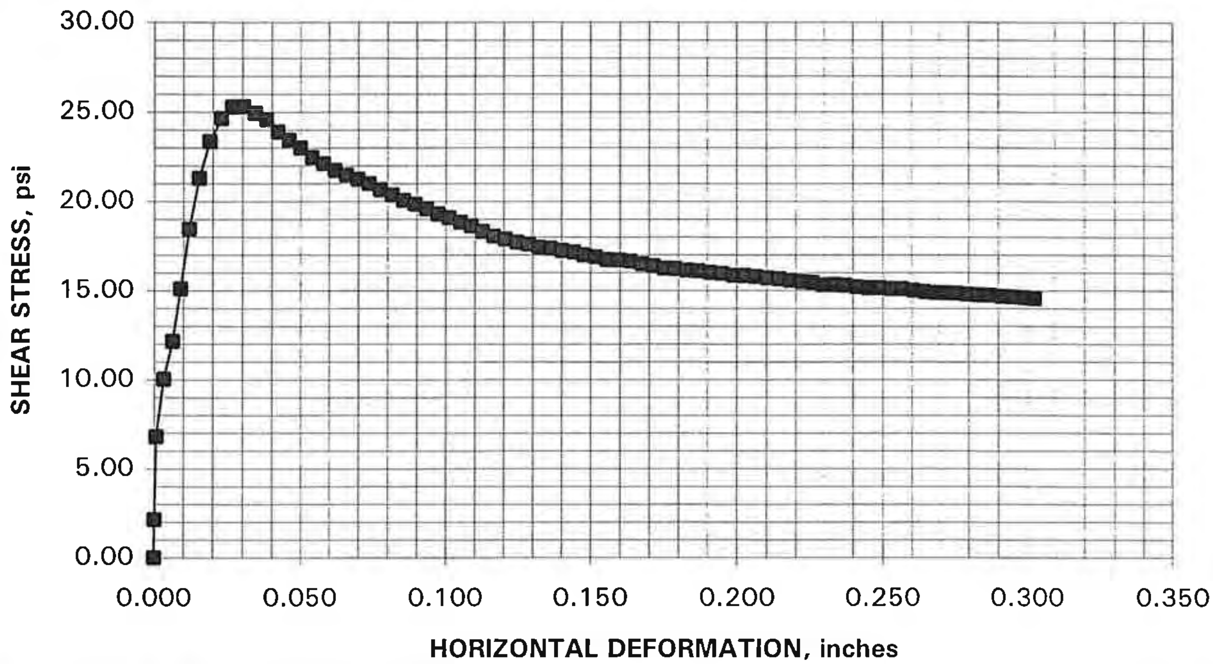
6/7/95

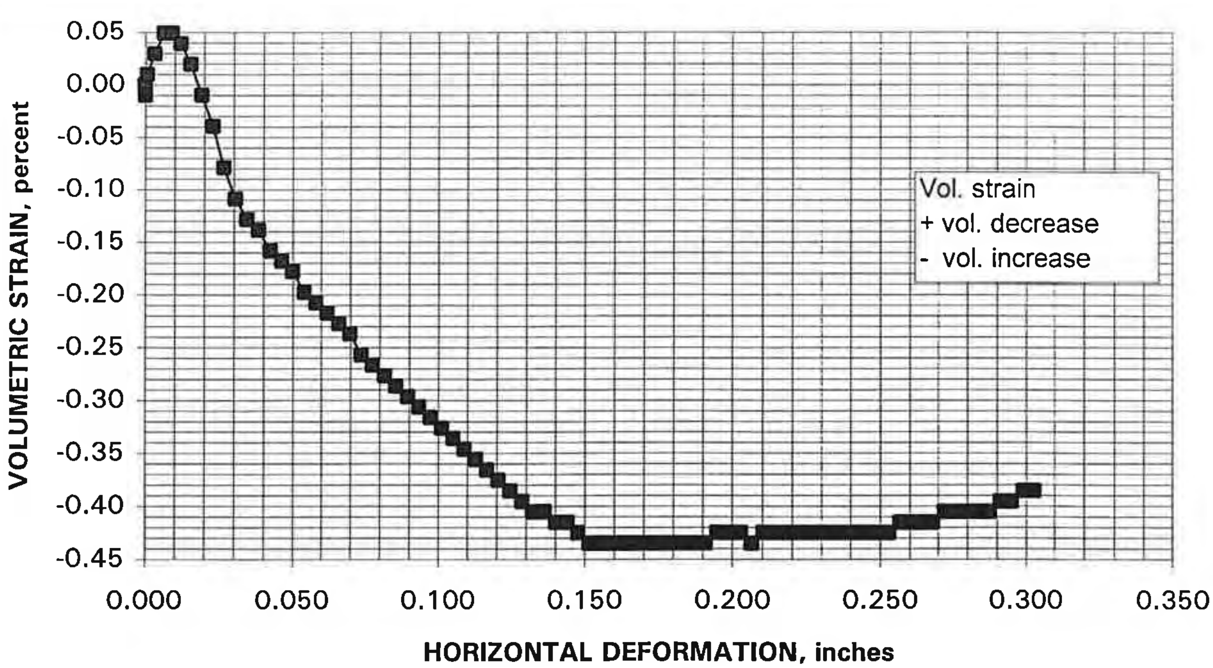
Figure B-14

DIRECT SHEAR TEST

Boring No.:	B-101	Spec. Hgt.:	1.012 in.	Proj. No.:	5E08560
Sample No.:	S-12	Spec. Dia.:	2.500 in.	Test No.:	DS-062
Spec. No.:	NONE	Load Rate:	4.8E-2 in/min		
Depth (ft):	54.25	Output Units:	psi		

Eff. Vert. Conf. Stress: 34.7 psi





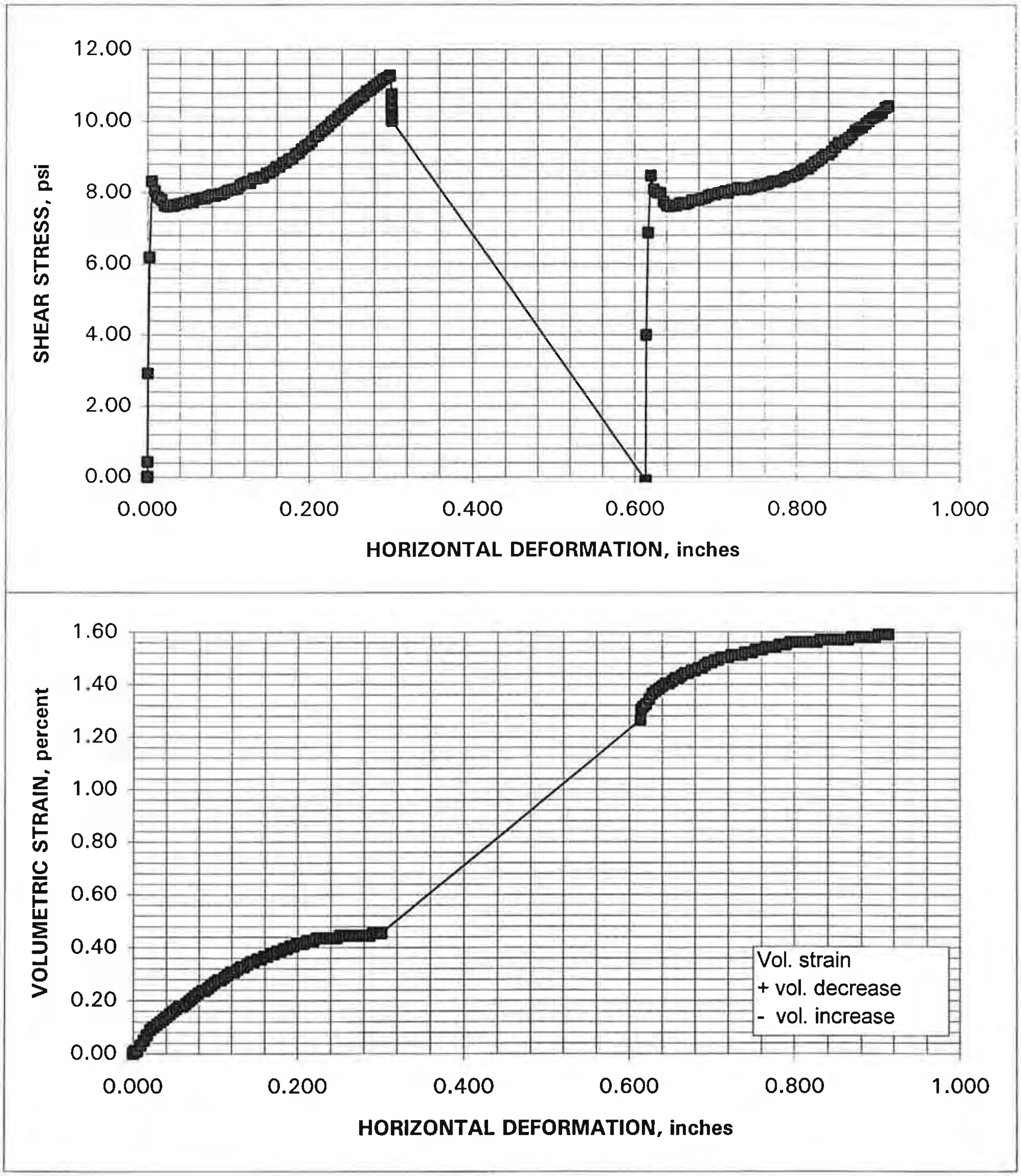
File: DS-062A.XLS Prepared by: CMT Reviewed by: GT Date: 5/16/95

Figure B-15

DIRECT SHEAR TEST

Boring No.:	B-101	Spec. Hgt.:	1.012 in.	Proj. No.:	5E08560
Sample No.:	S-12	Spec. Dia.:	2.500 in.	Test No.:	DS-062
Spec. No.:	NONE	Load Rate:	4.8E-2 in/min		
Depth (ft):	54.25	Output Units:	psi		

Eff. Vert. Conf. Stress: 34.7 psi



File: DS-062B.XLS Prepared by: CMT Reviewed by: ____ Date: 5/16/95 **Figure B-16**

APPENDIX C

INSTRUMENTATION

C-1 INCLINOMETERS

C-2 PEIZOMETER LOGS

C-3 ILLINOIS POWER CRACK GAGES

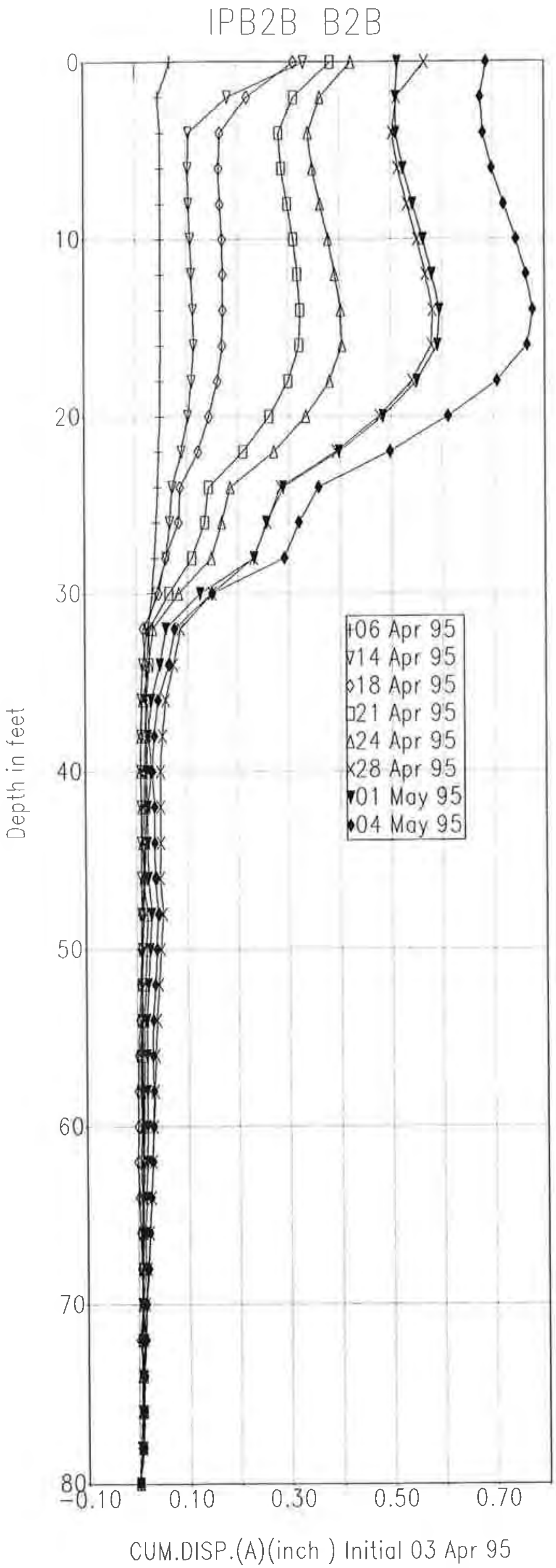
APPENDIX C
INSTRUMENTATION

APPENDIX C-1 - INCLINOMETERS

Six inclinometers were installed in borings within the landslide area. The purpose of the inclinometers was to determine the elevations of the slide planes and the rate of movement. Inclinometers were installed at depths ranging from 40 to 80 ft. Measurements within the inclinometers were made biweekly and summaries of the readings are shown in Figures C-1-1 through C-1-6. The amount of movement of the slides has been so great that all of the inclinometers eventually could not be read beyond the depth of the failure plane. Although new readings are not possible, the inclinometers clearly indicate the depth of the failure planes.

After the removal of soil for the interim repair, two additional inclinometers were installed to monitor possible movement along the failure plane. The readings taken in the month after installation indicate no significant movement and are shown in Figures C-1-7 and C-1-8.

Figure C-1-1


IPB2B B2B
Depth in feet
0
10
20
30
40
50
60
70
80
-0.10
0.10
0.30
0.50
0.70
CUM.DISP.(A)(inch) Initial 03 Apr 95
06 Apr 95
14 Apr 95
18 Apr 95
21 Apr 95
24 Apr 95
28 Apr 95
01 May 95
04 May 95

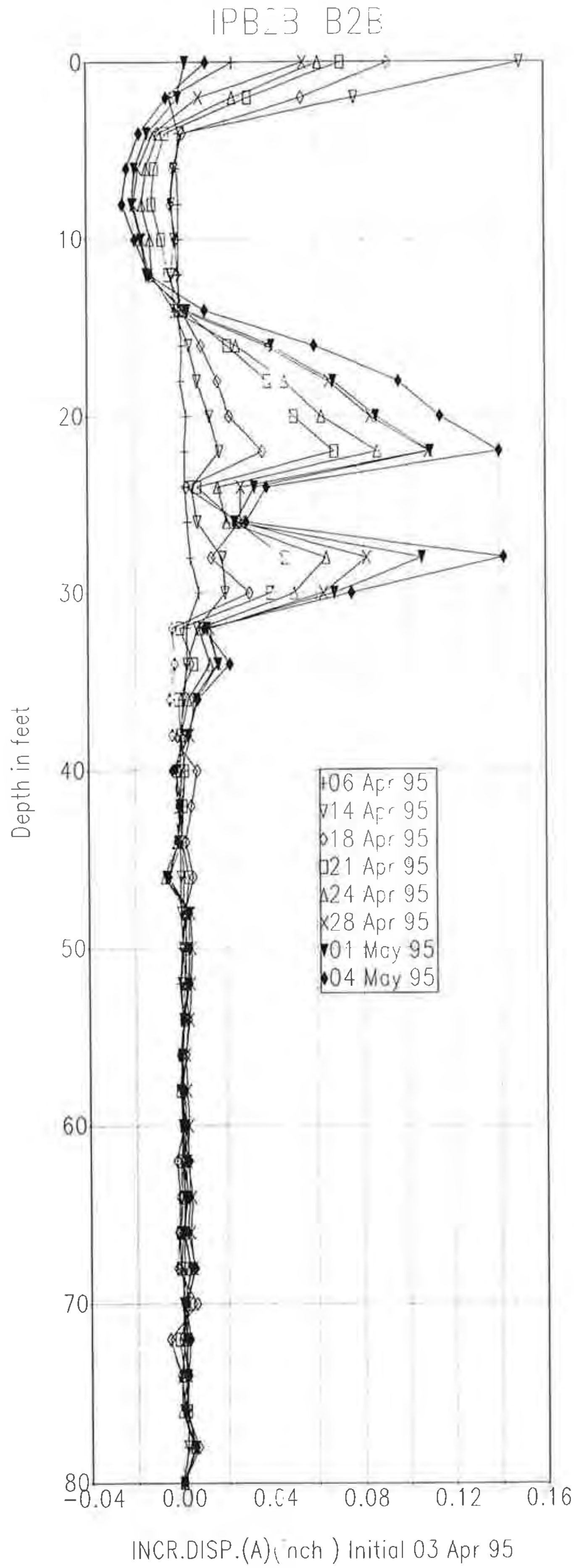
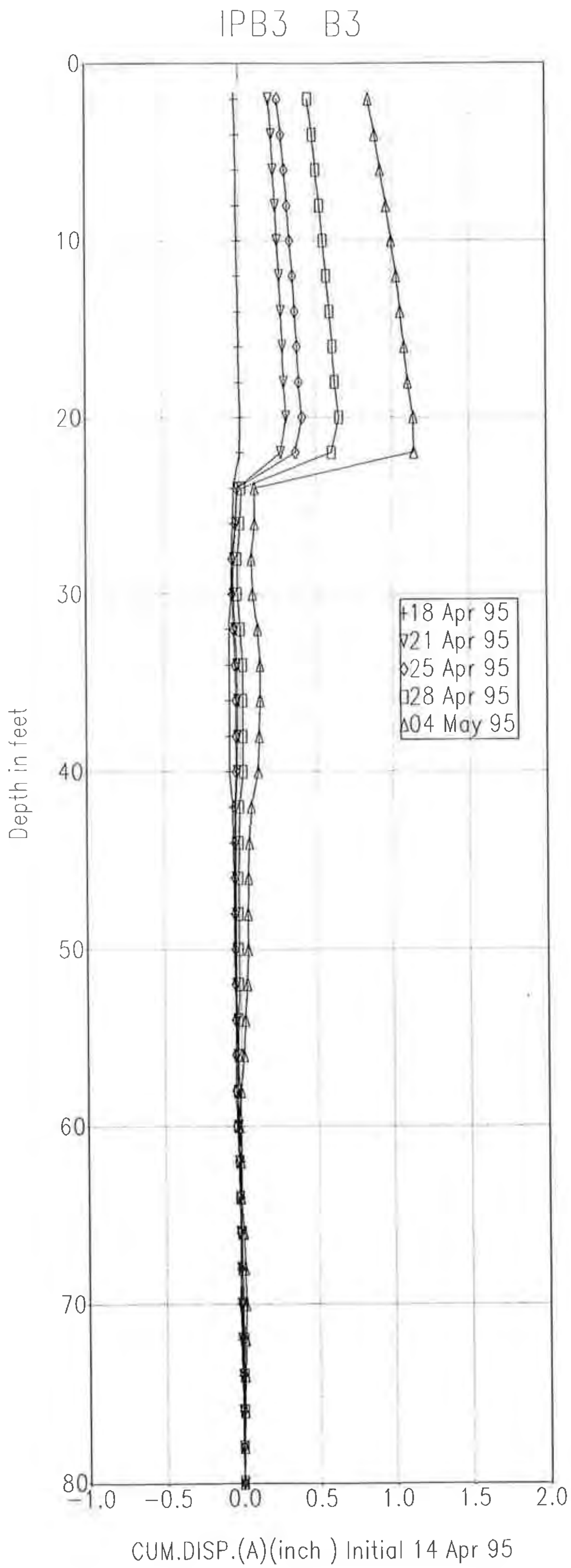

B2B
Depth in feet
0
10
20
30
40
50
60
70
80
-0.04
0.00
0.08
0.12
0.16
06 Apr 95
14 Apr 95
18 Apr 95
21 Apr 95
24 Apr 95
28 Apr 95
01 May 95
04 May 95

Figure C-1-2


IPB3 B3
Depth in feet
0
10
20
30
40
50
60
70
80
-1.0 -0.5 0.0 0.5 1.0 1.5 2.0
+18 Apr 95
▽21 Apr 95
◇25 Apr 95
□28 Apr 95
△04 May 95
CUM.DISP.(A)(inch) Initial 14 Apr 95

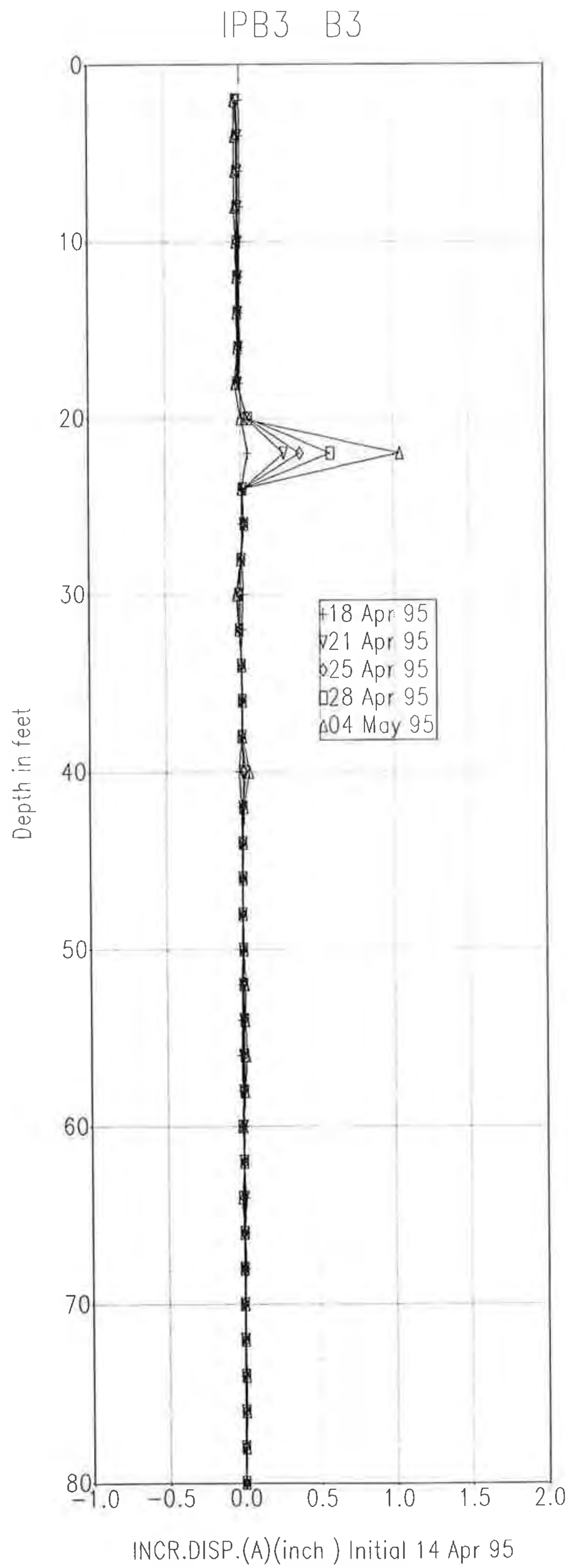
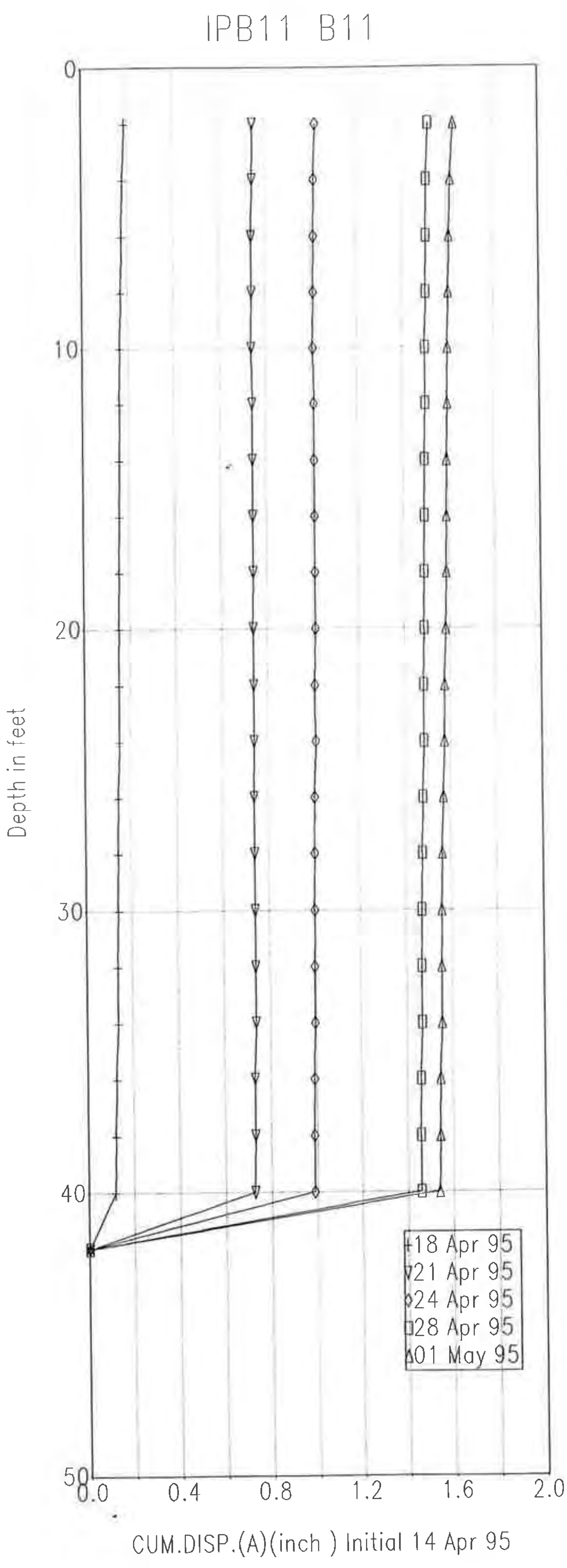

IPB3 B3
Depth in feet
0
10
20
30
40
50
60
70
80
-1.0 -0.5 0.0 0.5 1.0 1.5 2.0
+18 Apr 95
▽21 Apr 95
◇25 Apr 95
□28 Apr 95
△04 May 95
INCR.DISP.(A)(inch) Initial 14 Apr 95

Figure C-1-3


IPB11 B11
Depth in feet
0
10
20
30
40
50
0.0
0.4
0.8
1.2
1.6
2.0
CUM.DISP.(A)(inch) Initial 14 Apr 95
+18 Apr 95
▽21 Apr 95
◇24 Apr 95
□28 Apr 95
△01 May 95

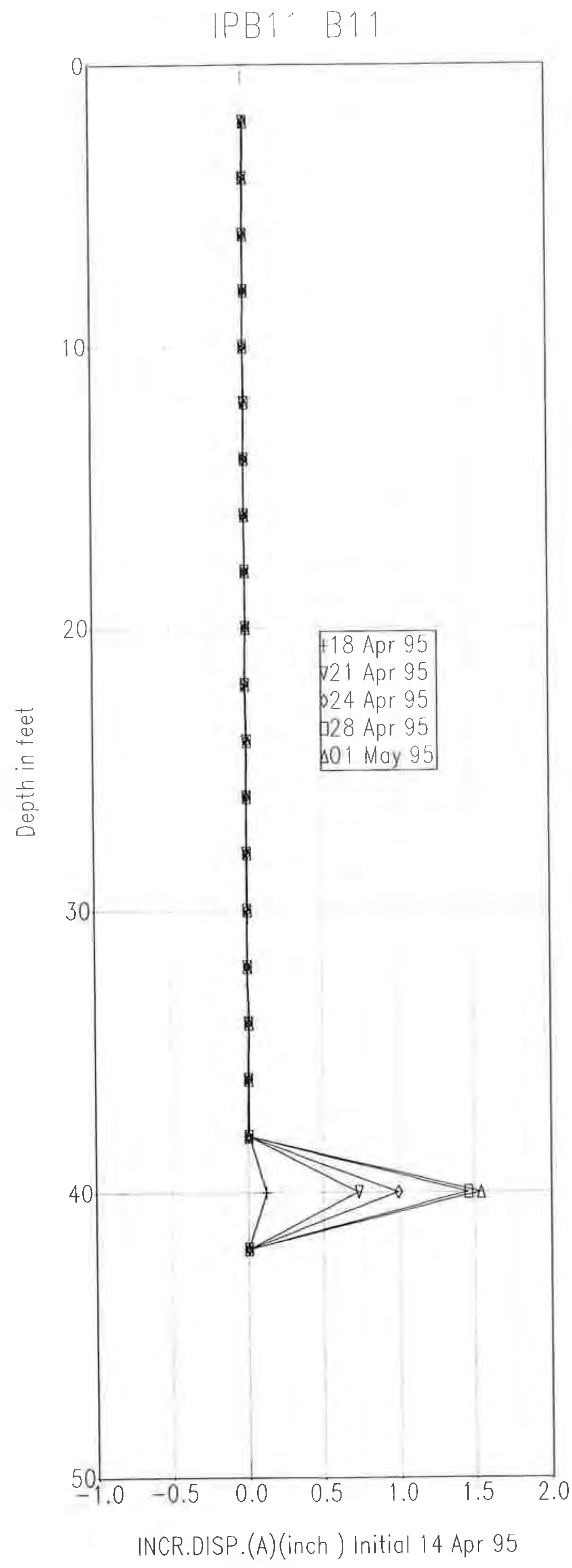
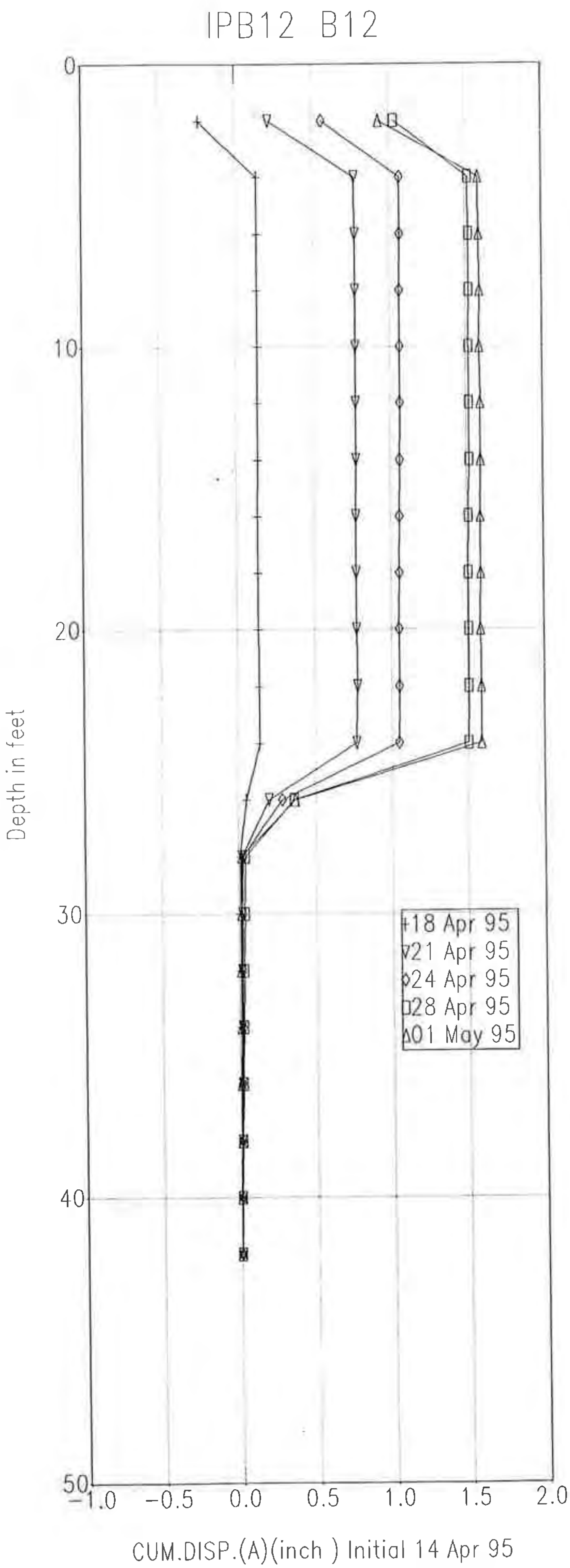
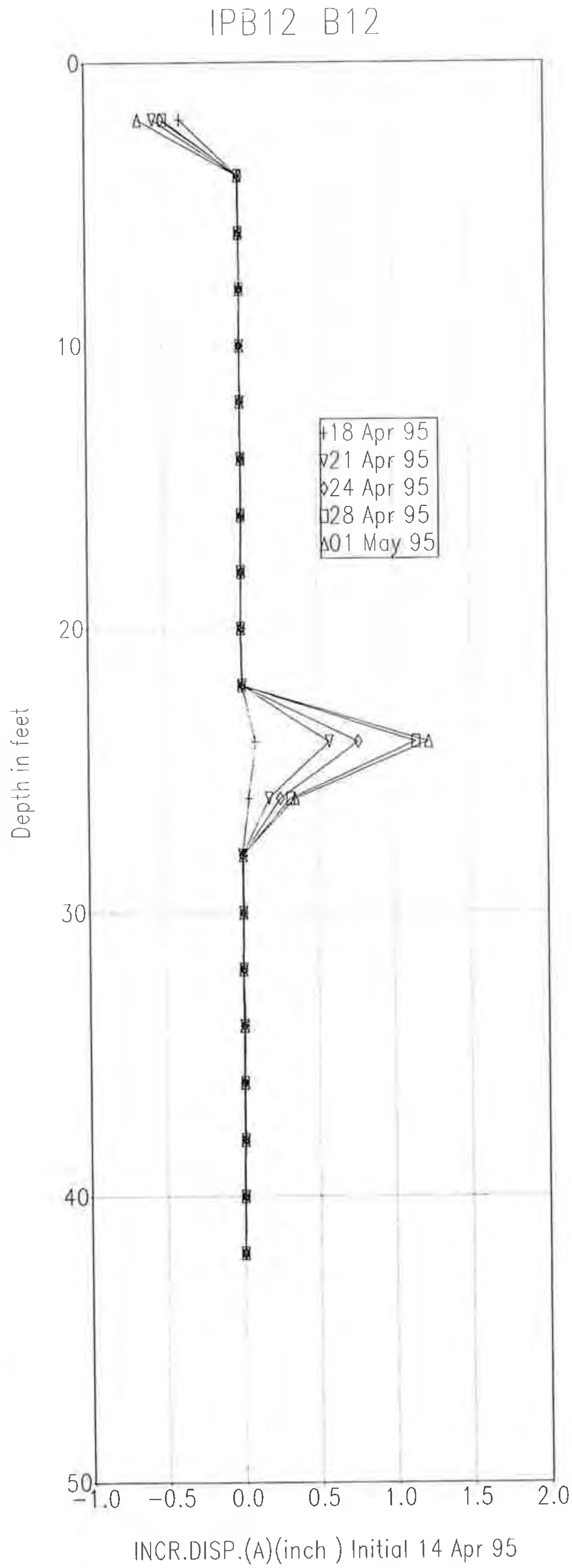

B11
Depth in feet
0
10
20
30
40
50
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
INCR.DISP.(A)(inch) Initial 14 Apr 95
+18 Apr 95
▽21 Apr 95
◇24 Apr 95
□28 Apr 95
△01 May 95

Figure C-1-4

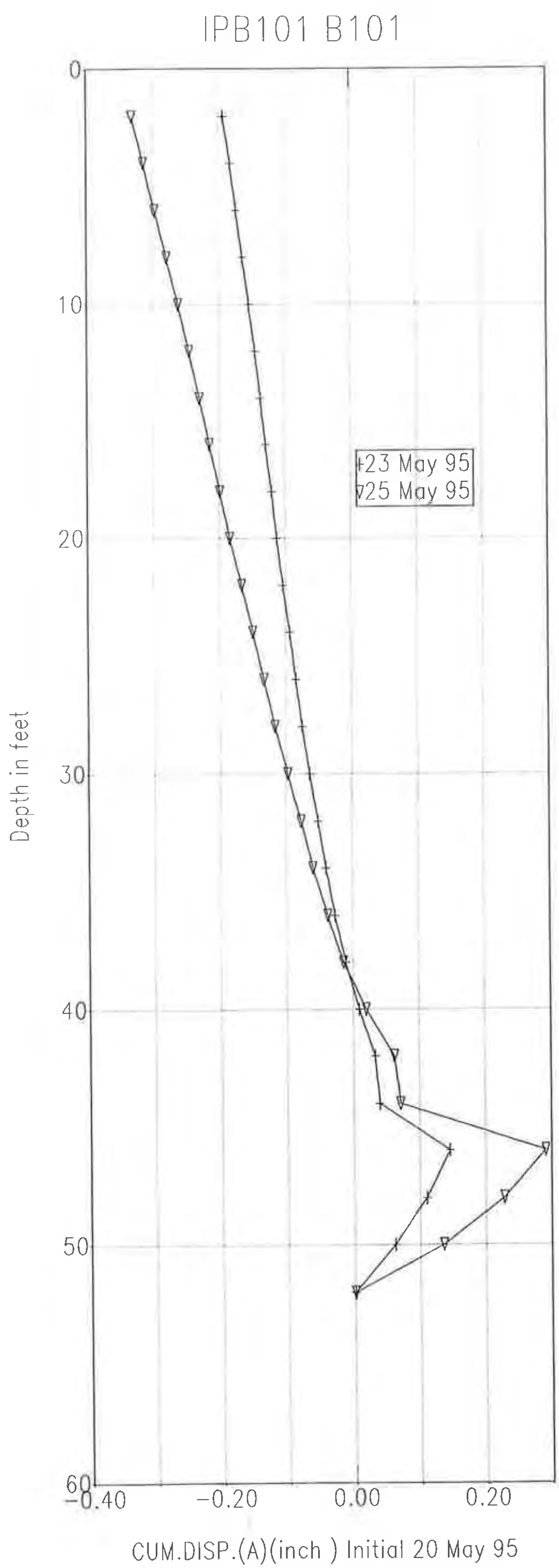


IPB12 B12
Depth in feet
CUM.DISP.(A)(inch) Initial 14 Apr 95
+18 Apr 95
∇21 Apr 95
◊24 Apr 95
□28 Apr 95
Δ01 May 95

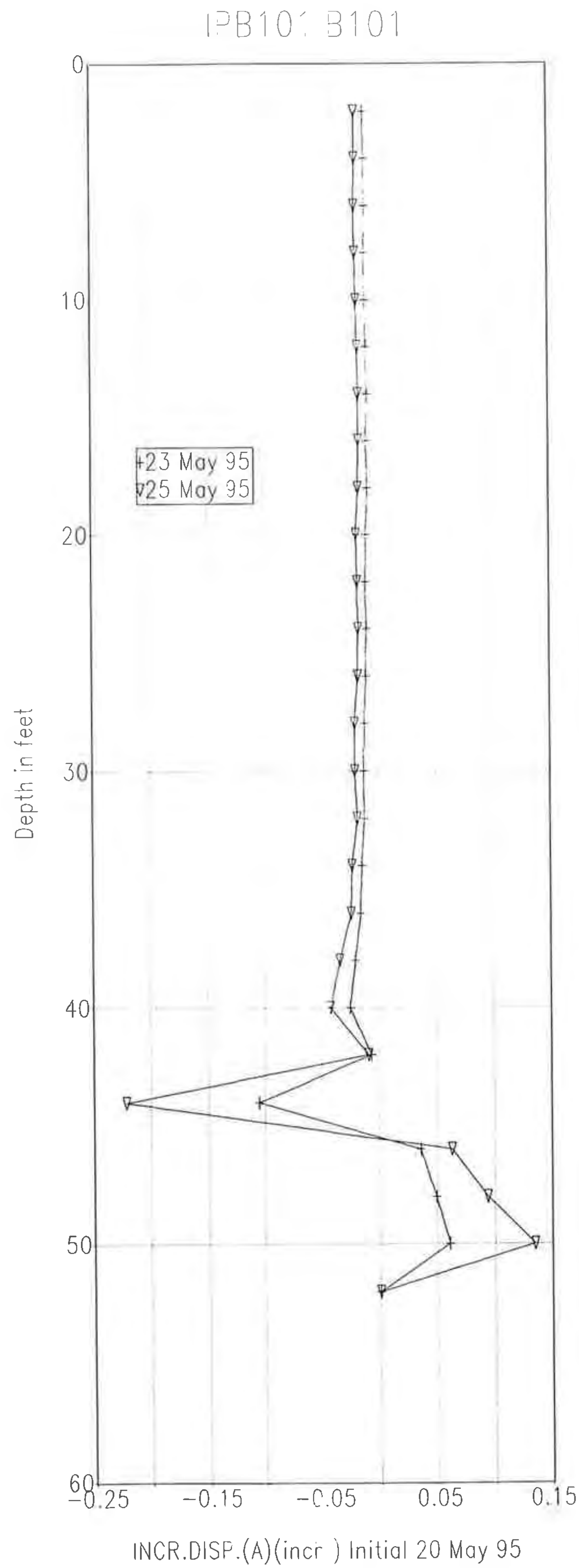


IPB12 B12
Depth in feet
INCR.DISP.(A)(inch) Initial 14 Apr 95
+18 Apr 95
∇21 Apr 95
◊24 Apr 95
□28 Apr 95
Δ01 May 95

Figure C-1-5

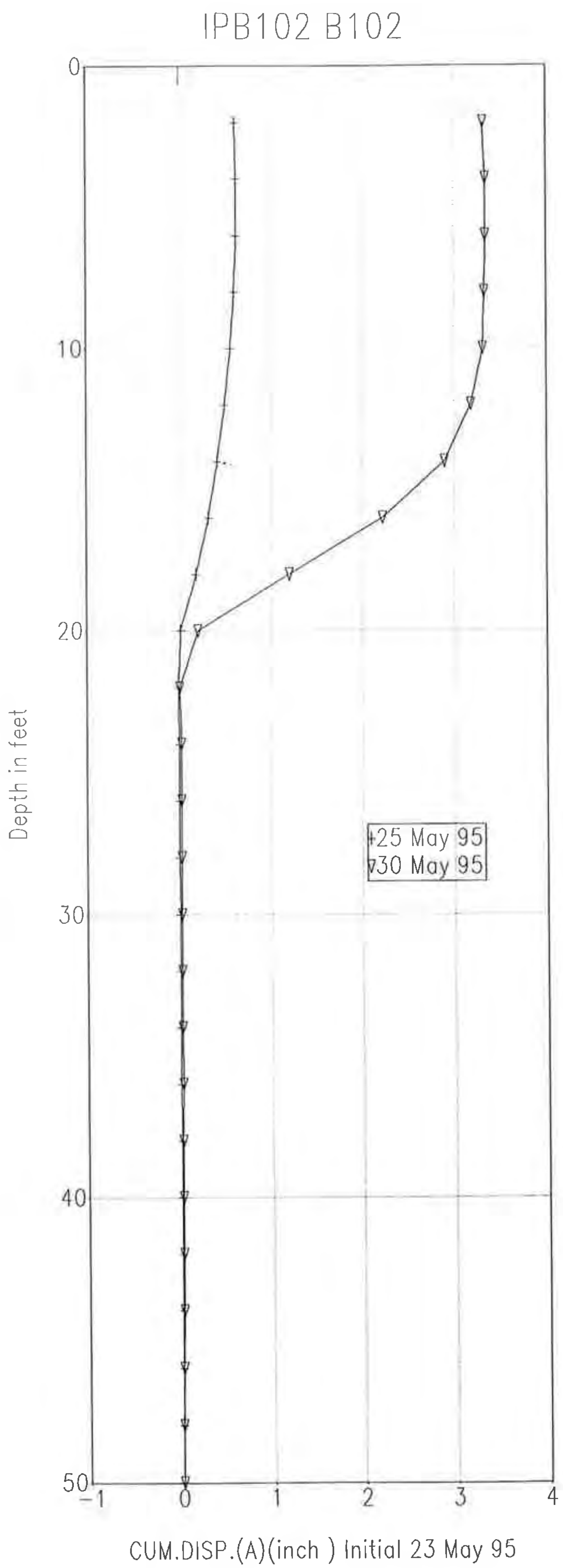


IPB101 B101
+23 May 95
▽25 May 95
Depth in feet
0
10
20
30
40
50
60
-0.40
-0.20
0.00
0.20
CUM.DISP.(A)(inch) Initial 20 May 95



+23 May 95
▽25 May 95
Depth in feet
0
10
20
30
40
50
60
-0.25
-0.15
0.05
0.15

Figure C-1-6


IPB102 B102
Depth in feet
+25 May 95
▽30 May 95
CUM.DISP.(A)(inch) Initial 23 May 95

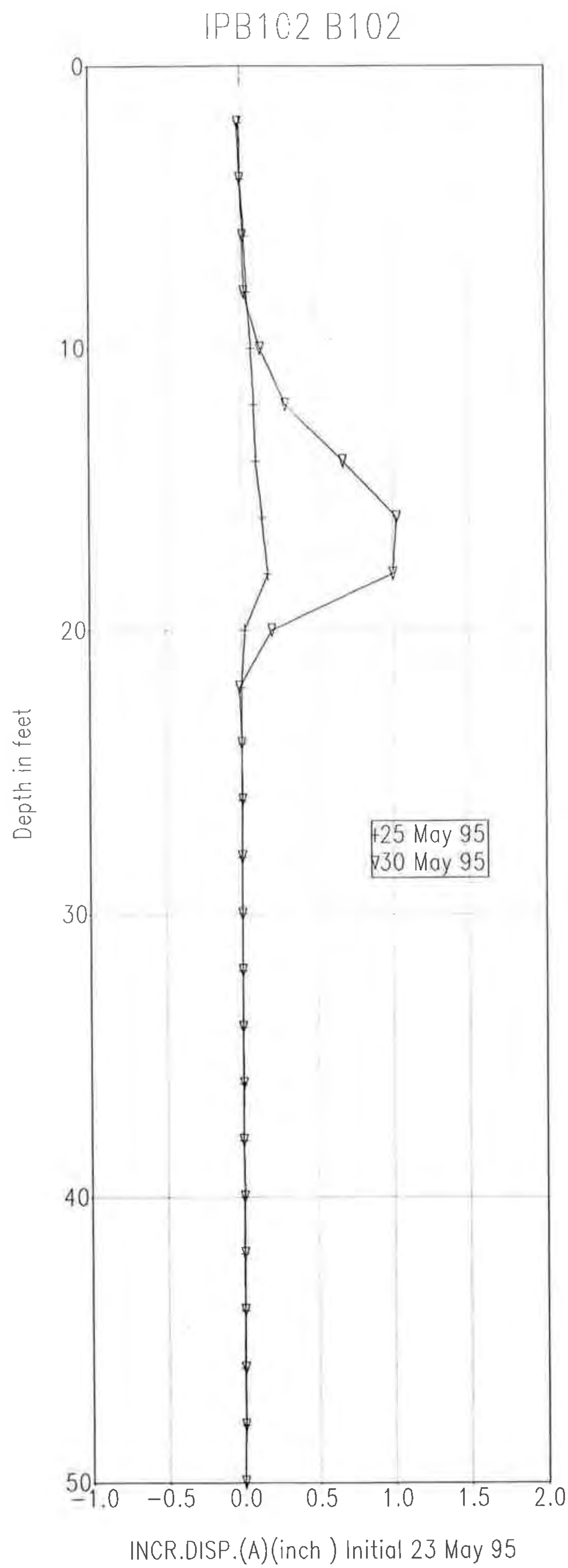
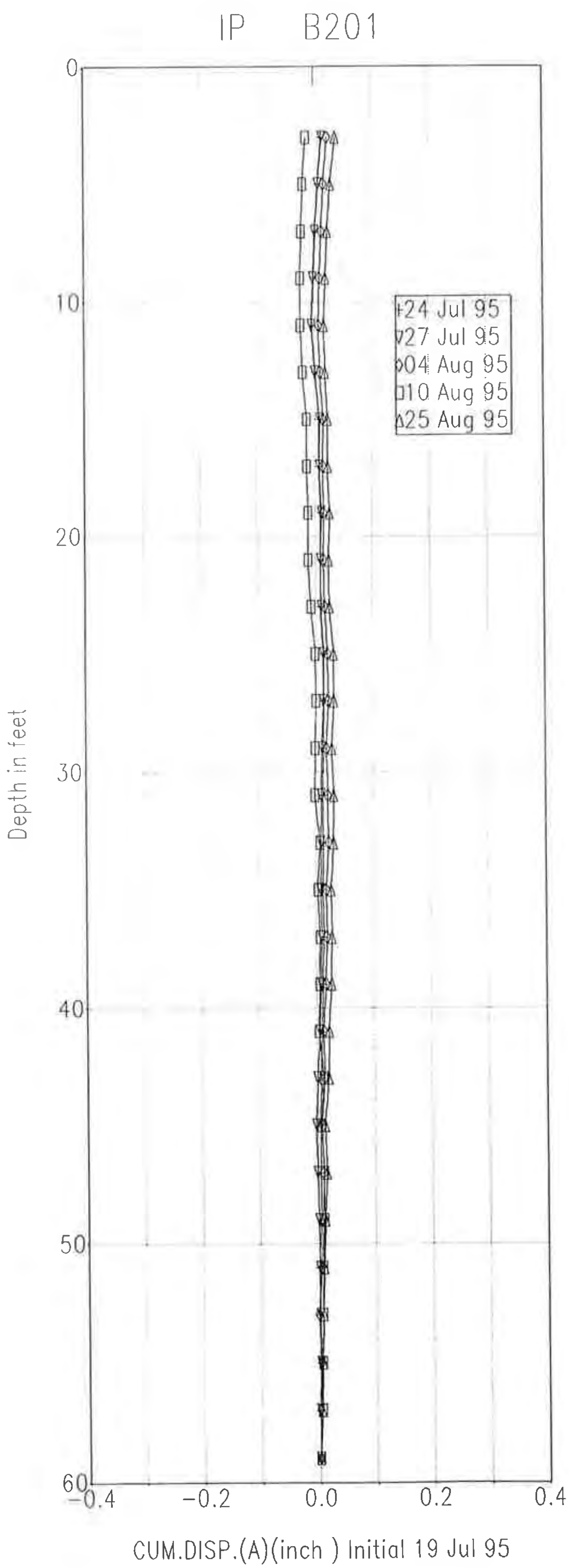

IPB102 B102
Depth in feet
+25 May 95
▽30 May 95
INCR.DISP.(A)(inch) Initial 23 May 95

Figure C-1-7


IP B201
0
10
20
30
40
50
60
Depth in feet
-0.4
-0.2
0.0
0.2
0.4
CUM.DISP.(A)(inch) Initial 19 Jul 95
+24 Jul 95
∇27 Jul 95
◇04 Aug 95
□10 Aug 95
△25 Aug 95

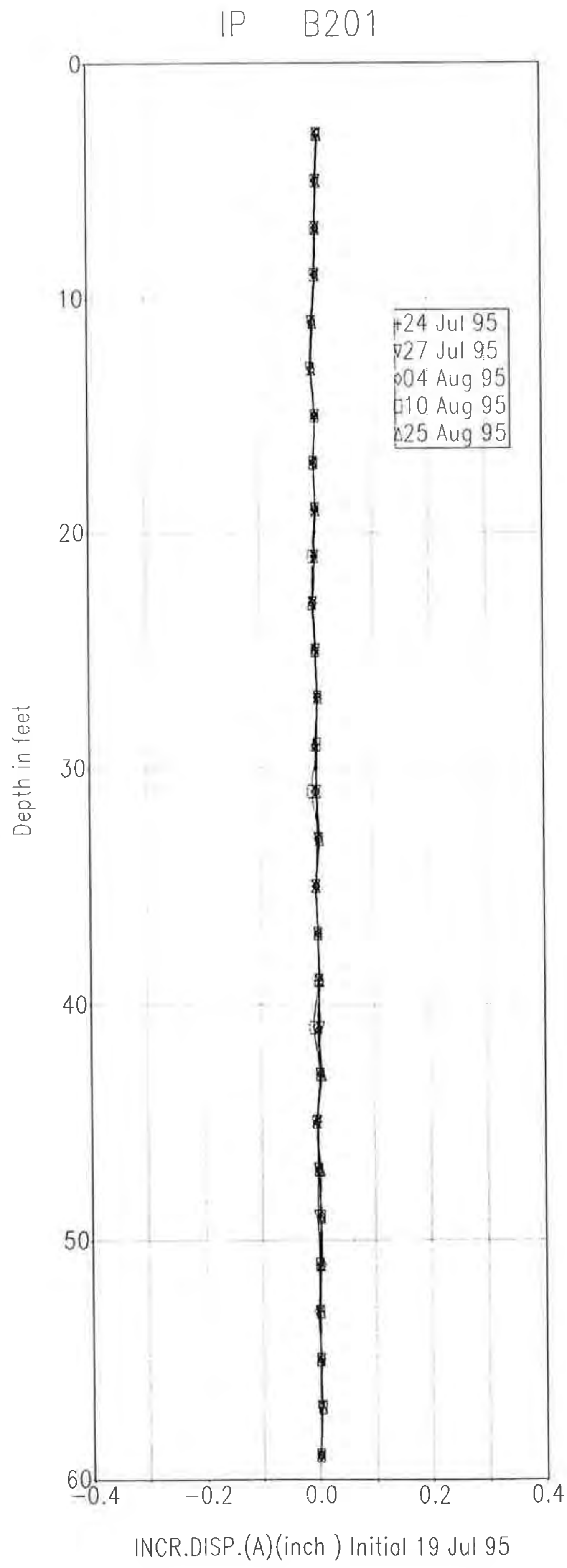
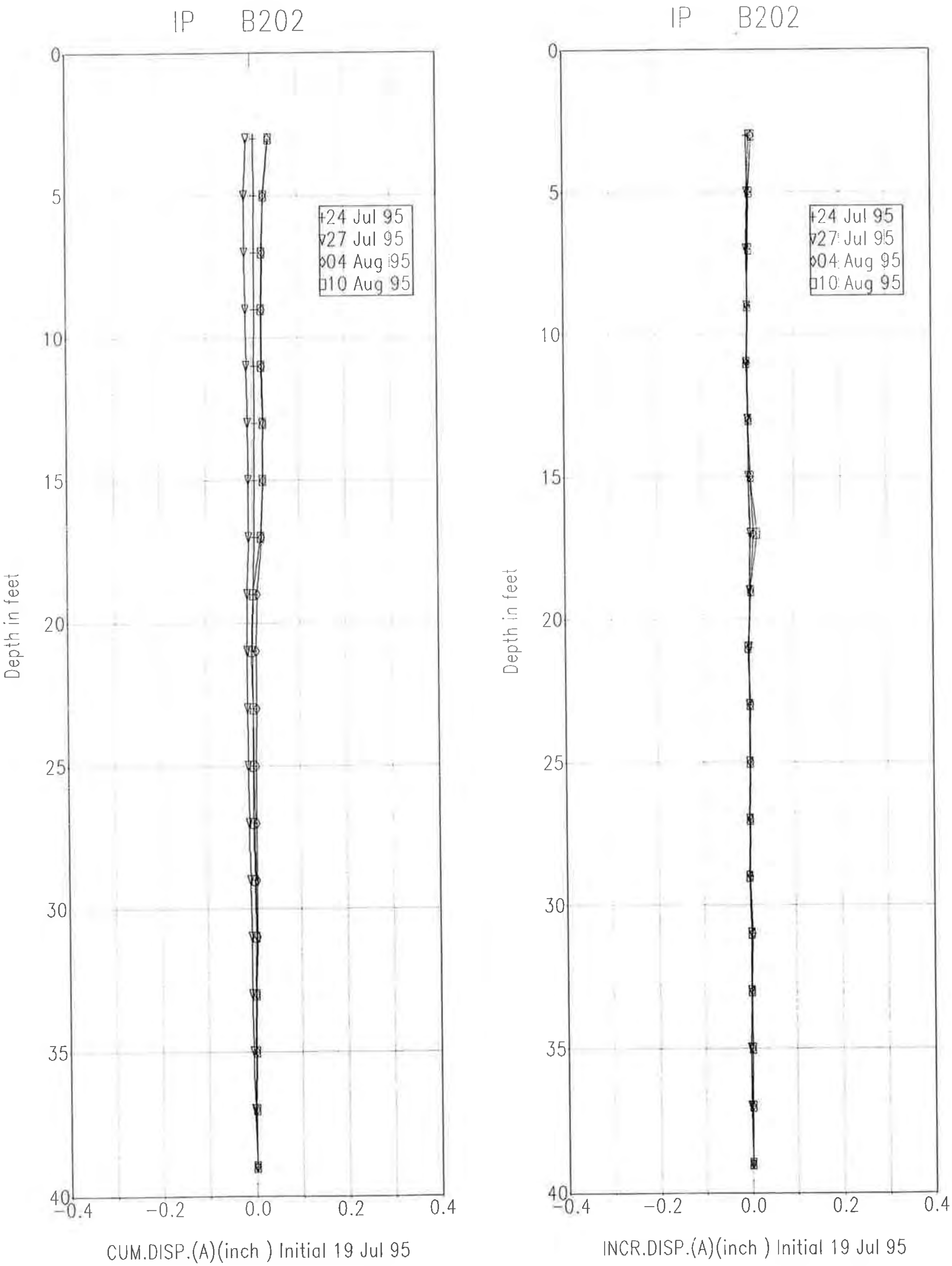

IP B201
0
10
20
30
40
50
60
Depth in feet
-0.4
-0.2
0.0
0.2
0.4
INCR.DISP.(A)(inch) Initial 19 Jul 95
+24 Jul 95
∇27 Jul 95
◇04 Aug 95
□10 Aug 95
△25 Aug 95

Figure C-1-8


IP B202
0
5
10
15
20
25
30
35
40
Depth in feet
+24 Jul 95
▽27 Jul 95
◇04 Aug 95
□10 Aug 95
-0.4
-0.2
0.0
0.2
0.4
CUM.DISP.(A)(inch) Initial 19 Jul 95
IP B202
Depth in feet
INCR.DISP.(A)(inch) Initial 19 Jul 95

APPENDIX C-2 - PIEZOMETER LOGS

A total of 10 piezometers were installed at the site to determine groundwater levels within the area. One stand-pipe piezometer was installed to a depth of 27-ft in P-1. Six vibrating wire piezometers were installed within the landslide, and three were installed east of the landslide. Detailed piezometer installation logs are included as Figures C-2-1 through C-2-10. A summary of the data collected from the piezometers is shown in Table 2. Results are plotted in Figure 10.

MONITORING WELL INSTALLATION REPORT FIG. C-2-1

Well No. PZ-01

Project Illinois Power/Baldwin Power Station | Location Baldwin, IL

Project No 5E08560 | Installed By Layne-Western | Date 3/20/95 | Time

Method of Installation

LOG OF BORING AND WELL

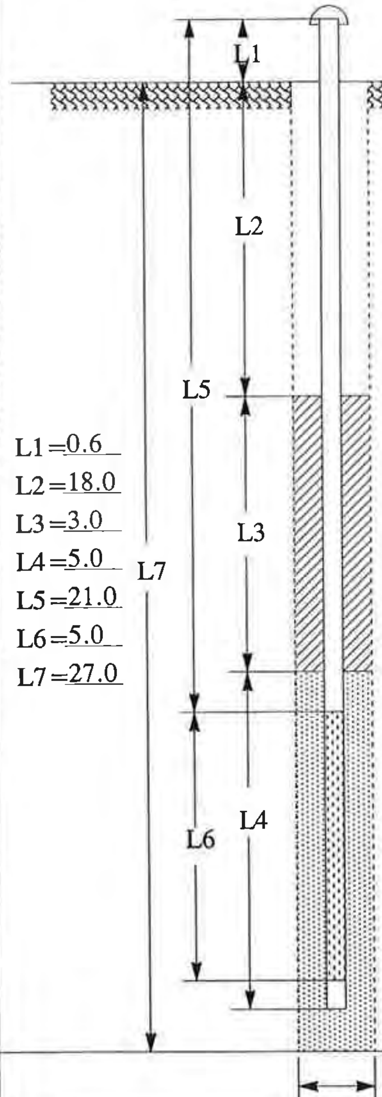
BORING

Depth in Ft.	Description	Symbol
0.00	Medium stiff, damp to moist, reddish-brown, low plastic, Silty CLAY (CL)(FILL) Becomes damp Becomes moist Grades trace gravel Becomes damp, brown Becomes gray with fly ash Becomes brown and gray	
21.00	Loose, moist, black, bottom ash (SP) Very loose, wet, black, bottom ash (SP)	

WELL

Type of Well Piezometer

Ground Elev. 98.0 | Top of Riser Elev. 98.0



L1 = 0.6
L2 = 18.0
L3 = 3.0
L4 = 5.0
L5 = 21.0
L6 = 5.0
L7 = 27.0

Riser Pipe I.D., in. 2

Type of Pipe Schedule 40 PVC

Backfill Type Around Riser Grout

Top of Seal Elevation 80.0

Type of Seal Material Enviroplug

Top of Filter Elevation 77.0

Type of Filter Material Sand and ash sluff

Size of Opening, in. 0.01

Diameter of Well Tip, in. 2.0

Bottom of Screen Elevation 72.0

Bottom of Riser Elevation 72.0

Bttm of Boring Elev. 71.0

Diameter of Boring, in. 4.3

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-2**

Well No. PZ-02

Project Illinois Power/Baldwin Power Station Location Baldwin, IL

Project No 5E08560 Installed By Layne-Western Date 4/13/95 Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

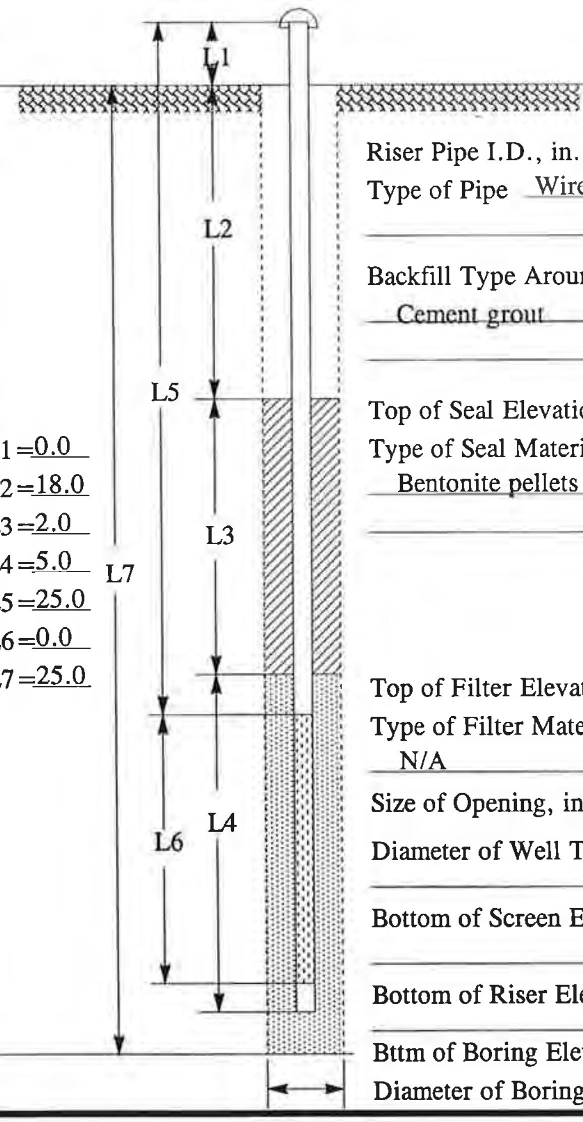
BORING

Depth in Ft.	Description	Symbol
0.00	Soft, damp, reddish-brown, Silty CLAY (CL); with organic roots	
2.00	Medium stiff, damp, reddish-gray with black specks, Silty CLAY (CL) Becoming reddish-brown Damp	
10.00	Becoming reddish-brown with gray, high plastic CLAY (CH)	
14.00	Reddish-brown-gray, low plastic CLAY (CL); with trace sand Becoming gray with reddish-brown; trace sand Gray with reddish brown	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 74.5 Top of Riser Elev. 74.5



L1 = 0.0
L2 = 18.0
L3 = 2.0
L4 = 5.0
L5 = 25.0
L6 = 0.0
L7 = 25.0

Riser Pipe I.D., in. N/A

Type of Pipe Wire

Backfill Type Around Riser Cement grout

Top of Seal Elevation 56.5

Type of Seal Material Bentonite pellets

Top of Filter Elevation 54.5

Type of Filter Material N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 49.5

Bottom of Riser Elevation 49.5

Bttm of Boring Elev. 54.5

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-3**

Well No. **PZ-02A**

Project **Illinois Power/Baldwin Power Station** Location Baldwin, IL

Project No **5E08560** Installed By Roberts Env. Date 5/10/95 Time

Method of Installation

LOG OF BORING AND WELL

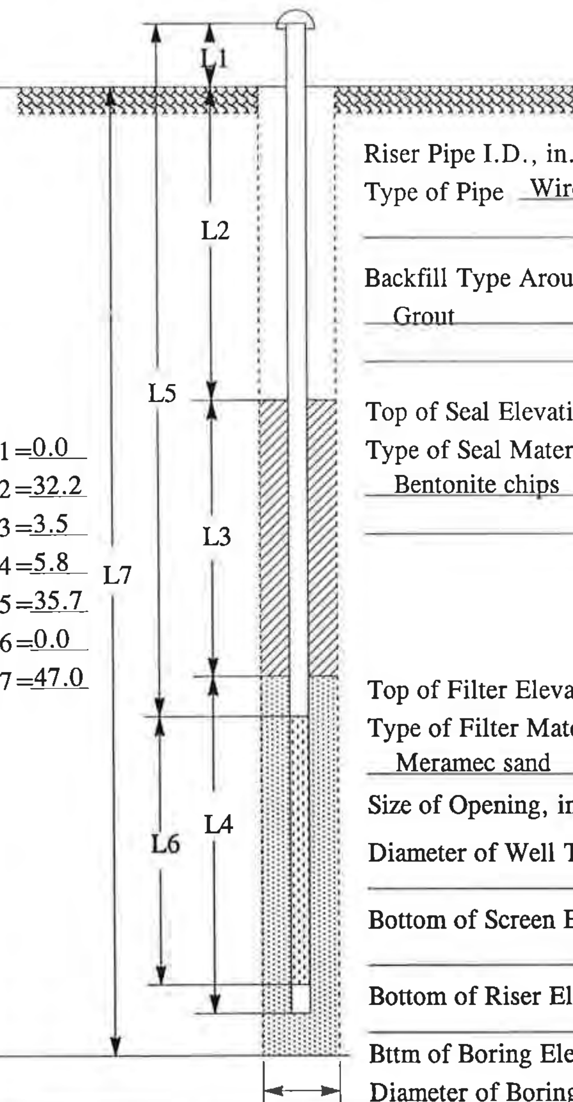
BORING

Depth in Ft.	Description	Symbol
0.00	Boring not sampled 0 - 29.0 feet (See Log of Boring B-11A)	
29.00	Stiff to very stiff, moist, orange and gray, high plastic CLAY (CH); with trace gravel Becomes very stiff, light brown; with little sand	
39.00	Hard, high plastic CLAY (CH) (highly weathered shale)	
41.50	Highly weathered LIMESTONE	
42.10	Brown and gray, high plastic, highly weathered SHALE; with trace sand and gravel Possible slickenside at 43.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 74.5 Top of Riser Elev. 74.5



L1 = 0.0
L2 = 32.2
L3 = 3.5
L4 = 5.8
L5 = 35.7
L6 = 0.0
L7 = 47.0

Riser Pipe I.D., in. N/A

Type of Pipe Wire

Backfill Type Around Riser Grout

Top of Seal Elevation 42.3

Type of Seal Material Bentonite chips

Top of Filter Elevation 38.8

Type of Filter Material Meramec sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 33.0

Bottom of Riser Elevation 33.0

Bttm of Boring Elev. 27.5

Diameter of Boring, in. 8.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-4**

Well No. PZ-03

Project Illinois Power/Baldwin Power Station

Location Baldwin, IL

Project No 5E08560

Installed By Layne-Western

Date 4/13/95

Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

BORING

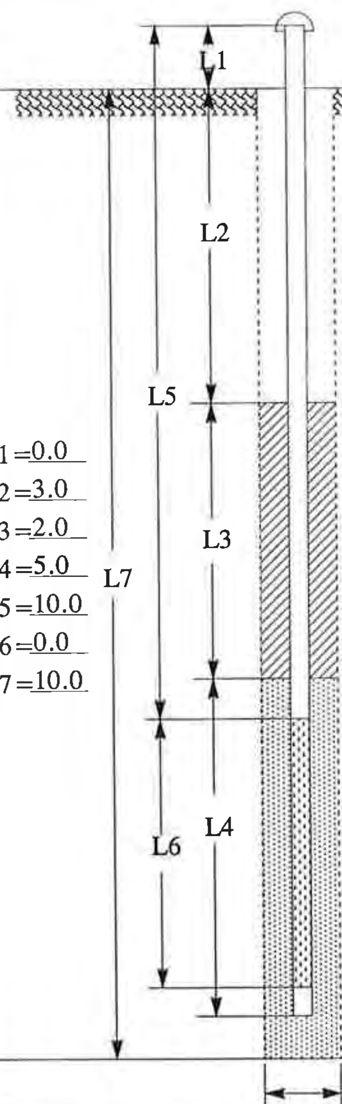
Depth in Ft.	Description	Symbol
0.00	Medium stiff, moist, brown, low plastic, silty CLAY (CL) to clayey silt	
	Becomes very soft, wet, gray; with some sand	
	Becomes stiff, gray and orangish-brown	
	Bottom of Boring at 10.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 50.8

Top of Riser Elev. 50.8



L1 = 0.0
L2 = 3.0
L3 = 2.0
L4 = 5.0
L5 = 10.0
L6 = 0.0
L7 = 10.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser
Cement grout

Top of Seal Elevation 47.8

Type of Seal Material
Bentonite pellets

Top of Filter Elevation 45.8

Type of Filter Material
N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 40.8

Bottom of Riser Elevation 40.8

Bttm of Boring Elev. 45.8

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT

FIG. C-2-5

Well No. PZ-03A

Project **Illinois Power/Baldwin Power Station**

Location Baldwin, IL

Project No **5E08560** Installed By Roberts Env. Date 5/15/95 Time

Method of Installation

LOG OF BORING AND WELL

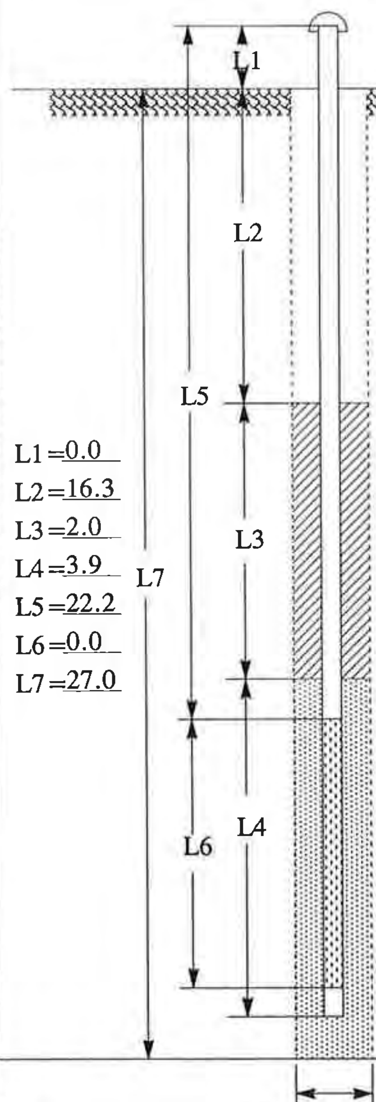
BORING

Depth in Ft.	Description	Symbol
0.00	Firm, moist to wet, medium gray, low plastic, Clayey SILT (ML); trace roots, wet, pocket of medium sand	
8.00	Firm, moist to wet, medium gray, medium to high plastic, Silty CLAY (CL); with 6-inch layer of fine grained, silty sand	
12.50	Firm, moist, light gray, medium to high plastic, Silty CLAY (CL); with mottles of tan, sandy clay, trace coarse to medium sand	
18.70	Dark gray, moderately weathered LIMESTONE	
19.30	Dark gray, severely weathered SHALE 0.2 feet Limestone at 20.0 feet Trace gravel, shale becomes greenish-gray at 23.8 feet Becomes maroon	
	Bottom of boring at 27.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 50.8 Top of Riser Elev. 50.8



L1 = 0.0
L2 = 16.3
L3 = 2.0
L4 = 3.9
L5 = 22.2
L6 = 0.0
L7 = 27.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Grout

Top of Seal Elevation 34.5

Type of Seal Material Bentonite chips

Top of Filter Elevation 32.5

Type of Filter Material WB-40 sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 28.6

Bottom of Riser Elevation 28.6

Bttm of Boring Elev. 23.8

Diameter of Boring, in. 2.9

Remarks

Inspected By T. Deddens

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT

FIG. C-2-6

Well No. PZ-04

Project Illinois Power/Baldwin Power Station

Location Baldwin, IL

Project No 5E08560 | Installed By Roberts Env. | Date 5/12/95 | Time

Method of Installation

LOG OF BORING AND WELL

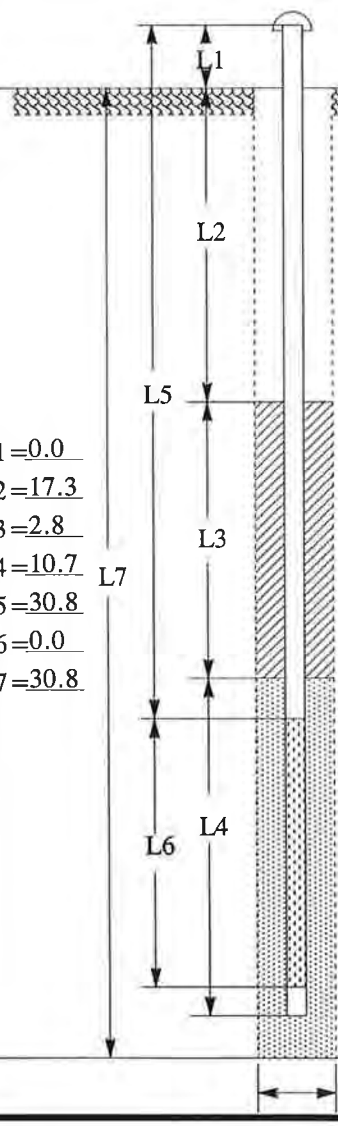
BORING

Depth in Ft.	Description
0.00	Medium stiff, moist, brown, low plastic CLAY (CL) (Fill)
	Becomes gray, more silty
20.00	Stiff to very stiff, moist to wet, brown, medium plastic, Silty CLAY (CL); some fine gravel, coarse sand, trace medium to fine sand
24.00	Firm to stiff, orange-brown, high plastic CLAY (CH); trace fine gravel, coarse sand
25.00	Moist, orange, silty CLAY (CL); with rock fragments
25.80	25.8 - 26.9: LIMESTONE
26.90	26.9 - 27.2: Probable clay (no recovery)
27.20	Damp, green, high plastic, highly weathered CLAY-SHALE; with silt and oxidation
30.50	Becomes highly weathered LIMESTONE
	Bottom of boring at 30.8 feet

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 58.7 | Top of Riser Elev. 58.7



L1 = 0.0
L2 = 17.3
L3 = 2.8
L4 = 10.7
L5 = 30.8
L6 = 0.0
L7 = 30.8

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Grout

Top of Seal Elevation 41.4

Type of Seal Material Bentonite chips

Top of Filter Elevation 38.6

Type of Filter Material Sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 27.9

Bottom of Riser Elevation 27.9

Bttm of Boring Elev. 27.9

Diameter of Boring, in. 8.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-7**

Well No. PZ-05

Project Illinois Power/Baldwin Power Station | Location Baldwin, IL

Project No 5E08560 | Installed By Layne-Western | Date 4/13/95 | Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

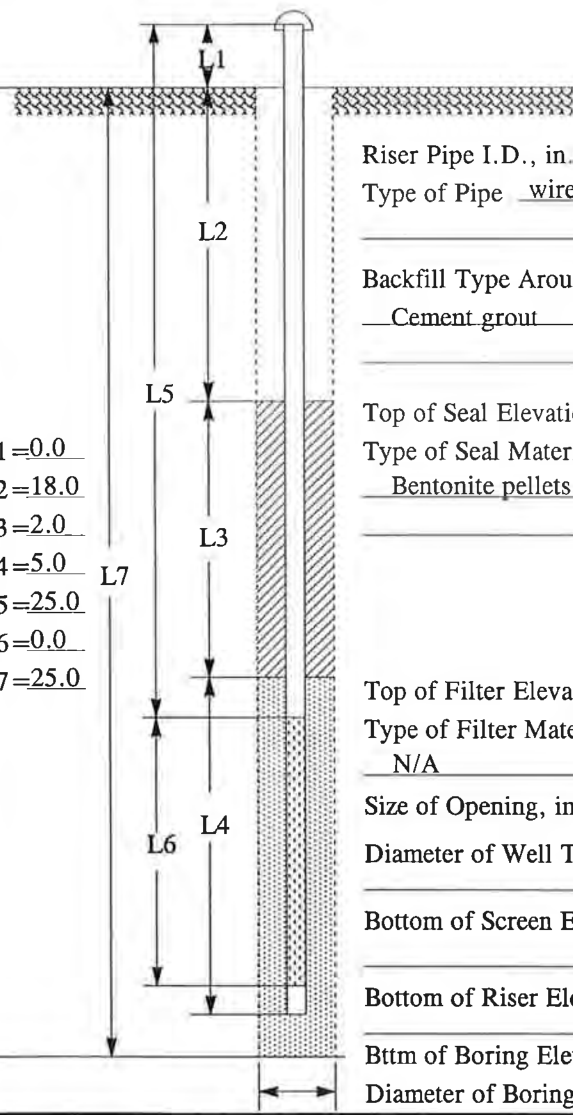
BORING

Depth in Ft.	Description	Symbol
0.00	Medium stiff, brown, low plastic, Silty CLAY (CL)	
6.00	Damp, fly ash/gravel (SP); with clay	
7.50	and bottom ash Very stiff, mottled gray and brown,	
10.00	low plastic, Silty CLAY (CL) Becoming reddish-brown with gray, high plastic CLAY (CH)	
14.00	Reddish-brown-gray, low plastic CLAY (CL); with trace sand Becoming gray with reddish-brown; trace sand Gray with reddish-brown	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 75.0 | Top of Riser Elev. 75.0



L1 = 0.0
L2 = 18.0
L3 = 2.0
L4 = 5.0
L5 = 25.0
L6 = 0.0
L7 = 25.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Cement grout

Top of Seal Elevation 57.0

Type of Seal Material Bentonite pellets

Top of Filter Elevation 55.0

Type of Filter Material N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 50.0

Bottom of Riser Elevation 50.0

Bttm of Boring Elev. 55.0

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-8**

Well No. PZ-05A

Project: Illinois Power/Baldwin Power Station

Location: Baldwin, IL

Project No: 5E08560 Installed By: Roberts Env. Date: 5/11/95 Time:

Method of Installation:

LOG OF BORING AND WELL

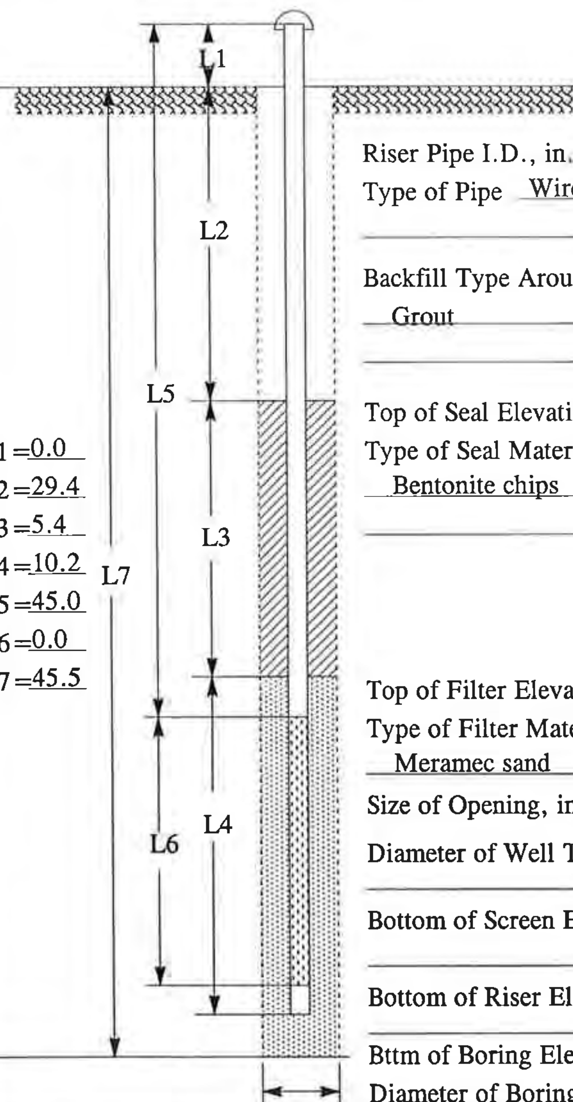
BORING

Depth in Ft.	Description	Symbol
0.00	Stiff, moist, low to medium plastic CLAY (CL) (Fill)	
	Becoming stiff, medium plastic CLAY (CL)	
14.70	Stiff, moist, gray, medium plastic CLAY (CL); with trace oxidation	
17.50	Stiff, moist, brown, medium plastic CLAY (CL); with trace fine roots	
	Firm to stiff, moist, gray, low plastic, Silty CLAY (CL); with little oxidation	
27.50	Soft to medium stiff, moist, orangish-brown, low plastic, silty CLAY (CL); with trace fine sand, pebbles	
34.00	Stiff, moist, light brown, medium to high plastic CLAY (CL); with trace sand (1/2 inch rounded pebbles)	
37.20	Very stiff to hard, damp, orangish-brown, low plastic CLAY (CL)	
41.50	Hard, damp, light green, high plastic CLAY (CH); with trace sand	
	Bottom of boring at 45.5 feet	

WELL

Type of Well: Vibr. Wire Piezo.

Ground Elev. 75.0 Top of Riser Elev. 75.0



L1 = 0.0
L2 = 29.4
L3 = 5.4
L4 = 10.2
L5 = 45.0
L6 = 0.0
L7 = 45.5

Riser Pipe I.D., in. N/A

Type of Pipe: Wire

Backfill Type Around Riser: Grout

Top of Seal Elevation: 45.6

Type of Seal Material: Bentonite chips

Top of Filter Elevation: 40.2

Type of Filter Material: Meramec sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation: 30.0

Bottom of Riser Elevation: 30.0

Bttm of Boring Elev. 29.5

Diameter of Boring, in. 8.0

Remarks:

Inspected By: K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-9**

Well No. PZ-06

Project Illinois Power/Baldwin Power Station | Location Baldwin, IL

Project No 5E08560 | Installed By Layne-Western | Date 4/12/95 | Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

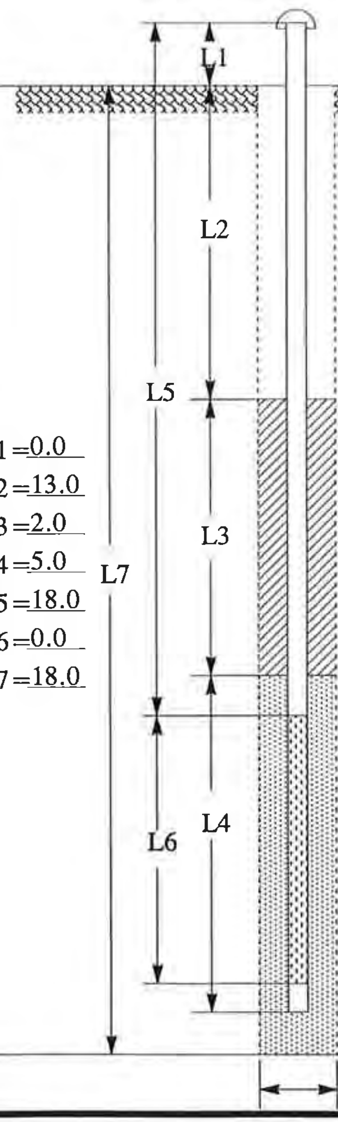
BORING

Depth in Ft.	Description	Symbol
0.00	Medium stiff, damp to moist, reddish-brown, low plastic, Silty CLAY (CL)(FILL) Becomes damp Becomes moist Grades trace gravel Becomes damp, brown Becomes gray with fly ash	

WELL

Type of Well Piezometer

Ground Elev. 97.9 | Top of Riser Elev. 97.9



L1 = 0.0
L2 = 13.0
L3 = 2.0
L4 = 5.0
L5 = 18.0
L6 = 0.0
L7 = 18.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser
Cement grout

Top of Seal Elevation 86.9

Type of Seal Material
Bentonite Pellets

Top of Filter Elevation 84.9

Type of Filter Material
N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 79.9

Bottom of Riser Elevation 79.9

Bttm of Boring Elev. 84.9

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-10**

Well No. PZ-07

Project: Illinois Power/Baldwin Power Station — Location: Baldwin, IL

Project No: 5E08560 — Installed By: Roberts Env. — Date: 5/15/95 — Time:

Method of Installation:

LOG OF BORING AND WELL

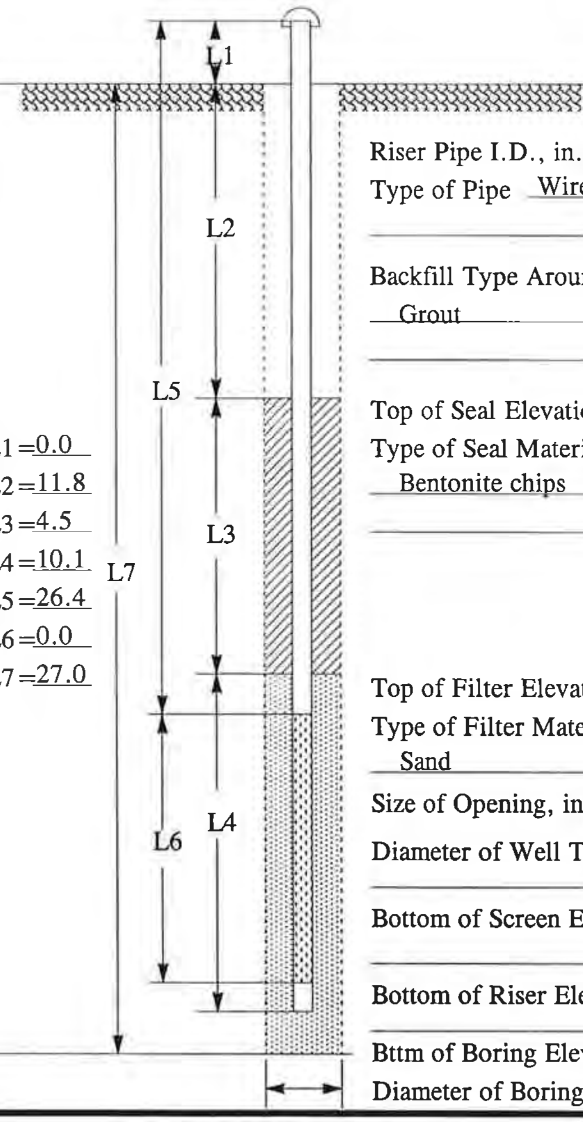
BORING

Depth in Ft.	Description	Symbol
0.00	Moist, brown, Silty CLAY (CL)	
4.00	Stiff, moist, greenish-gray, medium to high plastic CLAY (CL/CH); with trace organics	
7.00	Medium stiff, moist, mottled orangish brown, low plastic, silty clay and gray, high plastic CLAY (CL/CH); with little sand	
12.00	Stiff, moist, light brown, high plastic CLAY (CH); with little sand, fine pebbles Becomes mottled gray and brown	
22.00	Dry to damp, light gray, high plastic CLAY (highly weathered shale)	
	Bottom of boring at 27.0 feet	

WELL

Type of Well: Vibr. Wire Piezo.

Ground Elev.: 51.0 — Top of Riser Elev.: 51.0



L1 = 0.0
L2 = 11.8
L3 = 4.5
L4 = 10.1
L5 = 26.4
L6 = 0.0
L7 = 27.0

Riser Pipe I.D., in.: N/A

Type of Pipe: Wire

Backfill Type Around Riser: Grout

Top of Seal Elevation: 39.2

Type of Seal Material: Bentonite chips

Top of Filter Elevation: 34.7

Type of Filter Material: Sand

Size of Opening, in.: 0.00

Diameter of Well Tip, in.: 0.5

Bottom of Screen Elevation: 24.6

Bottom of Riser Elevation: 24.6

Bttm of Boring Elev.: 24.0

Diameter of Boring, in.: 8.0

Remarks: 11:07 - 11:22 temp

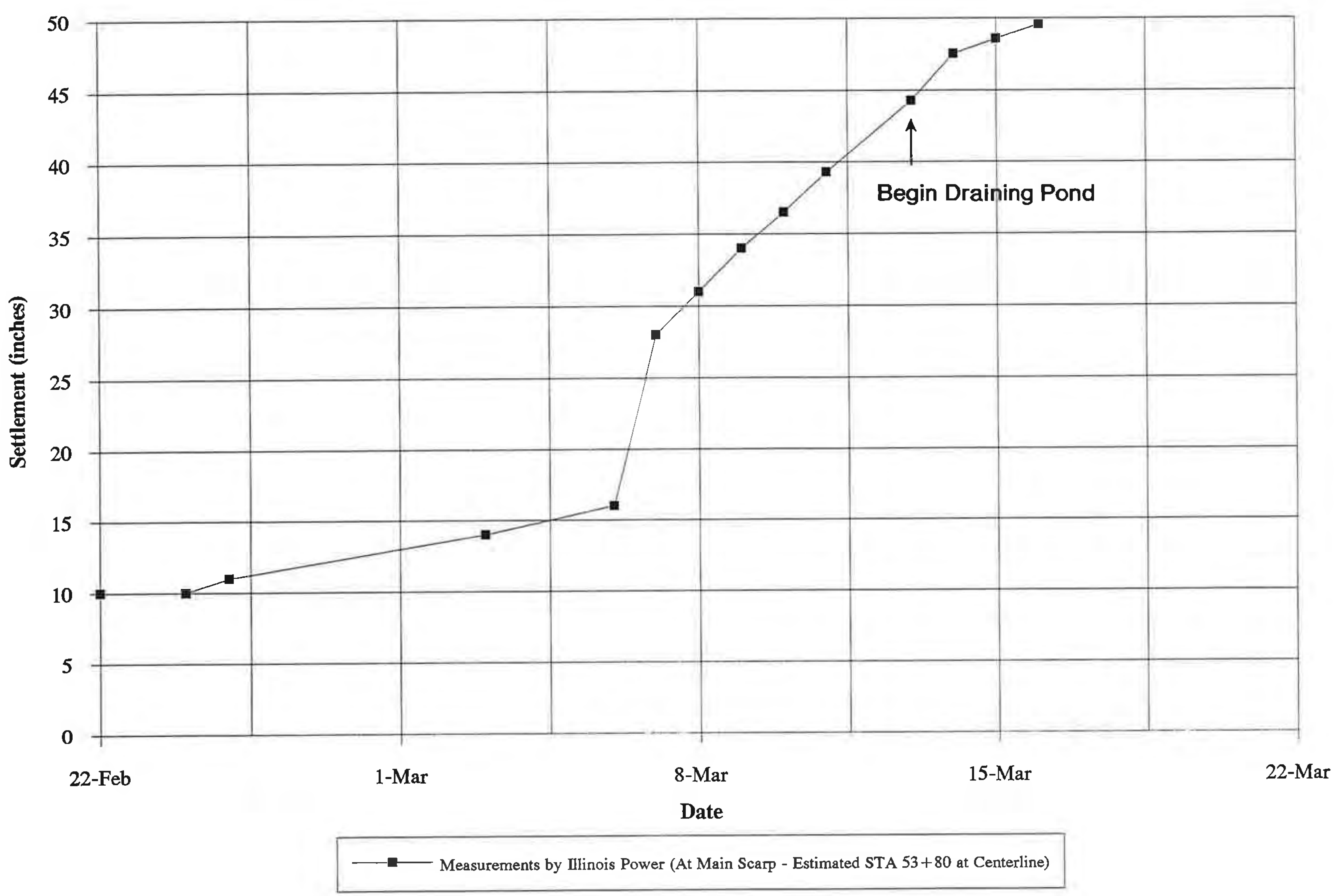
Inspected By: K. Berry

WOODWARD-CLYDE CONSULTANTS

APPENDIX C-3 - ILLINOIS POWER CRACK GAUGES

Crack monitoring gauges were installed across the crest and midslope scarps at major cracks by Illinois Power personnel in February and April, 1995. Crack gauges consisted of two reinforcing bars driven into the ground, one on each side of the crack. One was driven vertically, the other horizontally. The relative vertical and sometimes horizontal movement between the two was recorded by a tape measure. The initial crack gauge installed in February had to be removed in March to provide access for drilling activities. Plots of the crack gauges are shown in Figures C-3-1 and C-3-2.

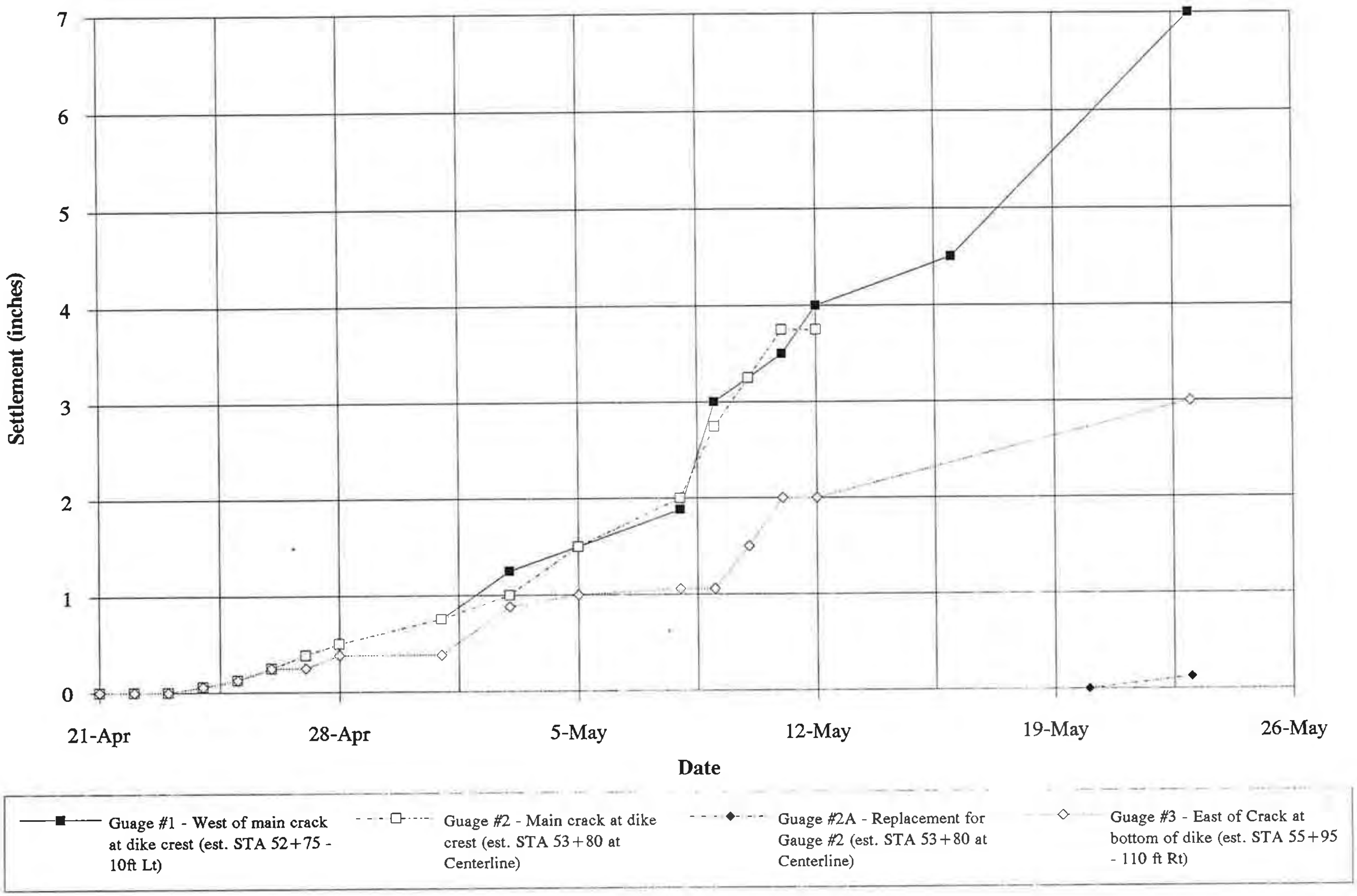
INITIAL SETTLEMENT MEASUREMENTS BY ILLINOIS POWER



SETLMNT.XLS Chart 3

Figure C-3-1

SETTLEMENT GAUGE READINGS BY ILLINOIS POWER



SETLMNT.XLS Chart 2

Figure C-3-2

APPENDIX D

PARALLEL WALL OPTION

APPENDIX D
PARALLEL WALL OPTION

This appendix describes in detail the "Parallel Wall" option which was conceived during our meeting of senior level personnel at the site on July 21, 1995. This option is currently the one favored by Illinois Power, primarily due to cost.

Areas of Potential Deep Failure (Sta. -6-50 to 5+50)

As noted during the July 21 meeting, lowering the groundwater level below the downstream slope of the dike has a significant stabilizing effect. Calculations indicate that a factor of safety of approximately 1.5 during steady state conditions can be achieved without use of a toe berm or lightweight fill by lowering the groundwater level below the downstream slope to within a few feet of the failure plan (el. 385$\pm$). This elevation is about 10 feet lower than the flow line of the stream near the downstream toe of the dike. Lowering the groundwater level below the stream will require a deep drainage trench extending a few thousand feet to the west, or the use of a pumped system. It was agreed during our meeting on July 21 that a pumped system would be the more easily implemented and economical solution. We recommend a pumped system using a drain wall located near the upstream toe of the dam, a drain wall near the downstream toe, and a soil-bentonite cutoff wall, as shown in Figure D-1.

To reduce the amount of water pumped, it is necessary to construct a cutoff wall through the bottom ash upstream of the drain wall. A soil-bentonite cutoff wall is recommended. The calculated amount of water to be pumped from the drain wall during full reservoir conditions is approximately 30 gallons per minute for a 2,400-foot long cutoff wall. Due to uncertainties in soil permeability, we recommend designing for approximately 300 gallons per minute. To handle this amount of water and to provide redundancy in case of well failure, we recommend that a minimum of three pumps be used within the upstream drain wall. These can be constructed using conventional well screens during installation of the drain wall.

With only a drain wall near the upstream slope, the phreatic surface beneath portions of the downstream slope would be expected to equal the elevation of the creek near the downstream toe. To maintain the phreatic surface below the entire slope near the failure plane, recharge from the creek needs to be controlled. Therefore, we recommend that a second, shallow drain wall be constructed near the creek to intercept the water and pump it back into the stream as shown in Figure D-1. Again, the inflow should be small. We have assumed three pumps on the downstream drain wall. A cross-section of this option is shown in Figure D-2. We also considered use of a cutoff wall instead of a drain wall at the toe. Seepage analysis, however, showed that a cutoff wall would not be as effective as a drain wall in lowering the head sufficiently.

The production of iron and manganese oxides and the formation of slime by iron bacteria, both of which are known to clog well screens, are issues that remain to be evaluated if pumped wells are to be used. It will be necessary for measurements to be made in the field and laboratory of the pH of the water in the bottom ash beneath the dikes and in the fly ash pond. The formation of iron oxides is most rapid when the pH is about 6 and of manganese oxides when the pH is about 9. The current pH of the water in the pond is between 8 and 9. The dissolved metals and the total metals in the water in the fly ash must also be determined to define the quantities of iron, magnesium, calcium and manganese that are present. For purposes of conceptual design, we have assumed that oxides and iron bacteria will not be a significant problem. Layne-Western has indicated costs of about $2,500 per well to clean the wells, if this becomes necessary. Tests are currently underway to identify if oxide problems are likely.

Another concern with this approach is that during a power outage, water could rise in the drain wall system and jeopardize stability. Because of the low inflow rate and the large volume of soil to resaturate, calculations indicate that several days would be needed for the water level to rise enough to decrease the factor of safety significantly. Emergency power could probably be provided in this time. The need for emergency power should be addressed in the operating and maintenance procedures for the system.

As the water level below the downstream toe is lowered, the stability of the dike is increased. Thus, a point in time will be reached when the clay fill removed during the interim repair can be replaced without jeopardizing stability. The time when the replacement can be made will be determined based on piezometers installed near the failure plane. A chimney drain has also been included within the clay dike to capture seepage from the pond and to drain it into the underlying bottom ash.

Another major benefit of this option is that by draining the bottom ash that is below the upper dike, the possibility of liquefaction in the ash is eliminated. Seismically induced settlements of 3 to 6 inches as a result of densification of the bottom ash would still be likely during the design level shaking, but massive failure due to liquefaction would be unlikely. Drainage of the ash may also produce settlement of the bottom ash of approximately 2 inches. We believe the effects of this amount of settlement to be insignificant.

This option relies on pumps to lower the head downstream to the level of the failure plane. While we believe that this is probable, there is some uncertainty that it can be done. The uncertainty is due to the unknown continuity and permeability of the water washed zone found at about the failure plane, which the pumping system is intended to drain. Therefore, there is some risk that the data obtained from the instrumentation will show that additional stabilization measures may be needed. These may involve things such as sand drains to enhance drainage, or stabilizing berms.

Areas of Potential Shallow Failure (Sta. -10-50 to -6-50 and 5+50 to 14+50)

In the areas identified as having the potential for shallow failure, the head in the bottom ash must be controlled to reduce the risk of failure as the pond level rises, and to reduce the potential for liquefaction. To accomplish this, we agreed at the meeting to construct a soil-bentonite cutoff wall at the upstream toe and to install pumps within the bottom ash to dewater the ash after the wall is in place. This concept is shown in Figure D-3. Flow through the bottom ash should be small once the cutoff wall is in place. We have assumed three wells to provide redundancy.

At the time of the eventual closure of the ash pond, it will be necessary to provide a drainage outlet for the drain walls in lieu of pumping. We understand that a gravity drain will be provided at that time and will extend westward from the toe of the drain wall to a lower area. The requirement for the gravity drain should be included in the operation and maintenance manual.

The plan location of the walls and elevation views are shown in Figure D-1. The estimated cost for the "Parallel Wall" option (for areas of both shallow and deep failure) is $4.3 million as summarized in Table D-1.

Construction

We believe it is most practical to construct the repairs in two phases.

The first phase will involve all work except replacement of the fill removed during the interim repair. It will include installation of the various walls and pumps needed to lower the pore pressures in the ground below the dam. The time for the pore pressures to drain is uncertain but estimated to be 6 to 12 months. Once the pore pressures are lowered (based on piezometer measurements), then the second phase of work (replacement of the fill and final grading) can be completed.

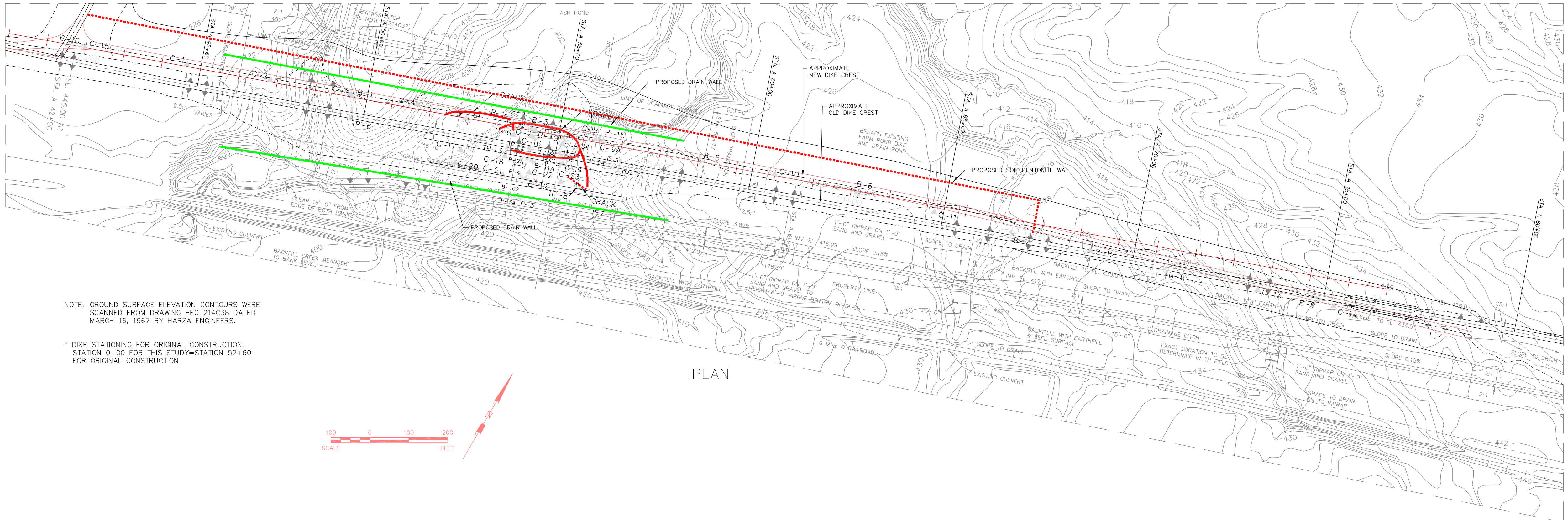
It seems reasonable to expect to construct the first phase in the Spring and Summer of 1996, and the final phase in the Fall of 1997; i.e. allowing about a year for pore pressures to dissipate.

Results of key stability analysis calculated are given in Figures D-4 through D-7.

Additional borings are needed along the cutoff and drain wall alignments to better define subsurface conditions for design and potential bidders. We have provided an allowance for this in the cost estimate. The borings are especially important to help locate rock ledges and estimate the quantity of hard rock removal needed in the drain wall trenches.

TABLE D-1
COST ESTIMATE FOR PARALLEL WALL SYSTEM

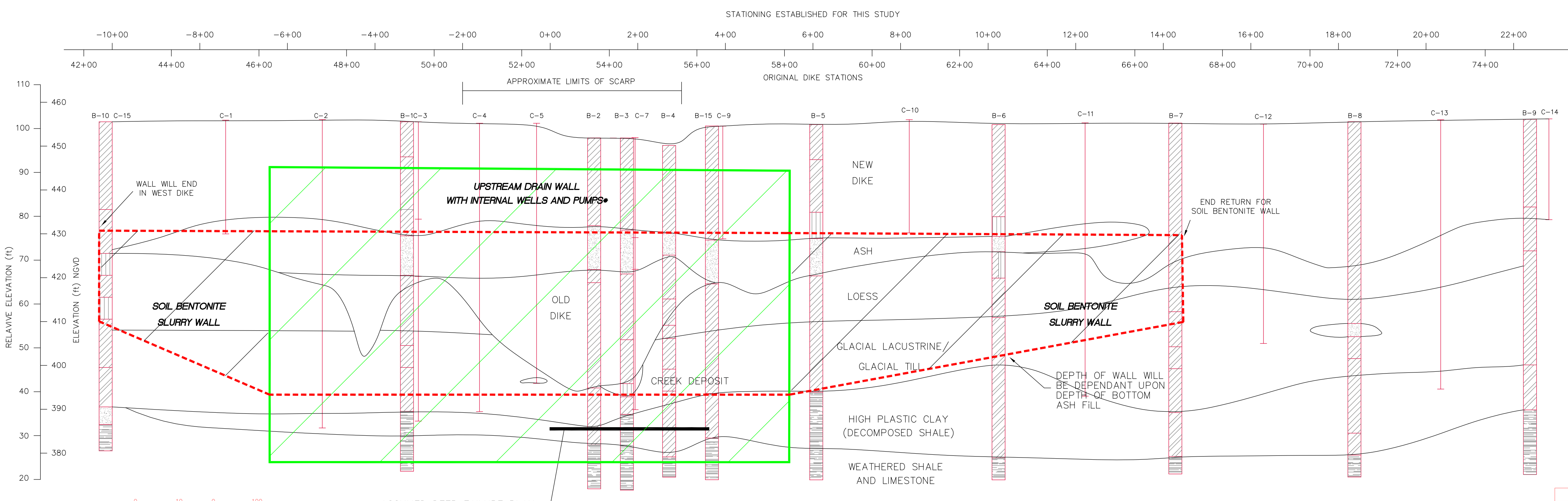
ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
	ESTIMATED CONSTRUCTION COST FOR PARALLEL WALL SYSTEM				
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	20,000	$0.90	cy	$18,000
3	Exacavate and stockpile soil	15,400	$2.50	cy	$38,500
4	Borings for information at proposed walls	1	$50,000	allow	$50,000
5	Soil-Bentonite Wall	95,000	$4.00	sf	$380,000
6	Drain Wall	69,600	$9.00	sf	$626,400
7	Wells, Pumps, Warning System	9	$15,000	ea	$135,000
8	Chimney Drain, French Drain	4,000	$15.00	cy	$60,000
9	Working Pads, Clay Cap	20,000	$5.00	cy	$100,000
10	Downstream Drain Wall	29,000	$9.00	sf	$261,000
11	Replacement of fill from Interim Fix	52,400	$5.00	cy	$262,000
12	Roadway on top of dike	2,300	$5.40	sy	$12,420
13	Seed and Mulch	25,000	$0.50	sy	$12,500
14	Instrumentation	1	$25,000	allow	$25,000
15	Provide electrical service	1	$20,000	allow	$20,000
		Subtotal			$2,200,820
		OH and profit @ 15%			$330,123
		Subtotal			$2,530,943
		Engineer'g/Const' Monit'g @ 15%			$379,641
		Subtotal			$2,910,584
16	Maintenance of Pumps (Present Worth Provided by IP)	1	$650,000	allow	$650,000
		Subtotal			$3,560,584
		Contingency @20%			$712,117
		TOTAL			**$4,272,701**



NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

* DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION

PLAN



*DOWNSTREAM DRAIN WALL NOT SHOWN FOR CLARITY

GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF NEW DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.
3. NO EXPLORATIONS WERE PERFORMED AT THE LOCATIONS OF THE PROPOSED WALLS. ALL SUBSURFACE CONDITIONS ARE GENERALIZED AND DO NOT REFLECT THE CONDITIONS AT THE PROPOSED WALLS.

Revision No.	Description	Date	By	App.

REVISIONS

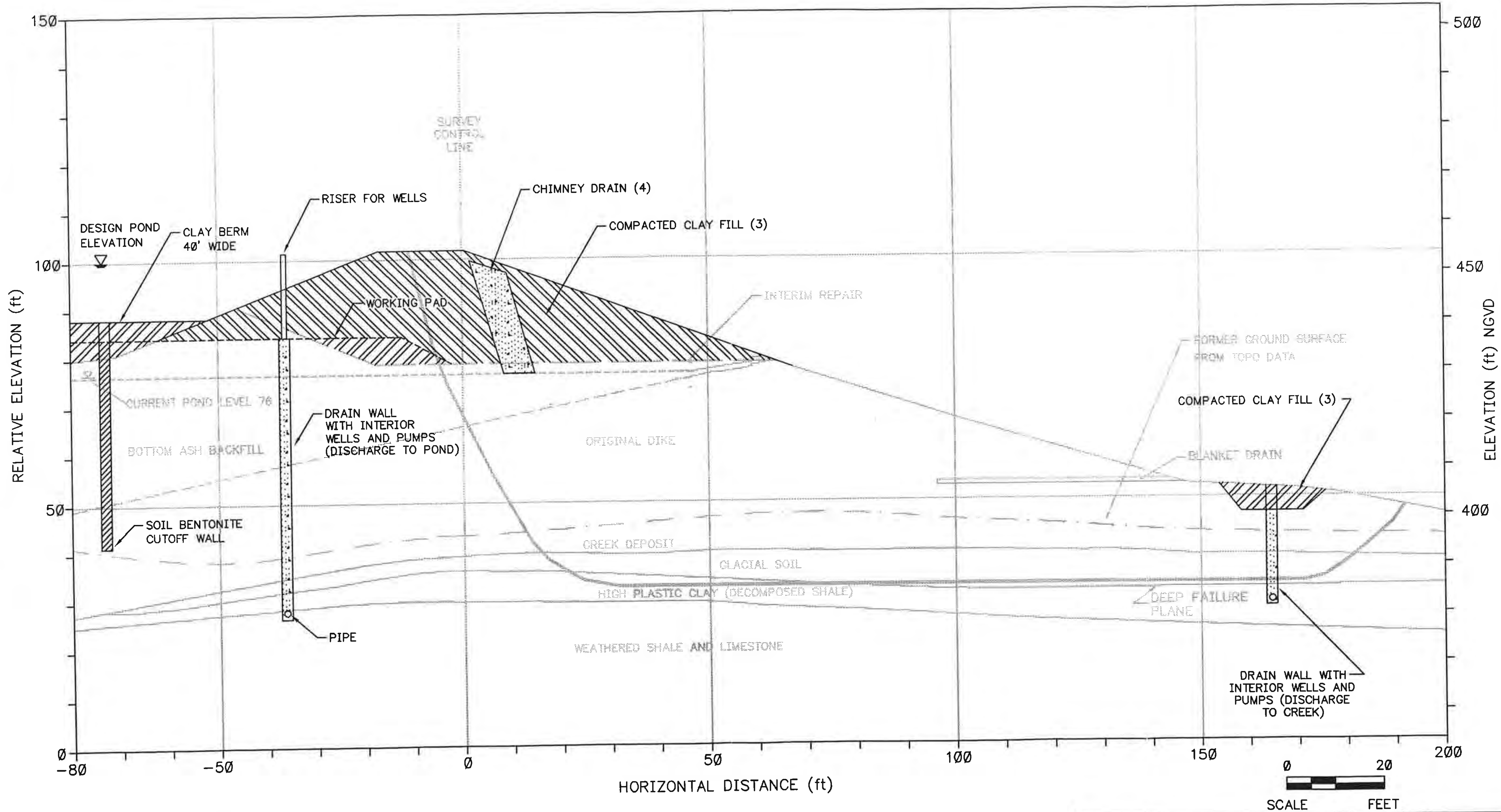
ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE OF REPAIRS
PARALLEL WALL ALTERNATIVE

Date: 7/31/95	Project Number: 5E08560	Figure Number: D-1
Drawn by: wdl	Design by: kmb	Checked by:

Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment

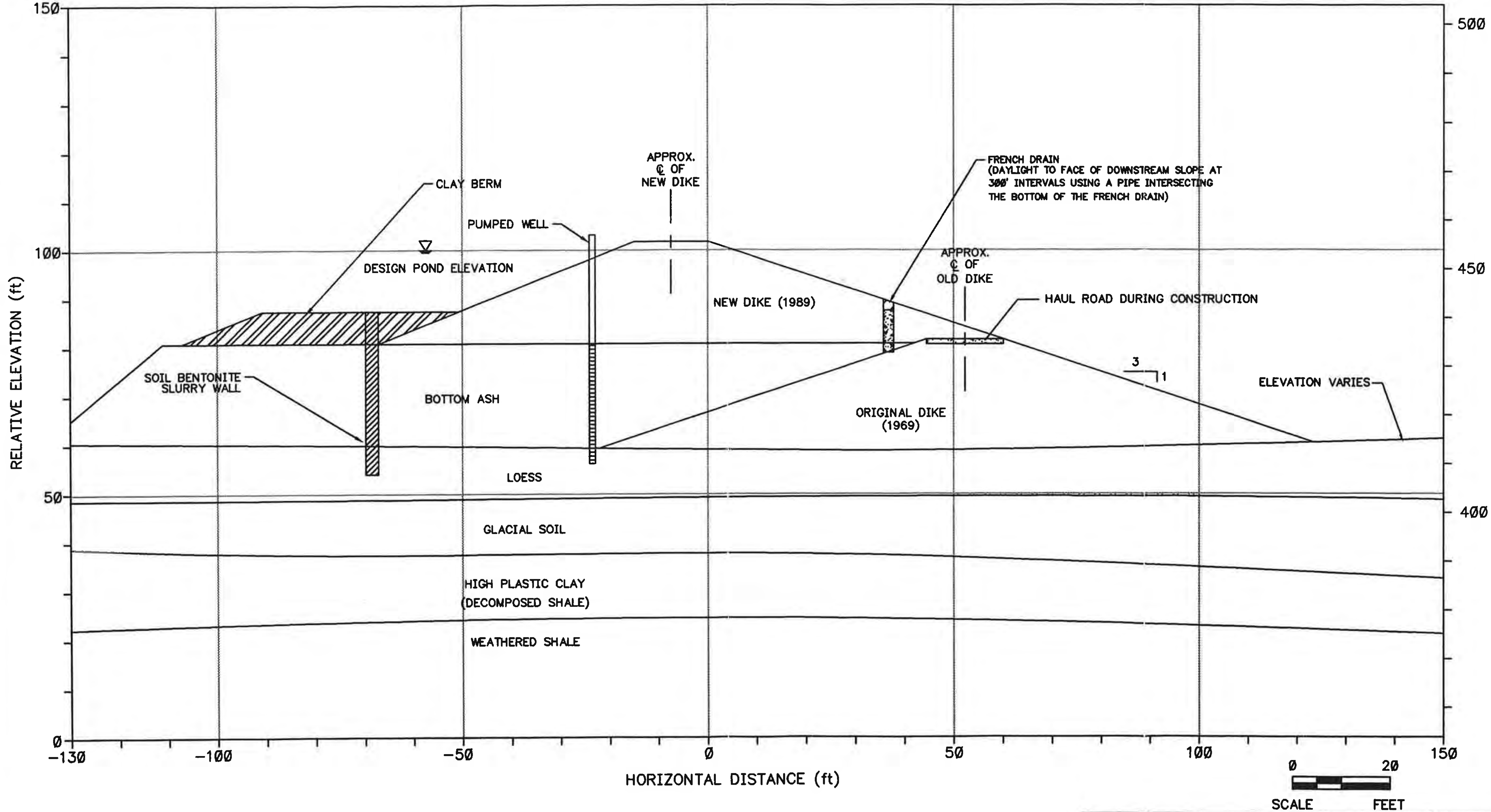
File: F:\5E08560\TASK240\DULWLSC1.DWG Last edited: 08/31/95 @ 5:00 p.m. @ WCC-ST.LOUIS



Notes:

1. There are no borings in the location of the proposed walls, therefore the bottom elevations of the walls are approximate.
2. The drain wall will contain a discontinuous pipe at the bottom and will be pumped using installed wells.
3. Place compacted clay fill after pore pressures downstream of drain wall are at el. 390 or below based on piezometer data.
4. Chimney drain will extend over approximately 600 feet of interim repair A french drain will be constructed over the remaining 600 feet of potential deep slide area.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 8/2/95 DSGN. BY: gaz CHKD. BY: KMB 9-5-95	Repair for Potential Deep Slides Parallel Wall Alternative
FIG. NO.	D-2



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 5/24/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	Repair for Potential Shallow Slides Parallel Wall Alternative	FIG. NO. D-3

File: F:\5E08560\TASK240\DWA.DWG Last edited: 09/05/95 @ 4:45 p.m. @ WCC-ST.LOUIS

BASIC GEOMETRY FOR DEEP REPAIR
PARALLEL WALL ALTERNATIVE

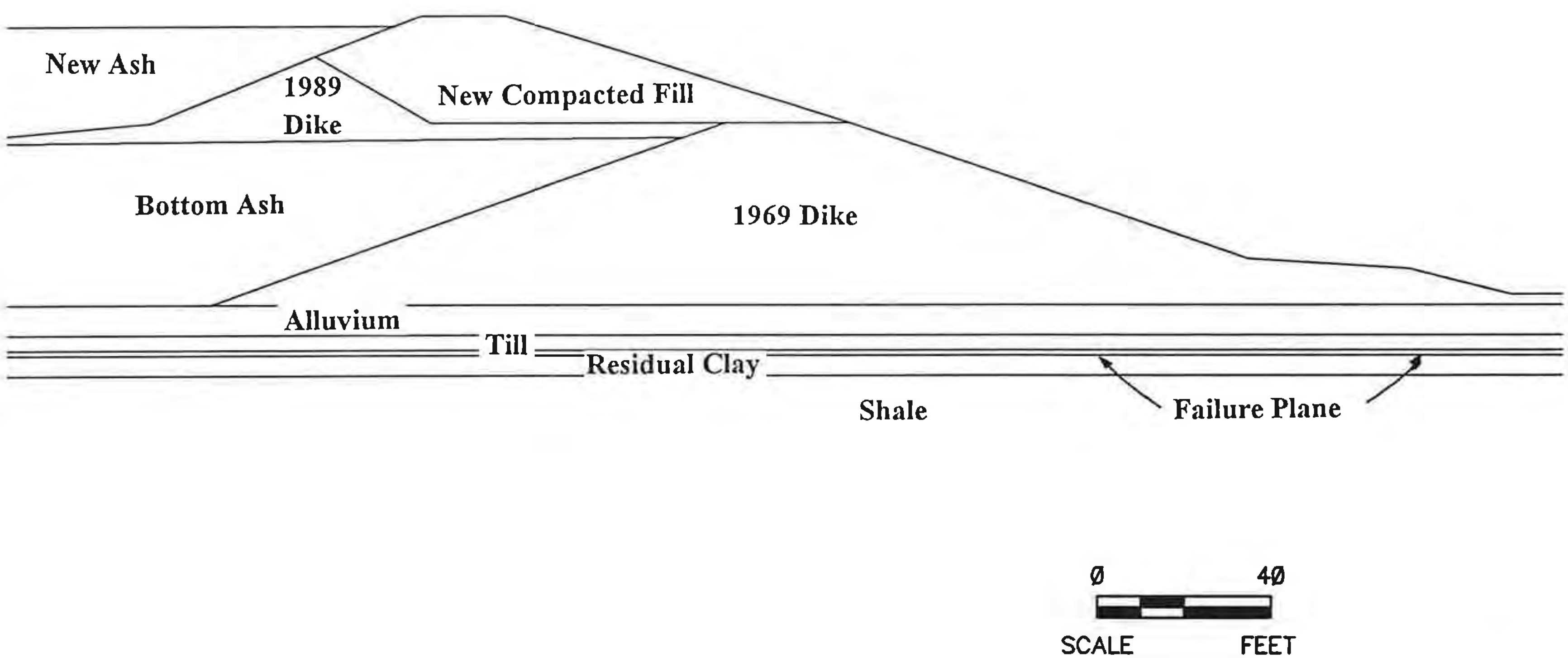
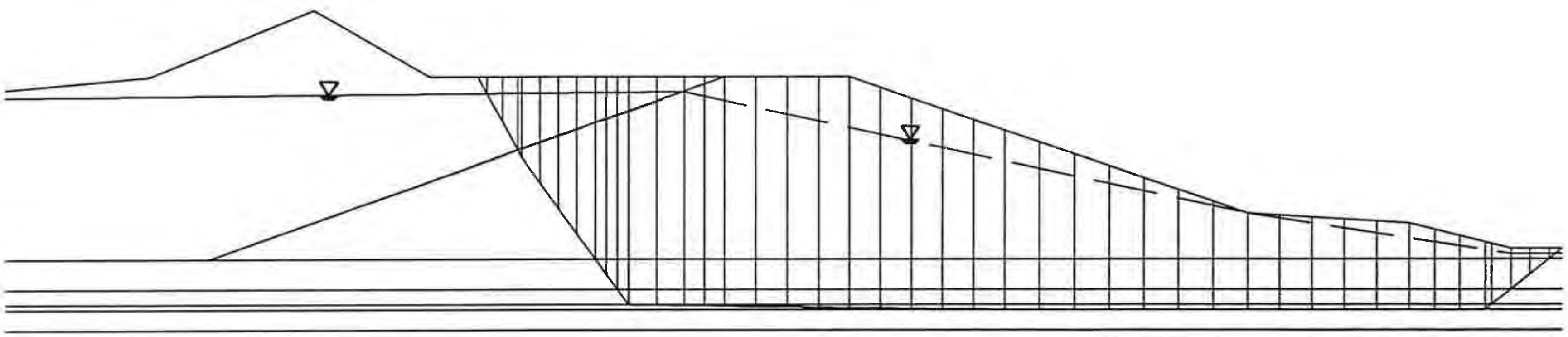


Figure D-4.

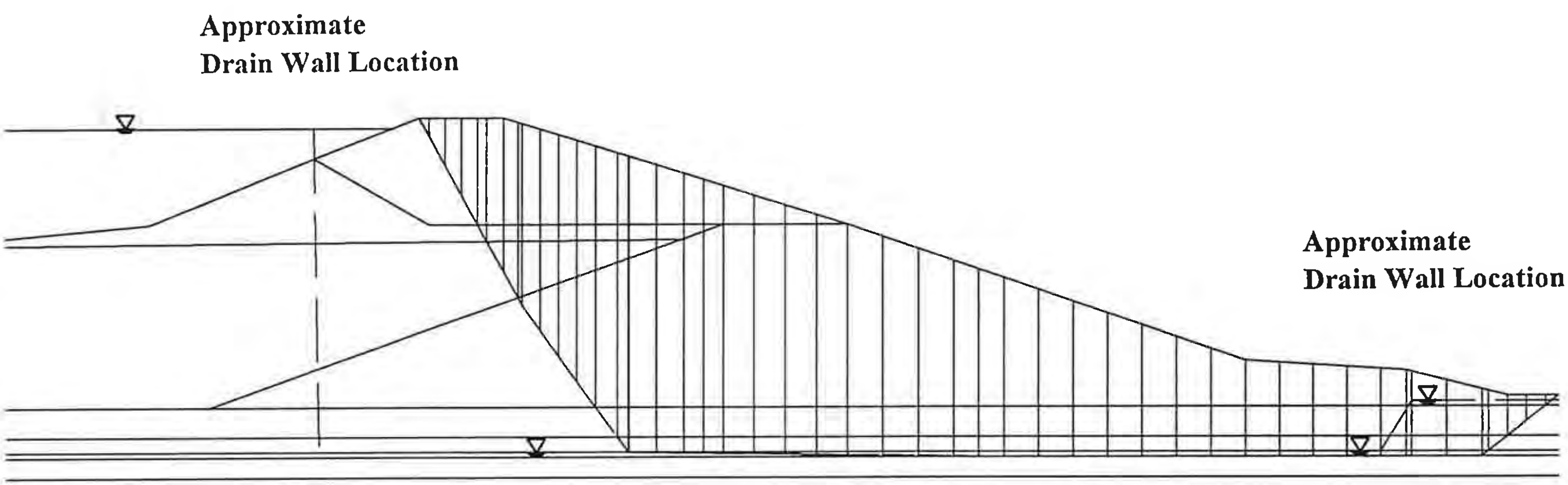
END OF CONSTRUCTION GEOMETERY
(BEFORE REPLACEMENT OF CLAY FILL)
WITH ASSUMED FAILURE
PARALLEL WALL ALTERNATIVE



FS = 1.27

Figure D–5

STEADY STATE CONDITION WITH ASSUMED FAILURE PLANE
PARALLEL WALL ALTERNATIVE



FS = 1.48

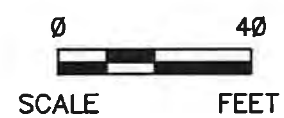
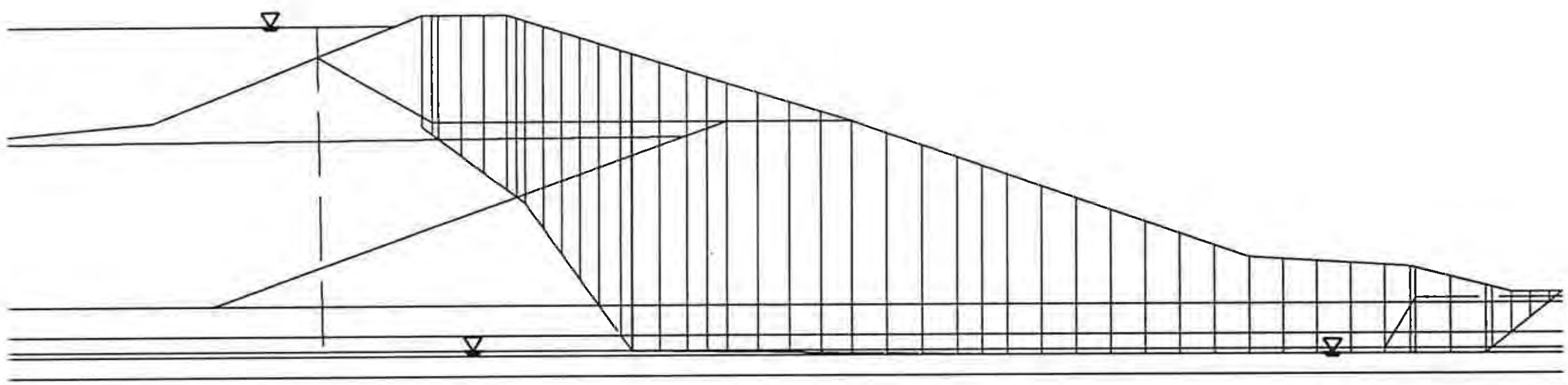


Figure D-6

EARTHQUAKE CONDITION WITH ASSUMED FAILURE PLANE
PARALLEL WALL ALTERNATIVE



FS = 1.02

Figure D–7

APPENDIX E

TRANSLATED DIKE

APPENDIX E
TRANSLATED DIKE

This option was also conceived during the July 21, 1995 meeting.

Areas of Potential Deep Failure

This option involves relocation and reconstruction of the dike further downstream, and the straddling of a portion of the creek as shown in Figure E-1. The primary advantage of this approach is that it is passive; i.e. does not require pumping or significant maintenance after construction. Major disadvantages, however, are cost and probable encroachment on the neighboring right-of-way. At this time, we are uncertain of the current limits of Illinois Power's property.

Calculations indicate that an inclination of 2.5H:1V is satisfactory for both the upstream and downstream slopes. Chimney and blanket drains are included in the dike for internal drainage. To control the head in the foundation soils, we included a drain wall below the dike located near the downstream toe of the existing dike. This drain wall would be expected to fill with water and to flow by artesian pressure into the blanket drain which will eventually drain to the creek by gravity.

Areas of Potential Shallow Failure

In order to use a passive system, the repair considered in these areas was similar to that shown in our draft report, i.e., a cutoff wall and lime slurry injection of the bottom ash fill. The cutoff wall is needed to control head below the 1989 clay fill dike to mitigate failure as the pond level is raised. The lime-fly ash injection is needed to mitigate liquefaction. A cross-section is shown in Figure E-2.

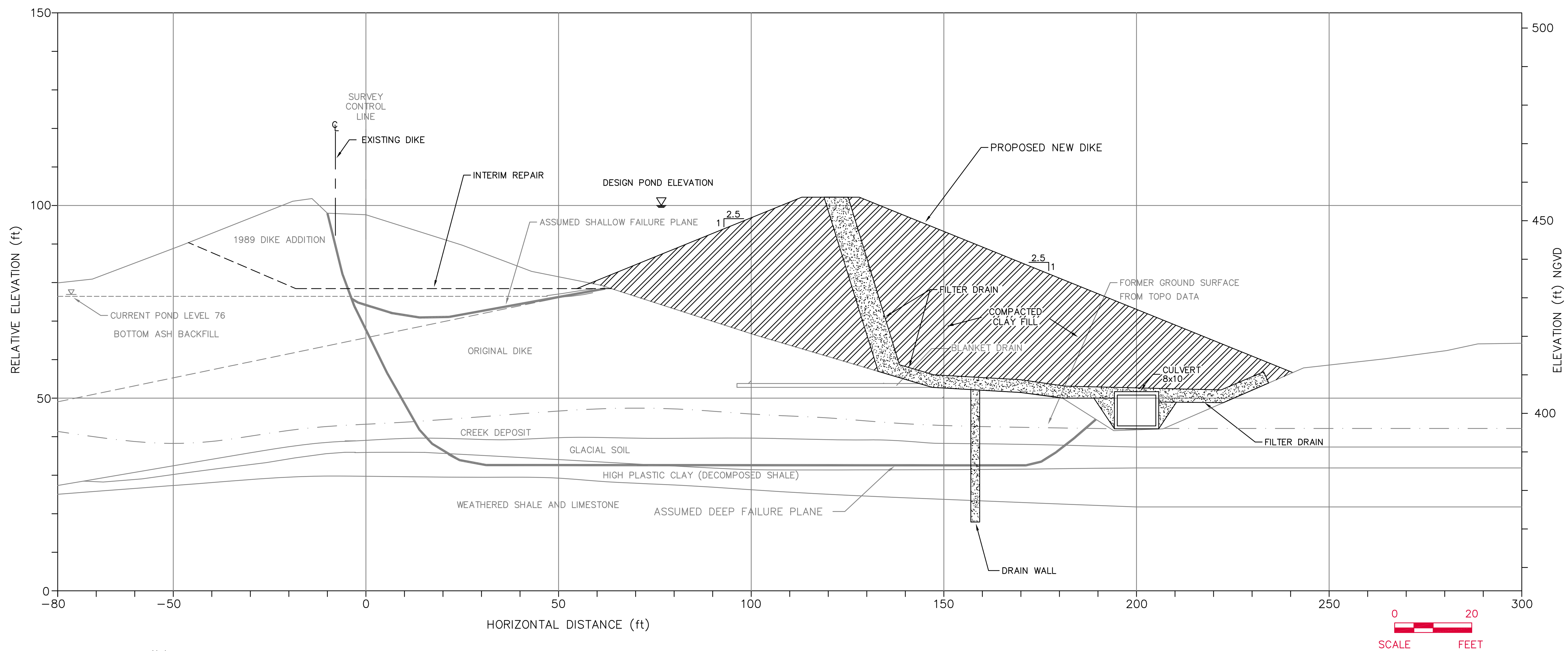
Other Details

A plan view of this option is shown in Figure E-3 and the estimated cost is summarized in Table E-1. The cost of this option, $6.1 million, does not include the cost of additional right-of-way.

Results of stability analysis are given in Figures E-4 through E-7. Detailed seepage calculations were not performed as water levels were assumed based on judgment considering the placement of the drains.

TABLE E-1
COST ESTIMATE FOR TRANSLATED DIKE

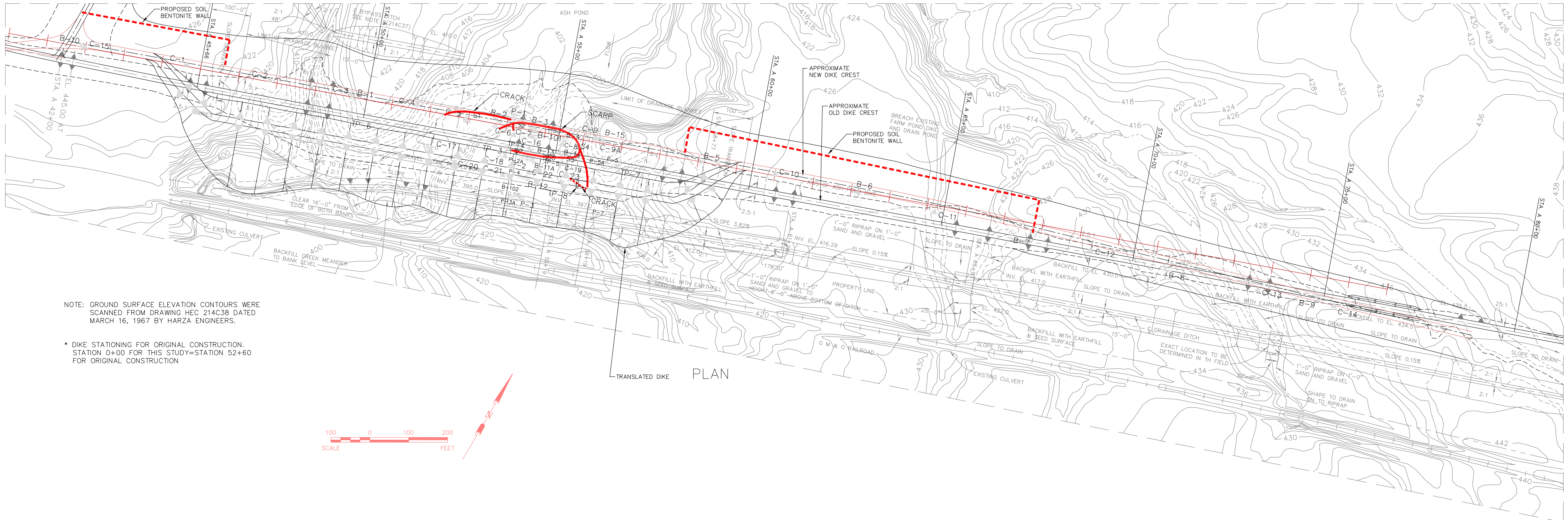
ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
ESTIMATED CONSTRUCTION FOR TRANSLATED DIKE					
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	13,000	$0.90	cy	$11,700
3	Box Culvert	1,200	$600	ft	$720,000
4	Borings at proposed relocation site	1	$100,000	allow	$100,000
5	Drain Wall	42,000	$9.00	sf	$378,000
6	Soil-Bentonite Wall	44,000	$4.00	sf	$176,000
7	Lime Injection	69,000	$3.50	cy	$241,500
8	Filter Drain	30,500	$15.00	cy	$457,500
9	Clay Fill	302,000	$5.00	cy	$1,510,000
10	Clearing and Grubbing	3	$3,000	ac	$9,000
11	Roadway on top of dike	2,300	$5.40	sy	$12,420
12	Seed and Mulch	42,000	$0.50	sy	$21,000
13	Instrumentation	1	$25,000	allow	$25,000
		Subtotal			$3,862,120
		OH and profit @ 15%			$579,318
		Subtotal			$4,441,438
		Engin'g/Constr' Monit'g @ 15%			$666,216
		Subtotal			$5,107,654
		Contingency @20%			$1,021,531
		TOTAL			**$6,129,184**



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.
3. Strata beyond 180 ft to the right at Survey Control Line have been approximated for this figure.

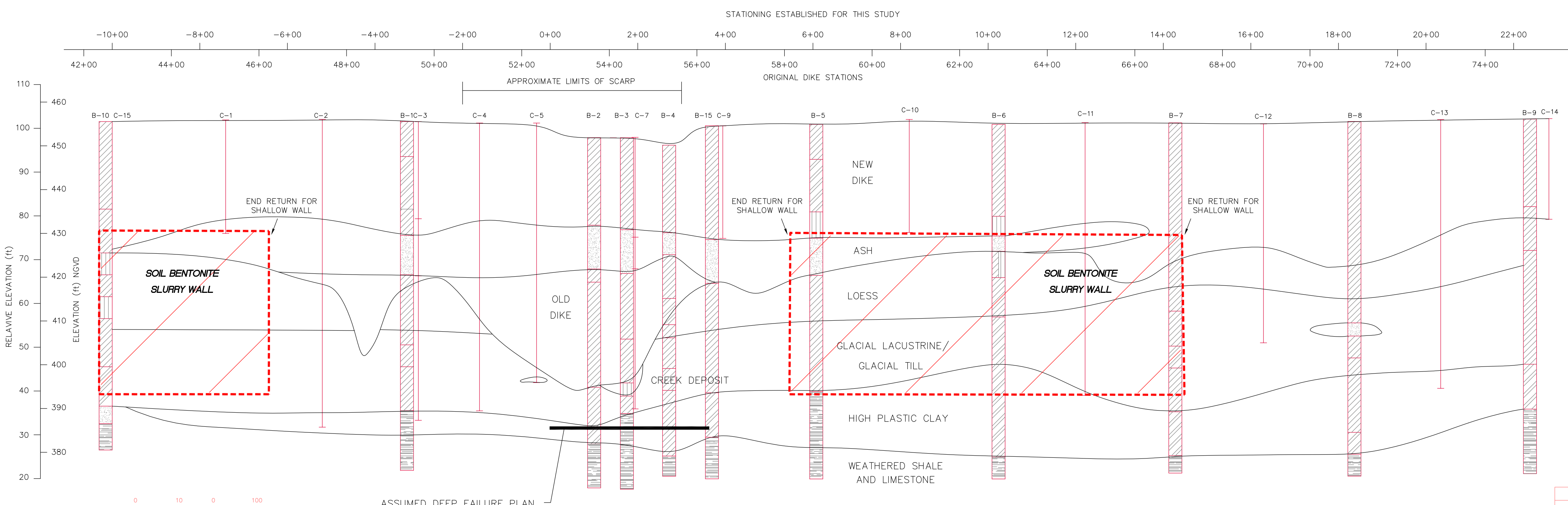
File: F:\5E08560\TASK240\RELOCALT.DWG Last edited: 09/05/95 @ 4:16 p.m. @ WCC-ST.LOUIS

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward–Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 8/2/95 DSGN. BY: gaz CHKD. BY:	Repair for Potential Deep Slides Translated Dike Alternative
FIG. NO.	E–1



NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

* DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION



GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF 1989 DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.

Revision No.	Description	Date	By	App.

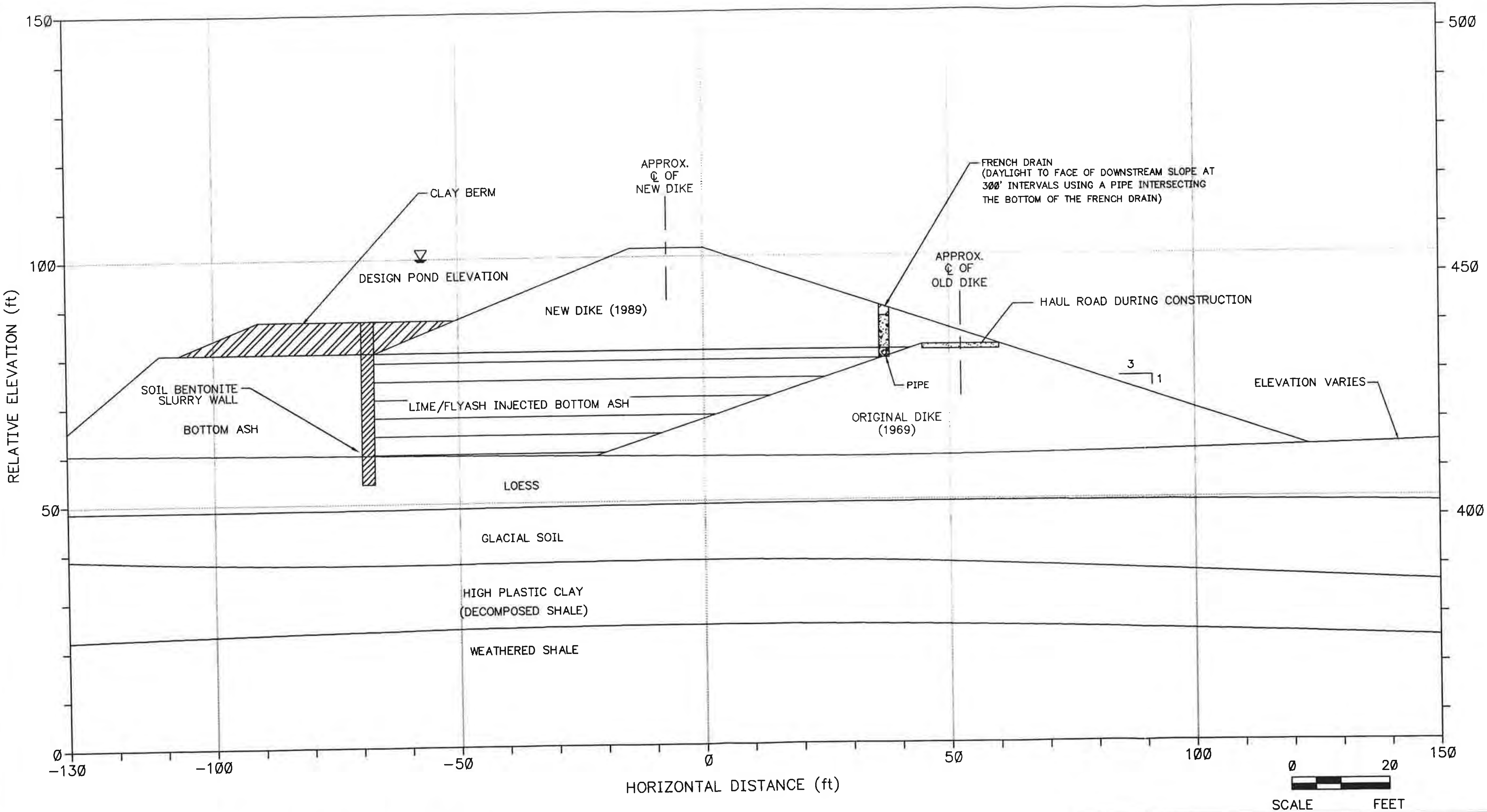
REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE OF REPAIRS
TRANSLATED DIKE ALTERNATIVE

Date: 8/2/95	Project Number: 5E08560	Figure Number: E-2
Drawn by: bdl	Design by: gaz	Checked by:

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/24/95 DSGN. BY: gaz CHKD. BY: KMB 9-5-95	Repair for Potential Shallow Slides Translated Dike Alternative
FIG. NO.	E-3

File: F:\5E08560\TASK240\TDA.DWG Last edited: 08/31/95 @ 4:57 p.m. @ WCC-ST.LOUIS

BASIC GEOMETRY FOR DEEP REPAIR
TRANSLATED DIKE ALTERNATIVE

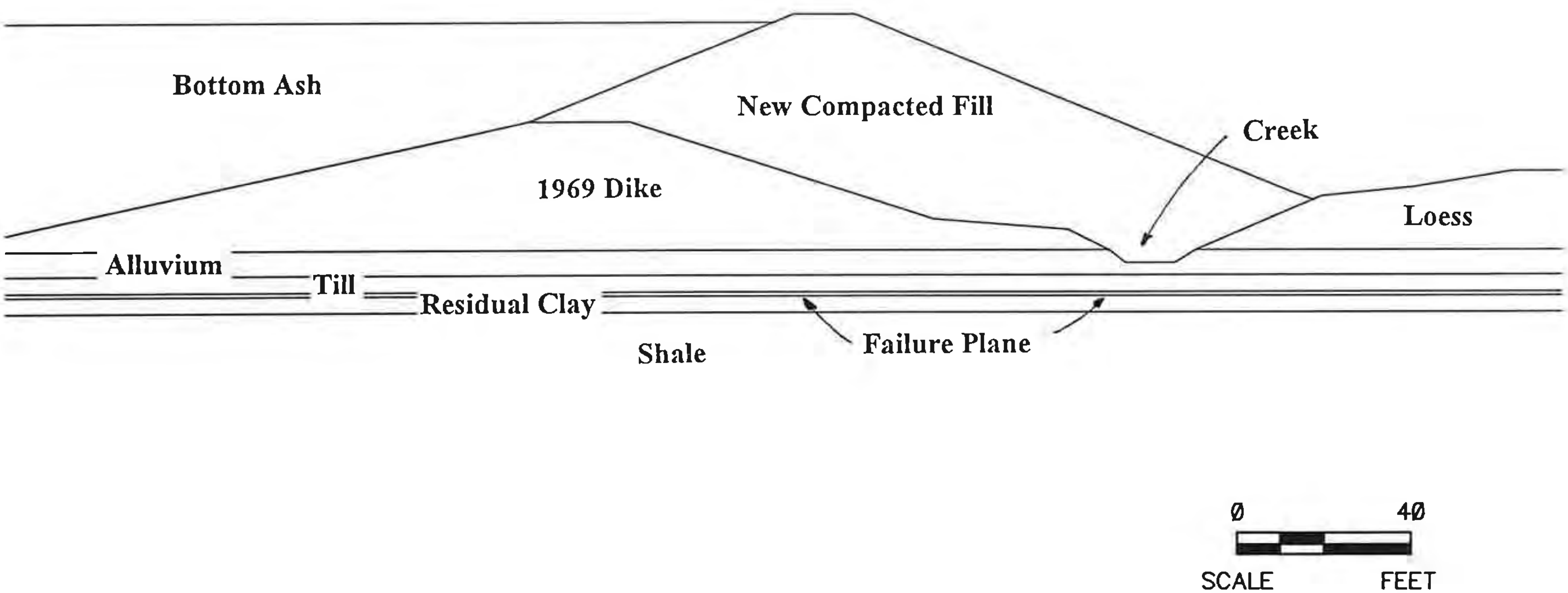
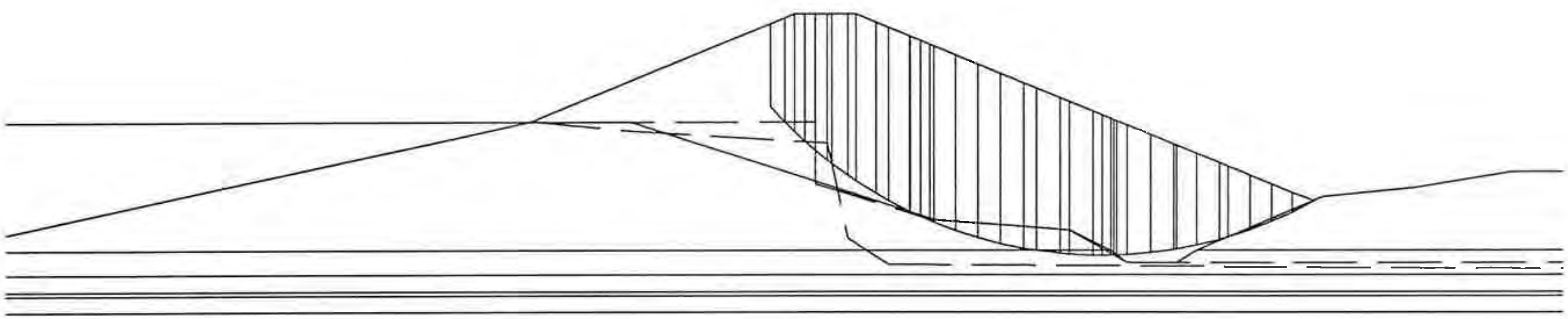


Figure E-4

END OF CONSTRUCTION CONDITION
TRANSLATED DIKE ALTERNATIVE



FS = 1.61

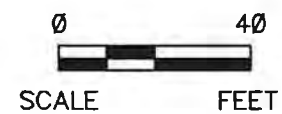
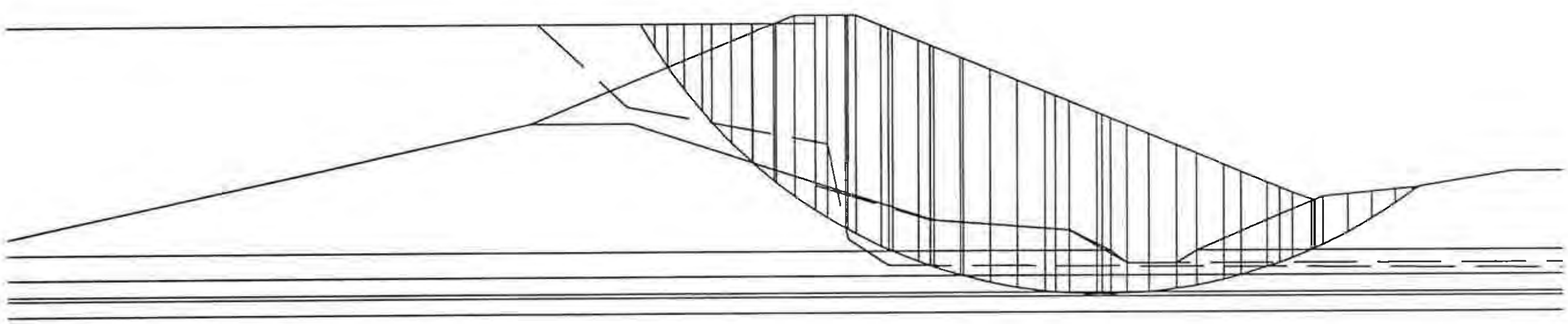


Figure E–5

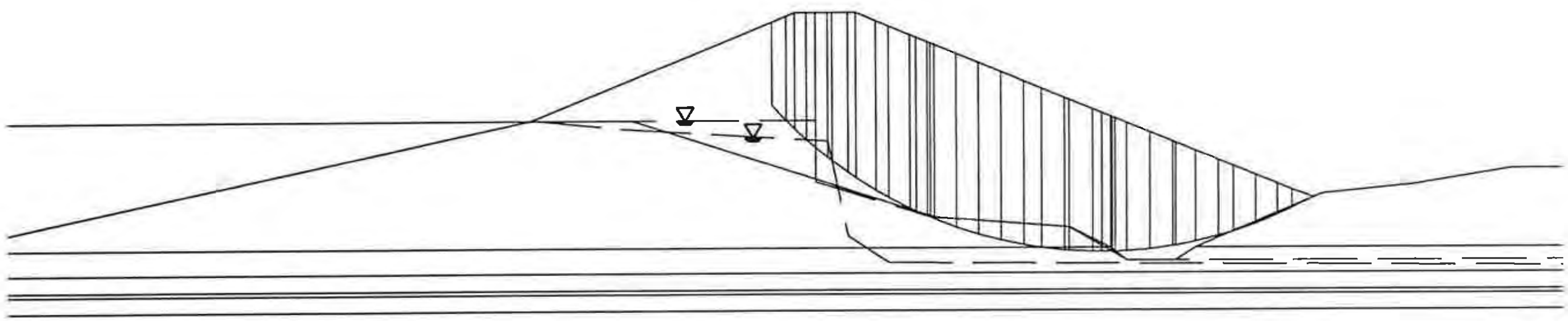
STEADY STATE CONDITION
TRANSLATED DIKE ALTERNATIVE



FS=1.70

Figure E-6

EARTHQUAKE CONDITION
TRANSLATED DIKE ALTERNATIVE



FS = 1.45

Figure E-7

APPENDIX F

HDPE OPTION

APPENDIX F
HPDE WALL OPTION

The HDPE option was the recommended option in the June 23, 1995 draft report. Subsequently developed options are now preferred.

The HDPE option for the deep slide area is shown in cross-section Figure F-1 and involves the following key elements:

1. Removal of the upper dike and replacement with a lightweight fill (compacted fly ash or slag) with a chimney drain and a blanket drain.

2. A centerline cutoff wall consisting of cement bentonite and an HDPE liner extending into the weathered shale constructed by the slurry trench method.

3. Inclined sand-filled drains connected to a drainage blanket at the elevation of the creek to intercept water that seeps beneath or through the cutoff wall.

4. A downstream berm consisting of compacted clay fill and a coarse rock.

5. Lime/fly ash slurry injection of the bottom ash below the upper rebuilt dike.

The aim of this repair is to significantly reduce the hydrostatic pressure on the failure surface. This is to be accomplished by a very low permeability cutoff wall (HDPE, 10^{-10} to 10^{-12} cm per second) and downstream inclined drains to collect seepage that passes either through or below the wall. The combined cutoff and drainage is designed to lower the groundwater level as low as possible (to the creek elevation) without use of pumps. Our calculations indicate however, that lowering the groundwater level to the elevation of the creek only provides a factor of safety for long term conditions of approximately 1.2$\pm$. To increase the factor of safety to the target level, additional measures are needed. Therefore, a toe berm and use of lightweight fill at the crest are recommended. In combination with drainage, these measures increase the factor of safety to the target values.

Other techniques could have been used in lieu of the berm, such as drilled piers or stone columns. However, preliminary calculations indicated the cost of these measures would be significantly greater than the cost of the toe berm. Piers or stone columns would have the advantage, however, of not changing the appearance of the downstream slope. Key elements of the recommended repair are described below.

HDPE Wall

We initially assumed that either a soil bentonite or cement bentonite cutoff wall would be sufficient to control water pressures. However, the permeability of these types of walls is not significantly different from that of the existing dam (except for the bottom ash) and foundation materials and therefore, would not significantly change the groundwater flow. To be effective, a cutoff wall must be significantly less permeable than the surrounding media. With this in mind, we selected an HDPE material developed by Gundle (Tradename: GundWall) that is installed as interlocking sheets similar to steel sheet piling except that a sealant can be used in the interlocks. This HDPE material is installed within a cement bentonite slurry wall approximately 2 ft wide excavated from the top of the existing ash elevation (el. 434±). Construction from this elevation will permit use of relatively economical backhoe excavation equipment to extend to the weathered shale. Above the elevation of the bottom ash, the HDPE will be raised as backfilling proceeds although special care will be required to avoid its damage by the earthwork contractor. Telephone conversations with a contractor (Slurry Walls, Inc.) indicate that this type wall will cost approximately $10.50 per square foot. WCC has previous experience with GundWall on a recent hazardous waste project.

A potential construction difficulty is the removal of limestone boulders and ledges below the failure plane. Borings suggest that these are not continuous and generally less than 1 ft thick. Rock removal techniques such as a chisel will probably be required in some areas to construct the wall. Rock removal is more costly than excavating shale and adds some uncertainty to the cost of installing the wall.

Inclined Drains

Inclined drains will be 10 to 12 in. diameter holes drilled with conventional rigs and backfilled with sand to collect seepage from the less pervious surrounding soil and the pervious zone at the failure plane. Due to the very low permeability of the surrounding soils, we do not believe a well screen is needed within the drains. Inclined wells will be drilled from a gravel working platform at approximately el. 395± (at creek level). The gravel working platform will then act as a gravel drain after the wells are installed. A geofabric is recommended below the gravel drain layer for trafficability.

A major concern with the inclined drains is the low permeability of the surrounding soil and the potential lack of a continuous permeable zone in the foundation that can be "tapped" by the drains. The pervious zone above the failure plane is the target drainage layer for the wells to "tap," however, it may be discontinuous causing drainage wells to be marginally effective. Therefore, monitoring pore pressure after construction will be important to evaluate the effectiveness of the wells. It is possible that additional wells or other measures may be needed to enhance drainage.

Compacted Lightweight Fill

To reduce driving forces, lightweight fill is recommended to rebuild the upper slope. For design purposes, we have assumed that the on-site fly ash treated with lime could be used as lightweight fill and would have a unit weight of approximately 95 pounds per cubic foot. It would be capped at the surface by 3 feet of clay fill to permit growth of vegetation and minimize erosion of fly ash. We have not evaluated the environmental implications of using the fly ash as a construction fill material. This would need to be done prior to construction, as well as testing of the fly ash to determine engineering properties. For design purposes, we have assumed properties based on previous experience with compacted fly ash. In lieu of fly ash, blast furnace slag could be used. We have had success using slag with acceptable chemical properties obtained from Granite City on previous projects.

Lime Fly Ash Injected Bottom Ash

We recommend lime/fly ash injection to strengthen the bottom ash and to reduce potential for liquefaction. This would be done by a specialty contractor such as Hayward-Baker whom we contacted regarding pricing and technical feasibility. They indicated that this procedure has been used to strengthen bottom ash. They also indicated a budget price of $3.50 per cubic yard of treated material. Prior to production injection, a test section on-site approximately 50 ft square will be needed to evaluate the effectiveness of the approach and for the contractor to adjust his mix to achieve the specified strength. Lime injection may be hampered in some areas due to the presence of hard lime treated ash at the surface of the bottom ash layer. This may require localized drilling to penetrate this "crust" of hard ash.

Downstream Berm

The downstream toe berm can be constructed of material removed from the crest of the slide and coarse rock. The rock will provide drainage, allow construction of a steeper slope (1.5H:1V), and provide erosion resistance along the creek. We had also considered a mechanically stabilized wall ("Tensar" wall), but judged the rock fill to be more economical and practical.

Sequence of Construction

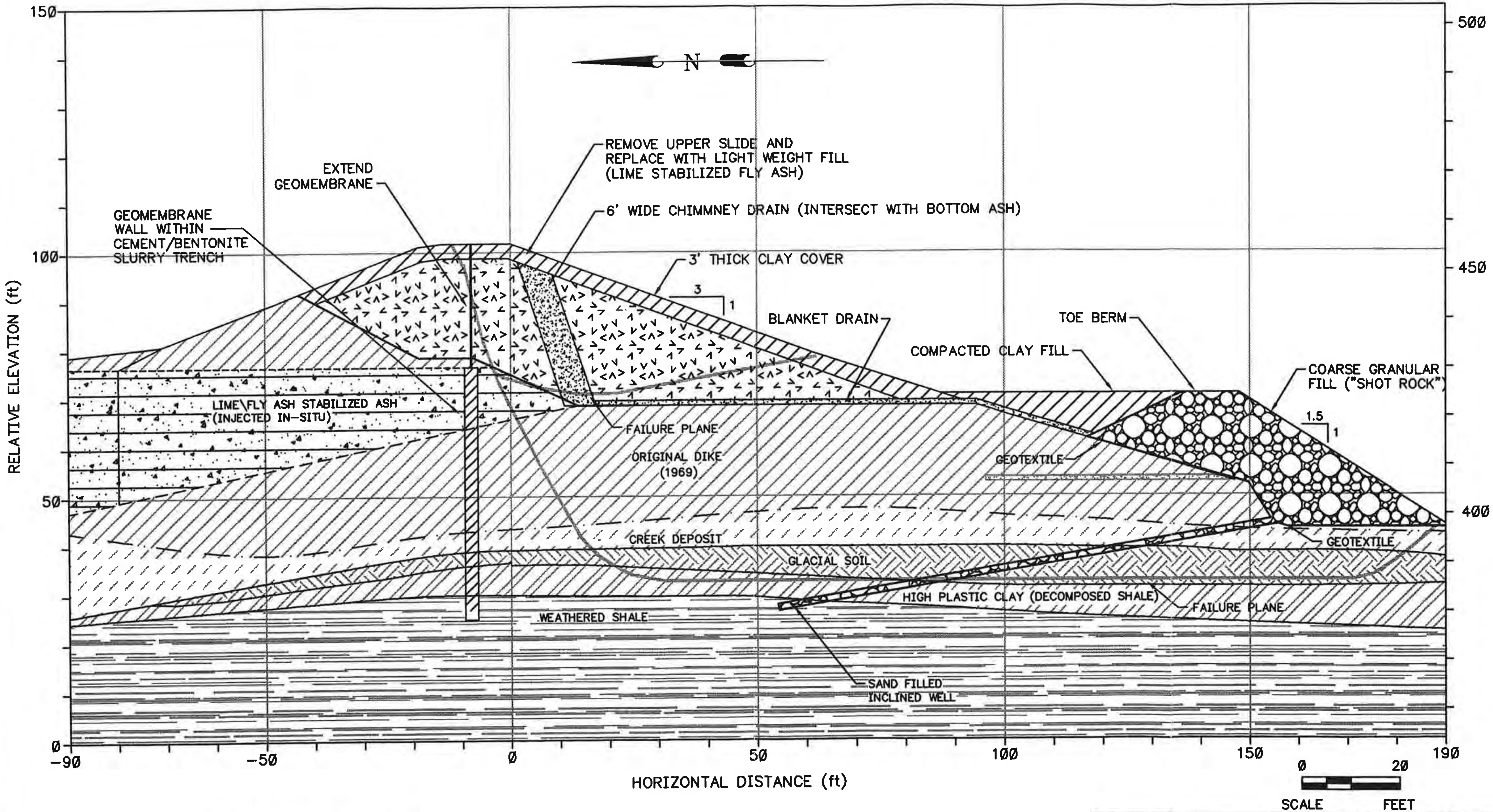
We envision the following sequence of construction, assuming that the upper dike has already been removed to el. 434 within the deep failure area.

1. Remove the upper dike to el. 433± outside the failed area.
2. Inject lime-fly ash into bottom ash.
3. Install HDPE wall.
4. Remove soil in failed area to el. 423± and install blanket drain.
5. Excavate at downstream toe to install gravel drain.
6. Install inclined wells from the downstream toe.
7. After completion of the drains, complete the toe berm.
8. After completion of the cutoff wall, place the lightweight fill at the crest.
9. Install instrumentation to monitor the slide area.

This treatment would be required from approximately Station -6-50 to Station 5+50 as shown in Figure F-2. At each end of the wall, a return would be made toward the downstream portion of the dike, as shown in Figure F-3. Interceptor wells would be installed at each return as shown to intercept seepage coming from either the east or west end of the slide area. A cross-section for areas of potential shallow failure is shown in Figure F-4. The estimated costs for this option is $5.7 million and are summarized in Table F-1. Seepage analyses are shown in Figures F-5 and F-6. The repair elements and Finite Element Mesh are in Figures F-7 and F-8. Results of stability analyses are given in Figure F-9 and F-10. Results of stability analyses for the shallow dikes are shown in Figure F-11.

TABLE F-1
COST ESTIMATE FOR HDPE OPTION REPAIR

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
ESTIMATED CONSTRUCTION COST FOR HDPE OPTION REPAIR					
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	13,000	$0.90	cy	$11,700
2	Exacavate and stockpile soil	43,900	$2.50	cy	$109,750
3	Deep HDPE slurry wall	99,400	$10.50	sf	$1,043,700
4	Shallow Slurry Wall	52,500	$4.25	sf	$223,125
5	Inclined Sand Drains	5,200	$40.00	ft	$208,000
6	Lime /flyash inject bottom ash	135,000	$3.50	cy	$472,500
7	Excavate for toe berm	10,700	$2.50	cy	$26,750
8	Rock toe berm	36,700	$15.00	cy	$550,500
9	Blanket and chimney drain	13,700	$15.00	cy	$205,500
10	Light weight fill	47,700	$5.00	cy	$238,500
11	Trench drains near toe of upper dike	3,300	$20.00	cy	$66,000
12	Geofabric	13,300	$2.00	sf	$26,600
13	Roadway on top of dike	2,300	$5.40	sy	$12,420
14	Seed and Mulch	25,000	$0.50	sy	$12,500
15	Instrumentation	1	$25,000	allow	$25,000
16	Clay fill at toe berm and cap over lt wt fill	27,500	$5	cy	$137,500
		Subtotal			$3,570,045
		OH and profit @ 15%			$535,507
		Subtotal			$4,105,552
		Engineering @ 15%			$615,833
		Subtotal			$4,721,385
		Contingency @20%			$944,277
		TOTAL			**$5,665,661**

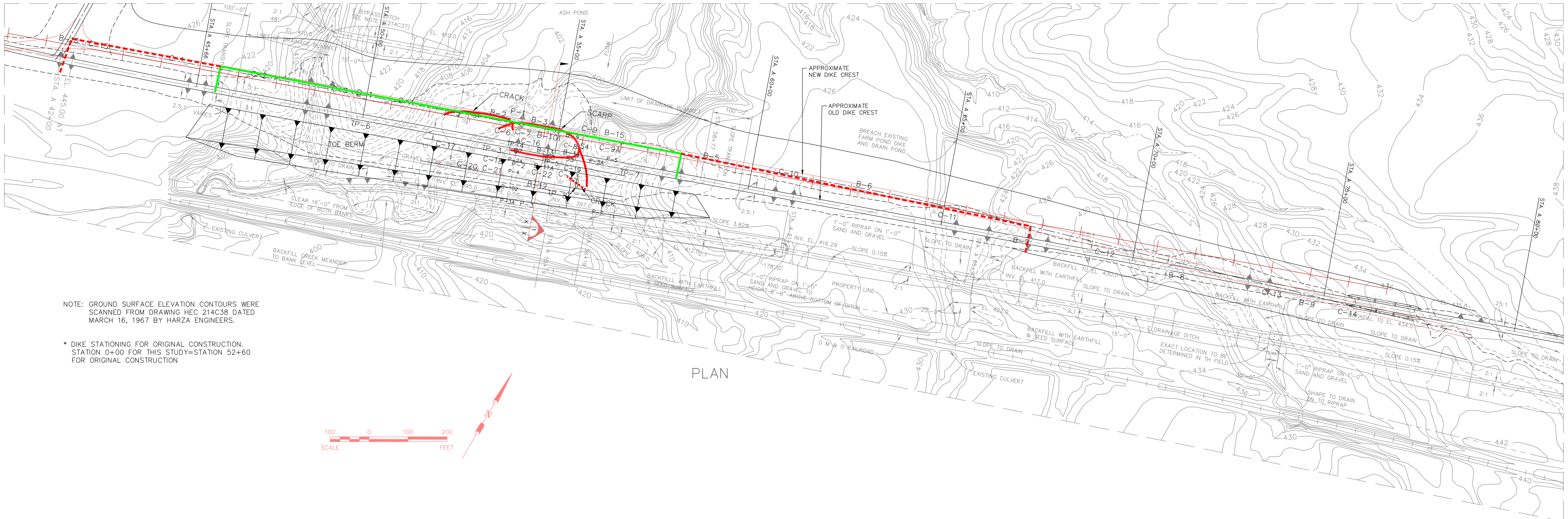


Notes:

1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location — not between.

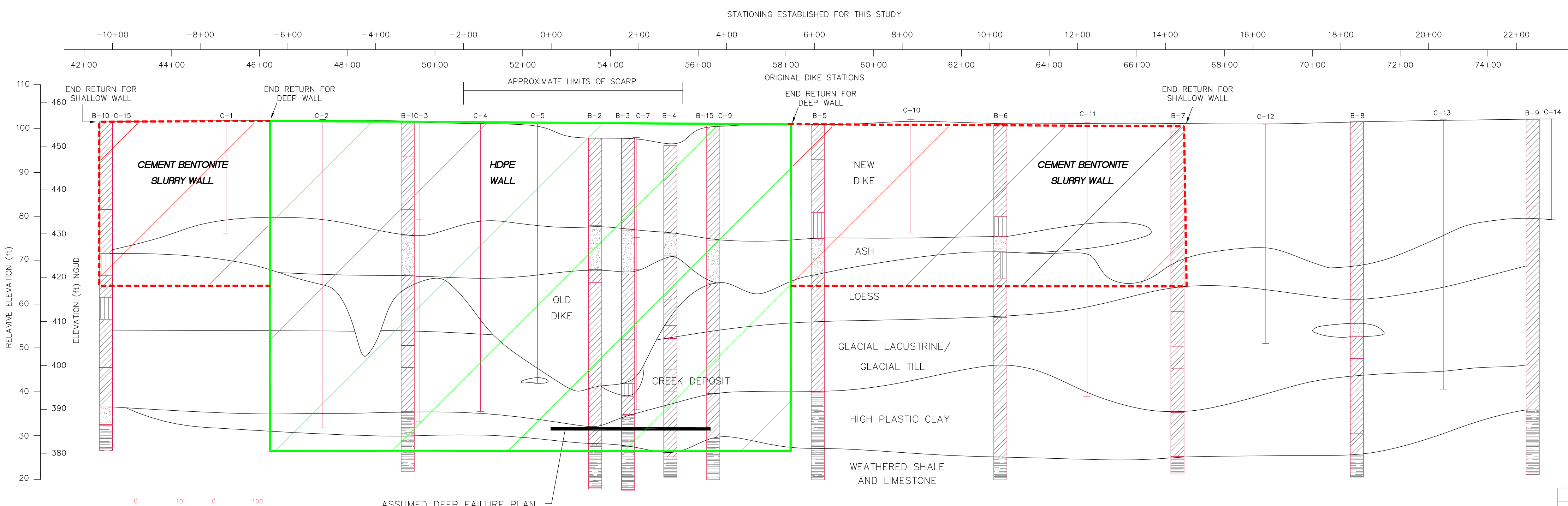
ILLINOIS POWER BALDWIN STATION SOUTH ASH POND BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	HDPE Repair in Areas of Potential Deep Failure
FIG. NO.	F-1

File: F:\5E08560\TASK240\FXFLDAR.DWG Last edited: 09/05/95 @ 4:22 p.m. @ WCC-ST.LOUIS



NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

* DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION



GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF NEW DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.

Revision No.	Description	Date	By	App.

REVISIONS

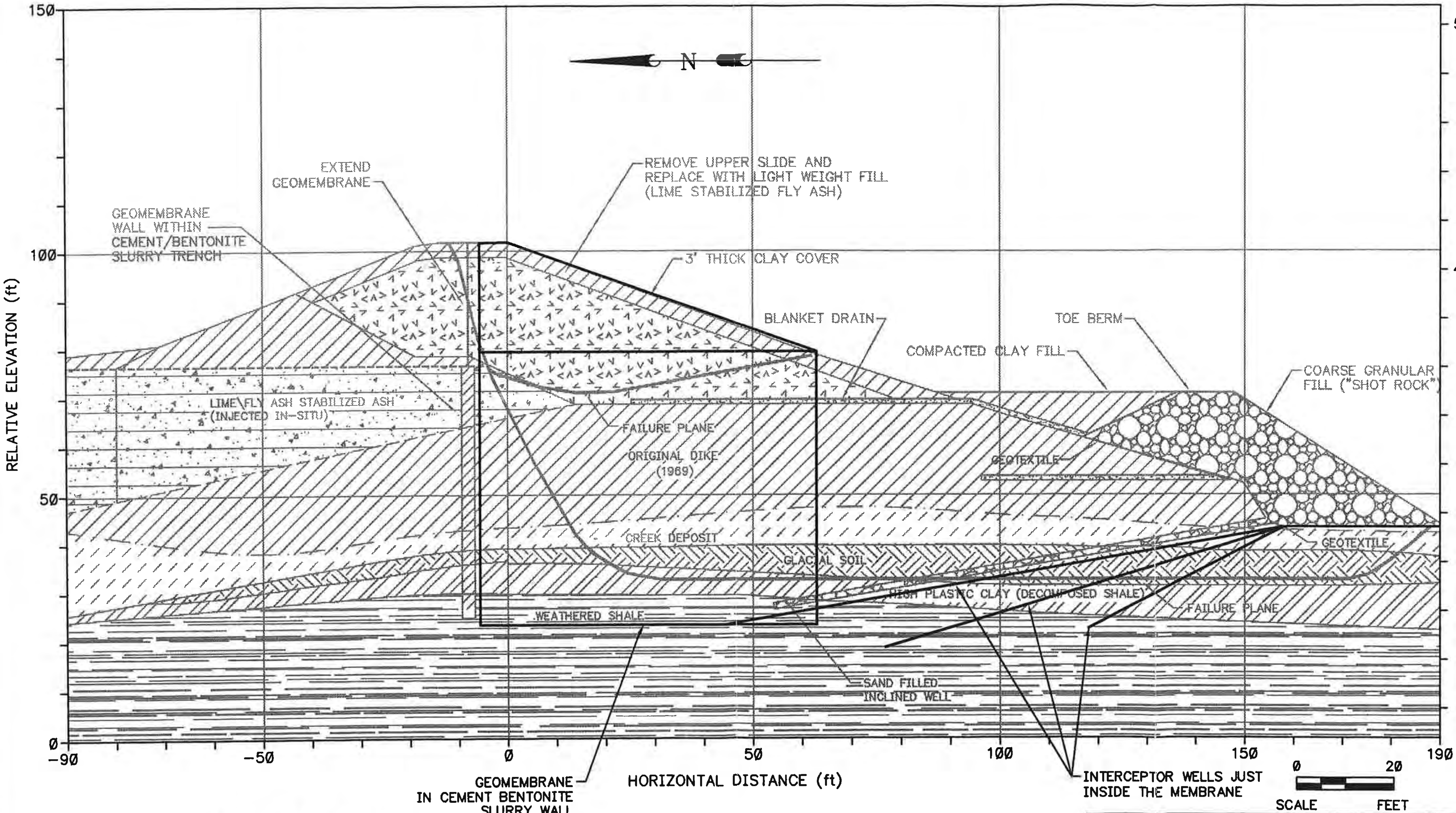
ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE OF REPAIRS
HDPE WALL ALTERNATIVE

Date: 4/10/95	Project Number: 5E08560	Figure Number: F-2
Drawn by: kdw	Design by: gaz	Checked by:

Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment

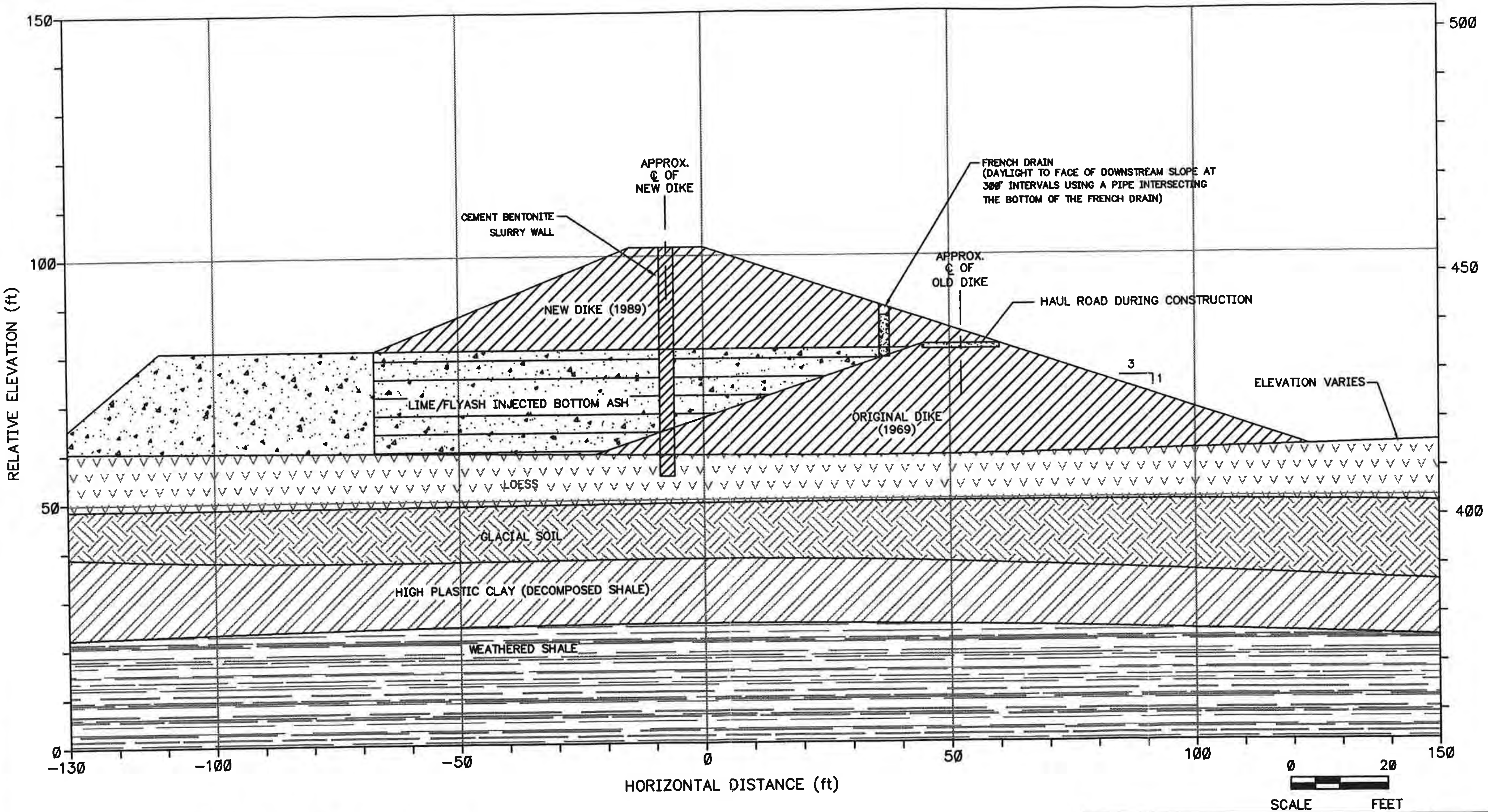
File: F:\5E08560\TASK240\PPOFRPRS.DWG Last edited: 09/26/95 @ 1:6 p.m. @ WCC-ST.LOUIS



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location — not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	Detail of End Return for Areas of Potential Deep Failure — FIG. NO. F-3

File: F:\5E08560\TASK240\ENDRTRN1.DWG Last edited: 09/05/95 @ 4:36 p.m. @ WCC-ST.LOUIS



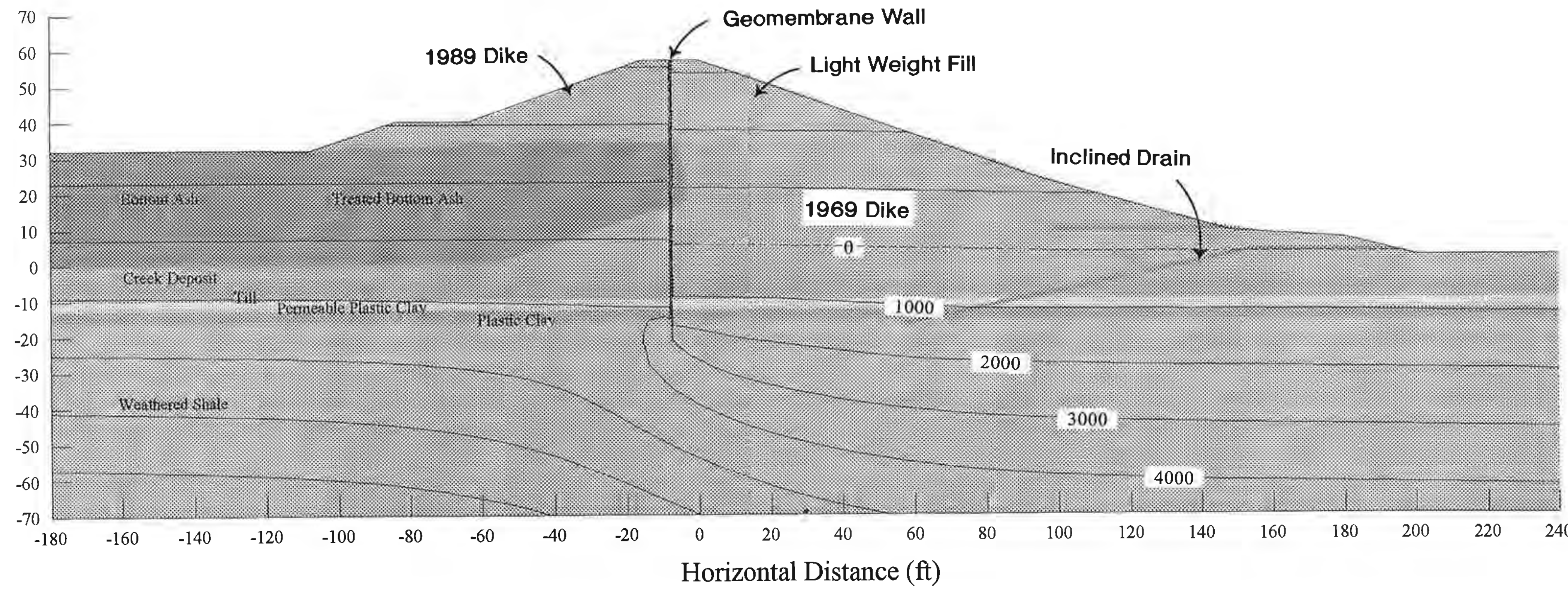
Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/24/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	HDPE Repair for Areas of Potential Shallow Slides — FIG. NO. F-4

File: F:\5E08560\TASK240\FXUNAREA.DWG Last edited: 09/05/95 @ 4:28 p.m. @ WCC-ST.LOUIS

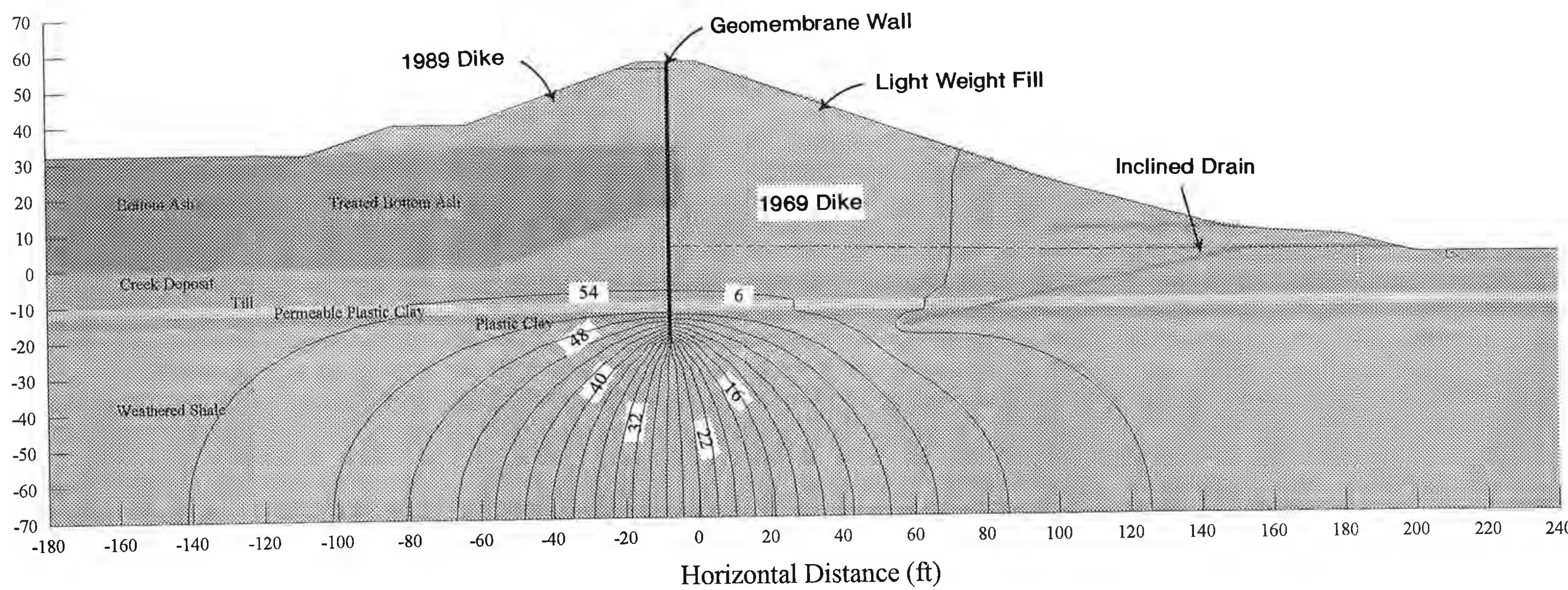
File: F:\5E08560\TASK240\F5.DWG Last edited: 09/06/95 @ 08:22 a.m. @ WCC-ST.LOUIS

SEEPAGE ANALYSIS FOR RECOMMENDED SLIDE REPAIR
PRESSURE CONTOURS



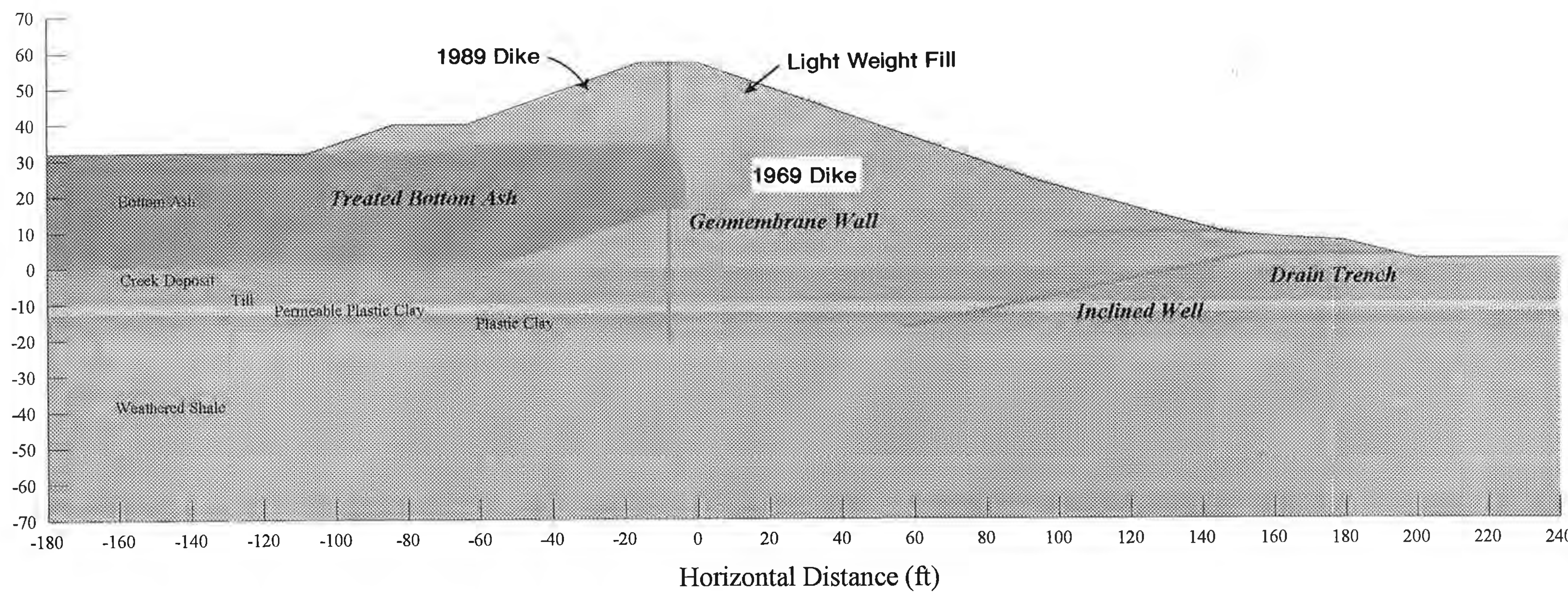
ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE		PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment		
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	SEEPAGE ANALYSIS FOR HDPE WALL OPTION WATER PRESSURE CONTOURS	FIG. NO. F-5

SEEPAGE ANALYSIS FOR RECOMMENDED SLIDE REPAIR
TOTAL HEAD CONTOURS



ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	SEEPAGE ANALYSIS FOR HDPE WALL OPTION TOTAL HEAD CONTOURS
FIG. NO. F-6	

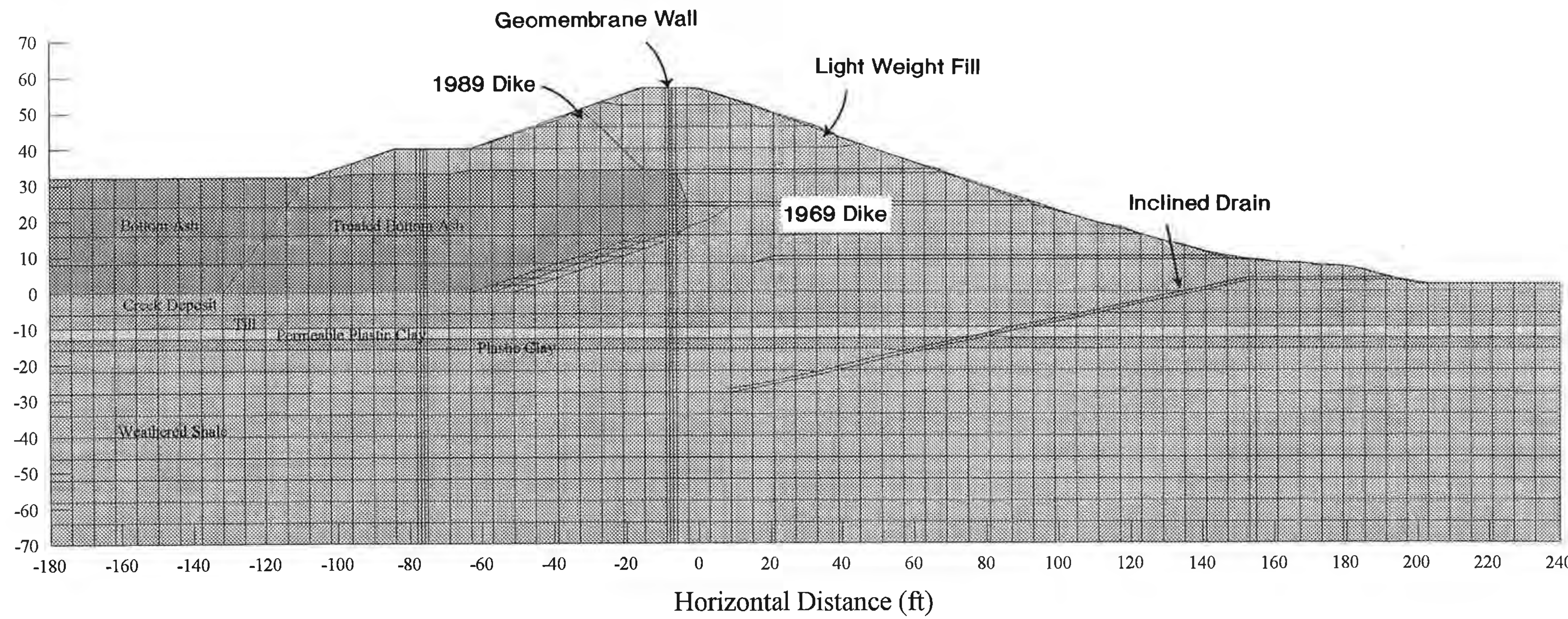
ELEMENTS OF RECOMMENDED SLIDE REPAIR



ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	ELEMENTS OF HDPE WALL OPTION SLIDE REPAIR
	FIG. NO. F-7

File: F:\5E08560\TASK240\F7.DWG Last edited: 09/06/95 @ 08:24 a.m. @ WCC-ST.LOUIS

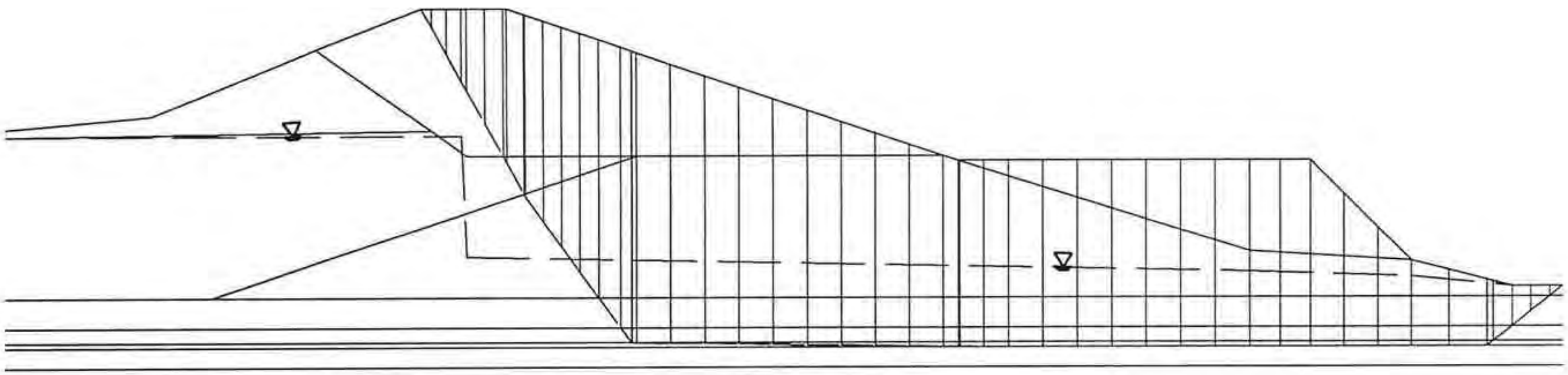
FINITE ELEMENT MESH FOR RECOMMENDED SLIDE REPAIR



ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	FINITE ELEMENT MESH HDPE WALL OPTION SLIDE REPAIR
FIG. NO. F-8	

File: F:\5E08560\TASK240\F8.DWG Last edited: 09/06/95 @ 08:23 a.m. @ WCC-ST.LOUIS

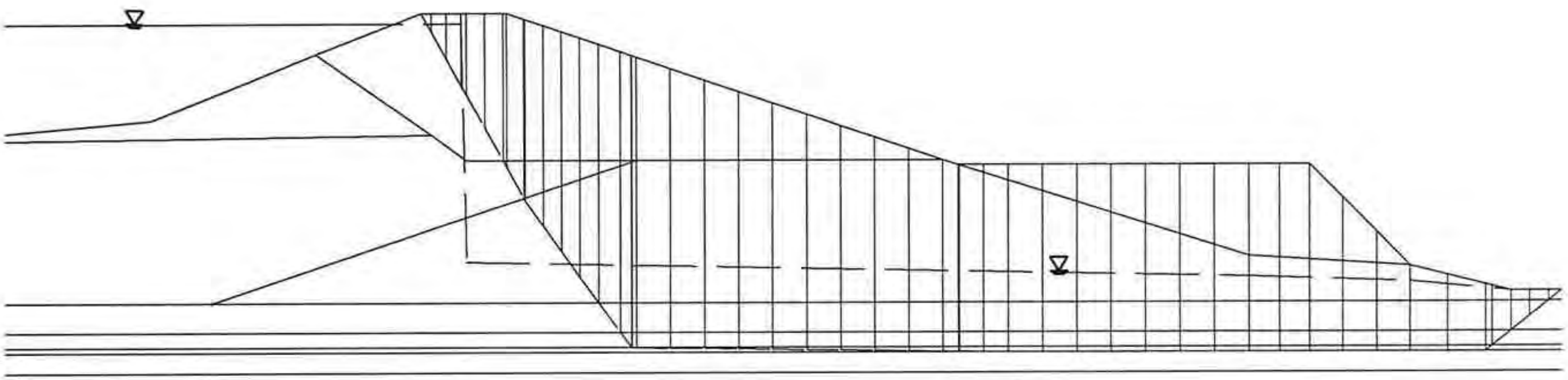
END OF CONSTRUCTION CONDITION
WITH LIGHT-WEIGHT FILL AND TOE BERM
HDPE WALL ALTERNATIVE



FS = 1.43

FIGURE F-9

STEADY STATE SEEPAGE
WITH LIGHT-WEIGHT FILL AND TOE BERM
HDPE WALL ALTERNATIVE



FS = 1.45

(FS = 1.08 Earthquake)

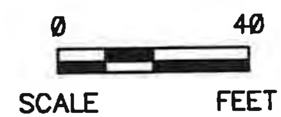
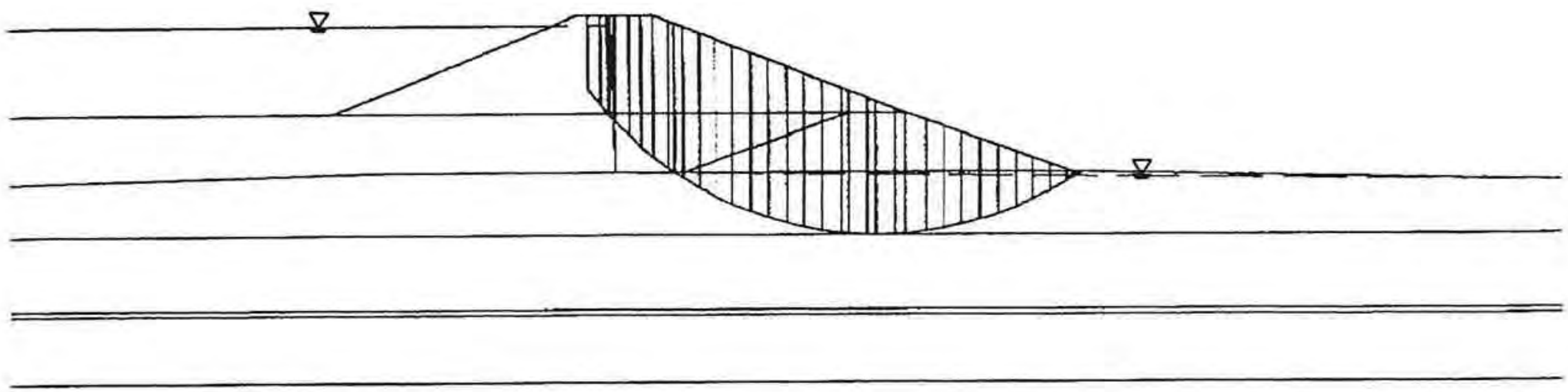


FIGURE F-10

SHALLOW FAILURE
HDPE WALL ALTERNATIVE



FS = 2.8 End of Construction
FS = 1.9 Steady State Seepage
FS = 1.6 Earthquake

Failure planes for each case are similar.

Note: Although these runs were done using the HDPE alternative, results are judjed to be similar for the other primary options since soil and seepage conditions are similar or better than this model.

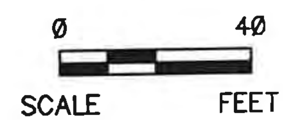


FIGURE F-11

APPENDIX G

SECONDARY OPTIONS

APPENDIX G
SECONDARY OPTIONS

This appendix includes four options that were considered early on, but not pursued in detail due to cost or other deficiencies. For purposes of discussion they are termed secondary options in this report. They were included in the June 23, 1995 Draft Report and are discussed as follows.

1. <u>Removal and Replacement and Deep Shear Key Trench Option</u>

The intent of this option was to remove the upper slide material and provide a shear key of coarse rock extending below the slide plane to strengthen the slide mass and stabilize it. A sketch of this option is given in Figure G-1 and a cost estimate is given in Table G-1. The shear key option involves the following:

- Excavating to below the depth of the deep failure plane to remove soil in the shallow failure and much of the deep failure area.

- Installing a rock-filled key trench below the failed area extending into the shale.

- Installing an HDPE wall in a cement bentonite slurry trench at the dike centerline (same as the HDPE option).

- Lime/fly ash slurry injection of the bottom ash (same as the HDPE option).

- Installing a cement-bentonite slurry wall and trench drains in areas of potential shallow failure (same as the HDPE option).

The estimated cost of this option is about $8 million and it was not considered further. A major concern with option is stability of the excavation during construction since a major cut (to el. 370) is needed.

2. Regrading Option

Regrading to flatten the slope was also considered as shown in Figure G-2. This approach has been used for tailings dams and maintains the downstream toe location and flattens the slope to about 5H:1V. This geometry moves the crest inside the existing pond where a new dike would be needed. A cutoff wall would still be required as well as stabilizing the bottom ash. Horizontal wells would be drilled from the toe to intercept the bottom ash which would act as a large drain.

The advantage of this system is that a downstream toe berm would probably not be needed. The disadvantage, however is that the dam crest would be moved and require construction inside the ash pond. Rough estimates show the cost to be about the same or somewhat more than the HDPE option. Due to the disadvantages noted, this approach was not considered further.

3. Drain Wall Option

Another option that is similar to the HDPE option is use of a "drain wall" at the center of the rebuilt dike in lieu of the HDPE cutoff wall (Figure G-3). (This is similar to the Parallel Wall option). The drain wall would be constructed by the slurry trench method but use a bio-degradable polymer drilling fluid instead of bentonite. The backfill in the drain wall trench would be free-draining such as concrete sand which would be left in place after the drilling fluid breaks down. The backfill would then act as a chimney drain. To remove the water from the drain wall is problematical. A series of inclined wells drilled from the toe to intersect the wall were considered.

This option has merit because it provides positive drainage. Our concern is difficulty of constructing a relatively deep wall and the inclined wells which would need to intersect the wall. Because of these concerns this option was not pursued further. We judged the cost to be similar to the HDPE repair.

4. Remove And Replace Bottom Ash (Shallow Slide Repair Option)

This option is for repair of potential shallow failures which could occur above the top of the old dike, even in areas without deep failure. The option involves removal and replacement of the bottom ash beneath the upper dike. To accomplish this, it will also be necessary to remove and replace the existing upper dike. This option would eliminate the need for the shallow cement-bentonite slurry wall in areas of potential shallow failure. This concept is shown schematically in Figure G-4. In areas of potential deep failure, the HDPE repair is assumed (i.e. HDPE slurry wall, inclined wells, and a toe berm) except that instead of lime/fly ash slurry injection of the bottom ash, we assume it is removed and replaced with compacted clay. The cost estimate of $8 million is given in Table G-2.

A major problem with this option is dewatering during replacement of the clay fill. To account for this we allowed $100,000 in dewatering costs based on judgment. Also, a temporary excavation or cofferdam would be needed within the pond to allow removal of the bottom ash. In any case, this option is significantly more expensive than the other options and was not considered further.

TABLE G-1
COST ESTIMATE FOR MASS EXCAVATION AND KEY TRENCH

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	22,000	$0.90	cy	$19,800
2	Exacavate and stockpile soil	323,000	$2.50	cy	$807,500
3	Deep HDPE slurry wall	99,400	$10.50	sf	$1,043,700
4	Shallow Slurry Wall	52,500	$4.25	sf	$223,125
5	Inclined Sand Drains	0	$40.00	ft	$0
6	Lime /flyash inject bottom ash	119,000	$3.25	cy	$386,750
7	Excavate for toe berm	0	$2.50	cy	$0
8	Rock key trench	28,000	$15.00	cy	$420,000
9	Blanket drain	19,600	$15.00	cy	$294,000
10	Replace stockpiled fill	275,400	$5.00	cy	$1,377,000
11	Trench drains near toe of upper dike	2,200	$20.00	cy	$44,000
12	Temp sheet pile	24,000	$10.00	sf	$240,000
13	Roadway on top of dike	2,300	$5.40	sy	$12,420
14	Seed and Mulch	50,000	$0.50	sy	$25,000
15	Instrumentation	1	$25,000	allow	$25,000
		Subtotal			$5,118,295
		OH and profit @ 15%			$767,744
		Subtotal			$5,886,039
		Engineering @ 15%			$882,906
		Subtotal			$6,768,945
		Contingency @20%			$1,353,789
		TOTAL			**$8,122,734**

TABLE G-2
COST ESTIMATE FOR REMOVAL AND REPLACEMENT OF BOTTOM ASH

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
1	Mobilization/Demobilization	1	$75,000	ls	$75,000
2	Strip	28,000	$0.90	cy	$25,200
2	Exacavate and stockpile soil	357,000	$2.50	cy	$892,500
3	Deep HDPE slurry wall	99,400	$10.50	sf	$1,043,700
4	Shallow Slurry Wall	0	$0.00	sf	$0
5	Inclined Sand Drains	5,200	$40.00	ft	$208,000
6	Replace with clay fill	348,000	$5.00	cy	$1,740,000
7	Excavate for toe berm	10,700	$2.50	cy	$26,750
8	Rock toe berm	36,700	$15.00	cy	$550,500
9	Blanket drain	9,100	$15.00	cy	$136,500
10	Dewatering	1	$100,000	allow	$100,000
11	Trench drains near toe of upper dike	2,200	$20.00	cy	$44,000
12	Temp excavate bottom ash at toe	83,000	$4.00	sf	$332,000
13	Roadway on top of dike	2,300	$5.40	sy	$12,420
14	Seed and Mulch	50,000	$0.50	sy	$25,000
15	Instrumentation	1	$25,000	allow	$25,000
		Subtotal			$5,236,570
		OH and profit @ 15%			$785,486
		Subtotal			$6,022,056
		Engineering @ 15%			$903,308
		Subtotal			$6,925,364
		Contingency @20%			$1,385,073
		TOTAL			**$8,310,437**

Woodward-Clyde Consultants

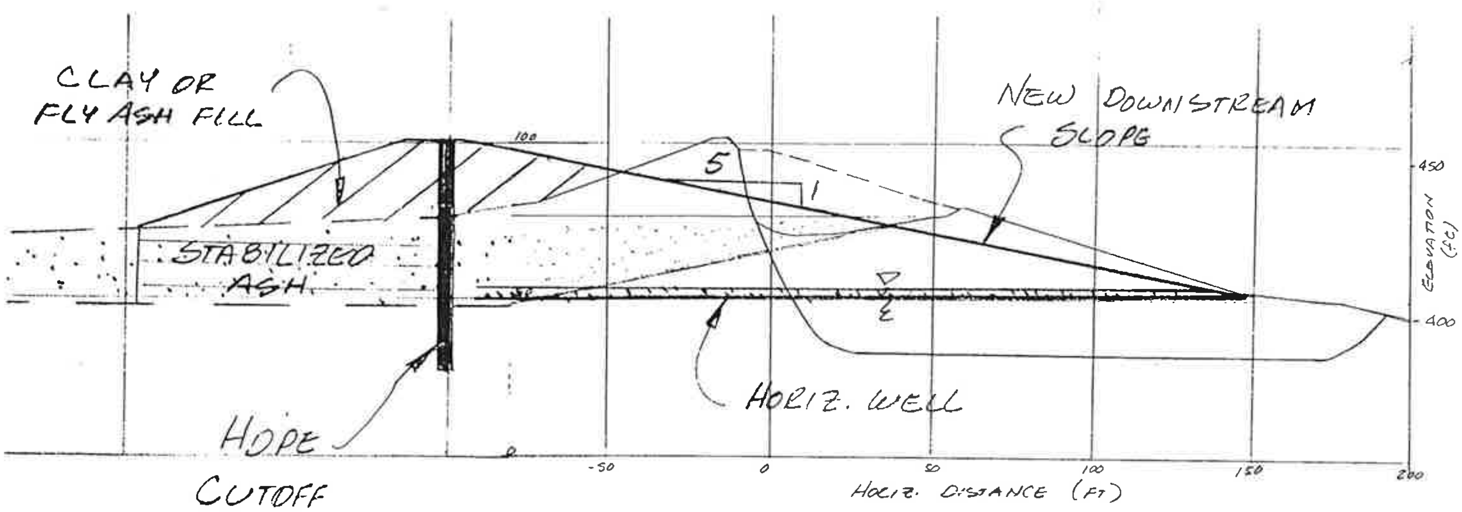
Sheet No. Of

File

FOR ILL Pwr.

Made by TE Date 6-21-95

Checked by Date



CONCEPTUAL REPAIR
FOR DEEP FAILURE

"RE-GRADE"

FIG. 6-2

Woodward-Clyde Consultants

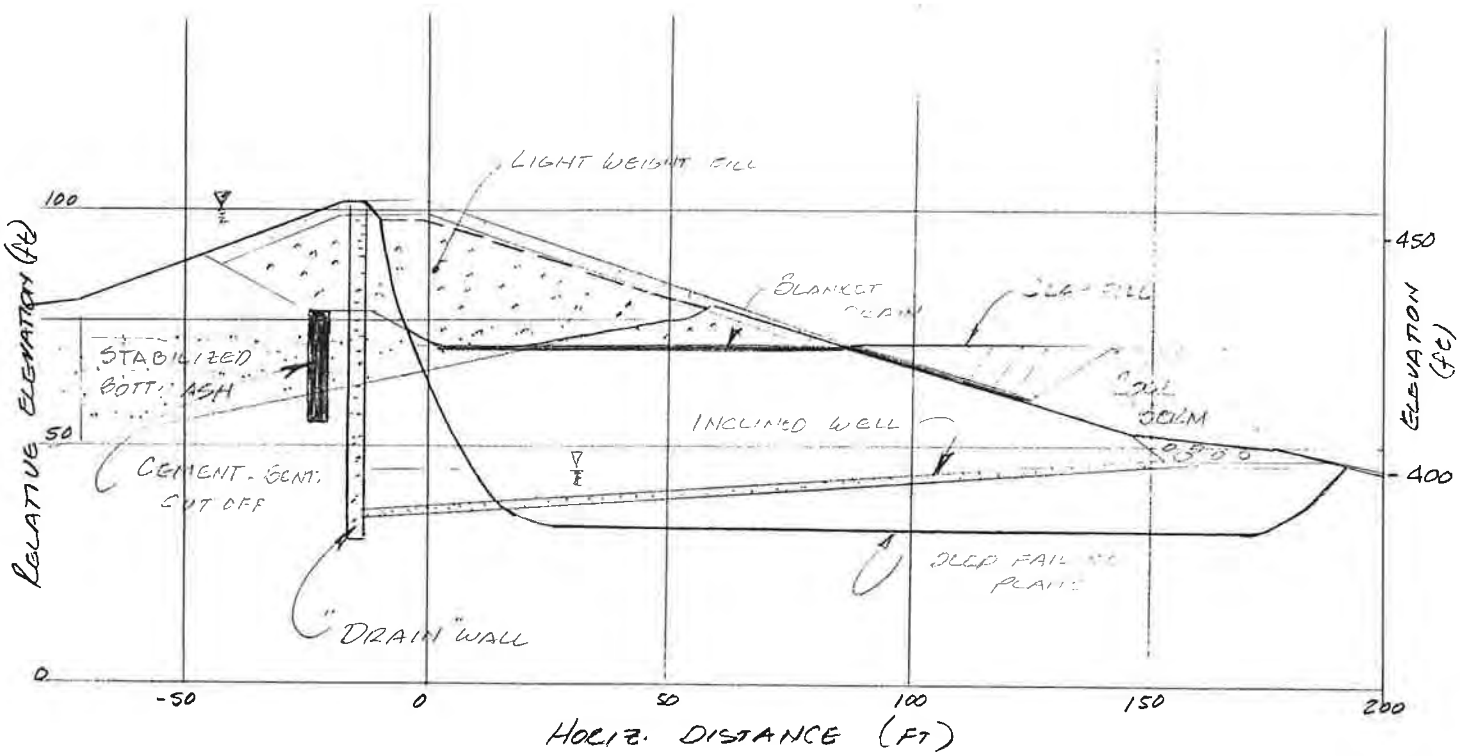
Sheet No. Of

File 5C08560

Made by TL Date 6 21 95

Checked by ____ Date ____

FOR ILL. POWER



DRAIN WALL INSTALLED BY SLURRY TRENCH METHOD USING BIO-DEGRADEABLE POLYMER - SAND BACKFILL

CONCEPTUAL REPAIR FOR DEEP FAILURE "DRAIN WALL"

FIG. G-3

Woodward-Clyde Consultants

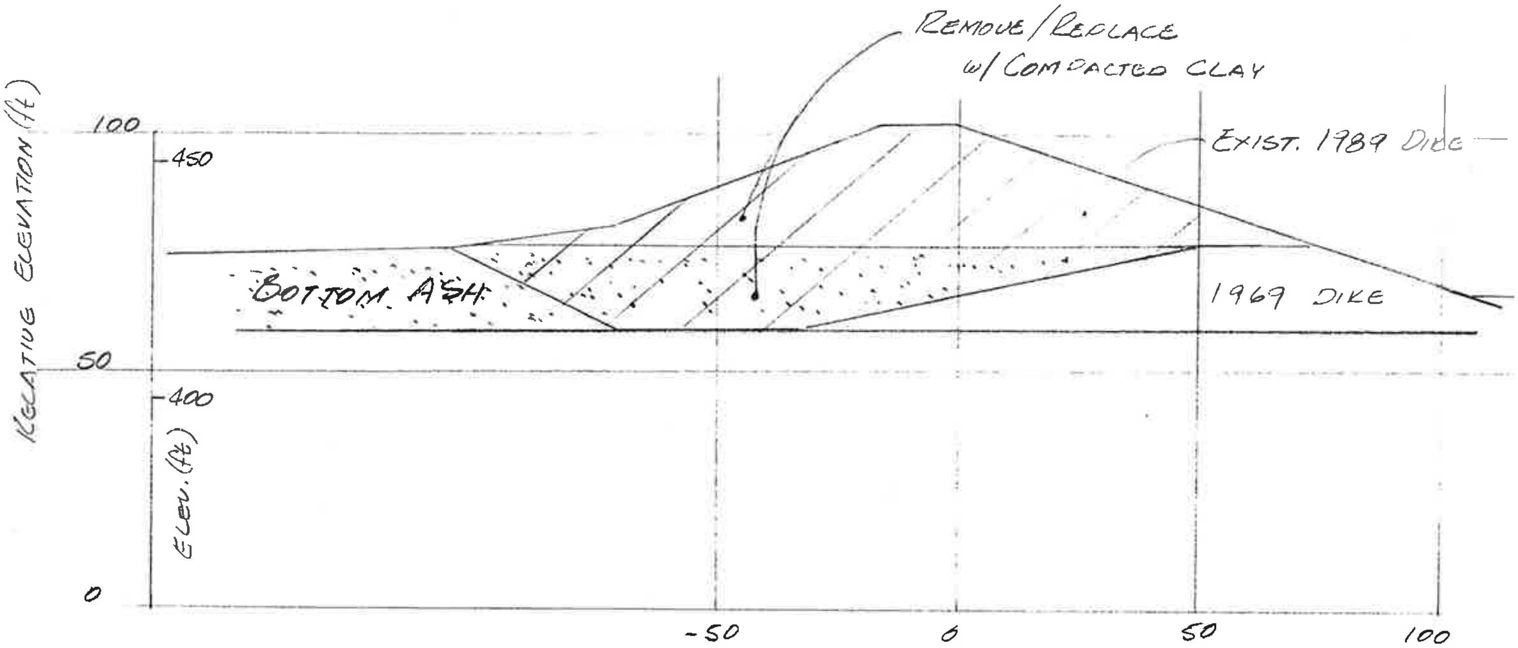
Sheet No. Of

File ECO8060

Made by TL Date 6-21-95

Checked by Date

FOR ILL. POWER



CONCEPTUAL REPAIR

SHALLOW FAILURE AREAS

"REMOVE AND REPLACE
BOTTOM ASH"

FIG. G-4

Woodward-Clyde Consultants

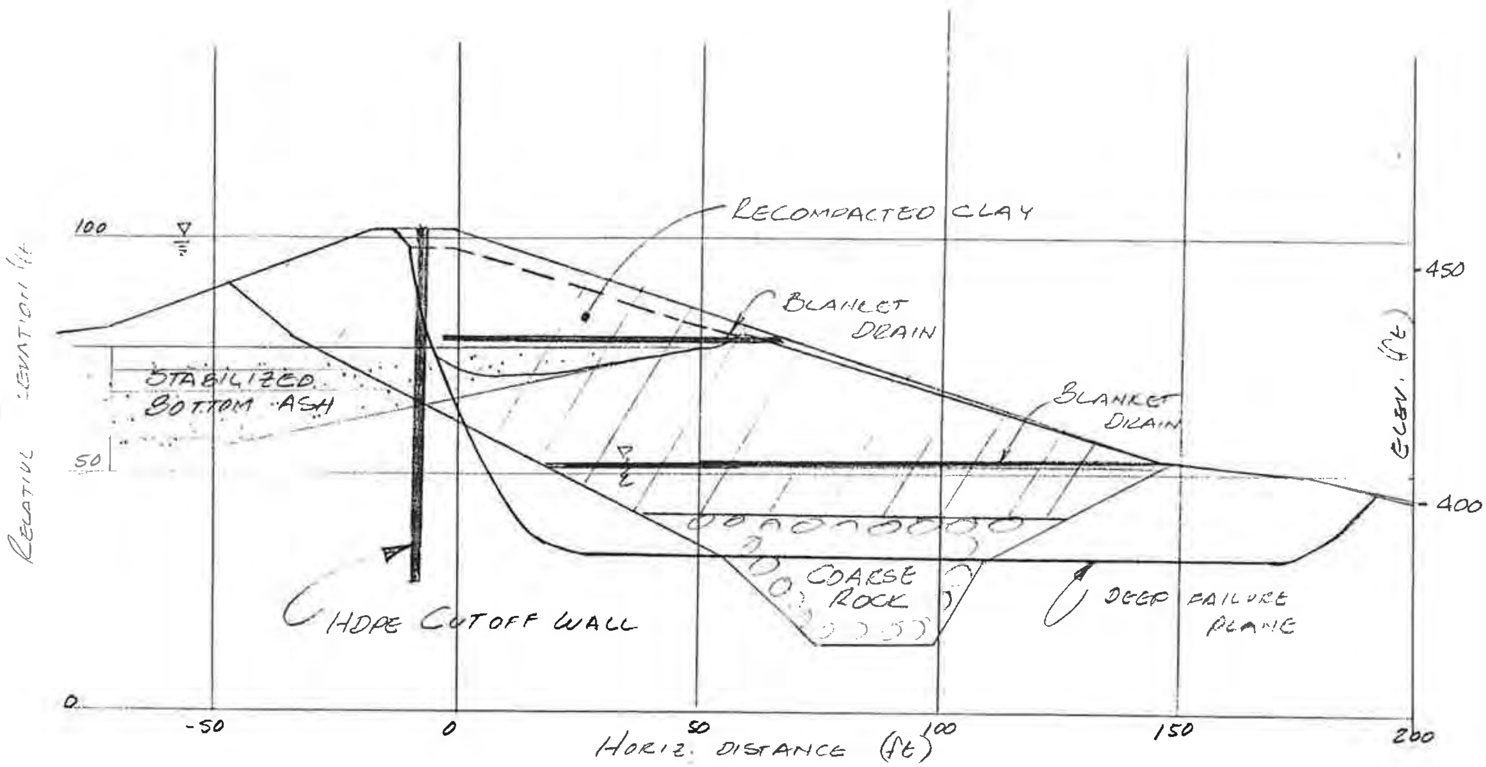
Sheet No. Of

File 5008560

Made by TL Date 6-21-95

Checked by ________ Date ________

FOR ILL. POWER



CONCEPTUAL REPAIR
FOR DEEP FAILURE
"KEY TRENCH"

FIG. G-1

AECOM

Appendix G: Observation of Slope Movement at Fly Ash Pond, Baldwin Energy Complex, Baldwin, Illinois, URS (2011)

URS

May 10, 2011

Mr. Charles Nerone
Environment and Chemistry Manager
Dynegy Midwest Generation, Inc.
10901 Baldwin Road, P.O. Box 146
Baldwin, IL 62217

SUBJECT: OBSERVATION OF SLOPE MOVEMENT AT FLY ASH POND BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

Dear Chuck:

I appreciated the opportunity to meet with you on May 2nd to view the slope movement at the north west portion of the Fly Ash Pond (Fly Ash West Cell). It is my understanding that Dynegy wanted me to observe the slope and then make comments on Dynegy's proposed remedial measures.

The embankment is exhibiting signs of distress believed to be due to the prolonged heavy rains that the site has been experiencing. There are signs of soil movement on the slope. The area of movement appears to be a stretch of the embankment which is slightly steeper than the rest of the embankment. The site was wet from recent heavy rains. Phil Morris stated that he was on site the previous week when it was drier, and no signs of seepage were observed. The top of the slide is a few feet below the crest of the embankment, and the bottom of the slide appears to be above the toe of the landside of the embankment. See the attached photos for a view of the movement.

Based on topographic data in our files, the approximate elevations of some key features are as follows:

Crest of embankment = El. 453
Landside toe of slope = El. 424
Pond water elevation = El. 426

Without performing any analyses, it is my opinion that the slide was caused by slope saturation due to the heavy precipitation that the site experienced. The area of the slope where movement occurred appears to be slightly steeper than the adjacent embankment. Given the water level of the pond, it is unlikely that pond seepage contributed to the slide. (This is just my opinion and would need numerical modeling to prove or disprove.)

URS Corporation
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110
Tel: 314.429.0100
Fax: 314.429.0462

URS

I concur with Dynegy's opinion that the area of movement should be remediated in order to prevent a progressive type failure of the slope. It is my understanding that Dynegy intends to perform a removal and replacement of the slide mass. My opinions and comments related to this are as follows:

1) The water level in the pond should remain at its current elevation permanently.

2) This method of slide repair is appropriate as long as the slide mass is relatively shallow (6 feet deep or less). It is unknown how deep the slide extends. The entire slide mass should be removed.

3) After removing the slide mass, the remaining slope will need to be benched to allow a proper connection of the new replacement soil to the remaining slope.

4) The final grade of the slope should be flattened to match the adjacent embankment.

5) The replacement material is anticipated to be clay. The clay fill will need to be thoroughly compacted in lifts at the appropriate moisture content.

We appreciate your consideration of URS for this work.

Sincerely,

Kenneth M Berry

Kenneth M. Berry, P.E.
Sr. Project Manager

Cc: Phil Morris

URS	PHOTOGRAPHIC LOG		
Client Name: Dynegy Midwest Generation	**Site Location:** Baldwin, IL	**Project No.** 21562663	

Photo No. 1	**Date:** 05/02/11

Description:

Northwest slope of Fly Ash Pond – Facing East.

Photo No. 2	**Date:** 05/02/11

Description:

Northwest slope of Fly Ash Pond – Facing West.

Appendix H: Photos from the 2015 surficial movement

Figure I.1. Photo of 2015 surficial movement prior to repairs.

Figure I.2. Photo of 2015 surficial movement area after repairs.

ATTACHMENT E


BALDWIN
OLD EAST FLY ASH POND
DYNEGY MIDWEST GENERATION, LLC


BALDWIN
WEST FLY ASH POND
ID #: W1578510001-03
DYNEGY MIDWEST
GENERATION, LLC

ATTACHMENT H

TECHNICAL MEMORANDUM

Date: **August 8, 2016**

To: **Tom Davis**

From: **Stuart Cravens**

Subject: **Baldwin Energy Complex Ash Pond Closure and Post-Closure Plan – Response to Illinois EPA Comments**

This technical memorandum is in response to the July 13, 2016 Illinois Environmental Protection Agency (Illinois EPA) correspondence regarding the Fly Ash Pond System Closure and Post Closure Care Plan (Plan) for the Baldwin Energy Complex. The Illinois EPA reviewed the Plan and provided comments for consideration and appropriate action by Dynegy Operating Company on behalf of Dynegy Midwest Generation, LLC, owner and operator of the Baldwin Energy Complex (BEC).

Responses to each of the Illinois EPA comments (italicized below) in the July 13, 2016 letter are provided below.

1. *The bedrock formations were chosen to represent the uppermost aquifer material to be monitored under the 257 regulations. However, the geometric mean of the horizontal hydraulic conductivity for the bedrock is 5.0 X 10^{-06} centimeters per second (cm/sec) and the geometric mean of the horizontal hydraulic conductivity for the unconsolidated material is 3.2 X 10^{-05} cm/sec. Table 2 of the Model Report Addendum lists 13 farm/domestic wells of which 10 utilize the unconsolidated materials. Given the higher hydraulic conductivity and greater use of the resource, please provide further explanation of how the unconsolidated materials were eliminated as the uppermost aquifer.*

Response: The predominant material underlying the Fly Ash Pond System and extending outward is clay and silty clay with randomly disseminated and discontinuous silt and sand seams. Conversely, the bedrock formation underlying the Fly Ash Pond System is laterally continuous and extends in all directions off-site of the BEC. Although the horizontal hydraulic conductivity of the shallow unconsolidated materials is higher than the underlying bedrock at some locations, the higher permeability lenses or seams of sand, silty sand, and clayey sand are not laterally continuous within the boundaries of the Fly Ash Pond System, nor are they laterally continuous outward from the Fly Ash Pond System to or beyond the property boundary of the BEC. Any sand seams or layers identified along the western side of the impoundment system, to the west of the Secondary and Tertiary Ponds, are localized and completely separated from the Fly Ash Pond System by the intervening bedrock low.

The geometric mean hydraulic conductivity of 3.2 X 10^{-05} cm/sec provided in the Plan was based on 12 field tested wells located around the BEC impoundment system. Five of those 12 tested wells[1] are distant from the Fly Ash Pond System (i.e., ranging in distance from 950 to 2,200 feet away from the nearest ash pond) and none are located downgradient. The geometric mean hydraulic conductivity measured at the seven wells in the shallow unconsolidated material closest to and immediately downgradient of the Fly Ash Pond System[2] is 8.7 X 10^{-06} cm/sec compared to a geometric mean of *5.0 X* 10^{-06} for the bedrock.

Table 2 of the Model Report Addendum listed 13 farm/domestic wells, 10 of which were identified as using the unconsolidated materials and two of which used the bedrock for water supply. However, looking at the well logs for those 10 wells, as included in the Water Well Survey report[3], shows that one of the 10 wells (Philip Cohen's 6-inch well drilled in 1950) was apparently a bedrock well and the remaining nine wells were all 33 to 42-inch diameter bored wells. Bored wells are generally installed at locations where there are low permeability unlithified deposits with no continuous saturated stratums to provide a continuous supply of groundwater to a conventional drilled well. In geologic materials which do not have sufficient hydraulic conductivity to produce a continuous supply of groundwater, bored wells essentially act as underground storage reservoirs that rely on slow seepage of water over a substantially larger surface area than conventional wells. The presence of a bored well in saturated materials does not constitute existence of an aquifer. Many bored wells are no longer utilized or have been long abandoned because they do not provide a "useable" quantity of groundwater, are subject to surface contamination, or go dry during extended dry periods or droughts.

Since the unlithified deposits at the Baldwin Fly Ash Pond System were previously recognized as being the uppermost water bearing zone and capable of locally transporting coal combustion residuals (CCRs), a groundwater monitoring network was established within the unlithified deposits at the BEC impoundment system, in addition to the uppermost bedrock aquifer, and is currently being monitored under Special Condition No. 17 of NPDES Permit No. IL0000043.

2. Figure No. 8 of the September 30, 2014 document, Prediction of Plume Stability by Groundwater Modeling, Model Report Addendum, projected boron impacted groundwater off site on private property. This projection was for the Base Case Scenario. The Groundwater Management Zone (GMZ) application

---

[1] MW-104DR, OW-156, MW-161, OW-256, MW-262

[2] MW-151, MW-152, OW-157, TPZ-166, MW-252, MW-253, OW-257

[3] NRT and Kelron Environmental, 2010. "Water Well Survey, Baldwin Ash Pond System, Baldwin Energy Complex, Baldwin, Illinois". Prepared for Dynegy Midwest Generation, LLC, dated June 7, 2010.

states "Capping the Baldwin Fly Ash Ponds as proposed will result in very similar results to the baseline transport model. The proposed cap does not minimize impacts to offsite groundwater and must be revised.

Response: The prediction modeling performed for the entire Baldwin Ash Pond System, inclusive of the Baldwin Fly Ash Pond System, evaluated both baseline conditions where no corrective action is implemented and various cap scenarios. The initial model report[4] was used to predict changes over a period of 50 years (2015-2065) using a transport model calibrated to simulate boron transport assuming steady-state flow conditions. The addendum[5] quantified the time for concentrations of the CCR leachate indicator boron to reach a stable status or to decrease in monitoring wells, determine the maximum extent of the boron plume, and to predict potential or future impairments to groundwater usage off-site.

The purpose of the proposed cap on the Baldwin Ash Pond System is to decrease impacts to groundwater both spatially and temporally. Given the inherent uncertainties with predictive modeling, the spatial difference in offsite migration of impacted groundwater exceeding the boron groundwater standard of 2 milligrams per Liter (mg/L) for the proposed cap versus a lower permeability (i.e., geomembrane cap) is relatively minor relative to the temporal difference. The long-term spatial difference in impacts to groundwater under baseline conditions with no cap versus a geomembrane cap as predicted by the groundwater model is exhibited on Figure 1. The maximum extent of the predicted boron plume under baseline conditions is reached in 600 years versus 1,200 years with a geomembrane cap. With the proposed clay cap the maximum boron extent will be reached in a period greater than 600 years before the plume begins dissipating, but significantly earlier (i.e., hundreds of years) than with a geomembrane cap.

With a baseline scenario condition of no cap on the Baldwin Ash Pond System the modeled duration for leachate depletion from the fly ash ponds (i.e., equivalent to background boron concentration) is 92 years. Installing the lowest permeability cap such as a geomembrane, which reduces surface infiltration into the fly ash ponds and reduces percolation out of the base of the ponds, increases the modeled duration of leachate depletion from the fly ash ponds to 558 years, or approximately six times longer. A clay cap with maximum permeability of 1×10^{-5} centimeters per second as proposed will still reduce the infiltration and

---

[4] NRT, 2014a. "Groundwater Model and Simulation of Closure Alternatives, Baldwin Ash Pond System, Baldwin Energy Complex, Baldwin, Illinois". Prepared for Dynegy Midwest Generation, LLC, dated June 18, 2014.

[5] NRT, 2014b. "Model Report Addendum, Prediction of Plume Stability by Groundwater Modeling, Baldwin Ash Pond System, Baldwin Energy Complex, Baldwin, Illinois". Prepared for Dynegy Operating Company, dated September 30, 2014.

percolation rates while substantially shortening the time for the groundwater plume to dissipate relative to a lower permeability cap.

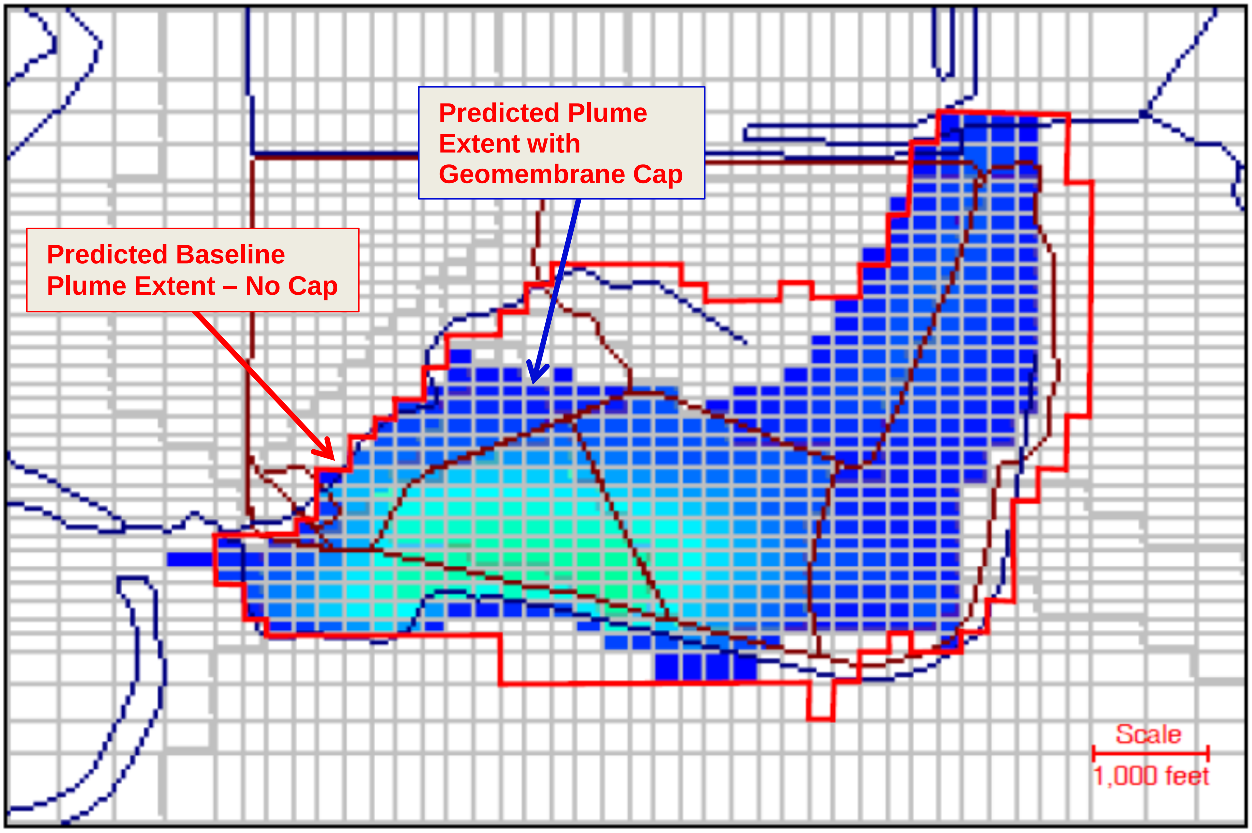


Figure 1. Baseline condition with no cap on the Baldwin ash ponds versus geomembrane cap

Predicted impacts to offsite groundwater quality based on groundwater modeling have been used to develop the initial corrective action of cap placement. The maximum plume extent as shown on Figure 1 will not occur because it is a modeled prediction based on current baseline conditions with no cap and no triggered corrective actions. The effects of the cap proposed in the closure plan on groundwater quality will be monitored in accordance with the groundwater monitoring plan. If concentrations of indicator parameters in groundwater show that there are statistically significant increasing trends attributable to the Baldwin Fly Ash Pond System then additional investigation and corrective actions appropriate to mitigate those exceedances, and prevent offsite migration of impacted groundwater exceeding groundwater standards, will be evaluated and proposed.

3. The GMZ application must specifically identify the corrective action which is proposed for the site.

Response: Section 2.3 of the GMZ application as submitted contains the three specific elements of the proposed corrective action, but has been modified slightly with the following underscored additions and strikeout deletions:

“The three ponds comprising the Baldwin Fly Ash Pond System are interconnected and are essentially three cells within one large pond. The Closure Plan for the Baldwin Fly Ash Pond System includes the following corrective action elements, preliminary designs of which are shown on Figure 4:

Closure will consist of pumping to remove surface water, redistributing and reshaping the existing CCR to fill in low areas and establish a subgrade for the final soil cover, and placing an earthen cover that complies with the CCR Rule.

The final cover system is comprised of a 6-inch vegetative support layer (topsoil) overlying 18-inch barrier soil.

Non-contact storm water runoff from the cover system will be collected and managed, with two new detention basins and channels directing water to the Secondary Pond.

The proposed corrective action elements will provide hydraulic control of surface water on the cover system and surrounding the Baldwin Fly Ash Pond System, will lower leachate levels and establish hydrostatic equilibrium within the ponds, and will decrease transport off-site both spatially and temporally.”

4. The boundary of the proposed GMZ appears to follow the property boundary for the site and include impoundments which have not been proposed to undergo closure at this time. The GMZ boundary needs to be revised to identify the specific area where groundwater quality standards are exceeded at the site as wells as the area in which the proposed corrective action will mitigate impaired groundwater.

Response: The GMZ application figures 1 to 4 will be revised to show the revised GMZ boundary. Figure 3 will be modified to show the revised GMZ boundary, approximate extent of impacted groundwater above Class II groundwater quality standards, and the model predicted corrective action mitigation area.

5. Section 6.9, page 6-6 of the plan indicates compliance with the applicable groundwater quality standards will be achieved when there are no statistically significant increasing trends attributable to the Baldwin Fly Ash Pond System for the parameters detected at the compliance boundary for 4 consecutive years following the change to annual monitoring frequency. The compliance section of the Plan and the GMZ application must be revised to identify the compliance point pursuant to 620.240(e)(1) and compliance concentrations at 35 Ill. Adm. Code 620.450(a)(4).

Response Part 1: The compliance section of the Plan, Section 6.9, will be revised with the following underscored additions and strikeout deletions:

”In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Natural Resource Technology

Compliance with on-site groundwater quality standards, as measured at the proposed monitoring well network (i.e., the modified NPDES monitoring well network), will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary ~~for~~ after a minimum 30 years of post-closure groundwater monitoring has been completed ~~four(4) consecutive years following the change to an annual monitoring frequency~~."

Response Part 2: The GMZ application will be revised with the following underscored additions and strikeout deletions:

"3.3 Compliance with Applicable On-Site Groundwater Quality Standards

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the proposed monitoring well network (i.e., the modified NPDES monitoring well network), will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary ~~for~~ after a minimum 30 years of post-closure groundwater monitoring has been completed.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94."

6. Figure No. 4 from Appendix A of the Plan indicates Boring PZ-171 has a 7.9 foot layer of sand. What is the extent of this sand layer, which is over 5 feet thick and therefore designated as Class I groundwater? Has the groundwater within the sand layer been analyzed to determine if it has been impacted by the ash impoundments? Does the sand layer extend off site?

Response: The 7.9 foot layer of sand observed at Boring PZ-171 may be either a localized lense or laterally continuous northward to Boring MW-161 and southward to Boring MW-262. However, based on six surrounding borings to the east and west (MW-154, MW-155, PZ-172, MW-388, MW-389, and TPZ-160) this layer is limited to the western edge of the Baldwin impoundments and is of limited lateral extent. Due to the presence of the bedrock valley, it is unlikely that this sand layer extends eastward beyond the western side of the Secondary Pond. The bedrock valley has a topographic elevation ranging from 366 to 390 feet and a land surface topographic elevation of 395 to 400 feet, both of which are close to or below the lowermost sand layer elevation of 395 feet. Surface topography between the Fly Ash Ponds and the western end of the impoundments (i.e., west of the Secondary and Tertiary Ponds) effectively isolates any sand lenses or layers observed in the western end of the site from the Fly Ash Pond System.

The sand layer observed at Boring PZ-171 or any of the other borings cannot extend significantly westward because the surface topography decreases westward towards the Kaskaskia River, with surface topography decreasing below an elevation of 395 feet. Borings advanced west of the impoundments towards the Kaskaskia River (i.e., MW-154 and MW-155) have sand or clayey sand layers ranging from 0.3 to 3.5 feet in thickness between the elevations of 369 and 381 feet, or approximately 14 to 26 feet below the base of the sand observed at Boring PZ-171. The sand layer at Boring PZ-171 does not extend off-site.

No groundwater samples have been collected from piezometer PZ-171 to determine if it has been impacted by the ash impoundments. However, wells MW-161 and MW-262 located directly north and south of PZ-171, respectively, were sampled for groundwater quality on four occasions in 2013 – 2014, with all boron concentrations at both wells below the reporting limit of 0.020 milligrams per Liter (mg/L) and sulfate concentrations were all less than 45 mg/L. Based on observed groundwater quality at monitoring wells located both north and south of PZ-171, and given the disconnection between any sand layers west of the Secondary and Tertiary Ponds from the rest of the impoundments, there is little possibility of impacts from the Fly Ash Pond System.

In order to confirm that there are no groundwater impacts related to coal combustion residuals to the west of the impoundments, a groundwater sample will be collected from piezometer PZ-171 and analyzed for chloride, sulfate, boron, total dissolved solids, and field pH. The laboratory report will be submitted to the Illinois EPA.

7. Section 6.2, page 6-4 of the Plan indicates the sampling schedule could be accomplished in 15 years. This appears to contradict the required 257 Regs post closure sampling of 30 years. This sampling schedule must be revised.

Response: The existing text in Section 6.2 of the Groundwater Monitoring Plan will be revised with the following underscored additions:

"Groundwater monitoring of the NPDES monitoring well network may be discontinued upon Illinois EPA's approval of a certified post-closure care report after a minimum 30 years of post-closure groundwater monitoring has been completed. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95. Post-closure care groundwater monitoring will continue for a minimum of 30 years in accordance with 40 CFR Part 257.104".

8. Section 6.4, page 6-4 of the Plan should contain a list of all the chemical concentrations required for groundwater monitoring by the 257 Regs, and a list of inorganic parameters required pursuant to the 620 Regs, for sampling each permanent monitoring well. Specifically, the inorganic parametes monitoring list for testing should be from 35 IAC 620.410 (a) and pH.

Response: The Plan will be revised by adding two imbedded tables into Section 6.4 that include the following:

- Subset of parameters from 35 IAC620.420(a) to be monitored and pH; and,
- List of Appendix III and IV parameters required for groundwater monitoring by the 257 Regs.

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATON AND GROUNDWATER MONITORING PLAN
Baldwin Fly Ash Pond System
Baldwin Energy Complex
Baldwin, Illinois
Project No: 2340
March 31, 2016

Revised Table of Contents page i
Revised Pages 6-4 to 6-8

TABLE OF CONTENTS

Groundwater monitoring of the NPDES monitoring well network may be discontinued upon Illinois EPA's approval of a certified post-closure care report after a minimum 30 years of post-closure groundwater monitoring has been completed. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95. Post-closure care groundwater monitoring will continue for a minimum of 30 years in accordance with 40 CFR Part 257.104.

6.3 Groundwater Sample Collection

Groundwater samples will be collected consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 as described in Appendix F. In addition to groundwater well samples, quality assurance samples will be collected as described in Section 6.5.

6.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 by a state-certified laboratory using methods approved by Illinois EPA and USEPA. The practical quantitation limit (PQL) for all parameters analyzed will be lower than the applicable groundwater quality standard. Concentrations lower than the PQL will be reported as less than the PQL. The laboratory analysis parameters for the two monitoring programs are listed below.

Laboratory Analysis Parameters from 35 IAC Part 620.420(a): Modified NPDES Monitoring Well Network		
Boron (dissolved)	Manganese (total)	Sulfate (dissolved)
Chloride (dissolved)	Nitrate (total)	Total Dissolved Solids (TDS)
Iron (total)		

Laboratory Parameters from Appendix III and Appendix IV of 40 CFR Part 257: 40 CFR Part 257 Monitoring Well Network		
Metals (totals)		
Antimony	Cadmium	Lithium
Arsenic	Calcium	Mercury
Barium	Chromium	Molybdenum
Beryllium	Cobalt	Selenium
Boron	Lead	Thallium
Inorganics (totals)		

Fluoride	Sulfate
Chloride	Total Dissolved Solids
Other (total)	
Radium 226 and 228 combined	

6.5 Quality Assurance Program

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93, the sampling and analysis program includes procedures and techniques for quality assurance and quality control. Additional quality assurance samples to be collected will include the following:

- Two blind duplicate groundwater samples from randomly selected monitoring wells
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, than equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

6.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.91, maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event. Monitoring well inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved

- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks that wells are clear of internal obstructions, and flow freely

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

6.7 Annual Statistical Analysis

6.7.1 Proposed Modified NPDES Monitoring Well Network

Trend analysis will be performed annually for each of the monitored parameters. Sen's Estimate of Slope will be applied to a minimum of four consecutive quarterly monitoring results. If there are increasing trends during closure and post-closure care periods, they will be further investigated as described below.

- If the results of sampling and analysis show an increasing trend at any compliance monitoring well, a Mann-Kendall analysis will be performed at 95 percent confidence to determine whether or not the increasing trend is statistically significant.
- If a statistically significant increasing trend occurs during post-closure care, further investigation of monitored concentrations will be performed as well as more frequent inspections of the surface of the cover system.
- If the investigation attributes a statistically significant increasing trend to a source other than the Baldwin Fly Ash Pond System, then the Illinois EPA will be notified in writing, stating the cause of the increasing trend and providing the rationale used in such a determination.
- If there is not an alternative source causing the statistically significant increasing concentration and the sampling frequency had been reduced to semi-annual or annual sampling, a quarterly sampling schedule will be reestablished. The frequency of sampling will return to either semi-annual or annual, once four consecutive quarterly samples show no statistically significant increasing trend.

Notifications concerning statistically significant increasing trends and revisions of the sampling frequency will be reported to Illinois EPA in writing within 30 days after making the determinations.

6.7.2 40 CFR Part 257 Monitoring Well Network

As required in 40 CFR Part 257.93, statistical analysis will be performed to determine whether or not a statistically significant increase over a background value has occurred for each constituent and at each well. Appropriate statistical methods will be chosen from the list of methods provided and the test chosen will be conducted separately for each constituent in each monitoring well. In addition, each statistical method chosen will comply with the performance standards, as appropriate, based on the test method used. If a statistically significant increase over background values is determined, procedures from 40 CFR Part 257 will be followed including 1) establishing an assessment monitoring program or 2) demonstrating that a source other than the Baldwin Fly Ash Pond System caused the increase or demonstrating another plausible reason for the increase (error in sampling, etc.).

6.8 Data Reporting

Sampling and analysis data from quarterly, semi-annual and/or annual groundwater monitoring for the modified NPDES monitoring well network will be reported to Illinois EPA within 60 days after completion of sampling. Statistical analysis of the laboratory analytical data will be reported to Illinois EPA with the annual report for the facility, as described in the closure plan.

Data reporting for the 40 CFR Part 257 monitoring well network will be consistent with recordkeeping, notification, and internet posting requirements described in 40 CFR 257.105 through 257.107.

6.9 Compliance with Applicable On-Site Groundwater Quality Standards

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the modified NPDES monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary after a minimum 30 years of post-closure groundwater monitoring has been completed.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.

6.10 Corrective Action

If a statistically significant increasing trend is observed to continue over a period of two or more years in groundwater sampled at the modified NPDES monitoring well network, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Baldwin Fly Ash Pond System and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan. A corrective action plan will be submitted to Illinois EPA within 180 days after completion of the investigation activities. The plan will propose corrective actions to be undertaken to mitigate the impacts associated with the constituents of concern which exceed applicable groundwater standards.

GROUNDWATER MANAGEMENT ZONE APPLICATION
Baldwin Fly Ash Pond System
Baldwin Energy Complex
Baldwin, Illinois
Project No: 2340
March 31, 2016

Revised Table of Contents
Revised Page 2-3
Revised Page 3-2
Revised Figures 1 – 4
Revised Appendix A – Groundwater Management Zone Legal Description

TABLE OF CONTENTS

FIGURES

APPENDICES

2.3 Closure of the Baldwin Fly Ash Pond System

The Closure Plan for the Baldwin Fly Ash Pond System is being submitted under separate cover (AECOM, 2016). In November 2015, in accordance with 40 CFR Part 257 Subpart D, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule. (CCR Rule), DMG submitted to Illinois EPA a notice of intent to close the East Fly Ash Pond and Old East Fly Ash Pond. A notice of intent to close the West Fly Ash Pond will be submitted by May 17, 2017. Because the East Fly Ash Pond and Old East Fly Ash Pond are inactive, the CCR Rule deadline for completing closure of these two ponds is November 2020.

The three ponds comprising the Baldwin Fly Ash Pond System are interconnected and are essentially three cells within one large pond. The Closure Plan for the Baldwin Fly Ash Pond System includes the following corrective action elements, preliminary designs of which are shown on Figure 4:

- Closure will consist of pumping to remove surface water, redistributing and reshaping the existing CCR to fill in low areas and establish a subgrade for the final soil cover, and placing an earthen cover that complies with the CCR Rule.
- The final cover system is comprised of a 6-inch vegetative support layer (topsoil) overlying 18-inch barrier soil.
- Non-contact storm water runoff from the cover system will be collected and managed, with two new detention basins and channels directing water to the Secondary Pond.

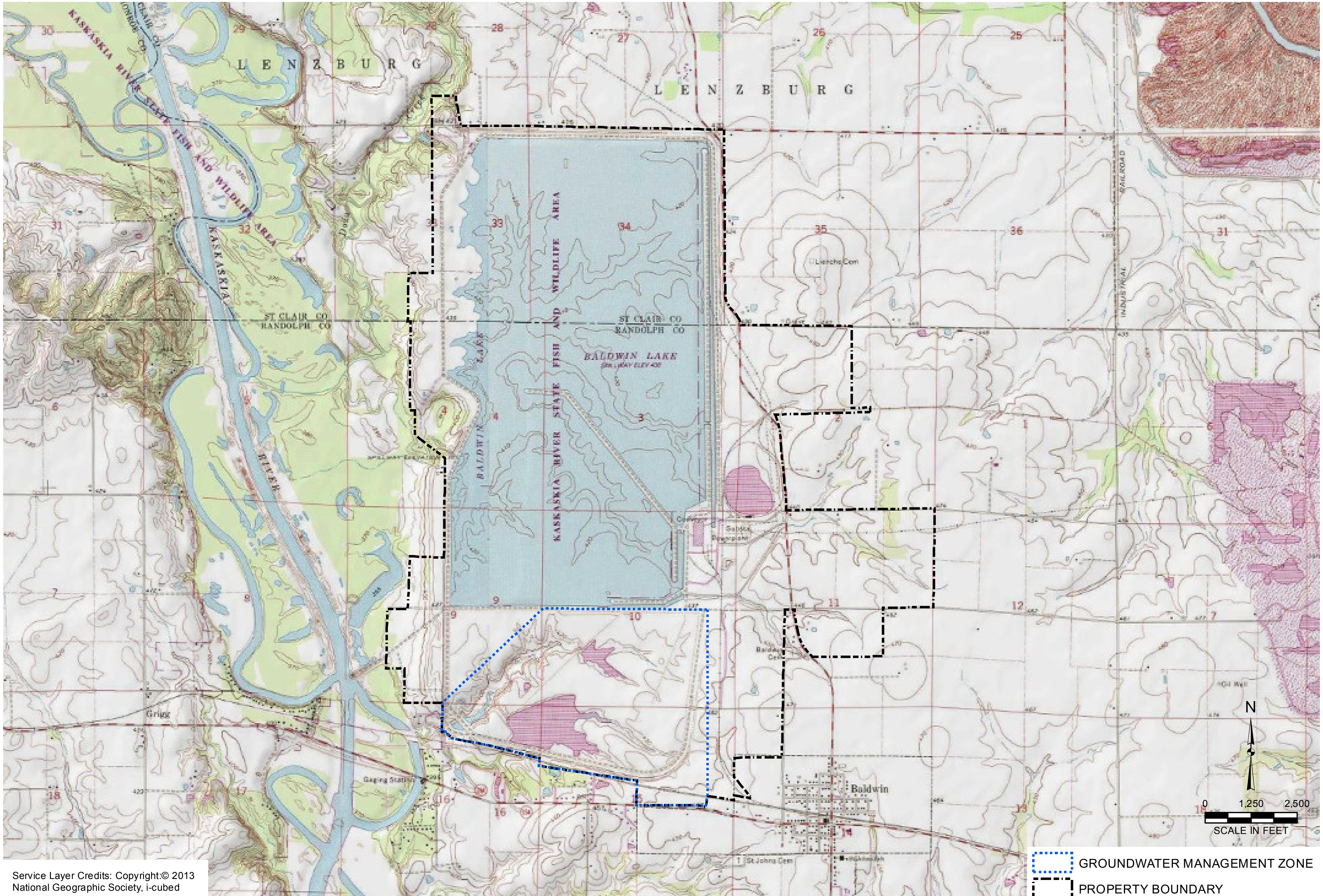
The proposed corrective action elements will provide hydraulic control of surface water on the cover system and surrounding the Baldwin Fly Ash Pond System, will lower leachate levels and establish hydrostatic equilibrium within the ponds, and will decrease transport off-site both spatially and temporally. There are no receptors off-site that would be potentially affected by the movement of impacted groundwater from the Baldwin Fly Ash Pond System.

3.3 Compliance with Applicable On-Site Groundwater Quality Standards

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the modified NPDES monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary after a minimum 30 years of post-closure groundwater monitoring has been completed.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.



DRAWN BY/DATE:
TDC 2/25/16
REVIEWED BY/DATE:
RJK 2/25/16
APPROVED BY/DATE:
SJC 7/25/16

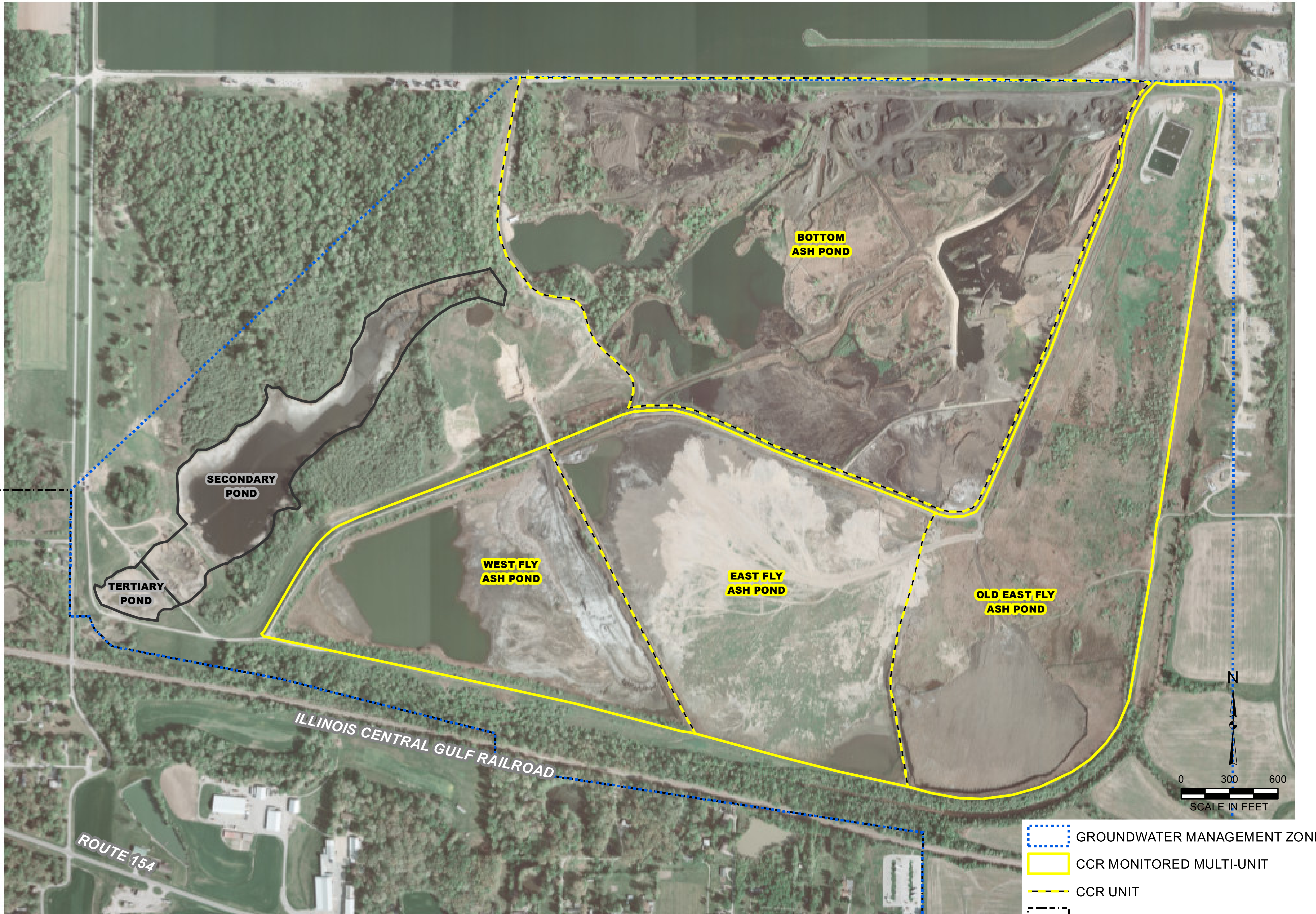
SITE LOCATION MAP

GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



AERIAL PHOTO SOURCE: HENDERSON AERIAL SURVEYS (4/2/2012).

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 7/25/16

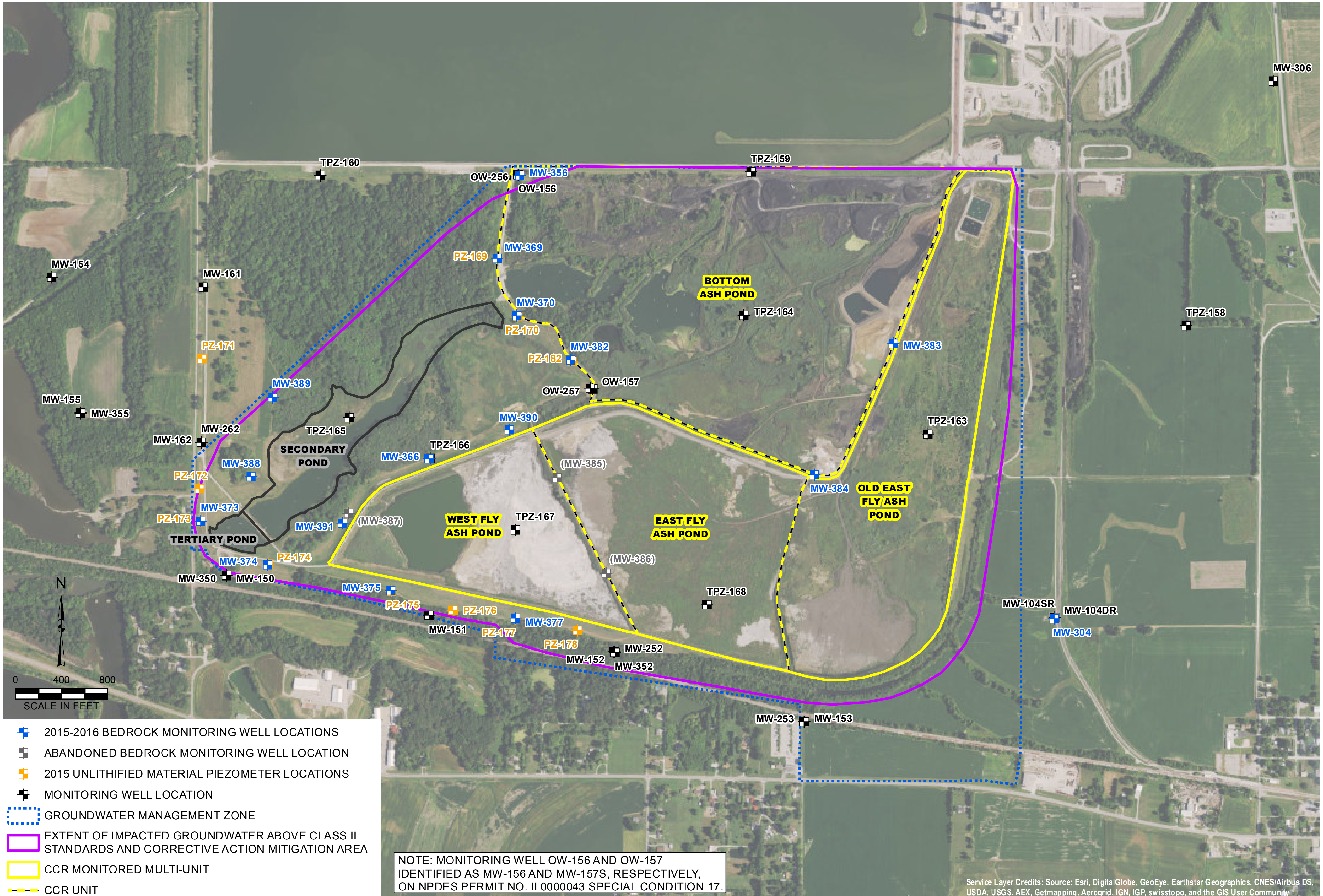
DETAILED SITE MAP WITH PARTIAL GMZ BOUNDARY

GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 2

NATURAL RESOURCE TECHNOLOGY



2015-2016 BEDROCK MONITORING WELL LOCATIONS
ABANDONED BEDROCK MONITORING WELL LOCATION
2015 UNLITHIFIED MATERIAL PIEZOMETER LOCATIONS
MONITORING WELL LOCATION
GROUNDWATER MANAGEMENT ZONE
EXTENT OF IMPACTED GROUNDWATER ABOVE CLASS II STANDARDS AND CORRECTIVE ACTION MITIGATION AREA
CCR MONITORED MULTI-UNIT
CCR UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 7/25/16

MONITORING WELL LOCATION MAP

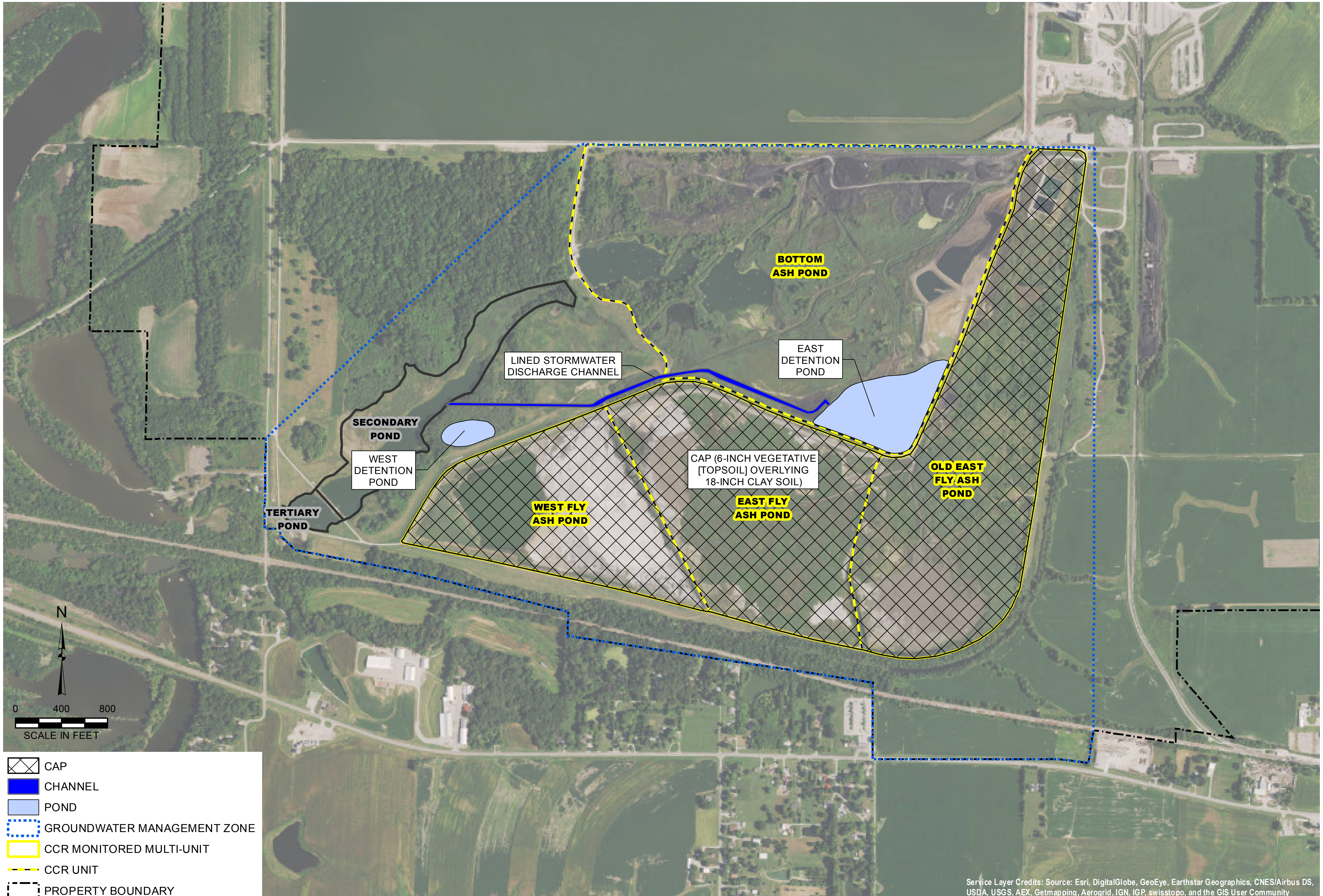
GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 3

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\GMZ_Application\Figure 3_Monitoring Well Location Map.mxd Author: sstolz; Date/Time: 7/25/2016, 5:52:06 PM



DRAWN BY/DATE: TDC 3/9/16
REVIEWED BY/DATE: SJC 3/9/16
APPROVED BY/DATE: SJC 7/25/16

SITE CLOSURE PLAN

GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 4

NATURAL RESOURCE TECHNOLOGY

APPENDIX A

GROUNDWATER MANAGEMENT ZONE LEGAL DESCRIPTION

LAND DESCRIPTION OF PROPOSED GROUNDWATER MANAGEMENT ZONE

A TRACT OF LAND BEING PART OF SECTIONS 9, 10 ,15, AND 16 IN TOWNSHIP 4 SOUTH, RANGE 7 WEST OF THE THIRD PRINCIPAL MERIDIAN, RANDOLPH COUNTY, ILLINOIS, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT A CONCRETE MONUMENT AT THE EAST QUARTER-CORNER OF SECTION 10, TOWNSHIP 4 SOUTH, RANGE 7 WEST; THENCE NORTH 0 DEGREES 57 MINUTES 30 SECONDS WEST, A DISTANCE OF 837.22 FEET TO THE POINT OF BEGINNING OF THE TRACT DESCRIBED HEREIN SOUTH 00 DEGREES 00 MINUTES 00 SECONDS EAST, A DISTANCE OF 5102.20 FEET; THENCE SOUTH 08 DEGREES 36 MINUTES 19 SECONDS WEST, A DISTANCE OF 289.20 FEET TO THE NORTH RIGHT OF WAY LINE OF ROUTE 154 ALSO BEING A NON-TANGENT CURVE TO THE LEFT, HAVING A RADIUS OF 5769.63 FEET, WITH A CHORD BEARING OF NORTH 82 DEGREES 42 MINUTES 22 SECONDS WEST; THENCE NORTHWESTERLY ALONG SAID CURVE AND NORTH RIGHT OF WAY LINE, A DISTANCE OF 275.47 FEET TO THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 15; THENCE NORTH 89 DEGREES 57 MINUTES 58 SECONDS WEST, ALONG SAID SOUTH LINE, A DISTANCE OF 1599.38 FEET TO THE WEST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 15; THENCE NORTH 00 DEGREES 26 MINUTES 31 SECONDS EAST, ALONG SAID WEST LINE, A DISTANCE OF 673.45 FEET TO THE CENTERLINE OF THE PROPERTY NOW OR FORMERLY OWNED BY THE GULF MOBILE, AND OHIO RAILROAD; THENCE NORTH 81 DEGREES 04 MINUTES 38 SECONDS WEST, ALONG SAID CENTERLINE, A DISTANCE OF 2679.12 FEET TO THE WEST LINE OF SAID SECTION 15; THENCE NORTH 00 DEGREES 54 MINUTES 21 SECONDS EAST, ALONG SAID WEST LINE, A DISTANCE OF 216.85 FEET; THENCE NORTH 75 DEGREES 38 MINUTES 34 SECONDS WEST, A DISTANCE OF 1371.51 FEET; THENCE NORTH 78 DEGREES 35 MINUTES 08 SECONDS WEST, A DISTANCE OF 1065.00 FEET; THENCE NORTH 45 DEGREES 05 MINUTES 08 SECONDS WEST, A DISTANCE OF 150.00 FEET; THENCE NORTH 20 DEGREES 35 MINUTES 08 SECONDS WEST, A DISTANCE OF 83.42 FEET; THENCE NORTH 89 DEGREES 06 MINUTES 39 SECONDS WEST, A DISTANCE OF 124.98 FEET TO THE WEST LINE OF THE NORTHEAST QUARTER OF SECTION 16, TOWNSHIP 4 SOUTH, RANGE 7 WEST; THENCE NORTH 01 DEGREES 00 MINUTES 09 SECONDS EAST, ALONG SAID WEST LINE, A DISTANCE OF 788.07 FEET; THENCE NORTH 46 DEGREES 54 MINUTES 02 SECONDS EAST, A DISTANCE OF 3757.78 FEET; THENCE SOUTH 89 DEGREES 24 MINUTES 27 SECONDS EAST, A DISTANCE OF 4429.72 FEET TO THE POINT OF BEGINNING; CONTAINING 654.28 ACRES MORE OR LESS; SUBJECT TO ALL RIGHTS TO THE PUBLIC FOR ROAD AND RAILROAD RIGHTS OF WAY, AND EASEMENTS OF RECORD, IF ANY.

LINE LEGEND

- BOUNDARY
- QUARTER SECTION LINES
- SECTION LINE

N

SCALE: 1" = 400'
0 200' 400' 800'

STATE OF ILLINOIS)
) SS
COUNTY OF MADISON)

I, MICHAEL J. GRAMINSKI, A PROFESSIONAL LAND SURVEYOR, DO CERTIFY THAT THIS DRAWING HAS BEEN PREPARED UNDER MY DIRECT SUPERVISION FOR THE CREATION OF A GMZ LIMITS LEGAL DESCRIPTION. ALL DIMENSIONS ARE IN FEET AND DECIMAL PARTS THEREOF.
DATED THIS 29th DAY OF JULY, 2016.

STATE OF ILLINOIS MICHAEL J. GRAMINSKI 35-2901 REGISTERED LAND SURVEYOR

IPLS LICENSE NUMBER 035.002901, EXPIRES 11/30/2016
PROFESSIONAL DESIGN FIRM LICENSE NUMBER 184.004638, EXPIRES 4/30/2017
THIS SURVEY DOES NOT CONFORM TO THE CURRENT ILLINOIS STANDARD FOR A BOUNDARY SURVEY.

IngenAE
514 Earth City Plaza
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:	Date:
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

PREPARED FOR:

DYNEGY

Project Name & Location:

DYNEGY BALDWIN POWER PLANT
BALDWIN, IL 62217

DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:

GROUNDWATER MANAGEMENT ZONE (GMZ) PARCEL DESCRIPTION EXHIBIT

Date: 7/27/16	Project No.
Type: SITE	Drawing No. 1 OF 1
Drawn By: CMB	
Approved By: EAS	
Scale: AS NOTED	

SMARTER SOLUTIONS

EXCEPTIONAL SERVICE

VALUE

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT AND GROUNDWATER MONITORING PLAN

Baldwin Fly Ash Pond System
Baldwin Energy Complex
Baldwin, Illinois

Project No: 2340

March 31, 2016

NATURAL RESOURCE TECHNOLOGY

ENVIRONMENTAL CONSULTANTS

NATURAL
RESOURCE
TECHNOLOGY
ENVIRONMENTAL CONSULTANTS

2422 E. WASHINGTON STREET, SUITE 104
BLOOMINGTON, ILLINOIS 61704
(P) 414.837.3607
(F) 414.837.3608

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION AND GROUNDWATER MONITORING PLAN

BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

Project No. 2340

Prepared For:

DYNEGY MIDWEST GENERATION, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

Prepared By:

Natural Resource Technology, Inc.
234 W. Florida Street, Fifth Floor
Milwaukee, Wisconsin 53204

March 31, 2016

Stuart J. Cravens, PG
Principal Hydrogeologist

Robert J. Karnauskas, PG
Senior Hydrogeologist

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1 INTRODUCTION

1.1 Overview

This Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan was prepared by Natural Resource Technology, Inc. (NRT) in support of a Closure Plan for fly ash ponds located at the Baldwin Energy Complex (BEC) which is owned by Dynegy Midwest Generation, LLC (DMG).

This report and the Closure Plan will apply specifically to the East Fly Ash Pond, Old East Fly Ash Pond and West Fly Ash Pond, hereinafter referred to as the Baldwin Fly Ash Pond System, which are part of a system of six Coal Combustion Residuals (CCR) surface impoundments, as defined further below.

Numerous subsurface investigations have been performed concerning the ash pond system at BEC. The information presented in this report supplements comprehensive data collection and evaluations from the prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System*** A Phase II assessment to further assess the hydrogeology and groundwater quality in the vicinity of the ash pond system at BEC, following the proposed scope of work (March 22, 2013) approved, with clarifications, by Illinois EPA, June 18, 2013).
- ***Dynegy, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System*** A plan for conducting a more comprehensive hydrogeologic investigation along with development of a groundwater model to evaluate various pond closure scenarios on groundwater quality in the vicinity of the ash pond system; accepted, with clarifications, by Illinois EPA August 31, 2011.
- ***Kelron Environmental, June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System*** Assessed the hydrogeology and groundwater quality in the vicinity of the ash pond system, but not beneath the ash ponds. Thirteen monitoring wells were installed around the perimeter of the ash pond system and sampled quarterly to assess upgradient and downgradient groundwater quality (full inorganic parameter list in IAC 35 Part 620.410). Submitted to Illinois EPA.
- ***Kelron Environmental, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex*** Off-site groundwater quality investigation, south and southwest of the ash pond system, to assess shallow off-site groundwater quality for the presence of inorganic parameters related to CCRs. Submitted to Illinois EPA.
- ***Kelron Environmental and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System*** A survey identifying water wells located within 2,500 feet (ft) of the BEC's ash pond system. The water well survey was prepared in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 IAC 1600.210(b)(1) and 1600.210(b)(2). Submitted to Illinois EPA.

- ***Kelron Environmental and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System*** A plan for initial evaluation of groundwater quality in the vicinity of the ash pond system along with an initial hydrogeologic characterization; accepted, with clarifications, by Illinois EPA August 31, 2011.

This Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan provides a summary of additional data collected and site investigations performed since submittal of the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014) in order to satisfy the following:

- Provide information to define hydrogeology and to assess the groundwater impacts related to the CCR surface impoundments.
- Provide information that could be used to perform a model to assess the groundwater impacts associated with closure of the Baldwin Fly Ash Pond System.
- Provide information to establish a groundwater monitoring program sufficient for long-term, post-closure monitoring.

In conjunction with the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014), groundwater flow and transport models were developed to evaluate the effect of various ash pond closure scenarios on groundwater quality (NRT, June 18, 2014) and to predict the fate and transport of CCR leachate components (NRT, September 30, 2014). Additional groundwater modeling is being conducted to enable estimation of the time required for hydrostatic equilibrium of groundwater beneath the unit. The existing groundwater flow and transport model for the ash pond system is also being updated to develop predictions for closure of the Baldwin Fly Ash Pond System. These groundwater modeling reports will be submitted under separate cover.

1.2 Site Location and Background

The BEC is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BEC is located within Sections 2, 3, 4, 9, 10, 11, 14, 15 and 16 of Township 4 South and Range West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The Baldwin Fly Ash Pond System is approximately one-half mile west-northwest of the Village of Baldwin. The site location is shown on Figure 1. In general, the BEC property is bordered: on the west by the Kaskaskia River; on the east by Baldwin Road, farmland, and strip mining areas; on the southeast by the village of Baldwin; on the south by the Illinois Central Gulf railroad tracks and State Route 154; and, on the north by the St. Clair/Randolph County Line.

The BEC utilizes four active ash ponds with two inactive fly ash ponds, located at the eastern end of the ash pond system (Figure 2):

- Bottom Ash Pond (177 acres, active)

- East Fly Ash Pond (76 acres, inactive)
- Old East Fly Ash Pond (102 acres, inactive)
- West Fly Ash Pond (54 acres, active)
- Secondary Pond (25 acres, active), used for water clarification rather than direct management of CCRs, but does contain a small volume of CCR
- Tertiary Pond (3.1 acres, active), used for final water clarification and contains a very small volume of CCR

There is one outfall from the ash pond system at the Tertiary Pond that discharges to a tributary of the Kaskaskia River, south of the Cooling Pond intake structure. All six impoundments of the ash pond system have been evaluated as part of the previously conducted hydrogeologic investigations, groundwater quality assessments and modeling.

2 GEOLOGY AND HYDROGEOLOGY

The additional site characterization activities performed at BEC since the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014) have included the following:

- Unlithified zone investigation
- Bedrock investigation
- Aquifer testing
- Geotechnical borings and soil laboratory testing

The results of these supplemental site investigations are discussed below.

2.1 Geology

Geologic units present at the ash pond system include fill, ash generated at BEC, unlithified geologic materials (i.e., Cahokia Alluvium, Equality Formation, and Vandalia Till Member) and Mississippian and Pennsylvanian bedrock.

2.1.1 Unlithified Material Investigations

Supplemental investigation within the unlithified materials was performed to further evaluate the potential presence of sand layers that could represent preferential migration pathways. Eleven borings (PZ-169 through PZ-178 and PZ-182) were performed during July-August 2015 as shown on Figure 3. Borings typically extended to bedrock where monitoring wells with 10 ft screens were installed. Boring depths ranged from 14 to 50 ft below ground surface (bgs). The boring logs and piezometer installation details are provided in Appendix C2.

The location of sand seams observed as well as their thickness and base elevation are shown on Figure 4, based on all borings performed within the unlithified materials. Sand seams appear randomly disseminated across the Site and range from one locally continuous unsaturated sand lens up to 7.9 ft in thickness to isolated, discontinuous thin seams 0.2 to 1 ft thick. No continuous sand seams were observed within or immediately adjacent to the Baldwin Fly Ash Pond System that represent significant preferential migration pathways.

Two overlapping sand seams that appear to be continuous between adjacent borings occur to the west of the Baldwin Fly Ash Pond System (Figure 4) and are vertically separated by at least 6 ft of clay. The shallower sand lens at elevations between 395 to 403 ft is not saturated. These sand lenses do not extend to the Baldwin Fly Ash Pond System as evidenced by several borings in which no sand was observed.

AECOM (2015) completed a geotechnical investigation that included additional borings that were reported in the 30% design data package for the ash ponds. The geotechnical exploratory program included the following:

- 26 auger borings at the Baldwin Fly Ash Pond System and Bottom Ash Pond. In addition, 3 hand auger borings were completed.
- 82 Cone Penetrometer Testing (CPT) soundings at the Baldwin Fly Ash Pond System and the Secondary, Tertiary, and Bottom Ash Ponds
- 13 vibrating wire piezometers installed at selected boring locations

The geotechnical exploration locations are shown on AECOM Figure D-01 in Appendix A.

Representative samples from the borings were submitted to AECOM of Conshohocken, Pennsylvania and Terrasense of Totowa, New Jersey for laboratory testing on the soil samples for geotechnical properties. A summary of the AECOM geotechnical laboratory test results on the soil samples is provided in Appendix A. The falling head permeability tests results are discussed below. The boring logs and other geotechnical testing data are being submitted under separate cover for the Bladwin Fly Ash Pond System closure plan.

2.1.2 Bedrock Investigations

Bedrock at the site consists of predominantly shale and limestone with lesser amounts of sandstone. As noted in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014), the Mississippian and Pennsylvanian rocks in the vicinity of the BEC yield small amounts of water to wells from interconnected pores, cracks, fractures, crevices, joints, and bedding planes. Water-bearing openings are variable from place to place and are best developed near the bedrock surface in thin limestones. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (i.e., highly mineralized) with increasing depth.

Supplemental evaluation of bedrock hydraulic conductivity was performed that initially included three deeper holes (MW-304, MW-356, MW-373) extending 95 to 135 ft bgs (82 to 100 ft bgs below the bedrock surface). Packer testing was performed in these coreholes but is not reported herein because the test results were inconclusive. The bedrock was physically deformed by hydrofracking during the test and did not represent actual hydraulic conductivity. Consistent with the site geology and water wells in surrounding area, it was concluded that the most transmissive zone was near the bedrock surface.

Because there were an insufficient number of existing wells for monitoring groundwater in bedrock at the Baldwin Fly Ash Pond System, 16 additional monitoring wells were installed during September 2015 through March 2016. The base of the monitoring well screens were installed an average of approximately 21 ft below the top of bedrock. The additional bedrock monitoring wells installed at each surface impoundment (SI) unit are shown on Figure 3 and included the following.

- 1 monitoring well at an upgradient location (MW-304)
- 10 monitoring wells within and downgradient of the Baldwin Fly Ash Pond System, which is designated as an inactive SI multi unit
- 4 monitoring wells downgradient of the Secondary and Tertiary Ash Ponds, which are designated as an active SI multi unit
- 4 monitoring wells downgradient of the Bottom Ash Pond, which is designated as an active SI unit

Monitoring of upgradient groundwater quality in bedrock will be supplemented with the addition of an existing monitoring well, MW-306, located northeast of the Baldwin Fly Ash Pond System, Well numbers, locations and screened intervals for each SI unit are summarized on the following table and are shown on Figure 3.

Well Number	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)
Upgradient Monitoring Well		
MW-304*	41	45 - 55
MW-306	39	71 - 86
Inactive SI Multi-Unit: Baldwin Fly Ash Pond System		
MW-383	50	58 - 68
MW-384	56	61 - 71
MW-385**	64	80 - 90
MW-386**	64	76 - 86
MW-366	36	42 - 52
MW-375	50	57 - 67
MW-377	31	46 - 56
MW-387**	36	48 - 58
MW-390	40	50 - 65
MW-391	36	55 - 70
Active SI Multi-Unit: Secondary and Tertiary Ponds		
MW-373*	13	20 - 30
MW-374	24	30 - 40
MW-388	27	33 - 43
MW-389	36	42 - 52
Active SI Unit: Bottom Ash Pond		
MW-356*	37	56 - 66
MW-369	47	56 - 66
MW-370	28	53 - 63
MW-382	34	56 - 66

* Deep bedrock borings were partially backfilled to set the well screens at the specified depths
**Monitoring well scheduled to be abandoned (See section 4.3)

Bedrock boring logs and well construction details are in provided in Appendix C5.

Bedrock topography slopes generally to the west and southwest across the CCR surface impoundments. Topographic relief is approximately 45 ft and is shown on Figure 5.

2.2 Hydrogeology

In March 2015, NRT began an assessment of the existing monitoring well network(s) at BEC with respect to the existing CCR units. Included in the assessment was a review of the current placement and number of monitoring wells with respect to individual and contiguous CCR units as well as potential locations for new monitoring wells, as appropriate. Analytical data for the existing monitoring wells was reviewed to assure that the current well constructions were adequate to provide low turbidity samples during collection of unfiltered samples. None of the monitoring wells exhibited poor construction, evidence of damage or appeared to be otherwise compromised.

The discussion below summarizes the results of the supplemental well installations.

2.2.1 Uppermost Aquifer

The hydrogeology of the ash pond system was comprehensively addressed in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). An uppermost aquifer within the area of the six impoundments at the BEC has not been previously designated. Off-site, immediately upgradient and downgradient of the site property boundaries, both the shallow glacial deposits and the shallow bedrock have served as a source of water supply. The shallow unlithified deposits off-site have yielded water through intermittent, discontinuous sand lenses and, in the bedrock, through fractured sandstone and limestone. However, within the area of the ash impoundment only thin and intermittent sand lenses are present. Based on the above, the bedrock is the only viable aquifer in the vicinity of the ash impoundments and is being designated the uppermost aquifer, consistent with the US Environmental Protection Agency (USEPA) definition in 40 CFR Part 257.53 (USEPA, 2015). Seventeen new monitoring wells, as described above, were installed in 2015 and 2016 for purposes of groundwater monitoring within bedrock to comply with the monitoring requirements of 40 CFR Part 257.

Groundwater flow in bedrock is generally to the west and southwest, based on elevation measurements collected on March 2, 2016 (Figure 6). Piezometric heads in bedrock range from less than 1 ft to about 29 ft bgs.

2.2.2 Other Monitorable Units

Other monitorable units representing potential ash constituent migration pathways include glacial deposits and the uppermost bedrock surrounding and within the ash impoundments. The glacial deposits and uppermost bedrock are currently monitored in compliance with existing Illinois EPA permits. Groundwater in these existing wells will continue to be monitored to comply with 35 IAC Part 620 and BEC's existing NPDES permit.

Groundwater elevation measurements have been measured on a quarterly basis. Groundwater flow in the unlithified glacial materials is to the west, based on elevation measurements collected on November 10, 2015 (Figure 7). The westerly direction of flow is consistent with previous groundwater contour maps in the unlithified deposits (NRT, June 11, 2014). The depth to the potentiometric surface in the unlithified materials ranges from 3.2 to 17.7 ft bgs.

2.2.3 Hydraulic Conductivity

Field hydraulic conductivity tests performed on the unlithified geologic materials (i.e., Cahokia Alluvium, Equality Formation, and Vandalia Till Member) and Mississippian and Pennsylvanian bedrock at the Site were presented the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). The unlithified and bedrock geologic materials had geometric mean hydraulic conductivities of approximately $3x10^{-5}$ cm/s and $5x10^{-6}$ cm/s, respectively.

Six falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on undisturbed soil samples collected from the AECOM (2015) geotechnical borings BAL-B001, BAL-B008, BAL-B010, BAL-B011, BAL-B017 and BAL-B027. Sample locations are shown on AECOM Figure D-01 in Appendix A. Test methods and details are provided in Appendix B and the results are summarized below.

Laboratory Hydraulic Conductivity Test Results

Boring Number	Sample Description	Sample Depth (feet)	Hydraulic Conductivity (cm/sec)
BAL-B001	Medium stiff, moist, pale gray with orange mottling, medium plasticity Lean CLAY (CL), trace fine gravel. [TILL]	35.6	$1.3 x10^{-8}$
BAL-B008	Very stiff, moist, light brown with orange and gray mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]	10.8	$5.5 x10^{-9}$
BAL-B010	Stiff, moist to wet, gray, Silty CLAY (CL), iron staining, trace sand and clay. [LOESS]	21.3	$2.4 x10^{-6}$
BAL-B011	Stiff, moist, gray with faint orange mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]	15.2	$1.8 x10^{-9}$
BAL-B017	Stiff, gray, medium plasticity CLAY (CL). [RESIDUAL]	26.7	$1.7 x10^{-8}$
BAL-B027	Stiff, moist to wet, gray, Lean CLAY (CL), with silt and fine sand, trace gravel, iron staining. [TILL]	26.9	$5.0 x10^{-9}$

3 GROUNDWATER QUALITY

3.1 Summary of Groundwater Monitoring Activities

An initial six quarters of sampling and analysis of groundwater from monitoring wells at the Baldwin Fly Ash Pond System was conducted from November 2010 through March 2012. The groundwater quality data collected from 2010 through 2012 included field parameters and the full list of inorganic parameters listed in 35 IAC Part 620 Section 420 (Groundwater Quality Standards for Class II: General Resource Groundwater) except for vanadium and perchlorate. Based on the results of the initial 2010–2012 (Phase I) investigation (Kelron, June 30, 2012), additional monitoring wells and piezometers were installed upgradient, downgradient, and within the ash pond system as part of the Phase II investigation (NRT, June 11, 2014). Further, the list of monitoring parameters was reduced to boron, iron, manganese, chloride, sulfate, TDS, and pH commencing in September 2013.

Samples are currently collected quarterly from 14 monitoring wells in accordance with NPDES Permit No. IL0000043 (effective January 1, 2015) for the following laboratory and/or field parameters:

Laboratory Parameters		
Boron	Manganese (total)	Sulfate
Chloride	Nitrate	Total Dissolved Solids (TDS)
Iron (total)		

Field Parameters	
pH	Depth of Well (ft bgs)
Specific Conductance	Elevation of measuring point (mp)
Temperature	Depth to Water (ft below mp)
	Groundwater Elevation (ft)

Groundwater monitoring results from sampling of the 14 wells are reported to the Illinois EPA annually in accordance with the NPDES permit.

3.2 Groundwater Monitoring Results

Analytical results from November 2010 through November 2015, including non-NPDES permit required wells, are summarized in Appendix D. Statistics showing the minimum and maximum concentrations detected in the unlithified materials, bedrock and leachate wells is included. Also, a comparison of groundwater data from wells screened in unlithified materials relative to the Groundwater Quality Standards for Class II: General Resource Groundwater is shown. The well locations are shown on Figure 3.

Parameters that have been detected in groundwater at concentrations exceeding the Class II groundwater quality standards include the following:

Boron	Iron	Sulfate
Chloride*	Manganese	TDS
pH		

*exceeded in bedrock well only; background chloride concentration in bedrock to be determined

Class II parameters that have not been detected in groundwater include the following:

Beryllium	Chromium	Mercury
Cadmium	Cyanide	Thallium

All other Class II parameters that have been detected are typically well below their respective groundwater quality standards.

Quarterly groundwater sampling of the new bedrock well network commenced in January 2016.

3.3 Statistical Evaluation of Background Groundwater Data

A statistical evaluation was performed to determine the maximum background concentrations likely to occur upgradient of the Baldwin Fly Ash Pond System within the unlithified glacial materials. The groundwater quality data collected from upgradient monitoring wells MW-104S/SR and MW-104D/DR was evaluated using the Electric Power Research Institute (EPRI, March 2014) computer database and analysis program, MANAGES™ (Version 3.4.49). The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," March 2009, EPA 530/R-09-2007 (USEPA, 2009).

The statistical methodology is provided in Appendix E. Establishing the tolerance interval(s) for the groundwater constituents was accomplished by using either a parametric or non-parametric procedure based on the percentage of non-detects in the data sets and the distribution of the sample population. If the statistical data for a constituent had less than 50 percent non-detects and was normally or log-normally distributed, a parametric procedure was used. If the data was not normally or log-normally distributed or had more than 50 percent non-detects, a non-parametric procedure was used. Appendix E, Figure E-1 is a flow chart which illustrates the processes followed to determine the appropriate statistical procedure used for each constituent based on its statistical characteristics.

3.4 Statistical Analysis Results

The results of the statistical analyses for the groundwater in the unlithified materials are located in Appendix E. A statistical summary of the background water quality data from MW-104S/SR and MW-104D/DR is provided in Table E-2, and includes the mean, median, minimum, maximum, standard deviation, Sen Slope trend, normality determination, and percent non-detects for the background dataset. The statistical analysis procedure inputs and results are provided in Table E-3.

Calculated background values (upper and lower limits) for the tested inorganic constituents and pH are listed in Appendix E, Table E-1 along with the percent non-detects, normal or lognormal distribution, test method, and confidence level. The calculated background values are also shown on Table 1 and are compared to the groundwater quality standards for Class II: General Resource Groundwater. The higher of the two values is shown as the Applicable Groundwater Standard on Table 1 (see additional discussion provided in Section 5.2).

4 GROUNDWATER MONITORING SYSTEM

A groundwater monitoring system is proposed for the Baldwin Fly Ash Pond System to monitor groundwater, evaluate post-closure groundwater quality and trends, and to demonstrate compliance with the applicable groundwater quality standards identified in Section 5. The proposed groundwater monitoring well networks consist of a sufficient number of wells, installed at appropriate locations and depths to monitor post-closure compliance with groundwater quality standards for Class II: General Resource Groundwater.

The groundwater monitoring program is consistent with the requirements of 35 IAC Part 620 and 40 CFR Part 257 and includes two monitoring well networks. As discussed in Section 2.2, groundwater within the glacial deposits and uppermost bedrock will continue to be monitored to comply with 35 IAC Part 620 and BEC's existing NPDES permit. The second monitoring well network will monitor groundwater within bedrock, which is the only viable aquifer in the vicinity of the ash impoundments and is being designated the uppermost aquifer.

The monitoring wells are designed and constructed in accordance with applicable standards, including the following:

- All monitoring wells are cased in a manner that maintains the integrity of the boreholes
- Wells are screened to allow sampling only at the specified interval
- All wells are covered with vented caps, unless located in flood-prone areas, and equipped with devices to protect against tampering and damage

Both monitoring well networks described below fulfill the following goals:

- Enable the collection of groundwater samples that represent the quality of background water that has not been affected by the Baldwin Fly Ash Pond System
- Enable the collection of groundwater samples that represent the quality of downgradient groundwater
- Include wells that are located within the stratigraphic unit(s) that may serve as potential chemical migration pathways

4.1 Proposed Modified NPDES Monitoring Well Network

The proposed modified NPDES monitoring well network includes 17 monitoring wells. Thirteen wells will be sampled and analyzed for laboratory and field parameters which are equivalent to the current NPDES Permit parameters. These wells include MW-104SR, MW-104DR, MW-150, MW-350, MW-151, MW-152, MW-252, MW-352, MW-153, MW-253, MW-154, MW-155, and MW-355. Eleven of these wells are screened in the unlithified materials and three wells are screened in the bedrock. Two background bedrock monitoring wells (MW-304, MW-306) will also be sampled and analyzed for an expanded laboratory parameter list and field parameters, as described in Section 6.1.1.

The above monitoring wells are supplemented by 2 locations (MW-156, and MW-157S) that will monitor specific conductance, temperature and groundwater elevations only.

The proposed modified NPDES monitoring well network goes beyond Special Condition 17 of the existing NPDES permit for the Baldwin groundwater sampling program with the addition of wells MW-151, MW-304 and MW-306 in the groundwater monitoring system,

Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix C. The proposed modified NPDES monitoring well network locations are shown on Figure 8. The well depths, well screen intervals, depth to groundwater elevations and monitored units at the proposed monitoring well network locations are summarized below:

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-104SR	15	5 - 15	10.5	Upgradient Shallow Unlithified	Clay
MW-104DR	35	23 - 28	10.6	Upgradient Deep Unlithified	Clay; Poorly Graded Sand
MW-304	135	45-55	10.6	Upgradient Bedrock	Limestone
MW-306	86	71-86	NM	Upgradient Bedrock	Limestone
MW-150	25	15 - 25	16.6	Downgradient Shallow Unlithified	Clay
MW-350	47	42 - 47	19.5	Downgradient Bedrock	Limestone
MW-151	16	6 - 16	NM	Downgradient Shallow Unlithified	Clay
MW-152	18	7 - 17	3.5	Downgradient Shallow Unlithified	Clay; Poorly Graded Sand
MW-252	50	44 - 49	2.7+	Downgradient Deep Unlithified	Clay
MW-352	74	68 - 73	3.7	Downgradient Bedrock	Shale and Limestone
MW-153	21	10 - 20	11.6	Downgradient Shallow Unlithified	Clay

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-253	35	30 - 35	9.8	Downgradient Deep Unlithified	Clay
MW-154	13	7 - 12	10.7	Downgradient Shallow Unlithified	Clay
MW-155	21	10 - 20	17.7	Downgradient Shallow Unlithified	Clay; Clayey Sand
MW-355	33	27 - 32	20.9	Downgradient Bedrock	Limestone
MW-156*	18	8 - 18	4.6	Downgradient Shallow Unlithified	Clay
MW-157S*	18	8 - 18	3.2	Downgradient Shallow Unlithified	Clay

+ indicates groundwater elevation above ground surface
Groundwater depth elevations shown are from November 10, 2015; NM indicates groundwater elevation was not measured.
* MW-156 also known as OW-156, MW-157S also known as OW-157; monitored for specific conductance, temperature and groundwater elevations only

4.2 40 CFR Part 257 Monitoring Well Network

The 40 CFR Part 257 well network consists of 7 monitoring wells installed in bedrock adjacent to the Baldwin Fly Ash Pond System (MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, MW-391) and 2 background monitoring wells (MW-304, MW-306). The bedrock wells monitor the uppermost aquifer. Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix C5. Sampling of these wells commenced in January 2016, with the exception of MW-306, MW-390 and MW-391 (expected to commence in March 2016). The 40 CFR Part 257 groundwater monitoring network well locations are shown on Figure 8.

The well depths, well screen intervals, depth to groundwater and monitored units at the 40 CFR Part 257 monitoring well network locations are summarized below:

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-304	135	45 - 55	8.0	Upgradient Bedrock	Shale and Limestone
MW-306	86	71-86	10.6	Upgradient Bedrock	Shale and Limestone
MW-366	52	42-52	10.5	Downgradient Bedrock	Shale and Limestone

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-375	67	57-67	29.0	Downgradient Bedrock	Shale and Limestone
MW-377	56	46-56	0.3	Downgradient Bedrock	Shale and Limestone
MW-383	73	58 - 68	17.0	Downgradient Bedrock	Shale and Limestone
MW-384	94	61 - 71	6.9	Downgradient Bedrock	Shale and Limestone
MW-390	65	50 - 65	NM	Downgradient Bedrock	Shale and Limestone
MW-391	70	55 - 70	NM	Downgradient Bedrock	Shale and Limestone

Groundwater depth elevations shown are from March 2, 2016
NM indicates groundwater elevation was not measured.
Groundwater elevations may have not yet fully stabilized.

4.3 Abandoned Wells

Three piezometers (TPZ-163, TP-167 and TPZ-168) are located within the Baldwin Fly Ash Pond System. These former leachate monitoring wells will be properly abandoned prior to their being damaged or destroyed during the impoundment closure activities. Leachate data collected from these piezometers are provided in Appendix D for a limited set of parameters.

Two bedrock monitoring wells (MW-385 and MW-386) are located within the Baldwin Fly Ash Pond System along the berm separating the East and West Fly Ash Ponds. These monitoring wells will also be properly abandoned prior to their being damaged/destroyed during the impoundment closure activities.

Monitoring well MW-387 is located on the West Fly Ash Pond berm and does not provide sufficient water depth for sampling. This bedrock monitoring well will be properly abandoned and will be replaced with a new well, MW-391.

The locations of monitoring wells to be abandoned are shown on Figure 3.

5 APPLICABLE GROUNDWATER QUALITY STANDARDS

5.1 Groundwater Classification

The classification of groundwater at the Baldwin Fly Ash Pond System was addressed in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). Field hydraulic conductivity tests performed on the unlithified geologic materials (i.e., Cahokia Alluvium, Equality Formation, and Vandalia Till Member) and Mississippian and Pennsylvanian bedrock at the Site had geometric mean hydraulic conductivities of approximately $3x10^{-5}$ cm/s and $5x10^{-6}$ cm/s, respectively.

Geologic material with a hydraulic conductivity of less than $1x10^{-4}$ cm/s which does not meet the provisions of Section 620.210 (Class I), Section 620.230 (Class III), or Section 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater. Based on the detailed geologic information provided for the unlithified materials and bedrock at BEC, along with the hydrogeologic data, the groundwater in both the unlithified deposits and underlying bedrock at the Site can be classified as Class II - General Resource Groundwater.

5.2 Applicable Groundwater Quality Standards

The groundwater quality standard for the proposed modified NPDES monitoring well network for wells screened in unlithified materials is the greater of either the background concentration or the groundwater quality standard for Class II General Resource Groundwater [35 IAC 620.420]. Based on the statistical evaluation of background groundwater data (Table 1), most background concentrations in the unlithified materials are below the groundwater quality standard for Class II General Resource Groundwater. Therefore, for these parameters, the groundwater quality standard for Class II General Resource Groundwater will apply to the proposed modified NPDES monitoring well network for wells screened within unlithified material. The exceptions include total iron, dissolved iron, dissolved manganese and pH (lower limit), where the background concentration is higher (or lower for pH lower limit) than the Class II standard. Therefore, for these parameters, the background concentration is the applicable groundwater standard.

Background groundwater quality in bedrock will be established through statistical evaluation following completion of 8 quarters of groundwater sampling of background wells MW-304 and MW-306 that commenced in January 2016. The groundwater quality standard for the proposed modified NPDES monitoring well network (bedrock wells) at the Baldwin Fly Ash Pond System will be the greater of either the background concentration or the groundwater quality standard for Class II General Resource

Groundwater. The list of applicable groundwater quality standards for the modified NPDES monitoring well network is shown on Table 1.

The groundwater quality standards (i.e., Groundwater Protection Standard) for the 40 CFR Part 257 well network will be established in accordance with the methods outlined in 40 CFR Part 257 following the collection of 8 independent samples from each of the upgradient and downgradient monitoring wells, with completion of the final sample event required by October 17, 2017.

5.3 Proposed Exceptions to the Groundwater Monitoring Parameters

Based on the results of groundwater monitoring performed at the site to date for the proposed modified NPDES monitoring well network, the following exceptions to the above applicable Class II: General Resource Groundwater standards are proposed:

- Analytical results (Appendix D) do not indicate exceedances of the groundwater quality standards for Class II General Resource Groundwater inorganic constituents listed in 35 IAC 620.420(a)(1). The analyzed constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, cyanide, fluoride, lead, mercury, nitrate, and thallium.[1] With the exception of nitrate, these constituents will not be monitored because they are well below the standards for Class II General Resource Groundwater and are not prevalent in groundwater associated with the Baldwin Fly Ash Pond System.
- Analytical results (Appendix D) do not indicate exceedances of the groundwater quality standards for Class II General Resource Groundwater for inorganic constituents copper, nickel, selenium, silver, and zinc listed in 35 IAC 620.420(a)(2). These constituents will not be monitored because they are well below the standards for Class II General Resource Groundwater and are not prevalent in groundwater associated with the Baldwin Fly Ash Pond System.
- Perchlorate is commonly used as an oxidizer in solid propellants, munitions, fireworks, airbag initiators for vehicles, matches and signal flares. It is also used in some electroplating operations and found in some disinfectants and herbicides (USEPA, 2014). Perchlorate is an inorganic constituent listed in 35 IAC 620.420(a)(1) but has not been previously analyzed. Perchlorate will not be monitored because it is not associated with the chemical characteristics of the Baldwin Fly Ash Pond System.

The proposed groundwater monitoring parameters for the proposed modified NPDES monitoring well network and 40 CFR Part 257 groundwater monitoring well network are discussed in Section 6.1.

[1] Perchlorate, vanadium and Ra-226/Ra-228 are parameters listed in 35 IAC 620.420(a)(1) but have not been analyzed.

6 GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards for Class II: General Resource Groundwater as well as USEPA parameters, as appropriate. As discussed in Section 4, the proposed post-closure groundwater sampling network consists of four background monitoring wells and 20 compliance monitoring wells as shown on Figure 8.

6.1 Monitoring Parameters

6.1.1 Proposed Modified NPDES Monitoring Well Network

The proposed modified NPDES monitoring well network includes 17 monitoring wells. Thirteen wells will continue to be sampled and analyzed for the laboratory and field parameters listed below which are equivalent to the current NPDES Permit parameters. These wells include MW-104SR, MW-104DR, MW-150, MW-350, MW-151, MW-152, MW-252, MW-352, MW-153, MW-253, MW-154, MW-155, and MW-355.

Laboratory Parameters		
Boron (dissolved)	Manganese (total)	Sulfate (dissolved)
Chloride (dissolved)	Nitrate (total)	Total Dissolved Solids (TDS)
Iron (total)		

Field Parameters	
pH	Depth of Well (ft bgs)
Specific Conductance	Elevation of measuring point (mp)
Temperature	Depth to Water (ft below mp)
	Groundwater Elevation (ft)

As discussed in Section 5, other constituents listed under 35 IAC 620 will not be monitored at the proposed modified NPDES monitoring well network because the groundwater monitoring results to date indicate that the inorganic constituents antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, cyanide, fluoride, lead, mercury, nickel, selenium, silver, thallium and zinc meet the Class II: General Resource Groundwater standards and are not associated with the chemical characteristics of the Baldwin Fly Ash Pond System.

Two monitoring wells, MW-156 and MW-157S, are monitored for specific conductance, temperature and groundwater elevation.

Two proposed background bedrock monitoring wells (MW-304, MW-306) will be sampled and analyzed for the following laboratory and field parameters:

Laboratory Parameters		
Boron (dissolved)	Manganese (total)	Sulfate (dissolved)
Chloride (dissolved)	Nitrate (total)	Total Dissolved Solids (TDS)
Iron (total)		
Field Parameters		
pH	Depth of Well (ft bgs)	
Specific Conductance	Elevation of measuring point (mp)	
Temperature	Depth to Water (ft below mp)	
	Groundwater Elevation (ft)	

As discussed in Section 5, perchlorate will not be monitored because this parameter is not associated with the chemical characteristics of the Baldwin Fly Ash Pond System.

6.1.2 40 CFR Part 257 Monitoring Well Network

The 40 CFR Part 257 well network consists of 7 monitoring wells installed in bedrock adjacent to the Baldwin Fly Ash Pond System (MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, MW-391) and 2 background monitoring wells (MW-304, MW-306). Groundwater samples will be collected and analyzed for the following laboratory and field parameters:

Laboratory Parameters		
Metals (totals)		
Antimony	Cadmium	Lithium
Arsenic	Calcium	Mercury
Barium	Chromium	Molybdenum
Beryllium	Cobalt	Selenium
Boron	Lead	Thallium
Inorganics (totals)		
Fluoride	Sulfate	
Chloride	Total Dissolved Solids	
Other (total)		
Radium 226 and 228 combined		
Field Parameters		
pH	Temperature	
Oxidation/Reduction Potential	Specific Conductivity	
Dissolved Oxygen	Turbidity	

All parameters listed above will be sampled a minimum of eight times by October 17, 2017 to establish background groundwater quality. Following the initial eight rounds of sampling, the parameters to be monitored will be in accordance with the requirements of 40 CFR Part 257.94 and 257.95.

6.2 Sampling Schedule

Groundwater sampling for the proposed modified NPDES monitoring well network will initially be performed quarterly according to the following schedule:

Frequency	Duration
Quarterly	Begins: upon approval of this plan.
	Ends: 5 years after completion of cap and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to the Baldwin Fly Ash Pond System.
Semiannual	Begins: after IEPA approves that quarterly monitoring requirements have been satisfied.
	Ends: 5 years after initiation of semiannual monitoring and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to the Baldwin Fly Ash Pond System.
Annual	Begins: after IEPA approves that semiannual monitoring requirements have been satisfied.
	Ends: upon IEPA approval of a certified post-closure care report.

Five years after approval of the Closure Plan, a request may be made to modify the post-closure care plan to reduce the frequency of groundwater monitoring to semi-annual sampling by demonstrating all of the following:

- Monitoring effectiveness will not be compromised by the reduced frequency of monitoring
- Sufficient data has been collected to characterize groundwater
- Concentrations of constituents monitored at the downgradient boundaries show no statistically significant increasing trends that can be attributed to the former ash ponds

If concentrations of parameters of concern at the downgradient boundaries of the site show no statistically significant increasing trends that can be attributed to the Baldwin Fly Ash Pond System for the five years after reducing the monitoring frequency to semi-annual, a request may be made to modify the post-closure care plan to reduce monitoring frequency to annual sampling by demonstrating the same items above as for the reduction to semi-annual monitoring.

Groundwater monitoring may be discontinued upon Illinois EPA's approval of a certified post-closure care report. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95.

6.3 Groundwater Sample Collection

Groundwater samples will be collected consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 as described in Appendix F. In addition to groundwater well samples, quality assurance samples will be collected as described in Section 6.5.

6.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 by a state-certified laboratory using methods approved by Illinois EPA and USEPA. The practical quantitation limit (PQL) for all parameters analyzed will be lower than the applicable groundwater quality standard. Concentrations lower than the PQL will be reported as less than the PQL.

6.5 Quality Assurance Program

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93, the sampling and analysis program includes procedures and techniques for quality assurance and quality control. Additional quality assurance samples to be collected will include the following:

- Two blind duplicate groundwater samples from randomly selected monitoring wells
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, than equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected

- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

6.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.91, maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event. Monitoring well inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks that wells are clear of internal obstructions, and flow freely

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

6.7 Annual Statistical Analysis

6.7.1 Proposed Modified NPDES Monitoring Well Network

Trend analysis will be performed annually for each of the monitored parameters. Sen's Estimate of Slope will be applied to a minimum of four consecutive quarterly monitoring results. If there are increasing trends during closure and post-closure care periods, they will be further investigated as described below.

- If the results of sampling and analysis show an increasing trend at any compliance monitoring well, a Mann-Kendall analysis will be performed at 95 percent confidence to determine whether or not the increasing trend is statistically significant.
- If a statistically significant increasing trend occurs during post-closure care, further investigation of monitored concentrations will be performed as well as more frequent inspections of the surface of the cover system.

- If the investigation attributes a statistically significant increasing trend to a source other than the Baldwin Fly Ash Pond System, then the Illinois EPA will be notified in writing, stating the cause of the increasing trend and providing the rationale used in such a determination.
- If there is not an alternative source causing the statistically significant increasing concentration and the sampling frequency had been reduced to semi-annual or annual sampling, a quarterly sampling schedule will be reestablished. The frequency of sampling will return to either semi-annual or annual, once four consecutive quarterly samples show no statistically significant increasing trend.

Notifications concerning statistically significant increasing trends and revisions of the sampling frequency will be reported to Illinois EPA in writing within 30 days after making the determinations.

6.7.2 40 CFR Part 257 Monitoring Well Network

As required in 40 CFR Part 257.93, statistical analysis will be performed to determine whether or not a statistically significant increase over a background value has occurred for each constituent and at each well. Appropriate statistical methods will be chosen from the list of methods provided and the test chosen will be conducted separately for each constituent in each monitoring well. In addition, each statistical method chosen will comply with the performance standards, as appropriate, based on the test method used. If a statistically significant increase over background values is determined, procedures from 40 CFR Part 257 will be followed including 1) establishing an assessment monitoring program or 2) demonstrating that a source other than the Baldwin Fly Ash Pond System caused the increase or demonstrating another plausible reason for the increase (error in sampling, etc.).

6.8 Data Reporting

Sampling and analysis data from quarterly, semi-annual and/or annual groundwater monitoring for the modified NPDES monitoring well network will be reported to Illinois EPA within 60 days after completion of sampling. Statistical analysis of the laboratory analytical data will be reported to Illinois EPA with the annual report for the facility, as described in the closure plan.

Data reporting for the 40 CFR Part 257 monitoring well network will be consistent with recordkeeping, notification, and internet posting requirements described in 40 CFR 257.105 through 257.107.

6.9 Compliance with Applicable On-Site Groundwater Quality Standards

Compliance with on-site groundwater quality standards, as measured at the modified NPDES monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary for four (4) consecutive years following the change to an annual monitoring frequency.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.

6.10 Corrective Action

If a statistically significant increasing trend is observed to continue over a period of two or more years in groundwater sampled at the modified NPDES monitoring well network, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Baldwin Fly Ash Pond System and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan. A corrective action plan will be submitted to Illinois EPA within 180 days after completion of the investigation activities. The plan will propose corrective actions to be undertaken to mitigate the impacts associated with the constituents of concern which exceed applicable groundwater standards.

7 REFERENCES

AECOM, December 17, 2015. 30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.

Dynegy, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System

Kelron Environmental and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System

Kelron Environmental and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System

Kelron Environmental, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex

Kelron Environmental, June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System

NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System

NRT, June 18, 2014. Groundwater Model and Simulation of Closure Alternatives, Baldwin Ash Pond System

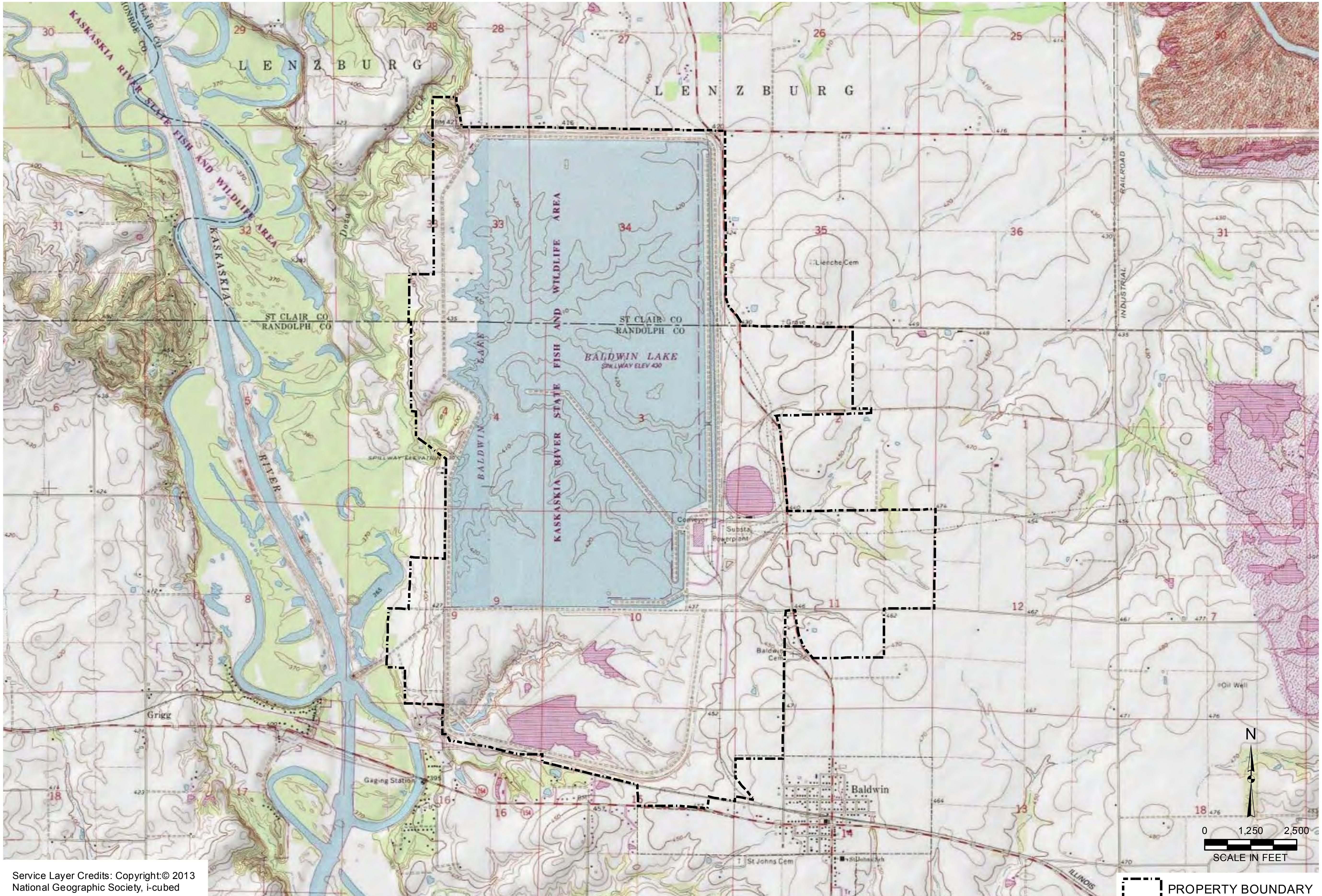
NRT, September 30, 2014. Groundwater Model and Simulation of Closure Alternatives, Model Report Addendum Baldwin Ash Pond System

USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09/007, U.S. Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, D.C., 554 p. + 4 app.

USEPA, January 2014. Technical Fact Sheet – Perchlorate

USEPA, April 17, 2015. 40 CFR Parts 257and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule

FIGURES



Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 1_Site Location Map.mxd Author: tcushman; Date/Time: 3/2/2016, 2:03:31 PM

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

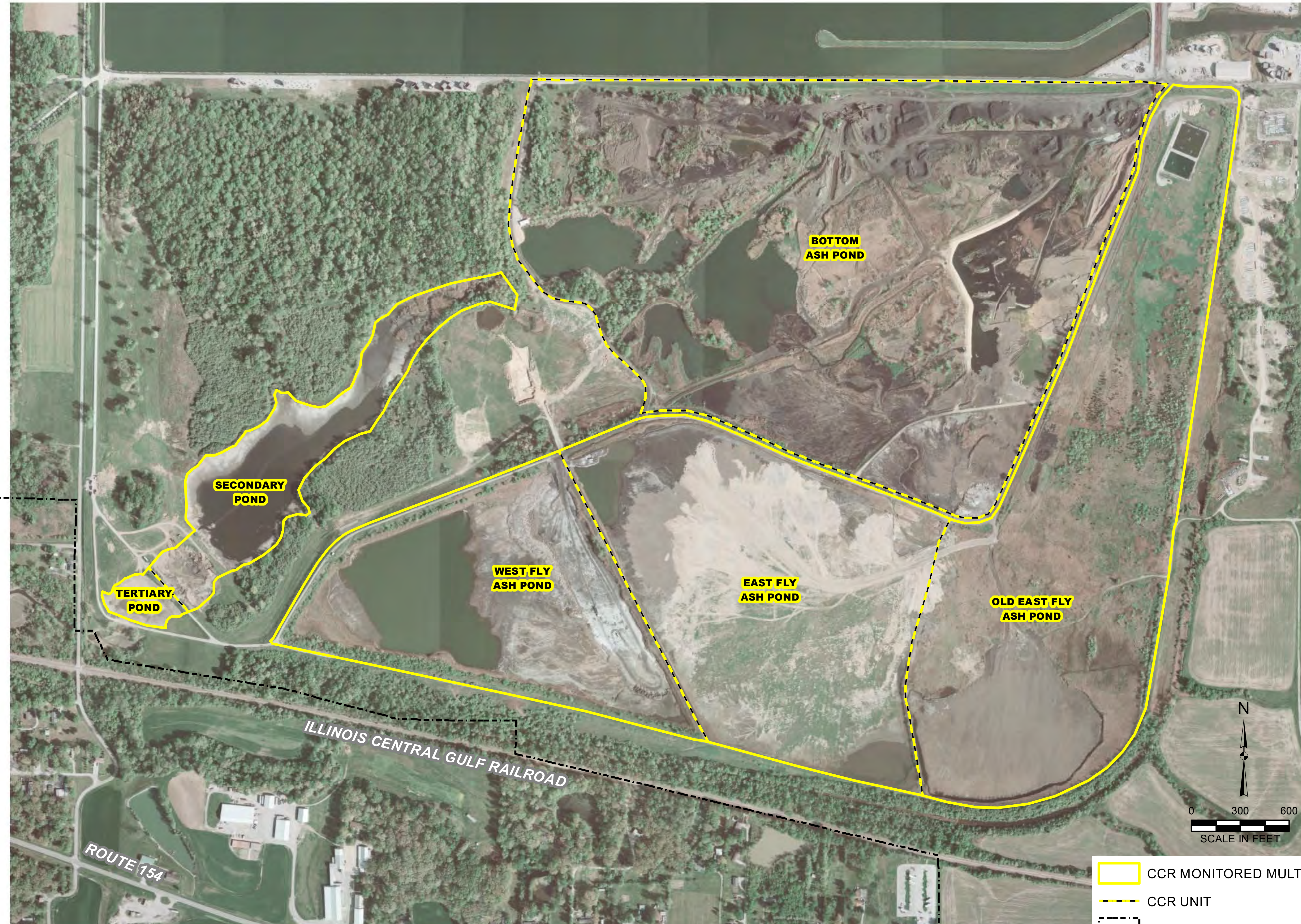
SITE LOCATION MAP

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



AERIAL PHOTO SOURCE: HENDERSON AERIAL SURVEYS (4/2/2012).

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

AERIAL PHOTOGRAPH OF SITE AND ASH POND SYSTEM

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 2

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 2_Aerial Photograph of Ash Pond System.mxd Author: tcushman; Date/Time: 3/2/2016, 2:03:10 PM

- 2015-2016 BEDROCK MONITORING WELL LOCATIONS
- ABANDONED BEDROCK MONITORING WELL LOCATION
- 2015 UNLITHIFIED MATERIAL PIEZOMETER LOCATIONS
- MONITORING WELL LOCATION
- CCR MONITORED MULTI-UNIT
- CCR UNIT

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

MONITORING WELL LOCATION MAP

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 3

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 3_Monitoring Well Location Map.mxd Author: tcushman; Date/Time: 3/7/2016, 9:31:47 AM

BORING LOCATION WITH OBSERVED SAND SEAM > 0.5 FT

BORING LOCATION WITH OBSERVED SAND SEAM =< 0.5 FT

BORING LOCATION WITH NO OBSERVED SAND SEAM

CCR MONITORED MULTI-UNIT

CCR UNIT

BORING/WELL NUMBER
SEAM DESCRIPTION, SEAM THICKNESS (FT), SEAM BASE ELEVATION

AREAS OF POTENTIALLY INTERCONNECTED SAND SEAMS AND SEAM ELEVATION INTERVAL

UNSATURATED SAND SEAM

SATURATED SAND SEAM

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

SAND SEAM OBSERVATIONS, THICKNESS AND ELEVATIONS

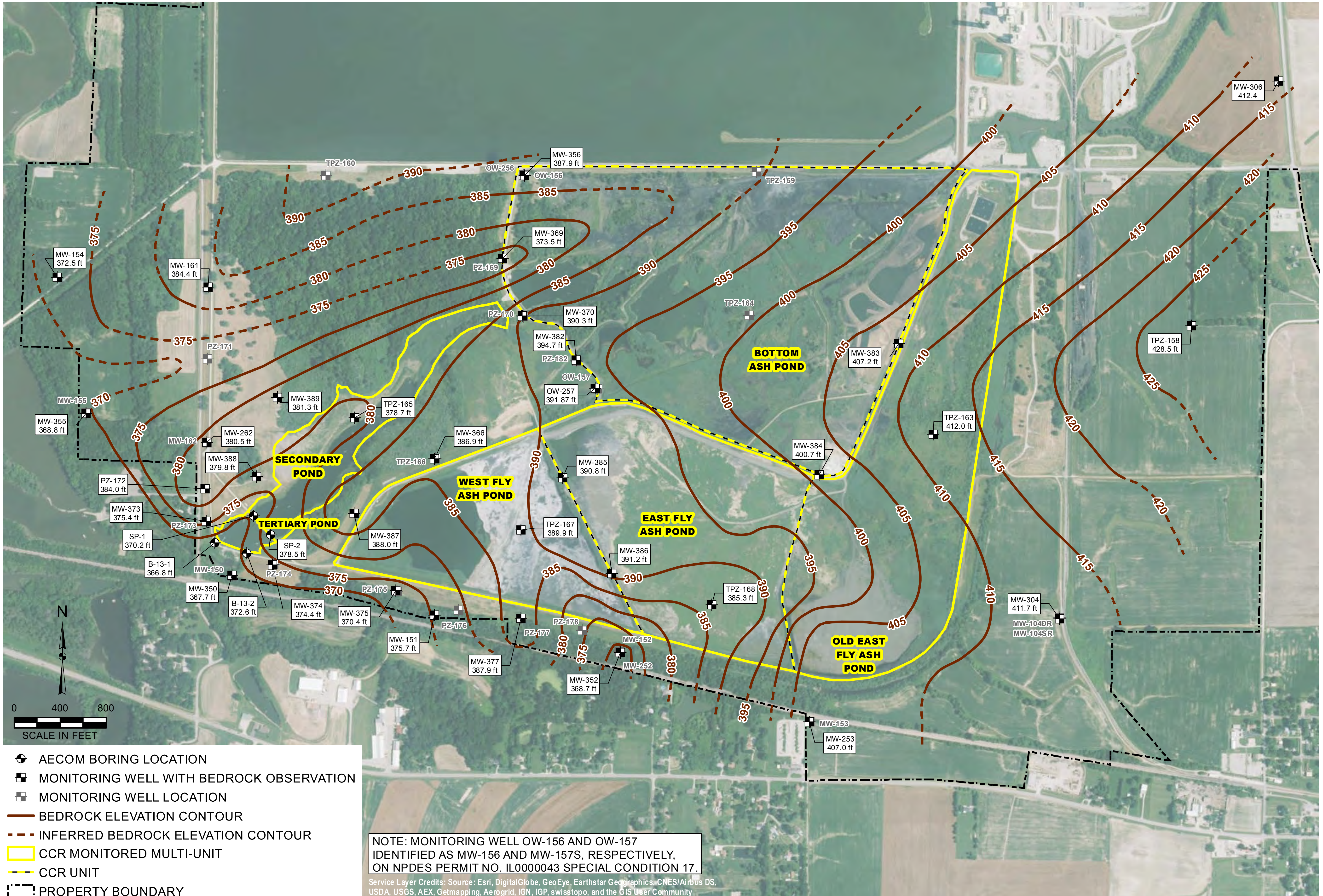
SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 4

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 4_Sand Seam Observations Thickness and Elevations.mxd Author: tcushman; Date/Time: 3/2/2016, 2:02:06 PM



Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 5_Bedrock Topography.mxd Author: tcushman; Date/Time: 3/2/2016, 2:01:23 PM

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: JJW 2/26/16
APPROVED BY/DATE: SJC 3/2/16

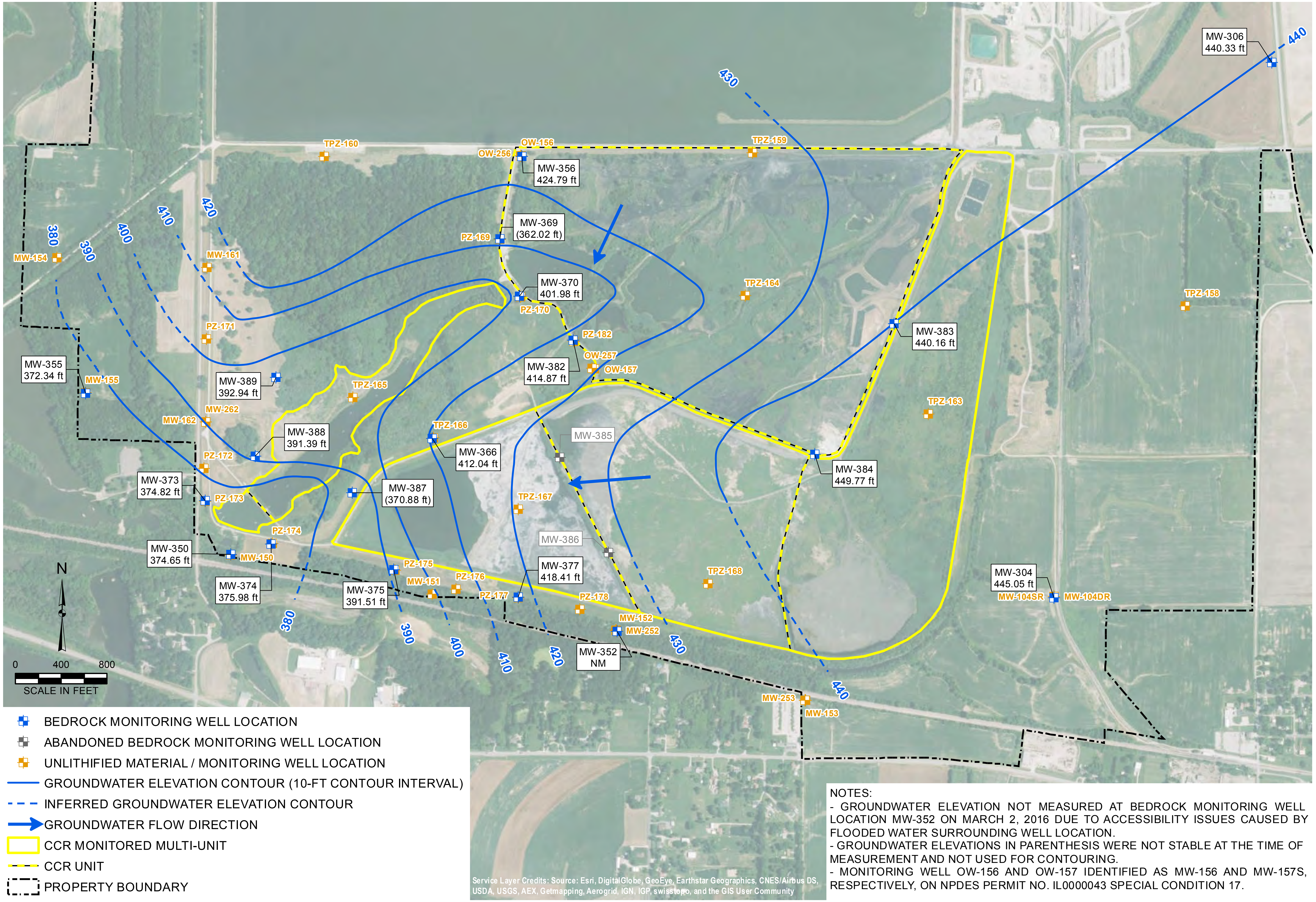
BEDROCK TOPOGRAPHY

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 5

NATURAL RESOURCE TECHNOLOGY



- BEDROCK MONITORING WELL LOCATION
- ABANDONED BEDROCK MONITORING WELL LOCATION
- UNLITHIFIED MATERIAL / MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED MULTI-UNIT
- CCR UNIT
- PROPERTY BOUNDARY

NOTES:

- GROUNDWATER ELEVATION NOT MEASURED AT BEDROCK MONITORING WELL LOCATION MW-352 ON MARCH 2, 2016 DUE TO ACCESSIBILITY ISSUES CAUSED BY FLOODED WATER SURROUNDING WELL LOCATION.
- GROUNDWATER ELEVATIONS IN PARENTHESIS WERE NOT STABLE AT THE TIME OF MEASUREMENT AND NOT USED FOR CONTOURING.
- MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

DRAWN BY/DATE: TDC 3/7/16
REVIEWED BY/DATE: JJW 3/7/16
APPROVED BY/DATE: SJC 3/7/16

POTENTIOMETRIC SURFACE IN BEDROCK CONTOUR MAP
MARCH 2, 2016

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

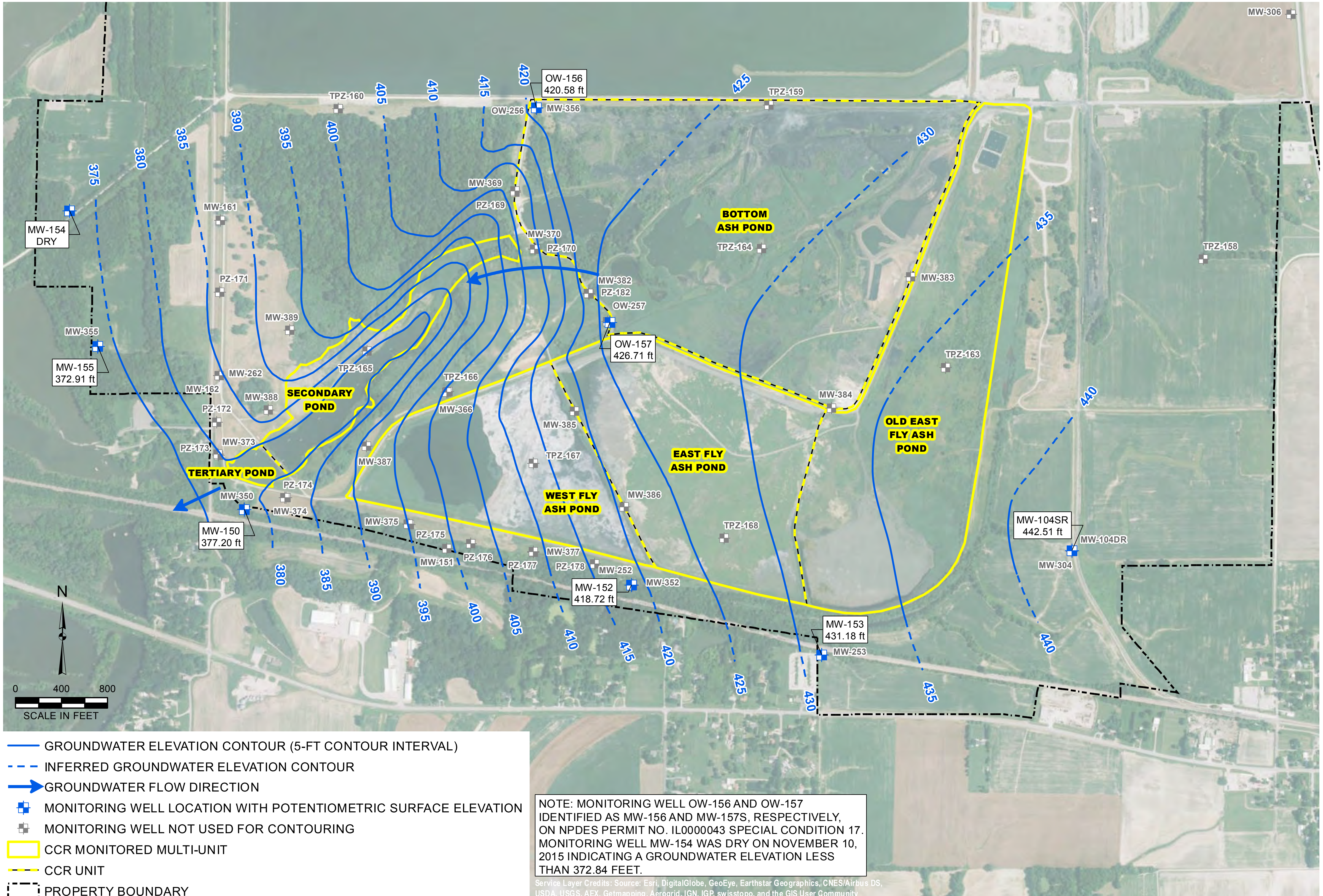
FIGURE NO: 6

NATURAL RESOURCE TECHNOLOGY

POTENTIOMETRIC SURFACE IN UNLITHIFIED DEPOSITS CONTOUR MAP
NOVEMBER 10, 2015

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16



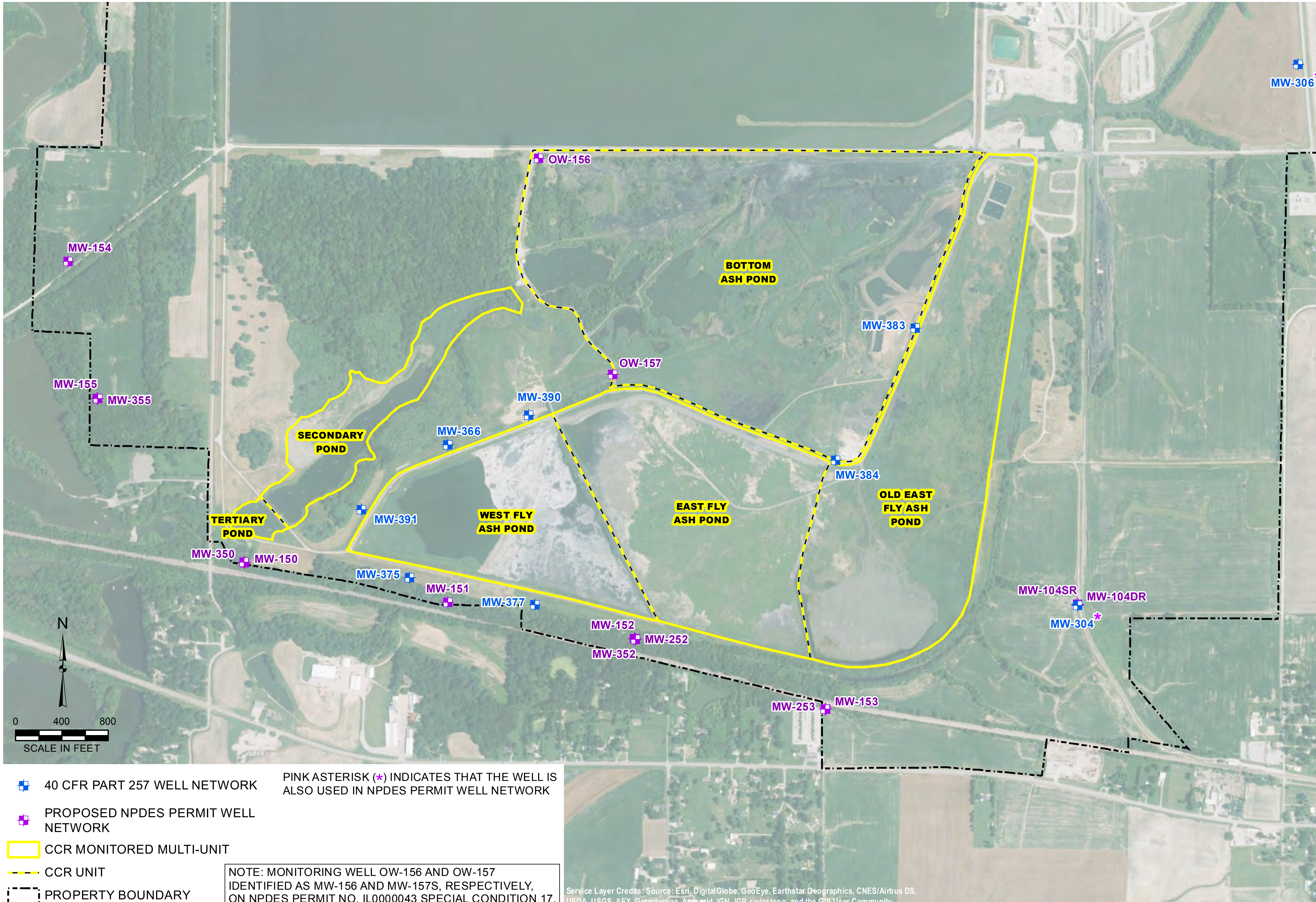
GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
MONITORING WELL LOCATION WITH POTENTIOMETRIC SURFACE ELEVATION
MONITORING WELL NOT USED FOR CONTOURING
CCR MONITORED MULTI-UNIT
CCR UNIT
PROPERTY BOUNDARY

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17. MONITORING WELL MW-154 WAS DRY ON NOVEMBER 10, 2015 INDICATING A GROUNDWATER ELEVATION LESS THAN 372.84 FEET.

PROJECT NO: 2340

FIGURE NO: 7

NATURAL RESOURCE TECHNOLOGY



40 CFR PART 257 WELL NETWORK

PROPOSED NPDES PERMIT WELL NETWORK

CCR MONITORED MULTI-UNIT

CCR UNIT

PROPERTY BOUNDARY

PINK ASTERISK (*) INDICATES THAT THE WELL IS ALSO USED IN NPDES PERMIT WELL NETWORK

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 8_Groundwater Monitoring Network Wells.mxd Author: tcushman; Date/Time: 3/7/2016, 9:49:28 AM

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

GROUNDWATER MONITORING NETWORK WELLS

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 8

NATURAL RESOURCE TECHNOLOGY

TABLES

Table 1
Background Groundwater Quality and Applicable Groundwater Quality Standards
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

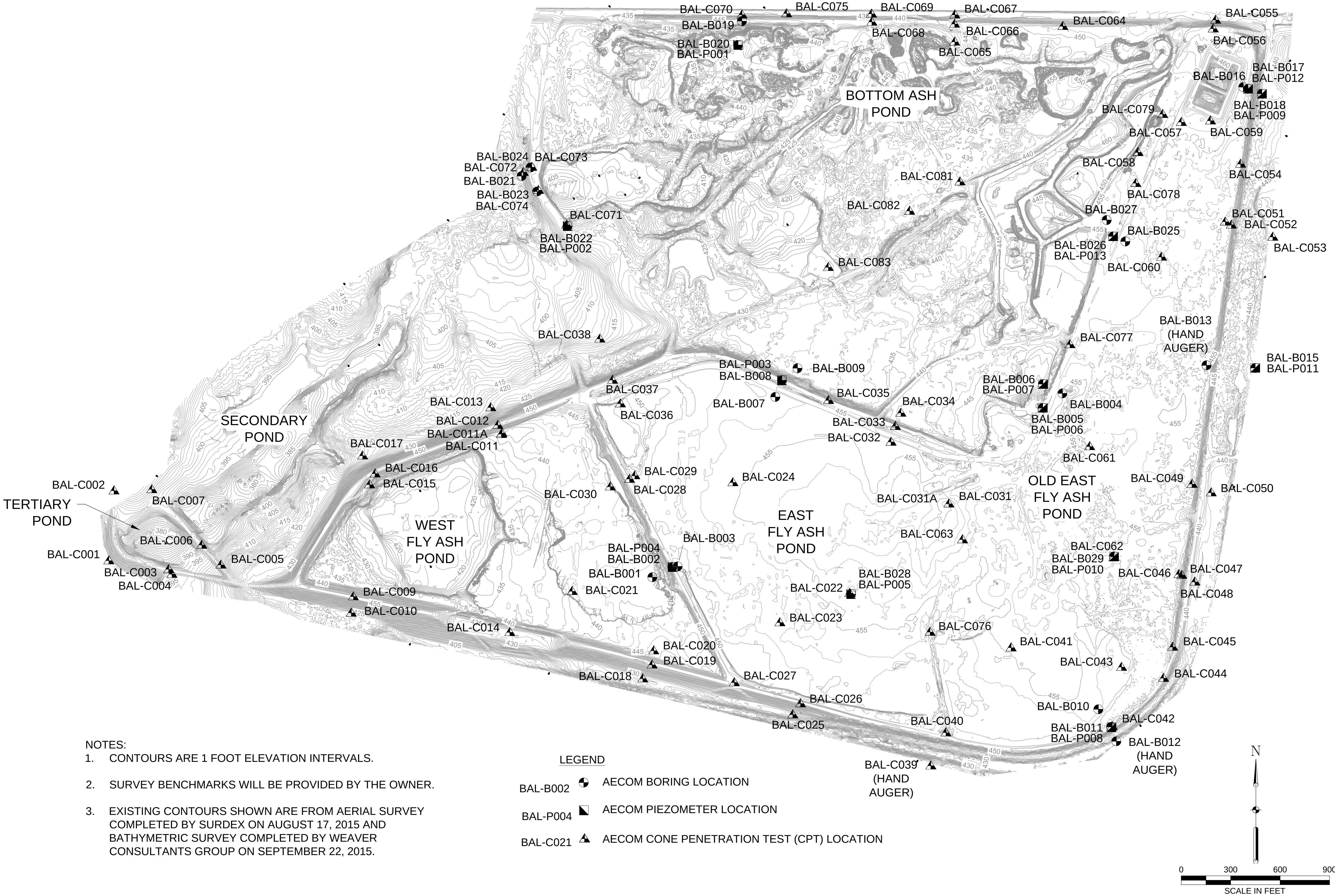
		Unlithified[4]				Bedrock[5]			
Parameter	**IL Class II Std[1] (mg/L)**	**Background Concentration[2] (mg/L)**	**Applicable Groundwater Standard[3] (mg/L)**	**Maximum (mg/L)**	**Minimum (mg/L)**	**Background Concentration (mg/L)**	**Applicable Groundwater Standard (mg/L)**	**Maximum (mg/L)**	**Minimum (mg/L)**
Antimony	0.024	0.005	0.024	<0.005	<0.005	USEPA (t)	na	0.0075	<0.005
Arsenic	0.2	0.032	0.2	0.032	<0.005	USEPA (t)	na	0.011	<0.005
Barium	2.0	0.621	2.0	0.24	0.0094	USEPA (t)	na	1.6	0.098
Beryllium	0.5	0.004	0.5	<0.005	<0.004	USEPA (t)	na	<0.005	<0.004
Boron (t)	2.0	na	na	--	--	USEPA (t)	na	--	--
Boron (d)	2.0	0.237	2.0	45.3	<0.02	**tbd**	**tbd[3]**	1.88	<0.02
Calcium	NS	na	NS	289	54.17	USEPA (t)	na	533	45
Cadmium	0.05	0.002	0.05	<0.002	<0.002	USEPA (t)	na	<0.002	<0.002
Chloride (t)	200	na	na	--	--	USEPA (t)	na	--	--
Chloride (d)	200	58.7	200	140	4.1	**tbd**	**tbd[3]**	642	9
Chromium	1.0	0.005	1.0	<0.005	<0.005	USEPA (t)	na	<0.005	<0.005
Cobalt	1.0	0.005	1.0	0.01	<0.005	USEPA (t)	na	<0.005	<0.005
Copper	0.65	0.005	0.65	0.016	<0.005	na	na	<0.005	<0.005
Cyanide (t)	0.6	0.008	0.6	<0.008	<0.007	na	na	<0.008	<0.007
Fluoride	4.0	0.793	4.0	0.865	0.119	USEPA (t)	na	0.756	0.174
Iron (t)	5.0	**11**	11	69.4	<0.02	**tbd**	**tbd[3]**	3.82	0.02
Iron (d)	5.0	**18**	18	18	<0.01	na	na	1.6	0.011
Lead	0.1	0.005	0.1	0.005	<0.005	USEPA (t)	na	<0.005	<0.005
Lithium	NS	na	na	--	--	USEPA (t)	na	--	--
Manganese (t)	10	8.2	10	24.4	<0.003	**tbd**	**tbd[3]**	0.58	<0.003
Manganese (d)	10	**48.8**	48.8	6.8	<0.003	na	na	0.87	<0.003
Mercury	0.01	0.002	0.01	<0.002	<0.002	USEPA (t)	na	<0.002	<0.002
Molybdenum	NS	na	NS	--	--	USEPA (t)	na	--	--
Nickel	2.0	0.005	2.0	<0.005	<0.005	na	na	0.007	<0.005
Nitrate (as N) (t)	100	2.26	100	10.7	<0.05	**tbd**	**tbd[3]**	1.13	0.103
Nitrate (as N) (d)	100	2.25	100	18	<0.05	na	na	2.04	0.06
Selenium	0.05	0.01	0.05	0.016	<0.01	USEPA (t)	na	<0.01	<0.01
Silver	0.05	0.005	0.05	0.006	<0.005	na	na	0.01	<0.005
Sulfate (t)	400	na	na	--	--	USEPA (t)	na	--	--
Sulfate (d)	400	328	400	2050	23	**tbd**	**tbd[3]**	65	<10
Thallium	0.02	0.002	0.02	<0.002	<0.002	USEPA (t)	na	<0.002	<0.002
Vanadium	0.1	na	0.1	--	--	na	na	--	--
Zinc	10	0.009	10	0.014	<0.005	na	na	0.006	<0.005
TDS	1,200	999	1,200	3470	188	**tbd** / USEPA	**tbd[3]**	1709	375
Field pH	6.5 - 9.0	**6.06** - 7.55	6.06 - 9.0	12.4	5.6	**tbd** / USEPA	**tbd[3]**	12.9	6.5
Radium 226/228*	5.0 / 5.0	na	na	--	--	USEPA (t)	na	- -	- -

[O: JAZ 1/28/16, C:GFF 1/29/16, QA:SJC 3/2/16]

Notes:
All parameters are dissolved unless noted. Standards apply to dissolved or total concentration
(t) Total (d) Dissolved
tbd = To Be Determined for Illinois EPA monitoring program; based on future monitoring beginning January 2016
Bold = Background Concentration exceeds Class II Groundwater Standard
Red = Exceeds Applicable Groundwater Standard
-- = not analyzed prior to 2016
na = not applicable; parameter [dissolved and total] not proposed for Illinois EPA monitoring program under proposed modified NPDES Permi
NS = No Class II Groundwater Standard
USEPA (t) = background concentration for parameter [total] required under USEPA program (40 CFR Part 257
[1] IPCB 620 Class II: General Resource Groundwater Standard
[2] Background Concentration obtained from Appendix E - Statistical Procedure for Calculation of Background (Table E-1 Tolerance Limits for Background Monitoring Wells MW-104S/SR and MW-104D/DR using the Upper and Low
[3] Applicable Groundwater Standard is the higher of the Background Concentration and the Class II Groundwater Standard (or the lower if compared to the pH lower limit).
[4] Unlithified Wells used for maximum and minimum include those designated as upgradient or downgradient in Appendix D.
[5] Bedrock wells used for maximum and minimum include MW-350, MW352, and MW-355 (all downgradient) as listed in Appendix D.
* Radium 226 and 228 reported separately for IPCB Class II Groundwater Standard, reported combined for USEPA 40 CFR Part 257.

APPENDIX A

AECOM (2015) GEOTECHNICAL LABORATORY RESULTS



NOTES:
1. CONTOURS ARE 1 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. EXISTING CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 17, 2015 AND BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 22, 2015.

LEGEND

BAL-B002	AECOM BORING LOCATION
BAL-P004	AECOM PIEZOMETER LOCATION
BAL-C021	AECOM CONE PENETRATION TEST (CPT) LOCATION

AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)

DYNEGY
Dynegy Inc.
1500 EastPort Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

BALDWIN POWER PLANT
BALDWIN, IL

30% DESIGN DRAWINGS FOR CLOSURE OF EAST ASH POND, OLD EAST ASH POND, AND WEST ASH POND

ISSUED FOR BIDDING DATE BY

ISSUED FOR CONSTRUCTION DATE BY

REVISIONS

NO.	DESCRIPTION	DATE

AECOM PROJECT NO:	60440742
DRAWN BY:	DJD
DESIGNED BY:	DJD
CHECKED BY:	SAV
DATE CREATED:	2015-10-13
PLOT DATE:	2015-10-13
SCALE:	1" = 300'
ACAD VER:	2014

SHEET TITLE

EXPLORATION LOCATIONS

D-01

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B001	S-4	7.5-9		66.9				SM	31.5	5										
BAL-B001	S-6	15-18		37.9				CL	93.9	6										
BAL-B001	ST-2	35-37									125.6									
BAL-B001	ST-2	35.35		23.1																
BAL-B001	ST-2A	35.6		23.8	63	15	48	CH			126.6	102.3		1.30E-08						P10576
BAL-B001	ST-2	35.9		23.2																
BAL-B001	ST-2	36.15		22.4				CH			128.4	104.9			UU@6.2	1.6	10.9			UU245g
BAL-B001	S-10	45.0-46.5	Brown silty CLAY, trace gravel	16.6																
BAL-B001	S-11	50.0-51.5	Brown silty, CLAY with gravel	12.4																
BAL-B001	S-14	65.0-66.5	Gray brown silty CLAY with fine gravel	19.0																
BAL-B001	S-16	75.0-75.5	Gray brown silty CLAY with fine gravel	12.5																
BAL-B002	S-1	0.0-1.5	Brown silty CLAY, trace sand and gravel	19.5																
BAL-B002	S-2	2.5-4.0	Brown silty CLAY, trace sand and gravel	16.5																
BAL-B002	S-3	5.0-6.5	Brown silty CLAY, trace sand and gravel	19.1	36	19														
BAL-B002	ST-1	8-10									120.5									
BAL-B002	ST-1A	8.25		19.1				CH	91.8	29										dispersion
BAL-B002	ST-1B	8.8		25.9	54	16	38	CH			120.1	95.4			UU@1.1	1	15			UU257i
BAL-B002	S-4	10.0-11.5	Brown silty CLAY, trace sand and gravel	21.0																
BAL-B002	ST-2	15-17									130.3									
BAL-B002	ST-2A	15.45		21.8	46	14	32	CL			123.3	101.2			UU@1.9	0.7	15			UU257j
BAL-B002	S-5	20.0-21.5	Brown silty CLAY, trace sand and gravel	21.7																
BAL-B002	S-6	25.0-26.5	Brown sandy silty CLAY	40.3																
BAL-B002	ST-3	27.5-30									113.5									
BAL-B002	ST-3A	27.75		34.8				ML			111.5	82.7			CIU@3.4	1.3	16.5			T3850
BAL-B002	ST-3B	28.1		26.4				ML			118.5	93.8						0.69	97	C15141
BAL-B002	ST-3C	28.45		32.1	21	21	NP	ML			114.9	87	2.491		CIU@3.5	2.9	19.6			T3851
BAL-B002	ST-3D	28.9		25.5				ML			122	97.2			CIU@3.6	10.1	24.8			T3852
BAL-B002	S-7	30.0-31.5	Brown sandy silty CLAY with gravel	47.9																
BAL-B002	S-8	35.0-36.5	Brown sandy silty CLAY with gravel	36.8																
BAL-B002	S-9	40-41.5		38.6				CL	94.3	5										
BAL-B002	S-10	45.0-46.5	Dark brown silty CLAY, trace sand	32.6																
BAL-B002	S-11	50.0-51.5	Dark brown silty CLAY, trace sand	25.0																
BAL-B002	S-12	55.0-56.5	Brown silty CLAY, trace sand	24.0	42	23														
BAL-B002	S-13	60.0-61.5	Dark brown silty CLAY with gravel, trace organics	33.3																
BAL-B002	S-14	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B002	S-15	75.0-76.0	Gray silty CLAY, trace sand	17.4	45	24														
BAL-B003	S-4	10.0-11.5	Brown CLAY with fine gravel	22.3	39	17														
BAL-B003	ST-2	15-17									125.3									
BAL-B003	ST-2	15.35		25.4																
BAL-B003	ST-2A	15.6																		
BAL-B003	ST-2	15.95		23.4																
BAL-B003	ST-2B	16.2		24.7	58	15	43	CH			124.8	100.1			UU@1.9	0.8	15			UU230d
BAL-B003	S-6	30.0-31.5	Brown CLAY	40.7				CL	97	7										
BAL-B003	S-8	40.0-41.5	Brown sandy silty CLAY	43.6									2.43							
BAL-B003	S-10	50.0-51.5	Brown fat CLAY, trace sand and gravel	19.3	39	17														
BAL-B003	S-12	60.0-61.5	Light brown silty CLAY	26.9																
BAL-B003	S-13	65.0-66.5	Light gray silty CLAY	21.6	57	30														
BAL-B003	S-14	70.0-75.4	Light gray silty CLAY	18.7																
BAL-B004	S-2	2.5-4		10.3				SW-SM	5.4	0										
BAL-B004	ST-2	25-27									118.1									
BAL-B004	ST-2A	25.35		37.1				PT			115.8	84.5			CIU@3.0	1.4	12.1			T3892
BAL-B004	ST-2B	25.85		23.6	47	14	33	CL			127	102.7			CIU@3.1	1.4	12.3			T3893
BAL-B004	ST-2C	26.35		29.9				CL			119.2	91.8			CIU@3.2	1.8	19			T3894
BAL-B004	S-8	30-31.5		31.4	37	18	19	CL												
BAL-B004	S-9	35.0-36.5	Light gray silty CLAY, trace sand	19.4	38	15														
BAL-B004	S-11	45.0-46.5	Light brown silty CLAY with gravel	20.3																
BAL-B005	S-1	0.0-1.5	Dark brown silty coarse SAND with gravel	9.8																
BAL-B005	S-2	2.5-4.0	Brown silty CLAY	25.7																
BAL-B005	ST-1	5.0-7.0									108.7									
BAL-B005	ST-1	5.75		24.3																UU275A

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B005	ST-1B	6		22	60	17	43	CH			126.5	103.7			UU@0.7	1.9	15			
BAL-B005	S-3	7.5-9.0	Brown silty CLAY	26.2																
BAL-B005	ST-2	10.0-12.0									115.1									
BAL-B005	ST-2A	10.3		25.8				CH			121.4	96.5			CIU@0.8	0.7	19.8			T3910
BAL-B005	ST-2B	10.85		24.8	60	16	44	CH			123.7	99.1			CIU@1.2	1.4	19.6			T3911
BAL-B005	S-4	15.0-16.5	Brown silty CLAY, trace sand	25.1																
BAL-B005	S-5	20.0-21.5	Brown gray silty CLAY	27.5																
BAL-B005	S-6	25.0-26.5	Brown silty CLAY	24.1																
BAL-B005	S-7	30.0-31.5	Brown silty CLAY	21.2	36	18														
BAL-B005	S-8	35.0-36.5	Brown silty CLAY	21.9																
BAL-B005	S-9	40.0-41.5	Brown silty CLAY	16.7																
BAL-B005	S-10	45.0-46.5	Gray silty CLAY	16.6																
BAL-B005	S-11	50.0-51.5	Gray silty CLAY	22.0																
BAL-B005	S-12	55.0-56.5	Gray silty CLAY, trace sand	16.6	44	25														
BAL-B005	S-13	60.0-60.4	Gray brown silty CLAY	18.8																
BAL-B006	S-1	0.0-1.5		11.6				SC	20.9	2										
BAL-B006	S-2	2.5-4.0		67.9				SC	44.4	4										
BAL-B006	S-3	5.0-6.5		31.6				SM	18.5	1										
BAL-B006	S-4	7.5-9.0		24.9				SC	12.8	0										
BAL-B006	S-5	10.0-11.5		19.9				CL	53.4	6										
BAL-B006	S-6	12.5-15	Gray brown silty CLAY, trace sand and fine gravel	21.2																
BAL-B006	ST-1	15.0-17.0									129									
BAL-B006	ST-1	15.15		25.2																
BAL-B006	ST-1	15.7		23.5																
BAL-B006	ST-1B	15.95		17.9				CL			135	114.5			UU@1.4	1.7	15			UU275G
BAL-B006	ST-1	16.25		15.9																
BAL-B006	S-7	20.0-21.5	Gray brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B006	S-8	25.0-26.5	Light brown silty CLAY, trace sand and fine gravel	20	32	14														
BAL-B006	ST-2	30.0-32									139.5									
BAL-B006	ST-2A	30.25		13.4	29	15	14	CL			138.3	122			CIU@2.0	6.1	17.4			T3886
BAL-B006	ST-2B	30.6		13				CL			135.3	119.7	2.682					0.398	87	C15157
BAL-B006	ST-2C	31		13.3				CL			134.8	119			CIU@2.2	7.2	21.8			T3887
BAL-B006	ST-2D	31.5		14				CL			137	120.1			CIU@2.4	5	18.5			T3888
BAL-B006	S-9	35.0-36.5	Light brown silty CLAY, trace sand and fine gravel	29.6																
BAL-B006	S-10	40.0-41.5	Gray silty CLAY, trace sand	22.4																
BAL-B006	S-11	45.0-46.5	Gray CLAY, trace sand	19.1	56	23														
BAL-B006	S-12	50-51.5	Gray silty GRAVEL	9.1																
BAL-B007	S-3	5.5-7.0		65.4	NP	NP														
BAL-B007	ST-1	30-32									123									
BAL-B007	ST-1A	30.4		25				CL			125.8	100.6			CIU@3.6	2.2	15.2			T3857
BAL-B007	ST-1B	30.95		25.8	48	17	31	CL			126.6	100.6	2.609		CIU@3.7	2.9	14.7			T3859
BAL-B007	ST-1C	31.35		22.8				CL			123	100.1						0.661	92	C15142
BAL-B007	ST-1D	31.8		26				CL			125.8	99.8			CIU@3.8	2.5	16.7			T3858
BAL-B008	S-1	0.0-1.5	Brown silty CLAY, trace sand	15.4																
BAL-B008	S-2	2.5-4.0	Brown silty, CLAY, trace sand	21.8																
BAL-B008	S-3	5.0-6.5	Brown silty CLAY, trace sand and fine gravel	21.6	48	21														
BAL-B008	S-4	10.0-11.5	Brown silty CLAY, trace sand and fine gravel	19.6																
BAL-B008	ST-1	10-12																		
BAL-B008	ST-1A	10.35		25.7				CH	84.2	25										dispersion
BAL-B008	ST-1B	10.8		23.1	65	17	48	CH			127.5	103.6		5.50E-09						P10595
BAL-B008	S-5	20.0-21.5	Brown silty CLAY, trace sand and fine gravel	22.5																
BAL-B008	ST-2	20-22									119.5									
BAL-B008	ST-2	20.05		43.5																
BAL-B008	ST-2A	20.3		23.4	58	18	40	CH			125.7	101.9			UU@2.5	0.4	15			UU278e
BAL-B008	S-6	25.0-26.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-7	30.0-31.5	Brown silty CLAY, trace sand and fine gravel	26.2	38	17														
BAL-B008	S-8	35.0-36.5	Brown silty CLAY, trace sand and fine gravel	22.9																
BAL-B008	S-9	40.0-41.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-10	45.0-46.5	Brown silty CLAY, trace sand and fine gravel	22.1																
BAL-B008	S-11	50.0-51.5	Brown silty CLAY, trace sand and fine gravel	18.0																
BAL-B008	S-12	55.0-56.5	Light brown SILTY SAND	19.2				SM	16											

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B008	S-13	60.0-61.5	Gray silty CLAY, trace sand	17.8	42	25														
BAL-B008	S-14	65.0-66.5	Gray silty CLAY, trace sand	14.0																
BAL-B009	S-1	0-1.5		85.3				MH	78.3	10										
BAL-B009	ST-2	10.5-12.5									122.5									
BAL-B009	ST-2A	10.65		4.3				CL												
BAL-B009	ST-2	10.9		24.9																
BAL-B009	ST-2B	11.15		25.2				CL			124.9	99.8			CIU@1.3	1.8	16.9			T3863
BAL-B009	ST-2	11.45		28																
BAL-B009	ST-2C	11.7		26.3				CL			124.1	98.3			CIU@1.4	1.6	14.6			T3889
BAL-B009	ST-2	12		24.1																
BAL-B009	ST-2D	12.25		26.3	40	19	21	CL	95.2	20	123.6	97.8			CIU@1.5	2.1	14.2			dispersion T3864
BAL-B009	ST-3	25-27									113.6									
BAL-B009	ST-3	25.25		22.1	49	14	35	CL			125.9	103.1			UU@3.1	0.7	15			UU278g
BAL-B009	ST-3	25.85		19.5																
BAL-B009	S-7	30.0-31.5	Brown POORLY GRADED GRAVEL	14.5				GP	3											
BAL-B009	S-8	35.0-36.5	Gray silty CLAY, trace sand	23.2	49	25														
BAL-B009	S-9	40.0-41.5	Gray silty CLAY, trace sand	21.2																
BAL-B010	S-2	2.5-4		50.2				SC	28.4	4										
BAL-B010	S-5	15-16.5		42.5				CL	98.3	7										
BAL-B010	ST-2	20-22									123.9									
BAL-B010	ST-2	20.5		24.7																
BAL-B010	ST-2	21.05		22.1																
BAL-B010	ST-2B	21.3		22.2	42	18	24	CL			124.2	101.7		2.40E-06						P10578
BAL-B010	ST-2	21.6		21.9																
BAL-B010	ST-2C	21.85		20.9				CL			124.9	103.3			UU@2.5	2	3.8			UU246d
BAL-B010	S-8	30.0-31.5	Light brown silty CLAY with sand and gravel	18.6	30	14														
BAL-B010	S-9	35.0-36.5	Brown silty CLAY with sand and gravel	15.0	22	14														
BAL-B010	S-11	45.0-46.5	Light brown silty CLAY with sand and gravel	21.7																
BAL-B010	S-12	50.0-51.5	Brown silty CLAY, trace sand	18.2																
BAL-B011	S-1	0.0-1.5	Brown silty CLAY, trace sand	13.0																
BAL-B011	S-2	2.5-4		23.0				CL	95.2	27										
BAL-B011	S-4	7.5-9.0	Brown silty CLAY, trace sand	18.8																
BAL-B011	S-5	10.0-11.5	Gray brown silty CLAY, trace sand	19.9																
BAL-B011	ST-1	15-17									122.8									
BAL-B011	ST-1A	15.2		25.8							123.3	98		1.80E-09						P10594
BAL-B011	ST-1B	15.7		24.8				CL			125.1	100.2			CIU@1.8	2.5	12.1			T3903
BAL-B011	ST-1C	16.2		24.9				CL			122.3	98			CIU@1.9	2.8	20.1			T3904
BAL-B011	ST-1	16.55		25.4																
BAL-B011	ST-1D	16.8		25.6	46	18	28	CL			121.3	96.6			CIU@2.0	1.7	19.2			T3905
BAL-B011	S-6	20.0-21.5	Gray brown silty CLAY, trace sand	21.7																
BAL-B011	S-7	30.0-31.5	Brown silty CLAY, trace sand	17.8																
BAL-B011	S-8	35.0-36.5	Brown silty sandy CLAY with gravel	8.8	19	11														
BAL-B011	S-9	42.5-44.0	Light brown silty CLAY, trace sand	18.2	49	24														
BAL-B011	S-10	47.5-49.0	Gray silty CLAY, trace sand	19.8																
BAL-B012	S-3	2.0-3.0	Brown silty CLAY, trace sand	22.0	54	24														
BAL-B012	S-7	6.0-7.0	Light brown silty CLAY	20.7	34	18														
BAL-B012	S-10	9.0-10.0	Light brown silty CLAY	21.3																
BAL-B015	S-1	0.0-1.5	Light brown sandy silty CLAY with find gravel and organics	12.5																
BAL-B015	S-2	2.5-4.0	Light brown sandy silty CLAY	21.5																
BAL-B015	ST-1	5.0-7.0									124.7									
BAL-B015	ST-1	5.6		24.8																
BAL-B015	ST-1	6.15		43																
BAL-B015	ST-1C	6.4		21.3	44	17	27	CL			129.1	106.4			UU@0.7	2.3	15			UU275D
BAL-B015	S-3	7.5-9.0	Light brown sandy silty CLAY	22.8																
BAL-B015	S-4	10.0-11.5	Light brown sandy silty CLAY, trace gravel	21.0																
BAL-B015	ST-2	11.5-13.5									128.6									
BAL-B015	ST-2	11.8		19.5																
BAL-B015	ST-2A	12.05		20.8				CH			129.5	107.2			CIU@1.0	1.8	18.7			T3912
BAL-B015	ST-2	12.35		20.8																
BAL-B015	ST-2B	12.6		20.1				CH			129.9	108.2			CIU@1.2	1.8	20.4			T3913
BAL-B015	ST-2	12.9		20.7																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B015	ST-2C	13.15		21.1	53	14	39	CH			128.8	106.4			CIU@1.4	1.9	20.1			T3914
BAL-B015	S-5	15.0-16.5	Light brown sandy silty CLAY, trace gravel	23.0																
BAL-B015	S-6	20.0-21.5	Light brown sandy silty CLAY with gravel	18.8																
BAL-B015	S-7	25.0-26.5	Light brown gray silty CLAY, trace sand and gravel	17.1	37	15														
BAL-B015	S-8	30.0-31.5	Light brown silty CLAY, with sand and gravel	23.7																
BAL-B015	S-9	35.0-36.5	Brown silty CLAY, trace sand	23.5																
BAL-B015	S-10	40.0-41.5	Gray brown silty CLAY	20.1																
BAL-B015	S-11	45.0-46.5	Light brown sandy silty CLAY with medium gravel	25.9																
BAL-B015	S-12	50.0-51.5	Gray fat CLAY	21.7	87	33														
BAL-B016	ST-1	4.0-6.0									114.6									
BAL-B016	ST-1	4.15		15.7																
BAL-B016	ST-1A	4.4		15				ML			128	111.3			CIU@0.5	0.8	21.2			T3825
BAL-B016	ST-1	4.7		19.8																
BAL-B016	ST-1B	4.95		27.6				ML			115.4	90.5			CIU@0.6	2.1	18			T3826
BAL-B016	ST-1	5.25		33.3																
BAL-B016	ST-1C	5.5		31.8	24	22	2	ML			107.7	81.7			CIU@0.7	1.9	11.1			T3827
BAL-B016	S-3B	7.5-9.0	Brown SILT	41.3				ML	96	6										
BAL-B016	ST-2	10.0-12.0									103.4									
BAL-B016	ST-2	10.15		44.3																
BAL-B016	ST-2	10.65		49.8																
BAL-B016	ST-2	11.15		54.9																
BAL-B016	ST-2B	10.9		62.1	-	29	NP	ML			96.8	59.7						1.562	97	C15119
BAL-B016	S-4	15.0-16.5		31.3																
BAL-B016	S-5	20.0-21.5	Dark brown SILT	29				ML	90	4										
BAL-B016	S-8	35.0-36.5		22.6																
BAL-B016	S-10	45.0-46.5		17.9																
BAL-B016	S-11	50.0-51.5		14.5	30	15														
BAL-B016	S-12	55.0-56.5		10.3	34	14														
BAL-B016	S-14	65.0-66.5		18.2																
BAL-B017	S-1	0.0-1.5		11.5				ML												
BAL-B017	S-2	2.5-4.0		14.7				ML	73.5	9										
BAL-B017	S-3	5.0-6.5		21.4				ML	67	4										
BAL-B017	S-4	7.5-9.0		28.9				ML	94.2	6										
BAL-B017	ST-1	10.0-12.0									108.5									
BAL-B017	ST-1	11.3		28.4																
BAL-B017	ST-1C	11.55		35	23	25	NP	ML	95.4	7	112.2	83.1			UU@0.8	0.4	15			UU278H
BAL-B017	S-5	15.0-16.5	Brown silty CLAY	30.5																
BAL-B017	S-6	20.0-21.5	Brown silty CLAY with fine gravel	21.4	33	15														
BAL-B017	ST-2	25.5-27.5									122.1									
BAL-B017	ST-2	25.9		30.3																
BAL-B017	ST-2A	26.15		22.6				CL			125.4	102.3			CIU@2.2	6.7	20.1			T3921
BAL-B017	ST-2	26.45		21.9																
BAL-B017	ST-2B	26.7		23.5	44	15	29	CL			124.5	100.8		1.70E-08	CIU@2.4	2	19.7			T3922
BAL-B017	ST-2	27		25																
BAL-B017	ST-2C	27.25		25.4				CL			124.4	99.2			CIU@2.6	1.8	12.9			T3923
BAL-B017	S-7	30.0-31.5	Brown silty CLAY with fine gravel	30.5																
BAL-B017	S-8	35.0-36.5	Brown silty CLAY with fine gravel	21.2	43	11														
BAL-B017	S-9	40.0-41.5	Gray brown sandy silty CLAY with fine gravel	18.1																
BAL-B017	S-10	45.0-45.1	Gray brown sandy silty CLAY with fine gravel	15.6																
BAL-B017	S-11	50.0-51.5	Gray brown sandy silty CLAY with fine gravel	22.6																
BAL-B017	S-12	55.0-56.5	Brown sandy silty CLAY with fine gravel	10.3	28	9														
BAL-B018	S-2	5.0-6.5	Light brown silty CLAY	30.0	37	20														
BAL-B018	ST-2	25-27									126.1									
BAL-B018	ST-2B	25.95		27.4				CH			123.3	96.8			CIU@3.0	0.9	22.7			T3890
BAL-B018	ST-2C	26.55		18.1	54	13	41	CH			129.7	109.9			CIU@3.2	2.2	18.2			T3865
BAL-B018	S-7	35.0-36.5	Light brown silty CLAY	23.6																
BAL-B018	S-8	40.0-41.5	Gray silty CLAY, trace sand	17.7	47	25														
BAL-B018	S-9	45.0-46.5	Gray silty CLAY, trace sand	18.4																
BAL-B019	S-1	0.0-1.5		15.3																
BAL-B019	S-3	5.0-6.5		22.4	40	19														
BAL-B019	S-7	15.0-16.5		17.5																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B019	ST-1	25-27.5									128.1									
BAL-B019	ST-1	25.45		24.3																
BAL-B019	ST-1	26		25.1																
BAL-B019	ST-1	26.55		23.9																
BAL-B019	ST-1C	26.8		24.5	38	17	21	CL			124.8	100.3			UU@3.1	1.5	14.6			UU231a
BAL-B019	ST-2	35-37.5									118.4									
BAL-B019	ST-2	35.35		34.7																
BAL-B019	ST-2	35.9		25.6																
BAL-B019	ST-2	36.5		22.3																
BAL-B019	ST-2C	36.8		22.1	55	15	40	CH			126.8	103.8			UU@4.1	2	8.8			UU231b
BAL-B019	S-11	45.0-46.5		16.7	33	16														
BAL-B019	S-13	55.0-56.5		18.6	40	18														
BAL-B019	S-14	60.0-61.5		21.9	43	26														
BAL-B019	S-16	70.0-71.0		15.4																
BAL-B019	S-18	80.0-80.8		17.5																
BAL-B020	S-2A	2.5-4		19.5				SP-SM	10.8	1										
BAL-B020	ST-2	9-11									121.1									
BAL-B020	ST-2A	9.4		30.8				CH			120.4	92.1			CIU@1.1	0.9	19			T3901
BAL-B020	ST-2B	9.9		25.6	51	17	34	CH			123.5	98.3			CIU@1.2	1.2	18.8			T3895
BAL-B020	ST-2C	10.4		24.7				CH			125.8	100.9			CIU@1.3	1.3	17.9			T3896
BAL-B020	S-5	20.0-21.5	Brown SANDY LEAN CLAY	22.6	38	16		CL	67											
BAL-B020	S-7B	30.0-31.5	Brown CLAY with SAND	18.7				CL	78											
BAL-B020	S-10	45.0-46.5	Gray silty sandy CLAY with fine gravel	11.2																
BAL-B020	S-13	60.0-61.5	Gray silty CLAY	21.6	73	36														
BAL-B020	S-17	80.0-81.5	Gray silty CLAY	21.3																
BAL-B021	ST-1	2.5-4.5									117.5									
BAL-B021	ST-1A	2.75		20.6				CL			125.8	104.3			CIU@0.3	0.6	18			T3834
BAL-B021	ST-1B	3.25		22.4	49	15	34	CL			124.9	102			CIU@0.54	0.9	20.5			T3835
BAL-B021	S-3	7.5-9.0		20.8	43	17														
BAL-B021	S-5	15.0-16.5		20.7																
BAL-B021	S-6	20.0-21.5		20.5																
BAL-B021	S-9	35.0-36.5		18.6	42	23														
BAL-B022	S-3	5.0-6.5	Brown silty CLAY, trace fine gravel	22.0	28	18														
BAL-B022	ST-1	10-12									130.3									
BAL-B022	ST-1	10.35		21.1																
BAL-B022	ST-1A	10.6		20.7				CL			129.4	107.2			CIU@1.2	2.2	20.1			T3906
BAL-B022	ST-1	10.9		19.9																
BAL-B022	ST-1B	11.15		19.1	40	15	25	CL	80.3	22	130.3	109.4			CIU@1.3	2	15.3			dispersion T3907
BAL-B022	ST-1	11.45		18.7																
BAL-B022	ST-1C	11.7		18.4				CL			130.7	110.4			CIU@1.4	2.5	20.2			T3908
BAL-B022	S-8	35.0-36.5	Gray silty CLAY, trace gravel	23.6	58	25														
BAL-B022	S-10	45.0-45.8	Gray silty CLAY, trace gravel	16.6																
BAL-B023	S-3	5.0-6.5		18.6	37	14														
BAL-B023	ST-1	10.0-12.5									129									
BAL-B023	ST-1	10.3		23.7																
BAL-B023	ST-1A	10.55		22.6	51	15	36	CH			127.7	104.1			UU@1.3	2.1	15			UU230b
BAL-B023	ST-1	10.85		22.3																
BAL-B023	ST-1B	11.1																		
BAL-B023	S-6	20.0-21.5		22.3	34	18														
BAL-B023	ST-2	25-27.5									132.8									
BAL-B023	ST-2B	25.65		17.9				CL			132.2	112.1			CIU@3.0	2.6	21.4			T3828
BAL-B023	ST-2C	26.05		16.2	36	14	22	CL			133.4	114.8			CIU@3.2	2.5	21			T3829
BAL-B023	S-7	30.0-31.5		26.7	59	30														
BAL-B023	S-8	35.0-36.5		17.8																
BAL-B023	S-11	50.0-50.8		16.1																
BAL-B024	S-4	7.5-9.0		18.7																
BAL-B024	S-6	15.0-16.5		24.1	41	19														
BAL-B024	ST-1	20.0-22.5									128									
BAL-B024	ST-1	20.45		28.1																
BAL-B024	ST-1A	20.7		19.4				CL			130	108.9			CIU@2.4	2.8	17.7			T3831
BAL-B024	ST-1	21.05		20.0																

Project: Dynergy CCR-Baldwin **Project No.: 60440739**

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B024	ST-1B	21.3		20.5	49	13	36	CL			129.6	107.6			CIU@2.5	2.8	11			T3832
BAL-B024	ST-1	21.6		20.6																
BAL-B024	ST-1C	21.9		19.4				CL			128.6	107.7			CIU@2.6	2.3	6.2			T3833
BAL-B024	S-7	25.0-26.5		18.1																
BAL-B024	S-10	40.0-41.5		14.5	45	23														
BAL-B024	S-12	50.0-51.5		22.6																
BAL-B025	ST-1	7.5-9.5									112.5									
BAL-B025	ST-1	7.75		22.4																
BAL-B025	ST-1A	8		22.0				CL	74.3	4										
BAL-B025	ST-1	8.3		25.6																
BAL-B025	ST-1	8.85		55.1																
BAL-B025	S-4	10.0-11.5		40.4									2.46							
BAL-B025	S-7	25.0-26.5		26.5	40	20														
BAL-B025	S-9B	40.0-41.5		19.3	32	16														
BAL-B025	S-11	50.0-51.5		24.2																
BAL-B025	S-12	55.0-56.5		16.7	43	21														
BAL-B026	S-4	7.5-9		9.4				SM	14.6											
BAL-B026	S-6	15-16.5		19.4				SW-SM	5.8											
BAL-B026	ST-1	20-22																		
BAL-B026	ST-1	20.45		37.3																
BAL-B026	ST-1	21		27.3																
BAL-B026	ST-1	21.55		23.5																
BAL-B026	ST-1C	21.8		20.1				CL	97.5	28	128	106.5			UU@2.6	2	8.7			UU257k
BAL-B026	S-7A	25-26.5		32.9				CL	78.9											
BAL-B026	ST-2	35-37									126.3									
BAL-B026	ST-2A	35.35		23.6				CH			125.4	101.4			CIU@4.2	2	19			T3860
BAL-B026	ST-2B	35.9		24.0				CH			125.9	101.6			CIU@4.3	2.1	19.2			T3861
BAL-B026	ST-2C	36.25		23.5	61	14	47	CH			124.3	100.6	2.675					0.649	96	C15144
BAL-B026	ST-2D	36.8		22.9				CH			126.4	102.9			CIU@4.4	1.9	15.9			T3862
BAL-B026	S-9	40.0-41.5	Brown silty CLAY, trace gravel	17.8	48	13														
BAL-B026	S-11	50.0-51.5	Brown silty CLAY, trace gravel	23.5	49	19														
BAL-B026	S-12	55.0-56.5	Brown silty CLAY, trace gravel	16.6	43	17														
BAL-B026	S-15	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B027	S-1	0-1.5		17.7				SW-SM	5.3											
BAL-B027	S-7	20-21.5		16.7				SP	0.2											
BAL-B027	ST-1	25-27									124.6									
BAL-B027	ST-1	25.55		21.1																
BAL-B027	ST-1	26.1		21.8																
BAL-B027	ST-1C	26.35		21.4				CL			128.5	105.9			UU@3.1	3.3	11.9			UU275e
BAL-B027	ST-1	26.65		21.1																
BAL-B027	ST-1D	26.9		21.2	43	16	27	CL			127.7	105.4		5.00E-09						P10596
BAL-B027	ST-2	35-37									127.3									
BAL-B027	ST-2	35.3		19.1																
BAL-B027	ST-2	35.85		19.9																
BAL-B027	ST-2	36.4		19.8																
BAL-B027	ST-2C	36.65		20.3	47	15	32	CL			130	108			UU@4.3	1.6	15			UU275f
BAL-B027	S-10	45.0-46.5	Light brown silty CLAY	24.1																
BAL-B027	S-12	55.0-56.5	Gray silty CLAY, trace sand	17.4	47	21														
BAL-B027	S-13	60.0-61.5	Gray silty CLAY, trace sand	19.4																
BAL-B028	S-1	0-1.5		72.5																
BAL-B028	S-2	2.5-4.0		70.8				ML	67.5	11										
BAL-B028	ST-1	5.0-7.0									89.5									
BAL-B028	ST-1	5.4		104.4																
BAL-B028	ST-1	5.95		76.6																
BAL-B028	ST-1	6.55		114.3																
BAL-B028	ST-1C	6.8		90.7	47	53	NP	ML	81.4		90.7	47.6			CYCTRX@0.7					CTXS488
BAL-B028	S-3	7.5-9.0		103.7				ML	75.6	13										
BAL-B028	ST-2	9.0-11.0									89.5									
BAL-B028	ST-2A	9.3		48.5				ML	67.9		104.4	70.3			CYCTRX@1.0					CTXS487
BAL-B028	ST-2B	9.95		65	47	52	NP	ML			101.8	61.7	2.684					1.716	102	C15154
BAL-B028	S-4	15-17		39.6				ML	64.3	6										

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B028	S-5	20-22		34.9				ML	97.7	8										
BAL-B028	S-6A&B	25-26.5		50.6				CL	89.4	9										
BAL-B028	S-7	30.0-31.5	Brown silty Clay	26.7																
BAL-B028	S-8	35.0-36.5	Brown silty CLAY with sand and gravel	20.3	40	18														
BAL-B028	S-9	40.0-41.5	Brown silty CLAY with sand and gravel	20.7																
BAL-B028	S-10	45.0-46.5	Brown silty CLAY with sand and gravel	16.5																
BAL-B028	S-11	50.0-51.5	Brown silty CLAY with sand and gravel	20.2																
BAL-B028	S-12	55.0-56.5	Gray silty CLAY, trace sand	21.0																
BAL-B028	S-13	60.0-61.5	Gray silty CLAY with sand and gravel	16.7																
BAL-B028	S-14	65.0-66.5	Gray silty CLAY, trace gravel	18.9	39	25														
BAL-B028	S-15	70.0-71.5	Gray silty CLAY, trace gravel	18.5																
BAL-B028	S-16	75.0-76.5	Gray silty CLAY, trace gravel	20.9																
BAL-B028	S-17	80.0-81.5	Gray silty CLAY, trace gravel	17.8																
BAL-B028	S-18	85.5-86.0	Gray silty CLAY, trace gravel	17.7																
BAL-B029	S-1	0.0-1.5		20.6	42	19	23	CL												
BAL-B029	S-2	2.0-4.0		31				CL	95.7	6										
BAL-B029	S-3	7.5-9.0		31.9				ML	86	7										
BAL-B029	S-4	10.0-11.5		34.1				ML	94.5	8										
BAL-B029	S-5	20.0-21.5	Gray sandy silty CLAY	22.1	32	16														
BAL-B029	S-6	25.0-26.5	Gray brown sandy silty CLAY	19.8																
BAL-B029	S-7	30.0-31.5	Gray brown sandy silty CLAY	21.9	47	22														
BAL-B029	S-8	35.0-56.5	Brown sandy CLAY with gravel	10.9																
BAL-B029	S-9	40.0-41.5	Brown sandy CLAY with gravel	26.3	56	20														
BAL-B029	S-11	50.0-51.5	Brown gray sandy silty CLAY	21.8																
BAL-C039	S-1	0.0-1.0	Brown silty CLAY, trace sand	34.0	52	26														
BAL-C039	S-2	2.0-3.0	Brown silty CLAY with organics	24.5	37	16														
BAL-C039	S-6	5.0-6.0	Brown silty CLAY with organics, trace sand and gravel	21.7																

NOTE: Laboratory tests were performed by AECOM, Conshoshocken, Pennsylvania and Terrasense, Totowa, New Jersey.

APPENDIX B

LABORATORY HYDRAULIC CONDUCTIVITY TEST RESULTS

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B001 | Test No.: P10576

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-2A | DEPTH (ft): 35.6

Specimen - Apparatus set-up - Test Information | Cell No. E | Apparatus No. 1 | Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.991	in	Lo=	10.137	cm
dLc=	0.091	in	Ao =	41.93	cm^2
Lc=	3.900	in	Vo =	424.99	cm^3
			Lc=	9.905	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	29.07	cm^3
			Vc =	395.92	cm^3
Sc =	0.248	cm^{-1}	Ac=	39.970	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or ____ top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	9/4/15	09	47	00	129.9	100.0	57.00	37.70	0.88	1.40E-08
final	23.1	9/4/15	11	34	00			55.87	38.10		1.30E-08
1	RT = 0.936	dT =	107.00 min			σ'_c =	4.3 ksf	0.085	0.096	io= 24.5	-1%
initial	23.1	9/4/15	11	35	00	129.9	100.0	59.27	37.04	1.00	1.49E-08
final	23.5	9/4/15	13	29	00			57.80	37.50		1.36E-08
2	RT = 0.924	dT =	114.00 min			σ'_c =	4.3 ksf	0.110	0.110	io= 28.2	4%
initial	23.5	9/4/15	13	30	00	129.9	100.0	59.65	36.90	0.97	1.48E-08
final	23.5	9/4/15	15	19	00			58.22	37.36		1.35E-08
3	RT = 0.919	dT =	109.00 min			σ'_c =	4.3 ksf	0.107	0.110	io= 28.9	2%
initial	23.5	9/4/15	15	20	00	129.9	100.0	60.00	36.78	1.02	1.37E-08
final	23.5	9/4/15	17	38	00			58.30	37.30		1.25E-08
4	RT = 0.919	dT =	138.00 min			σ'_c =	4.3 ksf	0.127	0.125	io= 29.5	-5%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	9.905	cm	ε_{axial} =	2.3%	
Ac =	40.425	cm^2			
Vc=	400.43	cm^3	ε_{vol} =	5.8%	
Sc =	0.245	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.79	126.6	102.3	94.0
PreTest	21.79	132.2	108.6	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **1.31E-08** cm/sec

(i_o)ave = 27.8

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 BORING: BAL-B008 Test No.: P10595
Project Name: Dynegy CCR - Baldwin SAMPLE: ST-1B DEPTH (ft): 10.8

Specimen - Apparatus set-up - Test Information Cell No. C Apparatus No. 2 Stage No.: 2

Preliminary Length/Area Calculations

Lo =	3.985	in	Lo=	10.121	cm
dLc=	0.010	in	Ao =	41.87	cm^2
Lc=	3.975	in	Vo =	423.74	cm^3
			Lc=	10.095	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	3.19	cm^3
			Vc =	420.55	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.657	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top / Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.3	10/3/15	15	11	00	105.0	100.0	58.00	43.50	1.16	6.53E-09
final	22.0	10/4/15	09	33	00			54.40	44.50		6.21E-09
6	RT = 0.952	dT =	1102.00 min			σ'_c =	0.7 ksf	0.268	0.231	io= 18.1	13%
initial	22.0	10/4/15	09	38	00	105.0	100.0	58.20	43.40	1.07	5.75E-09
final	23.6	10/4/15	14	32	00			57.20	43.70		5.38E-09
7	RT = 0.936	dT =	294.00 min			σ'_c =	0.7 ksf	0.074	0.069	io= 18.4	-2%
initial	23.6	10/4/15	14	36	00	105.0	100.0	58.15	43.50	1.61	5.39E-09
final	24.2	10/4/15	17	11	00			57.65	43.60		4.89E-09
8	RT = 0.909	dT =	155.00 min			σ'_c =	0.7 ksf	0.037	0.023	io= 18.2	-11%
initial	24.2	10/4/15	17	11	00	105.0	100.0	57.65	43.60	0.95	5.89E-09
final	22.6	10/5/15	08	49	00			54.85	44.55		5.43E-09
9	RT = 0.921	dT =	938.00 min			σ'_c =	0.7 ksf	0.208	0.220	io= 17.5	-1%
initial											
final											
10		dT =				σ'_c =					
initial											
final											
11		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.095 cm ε_{axial} = 0.3%

Ac = 41.674 cm^2

Vc= 420.72 cm^3 ε_{vol} = 0.7%

Sc = 0.242 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.07	127.5	103.6	94.9
PreTest	23.87	129.2	104.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 6-9

ave K @ 20 ºC: **5.48E-09** cm/sec

(i_o)ave = 18.1

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B010 | Test No.: P10578

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-2B | DEPTH (ft): 21.3

Specimen - Apparatus set-up - Test Information | Cell No. B | Apparatus No. 2 | Stage No.: 4

Preliminary Length/Area Calculations

Lo =	4.006	in	Lo=	10.174	cm
dLc=	0.057	in	Ao =	42.20	cm^2
Lc=	3.949	in	Vo =	429.34	cm^3
			Lc=	10.029	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.33	cm^3
			Vc =	411.01	cm^3
Sc =	0.245	cm^{-1}	Ac=	40.980	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3214

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.1	9/8/15	11	02	00	117.6	100.0	56.00	44.13	1.01	2.66E-06
final	23.1	9/8/15	11	15	00			48.37	46.55		2.44E-06
1	RT = 0.929	dT =	13.00 min			σ'_c =	2.5 ksf	0.568	0.560	io= 14.9	0%
initial	23.1	9/8/15	11	16	00	117.6	100.0	56.00	44.13	0.99	2.85E-06
final	23.2	9/8/15	11	31	00			47.88	46.77		2.62E-06
2	RT = 0.927	dT =	15.00 min			σ'_c =	2.5 ksf	0.604	0.611	io= 14.9	7%
initial	23.2	9/8/15	11	32	00	117.6	100.0	56.00	44.13	1.01	2.76E-06
final	23.2	9/8/15	11	40	00			49.70	46.13		2.53E-06
3	RT = 0.926	dT =	8.00 min			σ'_c =	2.5 ksf	0.469	0.463	io= 14.9	4%
initial	23.2	9/8/15	11	41	00	117.6	100.0	56.00	44.13	1.01	2.38E-06
final	23.2	9/8/15	12	02	00			47.60	46.80		2.18E-06
4	RT = 0.926	dT =	21.00 min			σ'_c =	2.5 ksf	0.625	0.618	io= 14.9	-11%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.029 cm ε_{axial} = 1.4%

Ac = 41.453 cm^2

Vc= 415.75 cm^3 ε_{vol} = 3.2%

Sc = 0.242 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	22.15	124.2	101.7	88.4
PreTest	23.11	129.2	105.0	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **2.44E-06** cm/sec

(i_o)ave = 14.9

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B011 | Test No.: P10594

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1A | DEPTH (ft): 15.2

Specimen - Apparatus set-up - Test Information | Cell No. D | Apparatus No. 1 | Stage No.: 3

Preliminary Length/Area Calculations

Lo =	3.998	in	Lo=	10.155	cm
dLc=	0.017	in	Ao =	42.08	cm^2
Lc=	3.981	in	Vo =	427.34	cm^3
			Lc=	10.112	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.45	cm^3
			Vc =	421.89	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.722	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or top + bottom

2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination

3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes

4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only

5) Direction of permeant : [x] Up during or [ ] Down during permeation

6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.7	10/1/15	17	22	00	105.0	100.0	56.45	37.90	0.95	2.70E-09
final	21.9	10/2/15	09	04	49			54.62	38.50		2.54E-09
5	RT = 0.936	dT =	942.82 min			σ'_c =	0.7 ksf	0.137	0.144	io= 23.1	39%
initial	22.5	10/2/15	15	34	00	105.0	100.0	57.61	37.55	1.10	2.25E-09
final	22.0	10/3/15	11	47	00			55.50	38.15		2.15E-09
6	RT = 0.949	dT =	1213.00 min			σ'_c =	0.7 ksf	0.158	0.144	io= 24.9	18%
initial	22.0	10/3/15	12	05	00	105.0	100.0	57.00	37.75	1.09	1.43E-09
final	22.0	10/4/15	09	35	00			55.60	38.15		1.37E-09
7	RT = 0.956	dT =	1290.00 min			σ'_c =	0.7 ksf	0.105	0.096	io= 23.9	-25%
initial	22.0	10/4/15	09	40	00	105.0	100.0	56.30	37.95	1.02	1.28E-09
final	22.2	10/5/15	08	54	00			55.00	38.35		1.23E-09
8	RT = 0.953	dT =	1394.00 min			σ'_c =	0.7 ksf	0.097	0.096	io= 22.8	-32%
initial											
final											
9		dT =				σ'_c =					
initial											
final											
10		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.112	cm	ε_{axial} =	0.4%
Ac =	41.467	cm^2		
Vc=	419.30	cm^3	ε_{vol} =	1.9%
Sc =	0.244	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	25.83	123.3	98.0	94.5
PreTest	26.15	126.0	99.9	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 5-8

ave K @ 20 ºC: **1.82E-09** cm/sec

(i_o)ave = 23.7

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.:	T60440739	Boring:	BAL-B017		Test No.: T3922
Project Name:	Dynegy CCR - Baldwin	Sample:	ST-2B	Depth:	26.7

Specimen - Apparatus set-up - Test Information Cell No. H-6 Apparatus No. 1 Stage No.: 3

Preliminary Length/Area Calculations

Lo =	5.975 in	Lo=	15.178 cm		
dLc=	0.064 in	Ao =	41.79 cm^2		
Lc=	5.911 in	Vo =	634.27 cm^3		
		Lc=	15.015 cm		
dVc = 3 Vo * (dLc/Lo)		dVc=	20.38 cm^3		
		Vc =	613.89 cm^3		
Sc =	0.367 cm^{-1}	Ac=	40.885 cm^2		

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or	Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	10/13/15	09	21	00	116.7	100.0	61.98	36.20	0.99	2.38E-08
final	22.5	10/13/15	13	38	00			58.10	37.42		2.21E-08
1	RT = 0.943	dT =	257.00 min			σ'c =	2.4 ksf	0.291	0.292	io= 21.6	30%
initial	22.5	10/13/15	13	40	00	116.7	100.0	61.78	36.30	1.05	2.05E-08
final	22.9	10/13/15	18	03	00			58.35	37.32		1.90E-08
2	RT = 0.939	dT =	263.00 min			σ'c =	2.4 ksf	0.257	0.244	io= 21.3	11%
initial	22.9	10/13/15	18	12	00	116.7	100.0	61.48	36.35	1.00	1.74E-08
final	22.4	10/14/15	09	00	00			53.30	38.91		1.61E-08
3	RT = 0.940	dT =	888.00 min			σ'c =	2.4 ksf	0.613	0.613	io= 21.0	-5%
initial	22.4	10/14/15	09	02	00	116.7	100.0	61.55	36.35	0.97	1.74E-08
final	24.0	10/14/15	12	31	00			59.20	37.11		1.58E-08
4	RT = 0.926	dT =	209.00 min			σ'c =	2.4 ksf	0.176	0.182	io= 21.1	-7%
initial	24.0	10/14/15	12	37	00	116.7	100.0	62.20	36.18	1.07	1.90E-08
final	22.9	10/14/15	15	37	00			59.90	36.85		1.72E-08
5	RT = 0.920	dT =	180.00 min			σ'c =	2.4 ksf	0.172	0.161	io= 21.8	1%
initial											
final											
6		dT =				σ'c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	15.015 cm	ε_{axial} =	1.1%	
Ac =	41.570 cm^2			
Vc=	624.17 cm^3	ε_{vol} =	1.6%	
Sc =	0.361 cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.51	124.5	100.8	95.4
PreTest	23.66	126.6	102.4	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 2-5

ave K @ 20 ºC: **1.70E-08** cm/sec

(i_o)ave = 21.3

Tested By: BB Reviewed By: GET

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE

ASTM D 5084 - Method F

Project No.: T60428794	BORING: BAL-B027		Test No.: P10596
Project Name: Dynegy CCR - Baldwin	SAMPLE: ST-1D	DEPTH (ft): 26.9	

Specimen - Apparatus set-up - Test Information Cell No. B Apparatus No. 3 Stage No.: 4

Preliminary Length/Area Calculations

Lo =	3.986	in	Lo=	10.125	cm
dLc=	0.018	in	Ao =	41.55	cm^2
Lc=	3.968	in	Vo =	420.72	cm^3
			Lc=	10.079	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.70	cm^3
			Vc =	415.02	cm^3
Sc =	0.245	cm^{-1}	Ac=	41.176	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	

Equations Used

Kt = - 0.0000755 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3132

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.9	10/5/15	11	34	00	121.5	100.0	65.60	46.90	1.05	9.40E-09
final	22.7	10/5/15	16	07	27			63.75	47.45		8.86E-09
1	RT = 0.936	dT =		273.45 min		σ'_c =	3.1 ksf	0.138	0.131	io= 23.3	79%
initial	22.7	10/5/15	16	43	00	121.5	100.0	65.65	46.85	0.27	7.28E-09
final	23.5	10/5/15	18	22	26			65.10	47.50		6.81E-09
2	RT = 0.929	dT =		99.43 min		σ'_c =	3.1 ksf	0.041	0.155	io= 23.4	37%
initial	23.5	10/5/15	18	24	00	121.5	100.0	66.40	46.65	1.01	5.93E-09
final	22.2	10/6/15	09	03	00			62.70	47.80		5.59E-09
3	RT = 0.935	dT =		879.00 min		σ'_c =	3.1 ksf	0.277	0.274	io= 24.6	13%
initial	22.2	10/6/15	09	07	00	121.5	100.0	65.85	46.80	1.01	5.07E-09
final	22.5	10/7/15	08	41	12			61.18	48.25		4.84E-09
4	RT = 0.947	dT =		1414.20 min		σ'_c =	3.1 ksf	0.349	0.346	io= 23.8	-2%
initial	22.6	10/7/15	08	57	00	121.5	100.0	65.58	46.85	1.04	5.18E-09
final	22.8	10/7/15	17	04	00			63.76	47.40		4.90E-09
5	RT = 0.938	dT =		487.00 min		σ'_c =	3.1 ksf	0.136	0.131	io= 23.4	-1%
initial	22.8	10/7/15	17	04	00	121.5	100.0	63.76	47.40	0.94	4.76E-09
final	22.8	10/8/15	09	16	00			61.00	48.32		4.49E-09
6	RT = 0.936	dT =		972.00 min		σ'_c =	3.1 ksf	0.206	0.220	io= 20.4	-9%

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.079	cm	ε_{axial} =	0.5%	
Ac =	40.862	cm^2			
Vc=	411.86	cm^3	ε_{vol} =	2.1%	
Sc =	0.247	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	21.16	127.7	105.4	90.0
PreTest	22.27	131.6	107.7	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 3-6

ave K @ 20 ºC: **4.95E-09** cm/sec

(i_o)ave = 23.0

Tested By: BB Reviewed By: G. Thomas

APPENDIX C

BORING LOGS AND WELL DETAILS

APPENDIX C1

MW 100 SERIES BORING LOGS AND WELL DETAILS

KELRON
ENVIRONMENTAL
INCORPORATED

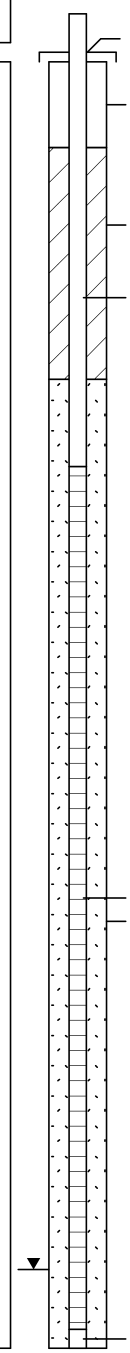
LOG OF BORING MW-104SR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/26/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.52
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.54
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554205

Depth in Feet	DESCRIPTION	Surf. Elev. 452.52	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-104DR for a descriptionof subsurface materials						
		450					
5							
		445					
10	(Slotted screen interval = 9.40 ft)						
		440					
	- groundwater level at completion = 14.06' bls						
15	END BOREHOLE AT 15 FEET BLS						

Well: MW-104SR
Elev.: 455.54



08-12-2011 c:\powerp~1\baldwin\ashmon~1\bec104sr.bor

KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

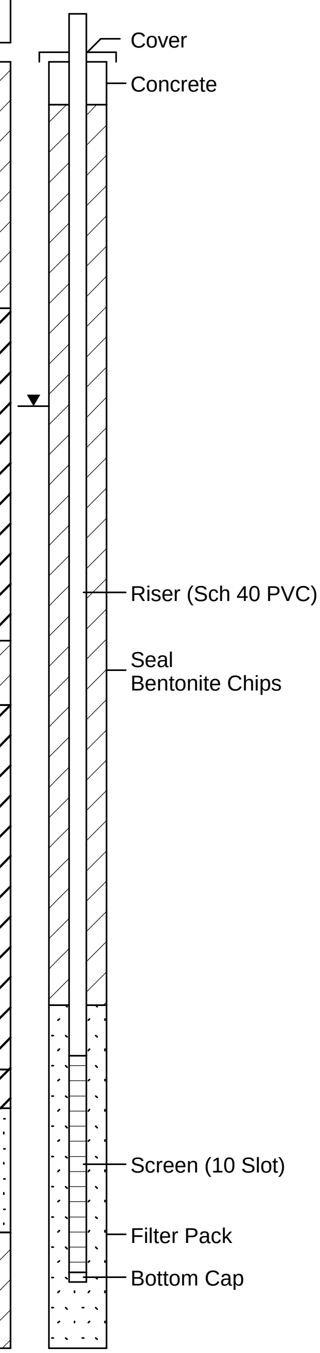
Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet	DESCRIPTION	USCS
0 – 5.7	SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry - moist	CL
5.7 – 13.5	CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist - groundwater level at completion = 8.03' bls - medium hardness - light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)	CH
13.5 – 15	CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)	CL
15 – 24.2	CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%) - trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%	CH
24.2 – 25.1	SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist	CH
25.1 – 27.3	SAND (fine to medium), trace gravel, poorly graded, light gray, wet - brown (Slotted screen interval = 4.52 ft)	SP
27.3 – 30	SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	CL

Surf. Elev. 452.62 (elevation marks: 450, 445, 440, 435, 430, 425)

Samples	Recovery inches	Qp TSF
1		>4.5
2		>4.5
3	60/60	3.5
4		2.5
5		2.5
6		2.5
7		2.5
8	60/60	1
9		1
10		1
11		1.75
12		2.25
13	60/60	2.25
14		3.0
15		2.5
16		3.75
17		2.75
18	60/60	3.5
19		3.5
20		3
21		3
22		2.5
23	60/60	2.5
24		2.5
25		2.5
26		
27		2.5
28	60/60	
29		4.0
30		4.5

Well: MW-104DR
Elev.: 455.62



08-12-2011 c:\powerp~1\baldwin\ashmon~1\bec104dr.bor

KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-104DR (Page 2 of 2)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Well: MW-104DR
Elev.: 455.62

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31		3.0	CL	
			32				
		420	33	60/60		SH	
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							

KELRON ENVIRONMENTAL
INCORPORATED

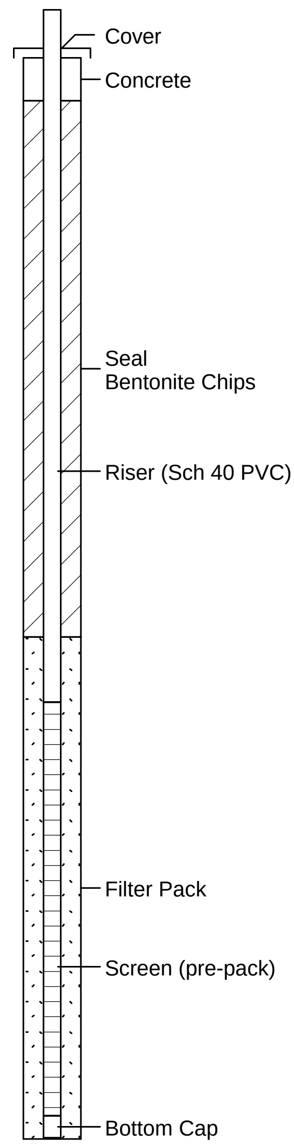
LOG OF BORING MW-150

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/08/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 393.84
Sampling Method	: MacroCore (60")	Top of Casing Elevation	396.54
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2379413, 554563

Depth in Feet	DESCRIPTION	Surf. Elev. 393.84	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-350 for a description of subsurface materials	393					
5		388					
10		383					
15		378					
20		373					
25	END BOREHOLE AT 25.2 FEET BLS	368					
30							

Well: MW-150
Elev.: 396.54



KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-151

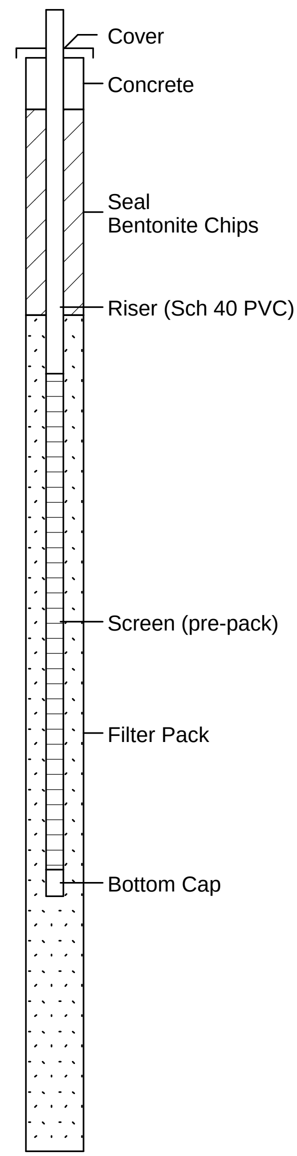
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/21/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 397.22
Sampling Method	: MacroCore (60")	Top of Casing Elevation	399.96
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2381171, 554221

Depth in Feet	DESCRIPTION	Surf. Elev. 397.22	USCS
0	SILTY CLAY, light brown, dry	397	CL
4.5	SANDY CLAY, dark gray (10YR 4/1) - moist - moist to wet - very dark gray-brown; grain size analysis @7.5-8 ft: 39% sand, 41.8% silt, 19.2% clay	392	CL
9.5	SILTY CLAY, yellowish-brown (10YR 5/1) - two small light gray sandy seams - 2-inch layer of dusky red CLAY (10R 3/2)	387	CL
14.5	CLAY, low plasticity, medium soft - shaley, light olive brown (2.5Y 5/4) grading to olive gray; grain size analysis @16-17 ft:: 1%sand, 28.5% silt, 70.5% clay - platy/laminated Refusal in bedrock at 21.5 feet BLS END BOREHOLE AT 21.5 FEET BLS	382, 377	CH
21.5	LIMESTONE, no recovery Drove split-spoon to 21.75 feet BLS - no recovery		LS

Samples	Recovery inches	Qp TSF
1	31/48	
2		1.5
3		1.0
4		1.5
5	32/60	
6		1.0
7		0.5
8		1.0
9		2.5
10	46/60	2.5
11		3.0
12		2.75
13		2.5
14		2.75
15	58/60	2.5
16		2.5
17		3.5
18		2.75
19		2.75
20	24/27	2.5
21		4.5+
22		

Well: MW-151
Elev.: 399.96



KELRON
ENVIRONMENTAL
INCORPORATED

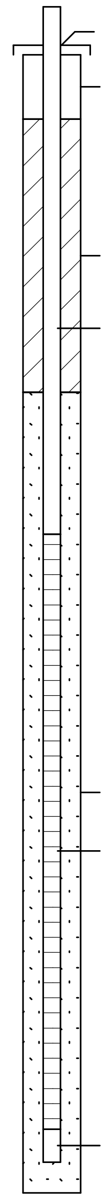
LOG OF BORING MW-152

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/22/10	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.18
Sampling Method	: MacroCore (60")	Top of Casing Elevation	424.99
Drilling Company	: PSC	X,Y Coordinates	: 2382779, 553906

Depth in Feet	DESCRIPTION	Surf. Elev. 422.18	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-352 for a description of subsurface materials.	422					
5		417					
10		412					
15		407					
	END BOREHOLE AT 17.7 FEET BLS						
20							

Well: MW-152
Elev.: 424.99



KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-153

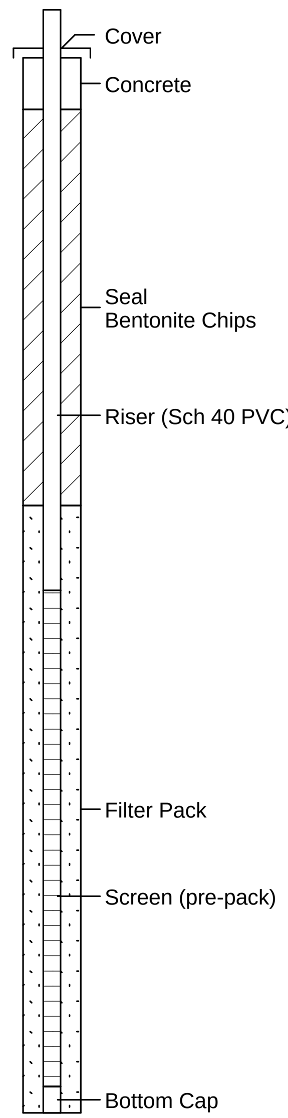
(Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/22/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.77
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.67
Drilling Company	: PSC	X,Y Coordinates	: 2384435, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.77	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-253 for a description of subsurface materials	442					
5		437					
10		432					
15		427					
20	END BOREHOLE AT 20.5 FEET BLS	422					
25							

Well: MW-153
Elev.: 445.67



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec153~1.bor

KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-154

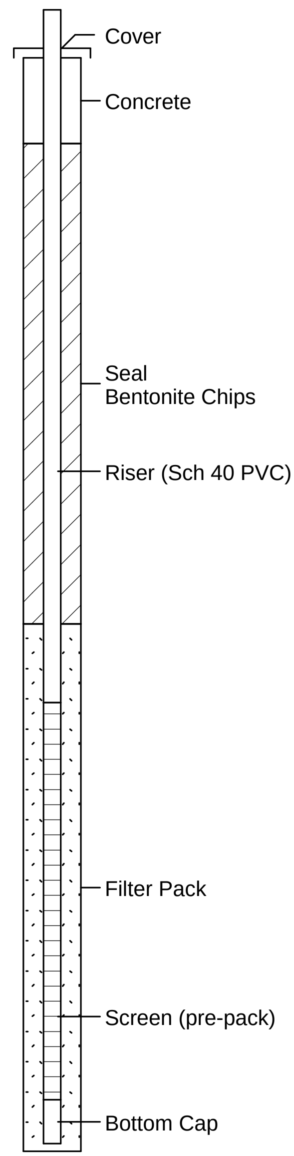
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, NE, SW

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 384.99
Sampling Method	: MacroCore (60")	Top of Casing Elevation	387.76
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2377892, 557163

Depth in Feet	DESCRIPTION	Surf. Elev. 384.99	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, hard, very dark gray (10YR 3/1), dry	384	1	35/48		CL
	CLAY, black, moist					CH
5		379	2	44/60		
	SANDY CLAY with gravel, very stiff to hard, low plasticity, dark gray with yellow-brown mottling, dry - grain size analysis @ 8-9.2 ft: 17.4% gravel, 30.5 %sand, 18.8% silt, 33.4% clay					CL
10			3	24/42		
	CLAY, shaley, gray with light olive-brown mottling - grain size analysis @ 11-12 ft: 12.5% sand, 23% silt, 64.5% clay Refusal in bedrock at 12.5 feet BLS	374				CH
	LIMESTONE		4	1/6		LS
	Drove split-spoon to 12.75 feet BLS - 1-inch recovery END BOREHOLE AT 12.75 FEET BLS					
15						

GRAPHIC

Well: MW-154
Elev.: 387.76



KELRON
ENVIRONMENTAL
INCORPORATED

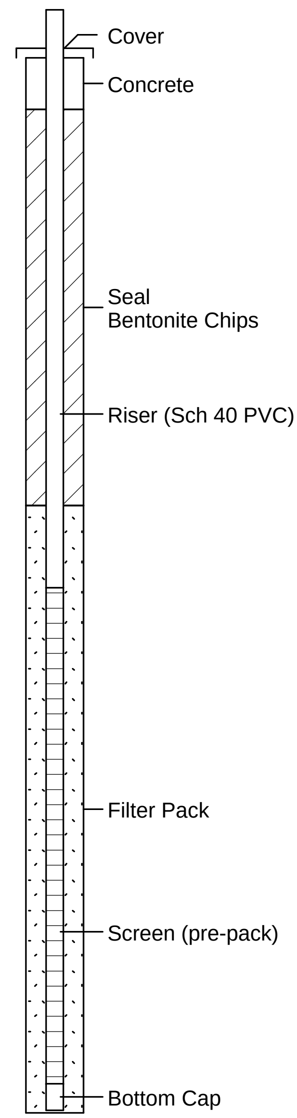
LOG OF BORING MW-155

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/10/2010
Hole Diameter	: 8 1/2"OD; 4 1/4" ID
Drilling Method	: Hollow-Stem (CME-550)
Sampling Method	: MacroCore (60")
Drilling Company	: Terra Drill, Inc.
Driller	: Matt Cooper
Geologist	: Brendon Wilder (PSC)
Land Surface Elevation	: 390.62
Top of Casing Elevation	393.55
X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev. 390.62	Samples	Recovery inches	Qp TSF	USCS
0 – 3.5	SILTY CLAY, hard, reddish brown, dry	390	1, 2, 3, 4	40/48	4.5	CL
3.5 – 8	CLAY (lean), hard, low plasticity, pale brown (10YR 6/3), grading to Fat CLAY - grain size analysis @ 7 - 8 ft: 2.5% sand, 47.2% silt, 50.3% clay	385	5, 6, 7, 8	53/60	4.5+	CL/CH
8 – 9	SANDY CLAY, dry		9		0.75	CL
9 – 9.3	SAND, 4-inch seam, poorly graded, loose					SP
9.3 – 17	CLAY with sand grading to SANDY CLAY, very soft, moist	380, 375	10, 11, 12, 13, 14, 15, 16, 17	44/60, 50/60	1.5, 1.5, 0.5	CL
17 – 20.5	CLAYEY SAND, poorly graded, dark yellow brown - grain size analysis @ 18.5 - 19.5 ft: 53.9 %sand, 28.1% silt, 18.0% clay	370	18, 19, 20		1.5	SC
20.5	END BOREHOLE AT 20.5 FEET BLS					

Well: MW-155
Elev.: 393.55



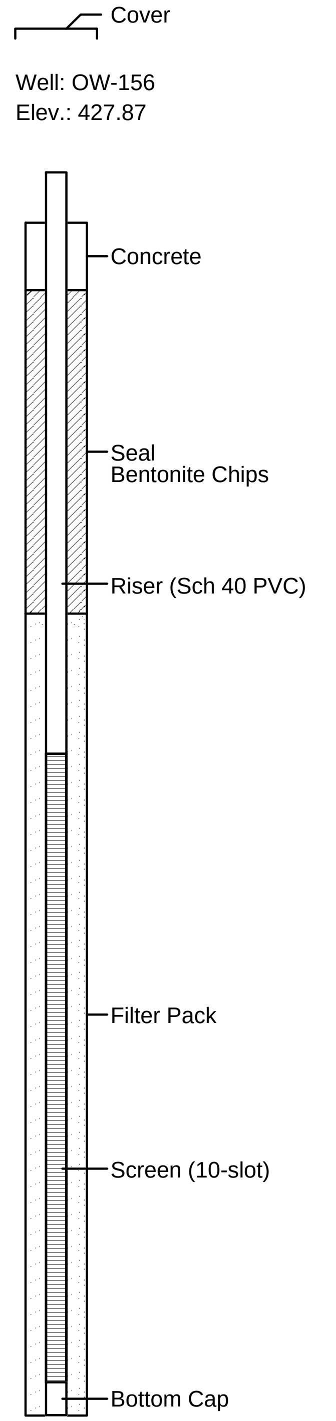
KELRON ENVIRONMENTAL Incorporated

LOG OF BORING OW-156

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 NW, NW, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	425.14
Sampling Method	: MacroCore (60")	Top of Casing Elevation:	427.87
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev.425.15	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY, stiff, medium brown, dry	425					
			1	32/48	2.5		
			2		1.5		
			3		3.5		
			4		1.75		
5	- stiff to very stiff, low plasticity	420	5	56/60	2.0		
			6		1.75		
	- dark gray-brown (10YR 3/3) with light brown mottling (10YR 6/3)		7		1.75		
			8		1.75		
			9		2.25	CL	
10	CLAY (lean) with Sand, soft to medium, light brown (10YR 6/3) with brown-yellow mottling (10YR 6/6), moist	415	10	60/60	1.0		
			11		1.5		
			12		1.75		
			13		1.75		
			14		1.5		
15		410	15	50/60	2.25		
			16		2.0		
			17		2.5		
	END BOREHOLE AT 17.7 FEET BLS		18		1.25		
	Terminated probing with MacroCore at 19.5 feet bls		19				
20							



KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING OW-157

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SW, SW

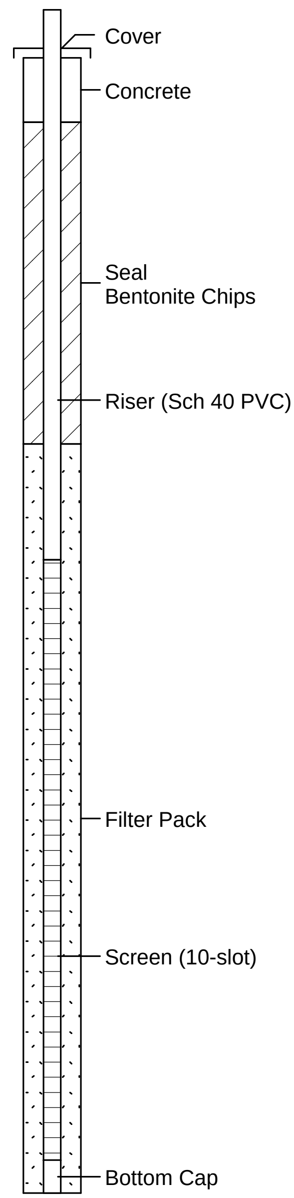
Date Completed	: 09/9/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	432.64
Sampling Method	: MacroCore (60")	Top of Casing Elevation	429.90
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2382593, 556189

Depth in Feet: 0, 5, 10, 15, 20

Surf. Elev. 429.90: 429, 424, 419, 414

DESCRIPTION	Samples	Recovery inches	Qp TSF	USCS
SILTY CLAY with Fly Ash, dark gray-brown, dry	1	48/48		CL/FL
CLAY with Silt, hard, medium plasticity, light olive brown, moist	2	60/60		CH
CLAY with Sand, stiff, wet				CL
CLAY, trace to some Sand, very stiff to hard, medium to high plasticity	3	60/60		CL/CH
END BOREHOLE AT 17.5 FEET BLS	4	60/60		
Terminated probing with MacroCore at 19.5 feet bls				

Well: OW-157
Elev.: 432.64



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

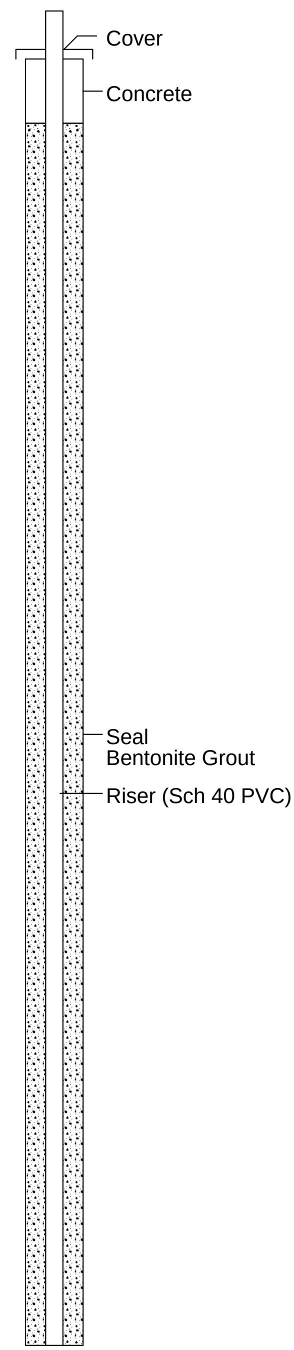
Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet: 0, 5, 10, 15, 20
Surf. Elev. 428.74: 425, 420, 415, 410

DESCRIPTION	USCS
FILL - Silt with clay, organics (roots), stiff, non-plastic, light yellowish brown (10YR 6/4), dry	FL/CL
SILT with clay, roots, hard, brownish yellow (10YR 6/6)	ML
Silty CLAY with roots, very stiff, medium plasticity, with reddish-brown mottling and manganese staining, moist - medium hardness, medium to high plasticity, light brownish gray (10YR 6/2) with mottling and manganese staining	CL
SILT, stiff, non-plastic, brownish yellow (10YR 6/6) - with clay, very soft, medium plasticity, wet	ML
Silty CLAY, stiff to very stiff, high plasticity, light brownish gray (10YR 6/2) with reddish brown and black mottling grading to light gray, moist	CL
SILT, very soft, non-plastic, light brownish gray (10YR 6/2) - wet	ML
Silty CLAY, stiff, medium plasticity, gray (10YR 6/1), moist - soft to medium hardness, high plasticity, yellowish brown (10YR 5/6) - <25% mottling	CL

Samples	Recovery inches	Qp TSF
1	38/42	2.75
2		>4.5
3		3.0
4	60/60	2.0
5		2.0
6		2.25
7		2.5
8		1.75
9	60/60	1.0
10		2.5
11		1.0
12		0.75
13		2.0
14	60/60	1.5
15		1.25
16		1.5
17		1.25
18		2.25
19	60/60	2.0
20		1.0

Well: MW-161
Elev.: 431.27



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC161.BOR

KELRON ENVIRONMENTAL
Incorporated

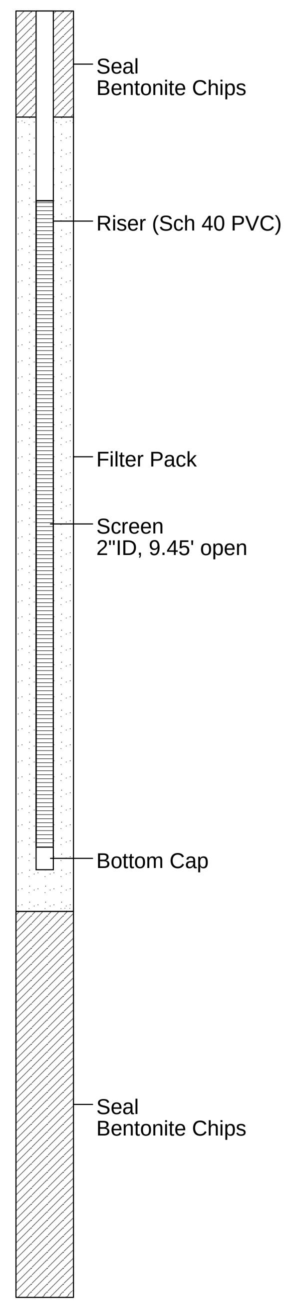
LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS
20			20		1.0	CL
	SILT with clay, stiff, low plasticity, brownish yellow (10YR 6/8)		21		2.0	ML
	- soft, yellowish brown (10YR 5/4), wet		22		2.0	
	Silty CLAY, stiff, low to medium plasticity, pale brown (10YR 6/3) with reddish-brown mottling, moist		23		1.0	CL
	- soft to very soft, high plasticity, light yellowish brown - brown (10YR 5/3) with <10% reddish brown mottling	405	24	60/60	0.75	
25			25			
			26			
	- with fine sand		27		1.0	
			28			
	SAND with Silt, fine grained, gray-brown, wet	400	29	53/60		SP/SM
30			30			
	<Sample MC161-32 @ 31.5-32.5'> grain size analysis: 89.8% Sand, 10.2% Silt		31			
	- pale green (Gley1 5G 6/2)		32			
	CLAY (lean), trace fine-medium sand, hard, low plasticity, greenish-gray (10GY 5/1), moist [TILL]		33		3.0	CL
	- medium to stiff, medium to high plasticity	395	34	60/60	2.5	
35			35		1.25	
			36		1.5	
			37		1.75	
			38		3.0	
	- trace sand, stiff to hard	390	39	44/60	2.0	
40			40		1.5	

Well: MW-161
Elev.: 431.27



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Well: MW-161
Elev.: 431.27

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS
40			40		1.5	CL
			41		2.0	CL
			42		1.5	CL
	Sandy SILT, medium hardness, non-plastic					ML
	Silty CLAY with shale and fine-coarse limestone gravel (rounded to sub-rounded up to 1.5"), stiff to very stiff, greenish gray (Gley1 10Y 5/1)	385	43		2.0	CL
			44	14/14	>4.5	CL
	SHALE, laminated, hard, weathered (top of bedrock = 44.3' bls)					SH
45	END BOREHOLE AT 44.7 FEET BLS Refusal of Macrocore and Auger on top of competent bedrock					
		380				
50						
		375				
55						
		370				
60						

Seal
Bentonite Chips

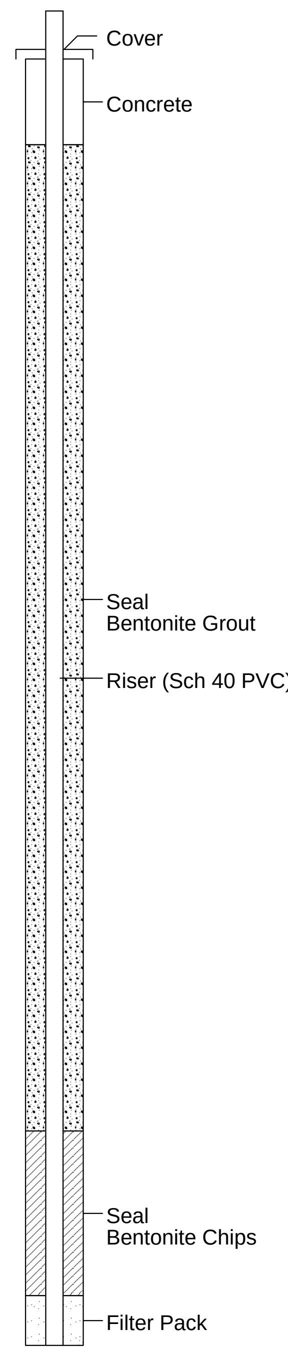
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-162 (Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous Boring - no soil sampling conducted. Descriptions of subsurface materials on this log are from adjacent boring log for well MW-262.	430					
	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry					CL	
	- brownish yellow (10YR 6/6), moist						
5	- medium stiff, high plasticity	425					
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]					ML	
10	- clayey, soft to medium hardness, low to medium plasticity	420					
	- soft, yellowish brown (10YR 5/4)						
	- non-plastic						
15							

Well: MW-162
Elev.: 433.20



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC162.BOR

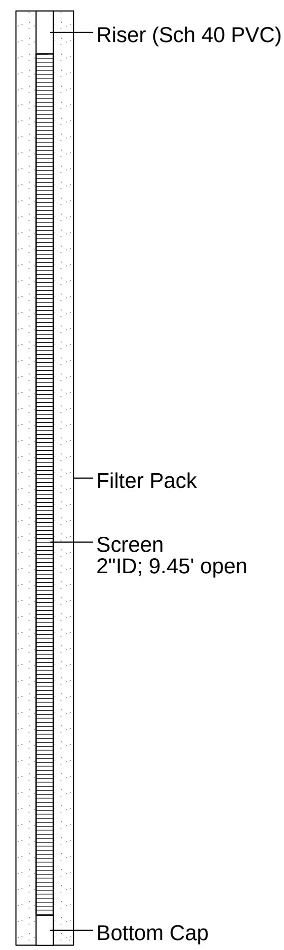
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-162 (Page 2 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
15		415				ML	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist					CL	
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist						
20		410				ML	
	Silty CLAY, very soft, low plasticity - medium plasticity, wet					CL	
25		405					
	END BOREHOLE AT 25.9 feet BLS						
30							

Well: MW-162
Elev.: 433.20



APPENDIX C2

PZ 100 SERIES BORING LOGS AND WELL DETAILS

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-169

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/27/2015	7/28/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-169	Feet (NAVD88)	420.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,323.57 N, 2,381,764.94 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 49.0632"
Long -89° 52' 12.9108"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15.5	4 9 10 11	0	0 - 0.2' **SILT:** ML, dark grayish brown (10YR 4/2), trace roots and clay, very soft (<0.25 tsf), dry.	ML								
			1	0.2 - 2' **SILTY CLAY** CL/ML, brown (10YR 5/3), cohesive, nonplastic to low plasticity, dry.	CL/ML								
2 ST	24 22		2	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 21	2 3 6 6	4	4 - 10' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/6), trace brown (10YR 5/3) and gray (10YR 6/1) mottling, cohesive, nonplastic to low plasticity, stiff to very stiff (1.0-2.5 tsf), dry to moist.	CL/ML								
4 SS	24 20	2 3 5 7	6										
5 SS	24 24	2 3 4 5	8	8' - 10' dark grayish brown (10YR 4/2), very dark brown (10YR 2/2) mottling, trace dark yellowish brown (10YR 6/3), cohesive, moist. 8.9' dark brown (10YR 3/3) mottling.									
6 SS	24 23	1 3 4 5	10	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML, dark yellowish brown (10YR 3/6), trace yellowish brown (10YR 5/6) mottling, decreasing silt content with depth, moist. 10.3' trace wood pieces. 11.4' - 11.7' trace very dark brown (10YR 2/2) mottling.	CL/ML								
7 ST	24 24		12	12 - 14' Shelby Tube Sample.									ST7: 24" push at 400lbs of pressure.
			14										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 22	2 4 5 6	14–16	14 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 3/6), grades to gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, trace very dark brown (10YR 2/2) mottling, silt (5-30%), cohesive, low to medium plasticity, stiff to very stiff (1.5-3.5 tsf), moist.	CL									
9 SS	24 22.5	2 3 5 5	16–18	16' - 19.9' dark yellowish brown (10YR 3/6) and yellowish brown (10YR 5/6) mottling.	CL									
10 SS	24 23	1 4 4 4	18–20	18' trace dark yellowish brown (10YR 6/3) mottling, trace silt, softer with depth. 18.8' trace very fine and coarse sand.	CL									
11 SS	24 21	1 3 4 4	20–22	20 - 22' **SILTY CLAY** CL/ML, gray (10YR 6/1), dark yellowish brown (10YR 3/6) and trace very dark brown (10YR 2/2) mottling, trace to few very fine sand seams, cohesive, nonplastic to low plasticity, stiff to very stiff (1.75-2.5 tsf), moist. 21' trace very fine sand seams.	CL/ML									
12 ST	24 25		22–24	22 - 24' Shelby Tube Sample.										ST12: 24" push at 150lbs of pressure, wet tube (free water)
13 SS	24 24	1 2 3 5	24–26	24 - 28' **LEAN CLAY WITH SAND:** s(CL), pale brown (10YR 6/3), trace brownish yellow (10YR 6/6) mottling, very fine sand, trace coarse sand, trace silt, cohesive, soft, moist to wet.	s(CL)									
14 SS	24 24	1 1 2 4	26–28		s(CL)									
15 SS	24 21.5	4 6 8 10	28–30	28 - 30' **SILTY CLAY** CL/ML, gray (10YR 5/1), trace strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling, very fine sand (10-20%), trace coarse sand and fine gravel, stiff to hard (1.25->4.5 tsf), moist to wet (on bottom).	CL/ML									
16 SS	24 21	3 7 9 14	30–32	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) and yellowish brown (10YR 5/6) mottling, silt (15-25%), trace very fine to fine gravel, cohesive, medium to high plasticity, very stiff (2.5-4.0 tsf), moist. 30.2' small dark brown (10YR 3/3) fragments (possible shale).	CL									
17 SS	24 20	4 6 10 13	32–34	32 - 38' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (5-15%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), dry to moist (increasing moisture content with depth). 33.1' - 33.3' dark gray (10YR 4/1).	CL									
18 SS	24 17	4 6 13 16	34–36	34' - 35.4' no coarse sand, moist.	CL									
19 SS	11 11	5 50 for 5"	36–37	36' - 37' low plasticity, moist (decreasing moisture content with depth).	CL									subangular gravel in shoe of sample SS19

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
					CL									
20 SS	24 0	13 20 23 25	38	38 - 40' No Recovery.										
21 SS	18 6	16 35 50 for 6"	40	40 - 42' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (0-10%), subrounded to subangular gravel (5-10%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), moist to wet.	CL									
			42	42' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-170

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/29/2015	7/29/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-170	Feet (NAVD88)	418.58 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,822.69 N, 2,381,944.92 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 44.106"
Long -89° 52' 10.6752"

Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 8	4 5 6 9	0–2	0 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (15-25%), trace roots, grass, gravel, and coarse sand, cohesive, nonplastic to low plasticity, hard (>4.5 tsf), dry.	CL/ML									
2 ST	24 / 21		2–4	2 - 4' Shelby Tube Sample.										ST2: 24" push at 500lbs of pressure.
3 SS	24 / 15	2 3 5 7	4–6	4 - 8' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, low plasticity, very stiff to hard (2.5->4.5 tsf), dry.	CL/ML									
4 SS	24 / 17	3 5 8 8	6–8	6' - 7.4' trace gray (10YR 5/1) mottling.										
5 SS	24 / 17	3 4 6 6	8–10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, silt content decreases with depth, clay content increases with depth, medium plasticity, very stiff (3.25 tsf), dry.	CL/ML									
6 SS	24 / 20	3 4 5 5	10–12	10 - 12' **LEAN CLAY:** CL, brown (5YR 4/3), trace very dark brown (10YR 2/2) mottling, trace silt, silt content increasing with depth, medium to high plasticity, stiff (1.75-2.0 tsf).	CL									
7 ST	24 / 24		12–13	12 - 14' Shelby Tube Sample.										ST7: 24" push at 250lbs of pressure.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-170

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				12 - 14' Shelby Tube Sample. *(continued)*									
8 SS	24 21	3 5 7 8	14	14 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-20%), trace gravel, cohesive, low plasticity, stiff to very stiff (1.0-3.0 tsf), dry to moist. 14.9' - 15.3' very dark brown (10YR 2/2) mottling.	CL/ML								
9 SS	24 24	2 4 4 6	16	16' - 18.5' increaed very dark brown (10YR 2/2) mottling (5-15%), very fine sand (0-10%), trace fine gravel, subangular, cohesive, low to medium plasticity, dry to moist. 16.8' - 17.1' very dark brown (10YR 2/2) mottling.									
10 SS	24 24	1 3 3 3	18	18' - 20' silt (15-25%), very fine sand (0-10%), trace fine gravel, medium plasticity, moist. 19' layer of gravel (2" thick, subangular to subrounded).									
11 SS	24 20	1 2 5 7	20	19.8' very soft (0.25 tsf). 20' - 24' subangular to subrounded gravel, low plasticity, dry to moist. 20.8' increased gravel content (10-15%). 21.2' decrease in gravel content (5-15%).									
12 SS	24 20.5	3 6 8 10	22										
13 ST	24 24		24	24 - 26' Shelby Tube Sample.									ST13: 24" push at 650lbs of pressure.
14 SS	24 22	3 6 12 14	26	26 - 28.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-30%), very fine sand (0-15%), trace fine subangular to subrounded gravel, gravel decreases with depth to no gravel, trace <1mm thick very fine sand seams, cohesive, low to medium plasticity, plasticity increasing with depth, very stiff to hard (2.0->4.5 tsf), moist, decreasing silt and sand content with depth.	CL/ML								
15 SS	24 22	9 17 24 35	28	28.2 - 30' **LEAN CLAY:** CL, very dark gray (2.5Y 3/1), trace silt, cohesive, medium to high plasticity, hard (>4.5 tsf), dry. 28.5' black (2.5Y 2.5/1). 28.9' greenish gray (GLEY 1 6/1).	CL								
16 SS	17 13	11 30 50 for 5"	30	30 - 31.1' **SHALE:** to **LEAN CLAY:** BDX (SH), greenish gray (GLEY 1 6/1), trace silt, cohesive, medium to high plasticity, dry, shale (residual soil to highly decomposed, very weak, fissile).	BDX (SH)								
			31	31.1' End of Boring.									Hollow Stem Auger Refusal at 31.1 ft bgs on Shale Bedrock.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-171

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/30/2015	7/31/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-171	Feet (NAVD88)	431.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,453.57 N, 2,379,199.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.542"
Long -89° 52' 45.0804"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 5 4 4	0–2	0 - 2' **SILT:** ML, brown (7.5YR 4/3), 5-15% clay, trace roots, cohesive, nonplastic, dry. 0.7' increase in clay content (15-25%).	ML								
2 ST	24 24		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 250lbs of pressure.
3 SS	24 18	1 3 3 3	4	4 - 10.8' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, low to medium plasticity, medium to stiff (0.5-1.75 tsf), moist.	CL/ML								
4 SS	24 24	1 3 3 5	6	6' low plasticity.									
5 SS	24 17	1 2 3 3	8	7.7' silt (25-35%), trace very fine sand, nonplastic to low plasticity. 8' silt (5-15%), medium plasticity.									
6 SS	24 24	2 2 3 4	10	10' silt (20-50%), silt content increasing with depth, moist.									
			10.8–12	10.8 - 12' **CLAYEY SILT** ML/CL, clay (30-50%), medium (0.5-0.75 tsf), moist.	ML/CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-171

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 ST	24 26		12–14	12 - 14' Shelby Tube Sample.									ST7: 24" push at 200lbs of pressure.
8 SS	24 24	2 3 3 5	14–16	14 - 20' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (30-40%), cohesive, low to medium plasticity, medium to stiff (0.75-2.0 tsf), moist.	CL/ML								
9 SS	24 24	2 3 5 5	16–18										
10 SS	24 20	1 3 5 8	18–20	17.4' - 19.7' dark yellowish brown (10YR 4/4), brown (10YR 5/3) mottling, clay (20-30%), cohesive, nonplastic, moist.									
11 ST	24 16		20–22	20 - 22' Shelby Tube Sample.									ST11: 24" push at 350lbs of pressure.
12 SS	24 21	1 1 2 2	22–24	22 - 26' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, low to medium plasticity, very soft to medium (0.25-1.0 tsf), moist. 22.8' - 23' sandy clay layer, very fine sand, wet.	CL/ML								
13 SS	24 17	WOR 1 2 3	24–26	24' - 26' silt (5-15%), medium to high plasticity, moist.									WOR = Weight of Rods
14 SS	24 24	1 1 2 2	26–28	26 - 28' **SILTY CLAY** to **SANDY LEAN CLAY:** CL/ML, yellowish brown (10YR 5/4), very fine sand (30-50%), increasing sand content with depth, silt (20-40%), decreasing silt content with depth, clay content decreasing with depth, cohesive, nonplastic to low plasticity, decreasing plasticity with depth, wet.	CL/ML								
15 SS	24 21.5	1 3 7 10	28–30	28 - 28.7' **CLAYEY SILT** to **POORLY-GRADED SAND:** ML/CL, yellowish brown (10YR 5/4), clay (10-20%), fine sand (10-20%), cohesive, nonplastic, wet. 28.7 - 36.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), fine sand, silt (5-15%), clay (5-15%), medium and coarse grained sand (5-10%), wet.	ML/CL SP								
16 SS	24 24	4 4 3 4	30–32	30' trace clay, trace medium and coarse sand.									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-171

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 21.5	5 9 15 20	33	28.7 - 36.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), fine sand, silt (5-15%), clay (5-15%), medium and coarse grained sand (5-10%), wet. *(continued)* 32' - 33.8' sand grading from fine to very fine with depth.	SP									
18 SS	24 22	5 15 19 22	34, 35											
19 SS	24 22	4 4 5 6	36, 37	36' - 36.6' increase in silt content with depth (5-15%). 36.4' clay layer (2mm thick). 36.5' clay layer (2mm thick).										
			38	36.6 - 38' **LEAN CLAY:** CL, dark gray (2.5Y 4/1) to very dark gray (2.5Y 3/1), trace silt, trace fine sand seams, high plasticity, stiff (1.5-1.75 tsf), moist.	CL									
				38' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-172

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/31/2015	7/31/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-172	Feet (NAVD88)	410.22 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,323.28 N, 2,379,176.11 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 29.3676" Long -89° 52' 45.4188"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	3 6 5 4	0	0 - 0.5' **FILL, TOPSOIL:** ML, dark grayish brown (10YR 4/2), trace clay, gravel, roots, and grass, noncohesive, dry. 0.4' angular gravel.	(FILL) ML						
			0.5	0.5 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), very dark brown (10YR 2/2) and strong brown (7.5YR 4/6) mottling, silt (5-15%), trace fine sand, cohesive, low plasticity, dry.	CL/ML						
2 ST	24 17		2	2 - 4' Shelby Tube Sample.							ST2: 24" push at 500lbs of pressure.
3 SS	24 19	2 3 4 6	4	4 - 9.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), increased very dark brown (10YR 2/2) and strong brown (7.5YR 4/6) mottling, silt (5-15%), trace fine sand, cohesive, medium plasticity, very soft to very stiff (0.25-2.5 tsf), moist.	CL/ML						
4 SS	24 22	2 2 4 8	6	6' silt (10-20%), low to medium plasticity.							
5 SS	24 20	1 3 5 9	8	8' decreased mottling, trace brown silt seams, silt content increasing with depth (20-50%).							
			9.2	9.2 - 10' **SILT:** ML, brown (7.5YR 4/4), clay (5-15%), cohesive, nonplastic, moist.	ML						
6 ST	24 16		10	10 - 12' Shelby Tube Sample.							ST6: 24" push at 450lbs of pressure.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-172

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	1 1 3 4	12–13	12 - 18' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), cohesive, nonplastic to low plasticity, stiff to very stiff (1.25-2.75 tsf), moist.	CL/ML						
			13–14	13.3' soft (0.5 tsf).							
8 SS	24 24	2 3 4 7	14–16								
9 SS	24 22.5	2 4 4 6	16–18	15.8' hard (4.0 tsf). 16.6' - 16.8' increased very dark brown (10YR 2/2) mottling.							
10 ST	24 22		18–20	18 - 20' Shelby Tube Sample.							ST10: 24" push at 350lbs of pressure.
11 SS	24 23	1 3 3 3	20–21	20 - 21' **SANDY LEAN CLAY:** s(CL), dark gray (10YR 4/1), with clay seams, trace yellowish brown (10YR 5/8 mottling), cohesive, nonplastic, wet, clay seams (medium to high plasticity).	s(CL)						
			21–22	21 - 22' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, mostly yellowish brown (10YR 5/8) with some dark gray (10YR 4/1), silt (>15%), cohesive, nonplastic.	s(CL)g						
12 SS	14 12	1 2 50 for 2"	22–24	22 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/8) with dark gray (10YR 4/1) mottling, sand (5-15%), cohesive, low plasticity.	CL/ML						
13 SS	22 18	15 14 18 50 for 4"	24–26	24 - 26' **LEAN CLAY:** CL, trace gravel, hard (4.5 tsf), cohesive, dry.	CL						
14 SS	2 2	50 for 2"	26–26.2	26 - 26.2' **SHALE:** BDX (SH), clay (5-15%). 26.2' End of Boring.	BDX (SH)						

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-173

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/3/2015	8/3/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-173	Feet (NAVD88)	388.43 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,035.38 N, 2,379,187.28 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 26.52"
Long -89° 52' 45.2892"

Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 0		0–2	0 - 2' No Recovery. Gravel Pad.	(FILL)								
2 SS	24 13	2 2 2 3	2	2 - 10.9' **SILTY CLAY** CL/ML, dark grayish brown (10YR 4/2), trace sand and wood, cohesive, medium plasticity, very stiff (2.5-3.5 tsf), moist.	CL/ML								
3 SS	24 7	2 5 4 5	4	4' yellowish red (5YR 4/6) mottling.									
4 SS	24 20	2 4 8 9	6	6' - 7.7' yellowish brown (10YR 5/6) with dark gray (10YR 4/1) mottling, hard, laminated, dry.									
5 SS	24 19	2 4 6 8	8	8.2' very dark gray (10YR 3/1), trace dark yellowish brown (10YR 4/6) mottling, small hard nodules of clay in the matrix, dry to moist.									
6 SS	24 18	2 3 6 7	10	10.6' olive (5Y 5/6) with bluish gray (GLEY2 5/2) mottling.									
			11	10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist.	ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-173

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	22 16	2 5 15 50 for 4"	13	10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist. *(continued)* 12' - 13.3' trace brown (7.5YR 4/4) mottling, trace gravel, trace sand, increasing sand and gravel with depth. 12.6' wet. 12.8' clay (0-15%).	ML									
8 SS 9 SS	2 0 1 1	50 for 2" 50 for 1"	14	13.8 - 14.1' **BEDROCK** BDX (SH), wet. 14.1' End of Boring.	BDX (SH)									Hollow Stem Auger Refusal at 13.5 ft bgs on Bedrock. SS8: Rock chips in spoon. Split Spoon Refusal at 14.1 ft bgs on Bedrock.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-174

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/4/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-174	Feet (NAVD88)	398.97 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,666.23 N, 2,379,774.23 E E/W (W circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 22.8552"
Long -89° 52' 37.9524"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 5	2 3 5 3	0–2	0 - 2' **TOPSOIL:** ML, brown (10YR 4/3), trace grass and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 0	2 2 2 4	2–4	2 - 4' No Recovery.									
3 SS	24 6	2 2 4 5	4	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist.	CL								
4 SS	24 6	4 4 5 7	6										
5 SS	24 23	3 4 5 5	8	8' - 9.9' increased yellowish brown (10YR 4/4) mottling, increase in silt content with depth (50%).									
6 SS	24 20	2 4 8 6	10	10' - 11.7' decrease in silt content with depth (10-20%). 10.6' - 11.2' dark yellowish brown (10YR 4/4) and very dark brown (10YR 2/2) mottling (50%), dry to moist.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-174

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 SS	24 21	2 3 5 7	13	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist. *(continued)* 12' - 13.8' trace coarse sand, dry.										
8 SS	24 21	2 4 5 8	14 15	14' - 15.8' increased sand content, trace gravel, dry.										
9 SS	24 24	2 4 5 7	16 17	16' - 18' yellowish brown (10YR 5/4), moist.										
10 SS	24 24	3 7 9 12	18 19	18' - 20' coarse sand and gravel (5-15%), moist.	CL									
11 SS	24 24	3 7 9 15	20 21											
12 SS	24 24	4 7 8 10	22 23											
13 SS	8 8	11 50 for 2"	24	24' - 24.7' decreased moisture content with depth.										Hollow Stem Auger Refusal at 24.7 ft bgs on Shale Bedrock.
				24.7' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		PZ-175	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Chad Dutton Bulldog Drilling	8/7/2015	8/7/2015	hollow stem auger
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
PZ-175	Feet (NAVD88)	419.87 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,433.02 N, 2,380,846.31 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 20.5152"
Long -89° 52' 24.5316"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	4 7 5 4	0–1	0 - 0.9' **SILT:** ML, brown (10YR 5/3), trace roots and grass, noncohesive, nonplastic, hard (3.0->4.5 tsf), dry.	ML								
2 SS	24 15	2 4 4 6	1–3	0.9 - 5.4' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), black (10YR 2/1) mottling, silt (5-15%), dry, cohesive, low plasticity, very stiff (2.5-3.0 tsf). 2' dry, increase in moisture content with depth, trace brown (10YR 5/3) silt seams.	CL								
3 SS	24 17	2 3 4 6	4–5	4' increased brown (10YR 5/3) and black mottling (10YR 2/1), moist.									
4 SS	24 23	2 2 4 4	6–7	5.4 - 13.5' **SILT:** ML, light yellowish brown (10YR 6/4), trace dark gray (10YR 4/1) mottling, clay (5-15%), moist, cohesive, nonplastic, medium to stiff (0.5- 1.5 tsf).	ML								
5 SS	24 22	1 2 3 3	8–9	8' decreased mottling.									
6 SS	24 24	1 2 2 2	10–11	10' brown (7.5YR 4/4), no mottling.									
7 SS	24 23	1 2 3 4	12–14	12' increasing clay content with depth, low plasticity.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-175

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 21	1 3 4 5	15	13.5 - 22.3' **LEAN CLAY:** CL, brown (7.5YR 4/4), silt (5-15%), moist, cohesive, low to medium plasticity, stiff to very stiff (1.5-4.0 tsf) increasing with depth. *(continued)* 14' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, trace silt.	CL									
9 SS	24 24	2 3 4 4	16 17	16' brown (7.5YR 5/4), silt (5-15%).										
10 SS	24 23	1 4 6 6	18 19	18' trace black (10YR 2/1) and dark gray (5-50% 10YR 4/1) mottling, trace silt, silt content decreasing with depth, wet.	CL									
11 SS	24 23	2 5 7 7	20 21	20' no black (10YR 2/1) mottling, yellowish brown (5-15% 10YR 5/8) mottling.										
12 SS	24 24	3 3 4 4	22 23	22.3 - 26' **SILT:** ML, clay (5-15%), trace coarse sand, decrease in clay content with depth, moist, cohesive, nonplastic, very soft to very stiff (<0.25-3.0 tsf) decreasing with depth.										
13 SS	24 24	2 2 2 3	24 25	23.9' sandy silt seam (2" thick), wet. 24' some sandy and clayey silt seams, trace coarse sand to fine gravel, moist to wet in sandy silt seams.	ML									
14 SS	24 24	11 8 9 10	26 27	26 - 28' **LEAN CLAY:** to **SILT:** CL, silt (40-60%), coarse sand to fine gravel (5-15%), trace fine sand seams, moist, cohesive, low plasticity, stiff (1.5-2.0 tsf).	CL									
15 SS	24 24	8 11 15 20	28 29	28 - 28.4' **SANDY SILT:** s(ML), yellowish brown (10YR 5/4), wet, cohesive, nonplastic, stiff (1.5 tsf). 28.4 - 31.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), coarse sand to fine gravel (5-15%), trace fine sand seams, hard (>4.5 tsf), dry to moist.	s(ML)									
16 SS	24 24	9 19 20 23	30 31		CL									
17 SS	24 24	6 6 8 10	32 33	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, dark yellowish brown (10YR 4/6), dry. 31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. 32' trace yellowish brown (10YR 5/6) seams and mottling, medium to high plasticity, increasing moisture content with depth.	(SW)g									
18 SS	24 24	7 5 6 8	34 35	34' trace mottling, moist, decreasing moisture content with depth.	CL									
19 SS	24 24	3 5 6 7	36 37	36' dry to moist, silty clay seam (4" thick, moist).										

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-175

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
20 SS	24 24	3 4 7 7	38 39	31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. *(continued)* 38' trace black (10YR 2/1) mottling. 38.3' yellowish brown (10YR 5/6) with gray (10YR 5/1) mottling.	CL									
21 SS	24 24	3 5 6 7	40 41											
22 SS	24 24	3 5 8 20	42 43	42' trace fine gravel.										
23 SS	24 20	3 11 12 14	44 45	43.8 - 45.7' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, brown (10YR 5/3), mostly broken rock, moist. 44' black (10YR 2/1) mottling, seams of wet gravel, coarse sand to coarse gravel.	s(CL)g									
24 SS	24 24	3 5 7 11	46 47	45.7 - 50' **LEAN CLAY:** CL, light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6) and dark gray (10YR 4/1) and black (10YR 2/1) mottling, trace fine gravel, some laminations, very stiff (2.5-3.5 tsf).	CL									
25 SS	24 24	4 7 12 20	48 49	48' moist to dry. 48.7' laminated, dry.										
26 SS	1 0	50 for 1"	50	50 - 50.2' **SHALE:** BDX (SH). 50.2' End of Boring.	BDX (SH)									Hollow Stem Auger Refusal at 50.2 ft bgs on Shale Bedrock.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-176

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/6/2015	8/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-176	Feet (NAVD88)	403.46 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,264.76 N, 2,381,381.02 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 18.834"
Long -89° 52' 17.8428"
Local Grid Location Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15	3 3 4 4		0 - 0.5' **TOPSOIL:** ML, dark grayish brown (10YR 4/2), clay (5-15%), trace grass and roots, cohesive, nonplastic, stiff (1.5 tsf), dry.	ML								
			1	0.5 - 2.4' **SILT:** ML, dark grayish brown (10YR 4/2), brownish yellow (10YR 6/6) and dark brown (10YR 3/3) mottling, clay (30-50%), trace roots, cohesive, low plasticity, very stiff (3.0 tsf), dry.	ML								
2 SS	24 16	3 3 5 5	2										
			3	2.4 - 6.3' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), dark gray (10YR 4/1) mottling, silt (5-15%), trace roots, cohesive, medium plasticity, moist.									
3 SS	24 9	2 3 4 4	4	4' increase in silt content (40-60%), dry to moist.	CL								
			5										
4 SS	24 21	3 3 3 4	6	6.3 - 12' **SILT:** ML, dark gray (10YR 4/1), cohesive, nonplastic, moist.									
			7										
5 SS	24 12	1 1 1 2	8	8' sand (0-40%), sand content increasing with depth, moist to wet.									
			9		ML								
6 SS	24 13	1 1 1 2	10	10' increase in sand content (40-60%).									
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-176

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 SS	24 20	1 2 3 5	13	12 - 12.3' **WELL-GRADED SAND:** SW, very dark grayish brown (10YR 3/2), fine gravel (>15%), moist. / 12.3 - 16' **LEAN CLAY:** CL, gray (10YR 5/1), brownish yellow (5-15% 10YR 6/6) and trace very dark brown (10YR 2/2) mottling, silt (5-15%), trace sand seams, cohesive, medium plasticity, stiff to very stiff (1.5-3.0 tsf).	SW									
8 SS	24	2 3 3 5	14, 15	14' increase in thickness of sand seams (1"-2" thick, moist, wet).	CL									
9 SS	24 17	2 4 7 10	16, 17	16 - 28.6' **LEAN CLAY:** CL, dark gray (10YR 4/1), light yellowish brown (10YR 6/4) mottling, cohesive, low plasticity, very stiff to hard (3.5->4.5 tsf) dry.										
10 SS	24 18	4 6 8 12	18, 19	18' increased mottling, mostly brown (10YR 5/3), brownish yellow (10YR 6/6), dark gray (10YR 4/1), and olive gray (5Y 5/2) mottling.										
11 SS	24 17	5 16 22 25	20, 21	20' olive gray (5Y 5/2), brownish yellow (10YR 6/6) mottling. 20.3' dark gray (2.5Y 4/1), brownish yellow (10YR 6/6) mottling, clay becoming blocky and laminated.										
12 SS	11 7	7 50 for 5"	22, 23	22' pale olive (5Y 6/3), dark gray (10YR 4/1) mottling, laminated.	CL									
13 SS	24 24	13 21 31 43	24, 25	24' brownish yellow (10YR 6/6) mottling.										At 23.6' rock fragment on bottom of split spoon. Refusal of split spoon.
14 SS	24 24	14 12 17 19	26, 27											
15 SS	8 8	9 50 for 2"	28	28' hard (4.5 tsf).										
16 SS	1 0	50 for 1"		28.6' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-177

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/5/2015	8/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-177	Feet (NAVD88)	417.93 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,192.18 N, 2,381,923.59 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.0996"
Long -89° 52' 11.0496"

Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 12	1 6 8 5	0–1	0 - 4' **TOPSOIL:** ML, dark yellowish brown (10YR 4/4), clay (5-15%), clay content increasing with depth, trace sand and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 4	4 4 6 7	2–3										
3 SS	24 17	2 3 4 5	4–5	4 - 19.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, silt (5-15%), moist, cohesive, medium plasticity, stiff to very stiff (1.0-3.5 tsf).	CL								
4 SS	24 23	1 2 4 4	6–7	6' dark yellowish brown (10YR 4/4), decreased mottling.									
5 SS	24 20	2 2 4 4	8–9	8' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling.									
6 SS	24 20	2 4 6 7	10–11										
7 SS	24 20	3 4 5 8	12–13	12' yellowish brown (10YR 5/4), yellowish brown (10YR 5/8) mottling, trace coarse sand to fine gravel, no black mottling.									
8 SS	24 23	3 3 6 7	14–15	14' trace black (10YR 2/1) mottling.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-177

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
9 SS	24 23	2 4 4 5	16–17	4 - 19.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, silt (5-15%), moist, cohesive, medium plasticity, stiff to very stiff (1.0-3.5 tsf). *(continued)* 16' increased gravel content.	CL									
10 SS	24 24	1 2 3 2	18–19											
11 SS	24	2 2 3 4	20–21	19.3 - 22' **SILT:** ML, yellowish brown (10YR 5/4), brownish yellow (10YR 6/8) mottling, clay (5-15%), trace sand, cohesive, nonplastic, soft (0.5 tsf), wet. 20' increase in clay content with depth (30-50%), trace gravel.	ML									
12 SS	24 16	2 4 13 11	22–23	22 - 29.7' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), strong brown (7.5YR 5/6) mottling, silt (5-15%), trace sand and gravel, stiff to hard (1.5->4.5 tsf) increasing with depth, moist to wet.	CL									
13 SS	24 24	3 4 7 9	24–25	24' sand (5-15%), moist. 24.5' - 25.3' black sand (0-15%).										
14 SS	24 24	4 6 11 13	26–27	26' no mottling, decreasing sand and gravel content with depth to trace, dry to moist, moisture content increases with depth, cohesive, low to medium plasticity, plasticity decreasing with depth.										
15 SS	24 22	5 7 15 50 for 5"	28–29	28' clay becoming laminated with depth. 28.7' brownish yellow (10YR 6/6), yellowish brown (10YR 5/4) mottling.										
16 SS	9 6	11 50 for 3"	30	29.7 - 30' **WELL-GRADED SAND:** SW, trace gravel and silt (noncohesive, nonplastic, rock flour), wet.	SW									
17 SS	1 1	50 for 1"		30 - 30.7' **SILTY GRAVEL:** GM, gravel is broken pieces of bedrock, silt is laminated, cohesive, and nonplastic. 30.7' End of Boring.	GM									Hollow Stem Auger Refusal at 30.7 ft bgs.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-178

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/5/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-178	Feet (NAVD88)	428.45 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,089.94 N, 2,382,460.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 17.0736"
Long -89° 52' 4.3248"
Local Grid Location Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 7 5 5		0 - 6.3' **SILT:** ML, brown (10YR 5/3), clay (10-20%), noncohesive, nonplastic, stiff to hard (1.5->4.5 tsf) decreasing with depth, dry.									
			1	1' - 1.3' cohesive, moist.									
2 SS	24 19	2 7 8 6	2	2' yellowish brown (10YR 5/4), clay (0-15%), brown and gray mottling (30-50%), dry to moist.									
			3		ML								
3 SS	24 18	2 4 6 8	4	4' dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/6) mottling, increasing clay content, moist.									
			5										
4 SS	24 23	2 3 4 5	6	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, silt (5-15%), moist, cohesive, medium plasticity.									
			7										
5 SS	24 23	1 3 3 4	8										
			9		CL								
6 SS	24 24	2 2 3 5	10	10' increased silt content.									
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] | Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-178

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 22	1 2 4 5	13	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, silt (5-15%), moist, cohesive, medium plasticity. *(continued)*									
8 SS	24 22	2 4 6 8	14, 15										
9 SS	24 22	3 4 6 7	16, 17	16' trace coarse sand.	CL								
10 SS	24 20	2 4 6 9	18, 19										
11 SS	24 24	2 4 7 6	20, 21	20 - 24.3' **LEAN CLAY:** to **SILT:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, clay (40-60%), silt (40-60%), trace coarse sand, cohesive, medium plasticity, moist.									
12 SS	24 24	1 2 5 4	22, 23	21.7' - 22' sand seam (mostly sand with silt). 23' interbedded sand (mostly fine to medium sand), silt and clay layers, wet.	CL								
13 SS	24 18	1 12 17 20	24, 25	24.3 - 26' **SANDY SILT:** s(ML), medium to coarse sand, moist, cohesive, nonplastic.	s(ML)								
14 SS	24 22	8 16 18 25	26, 27	26 - 26.3' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), mostly fine sand, trace medium sand and silt, wet. 26.3 - 43.5' **LEAN CLAY:** CL, fine to coarse sand (5-15%), trace gravel, yellowish brown (10YR 5/4), very stiff to hard (2.5->4.5 tsf), moist.	SP								
15 SS	24 22	7 8 9 11	28, 29	26.6' dark gray (10YR 4/1) mottling, silt (5-15%), increase in silt content with depth, trace very thin sand seams, trace black fine gravel, cohesive, nonplastic, dry. 28' - 28.6' wet in sand seams. 28.6' trace sand and silt, cohesive, medium to high plasticity, moist.	CL								
16 SS	24 19	4 7 9 13	30, 31, 32	30' trace fine gravel, no sand.									

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-178

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 17	4 5 16 22	33	26.3 - 43.5' **LEAN CLAY:** CL, fine to coarse sand (5-15%), trace gravel, yellowish brown (10YR 5/4), very stiff to hard (2.5->4.5 tsf), moist. *(continued)* 32' increased mottling, trace fine gravel, no sand. 33' brown (10YR 4/3), no mottling, no gravel, trace silt, cohesive, very stiff, dry.										
18 SS	24 20	10 21 25 37	34 35	34' brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-15%).										
19 SS	24 22	12 20 24 24	36 37	36' increase to yellowish brown (10YR 5/6) mottling (30-50%), trace coarse sand, becoming laminated with depth.										
20 SS	24	5 11 14 16	38 39	38.3' silt seam (very soft, wet), trace sand.	CL									
21 SS	24 24	5 10 13 17	40 41	39.6' dark gray grading to black with depth, trace olive yellow (2.5Y 6/6) mottling, silt (5-15%), dry to moist. 40' trace dark gray (10YR 4/1) and brownish yellow (10YR 6/8) mottling, no laminations, silt (5-15%), moist. 40.1' black seam (<0.25" thick).										
22 SS	17 17	7 16 50 for 5"	42 43	42' silt (30-50%), moist to dry, cohesive, nonplastic to low plasticity. 42.2' - 42.5' mostly silt seams [brownish yellow (10YR 6/6), dry]. 43.4' becoming laminated with depth.										
23 SS	1 0	50 for 1"		43.5' End of Boring.										Hollow Stem Auger Refusal at 43.5 ft bgs.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-182

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/29/2015	7/30/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-182	Feet (NAVD88)	428.47 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,433.70 N, 2,382,412.47 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.2432"
Long -89° 52' 4.836"

Local Grid Location
Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15	5 9 10 8	0–2	0 - 2' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), gravel (5-15%), cohesive, low to medium plasticity, dry. 0.9' - 2' yellowish brown (10YR 5/4), trace gray (10YR 6/1) mottling, silt (10-20%), medium to high plasticity.	CL/ML								
2 ST	24 23		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 550lbs.
3 SS	24 15.5	2 3 6 7	4–6	4 - 12' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), trace very dark brown (10YR 2/2) mottling, silt (5-15%) and gravel, trace sand, medium plasticity, medium to very stiff (0.75-2.75 tsf), moist.	CL/ML								
4 SS	24 20	3 4 5 6	6–8	6' - 7.7' low to medium plasticity. 7.2' increase in silt content (20-30%), increase in very fine sand content (5-15%).									
5 SS	24 23	1 3 3 4	8–10	9.3' sandy silt seams (sand is very fine).									
6 SS	24 20.5	1 3 4 4	10–12	9.9' sandy silt seams (sand is very fine). 10' - 12' medium plasticity.									
7 ST	24 21		12–14	12 - 14' Shelby Tube Sample.									ST7: 24" push.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-182

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			14	12 - 14' Shelby Tube Sample. *(continued)*									
8 SS	24 21	3 4 5 7	14–15	14 - 22' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), trace very dark brown (10YR 2/2) mottling, silt (10-20%), gravel (5-15%), trace sand, low to medium plasticity, medium to very stiff (0.75-3.0 tsf), moist.	CL/ML								
9 SS	24 22	3 4 6 7	16–17	16' color grades to grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling, medium plasticity. 16.3' - 17.4' very dark brown (10YR 2/2) mottling.									
10 SS	24 24	3 4 6 7	18–19	18.4' trace coarse sand and subangular fine gravel.									
11 SS	24 17	1 4 5 7	20–21	20' 0-10% sand. 21.1' pocket of weak red (10R 5/4), medium sand (1" diameter).									
12 ST	24 20		22–23	22 - 24' Shelby Tube Sample.									ST12: 24" push at 200lbs.
13 SS	24 20	1 1 4 5	24–25	24 - 27' **SILTY CLAY** CL/ML, brown (10YR 5/3), trace very dark brown (10YR 2/2) mottling, silt (20-30%), gravel (5-15%), very fine to fine sand (10-20%), cohesive, medium to high plasticity, medium (0.5-0.75 tsf), moist to wet. 24.5' - 25.6' yellowish brown (10YR 5/6), grayish brown (10YR 5/2) mottling, trace subrounded gravel.	CL/ML								
14 SS	24 24	6 10 11 12	26–27	25.4' black (10YR 2/1) gravel (shale, 1" diameter), sand content increasing with depth. 26' decrease in very fine sand content 5-15%, medium plasticity, wet. 26.6' seam of coarse sand and fine gravel. 26.7' very stiff (3.0 tsf).									WOR = Weight of Rods.
15 SS	24 18	WOR 2 6 9	27–29	27 - 29.1' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/6), trace silt, clay, and fine gravel, wet. 28' - 28.1' increase in very fine sand content.	SW								
			29–30	29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, yellowish brown (10YR 5/6), well-graded sand (10-20%), subangular fine gravel (5-15%), trace silt, wet.	s(CL)g								
16 SS	24 16	6 12 15 19	30–31	30 - 34' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) mottling, silt (20-30%), gravel (5-15%), very fine to fine sand (10-20%), cohesive, low to medium plasticity, stiff to very stiff (1.25-4.0 tsf), moist to wet.	CL/ML								
17 SS	24 10	16 15 19 26	32–34	30.8' - 31.1' layer of coarse sand and subangular fine gravel, clay (50%). 32' - 34' silt (10-20%), subangular gravel (5-10%), very fine sand (5-10%), sand and gravel content decreasing with depth, medium to low plasticity. 32.7' - 32.9' very dark gray (2.5Y 3/1), trace silt, high plasticity, dry.									
			34	34' End of Boring.									

APPENDIX C3

TPZ 100 SERIES BORING LOGS AND WELL DETAILS

KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-158

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

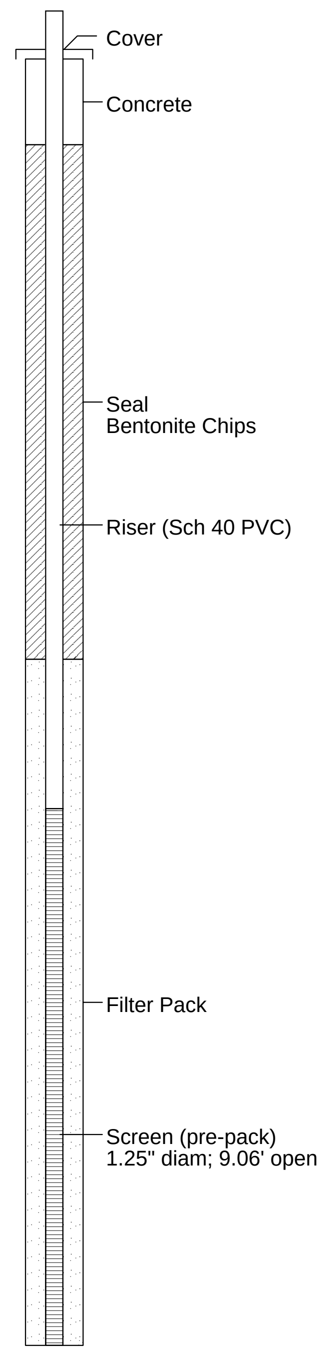
Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	USCS
0	Silty Loam with roots, stiff, non-plastic, pale brown (10YR 6/3), dry - dark brown (10YR 3/3)		CL
	Silty CLAY, very stiff, low plasticity, gray (10YR 5/1) with yellowish-brown mottling, moist	450	CL
5	- 25-50% mottling w/ black oxidation staining - high plasticity, <25% mottling	445	
10	- trace fine-medium sand, brownish yellow mottling (10YR 6/8) - trace fine-coarse sand and fine gravel (angular to sub-angular) - few to little sand and gravel, very stiff, 50-75% mottling	440	
15	- high plasticity		

Samples	Recovery inches	Qp TSF
1	60/60	2
2		2.75
3		3.75
4		3.5
5		4.5
6	60/60	2.5
7		2.5
8		1.25
9		1.25
10		1.75
11	60/60	1.75
12		3.5
13		2.25
14		2.75
15		2.5

GRAPHIC

Well: TPZ-158
Elev.: 456.26



KELRON ENVIRONMENTAL
Incorporated

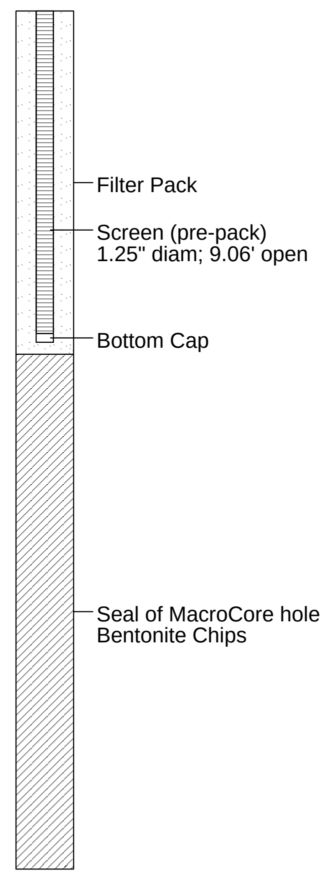
LOG OF PROBEHOLE TPZ-158

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Well: TPZ-158
Elev.: 456.26

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	Samples	Recovery inches	Qp TSF	USCS
15	- high plasticity		16	60/60	1.0	CL
	- trace fine to medium sand, soft, light gray (10YR 6/1) with 50-75% brownish-yellow mottling		17		0.75	CL
	Sandy CLAY (fine to medium sand) with trace fine-coarse gravel (<1"), very soft		18		- -	CL
	SAND, fine to coarse, well graded, brownish-yellow (10YR 6/8), wet	435				SW
	Sandy CLAY (fine-coarse sand) with gravel, hard, non-plastic, moist		19		>4.5	CL
20	Silty CLAY with trace sand and gravel, hard, medium to high plasticity, very pale brown (10YR 7/3)		20		>4.5	CL
	- very soft, high plasticity		21	60/60	<0.5	CL
	SAND, fine to coarse, well graded, yellowish-brown (10YR 5/8), wet		22		- -	SW
			23		- -	SW
		430	24		- -	SW
	Silty CLAY with trace fine to coarse sand, hard, brownish-yellow (10YR 6/6), moist		25		4.0	CL
25	SHALE, weathered, gray (10YR 6/1), dry at 24.75' - platy/laminated, dark gray (10YR 4/1), at 24.9' - top of bedrock = 24.75' bls					SH
	END BOREHOLE AT 25 FEET BLS					
		425				
30						



KELRON ENVIRONMENTAL
Incorporated

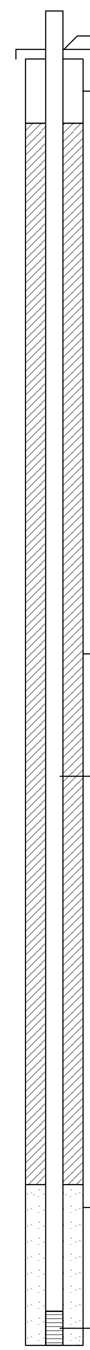
LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Bottom Ash with some clay and silt, soft, loose, dry					AR
	FILL - Silty CLAY with some bottom ash, sand, and gravel, hard, low-medium plasticity, yellowish brown (10YR 5/4) with variable brown to gray mottling		1	49/60	- -	FL/CL
5		440	2	7/42	- -	
			3	8/18	3.0	
10	- few bottom ash, very stiff, high plasticity, moist	435				
			4	0/60	- -	
15		430				
	Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist		5	60/60	2.5	CL
			6		3.25	
			7		1.75	
	- high plasticity, gray (10YR 5/1) with <10% yellowish-brown mottling		8		2.0	
20		425	9		3.0	

Well: TPZ-159
Elev.: 447.64



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet | DESCRIPTION | Surf. Elev. 444.69 | Samples | Recovery inches | Qp TSF | USCS | GRAPHIC

DESCRIPTION (20–40 ft):

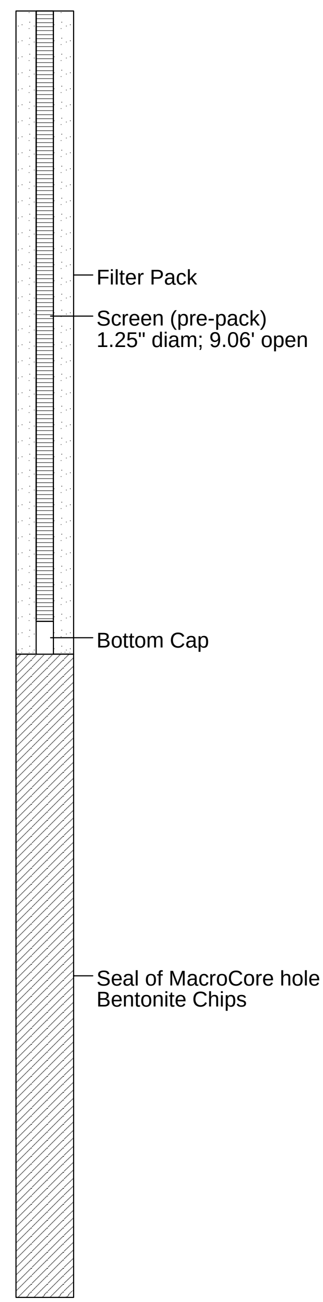
- 20: Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist
- - soft to medium hardness, yellowish-brown mottling with black manganese staining
- - high plasticity, brown (10YR 5/3)
- - trace fine-medium sand, very stiff, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 5/6)
- - no sand, brown
- - trace sand, gray (10YR 6/1) with 10-25% yellowish-brown mottling
- - trace fine-coarse sand and gravel (sub-angular to sub-rounded)
- - stiff, medium plasticity, pale brown (10YR 6/3) with <10% gray mottling
- - few fine-coarse sand and fine gravel, very stiff, yellowish brown (10YR 5/8)
- - hard, non-plastic, dry

Surface elevation marks: 420 (≈24.7 ft), 415 (≈29.7 ft), 410 (≈34.7 ft), 405 (≈39.7 ft)

USCS: CL

Samples	Recovery inches	Qp TSF
10	16/60	- -
11	32/60	1.5
12		- -
13		1.25
14		1.25
15		2.75
16	49/60	- -
17		1.5
18		1.0
19		2.0
20		2.0
21	60/60	2.5
22		2.0
23		1.0
24		0.5
25		3.0

Well: TPZ-159
Elev.: 447.64



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Well: TPZ-159
Elev.: 447.64

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC	Well
40	- trace sand and gravel, very stiff, high plasticity, brown (10YR 5/3) to pale brown (10YR 6/3)		26	50/60	2.75	CL		
			27		- -			
			28		<0.5			
	SAND, fine to coarse, well graded, greenish gray (Gley1 10Y 5/1), wet (2.4 inch seam)	400	29		>4.5	SW		
45	Silty CLAY, trace sand, hard grading to very stiff, low plasticity grading to high plasticity, dark gray (Gley1 4/N), moist [TILL]		30	5/60	- -	CL		Seal of MacroCore hole Bentonite Chips
		395	31		3.25			
50	END BOREHOLE AT 50 FEET BLS							
55		390						
60		385						

KELRON ENVIRONMENTAL
Incorporated

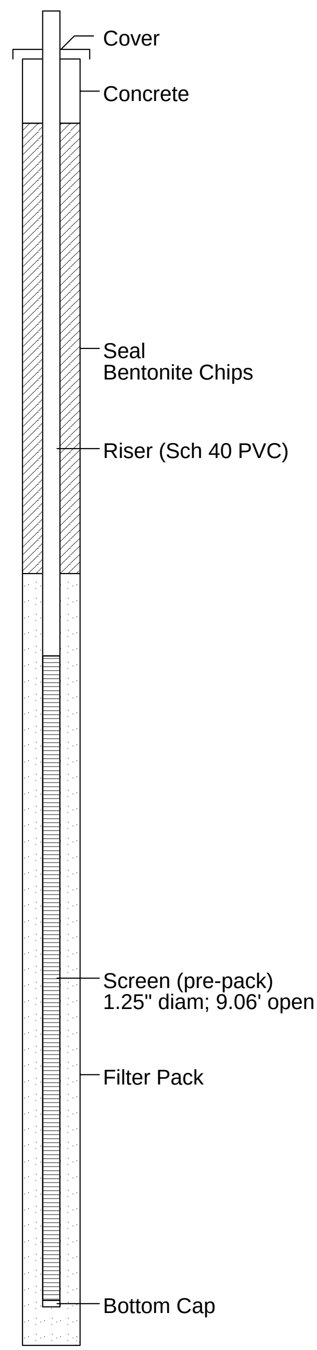
LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Silty CLAY with grass / roots, hard, non-plastic, pale brown (10YR 6/3), dry		1	58/60	4.5	CL	
	- gray (10YR 6/1) with reddish-brown mottling and black oxidation staining		2		3.25		
	- very stiff, low plasticity, brown (10YR 4/3), moist - high plasticity, grayish brown (10YR 5/2) with 10-25% reddish-brown mottling'		3		3.0		
		425	4		3.0		
5			5		2.25		
	- gray (10YR 6/1), <10% mottling		6	58/60	1.5		
			7		1.0		
	- 10-25% mottling, black organics		8		1.0		
		420	9		1.0		
10	Sandy SILT, fine sand, very soft, non-plastic, light brownish gray (10YR 6/2), wet		10		1.0	ML	
			11	41/60	- -		
	Clayey SILT, trace fine sand, very soft, medium plasticity, gray (10YR 6/1)		12		<0.5		
			13		<0.5		
		415	14		<0.5		
15	Silty CLAY, medium to high plasticity, gray with trace reddish-brown mottling, moist - 1-inch weathered zone with 75% yellowish-brown (10YR 5/8) mottling @ 14.5'		15		1.25	CL	
	SILT, gray (10YR 7/1), wet @ 14.9'		16	16/60	- -	ML	
	CLAY, medium hardness,brown (10YR 5/3), moist - greenish gray (Gley1 10GY 5/1)	410	17		1.25	CL	
20			18		1.5		

Well: TPZ-160
Elev.: 431.49



KELRON ENVIRONMENTAL Incorporated

LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Well: TPZ-160
Elev.: 431.49

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
20			19	24/60	- -	CL	
	- gray (10YR 6/1)						
	- very soft, brown (10YR 5/3)	405	20		<0.5		
	- soft, greenish gray		21		1.25		
25			22	27/60	- -		
			23		0.75		
		400	24		1.0		
			25		1.5		
			26		2.5		
30	Silty CLAY with fine-coarse sand and fine gravel (sub-angular to sub-rounded), very stiff, greenish gray with reddish-brown mottling [TILL]		27	27/60	- -	CL	
	- very soft, high plasticity, yellowish-brown (10YR 5/4)		28		0.5		
	- medium plasticity, greenish gray with 50-75% yellowish-brown mottling, moist	395	29		0.5		
			30		1.5		
35	Sandy CLAY, stiff, dark yellowish-brown (10YR 4/4) with <25% greenish-gray mottling, dry					CL	
	END BOREHOLE AT 35 FEET BLS						
		390					
40							

Seal of MacroCore Hole
Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC160.BOR

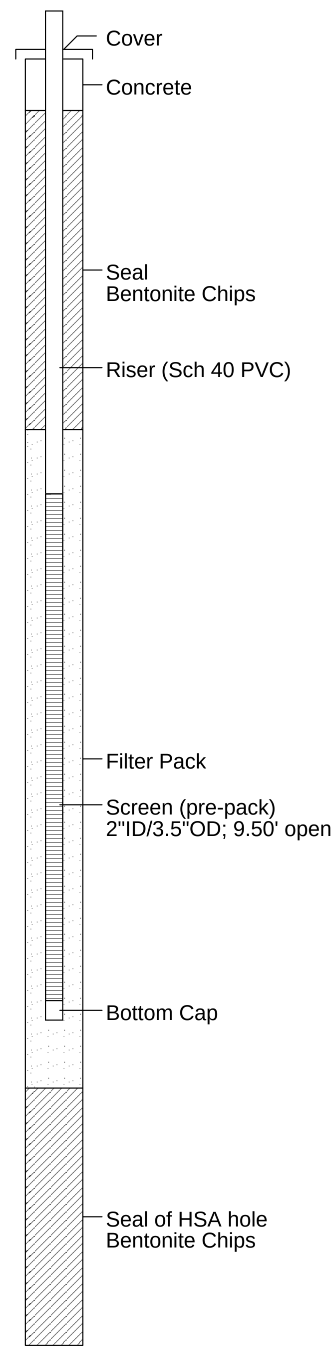
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-163
	(Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Silty clay loam with roots, loose, pale brown (10YR 6/3), dry (13" thick soil cover)						FL/CL
	FILL - Fly Ash, silty, loose very dark gray (10YR 3/1)						AR
	<Shelby Tube Sample ST163-3 @1.5-3.5'> grain size analysis (Ash - very dark brown): 51% Sand, 45.8% Silt, 3.2% Clay		1		9/24	- -	
5		450					
	- very soft, wet		2	1 0 1	18/18	<0.5	
10		445					
			3	1 0 1	18/18	<0.5	
15		440					
	Silty CLAY (lean to fat), trace fine sand, stiff, medium to high plasticity, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 6/8), moist		4	1 3 5	17/18	2.75	CL/CH
20		435					
	- very stiff		5	2 2 4	18/18	2.25	
25		430					

Well: TPZ-163
Elev.: 458.41



KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-163

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Well: TPZ-163
Elev.: 458.41

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
25–33.5	- dark yellowish brown <Shelby Tube Sample ST163-30 @ 28-30'> grain size analysis: 10.6% Sand, 51.2% Silt, 38.2% Clay	425	6		24/24	- -	CL/CH
33.5–43.5	Silty CLAY with trace fine-coarse sand and fine gravel, stiff to very stiff, high plasticity, brownish-yellow (10YR 6/6), moist [TILL]	420	7	2 2 5	18/18	2.5	CL
	- medium plasticity, pale brown (10YR 6/3) - brownish-yellow (10YR 6/6) with 10-25% light gray mottling (10YR 6/1)	415	8	5 5 7	18/18	3.5	
43.5–45	SHALE, platy/laminated with weathered clay layers; hard, gray (10YR 5/1) with 25-50% olive yellow clayey layers (2.5Y 6/6) (top of bedrock = 43.5' bls)		9	5 7 8	18/18	>4.5	SH
45	END BOREHOLE AT 45 FEET BLS	410					
50		405					

Seal of HSA hole
Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC163.BOR

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-164 (Page 1 of 1)

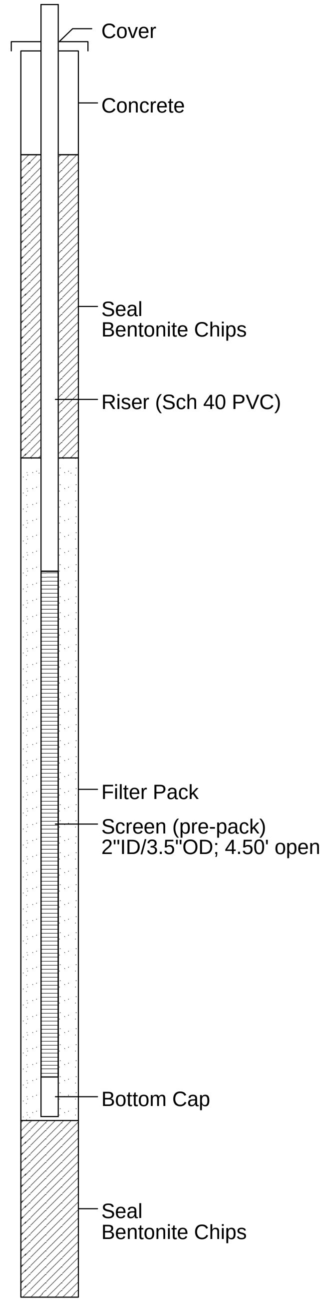
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Surf. Elev. 432.50	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry						
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	429					
4			1		17/24		AR
4.5	- wet	428					
8.7	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)		2	3 3 5	18/18		CL
10.3	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	422	3		23/24		CL
12	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS						

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Elevation scale: 430, 429, 428, 427, 426, 425, 424, 423, 422, 421, 420, 419

Well: TPZ-164
Elev.: 435.10



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC164.BOR

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-165
	(Page 1 of 1)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

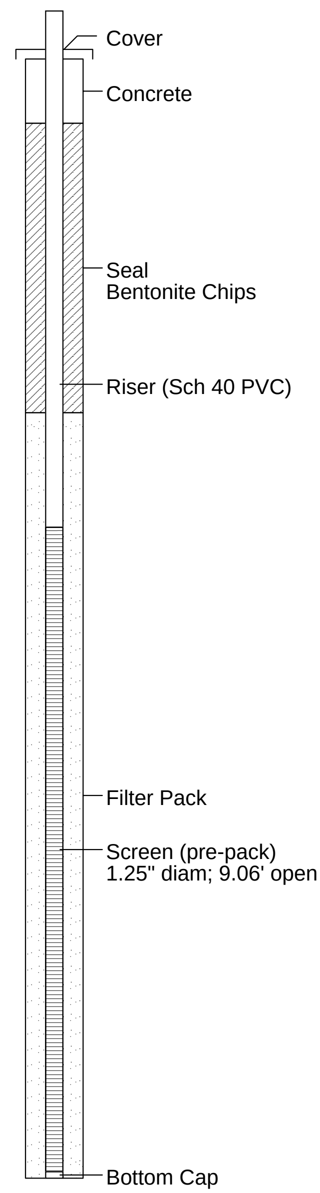
Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 396.10
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 398.85
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380478, 555940

Depth in Feet	DESCRIPTION	USCS
0–2.2	FILL - Fly Ash, silty, stiff, non-plastic to low plasticity, very dark grayish-brown (10YR 3/2), moist	AR
2.2–5.2	FILL - Silty Clay with Fly Ash, very soft, dark gray (10YR 4/1)	FL/CL
5.2–12.8	Silty CLAY (lean) with organics and roots, soft, high plasticity, dark gray - gray (10YR 5/1) - trace sand, very dark gray brown <Shelby Tube Sample ST165-10 @ 8-10'> grain size analysis: 11.2% Sand, 59.2% Silt, 29.6% Clay	CL
12.8–16.5	Silty CLAY (lean) with trace fine-coarse sand and fine gravel, very soft, medium to high plasticity, dark gray (10YR 4/1), moist [TILL]	CL
16.5–17.4	LIMESTONE, hard, light gray, hammer refusal at 16.5', auger refusal at 17.4' bls (top of bedrock)	LS
	END BOREHOLE AT 17.4 FEET BLS	

Surf. Elev. 396.10 (elevation marks: 395, 390, 385, 380)

Samples	Recovery inches	Qp TSF
1	41/60	1.75
2		0.75
3		- -
4		- -
5		- -
6	60/60	1.5
7		2.0
8		2.75
9		2.5
10		1.25
11	49/60	2.0
12		0.5
13		0.5
14		1.0
15		0.5
16	18/18	0.5
17		- -

Well: TPZ-165
Elev.: 398.85



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC165.BOR

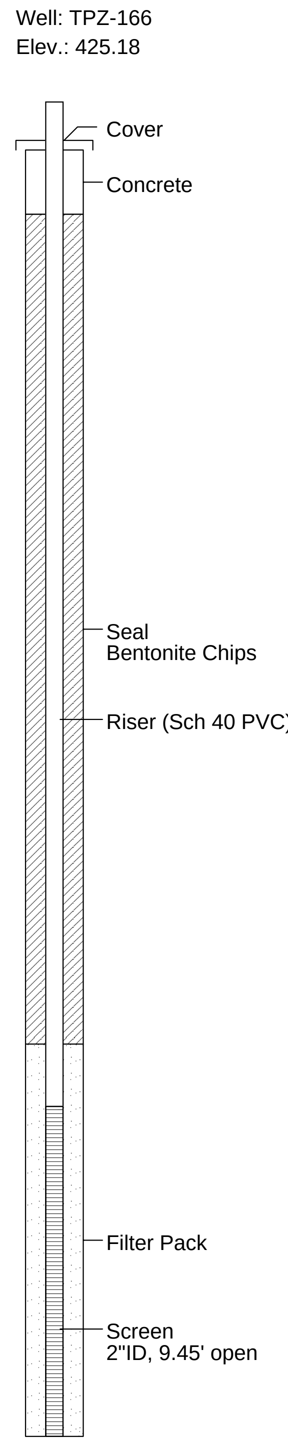
KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Silty CLAY, trace roots, very stiff, non-plastic, light brown gray (10YR 6/2), dry		1	60/60	2.75	FL/CL
	- medium plasticity, pale brown (10YR 6/3) w/ trace manganese and iron oxide staining		2		2.75	
	- very stiff, yellowish brown (10YR 5/4) with 25% reddish-brown mottling	420	3		3.75	
	- very stiff, low plasticity		4		1.5	
			5		2.75	
5	- gray mottling - 1-inch silt lense with high organics, trace roots		6	60/60	1.5	
	Silty CLAY, very stiff, medium plasticity, gray (10YR 6/1) with reddish-brown mottling and manganese staining					CL
	- medium to stiff, high plasticity, 25-50% manganese staining		7		2.75	
		415	8		1.75	
	- no manganese staining		9		2.5	
10			10		2.5	
			11	60/60	1.5	
			12		1.5	
	- stiff, medium plasticity, yellowish brown (10YR 5/4) with 10-25% reddish-brown mottling, moist	410	13		2.25	
			14		2.0	
			15		2.5	
15	- very soft, high plasticity		16	60/60	1.0	
	- very stiff, medium plasticity		17		3.0	
		405	18		3.0	
	Silty CLAY with trace fine-coarse sand and fine gravel, very stiff, medium plasticity, yellowish brown (10YR 5/4) with <10% reddish-brown mottling, moist [TILL] - hard, gray (10YR 6/1) with 10-25% reddish-brown mottling		19		3.5	CL
20			20		3.25	



KELRON ENVIRONMENTAL
Incorporated

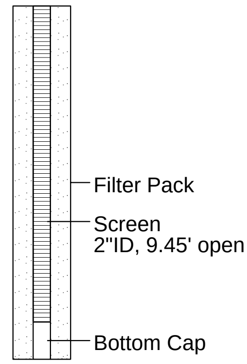
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
20			21	24/24	>4.5	CL	
	END BOREHOLE TPZ-166 AT 22' BLS.		22		>4.5		
	CONTINUE LOG USING URS BORINGS B-13-4 and B-13-5 FROM 08/01/2013	400					
25							
		395				CL	
30							
		390					
	SHALE, calcareous, fine grained, highly weathered, very weak, brown-gray to gray (top of bedrock = 32.53' bls; elevation = 389.8 ft NAVD88)						
35						SH	
		385					
	END URS LOGS AT 38 FEET BLS						
40							

Well: TPZ-166
Elev.: 425.18

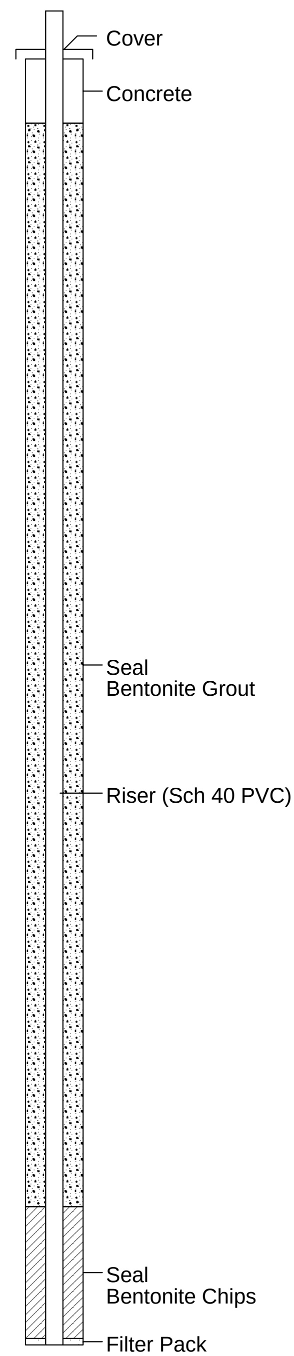


KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-167 (Page 1 of 3)

Phase II Hydrogeologic Investigation Baldwin Energy Complex Dynegy Midwest Generation, Inc.	Date Completed : 08/14/2013 Hole Diameter : 8 1/2" OD / 4 1/4" ID Drilling Method : HSA (CME-55LC) Sampling Method : Split Spoon / Shelby Tube Drilling Company : Bulldog Drilling, LLC	Driller : John Gates Geologist : Stuart Cravens (Kelron) Ground Elevation : 438.63 Casing (MP) Elevation : 441.38 X,Y Coordinates : 2381925, 554963	

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Fly Ash, silty to clayey with coarse sand grain size, soft, medium to high plasticity, dark gray (Gley 1 4/N), moist							
		435						
	- very soft, non-plastic, wet		1		18/18			
5								
	- dark greenish gray (10Y 4/1)	430						
			2	2 2 1	18/18			
10							AR	
	- silty with sand grain size, very dark greenish gray (10Y 3/1)	425						
			3	0 0 1	18/18			
15								
		420						
20								

Well: TPZ-167
Elev.: 441.38



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC167.BOR

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Well: TPZ-167
Elev.: 441.38

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
20								
	- dark greenish gray	415	4	0 0 1	18/18			
25							AR	
	- very dark gray brown <Sample SS167-30 @ 29-30'> grain size analysis (Ash): 1.5% Sand, 77.6% Silt, 20.8% Clay	410	5	0 0 0	18/18			
30								
	Silty CLAY (lean) with sand and trace fine gravel (chert, angular to sub-angular), very stiff, medium to high plasticity, light gray (10Y 7/N) with 15-50% reddish brown mottling, dry [TILL] <Shelby Tube Sample ST167-34 @ 32-34'> grain size analysis: 15.7% Sand, 52.6% Silt, 31.7% Clay	405	6		20/24			
35							CL	
		400	7	3 4 6	16/18	3.5		
40								

Well construction: Riser (Sch 40 PVC); Filter Pack; Screen (pre-pack) 2"ID/3.5"OD; 9.50' open; Bottom Cap; Seal of HSA hole Bentonite Chips

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Well: TPZ-167
Elev.: 441.38

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
40							CL	
	- soft, brownish-yellow (10YR 6/6), moist	395	8	2 2 2	18/18	>4.5		
45	- laminated, hard, non-plastic, black (3/4" thick organic-rich layer)						CL	
	CLAY (lean to fat) with sand, stiff to very stiff, medium to high plasticity, greenish gray (10YR 6/1), dry						CL/CH	
	- with sand and fine gravel (angular)		9	5 5 50	18/18	4.0		
		390	10	50	3/3			
	SHALE, weathered; clay (laminated) with platy and micaceous layer and limestone parting, dark gray (Gley1 4/N), dry (top of bedrock = 48.75' bls)		11	53	5/5		SH	
50	END BOREHOLE (Auger Refusal) at 48.75 feet BLS END Split-Spoon Sampling at 49.15 feet BLS							
		385						
55								
		380						
60								

Seal of HSA hole
Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC167.BOR

KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-168

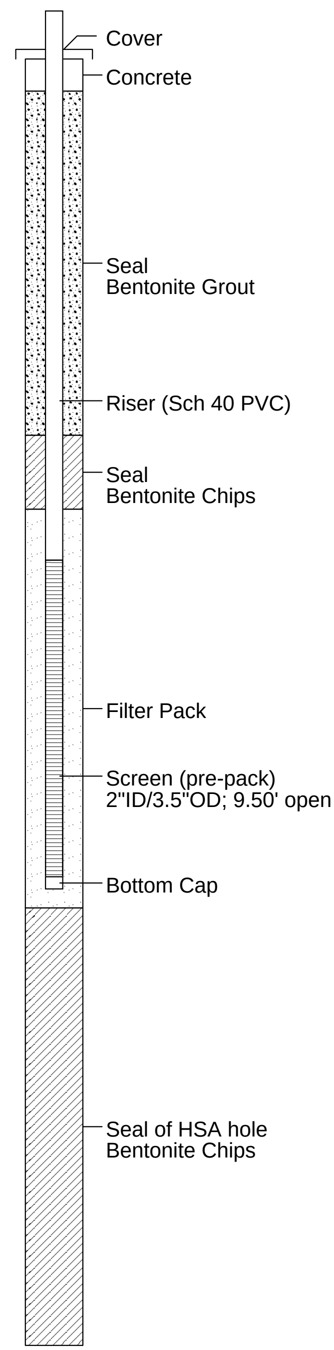
(Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Fly Ash, silt size, greenish gray (10Y 5/1), moist							
	<Shelby Tube Sample ST168-5 @ 3-5'> grain size analysis: 29.4% Sand, 50.2% Silt, 20.4% Clay		1		21/24			
5		450						
	- wet		2	3 2 3	18/18			
10		445						
	- silty with coarse sand grain size, greenish black (10Y 2.5/1)		3	1 1 1	16/18		AR	
15		440						
			4		0/24			
20		435						
			5		3/18			
25		430						
	Silty CLAY, medium to stiff, high plasticity, light gray (10YR 7/1) with 10-50% reddish-brown mottling		6	3 3 5	18/18	2.0		
30		425					CL	
35		420						
			7	2 4 5	18/18	3.5	CL	
40		415						

Well: TPZ-168
Elev.: 457.53



KELRON ENVIRONMENTAL

Incorporated

LOG OF PROBEHOLE TPZ-168

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Well: TPZ-168
Elev.: 457.53

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
40	Silty CLAY, trace sand and fine gravel (angular to sub-angular), stiff to very stiff, 10-25% reddish-brown mottling, moist [TILL]							
45		410						
	- light yellowish-brown (10YR 6/4) with <10% light gray mottling		8	3 7 10	18/18	3.5		
50	Clay, black (1/2" thick organic-rich layer) surrounded by highly weathered zone with >75% reddish-brown mottling	405						
55		400					CL	
	- medium to stiff, high plasticity, yellowish brown (10YR 5/4)		9	3 4 8	18/18	2.0		
60	- with 25-50% light gray mottling	395						
65		390						
	- with sand seams, very stiff, medium plasticity, dark gray (10YR 4/1)		10	10 16 18	18/18	>4.5		
70	SHALE, laminated, hard, dark gray (top of bedrock = 69.6' bls)	385					SH	
	END BOREHOLE AT 70 FEET BLS							
75		380						
80		375						

Seal of HSA hole
Bentonite Chips

APPENDIX C4

MW 200 SERIES BORING LOGS AND WELL DETAILS

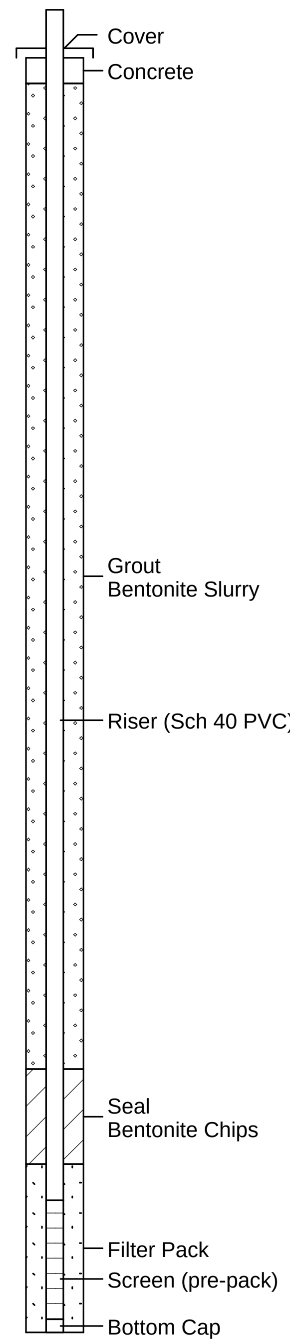
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-252 (Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/22/10	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.27
Sampling Method	: MacroCore (60")	Top of Casing Elevation	425.07
Drilling Company	: PSC	X,Y Coordinates	: 2382784, 553904

Depth in Feet	DESCRIPTION	Surf. Elev. 422.27	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted.	422					
	Refer to boring log for adjacent nested well MW-352 for a description of subsurface materials.						
5		417					
10		412					
15		407					
20		402					
25		397					
30		392					
35		387					
40		382					
45		377					
50	END BOREHOLE AT 49.54 FEET BLS						

Well: MW-252
Elev.: 425.07



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec252~1.bor

KELRON ENVIRONMENTAL INCORPORATED

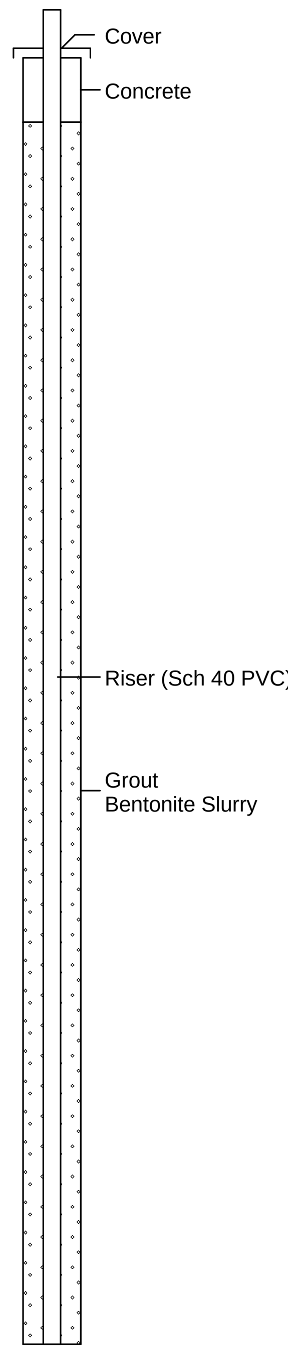
LOG OF BORING MW-253

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, trace gravel, hard, light brown, dry	442	1	25/48	4.5+	CL
			2		4.5+	
5	- hard, medium plasticity, gray (2.5Y 6/1) with yellow-brown mottling (10YR 5/6), moist		3	47/60	4.5	
		437	4		4.5	
			5		4.5	
10			6	53/60	4.5	
		432				
	CLAY (fat) with SAND, trace gravel, dark yellow brown with light gray mottling, mottling decreases with depth - grain size analysis @ 11 - 12 ft: 0.7% gravel, 16.4% sand, 41.4% silt, 41.4% clay		7		4.0	CH
			8		4.0	
			9		3.0	
15			10	52/60	4.5	
		427	11		3.5	
			12		3.5	
	- soft		13		2.0	
	CLAY (lean) with SAND, trace gravel, stiff to hard, medium plasticity, dark yellow brown		14	60/60		CL
20						

Well: MW-253
Elev.: 445.84



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec253~1.bor

KELRON
ENVIRONMENTAL
INCORPORATED

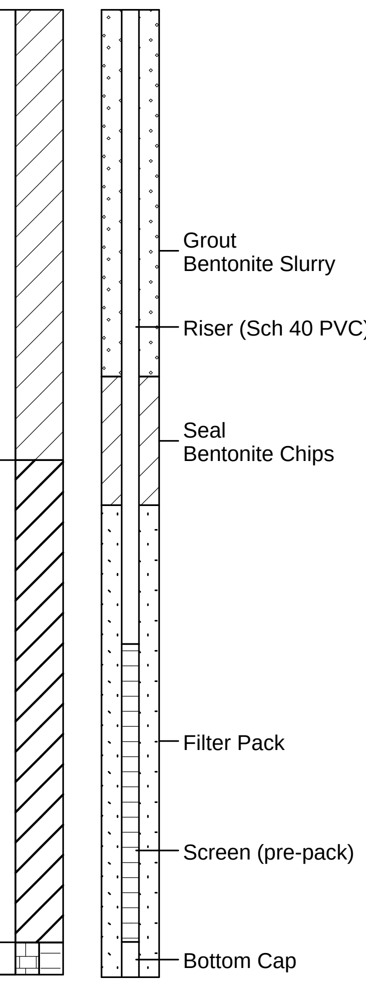
LOG OF BORING MW-253

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	Samples	Recovery inches	Qp TSF	USCS
20	- grain size analysis @ 19 - 19.5 ft: 0.7% gravel, 26.9% sand, 38.1% silt, 34.3% clay	422	14	60/60		CL
25	- small fine sand seams from 25 to 27 feet	417	15	60/60		CL
	CLAY (fat), shaley, platy/laminated, soft, low plasticity, light yellow brown (10YR 6/4)		16		3.5	CH
	- stiff to very stiff, light olive brown (2.5Y 5/4)		17		3.0	CH
30	- grain size analysis @ 29 - 30 ft: 6.7% sand, 21.6% silt, 71.7% clay	412	18	60/60	4.5	CH
			19		3.5	CH
	- Drove split-spoon 2-inches into bedrock: 34.5 to 34.7 feet bls		20		3.0	CH
	LIMESTONE with SHALE		21	2/2		LS/SH
35	Auger refusal at 35.0 feet END BOREHOLE AT 35.0 FEET BLS	407				
40						

Well: MW-253
Elev.: 445.84



KELRON ENVIRONMENTAL
Incorporated

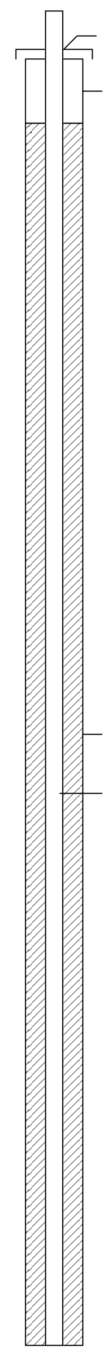
LOG OF PROBEHOLE OW-256

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	Samples	Recovery inches	Qp TSF	USCS
0	Continuous boring to 13.5 feet below ground surface. Refer to boring log for adjacent well OW-156.	425				CL
5		420				
10		415				
13.5	CLAY (lean), very stiff, high plasticity, pale brown (10YR 6/3),moist - 25% reddish-brown mottling with black manganese staining - light gray (10YR 7/1) with 10-25% mottling		1	60/60	3.0	CL
15		410	2		2.25	
			3		2.0	
			4		2.0	
			5		1.75	
18.5	Silty CLAY, trace fine to coarse sand [TILL]		6	60/60	2.5	CL
20			7		1.0	

Well: OW-256
Elev.: 427.70



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE OW-256

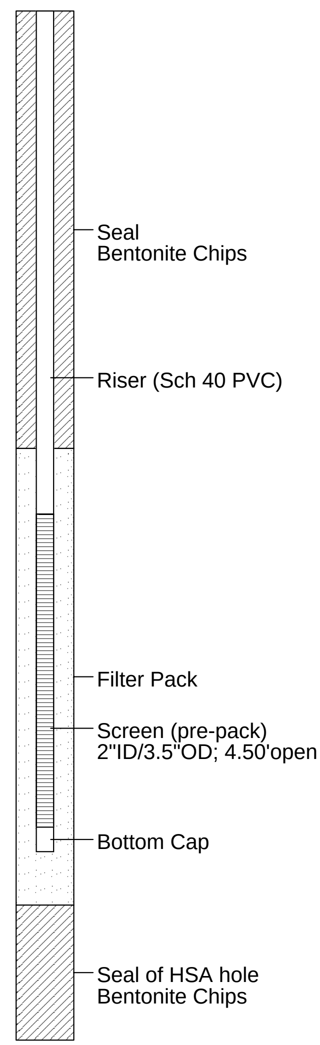
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	USCS
20–27.1	- trace fine-coarse gravel (angular to sub-angular; granite piece of 1 1/4"), 50-75% yellowish-brown (10YR 6/8) mottling - few sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-75% mottling - <25% mottling - with sand (fine-medium)	405 (20), 400 (25)	CL
27.1–28.6	SAND (fine-medium), well graded, brownish yellow (10YR 6/6), wet		SW
28.6–33.9	Silty CLAY (lean) with sand (fine-medium), medium plasticity, brownish yellow, wet - hard, non plastic, light brownish gray (10YR 6/2), moist [Vandalia Till @ 31.5'] - little sand (fine-coarse) and gravel (fine-coarse, sub-angular to sub-rounded), low to non-plastic, gray (10YR 5/1)	395 (30)	CL
33.9–35.7	SHALE and CLAY, semi-competent, laminated clay with up to 1/2-inch thick layers of hard shale, dry [note: top of weathered bedrock at 33.9 feet below ground surface]	390 (35)	SH/CL
35.7–38.5	SHALE with intermittent clay layers, hard, gray		SH
38.5	END Sampling at 38.5 feet BLS END WELL BOREHOLE at 36.0 feet BLS		

Samples	Recovery inches	Qp TSF
7		1.0
8		1.75
9		1.75
10		1.0
11	60/60	1.0
12		2.0
13		1.0
14		1.0
15		
16	35/60	
17		
18		>4.5
19		
20		
21	54/60	3.0
22		4.0
23		>4.5
24		>4.5
25		>4.5

Well: OW-256
Elev.: 427.70



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC256.BOR

KELRON ENVIRONMENTAL
Incorporated

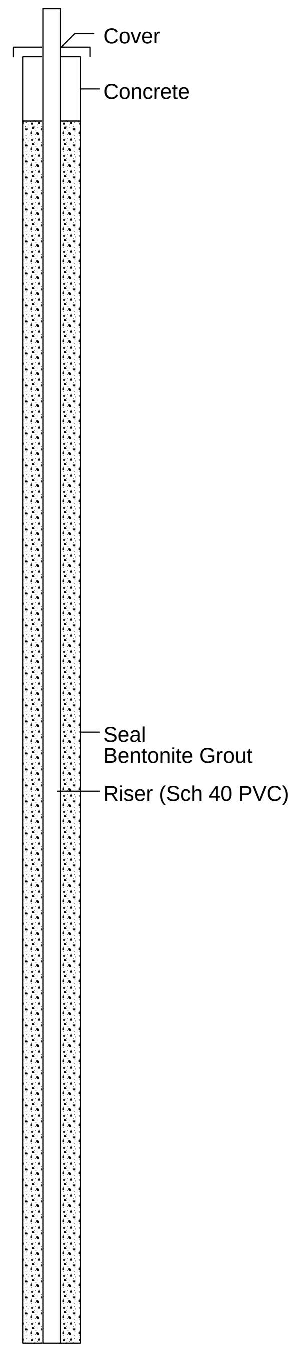
LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 18.5 feet below ground surface. Refer to boring log for adjacent well OW-157.					CL	
5		425					
10		420					
15		415					
		410					
18.5	Silty CLAY, trace sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-50% reddish-brown mottling, moist [TILL]		1	56/60	3.0	CL	
20			2		2.75		

Well: OW-257
Elev.: 431.02



KELRON ENVIRONMENTAL
Incorporated

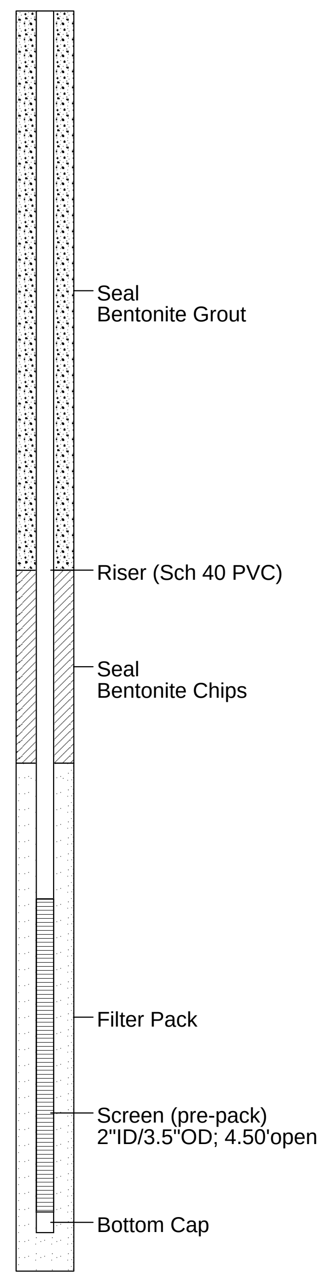
LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS
20			2		2.75	CL
	- >50% mottling		3		2.5	
	Sandy CLAY with gravel (fine-coarse, sub-angular; granite piece of 1.5"), brownish yellow (10YR 6/6), wet					CL
	Silty CLAY, trace sand and gravel, soft, high plasticity, yellowish brown (10YR5/6) with 10-25% light gray mottling		4		1.0	
		405	5		1.5	
	- very soft, brownish yellow with <10% mottling		6	60/60	0.5	
25	- with trace pyrite crystals		7		1.0	
	- medium hardness grading to stiff		8		2.0	
			9		2.0	
		400	10		3.25	
			11	60/60	1.5	CL
30			12		3.5	
	- stiff, high plasticity, gray with <10% reddish-brown mottling, moist		13		2.75	
	- very stiff, dark gray (10YR 4/1)		14		2.0	
		395	15		3.5	
			16	60/60	2.0	
35			17		2.0	
	- low plasticity, very dark gray (10YR 3/1)		18		4.0	
	SHALE and CLAY (fat), intermittent lamination, hard, very dark gray, moist [note: top of weathered bedrock at 36.3 feet below ground surface]		19		3.0	
		390	20		>4.5	SH/CL
			21	13/13		
40	END BOREHOLE at 39.6 feet BLS					

Well: OW-257
Elev.: 431.02



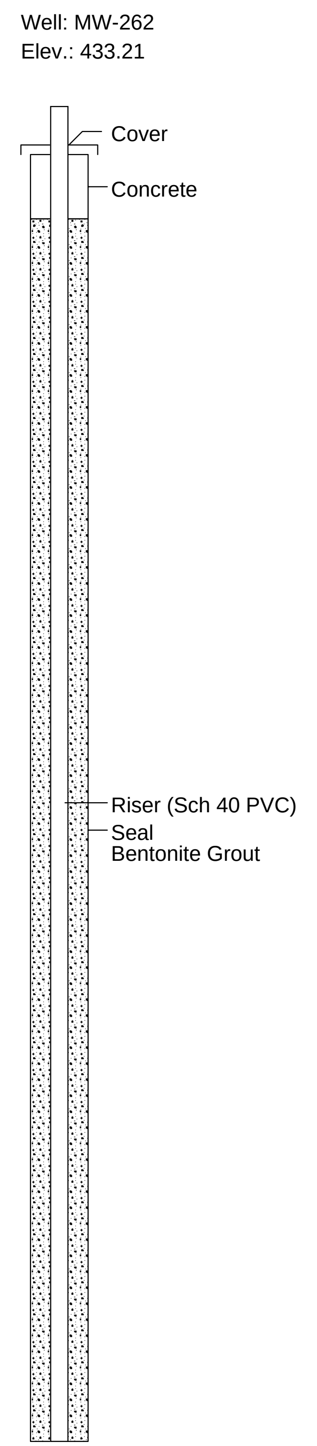
KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry		1	60/60	2.5	CL	
		430	2		>4.5		
	- brownish yellow (10YR 6/6), moist		3		3.25		
			4		2.5		
			5		2.25		
5	- medium stiff, high plasticity	425	6	42/42	1.5		
			7		1.75		
			8		2.0		
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]		9	60/60	1.0	ML	
10	- clayey, soft to medium hardness, low to medium plasticity		10		1.5		
		420	11		1.25		
			12		1.5		
			13		1.5		
	- soft, yellowish brown (10YR 5/4) - non-plastic		14	60/60	1.0		
15			15		1.25		
		415	16		1.25		
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist		17		1.5	CL	
			18		2.0		
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist		19	60/60	2.0	ML	
20			20				



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC262.BOR

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
20			20			ML
		410	21			ML
			22			ML
	Silty CLAY, very soft, low plasticity		23		0.75	CL
	- medium plasticity, wet		24	60/60	0.75	CL
25			25		0.75	CL
	- high plasticity, yellowish brown (10YR 5/4)	405	26		0.75	CL
	- moist		27		0.5	CL
			28		1.25	CL
			29	53/60	1.0	CL
30	- with fine sand		30		0.75	CL
		400	31			CL
	SAND, fine to medium grained, with clay, yellowish brown (10YR 5/6), wet		32			SW/SC
	- light brownish gray					SW/SC
	CLAY (fat), trace fine to medium sand, high plasticity, light brownish gray <Sample ST262-35 @ 33.5 - 35.5'> grain size analysis: 13.1% Sand, 33.2% Silt, 53.7% Clay		33			CH
			34	24/24		CH
35			35			CH
	- very stiff, greenish gray (Gley1 10Y 6/1)	395	36	16/36	2.75	CH
			37			CH
			38		2.75	CH
	- medium plasticity		39	56/60	1.0	CH
40			40		0.75	CH

Well: MW-262
Elev.: 433.21

Seal
Bentonite Grout

Riser (Sch 40 PVC)

Seal
Bentonite Chips

KELRON ENVIRONMENTAL Incorporated

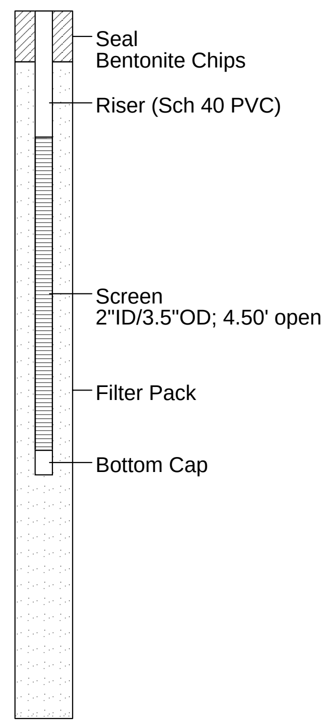
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Well: MW-262
Elev.: 433.21

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
40			40		0.75	CH
	- with <10% reddish-brown mottling	390	41		1.25	CH
			42		1.5	CH
	SAND with Silt, fine grained, poorly graded, light brown (10YR 6/4), wet					SP/SM
	Sandy SILT		43			ML
	Silty CLAY with fine sand, very soft, brownish yellow (10YR 6/6)		44	60/60	0.75	CL
45			45		0.75	CL
	SAND, fine grained, poorly graded	385	46		1.25	SP
	SAND, fine to coarse grained, well graded, trace gravel					SW
	Silty CLAY with trace and and gravel, stiff, high plasticity, light yellowish brown (10YR 6/4), moist [TILL]		47		3.0	CL
	- trace reddish-brown mottling		48		2.25	CL
			49	30/30	2.25	CL
50			50		2.25	CL
	SHALE, clay partings, laminated, gray, weathered, dry (top of bedrock = 50.4' bls)	380	51		3.5	SH
	END BOREHOLE AT 51 feet BLS					
55		375				
60						



APPENDIX C5

MW 300 SERIES BORING LOGS AND WELL DETAILS

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/9/2015	10/20/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-304	Feet (NAVD88)	453.03 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,194.03 N, 2,386,608.77 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 17.9952"
Long -89° 51' 12.39"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5.8	0 - 5.8' **SILTY CLAY** CL/ML.	CL/ML								0-35.4' Blind Drilled. See log MW-104DR for soil description details.
			5.8–12	5.8 - 13.5' **FAT CLAY:** CH.	CH								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	5.8 - 13.5' **FAT CLAY:** CH. *(continued)*	CH									
			14	13.5 - 15' **LEAN CLAY:** CL.	CL									
			15–23	15 - 23.5' **SILTY CLAY** CL/ML.	CL/ML									
			24	23.5 - 24.5' **SANDY FAT CLAY:** s(CH).	s(CH)									
			25–27	24.5 - 27.3' **POORLY-GRADED SAND:** SP.	SP									
			28–29	27.3 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30–32	30 - 35.4' **SHALE:** BDX (SH).	BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33–35	30 - 35.4' **SHALE:** BDX (SH). *(continued)*	BDX (SH)									
1 CORE	60 31		35.4–41.3	35.4 - 41.3' **LEAN CLAY:** CL, gray, 2" of wood on top of unit, stiff, dry. 36.3' stiff to very hard, dry. 36.7' trace chert gravel.	CL									
2 CORE	60 59.5			40.2' dry.										
			41.3–46.8	41.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, intensely to moderately fractured (extremely narrow apertures). 41.6' - 42' vertical fracture.	BDX (LS/SH)									
3 CORE	60 63			45.4' intensely fractured.										Core 3, RQD=75%
			46.8–52	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured.	BDX (SH)									
4 CORE	60 65			50.4' moderately fractured.										Core 4, RQD=95%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured. *(continued)*	BDX (SH)									
			54											
			55	54.4' intensely fractured.										
5 CORE	60 57		56	55.6 - 60.2' **LIMESTONE:** BDX (LS), shaley, thickly bedded, fossiliferous, unfractured to slightly fractured.	BDX (LS)									Core 5, RQD=95%
			57											
			58											
			59											Bedrock corehole reamed 6" in diameter to 59' for well installation.
6 CORE	60 64		60	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured.	BDX (LS/SH)									Core 6, RQD=73%
			61											
			62											
			63											
			64											
7 CORE	60 66		65											Core 7, RQD=64%
			66											
			67											
			68											
			69											
8 CORE	60 63		70	70.3' thickly bedded with dark gray shale.										Core 8, RQD=88%
			71											
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73–74	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured. *(continued)*										
9 CORE	60 60		75–76	75' diagonal fracture (narrow aperture). 75.3' intensely fractured.										Core 9, RQD=50%
			77–79		BDX (LS/SH)									
10 CORE	60 72		80–81	80.3' moderately fractured.										Core 10, RQD=43%
			82–84	81.6 - 91.9' **SHALE:** BDX (SH), gray, highly decomposed, intensely fractured.										
11 CORE	60 65		85–86	85.4' moderately to highly decomposed, intensely to moderately fractured.										Core 11, RQD=57%
			87–89		BDX (SH)									
12 CORE	60 61.5		90–92	90.5' extremely narrow to very narrow apertures.										Core 12, RQD=50%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*										
			94											
13 CORE	60 62		95	95.3' tight to very narrow apertures.										Core 13, RQD=48%
			96											
			97											
			98											
			99											
14 CORE	60 65		100	100.4' thickly bedded, moderately fractured.										Core 14, RQD=65%
			101											
			102		BDX (LS/SH)									
			103											
			104											
15 CORE	60 60		105	105.3' medium bedded, slightly fractured (very narrow apertures).										Core 15, RQD=98%
			106											
			107											
			108											
			109											
16 CORE	60 72		110	110.3' moderately fractured.										Core 16, RQD=91%
			111											
			112											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			113–115	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*	BDX (LS/SH)									
17 CORE	60 60.5		116	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures).										Core 17, RQD=100%
18 CORE	60 59		121	120.4' trace cherty limestone, slightly to moderately fractured (extremely narrow to very narrow apertures).	BDX (LS)									Core 18, RQD=97%
19 CORE	60 60.5		126	125.3' slightly fractured (very narrow to narrow apertures).										Core 19, RQD=98%
20 CORE	60 60		131–132	130.4' very narrow apertures.										Core 20, RQD=98%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			133 134 135	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures). *(continued)*	BDX (LS)									
				135.4' End of Boring.										

LOG OF BORING MW-306

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 450.9 Feet
Date Drilled: 09/25/91
Drilling Contractor: Burlington Environmental
Drilling Method: H.S.A. & NX Rock Core
Logged By: Burlington Environmental

Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
0–30 (450–425)				*Augered to 53.2 feet. No samples taken. See MW-124; BTB-39 for sample descriptions from 0-53.5 feet*				

(continued)

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER ∇ ▼

Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

LOG OF BORING MW-306 (Cont.)

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 450.9 Feet

Date Drilled: 09/25/91
Drilling Contractor: Burlington Environmental
Drilling Method: H.S.A. & NX Rock Core
Logged By: Burlington Environmental

Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
30 / 420				*Augered to 53.2 feet. No samples taken. See MW-124; BTB-39 for sample descriptions from 0-53.5 feet (continued)*				
35 / 415								
40 / 410								
45 / 405								
50 / 400								
		4/10		*Gray Clayey SHALE*				
55 / 395								
		62/108						
				Light Gray LIMESTONE				
60								

(continued)

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER

Piezometer Installed: No

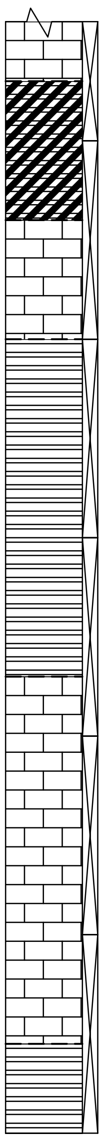
Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

LOG OF BORING MW-306 (Cont.)

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 450.9 Feet

Date Drilled: 09/25/91
Drilling Contractor: Burlington Environmental
Drilling Method: H.S.A. & NX Rock Core
Logged By: Burlington Environmental



Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
60 / 390				*Light Gray LIMESTONE (continued)*				
			CL	*Gray Shaley CLAY*				
65 / 385		*60/60*		*Light Gray LIMESTONE*				
				Olive Clayey SHALE				
70 / 380		*37/60*		*-Dark Gray, Calcareous below 70.3 Feet*				
75 / 375		*60/60*						
				Light Gray LIMESTONE				
80 / 370		*60/60*						
85 / 365		*59/60*						
				Dark Gray Clayey SHALE				
				TD - 88.0 Feet				
90								

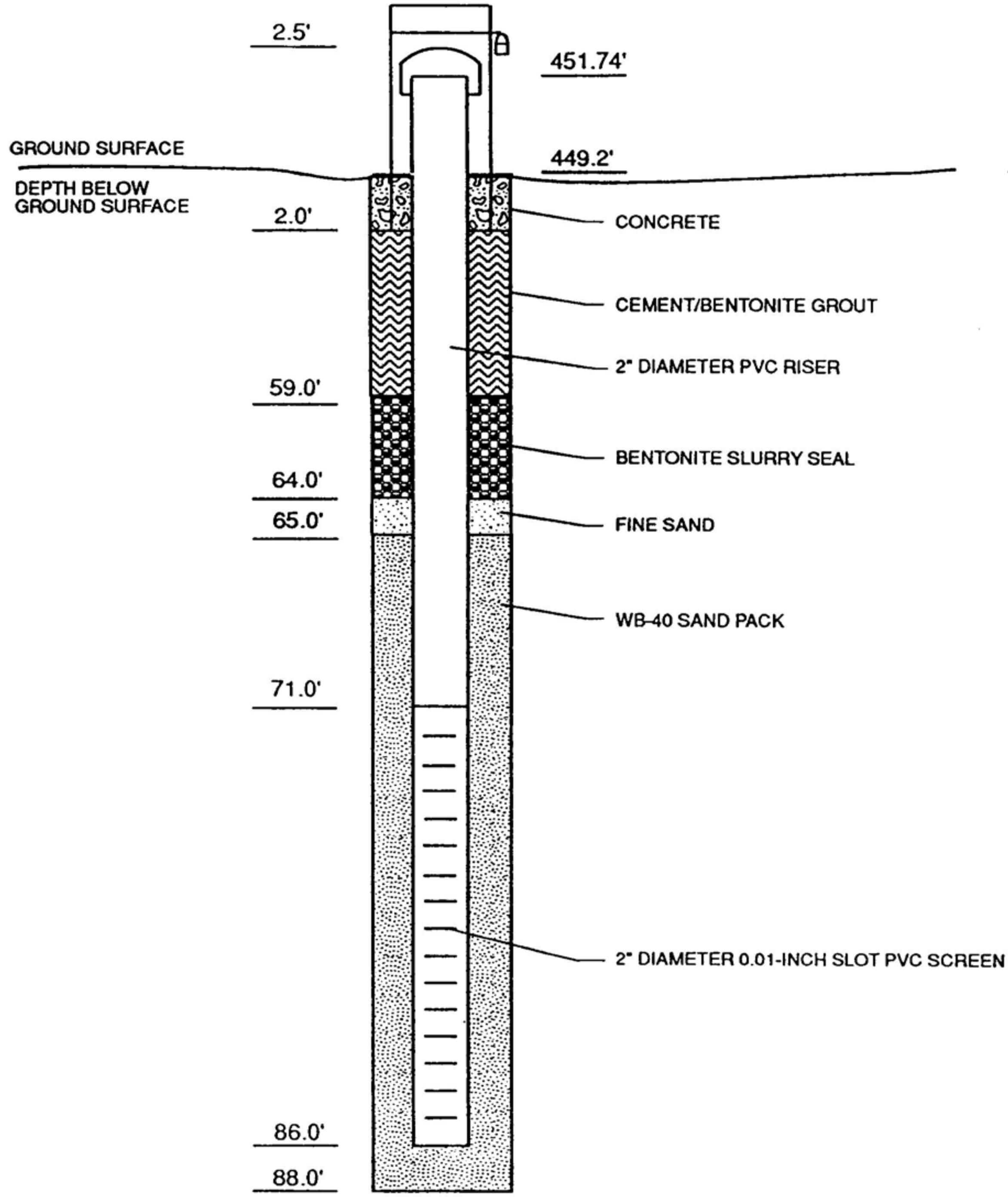
Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER ∇ ▼

Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414



NOT TO SCALE

Burlington Environmental Inc.

BAMW - 306
MONITORING WELL
CONSTRUCTION DIAGRAM

BALDWIN FGD SOLID WASTE BALDWIN, ILLINOIS 124081	BAMW-306

PROJECT MANAGER

PROJECT MANAGER

CHECKED BY

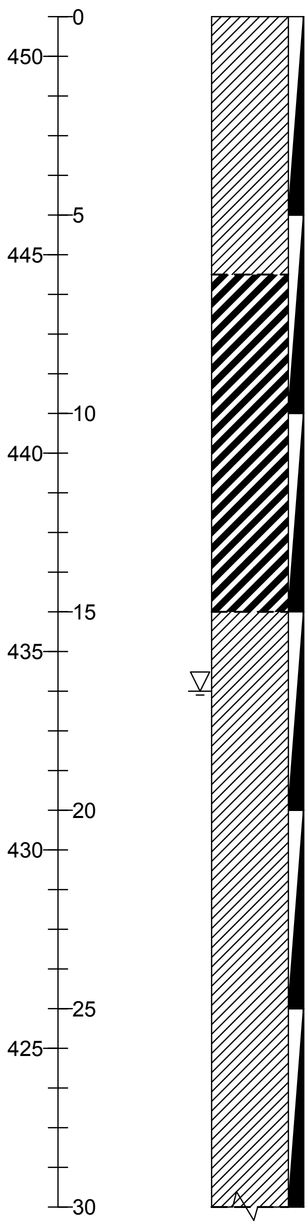
DRAWN BY

MH
REV. DATE
11/20/91

LOG OF BORING MW-124

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 451.0 Feet

Date Drilled: 09/19/91
Drilling Contractor: Burlington Environmental
Drilling Method: Hollow Stem Auger
Logged By: Burlington Environmental



Elevation/ Depth (feet)	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
451.0 / 0 – 445.0 / 6.0	47/60	CL	*Dark Brown Silty CLAY* *-2" Silt Seam at 0.2 Feet* *-Gray-Brown below 0.5 Feet*				
445.0 / 6.0 – 436.0 / 15.0	60/60 60/60	CH	*Gray-Brown CLAY, with Silt, Sand*				
436.0 / 15.0 – 421.0 / 30.0	50/60 60/60 60/60	CL	*Brown Silty CLAY* *-Gray-Brown from 19.5 to 20.0 Feet* *-Dark Gray-Brown with Sand, Trace Gravel below 20.0 Feet* *-1" Sand Seam at 21.3 Feet* *-2" Gravel Seam at 26.7 Feet*				*Hit water at 17.0 feet.*

(continued)

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER
▽ First Observed During Drilling - 17.0 Feet
▼

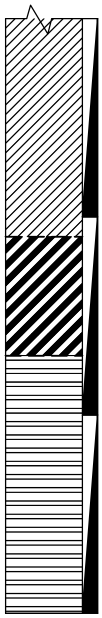
Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

LOG OF BORING MW-124 (Cont.)

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 451.0 Feet
Date Drilled: 09/19/91
Drilling Contractor: Burlington Environmental
Drilling Method: Hollow Stem Auger
Logged By: Burlington Environmental



Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
30–35 (420)		60/60	CL	*Dark Gray-Brown Silty CLAY, with Sand, Trace Gravel*				
35–40 (415)		60/60	CH	*Dark Gray-Brown CLAY, with Silt, Sand*				
40–45 (410)		60/60		*Dark Gray-Brown Weathered SHALE -Gray-Brown below 39.0 Feet*				
45 (405)				*TD - 45.0 Feet*				
50 (400), 55 (395), 60								

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER
∇ First Observed During Drilling - 17.0 Feet
▼
Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

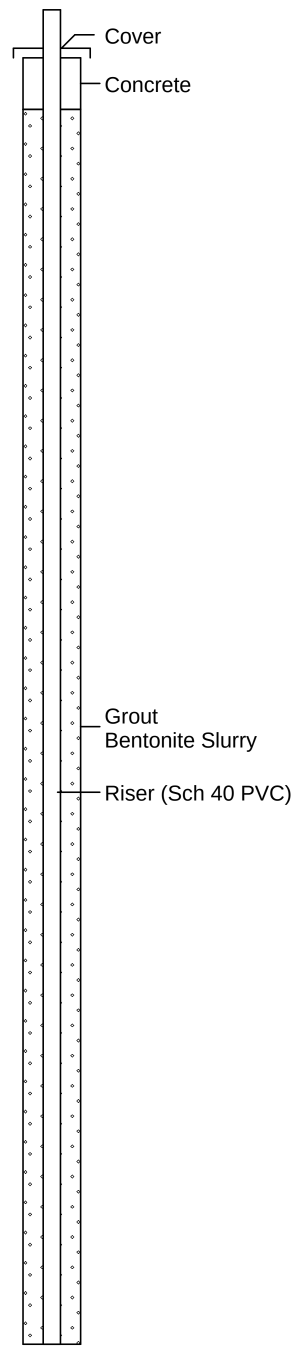
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-350 (Page 1 of 2)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 394.11
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	396.80
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS
0	CLAY, very stiff to hard, brown, grayish-brown (10YR 5/2) mottled yellowish brown (10YR 5/8), dry	394	1	19/54	4.5	CH
			2		2.25	
			3			
5	- grain size analysis @ 5 - 6 ft: 2.3% sand, 42.4% silt, 55.3% clay	389	4	47/60	4.5	
			5		3.5	
			6		3.25	
			7		4.0	
10		384	8	60/60	2.75	
			9		2.75	
11	CLAY, brown to olive brown, moist - grain size analysis @ 11 - 12 ft: 8.4% sand, 39.3% silt, 52.3% clay		10		2.75	CL/CH
			11		1.75	
			12		2.0	
15		379				
16	CLAY, soft, high plasticity, dark yellow brown, moist; 1-2" sand seams at 17' and 19' - grain size analysis @ 18 - 20 ft: 1.8% sand, 21.9% silt, 76.3% clay - very stiff to hard, high plasticity		13	45/60		CH
20		374				
			14	60/60		
25			15	23/23		

Well: MW-350
Elev.: 396.80



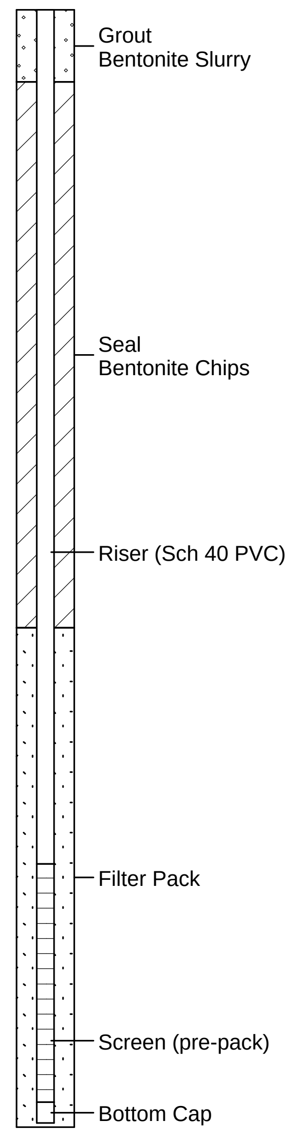
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-350
	(Page 2 of 2)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 394.11
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	396.80
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS
25	- Auger refusal at 26.4 feet bgs	369	15	23/23		CL
	LIMESTONE and SHALE, interbedded, banded, solid, very soft, light to dark gray; slightly weathered					LS/SH
	LIMESTONE, banded, medium bedded, solid, hard, medium gray; unweathered					LS
30	LIMESTONE and SHALE, interbedded; limestone is banded, medium bedded, hard, medium gray; shale is very soft to medium soft, dark gray Borehole diameter from 26.4 to 46.7 feet bgs = 3 7/8" RQD for 26.4 - 36.4' = 72% (Fair) Recovery = 116/120"	364	16	116/120		LS/SH
35	SHALE, banded, medium bedded, solid, soft to medium soft, dark gray	359				SH
40	LIMESTONE, banded, massive, solid, hard to very hard, light to medium gray RQD for 36.4 - 46.4' = 96% (Excellent) Recovery = 118/120"	354	17	118/120		LS
45		349				
	END BOREHOLE AT 46.7 FEET BLS					
50						

Well: MW-350
Elev.: 396.80



KELRON ENVIRONMENTAL
INCORPORATED

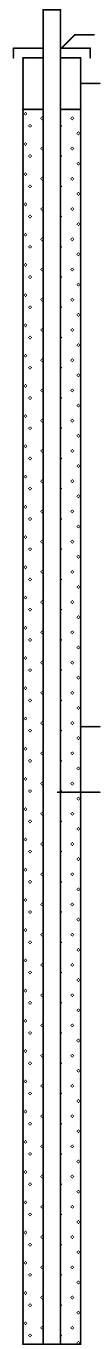
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, very stiff to hard, yellow brown (10YR 5/6), dry	422	1	46/48	4.5+	CL
			2	60/60	3.5	
5	CLAY, trace sand and fine gravel, very stiff, high plasticity, few black organic material	417	3		4.0	CL
			4		2.75	
			5		3.0	
10	- medium hard	412	6	60/60	2.75	
			7		2.0	
	- soft		8		1.0	
			9		1.25	
15		407	10	60/60	1.5	
	- medium hard		11		2.5	
	SAND, poorly graded, loose, wet (4-inch thick)					SP
	SANDY CLAY, trace fine gravel, yellow brown to olive brown (2.5Y 5/3)		12		2.75	CL
			13		3.5	
20		402	14	60/60	4.5+	
			15		2.5	
			16		2.5	
			17		2.75	
25			18	48/60	2.5	

Well: MW-352
Elev.: 425.04



KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Well: MW-352
Elev.: 425.04

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
25		397				CL
	- grain size analysis @ 26.5 - 27.5 ft: 33.7% sand, 27.1% silt, 39.2% clay		18	48/60	2.5	
	SAND with few gravel, yellow brown					SP
	CLAY, some sand and fine gravel, hard to very hard, high plasticity, dark yellow brown (10YR 4/6)					CL
			19	60/60	3.0	
30	CLAY, lean to fat	392	20		3.0	CL/CH
	- grain size analysis @ 32 - 33 ft: 13.2% sand, 43.9% silt, 42.8% clay		21		3.5	
			22		3.0	
35		387	23	48/60	1.5	
	- medium hard, high plasticity, gray brown to light olive brown (2.5Y 5/2-5/3)		24		1.5	
	- trace silt, dark yellow brown (10YR 4/4)		25		1.75	
			26		1.5	
40		382	27	54/60	1.75	
			28		2.0	
			29		2.5	
			30		2.5	
			31	57/60	2.0	
45		377	32		1.75	
			33		1.75	
	CLAY, medium hard, low plasticity, olive brown (2.5Y 5/4)		34		2.5	CL
			35		1.75	
			36	3/3		
50						

Grout
Bentonite Slurry

Riser (Sch 40 PVC)

KELRON
ENVIRONMENTAL
INCORPORATED

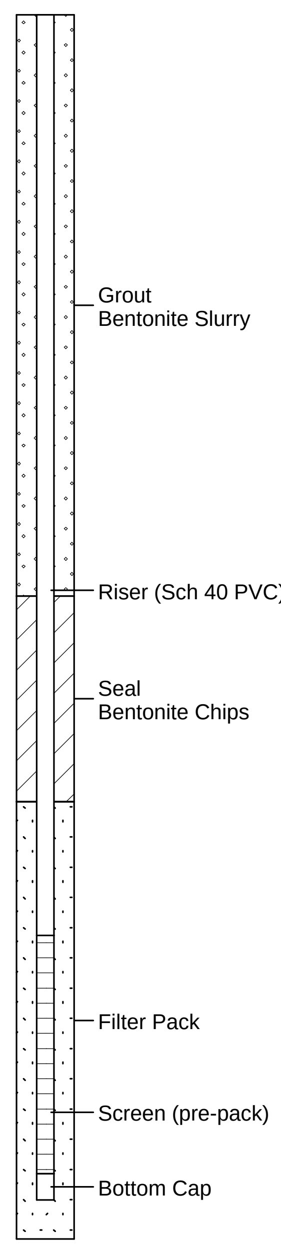
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation:	422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
50	- Auger refusal at 53.7 feet bgs	372				CL
55	LIMESTONE, weathered, thinly laminated, medium hard to hard, gray	367	37 38	5/5 8/27		LS
	SHALE, clayey, gray					SH
60	LIMESTONE, occasional shale partings - laminated, fossiliferous, medium gray	362	39 40	19/60 54/60		LS
65	SHALE, soft, dark gray	357				SH
70	LIMESTONE, medium hard to hard, light gray Borehole diameter from 53.7 to 73.8 feet bgs = 3 7/8" RQD for 53.8 - 73.8' = 57% (Fair) Recovery = 173/240"	352	41 42	59/60 33/34		LS
75	END BOREHOLE AT 73.8 FEET BLS					

Well: MW-352
Elev.: 425.04



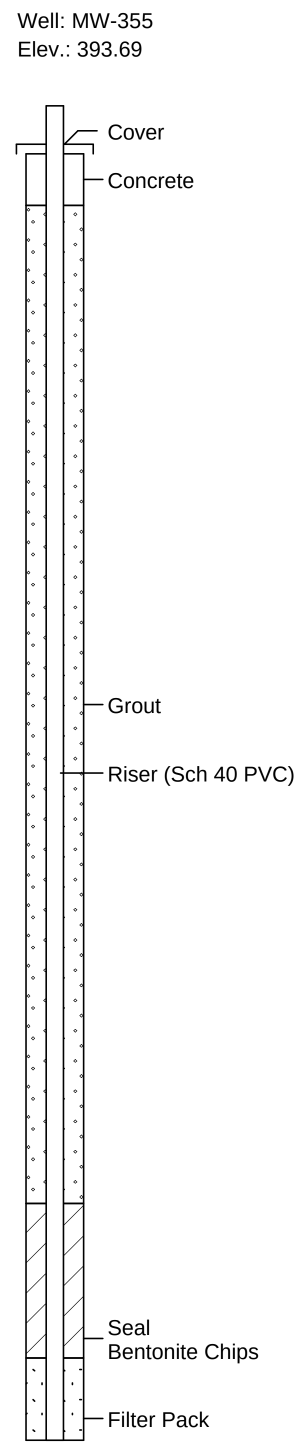
KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-355

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/14/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID; 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 390.82
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	393.69
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378145, 555980

Depth in Feet	DESCRIPTION	Surf. Elev. 390.82	Samples	Recovery inches	Qp TSF	USCS
0	Continuous boring to 20 feet below ground surface. Refer to boring log for adjacent well MW-155 for description of subsurface materials to 20 feet.	390				
5		385				
10		380				
15		375				
20	CLAYEY SAND, poorly graded, dark yellow brown, wet	370	1	23/23	3.5	SC
	CLAY, lean, very stiff, gray with yellow-brown mottling - Auger refusal at 22.1 feet bgs					CL
	LIMESTONE, lightly weathered, fine grained, slightly fossiliferous, medium soft, light gray banded with light red staining along horizontal fractures; three small shale lenses within 31 inch interval - coarse grained, medium soft to hard		2	108/124		LS
25						



c:\powerp~1\baldwin\ashmon~1\bec355~1.bor
01-14-2011

KELRON ENVIRONMENTAL
INCORPORATED

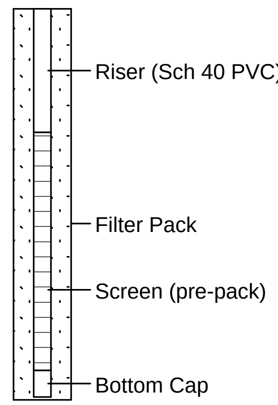
LOG OF BORING MW-355

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/14/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID; 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 390.82
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	393.69
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378145, 555980

Depth in Feet	DESCRIPTION	Surf. Elev. 390.82	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
25	- fine grained, slightly fossiliferous, light gray Borehole diameter from 22.1 to 32.6 feet bls = 3 7/8" RQD for 22.1 - 32.6' = 57% (Fair)	365	2	108/124		LS	
30		360					
	END BOREHOLE AT 32.6 FEET BLS						
35		355					
40		350					
45		345					
50							

Well: MW-355
Elev.: 393.69



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-356

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	9/28/2015	10/1/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-356	Feet (NAVD88)	425.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 558,050.37 N, 2,381,958.49 E E/Ⓦ

1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.2662"

Long -89° 52' 10.4808"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–10	0 - 10' **SILTY CLAY** CL/ML.	CL/ML								0-37.3' Blind Drilled. See logs OW-156 and OW-256 for soil description.
			10–12	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12–17.7	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s. *(continued)*	(CL)s									
			17.7–27.3	17.7 - 27.3' **SILTY CLAY** CL/ML.	CL/ML									
			27.3–28.6	27.3 - 28.6' **POORLY-GRADED SAND:** SP.	SP									
			28.6–32	28.6 - 33.9' **SILTY CLAY** CL/ML.	CL/ML									

Depth scale: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	28.6 - 33.9' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
			34, 35	33.9 - 35.7' **LEAN CLAY:** to **SHALE:** CL.	CL									
			36, 37	35.7 - 37.3' **SHALE:** BDX (SH).	BDX (SH)									
1 CORE	28 24.5		38, 39	37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured.	BDX (SH)									Core 1, RQD=92%
2 CORE	60 57		40, 41, 42	39.6' light to dark gray to tan.										Core 2, RQD = 58%
			43	42.3' - 43.2' limestone.										
			44	43.2' light to dark gray/tan, very weak.										
3 CORE	60 41		45, 46, 47, 48, 49	45' - 50' dark gray, intensely fractured.										Low recovery, possible washout. Core 3, RQD = 18%
4 CORE	36 36		50, 51, 52	50' - 53.1' thin beds of limestone, limestone is more competent, slightly fractured, wet.										Core 4, RQD=92%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured. *(continued)*	BDX (SH)								
5 CORE	24 21.5			53.1' - 53.8' intensely fractured.									Core 5, RQD=58%
			54	53.8 - 55.4' **LIMESTONE:** BDX (LS), white, thickly bedded, moderately fractured (moderately wide to very narrow apertures).	BDX (LS)								
6 CORE	60 60.5		55										Core 6, RQD=84%
			56	55.4 - 57.2' **SHALE:** BDX (SH), dark gray, trace limestone beds, moderately fractured.	BDX (SH)								
			57	56.8' soft, highly weathered bed, decomposed. 57.1' soft, highly weathered bed.									
			58	57.2 - 60' **LIMESTONE:** BDX (LS), trace shale beds, moderately fractured (moderately wide to very wide apertures).	BDX (LS)								
			59	59.4' - 59.7' vertical fractures with pyrite mineralization.									
7 CORE	60 61		60	60 - 65.8' **SHALE:** BDX (SH), gray, moderately fractured.	BDX (SH)								Core 7 RQD=75%
			61	61' -62' dark gray.									
			62	62' - 62.4' soft, clayey.									
			63										
			64										
8 CORE	60 61.5		65	65' dark gray, narrow to moderately wide apertures. 65.3' - 65.8' fossiliferous.									Core 8, RQD=67%
			66	65.8 - 68.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly to moderately fractured.	BDX (LS/SH)								
			67										
			68										
			69	68.8 - 70' **SHALE:** BDX (SH), gray, fossiliferous, moderately fractured (moderately wide to narrow apertures).	BDX (SH)								Bedrock corehole reamed 6" in diameter to 69' for well installation.
9 CORE	60 61		70	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures).	BDX (LS/SH)								Core 9, RQD=87%
			71										
			72										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73, 74	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures). *(continued)*	BDX (LS/SH)									
10 CORE	60 60		75	75 - 75.9' **SHALE:** BDX (SH), dark gray, soft, moderately fractured (narrow to moderately narrow apertures).	BDX (SH)									Core 10, RQD=95%
			76	75.9 - 76.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, narrow to moderately narrow apertures.	BDX (LS/SH)									
			77, 78, 79	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures.	BDX (LS)									
11 CORE	60 60.5		80	80' light gray to gray, unfractured.										Core 11, RQD=100%
			81, 82, 83, 84											
12 CORE	60 61.5		85											Core 12, RQD=100%
			86, 87, 88, 89											
13 CORE	60 59.5		90											Core 13, RQD=100%
			91, 92											

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures. *(continued)*										
			94											
14 CORE	61 61		95											Core 14, RQD=100%
			96											
			97		BDX (LS)									
			98											
			99											
			100	99.7' slightly weathered, decomposed. 100' gray, no fossils.										
15 CORE	60 59.5													Core 15, RQD=100%
			101											
			102	101.8 - 106.5' **SHALE:** BDX (SH), dark gray, thickly bedded, slightly fractured.										
			103											
			104		BDX (SH)									
16 CORE	60 58.5		105											Core 16, RQD=56%
			106	106.2' weathered, decomposed.										
			107	106.5 - 108.4' **LIMESTONE:** BDX (LS), light gray to green, highly decomposed, intensely fractured.	BDX (LS)									
			108											
			109	108.4 - 109.8' **SHALE:** BDX (SH), dark reddish-brown, highly decomposed.	BDX (SH)									
17 CORE	60 55		110	109.8 - 111.1' **LIMESTONE:** BDX (LS), gray, highly disintegrated (healed dissolution cracks with green highly decomposed infilling). 109.9' - 110.7' angular gravel-sized fragments. 110.7' moderately decomposed, very intensely fractured.	BDX (LS)									Core 17, RQD=49%
			111											
			112		BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			113	111.1 - 114' **SHALE:** BDX (SH), dark gray, moderately to highly decomposed, moderately fractured. *(continued)*	BDX (SH)									
18 CORE	60 61		114–116	114 - 116.3' **LIMESTONE:** BDX (LS), gray, moderately fractured.	BDX (LS)									Core 18, RQD=61%
				116.3 - 116.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			117–119	116.7 - 119.7' **SHALE:** BDX (SH), gray, slightly decomposed, intensely fractured.	BDX (SH)									
19 CORE	60 64		120	119.7 - 120.9' **SHALEY LIMESTONE:** BDX (LS/SH), gray, slightly decomposed, intensely fractured.	BDX (LS/SH)									Core 19, RQD=86%
			121–122	120.9 - 122.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
20 CORE	48 48		123–125	122.2 - 126.1' **LIMESTONE:** BDX (LS), gray, moderately fractured. 123.3' - 123.4' fossiliferous. 124.1' - 124.1' fossiliferous. 124.7' - 124.8' fossiliferous.	BDX (LS)									Core 20, RQD =88%
			126–127	126.1 - 127.6' **SHALE:** BDX (SH), dark gray, slightly decomposed. 126.7' - 127' limestone, gray. 127' moderately decomposed.	BDX (SH)									
			128	127.6 - 129.2' **LIMESTONE:** BDX (LS), slightly decomposed.	BDX (LS)									
21 CORE	12 12		129	129.2 - 130' **SHALE:** BDX (SH), gray, intensely fractured.	BDX (SH)									Core 21, RQD=0%
22 CORE	60 60		130	130 - 130.4' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									Core 22, RQD=94%
			131	130.4 - 131' **LIMESTONE:** BDX (LS), gray, fossiliferous, moderately fractured.	BDX (LS)									
			132	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			133	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									The casing dropped 3" during drilling.
			134	134 - 135' **LIMESTONE:** BDX (LS), gray, thickly bedded, moderately fractured.	BDX (LS)									
			135	135' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-366

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/3/2015	12/4/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-366	Feet (NAVD88)	422.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,581.80 N, 2,381,171.15 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 31.8876"
Long -89° 52' 20.4414"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5.6	0 - 5.6' **FILL, SILTY CLAY** CL/ML.	(FILL) CL/ML								0-33' Blind Drilled. See logs TPZ-166 and B-13-4 for soil description.
			5.6–12	5.6 - 33' **SILTY CLAY** CL/ML.	CL/ML								

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–32	5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML								

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML						
1 SS	23 18	17 21 20 50	33	33 - 35.6' **LEAN CLAY:** to **SHALE:** CL, gray, residual soil, hard (>4.5 tsf).	CL						
1 CORE	60 54		35.6	35.6 - 39.3' **SHALE:** BDX (SH), gray, highly decomposed, moderately fractured. 38.4' limestone layer (approximately 2.5").	BDX (SH)						Core 1, RQD=54%
2 CORE	60 47		39.3	39.3 - 42.3' **LIMESTONE:** BDX (LS), cherty, intensely fractured.	BDX (LS)						Core 2, RQD=32%
			42.3	42.3 - 42.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)						
			42.9	42.9 - 43.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)						
3 CORE	60 63		43.7	43.7 - 49.8' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)						Core 3, RQD=73%
4 CORE	60 49		49.8	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured.	BDX (LS/SH)						Core 4, RQD=96%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			53 54	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured. *(continued)* 52.8' - 53.1 shale bed. 53.1' fossiliferous.	BDX (LS/SH)									
				54.3' End of Boring.										Bedrock corehole reamed 6" in diameter to 54' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-369

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/17/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-369	Feet (NAVD88)	420.49 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,329.71 N, 2,381,765.41 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 49.1496"
Long -89° 52' 12.9288"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 0.2' **SILT:** ML.	ML								0-43' Blind Drilled. See log PZ-169 for soil description.
			0.2	0.2 - 2' **SILTY CLAY** CL/ML.	CL/ML								
			2	2 - 4' Shelby Tube Sample.									
			4	4 - 10' **SILTY CLAY** CL/ML.	CL/ML								
			10	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12 - 14	12 - 14' Shelby Tube Sample.										
			14 - 20	14 - 20' **LEAN CLAY:** CL.	CL									
			20 - 22	20 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22 - 24	22 - 24' Shelby Tube Sample.										
			24 - 28	24 - 28' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s									
			28 - 30	28 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30 - 32	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL.	CL									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

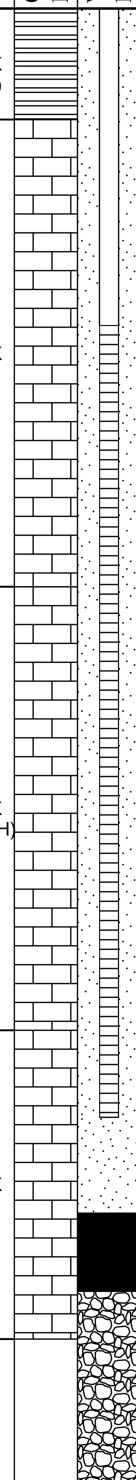
Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32–38	32 - 38' **LEAN CLAY:** CL.	CL								
			38–40	38 - 40' No Recovery.									
			40–42	40 - 42' **LEAN CLAY:** CL.	CL								
1 SS	24 0	10 18 30 40	42–45	42 - 45' No Recovery.									
2 SS	5 9	50/5"	45–45.3	45 - 45.3' **LEAN CLAY:** CL, dark brown (10YR 3/3), 30-50% pale brown (10YR 6/4) and brown (10YR 4/3) mottling, trace subrounded fine gravel, cohesive, low plasticity, moist.	CL								
3 SS	5 8	50/5"	45.3–48.7	45.3 - 48.7' **SHALE:** BDX (SH), dark grayish brown, highly decomposed. 47' trace clay layers (< 1" thick), highly decomposed, very weak.	BDX (SH)								
1 CORE	66 30		48.7–50.8	48.7 - 50.8' **LIMESTONE:** BDX (LS), white, fossiliferous, intensely fractured (extremely narrow to narrow apertures), microcrystalline, slightly to moderately decomposed.	BDX (LS)								Core 1, RQD=17%
			50.8–52	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak.	BDX (SH)								

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak. *(continued)*	BDX (SH)						
2 CORE	60 46		54–58	53.4 - 59.3' **LIMESTONE:** BDX (LS), white, moderately fractured (very narrow to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, very strong, pitted, trace mineralization.	BDX (LS)						Core 2, RQD=83%
				58.4' mud in fracture.							
3 CORE	60 64		59–64	59.3 - 64.9' **SHALEY LIMESTONE:** BDX (LS/SH), dark gray, medium bedded shale, intensely fractured (extremely narrow to narrow apertures), fossiliferous, microcrystalline, decomposed, very weak to weak, weathered, highly weathered shale cementing segments together.	BDX (LS/SH)						Core 3, RQD=63%
4 CORE	60 62		64								Core 4, RQD=79%
			65–68	64.9 - 68.8' **LIMESTONE:** BDX (LS), white, slightly fractured (tight to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, slightly disintegrated, pitted.	BDX (LS)						
			69–70	68.8 - 70.7' Overdrilled for Well Installation.							
				70.7' End of Boring.							Bedrock corehole reamed 6" in diameter to 70.7' for well installation.

Graphic Log / Well Diagram



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-370

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/20/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-370	Feet (NAVD88)	418.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,826.50 N, 2,381,936.14 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 44.1702"
Long -89° 52' 10.8084"

Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0-2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-28' Blind Drilled. See log PZ-170 for soil description.
			2-4	2 - 4' Shelby Tube Sample.									
			4-8	4 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8-10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			10-12	10 - 12' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 14' Shelby Tube Sample.										
			14	14 - 24' **SILTY CLAY** CL/ML.	CL/ML									
			24	24 - 26' Shelby Tube Sample.										
			26	26 - 28' **SILTY CLAY** CL/ML.	CL/ML									
1 SS	10 10	23 50/4"	28	28 - 28.4' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace angular limestone gravel, soft, medium plasticity, moist.	CL									
1 CORE	60 18.5		28.4	28.4 - 28.9' **SHALE:** BDX (SH), gray, highly decomposed, very weak.	BDX (SH)									Core 1, RQD=51%
			28.9	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong.	BDX (LS/SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong. *(continued)*									
2 CORE	51.5 12		34	33.9' - 38.1' gray, greenish gray in fractures, trace fossils, moderately to highly decomposed, slightly to moderately disintegrated, clay in shoe with a hard, reddish brown inclusion.	BDX (LS/SH)								Core 2, RQD=0%
			35–37	36' - 37.9' vertical fracture.									
3 CORE	24 25		38	38.1 - 44' **SHALE:** BDX (SH), bluish gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, weak.									Core 3, RQD=40%
4 CORE	24 11		40										Core 4, RQD=0%
5 CORE	36 32		41	40.6' - 40.8 shaley limestone layer, light gray to gray, microcrystalline, moderately decomposed, very strong. 41.1' - 43.2 gray, moderately to highly decomposed.	BDX (SH)								Core 5, RQD=78%
6 CORE	12 28		44	44 - 45.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to narrow apertures), thin to medium bedded, microcrystalline, slightly decomposed, clay cement in apertures, very strong.	BDX (LS/SH)								Core 6, RQD=29%
7 CORE	45 27		45	45' shale layer, bluish gray, moderately fractured (extremely narrow to narrow apertures), highly decomposed, weak.									Core 7, RQD=65%
			46	45.7 - 52.2' **SHALE:** BDX (SH), bluish gray, moderately fractured (tight to narrow), highly decomposed, weak.									
8 CORE	24 30		49		BDX (SH)								Core 8, RQD=78%
9 CORE	24 24		51–52										Core 9, RQD=0%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				52' clay cement.										
10 CORE	24 36		53 – 54	52.2 - 61.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (very narrow to narrow), thin to medium bedded, microcrystalline, slightly decomposed, cemented clay in apertures, very strong. 52.7' - 53' clayey sand in aperture. 53' - 53.1 shale bed, bluish gray, fossiliferous, moderately fractured (very narrow to narrow), highly decomposed, weak. 53.1' white to bluish gray, gray in the fractures (extremely narrow to moderately narrow apertures), thinly to medium bedded, slightly to moderately disintegrated. 55.7' moderately disintegrated.	BDX (LS/SH)									Core 10, RQD=0%
11 CORE	24 30		55 – 57											Core 11, RQD=18%
12 CORE	30 27		58 – 60	58.1' highly decomposed.										Core 12, RQD=39%
13 CORE	36 53		61											Core 13, RQD=89%
			62 – 65	61.7 - 65.3' **LIMESTONE:** BDX (LS).	BDX (LS)									
			66	65.3 - 66' Overdrilled for Well Installation.										
				66' End of Boring.										Bedrock corehole reamed 6" in diameter to 66' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-373

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/21/2015	10/28/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-373	Feet (NAVD88)	388.80 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,041.91 N, 2,379,186.06 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 26.613"
Long -89° 52' 45.3282"

Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–2	0 - 2' No Recovery. Gravel Pad.									0-13.4' Blind Drilled. See log PZ-173 for soil description detail.
			2–10.9	2 - 10.9' **SILTY CLAY** CL/ML.	CL/ML								
			10.9–12	10.9 - 13.4' **SILT:** ML.	ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	10.9 - 13.4' **SILT:** ML. *(continued)*	ML								
1 CORE	23 23		14	13.4 - 14.7' **LIMESTONE:** BDX (LS), fossiliferous, extremely fractured, thickly bedded.	BDX (LS)								Core 1, RQD=65%
			15	14.7 - 15.5' **SHALE:** BDX (SH), gray, trace limestone, highly decomposed.	BDX (SH)								
2 CORE	58.2 42		16	15.5 - 16.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, intensely fractured.	BDX (LS/SH)								Core 2, RQD=52%
			17	16.6 - 17.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								
			18	17.3 - 18.8' **LIMESTONE:** BDX (LS), thickly bedded.	BDX (LS)								
			19, 20	18.8 - 20.2' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)								
3 CORE	60 56			20.2 - 20.8' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, tight diagonal fracture.	BDX (LS/SH)								Core 3, RQD=57%
			21	20.8 - 21.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								
			22, 23, 24	21.5 - 24.9' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, extremely narrow to narrow apertures.	BDX (LS/SH)								
4 CORE	60 55		25, 26, 27, 28, 29	24.9 - 29.1' **SHALE:** BDX (SH), highly decomposed. 25.1' - 25.4' limestone, fossiliferous. 25.4' gray, fossiliferous, thickly bedded, hard.	BDX (SH)								Core 4, RQD=65%
5 CORE	60 60		30, 31, 32	29.1 - 48.3' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded. 30' - 35.1' moderately fractured, extremely narrow apertures.	BDX (LS)								Core 5, RQD=95%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				29.1 - 48.3' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded. *(continued)*										
			33											Bedrock corehole reamed 6" in diameter to 33.3' for well installation.
			34											
6 CORE	60 58		35	35.1' - 40' slightly fractured, narrow apertures.										Core 6, RQD=96%
			36											
			37											
			38											
			39											
7 CORE	60 60		40	40' - 45.1' moderately fractured, extremely narrow to narrow apertures.	BDX (LS)									Core 7, RQD=100%
			41	41.3' - 41.6' vuggy.										
			42											
			43											
			44											
8 CORE	60 61.5		45	45.1' - 48.3' moderately fractured.										Core 8, RQD=63%
			46											
			47											
			48	48.3 - 57' **SHALE:** BDX (SH), gray, thin limestone beds.										
			49											
9 CORE	60 63		50	49.9' moderately decomposed.	BDX (SH)									Core 9, RQD=57%
			51											
			52											

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	RQD/ Comments
			53–54	48.3 - 57' **SHALE:** BDX (SH), gray, thin limestone beds. *(continued)*	BDX (SH)	
10 CORE	60 46		55–56	54.7' - 55' fossiliferous.		Core 10, RQD=35%
			57–58	57 - 58.3' **LIMESTONE:** BDX (LS), intensely fractured, decomposed green infilling.	BDX (LS)	
			59	58.3 - 60' **LEAN CLAY:** CL, greenish gray to reddish brown. 58.7' reddish brown.	CL	
11 CORE	60 55		60–62	60 - 65.2' **SHALE:** BDX (SH), intensely fractured, thickly bedded, decomposed.	BDX (SH)	Core 11, RQD=51%
			63–64	62.8' gray.		
12 CORE	60 58		65–66	65.2 - 66.5' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, thinly bedded.	BDX (LS/SH)	Core 12, RQD=67%
			67–68	66.5 - 68.8' **SHALE:** BDX (SH), gray.	BDX (SH)	
			69	68.8 - 70.7' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured, decomposed (greenish gray).	BDX (LS/SH)	
13 CORE	46 48		70			Core 13, RQD=60%
			71–72	70.7 - 80.1' **SHALE:** BDX (SH), dark gray, thickly bedded.	BDX (SH)	

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				70.7 - 80.1' **SHALE:** BDX (SH), dark gray, thickly bedded. *(continued)*										
14 CORE	12 11		74											Core 14, RQD=91%
15 CORE	60 62		75											Core 15, RQD=61%
			76	76.1' dark to light gray, intensely fractured, highly decomposed.	BDX (SH)									
			77	77.5' dark gray, moderately fractured.										
			78	78.7' highly fractured, decomposed.										
16 CORE	60 64		80	80.1 - 83.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									Core 16, RQD=61%
			83	83.3 - 85.4' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
17 CORE	60 60		85	85.4 - 88.4' **SHALEY LIMESTONE:** BDX (LS/SH), thickly bedded, fossiliferous.	BDX (LS/SH)									Core 17, RQD=87%
			88	88.4 - 88.8' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
			89	88.8 - 94' **LIMESTONE:** BDX (LS), thickly bedded.	BDX (LS)									
18 CORE	60 59		90											Core 18, RQD=88%

Depth scale: 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			93	88.8 - 94' **LIMESTONE:** BDX (LS), thickly bedded. *(continued)*	BDX (LS)									
			94 95	94 - 95.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
				95.1' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-374

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/6/2015	11/9/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-374	Feet (NAVD88)	398.41 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,663.65 N, 2,379,766.63 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 22.8546"
Long -89° 52' 38.0706"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' **TOPSOIL:** ML.	ML								0-23.6' Blind Drilled. See log PZ-174 for soil description.
			2 - 4	2 - 4' No Recovery.									
			4 - 12	4 - 23.6' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-374

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–23	4 - 23.6' **LEAN CLAY:** CL. *(continued)*	CL									
1 SS	24 0.4	50/5"	24	23.6 - 24.1' **SILTY CLAY** CL/ML, brown, 3" of shale at bottom of sample.	CL/ML									
1 CORE	18 16		24–25	24.1 - 27.5' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, moderately fractured (very narrow to moderately narrow apertures).	BDX (LS)									Core 1, RQD=89%
2 CORE	60 44		26–27											Core 2, RQD=61%
			28	27.5 - 37.2' **SHALEY LIMESTONE:** BDX (LS/SH), decomposed, thickly bedded.										
3 CORE	38 30		30	29.7' moderately fractured.	BDX (LS/SH)									Core 3, RQD=67%
			31–32											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-374

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				27.5 - 37.2' **SHALEY LIMESTONE:** BDX (LS/SH), decomposed, thickly bedded. *(continued)*										
4 CORE	30 27		33											Core 4, RQD=56%
			34											
			35		BDX (LS/SH)									
5 CORE	59 59			35.4' - 36.2' fossiliferous.										Core 5, RQD=100%
			36	36.2' increase in shale content.										
			37											
				37.2 - 40.3' **SHALE:** to **LIMESTONE:** BDX (SH), gray, limestone content decreasing with depth, thickly bedded, moderately fractured.										
			38											
			39		BDX (SH)									
				39.6' dark gray, no limestone.										
			40											
6 CORE	25 25			40.3 - 42.3' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.										Core 6, RQD=100%
			41		BDX (LS)									
			42	41.9' very narrow diagonal fracture.										Bedrock corehole reamed 6" in diameter to 42' for well installation.
				42.3' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-375

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/3/2015	11/6/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-375	Feet (NAVD88)	420.50 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,434.97 N, 2,380,838.70 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 20.562"
Long -89° 52' 24.6504"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–0.9	0 - 0.9' **SILT:** ML.	ML								0- 44.8' Blind Drilled. See log PZ-175 for soil description details.
			0.9–5.4	0.9 - 5.4' **LEAN CLAY:** CL.	CL								
			5.4–13.5	5.4 - 13.5' **SILT:** ML.	ML								
			13.5–15	13.5 - 22.3' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16–22	13.5 - 22.3' **LEAN CLAY:** CL. *(continued)*	CL									
			22–26	22.3 - 26' **SILT:** ML.	ML									
			26–28	26 - 28' **LEAN CLAY:** to **SILT:** CL.	CL									
			28	28 - 28.4' **SANDY SILT:** s(ML).	s(ML)									
			28.4–31	28.4 - 31.3' **LEAN CLAY:** CL.	CL									
			31.3	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g.	(SW)g									
			32–41	31.5 - 43.8' **LEAN CLAY:** CL.	CL									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			42–43	31.5 - 43.8' **LEAN CLAY:** CL. *(continued)*	CL								
			44	43.8 - 44.8' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g								
1 CORE 1 SS	60 42 5 5	50 for 5"	45	44.8 - 45.3' **WELL-GRADED GRAVEL:** GW, gray, mostly limestone cobbles.	GW								Core 1, RQD=86% Broken limestone in split spoon at 45'.
			46–49	45.3 - 49.3' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/6).	CL/ML								
			50	49.3 - 50.1' **LEAN CLAY:** CL, dark gray (10YR 4/1).	CL								
2 CORE	24 18		51	50.1 - 51.3' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)								Core 2, RQD=33%
3 CORE	36 30.5		52–53	51.3 - 62.8' **SHALEY LIMESTONE:** BDX (LS/SH), gray, thickly bedded, fossiliferous, moderately fractured.	BDX (LS/SH)								Core 3, RQD=85%
4 CORE	60 55		55–56										Core 4, RQD=95%
5 CORE	60 62		60	59.9' very narrow to narrow apertures.									Core 5, RQD=94%
			63–64	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures).									
6 CORE	60 55		65	64.9' very narrow apertures.	BDX (LS)								Core 6, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			68	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures). *(continued)*										
			69											
7 CORE	60 63		70	69.5' slightly to moderately fractured (very narrow to moderately narrow apertures).										Core 7, RQD=95% Bedrock corehole reamed 6" in diameter to 70' for well installation.
			71											
			72											
			73											
			74											
8 CORE	60 62		75	74.9' extremely narrow apertures.										Core 8, RQD=100%
			76		BDX (LS)									
			77											
			78											
			79											
9 CORE	60 56		80	80.2' unfractured, cherty.										Core 9, RQD=100%
			81											
			82											
			83											
			84											
				84.7' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-377

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	10/29/2015	11/2/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-377	Feet (NAVD88)	418.75 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,198.46 N, 2,381,923.68 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.1896"
Long -89° 52' 11.0712"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 4	0 - 4' **TOPSOIL:** ML.	ML								0-28.5' Blind Drilled. See log PZ-177 for soil description.
			4 - 13	4 - 19.3' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature]	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			14–19	4 - 19.3' **LEAN CLAY:** CL. *(continued)*	CL									
			20–21	19.3 - 22' **SILT:** ML.	ML									
			22–28	22 - 28.5' **LEAN CLAY:** CL.	CL									
1 SS	24	3 6 9 17	29–30	28.5 - 30.8' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), gray (10YR 5/4) mottling, hard (4.5 tsf).	CL									
2 SS	24 12	12 20 27 30	31	30.8 - 34.9' **SHALE:** BDX (SH), gray, moderately to highly decomposed.	BDX (SH)									
1 CORE	41 51		32–34	31.7' grayish brown mottling, thickly bedded.										Core 1, RQD=92%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
2 CORE	55.8 16		35	34.9 - 35.3' **LIMESTONE:** BDX (LS), cherty, moderately decomposed, reddish gray mottling, moderately fractured.	BDX (LS)									Core 2, RQD=25%
			36	35.3 - 46.4' **SHALE:** BDX (SH), gray, moderately to highly decomposed.										
3 CORE	60 64.2		40	39.7' - 40.4' gray and brown mottling, highly decomposed, blocky structure.										Core 3, RQD=75%
			41	40.4' - 43.1' highly decomposed, moderately fractured.	BDX (SH)									
4 CORE	60 58		45											Core 4, RQD=12%
			46.4	46.4 - 51.1' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured (narrow apertures).										
			49		BDX (LS/SH)									
			49.5	49.5 - 49.9' vertical fracture.										
5 CORE	60 50		50											Core 5, RQD=58%
			51.1	51.1 - 55.5' **SHALE:** BDX (SH), gray, thickly bedded.										
			53		BDX (SH)									
6 CORE	60 41		55											Core 6, RQD=61%
			55.5	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			57 58	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									
				58.2' End of Boring.										Bedrock corehole reamed 6" in diameter to 58' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-382

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/19/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-382	Feet (NAVD88)	428.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,440.86 N, 2,382,404.51 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.344"
Long -89° 52' 4.9578"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-34' Blind Drilled. See log PZ-182 log for soil description details.
			2 - 4	2 - 4' Shelby Tube Sample.									
			4 - 12	4 - 12' **SILTY CLAY** CL/ML.	CL/ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 14' Shelby Tube Sample.										
			14	14 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22	22 - 24' Shelby Tube Sample.										
			24	24 - 27' **SILTY CLAY** CL/ML.	CL/ML									
			27	27 - 29.1' **WELL-GRADED SAND:** SW.	SW									
			29.1	29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g									
			30	30 - 34' **SILTY CLAY** CL/ML.	CL/ML									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	30 - 34' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
1 SS	23 20	12 20 25 50 for 5"	34–35	34 - 36' **SILTY CLAY** CL/ML, dark gray (10YR 4/1), dark yellowish brown 10YR 4/6 mottling, highly decomposed shale at bottom of spoon, hard (>4.5 tsf).	CL/ML									
1 CORE	53 48.5		36–38	36 - 38.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 1, RQD=94%
			39	38.3 - 40' **LIMESTONE:** BDX (LS), thinly laminated, intensely fractured (extremely narrow apertures).	BDX (LS)									
2 CORE	60 24.5		40–44	40 - 44.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 2, RQD=51%
			45	44.5 - 45.4' **LIMESTONE:** BDX (LS), thinly bedded.	BDX (LS)									
3 CORE	54 35		46–49	45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 3, RQD=51%
4 CORE	24 23.5		50–52	50.1' - 51.2' reddish brown and dark gray mottling. 51.2' - 52.1' limestone, intensely fractured.										Core 4, RQD=19%

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
5 CORE	41 41			45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed. *(continued)* 52.1' gray.	BDX (SH)								Core 5, RQD=63%
			53										
			54										
			55										
6 CORE	30 25		56	55.9' gray to dark gray, intensely fractured, few medium limestone beds.									Core 6, RQD=50%
			57										
7 CORE	30 30		58										Core 7, RQD=53%
			59	58.4 - 62' **LIMESTONE:** BDX (LS), cherty, moderately fractured. 59.5' - 59.9' vertical fracture.	BDX (LS)								
8 CORE	60 59		60	60' shale (2" layer). 60.4' - 61.4' shaley, intensely fractured.									Core 8, RQD=70%
			61										
			62	62 - 67.1' **SHALE:** BDX (SH), gray, hard, slightly fractured.	BDX (SH)								
			63										
			64										
			65										
9 CORE	60 59		66										Core 9, RQD=88%
			67	67.1 - 70.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured, (very narrow apertures).	BDX (LS/SH)								
			68										
			69										Bedrock corehole reamed 6" in diameter to 69' for well installation.
			70	70.6' End of Boring.									

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-383

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/7/2015	12/21/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-383	Feet (NAVD88)	457.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,586.04 N, 2,385,208.26 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 41.6862"
Long -89° 51' 29.8296"
Local Grid Location
Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24	4 2 2 4		0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf).									
			1										
2 SS	24	1 3 2 3	2										
			3										
3 SS	24 18	1 2 3 7	4										
			5										
4 SS	24 18	2 11 11 7	6		(FILL)								
			7										
5 SS	24 17	7 4 3 2	8	8' mostly black (10YR 2/1).									
			9										
6 SS	24 18	2 4 4 4	10										
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	2 3 4 1	13	0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf). *(continued)*	(FILL)									
8 SS	24	1 2 1 2	14–15	14' clay (2" thick layer).										
9 SS	24 10	WOH WOH 2 2	16–17	16 - 18' **LEAN CLAY:** CL, gray (5Y 5/1), stiff (1.75 tsf).	CL									WOH=weight of hammer
10 SS	24 14	WOH 2 2 2	18–19	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity.										
11 SS	24	WOH 2 2 2	20–21											
			22–23											Blind drill 22-24' bgs during casing install. Permanent 6" PVC casing was installed to 22.5' bgs.
13 SS	24 13	1 1 3 3	24–25	24' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling.	CL/ML									
14 SS	24 12	1 1 2 3	26–27	26' dark gray (10YR 5/6) mottling.										
15 SS	24 23	2 4 4 6	28–29											
16 SS	24 27	4 4 2 7	30–32	31' trace oxidation staining.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 27	4 4 5 5	33	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity. *(continued)* 32' light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) mottling, very stiff (3.0 tsf).										
18 SS	24 26	2 3 5 6	34 35	34' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, very stiff (2.0 tsf).										
19 SS	24 14	WOH WOH 3 4	36 37	36' very soft to stiff (0-1.75 tsf).	CL/ML									
20 SS	24 12	3 4 3 5	38 39	38' strong brown (7.5YR 4/6), gray (10Y R5/1) mottling, trace sand, very stiff (3.5 tsf).										
21 SS	24 22	1 2 2 2	40	40 - 41' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, moderately stiff (0.75 tsf).	(CL)s									
			41	41 - 42' **SILTY SAND:** SM, yellowish brown (10YR 5/6), mostly medium sand, trace coarse sand, soft.	SM									
22 SS	24 24	5 8 9 10	42 43	42 - 44' **SILTY CLAY** CL/ML, brown (10YR 5/3), >15% sand, moderately stiff (0.75 tsf), nonplastic.	CL/ML									
23 SS	24 20	4 6 8 7	44 45	44 - 50' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), trace black oxidation staining, very stiff to hard (3.25-4.5+ tsf), plastic.										
24 SS	24 16	4 6 10 11	46 47		CL									
25 SS	24 19	6 18 21 21	48 49	48' brown (10YR 5/3), hard (4.25-4.5+), low plasticity.										
26 SS 1 CORE	24 60	8 16 22 32	50 51 52	50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry.	BDX (SH)									Core 1, RQD=60%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	24	8 10 15 50/4"	53	50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry. *(continued)*	BDX (SH)									
			54, 55	53.1 - 55.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
2 CORE	60		56, 57, 58	55.1 - 58.6' **LIMESTONE:** BDX (LS), slightly fractured.	BDX (LS)									Core 2, RQD=82%
			59	58.6 - 59.5' **SHALE:** BDX (SH), thinly bedded with limestone, moderately fractured.	BDX (SH)									
3 CORE	60		60, 61, 62	59.5 - 70.1' **SHALE:** BDX (SH), gray, moderately decomposed. 60' intensely to moderately fractured.	BDX (SH)									Core 3, RQD=31%
			63, 64	63' moderately fractured.										
4 CORE	60		65, 66, 67, 68, 69, 70											Core 4, RQD=49%
5 CORE	34		71, 72	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured.	BDX (LS)									Core 5, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			73	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured. *(continued)*	BDX (LS)									
				73' End of Boring.										Bedrock corehole reamed 6" in diameter to 73' for well installation.

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-384

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	12/7/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-384	Feet (NAVD88)	456.70 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,446.11 N, 2,384,518.72 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 30.4398"
Long -89° 51' 38.5158"

Local Grid Location
Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 8	2 3 4 6		0 - 2.5' **FILL, ASH (Coal):** very soft to moderately stiff (0-0.75 tsf).	(FILL)									
2 SS	24 19	2 4 3 6	2											
			3	2.5 - 4' **FILL, SILTY CLAY** CL/ML, strong brown (7.5YR 4/6), trace gravel, very soft to very stiff (0-3.5 tsf).	(FILL) CL/ML									
3 SS	24 10	1 2 3 4	4	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf).										
4 SS	24	2 2 2 2	6											
5 SS	24	1 2 1 1	8		(FILL)									
6 SS	24	1 2 1 1	10											
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	1 5 10 10	13	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf). *(continued)*									
8 SS	24 14	5 10 11 11	14, 15	14' wet.	(FILL)								
9 SS	24 14	5 8 14 15	16, 17										
10 SS	24 16	2 2 3 4	18, 19	18 - 22' **SILTY CLAY** CL/ML, gray (5Y 6/1), organic odor, stiff to very stiff (1.25-3.75 tsf), wet.									
11 SS	24 18	2 2 6 4	20, 21		CL/ML								
12 SS	24 16	4 4 5 4	22, 23	22 - 24' **SILT:** ML, very dark gray (10YR 3/1), dark yellowish brown (10YR 3/6) mottling, hard (4.25-4.5 tsf).	ML								
13 SS	24 22	1 2 5 7	24, 25	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf).									Permanent 6" PVC casing set at 25' bgs.
14 SS	24 21	3 4 5 7	26, 27	26' yellowish brown (10YR 5/4), trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, 5-15% fine sand, trace fine gravel, stiff to very stiff (1.25-2.5 tsf), low to medium plasticity, moist.									
15 SS	24 21	3 4 5 6	28, 29	28' color grades to gray (10YR 5/1), 30-50% silt, soft to stiff (0.5-1.25 tsf).	CL/ML								
16 SS	24 17.5	1 5 5 7	30, 31, 32	30' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, no gravel, very soft to very stiff (<0.25-2.5 tsf), medium plasticity.									

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 20.5	4 4 4 6	33	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf). *(continued)* 32' trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, stiff to very stiff (1.75-3.5 tsf).									
18 SS	24 22	3 4 5 7	34, 35	34' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, stiff to very stiff (1.5-2.5), dry to moist. 35.3' yellowish brown (10YR 5/8), trace gray (10YR 5/1) and very dark gray (10YR 3/1) mottling.									
19 SS	24 21	4 3 3 4	36, 37	36' gray (10YR 5/1) mottling (15-30%), silt content increasing with depth, moderately stiff to stiff (0.75-1.25 tsf), low plasticity, moist.	CL/ML								
20 SS	24 24	2 4 7 14	38, 39	38' grayish brown (10YR 5/2), trace gray (10YR 5/1), trace strong brown (7.5YR 4/6) mottling, 30-50% silt, soft to very stiff (0.5-3.75 tsf). 38.7' - 40' very dark gray (10YR 3/1) mottling (5-15%), 5-15% fine gravel.									
21 SS	24 25	3 11 21 44	40, 41	40' sand (5-15%), trace gravel, very stiff to hard (3.5-4.5+ tsf). 40.3' wet. 40.8' very stiff to hard (3.5-4.5+ tsf), moist.									
22 SS	24 20	13 11 15 17	42, 43	41.8' fine sand seam (1/4" thick). 42' - 42.4' fine gravel, 30-50% clay, trace sand, wet. 42.4 - 44.3' **CLAYEY SILT** ML/CL, gray (10YR 5/1) to grayish brown (10YR 5/2), 30-50% clay, 5-15% fine sand, trace subrounded gravel, very stiff to hard (3.5-4.5+), nonplastic to low plasticity, moist.	ML/CL								
23 SS	24 17	6 8 10 14	44, 45	43.5' - 44.3' very dark grayish brown (10YR 3/2), brownish yellow trace (10YR 6/6) mottling, trace coal. 44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry.									
24 SS	24 16	5 10 11 15	46, 47	46' decreasing silt content, trace gravel, clay becoming laminated with depth, very stiff (2.25-3.0 tsf).									
25 SS	24 13.5	6 8 12 22	48, 49	48' silt (5-15%), trace shale gravel, very stiff (3.0 tsf), medium plasticity, dry. 49.2' gravel (2" diameter).	CL								
26 SS	24 16	8 9 15 19	50, 51, 52	50' very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2), trace silt, very stiff (3.5 tsf), medium to high plasticity, highly weathered shale (residual soil).									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	24 22	13 14 9 14	53	44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry. *(continued)* 52' - 54' clay is fractured, light brownish gray (10YR 6/2) to light yellowish brown (10YR 6/4) in fractures.	CL								
28 SS	24 24	12 12 14 22	54, 55	54' trace very dark brown (10YR 2/2) laminations, hard (>4.5 tsf).									
29 SS	23 20	11 14 20 50/5"	56, 57	56 - 58.2' **SHALE:** BDX (SH), very dark gray (10YR 3/1), highly weathered, fissile, totally healed fractures, very weak, highly decomposed [light brownish gray (10YR 6/2) in fractures], very intensely fractured (closed to narrow apertures).	BDX (SH)								3" steel casing set at 57.7 ft bgs.
1 CORE	24 40		58	57' light yellowish brown (10YR 6/4) to very dark gray (10YR 3/1) layers, thinly bedded, highly decomposed to residual soil.									Core 1, RQD=36%
2 CORE	60 64		59, 60	58.2 - 60.8' **LIMESTONE:** BDX (LS), light greenish gray (GLEY 1 7/10Y), microcrystalline, trace fossils, moderately strong to strong, medium bedded, slightly to moderately decomposed, moderately fractured.	BDX (LS)								Core 2, RQD=73%
			61, 62, 63	60.8 - 64' **SHALEY LIMESTONE:** BDX (LS/SH), weak, thin to medium bedded, moderately decomposed, slightly to moderately disintegrated.	BDX (LS/SH)								
3 CORE	60 73		64, 65, 66, 67	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures).	BDX (SH)								Core 3, RQD= 58%
			68	67.9' - 68.8' shale clasts within decomposed shale matrix.									
4 CORE	60 63		69, 70, 71, 72	68.8' - 69.2' light yellowish brown (10YR 6/4), trace dark yellowish brown (10YR 3/6) layers. 69.2' - 74' intensely fractured (extremely narrow to narrow aperture).									Core 4, RQD=46%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			73	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures). *(continued)*									
5 CORE	60 20		74	74' - 79' intensely to very intensely fractured.									Core 5, RQD=0%
			75–78		BDX (SH)								Bedrock corehole reamed 6" in diameter to 77' for well installation.
6 CORE	60 64		79	79' - 82.6' intensely fractured.									Core 6, RQD=64%
			80–82										
			83	82.6 - 83.9' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed.	BDX (LS/SH)								
7 CORE	60 37		84–85	83.9 - 85.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)								Core 7, RQD=15%
			86–88	85.6 - 88.7' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed. 86.4' - 87' SHALE layer, greenish gray (GLEY 1 5/10Y), very weak, medium bedded.	BDX (LS/SH)								
8 CORE	60 50		89–92	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)								Core 8, RQD=49%

![Natural Resource Technology]

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93 94	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures). *(continued)* 92.5' - 93.2' light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured, slightly decomposed.	BDX (SH)									
				94.1' End of Boring.										

Natural Resource Technology

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-385

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	12/4/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-385	Feet (NAVD88)	454.82 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,417.12 N, 2,382,285.24 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 30.2244"
Long -89° 52' 6.492"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 13	2 3 3 5		0 - 0.3' **FILL, ASH (Coal):** dark yellowish brown (10YR 4/6), sand and silt-sized ash, dark gray (10YR 4/1) slag pieces, dry to moist.	(FILL)								
			1	0.3 - 19.7' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to yellowish brown (10YR 5/4) inside, 10-30% silt, cohesive, stiff to hard (1.0-4.5 tsf), medium plasticity, moist.									
2 SS	24 9	1 2 2 3	2	2' dark gray (10YR 4/1) mottling (15-30%), moist.									
			3										
3 SS	24 15	1 3 4 5	4	4' trace sand, trace dark yellowish brown (10YR 4/6) oxidation staining, moist to dry.									
			5										
4 SS	24 16	1 3 5 6	6	6' dry to moist.	(FILL) CL								
			7										
5 SS	24 9	WOH 1 3 4	8	8' increased dark gray (10YR 4/1) mottling 20-30%, dry to moist.									WOH=weight of hammer
			9										
6 SS	24 13	1 2 3 5	10	10' moist.									
			11										
7 SS	24 18	WOH 2 5 7	12	12' moist to dry. 12.3' mostly dark gray (10YR 4/1), no mottling.									
			13										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 12	WOH WOH 3 3	14	0.3 - 19.7' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to yellowish brown (10YR 5/4) inside, 10-30% silt, cohesive, stiff to hard (1.0-4.5 tsf), medium plasticity, moist. *(continued)* 13' mostly brown (10YR 4/3), dark gray (10YR 4/1) mottling.									
			15	14' some dark gray (10YR 4/1) mottling, trace yellowish brown (10YR 5/6) oxidation staining, trace very dark grayish brown (10YR 3/2) mottling, moist.									
9 SS	24 16	WOH 1 3 4	16 17	16' moist. 16.5' dark gray (10YR 4/1) with dark yellowish brown (10YR 4/6) mottling, cohesive, medium to high plasticity.	(FILL) CL								
10 SS	24 24	WOH WOH 2 3	18 19	18' dark gray (10YR 4/1), dark yellowish brown (10YR 4/6) mottling, softer than above, moist to wet.									
11 SS	24 24	WOH WOH WOH 1	20 21	19.7 - 31.9' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2), silt-sized ash, trace sand-sized ash, cohesive, very soft (0 tsf), non-plastic, wet. 20' very dark grayish brown (10YR 3/2), trace sand seams, wet.									
12 SS	48 24	WOH 1 WOH 1	22 23 24 25	22' trace fine-grained sand seams.									
13 SS	24 21	1 WOH 1 WOH	26 27	25.7' medium-grained sand seam (2" thick).	(FILL)								
14 SS	24 24	1 2 2 1	28 29										
15 SS	24 24	WOH WOH WOH WOH	30 31										
			32 33	31.9 - 38' **SILT:** to **LEAN CLAY:** ML, olive gray (5Y 5/2), cohesive, very soft to soft (0.25-0.5 tsf), low to medium plasticity, moist to wet.	ML								
16 SS	24 24	WOH WOH WOH	34										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		WOH	35	31.9 - 38' **SILT:** to **LEAN CLAY:** ML, olive gray (5Y 5/2), cohesive, very soft to soft (0.25-0.5 tsf), low to medium plasticity, moist to wet. *(continued)*	ML									
			36											
			37											
17 SS	24 24	2 4 6 6	38	38 - 59' **LEAN CLAY:** CL, olive gray (5Y 5/2), dark yellowish brown (10YR 4/6) mottling, moist to dry.	CL									
			39											
			40											
			41											
18 SS	24 14	WOH 2 3 4	42	42' medium plasticity, moist.										Augered with 8" plug to 42' bgs.
			43											
19 SS	24 23	1 3 4 6	44											Permanent 6"PVC casing set at 45' bgs.
			45											
20 SS	24 27	2 3 3 5	46											
			47											
21 SS	24 16	WOH 2 4 4	48	48' gray (10YR 6/1), dark yellowish brown (10YR4/6), stiff (1.5 tsf), plastic.										
			49											
22 SS	24 24	WOH 3 4 4	50											
			51	51' trace sand, very stiff (2.5 tsf).										
23 SS	24 24	3 4 4 7	52											
			53											
24 SS	24 22	WOH 2 3 4	54	54' increase in sand content, stiff (1.75 tsf).										
			55											
25	24	WOH	56	56' trace root structures, oxidation staining.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
SS	21	3 3 4	57	38 - 59' **LEAN CLAY:** CL, olive gray (5Y 5/2), dark yellowish brown (10YR 4/6) mottling, moist to dry. *(continued)*	CL								
26 SS	24 23	WOH 5 11 27	58										
			59	59 - 60' **POORLY-GRADED SAND WITH CLAY:** SP-SC, fine-grained, trace coarse-grained sand, and trace gravel, very stiff (2.25 tsf).	SP-SC								
27 SS	24 22	6 8 13 13	60	60 - 61' **SILTY CLAY** to **POORLY-GRADED SAND:** CL/ML, yellowish brown (10YR 5/6), gray (10YR 5/1) mottling.	CL/ML								
			61	61 - 62' **LEAN CLAY:** to **SHALE:** CL, very dark gray (10YR 3/1), weathered, hard (>4.5 tsf), dry.	CL								
28 SS	24 22	9 13 15 50/4"	62–63	62 - 63.8' **SILTY CLAY** to **SHALE:** CL/ML, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6) mottling, weathered.	CL/ML								
1 CORE	12 11		64	63.8 - 65' **SHALE:** BDX (SH), weathered.	BDX (SH)								Core 1, RQD=0%
2 CORE	60 48		65	65 - 65.9' **SHALEY LIMESTONE:** BDX (LS/SH).	BDX (LS/SH)								Core 2, RQD=63%
			66–70	65.9 - 76.3' **SHALE:** BDX (SH), gray, decomposed, intensely to moderately fractured.									
3 CORE	60 55		71–75	71.2' - 72.5 vertical fracture (tight aperture).	BDX (SH)								Core 3, RQD=82%
4 CORE	60 60		76										Core 4, RQD=74%
				76.3 - 76.9' **LIMESTONE:** BDX (LS).	BDX (LS)								
			77–78	76.9 - 78.9' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)								

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				76.9 - 78.9' **SHALE:** BDX (SH), dark gray, moderately fractured. *(continued)*	BDX (SH)						
			79	78.9 - 81.1' **LIMESTONE:** BDX (LS), cherty, slightly fractured.	BDX (LS)						
5 CORE	60 54.5		80–81								Core 5, RQD=62%
			81	81.1 - 82.2' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)						
			82	82.2 - 82.9' **LIMESTONE:** BDX (LS), moderately fractured.	BDX (LS)						
			83	82.9 - 83.5' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)						
			84–87	83.5 - 87.4' **SHALE:** BDX (SH), gray.	BDX (SH)						
6 CORE	60 65		86								Core 6, RQD=58%
			88–93	87.4 - 93' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, intensely to moderately fractured.	BDX (LS/SH)						
7 CORE	30 30		91								Core 7, RQD=100%
			93	93' End of Boring.							Bedrock corehole reamed 6" in diameter to 93' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-386

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	12/1/2015	12/11/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-386	Feet (NAVD88)	454.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,585.18 N, 2,382,713.22 E E/W (W circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 21.9876"
Long -89° 52' 1.167"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	3 3 7 5		0 - 0.5' **FILL, WELL-GRADED SAND:** SW, dark brown (10YR 3/3) to black (10YR 2/1), fine to coarse sand-sized ash and slag, moist.	(FILL) SW								
			1	0.5 - 2.6' **FILL, SILT:** ML, dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/8) mottling, 20-40% clay, cohesive, hard (4.5 tsf), nonplastic, dry.	(FILL) ML								
2 SS	24 16	2 4 4 6	2	2' - 2.6' clay content increases with depth to mostly clay at 2.6', dry.									
			3	2.6 - 24.5' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), trace gray (10YR 5/1) mottling, 20-40% silt, cohesive, very stiff (2.0-4.0 tsf), high plasticity, moist.									
3 SS	24 17	2 4 4 5	4	4' gray (10YR 5/1), 20-30% yellowish brown (10YR 5/8) mottling, trace medium-grained sand, moist to dry.									
			5										
4 SS	24 12	3 2 3 4	6	6' trace sand, moist to dry.									
			7		(FILL) CL								
5 SS	24 14.5	2 2 4 5	8	8' moist.									
			9										
6 SS	24 12	2 2 3 4	10	10' stiff (1.75 tsf).									
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 16	2 2 3 7	13	2.6 - 24.5' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), trace gray (10YR 5/1) mottling, 20-40% silt, cohesive, very stiff (2.0-4.0 tsf), high plasticity, moist. *(continued)* 13.2' dark gray (10YR 4/1), trace sand, stiff to hard (1.5-4.5+ tsf), high plasticity, dry.									
8 SS	24 17	2 3 3 5	14 15	14' dark gray (10YR 4/1), dark yellowish brown (10YR 4/6), high plasticity, dry to moist.									
9 SS	24 14	2 2 3 3	16 17	16' dark yellowish brown (10YR 4/6), decrease to 30% dark gray (10YR 4/1), soft to very stiff (1.0-4.0 tsf), dry, increasing moisture content with depth.									
10 SS	24 15	1 1 2 2	18 19	18' brownish yellow (10YR 6/8) mottling, silt content increases with depth to 30-50%, trace fine gravel, very soft to very stiff (0.0 to 3.0 tsf), moist to wet.	(FILL) CL								
11 SS	24 24	3 2 2 4	20 21	20' yellowish brown (10YR 5/6), 30% dark gray (10YR 4/1) mottling, 20-40% silt, trace sand, trace fine gravel, soft to stiff (0.5-1.5 tsf), moist.									
12 SS	24 5	2 1 2 2	22 23	22' trace yellowish red (5YR 4/6), 5-15% sand, stiff (1.5 tsf).									
13 SS	24 24	2 2 1 1	24 25	24.5 - 26' **FILL, SILT:** ML, very dark grayish brown (10YR 3/2), low to medium plasticity, wet.	(FILL) ML								
14 SS	24 6	WOH WOH WOH WOH	26 27	26 - 28.2' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), 30-50% silt, cohesive, moderately stiff (0.75 tsf), medium to low plasticity, wet.	(FILL) CL								WOH=weight of hammer
15 SS	24 24	1 1 1 1	28 29	28.2 - 44.3' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2), mostly silt-sized ash, 15-30% sand-sized ash, sand-sized ash seams, noncohesive, nonplastic.									
16 SS	24 24	2 3 1 1	30 31 32	30' wet.	(FILL)								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 24	WOH WOH WOH WOH	33	28.2 - 44.3' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2), mostly silt-sized ash, 15-30% sand-sized ash, sand-sized ash seams, noncohesive, nonplastic. *(continued)*										
18 SS	24 24	WOH WOH 2 1	34, 35	34' trace dark gray (10YR 4/1) mottling of silt-sized ash, trace black (10YR 2/1) mottling of sand-sized ash, trace dark yellowish brown (10YR 4/6) mottling of clay-sized ash, very soft (0 tsf), wet.										
19 SS	24 23	1 WOH WOH WOH	36, 37											
20 SS	24 19	2 WOH WOH WOH	38, 39	38' mostly fine to medium sand-sized ash, 15-30% silt-sized ash, wet. 38.5' very dark grayish brown (10YR 3/2), black (10YR 2/1) mottling, mostly silt-sized ash, sand-sized ash seams, cohesive, nonplastic, wet.	(FILL)									
21 SS	24 24	1 2 WOH WOH	40, 41	40' dark gray (10YR 4/1) and black (10YR 2/1) mottling, wet.										
22 SS	24 21	1 WOH WOH WOH	42, 43											
23 SS	24 18	WOH 2 3 3	44, 45	44.3 - 46' **SILT:** ML, grades from very dark gray (10YR 3/1) to dark gray (10YR 4/1) with depth, 15-30% clay, cohesive, low plasticity, moist to wet.	ML									
24 SS	24 24	WOH 2 2 5	46, 47	46 - 60' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 4/5), 20-40% silt, cohesive, stiff (1.75 tsf), medium plasticity, moist.										
25 SS	24 24	WOH 2 4 6	48, 49	48' dry to moist.	CL/ML									Permanent 6" PVC casing set at 48.5' bgs.
26 SS	24 12	2 4 5 5	50, 51, 52	50' oxidation-stained nodules (15-30%), trace sand.										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	24 17	1 6 12 14	53	46 - 60' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 4/5), 20-40% silt, cohesive, stiff (1.75 tsf), medium plasticity, moist. *(continued)* 52' trace oxidation staining, very stiff (>4.5 tsf).										
28 SS	24 17	25 24	54, 55											
29 SS	24 12	8 16 33 24	56, 57	56' laminated weathered shale, dry.	CL/ML									
30 SS	24 24	7 11 15 24	58, 59											
31 SS	24 21	6 10 15 18	60, 61	60 - 60.3' **GRAVELLY FAT CLAY:** g(CH), black.	g(CH)									
				60.3 - 63.5' **SILTY CLAY** CL/ML, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, hard (>4.5 tsf).										
32 SS	24 18	9 15 50/5"	62		CL/ML									
1 CORE	28 35		63	63' gravel (>15%).										Core 1, RQD=34%
			64	63.5 - 64.8' **SHALE:** BDX (SH), weathered.	BDX (SH)									
			65	64.8 - 65.2' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
2 CORE	60 45		66, 67, 68, 69, 70	65.2 - 71' **SHALE:** BDX (SH), gray, slightly to moderately fractured, highly decomposed, some material washed-out.	BDX (SH)									Core 2, RQD=93%
3 CORE	60 28													Core 3, RQD=18%
			71, 72	71 - 76' **LIMESTONE:** BDX (LS), vertical fracture, intensely fractured.	BDX (LS)									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	71 - 76' **LIMESTONE:** BDX (LS), vertical fracture, intensely fractured. *(continued)* 72.3' vertical fracture.	BDX (LS)									
4 CORE	60 57		74–76											Core 4, RQD=37%
			76–77	76 - 77.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
5 CORE	60 55		77–81	77.2 - 81.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. 78.2' - 78.9 vertical fracture. 79.6' - 79.8' vertical fracture. 80.3' - 80.5' vertical fracture.	BDX (LS/SH)									Core 5, RQD=69%
			81–82	81.3 - 82.2' **SHALE:** to **LIMESTONE:** BDX (SH), slightly fractured.	BDX (SH)									
6 CORE	48 48		82–86	82.2 - 86.3' **SHALE:** BDX (SH), gray, slightly to moderately fractured.	BDX (SH)									Core 6, RQD=65%
			86–89	86.3 - 89' **SHALEY LIMESTONE:** BDX (LS/SH), slightly fractured.	BDX (LS/SH)									
			89	89' End of Boring.										Bedrock corehole reamed 6" in diameter to 89' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-387

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/13/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-387	Feet (NAVD88)	424.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,111.17 N, 2,380,474.78 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 27.258"
Long -89° 52' 29.1828"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 7 6 6	0–2	0 - 4' **FILL, SILTY CLAY** CL/ML, brown (10YR 5/3), trace roots, stiff to very stiff (2.5-4 tsf), low plasticity, dry.	(FILL) CL/ML								
2 SS	24 18	2 5 5 7	2–4	3' trace fine sand.									
3 SS	24 18	2 4 4 5	4–6	4 - 10.8' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/4), stiff to hard (1.5-4.5 tsf), medium plasticity, moist.	CL/ML								
4 SS	24 21	3 4 4 5	6–8	6' dark yellowish brown (10YR 3/4), trace oxidation staining.									
5 SS	24 0		8–10										
6 SS	24 16	WOH 3 4 5	10–12	10.8 - 12' **CLAYEY SILT** ML/CL, dark yellowish brown (10YR 4/4), nonplastic.	ML/CL								WOH=weight of hammer

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Brad Rodes (signed)

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	WOH 3 4 4		12 - 24' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/4), stiff to very stiff (1.5-2.75 tsf). 12.5' - 12.6' black staining.									
			13	13' increased silt content, moist.									
8 SS	24 24	1 2 4 5	14	14' dark yellowish brown (10YR 4/6).									
			15	15' trace oxidation staining, medium plasticity, moist.									
9 SS	24 26	2 3 5 6	16										
			17										
10 SS	24 25	1 3 4 5	18	18' low plasticity.	CL/ML								
			19	19' medium plasticity.									
11 SS	24 23	1 2 3 3	20	20' dark yellowish brown (10YR 4/4), grayish brown (10YR 5/2) mottling.									
			21										
12 SS	24 24	1 4 5 7	22										
			23										
13 SS	24 26	1 4 5 6	24	24 - 27.4' **LEAN CLAY:** CL, gray (10YR 5/1), stiff to very stiff (1.5-2.5 tsf), high plasticity.									
			25										
14 SS	24 24	1 3 6 4	26	26' trace black oxidation staining.	CL								
			27	27.4 - 28.5' **SILTY SAND:** to **LEAN CLAY:** SM, mostly fine sand, wet.	SM								
15 SS	24 24	1 2 2 3	28	28.5 - 32.5' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, very soft to very hard (0-4.5+ tsf).									
			29										
16 SS	24 20	WOH 1 4 7	30	30' dark yellowish brown (10YR 3/4), oxidation-stained nodules (1" layer).	CL/ML								
			31	31' brown (10YR 4/3).									
			32										

SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number MW-387

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 16	1 1 1 2												
			33	32.5 - 34' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), mostly medium sand, sand grain size decreasing with depth, silt and clay content increasing with depth.	SP									
18 SS	24	4 10 12 14	34	34 - 34.5' **SILTY SAND:** SM, yellowish brown (10YR 5/4), mostly fine sand.	SM									
			35	34.5 - 36' **SILTY CLAY** CL/ML, brown (10YR 4/3), very stiff to hard (2.5-4.5 tsf), low plasticity.	CL/ML									
19 SS 1 CORE	3 3 39 39	50 for 3"	36	36 - 40.6' **LIMESTONE:** BDX (LS), light gray, cherty, intensely fractured (fractures partly healed with shale).	BDX (LS)									Core 1, RQD=44%
			37											
			38											
			39											
			40											
2 CORE	60 49		41	40.6 - 43.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									Core 2, RQD=61%
			42											
			43											
			44	43.9 - 45.3' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			45	45.3 - 48.8' **LIMESTONE:** BDX (LS), fossiliferous, moderately fractured (fractures partly healed with shale).	BDX (LS)									
3 CORE	60 61		46											Core 3, RQD=75%
			47											
			48											
			49	48.8 - 53.9' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
			50											
4 CORE	64 64		51											Formation taking water during coring.
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	48.8 - 53.9' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. *(continued)*	BDX (LS/SH)									Core 4, RQD=92%
			54	53.9 - 55' **SHALE:** BDX (SH), dark gray, moderately fractured, slightly decomposed.	BDX (SH)									
			55	55 - 56.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
5 CORE	60 59		56											Core 5, RQD=100%
			57, 58, 59, 60	56.3 - 60.1' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured to unfractured.	BDX (LS)									
			61	60.1 - 61.3' Overdrilled for Well Installation.										
				61.3' End of Boring.										Bedrock corehole reamed 6" in diameter to 61.3' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-388

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/10/2015	11/12/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-388	Feet (NAVD88)	406.28 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,429.08 N, 2,379,624.09 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 30.426"
Long -89° 52' 39.8274"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 11	2 5 10 8	0–1	0 - 4' **FILL, SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/4), 30-50% silt, organic material at surface, very soft to very stiff (0.0-4.0 tsf), moist.									
2 SS	24 18	3 6 8 9	2		(FILL) CL/ML								
3 SS	24 15	3 4 8 9	4	4 - 18' **SILTY CLAY** CL/ML, brown (10YR 5/3), 30-50% silt, very soft to very stiff (0.0-4.0 tsf), moist.									
4 SS	24 18	1 4 6 4	6	6' yellowish brown (7.5YR 5/6), 30-50% fine sand.									
5 SS	24 22	1 1 2 4	8	8' yellowish brown (10YR 5/4).	CL/ML								
6 SS	24 21	2 2 3 3	10	10' brown (10YR 4/3), yellow (10YR 7/8) mottling.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-388

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 25	1 2 3 3		4 - 18' **SILTY CLAY** CL/ML, brown (10YR 5/3), 30-50% silt, very soft to very stiff (0.0-4.0 tsf), moist. *(continued)*									
			13	13.3' brown (10YR 5/3), trace sand.									
8 SS	24 20	1 2 4 7	14	14' grayish brown (10YR 5/2), increasing coarse sand content.									
			15		CL/ML								
9 SS	24 21	2 4 5 8	16	16' brownish yellow (10YR 6/8) mottling, very dark brown (10YR 2/2) stringers.									
			17	17 - 18' **SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/8).	(CL/ML)S								
10 SS	24 22	1 2 2 3	18	18 - 20' **SILTY CLAY** CL/ML, 30-50% silt, very soft to very stiff (0.0-4.0 tsf), slow dilatancy, wet.									
			19		CL/ML								
11 SS	24 14	WOH 2 4 7	20	20 - 23.5' **SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/6), fine sand, rapid dilatancy, very soft (0.0 tsf), wet.									WOH=weight of hammer
			21										
12 SS	24 22	3 9 12 9	22	22' yellowish brown (10YR 5/4), with clay.	(ML)s								
			23										
13 SS	24 18	WOH 4 6 9	24	23.5 - 26.5' **SILTY CLAY WITH SAND** (CL/ML)S, grayish brown (10YR 5/2), fine sand, very stiff (2.5-3.0 tsf), wet. 24' gray (10YR 5/1), no fine sand.									
			25		(CL/ML)S								
14 SS	8 7	4 50 for 2"	26	26.5 - 27' **SHALE:** BDX (SH), gray, decomposed.	BDX (SH)								
1 CORE	35 31		27	27 - 30' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (narrow to moderately narrow apertures).									Core 1, RQD = 97%
			28										
			29		BDX (LS)								
2 CORE	60 40		30	30 - 45' **SHALEY LIMESTONE:** BDX (LS/SH), highly decomposed, intensely fractured.									Core 2, RQD = 68%
			31		BDX (LS/SH)								
			32										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-388

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				30 - 45' **SHALEY LIMESTONE:** BDX (LS/SH), highly decomposed, intensely fractured. *(continued)*										
			33											
			34											
3 CORE	60 57.5		35	34.9' moderately fractured.										Core 3, RQD = 93%
			36											
			37	37' - 43.5' fossiliferous.										
			38											
			39		BDX (LS/SH)									
			40	40.1' slightly fractured.										
4 CORE	60 60.5		41	40.9' fossiliferous.										Core 4, RQD = 100%
			42											
			43											
			44											
			45	45 - 45.2' Overdrilled for Well Installation.										
				45.2' End of Boring.										Bedrock corehole reamed 6" in diameter to 45.2' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-389

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Tom Marlo Bulldog Drilling	11/25/2015	12/1/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-389	Feet (NAVD88)	417.30 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,119.33 N, 2,379,809.87 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 37.2444"
Long -89° 52' 37.4736"

Local Grid Location
Feet ☐ N ☐ S   Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	1 3 7 13		0 - 16' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), stiff to very hard (1-4.5+ tsf), low plasticity.	CL/ML								
			1										
2 SS	24 18	2 6 9 9	2										
			3										
3 SS	24 19.5	1 3 3 3	4	4.5' moist.									
			5										
4 SS	24 17	1 2 3 1	6										
			7	7' trace root structures.									
5 SS	24 17	2 2 4 5	8	8' black (10YR 2/1) oxidation mottling.									
			9										
6 SS	24 20	2 2 4 4	10	10' decreasing mottling, increasing silt content.									
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Brad Rodes (signed)

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 21	2 3 2 3	12–14	0 - 16' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), stiff to very hard (1-4.5+ tsf), low plasticity. *(continued)* 12' dark yellowish brown (10YR 4/4), wet.	CL/ML								
8 SS	24 20	2 3 3 5	14–16	14' brown (10YR 5/3), dark yellowish brown (10YR4/6) mottling.									
9 SS	24 24	1 3 5 6	16–18	16 - 23' **FAT CLAY:** CH, grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling, trace sand, stiff to very stiff (1.75-3.0 tsf), medium plasticity.	CH								
10 SS	24 24	1 3 4 4	18–20	18' black (10YR 2/1) oxidation nodules.									
11 SS	24 24	2 3 4 5	20–22										
12 SS	24 27	1 3 3 4	22–24	23 - 28.3' **SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling, trace fine gravel, stiff to hard (1.5-4.5 tsf), medium plasticity.	(CL/ML)S								
13 SS	24 27	1 2 4 4	24–26										
14 SS	24 26	1 3 5 10	26–28	27' low plasticity.									
15 SS	24	1 3 8 11	28–30	28.3 - 28.8' **POORLY-GRADED SAND WITH CLAY:** SP-SC, yellowish brown (10YR 5/6). 28.8 - 36' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, oxidation nodules, and fine gravel, very stiff to hard (2.5-4.5 tsf), wet.	SP-SC CL/ML								
16 SS	24	1 3 5 10	30–32										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
17 SS	24 23	1 3 5 8	33	28.8 - 36' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, oxidation nodules, and fine gravel, very stiff to hard (2.5-4.5 tsf), wet. *(continued)*									
18 SS	24 26	1 3 8 13	34	34' increasing gravel content.	CL/ML								
			35										
19 SS	4 4	50 for 4"	36	36 - 37.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)								
1 CORE	46 45		37										Core 1, RQD=86%
				37.3 - 37.7' **SHALE:** BDX (SH), decomposed, moderately fractured.	BDX (SH)								
			38	37.7 - 39.3' **LIMESTONE:** BDX (LS), shale at fractures, moderately fractured.	BDX (LS)								
			39										
2 CORE	13 12		40	39.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, decomposed, moderately fractured.									Core 2, RQD=67%
3 CORE	56 56		41	40.4' - 41' intensely fractured.									Core 3, RQD=65%
			42										
			43		BDX (LS/SH)								
			44										
			45	45.2' slightly fractured.									
4 CORE	63 63		46										Core 4, RQD=89%
			47	46.8 - 50.5' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.									
			48										
			49		BDX (LS)								
			50										
5 CORE	60 59		51	50.5 - 52.1' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous.	BDX (LS/SH)								Core 5, RQD=100%
			52										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53 54 55	52.1 - 55.7' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.	BDX (LS)									Bedrock corehole reamed 6" in diameter to 55' for well installation.
				55.7' End of Boring.										

APPENDIX D

GROUNDWATER QUALITY DATA

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well		Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard			ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)			27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)			2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)			28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)			5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)			17.7	6240	11.9		5120									109	2820					94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)			13.3	1070	7.6		1130									12	495					36.3					0.57	<0.02		0.01	<0.005							
Upgradient Wells (Unlithified Materials)																																						
MW104D	(N)	11/16/2010	15	1226	7		785		0.07		<0.007					15.7	245	0.469	<0.005	0.03	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.02	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104D		3/23/2011	16.7	1176	7	406	801		0.07		<0.007	143	58	63	<1	17	241	0.422	<0.005	0.0311	<0.005	0.021	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.04	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104D		6/7/2011	16.8	1213	6.9	404	776		<0.05		<0.007	134	58	58	<1	19	250	0.379	<0.005	0.033	<0.005	0.019	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.013	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		9/13/2011	16	1164	6.7	418	768		0.07		<0.007	134	49	58	2.2	18	225	0.37	<0.005	0.042	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.024	<0.005		0.42	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		12/8/2011	13.7	1127	6.8	410	739		0.06		<0.007	137	52	51	1.5	18	222	0.4	<0.005	0.038	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.025	<0.005		0.28	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		3/8/2012	11.3	1094	7.6	416	724		0.55		<0.008	145	58	56	1.3	24	214	0.31	<0.005	0.035	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.011	<0.005		0.21	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		9/16/2013	15.5	1130	6.9		676																				4.82			0.93								
MW104DR		11/20/2013	13.6	1250	6.8		630									16	194					0.02						0.07			0.29							
MW104DR		2/18/2014	12.2	991	6.8		652									18	175					<0.02						<0.02			0.04							
MW104DR		6/11/2014	14.3	1060	7		676									18	186					<0.02						0.028			0.123							
MW104DR		3/25/2015	14.4	775	7.1		630	<0.05		0.955						21	179					<0.02					0.54	<0.02		0.177	0.092							
MW104DR		6/24/2015	14.8	1030	7		718	<0.05		0.673						23	187					<0.02					0.77	<0.02		0.206	0.13							
MW104DR		9/25/2015	15.4	1090	7.1		634	<0.05		0.847						24	178					<0.02					0.74	<0.02		0.224	0.15							
MW104DR		11/10/2015	15.2	997	6.8		644	<0.05		0.924						25	195					<0.02					0.33	<0.02		0.234	0.172							
MW104S	(N)	11/16/2010	11.8	1550	6.6		943		<0.05		<0.007					33.7	148	0.629	0.032	0.15	<0.005	0.16	<0.002	<0.005	<0.005	<0.005		18	<0.005		6.8	<0.002	<0.005	<0.005	0.009	<0.005	<0.01	<0.002
MW104S		3/23/2011	15.9	1142	6.5	446	742		<0.05		<0.007	106	42	104	<1	56	169	0.401	0.0082	0.0899	<0.005	0.146	<0.002	<0.005	<0.005	<0.005		1.85	<0.005		3.0	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104S		6/7/2011	21.8	1290	6.5	550	824		0.07		<0.008	121	46	105	1.8	58.7	114	0.561	0.012	0.24	<0.005	0.22	<0.002	<0.005	<0.005	<0.005		14	<0.005		4.0	<0.002	<0.005	<0.005	0.009	<0.005	<0.01	<0.002
MW104SR		9/13/2011	19.9	1286	6.4	654	909		0.37		<0.007	157	65	92	<1	32	164	0.54	0.0058	0.059	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.08	<0.005		1.2	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104SR		12/8/2011	12.3	1405	6.9	616	965		0.14		<0.007	167	70	84	<1	31	237	0.523	<0.005	0.076	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.19	<0.005		1.1	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104SR		3/8/2012	10.1	1521	6.9	700	886		0.09		<0.008	168	77	85	<1	34	140	0.549	<0.005	0.097	<0.004	0.06	<0.002	<0.005	<0.005	<0.005		0.61	<0.005		1.9	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104SR		9/16/2013	17	1310	6.7		724																				3.18			4.97								
MW104SR		11/20/2013	15.1	1320	6.7		770									19	134					0.04						1.44			2.2							
MW104SR		2/18/2014	12.8	809	6.7		792									18	138					0.05						<0.02			0.59							
MW104SR		6/11/2014	14.9	1260	6.5		792									16	68					0.147						0.806			1.7							
MW104SR		3/25/2015	10.9	1000	6.8		770	<0.05		0.058						14	100					0.086					0.48	0.207		2.66	2.1							
MW104SR		6/24/2015	15.4	1390	6.6		880	<0.05		<0.05						23	47					0.178					7.12	3.74		3.46	3.1							
MW104SR		9/25/2015	18.7	1330	6.7		744	<0.05		<0.05						19	23					0.237					3.62	3.35		2.54	2.52							
MW104SR		11/10/2015	17	1150	6.3		732	0.06		0.321						19	57					0.149					0.98	1.19		2.78	3.09							
TPZ158		9/17/2013	16.4	720	7.1		394																				6.93			0.12								
TPZ158		11/20/2013	14.9	984	7.3		976									81	39					<0.02						1.43			0.35							
TPZ158		2/18/2014	10.2	584	6.7		380									65	44					<0.02						<0.02			<0.005							
TPZ158		6/12/2014	14.8	645	6.1		408									62	37					0.03						0.085			<0.005							
Downgradient Wells (Unlithified Materials)																																						
MW150	(N)	11/15/2010	13.5	1467	7.3		1133		<0.05		<0.007					65.4	507	0.826	0.005	0.02	<0.005	0.31	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		3/23/2011	15.3	1681	7.3	378	1205		0.06		<0.008	132	95	131	<1	65	555	0.841	0.006	0.0161	<0.005	0.473	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		6/7/2011	16.7	1910	7.1	370	1396		0.06		<0.008	138	105	134	<1	57.7	696	0.791	<0.005	0.017	<0.005	0.4	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		9/13/2011	14.4	1620	7.2	376	1162		0.05		<0.007	135	82	123	1.0	66	513	0.86	<0.005	0.017	<0.004	0.36	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		12/7/2011	13.1	1744	7.1	390	1278		<0.05		<0.007	136	92	126	<1	77	585	0.865	0.0053	0.019	<0.004	0.47	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	0.01	<0.002
MW150		3/7/2012	16.1	1704	7.3	388	1334		<0.05		<0.007	128	108	134	<1	69	584	0.798	<0.005	0.015	<0.004	0.56	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		9/16/2013	14.8	1350	7.5		1090																				20.1			0.32								
MW150		11/20/2013	13.3	1530	7.1		1090									51	502					0.65						0.07			0.03							
MW150		2/19/2014	12.7	1330	7		1200									51	521					0.8						<0.02			<0.005							
MW150		6/11/2014	13	1680	7.3		1300									49	552					0.98						<0.02			0.006							
MW150		3/25/2015	13.7	1290	7.4		1270	<0.05		0.134						47	550					1.19					14.5	<0.02		0.215	0.024							
MW150		6/24/2015	13.5	1650	7.2		1340	<0.05		<0.05						50	565					1.25					0.81	0.035		0.016	0.003							
MW150		9/25/2015	14	1710	7.2		1210	<0.05		<0.05						52	632					1.5					0.22	0.127		0.016	0.013							
MW150		11/10/2015	13.5	1550	7		1180	<0.05		0.057						54	584					1.47					0.08	0.0388		0.007	0.005							
MW151	(N)*	11/15/2010	15.3	1022	7.1		580		<0.05		<0.007					39.9	76.5	0.536	0.007	0.05	<0.005	0.25	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.14	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		3/23/2011	13.2	974	6.9	414	568		<0.05		<0.007	117	46	46	1.1	40	77	0.531	<0.005	0.0396	<0.005	0.226	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.064	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		6/7/2011	15	1001	6.9	410	539		<0.05		<0.007	97	45	45	1.0	38.7	82.3	0.483	<0.005	0.0396	<0.005	0.22	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.032	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		9/13/2011	22.8	1010	6.8	442	587		<0.05		<0.007	109	42	52	1.3	44	78	0.53	<0.005	0.041	<0.004	0.22	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.059	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		12/8/2011	9.2	953	7.8	430	576		<0.05		<0.007	114	45	48	1.0	40	77	0.54	0.006	0.049	<0.004	0.25	<0.002	<0.005	<0.005	<0.005		0.011	<0.005		0.021	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		3/7/2012	13.2	941	8.1	446	569		0.09		<0.007	119	48	48	<1	38	75	0.479	<0.005	0.039	<0.004	0.22	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.010	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		9/16/2013	17.3	855	7.2		526																				19.3			1.53								
MW151		11/20/2013	14.2	970	7.1		542									36	78					0.24						<0.02			<0.005							
MW151		2/19/2014	8.5	852	7.1		538									35	74					0.23						<0.02			<0.005							
MW151		6/12/2014	13.8	983	6.3		562									35	63					0.217						<0.02			0.005							
MW152	(N)	11/15/2010	15	2030	7		1759		0.17		<0.007					84.1	859	0.348	0.008	0.01	<0.005	12	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.05	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		3/23/2011	11.2	2128	7.4	360	1768		0.31		<0.007	249	104	131	1.4	75	914	0.268	0.0073	0.0109	<0.005	8.974	<0.002	<0.005	<0.005	<0.005		0.04	<0.005		0.021	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		6/7/2011	15.5	2103	7.3	408	1634		0.24		<0.007	205	100	148	1.0	53.7	772	0.274	<0.005	0.01	<0.005	3.6	<0.002	<0.005	<0.005	<0.005		0.026	<0.005		0.013	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		9/13/2011	17.6	2052	7.2	420	1607		0.09		<0.007	212	97	146	1.1	69	1000	0.3	<0.005	0.01	<0.004	7.8	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.072	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		12/6/2011	10.8	2299	6.5	420	1983		<0.05		<0.007	289	126	131	<1	140	1030	0.281	0.008	0.014	<0.004	18	<0.002	<0.005	<0.005	<0.005		0.012	<0.005		0.018	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		3/7/2012	13.7	2092	6.7	420	1511		0.25		<0.007	190	91	130	<1	52	700	0.258	<0.005	0.0094	<0.004	3.7	<0.002	<0.005	<0.005	<0.005		0.02	<0.005		0.0093	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		9/16/2013	16.2	1920	7		1620																				19.4			1.37								
MW152		11/20/2013	13.7	1950	7.2		1720									55	857					9.92						0.07			0.005							
MW152		2/19/2014	9.5	1880	6.4		1770									56	898					12.7						0.05			<0.005							
MW152		6/12/2014	12.9	1890	6.5		1530									32	636					2.36						0.456			0.102							
MW152		3/25/2015	10	1880	6.9		2150	<0.05		<0.05						71	1020					26.8					12.4	0.044		0.367	0.01							
MW152		6/24/2015	14	2580	6.8		2150	<0.05		0.207						68	978					19.5					16.6	0.118		0.639	0.091							
MW152		9/25/2015	16.3	2530	6.8		1920	<0.05		<0.05						63	949					17.7					2.65	0.033		0.105	0.019							
MW152		11/10/2015	15.2	2110	6.7		1920	<0.05		<0.05						27	965					16.9					3.93	0.076		0.158	0.040							
MW153	(N)	11/16/2010	14.8	730	7.1		462		13.2		<0.007					34.4	88.5	0.44	<0.005	0.03	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		3/23/2011	21.2	736	7.4	192	430		14.91		<0.007	58	24	59	<1	30	93	0.383	<0.005	0.025	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0091	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		6/7/2011	20.2	732	7.5	200	449		12		<0.007	56	24	56	<1	31.5	82.5	0.388	<0.005	0.025	<0.005	0.014	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0053	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		9/14/2011	16.2	718	6.9	194	446		18		<0.007	55	23	65	<1	33	83	0.4	<0.005	0.025	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.011	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		12/8/2011	5.5	789	7	206	451		15		<0.007	61	26	61	<1	34	93	0.41	<0.005	0.028	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.015	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		3/8/2012	11.9	669	7.3	200	416		12.9		<0.007	57	24	57	<1	29	81	0.394	<0.005	0.024	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0077	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		9/17/2013	15.5	778	7.3		448																				7.34			0.16								
MW153		11/21/2013	14.1	730	6.6		384									28	98					<0.02						<0.02			0.03							
MW153		2/19/2014	13.7	561	7.2		402									22	81					<0.02						<0.02			<0.005							
MW153		6/11/2014	13.2	686	7		426									21	80					<0.02						<0.02			0.009							
MW153		3/25/2015	12.9	491	7.3		354	<0.05		10.5						18	77					<0.02					0.64	<0.02		0.03	0.016							

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well		Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard			ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)			27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)			2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)			28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)			5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)			17.7	6240	11.9		5120									109	2820					94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)			13.3	1070	7.6		1130									12	495					36.3					0.57	<0.02		0.01	<0.005							
MW153		6/24/2015	14.3	648	7.2		442	<0.05		10.6						21	73					<0.02					0.18	<0.02		0.015	0.009							
MW153		9/25/2015	15.2	654	6.8		354	<0.05		10.5						22	75					<0.02					0.21	<0.02		0.014	0.0084							
MW153		11/10/2015	15.5	620	7.1		360	<0.05		10.7						22	75					<0.02					0.3	<0.02		0.017	0.0087							
MW154	(N)	3/23/2011	11.5	911	7.3	424	559		1.28		<0.007	110	40	53	1.2	12	94	0.623	0.0057	0.073	<0.005	0.026	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	0.0159	<0.002
MW154		6/7/2011	14.5	874	7.1	384	508		0.53		<0.007	106	38	28	<1	9.53	71.9	0.501	<0.005	0.076	<0.005	0.026	<0.002	<0.005	<0.005	<0.005		0.018	<0.005		0.18	<0.002	<0.005	<0.005	0.014	<0.005	<0.01	<0.002
MW154		9/12/2011																																				
MW154		12/7/2011	13.8	665	6.7	324	346		0.25		<0.007	89	25	22	<1	4.1	29	0.525	<0.005	0.1	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0062	<0.002	<0.005	<0.005	0.007	<0.005	<0.01	<0.002
MW154		3/6/2012	12.9	861	7.1	406	476		4.49		<0.007	114	40	20	<1	5.5	38	0.516	<0.005	0.08	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW154		9/17/2013	16	869	7.3		516																				7.1			0.19								
MW154		2/19/2014	11.3	713	7.4		454									8	48					0.02						<0.02			<0.005							
MW154		6/12/2014	13.3	825	6.9		492									12	30					<0.02						<0.02			<0.005							
MW154		3/25/2015	9.9	692	7.3		494	<0.05		0.957						7	39					<0.02					1.55	<0.02		0.019	<0.003							
MW154		6/30/2015	15	751	6.9		468	<0.05		<0.05						6	29					0.021					0.34	0.078		0.05	0.032							
MW154		9/25/2015	16.4	1040	6.9		550	<0.05		<0.05						9	49					<0.02					3.9	0.042		0.132	0.083							
MW155	(N)	11/16/2010	13.8	600	7.1		470		4.46		<0.007					6.55	61.8	0.39	<0.005	0.03	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.038	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		3/23/2011	15.5	763	7.1	360	455		1.98		<0.007	88	45	24	<1	10	53	0.398	<0.005	0.025	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.28	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		6/7/2011	16.1	806	7.1	400	487		1.4		<0.007	86	46	25	<1	8.58	49.6	0.385	<0.005	0.024	<0.005	0.012	<0.002	<0.005	<0.005	<0.005		0.016	<0.005		0.062	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		9/12/2011	19.3	526	6.8	376	470		2.1		<0.007	86	42	28	<1	9.3	50	0.38	<0.005	0.022	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.013	<0.005		0.37	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		12/7/2011	8.3	528	6.9	366	450		2		<0.007	91	44	26	<1	11	51	0.417	<0.005	0.023	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.015	<0.005		0.18	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		3/6/2012	16.3	774	6.9	392	446		1.85		<0.008	93	49	28	<1	8.8	49	0.401	<0.005	0.019	<0.004	<0.05	<0.002	<0.005	<0.005	0.016		<0.01	<0.005		0.081	<0.002	<0.005	<0.005	0.014	<0.005	<0.01	<0.002
MW155		9/17/2013	14.1	773	7.4		470																				48.3			24.4								
MW155		2/19/2014	13.7	3890	7		1080									8	54					<0.02						0.48			0.35							
MW155		6/12/2014	15	799	6.5		484									8	41					<0.02						<0.02			<0.005							
MW155		3/25/2015	13.6	588	7.3		402	<0.05		1.61						7	50					<0.02					0.09	<0.02		0.073	<0.003							
MW155		6/24/2015	13.5	796	7.2		498	<0.05		1.64						8	53					<0.02					0.23	<0.02		0.291	0.008							
MW155		9/25/2015	14.9	849	7.2		438	<0.05		1.82						9	50					<0.02					0.21	<0.02		0.132	0.0112							
MW155		11/10/2015	14.2	774	7		436	<0.05		2.13						9	51					<0.02					0.6	<0.02		0.273	<0.003							
MW252	(N)	11/15/2010	13.8	1730	7.8		1318		<0.05		<0.007					52.8	528	0.233	0.008	0.04	<0.005	0.97	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		1.7	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		3/23/2011	15.3	1845	7	534	1335		0.06		<0.007	232	90	100	5.3	61	559	0.25	0.006	0.039	<0.005	1.47	<0.002	<0.005	<0.005	0.0072		<0.01	<0.005		0.93	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		6/7/2011	14	1833	7.8	524	1341		0.05		<0.008	210	84	99	2.1	61.4	578	0.224	<0.005	0.04	<0.005	0.31	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.61	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		9/13/2011	14.9	1806	7.5	526	1301		<0.05		<0.007	206	78	104	3	52	510	0.22	0.0061	0.029	<0.004	0.32	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.97	<0.002	<0.005	<0.005	0.007	<0.005	<0.01	<0.002
MW252		12/6/2011	9.8	1745	6.8	524	1224		<0.05		<0.007	221	83	99	1.9	50	490	0.232	0.007	0.04	<0.004	0.29	<0.002	<0.005	0.01	<0.005		<0.01	<0.005		1.2	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		3/7/2012	21.6	1910	7	528	1286		<0.05		<0.007	225	91	99	1.4	49	576	0.21	<0.005	0.022	<0.004	0.19	<0.002	<0.005	<0.005	<0.005		0.026	<0.005		0.44	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		9/16/2013	14.1	1650	7		1260																				9.04			1.3								
MW252		11/20/2013	13.8	1670	7.1		1250									41	463					0.23						0.07			0.11							
MW252		2/19/2014	10.9	1320	8.1		1310									41	480					0.23						<0.02			0.01							
MW252		6/12/2014	14.3	1790	6.4		1390									38	447					0.223						<0.02			0.057							
MW252		3/25/2015	12.8	1350	7		1270	<0.05		<0.05						38	487					0.155					1.15	<0.02		0.324	0.053							
MW252		6/24/2015	13.7	1680	6.7		1320	<0.05		<0.05						41	488					0.132					12.3	0.1		0.585	0.198							
MW252		9/25/2015	14.5	1800	6.8		1250	<0.05		<0.05						38	459					0.14					2.09	<0.02		0.655	0.582							
MW252		11/10/2015	13.7	1600	6.6		1250	<0.05		<0.05						38	493					0.134					15.5	0.0221		0.717	0.152							
MW253	(N)	11/16/2010	13.4	765	6.9		1441		0.38		<0.007					27.4	806	0.408	0.008	0.02	<0.005	0.24	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.37	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		3/23/2011	25.9	1971	7.7	580	854		0.08		<0.008	54	1.0	168	78	26	262	0.119	0.0063	0.066	<0.005	0.124	<0.002	<0.005	<0.005	<0.005		<0.01	0.005		<0.005	<0.002	<0.005	0.006	<0.005	<0.005	<0.01	<0.002
MW253		6/7/2011	27.5	1564	11.3	187	698		0.06		<0.007	104	<5	108	18	22.2	411.4	0.369	<0.005	0.054	<0.005	0.064	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		9/14/2011	17.5	958	9.8	46	639		0.12		<0.007	61	15	95	9.1	23	424	0.29	<0.005	0.031	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.013	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		12/8/2011	2	908	7.4	105	744		<0.05		<0.007	76	48	94	4.9	27	483	0.349	0.0064	0.026	<0.004	0.11	<0.002	<0.005	<0.005	<0.005		0.014	<0.005		0.0071	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		3/8/2012	9.6	1142	11	115	634		<0.05		<0.007	110	2.8	86	6.4	22	406	0.246	<0.005	0.036	<0.004	0.076	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		9/17/2013	15.6	833	10.6		546																				0.16			0.02								
MW253		11/21/2013	13.9	735	8.6		602									18	405					0.09						<0.02			<0.005							
MW253		2/19/2014	14.4	833	7.8		564									16	368					0.06						<0.02			<0.005							
MW253		6/11/2014	14.1	1460	11.4		668									14	313					0.083						<0.02			<0.005							
MW253		3/25/2015	14.1	1910	12.4		820	<0.05		0.109						12	247					0.093					<0.02	<0.02		0.003	<0.003							
MW253		6/24/2015	14.8	3410	12.4		928	0.16		<0.05						10	142					0.05					0.09	<0.02		0.005	<0.003							
MW253		9/25/2015	14.6	631	11.1		346	<0.05		<0.05						12	241					0.044					<0.02	<0.02		<0.003	<0.003							
MW253		11/10/2015	14.8	589	10.1		300	<0.05		<0.05						12	216					0.033					<0.02	<0.02		<0.003	<0.003							
MW156	(N)	11/15/2010																																				
MW156		3/23/2011																																				
MW156		6/6/2011																																				
MW156		9/12/2011																																				
MW156		12/8/2011																																				
MW156		3/8/2012																																				
MW156		9/16/2013	16.4	814	6.7		480																				2.04			0.07								
MW156		11/21/2013	15.2	684	6.6		466									60	93					<0.02						0.06			0.05							
MW156		2/18/2014	13.3	662	6.8		470									55	88					0.03						<0.02			<0.005							
MW156		6/11/2014	15	825	6.8		506									60	86					0.024						<0.02			<0.005							
MW156		3/25/2015	11.8	611	7																																	
MW156		6/24/2015	15.9	794	6.8																																	
MW156		9/25/2015	18.3	848	7																																	
MW156		11/10/2015	16.6	778	6.8																																	
OW256		9/16/2013	15.1	862	7.1		520																				4.6			0.44								
OW256		11/21/2013	15.7	723	6.6		488									65	88					0.16						0.02			0.13							
OW256		2/18/2014	10.7	723	6.8		508									57	90					0.15						<0.02			<0.005							
OW256		6/11/2014	15.4	881	7.1		522									54	66					0.146						0.076			0.342							
MW157S	(N)	11/15/2010																																				
MW157S		3/23/2011																																				
MW157S		6/6/2011																																				
MW157S		9/12/2011																																				
MW157S		12/8/2011																																				
MW157S		3/8/2012																																				
MW157S		9/16/2013	16.4	3270	7.6		3170																				12.7			0.26								
MW157S		11/21/2013	15.1	2940	6.4		3160									121	1870					45.2						0.05			0.14							
MW157S		2/18/2014	13	3150	6.6		3180									124	2050					45.3						<0.02			0.13							
MW157S		6/11/2014	14.2	3560	6.3		3470									118	2000					44.6						0.03			0.13							

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well		Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)
Class II Standard			ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2
Max (Unlithified)			27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032
Min (Unlithified)			2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005
Max (Bedrock)			28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011
Min (Bedrock)			5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005
Max (Leachate)			17.7	6240	11.9		5120									109	2820		
Min (Leachate)			13.3	1070	7.6		1130									12	495		
MW157S		3/25/2015	12.6	3870	6.5														
MW157S		6/24/2015	15.1	3730	6.3														
MW157S		9/25/2015	18.4	3030	6.3														
MW157S		11/10/2015	17.3	3370	6.2														
OW257		9/16/2013	15.7	1430	7		960												
OW257		11/21/2013	14.6	1180	7.1		958									21	312		
OW257		2/18/2014	13.1	1120	7.1		900									18	310		
OW257		6/11/2014	15.8	1370	6.6		916									15	250		
MW161		9/16/2013	15.1	746	6.9		446												
MW161		11/21/2013	13.2	625	7.1		756									6	44		
MW161		2/18/2014	14.2	603	7		430									5	44		
MW161		6/11/2014	14.5	796	6.8		450									5	31		
MW262		9/16/2013	14.8	448	7		318												
MW262		11/21/2013	15.4	369	7.1		228									<5	40		
MW262		2/19/2014	14.7	301	7.5		188									<5	24		
MW262		6/11/2014	15.5	469	6.9		310									<5	44		
TPZ159		9/17/2013	17.9	849	6.6		588												
TPZ159		11/21/2013	14.5	642	6.5		448									35	96		
TPZ159		2/18/2014	15.1	593	6.5		480									35	98		
TPZ159		6/12/2014	18.6	674	5.6		460									34	92		
TPZ160		9/17/2013	17.7	880	7.2		490												
TPZ160		11/21/2013	15.6	659	7.3		454									42	60		
TPZ160		2/18/2014	13.4	682	7		510									44	63		
TPZ160		6/11/2014	15.2	806	6.8		494									42	46		
TPZ166		9/17/2013	16.5	612	7		396												
TPZ166		11/20/2013	14.7	951	7.7		304									12	56		
TPZ166		2/18/2014	13.5	423	7.2		306									12	38		
TPZ166		6/12/2014	15.8	495	5.8		302									12	23		
Downgradient Wells (Bedrock)																			
MW350	(N)	11/15/2010	11.4	629	12.2		375		<0.05		<0.007					21.4	53.7	0.51	<0.005
MW350		3/23/2011	18.7	1268	11.7	307	885		<0.05		<0.007	108	<5	182	84	27	30	0.46	0.0079
MW350		6/7/2011	16.4	5144	12.2	561	1257		<0.05		<0.008	218	<5	207	89	25.8	42.5	0.365	<0.005
MW350		9/13/2011	18.4	4508	12.1	505	1196		<0.05		<0.007	202	<5	200	70	34	46	0.33	0.0064
MW350		12/7/2011	7	5529	12.6	778	1423		<0.05		<0.007	323	<5	166	57	31	41	0.289	0.011
MW350		3/7/2012	14	7057	12.9	808	1709		<0.05		<0.007	533	<5	149	43	32	62	0.174	0.005
MW350		9/16/2013	14.6	5190	12.3		1640												
MW350		11/20/2013	13.5	4140	11.8		1370									34	11		
MW350		2/19/2014	13.3	4170	8.1		1420									33	<10		
MW350		6/11/2014	14.3	6120	12.4		1580									38	<50		
MW350		3/25/2015	14.4	6580	12.8		1430	0.35		<0.1						46	15		
MW350		6/24/2015	14.4	5990	12.5		1430	0.33		0.103						48	11		
MW350		9/25/2015	13.8	4200	12.6		1140	0.34		<0.05						43	27		
MW350		11/10/2015	13.5	2790	12.2		690	<0.05		<0.05						40	38		
MW352	(N)	11/15/2010	13.2	1102	10.6		779		<0.05		<0.007					521	12.6	0.692	0.005
MW352		3/23/2011	16.8	1877	11.6	102	783		<0.05		<0.007	93	<5	182	19	535	14	0.696	0.0066
MW352		6/7/2011	23.8	1922	11.2	70	862		<0.05		<0.007	79	<5	180	15	514.4	15.2	0.698	<0.005
MW352		9/13/2011	28.1	1704	11	39	735		0.06		<0.007	60	2.1	185	12	603	16	0.7	0.0082
MW352		12/8/2011	5.8	1426	10.7	20	706		<0.05		<0.007	70	6.2	190	9.6	642	14	0.652	0.0091
MW352		3/7/2012	20.1	1381	10.2	16	891		<0.05		<0.007	45	22	200	6.3	611	11	0.756	<0.005
MW352		9/16/2013	14.6	1740	9.4		1130												
MW352		11/20/2013	13.3	1740	7.3		996									583	11		
MW352		2/19/2014	11.5	1530	6.5		768									390	18		
MW352		6/12/2014	14.3	1920	8.9		1090									569	<20		
MW352		3/25/2015	13.3	1350	9		874	<0.05		0.606						415	12		
MW352		6/24/2015	14.6	1870	8.6		1100	<0.05		<0.05						508	<10		
MW352		9/25/2015	15.3	2070	8		1210	<0.05		<0.05						597	<10		
MW352		11/10/2015	13.8	1850	7.6		1100	<0.05		<0.05						567	<10		
MW355	(N)	11/16/2010	13.6	934	7		532		0.95		<0.007					14	56	0.403	<0.005
MW355		3/23/2011	15.5	848	7.1	432	486		0.56		<0.007	96	45	32	<1	14	36	0.405	0.0061
MW355		6/7/2011	17	841	7.2	404	491		0.21		<0.007	85	43	30	<1	13.4	45.9	0.397	<0.005
MW355		9/12/2011	17	824	6.7	396	490		1.6		<0.007	87	41	34	<1	12	53	0.41	0.0074
MW355		12/7/2011	8.2	812	6.8	412	486		0.82		<0.007	105	46	33	<1	14	48	0.412	<0.005
MW355		3/6/2012	16.3	879	6.8	396	447		2.04		<0.008	88	46	29	<1	12	50	0.42	<0.005
MW355		9/17/2013	14.1	811	7.4		468												
MW355		11/21/2013	13.1	682	7.2		450									11	61		
MW355		2/19/2014	13.5	691	7		458									11	65		
MW355		6/12/2014	14.8	797	6.8		532									10	51		
MW355		3/25/2015	14.2	600	7.5		418	<0.05		0.63						9	61		
MW355		6/24/2015	14.2	781	7.2		526	<0.05		1.13						9	58		
MW355		9/25/2015	14.2	826	7.1		422	<0.05		0.28						10	56		
MW355		11/10/2015	13.7	772	7		438	<0.05		1.06						10	57		

Well	Sample Date	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard		2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)		0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)		0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)		1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)		0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)				94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)				36.3					0.57	<0.02		0.01	<0.005							
MW157S	3/25/2015																			
MW157S	6/24/2015																			
MW157S	9/25/2015																			
MW157S	11/10/2015																			
OW257	9/16/2013								0.24			0.99								
OW257	11/21/2013			3.28						0.02			0.68							
OW257	2/18/2014			2.88						<0.02			0.01							
OW257	6/11/2014			2.25						0.027			0.309							
MW161	9/16/2013								11.8			1.84								
MW161	11/21/2013			<0.02						0.09			1.28							
MW161	2/18/2014			<0.02						<0.02			0.83							
MW161	6/11/2014			<0.02						0.047			0.272							
MW262	9/16/2013								69.4			2.42								
MW262	11/21/2013			<0.02						0.12			0.01							
MW262	2/19/2014			<0.02						0.02			0.02							
MW262	6/11/2014			<0.02						0.031			<0.005							
TPZ159	9/17/2013								1.77			0.47								
TPZ159	11/21/2013			0.11						0.06			0.68							
TPZ159	2/18/2014			0.12						<0.02			0.51							
TPZ159	6/12/2014			0.087						0.069			0.387							
TPZ160	9/17/2013								8.62			0.36								
TPZ160	11/21/2013			0.24						0.05			0.12							
TPZ160	2/18/2014			0.21						0.39			0.16							
TPZ160	6/11/2014			0.205						<0.02			0.215							
TPZ166	9/17/2013								0.09			0.23								
TPZ166	11/20/2013			0.1						<0.02			0.02							
TPZ166	2/18/2014			0.06						<0.02			0.28							
TPZ166	6/12/2014			0.028						<0.02			0.431							
Downgradient Wells (Bedrock)																				
MW350	11/15/2010	0.23	<0.005	0.6	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW350	3/23/2011	0.46	<0.005	0.417	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.009	<0.005	<0.005	<0.01	<0.002
MW350	6/7/2011	0.87	<0.005	0.26	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.007	<0.005	<0.005	<0.01	<0.002
MW350	9/13/2011	0.76	<0.004	0.21	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.005	<0.005	0.0075	<0.01	<0.002
MW350	12/7/2011	1.2	<0.004	0.13	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.006	<0.005	0.0069	<0.01	<0.002
MW350	3/7/2012	1.6	<0.004	0.056	<0.002	<0.005	<0.005	<0.005		0.011	<0.005		<0.005	<0.002	<0.005	0.01	<0.005	0.0075	<0.01	<0.002
MW350	9/16/2013								0.14			<0.005								
MW350	11/20/2013			0.03						<0.02			<0.005							
MW350	2/19/2014			0.03						<0.02			<0.005							
MW350	6/11/2014			0.021						<0.02			<0.005							
MW350	3/25/2015			0.032					0.08	<0.02		<0.003	<0.003							
MW350	6/24/2015			0.034					0.1	<0.02		<0.003	<0.003							
MW350	9/25/2015			0.103					0.04	<0.02		<0.003	<0.003							
MW350	11/10/2015			0.191					0.03	<0.02		<0.003	<0.003							
MW352	11/15/2010	0.18	<0.005	0.9	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352	3/23/2011	0.27	<0.005	0.869	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.007	<0.005	<0.005	<0.01	<0.002
MW352	6/7/2011	0.29	<0.005	0.84	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352	9/13/2011	0.19	<0.004	0.76	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352	12/8/2011	0.19	<0.004	0.76	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352	3/7/2012	0.11	<0.004	0.86	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352	9/16/2013								0.17			0.007								
MW352	11/20/2013			1.47						<0.02			<0.005							
MW352	2/19/2014			0.82						<0.02			<0.005							
MW352	6/12/2014			1.53						<0.02			<0.005							
MW352	3/25/2015			1.05					0.02	<0.02		0.004	<0.003							
MW352	6/24/2015			1.23					0.09	<0.02		0.004	<0.003							
MW352	9/25/2015			1.88					0.03	<0.02		0.007	0.007							
MW352	11/10/2015			1.79					0.03	<0.02		0.007	0.005							
MW355	11/16/2010	0.1	<0.005	0.02	<0.002	<0.005	<0.005	<0.005		1.6	<0.005		0.87	<0.002	0.007	<0.005	<0.005	<0.005	<0.01	<0.002
MW355	3/23/2011	0.10	<0.005	0.021	<0.002	<0.005	<0.005	<0.005		0.60	<0.005		0.45	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355	6/7/2011	0.12	<0.005	0.03	<0.002	<0.005	<0.005	<0.005		0.41	<0.005		0.2	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355	9/12/2011	0.11	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.55	<0.005		0.34	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355	12/7/2011	0.14	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.59	<0.005		0.43	<0.002	<0.005	<0.005	0.006	<0.005	<0.01	<0.002
MW355	3/6/2012	0.098	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.26	<0.005		0.13	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355	9/17/2013								3.82			0.58								
MW355	11/21/2013			0.03						0.62			0.06							
MW355	2/19/2014			0.02						0.03			0.05							
MW355	6/12/2014			0.024						0.071			0.024							
MW355	3/25/2015			0.024					0.3	0.072		0.031	0.015							
MW355	6/24/2015			0.024					0.51	0.022		0.042	0.01							
MW355	9/25/2015			0.025					0.3	0.056		0.073	0.062							
MW355	11/10/2015			<0.02					0.18	0.033		0.031	0.043							

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well	Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard		ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)		27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)		2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)		28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)		5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)		17.7	6240	11.9		5120									109	2820					94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)		13.3	1070	7.6		1130									12	495					36.3					0.57	<0.02		0.01	<0.005							
Leachate Wells in Old East, East and West Fly Ash Ponds (Screened in Fill/CCRs to be Abandoned)																																					
TPZ163	9/17/2013	15.6	1650	9.7		1410																				7.86			0.13								
TPZ163	11/20/2013	13.3	1350	8.8		1130									19	626					37.2						<0.02			<0.005							
TPZ163	2/18/2014	13.4	1070	7.6		1160									15	610					37.8						<0.02			<0.005							
TPZ163	6/12/2014	14.9	1340	9.5		1150									12	495					36.3						<0.02			<0.005							
TPZ167	9/17/2013	17.7	3830	9.9		3250																				0.57			0.01								
TPZ167	11/20/2013	16	2920	8.2		3010									100	1850					53						<0.02			<0.005							
TPZ167	2/18/2014	14.3	3540	7.7		3040									100	1840					54.5						<0.02			<0.005							
TPZ167	6/11/2014	17.2	4240	10		3590									101	1650					60						<0.02			<0.005							
TPZ168	9/17/2013	16.4	5330	10.8		3910																				90.6			1.58								
TPZ168	11/20/2013	14.4	5140	9.2		3680									109	2760					87.2						<0.02			<0.005							
TPZ168	2/18/2014	15.3	6020	8.1		5120									103	2820					78.8						0.06			<0.005							
TPZ168	6/11/2014	16.2	6240	11.9		4610									101	2240					94.7						0.055			<0.005							

[Cr By: JAZ 1/28/16, Chd By:GFF 1/29/16]

Notes:
(N) = NPDES permit monitoring well; * = added to NPDES well network
Red = Exceedance of Class II Groundwater Standard in wells screened in Unlithified Materials

APPENDIX E

STATISTICAL PROCEDURE FOR BACKGROUND

APPENDIX E
STATISTICAL PROCEDURE FOR CALCULATION OF BACKGROUND
Baldwin Fly Ash Pond System Closure
Groundwater Monitoring Plan
Baldwin Energy Complex, Baldwin, Illinois

Introduction

The purpose of the statistical calculations documented in this appendix is to determine the maximum background concentrations likely to occur upgradient of the Baldwin Old East and East Fly Ash ponds in the upper water bearing zone, which typically corresponds to the unlithified glacial materials. High predicted background concentrations relative to the Illinois Class II groundwater quality standards may suggest that downgradient concentrations for those parameters in the upper water bearing zone are due to a background source.

The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," March 2009, EPA 530/R-09-2007 (USEPA, 2009).

Compliance Data Operations - Limit Calculations

The range of potential background concentrations was statistically determined using parametric and non-parametric tolerance intervals. Tolerance intervals were chosen rather than prediction intervals because a tolerance interval makes no assumption about the future number of samples, while a prediction interval assumes a finite, and known, future number of samples.

The flow diagram (Figure E-1) outlines the logic flow for calculation of limits. Background values were calculated using parametric tolerance intervals for normally distributed data, and non-parametric tolerance intervals for data with no underlying distribution or with non-detect frequencies greater than 50 percent. Parametric tolerance intervals were calculated at a 95 percent coverage rate and a Type I individual comparison error level of 0.01 (i.e., false positive rate). Parameters with 100 percent non-detects were handled with the upper tolerance limit being set to the last Reporting Limit (RL).

Statistical Data Evaluation and Results

The input dataset (Appendix E-1) for background calculations were evaluated for the quarterly data from monitoring wells MW-104S/SR and MW-104D/DR, collected from November 2010 through December 2015, for the inorganic parameters listed in 35 IAC 620.410(a) and excluding vanadium, radium-226, radium-228, and perchlorate. All water quality data were stored, prepared, and statistically analyzed using MANAGES™ Version 3.4.49 software (EPRI, March 2014).

A statistical summary of the background water quality data from MW-104S/SR and MW-104D/DR is provided in Appendix E-2, and includes the mean, median, minimum, maximum, standard deviation, Sen Slope trend, normality determination, and percent non-detects for the background dataset. The statistical analysis procedure inputs and results are provided in Appendix E-3.

Calculated background values for the tested inorganic constituents and pH are listed in the following Table E-1 along with the percent non-detects, normal or lognormal distribution, test method, and confidence level.

Figure E-1. Statistical Analysis Flowchart

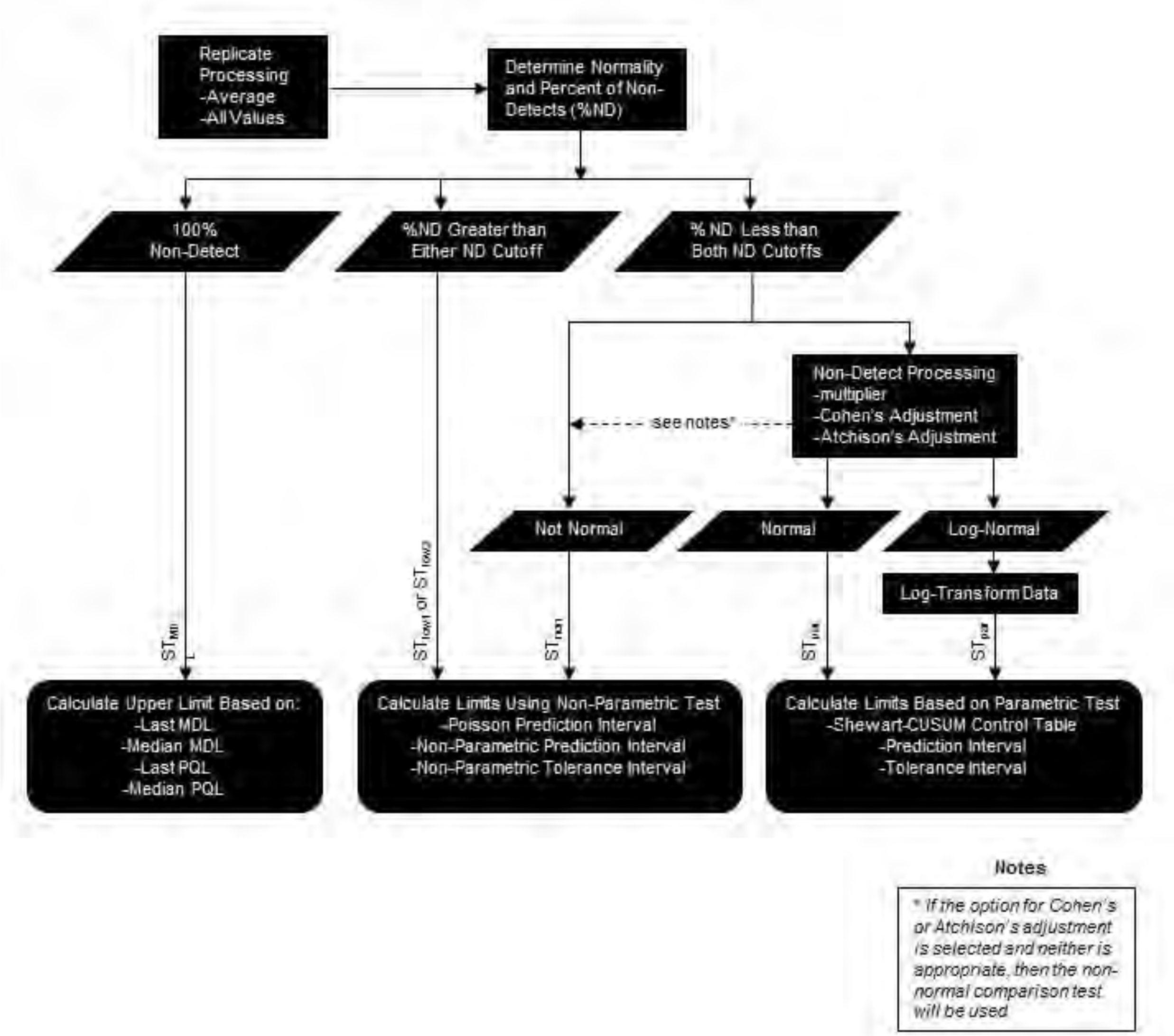


Table E-1. Tolerance Limits for Background Monitoring Wells MW-104S/SR and MW-104D/DR

Parameter	Count of Backround Results	Percent of Non Detects	Normal/ Lognormal	Test	Confidence Level	Upper Limit	Lower Limit
Ag, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
As, diss, mg/L	12	66.67	No/No	STlow2	N/A	0.032	
Ba, diss, mg/L	12	0.00	No/Yes	Stpar	99.00	0.621	
Be, diss, mg/L	12	100.00	Yes/No	STmdl	N/A	0.004	
B, diss, mg/L	26	46.20	No/No	Stnon	73.65	0.237	
Cd, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.002	
Cl, diss, mg/L	28	0.00	No/No	STnon	76.22	58.7	
CN, total, mg/L	12	100.00	No/No	STmdl	N/A	0.008	
Co, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
Cu, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
Cr, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
F, diss, mg/L	12	0.00	Yes/Yes	STpar	99.00	0.793	
Hg, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.002	
Fe, diss, mg/L	26	34.62	No/No	STnon	73.65	18.0	
Fe, tot, mg/L	10	0.00	Yes/Yes	STpar	99.00	11.0	
Mn, diss, mg/L	26	0.00	No/Yes	STpar	99.00	48.8	
Mn, tot, mg/L	10	0.00	Yes/Yes	STpar	99.00	8.2	
Ni, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
NO3, diss, mg/L	12	25.00	No/Yes	STpar	99.00	2.25	
Pb, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
pH (field), std	28	0.00	Yes/Yes	Stpar	99.00	7.55	6.06
Sb, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
Se, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.010	
SO4, diss, mg/L	28	0.00	Yes/Yes	STpar	99.00	328	
TDS, mg/L	28	0.00	Yes/Yes	STpar	99.00	999	
Tl, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.002	
Zn, diss, mg/L	12	83.33	No/N9o	STlow2	45.96	0.009	

* Key to Tests
STmdl = Comparison method if all background results are non-detect = Last MDL
STpar = Parametric Tolerance Interval on background
STlow1 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%)
STnon = Non-Parametric Tolerance Interval on background

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Arsenic, dissolved, mg/L	Barium, dissolved, mg/L	Beryllium, dissolved, mg/L	Boron, dissolved, mg/L	Cadmium, dissolved, mg/L	pH (field), SU
MW104D	11/16/2010		<0.005	0.030	<0.005	<0.020	<0.002	6.980
	03/23/2011		<0.005	0.031	<0.005	0.021	<0.002	7.010
	06/07/2011		<0.005	0.033	<0.005	0.019	<0.002	6.880
MW104DR	09/13/2011		<0.005	0.042	<0.004	<0.050	<0.002	6.710
	12/08/2011		<0.005	0.038	<0.004	<0.050	<0.002	6.790
	03/08/2012		<0.005	0.035	<0.004	<0.050	<0.002	7.650
	09/16/2013							6.900
	11/20/2013					0.020		6.820
	02/18/2014					<0.020		6.750
	06/11/2014					<0.020		6.990
	03/25/2015					<0.020		7.110
	06/24/2015					<0.020		6.990
	09/25/2015					<0.020		7.090
	11/10/2015					<0.020		6.800
MW104S	11/16/2010		0.032	0.150	<0.005	0.160	<0.002	6.580
	03/23/2011		0.008	0.090	<0.005	0.146	<0.002	6.550
	06/07/2011		0.012	0.240	<0.005	0.220	<0.002	6.500
MW104SR	09/13/2011		0.006	0.059	<0.004	<0.050	<0.002	6.440
	12/08/2011		<0.005	0.076	<0.004	<0.050	<0.002	6.900
	03/08/2012		<0.005	0.097	<0.004	0.060	<0.002	6.880
	09/16/2013							6.720
	11/20/2013					0.040		6.710
	02/18/2014					0.050		6.730
	06/11/2014					0.147		6.500
	03/25/2015					0.086		6.790
	06/24/2015					0.178		6.650
	09/25/2015					0.237		6.740
	11/10/2015					0.149		6.320

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Chloride, dissolved, mg/L	Chromium, dissolved, mg/L	Cobalt, dissolved, mg/L	Copper, dissolved, mg/L	Cyanide, total, mg/L	Fluoride, dissolved, mg/L
MW104D	11/16/2010		15.700	<0.005	<0.0050	<0.005	<0.007	0.469
	03/23/2011		16.749	<0.005	<0.0050	<0.005	<0.007	0.422
	06/07/2011		18.500	<0.005	<0.0050	<0.005	<0.007	0.379
MW104DR	09/13/2011		18.000	<0.005	<0.0050	<0.005	<0.007	0.370
	12/08/2011		18.000	<0.005	<0.0050	<0.005	<0.007	0.400
	03/08/2012		24.000	<0.005	<0.0050	<0.005	<0.008	0.310
	09/16/2013		20.000					
	11/20/2013		16.000					
	02/18/2014		18.000					
	06/11/2014		18.000					
	03/25/2015		21.000					
	06/24/2015		23.000					
	09/25/2015		24.000					
	11/10/2015		25.000					
MW104S	11/16/2010		33.700	<0.005	<0.0050	<0.005	<0.007	0.629
	03/23/2011		56.480	<0.005	<0.0050	<0.005	<0.007	0.401
	06/07/2011		58.700	<0.005	<0.0050	<0.005	<0.008	0.561
MW104SR	09/13/2011		32.000	<0.005	<0.0050	<0.005	<0.007	0.540
	12/08/2011		31.000	<0.005	<0.0050	<0.005	<0.007	0.523
	03/08/2012		34.000	<0.005	<0.0050	<0.005	<0.008	0.549
	09/16/2013		19.000					
	11/20/2013		19.000					
	02/18/2014		18.000					
	06/11/2014		16.000					
	03/25/2015		14.000					
	06/24/2015		23.000					
	09/25/2015		19.000					
	11/10/2015		19.000					

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Iron, dissolved, mg/L	Iron, total, mg/L	Lead, dissolved, mg/L	Manganese, dissolved, mg/L	Manganese, total, mg/L	Mercury, dissolved, mg/L
MW104D	11/16/2010		<0.010		<0.005	0.020		<0.0020
	03/23/2011		<0.010		<0.005	0.040		<0.0020
	06/07/2011		<0.010		<0.005	0.013		<0.0020
MW104DR	09/13/2011		0.024		<0.005	0.420		<0.0020
	12/08/2011		0.025		<0.005	0.280		<0.0020
	03/08/2012		0.011		<0.005	0.210		<0.0020
	09/16/2013			4.820			0.930	
	11/20/2013		0.070			0.290		
	02/18/2014		<0.020			0.040		
	06/11/2014		0.028			0.123		
	03/25/2015		<0.020	0.542		0.092	0.177	
	06/24/2015		<0.020	0.767		0.130	0.206	
	09/25/2015		<0.020	0.744		0.150	0.224	
	11/10/2015		<0.020	0.333		0.172	0.234	
MW104S	11/16/2010		18.000		<0.005	6.800		<0.0020
	03/23/2011		1.852		<0.005	3.014		<0.0020
	06/07/2011		14.000		<0.005	4.000		<0.0020
MW104SR	09/13/2011		0.080		<0.005	1.200		<0.0020
	12/08/2011		0.190		<0.005	1.100		<0.0020
	03/08/2012		0.610		<0.005	1.900		<0.0020
	09/16/2013			3.180			4.970	
	11/20/2013		1.440			2.200		
	02/18/2014		<0.020			0.590		
	06/11/2014		0.806			1.690		
	03/25/2015		0.207	0.476		2.100	2.660	
	06/24/2015		3.740	7.120		3.100	3.460	
	09/25/2015		3.350	3.620		2.520	2.540	
	11/10/2015		1.190	0.979		3.090	2.780	

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Nickel, dissolved, mg/L	Nitrate nitrogen, diss, deg. C	Residue, total filtrable, mg/L	Selenium, dissolved, mg/L	Silver, dissolved, mg/L	Sulfate, dissolved, mg/L
MW104D	11/16/2010		<0.005	0.07	785	<0.010	<0.005	245.000
	03/23/2011		<0.005	0.07	801	<0.010	<0.005	241.400
	06/07/2011		<0.005	<0.05	776	<0.010	<0.005	250.300
MW104DR	09/13/2011		<0.005	0.07	768	<0.010	<0.005	225.000
	12/08/2011		<0.005	0.06	739	<0.010	<0.005	222.000
	03/08/2012		<0.005	0.55	724	<0.010	<0.005	214.000
	09/16/2013				676			198.000
	11/20/2013				630			194.000
	02/18/2014				652			175.000
	06/11/2014				676			186.000
	03/25/2015				630			179.000
	06/24/2015				718			187.000
	09/25/2015				634			178.000
	11/10/2015				644			195.000
MW104S	11/16/2010		<0.005	<0.05	943	<0.010	<0.005	148.000
	03/23/2011		<0.005	<0.05	742	<0.010	<0.005	168.800
	06/07/2011		<0.005	0.07	824	<0.010	<0.005	114.400
MW104SR	09/13/2011		<0.005	0.37	909	<0.010	<0.005	164.000
	12/08/2011		<0.005	0.14	965	<0.010	<0.005	237.000
	03/08/2012		<0.005	0.09	886	<0.010	<0.005	140.000
	09/16/2013				724			43.000
	11/20/2013				770			134.000
	02/18/2014				792			138.000
	06/11/2014				792			68.000
	03/25/2015				770			100.000
	06/24/2015				880			47.000
	09/25/2015				744			23.000
	11/10/2015				732			57.000

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Thallium, dissolved, mg/L	Zinc, dissolved, mg/L
MW104D	11/16/2010		<0.002	<0.005
	03/23/2011		<0.002	<0.005
	06/07/2011		<0.002	<0.005
MW104DR	09/13/2011		<0.002	<0.005
	12/08/2011		<0.002	<0.005
	03/08/2012		<0.002	<0.005
MW104S	11/16/2010		<0.002	0.009
	03/23/2011		<0.002	<0.005
	06/07/2011		<0.002	0.009
MW104SR	09/13/2011		<0.002	<0.005
	12/08/2011		<0.002	<0.005
	03/08/2012		<0.002	<0.005

Appendix E-2

Baldwin Ash Ponds: Statistical Summary for Pooled Upgradient Monitoring Well Locations

User Supplied Information

Date Range: 11/01/2010 to 12/31/2015 **Option for LT Pts: x 0.5**

Pooled Locations: MW104D,MW104DR,MW104S,MW104SR

Parameter	Units	Count	Mean	Median	Maximum	Minimum	Std Dev	Sen Slope Units/yr	Normal / Log Normal	% of Non-Detects
Antimony, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Arsenic, dissolved	mg/L	12	0.006	0.003	0.032	0.003	0.009	0.000	No / No	66.67
Barium, dissolved	mg/L	12	0.077	0.051	0.240	0.030	0.063	0.023	No / Yes	0.00
Beryllium, dissolved	mg/L	12	0.002	0.002	0.003	0.002	0.000	0.000	No / No	100.00
Boron, dissolved	mg/L	26	0.066	0.025	0.237	0.010	0.073	0.010	No / No	46.15
Cadmium, dissolved	mg/L	12	0.001	0.001	0.001	0.001	0.000	0.000	No / Yes	100.00
Chloride, dissolved	mg/L	28	23.887	19.000	58.700	14.000	10.977	0.263	No / No	0.00
Chromium, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Cobalt, dissolved	mg/L	12	0.0025	0.0025	0.0025	0.0025	0.0000	0.0000	No / No	100.00
Copper, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Cyanide, total	mg/L	12	0.004	0.004	0.004	0.004	0.000	0.000	No / No	100.00
Fluoride, dissolved	mg/L	12	0.463	0.446	0.629	0.310	0.097	0.019	Yes / Yes	0.00
Iron, dissolved	mg/L	26	1.758	0.049	18.000	0.005	4.349	0.046	No / No	34.62
Iron, total	mg/L	10	2.258	0.873	7.120	0.333	2.331	0.401	No / Yes	0.00
Lead, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Manganese, dissolved	mg/L	26	1.357	0.505	6.800	0.013	1.651	0.476	No / Yes	0.00
Manganese, total	mg/L	10	1.818	1.735	4.970	0.177	1.697	1.139	Yes / No	0.00
Mercury, dissolved	mg/L	12	0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	No / Yes	100.00
Nickel, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Nitrate nitrogen, diss	deg. C	12	0.130	0.068	0.554	0.025	0.163	0.076	No / Yes	25.00
pH (field)	SU	28	6.803	6.790	7.650	6.320	0.258	-0.049	Yes / Yes	0.00
Residue, total filtrable	mg/L	28	761.643	756.000	965.000	630.000	92.687	0.000	Yes / Yes	0.00
Selenium, dissolved	mg/L	12	0.005	0.005	0.005	0.005	0.000	0.000	No / No	100.00
Silver, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00

Shapiro-Wilk Normality test performed at 0.05 significance level.

Baldwin Ash Ponds: Statistical Summary for Pooled Upgradient Monitoring Well Locations

User Supplied Information

Date Range: 11/01/2010 to 12/31/2015 **Option for LT Pts: x 0.5**

Pooled Locations: MW104D,MW104DR,MW104S,MW104SR

Parameter	Units	Count	Mean	Median	Maximum	Minimum	Std Dev	Sen Slope Units/yr	Normal / Log Normal	% of Non-Detects
Sulfate, dissolved	mg/L	28	159.711	176.500	250.300	23.000	65.781	-35.529	Yes / No	0.00
Thallium, dissolved	mg/L	12	0.001	0.001	0.001	0.001	0.000	0.000	No / Yes	100.00
Zinc, dissolved	mg/L	12	0.004	0.003	0.009	0.003	0.003	0.000	No / No	83.33

Shapiro-Wilk Normality test performed at 0.05 significance level.

Appendix E-3

Baldwin Ash Pond System: Background Statistics- Upper Water Bearing Zone (Unlithified Materials)

Background Date Range: 11/01/2010 to 12/31/2015
Background Locations: MW104D,MW104DR,MW104S,MW104SR

Compliance Date Range: 11/01/2010 to 04/01/2015
Compliance Locations: MW104SR

Comparison Method if all Background Results are Non-Detect:	STmdl = Last MDL
Statistical Test for Parametric Background Data Distributions:	STpar = Parametric Tolerance Interval on Background
Statistical Test for Cases with High Percentage of Non-Detect Background Data:	STlow1 = Non-Parametric Prediction Interval on Background (ND Frequency > 50%)
Statistical Test for Cases with High Percentage of Non-Detect Background Data:	STlow2 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%)
Statistical Test for Non-Parametric Background Data Distributions:	STnon = Non-Parametric Tolerance Interval on background
Background Comparison:	Interwell
Number of Verification Samples:	0
Default Type 1 Individual Comparison Error Level (False Positive Rate) for tests other than Prediction Interval	0.01
Non-Detect Processing (Parametric Tests):	<=15% using MDL * 0.5 >15% using MDL * 0.5
Non-Detect Processing (All Other):	<=50% using MDL * 0.5 >50% using MDL * 0.5

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Antimony, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Arsenic, dissolved, mg/L	09/13/2011	12	66.67	No/No	STlow2	45.96	0.032		0.006	No	
		12/08/2011	12	66.67	No/No		45.96	0.032		<0.005	No	
		03/08/2012	12	66.67	No/No		45.96	0.032		<0.005	No	
MW104SR	Barium, dissolved, mg/L	09/13/2011	12	0.00	No/Yes	STpar	99.00	0.621		0.059	No	
		12/08/2011	12	0.00	No/Yes		99.00	0.621		0.076	No	
		03/08/2012	12	0.00	No/Yes		99.00	0.621		0.097	No	
MW104SR	Beryllium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.004		<0.004	No	
		12/08/2011	12	100.00	No/No		N/A	0.004		<0.004	No	
		03/08/2012	12	100.00	No/No		N/A	0.004		<0.004	No	
MW104SR	Boron, dissolved, mg/L	09/13/2011	26	46.15	No/No	STnon	73.65	0.237		<0.050	No	
		12/08/2011	26	46.15	No/No		73.65	0.237		<0.050	No	
		03/08/2012	26	46.15	No/No		73.65	0.237		0.060	No	
		11/20/2013	26	46.15	No/No		73.65	0.237		0.040	No	
		02/18/2014	26	46.15	No/No		73.65	0.237		0.050	No	
		06/11/2014	26	46.15	No/No		73.65	0.237		0.147	No	
		03/25/2015	26	46.15	No/No		73.65	0.237		0.086	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Cadmium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.002		<0.002	No	
		12/08/2011	12	100.00	No/No		N/A	0.002		<0.002	No	
		03/08/2012	12	100.00	No/No		N/A	0.002		<0.002	No	
MW104SR	Chloride, dissolved, mg/L	09/13/2011	28	0.00	No/No	STnon	76.22	58.700		32.000	No	
		12/08/2011	28	0.00	No/No		76.22	58.700		31.000	No	
		03/08/2012	28	0.00	No/No		76.22	58.700		34.000	No	
		09/16/2013	28	0.00	No/No		76.22	58.700		19.000	No	
		11/20/2013	28	0.00	No/No		76.22	58.700		19.000	No	
		02/18/2014	28	0.00	No/No		76.22	58.700		18.000	No	
		06/11/2014	28	0.00	No/No		76.22	58.700		16.000	No	
		03/25/2015	28	0.00	No/No		76.22	58.700		14.000	No	
MW104SR	Chromium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Cobalt, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.0050		<0.0050	No	
		12/08/2011	12	100.00	No/No		N/A	0.0050		<0.0050	No	
		03/08/2012	12	100.00	No/No		N/A	0.0050		<0.0050	No	
MW104SR	Copper, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Cyanide, total, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.008		<0.007	No	
		12/08/2011	12	100.00	No/No		N/A	0.008		<0.007	No	
		03/08/2012	12	100.00	No/No		N/A	0.008		<0.008	No	
MW104SR	Fluoride, dissolved, mg/L	09/13/2011	12	0.00	Yes/Yes	STpar	99.00	0.793		0.540	No	
		12/08/2011	12	0.00	Yes/Yes		99.00	0.793		0.523	No	
		03/08/2012	12	0.00	Yes/Yes		99.00	0.793		0.549	No	
MW104SR	Iron, dissolved, mg/L	09/13/2011	26	34.62	No/No	STnon	73.65	18.000		0.080	No	
		12/08/2011	26	34.62	No/No		73.65	18.000		0.190	No	
		03/08/2012	26	34.62	No/No		73.65	18.000		0.610	No	
		11/20/2013	26	34.62	No/No		73.65	18.000		1.440	No	
		02/18/2014	26	34.62	No/No		73.65	18.000		<0.020	No	
		06/11/2014	26	34.62	No/No		73.65	18.000		0.806	No	
		03/25/2015	26	34.62	No/No		73.65	18.000		0.207	No	
MW104SR	Iron, total, mg/L	09/16/2013	10	0.00	Yes/Yes	STpar	99.00	10.986		3.180	No	
		03/25/2015	10	0.00	Yes/Yes		99.00	10.986		0.476	No	
MW104SR	Lead, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Manganese, dissolved, mg/L	09/13/2011	26	0.00	No/Yes	STpar	99.00	48.767		1.200	No	
		12/08/2011	26	0.00	No/Yes		99.00	48.767		1.100	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Manganese, dissolved, mg/L	03/08/2012	26	0.00	No/Yes	STpar	99.00	48.767		1.900	No	
		11/20/2013	26	0.00	No/Yes		99.00	48.767		2.200	No	
		02/18/2014	26	0.00	No/Yes		99.00	48.767		0.590	No	
		06/11/2014	26	0.00	No/Yes		99.00	48.767		1.690	No	
		03/25/2015	26	0.00	No/Yes		99.00	48.767		2.100	No	
MW104SR	Manganese, total, mg/L	09/16/2013	10	0.00	Yes/Yes	STpar	99.00	8.173		4.970	No	
		03/25/2015	10	0.00	Yes/Yes		99.00	8.173		2.660	No	
MW104SR	Mercury, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.0020		<0.0020	No	
		12/08/2011	12	100.00	No/No		N/A	0.0020		<0.0020	No	
		03/08/2012	12	100.00	No/No		N/A	0.0020		<0.0020	No	
MW104SR	Nickel, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Nitrate nitrogen, diss, deg. C	09/13/2011	12	25.00	No/Yes	STpar	99.00	2.25		0.37	No	
		12/08/2011	12	25.00	No/Yes		99.00	2.25		0.14	No	
		03/08/2012	12	25.00	No/Yes		99.00	2.25		0.09	No	
MW104SR	Nitrate nitrogen, total, mg/L	03/25/2015	8	25.00	Yes/Yes	STpar	99.00	2.264		0.058	No	
MW104SR	pH (field), SU	09/13/2011	28	0.00	Yes/Yes	STpar	99.00	7.547	6.059	6.440	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	pH (field), SU	12/08/2011	28	0.00	Yes/Yes	STpar	99.00	7.547	6.059	6.900	No	
		03/08/2012	28	0.00	Yes/Yes		99.00	7.547	6.059	6.880	No	
		09/16/2013	28	0.00	Yes/Yes		99.00	7.547	6.059	6.720	No	
		11/20/2013	28	0.00	Yes/Yes		99.00	7.547	6.059	6.710	No	
		02/18/2014	28	0.00	Yes/Yes		99.00	7.547	6.059	6.730	No	
		06/11/2014	28	0.00	Yes/Yes		99.00	7.547	6.059	6.500	No	
		03/25/2015	28	0.00	Yes/Yes		99.00	7.547	6.059	6.790	No	
MW104SR	Residue, total filtrable, mg/L	09/13/2011	28	0.00	Yes/Yes	STpar	99.00	999		909	No	
		12/08/2011	28	0.00	Yes/Yes		99.00	999		965	No	
		03/08/2012	28	0.00	Yes/Yes		99.00	999		886	No	
		09/16/2013	28	0.00	Yes/Yes		99.00	999		724	No	
		11/20/2013	28	0.00	Yes/Yes		99.00	999		770	No	
		02/18/2014	28	0.00	Yes/Yes		99.00	999		792	No	
		06/11/2014	28	0.00	Yes/Yes		99.00	999		792	No	
		03/25/2015	28	0.00	Yes/Yes		99.00	999		770	No	
MW104SR	Selenium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.010		<0.010	No	
		12/08/2011	12	100.00	No/No		N/A	0.010		<0.010	No	
		03/08/2012	12	100.00	No/No		N/A	0.010		<0.010	No	
MW104SR	Silver, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Sulfate, dissolved, mg/L	09/13/2011	28	0.00	Yes/No	STpar	99.00	327.885		164.000	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Sulfate, dissolved, mg/L	12/08/2011	28	0.00	Yes/No	STpar	99.00	327.885		237.000	No	
		03/08/2012	28	0.00	Yes/No		99.00	327.885		140.000	No	
		09/16/2013	28	0.00	Yes/No		99.00	327.885		43.000	No	
		11/20/2013	28	0.00	Yes/No		99.00	327.885		134.000	No	
		02/18/2014	28	0.00	Yes/No		99.00	327.885		138.000	No	
		06/11/2014	28	0.00	Yes/No		99.00	327.885		68.000	No	
		03/25/2015	28	0.00	Yes/No		99.00	327.885		100.000	No	
MW104SR	Thallium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.002		<0.002	No	
		12/08/2011	12	100.00	No/No		N/A	0.002		<0.002	No	
		03/08/2012	12	100.00	No/No		N/A	0.002		<0.002	No	
MW104SR	Zinc, dissolved, mg/L	09/13/2011	12	83.33	No/No	STlow2	45.96	0.009		<0.005	No	
		12/08/2011	12	83.33	No/No		45.96	0.009		<0.005	No	
		03/08/2012	12	83.33	No/No		45.96	0.009		<0.005	No	

APPENDIX F

GROUNDWATER SAMPLING PROTOCOL

Groundwater Sampling Protocol

The following procedures shall be used in sampling groundwater at the site. This sampling protocol shall apply to the routine quarterly (or modified semi-annual or annual) sampling events. A sample collector's worksheet, comparable to the one located in Exhibit 1, may be used for noting relevant information in regard to each well.

Water Levels

Water levels shall be taken in each well prior to purging and/or sampling. Water levels should be taken as close together as practical, to prevent any time distortion of the water surface data. The following steps shall be followed to obtain accurate water level readings:

1. Note the general condition of the monitoring well on the worksheet. This shall include, but is not limited to the condition of the casing, the lock, evidence of tampering, condition of the pad, and any standing water.
2. Remove the lock and open the monitoring well. Note the condition of the interior of the casing and the condition of the well cap and riser. Open the cap, taking care not to allow dirt or foreign material into the monitoring well.
3. The technician shall rinse the probe and cable of the water level meter with decon water.
4. Slowly lower the probe into the monitoring well until the meter indicates the water surface has been reached.
5. Note the depth to water (to the nearest 0.01 ft) and the time on the worksheet.
6. Lower the probe to the bottom of well. (If a dedicated pump is installed in the well, skip this step). Note the well depth on the worksheet. The depth of the well will be measured on an annual basis, at wells that do not contain dedicated pumps. The depth of wells with dedicated pumps will be measured at least once every 5 years, or whenever the pump is removed.
7. Slowly remove the probe from the well. Rinse the probe and line with decon water.
8. Replace cap. Close and lock the well. Proceed to the next well, and repeat.

Purging of Monitoring Well – Pump Method

After all water level measurements have been taken, the monitoring wells shall be purged to provide a representative sample. Each groundwater monitoring well shall be purged by using a dedicated pump. The pump construction shall consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells).

Purging shall be conducted utilizing a "low-flow" or minimal drawdown technique. Flow rates for this technique will typically fall below 0.5 liters/minutes, with an overall goal of not reducing the water level in the monitoring well by more than 0.3 ft during purging. Water levels should be checked frequently to ensure that the drawdown in the well does not exceed the 0.3-ft limits. Every 3 minutes to 5 minutes, readings shall be taken on the following water quality indicators to determine if a representative water sample is available.

- pH (in SU),
- Specific Conductance (in µmhos/cm or µS/cm),
- Temperature (in ºF),
- And, it is suggested, at least one of the following:
  - Redox Potential (in mV);
  - Dissolved Oxygen (in mg/L); and/or
  - Turbidity (in NTU).

The water quality indicators will be considered stabilized when the following tolerances are reached after three consecutive readings:

- pH.................................... ±0.05 SU
- Specific Conductance ...... ±5 percent
- Temperature.................... ±0.5ºF
- Redox Potential .... ±10 percent
- Dissolved Oxygen........... ±10 percent
- Turbidity......................... ±10 percent

Slow recovering wells require special consideration. If a well is dry, or is purged below the bottom of the pump intake, the well will be allowed to recharge for at least 12 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed, and any other parameters considered to be relevant.

Purging of Monitoring Well – Bailer Method

Purging and sample collection with a bailer shall be performed in the event of a non-functioning pump or from a well that does not have a dedicated pump installed. A sample shall be collected utilizing a factory packaged, clean, disposable bailer with an appropriate length of new, clean rope attached.

Calculate the number of bailer volumes of water needed to remove one (1) well volume of water.

Well Volume Calculations (2-inch well):

Schedule 40 PVC has an inside diameter of 2.067 inches.

$\therefore$ ((2.067 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0233 ft^3/ft of water.

0.0233 ft^3/ft • 7.48 gallons/ft^3 = 0.174 gallon/ft

Schedule 5 Stainless Steel (304 or 316) has an inside diameter of 2.245 inches.

$\therefore$ ((2.245 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0275 ft^3/ft of water.

0.0275 ft^3/ft • 7.48 gallons/ft^3 = 0.206 gallon/ft

Volume of well (in gallons) = well type gallon/ft • (DTB - DTW); where,
DTB $\equiv$ depth to bottom of well (from measuring point), and
DTW $\equiv$ depth to water (from measuring point)

Bailer Volumes:

Disposable bailer volumes will vary by type and manufacturer. Volume information should be obtained before going to the site. For comparison, a 3 ft stainless steel bailer has a volume of approximately 1220 cc or 0.322 gallon and a 5 ft PVC bailer of approximately 1085 cc or 0.287 gallon.

Open monitoring well, being careful that no potential contaminant enters the well.

Remove one (1) bailer volume of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet. (Turbidity, redox potential and dissolved oxygen will vary considerably due to the agitation a bailer will cause in the well. Testing for these parameters is not recommended with this method.)

Remove one-half (½) gallon of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet.

Remove ½ to 1 gallon of water. Test pH, specific conductance and temperature. Record data on worksheet.

Repeat until pH, specific conductance and temperature stabilize or three (3) well volumes of water have been removed.

If the monitoring well becomes dry, or there is insufficient water to obtain all necessary samples, the monitoring well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers are filled or the well becomes dry. Notes shall be kept on the worksheet regarding water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.

If there is sufficient water volume in the monitoring well to obtain all samples, sample collection shall begin at this time.

Sample Collection Order

Samples shall be collected starting at the monitoring well with the least likelihood for contamination. Sampling shall proceed from the well with the lowest potential for contamination to the well with the highest potential for contamination.

Field Measurements

General

Upon arrival at each groundwater monitoring well, the technician shall note on the sampler's worksheet or in a field notebook the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. (Note: Any observers shall need at a minimum, the same personal protective gear as the members of the sample team.)

Establish a "clean area" near the monitoring well where the sample containers and equipment can be stored while not in use. Every effort should be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable, plastic tarp can be used as a ground cover to prevent potential contamination of the sample containers and equipment. Typically, the back of the field vehicle will be used as the "clean area".

Any non-dedicated sampling equipment (meter probes, thermometers, etc.) shall be washed in a commercial, laboratory cleaner (Alconox®, Liquinox®, or equivalent), and thoroughly rinsed in decon water before each use. Calibration shall be performed at each new monitoring location after the initial decontamination. After use, each device shall be powered down (if necessary) decontaminated, and stored in its manufacturer-approved container.

Temperature

Obtain a water sample from the well. Place the sample aliquot in a disposable container, insert the thermometer (or electronic probe), wait until the readings have stabilized, and record the temperature on the worksheet. Temperature for a glass thermometer should be noted to the nearest degree Fahrenheit (1ºF). For electronic thermometers (thermocouples), temperature should be noted to the nearest tenth degree Fahrenheit (0.1ºF). The thermometer or probe shall be cleaned and rinsed with decon water after use.

pH

Confirm calibration of the instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with decon water. Obtain a sample from the well and place the probe in sample aliquot. Note the pH and record on the sample worksheet. Note pH readings to the nearest tenth unit (0.1).

Specific Conductance

Confirm calibration of the instrument by comparing against an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse the probe with decon water. Obtain a sample from the well and place the probe in sample aliquot. Note the specific conductance and record on the sample worksheet. Specific conductance should be noted to the nearest micromhos per centimeter (µmhos/cm) or microSiemens per centimeter (µS/cm).

Sample Collection Procedures

Jars and vials may ship pre-labeled from the laboratory, identifying the analysis and preservative for each type of sample. Dependent upon circumstances, sample containers may be prepared by non-laboratory personnel. If so, this should be noted on the sample worksheet or in the field notebook.

A technician shall remove a sample container from the cooler, affix a label, and in indelible, waterproof ink write the well number and/or sample I.D., the facility name, the sample collection date and time, the type of sample in the container, and the sample collector's name. A technician shall organize the containers in the following sampling order:

- Metals and Minerals (dissolved)
- Anions (dissolved)
- Total Dissolved Solids (TDS)
- Cyanides (total)

Dissolved parameters include dissolved metals and minerals, total dissolved solids (TDS), and nitrogen should be field filtered. Samples should be filtered using a 0.45-micron filter attached to the sample pump line. Other filter apparatus may be utilized as long as Illinois EPA guidelines are followed. Filters should be replaced no less frequently than at each new well, and may need to be replaced more often if flow is restricted due to particulate matter in the sample water.

Transportation of Monitoring Samples

<u>*Sample Preservation Techniques*</u>

The preservation techniques utilized in the groundwater samples will typically adhere to those listed in *Handbook for Sampling and Sample Preservation of Water and Wastewater*, U.S. EPA, EPA-600/4-82-029, September 1982 and/or *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, EPA/530/SW-846, $3^{rd.}$ Edition, Final Update IV (January 2008).

<u>*Transportation of Samples*</u>

Samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests, or coolers. The shipping containers should be sturdy, and if samples are contained in glass bottles, dividers and/or bubble wrap should be used to restrict potential breakage. All samples will be packed in ice or a packaged refrigerant as necessary for proper preservation. Samples should be packed to maintain sample temperatures as close to 4ºC (degrees Celsius) or 39ºF as possible from the time the samples are collected to the time the samples are received by the laboratory. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

All samples shall be accompanied by a chain-of-custody record. The sampler shall retain a copy of the record and forward the original with the samples to the analytical laboratory. Once the laboratory has received the samples, a representative from the laboratory is to complete the record, retain the original and return a copy with the chemical analysis reports to the sampler. The chain-of-custody shall contain the facility name, the wells sampled, time and date of sampling, members of the sampling party, type of samples (i.e. water, soil, leachate, etc.), number of sample bottles, requested analysis, overnight courier, etc. A sample chain-of-custody record is provided in Exhibit 2.

Attachments
Exhibit 1: Groundwater Sampling Worksheet
Exhibit 2: Example Chain-of-Custody Record

ATTACHMENT I

ENVIRONMENT
& HEALTH

Dynegy Midwest Generation, LLC
10901 Baldwin Road
Baldwin, IL 62217

Groundwater Monitoring Plan Addendum the Fly Ash Pond System
Baldwin Power Plant, Baldwin, IL

October 25, 2021

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
www.ramboll.com

Ref. 1940100806-001

Ramboll Americas Engineering Solutions, Inc. (Ramboll) is providing the attached Addendum to the Groundwater Monitoring Plan (GMP) for inclusion in the Operating Permit Applications as required under Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230 and allowed under 35 I.A.C. § 845.210(d)(1). The GMP was previously submitted to and approved by the Illinois Environmental Protection Agency (IEPA) as part of the *Closure and Post-Closure Care Plan for the Baldwin Fly Ash Pond System* (Closure Plan; AECOM, 2016) submitted for the Baldwin Power Plant (BPP) Fly Ash Pond System (FAPS; Vistra identification [ID] number [No.] 605 and National Inventory of Dams [NID] No. IL50723). The FAPS is comprised of the following three CCR units identified by IEPA:

- Old East Fly Ash Pond, IEPA ID No. W1578510001-01
- East Fly Ash Pond, IEPA ID No. W1578510001-02
- West Fly Ash Pond, IEPA ID No. W1578510001-03

This Addendum to the BPP FAPS GMP (Attachment 1), modifies the existing monitoring program and network to align with Part 845. Upon issuance of the Operating Permit, groundwater monitoring will be performed as specified in the Addendum.

BACKGROUND

AECOM submitted the Closure Plan for the FAPS on April 7, 2016. Included in Appendix A of that report was a Supplemental Hydrogeologic Site Characterization Study and Groundwater Monitoring Plan (Attachment 2). IEPA provided comments on these documents in a letter dated July 13, 2016. A Technical Memorandum from Natural Resource Technology, Inc. (NRT), dated August 8, 2016, provided additional information and revised portions of the documents to address comments provided by IEPA. The Closure Plan was approved by IEPA in a letter dated August 16, 2016. Closure of the FAPS was completed in November 2020.

On April 21, 2021 Part 845 became effective, and 35 I.A.C. § 845.100(i) provides the following with respect to certain CCR units closed prior to the effective date:

> *i) If a CCR surface impoundment has completed an Agency-approved closure before April 21, 2021, this Part does not require the owner or operator of the CCR surface impoundment to resubmit to the Agency any closure plan, closure report, or closure certification for that completed closure.*

SUBMITTALS

The attached documents are being provided to address requirements of 35 I.A.C. § 845.230 as follows:

- Addendum to the BPP FAPS GMP (new submittal, Attachment 1). This Addendum includes revisions to the monitoring well network, analytical parameters, and statistical procedures included in the previously submitted GMP (NRT, 2016). These modifications are proposed to meet and fulfill the requirements in 35 I.A.C. § 845.630 and 35 I.A.C. § 845.640 (Groundwater Monitoring Systems and Statistical Procedures); and 35 I.A.C. § 845.650(b) (background samples). The proposed modifications were identified and developed using existing and previously approved documents, but additional information has been provided where necessary.
- Groundwater Monitoring Plan as included in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (Attachment 2). This attachment provides a copy of the existing groundwater monitoring plan as it was approved by IEPA.

Sincerely,

Eric Tlachac, PE
Managing Engineer

D +1 414 837 3541
M +1 262 719 4526
eric.tlachac@ramboll.com

Brian G. Hennings, PG
Managing Hydrogeologist

D +1 414 837 3524
M +1 262 719 4512
brian.hennings@ramboll.com

ATTACHMENTS:

Attachment 1 Addendum to the Groundwater Monitoring Plan

Attachment 2 Groundwater Monitoring Plan, as included in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan submitted to the IEPA with the Closure and Post-Closure Care Plan dated March 2016

ATTACHMENT 1
ADDENDUM TO THE GROUNDWATER MONITORING PLAN

Intended for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100806-001

ADDENDUM TO THE GROUNDWATER MONITORING PLAN

FLY ASH POND SYSTEM
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

ADDENDUM TO THE GROUNDWATER MONITORING PLAN BALDWIN POWER PLANT FLY ASH POND SYSTEM

Project name	**Baldwin Power Plant Fly Ash Pond System**
Project no.	**1940100806-001**
Recipient	**Dynegy Midwest Generation, LLC**
Document type	**Addendum to the Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**October 25, 2021**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

Brian G. Hennings, PG
Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Nathaniel R. Keller
Senior Hydrogeologist

LICENSED PROFESSIONAL CERTIFICATIONS

35 I.A.C. § 845.630 Groundwater Monitoring Systems (PE)

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Addendum to the Groundwater Monitoring Plan, Baldwin Power Plant Fly Ash Pond System), meets the intent of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the IEPA approved Hydrogeologic Site Characterization Report submitted with the IEPA approved Closure and Post Closure Care Plan.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

35 I.A.C. § 845.630 Groundwater Monitoring Systems (PG)

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Addendum to the Groundwater Monitoring Plan, Baldwin Power Plant Fly Ash Pond System), meets the intent of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the IEPA approved Hydrogeologic Site Characterization Report submitted with the IEPA approved Closure and Post Closure Care Plan.

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

CONTENTS

TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES (ATTACHED)

APPENDICES

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
bgs	below ground surface
BPP	Baldwin Power Plant
CCR	coal combustion residuals
Closure Plan	*Baldwin Fly Ash Pond System Closure Plan, Post-Closure Plan*
cm/s	centimeters per second
DMG	Dynegy Midwest Generation, LLC
FAPS	Fly Ash Pond System
GMP	Groundwater Monitoring Plan
GWPS	groundwater protection standard
ID	identification
IEPA	Illinois Environmental Protection Agency
mp	measuring point
NID	National Inventory of Dams
No.	number
NPDES	National Pollution Discharge Elimination System
NRT	Natural Resource Technology, Inc.
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
PMP	potential migration pathway
QA/QC	quality assurance/quality control
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	reporting limit
SI	surface impoundment
TDS	total dissolved solids
UA	uppermost aquifer
Unified Guidance	*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals (CCR) in Surface Impoundments (SIs): Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845 (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Addendum to the Groundwater Monitoring Plan (GMP) on behalf of Baldwin Power Plant (BPP) (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This Addendum applies specifically to the CCR Multi-Unit referred to as the Fly Ash Pond System (FAPS; Vistra identification [ID] number [No.] 605 and National Inventory of Dams [NID] No. IL50723). The FAPS consists of three CCR SIs including the Old East Fly Ash Pond System (IEPA ID No. W1578510001-01), the East Fly Ash Pond (IEPA ID No. W1578510001-02), and the West Fly Ash Pond (IEPA ID No. W1578510001-03) (**Figure 1-2**). The FAPS is a closed, unlined CCR Multi-Unit that was previously used to manage CCR and non-CCR waste streams at the BPP.

AECOM submitted the *Closure and Post-Closure Care Plan for the Baldwin Fly Ash Pond System* (Closure Plan) dated March 2016, which was approved by the IEPA on August 16, 2016. The Closure Plan included the Groundwater Monitoring Plan (Natural Resource Technology, Inc. [NRT], 2016) which defined groundwater monitoring for the FAPS following approval of the Closure Plan. Closure of the FAPS was completed on November 17, 2020.

On April 21, 2021, Part 845 became effective, and for CCR units closed prior to the effective date the following section was included (35 I.A.C. § 845.100(i)):

> *If a CCR surface impoundment has completed an Agency-approved closure before April 21, 2021, this Part does not require the owner or operator of the CCR surface impoundment to resubmit to the Agency any closure plan, closure report, or closure certification for that completed closure.*

This Addendum includes modifications to the previously approved GMP to provide content required by 35 I.A.C. § 845.630 (Groundwater Monitoring System), 35 I.A.C. 845.640 (Groundwater Sampling and Analysis), and 35 I.A.C. 845.650 (Groundwater Monitoring Program) for the FAPS. Specifically, this Addendum incorporates additional monitoring wells to evaluate potential migration pathways and monitoring parameters specified in 35 I.A.C. § 845.600.

1.2 Purpose and Scope

The purpose of this Addendum is to provide updated GMP text, tables, and figures to incorporate modifications made to the existing monitoring program to comply with Part 845. Following issuance of the Part 845 Operating Permit, the application for which this Addendum is attached, groundwater monitoring at the FAPS will include the following:

- Monitoring required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 Subpart D (pre-existing with no modifications, until USEPA approves Part 845)
- Part 845 Monitoring (proposed)

Details of the monitoring programs (schedules and parameters), monitoring well networks, and analysis (statistical methods) are included in this Addendum. No changes are proposed to the monitoring networks utilized for NPDES Permit, IEPA Operating Permit, Closure Plan, or 40 C.F.R.

§ 257 Subpart D monitoring; however, those details have been included for completeness. Additional information regarding the hydrogeology and groundwater quality were included with the Closure Plan and are not reproduced in this Addendum.

2. GROUNDWATER MONITORING SYSTEMS

The Part 845 groundwater monitoring network for the FAPS was developed to monitor post-closure groundwater quality and trends and demonstrate compliance with the applicable groundwater quality standards identified in **Section 3**. The existing and proposed groundwater monitoring well networks consist of a sufficient number of wells, installed at appropriate locations and depths, to monitor post-closure compliance with groundwater quality standards for Class II - General Resource Groundwater, 40 C.F.R. § 257 and 35 I.A.C. § 845.600.

The monitoring wells are designed and constructed in a manner consistent with the standards of 40 C.F.R. § 257 and Title 77 of the Illinois Administrative Code § 920.170, as required by 35 I.A.C. § 845.630(e), including the following:

- All monitoring wells are cased in a manner that maintains the integrity of the boreholes.
- Wells are screened to allow sampling only at the specified interval.
- All wells are covered with vented caps, unless located in flood-prone areas, and equipped with devices to protect against tampering and damage.

Consistent with applicable standards, the monitoring well networks described below fulfill the following goals:

- Enable the collection of groundwater samples that represent the quality of background water that has not been affected by the FAPS.
- Enable the collection of groundwater samples that represent the quality of downgradient groundwater.
- Include wells that are located within the stratigraphic unit(s) that may serve as potential chemical migration pathways.

Groundwater monitoring at the FAPS is currently being performed in accordance with Special Condition No. 17 of NPDES Permit IL0000043, Special Condition No. 5 of IEPA Operating Permit 2020-EA-65016, the GMP that was approved in the Closure Plan, and 40 C.F.R. § 257. This Addendum proposes additions to that network which were developed to comply with the requirements of Part 845. It is anticipated that upon acceptance and approval of the Operating Permit application (and by extension the GMP) for the BPP and upon acceptance and approval of Part 845 by the United States Environmental Protection Agency (USEPA) as a State CCR Permit Program, the Part 845 monitoring program will supersede the NPDES Permit monitoring program Special Condition No. 17 (following approval of a future NPDES Permit modification), the IEPA Operating Permit monitoring program Special Condition No. 5 (following approval of a future Operating Permit modification), the Closure Plan monitoring program, and 40 C.F.R. § 257 monitoring program.

2.1 NPDES Permit Monitoring Network

The NPDES Permit monitoring well network includes fourteen monitoring wells, including three compliance wells (MW-350, MW-352, and MW-355) installed in bedrock, nine compliance wells (MW-104SR, MW-104DR, MW-150, MW-152, MW-252, MW-153, MW-253, MW-154, and MW-155) installed in unlithified materials, and two supplemental monitoring wells (MW-156 and MW-157S) installed in unlithified materials. These wells are monitored in accordance with Special Condition

No. 17 of expired NPDES Permit IL0000043. The NPDES Permit monitoring network well locations are shown on **Figure 2-1**.

The NPDES Permit monitoring well network exceeds the requirements of Special Condition No. 17 of NPDES Permit IL0000043 and groundwater samples are collected quarterly and analyzed for the parameters listed in **Table A** below. MW-156 and MW-157S are monitored for field parameters only. Results are submitted to IEPA by February 28 of the following year as required by the NPDES Permit.

Table A. NPDES Permit Groundwater Monitoring Program Parameters

Field Parameters [1]		
pH	Depth to Water (below land surface; feet)	Groundwater Elevation (feet)
Specific Conductance	Depth to Water (below measuring point [mp]; feet)	
Temperature	Elevation of mp; feet	
Inorganics		
Chloride (dissolved)	Sulfate (dissolved)	
Nitrate	Total Dissolved Solids (TDS)	
Metals		
Boron (dissolved)	Iron (total)	Manganese (total)

[1] Dissolved oxygen, oxidation/reduction potential, and turbidity are recorded during sample collection.

2.2 IEPA Operating Permit Monitoring Program

The IEPA Operating Permit monitoring well network includes seventeen monitoring wells, including two background monitoring wells (MW-304 and MW-306) installed in bedrock, three compliance wells (MW-350, MW352, and MW-355) installed in bedrock, ten compliance wells (MW-104SR, MW-104DR, MW-150, MW-151, MW-152, MW-252, MW-153, MW-253, MW-154, and MW-155) installed in unlithified materials, and two supplemental monitoring wells (OW-156[1] and OW-157S[1]) installed in the unlithified materials. These wells are monitored in accordance with Special Condition No. 5 of IEPA Operating Permit 2020-EA-65016, issued on March 31, 2020. The IEPA Operating Permit monitoring network well locations are shown on **Figure 2-1**.

The IEPA Operating Permit monitoring network wells are sampled quarterly for the laboratory and field parameters as required in Special Condition No. 5 of IEPA Operating Permit 2020-EA-65016 listed below in **Table B**. OW-156 and OW-157 are monitored for field parameters only. Results are submitted to IEPA by February 28 of the following year as required by the IEPA Operating Permit.

[1] OW-156 and OW-157 are identified in NPDES Permit IL0000043 as MW-156 and MW-157S, respectively.

B. IEPA Operating Permit Groundwater Monitoring Program Parameters

Field Parameters [1]		
pH	Depth to Water (below land surface; feet)	Groundwater Elevation (feet)
Specific Conductance	Depth to Water (below mp; feet)	
Temperature	Elevation of mp; feet	
Inorganics		
Chloride (dissolved)	Sulfate (dissolved)	
Nitrate	TDS	
Metals		
Boron (dissolved)	Iron (total)	Manganese (total)

[1] Dissolved oxygen, oxidation/reduction potential, and turbidity are recorded during sample collection.

2.3 IEPA Closure Plan Monitoring Program

The approved IEPA Closure Plan monitoring well network and monitored parameters align with the monitoring locations (**Figure 2-1**) and parameters included in the IEPA Operating Permit monitoring well program detailed above in **Section 2.2**.

2.4 40 C.F.R. § 257 Monitoring Program

The 40 C.F.R. § 257 monitoring well network consists of ten of the same bedrock groundwater monitoring wells used to monitor the uppermost aquifer, including two background wells (MW-304 and MW-306) and eight compliance wells (MW-350, MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, and MW-391). The 40 C.F.R. § 257 monitoring well network locations are shown on **Figure 2-1**.

Assessment monitoring in accordance with 40 C.F.R. § 257.95 was initiated on April 9, 2018. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the FAPS (NRT, 2017).

Groundwater samples are collected semi-annually and analyzed for the following laboratory and field parameters from Appendix III and Appendix IV of 40 C.F.R. § 257, summarized in **Table C** below.

Table C. 40 C.F.R. § 257 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH		
Appendix III Parameters (Total, except TDS)			
Boron	Chloride	Sulfate	
Calcium	Fluoride	TDS	
Appendix IV Parameters (Total)			
Antimony	Cadmium	Lithium	Selenium
Arsenic	Chromium	Mercury	Thallium
Barium	Cobalt	Molybdenum	Radium 226 and 228 combined
Beryllium	Lead		

[1] Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity are recorded during sample collection.

Results and analysis of groundwater sampling are reported annually by January 31 of the following year and made available on the CCR public website as required by 40 C.F.R. § 257.

2.5 Proposed Part 845 Monitoring Well Network

The groundwater monitoring network proposed in this plan will consist of seventeen wells, including two background monitoring wells (MW-304 and MW-306) installed in bedrock, nine compliance wells (MW-350, MW-352, MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, and MW-391) installed in bedrock, and six compliance wells (MW-150, MW-151, MW-152, MW-153, MW-252, and MW-253) installed within the unlithified materials potential migration pathway. The proposed network is summarized in **Table D** below and displayed on **Figure 2-2**.

The groundwater samples collected from the seventeen wells will be used to monitor and evaluate groundwater quality and demonstrate compliance with the groundwater quality standards listed in 35 I.A.C. § 845.600(a). The proposed monitoring wells will yield groundwater samples that represent the quality of downgradient groundwater at the CCR boundary (as required in 35 I.A.C. § 845.630(a)(2)). Monitoring well depths and construction details are listed in **Table 2-1** and summarized in **Table D** below.

Table D. Proposed Part 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type[1]
MW-150	PMP	15.0 – 24.7	Compliance
MW-151	PMP	6.1 – 15.8	Compliance
MW-152	PMP	7.5 – 16.7	Compliance
MW-153	PMP	10.4 – 20.0	Compliance
MW-252	PMP	44.4 – 49.0	Compliance
MW-253	PMP	29.9 – 34.5	Compliance
MW-304	UA	45.0 – 55.0	Background
MW-306	UA	72.7 – 87.7	Background
MW-350	UA	41.6 – 46.2	Compliance
MW-352	UA	67.9 – 72.5	Compliance
MW-366	UA	42.0 – 52.0	Compliance
MW-375	UA	57.0 – 67.0	Compliance
MW-377	UA	46.0 – 56.0	Compliance
MW-383	UA	58.0 – 68.0	Compliance
MW-384	UA	60.5 – 70.5	Compliance
MW-390	UA	50.0 – 65.0	Compliance
MW-391	UA	55.0 – 70.0	Compliance

[1] Well Type refers to the role of the well in the monitoring network.
bgs = below ground surface
PMP = potential migration pathway
UA = uppermost aquifer

2.6 Well Abandonment

No wells are currently proposed for abandonment.

3. APPLICABLE GROUNDWATER QUALITY STANDARDS

3.1 Groundwater Classification

The 35 I.A.C. § 620 groundwater classification at the FAPS was presented in the GMP (NRT, 2016) and is summarized here. Unlithified and bedrock groundwater at the FAPS each meet the definition of Class II - General Resource Groundwater (35 I.A.C. § 620.220) based on the following criteria:

- Groundwater which does not meet the provisions of 35 I.A.C. § 620.210 (Class I), 620.230 (Class III), or35 I.A.C. § 620.240 (Class IV).
- Geologic material with a hydraulic conductivity of less than 1 x 10^{-4} centimeters per second (cm/s).

3.2 Statistical Evaluation of Background Groundwater Data

A Statistical Analysis Plan (**Appendix A**) has been developed to describe procedures that will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring.

In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality was either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR multi-unit per 35 I.A.C. § 845.640(f)(1)(C). A comparison of the statistical background concentrations and groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) and the resulting Groundwater Protection Standards (GWPSs) are summarized in **Table 3-1**.

3.3 Applicable Groundwater Protection Standards

The applicable GWPS will be established in accordance with 35 I.A.C. § 845.600(a) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The results of the statistical analysis of background groundwater data (**Table 3-1**) indicate that most of the background concentrations in the uppermost aquifer and potential migration pathway are less than the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1). Therefore, for these parameters, the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) will be applied to the results from the proposed groundwater monitoring network. The exceptions include arsenic, lithium, pH, and TDS, where the background concentration or measurement are greater than the 35 I.A.C. 35 I.A.C. § 845.600(a)(1) standard. In these instances, the GWPS will be the background concentration.

Under most circumstances, the GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Exceptions are when there are high percentages (greater than 50 percent) of non-detects in compliance well data, for which a future mean (for 50 to 70 percent non-detects) or median (for greater than 70 percent non-detects) will be compared to the GWPS. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Evaluation of the applicable standards will occur in conjunction with the analysis of groundwater quality results. Background calculations and the resulting concentrations may be updated as appropriate, in accordance with the Statistical Analysis Plan included in **Appendix A**.

4. GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards included in 40 C.F.R. § 257.94(e), 40 C.F.R. § 257.95(h), and 35 I.A.C. § 845.600(a). The groundwater monitoring program will include sampling and analysis procedures that are consistent and provide an accurate representation of groundwater quality at the background and compliance wells as required by 35 I.A.C. § 845.630. As discussed within **Section 2**, five monitoring programs specific to the FAPS exist, the NPDES Permit monitoring program, the IEPA Operating Permit monitoring program, the Closure Plan monitoring program, the 40 C.F.R. § 257 monitoring program, and the proposed Part 845 monitoring program. It is expected that upon acceptance and approval of the Operating Permit applications (and by extension the GMPs) for the BPP and upon acceptance and approval of Part 845 by the USEPA as a State CCR Permit Program, the proposed Part 845 monitoring program will supersede the NPDES Permit, IEPA Operating Permit, Closure Plan, and 40 C.F.R. § 257 monitoring programs.

4.1 Monitoring Networks and Parameters

4.1.1 NPDES Permit Monitoring

The existing NPDES Permit monitoring program was discussed in detail in **Section 2.1**. Fourteen monitoring wells, including three compliance wells (MW-350, MW-352, and MW-355) installed in bedrock, nine compliance wells (MW-104SR, MW-104DR, MW-150, MW-152, MW-252, MW-153, MW-253, MW-154, and MW-155) installed in unlithified materials, and two supplemental monitoring wells (MW-156 and MW-157S) installed in unlithified materials are sampled on a quarterly frequency for the parameters listed in the NPDES Permit. Well locations and parameters will continue to be monitored and reported as required by Special Condition No. 17 of NPDES Permit IL0000043 until IEPA approves the proposed Part 845 monitoring network.

4.1.2 IEPA Operating Permit Monitoring

The existing IEPA Operating Permit monitoring program was discussed in detail in **Section 2.2**. Seventeen monitoring wells, including two background monitoring wells (MW-304 and MW-306) installed in bedrock, three compliance wells (MW-350, MW352, and MW-355) installed in bedrock, ten compliance wells (MW-104SR, MW-104DR, MW-150, MW-151, MW-152, MW-252, MW-153, MW-253, MW-154, and MW-155) installed in unlithified materials, and two supplemental monitoring wells (OW-156[2] and OW-157[2]) installed in the unlithified materials are sampled on a quarterly frequency for the parameters listed in the IEPA Operating Permit. Well locations and parameters will continue to be monitored and reported as required by Special Condition No. 5 of IEPA Operating Permit 2020-EA-65016 until IEPA approves an alternate schedule or removes Special Condition No. 5 from the IEPA Operating Permit.

4.1.3 IEPA Closure Plan Monitoring

The existing IEPA-approved Closure Plan monitoring program was discussed in **Section 2.3**, and is in alignment with the IEPA Operating Permit monitoring program, which are sampled on a quarterly frequency for the parameters listed in the GMP (NRT, 2016). Well locations and

[2] OW-156 and OW-157 are identified in NPDES Permit IL0000043 as MW-156 and MW-157S, respectively.

parameters will continue to be monitored and reported as required by the Closure Plan until IEPA approves the proposed Part 845 monitoring network.

4.1.4 40 C.F.R. § 257 Monitoring

The existing 40 C.F.R. § 257 monitoring program was discussed in detail in **Section 2.4**. Ten bedrock groundwater monitoring wells used to monitor the uppermost aquifer, including two background wells (MW 304 and MW 306) and eight compliance wells (MW-350, MW-366, MW-375, MW-377, MW 383, MW 384, MW 390, and MW 391) are sampled for Appendix III and Appendix IV parameters on a semi-annual frequency. Well locations and parameters will continue to be monitored and reported as required by 40 C.F.R. § 257 until USEPA approves Part 845.

4.1.5 Part 845 Groundwater Monitoring

The proposed Part 845 Monitoring Network will consist of seventeen wells, including two background monitoring wells (MW-304 and MW-306) installed in bedrock, nine compliance wells (MW-350, MW-352, MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, and MW-391) installed in bedrock, and six compliance wells (MW-150, MW-151, MW-152, MW-153, MW-252 and MW-253) installed within the unlithified materials potential migration pathway to monitor potential impacts from the FAPS (**Figure 2-2**). Groundwater samples will be collected and analyzed for the laboratory and field parameters summarized in **Table E** below.

Table E. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH	Turbidity	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total, except TDS)			
Chloride	Fluoride	Sulfate	TDS
Other (Total)			
Radium 226 and 228 combined			

[1] Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential will be recorded during sample collection.

4.2 Sampling Schedule

Groundwater sampling for the NPDES Permit and approved Closure Plan will be maintained until IEPA approval of the Part 845 GMP. Groundwater sampling for the Part 845 monitoring well network will initially be performed quarterly according to the schedule summarized in **Table F** below.

Table F. Part 845 Sampling Schedule

Frequency	Duration
Monthly (groundwater elevations only)	Begins: the quarter following approval of this plan and issuance of the Operating Permit.
	Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii).
Quarterly (groundwater quality)	Begins: the quarter following approval of this plan and issuance of the Operating Permit.
	Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii), or upon IEPA approval of an alternate schedule as allowed by 35 I.A.C. § 845.650(b)(4).
Semi-annual (groundwater quality)	Begins: Following 5 years of quarterly groundwater monitoring and IEPA approval of a demonstration that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and not exhibiting statistically-significant increasing trends, monitoring effectiveness is not compromised by a semi-annual schedule, and sufficient data has been collected to characterize groundwater.
	Ends: Following detection of a statistically-significant increasing trend in groundwater concentrations or an exceedance of the standards in 35 I.A.C. § 845.600 (quarterly monitoring shall be resumed in these circumstances), or following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii).

Groundwater monitoring for the 40 C.F.R. § 257 well network will continue to follow a schedule in accordance with the requirements of 40 C.F.R. § 257.94 and 40 C.F.R. § 257.95. Upon USEPA approval of Part 845 as a State CCR Permit Program, the 40 C.F.R. § 257 monitoring will be discontinued and replaced by the Part 845 monitoring.

4.3 Groundwater Sample Collection

Groundwater sampling procedures have been developed and the collection of groundwater samples is being implemented to meet the requirements of 35 I.A.C. § 845.640. In addition to groundwater well samples, quality assurance samples will be collected as described in **Section 4.5** (**Table 4-1**).

4.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 I.A.C. § 845.640(j) by a state-certified laboratory using methods approved by IEPA and USEPA. Laboratory methods may be modified based on laboratory equipment availability or procedures, but the Reporting Limit (RL) for all parameters analyzed, regardless of method, will be lower than the applicable groundwater quality standard. RLs for the applicable parameters are summarized in **Table 4-2**. Concentrations lower than the RL will be reported as less than the RL.

4.5 Quality Assurance Program

Consistent with the requirements of 35 I.A.C. § 845.640(a)(5), the sampling and analysis program includes procedures and techniques for quality assurance/quality control (QA/QC). Additional quality assurance samples to be collected will include the following:

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.
- The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:
  - Regular generation of instrument calibration curves to assure instrument reliability
  - Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
  - Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
  - Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
  - Analysis of method blanks to assure that the system is free of contamination

Water quality meters used to measure pH and turbidity will be calibrated according to manufacturer's specifications. At a minimum, it is recommended that calibration of pH occur daily prior to sampling and checked for accuracy at the end of each day. Unusual or suspect pH measurements during sampling events will be flagged, evaluated, and additional calibration may be performed throughout the sampling events. Turbidity meters will be checked daily, prior to and following sampling. Unusual measurements or erratic meter performance will be flagged and evaluated for overall effects on the data prior to reporting.

4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible.
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved.
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional.
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented.

- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well.
- Checks to assure that wells are clear of internal obstructions, and flow freely.

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

4.7 Statistical Analysis

Statistical analysis will be consistent with procedures listed in 35 I.A.C. § 845.640(f). A Statistical Analysis Plan, provided in **Appendix A**, has been developed to summarize the statistical procedures that will be used to evaluate the groundwater results.

4.8 Data Reporting

Data reporting for the 40 C.F.R. § 257 monitoring program will be consistent with recordkeeping, notification, and internet posting requirements described in 40 C.F.R. § 257.105 through 40 C.F.R. § 257.-107.

Groundwater monitoring and analysis completed in accordance with the Part 845 monitoring under an approved monitoring program will be reported to IEPA within 60 days after completion of sampling and place the data in the facility's operating record as required by 35 I.A.C. § 845.610(b)(3)(D). Within 14 days of posting to the operating record, information will be posted to the publicly accessible internet site "Illinois CCR Rule Compliance Data and Information" as required by 35 I.A.C. § 845.810(d). Information will also be submitted to IEPA annually by January 31 as required by 35 I.A.C. § 845.550, for data collected the preceding year. The report will include the status of the groundwater monitoring and corrective action plan for the BPP FPAS in addition to other requirements detailed in 35 I.A.C. § 845.610(e).

4.9 Compliance with Applicable On-site Groundwater Quality Standards

In accordance with 35 I.A.C. § 845.600(a)(1), the groundwater protection standard at the waste boundary will be the higher of either the 35 I.A.C. § 845.600 standard or the concentration determined by background groundwater monitoring.

As provided in 35 I.A.C. § 845.780(c)(2), at the end of the 30-year post-closure care period, groundwater monitoring will continue to be conducted in post-closure care until the groundwater results show the concentrations are:

- Below the GWPS in 35 I.A.C. § 845.600; and
- Not increasing for those constituents over background, using the statistical procedures and performance standards in 35 I.A.C. § 845.640(f) and (g), provided that:
  - Concentrations have been reduced to the maximum extent feasible; and
  - Concentrations are protective of human health and the environment.

Following detection of an exceedance of the GWPS, an Alternate Source Demonstration (ASD) will be evaluated as described in **Section 4.10**.

4.10 Alternate Source Demonstrations

As allowed in 35 I.A.C. § 845.650(e), following detection of an exceedance of the GWPS, an ASD will be evaluated and, if completed, submitted to IEPA within 60 days. The ASD will provide lines of evidence that a source other than the FAPS caused the contamination and the FAPS did not contribute to the contamination, or that the exceedance of the GWPS resulted from error in sampling, analysis, statistical evaluation, natural variation in groundwater quality, or a change in the potentiometric surface and groundwater flow direction.

The ASD will include information and analysis that supports the conclusions and a certification of accuracy by a qualified professional engineer. Once the ASD is approved by IEPA, the Part 845 groundwater monitoring will continue as defined in **Section 4.1.5**.

If an ASD is not completed and submitted, or IEPA does not approve the ASD, a notification of the exceedance will be provided to IEPA and placed in the operating record. Additional actions will also be completed as required by 35 I.A.C § 845.650(d)(1) through (3), including initiation of an assessment of corrective measures under 35 I.A.C § 845.660. As allowed in 35 I.A.C § 845.650(e)(7), a petition for review of IEPA's non-concurrence under 35 I.A.C. § 105 may also be filed.

5. REFERENCES

AECOM, 2016. *Closure and Post-Closure Care Plan for the Baldwin Fly Ash Pond System. Baldwin Energy Complex. Baldwin, Illinois.* March 31, 2016.

Illinois Environmental Protection Agency, 2021. *Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845*, April 15, 2021.

Natural Resource Technology, Inc. (NRT), 2016. *Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan. Baldwin Fly Ash Pond System, Baldwin Energy Complex. Baldwin, Illinois*. March 31, 2016.

Natural Resource Technology, Inc. (NRT), 2017. *Sampling and Analysis Plan, Baldwin Fly Ash Pond System, Baldwin Energy Complex. Baldwin, Illinois.* October 17, 2017.

United States Environmental Protection Agency (USEPA), March 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. Office of Resource Conservation and Recovery, Program Implementation and Information Division, United States Environmental Protection Agency, Washington D.C. EPA/530/R-09/007.

TABLES

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Well Number	Type	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
MW-150	C	PMP	09/01/2010	396.54	396.54	Top of PVC	393.84	15.00	24.70	378.80	369.20	25.20	368.70	9.6	2	38.189401	-89.878468
MW-151	C	PMP	09/01/2010	399.96	399.96	Top of PVC	397.22	6.10	15.80	391.10	381.40	16.30	380.90	9.6	2	38.188449	-89.872354
MW-152	C	PMP	09/01/2010	424.99	424.99	Top of PVC	422.18	7.50	16.70	414.70	405.50	17.20	405.00	9.3	2	38.187569	-89.866764
MW-153	C	PMP	09/01/2010	445.67	445.67	Top of PVC	442.77	10.40	20.00	432.40	422.80	20.50	422.30	9.6	2	38.185884	-89.86101
MW-252	C	PMP	09/01/2010	425.07	425.07	Top of PVC	422.27	44.40	49.00	377.90	373.20	49.50	372.70	4.6	2	38.187563	-89.866745
MW-253	C	PMP	09/01/2010	445.84	445.84	Top of PVC	442.70	29.90	34.50	412.80	408.20	35.00	407.70	4.6	2	38.185885	-89.861026
MW-304	B	UA	10/20/2015	455.49	455.49	Top of PVC	453.03	45.00	55.00	408.00	398.00	55.00	317.60	10	2	38.188332	-89.853441
MW-306	B	UA	09/25/1991	453.17	453.17	Top of PVC	450.91	72.70	87.70	378.20	363.20	87.70	361.20	15	2	38.20114	-89.846756
MW-350	C	UA	09/01/2010	396.80	396.80	Top of PVC	394.11	41.60	46.20	352.50	347.90	46.60	347.40	4.6	2	38.189416	-89.878477
MW-352	C	UA	09/01/2010	425.04	425.04	Top of PVC	422.36	67.90	72.50	354.50	349.80	73.00	348.60	4.6	2	38.187554	-89.866729
MW-366	C	UA	12/04/2015	425.08	425.08	Top of PVC	422.54	42.00	52.00	380.50	370.50	52.00	368.20	10	2	38.192191	-89.872345
MW-375	C	UA	11/06/2015	423.05	423.05	Top of PVC	420.50	57.00	67.00	363.50	353.50	67.00	335.80	10	2	38.189045	-89.873514
MW-377	C	UA	11/02/2015	421.36	421.36	Top of PVC	418.75	46.00	56.00	372.80	362.80	56.00	360.50	10	2	38.188386	-89.869742
MW-383	C	UA	12/21/2015	459.49	459.49	Top of PVC	457.18	58.00	68.00	399.20	389.20	68.00	384.20	10	2	38.194913	-89.858286
MW-384	C	UA	12/18/2015	458.95	458.95	Top of PVC	456.70	60.50	70.50	396.20	386.20	70.50	362.60	10	2	38.191789	-89.860699
MW-390	C	UA	03/04/2016	428.06	428.06	Top of PVC	425.98	50.00	65.00	376.00	361.00	65.00	358.00	15	2	38.192956	-89.869793
MW-391	C	UA	03/10/2016	426.63	426.63	Top of PVC	424.24	55.00	70.00	369.20	354.20	70.00	349.80	15	2	38.190869	-89.874759

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
Type refers to the role of the well in the monitoring network: background (B), compliance (C), or water level measurements only (WLO)
WLO wells are temporary pending implementation of impoundment closure per an approved Construction Permit application
BGS = below ground surface
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = potential migration pathway
PVC = polyvinyl chloride
UA = uppermost aquifer

generated 10/22/2021, 1:24:03 PM CDT

TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS
ADDENDUM TO THE GROUNDWATER MONITORING PLAN
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.001	0.006	0.006	mg/L
Arsenic, total	0.015	0.010	0.015	mg/L
Barium, total	0.027	2.0	2.0	mg/L
Beryllium, total	0.001	0.004	0.004	mg/L
Boron, total	1.95	2	2	mg/L
Cadmium, total	0.001	0.005	0.005	mg/L
Chloride, total	160	200	200	mg/L
Chromium, total	0.0015	0.1	0.1	mg/L
Cobalt, total	0.001	0.006	0.006	mg/L
Fluoride, total	2	4.0	4.0	mg/L
Lead, total	0.001	0.0075	0.0075	mg/L
Lithium, total	0.096	0.04	0.096	mg/L
Mercury, total	0.0002	0.002	0.002	mg/L
Molybdenum, total	0.092	0.1	0.1	mg/L
pH (field)	11.5 / 7.4	9.0 / 6.5	11.5 / 6.5	SU
Radium 226 and 228 combined	1.5	5	5	pCi/L
Selenium, total	0.001	0.05	0.05	mg/L
Sulfate, total	208	400	400	mg/L
Thallium, total	0.002	0.002	0.002	mg/L
Total Dissolved Solids	1420	1200	1420	mg/L

Notes:
For pH, the values presented are the upper / lower limits
Groundwater protection standards for calcium and turbidity do not apply per 35 I.A.C. § 845.600(b)
mg/L = milligrams per liter
SU = standard units
pCi/L = picocuries per liter

generated 10/07/2021, 6:47:22 AM CDT

TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY
ADDENDUM TO THE GROUNDWATER MONITORING PLAN
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Parameter	Analytical Method [1]	Number of Samples	Field Duplicates [2]	Field Blanks [3]	Equipment Blanks [3]	MS/MSD [4]	Total	Container Type	Minimum Volume [5]	Preservation (Cool to 4 °C for all samples)	Sample Hold Time from Collection Date
Metals											
Metals [6]	6020, Li - EPA 200.7	17	2	0	0	1	20	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	17	2	0	0	1	20	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	17	2	0	0	1	20	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	17	2	0	0	1	20	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	17	2	0	0	1	20	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	17	2	0	0	1	20	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	17	0	0	0	0	17	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	17	0	0	0	0	17	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	17	NA	NA	NA	NA	17	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	17	NA	NA	NA	NA	17	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	17	NA	NA	NA	NA	17	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	17	NA	NA	NA	NA	17	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	17	NA	NA	NA	NA	17	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	17	NA	NA	NA	NA	17	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 08/18/21; C: LDC 08/31/21; U:KLT 10/4/21; C: CJC 10/4/21; U:KLT 10/7/21, C: LDC 10/20/21]

Notes:
[1] Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
[2] Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water samples. Field duplicates will not be collected for radium analysis.
[3] Field blanks will be collected at the discretion of the project manager; Equipment blanks will be collected at a rate of 1 per sampling event if non-dedicated equipment is used.
[4] Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of one per group of 20 or fewer investigative water samples per CCR unit/multi-unit. Additional volume to be determined by laboratory.
[5] Sample volume is estimated and will be determined by the laboratory.
[6] Metals = antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium. Metals may be analyzed via ICP/ ICP-MS USEPA methods 6010 or 6020 depending on laboratory instrument availability.
[7] If turbidity exceeds 10 NTUs, a duplicate sample filtered through a .45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.
[8] Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under Part 845; collection of parameter may be discontinued without notification.
< = less than
°C = degrees Celsius
HNO_3 = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit

RAMBOLL

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

ADDENDUM TO THE GROUNDWATER MONITORING PLAN

BALDWIN POWER PLANT

FLY ASH POND SYSTEM

BALDWIN, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	35 I.A.C. § 845.600	RL [4, 5]	MDL [5]
Metals							
Antimony	7440-36-0	mg/L	6020	0.006	0.006	0.003	0.00036
Arsenic	7440-38-2	mg/L	6020	0.01	0.01	0.001	0.00013
Barium	7440-39-3	mg/L	6020	2	2	0.001	0.00028
Beryllium	7440-41-7	mg/L	6020	0.004	0.004	0.001	0.000017
Boron	7440-42-8	mg/L	6020	NS	2	0.01	0.0023
Cadmium	7440-43-9	mg/L	6020	0.005	0.005	0.001	0.000042
Calcium	7440-70-2	mg/L	6020	NS	NS	0.15	0.15
Chromium	7440-47-3	mg/L	6020	0.1	0.1	0.004	0.00027
Cobalt	7440-48-4	mg/L	6020	0.006	0.006	0.002	0.000017
Lead	7439-92-1	mg/L	6020	0.015	0.0075	0.001	0.000025
Lithium	7439-93-2	mg/L	6020 or EPA 200.7	0.04	0.04	0.02	0.0001
Mercury	7439-97-6	mg/L	6020 or 7470A	0.002	0.002	0.0002	0.000078
Molybdenum	7439-98-7	mg/L	6020	0.1	0.1	0.001	0.000063
Selenium	7782-49-2	mg/L	6020	0.05	0.05	0.001	0.00032
Thallium	7440-28-0	mg/L	6020	0.002	0.002	0.001	0.000062
Inorganics							
Fluoride	7681	mg/L	9214 or EPA 300	4	4	0.25	0.065
Chloride	16887-00-6	mg/L	9251 or EPA 300	250 [3]	200	1	0.15
Sulfate	18785-72-3	mg/L	9036 or EPA 300	250 [3]	400	1	0.24
Total Dissolved Solids	10052	mg/L	SM 2540C	500 [3]	1200	17	--
Other							
Radium 226 and 226 combined	7440-14-4	pCi/L	9315/9320 or EPA 903/904	5	5	-- [6]	-- [7]
Field							
pH	NA	SU	SM 4500-H+ B	NS	6.5-9.0	NA	NA
Oxidation/Reduction Potential	NA	mV	SM 2580 B	NS	NS	NA	NA
Dissolved Oxygen	NA	mg/L	SM 4500-O/405.1	NS	NS	NA	NA
Temperature	NA	°C	SM 2550	NS	NS	NA	NA
Specific Conductance	NA	µS/cm	SM 2510 B	NS	NS	NA	NA

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

ADDENDUM TO THE GROUNDWATER MONITORING PLAN

BALDWIN POWER PLANT

FLY ASH POND SYSTEM

BALDWIN, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	35 I.A.C. § 845.600	RL [4, 5]	MDL [5]
Turbidity	NA	NTU	SM 2130 B	NS	NS	NA	NA

[O: CJC 08/18/21; C: LDC 08/31/21; U:KLT 9/23/21; C: CJC 10/4/21]

Notes:

[1] Analytical method numbers are from SW-846 unless otherwise indicated. Metals will be analyzed via Method 6020 or 6010 depending on laboratory equipment availability. Selected method will ensure reporting limits (RL) are below Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.600 groundwater protection standards.

[2] USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level.

[3] USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.

[4] RLs will be less than the 35 I.A.C. § 845.600 groundwater protection standards.

[5] RLs and method detection limits (MDL) will vary depending on the laboratory performing the work.

[6] All radium results will be reported (values may be positive or negative) and will include uncertainty and the calculated MDC.

[7] Laboratories calculate a minimum detectable concentration (MDC) based on the sample.

^{o}C = degrees Celsius

µS/cm = microSiemens per centimeter

CAS = Chemical Abstract Number

MDL = Method detection limit as established by the laboratory

mg/L = milligrams per liter

mV = millivolts

NA = Not applicable

NS = No standard

NTU = nephelometric turbidity unit

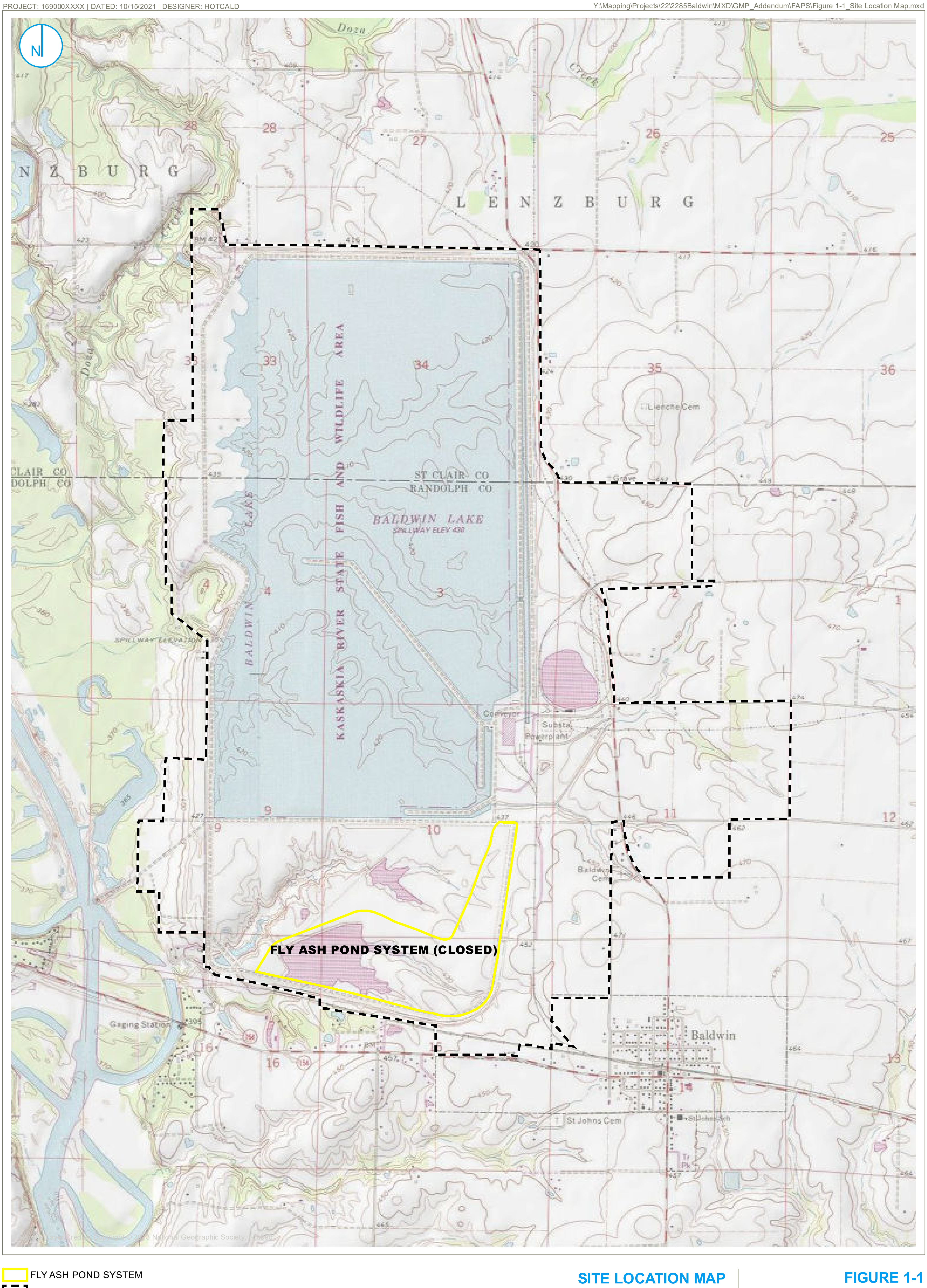
pCi/L = picoCuries per liter

RL = Reporting limit as established by the laboratory

SM = Standard Methods for the Examination of Water and Wastewater

SU = standard units

FIGURES



SITE LOCATION MAP

FIGURE 1-1

ADDENDUM TO THE GROUNDWATER MONITORING PLAN
FLY ASH POND SYSTEM
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\Baldwin\MXD\GMP_Addendum\FAPS\Figure 1-2_Site Map.mxd

PROJECT: 169000XXXX | DATED: 10/15/2021 | DESIGNER: HOTCALD

PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

SITE MAP

ADDENDUM TO THE GROUNDWATER MONITORING PLAN
FLY ASH POND SYSTEM
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\Baldwin\MXD\GMP_Addendum\FAPS\Figure 2-1_Monitoring Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/15/2021 | DESIGNER: HOTCALD

MONITORING WELL AND PIEZOMETER LOCATIONS
ABANDONED MONITORING WELL AND PIEZOMETER LOCATIONS
PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

MONITORING WELL LOCATION MAP

ADDENDUM TO THE GROUNDWATER MONITORING PLAN
FLY ASH POND SYSTEM
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/22/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\Baldwin\MXD\GMP_Addendum\FAPS\Figure 2-2_Proposed Part 845 GM Well Network.mxd

BACKGROUND WELL
COMPLIANCE WELL
PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

PROPOSED PART 845 GROUNDWATER MONITORING WELL NETWORK

ADDENDUM TO THE GROUNDWATER MONITORING PLAN
FLY ASH POND SYSTEM
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Dynegy Midwest Generation, LLC

Date
October 25, 2021

Project No.
1940100806-001

STATISTICAL ANALYSIS PLAN
FLY ASH POND SYSTEM
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
BALDWIN POWER PLANT FLY ASH POND SYSTEM

Project name	**Baldwin Power Plant Fly Ash Pond System**
Project no.	**1940100806-001**
Recipient	**Dynegy Midwest Generation, LLC**
Document type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**October 25, 2021**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

Brian G. Hennings, PG
Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Rachel A. Banoff, EIT
Project Statistician

LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following Statistical Analysis Plan; Baldwin Power Plant Fly Ash Pond System. The procedures described in the plan will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in the United States Environmental Protection Agency (USEPA)'s *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring. In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality will be either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). Groundwater Protection Standards (GWPS) will be established in accordance with 35 I.A.C. § 845.600(a) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Description of the statistical methods chosen for analysis of groundwater monitoring data and application of these methods for determining exceedances of the GWPS identified in 35 I.A.C. § 845.600(a) is provided in this Statistical Analysis Plan.

35 I.A.C. § 845.640 Statistical Analysis (PE)

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the statistical methods summarized above and described in this document (Statistical Analysis Plan; Baldwin Power Plant Fly Ash Pond System) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

35 I.A.C. § 845.640 Statistical Analysis (PG)

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the statistical methods described in this document (Statistical Analysis Plan; Baldwin Power Plant Fly Ash Pond System) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § *845.640.*

____

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

LICENSED PROFESSIONAL GEOLOGIST
BRIAN G. HENNINGS
196.001482
ILLINOIS

35 I.A.C. § 845.640 Statistical Analysis

I, Rachel A. Banoff, a qualified professional, certify that the statistical methods described in this document (Statistical Analysis Plan; Baldwin Power Plant Fly Ash Pond System), are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § *845.640.*

____

Rachel A. Banoff, EIT
Project Statistician
Date: October 25, 2021

CONTENTS

TABLES (IN TEXT)

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
ANOVA	analysis of variance
CCR	coal combustion residuals
COC	constituents of concern
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
LTL	lower tolerance limit
MSE	mean squared error
P	probability
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
ROS	regression on order statistics
SI	surface impoundment
SSI	statistically significant increase
SWFPR	site-wide false positive rate
Unified Guidance	*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009)
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit

1. INTRODUCTION

In April 2021, the Illinois Environmental Protection Agency (IEPA) issued a final rule for the regulation and management of Coal Combustion Residuals (CCR) in surface impoundments (SIs) under the Standards for the Disposal of CCR in Surface Impoundments: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845). Facilities regulated under Part 845 are required to develop and sample a groundwater monitoring well network to evaluate whether impounded CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used. The procedures described in the evaluation will be used to establish background conditions and implement compliance and corrective action monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. This Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA's) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance*) (March 2009).

This Statistical Analysis Plan does not include procedures for groundwater sample collection and analysis, as these activities are conducted in accordance with the Sampling and Analysis Plan prepared for each CCR unit in accordance with 35 I.A.C. § 845.640. This Statistical Analysis Plan will be used as the primary reference for evaluating groundwater quality during operation and post-closure care.

1.1 Statistical Analysis Objectives

This Statistical Analysis Plan is intended to provide a logical process and framework for conducting the statistical analyses of data obtained during groundwater monitoring conducted in accordance with the Sampling and Analysis Plan for each CCR unit. The Statistical Analysis Plan will enable a qualified professional engineer to certify that the selected statistical methods are appropriate for evaluating the groundwater monitoring data for the applicable CCR unit(s).

1.2 Statistical Analysis Plan Approach

The main sections of this Statistical Analysis Plan should be viewed as a "generic" outline of statistical methods utilized for each CCR unit and constituent required to be monitored. The statistical analysis of the groundwater monitoring data, however, will be conducted on an individual-constituent or well basis, and may involve the use of appropriate statistical procedures depending on multiple factors such as detection frequency and normality distributions.

The CCR Rule outlines two phases of groundwater monitoring:

- Background Monitoring in accordance with 35 I.A.C. § 845.650(b)(1)
- Compliance Monitoring in accordance with 35 I.A.C. § 845.650

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the background monitoring phase, background groundwater quality will be established utilizing upgradient and background wells and downgradient groundwater quality data will be collected to facilitate statistics in subsequent phases. Compliance Monitoring is then initiated through the evaluation of the downgradient groundwater monitoring data for exceedances of the groundwater protection standard (GWPS) established by Part 845 (concentration specified in 35 I.A.C. § 845.600 or an IEPA-approved background concentration). The developed statistical analysis plan will be implemented for each monitoring phase and in accordance with the statistical procedures.

2. BACKGROUND MONITORING AND DATA PREPARATION

The background and compliance monitoring wells were sampled and analyzed for constituents, as listed in Part 845 (antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, pH, radium 226 and 228 combined, selenium, sulfate, thallium, total dissolved solids, and turbidity), during the baseline phase of the groundwater monitoring program.

The upgradient or background monitoring well(s) were placed upgradient of the CCR unit, or at an alternative background location, where they are not affected by potential leakage from the CCR unit. Compliance monitoring wells were placed at the waste boundary of the CCR unit, along the same groundwater flow path. As 35 I.A.C. § 845.630(a) specifies, the location of these wells ensures that background accurately represents the quality of unaffected groundwater, while compliance wells accurately represent groundwater quality at the waste boundary and monitor all potential contaminant pathways.

As required by 35 I.A.C. § 845.650(a)(1), eight independent sampling events were completed within 180 days of April 21, 2021. As outlined, groundwater sampling procedures included sampling of the upgradient, background, and compliance wells using low-flow sampling methods, collection of one field quality control sample per event, and groundwater samples were not field filtered before laboratory analysis of total recoverable metals.

Following completion of the eight sampling events, background groundwater quality was established for Part 845 constituents. Groundwater monitoring will be conducted quarterly for at least the first five years. In accordance with 35 I.A.C. § 845.650(b)(4), after the first five years, a request to reduce the monitoring frequency to semiannual may be submitted to IEPA if all of the following can be demonstrated:

- Groundwater monitoring effectiveness will not be compromised by the reduced frequency
- Sufficient data has been collected to characterize groundwater
- Monitoring to date does not show any statistically significant increasing trends
- The concentrations of monitored constituents at the compliance monitoring wells are below the applicable GWPSs established in 35 I.A.C. § 845.600

The following subsections outline the statistical tests and procedures (methods) that will be utilized to evaluate data collected for each constituent in both background and compliance wells for Background and Compliance Monitoring. When necessary and contingent upon equivalent statistical power, an alternative test not included in this Statistical Analysis Plan may be chosen due to site-specific data requirements.

2.1 Sample Independence

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. The sampling schedules for both the baseline and compliance monitoring periods are specified in 35 I.A.C. § 845.650(b) and may conflict with the statistical assumption of independence of sample results.

2.2 Non-Detect Data Processing

The reporting limit (RL) will be used as the lower level for the reporting of non-detected groundwater quality data. For all summary statistics (box plots, timeseries, etc.), the RL will be substituted for concentrations reported below the RL, including non-detects. With professional judgement, analytical results between the RL and the method detection limit, *i.e.,* estimated values, typically identified with a "J" flag, may be utilized if provided by the laboratory.

For all statistical test procedures:

- If the frequency of non-detect data are less than or equal to 15 percent, half of the RL will be substituted for these data
- If the non-detect frequency is between 15 percent and 50 percent, either the Kaplan-Meier or robust regression on order statistics (ROS) will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values
- If the non-detect frequency is greater than 50 percent, a non-parametric test will be used
- If only one background result is detected that value will be used as the non-parametric upper prediction limit (UPL)

2.3 Testing for Normality

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently not normally distributed (nonparametric). 35 I.A.C. § 845.640(g) requires the knowledge of the background data distribution for comparison to compliance results. The *Unified Guidance* document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50.

When possible, transformation of datasets to achieve normal distributions is preferred.

2.4 Testing for Outliers

Part 845 constituents will be screened for the existence of outliers using a method described by the *Unified Guidance*. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Rosner's test, for well-constituent pairs with more than 20 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. The outlier tests cannot be used alone to determine whether a value is a true outlier that should be excluded from future statistical analysis. Corroborating evidence needed to exclude values includes a discrete data reporting or analytical error, or potential laboratory bias. Absent corroborating evidence, the flagged values are considered true, but extreme, values in the data set. Professional judgement will be used to exclude extreme outliers from further statistical analyses. Outliers will be retained in the database.

With professional judgement, a confirmatory sample may be collected to allow for the distinction between an outlier and a true representation of groundwater quality at the monitoring point. If re-sampling is conducted, this sample will be collected within 90 days following outlier identification. If the confirmatory sample indicates the original result as an outlier, it will be reported as such.

2.5 Trend Analysis

Statistical analyses supporting the lack of trend are a fundamental step to confirm the assumption that groundwater quality values are stationary or constant over time at a CCR unit. These analyses allow for evaluation of variation in the background and compliance data for each constituent over time. A statistically significant increasing trend in background data could indicate an existing release from the CCR unit or alternate source, requiring further investigation. In addition, statistically significant trending background data can result in increased standard deviation and, therefore, greater prediction or control limits. Consequently, the increased prediction or control limit will have less power or ability to identify a release from the CCR unit.

A linear regression, coupled with a t-test for slope significance at a 95 percent confidence level (0.05 significance level), may be used on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test for slope significance at a 95 percent confidence level (0.05 significance level), will be used for datasets with frequent non-detects or non-normal variance. Similarly, trend analyses could also be used on compliance data to evaluate a possible release from the CCR unit.

2.6 Spatial Variation

Spatial trends and/or variation between background wells could indicate an existing release from a CCR unit. If the spatial variability is not due to an existing release, intrawell comparisons in compliance wells may be used to account for spatial variability and monitor for a future release. However, the CCR unit being monitored was placed into service prior to the start of groundwater monitoring and it is unknown whether a previous release has occurred. Accordingly, intrawell comparisons in compliance wells cannot be used to determine the occurrence of a future release. Interwell comparisons between compliance wells and background wells will be used.

2.7 Temporal Variation

Time series plots can be used to identify temporal dependence. Potentially significant temporal components of variability can be identified by graphing single constituent data from multiple wells together on a time series plot. With temporal dependence, the time series plot as a pattern of parallel traces, in which the individual wells will tend to rise and fall together across the sequence of sampling dates. Time series plots can be helpful by plotting multiple constituents over time for the same well, or averaging values for each constituent across wells on each sampling event and then plotting the averages over time. In either case, the plots can signify whether the general concentration pattern over time is simultaneously observed for different constituents. If so, it may indicate that a group of constituents is highly correlated in groundwater or that the same artifacts of sampling and/or lab analysis impacted the results of several monitoring parameters.

Hydrologic factors such as drought, recharge patterns or regular (*e.g.,* seasonal) water table fluctuations may be responsible for the temporal variation. In these cases, it may be useful to test for the presence of a significant temporal effect by first constructing a parallel time series plot and then running a formal one-way analysis of variance (ANOVA) ($\alpha = 0.05$) for temporal effects. A one-way ANOVA for temporal effects considers multiple well data sets for individual sampling events or seasons as the relevant statistical factor. If event-specific analytical differences or seasonality appear to be an important temporal factor, the one-way ANOVA for temporal effects can be used to formally identify seasonality, parallel trends, or changes in lab performance that affect other temporal effects. The one-way ANOVA for temporal effects assumes that the data groups are normally distributed with constant variance. It is also assumed that for each of a series of background wells, measurements are collected at each well on sampling events or dates common to all the wells. Results of the ANOVA can also be used to create temporally stationary residuals, where the temporal effect has been 'subtracted from' the original measurements. These stationary residuals may be used to replace the original data in subsequent statistical testing.

If the data cannot be normalized, a similar test for a temporal or seasonal effect can be performed using the Kruskal-Wallis test ($\alpha = 0.05$). Each sampling event should be treated as a separate 'well,' while each well is treated as a separate 'sampling event.' In this case, no residuals can be computed since the Kruskal-Wallis test employs ranks of the data rather than the measurements themselves.

Where both spatial and temporal variation occur, two-way ANOVA can be considered where both well location and sampling event/season are treated as statistical factors. This procedure is described in Davis (1994).

2.8 Updating Background

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The *Unified Guidance* recommends updating statistical limits (background) when at least four to eight new measurements (every 1 to 2 years under a quarterly monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or appropriate non-parametric test (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to evaluate whether the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the null hypothesis that they are equivalent. In addition, time series graphs or other trend evaluation statistics will be conducted on the new background dataset to verify the absence of a release or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a release (if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. In accordance with the *Unified Guidance*, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison.

3. COMPLIANCE MONITORING

Compliance monitoring is designed to monitor groundwater for evidence of a release by comparing Part 845 constituents in compliance wells to both background concentrations and the GWPS. Compliance Monitoring will begin the quarter following approval of this Addendum to the Groundwater Monitoring Plan and issuance of the Operating Permit. These samples will be analyzed for Part 845 constituents. The selected Compliance Monitoring statistical method used to compare compliance groundwater quality data for each constituent to the GWPS will provide for adequate statistical power, error levels and individual test false positive rates, and be appropriate for the distribution and detection frequency of the background dataset. Statistical power is the ability of a statistical test to detect a true exceedance

In accordance with 35 I.A.C. § 845.610(b)(3)(D), compliance monitoring statistical analyses will be completed and submitted to IEPA within 60 days after completion of sampling.

3.1 GWPS Establishment and Exceedance Determination

In accordance with 35 I.A.C. § 845.600(a), the GWPS will be the constituent concentrations specified in 35 I.A.C. § 845.600(a)(1) except for when the background concentration is greater, or no concentration is specified (*i.e.,* for calcium and turbidity), in which case the GWPS will be the background concentration. The GWPS based on background concentration will be calculated using a parametric upper tolerance limit (UTL), a parametric UPL for a future mean, or a non-parametric UPL for a future median.

Statistical calculations that will be utilized in Compliance Monitoring procedures are summarized in **Table A** below and listed in **Sections 3.1.1** through **3.1.7**. Depending on the distribution of the data and the percentage of non-detects, it may be more appropriate to use a parametric model over a non-parametric model. As necessary, other techniques as mentioned in the *Unified Guidance* and/or new methods will be implemented.

Table A. Statistical Calculations Used in Compliance Monitoring Procedures

Compliance Monitoring						
Significant Trend?	Background Data			Compliance Data		
	Percent Non-Detects	Distribution	GWPS Determination	Percent Non-Detects	Distribution	Method to Determine Exceedance
No	0 ≤ 50	Normal	35 I.A.C § 845.600(a)(1) constituent concentration or The Upper Tolerance Limit	≤75	Normal	Parametric Lower Confidence Limit around a Normal Mean
				≤75	Log-Normal	Parametric Lower Confidence Limit around a Lognormal Geometric Mean
				NA	Non-Normal	Non-Parametric Lower Confidence Limit around a Median
				>75	Unknown/ Cannot be determined	
	50 ≤ 70	Normal	The Upper Prediction Limit for a Future Mean	NA	NA	Future mean
	>70	Non-Normal	Upper Prediction Limit for a Future Median	NA	NA	Future median
	100	Non-Normal	Double Quantification Rule	NA	NA	Individual Retesting Values
Yes	0 ≤ 50	Normal	UCL of Confidence Band around Linear Regression	≤75	Residuals after subtracting trend are normal, equal variance	Lower Limit from Confidence Band around Linear Regression
	50 ≤ 100	Non-Normal	UCL of Confidence Band around Thiel-Sen trend line	≤75	Residuals not normal	Lower Limit from Confidence Band around Thiel-Sen

3.1.1 The Upper Tolerance Limit

The UTL will be used to calculate the GWPS when pooled background data are normally distributed, with a non-detect frequency of 50 percent or less. When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects. The *Unified Guidance* recommends 95 percent confidence level and 95 percent coverage (95/95 tolerance interval).

- When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects (simple substitution), and the normal mean and standard deviation will be calculated.

- The Kaplan-Meier or the ROS method will be used when the detection frequency is between 15 percent and 50 percent. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation.
- If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95 percent coverage).

The parametric UTL on a future mean will be calculated from the background dataset as follows:

$$UTL = \overline{x} + \kappa\,(n, \gamma, \alpha - 1) \cdot s$$

$\overline{x}$ = background sample mean

s = background sample standard deviation

$\kappa\,(n, \gamma, \alpha - 1)$ = one-sided normal tolerance factor based on the chosen coverage (γ) and confidence level (α -1) and the size of the background dataset (n). Values are tabulated in Table 17-3 in Appendix D of the *Unified Guidance*. If exact values are not provided, then κ values can be estimated by linear interpolation.

If the UTL is constructed on the logarithms of original observations to achieve normality, where $\overline{y}$ and s_y are the log-mean and log-standard deviation, the limit will be exponentiated for back-transformation to the concentration scale as follows:

$$TL = \exp\left[\overline{y} + \kappa\,(n, \gamma, \alpha - 1) \cdot s_y\right]$$

$\overline{y}$ = background sample log-mean

s_y = background sample log-standard deviation

When the GWPS is based on the 35 I.A.C. § 845.600(a)(1) constituent concentrations or a UTL derived from the background dataset, an exceedance in compliance wells relative to the GWPS will be evaluated using confidence intervals. A confidence interval defines the upper and lower bound of the true mean of a constituent concentration in groundwater within a specified confidence range.

- Non-detects in compliance data will be handled similarly to upgradient analyses, with half the RL substituted for non-detects when the frequency is 15 percent or less.
- The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15 percent and 50 percent to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. These estimates will then be substituted for the sample mean and standard deviation.

Once the GWPS is established for background data using the UTL, either parametric or non-parametric confidence intervals will be computed for each constituent in compliance wells to identify GWPS exceedances.

3.1.2 Parametric Confidence Intervals around a Mean

If compliance data are approximately normal, one-sided parametric confidence intervals around a sample mean will be constructed for each constituent and well pair. The lower confidence limit (LCL) will be calculated as:

$$LCL_{1-\alpha} = \overline{x} - t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

$\overline{x}$ = compliance sample mean

s = compliance sample standard deviation

n = compliance sample size

$t_{1-\alpha,n-1}$ = obtained from a Student's t-table with (n–1) degrees of freedom (Table 16-1 in Appendix D of the *Unified Guidance*)

The chosen t value will aim to achieve both a low false-positive rate, and high statistical power. Minimum ɑ values are tabulated in Table 22-2 of Appendix D of the *Unified Guidance*. The selected minimum ɑ value, from which the t value will be derived, will have at least 80 percent power (1-β = 0.8) when the underlying mean concentration is twice the GWPS.

If compliance data are distributed lognormally, the LCL will be computed around the lognormal geometric mean as:

$$LCL_{1-\alpha} = \exp\left(\overline{y} - t_{1-\alpha,n-1} \cdot \frac{s_y}{\sqrt{n}}\right)$$

$\overline{y}$ = compliance sample log-mean

s_y = compliance sample log-standard deviation

3.1.3 Non-Parametric Confidence Intervals around a Median

Non-parametric confidence intervals around the median will be computed if the compliance data contain greater than 50 percent non-detects or are not normally distributed. The mathematical algorithm used to construct non-parametric confidence intervals is based on the probability (*P*) that any randomly selected measurement in a sample of n concentration measurements will be less than an unknown *P* x 100th percentile of interest (where *P* is between 0 and 1). Then the probability that the measurement will exceed the *P* x 100th percentile is (1–*P*). The number of sample values falling below the *P* x 100th percentile out of a set of n should follow a binomial distribution with parameters n and success probability *P*, where 'success' is defined as the event that a sample measurement is below the *P* x 100th percentile. The probability that the interval formed by a given pair of order statistics will contain the percentile of interest will then be determined by a cumulative binomial distribution *Bin(x;n,p)*, representing the probability of *x* or fewer successes occurring in *n* trials with success probability p. *P* will be set to 0.50 for an interval around the median.

The sample size n will be ordered from least to greatest. Given *P* = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks close to the product of (n+1) x 0.50. If the result of (n+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (n+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added to and subtracted from the result to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted L* and U*. For a one-sided LCL, the confidence level associated with endpoint L* will be computed as:

$$1 - \alpha = Bin(L^* - 1; n, .50) = \sum_{x=L^*}^{n} \binom{n}{x} \left(\frac{1}{2}\right)^n$$

If the candidate endpoint(s) do not achieve the desired confidence level, new candidate endpoints (L*−1) and (U*+1) and achieved confidence levels will be calculated. If one candidate endpoint equals the data minimum or maximum, only the rank of the other endpoint will be changed. Achievable confidence levels are tabulated using these equations in Table 21-11 in Appendix D of the *Unified Guidance*.

Both parametric and non-parametric confidence limits will then be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance monitoring wells. A GWPS exceedance is determined if the LCL exceeds the GWPS.

3.1.4 The Upper Prediction Limit for a Future Mean

The parametric UPL for a future mean will be used to calculate the GWPS if the pooled background data contain 50 to 70 percent non-detects and normality can be achieved. The Kaplan-Meier or ROS methods will be used to estimate the mean and standard deviation. The non-parametric UPL for a future median will be calculated as the GWPS if background samples cannot be normalized or contain greater than 70 percent non-detects. The parametric UPL for a future mean will be calculated from the background dataset at follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\overline{x}$ = background sample mean

s = background standard deviation

κ = multiplier based on the order (p) of the future mean to be predicted, the number of compliance wells to be tested (w), the background sample size (n) the number (c) of constituents of concern (COCs), the "1-of-m" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Values are tabulated in 19-5 to 19-9 in Appendix D of the *Unified Guidance*.

The mean of order p will be computed for each well and compared against the UPL. For any compliance point mean that exceeds the limit, p additional resamples may be collected at that well for a 1-of-2 retesting scheme. Resample means will then be compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when the initial mean and all resample means exceed the UPL.

3.1.5 The Non-Parametric Upper Prediction Limit for a Future Median

The non-parametric UPL for a future median will be used to calculate the GWPS if the pooled background data contain greater than 70 percent non-detects and normality cannot be achieved. Non-parametric methods assume that the data does not have an underlying distribution. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate (α_{const}) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

α = the site-wide false positive rate (SWFPR) of 0.10 recommended by the *Unified Guidance*

c = the number of monitoring constituents

The number of yearly statistical evaluation (nE) will be multiplied by the number of compliance wells (w) to determine the look-up table entry, w*. The background sample size (n) and w* will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the *Unified Guidance*. The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used. The use of the Double Quantification rule in Compliance Monitoring will only be applicable if the RL is above the 35 I.A.C. § 845.600(a)(1) constituent concentration or a constituent concentration is not specified in § 845.600(a)(1). This scenario is highly unlikely. The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will may be collected from that well. The resample median will be computed and compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If the concentrations of detected constituents are below the established GWPS, Compliance Monitoring will continue.

3.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size (n). A wider confidence interval will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of confidence intervals is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band does also to reflect this change at that point in time.

Linear regression will be used when background or compliance data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

$$\hat{b} = \sum_{i=1}^{n}(t_i - \bar{t}) \cdot x_i/(n-1) \cdot s_t^2$$

xi = i^{th} concentration value and

ti = i^{th} sampling date

$\bar{t}$ = sampling mean date

s_t^2 = variance of the sampling dates

This estimate leads to the following regression equation:

$$\hat{x} = \bar{x} + \hat{b} \cdot (\mathrm{t} - \bar{t})$$

$\bar{x}$ = mean concentration level

$\hat{x}$ = estimated mean concentration at time t

The regression residuals will also be computed at each sampling event to ensure uniformity and lack of significant skewness. Regression residuals will be computed at each sampling event as follows:

$$r_i = x_i - \hat{x}_i$$

The estimated variance around the regression line, or mean squared error (MSE) will be computed as follows:

$$s_e^2 = \frac{1}{n-2}\sum_{i=1}^{n} r_i^2$$

The confidence intervals around a linear regression trend line given confidence level (1-ɑ) and a point in time (t_0), will be computed as follows:

$$LCL_{1-\alpha} = \hat{x}_0 - \sqrt{2s_e^2 \cdot F_{1-2\alpha,2,\mathrm{n}-1} \cdot \left[\frac{1}{n} + \frac{(t_0 - \bar{t})^2}{(n-1) \cdot s_t^2}\right]}$$

$$UCL_{1-\alpha} = \hat{x}_0 - \sqrt{2s_e^2 \cdot F_{1-2\alpha,2,\mathrm{n}-2} \cdot \left[\frac{1}{n} + \frac{(t_0 - \bar{t})^2}{(n-1) \cdot s_t^2}\right]}$$

$\hat{x}_0$ = estimated mean concentration from the regression equation at time t_0

$F_{1-2\alpha,2,\mathrm{n}-2}$ = upper $(1\text{-}2\alpha)^{\text{th}}$ percentage point from an F-distribution with 2 and (n-2) degrees of freedom

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the linear regression line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is determined when the LCL based on the trend line first exceeds the GWPS.

3.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or compliance data. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line, the data will first be ordered by sampling event x1, x2, xn. All possible distinct pairs of measurements (xi, xj) for j > i will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

$$m_{ij} = (x_j - x_i)/(j - i)$$

With a sample size of n, there will be a total of N = n(n-1)/2 pairwise estimates (m_{ij}). If a given observation is a non-detect, half the RL will be substituted. The N pairwise slope estimates (m_{ij}) will be ordered from least to greatest (renamed m(1), m(2),..m(N)). The Thiel-Sen estimate of slope (Q) will be calculated as the median value of the list depending on whether N is even or odd as follows:

$$Q = \begin{cases} m_{([N+1]/2)} \; if \; N \; is \; odd \\ (m_{(N/2)} + m_{([N+2]/2)})/2 \; if \; N \; is \; even \end{cases}$$

The sample concentration magnitude will be ordered from least to greatest, x(1), x(2), to x(n) and the median concentration will be calculated as follows:

$$\tilde{x} = \begin{cases} x_{([n+1]/2)} \; if \; n \; is \; odd \\ (x_{(n/2)} + x_{([n+2]/2)})/2 \; if \; n \; is \; even \end{cases}$$

The median sampling date ($\tilde{t}$) with ordered times (t(1), t(2), to t(n)) will also be determined in this way. The Thiel-Sen trend line will then be computed for an estimate at any time (t) of the expected median concentration (x) as follows:

$$x = \tilde{x} + Q \cdot (\mathrm{t} - \tilde{t}) = (\tilde{x} - Q \cdot \tilde{t}) + Q \cdot \mathrm{t}$$

To construct a confidence band around the Thiel-Sen line, sample pairs (ti, xi) will be formed with a sample date (ti) and the concentration measurement from that date (xi). Bootstrap samples (B) will be formed by repeatedly sampling n pairs at random with replacement from the original sample pairs. This will be repeated 500 times. For each bootstrap sample, a Thiel-Sen trend line will be constructed using the equation above. A series of equally spaced time points (tj) will be identified along the range of sampling dates represented in the original sample, j =1 to m. The Thiel-Sen trend line associated with each bootstrap replicate will be used to compute an estimated concentration ($\hat{x}_j^B$). An LCL will be constructed for the lower α^{th} percentile $\hat{x}_j^{[\alpha]}$ from the distribution of estimated concentrations at each time point (tj). For a UCL, compute the upper $(1-\alpha)^{th}$ percentile, $\hat{x}_j^{[1-\alpha]}$ at each time point (tj).

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

4. REFERENCES

Davis, C.B., 1994. *Environmental Regulatory Statistics.* In GP Patil & CR Rao (Eds.) *Handbook of Statistics, Volume 12: Environmental Statistics*, Chapter 26. New York: Elsevier Science B.V.

United States Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530-R-09-007. March 2009.

ATTACHMENT 2
REVISIONS TO THE GROUNDWATER MONITORING PLAN AND GROUNDWATER MANAGEMENT ZONE APPLICATION

TECHNICAL MEMORANDUM

Date: August 8, 2016

To: Tom Davis

From: Stuart Cravens

Subject: Baldwin Energy Complex Ash Pond Closure and Post-Closure Plan – Response to Illinois EPA Comments

This technical memorandum is in response to the July 13, 2016 Illinois Environmental Protection Agency (Illinois EPA) correspondence regarding the Fly Ash Pond System Closure and Post Closure Care Plan (Plan) for the Baldwin Energy Complex. The Illinois EPA reviewed the Plan and provided comments for consideration and appropriate action by Dynegy Operating Company on behalf of Dynegy Midwest Generation, LLC, owner and operator of the Baldwin Energy Complex (BEC).

Responses to each of the Illinois EPA comments (italicized below) in the July 13, 2016 letter are provided below.

1. *The bedrock formations were chosen to represent the uppermost aquifer material to be monitored under the 257 regulations. However, the geometric mean of the horizontal hydraulic conductivity for the bedrock is 5.0 X 10^{-06} centimeters per second (cm/sec) and the geometric mean of the horizontal hydraulic conductivity for the unconsolidated material is 3.2 X 10^{-05} cm/sec. Table 2 of the Model Report Addendum lists 13 farm/domestic wells of which 10 utilize the unconsolidated materials. Given the higher hydraulic conductivity and greater use of the resource, please provide further explanation of how the unconsolidated materials were eliminated as the uppermost aquifer.*

Response: The predominant material underlying the Fly Ash Pond System and extending outward is clay and silty clay with randomly disseminated and discontinuous silt and sand seams. Conversely, the bedrock formation underlying the Fly Ash Pond System is laterally continuous and extends in all directions off-site of the BEC. Although the horizontal hydraulic conductivity of the shallow unconsolidated materials is higher than the underlying bedrock at some locations, the higher permeability lenses or seams of sand, silty sand, and clayey sand are not laterally continuous within the boundaries of the Fly Ash Pond System, nor are they laterally continuous outward from the Fly Ash Pond System to or beyond the property boundary of the BEC. Any sand seams or layers identified along the western side of the impoundment system, to the west of the Secondary and Tertiary Ponds, are localized and completely separated from the Fly Ash Pond System by the intervening bedrock low.

The geometric mean hydraulic conductivity of 3.2 X 10^{-05} cm/sec provided in the Plan was based on 12 field tested wells located around the BEC impoundment system. Five of those 12 tested wells[1] are distant from the Fly Ash Pond System (i.e., ranging in distance from 950 to 2,200 feet away from the nearest ash pond) and none are located downgradient. The geometric mean hydraulic conductivity measured at the seven wells in the shallow unconsolidated material closest to and immediately downgradient of the Fly Ash Pond System[2] is 8.7 X 10^{-06} cm/sec compared to a geometric mean of *5.0 X* 10^{-06} for the bedrock.

Table 2 of the Model Report Addendum listed 13 farm/domestic wells, 10 of which were identified as using the unconsolidated materials and two of which used the bedrock for water supply. However, looking at the well logs for those 10 wells, as included in the Water Well Survey report[3], shows that one of the 10 wells (Philip Cohen's 6-inch well drilled in 1950) was apparently a bedrock well and the remaining nine wells were all 33 to 42-inch diameter bored wells. Bored wells are generally installed at locations where there are low permeability unlithified deposits with no continuous saturated stratums to provide a continuous supply of groundwater to a conventional drilled well. In geologic materials which do not have sufficient hydraulic conductivity to produce a continuous supply of groundwater, bored wells essentially act as underground storage reservoirs that rely on slow seepage of water over a substantially larger surface area than conventional wells. The presence of a bored well in saturated materials does not constitute existence of an aquifer. Many bored wells are no longer utilized or have been long abandoned because they do not provide a "useable" quantity of groundwater, are subject to surface contamination, or go dry during extended dry periods or droughts.

Since the unlithified deposits at the Baldwin Fly Ash Pond System were previously recognized as being the uppermost water bearing zone and capable of locally transporting coal combustion residuals (CCRs), a groundwater monitoring network was established within the unlithified deposits at the BEC impoundment system, in addition to the uppermost bedrock aquifer, and is currently being monitored under Special Condition No. 17 of NPDES Permit No. IL0000043.

2. Figure No. 8 of the September 30, 2014 document, Prediction of Plume Stability by Groundwater Modeling, Model Report Addendum, projected boron impacted groundwater off site on private property. This projection was for the Base Case Scenario. The Groundwater Management Zone (GMZ) application

---

[1] MW-104DR, OW-156, MW-161, OW-256, MW-262

[2] MW-151, MW-152, OW-157, TPZ-166, MW-252, MW-253, OW-257

[3] NRT and Kelron Environmental, 2010. "Water Well Survey, Baldwin Ash Pond System, Baldwin Energy Complex, Baldwin, Illinois". Prepared for Dynegy Midwest Generation, LLC, dated June 7, 2010.

states "Capping the Baldwin Fly Ash Ponds as proposed will result in very similar results to the baseline transport model. The proposed cap does not minimize impacts to offsite groundwater and must be revised.

Response: The prediction modeling performed for the entire Baldwin Ash Pond System, inclusive of the Baldwin Fly Ash Pond System, evaluated both baseline conditions where no corrective action is implemented and various cap scenarios. The initial model report[4] was used to predict changes over a period of 50 years (2015-2065) using a transport model calibrated to simulate boron transport assuming steady-state flow conditions. The addendum[5] quantified the time for concentrations of the CCR leachate indicator boron to reach a stable status or to decrease in monitoring wells, determine the maximum extent of the boron plume, and to predict potential or future impairments to groundwater usage off-site.

The purpose of the proposed cap on the Baldwin Ash Pond System is to decrease impacts to groundwater both spatially and temporally. Given the inherent uncertainties with predictive modeling, the spatial difference in offsite migration of impacted groundwater exceeding the boron groundwater standard of 2 milligrams per Liter (mg/L) for the proposed cap versus a lower permeability (i.e., geomembrane cap) is relatively minor relative to the temporal difference. The long-term spatial difference in impacts to groundwater under baseline conditions with no cap versus a geomembrane cap as predicted by the groundwater model is exhibited on Figure 1. The maximum extent of the predicted boron plume under baseline conditions is reached in 600 years versus 1,200 years with a geomembrane cap. With the proposed clay cap the maximum boron extent will be reached in a period greater than 600 years before the plume begins dissipating, but significantly earlier (i.e., hundreds of years) than with a geomembrane cap.

With a baseline scenario condition of no cap on the Baldwin Ash Pond System the modeled duration for leachate depletion from the fly ash ponds (i.e., equivalent to background boron concentration) is 92 years. Installing the lowest permeability cap such as a geomembrane, which reduces surface infiltration into the fly ash ponds and reduces percolation out of the base of the ponds, increases the modeled duration of leachate depletion from the fly ash ponds to 558 years, or approximately six times longer. A clay cap with maximum permeability of 1×10^{-5} centimeters per second as proposed will still reduce the infiltration and

---

[4] NRT, 2014a. "Groundwater Model and Simulation of Closure Alternatives, Baldwin Ash Pond System, Baldwin Energy Complex, Baldwin, Illinois". Prepared for Dynegy Midwest Generation, LLC, dated June 18, 2014.

[5] NRT, 2014b. "Model Report Addendum, Prediction of Plume Stability by Groundwater Modeling, Baldwin Ash Pond System, Baldwin Energy Complex, Baldwin, Illinois". Prepared for Dynegy Operating Company, dated September 30, 2014.

percolation rates while substantially shortening the time for the groundwater plume to dissipate relative to a lower permeability cap.

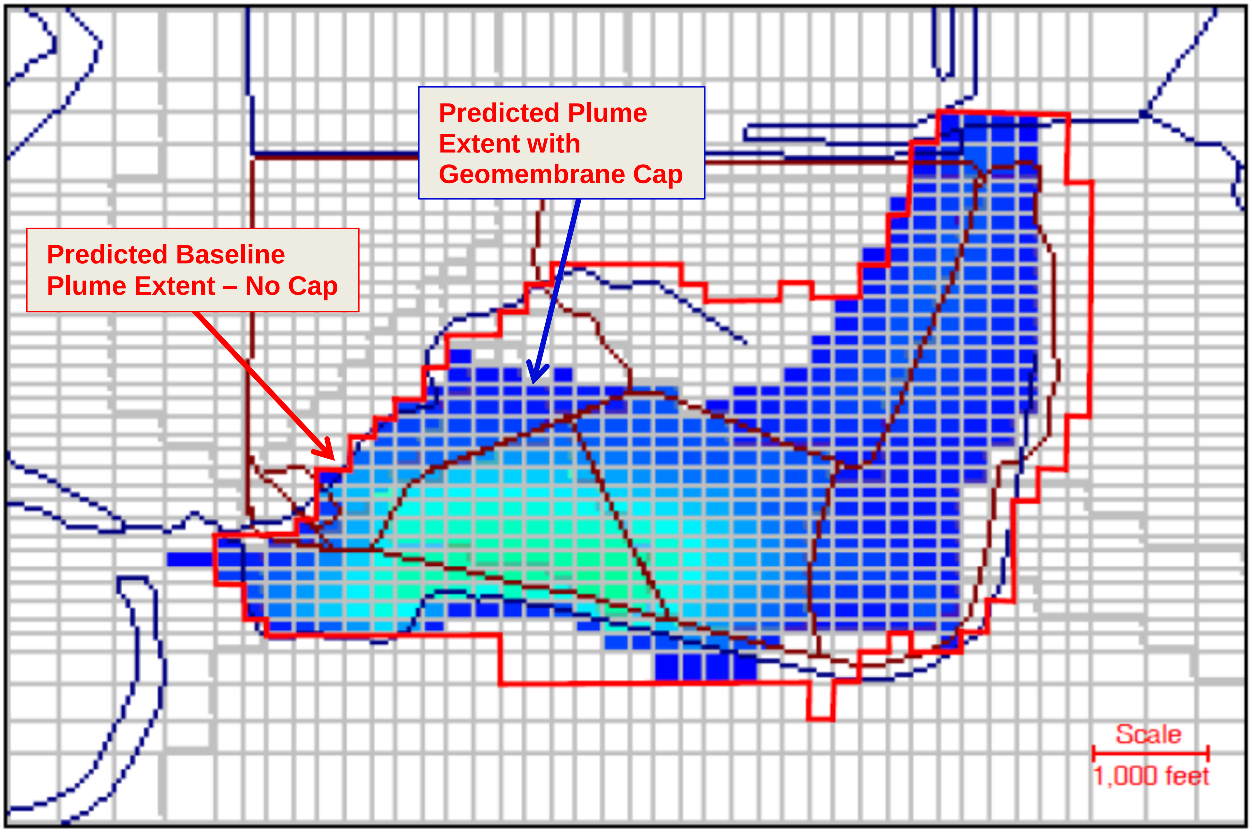


Figure 1. Baseline condition with no cap on the Baldwin ash ponds versus geomembrane cap

Predicted impacts to offsite groundwater quality based on groundwater modeling have been used to develop the initial corrective action of cap placement. The maximum plume extent as shown on Figure 1 will not occur because it is a modeled prediction based on current baseline conditions with no cap and no triggered corrective actions. The effects of the cap proposed in the closure plan on groundwater quality will be monitored in accordance with the groundwater monitoring plan. If concentrations of indicator parameters in groundwater show that there are statistically significant increasing trends attributable to the Baldwin Fly Ash Pond System then additional investigation and corrective actions appropriate to mitigate those exceedances, and prevent offsite migration of impacted groundwater exceeding groundwater standards, will be evaluated and proposed.

3. The GMZ application must specifically identify the corrective action which is proposed for the site.

Response: Section 2.3 of the GMZ application as submitted contains the three specific elements of the proposed corrective action, but has been modified slightly with the following underscored additions and strikeout deletions:

NATURAL RESOURCE TECHNOLOGY

"The three ponds comprising the Baldwin Fly Ash Pond System are interconnected and are essentially three cells within one large pond. The Closure Plan for the Baldwin Fly Ash Pond System includes the following corrective action elements, preliminary designs of which are shown on Figure 4:

Closure will consist of pumping to remove surface water, redistributing and reshaping the existing CCR to fill in low areas and establish a subgrade for the final soil cover, and placing an earthen cover that complies with the CCR Rule.

The final cover system is comprised of a 6-inch vegetative support layer (topsoil) overlying 18-inch barrier soil.

Non-contact storm water runoff from the cover system will be collected and managed, with two new detention basins and channels directing water to the Secondary Pond.

The proposed corrective action elements will provide hydraulic control of surface water on the cover system and surrounding the Baldwin Fly Ash Pond System, will lower leachate levels and establish hydrostatic equilibrium within the ponds, and will decrease transport off-site both spatially and temporally."

4. The boundary of the proposed GMZ appears to follow the property boundary for the site and include impoundments which have not been proposed to undergo closure at this time. The GMZ boundary needs to be revised to identify the specific area where groundwater quality standards are exceeded at the site as wells as the area in which the proposed corrective action will mitigate impaired groundwater.

Response: The GMZ application figures 1 to 4 will be revised to show the revised GMZ boundary. Figure 3 will be modified to show the revised GMZ boundary, approximate extent of impacted groundwater above Class II groundwater quality standards, and the model predicted corrective action mitigation area.

5. Section 6.9, page 6-6 of the plan indicates compliance with the applicable groundwater quality standards will be achieved when there are no statistically significant increasing trends attributable to the Baldwin Fly Ash Pond System for the parameters detected at the compliance boundary for 4 consecutive years following the change to annual monitoring frequency. The compliance section of the Plan and the GMZ application must be revised to identify the compliance point pursuant to 620.240(e)(1) and compliance concentrations at 35 Ill. Adm. Code 620.450(a)(4).

Response Part 1: The compliance section of the Plan, Section 6.9, will be revised with the following underscored additions and strikeout deletions:

"In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the proposed monitoring well network (i.e., the modified NPDES monitoring well network), will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary ~~for~~ after a minimum 30 years of post-closure groundwater monitoring has been completed ~~four(4) consecutive years following the change to an annual monitoring frequency~~."

Response Part 2: The GMZ application will be revised with the following underscored additions and strikeout deletions:

"3.3 Compliance with Applicable On-Site Groundwater Quality Standards

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the proposed monitoring well network (i.e., the modified NPDES monitoring well network), will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary ~~for~~ after a minimum 30 years of post-closure groundwater monitoring has been completed.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94."

6. Figure No. 4 from Appendix A of the Plan indicates Boring PZ-171 has a 7.9 foot layer of sand. What is the extent of this sand layer, which is over 5 feet thick and therefore designated as Class I groundwater? Has the groundwater within the sand layer been analyzed to determine if it has been impacted by the ash impoundments? Does the sand layer extend off site?

Response: The 7.9 foot layer of sand observed at Boring PZ-171 may be either a localized lense or laterally continuous northward to Boring MW-161 and southward to Boring MW-262. However, based on six surrounding borings to the east and west (MW-154, MW-155, PZ-172, MW-388, MW-389, and TPZ-160) this layer is limited to the western edge of the Baldwin impoundments and is of limited lateral extent. Due to the presence of the bedrock valley, it is unlikely that this sand layer extends eastward beyond the western side of the Secondary Pond. The bedrock valley has a topographic elevation ranging from 366 to 390 feet and a land surface topographic elevation of 395 to 400 feet, both of which are close to or below the lowermost sand layer elevation of 395 feet. Surface topography between the Fly Ash Ponds and the western end of the impoundments (i.e., west of the Secondary and Tertiary Ponds) effectively isolates any sand lenses or layers observed in the western end of the site from the Fly Ash Pond System.

The sand layer observed at Boring PZ-171 or any of the other borings cannot extend significantly westward because the surface topography decreases westward towards the Kaskaskia River, with surface topography decreasing below an elevation of 395 feet. Borings advanced west of the impoundments towards the Kaskaskia River (i.e., MW-154 and MW-155) have sand or clayey sand layers ranging from 0.3 to 3.5 feet in thickness between the elevations of 369 and 381 feet, or approximately 14 to 26 feet below the base of the sand observed at Boring PZ-171. The sand layer at Boring PZ-171 does not extend off-site.

No groundwater samples have been collected from piezometer PZ-171 to determine if it has been impacted by the ash impoundments. However, wells MW-161 and MW-262 located directly north and south of PZ-171, respectively, were sampled for groundwater quality on four occasions in 2013 – 2014, with all boron concentrations at both wells below the reporting limit of 0.020 milligrams per Liter (mg/L) and sulfate concentrations were all less than 45 mg/L. Based on observed groundwater quality at monitoring wells located both north and south of PZ-171, and given the disconnection between any sand layers west of the Secondary and Tertiary Ponds from the rest of the impoundments, there is little possibility of impacts from the Fly Ash Pond System.

In order to confirm that there are no groundwater impacts related to coal combustion residuals to the west of the impoundments, a groundwater sample will be collected from piezometer PZ-171 and analyzed for chloride, sulfate, boron, total dissolved solids, and field pH. The laboratory report will be submitted to the Illinois EPA.

7. Section 6.2, page 6-4 of the Plan indicates the sampling schedule could be accomplished in 15 years. This appears to contradict the required 257 Regs post closure sampling of 30 years. This sampling schedule must be revised.

Response: The existing text in Section 6.2 of the Groundwater Monitoring Plan will be revised with the following underscored additions:

"Groundwater monitoring of the NPDES monitoring well network may be discontinued upon Illinois EPA's approval of a certified post-closure care report after a minimum 30 years of post-closure groundwater monitoring has been completed. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95. Post-closure care groundwater monitoring will continue for a minimum of 30 years in accordance with 40 CFR Part 257.104".

8. Section 6.4, page 6-4 of the Plan should contain a list of all the chemical concentrations required for groundwater monitoring by the 257 Regs, and a list of inorganic parameters required pursuant to the 620 Regs, for sampling each permanent monitoring well. Specifically, the inorganic parametes monitoring list for testing should be from 35 IAC 620.410 (a) and pH.

Response: The Plan will be revised by adding two imbedded tables into Section 6.4 that include the following:

- Subset of parameters from 35 IAC620.420(a) to be monitored and pH; and,
- List of Appendix III and IV parameters required for groundwater monitoring by the 257 Regs.

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATON AND GROUNDWATER MONITORING PLAN
Baldwin Fly Ash Pond System
Baldwin Energy Complex
Baldwin, Illinois
Project No: 2340
March 31, 2016

Revised Table of Contents page i
Revised Pages 6-4 to 6-8

TABLE OF CONTENTS

Groundwater monitoring of the NPDES monitoring well network may be discontinued upon Illinois EPA's approval of a certified post-closure care report after a minimum 30 years of post-closure groundwater monitoring has been completed. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95. Post-closure care groundwater monitoring will continue for a minimum of 30 years in accordance with 40 CFR Part 257.104.

6.3 Groundwater Sample Collection

Groundwater samples will be collected consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 as described in Appendix F. In addition to groundwater well samples, quality assurance samples will be collected as described in Section 6.5.

6.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 by a state-certified laboratory using methods approved by Illinois EPA and USEPA. The practical quantitation limit (PQL) for all parameters analyzed will be lower than the applicable groundwater quality standard. Concentrations lower than the PQL will be reported as less than the PQL. The laboratory analysis parameters for the two monitoring programs are listed below.

Laboratory Analysis Parameters from 35 IAC Part 620.420(a): Modified NPDES Monitoring Well Network		
Boron (dissolved)	Manganese (total)	Sulfate (dissolved)
Chloride (dissolved)	Nitrate (total)	Total Dissolved Solids (TDS)
Iron (total)		

Laboratory Parameters from Appendix III and Appendix IV of 40 CFR Part 257: 40 CFR Part 257 Monitoring Well Network		
Metals (totals)		
Antimony	Cadmium	Lithium
Arsenic	Calcium	Mercury
Barium	Chromium	Molybdenum
Beryllium	Cobalt	Selenium
Boron	Lead	Thallium
Inorganics (totals)		

Fluoride	Sulfate
Chloride	Total Dissolved Solids
Other (total)	
Radium 226 and 228 combined	

6.5 Quality Assurance Program

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93, the sampling and analysis program includes procedures and techniques for quality assurance and quality control. Additional quality assurance samples to be collected will include the following:

- Two blind duplicate groundwater samples from randomly selected monitoring wells
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, than equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

6.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.91, maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event. Monitoring well inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved

- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks that wells are clear of internal obstructions, and flow freely

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

6.7 Annual Statistical Analysis

6.7.1 Proposed Modified NPDES Monitoring Well Network

Trend analysis will be performed annually for each of the monitored parameters. Sen's Estimate of Slope will be applied to a minimum of four consecutive quarterly monitoring results. If there are increasing trends during closure and post-closure care periods, they will be further investigated as described below.

- If the results of sampling and analysis show an increasing trend at any compliance monitoring well, a Mann-Kendall analysis will be performed at 95 percent confidence to determine whether or not the increasing trend is statistically significant.
- If a statistically significant increasing trend occurs during post-closure care, further investigation of monitored concentrations will be performed as well as more frequent inspections of the surface of the cover system.
- If the investigation attributes a statistically significant increasing trend to a source other than the Baldwin Fly Ash Pond System, then the Illinois EPA will be notified in writing, stating the cause of the increasing trend and providing the rationale used in such a determination.
- If there is not an alternative source causing the statistically significant increasing concentration and the sampling frequency had been reduced to semi-annual or annual sampling, a quarterly sampling schedule will be reestablished. The frequency of sampling will return to either semi-annual or annual, once four consecutive quarterly samples show no statistically significant increasing trend.

Notifications concerning statistically significant increasing trends and revisions of the sampling frequency will be reported to Illinois EPA in writing within 30 days after making the determinations.

6.7.2 40 CFR Part 257 Monitoring Well Network

As required in 40 CFR Part 257.93, statistical analysis will be performed to determine whether or not a statistically significant increase over a background value has occurred for each constituent and at each well. Appropriate statistical methods will be chosen from the list of methods provided and the test chosen will be conducted separately for each constituent in each monitoring well. In addition, each statistical method chosen will comply with the performance standards, as appropriate, based on the test method used. If a statistically significant increase over background values is determined, procedures from 40 CFR Part 257 will be followed including 1) establishing an assessment monitoring program or 2) demonstrating that a source other than the Baldwin Fly Ash Pond System caused the increase or demonstrating another plausible reason for the increase (error in sampling, etc.).

6.8 Data Reporting

Sampling and analysis data from quarterly, semi-annual and/or annual groundwater monitoring for the modified NPDES monitoring well network will be reported to Illinois EPA within 60 days after completion of sampling. Statistical analysis of the laboratory analytical data will be reported to Illinois EPA with the annual report for the facility, as described in the closure plan.

Data reporting for the 40 CFR Part 257 monitoring well network will be consistent with recordkeeping, notification, and internet posting requirements described in 40 CFR 257.105 through 257.107.

6.9 Compliance with Applicable On-Site Groundwater Quality Standards

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the modified NPDES monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary after a minimum 30 years of post-closure groundwater monitoring has been completed.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.

6.10 Corrective Action

If a statistically significant increasing trend is observed to continue over a period of two or more years in groundwater sampled at the modified NPDES monitoring well network, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Baldwin Fly Ash Pond System and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan. A corrective action plan will be submitted to Illinois EPA within 180 days after completion of the investigation activities. The plan will propose corrective actions to be undertaken to mitigate the impacts associated with the constituents of concern which exceed applicable groundwater standards.

GROUNDWATER MANAGEMENT ZONE APPLICATION
Baldwin Fly Ash Pond System
Baldwin Energy Complex
Baldwin, Illinois
Project No: 2340
March 31, 2016

Revised Table of Contents
Revised Page 2-3
Revised Page 3-2
Revised Figures 1 – 4
Revised Appendix A – Groundwater Management Zone Legal Description

TABLE OF CONTENTS

FIGURES

APPENDICES

2.3 Closure of the Baldwin Fly Ash Pond System

The Closure Plan for the Baldwin Fly Ash Pond System is being submitted under separate cover (AECOM, 2016). In November 2015, in accordance with 40 CFR Part 257 Subpart D, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule. (CCR Rule), DMG submitted to Illinois EPA a notice of intent to close the East Fly Ash Pond and Old East Fly Ash Pond. A notice of intent to close the West Fly Ash Pond will be submitted by May 17, 2017. Because the East Fly Ash Pond and Old East Fly Ash Pond are inactive, the CCR Rule deadline for completing closure of these two ponds is November 2020.

The three ponds comprising the Baldwin Fly Ash Pond System are interconnected and are essentially three cells within one large pond. The Closure Plan for the Baldwin Fly Ash Pond System includes the following corrective action elements, preliminary designs of which are shown on Figure 4:

- Closure will consist of pumping to remove surface water, redistributing and reshaping the existing CCR to fill in low areas and establish a subgrade for the final soil cover, and placing an earthen cover that complies with the CCR Rule.
- The final cover system is comprised of a 6-inch vegetative support layer (topsoil) overlying 18-inch barrier soil.
- Non-contact storm water runoff from the cover system will be collected and managed, with two new detention basins and channels directing water to the Secondary Pond.

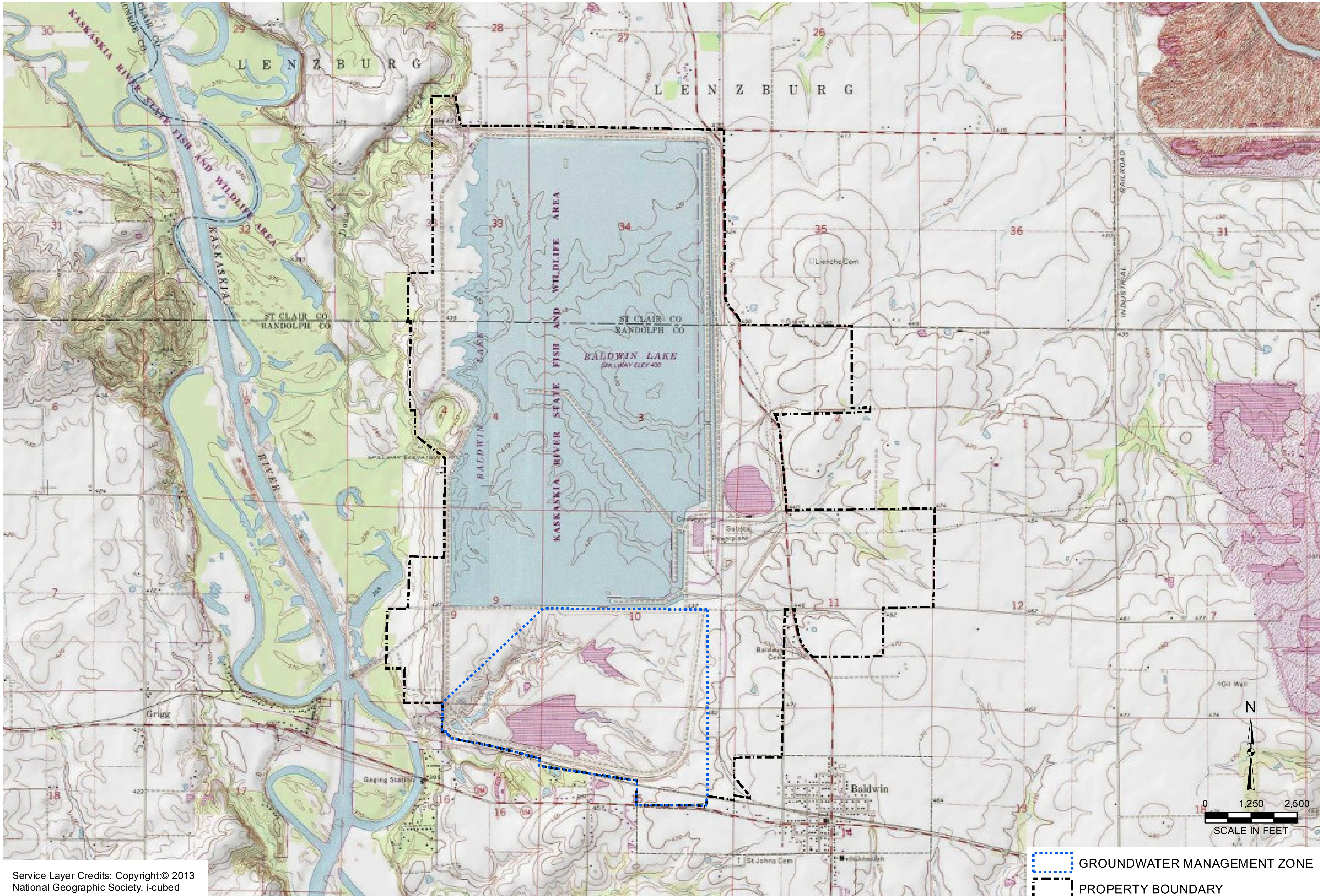
The proposed corrective action elements will provide hydraulic control of surface water on the cover system and surrounding the Baldwin Fly Ash Pond System, will lower leachate levels and establish hydrostatic equilibrium within the ponds, and will decrease transport off-site both spatially and temporally. There are no receptors off-site that would be potentially affected by the movement of impacted groundwater from the Baldwin Fly Ash Pond System.

3.3 Compliance with Applicable On-Site Groundwater Quality Standards

In accordance with IAC 620 Section 620.240, the compliance boundary is a lateral distance of 25 feet outward from the outermost edge of the the Baldwin Fly Ash Pond System berms. Following completion of the corrective action, the groundwater standard at the compliance boundary will be in accordance with IAC 620 Section 450(a)(4) for groundwater quality restoration such that the standard for each released chemical constituent will be the higher of either the Class II groundwater standard or the concentration determined by groundwater monitoring at the compliance boundary.

Compliance with on-site groundwater quality standards, as measured at the modified NPDES monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary after a minimum 30 years of post-closure groundwater monitoring has been completed.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.



DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 7/25/16

SITE LOCATION MAP

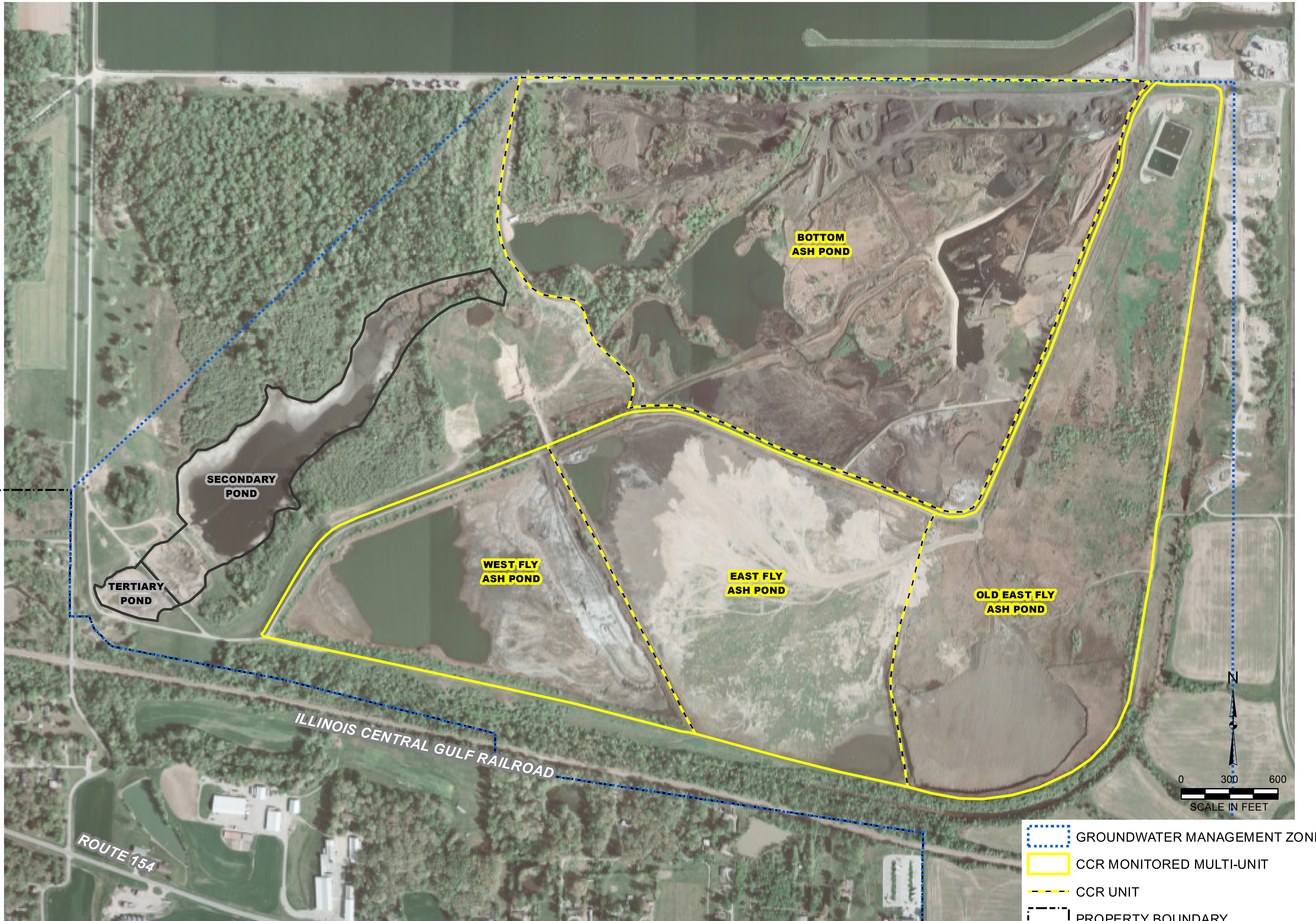
GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\GMZ_Application\Figure 1_Site Location Map.mxd Author: sstolz; Date/Time: 7/25/2016, 5:49:35 PM



AERIAL PHOTO SOURCE: HENDERSON AERIAL SURVEYS (4/2/2012).

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 7/25/16

DETAILED SITE MAP WITH PARTIAL GMZ BOUNDARY

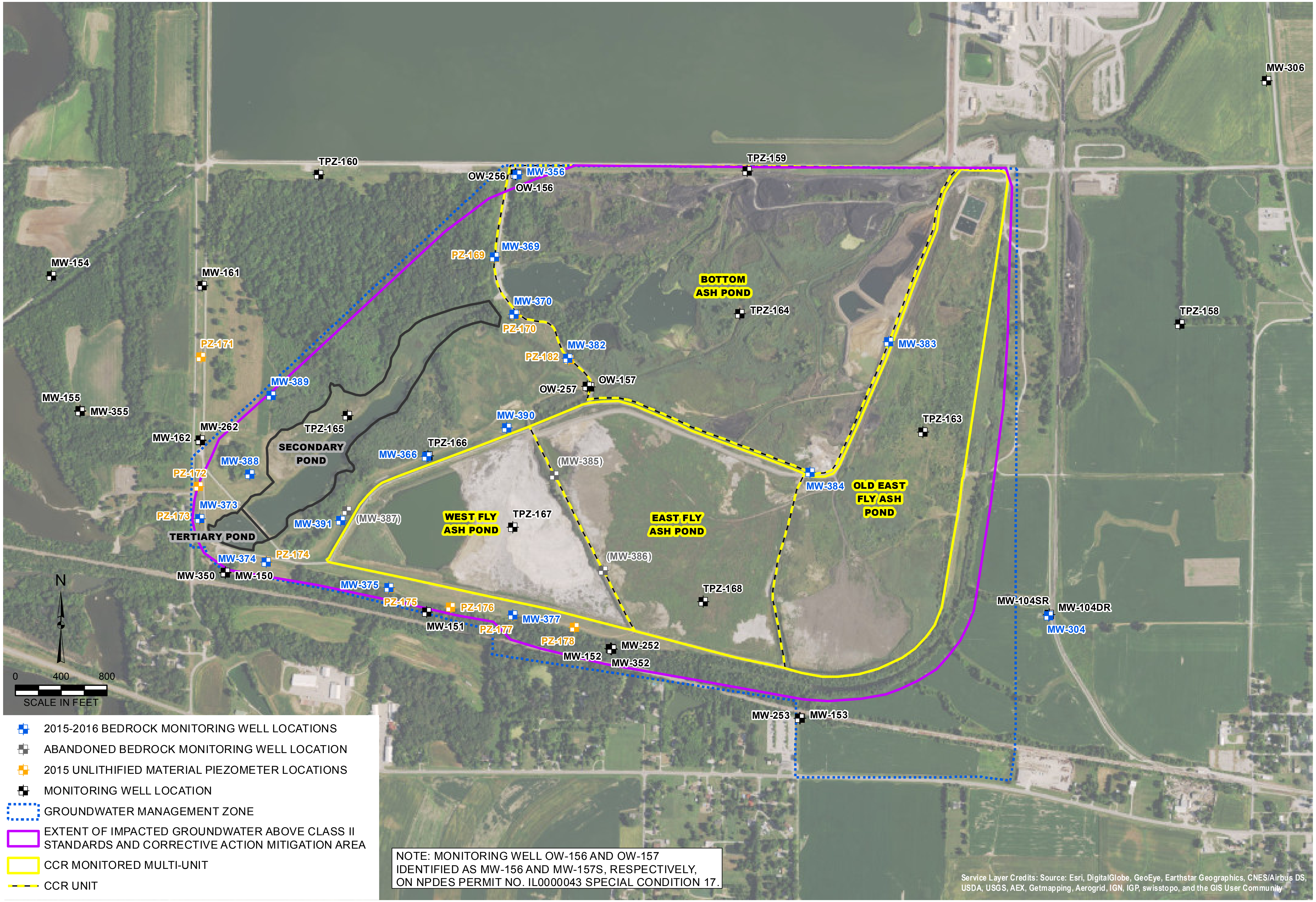
GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 2

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\GMZ_Application\Figure 2_Detailed Site Map with GMZ Boundary.mxd Author: sstolz; Date/Time: 7/25/2016, 5:47:48 PM



NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 7/25/16

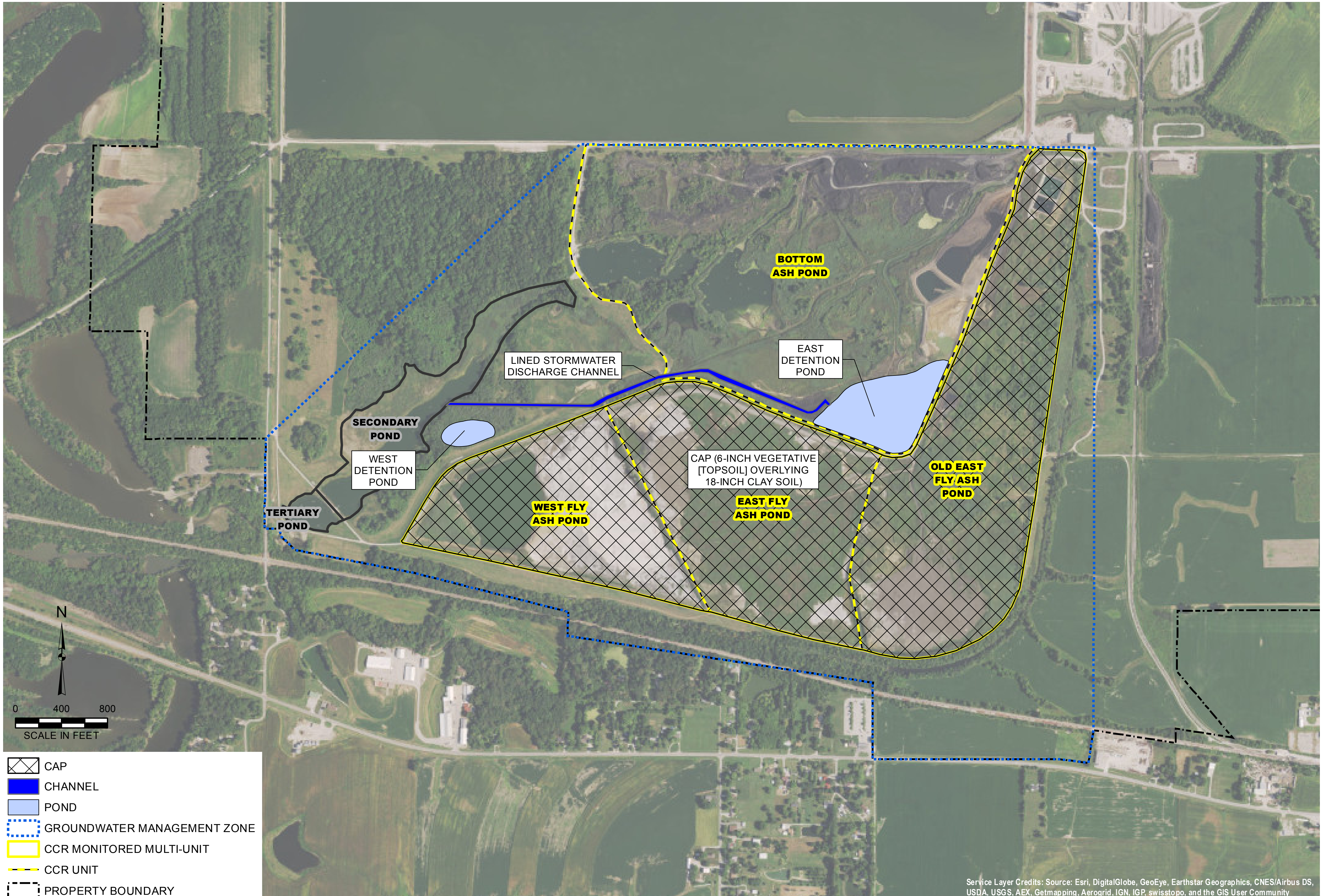
MONITORING WELL LOCATION MAP

GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 3

NATURAL RESOURCE TECHNOLOGY



DRAWN BY/DATE: TDC 3/9/16
REVIEWED BY/DATE: SJC 3/9/16
APPROVED BY/DATE: SJC 7/25/16

SITE CLOSURE PLAN

GROUNDWATER MANAGEMENT ZONE APPLICATION
BALDWIN ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 4

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\GMZ_Application\Figure 4_Site Closure Plan.mxd Author: sstolz; Date/Time: 7/25/2016, 5:54:40 PM

APPENDIX A

GROUNDWATER MANAGEMENT ZONE LEGAL DESCRIPTION

LINE LEGEND

(solid line)	BOUNDARY
(dashed line)	QUARTER SECTION LINES
(long-short dashed line)	SECTION LINE

N

SCALE: 1" = 400'
0 200' 400' 800'

LAND DESCRIPTION OF PROPOSED GROUNDWATER MANAGEMENT ZONE

A TRACT OF LAND BEING PART OF SECTIONS 9, 10 ,15, AND 16 IN TOWNSHIP 4 SOUTH, RANGE 7 WEST OF THE THIRD PRINCIPAL MERIDIAN, RANDOLPH COUNTY, ILLINOIS, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT A CONCRETE MONUMENT AT THE EAST QUARTER-CORNER OF SECTION 10, TOWNSHIP 4 SOUTH, RANGE 7 WEST; THENCE NORTH 0 DEGREES 57 MINUTES 30 SECONDS WEST, A DISTANCE OF 837.22 FEET TO THE POINT OF BEGINNING OF THE TRACT DESCRIBED HEREIN SOUTH 00 DEGREES 00 MINUTES 00 SECONDS EAST, A DISTANCE OF 5102.20 FEET; THENCE SOUTH 08 DEGREES 36 MINUTES 19 SECONDS WEST, A DISTANCE OF 289.20 FEET TO THE NORTH RIGHT OF WAY LINE OF ROUTE 154 ALSO BEING A NON-TANGENT CURVE TO THE LEFT, HAVING A RADIUS OF 5769.63 FEET, WITH A CHORD BEARING OF NORTH 82 DEGREES 42 MINUTES 22 SECONDS WEST; THENCE NORTHWESTERLY ALONG SAID CURVE AND NORTH RIGHT OF WAY LINE, A DISTANCE OF 275.47 FEET TO THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 15; THENCE NORTH 89 DEGREES 57 MINUTES 58 SECONDS WEST, ALONG SAID SOUTH LINE, A DISTANCE OF 1599.38 FEET TO THE WEST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 15; THENCE NORTH 00 DEGREES 26 MINUTES 31 SECONDS EAST, ALONG SAID WEST LINE, A DISTANCE OF 673.45 FEET TO THE CENTERLINE OF THE PROPERTY NOW OR FORMERLY OWNED BY THE GULF MOBILE, AND OHIO RAILROAD; THENCE NORTH 81 DEGREES 04 MINUTES 38 SECONDS WEST, ALONG SAID CENTERLINE, A DISTANCE OF 2679.12 FEET TO THE WEST LINE OF SAID SECTION 15; THENCE NORTH 00 DEGREES 54 MINUTES 21 SECONDS EAST, ALONG SAID WEST LINE, A DISTANCE OF 216.85 FEET; THENCE NORTH 75 DEGREES 38 MINUTES 34 SECONDS WEST, A DISTANCE OF 1371.51 FEET; THENCE NORTH 78 DEGREES 35 MINUTES 08 SECONDS WEST, A DISTANCE OF 1065.00 FEET; THENCE NORTH 45 DEGREES 05 MINUTES 08 SECONDS WEST, A DISTANCE OF 150.00 FEET; THENCE NORTH 20 DEGREES 35 MINUTES 08 SECONDS WEST, A DISTANCE OF 83.42 FEET; THENCE NORTH 89 DEGREES 06 MINUTES 39 SECONDS WEST, A DISTANCE OF 124.98 FEET TO THE WEST LINE OF THE NORTHEAST QUARTER OF SECTION 16, TOWNSHIP 4 SOUTH, RANGE 7 WEST; THENCE NORTH 01 DEGREES 00 MINUTES 09 SECONDS EAST, ALONG SAID WEST LINE, A DISTANCE OF 788.07 FEET; THENCE NORTH 46 DEGREES 54 MINUTES 02 SECONDS EAST, A DISTANCE OF 3757.78 FEET; THENCE SOUTH 89 DEGREES 24 MINUTES 27 SECONDS EAST, A DISTANCE OF 4429.72 FEET TO THE POINT OF BEGINNING; CONTAINING 654.28 ACRES MORE OR LESS; SUBJECT TO ALL RIGHTS TO THE PUBLIC FOR ROAD AND RAILROAD RIGHTS OF WAY, AND EASEMENTS OF RECORD, IF ANY.

STATE OF ILLINOIS MICHAEL J. GRAMINSKI 35-2901 REGISTERED LAND SURVEYOR

STATE OF ILLINOIS)
) SS
COUNTY OF MADISON)

I, MICHAEL J. GRAMINSKI, A PROFESSIONAL LAND SURVEYOR, DO CERTIFY THAT THIS DRAWING HAS BEEN PREPARED UNDER MY DIRECT SUPERVISION FOR THE CREATION OF A GMZ LIMITS LEGAL DESCRIPTION. ALL DIMENSIONS ARE IN FEET AND DECIMAL PARTS THEREOF.
DATED THIS 29th DAY OF JULY, 2016.

IPLS LICENSE NUMBER 035.002901, EXPIRES 11/30/2016
PROFESSIONAL DESIGN FIRM LICENSE NUMBER 184.004638, EXPIRES 4/30/2017
THIS SURVEY DOES NOT CONFORM TO THE CURRENT ILLINOIS STANDARD FOR A BOUNDARY SURVEY.

IngenAE
514 Earth City Plaza
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:	Date:
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

PREPARED FOR:

DYNEGY

Project Name & Location:

DYNEGY BALDWIN POWER PLANT
BALDWIN, IL 62217

Drawing Name:

GROUNDWATER MANAGEMENT ZONE (GMZ) PARCEL DESCRIPTION EXHIBIT

Date: 7/27/16	Project No.
Type: SITE	Drawing No.
Drawn By: CMB	1
Approved By: EAS	OF 1
Scale: AS NOTED	

SMARTER SOLUTIONS

EXCEPTIONAL SERVICE

VALUE

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT AND GROUNDWATER MONITORING PLAN

Baldwin Fly Ash Pond System
Baldwin Energy Complex
Baldwin, Illinois

Project No: 2340

March 31, 2016

NATURAL
RESOURCE
TECHNOLOGY

ENVIRONMENTAL CONSULTANTS

NATURAL RESOURCE TECHNOLOGY
ENVIRONMENTAL CONSULTANTS

2422 E. WASHINGTON STREET, SUITE 104
BLOOMINGTON, ILLINOIS 61704
(P) 414.837.3607
(F) 414.837.3608

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION AND GROUNDWATER MONITORING PLAN

BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX
BALDWIN, ILLINOIS

Project No. 2340

Prepared For:

DYNEGY MIDWEST GENERATION, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

Prepared By:

Natural Resource Technology, Inc.
234 W. Florida Street, Fifth Floor
Milwaukee, Wisconsin 53204

March 31, 2016

Stuart J. Cravens, PG
Principal Hydrogeologist

Robert J. Karnauskas, PG
Senior Hydrogeologist

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1 INTRODUCTION

1.1 Overview

This Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan was prepared by Natural Resource Technology, Inc. (NRT) in support of a Closure Plan for fly ash ponds located at the Baldwin Energy Complex (BEC) which is owned by Dynegy Midwest Generation, LLC (DMG).

This report and the Closure Plan will apply specifically to the East Fly Ash Pond, Old East Fly Ash Pond and West Fly Ash Pond, hereinafter referred to as the Baldwin Fly Ash Pond System, which are part of a system of six Coal Combustion Residuals (CCR) surface impoundments, as defined further below.

Numerous subsurface investigations have been performed concerning the ash pond system at BEC. The information presented in this report supplements comprehensive data collection and evaluations from the prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System*** A Phase II assessment to further assess the hydrogeology and groundwater quality in the vicinity of the ash pond system at BEC, following the proposed scope of work (March 22, 2013) approved, with clarifications, by Illinois EPA, June 18, 2013).

- ***Dynegy, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System*** A plan for conducting a more comprehensive hydrogeologic investigation along with development of a groundwater model to evaluate various pond closure scenarios on groundwater quality in the vicinity of the ash pond system; accepted, with clarifications, by Illinois EPA August 31, 2011.

- ***Kelron Environmental, June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System*** Assessed the hydrogeology and groundwater quality in the vicinity of the ash pond system, but not beneath the ash ponds. Thirteen monitoring wells were installed around the perimeter of the ash pond system and sampled quarterly to assess upgradient and downgradient groundwater quality (full inorganic parameter list in IAC 35 Part 620.410). Submitted to Illinois EPA.

- ***Kelron Environmental, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex*** Off-site groundwater quality investigation, south and southwest of the ash pond system, to assess shallow off-site groundwater quality for the presence of inorganic parameters related to CCRs. Submitted to Illinois EPA.

- ***Kelron Environmental and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System*** A survey identifying water wells located within 2,500 feet (ft) of the BEC's ash pond system. The water well survey was prepared in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 IAC 1600.210(b)(1) and 1600.210(b)(2). Submitted to Illinois EPA.

- ***Kelron Environmental and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System*** A plan for initial evaluation of groundwater quality in the vicinity of the ash pond system along with an initial hydrogeologic characterization; accepted, with clarifications, by Illinois EPA August 31, 2011.

This Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan provides a summary of additional data collected and site investigations performed since submittal of the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014) in order to satisfy the following:

- Provide information to define hydrogeology and to assess the groundwater impacts related to the CCR surface impoundments.
- Provide information that could be used to perform a model to assess the groundwater impacts associated with closure of the Baldwin Fly Ash Pond System.
- Provide information to establish a groundwater monitoring program sufficient for long-term, post-closure monitoring.

In conjunction with the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014), groundwater flow and transport models were developed to evaluate the effect of various ash pond closure scenarios on groundwater quality (NRT, June 18, 2014) and to predict the fate and transport of CCR leachate components (NRT, September 30, 2014). Additional groundwater modeling is being conducted to enable estimation of the time required for hydrostatic equilibrium of groundwater beneath the unit. The existing groundwater flow and transport model for the ash pond system is also being updated to develop predictions for closure of the Baldwin Fly Ash Pond System. These groundwater modeling reports will be submitted under separate cover.

1.2 Site Location and Background

The BEC is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BEC is located within Sections 2, 3, 4, 9, 10, 11, 14, 15 and 16 of Township 4 South and Range West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The Baldwin Fly Ash Pond System is approximately one-half mile west-northwest of the Village of Baldwin. The site location is shown on Figure 1. In general, the BEC property is bordered: on the west by the Kaskaskia River; on the east by Baldwin Road, farmland, and strip mining areas; on the southeast by the village of Baldwin; on the south by the Illinois Central Gulf railroad tracks and State Route 154; and, on the north by the St. Clair/Randolph County Line.

The BEC utilizes four active ash ponds with two inactive fly ash ponds, located at the eastern end of the ash pond system (Figure 2):

- Bottom Ash Pond (177 acres, active)

- East Fly Ash Pond (76 acres, inactive)
- Old East Fly Ash Pond (102 acres, inactive)
- West Fly Ash Pond (54 acres, active)
- Secondary Pond (25 acres, active), used for water clarification rather than direct management of CCRs, but does contain a small volume of CCR
- Tertiary Pond (3.1 acres, active), used for final water clarification and contains a very small volume of CCR

There is one outfall from the ash pond system at the Tertiary Pond that discharges to a tributary of the Kaskaskia River, south of the Cooling Pond intake structure. All six impoundments of the ash pond system have been evaluated as part of the previously conducted hydrogeologic investigations, groundwater quality assessments and modeling.

2 GEOLOGY AND HYDROGEOLOGY

The additional site characterization activities performed at BEC since the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014) have included the following:

- Unlithified zone investigation
- Bedrock investigation
- Aquifer testing
- Geotechnical borings and soil laboratory testing

The results of these supplemental site investigations are discussed below.

2.1 Geology

Geologic units present at the ash pond system include fill, ash generated at BEC, unlithified geologic materials (i.e., Cahokia Alluvium, Equality Formation, and Vandalia Till Member) and Mississippian and Pennsylvanian bedrock.

2.1.1 Unlithified Material Investigations

Supplemental investigation within the unlithified materials was performed to further evaluate the potential presence of sand layers that could represent preferential migration pathways. Eleven borings (PZ-169 through PZ-178 and PZ-182) were performed during July-August 2015 as shown on Figure 3. Borings typically extended to bedrock where monitoring wells with 10 ft screens were installed. Boring depths ranged from 14 to 50 ft below ground surface (bgs). The boring logs and piezometer installation details are provided in Appendix C2.

The location of sand seams observed as well as their thickness and base elevation are shown on Figure 4, based on all borings performed within the unlithified materials. Sand seams appear randomly disseminated across the Site and range from one locally continuous unsaturated sand lens up to 7.9 ft in thickness to isolated, discontinuous thin seams 0.2 to 1 ft thick. No continuous sand seams were observed within or immediately adjacent to the Baldwin Fly Ash Pond System that represent significant preferential migration pathways.

Two overlapping sand seams that appear to be continuous between adjacent borings occur to the west of the Baldwin Fly Ash Pond System (Figure 4) and are vertically separated by at least 6 ft of clay. The shallower sand lens at elevations between 395 to 403 ft is not saturated. These sand lenses do not extend to the Baldwin Fly Ash Pond System as evidenced by several borings in which no sand was observed.

AECOM (2015) completed a geotechnical investigation that included additional borings that were reported in the 30% design data package for the ash ponds. The geotechnical exploratory program included the following:

- 26 auger borings at the Baldwin Fly Ash Pond System and Bottom Ash Pond. In addition, 3 hand auger borings were completed.
- 82 Cone Penetrometer Testing (CPT) soundings at the Baldwin Fly Ash Pond System and the Secondary, Tertiary, and Bottom Ash Ponds
- 13 vibrating wire piezometers installed at selected boring locations

The geotechnical exploration locations are shown on AECOM Figure D-01 in Appendix A.

Representative samples from the borings were submitted to AECOM of Conshohocken, Pennsylvania and Terrasense of Totowa, New Jersey for laboratory testing on the soil samples for geotechnical properties. A summary of the AECOM geotechnical laboratory test results on the soil samples is provided in Appendix A. The falling head permeability tests results are discussed below. The boring logs and other geotechnical testing data are being submitted under separate cover for the Bladwin Fly Ash Pond System closure plan.

2.1.2 Bedrock Investigations

Bedrock at the site consists of predominantly shale and limestone with lesser amounts of sandstone. As noted in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014), the Mississippian and Pennsylvanian rocks in the vicinity of the BEC yield small amounts of water to wells from interconnected pores, cracks, fractures, crevices, joints, and bedding planes. Water-bearing openings are variable from place to place and are best developed near the bedrock surface in thin limestones. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (i.e., highly mineralized) with increasing depth.

Supplemental evaluation of bedrock hydraulic conductivity was performed that initially included three deeper holes (MW-304, MW-356, MW-373) extending 95 to 135 ft bgs (82 to 100 ft bgs below the bedrock surface). Packer testing was performed in these coreholes but is not reported herein because the test results were inconclusive. The bedrock was physically deformed by hydrofracking during the test and did not represent actual hydraulic conductivity. Consistent with the site geology and water wells in surrounding area, it was concluded that the most transmissive zone was near the bedrock surface.

Because there were an insufficient number of existing wells for monitoring groundwater in bedrock at the Baldwin Fly Ash Pond System, 16 additional monitoring wells were installed during September 2015 through March 2016. The base of the monitoring well screens were installed an average of approximately 21 ft below the top of bedrock. The additional bedrock monitoring wells installed at each surface impoundment (SI) unit are shown on Figure 3 and included the following.

- 1 monitoring well at an upgradient location (MW-304)
- 10 monitoring wells within and downgradient of the Baldwin Fly Ash Pond System, which is designated as an inactive SI multi unit
- 4 monitoring wells downgradient of the Secondary and Tertiary Ash Ponds, which are designated as an active SI multi unit
- 4 monitoring wells downgradient of the Bottom Ash Pond, which is designated as an active SI unit

Monitoring of upgradient groundwater quality in bedrock will be supplemented with the addition of an existing monitoring well, MW-306, located northeast of the Baldwin Fly Ash Pond System, Well numbers, locations and screened intervals for each SI unit are summarized on the following table and are shown on Figure 3.

Well Number	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)
Upgradient Monitoring Well		
MW-304*	41	45 - 55
MW-306	39	71 - 86
Inactive SI Multi-Unit: Baldwin Fly Ash Pond System		
MW-383	50	58 - 68
MW-384	56	61 - 71
MW-385**	64	80 - 90
MW-386**	64	76 - 86
MW-366	36	42 - 52
MW-375	50	57 - 67
MW-377	31	46 - 56
MW-387**	36	48 - 58
MW-390	40	50 - 65
MW-391	36	55 - 70
Active SI Multi-Unit: Secondary and Tertiary Ponds		
MW-373*	13	20 - 30
MW-374	24	30 - 40
MW-388	27	33 - 43
MW-389	36	42 - 52
Active SI Unit: Bottom Ash Pond		
MW-356*	37	56 - 66
MW-369	47	56 - 66
MW-370	28	53 - 63
MW-382	34	56 - 66

* Deep bedrock borings were partially backfilled to set the well screens at the specified depths
**Monitoring well scheduled to be abandoned (See section 4.3)

Bedrock boring logs and well construction details are in provided in Appendix C5.

Bedrock topography slopes generally to the west and southwest across the CCR surface impoundments. Topographic relief is approximately 45 ft and is shown on Figure 5.

2.2 Hydrogeology

In March 2015, NRT began an assessment of the existing monitoring well network(s) at BEC with respect to the existing CCR units. Included in the assessment was a review of the current placement and number of monitoring wells with respect to individual and contiguous CCR units as well as potential locations for new monitoring wells, as appropriate. Analytical data for the existing monitoring wells was reviewed to assure that the current well constructions were adequate to provide low turbidity samples during collection of unfiltered samples. None of the monitoring wells exhibited poor construction, evidence of damage or appeared to be otherwise compromised.

The discussion below summarizes the results of the supplemental well installations.

2.2.1 Uppermost Aquifer

The hydrogeology of the ash pond system was comprehensively addressed in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). An uppermost aquifer within the area of the six impoundments at the BEC has not been previously designated. Off-site, immediately upgradient and downgradient of the site property boundaries, both the shallow glacial deposits and the shallow bedrock have served as a source of water supply. The shallow unlithified deposits off-site have yielded water through intermittent, discontinuous sand lenses and, in the bedrock, through fractured sandstone and limestone. However, within the area of the ash impoundment only thin and intermittent sand lenses are present. Based on the above, the bedrock is the only viable aquifer in the vicinity of the ash impoundments and is being designated the uppermost aquifer, consistent with the US Environmental Protection Agency (USEPA) definition in 40 CFR Part 257.53 (USEPA, 2015). Seventeen new monitoring wells, as described above, were installed in 2015 and 2016 for purposes of groundwater monitoring within bedrock to comply with the monitoring requirements of 40 CFR Part 257.

Groundwater flow in bedrock is generally to the west and southwest, based on elevation measurements collected on March 2, 2016 (Figure 6). Piezometric heads in bedrock range from less than 1 ft to about 29 ft bgs.

2.2.2 Other Monitorable Units

Other monitorable units representing potential ash constituent migration pathways include glacial deposits and the uppermost bedrock surrounding and within the ash impoundments. The glacial deposits and uppermost bedrock are currently monitored in compliance with existing Illinois EPA permits. Groundwater in these existing wells will continue to be monitored to comply with 35 IAC Part 620 and BEC's existing NPDES permit.

Groundwater elevation measurements have been measured on a quarterly basis. Groundwater flow in the unlithified glacial materials is to the west, based on elevation measurements collected on November 10, 2015 (Figure 7). The westerly direction of flow is consistent with previous groundwater contour maps in the unlithified deposits (NRT, June 11, 2014). The depth to the potentiometric surface in the unlithified materials ranges from 3.2 to 17.7 ft bgs.

2.2.3 Hydraulic Conductivity

Field hydraulic conductivity tests performed on the unlithified geologic materials (i.e., Cahokia Alluvium, Equality Formation, and Vandalia Till Member) and Mississippian and Pennsylvanian bedrock at the Site were presented the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). The unlithified and bedrock geologic materials had geometric mean hydraulic conductivities of approximately $3x10^{-5}$ cm/s and $5x10^{-6}$ cm/s, respectively.

Six falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on undisturbed soil samples collected from the AECOM (2015) geotechnical borings BAL-B001, BAL-B008, BAL-B010, BAL-B011, BAL-B017 and BAL-B027. Sample locations are shown on AECOM Figure D-01 in Appendix A. Test methods and details are provided in Appendix B and the results are summarized below.

Laboratory Hydraulic Conductivity Test Results

Boring Number	Sample Description	Sample Depth (feet)	Hydraulic Conductivity (cm/sec)
BAL-B001	Medium stiff, moist, pale gray with orange mottling, medium plasticity Lean CLAY (CL), trace fine gravel. [TILL]	35.6	$1.3 x10^{-8}$
BAL-B008	Very stiff, moist, light brown with orange and gray mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]	10.8	$5.5 x10^{-9}$
BAL-B010	Stiff, moist to wet, gray, Silty CLAY (CL), iron staining, trace sand and clay. [LOESS]	21.3	$2.4 x10^{-6}$
BAL-B011	Stiff, moist, gray with faint orange mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]	15.2	$1.8 x10^{-9}$
BAL-B017	Stiff, gray, medium plasticity CLAY (CL). [RESIDUAL]	26.7	$1.7 x10^{-8}$
BAL-B027	Stiff, moist to wet, gray, Lean CLAY (CL), with silt and fine sand, trace gravel, iron staining. [TILL]	26.9	$5.0 x10^{-9}$

3 GROUNDWATER QUALITY

3.1 Summary of Groundwater Monitoring Activities

An initial six quarters of sampling and analysis of groundwater from monitoring wells at the Baldwin Fly Ash Pond System was conducted from November 2010 through March 2012. The groundwater quality data collected from 2010 through 2012 included field parameters and the full list of inorganic parameters listed in 35 IAC Part 620 Section 420 (Groundwater Quality Standards for Class II: General Resource Groundwater) except for vanadium and perchlorate. Based on the results of the initial 2010–2012 (Phase I) investigation (Kelron, June 30, 2012), additional monitoring wells and piezometers were installed upgradient, downgradient, and within the ash pond system as part of the Phase II investigation (NRT, June 11, 2014). Further, the list of monitoring parameters was reduced to boron, iron, manganese, chloride, sulfate, TDS, and pH commencing in September 2013.

Samples are currently collected quarterly from 14 monitoring wells in accordance with NPDES Permit No. IL0000043 (effective January 1, 2015) for the following laboratory and/or field parameters:

Laboratory Parameters		
Boron	Manganese (total)	Sulfate
Chloride	Nitrate	Total Dissolved Solids (TDS)
Iron (total)		

Field Parameters	
pH	Depth of Well (ft bgs)
Specific Conductance	Elevation of measuring point (mp)
Temperature	Depth to Water (ft below mp)
	Groundwater Elevation (ft)

Groundwater monitoring results from sampling of the 14 wells are reported to the Illinois EPA annually in accordance with the NPDES permit.

3.2 Groundwater Monitoring Results

Analytical results from November 2010 through November 2015, including non-NPDES permit required wells, are summarized in Appendix D. Statistics showing the minimum and maximum concentrations detected in the unlithified materials, bedrock and leachate wells is included. Also, a comparison of groundwater data from wells screened in unlithified materials relative to the Groundwater Quality Standards for Class II: General Resource Groundwater is shown. The well locations are shown on Figure 3.

Parameters that have been detected in groundwater at concentrations exceeding the Class II groundwater quality standards include the following:

Boron	Iron	Sulfate
Chloride*	Manganese	TDS
pH		

*exceeded in bedrock well only; background chloride concentration in bedrock to be determined

Class II parameters that have not been detected in groundwater include the following:

Beryllium	Chromium	Mercury
Cadmium	Cyanide	Thallium

All other Class II parameters that have been detected are typically well below their respective groundwater quality standards.

Quarterly groundwater sampling of the new bedrock well network commenced in January 2016.

3.3 Statistical Evaluation of Background Groundwater Data

A statistical evaluation was performed to determine the maximum background concentrations likely to occur upgradient of the Baldwin Fly Ash Pond System within the unlithified glacial materials. The groundwater quality data collected from upgradient monitoring wells MW-104S/SR and MW-104D/DR was evaluated using the Electric Power Research Institute (EPRI, March 2014) computer database and analysis program, MANAGES™ (Version 3.4.49). The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. “Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance,” March 2009, EPA 530/R-09-2007 (USEPA, 2009).

The statistical methodology is provided in Appendix E. Establishing the tolerance interval(s) for the groundwater constituents was accomplished by using either a parametric or non-parametric procedure based on the percentage of non-detects in the data sets and the distribution of the sample population. If the statistical data for a constituent had less than 50 percent non-detects and was normally or log-normally distributed, a parametric procedure was used. If the data was not normally or log-normally distributed or had more than 50 percent non-detects, a non-parametric procedure was used. Appendix E, Figure E-1 is a flow chart which illustrates the processes followed to determine the appropriate statistical procedure used for each constituent based on its statistical characteristics.

3.4 Statistical Analysis Results

The results of the statistical analyses for the groundwater in the unlithified materials are located in Appendix E. A statistical summary of the background water quality data from MW-104S/SR and MW-104D/DR is provided in Table E-2, and includes the mean, median, minimum, maximum, standard deviation, Sen Slope trend, normality determination, and percent non-detects for the background dataset. The statistical analysis procedure inputs and results are provided in Table E-3.

Calculated background values (upper and lower limits) for the tested inorganic constituents and pH are listed in Appendix E, Table E-1 along with the percent non-detects, normal or lognormal distribution, test method, and confidence level. The calculated background values are also shown on Table 1 and are compared to the groundwater quality standards for Class II: General Resource Groundwater. The higher of the two values is shown as the Applicable Groundwater Standard on Table 1 (see additional discussion provided in Section 5.2).

4 GROUNDWATER MONITORING SYSTEM

A groundwater monitoring system is proposed for the Baldwin Fly Ash Pond System to monitor groundwater, evaluate post-closure groundwater quality and trends, and to demonstrate compliance with the applicable groundwater quality standards identified in Section 5. The proposed groundwater monitoring well networks consist of a sufficient number of wells, installed at appropriate locations and depths to monitor post-closure compliance with groundwater quality standards for Class II: General Resource Groundwater.

The groundwater monitoring program is consistent with the requirements of 35 IAC Part 620 and 40 CFR Part 257 and includes two monitoring well networks. As discussed in Section 2.2, groundwater within the glacial deposits and uppermost bedrock will continue to be monitored to comply with 35 IAC Part 620 and BEC's existing NPDES permit. The second monitoring well network will monitor groundwater within bedrock, which is the only viable aquifer in the vicinity of the ash impoundments and is being designated the uppermost aquifer.

The monitoring wells are designed and constructed in accordance with applicable standards, including the following:

- All monitoring wells are cased in a manner that maintains the integrity of the boreholes
- Wells are screened to allow sampling only at the specified interval
- All wells are covered with vented caps, unless located in flood-prone areas, and equipped with devices to protect against tampering and damage

Both monitoring well networks described below fulfill the following goals:

- Enable the collection of groundwater samples that represent the quality of background water that has not been affected by the Baldwin Fly Ash Pond System
- Enable the collection of groundwater samples that represent the quality of downgradient groundwater
- Include wells that are located within the stratigraphic unit(s) that may serve as potential chemical migration pathways

4.1 Proposed Modified NPDES Monitoring Well Network

The proposed modified NPDES monitoring well network includes 17 monitoring wells. Thirteen wells will be sampled and analyzed for laboratory and field parameters which are equivalent to the current NPDES Permit parameters. These wells include MW-104SR, MW-104DR, MW-150, MW-350, MW-151, MW-152, MW-252, MW-352, MW-153, MW-253, MW-154, MW-155, and MW-355. Eleven of these wells are screened in the unlithified materials and three wells are screened in the bedrock. Two background bedrock monitoring wells (MW-304, MW-306) will also be sampled and analyzed for an expanded laboratory parameter list and field parameters, as described in Section 6.1.1.

The above monitoring wells are supplemented by 2 locations (MW-156, and MW-157S) that will monitor specific conductance, temperature and groundwater elevations only.

The proposed modified NPDES monitoring well network goes beyond Special Condition 17 of the existing NPDES permit for the Baldwin groundwater sampling program with the addition of wells MW-151, MW-304 and MW-306 in the groundwater monitoring system,

Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix C. The proposed modified NPDES monitoring well network locations are shown on Figure 8. The well depths, well screen intervals, depth to groundwater elevations and monitored units at the proposed monitoring well network locations are summarized below:

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-104SR	15	5 - 15	10.5	Upgradient Shallow Unlithified	Clay
MW-104DR	35	23 - 28	10.6	Upgradient Deep Unlithified	Clay; Poorly Graded Sand
MW-304	135	45-55	10.6	Upgradient Bedrock	Limestone
MW-306	86	71-86	NM	Upgradient Bedrock	Limestone
MW-150	25	15 - 25	16.6	Downgradient Shallow Unlithified	Clay
MW-350	47	42 - 47	19.5	Downgradient Bedrock	Limestone
MW-151	16	6 - 16	NM	Downgradient Shallow Unlithified	Clay
MW-152	18	7 - 17	3.5	Downgradient Shallow Unlithified	Clay; Poorly Graded Sand
MW-252	50	44 - 49	2.7+	Downgradient Deep Unlithified	Clay
MW-352	74	68 - 73	3.7	Downgradient Bedrock	Shale and Limestone
MW-153	21	10 - 20	11.6	Downgradient Shallow Unlithified	Clay

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-253	35	30 - 35	9.8	Downgradient Deep Unlithified	Clay
MW-154	13	7 - 12	10.7	Downgradient Shallow Unlithified	Clay
MW-155	21	10 - 20	17.7	Downgradient Shallow Unlithified	Clay; Clayey Sand
MW-355	33	27 - 32	20.9	Downgradient Bedrock	Limestone
MW-156*	18	8 - 18	4.6	Downgradient Shallow Unlithified	Clay
MW-157S*	18	8 - 18	3.2	Downgradient Shallow Unlithified	Clay

+ indicates groundwater elevation above ground surface
Groundwater depth elevations shown are from November 10, 2015; NM indicates groundwater elevation was not measured.
* MW-156 also known as OW-156, MW-157S also known as OW-157; monitored for specific conductance, temperature and groundwater elevations only

4.2 40 CFR Part 257 Monitoring Well Network

The 40 CFR Part 257 well network consists of 7 monitoring wells installed in bedrock adjacent to the Baldwin Fly Ash Pond System (MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, MW-391) and 2 background monitoring wells (MW-304, MW-306). The bedrock wells monitor the uppermost aquifer. Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix C5. Sampling of these wells commenced in January 2016, with the exception of MW-306, MW-390 and MW-391 (expected to commence in March 2016). The 40 CFR Part 257 groundwater monitoring network well locations are shown on Figure 8.

The well depths, well screen intervals, depth to groundwater and monitored units at the 40 CFR Part 257 monitoring well network locations are summarized below:

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-304	135	45 - 55	8.0	Upgradient Bedrock	Shale and Limestone
MW-306	86	71-86	10.6	Upgradient Bedrock	Shale and Limestone
MW-366	52	42-52	10.5	Downgradient Bedrock	Shale and Limestone

Well Number	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Depth To Groundwater (ft bgs)	Unit Monitored	Screened Interval Lithology
MW-375	67	57-67	29.0	Downgradient Bedrock	Shale and Limestone
MW-377	56	46-56	0.3	Downgradient Bedrock	Shale and Limestone
MW-383	73	58 - 68	17.0	Downgradient Bedrock	Shale and Limestone
MW-384	94	61 - 71	6.9	Downgradient Bedrock	Shale and Limestone
MW-390	65	50 - 65	NM	Downgradient Bedrock	Shale and Limestone
MW-391	70	55 - 70	NM	Downgradient Bedrock	Shale and Limestone

Groundwater depth elevations shown are from March 2, 2016
NM indicates groundwater elevation was not measured.
Groundwater elevations may have not yet fully stabilized.

4.3 Abandoned Wells

Three piezometers (TPZ-163, TP-167 and TPZ-168) are located within the Baldwin Fly Ash Pond System. These former leachate monitoring wells will be properly abandoned prior to their being damaged or destroyed during the impoundment closure activities. Leachate data collected from these piezometers are provided in Appendix D for a limited set of parameters.

Two bedrock monitoring wells (MW-385 and MW-386) are located within the Baldwin Fly Ash Pond System along the berm separating the East and West Fly Ash Ponds. These monitoring wells will also be properly abandoned prior to their being damaged/destroyed during the impoundment closure activities.

Monitoring well MW-387 is located on the West Fly Ash Pond berm and does not provide sufficient water depth for sampling. This bedrock monitoring well will be properly abandoned and will be replaced with a new well, MW-391.

The locations of monitoring wells to be abandoned are shown on Figure 3.

5 APPLICABLE GROUNDWATER QUALITY STANDARDS

5.1 Groundwater Classification

The classification of groundwater at the Baldwin Fly Ash Pond System was addressed in the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014). Field hydraulic conductivity tests performed on the unlithified geologic materials (i.e., Cahokia Alluvium, Equality Formation, and Vandalia Till Member) and Mississippian and Pennsylvanian bedrock at the Site had geometric mean hydraulic conductivities of approximately $3x10^{-5}$ cm/s and $5x10^{-6}$ cm/s, respectively.

Geologic material with a hydraulic conductivity of less than $1x10^{-4}$ cm/s which does not meet the provisions of Section 620.210 (Class I), Section 620.230 (Class III), or Section 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater. Based on the detailed geologic information provided for the unlithified materials and bedrock at BEC, along with the hydrogeologic data, the groundwater in both the unlithified deposits and underlying bedrock at the Site can be classified as Class II - General Resource Groundwater.

5.2 Applicable Groundwater Quality Standards

The groundwater quality standard for the proposed modified NPDES monitoring well network for wells screened in unlithified materials is the greater of either the background concentration or the groundwater quality standard for Class II General Resource Groundwater [35 IAC 620.420]. Based on the statistical evaluation of background groundwater data (Table 1), most background concentrations in the unlithified materials are below the groundwater quality standard for Class II General Resource Groundwater. Therefore, for these parameters, the groundwater quality standard for Class II General Resource Groundwater will apply to the proposed modified NPDES monitoring well network for wells screened within unlithified material. The exceptions include total iron, dissolved iron, dissolved manganese and pH (lower limit), where the background concentration is higher (or lower for pH lower limit) than the Class II standard. Therefore, for these parameters, the background concentration is the applicable groundwater standard.

Background groundwater quality in bedrock will be established through statistical evaluation following completion of 8 quarters of groundwater sampling of background wells MW-304 and MW-306 that commenced in January 2016. The groundwater quality standard for the proposed modified NPDES monitoring well network (bedrock wells) at the Baldwin Fly Ash Pond System will be the greater of either the background concentration or the groundwater quality standard for Class II General Resource

Groundwater. The list of applicable groundwater quality standards for the modified NPDES monitoring well network is shown on Table 1.

The groundwater quality standards (i.e., Groundwater Protection Standard) for the 40 CFR Part 257 well network will be established in accordance with the methods outlined in 40 CFR Part 257 following the collection of 8 independent samples from each of the upgradient and downgradient monitoring wells, with completion of the final sample event required by October 17, 2017.

5.3 Proposed Exceptions to the Groundwater Monitoring Parameters

Based on the results of groundwater monitoring performed at the site to date for the proposed modified NPDES monitoring well network, the following exceptions to the above applicable Class II: General Resource Groundwater standards are proposed:

- Analytical results (Appendix D) do not indicate exceedances of the groundwater quality standards for Class II General Resource Groundwater inorganic constituents listed in 35 IAC 620.420(a)(1). The analyzed constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, cyanide, fluoride, lead, mercury, nitrate, and thallium.[1] With the exception of nitrate, these constituents will not be monitored because they are well below the standards for Class II General Resource Groundwater and are not prevalent in groundwater associated with the Baldwin Fly Ash Pond System.

- Analytical results (Appendix D) do not indicate exceedances of the groundwater quality standards for Class II General Resource Groundwater for inorganic constituents copper, nickel, selenium, silver, and zinc listed in 35 IAC 620.420(a)(2). These constituents will not be monitored because they are well below the standards for Class II General Resource Groundwater and are not prevalent in groundwater associated with the Baldwin Fly Ash Pond System.

- Perchlorate is commonly used as an oxidizer in solid propellants, munitions, fireworks, airbag initiators for vehicles, matches and signal flares. It is also used in some electroplating operations and found in some disinfectants and herbicides (USEPA, 2014). Perchlorate is an inorganic constituent listed in 35 IAC 620.420(a)(1) but has not been previously analyzed. Perchlorate will not be monitored because it is not associated with the chemical characteristics of the Baldwin Fly Ash Pond System.

The proposed groundwater monitoring parameters for the proposed modified NPDES monitoring well network and 40 CFR Part 257 groundwater monitoring well network are discussed in Section 6.1.

[1] Perchlorate, vanadium and Ra-226/Ra-228 are parameters listed in 35 IAC 620.420(a)(1) but have not been analyzed.

6 GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards for Class II: General Resource Groundwater as well as USEPA parameters, as appropriate. As discussed in Section 4, the proposed post-closure groundwater sampling network consists of four background monitoring wells and 20 compliance monitoring wells as shown on Figure 8.

6.1 Monitoring Parameters

6.1.1 Proposed Modified NPDES Monitoring Well Network

The proposed modified NPDES monitoring well network includes 17 monitoring wells. Thirteen wells will continue to be sampled and analyzed for the laboratory and field parameters listed below which are equivalent to the current NPDES Permit parameters. These wells include MW-104SR, MW-104DR, MW-150, MW-350, MW-151, MW-152, MW-252, MW-352, MW-153, MW-253, MW-154, MW-155, and MW-355.

Laboratory Parameters		
Boron (dissolved)	Manganese (total)	Sulfate (dissolved)
Chloride (dissolved)	Nitrate (total)	Total Dissolved Solids (TDS)
Iron (total)		

Field Parameters	
pH	Depth of Well (ft bgs)
Specific Conductance	Elevation of measuring point (mp)
Temperature	Depth to Water (ft below mp)
	Groundwater Elevation (ft)

As discussed in Section 5, other constituents listed under 35 IAC 620 will not be monitored at the proposed modified NPDES monitoring well network because the groundwater monitoring results to date indicate that the inorganic constituents antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, cyanide, fluoride, lead, mercury, nickel, selenium, silver, thallium and zinc meet the Class II: General Resource Groundwater standards and are not associated with the chemical characteristics of the Baldwin Fly Ash Pond System.

Two monitoring wells, MW-156 and MW-157S, are monitored for specific conductance, temperature and groundwater elevation.

Two proposed background bedrock monitoring wells (MW-304, MW-306) will be sampled and analyzed for the following laboratory and field parameters:

Laboratory Parameters		
Boron (dissolved)	Manganese (total)	Sulfate (dissolved)
Chloride (dissolved)	Nitrate (total)	Total Dissolved Solids (TDS)
Iron (total)		
Field Parameters		
pH	Depth of Well (ft bgs)	
Specific Conductance	Elevation of measuring point (mp)	
Temperature	Depth to Water (ft below mp)	
	Groundwater Elevation (ft)	

As discussed in Section 5, perchlorate will not be monitored because this parameter is not associated with the chemical characteristics of the Baldwin Fly Ash Pond System.

6.1.2 40 CFR Part 257 Monitoring Well Network

The 40 CFR Part 257 well network consists of 7 monitoring wells installed in bedrock adjacent to the Baldwin Fly Ash Pond System (MW-366, MW-375, MW-377, MW-383, MW-384, MW-390, MW-391) and 2 background monitoring wells (MW-304, MW-306). Groundwater samples will be collected and analyzed for the following laboratory and field parameters:

Laboratory Parameters		
Metals (totals)		
Antimony	Cadmium	Lithium
Arsenic	Calcium	Mercury
Barium	Chromium	Molybdenum
Beryllium	Cobalt	Selenium
Boron	Lead	Thallium
Inorganics (totals)		
Fluoride	Sulfate	
Chloride	Total Dissolved Solids	
Other (total)		
Radium 226 and 228 combined		
Field Parameters		
pH	Temperature	
Oxidation/Reduction Potential	Specific Conductivity	
Dissolved Oxygen	Turbidity	

All parameters listed above will be sampled a minimum of eight times by October 17, 2017 to establish background groundwater quality. Following the initial eight rounds of sampling, the parameters to be monitored will be in accordance with the requirements of 40 CFR Part 257.94 and 257.95.

6.2 Sampling Schedule

Groundwater sampling for the proposed modified NPDES monitoring well network will initially be performed quarterly according to the following schedule:

Frequency	Duration
Quarterly	Begins: upon approval of this plan.
	Ends: 5 years after completion of cap and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to the Baldwin Fly Ash Pond System.
Semiannual	Begins: after IEPA approves that quarterly monitoring requirements have been satisfied.
	Ends: 5 years after initiation of semiannual monitoring and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to the Baldwin Fly Ash Pond System.
Annual	Begins: after IEPA approves that semiannual monitoring requirements have been satisfied.
	Ends: upon IEPA approval of a certified post-closure care report.

Five years after approval of the Closure Plan, a request may be made to modify the post-closure care plan to reduce the frequency of groundwater monitoring to semi-annual sampling by demonstrating all of the following:

- Monitoring effectiveness will not be compromised by the reduced frequency of monitoring
- Sufficient data has been collected to characterize groundwater
- Concentrations of constituents monitored at the downgradient boundaries show no statistically significant increasing trends that can be attributed to the former ash ponds

If concentrations of parameters of concern at the downgradient boundaries of the site show no statistically significant increasing trends that can be attributed to the Baldwin Fly Ash Pond System for the five years after reducing the monitoring frequency to semi-annual, a request may be made to modify the post-closure care plan to reduce monitoring frequency to annual sampling by demonstrating the same items above as for the reduction to semi-annual monitoring.

Groundwater monitoring may be discontinued upon Illinois EPA's approval of a certified post-closure care report. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

Groundwater monitoring for the 40 CFR Part 257 well network will follow a schedule in accordance with the requirements of 40 CFR Part 257.94 and 257.95.

6.3 Groundwater Sample Collection

Groundwater samples will be collected consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 as described in Appendix F. In addition to groundwater well samples, quality assurance samples will be collected as described in Section 6.5.

6.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93 by a state-certified laboratory using methods approved by Illinois EPA and USEPA. The practical quantitation limit (PQL) for all parameters analyzed will be lower than the applicable groundwater quality standard. Concentrations lower than the PQL will be reported as less than the PQL.

6.5 Quality Assurance Program

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.93, the sampling and analysis program includes procedures and techniques for quality assurance and quality control. Additional quality assurance samples to be collected will include the following:

- Two blind duplicate groundwater samples from randomly selected monitoring wells
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, than equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected

- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

6.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 IAC Part 620 and 40 CFR 257.91, maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event. Monitoring well inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks that wells are clear of internal obstructions, and flow freely

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

6.7 Annual Statistical Analysis

6.7.1 Proposed Modified NPDES Monitoring Well Network

Trend analysis will be performed annually for each of the monitored parameters. Sen's Estimate of Slope will be applied to a minimum of four consecutive quarterly monitoring results. If there are increasing trends during closure and post-closure care periods, they will be further investigated as described below.

- If the results of sampling and analysis show an increasing trend at any compliance monitoring well, a Mann-Kendall analysis will be performed at 95 percent confidence to determine whether or not the increasing trend is statistically significant.
- If a statistically significant increasing trend occurs during post-closure care, further investigation of monitored concentrations will be performed as well as more frequent inspections of the surface of the cover system.

- If the investigation attributes a statistically significant increasing trend to a source other than the Baldwin Fly Ash Pond System, then the Illinois EPA will be notified in writing, stating the cause of the increasing trend and providing the rationale used in such a determination.
- If there is not an alternative source causing the statistically significant increasing concentration and the sampling frequency had been reduced to semi-annual or annual sampling, a quarterly sampling schedule will be reestablished. The frequency of sampling will return to either semi-annual or annual, once four consecutive quarterly samples show no statistically significant increasing trend.

Notifications concerning statistically significant increasing trends and revisions of the sampling frequency will be reported to Illinois EPA in writing within 30 days after making the determinations.

6.7.2 40 CFR Part 257 Monitoring Well Network

As required in 40 CFR Part 257.93, statistical analysis will be performed to determine whether or not a statistically significant increase over a background value has occurred for each constituent and at each well. Appropriate statistical methods will be chosen from the list of methods provided and the test chosen will be conducted separately for each constituent in each monitoring well. In addition, each statistical method chosen will comply with the performance standards, as appropriate, based on the test method used. If a statistically significant increase over background values is determined, procedures from 40 CFR Part 257 will be followed including 1) establishing an assessment monitoring program or 2) demonstrating that a source other than the Baldwin Fly Ash Pond System caused the increase or demonstrating another plausible reason for the increase (error in sampling, etc.).

6.8 Data Reporting

Sampling and analysis data from quarterly, semi-annual and/or annual groundwater monitoring for the modified NPDES monitoring well network will be reported to Illinois EPA within 60 days after completion of sampling. Statistical analysis of the laboratory analytical data will be reported to Illinois EPA with the annual report for the facility, as described in the closure plan.

Data reporting for the 40 CFR Part 257 monitoring well network will be consistent with recordkeeping, notification, and internet posting requirements described in 40 CFR 257.105 through 257.107.

6.9 Compliance with Applicable On-Site Groundwater Quality Standards

Compliance with on-site groundwater quality standards, as measured at the modified NPDES monitoring well network, will be achieved when there are no statistically significant increasing trends that are attributed to the Baldwin Fly Ash Pond System for parameters detected at the compliance boundary for four (4) consecutive years following the change to an annual monitoring frequency.

Evaluation of groundwater quality data under USEPA (2015) will be consistent with 40 CFR Part 257.93 and 257.94.

6.10 Corrective Action

If a statistically significant increasing trend is observed to continue over a period of two or more years in groundwater sampled at the modified NPDES monitoring well network, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Baldwin Fly Ash Pond System and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan. A corrective action plan will be submitted to Illinois EPA within 180 days after completion of the investigation activities. The plan will propose corrective actions to be undertaken to mitigate the impacts associated with the constituents of concern which exceed applicable groundwater standards.

7 REFERENCES

AECOM, December 17, 2015. 30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.

Dynegy, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System

Kelron Environmental and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System

Kelron Environmental and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System

Kelron Environmental, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex

Kelron Environmental, June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System

NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System

NRT, June 18, 2014. Groundwater Model and Simulation of Closure Alternatives, Baldwin Ash Pond System

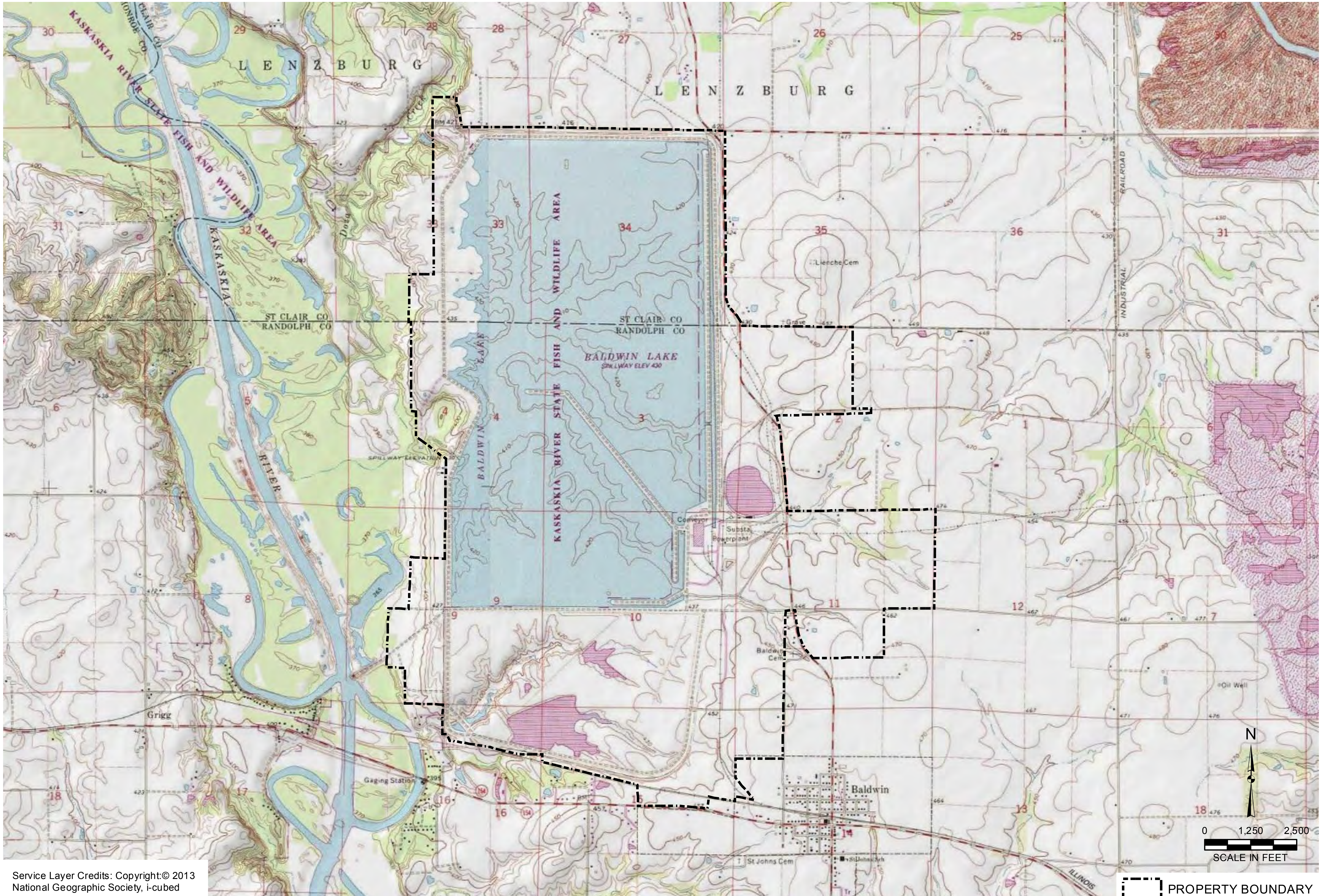
NRT, September 30, 2014. Groundwater Model and Simulation of Closure Alternatives, Model Report Addendum Baldwin Ash Pond System

USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09/007, U.S. Environmental Protection Agency, Office of Resource Conservation and Recovery, Washington, D.C., 554 p. + 4 app.

USEPA, January 2014. Technical Fact Sheet – Perchlorate

USEPA, April 17, 2015. 40 CFR Parts 257and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule

FIGURES



DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

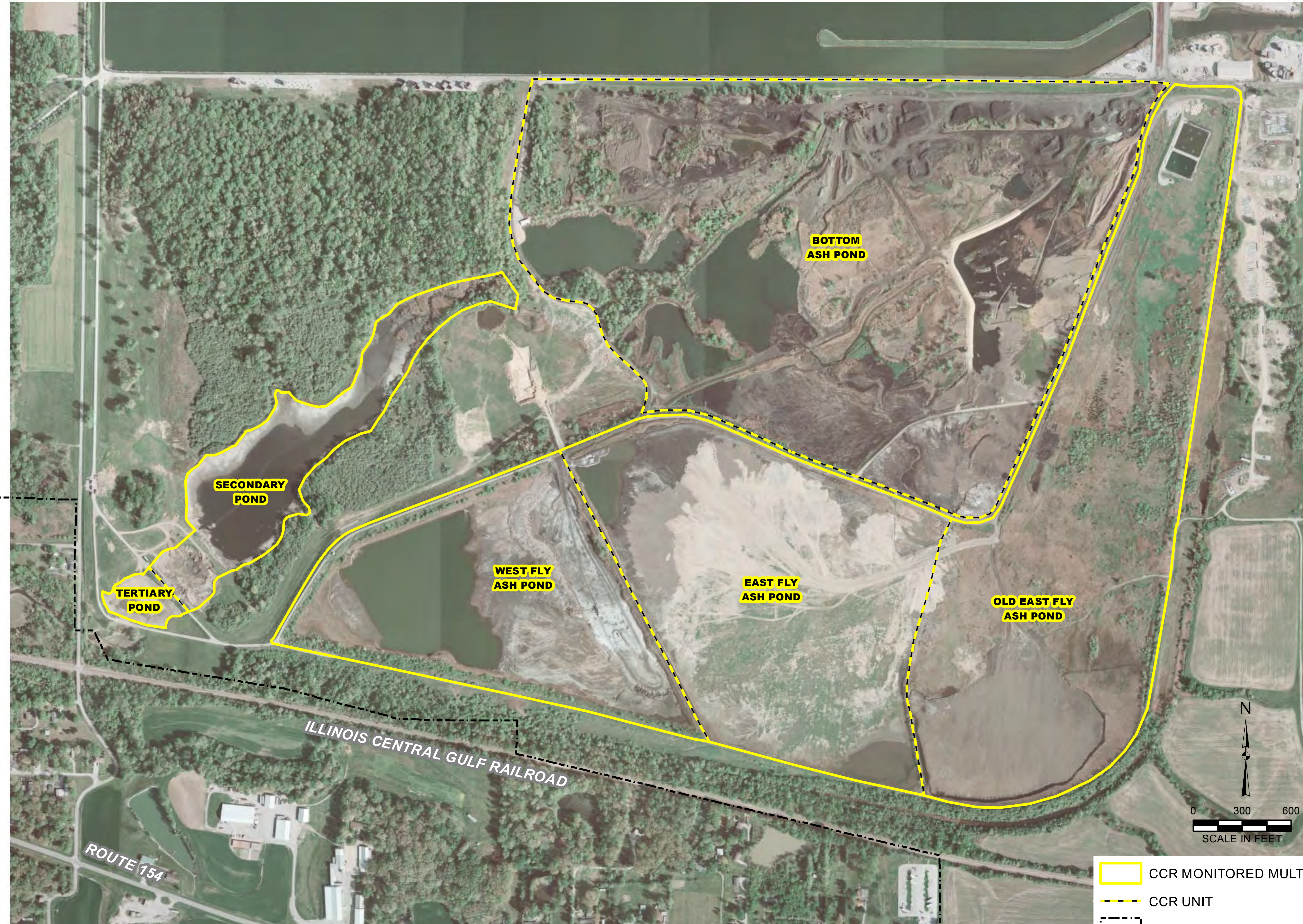
SITE LOCATION MAP

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



AERIAL PHOTO SOURCE: HENDERSON AERIAL SURVEYS (4/2/2012).

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

AERIAL PHOTOGRAPH OF SITE AND ASH POND SYSTEM

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 2

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 2_Aerial Photograph of Ash Pond System.mxd Author: tcushman; Date/Time: 3/2/2016, 2:03:10 PM

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

MONITORING WELL LOCATION MAP

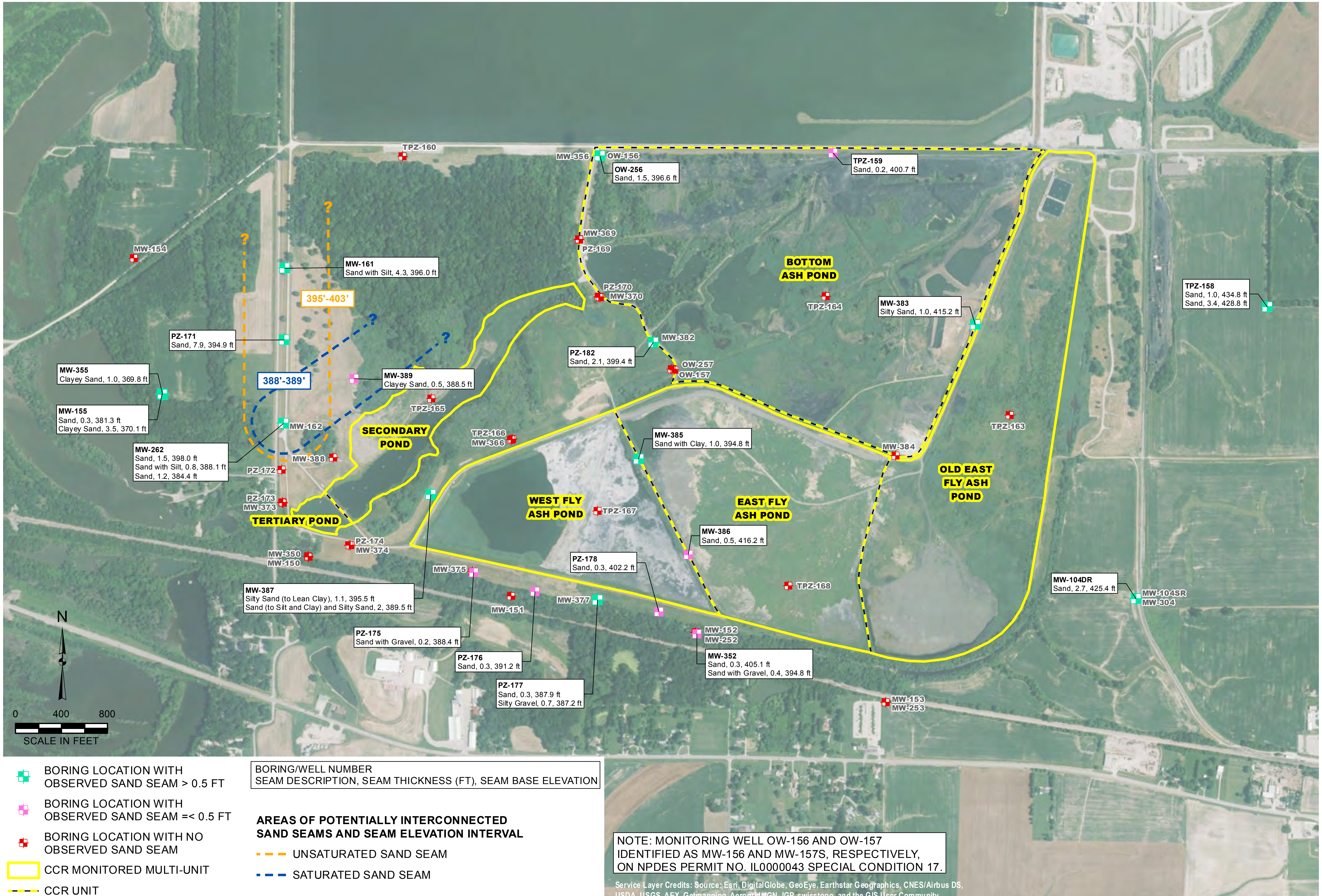
SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 3

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 3_Monitoring Well Location Map.mxd Author: tcushman; Date/Time: 3/7/2016, 9:31:47 AM



DRAWN BY/DATE:
TDC 2/25/16
REVIEWED BY/DATE:
RJK 2/25/16
APPROVED BY/DATE:
SJC 3/2/16

SAND SEAM OBSERVATIONS, THICKNESS AND ELEVATIONS

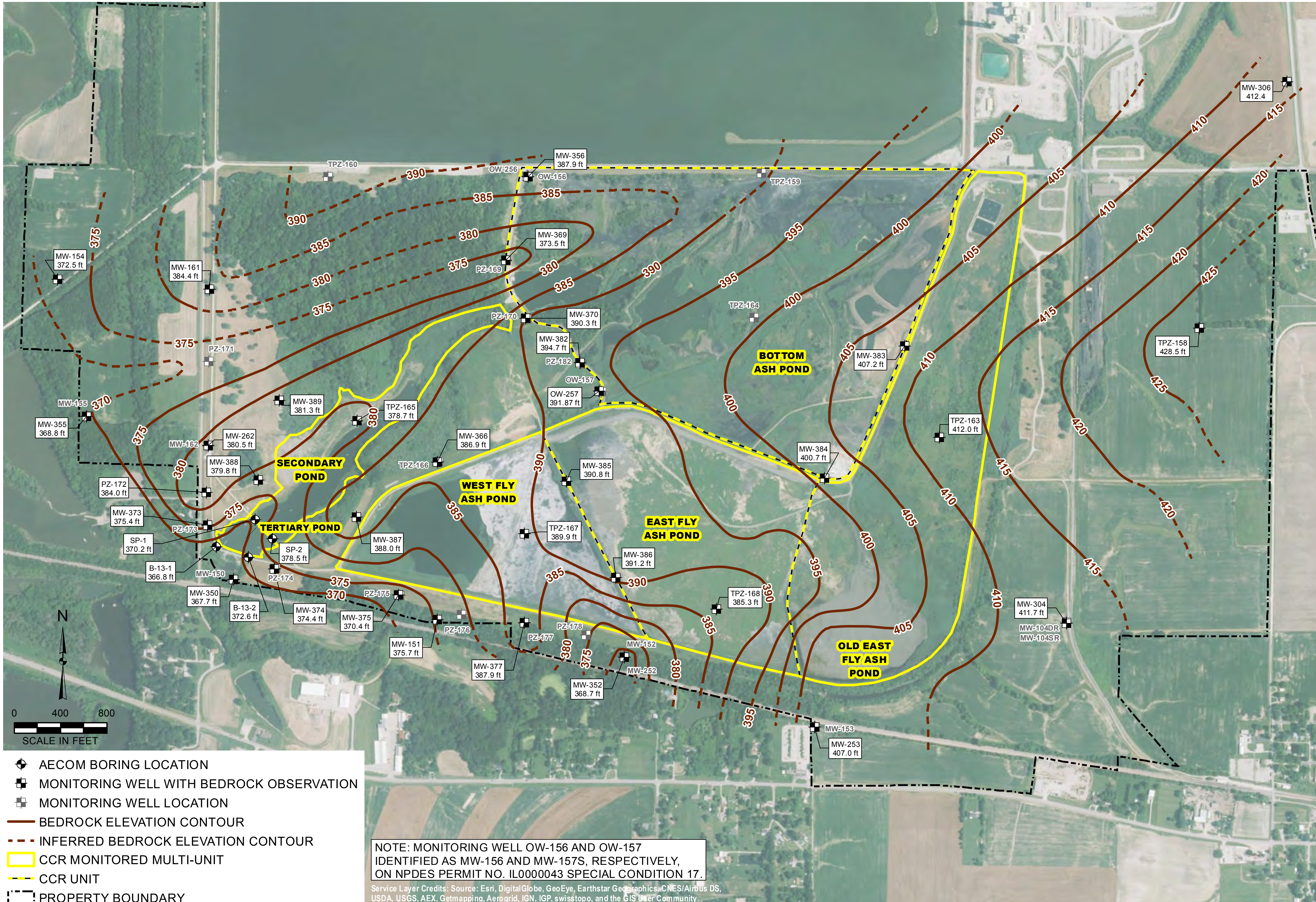
SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 4

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 4_Sand Seam Observations Thickness and Elevations.mxd Author: tcushman; Date/Time: 3/2/2016, 2:02:06 PM



DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: JJW 2/26/16
APPROVED BY/DATE: SJC 3/2/16

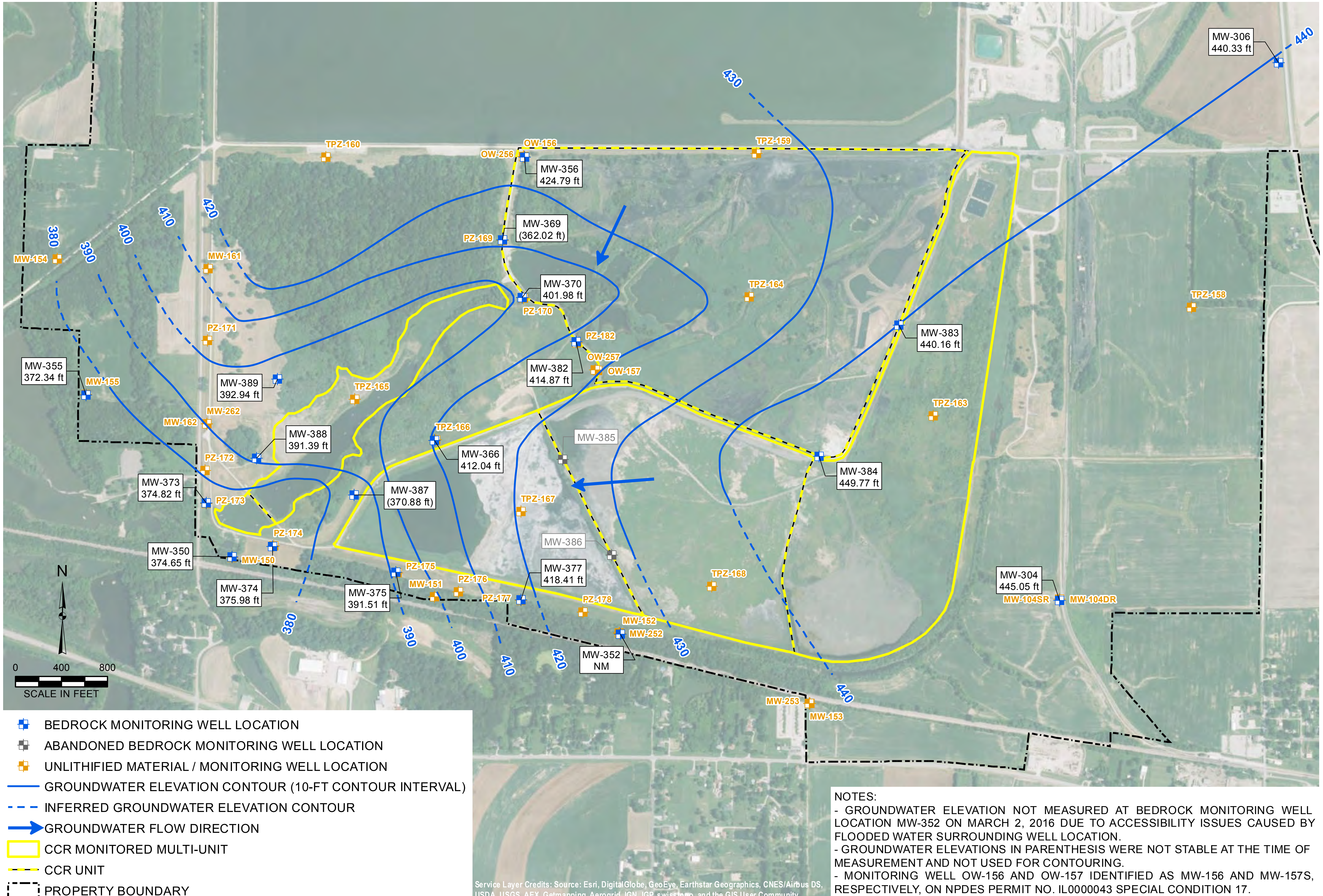
BEDROCK TOPOGRAPHY

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 5

NATURAL RESOURCE TECHNOLOGY



BEDROCK MONITORING WELL LOCATION
ABANDONED BEDROCK MONITORING WELL LOCATION
UNLITHIFIED MATERIAL / MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED MULTI-UNIT
CCR UNIT
PROPERTY BOUNDARY

NOTES:
- GROUNDWATER ELEVATION NOT MEASURED AT BEDROCK MONITORING WELL LOCATION MW-352 ON MARCH 2, 2016 DUE TO ACCESSIBILITY ISSUES CAUSED BY FLOODED WATER SURROUNDING WELL LOCATION.
- GROUNDWATER ELEVATIONS IN PARENTHESIS WERE NOT STABLE AT THE TIME OF MEASUREMENT AND NOT USED FOR CONTOURING.
- MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

DRAWN BY/DATE: TDC 3/7/16
REVIEWED BY/DATE: JJW 3/7/16
APPROVED BY/DATE: SJC 3/7/16

POTENTIOMETRIC SURFACE IN BEDROCK CONTOUR MAP
MARCH 2, 2016

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

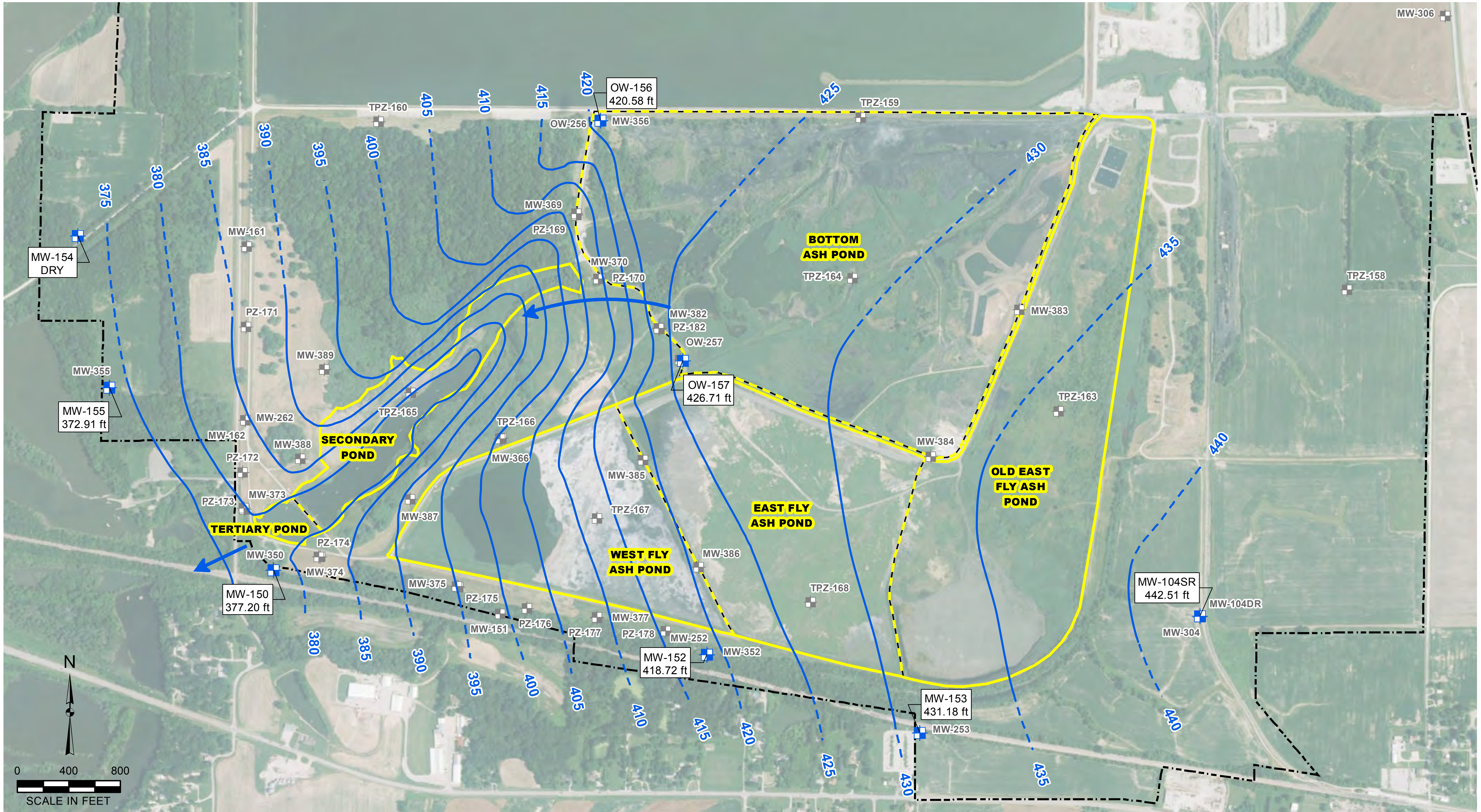
FIGURE NO: 6

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 6_Bedrock Groundwater Contour Map_Mar 2016.mxd Author: tcushman; Date/Time: 3/7/2016, 11:39:28 AM

POTENTIOMETRIC SURFACE IN UNLITHIFIED DEPOSITS CONTOUR MAP
NOVEMBER 10, 2015

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS



GROUNDWATER ELEVATION CONTOUR (5-FT CONTOUR INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
MONITORING WELL LOCATION WITH POTENTIOMETRIC SURFACE ELEVATION
MONITORING WELL NOT USED FOR CONTOURING
CCR MONITORED MULTI-UNIT
CCR UNIT
PROPERTY BOUNDARY

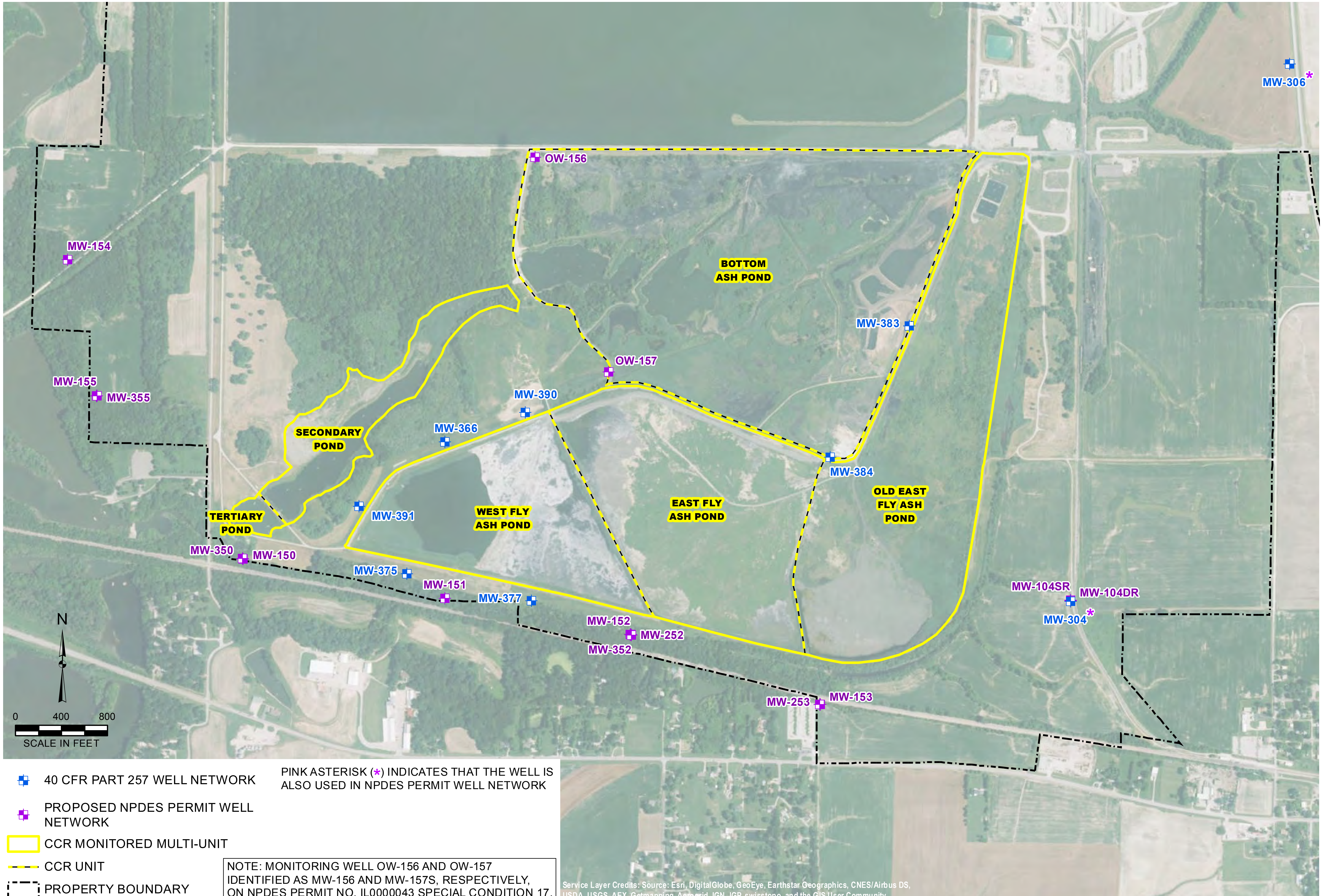
NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17. MONITORING WELL MW-154 WAS DRY ON NOVEMBER 10, 2015 INDICATING A GROUNDWATER ELEVATION LESS THAN 372.84 FEET.

DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

PROJECT NO: 2340

FIGURE NO: 7

NATURAL RESOURCE TECHNOLOGY



DRAWN BY/DATE: TDC 2/25/16
REVIEWED BY/DATE: RJK 2/25/16
APPROVED BY/DATE: SJC 3/2/16

GROUNDWATER MONITORING NETWORK WELLS

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
AND GROUNDWATER MONITORING PLAN
BALDWIN FLY ASH POND SYSTEM
BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

PROJECT NO: 2340

FIGURE NO: 8

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2340\MXD\HydroGeo and GWMP_2015\Figure 8_Groundwater Monitoring Network Wells.mxd Author: tcushman; Date/Time: 3/7/2016, 9:49:28 AM

TABLES

Table 1
Background Groundwater Quality and Applicable Groundwater Quality Standards
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

		Unlithified[4]				Bedrock[5]			
Parameter	**IL Class II Std[1] (mg/L)**	**Background Concentration[2] (mg/L)**	**Applicable Groundwater Standard[3] (mg/L)**	**Maximum (mg/L)**	**Minimum (mg/L)**	**Background Concentration (mg/L)**	**Applicable Groundwater Standard (mg/L)**	**Maximum (mg/L)**	**Minimum (mg/L)**
Antimony	0.024	0.005	0.024	<0.005	<0.005	USEPA (t)	na	0.0075	<0.005
Arsenic	0.2	0.032	0.2	0.032	<0.005	USEPA (t)	na	0.011	<0.005
Barium	2.0	0.621	2.0	0.24	0.0094	USEPA (t)	na	1.6	0.098
Beryllium	0.5	0.004	0.5	<0.005	<0.004	USEPA (t)	na	<0.005	<0.004
Boron (t)	2.0	na	na	--	--	USEPA (t)	na	--	--
Boron (d)	2.0	0.237	2.0	45.3	<0.02	**tbd**	**tbd[3]**	1.88	<0.02
Calcium	NS	na	NS	289	54.17	USEPA (t)	na	533	45
Cadmium	0.05	0.002	0.05	<0.002	<0.002	USEPA (t)	na	<0.002	<0.002
Chloride (t)	200	na	na	--	--	USEPA (t)	na	--	--
Chloride (d)	200	58.7	200	140	4.1	**tbd**	**tbd[3]**	642	9
Chromium	1.0	0.005	1.0	<0.005	<0.005	USEPA (t)	na	<0.005	<0.005
Cobalt	1.0	0.005	1.0	0.01	<0.005	USEPA (t)	na	<0.005	<0.005
Copper	0.65	0.005	0.65	0.016	<0.005	na	na	<0.005	<0.005
Cyanide (t)	0.6	0.008	0.6	<0.008	<0.007	na	na	<0.008	<0.007
Fluoride	4.0	0.793	4.0	0.865	0.119	USEPA (t)	na	0.756	0.174
Iron (t)	5.0	**11**	11	69.4	<0.02	**tbd**	**tbd[3]**	3.82	0.02
Iron (d)	5.0	**18**	18	18	<0.01	na	na	1.6	0.011
Lead	0.1	0.005	0.1	0.005	<0.005	USEPA (t)	na	<0.005	<0.005
Lithium	NS	na	na	--	--	USEPA (t)	na	--	--
Manganese (t)	10	8.2	10	24.4	<0.003	**tbd**	**tbd[3]**	0.58	<0.003
Manganese (d)	10	**48.8**	48.8	6.8	<0.003	na	na	0.87	<0.003
Mercury	0.01	0.002	0.01	<0.002	<0.002	USEPA (t)	na	<0.002	<0.002
Molybdenum	NS	na	NS	--	--	USEPA (t)	na	--	--
Nickel	2.0	0.005	2.0	<0.005	<0.005	na	na	0.007	<0.005
Nitrate (as N) (t)	100	2.26	100	10.7	<0.05	**tbd**	**tbd[3]**	1.13	0.103
Nitrate (as N) (d)	100	2.25	100	18	<0.05	na	na	2.04	0.06
Selenium	0.05	0.01	0.05	0.016	<0.01	USEPA (t)	na	<0.01	<0.01
Silver	0.05	0.005	0.05	0.006	<0.005	na	na	0.01	<0.005
Sulfate (t)	400	na	na	--	--	USEPA (t)	na	--	--
Sulfate (d)	400	328	400	2050	23	**tbd**	**tbd[3]**	65	<10
Thallium	0.02	0.002	0.02	<0.002	<0.002	USEPA (t)	na	<0.002	<0.002
Vanadium	0.1	na	0.1	--	--	na	na	--	--
Zinc	10	0.009	10	0.014	<0.005	na	na	0.006	<0.005
TDS	1,200	999	1,200	3470	188	**tbd** / USEPA	**tbd[3]**	1709	375
Field pH	6.5 - 9.0	**6.06** - 7.55	6.06 - 9.0	12.4	5.6	**tbd** / USEPA	**tbd[3]**	12.9	6.5
Radium 226/228*	5.0 / 5.0	na	na	--	--	USEPA (t)	na	- -	- -

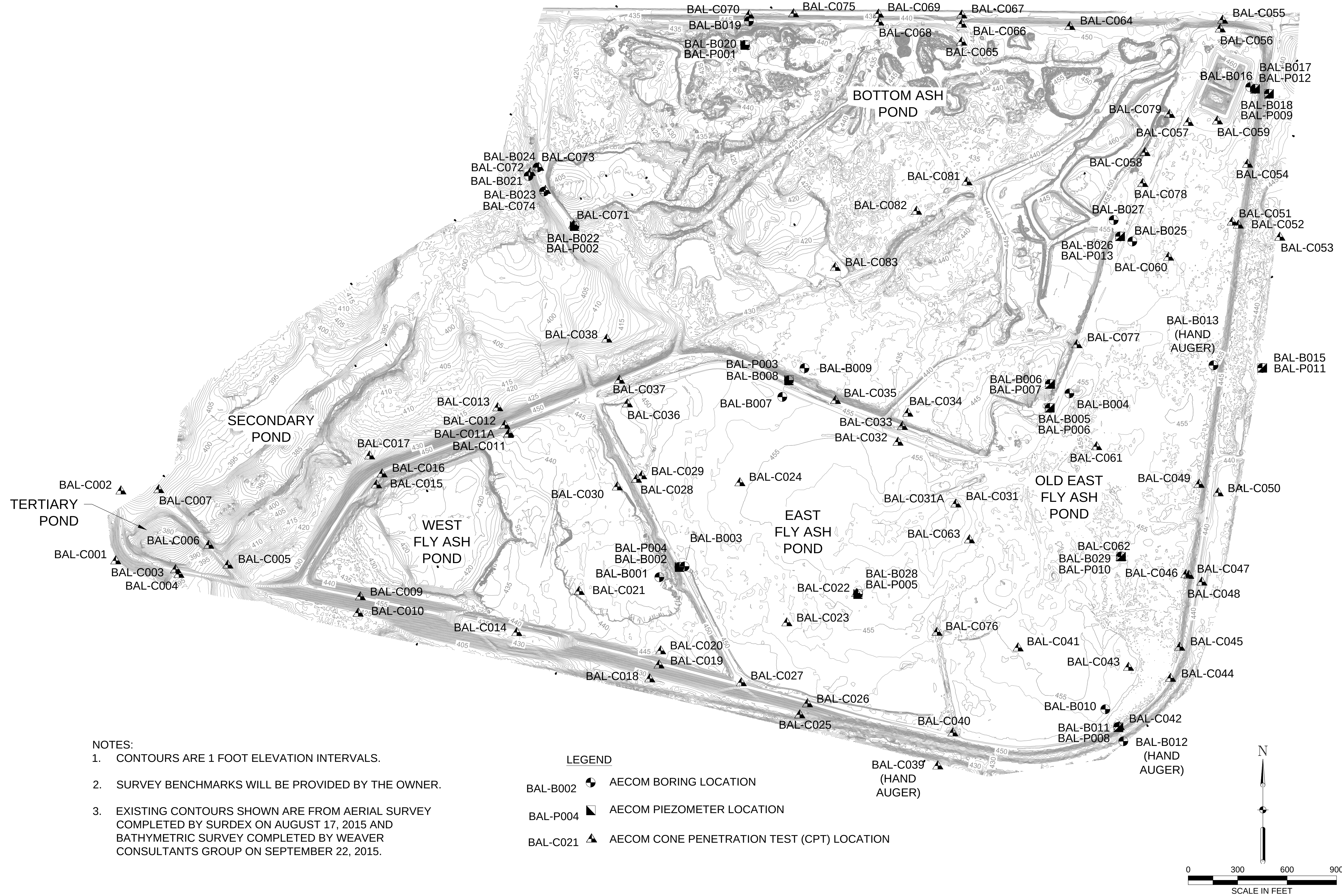
[O: JAZ 1/28/16, C:GFF 1/29/16, QA:SJC 3/2/16]

Notes:
All parameters are dissolved unless noted. Standards apply to dissolved or total concentration
(t) Total (d) Dissolved
tbd = To Be Determined for Illinois EPA monitoring program; based on future monitoring beginning January 2016
Bold = Background Concentration exceeds Class II Groundwater Standard
Red = Exceeds Applicable Groundwater Standard
-- = not analyzed prior to 2016
na = not applicable; parameter [dissolved and total] not proposed for Illinois EPA monitoring program under proposed modified NPDES Permi
NS = No Class II Groundwater Standard
USEPA (t) = background concentration for parameter [total] required under USEPA program (40 CFR Part 257

[1] IPCB 620 Class II: General Resource Groundwater Standard
[2] Background Concentration obtained from Appendix E - Statistical Procedure for Calculation of Background (Table E-1 Tolerance Limits for Background Monitoring Wells MW-104S/SR and MW-104D/DR using the Upper and Low
[3] Applicable Groundwater Standard is the higher of the Background Concentration and the Class II Groundwater Standard (or the lower if compared to the pH lower limit).
[4] Unlithified Wells used for maximum and minimum include those designated as upgradient or downgradient in Appendix D.
[5] Bedrock wells used for maximum and minimum include MW-350, MW352, and MW-355 (all downgradient) as listed in Appendix D.
* Radium 226 and 228 reported separately for IPCB Class II Groundwater Standard, reported combined for USEPA 40 CFR Part 257.

APPENDIX A

AECOM (2015) GEOTECHNICAL LABORATORY RESULTS



NOTES:

1. CONTOURS ARE 1 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. EXISTING CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 17, 2015 AND BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 22, 2015.

LEGEND

BAL-B002	AECOM BORING LOCATION
BAL-P004	AECOM PIEZOMETER LOCATION
BAL-C021	AECOM CONE PENETRATION TEST (CPT) LOCATION

AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)

DYNEGY
Dynegy Inc.
1500 EastPort Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

BALDWIN POWER PLANT
BALDWIN, IL

30% DESIGN DRAWINGS FOR CLOSURE OF EAST ASH POND, OLD EAST ASH POND, AND WEST ASH POND

ISSUED FOR BIDDING DATE BY

ISSUED FOR CONSTRUCTION DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	60440742
DRAWN BY:	DJD
DESIGNED BY:	DJD
CHECKED BY:	SAV
DATE CREATED:	2015-10-13
PLOT DATE:	2015-10-13
SCALE:	1" = 300'
ACAD VER:	2014

SHEET TITLE

EXPLORATION LOCATIONS

D-01

SHEET 1 OF 3

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B001	S-4	7.5-9		66.9				SM	31.5	5										
BAL-B001	S-6	15-18		37.9				CL	93.9	6										
BAL-B001	ST-2	35-37									125.6									
BAL-B001	ST-2	35.35		23.1																
BAL-B001	ST-2A	35.6		23.8	63	15	48	CH			126.6	102.3		1.30E-08						P10576
BAL-B001	ST-2	35.9		23.2																
BAL-B001	ST-2	36.15		22.4				CH			128.4	104.9			UU@6.2	1.6	10.9			UU245g
BAL-B001	S-10	45.0-46.5	Brown silty CLAY, trace gravel	16.6																
BAL-B001	S-11	50.0-51.5	Brown silty, CLAY with gravel	12.4																
BAL-B001	S-14	65.0-66.5	Gray brown silty CLAY with fine gravel	19.0																
BAL-B001	S-16	75.0-75.5	Gray brown silty CLAY with fine gravel	12.5																
BAL-B002	S-1	0.0-1.5	Brown silty CLAY, trace sand and gravel	19.5																
BAL-B002	S-2	2.5-4.0	Brown silty CLAY, trace sand and gravel	16.5																
BAL-B002	S-3	5.0-6.5	Brown silty CLAY, trace sand and gravel	19.1	36	19														
BAL-B002	ST-1	8-10									120.5									
BAL-B002	ST-1A	8.25		19.1				CH	91.8	29										dispersion
BAL-B002	ST-1B	8.8		25.9	54	16	38	CH			120.1	95.4			UU@1.1	1	15			UU257i
BAL-B002	S-4	10.0-11.5	Brown silty CLAY, trace sand and gravel	21.0																
BAL-B002	ST-2	15-17									130.3									
BAL-B002	ST-2A	15.45		21.8	46	14	32	CL			123.3	101.2			UU@1.9	0.7	15			UU257j
BAL-B002	S-5	20.0-21.5	Brown silty CLAY, trace sand and gravel	21.7																
BAL-B002	S-6	25.0-26.5	Brown sandy silty CLAY	40.3																
BAL-B002	ST-3	27.5-30									113.5									
BAL-B002	ST-3A	27.75		34.8				ML			111.5	82.7			CIU@3.4	1.3	16.5			T3850
BAL-B002	ST-3B	28.1		26.4				ML			118.5	93.8						0.69	97	C15141
BAL-B002	ST-3C	28.45		32.1	21	21	NP	ML			114.9	87	2.491		CIU@3.5	2.9	19.6			T3851
BAL-B002	ST-3D	28.9		25.5				ML			122	97.2			CIU@3.6	10.1	24.8			T3852
BAL-B002	S-7	30.0-31.5	Brown sandy silty CLAY with gravel	47.9																
BAL-B002	S-8	35.0-36.5	Brown sandy silty CLAY with gravel	36.8																
BAL-B002	S-9	40-41.5		38.6				CL	94.3	5										
BAL-B002	S-10	45.0-46.5	Dark brown silty CLAY, trace sand	32.6																
BAL-B002	S-11	50.0-51.5	Dark brown silty CLAY, trace sand	25.0																
BAL-B002	S-12	55.0-56.5	Brown silty CLAY, trace sand	24.0	42	23														
BAL-B002	S-13	60.0-61.5	Dark brown silty CLAY with gravel, trace organics	33.3																
BAL-B002	S-14	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B002	S-15	75.0-76.0	Gray silty CLAY, trace sand	17.4	45	24														
BAL-B003	S-4	10.0-11.5	Brown CLAY with fine gravel	22.3	39	17														
BAL-B003	ST-2	15-17									125.3									
BAL-B003	ST-2	15.35		25.4																
BAL-B003	ST-2A	15.6																		
BAL-B003	ST-2	15.95		23.4																
BAL-B003	ST-2B	16.2		24.7	58	15	43	CH			124.8	100.1			UU@1.9	0.8	15			UU230d
BAL-B003	S-6	30.0-31.5	Brown CLAY	40.7				CL	97	7										
BAL-B003	S-8	40.0-41.5	Brown sandy silty CLAY	43.6									2.43							
BAL-B003	S-10	50.0-51.5	Brown fat CLAY, trace sand and gravel	19.3	39	17														
BAL-B003	S-12	60.0-61.5	Light brown silty CLAY	26.9																
BAL-B003	S-13	65.0-66.5	Light gray silty CLAY	21.6	57	30														
BAL-B003	S-14	70.0-75.4	Light gray silty CLAY	18.7																
BAL-B004	S-2	2.5-4		10.3				SW-SM	5.4	0										
BAL-B004	ST-2	25-27									118.1									
BAL-B004	ST-2A	25.35		37.1				PT			115.8	84.5			CIU@3.0	1.4	12.1			T3892
BAL-B004	ST-2B	25.85		23.6	47	14	33	CL			127	102.7			CIU@3.1	1.4	12.3			T3893
BAL-B004	ST-2C	26.35		29.9				CL			119.2	91.8			CIU@3.2	1.8	19			T3894
BAL-B004	S-8	30-31.5		31.4	37	18	19	CL												
BAL-B004	S-9	35.0-36.5	Light gray silty CLAY, trace sand	19.4	38	15														
BAL-B004	S-11	45.0-46.5	Light brown silty CLAY with gravel	20.3																
BAL-B005	S-1	0.0-1.5	Dark brown silty coarse SAND with gravel	9.8																
BAL-B005	S-2	2.5-4.0	Brown silty CLAY	25.7																
BAL-B005	ST-1	5.0-7.0									108.7									
BAL-B005	ST-1	5.75		24.3																UU275A

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B005	ST-1B	6		22	60	17	43	CH			126.5	103.7			UU@0.7	1.9	15			
BAL-B005	S-3	7.5-9.0	Brown silty CLAY	26.2																
BAL-B005	ST-2	10.0-12.0									115.1									
BAL-B005	ST-2A	10.3		25.8				CH			121.4	96.5			CIU@0.8	0.7	19.8			T3910
BAL-B005	ST-2B	10.85		24.8	60	16	44	CH			123.7	99.1			CIU@1.2	1.4	19.6			T3911
BAL-B005	S-4	15.0-16.5	Brown silty CLAY, trace sand	25.1																
BAL-B005	S-5	20.0-21.5	Brown gray silty CLAY	27.5																
BAL-B005	S-6	25.0-26.5	Brown silty CLAY	24.1																
BAL-B005	S-7	30.0-31.5	Brown silty CLAY	21.2	36	18														
BAL-B005	S-8	35.0-36.5	Brown silty CLAY	21.9																
BAL-B005	S-9	40.0-41.5	Brown silty CLAY	16.7																
BAL-B005	S-10	45.0-46.5	Gray silty CLAY	16.6																
BAL-B005	S-11	50.0-51.5	Gray silty CLAY	22.0																
BAL-B005	S-12	55.0-56.5	Gray silty CLAY, trace sand	16.6	44	25														
BAL-B005	S-13	60.0-60.4	Gray brown silty CLAY	18.8																
BAL-B006	S-1	0.0-1.5		11.6				SC	20.9	2										
BAL-B006	S-2	2.5-4.0		67.9				SC	44.4	4										
BAL-B006	S-3	5.0-6.5		31.6				SM	18.5	1										
BAL-B006	S-4	7.5-9.0		24.9				SC	12.8	0										
BAL-B006	S-5	10.0-11.5		19.9				CL	53.4	6										
BAL-B006	S-6	12.5-15	Gray brown silty CLAY, trace sand and fine gravel	21.2																
BAL-B006	ST-1	15.0-17.0									129									
BAL-B006	ST-1	15.15		25.2																
BAL-B006	ST-1	15.7		23.5																
BAL-B006	ST-1B	15.95		17.9				CL			135	114.5			UU@1.4	1.7	15			UU275G
BAL-B006	ST-1	16.25		15.9																
BAL-B006	S-7	20.0-21.5	Gray brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B006	S-8	25.0-26.5	Light brown silty CLAY, trace sand and fine gravel	20	32	14														
BAL-B006	ST-2	30.0-32									139.5									
BAL-B006	ST-2A	30.25		13.4	29	15	14	CL			138.3	122			CIU@2.0	6.1	17.4			T3886
BAL-B006	ST-2B	30.6		13				CL			135.3	119.7	2.682					0.398	87	C15157
BAL-B006	ST-2C	31		13.3				CL			134.8	119			CIU@2.2	7.2	21.8			T3887
BAL-B006	ST-2D	31.5		14				CL			137	120.1			CIU@2.4	5	18.5			T3888
BAL-B006	S-9	35.0-36.5	Light brown silty CLAY, trace sand and fine gravel	29.6																
BAL-B006	S-10	40.0-41.5	Gray silty CLAY, trace sand	22.4																
BAL-B006	S-11	45.0-46.5	Gray CLAY, trace sand	19.1	56	23														
BAL-B006	S-12	50-51.5	Gray silty GRAVEL	9.1																
BAL-B007	S-3	5.5-7.0		65.4	NP	NP														
BAL-B007	ST-1	30-32									123									
BAL-B007	ST-1A	30.4		25				CL			125.8	100.6			CIU@3.6	2.2	15.2			T3857
BAL-B007	ST-1B	30.95		25.8	48	17	31	CL			126.6	100.6	2.609		CIU@3.7	2.9	14.7			T3859
BAL-B007	ST-1C	31.35		22.8				CL			123	100.1						0.661	92	C15142
BAL-B007	ST-1D	31.8		26				CL			125.8	99.8			CIU@3.8	2.5	16.7			T3858
BAL-B008	S-1	0.0-1.5	Brown silty CLAY, trace sand	15.4																
BAL-B008	S-2	2.5-4.0	Brown silty, CLAY, trace sand	21.8																
BAL-B008	S-3	5.0-6.5	Brown silty CLAY, trace sand and fine gravel	21.6	48	21														
BAL-B008	S-4	10.0-11.5	Brown silty CLAY, trace sand and fine gravel	19.6																
BAL-B008	ST-1	10-12																		
BAL-B008	ST-1A	10.35		25.7				CH	84.2	25										dispersion
BAL-B008	ST-1B	10.8		23.1	65	17	48	CH			127.5	103.6		5.50E-09						P10595
BAL-B008	S-5	20.0-21.5	Brown silty CLAY, trace sand and fine gravel	22.5																
BAL-B008	ST-2	20-22									119.5									
BAL-B008	ST-2	20.05		43.5																
BAL-B008	ST-2A	20.3		23.4	58	18	40	CH			125.7	101.9			UU@2.5	0.4	15			UU278e
BAL-B008	S-6	25.0-26.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-7	30.0-31.5	Brown silty CLAY, trace sand and fine gravel	26.2	38	17														
BAL-B008	S-8	35.0-36.5	Brown silty CLAY, trace sand and fine gravel	22.9																
BAL-B008	S-9	40.0-41.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-10	45.0-46.5	Brown silty CLAY, trace sand and fine gravel	22.1																
BAL-B008	S-11	50.0-51.5	Brown silty CLAY, trace sand and fine gravel	18.0																
BAL-B008	S-12	55.0-56.5	Light brown SILTY SAND	19.2				SM	16											

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B008	S-13	60.0-61.5	Gray silty CLAY, trace sand	17.8	42	25														
BAL-B008	S-14	65.0-66.5	Gray silty CLAY, trace sand	14.0																
BAL-B009	S-1	0-1.5		85.3				MH	78.3	10										
BAL-B009	ST-2	10.5-12.5									122.5									
BAL-B009	ST-2A	10.65		4.3				CL												
BAL-B009	ST-2	10.9		24.9																
BAL-B009	ST-2B	11.15		25.2				CL			124.9	99.8			CIU@1.3	1.8	16.9			T3863
BAL-B009	ST-2	11.45		28																
BAL-B009	ST-2C	11.7		26.3				CL			124.1	98.3			CIU@1.4	1.6	14.6			T3889
BAL-B009	ST-2	12		24.1																
BAL-B009	ST-2D	12.25		26.3	40	19	21	CL	95.2	20	123.6	97.8			CIU@1.5	2.1	14.2			dispersion T3864
BAL-B009	ST-3	25-27									113.6									
BAL-B009	ST-3	25.25		22.1	49	14	35	CL			125.9	103.1			UU@3.1	0.7	15			UU278g
BAL-B009	ST-3	25.85		19.5																
BAL-B009	S-7	30.0-31.5	Brown POORLY GRADED GRAVEL	14.5				GP	3											
BAL-B009	S-8	35.0-36.5	Gray silty CLAY, trace sand	23.2	49	25														
BAL-B009	S-9	40.0-41.5	Gray silty CLAY, trace sand	21.2																
BAL-B010	S-2	2.5-4		50.2				SC	28.4	4										
BAL-B010	S-5	15-16.5		42.5				CL	98.3	7										
BAL-B010	ST-2	20-22									123.9									
BAL-B010	ST-2	20.5		24.7																
BAL-B010	ST-2	21.05		22.1																
BAL-B010	ST-2B	21.3		22.2	42	18	24	CL			124.2	101.7		2.40E-06						P10578
BAL-B010	ST-2	21.6		21.9																
BAL-B010	ST-2C	21.85		20.9				CL			124.9	103.3			UU@2.5	2	3.8			UU246d
BAL-B010	S-8	30.0-31.5	Light brown silty CLAY with sand and gravel	18.6	30	14														
BAL-B010	S-9	35.0-36.5	Brown silty CLAY with sand and gravel	15.0	22	14														
BAL-B010	S-11	45.0-46.5	Light brown silty CLAY with sand and gravel	21.7																
BAL-B010	S-12	50.0-51.5	Brown silty CLAY, trace sand	18.2																
BAL-B011	S-1	0.0-1.5	Brown silty CLAY, trace sand	13.0																
BAL-B011	S-2	2.5-4		23.0				CL	95.2	27										
BAL-B011	S-4	7.5-9.0	Brown silty CLAY, trace sand	18.8																
BAL-B011	S-5	10.0-11.5	Gray brown silty CLAY, trace sand	19.9																
BAL-B011	ST-1	15-17									122.8									
BAL-B011	ST-1A	15.2		25.8							123.3	98		1.80E-09						P10594
BAL-B011	ST-1B	15.7		24.8				CL			125.1	100.2			CIU@1.8	2.5	12.1			T3903
BAL-B011	ST-1C	16.2		24.9				CL			122.3	98			CIU@1.9	2.8	20.1			T3904
BAL-B011	ST-1	16.55		25.4																
BAL-B011	ST-1D	16.8		25.6	46	18	28	CL			121.3	96.6			CIU@2.0	1.7	19.2			T3905
BAL-B011	S-6	20.0-21.5	Gray brown silty CLAY, trace sand	21.7																
BAL-B011	S-7	30.0-31.5	Brown silty CLAY, trace sand	17.8																
BAL-B011	S-8	35.0-36.5	Brown silty sandy CLAY with gravel	8.8	19	11														
BAL-B011	S-9	42.5-44.0	Light brown silty CLAY, trace sand	18.2	49	24														
BAL-B011	S-10	47.5-49.0	Gray silty CLAY, trace sand	19.8																
BAL-B012	S-3	2.0-3.0	Brown silty CLAY, trace sand	22.0	54	24														
BAL-B012	S-7	6.0-7.0	Light brown silty CLAY	20.7	34	18														
BAL-B012	S-10	9.0-10.0	Light brown silty CLAY	21.3																
BAL-B015	S-1	0.0-1.5	Light brown sandy silty CLAY with find gravel and organics	12.5																
BAL-B015	S-2	2.5-4.0	Light brown sandy silty CLAY	21.5																
BAL-B015	ST-1	5.0-7.0									124.7									
BAL-B015	ST-1	5.6		24.8																
BAL-B015	ST-1	6.15		43																
BAL-B015	ST-1C	6.4		21.3	44	17	27	CL			129.1	106.4			UU@0.7	2.3	15			UU275D
BAL-B015	S-3	7.5-9.0	Light brown sandy silty CLAY	22.8																
BAL-B015	S-4	10.0-11.5	Light brown sandy silty CLAY, trace gravel	21.0																
BAL-B015	ST-2	11.5-13.5									128.6									
BAL-B015	ST-2	11.8		19.5																
BAL-B015	ST-2A	12.05		20.8				CH			129.5	107.2			CIU@1.0	1.8	18.7			T3912
BAL-B015	ST-2	12.35		20.8																
BAL-B015	ST-2B	12.6		20.1				CH			129.9	108.2			CIU@1.2	1.8	20.4			T3913
BAL-B015	ST-2	12.9		20.7																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B015	ST-2C	13.15		21.1	53	14	39	CH			128.8	106.4			CIU@1.4	1.9	20.1			T3914
BAL-B015	S-5	15.0-16.5	Light brown sandy silty CLAY, trace gravel	23.0																
BAL-B015	S-6	20.0-21.5	Light brown sandy silty CLAY with gravel	18.8																
BAL-B015	S-7	25.0-26.5	Light brown gray silty CLAY, trace sand and gravel	17.1	37	15														
BAL-B015	S-8	30.0-31.5	Light brown silty CLAY, with sand and gravel	23.7																
BAL-B015	S-9	35.0-36.5	Brown silty CLAY, trace sand	23.5																
BAL-B015	S-10	40.0-41.5	Gray brown silty CLAY	20.1																
BAL-B015	S-11	45.0-46.5	Light brown sandy silty CLAY with medium gravel	25.9																
BAL-B015	S-12	50.0-51.5	Gray fat CLAY	21.7	87	33														
BAL-B016	ST-1	4.0-6.0									114.6									
BAL-B016	ST-1	4.15		15.7																
BAL-B016	ST-1A	4.4		15				ML			128	111.3			CIU@0.5	0.8	21.2			T3825
BAL-B016	ST-1	4.7		19.8																
BAL-B016	ST-1B	4.95		27.6				ML			115.4	90.5			CIU@0.6	2.1	18			T3826
BAL-B016	ST-1	5.25		33.3																
BAL-B016	ST-1C	5.5		31.8	24	22	2	ML			107.7	81.7			CIU@0.7	1.9	11.1			T3827
BAL-B016	S-3B	7.5-9.0	Brown SILT	41.3				ML	96	6										
BAL-B016	ST-2	10.0-12.0									103.4									
BAL-B016	ST-2	10.15		44.3																
BAL-B016	ST-2	10.65		49.8																
BAL-B016	ST-2	11.15		54.9																
BAL-B016	ST-2B	10.9		62.1	-	29	NP	ML			96.8	59.7						1.562	97	C15119
BAL-B016	S-4	15.0-16.5		31.3																
BAL-B016	S-5	20.0-21.5	Dark brown SILT	29				ML	90	4										
BAL-B016	S-8	35.0-36.5		22.6																
BAL-B016	S-10	45.0-46.5		17.9																
BAL-B016	S-11	50.0-51.5		14.5	30	15														
BAL-B016	S-12	55.0-56.5		10.3	34	14														
BAL-B016	S-14	65.0-66.5		18.2																
BAL-B017	S-1	0.0-1.5		11.5				ML												
BAL-B017	S-2	2.5-4.0		14.7				ML	73.5	9										
BAL-B017	S-3	5.0-6.5		21.4				ML	67	4										
BAL-B017	S-4	7.5-9.0		28.9				ML	94.2	6										
BAL-B017	ST-1	10.0-12.0									108.5									
BAL-B017	ST-1	11.3		28.4																
BAL-B017	ST-1C	11.55		35	23	25	NP	ML	95.4	7	112.2	83.1			UU@0.8	0.4	15			UU278H
BAL-B017	S-5	15.0-16.5	Brown silty CLAY	30.5																
BAL-B017	S-6	20.0-21.5	Brown silty CLAY with fine gravel	21.4	33	15														
BAL-B017	ST-2	25.5-27.5									122.1									
BAL-B017	ST-2	25.9		30.3																
BAL-B017	ST-2A	26.15		22.6				CL			125.4	102.3			CIU@2.2	6.7	20.1			T3921
BAL-B017	ST-2	26.45		21.9																
BAL-B017	ST-2B	26.7		23.5	44	15	29	CL			124.5	100.8		1.70E-08	CIU@2.4	2	19.7			T3922
BAL-B017	ST-2	27		25																
BAL-B017	ST-2C	27.25		25.4				CL			124.4	99.2			CIU@2.6	1.8	12.9			T3923
BAL-B017	S-7	30.0-31.5	Brown silty CLAY with fine gravel	30.5																
BAL-B017	S-8	35.0-36.5	Brown silty CLAY with fine gravel	21.2	43	11														
BAL-B017	S-9	40.0-41.5	Gray brown sandy silty CLAY with fine gravel	18.1																
BAL-B017	S-10	45.0-45.1	Gray brown sandy silty CLAY with fine gravel	15.6																
BAL-B017	S-11	50.0-51.5	Gray brown sandy silty CLAY with fine gravel	22.6																
BAL-B017	S-12	55.0-56.5	Brown sandy silty CLAY with fine gravel	10.3	28	9														
BAL-B018	S-2	5.0-6.5	Light brown silty CLAY	30.0	37	20														
BAL-B018	ST-2	25-27									126.1									
BAL-B018	ST-2B	25.95		27.4				CH			123.3	96.8			CIU@3.0	0.9	22.7			T3890
BAL-B018	ST-2C	26.55		18.1	54	13	41	CH			129.7	109.9			CIU@3.2	2.2	18.2			T3865
BAL-B018	S-7	35.0-36.5	Light brown silty CLAY	23.6																
BAL-B018	S-8	40.0-41.5	Gray silty CLAY, trace sand	17.7	47	25														
BAL-B018	S-9	45.0-46.5	Gray silty CLAY, trace sand	18.4																
BAL-B019	S-1	0.0-1.5		15.3																
BAL-B019	S-3	5.0-6.5		22.4	40	19														
BAL-B019	S-7	15.0-16.5		17.5																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B019	ST-1	25-27.5									128.1									
BAL-B019	ST-1	25.45		24.3																
BAL-B019	ST-1	26		25.1																
BAL-B019	ST-1	26.55		23.9																
BAL-B019	ST-1C	26.8		24.5	38	17	21	CL			124.8	100.3			UU@3.1	1.5	14.6			UU231a
BAL-B019	ST-2	35-37.5									118.4									
BAL-B019	ST-2	35.35		34.7																
BAL-B019	ST-2	35.9		25.6																
BAL-B019	ST-2	36.5		22.3																
BAL-B019	ST-2C	36.8		22.1	55	15	40	CH			126.8	103.8			UU@4.1	2	8.8			UU231b
BAL-B019	S-11	45.0-46.5		16.7	33	16														
BAL-B019	S-13	55.0-56.5		18.6	40	18														
BAL-B019	S-14	60.0-61.5		21.9	43	26														
BAL-B019	S-16	70.0-71.0		15.4																
BAL-B019	S-18	80.0-80.8		17.5																
BAL-B020	S-2A	2.5-4		19.5				SP-SM	10.8	1										
BAL-B020	ST-2	9-11									121.1									
BAL-B020	ST-2A	9.4		30.8				CH			120.4	92.1			CIU@1.1	0.9	19			T3901
BAL-B020	ST-2B	9.9		25.6	51	17	34	CH			123.5	98.3			CIU@1.2	1.2	18.8			T3895
BAL-B020	ST-2C	10.4		24.7				CH			125.8	100.9			CIU@1.3	1.3	17.9			T3896
BAL-B020	S-5	20.0-21.5	Brown SANDY LEAN CLAY	22.6	38	16		CL	67											
BAL-B020	S-7B	30.0-31.5	Brown CLAY with SAND	18.7				CL	78											
BAL-B020	S-10	45.0-46.5	Gray silty sandy CLAY with fine gravel	11.2																
BAL-B020	S-13	60.0-61.5	Gray silty CLAY	21.6	73	36														
BAL-B020	S-17	80.0-81.5	Gray silty CLAY	21.3																
BAL-B021	ST-1	2.5-4.5									117.5									
BAL-B021	ST-1A	2.75		20.6				CL			125.8	104.3			CIU@0.3	0.6	18			T3834
BAL-B021	ST-1B	3.25		22.4	49	15	34	CL			124.9	102			CIU@0.54	0.9	20.5			T3835
BAL-B021	S-3	7.5-9.0		20.8	43	17														
BAL-B021	S-5	15.0-16.5		20.7																
BAL-B021	S-6	20.0-21.5		20.5																
BAL-B021	S-9	35.0-36.5		18.6	42	23														
BAL-B022	S-3	5.0-6.5	Brown silty CLAY, trace fine gravel	22.0	28	18														
BAL-B022	ST-1	10-12									130.3									
BAL-B022	ST-1	10.35		21.1																
BAL-B022	ST-1A	10.6		20.7				CL			129.4	107.2			CIU@1.2	2.2	20.1			T3906
BAL-B022	ST-1	10.9		19.9																
BAL-B022	ST-1B	11.15		19.1	40	15	25	CL	80.3	22	130.3	109.4			CIU@1.3	2	15.3			dispersion T3907
BAL-B022	ST-1	11.45		18.7																
BAL-B022	ST-1C	11.7		18.4				CL			130.7	110.4			CIU@1.4	2.5	20.2			T3908
BAL-B022	S-8	35.0-36.5	Gray silty CLAY, trace gravel	23.6	58	25														
BAL-B022	S-10	45.0-45.8	Gray silty CLAY, trace gravel	16.6																
BAL-B023	S-3	5.0-6.5		18.6	37	14														
BAL-B023	ST-1	10.0-12.5									129									
BAL-B023	ST-1	10.3		23.7																
BAL-B023	ST-1A	10.55		22.6	51	15	36	CH			127.7	104.1			UU@1.3	2.1	15			UU230b
BAL-B023	ST-1	10.85		22.3																
BAL-B023	ST-1B	11.1																		
BAL-B023	S-6	20.0-21.5		22.3	34	18														
BAL-B023	ST-2	25-27.5									132.8									
BAL-B023	ST-2B	25.65		17.9				CL			132.2	112.1			CIU@3.0	2.6	21.4			T3828
BAL-B023	ST-2C	26.05		16.2	36	14	22	CL			133.4	114.8			CIU@3.2	2.5	21			T3829
BAL-B023	S-7	30.0-31.5		26.7	59	30														
BAL-B023	S-8	35.0-36.5		17.8																
BAL-B023	S-11	50.0-50.8		16.1																
BAL-B024	S-4	7.5-9.0		18.7																
BAL-B024	S-6	15.0-16.5		24.1	41	19														
BAL-B024	ST-1	20.0-22.5									128									
BAL-B024	ST-1	20.45		28.1																
BAL-B024	ST-1A	20.7		19.4				CL			130	108.9			CIU@2.4	2.8	17.7			T3831
BAL-B024	ST-1	21.05		20.0																

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B024	ST-1B	21.3		20.5	49	13	36	CL			129.6	107.6			CIU@2.5	2.8	11			T3832
BAL-B024	ST-1	21.6		20.6																
BAL-B024	ST-1C	21.9		19.4				CL			128.6	107.7			CIU@2.6	2.3	6.2			T3833
BAL-B024	S-7	25.0-26.5		18.1																
BAL-B024	S-10	40.0-41.5		14.5	45	23														
BAL-B024	S-12	50.0-51.5		22.6																
BAL-B025	ST-1	7.5-9.5									112.5									
BAL-B025	ST-1	7.75		22.4																
BAL-B025	ST-1A	8		22.0				CL	74.3	4										
BAL-B025	ST-1	8.3		25.6																
BAL-B025	ST-1	8.85		55.1																
BAL-B025	S-4	10.0-11.5		40.4									2.46							
BAL-B025	S-7	25.0-26.5		26.5	40	20														
BAL-B025	S-9B	40.0-41.5		19.3	32	16														
BAL-B025	S-11	50.0-51.5		24.2																
BAL-B025	S-12	55.0-56.5		16.7	43	21														
BAL-B026	S-4	7.5-9		9.4				SM	14.6											
BAL-B026	S-6	15-16.5		19.4				SW-SM	5.8											
BAL-B026	ST-1	20-22																		
BAL-B026	ST-1	20.45		37.3																
BAL-B026	ST-1	21		27.3																
BAL-B026	ST-1	21.55		23.5																
BAL-B026	ST-1C	21.8		20.1				CL	97.5	28	128	106.5			UU@2.6	2	8.7			UU257k
BAL-B026	S-7A	25-26.5		32.9				CL	78.9											
BAL-B026	ST-2	35-37									126.3									
BAL-B026	ST-2A	35.35		23.6				CH			125.4	101.4			CIU@4.2	2	19			T3860
BAL-B026	ST-2B	35.9		24.0				CH			125.9	101.6			CIU@4.3	2.1	19.2			T3861
BAL-B026	ST-2C	36.25		23.5	61	14	47	CH			124.3	100.6	2.675					0.649	96	C15144
BAL-B026	ST-2D	36.8		22.9				CH			126.4	102.9			CIU@4.4	1.9	15.9			T3862
BAL-B026	S-9	40.0-41.5	Brown silty CLAY, trace gravel	17.8	48	13														
BAL-B026	S-11	50.0-51.5	Brown silty CLAY, trace gravel	23.5	49	19														
BAL-B026	S-12	55.0-56.5	Brown silty CLAY, trace gravel	16.6	43	17														
BAL-B026	S-15	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B027	S-1	0-1.5		17.7				SW-SM	5.3											
BAL-B027	S-7	20-21.5		16.7				SP	0.2											
BAL-B027	ST-1	25-27									124.6									
BAL-B027	ST-1	25.55		21.1																
BAL-B027	ST-1	26.1		21.8																
BAL-B027	ST-1C	26.35		21.4				CL			128.5	105.9			UU@3.1	3.3	11.9			UU275e
BAL-B027	ST-1	26.65		21.1																
BAL-B027	ST-1D	26.9		21.2	43	16	27	CL			127.7	105.4		5.00E-09						P10596
BAL-B027	ST-2	35-37									127.3									
BAL-B027	ST-2	35.3		19.1																
BAL-B027	ST-2	35.85		19.9																
BAL-B027	ST-2	36.4		19.8																
BAL-B027	ST-2C	36.65		20.3	47	15	32	CL			130	108			UU@4.3	1.6	15			UU275f
BAL-B027	S-10	45.0-46.5	Light brown silty CLAY	24.1																
BAL-B027	S-12	55.0-56.5	Gray silty CLAY, trace sand	17.4	47	21														
BAL-B027	S-13	60.0-61.5	Gray silty CLAY, trace sand	19.4																
BAL-B028	S-1	0-1.5		72.5																
BAL-B028	S-2	2.5-4.0		70.8				ML	67.5	11										
BAL-B028	ST-1	5.0-7.0									89.5									
BAL-B028	ST-1	5.4		104.4																
BAL-B028	ST-1	5.95		76.6																
BAL-B028	ST-1	6.55		114.3																
BAL-B028	ST-1C	6.8		90.7	47	53	NP	ML	81.4		90.7	47.6			CYCTRX@0.7					CTXS488
BAL-B028	S-3	7.5-9.0		103.7				ML	75.6	13										
BAL-B028	ST-2	9.0-11.0									89.5									
BAL-B028	ST-2A	9.3		48.5				ML	67.9		104.4	70.3			CYCTRX@1.0					CTXS487
BAL-B028	ST-2B	9.95		65	47	52	NP	ML			101.8	61.7	2.684					1.716	102	C15154
BAL-B028	S-4	15-17		39.6				ML	64.3	6										

Summary of Laboratory Test Results

				IDENTIFICATION TESTS											STRENGTH			CONSOLIDATION INITIAL CONDITIONS		
BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B028	S-5	20-22		34.9				ML	97.7	8										
BAL-B028	S-6A&B	25-26.5		50.6				CL	89.4	9										
BAL-B028	S-7	30.0-31.5	Brown silty Clay	26.7																
BAL-B028	S-8	35.0-36.5	Brown silty CLAY with sand and gravel	20.3	40	18														
BAL-B028	S-9	40.0-41.5	Brown silty CLAY with sand and gravel	20.7																
BAL-B028	S-10	45.0-46.5	Brown silty CLAY with sand and gravel	16.5																
BAL-B028	S-11	50.0-51.5	Brown silty CLAY with sand and gravel	20.2																
BAL-B028	S-12	55.0-56.5	Gray silty CLAY, trace sand	21.0																
BAL-B028	S-13	60.0-61.5	Gray silty CLAY with sand and gravel	16.7																
BAL-B028	S-14	65.0-66.5	Gray silty CLAY, trace gravel	18.9	39	25														
BAL-B028	S-15	70.0-71.5	Gray silty CLAY, trace gravel	18.5																
BAL-B028	S-16	75.0-76.5	Gray silty CLAY, trace gravel	20.9																
BAL-B028	S-17	80.0-81.5	Gray silty CLAY, trace gravel	17.8																
BAL-B028	S-18	85.5-86.0	Gray silty CLAY, trace gravel	17.7																
BAL-B029	S-1	0.0-1.5		20.6	42	19	23	CL												
BAL-B029	S-2	2.0-4.0		31				CL	95.7	6										
BAL-B029	S-3	7.5-9.0		31.9				ML	86	7										
BAL-B029	S-4	10.0-11.5		34.1				ML	94.5	8										
BAL-B029	S-5	20.0-21.5	Gray sandy silty CLAY	22.1	32	16														
BAL-B029	S-6	25.0-26.5	Gray brown sandy silty CLAY	19.8																
BAL-B029	S-7	30.0-31.5	Gray brown sandy silty CLAY	21.9	47	22														
BAL-B029	S-8	35.0-56.5	Brown sandy CLAY with gravel	10.9																
BAL-B029	S-9	40.0-41.5	Brown sandy CLAY with gravel	26.3	56	20														
BAL-B029	S-11	50.0-51.5	Brown gray sandy silty CLAY	21.8																
BAL-C039	S-1	0.0-1.0	Brown silty CLAY, trace sand	34.0	52	26														
BAL-C039	S-2	2.0-3.0	Brown silty CLAY with organics	24.5	37	16														
BAL-C039	S-6	5.0-6.0	Brown silty CLAY with organics, trace sand and gravel	21.7																

NOTE: Laboratory tests were performed by AECOM, Conshoshocken, Pennsylvania and Terrasense, Totowa, New Jersey.

APPENDIX B

LABORATORY HYDRAULIC CONDUCTIVITY TEST RESULTS

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE

ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B001 | Test No.: P10576

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-2A | DEPTH (ft): 35.6

Specimen - Apparatus set-up - Test Information | Cell No. E | Apparatus No. 1 | Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.991	in	Lo=	10.137	cm
dLc=	0.091	in	Ao =	41.93	cm^2
Lc=	3.900	in	Vo =	424.99	cm^3
			Lc=	9.905	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	29.07	cm^3
			Vc =	395.92	cm^3
Sc =	0.248	cm^{-1}	Ac=	39.970	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	Permeability

Equations Used

$Kt = - 0.0000757 * Sc/dT(min) * \ln (ho/hf)$

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	9/4/15	09	47	00	129.9	100.0	57.00	37.70	0.88	1.40E-08
final	23.1	9/4/15	11	34	00			55.87	38.10		1.30E-08
1	RT = 0.936	dT =	107.00 min			σ'_c =	4.3 ksf	0.085	0.096	io= 24.5	-1%
initial	23.1	9/4/15	11	35	00	129.9	100.0	59.27	37.04	1.00	1.49E-08
final	23.5	9/4/15	13	29	00			57.80	37.50		1.36E-08
2	RT = 0.924	dT =	114.00 min			σ'_c =	4.3 ksf	0.110	0.110	io= 28.2	4%
initial	23.5	9/4/15	13	30	00	129.9	100.0	59.65	36.90	0.97	1.48E-08
final	23.5	9/4/15	15	19	00			58.22	37.36		1.35E-08
3	RT = 0.919	dT =	109.00 min			σ'_c =	4.3 ksf	0.107	0.110	io= 28.9	2%
initial	23.5	9/4/15	15	20	00	129.9	100.0	60.00	36.78	1.02	1.37E-08
final	23.5	9/4/15	17	38	00			58.30	37.30		1.25E-08
4	RT = 0.919	dT =	138.00 min			σ'_c =	4.3 ksf	0.127	0.125	io= 29.5	-5%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	9.905	cm	ε_{axial} =	2.3%	
Ac =	40.425	cm^2			
Vc=	400.43	cm^3	ε_{vol} =	5.8%	
Sc =	0.245	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.79	126.6	102.3	94.0
PreTest	21.79	132.2	108.6	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **1.31E-08** cm/sec

(i_o)ave = 27.8

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B008 | Test No.: P10595

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1B | DEPTH (ft): 10.8

Specimen - Apparatus set-up - Test Information | Cell No. C | Apparatus No. 2 | Stage No.: 2

Preliminary Length/Area Calculations

Lo =	3.985	in	Lo=	10.121	cm
dLc=	0.010	in	Ao =	41.87	cm^2
Lc=	3.975	in	Vo =	423.74	cm^3
			Lc=	10.095	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	3.19	cm^3
			Vc =	420.55	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.657	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or ______ top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage-Trial No.	Temp. º C	Date	Time hr	Time min	Time sec	Initial σ_c psi	Initial Ub psi	U-tube Reading Head (cm) (cc)	U-tube Reading Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.3	10/3/15	15	11	00	105.0	100.0	58.00	43.50	1.16	6.53E-09
final	22.0	10/4/15	09	33	00			54.40	44.50		6.21E-09
6	RT = 0.952	dT =	1102.00 min			σ'_c =	0.7 ksf	0.268	0.231	io= 18.1	13%
initial	22.0	10/4/15	09	38	00	105.0	100.0	58.20	43.40	1.07	5.75E-09
final	23.6	10/4/15	14	32	00			57.20	43.70		5.38E-09
7	RT = 0.936	dT =	294.00 min			σ'_c =	0.7 ksf	0.074	0.069	io= 18.4	-2%
initial	23.6	10/4/15	14	36	00	105.0	100.0	58.15	43.50	1.61	5.39E-09
final	24.2	10/4/15	17	11	00			57.65	43.60		4.89E-09
8	RT = 0.909	dT =	155.00 min			σ'_c =	0.7 ksf	0.037	0.023	io= 18.2	-11%
initial	24.2	10/4/15	17	11	00	105.0	100.0	57.65	43.60	0.95	5.89E-09
final	22.6	10/5/15	08	49	00			54.85	44.55		5.43E-09
9	RT = 0.921	dT =	938.00 min			σ'_c =	0.7 ksf	0.208	0.220	io= 17.5	-1%
initial											
final											
10		dT =				σ'_c =					
initial											
final											
11		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.095 cm ε_{axial} = 0.3%

Ac = 41.674 cm^2

Vc= 420.72 cm^3 ε_{vol} = 0.7%

Sc = 0.242 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.07	127.5	103.6	94.9
PreTest	23.87	129.2	104.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 6-9

ave K @ 20 ºC: **5.48E-09** cm/sec

(i_o)ave = 18.1

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794	BORING: BAL-B010	Test No.: P10578
Project Name: Dynegy CCR - Baldwin	SAMPLE: ST-2B	DEPTH (ft): 21.3

Specimen - Apparatus set-up - Test Information Cell No. B Apparatus No. 2 Stage No.: 4

Preliminary Length/Area Calculations

Lo =	4.006	in	Lo=	10.174	cm
dLc=	0.057	in	Ao =	42.20	cm^2
Lc=	3.949	in	Vo =	429.34	cm^3
			Lc=	10.029	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.33	cm^3
			Vc =	411.01	cm^3
Sc =	0.245	cm^{-1}	Ac=	40.980	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top / Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3214

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.029	cm	ε_{axial} =	1.4%
Ac =	41.453	cm^2		
Vc=	415.75	cm^3	ε_{vol} =	3.2%
Sc =	0.242	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	22.15	124.2	101.7	88.4
PreTest	23.11	129.2	105.0	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **2.44E-06** cm/sec

(i_o)ave = 14.9

Tested By: BB Reviewed By: G. Thomas

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.1	9/8/15	11	02	00	117.6	100.0	56.00	44.13	1.01	2.66E-06
final	23.1	9/8/15	11	15	00			48.37	46.55		2.44E-06
1	RT = 0.929	dT =	13.00 min			σ'c =	2.5 ksf	0.568	0.560	io= 14.9	0%
initial	23.1	9/8/15	11	16	00	117.6	100.0	56.00	44.13	0.99	2.85E-06
final	23.2	9/8/15	11	31	00			47.88	46.77		2.62E-06
2	RT = 0.927	dT =	15.00 min			σ'c =	2.5 ksf	0.604	0.611	io= 14.9	7%
initial	23.2	9/8/15	11	32	00	117.6	100.0	56.00	44.13	1.01	2.76E-06
final	23.2	9/8/15	11	40	00			49.70	46.13		2.53E-06
3	RT = 0.926	dT =	8.00 min			σ'c =	2.5 ksf	0.469	0.463	io= 14.9	4%
initial	23.2	9/8/15	11	41	00	117.6	100.0	56.00	44.13	1.01	2.38E-06
final	23.2	9/8/15	12	02	00			47.60	46.80		2.18E-06
4	RT = 0.926	dT =	21.00 min			σ'c =	2.5 ksf	0.625	0.618	io= 14.9	-11%
initial											
final											
5		dT =				σ'c =					
initial											
final											
6		dT =				σ'c =					

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B011 | Test No.: P10594
Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1A | DEPTH (ft): 15.2

Specimen - Apparatus set-up - Test Information | Cell No. D | Apparatus No. 1 | Stage No.: 3

Preliminary Length/Area Calculations

Lo =	3.998	in	Lo=	10.155	cm
dLc=	0.017	in	Ao =	42.08	cm^2
Lc=	3.981	in	Vo =	427.34	cm^3
			Lc=	10.112	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.45	cm^3
			Vc =	421.89	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.722	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or ______ top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)
RT = (-0.02452*(ave. temp in C) + 1.495)
K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.7	10/1/15	17	22	00	105.0	100.0	56.45	37.90	0.95	2.70E-09
final	21.9	10/2/15	09	04	49			54.62	38.50		2.54E-09
5	RT = 0.936	dT =	942.82 min			σ'_c =	0.7 ksf	0.137	0.144	io= 23.1	39%
initial	22.5	10/2/15	15	34	00	105.0	100.0	57.61	37.55	1.10	2.25E-09
final	22.0	10/3/15	11	47	00			55.50	38.15		2.15E-09
6	RT = 0.949	dT =	1213.00 min			σ'_c =	0.7 ksf	0.158	0.144	io= 24.9	18%
initial	22.0	10/3/15	12	05	00	105.0	100.0	57.00	37.75	1.09	1.43E-09
final	22.0	10/4/15	09	35	00			55.60	38.15		1.37E-09
7	RT = 0.956	dT =	1290.00 min			σ'_c =	0.7 ksf	0.105	0.096	io= 23.9	-25%
initial	22.0	10/4/15	09	40	00	105.0	100.0	56.30	37.95	1.02	1.28E-09
final	22.2	10/5/15	08	54	00			55.00	38.35		1.23E-09
8	RT = 0.953	dT =	1394.00 min			σ'_c =	0.7 ksf	0.097	0.096	io= 22.8	-32%
initial											
final											
9		dT =				σ'_c =					
initial											
final											
10		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.112	cm	ε_{axial} =	0.4%	
Ac =	41.467	cm^2			
Vc=	419.30	cm^3	ε_{vol} =	1.9%	
Sc =	0.244	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	25.83	123.3	98.0	94.5
PreTest	26.15	126.0	99.9	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 5-8
ave K @ 20 ºC: **1.82E-09** cm/sec
(i_o)ave = 23.7

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE

ASTM D 5084 - Method F

Project No.:	T60440739	Boring:	BAL-B017		Test No.: T3922
Project Name:	Dynegy CCR - Baldwin	Sample:	ST-2B	Depth: 26.7	

Specimen - Apparatus set-up - Test Information Cell No. H-6 Apparatus No. 1 Stage No.: 3

Preliminary Length/Area Calculations

Lo =	5.975	in	Lo=	15.178	cm
dLc=	0.064	in	Ao =	41.79	cm^2
Lc=	5.911	in	Vo =	634.27	cm^3
			Lc=	15.015	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	20.38	cm^3
			Vc =	613.89	cm^3
Sc =	0.367	cm^{-1}	Ac=	40.885	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top / Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	10/13/15	09	21	00	116.7	100.0	61.98	36.20	0.99	2.38E-08
final	22.5	10/13/15	13	38	00			58.10	37.42		2.21E-08
1	RT = 0.943	dT =	257.00 min			σ'c =	2.4 ksf	0.291	0.292	io= 21.6	30%
initial	22.5	10/13/15	13	40	00	116.7	100.0	61.78	36.30	1.05	2.05E-08
final	22.9	10/13/15	18	03	00			58.35	37.32		1.90E-08
2	RT = 0.939	dT =	263.00 min			σ'c =	2.4 ksf	0.257	0.244	io= 21.3	11%
initial	22.9	10/13/15	18	12	00	116.7	100.0	61.48	36.35	1.00	1.74E-08
final	22.4	10/14/15	09	00	00			53.30	38.91		1.61E-08
3	RT = 0.940	dT =	888.00 min			σ'c =	2.4 ksf	0.613	0.613	io= 21.0	-5%
initial	22.4	10/14/15	09	02	00	116.7	100.0	61.55	36.35	0.97	1.74E-08
final	24.0	10/14/15	12	31	00			59.20	37.11		1.58E-08
4	RT = 0.926	dT =	209.00 min			σ'c =	2.4 ksf	0.176	0.182	io= 21.1	-7%
initial	24.0	10/14/15	12	37	00	116.7	100.0	62.20	36.18	1.07	1.90E-08
final	22.9	10/14/15	15	37	00			59.90	36.85		1.72E-08
5	RT = 0.920	dT =	180.00 min			σ'c =	2.4 ksf	0.172	0.161	io= 21.8	1%
initial											
final											
6		dT =				σ'c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	15.015	cm	ε_{axial} =	1.1%
Ac =	41.570	cm^2		
Vc=	624.17	cm^3	ε_{vol} =	1.6%
Sc =	0.361	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.51	124.5	100.8	95.4
PreTest	23.66	126.6	102.4	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 2-5

ave K @ 20 ºC: **1.70E-08** cm/sec

(i_o)ave = 21.3

Tested By: BB Reviewed By: GET

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794	BORING: BAL-B027		Test No.: P10596
Project Name: Dynegy CCR - Baldwin	SAMPLE: ST-1D	DEPTH (ft): 26.9	

Specimen - Apparatus set-up - Test Information Cell No. B Apparatus No. 3 Stage No.: 4

Preliminary Length/Area Calculations

Lo =	3.986	in	Lo=	10.125	cm
dLc=	0.018	in	Ao =	41.55	cm^2
Lc=	3.968	in	Vo =	420.72	cm^3
			Lc=	10.079	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.70	cm^3
			Vc =	415.02	cm^3
Sc =	0.245	cm^{-1}	Ac=	41.176	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top		Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000755 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3132

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.9	10/5/15	11	34	00	121.5	100.0	65.60	46.90	1.05	9.40E-09
final	22.7	10/5/15	16	07	27			63.75	47.45		8.86E-09
1	RT = 0.936	dT =	273.45 min			σ'_c =	3.1 ksf	0.138	0.131	io= 23.3	79%
initial	22.7	10/5/15	16	43	00	121.5	100.0	65.65	46.85	0.27	7.28E-09
final	23.5	10/5/15	18	22	26			65.10	47.50		6.81E-09
2	RT = 0.929	dT =	99.43 min			σ'_c =	3.1 ksf	0.041	0.155	io= 23.4	37%
initial	23.5	10/5/15	18	24	00	121.5	100.0	66.40	46.65	1.01	5.93E-09
final	22.2	10/6/15	09	03	00			62.70	47.80		5.59E-09
3	RT = 0.935	dT =	879.00 min			σ'_c =	3.1 ksf	0.277	0.274	io= 24.6	13%
initial	22.2	10/6/15	09	07	00	121.5	100.0	65.85	46.80	1.01	5.07E-09
final	22.5	10/7/15	08	41	12			61.18	48.25		4.84E-09
4	RT = 0.947	dT =	1414.20 min			σ'_c =	3.1 ksf	0.349	0.346	io= 23.8	-2%
initial	22.6	10/7/15	08	57	00	121.5	100.0	65.58	46.85	1.04	5.18E-09
final	22.8	10/7/15	17	04	00			63.76	47.40		4.90E-09
5	RT = 0.938	dT =	487.00 min			σ'_c =	3.1 ksf	0.136	0.131	io= 23.4	-1%
initial	22.8	10/7/15	17	04	00	121.5	100.0	63.76	47.40	0.94	4.76E-09
final	22.8	10/8/15	09	16	00			61.00	48.32		4.49E-09
6	RT = 0.936	dT =	972.00 min			σ'_c =	3.1 ksf	0.206	0.220	io= 20.4	-9%

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.079	cm	ε_{axial} =	0.5%
Ac =	40.862	cm^2		
Vc=	411.86	cm^3	ε_{vol} =	2.1%
Sc =	0.247	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	21.16	127.7	105.4	90.0
PreTest	22.27	131.6	107.7	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 3-6

ave K @ 20 ºC: **4.95E-09** cm/sec

(i_o)ave = 23.0

Tested By: BB Reviewed By: G. Thomas

APPENDIX C

BORING LOGS AND WELL DETAILS

APPENDIX C1

MW 100 SERIES BORING LOGS AND WELL DETAILS

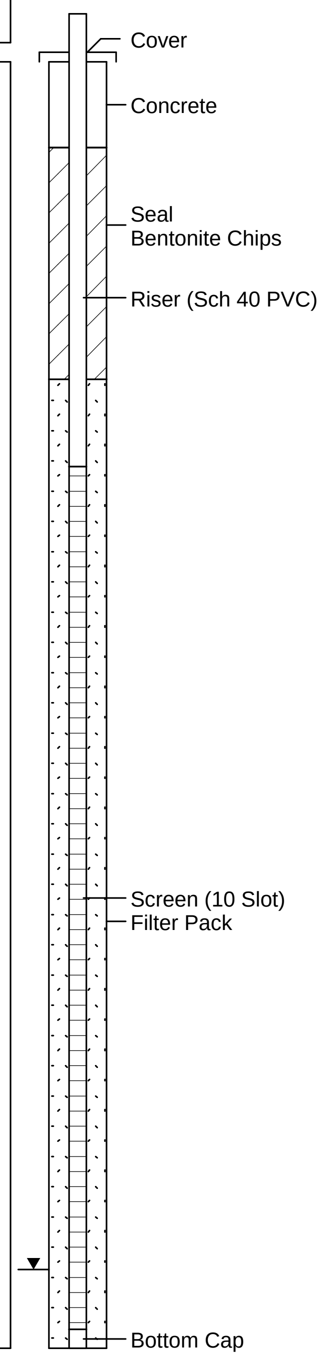
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-104SR (Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/26/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation: 452.52	
Sampling Method	: MacroCore (60")	Top of Casing Elevation 455.54	
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554205

Depth in Feet	DESCRIPTION	Surf. Elev. 452.52	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-104DR for a descriptionof subsurface materials						
		450					
5							
		445					
10	(Slotted screen interval = 9.40 ft)						
		440					
	- groundwater level at completion = 14.06' bls						
15	END BOREHOLE AT 15 FEET BLS						

Well: MW-104SR
Elev.: 455.54



08-12-2011 c:\powerp~1\baldwin\ashmon~1\bec104sr.bor

KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-104DR (Page 1 of 2)

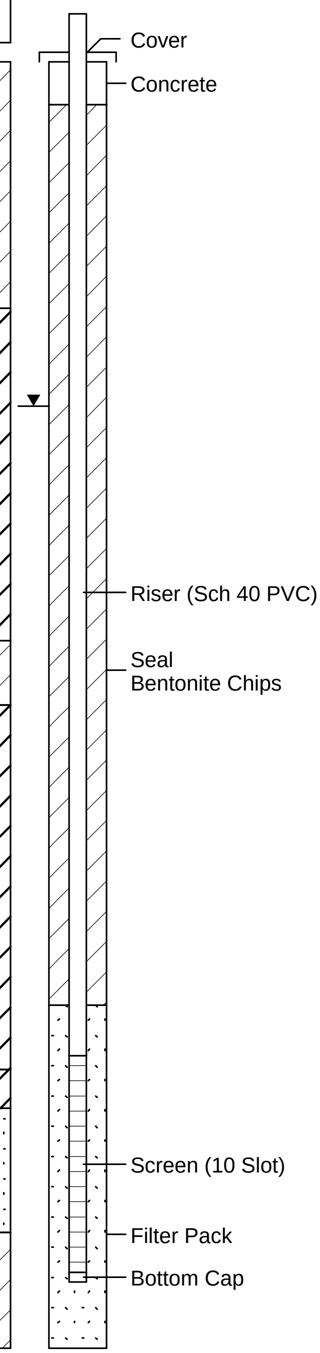
Ash Pond System Monitoring Well Network Baldwin Energy Complex Dynegy Midwest Generation, Inc. Location: Twp 04S, Rng 07W, 10 SE, SE, SE	Date Completed : 07/25/11 Hole Diameter : 7 3/4"OD; 3 3/4" ID Drilling Method : Hollow-Stem (CME-550) Sampling Method : MacroCore (60") Drilling Company : Terra Drill, Inc.	Driller : Matt Cooper Geologist : Stu Cravens (Kelron) Land Surface Elevation: 452.62 Top of Casing Elevation 455.62 X,Y Coordinates : 2386609, 554201	

Depth in Feet: 0, 5, 10, 15, 20, 25, 30 — Surf. Elev. 452.62: 450, 445, 440, 435, 430, 425

DESCRIPTION	USCS
SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry - moist	CL
CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist - groundwater level at completion = 8.03' bls - medium hardness - light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)	CH
CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)	CL
CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%) - trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%	CH
SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist	CH
SAND (fine to medium), trace gravel, poorly graded, light gray, wet - brown (Slotted screen interval = 4.52 ft)	SP
SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	CL

Samples	Recovery inches	Qp TSF
1		>4.5
2		>4.5
3	60/60	3.5
4		2.5
5		2.5
6		2.5
7		2.5
8	60/60	1
9		1
10		1
11		1.75
12		2.25
13	60/60	2.25
14		3.0
15		2.5
16		3.75
17		2.75
18	60/60	3.5
19		3.5
20		3
21		3
22		2.5
23	60/60	2.5
24		2.5
25		2.5
26		
27		2.5
28	60/60	
29		4.0
30		4.5

Well: MW-104DR
Elev.: 455.62



KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Well: MW-104DR
Elev.: 455.62

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31		3.0	CL	
			32				
		420	33	60/60		SH	
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							

KELRON
ENVIRONMENTAL
INCORPORATED

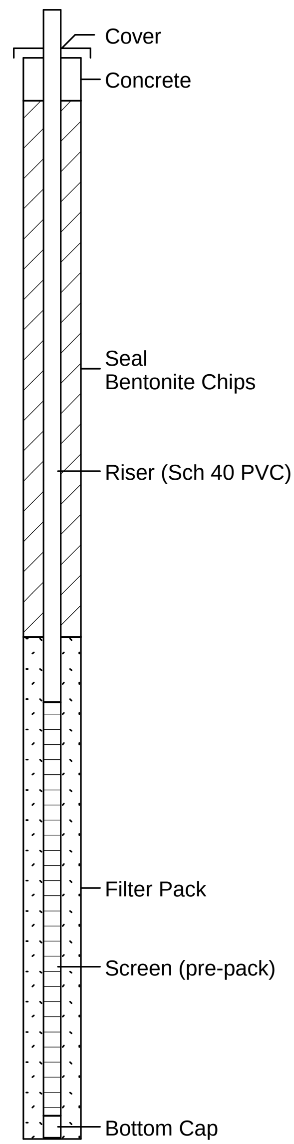
LOG OF BORING MW-150

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/08/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 393.84
Sampling Method	: MacroCore (60")	Top of Casing Elevation	396.54
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2379413, 554563

Depth in Feet	DESCRIPTION	Surf. Elev. 393.84	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-350 for a description of subsurface materials	393					
5		388					
10		383					
15		378					
20		373					
25	END BOREHOLE AT 25.2 FEET BLS	368					
30							

Well: MW-150
Elev.: 396.54



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec150~1.bor

KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-151

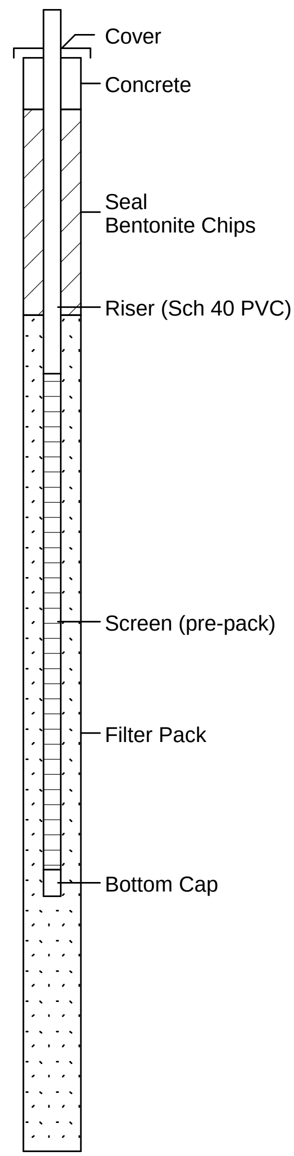
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/21/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	397.22
Sampling Method	: MacroCore (60")	Top of Casing Elevation	399.96
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2381171, 554221

Depth in Feet	DESCRIPTION	Surf. Elev. 397.22	USCS
0	SILTY CLAY, light brown, dry	397	CL
4.5	SANDY CLAY, dark gray (10YR 4/1) - moist - moist to wet - very dark gray-brown; grain size analysis @7.5-8 ft: 39% sand, 41.8% silt, 19.2% clay	392	CL
9.5	SILTY CLAY, yellowish-brown (10YR 5/1) - two small light gray sandy seams - 2-inch layer of dusky red CLAY (10R 3/2)	387	CL
14.5	CLAY, low plasticity, medium soft - shaley, light olive brown (2.5Y 5/4) grading to olive gray; grain size analysis @16-17 ft:: 1%sand, 28.5% silt, 70.5% clay - platy/laminated	382, 377	CH
	Refusal in bedrock at 21.5 feet BLS END BOREHOLE AT 21.5 FEET BLS		
21.5	LIMESTONE, no recovery Drove split-spoon to 21.75 feet BLS - no recovery		LS

Samples	Recovery inches	Qp TSF
1	31/48	
2		1.5
3		1.0
4		1.5
5	32/60	
6		1.0
7		0.5
8		1.0
9		2.5
10	46/60	2.5
11		3.0
12		2.75
13		2.5
14		2.75
15	58/60	2.5
16		2.5
17		3.5
18		2.75
19		2.75
20	24/27	2.5
21		4.5+
22		

Well: MW-151
Elev.: 399.96

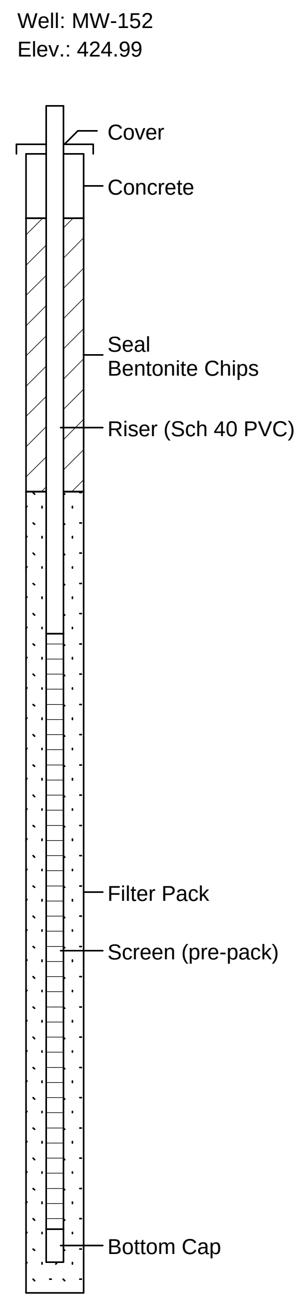


KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-152 (Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/22/10	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.18
Sampling Method	: MacroCore (60")	Top of Casing Elevation	424.99
Drilling Company	: PSC	X,Y Coordinates	: 2382779, 553906

Depth in Feet	DESCRIPTION	Surf. Elev. 422.18	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-352 for a description of subsurface materials.	422					
5		417					
10		412					
15		407					
	END BOREHOLE AT 17.7 FEET BLS						
20							



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec152~1.bor

KELRON ENVIRONMENTAL
INCORPORATED

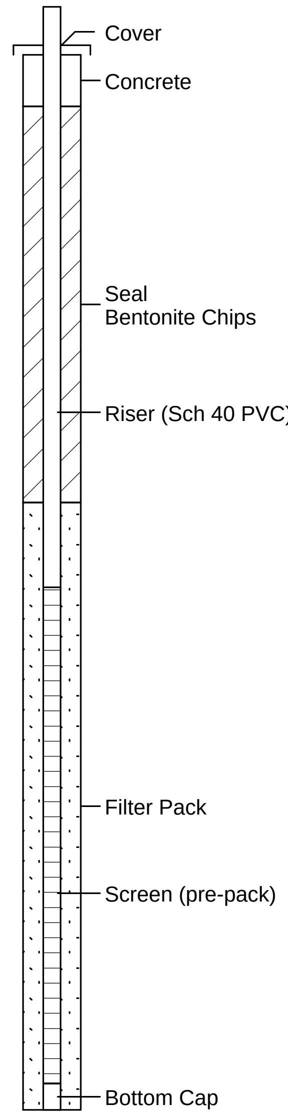
LOG OF BORING MW-153

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/22/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.77
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.67
Drilling Company	: PSC	X,Y Coordinates	: 2384435, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.77	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-253 for a description of subsurface materials	442					
5		437					
10		432					
15		427					
20	END BOREHOLE AT 20.5 FEET BLS	422					
25							

Well: MW-153
Elev.: 445.67



KELRON ENVIRONMENTAL INCORPORATED

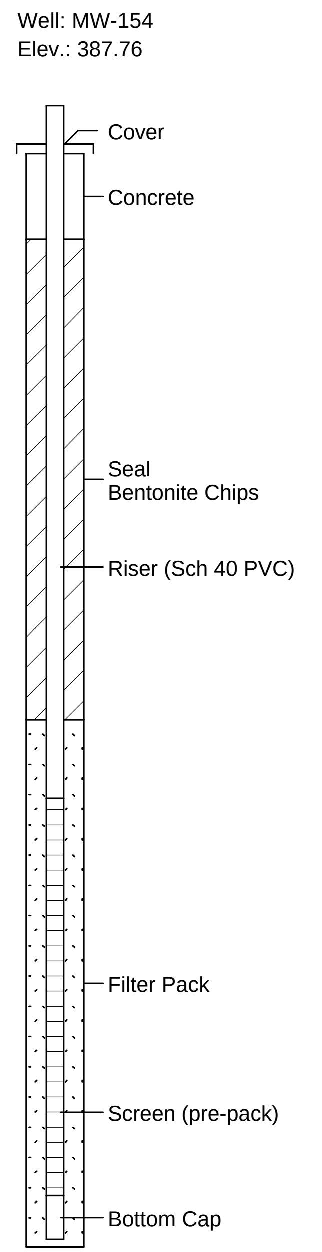
LOG OF BORING MW-154

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, NE, SW

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 384.99
Sampling Method	: MacroCore (60")	Top of Casing Elevation	387.76
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2377892, 557163

Depth in Feet	DESCRIPTION	Surf. Elev. 384.99	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, hard, very dark gray (10YR 3/1), dry	384	1	35/48		CL
2	CLAY, black, moist	379	2	44/60		CH
8	SANDY CLAY with gravel, very stiff to hard, low plasticity, dark gray with yellow-brown mottling, dry - grain size analysis @ 8-9.2 ft: 17.4% gravel, 30.5 %sand, 18.8% silt, 33.4% clay		3	24/42		CL
11	CLAY, shaley, gray with light olive-brown mottling - grain size analysis @ 11-12 ft: 12.5% sand, 23% silt, 64.5% clay Refusal in bedrock at 12.5 feet BLS	374				CH
12.5	LIMESTONE		4	1/6		LS
	Drove split-spoon to 12.75 feet BLS - 1-inch recovery END BOREHOLE AT 12.75 FEET BLS					

Depth scale: 0, 5, 10, 15



KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-155

(Page 1 of 1)

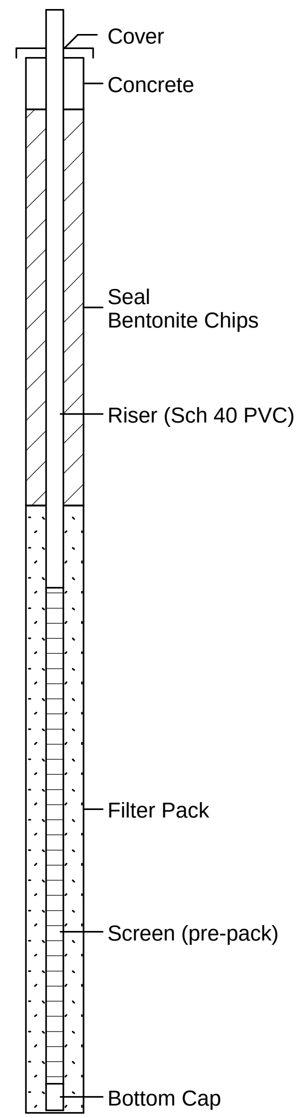
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	390.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	393.55
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev. 390.62	USCS
0 – 3.5	SILTY CLAY, hard, reddish brown, dry	390	CL
3.5 – 8	CLAY (lean), hard, low plasticity, pale brown (10YR 6/3), grading to Fat CLAY - grain size analysis @ 7 - 8 ft: 2.5% sand, 47.2% silt, 50.3% clay	385	CL/CH
8 – 9	SANDY CLAY, dry		CL
9 – 9.3	SAND, 4-inch seam, poorly graded, loose		SP
9.3 – 17	CLAY with sand grading to SANDY CLAY, very soft, moist	380, 375	CL
17 – 20.5	CLAYEY SAND, poorly graded, dark yellow brown - grain size analysis @ 18.5 - 19.5 ft: 53.9 %sand, 28.1% silt, 18.0% clay		SC
20.5	END BOREHOLE AT 20.5 FEET BLS	370	

Samples	Recovery inches	Qp TSF
1	40/48	
2		
3		
4		4.5
5	53/60	
6		
7		4.5+
8		
9		0.75
10	44/60	
11		
12		1.5
13		
14		1.5
15	50/60	
16		0.5
17		
18		1.5
19		
20		

Well: MW-155
Elev.: 393.55



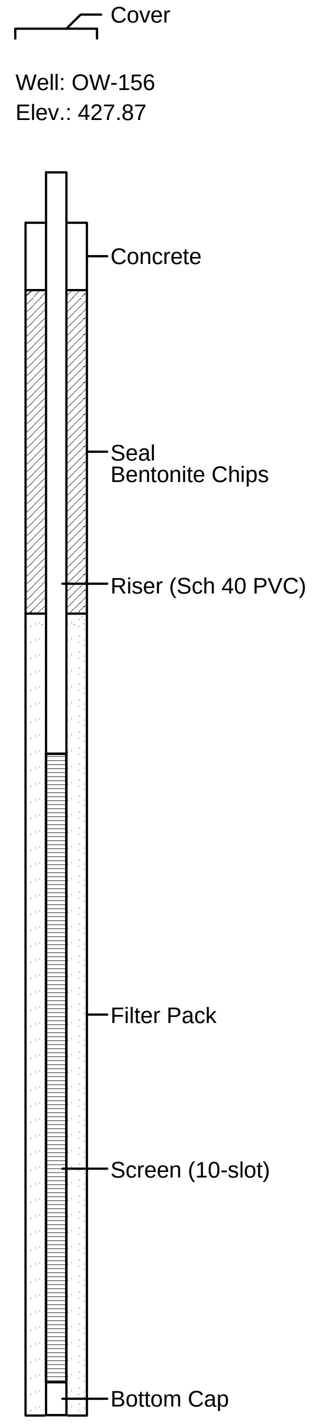
01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec155~1.bor

KELRON ENVIRONMENTAL Incorporated	LOG OF BORING OW-156
	(Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 NW, NW, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	425.14
Sampling Method	: MacroCore (60")	Top of Casing Elevation:	427.87
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev.425.15	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY, stiff, medium brown, dry	425					
			1	32/48	2.5		
			2		1.5		
			3		3.5		
			4		1.75		
5	- stiff to very stiff, low plasticity	420	5	56/60	2.0		
			6		1.75		
	- dark gray-brown (10YR 3/3) with light brown mottling (10YR 6/3)		7		1.75		
			8		1.75		
			9		2.25		
10	CLAY (lean) with Sand, soft to medium, light brown (10YR 6/3) with brown-yellow mottling (10YR 6/6), moist	415	10	60/60	1.0	CL	
			11		1.5		
			12		1.75		
			13		1.75		
			14		1.5		
15		410	15	50/60	2.25		
			16		2.0		
			17		2.5		
	END BOREHOLE AT 17.7 FEET BLS		18		1.25		
	Terminated probing with MacroCore at 19.5 feet bls		19				
20							



04-09-2014

KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING OW-157

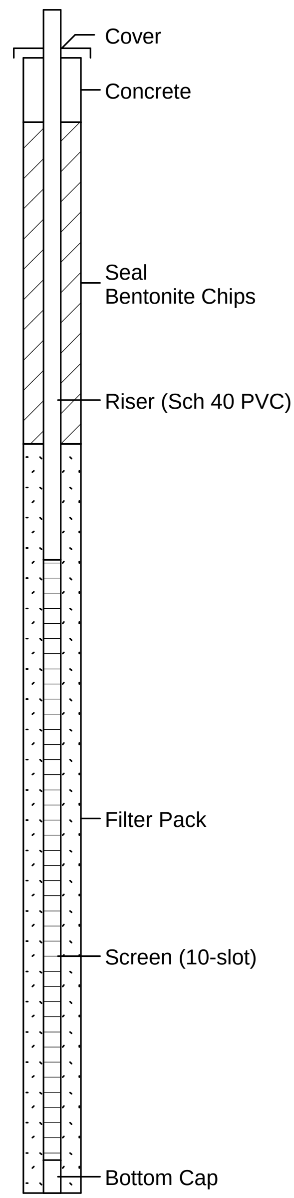
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SW, SW

Date Completed	: 09/9/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 432.64
Sampling Method	: MacroCore (60")	Top of Casing Elevation	429.90
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2382593, 556189

Depth in Feet	DESCRIPTION	Surf. Elev. 429.90	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY with Fly Ash, dark gray-brown, dry	429	1	48/48		CL/FL
5	CLAY with Silt, hard, medium plasticity, light olive brown, moist	424	2	60/60		CH
10	CLAY with Sand, stiff, wet	419	3	60/60		CL
15	CLAY, trace to some Sand, very stiff to hard, medium to high plasticity	414	4	60/60		CL/CH
	END BOREHOLE AT 17.5 FEET BLS					
20	Terminated probing with MacroCore at 19.5 feet bls					

GRAPHIC

Well: OW-157
Elev.: 432.64



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec157~1.bor

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

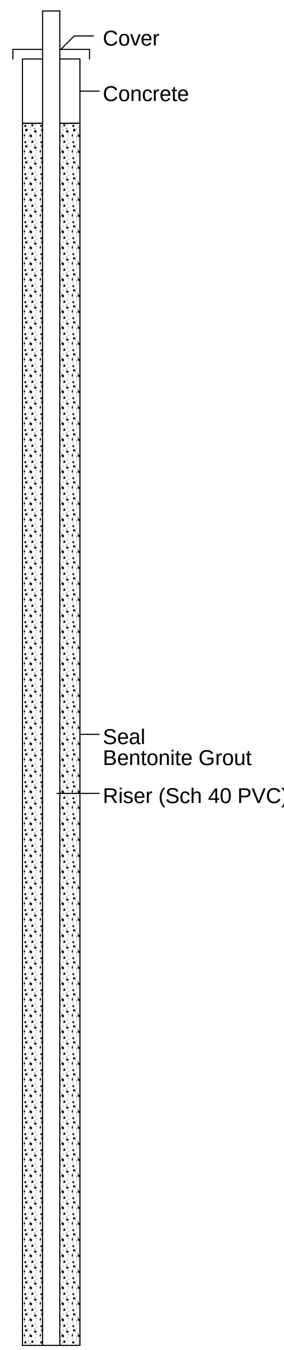
Date Completed	: 08/21/2013
Hole Diameter	: 8 1/2" OD / 4 1/4" ID
Drilling Method	: HSA (CME-55LC)
Sampling Method	: MacroCore (60")
Drilling Company	: Bulldog Drilling, LLC
Driller	: John Gates
Geologist	: Stuart Cravens (Kelron)
Ground Elevation	: 428.74
Casing (MP) Elevation	: 431.27
X,Y Coordinates	: 2379206, 557078

Depth in Feet: 0 – 20 (ticks at 0, 5, 10, 15, 20)
Surf. Elev. 428.74 (marks at 425, 420, 415, 410)

DESCRIPTION	USCS
FILL - Silt with clay, organics (roots), stiff, non-plastic, light yellowish brown (10YR 6/4), dry	FL/CL
SILT with clay, roots, hard, brownish yellow (10YR 6/6)	ML
Silty CLAY with roots, very stiff, medium plasticity, with reddish-brown mottling and manganese staining, moist - medium hardness, medium to high plasticity, light brownish gray (10YR 6/2) with mottling and manganese staining	CL
SILT, stiff, non-plastic, brownish yellow (10YR 6/6) - with clay, very soft, medium plasticity, wet	ML
Silty CLAY, stiff to very stiff, high plasticity, light brownish gray (10YR 6/2) with reddish brown and black mottling grading to light gray, moist	CL
SILT, very soft, non-plastic, light brownish gray (10YR 6/2) - wet	ML
Silty CLAY, stiff, medium plasticity, gray (10YR 6/1), moist - soft to medium hardness, high plasticity, yellowish brown (10YR 5/6) - <25% mottling	CL

Samples	Recovery inches	Qp TSF
1	38/42	2.75
2		>4.5
3		3.0
4	60/60	2.0
5		2.0
6		2.25
7		2.5
8		1.75
9	60/60	1.0
10		2.5
11		1.0
12		0.75
13		2.0
14	60/60	1.5
15		1.25
16		1.5
17		1.25
18		2.25
19	60/60	2.0
20		1.0

Well: MW-161
Elev.: 431.27



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-161

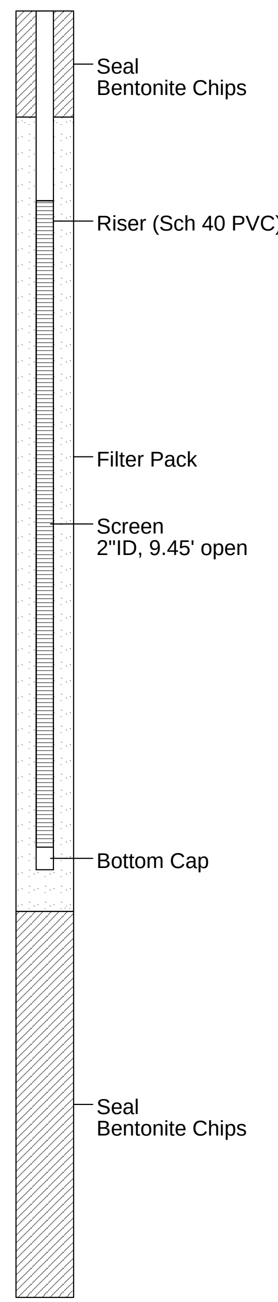
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	USCS
20			CL
	SILT with clay, stiff, low plasticity, brownish yellow (10YR 6/8) - soft, yellowish brown (10YR 5/4), wet		ML
	Silty CLAY, stiff, low to medium plasticity, pale brown (10YR 6/3) with reddish-brown mottling, moist - soft to very soft, high plasticity, light yellowish brown - brown (10YR 5/3) with <10% reddish brown mottling - with fine sand	405	CL
25			
	SAND with Silt, fine grained, gray-brown, wet <Sample MC161-32 @ 31.5-32.5'> grain size analysis: 89.8% Sand, 10.2% Silt - pale green (Gley1 5G 6/2)	400	SP/SM
30			
	CLAY (lean), trace fine-medium sand, hard, low plasticity, greenish-gray (10GY 5/1), moist [TILL] - medium to stiff, medium to high plasticity - trace sand, stiff to hard	395 390	CL
35			
40			

Samples	Recovery inches	Qp TSF
20		1.0
21		2.0
22		2.0
23		1.0
24	60/60	0.75
25		
26		
27		1.0
28		
29	53/60	
30		
31		
32		
33		3.0
34	60/60	2.5
35		1.25
36		1.5
37		1.75
38		3.0
39	44/60	2.0
40		1.5

Well: MW-161
Elev.: 431.27



KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-161 (Page 3 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Well: MW-161
Elev.: 431.27

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS
40			40		1.5	CL
			41		2.0	CL
			42		1.5	CL
	Sandy SILT, medium hardness, non-plastic					ML
	Silty CLAY with shale and fine-coarse limestone gravel (rounded to sub-rounded up to 1.5"), stiff to very stiff, greenish gray (Gley1 10Y 5/1)	385	43		2.0	CL
			44	14/14	>4.5	CL
	SHALE, laminated, hard, weathered (top of bedrock = 44.3' bls)					SH
45	END BOREHOLE AT 44.7 FEET BLS Refusal of Macrocore and Auger on top of competent bedrock					
		380				
50						
		375				
55						
		370				
60						

Seal
Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC161.BOR

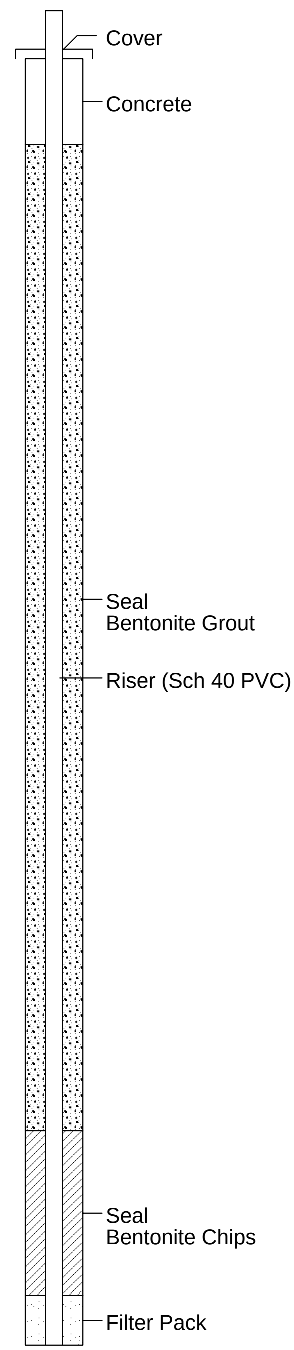
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-162 (Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous Boring - no soil sampling conducted. Descriptions of subsurface materials on this log are from adjacent boring log for well MW-262.	430					
	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry					CL	
	- brownish yellow (10YR 6/6), moist						
5	- medium stiff, high plasticity	425					
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]					ML	
10	- clayey, soft to medium hardness, low to medium plasticity	420					
	- soft, yellowish brown (10YR 5/4)						
15	- non-plastic						

Well: MW-162
Elev.: 433.20



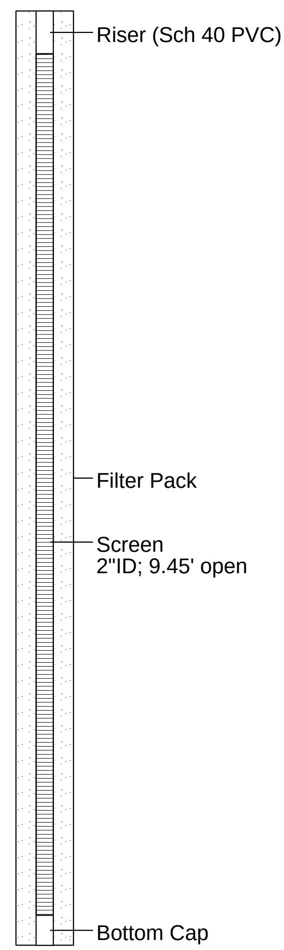
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-162 (Page 2 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Well: MW-162
Elev.: 433.20

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
15		415				ML	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist					CL	
20	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist	410				ML	
25	Silty CLAY, very soft, low plasticity - medium plasticity, wet	405				CL	
30	END BOREHOLE AT 25.9 feet BLS						



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC162.BOR

APPENDIX C2

PZ 100 SERIES BORING LOGS AND WELL DETAILS

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-169

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/27/2015	7/28/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-169	Feet (NAVD88)	420.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,323.57 N, 2,381,764.94 E E/W(circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 49.0632"
Long -89° 52' 12.9108"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15.5	4 9 10 11	0–2	0 - 0.2' **SILT:** ML, dark grayish brown (10YR 4/2), trace roots and clay, very soft (<0.25 tsf), dry.	ML									
				0.2 - 2' **SILTY CLAY** CL/ML, brown (10YR 5/3), cohesive, nonplastic to low plasticity, dry.	CL/ML									
2 ST	24 22		2–4	2 - 4' Shelby Tube Sample.										ST2: 24" push at 500lbs of pressure.
3 SS	24 21	2 3 6 6	4–6	4 - 10' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/6), trace brown (10YR 5/3) and gray (10YR 6/1) mottling, cohesive, nonplastic to low plasticity, stiff to very stiff (1.0-2.5 tsf), dry to moist.	CL/ML									
4 SS	24 20	2 3 5 7	6–8											
5 SS	24 24	2 3 4 5	8–10	8' - 10' dark grayish brown (10YR 4/2), very dark brown (10YR 2/2) mottling, trace dark yellowish brown (10YR 6/3), cohesive, moist. 8.9' dark brown (10YR 3/3) mottling.										
6 SS	24 23	1 3 4 5	10–12	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML, dark yellowish brown (10YR 3/6), trace yellowish brown (10YR 5/6) mottling, decreasing silt content with depth, moist. 10.3' trace wood pieces. 11.4' - 11.7' trace very dark brown (10YR 2/2) mottling.	CL/ML									
7 ST	24 24		12–14	12 - 14' Shelby Tube Sample.										ST7: 24" push at 400lbs of pressure.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 22	2 4 5 6	15	14 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 3/6), grades to gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, trace very dark brown (10YR 2/2) mottling, silt (5-30%), cohesive, low to medium plasticity, stiff to very stiff (1.5-3.5 tsf), moist.										
9 SS	24 22.5	2 3 5 5	16, 17	16' - 19.9' dark yellowish brown (10YR 3/6) and yellowish brown (10YR 5/6) mottling.	CL									
10 SS	24 23	1 4 4 4	18, 19	18' trace dark yellowish brown (10YR 6/3) mottling, trace silt, softer with depth. 18.8' trace very fine and coarse sand.										
11 SS	24 21	1 3 4 4	20, 21	20 - 22' **SILTY CLAY** CL/ML, gray (10YR 6/1), dark yellowish brown (10YR 3/6) and trace very dark brown (10YR 2/2) mottling, trace to few very fine sand seams, cohesive, nonplastic to low plasticity, stiff to very stiff (1.75-2.5 tsf), moist. 21' trace very fine sand seams.	CL/ML									
12 ST	24 25		22, 23	22 - 24' Shelby Tube Sample.										ST12: 24" push at 150lbs of pressure, wet tube (free water)
13 SS	24 24	1 2 3 5	24, 25	24 - 28' **LEAN CLAY WITH SAND:** s(CL), pale brown (10YR 6/3), trace brownish yellow (10YR 6/6) mottling, very fine sand, trace coarse sand, trace silt, cohesive, soft, moist to wet.										
14 SS	24 24	1 1 2 4	26, 27		s(CL)									
15 SS	24 21.5	4 6 8 10	28, 29	28 - 30' **SILTY CLAY** CL/ML, gray (10YR 5/1), trace strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling, very fine sand (10-20%), trace coarse sand and fine gravel, stiff to hard (1.25->4.5 tsf), moist to wet (on bottom).	CL/ML									
16 SS	24 21	3 7 9 14	30, 31	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) and yellowish brown (10YR 5/6) mottling, silt (15-25%), trace very fine to fine gravel, cohesive, medium to high plasticity, very stiff (2.5-4.0 tsf), moist. 30.2' small dark brown (10YR 3/3) fragments (possible shale).	CL									
17 SS	24 20	4 6 10 13	32, 33	32 - 38' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (5-15%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), dry to moist (increasing moisture content with depth). 33.1' - 33.3' dark gray (10YR 4/1).										
18 SS	24 17	4 6 13 16	34, 35	34' - 35.4' no coarse sand, moist.	CL									
19 SS	11 11	5 50 for 5"	36, 37	36' - 37' low plasticity, moist (decreasing moisture content with depth).										subangular gravel in shoe of sample SS19

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
					CL									
20 SS	24 0	13 20 23 25	38	38 - 40' No Recovery.										
			39											
21 SS	18 6	16 35 50 for 6"	40	40 - 42' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (0-10%), subrounded to subangular gravel (5-10%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), moist to wet.	CL									
			41											
			42	42' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-170

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/29/2015	7/29/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-170	Feet (NAVD88)	418.58 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,822.69 N, 2,381,944.92 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 44.106"
Long -89° 52' 10.6752"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 8	4 5 6 9	0–2	0 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (15-25%), trace roots, grass, gravel, and coarse sand, cohesive, nonplastic to low plasticity, hard (>4.5 tsf), dry.	CL/ML								
2 ST	24 / 21		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 / 15	2 3 5 7	4–8	4 - 8' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, low plasticity, very stiff to hard (2.5->4.5 tsf), dry.	CL/ML								
4 SS	24 / 17	3 5 8 8		6' - 7.4' trace gray (10YR 5/1) mottling.									
5 SS	24 / 17	3 4 6 6	8–10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, silt content decreases with depth, clay content increases with depth, medium plasticity, very stiff (3.25 tsf), dry.	CL/ML								
6 SS	24 / 20	3 4 5 5	10–12	10 - 12' **LEAN CLAY:** CL, brown (5YR 4/3), trace very dark brown (10YR 2/2) mottling, trace silt, silt content increasing with depth, medium to high plasticity, stiff (1.75-2.0 tsf).	CL								ST7: 24" push at 250lbs of pressure.
7 ST	24 / 24		12–14	12 - 14' Shelby Tube Sample.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-170

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				12 - 14' Shelby Tube Sample. *(continued)*										
8 SS	24 21	3 5 7 8	14	14 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-20%), trace gravel, cohesive, low plasticity, stiff to very stiff (1.0-3.0 tsf), dry to moist. 14.9' - 15.3' very dark brown (10YR 2/2) mottling.	CL/ML									
9 SS	24 24	2 4 4 6	16	16' - 18.5' increaed very dark brown (10YR 2/2) mottling (5-15%), very fine sand (0-10%), trace fine gravel, subangular, cohesive, low to medium plasticity, dry to moist. 16.8' - 17.1' very dark brown (10YR 2/2) mottling.										
10 SS	24 24	1 3 3 3	18	18' - 20' silt (15-25%), very fine sand (0-10%), trace fine gravel, medium plasticity, moist. 19' layer of gravel (2" thick, subangular to subrounded). 19.8' very soft (0.25 tsf).										
11 SS	24 20	1 2 5 7	20	20' - 24' subangular to subrounded gravel, low plasticity, dry to moist. 20.8' increased gravel content (10-15%). 21.2' decrease in gravel content (5-15%).										
12 SS	24 20.5	3 6 8 10	22											
13 ST	24 24		24	24 - 26' Shelby Tube Sample.										ST13: 24" push at 650lbs of pressure.
14 SS	24 22	3 6 12 14	26	26 - 28.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-30%), very fine sand (0-15%), trace fine subangular to subrounded gravel, gravel decreases with depth to no gravel, trace <1mm thick very fine sand seams, cohesive, low to medium plasticity, plasticity increasing with depth, very stiff to hard (2.0->4.5 tsf), moist, decreasing silt and sand content with depth.	CL/ML									
15 SS	24 22	9 17 24 35	28	28.2 - 30' **LEAN CLAY:** CL, very dark gray (2.5Y 3/1), trace silt, cohesive, medium to high plasticity, hard (>4.5 tsf), dry. 28.5' black (2.5Y 2.5/1). 28.9' greenish gray (GLEY 1 6/1).	CL									
16 SS	17 13	11 30 50 for 5"	30	30 - 31.1' **SHALE:** to **LEAN CLAY:** BDX (SH), greenish gray (GLEY 1 6/1), trace silt, cohesive, medium to high plasticity, dry, shale (residual soil to highly decomposed, very weak, fissile).	BDX (SH)									
			31	31.1' End of Boring.										Hollow Stem Auger Refusal at 31.1 ft bgs on Shale Bedrock.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-171

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/30/2015	7/31/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-171	Feet (NAVD88)	431.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,453.57 N, 2,379,199.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.542"
Long -89° 52' 45.0804"

Local Grid Location
Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 5 4 4	0–2	0 - 2' **SILT:** ML, brown (7.5YR 4/3), 5-15% clay, trace roots, cohesive, nonplastic, dry. 0.7' increase in clay content (15-25%).	ML						
2 ST	24 24		2–4	2 - 4' Shelby Tube Sample.							ST2: 24" push at 250lbs of pressure.
3 SS	24 18	1 3 3 3	4–6	4 - 10.8' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, low to medium plasticity, medium to stiff (0.5-1.75 tsf), moist.	CL/ML						
4 SS	24 24	1 3 3 5	6–8	6' low plasticity.							
5 SS	24 17	1 2 3 3	8–10	7.7' silt (25-35%), trace very fine sand, nonplastic to low plasticity. 8' silt (5-15%), medium plasticity.							
6 SS	24 24	2 2 3 4	10–12	10' silt (20-50%), silt content increasing with depth, moist. 10.8 - 12' **CLAYEY SILT** ML/CL, clay (30-50%), medium (0.5-0.75 tsf), moist.	ML/CL						

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature] | Firm Natural Resource Technology, 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 | Tel: (414) 837-3607 Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-171

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 ST	24 26		12–14	12 - 14' Shelby Tube Sample.									ST7: 24" push at 200lbs of pressure.
8 SS	24 24	2 3 3 5	14	14 - 20' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (30-40%), cohesive, low to medium plasticity, medium to stiff (0.75-2.0 tsf), moist.	CL/ML								
9 SS	24 24	2 3 5 5	16										
10 SS	24 20	1 3 5 8	18	17.4' - 19.7' dark yellowish brown (10YR 4/4), brown (10YR 5/3) mottling, clay (20-30%), cohesive, nonplastic, moist.									
11 ST	24 16		20	20 - 22' Shelby Tube Sample.									ST11: 24" push at 350lbs of pressure.
12 SS	24 21	1 1 2 2	22	22 - 26' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, low to medium plasticity, very soft to medium (0.25-1.0 tsf), moist. 22.8' - 23' sandy clay layer, very fine sand, wet.	CL/ML								
13 SS	24 17	WOR 1 2 3	24	24' - 26' silt (5-15%), medium to high plasticity, moist.									WOR = Weight of Rods
14 SS	24 24	1 1 2 2	26	26 - 28' **SILTY CLAY** to **SANDY LEAN CLAY:** CL/ML, yellowish brown (10YR 5/4), very fine sand (30-50%), increasing sand content with depth, silt (20-40%), decreasing silt content with depth, clay content decreasing with depth, cohesive, nonplastic to low plasticity, decreasing plasticity with depth, wet.	CL/ML								
15 SS	24 21.5	1 3 7 10	28	28 - 28.7' **CLAYEY SILT** to **POORLY-GRADED SAND:** ML/CL, yellowish brown (10YR 5/4), clay (10-20%), fine sand (10-20%), cohesive, nonplastic, wet. 28.7 - 36.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), fine sand, silt (5-15%), clay (5-15%), medium and coarse grained sand (5-10%), wet.	ML/CL SP								
16 SS	24 24	4 4 3 4	30	30' trace clay, trace medium and coarse sand.									
			32										

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-171

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 21.5	5 9 15 20	33	28.7 - 36.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), fine sand, silt (5-15%), clay (5-15%), medium and coarse grained sand (5-10%), wet. *(continued)* 32' - 33.8' sand grading from fine to very fine with depth.										
18 SS	24 22	5 15 19 22	34, 35		SP									
19 SS	24 22	4 4 5 6	36, 37	36' - 36.6' increase in silt content with depth (5-15%). 36.4' clay layer (2mm thick). 36.5' clay layer (2mm thick).										
			38	36.6 - 38' **LEAN CLAY:** CL, dark gray (2.5Y 4/1) to very dark gray (2.5Y 3/1), trace silt, trace fine sand seams, high plasticity, stiff (1.5-1.75 tsf), moist.	CL									
				38' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-172

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/31/2015	7/31/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-172	Feet (NAVD88)	410.22 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,323.28 N, 2,379,176.11 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 29.3676"
Long -89° 52' 45.4188"

Local Grid Location
Feet ☐ N ☐ S
Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	3 6 5 4	0	0 - 0.5' **FILL, TOPSOIL:** ML, dark grayish brown (10YR 4/2), trace clay, gravel, roots, and grass, noncohesive, dry. 0.4' angular gravel.	(FILL) ML								
			1	0.5 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), very dark brown (10YR 2/2) and strong brown (7.5YR 4/6) mottling, silt (5-15%), trace fine sand, cohesive, low plasticity, dry.	CL/ML								
2 ST	24 17		2	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
			3										
3 SS	24 19	2 3 4 6	4	4 - 9.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), increased very dark brown (10YR 2/2) and strong brown (7.5YR 4/6) mottling, silt (5-15%), trace fine sand, cohesive, medium plasticity, very soft to very stiff (0.25-2.5 tsf), moist.	CL/ML								
			5										
4 SS	24 22	2 2 4 8	6	6' silt (10-20%), low to medium plasticity.									
			7										
5 SS	24 20	1 3 5 9	8	8' decreased mottling, trace brown silt seams, silt content increasing with depth (20-50%).									
			9	9.2 - 10' **SILT:** ML, brown (7.5YR 4/4), clay (5-15%), cohesive, nonplastic, moist.	ML								
6 ST	24 16		10	10 - 12' Shelby Tube Sample.									ST6: 24" push at 450lbs of pressure.
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-172

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	1 1 3 4	13	12 - 18' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), cohesive, nonplastic to low plasticity, stiff to very stiff (1.25-2.75 tsf), moist. 13.3' soft (0.5 tsf).	CL/ML									
8 SS	24 24	2 3 4 7	14, 15											
9 SS	24 22.5	2 4 4 6	16, 17	15.8' hard (4.0 tsf). 16.6' - 16.8' increased very dark brown (10YR 2/2) mottling.										
10 ST	24 22		18, 19	18 - 20' Shelby Tube Sample.										ST10: 24" push at 350lbs of pressure.
11 SS	24 23	1 3 3 3	20	20 - 21' **SANDY LEAN CLAY:** s(CL), dark gray (10YR 4/1), with clay seams, trace yellowish brown (10YR 5/8 mottling), cohesive, nonplastic, wet, clay seams (medium to high plasticity).	s(CL)									
			21	21 - 22' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, mostly yellowish brown (10YR 5/8) with some dark gray (10YR 4/1), silt (>15%), cohesive, nonplastic.	s(CL)g									
12 SS	14 12	1 2 50 for 2"	22, 23	22 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/8) with dark gray (10YR 4/1) mottling, sand (5-15%), cohesive, low plasticity.	CL/ML									
13 SS	22 18	15 14 18 50 for 4"	24, 25	24 - 26' **LEAN CLAY:** CL, trace gravel, hard (4.5 tsf), cohesive, dry.	CL									
14 SS	2 2	50 for 2"	26	26 - 26.2' **SHALE:** BDX (SH), clay (5-15%). 26.2' End of Boring.	BDX (SH)									

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-173

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/3/2015	8/3/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-173	Feet (NAVD88)	388.43 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,035.38 N, 2,379,187.28 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 26.52"
Long -89° 52' 45.2892"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 0		0–2	0 - 2' No Recovery. Gravel Pad.	(FILL)									
2 SS	24 13	2 2 2 3	2–4	2 - 10.9' **SILTY CLAY** CL/ML, dark grayish brown (10YR 4/2), trace sand and wood, cohesive, medium plasticity, very stiff (2.5-3.5 tsf), moist.										
3 SS	24 7	2 5 4 5	4–6	4' yellowish red (5YR 4/6) mottling.										
4 SS	24 20	2 4 8 9	6–8	6' - 7.7' yellowish brown (10YR 5/6) with dark gray (10YR 4/1) mottling, hard, laminated, dry.	CL/ML									
5 SS	24 19	2 4 6 8	8–10	8.2' very dark gray (10YR 3/1), trace dark yellowish brown (10YR 4/6) mottling, small hard nodules of clay in the matrix, dry to moist.										
6 SS	24 18	2 3 6 7	10–12	10.6' olive (5Y 5/6) with bluish gray (GLEY2 5/2) mottling. 10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist.	ML									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 SS	22 16	2 5 15 50 for 4"	13	10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist. *(continued)* 12' - 13.3' trace brown (7.5YR 4/4) mottling, trace gravel, trace sand, increasing sand and gravel with depth. 12.6' wet. 12.8' clay (0-15%).	ML									
8 SS 9 SS	2 0 1 1	50 for 2" 50 for 1"	14	13.8 - 14.1' **BEDROCK** BDX (SH), wet. 14.1' End of Boring.	BDX (SH)									Hollow Stem Auger Refusal at 13.5 ft bgs on Bedrock. SS8: Rock chips in spoon. Split Spoon Refusal at 14.1 ft bgs on Bedrock.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-174

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/4/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-174	Feet (NAVD88)	398.97 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,666.23 N, 2,379,774.23 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 22.8552"
Long -89° 52' 37.9524"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 5	2 3 5 3	0–2	0 - 2' **TOPSOIL:** ML, brown (10YR 4/3), trace grass and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 0	2 2 2 4	2–4	2 - 4' No Recovery.									
3 SS	24 6	2 2 4 5	4–6	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist.	CL								
4 SS	24 6	4 4 5 7	6–8										
5 SS	24 23	3 4 5 5	8–10	8' - 9.9' increased yellowish brown (10YR 4/4) mottling, increase in silt content with depth (50%).									
6 SS	24 20	2 4 8 6	10–12	10' - 11.7' decrease in silt content with depth (10-20%). 10.6' - 11.2' dark yellowish brown (10YR 4/4) and very dark brown (10YR 2/2) mottling (50%), dry to moist.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-174

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 21	2 3 5 7	13	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist. *(continued)* 12' - 13.8' trace coarse sand, dry.										
8 SS	24 21	2 4 5 8	14 15	14' - 15.8' increased sand content, trace gravel, dry.										
9 SS	24 24	2 4 5 7	16 17	16' - 18' yellowish brown (10YR 5/4), moist.										
10 SS	24 24	3 7 9 12	18 19	18' - 20' coarse sand and gravel (5-15%), moist.	CL									
11 SS	24 24	3 7 9 15	20 21											
12 SS	24 24	4 7 8 10	22 23											
13 SS	8 8	11 50 for 2"	24	24' - 24.7' decreased moisture content with depth.										Hollow Stem Auger Refusal at 24.7 ft bgs on Shale Bedrock.
				24.7' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		PZ-175	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Chad Dutton Bulldog Drilling	8/7/2015	8/7/2015	hollow stem auger
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
PZ-175	Feet (NAVD88)	419.87 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,433.02 N, 2,380,846.31 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 20.5152"
Long -89° 52' 24.5316"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	4 7 5 4	0–1	0 - 0.9' **SILT:** ML, brown (10YR 5/3), trace roots and grass, noncohesive, nonplastic, hard (3.0->4.5 tsf), dry.	ML								
2 SS	24 15	2 4 4 6	1–3	0.9 - 5.4' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), black (10YR 2/1) mottling, silt (5-15%), dry, cohesive, low plasticity, very stiff (2.5-3.0 tsf). 2' dry, increase in moisture content with depth, trace brown (10YR 5/3) silt seams.	CL								
3 SS	24 17	2 3 4 6	4–5	4' increased brown (10YR 5/3) and black mottling (10YR 2/1), moist.									
4 SS	24 23	2 2 4 4	6–7	5.4 - 13.5' **SILT:** ML, light yellowish brown (10YR 6/4), trace dark gray (10YR 4/1) mottling, clay (5-15%), moist, cohesive, nonplastic, medium to stiff (0.5- 1.5 tsf).	ML								
5 SS	24 22	1 2 3 3	8–9	8' decreased mottling.									
6 SS	24 24	1 2 2 2	10–11	10' brown (7.5YR 4/4), no mottling.									
7 SS	24 23	1 2 3 4	12–14	12' increasing clay content with depth, low plasticity.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 21	1 3 4 5	15	13.5 - 22.3' **LEAN CLAY:** CL, brown (7.5YR 4/4), silt (5-15%), moist, cohesive, low to medium plasticity, stiff to very stiff (1.5-4.0 tsf) increasing with depth. *(continued)* 14' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, trace silt.	CL								
9 SS	24 24	2 3 4 4	16 17	16' brown (7.5YR 5/4), silt (5-15%).									
10 SS	24 23	1 4 6 6	18 19	18' trace black (10YR 2/1) and dark gray (5-50% 10YR 4/1) mottling, trace silt, silt content decreasing with depth, wet.	CL								
11 SS	24 23	2 5 7 7	20 21	20' no black (10YR 2/1) mottling, yellowish brown (5-15% 10YR 5/8) mottling.									
12 SS	24 24	3 3 4 4	22 23	22.3 - 26' **SILT:** ML, clay (5-15%), trace coarse sand, decrease in clay content with depth, moist, cohesive, nonplastic, very soft to very stiff (<0.25-3.0 tsf) decreasing with depth.									
13 SS	24 24	2 2 2 3	24 25	23.9' sandy silt seam (2" thick), wet. 24' some sandy and clayey silt seams, trace coarse sand to fine gravel, moist to wet in sandy silt seams.	ML								
14 SS	24 24	11 8 9 10	26 27	26 - 28' **LEAN CLAY:** to **SILT:** CL, silt (40-60%), coarse sand to fine gravel (5-15%), trace fine sand seams, moist, cohesive, low plasticity, stiff (1.5-2.0 tsf).	CL								
15 SS	24 24	8 11 15 20	28 29	28 - 28.4' **SANDY SILT:** s(ML), yellowish brown (10YR 5/4), wet, cohesive, nonplastic, stiff (1.5 tsf). 28.4 - 31.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), coarse sand to fine gravel (5-15%), trace fine sand seams, hard (>4.5 tsf), dry to moist.	s(ML)								
16 SS	24 24	9 19 20 23	30 31		CL								
17 SS	24 24	6 6 8 10	32 33	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, dark yellowish brown (10YR 4/6), dry. 31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. 32' trace yellowish brown (10YR 5/6) seams and mottling, medium to high plasticity, increasing moisture content with depth.	(SW)g								
18 SS	24 24	7 5 6 8	34 35	34' trace mottling, moist, decreasing moisture content with depth.	CL								
19 SS	24 24	3 5 6 7	36 37	36' dry to moist, silty clay seam (4" thick, moist).									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-175

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
20 SS	24 24	3 4 7 7	38, 39	31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. *(continued)* 38' trace black (10YR 2/1) mottling. 38.3' yellowish brown (10YR 5/6) with gray (10YR 5/1) mottling.	CL								
21 SS	24 24	3 5 6 7	40, 41										
22 SS	24 24	3 5 8 20	42, 43	42' trace fine gravel.									
23 SS	24 20	3 11 12 14	44, 45	43.8 - 45.7' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, brown (10YR 5/3), mostly broken rock, moist. 44' black (10YR 2/1) mottling, seams of wet gravel, coarse sand to coarse gravel.	s(CL)g								
24 SS	24 24	3 5 7 11	46, 47	45.7 - 50' **LEAN CLAY:** CL, light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6) and dark gray (10YR 4/1) and black (10YR 2/1) mottling, trace fine gravel, some laminations, very stiff (2.5-3.5 tsf).	CL								
25 SS	24 24	4 7 12 20	48, 49	48' moist to dry. 48.7' laminated, dry.									
26 SS	1 0	50 for 1"	50	50 - 50.2' **SHALE:** BDX (SH). 50.2' End of Boring.	BDX (SH)								Hollow Stem Auger Refusal at 50.2 ft bgs on Shale Bedrock.

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-176

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/6/2015	8/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-176	Feet (NAVD88)	403.46 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,264.76 N, 2,381,381.02 E E/W (W circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 18.834"
Long -89° 52' 17.8428"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 15	3 3 4 4		0 - 0.5' **TOPSOIL:** ML, dark grayish brown (10YR 4/2), clay (5-15%), trace grass and roots, cohesive, nonplastic, stiff (1.5 tsf), dry.	ML								
			1	0.5 - 2.4' **SILT:** ML, dark grayish brown (10YR 4/2), brownish yellow (10YR 6/6) and dark brown (10YR 3/3) mottling, clay (30-50%), trace roots, cohesive, low plasticity, very stiff (3.0 tsf), dry.	ML								
2 SS	24 / 16	3 3 5 5	2										
			3	2.4 - 6.3' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), dark gray (10YR 4/1) mottling, silt (5-15%), trace roots, cohesive, medium plasticity, moist.	CL								
3 SS	24 / 9	2 3 4 4	4	4' increase in silt content (40-60%), dry to moist.									
			5										
4 SS	24 / 21	3 3 3 4	6	6.3 - 12' **SILT:** ML, dark gray (10YR 4/1), cohesive, nonplastic, moist.	ML								
			7										
5 SS	24 / 12	1 1 1 2	8	8' sand (0-40%), sand content increasing with depth, moist to wet.									
			9										
6 SS	24 / 13	1 1 1 2	10	10' increase in sand content (40-60%).									
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-176

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 20	1 2 3 5		12 - 12.3' **WELL-GRADED SAND:** SW, very dark grayish brown (10YR 3/2), fine gravel (>15%), moist.	SW									
			13	12.3 - 16' **LEAN CLAY:** CL, gray (10YR 5/1), brownish yellow (5-15% 10YR 6/6) and trace very dark brown (10YR 2/2) mottling, silt (5-15%), trace sand seams, cohesive, medium plasticity, stiff to very stiff (1.5-3.0 tsf).										
8 SS	24	2 3 3 5	14	14' increase in thickness of sand seams (1"-2" thick, moist, wet).	CL									
			15											
9 SS	24 17	2 4 7 10	16	16 - 28.6' **LEAN CLAY:** CL, dark gray (10YR 4/1), light yellowish brown (10YR 6/4) mottling, cohesive, low plasticity, very stiff to hard (3.5->4.5 tsf) dry.										
			17											
10 SS	24 18	4 6 8 12	18	18' increased mottling, mostly brown (10YR 5/3), brownish yellow (10YR 6/6), dark gray (10YR 4/1), and olive gray (5Y 5/2) mottling.										
			19											
11 SS	24 17	5 16 22 25	20	20' olive gray (5Y 5/2), brownish yellow (10YR 6/6) mottling. 20.3' dark gray (2.5Y 4/1), brownish yellow (10YR 6/6) mottling, clay becoming blocky and laminated.										
			21											
12 SS	11 7	7 50 for 5"	22	22' pale olive (5Y 6/3), dark gray (10YR 4/1) mottling, laminated.	CL									
			23											
13 SS	24 24	13 21 31 43	24	24' brownish yellow (10YR 6/6) mottling.										At 23.6' rock fragment on bottom of split spoon. Refusal of split spoon.
			25											
14 SS	24 24	14 12 17 19	26											
			27											
15 SS	8 8	9 50 for 2"	28	28' hard (4.5 tsf).										
16 SS	1 0	50 for 1"		28.6' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-177

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/5/2015	8/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-177	Feet (NAVD88)	417.93 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,192.18 N, 2,381,923.59 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.0996"
Long -89° 52' 11.0496"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 12	1 6 8 5	0–1	0 - 4' **TOPSOIL:** ML, dark yellowish brown (10YR 4/4), clay (5-15%), clay content increasing with depth, trace sand and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 4	4 4 6 7	2–3										
3 SS	24 17	2 3 4 5	4–5	4 - 19.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, silt (5-15%), moist, cohesive, medium plasticity, stiff to very stiff (1.0-3.5 tsf).	CL								
4 SS	24 23	1 2 4 4	6–7	6' dark yellowish brown (10YR 4/4), decreased mottling.									
5 SS	24 20	2 2 4 4	8–9	8' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling.									
6 SS	24 20	2 4 6 7	10–11										
7 SS	24 20	3 4 5 8	12–13	12' yellowish brown (10YR 5/4), yellowish brown (10YR 5/8) mottling, trace coarse sand to fine gravel, no black mottling.									
8 SS	24 23	3 3 6 7	14–15	14' trace black (10YR 2/1) mottling.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-177

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
9 SS	24 23	2 4 4 5	16–17	4 - 19.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, silt (5-15%), moist, cohesive, medium plasticity, stiff to very stiff (1.0-3.5 tsf). *(continued)* 16' increased gravel content.	CL								
10 SS	24 24	1 2 3 2	18–19										
11 SS	24	2 2 3 4	20–21	19.3 - 22' **SILT:** ML, yellowish brown (10YR 5/4), brownish yellow (10YR 6/8) mottling, clay (5-15%), trace sand, cohesive, nonplastic, soft (0.5 tsf), wet. 20' increase in clay content with depth (30-50%), trace gravel.	ML								
12 SS	24 16	2 4 13 11	22–23	22 - 29.7' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), strong brown (7.5YR 5/6) mottling, silt (5-15%), trace sand and gravel, stiff to hard (1.5->4.5 tsf) increasing with depth, moist to wet.	CL								
13 SS	24 24	3 4 7 9	24–25	24' sand (5-15%), moist. 24.5' - 25.3' black sand (0-15%).									
14 SS	24 24	4 6 11 13	26–27	26' no mottling, decreasing sand and gravel content with depth to trace, dry to moist, moisture content increases with depth, cohesive, low to medium plasticity, plasticity decreasing with depth.									
15 SS	24 22	5 7 15 50 for 5"	28–29	28' clay becoming laminated with depth. 28.7' brownish yellow (10YR 6/6), yellowish brown (10YR 5/4) mottling.									
16 SS	9 6	11 50 for 3"	30	29.7 - 30' **WELL-GRADED SAND:** SW, trace gravel and silt (noncohesive, nonplastic, rock flour), wet.	SW								
17 SS	1 1	50 for 1"		30 - 30.7' **SILTY GRAVEL:** GM, gravel is broken pieces of bedrock, silt is laminated, cohesive, and nonplastic. 30.7' End of Boring.	GM								Hollow Stem Auger Refusal at 30.7 ft bgs.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-178

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/5/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-178	Feet (NAVD88)	428.45 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,089.94 N, 2,382,460.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 17.0736"
Long -89° 52' 4.3248"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 16	2 7 5 5	0–1	0 - 6.3' **SILT:** ML, brown (10YR 5/3), clay (10-20%), noncohesive, nonplastic, stiff to hard (1.5->4.5 tsf) decreasing with depth, dry. 1' - 1.3' cohesive, moist.	ML								
2 SS	24 / 19	2 7 8 6	2	2' yellowish brown (10YR 5/4), clay (0-15%), brown and gray mottling (30-50%), dry to moist.									
3 SS	24 / 18	2 4 6 8	4	4' dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/6) mottling, increasing clay content, moist.									
4 SS	24 / 23	2 3 4 5	6	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, silt (5-15%), moist, cohesive, medium plasticity.	CL								
5 SS	24 / 23	1 3 3 4	8										
6 SS	24 / 24	2 2 3 5	10–12	10' increased silt content.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-178

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 SS	24 22	1 2 4 5	13	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, silt (5-15%), moist, cohesive, medium plasticity. *(continued)*									
8 SS	24 22	2 4 6 8	14, 15										
9 SS	24 22	3 4 6 7	16, 17	16' trace coarse sand.	CL								
10 SS	24 20	2 4 6 9	18, 19										
11 SS	24 24	2 4 7 6	20, 21	20 - 24.3' **LEAN CLAY:** to **SILT:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, clay (40-60%), silt (40-60%), trace coarse sand, cohesive, medium plasticity, moist.									
12 SS	24 24	1 2 5 4	22, 23	21.7' - 22' sand seam (mostly sand with silt). 23' interbedded sand (mostly fine to medium sand), silt and clay layers, wet.	CL								
13 SS	24 18	1 12 17 20	24, 25	24.3 - 26' **SANDY SILT:** s(ML), medium to coarse sand, moist, cohesive, nonplastic.	s(ML)								
14 SS	24 22	8 16 18 25	26, 27	26 - 26.3' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), mostly fine sand, trace medium sand and silt, wet. 26.3 - 43.5' **LEAN CLAY:** CL, fine to coarse sand (5-15%), trace gravel, yellowish brown (10YR 5/4), very stiff to hard (2.5->4.5 tsf), moist.	SP								
15 SS	24 22	7 8 9 11	28, 29	26.6' dark gray (10YR 4/1) mottling, silt (5-15%), increase in silt content with depth, trace very thin sand seams, trace black fine gravel, cohesive, nonplastic, dry. 28' - 28.6' wet in sand seams. 28.6' trace sand and silt, cohesive, medium to high plasticity, moist.	CL								
16 SS	24 19	4 7 9 13	30, 31, 32	30' trace fine gravel, no sand.									

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-178

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 17	4 5 16 22	33	26.3 - 43.5' **LEAN CLAY:** CL, fine to coarse sand (5-15%), trace gravel, yellowish brown (10YR 5/4), very stiff to hard (2.5->4.5 tsf), moist. *(continued)* 32' increased mottling, trace fine gravel, no sand. 33' brown (10YR 4/3), no mottling, no gravel, trace silt, cohesive, very stiff, dry.										
18 SS	24 20	10 21 25 37	34 35	34' brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-15%).										
19 SS	24 22	12 20 24 24	36 37	36' increase to yellowish brown (10YR 5/6) mottling (30-50%), trace coarse sand, becoming laminated with depth.										
20 SS	24	5 11 14 16	38 39	38.3' silt seam (very soft, wet), trace sand.	CL									
21 SS	24 24	5 10 13 17	40 41	39.6' dark gray grading to black with depth, trace olive yellow (2.5Y 6/6) mottling, silt (5-15%), dry to moist. 40' trace dark gray (10YR 4/1) and brownish yellow (10YR 6/8) mottling, no laminations, silt (5-15%), moist. 40.1' black seam (<0.25" thick).										
22 SS	17 17	7 16 50 for 5"	42 43	42' silt (30-50%), moist to dry, cohesive, nonplastic to low plasticity. 42.2' - 42.5' mostly silt seams [brownish yellow (10YR 6/6), dry]. 43.4' becoming laminated with depth.										
23 SS	1 0	50 for 1"		43.5' End of Boring.										Hollow Stem Auger Refusal at 43.5 ft bgs.

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-182

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/29/2015	7/30/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-182	Feet (NAVD88)	428.47 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,433.70 N, 2,382,412.47 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 40.2432"
Long -89° 52' 4.836"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15	5 9 10 8	1	0 - 2' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), gravel (5-15%), cohesive, low to medium plasticity, dry. 0.9' - 2' yellowish brown (10YR 5/4), trace gray (10YR 6/1) mottling, silt (10-20%), medium to high plasticity.	CL/ML								
2 ST	24 23		2 3	2 - 4' Shelby Tube Sample.									ST2: 24" push at 550lbs.
3 SS	24 15.5	2 3 6 7	4 5	4 - 12' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), trace very dark brown (10YR 2/2) mottling, silt (5-15%) and gravel, trace sand, medium plasticity, medium to very stiff (0.75-2.75 tsf), moist.									
4 SS	24 20	3 4 5 6	6 7	6' - 7.7' low to medium plasticity. 7.2' increase in silt content (20-30%), increase in very fine sand content (5-15%).									
5 SS	24 23	1 3 3 4	8 9	9.3' sandy silt seams (sand is very fine).	CL/ML								
6 SS	24 20.5	1 3 4 4	10 11	9.9' sandy silt seams (sand is very fine). 10' - 12' medium plasticity.									
7 ST	24 21		12 13	12 - 14' Shelby Tube Sample.									ST7: 24" push.

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-182

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				12 - 14' Shelby Tube Sample. *(continued)*									
8 SS	24 21	3 4 5 7	14	14 - 22' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), trace very dark brown (10YR 2/2) mottling, silt (10-20%), gravel (5-15%), trace sand, low to medium plasticity, medium to very stiff (0.75-3.0 tsf), moist.									
9 SS	24 22	3 4 6 7	16	16' color grades to grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling, medium plasticity. 16.3' - 17.4' very dark brown (10YR 2/2) mottling.									
10 SS	24 24	3 4 6 7	18	18.4' trace coarse sand and subangular fine gravel.	CL/ML								
11 SS	24 17	1 4 5 7	20	20' 0-10% sand. 21.1' pocket of weak red (10R 5/4), medium sand (1" diameter).									
12 ST	24 20		22	22 - 24' Shelby Tube Sample.									ST12: 24" push at 200lbs.
13 SS	24 20	1 1 4 5	24	24 - 27' **SILTY CLAY** CL/ML, brown (10YR 5/3), trace very dark brown (10YR 2/2) mottling, silt (20-30%), gravel (5-15%), very fine to fine sand (10-20%), cohesive, medium to high plasticity, medium (0.5-0.75 tsf), moist to wet. 24.5' - 25.6' yellowish brown (10YR 5/6), grayish brown (10YR 5/2) mottling, trace subrounded gravel. 25.4' black (10YR 2/1) gravel (shale, 1" diameter), sand content increasing with depth.	CL/ML								
14 SS	24 24	6 10 11 12	26	26' decrease in very fine sand content 5-15%, medium plasticity, wet. 26.6' seam of coarse sand and fine gravel. 26.7' very stiff (3.0 tsf).									
15 SS	24 18	WOR 2 6 9	28	27 - 29.1' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/6), trace silt, clay, and fine gravel, wet. 28' - 28.1' increase in very fine sand content.	SW								WOR = Weight of Rods.
			29	29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, yellowish brown (10YR 5/6), well-graded sand (10-20%), subangular fine gravel (5-15%), trace silt, wet.	s(CL)g								
16 SS	24 16	6 12 15 19	30	30 - 34' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) mottling, silt (20-30%), gravel (5-15%), very fine to fine sand (10-20%), cohesive, low to medium plasticity, stiff to very stiff (1.25-4.0 tsf), moist to wet. 30.8' - 31.1' layer of coarse sand and subangular fine gravel, clay (50%).									
17 SS	24 10	16 15 19 26	32	32' - 34' silt (10-20%), subangular gravel (5-10%), very fine sand (5-10%), sand and gravel content decreasing with depth, medium to low plasticity. 32.7' - 32.9' very dark gray (2.5Y 3/1), trace silt, high plasticity, dry.	CL/ML								
			34	34' End of Boring.									

APPENDIX C3

TPZ 100 SERIES BORING LOGS AND WELL DETAILS

KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-158

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

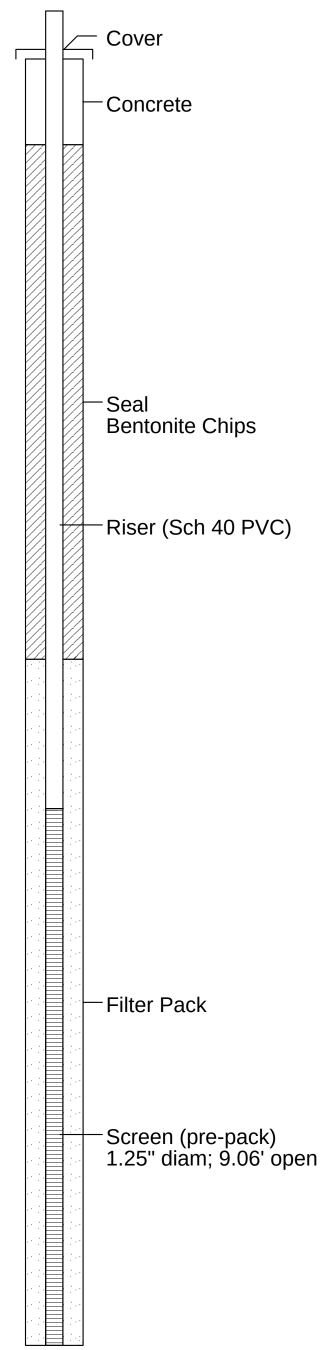
Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	USCS
0	Silty Loam with roots, stiff, non-plastic, pale brown (10YR 6/3), dry - dark brown (10YR 3/3)		CL
	Silty CLAY, very stiff, low plasticity, gray (10YR 5/1) with yellowish-brown mottling, moist	450	CL
5	- 25-50% mottling w/ black oxidation staining - high plasticity, <25% mottling	445	
10	- trace fine-medium sand, brownish yellow mottling (10YR 6/8) - trace fine-coarse sand and fine gravel (angular to sub-angular) - few to little sand and gravel, very stiff, 50-75% mottling	440	
15	- high plasticity		

Samples	Recovery inches	Qp TSF
1	60/60	2
2		2.75
3		3.75
4		3.5
5		4.5
6	60/60	2.5
7		2.5
8		1.25
9		1.25
10		1.75
11	60/60	1.75
12		3.5
13		2.25
14		2.75
15		2.5

GRAPHIC

Well: TPZ-158
Elev.: 456.26



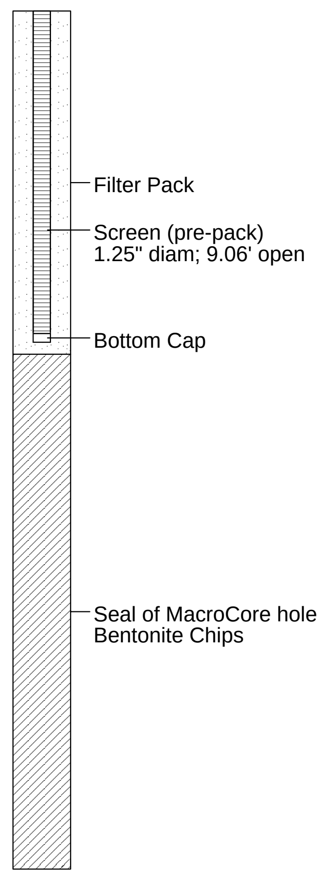
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-158 (Page 2 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	Samples	Recovery inches	Qp TSF	USCS
15	- high plasticity - trace fine to medium sand, soft, light gray (10YR 6/1) with 50-75% brownish-yellow mottling Sandy CLAY (fine to medium sand) with trace fine-coarse gravel (<1"), very soft		16 17 18	60/60	1.0 0.75 - -	CL
	SAND, fine to coarse, well graded, brownish-yellow (10YR 6/8), wet	435	19		>4.5	SW
20	Sandy CLAY (fine-coarse sand) with gravel, hard, non-plastic, moist Silty CLAY with trace sand and gravel, hard, medium to high plasticity, very pale brown (10YR 7/3) - very soft, high plasticity		20 21	60/60	>4.5 <0.5	CL
	SAND, fine to coarse, well graded, yellowish-brown (10YR 5/8), wet	430	22 23 24 25		- - - - - - 4.0	SW
25	Silty CLAY with trace fine to coarse sand, hard, brownish-yellow (10YR 6/6), moist					CL
	SHALE, weathered, gray (10YR 6/1), dry at 24.75' - platy/laminated, dark gray (10YR 4/1), at 24.9' - top of bedrock = 24.75' bls					SH
	END BOREHOLE AT 25 FEET BLS	425				
30						

Well: TPZ-158
Elev.: 456.26



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC158.BOR

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-159

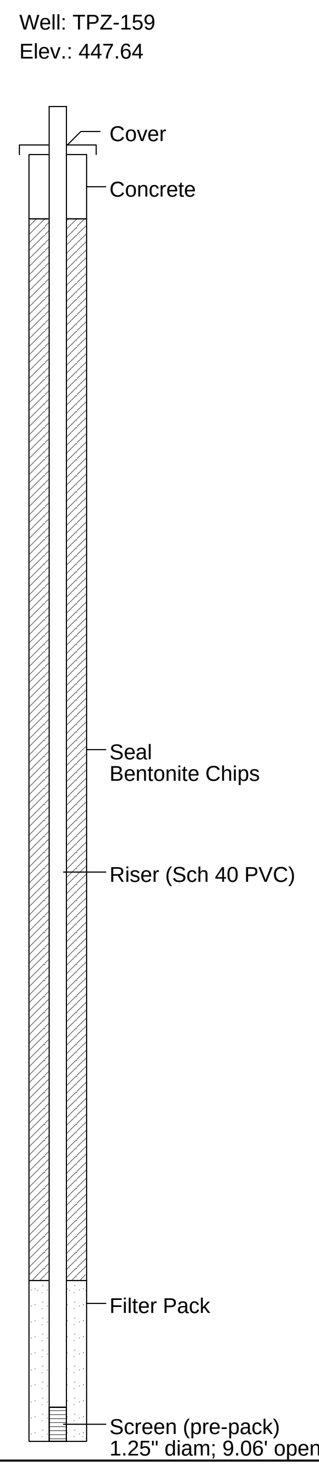
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69
0	FILL - Bottom Ash with some clay and silt, soft, loose, dry	
	FILL - Silty CLAY with some bottom ash, sand, and gravel, hard, low-medium plasticity, yellowish brown (10YR 5/4) with variable brown to gray mottling	
5		440
10	- few bottom ash, very stiff, high plasticity, moist	435
15	Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist	430
	- high plasticity, gray (10YR 5/1) with <10% yellowish-brown mottling	
20		425

Samples	Recovery inches	Qp TSF	USCS
			AR
1	49/60	- -	FL/CL
2	7/42	- -	FL/CL
3	8/18	3.0	FL/CL
4	0/60	- -	FL/CL
5	60/60	2.5	CL
6		3.25	CL
7		1.75	CL
8		2.0	CL
9		3.0	CL

GRAPHIC



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet | DESCRIPTION | Surf. Elev. 444.69 | Samples | Recovery inches | Qp TSF | USCS | GRAPHIC

Depth 20: Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist

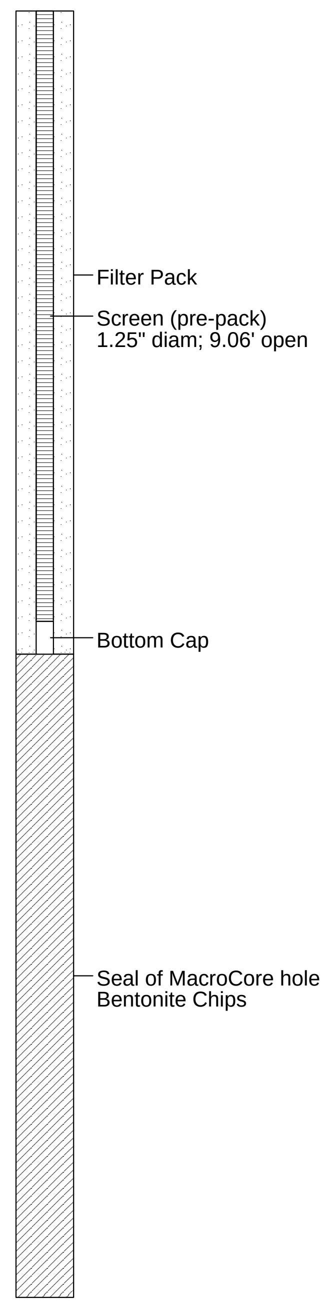
- soft to medium hardness, yellowish-brown mottling with black manganese staining
- high plasticity, brown (10YR 5/3)
- trace fine-medium sand, very stiff, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 5/6)
- no sand, brown
- trace sand, gray (10YR 6/1) with 10-25% yellowish-brown mottling
- trace fine-coarse sand and gravel (sub-angular to sub-rounded)
- stiff, medium plasticity, pale brown (10YR 6/3) with <10% gray mottling
- few fine-coarse sand and fine gravel, very stiff, yellowish brown (10YR 5/8)
- hard, non-plastic, dry

Depth markers: 20, 25, 30, 35, 40. Surface elevation markers: 420, 415, 410, 405.

USCS: CL

Samples	Recovery inches	Qp TSF
10	16/60	- -
11	32/60	1.5
12		- -
13		1.25
14		1.25
15		2.75
16	49/60	- -
17		1.5
18		1.0
19		2.0
20		2.0
21	60/60	2.5
22		2.0
23		1.0
24		0.5
25		3.0

Well: TPZ-159
Elev.: 447.64



KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-159 (Page 3 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Well: TPZ-159
Elev.: 447.64

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS
40	- trace sand and gravel, very stiff, high plasticity, brown (10YR 5/3) to pale brown (10YR 6/3)		26	50/60	2.75	CL
			27		- -	
			28		<0.5	
	SAND, fine to coarse, well graded, greenish gray (Gley1 10Y 5/1), wet (2.4 inch seam)	400	29		>4.5	SW
45	Silty CLAY, trace sand, hard grading to very stiff, low plasticity grading to high plasticity, dark gray (Gley1 4/N), moist [TILL]		30	5/60	- -	CL
		395	31		3.25	
50	END BOREHOLE AT 50 FEET BLS					
55		390				
60		385				

Seal of MacroCore hole Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC159.BOR

KELRON ENVIRONMENTAL
Incorporated

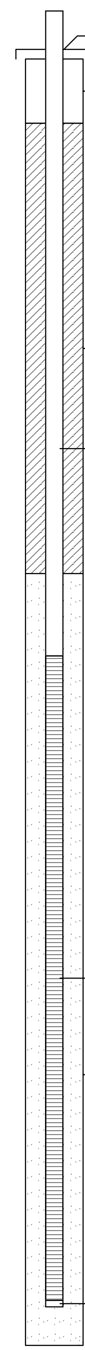
LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Silty CLAY with grass / roots, hard, non-plastic, pale brown (10YR 6/3), dry		1	58/60	4.5	CL	
	- gray (10YR 6/1) with reddish-brown mottling and black oxidation staining		2		3.25		
	- very stiff, low plasticity, brown (10YR 4/3), moist - high plasticity, grayish brown (10YR 5/2) with 10-25% reddish-brown mottling'		3		3.0		
		425	4		3.0		
5			5		2.25		
	- gray (10YR 6/1), <10% mottling		6	58/60	1.5		
			7		1.0		
	- 10-25% mottling, black organics		8		1.0		
		420	9		1.0		
10	Sandy SILT, fine sand, very soft, non-plastic, light brownish gray (10YR 6/2), wet		10		1.0	ML	
			11	41/60	- -		
	Clayey SILT, trace fine sand, very soft, medium plasticity, gray (10YR 6/1)		12		<0.5		
			13		<0.5		
		415	14		<0.5		
	Silty CLAY, medium to high plasticity, gray with trace reddish-brown mottling, moist - 1-inch weathered zone with 75% yellowish-brown (10YR 5/8) mottling @ 14.5'		15		1.25	CL	
15	SILT, gray (10YR 7/1), wet @ 14.9'		16	16/60	- -	ML	
	CLAY, medium hardness,brown (10YR 5/3), moist - greenish gray (Gley1 10GY 5/1)	410	17		1.25	CL	
20			18		1.5		

Well: TPZ-160
Elev.: 431.49



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC160.BOR

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Well: TPZ-160
Elev.: 431.49

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	Samples	Recovery inches	Qp TSF	USCS
20			19	24/60	- -	
	- gray (10YR 6/1)					
	- very soft, brown (10YR 5/3)	405	20		<0.5	
	- soft, greenish gray		21		1.25	
25						CL
			22	27/60	- -	
			23		0.75	
		400	24		1.0	
			25		1.5	
			26		2.5	
30	Silty CLAY with fine-coarse sand and fine gravel (sub-angular to sub-rounded), very stiff, greenish gray with reddish-brown mottling [TILL]					
			27	27/60	- -	CL
	- very soft, high plasticity, yellowish-brown (10YR 5/4)		28		0.5	
		395	29		0.5	
	- medium plasticity, greenish gray with 50-75% yellowish-brown mottling, moist		30		1.5	
35	Sandy CLAY, stiff, dark yellowish-brown (10YR 4/4) with <25% greenish-gray mottling, dry					CL
	END BOREHOLE AT 35 FEET BLS					
		390				
40						

Seal of MacroCore Hole
Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC160.BOR

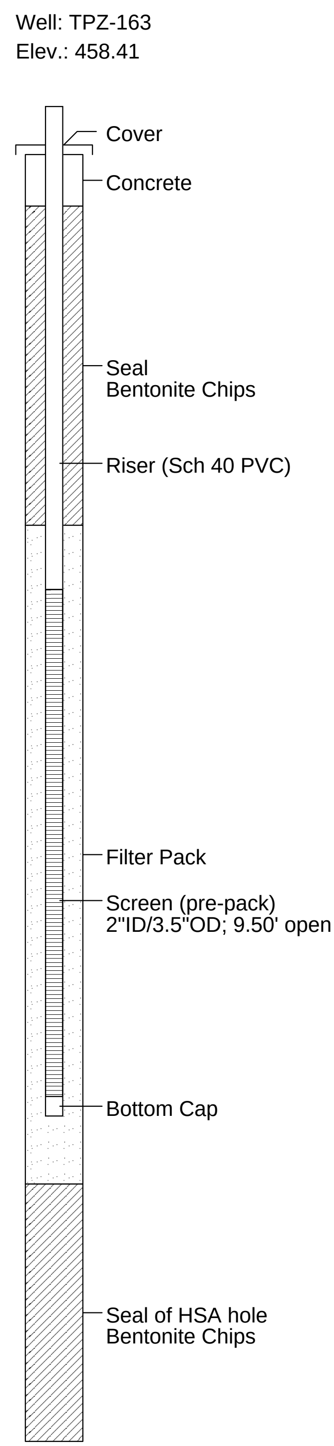
KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-163

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Silty clay loam with roots, loose, pale brown (10YR 6/3), dry (13" thick soil cover)						FL/CL
	FILL - Fly Ash, silty, loose very dark gray (10YR 3/1)						AR
	<Shelby Tube Sample ST163-3 @1.5-3.5'> grain size analysis (Ash - very dark brown): 51% Sand, 45.8% Silt, 3.2% Clay		1		9/24	- -	
5		450					
	- very soft, wet		2	1 0 1	18/18	<0.5	
10		445					
			3	1 0 1	18/18	<0.5	
15		440					
	Silty CLAY (lean to fat), trace fine sand, stiff, medium to high plasticity, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 6/8), moist		4	1 3 5	17/18	2.75	CL/CH
20		435					
	- very stiff		5	2 2 4	18/18	2.25	
25		430					



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC163.BOR

LOG OF PROBEHOLE TPZ-163

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Well: TPZ-163
Elev.: 458.41

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
25							
	- dark yellowish brown <Shelby Tube Sample ST163-30 @ 28-30'> grain size analysis: 10.6% Sand, 51.2% Silt, 38.2% Clay		6		24/24	- -	CL/CH
30		425					
	Silty CLAY with trace fine-coarse sand and fine gravel, stiff to very stiff, high plasticity, brownish-yellow (10YR 6/6), moist [TILL]		7	2 2 5	18/18	2.5	
35		420					
	- medium plasticity, pale brown (10YR 6/3)						CL
			8	5 5 7	18/18	3.5	
40	- brownish-yellow (10YR 6/6) with 10-25% light gray mottling (10YR 6/1)	415					
	SHALE, platy/laminated with weathered clay layers; hard, gray (10YR 5/1) with 25-50% olive yellow clayey layers (2.5Y 6/6) (top of bedrock = 43.5' bls)		9	5 7 8	18/18	>4.5	SH
45	END BOREHOLE AT 45 FEET BLS	410					
50		405					

Seal of HSA hole
Bentonite Chips

KELRON
ENVIRONMENTAL
Incorporated

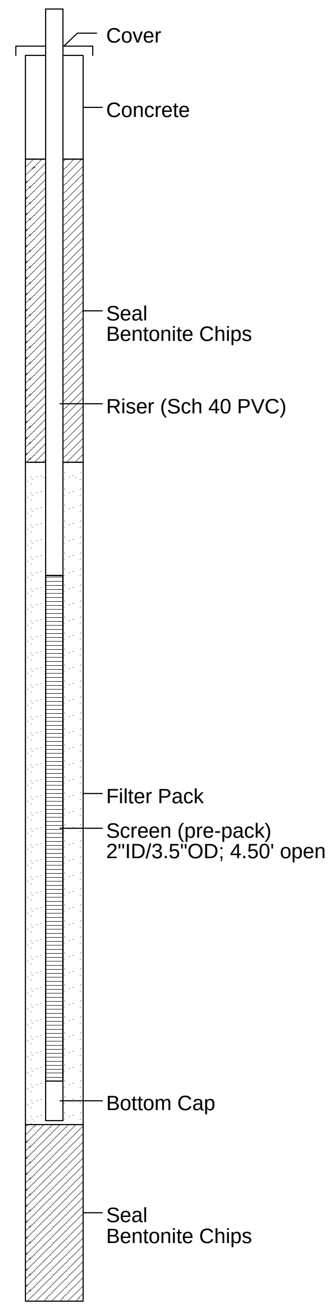
LOG OF PROBEHOLE TPZ-164

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Surf. Elev. 432.50	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry							
2.5		430						
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	429						
4			1		17/24			
4.5	- wet	428					AR	
5.5		427						
6.5		426						
7.5		425						
8.5		424		3				
8.9	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)	423	2	3 5	18/18		CL	
10.3	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	422 421	3		23/24		CL	
12	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS	420 419						

Well: TPZ-164
Elev.: 435.10



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-165

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 396.10
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 398.85
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380478, 555940

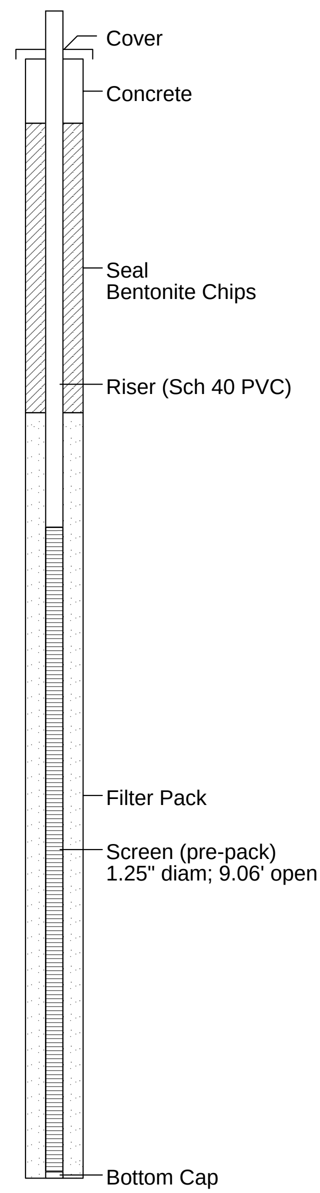
Depth in Feet: 0, 5, 10, 15, 20 — Surf. Elev. 396.10: 395, 390, 385, 380

DESCRIPTION	USCS
FILL - Fly Ash, silty, stiff, non-plastic to low plasticity, very dark grayish-brown (10YR 3/2), moist	AR
FILL - Silty Clay with Fly Ash, very soft, dark gray (10YR 4/1)	FL/CL
Silty CLAY (lean) with organics and roots, soft, high plasticity, dark gray - gray (10YR 5/1) - trace sand, very dark gray brown <Shelby Tube Sample ST165-10 @ 8-10'> grain size analysis: 11.2% Sand, 59.2% Silt, 29.6% Clay	CL
Silty CLAY (lean) with trace fine-coarse sand and fine gravel, very soft, medium to high plasticity, dark gray (10YR 4/1), moist [TILL]	CL
LIMESTONE, hard, light gray, hammer refusal at 16.5', auger refusal at 17.4' bls (top of bedrock)	LS

END BOREHOLE AT 17.4 FEET BLS

Samples	Recovery inches	Qp TSF
1	41/60	1.75
2		0.75
3		- -
4		- -
5		- -
6	60/60	1.5
7		2.0
8		2.75
9		2.5
10		1.25
11	49/60	2.0
12		0.5
13		0.5
14		1.0
15		0.5
16	18/18	0.5
17		- -

Well: TPZ-165
Elev.: 398.85



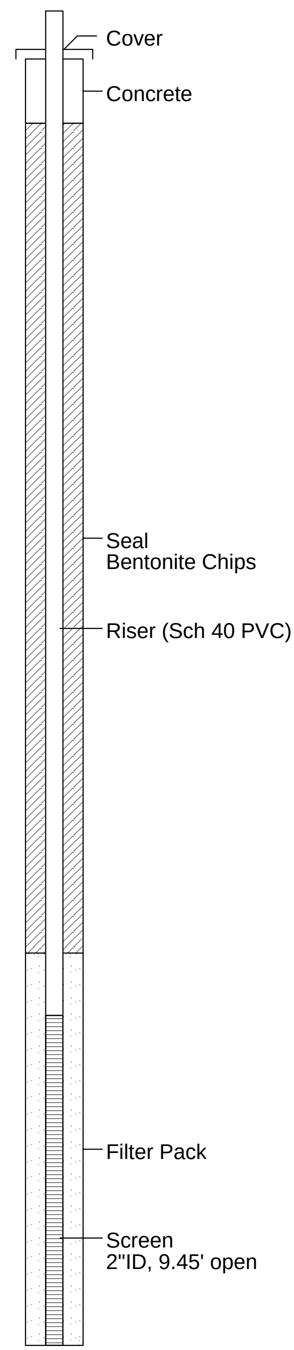
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Silty CLAY, trace roots, very stiff, non-plastic, light brown gray (10YR 6/2), dry		1	60/60	2.75	FL/CL
	- medium plasticity, pale brown (10YR 6/3) w/ trace manganese and iron oxide staining		2		2.75	
	- very stiff, yellowish brown (10YR 5/4) with 25% reddish-brown mottling	420	3		3.75	
	- very stiff, low plasticity		4		1.5	
			5		2.75	
5	- gray mottling - 1-inch silt lense with high organics, trace roots		6	60/60	1.5	
	Silty CLAY, very stiff, medium plasticity, gray (10YR 6/1) with reddish-brown mottling and manganese staining		7		2.75	CL
	- medium to stiff, high plasticity, 25-50% manganese staining	415	8		1.75	
	- no manganese staining		9		2.5	
10			10		2.5	
			11	60/60	1.5	
			12		1.5	
	- stiff, medium plasticity, yellowish brown (10YR 5/4) with 10-25% reddish-brown mottling, moist	410	13		2.25	
			14		2.0	
15			15		2.5	
	- very soft, high plasticity		16	60/60	1.0	
	- very stiff, medium plasticity		17		3.0	
		405	18		3.0	
	Silty CLAY with trace fine-coarse sand and fine gravel, very stiff, medium plasticity, yellowish brown (10YR 5/4) with <10% reddish-brown mottling, moist [TILL] - hard, gray (10YR 6/1) with 10-25% reddish-brown mottling		19		3.5	CL
20			20		3.25	

Well: TPZ-166
Elev.: 425.18



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC166.BOR

KELRON ENVIRONMENTAL
Incorporated

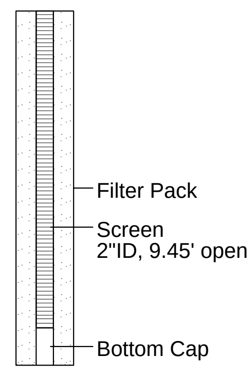
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
20			21	24/24	>4.5	CL	
	END BOREHOLE TPZ-166 AT 22' BLS.		22		>4.5		
	CONTINUE LOG USING URS BORINGS B-13-4 and B-13-5 FROM 08/01/2013	400				CL	
25							
		395					
30							
		390					
	SHALE, calcareous, fine grained, highly weathered, very weak, brown-gray to gray (top of bedrock = 32.53' bls; elevation = 389.8 ft NAVD88)					SH	
35							
		385					
	END URS LOGS AT 38 FEET BLS						
40							

Well: TPZ-166
Elev.: 425.18



KELRON ENVIRONMENTAL
Incorporated

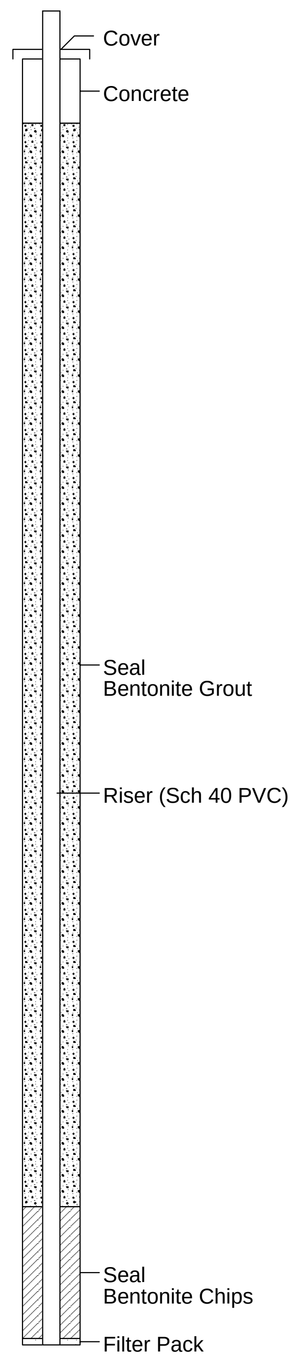
LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Fly Ash, silty to clayey with coarse sand grain size, soft, medium to high plasticity, dark gray (Gley 1 4/N), moist							
		435						
	- very soft, non-plastic, wet		1		18/18			
5								
	- dark greenish gray (10Y 4/1)	430		2				
			2	2	18/18			
				1				
10							AR	
	- silty with sand grain size, very dark greenish gray (10Y 3/1)	425		0				
			3	0	18/18			
				1				
15								
		420						
20								

Well: TPZ-167
Elev.: 441.38



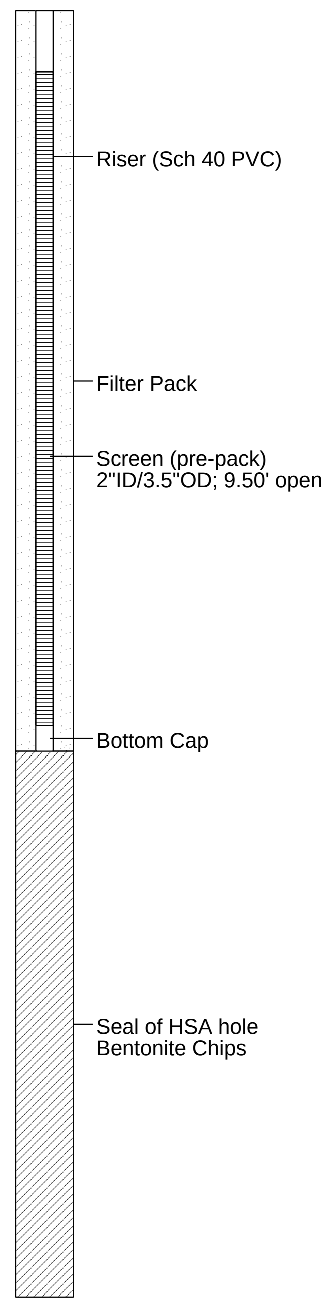
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-167 (Page 2 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
20								
	- dark greenish gray	415	4	0 0 1	18/18			
25							AR	
	- very dark gray brown <Sample SS167-30 @ 29-30'> grain size analysis (Ash): 1.5% Sand, 77.6% Silt, 20.8% Clay	410	5	0 0 0	18/18			
30								
	Silty CLAY (lean) with sand and trace fine gravel (chert, angular to sub-angular), very stiff, medium to high plasticity, light gray (10Y 7/N) with 15-50% reddish brown mottling, dry [TILL] <Shelby Tube Sample ST167-34 @ 32-34'> grain size analysis: 15.7% Sand, 52.6% Silt, 31.7% Clay	405	6		20/24			
35							CL	
		400	7	3 4 6	16/18	3.5		
40								

Well: TPZ-167
Elev.: 441.38



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC167.BOR

KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Well: TPZ-167
Elev.: 441.38

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
40							CL	
	- soft, brownish-yellow (10YR 6/6), moist	395	8	2 2 2	18/18	>4.5		
45	- laminated, hard, non-plastic, black (3/4" thick organic-rich layer)						CL	
	CLAY (lean to fat) with sand, stiff to very stiff, medium to high plasticity, greenish gray (10YR 6/1), dry						CL/CH	
	- with sand and fine gravel (angular)		9	5 5 50	18/18	4.0		
		390	10	50	3/3			
	SHALE, weathered; clay (laminated) with platy and micaceous layer and limestone parting, dark gray (Gley1 4/N), dry (top of bedrock = 48.75' bls)		11	53	5/5		SH	
50	END BOREHOLE (Auger Refusal) at 48.75 feet BLS END Split-Spoon Sampling at 49.15 feet BLS							
		385						
55								
		380						
60								

Seal of HSA hole
Bentonite Chips

11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC167.BOR

KELRON ENVIRONMENTAL
Incorporated

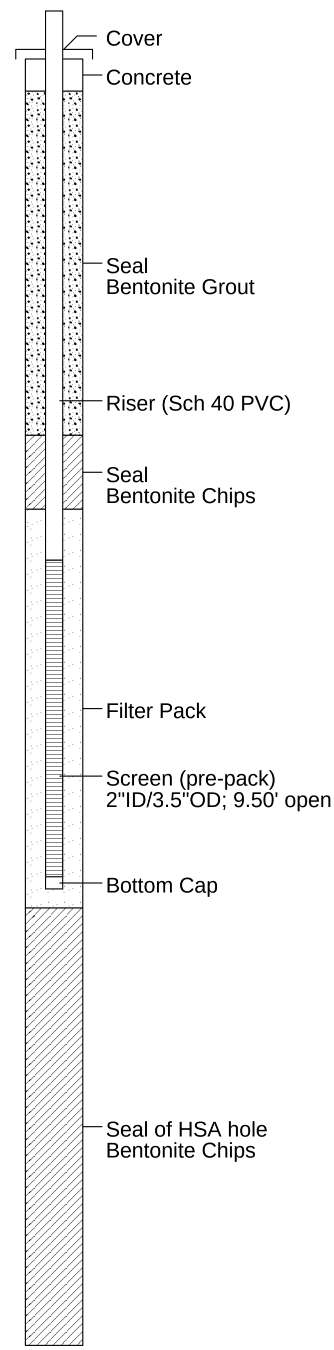
LOG OF PROBEHOLE TPZ-168

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Fly Ash, silt size, greenish gray (10Y 5/1), moist						
5	<Shelby Tube Sample ST168-5 @ 3-5'> grain size analysis: 29.4% Sand, 50.2% Silt, 20.4% Clay	450	1		21/24		
10	- wet	445	2	3 2 3	18/18		
15	- silty with coarse sand grain size, greenish black (10Y 2.5/1)	440	3	1 1 1	16/18		AR
20		435	4		0/24		
25		430	5		3/18		
30	Silty CLAY, medium to stiff, high plasticity, light gray (10YR 7/1) with 10-50% reddish-brown mottling	425	6	3 3 5	18/18	2.0	CL
35		420					
40		415	7	2 4 5	18/18	3.5	CL

Well: TPZ-168
Elev.: 457.53



KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-168

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Well: TPZ-168
Elev.: 457.53

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
40	Silty CLAY, trace sand and fine gravel (angular to sub-angular), stiff to very stiff, 10-25% reddish-brown mottling, moist [TILL]							
45		410						
	- light yellowish-brown (10YR 6/4) with <10% light gray mottling		8	3 7 10	18/18	3.5		
50	Clay, black (1/2" thick organic-rich layer) surrounded by highly weathered zone with >75% reddish-brown mottling	405						
55		400					CL	
	- medium to stiff, high plasticity, yellowish brown (10YR 5/4)		9	3 4 8	18/18	2.0		
60	- with 25-50% light gray mottling	395						
65		390						
	- with sand seams, very stiff, medium plasticity, dark gray (10YR 4/1)		10	10 16 18	18/18	>4.5		
70	SHALE, laminated, hard, dark gray (top of bedrock = 69.6' bls)	385					SH	
	END BOREHOLE AT 70 FEET BLS							
75		380						
80		375						

Seal of HSA hole
Bentonite Chips

APPENDIX C4

MW 200 SERIES BORING LOGS AND WELL DETAILS

KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-252

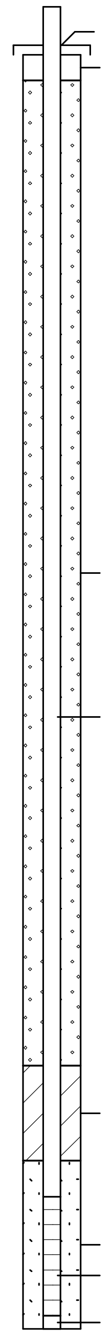
(Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/22/10	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.27
Sampling Method	: MacroCore (60")	Top of Casing Elevation	425.07
Drilling Company	: PSC	X,Y Coordinates	: 2382784, 553904

Depth in Feet	DESCRIPTION	Surf. Elev. 422.27	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-352 for a description of subsurface materials.	422					
5		417					
10		412					
15		407					
20		402					
25		397					
30		392					
35		387					
40		382					
45		377					
50	END BOREHOLE AT 49.54 FEET BLS						

Well: MW-252
Elev.: 425.07



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec252~1.bor

KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-253

(Page 1 of 2)

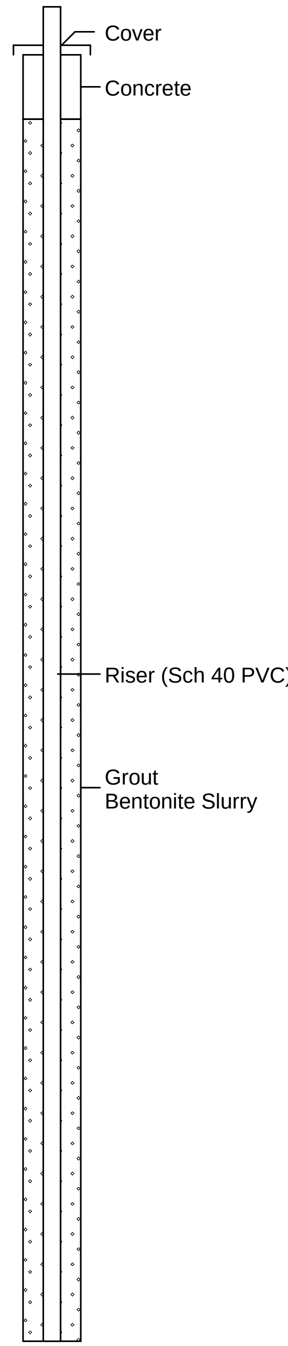
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	USCS
0 – 11	SILTY CLAY, trace gravel, hard, light brown, dry - hard, medium plasticity, gray (2.5Y 6/1) with yellow-brown mottling (10YR 5/6), moist	442, 437, 432	CL
11 – 19	CLAY (fat) with SAND, trace gravel, dark yellow brown with light gray mottling, mottling decreases with depth - grain size analysis @ 11 - 12 ft: 0.7% gravel, 16.4% sand, 41.4% silt, 41.4% clay - soft	427	CH
19 – 20	CLAY (lean) with SAND, trace gravel, stiff to hard, medium plasticity, dark yellow brown		CL

Samples	Recovery inches	Qp TSF
1	25/48	4.5+
2		4.5+
3	47/60	4.5
4		4.5
5		4.5
6	53/60	4.5
7		4.0
8		4.0
9		3.0
10	52/60	4.5
11		3.5
12		3.5
13		2.0
14	60/60	

Well: MW-253
Elev.: 445.84



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec253~1.bor

KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-253

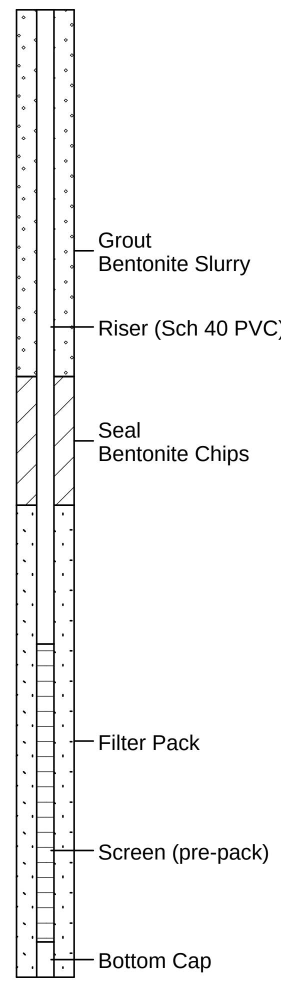
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	Samples	Recovery inches	Qp TSF	USCS
20	- grain size analysis @ 19 - 19.5 ft: 0.7% gravel, 26.9% sand, 38.1% silt, 34.3% clay	422	14	60/60		CL
25	- small fine sand seams from 25 to 27 feet	417	15	60/60		CL
	CLAY (fat), shaley, platy/laminated, soft, low plasticity, light yellow brown (10YR 6/4)		16		3.5	CH
	- stiff to very stiff, light olive brown (2.5Y 5/4)		17		3.0	CH
30	- grain size analysis @ 29 - 30 ft: 6.7% sand, 21.6% silt, 71.7% clay	412	18	60/60	4.5	CH
			19		3.5	CH
	- Drove split-spoon 2-inches into bedrock: 34.5 to 34.7 feet bls		20		3.0	CH
	LIMESTONE with SHALE		21	2/2		LS/SH
35	Auger refusal at 35.0 feet END BOREHOLE AT 35.0 FEET BLS	407				
40						

GRAPHIC

Well: MW-253
Elev.: 445.84



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec253~1.bor

KELRON ENVIRONMENTAL
Incorporated

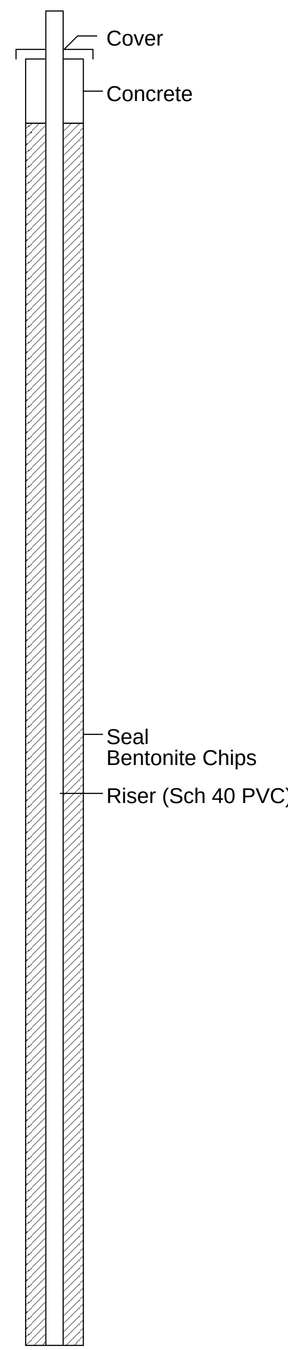
LOG OF PROBEHOLE OW-256

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	Samples	Recovery inches	Qp TSF	USCS
0 – 13.5	Continuous boring to 13.5 feet below ground surface. Refer to boring log for adjacent well OW-156.	425 (0), 420 (5), 415 (10)				CL
13.5 – 18.2	CLAY (lean), very stiff, high plasticity, pale brown (10YR 6/3),moist - 25% reddish-brown mottling with black manganese staining - light gray (10YR 7/1) with 10-25% mottling	410 (15)	1	60/60	3.0	CL
			2		2.25	
			3		2.0	
			4		2.0	
			5		1.75	
18.2 – 20	Silty CLAY, trace fine to coarse sand [TILL]		6	60/60	2.5	CL
			7		1.0	

Well: OW-256
Elev.: 427.70



KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE OW-256

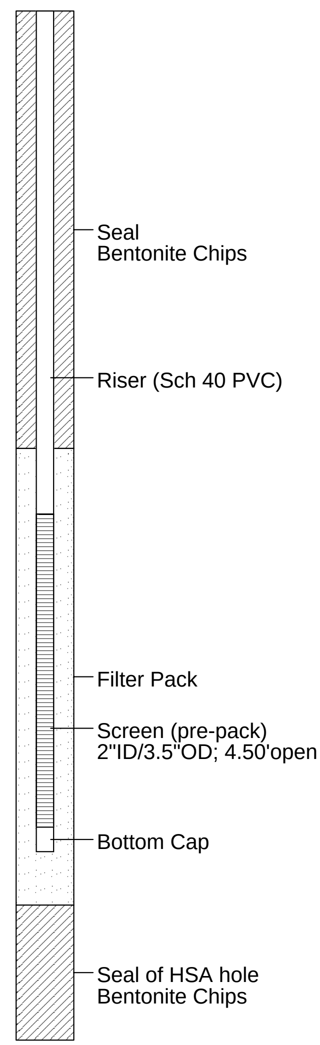
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20
20		405
	- trace fine-coarse gravel (angular to sub-angular; granite piece of 1 1/4"), 50-75% yellowish-brown (10YR 6/8) mottling - few sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-75% mottling	
25	- <25% mottling - with sand (fine-medium)	400
	SAND (fine-medium), well graded, brownish yellow (10YR 6/6), wet	
	Silty CLAY (lean) with sand (fine-medium), medium plasticity, brownish yellow, wet	
30	- hard, non plastic, light brownish gray (10YR 6/2), moist [Vandalia Till @ 31.5'] - little sand (fine-coarse) and gravel (fine-coarse, sub-angular to sub-rounded), low to non-plastic, gray (10YR 5/1)	395
	SHALE and CLAY, semi-competent, laminated clay with up to 1/2-inch thick layers of hard shale, dry [note: top of weathered bedrock at 33.9 feet below ground surface]	
35	SHALE with intermittent clay layers, hard, gray	390
	END Sampling at 38.5 feet BLS END WELL BOREHOLE at 36.0 feet BLS	
40		

Samples	Recovery inches	Qp TSF	USCS
7		1.0	CL
8		1.75	CL
9		1.75	CL
10		1.0	CL
11	60/60	1.0	CL
12		2.0	CL
13		1.0	CL
14		1.0	CL
15			SW
16	35/60		CL
17			CL
18		>4.5	CL
19			CL
20			CL
21	54/60	3.0	SH/CL
22		4.0	SH/CL
23		>4.5	SH
24		>4.5	SH
25		>4.5	SH

Well: OW-256
Elev.: 427.70



KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE OW-257

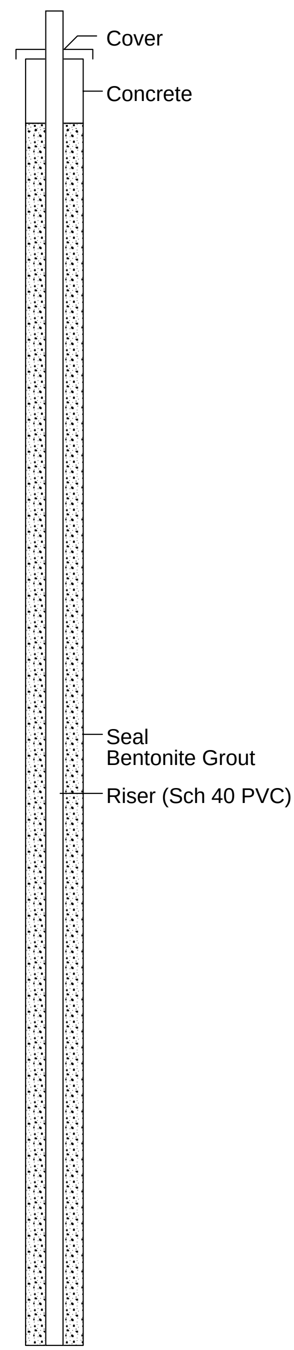
(Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 18.5 feet below ground surface. Refer to boring log for adjacent well OW-157.						
		425					
5							
		420					
						CL	
10							
		415					
15							
		410					
	Silty CLAY, trace sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-50% reddish-brown mottling, moist [TILL]		1	56/60	3.0	CL	
			2		2.75		
20							

Well: OW-257
Elev.: 431.02



11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC257.BOR

KELRON ENVIRONMENTAL Incorporated

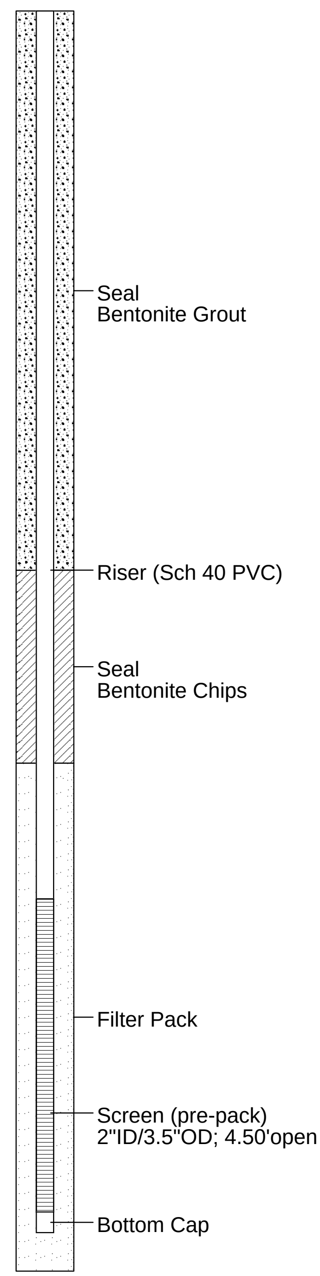
LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS
20			2		2.75	CL
	- >50% mottling		3		2.5	
	Sandy CLAY with gravel (fine-coarse, sub-angular; granite piece of 1.5"), brownish yellow (10YR 6/6), wet					CL
	Silty CLAY, trace sand and gravel, soft, high plasticity, yellowish brown (10YR5/6) with 10-25% light gray mottling		4		1.0	
		405	5		1.5	
	- very soft, brownish yellow with <10% mottling		6	60/60	0.5	
25	- with trace pyrite crystals		7		1.0	
	- medium hardness grading to stiff		8		2.0	
			9		2.0	
		400	10		3.25	
			11	60/60	1.5	CL
30	- stiff, high plasticity, gray with <10% reddish-brown mottling, moist		12		3.5	
			13		2.75	
	- very stiff, dark gray (10YR 4/1)		14		2.0	
		395	15		3.5	
			16	60/60	2.0	
35			17		2.0	
	- low plasticity, very dark gray (10YR 3/1)		18		4.0	
	SHALE and CLAY (fat), intermittent lamination, hard, very dark gray, moist [note: top of weathered bedrock at 36.3 feet below ground surface]		19		3.0	
		390	20		>4.5	SH/CL
			21	13/13		
40	END BOREHOLE at 39.6 feet BLS					

Well: OW-257
Elev.: 431.02



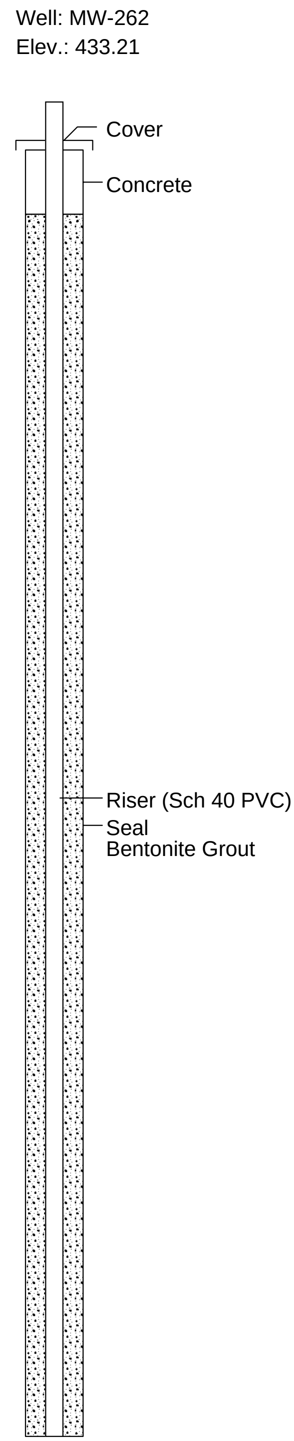
KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
0	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry	430	1	60/60	2.5	CL
			2		>4.5	
	- brownish yellow (10YR 6/6), moist		3		3.25	
			4		2.5	
			5		2.25	
5	- medium stiff, high plasticity	425	6	42/42	1.5	
			7		1.75	
			8		2.0	
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]		9	60/60	1.0	ML
10	- clayey, soft to medium hardness, low to medium plasticity		10		1.5	
		420	11		1.25	
			12		1.5	
			13		1.5	
	- soft, yellowish brown (10YR 5/4)		14	60/60	1.0	
15	- non-plastic		15		1.25	
		415	16		1.25	
			17		1.5	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist		18		2.0	CL
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist		19	60/60	2.0	ML
20			20			



KELRON ENVIRONMENTAL
Incorporated

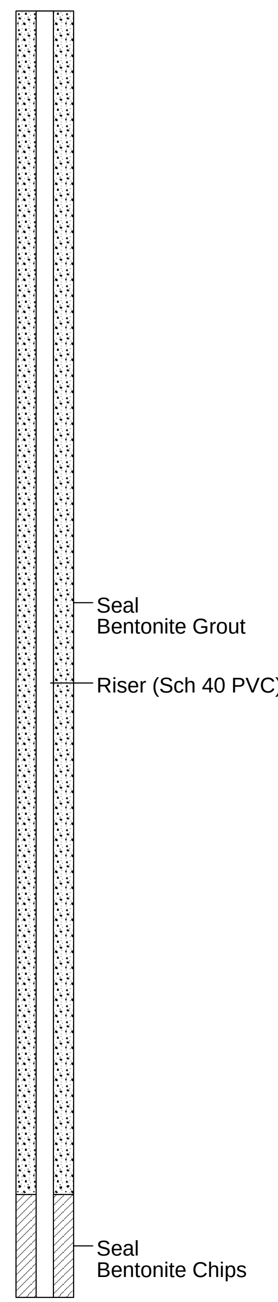
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
20			20			ML
		410	21			ML
			22			ML
	Silty CLAY, very soft, low plasticity		23		0.75	CL
	- medium plasticity, wet		24	60/60	0.75	CL
25			25		0.75	CL
	- high plasticity, yellowish brown (10YR 5/4)	405	26		0.75	CL
	- moist		27		0.5	CL
			28		1.25	CL
			29	53/60	1.0	CL
30	- with fine sand		30		0.75	CL
		400	31			CL
	SAND, fine to medium grained, with clay, yellowish brown (10YR 5/6), wet - light brownish gray		32			SW/SC
	CLAY (fat), trace fine to medium sand, high plasticity, light brownish gray <Sample ST262-35 @ 33.5 - 35.5'> grain size analysis: 13.1% Sand, 33.2% Silt, 53.7% Clay		33			CH
			34	24/24		CH
35			35			CH
	- very stiff, greenish gray (Gley1 10Y 6/1)	395	36	16/36	2.75	CH
			37			CH
			38		2.75	CH
	- medium plasticity		39	56/60	1.0	CH
40			40		0.75	CH

Well: MW-262
Elev.: 433.21



KELRON ENVIRONMENTAL
Incorporated

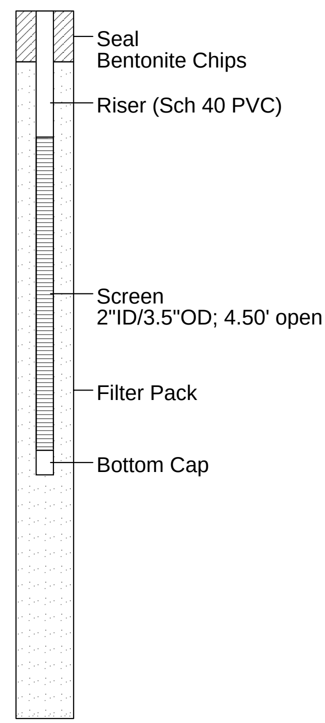
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
40			40		0.75	CH
	- with <10% reddish-brown mottling	390	41		1.25	CH
			42		1.5	CH
	SAND with Silt, fine grained, poorly graded, light brown (10YR 6/4), wet					SP/SM
	Sandy SILT		43			ML
	Silty CLAY with fine sand, very soft, brownish yellow (10YR 6/6)		44	60/60	0.75	CL
45			45		0.75	CL
	SAND, fine grained, poorly graded	385	46		1.25	SP
	SAND, fine to coarse grained, well graded, trace gravel					SW
	Silty CLAY with trace and and gravel, stiff, high plasticity, light yellowish brown (10YR 6/4), moist [TILL]		47		3.0	CL
	- trace reddish-brown mottling		48		2.25	CL
			49	30/30	2.25	CL
50			50		2.25	CL
	SHALE, clay partings, laminated, gray, weathered, dry (top of bedrock = 50.4' bls)	380	51		3.5	SH
	END BOREHOLE AT 51 feet BLS					
55		375				
60						

Well: MW-262
Elev.: 433.21



APPENDIX C5

MW 300 SERIES BORING LOGS AND WELL DETAILS

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/9/2015	10/20/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-304	Feet (NAVD88)	453.03 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,194.03 N, 2,386,608.77 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 17.9952"
Long -89° 51' 12.39"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–5.8	0 - 5.8' **SILTY CLAY** CL/ML.	CL/ML								0-35.4' Blind Drilled. See log MW-104DR for soil description details.
			5.8–12	5.8 - 13.5' **FAT CLAY:** CH.	CH								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12.5 - 13.5	5.8 - 13.5' **FAT CLAY:** CH. *(continued)*	CH									
			13.5 - 15	13.5 - 15' **LEAN CLAY:** CL.	CL									
			15 - 23.5	15 - 23.5' **SILTY CLAY** CL/ML.	CL/ML									
			23.5 - 24.5	23.5 - 24.5' **SANDY FAT CLAY:** s(CH).	s(CH)									
			24.5 - 27.3	24.5 - 27.3' **POORLY-GRADED SAND:** SP.	SP									
			27.3 - 30	27.3 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30 - 32	30 - 35.4' **SHALE:** BDX (SH).	BDX (SH)									

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32-35	30 - 35.4' **SHALE:** BDX (SH). *(continued)*	BDX (SH)						
1 CORE	60 31		35.4	35.4 - 41.3' **LEAN CLAY:** CL, gray, 2" of wood on top of unit, stiff, dry.	CL						
			36.3	36.3' stiff to very hard, dry.							
			36.7	36.7' trace chert gravel.							
2 CORE	60 59.5		40.2	40.2' dry.							
			41.3	41.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, intensely to moderately fractured (extremely narrow apertures). 41.6' - 42' vertical fracture.	BDX (LS/SH)						
3 CORE	60 63		45.4	45.4' intensely fractured.							Core 3, RQD=75%
			46.8	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured.	BDX (SH)						
4 CORE	60 65		50.4	50.4' moderately fractured.							Core 4, RQD=95%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured. *(continued)*										
			54		BDX (SH)									
			55	54.4' intensely fractured.										
5 CORE	60 57		56	55.6 - 60.2' **LIMESTONE:** BDX (LS), shaley, thickly bedded, fossiliferous, unfractured to slightly fractured.										Core 5, RQD=95%
			57											
			58		BDX (LS)									
			59											Bedrock corehole reamed 6" in diameter to 59' for well installation.
6 CORE	60 64		60	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured.										Core 6, RQD=73%
			61											
			62											
			63											
			64											
7 CORE	60 66		65											Core 7, RQD=64%
			66		BDX (LS/SH)									
			67											
			68											
			69											
8 CORE	60 63		70	70.3' thickly bedded with dark gray shale.										Core 8, RQD=88%
			71											
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured. *(continued)*										
			74											
9 CORE	60 60		75	75' diagonal fracture (narrow aperture). 75.3' intensely fractured.										Core 9, RQD=50%
			76–79		BDX (LS/SH)									
10 CORE	60 72		80	80.3' moderately fractured.										Core 10, RQD=43%
			81											
			82	81.6 - 91.9' **SHALE:** BDX (SH), gray, highly decomposed, intensely fractured.										
			83–84											
11 CORE	60 65		85	85.4' moderately to highly decomposed, intensely to moderately fractured.										Core 11, RQD=57%
			86–89		BDX (SH)									
12 CORE	60 61.5		90	90.5' extremely narrow to very narrow apertures.										Core 12, RQD=50%
			91–92											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*										
			94											
			95											
13 CORE	60 62		96	95.3' tight to very narrow apertures.										Core 13, RQD=48%
			97											
			98											
			99											
			100											
14 CORE	60 65		101	100.4' thickly bedded, moderately fractured.										Core 14, RQD=65%
			102		BDX (LS/SH)									
			103											
			104											
			105											
15 CORE	60 60		106	105.3' medium bedded, slightly fractured (very narrow apertures).										Core 15, RQD=98%
			107											
			108											
			109											
			110											
16 CORE	60 72		111	110.3' moderately fractured.										Core 16, RQD=91%
			112											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			113–115	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*	BDX (LS/SH)									
17 CORE	60 60.5		116–120	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures).	BDX (LS)									Core 17, RQD=100%
18 CORE	60 59		121–125	120.4' trace cherty limestone, slightly to moderately fractured (extremely narrow to very narrow apertures).										Core 18, RQD=97%
19 CORE	60 60.5		126–130	125.3' slightly fractured (very narrow to narrow apertures).										Core 19, RQD=98%
20 CORE	60 60		131–132	130.4' very narrow apertures.										Core 20, RQD=98%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			133 134 135	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures). *(continued)*	BDX (LS)									
				135.4' End of Boring.										

LOG OF BORING MW-306

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 450.9 Feet
Date Drilled: 09/25/91
Drilling Contractor: Burlington Environmental
Drilling Method: H.S.A. & NX Rock Core
Logged By: Burlington Environmental

Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
0 – 30 (450 – 425)				*Augered to 53.2 feet. No samples taken. See MW-124; BTB-39 for sample descriptions from 0-53.5 feet*				

(continued)

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER

Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.
Missouri (314) 241-0900
Illinois (618) 398-1414

LOG OF BORING MW-306 (Cont.)

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 450.9 Feet

Date Drilled: 09/25/91
Drilling Contractor: Burlington Environmental
Drilling Method: H.S.A. & NX Rock Core
Logged By: Burlington Environmental

Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
420 / 30				*Augered to 53.2 feet. No samples taken. See MW-124; BTB-39 for sample descriptions from 0-53.5 feet (continued)*				
415 / 35								
410 / 40								
405 / 45								
400 / 50								
395 / 55		*4/10*		*Gray Clayey SHALE*				
60		*62/108*		*Light Gray LIMESTONE*				

(continued)

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER ∇ ▼

Piezometer Installed: No

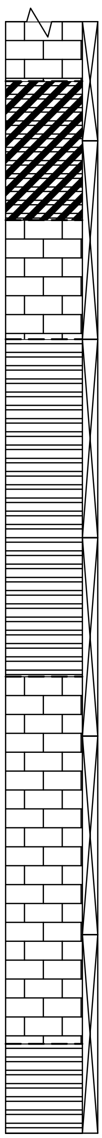
Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

LOG OF BORING MW-306 (Cont.)

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 450.9 Feet

Date Drilled: 09/25/91
Drilling Contractor: Burlington Environmental
Drilling Method: H.S.A. & NX Rock Core
Logged By: Burlington Environmental



Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
60 / 390				*Light Gray LIMESTONE (continued)*				
			CL	*Gray Shaley CLAY*				
65 / 385		*60/60*		*Light Gray LIMESTONE*				
				Olive Clayey SHALE				
70 / 380		*37/60*		*-Dark Gray, Calcareous below 70.3 Feet*				
75 / 375		*60/60*						
				Light Gray LIMESTONE				
80 / 370		*60/60*						
85 / 365		*59/60*						
				Dark Gray Clayey SHALE				
				TD - 88.0 Feet				
90								

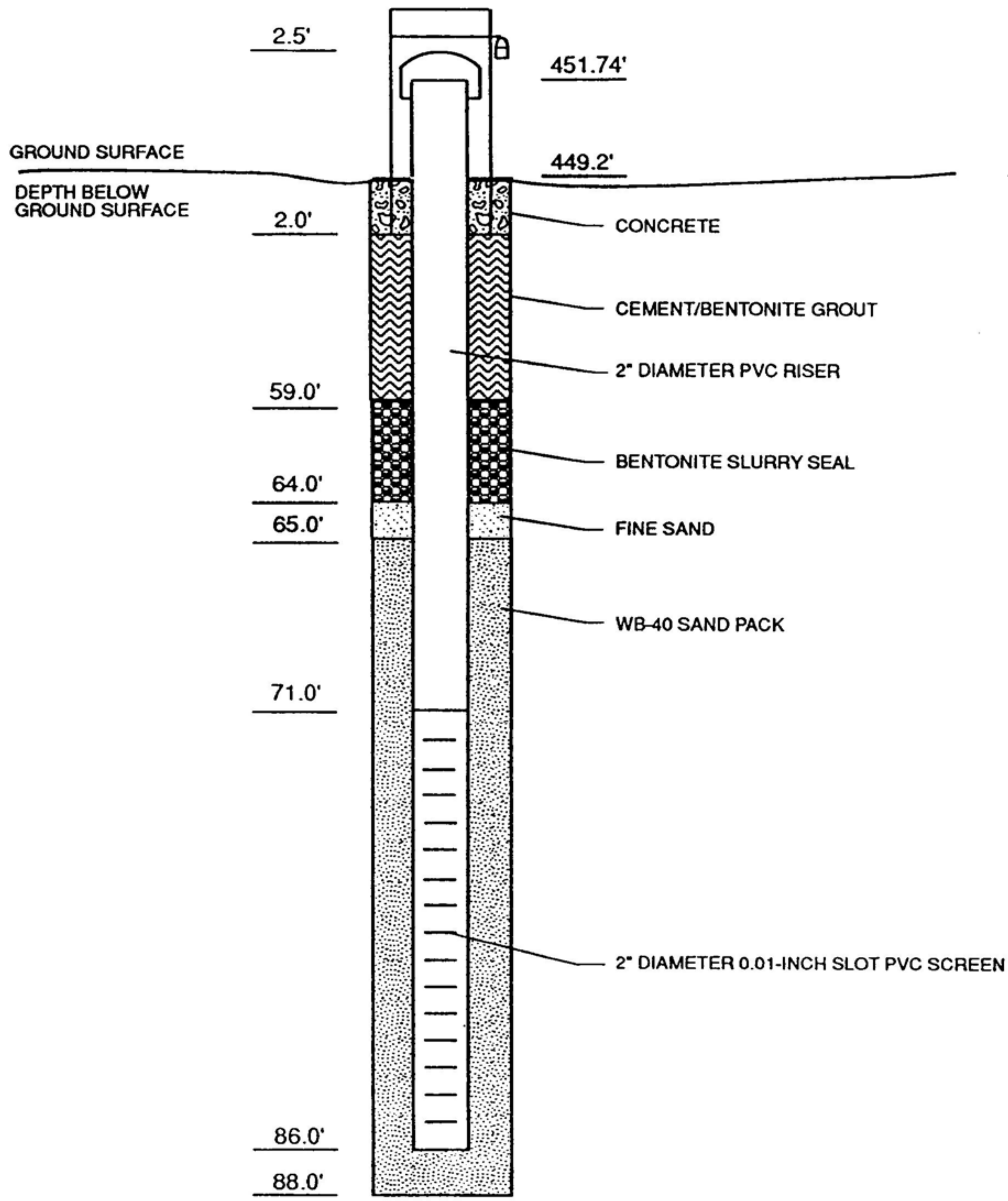
Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER ∇ ▼

Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414



NOT TO SCALE

Burlington Environmental Inc.	
BAMW - 306 MONITORING WELL CONSTRUCTION DIAGRAM	
BALDWIN FGD SOLID WASTE BALDWIN, ILLINOIS 124081	BAMW-306

PROJECT MANAGER

PROJECT MANAGER

CHECKED BY

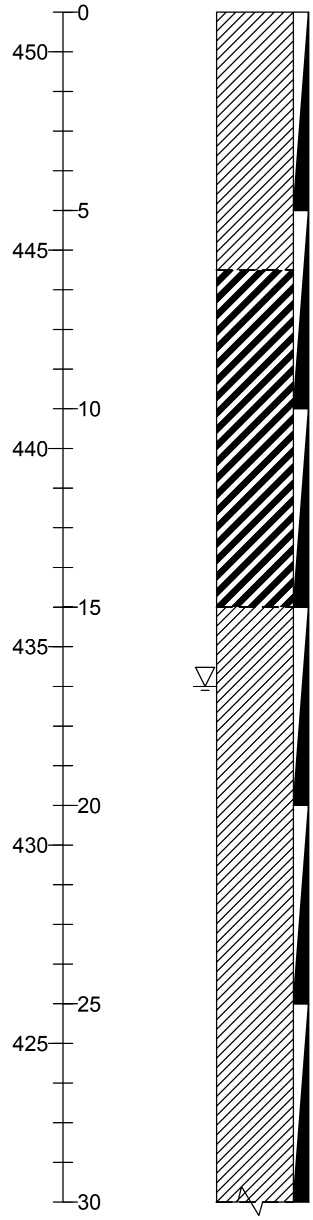
DRAWN BY

MH
REV. DATE
11/20/91

LOG OF BORING MW-124

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 451.0 Feet

Date Drilled: 09/19/91
Drilling Contractor: Burlington Environmental
Drilling Method: Hollow Stem Auger
Logged By: Burlington Environmental



Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
451.0 / 0 – 446.0 / 5		47/60	CL	*Dark Brown Silty CLAY* *-2" Silt Seam at 0.2 Feet* *-Gray-Brown below 0.5 Feet*				
446.0 / 5 – 441.0 / 10		60/60	CH	*Gray-Brown CLAY, with Silt, Sand* (from 6.5 Feet)				
441.0 / 10 – 436.0 / 15		60/60						
436.0 / 15 – 431.0 / 20		50/60	CL	*Brown Silty CLAY*				*Hit water at 17.0 feet.*
431.0 / 20 – 426.0 / 25		60/60		*-Gray-Brown from 19.5 to 20.0 Feet* *-Dark Gray-Brown with Sand, Trace Gravel below 20.0 Feet* *-1" Sand Seam at 21.3 Feet*				
426.0 / 25 – 421.0 / 30		60/60		*-2" Gravel Seam at 26.7 Feet*				

(continued)

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER
∇ First Observed During Drilling - 17.0 Feet
▼

Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

LOG OF BORING MW-124 (Cont.)

Project Name: SDR Landfill Project
Project Location: Baldwin Energy Complex, Baldwin, IL
Project Number: 6225
Elevation: 451.0 Feet

Date Drilled: 09/19/91
Drilling Contractor: Burlington Environmental
Drilling Method: Hollow Stem Auger
Logged By: Burlington Environmental

Elevation/ Depth (feet)	Graphic Log Sampler Symbols and SPT Blows	Rec. (in./in.)	USCS	Description	DD (pcf)	UCS (tsf)	MC (%)	Remarks
30–35 (420)		60/60	CL	*Dark Gray-Brown Silty CLAY, with Sand, Trace Gravel*				
35–38 (415)		60/60	CH	*Dark Gray-Brown CLAY, with Silt, Sand*				
38–45 (410)		60/60		*Dark Gray-Brown Weathered SHALE -Gray-Brown below 39.0 Feet*				
45 (405)				*TD - 45.0 Feet*				

Depth scale: 30, 35, 40, 45, 50, 55, 60. Elevation scale: 420, 415, 410, 405, 400, 395.

Notes: Data presented on this log has been transcribed from Boring Logs prepared by Burlington Environmental, presented in a report dated April 22, 1992.

GROUNDWATER
First Observed During Drilling - 17.0 Feet

Piezometer Installed: No

Shively Geotechnical
A Division of Environmental Operations, Inc.

Missouri (314) 241-0900
Illinois (618) 398-1414

KELRON
ENVIRONMENTAL
INCORPORATED

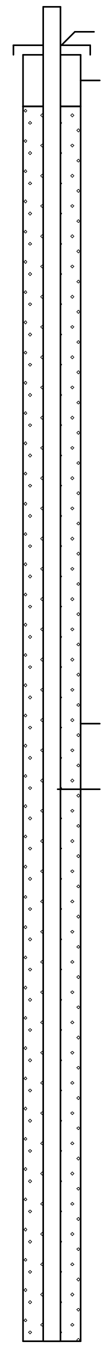
LOG OF BORING MW-350

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation: 394.11	
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation 396.80	
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	CLAY, very stiff to hard, brown, grayish-brown (10YR 5/2) mottled yellowish brown (10YR 5/8), dry	394	1	19/54	4.5		
			2		2.25		
			3				
5	- grain size analysis @ 5 - 6 ft: 2.3% sand, 42.4% silt, 55.3% clay	389	4	47/60	4.5	CH	
			5		3.5		
			6		3.25		
			7		4.0		
10		384	8	60/60	2.75		
	CLAY, brown to olive brown, moist		9		2.75		
	- grain size analysis @ 11 - 12 ft: 8.4% sand, 39.3% silt, 52.3% clay		10		2.75		
			11		1.75	CL/CH	
			12		2.0		
15		379					
	CLAY, soft, high plasticity, dark yellow brown, moist; 1-2" sand seams at 17' and 19'		13	45/60			
	- grain size analysis @ 18 - 20 ft: 1.8% sand, 21.9% silt, 76.3% clay						
	- very stiff to hard, high plasticity						
20		374				CH	
			14	60/60			
25			15	23/23			

Well: MW-350
Elev.: 396.80



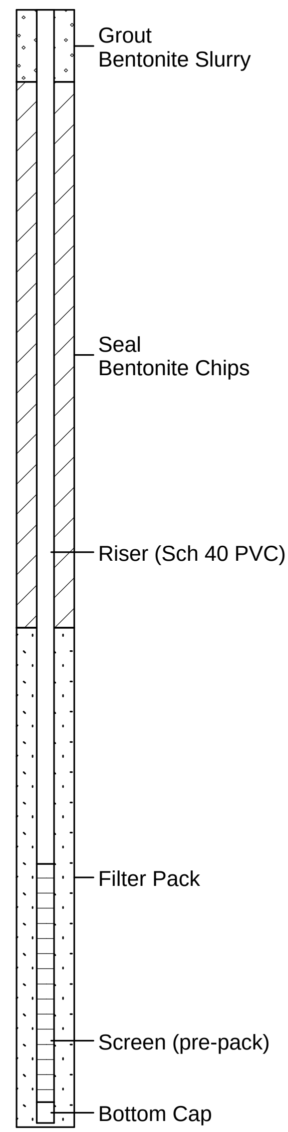
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-350 (Page 2 of 2)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 394.11
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	396.80
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS
25	- Auger refusal at 26.4 feet bgs	369	15	23/23		CL
	LIMESTONE and SHALE, interbedded, banded, solid, very soft, light to dark gray; slightly weathered					LS/SH
	LIMESTONE, banded, medium bedded, solid, hard, medium gray; unweathered					LS
30	LIMESTONE and SHALE, interbedded; limestone is banded, medium bedded, hard, medium gray; shale is very soft to medium soft, dark gray Borehole diameter from 26.4 to 46.7 feet bgs = 3 7/8" RQD for 26.4 - 36.4' = 72% (Fair) Recovery = 116/120"	364	16	116/120		LS/SH
35	SHALE, banded, medium bedded, solid, soft to medium soft, dark gray	359				SH
40	LIMESTONE, banded, massive, solid, hard to very hard, light to medium gray	354	17	118/120		LS
45	RQD for 36.4 - 46.4' = 96% (Excellent) Recovery = 118/120"	349				
	END BOREHOLE AT 46.7 FEET BLS					
50						

Well: MW-350
Elev.: 396.80



01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec350~1.bor

KELRON ENVIRONMENTAL INCORPORATED

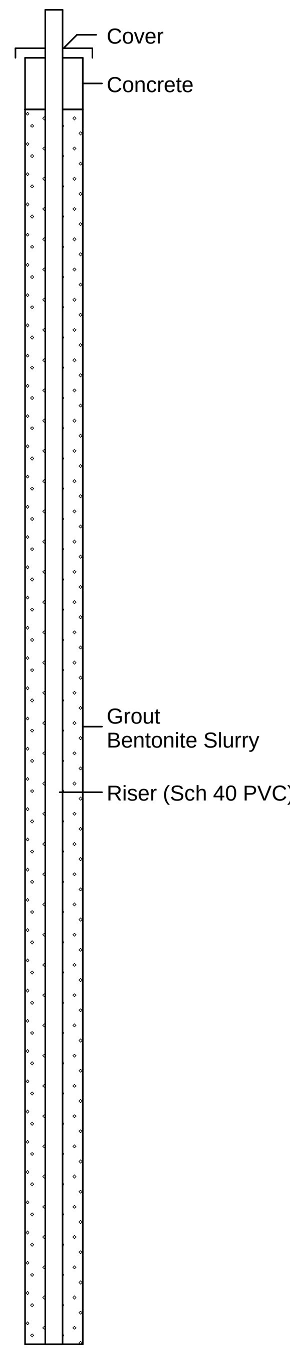
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, very stiff to hard, yellow brown (10YR 5/6), dry	422	1	46/48	4.5+	CL
			2	60/60	3.5	
5	CLAY, trace sand and fine gravel, very stiff, high plasticity, few black organic material	417	3		4.0	CL
			4		2.75	
			5		3.0	
10	- medium hard	412	6	60/60	2.75	
			7		2.0	
	- soft		8		1.0	
			9		1.25	
15		407	10	60/60	1.5	
	- medium hard		11		2.5	
	SAND, poorly graded, loose, wet (4-inch thick)					SP
	SANDY CLAY, trace fine gravel, yellow brown to olive brown (2.5Y 5/3)		12		2.75	CL
			13		3.5	
20		402	14	60/60	4.5+	
			15		2.5	
			16		2.5	
			17		2.75	
25			18	48/60	2.5	

Well: MW-352
Elev.: 425.04



KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation:	422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Well: MW-352
Elev.: 425.04

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
25		397				CL
	- grain size analysis @ 26.5 - 27.5 ft: 33.7% sand, 27.1% silt, 39.2% clay		18	48/60	2.5	
	SAND with few gravel, yellow brown					SP
	CLAY, some sand and fine gravel, hard to very hard, high plasticity, dark yellow brown (10YR 4/6)					CL
			19	60/60	3.0	
30	CLAY, lean to fat	392	20		3.0	CL/CH
	- grain size analysis @ 32 - 33 ft: 13.2% sand, 43.9% silt, 42.8% clay		21		3.5	
			22		3.0	
35		387	23	48/60	1.5	
	- medium hard, high plasticity, gray brown to light olive brown (2.5Y 5/2-5/3)		24		1.5	
	- trace silt, dark yellow brown (10YR 4/4)		25		1.75	
			26		1.5	
40		382	27	54/60	1.75	
			28		2.0	
			29		2.5	
			30		2.5	
			31	57/60	2.0	
45		377	32		1.75	
			33		1.75	
	CLAY, medium hard, low plasticity, olive brown (2.5Y 5/4)		34		2.5	CL
			35		1.75	
			36	3/3		
50						

Grout
Bentonite Slurry

Riser (Sch 40 PVC)

01-14-2011 c:\powerp~1\baldwin\ashmon~1\bec352~1.bor

KELRON ENVIRONMENTAL
INCORPORATED

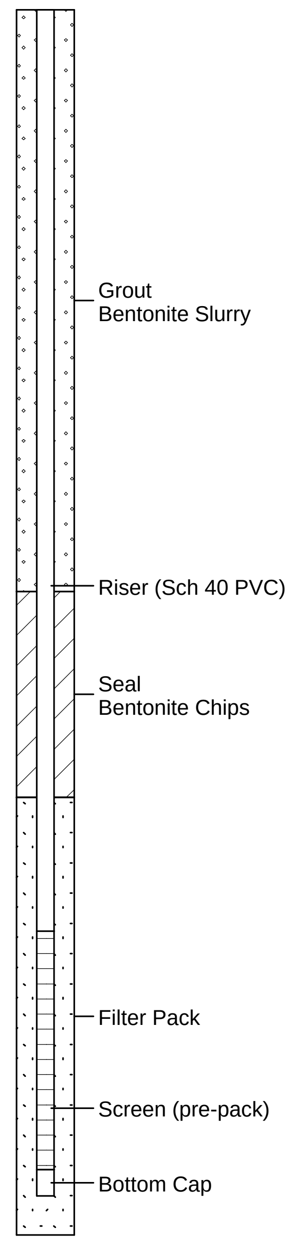
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
50	- Auger refusal at 53.7 feet bgs	372				CL	
55	LIMESTONE, weathered, thinly laminated, medium hard to hard, gray	367	37 38	5/5 8/27		LS	
	SHALE, clayey, gray					SH	
60	LIMESTONE, occasional shale partings - laminated, fossiliferous, medium gray	362	39 40	19/60 54/60		LS	
65	SHALE, soft, dark gray	357				SH	
70	LIMESTONE, medium hard to hard, light gray Borehole diameter from 53.7 to 73.8 feet bgs = 3 7/8" RQD for 53.8 - 73.8' = 57% (Fair) Recovery = 173/240"	352	41 42	59/60 33/34		LS	
75	END BOREHOLE AT 73.8 FEET BLS						

Well: MW-352
Elev.: 425.04



KELRON ENVIRONMENTAL INCORPORATED

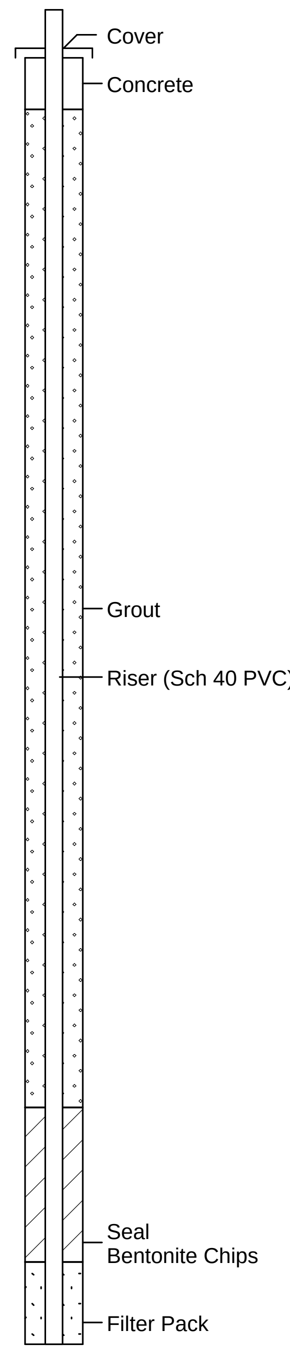
LOG OF BORING MW-355

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/14/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID; 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 390.82
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	393.69
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378145, 555980

Depth in Feet	DESCRIPTION	Surf. Elev. 390.82	Samples	Recovery inches	Qp TSF	USCS
0	Continuous boring to 20 feet below ground surface. Refer to boring log for adjacent well MW-155 for description of subsurface materials to 20 feet.	390				
5		385				
10		380				
15		375				
20	CLAYEY SAND, poorly graded, dark yellow brown, wet	370	1	23/23	3.5	SC
	CLAY, lean, very stiff, gray with yellow-brown mottling - Auger refusal at 22.1 feet bgs					CL
	LIMESTONE, lightly weathered, fine grained, slightly fossiliferous, medium soft, light gray banded with light red staining along horizontal fractures; three small shale lenses within 31 inch interval - coarse grained, medium soft to hard		2	108/124		LS
25						

Well: MW-355
Elev.: 393.69



KELRON ENVIRONMENTAL INCORPORATED

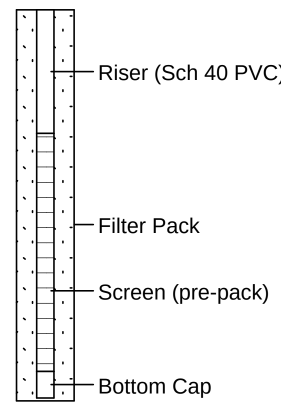
LOG OF BORING MW-355

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/14/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID; 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 390.82
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	393.69
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378145, 555980

Depth in Feet	DESCRIPTION	Surf. Elev. 390.82	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
25	- fine grained, slightly fossiliferous, light gray Borehole diameter from 22.1 to 32.6 feet bls = 3 7/8" RQD for 22.1 - 32.6' = 57% (Fair)	365	2	108/124		LS	
30		360					
	END BOREHOLE AT 32.6 FEET BLS						
35		355					
40		350					
45		345					
50							

Well: MW-355
Elev.: 393.69



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-356

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	9/28/2015	10/1/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-356	Feet (NAVD88)	425.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,050.37 N, 2,381,958.49 E E/W(circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.2662"
Long -89° 52' 10.4808"

Local Grid Location
Feet ☐ N ☐ S   Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 10' **SILTY CLAY** CL/ML.	CL/ML								0-37.3' Blind Drilled. See logs OW-156 and OW-256 for soil description.
			10	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–17	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s. *(continued)*	(CL)s									
			18–27	17.7 - 27.3' **SILTY CLAY** CL/ML.	CL/ML									
			28	27.3 - 28.6' **POORLY-GRADED SAND:** SP.	SP									
			29–32	28.6 - 33.9' **SILTY CLAY** CL/ML.	CL/ML									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	28.6 - 33.9' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
			34–35	33.9 - 35.7' **LEAN CLAY:** to **SHALE:** CL.	CL									
			36–37	35.7 - 37.3' **SHALE:** BDX (SH).	BDX (SH)									
1 CORE	28 24.5		38–39	37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured.	BDX (SH)									Core 1, RQD=92%
2 CORE	60 57		40–44	39.6' light to dark gray to tan. 42.3' - 43.2' limestone. 43.2' light to dark gray/tan, very weak.										Core 2, RQD = 58%
3 CORE	60 41		45–49	45' - 50' dark gray, intensely fractured.										Low recovery, possible washout. Core 3, RQD = 18%
4 CORE	36 36		50–52	50' - 53.1' thin beds of limestone, limestone is more competent, slightly fractured, wet.										Core 4, RQD=92%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured. *(continued)*	BDX (SH)									
5 CORE	24 21.5		53	53.1' - 53.8' intensely fractured.										Core 5, RQD=58%
			54	53.8 - 55.4' **LIMESTONE:** BDX (LS), white, thickly bedded, moderately fractured (moderately wide to very narrow apertures).	BDX (LS)									
6 CORE	60 60.5		55											Core 6, RQD=84%
			56	55.4 - 57.2' **SHALE:** BDX (SH), dark gray, trace limestone beds, moderately fractured.	BDX (SH)									
			57	56.8' soft, highly weathered bed, decomposed. 57.1' soft, highly weathered bed.										
			58	57.2 - 60' **LIMESTONE:** BDX (LS), trace shale beds, moderately fractured (moderately wide to very wide apertures).	BDX (LS)									
			59	59.4' - 59.7' vertical fractures with pyrite mineralization.										
7 CORE	60 61		60	60 - 65.8' **SHALE:** BDX (SH), gray, moderately fractured.	BDX (SH)									Core 7 RQD=75%
			61	61' -62' dark gray.										
			62	62' - 62.4' soft, clayey.										
			63											
			64											
8 CORE	60 61.5		65	65' dark gray, narrow to moderately wide apertures. 65.3' - 65.8' fossiliferous.										Core 8, RQD=67%
			66	65.8 - 68.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly to moderately fractured.	BDX (LS/SH)									
			67											
			68											
			69	68.8 - 70' **SHALE:** BDX (SH), gray, fossiliferous, moderately fractured (moderately wide to narrow apertures).	BDX (SH)									Bedrock corehole reamed 6" in diameter to 69' for well installation.
9 CORE	60 61		70	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures).	BDX (LS/SH)									Core 9, RQD=87%
			71											
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73–74	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures). *(continued)*	BDX (LS/SH)									
10 CORE	60 60		75	75 - 75.9' **SHALE:** BDX (SH), dark gray, soft, moderately fractured (narrow to moderately narrow apertures).	BDX (SH)									Core 10, RQD=95%
			76	75.9 - 76.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, narrow to moderately narrow apertures.	BDX (LS/SH)									
			77–79	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures.	BDX (LS)									
11 CORE	60 60.5		80	80' light gray to gray, unfractured.										Core 11, RQD=100%
12 CORE	60 61.5		85											Core 12, RQD=100%
13 CORE	60 59.5		90–92											Core 13, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93–101	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures. *(continued)*	BDX (LS)									
14 CORE	61 61		95											Core 14, RQD=100%
15 CORE	60 59.5		100	99.7' slightly weathered, decomposed. 100' gray, no fossils.										Core 15, RQD=100%
			102–106	101.8 - 106.5' **SHALE:** BDX (SH), dark gray, thickly bedded, slightly fractured.	BDX (SH)									
16 CORE	60 58.5		105	106.2' weathered, decomposed.										Core 16, RQD=56%
			107–108	106.5 - 108.4' **LIMESTONE:** BDX (LS), light gray to green, highly decomposed, intensely fractured.	BDX (LS)									
			109	108.4 - 109.8' **SHALE:** BDX (SH), dark reddish-brown, highly decomposed.	BDX (SH)									
17 CORE	60 55		110–111	109.8 - 111.1' **LIMESTONE:** BDX (LS), gray, highly disintegrated (healed dissolution cracks with green highly decomposed infilling). 109.9' - 110.7' angular gravel-sized fragments. 110.7' moderately decomposed, very intensely fractured.	BDX (LS)									Core 17, RQD=49%
			112		BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			113	111.1 - 114' **SHALE:** BDX (SH), dark gray, moderately to highly decomposed, moderately fractured. *(continued)*	BDX (SH)									
18 CORE	60 61		114–116	114 - 116.3' **LIMESTONE:** BDX (LS), gray, moderately fractured.	BDX (LS)									Core 18, RQD=61%
				116.3 - 116.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			117–119	116.7 - 119.7' **SHALE:** BDX (SH), gray, slightly decomposed, intensely fractured.	BDX (SH)									
			120	119.7 - 120.9' **SHALEY LIMESTONE:** BDX (LS/SH), gray, slightly decomposed, intensely fractured.	BDX (LS/SH)									
19 CORE	60 64		121–122	120.9 - 122.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									Core 19, RQD=86%
			123–125	122.2 - 126.1' **LIMESTONE:** BDX (LS), gray, moderately fractured. 123.3' - 123.4' fossiliferous. 124.1' - 124.1' fossiliferous. 124.7' - 124.8' fossiliferous.	BDX (LS)									
20 CORE	48 48		126–127	126.1 - 127.6' **SHALE:** BDX (SH), dark gray, slightly decomposed. 126.7' - 127' limestone, gray. 127' moderately decomposed.	BDX (SH)									Core 20, RQD =88%
			128–129	127.6 - 129.2' **LIMESTONE:** BDX (LS), slightly decomposed.	BDX (LS)									
21 CORE	12 12			129.2 - 130' **SHALE:** BDX (SH), gray, intensely fractured.	BDX (SH)									Core 21, RQD=0%
22 CORE	60 60		130	130 - 130.4' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									Core 22, RQD=94%
			131	130.4 - 131' **LIMESTONE:** BDX (LS), gray, fossiliferous, moderately fractured.	BDX (LS)									
			132	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			133	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									The casing dropped 3" during drilling.
			134	134 - 135' **LIMESTONE:** BDX (LS), gray, thickly bedded, moderately fractured.	BDX (LS)									
			135	135' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-366

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/3/2015	12/4/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-366	Feet (NAVD88)	422.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,581.80 N, 2,381,171.15 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 31.8876"
Long -89° 52' 20.4414"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 5.6	0 - 5.6' **FILL, SILTY CLAY** CL/ML.	(FILL) CL/ML								0-33' Blind Drilled. See logs TPZ-166 and B-13-4 for soil description.
			5.6 - 12	5.6 - 33' **SILTY CLAY** CL/ML.	CL/ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–32	5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
1 SS	23 18	17 21 20 50	33	33 - 35.6' **LEAN CLAY:** to **SHALE:** CL, gray, residual soil, hard (>4.5 tsf).	CL									
			34											
			35											
1 CORE	60 54		36	35.6 - 39.3' **SHALE:** BDX (SH), gray, highly decomposed, moderately fractured.	BDX (SH)									Core 1, RQD=54%
			37											
			38	38.4' limestone layer (approximately 2.5").										
			39											
			40	39.3 - 42.3' **LIMESTONE:** BDX (LS), cherty, intensely fractured.	BDX (LS)									
2 CORE	60 47		41											Core 2, RQD=32%
			42											
				42.3 - 42.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
			43	42.9 - 43.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			44	43.7 - 49.8' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
			45											
3 CORE	60 63		46											Core 3, RQD=73%
			47											
			48											
			49											
			50	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured.	BDX (LS/SH)									
4 CORE	60 49		51											Core 4, RQD=96%
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			53 54	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured. *(continued)* 52.8' - 53.1 shale bed. 53.1' fossiliferous.	BDX (LS/SH)									
				54.3' End of Boring.										Bedrock corehole reamed 6" in diameter to 54' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-369

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/17/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-369	Feet (NAVD88)	420.49 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,329.71 N, 2,381,765.41 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 49.1496"
Long -89° 52' 12.9288"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 0.2	0 - 0.2' **SILT:** ML.	ML									0-43' Blind Drilled. See log PZ-169 for soil description.
			0.2 - 2	0.2 - 2' **SILTY CLAY** CL/ML.	CL/ML									
			2 - 4	2 - 4' Shelby Tube Sample.										
			4 - 10	4 - 10' **SILTY CLAY** CL/ML.	CL/ML									
			10 - 12	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 14' Shelby Tube Sample.										
			14	14 - 20' **LEAN CLAY:** CL.	CL									
			20	20 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22	22 - 24' Shelby Tube Sample.										
			24	24 - 28' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s									
			28	28 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL.	CL									
			32											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32–38	32 - 38' **LEAN CLAY:** CL.	CL									
			38–40	38 - 40' No Recovery.										
			40–42	40 - 42' **LEAN CLAY:** CL.	CL									
1 SS	24 0	10 18 30 40	42–45	42 - 45' No Recovery.										
2 SS	5 9	50/5"	45–45.3	45 - 45.3' **LEAN CLAY:** CL, dark brown (10YR 3/3), 30-50% pale brown (10YR 6/4) and brown (10YR 4/3) mottling, trace subrounded fine gravel, cohesive, low plasticity, moist.	CL									
3 SS	5 8	50/5"	45.3–48.7	45.3 - 48.7' **SHALE:** BDX (SH), dark grayish brown, highly decomposed. 47' trace clay layers (< 1" thick), highly decomposed, very weak.	BDX (SH)									
1 CORE	66 30		48.7–50.8	48.7 - 50.8' **LIMESTONE:** BDX (LS), white, fossiliferous, intensely fractured (extremely narrow to narrow apertures), microcrystalline, slightly to moderately decomposed.	BDX (LS)									Core 1, RQD=17%
			50.8–52	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak.	BDX (SH)									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak. *(continued)*	BDX (SH)									
2 CORE	60 46		54–59	53.4 - 59.3' **LIMESTONE:** BDX (LS), white, moderately fractured (very narrow to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, very strong, pitted, trace mineralization.	BDX (LS)									Core 2, RQD=83%
				58.4' mud in fracture.										
3 CORE	60 64		60–64	59.3 - 64.9' **SHALEY LIMESTONE:** BDX (LS/SH), dark gray, medium bedded shale, intensely fractured (extremely narrow to narrow apertures), fossiliferous, microcrystalline, decomposed, very weak to weak, weathered, highly weathered shale cementing segments together.	BDX (LS/SH)									Core 3, RQD=63%
4 CORE	60 62		65–68	64.9 - 68.8' **LIMESTONE:** BDX (LS), white, slightly fractured (tight to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, slightly disintegrated, pitted.	BDX (LS)									Core 4, RQD=79%
			69–70	68.8 - 70.7' Overdrilled for Well Installation.										Bedrock corehole reamed 6" in diameter to 70.7' for well installation.
				70.7' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-370	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Mark Baetje Bulldog Drilling	11/20/2015	11/24/2015	4 1/4 HSA and rotary
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
MW-370	Feet (NAVD88)	418.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,826.50 N, 2,381,936.14 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 44.1702"
Long -89° 52' 10.8084"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-28' Blind Drilled. See log PZ-170 for soil description.
			2 - 4	2 - 4' Shelby Tube Sample.									
			4 - 8	4 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8 - 10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			10 - 12	10 - 12' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12 - 14	12 - 14' Shelby Tube Sample.										
			14 - 24	14 - 24' **SILTY CLAY** CL/ML.	CL/ML									
			24 - 26	24 - 26' Shelby Tube Sample.										
			26 - 28	26 - 28' **SILTY CLAY** CL/ML.	CL/ML									
1 SS	10 10	23 50/4"	28 - 28.4	28 - 28.4' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace angular limestone gravel, soft, medium plasticity, moist.	CL									
1 CORE	60 18.5		28.4 - 28.9	28.4 - 28.9' **SHALE:** BDX (SH), gray, highly decomposed, very weak.	BDX (SH)									Core 1, RQD=51%
			28.9 - 38.1	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong.	BDX (LS/SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong. *(continued)*									
2 CORE	51.5 12		34	33.9' - 38.1' gray, greenish gray in fractures, trace fossils, moderately to highly decomposed, slightly to moderately disintegrated, clay in shoe with a hard, reddish brown inclusion.									Core 2, RQD=0%
			35		BDX (LS/SH)								
			36	36' - 37.9' vertical fracture.									
			37										
3 CORE	24 25		38	38.1 - 44' **SHALE:** BDX (SH), bluish gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, weak.									Core 3, RQD=40%
			39										
4 CORE	24 11		40										Core 4, RQD=0%
5 CORE	36 32		41	40.6' - 40.8 shaley limestone layer, light gray to gray, microcrystalline, moderately decomposed, very strong. 41.1' - 43.2 gray, moderately to highly decomposed.	BDX (SH)								Core 5, RQD=78%
			42										
			43										
6 CORE	12 28		44	44 - 45.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to narrow apertures), thin to medium bedded, microcrystalline, slightly decomposed, clay cement in apertures, very strong.	BDX (LS/SH)								Core 6, RQD=29%
7 CORE	45 27		45	45' shale layer, bluish gray, moderately fractured (extremely narrow to narrow apertures), highly decomposed, weak.									Core 7, RQD=65%
			46	45.7 - 52.2' **SHALE:** BDX (SH), bluish gray, moderately fractured (tight to narrow), highly decomposed, weak.									
			47										
			48										
8 CORE	24 30		49		BDX (SH)								Core 8, RQD=78%
			50										
			51										
9 CORE	24 24		52										Core 9, RQD=0%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				52' clay cement.										
			53	52.2 - 61.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (very narrow to narrow), thin to medium bedded, microcrystalline, slightly decomposed, cemented clay in apertures, very strong.	BDX (LS/SH)									
10 CORE	24 36		54	52.7' - 53' clayey sand in aperture. 53' - 53.1 shale bed, bluish gray, fossiliferous, moderately fractured (very narrow to narrow), highly decomposed, weak.										Core 10, RQD=0%
			55	53.1' white to bluish gray, gray in the fractures (extremely narrow to moderately narrow apertures), thinly to medium bedded, slightly to moderately disintegrated.										
11 CORE	24 30		56	55.7' moderately disintegrated.										Core 11, RQD=18%
			57											
12 CORE	30 27		58	58.1' highly decomposed.										Core 12, RQD=39%
			59											
			60											
13 CORE	36 53		61											Core 13, RQD=89%
			62	61.7 - 65.3' **LIMESTONE:** BDX (LS).	BDX (LS)									
			63											
			64											
			65	65.3 - 66' Overdrilled for Well Installation.										
			66	66' End of Boring.										Bedrock corehole reamed 6" in diameter to 66' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-373

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/21/2015	10/28/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-373	Feet (NAVD88)	388.80 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,041.91 N, 2,379,186.06 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 26.613"
Long -89° 52' 45.3282"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' No Recovery. Gravel Pad.									0-13.4' Blind Drilled. See log PZ-173 for soil description detail.
			2 - 10.9	2 - 10.9' **SILTY CLAY** CL/ML.	CL/ML								
			10.9 - 12	10.9 - 13.4' **SILT:** ML.	ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	10.9 - 13.4' **SILT:** ML. *(continued)*	ML								
1 CORE	23 23		14	13.4 - 14.7' **LIMESTONE:** BDX (LS), fossiliferous, extremely fractured, thickly bedded.	BDX (LS)								Core 1, RQD=65%
			15	14.7 - 15.5' **SHALE:** BDX (SH), gray, trace limestone, highly decomposed.	BDX (SH)								
2 CORE	58.2 42		16	15.5 - 16.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, intensely fractured.	BDX (LS/SH)								Core 2, RQD=52%
			17	16.6 - 17.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								
			18	17.3 - 18.8' **LIMESTONE:** BDX (LS), thickly bedded.	BDX (LS)								
			19, 20	18.8 - 20.2' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)								
3 CORE	60 56			20.2 - 20.8' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, tight diagonal fracture.	BDX (LS/SH)								Core 3, RQD=57%
			21	20.8 - 21.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								
			22, 23, 24	21.5 - 24.9' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, extremely narrow to narrow apertures.	BDX (LS/SH)								
4 CORE	60 55		25, 26, 27, 28, 29	24.9 - 29.1' **SHALE:** BDX (SH), highly decomposed. 25.1' - 25.4' limestone, fossiliferous. 25.4' gray, fossiliferous, thickly bedded, hard.	BDX (SH)								Core 4, RQD=65%
5 CORE	60 60		30, 31, 32	29.1 - 48.3' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded. 30' - 35.1' moderately fractured, extremely narrow apertures.	BDX (LS)								Core 5, RQD=95%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
				29.1 - 48.3' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded. *(continued)*										
			33											Bedrock corehole reamed 6" in diameter to 33.3' for well installation.
			34											
6 CORE	60 58		35	35.1' - 40' slightly fractured, narrow apertures.										Core 6, RQD=96%
			36											
			37											
			38											
			39											
7 CORE	60 60		40	40' - 45.1' moderately fractured, extremely narrow to narrow apertures.	BDX (LS)									Core 7, RQD=100%
			41	41.3' - 41.6' vuggy.										
			42											
			43											
			44											
8 CORE	60 61.5		45	45.1' - 48.3' moderately fractured.										Core 8, RQD=63%
			46											
			47											
			48	48.3 - 57' **SHALE:** BDX (SH), gray, thin limestone beds.										
			49											
9 CORE	60 63		50	49.9' moderately decomposed.	BDX (SH)									Core 9, RQD=57%
			51											
			52											

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			52 - 57	48.3 - 57' **SHALE:** BDX (SH), gray, thin limestone beds. *(continued)* 54.7' - 55' fossiliferous.	BDX (SH)									
10 CORE	60 46													Core 10, RQD=35%
			57 - 58.3	57 - 58.3' **LIMESTONE:** BDX (LS), intensely fractured, decomposed green infilling.	BDX (LS)									
			58.3 - 60	58.3 - 60' **LEAN CLAY:** CL, greenish gray to reddish brown. 58.7' reddish brown.	CL									
11 CORE	60 55		60 - 65.2	60 - 65.2' **SHALE:** BDX (SH), intensely fractured, thickly bedded, decomposed. 62.8' gray.	BDX (SH)									Core 11, RQD=51%
12 CORE	60 58		65.2 - 66.5	65.2 - 66.5' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, thinly bedded.	BDX (LS/SH)									Core 12, RQD=67%
			66.5 - 68.8	66.5 - 68.8' **SHALE:** BDX (SH), gray.	BDX (SH)									
			68.8 - 70.7	68.8 - 70.7' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured, decomposed (greenish gray).	BDX (LS/SH)									
13 CORE	46 48													Core 13, RQD=60%
			70.7 - 72	70.7 - 80.1' **SHALE:** BDX (SH), dark gray, thickly bedded.	BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				70.7 - 80.1' **SHALE:** BDX (SH), dark gray, thickly bedded. *(continued)*	BDX (SH)									
14 CORE	12 11		74											Core 14, RQD=91%
15 CORE	60 62		75											Core 15, RQD=61%
			76	76.1' dark to light gray, intensely fractured, highly decomposed.										
			77	77.5' dark gray, moderately fractured.										
			78	78.7' highly fractured, decomposed.										
16 CORE	60 64		80	80.1 - 83.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									Core 16, RQD=61%
			83	83.3 - 85.4' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
17 CORE	60 60		85	85.4 - 88.4' **SHALEY LIMESTONE:** BDX (LS/SH), thickly bedded, fossiliferous.	BDX (LS/SH)									Core 17, RQD=87%
			88	88.4 - 88.8' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
			89	88.8 - 94' **LIMESTONE:** BDX (LS), thickly bedded.	BDX (LS)									
18 CORE	60 59		90											Core 18, RQD=88%
			92											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93	88.8 - 94' **LIMESTONE:** BDX (LS), thickly bedded. *(continued)*	BDX (LS)									
			94 95	94 - 95.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
				95.1' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-374

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/6/2015	11/9/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-374	Feet (NAVD88)	398.41 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,663.65 N, 2,379,766.63 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 22.8546"
Long -89° 52' 38.0706"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' **TOPSOIL:** ML.	ML								0-23.6' Blind Drilled. See log PZ-174 for soil description.
			2 - 4	2 - 4' No Recovery.									
			4 - 12	4 - 23.6' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-374

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			4 - 23.6' **LEAN CLAY:** CL. *(continued)*	CL						
1 SS	24 0.4	50/5"	23.6 - 24.1' **SILTY CLAY** CL/ML, brown, 3" of shale at bottom of sample.	CL/ML						
1 CORE	18 16		24.1 - 27.5' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, moderately fractured (very narrow to moderately narrow apertures).	BDX (LS)						Core 1, RQD=89%
2 CORE	60 44									Core 2, RQD=61%
			27.5 - 37.2' **SHALEY LIMESTONE:** BDX (LS/SH), decomposed, thickly bedded.							
3 CORE	38 30		29.7' moderately fractured.	BDX (LS/SH)						Core 3, RQD=67%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-374

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				27.5 - 37.2' **SHALEY LIMESTONE:** BDX (LS/SH), decomposed, thickly bedded. *(continued)*										
4 CORE	30 27		33											Core 4, RQD=56%
			34											
			35		BDX (LS/SH)									
5 CORE	59 59			35.4' - 36.2' fossiliferous.										Core 5, RQD=100%
			36	36.2' increase in shale content.										
			37											
				37.2 - 40.3' **SHALE:** to **LIMESTONE:** BDX (SH), gray, limestone content decreasing with depth, thickly bedded, moderately fractured.										
			38											
			39		BDX (SH)									
				39.6' dark gray, no limestone.										
			40											
6 CORE	25 25			40.3 - 42.3' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.										Core 6, RQD=100%
			41		BDX (LS)									
			42	41.9' very narrow diagonal fracture.										Bedrock corehole reamed 6" in diameter to 42' for well installation.
				42.3' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-375

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/3/2015	11/6/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-375	Feet (NAVD88)	420.50 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,434.97 N, 2,380,838.70 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 20.562"
Long -89° 52' 24.6504"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 0.9	0 - 0.9' **SILT:** ML.	ML								0- 44.8' Blind Drilled. See log PZ-175 for soil description details.
			0.9 - 5.4	0.9 - 5.4' **LEAN CLAY:** CL.	CL								
			5.4 - 13.5	5.4 - 13.5' **SILT:** ML.	ML								
			13.5 - 15	13.5 - 22.3' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16–22	13.5 - 22.3' **LEAN CLAY:** CL. *(continued)*	CL									
			22.3	22.3 - 26' **SILT:** ML.	ML									
			26	26 - 28' **LEAN CLAY:** to **SILT:** CL.	CL									
			28	28 - 28.4' **SANDY SILT:** s(ML).	s(ML)									
			28.4	28.4 - 31.3' **LEAN CLAY:** CL.	CL									
			31.3	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g.	(SW)g									
			31.5–41	31.5 - 43.8' **LEAN CLAY:** CL.	CL									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			41.5–43.8	31.5 - 43.8' **LEAN CLAY:** CL. *(continued)*	CL								
			43.8–44.8	43.8 - 44.8' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g								
1 CORE 1 SS	60 42 5 5	50 for 5"	44.8–45.3	44.8 - 45.3' **WELL-GRADED GRAVEL:** GW, gray, mostly limestone cobbles.	GW								Core 1, RQD=86% Broken limestone in split spoon at 45'.
			45.3–49.3	45.3 - 49.3' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/6).	CL/ML								
			49.3–50.1	49.3 - 50.1' **LEAN CLAY:** CL, dark gray (10YR 4/1).	CL								
2 CORE	24 18		50.1–51.3	50.1 - 51.3' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)								Core 2, RQD=33%
3 CORE	36 30.5		51.3–62.8	51.3 - 62.8' **SHALEY LIMESTONE:** BDX (LS/SH), gray, thickly bedded, fossiliferous, moderately fractured.	BDX (LS/SH)								Core 3, RQD=85%
4 CORE	60 55												Core 4, RQD=95%
5 CORE	60 62		59.9	59.9' very narrow to narrow apertures.									Core 5, RQD=94%
			62.8–67	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures).	BDX (LS)								
6 CORE	60 55		64.9	64.9' very narrow apertures.									Core 6, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			68	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures). *(continued)*										
			69											
7 CORE	60 63		70	69.5' slightly to moderately fractured (very narrow to moderately narrow apertures).										Core 7, RQD=95% Bedrock corehole reamed 6" in diameter to 70' for well installation.
			71											
			72											
			73											
			74											
8 CORE	60 62		75	74.9' extremely narrow apertures.										Core 8, RQD=100%
			76		BDX (LS)									
			77											
			78											
			79											
9 CORE	60 56		80	80.2' unfractured, cherty.										Core 9, RQD=100%
			81											
			82											
			83											
			84											
				84.7' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-377

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	10/29/2015	11/2/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-377	Feet (NAVD88)	418.75 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,198.46 N, 2,381,923.68 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 18.1896"
Long -89° 52' 11.0712"
Local Grid Location: Feet ☐ N ☐ S, Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–4	0 - 4' **TOPSOIL:** ML.	ML								0-28.5' Blind Drilled. See log PZ-177 for soil description.
			4–13	4 - 19.3' **LEAN CLAY:** CL.	CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Brad Roders (signed)

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			14–19	4 - 19.3' **LEAN CLAY:** CL. *(continued)*	CL									
			19.3–22	19.3 - 22' **SILT:** ML.	ML									
			22–28.5	22 - 28.5' **LEAN CLAY:** CL.	CL									
1 SS	24	3 6 9 17	28.5–30.8	28.5 - 30.8' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), gray (10YR 5/4) mottling, hard (4.5 tsf).	CL									
2 SS	24 12	12 20 27 30	30.8–34.9	30.8 - 34.9' **SHALE:** BDX (SH), gray, moderately to highly decomposed.	BDX (SH)									
1 CORE	41 51		31.7	31.7' grayish brown mottling, thickly bedded.										Core 1, RQD=92%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
2 CORE	55.8 16		35	34.9 - 35.3' **LIMESTONE:** BDX (LS), cherty, moderately decomposed, reddish gray mottling, moderately fractured.	BDX (LS)						Core 2, RQD=25%
			36	35.3 - 46.4' **SHALE:** BDX (SH), gray, moderately to highly decomposed.							
3 CORE	60 64.2		40	39.7' - 40.4' gray and brown mottling, highly decomposed, blocky structure.							Core 3, RQD=75%
			41	40.4' - 43.1' highly decomposed, moderately fractured.	BDX (SH)						
4 CORE	60 58		45								Core 4, RQD=12%
			47	46.4 - 51.1' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured (narrow apertures).							
			49		BDX (LS/SH)						
			50	49.5 - 49.9' vertical fracture.							
5 CORE	60 50		50								Core 5, RQD=58%
			51	51.1 - 55.5' **SHALE:** BDX (SH), gray, thickly bedded.							
			54		BDX (SH)						
6 CORE	60 41		55								Core 6, RQD=61%
			56	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)						

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			57 58	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									
				58.2' End of Boring.										Bedrock corehole reamed 6" in diameter to 58' for well installation.

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-382

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/19/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-382	Feet (NAVD88)	428.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,440.86 N, 2,382,404.51 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 40.344"
Long -89° 52' 4.9578"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-34' Blind Drilled. See log PZ-182 log for soil description details.
			2 - 4	2 - 4' Shelby Tube Sample.									
			4 - 12	4 - 12' **SILTY CLAY** CL/ML.	CL/ML								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signatur [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 14' Shelby Tube Sample.										
			14	14 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22	22 - 24' Shelby Tube Sample.										
			24	24 - 27' **SILTY CLAY** CL/ML.	CL/ML									
			27	27 - 29.1' **WELL-GRADED SAND:** SW.	SW									
			29.1	29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g									
			30	30 - 34' **SILTY CLAY** CL/ML.	CL/ML									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	30 - 34' **SILTY CLAY** CL/ML. *(continued)*	CL/ML								
1 SS	23 20	12 20 25 50 for 5"	34, 35	34 - 36' **SILTY CLAY** CL/ML, dark gray (10YR 4/1), dark yellowish brown 10YR 4/6 mottling, highly decomposed shale at bottom of spoon, hard (>4.5 tsf).	CL/ML								
1 CORE	53 48.5		36, 37, 38	36 - 38.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								Core 1, RQD=94%
			39	38.3 - 40' **LIMESTONE:** BDX (LS), thinly laminated, intensely fractured (extremely narrow apertures).	BDX (LS)								
2 CORE	60 24.5		40, 41, 42, 43, 44	40 - 44.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								Core 2, RQD=51%
			45	44.5 - 45.4' **LIMESTONE:** BDX (LS), thinly bedded.	BDX (LS)								
3 CORE	54 35		46, 47, 48, 49	45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)								Core 3, RQD=51%
4 CORE	24 23.5		50, 51, 52	50.1' - 51.2' reddish brown and dark gray mottling. 51.2' - 52.1' limestone, intensely fractured.									Core 4, RQD=19%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
5 CORE	41 41			45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed. *(continued)* 52.1' gray.	BDX (SH)								Core 5, RQD=63%
6 CORE	30 25		56	55.9' gray to dark gray, intensely fractured, few medium limestone beds.									Core 6, RQD=50%
7 CORE	30 30		58.4	58.4 - 62' **LIMESTONE:** BDX (LS), cherty, moderately fractured. 59.5' - 59.9' vertical fracture. 60' shale (2" layer).	BDX (LS)								Core 7, RQD=53%
8 CORE	60 59		60.4	60.4' - 61.4' shaley, intensely fractured.									Core 8, RQD=70%
			62	62 - 67.1' **SHALE:** BDX (SH), gray, hard, slightly fractured.	BDX (SH)								
9 CORE	60 59		65.5										Core 9, RQD=88%
			67.1	67.1 - 70.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured, (very narrow apertures).	BDX (LS/SH)								Bedrock corehole reamed 6" in diameter to 69' for well installation.
			70.6	70.6' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-383

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/7/2015	12/21/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-383	Feet (NAVD88)	457.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,586.04 N, 2,385,208.26 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 41.6862"
Long -89° 51' 29.8296"

Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24	4 2 2 4	0–1	0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf).	(FILL)								
2 SS	24	1 3 2 3	2										
3 SS	24 18	1 2 3 7	4										
4 SS	24 18	2 11 11 7	6										
5 SS	24 17	7 4 3 2	8	8' mostly black (10YR 2/1).									
6 SS	24 18	2 4 4 4	10–12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	2 3 4 1	13	0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf). *(continued)*	(FILL)									
8 SS	24	1 2 1 2	14–15	14' clay (2" thick layer).										
9 SS	24 10	WOH WOH 2 2	16–17	16 - 18' **LEAN CLAY:** CL, gray (5Y 5/1), stiff (1.75 tsf).	CL									WOH=weight of hammer
10 SS	24 14	WOH 2 2 2	18–19	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity.	CL/ML									
11 SS	24	WOH 2 2 2	20–23											Blind drill 22-24' bgs during casing install. Permanent 6" PVC casing was installed to 22.5' bgs.
13 SS	24 13	1 1 3 3	24–25	24' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling.										
14 SS	24 12	1 1 2 3	26–27	26' dark gray (10YR 5/6) mottling.										
15 SS	24 23	2 4 4 6	28–29											
16 SS	24 27	4 4 2 7	30–32	31' trace oxidation staining.										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 27	4 4 5 5	33	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity. *(continued)* 32' light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) mottling, very stiff (3.0 tsf).										
18 SS	24 26	2 3 5 6	34, 35	34' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, very stiff (2.0 tsf).										
19 SS	24 14	WOH WOH 3 4	36, 37	36' very soft to stiff (0-1.75 tsf).	CL/ML									
20 SS	24 12	3 4 3 5	38, 39	38' strong brown (7.5YR 4/6), gray (10Y R5/1) mottling, trace sand, very stiff (3.5 tsf).										
21 SS	24 22	1 2 2 2	40	40 - 41' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, moderately stiff (0.75 tsf).	(CL)s									
			41	41 - 42' **SILTY SAND:** SM, yellowish brown (10YR 5/6), mostly medium sand, trace coarse sand, soft.	SM									
22 SS	24 24	5 8 9 10	42, 43	42 - 44' **SILTY CLAY** CL/ML, brown (10YR 5/3), >15% sand, moderately stiff (0.75 tsf), nonplastic.	CL/ML									
23 SS	24 20	4 6 8 7	44, 45	44 - 50' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), trace black oxidation staining, very stiff to hard (3.25-4.5+ tsf), plastic.										
24 SS	24 16	4 6 10 11	46, 47		CL									
25 SS	24 19	6 18 21 21	48, 49	48' brown (10YR 5/3), hard (4.25-4.5+), low plasticity.										
26 SS 1 CORE	24 60	8 16 22 32	50, 51, 52	50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry.	BDX (SH)									Core 1, RQD=60%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
27 SS	24	8 10 15 50/4"	53	50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry. *(continued)*	BDX (SH)									
			54	53.1 - 55.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
2 CORE	60		55, 56, 57, 58	55.1 - 58.6' **LIMESTONE:** BDX (LS), slightly fractured.	BDX (LS)									Core 2, RQD=82%
			59	58.6 - 59.5' **SHALE:** BDX (SH), thinly bedded with limestone, moderately fractured.	BDX (SH)									
3 CORE	60		60, 61, 62, 63, 64	59.5 - 70.1' **SHALE:** BDX (SH), gray, moderately decomposed. 60' intensely to moderately fractured. 63' moderately fractured.	BDX (SH)									Core 3, RQD=31%
4 CORE	60		65, 66, 67, 68, 69, 70											Core 4, RQD=49%
5 CORE	34		71, 72	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured.	BDX (LS)									Core 5, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured. *(continued)*	BDX (LS)									
				73' End of Boring.										Bedrock corehole reamed 6" in diameter to 73' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-384

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	12/7/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-384	Feet (NAVD88)	456.70 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,446.11 N, 2,384,518.72 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 30.4398"
Long -89° 51' 38.5158"

Local Grid Location
Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 8	2 3 4 6		0 - 2.5' **FILL, ASH (Coal):** very soft to moderately stiff (0-0.75 tsf).	(FILL)								
2 SS	24 19	2 4 3 6	2										
				2.5 - 4' **FILL, SILTY CLAY** CL/ML, strong brown (7.5YR 4/6), trace gravel, very soft to very stiff (0-3.5 tsf).	(FILL) CL/ML								
3 SS	24 10	1 2 3 4	4	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf).									
4 SS	24	2 2 2 2	6										
5 SS	24	1 2 1 1	8		(FILL)								
6 SS	24	1 2 1 1	10										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	1 5 10 10	13	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf). *(continued)*										
8 SS	24 14	5 10 11 11	14	14' wet.										
			15		(FILL)									
9 SS	24 14	5 8 14 15	16											
			17											
10 SS	24 16	2 2 3 4	18	18 - 22' **SILTY CLAY** CL/ML, gray (5Y 6/1), organic odor, stiff to very stiff (1.25-3.75 tsf), wet.										
			19											
11 SS	24 18	2 2 6 4	20		CL/ML									
			21											
12 SS	24 16	4 4 5 4	22	22 - 24' **SILT:** ML, very dark gray (10YR 3/1), dark yellowish brown (10YR 3/6) mottling, hard (4.25-4.5 tsf).										
			23		ML									
13 SS	24 22	1 2 5 7	24	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf).										
			25											Permanent 6" PVC casing set at 25' bgs.
14 SS	24 21	3 4 5 7	26	26' yellowish brown (10YR 5/4), trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, 5-15% fine sand, trace fine gravel, stiff to very stiff (1.25-2.5 tsf), low to medium plasticity, moist.										
			27											
15 SS	24 21	3 4 5 6	28	28' color grades to gray (10YR 5/1), 30-50% silt, soft to stiff (0.5-1.25 tsf).	CL/ML									
			29											
16 SS	24 17.5	1 5 5 7	30	30' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, no gravel, very soft to very stiff (<0.25-2.5 tsf), medium plasticity.										
			31											
			32											

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 20.5	4 4 4 6	33	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf). *(continued)* 32' trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, stiff to very stiff (1.75-3.5 tsf).										
18 SS	24 22	3 4 5 7	34, 35	34' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, stiff to very stiff (1.5-2.5), dry to moist. 35.3' yellowish brown (10YR 5/8), trace gray (10YR 5/1) and very dark gray (10YR 3/1) mottling.										
19 SS	24 21	4 3 3 4	36, 37	36' gray (10YR 5/1) mottling (15-30%), silt content increasing with depth, moderately stiff to stiff (0.75-1.25 tsf), low plasticity, moist.	CL/ML									
20 SS	24 24	2 4 7 14	38, 39	38' grayish brown (10YR 5/2), trace gray (10YR 5/1), trace strong brown (7.5YR 4/6) mottling, 30-50% silt, soft to very stiff (0.5-3.75 tsf). 38.7' - 40' very dark gray (10YR 3/1) mottling (5-15%), 5-15% fine gravel.										
21 SS	24 25	3 11 21 44	40, 41	40' sand (5-15%), trace gravel, very stiff to hard (3.5-4.5+ tsf). 40.3' wet. 40.8' very stiff to hard (3.5-4.5+ tsf), moist.										
22 SS	24 20	13 11 15 17	42, 43	41.8' fine sand seam (1/4" thick). 42' - 42.4' fine gravel, 30-50% clay, trace sand, wet. 42.4 - 44.3' **CLAYEY SILT** ML/CL, gray (10YR 5/1) to grayish brown (10YR 5/2), 30-50% clay, 5-15% fine sand, trace subrounded gravel, very stiff to hard (3.5-4.5+), nonplastic to low plasticity, moist.	ML/CL									
23 SS	24 17	6 8 10 14	44, 45	43.5' - 44.3' very dark grayish brown (10YR 3/2), brownish yellow trace (10YR 6/6) mottling, trace coal. 44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry.										
24 SS	24 16	5 10 11 15	46, 47	46' decreasing silt content, trace gravel, clay becoming laminated with depth, very stiff (2.25-3.0 tsf).										
25 SS	24 13.5	6 8 12 22	48, 49	48' silt (5-15%), trace shale gravel, very stiff (3.0 tsf), medium plasticity, dry. 49.2' gravel (2" diameter).	CL									
26 SS	24 16	8 9 15 19	50, 51, 52	50' very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2), trace silt, very stiff (3.5 tsf), medium to high plasticity, highly weathered shale (residual soil).										

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	24 22	13 14 9 14	53	44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry. *(continued)*	CL								
28 SS	24 24	12 12 14 22	54, 55	52' - 54' clay is fractured, light brownish gray (10YR 6/2) to light yellowish brown (10YR 6/4) in fractures. 54' trace very dark brown (10YR 2/2) laminations, hard (>4.5 tsf).									
29 SS	23 20	11 14 20 50/5"	56, 57	56 - 58.2' **SHALE:** BDX (SH), very dark gray (10YR 3/1), highly weathered, fissile, totally healed fractures, very weak, highly decomposed [light brownish gray (10YR 6/2) in fractures], very intensely fractured (closed to narrow apertures).	BDX (SH)								3" steel casing set at 57.7 ft bgs.
1 CORE	24 40		58	57' light yellowish brown (10YR 6/4) to very dark gray (10YR 3/1) layers, thinly bedded, highly decomposed to residual soil.									Core 1, RQD=36%
2 CORE	60 64		59, 60	58.2 - 60.8' **LIMESTONE:** BDX (LS), light greenish gray (GLEY 1 7/10Y), microcrystalline, trace fossils, moderately strong to strong, medium bedded, slightly to moderately decomposed, moderately fractured.	BDX (LS)								Core 2, RQD=73%
			61, 62, 63	60.8 - 64' **SHALEY LIMESTONE:** BDX (LS/SH), weak, thin to medium bedded, moderately decomposed, slightly to moderately disintegrated.	BDX (LS/SH)								
3 CORE	60 73		64, 65, 66, 67	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures).	BDX (SH)								Core 3, RQD= 58%
			68	67.9' - 68.8' shale clasts within decomposed shale matrix.									
4 CORE	60 63		69, 70, 71, 72	68.8' - 69.2' light yellowish brown (10YR 6/4), trace dark yellowish brown (10YR 3/6) layers. 69.2' - 74' intensely fractured (extremely narrow to narrow aperture).									Core 4, RQD=46%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			73	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures). *(continued)*									
5 CORE	60 20		74	74' - 79' intensely to very intensely fractured.									Core 5, RQD=0%
			75–78		BDX (SH)								Bedrock corehole reamed 6" in diameter to 77' for well installation.
6 CORE	60 64		79	79' - 82.6' intensely fractured.									Core 6, RQD=64%
			80–82										
			83	82.6 - 83.9' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed.	BDX (LS/SH)								
7 CORE	60 37		84–85	83.9 - 85.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)								Core 7, RQD=15%
			86–88	85.6 - 88.7' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed. 86.4' - 87' SHALE layer, greenish gray (GLEY 1 5/10Y), very weak, medium bedded.	BDX (LS/SH)								
8 CORE	60 50		89–92	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)								Core 8, RQD=49%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			93 94	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures). *(continued)* 92.5' - 93.2' light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured, slightly decomposed.	BDX (SH)									
				94.1' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-385

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	12/4/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-385	Feet (NAVD88)	454.82 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,417.12 N, 2,382,285.24 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 30.2244"
Long -89° 52' 6.492"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 13	2 3 3 5		0 - 0.3' **FILL, ASH (Coal):** dark yellowish brown (10YR 4/6), sand and silt-sized ash, dark gray (10YR 4/1) slag pieces, dry to moist.	(FILL)								
			1	0.3 - 19.7' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to yellowish brown (10YR 5/4) inside, 10-30% silt, cohesive, stiff to hard (1.0-4.5 tsf), medium plasticity, moist.									
2 SS	24 9	1 2 2 3	2	2' dark gray (10YR 4/1) mottling (15-30%), moist.									
3 SS	24 15	1 3 4 5	3–4	4' trace sand, trace dark yellowish brown (10YR 4/6) oxidation staining, moist to dry.									
4 SS	24 16	1 3 5 6	5–6	6' dry to moist.	(FILL) CL								
5 SS	24 9	WOH 1 3 4	7–8	8' increased dark gray (10YR 4/1) mottling 20-30%, dry to moist.									WOH=weight of hammer
6 SS	24 13	1 2 3 5	9–10	10' moist.									
7 SS	24 18	WOH 2 5 7	11–13	12' moist to dry. 12.3' mostly dark gray (10YR 4/1), no mottling.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.3 - 19.7' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to yellowish brown (10YR 5/4) inside, 10-30% silt, cohesive, stiff to hard (1.0-4.5 tsf), medium plasticity, moist. *(continued)*										
8 SS	24 12	WOH WOH 3 3	14	13' mostly brown (10YR 4/3), dark gray (10YR 4/1) mottling.										
			15	14' some dark gray (10YR 4/1) mottling, trace yellowish brown (10YR 5/6) oxidation staining, trace very dark grayish brown (10YR 3/2) mottling, moist.										
9 SS	24 16	WOH 1 3 4	16	16' moist.	(FILL) CL									
			17	16.5' dark gray (10YR 4/1) with dark yellowish brown (10YR 4/6) mottling, cohesive, medium to high plasticity.										
10 SS	24 24	WOH WOH 2 3	18	18' dark gray (10YR 4/1), dark yellowish brown (10YR 4/6) mottling, softer than above, moist to wet.										
			19											
11 SS	24 24	WOH WOH WOH 1	20	19.7 - 31.9' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2), silt-sized ash, trace sand-sized ash, cohesive, very soft (0 tsf), non-plastic, wet.										
			21	20' very dark grayish brown (10YR 3/2), trace sand seams, wet.										
12 SS	48 24	WOH 1 WOH 1	22	22' trace fine-grained sand seams.										
			23											
			24											
			25											
13 SS	24 21	1 WOH 1 WOH	26	25.7' medium-grained sand seam (2" thick).	(FILL)									
			27											
14 SS	24 24	1 2 2 1	28											
			29											
15 SS	24 24	WOH WOH WOH WOH	30											
			31											
			32	31.9 - 38' **SILT:** to **LEAN CLAY:** ML, olive gray (5Y 5/2), cohesive, very soft to soft (0.25-0.5 tsf), low to medium plasticity, moist to wet.										
			33		ML									
16 SS	24 24	WOH WOH WOH	34											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
		WOH	35	31.9 - 38' **SILT:** to **LEAN CLAY:** ML, olive gray (5Y 5/2), cohesive, very soft to soft (0.25-0.5 tsf), low to medium plasticity, moist to wet. *(continued)*	ML									
17 SS	24 24	2 4 6 6	38	38 - 59' **LEAN CLAY:** CL, olive gray (5Y 5/2), dark yellowish brown (10YR 4/6) mottling, moist to dry.	CL									
18 SS	24 14	WOH 2 3 4	42	42' medium plasticity, moist.										Augered with 8" plug to 42' bgs.
19 SS	24 23	1 3 4 6	44											Permanent 6"PVC casing set at 45' bgs.
20 SS	24 27	2 3 3 5	46											
21 SS	24 16	WOH 2 4 4	48	48' gray (10YR 6/1), dark yellowish brown (10YR4/6), stiff (1.5 tsf), plastic.										
22 SS	24 24	WOH 3 4 4	50											
			51	51' trace sand, very stiff (2.5 tsf).										
23 SS	24 24	3 4 4 7	52											
24 SS	24 22	WOH 2 3 4	54	54' increase in sand content, stiff (1.75 tsf).										
25	24	WOH	56	56' trace root structures, oxidation staining.										

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

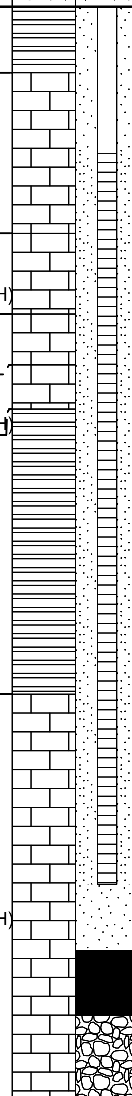
Boring Number MW-385

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
SS	21	3 3 4	57	38 - 59' **LEAN CLAY:** CL, olive gray (5Y 5/2), dark yellowish brown (10YR 4/6) mottling, moist to dry. *(continued)*	CL									
26 SS	24 23	WOH 5 11 27	58											
			59	59 - 60' **POORLY-GRADED SAND WITH CLAY:** SP-SC, fine-grained, trace coarse-grained sand, and trace gravel, very stiff (2.25 tsf).	SP-SC									
27 SS	24 22	6 8 13 13	60	60 - 61' **SILTY CLAY** to **POORLY-GRADED SAND:** CL/ML, yellowish brown (10YR 5/6), gray (10YR 5/1) mottling.	CL/ML									
			61	61 - 62' **LEAN CLAY:** to **SHALE:** CL, very dark gray (10YR 3/1), weathered, hard (>4.5 tsf), dry.	CL									
28 SS	24 22	9 13 15 50/4"	62, 63	62 - 63.8' **SILTY CLAY** to **SHALE:** CL/ML, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6) mottling, weathered.	CL/ML									
1 CORE	12 11		64	63.8 - 65' **SHALE:** BDX (SH), weathered.	BDX (SH)									Core 1, RQD=0%
2 CORE	60 48		65	65 - 65.9' **SHALEY LIMESTONE:** BDX (LS/SH).	BDX (LS/SH)									Core 2, RQD=63%
			66–70	65.9 - 76.3' **SHALE:** BDX (SH), gray, decomposed, intensely to moderately fractured.	BDX (SH)									
3 CORE	60 55		71	71.2' - 72.5 vertical fracture (tight aperture).										Core 3, RQD=82%
			72–75											
4 CORE	60 60		76	76.3 - 76.9' **LIMESTONE:** BDX (LS).	BDX (LS)									Core 4, RQD=74%
			77, 78	76.9 - 78.9' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				76.9 - 78.9' **SHALE:** BDX (SH), dark gray, moderately fractured. *(continued)*	BDX (SH)									
			79	78.9 - 81.1' **LIMESTONE:** BDX (LS), cherty, slightly fractured.	BDX (LS)									
			80											
5 CORE	60 54.5		81	81.1 - 82.2' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									Core 5, RQD=62%
			82	82.2 - 82.9' **LIMESTONE:** BDX (LS), moderately fractured.	BDX (LS)									
			83	82.9 - 83.5' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			84	83.5 - 87.4' **SHALE:** BDX (SH), gray.	BDX (SH)									
			85											
6 CORE	60 65		86											Core 6, RQD=58%
			87											
			88	87.4 - 93' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, intensely to moderately fractured.	BDX (LS/SH)									
			89											
			90											
7 CORE	30 30		91											Core 7, RQD=100%
			92											
			93	93' End of Boring.										Bedrock corehole reamed 6" in diameter to 93' for well installation.



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-386

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	12/1/2015	12/11/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-386	Feet (NAVD88)	454.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,585.18 N, 2,382,713.22 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 21.9876"
Long -89° 52' 1.167"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	3 3 7 5		0 - 0.5' **FILL, WELL-GRADED SAND:** SW, dark brown (10YR 3/3) to black (10YR 2/1), fine to coarse sand-sized ash and slag, moist.	(FILL) SW								
			1	0.5 - 2.6' **FILL, SILT:** ML, dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/8) mottling, 20-40% clay, cohesive, hard (4.5 tsf), nonplastic, dry.	(FILL) ML								
2 SS	24 16	2 4 4 6	2	2' - 2.6' clay content increases with depth to mostly clay at 2.6', dry.									
			3	2.6 - 24.5' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), trace gray (10YR 5/1) mottling, 20-40% silt, cohesive, very stiff (2.0-4.0 tsf), high plasticity, moist.									
3 SS	24 17	2 4 4 5	4	4' gray (10YR 5/1), 20-30% yellowish brown (10YR 5/8) mottling, trace medium-grained sand, moist to dry.									
			5										
4 SS	24 12	3 2 3 4	6	6' trace sand, moist to dry.									
			7		(FILL) CL								
5 SS	24 14.5	2 2 4 5	8	8' moist.									
			9										
6 SS	24 12	2 2 3 4	10	10' stiff (1.75 tsf).									
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 16	2 2 3 7	13	2.6 - 24.5' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), trace gray (10YR 5/1) mottling, 20-40% silt, cohesive, very stiff (2.0-4.0 tsf), high plasticity, moist. *(continued)* 13.2' dark gray (10YR 4/1), trace sand, stiff to hard (1.5-4.5+ tsf), high plasticity, dry.									
8 SS	24 17	2 3 3 5	14, 15	14' dark gray (10YR 4/1), dark yellowish brown (10YR 4/6), high plasticity, dry to moist.									
9 SS	24 14	2 2 3 3	16, 17	16' dark yellowish brown (10YR 4/6), decrease to 30% dark gray (10YR 4/1), soft to very stiff (1.0-4.0 tsf), dry, increasing moisture content with depth.									
10 SS	24 15	1 1 2 2	18, 19	18' brownish yellow (10YR 6/8) mottling, silt content increases with depth to 30-50%, trace fine gravel, very soft to very stiff (0.0 to 3.0 tsf), moist to wet.	(FILL) CL								
11 SS	24 24	3 2 2 4	20, 21	20' yellowish brown (10YR 5/6), 30% dark gray (10YR 4/1) mottling, 20-40% silt, trace sand, trace fine gravel, soft to stiff (0.5-1.5 tsf), moist.									
12 SS	24 5	2 1 2 2	22, 23	22' trace yellowish red (5YR 4/6), 5-15% sand, stiff (1.5 tsf).									
13 SS	24 24	2 2 1 1	24										
			25	24.5 - 26' **FILL, SILT:** ML, very dark grayish brown (10YR 3/2), low to medium plasticity, wet.	(FILL) ML								
14 SS	24 6	WOH WOH WOH WOH	26, 27	26 - 28.2' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), 30-50% silt, cohesive, moderately stiff (0.75 tsf), medium to low plasticity, wet.	(FILL) CL								WOH=weight of hammer
15 SS	24 24	1 1 1 1	28, 29	28.2 - 44.3' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2), mostly silt-sized ash, 15-30% sand-sized ash, sand-sized ash seams, noncohesive, nonplastic.									
16 SS	24 24	2 3 1 1	30, 31, 32	30' wet.	(FILL)								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 24	WOH WOH WOH WOH	33	28.2 - 44.3' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2), mostly silt-sized ash, 15-30% sand-sized ash, sand-sized ash seams, noncohesive, nonplastic. *(continued)*										
18 SS	24 24	WOH WOH 2 1	34, 35	34' trace dark gray (10YR 4/1) mottling of silt-sized ash, trace black (10YR 2/1) mottling of sand-sized ash, trace dark yellowish brown (10YR 4/6) mottling of clay-sized ash, very soft (0 tsf), wet.										
19 SS	24 23	1 WOH WOH WOH	36, 37											
20 SS	24 19	2 WOH WOH WOH	38, 39	38' mostly fine to medium sand-sized ash, 15-30% silt-sized ash, wet. 38.5' very dark grayish brown (10YR 3/2), black (10YR 2/1) mottling, mostly silt-sized ash, sand-sized ash seams, cohesive, nonplastic, wet.	(FILL)									
21 SS	24 24	1 2 WOH WOH	40, 41	40' dark gray (10YR 4/1) and black (10YR 2/1) mottling, wet.										
22 SS	24 21	1 WOH WOH WOH	42, 43											
23 SS	24 18	WOH 2 3 3	44, 45	44.3 - 46' **SILT:** ML, grades from very dark gray (10YR 3/1) to dark gray (10YR 4/1) with depth, 15-30% clay, cohesive, low plasticity, moist to wet.	ML									
24 SS	24 24	WOH 2 2 5	46, 47	46 - 60' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 4/5), 20-40% silt, cohesive, stiff (1.75 tsf), medium plasticity, moist.										
25 SS	24 24	WOH 2 4 6	48, 49	48' dry to moist.	CL/ML									Permanent 6" PVC casing set at 48.5' bgs.
26 SS	24 12	2 4 5 5	50, 51, 52	50' oxidation-stained nodules (15-30%), trace sand.										

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	24 17	1 6 12 14	53	46 - 60' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 4/5), 20-40% silt, cohesive, stiff (1.75 tsf), medium plasticity, moist. *(continued)* 52' trace oxidation staining, very stiff (>4.5 tsf).										
28 SS	24 17	25 24	54, 55											
29 SS	24 12	8 16 33 24	56, 57	56' laminated weathered shale, dry.	CL/ML									
30 SS	24 24	7 11 15 24	58, 59											
31 SS	24 21	6 10 15 18	60, 61	60 - 60.3' **GRAVELLY FAT CLAY:** g(CH), black. 60.3 - 63.5' **SILTY CLAY** CL/ML, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, hard (>4.5 tsf).	g(CH)									
32 SS	24 18	9 15 50/5"	62		CL/ML									
1 CORE	28 35		63, 64	63' gravel (>15%). 63.5 - 64.8' **SHALE:** BDX (SH), weathered.	BDX (SH)									Core 1, RQD=34%
2 CORE	60 45		65, 66, 67, 68, 69, 70	64.8 - 65.2' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. 65.2 - 71' **SHALE:** BDX (SH), gray, slightly to moderately fractured, highly decomposed, some material washed-out.	BDX (LS/SH) BDX (SH)									Core 2, RQD=93%
3 CORE	60 28		71, 72	71 - 76' **LIMESTONE:** BDX (LS), vertical fracture, intensely fractured.	BDX (LS)									Core 3, RQD=18%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
4 CORE	60 57		73, 74, 75	71 - 76' **LIMESTONE:** BDX (LS), vertical fracture, intensely fractured. *(continued)* 72.3' vertical fracture.	BDX (LS)									Core 4, RQD=37%
			76, 77	76 - 77.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
5 CORE	60 55		78, 79, 80, 81	77.2 - 81.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. 78.2' - 78.9 vertical fracture. 79.6' - 79.8' vertical fracture. 80.3' - 80.5' vertical fracture.	BDX (LS/SH)									Core 5, RQD=69%
			82	81.3 - 82.2' **SHALE:** to **LIMESTONE:** BDX (SH), slightly fractured.	BDX (SH)									
6 CORE	48 48		83, 84, 85, 86	82.2 - 86.3' **SHALE:** BDX (SH), gray, slightly to moderately fractured.	BDX (SH)									Core 6, RQD=65%
			87, 88, 89	86.3 - 89' **SHALEY LIMESTONE:** BDX (LS/SH), slightly fractured.	BDX (LS/SH)									
				89' End of Boring.										Bedrock corehole reamed 6" in diameter to 89' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-387	

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/13/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-387	Feet (NAVD88)	424.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,111.17 N, 2,380,474.78 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 27.258"
Long -89° 52' 29.1828"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 7 6 6	0–2	0 - 4' **FILL, SILTY CLAY** CL/ML, brown (10YR 5/3), trace roots, stiff to very stiff (2.5-4 tsf), low plasticity, dry.	(FILL) CL/ML								
2 SS	24 18	2 5 5 7	2–4	3' trace fine sand.									
3 SS	24 18	2 4 4 5	4–6	4 - 10.8' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/4), stiff to hard (1.5-4.5 tsf), medium plasticity, moist.	CL/ML								
4 SS	24 21	3 4 4 5	6–8	6' dark yellowish brown (10YR 3/4), trace oxidation staining.									
5 SS	24 0		8–10										
6 SS	24 16	WOH 3 4 5	10–12	10.8 - 12' **CLAYEY SILT** ML/CL, dark yellowish brown (10YR 4/4), nonplastic.	ML/CL								WOH=weight of hammer

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Brad [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	WOH 3 4 4	12–14	12 - 24' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/4), stiff to very stiff (1.5-2.75 tsf). 12.5' - 12.6' black staining. 13' increased silt content, moist.	CL/ML								
8 SS	24 24	1 2 4 5	14–16	14' dark yellowish brown (10YR 4/6). 15' trace oxidation staining, medium plasticity, moist.									
9 SS	24 26	2 3 5 6	16–18										
10 SS	24 25	1 3 4 5	18–20	18' low plasticity. 19' medium plasticity.									
11 SS	24 23	1 2 3 3	20–22	20' dark yellowish brown (10YR 4/4), grayish brown (10YR 5/2) mottling.									
12 SS	24 24	1 4 5 7	22–24										
13 SS	24 26	1 4 5 6	24–26	24 - 27.4' **LEAN CLAY:** CL, gray (10YR 5/1), stiff to very stiff (1.5-2.5 tsf), high plasticity.	CL								
14 SS	24 24	1 3 6 4	26–28	26' trace black oxidation staining. 27.4 - 28.5' **SILTY SAND:** to **LEAN CLAY:** SM, mostly fine sand, wet.	SM								
15 SS	24 24	1 2 2 3	28–30	28.5 - 32.5' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, very soft to very hard (0-4.5+ tsf).	CL/ML								
16 SS	24 20	WOH 1 4 7	30–32	30' dark yellowish brown (10YR 3/4), oxidation-stained nodules (1" layer). 31' brown (10YR 4/3).									

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-387

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 16	1 1 1 2											
			33	32.5 - 34' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), mostly medium sand, sand grain size decreasing with depth, silt and clay content increasing with depth.	SP								
18 SS	24	4 10 12 14	34	34 - 34.5' **SILTY SAND:** SM, yellowish brown (10YR 5/4), mostly fine sand.	SM								
			35	34.5 - 36' **SILTY CLAY** CL/ML, brown (10YR 4/3), very stiff to hard (2.5-4.5 tsf), low plasticity.	CL/ML								
19 SS 1 CORE	3 3 39 39	50 for 3"	36, 37, 38, 39, 40	36 - 40.6' **LIMESTONE:** BDX (LS), light gray, cherty, intensely fractured (fractures partly healed with shale).	BDX (LS)								Core 1, RQD=44%
2 CORE	60 49		41, 42, 43	40.6 - 43.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)								Core 2, RQD=61%
			44, 45	43.9 - 45.3' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)								
3 CORE	60 61		46, 47, 48	45.3 - 48.8' **LIMESTONE:** BDX (LS), fossiliferous, moderately fractured (fractures partly healed with shale).	BDX (LS)								Core 3, RQD=75%
4 CORE	64 64		49, 50, 51, 52	48.8 - 53.9' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)								Formation taking water during coring.

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	48.8 - 53.9' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. *(continued)*	BDX (LS/SH)									Core 4, RQD=92%
			54, 55	53.9 - 55' **SHALE:** BDX (SH), dark gray, moderately fractured, slightly decomposed.	BDX (SH)									
5 CORE	60 59		56	55 - 56.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									Core 5, RQD=100%
			57, 58, 59, 60	56.3 - 60.1' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured to unfractured.	BDX (LS)									
			61	60.1 - 61.3' Overdrilled for Well Installation.										
				61.3' End of Boring.										Bedrock corehole reamed 6" in diameter to 61.3' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-388

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/10/2015	11/12/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-388	Feet (NAVD88)	406.28 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,429.08 N, 2,379,624.09 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 30.426"
Long -89° 52' 39.8274"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 11	2 5 10 8		0 - 4' **FILL, SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/4), 30-50% silt, organic material at surface, very soft to very stiff (0.0-4.0 tsf), moist.	(FILL) CL/ML								
2 SS	24 18	3 6 8 9	2										
3 SS	24 15	3 4 8 9	4	4 - 18' **SILTY CLAY** CL/ML, brown (10YR 5/3), 30-50% silt, very soft to very stiff (0.0-4.0 tsf), moist.	CL/ML								
4 SS	24 18	1 4 6 4	6	6' yellowish brown (7.5YR 5/6), 30-50% fine sand.									
5 SS	24 22	1 1 2 4	8	8' yellowish brown (10YR 5/4).									
6 SS	24 21	2 2 3 3	10	10' brown (10YR 4/3), yellow (10YR 7/8) mottling.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-388

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 25	1 2 3 3	13	4 - 18' **SILTY CLAY** CL/ML, brown (10YR 5/3), 30-50% silt, very soft to very stiff (0.0-4.0 tsf), moist. *(continued)* 13.3' brown (10YR 5/3), trace sand.	CL/ML									
8 SS	24 20	1 2 4 7	14 15	14' grayish brown (10YR 5/2), increasing coarse sand content.										
9 SS	24 21	2 4 5 8	16 17	16' brownish yellow (10YR 6/8) mottling, very dark brown (10YR 2/2) stringers. 17 - 18' **SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/8).	(CL/ML)S									
10 SS	24 22	1 2 2 3	18 19	18 - 20' **SILTY CLAY** CL/ML, 30-50% silt, very soft to very stiff (0.0-4.0 tsf), slow dilatancy, wet.	CL/ML									
11 SS	24 14	WOH 2 4 7	20 21	20 - 23.5' **SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/6), fine sand, rapid dilatancy, very soft (0.0 tsf), wet.	(ML)s									WOH=weight of hammer
12 SS	24 22	3 9 12 9	22 23	22' yellowish brown (10YR 5/4), with clay.										
13 SS	24 18	WOH 4 6 9	24 25	23.5 - 26.5' **SILTY CLAY WITH SAND** (CL/ML)S, grayish brown (10YR 5/2), fine sand, very stiff (2.5-3.0 tsf), wet. 24' gray (10YR 5/1), no fine sand.	(CL/ML)S									
14 SS	8 7	4 50 for 2"	26	26.5 - 27' **SHALE:** BDX (SH), gray, decomposed.	BDX (SH)									
1 CORE	35 31		27 28 29	27 - 30' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (narrow to moderately narrow apertures).	BDX (LS)									Core 1, RQD = 97%
2 CORE	60 40		30 31 32	30 - 45' **SHALEY LIMESTONE:** BDX (LS/SH), highly decomposed, intensely fractured.	BDX (LS/SH)									Core 2, RQD = 68%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-388

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				30 - 45' **SHALEY LIMESTONE:** BDX (LS/SH), highly decomposed, intensely fractured. *(continued)*										
			33											
			34											
3 CORE	60 57.5		35	34.9' moderately fractured.										Core 3, RQD = 93%
			36											
			37	37' - 43.5' fossiliferous.										
			38											
			39		BDX (LS/SH)									
			40	40.1' slightly fractured.										
4 CORE	60 60.5		41	40.9' fossiliferous.										Core 4, RQD = 100%
			42											
			43											
			44											
			45	45 - 45.2' Overdrilled for Well Installation.										
				45.2' End of Boring.										Bedrock corehole reamed 6" in diameter to 45.2' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name: Baldwin Energy Complex	License/Permit/Monitoring Number:	Boring Number: MW-389

Boring Drilled By: Name of crew chief (first, last) and Firm: Tom Marlo, Bulldog Drilling	Date Drilling Started: 11/25/2015	Date Drilling Completed: 12/1/2015	Drilling Method: 4 1/4 HSA and rotary

Common Well Name: MW-389	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 417.30 Feet (NAVD88)	Borehole Diameter: 8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,119.33 N, 2,379,809.87 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 37.2444"
Long -89° 52' 37.4736"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 16	1 3 7 13	0–1	0 - 16' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), stiff to very hard (1-4.5+ tsf), low plasticity.	CL/ML								
2 SS	24 / 18	2 6 9 9	2–3										
3 SS	24 / 19.5	1 3 3 3	4–5	4.5' moist.									
4 SS	24 / 17	1 2 3 1	6–7	7' trace root structures.									
5 SS	24 / 17	2 2 4 5	8–9	8' black (10YR 2/1) oxidation mottling.									
6 SS	24 / 20	2 2 4 4	10–12	10' decreasing mottling, increasing silt content.									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 21	2 3 2 3	12–14	0 - 16' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), stiff to very hard (1-4.5+ tsf), low plasticity. *(continued)* 12' dark yellowish brown (10YR 4/4), wet.									
8 SS	24 20	2 3 3 5	14–16	14' brown (10YR 5/3), dark yellowish brown (10YR4/6) mottling.	CL/ML								
9 SS	24 24	1 3 5 6	16–18	16 - 23' **FAT CLAY:** CH, grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling, trace sand, stiff to very stiff (1.75-3.0 tsf), medium plasticity.									
10 SS	24 24	1 3 4 4	18–20	18' black (10YR 2/1) oxidation nodules.									
11 SS	24 24	2 3 4 5	20–22		CH								
12 SS	24 27	1 3 3 4	22–24										
			23	23 - 28.3' **SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling, trace fine gravel, stiff to hard (1.5-4.5 tsf), medium plasticity.									
13 SS	24 27	1 2 4 4	24–26										
14 SS	24 26	1 3 5 10	26–28	27' low plasticity.	(CL/ML)S								
15 SS	24	1 3 8 11	28–30	28.3 - 28.8' **POORLY-GRADED SAND WITH CLAY:** SP-SC, yellowish brown (10YR 5/6).	SP-SC								
			28.8	28.8 - 36' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, oxidation nodules, and fine gravel, very stiff to hard (2.5-4.5 tsf), wet.									
16 SS	24	1 3 5 10	30–32		CL/ML								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 23	1 3 5 8	33	28.8 - 36' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, oxidation nodules, and fine gravel, very stiff to hard (2.5-4.5 tsf), wet. *(continued)*	CL/ML						
18 SS	24 26	1 3 8 13	34–35	34' increasing gravel content.							
19 SS	4 4	50 for 4"	36	36 - 37.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)						
1 CORE	46 45		37								Core 1, RQD=86%
				37.3 - 37.7' **SHALE:** BDX (SH), decomposed, moderately fractured.	BDX (SH)						
			38–39	37.7 - 39.3' **LIMESTONE:** BDX (LS), shale at fractures, moderately fractured.	BDX (LS)						
2 CORE	13 12		40	39.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, decomposed, moderately fractured.	BDX (LS/SH)						Core 2, RQD=67%
3 CORE	56 56		41–44	40.4' - 41' intensely fractured.							Core 3, RQD=65%
4 CORE	63 63		45–46	45.2' slightly fractured.							Core 4, RQD=89%
			47–50	46.8 - 50.5' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.	BDX (LS)						
5 CORE	60 59		51–52	50.5 - 52.1' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous.	BDX (LS/SH)						Core 5, RQD=100%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			53 54 55	52.1 - 55.7' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.	BDX (LS)									Bedrock corehole reamed 6" in diameter to 55' for well installation.
				55.7' End of Boring.										

APPENDIX D

GROUNDWATER QUALITY DATA

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well		Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard			ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)			27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)			2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)			28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)			5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)			17.7	6240	11.9		5120									109	2820					94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)			13.3	1070	7.6		1130									12	495					36.3					0.57	<0.02		0.01	<0.005							
Upgradient Wells (Unlithified Materials)																																						
MW104D	(N)	11/16/2010	15	1226	7		785		0.07		<0.007					15.7	245	0.469	<0.005	0.03	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.02	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104D		3/23/2011	16.7	1176	7	406	801		0.07		<0.007	143	58	63	<1	17	241	0.422	<0.005	0.0311	<0.005	0.021	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.04	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104D		6/7/2011	16.8	1213	6.9	404	776		<0.05		<0.007	134	58	58	<1	19	250	0.379	<0.005	0.033	<0.005	0.019	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.013	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		9/13/2011	16	1164	6.7	418	768		0.07		<0.007	134	49	58	2.2	18	225	0.37	<0.005	0.042	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.024	<0.005		0.42	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		12/8/2011	13.7	1127	6.8	410	739		0.06		<0.007	137	52	51	1.5	18	222	0.4	<0.005	0.038	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.025	<0.005		0.28	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		3/8/2012	11.3	1094	7.6	416	724		0.55		<0.008	145	58	56	1.3	24	214	0.31	<0.005	0.035	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.011	<0.005		0.21	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104DR		9/16/2013	15.5	1130	6.9		676																				4.82			0.93								
MW104DR		11/20/2013	13.6	1250	6.8		630									16	194					0.02						0.07			0.29							
MW104DR		2/18/2014	12.2	991	6.8		652									18	175					<0.02						<0.02			0.04							
MW104DR		6/11/2014	14.3	1060	7		676									18	186					<0.02						0.028			0.123							
MW104DR		3/25/2015	14.4	775	7.1		630	<0.05		0.955						21	179					<0.02					0.54	<0.02		0.177	0.092							
MW104DR		6/24/2015	14.8	1030	7		718	<0.05		0.673						23	187					<0.02					0.77	<0.02		0.206	0.13							
MW104DR		9/25/2015	15.4	1090	7.1		634	<0.05		0.847						24	178					<0.02					0.74	<0.02		0.224	0.15							
MW104DR		11/10/2015	15.2	997	6.8		644	<0.05		0.924						25	195					<0.02					0.33	<0.02		0.234	0.172							
MW104S	(N)	11/16/2010	11.8	1550	6.6		943		<0.05		<0.007					33.7	148	0.629	0.032	0.15	<0.005	0.16	<0.002	<0.005	<0.005	<0.005		18	<0.005		6.8	<0.002	<0.005	<0.005	0.009	<0.005	<0.01	<0.002
MW104S		3/23/2011	15.9	1142	6.5	446	742		<0.05		<0.007	106	42	104	<1	56	169	0.401	0.0082	0.0899	<0.005	0.146	<0.002	<0.005	<0.005	<0.005		1.85	<0.005		3.0	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104S		6/7/2011	21.8	1290	6.5	550	824		0.07		<0.008	121	46	105	1.8	58.7	114	0.561	0.012	0.24	<0.005	0.22	<0.002	<0.005	<0.005	<0.005		14	<0.005		4.0	<0.002	<0.005	<0.005	0.009	<0.005	<0.01	<0.002
MW104SR		9/13/2011	19.9	1286	6.4	654	909		0.37		<0.007	157	65	92	<1	32	164	0.54	0.0058	0.059	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.08	<0.005		1.2	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104SR		12/8/2011	12.3	1405	6.9	616	965		0.14		<0.007	167	70	84	<1	31	237	0.523	<0.005	0.076	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.19	<0.005		1.1	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104SR		3/8/2012	10.1	1521	6.9	700	886		0.09		<0.008	168	77	85	<1	34	140	0.549	<0.005	0.097	<0.004	0.06	<0.002	<0.005	<0.005	<0.005		0.61	<0.005		1.9	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW104SR		9/16/2013	17	1310	6.7		724																				3.18			4.97								
MW104SR		11/20/2013	15.1	1320	6.7		770									19	134					0.04						1.44			2.2							
MW104SR		2/18/2014	12.8	809	6.7		792									18	138					0.05						<0.02			0.59							
MW104SR		6/11/2014	14.9	1260	6.5		792									16	68					0.147						0.806			1.7							
MW104SR		3/25/2015	10.9	1000	6.8		770	<0.05		0.058						14	100					0.086					0.48	0.207		2.66	2.1							
MW104SR		6/24/2015	15.4	1390	6.6		880	<0.05		<0.05						23	47					0.178					7.12	3.74		3.46	3.1							
MW104SR		9/25/2015	18.7	1330	6.7		744	<0.05		<0.05						19	23					0.237					3.62	3.35		2.54	2.52							
MW104SR		11/10/2015	17	1150	6.3		732	0.06		0.321						19	57					0.149					0.98	1.19		2.78	3.09							
TPZ158		9/17/2013	16.4	720	7.1		394																				6.93			0.12								
TPZ158		11/20/2013	14.9	984	7.3		976									81	39					<0.02						1.43			0.35							
TPZ158		2/18/2014	10.2	584	6.7		380									65	44					<0.02						<0.02			<0.005							
TPZ158		6/12/2014	14.8	645	6.1		408									62	37					0.03						0.085			<0.005							
Downgradient Wells (Unlithified Materials)																																						
MW150	(N)	11/15/2010	13.5	1467	7.3		1133		<0.05		<0.007					65.4	507	0.826	0.005	0.02	<0.005	0.31	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		3/23/2011	15.3	1681	7.3	378	1205		0.06		<0.008	132	95	131	<1	65	555	0.841	0.006	0.0161	<0.005	0.473	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		6/7/2011	16.7	1910	7.1	370	1396		0.06		<0.008	138	105	134	<1	57.7	696	0.791	<0.005	0.017	<0.005	0.4	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		9/13/2011	14.4	1620	7.2	376	1162		0.05		<0.007	135	82	123	1.0	66	513	0.86	<0.005	0.017	<0.004	0.36	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		12/7/2011	13.1	1744	7.1	390	1278		<0.05		<0.007	136	92	126	<1	77	585	0.865	0.0053	0.019	<0.004	0.47	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	0.01	<0.002
MW150		3/7/2012	16.1	1704	7.3	388	1334		<0.05		<0.007	128	108	134	<1	69	584	0.798	<0.005	0.015	<0.004	0.56	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW150		9/16/2013	14.8	1350	7.5		1090																				20.1			0.32								
MW150		11/20/2013	13.3	1530	7.1		1090									51	502					0.65						0.07			0.03							
MW150		2/19/2014	12.7	1330	7		1200									51	521					0.8						<0.02			<0.005							
MW150		6/11/2014	13	1680	7.3		1300									49	552					0.98						<0.02			0.006							
MW150		3/25/2015	13.7	1290	7.4		1270	<0.05		0.134						47	550					1.19					14.5	<0.02		0.215	0.024							
MW150		6/24/2015	13.5	1650	7.2		1340	<0.05		<0.05						50	565					1.25					0.81	0.035		0.016	0.003							
MW150		9/25/2015	14	1710	7.2		1210	<0.05		<0.05						52	632					1.5					0.22	0.127		0.016	0.013							
MW150		11/10/2015	13.5	1550	7		1180	<0.05		0.057						54	584					1.47					0.08	0.0388		0.007	0.005							
MW151	(N)*	11/15/2010	15.3	1022	7.1		580		<0.05		<0.007					39.9	76.5	0.536	0.007	0.05	<0.005	0.25	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.14	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		3/23/2011	13.2	974	6.9	414	568		<0.05		<0.007	117	46	46	1.1	40	77	0.531	<0.005	0.0396	<0.005	0.226	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.064	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		6/7/2011	15	1001	6.9	410	539		<0.05		<0.007	97	45	45	1.0	38.7	82.3	0.483	<0.005	0.0396	<0.005	0.22	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.032	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		9/13/2011	22.8	1010	6.8	442	587		<0.05		<0.007	109	42	52	1.3	44	78	0.53	<0.005	0.041	<0.004	0.22	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.059	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		12/8/2011	9.2	953	7.8	430	576		<0.05		<0.007	114	45	48	1.0	40	77	0.54	0.006	0.049	<0.004	0.25	<0.002	<0.005	<0.005	<0.005		0.011	<0.005		0.021	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		3/7/2012	13.2	941	8.1	446	569		0.09		<0.007	119	48	48	<1	38	75	0.479	<0.005	0.039	<0.004	0.22	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.010	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW151		9/16/2013	17.3	855	7.2		526																				19.3			1.53								
MW151		11/20/2013	14.2	970	7.1		542									36	78					0.24						<0.02			<0.005							
MW151		2/19/2014	8.5	852	7.1		538									35	74					0.23						<0.02			<0.005							
MW151		6/12/2014	13.8	983	6.3		562									35	63					0.217						<0.02			0.005							
MW152	(N)	11/15/2010	15	2030	7		1759		0.17		<0.007					84.1	859	0.348	0.008	0.01	<0.005	12	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.05	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		3/23/2011	11.2	2128	7.4	360	1768		0.31		<0.007	249	104	131	1.4	75	914	0.268	0.0073	0.0109	<0.005	8.974	<0.002	<0.005	<0.005	<0.005		0.04	<0.005		0.021	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		6/7/2011	15.5	2103	7.3	408	1634		0.24		<0.007	205	100	148	1.0	53.7	772	0.274	<0.005	0.01	<0.005	3.6	<0.002	<0.005	<0.005	<0.005		0.026	<0.005		0.013	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		9/13/2011	17.6	2052	7.2	420	1607		0.09		<0.007	212	97	146	1.1	69	1000	0.3	<0.005	0.01	<0.004	7.8	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.072	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		12/6/2011	10.8	2299	6.5	420	1983		<0.05		<0.007	289	126	131	<1	140	1030	0.281	0.008	0.014	<0.004	18	<0.002	<0.005	<0.005	<0.005		0.012	<0.005		0.018	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		3/7/2012	13.7	2092	6.7	420	1511		0.25		<0.007	190	91	130	<1	52	700	0.258	<0.005	0.0094	<0.004	3.7	<0.002	<0.005	<0.005	<0.005		0.02	<0.005		0.0093	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW152		9/16/2013	16.2	1920	7		1620																				19.4			1.37								
MW152		11/20/2013	13.7	1950	7.2		1720									55	857					9.92						0.07			0.005							
MW152		2/19/2014	9.5	1880	6.4		1770									56	898					12.7						0.05			<0.005							
MW152		6/12/2014	12.9	1890	6.5		1530									32	636					2.36						0.456			0.102							
MW152		3/25/2015	10	1880	6.9		2150	<0.05		<0.05						71	1020					26.8					12.4	0.044		0.367	0.01							
MW152		6/24/2015	14	2580	6.8		2150	<0.05		0.207						68	978					19.5					16.6	0.118		0.639	0.091							
MW152		9/25/2015	16.3	2530	6.8		1920	<0.05		<0.05						63	949					17.7					2.65	0.033		0.105	0.019							
MW152		11/10/2015	15.2	2110	6.7		1920	<0.05		<0.05						27	965					16.9					3.93	0.076		0.158	0.040							
MW153	(N)	11/16/2010	14.8	730	7.1		462		13.2		<0.007					34.4	88.5	0.44	<0.005	0.03	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		3/23/2011	21.2	736	7.4	192	430		14.91		<0.007	58	24	59	<1	30	93	0.383	<0.005	0.025	<0.005	<0.02	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0091	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		6/7/2011	20.2	732	7.5	200	449		12		<0.007	56	24	56	<1	31.5	82.5	0.388	<0.005	0.025	<0.005	0.014	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0053	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		9/14/2011	16.2	718	6.9	194	446		18		<0.007	55	23	65	<1	33	83	0.4	<0.005	0.025	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.011	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		12/8/2011	5.5	789	7	206	451		15		<0.007	61	26	61	<1	34	93	0.41	<0.005	0.028	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.015	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		3/8/2012	11.9	669	7.3	200	416		12.9		<0.007	57	24	57	<1	29	81	0.394	<0.005	0.024	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		0.0077	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW153		9/17/2013	15.5	778	7.3		448																				7.34			0.16								
MW153		11/21/2013	14.1	730	6.6		384									28	98					<0.02						<0.02			0.03							
MW153		2/19/2014	13.7	561	7.2		402									22	81					<0.02						<0.02			<0.005							
MW153		6/11/2014	13.2	686	7		426									21	80					<0.02						<0.02			0.009							
MW153		3/25/2015	12.9	491	7.3		354	<0.05		10.5						18	77					<0.02					0.64	<0.02		0.03	0.016							

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well		Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)
Class II Standard			ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns
Max (Unlithified)			27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126
Min (Unlithified)			2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0
Max (Bedrock)			28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46
Min (Bedrock)			5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1
Max (Leachate)			17.7	6240	11.9		5120						
Min (Leachate)			13.3	1070	7.6		1130						
MW153		6/24/2015	14.3	648	7.2		442	<0.05		10.6			
MW153		9/25/2015	15.2	654	6.8		354	<0.05		10.5			
MW153		11/10/2015	15.5	620	7.1		360	<0.05		10.7			
MW154	(N)	3/23/2011	11.5	911	7.3	424	559		1.28		<0.007	110	40
MW154		6/7/2011	14.5	874	7.1	384	508		0.53		<0.007	106	38
MW154		9/12/2011											
MW154		12/7/2011	13.8	665	6.7	324	346		0.25		<0.007	89	25
MW154		3/6/2012	12.9	861	7.1	406	476		4.49		<0.007	114	40
MW154		9/17/2013	16	869	7.3		516						
MW154		2/19/2014	11.3	713	7.4		454						
MW154		6/12/2014	13.3	825	6.9		492						
MW154		3/25/2015	9.9	692	7.3		494	<0.05		0.957			
MW154		6/30/2015	15	751	6.9		468	<0.05		<0.05			
MW154		9/25/2015	16.4	1040	6.9		550	<0.05		<0.05			
MW155	(N)	11/16/2010	13.8	600	7.1		470		4.46		<0.007		
MW155		3/23/2011	15.5	763	7.1	360	455		1.98		<0.007	88	45
MW155		6/7/2011	16.1	806	7.1	400	487		1.4		<0.007	86	46
MW155		9/12/2011	19.3	526	6.8	376	470		2.1		<0.007	86	42
MW155		12/7/2011	8.3	528	6.9	366	450		2		<0.007	91	44
MW155		3/6/2012	16.3	774	6.9	392	446		1.85		<0.008	93	49
MW155		9/17/2013	14.1	773	7.4		470						
MW155		2/19/2014	13.7	3890	7		1080						
MW155		6/12/2014	15	799	6.5		484						
MW155		3/25/2015	13.6	588	7.3		402	<0.05		1.61			
MW155		6/24/2015	13.5	796	7.2		498	<0.05		1.64			
MW155		9/25/2015	14.9	849	7.2		438	<0.05		1.82			
MW155		11/10/2015	14.2	774	7		436	<0.05		2.13			
MW252	(N)	11/15/2010	13.8	1730	7.8		1318		<0.05		<0.007		
MW252		3/23/2011	15.3	1845	7	534	1335		0.06		<0.007	232	90
MW252		6/7/2011	14	1833	7.8	524	1341		0.05		<0.008	210	84
MW252		9/13/2011	14.9	1806	7.5	526	1301		<0.05		<0.007	206	78
MW252		12/6/2011	9.8	1745	6.8	524	1224		<0.05		<0.007	221	83
MW252		3/7/2012	21.6	1910	7	528	1286		<0.05		<0.007	225	91
MW252		9/16/2013	14.1	1650	7		1260						
MW252		11/20/2013	13.8	1670	7.1		1250						
MW252		2/19/2014	10.9	1320	8.1		1310						
MW252		6/12/2014	14.3	1790	6.4		1390						
MW252		3/25/2015	12.8	1350	7		1270	<0.05		<0.05			
MW252		6/24/2015	13.7	1680	6.7		1320	<0.05		<0.05			
MW252		9/25/2015	14.5	1800	6.8		1250	<0.05		<0.05			
MW252		11/10/2015	13.7	1600	6.6		1250	<0.05		<0.05			
MW253	(N)	11/16/2010	13.4	765	6.9		1441		0.38		<0.007		
MW253		3/23/2011	25.9	1971	7.7	580	854		0.08		<0.008	54	1.0
MW253		6/7/2011	27.5	1564	11.3	187	698		0.06		<0.007	104	<5
MW253		9/14/2011	17.5	958	9.8	46	639		0.12		<0.007	61	15
MW253		12/8/2011	2	908	7.4	105	744		<0.05		<0.007	76	48
MW253		3/8/2012	9.6	1142	11	115	634		<0.05		<0.007	110	2.8
MW253		9/17/2013	15.6	833	10.6		546						
MW253		11/21/2013	13.9	735	8.6		602						
MW253		2/19/2014	14.4	833	7.8		564						
MW253		6/11/2014	14.1	1460	11.4		668						
MW253		3/25/2015	14.1	1910	12.4		820	<0.05		0.109			
MW253		6/24/2015	14.8	3410	12.4		928	0.16		<0.05			
MW253		9/25/2015	14.6	631	11.1		346	<0.05		<0.05			
MW253		11/10/2015	14.8	589	10.1		300	<0.05		<0.05			
MW156	(N)	11/15/2010											
MW156		3/23/2011											
MW156		6/6/2011											
MW156		9/12/2011											
MW156		12/8/2011											
MW156		3/8/2012											
MW156		9/16/2013	16.4	814	6.7		480						
MW156		11/21/2013	15.2	684	6.6		466						
MW156		2/18/2014	13.3	662	6.8		470						
MW156		6/11/2014	15	825	6.8		506						
MW156		3/25/2015	11.8	611	7								
MW156		6/24/2015	15.9	794	6.8								
MW156		9/25/2015	18.3	848	7								
MW156		11/10/2015	16.6	778	6.8								
OW256		9/16/2013	15.1	862	7.1		520						
OW256		11/21/2013	15.7	723	6.6		488						
OW256		2/18/2014	10.7	723	6.8		508						
OW256		6/11/2014	15.4	881	7.1		522						
MW157S	(N)	11/15/2010											
MW157S		3/23/2011											
MW157S		6/6/2011											
MW157S		9/12/2011											
MW157S		12/8/2011											
MW157S		3/8/2012											
MW157S		9/16/2013	16.4	3270	7.6		3170						
MW157S		11/21/2013	15.1	2940	6.4		3160						
MW157S		2/18/2014	13	3150	6.6		3180						
MW157S		6/11/2014	14.2	3560	6.3		3470						

Well		Sample Date	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)
Class II Standard			ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0
Max (Unlithified)			168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01
Min (Unlithified)			20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005
Max (Bedrock)			207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005
Min (Bedrock)			29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005
Max (Leachate)					109	2820					94.7			
Min (Leachate)					12	495					36.3			
MW153		6/24/2015			21	73					<0.02			
MW153		9/25/2015			22	75					<0.02			
MW153		11/10/2015			22	75					<0.02			
MW154	(N)	3/23/2011	53	1.2	12	94	0.623	0.0057	0.073	<0.005	0.026	<0.002	<0.005	<0.005
MW154		6/7/2011	28	<1	9.53	71.9	0.501	<0.005	0.076	<0.005	0.026	<0.002	<0.005	<0.005
MW154		9/12/2011												
MW154		12/7/2011	22	<1	4.1	29	0.525	<0.005	0.1	<0.004	<0.05	<0.002	<0.005	<0.005
MW154		3/6/2012	20	<1	5.5	38	0.516	<0.005	0.08	<0.004	<0.05	<0.002	<0.005	<0.005
MW154		9/17/2013												
MW154		2/19/2014			8	48					0.02			
MW154		6/12/2014			12	30					<0.02			
MW154		3/25/2015			7	39					<0.02			
MW154		6/30/2015			6	29					0.021			
MW154		9/25/2015			9	49					<0.02			
MW155	(N)	11/16/2010			6.55	61.8	0.39	<0.005	0.03	<0.005	<0.02	<0.002	<0.005	<0.005
MW155		3/23/2011	24	<1	10	53	0.398	<0.005	0.025	<0.005	<0.02	<0.002	<0.005	<0.005
MW155		6/7/2011	25	<1	8.58	49.6	0.385	<0.005	0.024	<0.005	0.012	<0.002	<0.005	<0.005
MW155		9/12/2011	28	<1	9.3	50	0.38	<0.005	0.022	<0.004	<0.05	<0.002	<0.005	<0.005
MW155		12/7/2011	26	<1	11	51	0.417	<0.005	0.023	<0.004	<0.05	<0.002	<0.005	<0.005
MW155		3/6/2012	28	<1	8.8	49	0.401	<0.005	0.019	<0.004	<0.05	<0.002	<0.005	<0.005
MW155		9/17/2013												
MW155		2/19/2014			8	54					<0.02			
MW155		6/12/2014			8	41					<0.02			
MW155		3/25/2015			7	50					<0.02			
MW155		6/24/2015			8	53					<0.02			
MW155		9/25/2015			9	50					<0.02			
MW155		11/10/2015			9	51					<0.02			
MW252	(N)	11/15/2010			52.8	528	0.233	0.008	0.04	<0.005	0.97	<0.002	<0.005	<0.005
MW252		3/23/2011	100	5.3	61	559	0.25	0.006	0.039	<0.005	1.47	<0.002	<0.005	<0.005
MW252		6/7/2011	99	2.1	61.4	578	0.224	<0.005	0.04	<0.005	0.31	<0.002	<0.005	<0.005
MW252		9/13/2011	104	3	52	510	0.22	0.0061	0.029	<0.004	0.32	<0.002	<0.005	<0.005
MW252		12/6/2011	99	1.9	50	490	0.232	0.007	0.04	<0.004	0.29	<0.002	<0.005	0.01
MW252		3/7/2012	99	1.4	49	576	0.21	<0.005	0.022	<0.004	0.19	<0.002	<0.005	<0.005
MW252		9/16/2013												
MW252		11/20/2013			41	463					0.23			
MW252		2/19/2014			41	480					0.23			
MW252		6/12/2014			38	447					0.223			
MW252		3/25/2015			38	487					0.155			
MW252		6/24/2015			41	488					0.132			
MW252		9/25/2015			38	459					0.14			
MW252		11/10/2015			38	493					0.134			
MW253	(N)	11/16/2010			27.4	806	0.408	0.008	0.02	<0.005	0.24	<0.002	<0.005	<0.005
MW253		3/23/2011	168	78	26	262	0.119	0.0063	0.066	<0.005	0.124	<0.002	<0.005	<0.005
MW253		6/7/2011	108	18	22.2	411.4	0.369	<0.005	0.054	<0.005	0.064	<0.002	<0.005	<0.005
MW253		9/14/2011	95	9.1	23	424	0.29	<0.005	0.031	<0.004	<0.05	<0.002	<0.005	<0.005
MW253		12/8/2011	94	4.9	27	483	0.349	0.0064	0.026	<0.004	0.11	<0.002	<0.005	<0.005
MW253		3/8/2012	86	6.4	22	406	0.246	<0.005	0.036	<0.004	0.076	<0.002	<0.005	<0.005
MW253		9/17/2013												
MW253		11/21/2013			18	405					0.09			
MW253		2/19/2014			16	368					0.06			
MW253		6/11/2014			14	313					0.083			
MW253		3/25/2015			12	247					0.093			
MW253		6/24/2015			10	142					0.05			
MW253		9/25/2015			12	241					0.044			
MW253		11/10/2015			12	216					0.033			
MW156	(N)	11/15/2010												
MW156		3/23/2011												
MW156		6/6/2011												
MW156		9/12/2011												
MW156		12/8/2011												
MW156		3/8/2012												
MW156		9/16/2013												
MW156		11/21/2013			60	93					<0.02			
MW156		2/18/2014			55	88					0.03			
MW156		6/11/2014			60	86					0.024			
MW156		3/25/2015												
MW156		6/24/2015												
MW156		9/25/2015												
MW156		11/10/2015												
OW256		9/16/2013												
OW256		11/21/2013			65	88					0.16			
OW256		2/18/2014			57	90					0.15			
OW256		6/11/2014			54	66					0.146			
MW157S	(N)	11/15/2010												
MW157S		3/23/2011												
MW157S		6/6/2011												
MW157S		9/12/2011												
MW157S		12/8/2011												
MW157S		3/8/2012												
MW157S		9/16/2013												
MW157S		11/21/2013			121	1870					45.2			
MW157S		2/18/2014			124	2050					45.3			
MW157S		6/11/2014			118	2000					44.6			

Well		Sample Date	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard			0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)			0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)			<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)			<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)			<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)				90.6	0.06		1.58	<0.005							
Min (Leachate)				0.57	<0.02		0.01	<0.005							
MW153		6/24/2015		0.18	<0.02		0.015	0.009							
MW153		9/25/2015		0.21	<0.02		0.014	0.0084							
MW153		11/10/2015		0.3	<0.02		0.017	0.0087							
MW154	(N)	3/23/2011	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	0.0159	<0.002
MW154		6/7/2011	<0.005		0.018	<0.005		0.18	<0.002	<0.005	<0.005	0.014	<0.005	<0.01	<0.002
MW154		9/12/2011													
MW154		12/7/2011	<0.005		<0.01	<0.005		0.0062	<0.002	<0.005	<0.005	0.007	<0.005	<0.01	<0.002
MW154		3/6/2012	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW154		9/17/2013		7.1			0.19								
MW154		2/19/2014			<0.02			<0.005							
MW154		6/12/2014			<0.02			<0.005							
MW154		3/25/2015		1.55	<0.02		0.019	<0.003							
MW154		6/30/2015		0.34	0.078		0.05	0.032							
MW154		9/25/2015		3.9	0.042		0.132	0.083							
MW155	(N)	11/16/2010	<0.005		<0.01	<0.005		0.038	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		3/23/2011	<0.005		<0.01	<0.005		0.28	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		6/7/2011	<0.005		0.016	<0.005		0.062	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		9/12/2011	<0.005		0.013	<0.005		0.37	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		12/7/2011	<0.005		0.015	<0.005		0.18	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW155		3/6/2012	0.016		<0.01	<0.005		0.081	<0.002	<0.005	<0.005	0.014	<0.005	<0.01	<0.002
MW155		9/17/2013		48.3			24.4								
MW155		2/19/2014			0.48			0.35							
MW155		6/12/2014			<0.02			<0.005							
MW155		3/25/2015		0.09	<0.02		0.073	<0.003							
MW155		6/24/2015		0.23	<0.02		0.291	0.008							
MW155		9/25/2015		0.21	<0.02		0.132	0.0112							
MW155		11/10/2015		0.6	<0.02		0.273	<0.003							
MW252	(N)	11/15/2010	<0.005		<0.01	<0.005		1.7	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		3/23/2011	0.0072		<0.01	<0.005		0.93	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		6/7/2011	<0.005		<0.01	<0.005		0.61	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		9/13/2011	<0.005		<0.01	<0.005		0.97	<0.002	<0.005	<0.005	0.007	<0.005	<0.01	<0.002
MW252		12/6/2011	<0.005		<0.01	<0.005		1.2	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		3/7/2012	<0.005		0.026	<0.005		0.44	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW252		9/16/2013		9.04			1.3								
MW252		11/20/2013			0.07			0.11							
MW252		2/19/2014			<0.02			0.01							
MW252		6/12/2014			<0.02			0.057							
MW252		3/25/2015		1.15	<0.02		0.324	0.053							
MW252		6/24/2015		12.3	0.1		0.585	0.198							
MW252		9/25/2015		2.09	<0.02		0.655	0.582							
MW252		11/10/2015		15.5	0.0221		0.717	0.152							
MW253	(N)	11/16/2010	<0.005		<0.01	<0.005		0.37	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		3/23/2011	<0.005		<0.01	0.005		<0.005	<0.002	<0.005	0.006	<0.005	<0.005	<0.01	<0.002
MW253		6/7/2011	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		9/14/2011	<0.005		0.013	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		12/8/2011	<0.005		0.014	<0.005		0.0071	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		3/8/2012	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW253		9/17/2013		0.16			0.02								
MW253		11/21/2013			<0.02			<0.005							
MW253		2/19/2014			<0.02			<0.005							
MW253		6/11/2014			<0.02			<0.005							
MW253		3/25/2015		<0.02	<0.02		0.003	<0.003							
MW253		6/24/2015		0.09	<0.02		0.005	<0.003							
MW253		9/25/2015		<0.02	<0.02		<0.003	<0.003							
MW253		11/10/2015		<0.02	<0.02		<0.003	<0.003							
MW156	(N)	11/15/2010													
MW156		3/23/2011													
MW156		6/6/2011													
MW156		9/12/2011													
MW156		12/8/2011													
MW156		3/8/2012													
MW156		9/16/2013		2.04			0.07								
MW156		11/21/2013			0.06			0.05							
MW156		2/18/2014			<0.02			<0.005							
MW156		6/11/2014			<0.02			<0.005							
MW156		3/25/2015													
MW156		6/24/2015													
MW156		9/25/2015													
MW156		11/10/2015													
OW256		9/16/2013		4.6			0.44								
OW256		11/21/2013			0.02			0.13							
OW256		2/18/2014			<0.02			<0.005							
OW256		6/11/2014			0.076			0.342							
MW157S	(N)	11/15/2010													
MW157S		3/23/2011													
MW157S		6/6/2011													
MW157S		9/12/2011													
MW157S		12/8/2011													
MW157S		3/8/2012													
MW157S		9/16/2013		12.7			0.26								
MW157S		11/21/2013			0.05			0.14							
MW157S		2/18/2014			<0.02			0.13							
MW157S		6/11/2014			0.03			0.13							

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well		Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard			ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)			27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)			2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)			28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)			5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)			17.7	6240	11.9		5120									109	2820					94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)			13.3	1070	7.6		1130									12	495					36.3					0.57	<0.02		0.01	<0.005							
MW157S		3/25/2015	12.6	3870	6.5																																	
MW157S		6/24/2015	15.1	3730	6.3																																	
MW157S		9/25/2015	18.4	3030	6.3																																	
MW157S		11/10/2015	17.3	3370	6.2																																	
OW257		9/16/2013	15.7	1430	7		960																				0.24			0.99								
OW257		11/21/2013	14.6	1180	7.1		958									21	312					3.28						0.02			0.68							
OW257		2/18/2014	13.1	1120	7.1		900									18	310					2.88						<0.02			0.01							
OW257		6/11/2014	15.8	1370	6.6		916									15	250					2.25						0.027			0.309							
MW161		9/16/2013	15.1	746	6.9		446																				11.8			1.84								
MW161		11/21/2013	13.2	625	7.1		756									6	44					<0.02						0.09			1.28							
MW161		2/18/2014	14.2	603	7		430									5	44					<0.02						<0.02			0.83							
MW161		6/11/2014	14.5	796	6.8		450									5	31					<0.02						0.047			0.272							
MW262		9/16/2013	14.8	448	7		318																				69.4			2.42								
MW262		11/21/2013	15.4	369	7.1		228									<5	40					<0.02						0.12			0.01							
MW262		2/19/2014	14.7	301	7.5		188									<5	24					<0.02						0.02			0.02							
MW262		6/11/2014	15.5	469	6.9		310									<5	44					<0.02						0.031			<0.005							
TPZ159		9/17/2013	17.9	849	6.6		588																				1.77			0.47								
TPZ159		11/21/2013	14.5	642	6.5		448									35	96					0.11						0.06			0.68							
TPZ159		2/18/2014	15.1	593	6.5		480									35	98					0.12						<0.02			0.51							
TPZ159		6/12/2014	18.6	674	5.6		460									34	92					0.087						0.069			0.387							
TPZ160		9/17/2013	17.7	880	7.2		490																				8.62			0.36								
TPZ160		11/21/2013	15.6	659	7.3		454									42	60					0.24						0.05			0.12							
TPZ160		2/18/2014	13.4	682	7		510									44	63					0.21						0.39			0.16							
TPZ160		6/11/2014	15.2	806	6.8		494									42	46					0.205						<0.02			0.215							
TPZ166		9/17/2013	16.5	612	7		396																				0.09			0.23								
TPZ166		11/20/2013	14.7	951	7.7		304									12	56					0.1						<0.02			0.02							
TPZ166		2/18/2014	13.5	423	7.2		306									12	38					0.06						<0.02			0.28							
TPZ166		6/12/2014	15.8	495	5.8		302									12	23					0.028						<0.02			0.431							
Downgradient Wells (Bedrock)																																						
MW350	(N)	11/15/2010	11.4	629	12.2		375		<0.05		<0.007					21.4	53.7	0.51	<0.005	0.23	<0.005	0.6	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW350		3/23/2011	18.7	1268	11.7	307	885		<0.05		<0.007	108	<5	182	84	27	30	0.46	0.0079	0.46	<0.005	0.417	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.009	<0.005	<0.005	<0.01	<0.002
MW350		6/7/2011	16.4	5144	12.2	561	1257		<0.05		<0.008	218	<5	207	89	25.8	42.5	0.365	<0.005	0.87	<0.005	0.26	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.007	<0.005	<0.005	<0.01	<0.002
MW350		9/13/2011	18.4	4508	12.1	505	1196		<0.05		<0.007	202	<5	200	70	34	46	0.33	0.0064	0.76	<0.004	0.21	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.005	<0.005	0.0075	<0.01	<0.002
MW350		12/7/2011	7	5529	12.6	778	1423		<0.05		<0.007	323	<5	166	57	31	41	0.289	0.011	1.2	<0.004	0.13	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.006	<0.005	0.0069	<0.01	<0.002
MW350		3/7/2012	14	7057	12.9	808	1709		<0.05		<0.007	533	<5	149	43	32	62	0.174	0.005	1.6	<0.004	0.056	<0.002	<0.005	<0.005	<0.005		0.011	<0.005		<0.005	<0.002	<0.005	0.01	<0.005	0.0075	<0.01	<0.002
MW350		9/16/2013	14.6	5190	12.3		1640																				0.14			<0.005								
MW350		11/20/2013	13.5	4140	11.8		1370									34	11					0.03						<0.02			<0.005							
MW350		2/19/2014	13.3	4170	8.1		1420									33	<10					0.03						<0.02			<0.005							
MW350		6/11/2014	14.3	6120	12.4		1580									38	<50					0.021						<0.02			<0.005							
MW350		3/25/2015	14.4	6580	12.8		1430	0.35		<0.1						46	15					0.032					0.08	<0.02		<0.003	<0.003							
MW350		6/24/2015	14.4	5990	12.5		1430	0.33		0.103						48	11					0.034					0.1	<0.02		<0.003	<0.003							
MW350		9/25/2015	13.8	4200	12.6		1140	0.34		<0.05						43	27					0.103					0.04	<0.02		<0.003	<0.003							
MW350		11/10/2015	13.5	2790	12.2		690	<0.05		<0.05						40	38					0.191					0.03	<0.02		<0.003	<0.003							
MW352	(N)	11/15/2010	13.2	1102	10.6		779		<0.05		<0.007					521	12.6	0.692	0.005	0.18	<0.005	0.9	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352		3/23/2011	16.8	1877	11.6	102	783		<0.05		<0.007	93	<5	182	19	535	14	0.696	0.0066	0.27	<0.005	0.869	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	0.007	<0.005	<0.005	<0.01	<0.002
MW352		6/7/2011	23.8	1922	11.2	70	862		<0.05		<0.007	79	<5	180	15	514.4	15.2	0.698	<0.005	0.29	<0.005	0.84	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352		9/13/2011	28.1	1704	11	39	735		0.06		<0.007	60	2.1	185	12	603	16	0.7	0.0082	0.19	<0.004	0.76	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352		12/8/2011	5.8	1426	10.7	20	706		<0.05		<0.007	70	6.2	190	9.6	642	14	0.652	0.0091	0.19	<0.004	0.76	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352		3/7/2012	20.1	1381	10.2	16	891		<0.05		<0.007	45	22	200	6.3	611	11	0.756	<0.005	0.11	<0.004	0.86	<0.002	<0.005	<0.005	<0.005		<0.01	<0.005		<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW352		9/16/2013	14.6	1740	9.4		1130																				0.17			0.007								
MW352		11/20/2013	13.3	1740	7.3		996									583	11					1.47						<0.02			<0.005							
MW352		2/19/2014	11.5	1530	6.5		768									390	18					0.82						<0.02			<0.005							
MW352		6/12/2014	14.3	1920	8.9		1090									569	<20					1.53						<0.02			<0.005							
MW352		3/25/2015	13.3	1350	9		874	<0.05		0.606						415	12					1.05					0.02	<0.02		0.004	<0.003							
MW352		6/24/2015	14.6	1870	8.6		1100	<0.05		<0.05						508	<10					1.23					0.09	<0.02		0.004	<0.003							
MW352		9/25/2015	15.3	2070	8		1210	<0.05		<0.05						597	<10					1.88					0.03	<0.02		0.007	0.007							
MW352		11/10/2015	13.8	1850	7.6		1100	<0.05		<0.05						567	<10					1.79					0.03	<0.02		0.007	0.005							
MW355	(N)	11/16/2010	13.6	934	7		532		0.95		<0.007					14	56	0.403	<0.005	0.1	<0.005	0.02	<0.002	<0.005	<0.005	<0.005		1.6	<0.005		0.87	<0.002	0.007	<0.005	<0.005	<0.005	<0.01	<0.002
MW355		3/23/2011	15.5	848	7.1	432	486		0.56		<0.007	96	45	32	<1	14	36	0.405	0.0061	0.10	<0.005	0.021	<0.002	<0.005	<0.005	<0.005		0.60	<0.005		0.45	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355		6/7/2011	17	841	7.2	404	491		0.21		<0.007	85	43	30	<1	13.4	45.9	0.397	<0.005	0.12	<0.005	0.03	<0.002	<0.005	<0.005	<0.005		0.41	<0.005		0.2	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355		9/12/2011	17	824	6.7	396	490		1.6		<0.007	87	41	34	<1	12	53	0.41	0.0074	0.11	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.55	<0.005		0.34	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355		12/7/2011	8.2	812	6.8	412	486		0.82		<0.007	105	46	33	<1	14	48	0.412	<0.005	0.14	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.59	<0.005		0.43	<0.002	<0.005	<0.005	0.006	<0.005	<0.01	<0.002
MW355		3/6/2012	16.3	879	6.8	396	447		2.04		<0.008	88	46	29	<1	12	50	0.42	<0.005	0.098	<0.004	<0.05	<0.002	<0.005	<0.005	<0.005		0.26	<0.005		0.13	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
MW355		9/17/2013	14.1	811	7.4		468																				3.82			0.58								
MW355		11/21/2013	13.1	682	7.2		450									11	61					0.03						0.62			0.06							
MW355		2/19/2014	13.5	691	7		458									11	65					0.02						0.03			0.05							
MW355		6/12/2014	14.8	797	6.8		532									10	51					0.024						0.071			0.024							
MW355		3/25/2015	14.2	600	7.5		418	<0.05		0.63						9	61					0.024					0.3	0.072		0.031	0.015							
MW355		6/24/2015	14.2	781	7.2		526	<0.05		1.13						9	58					0.024					0.51	0.022		0.042	0.01							
MW355		9/25/2015	14.2	826	7.1		422	<0.05		0.28						10	56					0.025					0.3	0.056		0.073	0.062							
MW355		11/10/2015	13.7	772	7		438	<0.05		1.06						10	57					<0.02					0.18	0.033		0.031	0.043							

Appendix D - Groundwater Quality Data
Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan
Baldwin Fly Ash Pond System
Baldwin Energy Center

Well	Sample Date	Temperature (deg. C)	Specific Cond (Field) (micromhos/cm)	pH (field) (SU)	Alkalinity, total (mg/L)	Total Dissolved Solids (mg/L)	Nitrite nitrogen, total (mg/L)	Nitrate nitrogen, diss (mg/L)	Nitrate nitrogen, total (mg/L)	Cyanide, total (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Arsenic, dissolved (mg/L)	Barium, dissolved (mg/L)	Beryllium, dissolved (mg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (mg/L)	Chromium, dissolved (mg/L)	Cobalt, dissolved (mg/L)	Copper, dissolved (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)	Lead, dissolved (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Thallium, dissolved (mg/L)	Nickel, dissolved (mg/L)	Silver, dissolved (mg/L)	Zinc, dissolved (mg/L)	Antimony, dissolved (mg/L)	Selenium, dissolved (mg/L)	Mercury, dissolved (mg/L)
Class II Standard		ns	ns	6.5-9.0	ns	1200	ns	100	100	0.6	ns	ns	ns	ns	200	400	4.0	0.2	2.0	0.5	2.0	0.05	1.0	1.0	0.65	5.0	5.0	0.1	10	10	0.02	2.0	0.05	10	0.024	0.05	0.01
Max (Unlithified)		27.5	3890	12.4	700	3470	0.16	18	10.7	<0.008	289	126	168	77.54	140	2050	0.865	0.032	0.24	<0.005	45.3	<0.002	<0.005	0.01	0.016	69.4	18	0.005	24.4	6.8	<0.002	<0.005	0.006	0.014	<0.005	0.016	<0.002
Min (Unlithified)		2	301	5.6	46	188	<0.05	<0.05	<0.05	<0.007	54.17	1.0	20	<1	4.1	23	0.119	<0.005	0.0094	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Bedrock)		28.1	7057	12.9	808	1709	0.35	2.04	1.13	<0.008	533	46	207	89	642	65	0.756	0.011	1.6	<0.005	1.88	<0.002	<0.005	<0.005	<0.005	3.82	1.6	<0.005	0.58	0.87	<0.002	0.007	0.01	0.006	0.0075	<0.01	<0.002
Min (Bedrock)		5.8	600	6.5	16	375	0.33	0.06	0.103	<0.007	45	2.1	29	<1	9	<10	0.174	<0.005	0.098	<0.004	<0.02	<0.002	<0.005	<0.005	<0.005	0.02	0.011	<0.005	<0.003	<0.003	<0.002	<0.005	<0.005	<0.005	<0.005	<0.01	<0.002
Max (Leachate)		17.7	6240	11.9		5120									109	2820					94.7					90.6	0.06		1.58	<0.005							
Min (Leachate)		13.3	1070	7.6		1130									12	495					36.3					0.57	<0.02		0.01	<0.005							
Leachate Wells in Old East, East and West Fly Ash Ponds (Screened in Fill/CCRs to be Abandoned)																																					
TPZ163	9/17/2013	15.6	1650	9.7		1410																				7.86			0.13								
TPZ163	11/20/2013	13.3	1350	8.8		1130									19	626					37.2						<0.02			<0.005							
TPZ163	2/18/2014	13.4	1070	7.6		1160									15	610					37.8						<0.02			<0.005							
TPZ163	6/12/2014	14.9	1340	9.5		1150									12	495					36.3						<0.02			<0.005							
TPZ167	9/17/2013	17.7	3830	9.9		3250																				0.57			0.01								
TPZ167	11/20/2013	16	2920	8.2		3010									100	1850					53						<0.02			<0.005							
TPZ167	2/18/2014	14.3	3540	7.7		3040									100	1840					54.5						<0.02			<0.005							
TPZ167	6/11/2014	17.2	4240	10		3590									101	1650					60						<0.02			<0.005							
TPZ168	9/17/2013	16.4	5330	10.8		3910																				90.6			1.58								
TPZ168	11/20/2013	14.4	5140	9.2		3680									109	2760					87.2						<0.02			<0.005							
TPZ168	2/18/2014	15.3	6020	8.1		5120									103	2820					78.8						0.06			<0.005							
TPZ168	6/11/2014	16.2	6240	11.9		4610									101	2240					94.7						0.055			<0.005							

[Cr By: JAZ 1/28/16, Chd By:GFF 1/29/16]

Notes:
(N) = NPDES permit monitoring well; * = added to NPDES well network
Red = Exceedance of Class II Groundwater Standard in wells screened in Unlithified Materials

APPENDIX E

STATISTICAL PROCEDURE FOR BACKGROUND

APPENDIX E
STATISTICAL PROCEDURE FOR CALCULATION OF BACKGROUND
Baldwin Fly Ash Pond System Closure
Groundwater Monitoring Plan
Baldwin Energy Complex, Baldwin, Illinois

Introduction

The purpose of the statistical calculations documented in this appendix is to determine the maximum background concentrations likely to occur upgradient of the Baldwin Old East and East Fly Ash ponds in the upper water bearing zone, which typically corresponds to the unlithified glacial materials. High predicted background concentrations relative to the Illinois Class II groundwater quality standards may suggest that downgradient concentrations for those parameters in the upper water bearing zone are due to a background source.

The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," March 2009, EPA 530/R-09-2007 (USEPA, 2009).

Compliance Data Operations - Limit Calculations

The range of potential background concentrations was statistically determined using parametric and non-parametric tolerance intervals. Tolerance intervals were chosen rather than prediction intervals because a tolerance interval makes no assumption about the future number of samples, while a prediction interval assumes a finite, and known, future number of samples.

The flow diagram (Figure E-1) outlines the logic flow for calculation of limits. Background values were calculated using parametric tolerance intervals for normally distributed data, and non-parametric tolerance intervals for data with no underlying distribution or with non-detect frequencies greater than 50 percent. Parametric tolerance intervals were calculated at a 95 percent coverage rate and a Type I individual comparison error level of 0.01 (i.e., false positive rate). Parameters with 100 percent non-detects were handled with the upper tolerance limit being set to the last Reporting Limit (RL).

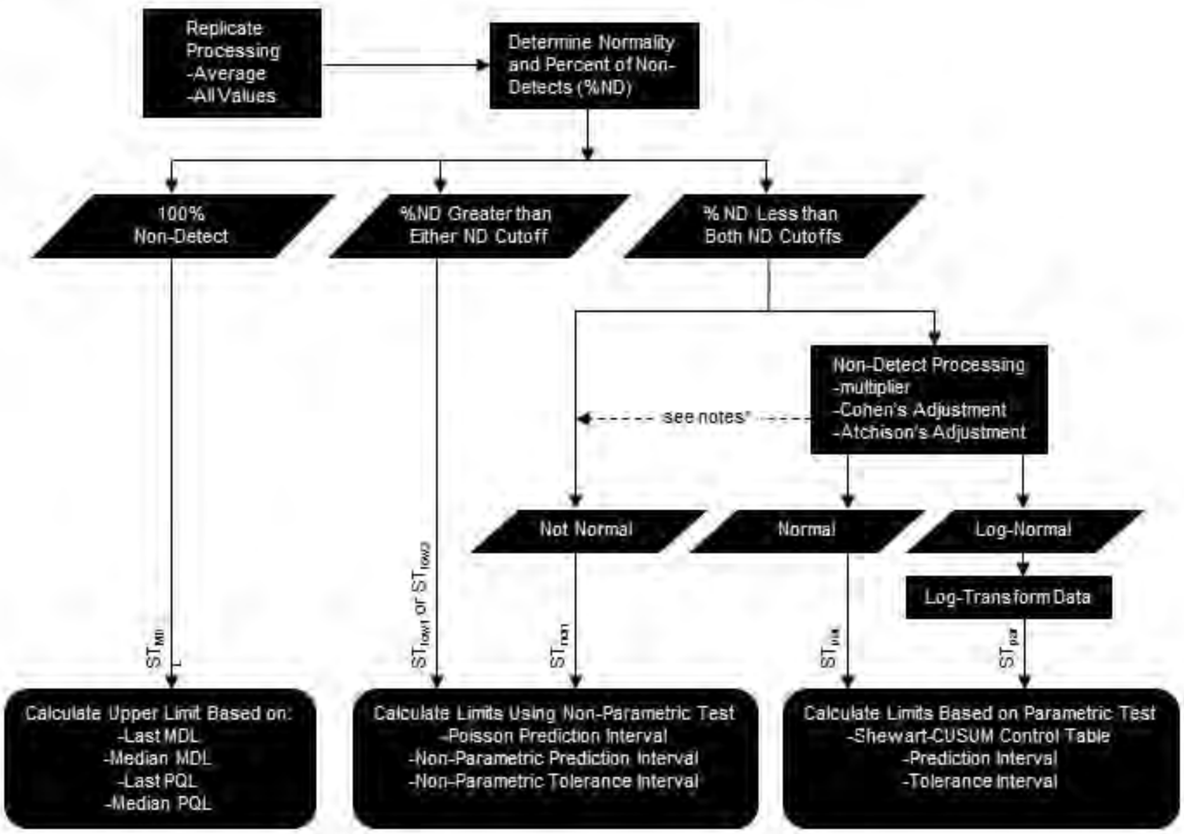
Statistical Data Evaluation and Results

The input dataset (Appendix E-1) for background calculations were evaluated for the quarterly data from monitoring wells MW-104S/SR and MW-104D/DR, collected from November 2010 through December 2015, for the inorganic parameters listed in 35 IAC 620.410(a) and excluding vanadium, radium-226, radium-228, and perchlorate. All water quality data were stored, prepared, and statistically analyzed using MANAGES™ Version 3.4.49 software (EPRI, March 2014).

A statistical summary of the background water quality data from MW-104S/SR and MW-104D/DR is provided in Appendix E-2, and includes the mean, median, minimum, maximum, standard deviation, Sen Slope trend, normality determination, and percent non-detects for the background dataset. The statistical analysis procedure inputs and results are provided in Appendix E-3.

Calculated background values for the tested inorganic constituents and pH are listed in the following Table E-1 along with the percent non-detects, normal or lognormal distribution, test method, and confidence level.

Figure E-1. Statistical Analysis Flowchart



Notes

** If the option for Cohen's or Atchison's adjustment is selected and neither is appropriate, then the non-normal comparison test will be used*

Table E-1. Tolerance Limits for Background Monitoring Wells MW-104S/SR and MW-104D/DR

Parameter	Count of Backround Results	Percent of Non Detects	Normal/ Lognormal	Test	Confidence Level	Upper Limit	Lower Limit
Ag, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
As, diss, mg/L	12	66.67	No/No	STlow2	N/A	0.032	
Ba, diss, mg/L	12	0.00	No/Yes	Stpar	99.00	0.621	
Be, diss, mg/L	12	100.00	Yes/No	STmdl	N/A	0.004	
B, diss, mg/L	26	46.20	No/No	Stnon	73.65	0.237	
Cd, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.002	
Cl, diss, mg/L	28	0.00	No/No	STnon	76.22	58.7	
CN, total, mg/L	12	100.00	No/No	STmdl	N/A	0.008	
Co, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
Cu, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
Cr, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
F, diss, mg/L	12	0.00	Yes/Yes	STpar	99.00	0.793	
Hg, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.002	
Fe, diss, mg/L	26	34.62	No/No	STnon	73.65	18.0	
Fe, tot, mg/L	10	0.00	Yes/Yes	STpar	99.00	11.0	
Mn, diss, mg/L	26	0.00	No/Yes	STpar	99.00	48.8	
Mn, tot, mg/L	10	0.00	Yes/Yes	STpar	99.00	8.2	
Ni, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
NO3, diss, mg/L	12	25.00	No/Yes	STpar	99.00	2.25	
Pb, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
pH (field), std	28	0.00	Yes/Yes	Stpar	99.00	7.55	6.06
Sb, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.005	
Se, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.010	
SO4, diss, mg/L	28	0.00	Yes/Yes	STpar	99.00	328	
TDS, mg/L	28	0.00	Yes/Yes	STpar	99.00	999	
Tl, diss, mg/L	12	100.00	No/No	STmdl	N/A	0.002	
Zn, diss, mg/L	12	83.33	No/N9o	STlow2	45.96	0.009	

* Key to Tests

STmdl = Comparison method if all background results are non-detect = Last MDL

STpar = Parametric Tolerance Interval on background

STlow1 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%)

STnon = Non-Parametric Tolerance Interval on background

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Arsenic, dissolved, mg/L	Barium, dissolved, mg/L	Beryllium, dissolved, mg/L	Boron, dissolved, mg/L	Cadmium, dissolved, mg/L	pH (field), SU
MW104D	11/16/2010		<0.005	0.030	<0.005	<0.020	<0.002	6.980
	03/23/2011		<0.005	0.031	<0.005	0.021	<0.002	7.010
	06/07/2011		<0.005	0.033	<0.005	0.019	<0.002	6.880
MW104DR	09/13/2011		<0.005	0.042	<0.004	<0.050	<0.002	6.710
	12/08/2011		<0.005	0.038	<0.004	<0.050	<0.002	6.790
	03/08/2012		<0.005	0.035	<0.004	<0.050	<0.002	7.650
	09/16/2013							6.900
	11/20/2013					0.020		6.820
	02/18/2014					<0.020		6.750
	06/11/2014					<0.020		6.990
	03/25/2015					<0.020		7.110
	06/24/2015					<0.020		6.990
	09/25/2015					<0.020		7.090
	11/10/2015					<0.020		6.800
MW104S	11/16/2010		0.032	0.150	<0.005	0.160	<0.002	6.580
	03/23/2011		0.008	0.090	<0.005	0.146	<0.002	6.550
	06/07/2011		0.012	0.240	<0.005	0.220	<0.002	6.500
MW104SR	09/13/2011		0.006	0.059	<0.004	<0.050	<0.002	6.440
	12/08/2011		<0.005	0.076	<0.004	<0.050	<0.002	6.900
	03/08/2012		<0.005	0.097	<0.004	0.060	<0.002	6.880
	09/16/2013							6.720
	11/20/2013					0.040		6.710
	02/18/2014					0.050		6.730
	06/11/2014					0.147		6.500
	03/25/2015					0.086		6.790
	06/24/2015					0.178		6.650
	09/25/2015					0.237		6.740
	11/10/2015					0.149		6.320

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Chloride, dissolved, mg/L	Chromium, dissolved, mg/L	Cobalt, dissolved, mg/L	Copper, dissolved, mg/L	Cyanide, total, mg/L	Fluoride, dissolved, mg/L
MW104D	11/16/2010		15.700	<0.005	<0.0050	<0.005	<0.007	0.469
	03/23/2011		16.749	<0.005	<0.0050	<0.005	<0.007	0.422
	06/07/2011		18.500	<0.005	<0.0050	<0.005	<0.007	0.379
MW104DR	09/13/2011		18.000	<0.005	<0.0050	<0.005	<0.007	0.370
	12/08/2011		18.000	<0.005	<0.0050	<0.005	<0.007	0.400
	03/08/2012		24.000	<0.005	<0.0050	<0.005	<0.008	0.310
	09/16/2013		20.000					
	11/20/2013		16.000					
	02/18/2014		18.000					
	06/11/2014		18.000					
	03/25/2015		21.000					
	06/24/2015		23.000					
	09/25/2015		24.000					
	11/10/2015		25.000					
MW104S	11/16/2010		33.700	<0.005	<0.0050	<0.005	<0.007	0.629
	03/23/2011		56.480	<0.005	<0.0050	<0.005	<0.007	0.401
	06/07/2011		58.700	<0.005	<0.0050	<0.005	<0.008	0.561
MW104SR	09/13/2011		32.000	<0.005	<0.0050	<0.005	<0.007	0.540
	12/08/2011		31.000	<0.005	<0.0050	<0.005	<0.007	0.523
	03/08/2012		34.000	<0.005	<0.0050	<0.005	<0.008	0.549
	09/16/2013		19.000					
	11/20/2013		19.000					
	02/18/2014		18.000					
	06/11/2014		16.000					
	03/25/2015		14.000					
	06/24/2015		23.000					
	09/25/2015		19.000					
	11/10/2015		19.000					

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Iron, dissolved, mg/L	Iron, total, mg/L	Lead, dissolved, mg/L	Manganese, dissolved, mg/L	Manganese, total, mg/L	Mercury, dissolved, mg/L
MW104D	11/16/2010		<0.010		<0.005	0.020		<0.0020
	03/23/2011		<0.010		<0.005	0.040		<0.0020
	06/07/2011		<0.010		<0.005	0.013		<0.0020
MW104DR	09/13/2011		0.024		<0.005	0.420		<0.0020
	12/08/2011		0.025		<0.005	0.280		<0.0020
	03/08/2012		0.011		<0.005	0.210		<0.0020
	09/16/2013			4.820			0.930	
	11/20/2013		0.070			0.290		
	02/18/2014		<0.020			0.040		
	06/11/2014		0.028			0.123		
	03/25/2015		<0.020	0.542		0.092	0.177	
	06/24/2015		<0.020	0.767		0.130	0.206	
	09/25/2015		<0.020	0.744		0.150	0.224	
	11/10/2015		<0.020	0.333		0.172	0.234	
MW104S	11/16/2010		18.000		<0.005	6.800		<0.0020
	03/23/2011		1.852		<0.005	3.014		<0.0020
	06/07/2011		14.000		<0.005	4.000		<0.0020
MW104SR	09/13/2011		0.080		<0.005	1.200		<0.0020
	12/08/2011		0.190		<0.005	1.100		<0.0020
	03/08/2012		0.610		<0.005	1.900		<0.0020
	09/16/2013			3.180			4.970	
	11/20/2013		1.440			2.200		
	02/18/2014		<0.020			0.590		
	06/11/2014		0.806			1.690		
	03/25/2015		0.207	0.476		2.100	2.660	
	06/24/2015		3.740	7.120		3.100	3.460	
	09/25/2015		3.350	3.620		2.520	2.540	
	11/10/2015		1.190	0.979		3.090	2.780	

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Nickel, dissolved, mg/L	Nitrate nitrogen, diss, deg. C	Residue, total filtrable, mg/L	Selenium, dissolved, mg/L	Silver, dissolved, mg/L	Sulfate, dissolved, mg/L
MW104D	11/16/2010		<0.005	0.07	785	<0.010	<0.005	245.000
	03/23/2011		<0.005	0.07	801	<0.010	<0.005	241.400
	06/07/2011		<0.005	<0.05	776	<0.010	<0.005	250.300
MW104DR	09/13/2011		<0.005	0.07	768	<0.010	<0.005	225.000
	12/08/2011		<0.005	0.06	739	<0.010	<0.005	222.000
	03/08/2012		<0.005	0.55	724	<0.010	<0.005	214.000
	09/16/2013				676			198.000
	11/20/2013				630			194.000
	02/18/2014				652			175.000
	06/11/2014				676			186.000
	03/25/2015				630			179.000
	06/24/2015				718			187.000
	09/25/2015				634			178.000
	11/10/2015				644			195.000
MW104S	11/16/2010		<0.005	<0.05	943	<0.010	<0.005	148.000
	03/23/2011		<0.005	<0.05	742	<0.010	<0.005	168.800
	06/07/2011		<0.005	0.07	824	<0.010	<0.005	114.400
MW104SR	09/13/2011		<0.005	0.37	909	<0.010	<0.005	164.000
	12/08/2011		<0.005	0.14	965	<0.010	<0.005	237.000
	03/08/2012		<0.005	0.09	886	<0.010	<0.005	140.000
	09/16/2013				724			43.000
	11/20/2013				770			134.000
	02/18/2014				792			138.000
	06/11/2014				792			68.000
	03/25/2015				770			100.000
	06/24/2015				880			47.000
	09/25/2015				744			23.000
	11/10/2015				732			57.000

Baldwin Ash Ponds - Upgradient Monitoring Wells: Upper Water-Bearing Zone (Unlitified Materials)

Date Range: 11/01/2010 to 12/31/2015

Well Id	Date Sampled	Lab Id	Thallium, dissolved, mg/L	Zinc, dissolved, mg/L
MW104D	11/16/2010		<0.002	<0.005
	03/23/2011		<0.002	<0.005
	06/07/2011		<0.002	<0.005
MW104DR	09/13/2011		<0.002	<0.005
	12/08/2011		<0.002	<0.005
	03/08/2012		<0.002	<0.005
MW104S	11/16/2010		<0.002	0.009
	03/23/2011		<0.002	<0.005
	06/07/2011		<0.002	0.009
MW104SR	09/13/2011		<0.002	<0.005
	12/08/2011		<0.002	<0.005
	03/08/2012		<0.002	<0.005

Appendix E-2

Baldwin Ash Ponds: Statistical Summary for Pooled Upgradient Monitoring Well Locations

User Supplied Information

Date Range: 11/01/2010 to 12/31/2015 **Option for LT Pts: x 0.5**

Pooled Locations: MW104D,MW104DR,MW104S,MW104SR

Parameter	Units	Count	Mean	Median	Maximum	Minimum	Std Dev	Sen Slope Units/yr	Normal / Log Normal	% of Non-Detects
Antimony, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Arsenic, dissolved	mg/L	12	0.006	0.003	0.032	0.003	0.009	0.000	No / No	66.67
Barium, dissolved	mg/L	12	0.077	0.051	0.240	0.030	0.063	0.023	No / Yes	0.00
Beryllium, dissolved	mg/L	12	0.002	0.002	0.003	0.002	0.000	0.000	No / No	100.00
Boron, dissolved	mg/L	26	0.066	0.025	0.237	0.010	0.073	0.010	No / No	46.15
Cadmium, dissolved	mg/L	12	0.001	0.001	0.001	0.001	0.000	0.000	No / Yes	100.00
Chloride, dissolved	mg/L	28	23.887	19.000	58.700	14.000	10.977	0.263	No / No	0.00
Chromium, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Cobalt, dissolved	mg/L	12	0.0025	0.0025	0.0025	0.0025	0.0000	0.0000	No / No	100.00
Copper, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Cyanide, total	mg/L	12	0.004	0.004	0.004	0.004	0.000	0.000	No / No	100.00
Fluoride, dissolved	mg/L	12	0.463	0.446	0.629	0.310	0.097	0.019	Yes / Yes	0.00
Iron, dissolved	mg/L	26	1.758	0.049	18.000	0.005	4.349	0.046	No / No	34.62
Iron, total	mg/L	10	2.258	0.873	7.120	0.333	2.331	0.401	No / Yes	0.00
Lead, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Manganese, dissolved	mg/L	26	1.357	0.505	6.800	0.013	1.651	0.476	No / Yes	0.00
Manganese, total	mg/L	10	1.818	1.735	4.970	0.177	1.697	1.139	Yes / No	0.00
Mercury, dissolved	mg/L	12	0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	No / Yes	100.00
Nickel, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00
Nitrate nitrogen, diss	deg. C	12	0.130	0.068	0.554	0.025	0.163	0.076	No / Yes	25.00
pH (field)	SU	28	6.803	6.790	7.650	6.320	0.258	-0.049	Yes / Yes	0.00
Residue, total filtrable	mg/L	28	761.643	756.000	965.000	630.000	92.687	0.000	Yes / Yes	0.00
Selenium, dissolved	mg/L	12	0.005	0.005	0.005	0.005	0.000	0.000	No / No	100.00
Silver, dissolved	mg/L	12	0.003	0.003	0.003	0.003	0.000	0.000	No / No	100.00

Shapiro-Wilk Normality test performed at 0.05 significance level.

Baldwin Ash Ponds: Statistical Summary for Pooled Upgradient Monitoring Well Locations

User Supplied Information

Date Range: 11/01/2010 to 12/31/2015 **Option for LT Pts: x 0.5**

Pooled Locations: MW104D,MW104DR,MW104S,MW104SR

Parameter	Units	Count	Mean	Median	Maximum	Minimum	Std Dev	Sen Slope Units/yr	Normal / Log Normal	% of Non-Detects
Sulfate, dissolved	mg/L	28	159.711	176.500	250.300	23.000	65.781	-35.529	Yes / No	0.00
Thallium, dissolved	mg/L	12	0.001	0.001	0.001	0.001	0.000	0.000	No / Yes	100.00
Zinc, dissolved	mg/L	12	0.004	0.003	0.009	0.003	0.003	0.000	No / No	83.33

Shapiro-Wilk Normality test performed at 0.05 significance level.

Appendix E-3

Baldwin Ash Pond System: Background Statistics- Upper Water Bearing Zone (Unlithified Materials)

Background Date Range: 11/01/2010 to 12/31/2015
Background Locations: MW104D,MW104DR,MW104S,MW104SR

Compliance Date Range: 11/01/2010 to 04/01/2015
Compliance Locations: MW104SR

Comparison Method if all Background Results are Non-Detect:	STmdl = Last MDL
Statistical Test for Parametric Background Data Distributions:	STpar = Parametric Tolerance Interval on Background
Statistical Test for Cases with High Percentage of Non-Detect Background Data:	STlow1 = Non-Parametric Prediction Interval on Background (ND Frequency > 50%)
Statistical Test for Cases with High Percentage of Non-Detect Background Data:	STlow2 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%)
Statistical Test for Non-Parametric Background Data Distributions:	STnon = Non-Parametric Tolerance Interval on background
Background Comparison:	Interwell
Number of Verification Samples:	0
Default Type 1 Individual Comparison Error Level (False Positive Rate) for tests other than Prediction Interval	0.01
Non-Detect Processing (Parametric Tests):	<=15% using MDL * 0.5 >15% using MDL * 0.5
Non-Detect Processing (All Other):	<=50% using MDL * 0.5 >50% using MDL * 0.5

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Antimony, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Arsenic, dissolved, mg/L	09/13/2011	12	66.67	No/No	STlow2	45.96	0.032		0.006	No	
		12/08/2011	12	66.67	No/No		45.96	0.032		<0.005	No	
		03/08/2012	12	66.67	No/No		45.96	0.032		<0.005	No	
MW104SR	Barium, dissolved, mg/L	09/13/2011	12	0.00	No/Yes	STpar	99.00	0.621		0.059	No	
		12/08/2011	12	0.00	No/Yes		99.00	0.621		0.076	No	
		03/08/2012	12	0.00	No/Yes		99.00	0.621		0.097	No	
MW104SR	Beryllium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.004		<0.004	No	
		12/08/2011	12	100.00	No/No		N/A	0.004		<0.004	No	
		03/08/2012	12	100.00	No/No		N/A	0.004		<0.004	No	
MW104SR	Boron, dissolved, mg/L	09/13/2011	26	46.15	No/No	STnon	73.65	0.237		<0.050	No	
		12/08/2011	26	46.15	No/No		73.65	0.237		<0.050	No	
		03/08/2012	26	46.15	No/No		73.65	0.237		0.060	No	
		11/20/2013	26	46.15	No/No		73.65	0.237		0.040	No	
		02/18/2014	26	46.15	No/No		73.65	0.237		0.050	No	
		06/11/2014	26	46.15	No/No		73.65	0.237		0.147	No	
		03/25/2015	26	46.15	No/No		73.65	0.237		0.086	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Cadmium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.002		<0.002	No	
		12/08/2011	12	100.00	No/No		N/A	0.002		<0.002	No	
		03/08/2012	12	100.00	No/No		N/A	0.002		<0.002	No	
MW104SR	Chloride, dissolved, mg/L	09/13/2011	28	0.00	No/No	STnon	76.22	58.700		32.000	No	
		12/08/2011	28	0.00	No/No		76.22	58.700		31.000	No	
		03/08/2012	28	0.00	No/No		76.22	58.700		34.000	No	
		09/16/2013	28	0.00	No/No		76.22	58.700		19.000	No	
		11/20/2013	28	0.00	No/No		76.22	58.700		19.000	No	
		02/18/2014	28	0.00	No/No		76.22	58.700		18.000	No	
		06/11/2014	28	0.00	No/No		76.22	58.700		16.000	No	
		03/25/2015	28	0.00	No/No		76.22	58.700		14.000	No	
MW104SR	Chromium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Cobalt, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.0050		<0.0050	No	
		12/08/2011	12	100.00	No/No		N/A	0.0050		<0.0050	No	
		03/08/2012	12	100.00	No/No		N/A	0.0050		<0.0050	No	
MW104SR	Copper, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Cyanide, total, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.008		<0.007	No	
		12/08/2011	12	100.00	No/No		N/A	0.008		<0.007	No	
		03/08/2012	12	100.00	No/No		N/A	0.008		<0.008	No	
MW104SR	Fluoride, dissolved, mg/L	09/13/2011	12	0.00	Yes/Yes	STpar	99.00	0.793		0.540	No	
		12/08/2011	12	0.00	Yes/Yes		99.00	0.793		0.523	No	
		03/08/2012	12	0.00	Yes/Yes		99.00	0.793		0.549	No	
MW104SR	Iron, dissolved, mg/L	09/13/2011	26	34.62	No/No	STnon	73.65	18.000		0.080	No	
		12/08/2011	26	34.62	No/No		73.65	18.000		0.190	No	
		03/08/2012	26	34.62	No/No		73.65	18.000		0.610	No	
		11/20/2013	26	34.62	No/No		73.65	18.000		1.440	No	
		02/18/2014	26	34.62	No/No		73.65	18.000		<0.020	No	
		06/11/2014	26	34.62	No/No		73.65	18.000		0.806	No	
		03/25/2015	26	34.62	No/No		73.65	18.000		0.207	No	
MW104SR	Iron, total, mg/L	09/16/2013	10	0.00	Yes/Yes	STpar	99.00	10.986		3.180	No	
		03/25/2015	10	0.00	Yes/Yes		99.00	10.986		0.476	No	
MW104SR	Lead, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Manganese, dissolved, mg/L	09/13/2011	26	0.00	No/Yes	STpar	99.00	48.767		1.200	No	
		12/08/2011	26	0.00	No/Yes		99.00	48.767		1.100	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Manganese, dissolved, mg/L	03/08/2012	26	0.00	No/Yes	STpar	99.00	48.767		1.900	No	
		11/20/2013	26	0.00	No/Yes		99.00	48.767		2.200	No	
		02/18/2014	26	0.00	No/Yes		99.00	48.767		0.590	No	
		06/11/2014	26	0.00	No/Yes		99.00	48.767		1.690	No	
		03/25/2015	26	0.00	No/Yes		99.00	48.767		2.100	No	
MW104SR	Manganese, total, mg/L	09/16/2013	10	0.00	Yes/Yes	STpar	99.00	8.173		4.970	No	
		03/25/2015	10	0.00	Yes/Yes		99.00	8.173		2.660	No	
MW104SR	Mercury, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.0020		<0.0020	No	
		12/08/2011	12	100.00	No/No		N/A	0.0020		<0.0020	No	
		03/08/2012	12	100.00	No/No		N/A	0.0020		<0.0020	No	
MW104SR	Nickel, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Nitrate nitrogen, diss, deg. C	09/13/2011	12	25.00	No/Yes	STpar	99.00	2.25		0.37	No	
		12/08/2011	12	25.00	No/Yes		99.00	2.25		0.14	No	
		03/08/2012	12	25.00	No/Yes		99.00	2.25		0.09	No	
MW104SR	Nitrate nitrogen, total, mg/L	03/25/2015	8	25.00	Yes/Yes	STpar	99.00	2.264		0.058	No	
MW104SR	pH (field), SU	09/13/2011	28	0.00	Yes/Yes	STpar	99.00	7.547	6.059	6.440	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	pH (field), SU	12/08/2011	28	0.00	Yes/Yes	STpar	99.00	7.547	6.059	6.900	No	
		03/08/2012	28	0.00	Yes/Yes		99.00	7.547	6.059	6.880	No	
		09/16/2013	28	0.00	Yes/Yes		99.00	7.547	6.059	6.720	No	
		11/20/2013	28	0.00	Yes/Yes		99.00	7.547	6.059	6.710	No	
		02/18/2014	28	0.00	Yes/Yes		99.00	7.547	6.059	6.730	No	
		06/11/2014	28	0.00	Yes/Yes		99.00	7.547	6.059	6.500	No	
		03/25/2015	28	0.00	Yes/Yes		99.00	7.547	6.059	6.790	No	
MW104SR	Residue, total filtrable, mg/L	09/13/2011	28	0.00	Yes/Yes	STpar	99.00	999		909	No	
		12/08/2011	28	0.00	Yes/Yes		99.00	999		965	No	
		03/08/2012	28	0.00	Yes/Yes		99.00	999		886	No	
		09/16/2013	28	0.00	Yes/Yes		99.00	999		724	No	
		11/20/2013	28	0.00	Yes/Yes		99.00	999		770	No	
		02/18/2014	28	0.00	Yes/Yes		99.00	999		792	No	
		06/11/2014	28	0.00	Yes/Yes		99.00	999		792	No	
		03/25/2015	28	0.00	Yes/Yes		99.00	999		770	No	
MW104SR	Selenium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.010		<0.010	No	
		12/08/2011	12	100.00	No/No		N/A	0.010		<0.010	No	
		03/08/2012	12	100.00	No/No		N/A	0.010		<0.010	No	
MW104SR	Silver, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.005		<0.005	No	
		12/08/2011	12	100.00	No/No		N/A	0.005		<0.005	No	
		03/08/2012	12	100.00	No/No		N/A	0.005		<0.005	No	
MW104SR	Sulfate, dissolved, mg/L	09/13/2011	28	0.00	Yes/No	STpar	99.00	327.885		164.000	No	

Compliance Location	Parameter	Sample Date	Count Of Bkg Results	Percent of Non detects	Normal / Lognormal	Test	Confidence Level	Upper Limit	Lower Limit	Analysis Result	Exceedance	Trend
MW104SR	Sulfate, dissolved, mg/L	12/08/2011	28	0.00	Yes/No	STpar	99.00	327.885		237.000	No	
		03/08/2012	28	0.00	Yes/No		99.00	327.885		140.000	No	
		09/16/2013	28	0.00	Yes/No		99.00	327.885		43.000	No	
		11/20/2013	28	0.00	Yes/No		99.00	327.885		134.000	No	
		02/18/2014	28	0.00	Yes/No		99.00	327.885		138.000	No	
		06/11/2014	28	0.00	Yes/No		99.00	327.885		68.000	No	
		03/25/2015	28	0.00	Yes/No		99.00	327.885		100.000	No	
MW104SR	Thallium, dissolved, mg/L	09/13/2011	12	100.00	No/No	STmdl	N/A	0.002		<0.002	No	
		12/08/2011	12	100.00	No/No		N/A	0.002		<0.002	No	
		03/08/2012	12	100.00	No/No		N/A	0.002		<0.002	No	
MW104SR	Zinc, dissolved, mg/L	09/13/2011	12	83.33	No/No	STlow2	45.96	0.009		<0.005	No	
		12/08/2011	12	83.33	No/No		45.96	0.009		<0.005	No	
		03/08/2012	12	83.33	No/No		45.96	0.009		<0.005	No	

APPENDIX F

GROUNDWATER SAMPLING PROTOCOL

Groundwater Sampling Protocol

The following procedures shall be used in sampling groundwater at the site. This sampling protocol shall apply to the routine quarterly (or modified semi-annual or annual) sampling events. A sample collector's worksheet, comparable to the one located in Exhibit 1, may be used for noting relevant information in regard to each well.

Water Levels

Water levels shall be taken in each well prior to purging and/or sampling. Water levels should be taken as close together as practical, to prevent any time distortion of the water surface data. The following steps shall be followed to obtain accurate water level readings:

1. Note the general condition of the monitoring well on the worksheet. This shall include, but is not limited to the condition of the casing, the lock, evidence of tampering, condition of the pad, and any standing water.
2. Remove the lock and open the monitoring well. Note the condition of the interior of the casing and the condition of the well cap and riser. Open the cap, taking care not to allow dirt or foreign material into the monitoring well.
3. The technician shall rinse the probe and cable of the water level meter with decon water.
4. Slowly lower the probe into the monitoring well until the meter indicates the water surface has been reached.
5. Note the depth to water (to the nearest 0.01 ft) and the time on the worksheet.
6. Lower the probe to the bottom of well. (If a dedicated pump is installed in the well, skip this step). Note the well depth on the worksheet. The depth of the well will be measured on an annual basis, at wells that do not contain dedicated pumps. The depth of wells with dedicated pumps will be measured at least once every 5 years, or whenever the pump is removed.
7. Slowly remove the probe from the well. Rinse the probe and line with decon water.
8. Replace cap. Close and lock the well. Proceed to the next well, and repeat.

Purging of Monitoring Well – Pump Method

After all water level measurements have been taken, the monitoring wells shall be purged to provide a representative sample. Each groundwater monitoring well shall be purged by using a dedicated pump. The pump construction shall consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells).

Purging shall be conducted utilizing a "low-flow" or minimal drawdown technique. Flow rates for this technique will typically fall below 0.5 liters/minutes, with an overall goal of not reducing the water level in the monitoring well by more than 0.3 ft during purging. Water levels should be checked frequently to ensure that the drawdown in the well does not exceed the 0.3-ft limits. Every 3 minutes to 5 minutes, readings shall be taken on the following water quality indicators to determine if a representative water sample is available.

- pH (in SU),
- Specific Conductance (in µmhos/cm or µS/cm),
- Temperature (in ºF),
- And, it is suggested, at least one of the following:
  - Redox Potential (in mV);
  - Dissolved Oxygen (in mg/L); and/or
  - Turbidity (in NTU).

The water quality indicators will be considered stabilized when the following tolerances are reached after three consecutive readings:

- pH.................................... ±0.05 SU
- Specific Conductance ...... ±5 percent
- Temperature.................... ±0.5ºF
- Redox Potential .... ±10 percent
- Dissolved Oxygen........... ±10 percent
- Turbidity......................... ±10 percent

Slow recovering wells require special consideration. If a well is dry, or is purged below the bottom of the pump intake, the well will be allowed to recharge for at least 12 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed, and any other parameters considered to be relevant.

Purging of Monitoring Well – Bailer Method

Purging and sample collection with a bailer shall be performed in the event of a non-functioning pump or from a well that does not have a dedicated pump installed. A sample shall be collected utilizing a factory packaged, clean, disposable bailer with an appropriate length of new, clean rope attached.

Calculate the number of bailer volumes of water needed to remove one (1) well volume of water.

Well Volume Calculations (2-inch well):

Schedule 40 PVC has an inside diameter of 2.067 inches.

$\therefore$ ((2.067 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0233 ft^3/ft of water.

0.0233 ft^3/ft • 7.48 gallons/ft^3 = 0.174 gallon/ft

Schedule 5 Stainless Steel (304 or 316) has an inside diameter of 2.245 inches.

$\therefore$ ((2.245 inches/12 inches/ft)/2)^2 • π • 1 ft of water = 0.0275 ft^3/ft of water.

0.0275 ft^3/ft • 7.48 gallons/ft^3 = 0.206 gallon/ft

Volume of well (in gallons) = well type gallon/ft • (DTB - DTW); where,
DTB $\equiv$ depth to bottom of well (from measuring point), and
DTW $\equiv$ depth to water (from measuring point)

Bailer Volumes:

Disposable bailer volumes will vary by type and manufacturer. Volume information should be obtained before going to the site. For comparison, a 3 ft stainless steel bailer has a volume of approximately 1220 cc or 0.322 gallon and a 5 ft PVC bailer of approximately 1085 cc or 0.287 gallon.

Open monitoring well, being careful that no potential contaminant enters the well.

Remove one (1) bailer volume of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet. (Turbidity, redox potential and dissolved oxygen will vary considerably due to the agitation a bailer will cause in the well. Testing for these parameters is not recommended with this method.)

Remove one-half (½) gallon of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet.

Remove ½ to 1 gallon of water. Test pH, specific conductance and temperature. Record data on worksheet.

Repeat until pH, specific conductance and temperature stabilize or three (3) well volumes of water have been removed.

If the monitoring well becomes dry, or there is insufficient water to obtain all necessary samples, the monitoring well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers are filled or the well becomes dry. Notes shall be kept on the worksheet regarding water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.

If there is sufficient water volume in the monitoring well to obtain all samples, sample collection shall begin at this time.

Sample Collection Order

Samples shall be collected starting at the monitoring well with the least likelihood for contamination. Sampling shall proceed from the well with the lowest potential for contamination to the well with the highest potential for contamination.

Field Measurements

General

Upon arrival at each groundwater monitoring well, the technician shall note on the sampler's worksheet or in a field notebook the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. (Note: Any observers shall need at a minimum, the same personal protective gear as the members of the sample team.)

Establish a "clean area" near the monitoring well where the sample containers and equipment can be stored while not in use. Every effort should be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable, plastic tarp can be used as a ground cover to prevent potential contamination of the sample containers and equipment. Typically, the back of the field vehicle will be used as the "clean area".

Any non-dedicated sampling equipment (meter probes, thermometers, etc.) shall be washed in a commercial, laboratory cleaner (Alconox®, Liquinox®, or equivalent), and thoroughly rinsed in decon water before each use. Calibration shall be performed at each new monitoring location after the initial decontamination. After use, each device shall be powered down (if necessary) decontaminated, and stored in its manufacturer-approved container.

Temperature

Obtain a water sample from the well. Place the sample aliquot in a disposable container, insert the thermometer (or electronic probe), wait until the readings have stabilized, and record the temperature on the worksheet. Temperature for a glass thermometer should be noted to the nearest degree Fahrenheit (1ºF). For electronic thermometers (thermocouples), temperature should be noted to the nearest tenth degree Fahrenheit (0.1ºF). The thermometer or probe shall be cleaned and rinsed with decon water after use.

pH

Confirm calibration of the instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with decon water. Obtain a sample from the well and place the probe in sample aliquot. Note the pH and record on the sample worksheet. Note pH readings to the nearest tenth unit (0.1).

Specific Conductance

Confirm calibration of the instrument by comparing against an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse the probe with decon water. Obtain a sample from the well and place the probe in sample aliquot. Note the specific conductance and record on the sample worksheet. Specific conductance should be noted to the nearest micromhos per centimeter (µmhos/cm) or microSiemens per centimeter (µS/cm).

Sample Collection Procedures

Jars and vials may ship pre-labeled from the laboratory, identifying the analysis and preservative for each type of sample. Dependent upon circumstances, sample containers may be prepared by non-laboratory personnel. If so, this should be noted on the sample worksheet or in the field notebook.

A technician shall remove a sample container from the cooler, affix a label, and in indelible, waterproof ink write the well number and/or sample I.D., the facility name, the sample collection date and time, the type of sample in the container, and the sample collector's name. A technician shall organize the containers in the following sampling order:

- Metals and Minerals (dissolved)
- Anions (dissolved)
- Total Dissolved Solids (TDS)
- Cyanides (total)

Dissolved parameters include dissolved metals and minerals, total dissolved solids (TDS), and nitrogen should be field filtered. Samples should be filtered using a 0.45-micron filter attached to the sample pump line. Other filter apparatus may be utilized as long as Illinois EPA guidelines are followed. Filters should be replaced no less frequently than at each new well, and may need to be replaced more often if flow is restricted due to particulate matter in the sample water.

Transportation of Monitoring Samples

Sample Preservation Techniques

The preservation techniques utilized in the groundwater samples will typically adhere to those listed in *Handbook for Sampling and Sample Preservation of Water and Wastewater*, U.S. EPA, EPA-600/4-82-029, September 1982 and/or *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, EPA/530/SW-846, 3$^{rd.}$ Edition, Final Update IV (January 2008).

Transportation of Samples

Samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests, or coolers. The shipping containers should be sturdy, and if samples are contained in glass bottles, dividers and/or bubble wrap should be used to restrict potential breakage. All samples will be packed in ice or a packaged refrigerant as necessary for proper preservation. Samples should be packed to maintain sample temperatures as close to 4ºC (degrees Celsius) or 39ºF as possible from the time the samples are collected to the time the samples are received by the laboratory. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

All samples shall be accompanied by a chain-of-custody record. The sampler shall retain a copy of the record and forward the original with the samples to the analytical laboratory. Once the laboratory has received the samples, a representative from the laboratory is to complete the record, retain the original and return a copy with the chemical analysis reports to the sampler. The chain-of-custody shall contain the facility name, the wells sampled, time and date of sampling, members of the sampling party, type of samples (i.e. water, soil, leachate, etc.), number of sample bottles, requested analysis, overnight courier, etc. A sample chain-of-custody record is provided in Exhibit 2.

Attachments
Exhibit 1: Groundwater Sampling Worksheet
Exhibit 2: Example Chain-of-Custody Record

ATTACHMENT J

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 I.A.C. Section 845.430 – Slope Maintenance Documentation for Fly Ash System at Baldwin Power Plant

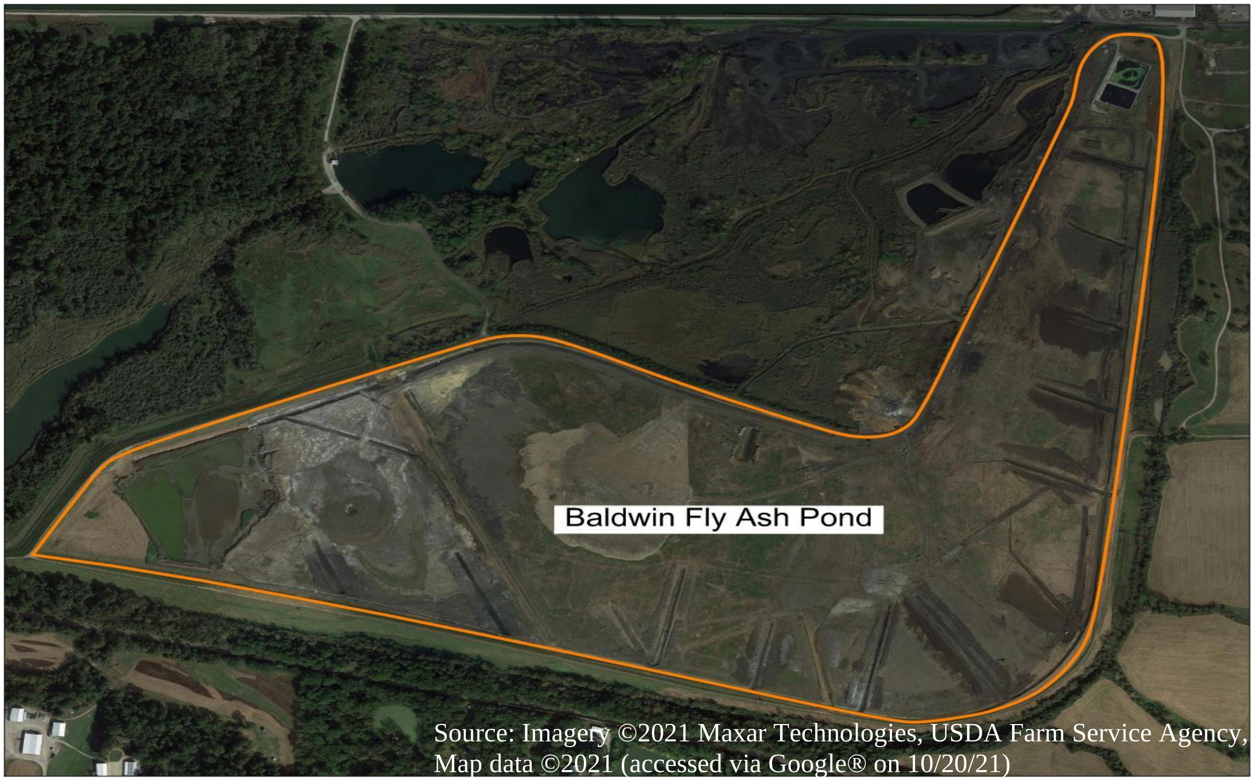
Dynegy Midwest Generation, LLC (DMG) operates the coal-fired Baldwin Power Plant located in Randolph County near Baldwin, Illinois. The Baldwin Fly Ash System is a closed inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the Baldwin Fly Ash System are found in 35 Ill. Admin. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

Pursuant to Part 845, Section 845.230(d)(3)(C), the initial operating permit application for inactive closed CCR surface impoundments that have completed an Agency approved closure before prior to July 30, 2021, must contain documentation that the CCR surface impoundment, if not incised, will be operated, and maintained with one of the forms of slope protection specified in Section 845.430. This statement addresses the requirements of Part 845, Section 845.430 Slope Maintenance, which states:

> *<u>Section 845.430:</u> The slopes and pertinent surrounding areas of the CCR surface impoundment must be designed, constructed, operated, and maintained with one of the forms of slope protection specified in subsection (a) that meets all the performance standards of subsection (b).*
>
> *<u>Section 845.430(a):</u> Slope protection must consist of one of the following: 1) A vegetative cover consisting of grassy vegetation; 2) An engineered cover consisting of a single form or combination of forms of engineered slope protection measures; or 3) A combination of the forms of cover specified in subsections (a)(1) or (a)(2).*
>
> *<u>Section 845.430(b):</u> Any form of cover for slope protection must meet the following performance standards: 1) The cover must be installed and maintained on the slopes and pertinent surrounding areas of the CCR surface impoundment; 2) The cover must provide protection against surface erosion, wave action, and adverse effects of rapid drawdown; 3) The cover must be maintained to allow for the observation of, and access to, the slopes and pertinent surrounding areas during routine and emergency events; 4) Woody vegetation must be removed from the slopes or pertinent surrounding areas. Any removal of woody vegetation with a diameter greater than 1/2 inch must be directed by a person familiar with the design and operation of the CCR surface impoundment and in consideration of the complexities of removal of a tree or a shrubbery, who must ensure the removal does not create a risk of destabilizing the CCR surface impoundment or otherwise adversely affect the stability and safety of the CCR surface impoundment or*

personnel undertaking the removal; and 5) The height of vegetation must not exceed 12 inches.

Slope protection, consisting of vegetative cover, was installed on the slopes and pertinent surrounding areas of the Baldwin Fly Ash System, and is inspected, maintained, and repaired as needed. Based on observations from weekly inspections conducted in accordance with Section 845.540(a), and the 2020 annual inspections conducted by Hanson Professional Services Inc., the vegetative cover is described to be in good working condition with a maximum vegetation height of 12 inches. The owner's Operations and Maintenance Plan (O&M Plan) provides details for maintaining grass and removing woody vegetation and addressing erosion features on the slopes. Based on a review of the documentation described above, the owner is implementing the O&M Plan, including the completion of repairs and maintenance as needed and when issues are identified during weekly and/or annual inspections. The slope maintenance portion of the O&M Plan and the Annual Inspection performed by Hanson in 2020 are included in Attachment J. The surface impoundment slope protection (vegetative cover) installed and maintained on the slopes and pertinent areas around the slopes is depicted in the aerial photograph provided below.



Dam Inspection Report

Name of Dam: Baldwin Plant Ash Ponds Dam Dam ID No.: NA

Permit Number: NA Class of Dam: NA

Location: ---- Sections: 9,10,15,16 Township: 4S Range: 7W

Owner: Dynegy Midwest Genereation, LLC (Name) ______ (Telephone Number (Day))

10901 Baldwin Road (Street) ______ (Telephone Number (Night))

Baldwin, IL (City) 62217 (Zip Code) County: Randolph / St. Clair

Type of Dam: Earth and Rock Fill Embankment Dams

Type of Spillway: Concrete Drop Inlets at Bottom Ash Pond, Secondary Settling Pond, and Tertiary Settling Pond. None noted at other disposal areas.

Date(s) Inspected: 17-Nov-20

Weather When Inspected: Clear

Temperature When Inspected: 42° F

Pool Elevation When Inspected: Unknown

Tailwater Elevation When Inspected: Unknown

Inspection Personnel:

Name	Title
James P. Knutelski, P.E.	Geotech. Engineer - Hanson
Jason Campbell, P.E.	Dam Safety Manager - Dynegy
Mark McCauley	IDNR-OWR

LICENSED PROFESSIONAL ENGINEER
JAMES P. KNUTELSKI
062-054206
OF ILLINOIS

[signature] 12/29/2020

Professional Engineer's Seal

Exp 11/30/21

The Department of Nautural Resources is requesting information that is necessary to accomplish the statutory purpose as outlined under the River, Lakes and Streams Act, 615 ILCS 5. Submittal of this information is REQUIRED. Failure to provide the required information could result in the initiation of non-compliance procedures as outlined in Section 3702.160 of the "Rules for Construction and Maintenance of Dams".

CONDITION CODES

NE - No evidence of a problem

GC - Good condition

MM - Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled

IM - Item needing immediate maintenance to restore or ensure its safety or integrity

EC - Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam

OB - Condition requires regular observation to ensure that the condition does not become worse

NA - Not applicable to this dam

NI - Not inspected - list the reason for non-inspection under deficiencies

EARTH EMBANKMENT

Closure construction in progress during inspection - contractor responsible for condition of slopes, seepage, vegetation, etc. at ash pond com

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Surface Cracks	NE		
Vertical and Horizontal Alignment of Crest	NE		
Unusual Movement or Cracking At or Beyond Toe	NE		
Sloughing or Erosion of Embankment and Abutment Slopes	NE		
Upstream Face Slope Protection	MM	Vegetation in riprap at secondary pond.	Continue to spray riprap/remove vegetation.
Seepage	NE		
Filter and Filter Drains	NE		

EARTH EMBANKMENT
(Continued)

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Animal Damage	NE		
Embankment Drainage Ditches	GC		
Vegetative Cover	MM	Woody vegetation on tertiary pond downstream slope. East side slope has not been mowed.	Remove woody vegetation in these areas. Mow east side slope.
Seepage - Normal Operation	OB	Seepage through secondary settling pond dam and through crushed stone at tertiary settling pond emergency spillway (flow through per construction).	Construction of dams allow for overflow/seepage through coarse materials near crest. Observe this areas for evidence of deterioration.
Other	NA		
Other	NA		
Other	NA		

SUMMARY OF MAINTENANCE DONE AND/OR

REPAIRS MADE SINCE THE LAST INSPECTION

DATE OF PRESENT INSPECTION 17-Nov-20

DATE OF LAST INSPECTION 23-Oct-19

1. EARTH EMBANKMENT DAMS
   Closure construction complete. Trees removed at bottom ash pond embankment.

2. CONCRETE MASONRY DAMS

   NA

3. PRINCIPAL SPILLWAY

   None noted.

4. OUTLET WORKS

   NA

5. EMERGENCY SPILLWAY

   None noted.

Closed ash pond – south side

Closed ash pond – east side – mow slope

Closed ash pond – interior

Closed ash pond – interior

Closed ash pond – interior

Closed ash pond – interior

Closed ash pond – typical let-down

Closed ash pond – typical let-down

Excerpt from the Baldwin Operations and Maintenance Manual

1.0 Maintenance Requirements

1.1 Maintenance Program - The plant's impoundment and flood prevention structures shall be inspected and maintained in a manner to ensure safe and environmentally responsible operations. A regular maintenance program shall be performed and shall consist of the following inspection items:

1. Earth embankments: Walk the crest, side slopes, and downstream toe of the dam concentrating on surface erosion, seepage, cracks, settlement, slumps, slides, and animal burrows. Frequency of inspection: Quarterly.
2. Vegetation: Grass should be a thick vigorous growth to stabilize the earth embankment soils and prevent erosion form occurring. Note the height of the grass; if greater than one foot a mowing of the area should be scheduled before the next inspection. There should be NO trees on the earth embankment and none within a minimum of 20 feet of the embankment toe or other structures. Frequency of inspection: Weekly.
3. Pond Outlet Structure: Check for any debris or other obstructions around the concrete inlet which may block or restrict the flow of water. Check for the development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of concrete. Check for settlement or cracking in the walkway structure. Frequency of inspection: Monthly.
4. Outlet Pipe Slide Gate: Check the structure for development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of concrete. Check the slide gate stem, grease the stem, and operate the slide gate through its full range of motion to ensure proper operation. Check for buildup of debris in the manhole. Frequency of inspection: Quarterly.
5. Pond/Levee Perimeter: Check the perimeter of the embankment and levee for a distance of at least 100 feet from the toe for signs of seepage or boils. Inspection frequency for levee will be determined by Dam Safety Engineer during flood events. Frequency of ash pond embankment inspection: Quarterly for ash pond embankment.
6. Special Inspections – Special inspections of ash pond berms shall be performed after earthquakes, floods, water level exceedance in the ponds, or heavy rainfall events. Inspection and report shall be equal to an annual inspection level of detail. Water level in the pond should be noted after a heavy rainfall. Dam Safety staff shall accompany plant personnel on special inspections. Frequency: As required.

ATTACHMENT K

POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 C.F.R. § 257.104 and 35 I.A.C. 845.780
REV 0 – 10/30/2021

SITE INFORMATION			
Site Name / Address	Baldwin Power Plant / 10901 Baldwin Road, Baldwin, IL 62217		
Owner Name / Address	Dynegy Midwest Generation, LLC / 1500 Eastport Plaza Drive, Collinsville, IL 62234		
CCR Unit	Old East, East and West Fly Ash Ponds (Fly Ash Pond System)	Closure Method and Final Cover Type	Closed In-Place Clayey Soil Cover with Vegetation

POST-CLOSURE PLAN DESCRIPTION	
40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1) – Length of post-closure care period.	Post-closure care will be conducted for a period of 30 years as required by 40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1), except as provided by 40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2).
40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2) – Circumstances extending the post closure care period.	If at the end of the post-closure care period the CCR unit is operating under assessment monitoring in accordance with §257.95, the post-closure care as described in this plan will continue until returning to detection monitoring in accordance with §257.95. Under 35 I.A.C. 845.780(c)(2), the post-closure care period will be extended until groundwater monitoring data demonstrate that concentrations are below the groundwater protection standards in Section 845.600 and are not increasing for those constituents over background, using the statistical procedures and performance standards in Section 845.640(f) and (g), provided that concentrations have been reduced to the maximum extent feasible and concentrations are protective of human health and the environment.
40 C.F.R. § 257.104(d)(1)(i) and 35 I.A.C. 845.780(d)(1)(A) – A description of the monitoring and maintenance activities required in 40 C.F.R. § 257.104(b) and 35 I.A.C. 845.780(b), and the frequency at which these activities will be performed, to maintain the integrity and effectiveness of the final cover system, maintain the groundwater monitoring system and monitor the groundwater.	Pursuant to § 257.104(b)(1) and 35 I.A.C. 845.780(b)(1), throughout the post-closure care period, periodic visual observations of the final cover system and stormwater management system will be performed at least annually for evidence of settlement, subsidence, erosion, or other damage that may adversely affect the integrity and effectiveness of the final cover system. When practical, visual observations of the final cover will be made concurrent with groundwater monitoring activities. Noted evidence of damage, such as rills, surface cracks and settlement, will be repaired to maintain the integrity and effectiveness of the final cover system. Vegetation will be established and maintained on the final cover system, including storm drainage areas, where appropriate, to provide long-term erosion control. Established vegetation and the slope design of the final cover system will prevent potential erosion and damage that may be caused by run-on and run-off. Repair activities may include, but are not limited to, replacing and compacting soil cover, repairing drainage channels that have been

	eroded, filling in depressions with soil, regrading, and reseeding areas of failed vegetation, as necessary. Pursuant to § 257.104(b)(3) and 35 I.A.C. 845.780(b)(3), the groundwater monitoring system will be maintained, and groundwater will be monitored as required by 40 C.F.R. § 257.90 through 40 C.F.R. § 257.98 and 35 I.A.C. 845.600 through 35 I.A.C. 845.680. Monitoring wells will be inspected during each groundwater sampling event. Monitoring wells and associated instrumentation will be maintained so that they perform to the design specifications throughout the life of the monitoring program. Groundwater monitoring frequency will be at least quarterly, except as provided in 40 C.F.R. § 257.94(d), 257.95(c) and 35 I.A.C. 845.650(b)(4).
40 C.F.R. § 257.104(d)(1)(ii) and 35 I.A.C. 845.780(d)(1)(B) – The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.	Dynegy Midwest Generation, LLC 6555 Sierra Drive Irving, Texas 75039 800.633.4704 ccr@dynegy.com
40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) – A description of the planned uses of the property during the post-closure period.	The CCR unit is located at an operating electric generation facility. Planned uses of the property during the post-closure period are currently unknown, except for post-closure care of the CCR unit. Post-closure use of the property will not disturb the integrity of the final cover system or other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements of 40 C.F.R. Part § 257, Subpart D and 35 I.A.C. Part 845. Any other disturbance will be conducted following a demonstration that it will not increase the potential threat to human health or the environment, as required by 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780 (d)(1)(C). The demonstration will be certified by a qualified professional engineer and submitted to the Illinois Environmental Protection Agency (IEPA). Per 40 C.F.R. § 257.104(d)(1)(iii) notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible internet site. This CCR unit is closed. A notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 C.F.R. § 257.102(i) and 35 I.A.C. 845.760(h). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements in 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) or groundwater monitoring requirements per 35 I.A.C. 845.740(b). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be submitted to the IEPA and placed in the facility's operating record per 35 I.A.C. 845.760(h)(3). The notification will be placed on the owner or operator's publicly accessible CCR Web site in accordance with 40 C.F.R. § 257.107(i)(9) and 35 I.A.C. 845.810(e) and placed in the facility's operating record as required by 35 I.A.C. 845.800(d)(26) and §257.105(i)(9).
40 C.F.R. § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3) – Amendments to the initial or subsequent written post-closure plan.	Pursuant to 40 C.F.R. § 257.104(d), the initial post closure care plan for the Baldwin Fly Ash Pond System was prepared on October 17, 2016. That plan is being amended pursuant to 40 C.F.R. § 257.104(d)(3)(i). This plan also serves as the initial post-closure care plan, prepared in accordance with 35 I.A.C. 845.780(d).

	Pursuant to § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3), an operating permit modification application to amend the initial or any subsequent written post-closure care plan developed under 35 I.A.C. 845.780 (d)(1) and § 257.104(d)(1) will be submitted to IEPA. The written post-closure care plan will be amended whenever there is a change in the operation of the CCR surface impoundment that would substantially affect the written post-closure care plan in effect; or unanticipated events necessitate a revision of the written post-closure care plan, after post-closure activities have started. The written post-closure care plan will be amended at least 60 days before a planned change in the operation of the facility or CCR surface impoundment, or within 60 days after an unanticipated event requires the need to revise the existing plan. If the plan is revised after post-closure activities have started, a request to modify the operating permit, including an amended written post-closure care plan, will be submitted to the IEPA within 30 days following the triggering event.
40 C.F.R. § 257.104(d)(4) and 35 I.A.C. 845.780(d)(4) – Qualified professional engineering certification.	Certification by a qualified professional engineer will be appended to this plan and any amendment of this plan.
35 I.A.C. 845.780(e) – Termination of post-closure care	Upon completion of the post-closure period, a request to terminate post-closure care will be submitted to the IEPA. The request will include a certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the post-closure care plan specified in 35 I.A.C. 845.780(d) and the requirements of 35 I.A.C. 845.780.
40 C.F.R. § 257.104(e) and 35 I.A.C. 845.780(f) – Notification of completion of the post-closure care period.	A notification of completion of post-closure care will be prepared and placed in the facility's operating record within 30 days after IEPA approval of the request to terminate post-closure care. The notification will be placed in the facility's operating record in accordance with 35 I.A.C. 845.800(d)(31) and § 257.105(i)(13). The notification will be placed on the owner or operator's publicly accessible CCR Internet site in accordance with the requirements of § 257.107(i)(13) and 35 I.A.C. 845.810(e). The IEPA will be notified when the notification has been placed in the operating record and on the owner or operator's publicly accessible Internet site in accordance with the requirements of § 257.106(i)(13).

Certification Statement 40 C.F.R. § 257.104(d)(4) and 35 I.A.C. 845.780(d)(4) – Amended/Initial Written Post Closure Plan for a CCR Surface Impoundment

CCR Unit: Dynegy Midwest Generation, LLC; Baldwin Power Plant; Fly Ash Pond System

I, John R. Hesemann, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the amended/initial written post closure plan, dated October 30, 2021, meets the requirements of 40 C.F.R. § 257.104 and 35 I.A.C. 845.780.

John R. Hesemann

Printed Name

9/27/2021

Date

JOHN ROBERT HESEMANN
062-058523
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

Exp.: 11/30/2021

ATTACHMENT M

RAMBOLL

HISTORY OF POTENTIAL EXCEEDANCES

This presentation of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(3)(G) for the Baldwin Power Plant Fly Ash Pond System, Illinois Environmental Protection Agency (IEPA) ID No. W1578510001-01/-02/-03.

Note

Groundwater concentrations observed from 2015 to 2021 in monitoring wells included in an existing groundwater monitoring program have been evaluated and summarized in the following tables. These concentrations are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to Groundwater Monitoring Plan [GMP]), which has not been reviewed or approved by the IEPA at the time of submittal of the 35 I.A.C. § 845 Operating Permit application.

Alternate sources for potential exceedances as allowed by 35 I.A.C. § 845.650(e) have not yet been evaluated. These will be evaluated and presented in future submittals to IEPA as appropriate.

Table 1 summarizes how the potential exceedances were determined. Table 2 is a summary of all potential exceedances.

Background Concentrations

Background monitoring wells identified in the GMP include MW-304 and MW-306.

Background concentrations calculated from sampling events in 2015-2017 were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations in 2015-2017 greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as Groundwater Protection Standards (GWPSs) for comparing to statistical calculation results for each compliance well to determine potential exceedances. Compliance well statistical calculations consider concentrations from all sampling events in 2015-2021.

Corrective Action

A Corrective Measures Assessment (CMA) was completed to address statistically significant levels of total lithium, as required by 40 C.F.R. § 257.96. The CMA indicated the source control measure consists of closure in place with a final cover system of earthen material in accordance with the Closure and Post Closure Care Plan submitted to the IEPA in March 2016 and approved on August 16, 2016. Closure construction began in 2018 and was completed in November 2020.

Activities completed associated with the selection of a groundwater remedy include review of existing groundwater and source water data, identification and collection of additional groundwater and source water samples to support analysis of natural attenuation mechanisms, rates, and aquifer capacity. Preliminary results indicate that site-specific conditions are favorable for implementation of monitored natural attenuation (MNA) in combination with the recently completed closure referenced above.

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-150	PMP	pH (field)	SU	03/25/2015 - 06/21/2021	Future median	7.0	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-150	PMP	Total Dissolved Solids	mg/L	03/25/2015 - 06/21/2021	CB around linear reg	1610	1420	1420	1200	Background
MW-151	PMP	pH (field)	SU	03/16/2017 - 06/21/2021	Future median	6.9	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-151	PMP	Total Dissolved Solids	mg/L	03/16/2017 - 06/21/2021	Future median	552	1420	1420	1200	Background
MW-152	PMP	pH (field)	SU	03/25/2015 - 07/19/2021	Future median	6.9	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-152	PMP	Total Dissolved Solids	mg/L	03/25/2015 - 07/19/2021	CB around linear reg	821	1420	1420	1200	Background
MW-153	PMP	pH (field)	SU	03/25/2015 - 06/22/2021	Future median	7.1	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-153	PMP	Total Dissolved Solids	mg/L	03/25/2015 - 06/22/2021	Future median	368	1420	1420	1200	Background
MW-252	PMP	pH (field)	SU	03/25/2015 - 07/19/2021	Future median	6.8	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-252	PMP	Total Dissolved Solids	mg/L	03/25/2015 - 07/19/2021	CB around linear reg	1170	1420	1420	1200	Background
MW-253	PMP	pH (field)	SU	03/25/2015 - 06/22/2021	Future median	11.8	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-253	PMP	Total Dissolved Solids	mg/L	03/25/2015 - 06/22/2021	Future median	530	1420	1420	1200	Background
MW-350	UA	Antimony, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.0043	0.006	0.001	0.006	Standard
MW-350	UA	Arsenic, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.001	0.010	0.0036	0.01	Standard
MW-350	UA	Barium, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.17	2.0	0.028	2	Standard
MW-350	UA	Beryllium, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.001	0.004	0.001	0.004	Standard
MW-350	UA	Boron, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.68	2.0	1.8	2	Standard
MW-350	UA	Cadmium,total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.001	0.005	0.001	0.005	Standard
MW-350	UA	Chloride, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	43	200	153	200	Standard
MW-350	UA	Chromium, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.0015	0.10	0.0015	0.1	Standard
MW-350	UA	Cobalt, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.001	0.006	0.001	0.006	Standard
MW-350	UA	Fluoride, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.17	4.0	1.9	4	Standard
MW-350	UA	Lead, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.0011	0.0075	0.001	0.0075	Standard
MW-350	UA	Lithium, total	mg/L	06/25/2019 - 03/10/2021	Future median	0.086	0.096	0.096	0.04	Background
MW-350	UA	Mercury, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
MW-350	UA	Molybdenum, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.0068	0.10	0.030	0.1	Standard

RAMBOLL

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-350	UA	pH (field)	SU	03/25/2015 - 07/19/2021	CB around T-S line	10.1	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-350	UA	Radium-226 + Radium 228, tot	pCi/L	03/26/2020 - 03/10/2021	Most recent sample	0.89	5.0	1.6	5	Standard
MW-350	UA	Selenium, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.001	0.050	0.001	0.05	Standard
MW-350	UA	Sulfate, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	52	400	208	400	Standard
MW-350	UA	Thallium, total	mg/L	03/26/2020 - 03/10/2021	Most recent sample	0.002	0.002	0.002	0.002	Standard
MW-350	UA	Total Dissolved Solids	mg/L	03/25/2015 - 07/19/2021	CB around linear reg	-88.1	1420	1420	1200	Background
MW-352	UA	pH (field)	SU	03/25/2015 - 07/19/2021	CB around T-S line	6.9	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-352	UA	Total Dissolved Solids	mg/L	03/25/2015 - 07/19/2021	CB around linear reg	1140	1420	1420	1200	Background
MW-366	UA	Antimony, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-366	UA	Arsenic, total	mg/L	01/20/2016 - 03/12/2021	CI around median	0.001	0.010	0.0036	0.01	Standard
MW-366	UA	Barium, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	0.011	2.0	0.028	2	Standard
MW-366	UA	Beryllium, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-366	UA	Boron, total	mg/L	01/20/2016 - 03/12/2021	CI around mean	1.4	2.0	1.8	2	Standard
MW-366	UA	Cadmium,total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-366	UA	Chloride, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	43	200	153	200	Standard
MW-366	UA	Chromium, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.0015	0.10	0.0015	0.1	Standard
MW-366	UA	Cobalt, total	mg/L	01/20/2016 - 03/12/2021	CI around median	0.001	0.006	0.001	0.006	Standard
MW-366	UA	Fluoride, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	0.12	4.0	1.9	4	Standard
MW-366	UA	Lead, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
MW-366	UA	Lithium, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	-0.00135	0.096	0.096	0.04	Background
MW-366	UA	Mercury, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-366	UA	Molybdenum, total	mg/L	01/20/2016 - 03/12/2021	CI around mean	0.0023	0.10	0.030	0.1	Standard
MW-366	UA	pH (field)	SU	01/20/2016 - 03/12/2021	Future median	7.0	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-366	UA	Radium-226 + Radium 228, tot	pCi/L	01/20/2016 - 03/12/2021	CI around geomean	0.42	5.0	1.6	5	Standard
MW-366	UA	Selenium, total	mg/L	01/20/2016 - 03/12/2021	CI around median	0.001	0.050	0.001	0.05	Standard
MW-366	UA	Sulfate, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	393	400	208	400	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-366	UA	Thallium, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-366	UA	Total Dissolved Solids	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	951	1420	1420	1200	Background
MW-375	UA	Antimony, total	mg/L	01/20/2016 - 03/12/2021	CI around geomean	0.00106	0.006	0.001	0.006	Standard
MW-375	UA	Arsenic, total	mg/L	01/20/2016 - 03/12/2021	CI around mean	0.00153	0.010	0.0036	0.01	Standard
MW-375	UA	Barium, total	mg/L	01/20/2016 - 03/12/2021	CI around median	0.024	2.0	0.028	2	Standard
MW-375	UA	Beryllium, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-375	UA	Boron, total	mg/L	01/20/2016 - 03/12/2021	CB around T-S line	1.4	2.0	1.8	2	Standard
MW-375	UA	Cadmium,total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-375	UA	Chloride, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	99	200	153	200	Standard
MW-375	UA	Chromium, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.0015	0.10	0.0015	0.1	Standard
MW-375	UA	Cobalt, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-375	UA	Fluoride, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	2.2	4.0	1.9	4	Standard
MW-375	UA	Lead, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
MW-375	UA	Lithium, total	mg/L	01/20/2016 - 03/12/2021	CB around linear reg	0.080	0.096	0.096	0.04	Background
MW-375	UA	Mercury, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-375	UA	Molybdenum, total	mg/L	01/20/2016 - 03/12/2021	CI around mean	0.023	0.10	0.030	0.1	Standard
MW-375	UA	pH (field)	SU	01/20/2016 - 03/12/2021	Future median	7.8	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-375	UA	Radium-226 + Radium 228, tot	pCi/L	01/20/2016 - 03/12/2021	CI around mean	0.22	5.0	1.6	5	Standard
MW-375	UA	Selenium, total	mg/L	01/20/2016 - 03/12/2021	CI around median	0.001	0.050	0.001	0.05	Standard
MW-375	UA	Sulfate, total	mg/L	01/20/2016 - 03/12/2021	CI around mean	110	400	208	400	Standard
MW-375	UA	Thallium, total	mg/L	01/20/2016 - 03/12/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-375	UA	Total Dissolved Solids	mg/L	01/20/2016 - 03/12/2021	CB around T-S line	979	1420	1420	1200	Background
MW-377	UA	Antimony, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-377	UA	Arsenic, total	mg/L	01/19/2016 - 03/12/2021	CI around median	0.001	0.010	0.0036	0.01	Standard
MW-377	UA	Barium, total	mg/L	01/19/2016 - 03/12/2021	CI around mean	0.061	2.0	0.028	2	Standard
MW-377	UA	Beryllium, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-377	UA	Boron, total	mg/L	01/19/2016 - 03/12/2021	CI around mean	1.7	2.0	1.8	2	Standard
MW-377	UA	Cadmium,total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-377	UA	Chloride, total	mg/L	01/19/2016 - 03/12/2021	CI around mean	88	200	153	200	Standard
MW-377	UA	Chromium, total	mg/L	01/19/2016 - 03/12/2021	CB around T-S line	0.001	0.10	0.0015	0.1	Standard
MW-377	UA	Cobalt, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-377	UA	Fluoride, total	mg/L	01/19/2016 - 03/12/2021	CB around linear reg	1.2	4.0	1.9	4	Standard
MW-377	UA	Lead, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
MW-377	UA	Lithium, total	mg/L	01/19/2016 - 03/12/2021	CB around linear reg	0.059	0.096	0.096	0.04	Background
MW-377	UA	Mercury, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-377	UA	Molybdenum, total	mg/L	01/19/2016 - 03/12/2021	CB around linear reg	0.00054	0.10	0.030	0.1	Standard
MW-377	UA	pH (field)	SU	01/19/2016 - 03/12/2021	Future median	7.2	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-377	UA	Radium-226 + Radium 228, tot	pCi/L	01/19/2016 - 03/12/2021	CI around mean	0.25	5.0	1.6	5	Standard
MW-377	UA	Selenium, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.001	0.050	0.001	0.05	Standard
MW-377	UA	Sulfate, total	mg/L	01/19/2016 - 03/12/2021	CB around linear reg	34	400	208	400	Standard
MW-377	UA	Thallium, total	mg/L	01/19/2016 - 03/12/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-377	UA	Total Dissolved Solids	mg/L	01/19/2016 - 03/12/2021	Future median	580	1420	1420	1200	Background
MW-383	UA	Antimony, total	mg/L	01/21/2016 - 03/12/2021	CB around linear reg	0.00072	0.006	0.001	0.006	Standard
MW-383	UA	Arsenic, total	mg/L	01/21/2016 - 03/12/2021	CI around median	0.001	0.010	0.0036	0.01	Standard
MW-383	UA	Barium, total	mg/L	01/21/2016 - 03/12/2021	CB around linear reg	0.040	2.0	0.028	2	Standard
MW-383	UA	Beryllium, total	mg/L	01/21/2016 - 03/12/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-383	UA	Boron, total	mg/L	01/21/2016 - 03/12/2021	CI around median	1.3	2.0	1.8	2	Standard
MW-383	UA	Cadmium,total	mg/L	01/21/2016 - 03/12/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-383	UA	Chloride, total	mg/L	01/21/2016 - 03/12/2021	CI around median	39	200	153	200	Standard
MW-383	UA	Chromium, total	mg/L	01/21/2016 - 03/12/2021	CB around T-S line	0.001	0.10	0.0015	0.1	Standard
MW-383	UA	Cobalt, total	mg/L	01/21/2016 - 03/12/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-383	UA	Fluoride, total	mg/L	01/21/2016 - 03/12/2021	CB around linear reg	0.66	4.0	1.9	4	Standard

RAMBOLL

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-383	UA	Lead, total	mg/L	01/21/2016 - 03/12/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
MW-383	UA	Lithium, total	mg/L	01/21/2016 - 03/12/2021	Future median	0.037	0.096	0.096	0.04	Background
MW-383	UA	Mercury, total	mg/L	01/21/2016 - 03/12/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-383	UA	Molybdenum, total	mg/L	01/21/2016 - 03/12/2021	CB around T-S line	0.00405	0.10	0.030	0.1	Standard
MW-383	UA	pH (field)	SU	01/21/2016 - 03/12/2021	Future median	7.6	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-383	UA	Radium-226 + Radium 228, tot	pCi/L	01/21/2016 - 03/12/2021	CI around mean	0.28	5.0	1.6	5	Standard
MW-383	UA	Selenium, total	mg/L	01/21/2016 - 03/12/2021	CI around median	0.001	0.050	0.001	0.05	Standard
MW-383	UA	Sulfate, total	mg/L	01/21/2016 - 03/12/2021	CI around mean	175	400	208	400	Standard
MW-383	UA	Thallium, total	mg/L	01/21/2016 - 03/12/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-383	UA	Total Dissolved Solids	mg/L	01/21/2016 - 03/12/2021	Future median	884	1420	1420	1200	Background
MW-384	UA	Antimony, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-384	UA	Arsenic, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.010	0.0036	0.01	Standard
MW-384	UA	Barium, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	0.035	2.0	0.028	2	Standard
MW-384	UA	Beryllium, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-384	UA	Boron, total	mg/L	01/21/2016 - 03/11/2021	CI around mean	1.4	2.0	1.8	2	Standard
MW-384	UA	Cadmium,total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-384	UA	Chloride, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	291	200	153	200	Standard
MW-384	UA	Chromium, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.0015	0.10	0.0015	0.1	Standard
MW-384	UA	Cobalt, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-384	UA	Fluoride, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	2.2	4.0	1.9	4	Standard
MW-384	UA	Lead, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
MW-384	UA	Lithium, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	0.042	0.096	0.096	0.04	Background
MW-384	UA	Mercury, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-384	UA	Molybdenum, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	0.028	0.10	0.030	0.1	Standard
MW-384	UA	pH (field)	SU	01/21/2016 - 03/11/2021	Future median	8.1	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-384	UA	Radium-226 + Radium 228, tot	pCi/L	01/21/2016 - 03/11/2021	CI around geomean	0.32	5.0	1.6	5	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-384	UA	Selenium, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.001	0.050	0.001	0.05	Standard
MW-384	UA	Sulfate, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	25	400	208	400	Standard
MW-384	UA	Thallium, total	mg/L	01/21/2016 - 03/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-384	UA	Total Dissolved Solids	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	1220	1420	1420	1200	Background
MW-390	UA	Antimony, total	mg/L	03/22/2016 - 03/12/2021	CI around median	0.001	0.006	0.001	0.006	Standard
MW-390	UA	Arsenic, total	mg/L	03/22/2016 - 03/12/2021	CI around mean	0.00128	0.010	0.0036	0.01	Standard
MW-390	UA	Barium, total	mg/L	03/22/2016 - 03/12/2021	CB around linear reg	0.076	2.0	0.028	2	Standard
MW-390	UA	Beryllium, total	mg/L	03/22/2016 - 03/12/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-390	UA	Boron, total	mg/L	03/22/2016 - 03/12/2021	CB around linear reg	-1.06	2.0	1.8	2	Standard
MW-390	UA	Cadmium,total	mg/L	03/22/2016 - 03/12/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-390	UA	Chloride, total	mg/L	03/22/2016 - 03/12/2021	CI around mean	63	200	153	200	Standard
MW-390	UA	Chromium, total	mg/L	03/22/2016 - 03/12/2021	All ND - Last	0.0015	0.10	0.0015	0.1	Standard
MW-390	UA	Cobalt, total	mg/L	03/22/2016 - 03/12/2021	CB around linear reg	0.000145	0.006	0.001	0.006	Standard
MW-390	UA	Fluoride, total	mg/L	03/22/2016 - 03/12/2021	CI around mean	0.75	4.0	1.9	4	Standard
MW-390	UA	Lead, total	mg/L	03/22/2016 - 03/12/2021	CI around median	0.001	0.0075	0.001	0.0075	Standard
MW-390	UA	Lithium, total	mg/L	03/22/2016 - 03/12/2021	Future median	0.017	0.096	0.096	0.04	Background
MW-390	UA	Mercury, total	mg/L	03/22/2016 - 03/12/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-390	UA	Molybdenum, total	mg/L	03/22/2016 - 03/12/2021	CI around geomean	0.00286	0.10	0.030	0.1	Standard
MW-390	UA	pH (field)	SU	03/22/2016 - 03/12/2021	Future median	7.2	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-390	UA	Radium-226 + Radium 228, tot	pCi/L	03/22/2016 - 03/12/2021	CI around mean	0.56	5.0	1.6	5	Standard
MW-390	UA	Selenium, total	mg/L	03/22/2016 - 03/12/2021	CI around median	0.001	0.050	0.001	0.05	Standard
MW-390	UA	Sulfate, total	mg/L	03/22/2016 - 03/12/2021	CI around mean	138	400	208	400	Standard
MW-390	UA	Thallium, total	mg/L	03/22/2016 - 03/12/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-390	UA	Total Dissolved Solids	mg/L	03/22/2016 - 03/12/2021	Future median	654	1420	1420	1200	Background
MW-391	UA	Antimony, total	mg/L	12/22/2016 - 03/12/2021	CI around geomean	0.00141	0.006	0.001	0.006	Standard
MW-391	UA	Arsenic, total	mg/L	12/22/2016 - 03/12/2021	CI around geomean	0.00123	0.010	0.0036	0.01	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-391	UA	Barium, total	mg/L	12/22/2016 - 03/12/2021	CI around mean	0.025	2.0	0.028	2	Standard
MW-391	UA	Beryllium, total	mg/L	12/22/2016 - 03/12/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-391	UA	Boron, total	mg/L	12/22/2016 - 03/12/2021	CI around mean	2.2	2.0	1.8	2	Standard
MW-391	UA	Cadmium,total	mg/L	12/22/2016 - 03/12/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-391	UA	Chloride, total	mg/L	12/22/2016 - 03/12/2021	CI around mean	165	200	153	200	Standard
MW-391	UA	Chromium, total	mg/L	12/22/2016 - 03/12/2021	All ND - Last	0.0015	0.10	0.0015	0.1	Standard
MW-391	UA	Cobalt, total	mg/L	12/22/2016 - 03/12/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-391	UA	Fluoride, total	mg/L	12/22/2016 - 03/12/2021	CI around median	1.9	4.0	1.9	4	Standard
MW-391	UA	Lead, total	mg/L	12/22/2016 - 03/12/2021	All ND - Last	0.001	0.0075	0.001	0.0075	Standard
MW-391	UA	Lithium, total	mg/L	12/22/2016 - 06/22/2021	Future median	0.073	0.096	0.096	0.04	Background
MW-391	UA	Mercury, total	mg/L	12/22/2016 - 03/12/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-391	UA	Molybdenum, total	mg/L	12/22/2016 - 03/12/2021	CI around geomean	0.031	0.10	0.030	0.1	Standard
MW-391	UA	pH (field)	SU	12/22/2016 - 06/22/2021	Future median	7.7	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-391	UA	Radium-226 + Radium 228, tot	pCi/L	12/22/2016 - 03/12/2021	CI around mean	0.52	5.0	1.6	5	Standard
MW-391	UA	Selenium, total	mg/L	12/22/2016 - 03/12/2021	CB around linear reg	-0.00794	0.050	0.001	0.05	Standard
MW-391	UA	Sulfate, total	mg/L	12/22/2016 - 03/12/2021	CI around mean	831	400	208	400	Standard
MW-391	UA	Thallium, total	mg/L	12/22/2016 - 06/22/2021	CI around mean	0.00104	0.002	0.002	0.002	Standard
MW-391	UA	Total Dissolved Solids	mg/L	12/22/2016 - 03/12/2021	Future median	2630	1420	1420	1200	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Notes:
Potential exceedance of GWPS
HSU = hydrostratigraphic unit:
PMP = potential migration pathway
UA = uppermost aquifer
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Statistical Calculation = method used to calculate the statistical result:
All ND - Last = All results were below the reporting limit, and the last determined reporting limit is shown
CB around linear reg = Confidence band around linear regression
CB around T-S line = Confidence band around Thiel-Sen line
CI around geomean = Confidence interval around the geometric mean
CI around mean = Confidence interval around the mean
CI around median = Confidence interval around the median
Future median = Median of the three most recent samples
Most recent sample = Result for the most recently collected sample used due to insufficient data
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
Background = background concentration (see cover page for additional information)

RAMBOLL

TABLE 2. SUMMARY OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
FLY ASH POND SYSTEM
BALDWIN, ILLINOIS

Sample Location	HSU	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-150	PMP	Total Dissolved Solids	mg/L	03/25/2015 - 06/21/2021	CB around linear reg	1610	1420	1420	1200	Background
MW-253	PMP	pH (field)	SU	03/25/2015 - 06/22/2021	Future median	11.8	6.5/12	7.4/11.5	6.5/9	Standard/Background
MW-384	UA	Chloride, total	mg/L	01/21/2016 - 03/11/2021	CB around linear reg	291	200	153	200	Standard
MW-391	UA	Boron, total	mg/L	12/22/2016 - 03/12/2021	CI around mean	2.2	2.0	1.8	2	Standard
MW-391	UA	Sulfate, total	mg/L	12/22/2016 - 03/12/2021	CI around mean	831	400	208	400	Standard
MW-391	UA	Total Dissolved Solids	mg/L	12/22/2016 - 03/12/2021	Future median	2630	1420	1420	1200	Background

Notes:
HSU = hydrostratigraphic unit:
PMP = potential migration pathway
UA = uppermost aquifer
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Statistical Calculation = method used to calculate the statistical result:
CB around linear reg = Confidence band around linear regression
CI around mean = Confidence interval around the mean
Future median = Median of the three most recent samples
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
Background = background concentration (see cover page for additional information)

ATTACHMENT N

Certification of Financial Assurance Requirements

On June 17, 2021, Dynegy Midwest Generation, LLC provided financial assurance in the form of performance bonds to the Illinois Environmental Protection Agency in the amount of $29,230,815 for the Fly Ash Pond System and the Bottom Ash Pond at the Baldwin Power Plant.

I, Matthew A. Goering, Senior Vice President of Dynegy Midwest Generation, LLC, do hereby certify to the best of my knowledge for the above referenced CCR Units that the financial assurance instruments satisfy the requirements of 35 I.A.C. Part 845, Subpart I.

Matthew A. Goering
Senior Vice President
Dynegy Midwest Generation, LLC